TOPCON

INSTRUCTION MANUAL

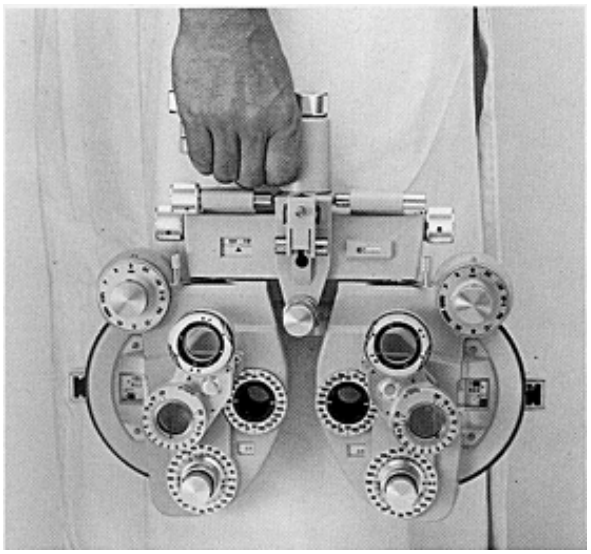
VISION TESTER

VT-10

Thank you for purchasing the TOPCON Vision Tester VT-10. To get the best use from the instrument, please carefully read these instructions and place it in a convenient location for future reference.

PRECAUTIONS

1. TOPCON VISION TESTER VT-10 should always be carried while holding the top of instrument by the bracket or by supporting the back (the face without knobs) using both hands, as shown in Fig.1 and 2.
2. Never place the instrument with the face down or let pressure be applied to the loupes. Never touch the sight apertures or power indication windows.
3. Never leave the instrument in a damp or dusty place.
4. Ail moving parts turn in both directions safely but use care never to forcibly turn beyond the stops as damage will result.
5. Wipe plastic parts (forehead rest, levers, etc.) with a silicone or damp cloth, never using cleansers or other chemicals.
6. TOPCON takes no responsibility for any unauthorized adapting or disassembling of the instrument.
7. If the instrument fails to operate, satisfactorily even after following the instructions in this manual, contact TOPCON's nearest authorized agent or ex-port office.



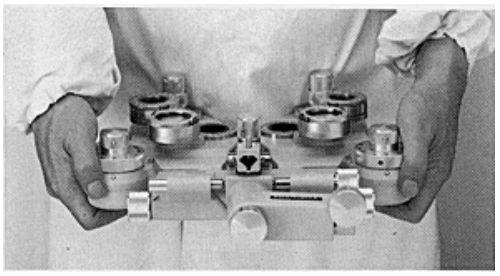


Fig. 1

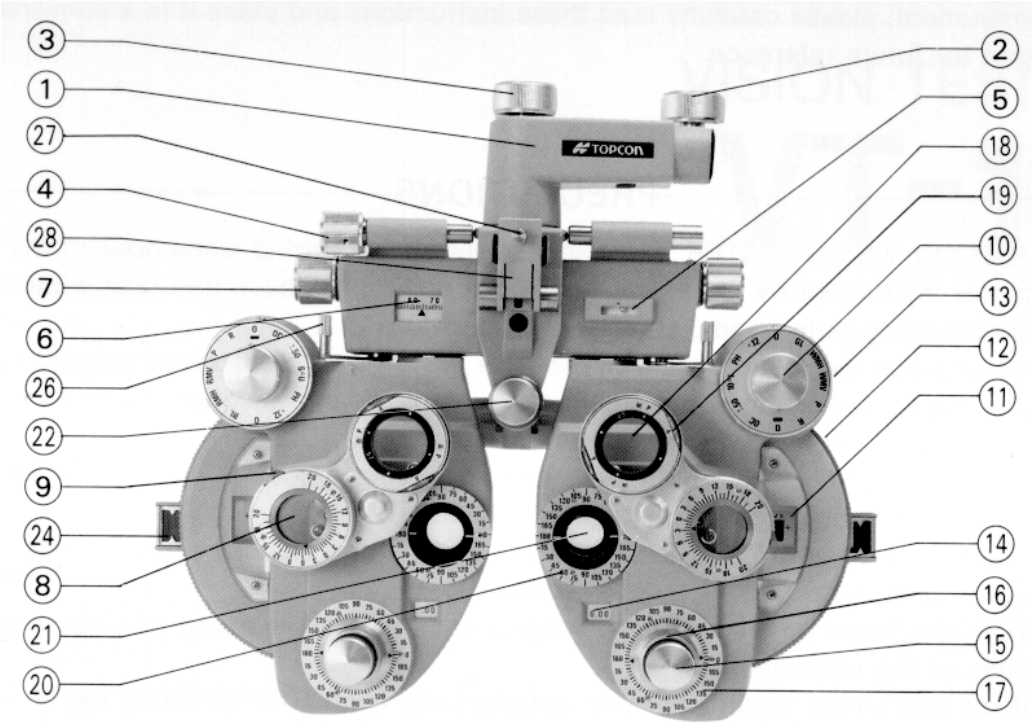

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Fig. 3

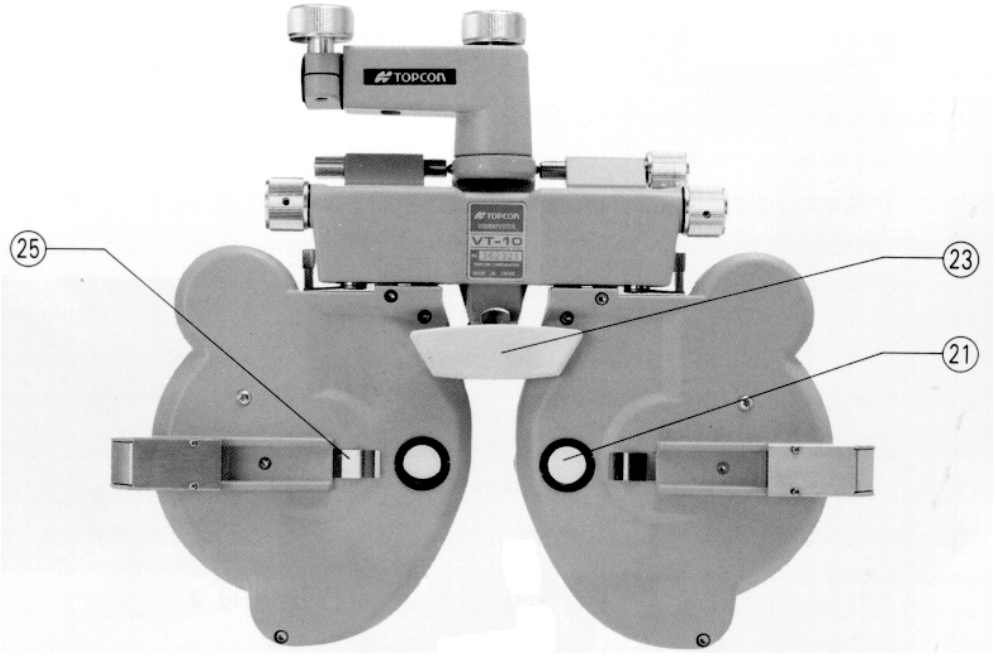

TOPCON
VT-10
25
23
21

Fig. 4

CONTENTS

1. NOMENCLATURE

(1) **Mounting bracket**
Used to mount VT-10 to the ophthalmic stand.
(2) **Tightening knob**
Used when fixing VT-10 to the ophthalmic stand.
(3) **Rotation adjustment knob**
Turning this knob adjusts direction of the main unit.
(4) **Leveling knob**
For leveling adjustment.
(5) **Spirit level**
Indicates level position.
(6) **PD scale**
Indicates pupil distance setting
(7) **PD knob**
For adjusting pupil distance setting
(8) **Rotary prism**
Used when checking patients for phoria test or in binocular balance test.
(9) **Prism rotation knob**
Used to adjust the prism diopter.
(10) **Auxiliary lens knob**
Used for various visual acuity tests
(11) **Spherical power scale**
Indicates spherical power
(12) **Weak spherical power dial**
Spherical lens is set to the examination aperture by 0.25 diopter.
(13) **Strong spherical power knob**
Spherical lens is set to the examination aperture by 3.00 diopter.
(14) **Cylindrical power scale**
Indicates cylindrical power
(15) **Cylindrical lens knob**
Cylindrical lens is set to the examination aperture.
(16) **Cylindrical axis knob**
Adjustments cylindrical lens axis
(17) **Cylindrical axis scale**
Indicates cylindrical lens axis angle
(18) **Cross cylinder**
For checking fine astigmatic power, astigmatic axis, and spherical power at far point.
(19) **Reverse knob**
Changes plus or minus cross cylinder axis
(20) **Cylindrical axis reference scale**
For reference of cylindrical lens axis

(21) **Examination aperture**
For patient's observation. Various lenses for tests are set here.
(22) **Forehead rest knob**
For adjusting patient's forehead position.
(23) **Forehead rest**
Patient's forehead rests here.
(24) **Corneal aligning aperture**
Examiner can observe the position of patient’s cornea.
(25) **Face shield clip**
Positions the patient’s face using a face shield (accessory).
(26) **Vergence lever**
Used to adjust unit vergence
(27) **Near point rod clamp screw**
Fixes near point rod
(28) **Near point rod holder**
Attach near point rod with this holder.

*** Accessories**

(29) **Instruction manual**

(30) **Near point rod**
Card holder is attached to the position of near point measuring on this rod.

(31) **Rotary near point card**
Includes near point chart.

(32) **Card holder**
Attach rotary near point card here.

