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PTS 1000
automated perimeter
Instruction manual

ver.4.5
revision A



Make sure you read this manual before using the instrument. Keep this manual in a safe place so that you can use it in the future.

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1. Symbol information



CAUTION



Follow operating instruction



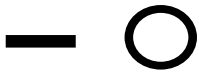
WARNING – Dangerous voltage



General warning sign



Indicates a fuse is present near this symbol



On / Off



Type B Applied Parts



Date of manufacture



Manufacturer



Electrical and Electronic Equipment waste. Do not throw the product away with a normal household waste at the end of its life.



Sign conformity with essential requirements – The Medical Device Directive 93/42/EEG.

2. Introduction

Intended Purpose

The PTS 1000 automated perimeter is a diagnostic device for examining the visual field of the human eye. It is used to detect the early stages of glaucoma, cataract, neurological defects, diplopy, retinal diseases such as macular degeneration, retinitis pigmentosa, and scintillating scotoma.

- The PTS 1000 introduces several new concepts to the practice of perimetry:
- Advanced examination algorithm that reduces examination time and maintains precision.
- A kinetic strategy that allows detection of visual field losses in the central and paracentral areas in patients in whom a static examination is not possible.
- A stimuli projection method that offers all Goldmann standard stimuli sizes (I-V).
- Four stimuli colors: white, green, blue, red.
- Digital algorithms that enable detection of any defects in the patient's visual field.
- Patient reaction time is measured automatically and examination speed is adjusted, enabling a more efficient examination and greater patient comfort.
- A "demo" function that allows patients to become comfortable with the examination process before it begins.
- Computer-controlled fixation with the Heijl-Krakau method or by digital image analysis, enabling continuous monitor fixation.
- Live-eye preview to position the patient's head precisely and to observe his or her behavior during testing.
- Electronic adjustment of chin-rest height.
- Flicker (**Critical Fusion Frequency**) measurement strategy.
- Blue on Yellow (**Short Wave Automatic Perimetry**) examination mode.
- BDT (**Binocular Driving Test**) strategy, which produces an Esterman score calculation.
- Self-diagnostics.

Essential Performance

The Essential Performance of the PTS 1000 perimeter is to carry out accurate visual field tests.

Principle of operation

Testing of the visual field is carried out using the technique of static and kinetic perimetry, with the stimulus targets exposed on the examination bowl. The stimulus is generated by optical system and guided by motorized scanner to the specific locations. The stimulus exposed with different brightness is observing by the patient. The patient should look at the fixation point, and if stimulus is seen, the patient should react pressing the patient response button. For static perimetry, the stimulus appears on the stationary predefined locations, whereas for kinetic perimetry the stimulus moves on the examination bowl with predefined direction, speed and brightness. Color and size of stimulus can be selected by the user. Test results are displayed on the external PC with application software installed. The test results can be also printed on the paper or sent to print file.

Patient Population

The PTS 1000 automated perimeter is intended to be used for all adults, geriatric and children over the age of seven. The patients with disabilities like postural problems, fixation problems, deafness, obesity or wheelchair users can also be examined on the perimeter. The general requirement is that the patient is able to sit on the stool or on the chair, place his or her face in the chinrest and forehead rest of the perimeter and maintain stable position of his or her head for the examination time. The patient should be able to hold and to press the patient response button during examination.

Part of the Body

The PTS 1000 automated perimeter interacts physically with the patient's chin and forehead. The patient also holds the patient response button and presses it.

Application

The PTS 1000 automated perimeter is designed for continuous use. The device should be installed in the consulting rooms, clinics, hospitals or teaching facilities at room temperature with clean air free of any kind of contaminants. See section *15 Ambient conditions*, for the operating environment specification.

Intended User

The PTS 1000 perimeter can be used by Ophthalmologists, Optometrists, Opticians, Orthoptists or other trained health personnel.

The minimum knowledge

The user must be able to distinguish right eye and left eye, chin and forehead, read and understand the language and the functionality used in the PTS 1000 application software.

Education needed for operating the perimeter

Ophthalmologist, Optometrist, Nurse, Certified Medical Technician, Assistant.

Operating Skills

For instrument operation, the user should be able to perform the following functions:

- Power on and power off the perimeter.
- Disinfect surfaces which interact with patient.
- Enter and modify the patient data.
- Adjust position of the patient, position of the instrument, the table height, and the patient's chair.
- Set the examination parameters, start examination and save examination.
- Select or create the required type of printout.

- Verify the printout for completeness of data.
- Print, export and save the selected report.
- Archive and recover the patient database.

Occupational Skills

The user should be able to work with, elderly patients, disabled patients and with children.

Job requirements for the user

The PTS 1000 perimeter training in scope of usage and operation is mandatory. The user should be also trained in the analysis and treatment of ophthalmic diseases or other eye-related medical issues, as it is stated by governing bodies. The user should be a computer literate person.

CAUTION: 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. Optopol Technology Sp. z o.o. cannot be held responsible for misdiagnosis of results.

Disposal

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

CAUTION: Do not use this instrument other than intended and specified.

Purpose of this Instruction Manual

This manual serves as the usage reference and training guide. It has been developed to make learning easy. The instructions and illustrations give a user friendly shape of the manual. We recommend to read this manual in whole before usage, as well as to read it while sitting at the instrument and practicing usage the PTS 1000 before using it with patients.

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. Optopol Technology Sp. z o.o. cannot be held responsible for misdiagnosis of results.

Instruction Manual Availability.

The PTS 1000 Instruction Manual hard copy is included in the standard package of the perimeter.

The PTS 1000 Instruction Manual in PDF format for use on a computer is available on the PTS 1000 Installation CD, included in the standard package of the perimeter. Download and install the free Adobe Reader from the www.adobe.com website to read the manual in PDF format.

Instruction Manual Applicability

This document applies to the PTS 1000 automated perimeter running with the application software version 4.4.0 or higher, unless superseded.

Product Compliance



Complies with The Medical Device Directive 93/42/EWG .

Product Safety

Protection against electric shock
Degree of protection against electric shock
Mode of Operation
Oxygen Rich Environment

Class I
Type B
Continuous Operation
This instrument is not appropriate for use in
oxygen rich environment

3. *Technical data*

Dimensions	693 x 585 x 444 mm	±2mm
Outer diameter of bowl	550 mm	±2mm
Height of center of bowl	381 mm	±2mm
Chinrest vertical movement range	70 mm	±2mm
Weight	19 kg	±0.5kg
Power supply	100-120V AC 50-60 Hz or 220-240V AC 50 Hz	
Power consumption	110 VA	
Stimulus type	projected	
Stimulus colors	white, green, blue, red	
Maximum stimulus intensity	10000 asb	±20%
Minimum stimulus intensity	0.32 asb	±20%
Exposure time	0.1 to 7.5 s	(default 0.2s)
Number of predefined fields	10 + user defined	
Number of strategies	9	
Stimulus size	I-V Goldman	
Background illumination	31.5 asb ±20% (white on white)	
	10 asb ±20% (green on white and red on white)	
	314 asb ±20% (blue on yellow)	
Dynamic range	45dB	
Accuracy of stimulus positioning	±0.5° (for 0° to 10° eccentricity range)	
	±1° (for above 10° to 30° eccentricity range)	
	±2° (for above 30° eccentricity range)	

3.1. *Minimum system requirements*

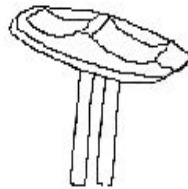
Processor	Intel Core 2 Duo 2GHz (or equivalent)
RAM	2GB
Operating system	MS Windows 7/8/10
Hard disk	100 MB free space
Graphic card	1024x768, 24 bits of color depth (True color), 3D accelerator supporting OpenGL
Communication sockets	1 x USB 2.0

4. Unpacking and installation

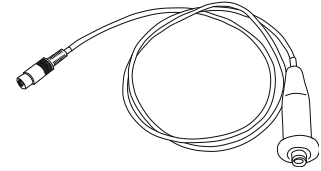
The standard PTS 1000 set includes the following elements:



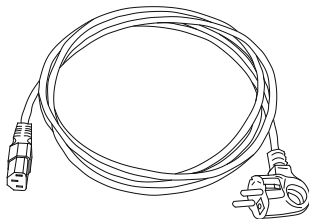
Examination Bowl



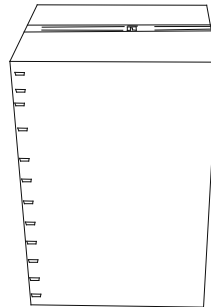
Binocular chinrest



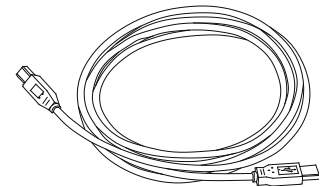
Patient Response Button



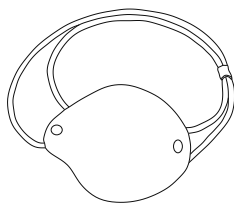
Power Supply Cable



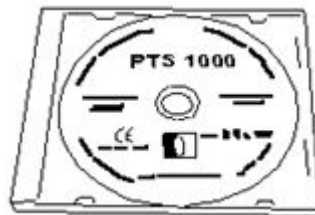
Perimeter Box



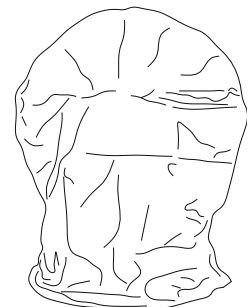
USB Communication Cable



Eye Occluder



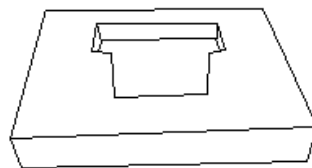
Installation CD-ROM



Dust Cover



Top Foam



Bottom Foam

Figure 4.1. Components of the standard package.

Warning!

Do not hold the perimeter bowl by the opening. Doing so could damage the device.



Figure 4.2. Unallowable method of transportation.

Important!

To allow the electronic components inside the PTS 1000 to adjust to your institution's ambient temperature, wait until at least one hour after the device has been delivered before plugging it in for the first time.

After unpacking the PTS 1000, confirm that all components have been included. Also check for any signs of mechanical damage that may have occurred in transport. If damage is present, do not plug in the device and contact your local distributor.

Assembly procedure

1. Unpack the examination bowl and place it on a table that has electrically or manually controlled height.
2. Connect the examination bowl to the computer using the USB cable.
3. Connect the patient response button to the examination bowl.
4. Connect the examination bowl's power supply cable.

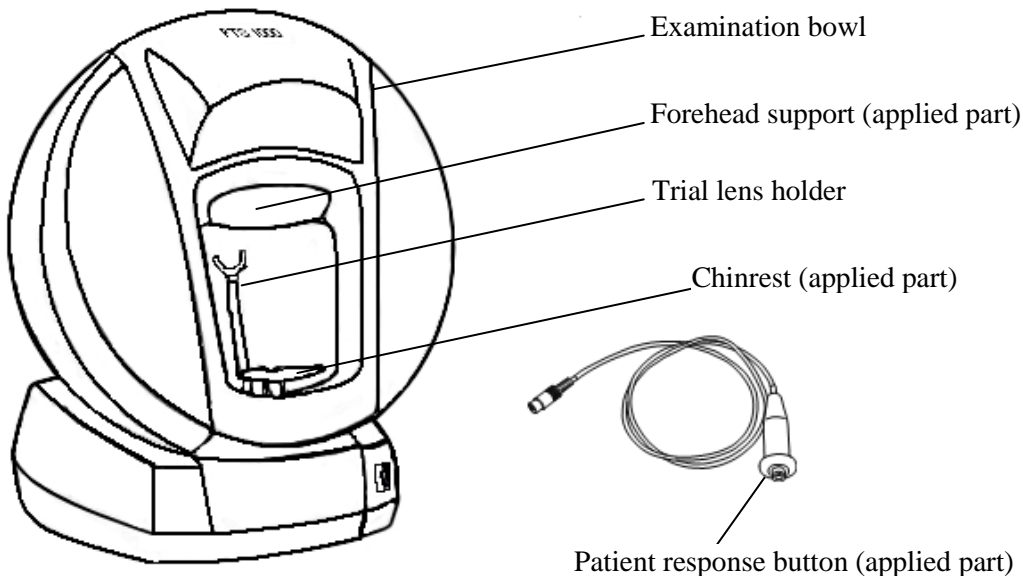


Figure 4.3. The components of the perimeter bowl.

4.1. Safety standards

The PTS 1000:

- Should only be connected to a power supply equipped with a properly connected grounding pin.
- Complies with the requirements of directive 93/42/EEC (MDD Medical Device Directive).
- Is a type b applied parts (chin rest support, forehead support and patient response button), class I protection against electric shock.
- Is usually integrated with a larger medical system consisting of other medical and nonmedical devices including a PC set for operation within the patient environment. The medical system as a whole and each device alone must also be compliant with the MDD standard. Therefore, the distributor or manufacturer of all devices included in the medical system must warranty that their respective devices comply with MDD rules.
- Is connected to a computer via a USB cable. The cable is electrically separate from the perimeter, offering additional protection when the PTS 1000 and computer are connected to different power supply sources with different ground level potential.

Electrical connections of PTS 1000 medical system

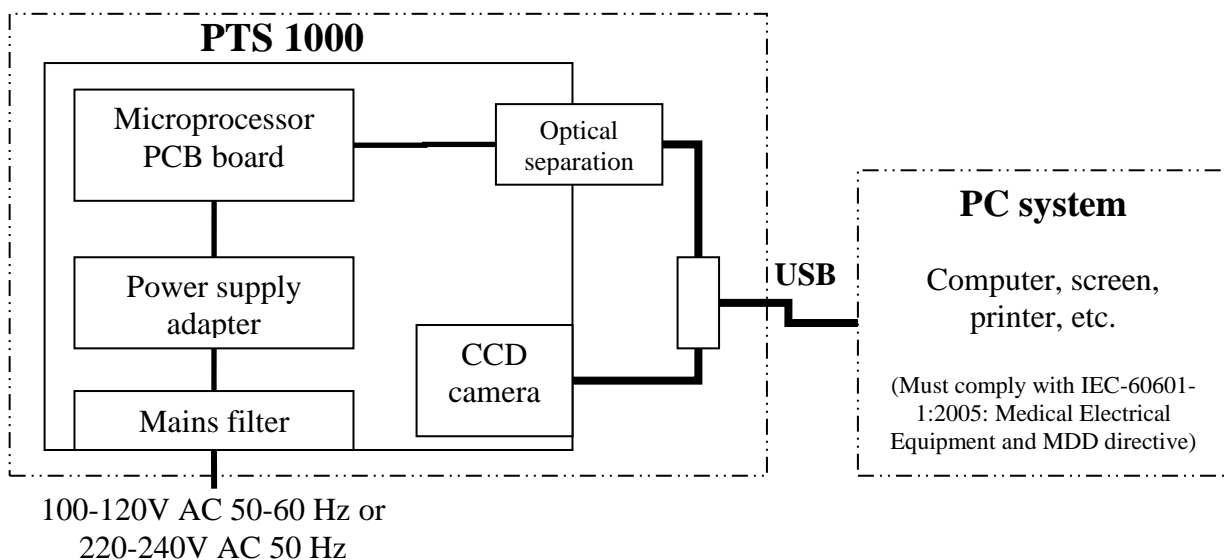


Figure 4.4. Electrical connections of PTS 1000 medical system.

Warning!

- If the PTS 1000 and entire medical system have been installed by the manufacturer or other authorized personnel, the manufacturer or other authorized personnel warrant that the system has been properly installed and is in compliance with MDD rules.
- If the PTS 1000 and ancillary devices have been improperly installed or installation was not performed by the manufacturer or authorized personnel, the manufacturer takes no responsibility for violation of the relevant safety standards.
- Any computer system or device attached to the PTS 1000 must be MDD compliant.
- To avoid risk of electric shock, the PTS 1000 must only be connected to a power supply mains with protective grounding.
- The manufacturer of the PTS 1000 takes no responsibility for an incorrect diagnosis or the consequences of an incorrect diagnosis made using the PTS 1000.



The PTS 1000 can only be used with device approved for IEC 60950 at least any other case the patient may be subjected to electrical shock.

Warning!

Removal of the PTS 1000’s main body housing may be performed only by the manufacturer or by authorized personnel trained by the manufacturer. Otherwise, death or serious injury may result.

4.2. Software installation and configuration

4.2.1. Software installation and configuration in Windows 7/8/10

4.2.1.1. Compatibility of PTS 1000 with Windows 7/8/10

PTS 1000 4.4 version software is fully compatible with Windows 7/8/10. Administrator and UAC restrictions are not applicable for running the 4.4 version.

Note: Administrator rights are needed for installation.

4.2.1.2. Setting the screen resolution in Windows 7/8/10

The PTS 1000 software requires screen resolution of 1024 x 768 pixels or better and 24 bits of color depth (True Color) or better.

1. Click the right mouse button on the Windows desktop and select 'Screen Resolution'.
2. Set the correct parameters.

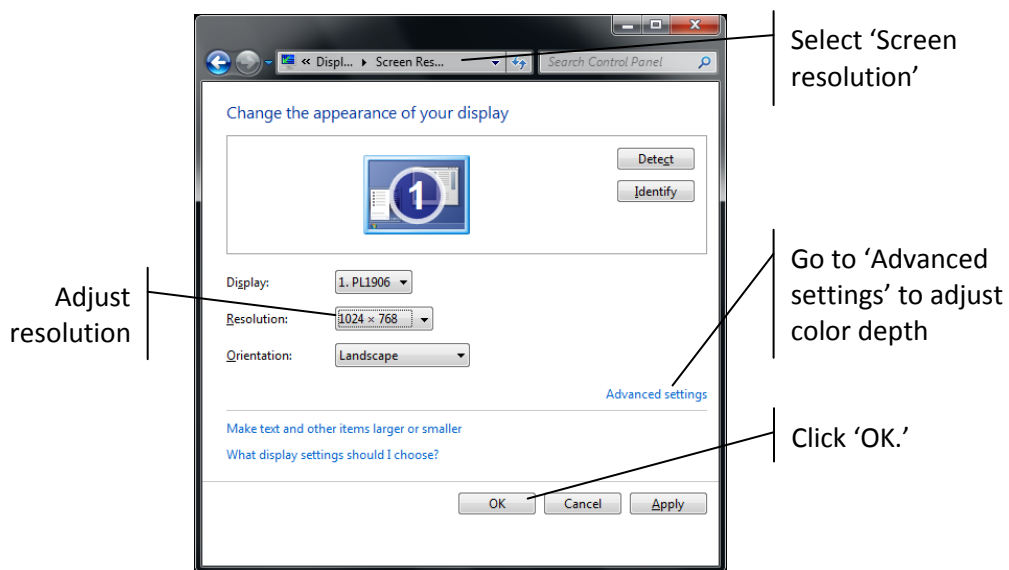


Figure 4.5. Display settings screen.

4.2.1.3. **PTS 1000 drivers and software installation in Windows 7/8/10**

The first step is PTS 1000 drivers installation:

1. Switch on the PTS 1000 perimeter bowl, switch on the PC then wait until the Windows 7/8/10 system is ready. Insert the *PTS 1000 4.4.2* installation CD/DVD into CD-ROM drive (usually drive D: or E:). Connect the PTS 1000 perimeter bowl and the PC with a USB cable. The computer will display a message that new devices are found: *USB Serial Converter*, *USB Serial Port*, *USB camera*. Windows 7/8/10 will automatically select and install the *USB camera*, *USB Serial Port* and *USB Serial converter* drivers for these found devices. A message that the device is ready to use will appear. The components installed by Windows 7/8/10 can be checked with *Device Manager*, as shown below.

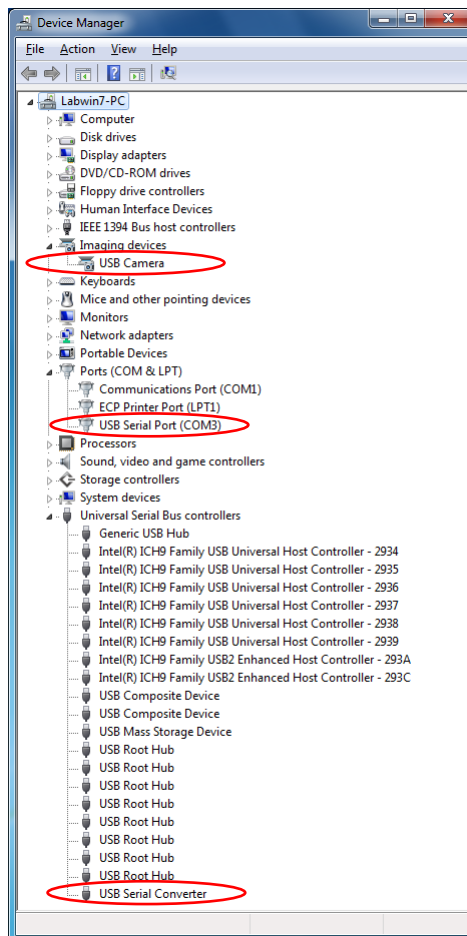


Figure 4.6. Device manager screen. Status with drivers preinstalled by Windows.

The installed *USB camera* device is the perimeter camera, and it is ready for use. The *USB Serial Port* and *USB Serial converter* drivers must be updated with '*DriversInstall*' software. Follow these steps to complete installation.

2. Go to '*My Computer*' and go to '*PTS 1000 4.4.2*' installation CD.

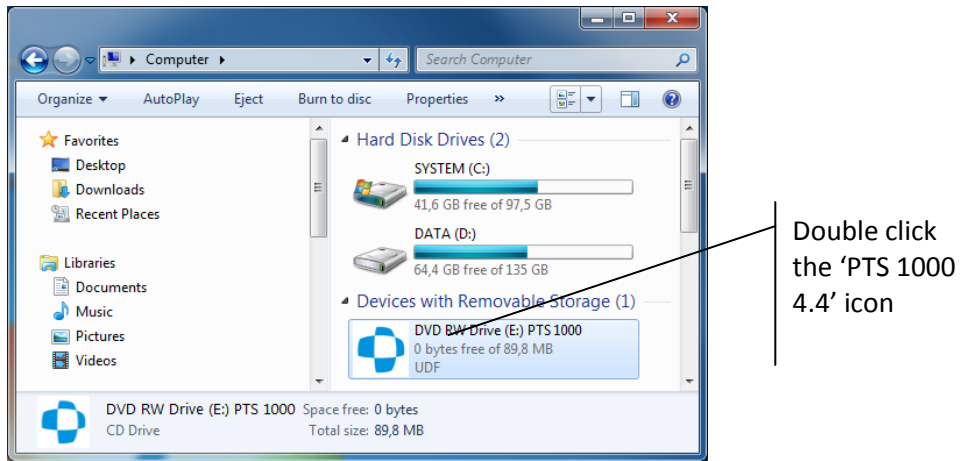


Figure 4.7. My computer screen with PTS 1000 installation CD icon.

3. Double click 'DriversInstall' icon to start drivers installation.

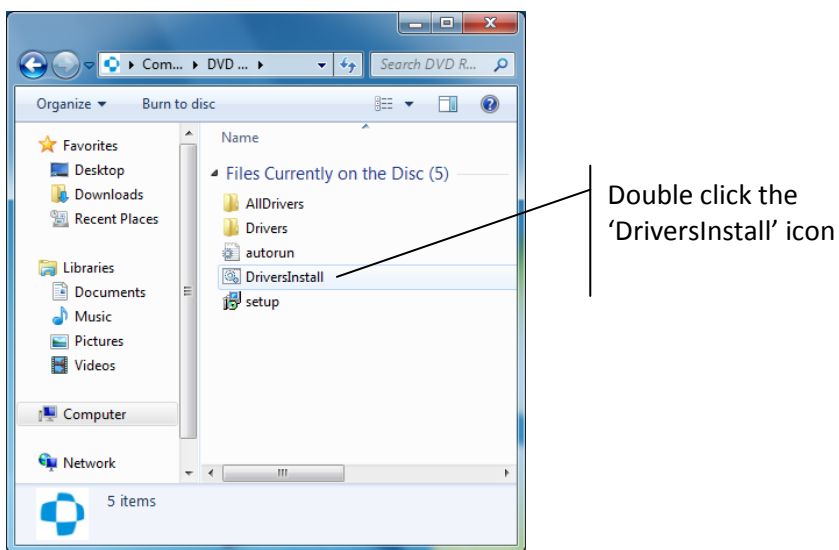


Figure 4.8. Directory of PTS 1000 installation CD screen.

4. A 'DriversInstall' wizard window will appear on the screen. Click 'Next >' to continue.



Figure 4.9. Device Driver Installation Wizard welcome screen.

5. Wait until the all drivers are installed.

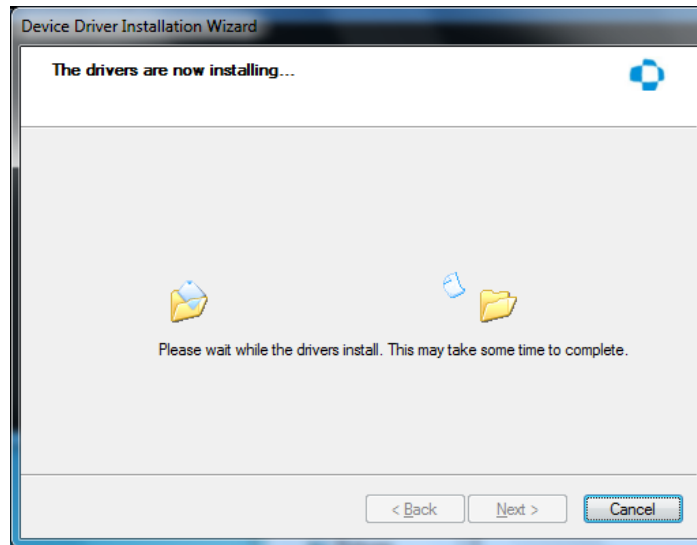


Figure 4.10. Installation in progress screen.

6. A window will appear on the screen indicating that the drivers are installed successfully on the PC. Click 'Finish' to complete drivers installation.

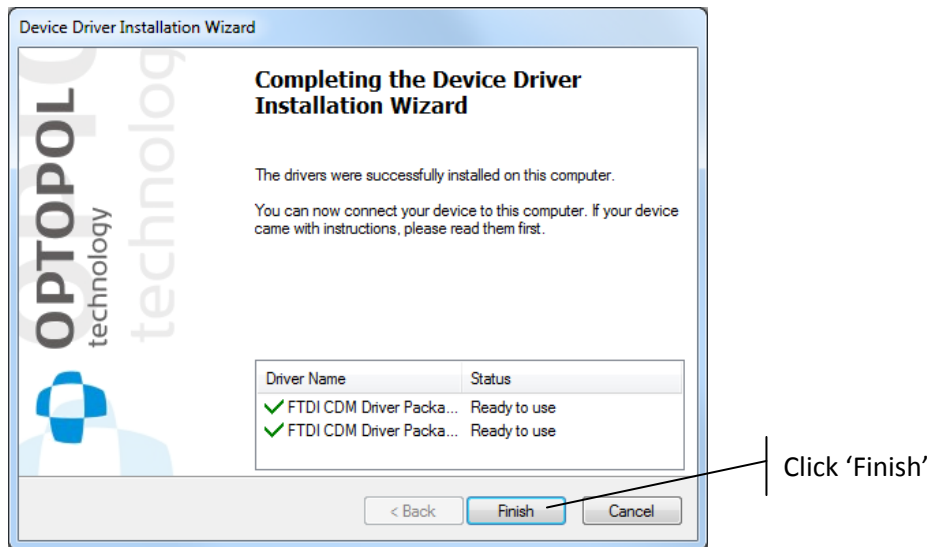


Figure 4.11. Installation completed message screen.

Install the PTS 1000 software

1. Insert the PTS 1000 installation CD into the CD-ROM drive. Click 'Computer' and open CD-ROM drive (usually D: or E:) and run SETUP.EXE file.

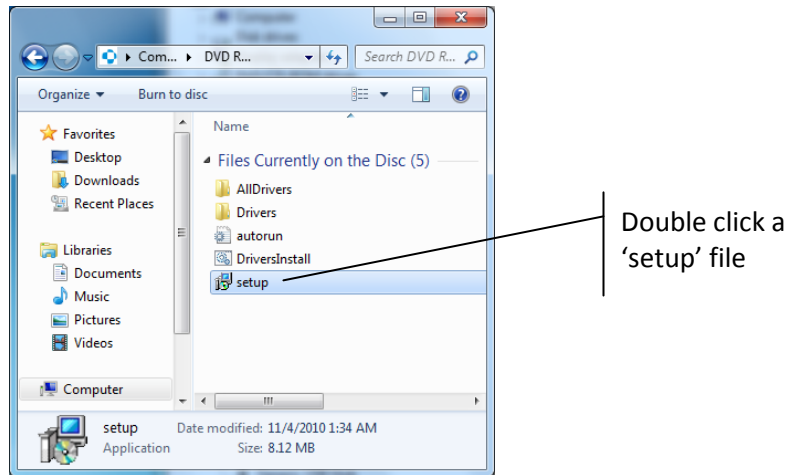


Figure 4.12. Directory of PTS 1000 installation CD screen.

2. After the message is displayed click 'Next >'.

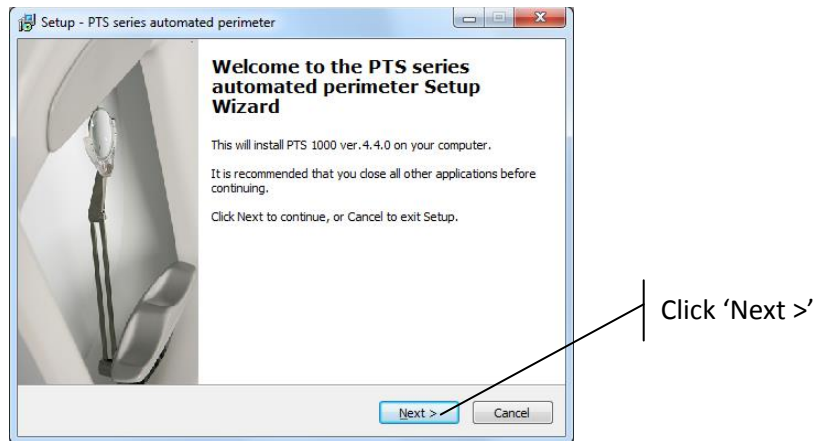


Figure 4.13. PTS 1000 installation wizard welcome screen.

3. Select the destination folder where the PTS 1000 application will be installed and click 'Next >' (the default destination folder is: C:\Program Files (x86)\PTS 1000 - for 64-bit version of Windows Vista, 7, 8, and C:\Program Files\PTS 1000 - for 32-bit version of Windows Vista, 7, 8).

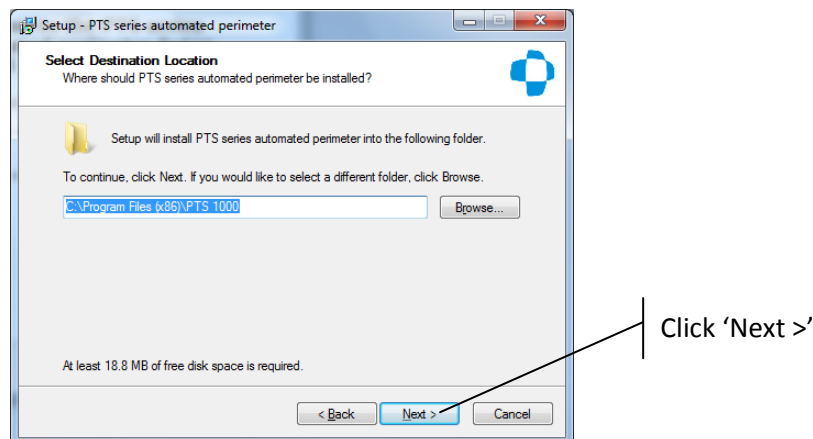


Figure 4.14. Select destination location for PTS 1000 installation screen.

4. Select the menu start group where the PTS 1000 icons will be placed (default: PTS 1000), click 'Next >'.

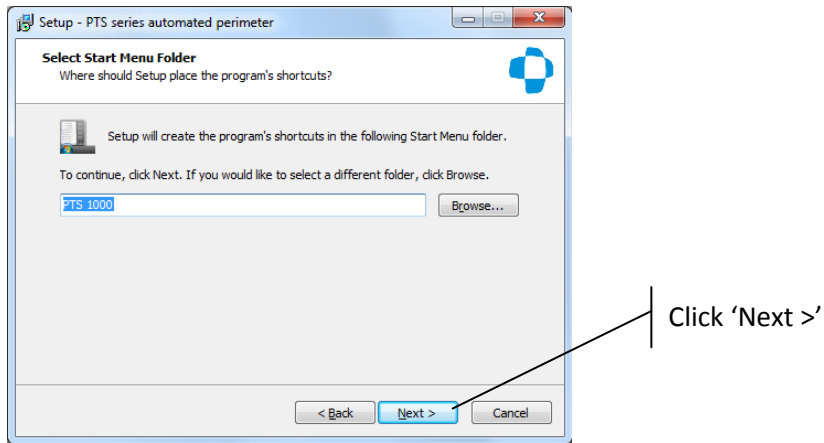


Figure 4.15. Select PTS 1000 start menu folder screen.

5. Check the box if you want the program to create a desktop icon and click 'Next >'.

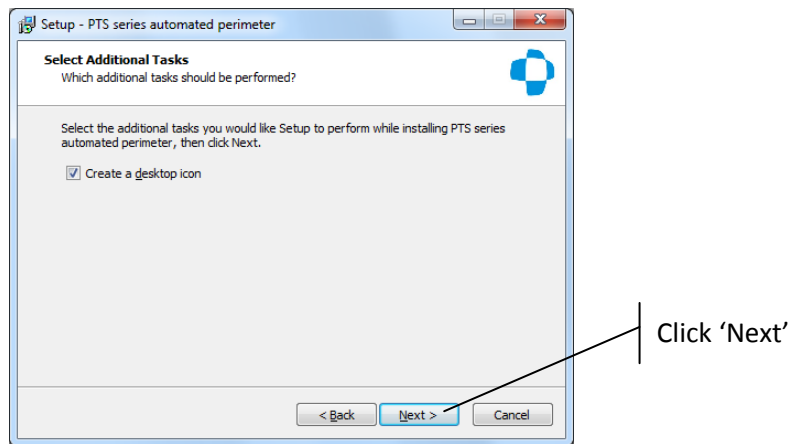


Figure 4.16. Create PTS 1000 desktop icon screen.

6. Click 'Install'.

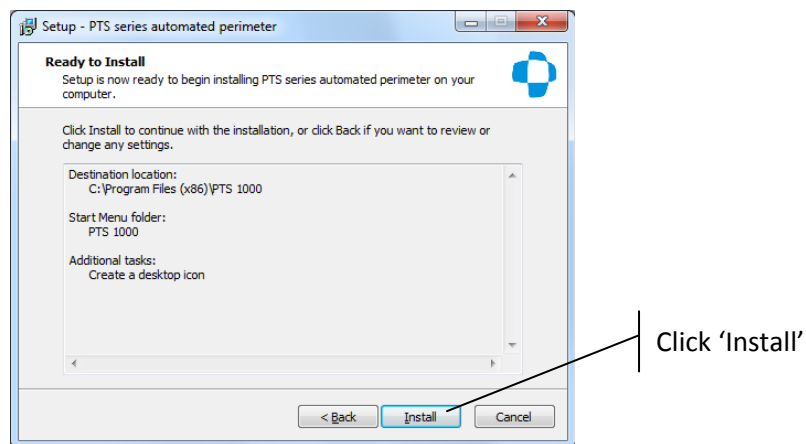


Figure 4.17. Ready to install screen.

7. Wait until the installation is complete.

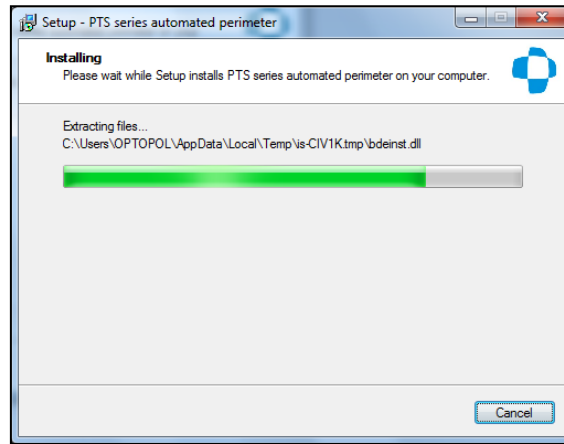


Figure 4.18. Installation in progress screen.

8. After the software is installed, click 'OK' to install BDE.

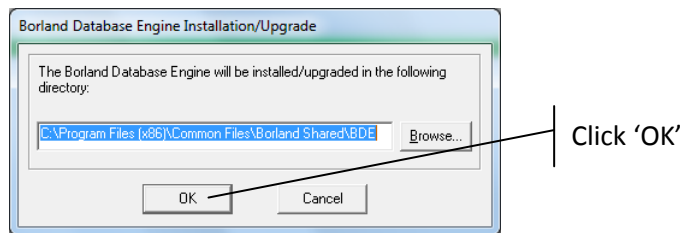


Figure 4.19. Borland database engine installation screen.

9. If a directory is not already present, the system will display a message. Click 'Yes'.

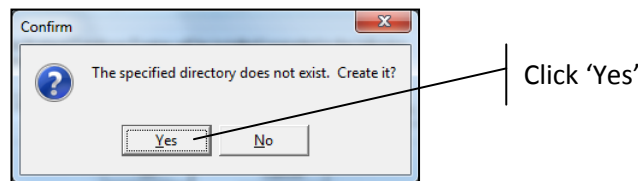


Figure 4.20. Confirmation screen.

10. Click the 'Finish' button to complete installation.

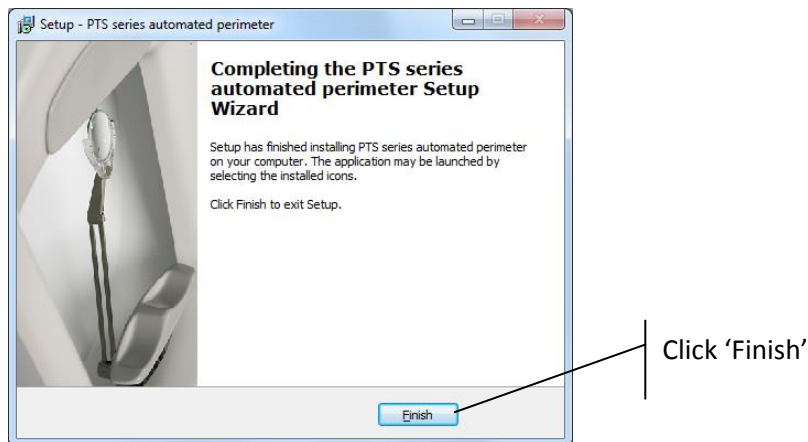


Figure 4.21. Installation completed screen.

Configure the software:

1. Double click the PTS 1000 icon to run the application (details are explained in “5. System

startup” and “6. Program structure” parts of this manual).

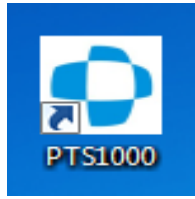


Figure 4.22. PTS 1000 icon screen.

