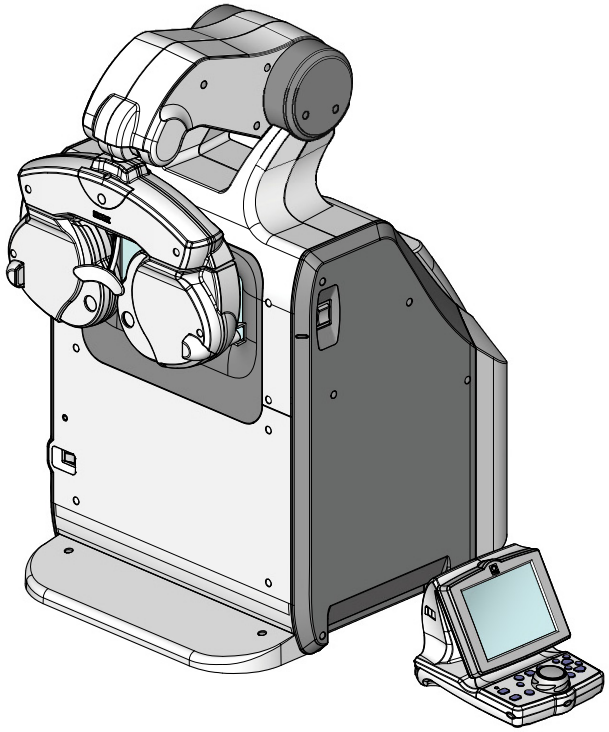
NIDEK

Tabletop Refraction System

TS-310

OPERATOR'S MANUAL



Be sure to read the SOFTWARE LICENSE AGREEMENT (page 2) before using this product.

Original instructions

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Before Use

This operator's manual includes operating procedures, safety precautions, maintenance, and specifications for the NIDEK Tabletop Refraction System, TS-310. Be sure to read the operator's manual prior to use of the device to understand the safety precautions and operating procedures thoroughly.

Keep this manual handy for reference.

If you encounter any problems or have questions about the device, please contact NIDEK or your authorized distributor.

SS001-P902-A9

IMPORTANT - READ CAREFULLY

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a) such Amendments are appropriate in terms of interests for customers of this Software; or

b) such Amendments are commercially reasonable and not contrary to the objective of this Agreement, even if such Amendments are disadvantageous to you.

Prior to the amendments, NIDEK will notify you of the terms and the effective date of such Amendments on the website or by any other means.

6.3. If you use the Software after the effective date of such Amendments, you shall be deemed to have agreed to such Amendments.

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7.1. This Agreement is effective until terminated. If you breach any term or condition of this Agreement, NIDEK may, without giving any prior notice to you, terminate this Agreement with immediate effect. Upon termination of this Agreement due to the breach of this Agreement, NIDEK reserves all the rights to claim damages resulting from such breach.

7.2. If this Agreement is terminated in accordance with the provision of 7.1., you must immediately cease the use of the Software, and delete, destroy and erase all the Software. Any fees paid by you for the license of the Software will not be refund for any reasons.

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10. GOVERNING LAW AND ARBITRATION

10.1. This Agreement will be governed by and construed in accordance with the laws of Japan.

10.2. All disputes arising between you and NIDEK relating to this Agreement or the interpretation or performance thereof will be finally settled by binding arbitration in Tokyo in accordance with the Commercial Arbitration Rules of The Japan Commercial Arbitration Association. Judgment upon the award rendered by arbitration will be final and may be entered in any court having jurisdiction thereof.

11. SEVERABILITY

11.1. If any provision or any portion of any provision of this Agreement will be held to be invalid or unenforceable, that provision will be severed from this Agreement and such invalidity or unenforceability will not affect the remaining provisions of this Agreement. The remaining provisions of this Agreement will continue in full force and effect.

12. SURVIVAL

12.1. The provisions of 2, 3, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19 and this provision will survive the termination of this Agreement and will be binding after the termination of the Agreement.

13. ASSIGNMENT

13.1. This Agreement or any part of this Agreement may not be assigned or transferred without prior written consent of NIDEK. The permitted assignee or transferee must agree to all the terms and conditions of this Agreement prior to the assignment or transfer.

13.2. This Agreement will be binding upon the permitted assignee or transferee and be enforceable by NIDEK.

14. ENTIRE AGREEMENT

14.1. This Agreement constitutes the entire agreement between you and NIDEK concerning the Software, and supersedes any prior written or oral agreement between you and NIDEK. No modification of this Agreement will be binding unless otherwise agreed in writing.

15. NO WAIVER

15.1. The failure of NIDEK to enforce at any time or for any period the provisions hereof in accordance with its terms will not be construed to be a waiver of such provisions or of the rights thereafter to enforce each and every provision.

16. NO THIRD PARTY RIGHTS

16.1. This Agreement is intended to be solely for the benefit of you and NIDEK and is not intended to confer any benefits upon or create any rights in favor of any person other than you and NIDEK.

17. HEADINGS

17.1. All headings are for convenience only and will not affect the meaning of any provision of this Agreement.

18. LANGUAGE

18.1. The license agreement for the Software may be provided in multiple languages. In such event, unless otherwise agreed in writing, the following shall apply:

a) If you use the Software in any countries outside Japan, the license agreement for the Software shall be executed and delivered in a text using the English language. The text using the English language shall prevail and control; and

b) If you use the Software in Japan, the license agreement for the Software shall be executed and delivered in a text using Japanese language. The text using the Japanese language shall prevail and control.

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19.1. If the terms and conditions of the "Software License Agreement" included in operations manuals for NIDEK product are inconsistent with the terms and conditions of the "Software License Agreement" displayed on NIDEK product, the terms and conditions of the "Software License Agreement" included in operations manuals for NIDEK product prevail.

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1 SAFETY PRECAUTIONS

1.1 For Safe Use

⚠ BEFORE USE, READ THIS MANUAL.
The safety precautions and operating procedures must be thoroughly understood prior to operation of the device. Keep this manual handy for reference.

In this manual, signal words are used to designate the degree or level of safety alerting. The definitions are as follows.
⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.
⚠ CAUTION Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage accident.
Even situations indicated by ⚠ CAUTION may result in serious injury under certain conditions. Safety precautions must be strictly followed at all times.

1.2 Usage Precautions

Before use

⚠ WARNING

- If any serious device-related incident occurs, report it to NIDEK and the competent authority in the country where the user or patient, or both reside.
- Be sure to firmly secure the refractor head so that it will not fall off.
  If the device falls off, injury or device failure may result.
- Be sure to connect the power plug to a grounded power outlet.
  Electric shock or fire may occur in the event of malfunction or power leakage.

⚠ CAUTION

- Do not use this device for any purposes other than those intended.
  NIDEK is not responsible for accidents or malfunctions caused by misuse.
  "♦ Intended use" (page 19)
- Be sure to use only the accessories specified by NIDEK.
  Use of the accessories other than specified by NIDEK may cause malfunctions or adverse events.
- If the connection between devices needs to be disconnected or reconnected, contact NIDEK or your authorized distributor.
- Install the device in a location that meets the following conditions. If the following conditions are not met, inaccurate measurement, electric shock, malfunction, or toppling over causing injury may occur.
  - Free from impact and vibration
  - Level and stable
  - Not exposed to water
  - No light such as direct sunlight or spot light directly shines on the chart window front.
  - There is no magnetic force near the device.
- Install the device in an environment that meets the usage conditions.
  " Environmental conditions (during use)" (page 181)
- Do not damage the measuring windows or chart window, or smudge it with fingerprints or dust.
  Scratch or dirt may result in an inaccurate measurement.
- Clean the measuring windows, forehead rest, and face shields using a cloth dampened with rubbing alcohol before refraction.
- When handling the power supply and electrical components, observe the following precautions. Failure to do so may result in malfunction, electric shock, or fire.
  - Be sure to use the supplied power cord. Also do not connect the provided power cord to any other device.
  - Be sure to use a power outlet that meets the specified power requirements.
  - Fully insert the power plug into the power outlet.
  - Install the device to a place where the power plug can be easily disconnected from the power outlet.
  - Do not crush or pinch the power cord with heavy objects.
  - Do not use power strips or extension cables for power supply.
  - Do not move the device with the power cord or cables connected.
  - Before connecting cables to the device, turn off the power switch.

During use

⚠ WARNING

- Only personnel authorized by NIDEK are allowed to remove the covers and set screws other than the rear cover. Do not disassemble, repair, or modify the device.
  Otherwise, electric shock, injury, or malfunction may result.

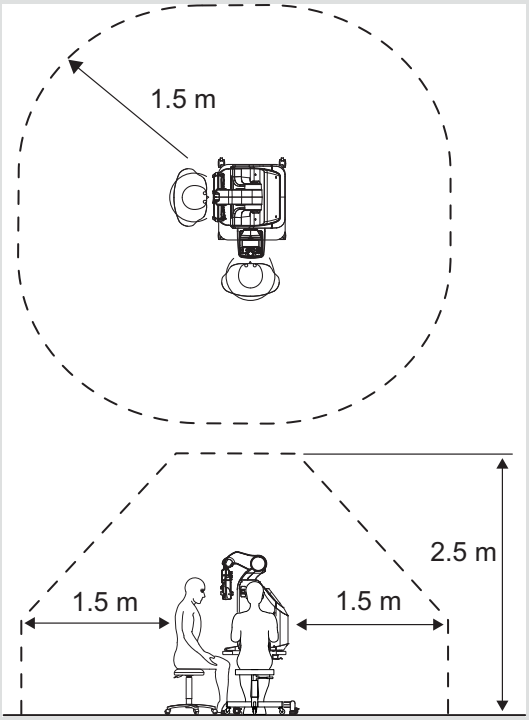
⚠ CAUTION

- Do not perform servicing or maintenance on the device during use.
- Be sure to check the device before use for that day.
  "3.1.1 Pre-use check and device startup" (page 39)
- In the event of smoke or strange odors, immediately turn off the power switch and disconnect the power plug from the power outlet. After you are sure that the smoke has stopped, then contact NIDEK or your authorized distributor.
  Use of the device under such abnormal conditions may cause fire or electric shock. In case of fire, use a dry chemical (ABC) extinguisher to extinguish fire.
- Immediately replace the power cord if its internal wires are exposed, power is intermittent when the cord is moved, or the cord and/or plug are hot to the touch.
  Electric shock or fire may result.
- If the device fails, disconnect the power cord from the power outlet and contact NIDEK or your authorized distributor without touching the interior of the device.
  Electric shock may result.
- When moving the refractor head up or down, have the patient keep their hands on their knees and maintain 20 cm or more between the refractor head and the patient's face. If hands become caught in the arm unit, release the refractor head vertical motion switch immediately to stop the movement.
  The refractor head may strike the patient's face or hands may become caught in the arm unit during movement.
- When the refractor head moves to switch between the distance vision test and the near vision test, keep the patient's face 20 cm or more apart.
- If the device is connected to a computer that does not comply with IEC 60601-1 (except one that uses an AC adapter that meets the Class II requirements of IEC 60950-1 or 62368-1), supply power to the device and computer through isolation transformers.
  Otherwise, electric shock may result. Contact NIDEK or your authorized distributor for installing isolation transformers.

⚠ CAUTION

- Use devices that comply with IEC 60601-1 in the patient environment. If any device that does not comply with IEC 60601-1 is to be used, install the device outside the patient environment. For a generalized information system, use the device that complies with IEC 60950-1 or IEC 62368-1. For other devices, use any separation device that complies with IEC 60601-1 and keep sufficient distance between the device and patient environment.

  The volume of space (patient environment) where contact can occur between the patient and any part of the device (including connected ones) or between the patient and any other person(s) touching the device (including connected ones) is as shown to the right.



After use

⚠ CAUTION

- Be sure to perform after-use check.

  "3.1.2 Device shutdown and after-use check" (page 41)

- Do not pull on the power cord but hold the plug when disconnecting it from the power outlet.

  Cord breaking may result.

- Occasionally clean the prongs of the power plug with a dry cloth.

  If dust settles between the prongs, short circuit or fire may occur.

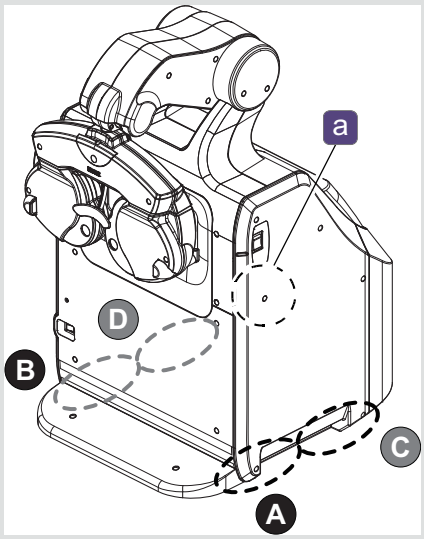
- If the device will not be used for an extended period of time, disconnect the power cord from the power outlet.
- Do not store the device in an area that is exposed to rain, moisture, harmful gases, or where liquids are stored.

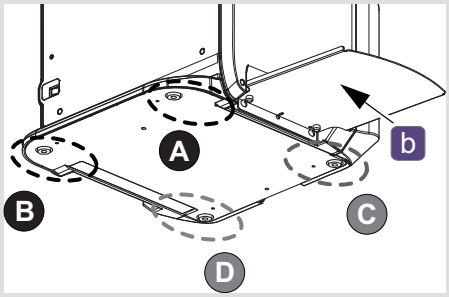
Device movement and maintenance

⚠ CAUTION

- To move the device, remove the cables and turn clockwise the distance/near switching unit fastening screw a shown in the figure to the right with a hexagonal wrench to tighten the screw. Carry the device by two or more people holding its handle parts at A and B from the front, C and D from behind.

  Do not hold the control box tray (optional) b when moving the device. When setting the device down, first lower the B and D side to prevent hands from becoming caught under the device.





- Only service personnel trained by NIDEK are allowed to disassemble or repair the device.
  NIDEK assumes no responsibility for any adverse events resulting from improper servicing.
- When performing maintenance and checks, secure a sufficient work space.
  Work in an insufficient space may result in injury.
- To ensure the continued safe use of the device, it is recommended that the manager of this device make sure that maintenance and preventive inspection are performed at least once a year.
  For details, see *"7.3 Periodical Inspection" (page 168)*.
- For details of failures or maintenance and inspection, check and take actions with *"7.1 Troubleshooting" (page 165)* before contacting NIDEK or your authorized distributor.
- To transport the device, use dedicated packing material.
  Excessive vibration or impact may cause device malfunction.
- Maintain the surrounding temperature and humidity within the following conditions during transport and storage of the device in a packed condition.
  " Environmental conditions (during storage, unpacked condition)" (page 181)
- When the device is sent back to NIDEK or your authorized distributor for repair, wipe the surfaces of the device (especially, the areas that come into contact with the patient) with a clean cloth dampened with rubbing alcohol.