(33) **Dust cover**
For storage. Always use this cover when not in use, to protect the instrument from dust and foreign matter.

(34) **Accessory box**
For storing the standard accessories.

(35) **Face shield**
Attach this to the equipment to position the patient's face.

(36) **Accessory screwdriver**
Used for removing or attaching the glass of examination aperture.

(37) **Lens cleaner**
Used for cleaning lenses.

(38) **Accessory lens**
Used to change the measuring range or steps of lens diopter

(39) **Retaining screw**
Fixes VT-10 so that it cannot be removed from the ophthalmic stand.

(40) **Hexagon socket screw key**
Used for tightening retaining screw (39).

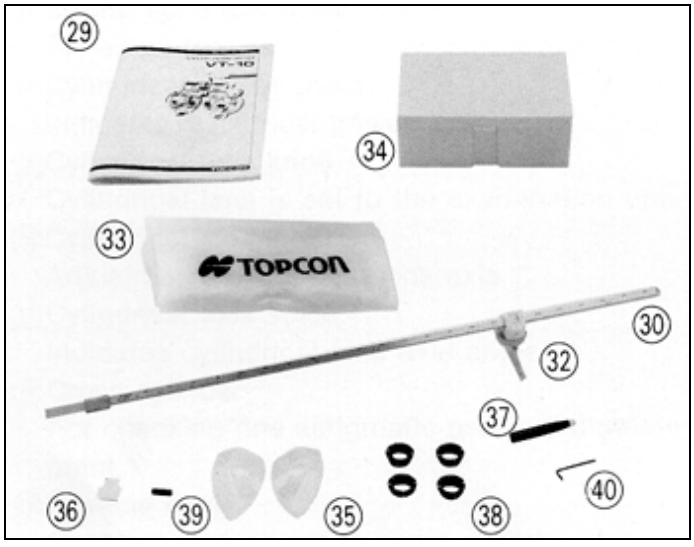


Fig. 5

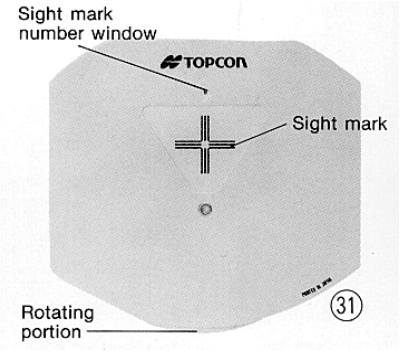


Fig. 6

2. ASSEMBLY

2.1 Components

The complete set of Topcon Vision Tester VT-10 includes the following:

A) Accessory box
B) Retaining screw
C) Face shield
D) Near point rod
E) Card holder
F) Rotary near point card
G) Accessory lens
H) Accessory screwdriver
I) Lens cleaner
J) Dust cover
K) Hexagon socket screw key
L) Instruction manual

2.2 Assembly Procedure

2.2.1 Attaching unit to ophthalmic stand

In use, the instrument is suspended from mounting bracket (1). Insert the mounting rod extending from the ophthalmic stand to the holes in both the arm and underside of the mounting bracket, then fix them with tightening knob (2). Finally, screw in retaining screw (39) included in the standard accessories, in the hole in the underside of the mounting bracket. To level the instrument, turn leveling knob (4) until the spirit-level bubble (5) matches the orange colored dot. To adjust the direction of the instrument, loosen rotation adjustment knob (3), then turn the instrument until it faces to the required direction. (See Fig. 7).

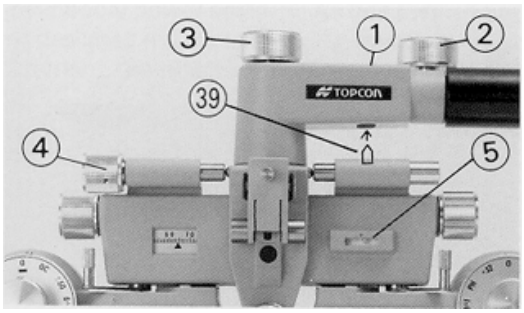


Fig. 7

2.2.2 Attaching near point rod (30), card holder (32) and rotary near point card (31)

Insert card holder (32) from the top end of near point rod (30). Once inserted, the card holder can be slid along near point rod (30).
To attach rotary near point card (31) to the holder, put the card in the spring of card holder (32). (See Fig. 8)
Next, put near point rod (30) into near point rod holder (28), then fix it by tightening near point rod clamp screw (27). When the rod is not used, store it by raising it as shown in Fig. 9.

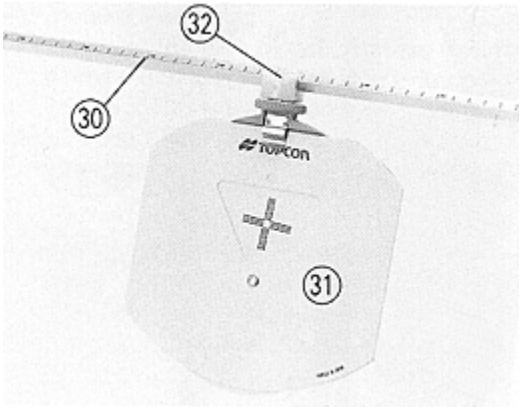


Fig. 8

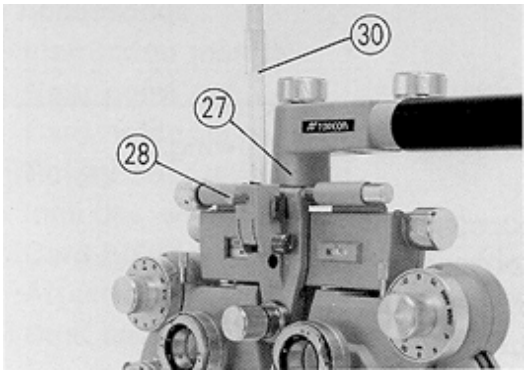


Fig. 9

2.2.3 Attaching face shield

Attach face shield (35) so that the face shield clip (25) catches it, then fit them into the frame at the patient's side of examination aperture (21). (See Fig. 10)

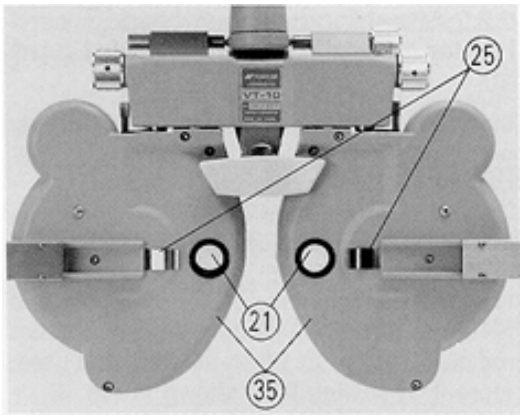


Fig. 10

3. OPERATION PROCEDURES

3.1 Spherical Lens

To show only the spherical power (from here simply: S), set auxiliary lens knob (10) to O or O, then turn cylindrical power knob (15) until '.00' showns on cylindirical power scale (14). Now by turning weak spherical power dial (12), S value displays in spherical power scale (11) within a range from -19.00 to +16.75 diopter in 0.25 diopter steps (See Fig. 11). Although several figures will appear on the scale, only the three- or four-digit numbers have meaning. For example, if '075' shows, it should be read as '0.75 diopter' and if '1150' shows, it should be read as '11.50 diopter'.

To obtain to the desired diopter setting quickly, use strong spherical power knob (13). S values shown change by 3.00 diopter steps (See Fig. 12).

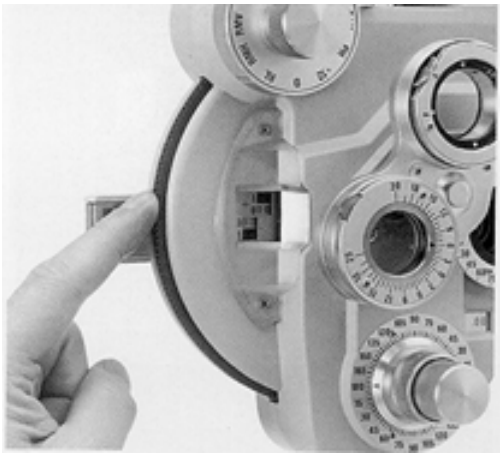


Fig. 11

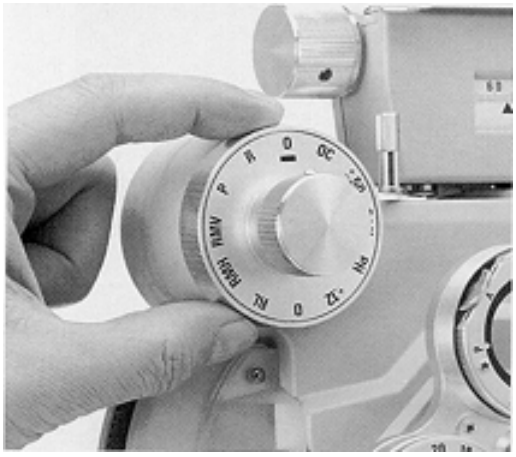
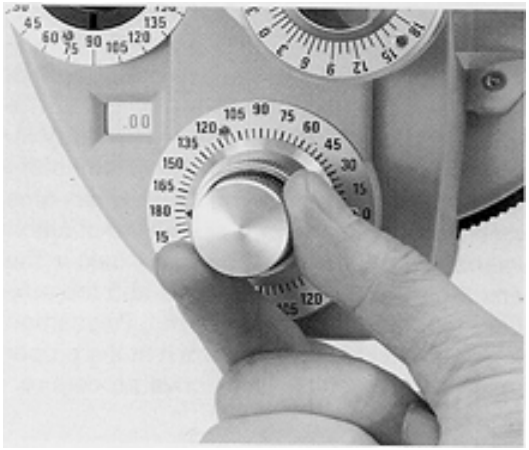


Fig. 12

3.2 Cylinder Lens

By turning cylindrical lens knob (15), the cylinder lenses from 0.00 to 6.00 diopter are set in 0.25 diopter steps. The cylidrical power of the lens cylinder setting is shown on cylindrical power scale (14). As this instrument is designed mainly for 'fogging method' measurement, the results are always shown as minus (-). (If required, a model with plus (+) display is also available.)