2. Click on the 'Setup' button and go to Setup Window.

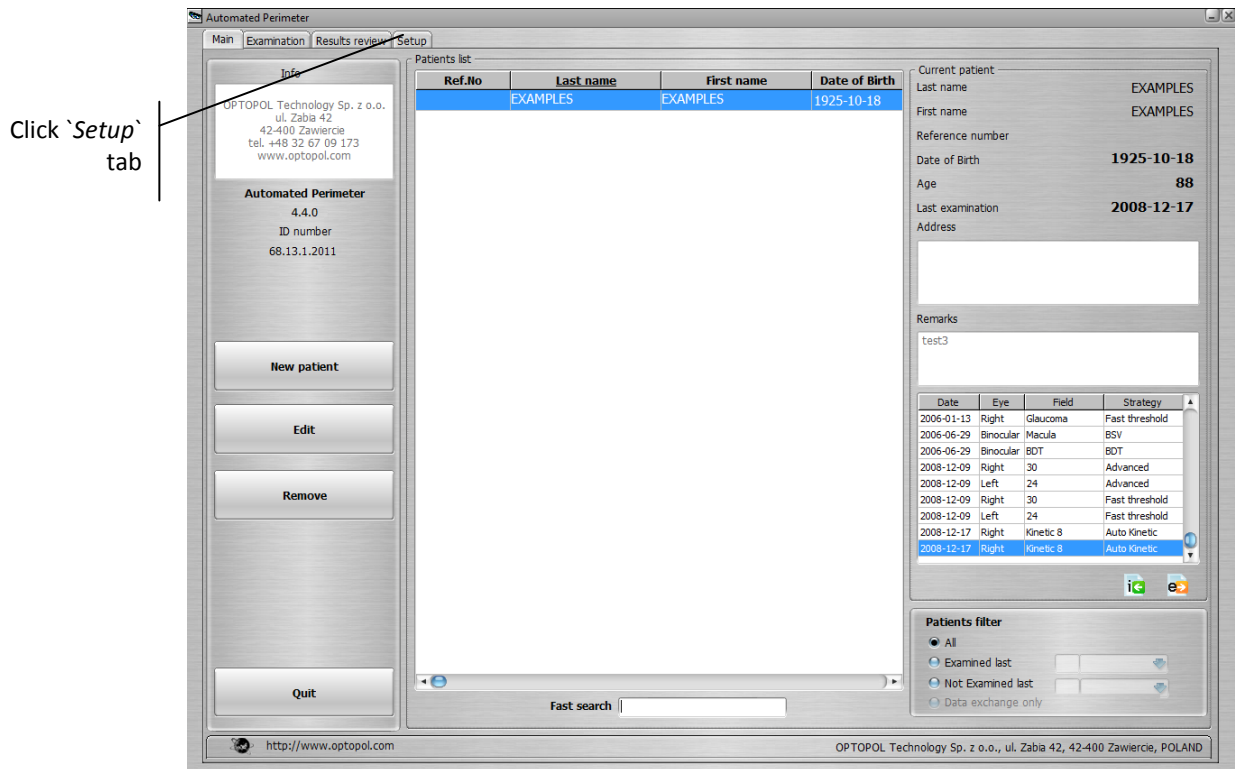


Figure 4.23. PTS 1000 main tab screen.

3. Select 'Parameters' tab.

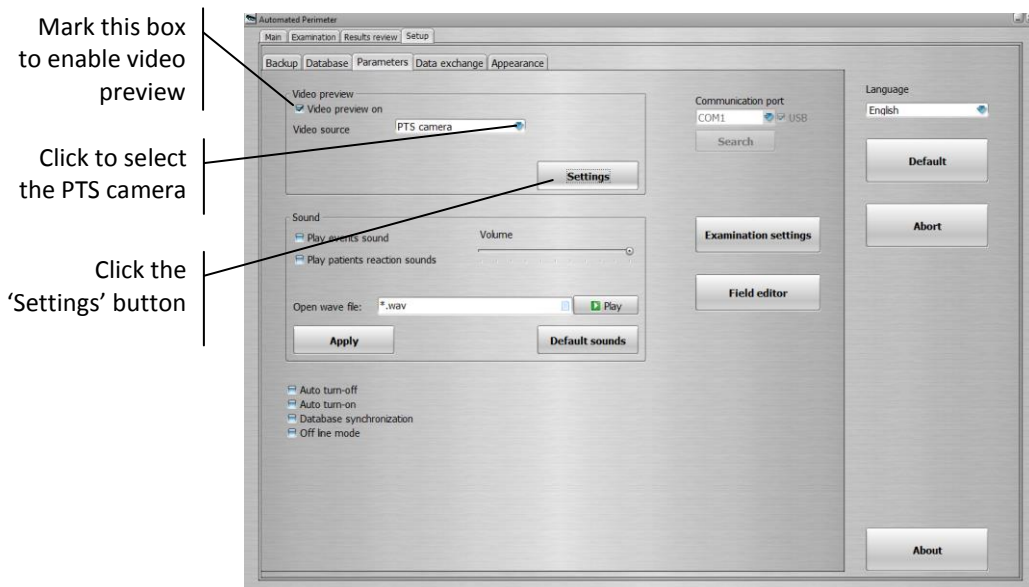


Figure 4.24. Setup window screen with parameters tab.

4. Click the 'Setting' button. The camera settings window will appear. Check if settings are default. Click 'Default' button if necessary.

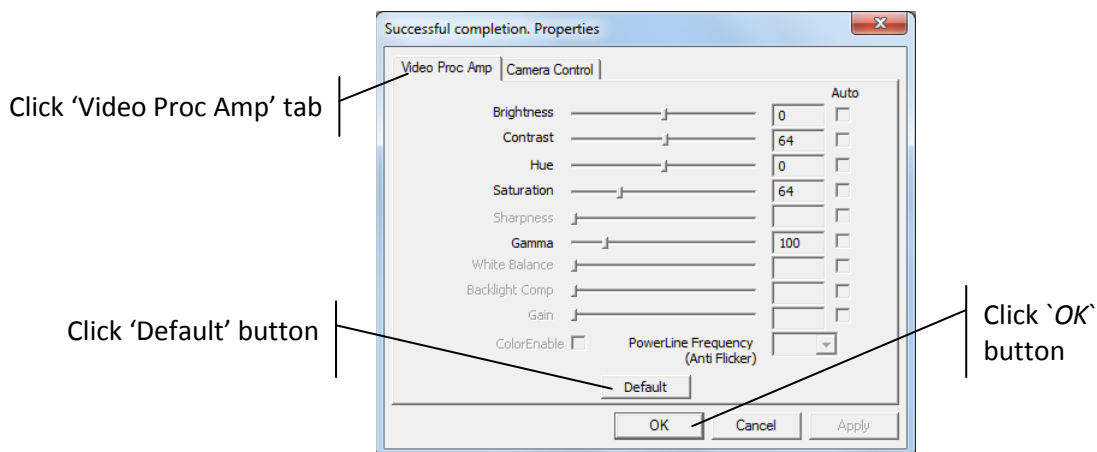


Figure 4.25. Camera settings screen.

4.2.1.4. Running PTS 1000 application in Windows 7/8/10 as Administrator

The setting “Running PTS 1000 application in Windows 7/8/10 as Administrator” is not applicable for PTS 1000 4.4 version. No administrator rights are needed to start the PTS 1000 application on the User account.

4.2.1.5. Running PTS 1000 application on Windows 7/8/10 with UAC turned off

The setting “Running the PTS 1000 application with the UAC turned off is not applicable for PTS 1000 4.4 version.

GRANTING ACCESS TO PTS 1000 FOLDER TO ALL USERS WHO WILL BE USING

PTS 1000

The setting “Granting access to PTS 1000 folder to all users” is not applicable for PTS 1000 4.4 version.

4.3. *Finishing up*

Do the following steps to finish the work with PTS 1000 perimeter up.

1. Quit the PTS 1000 application.
2. Turn off the PTS 1000 perimeter bowl.

Wait several seconds after shutting off the PTS 1000 device before turning it on again.

5. PTS 1000 maintenance

Warning!

All cleaning procedures can only be performed when the PTS 1000 series device is turned off and unplugged from mains socket.

During its lifespan, the PTS 1000 series device should not require any special cleaning maintenance. All surfaces of the bowl should be kept tidy and free of dust. Use only mild solvents for cleaning. Make sure water or any other liquid doesn't break into the interior of the bowl. Be careful not to get water or any other liquid inside the device. Periodically check to make sure there has been no mechanical damage to the bowl. Make sure the plugs are securely attached.

Disinfect the chin rest and forehead rest after each examination.

5.1. Cleaning the PTS 1000

5.1.1. Cleaning the casing

Clean the casing with a soft cloth. Only use cleaners appropriate for electronic equipment.

5.1.2. Cleaning of the bowl

Clean the bowl with a soft, slightly wet cloth. Use an appropriate glass cleaner that is transparent and colourless. Be careful not to get water inside the device.

Periodically clean the projector lens, or whenever surface contamination is present. Use only cleaners that are appropriate for glass surface and clean gently with light pressure.

5.1.3. Cleaning the applicable parts

The PTS 1000 examination bowl is equipped with the following applicable parts: chin rest, forehead rest and patient response button.

The applicable parts should be sterilized after each examination of each and every patient. Use a soft cloth, wet with ethanol solution for sterilization. The applicable parts should also be sterilized when not used for long periods of time.

Warning!

The chin rest may be detached from the bowl for easier cleaning, as shown below.

Warning!

Do not put your hands into the bowl except when cleaning it. Do not touch the scanner.

Warning!

Put the dust cover on the device when the device is not used.

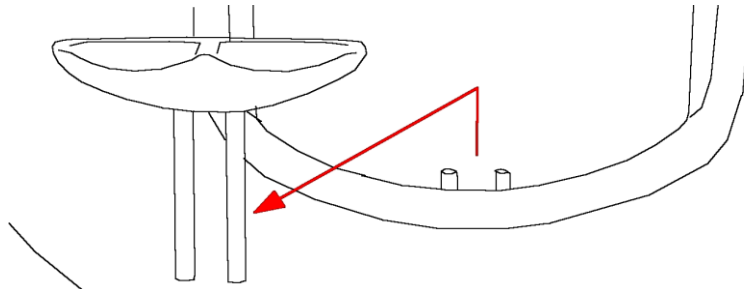


Figure 5.1. Removing the chinrest for cleaning view.

Warning !

There are no user-serviceable parts inside the device. Do not remove the device cover.

5.2. Replacing blown fuses

If the examination bowl is not operating properly after being turned on (e.g., no change in stimulus colour or sizes in the centre of the bowl), check the fuses in the power supply socket. If any fuses are damaged, replace them with new ones. Acceptable fuse types: M 3,15A L 250V, 5x20mm.

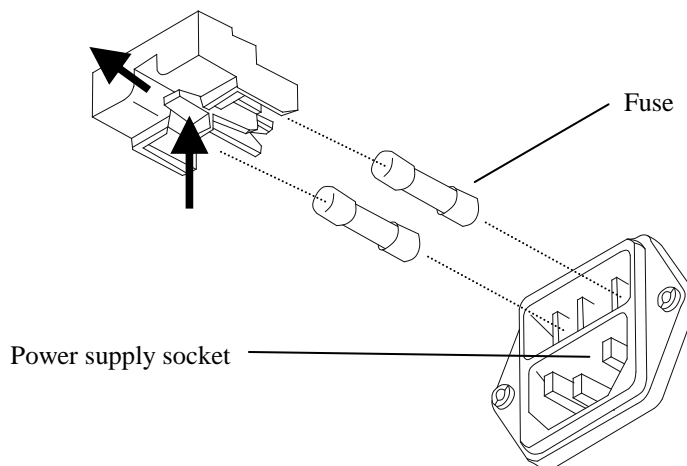


Figure 5.2. Replacing the fuses screen.

5.3. Checking the perimeter calibration

Install the perimeter bowl in the room with a dimmed light. Lower the correction lens holder down to the park position. Power on the perimeter bowl. Right after the perimeter bowl is turned on the diagnostic procedure will start. The perimeter bowl will verify the stimulus reference coordinates. Wait until the diagnostic procedure will be completed. The central fixation target LED and the background illumination will be on when the diagnostic procedure is passed.

When the background illumination is blinking after the diagnostic procedure, it means the perimeter's bowl diagnostic procedure is failed. Turn off and turn on the perimeter bowl again. If the problem repeats contact your local distributor.

Note: Lower the correction lens holder down to the park position before turning on the perimeter's bowl. Otherwise the diagnostic procedure may be disrupted.

6. System and PTS 1000 program startup

After Windows has started, you can run the PTS 1000 software. Click the “Start” button and find the proper folder containing the PTS 1000 application. Click the PTS 1000 icon, or click the desktop shortcut if you created one. The program will be started.

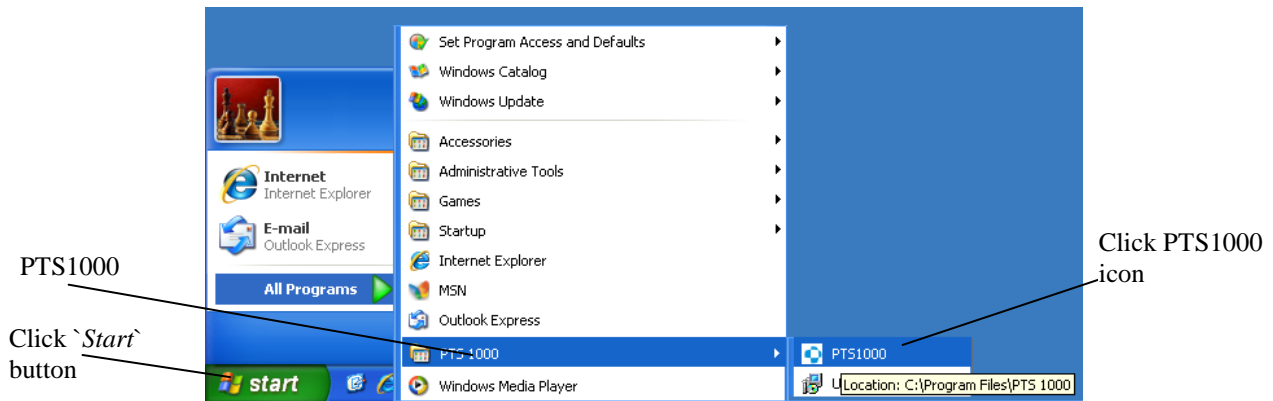


Figure 6.1. Windows start menu with PTS 1000 folder.

If you are using this computer only for the PTS 1000, you can set it up to start automatically. See details in the next section of this manual.

7. Program structure

PTS 1000 software is designed to make operation as easy as possible for the user. Buttons are easy to identify and use and are conveniently located on the screen.

The PTS 1000 software is operated by setting the cursor on desired field and clicking the left mouse button. Cursor takes a shape adequate to the field:

- The cursor placed on the active field (i.e. button, check box, list of parameters) has an index finger shape.
- The cursor placed on the text field has an vertical line shape.
- The cursor placed on no active field (without any assigned function) has an arrow shape.
- When the left mouse button is clicked, the keyboard cursor will appear in the same place as the mouse cursor (if the keyboard cursor is allowed to be placed there). Each character entered from keyboard will appear in place of this cursor.



- Switch between different controls using the mouse cursor or *TAB* key. Choosing the active control is confirmed by pressing the *ENTER* key.

The PTS 1000 application is divided into four main tabs. You can move freely between them.

- Main tab** – basic window visible just after program startup. It enables the user to operate the database, register new patients, edit patient data, etc.
- Examination tab** – contains all controls that are used to conduct a new examination.
- Result review tab** – is used to review examination results.
- Setup tab** – is used to configure the entire application and to perform some database operations (backup, data recovery, etc.).

8. Main tab

The main tab appears on the screen just after the application is started. It enables the user to control the patient's database:

- register new patients,
- remove patients,
- edit patient's personal data,
- enter remarks concerning selected patients.

All controls located on main window are shown below:

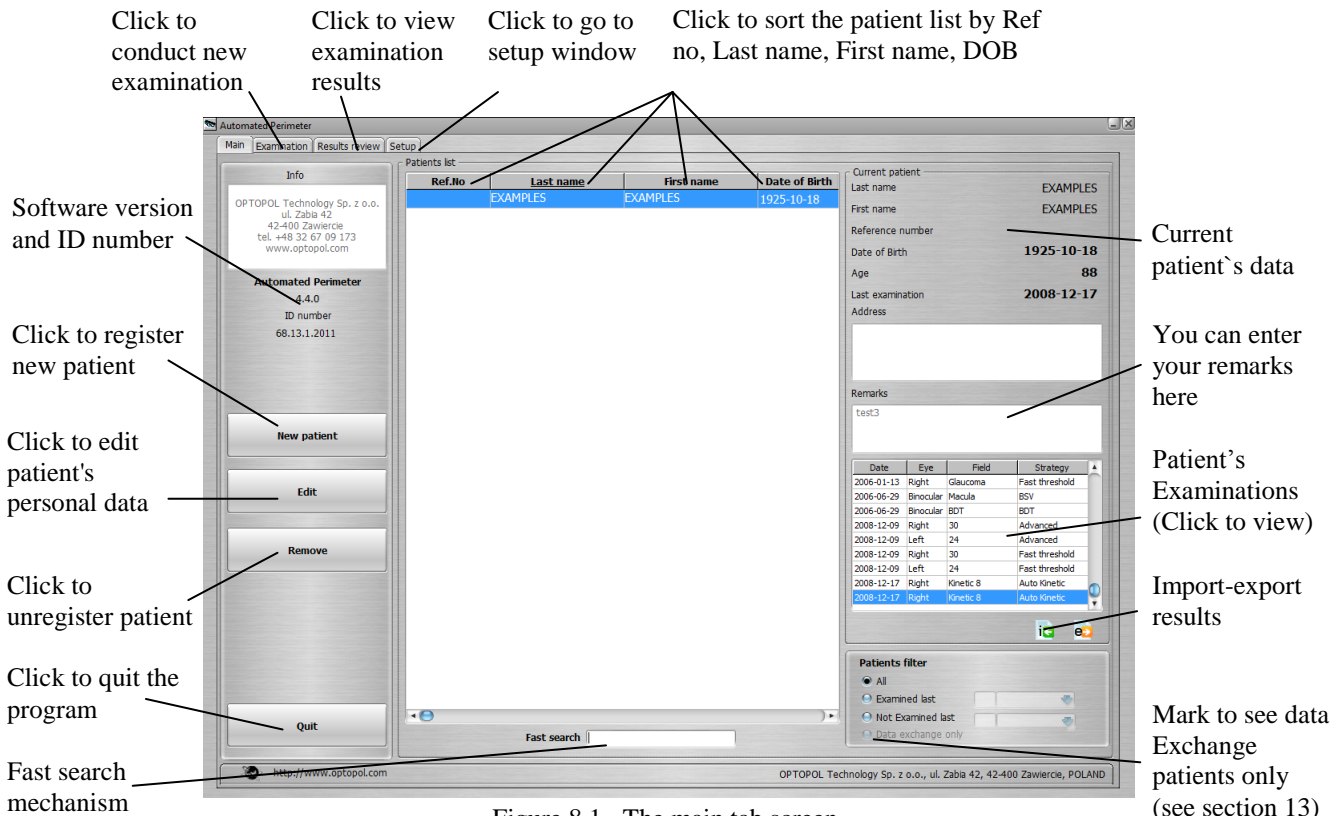


Figure 8.1. The main tab screen.

8.1. Fast search mechanism

If you find it difficult to locate your patient in the database, click the patient list column you want to use for searching, go to fast search control and patients filter. Enter the first few letters of the patient's name to quickly locate the patient in patients list. The program will automatically search for the closest match.



Figure 8.2. The fast search and patients filter tools.

You can also use the patients filter. It can be used to display only those patients who have been examined during last [days/months/years] or who have not been tested in a given period.

8.2. Registering new patients

In order to register a new patient, click “New patient” button. Enter last name, first name and date of birth. Enter patient’s address and add some of your remarks. The patient diagnostic data can be entered respectively in the left eye and right eye column.

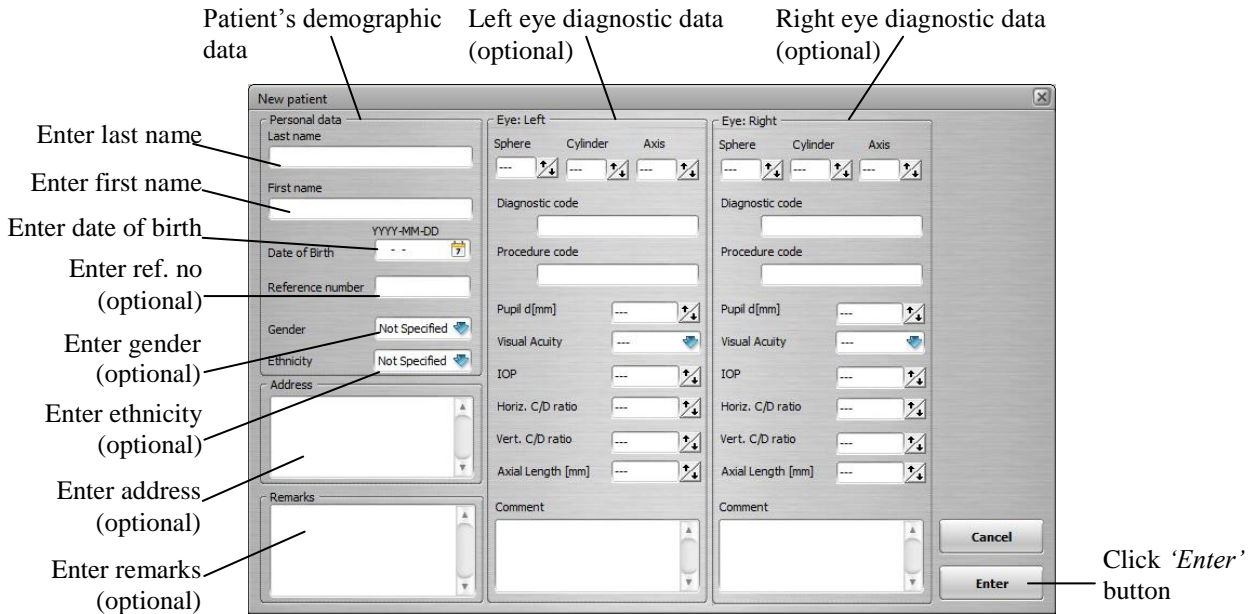


Figure 8.3. New patient window screen.

Demographic Data

Description

Last name	Last name of the registered patient. Up to 60 characters can be entered. Any character from the keyboard including spaces can be used. The field is filled with uppercase letters irrespectively of caps lock button status.
First name	First name of the registered patient. Up to 60 characters can be entered. Any character from the keyboard including spaces can be used. The field is filled with uppercase letters irrespectively of caps lock button status.
Date of birth	Date of birth of the registered patient. Format of date of birth is displayed according to the current Windows regional settings. Date of birth can be entered by typing the numbers on the keyboard or selecting the date in calendar. Click the calendar icon in Date of birth field to use the calendar.
Reference number	Reference number of the registered patient. Up to 64 characters can be entered. Any character from the keyboard including spaces can be used. The field is filled with uppercase letters irrespectively of caps lock button status.

Note: reference number of the patient is not mandatory, however, it is recommended to use it. It will eliminate a conflicts in case when two patients of the same names and date of birds are registered.

Gender	Gender of the registered patient. Available status: Male, Female, Not Specified. Default status: Not Specified.
Ethnicity	Caucasian, African American, Japanese, South Asian, East Asia, Hispanic, Other Combined, Not Specified. Default status: Not Specified. Note: There is no influence on the results in relation to the currently selected ethnicity, the ethnicity is used only for information. This field is not mandatory.
Address	Address of the registered patient. Up to 255 characters can be entered. All types of characters can be used. Not mandatory field.
Remarks	Remark concerned the registered patient. Up to 255 alphanumeric characters can be entered. All types of characters can be used. Not mandatory field.

**Left eye / Right eye
Diagnostic Data**

Description

Sphere	A spherical component of the patient's refraction. Input range: -20D - +20D in 0.25D step.
Cylinder	A cylindrical component of the patient's refraction. Input range: -20D - +20D in 0.25D step.
Axis	Axis of cylindrical component of the patient's refraction. Input range: 0° - 180°. Axis value can be adjusted with up and down increment arrows in 5° step, or with numeric keyboard in 1° step.
Diagnostic code	A clinical code to group and identify diseases, disorders, symptoms, poisonings adverse effects of drug and chemicals and other reasons of patient encounters. Input range: up to 14 characters can be entered. All types of characters can be used. Uppercase and lowercase characters are considered.
Procedure code	A clinical code used to identify health interventions taken by medical professionals. Input range: up to 14 alphanumeric characters can be entered. All types of characters can be used. Uppercase and lowercase characters are considered.
Pupil d[mm]	Diameter of the pupil. Input range: 0 - 14mm, in 0,1mm step. Pupil value can be adjusted with up and down increment arrows in 1mm step, or with numeric keyboard in 0,1mm step.
Visual acuity	Visual acuity of the patient's eye. Click the blue arrow in the Visual acuity field to develop list and select a desired value with mouse. Input range: 20/10 up to >20/400 in Snellen scale.

IOP	Intraocular Pressure Input range: 0 - 75mmHg, in 1mmHg step.
Horizontal C/D	Horizontal Cup to Disk ratio Input range: 0.00 - 1.00, in 0.01 step.
Vertical C/D	Vertical Cup to Disk ratio Input range: 0.00 - 1.00, in 0.01 step.
Axial Length	Axial length of the eyeball Input range: 0 - 30mm, in 1mm step.
Comment	Additional information related to the eye status. All types of characters can be used.

Note: the patient refraction is not the mandatory field, however it is recommended to update it, because it has a significant influence for the examination results.

Click “Enter” to complete registration of a new patient. The program will check the entered data. You will be prompted to fill in any missing data.

Important!

Remember to enter the patient's name correctly. Otherwise, it may be difficult to locate the patient in the database in the future.

If a patient is already registered in database, you will receive a warning message:



Figure 8.4. Patient already registered warning screen.

When the program finds a patient with the same last name and first name, but different date of birth, you will receive a warning message: “There is a patient with the same name already registered”. After that you should check the patient's personal data in the database since the same patient could have been registered before with an incorrect date of birth.

Choose “Yes” to register the patient. Chose “No” when you want to correct the data.

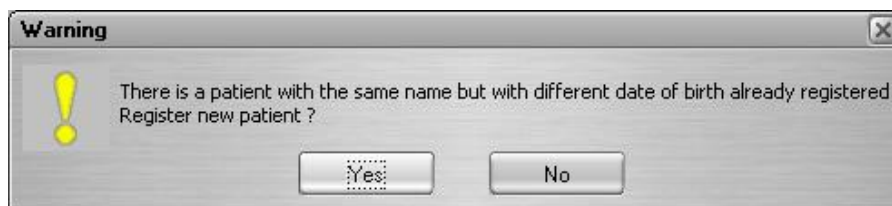


Figure 8.5. Register new patient confirm screen.

Important!

It is recommended to enter the actual patient’s refraction data to ensure correct lens usage.

8.3. *Editing a patient's personal data*

To edit incorrect data, select the patient from the patients list and press the “*Edit*” button. The ‘Edit’ window will appear and you will be able to enter the proper data. After the data are entered, the program will check the new data and they will be saved in database.

8.4. *Unregistering patients*

To unregister a patient, select the patient from the patients list and press the “*Remove*” button. A warning message will appear:



Figure 8.6. Are you sure screen.

When you choose “*Yes*”, a second and last warning message will appear:

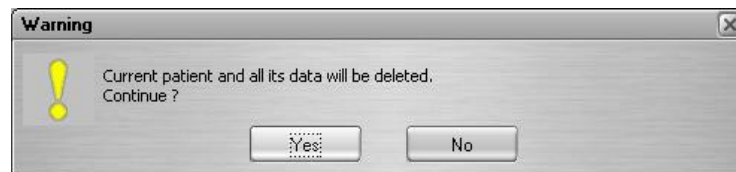


Figure 8.7. Warning screen.

When you chose “*Yes*” again the patient and his or her examination results will be unregistered and deleted.

Once deleted, a patient cannot be restored. Make sure you are unregistering the proper patient.

9. Examination tab

The examination tab is used to perform new examinations and to control examination parameters. It is possible to conduct static or kinetic examination. Choose by clicking the proper tab at the top of the window. By default, the static examination window is selected.

9.1. Static examination

Picture of “Examination tab” is printed below:

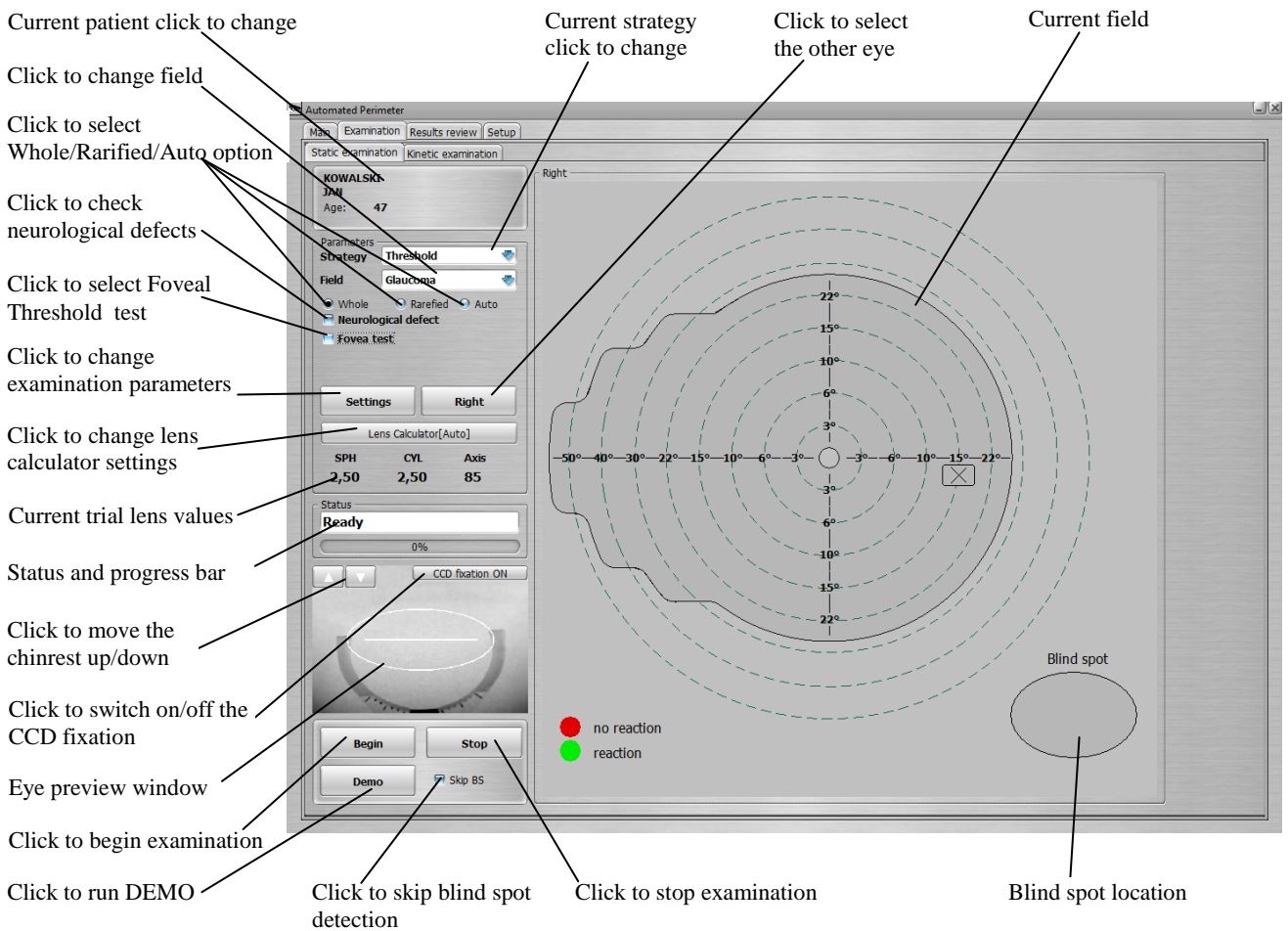


Figure 9.1. Static examination window screen.

The following instantaneous values of the parameters, processing during examination are show during the examination:

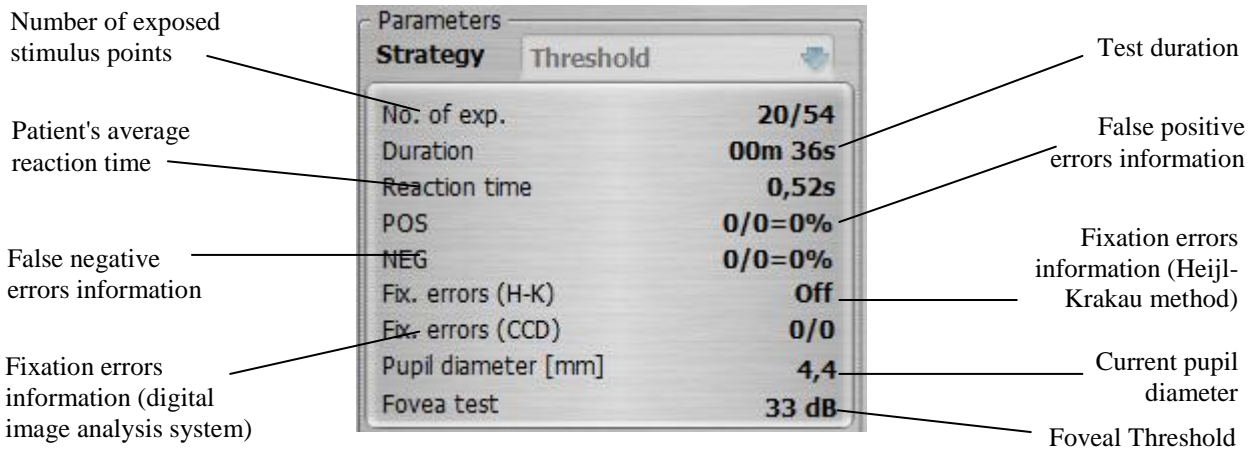


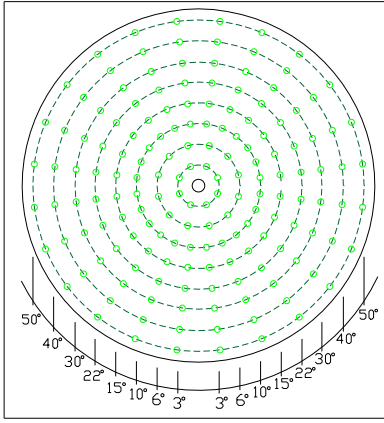
Figure 9.2. Current examination parameters screen.

9.1.1. Field selection

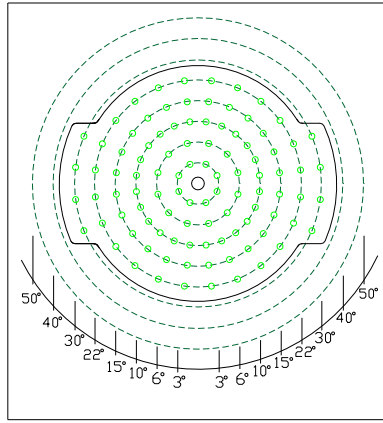
To select the proper field range click the “*Field*” box from the Examination window. A small tab will be opened showing you all available fields. Select one by clicking the mouse cursor.

Available fields:

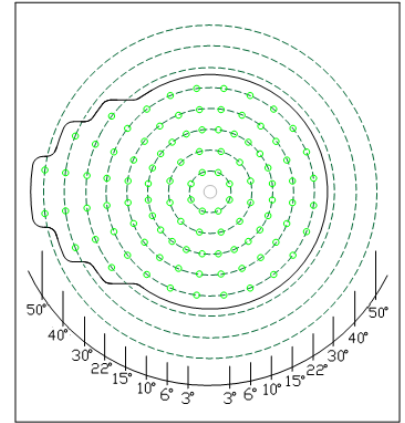
- Full (50° in every directions)
- Central (30° in horizontal axis and 22° in vertical axis)
- Glaucoma (30° with extend up to 50° in nasal direction)
- Peripheral (from 30° to 50°)
- Macula (up to 10°)
- Extended (special field for drivers examination – 50° in nasal direction; 80° in temporal direction)
- Fast (up to 30° with scarce locations)
- User (up to 50° user defined)
- Binocular Driving Test(up to 80° in horizontal axis, up to 50° in vertical axis)
- 30 (30° in horizontal and vertical axis, locations placed on square basis)
- 24 (24° in horizontal and vertical axis, extended to 30° in nasal direction)



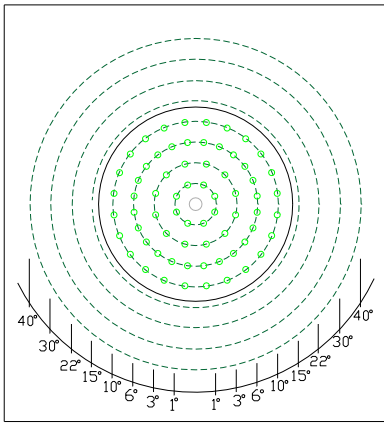
Full field



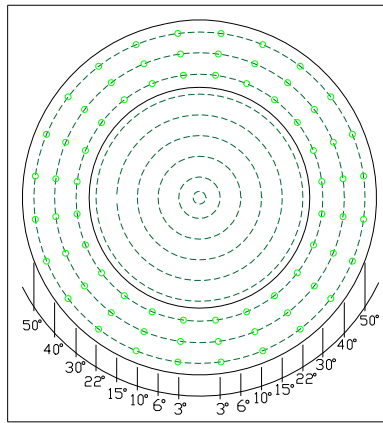
Central field



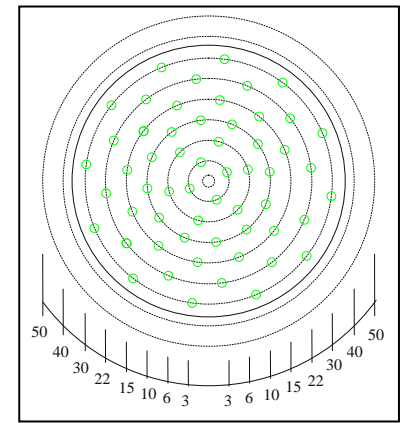
Glaucoma field, Right Eye



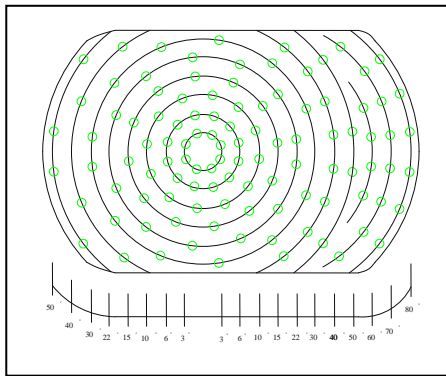
Macula field



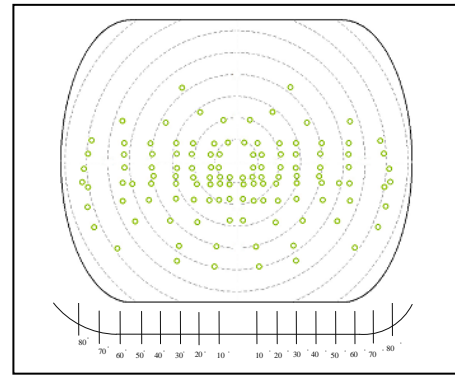
Peripheral field



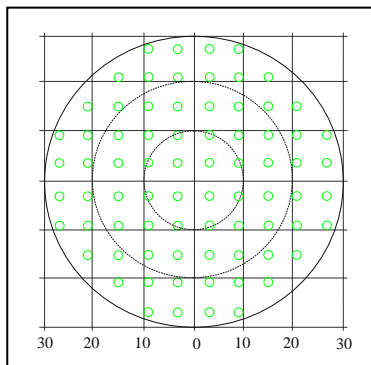
Fast field



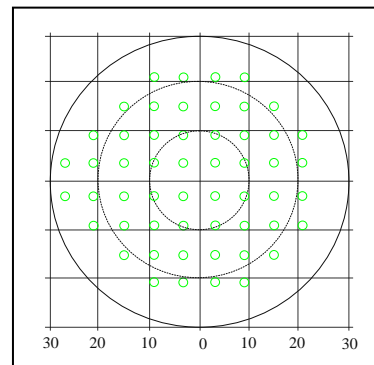
Extended field, Right Eye



Binocular Driving Test field



30



24, Right Eye

Figure 9.3. PTS 1000 testing fields.

9.1.2. Strategy selection

Select the “Strategy” box to choose the desired strategy. A small tab will be open showing all available strategies. Select the desired strategy using the mouse cursor.

There are five available strategies:

- Threshold,
- Fast Threshold,
- Advanced,
- 3-Zone,
- Screening,
- Binocular Single Vision (BSV),
- Flicker,
- Binocular Driving Test (BDT).

9.1.2.1. Threshold strategy

The threshold strategy tests the profile of the entire eye. It not only locates defects and measures their depth, but also exactly measures the shape of the visual field. While the threshold strategy is the most accurate approach, it requires the longest examination times of all five available strategies.

The first exposure is made at HOV level. When patient reacts, intensity of the next stimulus is decreased by 3dB. In case of no reaction, intensity of the next stimulus is increased by 6dB. The stimulus intensity is changed until the sensitivity edge is reached, then the stimulus intensity is reversed in 3dB steps. Value of the last seen intensity is assigned as the threshold of differential light sensitivity. This double-check enables the determination of the most precise sensitivity level for each patient.

This process is shown below.

