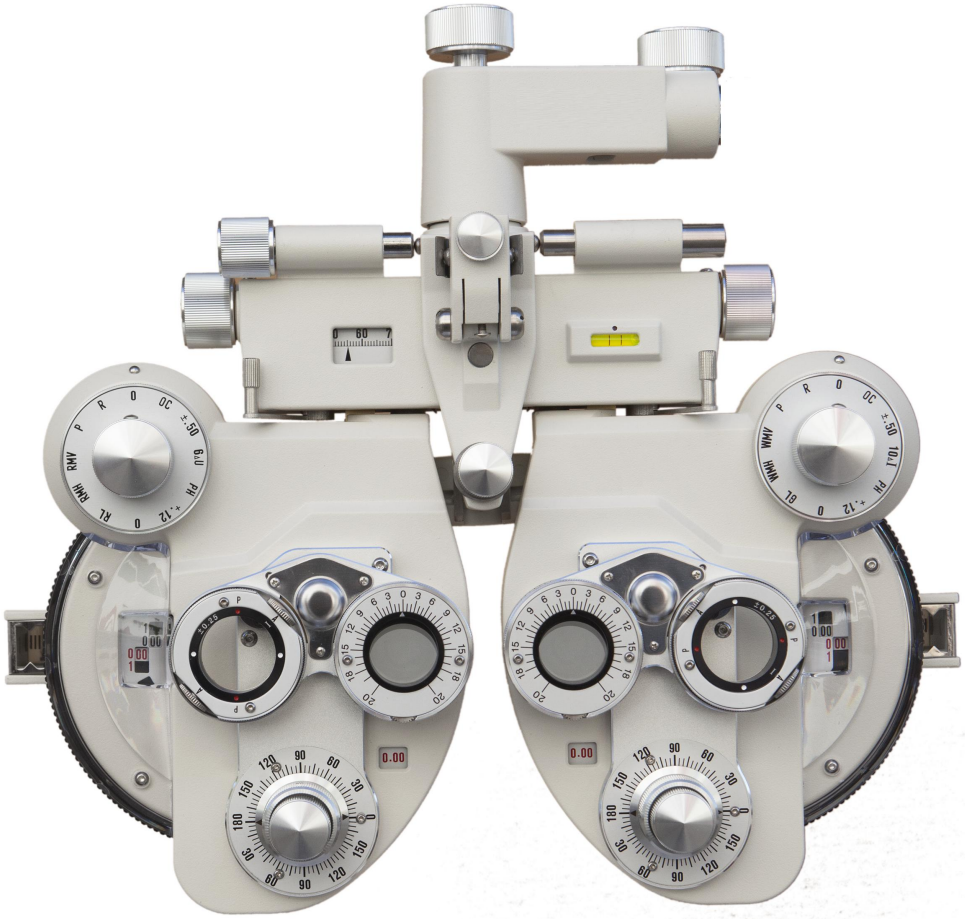
# INSTRUCTION MANUAL

## PHOROPTOR



In order to make you better use this instrument, please read the instruction carefully and keep it properly for future use.

# Attention

1. When using the phoroptor, hold the upper corner of the instrument (Fig. 1) or hold the instrument with both hands (Fig. 2).
2. Don’t place the instrument face down or press the lens forcefully. Don’t touch the lens with your hand.
3. Don’t place the instrument in a damp and dusty room.
4. All the knobs can be rotated in two ways, Please use them carefully. Don’t exceed the rotation limit to avoid damaging the instrument.
5. Use the cotton cloth to scrub the parts in contact with people, such as the forehead rest, face shield, and so on. Cleaning fluid or other chemicals are strictly prohibited.
6. Without authorization or our company's guidance, it is strictly forbidden to install or disassemble the instrument, otherwise, our company will not assume any responsibility.
7. If you are unable to operate the instrument according to the instruction, please contact your nearest authorized agent.

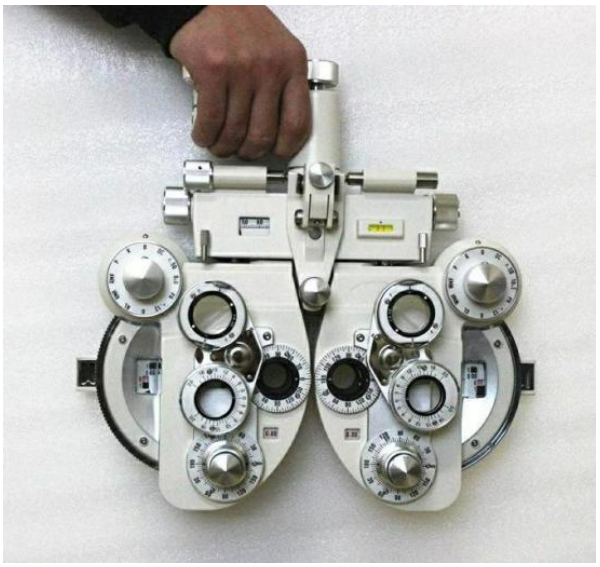


Fig.1

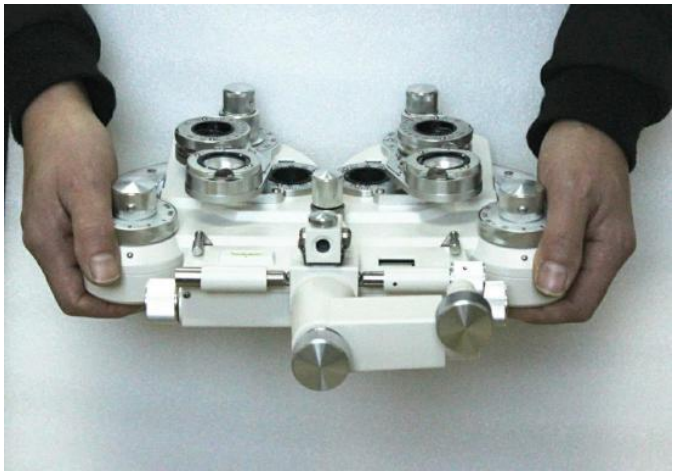


Fig.2

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# 1. Product structure diagram

(1) Rotating adjusting knob: adjust the direction of the main body of the instrument
(2) Fixing knob: fix the instrument on the ophthalmic examination table
(3) Installed handle: install the instrument on the ophthalmic examination table
(4) Locking screw of near point rod: fix the near point rod
(5) Horizontal bubble: show horizontal state
(6) Auxiliary lens mark
(7) Cross cylinder lens: accurate measurement of astigmatism power, axis and sphere power
(8) Cross cylinder rotating knob: change positive or negative cross astigmatism axis
(9) Forehead adjusting knob: adjust the forehead position of the examinee
(10) Corneal distance observation window: observe the corneal position of the examinee
(11) Cylinder axis mark
(12) Display dial of the cylinder axis: display cylinder axis
(13) Cylinder numerical value display window: display cylinder numerical value
(14) Lens hole

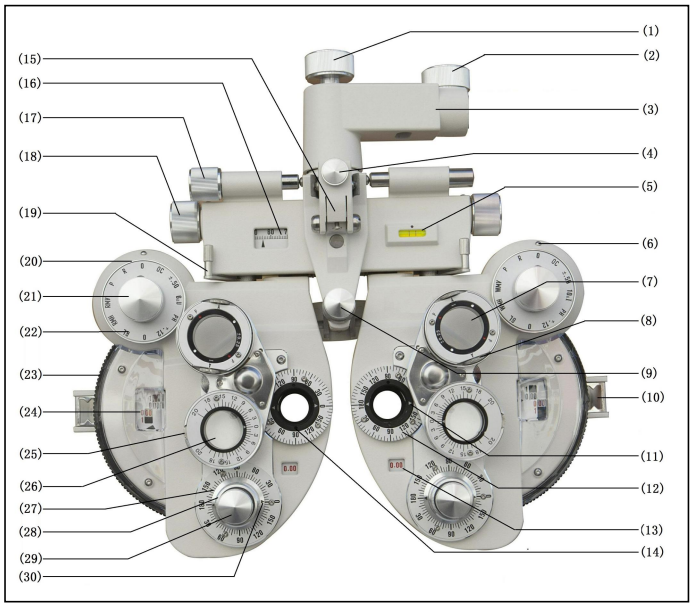



Fig.3

(15) Near point rod holder: attach the rod to the holder
(16) Pupil distance display window: display pupil distance
(17) Horizontal adjusting knob: adjust the horizontal direction of the instrument
(18) Pupil distance knob: adjust pupil distance
(19) Focusing handle: adjust the instrument included angle
(20) Fast 3D knob of sphere lens power: sphere lens power increases or decreases with 3D each gear
(21) Auxiliary lens knob: used for different vision function tests
(22) Auxiliary lens dial: show the lens position state
(23) Spherical disk: sphere power increases or decreases with 0.25D each gear
(24) Sphere numerical value display window: show sphere lens power
(25) Prism rotation knob: adjust the prism power

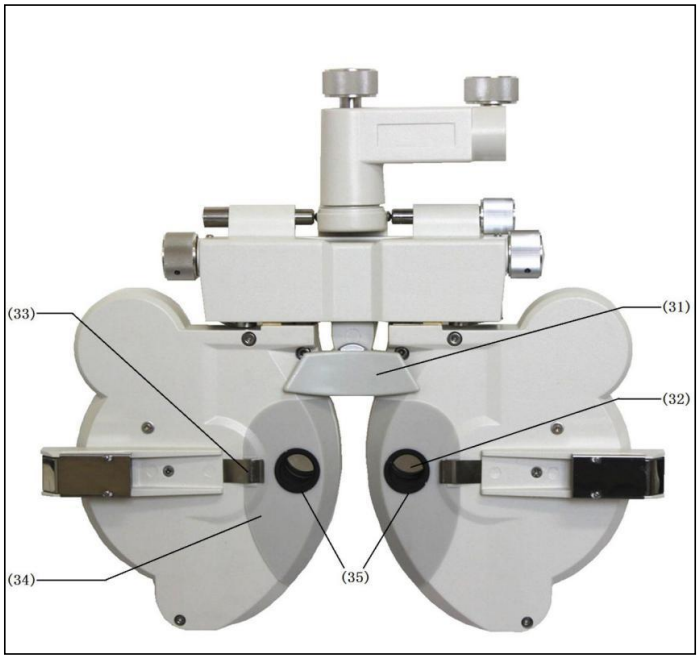
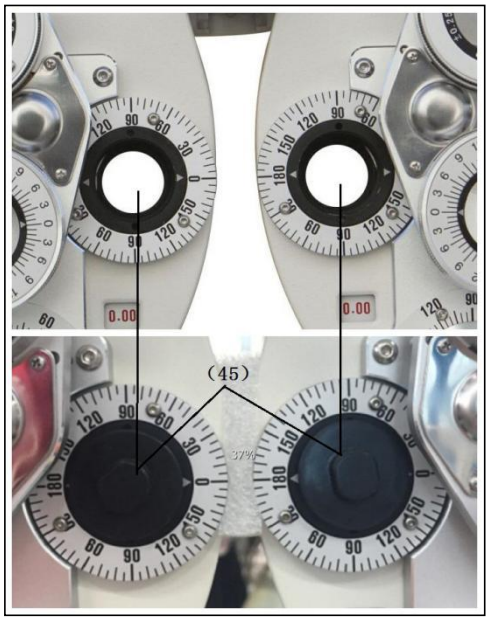