To determine the axis of astigmatism (cylindrical lens axis), turn cylindrical axis knob (16) and axis direction is shown on cylindrical axis scale (17) (See Fig. 14).



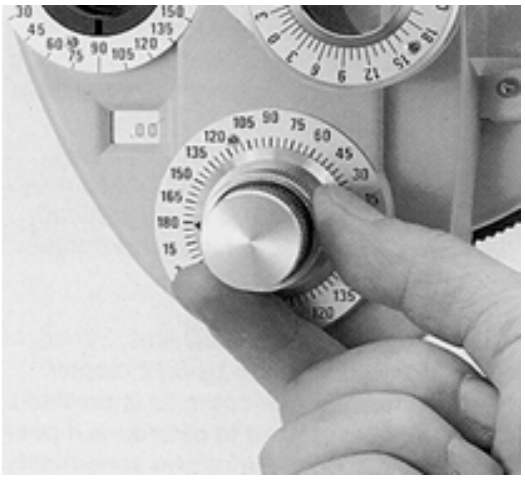


Fig. 13

Fig. 14

3.3 Auxiliary Lens

Turn the auxiliary lens knob (10) so that the desired lens indexes at the 12 o'clock position. The referenced lens will now appear in the examination aperture (21).

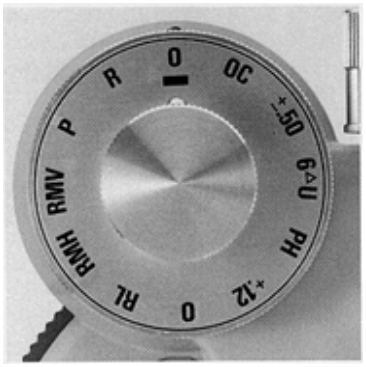


Fig. 15

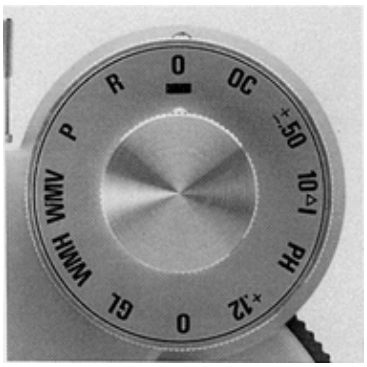


Fig. 16

O,O :Open aperture
R :Retinoscopic lens; +1.50 diopter spherical lens (for 67cm)
P :Polarizing filter. Used for polarizing testing of phoria, binocular balance of stereoscopic vision.
RMV :Red Maddox rod is set vertically.
RMH :Red Maddox rod is set horizontally.
WMV :White Maddox rod is set vertically.
WMH :White Maddox rod is set horizontally.
RL :Red lens.
GL :Green lens.
+.12 :+.12diopter spherical lens. Spherical power can be set by 0.12 diopter.
PH :A 1mm diameter pinhole is provided. This lens is used to determine if poor vision is due to refractive abnormality or other causes.
6 U :6 diopter base up prism. Used for the tests such as horizontal phoria test.
10 I :10 diopter base in prism. Used for the tests such as vertical phoria test.
±.50 :±0.5 diopter cross cylinder with horizontal plus (+) axis. Used for presbyopia test.
OC :Occuluder

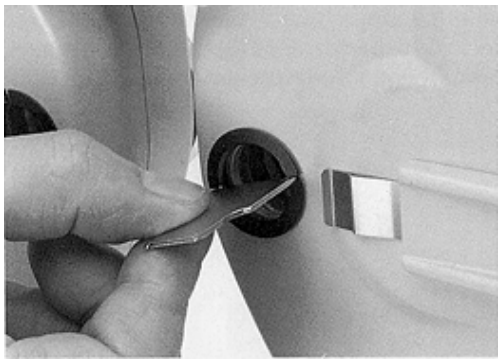


Fig. 17

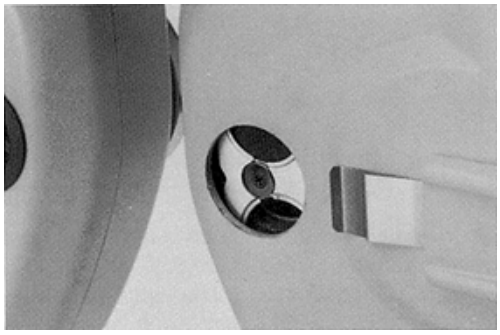


Fig. 18

To change either ±.50 cross cylinder, polaroid filter, or retinoscope lens, first remove the rear cover glass and retaining ring with the accessory screwdriver (36) as shown in Fig. 17. Rotate the auxiliary lens knob until the accessory lens to be changed is properly indexed and in alignment with the examination aperture. By slightly turning the auxiliary lens knob in both directions, a screw and position washer can be seen above and below the lens. Remove these two screws and the auxiliary lens can then be removed. Reposition or replace the lens and secure it in the proper position by reversing the above procedure.

3.4 Cross Cylinder (18)

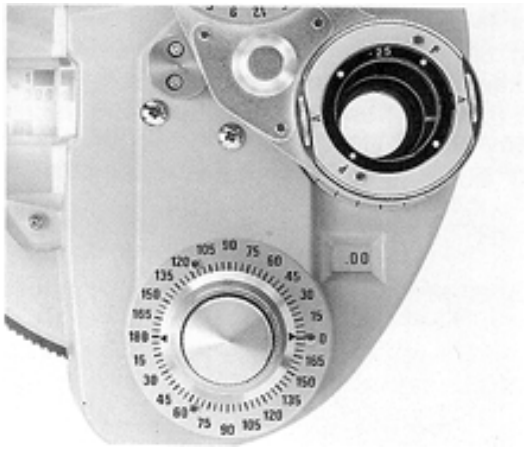


Fig. 19

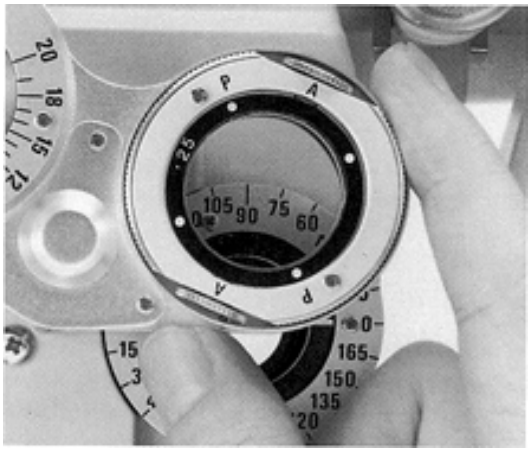


Fig. 20

Used for precise determination of cylinder power and axis. Hold outer frame of cross cylinder lens to set it to the examination aperture. The letter ‘A’ at the front stands for Axis and 'P' for Power. An inner white dot indicates plus axis and outer orange dot indicaters minus axis position. ‘A’ changes to ‘P’ or vice versa as the outer frame is turned. Plus and minus axes can be altered by turning reverse knob (19).±0.37 diopter or ±0.50 diopter cylinder lenses are optionally available to be attached to VT-10.

* Replacing cross cylinder lens

(1) Remove the two setscrews on the cross cylinder lens.
(2) Remove retaining ring with letters, ‘A’ and ‘P’ then remove the spring behind the ring.
(3) Remove the previously set cross cylinder.
(1) Set the new cross cylinder lens following steps 1 to 3 above in reverse.

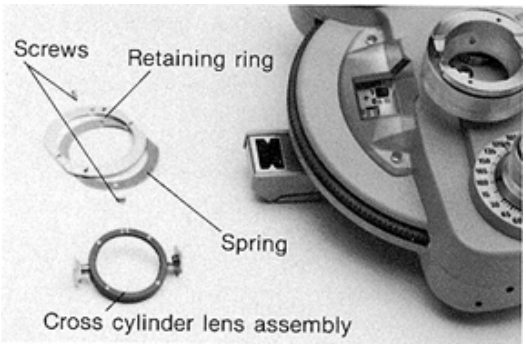


Fig. 21

3.5 Rotary Prism (8)

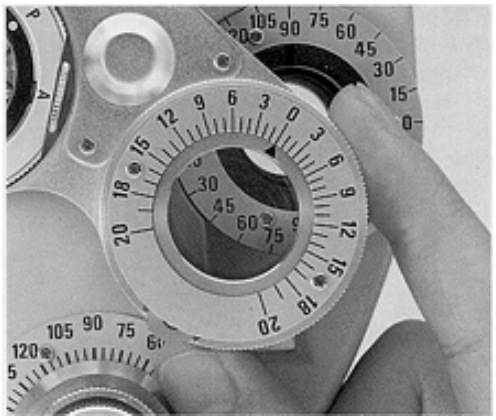


Fig. 22

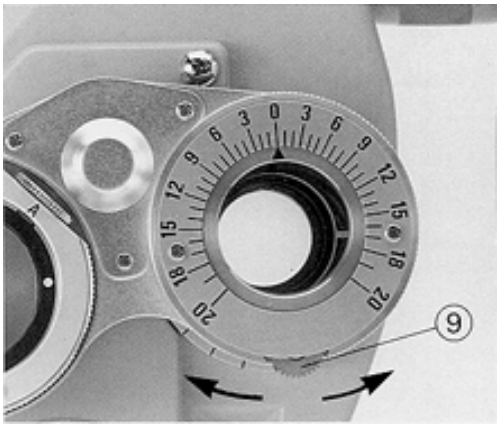


Fig. 23

Turn rotary prism (8) by holding the base of rotary prism to set it on the examination aperture. To change prism power, turn prism rotation knob (9) (see Fig. 23) until the prism with required power is set. For example, if prism rotation is set as Fig. 23, as the prism diopter of set lens is 0, it is the same as if no prism is set. Fig. 24 means 3 prism diopter base-in (3 BI). By turning the entire prism unit, the direction of prism base in changes. In Fig. 25, it mean 3 Base up 3. Fig. 25 shows the rotary prism setting when 3 prism diopter (3´BU) base direction moves upward.