Disposal

⚠ CAUTION

- Follow the local ordinances and recycling regulations regarding disposal or recycling of the components. Follow local governing ordinances and recycling plans regarding disposal or recycling of device components, particularly when disposing of the lithium ion battery, circuit board, plastic parts that contain brominated flame retardant, LCD, or power cord.

  It is recommended to entrust the disposal to a designated industrial waste disposal contractor.

  Inappropriate disposal may contaminate the environment.

- When disposing of packing materials, sort them by material and follow local ordinances and recycling regulations.

  Inappropriate disposal may contaminate the environment.

Other precautions

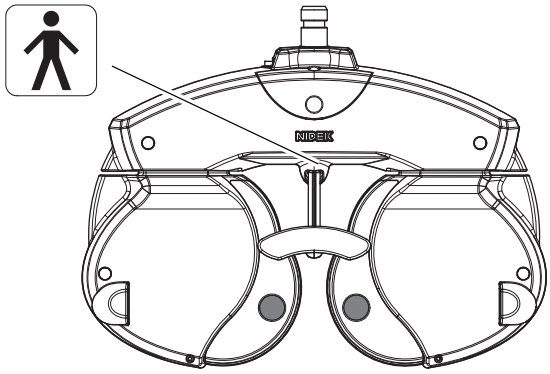
- Use the supplied touch pen to operate the control box touch screen.
  Touching with a hard object such as a ballpoint pen tip may scratch the touch screen.
  In addition, pressing the touch pen excessively may damage the touch screen.
- This device uses heat-sensitive printer paper. When keeping the printed data for a long period of time, make copies of the printouts or write down the results by hand.
  The paper degrades over time and the printed characters may become illegible. If glue containing organic solvents or adhesives such as on adhesive tape comes in contact with the printer paper, the printed characters may become illegible.
- Do not place heavy objects on the control box tray, sit on it, or brace your hands against it.
- Instruct the patient not to touch the refractor head, control box tray, or main device when they sit or stand for refraction.
- Avoid the following environmental conditions when storing the device.
  Do not store the device in an area that is exposed to rain, moisture, harmful gases, dust, direct sunlight, or high temperatures and humidity.
- Maintain the following environmental conditions during transport or storage of the device in a packed condition.
  For the environmental conditions during storage, see *" Environmental conditions (during storage, unpacked condition)" (page 181)*.
- When transporting the device, use dedicated packing material to protect the device from impact due to dropping or such.
  Excessive vibration or impact may cause device malfunction.
- When cleaning the measuring windows, chart window, or LCD, remove dust with a blower brush and gently wipe with a soft cloth.
- Do not clean the measuring windows, chart window, or LCD using a cloth moistened with detergent or such.
  Wiping marks may be left or the surface coating may be damaged.
- Do not use organic solvents such as paint thinner to clean the device.
  The surface of the device may be damaged.
- Be sure to use only the printer paper specified by NIDEK.
  If printer paper other than those specified is used, the printer head may be damaged.
- Do not use the device beyond its service life.
  Even with proper maintenance and checks, after time, the device reliability or safety may become degraded and fail to achieve the target values.
- Equipment connected to the analog or digital interfaces must be certified according to the representative appropriate national standards such as IEC 60601-1.
  Furthermore, all configurations must comply with the system standard IEC 60601-1. Anyone who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1. If you have any questions, contact NIDEK or your authorized distributor.

1.3 Labels and Symbols

To call attention to users, labels and indications are provided on the device. If labels are peeling off, characters are fading, or otherwise becoming illegible, contact NIDEK or your authorized distributor.

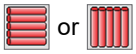
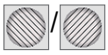
	Indicates that the operator is advised to refer to the related instructions in the operator's manual. This symbol is provided on the identification label.
	Indicates that the degree of protection against electric shock is of a Type B Applied Part. The applied part is the forehead rest.
	Indicates the power switch state. When the switch is set to this symbol position, power is not supplied to the device.
	Indicates the power switch state. When the switch is set to this symbol position, power is supplied to the device.
	Indicates that the device must be supplied only with alternating current.
	Indicates the date of manufacture. This symbol is provided on the identification label.
	Indicates the manufacturer. This symbol is provided on the identification label.
	Indicates that this product shall be disposed of in a separate collection of electrical and electronic equipment in EU. This symbol is provided on the identification label.
	Medical device
	EU authorized representative
	Serial number
	Swiss authorized representative

◆ Symbol details



Refractor head

The symbols displayed on the control box touch screen correspond to the symbols and names defined in ISO 10341 (Ophthalmic instruments - Refractor heads) as shown in the table below.

Auxiliary lens	Symbol		
	Control box touch screen	ISO 10341	
Horizontal/Vertical Maddox		MR	Maddox rods
Pinhole plate with a hole diameter of 2 mm		PH 	Pinhole
Occluder		BL 	Occluder
PD check lens		CL 	Cross line
Red filter		RF	Red filter
Green filter		GF	Green filter
Polarizing filter (not used)		PF	Polarizing filter
Open aperture		OA	Open aperture
Spherical lens for retinoscope		RL	Retinoscope lens

2 INTRODUCTION

2.1 Device Outline

■ The TS-310 is a space-saving automated refraction system that uses a combination of the refractor head of the RT-3100 and a control box.

- With the high precision LCD, visual acuity of 5 m as well as near visual acuity of 40 cm can be measured with the same accuracy as a standard refraction using actual distances.
- The objective data measured by a NIDEK auto refractometer and the lensometry data measured by a NIDEK lensmeter can be imported and used in this device.

◆ Intended use

- The TS-310 is a combination device that consists of a device that optically presents charts for distance and near vision and a refractor incorporating lenses of various dioptric powers intended to determine the refractive error of the eye.

◆ Intended patient population

- Age

  Except for infants (under 3 years old)
- Physical restrictions

  Recommendation: The distance from the top of the chair to the eyes is 600 mm or more.

  Not eligible: Those who has difficulty in leaning forward

  Those who cannot push their forehead against forehead rest

  Those who cannot look through the chart window in a sitting position or standing position
- Health condition

  Able to undergo an examination in a sitting position or standing position

  Those who can answer questions of examiners

  Able to fixate their eyes
- Conditions - Visual function

  One or both eyes are normal or have disease. Eyes with no visual function are not eligible.

◆ Intended user profile

- Any qualified personnel such as ophthalmologists, nurses, ORT/OD, or optician facility staff (irrespective of nationality, culture, or style of dress)

◆ Intended use environment

Medical facility or optical store

⚠ CAUTION

- If the device is used outside the specified use location, intended performance and security level cannot be maintained.

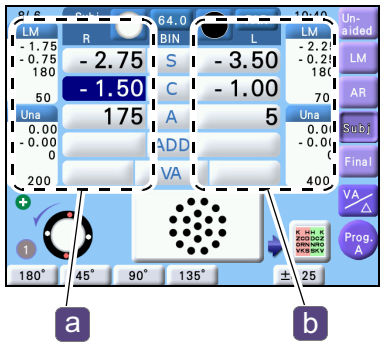
◆ Principles

- This device eliminates the need for a large refraction area by presenting a chart visually equivalent to the 5 m distance on the LCD via its internal concave mirror. The refractor head contains trial lenses. The operator presents various charts to the patient through the measuring windows to measure subjective refraction of the patient while switching trial lenses in the refractor head.

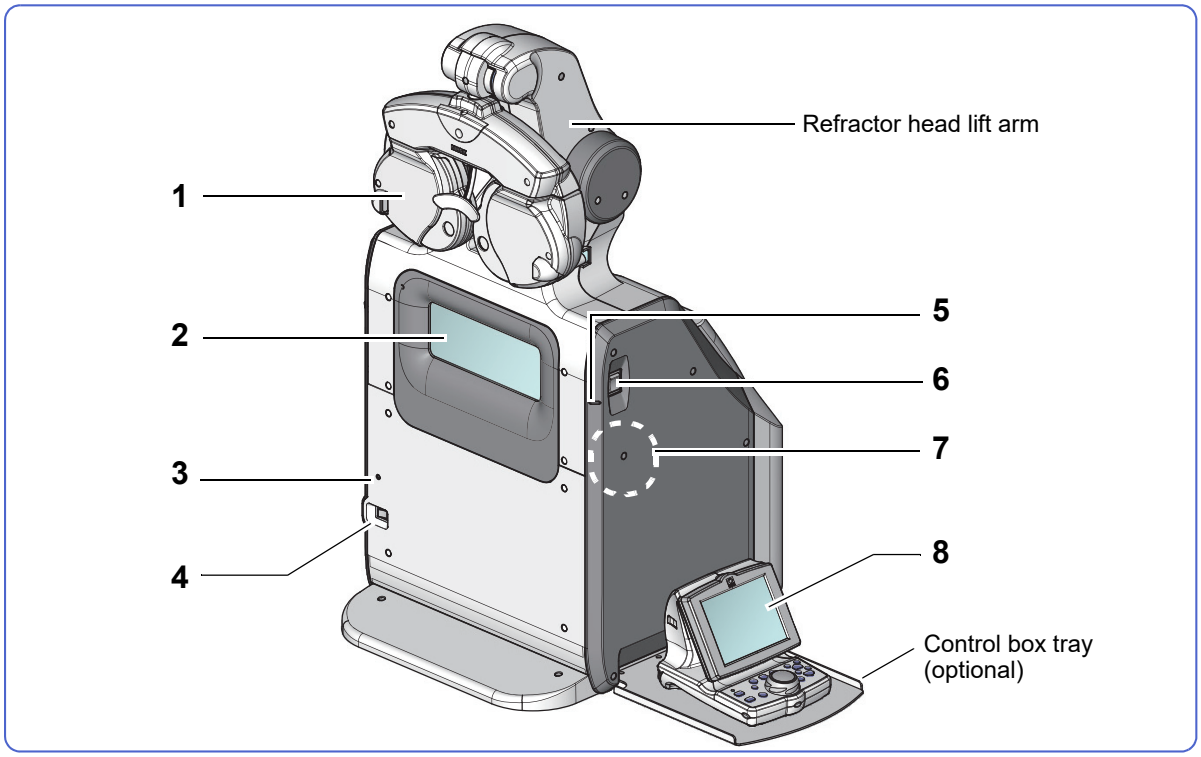
● Regarding button operations and right and left orientations in this manual

Note

- On the touch screen, right and left are mirrored with the values for the right eye side (R) a displayed on the left and the values for the left eye side (L) b displayed on the right.
  This is the alignment of the patient's eyes as viewed by the operator looking at the patient from the front.
- The control panel buttons on the control box are indicated by Shift, dial button, and such.
- Shift + ⊖ indicates pressing ⊖ while holding Shift.



2.2 Device Configuration



1 Refractor head

"♦ *Refractor head" (page 23)*

2 Chart window

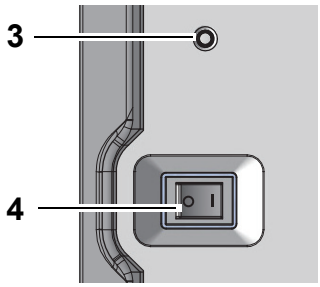
Presents charts.

3 Pilot lamp

Illuminates while the power switch is ON. The lamp blinks slowly in auto light off mode.

4 Power switch

Used to turn ON (|) or OFF (○) the entire system.



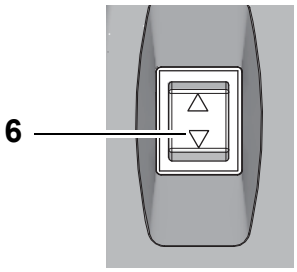
5 Eye level marker (one place on the right and left each)

6 Refractor head vertical motion switch (one place on the right and left each)

Used to move the refractor head vertical motion unit.

Pressing the up arrow. → Moves up.

Pressing the down arrow. → Moves down.

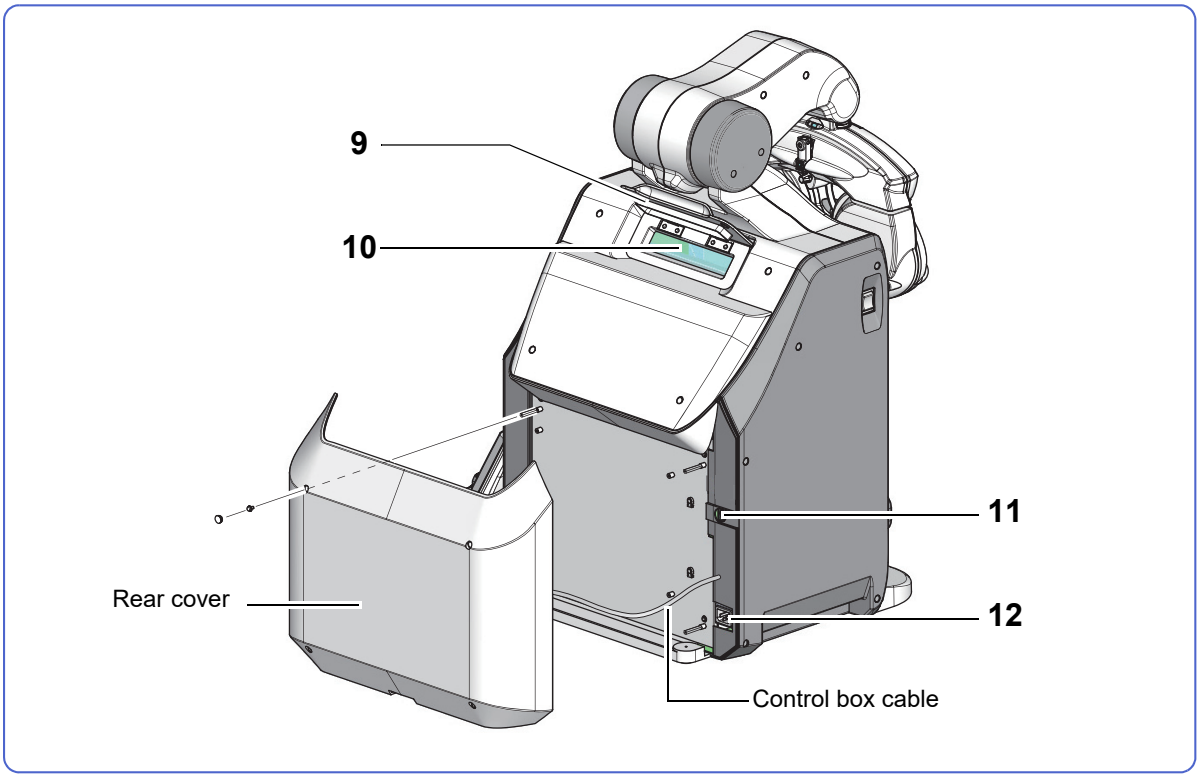


7 Distance/near switching unit fastening screw

Used to secure the distance/near switching unit. Removing the cap allows the access to the screw.

