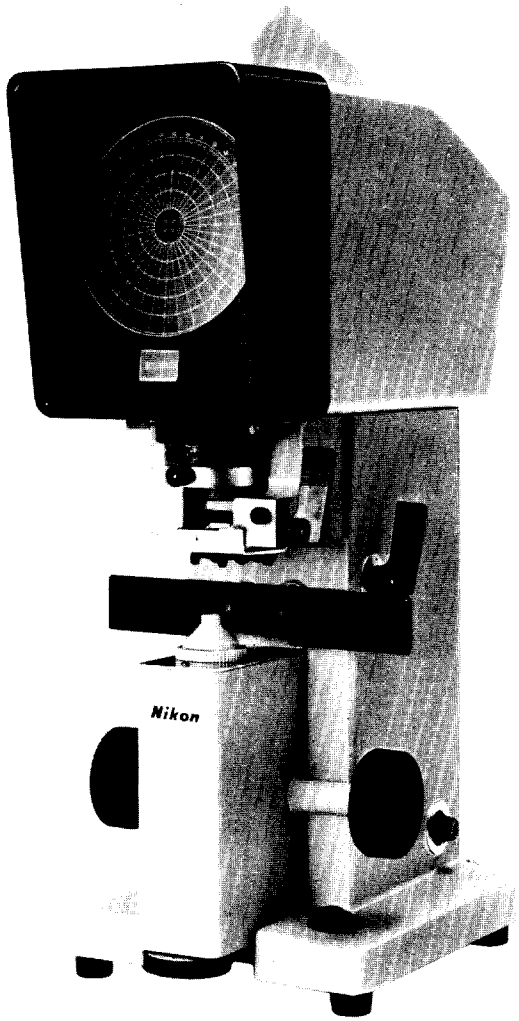
Nikon

PROJECTION LENSMETER PL-2

INSTRUCTIONS



NIKON CORPORATION

- Avoid a dusty place to use or store the instrument.
- As the instrument is precisely made, handle it with care.
- Do not disassemble the instrument.

SPECIFICATIONS

- **Spherical Power:**
  Measurement range: ±25 D (±50 D with PL-2WR)
  Increments: 0.125 D (up to ±3 D); 0.25 D (over ±3 D)
- **Prismatic Power:**
  Measurement range: 6 Δ; 22 Δ with prism compensator (optional)
  Increments: 1 Δ
- **Cylindrical Axis:**
  Reading angle: 0° ~ 180°
  Increments: 1°; 5° on target rotation wheel
- **Acceptable Lenses:**
  Maximum thickness: 28 mm
  Diameter: 28 mm ~ 86 mm (unmounted or framed); engraved half-diameter (14 mm ~ 43 mm) scale; separate holder available for contact lenses
- **Target:** Cross hairs with dotted circle; rotatable 360° (endless) target projection
- **Magnification of Target Projection:** 34X
- **Projection Screen:** 102 mmϕ
- **Power Source:** AC 100/115/220/240 V
- **Light Source:** 6V-15W bulb
- **Dimensions:** 482 mm (Height) × 174 mm (Weight) × 324 mm (Depth)
- **Weight:** Approx. 8.3 kg
- **Option:**
  Prism compensator: Extends range up to 22 Δ