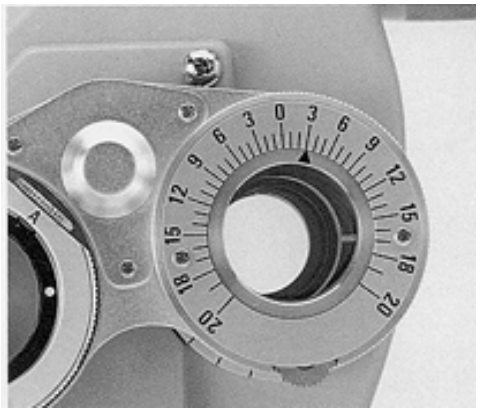


Fig. 24

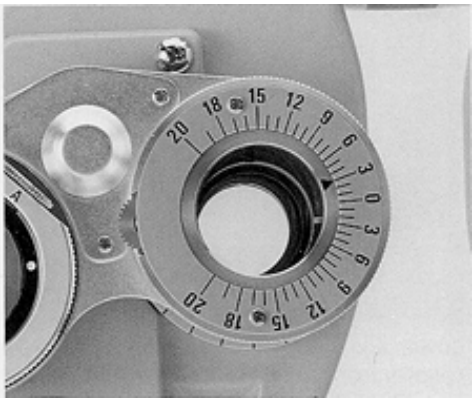


Fig. 25

3.6 Corneal Aligning Device

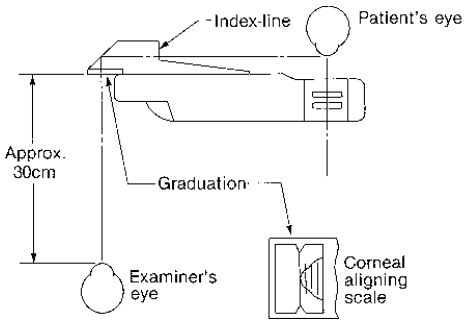


Fig. 26

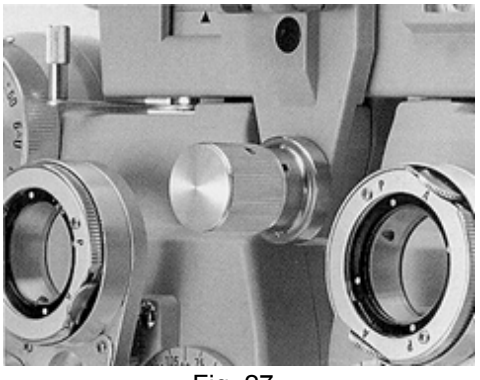


Fig. 27

Turn forehead rest knob (22) to adjust the position of forehead rest (23) (See Fig. 27). After settling the patient's forehead on the rest, look through the corneal aligning aperture (24) from approx. 20cm away. Look at the patient's apex of the cornea after the pointer aligns with the longer line on the scale as shown in Fig. 26. The longer line in the aperture means the measuring distance is 13.75mm which is the standard spectacle wearing distance. Three shorter lines are provided by 2mm steps from the longest. Therefore, if the apex of the cornea positions on the second shortest line from the longest, the lens power obtained by measurement is that when the spectacle is placed at 17.75mm away from the apex of the cornea; 13.75 (standard distance) + 4 (the value corresponding to the second shorter line) = 17.75mm. If the actual spectacle wearing distance is different from the standard (13.75mm), correction according to Table 1 and 2 is required.

Example 1.

Assume that the prescription of S +8.00 diopter is obtained when the apex of the cornea positions at the second shortest line from the longest line meaning that it is 4mm away from the standard wearing distance: Refering the correction factor for +8.00 diopter and 4mm distance in Table 1, the applied correction factor is +0.26 diopter. So, the lens power at 13.75 distance from the apex of the cornea should be (+8.00) + (+0.26) = 8.26 diopter. The value after correction should be rounded by 0.25 or 0.12 diopter steps.

Example 2.

When the apex of the cornea is between second and third shortest lines from the longest line (5mm from the standard), the prescription of S -11.50 diopter is given:

Referring the corresponding correction factor for -11.50 diopter and 5mm distance in Table2, the correction factor to be used is: (0.57 + 0.67)/2 = 0.62 diopter. So, the lens power at 13.75 mm distance from the apex of the cornea should be (-11.50) + (+0.62)=-10.88 diopter.

Example 3.

When the apex of the cornea is on the third shortest line from the longest one, the prescription of S -14.00 diopter is given:

Referring the corresponding correction factor for -11.50 diopter and 5mm distance in Table2, the correction factor to be used is 1.08 diopter. So, the lens power at 13.75mm distance from the apex of cornea should be (-14.00) + (+1.08) = -12.92 diopter. And for cylindrical power, first calculate (-14.00) + (-6.00) = -20.00 diopter. Then, refer the corresponding correction factor on Table2 for -20.00 diopter and 6mm and the correction factor is 2.14 diopter. The lens power at 13.75mm distance from the apex of cornea is (-20) + (+2.14) = -17.86 diopter. Accordingly, S: -12.92 diopter C: -4.94 diopter. For more precise calculation, you may desire to use the following

$$D' = D \pm \frac{L \cdot D2}{1000 - L \cdot D}$$

fomula for the correction factor.

D :Measured power (diopter)
D' :Corrected power (diopter)
L :Difference between measuring distance and wearing distance (mm)

L mm / D dptr	1	2	3	4	5	6	7	8	9	10
+ 1.00	.001	.002	.003	.004	.005	.006	.007	.008	.009	.01
+ 2.00	.004	.008	.01	.02	.02	.02	.03	.03	.04	.04
+ 3.00	.009	.02	.03	.04	.05	.06	.06	.07	.08	.09
+ 4.00	.02	.03	.05	.07	.08	.10	.12	.13	.15	.17
+ 5.00	.03	.05	.08	.10	.13	.15	.18	.21	.24	.26
+ 6.00	.04	.07	.11	.15	.19	.22	.26	.30	.34	.38
+ 7.00	.05	.10	.15	.20	.25	.31	.36	.42	.47	.53
+ 8.00	.06	.13	.20	.26	.33	.40	.47	.55	.62	.70
+ 9.00	.08	.16	.25	.34	.42	51	.61	.70	.79	.89
+10.00	.10	.20	.31	.42	.53	.64	.75	.87	.99	1.11
+11.00	.12	.25	.38	.51	.64	.78	.92	1.06	1.21	1.36
+12.00	.15	.30	.45	.61	.77	.93	1.10	1.27	1.45	1.64
+13.00	.17	.35	.53	.71	.90	1.10	1.30	1.51	1.72	1.94
+14.00	.20	.40	.61	.83	1.05	1.28	1.52	1.77	2.02	2.28
+15.00	.23	.46	.71	.96	1.22	1.48	1.76	2.05	2.34	2.65
+16.00	.26	.53	.81	1.09	1.39	1.70	2.02	2.35	2.69	3.05
+17.00	.29	.60	.91	1.24	1.58	1.93	2.30	2.68	3.07	3.48
+18.00	.33	.67	1.03	1.40	1.78	2.18	2.59	3.03	3.48	3.95
+19.00	.37	.75	1.15	1.56	1.99	2.44	2.91	3.41	3.92	4.46
+20.00	.41	.83	1.28	1.74	2.22	2.73	3.26	3.81	4.39	5.00

Table.1 Correction factor (when measured power is in plus (+) region

L mm / D dptr	1	2	3	4	5	6	7	8	9	10
− 1.00	.001	.002	.003	.004	.005	.006	.007	.008	.009	.01
− 2.00	.004	.008	.01	.02	.02	.02	.03	.03	.04	.04
− 3.00	.009	.02	.03	.04	.04	.05	.06	.07	.08	.09
− 4.00	.02	.03	.05	.06	.08	.09	.11	.12	.14	.15
− 5.00	.02	.05	.07	.10	.12	.15	.17	.19	.22	.24
− 6.00	.04	.07	.11	.14	.17	.21	.24	.27	.31	.34
− 7.00	.05	.10	.14	.19	.24	.28	.33	.37	.41	.46
− 8.00	.06	.13	.19	.25	.31	.37	.42	.48	.54	.59
− 9.00	.08	.16	.24	.31	.39	.46	.53	.60	.67	.74
−10.00	.10	.20	.29	.38	.48	.57	.65	.74	.83	.91
−11.00	.12	.24	.35	.46	.57	.68	.79	.89	.99	1.09
−12.00	.14	.28	.42	.55	.68	.81	.93	1.05	1.17	1.29
−13.00	.17	.33	.49	.64	.79	.94	1.08	1.22	1.36	1.50
−14.00	.19	.38	.56	.74	.92	1.08	1.25	1.41	1.57	1.72
−15.00	.22	.44	.65	.85	1.05	1.24	1.43	1.61	1.78	1.96
−16.00	.25	.50	.73	.96	1.19	1.40	1.61	1.82	2.01	2.21
−17.00	.28	.56	.82	1.08	1.33	1.57	1.81	2.04	2.26	2.47
−18.00	.32	.63	.92	1.21	1.49	1.75	2.01	2.27	2.51	2.75
−19.00	.35	.70	1.02	1.34	1.65	1.94	2.23	2.51	2.77	3.03
−20.00	.39	.77	1.13	1.48	1.82	2.14	2.46	2.76	3.05	3.33

Table.2 Correction factor (when measured power is in minus (-) region

3.7 Rotary Near Point Card (31)

If the lens is multifocal, measuring the lens diopter at near distance will be required. Then use near point rod (30), near point card holder (32) and near point card (31) (for attaching them to the instrument, see 2.2.2 (1) and (2)). Lower the near point rod as shown in Fig. 28. At this position, the rod should be horizontal and at the correct setting for measurement.

