# PERISTAT AND PERIMAT
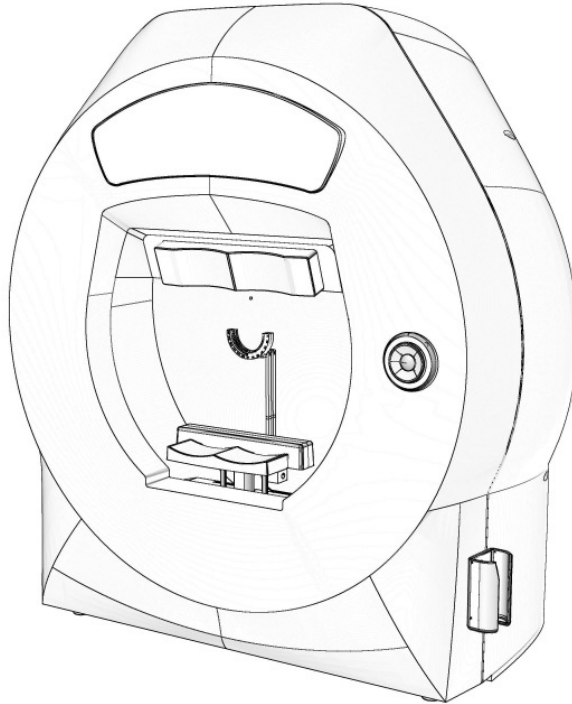## AUTOMATED PERIMETERS



## OPERATION MANUAL
54-11902.02

All specifications are subject to changes without notice.
November 2012

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RODENSTOCK

RODENSTOCK

## TABLE OF CONTENTS

## 1. INTRODUCTION

This OPERATION MANUAL describes the purpose, overall view and user maintenance of the RODENSTOCK Automated Perimeters. This manual is intended for medical personnel and engineers who will perform test on patients, and also for qualified people that will use perimeter software to view and examine test results. This instruction provides information concerning cleaning and basic user maintenance that should be very precisely presented to the cleaning and technical personnel of the clinic in order to decrease the probability to harm the equipment.

If you have encountered problems when using your Automated Perimeter which you cannot solve, or the Automated Perimeter parameters are changed, please, in all these cases contact the Manufacturer or his authorized representative.

NOTE! **MEDICAL RESPONSIBILITY** – The manual does not provide guidance or interpretation of clinical results. The operator must ensure that he or she has received an appropriate medical training in such interpretation. For the same reason, RODENSTOCK cannot be held responsible for misdiagnosis of results.

NOTE! The right to repair or set up the Automated Perimeter or to carry out periodical part replacements is reserved only to the Manufacturer or to persons authorized by the Manufacturer.

NOTE! The Automated Perimeter is to be used only in accordance with this Operation Manual.

## 2. SYSTEM DESCRIPTION

The Automated Perimeter AP is a modern diagnostic device for fast and precise testing of a patient's visual field utilizing one of many available test strategies. It enables to define the sensitivity threshold of the retina in a given area, as well as to make a fast screening test. Perimeter software has built-in many internal mechanisms that increase the reliability of the test results. Testing of a patient is performed automatically, and detailed information about the test progress is continuously presented to the operator on the screen. The friendly and easy user interface allows intuitive movement over available options. The user can view and analyse test results in many different presentation methods including regression analysis.

The subject's fixation performance is monitored by one of two possible techniques: One is the Heijl-Krakau technique, with random stimulus presentation in the blind spot region. The second one is based on the built-in digital camera allowing eye-detection during examination and during adjusting the patient's position. Due to auto-detection of the pupil position, it allows a continuous automatic control of the fixation. The patient's fixation performance is continuously presented to the operator in both cases.

In order to avoid the possibility of uneven ambient lighting falling onto the bowl surface, all overhead lighting must be switched off and field testing be carried out in a dimly lit or completely darkened environment.

NOTE! Conducting a test in improper lighting conditions may cause systematic errors of the test results due to a lower contrast of the stimulus over the stimulator bowl surface. This will decrease the overall sensitivity of the retina as acquired in the test result.

## 3. SAFETY PRECAUTIONS

**Preparation for transport:**
- Before transport of AP-2500, AP-2500BY and AP-3000 perimeters please remove the forehead and chinrest attached magnetically to the perimeter. Leaving these parts for transport can cause perimeter damage!

**Power connections:**
- Before connecting the power cord to the mains outlet, check that the local voltage and frequency ratings correspond with the ratings of the Automated Perimeter.
- Connect the perimeter to a three-wire, grounded receptacle. Do not remove the grounding prong from the power plug.
- Use an intact power cord. Replace the cord if it is cracked, frayed, broken or otherwise damaged.
- Do not apply tension to the power cord. The cord may get broken.
- Do not use extension cords or adapters of any type.

**External connection:**
- Do not connect any other external devices to the Automated Perimeter than those specified by manufacturer.

**Fuses replacement:**
- Replace the fuse with a fuse of the same type and with the same rating.

**Patient Safety:**
- Do not perform any testing or maintenance of the perimeter while it is being used on a patient.

**Cleaning:**
- Switch the power off and unplug the power cord before cleaning or servicing. Get rid of moisture completely before reconnecting to the mains outlet.
- Do not use ammonia-, phenol-, or acetone-based cleaners. These cleaners may damage the perimeter surface.
- Do not immerse Automated Perimeter in any liquid. Do not allow liquid to enter the perimeter.
- Do not sterilize or autoclave the Automated Perimeter.

**Installation:**

- Do not put any objects on top of the Automated Perimeter. Fix the Automated Perimeter securely. If the Automated Perimeter falls down, do not use it because the absence of external damages does not mean there is no damage inside.
- Do not expose the Automated Perimeter to direct sunlight.
- Do not place near heat source.
- Exercise care to locate the Automated Perimeter away from any hazardous sources.

**Radiation:**

- This Automated Perimeter emits a certain level of electromagnetic radiation that is within the levels specified by IEC 60601-2-24 and IEC 60601-1-2.
- This instrument has been tested against the effects of external interference including high energy frequency emission, magnetic fields and electrostatic discharge (for example large motors, portable radios, cellular phones, etc.). It has been tested to the following specification: EN 60601-2-24:1998.
- Excessive interference may affect the Automated Perimeter operation. If it occurs the failure cause shall be removed.

The manufacturer is responsible for the safety, reliability and performance of the Automated Perimeter only if:

- All operations of assembly extensions, adjustment, modification or repairs have been carried out by people authorized by manufacturer.

- The electric setting of the room complies with the electric standards.

- The instrument is used in compliance with Operation Manual.

The manufacturer accepts no responsibility for any modifications made to the Automated Perimeter outside the factory.

## 4.A. TECHNICAL DATA (PERISTAT)

| | | |
|---|---|---|
| Stimulator Bowl Type | Part hemispherical Radius 300mm. Integrating diffusing surface. | |
| Visual Field Extent | 100˚ | |
| Standard Test Fields | Full 50˚ | 164 points |
| | Glaucoma 22˚/50˚ | 104 points |
| | Central 30˚ | 120 points |
| | Central 22˚ | 96 points |
| | Wide  22˚/30˚ | 128 points |
| | Peripheral 30˚ to 50˚ | 72 points |
| | Macula 10˚ | 48 points |
| | Driving 50˚/80˚ | 192 points |
| Stimulus Source | Rear projection LED | |
| Stimulus Color | Green 570 nm | |
| Stimulus Size | Goldmann size III ( 0,43˚ ) | |
| Stimulus Intensity | 0.03 asb to 1000 asb in 15 3dB or 45 1dB steps | |
| Exposure Time | Adjustable : 0.1 to 9.9s | |
| Response Time | Adjustable : 0.1 to 9.9s | |
| Inter Test Delay | Adjustable : 0.1 to 9.9s | |
| Background illumination | 10asb (3.2 cm/m2), automatic level control | |
| Fixation control method | Heijl-Krakau – blind spot method  and CCD camera | |
| Fixation Monitor | Yellow LED, 588nm | |
| Test Lens Diameter | 38 mm | |
| Operating Conditions  Ambient Temperature  Relative Humidity  Atmospheric Pressure | +10˚ to +40˚ C  30 to 85 %  700 to 1060 hPa | |

| Transport and Storage | | |
|---|---|---|
| Ambient Temperature | -10˚ to +40˚ C | |
| Relative Humidity | 30 to 85 % | |
| Atmospheric Pressure | 500 to 1060 hPa | |
| ISM Classification | I B | |
| Compliances | CE – mark | |
| Expected Lifetime | 10 Years | |
| Stimulator Unit | Dimensions W/S/D | 566 x 633 x 396 mm |
| | Weight | 19,5kg |
| | Voltage | 115-230 VAC 50/60 Hz |
| | Power consumption | Max 60W |
| | Fuse Rating | 2 x T 630mA |
| Application Part | Patient Chin Rest | |

## 4.B. TECHNICAL DATA (PERIMAT)

| | | |
|---|---|---|
| Stimulator Bowl Type | Part hemispherical Radius 300mm. Integrating diffusing surface. | |
| Visual Field Extent | 100˚ | |
| Standard Test Fields | Field name | Number of measurement points |
| | Full 50˚ | 165 points |
| | Glaucoma 22˚/50˚ | 101 points |
| | Central 30˚ | 117points |
| | Central 22˚ | 93 points |
| | Wide 22˚/30˚ | 128 points |
| | Peripheral 30˚ to 50˚ | 72 points |
| | Macula 10˚ | 45 points |
| | Driving 50˚/80˚ | 189 points |
| Kinetic Test | Test fields: 30˚, 40˚, 50˚ | |
| | Meridian angles: 0˚ to 360˚ with steps 10˚, 15˚, 20˚, 30˚ or 45˚ | |
| | Number of isopters: 1 to 8 | |
| | Stimulus speed: 2˚/s, 4˚/s, 6˚/s, 8˚/s | |
| Stimulus Source | Front projection LED | |
| Stimulus Color | White, Green, Blue , Red | |
| Stimulus Size | Goldmann size I, II, II, IV, V | |
| Stimulus Intensity | 0.03 asb to 10000 asb in 15 3dB or 45 1dB steps | |
| Exposure Time | Adjustable : 0.1 to 9.9s | |
| Response Time | Adjustable : 0.1 to 9.9s | |
| Inter Test Delay | Adjustable : 0.1 to 9.9s | |
| Background illumination | White 3.2 cd/m2 or 10cd/ m2 Yellow 100 cd/m2, automatic level control | |
| Fixation control method | Heijl-Krakau – blind spot method and CCD camera | |

| Fixation Monitor | Yellow LED |
|---|---|
| Test Lens Diameter | 38 mm |

| Operating Conditions | | |
|---|---|---|
| Ambient Temperature | +10˚ to +40˚ C | |
| Relative Humidity | 30 to 85 % | |
| Atmospheric Pressure | 700 to 1060 hPa | |
| Transport and Storage | | |
| Ambient Temperature | -10˚ to +40˚ C | |
| Relative Humidity | 30 to 85 % | |
| Atmospheric Pressure | 500 to 1060 hPa | |
| ISM Classification | I B | |
| Compliances | CE – mark | |
| Expected Lifetime | 10 Years | |
| Stimulator Unit | Dimensions W/S/D | 566 x 633 x 396 mm |
| | Weight | 19,5kg |
| | Voltage | 115-230 VAC 50/60 Hz |
| | Power consumption | Max 95W |
| | Fuse Rating | 2 x T 800mA |
| Application Part | Patient electric chinrest and forehead | |

## 5.A. INSTALLATION AND USE (PERISTAT)

### 5.A.1. Package Contents

- Automated Perimeter
- Patient response button
- Power cord
- USB cable
- Eye cover 2 pcs.
- Spare fuses 2 pcs.
- Operation Manual
- Dust cover
- Hygienic set 2 pcs.

### 5.A.2. Configuration

The Rodenstock PERISTAT Automated Perimeter consists of three basic components:
1. Stimulator bowl.
2. PC computer, which controls the stimulator bowl and all test function.
3. PC compatible color printer.

PC compatible computer and printer are not supplied with the Rodenstock PERISTAT Automated Perimeter. The Operation Manual does not include information how to prepare or configure PC computer. This information, together with software installation guide is described in separate document called **Installation Guide**. This document is intended for qualified personnel trained by the Rodenstock.

### 5.A.3. System Description

- **Stimulator bowl** – this is the main component of the device. It should be situated on a motorized table, allowing for fast and easy access and adjustment for patient's height. The principle for a fast and reliable performance of the examination is a correct and comfortable positioning of a patient. The Stimulator Bowl is equipped with a video camera used for automatic fixation monitoring

- **Computer PC** – this is a device used for controlling the operation of the Rodenstock PERISTAT Automated Perimeter and storing test results. ***The computer must be compatible with the standard PC operating system Windows 7***.

IMPORTANT NOTE:

PC computer connected to the perimeter must comply with all safety protocols for active medical devices according to IEC 60601.

- **Printer** – required for printing the test results. A high quality color ink jet or laser printer is recommended.
- **The patient's response unit (joystick)** is connected to the stimulator unit. Always ensure the connector has been plugged firmly.
- **Communication USB cable** is connected to the USB port of the PC Computer. Ensure a proper connection between the stimulator bowl and the computer. The communication cable provided with the Rodenstock PERISTAT Automated Perimeter is a standard USB cable.
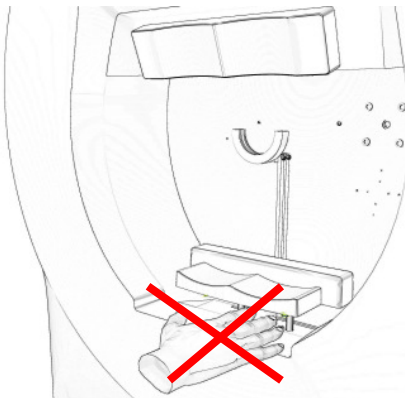


NOTE!

Do not put patient and operator hands in the area between patient chinrest and perimeter unit!
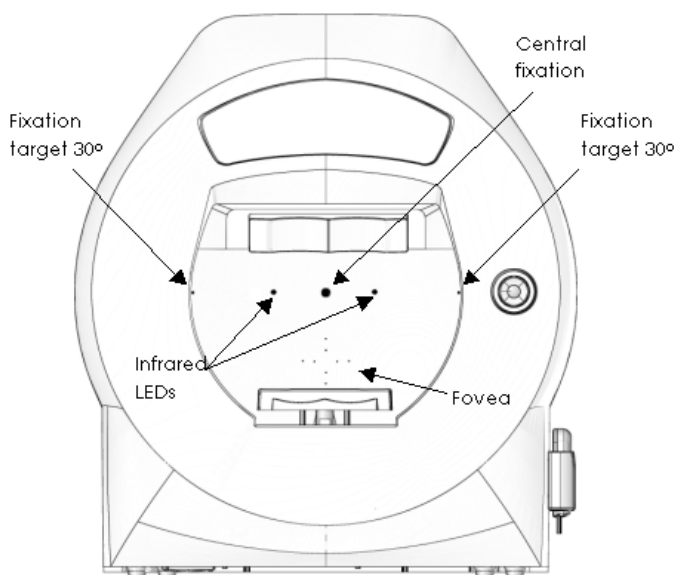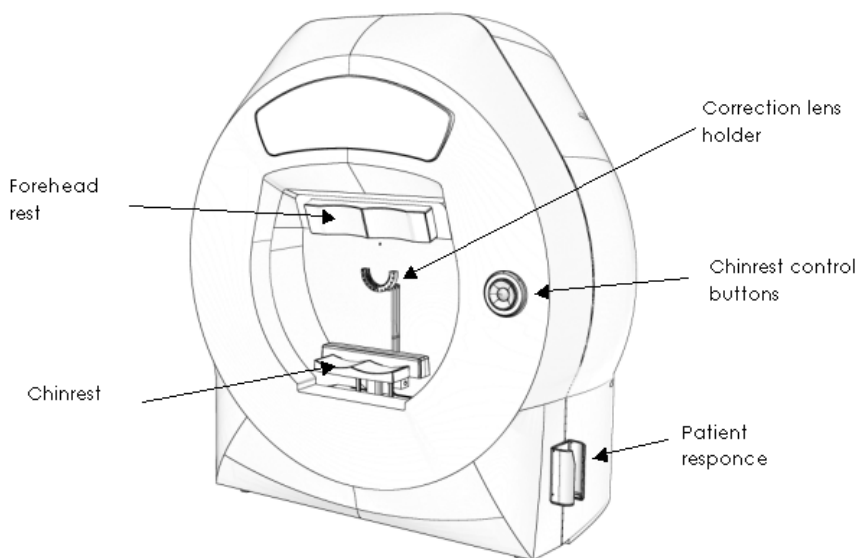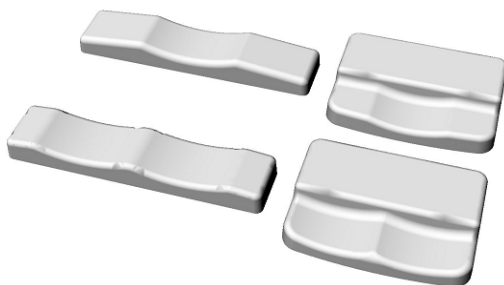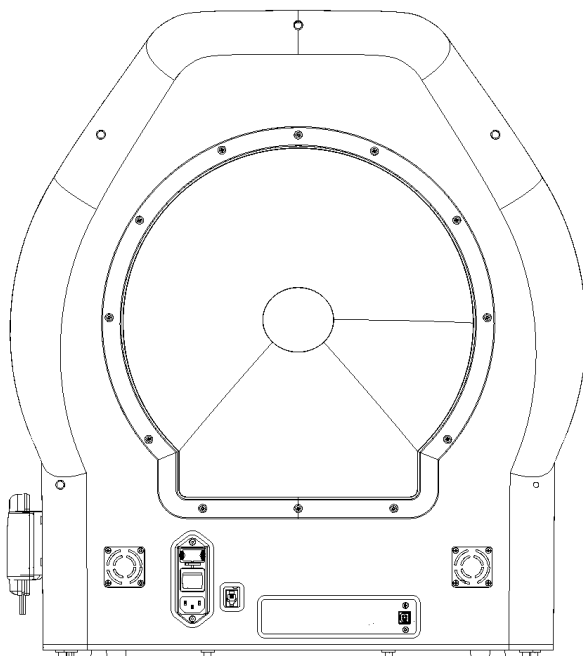
Removable forehead rests and chinrests
(top: for binocular tests, bottom: for monocular tests)

## 5.B. INSTALLATION AND USE (PERIMAT)

### 5.B.1. Package Contents

- Automated Perimeter
- Patient response button
- Power cord
- Eye cover 2 pcs.
- Spare fuses 2 pcs.
- Operation Manual
- Dust cover
- Hygienic set 2 pcs.

### 5.B.2. Configuration

The RODENSTOCK PERIMAT Automated Perimeter consists of three basic components:

4. Stimulator bowl with an internal PC computer,
5. PC compatible monitor,
6. PC compatible colour printer.

Printer and monitor are not typically supplied with the perimeter. This Operation Manual does not include information how to configure internal PC computer. All that, together with the software installation guide is described in a separate document called "Installation Guide". This document is intended for qualified personnel trained by the Manufacturer.

The PERIMAT Automated Perimeter is designed to operate on AC 110-120 or 220-240V and have to be connected to a socket with grounding pin.

### 5.B.3. System Description.

- **Stimulator bowl** – It should be situated on a motorized table to enable fast and easy access and adjustment of the patient's height. The principle for a fast and reliable performance of the examination is a correct and comfortable positioning of the patient. The Stimulator Bowl is equipped with a PC and a video camera used for automatic fixation monitoring.

- **Printer** – required for printing the test results. A high quality colour ink jet or laser printer is recommended.

- **Patient's response unit (joystick)** - is connected to the stimulator unit. Always ensure the connector has been plugged firmly.



| NOTE! | Do not put patient and operator hands in the area between patient chinrest and perimeter unit! |
|-------|-----------------------------------------------------------------------------------------------|

Correction lens holder

Forehead rest

Chinrest control buttons

Chinrest

Patient responce

Central fixation

Fixation target 30°

Fixation target 30°

Infrared LEDs

Fovea

Power entry    Patient
module         responce
               switch



Fuse
compartm
.

ON/OFF
switch

110V-220V
power
cable

LAN

3 x USB
connector

External
display VGA

Speakers
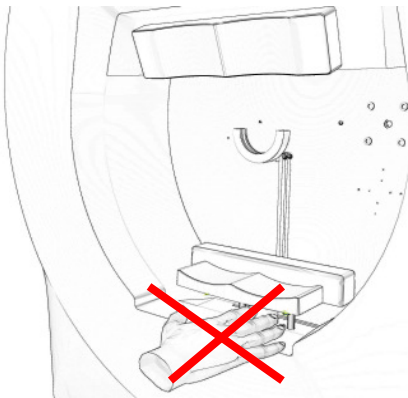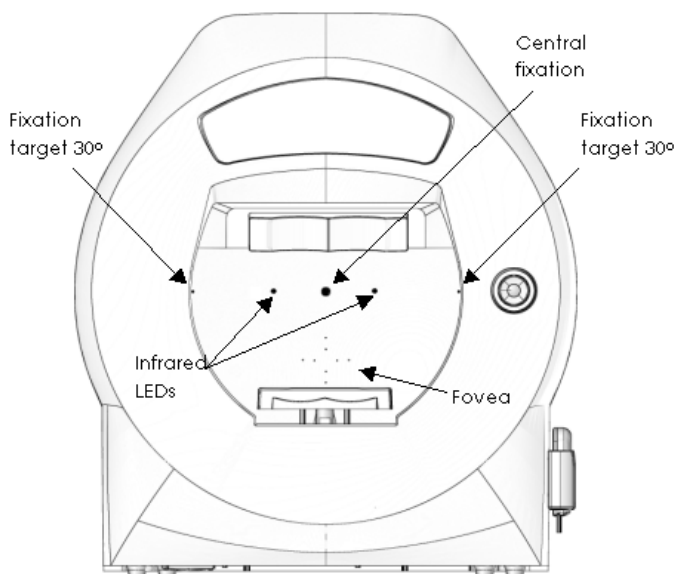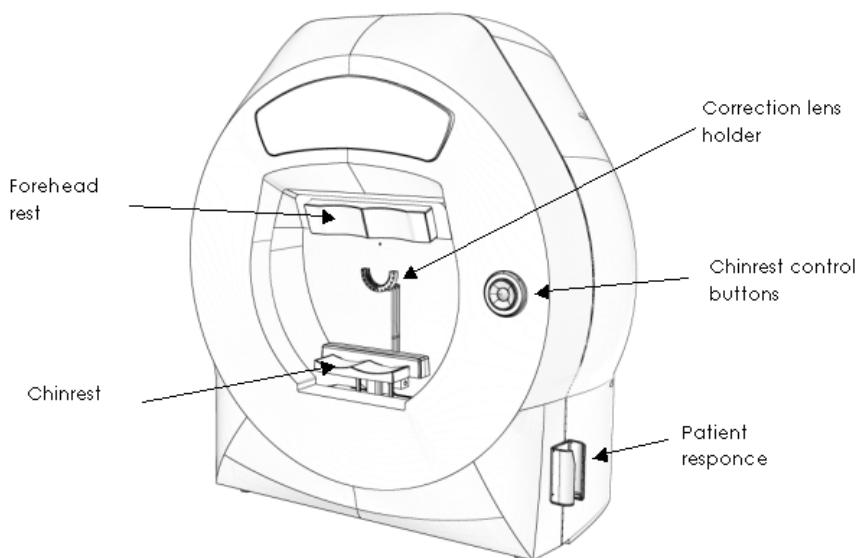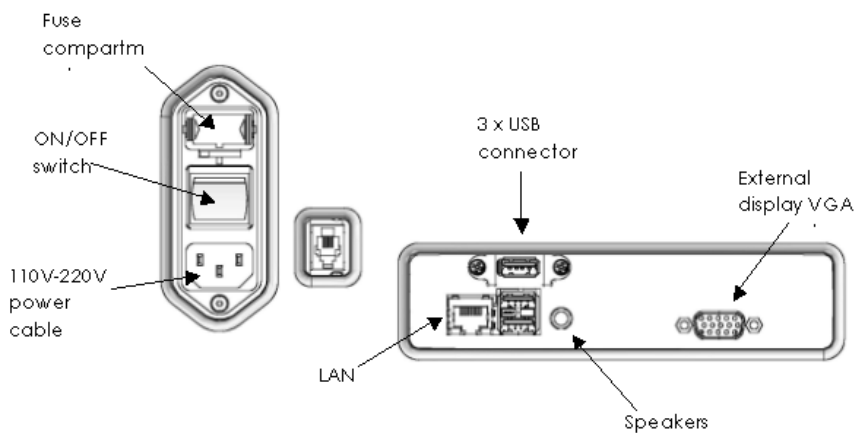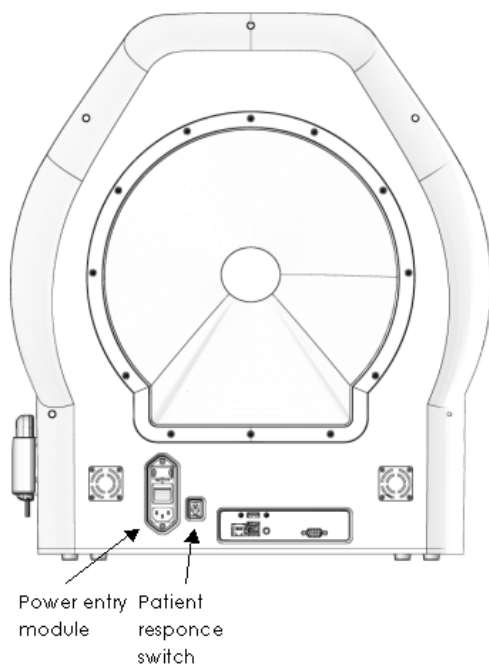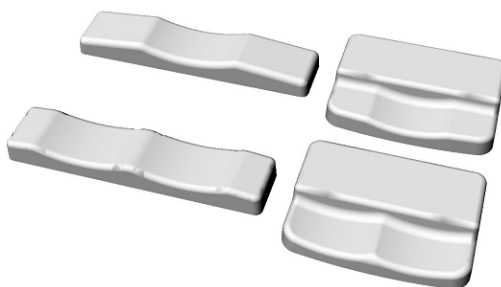
Removable forehead rests and chinrests
(top: for binocular tests, bottom: for monocular tests)