Fig.4

(26) Rotating prism: heterophoria or both eye balance test
(27) Cylinder axis dial: display cylinder axis angle
(28) Cylinder axis knob: adjust cylinder axis
(29) Cylinder knob: Add the cylinder lens to the inspection path , increases or decreases with 0.25D each gear
(30) Cylinder axis mark
(31) Forehead rest: the examinee places his head here

(32) Examination window: used to the examination of the examinee
(33) Face shield holder: used to fix face shield
(34) Face shield: convenient for cleaning and replacement
(35) Eyepiece: dustproof

* The attachment
(36) Specification
(37) Dustproof cover:
When the instrument is not in use, use the dustproof cover to avoid dust falling into the instrument
(38) Fastening bolt:
The instrument is fixed on the eye inspection table and tightened to prevent it falling
(39) Eyepiece loading and unloading blade:
Install or remove the eyepiece
(40) Accessory box:
Save standard the accessories
(41) Additional lens:
Change test range and accuracy
(42) Near point chart clamp:
Connect the near point chart and the near point rod
(43) Near point rod:
Connect the near point chart to the near point rod
(44) Rotating near point chart:
Include the test chart
(45) Transport dust plug



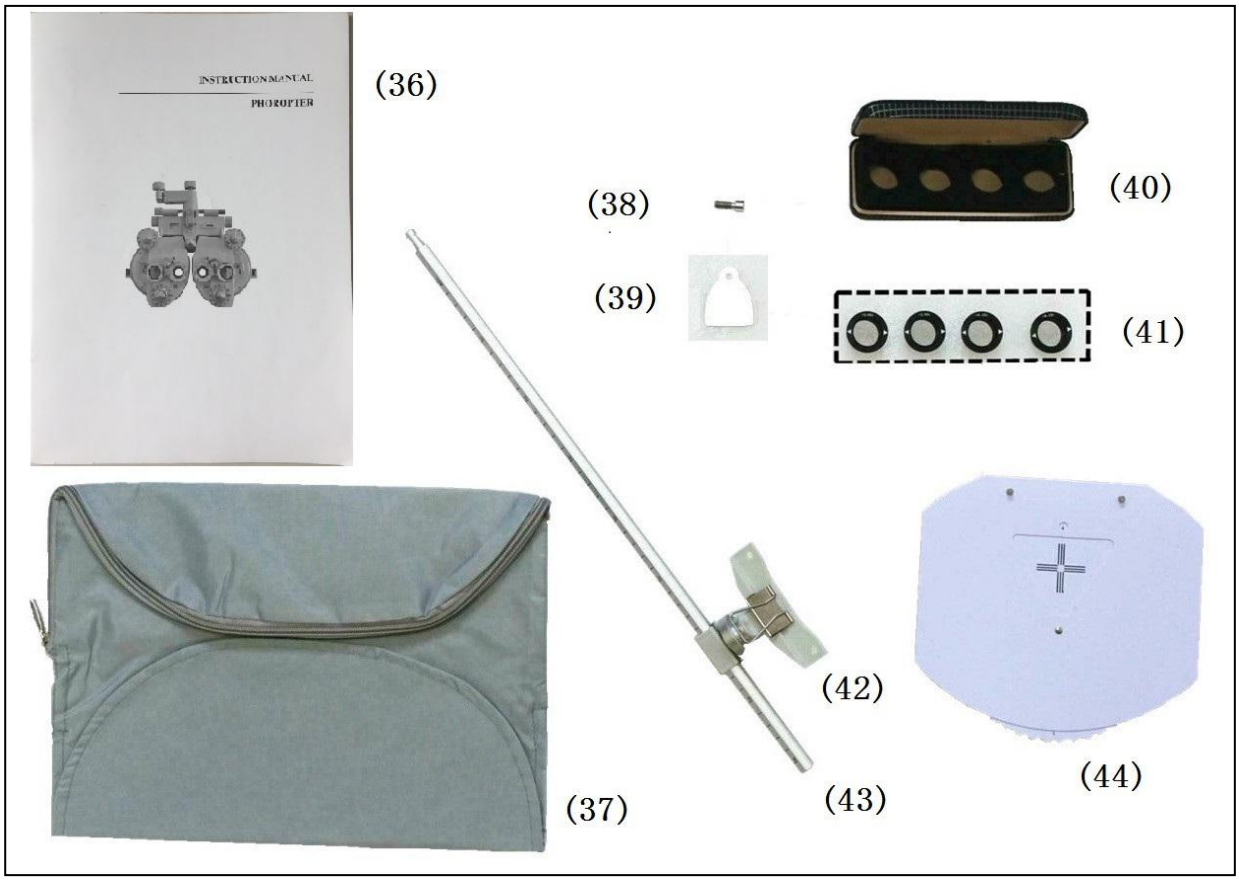




Fig.5

# 2. Installation

## 2.1 Composition

A〉 Phoroptor main body
B〉 Instruction manual
C〉 Dustproof cover
D〉 Near point rod
E〉 Near point chart clamp
F〉 Rotating near point chart
G〉 Accessory box
H〉 Eyepiece loading and unloading blade
I〉 Fastening bolt
J〉 Additional lens

## 2.2 Installation steps

### 2.2.1 Install the instrument on the examination table

When in use, the instrument is suspended on the upper mounting handle (3). Insert the extension part of the mounting rod of the eye inspection table into the hole of the mounting handle, and fix them with the fixing knob (2). Finally, tighten the fastening bolt (38) into the bolt hole at the bottom of the mounting handle (46). The fastening bolt (38) is included in the standard accessories. Use the horizontal adjustment knob (17) to adjust the level of the instrument, when the black spot on the upper part of the horizontal bubble (5) is between the two red lines of the horizontal bubble, the state of the instrument is level. When adjusting the direction of the instrument, loosen the rotating adjusting knob(1) and rotate the instrument to the specified direction and lock it, as shown in Fig.6.

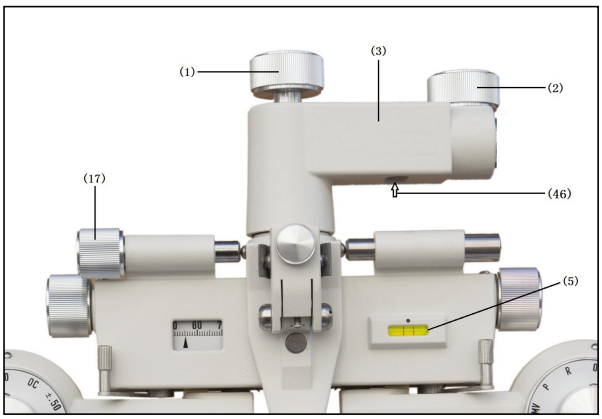



Fig.6

### 2.2.2 Install the near point rod, near point chart and chart clamp

Insert the tail of the near point rod (43) into the near point chart clamp(42), the near point chart clamp can slide along the near point rod (43).When installing the rotating near point chart (44), install the rotating near point chart (44) into the shrapnel clamp on the bottom of the near point chart clamp (42) (as shown in Fig.7). Then install the near point rod (43) on the near point rod holder(15) and fix the near point rod locking knob (4). When the test rod is not in use, Take it up and save it (as shown in Fig.8).

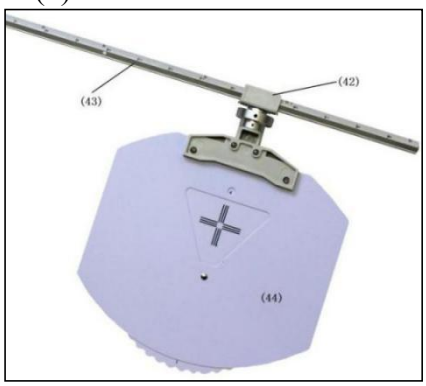



Fig.7

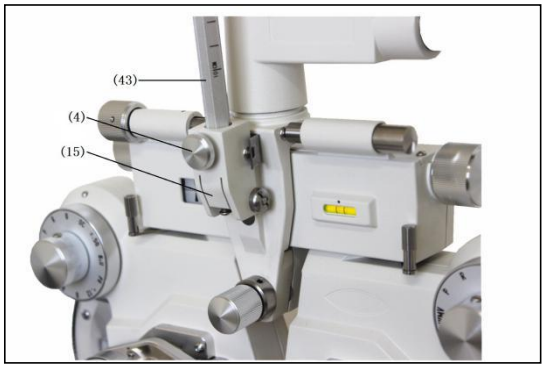



Fig.8

### 2.2.3 Install the face shield

Clamp the face shield (34) with the face shield holder (33) and install them in the box of the examination window (32) (as shown in Fig.9).