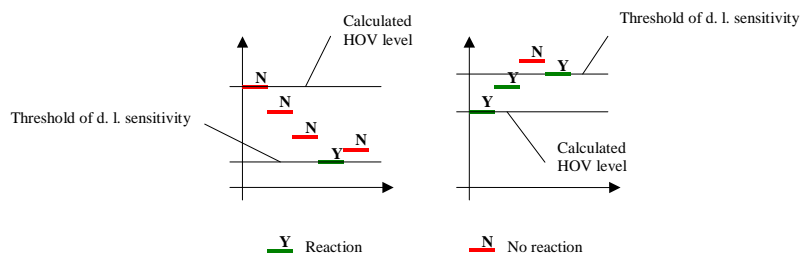


Figure 9.4. Threshold strategy principle of action diagrams.

9.1.2.2. Fast threshold strategy

Fast threshold strategy is very similar to threshold strategy. The difference is in the duration of the examination. After calibration, initial levels of stimuli intensity are additionally modified on the basis of measured sensitivity locations from previous examinations of a given patient to minimize the examination time. The examination consists of two stages.

In stage one, locations are tested using ordinary threshold strategy (see section 9.1.2.1 *Threshold strategy*). After collecting half of the data, the program calculates expected sensitivity levels for the rest of locations that haven't been tested yet. In stage two, the program detects threshold within the range from HOV[dB] level to 0[dB] level with 3dB steps. As a result, the fast threshold strategy provides accuracy comparable to that of threshold strategy but does so in 30% to 40% less time.

9.1.2.3. Advanced strategy

Advanced strategy was developed to decrease examination time without loss in resolution. In this mode the examination is divided into 3 virtual stages (Quick – Intermediate – Accurate). Within the each particular stage, testing points are organized in the regular square grid, based on the every second location of the field. Each stage has its own individual grid.

Therefore, completing only the first stage of the examination (50% of locations are tested) provides information about the whole tested area through the use of interpolation. Locations examined further increase density of tested locations within the tested area. After completing all 3 stages, all locations in the 30(24) pattern are tested and the degree of interpolation is decreased to 0. The examination can be stopped at any time after completing the first stage; all data collected up to then is utilized to generate a result. By default, an *Accurate* mode of the advance strategy is preset.

By using the track bar, the operator can select how many stages should be examined:

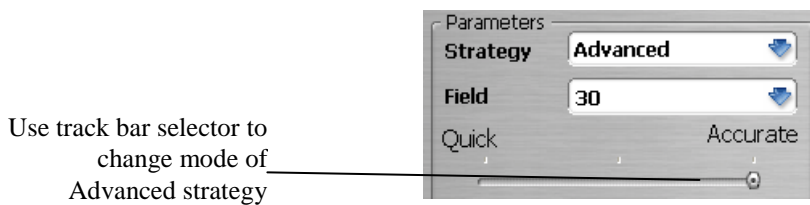


Figure 9.5. Advanced strategy mode adjustment: Accurate / Intermediate / Quick.

9.1.2.4. 3-zone strategy

In 3-zone strategy, each location is tested a maximum of 3 times. The first exposure is made at 6dB below HOV level (stimulus is brighter than expected). If he or she reacts, the location is no longer tested and marked as NO DEFECT (a small dot appears on screen ●).

If there is no reaction for stimulus, the location is exposed with maximum intensity (0dB). If there is no reaction for maximum intensity, the location is no longer tested and marked as ABSOLUTE DEFECT (filled square appears on screen ■). If there is a reaction for maximum intensity, the location is tested again at 6dB below expected HOV level. If there is no reaction, the location is marked as RELATIVE DEFECT (small empty square appears on screen □), otherwise the location is marked as NO DEFECT. The following schematics illustrate this process:

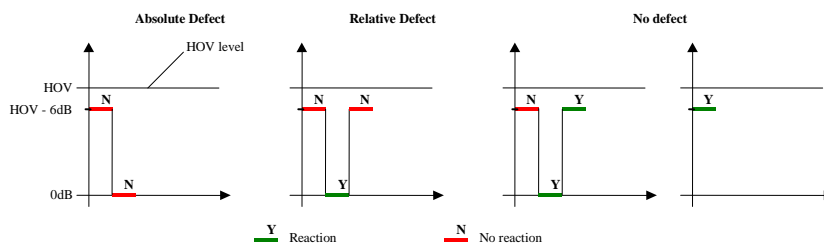


Figure 9.6. 3-zone strategy principle of action diagrams.

As shown, the 3-zone strategy can be used for locating visual field defects without measuring the depth of those defects.

9.1.2.4.1. 3-Zone testing using extended field

Unlike the all other fields, extended field enables visual field testing up to 80 degrees. It can be achieved by shifting the fixation point 30 degrees left or right. The examination consists of several stages.

In stage one, a normal 3-Zone test is performed (just as for all other fields). After a certain number of locations are tested, the fixation point is shifted.

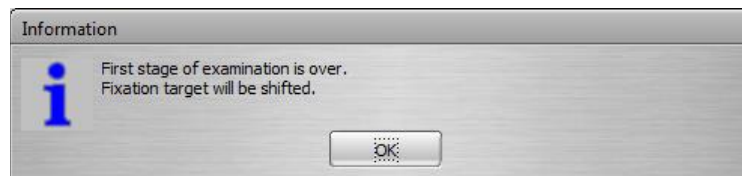


Figure 9.7. Fixation shift information screen.

The patient should be instructed to look in the new fixation target. The examination may be resumed when the user ensures that the patient's position is correct.

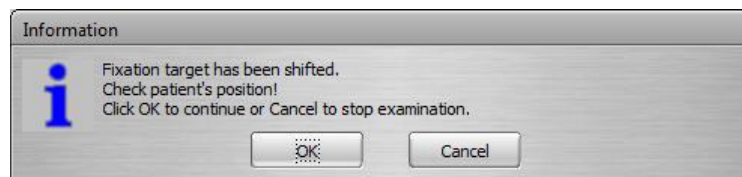


Figure 9.9. Fixation shifted information screen.

Confirm that the patient is looking at the new fixation point, then click the 'OK' button to continue.

Extended field can be tested only with the 3-Zone strategy

After moving the fixation point, retesting the blind spot is not available.

9.1.2.5. Screening strategy

Screening strategy provides more accurate results than 3-zone strategy. It not only locates defects but also measures the depths of those defects. The first stimulus exposure is made at 6dB below expected HOV level (stimulus is brighter than expected). If the patient's reaction is observed, current intensity is assumed as measured sensitivity for this location and it is no longer tested.

If there is no reaction, the intensity is increased in 6dB steps until the patients reacts for the stimulus or until maximum intensity is reached. If maximum intensity is reached, the location is marked as absolute defect and no longer tested (X mark is displayed on the screen).

If the patient reacts, the stimulus intensity is decreased in 3dB steps until stimulus is invisible to the patient. The value of the last seen intensity is assumed as a threshold of differential light sensitivity.

The following schematics illustrate this process:

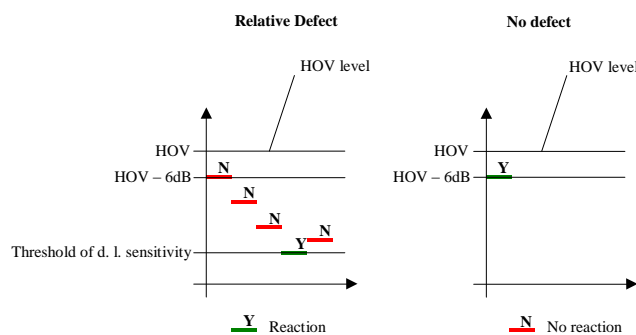


Figure 9.10. Screening strategy principle of action diagrams.

As can be seen from the graphs above, screening strategy can detect defects deeper than 6dB. It doesn't detect areas that are more sensitive than expected; i.e., it doesn't test actual eye profile, it detects defects only.

9.1.2.6. BSV strategy

The BSV strategy is used to diagnose diseases related to common eyes movement coordination and for diplopia.

During the examination the patient observes the examination bowl with both eyes open, with his or her head placed centrally using the chin-rest adapter. The device will expose stimuli with maximum intensity at different locations of the examination bowl. The patient should follow the stimuli with his or her eyes and react on the patient response button. If the patient sees a single point, he or she should press the button once. If he or she sees two points, then he or she should press the button twice.

Each of the examined locations can have one of three possible values:

- - normal single vision
- ✗ - total no reaction
- - dual vision

A detailed description of how to perform examinations using BSV can be found in section 9.7.5 *Examination with BSV strategy* of this manual.

9.1.2.7. Flicker strategy

Flicker strategy is used to measure a patient's Critical Fusion Frequency (CFF). In this strategy the examination is performed differently than in other strategies. Exposed stimuli are not static; they blink with different frequencies. Instead of measuring the brightness sensitivity threshold in each location, CFF measures the frequency where the patient can see the blinking. Each stimulus is presented with maximum intensity and maximum frequency. During examination, the frequency is decreased until the patient can see the flickering. The patient should be instructed to press the button only if the flickering point is visible. Stimuli are exposed in random places of the examination field for 3 seconds each. During exposure, frequency of stimulus decreases from 60 Hz with 4 Hz steps until the patient reacts or exposure time ends. Minimum flicker frequency is 3 Hz.

Results are measured in Hz. If flicker frequency reaches a value of 3 Hz and there is still no reaction from the patient, location is marked as "X".

A detailed description of how to perform examinations using Flicker strategy can be found in section 9.7.6 *Examination with Flicker strategy* of this manual. A schematic of the Flicker strategy is shown below.

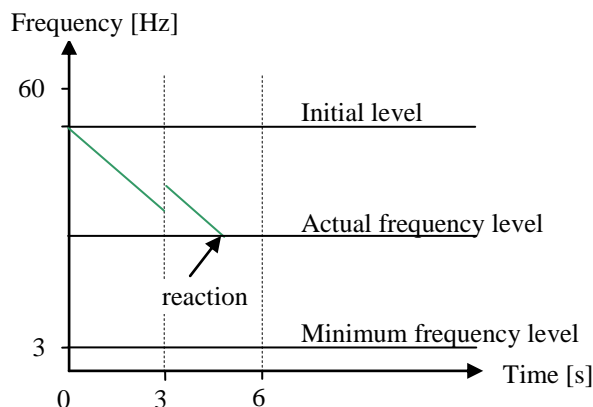


Figure 9.11. Flicker strategy principle of action diagram.

9.1.2.8. BDT strategy

The BDT strategy is a binocular test measuring full field of vision for drivers (by default it suits III4e Goldmann stimuli).

During the examination the patient observes the examination bowl with both eyes open, with his or her head centrally placed using the chin-rest adapter. The device will expose stimuli with the same intensity for all locations at different places of the examination bowl. The intensity can be selected in the settings window. The patient should look at the fixation point with both eyes and react on the patient response button when he or she sees any points appear.

Each of the examined locations can have one of two possible values:

- - seen location
- - missed location

A detailed description of how to perform examinations using BDT can be found in section 9.7.7 *Examination with BDT strategy* of this instruction manual.

9.1.3. Reduced field

After starting a new examination, the program searches its database for previous examinations of the patient. If those examination results are found, the program searches for absolute defects in those examination results („X” marked). If absolute defects are found, the program asks if the new examination should be performed without testing absolute defect areas. If reduced field is not used, the whole field is tested. Otherwise, absolute defect areas are excluded from the examination. The reduced field feature doesn't apply to 3-Zone, BSV and Flicker strategy.



Figure 9.12. Use reduced field confirmation screen.

9.1.4. Rarefying of tested locations

It is possible to reduce examination time by decreasing the number of examined locations. There are 2 options for field rarefaction:

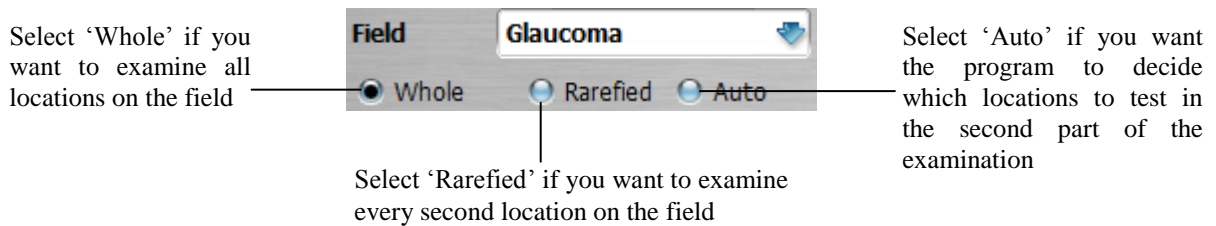


Figure 9.13. Selecting the Whole – Rarefied – Auto option screen.

- Rarefied c number of examined locations is halved,
- Auto – in the middle of the examination, the program checks which location lies, between defective locations and requires testing.

9.1.5. Neurological field reduction

The PTS 1000 automated perimeter drastically shorten exam duration by using neurological reduction. If the neurological option is “On” after the process of calibration, the program analyzes the four calibrated locations. If none of them is marked “X”, then there is no neurological reduction, and examination is continued. If one or more are marked “X”, an additional three locations are exposed at maximum luminance at the selected quadrants. If the patient doesn't respond to any of those stimuli at the current quadrant, the whole quadrant is marked “X” and excluded from further examination.

Mark checkbox to use neurological defect option

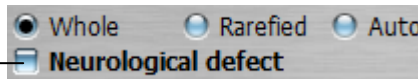
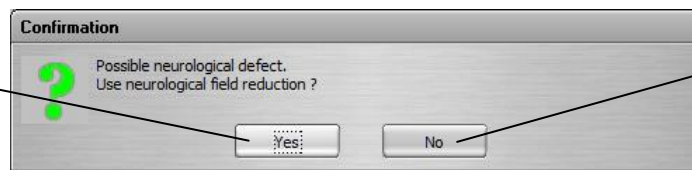


Figure 9.14. Neurological defect checkbox screen.

Click 'Yes' if you want to use neurological field reduction



Click 'No' if you want to continue examination without neurological reduction

Figure 9.15. Use neurological field reduction confirmation screen.

Neurological reduction cannot be turned on when using 3-zone, BSV, Flicker, Advanced and BDT strategy.

9.1.6. Foveal threshold test

The foveal threshold test measures the sensitivity of the central part of the macula, the fovea. The foveal threshold test is turned on before examination, with the 'Foveal test' check box.

Click to turn on / turn off the Foveal threshold test

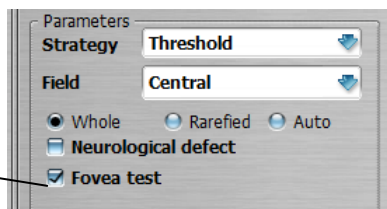
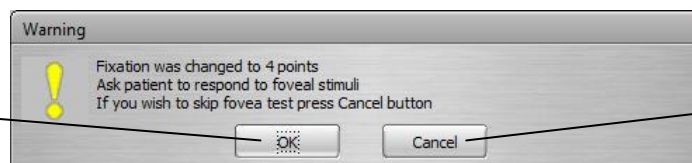


Figure 9.16. Selecting the Foveal threshold test.

The foveal threshold test is performed as follows:

After the examination is started, the fixation target is changed to 4 points – diamond shape, and stimulus is exposing in the center of diamond. The patient is asked to look in the center of diamond shape and to respond to the stimulus he or she can see. The corresponding information window appears on the screen as below. The examination is paused and it waits for confirmation. Click 'OK' if you want to do examination with foveal threshold test. Click 'Cancel' if you want to continue examination without foveal threshold test.

Click OK to proceed examination with Foveal threshold test



Click Cancel to continue examination without Foveal threshold test

Figure 9.17. Fixation target changed to diamond information screen.

When Foveal threshold test is completed, the fixation target is switched back, as it was originally set in the examination settings. The examination is paused and it waits for confirmation. The message window will appear as follows:

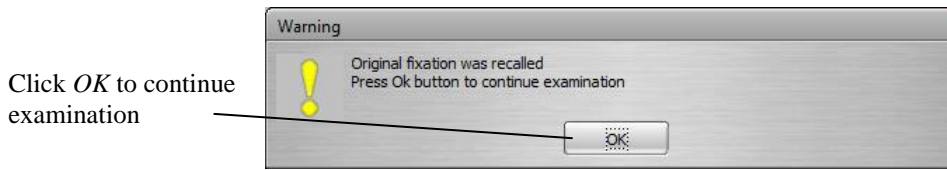


Figure 9.18. Fixation target changed to original information screen.

Confirm the message with 'OK' to continue examination.

9.1.7. Blind spot test

The blind spot test detects the blind spot of the examined eye. During the test, the stimulus of maximum brightness is randomly exposed on the eleven predefined points located within the suspected blind spot area of the patient's eye. If the patient's fixation is correct, he or she should not see the stimulus (Heijl-Krakau method). Not seen stimulus is represented with red points, and seen stimulus is represented with green points on the examination tab. See the picture below.

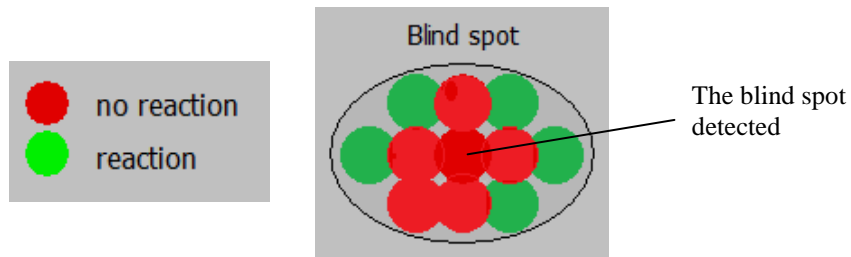


Figure 9.19. Blind spot area mapping screen.

The blind spot test feature covers the following actions:

- detecting the blind spot at the beginning of examination,
- checking the blind spot periodically during examination.

Blind spot test starts automatically at the beginning of a monocular examination. If the fixation of the patient is not correct, the blind spot cannot be found. In that case the eye fixation should be corrected and the blind spot test should be repeated by clicking the 'BS' button.

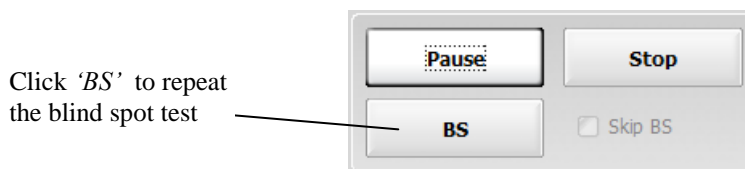


Figure 9.20. Start the blind spot test button screen.

The blind spot is tested in the most suspected blind spot area occurrence. The picture below shows coordinates used for the blind spot test in the PTS 1000 perimeter.

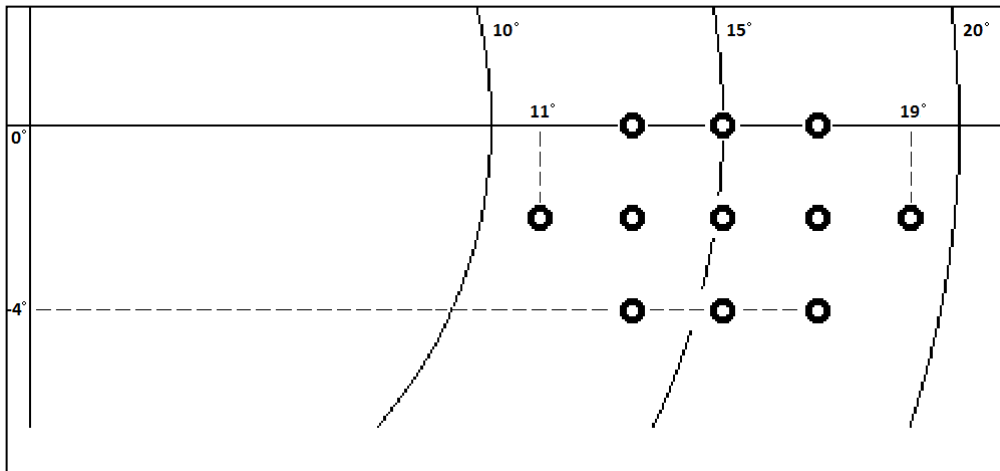


Figure 9.21. Blind spot mapping coordinates chart.

9.1.8. Skipping the blind spot test

In some exceptional cases, the blind spot test can be switched off before examination, with 'Skip BS' check box located on the lower part of 'Examination' tab.

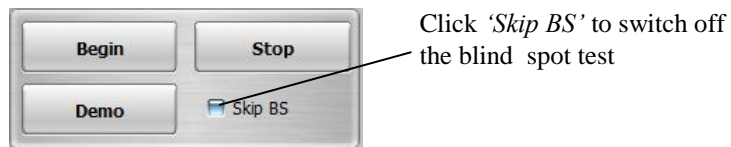
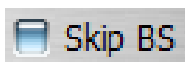


Figure 9.22. Selecting the Skip BS option screen.



– the blind spot test is performed (default setting)



– the blind spot test is not performed

Note: The reliability test parameters: 'Fixation errors: H-K' and 'Fixation errors: CCD' are disabled if the 'Skip BS' option is checked. The patient's fixation can be verified only by camera preview.

Note: The manual blind spot area test is available during examination. You can do the blind spot area test by clicking the 'BS' button.

Note: If the current patient is switch to another patient (i.e. another patient is selected from the patient list), the program switches the 'Skip to BS' status back to default setting ('Skip BS' not checked).

9.2. Kinetic examination

Shown below is a sample screen from a kinetic examination.

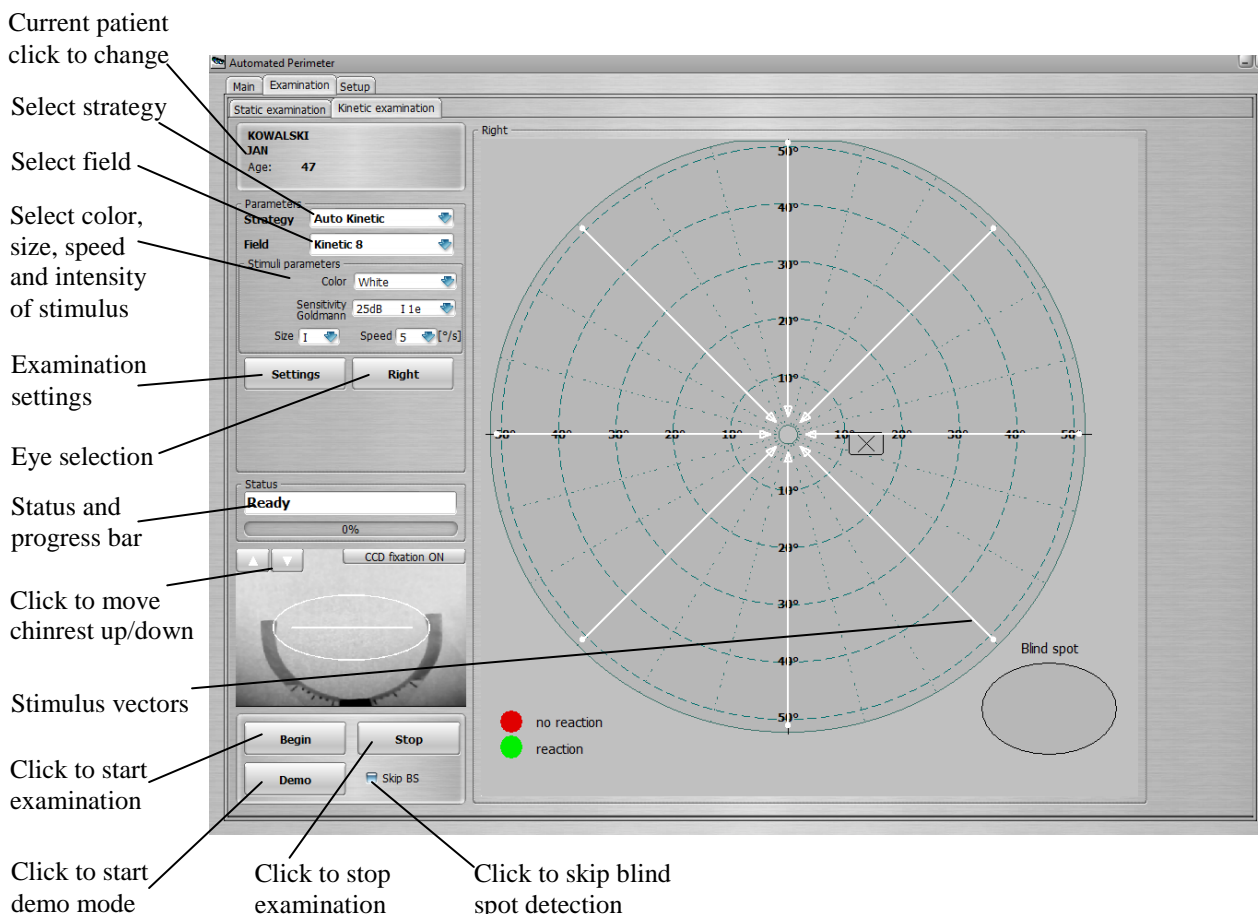


Figure 9.23. Kinetic examination window screen.

Selectable stimulus intensity is expressed in the form of dB retinal sensitivity and corresponds to the size and intensity of Goldmann symbols. See **Appendix A** for a table of conversion of dB values to Goldmann notation.

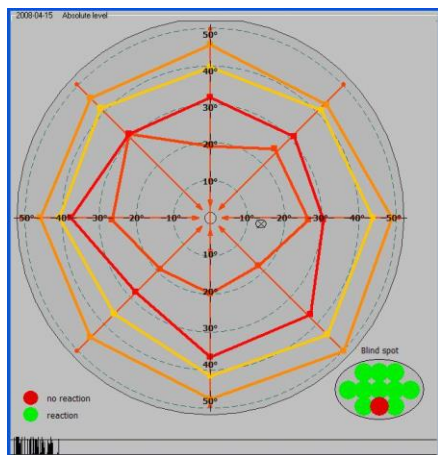


Figure 9.24. The isopteran map screen.

Isopteran map – visual field is presented in the form of a graph with approximated isopters. In this mode isopters join locations with the same sensitivity covering the whole visual field.

9.2.1. Kinetic strategy

In kinetic strategy the patient concentrates on a fixation point and reacts when seeing the stimuli moving from the periphery toward the centre of the visual field.

At the beginning of this examination strategy, the blind spot is tested to check if the patient fixates properly. Then reaction time is measured. A first stimulus should be a bit brighter than expected normal threshold value in the central part. If the patient reacts, the location is marked as a location with known sensitivity. Locations where the patient reacted are marked on a plot. These locations join with a line to create one isopteran.

After completion of every isopter, the following information is displayed:

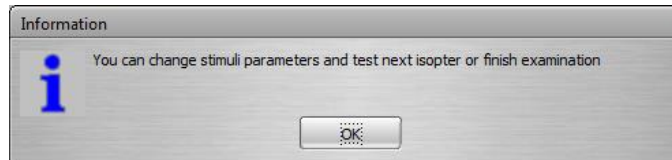
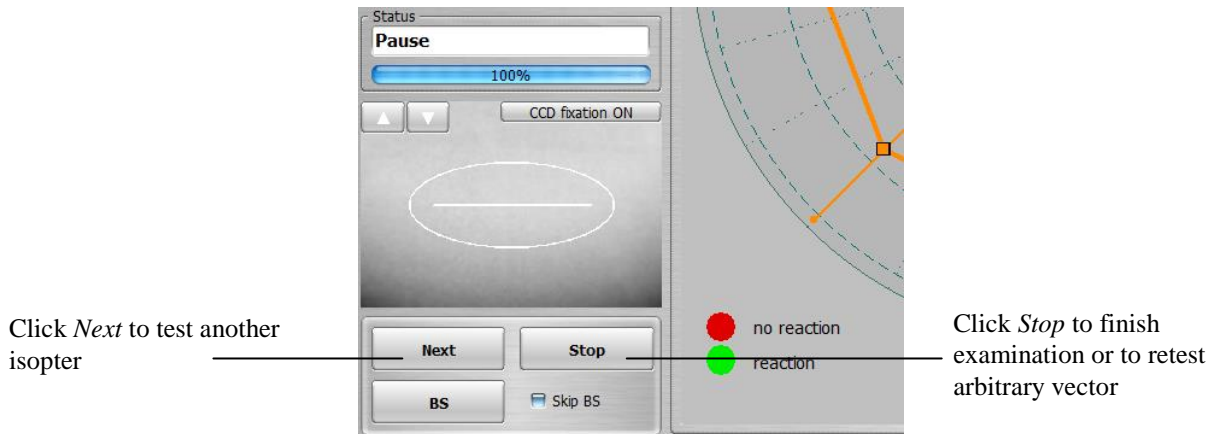


Figure 9.25. The kinetic examination continuing options information screen.

After clicking 'OK' the user can change the color, size, speed and intensity of stimuli and continue with examining the next isopter. To continue the examination, click 'Next' button. In this way up to 8 isopters can be tested in one examination.

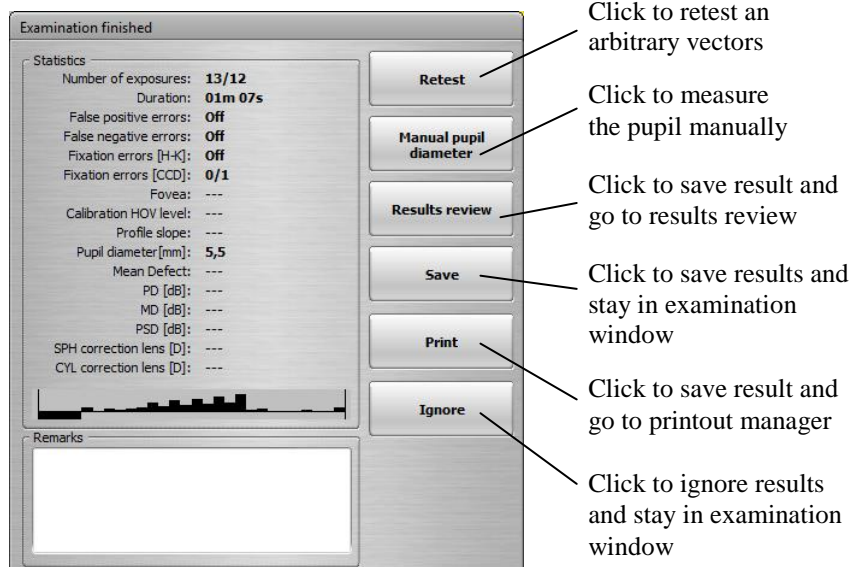


Click *Next* to test another isopter

Click *Stop* to finish examination or to retest arbitrary vector

Figure 9.26. Selecting the Next isopter / Finish or Retest options screen.

The user can also finish a kinetic examination after completing every isopter. To do so, click the *Stop* button. The following window will appear:



Click to retest an arbitrary vectors

Click to measure the pupil manually

Click to save result and go to results review

Click to save results and stay in examination window

Click to save result and go to printout manager

Click to ignore results and stay in examination window

Figure 9.27. Examination finished screen.

Recommended examination parameters:

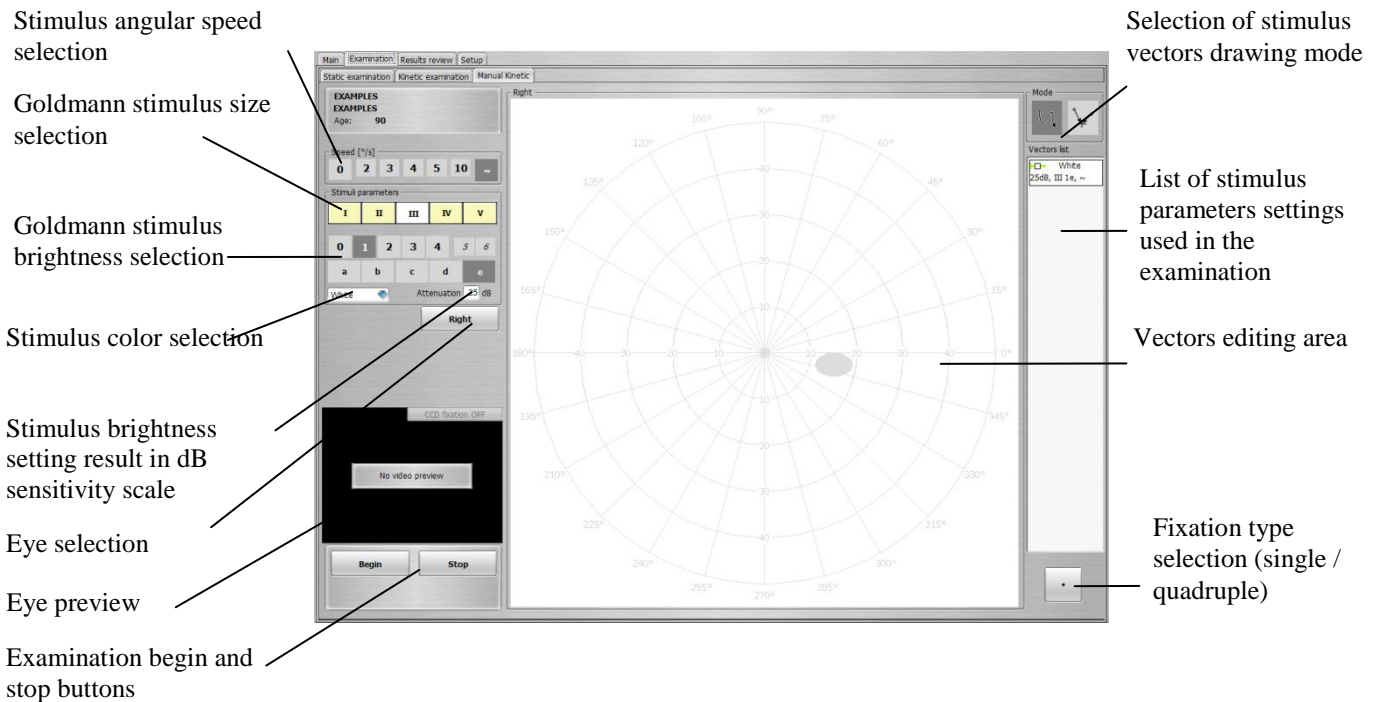
It is generally recommended to perform the kinetic examination with the following stimuli parameters (in order of conduction):

- Size: I – Intensity: 25dB – Goldmann: I 1e
- Size: I – Intensity: 20dB – Goldmann: I 2e
- Size: I – Intensity: 15dB – Goldmann: I 3e
- Size: I – Intensity: 10dB – Goldmann: I 4e
- Size: II – Intensity: 10dB – Goldmann: II 4e
- Size: III – Intensity: 10dB – Goldmann: III 4e
- Size: IV – Intensity: 10dB – Goldmann: IV 4e
- Size: V – Intensity: 10dB – Goldmann: V 4e.

9.3. Manual kinetic

The Manual Kinetic window is used for performing a kinetic examination, in which it is the operator who decides on the stimulus movement trajectory on the bowl. This type of examination is used in special cases, where automatic examination is insufficient for diagnosis.

Below is a screenshot of the Manual Kinetic window.



9.3.1. Course of manual kinetic examination

The examination consists in selecting stimulus parameters, including size, brightness, colour and speed. Then, the operator draws the stimulus movement trajectory using a mouse. The device connected to a computer reproduces the stimulus movement path on the bowl in a continuous manner. The task of the patient is to look at the fixation point and press the reaction button whenever the stimulus appears within his field of view (unless the operator instructs otherwise).

In a standard examination scenario, the operator begins the examination by clicking [Begin] button. Then, he presets stimulus parameters. The stimulus appears on the perimeter bowl upon pressing left mouse button in the vectors editing field. Location of the stimulus on the bowl

corresponds to position of the cursor in the vectors editing area at which the mouse button was clicked. Movement trajectory is registered whenever the mouse button is held depressed. Stimulus movement on the perimeter bowl will begin upon reaching the minimum length of the movement trajectory. At that time, any further movement of the mouse cursor on the screen will effect in the further registering of trajectory. The stimulus goes off upon the patient's reaction, or upon completing the entire movement trajectory on the bowl.

If the patient reacts to the displayed stimulus - be it static or moving - patient reaction symbol will be drawn in the trajectory area. The shape and colour of the symbol depends on the stimulus parameters set, and may be verified on the "List of stimulus parameters settings used in the examination". In case of no reaction from the patient, no additional markers will be displayed in the trajectory area.

It is possible to erase trajectory along with reaction markers during the examination, if they are deemed unuseful or erroneous. This is done with the right mouse button. To erase trajectory along with marker, point the cursor to the trajectory to highlight it, and then click the right mouse button.

The examination is completed by clicking [Stop].

9.3.1.1. Selection of trajectory drawing mode in Manual Kinetic

Movement trajectory may be drawn in two modes: "path" and "straight vectors". The two buttons located in the right-top corner of the kinetic examination window are used to switch the mode.




Path mode – default mode of manual kinetic examination. In this mode, the operator may draw the trajectory freely. This means that the stimulus movement path can be twisted in any way preferable, and movement speed can change at each section of the path drawn.



Straight vectors mode – it is possible to draw only paths consisting of linear sections with preset speed. These paths may be created using two different methods.

The first method allows to draw a vector with any desired end position. Clicking left mouse button at selected location will cause the perimeter to set and light up the stimulus on the bowl at the preset location. By holding left mouse button depressed and moving the cursor, a linear vector is drawn from the cursor's starting position up to the current position. Releasing the left mouse button at the given location will end vector creation. At this point, the perimeter will begin movement of the stimulus along the vector drawn, and at preset speed.

The second method employs the vector end marker . Clicking left mouse button at a selected location will cause the perimeter to set and light up the stimulus on the bowl at the preset location. Releasing the left mouse button at the same starting point will cause a vector to be drawn all the way from the starting position to the vector end marker position. The perimeter will begin movement of the stimulus along the vector drawn, and at preset speed. Vector end marker position can be changed by "drag & drop" method using the right mouse button.

9.3.1.2. Selection of stimulus movement speed in Manual Kinetic

The 7 buttons located in the upper part of the stimulus settings panel are used to select stimulus speed in manual kinetic mode.



The speed is expressed in degrees per second ($^{\circ}/s$). At small stimulus speed, the impact of patient's reaction delay on the position of the reaction registered is minimized. **It is recommended not to exceed 10 $^{\circ}/s$.**

Stimulus speed values have the following effect on the operation of the system:

“0 $^{\circ}/s$ ” - at this setting, the stimulus appears on the perimeter bowl upon pressing left mouse button, and at the location corresponding to the location of the cursor in the vectors editing area. The stimulus disappears upon the patient's reaction, or upon releasing the left mouse button. The stimulus cannot be moved in this setting - it will merely appear and go off at the starting point, regardless of any mouse movements.

“2-10 $^{\circ}/s$ ” - speed of the stimulus movement on the bowl will be limited to the selected value, even if the user has drawn the trajectory with a mouse at higher speed. Additionally, an arrow head will be added to the trajectory drawn, indicating stimulus movement direction. The length of the arrow head will increase in proportion to the speed selected.

“~” - speed of stimulus movement on the bowl will only be limited by the device capacity 50 $^{\circ}/s$). In this setting, the colour of the trajectory drawn on the screen will change depending on the stimulus speed resulting from the mouse movement. For speeds $\leq 10^{\circ}/s$, the trajectory drawn will be black. For speeds $> 10^{\circ}/s$, the trajectory drawn will be violet.

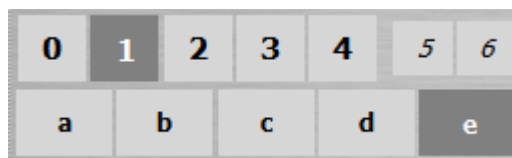
9.3.1.3. Selection of stimulus size in Manual Kinetic

The 5 buttons located on the stimulus settings panel below the speed buttons are used to select stimulus size in Manual Kinetic. The operator may select one of 5 Goldmann sizes: I, II, III, IV, V. Remember that the smaller the stimulus, the more difficult it will be for the patient to locate it. An excessively large stimulus, on the other hand, may result in omitting smaller defects and impact sensitivity of the examination. Each stimulus size has a different reaction symbol displayed by the program:

- size I - ○
- size II - △
- size III - □
- size IV - ◇
- size V - ▽

9.3.1.4. Selection of stimulus brightness in Manual Kinetic

Stimulus brightness in Manual Kinetic is selected using two groups of buttons located on the stimulus settings panel. Group I of buttons marked from 0 to 6 is used to change stimulus brightness at 5 dB increments.



Group II of buttons marked from a to e is used to change stimulus brightness by at 1 dB increments. Initial brightness of the stimulus displayed on the bowl is the result of maximum stimulus brightness for the given colour, as defined in the system, and of any modifiers chosen. The resulting retinal sensitivity that may be examined using the given stimulus brightness (assuming that stimulus of Goldmann size III is used) is specified below the buttons in decibels [dB].