## 6. TOUCHSCREEN KEYBOARD

The AP software can be used with a mouse, keyboard and conventional monitor or with a touchscreen monitor only. In such case entering data is possible by a touchscreen keyboard (pic. 1)
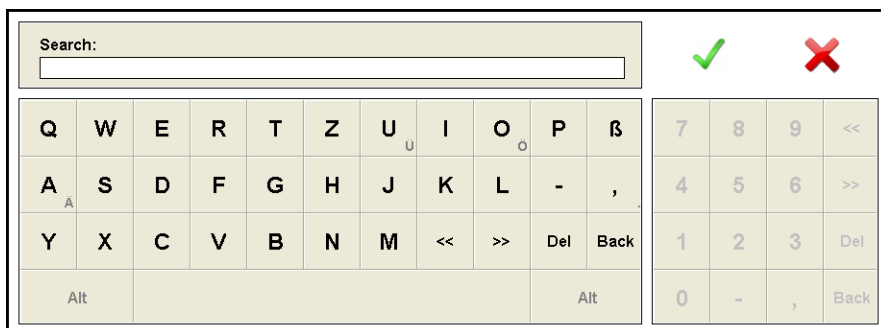


**Pic. 1.** Touchscreen keyboard

Touchscreen keyboard appears when any edit control in the software is pressed. Entered data can be accepted by pressing a green acceptance sign or rejected by pressing a red cross.

- The buttons **<<** and **>>** are to move a cursor backward and forward respectively.

- Button **Del** = 'Delete' button on a conventional keyboard.

- Button **Back** = 'Backspace' button on a conventional keyboard (sometimes denoted as left arrow).

- The national letters are available after pressing **Alt** button.
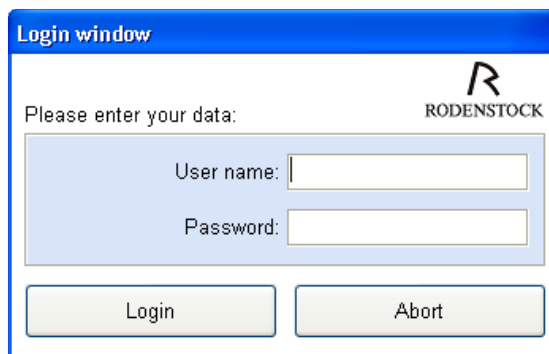
## 7. SYSTEM START-UP AND USER LOGON

System start-up:

- Turn on the perimeter. The main switch is built into the power entry module located at the rear of perimeter housing. Both the central fixation LED and the bowl illumination light will appear after the unit is turned on.

- Turn on monitor and printer.

- Wait while the Windows operating system is starting.

- If *Perimeter.exe* shortcut is added to the automatic startup directory, the application will run automatically. Otherwise start the AP program by clicking on the icon located on the desktop.

Your working place is ready to use.

A user logon window is displayed on the screen after AP software was launched. When only one user exists in the database, the logon window will not be displayed and the logon process will be skipped. A standard user with administrator rights is created during installation of AP software (user name: ADMIN, password: ADMIN).



**Pic. 2.** User logon window.

Every user with rights to launch AP software has a unique name and password. User with administrator rights can create new user accounts and modify the data of existing users. Three groups of user accounts can be created in the AP software as described below:

- **Administrator** – has all rights needed to create new users, to modify the data of existing users and to perform read/write/delete tasks with patient and exam data.
- **User** – has the rights to perform exams and some of the tasks with patient and exam data. A User is neither able to change service settings nor to modify the data of another user.
- **Guest** – has only the right to read and view patient and exam data. A Guest cannot perform write/delete tasks nor can he conduct exams.

Please enter your user name and your password. Click on the 'Login' button. If you don't know your user name and/or your password, select the 'Abort' button and contact your system administrator. If user name or password were entered incorrectly, the software will ask to enter the needed data again.

## 8. THE MAIN SCREEN OF THE SOFTWARE

The standard main screen of the AP software is divided into four functional parts: On the right side there is a vertical toolbar with buttons enabling an easy access to available options of the software. Below the toolbar there is a minature of the currently active test results. On the left side of the screen there are two tables. The table in the top part contains patients' data. The bottom table contains the test results of the active patient. Additionally, in the left top part of the window there are a pull-down menues with access to maintenance and installation options.

a)
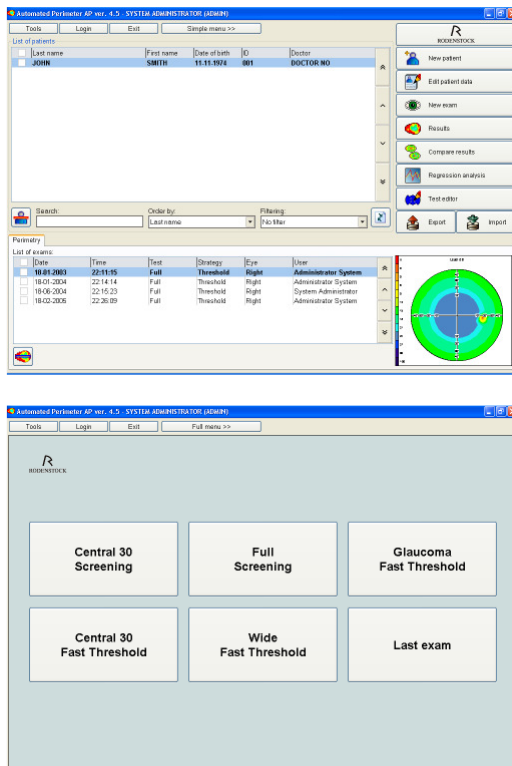


**Pic. 3.** The main screen of the software – a) standard mode, b) simple menu mode.

## 8.1. Table with Patients' Data

The *'Patients' list'* contains the following data:

- Name and surname of patient.
- Date of birth.
- ID number.
- Name of the doctor the patient is assigned to.

You can use mouse or keyboard (cursors, Page Up, Page Down, Home, End) to navigate in the table.

Active patient data are highlighted by a blue horizontal bar. If the selected patient has any accessible tests in the archive, they will be automatically displayed in the tests table.

Between the two lists of patients and exams, there are additional areas allowing easy searching, ordering and filtering the data. Records in the table are usually in alphabetic order, or can be sorted otherwise in ascending order.

- Looping-up of the table of patient data is made always based on the patient's surname. To find a particular patient just type his/her surname or a part of it – gradually, until the moment when the searched surname is found.

- Sorting can be made by patients' name, data of birth, ID or by the doctor's surname.

- The filter option allows displaying results of patients assigned only to a concrete doctor. Data of the other patients won't be displayed.

On the left side of the '*Search*' area there is the '*Delete patient'* icon. To delete a patient mark his/her data and click on that icon. It is possible to delete more than one patient at one time: mark all patients to be deleted using checkboxes displayed on the left side of the patients' records.

 Delete Patient Icon.

On the right side of the '*Filter*' area there is '*Refresh database icon*'. This option is imporatant when working in a computer network. If patients' data is modified on another computer, the USER can refresh database to see the changes immediately.

Refresh database icon.

NOTE!        The software will not delete a patient if there is any test available for him/her. Before deleting such a patient you have to delete his/her test results.

## 8.2. Test Results Table

The *'List of patient's exams'* contains the following data:
- Test date.
- Test hour.
- Test name.
- Name of used test strategy.
- Tested eye.
- Name of the doctor the patient was assigned to.

Navigation in the tests table is the same as in the patients' data table. Additionally, clicking on a test result with the right mouse button opens an option allowing to copy the test result to a different place – e.g. to data of another patient.
Below the Results Table there is the '*Delete result'* icon. To remove test results you mark them and click on the icon.

In order to reduce the possibility of accidentally deleting of tests results or patient data, the software always asks to confirm data deleting operations. There is no possibility of recovering deleted data if there was no backup performed earlier!

Delete result icon.

NOTE!        User or Administrator rights are required to delete patient results data.

## 8.3. Test Result Miniature

In the right bottom corner of the screen there is a miniature representing a graphic result of the currently active test. There is a possibility of changing the mode of miniature displaying. There are four displaying ways available:

- Points scale
- Gray scale
- Colour scale
- 3D image

In default settings the grey scale is set. To change the displaying mode, right-click on the miniature zone to open a pop-up menu and then select an option via left mouse-click.

While working in the 3D mode, it is possible to turn the picture by simultaneously pressing the left mouse button and moving the cursor on the 3D zone.

In other modes, if you move the mouse cursor over the miniature pressing simultaneously the left mouse button, the local decibel value for the displayed zone will be displayed.
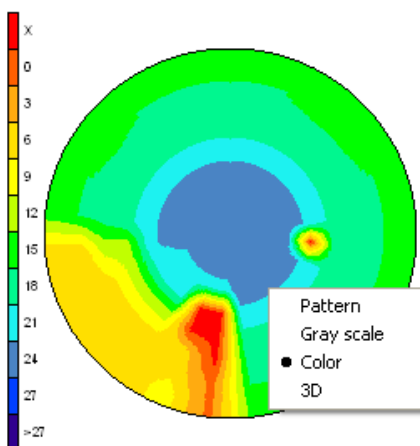


**Pic. 4.** Result miniature

## 8.4. Tool Bar

There are 10 buttons on the Toolbar; each of them is defined with a text description, and an icon represents a symbolic drawing of the performed function. The first button represents the logo of the equipment provider and does not have any function assigned to it. The last button is divided in two smaller buttons: Export and Import.

### New patient
It opens a form to enter data for a new patient.

### Edit Patient data
It opens a form where you can change data of the actually selected patient. The button remains inactive when there are no patients in database.

### New test
Herewith you start a new test. A form opens with parameters for to setting the test scenario. Before selecting this option, you have to make sure that the right patient from the relevant list has been chosen. This option remains inactive if there are no patients in the database.

| NOTE! | This option remains inactive if there is no communication between the perimeter and the PC. |
|---|---|

### Results
A window opens to list tests results. There is detailed information about this function in Chapter 15.

### Compare result
The according form enables you to compare two marked results.

| NOTE! | The marked results must belong to the same patient; the comparison has to be made for the same eye and field. Tests made with strategies *2 Zone*, *3 Zone*, *Quantify defect, Binocular, Constant* and *Bi-Driving* cannot be compared. |
|---|---|

Use checkboxes displayed on the left side of the test result records to mark more than one result. All the marked tests will be highlighted with the light blue horizontal stripe.

### Regression analysis

It opens a form to list the progress of changes in a patient's field of view. To be able to make a regression analysis, it is necessary to have at least two results for one eye, both made with the same test. There are more details concerning the regression analysis in Chapter 19.

| NOTE! | A regression analysis cannot be made on the base of results of two tests performed on the same day. |
|---|---|

### Test editor

You can design custom made tests based on standard tests. The ways of test editing are described in Chapter 20.

### Export and Import

This button allows to import and export single results, patients' data or a whole database to an external file. There is detailed information concerning the export and import process in Chapter 26.

### 8.5. Pull-down Menu

In the left top corner there is a 4 columns pull-down menu.

| Tools | Login | Exit | Simple menu >> |
|---|---|---|---|
| Service mode | | | |
| Advanced service mode | | | |
| Database info | | | |
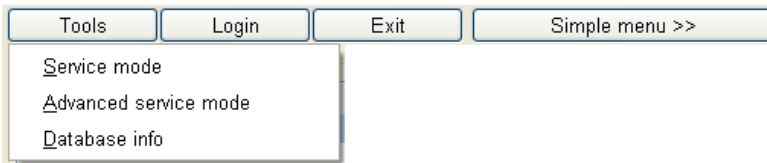
**Pic. 5.** Pull-down menu.

In the 'Tools' menu there are three options to select from:

- Service mode – displays tabs for setting many parameters concerning the software.
- Advanced service mode – displays tabs for setting hardware parameters of the AP perimeter. Available only after entering service password.

- Database info – shows the total number of patients in the database, the total number of exams and the number of exams of a currently selected patient.

There are detailed descriptions of these options in respective chapters (except **Advanced service mode** described in a service manual).

'Log-in' allows to login as a different user.

Exit allows to quit the software.

NOTE!          Login of a new user will automatically logout previously logged-in person.

'Simple menu >>' switches the screen to the simple menu mode (pic. 3b). Instead of standard main screen the six buttons are displayed on the screen. These buttons allow user to start preselected exam with a predefined settings. For the details please check chapter 27.7. To switch to a standard mode please press 'Full menu >>' button.

## 9. RECEPTION OF A NEW PATIENT
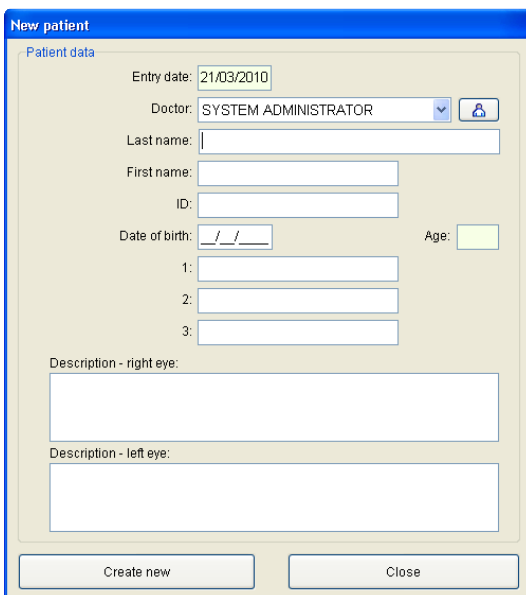
The function allows adding a new patient to the database. After clicking on the '*New Patient*' button the form of patient reception is displayed.

Boxes marked in green containing patient number and date of reception are filled automatically by the software.

*Last name, First name, and Date of birth* are mandatory to be inserted, so that the software of perimeter works correctly.

The '*ID*' box is filled optionally and can remain empty. This box can be used in clinics which use their own internal patients marking system.

The patient's age is calculated automatically according to the Date of birth. You can set the date format in the *Service options* window (see section 25.1).

**Pic. 6.** Window of new patient reception.

| NOTE! | Entries into the box with the patient's date of birth have to be the according to the box *'Entry date'*. Otherwise the software will display information about wrongly entered data. |
|---|---|

The last three boxes also do not need to be filled. The user can define what kind of information will be stored in them and if they are supposed to be displayed at all. The description of these boxes can be edited through the menu *'Tools'*, option *'Settings'*, group *'Others'*. Information stored in this area can regard i.e.: phone number of patient, his/her address etc. The standard marking of these boxes are three numbers – respectively: 1, 2 and 3.

The two lowest text boxes '*Left eye – description'* and '*Right eye - description'* allow inserting put medical information – respectively regarding the left and the right eye of the patient. There could be doctor's remarks or to the medical history of the illness course. Information stored in these boxes is optional and it is not necessary for the correct functioning of the program.

Information input in the boxes of this form is saved in the database by clicking on the button '*Add patient'* which is placed in the bottom part of the screen.

The *'Doctor'* box contains name and surname of the doctor whom the patient is assigned to or who sent him/her for the test. This data is placed then on the blueprint in the reading next to the name and surname of person running the test. If data of a doctor we are looking for are absent in the pull-down menu, we can add his/her data by clicking on the doctor icon which will open a menu to add a new user (see Chapter 24.1. Pic. 60).

## 10. EDITING PATIENTS' DATA

This function allows editing of data of patients that already exist in the database. Changes can be made for a patient that has been marked as active in the '*Patients*' table of the main screen of the program. All the data put in earlier are displayed in their boxes of reference.

Once information has been changed, it can be stored into the database by clicking on the '*Apply changes*' button which is in the bottom part of the dialog window. A click on '*Close*' will end editing of patient data.

Clicking on the '*Close*' button without having clicked on the'*Apply changes*' button before will lead to the main screen of the software without saving any changes.



**Pic. 7.** Dialog window of patient data editing.

## 11. ADJUSTING TEST PARAMETERS

A window is opened automatically after choosing the button *'New test'* on the main screen of the software. The window cannot be opened if there is no communication between PC and the perimeter bowl.



**Pic. 8.** Window of test parameters choice.

*Eye* – allows choosing between the left and the right eye.

*Test* – defines the type of field that will be used during the test.

*Strategy* –defines with which particular strategy the test process will be running. Details of accessible strategies are described in Chapter 22.

*Pupil* – box to type in the pupil diameter of the tested eye. There is a possibility of making an automatic measurement of the pupil diameter using the image of the eye as shot by digital camera.

*Correction* – this box accommodates information about correction lenses used by patient, e.g. +3.5 cylinder.

NOTE!

The correction box must be filled if the field used in the test process is larger than 22˚ and the patient is wearing glasses or any other type of correction lenses during the test. In such case the test course is divided in two phases: During the first one, any two points in the scope of 22˚ from the centre are tested and then the software asks to remove the correction lens or glasses in order to test the points which are on the circumference. If you don't fill in the information about correction, the software will test the whole field in one phase and the framed glasses or the correction lens will overcast part of the tested visual field, and it will introduce a significant error into the results of the test.

*Fixation control* – allows choosing between the automatic fixation control with the camera and the standard method Heijl-Krakau. Fixation control details are described in Chapter 12.

*Flicker* – defines if the stimulus is supposed to shine constantly or if it is supposed to flicker with a set frequency. If the option *Custom* selected, the frequency of the flicker is dependend on a position of the stimulus according to the settings in *Service Menu.*

The option box contains additional five parameters that can be chosen. These are: *False positive, False negative, Wide fixation*, *Fluctuation, Use selected pattern*. These options are activated by marking the corresponding box.

NOTE!

*Fluctuation* option can be activated only if the chosen strategy is *Threshold* or *Fast threshold*.

*Use selected pattern* – is based on the use of previous tests results of the same patient as a model for a new test. Then the software does not make any initial calibration. All the cells of the box have assigned initial brightness levels based on the levels resulting from the test used as the model. If you choose this strategy the test duration is significantly reduced, especially in case of patients with much worse eyesight.

NOTE!

*Use selected pattern* option is not available in strategies: *2 Zone, 3 Zone, Quantify Defect, Binocular, Contant* and *Bi-Driving*.

*Fovea* – an option to test a selected cell in the initial stage of an exam. The cell is surrounded by four fixation cells (so called 'diamond'). The result is used then to calculate the initial dB values of the cells instead of testing the calibration cells.

NOTE!

*Fovea* option is not available in the strategies where an initial calibration is not necessary.

*Stimulus size* (PERIMAT only) – an option to select an appropriate stimulus size according to the Goldmann standard (sizes denoted from I to V). Size of stimulus = V is set by default for the blue on yellow strategies and III for another strategies.

*Stimulus color* (PERIMAT only) – an option to select an appropraite stimulus color. In case of the blue on yellow strategies only a blue stimulus is available, in case of another strategies there are three available colors: white, green and red.

## 12. TESTING A PATIENT – STATIC PERIMETRY

### 12.1. Use

This chapter describes the process of testing a patient.

### 12.2. Quick Start of a Test

This chapter is designated to users who are familiar with the Windows system and basic rules of perimeter tests.

1. Start the AP application.

2. Add a new patient with '*New patient*' or – if the patient has been already added to the database – select him/her from the patients table.

3. Select '*New test*' and set test parameters.

4. Make sure the patient is in the correct position.

5. Run the demonstration program in order to get the patient ready for the test and check operation of the automatic fixation.

6. Start the test.

| NOTE! | Automatic fixation measurement can work incorrectly in case of a certain number of patients (about. 5% of total population). In such a case set the standard control of fixation according to the Heijl-Krakau method. |
|---|---|

## 12.3. Test Screen

The test screen is divided into many functional blocks. The main part of the form placed on the right side of the screen shows the graphic image of the tested field. It contains many cells and each of them corresponds to a single test point. Four cells marked in yellow, placed on the 10˚ circle, are the calibration points. They are used to define the initial sensibility of the retina for the remaining zones. The cell marked as 'BS' represents the blind spot. During the test each of the test points can be checked again, and you can manually assign the brightness level used during the next stimulation of this point. This option is recommended to be used only by advanced users.
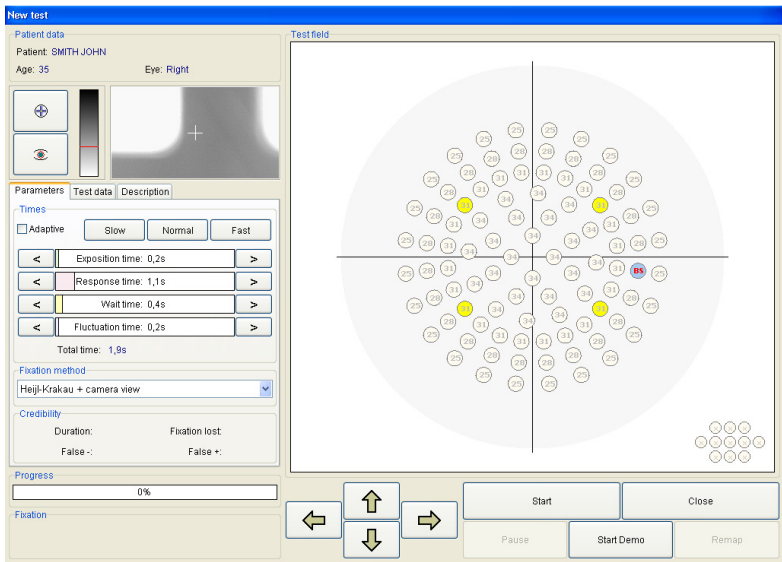


**Pic. 9.** Test screen.

## 12.4. Patient Data

This tab contains information about name, surname and date of birth of the patient. It also informs if the eye which is being tested is the right or the left one.