D = Diopter, Δ = Prism

CONTENTS

I. NOMENCLATURE

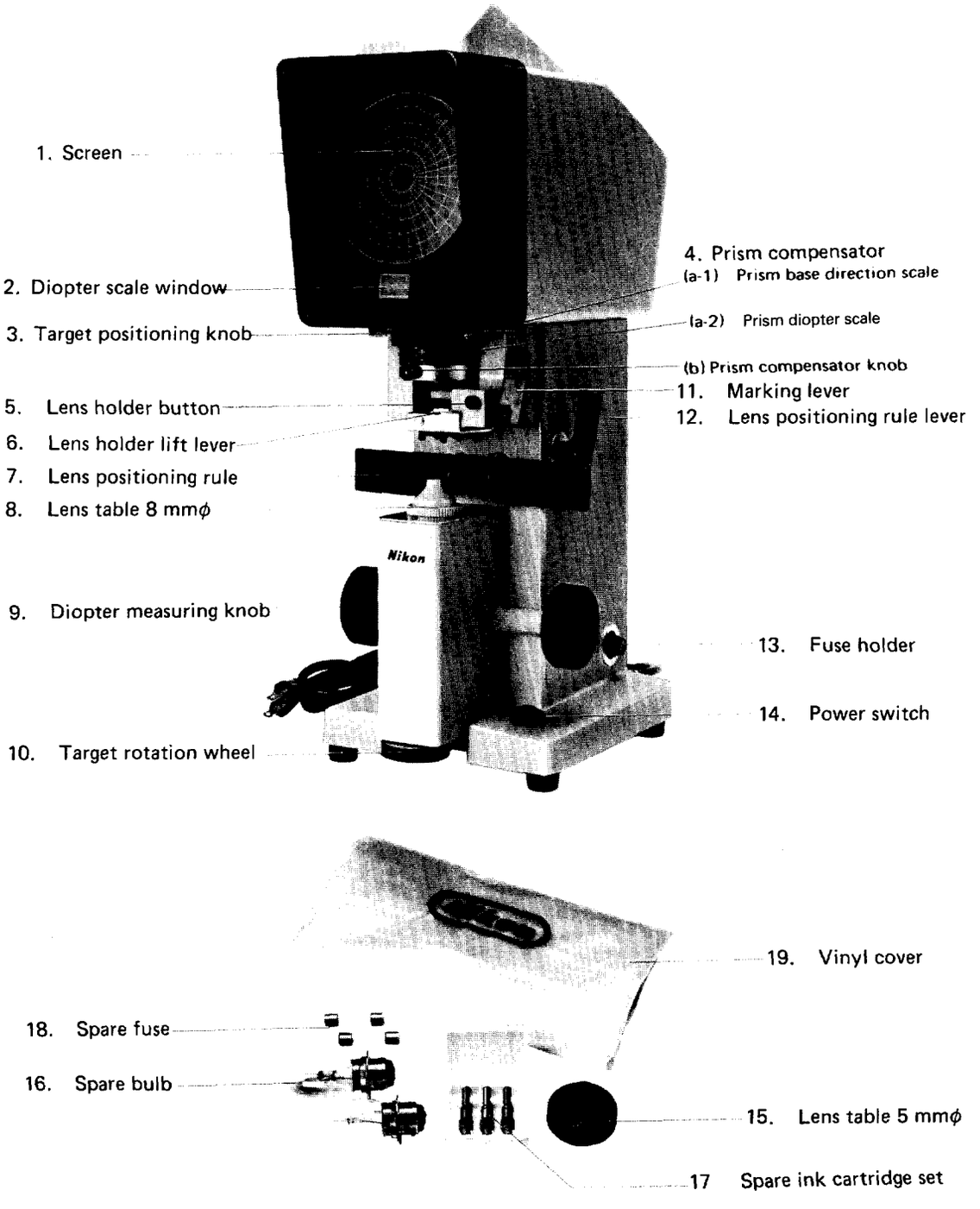


Photo 1.

1. **Screen**

Astigmatic axis of the lens on the lens table can be measured with utmost accuracy by means of the projected crossline-pinhole target.

2. **Diopter scale window**

Diopter power of the lens is displayed in this window.

3. **Target positioning knob**

Position of the target can be corrected by revolving this knob.

4. **Prism compensator**

Measurement of the lens with strong prismatic power as well as the astigmatic lens with prismatic power can be made with ease.

(a-1) **Prism base direction scale**

Prismatic base direction can be read by this scale.

(a-2) **Prism diopter scale**

Prismatic power can be read by this scale.

(b) **Prism compensator knob**

Position of the target on the screen can be changed as desired by revolving this knob. Target position can be read by the above scales (a-1, a-2).

5. **Lens holder button**

The lens holder goes down to secure the lens on the table by pushing this button lightly.

6. **Lens holder lift lever**

Pull up this lever when the lens is released from the table.

7. **Lens positioning rule**

It comes forward to touch the front top of spectacle frame on the lens table by operating the rule lever (12) so that basis for astigmatic axis and prismatic base direction are given.

8. **Lens table 8 mmϕ**

Interchangeable with the lens table 5 mmϕ provided for contact lens.

9. **Diopter measuring knob**

Used for measuring refractive power of the lens.

10. **Target rotation wheel**

Used to rotate the target for measuring astigmatic axis.

11. **Marking lever**

Used to operate the marking device.

12. **Lens positioning rule lever**

Operated to move the rule forward and backward.

13. **Fuse holder**

Turn it counter-clockwise to replace the fuse.

14. **Power switch**

The lamp is lit when the switch is pushed to white dot side.

15. **Lens table 5 mmϕ**

Replace the lens table 8 mmϕ (8) into this table to measure a contact lens.

16. **Spare bulb**

When an order the lamp bulb is to be placed, specify the bulb as 6V 15W for Model PL-2.

17. **Spare ink cartridge set**

18. **Spare fuse**

19. **Vinyl cover**

II. PREPARATION

1. Power on

- Connect the power cord plug to the wall outlet, and turn the power switch (14) on.
- The diopter scale window illuminates.

2. Centering of target

- If the instrument is equipped with the prism compensator, set the prism diopter scale at 0.
- Focus the target on the screen by rotating the focusing knob and setting the diopter scale at 0.
- If the target is not centered on the screen, bring it to the center by the two target positioning knobs (3) **(Photo 2, 3)**.
- If the target is off the center upward or downward, it can be centered by rotating the two positioning knobs simultaneously in the same direction.
- If the target is off the center right or left, it can be centered by rotating the two positioning knobs simultaneously in opposite direction.
- If the target is off the center, and if it is not on $0^\circ \sim 180^\circ$ line or on $90^\circ \sim 270^\circ$ line, adjust it up or down firstly, then adjust it right or left secondly.

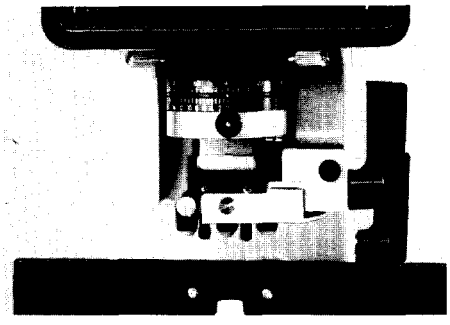


Photo 2

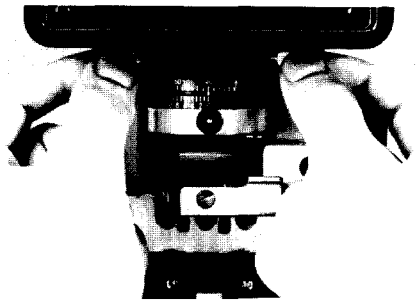
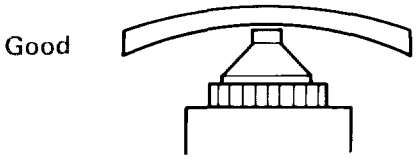


Photo 3

3. Setting the lens for measurement

- Place the lens on the lens table (8) so that its concave surface should face the lens table.