The values of brightness modifiers for both button groups are as follows:

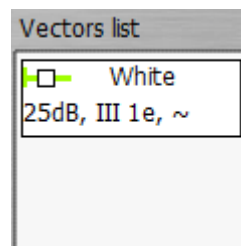
Group I		Group II	
0	-30 dB	a	-4 dB
1	-25 dB	b	-3 dB
2	-20 dB	c	-2 dB
3	-15 dB	d	-1 dB
4	-10 dB	e	-0 dB
5	-5 dB		
6	-0 dB		

Example 1: For white stimulus and **4e** modifiers setting, the perimeter will display a stimulus of maximum brightness 10000asb, modified by -10dB. As a result, a stimulus of circa 1000 asb brightness will appear on the bowl.

Example 2: For white stimulus and **6b** modifiers setting, the perimeter will display a stimulus of maximum brightness 10000asb, modified by -3dB. As a result, a stimulus of circa 5000 asb brightness will appear on the bowl.

9.3.1.5. List of stimulus parameters settings used in the examination

While performing manual kinetic examination, each stimulus setting used in the examination is added to a list and displayed in the right section of the examination window as "Vectors list".



The vectors list allows to view and restore previously used stimulus settings in order to continue examinations with previous settings. After clicking an item on the list, all corresponding stimulus parameters (speed, size, brightness, colour) will be set in the current stimulus settings field. Additionally, all results that were generated with the use of current stimulus settings are always displayed on the examination area at full colour intensity. The results corresponding to other settings are greyed out. This allows for easier orientation as to which results on the screen come from which stimulus settings.

9.4. Correction lens

The PTS 1000 is equipped with a lens holder that enables examinations with spherical (SPH) and cylindrical (CYL) correction lenses individually or together.

9.4.1. Lens calculator

Power of the correction lens is calculated on the base of patient's refraction. Go to 'Examination' tab, select a desired patient. Click the 'Lens Calculator' button to open the Lens Calculator dialog window.

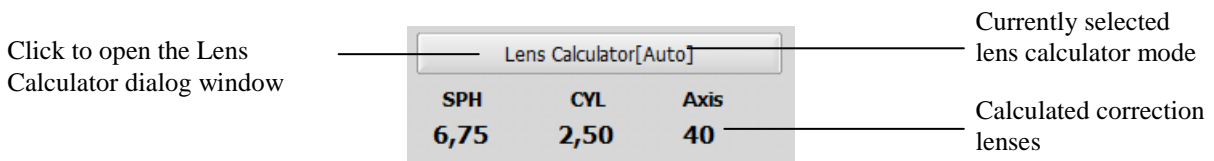


Figure 9.28. Lens calculator button, the current mode and the result screen.

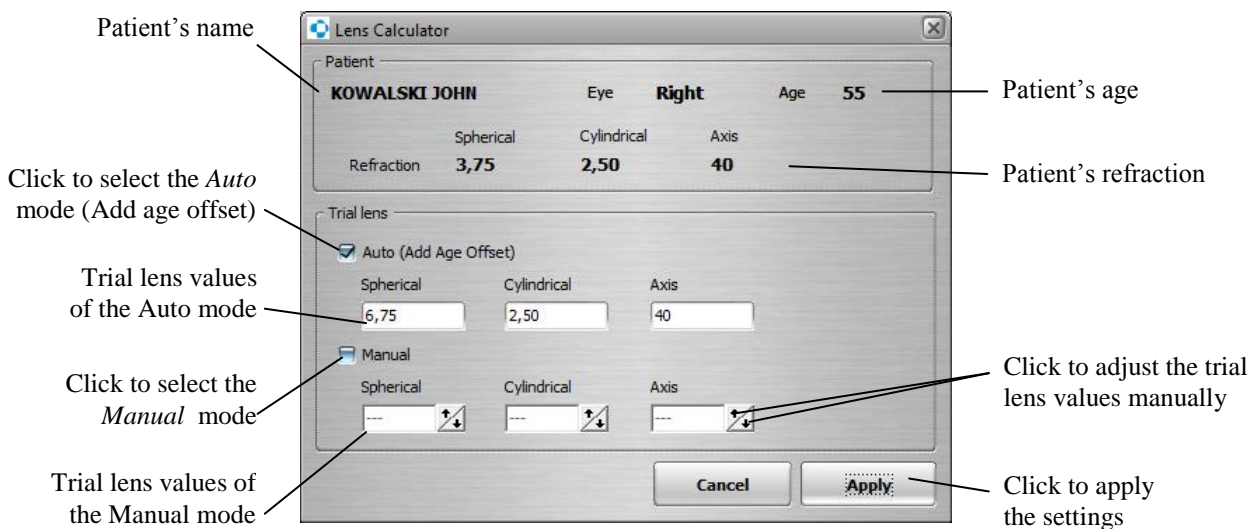


Figure 9.29. Lens calculator dialog window.

Parameter

Description

Auto mode

On (default status)

In the 'Auto' mode, *Age offset* is added automatically to the patient refraction.

Result of calculation is displayed in the output fields of the auto mode of the lens calculator dialog window, and in the Examination window. Note: if no refraction is entered in the patient's data for the currently selected eye, the auto mode is not available.

Manual mode On

The trial lens are adjusted manually with incremental control fields. Result of the 'Manual' mode is displayed also in the Examination window. When 'Manual' mode is selected, result of the 'Auto' mode will be copied to the manual refraction fields. If there is no patient's refraction entered for the currently selected eye, and 'Manual' mode is selected, zero power will appear in the manual mode refraction fields.

Note: If no patient refraction is entered in the patient data, neither 'Auto' nor 'Manual' mode is preselected in the lens calculator and refraction numerical fields are dashed. Click the 'Manual' checkbox, the zero values will appear. Click the incremental arrows to set a desired correction lens manually.

Input range for sphere: -25D - +25D in 0.25D step
 Input range for cylinder: -20D - +20D in 0.25D step
 Input range for axis: 0° - 180° in 5° step

Note: If *Auto* mode and *Manual* mode are deselected the values on the correction lens fields are dimmed and if this status is accepted by *Apply* button, the correction lens values will be dashed in the examination tab.

Note: The selected lens calculator mode is memorized until the user will change it.

Mode 'Auto' runs according to the following rules.

1. The cylinders within the range of -0.25 D to +0.25 D are ignored (the values replaced with zero).
2. For the cylinder range (0.25 to 1.25)DC and (-0.25 to -1.25)DC, the spherical equivalent is used instead of the cylinder.

The spherical equivalent is determined according to the following rule:

- a half power of the cylinder is calculated,
- the result is added to the original spherical power.

Example:

The spherical equivalent of the cylinder, +1.00 DC, is the sphere, +0.50 DS.
 The spherical equivalent of the cylinder, - 0.50 DC, is the sphere, - 0.25 DS.

Original refraction:	→	Refraction with spherical equivalent:
3.00 DS +1.00 DC x 80	→	3.50 DS
2.50 DS - 0.50 DC x 30	→	2.25 DS

3. For the cylinder errors 1.25 DC or more, and -1.25 DC or less, the full cylinder correction is used.
4. The age based sphere offset used in the lens calculator show the tables below.

Table 9.1. Age based sphere offset for hyperopic and emmetropic patients.

Age	Sphere [DS]
0 – 29	None
30 – 39	+1.00
40 – 44	+1.50
45 – 49	+2.00
50 – 54	+2.50
55 – 59	+3.00
60 +	+3.25

Table 9.2. Age based sphere offset for myopic patients:

Age \ RX	Sphere [DS]						
	-0.50	-1.00	-1.50	-2.00	-2.50	-3.00	Over -3.00
0 – 29	None	None	None	None	None	None	RX+3.25
30 – 39	+0.50	None	None	None	None	None	RX+3.25
40 – 44	+1.00	+0.50	None	None	None	None	RX+3.25
45 – 49	+1.50	+1.00	+0.50	None	None	None	RX+3.25
50 – 54	+2.00	+1.50	+1.00	+0.50	None	None	RX+3.25
55 – 59	+2.50	+2.00	+1.50	+1.00	+0.50	None	RX+3.25
60 +	+2.75	+2.25	+1.75	+1.25	+0.75	None	RX+3.25

If setting of the correction lenses are completed, click the ‘Apply’ button. The lens calculator dialog window will be closed. Information about the currently selected correction lenses and mode of operation (‘Auto’ or ‘Manual’) will be displayed in the ‘Examination’ tab, near to the correction lens power.

Note: The spherical equivalent of the cylinder is calculated before adding the Age Offset.

Example:

Patient age 57, RX: -3.00DS -1.00DC X 10.

Operation of the lens calculator:

1. Spherical equivalent: $-3.00\text{DS} + (-1.00\text{DC} * 0,5) = -3.50\text{DS}$
2. Age offset for myopic patients [RX over -3.00]: $\text{RX} + 3.25 = -3.50 + 3,25 = -0,25\text{DS}$

Calculated correction lens: -0.25DS

Note: Check the current Lens Calculator settings before start the examination to be sure that correction lens are selected with your requirements.

9.4.2. Positioning of correction lens

Use the correction lenses with the currently selected power, displayed in the 'Examination' tab. Move the correction lens holder to upright position. Place the sphere correction lens in the slot closest to the patient's eye and the cylinder lens behind the sphere. Adjust the trial lens holder so that the lenses are as close to the patient's eye as comfort will allow, without touching any lashes. Center the trial lenses up observing the eye preview window from the perimeter's camera.



Insert correction lens to trial lens holder and click 'OK'

Figure 9.30. Place the correction lens information screen.

The correction lenses can be used during monocular examinations with 30° eccentricity. For the fields, with more than 30° eccentricity, when all the locations up to 30° eccentricity are tested, the examination is paused and information window is displayed as below. Remove the trial lenses, lower the trial lens holder manually and click 'OK' to confirm. Examination will be continued.



Remove the correction lens from the trial lens holder, lower the trial lens holder and click 'OK'

Figure 9.31. Remove the correction lens information screen.

For a binocular examinations: BDT and BSV, the correction lenses are not applicable.

9.5. Examination parameters setup

In order to set an examination parameters, click the “Settings” button. A window will open as shown below:

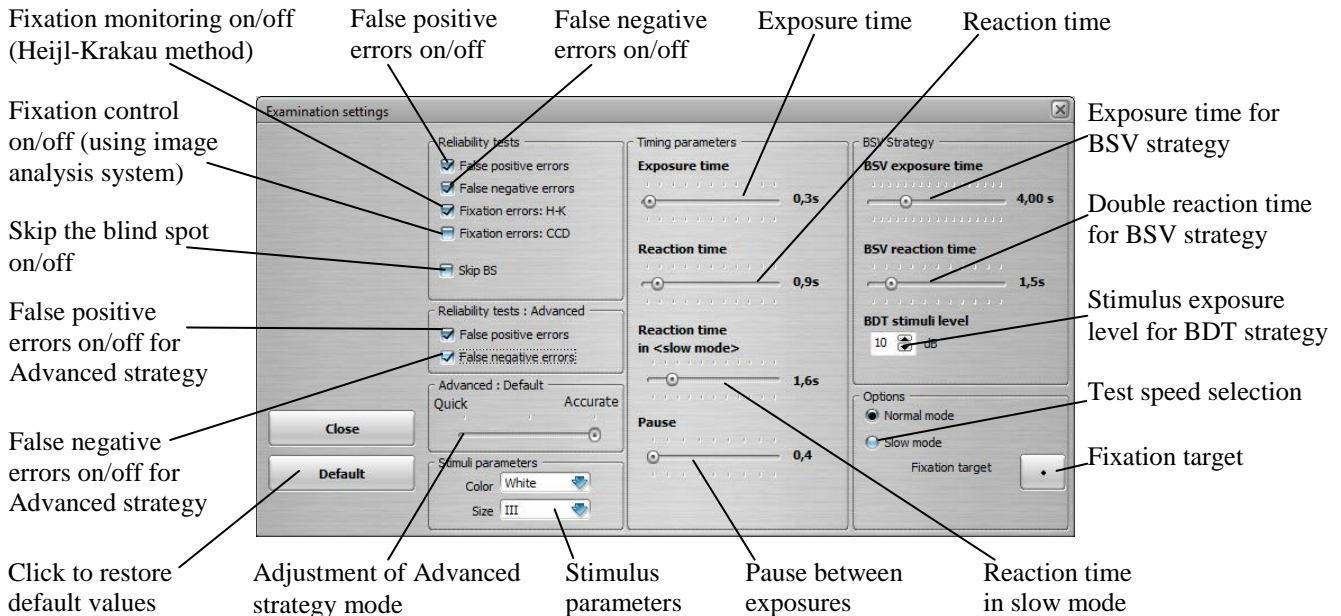


Figure 9.32. Examination settings screen.

Fixation errors – Heijl-Krakau

Blind spot oriented stimuli are randomly exposed during examination. If the reaction is negative (no reaction), the program continues the examination. If the patient reacts to the stimulus, another stimulus is exposed into the blind spot. If there is another reaction, the program displays a warning message and the fixation errors index increases. The examination can be presumed reliable if the fixation errors ratio (fixation errors ratio = amount of errors/amount of trials) is less than 25%. The Heijl-Krakau fixation errors feature is available for all monocular tests, except of the tests with Advanced strategy.

Digital fixation control

Digital fixation control is much more efficient and accurate than the H-K method as it continuously monitors fixation.

During the examination, an algorithm constantly analyses images from the camera and controls fixation. Digital fixation control allows the system to follow the movement of the patient's eyes during the examination. If the fixation is good, no exposures to blind spot are made, resulting in a more efficient examination. If the patient tries to stare away from the fixation point, the program notices it immediately. Exposure to the blind spot is made to ensure that the fixation is incorrect. If there is no reaction from the patient's side, the examination is continued. In the case of reaction to blind-spot locations, the program increases the number of fixation errors and turns on the attraction mechanism (see section 9.7.2.1 *Active patient's attraction mechanism* for details). The digital fixation control feature is available for all monocular tests.

False negative errors

If this option is activated, exposure is randomly made to a location that has already been tested. The stimulus is 6dB brighter than the previously tested sensitivity level. The patient should respond to this stimulus. No reaction from the patient is treated as false negative error.

The *False Negative Errors* feature is available for: Threshold, Fast Threshold, BDT and Flicker strategy.

If the Flicker strategy is used, exposure is randomly made to a location that has already been tested. The testing stimulus is exposed with frequency 5Hz and with the maximum brightness. The patient should respond to this stimulus. No reaction from the patient is treated as false negative error.

False positive errors

If this option is activated, no exposure is made randomly at all. If the patient reacts (because of the so-called „learning effect”), the number of false positive errors is increased. The *False Positive Errors* feature is available for: Threshold, Fast Threshold, Screening, 3-zone, BDT and Flicker strategy.

If the Flicker strategy is used, exposure is randomly made to a location that has already been tested. The testing stimulus is exposed with frequency 60Hz and with the maximum brightness. The patient should not respond to this stimulus. If the patient reacts, it is treated as false positive errors and the number of false positive errors is increased.

False negative errors for Advanced strategy

The parameter *False negative errors for Advanced strategy* is defined in the same way as the parameter *False negative errors*. The only difference is that the parameter *False negative errors for Advanced strategy* is related to Advanced strategy only.

False positive errors for Advanced strategy

The parameter *False positive errors for Advanced strategy* is defined in the same way as the parameter *False negative errors*. The only difference is that the parameter *False positive errors for Advanced strategy* is related to Advanced strategy only.

Adjustment of Advanced strategy mode

See section 9.1.2.3 *Advanced strategy*, p. 38.

Exposure time

Exposure time is the length of time the patient is exposed to a stimulus. It applies to all strategies with the exception of the BSV and Flicker strategy.

Reaction time

Reaction time is the amount of time the device waits for the patient’s reaction after the *Exposure time* is expired. During the examination, this interval is automatically adapted to the patient’s reaction speed. It applies to all strategies with the exception of the BSV and Flicker strategy.

Note: Exposure time and reaction time in total are limited to 10 seconds. Exposure time and reaction time in <slow mode> in total, are also limited to 10 seconds. When, for example, the *Exposure time* trackbar is increased, the *Reaction time* trackbar and *Reaction time in <slow mode>* track bar will be automatically decreased to maintain 10 seconds of the maximum total time.

When the *Reaction time* trackbar or *Reaction time in <slow mode>* track bar are increased, the *Exposure time* trackbar will be automatically decreased to maintain 10 seconds of the maximum total time.

Pause

During pause, the computer delays the next stimulus exposure after the patient releases the patient response button.

Sequence of time parameters

The *Exposure time* and the *Reaction time* in total, is the time available to receive the patient's reaction for the successive stimulus exposure.

If no reaction occurs and the *Exposure time* is expired, the *Reaction time* starts. If the *Reaction time* expires and still no reaction occurs, the next *Exposure time* starts automatically (Case 1).

If a reaction occurs during the *Exposure time*:

The *Exposure time* is terminated, and the *Pause time* starts in the moment of reaction. When the *Pause time* is finished the next *Exposure time* starts automatically (Case 2).

If a reaction occurs during the *Reaction time*:

The *Reaction time* is terminated, and the *Pause time* starts in the moment of reaction. When the *Pause time* is finished the next *Exposure time* starts automatically (Case 3).

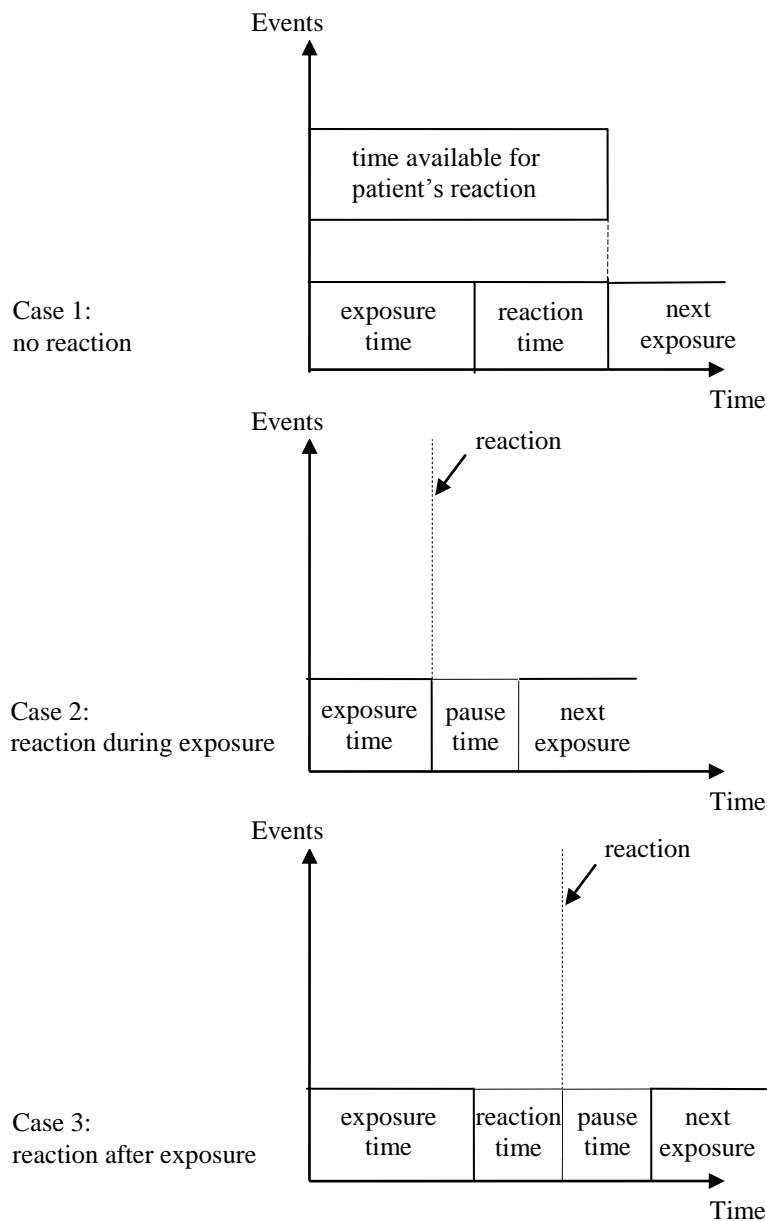


Figure 9.33. Stimulus timing plots.

Depending on the patient's reaction speed, the current reaction time is modifying during examination. If the patient's reaction is fast, and it occurs at the beginning of the exposure time, the current reaction time is shortened adequately. If patient's reaction is slow, and it occurs at the end of exposure time or during reaction time, the current reaction time is extended. In the result of that, the pace of examination follows the patient's reaction speed.

If the *Slow mode* is selected, the adjustment: *Reaction time in <slow mode>* is in use.

Exposure time for BSV strategy

The amount of time the stimulus is exposed during the BSV strategy.

Reaction time for BSV strategy

Reaction time for BSV strategy is the amount of time the device waits for the patient's reaction after the *BSV exposure time* is expired.

Sequence of time parameters for BSV strategy

If no reaction occurs and the *BSV exposure time* is expired, the *BSV reaction time* starts. If the *BSV reaction time* expires and still no reaction occurs, the next *BSV exposure time* starts automatically.

If a single reaction occurs during the *BSV exposure time*:

The *BSV exposure time* is terminated, and the *BSV reaction time* starts in the moment of single reaction. When the *BSV reaction time* is finished, the next *BSV exposure time* starts automatically.

If a double reaction occurs during the *BSV exposure time*:

The *BSV exposure time* is terminated, and the *Pause time* starts in the moment of double reaction. When the *Pause time* is finished the next *BSV exposure time* starts automatically.

If a single reaction occurs during the *BSV reaction time*:

The current *BSV reaction time* is terminated, and the *BSV reaction time* starts again in the moment of a single reaction. When the *BSV reaction time* is finished the next *BSV exposure time* starts automatically.

If a double reaction occurs during *BSV reaction time*:

The *BSV reaction time* is terminated, and the *Pause time* starts in the moment of double reaction. When the *Pause time* is finished the next *BSV exposure time* starts automatically.

BDT stimuli level

The stimuli's exposure level for all locations. Its values range from 3 to 30 dB with 1 dB step.

Bear in mind that fixation errors, false positive errors and false negative errors can increase the duration of the examination due to the necessity of exposing additional stimuli.

9.5.1. Fixation target selection

There are four fixation targets in the PTS 1000 automated perimeter.

Two central fixation targets, available for the user setting:

- the point (used as the default),
- the diamond (composition of four paracentral fixation diodes) used for the patients with central vision defect.

Two shift fixation targets turning on during examination with BDT or with Extended field:

- the left fixation point, shift 30° with reference to central fixation point,
- the right fixation point, shift 30° with reference to central fixation point.

The tables below shows availability of fixation targets.

Table 9.3. Fixation targets availability with reference to fields.

Field:	Central point	Central diamond	Left point 30°	Right point 30°
24	✓	✓	-	-
30	✓	✓	-	-
Central	✓	✓	-	-
Glaucoma	✓	✓	-	-
Macula	✓	✓	-	-
Full	✓	✓	-	-
Peripheral	✓	✓	-	-
Fast	✓	✓	-	-
User	✓	✓	-	-
Extended left eye	✓	✓	-	✓
Extended right eye	✓	✓	✓	-
BDT	✓	-	✓	✓

Table 9.4. Fixation targets availability with reference to strategies.

Strategy:	Central point	Central diamond	Left point 30°	Right point 30°
Flicker	✓	✓	-	-
BSV	-	-	-	-

Setting the fixation target is available in the examination settings window.

Click the fixation target button to change the fixation type to diamond / point.



Figure 9.34. Fixation target selection buttons screens.

9.6. Performing the examination

To perform a new examination, please follow the instructions below:

1. In the main Window select the proper patient. You can use the “*Fast search*” mechanism. If the patient is not yet registered, click the “*New patient*” button and register the patient.
2. Click the “*Examination*” tab to go to the examination window.
3. Confirm you have selected proper patient. The name is displayed on a panel in upper left corner of the screen. If you selected the wrong patient, click the patient's name. A list will be opened from which you can select the proper patient.
4. Select the desired testing strategy:

Table 9.5. Characteristics of the fields in PTS 1000.

Strategy	Usage
Threshold	Detects sensitivity level in each tested location. Basic strategy advised to monitor glaucoma. Can be used to detect both defects and areas of so called super vision. Gives most accurate results but duration of examination is longest.
Fast threshold	Detects sensitivity level in each tested location. It is an advanced threshold strategy, analyzing neighboring locations and predicting threshold levels. Can be used to monitor glaucoma. It is characterized by high accuracy (comparable to threshold strategy) but reduces duration of examination by 30%-40%.
Advanced	Offers 3 modes: Quick – Intermediate – Accurate. Saves time while still providing full information about retinal sensitivity. Quick mode makes the test very fast but some information is obtained from interpolation (50% of locations are tested). Accurate mode takes more time but there is no interpolation used (100% of locations are tested). Intermediate mode is a compromise between exam time and accuracy (75% of locations are tested).
Screening	Can be used to detect defects deeper than 6dB and measure depth of those defects. Duration of examination is relatively short.
3-Zone	The results of this strategy can be no defect, absolute defect, relative defect. It does not measure depth of defects, just the location. It is used to make screening examinations and for detecting very deep and broad field loss.
BSV	Enables examination of both-eye movement coordination. It's used to monitor diplopy, usually in conjunction with symmetrical fields (Full, Central, Peripheral).
Flicker	Detects Critical Fusion Frequency (CFF), which is useful in glaucoma diagnosis.
BDT	Used only with BDT fields, enables binocular examination of visual field. Examination is performed with constant intensity level. It provides the Esterman score. The BDT examination is used to test the drivers for driving license.

5. Select the field range for the examination.

Table 9.6. Characteristics of the strategies in PTS 1000.

Field name	Usage
Full	Used in monitoring neurological changes in both central and peripheral areas of visual field. All other fields are contained in full field (except for extended field). Usually used with screening strategy.
Glaucoma	Used in glaucoma diagnosis. It is the field extended nasally to 50 degrees. Any defects in nasal area can suggest glaucoma treatment; e.g., central or macular. Used mostly with Fast threshold and Threshold strategies.
Central	Used to monitor changes in the center part of visual field; i.e., caused by glaucoma after previous examinations performed using glaucoma field.
Macula	Used in case of macula diseases to detect field loss and to monitor changes with field limited below 10 degrees. Usually used with Threshold and Fast Threshold strategies and Blue on Yellow examination.
Peripheral	Used to detect peripheral changes; can be implemented as a supplementary test to follow further field loss above 22 degrees.
Extended	Used for drivers. Can be tested using 3-Zone strategy only.
Fast	Used mostly as first examination of a new patient and also to do large population tests. Usually performed using Screening or 3-Zone strategy or Blue and Yellow examination.
User	User defined field can include any locations in 50 degrees range.
BDT	Used only with BDT strategy to examine whole drivers field range. Includes 120 locations in 80 degree horizontal and 50 degree vertical ranges.
30	Field covering central 30 degrees – 76 locations on square basis evenly spaced every 6 degrees.
24	Field covering central 24 degrees – 54 locations on square basis evenly spaced every 6 degrees. It provides the most information about the retina and reduces duration and influence of artifacts.

The table below shows the fields that can be used by the respective strategies:

Table 9.7. Availability of strategies with reference to the fields.

	Full	Glaucoma	Central	Macula	Peripheral	Extended	Fast	User	BDT	30	24
Threshold	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	✓
Fast threshold	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✓
Advanced	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓
Screening	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	✓
3-zone	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
BSV	✓	✗	✓	✓	✓	✗	✓	✓	✗	✓	✗
Flicker	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	✓
BDT	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗

If a selected strategy does not match to the field program, its name is grayed on the fields list. Following an attempt to select it, the field will be automatically switched to first matched.

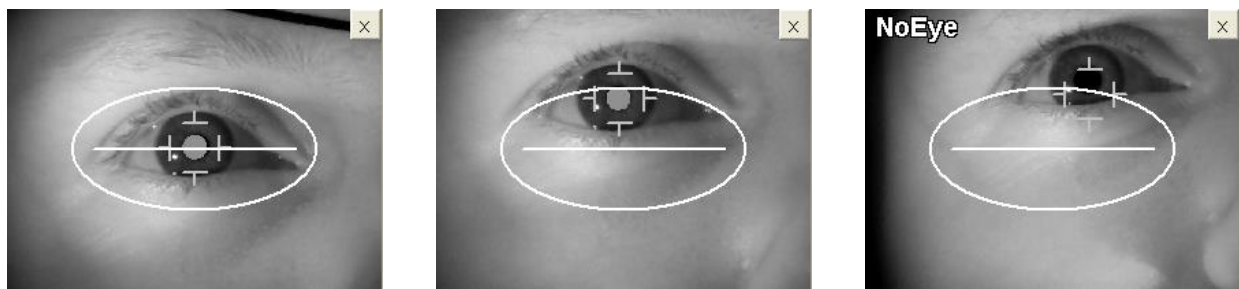
6. Select the fixation target best suited for patient. The default fixation target is a single central point. If the patient finds it difficult to focus on that point, select “diamond” – the four paracentral fixation targets (see section 9.5.1 of this manual).
7. Specify the power of the correction lenses (or no correction lens) and put the lens/lenses in the trial lens holder. It is possible to use the patient’s own near-vision spectacles or contact lenses. The frame should not be too loose or too small. Patient frames and bifocal or progressive lenses cannot be used. Patient eyeglasses up to +6.0D can be used. Keep in mind the potential for optical artifacts when using larger corrections. In such a case, using correction lens assures better parameters. With a correction of 8D or higher, it is recommend to use a contact lens. In an examination using the BSV or the BDT strategy, no correction lens can be mounted in the lens holder (see section 9.4.1 *Lens calculator* and section 9.4.2 *Positioning of correction lens* for details how to select and use the correction lenses).

Note: Check the current Lens Calculator settings before start examination to be sure that correction lens are selected with your requirements.
8. Select the tested eye (left or right). In the BSV or BDT strategy you cannot select the tested eye because this strategy examines both eyes simultaneously.
9. If there is a suspicion of a neurological defect mark this option in the program (the neurological option is inaccessible in 3-zone, BSV, Flicker, Advanced and BDT strategies).
10. Check the ‘Foveal test’ checkbox, if you want to perform the foveal threshold test during examination (see section 9.1.6 *Foveal threshold test* for details how to carry out the foveal threshold test).

11. Check the *'Skip BS'* checkbox, if you want to perform the examination without the blind spot detection. Blind spot is not mapped during examination, and no information is available on the report, if the *'Skip BS'* checkbox is checked.

Please consider, that option 'skip the blind spot' should be used only for individual cases, when detection of blind spot is not possible or difficult. For other cases, when blind spot is detectable, the option 'skip the blind spot' should not be used.

12. Cover the other eye using the occluder supplied with the perimeter. The patient should be informed that during the examination he or she must have both eyes opened, and can blink (it does not concern BSV and BDT strategy). Keeping eyes the half-open may significantly lower examination accuracy.
13. If using BSV or BDT strategies install the chin-rest adapter, which enables the patient to place his or her head in a central position.
14. Place the patient's chin on the chinrest. The forehead should touch the forehead support. The height of the table should be set in a comfortable position for the patient.
15. Set the patient's head height using the mouse cursor and click "up" or "down" button. The patient's pupil should be on a horizontal line as shown in preview window (see below image).



Proper patient's head height

Head too high – pupil above the horizontal line

Head too high – pupil beyond the eye detection area

Figure 9.35. Eye preview showing correct and incorrect eye position screens.



WARNING: Make sure that the patient does not put his head inside the bowl when the "up" or "down" chinrest elevation button is pressed.

16. Describe the examination to the patient. Let him or her blink. The patient can pause the examination any time by depressing the patient response button for about 3 seconds. Tell the patient that if the fixation diode is blinking he or she must look at it.
17. For inexperienced who are having their eyes tested for the first time, it is suggested that you first perform the DEMO program. It will allow the patient to get acquainted with the procedure and may produce more credible results. When the patient is comfortable with the procedure, the DEMO program should be cancelled.
18. There is an eye preview window on the computer screen. Look at the image from the camera and set the patient's head height again. The patient's pupil should be on the horizontal line and inside the ellipse (it does not apply to BSV and BDT strategy – in BSV and BDT, strategy height setting proceeds only according to point no 13).

19. Once the patient is ready, start the examination using the “*Begin*” button.

You can pause the examination by using the “*Pause*” button; the patient can pause the examination by pressing and holding the patient response button for about 3 seconds.

In the moment when the pause occurs (button “*Pause*” is clicked on the screen or the patient response button is pressed for 3 seconds) the currently exposed stimulus is not registered, and the “P” character is displayed instead of the numerical value at the corresponding location. The exposure cancelled by pause is repeated when the examination is resumed. The examination can be resumed using the “*Resume*” button by the doctor only. This also applies to DEMO mode.

The following examination strategies are described below:

- Threshold
- Screening
- 3-Zone
- Fast threshold
- Advanced.

The examination process for BSV strategy is described in section 9.1.2.6.

The examination process for Flicker strategy is described in section 9.1.2.7.

The examination process for BDT strategy is described in section 9.1.2.8.

9.7. Stages of examination for Threshold, Fast threshold, Advanced, Screening, 3-Zone strategies

Stage I – calibration

During this stage the program automatically locates the position and size of the blind spot and measures the sensitivity levels of four calibration locations.

If the blind spot is not found, a warning message is displayed.

You should then check the patient’s position and relocate blind spot.

If you stop blind-spot location, the test will be performed without any fixation monitoring. This will significantly affect the credibility of the results.

During the calibration process, the calibrated HOV level may be much lower than the average value and below 18dB. This may be due to some defects which occur in/around the calibration location’s area. The program detects this occurrence and displays a warning message. The calibration level can then be selected manually.

After sensitivity levels for all calibration locations are tested, the program calculates average sensitivity by omitting two extreme values and by calculating an average value from the remaining two figures. This average value is used to calculate a reference profile for all other field locations, according, to the graph presented below:

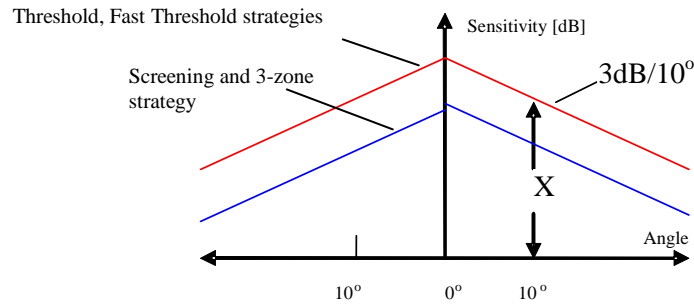


Figure 9.36. Calculated hill of vision profile plot used as the reference for initial levels of threshold testing.

where X is the average sensitivity of 4 locations for 10 degree ring calculated from calibration.

The sensitivity profile has a slope of 3 dB/10° for all strategies. The sensitivity profile height matches the average sensitivity of 4 calibration locations for threshold and fast threshold strategies, while it is 6 dB lower for screening and 3-Zone strategies.

Important !!!

In Advanced, BSV and BDT strategies, the computer skips calibration and starts the examination process immediately.

Stage II – Testing

During this stage, sensitivity levels are tested and threshold levels are determined for each field location.

If fixation monitoring using Heijl-Krakau method is turned on, random exposures are made to the blind spot location. If a patient reacts to two consecutive exposures of blind spot stimulus, the computer increases the number of H-K fixation errors.

If digital fixation is turned on, no exposures to the blind spot are made when the patient is fixating well. Some exposures to the blind spot are made only if the program detects any incorrect fixation. If a patient reacts to the blind spot stimulus, the computer increases the number of digital fixation errors.

Digital fixation control is a more advanced and reliable method than the classic Heijl-Krakau method. In this method, fixation is controlled continuously during testing. In classic methods, fixation tests are performed randomly, and they do not guarantee detection of all moments of fixation loss.

Stage III – Final settings

When a sensitivity level for each location is measured, the LEDs on the bowl blink for a moment and a single sound (if enabled) is emitted to inform the patient that the examination is completed. The window with collection of BASIC examination parameters is displayed on the PC screen. You may enter remarks concerning the examination and save the exam to the database, print it, or delete it.

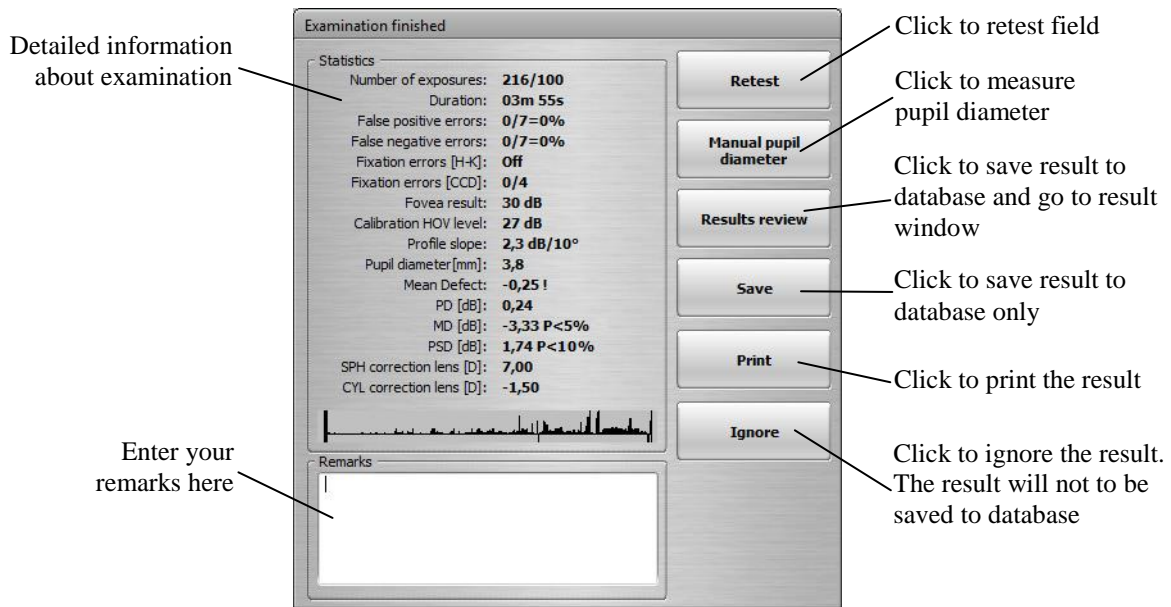


Figure 9.37. Examination finished screen.

9.7.1. Examination without digital fixation control

If digital fixation control is off, the program doesn't analyze images from the camera. However, the image will be displayed during the examination and you can constantly observe the patient's reactions. With this setting, the diameter of pupil is not measured automatically.

9.7.2. Examination with digital fixation control

If an examination is performed using digital fixation control, the program automatically analyzes images received from the camera and locates the position of pupil. The pupil is marked with a white dot on the screen. The program measures the diameter of the pupil and detects blinking.

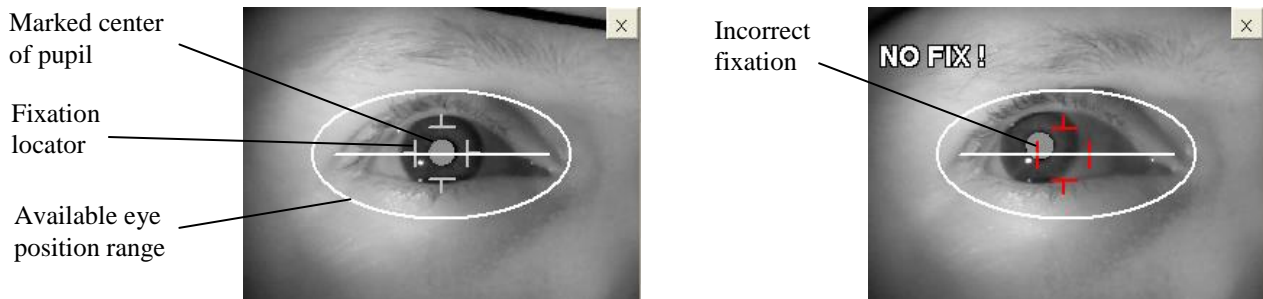


Figure 9.38. Eye preview with correct and incorrect fixation screen.

If the patient is fixating well, the examination is conducted without exposures to a blind spot. If the program detects that the patient is trying to stare away from center, blind spot exposures are made with the intention of verifying whether the patient has an incorrect fixation. If the patient does not react to blind spot stimuli, the examination is continued. If a patient's reaction to blind spot stimuli is detected, the patient attraction mechanism is activated.

9.7.2.1. Active patient's attraction mechanism

The position of the pupil is constantly monitored during the examination. If the patient is not fixating well, the active attraction mechanism is turned on. The central fixation point starts to blink rapidly, causing the patient to look at it. When fixation is back to normal, the examination continues.

9.7.2.2. Possible issues with digital fixation control

In rare cases, due to pupil disease, mechanical pupil shape distortion, or poor ambient light, the program will not be able to locate the position of the pupil. In this case digital fixation control can be turned off, using the 'CCD fixation ON' button in the upper right corner of camera image. Also try to arrange the examination room to avoid side lighting sources.