8 Control box

"♦ *Control box" (page 24)*



9 Cover of pupil position check window

Lift open this cover by hand when the pupil position is checked. Close the cover when the pupil position is not checked.

10 Pupil position check window

The operator checks the pupil position through this window.

11 Communication connector

Connect the communication cable of a computer or auto refractometer.

"6.1 Connecting Peripheral Devices" (page 145)

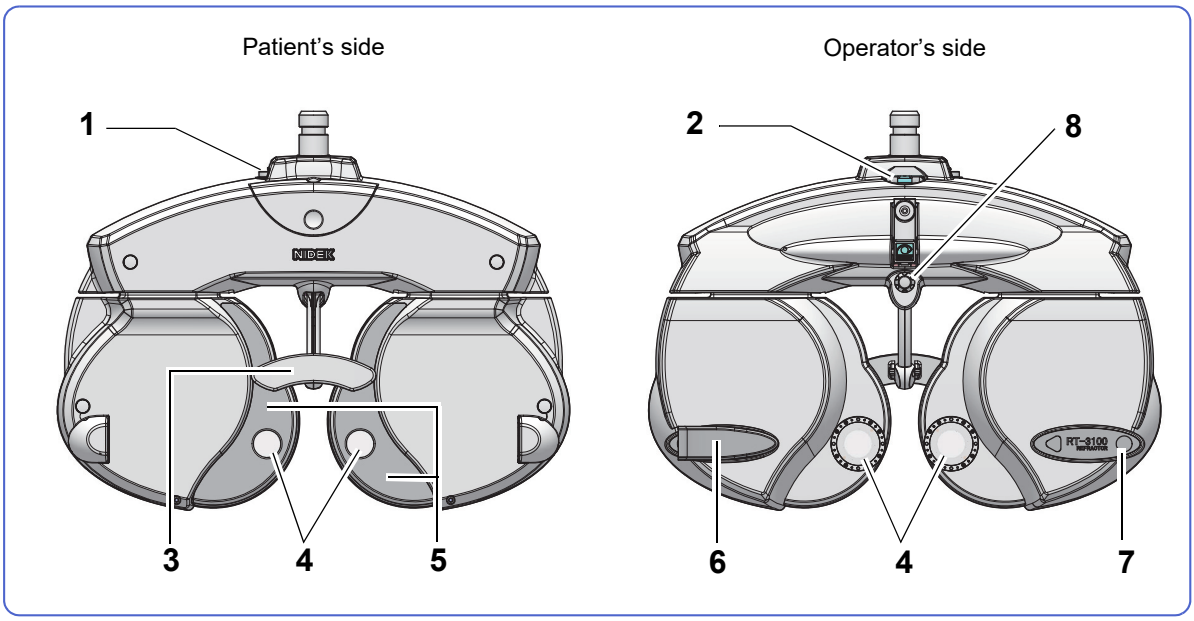
12 Power inlet

Connector for the power cord.

Note

- When connecting the power cord or communication cable, remove the caps and screws (n = 4 for each), and then remove the rear cover.

◆ Refractor head



1 Level adjustment knob

Used to adjust the level of the refractor head.

2 Level

Used to check whether the refractor head is level.

Turn the level adjustment knob until the bubble is centered.

3 Forehead rest

Location where the patient places their forehead.

4 Measuring windows

Windows through which the patient views the chart.

5 Face shields

Locations where the patient places their cheeks.

6 VD check adapter

Reflector adapter to check the vertex distance (VD).

It can be attached either to the right or left of the VD check window.

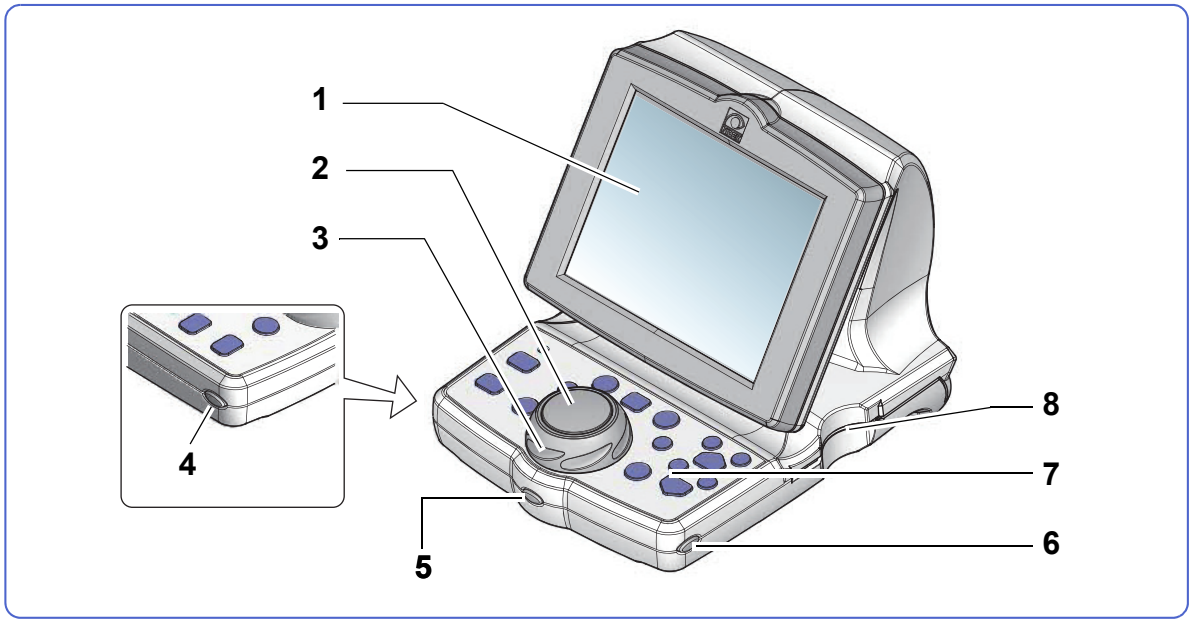
7 VD check window (right and left)

Used to check the vertex distance.

8 Forehead rest adjustment knob

Used to move the forehead rest forward and backward to adjust the vertex distance.

◆ Control box



1 Touch screen

This is an LCD touch screen.

Operation buttons, data, and charts are displayed.

2 Dial button

Switches the mode among sphere (spherical power), cylinder (cylindrical power), and axis (cylinder axis).

3 Dial

Used to change measured values.

Turning the dial while holding Shift changes the numeric quantity by one step of the set increment.

The numeric value currently selected and highlighted can be changed.

Dial rotation	Measured value
Turning to the left (counterclockwise)	Increases the value.
Turning to the right (clockwise)	Decreases the value.

4 (Left side) button

Used to display the chart operation screen.

- Pressing the chart display icon a also displays the chart operation screen.

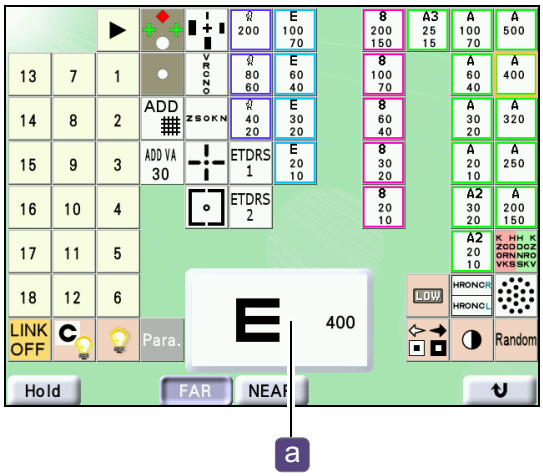
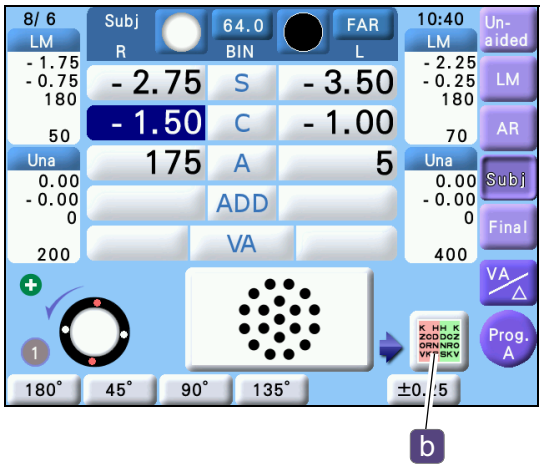


Chart operation screen

5 (Front) button

Used to display the next programmed chart.

- Pressing the next chart display icon b also displays the next chart.
- Shift + (Front) returns to the previous chart.



6 (Right side) button

Used to display the main menu screen.

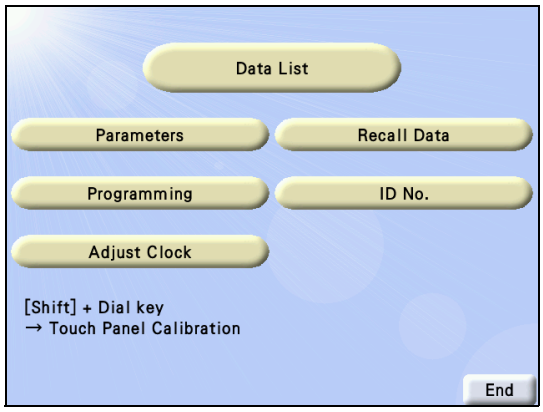
7 Control panel

"♦ Control panel" (page 27)

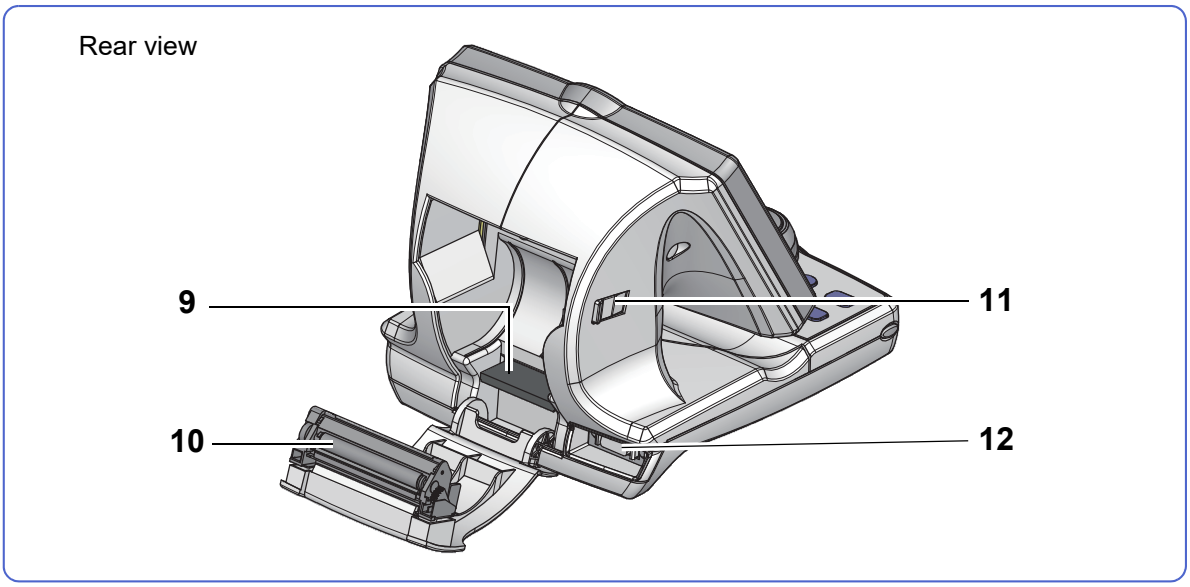
8 Eye Care card slot

Used to insert the Eye Care card (optional).

"3.2.3 To import data from Eye Care card" (page 45)



Main menu screen



9 CompactFlash (CF) card

"7.6 Inserting CF Card" (page 172)

10 Printer

Prints measured values.

"3.11 Printing" (page 65)

"7.5 Replacing Printer Paper" (page 170)

11 Printer cover lever

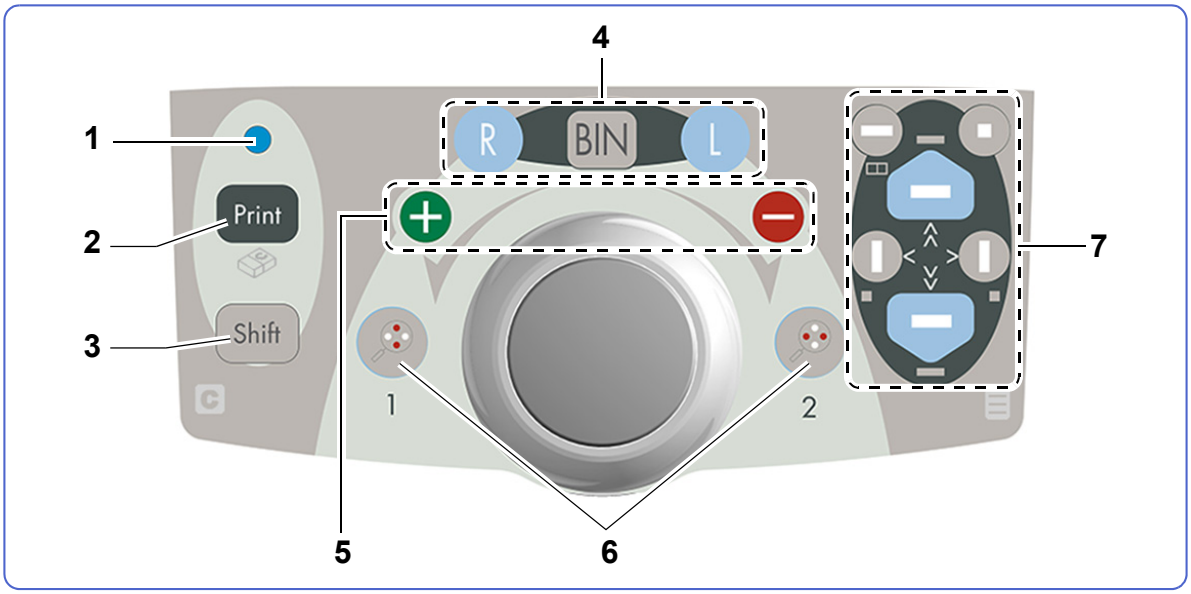
Used to open the printer cover by sliding this lever to the front.

12 Communication connector

Used to connect the control box cable from the TS-310 main device.

"6.1 Connecting Peripheral Devices" (page 145)

◆ Control panel



1 Pilot lamp

Illuminates when the main device is turned on.

2 Print Print button

Used to print data. This button functions only on the measurement screen.