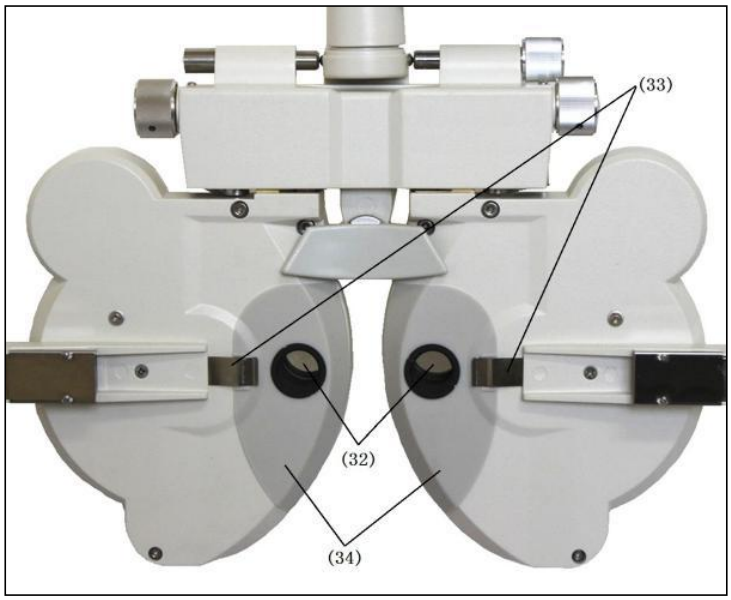



Fig.9

## 3. Operation process

### 3.1 Sphere

Only to display the refractive power of sphere (abbreviated as "S"), rotate the auxiliary lens knob (21) to 0 , as shown in Fig.11, then rotate the cylinder knob (29) until "0.00" appears in the cylinder numerical value display window (13) , as shown in Fig.10. Rotate the spherical disk (23), then S value will be displayed in the sphere numerical value display window and change with an accuracy of 0.25D, range is from -19.00 to + 16.75D, as shown in Fig.10. In the display window, only 3 or 4 digits are valid. For example, if '075' is displayed, it should be read '0.75D', and if '1150', it should be read '11.50D'. In order to quickly adjust to the required power, use the fast 3D knob of sphere lens power (20), and S value will changes at 3.00D step, as shown in Fig.11.

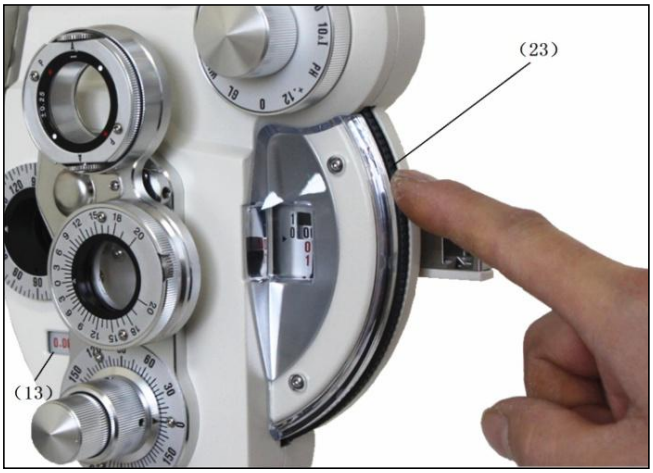



Fig.10

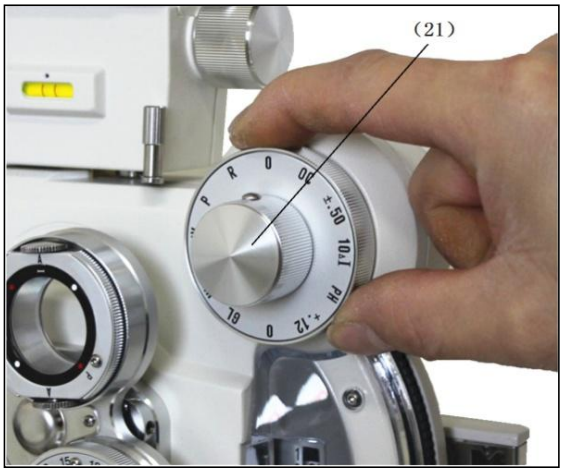



Fig.11

### 3.2 Cylinder

Rotate the cylinder knob (29), and the cylinder will change from 0.00 to -6.00D at 0.25D step. The

cylinder set value will be displayed in cylinder numerical value display window (13). The instrument adopts the scieropia principle, so the power displayed is always negative- (positive +can be selected if necessary), as shown in Fig.12.
When measuring the astigmatic axis (cylinder axis), rotate the cylinder axis knob (28), the axis will be displayed on the cylinder axis dial (27), as shown in Fig.13.

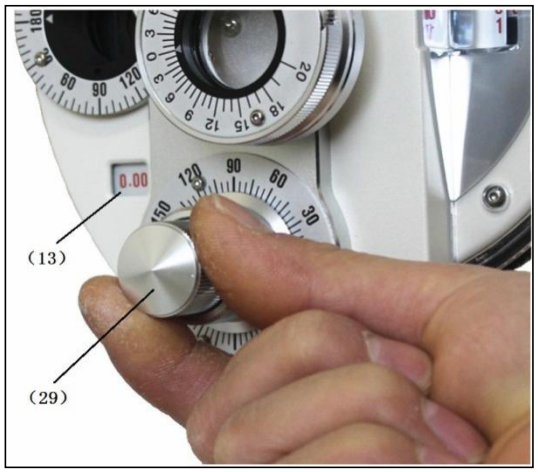



Fig.12

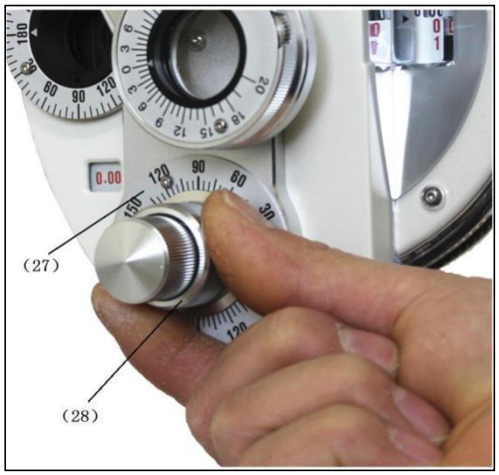



Fig.13

## 3.3 Auxiliary lens

Rotate the Auxiliary lens knob (21) to make the need lens be positioned at the auxiliary lens mark (6). The reference lens will display in the examination window (32).

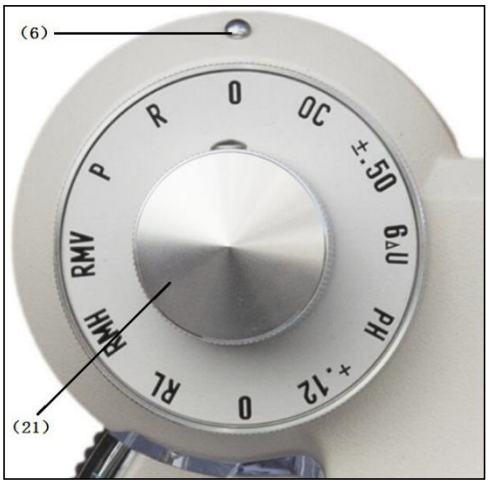



Fig.14

Fig.15

O…… Open aperture

R …… Retinoscope lens，+2.00 sphere (50cm)

P …… Polaroid，used for heterophoria or both eye balance test

RMV …… Red Maddox rod, vertical, (examine heterophoria)

RMH …… Red Maddox rod, horizontal (examine heterophoria)

WMV ……White Maddox rod, vertical (examine heterophoria)

WMH ……White Maddox rod, horizontal (examine heterophoria)

RL …… Red filter (examine binocular image fusion)

GL …… Green filter (examine binocular image fusion)

+.12 …… +0.12D attached lens (sphere power compensation )

PH …… Provide a 1mm diameter pinhole to determine the cause of amblyopia

6△U …… 6 prism diopter base up (examine both eye balance)

10△I …… 10 prism diopter base in (examine both eye balance)

±.50 …… ±.50DC cross cylinder (examine adjustment ahead or lag)

OC …… Occluder

## 3.4 Cross cylinder

Fig.16

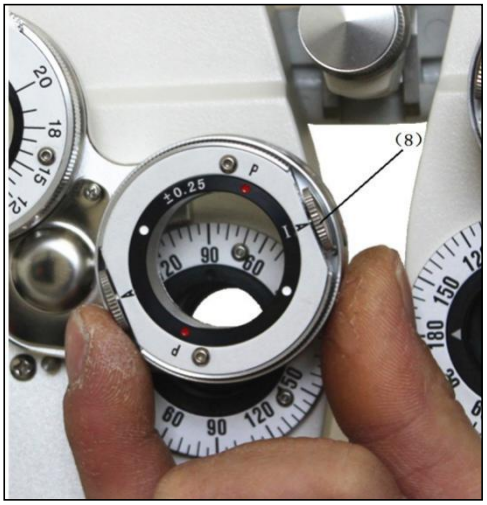



Fig.17

The cross cylinder is used to precisely examine the astigmatism power and axis. Rotate the cross cylinder to the examination window. There are letter calibration "A" and "P" on the front frame of the cross cylinder, "A" is the axis and "P" is power. The white point inside represent the positive axis and the red point outside represent the negative axis. When the frame rotates, "A" will become "P" or opposite. Positive axis and negative axis can be selected by rotating knob (8).

