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Introduction

Dear User :

Welcome to use Electronic Keratometer.

We introduce this instrument to you by two parts: interface and operation. This User's Guide is designed as a training and reference manual. We recommend you read carefully and follow the steps in this guide to ensure that the machine would have optimal performance.

Theory and function

Electronic keratometer is a precise optical measure instrument, designed for detecting curvature radius and diopter of cornea.

This keratometer consists of four parallel luminants,

telecentric optical system, CCD transducer and corresponding circuits. The four parallel luminants are strictly symmetrical to the center with a certain angle between each other. Four lights that emit from luminants create four image points after refracted by the cornea. Move this instrument to focus this four lights to one point. When this point is almost on the cornea, the distance between keratometer and eye is about 40mm, CCD transducer can capture this four image point and display them on the LCD. When all the four image points are in the center of the screen, instrument will calculate automatically the curvature radius and diopter and display the result on the screen.

The measurement includes measurement of curvature radius and diopter of cornea. It measures continuously for several times and calculates the average automatically. This instrument is not harmful to cornea with high precision and easy operation. Infrared printer makes the printing easier.

Parameters and environment requirements

Device type : Type B, power inside

Measuring range : 3mm ~ 12mm curvature radius

Measuring repeatability of curvature : $\leq 0.08\text{mm}$

Precision of curvature radius of cornea : 0.1mm (0.5D)

Resolution of curvature radius of cornea : 0.02mm (0.1D)

Resolution of axial angle of cornea : 1 deg

Single measurement time : 0.03s

Output : infrared output

Weight : $< 0.5\text{Kg}$ (include battery)

Dimension : 240mm \times 90mm \times 60mm

standby power : 5mW

Measuring power : 300mW (without back light)

Measuring power : 500mW (with back light)

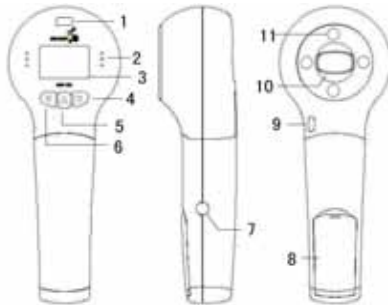
Power supply : three AA battery

Ambient temperature : + 5 ~ + 40

Relative moisture : $\leq 80\%$

Instrument introduction

Form of instrument



1. Level instrument : show level degree of the karatometer
2. Speaker : “beep” after the completion of one measurement.

3. Display screen : show position of reflected lights and measurement results.
4. Left eye button : use to measure the left eye
5. Print button : print the measurement results
6. Right eye button : use to measure right eye
7. Power switch : turn on of off the power
8. Battery case : three batteries included
9. Infrared sensor :transfer signal with infrared printer.
10. Lens : receive reflect lights and reflect them to the

optical sensor.

11. Parallel illuminant : emits four parallel lights which are strictly symmetrical to the center with a certain angle between each other.

- * Button group : press both left and right eye button to switch between the results of curvature radius and diopter of cornea.

Display screen

Pic 2 is the display screen. The readings on the left are for the right eye, while the readings on the right are for the left eye. They are (from top to bottom) :

Curvature radius of long axis (or diopter) of long axis

Curvature radius of short axis (or diopter) of short axis

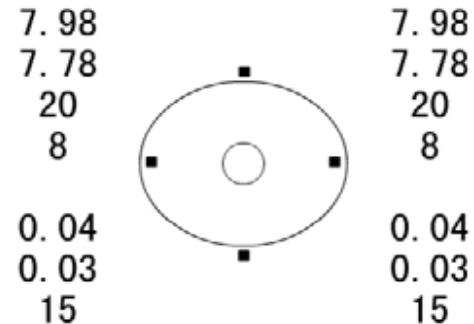
Axial angle: (unit: degree)

Measurement times

Mean variance of curvature radius (or diopter) of long axis

Mean variance of curvature radius (or diopter) of short axis

Mean square error of axial angle



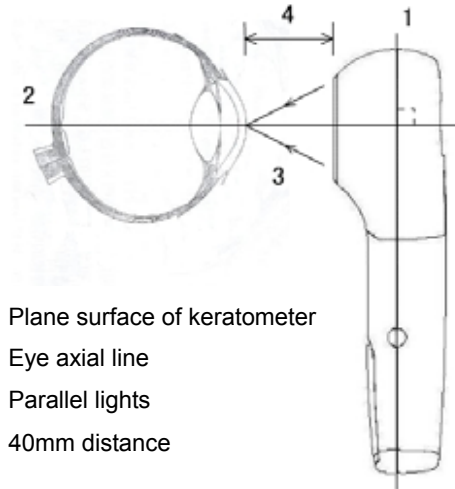
Pic 2

Printer



Pic 3

Measurement



1. Plane surface of keratometer
2. Eye axial line
3. Parallel lights
4. 40mm distance

Pic 4 right position when measuring

Measurement



Step1. Let the four parallel lights focus on the under-eyelid to fix the distance between the eye and the keratometer.