"3.11 Printing" (page 65)

3 Shift Shift button

Turning the dial while holding Shift changes the numeric quantity by one step of the set increment.

Pressing another button while holding Shift works differently as follows:

Button operation example	Function
Shift + Dial	Changes the numeric quantity by one step of the set increment.
Shift + (Front)	Returns to the previous step of the program.
Shift + Print	Clears all the data displayed.
Shift + AR (Measurement mode button)	Copies the displayed numeric values.
Shift + Next chart display icon	Returns to the previous step of the program.

4 Patient's eye selection buttons

Used to select the right eye (R), both eyes [BIN] (binocular), or left eye (L).

Button	Function
R	The right eye is opened and the left eye is occluded. Numeric entry is possible only for the right eye.
BIN	Both eyes are opened. Numeric entry is possible for both eyes.
L	The left eye is opened and the right eye is occluded. Numeric entry is possible only for the left eye.

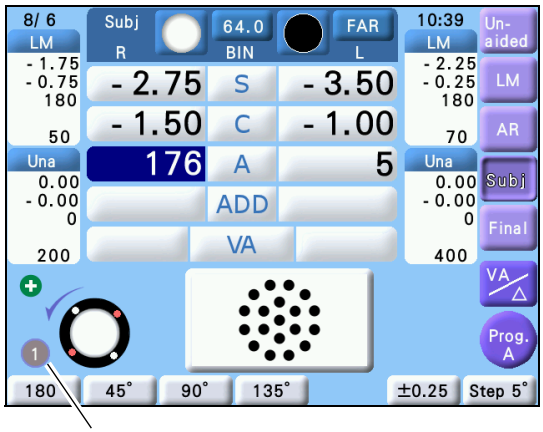
5 Numeric entry buttons

Functions the same as the dial.

Button	Function
+	Increases the numeric quantity by one step of the set increment.
−	Decreases the numeric quantity by one step of the set increment.
Shift + +	Changes the numeric quantity by one step of the set increment.
Shift + −	

6 (1), (2) Cross cylinder switching buttons

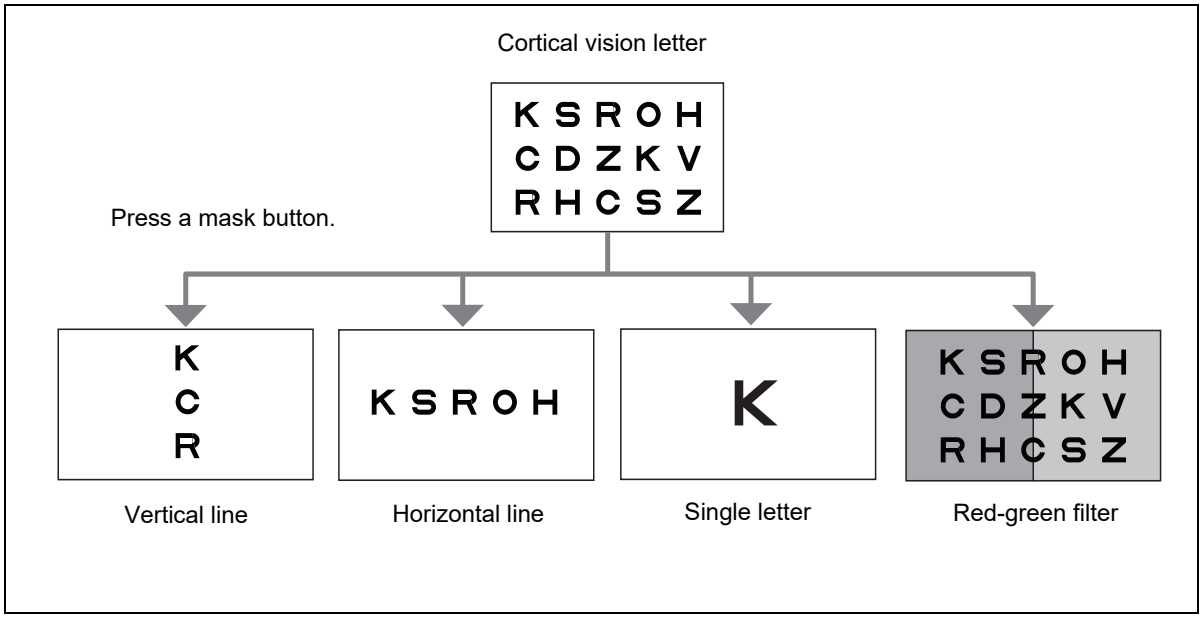
Cross cylinder lens 1 or 2 is placed.



Indicates which cylinder lens ((1) or (2)) is placed.

7 Mask buttons

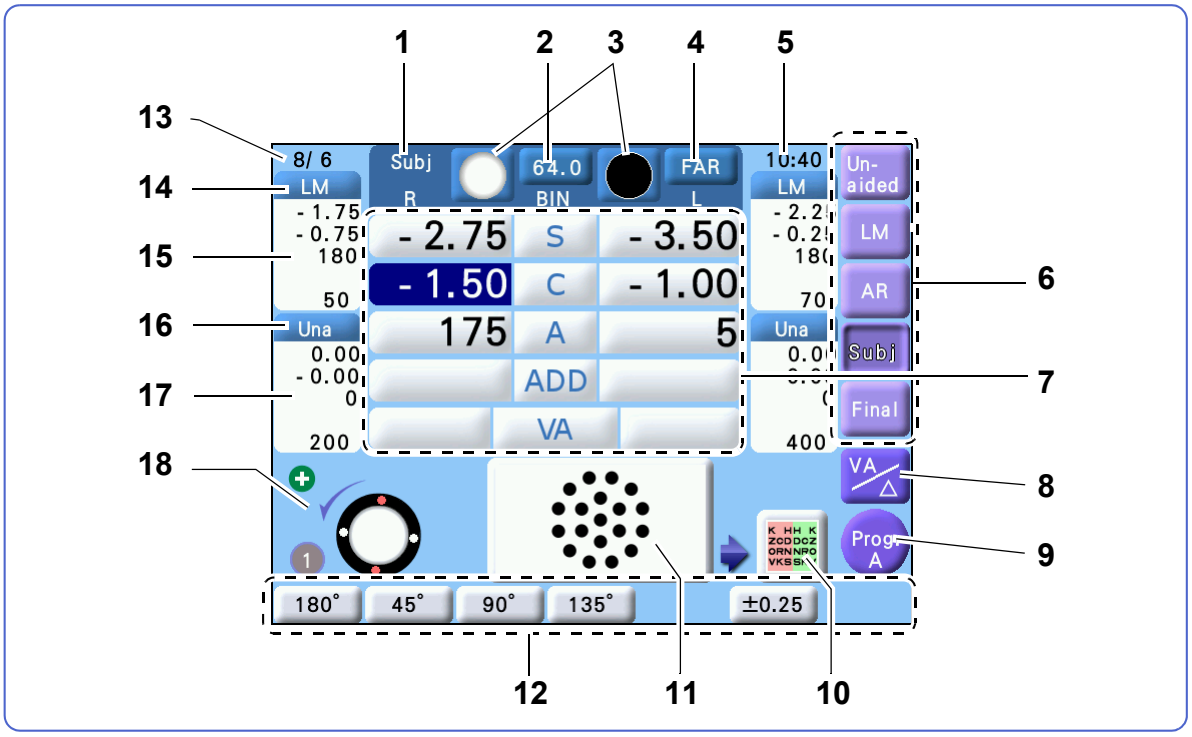
Used to select the visual acuity chart.



Button	Function
,	Displays the upper or lower row of the presented visual acuity chart.
	Displays the middle horizontal line of the cortical vision letter.
Shift +	Displays the single letter in the upper left corner of the cortical vision letter.
	Displays the single letter in the upper right corner of the cortical vision letter.
<, >	Displays the leftmost or rightmost vertical line of the cortical vision letter.
Shift + </>	Displays the single letter in the lower left corner or lower right corner of the cortical vision letter.
Shift +	Applies the red-green filter to the visual acuity chart.

❖ For details of mask buttons, see *"3.5.2 To select visual acuity charts" (page 51)*.

◆ Measurement screen



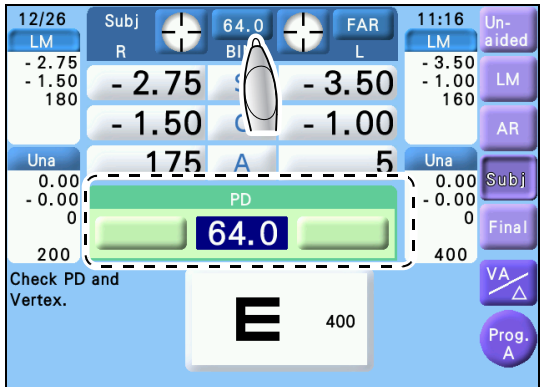
1 Mode indication

Displays the mode selected by the measurement mode button.

2 64.0 PD button

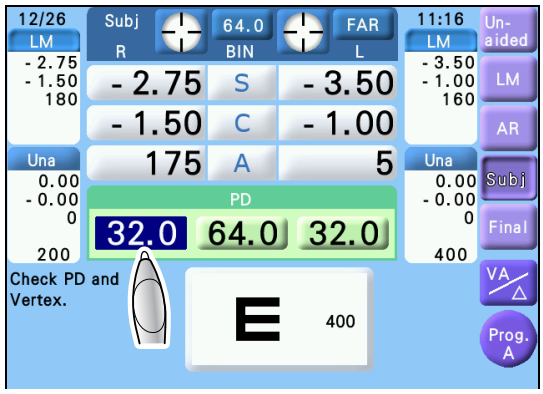
Pressing this button enters the mode in which the pupillary distance (PD) of the refractor head is changed (PD mode).

"4.1.3 To adjust pupillary distance" (page 72)



- When entering the binocular PD

  In PD mode, turn the dial to change the binocular PD.



- When entering the monocular PD (1/2PD)

  In PD mode, press the R or L side field and turn the dial to change the monocular PD.

  (In PD mode, pressing R or L also allows the monocular PD to be changed.)

3 / R/L auxiliary lens display button

Pressing either button displays the Auxiliary Lenses window of the R/L eye.

"5.5 Placing Auxiliary Lenses" (page 136)

4 FAR Distance / NEAR Near button

Pressing this button toggles between Distance mode and Near mode.

When the device is turned on or data is cleared, Distance mode is activated. Near mode is used to perform a near vision test. The addition (ADD) function does not work in Near mode.

5 Time display

"6.4 Setting Date and Time" (page 164)

6 Measurement mode buttons

Used to specify each mode for measurement.

The measured values in the selected mode are displayed in the center of the touch screen.

- Pressing Subj with no subjective values entered copies AR or LM data in the current data display according to the *" Preset power of Subj" (page 154)* parameter.
- Pressing a button for which no data is entered copies the numeric values that are displayed before pressing the button in the current data display.
- Pressing the measurement mode button while holding Shift copies the displayed numeric values in the current data display regardless of whether data is present.

Button	Function
Un-aided	Measures unaided visual acuity. • The lens set in the refractor head has no power (0 D). • Pressing Shift when the *" PC port" (page 155)* parameter is set to other than "PC" displays IN (button to import data from an auto refractometer or lensmeter).
LM	Imports the measured values from a lensmeter.
AR	Imports the measured values from an auto refractometer or retinoscope.
Subj	Measures the full correction. When data of a lensmeter or auto refractometer is imported from an Eye Care card, this mode is automatically activated.
Final	Measures the final prescription and visual acuity values. With this button, copy the full correction to the prescription field and adjust it to the final prescription.

7 Current data display

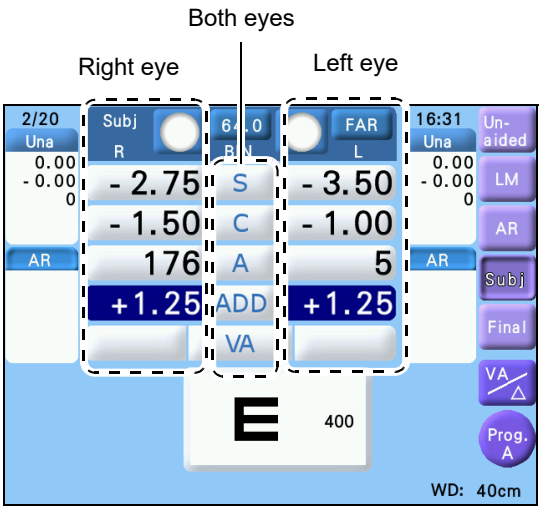
Displays the lens data that is currently placed in the refractor.

Pressing data to be changed highlights its button and allows the data to be changed. Change the numeric value using the dial, ⊕, or ⊖.

- S Sphere button

Used to enter the mode that allows sphere (spherical power) values to be entered for both eyes.

Pressing an R side value enters the mode for the right eye. Pressing an L side value enters the mode for the left eye.



- C Cylinder button

Used to enter the mode that allows cylinder (cylindrical power) values to be entered for both eyes.

Pressing an R side value enters the mode for the right eye. Pressing an L side value enters the mode for the left eye.

- A Axis button

Used to enter the mode that allows axis (axis angle) values to be entered for both eyes.

Pressing an R side value enters the mode for the right eye. Pressing an L side value enters the mode for the left eye.

- ADD Addition button

Used to enter the mode that allows addition values to be entered for both eyes.

Pressing an R side value enters the mode for the right eye. Pressing an L side value enters the mode for the left eye.

- VA Visual acuity button

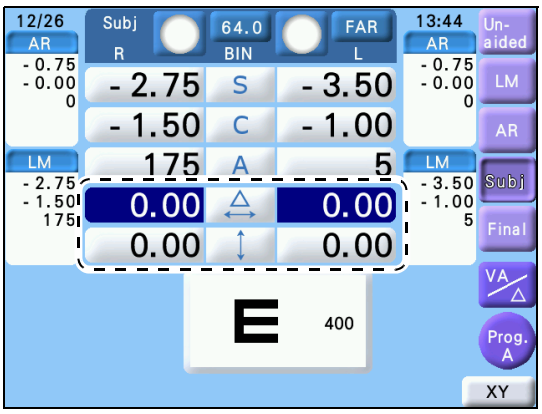
Used to enter the mode that allows visual acuity values to be entered for both eyes.

Pressing an R side value enters the mode for the right eye. Pressing an L side value enters the mode for the left eye.

- △↔ / △↕

Pressing VA△ enters the mode that allows prism values to be entered in rectangular coordinates (BASE IN/OUT △↔ or UP/DOWN △↕).