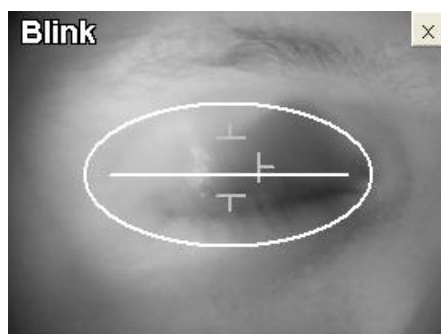


Figure 9.39. Eye preview with blinked eye screen.

9.7.3. Manual pupil diameter calculation

The PTS 1000 series perimeter measures the pupil diameter automatically (when the *Fixation errors: CCD* option is selected). You can also measure the diameter of pupil manually.

Do the following steps to measure the pupil manually.

1. When the *Examination finished* window appears, Click the 'Manual pupil diameter' button.

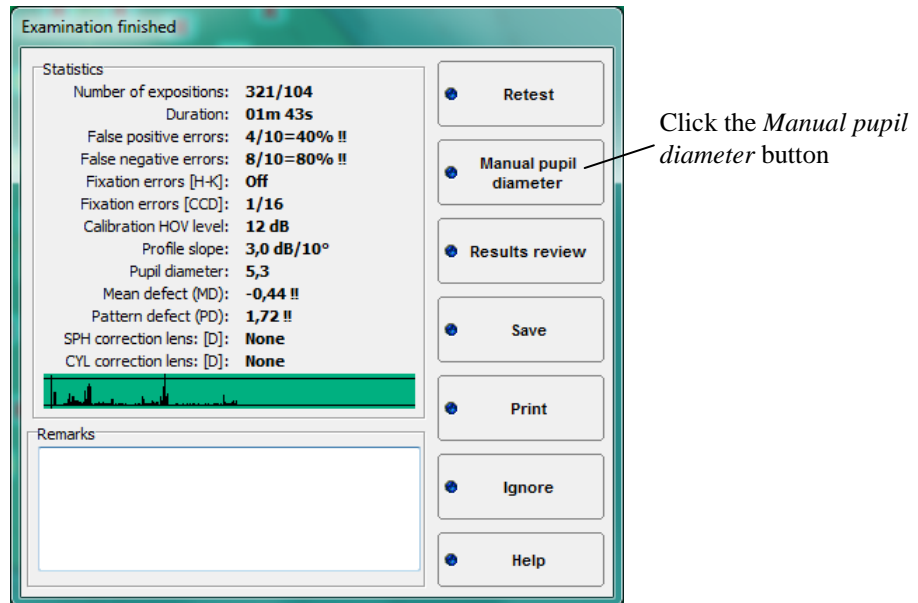


Figure 9.40. Examination finished screen.

2. The *Pupil diameter* window will appear. There is a series of pictures captured to select on the window. Use '>>' button to select the best eye image. Move the cross at the center of the pupil and click left mouse button.

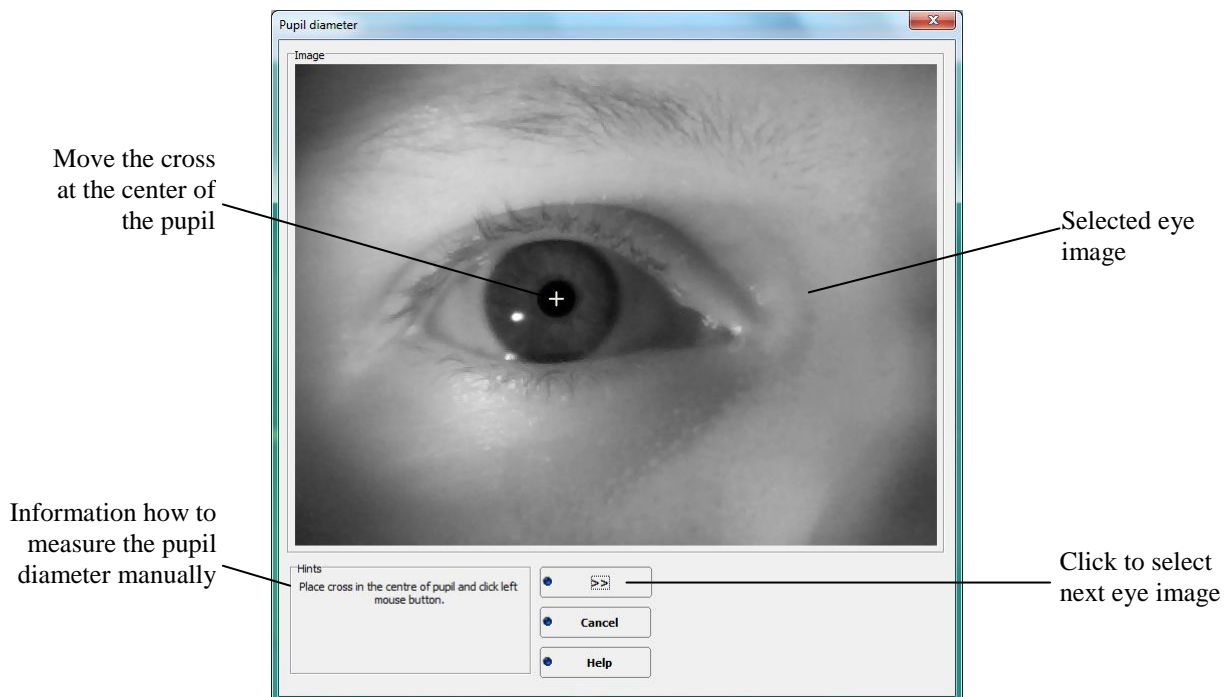


Figure 9.41. Manual pupil measurement screen, step 1.

3. The horizontal reference line will appear. Move the cross at the intersection of horizontal line and the left pupil border. Click the left mouse button.

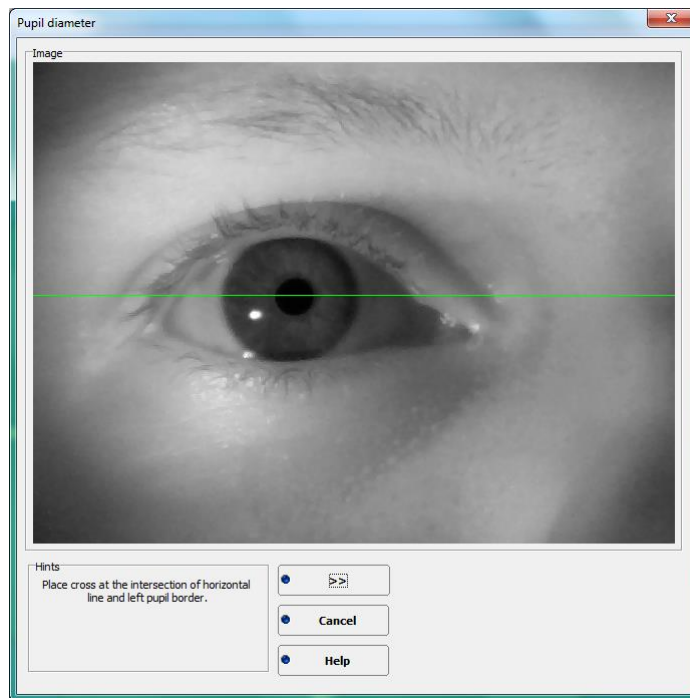


Figure 9.42. Manual pupil measurement screen, step 2.

4. The vertical line will appear. Move the cross at the intersection of horizontal line and the right pupil border. Click left mouse button. The manual pupil measurement will be done and the *Pupil diameter* window will be closed automatically.

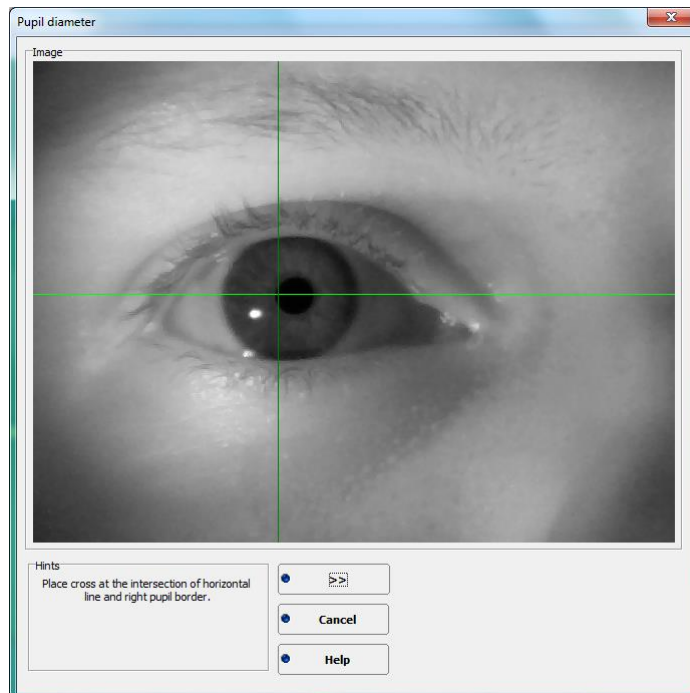


Figure 9.43. Manual pupil measurement screen, step 3.

- Information window about measured pupil diameter will appear. Confirm the information with OK button.

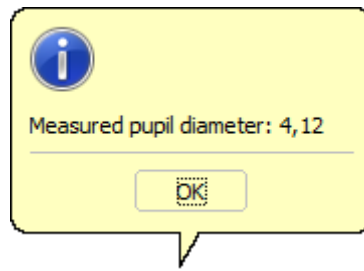


Figure 9.44. Information that pupil diameter is measured.

- The *Examination finished* window will appear again. The measured pupil diameter value will be displayed under *Pupil diameter* parameter.

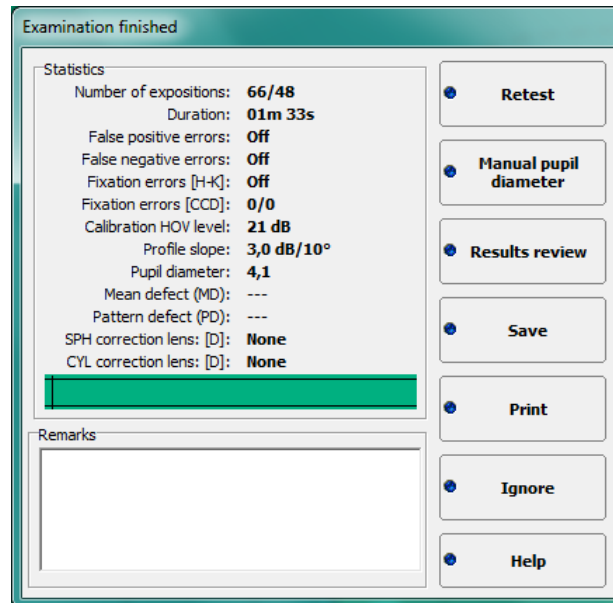


Figure 9.45. Examination finished screen.

9.7.4. Field retest

After the examination is over, you can retest selected single locations if necessary. Click the 'Retest' button, select the locations you want to retest and click 'Retest' button.

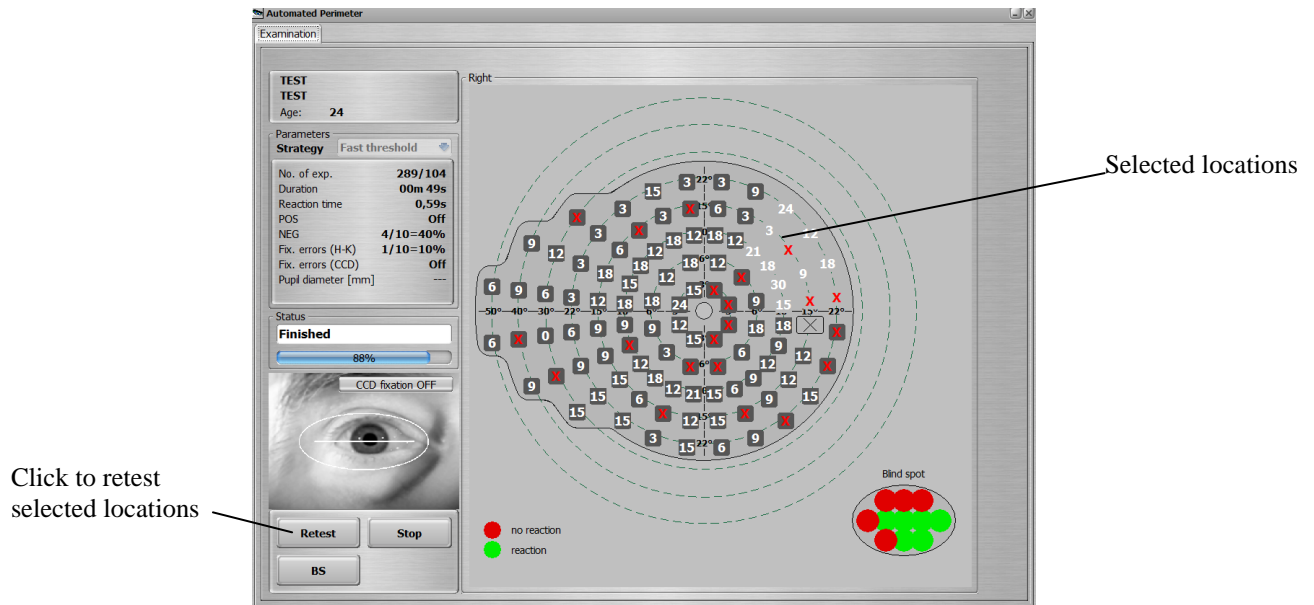


Figure 9.46. Examination window with retesting the selected points screen.

9.7.5. Examination with BSV strategy

Examination with BSV strategy is a binocular type examination. Before the examination, the doctor should place a special adapter on the chin rest which enables alignment of the patient's head in a central position relative to device. Set the chin rest-height using “up” and “down” buttons (see section 9.6 number 13) so the eyes are located at the same height as markers.

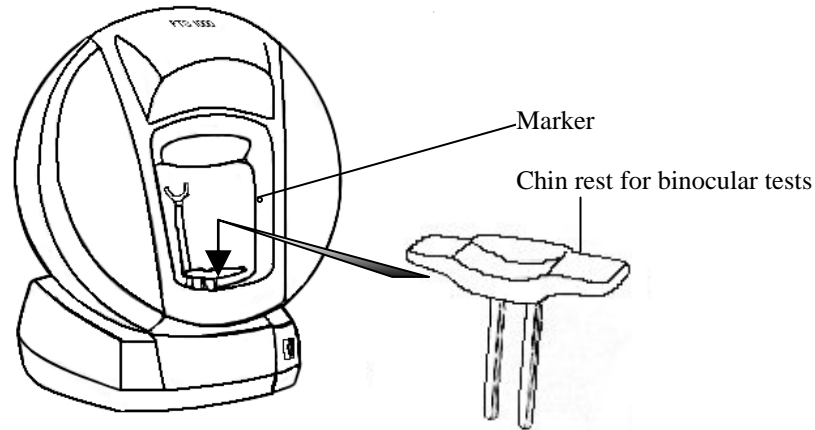


Figure 9.47. Installing the binocular test chinrest view.

Inform the patient that he or she must observe the bowl and click the patient response button once if he or she sees single light point. If the patient sees two points, he or she must click the patient response button twice. Exposure time of each stimulus is much longer than in other strategies. Each stimulus has maximum brightness. Central fixation is turned off during the examination.

The BSV strategy examination result is field with marked defects. A location with a dot (•) means single vision. A location with an X symbol means no reaction. A location with filled square means double vision.

Pictured below is an example of an examination result with BSV strategy.

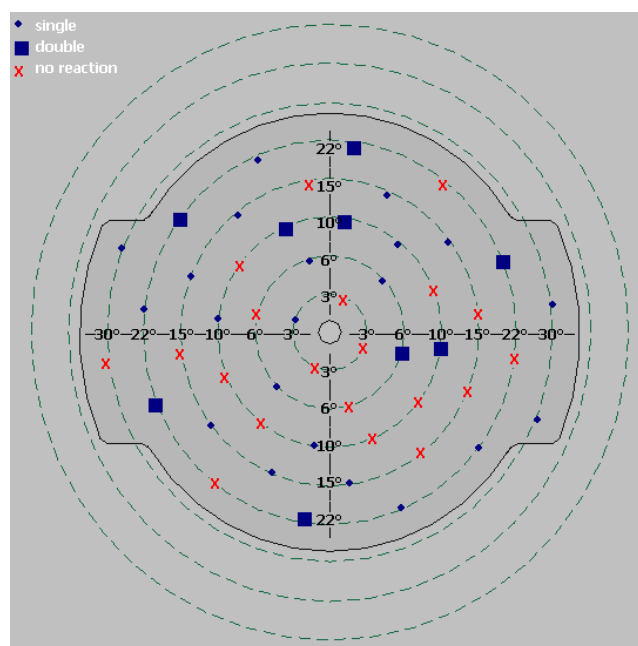


Figure 9.48. BSV strategy screen (with Central field).

9.7.6. Examination with Flicker strategy

During the examination with *Flicker* strategy stimuli are exposed with maximum luminance, but the stimulus is not static. The stimulus is blinking (flickering) with different frequencies. The patient should react only when the flickering stimulus is visible. If the patient can see static stimulus or doesn't see any stimulus, he or she should not press the button.

In the calibration stage the computer examines 4 locations at 10° decentration, calculates mean value ('X' on graph below) and increases it by 12 Hz. This is the initial level of stimuli flicker frequency examination. During calibration, the computer also detects a blind spot by presenting flickering stimuli with 5 Hz frequency in each blind spot location.

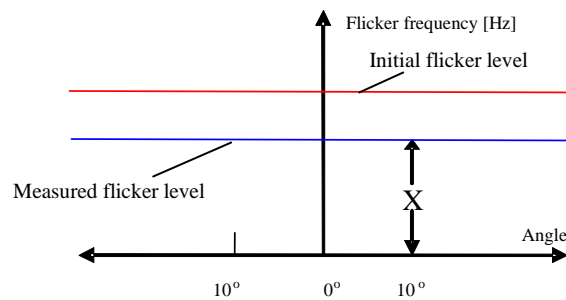


Figure 9.49. Flicker strategy calibration levels diagram.

During examination every stimulus starts flickering with a calculated initial frequency level and then the frequency is decreased with steps of 4Hz until the patient reacts or 3 seconds elapse. The frequency is decreased until the patient reacts (sees flickering point) or 3Hz level is reached. If the 3Hz level is reached and the patient didn't react, the location is marked as an absolute defect (red 'X' on the map).

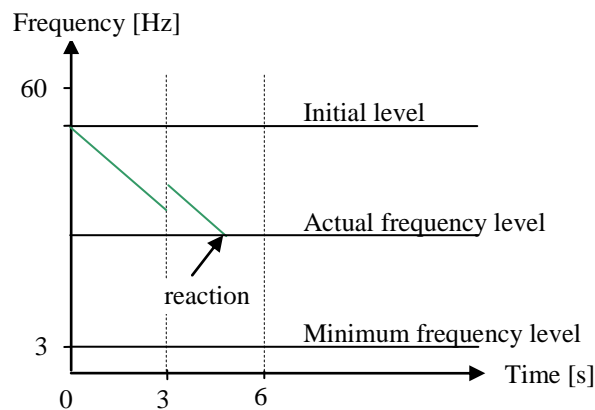


Figure 9.50. Flicker strategy principle of action diagram.

False positive and negative tests are performed for Flicker strategy (false positive – 60 Hz, false negative – 5 Hz frequency used).

9.7.7. Examination with BDT strategy

Examination with BDT strategy is different from other strategies. Before the examination, the doctor should place the special adapter on the chin rest to align the patient's head in central position relative to device. Set the chin-rest height using “up” and “down” buttons (see section 9.6 number 13) so the eyes are located at the same height as the markers.

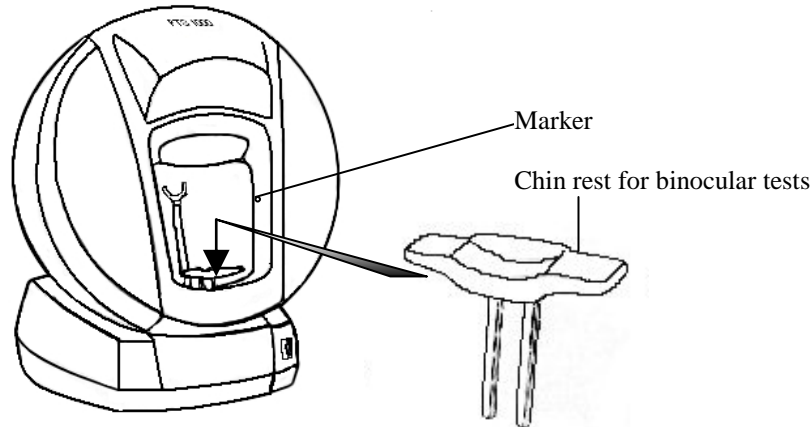


Figure 9.51. Installing the binocular test chinrest view.

Examinations with BDT strategy can be performed only on the BDT field. Inform the patient that he or she must observe the fixation point and if he or she detects any point should indicate so by using the patient response button. Each stimulus has a constant brightness which can be set in the settings window (see section 9.5).

The BDT strategy examination result is field with marked defects. A location with a circle (○) means seen stimuli; a location with a rectangle symbol (■) means missed stimuli. After the test, the program adds the following factors into the examination remarks:

Stimuli level: 10 dB

Locations seen: 119/120 (number of seen locations of whole field/number of all locations)

Locations missed: 1/120 (number of missed locations of whole field/number of all locations)

Esterman efficiency score: 99 (percentage value of seen locations).

An example of an examination result using the BDT strategy is shown below.

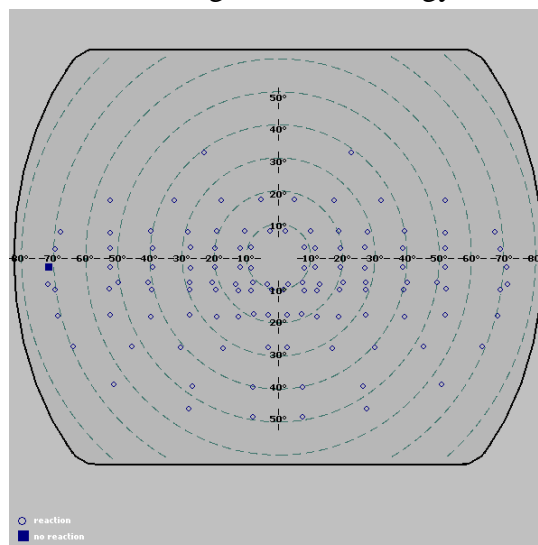


Figure 9.52. BDT (Binocular Driving Test) strategy plot.

10. Results review tab

The results review tab is used to view and analyze examination results that are already saved in the database.

Result review tab with description of each function is shown below:

Current patient. Click to select a different one

Visualization options

Active window

Click to select graph type in active window

Click to select analysis type in active window

Click to choose Results Comparison option

List of current patient's examinations

Examinations filtering options

Click to view next/previous test result

Click to print the result

Click to import examination result

Click to export current examination result

Enter any remarks here

Click to delete an examination result

Automated Perimeter

Main Examination Results review Setup

JAN KOWALSKI
Age: 47

Parameters

Graph: Decibels

View

Analysis

ABS T.DV P.DV 3D TDP
INFO PRG BB CMP PDP
STD

Date	Eye	Field	Strategy
2001-02-23	Left	Glaucoma	Screening
2002-06-07	Right	Full	Fast threshold
2005-10-24	Left	Glaucoma	Fast threshold
2006-02-23	Right	Fast	Blue on Yellow
2006-06-29	Binocular	BDT	BDT
2008-12-09	Left	24	Advanced
2008-12-09	Right	30	Fast threshold
2008-12-09	Left	24	Fast threshold
2008-12-17	Right	Kinetic 8	Auto Kinetic
2013-07-22	Right	24	Advanced

Filters

Field Strategy Eye Date

From To

Remarks

2013-07-22 Absolute level

2013-07-22 Total deviation

2013-07-22 Pattern deviation

2013-07-22 Details

Examination date: 2013-07-22
Strategy: Advanced
Field: 24
Stimuli color: White
Stimuli size: III
Duration: 02m 50s
No. of exp.: 95/54
SPH [D]: None
CYL [D]: None
Pupil diam. [mm]: 3,2
Fovea result [dB]: ---
PD: 2,43
Slope [dB/10°]: 0/1
Cal. HOV at 10° [dB]: ---
MD: -2,09
FIx (CCD): 0/1
FIx (HK): Off
POS: 0/5=0%
NEG: 0/6=0%

Figure 10.1. Result review window screen.

10.1. Visualization options

The results review window was designed to provide all of the most important data simultaneously via a four-window display. The active window is surrounded by a grey frame. Any window can be activated by clicking inside it. Shown below are the controls used to change visualization status.



Figure 10.2. Visualization control buttons

- **Blocking all four subwindows to display results of one examination.**

By default, all four subwindows are related to one examination. However, you may display the results of different examinations in different subwindows. To do so, turn off window blocking by clicking on the button that has a padlock symbol.



- blocking turned on



- blocking turned off

- **Enlarging the active window**

You can display the contents of the active window enlarged onto the results field. To do so, double click on the active subwindow or press the enlarging button.



- 4 windows mode is active



- enlarged window mode is active

- **Restoring the standard settings**

To restore the standard settings, (i.e., to display default maps in all four windows), press the “STD” button. The default maps for each window can be selected in the Setup/Appearance tab. Both analysis type (ABS, HOV, AGE a.s.o.) and map style (dB, dot scale, grey scale, color scale) can be adjusted according to preference.



- Restore the standard maps in results review.

10.2. Visual field analysis

The PTS 1000 automated perimeter offers four different graph types. Changing graph types is done by choosing one of the windows and selecting the desired graph from the ‘Graph’ list.

- **Decibels:** field range is presented as a graph with values expressed in decibels of measured sensitivity levels of field locations.

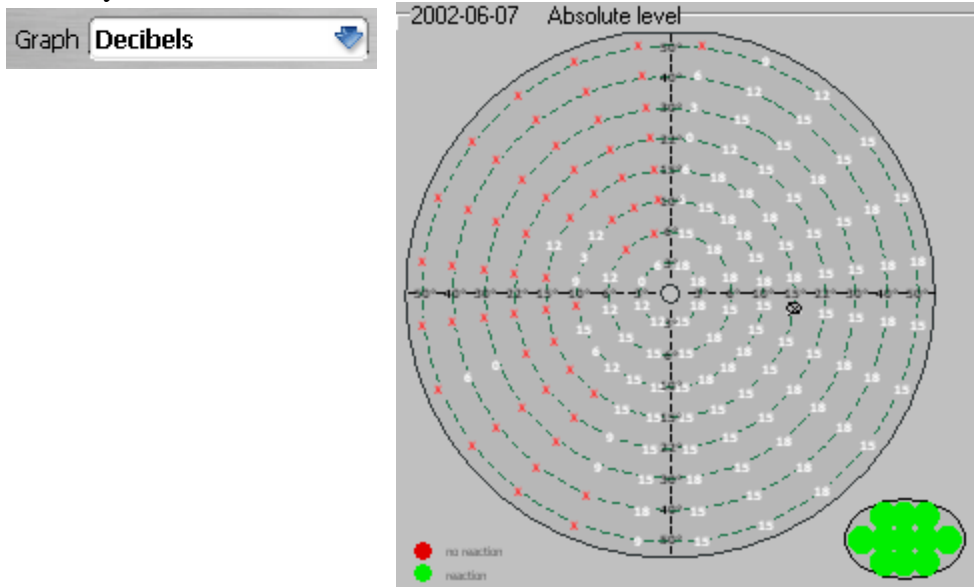


Figure 10.3. Decibel graph.

- **Grey scale:** the result is shown as a grey scale with approximated values between tested locations. In this mode, the computer analyzes and calculates a sensitivity map for the complete vision field, based on location-measured sensitivity, and presents results in shades of grey. The darker the location, the lower the sensitivity.

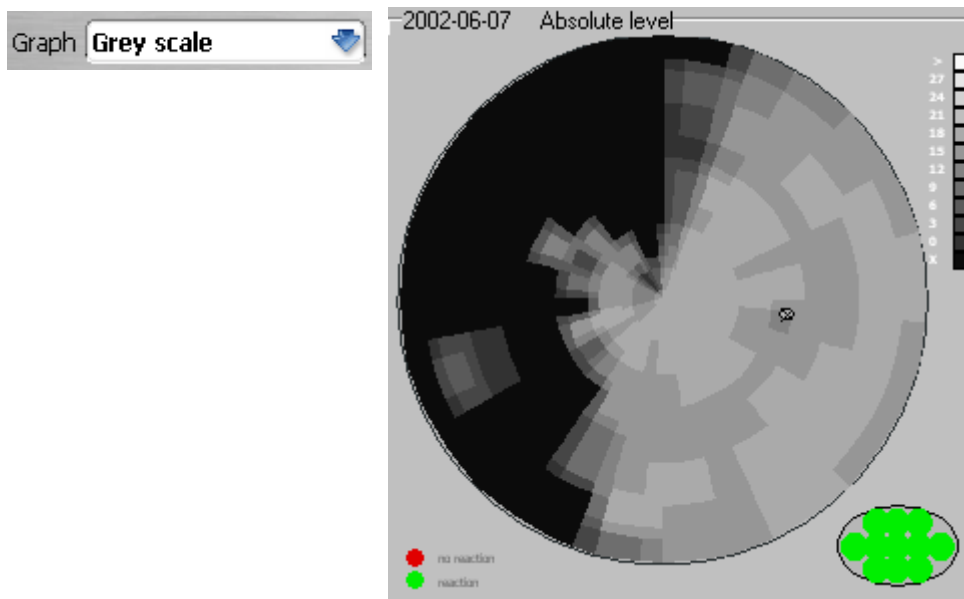


Figure 10.4. Grey scale graph.

- **Dot scale:** this graph is similar to grey scale, but sensitivity values are shown as small dots, for easier recognition of areas with a given sensitivity level.



Figure 10.5. Dot scale graph.

- **Color scale:** this graph is similar to dot scale, but pictograms are displayed in colors.

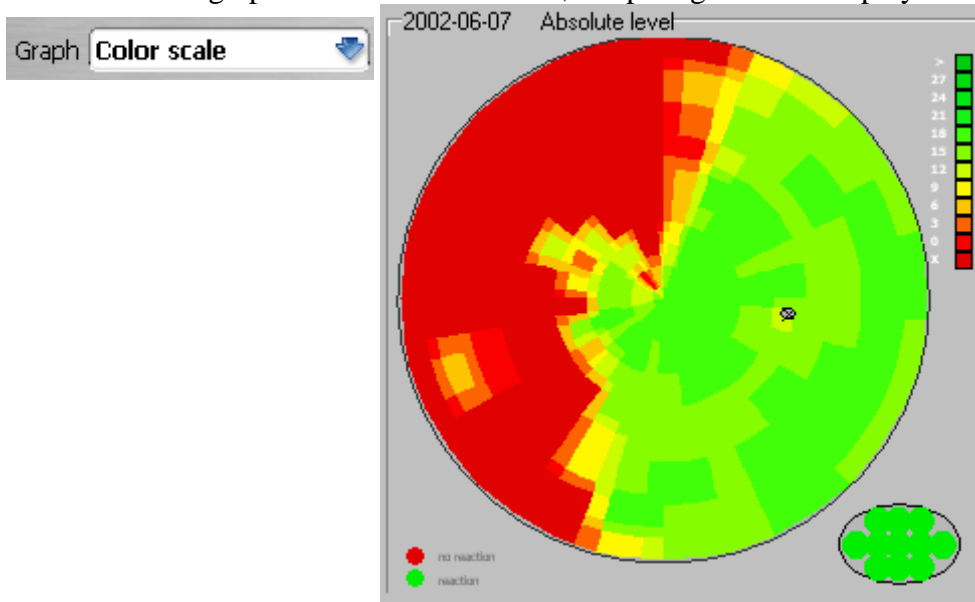


Figure 10.6. Color scale graph.

3-Zone and BSV results can be viewed only in decibel scale.

10.3. Analysis of results

The PTS 1000 collects data during testing and analyses results to efficiently detect all defects. To change the analysis type, select one of the subwindows and press the "Analysis" button.

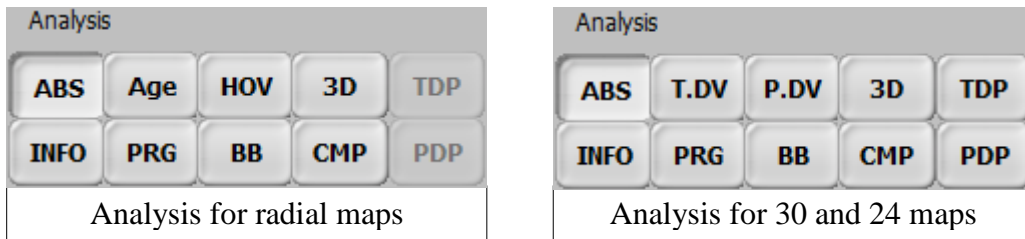


Figure 10.7. Analysis control panel.

- Absolute level



Absolute level graph shows sensitivity levels expressed in decibels just as they were tested. To select Absolute level analysis click “ABS” button.

- Age norm deviation / Total Deviation



This graph shows the deviation between actual sensitivity of each location compared to the normative sensitivity calculated on the patient’s age. A negative number means that the actual sensitivity is lower than expected. A positive value means that the sensitivity is higher than expected. To select Age norm deviation analysis click “AGE” button.

Note: Age norm deviation graph is not available for the ‘Extended’ field.

IMPORTANT!
Age norm is available only for patients examined with green or white stimuli size III.

- HOV deviation / Pattern Deviation



HOV (Hill of Vision) - For each location of tested field this graph shows the deviation between a patient’s actual sensitivity and the correct sensitivity. Correct sensitivity is calculated on the basis of calibration and examination. A negative number in each location means that the actual sensitivity is lower than expected. A positive value means that the sensitivity is higher than expected. To select HOV deviation analysis click “HOV” button.

Pattern Deviation – The pattern deviation map is the Total Deviation map without depression bias. It therefore shows deviations from the patient’s ideal profile and has a functionality of HOV deviation. General depression is removed by zeroing the 7th best result from Total Deviation.

Note: HOV deviation graph is not available for the ‘Extended’ field.

- 3D visualization



This graph shows the 3-dimensional visualization of a patient's result. The absolute level graph, Age norm 3D graph, Age norm deviation graph, and Hill of Vision deviation graph can be displayed on the 3D visualization window.

Note: 3D visualization graph is not available for the 'Extended' field.

- Examination details



Shows information about a selected examination. It includes: field type, strategy, time of an examination, number of exposures, fixation errors and the global indices: Mean Defect, PD, MD and PSD.

- Defect progress



This graph shows changes in values of a PSD - Pattern Standard Deviation and MD - Mean Deviation indices in time. It is based on previously taken examinations.

Note: Defect progress graph is not available for the 'Extended' field.

- Bebie curve



The Bebie curve is a patient's vision quality graph organized as cumulative plot.

Note: Bebie curve is not available for the 'Extended' and 'User' fields.

- Comparison



Opens the Overview window, in which different examination results can be listed and compared.

- Total Deviation Probability - Presents age norm deviation in the form of the probability of such deviation in the normal population. Different dot patterns are used for different levels of probability.



- Pattern Deviation Probability - Presents pattern deviation in the form of the probability of such deviation in the normal population. Different dot patterns are used for different levels of probability.



10.3.1. Absolute results graph

Selecting the absolute results graph will show a graph with absolute values of sensitivity in decibels (Hz for Flicker strategy), grey, dot, or color scale. All location marked with an "X" are absolute defect locations. This means that the patient didn't react to even the brightest stimulus (3 Hz for Flicker strategy).

Note: Absolute result graph is available for all strategies available in PTS 1000.

10.3.2. Age norm deviation graph

After choosing the “Age Norm Deviation” option, the screen displays values calculated as the difference between the real sensitivity level presented on the absolute level graph and the level fixed as a pattern for a given age group (normative values). The pattern level for a given age group is set on the basis of statistics derived from approximately 50 thousand examinations, and specified according to patient age, as per the table below:

I	<20 years old
II	20-30 years old
III	30-40 years old
IV	40-50 years old
V	50-60 years old
VI	>60 years old

Positive numbers mean that the patient’s eye is more sensitive than the normal value and shows how much it is higher in dB. A negative number shows how much worse the patient's vision is compared with the age normal in given location.

Age Norm: normative threshold values designated for given age group.

IMPORTANT!
Age norm is available only for patients examined with white or green stimuli size III.

Note: Age norm deviation graph is available for Threshold and Fast threshold strategy.

10.3.3. Total deviation graph

The total deviation graph is an age norm deviation equivalent for 30 and 24 maps. It shows the differences between the real sensitivity level presented on the absolute level graph and a fixed level as a pattern for a given age group (normative values). For the total deviation graph, age groups are ordered according to the same table as for the age norm deviation graph (see section *10.3.2 Age norm deviation graph*).

Positive numbers mean that the patient’s eye is more sensitive than the normal value. The program shows how much it is higher in dB. A negative number indicates how much worse the patient's vision is than the age normal in given location.

IMPORTANT!
Total deviation analysis is available for Threshold, Fast threshold and Advanced strategies with white or green stimuli of size III on maps 24 and 30.

10.3.4. HOV deviation graph

After you select the HOV deviation, the program calculates the desired eye profile for the patient based on sensitivity levels of four calibration locations and examination results. This calculated level is then compared with the actual sensitivity level for each location. The number in each location shows the depth of defect, in decibels (Hz for Flicker strategy), grey scale or dot scale. For an examination using Screening strategy, defects that are 6dB or deeper are shown. For Threshold and Fast Threshold strategies this margin of defect is different for each ring. For 1° - 10° rings the margin is 4dB, for 15° ring the margin is 6dB, and for rings 22° - 50° the margin is 8dB. For the Flicker strategy, locations are marked as defects if they are deeper than 8 Hz.

Locations marked with a • mean no defect. Locations with absolute defects are marked with an 'X'. Setting pattern levels is different in the Screening strategy than in other strategies.

With the Screening strategy, the pattern level for each ring is set in the same way as during the patient examination (see section 9.7 – Stage I – Calibration).

For Threshold and Fast Threshold strategies, the pattern level for each ring is set by using interpolation of the real examination result, without deep defects.

For the Flicker strategy, the pattern level corresponds to the calibration level and is flat for whole field of examination.

Considering result reference to correct state, deviation is easy to interpret, and serves as BASIC interpretation graph for specifying defects of visual field.

IMPORTANT!
HOV deviation analysis is available for Threshold and Fast threshold strategies on radial maps and white or green stimuli of size III.

10.3.5. Pattern Deviation graph

Pattern Deviation is the HOV deviation equivalent for maps 24 and 30. It highlights local depressions (scotomas) by zeroing influence of general depression of Hill Of Vision. The base for Pattern Deviation graph is Total Deviation graph. By zeroing seventh best value from Total Deviation the general depression is diminished in visualization of result.

The pattern deviation, as it is referenced with the interpolated pattern profile, is easy to interpret, and serves as the BASIC interpretation graph for specifying defects of visual field.

IMPORTANT!
Pattern Deviation analysis is available for Threshold, Fast threshold and Advanced strategies on 24, 30 maps and white or green stimuli of size III.

10.3.6. Total Deviation Probability graph

Total Deviation Probability graph is composed with dot scale rectangular elements, whereas each element corresponds to a specific location in the field. The probability is categorized with the following probability levels: $p < 5\%$, $p < 2\%$, $p < 1\%$ and $p < 0.5\%$.

The probability level of the particular element refers to a total deviation value of the specific location.

For example if $p < 2\%$ dot scale element is displayed, it means that less than 2% of normal (healthy) population will have total deviation value of the specific location larger than that found in the examination.

The following image illustrates dot scale textures and corresponding probability levels used in Total Deviation Probability graph.



Figure 10.8. Total Deviation / Pattern Deviation Probability scale.

10.3.7. Pattern Deviation Probability graph

Pattern Deviation Probability graph is composed with the same dot scale rectangular elements, as the Total Deviation Probability graph, categorized with the same probability levels: $p < 5\%$, $p < 2\%$, $p < 1\%$ and $p < 0.5\%$

The probability level of the particular element refers to a pattern deviation value of the specific location.

For example, $p < 2\%$ dot scale element means that less than 2% of normal (healthy) population will have pattern deviation value in the specific location larger than that found in the examination.

Dot scale textures and corresponding probability levels used in Pattern Deviation Probability graph are the same as the ones used in the Total Deviation Probability graph. It is illustrated on the above image.