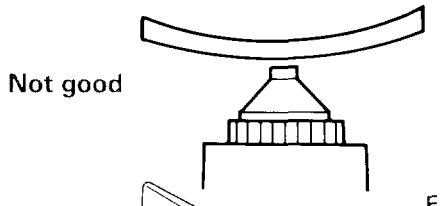


Fig. 1

- In case of a framed lens, place the frame on the lens table so that its front top comes into contact with the lens positioning rule (7).

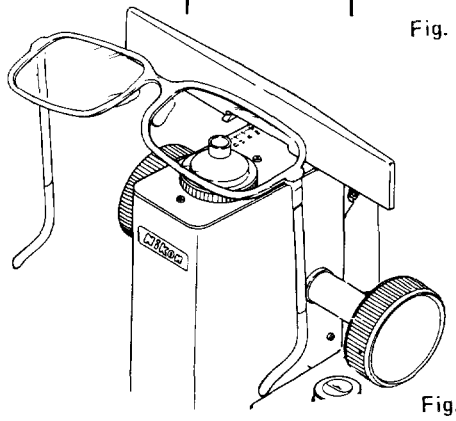


Fig. 2

3-1 Lens holder

- By pushing lightly the lens holder button (5), the lens holder is lowered to fix the lens position.
- When the lens is to be moved for positioning or is to be removed, hold the lens by your left hand and lift the lens holder lift lever (6) up. **(Photo 4)**

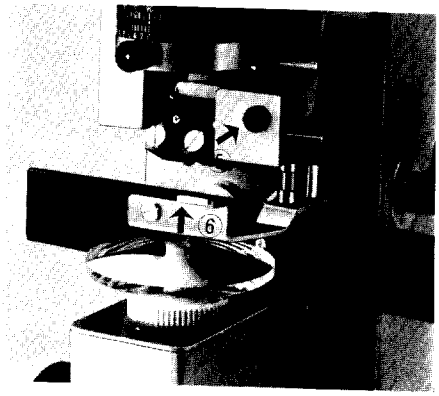


Photo 4

In case of a plastic lens, lift the lens holder slightly up, whenever the lens position is adjusted, so that the back surface of the lens will not be scratched by the edge of the lens table.

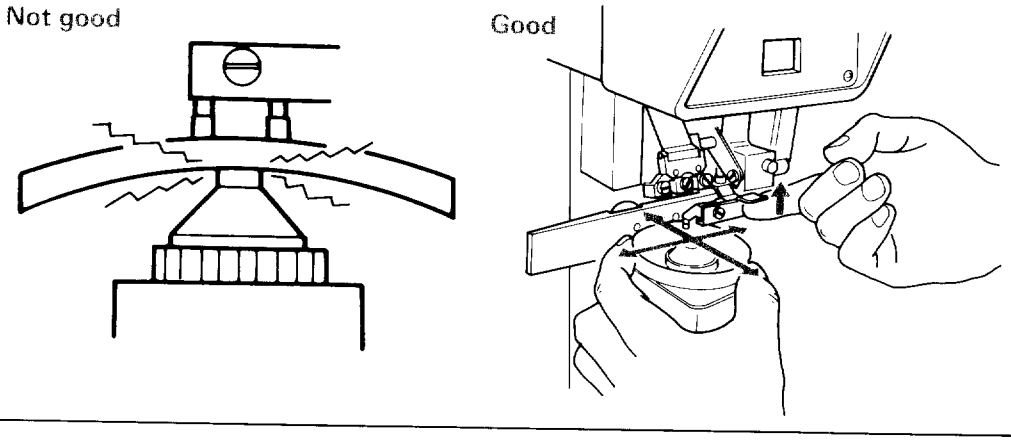


Fig. 3

3-2 Lens positioning rule

- By rotating the lens positioning rule lever (12), the lens positioning rule is moved to and fro.
- To hold the framed lens, make the lens positioing rule come into contact with the front top of the frame so that the frame is positioned in parallel to the 0° – 180° line direction. **(Photo 5)**
- Optical center of the lens can be measured by the scale under the rule.

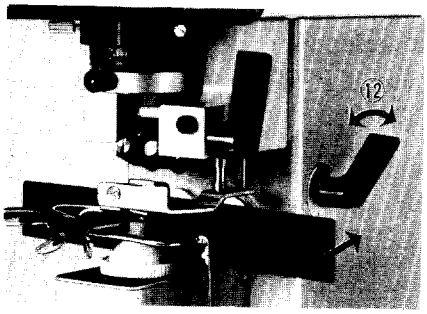


Photo 5

III. MEASUREMENT

- Before measurement, make it sure without fail that the target is centered on the screen.
- When the instrument is equipped with the compensator, set the prism diopter scale (4. a-2) at 0 firstly and check if the target is centered on the screen secondly.