## 3.5 Rotating prism

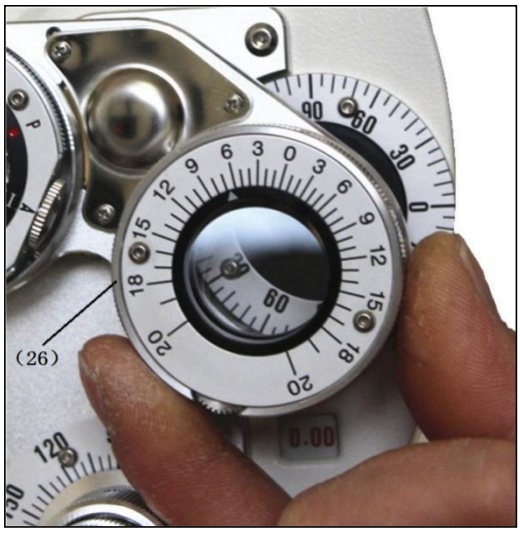



Fig.18

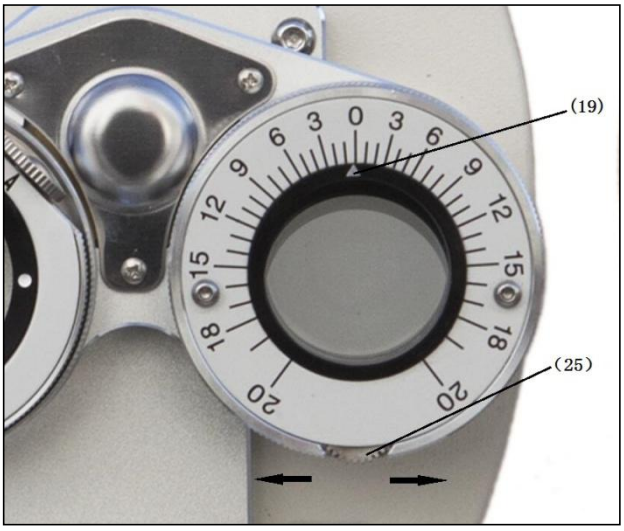



Fig.19

Turn the rotating prism (26) to the examination window. Turn the rotating prism knob (25) to change the

rotation angle to get the need power, as shown in Fig.19. For example, if the rotation prism knob is set at the position shown in Fig.19, the prism power is 0. Figure 20 represents 3D prism diopter base in (3△BI). By rotating the entire prism, the direction of the prism base will also be changed. Fig.21 represents the rotation prism setting while 3D prism diopter base (3 △ BU) moves upward.

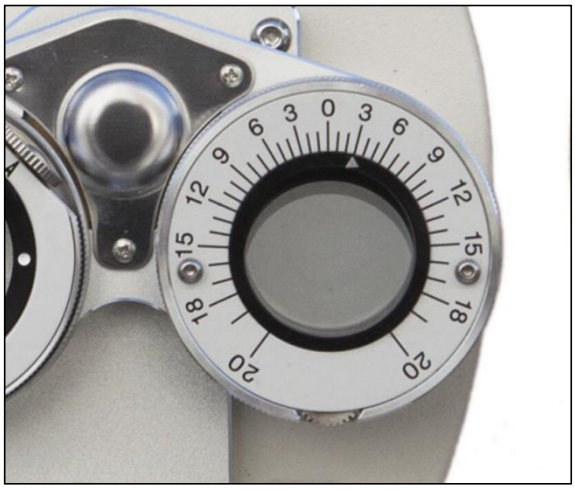


Fig.20

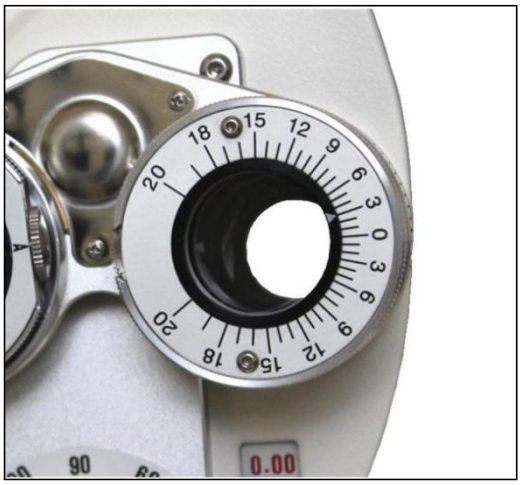



Fig.21

## 3.6 Distance correction of cornealvertex point

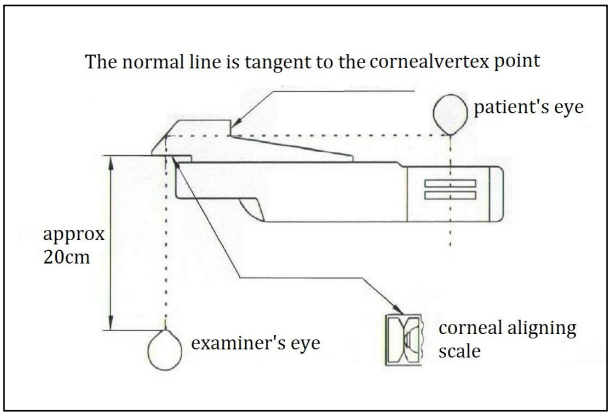



Fig.22

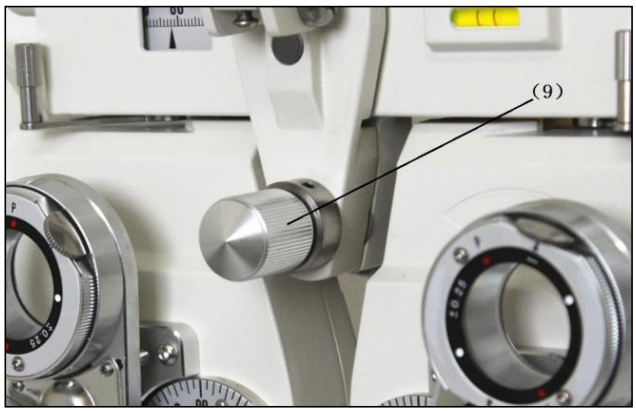



Fig.23

Turn the forehead adjustment knob (9) to adjust the position of the forehead rest (31), as shown in Fig. 23. Observe from about 20cm through the corneal distance observation window (10) when the subject's head is placed on the forehead rest. Calibrate with the long line in the display window and observe the cornealvertex point of the subject , as shown in Fig.22. The long line in the observation window represents that the measured distance is 13.75mm, which is the standard glasses wearing distance. Three short lines keep from the long line with a spacing of 2mm. Therefore, if the cornealvertex point is on the second short line from the long line, the diopter value should be measured at the position of 17.75mm from the lens to the cornealvertex point : 13.75 (standard value) +4 (corrected value of the second short line) =17.75mm. If the actual lens wearing distance is not the standard value (13.75mm), correct it with table 1 and table 2.

Case 1

If obtain the measured value S+ 8.00d at the cornealvertex point and on the second short line away from the long line, that is, the distance is 4mm from the labeled wearing distance: the corrected value is + 0.26D, by referring to the distance of + 8.00d and 4mm in table 1. Therefore, for patients wearing 13.75 standard lens distance, the actual power is (+ 8.00D) + (+ 0.26D) = 8.26D.

Case 2

If the cornealvertex point is between the second and third short line from the long line (5mm from the

standard line), the measured value is S-11.50D: referring to the distance of -11.50D and 5mm in table 2, the corrected value should be (0.57+0.68) /2= 0.62D. Therefore, for patients wearing13.75 standard lens distance, the actual power is (-11.50) + (+0.62) = -10.88D.
If you need more accurate measurements, follow the formula below.

$$D' = D \pm \frac{L \cdot D^2}{1000 - L \cdot D}$$

D: measured value (D)

D ': corrected value

L: difference between measuring distance and wearing distance (mm)

Table1: corrected diopter value of positive lens

| L mm / D dptr | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| +1.00 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.007 | 0.008 | 0.009 | 0.01 |
| +2.00 | 0.004 | 0.008 | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 |
| +3.00 | 0.009 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.09 |
| +4.00 | 0.02 | 0.03 | 0.05 | 0.07 | 0.08 | 0.10 | 0.12 | 0.13 | 0.15 | 0.17 |
| +5.00 | 0.03 | 0.05 | 0.08 | 0.10 | 0.13 | 0.15 | 0.18 | 0.21 | 0.24 | 0.26 |
| +6.00 | 0.04 | 0.07 | 0.11 | 0.15 | 0.19 | 0.22 | 0.26 | 0.30 | 0.34 | 0.38 |
| +7.00 | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.31 | 0.36 | 0.42 | 0.47 | 0.53 |
| +8.00 | 0.06 | 0.13 | 0.20 | 0.26 | 0.33 | 0.40 | 0.47 | 0.55 | 0.62 | 0.70 |
| +9.00 | 0.08 | 0.16 | 0.25 | 0.34 | 0.42 | 0.51 | 0.61 | 0.70 | 0.79 | 0.89 |
| +10.00 | 0.10 | 0.20 | 0.31 | 0.42 | 0.53 | 0.64 | 0.75 | 0.87 | 0.99 | 1.11 |
| +11.00 | 0.12 | 0.25 | 0.38 | 0.51 | 0.64 | 0.78 | 0.92 | 1.06 | 1.21 | 1.36 |
| +12.00 | 0.15 | 0.30 | 0.45 | 0.61 | 0.77 | 0.93 | 1.10 | 1.27 | 1.45 | 1.64 |
| +13.00 | 0.17 | 0.35 | 0.53 | 0.71 | 0.90 | 1.10 | 1.30 | 1.51 | 1.72 | 1.94 |
| +14.00 | 0.20 | 0.40 | 0.61 | 0.83 | 1.05 | 1.28 | 1.52 | 1.77 | 2.02 | 2.28 |
| +15.00 | 0.23 | 0.46 | 0.71 | 0.96 | 1.22 | 1.48 | 1.76 | 2.05 | 2.34 | 2.65 |
| +16.00 | 0.26 | 0.53 | 0.83 | 1.09 | 1.39 | 1.70 | 2.02 | 2.35 | 2.69 | 3.05 |
| +17.00 | 0.29 | 0.60 | 0.91 | 1.24 | 1.58 | 1.93 | 2.30 | 2.68 | 3.07 | 3.48 |
| +18.00 | 0.33 | 0.67 | 1.03 | 1.40 | 1.78 | 2.18 | 2.59 | 3.03 | 3.48 | 3.95 |
| +19.00 | 0.37 | 0.75 | 1.15 | 1.56 | 1.99 | 2.44 | 2.91 | 3.41 | 3.92 | 4.46 |
| +20.00 | 0.41 | 0.83 | 1.28 | 1.74 | 2.22 | 2.73 | 3.26 | 3.81 | 4.39 | 5.00 |