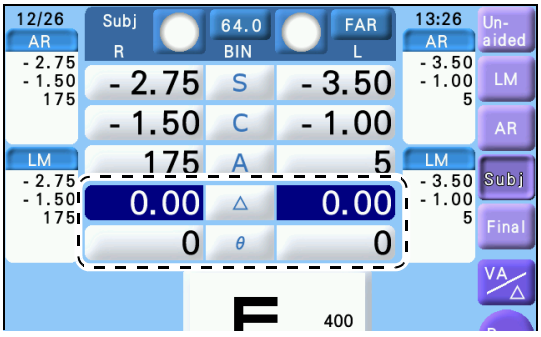
Pressing an R side value enters the mode for the right eye. Pressing an L side value enters the mode for the left eye.



- △ / θ

Pressing VA△, then pressing XY enters the mode that allows the absolute value to be entered in polar coordinates △ or the base direction angle in polar coordinates θ.

Pressing an R side value enters the mode for the right eye. Pressing an L side value enters the mode for the left eye.



8 **Visual acuity / Prism display button**

Used to toggle between the VA (visual acuity) + ADD (addition) display and the prism display.

9 **Program selection button**

Used to start each program. Pressing the button again during program execution returns to the beginning of the program.

Pressing the program selection button while holding Shift switches the program mode (A, B, C, ☼ ☽) in order.

"5.3 Programming" (page 129)

10 **Next chart display icon**

Used to display the next chart.

- Pressing (Front) also displays the next chart.

11 **Chart display icon**

Used to display the chart operation screen.

- Pressing (Left side) also displays the chart operation screen.

12 **Function buttons**

Supplementary function buttons.

The buttons displayed differ depending on the chart displayed or the selected numeric field.

Ex.— [180°], [45°], [90°], [135°]: Enter the axis.

[C+/-]: Toggles the cylinder reading between + and -.

13 **Date display**

For setting date, see *"6.4 Setting Date and Time" (page 164)*.

14 **Display data setting 1 button (right eye / left eye)**

Used to open the window that specifies items to be displayed in Subwindow 1.

15 **Subwindow 1 (right eye / left eye)**

Displays the items specified by the display data setting 1 button. If not specified otherwise, the measurement mode values previously set are displayed.

16 **Display data setting 2 button (right eye / left eye)**

Used to open the window that specifies items to be displayed in Subwindow 2.

17 **Subwindow 2 (right eye / left eye)**

Displays the items specified by the display data setting 2 button. If not specified otherwise, the measurement mode values set before the previous setting are displayed.

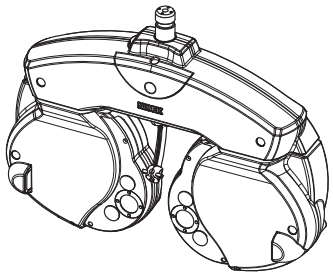
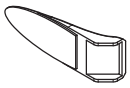
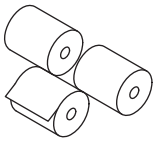
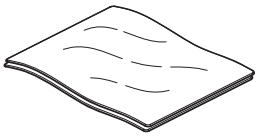
If the display items are specified in Subwindow 1, the measurement mode values previously set are displayed.

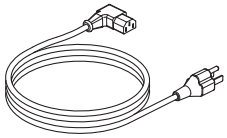
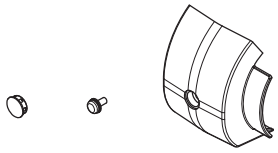
18 **Next operation image**

A guide image that leads to the next operation.

2.3 Packed Contents

Unpack the contents from the shipping carton and make sure that all are present.

Part name	Quantity	Appearance
Refractor head	1	
Control box	1	
Forehead rest	1	
Face shields (provided with the refractor head)	1 set	
VD check adapter	1	
Touch pen	1	
Printer paper	3	
Dust cover	1	

Part name	Quantity	Appearance
Power cord	1	
Cover plate Cap Screw	1 unit each	
Hexagonal wrench	1	
Phillips screwdriver	1	
Operator’s manual	1	

2.4 Before Initial Use

◆ Before initial use or after movement

The following shows an example that this device is installed on the table.

Note

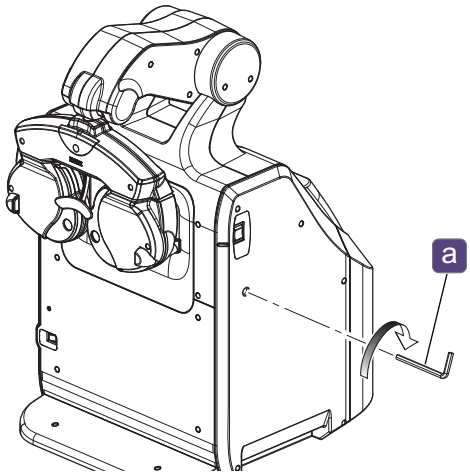
- In order to align the refractor head with the eye level of the patient, the table on which this device is installed must be equipped with an elevating method.

⚠ CAUTION

- Carry the device by two or more people holding its handle parts from the front and behind.
  “ Device movement and maintenance” (page 13)

1 Tighten the distance/near switching unit fastening screw if it is not tightened.

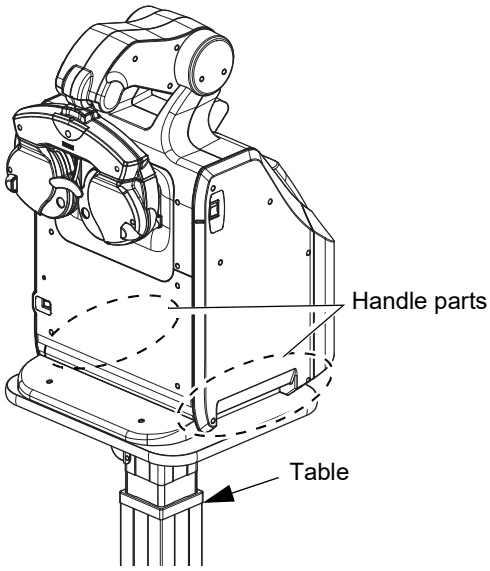
1) Remove the cap with a flatblade screwdriver.
2) Turn the distance/near switching unit fastening screw clockwise with a hexagonal wrench a to secure the switching unit.



2 With two or more people, place hands at the handle parts on the right and left of the main device to lift and place the device on the table.

Make sure that the table is level and there is no rattling.

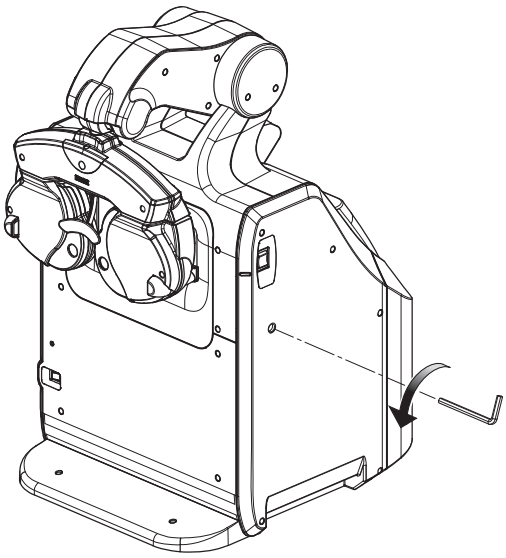
- For installation precautions, see *“ Before use” (page 10)*.
- For details of the installation procedure, contact NIDEK or your authorized distributor.



3 Loosen the distance/near switching unit fastening screw.

1) Turn the fastening screw counterclockwise with a hexagonal wrench to loosen it.

2) Attach the cap.



⚠ CAUTION

- Do not turn on the device before loosening the distance/near switching unit fastening screw.
  Otherwise, malfunction may occur.

4 Load the printer paper.

"7.5 Replacing Printer Paper" (page 170)

5 Perform pre-use check.

"3.1.1 Pre-use check and device startup" (page 39)

"♦ Pre-use Checklist" (page 40)

❖ This completes the setup procedure.

3 OPERATING PROCEDURE

■ This chapter explains the basic operations and functions for refraction.

3.1 Device Startup and Shutdown

3.1.1 Pre-use check and device startup

⚠ CAUTION

- Be sure to perform pre-use check according to the Pre-use Checklist. It is recommended to record the check items.
  Failure to perform pre-use check may result in an inaccurate measurement. Device malfunction may also result.
  “♦ Pre-use Checklist” (page 40)

1 Do a check with the check items before turning on the device.

“♦ Pre-use Checklist” (page 40)

2 Turn ON (|) the power switch of the device.

In a few seconds after the device is turned on, the startup screen appears and then the screen changes to the measurement screen.

3 Do a check with the check items after turning on the device.

Startup screen

◆ Pre-use Checklist

Check items before turning on the device

Item	Checked (date and by whom)
Make sure that the power cord is connected to the power outlet properly.	
The cables of the connected devices are connected securely.	
The main device is clean.	
The chart window and the pupil position check window are clean.	
The face shields and the forehead rest are attached to the main device.	
The face shields and the forehead rest are clean.	
The measuring windows of the refractor head are clean.	
The refractor head is level.	
The control box touch screen is clean.	
Printer paper is sufficient.	
The connected devices are turned on.	
Check items after turning on the device	
When the device is turned on, no error message is displayed.	
The refractor head moves up and down.	
The control box touch screen presents the screen for minimum visual acuity.	
The chart for minimum visual acuity is displayed.	
The chart brightness is even.	
The chart can be changed with the control box.	
The chart shown on the chart window matches that shown on the control box touch screen.	

3.1.2 Device shutdown and after-use check

Note

- Recovery from auto light off mode
  When the device is idle for 15 minutes (changeable by parameter setting), auto light off mode is activated. In auto light off mode, the backlights for the chart window and the control box touch screen go out and the pilot lamp blinks.
  " Auto lamp off" (page 154)
  To recover from auto light off mode, press any button on the control box.

- Do not turn off the device during printing. Malfunction may occur.
- When the device will not be used for an extended period of time:
  - Disconnect the power cord from the power outlet.
  - Tighten the distance/near switching unit fastening screw and put the dust cover on the device.
    " Environmental conditions (during storage, unpacked condition)" (page 181)

1 Turn OFF（○）the power switch.

2 Clean as necessary.

"7.7 Cleaning" (page 173)

3 Perform after-use check.

It is recommended to create a checklist and fill in the check results.

- The power is turned off.
- The face shields and forehead rest are clean.
- The device is clean and has no damage.
- Printer paper is sufficient.
- Accessories have no damage and are not lost.

4 Put the dust cover on the device.

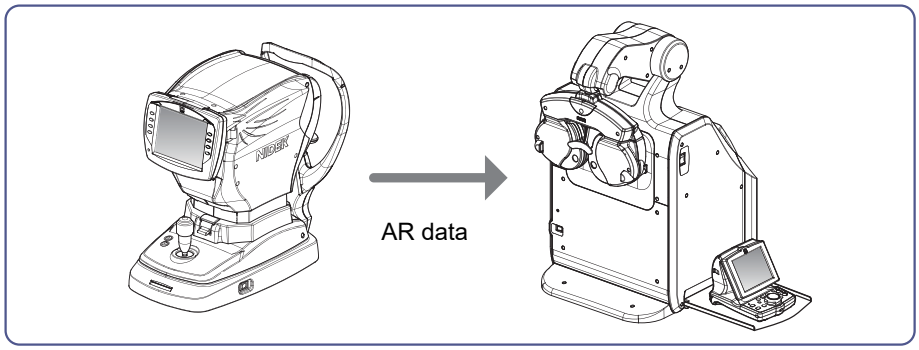
3.2 Importing Data before Refraction

3.2.1 To import data from auto refractometer

This section explains how to import objective (AR) data from an auto refractometer.

For the operating procedure of the auto refractometer, refer to its operator's manual.

Connectable auto refractometers	AR: AR-1 series, AR-20, AR-300 series, AR-600 series, HandyRef ARK: ARK-1 series, ARK-30, ARK-500 series, ARK-700 series, ARK-9000, ARK-10000, HandyRef-K, OPD-Scan series RKT: TONOREF series



Note

- To import data from an auto refractometer, set the *" PC port" (page 155)* parameter as follows:
  - When an auto refractometer is connected-> "AR"
  - When an auto ref/keratometer (ARK) or OPD-Scan series is connected -> "ARK"
  - When TONOREF series is connected-> "RKT"
- Parameter setting of the auto refractometer: "PATIENT NO."-> "YES"
  * Only available for specification on certain models.
- OPD-Scan series in AR/KM mode: "RT TYPE"-> "5100"
  * Only available for specification on certain models.
- It is recommended to specify Manual mode as Print mode of the TONOREF series.
  "PRINT"-> "MANUAL"

1 Measure the patient's eyes with an auto refractometer.

2 When measurement is complete, press the print button of the auto refractometer.

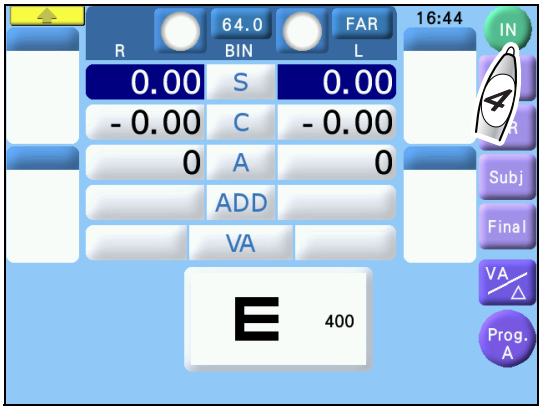
Upon printing, the measured values are automatically transferred to the memory of the control box. (Only a single measurement result can be stored.)

3 Press Shift.

Un-aided changes to IN.

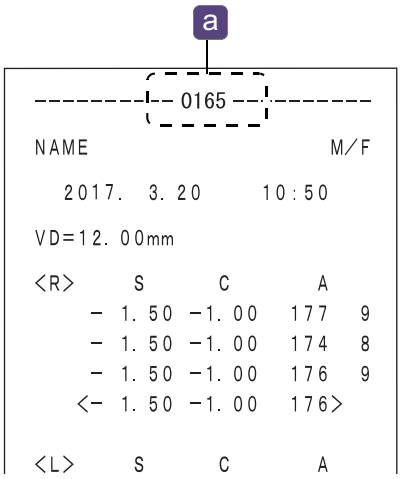
This function is disabled when the *" PC port" (page 155)* parameter is set to "PC".

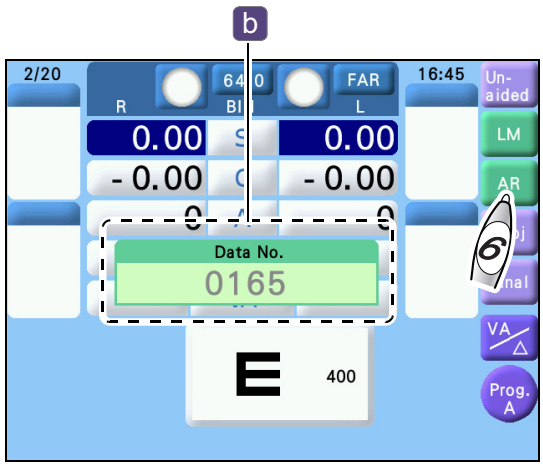
4 Press IN immediately after printing.