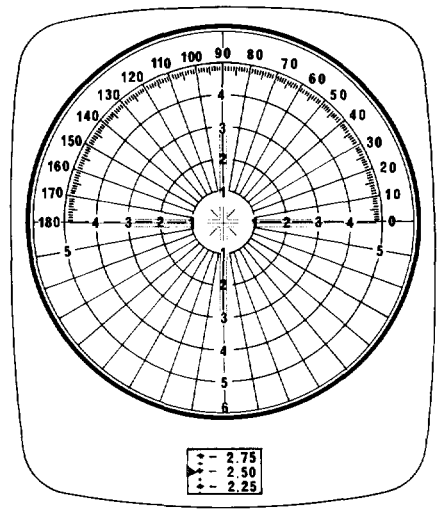


Fig. 4

1. Measurement of spherical lens

- Set the lens on the lens table. Focus the target on the screen by rotating the diopter measuring knob (9). If the target is not at the screen center, bring it to the center by moving the lens on the lens table and focus the image. Read the figure (vertex refractive power) in the diopter scale window at the screen bottom. **(Fig. 4)**

Example of Fig. 4: −2.50 D

2. Measurement of astigmatic lens (by −C form)

(1) S diopter power

- Set the lens on the lens table and rotate the diopter measuring knob starting from 0.00 D position until an oval-shaped image of the target is produced on the screen. Rotate the target rotation wheel (10) to align the shorter crossline which may look blurred to the longer oval axis. Then, the shorter crossline looks clearer. Rotate the diopter measuring knob and the target rotation wheel further until the shorter crossline looks most clear. Read the diopter scale window to obtain the S diopter power. **(Fig. 5)**

Example of Fig. 5: S −2.50 D

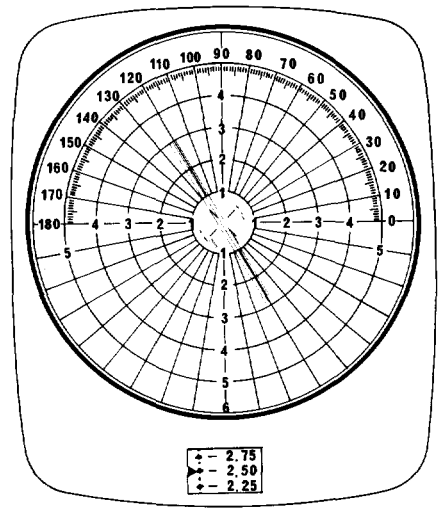


Fig. 5

(2) C diopter power

- Rotate the diopter measuring knob (9) further in the same direction to focus the longer crossline. **(Fig. 6)** Then, read the diopter scale window.

Example of Fig. 6: −3.50 D

- The C diopter power is given by subtracting the S diopter power from the above reading, in case of −(minus) cylinder form:

C = (−3.50) − (−2.50) = −1.00 D

(3) Measurement of astigmatic axis

- Astigmatic axis can be measured by reading direction of the longer crossline which is focused clearly on the screen protractor. **(Fig. 6)**

  Example of Fig. 6: Axis 30°

  Astigmatic axis can also be read by the protractor of the target rotation wheel.

(4) Measurement result

- Result of above measurement by − (minus) cylinder form is as follows:

  Sph. −2.50 D Cyl. −1.00 D Axis 30°

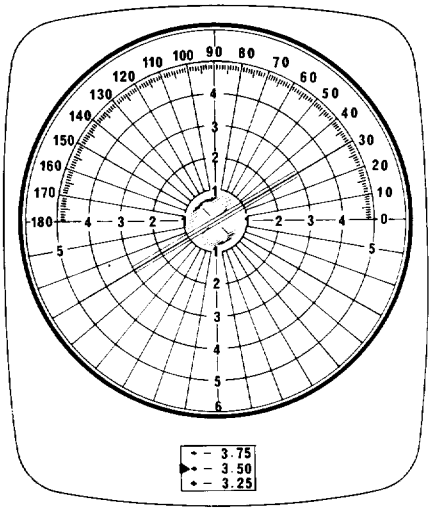


Fig. 6

3. Measurement of prismatic power

- When the optical center of the lens is not at the optical center of the instrument, the target is off the screen center.

  Measuring the prism diopter power means measuring the lens under the above condition.
- Mark the position of the pupil center of the spectacle wearer's eye on the lens while the spectacle is worn. **(Fig. 7)**
- Set the lens on the lens table so that the above pupil center mark is coincided with the optical center of the instrument. **(Fig. 8)**

  Note: Although the lens table is approximately centered at the optical center of the instrument, it may be more accurate to set the lens so that the above pupil center mark is coincided with the central mark by the ink cartridge.

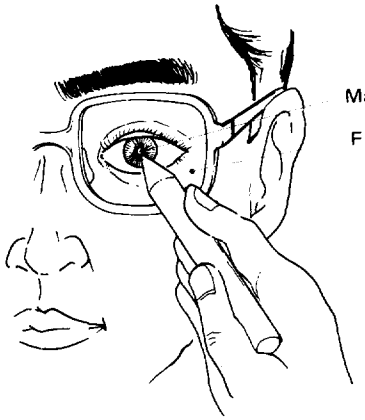


Fig. 7

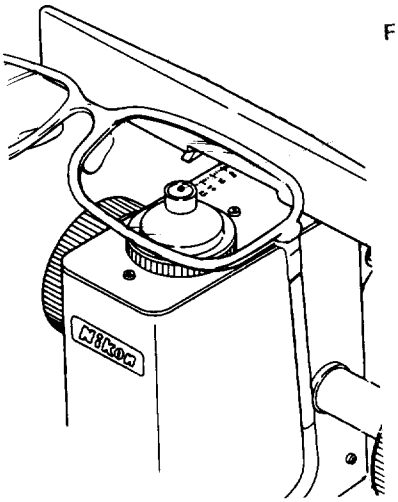
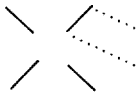