Table2: corrected diopter value of negative lens

| L mm / D dptr | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| -1.00 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.007 | 0.008 | 0.009 | 0.01 |
| -2.00 | 0.004 | 0.008 | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 |
| -3.00 | 0.009 | 0.02 | 0.03 | 0.04 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
| -4.00 | 0.02 | 0.03 | 0.05 | 0.06 | 0.08 | 0.09 | 0.11 | 0.12 | 0.14 | 0.15 |
| -5.00 | 0.02 | 0.05 | 0.07 | 0.10 | 0.12 | 0.15 | 0.17 | 0.19 | 0.22 | 0.24 |
| -6.00 | 0.04 | 0.07 | 0.11 | 0.14 | 0.17 | 0.21 | 0.24 | 0.27 | 0.31 | 0.34 |
| -7.00 | 0.05 | 0.10 | 0.14 | 0.19 | 0.24 | 0.28 | 0.33 | 0.37 | 0.41 | 0.46 |
| -8.00 | 0.06 | 0.13 | 0.19 | 0.25 | 0.31 | 0.37 | 0.42 | 0.48 | 0.54 | 0.59 |
| -9.00 | 0.08 | 0.16 | 0.24 | 0.31 | 0.39 | 0.46 | 0.53 | 0.60 | 0.67 | 0.74 |
| -10.00 | 0.10 | 0.20 | 0.29 | 0.38 | 0.48 | 0.57 | 0.65 | 0.74 | 0.83 | 0.91 |
| -11.00 | 0.12 | 0.24 | 0.35 | 0.46 | 0.57 | 0.68 | 0.79 | 0.89 | 0.99 | 1.09 |
| -12.00 | 0.14 | 0.28 | 0.42 | 0.55 | 0.68 | 0.81 | 0.93 | 1.05 | 1.17 | 1.29 |
| -13.00 | 0.17 | 0.33 | 0.49 | 0.64 | 0.79 | 0.94 | 1.08 | 1.22 | 1.36 | 1.50 |
| -14.00 | 0.19 | 0.38 | 0.56 | 0.74 | 0.92 | 1.08 | 1.25 | 1.41 | 1.57 | 1.72 |
| -15.00 | 0.22 | 0.44 | 0.65 | 0.85 | 1.05 | 1.24 | 1.43 | 1.61 | 1.78 | 1.96 |
| -16.00 | 0.25 | 0.50 | 0.73 | 0.96 | 1.19 | 1.40 | 1.61 | 1.82 | 2.01 | 2.21 |
| -17.00 | 0.28 | 0.56 | 0.82 | 1.08 | 1.33 | 1.57 | 1.81 | 2.04 | 2.26 | 2.47 |
| -18.00 | 0.32 | 0.63 | 0.92 | 1.21 | 1.49 | 1.75 | 2.01 | 2.27 | 2.51 | 2.75 |
| -19.00 | 0.35 | 0.70 | 1.02 | 1.34 | 1.65 | 1.94 | 2.23 | 2.51 | 2.77 | 3.03 |
| -20.00 | 0.39 | 0.77 | 1.13 | 1.48 | 1.82 | 2.14 | 2.46 | 2.76 | 3.05 | 3.33 |

## 3.7 Rotating near point chart

If the lens is multifocal lens that the diopter of the near distance need to be tested by using the near point rod (43), the near point chart clamp (42) and the rotating near point chart (44) (see 2.2.2 for installation). Lower the near point rod as shown in Fig.24, keeping the near point rod level is the correct measurement position. The near point distance is from 10cm to 50cm.The corresponding value of the near eye chart clip is the value of the card to the cornealvertex point, as shown in Fig.25. Select the need visual AIDS on the near point chart. Rotate the bottom of the chart with your finger to switch between different visual AIDS until the need value is displayed in the window.

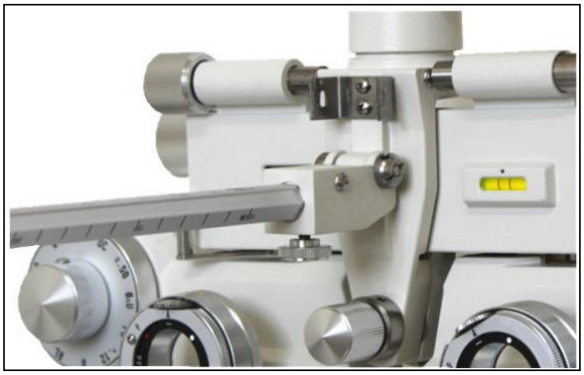


Fig.24

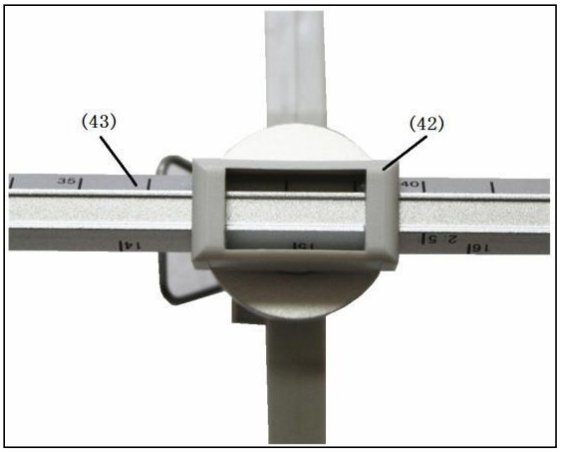



Fig.25

Numerical meaning of near point chart:

1.E (or C) visual chart (0.6 (40/60))
2. Alphabetic visual chart (40cm, 0.4-1.0 vision)
3. Letter test visual chart
4. Squint test visual chart
5. Single-row digital visual chart (0.6 (40/60))
6. Single-column visual chart (1.0 (40/40))
7.C visual chart (40cm, 0.1-0.3vision)
8. Letter visual chart (40cm, 0.1-0.3 vision)
9. Letter visual chart (0.6 (40/60))
10. Astigmatism visual chart ((1.12) 40/200)
11. Single-column digital visual chart (0.6 (40/60))
12. Single-column digital visual chart (1.0 (40/40))

Turn the focusing handle (19) inward and rotate the instrument so that the main axis of the lens is at the position of 40cm to conduct the near point test, as shown in Fig.26.

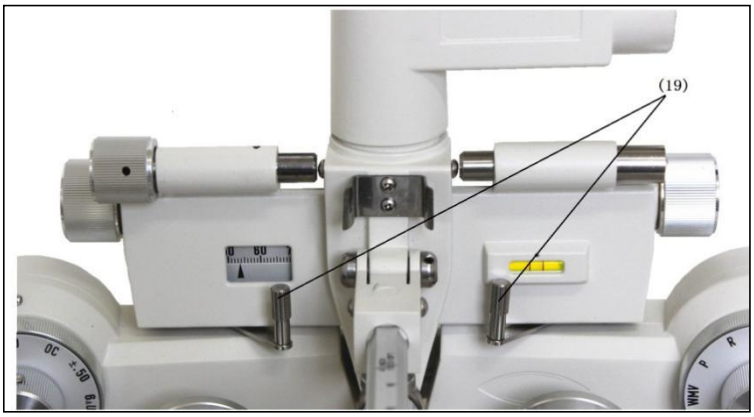



Fig.26

## 3.8 Examination process

Here is an example of the measurement. Prior to the actual test, First measure the patient's vision, history, pupil distance and other data. In order to use the instrument better, the operator should be familiar with the use of the instrument. Refer to other publications for ophthalmology professionals.

For ease of use, a case of virtual medical record is provided below.

Mr. A is 25 years old and wears glasses. He thinks his vision is not corrected enough.

Suppose the lens he is wearing is checked with a lens meter first. The results are as follows:

P.D. 63cm

R S-1.00D ⌓C－0.50D A90°

L S-1.25D ⌓C－0.50D A180°

Represents that Mr A's pupil distance is 63mm. The right sphere lens is -1.00D. Astigmatism is -0.50D, wheelbase is 90°. The left sphere lens is -1.25D, astigmatism is -0.50D, and the wheelbase is 180°. Wearing glasses, Mr. A's vision test is 0.7 (20/30) in both eyes, without any visual lesions. Next, measure Mr. A's power with the instrument according to the above method, and make sure to check all parts of the instrument.

**3.8.1 Install the instrument**

<1> Install the instrument on the examining table, and insert the near point rod(43) into the near point rod holder (15), as shown in Fig. 8.
<2> Set the sphere value (represented by S below) and cylinder value (represented by C below) to 0.
<3> Before examination, should measure the pupil distance first. Turn the pupil distance knob (18), and Mr. A's pupil distance will be displayed in the pupil distance display window (16). Set the pupil distance value.
<4> Move the instrument so that the side of the instrument shown in Fig. 4 faces the subject. Let Mr. A's forehead rest on the forehead rest(31).
<5> Observe the reflected image of the horizontal bubble (5) and adjust the horizontal adjusting knob (17) until the black spot on the upper part of the horizontal bubble (5) is between the two red lines of the horizontal bubble
<6> Determine the distance between the cornealvertex point and the instrument.
<7> First measure the right eye and turn the auxiliary lens knob to set 0 as the right eye and 0C as the left eye.

**3.8.2 Scieropia examination**

<1> Increased the estimated S value of the right eye by 3.00D. The power he weared is -1.00D, which means (-1.00) + (+3.00) =+2.00D.
<2> Under these conditions, Mr. A cannot see the picture clearly. Gradually increase the negative power. In Mr. A's example, the S value is gradually decreased by rotating the spherical disk (23), from: 2.00→1.75→1.5 to 0.5. It shows -1.00.

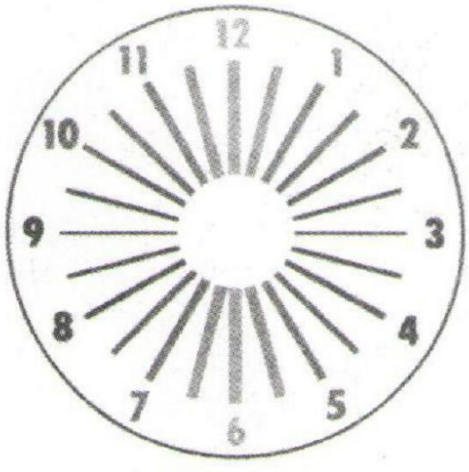



Fig.27

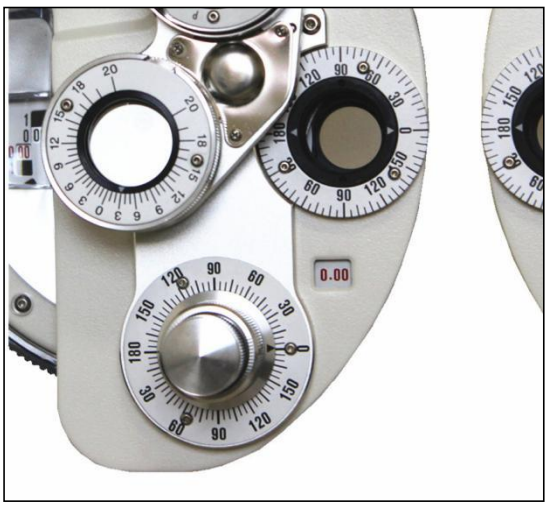



Fig.28

<3> Project astigmatism screen and asked Mr. A if he could see clearly. If Mr. A replies that he could see

the picture as shown in Fig. 27, rotate the cylinder axis knob (28) 90° from the blackest line he could see, as shown in Fig.28. (If Mr. A answers the same, then there is no astigmatism and steps<3>, <4> in 3.8.2 and all steps in 3.8.3 are not required to do).