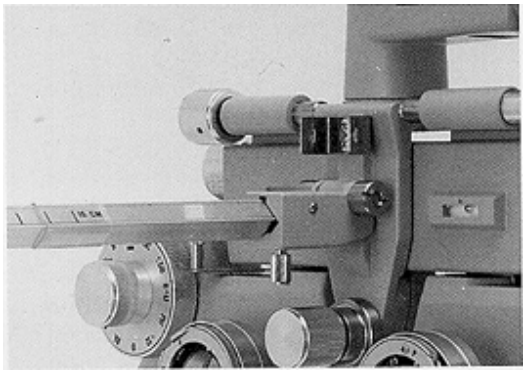


Fig. 28

On the near distance rod scale, indices for inches (5 to 28), diopter (8 to 1.5) and cm (15 to 70) are provided. As shown in Fig. 29, the values matching with the ends of the card holder mean the distance to the card from the apex of the cornea. Now select the required sight mark on the near point card. Turn the rotating portion underneath the card by the finger, until the desired sight appears in the sight window.

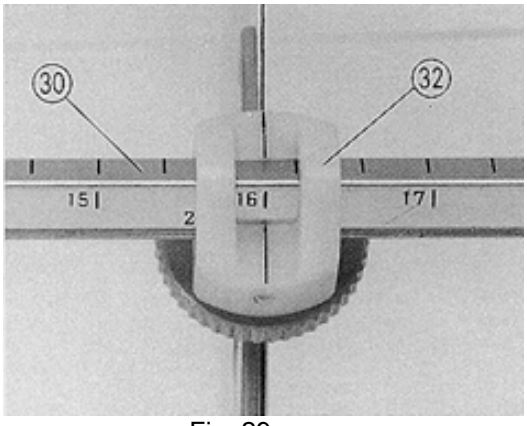


Fig. 29

Sight number of near point card:

1. Near point visual acuity test chart (for 40cm distance)
2. Chart for testing presbyopia
3. Chart for testing near and middle point horizontal phorias
4. Chart for near distance visual acuity (for 40cm distance to 1.0 vision)
5. Chart for testing presbyopia
6. Chart for near distance visual acuity (for 40cm distance)
7. Chart for middle distance visual acuity (for 67cm distance)
8. Chart for testing near and middle point vertical phorias
9. Chart for near distance visual acuity test (for 40cm distance to 1.0 vision)
10. Chart for astigmatic test

Next, turn vergence lever (26) inward and the instrument moves so that the main axis of lens faces at 16 inch so near point testing is possible (See Fig. 30).

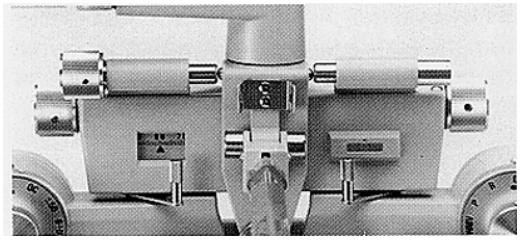


Fig. 30

3.8 Examination Procedures

The following is an example of an examination. Before actual examination, the patient's visual acuity, history, measurement of P.D. and other data should be determined. For optimum performance of the instrument, the examination method should be well known by the examiner. Refer to other literature published for vision specialists.
For convenience, a model patient is taken here as an example.
Mr. A who is 25 years old and wearing spectacles visits the premises. He claims that his visual acuity is insufficient.
Assume that by measuring the spectacles he is wearing by using Topcon Lens Meter, for example, the following results are shown:

P.D. 63mm.
R S - 1.00^{D} ⊂ C - 0.50^{D} A90°
L S - 1.25^{D} ⊂ C - 0.50^{D} A180°

means:
At P.D. 63mm.
Right eye shows a spherical power of -1.00 diopter
Astigmatic power -0.50 diopter Axis 90° Left eye shows a spherical power of -1.25 diopter
Astigmatic power -0.50 diopter Axis 180°

With these spectacles worn his visual acuity shows 0.7 (20/30), right and left eyes, and he has no ocular pathology. Now, how to determine his proper spectacles power using VT-10 is described. When reading this description, be sure to actually check each part of the instrument.

3.8.1 Installing the instrument

(1) Attach the instrument to the ophthalmic stand. Attach the near point rod (30) to near point rod holder (28) and keep it upwards as shown in Fig. 9.
(2) Set the spherical power (from here referred to as S) and cylinder power (referred to as C) to zero.
(3) Set P.D., which has been measured previously, in the instrument. For this, turn P.D. knob (7) so that P.D. scale (6) shows Mr. A's P.D. value.
(4) Position the instrument to the patient so that the instrument's side which is shown at Fig. 4 is facing to the patient. Place the face of Mr.A on the forehead rest (23).
(5) Turn the leveling knob (4) while looking at the reflected image of the spirit level (5) until the bubble matches with the orange colored dot.
(6) Ascertain the distance between the vertex of the cornea and the instrument.
(7) As the right eye is to be measured first, turn auxiliary lens knob (10) so that 'O or O' is set for the right eye and 'OC' is set for the left eye.

3.8.2 Examination using 'fogging method'

(1) Increase +3.00 diopter to the estimated S for right eye. Add (-1.00) + (+3.00) = +2.00 diopter since his contemporary spectacle power is -1.00 diopter. (2.00 by white colored number).
(2) In this condition, Mr. A will be unable to clearly see the projected chart. Gradually add minus power. In Mr. A's example, reduce S gradually by turning weak spherical power dial (12): 2.00 → 1.75 → 1.50 to 0.5. It shows -1.00 (100 by orange colored number).
(3) Project the astigmatic chart and ask him how he sees it. Mr. A says he sees it as shown in Fig. 31. Turn the cylinder axis knob (16) to 90° from the reported darkest line. (Fig. 32). (If Mr. A responds that all lines are equal, no astigmatism is present, then, naturally, the procedures 3.8.2.(3), (4) and 3.8.3 are not required.)

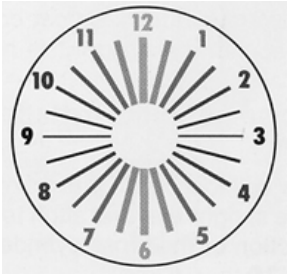


Fig. 31

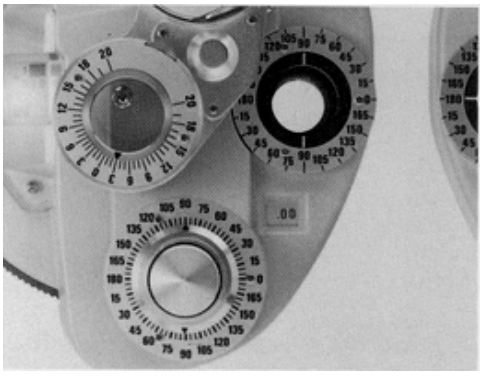


Fig. 32

(4) Turn the cylindrical lens knob (15) to change C to .00 → .25 → .50 so every line is seen equally. At -.50 the chart is as seen shown in Fig. 33.

Fig. 33

(5) Change S by 0.25 steps by turning weak spherical power dial (12) so that the visual acuity chart becomes 1.2 to 1.5. Take note when the value is changed.

-1.00→ -1.25→ -1.50.

-1.00	0.7
-1.25	0.9
-1.50	1.2
-1.75	1.5
-2.00	1.5
-2.25	1.5

The correct spectacles are prepared taking the least power, and presbyopia spectacles are prepared taking the largest power. To correct Mr. A's vision to that of 1.5, his spectacle power will be -1.75, -2.00 or -2.25 so the least, -1.75 should be taken for his spectacles. The examination is almost complete but more precise measurement is required.

3.8.3 Precise refining cylinder axis and power

(1) Set cross cylinder lens (18) in front of the (examinee's) right eye and align letter "A" with direction of the cross cylinder's axis (See Fig. 34).