## 12.5. Test Course Control

In the left bottom part of the window there are buttons which control the test course, *Pause*, *Start, Start/Stop Demo, Remap*, *End*.
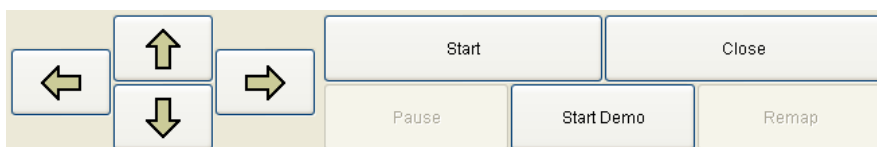


**Pic. 10.** Test course control buttons

 – buttons to move the electric chinrest.

*Start* – starts the test.

*Close* – finishes the test at any moment and returns to the main window of the software. If this option is selected before the planned end of the test, the software will display a question if you are sure to close the testing process and if the incomplete results should be saved in database.

*Pause* – clicking on this button will stop the test for a moment. The test will be continued after clicking on '*Continue*'.

| NOTE! | The patient can stop the test at any time by pressing continuously the response button. Information about this will be displayed on the screen. |
|---|---|

*Demo* – activates the demonstration working mode. It shows to the patient rules and course of the test. Additionally, the DEMO mode allows checking the correctness of the automatic eye fixation control.

*Remap* – remapping of blind spot placement. It concerns only the working mode according to the Heijl-Krakau method. See more details about this option in Chapter 12.

### 12.6. Control Keys of Eye Preview
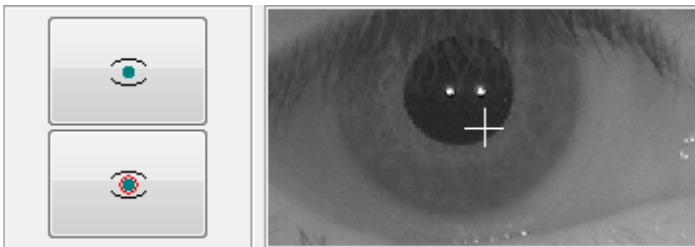


**Pic. 11.** Control keys of eye preview.

The white cross of the camera image indicates the center point on the image. Before the exam is started, patient should be positioned that his/her eye is in the center of the image.

If the automatic method of fixation monitoring is used, the software will detect a current position of the eye. There is no need to keep the eye in the center of the image during the test – it is rather important that patient is looking into the fixation point all the time. The perimeter software performs calculations based on the analysis of the two white dots (infrared reflections).

The buttons on the left are to perform a manual and automatical (respectively) measurement of a patient pupil.

## 12.7. Pupil Measurement

The icon representing schematically an eye (Pic.12) is for measuring the pupil size.
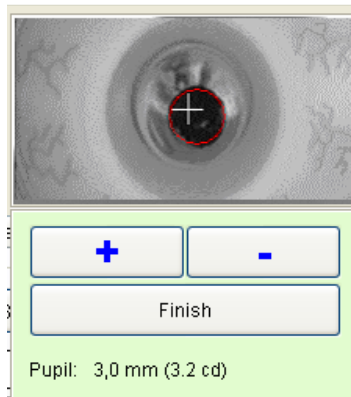


**Pic. 12.** Manual pupil measurement.

Clicking the blue arrows will change the red circle so that you can adapt it to the pupil size. The red circle is moved with the cursor keys on the keyboard. It is also possible to indicate the pupil centre by moving the white cross with pressed left mouse button. Selecting '*Finish*', the software saves the measurement results and closes this tab.

The result of measurement is presented in millimiters. The value of the bowl illumination is displayed in the brackets (in candelas).

## 12.8. Information Tabs

There are three registers presenting parameters and test course: *Parameters*, *Credibility* and *Description*.

### 12.8.1. Register **Parameters**

On the tab there are functions that require a constant and quick access all along the test duration. It allows changing the time parameters of stimuli and tracking the test indicators which are critical for the test credibility.



**Pic. 13.** Parameters tab

The buttons 'Slow', 'Normal', 'Fast' are to be used for a quick change of all the time parameters of the test. The following times are assigned to them:

| Slow | Duration Time | 0.2 s |
|------|---------------|-------|
|      | Response Time | 1.1 s |
|      | Wait Time | 0.6 s |
|      | Fluctuation Time | 0.6 s |
| Normal | Duration Time | 0.2 s |
|      | Response Time | 1.1 s |
|      | Wait Time | 0.4 s |
|      | Fluctuation Time | 0.4 s |
| Fast | Duration Time | 0.2 s |
|      | Response Time | 0.8 s |
|      | Wait Time | 0.4 s |
|      | Fluctuation Time | 0.3 s |

You can modify the time parameters manually by pulling one of the horizontal time bars via mouse.

*Adaptive* – It activates the automatic control of the time parameters. The software will estimate the times of the patient's reaction speed and it will change the times in such a way as to reduce the test duration, thus making sure that the result credibility does not suffer.

*Exposition Time* – Time of stimulus shining.

*Response Time* – Time during which the perimeter waits for the patient reaction after the stimulus is switched off.

*Wait Time* – Parameter defining the time flow between two succeeding test cycles. It is counted from the end of the *Response Time.* After that time the next test cycle will start which means that the next point will light up.

*Fluctuation time* – Random time in the scope between 0 to the set value, by which the *Wait Time* will be extended*.*

NOTE!            If the patient presses the button during the delay time, the software will display a message '*Reaction out of time'*. This answer will not be taken into account – it will be omitted. It is a sign for the test operator that it is necessary to extend slightly the time parameters.

*Total time* – total maximum duration of a single cycle. It takes into account the maximum time of the fluctuation duration.

*Fixation method* - It defines the mode of fixation control. Any change can be implemented only before the test. Any attempt to change the fixation method during the test will make it restart right from the beginning.

### 12.8.1.1. Box Credibility

It contains information concerning measured parameters defining the credibility of the test result.

*False +*   Parameter defining the number of false positive errors.

*False –*   Parameter defining the number of false negative errors.

*Fixation loss* – Counter of fixation losses by the patient. The information is displayed in the form (number of erroneous reactions) / (number of tries) and is defined in percent with additional text description.
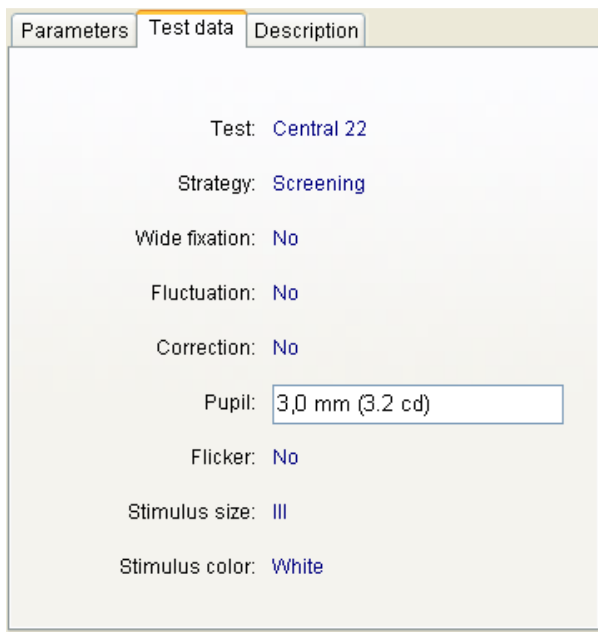
| NOTE! | If the parameter *Fixation loss* goes above 30%, the test must be considered as not reliable. |

More detailed information concerning the credibility of tests is described in Chapter 21.

*Duration* – time flow since the beginning of the test.

### 12.8.2. *Register* **Test data**

It contains basic information concerning the test which is currently selected.



**Pic. 14.** Parameters tab.

*Test* – informs on the type of test field which has been used for test purposes.

*Strategy* – tells the chosen strategy according to which points will be tested.

*Wide fixation* – tells the type of the fixation point – wide or central.

*Fluctuation* – informs if a fluctuation measurement will be made during the test.

*Correction* – states the type of correction that is used during the test. The correction should be always entered into the test parameters before starting the test with the '*Start'* button. Otherwise it will not have any influence on the test course.

*Pupil* – Pupil diameter expressed in millimetres. In case of an automatic or manual measurement this box will be filled automatically. If this box was filled manually the software will change the entered value.

*Flicker* – informs on the flickering frequency of the stimulus.

### 12.8.3. *Register* Description

It contains a form which allows adding any commentary to the test in running. This form can be filled in also once the test has been finished, e.g. giving a results review. The test description can be printed – see Chapter 17.

### 12.9. Box *Progress*

A graphic representation of the test progress. Thanks to it a person running the test can estimate how much time is left before the test finishes.

### 12.10. Box *Fixation Bar*

This tab remains inactive if the fixation control method is the one of Heijl-Krakau. It shows the graph of fixation in time. On the right side of the fixation bar there is a momentary fixation indicator. It changes its height and colour according to the fixation state. Details concerning fixation control are described in Chapter 12.
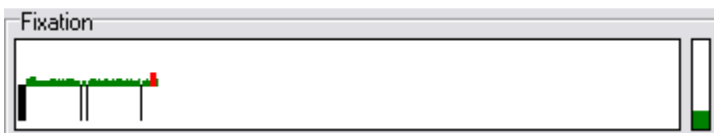


**Pic. 15.** Fixation bar box.

## 12.11. Box *Blind Spot*

It is a graphic representation of the blind spot and it shows which points have been seen by the patient and which ones were used for the fixation control. The '-' symbol defines the zones that were seen, the '**X**' the ones that have not been tested yet, the '**V**' symbols defines the ones that were not seen.



**Pic. 16.** Blind spot.

## 13. FIXATION CONTROL

AP Automated Perimeter has two mechanisms of fixation control:

- Heijl-Krakau method based on blind spot position control,
- method of eye position analysis by means of a video camera image.

### 13.1. Fixation Control by Heijl-Krakau Method

It is a classic fixation control method used in most of the perimeters. It is based on verifying the blind spot position by random stimulation of each of eleven points belonging to it with high brightness during the test. Diodes assigned to the blind spot are respectively in the field from 11˚ to 19˚ from the bowl centre and between parallels 0˚ and the line defining a 15˚ deviation from it. It results from the eye anatomy and from the location of the blind spot on the retina surface.

A scheme representing the 11 points of the blind spot is represented in the diagram 17.



**Pic. 17.** Blind spot.

The blind spot is described with the following symbols:

**X**     A point that has not been tested yet.
-       A point where the answer of the patient was positive. This point is eliminated from the group of points for the fixation control.
**V**     A point with a negative answer by the patient. It will be used again for the fixation control.

During the first phase of the test the placement of the blind spot is checked alternately with four yellow calibration points. In case of a test to define the sensibility of calibration points, the test starts with a check of a total of 11 blind spot points. The software will use only those among the 11 points which were not seen during the first checking phase.

If during the checking phase the patient sees more than 6 of 11 points, the software will display a message about a probably wrong setting of the patient's position. If this number will grow up to 8 visible points, the software will inform us that the patient's position has been set wrongly. In both of these cases the '*Remap*' option will be activated which will re-check the placement of the blind spot after a correction of the patient's position. The '*Remap*' option will also remain active during the test if the number of invisible points in the blind spot will drop down below 3.

Invisible points of the blind spot are checked during the test alternately with other stimulation points. The frequency of testing blind spot points is defined by the parameter '*Test expositions per BS exp.*' in the maintenance tab. The standard setting of this parameter is 15. It means that the blind spot will be tested on average once per every 15 standard measurement cycles.

When the patient's position is set correctly the blind spot should contain at least five invisible points, placed in its centre. See field a) on the diagram 18. If this number is lower or the positions of invisible points are moved in the direction of blind spot limits, it means that the patient's position is incorrect.
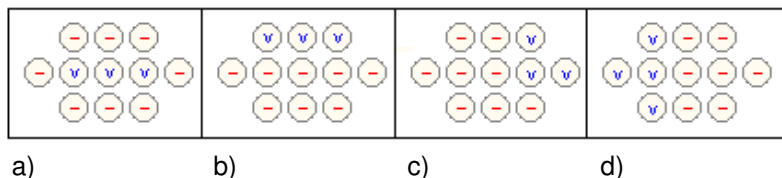


a)                    b)                    c)                    d)

**Pic. 18.** Examples of blind spot (BS) position.

Diagram b) represents the BS field image when the patient is positioned too high. Diagrams c) and d) show an extended movement to the left or to the right. The presented examples do not disqualify the test results. It is possible to achieve a high probability of the results even in cases when there is only one invisible point on the BS field. Nevertheless it is important that this point remains invisible during the entire test.

The brightness of blind spot stimuli can be set. The recommended level is 3 or 6 dB – see "*Tools Service Mode-Settings-BS Brightness*".
The test should be repeated if the parameter *Fixation loss* is bigger than 30% and has a value '*Bad*'.

## 13.2. Digital Fixation

It is based on the analysis of a video camera image. The pupil is found in the image, and its centre is marked due to complex algorithms. Then the pupil position is constantly monitored during the test. When this fixation method is used, the blind spot region is not tested at all. The advantage of digital analysis is the possibility of rejecting patient's answers given while there is no fixation. Besides, the fixation is checked during the exposure of all the test points, and not only randomly.
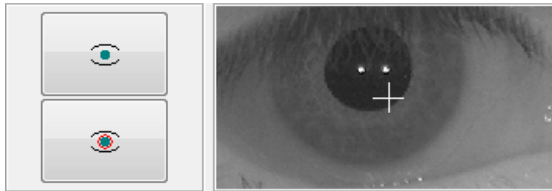


**Pic. 19.** Eye preview.

In the bottom part of the test screen there is a tab of the fixation toolbar. The graph of the fixation level in the time flow is drawn on it. On the left side of the toolbar there is an indicator of the momentary fixation factor. This bar can appear in three possible colours:

- Black, if it is not possible to define the fixation level (eye closed etc.)
- Red, if the fixation loss is high.
- Green, when the fixation level is correct

The height of the bar shows the actual fixation level. If the program is not able to find the pupil in the image (closed eye, blink, wrong lighting), the momentary fixation bar goes up towards the maximum height. On the fixation graph it will be marked by a black line going from the bottom to the centre of the graph. Colour and height of the momentary bar are moved on the horizontal fixation graph after the end of each measurement cycle.

The buttons on the left are to perform a manual and automatical (respectively) measurement of a patient pupil.

NOTE!          Digital fixation does not work if the room is not dark enough.

## 14. TEST COURSE – STATIC PERIMETRY

According to the type of the test's initial settings, its first phase can have different courses.

If the strategy chosen is *2 Zone, 3 Zone, Quantify Defect, Binocular, Constant, Bi-Driving* or *User-selected pattern* the software will not make an initial calibration of four yellow points. If one of the three first mentioned strategies is applied the program assumes the initial values for all the points of the zone being on the level resulting from the age norm. Using a pattern, the initial values for the points are taken from the pattern field. In such a case the first phase of the test will be composed of blind spot control, if the chosen fixation method was the one according to Heijl-Krakau. In case of digital fixation the BS point will not be tested, the software will go automatically to the second phase of the test.

In all other cases the first phase of the test will be the definition of the calibration points' sensitivity level. It will be done alternately with blind spot testing in case of choosing the fixation method of Heijl-Krakau. In case of digital fixation, the BS point will not be tested. After testing the calibration points the zone will be filled with respective values and the test will go to the second phase.

| NOTE! | If the test is made with the '*Screening*' strategy, and the defined level of sensitivity for four calibration points will be too low in reference to the age norm, the software will display a message about calibration error. The user will have to select manually a new calibration level for calibration cells or to continue with the measured values. |

The second phase of the test goes according to the strategy and the chosen parameters for the test credibility. The points are tested in a random order. The cell corresponding to the point being tested is highlighted in green during the exposition time. The points which were not tested yet are marked with a light brown text. The initial dB value of a point being tested is equal to a value shown in a corresponding cell. If there is no answer to the stimulus the cell description changes its colour to red. The positive answer is green. The point already tested is marked by a text in blue.

Between the standard exposures of test points the software makes special cycles. It includes the control of false positive and false negative errors, fluctuations and control of the blind spot (in case of Heijl-Krakau fixation). Information about making a special cycle is displayed in the left top corner of the tested field.

You can manually change the dB level of the point which will be tested during the test. It is also possible to verify once again already tested points.
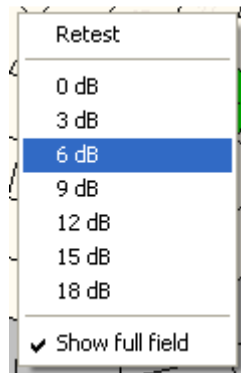


**Pic. 20.** Retest options.

A right mouse click on any cell of the field opens a list of available options. The function '*Retest*' activates a retest of the selected cell. Testing will be started from the level assigned to the cell at the beginning of the test. A left mouse click on one of the dB values of the pop-up menu assigns the level to the marked cell on which it will be tested by the next exposition.

The function *'Show full field'* shows all cells that do not count into the field being currently tested. Right clicking on an inactive (gray) cell and selecting then *Add to field* option allows user to activate it.

| NOTE! | In case of working with a correction lens when the test is divided in two phases or in case of *Driving Test*, you can modify only the cells of the part of the field that is being tested currently. |
|---|---|
| NOTE! | Changing the brightness levels in an unreasonable way can result in errors of the test results. It is recommended that this option is used only by advanced users. |

## 15. TIME PARAMETERS OF STIMULI – STATIC PERIMETRY

Each test cycle can be considered as a summation of four time segments:

| Exposition time | Response time | Wait time | Fluctuation time |
|---|---|---|---|
| Stimulus presented | Waiting for an answer | Delay between stimuli | |
| **Cycle duration** | | | |

 **Pic. 21.** Scheme of a single test cycle.

*Exposition time* – duration of a presented stimulus. The duration range can be set from 0.1 s to 9.9 s with 0.1 s accuracy.

*Response time* –time until the response from a patient after the stimulus is turned off. The response time range can be set from 0.1 s to 9.9 s with 0.1 s accuracy.

*Wait time* – time between stimuli are visible. Wait time is defined as the time between the end of one cycle (when the patient's button is released or the response time is over) and the beginning of the next cycle.

*Fluctuation time* – this parameter introduces a random delay between consecutive test cycles. So, *Wait time* can vary as presented below:

**min**: *Wait time + 0 s* to **max**: *Wait time + Fluctuation time*.

Fluctuation parameters decrease the monotony of a test by introducing a random factor.

## 16. REVIEWING RESULTS – STATIC PERIMETRY

The '*Results'* screen is divided into functional group boxes. The detailed descriptions of the group boxes are provided in the present section.
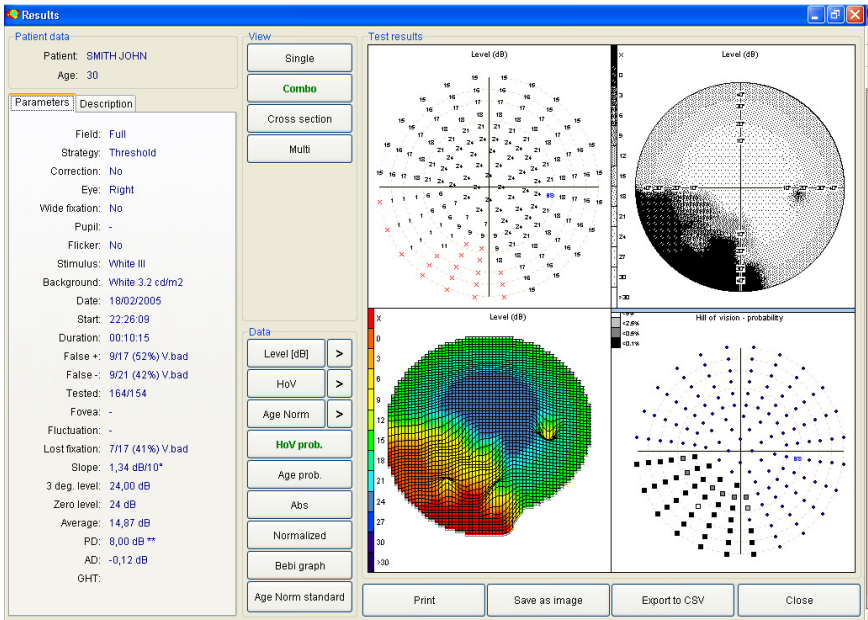


**Pic. 22.** Results screen.

### 16.1. Box *Patient data*

*'Patient data'* box is located in the left top part of the screen. The patient's name and age are listed in this box.

### 16.2. Tab Parameters

*'Parameters' tab* contains all input parameters of the conducted test.

- *Test type* – name of the test
- *Strategy* – strategy of the test

- *Correction* – details of the applied correction
- *Eye* – tested eye (left or right).
- *Wide fix.* – so called wide fixation points were used or not.
- *Pupil* – diameter of the patient's pupil (measured or entered manually). This field can be empty if the pupil diameter was not measured.
- *Flicker* – a flickering stimulus was used or not.
- *Stimulus* – color and size of stimulus
- *Background* – intensity of background illumination in cd/m²
- *Fovea* – dB value of a fovea point (if tested)
- *Date* – date of exam
- *Start* – start time of exam
- *Duration* – total time of exam
- *False +* - number of false positive responses.
- *False –* - number of false negative responses.
- *Tested* – ratio of number of tested points to number of expositions.
- *Fluctuation* – fluctuation of patient's responses during test
- *Fixation lost* – number of lost fixation during test.
- *Slope* – calculated slope of patient's hill of vision.
- *3 deg. lev* – level of hill of vision up to 3 deg. from the centre.
- *Zero level* – most common value in the field
- *Average* – dB average value of the field
- *PD* – pattern defect.
- *AD* – average defect.
- *GHT* – zone comparison.

Detailed information about the parameters mentioned above can be found in section 21.

A description of the finished exam is placed at the left bottom of the screen. This description can be modified at will and the changes will be saved in the database even after the test is finished.

If Heijl-Krakau fixation control was used during the test, a blind-spot scheme with 11 fields will be drawn in the right bottom of the presentation. When the test was conducted using digital fixation control, then the fixation data will be visible at the bottom of the screen.

The fixation bar is drawn also on the printout. Red lines indicate a bad fixation, green lines a good fixation. Black lines indicate the moments when it was impossible to detect a fixation level, for example due to closed eyes or not proper illumination of the room etc.

### 16.3. Box *View*

### *16.3.1* Single *view*

A single graphical map of the current exam is displayed on the screen.
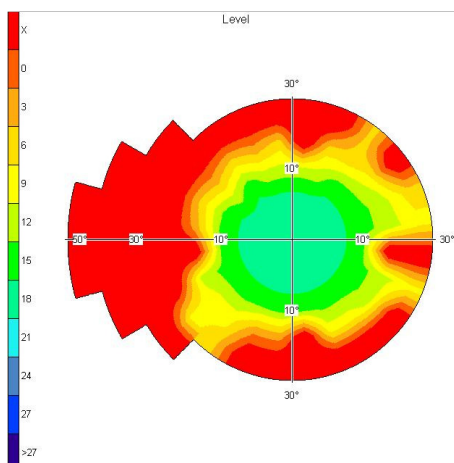


**Pic. 23.** *Single* view.

If the exam results are drawn in 2D scale (pict. b, c, d), an appropriate scale is drawn on the left part of the presentation. The scale is not present when working with a numerical map.