10.3.8. Three-dimensional visualization

As shown in the example below, the PTS 1000 displays results as 3D graphs.

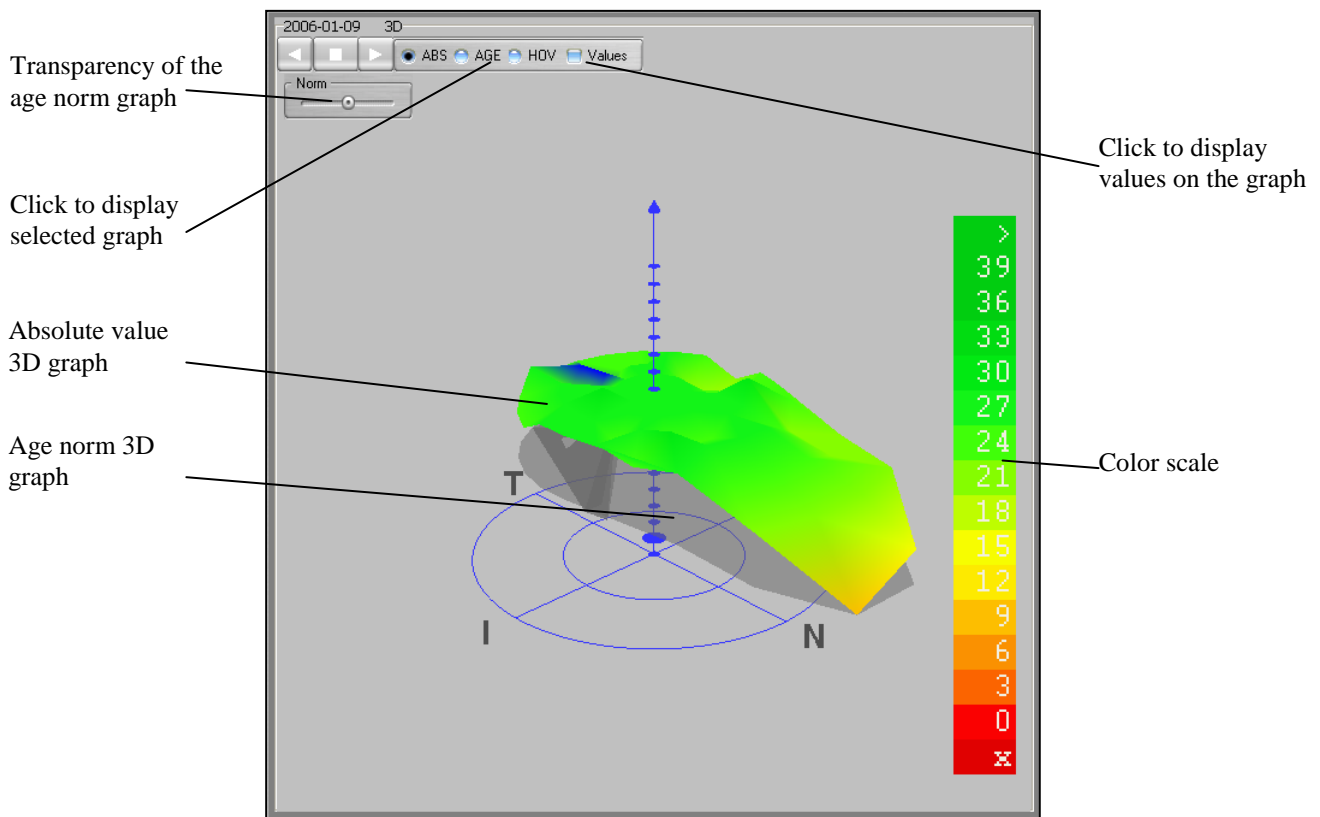


Figure 10.9. 3D plot screen.

User can change the point of view of the 3D cone by pressing the left mouse button and dragging the mouse over the 3D graph. You can change the scale of the graph by pressing the right mouse button and dragging the mouse up/down. You can also rotate the graph by using the *Play Right*, *Play Left*, and *Stop* buttons.

Three kinds of graphs can be displayed in the 3D window: Absolute level graph '*ABS*', Age norm deviation graph '*AGE*' and Hill of Vision deviation graph '*HOV*'. The user can select a 3D graph with the '*ABS; AGE; HOV*' group box. Related values can be also displayed on the selected graph. Tick the '*Values*' checkbox to display values on the graph.

To provide a better reference, the age norm 3D graph is displayed together with the absolute level 3D graph. The age norm 3D graph is semitransparent. The user can adjust the transparency of the age norm graph using the '*Norm*' trackbar. By default, the transparency of the age norm graph is set to the middle position.

The age norm 3D graph is displayed only for Threshold, Fast threshold and Advanced strategy.

This graph is intended to help the patient understand and interpret the test, contributing to productive patient/doctor communication and facilitating a more efficient and confident examination.

10.3.10. Pupil movement graph

During an examination performed with digital image analysis, the program automatically stores movements of the patient's eyes into memory. This type of data is useful in determining the reliability of an examination. In the example shown below, fixation is poor.



Figure 10.11. Eye movement plot: Poor fixation.

An example of good fixation is shown below.



Figure 10.12. Eye movement plot: Good fixation.

Vertical bars represent eye deviation from the center. The higher the bar, the bigger the deviation from the bowl center. Bars below the horizontal bottom line mark the moments when eye blinking has interfered with exposure. Bars of full height represent the time when no eye was detected at all. In the example below, a patient has removed his head during an examination.



Figure 10.13. Eye movement plot: poor fixation and detected removed eye.

10.3.11. Examination parameters panel

Date the test was taken	Examination date	2014-01-28	
	Strategy	Fast threshold	Strategy of examination
Tested field	Field	Central	
	Stimuli color	White	Stimuli color of examination
Stimuli size	Stimuli size	III	
	Duration	03m 55s	Duration of test
Number of exposures / number of total field points	No. of exp.	216/100	
	SPH [D]	7,00	Trial lens information
	CYL [D]	-1,50	
Pupil diameter	Pupil diam. [mm]	3,8	
	Fovea result [dB]	30 dB	Foveal threshold value
	Slope [dB/10°]	2,3	Eye profile slope
Calibrated HOV level at 10 degree	Cal. HOV at 10° [dB]	27 dB	
	Mean Defect	-0,25 !	Statistical indices
	PD [dB]	0,24	
	MD [dB]	-3,33 P<5%	
	PSD [dB]	1,74 P<10%	
	FIX (CCD)	0/4	
Quality indexes	FIX (HK)	Off	
	POS	0/7=0%	
	NEG	0/7=0%	

Figure 10.14. Examination parameters panel screen.

This panel displays all of the information about the currently viewed examination result, including:

Duration

Total duration of the exam, including only effective examining, without pauses and breaks. When the examination is paused, this timer is paused too.

Number of exposures

The number of stimulus points that have been exposed to the patient in a ratio to total number of field locations. For example: 216/100 indicates that the exam included 100 locations and 216 exposures; i.e., each location was tested twice on average.

HOV level

Calculated on the basis of a fixed sensitivity level in four calibration locations placed on a 10 degree ring, after omitting two extreme values and calculating the average figure from the remaining two. This value is a HOV value, calculated during calibration.

Fovea result

The Foveal threshold [dB] value, given as a result of the Foveal threshold test. See section 9.1.6 Foveal threshold test for details.

Eye profile slope

Contains information about how steep the eye profile is. For screening strategy it is set by default to 3 [dB/10°]. In threshold strategy the slope is calculated upon test result data. Calculated profile slope should be between 1 [dB/10°] to 4.5 [dB/10°]. If it is out of range, one of the values listed above is chosen.

Correction lens

Contains information about the trial lens used during testing. PTS 1000 perimeters can perform examinations using two correction lenses simultaneously (sphere and cylinder).

Quality factors

Mean Defect

The Mean Defect parameter specifies loss of eye sensitivity calculated as a mean difference between the „ideal” profile calculated by the computer for a given patient on the basis of his or her examination results, and age norm appropriate for this patient. This factor does not take into account losses in visual field (scotoma).

The parameter can only be calculated for examinations taken by threshold and fast threshold strategies. The index can change in a range from -1 to +1. The value -1 on average, means that sensitivity is twofold lower in the whole field than expected for the age norm of a given patient (e.g., if the age norm for a patient is 24dB for a 10° ring, the real sensitivity will be 12dB for 10° ring).

The warning level is marked with one exclamation mark „!” next to a given value. The limit for every field is presented in the table below (it refers to the location of Bebie curve on bottom line of tolerance path).

The alarm level is marked with two exclamation marks „!!” next to a given value. The limit for every field is presented in the table below (it refers to the location of Bebie curve below its tolerance path).

Table 10.1. Warning and alarm levels for Mean Defect index.

Field/Limit	Full	Central	Glaucoma	Peripheral	Macula	Fast
Warning level (!)	-0,25	-0,25	-0,25	-0,25	-0,25	-0,25
Alarm level (!!)	-0,35	-0,35	-0,35	-0,35	-0,35	-0,35

Note: *Mean Defect* index is available for radial fields as follows: Central, Glaucoma, Macula, Full, Fast, Peripheral, User, used with Threshold and Fast threshold strategies.

Note: *Mean Defect* index is available for normative stimulus parameters: size III, white color and green color.

For extended field, the *Mean Defect* index is not given, because this field is examined only with the 3-zone strategy.

PD – Pattern Defect

The PD index gives information about the regularity of the patient's eye profile. Generally, it specifies quantity and depth of local defects (scotoma) as compared with pattern sensitivity. A zero value means that the profile is smooth, without any local defects. The bigger the value, the deeper the local defects are.

The warning level is marked with one exclamation mark „!” next to a given value. The limit for every field is presented in the table below. It refers to 2 deep defects (sensitivity 0dB for a 10° ring).

The alarm level is marked with two exclamation marks „!!” next to a given value. The limit for every field is presented in the table below. It refers to 5 deep defects (sensitivity 0dB for a 10° ring).

Table 10.2. Warning and alarm levels for PD (Pattern Defect) index.

Field/Limit	Full	Central	Glaucoma	Peripheral	Macula	Fast
Warning level (!)	0,26	0,42	0,40	0,58	0,83	0,72
Alarm level (!!)	0,64	1,05	1,01	1,46	2,08	1,81

Note: PD (Pattern Defect) index is available for the fields as follows: Central, Glaucoma, Macula, Full, Fast, Peripheral, User, used with Threshold, Fast threshold and Screening strategy, and for the fields 24, 30 used with Screening strategy.

Note: PD (Pattern Defect) index is available for all combinations of the stimulus parameters available in PTS 1000: size I, II, III, IV, V, color: white, green, blue, red.

For extended field, PD index is not given, because this field is examined only with the 3-zone strategy.

MD – Mean Deviation (index used for 30, 24 maps and for radial maps)

The MD calculation is the average value of locations from the Total Deviation graph – for 24, 30 fields and from the Age deviation graph – for radial maps. The MD index shows how far the patient’s visual field deviated from the normal values. For vision below the normal, the values of MD index are negative.

MD (Mean Deviation) index is calculated according to the following formula:

$$MD = \left[\frac{1}{n} \sum_{i=1}^n \frac{(X_i - N_i)}{S^2_{li}} \right] / \left[\frac{1}{n} \sum_{i=1}^n \frac{1}{S^2_{li}} \right]$$

where:

- X – dB threshold value in location i
- N – Age norm value in location i
- S – Standard deviation in location i
- n – number of locations on the map.

Figure 10.15. MD (Mean Deviation) formula.

Note: MD (Mean Deviation) index is available for the fields as follows: Central, Glaucoma, Macula, Full, Fast, Peripheral, User, 24, 30, and for the strategies: Threshold, Fast threshold and Advanced.

Note: MD (Mean Deviation) index and PSD (Pattern Standard Deviation) index are available for normative stimulus parameters: white III and green III.

Probability levels for MD (Mean Deviation) index

If the MD value differs significantly from the population norms a “P” (probability) value is given. The “P” value is categorized with the following levels: P < 10%, P < 5%, P < 2%, P < 1% and P < 0.5%. For example if P < 2% is displayed, it means that less than 2% of normal (healthy) population will have the MD value larger (below zero or above zero value) than that found in the examination.

Probability value “P” is available for normative stimulus parameters.

Probability value “P” is not available for Peripheral field and for User field.

PSD – Pattern Standard Deviation (index used for 30, 24 maps and for radial maps)

The PSD value is calculated as the average difference between values from the Total Deviation graph for 24, 30 fields (and from the Age deviation graph for radial fields), and MD (Mean Deviation) index value. As such, for general depression without localized defects, PSD will be approximately zero with a high MD (Mean Deviation) value. If there is a high level of scotoma without depression, both PSD and MD (Mean Deviation) indexes will be significant.

The Pattern Standard Deviation value is calculated according to the following formula:

$$\text{PSD} = \sqrt{\left[\frac{1}{n} \sum_{i=1}^n \frac{1}{S^2_{1i}} \right] \times \left[\frac{1}{n-1} \sum_{i=1}^n \frac{(X_i - N_i - \text{MD})^2}{S^2_{1i}} \right]}$$

Figure 10.16. PSD (Pattern Standard Deviation) formula.

Note: PSD (Pattern Standard Deviation) index is available for the fields as follows: Central, Glaucoma, Macula, Full, Fast, 24, 30, and for the strategies: Threshold, Fast threshold and Advanced.

Note: PSD (Pattern Standard Deviation) index is available for normative stimulus parameters: white III and green III.

Probability levels for PSD (Pattern Standard Deviation) index

If the PSD value differs significantly from the population norms a “P” (probability) value is given. The “P” value is categorized with the following levels: P < 10%, P < 5%, P < 2%, P < 1% and P < 0.5%. For example if P < 2% is displayed, it means that less than 2% of normal (healthy) population will have the PSD value larger (above zero value) than that found in the examination.

Probability value “P” is available for normative stimulus parameters.

Probability value “P” is not available for Peripheral field and for User field.

Statistical tests***FIX (H-K) – fixation errors***

This index specifies the number of fixation errors detected for the Heijl-Krakau method (blind spot location analysis). This factor is calculated only in examinations where the system of digital analysis of eyeball location was *switched off*.

The factor is presented as $A/B=C\%$, where A stands for the number of fixation errors, B for the number of fixation controls, and C for the percentage value of fixation errors in relation to total fixation tests.

The warning level is marked with one exclamation mark „!” next to a value higher than 15%.

The alarm level is marked with two exclamation marks „!!” next to a value higher than 25%.

Note: The *Heijl-Krakau fixation errors* statistical test is available for all monocular tests, except of the tests with Advanced strategy.

FIX (CCD) – fixation errors

This index is similar to the FIX index, but is considerably more reliable. This factor is calculated only in examinations when the system of digital analysis of eyeball location was *switched on*. The program uses digital image analysis to calculate the index. Proper fixation is controlled continuously during the test.

It is shown as a ratio of A/B , where A stands for the number of fixation errors, and B for the number of situations in which the system suspected patient’s bad fixation.

The warning level is marked with one exclamation mark „!”, and its value refers to *FIX (H-K)* factor of 15% value.

The alarm level is marked with two exclamation marks „!!”, and its value refers to *FIX (H-K)* factor of 25% value.

Note: The *FIX (CCD) – fixation errors* statistical test is available for all monocular tests.

POS – false positive errors

This index refers to the number of false positive errors committed by a patient during the test presented as a ratio. Details are described in section 9.5.

The factor is presented as $A/B=C\%$, where A stands for the number of false positive errors, B for the number of trials, and C for the percentage value of errors in relation to the total number of trials.

The warning level is marked with one exclamation mark „!” next to a value higher than 15%.

The alarm level is marked with two exclamation marks „!!” next to a value higher than 25%.

Note: The *False Positive Errors* test is available for: Threshold, Fast Threshold, Screening, 3-zone, Advanced, BDT and Flicker strategy.

NEG – false negative errors

This index refers to the number of false negative errors committed by the patient during the test presented as a ratio. Details are described in section 9.5.

The factor is presented as $A/B=C\%$, where A stands for the number of false negative errors, B for the number of trials, and C for the percentage value of errors in relation to the total number of trials.

The warning level is marked with one exclamation mark „!” next to a value higher than 15%.

The alarm level is marked with two exclamation marks „!!” next to a value higher than 25%.

Note: The *False Negative Errors* test is available for: Threshold, Fast Threshold, Advanced, BDT and Flicker strategy.

10.3.12. *Bebie curve graph*

A *Bebie curve* enables easy and efficient estimation of the patient’s visual field quality. The *Bebie curve* is constructed by ordering the sensitivities of each tested location in descending order, from highest to lowest sensitivity location. Because of the order, the curve will have a negative slope (always lowering).

- **Radial maps, stimuli size 3, green or white**

On the basis of statistical examinations performed by the manufacturer on approximately 50 thousand examination results, a margin of tolerance applied. Upper and lower margin is selected as +3dB and -3dB deviation from norm, defined for normal patients age groups <20, 20-30, 30-40, 40-50, 50-60, >60 years. The scale on the left is adjusted to a zero dB value for the location in the middle of normal *Bebie curve*. The *Bebie curve* for a healthy visual field should be within the +3dB and -3dB deviation from norm. On the basis of the *Bebie curve* shape (and additionally PD and MD indexes) crucial information can be obtained. The *Bebie curve* is also helpful for estimating the reliability of examination results.

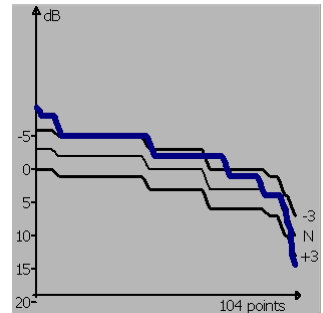


Figure 10.17. *Bebie curve* for radial maps.

- **24, 30 maps, stimuli size 3, white**

The normal *Bebie curve* shape is drawn on the basis of the age norm defined for normal patients age groups <20, 20-30, 30-40, 40-50, 50-60, >60 years. Upper and lower margin is selected as +3dB and -3dB deviation from norm. The scale on the left is adjusted to a zero dB value for the location in the middle of normal *Bebie curve*.

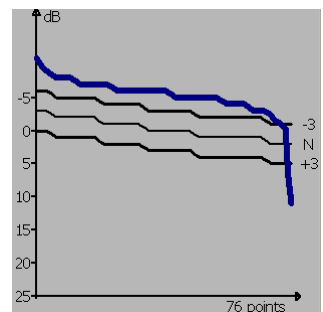


Figure 10.18. *Bebie curve* for 24, 30 maps.

- **Sample *Bebie curve* graphs and their meaning**

A *Bebie curve* for a sample examination result is shown at right. It provides information about large, deep defects in the visual field but will not specify the location of the defects. The more that the larger part of *Bebie curve* is outside the tolerance margin, the more extensive the defects are. The part of *Bebie curve* on the horizontal axis reflects the locations of absolute defect (marked with an X on visual field map). The part of the curve within tolerance limits reflects the part of the field without defects. In this example, there will also be a high value of PD index.

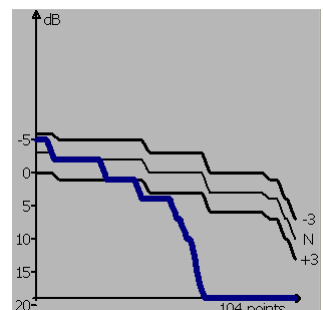


Figure 10.19. *Bebie curve* plot showing occurrence of local defects.

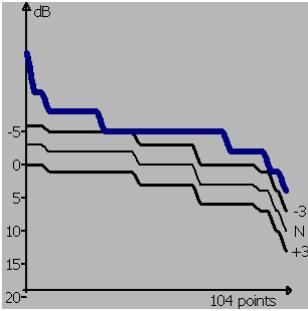


Figure 10.20. Bebie curve plot with trigger happy reactions.

The example on the right shows a Bebie curve of a visual field with one or several small but quite deep defects. For this patient the MD index will be normal (low), but the PD index should confirm the existence of local defects.

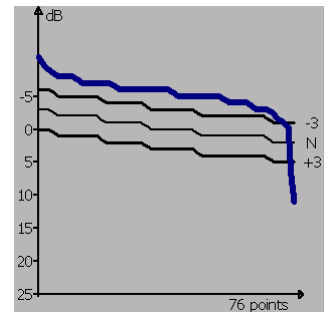


Figure 10.21. Bebie curve plot showing occurrence of deep defect on a small area.

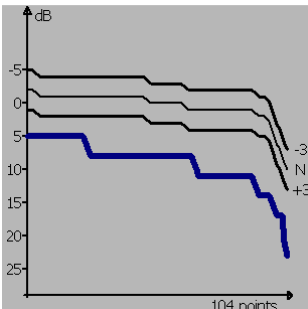


Figure 10.22. Bebie curve plot showing shallow defect.

The example at left represents a patient with a very extensive shallow defect covering almost the entire visual field. This type of defect is confirmed by the high value of the MD index, while the PD index should be normal (because there are no local deep defects).

10.3.13. Defects progress analysis

The defects progress analysis window includes two graphs: MD (Mean Deviation) index progress and PSD (Pattern Standard Deviation) index progress. These graphs show MD and PSD levels of all examinations for a given eye ordered by examination dates from the oldest examination to the newest examination.

The MD and PSD graphs are generated by clicking the appropriate examination on the examination list displayed on the Result review tab. The MD and PSD graphs are constructed with the MD and PSD values belonged to examinations performed for the same eye and with the same field as the examination selected by clicking. For example, if you click the examination performed with the left eye and with Glaucoma field, the MD and PSD graphs will be constructed only with examinations performed for the left eye and with Glaucoma field.

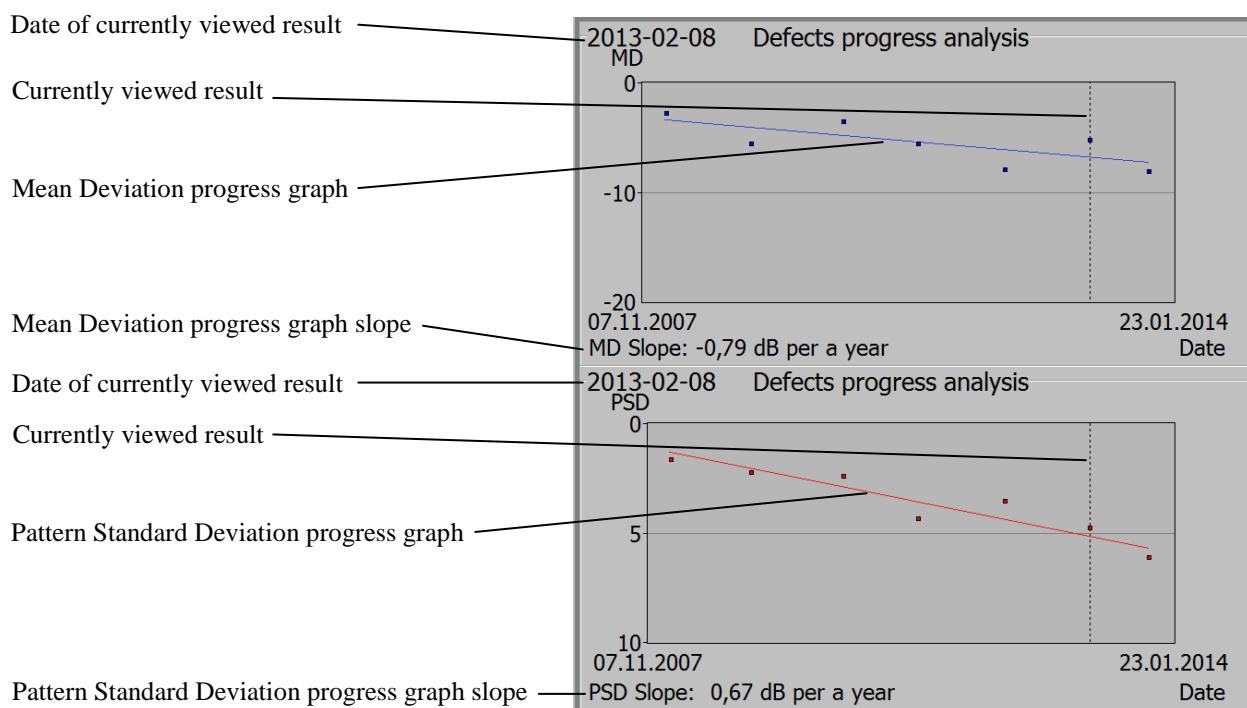


Figure 10.23. Defect progress analysis screen.

The MD and PSD values are illustrated by blue and red points on the graphs. A vertical dashed line shows the currently selected examination. Date of a currently selected examination is shown above the graph. It is also a currently viewed examination in the 'Result review' tab.

The MD Slope and PSD Slope parameters, which are expressed in decibels per year, indicates level of the MD and PSD trend. The greater the negative slope value, the faster the deterioration rate of the visual field.

The MD and PSD progress graphs are available for examinations performed with Threshold, Fast threshold and Advanced strategies.

10.4. Patient's examinations list

In the 'Results review' window there is a list of all patients' examinations. You can select a different examination by clicking it in the list or by using the arrows next to the list.

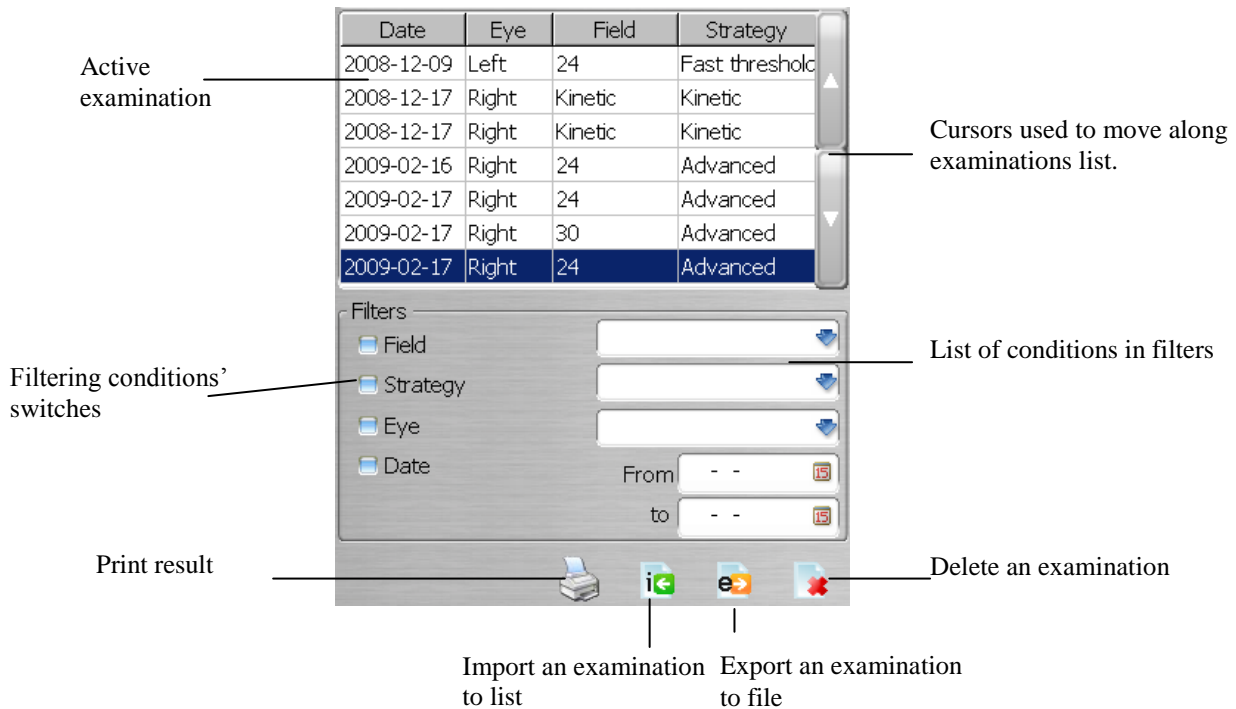


Figure 10.24. Patient's examination list and filtering tools.

10.4.1. Filtering of an examinations list

The program includes a search filter for used field, used strategy, examined eye, and examination date(s).

To activate filter, select one of the filter conditions from the list. The appropriate condition will be automatically checked. Clicking on the condition checkbox again will deactivate it. Different conditions can be selected simultaneously to limit the number of displayed results.

10.4.2. Data export/import

The PTS 1000 has a mechanism for transferring single examination results between different users/computers. Data are exported as GDT files. GDT files can be saved to hard disk (or other data storage media) or directly sent by e-mail.

- **Import**

To import a saved examination result, click the “*Import*” button, and then select a source folder and select GDT file in the “*Open*” window.

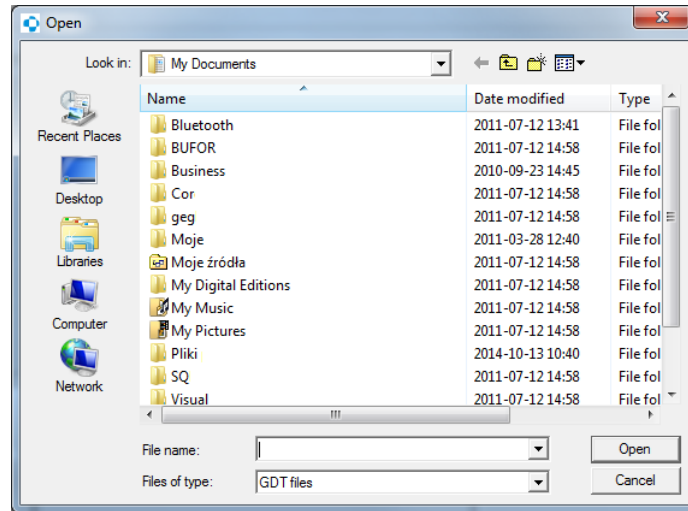


Figure 10.25. Open window for import examination screen.

The perimeter program will check the validity of the imported GDT file and insert it into database. If the imported result comes from an older software version, a message will appear:

Imported result derived from older software version can cause result review errors.

Only GDT files can be imported.

- **Export**

To export the current examination result, click the “*Export*” button and the *Export* window will appear.

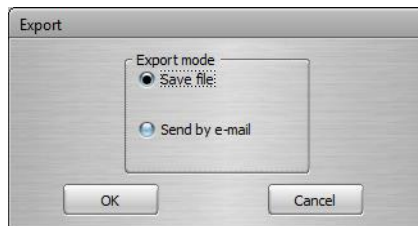


Figure 10.26. Export panel screen.

Mark the desired export mode in the “*Export mode*” panel. Click the “*OK*” button. The *Save as* window will appear. Select the destination folder and enter the file name (by default, the system will prompt ‘My Documents’ folder and file name as *name_surname_x_min_sec_yyyy_mm_dd.gdt* where “*x*” stands for examined eye R or L, “*min_sec*” stands for duration of examination e.g. 04_37 means 4min 37sec, “*yyyy_mm_dd*” stands for date of examination).

Click the “*OK*” button to save file.

If “*Send by e-mail*” mode is selected, the program will open *New message* window of default mail client installed on operating system with exported file attached to it. For “*Send by e-mail*” option, the default file name is *name_surname.gdt*

Sending exported file by e-mail is available only if the e-mail client is installed and the mail account is configured.

10.5. Printing results

The PTS 1000 software has a printout manager that allows the user to select from predefined examination printout templates, create a template, print examination result on a printer, save it as PDF file, or save it as graphic file. Click the “Print” button to activate it. A progress bar ‘Please wait’ will appear for about two seconds.



Figure 10.27. Progress bar screen.

Then, the main printout screen will appear on the screen. An example is shown below.

The screenshot shows the 'Print Manager' window. On the left, there are controls for template management: a list of stored templates (currently '7in1'), a text field to enter a new template name, and buttons for 'Save Template' and 'Delete Template'. Below this are checkboxes for 'Hide Personal Data' and 'Hide Remarks_Signatures', and buttons for 'Print', 'Save as...', and 'Close'. On the right, a preview of the printout is shown, including patient information, examination data, and various visualizations: Absolute level [dB] and [dot scale], Total deviation [dB] and [dot scale], Pattern deviation [dB] and [dot scale], Total Deviation probability [dot scale] and [dot scale], Pattern deviation probability [dot scale] and [dot scale], and an Eye movement graph. A table at the bottom right provides summary statistics.

Annotations on the left side of the screenshot point to specific elements:

- List of stored templates
- Enter name of your own template
- Save your own template
- Delete selected template
- Check to hide personal data on the printout
- Check to hide remarks and signatures on the printout
- Print examination result
- Save the printout as a file
- Close printout manager
- Print preview

No. of exp.	76/54	Fovea result [dB]	---	MD [dB]	-1.53
Fix. errors (H-K)	Off	Cal.HOV level	---	PSD [dB]	1.76 P<10%
Fix. errors (CCD)	0/0	Slope [dB/10°]	---	Stimuli color	White
NES	0/2=0%	Pupill diameter [mm]	4,8	Stimuli size	III
POS	0/2=0%	Near Defect	---	Max. luminance	10000 asb
		PD [dB]	---	Background	31,4 asb

Figure 10.28. Print manager screen.

10.5.1. Inserting new map

To insert a new map into the printout, right-click anywhere in a printout preview. Choose ‘New’ from the list.

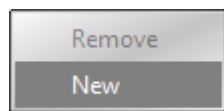


Figure 10.29. Remove a component / Insert a new component button screen.

A new map field will appear in the preview. The active field is always marked with a grey color.

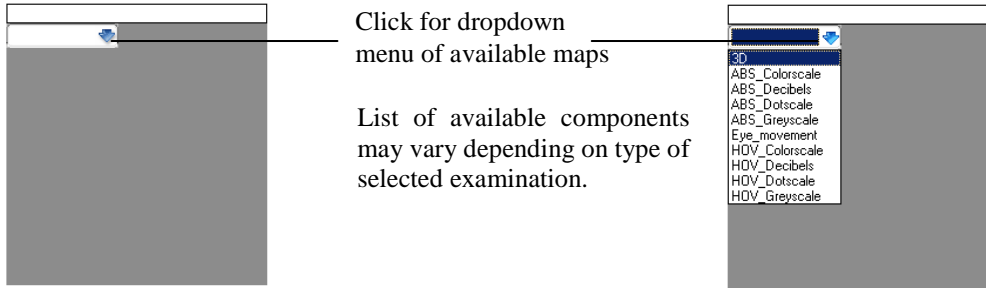


Figure 10.30. A new component field with available maps dropdown menu screen.

Select one of the available maps. The title of the map in the printout will be automatically added. A title of any selected map is specific and it cannot be changed by the user.

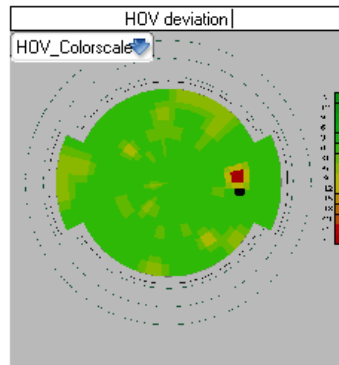


Figure 10.31. An example a new component selected for printout screen.

10.5.2. Editing map

If the map is present on the preview you can edit its position, size and contents. To do so, put the cursor over any map that is present on the preview to mark it in grey.

- To change the contents of the map, select the desired map from the dropdown menu.

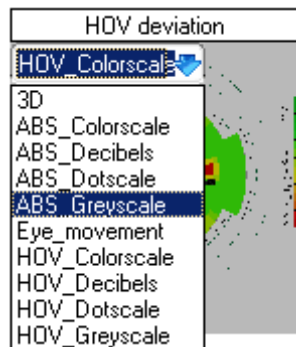


Figure 10.32. Editing the existing component to change the component type.

- To change the position of the map, press and hold the left mouse button over the area of the map. Move the map to the desired position and then release the left mouse button.

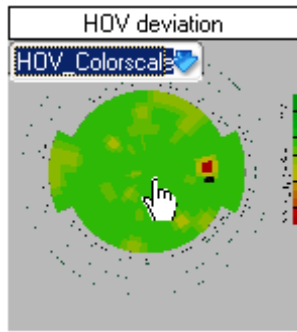


Figure 10.33. Method of changing the position of the selected component.

To change the dimensions of the map, place the mouse cursor in the bottom right-hand corner of the map. When the cursor changes the icon, press and hold the left mouse button. Moving the mouse diagonally on the images while holding the left mouse button will cause resizing of the map. Release the left mouse button after resizing.

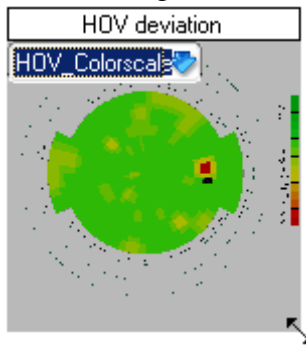


Figure 10.34. Method of changing the size of the selected component.

10.5.3. Removing map from printout

To remove any map from the printout, move mouse the cursor over the area of the map which you want to delete. Right-click to open the pop-up menu. Select 'Remove' to remove the map.

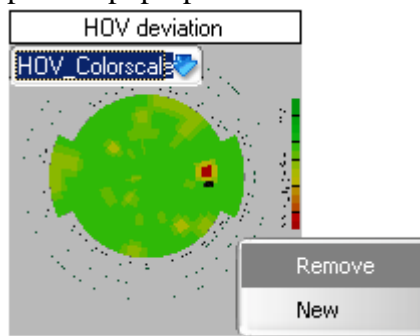
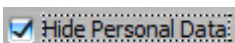


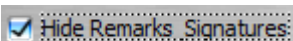
Figure 10.35. Removing the selected component from the printout.

10.5.4. Changing printout options

Two additional options are available in the printout manger.



- Hide patient's personal data – this option removes the patient's name and date of birth from the printout.



- Hide field for remarks and signatures – this option removes the additional field for remarks and signatures from the bottom of the printout.

10.5.5. Printing and saving results in printout manager

After clicking ‘Print’ a window will appear, enabling you to set the desired printer parameters:

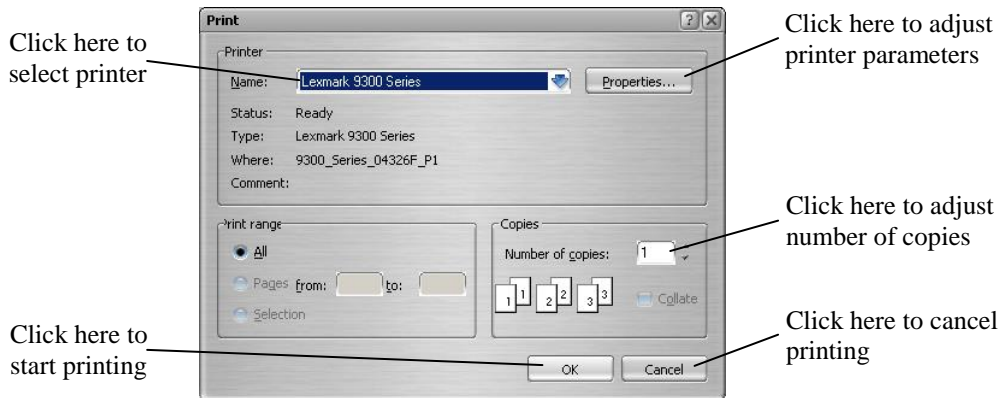


Figure 10.36. Print window.

The appearance of the this window, and the choices it offers, will vary depending on the model of printer you are using.

After clicking ‘Save as’ a window will appear, enabling you to select file name and file type for examination results:

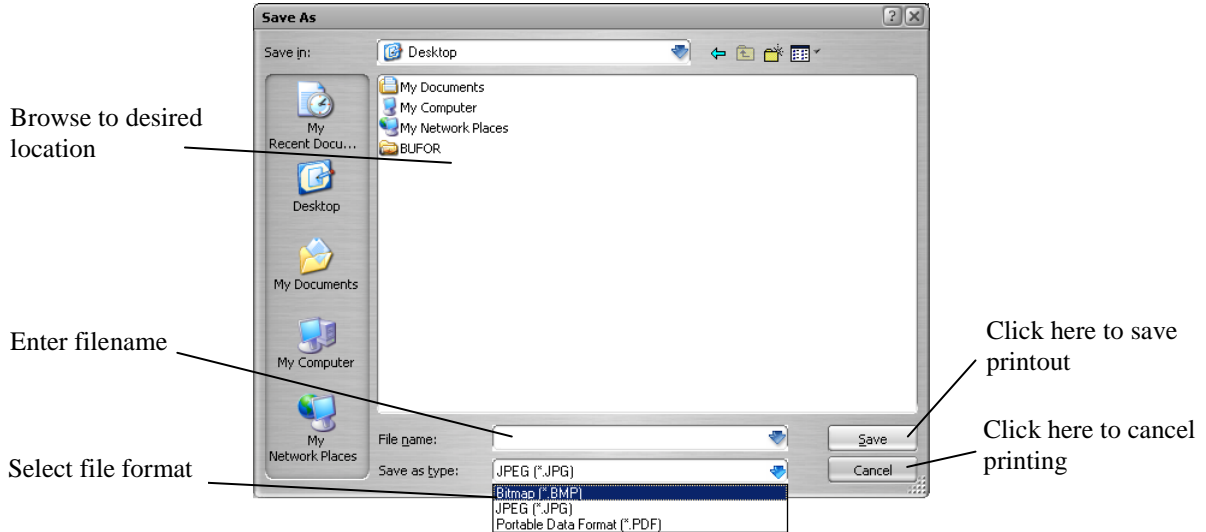


Figure 10.37. Save As window.