<4> Turn the cylinder knob (29) to change the C value from 0.00 to 0.25 to 0.50 so that each line looks the same. When turn to -0.50, the chart is shown in Fig. 29.

<5> Rotate the spherical disk (23) to change S value at 0.25D step, making the visual chart from 1.2 to 1.5. Record the value changed. - 1.00→1.25→1.50.

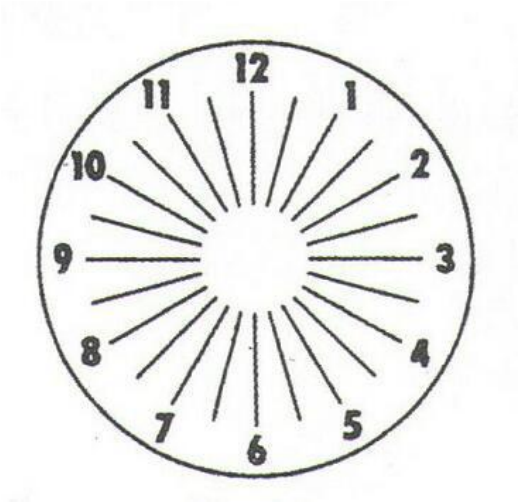



Fig.29

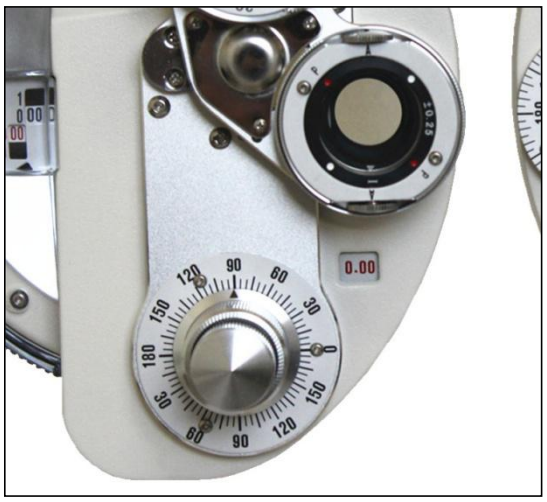



Fig.30

Myopic lens should be the lowest power, hyperopia lens should be the highest power. To correct Mr. A's power to 1.5, his glasses can be -1.75, -2.00 or -2.25, and choose the lowest -1.75. Vision test is almost done, but more precise measurements are needed.

**3.8.3 Accurate measurement of astigmatic axis and power**

<1> Set the cross cylinder lens (7) in front of the right eye of the subject, and adjust the letter "A" to the axis of the column mirror, as shown in Fig. 30.

<2> Project the cross cylinder lens dot diagram as shown in Fig.31. Flip the cross cylinder lens (7) by turning cross cylinder rotating knob(8). Then ask Mr. A to compare the images he saw before and after the cross cylinder lens flipped. Stop on the side that feels good. For example, if Mr. A can see the images most clearly when the cross cylinder lens shown as Fig.32, rotate cylinder axis knob (28) so that the axis of the cross cylinder lens moves 5° towards the red dot, and the cylinder axis dial (27) is positioned at 95°.

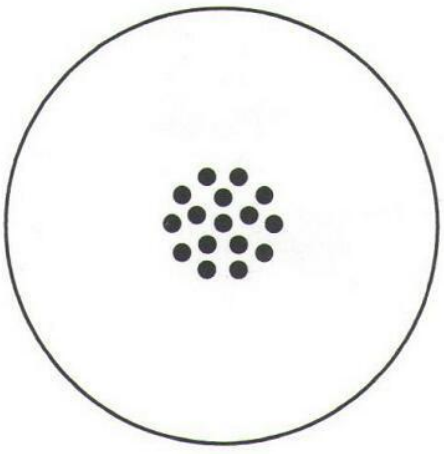


Fig.31

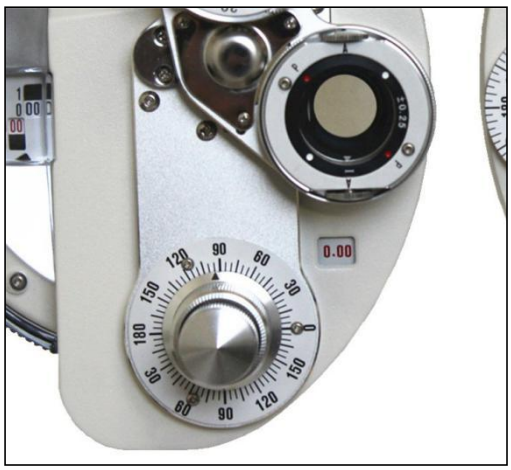



Fig.32

<3> Rotate lens and compare again. If Mr. A can see most clearly in Fig. 33, moves the axis of the cross cylinder lens 5°again towards the red dot to make it become 100°.
<4> Rotate the lens again, and if Mr. A doesn't see any difference, then the precise detection of the axial position is complete.(axis is 100 °)
<5> Then accurately measure the cylinder power (C) and rotate the letter P to the original axis position (Fig. 34).

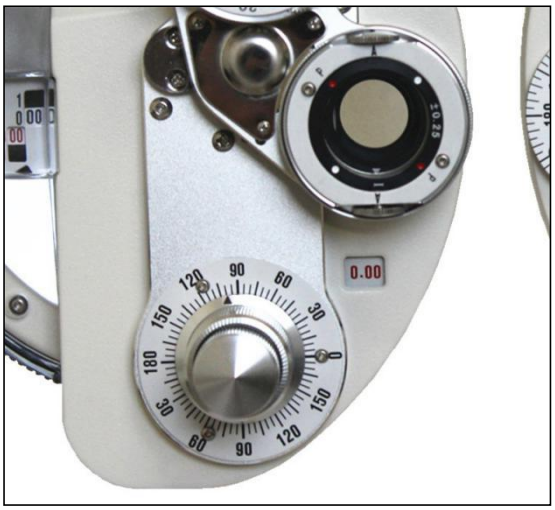


Fig.33

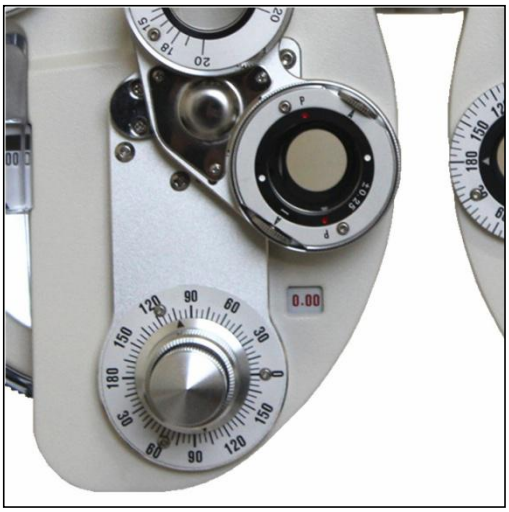


Fig.34

<6> Ask the subjects compare the images they saw through the dot diagram as shown in Fig.31, the steps are the same as <2>.
If when the red dot is marked at the position of letter P, the subject can see it most clearly, as shown in Fig.35, it means the subject's power has been increased by 0.25D. (Now is 0.75D.)
<7> Rotate lens and compare again. Assume the diagram is clearest when as shown in Fig. 36. Because the white dot is at P, the power should be reduced by 0.25D. If the red dot is at P, the power is increased by 0.25D. So the power is increased by a total of 0.5D.

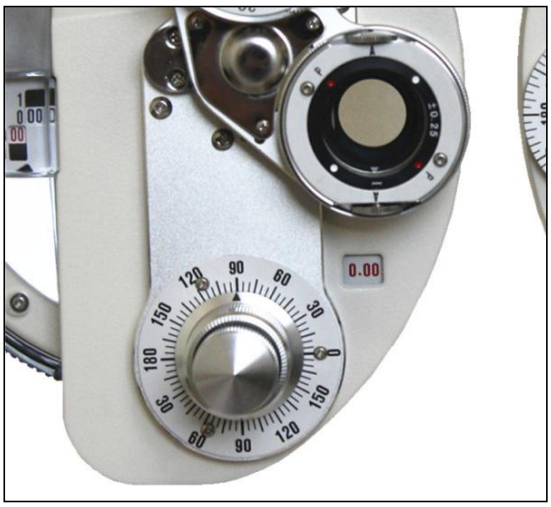


Fig.35

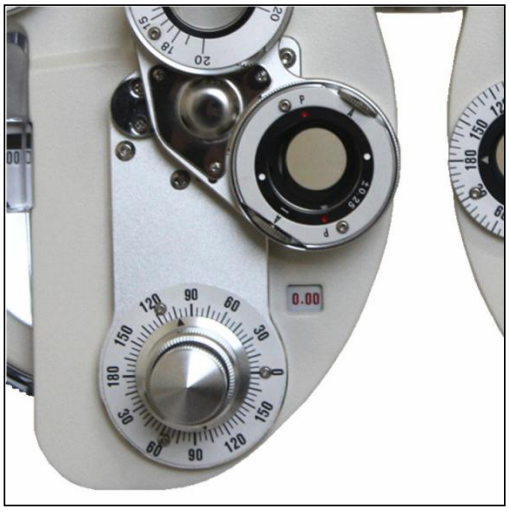


Fig.36

<8> Rotate the lens again to determine the result. If Mr. A thinks the diagram is clearest when as shown in Fig. 35, the correct correction power should be between 0.25D and 0.5D. Therefore, the exact power should be -0.62D.