Horizontal and vertical axes are drawn on the graphical map with a degree ruler. Axes are not visible when a dB numerical map is displayed.

Pressing the left mouse button when the mouse cursor is placed on a certain point of the field, a dB value will be shown which corresponds to this point. This option is available only when working in 'Single' mode.

### 16.3.2. Combo *view*

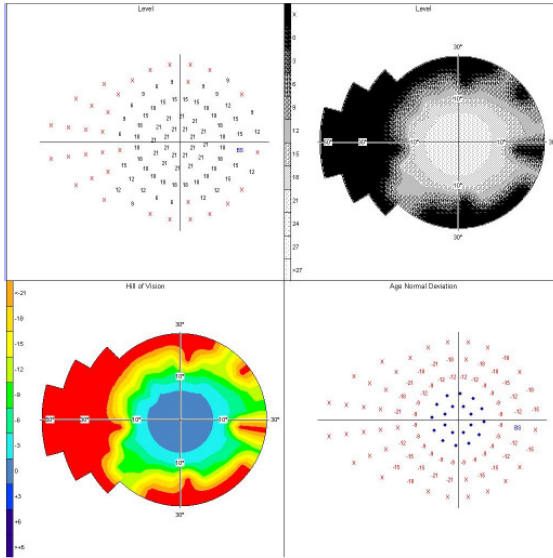The exam results can be shown in four different forms.



**Pic. 24.** *Combo* view.

An active field is marked with a blue, vertical bar. All possible options are available only for the selected field. If 3D mode is selected, it is possible to change the angle of view of 3D presentation for every single field. Every displayed field contains information on what type of presentation is currently displayed.

### 16.3.3. Cross section *view*

A '*Cross section view*' displays a graphical map in one of the selected modes. Additionally, a cross-section by the selected angle through the field is shown at the bottom.
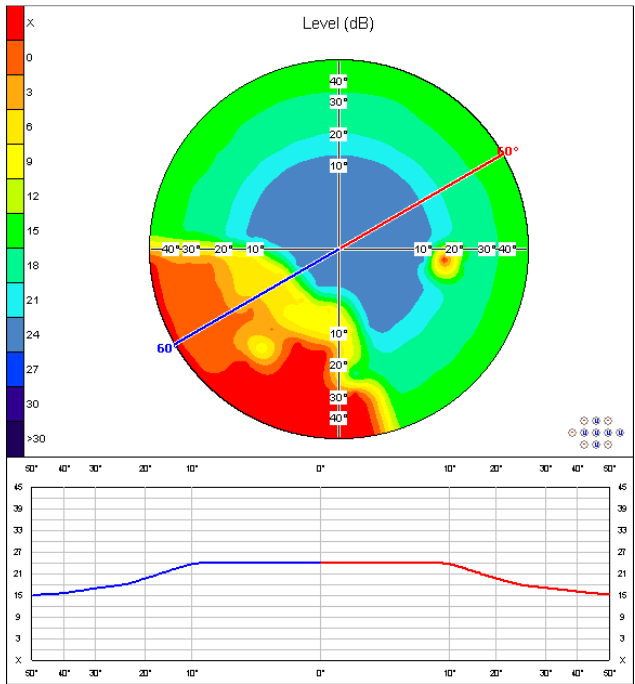
**Pic. 25.** *Cross section* view.

The cross section angle can be modified using the buttons located on the left top of the screen. The section angle value is displayed on the image. The cross section line as well as the cross section graph below is drawn using two different colours (red and blue) to distinguish between two different parts of the field.

The following presentations cannot be displayed when "*Cross section view*" is selected: *HoV probability, AN probability, ABS, Normalized, Bebi graph.* The exams conducted using *2 Zone, 3 Zone, Quantify Defect, Binocular, Constant* and *Bi-Driving* strategies cannot be displayed in the cross section view, too.

### _16.3.4._ **Multi _view_**

_'Multi view'_ allows displaying up to four different exams of the same patient. All exam results are presented in the same format (Mode and Data settings are applicable to all four exams). The presentation design is like in 'Combo view'. All parameters displayed on the right part of the screen correspond to the selected exam which is marked with a blue vertical bar.
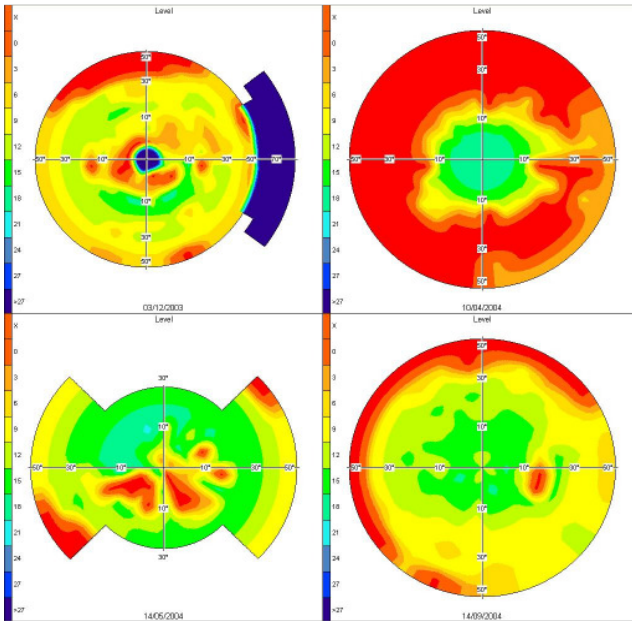


**Pic. 26.** _Multi_ view.

'Multi view' is an appropriate option to see patient's results gathered by using different test fields and strategies.

## 16.4. Box *Data*

*'Data* group box' allows selecting data which will be presented on the screen. The following options are available:

- *Decibel level*
- *HoV* – Hill of vision
- *AN* – Age normal deviation
- *HoV pro* – Hill of vision probability
- *AN pro* – Age normal probability
- *ABS* – so called absolute map, generated by dividing of all field values (in dB) by 3
- *Normalized* – normalized map.
- *Defect curve* (Bebi graph)
- *Age Normal Standard*

*Level [dB]* – the retina sensitivity is presented in the form of dB values. All dB values represent the brightness of the stimuli when the patient's responses were detected. The higher the dB value, the lower the brightness of the stimulus when the patient's reaction was detected. All points not seen by patient are denoted as '**X**' mark. The level map can display the values from 0dB to 45dB in 1dB steps which is dependent on the test strategy.

*HoV [dB]* – presents differences (in dB) between test results and the theoretical hill of vision as calculated by the program. The method of calculating the theoretical hill of vision is described in section 21. The values presented by the HoV display can be positive or negative since this kind of presentation is a differential map. The positive values indicate better results than those obtained from a theoretical hill of vision; the negative ones indicate worse results. All negative values as well as points not seen by the patient are displayed using red colour.

*HoV (Probability)* – displays the probabilities of defects in the field of view. Probability is obtained from dB HoV values. The HoV probability map is a different type of presentation of the HoV dB map.

*Age normal* – a map presenting differences in dB between exam results and so called age normal values for patients of a certain age range.

*Age normal (Probability)* – displays the probabilities of defects in the field of view. Probability is obtained from dB Age normal values.

*ABS* – a map displaying so called absolute values in numerical format only, generated by division of all field values (in dB) by 3

*Normalized* – a map obtained by subtracting Zero level values from ABS values for the corresponding points. All negative values are displayed in red, all positive ones in black.

*Defect curve (Bebi graph)* – a general graph presenting summarized amounts of defects in a field. The defect curve is calculated from the age normal values.

*Age Normal Standard* – a numerical map presenting an age norm dB values appropriate for patient's age

The exam results are presented on the right part of the screen according to the current settings which can be changed using two groups of buttons. The first group of buttons titled *'View'* is to select a style of presentation as follows:

- *Single* – single map
- *Combo* – four different presentations of the same field
- *Cross section* – single field with an additional cross section
- *Multi view* – simultaneous view of four different exams of the same patient

Exam results can be presented using one of the following settings available by pressing button > on the right of the Level, HoV and Age Norm buttons (pic. 27):

- Level in dB a)
- Gray scale b)
- Color scale c)
- Pattern scale d)
- Color 3D e)
- Gray scale 3D f)

a)  b)  c)  d)



e)  f)
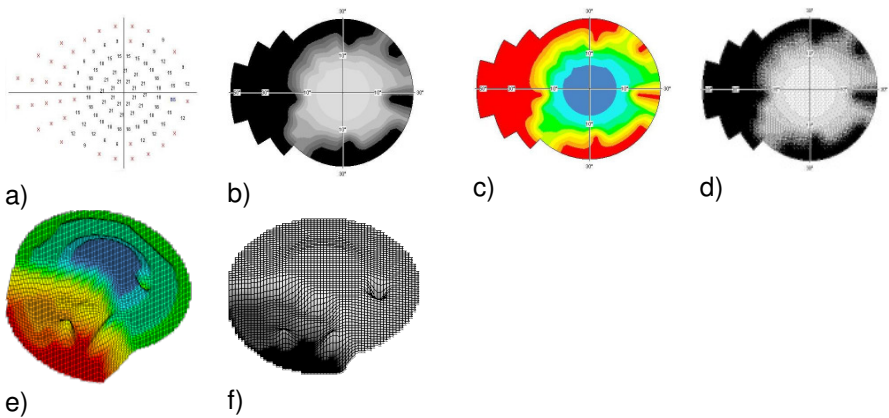
**Pic. 27.** Available presentations.

NOTE!

When *2-Zone, 3-Zone*, *Quantify Defect, Binocular, Constant* or *Bi-Driving* is reviewed; only *Level* view can be selected.

If the exam results are drawn in 2D scales (Pic. b), c), d), an appropriate scale is drawn on the left part of the presentation. The scale is not present when working with a numerical map.

Horizontal and vertical axes are drawn on the graphical map with a degree ruler. Axes are not visible when a dB numerical map is displayed.

In case of 3D presentation the field height is proportional to the value of the point in dB. The bigger the dB value, the higher the elevation of the point on Z axis.

### 16.5. Saving to file

The software allows saving a map being currently displayed on the screen to an external file (in '*.BMP*' or '*.JPG*' format). Click the *'Save as image'* button and enter the name of the file when the file dialog box is open.

### 16.6. Printing

All details are described in section 17.

## 17. PRINTING OF RESULTS – STATIC PERIMETRY

In order to print the results of an exam, select an appropriate exam and click on the '*Results*' button. A form will be shown containing detailed exam data. Click on the '*Print*' button at the bottom of the form to open a window with print settings.
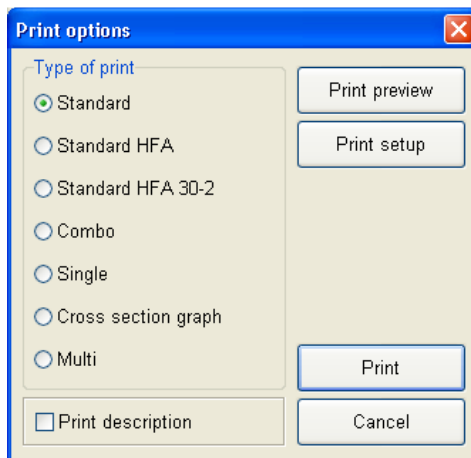


**Pic.28.** Print settings.

NOTE!  It is highly recommended to use high quality colour inkjet or colour laser printers.

*Type of print - t*o select which type of exam presentation will be printed. Five types of printouts are available (*Standard, Combo, Single, Cross section* and *Multiview*).

*Print preview* – to open a window to display the page which is to be printed.

*Print setup* – to open a window with advanced printer settings.

*Print* – to print results in one of the selected print types.

*Print description* – to print an additional page with a description of the exam.

## 17.1. *Standard* printout

The most common used type of print. It contains six graphic maps and all information needed to analyse exam data. The following information is presented in the top-left part of print: manufacturer logo and software version. Name of clinic, date of print, examiner data and doctor's name are located on the right.
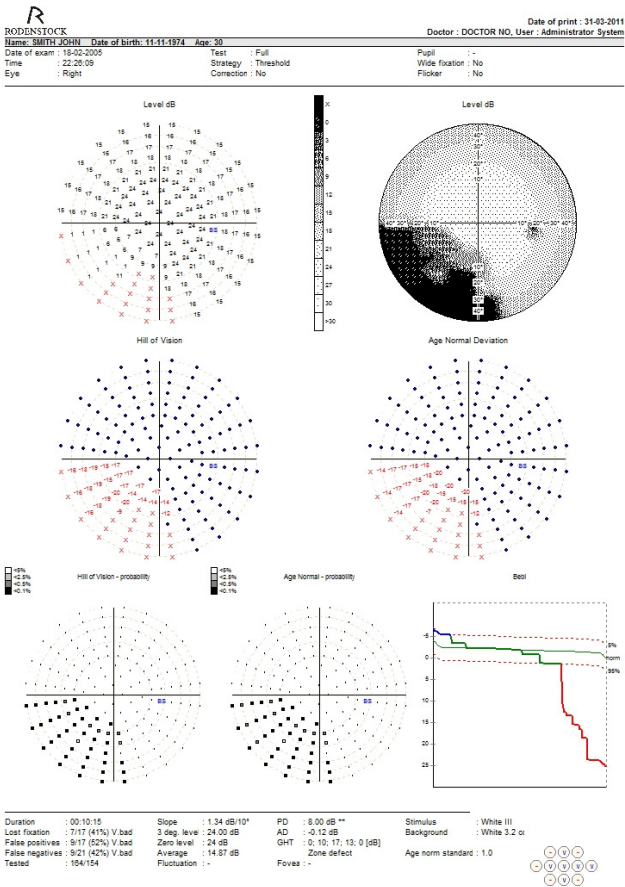


**Pic. 29.** Standard printout.

They grey bar on top contains patient data: name, date of birth and age when exam was performed.

Below the bar the following exam parameters are printed:
- Date and time of exam.
- Test type: name of field being tested
- Strategy used to perform exam.
- Correction (if used).
- Diameter of pupil (if measured).
- If wide fixation was in use.
- If flicker stimulus was in use.
- Value of fovea in dB (if tested)
- Stimulus color and size
- Intensity of background illumination

The result of an examination is presented in different graphical forms. The program allows configuring all details of the standard print. You can set the type of six graphical maps representing exam results. The configuration of print is described in section 24.6. The standard print contains the following maps by default:

- dB Level (values).
- dB Level (pattern scale).
- Hill of Vision (dB values).
- Age Normal Deviation (dB values).
- Hill of Vision – probability.
- Age Normal Deviation – probability.

Additionally, Bebi graph and Blind Spot image are shown on the right part of the page.

All exam parameters calculated by the program after testing is finished are located on the bottom of the page.

If you select the option '*Print description'* two pages will be printed. The second page will contain a description of performed as you previously had entered.

### 17.2. *Standard HFA* printout

It contains six maps according to a HFA standard printout for threshold strategies.

### 17.3. *Standard HFA 30-2* printout

It contains six maps according to a HFA standard printout for threshold strategies. Points of the original test field are extrapolated to the HFA 30-2 field.

## 17.4. *Combo* printout

Four different graphical maps representing exam result are printed. Header and foot data is identical as in Standard print. The advantage of this type of print is to get bigger and more readable graphical maps. You can configure *'Combo printout'* according to personal preferences.
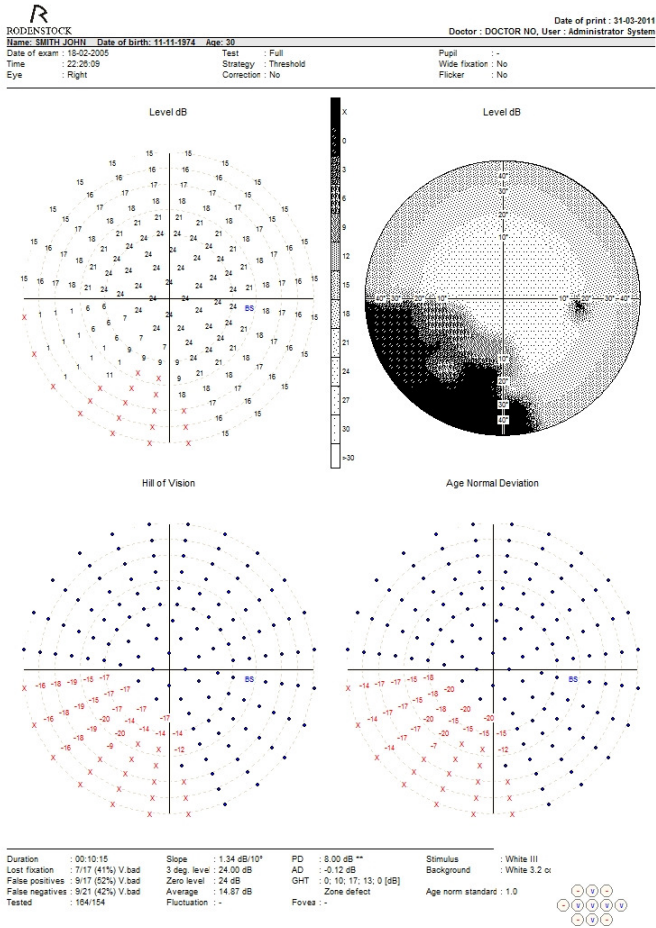


**Pic. 30.** *Combo* printout.

## 17.5. *Single* printout

The simplest form of print which contains one big graphical map representing the exam results. These will be printed in the same form as chosen on the *'Results'* screen in *'Single mode'*. When *'Single mode'* is not selected, the dB level map in grey scale will be printed by default. The advantage of the *'Single printout'* option is a very high readability of the print.
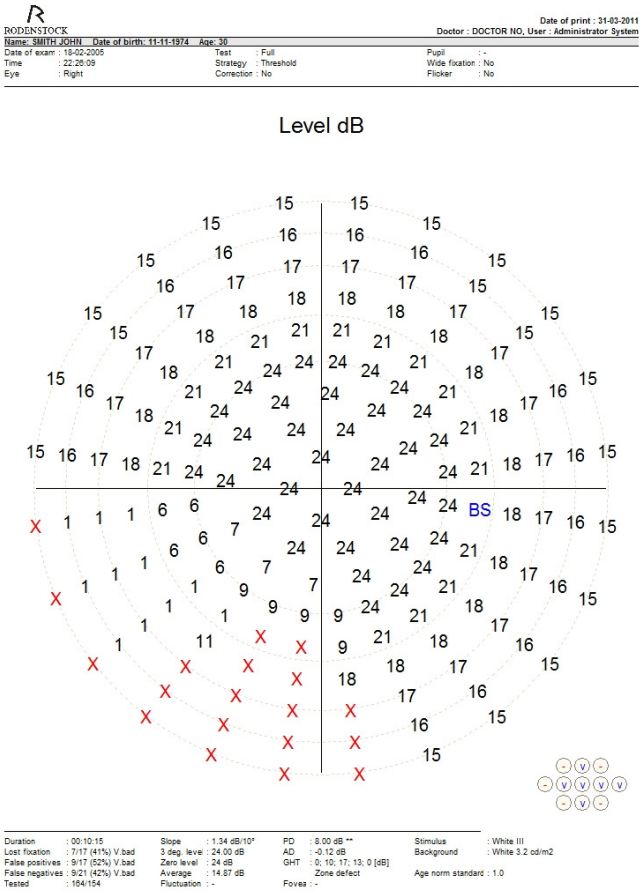


**Pic. 31.** *Single* printout.

## 17.6. C*ross section* printout

A *'Cross section'* printout contains one big graphical map and its section. The section line as well as the section graph below is drawn in red and blue colour. This helps to refer certain parts of the section to a corresponding part of the graph. Graphical map and section angle are always presented in the same form as selected by the user on the *'Results'* screen in *'Cross-section mode'*.
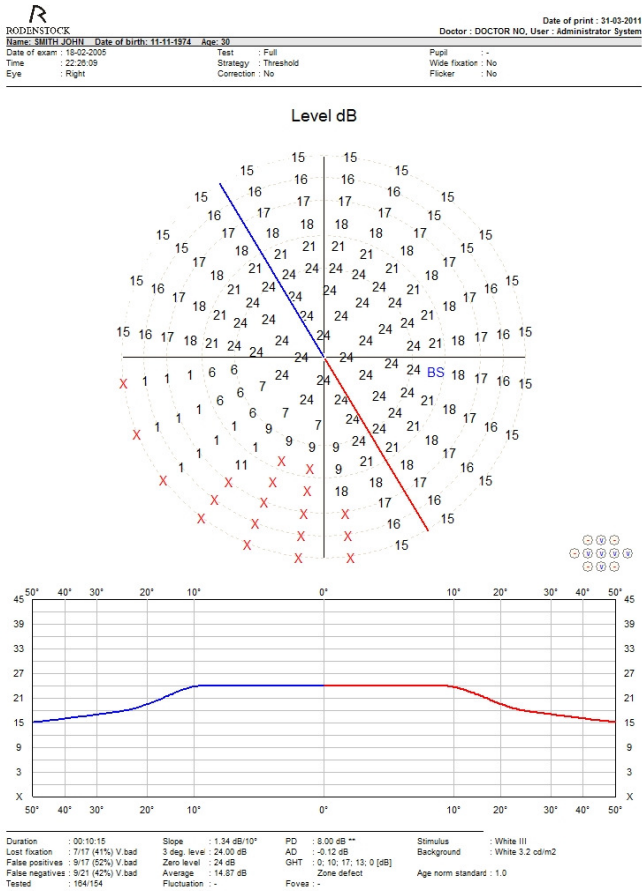


**Pic. 32.** *Cross section* printout.

By default, the dB level map is printed in grey scale with cross section angle at 0˚ (section along the vertical axis Y).

## 17.7. *Multi* printout

A *'Multi printout'* can contain up to four different exams of the same patient. Every exam is presented in four different forms. Therefore, a 'Multi print' can contain 16 graphical maps maximally. The program allows configuring 'Multi print' as described in section 24.6.
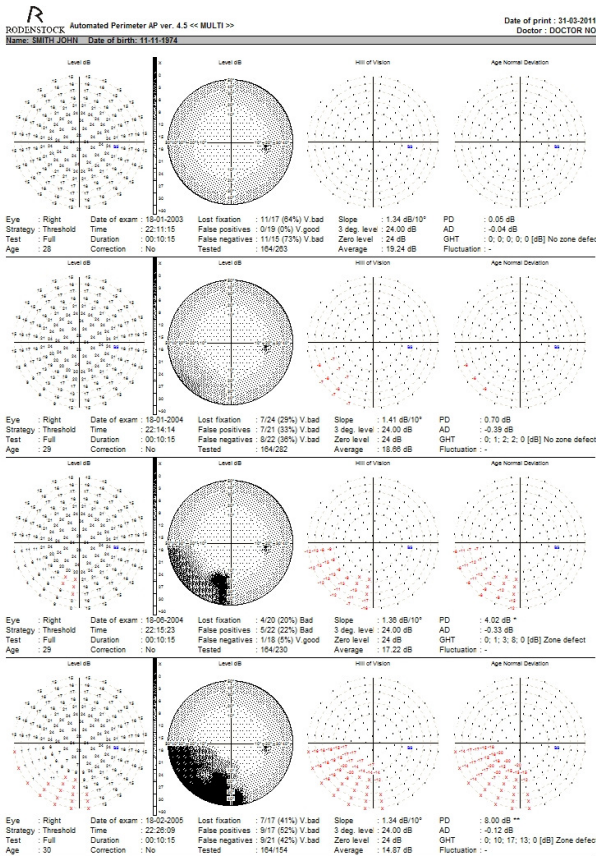


**Pic. 33.** *Multi* printout

Due to the limited print area, the sizes of the graphical maps are as small as possible. However, *'Multi printout'* shows most of the parameters (input, calculated and referring to reliability) needed to analyse every exam result.