Note: The selected path for saving the file is memorized.

10.5.6. Results comparison printout

In order to print *Compared results*, click the “Print” button in the *Overview* window. A Standard Print dialogue window will be opened (see section 10.5.5) and a printout will be created. The printout contains all analysis and all examinations that were set on the form when print was initialized.

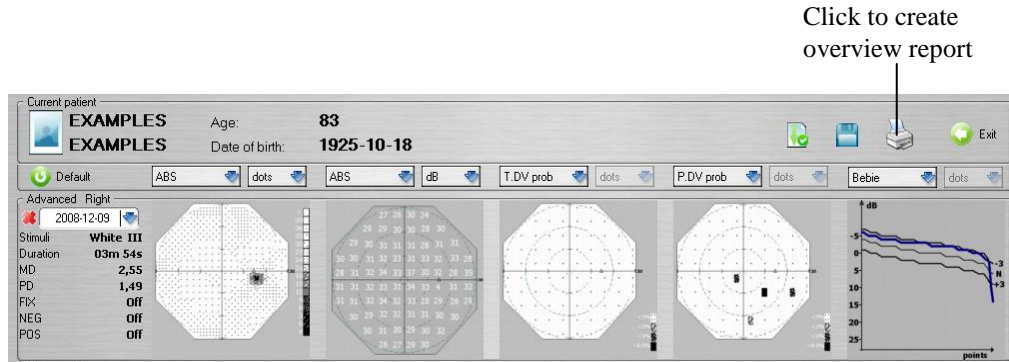


Figure 10.38. The Overview window.

Sample overview report:

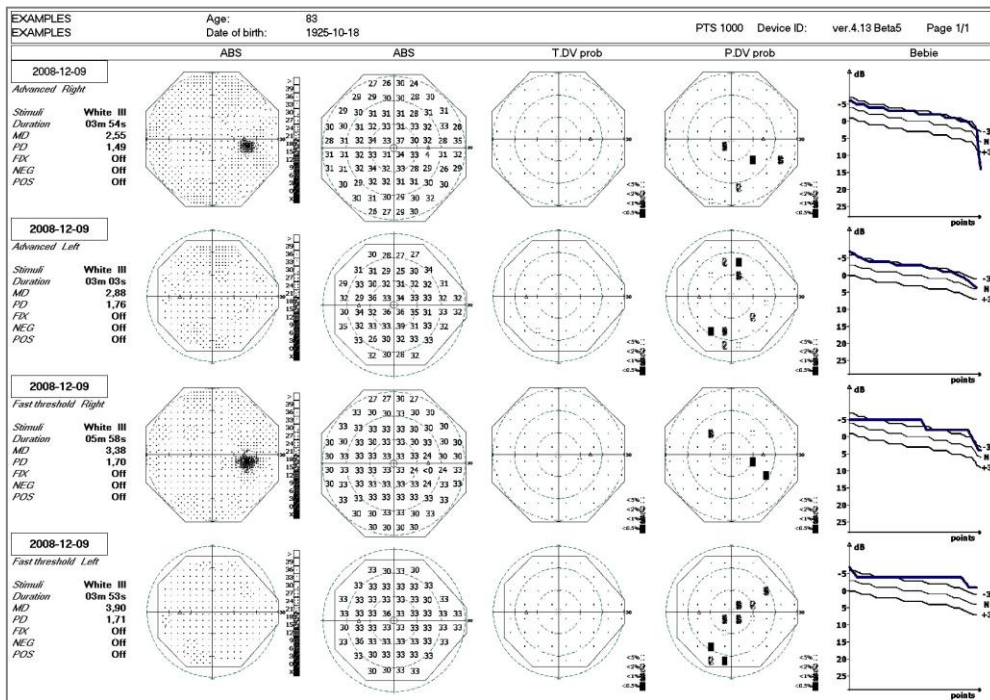


Figure 10.39. The Overview printout.

10.5.7. Sample printout

A sample printout using the Advanced strategy is shown below. All printouts are in A4 format (the example below has been scaled for this manual only).

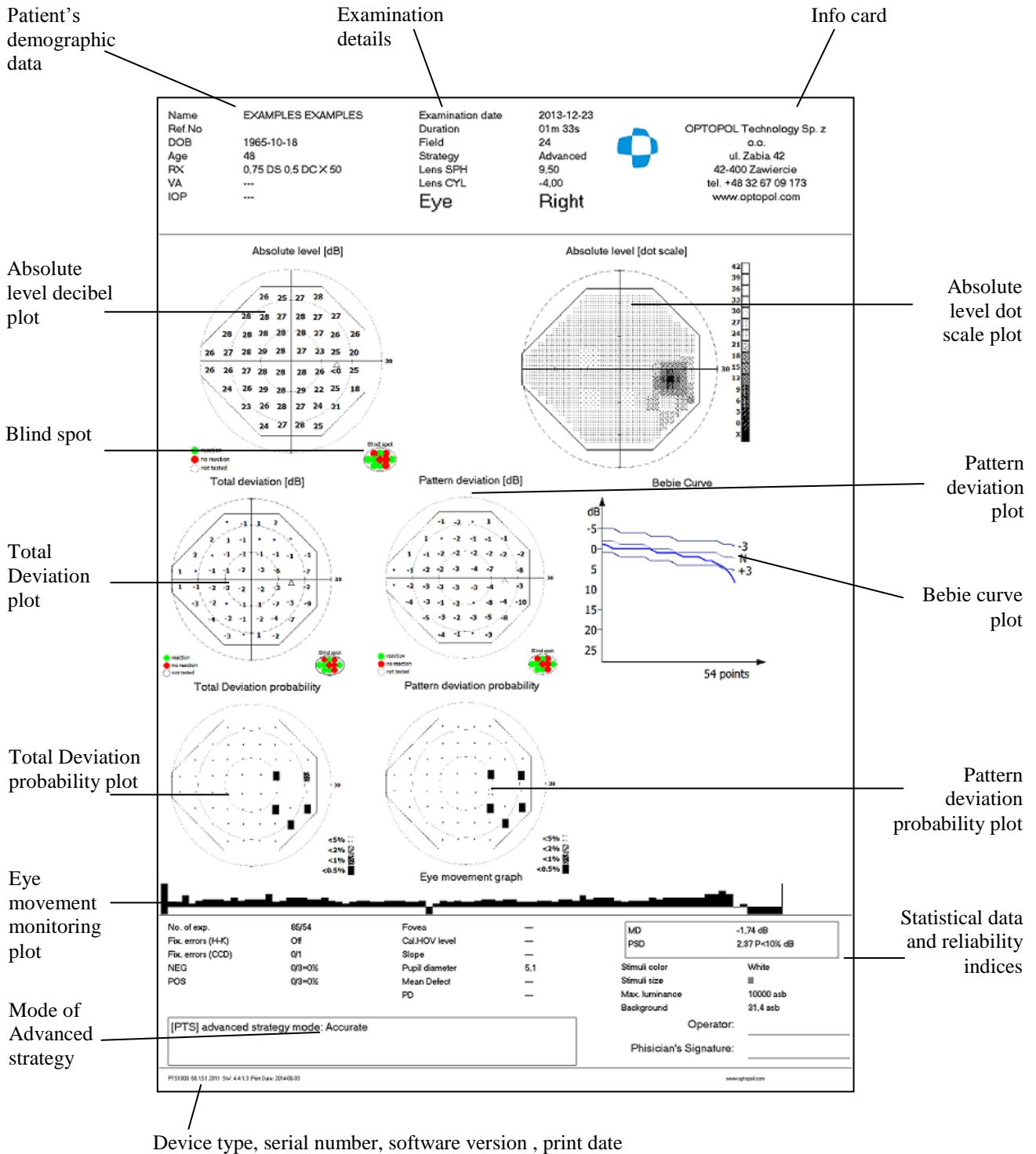


Figure 10.40. Printout screen. The sample.

11. Setup tab

This tab permits setup of the general parameters of the system and enables you to control the state of the database (e.g., removing unused test results, etc.). You can also perform the backup process here to secure against data loss in case of operation system failure.

11.1. Language selection

PTS 1000 software is multilingual. You can change the application language by selecting the desired language in the Language list box in the Setup window.

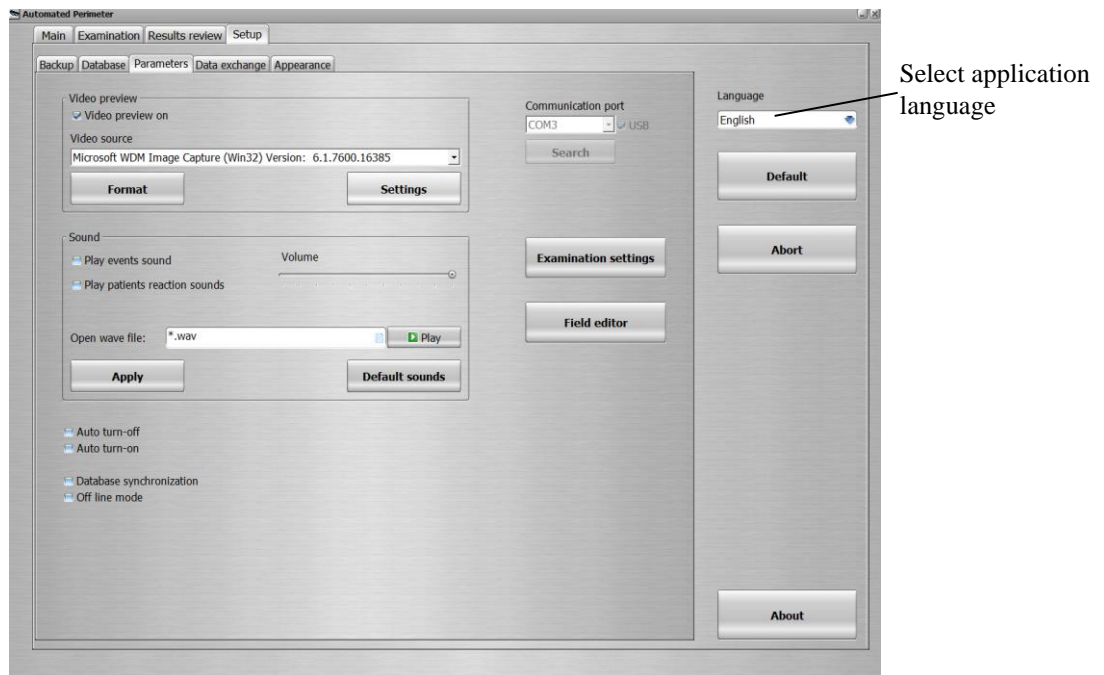


Figure 11.1. Setup window with language selection screen.

11.2. Database tab

The database tab permits organization, maintenance and repair of the database. You can delete old examination results or patients who have not been examined for a long period of time.

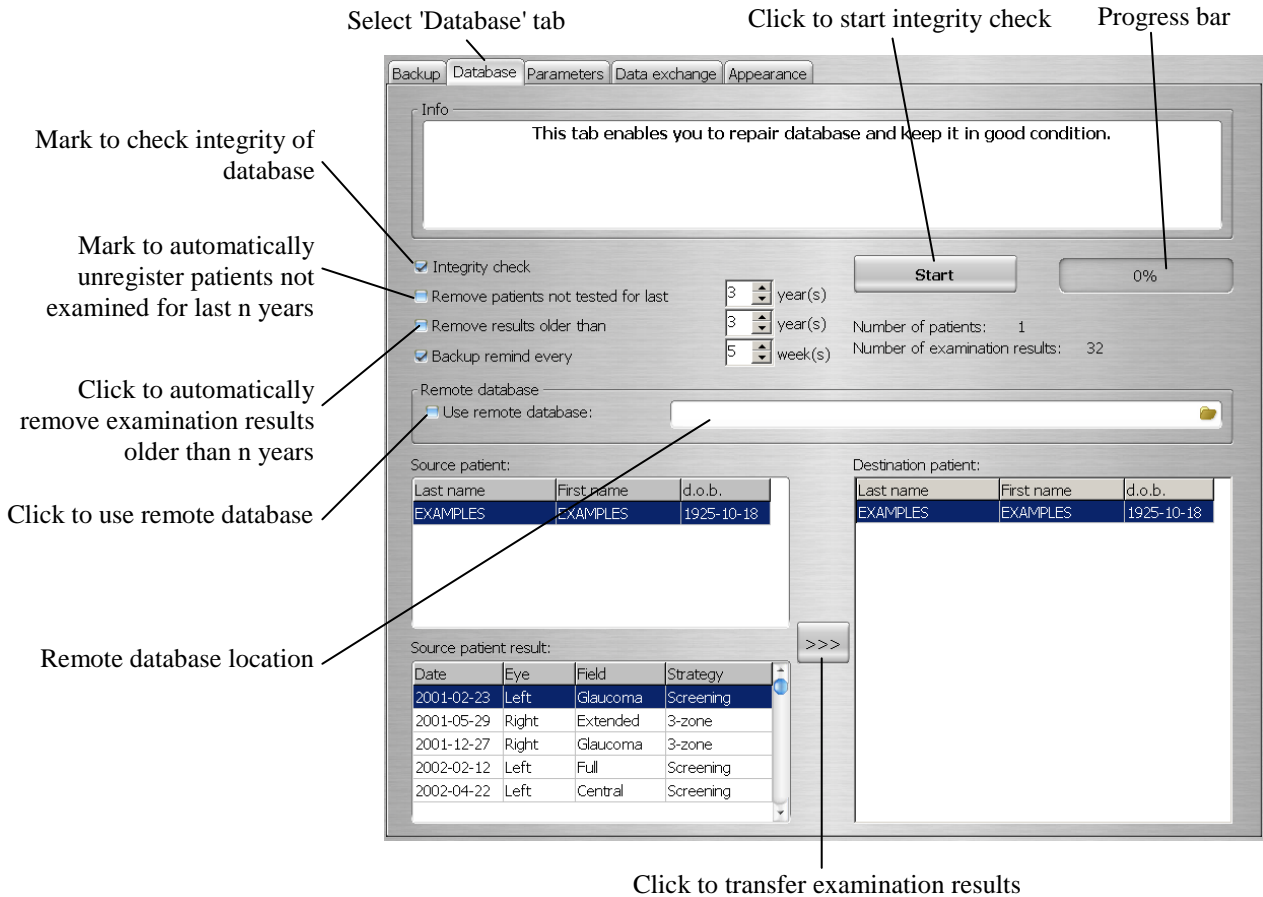


Figure 11.2. Setup window with Database tab screen.

After pressing the “Start” button, the options marked on the left will be performed. If the „Check Database” box is ticked, the software will verify the status of database and, if necessary, the system will repair it automatically.

Note: If “Remove patients not tested for last” 3 years is selected, all the patients with the last test done earlier than 3 years ago, including the corresponding date, are removed from database irreversibly.

Example:

Setting:

- Current date is: 10.03.2013, and “Remove patients not tested for last” 3 years is selected.

Result:

- Patients with the last test dated on 10.03.2010 will be removed.
- Patients with the last test dated on 09.03.2010 will remain in database.

11.2.1. Examination results transfer

Occasionally there is a need to transfer single examination results between different patients (e.g., if an examination was linked to the wrong name in the database).

The program enables the transfer of examination results between patients in the current database. To transfer results click the “*Database*” button from the “*Setup*” window. A *Database* window will appear and result transfer menu will be on it, as shown below.

The result transfer menu is divided into three parts. Two panels on the left side specify the source patient and source examination results. The panel on the right specifies the destination patient. In order to transfer examination results, do the following:

- select patient in the left panel from whom the examination should be transferred (source patient),
- select examination result which will be transferred in left panel (source examination),
- select patient in the right panel to whom the examination will be transferred (destination patient),
- click “>>>” button to transfer the examination.

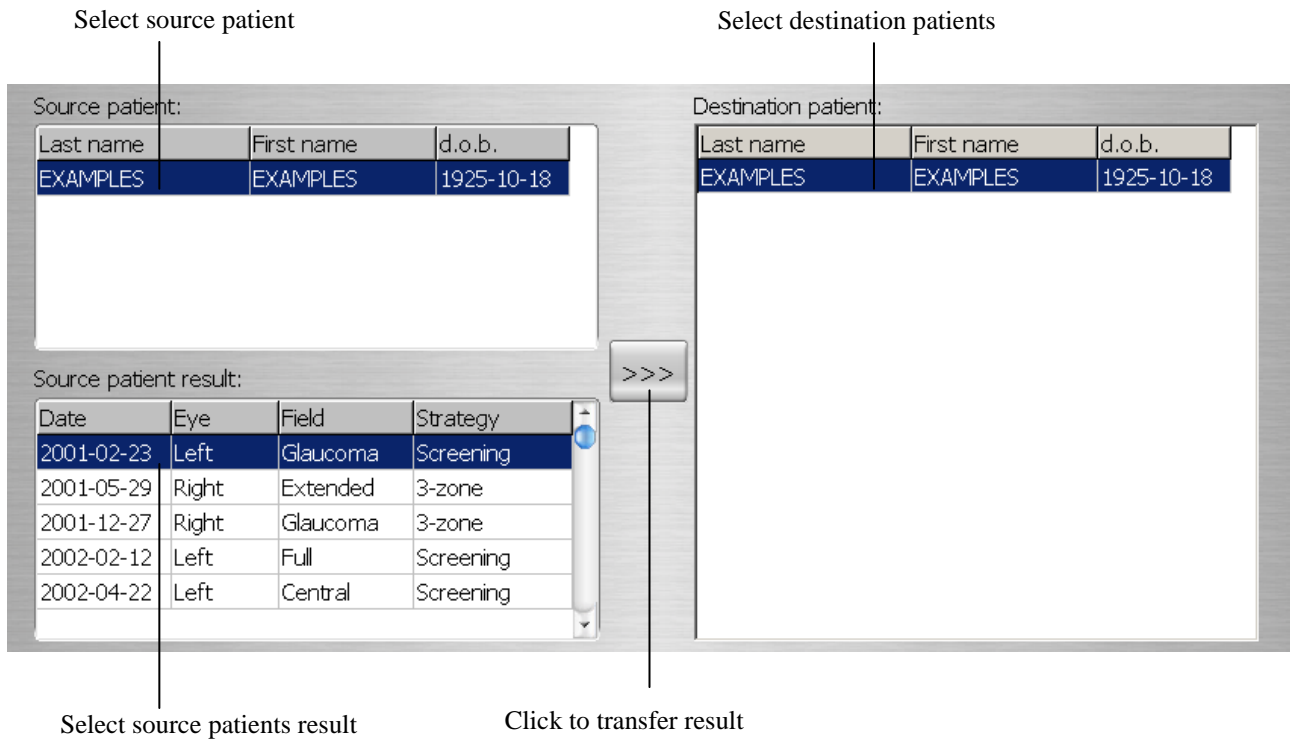


Figure 11.3. Result transfer screen.

11.3. Backup

This tab enables you to create a backup copy of the entire database. Click the “*Backup*” button, and a *Save as* window will appear. Select the drive and destination directory. By default, the backup copy will be created on the hard drive in the “C:\” folder named “PTS-YY-MM-DD.zip”. However, you can change the name and any location in the save dialog window. Backup frequency depends on the number of examinations that are done weekly. The more examinations that are performed, the more frequently you should make a backup copy.

In any case, to protect against data loss, back up your data at least once a week.

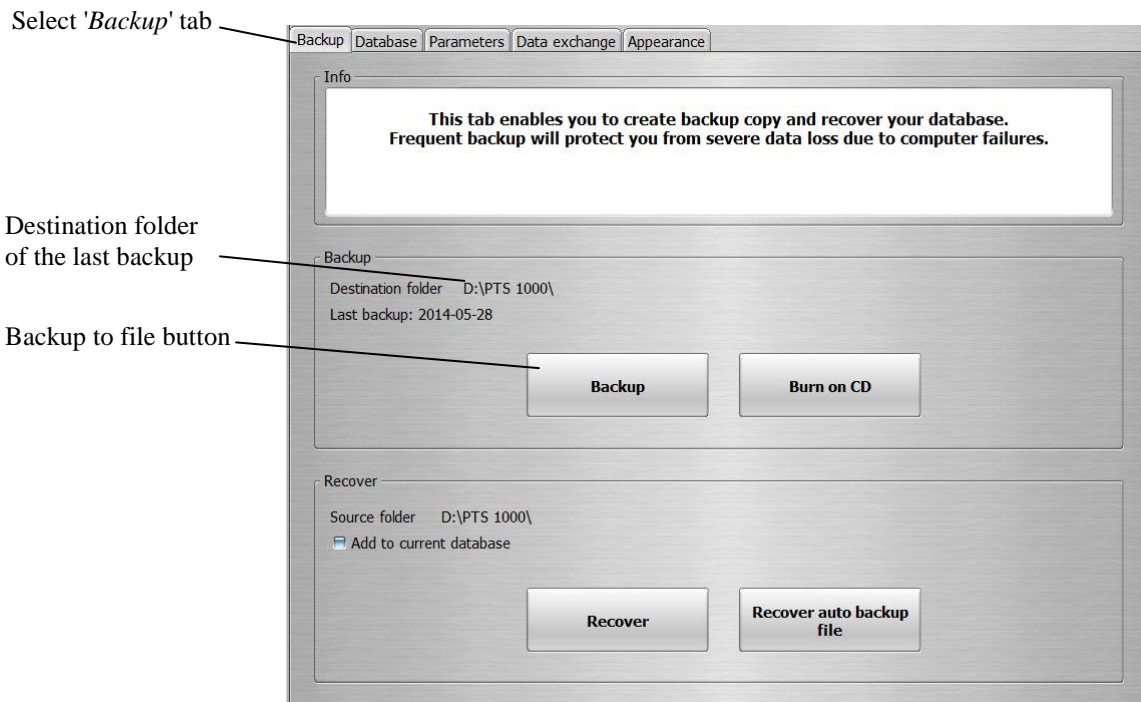


Figure 11.4. Setup window with Backup tab screen.

11.3.1. Backup to DVD/CD

PTS software can save the database backup file directly to DVD/CD. To do so, click the “*Burn on CD*” button. A “*CD/DVD burning*” window will appear. If the computer has more than one DVD/CD writer, select the proper drive, insert an empty or multisession DVD/CD into the drive and click the “*Burn*” button. A backup copy will be created named “PTS-YY-MM-DD.zip”.



Figure 11.5. CD Burning screen.

Saving backup file on DVD/CD is possible only in computers applied with DVD/CD writer

11.3.2. Recovering data from backup copy

This tab enables you to recover all lost data from a backup copy created on data storage media (hard disks, CD-ROMs etc.). You can also add the database from a backup copy into the existing database.

11.3.2.1. Recovering the entire database

Use this option only in severe cases; e.g., when all data from the database has been lost. Contact your local distributor before performing the recovery operation.

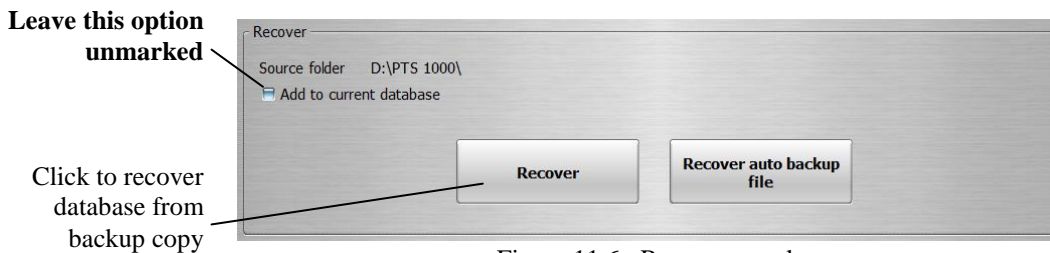


Figure 11.6. Recover panel.

To recover data from the backup copy, click the “*Recover*” button. Make sure the option “*Add to current database*” is **not marked**. An *Open* window will appear; select the source backup copy file to be recovered. The program will display a warning message: “Whole current database will be replaced with data read from backup copy”.

The program will replace all database files with the files from backup copy. This enables damaged databases to be repaired.

When performing the recovery process, make sure the backup copy was created using the same software version which is used when recovering.

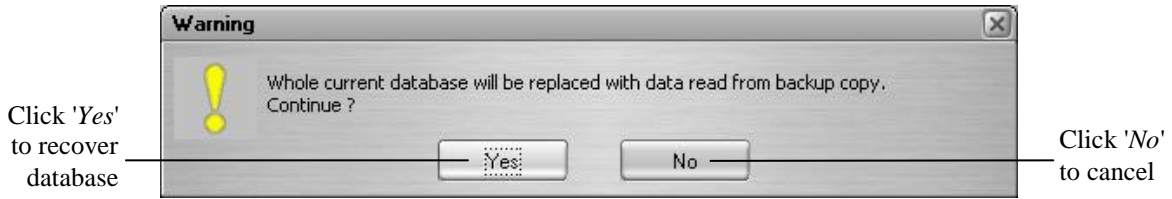


Figure 11.7. The whole database will be replaced with backup copy confirmation screen.

If recovered database derive from older software version, message will appear, and program will rebuild database.

11.3.2.2. Inserting the backup copy database into an existing database

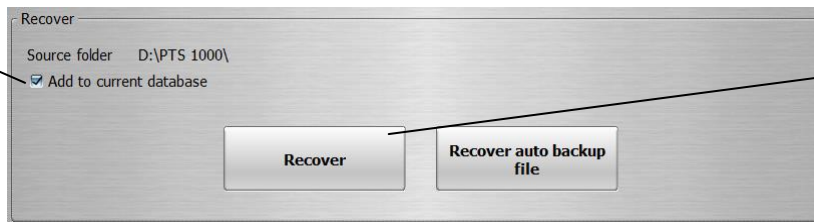
The PTS 1000 enables you to add a backup copy of the database into an existing database. This option is used to join two databases into one.

To add a Database from a backup copy to the current database, mark the “Add to current database” option and click the “Recover” button. An *Open* window will appear; select the source backup copy file to add. The program will display a confirmation message. If you click the “Yes” button, the database will be added to the current database.

The recovered database can have any format (it can be created by earlier versions of software) and will always be converted to the current format.

This mode doesn't replace database files. Any existing damages to a database will not be repaired.

Mark this option



Click to recover database from backup copy

Figure 11.8. Recover panel with 'Add to current database' option marked.

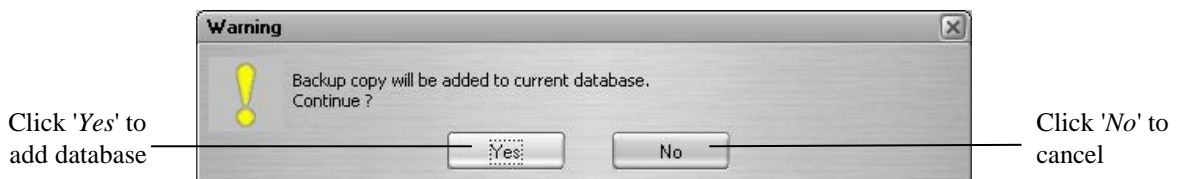


Figure 11.9. Backup copy will be added to current database confirmation screen.

11.3.2.3. Recovering database from auto backup file

The PTS 1000 software has an auto-backup mechanism. Every day, after closing the PTS 1000 software, the system creates a backup copy of the exams and other information produced during that day. It archives the last 10 backup copies.

To recover an auto-backup file, click the “*Recover auto backup file*” button and confirm the warning message.

“*Open auto backup file*” dialog window will appear. Select the auto backup file you want to recover and click “*Open*” button.

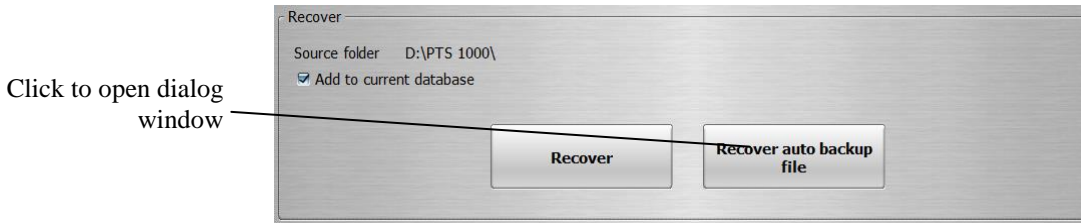


Figure 11.10. Recover panel with ‘Recover auto backup file’ button shown.

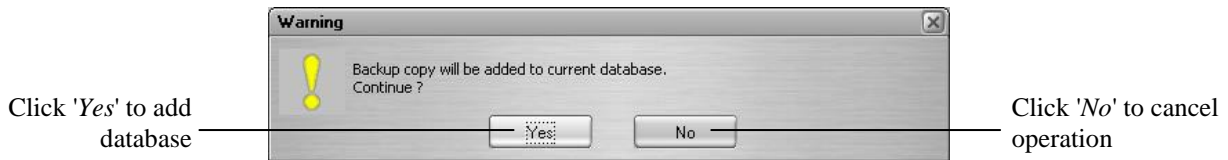


Figure 11.11. Backup copy will be added to current database confirmation screen.

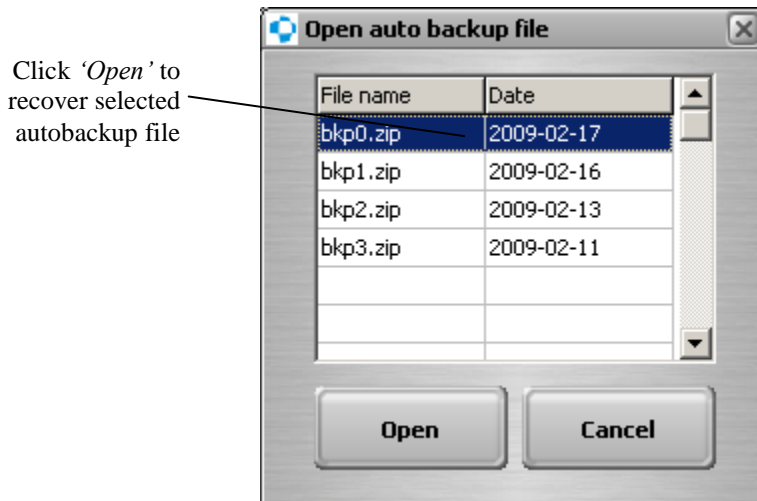


Figure 11.12. Selecting the auto backup file for recovery screen.

11.4. Application settings

This tab allows the user to set some individual parameters of the system. It also contains information about camera settings. It is recommended that only properly trained staff change camera settings.

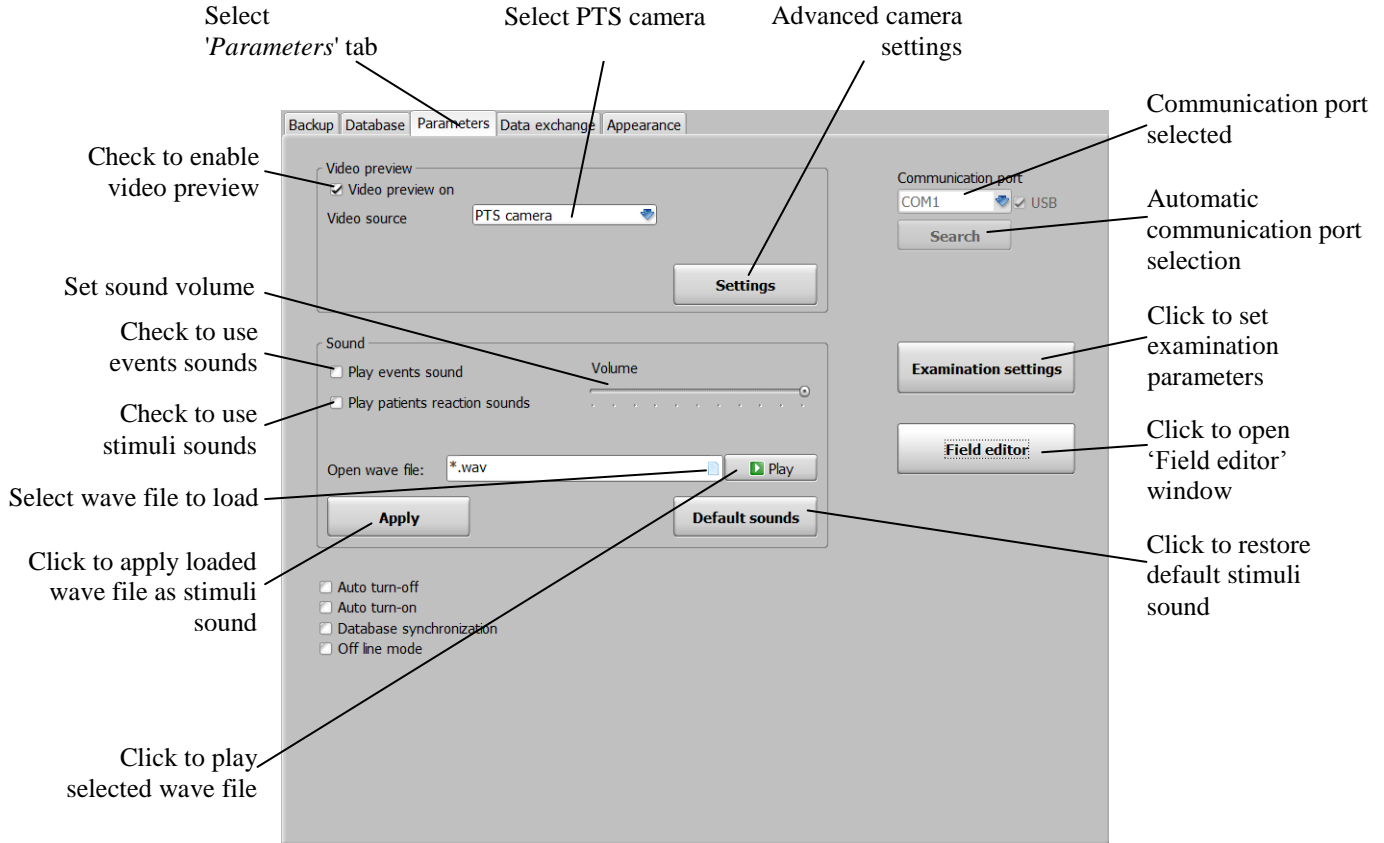


Figure 11.13. Setup window with Parameters tab showing application settings screen.

PTS 1000 software has an integrated sound events mode that can be used on computers equipped with a sound card. If sound is enabled, messages and actions will trigger a sound alert. The messages program uses default operating system sounds.

In addition, user-defined sound alerts can be triggered during stimulus exposures.

Four different types of sounds may be used:

- stimulus exposure
- events not requiring operator action (for example, fix error)
- events requiring operator action (for example, examination paused etc.)

To use sounds in software, mark the “Play sounds” checkbox in “Sound” tab of the “Setup” window.

Set the sounds volume and, optionally, load the sound wave file from the hard drive to use as stimulus sound.

Click “Default” to use the default PTS 1000 stimulus sound.

**If computers sound card is not compatible with PTS software
„Sounds” tab will be invisible.**

Available options include:

Auto turn off - if this option is marked the computer will be shut down automatically when the user quits the PTS 1000 program.

Auto turn on - if this option is marked the PTS 1000 software will be automatically started when Windows is loaded.

Database synchronization - this option is valid only if there are two or more Optopol devices installed on one computer. If this option is marked, the system will share the same patient database.

Off line mode - if this option is marked, the perimeter program is in off line mode and cannot perform examinations. This option is useful when the program is being used with a remote database.

11.4.1. Field editor

PTS software enables you to define your own examination field in a range of 50 degrees in every direction, separately for each eye or symmetrically for both eyes.

You can save a defined field to a file and open the defined field from a file. Consequently, you can create a collection of defined fields and send it to another user.

To define the user field, click the “Field editor” button in the “Setup” window. A “Field editor” window will appear as shown below.

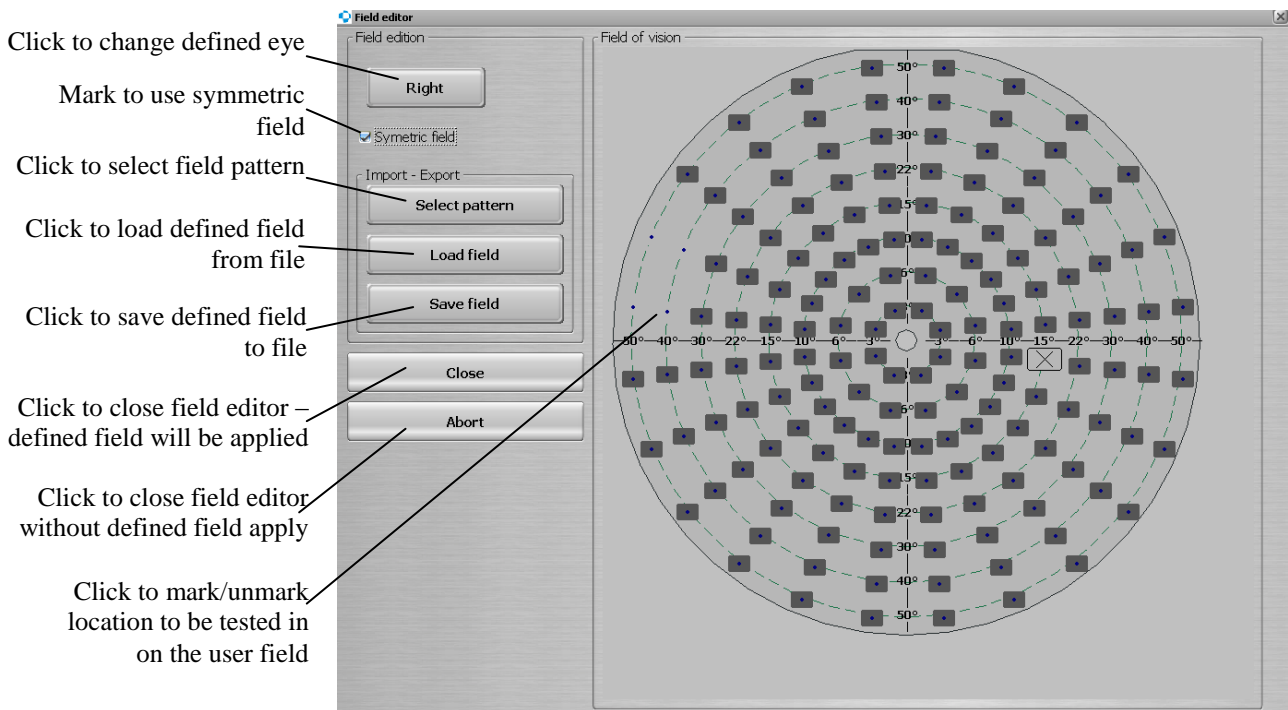


Figure 11.14. Field editor screen.

11.4.2. Appearance adjustment

PTS 1000 enables the color style used to display graph results to be set according to individual preference. If “Angular ruler” is marked, there will be a ruler displayed in each decibels graph on screen. You can select which analysis and what style of the map will appear in the results review as standard. This setup will be recalled after pressing the STD button in results review. The information card and logo can also be set here.