- Be sure to press IN before transferring subsequent data with the auto refractometer or lensmeter. Note that the subsequent data overwrites the data stored in the control box when the print button of the auto refractometer or lensmeter is pressed.
- Turning off the device clears stored data.

5 Make sure that the patient ID number a of the data printed on the auto refractometer in Step 2 is the same as the displayed data number b.

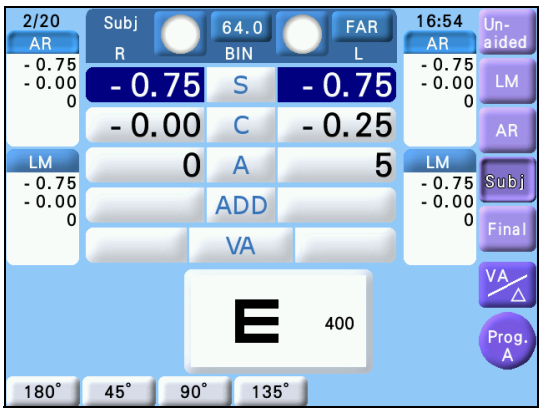




6 If the number is the same, press AR.

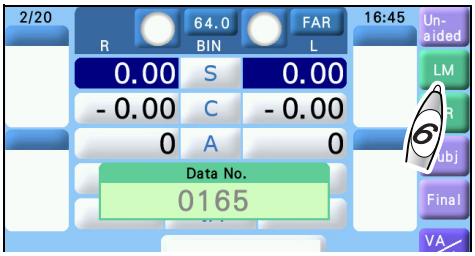
AR data is imported and Subjective refraction mode is activated.

When the *" Preset power of Subj" (page 154)* parameter is set to "LM" and data is already imported in the subjective data field, AR data is not automatically imported.



Note

- LM data can be imported by connecting the lensmeter to the auto refractometer.
  For the operating procedure of the lensmeter, refer to its operator's manual.
- Press LM in Step 6 to import LM data.



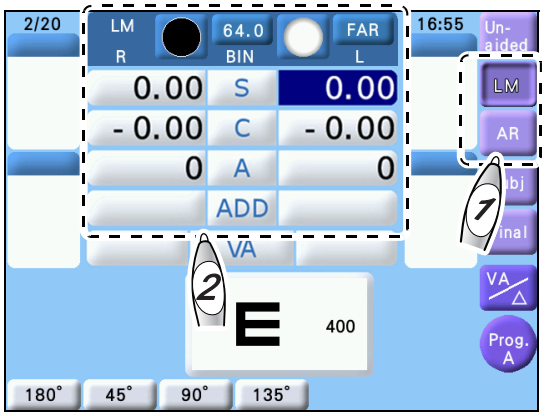
3.2.2 To enter data manually

Data measured by an auto refractometer or lensmeter can be entered using the dial (manual operation).

For the operating procedure of the auto refractometer or lensmeter, refer to the operator's manual of each device.

1 Press LM or AR.

- LM : Data of a lensmeter
- AR : Data of an auto refractometer



2 Press the desired numeric field.

Pressing a numeric field highlights in dark blue, indicating that the value is changeable.

Pressing S, C, A, or ADD allows binocular values to be entered.

Pressing 64.0 (PD) allows the PD value to be entered.

3 Turn the dial to enter the measured values of the auto refractometer or lensmeter.

3.2.3 To import data from Eye Care card

Data measured by an auto refractometer or lensmeter can be imported from the Eye Care card (optional). For the operating procedure of the Eye Care card, refer to its operator's manual.

- Note the following when handling the Eye Care card.
  - When EyeCa is displayed in the upper right of the screen, do not remove the card because it is being accessed.
  - Do not fold or strike the card.
  - Do not allow the IC terminal (gold part of the card) to get wet or become soiled.
  - Do not leave the card in a location exposed to high temperatures or static electricity.
  - When writing on the card, do not press down strongly with a pen or such.
- Data measured by an auto refractometer or lensmeter in the Eye Care card is automatically cleared when imported. Use the card with all data cleared by saving and importing data for each patient.

1 Insert the Eye Care card into the Eye Care card slot.

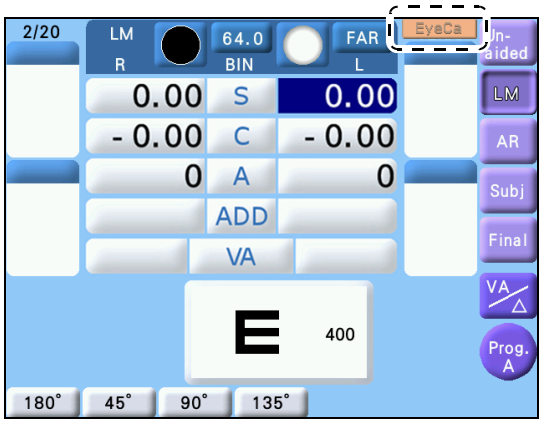
Insert the Eye Care card as far as possible with the ▲ mark a side up.

Eye Care card

2 When the card is correctly set, the Eye Care card indicator EyeCa is temporarily displayed in the upper right of the screen.

Measured data is automatically entered in the AR or LM field.

When the import is complete, the data on the Eye Care card is automatically erased.



Note

- If measured data of both the auto refractometer and lensmeter are written on the Eye Care card, the setting of the *" Preset power of Subj" (page 154)* parameter is applied. Data is automatically imported in the subjective data field and Subjective refraction mode is activated.
- Parameter setting according to the type of data imported from the Eye Care card is possible so that the specified program is automatically activated.

  " Program for imported WF data" (page 155) to *" Program for imported Night data" (page 155)*
- The following data imported from the Eye Care card is displayed only in the data list and printed together with other data at the time of printing.
  - Kerato data of auto ref/keratometer
  - Intraocular pressure data of TONOREF
- Accommodation imported from the Eye Care card can be checked during refraction. In addition, it is printed together with other data at the time of printing.

  "3.10 Displaying Accommodation" (page 64)

3 When the test is complete, remove the Eye Care card.

◆ To import Wave Front data

When data measured by the OPD-Scan series or ARK-10000 is Wave Front data, it is imported instead of AR data. In this case, the indication "WF" is shown instead of "AR" on the screen or printout.

To import and use Wave Front data, change the *" Program for imported WF data" (page 155)* parameter from "No" to "B" or "C" that is available for user configuration (recommended).

After that, rewrite the program "B" or "C" to a program that supports Wave Front data.

◆ To import data from computer

For the data import operation from a computer, refer to the operator's manual included with the computer program or interface manual.

3.3 Exporting Data to Computer

◆ When printing and exporting data

Pressing Print prints and exports all of the displayed data to the connected computer.

Note

- If the measured data on the control box has been cleared along with the printout, recall the data referring to *"5.8 Recalling Previous Data" (page 142)* and export it.
- To prevent data from being cleared at the time of printing, set the *" Clear after print" (page 153)* parameter to "No".

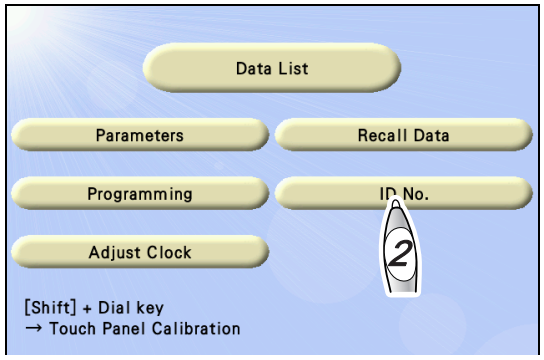
◆ When exporting data without printing

1 Press (Right side).

The main menu screen is displayed.

2 Press the ID No. button.

The numeric entry window appears.

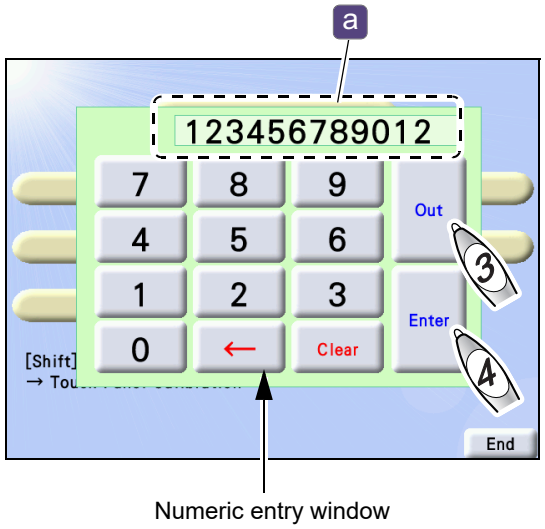


3 Check the ID number a and then press the Out button.

The data is exported.

4 Press the Enter button or (Right side).

The screen returns to the measurement screen.

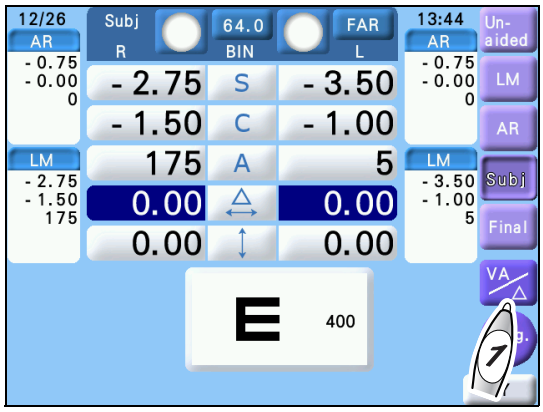


3.4 Entering Prism Values

3.4.1 To specify prism display format

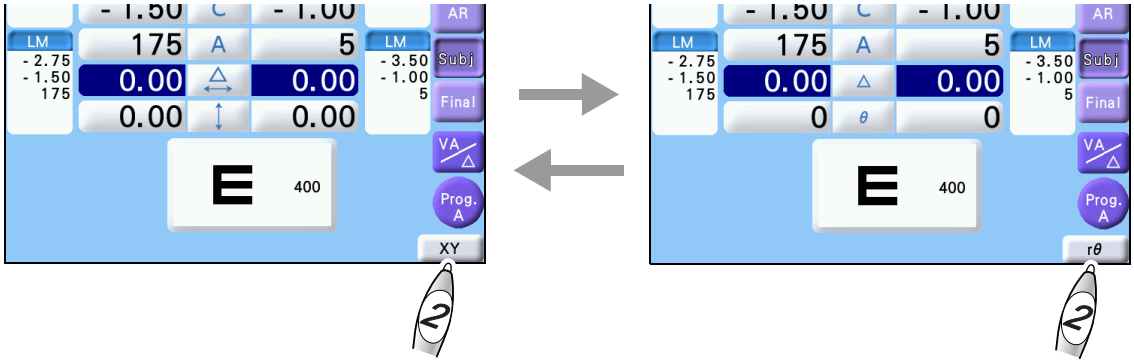
1 Set the device to Prism mode.

Press VA△.



2 Select rectangular coordinates or polar coordinates.

Press the rectangular coordinates button XY or polar coordinates button rθ. Pressing the button toggles the indication.



Ex.— Right eye 1.0ΔBI, 1.0ΔBU ⟶ 1.40Δ, BASE 45°
Left eye 2.0ΔBO, 1.5ΔBD ⟶ 2.50Δ, BASE 323°

3.4.2 To enter rectangular coordinates (XY)

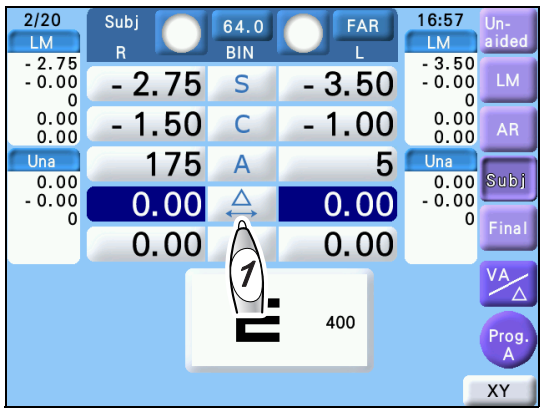
1 Press △ on the screen.

Prism values can be entered in rectangular coordinates.

2 Enter the prism power in the BASE (IN/OUT) direction.

Turn the dial to change the prism value in 0.5Δ increments.

- Turning clockwise ⟶ To BO (BASE OUT)
- Turning counterclockwise ⟶ To BI (BASE IN)

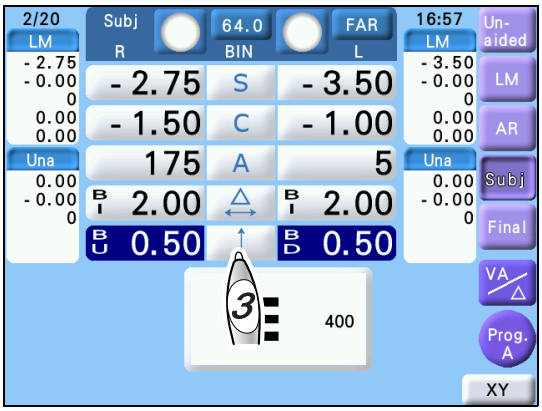


3 Press [↕].

4 Enter the prism power in the BASE (UP/DOWN) direction.

Turn the dial to change the prism value in 0.5Δ increments.

- Turning clockwise → Left eye to BD (BASE DOWN)
  Right eye to BU (BASE UP)
- Turn counterclockwise → Left eye to BU (BASE UP)
  Right eye to BD (BASE DOWN)



Instead of turning the dial, pressing ⊕ or ⊖ changes the prism value in 0.1Δ increments. In addition, pressing and holding the button changes the prism value continuously.

Turning the dial while holding Shift changes the prism value in 2Δ increments.

3.4.3 To enter polar coordinates (θ)

1 Press [△].

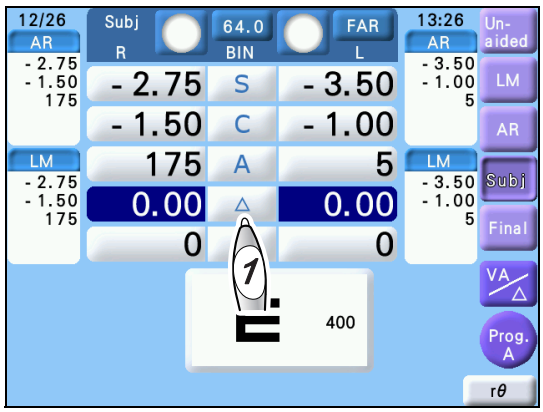
2 Enter the prism absolute value.