## 17.8. Print Preview

The *'Print preview'* option allows seeing a printout on the screen before being actually printed.
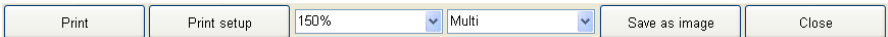


**Pic. 34.** Print preview – available options.

Preview images can be exported to external files in JPG or BMP format.

It is recommended to use high magnification (150%) in order to obtain a good quality of the exported image.

## 18. COMPARISON OF RESULTS – STATIC PERIMETRY

This section describes how to compare different exam results and how to print a comparison of results.

### 18.1. Option *Compare Results*

This option allows showing a graphical map representing a comparison of results of two different exams. In order to obtain comparison, select two appropriate exam results in the table *'Exams'* on the main screen and click on the button *'Compare Results'*. A window containing the comparison of those results will be shown as presented below.
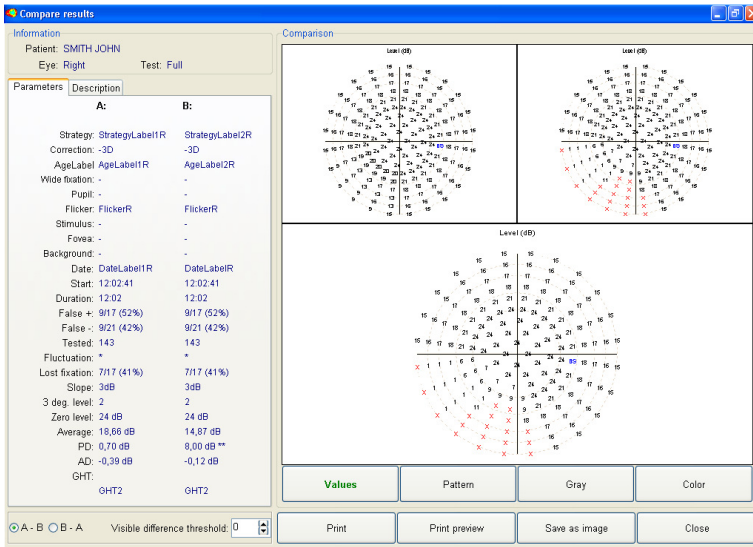


**Pic.35.** Comparison of results screen.

The name of the patient whose results are being compared is listed at the top of the screen as well as test type and eye.

NOTE!  A comparison can be shown only for two exams of the same patient. The following parameters of exams must be identical: Test type, Strategy, Eye.

Two graphical maps are shown at the top of the screen and they refer to exams taken for comparison. The left map is denoted as *A*, the right one as *B*. On the left, parameters referring to the selected exams are listed (date of exam, patient's age when test was performed, reliability parameters and calculated parameters like PD and AD).

A big graphical map with the comparison of results is located on the bottom. The comparison is a difference between decibel values of the corresponding points of the two exams. If the option *A-B* in the group box *'Settings'* is selected, the result will be the difference between exams A and B, otherwise the result will be the difference between exams B and A. You can also change the parameter *'Visible difference threshold'* which sets a level from which the difference can be seen on the comparison map. This parameter can be changed from 0dB up to 12dB in 3dB steps. For example, if *'Visible difference threshold'* = 3dB, then differences between two exams within the range from -3dB to 3dB will be presented as 0dB difference on the comparison map, so they will not be visible.

Four buttons located under the graphical map are to select an appropriate displaying mode as follows:

- Decibel scale
- Grey scale
- Colour scale
- Pattern scale

All three graphical maps (exams and comparison) are drawn in the same mode.

In case of using *'Decibel scale'*, a comparison map can contain fields with blue dots (●), black (*+NdB*) and red (*-NdB*) numerical values. A blue dot denotes that there is no difference between two fields in this point. Red values indicate that a result of exam A in a certain point is worse than the result of exam B in the same point. Values given in dB describe a numerical difference between two results. Respectively, black values indicate that a result of exam A in some point is better than that of exam B.

> | NOTE! | Please note that setting a relatively high value of the parameter *'Visible difference threshold'* can lead to a situation when some points with a big dB difference will be seen as points with 0dB difference. This option should be used by advanced users only. |

The differences are shown using an appropriate scale which is drawn also on the right part of the comparison when selecting the grey, colour or pattern scale option.

The buttons for print preview, print and saving images are located at the bottom of the screen.

## 18.2. Printing of Comparisons

*Print preview* – to display the page which is to be printed out. Two graphical maps corresponding to exam A and exam B and a comparison map are drawn using the same style as the maps drawn on the screen.
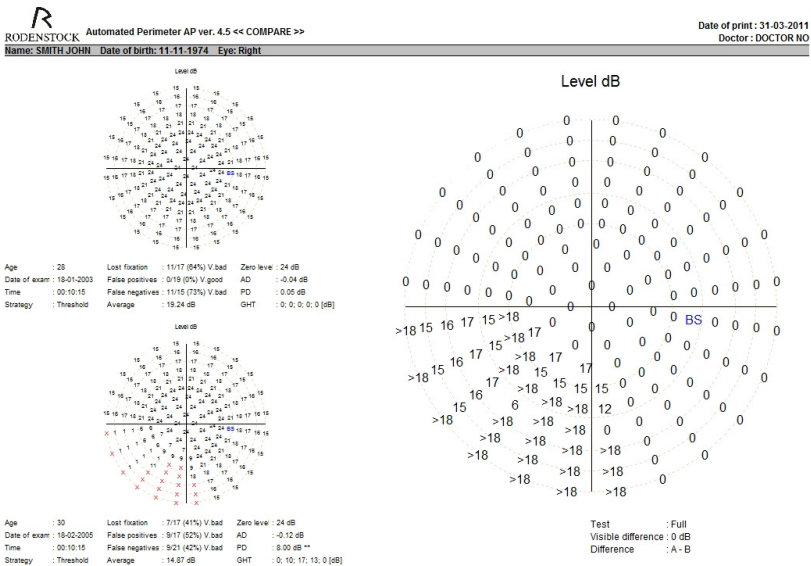


**Pic.36.** Print preview – comparison.

A bar with additional options is located at the bottom of the print preview window.
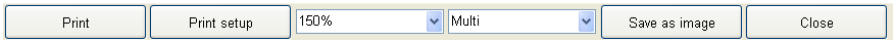


**Pic 37.** Print preview – options.

*Print* – to print out the comparison on a printer

*Print setup* – to configure advanced printer settings

*Scale* – to scale the print preview on the screen (does not affect the layout of a printout). If the print preview is saved as a JPG or BMP, it is recommended to use high magnification (150%) in order to obtain a good quality of the exported image (see paragraph below). Please note: the higher the magnification, the bigger the file to be saved.

*Save as Image* – the preview image can be exported to an external file in JPG or BMP format. These options are very convenient for users who have to send the result of an exam via Internet for consultation. The recipient can print such file on a printer or display it on a screen.

## 19. REGRESSION ANALYSIS – STATIC PERIMETRY

AP software is equipped with a set of options to observe changes of a patient's vision in many different ways. A first possibility is the simple comparison of results which was described in the previous section. A second possibility, much more advanced, is regression analysis which helps to observe regression or progression of patient's vision in time.

| NOTE! | At least two patient's exam results are needed to perform regression analysis. The exams should be conducted using the same strategy, but on different days. |
|---|---|

The patient's name, age and tested eye are listed on the left top part of the screen. A combo box located on the middle top part of the screen lets choose one of five parameters that will be used to calculate and to display the regression graph. The following parameters can be selected:

- Decibel level
- Hill of Vision decibel level
- Age Normal Deviation decibel level
- Pattern defect (PD)
- Average defect (AD)

The combo box is available when *'Single* mode*'* is selected (on the right bottom of the screen). '*Combo* mode*'* displays all five modes of regression graphs together.
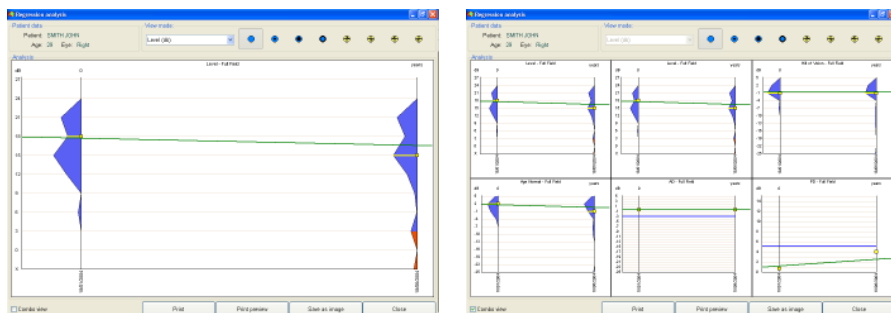


**Rys.38.** Regression analysis - *'Single'* graph and *'Combo'* graph

The buttons located on the right top part of the screen are to define which region of a tested field will be taken for analysis. The following regions can be used to calculate regressions:

| | | |
|---|---|---|
|  | Full | Depended on field type |
|  | Macula | 1˚ -10 ˚ |
|  | Central | 1˚-22˚ |
|  | Peripheral | 30˚-50˚ |
|  | Right top quadrant | Depended on field type |
|  | Right bottom quadrant | Depended on field type |
|  | Left top quadrant | Depended on field type |
|  | Left bottom quadrant | Depended on field type |

NOTE!

Regression analysis is always calculated for a full field in case of PD and AD parameters.

'*Combo*' mode contains two graphs representing decibel levels. The first one is always calculated for a full field, the second one for a region of the field selected as described above.

Three buttons are located at the bottom of the screen and their functions are as follows: print of regression presentation, print preview, save as image.

*Save as image* – to save a current presentation to an external file in '*.JPG*' or '*.BMP*' graphic format.

*Print* – to print a presentation by a printer. Before printing is executed, a window to configure print parameters appears. Print modes (*Combo* or *Single*) correspond to the mode of presentation on the screen.

*Print preview* – to preview a printout on the screen. You can also save a preview as an external image file JPG, BMP or in HTML format.

## 19.1. Presentation: *Decibel Level*

The horizontal axis represents a time scale. Every single graph on the presentation is marked with a corresponding date of exam. Graphs are drawn in chronological order from left to right. The vertical axis has a dB ruler. The width of graph for a certain dB elevation refers to a number of points (in the patient's field of view) with this dB value. All points not seen by the patient ('**X**') are denoted as red areas on the graph. Blue areas correspond to the points seen by the patient. Yellow lines denote average dB field values.

Example: The first graph taken from picture 40 shows that the patient's field of view contains the biggest number of the points not seen by the patient ('**X**'). There are no values 0dB and 3dB in the field, but there are points with values between 3dB and 24dB. An average value for the field is 6dB. The third graph contains a small number of points not seen by the patient. Most of the values are between 6dB and 21dB and therefore an average for this field is 15dB.
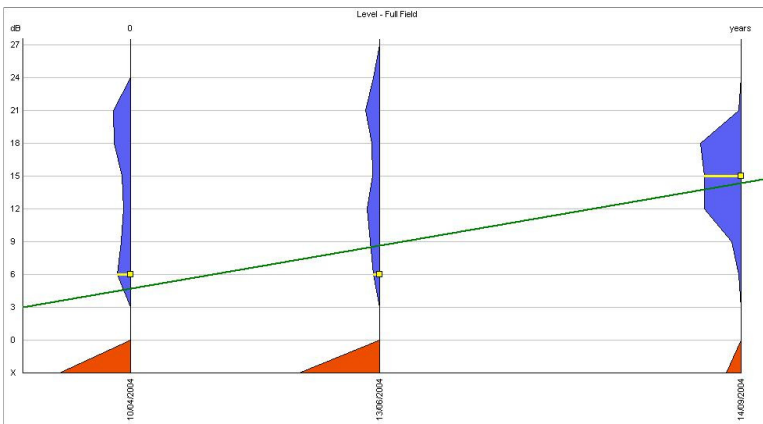


 **Pic.39.** Regression presentation – dB level.

A green sloping line going across all graphs indicates a trend of average dB values of the fields taken into consideration. A line going up from left to right suggests that the patient's vision progressed in time. Respectively, a line going down from left to right suggests a regression of the patient's field of view.

In case of threshold tests results are gathered with 1dB steps. When regression is displayed, all points with decibel values not being divisible by 3 will be grouped with points divisible by 3. For example, 1dB point will be grouped with all 0dB points and points with 2dB and 4dB values will be grouped with 3dB points.

### 19.2. Presentation: *Hill of Vision and Age Normal*

The presentations are very similar in form to '*Decibel level*' presentations described in the previous section. Graphs' Widths don't correspond to the number of points with a dB value, but to the calculated '*Hill of Vision*' or '*Age Normal Deviation*' values respectively. The vertical dB scale ranges from –25dB to 5dB, because *Hill of Vision* and *Age Normal* results can reach both minus and plus values. All points with values below –25dB and over 5dB are regarded as points –25dB and 5dB.

Pic. 41 shows Hill of Vision regression presentation.
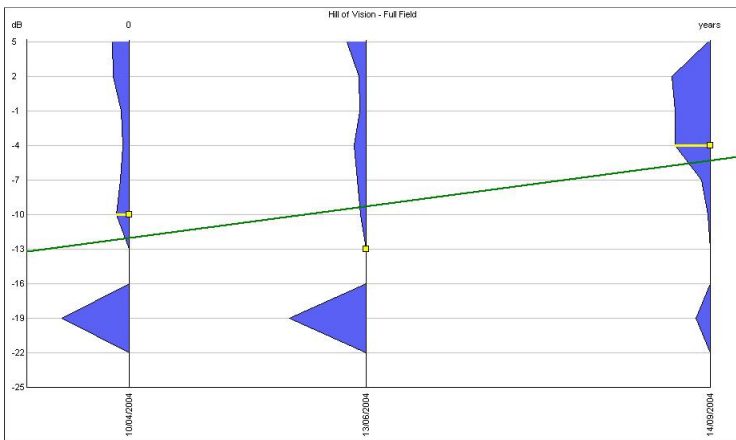


**Pic.40**. Regression presentation – Hill of Vision.

A green sloping line going across all graphs indicates a trend of average dB values of the fields taken into consideration. A line going up from left to right suggests that the patient's vision progressed in time. Respectively, a line going down from left to right suggests a regression of the patient's field of view.

## 19.3. Presentation: *Pattern Defect (PD*)

A pattern defect regression graph is a set of points with different elevations drawn along the time axis. Every point of the graph represents Pattern Defect parameters of a corresponding exam. The elevation of a point is depending on Pattern Defect values.

A blue horizontal line indicates the 95% probability level of PD parameters. In other word, less than 5% of fields of view (in a population) will have PD parameter lying above this level.

To illustrate a trend of PD parameter in time, a green sloping line is drawn between all points of the graph. Note: that line is drawn to come as close as possible to every point of the graph, so a trend can be displayed with the highest possible reliability. The slope angle of the trend line is taken to calculate average PD changes in dB per year.

If local defects are present which do not change in time, the trend line will be parallel to the time axis. If the defects progress in time, the trend line will be going up from left to right.

## 19.4. Presentation: *Average Defect (AD)*

Average defect (AD) parameters can reach both minus and plus values. Minus values correspond to a global loss of sensitivity referred to a normal field. Plus values indicate that the sensitivity is better than expected. AD parameters can be increased or decreased by global defects. Local defects do not affect AD parameters.

The AD regression graph is a set of points with different elevations drawn along the time axis. Every point of the graph represents AD parameters of a corresponding exam. The elevation of a point is depending on Average Defect values. If a trend line is parallel to the time axis, a global profile of hill of vision does not change with time. Note: the AD graph is not affected by local defects. If a trend line is rising from left to right, the patient's vision progressed with time. Otherwise, the patient's vision regressed.

## 20. TEST EDITING

This function allows defining a custom test field. It is especially convenient in case when only a part of the patient's visual field should be examined, for example the part with visual field loss observed during earlier examinations. Using a custom test field can decrease both the patient's discomfort and the time of exam.
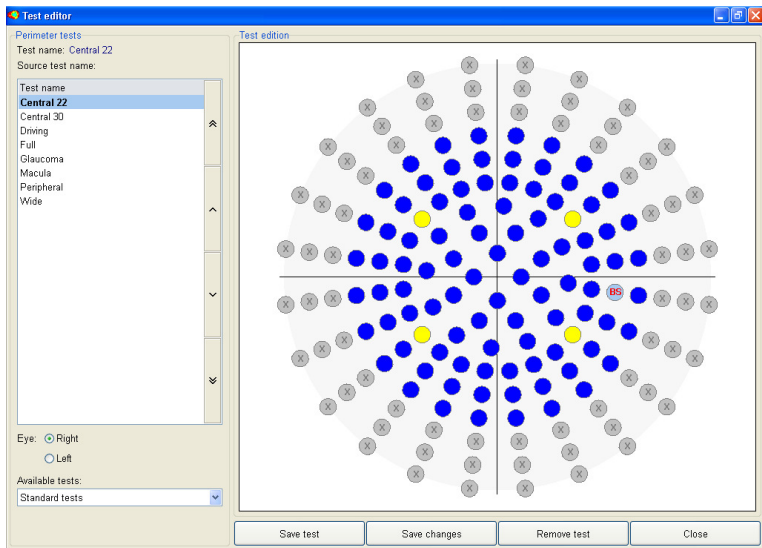


**Pic.41.** Test field editing.

Eye (left or right) and test field name used as a pattern should be selected before starting editing. The following test fields are available by default:

- *Central 22˚*
- *Central 30˚*
- *Driving*
- *Full*
- *Glaucoma*
- *Macula*
- *Peripheral*
- *Wide*

The selection can be done by clicking on the appropriate test field name in the table. A filter can be used which will make available:

- Standard tests only,
- User defined tests only,
- Both standard and user defined tests.

The filter is set to '*Standard*" by default.

When eye and test type are selected, you can start test editing. Blue cells on the image representing the field of vision are treated as selected for testing. Please click left mouse button on a region to deselect it. It will be filled with a grey colour and the symbol 'X' will appear. To select/deselect a bigger number of sectors just move the mouse cursor over the required sectors with the left mouse button pressed. Please note that four yellow calibration points cannot be deselected.

When editing is finished, the test field can be saved in a database. Click on the button *'Save test'* and the program will ask to enter a name for the defined test field. A new test filed will be available to be used during the test ('*New Exam'* option).

If one edits so called user tests, all changes can be saved using the '*Save changes'* option.

| NOTE! | *'Save changes'* and *'Delete'* options cannot be used to modify or delete standard tests. The name of a new test should be different to that of an already existing test. |

## 21. PARAMETERS AND PRESENTATION OF RESULTS

This section explains the methods used to calculate all field parameters as well as gives a review on how the exam results can be presented on the screen and printed on a printer. The information gathered in this section should help analysing the obtained results.

### 21.1. Decibel Level Map

A decibel level map is a classical presentation of the exam results. Every point of a tested field is denoted with a corresponding value measured during the test. The decibel map refers to the sensitivity of the retina. The bigger the dB value, the better the retina's sensitivity. A decibel level map can contain the values in the range 0-45dB and can be drawn in the following formats: numerical, grey scale, colour scale, pattern scale and 3D graph.
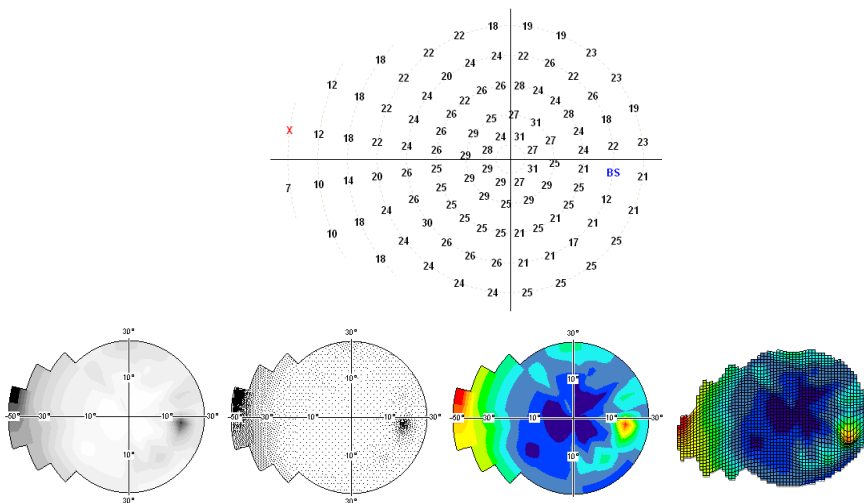


**Pic. 42**. Available formats of *Decibel level* map (numerical – top, grey scale, colour scale, pattern scale, 3D graph).

In case of the numerical presentation, all points not seen by a patient are marked as '**X**'. 'BS' indicates where the blind spot is located. Values in black colour represent the sensitivity of the retina in the corresponding locations. In case of *Constant* and *Bi-Driving* strategies the dB value used to test is displayed in the left bottom part of map.

In case of graphical presentations, the following scales are used to display a map:

| dB levels | Scales | | |
|:---:|:---:|:---:|:---:|
| | Pattern | Grey | Pattern |
| X | | | |
| 0 | | | |
| 3 | | | |
| 6 | | | |
| 9 | | | |
| 12 | | | |
| 15 | | | |
| 18 | | | |
| 21 | | | |
| 24 | | | |
| 27 | | | |
| > 27 | | | |

### 21.2. Hill of Vision Map

A Hill of vision map is a map of the differences between theoretical and calculated hills of vision. A theoretical hill of vision is calculated on the basis of the two parameters: '*3 deg. Level* and *'Slope'*.

In case of *Screening* strategy, Hill of Vision is assumed to be equal to *3 deg. Level.* The *Slope* of hill of vision is assumed to be equal to 3dB. When a theoretical *3 deg Level* = N dB, then a Hill of vision profile for the following rings is listed as below:

| Ring | Theoretical value of hill of vision |
|------|-------------------------------------|
| 1˚   | N    |
| 3˚   | N    |
| 6˚   | N    |
| 10˚  | N-3  |
| 22˚  | N-6  |
| 30˚  | N-9  |
| 40˚  | N-12 |
| 50˚  | N-15 |

In case of threshold strategies (*Threshold* and *Fast threshold*), the hill of vision is also assumed to be equal to *3 deg. Level.* However, *Slope* parameter is calculated from the obtained results. Therefore slope can be different for the following rings. When *Slope* = Z and *3 deg. Level* = N, then a theoretical hill of vision profile is as follows:

| Ring | Theoretical value of hill of vision |
|------|-------------------------------------|
| 1˚   | N          |
| 3˚   | N          |
| 6˚   | N          |
| 10˚  | N – Z      |
| 22˚  | N – ( Z * 2 ) |
| 30˚  | N – ( Z * 3 ) |
| 40˚  | N – ( Z * 4 ) |
| 50˚  | N – ( Z * 5 ) |

The real hill of vision values are then subtracted from the theoretical ones. The result is presented as a map of differences demonstrated by picture 43.
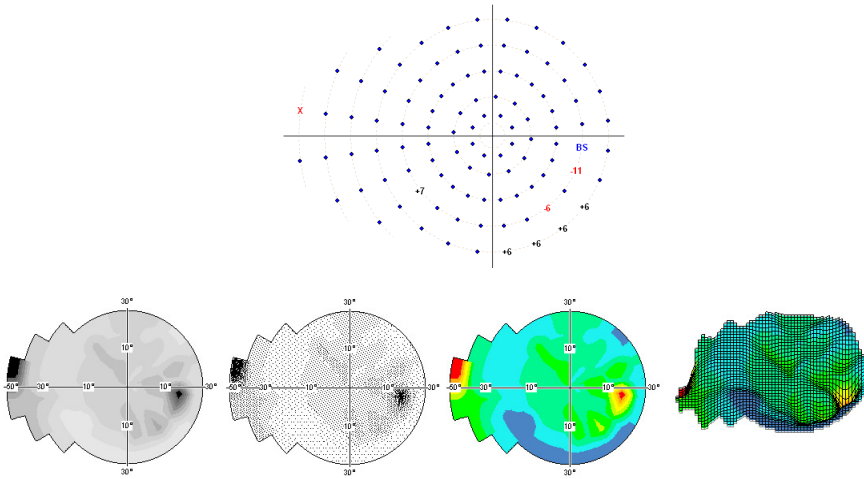
**Pic.43.** Available formats of Hill of Vision maps (numerical, grey scale, colour scale, pattern scale, 3D graph).