Fig. 8

(1) Measurement of prismatic power without using prism compensator

- By rotating the diopter measuring knob, focus the target image which is off the screen center.
- The coaxial circles are engraved on the screen in step of 1 Δ (prism diopter).
  - ○ As the screen has 6 coaxial circles, the prism diopter can be measured up to 6Δ by the screen.
- The prism base direction can be measured by the radial lines on the screen. **(Fig. 9)**

  Example of Fig. 9: 2Δ Base direction 150°
  - ○ The central mark of the screen will be a help for measuring weak prismatic power:



outer edge of the line ---- 0.5Δ

inner edge of the line ---- 0.25Δ

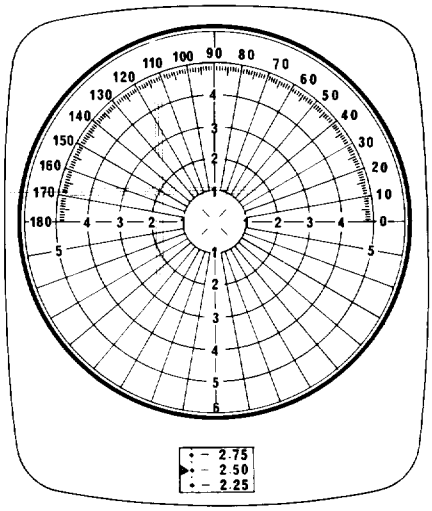


Fig. 9

(2) Measurement of prismatic power using prism compensator

(a) Measurement of prismatic power within 6Δ

- Focusing the decentered target image, bring it to the screen center by means of the prism compensator knob (4b). Pull it out and rotate it. Then, read prism diopter and prism base direction by the scales (4. a-1, 4. a-2) **(Photo 6)**.

  Example of Photo 6: 2Δ Base direction 0°(360°)

Note: When the prism diopter was read by the red figures, add 180° to the prism base direction to obtain the actual prism base direction, in case 360°-prism- prescription-form is used.

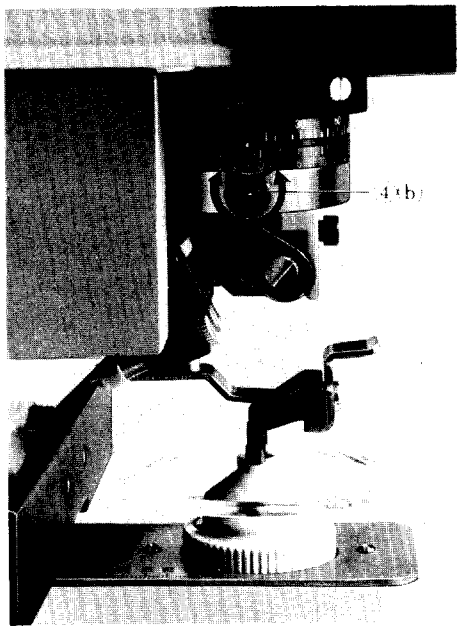


Photo 6

(b) Measurement of prismatic power over 6Δ

- In case prismatic power is over 6Δ, it is not possible to measure prismatic power by the screen only. Preset the diopter measuring knob to refractive power of the lens roughly.
- Bring the target image to the screen center by rotating the prism compensator knob around its own axis or swinging the whole prism compensator. If the knob is set to horizontal (0°) or vertical (90°) position, it will be easy to find the target image.
  When the target came to the screen center, focus the image precisely by the prism compensator knob to read the prism diopter. **(Photo 7)**
  Example of Photo 7: 8Δ Base direction 30°

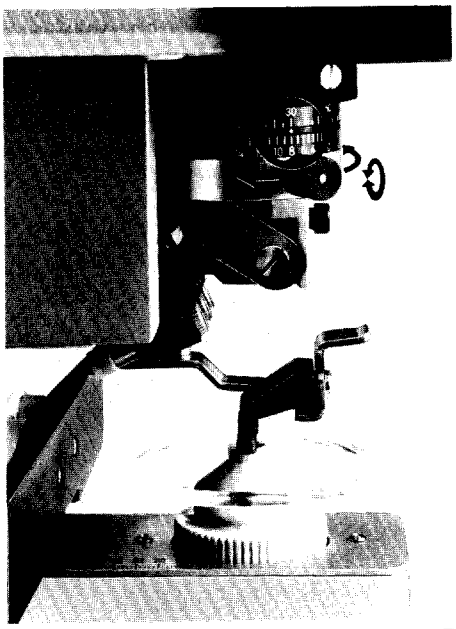


Photo 7

Note: When the prism diopter was read by the red figures, add 180° to prism base direction to obtain the actual prism base direction.

(c) Measurement of prismatic power over 16Δ

- Set the compensator to 16Δ and rotate the whole compensator. The target image will run across the screen drawing an arc. **(Fig. 10)**
- When the target image comes nearest the screen center, stop rotating the compensator and read the prismatic power by the coaxial circle where the target image stopped.
- Add 16Δ to the reading from the screen to obtain final prismatic power. Prism base direction is read by the prism base direction scale (4. a-1).
  Example of Fig. 10: 19Δ Base direction 40°

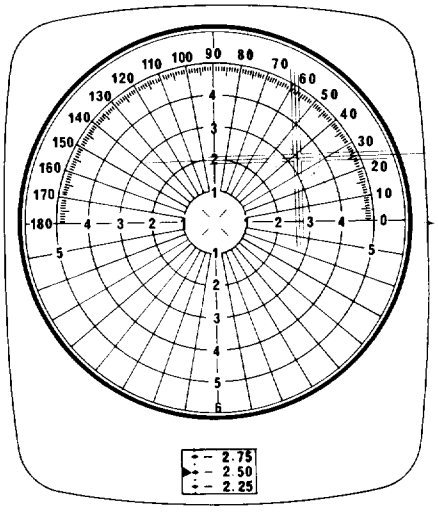


Fig. 10

Note: The prism compensator knob can be clamped by pushing it toward the rotation center of the prism compensator.