Step2 .Move the focus to the cornea.

Step 3. Look at the screen and move the keratometer slightly to make the four image points be shown on the center of the screen.




Let the examinee look at the green point in the keratometer with a best posture to cooperate with the examiner.


Switch on and press the measure button to turn on the four illuminates (press left eye button to measure left eye and press right eye button to measure right eye). Hold the bottom of the keratometer and place it at a distance 40mm from the cornea, keep the plane surface of the keratometer perpendicular with the eye axis. Move the keratometer slightly to let the four lights focus on the examinee's under-eyelid, then move the focus to the cornea. (if the examinee cannot open his eye large enough, then hand of examiner is needed to make it

larger) . Then look at the screen, move the keratometer to make the four image points be shown on the center of the screen(see Pic 2), then keratometer will capture data and calculate automatically the diopter. Press both left and right eye button at the same time, it will switch between curvature radius and diopter of cornea. Press print key to print the measuring result.

The keratometer will give a short “beep” after each measurement, and each eye can be measured 8 times continuously with this keratometer. A long “beep” will be given after completion of 8 measures and the average will be shown on the screen. If it is less than 8 times, average of these measurements will be also shown on

the screen.

 **Caution and trouble shooting**

( Warning! Pay more attention)

1. The position of the handle in your hand depends on your habit. Handling the bottom of keratometer is the suggested and best way to handle it (easy to move).
2. Use another hand to support your handling hand to avoid any slight swayness.
3. If the four image points are not on the central screen, then move the keratometer horizontally to the opposite side of the four image points.
4. If only three image points appears on the screen, it means the plane surface of the keratometer is not perpendicular with the examinee's eye axis. So adjust the handling posture to make them perpendicular.
5. If one or several image points are pulsatile on the screen, means one or several parallel lights irradiate on the eyelid. Then adjust the keratometer slightly or make the eye open larger.
6. If no image points on the screen, check if the four parallel luminants has been turned on or if the four parallel lights focus on the cornea.
7. Observe the bubble in the level instrument when measuring, the best result can be obtained when

the bubble is in the center of the level instrument. If it is not in the center, adjust the keratometer to keep it in the center.

8. Shut up all other interference sources



Measuring assumption

There are some assumptions to assure the accuracy of the measuring result.

1. The examined cornea is regulated cornea, means it is a toric surface. Big errors will appear if the examined cornea is conical cornea or other unregulated cornea.
2. The astigmatia of the cornea is regulated astigmatia(positive astigmatia or reverse astigmatia). Big

errors will appear if the astigmatia is not regulated, like oblique astigmatia. But the absolute error for curvature radius will not exceed 0.2mm ;

3. The bubble is in the center of the level instrument, and the plane surface of keratometer is perpendicular with the eye axis.
4. There is no tear on the cornea. (including nature tear and artificial tear) .

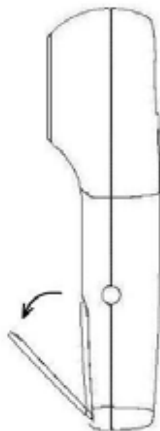
The measuring result can not be assured by this instrument in the condition without the assumptions above.

Changing battery

Hold the keratometer with one hand, press the upper part of the battery cover with another hand to open the cover(see Pic 5), put into three batteries , pay attention of the direction. Then cover it.



Pic 5



Pic 6

Usage of printer


The printer is thermal infrared printer. Move the keratometer to make the infrared sensors of both keratometer and printer close enough, press print button.

Caution and maintenance.

1. This instrument should be store in a place with good ventilation, and without direct sun irradiation.
2. The screen, lens and illuminants of this instrument should be wiped with special tissue to avoid any laceration.
3. Don't use organic solution to clean the instrument, like thinner, or it will cause instrument corrosion.

Avoid any water or other liquid filtering into the machine. Switch off before cleaning.

4. This ketatometer is a delicate instrument, don't press, shock or drop it with strength.
5. Check the batteries periodically to see if they are corroded. If the machine hasn't been put into use for a long time, the batteries should be taken out.
6. Don't try to disassemble the machine yourself when there comes a problems. Please contact the company or the sales person.

 Disused batteries will cause environmental pollution, Please don't throw them away randomly.

Warranty

All the accessories should be well kept. If anything is missing, the instrument could not be warranted.

This instrument had been strictly inspected and tested before putting into sales. We will offer free service or change defective parts only in the warranty period. But it will not prolong the warranty period, and the replaced defective part should be sent back to the manufacturer. We will not take the responsibility if it is broken because of the wrong operation of user.

All the pictures in this guide is for reference only, please see practicality as standard.