In case of graphical presentations, the following scales are used to display a map:

| Difference in dB | Scales | | |
|---|---|---|---|
| | Pattern | Grey | Pattern |
| < -21dB | | | |
| -18 dB | | | |
| -15 dB | | | |
| -12 dB | | | |
| -9 dB | | | |
| -6 dB | | | |
| -3 dB | | | |
| 0 dB | | | |
| +3 dB | | | |
| +6 dB | | | |
| >+6 dB | | | |

## 21.3. Hill of Vision Probability Map

A 'Hill of vision probability map' shows the probability of Hill of Vision defects for every single point of a field. The probabilities are calculated from the differences between theoretical and calculated hills of vision. The lower the probability, the bigger the defect in the field of vision.
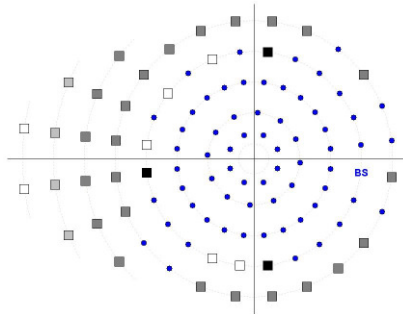


**Pic.44.** Hill of vision probability map.

Hill of vision probability ranges are assumed as follows:

| Symbol | Difference between calculated and theoretical HoV | Description |
|---|---|---|
| ● | < -6 ,  N ) | No defect. |
| □ < 5 % | < -9 , -6 ) | Value would appear in less than 5% of population. Small defect possible. |
| ■ < 2.5 % | < -12 , -9 ) | Value would appear in less than 2.5% of population. Medium defect. |
| ■ < 0.5 % | < -15 , -12 ) | Value would appear in less than 0.5% of population. Deep defect. |
| ■ < 0.1 % | ( -N , -15 ) | Value would appear in less than 0.1% of population. Very deep defect. |

## 21.4. Age Normal Map.

An *Age Normal map* displays the differences between the age normal values and the values obtained in the test. Therefore the *Age Normal map* is considered as difference between the theoretical dB level map and the measured one.

An *Age Normal map* can be drawn in the following formats: numerical, grey scale, colour scale, pattern scale and 3D graph.
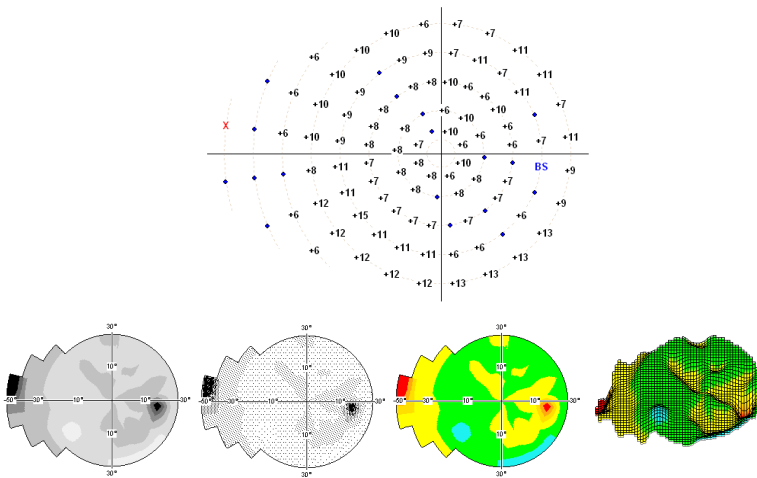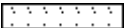


**Pic.45.** Available formats of Age Normal map (numerical, grey scale, colour scale, pattern scale, 3D graph).

In case of numerical display, the following notation is used:

| Symbol | Description |
| --- | --- |
| ● | Difference between dB level and theoretical age normal value is not bigger than ±6dB |
| **-N** | Points with defects (difference N is bigger than –6dB) |
| +N | Points where the retina sensitivity is better than expected (difference is bigger than +6dB) |
| **X** | Points not seen by the patient |
| BS | Blind spot |

The scales of Age Normal graphical maps have less numbers of levels than in the case of dB Level or HoV maps. The following scales are used to display a map:

| Difference in dB | Scales | | |
|---|---|---|---|
| | Pattern | Grey | Pattern |
| ≤ -18dB | | | |
| -12 dB | | | |
| -6 dB | | | |
| 0 dB | | | |
| +6 dB | | | |
| +12 dB | | | |
| >+12 dB | | | |

Note that a certain number of different values will be presented as the same grey, pattern or colour level. For example: the left part of map from picture 45 contains values **-12 dB** and **-15 dB**. Graphical maps will mark the regions **-12 dB** and **-15 dB** using the same colour as set for all values in the range from -17dB to -12dB.

### 21.5. Age Normal Probability Map

An *Age Normal probability* map shows the probability of defect for every single point of the field. The probabilities are calculated from the differences between theoretical and calculated Age Normal values. The lower the probability, the bigger the defect in the field of vision.
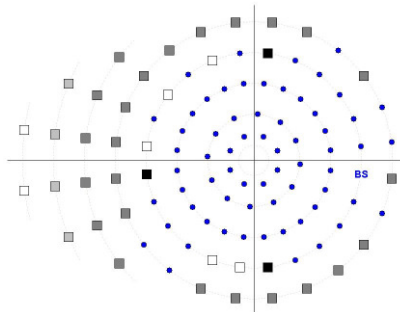


**Pic. 46.** Age normal probability map.

*Age Normal probability* ranges are assumed as follows:

| Symbol | Age Normal deviation range | Description |
|---|---|---|
| ● | < -6 , N ) | Point with no defect. |
| □ < 5 % | < -9 , -6 ) | Value would appear in less than 5% of population. Small defect possible. |
| ■ < 2.5 % | < -12 , -9 ) | Value would appear in less than 2.5% of population. Medium defect. |
| ■ < 0.5 % | < -15 , -12 ) | Value would appear in less than 0.5% of population. Deep defect. |
| ■ < 0.1 % | ( -N , -15 ) | Value would appear in less than 0.1% of population. Very deep defect. |

## 21.6. ABS Map

An ABS map is obtained by dividing all values from a level dB map by 3 which decreases the dynamics of the presentation. Big values disappear and local changes are brought out. Therefore an ABS map is easy to analyse.
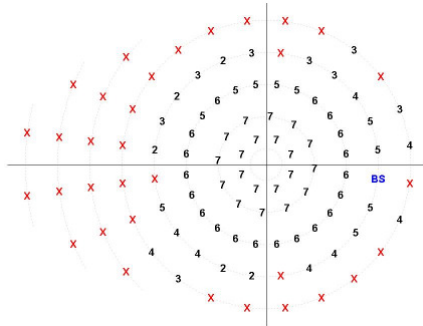


**Pic.47.** ABS presentation.

An ASB map can be presented in the numerical format only.

## 21.7. Normalized ABS Map

A Normalized ABS map is obtained by subtraction the *Zero Level* value from all values creating a *Decibel level* map.

$$\text{ABS norm.} = \text{ABS} - \text{Zero}$$

The minus values indicate the points with decreased sensitivity and are drawn in red colour. Therefore all local changes are more readable.
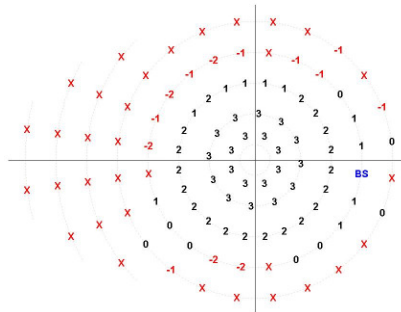


**Pic.48.** Normalized ABS map.

An ABS Normalized map can be presented in the numerical format only.

## 21.8. Defect Graph (Bebi graph)

A Defect graph illustrates the summarized defect of an exam result. The graph is obtained on the basis of *Age Normal deviation* values. The vertical axis represents Age Normal deviation values. All tested points are located along the horizontal axis in decreasing order, so that points with high sensitivity are located on the left and points with low sensitivity are located on the right.

When the eye's sensitivity is decreased (for example in case of cataract), a defect curve would be lowered. Local changes of the field of vision will lower a defect curve in its right part. The deeper the defects, the steeper the profile of a curve. If the local sensitivity is better than expected, a defect curve will be elevated in its left part.
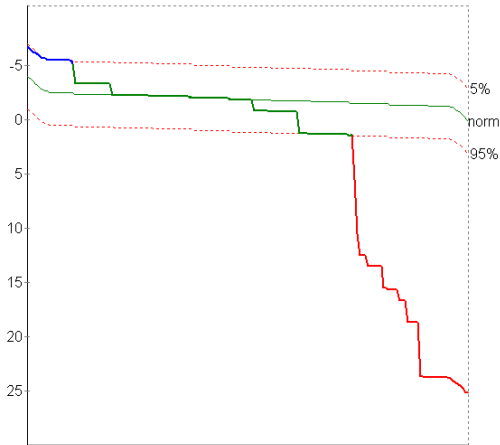
**Pic.49.**  Defect curve.

All points within the norm are marked with green colour, above the norm with blue colour and below the norm with red colour.

### 21.9. Lost Fixation

The *Lost fixation* parameter can be measured using two different methods: Heijl-Krakau method (based on a stimulation of the blind spot) or digital fixation method (on-line eye tracking). Heijl-Krakau method stimulates the blind spot with a certain interval between the normal test cycles. Digital fixation method measures the movements of the eye on-line; therefore you get information about the fixation when every single point is being tested. *Lost fixation* parameters have the following form:

Fixation lost: 12/33 = 20 % Average

The first number indicates the number of seen stimuli which should not be seen. The second one indicates the number of trials. In case of the example presented above, fixation was tested 33 times and the program detected loss of fixation 12 times. The final results are presented as a percentage value with an additional description. The following descriptions are possible:

| | |
|---|---|
| 0%   to 10% | Very good |
| 11% to 15% | Good |
| 16% to 20% | Average |
| 21% to 25% | Bad |
| 26% to 100% | Very bad |

## 21.10. False Positive Error

False positive errors inform about patients' responses to the stimuli which should not be seen. The perimeter program sometimes performs idle cycles during testing (without presenting any stimulus) to check for possible positive responses from the patient. The most common reasons that false positive errors appear are: the patient presses the button rhythmically or the patient doesn't understand the principle of the exam. To minimize the risk that such error can appear it is recommended to increase *'Fluctuation time'* parameter. The stimuli are presented then with a more random frequency. False positive error has the following form:

      False +: 12/33 = 20% Average

The first number indicates the number of seen stimuli which should not be seen. The second one indicates the number of trials. In case of the example presented above, false positive error was tested 33 times and the program detected it 12 times. The final results are presented as a percentage value with an additional description. Descriptions are like those for the Fixation Lost parameters. False positive error should be less than 15%.

## 21.11. False Negative Error

*False negative errors* appear when there is no response from a patient when such response is expected (a tested point should be seen). *False negative errors* are tested in points which have already been successfully tested. The stimuli are presented at a level 6dB brighter than the measured dB values in these points.

The most common reasons that *False negative errors* appear are: the patient is already tired or the patient does not understand the principle of the exam.

False - : 12/33 = 20 % Average

The first number indicates the number of not seen stimuli which should be seen. The second one indicates the number of trials. The final results are presented as a percentage value with an additional description. Descriptions are like the ones for the Fixation Lost parameters. False positive error should be less than 15%.

## 21.12. Fluctuation

The Fluctuation parameter describes the variability of exam results. Fluctuation checking is performed by additional testing of four points which have been already tested with their dB values known. One point from every quadrant located up to the 22˚ ring is selected. A fluctuation test starts when all points within rings up to 22˚ are already tested. A fluctuation value is proportional to the difference between the dB value measured during a normal test and the value measured during an additional fluctuation test. Fluctuation parameters have the following form:

Fluctuation: -0.75dB(+2, -2, **X**, 3)

The first number is the average fluctuation value given in dB. This parameter can reach both minus or plus values. If the results of a normal test were better than those of a fluctuation test, the average will be a plus value, otherwise a minus value. The four numbers in brackets are the fluctuations of the particular points. If the fluctuation could not be tested in a certain quadrant, it is marked as '-' instead of displaying numerical value. If a point selected by the program to test fluctuation could not be seen by a patient, it is marked as '**X**'.

NOTE! Fluctuation can be tested only with the threshold strategies (*Threshold, Fast threshold*).

In case of a normal test, the fluctuation should not be bigger than ±3 dB.

## 21.13. Tested – Number of Tested Points

This parameter gives the number of presented stimuli and the total number of tested points. It has the following form:

Tested : 420/164

The first is the number of presented stimuli. Neither False positive stimuli nor fixation testing stimuli are counted. False negative stimuli and those used to test fluctuation are added to the number of presented stimuli. The second number is the total number of tested points in the field. Blind spot points are not added to this number.

## 21.14. 3 deg. Level

*3 deg. Level* parameters are calculated from dB values of the tested points located within 1˚ and 3˚ rings. The point with the highest dB value is selected as reference. An average is calculated then from all points which are no more different than 6dB from the reference point. The obtained average can be considered as sensitivity of the hill of vision. If *3 deg. Level* parameters cannot be calculated, it is assumed from age normal values and is marked with '*'. For example, if a patient does not see any point in the centre (all points taken to calculate *3 deg Level* are '**X**'), *3 deg. Level* is displayed as 0dB*.

## 21.15. Slope – Theoretical Slope of a Hill of Vision

This parameter is the expected slope of a hill of vision. Slope is given in decibels per 10˚.

For the screening strategies, the Slope parameter is assumed to be 3.0 dB/10˚.

Slope parameters are calculated for the threshold strategies (*Threshold, Fast Threshold*) according to the following algorithm: The point with the highest dB value is defined in every ring. Next, averages are calculated for every ring from all points not more different than 6dB from the maximum. Finally, a set of averages is used to define a virtual line drawn as close as possible to all averages. Its slope corresponds to the theoretical slope of a

hill of vision. Slope parameters should be within the range from 1.0dB to 4.5dB/10˚.

When calculated slope values exceed those limits, Slope is assumed to be a border value (1.0 or 4.5dB/10˚) and marked with '*', e.g. Slope: 4.5dB *

### 21.16. Zero Level

Zero Level parameters are most common dB values in the field.

### 21.17. Average

Average is given in dB and is calculated from all points of a tested field. All points not seen by a patient ('**X**') have virtual value –1dB used to calculated average.

### 21.18. Pattern Defect (PD)

Pattern Defect parameters are obtained from an expected hill of vision. First, the standard deviations are calculated for values in every ring. They can be considered as local changes in the field of vision. Next, the standard deviations are multiplied by weighing factors. The rings located far from the centre have smaller factors than those in the centre. Therefore, local changes in the centre have a stronger influence on Pattern Defect values. So, Pattern Defect is an average of the standard deviations multiplied by the mentioned weighing factors.

Pattern Defect can be positive values only. The additional descriptions, depending on Pattern Defect values, are defined as follows:

| PD range | Description |
|---|---|
| < 0 dB , 3 dB > | PD : N dB |
| ( 3 dB , 6 dB > | PD : N dB * |
| ( 6 dB , 9 dB > | PD : N dB ** |
| ( 9 dB ,  N dB ) | PD : N dB *** |

High values of Pattern Defect parameters correspond to a big number of local changes and defects in the field of view. A smooth field with no

defects will have Pattern Defect close to zero. A global field depression or elevation does not affect the Pattern Defect value.

## 21.19. Average Defect (AD)

Average Defect parameters are an average calculated from differences between measured values and age normal values. Only points considered being within a hill of vision norm (blue dot points on Hill of Vision map) are used to calculate Average Defect.

Average Defect can reach plus or minus values. Local changes and defects of a field of view do not affect these parameters. Otherwise, global field depressions or elevations have a great influence on Average Defect. If a field is depressed, than Average Defect is of minus values, if it is elevated it is of plus values.

The additional descriptions, depending on Average Defect values, are defined as follows:

| AD range | Description |
|---|---|
| < -3 dB , 3 dB > | AD : ±N dB |
| < -6 dB , -3 dB )<br>( 3 dB , 6 dB > | AD : ±N dB * |
| < -9 dB , -6 dB )<br>( 6 dB , 9 dB > | AD : ±N dB ** |
| ( -N dB , -9 dB )<br>( 9 dB , N dB ) | AD : ±N dB *** |

## 21.20. GHT – Glaucoma Region Comparison

This parameter is constructed by comparing five zones from the upper hemi field with identical, mirror-like zones located in the lower hemi field. Zones are located in places where the effect of glaucoma can be seen with high probability. Those zones cover a part of the field up to 30˚ from the centre. 1˚ ring and points closest to the blind spot are not compared. Picture 50 illustrates how the zones cover the upper hemi field for the right and the left eye.
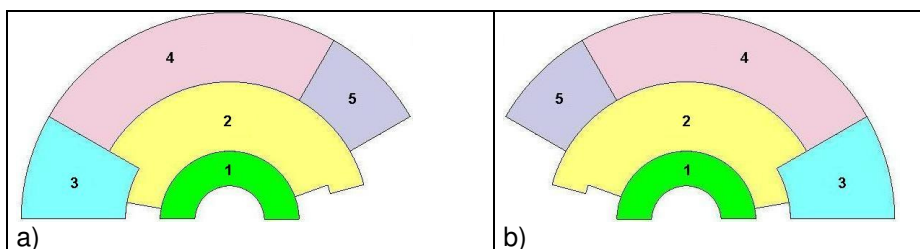
**Pic.50.** GHT – zones. Right eye – a), left eye –b).

The average values of mirror sectors are calculated and compared. GHT parameters have the following form:

GHT : +2,-3,0,+1,-3  Suspect zone defect

Every value represents a decibel difference between average values of symmetrical zones. The first number refers to zone 1, the fifth number to zone 5. Notation for GHT parameters are listed in the following table:

| 0 | No difference |
|-----|---------------------------------------------|
| + N | Sensitivity in upper zone is bigger by N dB |
| - N | Sensitivity in lower zone is bigger by N dB |

When a GHT parameter cannot be calculated, it won't be displayed.

The additional descriptions for GHT parameters are defined as follows:

| **Description** | **Classification** |
|-----------------------|------------------------------------------------------------------|
| No defects | No differences |
| Suspect zone defect | Difference in one zone > 3dB |
| Zone defect | Difference >=6dB in one zone or difference > 3dB in two or more zones |
| Hemi field depression | Difference in three or more zones > 3dB |

## 22. STRATEGIES – STATIC PERIMETRY

### 22.1. *2 Zone* Strategy

*2 Zone* is the fastest strategy available. Before a test is started, initial dB levels are assigned to all points. These initial levels are taken from Age normal reference. The program doesn't perform calibration of the four yellow points. Every point from the field is tested only once. If the response of a patient is positive, the point will be marked with '○'. When a tested point was not seen, then '**X**' will appear.

```
┌─────────────────────────────┐
│ Initial brightness level for│
│ each cell in tested field of│
│ vision is estimated from    │
│ age normal.                 │
└─────────────────────────────┘
              │
              │ stimulus
              ▼
          ◇ Seen ◇ ── no ──►  ┌──────────────────────────┐
              │                │ Cell testing is completed.│
              │ yes           │ Cell is marked with letter│
              ▼                │ 'X'. Possible defect.     │
┌─────────────────────────────┐└──────────────────────────┘
│ Cell testing is completed.  │
│ Cell is marked with 'o'     │
│ symbol. No defect.          │
└─────────────────────────────┘
```
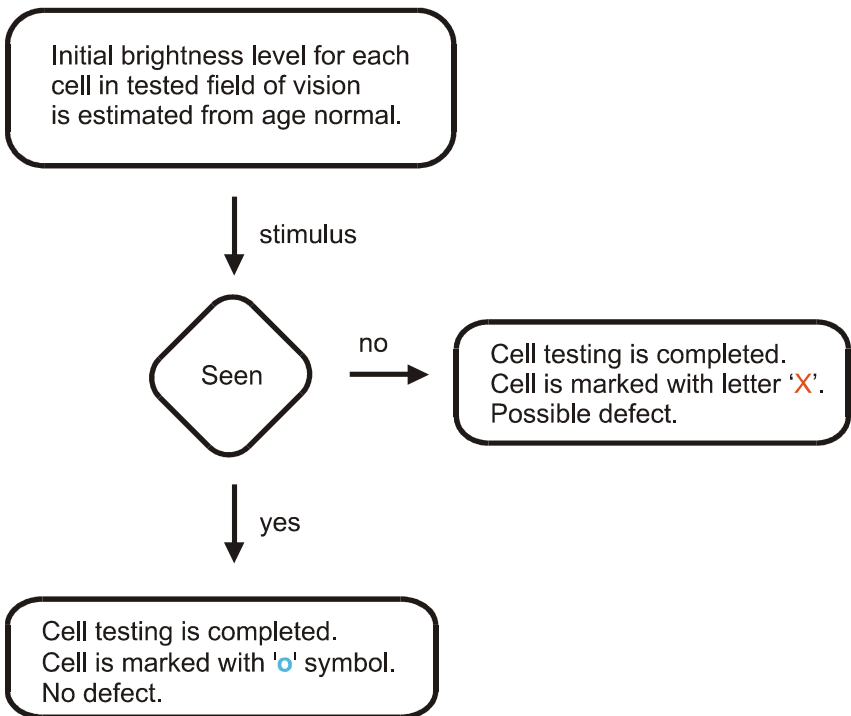
**Pic. 51.** *2 Zone* strategy algorithm.