4. Measurement of astigmatic lens with prismatic power

- Both of the astigmatic lens measurement and the prism diopter measurement are to be carried out simultaneously following the procedures in page 6 ~ 9.
- It would be convenient to read astigmatic axis by the target rotation wheel (10) and prism base direction by the radial lines on the screen. **(Fig. 11)**

Example of Fig. 11: S −2.50 D C −1.00 D
A x 30°
2⊿ Base direction 90°

- The prism compensator makes the measurement easy because the target image can be observed at the center during measurement.

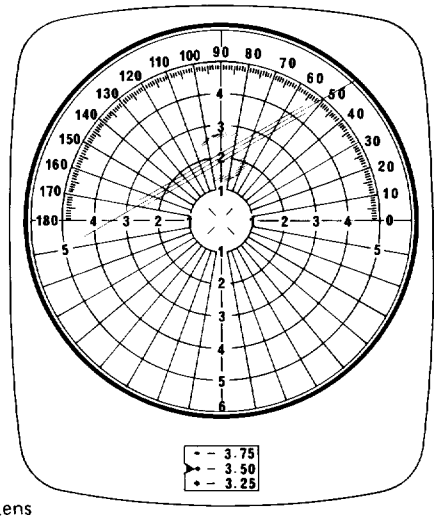


Fig. 11

5. Measurement of contact lens

- Replace the lens table 8 mmϕ into the lens table 5 mmϕ for contact lens.
- The lens may be held by your hand, however, it will be more convenient to use the contact lens holder provided.

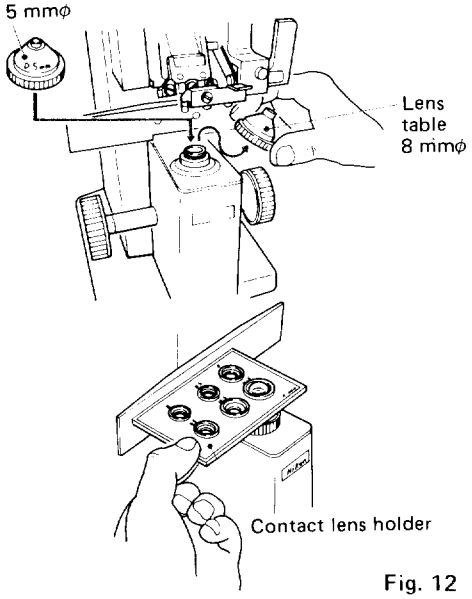


Fig. 12

Avoid to use the lens table 5 mmϕ for measuring the spectacle lens. Avoid to use the lens table 8 mmϕ for measuring the contact lens. Otherwise, measurement result will not be correct.

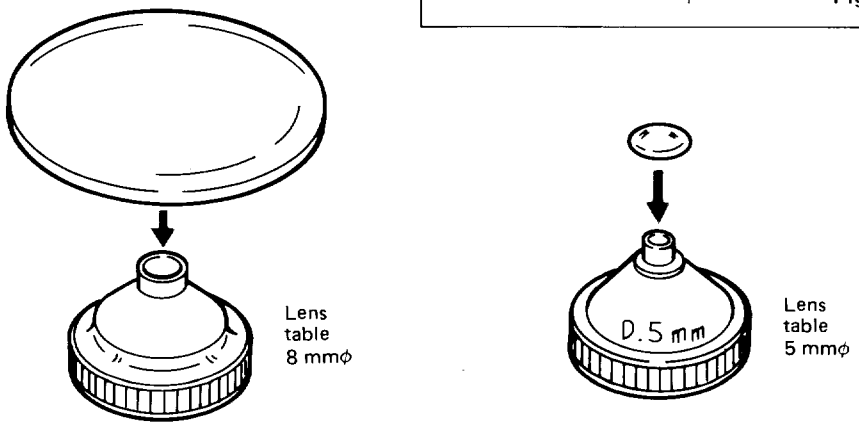


Fig. 13

IV. MARKING

- The marker nibs are made of special stamp rubber containing ink, and ink supply is not required.
- Although consecutive marking may result in fainting of ink, it will soon return to normal.
- It is not necessary to cover the marker by a cap, because ink is not dried up easily.

1. Operating

- Push down the marking lever softly to mark the lens. If the lever is released, the marker will return to its original position. **(Photo 8)**.
- Handle the marking lever lightly and gently.

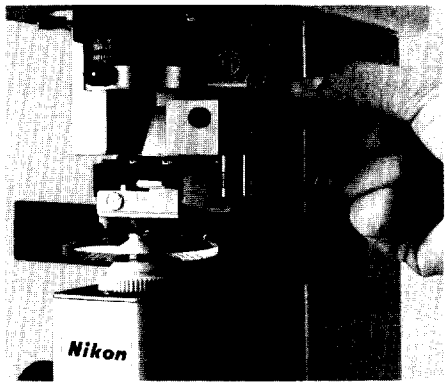


Photo 8

2. Lens positioning

- In order to mark the optical center, position the lens so that the target image is at the screen center.
- For marking the astigmatic lens to be framed in accordance with the prescription, turn the target in advance so that the longer cross line is in the prescribed axis direction and set the diopter scale window to "S + C" value by the diopter measuring knob. Then, place the lens on the lens table and rotate the lens so that the longer cross line looks clear. Check if the target is at the screen center.
  If the lens is marked, the 3 dots of marks will be on the horizontal line after framing of the lens. **(Fig. 15)**
- If it is necessary to put the 3 dots of marks on the astigmatic axis, turn the longer cross line in advance to 0° – 180° line. Then, place the lens on the lens table and mark it.
- When the lens is to be framed with prismatic power, position the lens on the lens table so that the target image is off center of the screen by prescribed prismatic power and in prescribed base direction, or, set the prism compensator to prescribed prismatic power and base direction in advance, then position the lens so that the target is positioned at the screen center. Then, mark the lens.