Turn the dial to change the prism power in 0.5Δ increments.

Turning the dial while holding Shift changes the prism value in 2Δ increments.

Instead of turning the dial, pressing ⊕ or ⊖ changes the prism value in 0.1Δ increments.

In addition, pressing and holding ⊕ or ⊖ changes the prism value continuously.

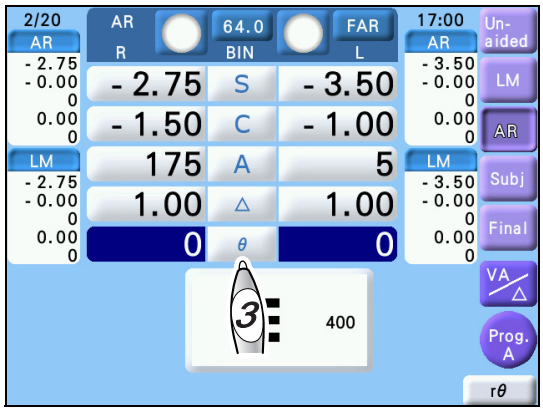


3 Press [θ].

4 Enter the angle in the prism base direction.

Turn the dial to change the angle in 1° increments.

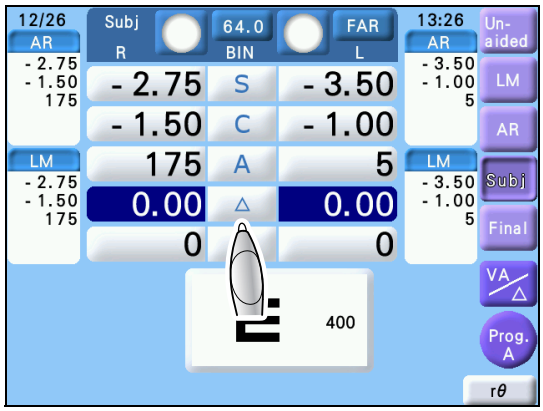
Turning the dial while holding Shift changes the angle in 5° increments.



◆ To insert or remove rotary prisms

The rotary prisms can be inserted into or removed from the measuring windows.

With the rotary prisms inserted, press the button of the numeric field highlighted in dark blue among △, θ, △↔, and ↕. (When only the numeric field of a single eye is highlighted, press its numeric field.)

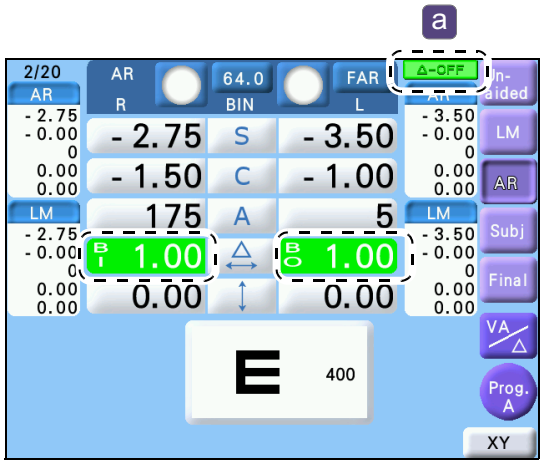


The rotary prisms are removed from the measuring windows.

The color of the cursor turns green and the time display changes to "Δ-OFF" a, indicating that the rotary prisms are removed.

Even if the rotary prisms are removed, the selected prism values are changeable.

Pressing △, θ, △↔, or ↕ again reinserts the rotary prisms.



◆ To clear prism data

Prism values can be cleared (0.00) separately for the right and left eyes.

1 button → Clears the right-eye prism.

2 button → Clears the left-eye prism.

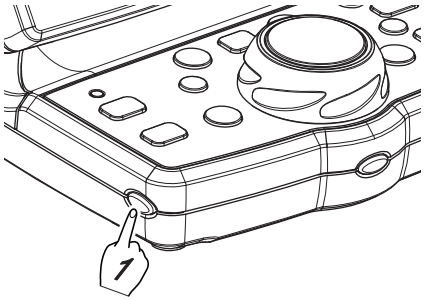
3.5 Presenting Charts

■ This section explains chart selection and visual acuity chart display (cortical vision letter, vertical line, horizontal line, single letter, or red-green filter).

3.5.1 To select charts

1 Press (Left side).

The chart operation screen is displayed.



2 Press FAR or NEAR.

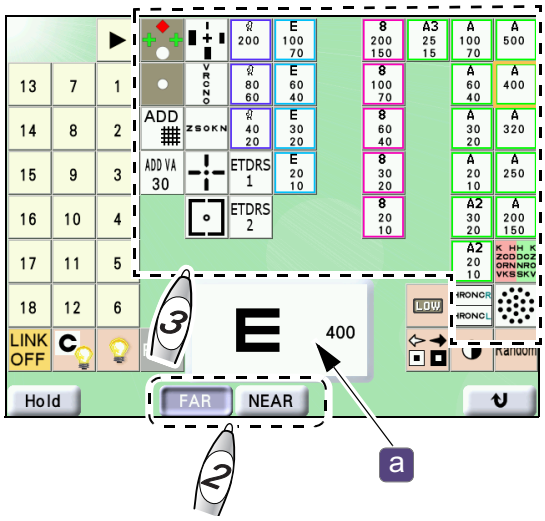
3 Press the button for the chart to be presented.

The selected chart is presented.

The presented chart can be checked in the chart display field a at the lower center of the screen.

Selecting a chart returns to the measurement screen.

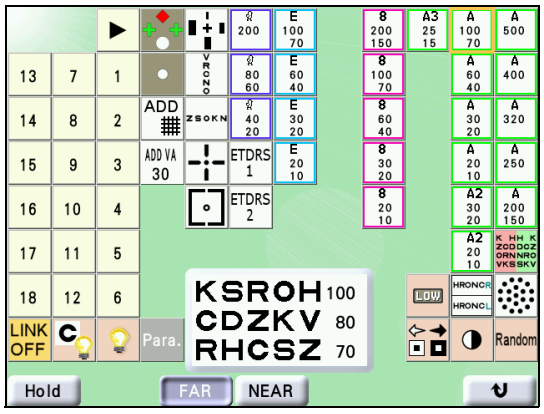
If Hold is pressed in advance, the chart operation screen remains. In this case, pressing the icon of the presented chart or returns to the measurement screen.



3.5.2 To select visual acuity charts

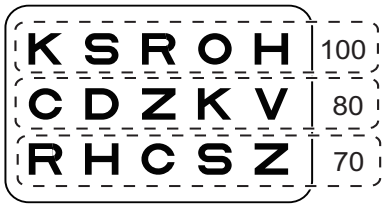
Press the button for the chart to be presented.

The cortical vision letter of the selected visual acuity chart is presented.



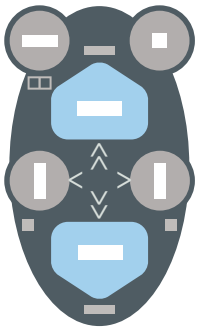
Note

- The cortical vision letter shows multiple charts in the order of visual acuity. The charts surrounded by the dotted lines in the figure below indicate the same visual acuity value.



To mask visual acuity charts

With the mask button, the cortical vision letter can be changed to the vertical line, horizontal line, single letter, or red-green filter.



To display the upper or lower row

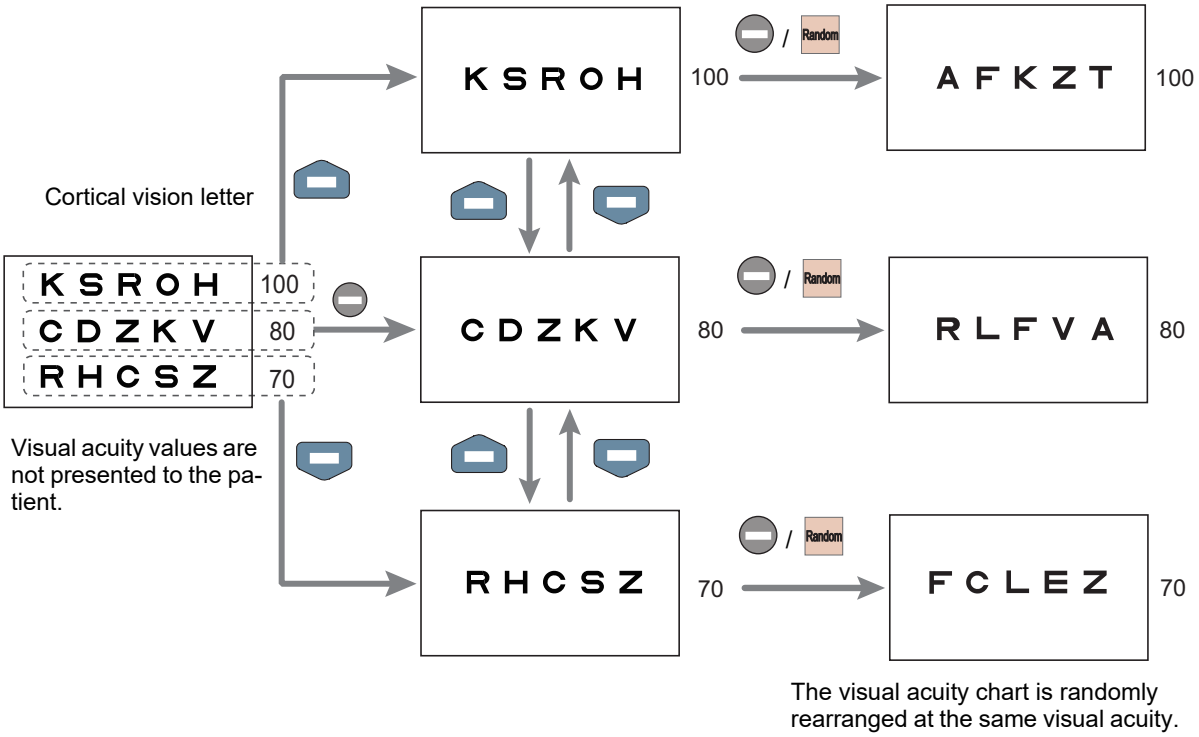
Button	Function
	Displays the upper row of the presented visual acuity chart.
	Displays the lower row of the presented visual acuity chart.

To display the horizontal line

Pressing  with the cortical vision letter shown displays the middle horizontal line.

Button	Function
	• Displays the middle horizontal line of the cortical vision letter. • Pressing  or  again displays another chart with the same visual acuity randomly.

- Mask button operation and flow for horizontal line

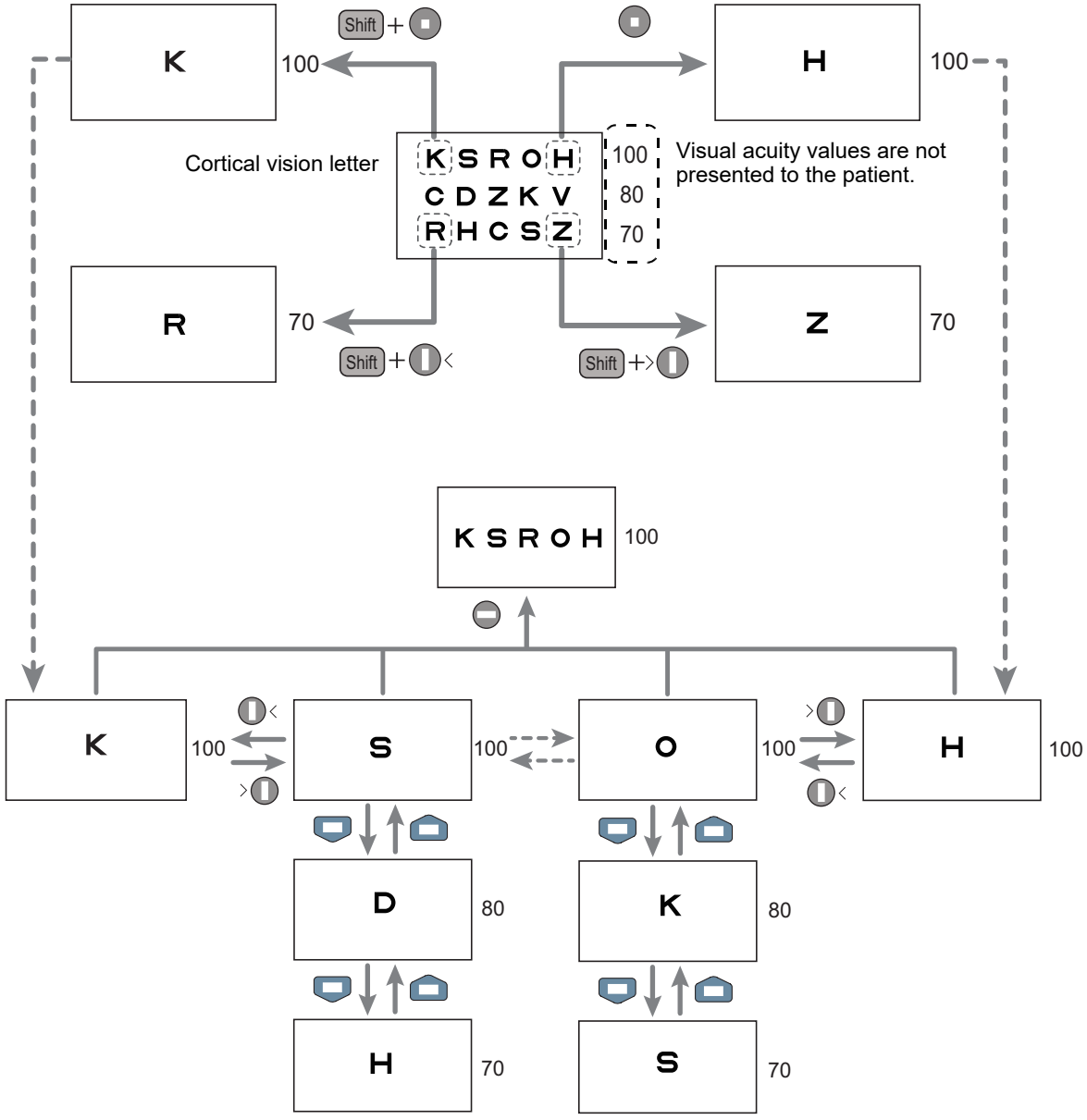


◆ To display a single letter

With the cortical vision letter shown, pressing ■ while holding Shift or pressing ■ displays a single letter.

Button	Function
Shift + ■	Displays the single letter in the upper left corner of the cortical vision letter.
■	Displays the single letter in the upper right corner of the cortical vision letter.
Shift + ▌<	Displays the single letter in the lower left corner of the cortical vision letter.
Shift + > ▌	Displays the single letter in the lower right corner of the cortical vision letter.