## 22.2. *3 Zone* Strategy

The *3 Zone* strategy is very similar to the *2 Zone* strategy. Before a test is started, initial dB levels are assigned to all points. These initial levels are taken from Age normal reference. The program doesn't perform calibration of the four yellow points. Then all points are tested according to the scheme: A point is presented at initial brightness level. If the response of a patient is positive, the point will be marked with '○' and its testing is finished. If there is no response, the point will be tested again at 0dB brightness level. If such stimulus is seen, the point will be marked with '**RD**' (relative defect). If the stimulus is not seen, '**AD**' (absolute defect) will appear.
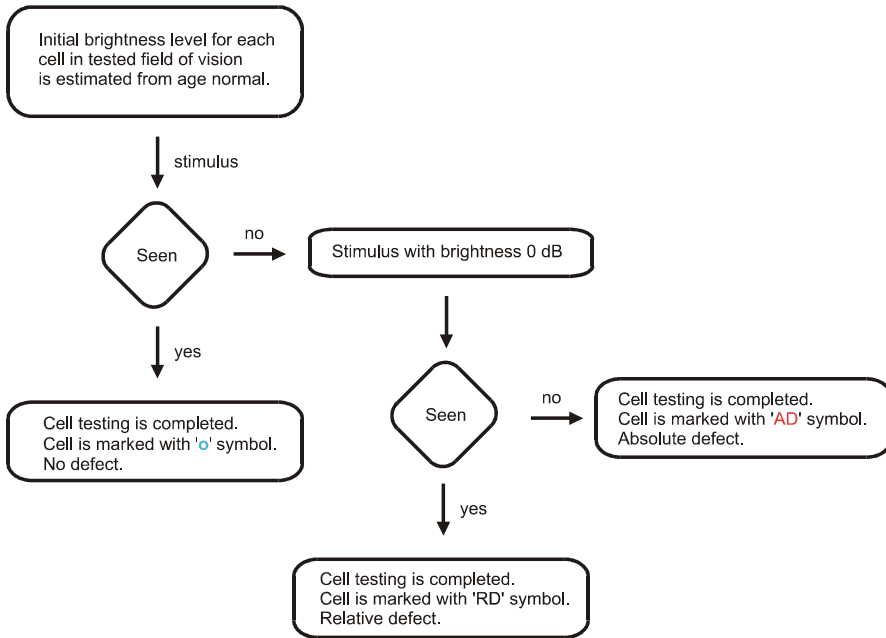


**Pic. 52.** *3 Zone* strategy algorithm.

## 22.3. *Quantify Defect* Strategy

The *Quantified Defect* (QD) strategy is a simplified version of the *Screening* strategy. Before a test is started, initial dB levels are assigned to all points (like for *2 Zone* and *3 Zone* strategies). Initial levels are taken from Age normal reference. The program doesn't perform calibration of the four yellow points. Then all points are tested according to the scheme: A point is presented at initial brightness level. If the response of a patient is positive, the point will be marked with '○' and its testing is finished. Otherwise, the point is consecutively tested with the brightness decreased by 6dB until a positive response. If the point cannot be seen by a patient and therefore there is no response, the point will be marked with '**X**'. If the patient's response is positive at Z brightness level, the point will be additionally tested with brightness Z + 3dB. If the response is positive, the result is saved as Z + 3dB and the testing of this point is finished. If not, the result is equal Z dB and the testing of this point is also finished.
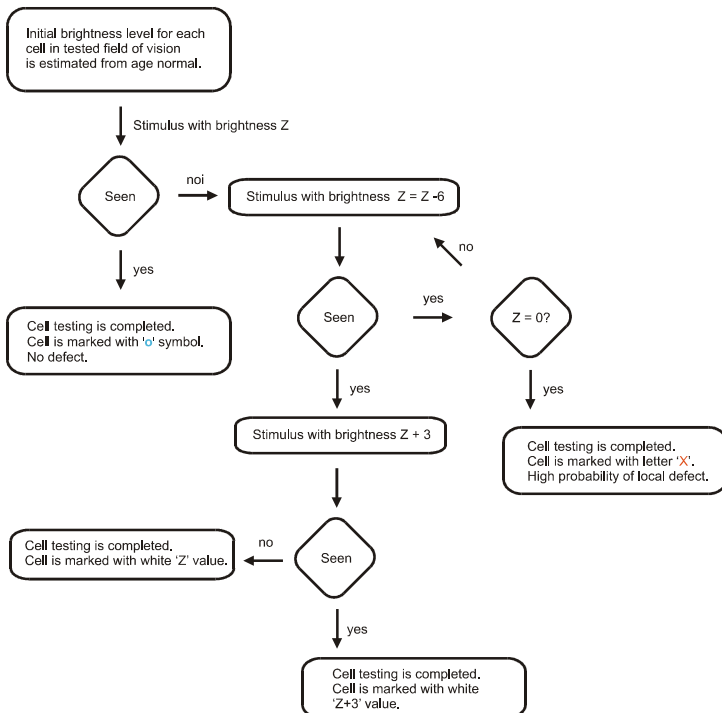


**Pic. 53.** Scheme of *Quantify Defect strategy*.

## 22.4. *Screening* Strategy

*Screening* is a standard strategy in perimetry. First, the four yellow points have to be tested in order to determine initial levels for all points in the field. Calibration of all four calibration points is performed by using the *Screening* strategy. The calibration points are presented initially at intensities taken from age normal reference. The calibration is skipped if a pattern is used to fill the field with initial values. When the calibration is finished, a point with minimum brightness (maximum sensitivity) is taken to calculate the initial dB levels for the rest of points in the field. If the calibration point with maximum brightness = N dB was found, intensity levels for other points will be calculated as follows:

| Ring (degree) | Initial brightness ( dB ) |
|:---:|:---:|
| 1˚ | *N* |
| 3˚ | *N* |
| 6˚ | *N* |
| 10˚ | *N* |
| 15˚ | *N* -3 |
| 22˚ | *N* -6 |
| 30˚ | *N-9* |
| 40˚ | *N-12* |
| 50˚ | *N-15* |

Every calibration point with a dB value less than maximum will be retested starting from the initial level assigned as written in the table above.

If all four calibration points have calibration levels at less than 6dB than age normal level, a message about a possible calibration error will be displayed. You can accept the measured calibration level and continue with the test or you can choose a calibration level corresponding to the patient's age. It is recommended to continue with the calibration level as measured during the test.

The second stage of the *Screening* strategy is conducted by presenting the points with the appropriate intensities calculated from the calibration level. If a point is not seen, the intensity is increased by 3dB and the point will be tested again. Testing of the point will be stopped when the patient gives a positive response.

## 22.5. *Neurological* Strategy

The *Neurological* strategy is based on the *Screening* strategy. The first test stage is identical as in the case of *Screening*, so four yellow calibration points are tested to calculate the initial levels for all points in the field using the formula from chapter 22.4. After that, the four randomly selected points from every quadrant are selected and tested (from rings located up to 30˚). If neither all four points nor one calibration point from a certain quadrant are seen, all other points in this quadrant are also assumed as not seen and won't be tested (the whole quadrant is filled with '**X**'). The rest of the test is conducted as described before. The *Neurological* strategy doesn't allow using pattern from earlier exam results.

## 22.6. *Fast Threshold* Strategy

The *Fast Threshold* strategy yields results very similar to the typical *Threshold* strategy but the test duration can be shortened significantly which improves the results' reliability. First, four yellow calibration points are tested to calculate the initial levels for all points in the field. The test is conducted according to the rules presented below:
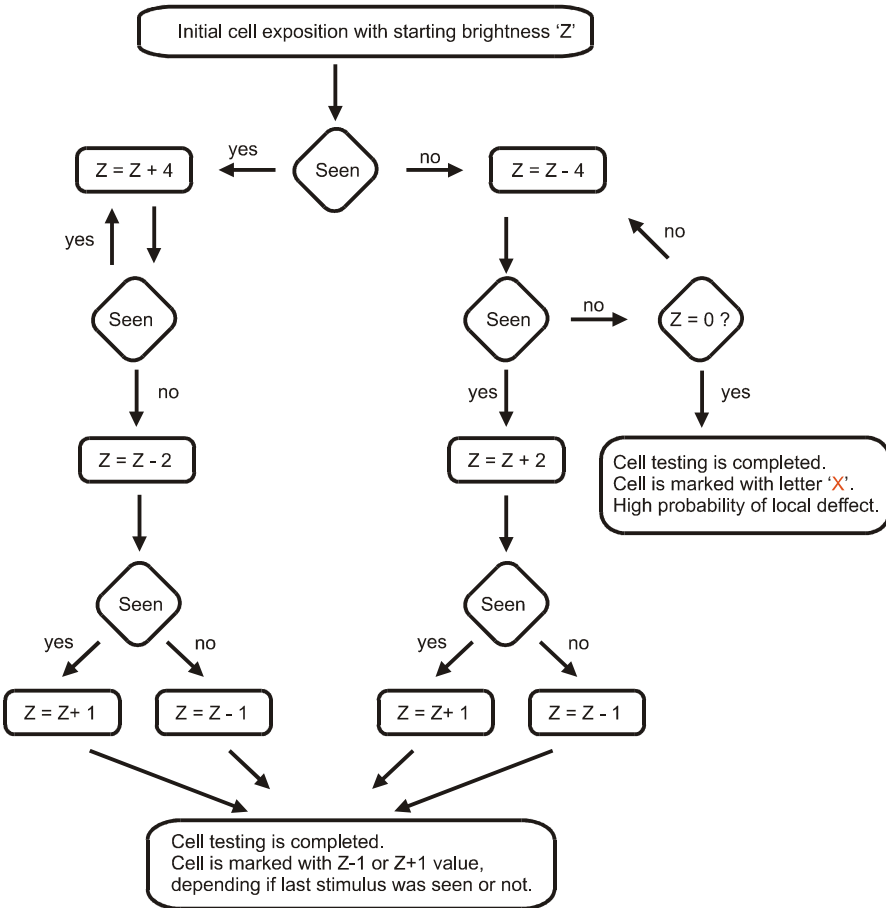


**Pic. 54.** *Fast Threshold* algorithm

Then a set of points is selected (one point from every angle ring in every quadrant). These points will be tested at initial intensities according to the table:

| Ring (degrees) | Assign sensitivity level( dB ) |
|:---:|:---:|
| 1˚ | *N+3* |
| 3˚ | *N+3* |
| 6˚ | *N+3* |
| 10˚ | *N* |
| 15˚ | *N -3* |
| 22˚ | *N -6* |
| 30˚ | *N-6* |
| 40˚ | *N-9* |
| 50˚ | *N-12* |

.

The selected points are tested using the *Threshold* strategy. The measured dB values of these points are used then to initialise their neighbours from a part of the ring located in an appropriate quadrant. This method helps to forecast the threshold level for 80% of the points which were not tested yet. Such points are tested then using the *Threshold* method referenced to age normal values. It means that testing is finished when the dB value in a certain point is within or above the age normal value.

## 22.7. *Threshold* Strategy

The *Threshold* strategy is conducted identically as the *Fast Threshold* strategy. As the only difference there is no reference to age normal values here, so the result is the real sensitivity of the patient's retina given in dB. The results are very precise and the sensitivity is measured with an accuracy of 1dB.

## 22.8. *Fastscan* Strategy

The *Fastscan* strategy is conducted identically as the *Screening* strategy. The only difference is that approximately half of the number of points of a selected field are tested. This helps to increase speed of examination but decreases also a spatial resolution of the results.

### 22.9. *Binocular* Strategy

The *Binocular* strategy is used to test so called binocular single vision. Both eyes are tested simultaneously. The points are shown with maximum intensity (0 db). The patient decides if the presented point appears as a single or double point. If single – the patient should press the button once, if double – twice, if the point is not seen – the button should remain unpressed. All points appearing as single are denoted by 's' letter, as double – by 'D' letter. The points which were not seen are tested once again and if there is no response again they are marked as 'X'.

In case of the *Binocular* strategy the exposition time = 4.0s, the response time = 1.5s, the wait time = 0.2s and the delay time = 0.2s. These times cannot be changed.

Please note also that in case of the *Binocular* strategy a fixation monitoring is not active.

### 22.10. *Fast Threshold BY* Strategy - Blue on yellow (PERIMAT)

NOTE!

Before a test using BY strategy is conducted, it is neccessary to adapt a patient to the new yellow lightning conditions. The patient should observe the yellow perimeter bowl from several up to over a dozen minutes. Typical adaptive times are given by the literature of subject.

The *Fast Threshold BY* strategy is conducted identically as the *Fast Threshold* strategy (see 22.6.) but using a yellow background color and the blue stimuli. The size of a blue stimulus is Goldmann V.

### 22.11. *Threshold BY* Strategy - Blue on yellow (PERIMAT)

The *Threshold BY* strategy is conducted identically as the *Fast Threshold BY* strategy. The only difference is that there is no reference to age normal values, therefore, the result is actual sensitivity of patient's retina represented in dB value. The results are very precise and sensitivity is measured with accuracy = 1dB.

### 22.12. *Constant* Strategy

The *Constant* strategy is conducted identically as the *2 Zone* strategy. The only difference is that all cells are tested with the same constant value. The value equals 10dB (white stimulus) or 3dB (green stimulus) by default and

can be changed in the Test Parameters window (chapter 10). If the *Constant* strategy is chosen in the Test Parameters windows, the numerical field appears which allows the USER to set the constant value. In case of the *Constant* strategy the four calibration points are not tested because all cells are tested using the same dB value, which is later presented in the left bottom part of a numerical map.

## 22.13. *Bi-Driving* Strategy

The *Bi-Driving* strategy is intended to perform a binocular test using both extended fields (up to 80˚ to the right and to the left). In the *Bi-Driving* strategy a test field is generated automatically and the USER cannot choose a particular field. All cells are tested with the constant value 10dB (white stimulus) or 3dB (green stimulus). The exposition time = 0.4s and cannot be changed. The live video is extended horizontally to provide a preview of both eyes. The patient should be tested with the correction glasses (if needed). The patient should observe the fixation point with two eyes open. When the central field is already tested the peripheral fields are being tested. The fixation point is moved then (twice, to the right and to the left in order to test both extended fields).

## 22.14. *Smart Threshold* Strategy

The *Smart Threshold* strategy is based on the *Fast Threshold* strategy but only half of the cells are initially chosen to test. All not chosen cells are successively filled with a dB level being an average of the level values of two adjacent cells (on the same ring). If a difference between these two level values is less than 4dB, the cell will be not tested, otherwise it will be tested. The *Smart Threshold* strategy increases significantly (approx. 50%) a test time when compared to the *Fast Threshold* strategy.

## 22.15. *Smart Threshold BY* Strategy (Blue on yellow)

The *Smart Threshold BY* strategy is conducted identically as the *Smart Threshold* strategy but using a yellow background color and the blue stimuli. The size of a blue stimulus is Goldmann V.

## 22.16. *Monocular* Strategy

The *Monocular* strategy is conducted identically as the *Bi-Driving* strategy but only one eye is tested.

## 23. STANDARD TESTS – STATIC PERIMETRY

Standard tests are available in the AP software by default and are described in the tables and pictures below.

| Test name | Angle | | Number of points to test | Picture |
|---|---|---|---|---|
| | **Nasal** | **Temple** | | |
| Central 22˚ | 22˚ | 22˚ | 93 | a) |
| Central 30˚ | 30˚ | 30˚ | 117 | b) |
| Driving | 50˚ | 80˚ | 189 | c) |
| Full | 50˚ | 50˚ | 162 | d) |
| Glaucoma | 50˚ | 30˚ | 102 | e) |
| Macula | 10˚ | 10˚ | 45 | f) |
| Wide | 50˚ | 30˚ | 126 | g) |
| Peripheral | from 30˚ to 50˚ | from 30˚ to 50˚ | 72 | h) |



a)    b)    c)    d)

e)    f)    g)    h)
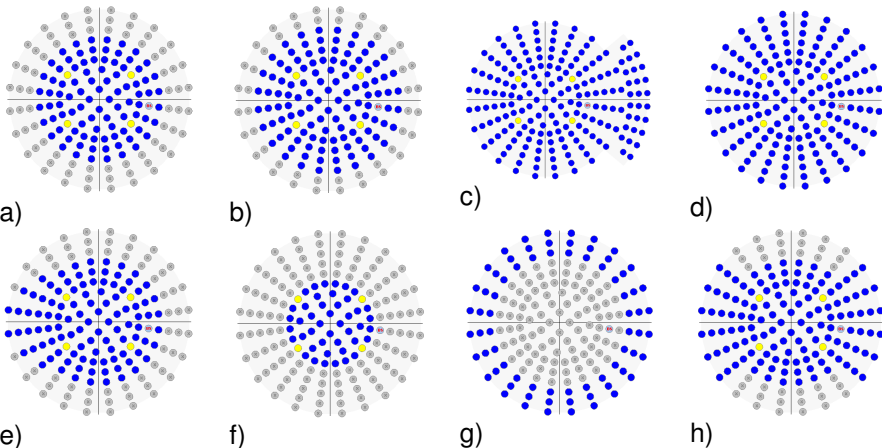
**Pic.55.** Standard test fields – only blue and yellow cells are tested.

### 23.1. Central 22˚

Standard central test field. The small number of points decreases the test duration regardless of the strategy.

### 23.2. Central 30˚

*Central test field* up to 30˚. It can be used with *Threshold* and *Fast Threshold* strategies due to the small number of points.

### 23.3. Driving

The *Driving test field* is designed to examine drivers. Due to the big number of points to be tested, it is recommended to use it together with *Quantify Defect* or *Screening* strategies. Driving field testing is performed in two stages. First, all points in the centre up to 50˚ are tested. Then, the fixation point is moved to another, peripheral position and all points from the extended field (60˚ - 80˚) are tested. In case of the Heijl-Krakau fixation method, the blind spot is not examined when testing the extended field. If the digital fixation method is used, it is necessary to correct the position of the reference poin ⊕ the centre of a patient's pupil via the button       and to continue testing after this correction.

### 23.4. Full

A *Full test field* covers 50˚ of the patient's field of view. It is recommended to use it with *2 Zone, 3 Zone, Quantify Defect* or *Screening* strategies due to the big number of points and a possible long test duration.

### 23.5. Glaucoma

A *Glaucoma field* is a Central 30˚ field extended to 50˚ in the nasal direction. It can be used to trace glaucoma regressions and is an alternative for *Central test fields*.

## 23.6. Macula

A *Macula test field* covers a small part – up to 10˚ from the centre - of the patient's field of vision. It provides a fast diagnosis of the patient's macula. It is recommended to be used with *Threshold* strategies.

## 23.7. Wide

A *Wide test field* is a *Central* 30˚ extended to 50˚ in the horizontal plane. It is convenient for to examine glaucoma regressions. In case of older patients, it eliminates the problem of the falling eyelids because it reaches only 30˚ to the temporal direction.

## 23.8. Peripheral

A *Peripheral test field* covers the three rings: 30˚, 40˚ and 50˚. It is recommended to use this field when testing the sensitivity of a peripheral part of the patient's retina.

## 24. TESTING A PATIENT – KINETIC PERIMETRY (PERIMAT)

### 24.1. Use

This chapter describes the process of testing a patient.

### 24.2. Quick Start of a Test

This chapter is designated to users who are familiar with the Windows system and basic rules of perimeter tests.

1. Start the AP application.

2. Add a new patient with '*New patient*' or – if the patient has been already added to the database – select him/her from the patients table.

3. Select '*New test*' and choose '*Auto Kinetic'* strategy from '*Strategy'* combo box.

4. Make sure the patient is in the correct position.

5. Run the demonstration program in order to get the patient ready for the test and check operation of the automatic fixation.

| NOTE! | Automatic fixation measurement can work incorrectly in case of a certain number of patients (about. 5% of total population). In such a case use a camera view instead. |

6. Start the test.

## 24.3. Test screen

The test screen is divided into many functional blocks. The main part of the form placed on the right side of the screen shows the graphic image of the tested field with the meridians and field angles.
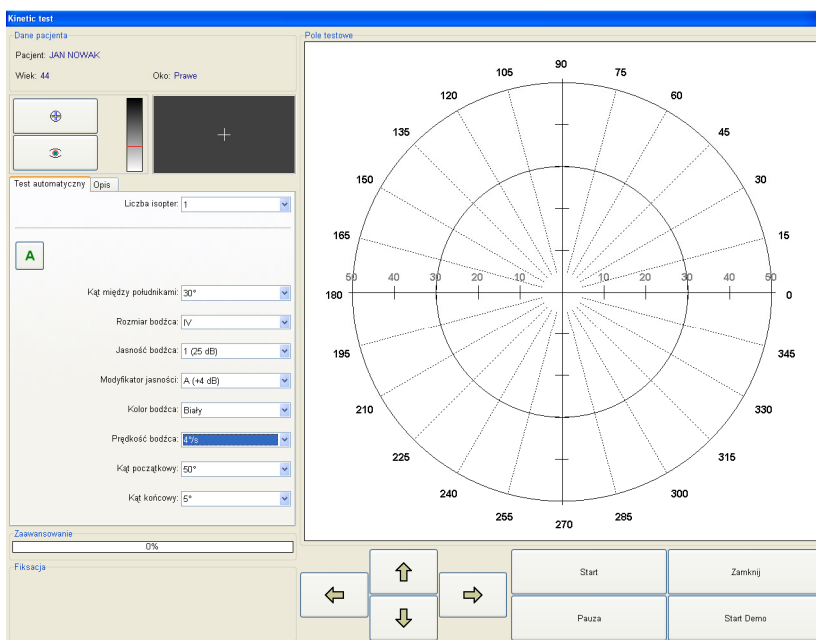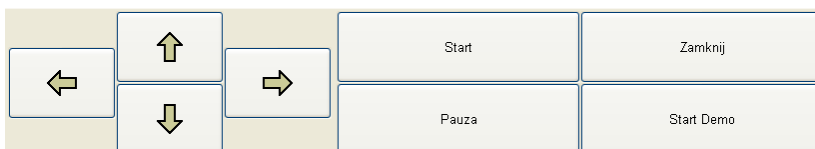


**Pic. 56.** Kinetic test screen.

## 24.4. Patient Data

This tab contains information about name, surname and date of birth of the patient. It also informs if the eye which is being tested is the right or the left one.

## 24.5. Test Course Control

In the left bottom part of the window there are buttons which control the test course, *Pause*, *Start, Start/Stop Demo, Close*.



**Pic. 57.** Test course control buttons

 – buttons to move the electric chinrest in four directions.

*Start* – starts the test.

*Close* – finishes the test at any moment and returns to the main window of the software. If this option is selected before the planned end of the test, the software will display a question if you are sure to close the testing process and if the incomplete results should be saved in database.

*Pause* – clicking on this button will stop the test for a moment. The test will be continued after clicking on '*Continue*'.

| NOTE! | The patient can stop the test at any time by pressing continuously the response button. Information about this will be displayed on the screen. |
|---|---|

*Demo* – activates the demonstration working mode. It shows to the patient rules and course of the test. Additionally, the DEMO mode allows checking the correctness of the automatic eye fixation control.

## 24.6. Eye Preview
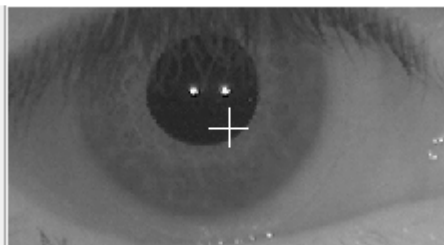


**Pic. 58.** Eye preview.

The white cross of the camera image indicates the center point on the image. Before the exam is started, patient should be positioned that his/her eye is in the center of the image.

If the automatic method of fixation monitoring is used, the software will detect a current position of the eye. There is no need to keep the eye in the center of the image during the test – it is rather important that patient is looking into the fixation point all the time. The perimeter software performs calculations based on the analysis of the two white dots (infrared reflections).

## 24.7. Kinetic Test Course

In the first stage of a kinetic test a stimulus is displayed for 1 second in the outer part of the perimeter bowl. If patient did not see it, the stimulus begins moving to the center of the perimeter bowl along certain meridian. If patient see the stimulus during movement and presses a response button, the AP software will end testing current meridian and will start testing next one, randomly selected. For user convenience, a stimulus movement is displayed on the screen as a circle with a colour and size corresponding to the stimulus properties.

A graphical representation of a kinetic test result is an isopter: a line connecting the points placed on the tested meridians. In these points the patient responses were detected. One isopter can consist of a different number of points – it is dependent on how many meridians were used to

test a particular isopter. One kinetic test can consist of maximum 8 isopters. Kinetic test parameters are set using *'Test'* register.

## 24. 8. Kinetic test parameters



**Pic. 60.** Kinetic test parameters

*Isopters* – up to 8 isopters can be set. For every isopter a different set of kinetic test parameters can be selected. Isopters are denoted by letters (form A to H). Pressing a button corresponding to an appropriate isopter you can access its set of parameters.

Below there is a combo box with four options available: *Custom test, Standard 45, Standard 30* and *High Res 15. Standard 45, Standard 30* and *High Res 15* are standard tests with all parameters predefined and fixed (they cannot be changed by a user). When *Custom test* is selected the following combo boxes with the test parameters are enabled:

*Angle between meridians* – to set a number of meridians in the current isopter. Number of meridians = 360 / angle between meridians. For example: if angle between meridians is 10 degrees, the number of

meridians will be 36 and such number of meridians will be tested. The bigger number of meridians, the better resolution of an exam result.

*Stimulus size* – size of a stimulus according to Goldmann standard (I to V).