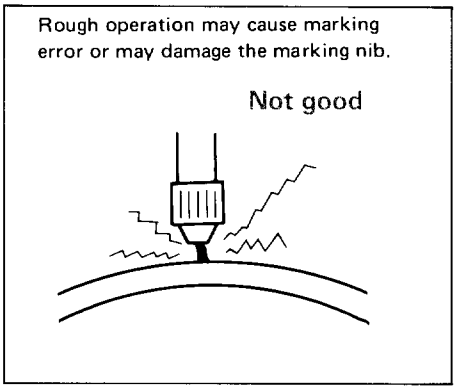


Fig. 14

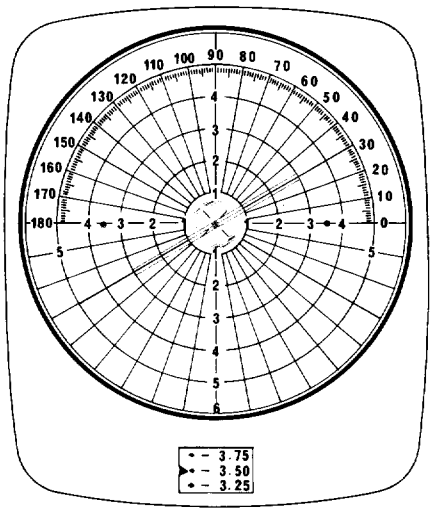


Fig. 15

V. MAINTENANCE

1. Replacement of marker cartridge

- Exchange the cartridge when the marking nib damaged or the ink exhausted. **(Fig. 16)**.
- Holding the cartridge near the marking nib by your fingers, unscrew the retaining screw on the top.
- The retaining screw and the spring are used again.
- Insert the spring into the new cartridge **(Fig. 17)** and tighten the retaining screw.
- If the three marking nibs are not at the same level, fasten each screw tightly. **(Fig. 18)**

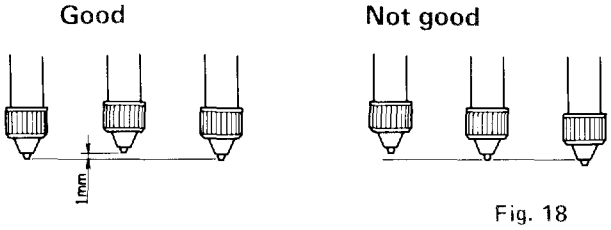


Fig. 18

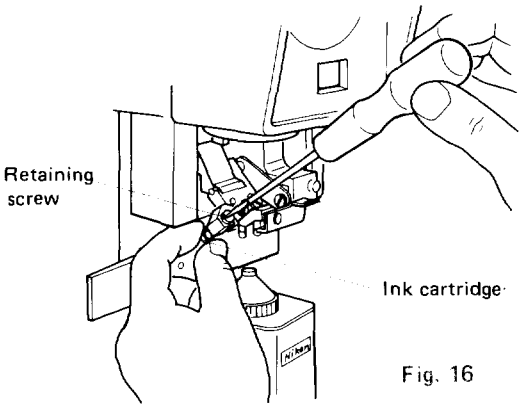


Fig. 16

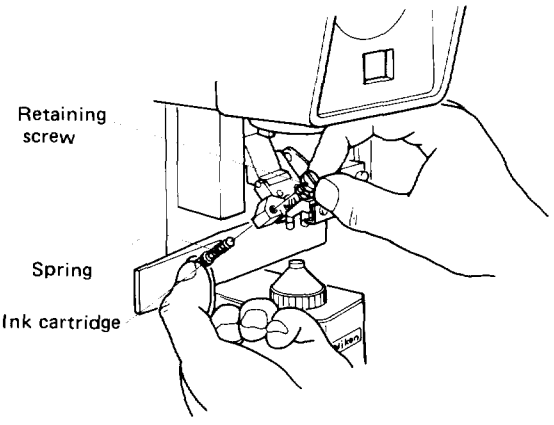


Fig. 17

2. Replacement of bulb

> Take care not to touch the heated lamp surface. Wait enough time to allow lamp to cool off after switch has been turned off.
> Hold it with thick cloth, when immediate replacement is required.

- Holding the socket head, take it out from the back of the instrument.
- Depress and turn the bulb counter-clockwise, so that the bulb is removed from the socket.
- Insert the new bulb into the socket and turn it clockwise.

> Do not touch the glass part of the new lamp directly with fingers. Fingerprint or any dirt on it may shorten lamp's life.

- Hold the socket so that its key groove will face downward and push the socket fully into the instrument body **(Fig 19)**. If the illumination on the screen is not uniform, adjust position of the bulb.

> **IMPORTANT** Use only replacement lamps as specified by ***NIKON***.