**3.8.4 Accurate measurement of sphere power(red and green test)**

<1> Use the red and green test table to accurately measure the sphere value (Fig. 37). Ask the subject which of the red and green tables he can see more clearly. If the green one is clearer, it means myopia

increased (farsightedness reduced). Reduce the sphere value by 0.25D. -1.75→-1.50

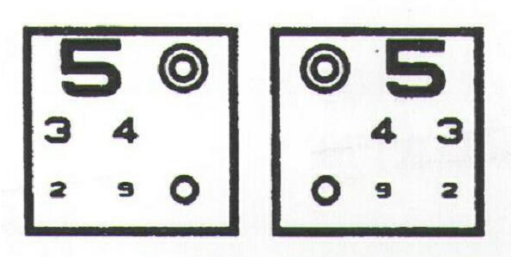


Fig.37

<2> Confirm with Mr. A again which chart is clearer. Red is clearer, that means myopia reduced (farsightedness increased). Mr. A's power is -1.62D. In general, myopia is regulated by the small sphere (the large sphere disk regulates farsightedness).

<3> Right eye test completed. Visual examination results are as follows:

Sphere value 1.50 cylinder lens value 0.50 axial distance 100°

R. $S-1.50^{D} \bigcirc C-0.50^{D}$ A100°

Next, measure the left eye. Rotate the auxiliary lens knob(21), set the left eye to 0 and the right eye to 0C. Measure the left eye by the method measuring the right eye, 3.8.2 Scieropia examination, 3.8.3 Accurate measurement of astigmatic axis and power, 3.8.4 Accurate measurement of sphere power(red and green test). Mr. A's left eye is:

L. $S-2.00^{D} \bigcirc C-0.50^{D}$ A170°

### 3.8.5 Both eye balance test

<1> Rotating prism mode

<a> Test is performed independently of the left and right eyes, but both with a binocular prism. These tests are basically binocular balance tests. Set both eyes to 0. Use the picture shown in Fig.31. Set the prism to 2△BU (right eye) and 2△BD (left eye) (Fig. 38).

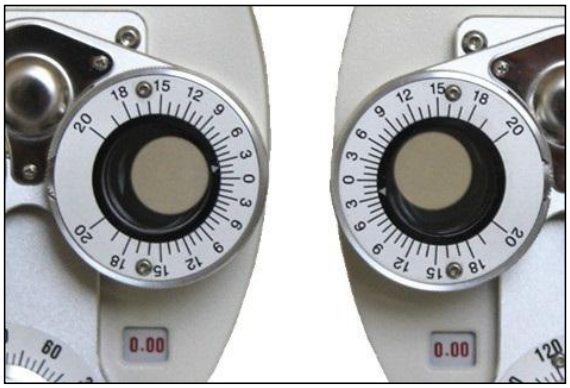



Fig.38

Mr. A now sees two pictures, one on top of the other. When asked which picture is clear, Mr. A replies that the above picture is clearer. The left sphere value increased by +0.25D, that is (-1.50) + (+0.25) =-1.25D. If he answers below is more clearer, the right sphere value increased by +0.25D. That is (-2.00) + (+0.25) = -1.75D.

<c> Confirm with Mr. A again which is clearer. When he sees both equally clear, the balance test is completed.

<d> Remove away the rotating prism. The sphere lens power of both eyes increased by +1.00D. Therefore, Mr. A's eyesight should be

R. S-0.25D C-0.50D A100°

L. S-0.75D C-0.50D A170°

<e>Increase the binocular sphere lens value with a minimum power of 0.25D. Gradually change the lens value until he can see clearly 1.2 or 1.5 (20/15). If he wants to see 1.5 (20/15) clear, change the sphere as follows:

R. S-1.25D C-0.50D A100°

L. S-1.75D C-0.50D A170°

<2> Polaroid test mode

<a> Turn the auxiliary lens knob (21) to P (both eyes). Project binocular balance test screen.

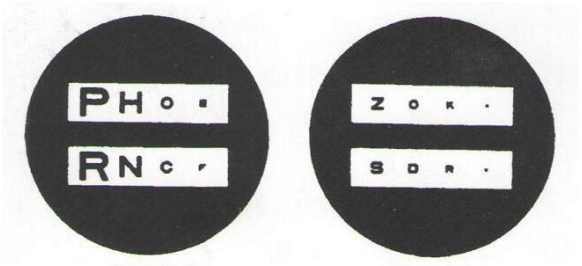


Fig.39 Fig.40

<b> Now Mr. A sees two pictures, one on top of the other, When asked which picture is clear, Mr. A replies that the above picture is clearer, his right eye can see the upper row, and his left eye can see the lower row. If the two rows are equally clear, the balance is good. If the two rows are not equally clear, increase the value by + 0.25D to the sphere lens of the eye that sees the clearer picture until the two rows are equally clear.

<c> Turn the auxiliary lens knob (21) to 0 (both eyes). Increase the sphere lens value by + 1.00D in both eyes.

<d> Gradually reduce the binocular sphere lens value with a minimum power of 0.25D until binocular power is 1.2 or 1.5.

**3.8.6 Long distance heterophoria examination**

<1> Maddox cross and rotating prism mode

<a> First examine the horizontal heterophoria. In the same way of rotating prism as the 3.8.5 binocular balance test <1>, rotate the auxiliary lens knob(21), set the right eye to RMH(Fig.44), and rotate the rotating prism(26) so that its 0 is set on the triangle sign and on the left eye. Place a small fixed light beam on the chart. Mr A can see a straight red line with his right eye(Fig.43-a) and a bright spot with his left eye (Fig.43-b). They could be a or b in Fig.45. When the prism rotation knob (25)is be rotated, the bright spot also moves. Ask the subject when they see the image shown in Fig. 43-b. The test results are shown in Fig.44. The prism rotation value is shown as 2. The result is 2△BI (base inward), representing 2△outward inclination.

<b> Vertical heterophoria measurement. As shown in Fig.42, turn the auxiliary lens knob(21) to set RMV to the right eye, and turn the rotating prism(26) to set the left eye to the horizontal position. Mr. A can see a horizontal red line with his right eye and a bright spot with his left eye. The steps are the same as <a>. When turning the prism rotation knob(25), ask Mr. A when the red line and the bright spot coincide. When shown in Fig.46, Mr. A indicates that they coincide, the reading is 0.5 and below 0, that represents 0.5△BD of the left eye, and is called 0.5△anaphoria.




Fig.41


Fig.42

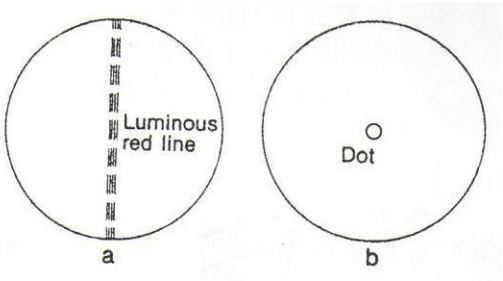



Fig.43

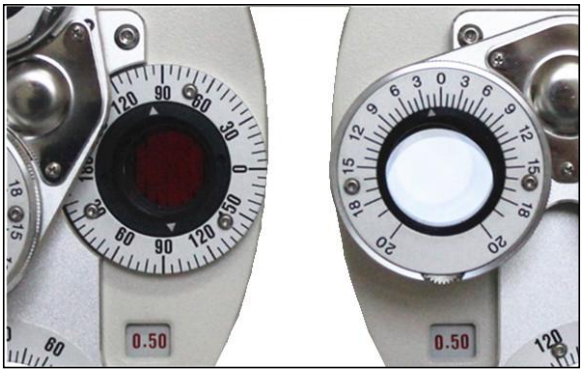



Fig.44

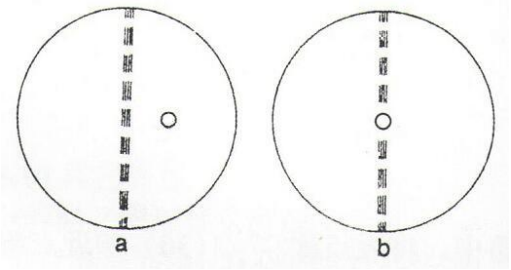



Fig.45


Fig.46

<2> Polaroid test mode

<a> Turn the auxiliary lens knob (21) to P. Use a visual chart to project a polarized image (Fig. 47).

<b> If the subject does not squint, the subject will see four lines as shown in Fig.47. If the subject has a squint, the four lines the subject sees will not align.

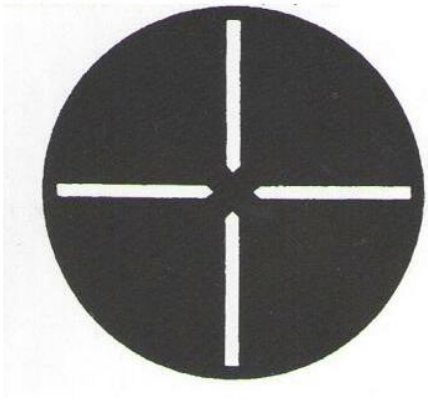


Fig.47

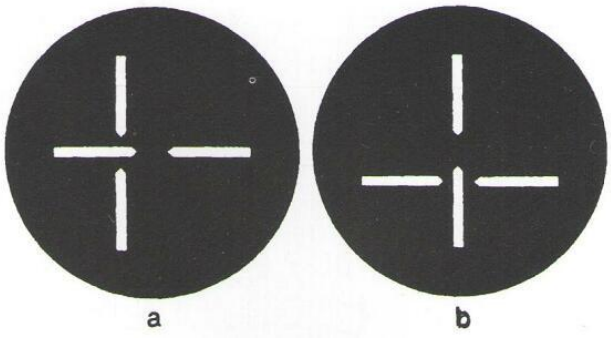



Fig.48

<c> When the vertical line distribution seen by the subject is shown as Fig.48-a, rotate the rotating prism(26) of the left eye to position 0 upward. Slowly turn the prism rotation knob(25) so that the image is shown as Fig. 47 (horizontal heterophoria).
<d> When the horizontal line distribution seen by the subject is shown as Fig.48-b, adjust 0 to the horizontal position, and then turn the prism rotation knob(25) to make the image shown as Fig.47 (vertical heterophoria).
<e> When the horizontal and vertical lines the subject seen are both squint, as shown in Fig.49, adjust the rotating prism(26) to 0 so that the vertical line is in the middle of the horizontal line, as shown in Fig.48-b (horizontal heterophoria). Then adjust position 0 horizontally and rotate the prism rotation knob (25) so that the horizontal line is in the middle of the vertical line, as shown in Fig.48-a (vertical heterophoria).