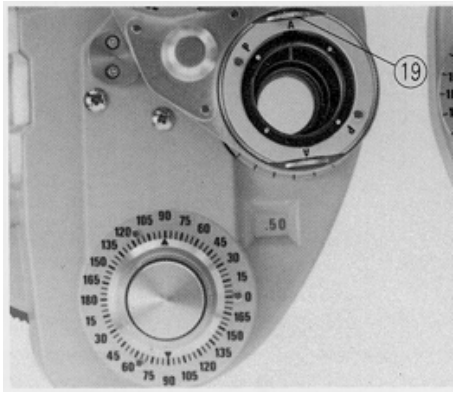


Fig. 34

(2) Project the cross cylinder dot chart as in Fig. 35. Turn reverse knob (19) with the finger to reverse cross cylinder (18). Then ask Mr. A to compare how he sees the two images after and before reversing the cross cylinder. Stop at the better side. For example, if the image at the cross cylinder lens setting shown in Fig. 36 appears better to Mr. A, move the axis of cross cylinder lens 5° in the direction of the orange colored dot by turning cylindrical axis knob (16) to position 95° on the cylindrical axis scale (17).

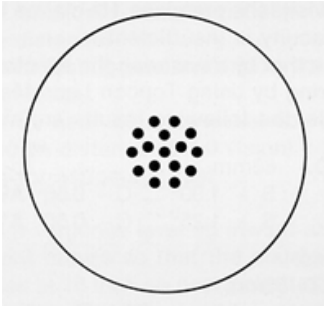


Fig. 35

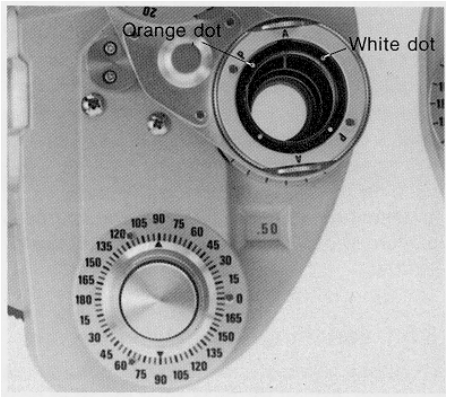


Fig. 36

(3) Reverse the lens again to compare. If the setting as Fig. 37 is better, move the cross cylinder axis towards the orange point by 5° so to become 100°.

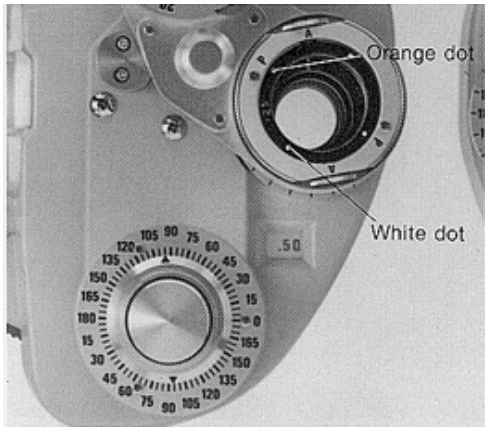


Fig. 37

(4) Reverse the lens again, and if Mr. A cannot report any difference, precise refining of cylinder axis is now completed. (Axis is refined 100°).

(5) Next, to determine the precise power of cylinder (C), turn the letter P to meet the axis (See Fig. 38).

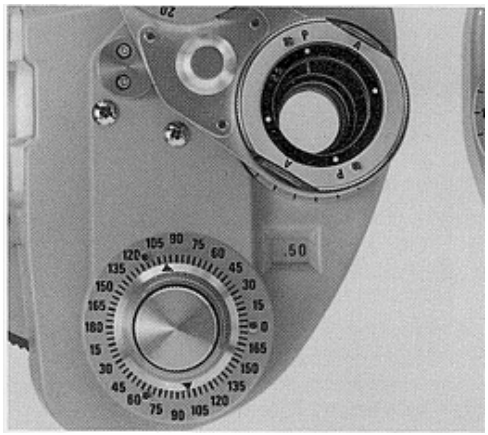


Fig. 38

(6) Use the cross cylinder dot chart as in Fig. 35 and reverse the cross cylinder as described in (2), then ask to compare and report how the chart is seen. The result is shown as in Fig. 39.
If best comparison is achieved when the orange point is matched with letter 'P', (as shown in Fig. 39), it means that 'C' should be increased by O.25 diopter. (Mr. A is now at 0.75 diopter.)

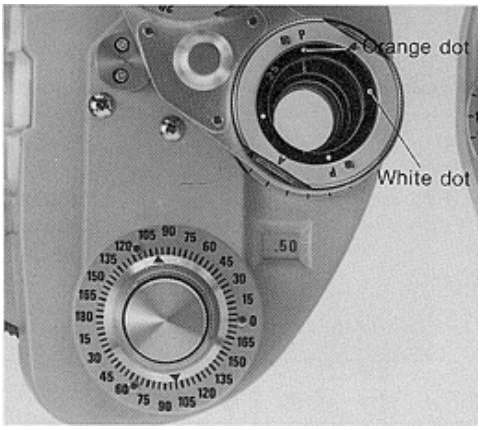


Fig. 39

(7) Reverse the lens again to compare. Assume that in the setting of Fig. 40 the chart is seen best. Since the white point is positioned at P, C should be decreased by 0.25 diopter. If the orange point is at P, a further 0.25 should be added. Therefore, a total 0.50 diopter would be added.

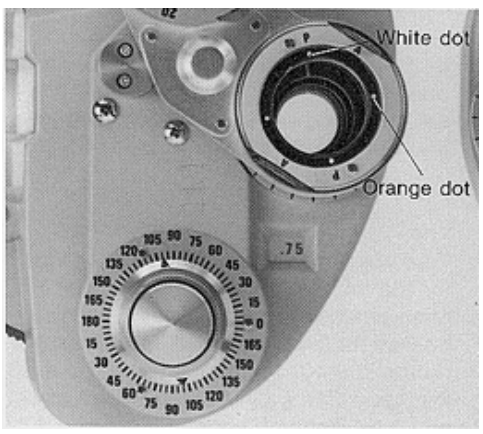


Fig. 40

(8) To verify the finding, reverse the lens again. Mr.A reports that the chart in the setting of Fig. 39 is seen best. In view of this the correct factor is between 0.50 and 0.25 diopter. Therefore, the accurate C is -0.62 diopter.

3.8.4 Refining spherical power (Red-green test)

(1) To test for precise S, use the red green chart on the projector. (Fig. 41). Ask the patient which of the red or green chart is seen better. If the green chart is seen better, this indicates a slightly strong myopia (weaker for hyperopia). Then reduce S by 0.25;→ -1.75→ -1.50.

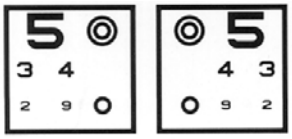


Fig. 41

(2) Once again ask Mr. A which one is seen better. Red is better seen so it stands as a weaker myopia (stronger for hyperopia). Then Mr. A's S becomes -1.62. Generally, the weaker power is taken for myopia (stronger for hyperopia).

(3) Right eye examination is completed. To summarize the lens power:

S (Spherical power) is 1.50 shown in orange,
C (Cylinder power) is 0.50 shown in orange, and the axis is 100° so,

R. S -1.50^{D} ⊂ C -0.50^{D} A 100°

Then the left eye is to be examined.
Turn auxiliary lens knob (10) to set O or O for the left eye and OC for the right eye. Then proceed in the same measuring sequence for the right eye as in 3.8.2 Examination using 'fogging method', 3.8.3 Precise refining cylinder axis and power and 3.8.4 Refining spherical power.
Mr. A's left eye is measured:

L. S -2.00^{D} ⊂ C -0.50^{D} A 170°

3.8.5 Binocular balance test

(1) Rotary prism method

(a) The tests performed were for the left and right eyes independently, but, both eyes should be examined binocularly. These tests are generally referred to as the binocular balance test.
Set both eyes to O or O. Use the chart shown in Fig. 35. Set the prisms for both eyes, 2 BU (for right eye) and 2 BD (for left eye). (Fig. 42)

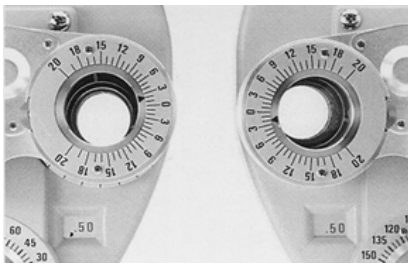


Fig. 42

(b) Mr. A sees two images of the chart, upper side and lower side. Ask him which image is seen better. He says the upper is better. Add +0.25 diopter to S to the right side. When the upper side shows better, add + 0.25 diopter to the left eye for which 2 BD covers.
Therefore, (-2.00) + (+0.25) = -1.75 diopter.

(c) Ask him again which one is seen better. When both become similar, the balance is made.

(d) Remove the rotary prisms for both eyes. Add +1.00 diopter to both eyes S's. Therefore, Mr. A's lens power is:

R. S -0.50^{D} ⊂ C -0.50^{D} A 100
L. S -0.75^{D} ⊂ C -0.50^{D} A 170

(e) Increase the minus value of S for both eyes by 0.25 diopter. And change S slowly until he sees 1.2 or 1.5 (20/15). He desires to be able to see 1.5 (20/15). Now change S as follows:

R. S -1.50^{D} ⊂ C -0.50^{D} A 100
L. S -0.75^{D} ⊂ C -0.50^{D} A 170

(2) Polarizing filter method

(a) Turn auxiliary lens knob (10) to P for both eyes. Project the Polarized Binocular Balance Test by the chart projector.