*Stimulus intensity* – stimulus intensisty can be chosen from the set:

- 1 = 25dB
- 2 = 20dB
- 3 = 15dB
- 4 = 10dB

*Intensity modifier* – an additional intensity which is added to the stimulus intensity:

- A = +4dB
- B = +3dB
- C = +2dB
- D = +1dB
- E = +0dB

For example if stimulus intensity = 1 (25dB) and intensity modifier = D (+1dB), a real stimulus intensity will be 25 dB + 1dB = 26dB and denoted as 1D.

*Stimulus color* – four colors are available

- White (with white background)
- Green (with white background)
- Blue (with yellow background)
- Red (with white background)

*Stimulus speed* – stimulus is moving along meridians with a certaing angle speed.
Available speeds are as follows:

- 2 degrees/s
- 4 degrees /s
- 6 degrees /s
- 8 degrees /s

*Start angle* – field angle setting meridian starting point

*End angle* – field angle setting meridian end point.

### 24.9. Register *Description*

It contains a form which allows adding any commentary to the test in running. This form can be filled in also once the test has been finished, e.g. giving a results review. The test description can be printed – see Chapter 17 and 25

### 24.10. Box *Progress*

A graphic representation of the test progress. Thanks to it a person running the test can estimate how much time is left before the test finishes.

### 24.11. Box *Fixation Bar*

This tab remains inactive if the fixation control method is the one of Heijl-Krakau. It shows the graph of fixation in time. On the right side of the fixation bar there is a momentary fixation indicator. It changes its height and colour according to the fixation state. Details concerning fixation control are described in Chapter 13.
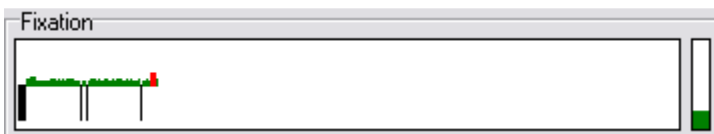


**Pic. 61.** Fixation bar box.

## 25. REVIEWING AND PRINTING RESULTS – KINETIC PERIMETRY (PERIMAT)

The kinetic test results screen is divided into many functional blocks which are described below:
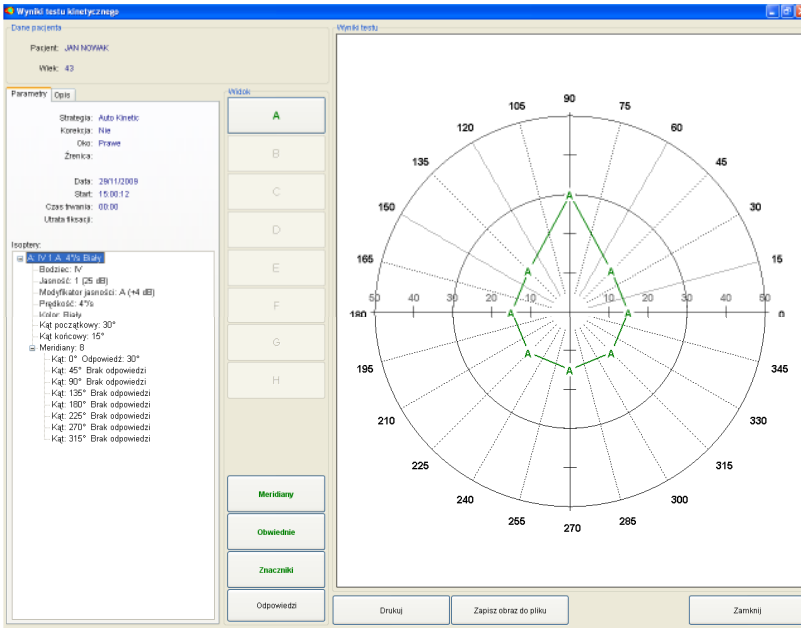


**Pic. 62.** Kinetic test results screen.

### 25.1. Box *Patient data*

*'Patient data'* box is located in the left top part of the screen. The patient's name and age are listed in this box.

### 25.2. Tab *Parameters*

*'Parameters' tab* contains all parameters of the conducted test.

- *Strategy* – kinetic.
- *Correction* – details of the applied correction.
- *Eye* – tested eye (left or right).
- *Pupil* – diameter of the patient's pupil (measured or entered manually). This field can be empty if the pupil diameter was not measured.
- *Date* – date of exam.
- *Start* – start time of exam.
- *Duration* – total time of exam.
- *Fixation lost* – number of lost fixation during test.
- *Isopters* – field with the pull down lists displaying all parameters of a particular isopter and patients answers on all tested meridians.

## 25.3. Box *View*

The buttons in the box *'View'* can be in two states: active – with a green text and inactive – with a black text. The functions of the buttons are as follows:

- *Buttons A to H* – these buttons correspond to the isopters (A – first isopter, B – second, H – eight). Pressing a button shows or hides a corresponding isopter. This option is important especially when many isopters were tested durning one kinetic test. For example drawing all 8 isopters together could cause that results are not readable. Every isopter is drawn using a different color.
- *Meridians* – draws results with or without meridian lines.
- *Obwiednie* – draws results with or without the outlines of the perimeter bowl on 30 and 50 degrees.
- *Markers* – draws results with or without the field angles.
- *Answers* – draws results with or without patients answers in form of angle positions.

## 25.4. Printing kinetic test results

Kinetic test results can be printed using *'Print'* button available on the bottom of the screen. A printout will reflect the same graphical representation of the kinetic test results which is currently shown on the screen. This feature allows for example preparing separate printouts for every isopter from the test.

## 26. DATA EXPORT / IMPORT

Selected data (patients and/or exams) from the AP database can be exported to an external file, for example to exchange the data between AP systems working in different places. The external file can also be given to the patient who can then show the exam results to another doctor working with AP software. The export option is available on the main screen.

To perform an export, select the appropriate records from the patient and/or exam table and click on the '*Export*' button. When more then one record should be selected, press the CTRL key during selection.
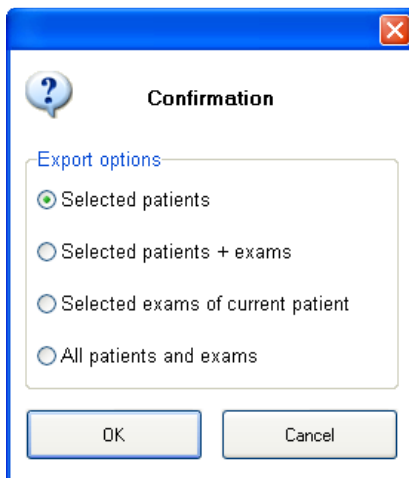


**Pic. 63.** Export options.

It is possible to perform the following export operations:
- Export data of the selected patients.
- Export data of the selected patients and all their exams
- Export data of the selected exams of a patient

Data are exported to a file with *'.VEX'* extension. Such files can be read by AP software only.

In order to perform data import, click on the '*Import'* button on the main screen and select a file with *'.VEX'* extension. If a result is imported which is already in the database, it will be shown as a second, identical record after import is finished.

If a patient's data are imported to a database which already contains this patient, his exam results will be added to the existing records. AP software will not create a new patient record in such case.

## 27. SOFTWARE CONFIGURATION AND SETTINGS

Configuration registers are accessible on the main screen via the drop-down menu located on the top-left part of the screen.
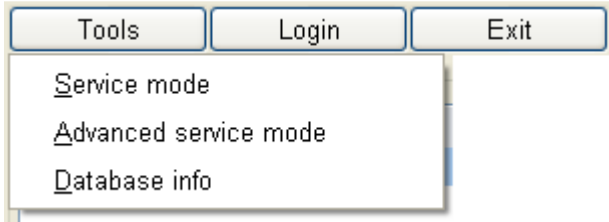


**Pic. 64.** Service mode.

Select the 'Tools' and then the 'Service mode' option from the drop-down menu. A number of registers will be shown on the screen. The following registers are available:

- *Users* – user management
- *Backup options* – database backup management
- *Sounds* – configuration of the sounds used in the software
- *Settings* – configuration of software properties and settings
- *Print layout* – configuration of the printouts
- *Service* – service settings (should be used by a qualified personnel only)
- *Import / Export settings* – import and export of the AP settings from/to an external file
- *Local  settings* – local settings (language and date format)

NOTE!     Some of the registers can be disabled depending on the current user's rights. Guest users cannot access all registers.

NOTE!     In order to apply the changes click on the 'Save' button – otherwise the changes will be cancelled.

| NOTE! | The 'Default settings' button is located at the bottom-left part of the form. Use this option when you need to restore the default settings of the AP software. |
|---|---|

## 27.1. Register *User management*

Available only for users with administrator rights. It allows you to add, to delete and to modify data of all existing users in the system.



**Pic. 65.** User management.

All available users and their rights are listed in the table on the right side of the form. The left side contains all information about the user such as: login, first name, last name, password. The field '*Password*' will be always empty due to safety reasons. Overleaf '*Rights*' gives information about rights of the currently selected user.

Three buttons are located at the bottom-left part of the screen: to create or to delete a user and to apply the introduced changes into the users' data. When user data are modified, it is needed to enter the user's password.

'ADMIN' users cannot be removed from the database. It is possible only to modify the 'ADMIN' user data: password, first name and last name.

If a user was selected to be deleted, the software is looking for all patients attached to the user. If such patients exist, the software will ask to select a new user to whom these patients should be attached instead of the deleted user.
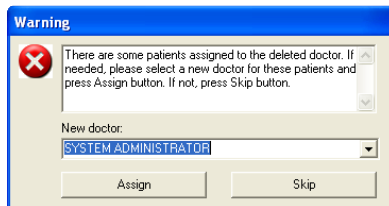


**Pic. 66.** Attaching patients to a new user
instead of a deleted user.

Selecting the *'Create'* option will display a dialog box where all data of a new user should be entered. The user name is unique – it is not allowed to have two users with the same user name in the database.



**Pic. 67.** Creating new user.

The new user data will be accepted by clicking on the '*OK*' button. The new user will be added to the database.

### 27.2. Register *Backup service*

This option allows carrying out a database backup and restoring data from a previously performed backup.
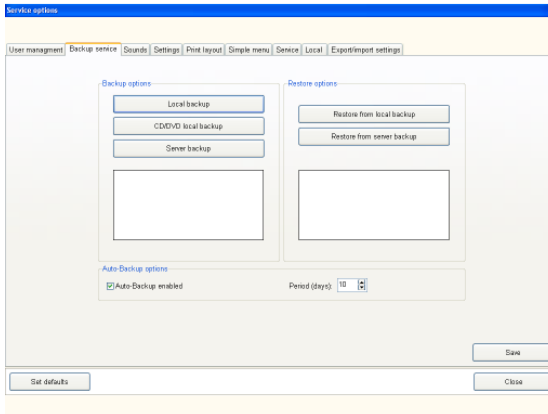


**Pic. 68.** Restore/backup options.

*Local backup* – creates a copy of the current database in a user defined location

*CD/DVD local backup* – creates a copy of the current database and allows the user to burn it on a selected CD or DVD disk.

*Server backup* – creates a copy of the current database on the server.

*Restore from local backup* – restore a previously stored database from a user defined location

*Restore from server backup* – restore a previously stored database from the server.

*Auto backup enabled* – option that executes an automatic server backup. This procedure is executed in cycles with a time interval defined by the '*Period'* parameter.

| NOTE! | Automatic and manual backups can be performed correctly only if all other users are logged out from the database. Otherwise the backup procedure will fail. |
|---|---|

## 27.3. Register *Sounds*

The AP software is informing the user about test events during testing. Information is given in form of messages displayed on the screen. The most important events can be reported also by appropriate sounds. Events like loss of fixation, false positive error, false negative error and many others which are important for the test reliability can be connected with certain sounds. 'Sounds enabled' must be selected to activate the sounds in the software.

All events which can occur during testing are listed on the screen. On the left side of every description a check box is located to select if a certain event should be reported by a sound. The buttons on the left allow to play the sounds. The buttons on the right are to select the appropriate sound files.
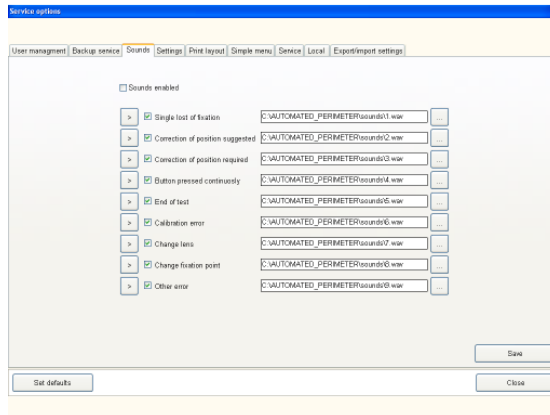


**Pic. 69.** Sounds configuration.

The AP software allows attaching any sound file to an event. A sound file must be in '.WAV' format. In case of using non-standard sounds, these should last no longer than 3 seconds.

## 27.4. Register *Settings*
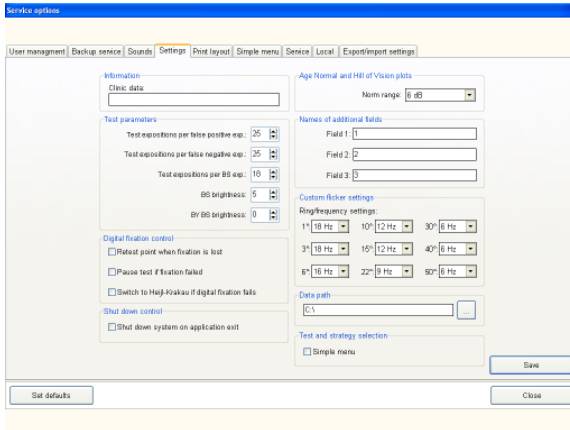


**Pic. 70.** Settings.

*Clinic data*: data like the clinic's name can be entered. These data will appear on top of every results' printout.

*Test exposition per false positive exp.:* parameter defining how many normal test expositions will be displayed between false positive expositions.

*Test exposition per false negative exp.:* parameter defining how many normal test expositions will be displayed between false negative expositions.

*Test exposition per BS exposition:* parameter defining how many normal test expositions will be displayed between blind spot testing. This parameter is valid only for the Heijl-Krakau fixation checking method.

*Retest point when fixation is lost:* to be selected if, every tested point should be tested again if the fixation was lost in the moment of testing. This parameter is valid only using the digital fixation checking method.

*Pause test if fixation failed:* if the fixation is lost 10 times one by one, a test will be automatically paused. This parameter is valid only using the digital fixation checking method.

*Switch to Heijl-Krakau if digital fixation fails:* if the fixation is lost 15 times one by one, the digital fixation checking method will be switched automatically to the Heijl-Krakau method. User will be also asked to correct patient's position and press 'Continue' button to resume the exam.

*Shut down system on application exit:* if this option is selected, the system will be automatically closed on the application exit.

*Norm range:* this parameter sets a threshold for drawing blue dots in the Age Norm and Hill of Vision plots. All points which have value equal to the threshold or above will be depicted as blue dots instead of numerical value.

*BS brightness:* option to set the brightness of the blind spot points. It is recommended to use 3dB or 6dB as brightness level.

*Names of additional fields:* Text fields in this group box are to attach a user's own descriptions of the three fields in the 'New Patient' form. Details how to create a new patient in the database are described in section 8. These fields are optional and do not need to be used. However they allow adding some non-standard patient information.

*Custom flicker settings*: The user can define the frequencies for the custom flicker testing. The points lying on a certain ring (rings are denoted as 1˚ to 50˚) can appear with the frequency defined for this ring.

*Data path:* The user can define a default disk path, where the exam results will be saved as a jpg or bmp image.

*Simple menu*: If this option is checked, the simple menu screen will be shown on application start.


## 27.5. Register *Print layout*

*Default:* you can define which type of printout will be selected as a default printout in the print selection window.

In this register you can also configure three types of printouts: *Standard*, *Combo* and *Multiview*. Each of the three buttons located in the upper part of the form opens a schematic layout of the printout. *Standard* printout has six maps, *Combo* and *Multiview* have four printouts each.
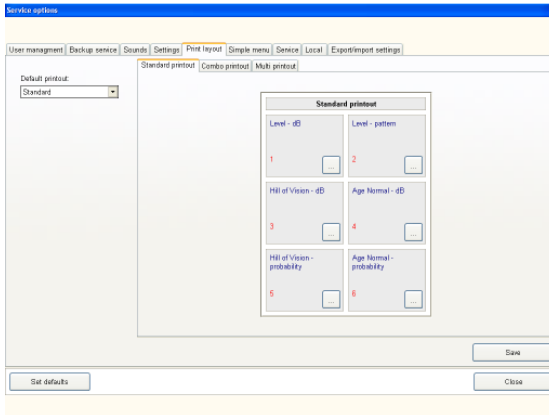
**Pic. 71.** Layout of *Standard* printout.

On each layout of the printout there is a set of boxes. One box corresponds to one printed map on the final printout. On top of each box information about the selected map for this box is listed. You can change the type of display by clicking on the [...] button. This will open a list off all available types of maps to be printed.

You can choose the interesting printout type from this list. Information on the selected box should change automatically for the new type of selected printout.
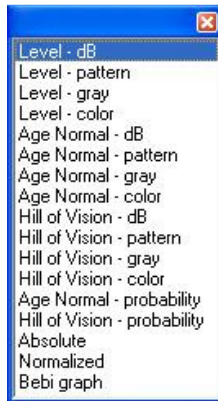


**Pic. 72.** All available maps.

## 27.6. Register *Simple Menu*

It allows to define what types of perimeter fields and strategies will be assigned to the buttons displayed on the simple menu screen. Press one of the eight active buttons to open a window in which all desired test parameters can be set. You can also name the test with according to your needs using *User exam name* text field. If you name your defined test, its name will be shown on the button. If you decided not to name your test, only field name and strategy name will be displayed on the button. The number of buttons active on the simple menu screen can be changed using a combo box on the left.
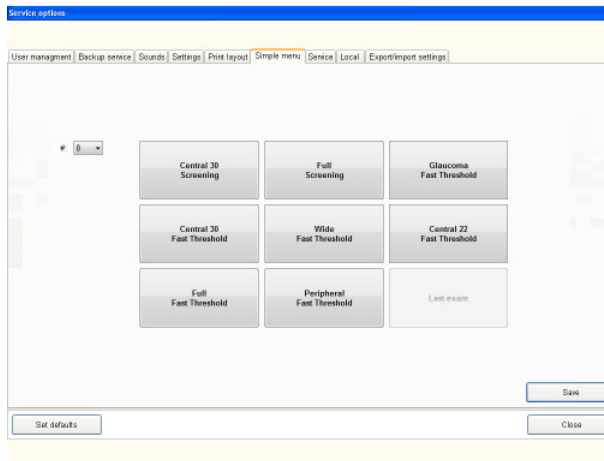


**Pic. 73.** Simple menu settings.
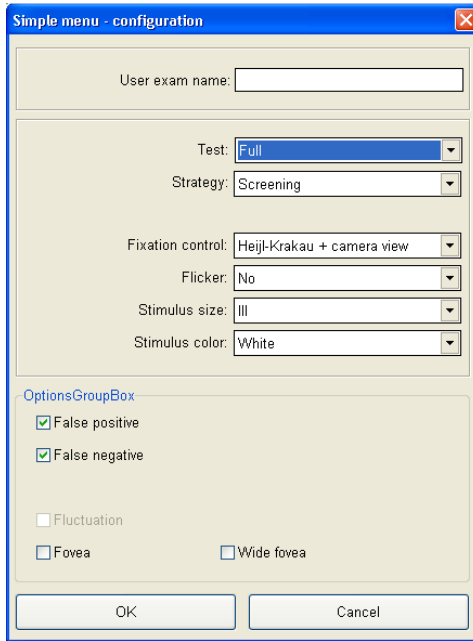
**Pic. 74.** Simple menu – configuration window.

### 27.7. Register *Service*

This register is intended for technical personnel trained by the Manufacturer. All options are described in the Service Manual

### 27.8. Register *Local*

It allows choosing one of the available language and touchscreen keyboard versions. If you cannot find your native language in the pull-down lists contact the Manufacturer or supplier of the equipment.

You can also change the data format to the one most suitable for your country.
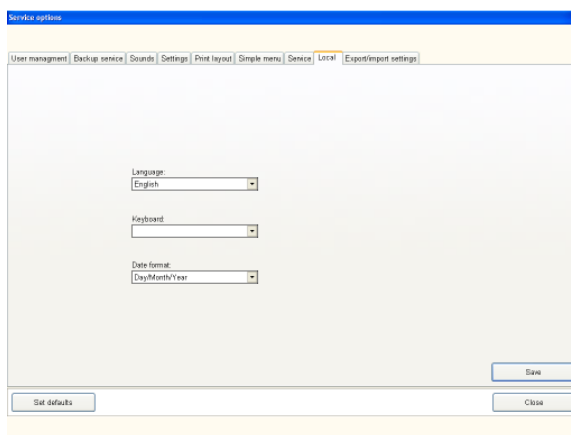
**Pic. 75.** Regional settings.

| NOTE! | All changes made in this register will take effect only after restarting the AP software. Remember to click on 'Save' to apply any changes. |
|---|---|

### 27.9. Register Export/Import settings

This feature allows saving all important configuration data to an external file. The clinic's name is exported to a file with the extension '*.VLC'*. All other settings are added to a file with the extension '*.VST*'. Please define the name for each file with exported data.

You can export those settings to any selected location. This function is very useful in places where you have many computers with network access to the AP database. In that case you can configure all settings on one location and then save the configuration files. Then you can use those files to configure other computers in the network by simply copy all previously configured settings.
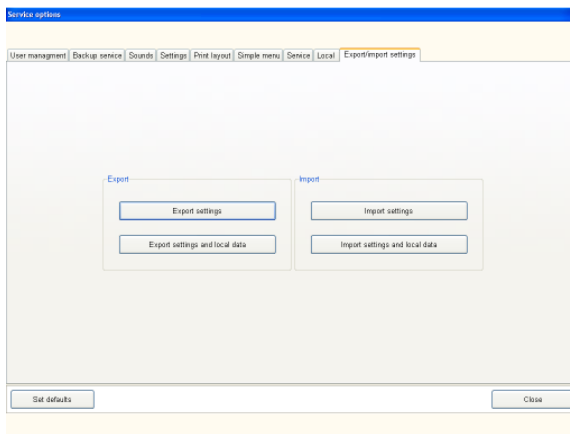
**Pic. 76.** Export/Import settings.

## 28. A. SPARE PARTS PERISTAT

| No. | Part name | Part number |
|---|---|---|
| 1 | Patient response button | 53-01018.01 |
| 2 | Eye cover 2 pcs. | 38-19093.01 |
| 3 | Fuses - 0,63A T 2 pcs. | 06-30302 |
| 4 | Power cord (Europe standard) | 06-49011 |
| 5 | Dust cover | 53-20004.01 |
| 6 | Paper set for chin and forehead rest | 53-19102.01 |
| 7 | USB cable 1,8 m | 06-49505 |
| 6 | Right/left chinrest | 53-04342.01 |
| 7 | Right/left forehead rest | 53-84524.01 |
| 8 | Central chinrest | 53-04340.01 |
| 9 | Central forehead rest | 53-84522.01 |

## 28. B. SPARE PARTS PERIMAT

| No. | Part name | Part number |
|-----|-----------|-------------|
| 1 | Patient response button | 53-01018.01 |
| 2 | Eye cover 2 pcs. | 38-19093.01 |
| 3 | Fuses - 0,80A T 2 pcs. | 06-30014 |
| 4 | Power cord (Europe standard) | 06-49011 |
| 5 | Dust cover | 53-20004.01 |
| 6 | Paper set for chin and forehead rest | 53-19102.01 |
| 7 | Right/left chinrest | 53-04342.01 |
| 8 | Right/left forehead rest | 53-84524.01 |
| 9 | Central chinrest | 53-04340.01 |
| 10 | Central forehead rest | 53-84522.01 |

## 29. NOTES