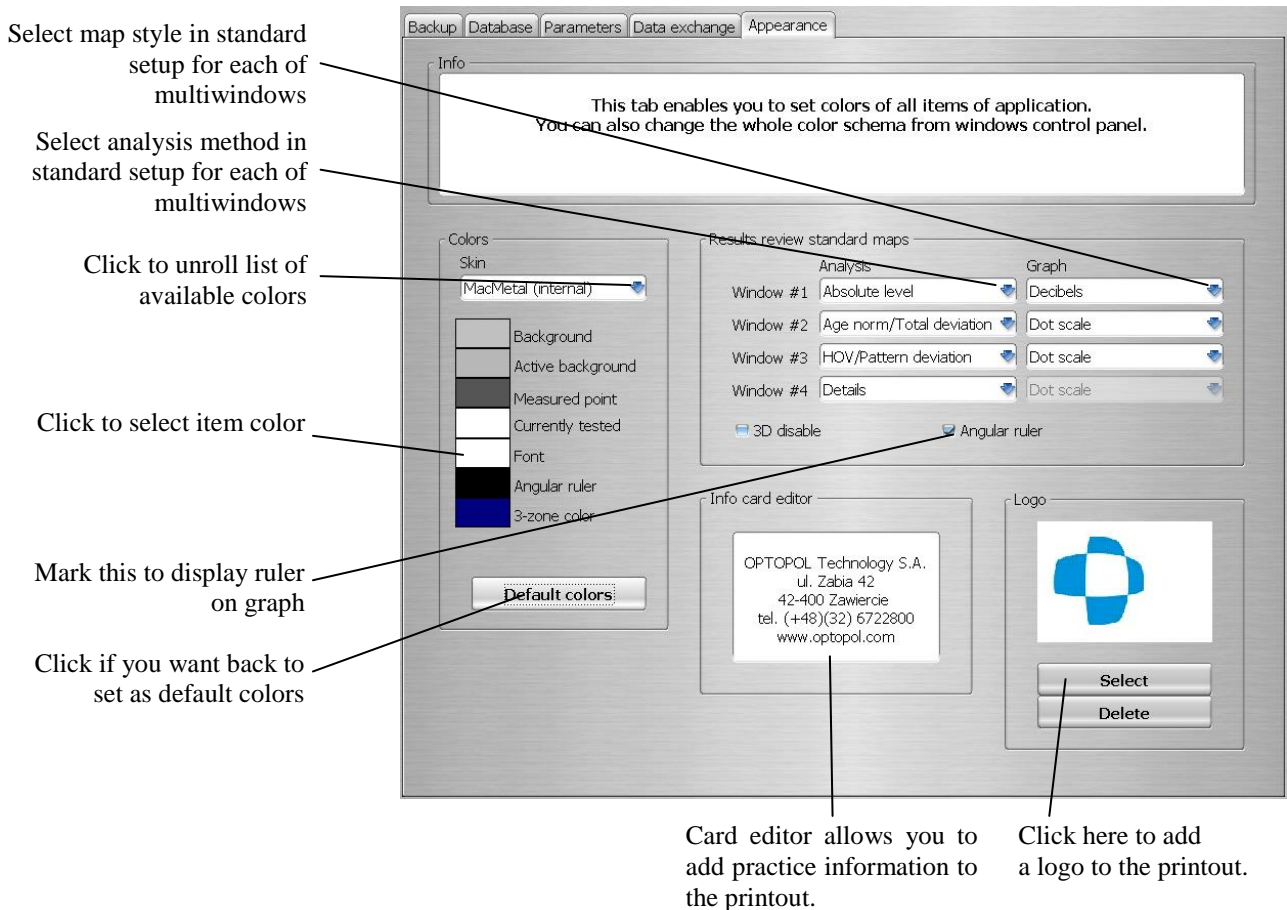


Figure 11.15. Setup window with Appearance tab.

3D disable - if this option is marked, 3D view in the result review window is disabled. This option is used to avoid software malfunctions with computers equipped with incompatible graphics cards (e.g., not supported OpenGL).

12. Multiuser access in computer network environment

Beginning with automated perimeter PTS 1000 software version 4.12, databases can be accessed by many users simultaneously from different computers in the examination lane and your office, for greater efficiency and productivity.

PTS 1000 software is based on a client-server model. If one of the computers in the network is configured as *Server* (database files are stored on this computer), the rest of the computers are *Clients* (they access the database located at *Server*).

To configure the perimeter program for a multi-user environment:

- install the same PTS 1000 software on all computers (both clients and server).
- choose one of the computers as *Server* (for small local networks it is usually the computer with a direct connection to the PTS 1000; for larger networks the computer should be clearly distinguished).

Important !!!

To let any *Client* computers work with the perimeter program the *Server* computer must be turned on.

The following sections describe the configuration for server computers and client computers and on all of the *Client* computers.

12.1. Program configuration as database server

- The folder where the PTS 1000 application is located should be shared on the network for all Client computers with full access rights (read+write+change). Default location: C:\Program Files\PTS 1000).
- Run the perimeter program, and go to *Setup-->Database*. **Make sure that the “Use remote database” checkbox is unchecked.** The content in the right-hand field (specifying the location of remote database) will be ignored.

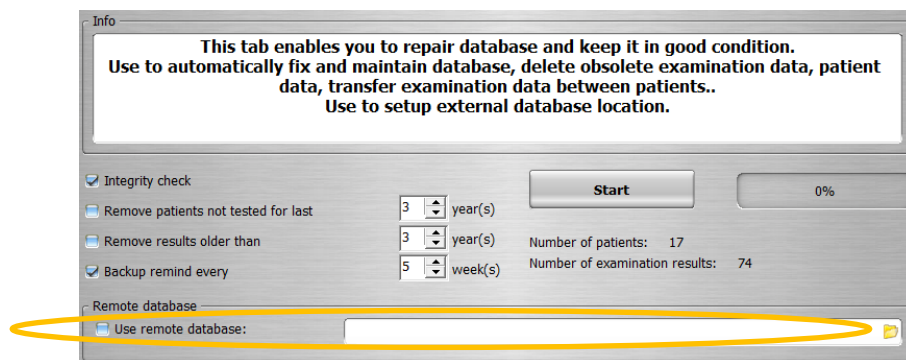


Figure 12.1. Setup window with use remote database settings screen.

- If the PTS 1000 is not connected directly to the *Server* computer, mark “*Off line mode*” in *Setup-->Parameters*. If it is connected to the *Server* computer, “*Off line mode*” should not be marked.

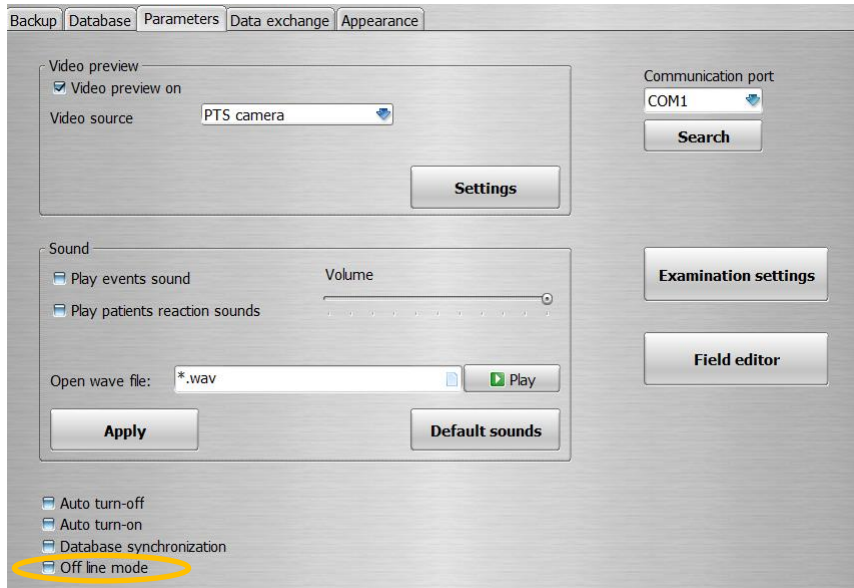


Figure 12.2. Setup window with Off line mode option screen.

12.2. Program configuration as database client

The following procedure should be conducted on all *Client* computers.

- Run the perimeter program, and go to *Setup-->Database*. **Make sure that the “Use remote database” checkbox is marked.**
- In the field at right, specify the network location of the PTS 1000 database on the *Server* computer (for example, if the *Server* computer is named ‘LAB1’, and the database folder with access is named PTS 1000, key in this location: \\LAB1\PTS 1000).

Warning !!!

It is suggested that you use UNC format when specifying the location of the database (e.g., \\COMPUTER\\folder). Optionally, network disk mapping can be used.

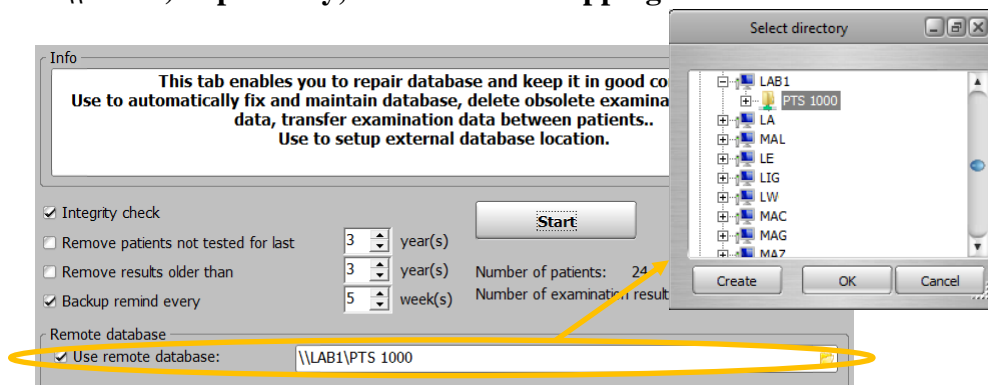


Figure 12.3. Setup window with remote database folder selection.

- If the PTS 1000 device is not connected directly to the *Client* computer, mark “Off line mode” in *Setup-->Parameters* tab. If the PTS 1000 device is connected to the *Client* computer, “Off line mode” should not be set.

12.3. Program limitations on client computer

A perimeter program configured as a *Client* computer (using remote database) has functional limits which do not apply to *Server* computer. On the *Client* computer the following options are blocked:

- Database backup
- Database recovering
- Database ordering
- Results transferring

Additionally, on all computers with “*Off line mode*” turned on, the examination window is blocked and it will not be possible to perform an examination.

12.4. Sharing the PTS database on a Windows VISTA computer in a Local Network

Sharing the PTS database on a Windows Vista computer is similar to using Windows XP but requires some additional configuration. The following points explain how to configure PTS database sharing.

1. Go to the Control Panel and ‘Network And Sharing Center’.



Figure 12.4. Network and sharing center icon screen.

2. Turn on ‘Network discovery’ and apply changes.



Figure 12.5. Network and sharing center window with Turn on network discovery option.

3. Windows will show two possible choices. Select the one you want. If you use only a private network, choose the first option.

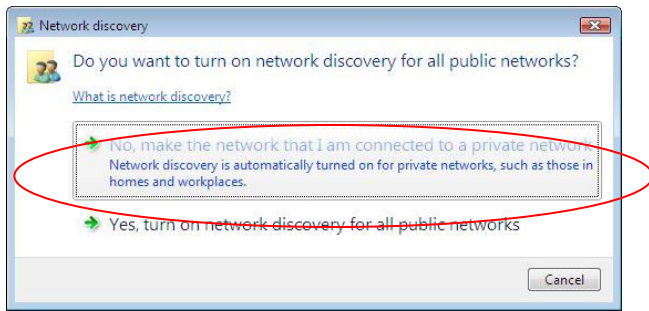


Figure 12.6. Network discovery options screen.

4. Next, turn on 'File sharing' and apply changes.

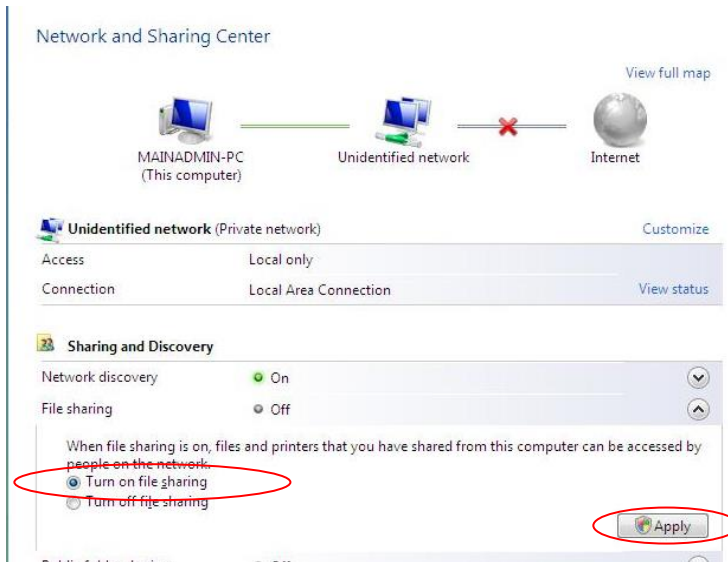


Figure 12.7. Network and sharing center window with Turn on file sharing option screen.

5. Turn off 'Password protected sharing' and apply changes.



Figure 12.8. Network and sharing center window with Turn off password protected sharing.

6. Now change the network type to private. Press 'Customize' next to unidentified network.

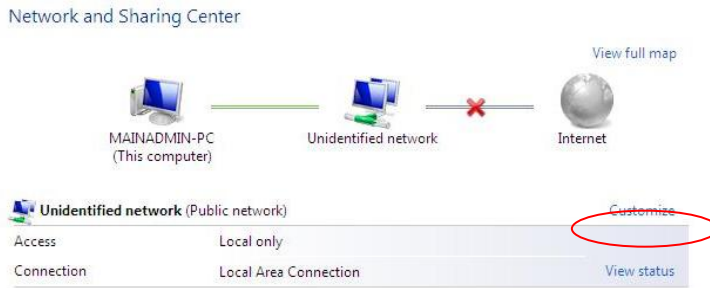


Figure 12.9. Network and sharing center window with Customize option screen.

7. You can name this network or leave it unidentified. Select 'Private' and click 'Next'.

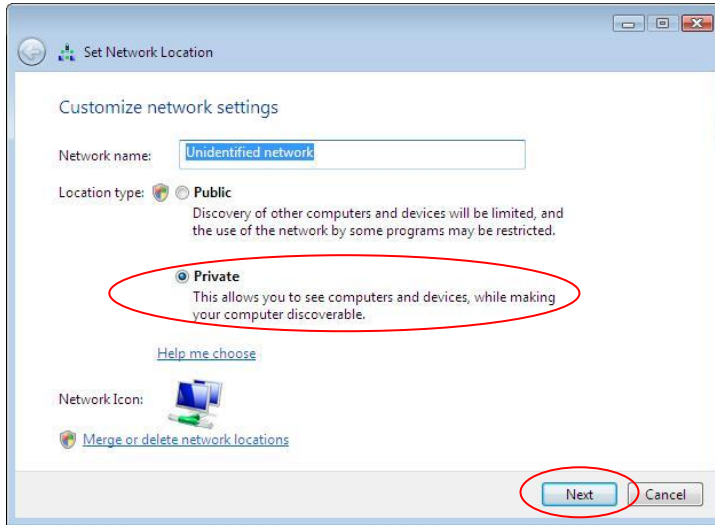


Figure 12.10. Set network location screen with private option.

8. Now you need to share the PTS 1000 folder on the network. Select Computer from the Start menu and explore your PT1000 folder (by default C:\Program Files\PTS 1000). Right click on it and select 'Share...'. .

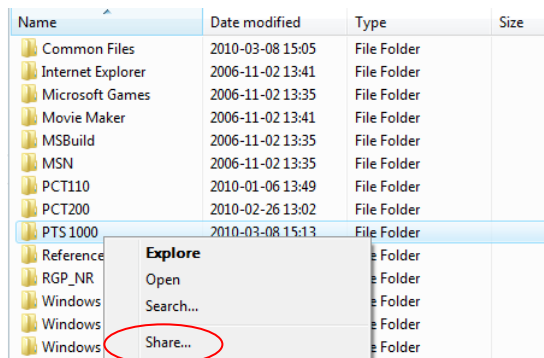


Figure 12.11. Program Files folder directory with Share option screen.

9. In the next window, select 'Advanced Sharing..'. .

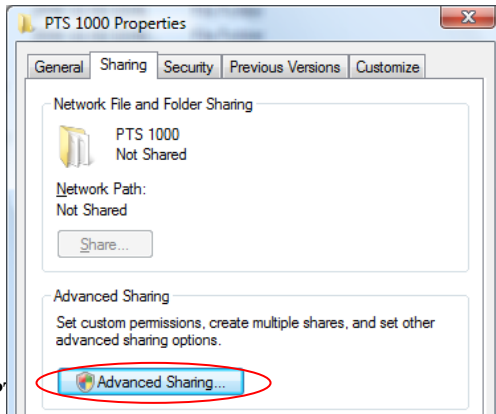


Figure 12.12. PTS 1000 Properties dialog box, Sharing option screen.

10. Select 'Share this folder' and enter the name under which it will appear in the network. Then click 'Permissions' button.

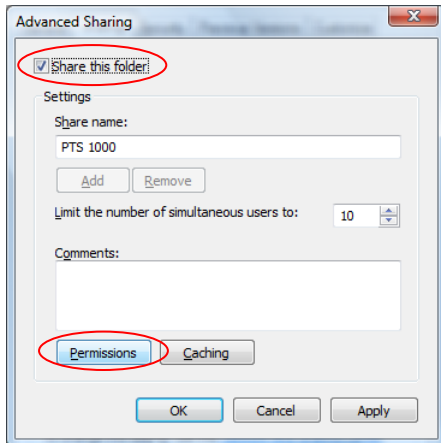


Figure 12.13. Advanced sharing window with Share this folder option screen.

11. Next, configure the share permissions. Specify users who will have network access to the PTS 1000 folder. Grant them 'Full Control'. You can select 'Everyone' if you wish to grant access to everyone.

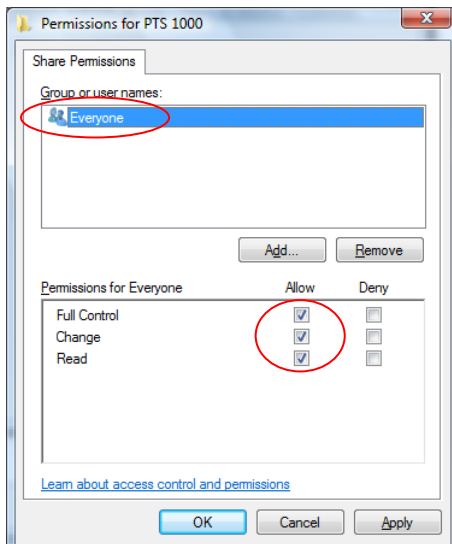


Figure 12.14. Permissions for PTS 1000 screen.

12. Click 'OK'. Now you can share the PTS 1000 database from different computers in the network.

12.5. Sharing the PTS database on a Windows 7 computer in

a Local Network

The following points should be done to configure PTS database sharing.

1. Go to Control Panel and ‘Network And Sharing Center’.

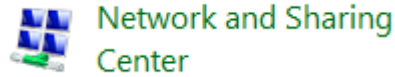


Figure 12.15. Network and sharing center icon screen.

2. Go to ‘Change advanced sharing settings’ menu.
3. Select a desired network profile.
4. Turn the ‘Network discovery’ on.

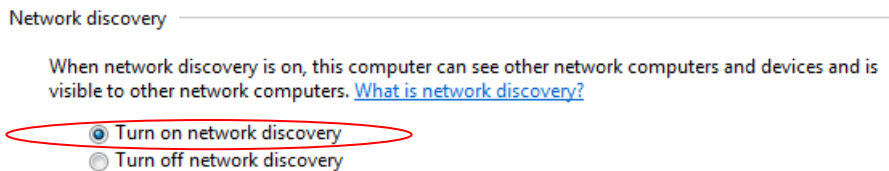


Figure 12.16. Network and sharing center window with Turn on network discovery option.

5. Next turn on the ‘File and printer sharing’ on.

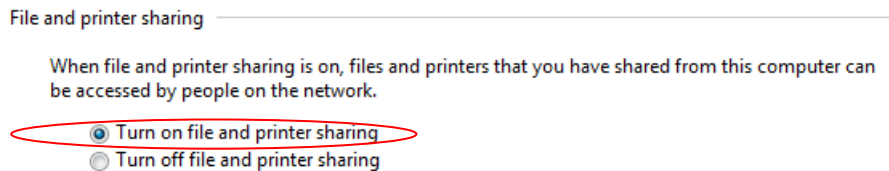


Figure 12.17. Network and sharing center window with Turn on file and printer sharing screen.

6. Choose the second option if you use only private network.

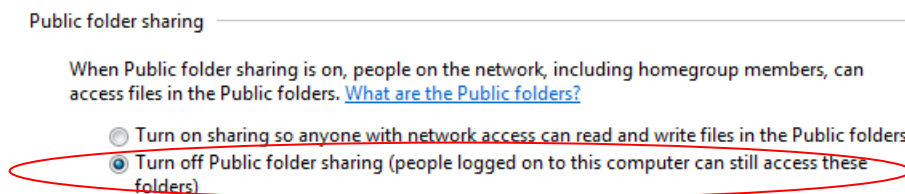


Figure 12.18. Network and sharing center window with Turn off Public folder sharing option.

7. Turn ‘Password protected sharing’ off .
8. Click ‘Save changes’ button to apply the above settings.

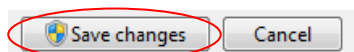


Figure 12.19. Save changes button screen.

9. Now, share the PTS 1000 folder on the network. Select Computer from Start menu and explore

your PT1000 folder (by default C:\Program Files (x86)\PTS 1000). Right click on it and select 'Properties'.

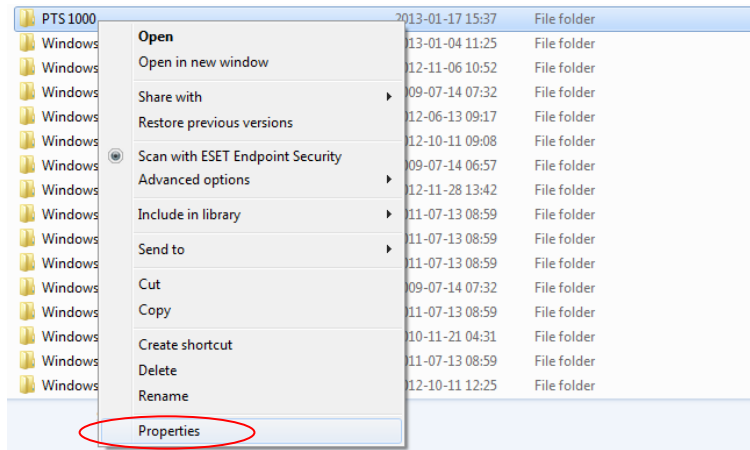


Figure 12.20. Program Files (x86) folder directory with Properties option.

10. Go to 'Sharing' tab and select 'Advanced Sharing.. '.

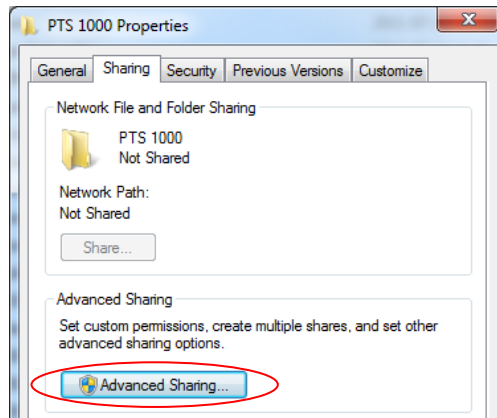


Figure 12.21. PTS 1000 Properties window with Advanced Sharing option.

11. Select 'Share this folder' and enter the name under which it will appear in the network. Then click 'Permissions' button.

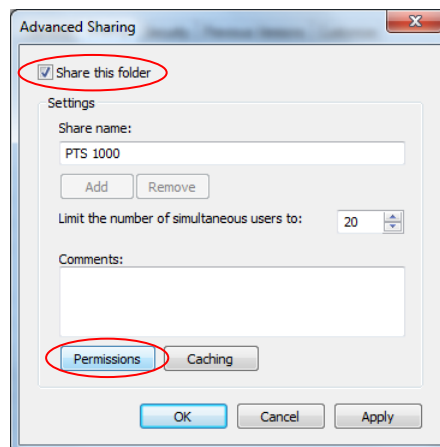


Figure 12.22. Advanced Sharing window with Share this folder option screen.

12. Next, configure the share permissions. Specify users which will have network access to PTS

1000 folder. Grant them *'Full Control'*. Select *'Everyone'* if you wish to grant access to everyone.

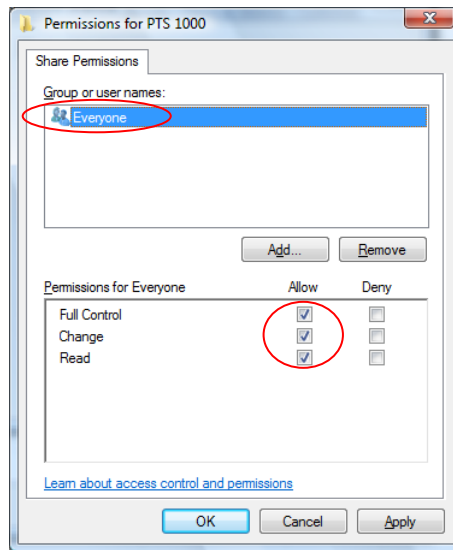


Figure 12.23. Permissions for PTS 1000 screen.

13. Click *'OK'*. Now you can share PTS 1000 data base from different computers in the network.

12.6. Sharing the PTS database on a Windows 8 computer in a Local Network

The procedure of sharing the PTS data base on Windows 8 computer in Local Network in Windows 8 is very similar to the procedure used in Windows 7.

Please refer to section *12.5 Sharing the PTS database on a Windows 7 computer in a Local Network* to share the database in local network on Windows 8 computer.

13. Data exchange interfaces

PTS software can exchange data with electronic medical record systems (EMR). Currently supported systems are IRIS, KS-SOMED and Optomate. Data exchange is performed using data exchange files which are loaded and saved in the exchange folder localized on the computer's hard drive.

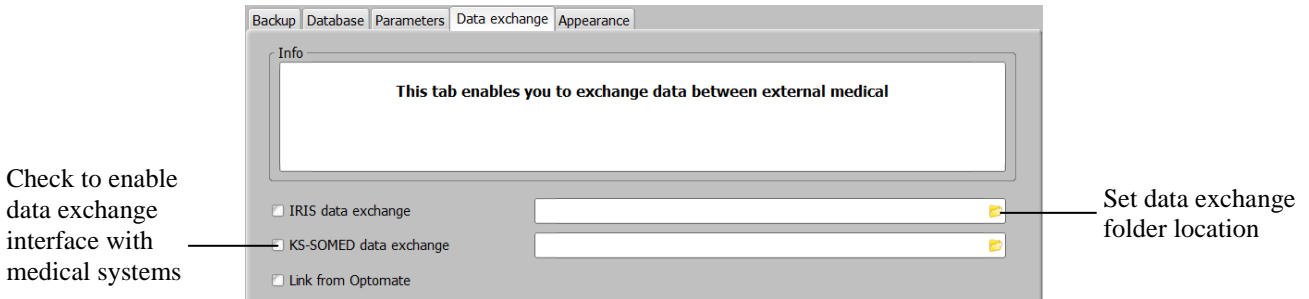


Figure 13.1. Setup window with data exchange settings screen.

To enable a data exchange interface, set the data exchange folder location as you would in the medical system and mark the proper checkbox in the “Data exchange” tab of the setup window.

When the data exchange interface is enabled, the PTS 1000 system automatically detects if any examination requests from the medical system appear in the exchange folder.

In case of Somed data exchange, a message will appear that a number of new patients are available to import. After you confirm, the program will import a new patients to the local database. In case of IRIS this will be done automatically. Description of requested examination will appear in imported patient's remarks.

You can display only imported patients by marking the “Data exchange only” checkbox in “Main” tab or in the “Data exchange” tab of the “Setup” tab.

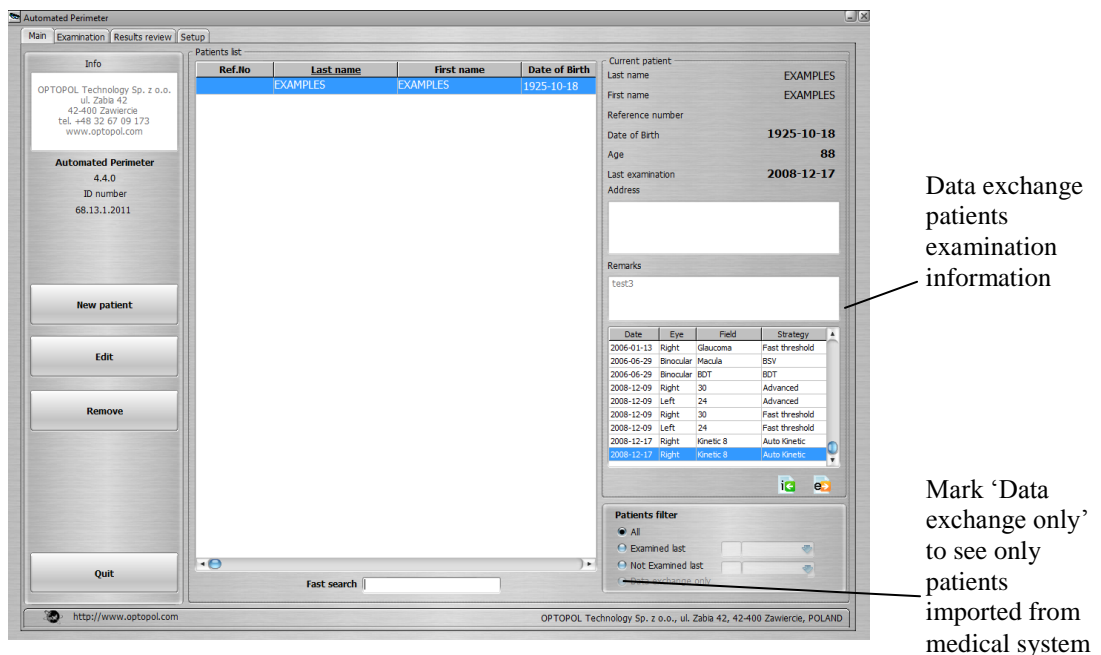


Figure 13.2. Main window with data exchange settings screen.

After the patient's examination has been imported, the PTS program automatically saves files into the data exchange folder. This information stays in the current PTS 1000 database. For information on the medical systems that collaborate with PTS 1000 software, contact your PTS 1000 device distributor.

13.1. Optomate data exchange interface

PTS 1000 software is able to connect to the Optomate medical system. Mark the “*Link to Optomate*” checkbox in the “*Data exchange*” tab of the “*Setup*” window.

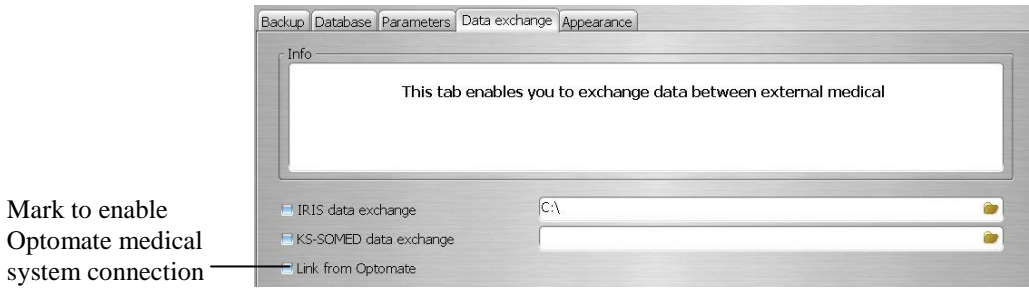


Figure 13.3. Setup window with Optomate data exchange settings screen.

14. Problem solving

If you encounter any of the malfunctions listed below, apply the respective solutions.

Table 14.1. The problem solving specification.

<i>Problem</i>	<i>Cause</i>	<i>Solution</i>
Message: "Examination bowl not connected to computer. Check cables!"	No physical connection between computer and examination bowl on selected communication port.	Check cable connection between examination bowl and computer. If computer ask "Perform automatic ports search ?" click "Ok" button.
Message: "I can't establish communication with testing bowl"	No communication between computer and examination bowl.	Check if power supply cable is connected. Check if examination bowl is turned on.
Message: "Backup process hasn't been performed for at least xx weeks"	Database backup hasn't been performed for at least xx weeks. You can lose your patients' data if the computer or Windows software crashes.	Create backup copy of the whole database. See section 11.3.
Message: "I can't establish connection with CCD camera"	Camera drivers are not installed properly, wrong camera source is selected or camera is damaged.	Check if USB cable is connected properly. See section 4.2 and reinstall camera drivers. Make sure proper drivers are selected.
No video preview in "Examination window"	Camera drivers are not installed or video preview is disabled.	Check if video preview is selected in 'Setup' window. Check if camera source is selected properly. See sections 4.2 and 11.4 for these options.
Message: "Not supported DIB format"	Wrong camera configuration.	See section 3.2.1 to configure camera.
After turning on, the examination bowl is not illuminated and there is no central fixation point	Examination bowl has no power.	Make sure the bowl is connected to power supply socket with proper parameters (230V, 50Hz or 60 Hz) and turned on. If green light on the power button is not lighting then turn off power and check fuses.
Message: "Critical database damage"	Database files damaged or backup has been done from older version of program.	Close program and reboot system. If problem appears again use backup diskette to recover database or reinstall PTS 1000 software. Look Charter 10.2 for database repair.
Message: "I can't open communications port"	Selected COM port is being used by another application.	Select different COM port or quit the application that uses the COM port.
No 3D visualization in results review on Windows VISTA	No drivers for graphics card.	Download and install latest drivers for your graphic card.
Yellow background illumination blinks when calibration procedure is completed	<ol style="list-style-type: none"> The light sensors on the bowl are eclipsed by the lens holder. Room light is too high. 	<ol style="list-style-type: none"> Lower down the lens holder to the park position. Dim the room light.

Consumable spare parts:

- fuse type: M 3.15A H 250V, 5x20mm - 2 pcs.

(Other fuses can be used, but they must have the same electrical parameters and F,M characteristics, or T characteristics according to the IEC standard).

15. Ambient conditions

15.1. Storage

Temperature:	5°C	to	40°C
Relative humidity:	10%	to	90%
Atmospheric pressure:	740 hPa	to	1060 hPa

15.2. Transport

Temperature:	-30°C	to	40°C
Relative humidity:	10%	to	90%
Atmospheric pressure:	740 hPa	to	1060 hPa

15.3. Operation

Temperature:	10°C	to	35°C
Relative humidity:	30%	to	75%
Atmospheric pressure:	740 hPa	to	1060 hPa

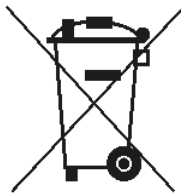
16. Service

The supplier will make available on request circuit diagrams, components part lists, descriptions, calibration instructions, or other information which will assist the user's appropriately qualified technical personnel to repair those parts of equipment which are designated by the manufacturer as repairable.

In case of problems contact your local distributor.

17. Disposal

The maximum lifetime of this device is 10 years from the date of manufacture as shown on the data plate. It is recommended to contact your local distributor to agree the method of disposing (plastic, epoxy resin, polyurethane foam, metal, etc.) after the device usage duration period is over.



18. APPENDIX A

Conversion of decibels to apostilbs and Goldmann units.

Table 18.1. Goldmann units conversion table.

dB	Intensity	Actual Stimulus Size				
	Asb	I	II	III	IV	V
0	10,000	III 4e	IV 4e	V 4e	---	---
1	7,943	III 4d	IV 4d	V 4d	---	---
2	6,310	III 4c	IV 4c	V 4c	---	---
3	5,012	III 4b	IV 4b	V 4b	---	---
4	3,981	III 4a	IV 4a	V 4a	---	---
5	3,162	II 4e	III 4e	IV 4e	V 4e	---
6	2,512	II 4d	III 4d	IV 4d	V 4d	---
7	1,995	II 4c	III 4e	IV 4c	V 4c	---
8	1,585	II 4b	III 4b	IV 4b	V 4b	---
9	1,259	II 4a	III 4a	IV 4a	V 4a	---
10	1,000	I 4e	II 4e	III 4e	IV 4e	V 4e
11	794	I 4d	II 4d	III 4d	IV 4d	V 4d
12	631	I 4c	II 4c	III 4c	IV 4c	V 4c
13	501	I 4b	II 4b	III 4b	IV 4b	V 4b
14	398	I 4a	II 4a	III 4a	IV 4a	V 4a
15	316	I 3e	II 3e	III 3e	IV 3e	V 3e
16	251	I 3d	II 3d	III 3d	IV 3d	V 3d
17	200	I 3c	II 3c	III 3c	IV 3c	V 3c
18	159	I 3b	II 3b	III 3b	IV 3b	V 3b
19	126	I 3a	II 3a	III 3a	IV 3a	V 3a
20	100	I 2e	II 2e	III 2e	IV 2e	V 2e
21	79	I 2d	II 2d	III 2d	IV 2d	V 2d
22	63	I 2c	II 2c	III 2c	IV 2c	V 2c
23	50	I 2b	II 2b	III 2b	IV 2b	V 2b
24	40	I 2a	II 2a	III 2a	IV 2a	V 2a
25	32	I 1e	II 1e	III 1e	IV 1e	V 1e
26	25	I 1d	II 1d	III 1d	IV 1d	V 1d
27	20	I 1c	II 1c	III 1c	IV 1c	V 1c
28	16	I 1b	II 1b	III 1b	IV 1b	V 1b
29	13	I 1a	II 1a	III 1a	IV 1a	V 1a
30	10	I ⁴ e	I 1e	II 1e	III 1e	IV 1e
31	8	I ⁴ d	I 1d	II 1d	III 1d	IV 1d
32	6	I ⁴ c	I 1c	II 1c	III 1c	IV 1c
33	5	I ⁴ b	I 1b	II 1b	III 1b	IV 1b
34	4	I ⁴ a	I 1a	II 1a	III 1a	IV 1a
35	3.2	I ³ e	I ⁴ e	I 1e	II 1e	III 1e
36	2.5	I ³ d	I ⁴ d	I 1d	II 1d	III 1d
37	2.0	I ³ c	I ⁴ c	I 1c	II 1c	III 1c
38	1.6	I ³ b	I ⁴ b	I 1b	II 1b	III 1b
39	1.3	I ³ a	I ⁴ a	I 1a	II 1a	III 1a
40	1.0	I ² e	I ³ e	I ⁴ e	I 1e	II 1e
41	0.8	I ² d	I ³ d	I ⁴ d	I 1d	II 1d
42	0.6	I ² c	I ³ c	I ⁴ c	I 1c	II 1c
43	0.5	I ² b	I ³ b	I ⁴ b	I 1b	II 1b
44	0.4	I ² a	I ³ a	I ⁴ a	I 1a	II 1a
45	0.32	I ¹ e	I ² e	I ³ e	I ⁴ e	I 1e

19. APPENDIX B – EMC information


Table 19.1. EMC declaration specification. Electromagnetic emissions.

Guidance and manufacturer's declaration – electromagnetic emissions		
The PTS 1000 is intended for use in the electromagnetic environment specified below. The customer or the user of the PTS 1000 should assure that it is used in such an environment.		
Emission test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The PTS 1000 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 B	The PTS 1000 is suitable for use in all establishments, including domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic use.
Harmonic emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Not applicable	

Table 19.2. EMC declaration specification. Electromagnetic immunity.

Guidance and manufacturer's declaration – electromagnetic immunity			
The PTS 1000 is intended for use in the electromagnetic environment specified below. The customer or the user of the PTS 1000 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 ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1kV line(s) to line(s) ± 2 kV line(s) to earth	± 1kV 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% U_T (>95% dip in U_T) For 0,5 cycle 40% U_T (60% dip in U_T) For 5 cycles 70% U_T (30% dip in U_T) For 25 cycles <5% U_T (>95% dip in U_T) For 5s	<5% U_T (>95% dip in U_T) For 0,5 cycle 40% U_T (60% dip in U_T) For 5 cycles 70% U_T (30% dip in U_T) For 25 cycles <5% U_T (>95% dip in U_T) For 5s	Mains power quality should be that of a typical commercial or hospital environment. If the user of the PTS 1000 requires mains interruptions, it is recommended that the PTS 1000 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 commercial or hospital environment.
NOTE U_T is the AC mains voltage prior to application of the test level.			

Table 19.3. EMC declaration specification. Electromagnetic immunity – continued.

Guidance and manufacturer’s declaration – electromagnetic immunity			
The PTS 1000 is intended for use in the electromagnetic environment specified below. The customer or the user of the PTS 1000 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	3 Vrms 150 kHz to 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of the PTS 1000 , including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1,2 \sqrt{P}$ $d = 1,2 \sqrt{P}$ 80 MHz to 800 MHz $d = 2,3 \sqrt{P}$ 800 MHz to 2,5 GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (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: 
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3 V/m 80 MHz to 2,5 GHz	
NOTE 1	At 80 MHz and 800 MHz, the higher frequency range applies.		
NOTE2	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 with the PTS 1000 is used exceeds the applicable RF compliance level above, the PTS 1000 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the PTS 1000 .

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

Table 19.4. EMC declaration specification. Recommended separation distance.

Recommended separation distance between portable and mobile RF communications equipment and the PTS 1000			
The PTS 1000 is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the PTS 1000 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the PTS 1000 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		
	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 meters (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.			
NOTE2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

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