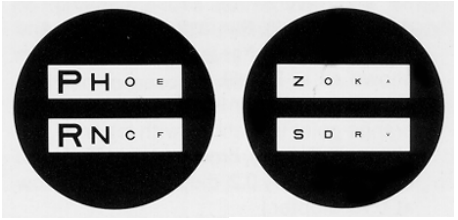
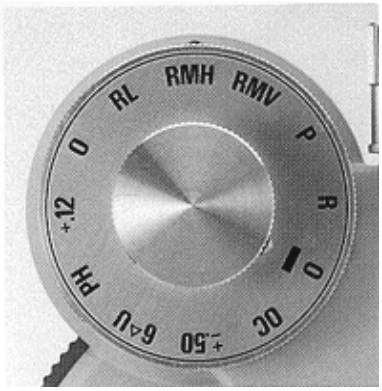


Fig. 43 Fig. 44

(b) Mr. A sees two images, upper side and lower side. Ask him which image is seen better. He can see the upper row of the chart by his right eye and the lower row by his left eye.
If both rows can be seen with equal clarity the balance is good. When both rows are not seen at the same points, add +0.25 diopter to the S which correlates to the better view until both columns are seen equally.

(c) Set auxiliary lens knob (10) to O or O for both eyes. Add further +1.00 diopter to S of both eyes.

(d) Proceed with S of both eyes to deduct 0.25 diopter each for minus direction. And change S slowly until visual acuity for both eyes reaches 1.2 or 1.5.



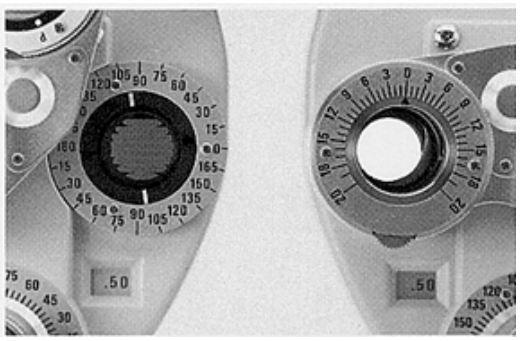


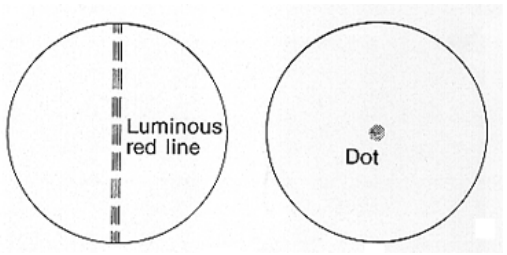
Fig. 45

3.8.6 Measuring phoria at far point

(1) Maddox rod and rotary prism method

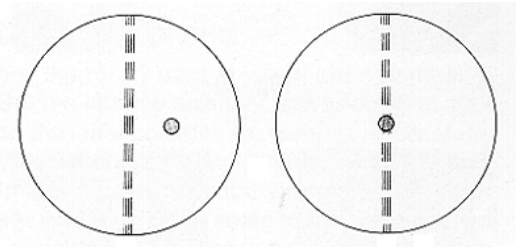
(a) Start by measuring horizontal phoria. Proceed as the result obtained in 3.8.5 Binocular Balance Test,(1) Rotary Prism Method. Set auxiliary lens knob for right eye (10) to RMH as shown in Fig. 45. Set rotary prism (9) so its 0 setting on the scale is facing upwards for the left eye. Light a small fixation light at the position where the chart was projected. A red vertical line (Fig. 46-a) is seen to the right eye of Mr. A and the light spot (Fig. 46-b) is seen to the left eye. These are seen as either a or b of Fig. 47. The light spot moves when prism rotation knob (9) is turned. Ask the patient to tell when he sees the targets as shown in Fig. 47-b. The result is as shown in Fig. 48. The prism rotation scale shows 2 which is further in than 0. This stands 2 BI and indicates exphoria of 2 prism diopter.

(b) Then vertical phoria is measured. Set auxiliary lens knob (10) to RMV as shown in Fig. 49 for the right eye, and set rotary prism (8) for the left eye at the horizontal position. Mr. A can see the red horizontal line with the right eye and the light spot with the left eye. Using the same procedure as (a), while rotating the prism by turning prism rotation knob (9) ask him to tell when he perceives the red line and spot meeting. Since he signalled as shown in Fig. 50, read the scale. The scale meets at 0.5 which is below 0. This shows the left eye is 0.5 BD, namely 0.5 prism hyperphoria (or right eye may be 0.5 DU, hyperphoria).



a b

Fig. 46



a b

Fig. 47

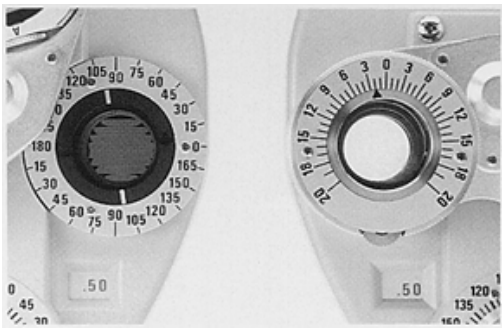
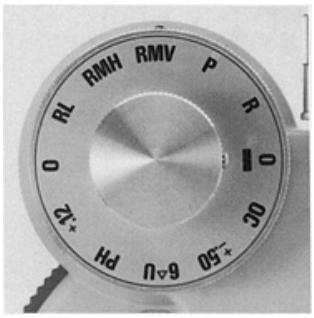


Fig. 48



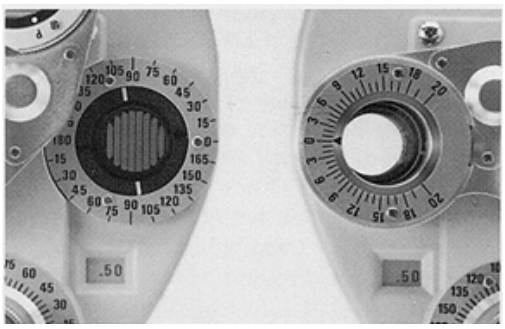


Fig. 49

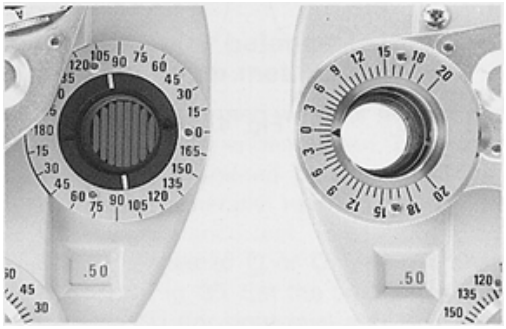


Fig. 50

(2) Polarizing filter method

(a) Turn auxiliary lens knob (10) to set P. Project the phoria chart (Fig. 51) by the TOPCON Chart Projector.

(b) Unless the patient has phoria, the four lines will be seen as shown in Fig. 51.The lines will not be in alignment when the patient has phoria.

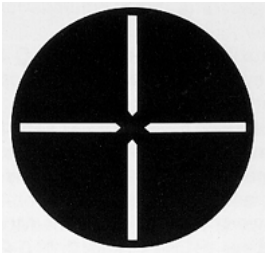
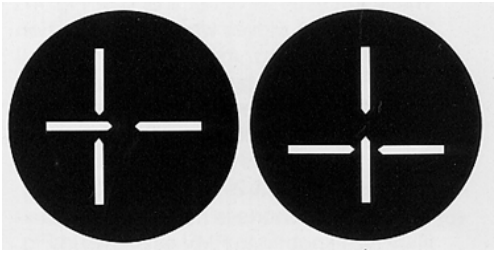


Fig. 51

(c) When only the vertical lines are seen dispositioned as shown in Fig. 52-a, set rotary prism (8) to the left eye with 0 (zero) scale upward. Turn prism rotation knob (9) slowly so the image is shown as in Fig. 51. (Horizontal phoria).

(d) When only horizontal lines are seen dispositioned as shown in Fig. 52-b, adjust 0 (zero) scale to horizontal and turn (9) so the image is as shown in Fig. 51. (vertical phoria).



A b

Fig. 52

(e) When both vertical and horizontal lines are dispositioned as shown in Fig. 52-c, adjust the 0 (zero) scale of the rotary prism so the vertical lines are seen in the horizontal line as shown in Fig. 52-b. (horizontal phoria). Then make the 0 (zero) scale horizontal. Turn (9) so the horizontal lines are in a horizontal line as shown in Fig. 52-a. (vertical phoria).

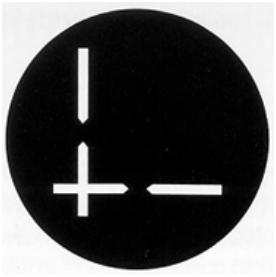


Fig. 52-c

3.8.7 Arranging results

Mr. A's examination is complete. If a large phoria results, the spectacles should be adjusted. Assume that Mr. A does not have such a problem, then the prescription would be:

P.D. 63mm
R. S -1.50^{D} ⌓ C -0.50^{D} A 100°
L. S -1.75^{D} ⌓ C -0.50^{D} A 170°

3.8.8 Presbyopia test

This test is made for those who are more than 45 years old.

(a) First, be sure to measure for the distance power and put it in the examination aperture. Attach near point rod (30) and near point rod holder (28) to the instrument and fix them firmly using near point rod clamping screw (27).
(b) Turn auxiliary lens knob (10) to .±.50 for both eyes.
(c) Use the crossmark chart of near point card (31) (No. 5 visual chart in the Fig. 6) at the patient's required near distance. Ask him how the vertical and horizontal lines are seen. In presbyopia, the horizontal line is seen clearly and the vertical line is seen as being dull. (If both lines are seen equally presbyopia spectacles are not necessary).
(d) Advance both eyes' S in the plus direction by 0.25 at the same time so the vertical and horizontal lines are seen equally.
(e) Change ±.50 for both eyes to O or O. Turn the near distance card to show the small letters, setting the visual chart No. 1 or 6. And ask the patient if letters are clear. S may require slight adjustment. The measurement is complete. Record all results looking the scales.