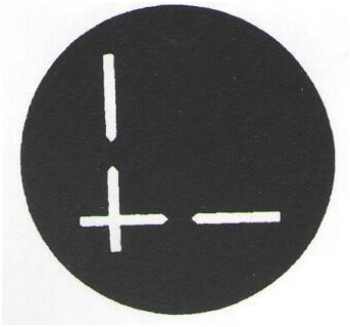


Fig.49

### 3.8.7 Examining report out

Mr. A finished his examination. If heterophoria is serious, he should adjust lens. If Mr. A does not have severe heterophoria, the optometry results are as follows:

| | |
|---|---|
| P. D. | 63mm |
| R. | $S-1.25^{D} \bigcirc\!\!\!\!\frown C-0.50^{D}$ A100° |
| L. | $S-1.75^{D} \bigcirc\!\!\!\!\frown C-0.50^{D}$ A170° |

### 3.8.8 Presbyopia test

This test is for people over the age of 45.
<a> First confirm the measured distance and place it in the inspection optical path. Install the near point rod (43) on the near point rod holder(15) and fix the near point rod locking knob (4).
<b> Turn the auxiliary lens knob (21) to ±0.5 (both eyes).
<c> Use the rotating near point chart (44) (visual chart 3) for the near point test of the subject. Ask the subject about the vertical and horizontal lines he sees. If he is presbyopia, he will see a clear horizontal line and a blurry vertical line (If the two lines look the same, you don't need wearing presbyopic glasses).
<d> Increase S value by 0.25 in both eyes until the horizontal line is as clear as the vertical line.

<e> Change the value of both eyes ±0.5 to 0, rotate the near point chart to display lowercase characters, set the chart to 6, then ask whether the characters are clear, S value needs to be adjusted appropriately. The test is completed and the record the results.

**3.8.9 Short distance heterophoria examination**

<1> Horizontal heterophoria

If the subject has no presbyopia, set the results of long distance heterophoria examination in the optical path. If the subject has presbyopia, put the results on the short distance test. Place it nearly 40cm away from the visual chart and set it to 6. Rotate the auxiliary lens knob (21), set the right eye to 6△U to separate the digital rows completely. If the subject has horizontal presbyopia, as shown in Fig.50. Turn the rotating prism (26) to another eye, 0 upwards (Fig.52). Rotate the prism rotation knob (25) so that the both eyes are indistinguishable (Fig.51). At this time, the value of the rotation prism is prism power.

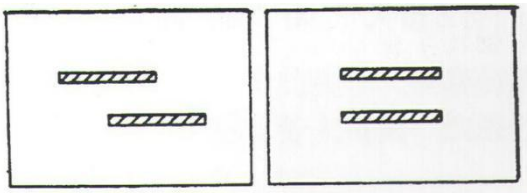


Fig.50 Fig.51

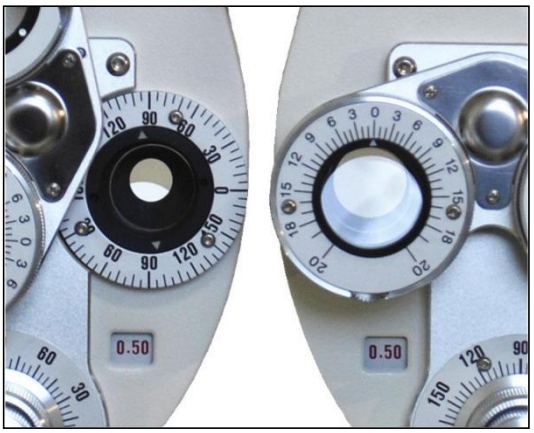



Fig.52

<2> Vertical heterophoria

Set the near point chart to 12. Rotate the auxiliary lens knob(21), and set the left eye to 10△I to completely separate the digital column, if the subject has a vertical heterophoria, as shown in Fig.53. Rotate the rotating prism to another eye, 0 level(Fig. 55). Rotate the prism rotation knob (25) so that there is no difference between the top and the bottom (Fig.54). Rotating prism value is the vertical heterophoria power.

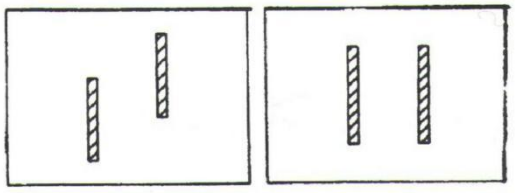


Fig.53 Fig.54

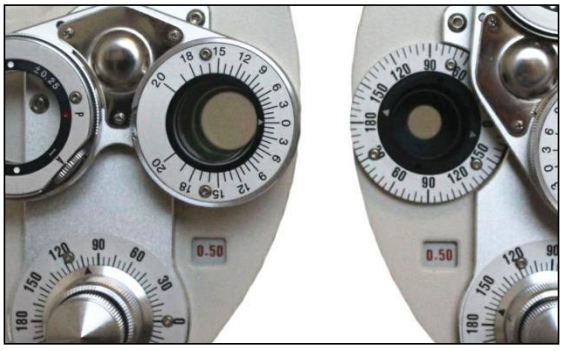



Fig.55

**3.8.10 Other measurements**

<1> movement (eye abnormal movement)

Set the rotating prism (26) in front of both eyes and set the 0 on top. Measure the adduction of the eye at a long distance, turning the prisms of both eyes outward simultaneously. When the chart is viewed as two images(the point first appears) in the vertical direction, the reading indicates adduction. Rotating prism can measure the maximum value is 40△(about 22°). When measuring abduction, the prisms of both eyes rotate inward simultaneously. Record readings when an object is viewed as two images. The maximum test range is 40△, if the auxiliary lens tray uses 10△BI, the maximum test value is 50△. When the rotating near point chart is fixed on the near point rod(43), the adduction and abduction of the near point

can be measured. Other measurements are the same.
<2> Vertical abduction
Adjust the rotating prism (26) in front of both eyes and set the 0 level. Use the horizontal characters in the visual chart to do the far point test (5m), and the near point chart to do the near point test. Rotate the prism rotation knob (25) to record the reading that is the subject's vertical abduction force when the horizontal character appears double image.

### 3.8.11 Result conversion calculation

The phoroptor uses the way of myopic and astigmatism to measure scieropia measurement. However, hyperopia and astigmatism are sometimes required. Please use the following formula to correct the results.

$SX^{D} \overset{\frown}{\frown} CY^{D} AZ^{O} \rightarrow S（X+Y）^{D} \overset{\frown}{\frown} C（-Y）^{D} A（Z±90）°$

S: add the astigmatism power to the sphere power
C: change astigmatism power index (+-)
A: when Z value is less than 90°, add 90°; When Z value is greater than 90°, reduce 90°.

Case 1

To $S+3.00^{D} \overset{\frown}{\frown} C-1.00^{D}$ A175°becomes

S: （+3.00）+（-1.00）=+2.00
C: （-1.00）=+1.00
A: 175°-90°=85°
So the result is:
$S+2.00^{D} \overset{\frown}{\frown} C+1.00^{D} A85°$

Case 2

To $S+0.5^{D} \overset{\frown}{\frown} C+0.75^{D} A85°$

S:（+0.5）+（+0.75）=+1.25
C:-（+0.75）=-0.75
A:85°+90°=175°
So the result is:
$S+1.25^{D} \overset{\frown}{\frown} C-0.75^{D} A175°$

# 4. Maintenance

## 4.1 Daily maintenance

<1> Use a dustproof cover (37) to prevent dust when the instrument is not used.
<2> For long-term storage, keep the instrument in a dry and dust-free place.
<3> Lens dirty, with cotton glasses cloth wipe, can add a little alcohol appropriately .

## 4.2 Check and maintenance procedures

No special check or service is required for normal use. However, when used at extremely low temperatures, all rotating knobs or discs will become heavy because of internal lubricants, not any

mechanical reason. When the temperature returns to normal, everything will be normal.
Due to the conditions or environmental relations, the instrument cleaning and lubrication is also necessary, but generally speaking after 3 or 4 years it needs our after-sales service personnel to do a service. Then, please contact our authorized agent.

## 5. Fault description before repair request

If any failure occurs, first do the following steps following the recommendations, and then contact us when the failure still cannot be eliminated.

<1> Lens required cannot be set in the inspection optical path.

- Is the knob rotated in place?
- Are there any other lens in the optical path?

<2>Dose the instrument work when adjusting the focusing handle?

Is PD less than 54MM?

(when PD is less than 54mm, the focusing handle cannot be adjusted)

## 6. Instrument parameters

<1>Sphere powers range:

+16.75D to-19.00D, with minimum reading 0.25D or 0.12D

(When +0.12D auxiliary lens or optional ±0.12D lens is in use)

<2>Cylinder power range:

0 to-6.00D, with minimum reading 0.25D or 0.12D (when auxiliary lens is in use)

0 to-8.00D (when-2.00D auxiliary lens is in use)

<3>Astigmatic axis scale:

0 to 180°, each step is 5°

<4>Cross cylinder:

±0.25D, reversal type (synchronized with astigmatic axis)

<5>Rotary prism:

0 to 20ΔD, each step is 1ΔD.

<6>Interpupillary adjustment:

50mm to 80mm, each step is 1mm (right and left synchronized)

<7>Forehead rest adjustment:

13mm backward and forward

<8>Convergence:

The optical axes of the lens are aligned at a distance of 400mm from the vertexes of the corneas (2mm each for right and left inward)

Interpupillary distance enabling convergence=57mm to 80mm

<9>Effective field of view: 18.5mm

<10>Weight: 5kgs

<11>Size: 323mm×315mm×85mm