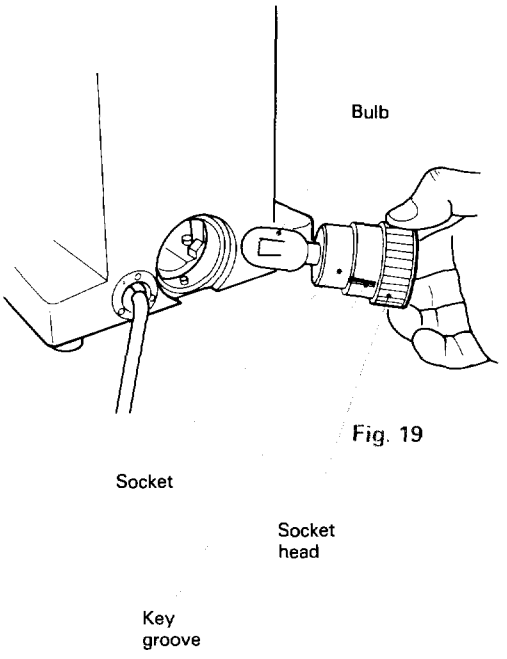


Fig. 19

3. Replacement of fuse

- If the bulb is not lit, although it is not burnt, the fuse may be blown.
- Unscrew the fuse holder (13), and exchange the fuse (0.2A). **(Fig. 20)**

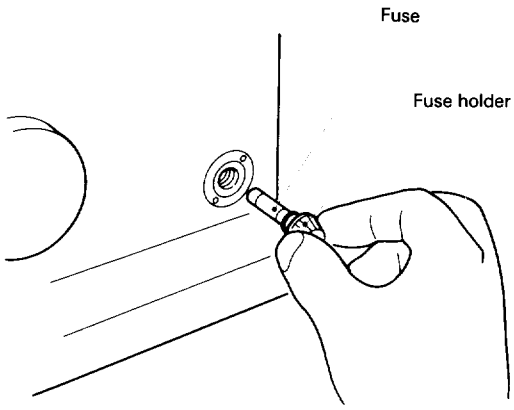


Fig. 20

4. When the instrument is not in use

- Turn off the power switch every time after measurement, so that the bulb life will be extended.
- Protect the instrument from dust using the vinyl cover provided.

VI. CHECKING AND ADJUSTMENT

○ The PL-2 is precision instrument. It should be checked and adjusted, if it received shock or it was continuously vibrated.

1. Checking and adjustment of target

- Set the diopter scale window to 0. If the prism compensator is attached, set its scales to 0. Then, check if the center of the target is at the center on the screen.
- If the target is off center, adjust the target position refering page 4.

2. Positioning the bulb

- If illumination of the target and the diopter scale window is uneven or cut, the bulb position should be adjusted.
- Push the bulb socket fully into the housing, then draw out the socket a little by a little to find the best position for even illumination.

  Note: If illumination is all right when the socket is fully pushed in, no more adjustment is needed.

3. Checking the marking position

- Mark the lens at 0° firstly. Then, rotate the lens by 180° and mark it secondly. If the both marks do not overlap **(Fig. 22)**, loosen the two Phillips screws which hold the marker **(Fig. 21)**, and adjust the marker position, so that the marker nibs drop between the marks. **(Fig. 23)**.

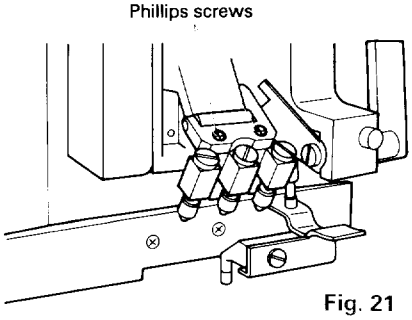


Fig. 21

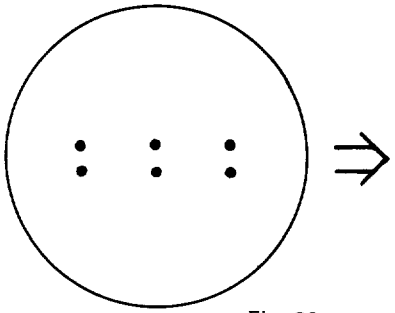


Fig. 22

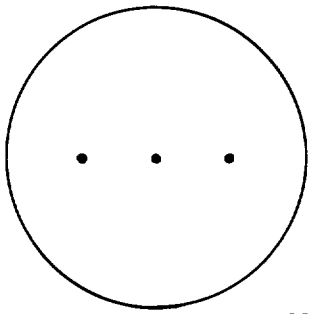
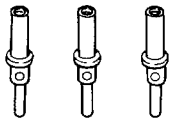
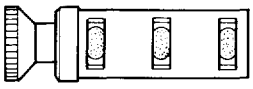


Fig. 23

A marking device set of conventional ink-pod type is available as an optional accessory.
It can be easily attached as the picture.
Contact Nikon dealer or distributor for further information.

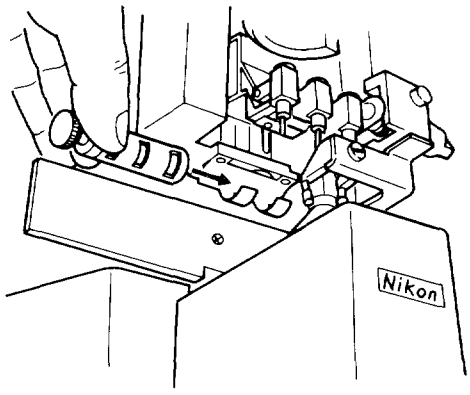


Pin



Ink pod

Ink



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