3.8.9 Phoria at near distance

(1) Horizontal phoria

Set the results of the far point test in both examination apertures for patients who are not presbyopic. Put the results on the near point test for those who are presbyopia. Set the rotary card at 16 inches. Set auxiliary lens knob (10) for the right eye at 6 U so the letter rows are fully separated. When there is horizontal phoria, it is as shown in Fig. 53. Set rotary prism (8) to the other eye and turn the 0 scale upward. Turn prism rotation knob (9) so there is no difference between the left and right eyes, the scale of the rotary prism indicates the prism power.

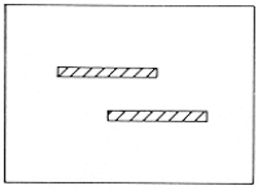


Fig. 53

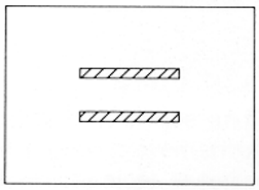


Fig. 54

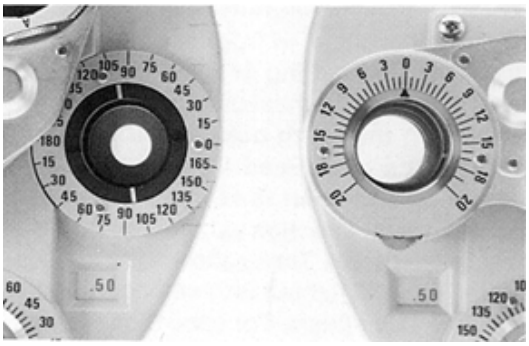


Fig. 55

(2) Vertical phoria

Set the rotary card at visual chart number 8. Set the left eye auxiliary lens knob (10) at 10 l so the letter columns are completely separate. When there is vertical phoria, it is as shown in Fig. 56. Set the rotatry prism of the other eye and bring the 0 scale to the horizontal as shown in Fig. 58. Turn (9) so there is no difference between upper and lower (See Fig. 57). The scale of the rotatry prism shows vertical phoria power.

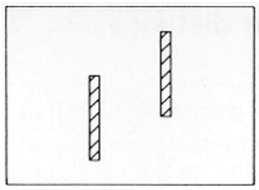


Fig. 56

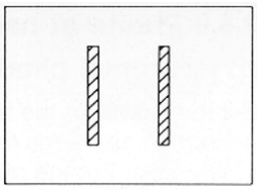


Fig. 57

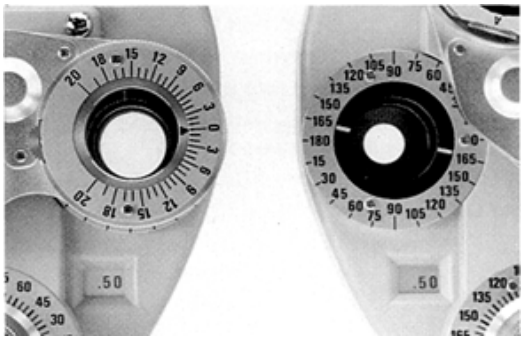


Fig. 58

3.8.10 Other measurements

(1) Vergence

Set rotary prism (8) in front of both eyes and place the zero setting of scale in the uppermost position. To measure adduction for far point, turn the prism outward for both eyes at the same time. Read the scale at a position where the chart is seen as two images in the vertical direction (where double vision first takes place). These show the adduction power. Only 40 (about 22°) can be measured by the rotating prism. For abduction measurement, move the rotating prism for both eyes to inner at the same time. Read the scale at where the object is seen first as a double image. 40 , can be measured by the rotating prism, while a total of 50 can be measured using 10 BI on the auxiliary lens disk. Adduction and abduction at near distance can be measured when the rotary card (visual chart number 8) is fixed to near point rod (30). The method is the same as for other measurements.

(2) Vertical abduction

Set rotary prism (8) in front of both eyes make 0 scale horizontal. Use the horizontal letters in the visual acuity chart for far point (5m), and use visual chart number 3 of the rotary card for near point. Turn prism rotation knob (9) and read the scale at where the horizontal letters are seen as a double image (where double vision occurs). The value shows the vertical abduction.

3.8.11 Transposition of prescriptions

The minus cylinder model of TOPCON VISION TESTER VT-10 is designed for carrying out the fogging method of visual acuity testing. However, when a plus cylinder prescription is desired, the following formula is used for conversion.

$S\ X^{D} \bigcirc CY^{D}\ AZ°$

$\rightarrow S\ (X + Y)^{D} \bigcirc C\ (-Y)^{D}\ A\ (Z \pm 90)°$

S :Add the cylinder lens power to the spherical lens power.

C :Convert the index (+, -) of cylinder lens power.

A :Add 90° when Z is less than 90°
Deduct 90° when Z is larger than 90°

Example 1.

For $S\ +3.00^{D} \bigcirc C\ -1.00^{D}\ A\ 175°$

S: (+3.00) + (-1.00) = +2.00

C: (-1.00) = +1.00

A: 175° - 90° = 85°

Therefore:

$S + 2.00^{D} \bigcirc C + 100^{D}\ A85°$

When it is necessary to convert the measured value which is to be set in TOPCON VISION TESTER VT-10 from a plus cylinder prescription, the same formula is used.

Example 2.

When $S\ +0.50^{D} \bigcirc C\ +0.75^{D}\ A\ 85°$,

S: (+0.50) + (-0.75) = +1.25

C: -(+0.75) = -0.75

A: 85° + 90° = 175°

Therefore:

$S + 1.25^{D} \bigcirc C + -0.75^{D}\ A175°$

4. MAINTENANCE

4.1 Daily care

(1) Always keep your VT-10 covered with dust cover (33) when not in use.
(2) For storage, keep VT-10 in a dry place free of any dust or foreign matter.
(3) If lens surfaces become dirty, use the lens cleaner included in the accessories. In case any dust still remains, wipe it off using a soft cotton cloth moistened with a little alcohol.
If any dust is present on internal lenses, wipe off the dust on the examiner's side of examination aperture using the cotton cloth described above. For the dust on the patient's side of examination aperture, after removing the frame of patient's side examination aperture carry out the same cleaning procedure. To remove the frame, turn it counterclockwise using the accessory screwdriver (36) as illustrated in Fig. 17.

4.2 Checking and servicing procedure

No special checking or servicing is necessary in normal use. However, when using at extremely low temperatures, turning knobs or dials may become heavier than usual because of the lubrication used, not for any mechanical reason. When temperatures return to normal, such will be unnoticeable.
To avoid inconvenience, it is recommended to warm up the instrument by carrying out preliminary use in the morning.
When periodic thorough cleaning is necessary varies depending on conditions of use and storage, but, generally it is good preventative maintenance to have all machanical assemblies cleaned and lubricated once 3 or 4 years by our trained serviceman. At this time, be sure to call TOPCON or authorized TOPCON dealer.

5. BEFORE REQUESTING SERVICE — TOROUBLESHOOTING GUIDE

If any problem occurs, first check the following items, and follow the suggested instructions. Then, if the trouble is not corrected, contact your nearest TOPCON dealer.

(1) The desired lens cannot be set at examination aperture.
- Is knob you operated correct?
- Is any accessory lens attached to the patient's side examination aperture (21)?

(2) When operating vergence lever, corresponding vergence does not occur.
- Has less than 54mm been set for P.D.? (With less than 54mm P.D. set, vergence operation is not possible.)

6. OPTIONAL ACCESSORY – Cross Cylinder

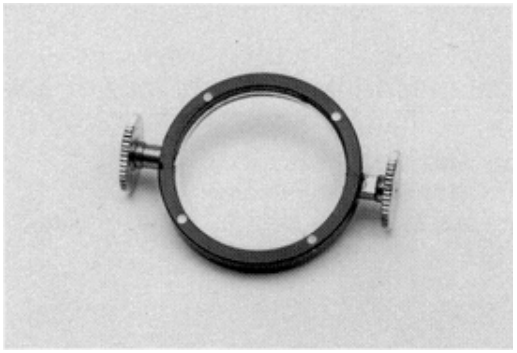


Fig. 59

Two types of cross cylinder are available: ±0.37 model and ±0.50 model.

7. SPECIFICATIONS

(1) Type

Subjective refraction testing equipment

(2) Item and range Of measurement (the value in ( ) with accessory lens or auxiliary lens attached):

Myopia	0 to -19.00 diopter in 0.25 diopter step (0.12 diopter step)
Hyperopia	0 to +16.75 diopter in 0.25 diopter step (0.12 diopter step)
Astigmatism	0 to -6.00 diopter (-8.00 diopter) in 0.25 diopter step (0.12 diopter step)
Phoria and vergency	20 to 0 to 20 by 1 step
	Inner 40
	Outer 40 (50)
	Upward and downward 40 (46)
Near vision test	Main optical axes of both lenses converges by means of a tilt mechanism at 40cm in front of the eyes at 64mm P.D. If P.D. for far vision is less than 54mm, converging operation stops.
Binocular balance test	Rotary prism and polarizing lens methods are available.
P.D.	48 to 75mm by 1mm step
Level adjustment	More than 4.5° for right and left banks
Dimensions	335 (at 64mm P.D. setting) × 97 × 294mm
Weight	4.5 kg

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