● Mask button operation and flow for single letter

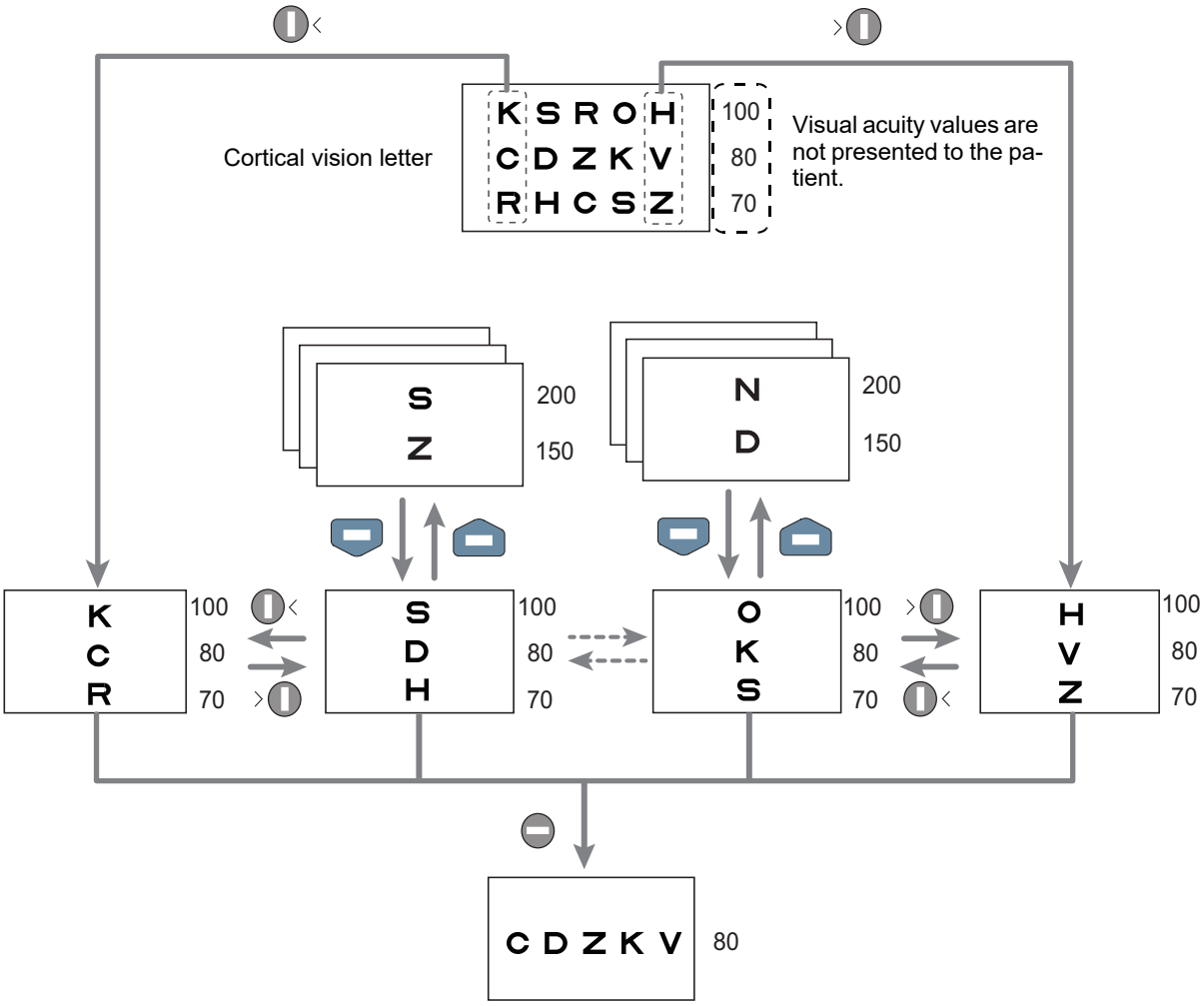


◆ To display a vertical line

Pressing < or > with the cortical vision letter shown displays a vertical line.

Button	Function
<	• Displays the leftmost vertical line of the cortical vision letter. • Pressing < or > again with the cortical vision letter shown displays the vertical line on the left or right at the same visual acuity.
>	• Displays the rightmost vertical line of the cortical vision letter. • Pressing < or > again with the cortical vision letter shown displays the vertical line on the left or right at the same visual acuity.

● Mask button operation and flow for vertical line



◆ To release the vertical line, horizontal line, or single letter mask

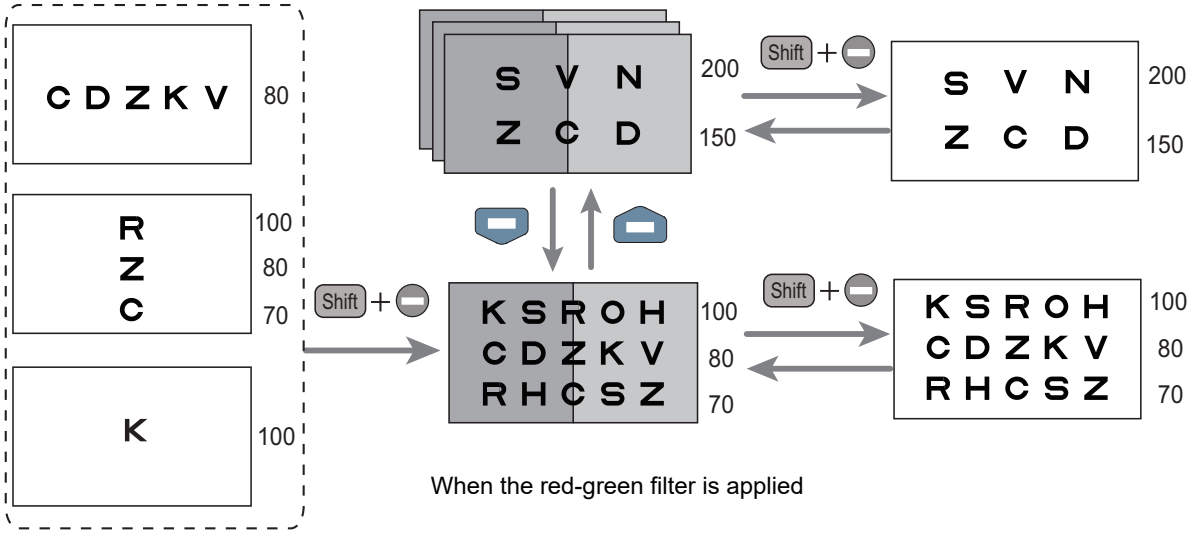
Switching the chart on the chart operation screen releases the mask and returns to the cortical vision letter.

◆ To apply the red-green filter

Pressing − while holding Shift with the vertical line, horizontal line, or single letter shown applies the red-green filter to the presented chart.

Button	Function
Shift + −	• Applies the red-green filter to the vertical line, horizontal line, or single letter. • Pressing − again while holding Shift releases the red-green filter.
	Displays the upper row of the presented visual acuity chart with the red-green filter applied.
	Displays the lower row of the presented visual acuity chart with the red-green filter applied.

● Mask button operation and flow for red-green filter



When the red-green filter is applied

◆ To release the red-green filter

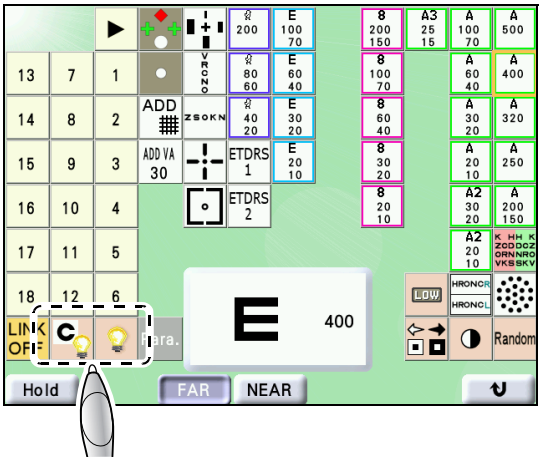
Switching the chart on the chart operation screen releases the red-green filter. Pressing − while holding Shift also releases the red-green filter.

3.6 Chart ON/OFF, Contrast Change, Low Illumination, Black and White Inversion

■ This section explains , , , , and displayed on the chart operation screen.

For , see *"♦ To release the vertical line, horizontal line, or single letter mask" (page 54)*.

- : Turns off the backlight of the chart window and control box touch screen. Pressing any button on the control panel or anywhere on the control box touch screen activates the illumination.
- : Turns on or off the chart.

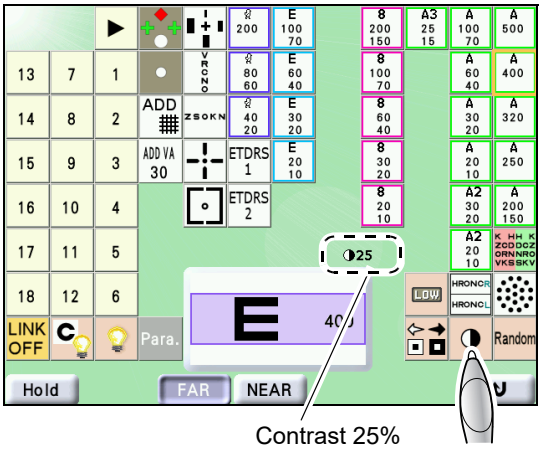


- : Changes the chart contrast in the order of 25%, 12.5%, 6%, and 100% (normal contrast).

  The contrast change function enables measurement of visual acuity with low contrast conditions (25%, 12.5%, 6%).

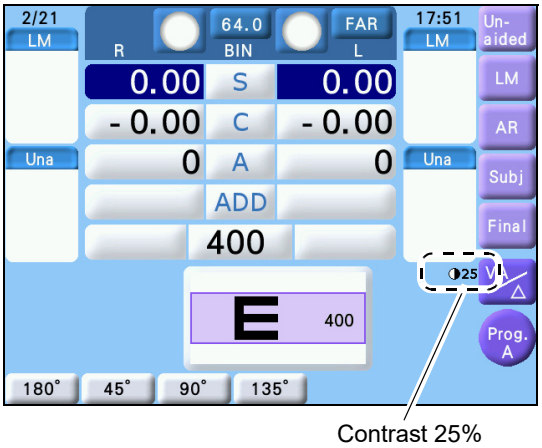
  This function enables evaluation of the visual function according to contrast sensitivity and observation of changes over time.

  - Contrast 25%: 25
  - Contrast 12.5%: 12
  - Contrast 6%: 6



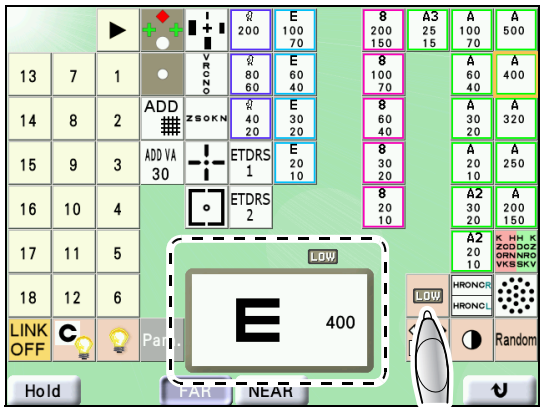
Note

- The contrast change function is only available for visual acuity charts. In addition, it is disabled in Near mode.
- This function is disabled during low illumination or black and white inversion.
- When a contrast other than 100% is specified in Distance mode and the mode is changed to Near mode, the contrast returns to 100% because the contrast function is disabled in Near mode. However, low illumination or black and white inversion cannot be operated because the contrast setting is internally retained.

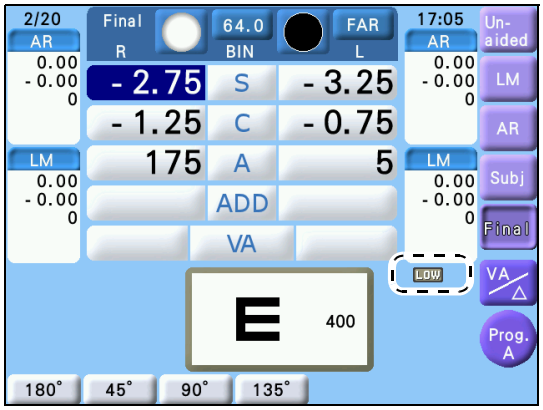


- LOW : Switches between low illumination and normal illumination.

  Low illumination is used to measure visual acuity in dark ambient conditions. Testing the visual performance to recognize low intensity charts may be used in the determination of a visual defect such as disturbance of light sense.



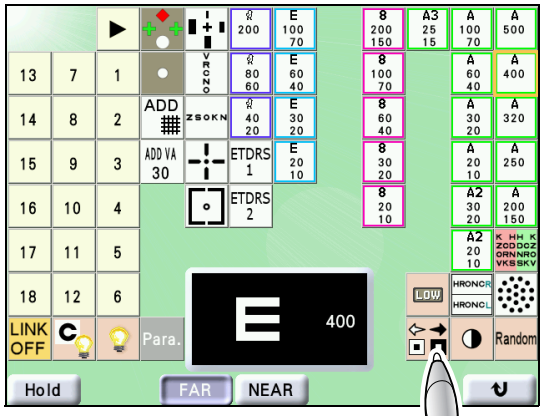
LOW is shown at the right of the displayed chart during low illumination.



Note

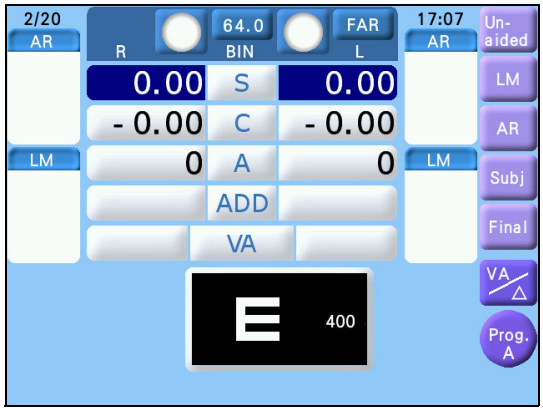
- The low illumination function is only available for visual acuity charts. It is enabled in either Distance or Near mode.
- The low illumination function is disabled when the contrast is not 100% or during black and white inversion.

- : Alternately inverts the black and white of visual acuity charts.



Note

- Inverted black and white visual acuity charts (white letters on the black background) are used for special testing such as amblyopia. The visual acuity is a reference value.
- The black and white inversion function is only available for visual acuity charts. It is enabled in either Distance or Near mode.
- The black and white inversion function is disabled when the contrast is not 100% or during low illumination.



3.7 Measuring Distance Vision or Near Vision

⚠ CAUTION

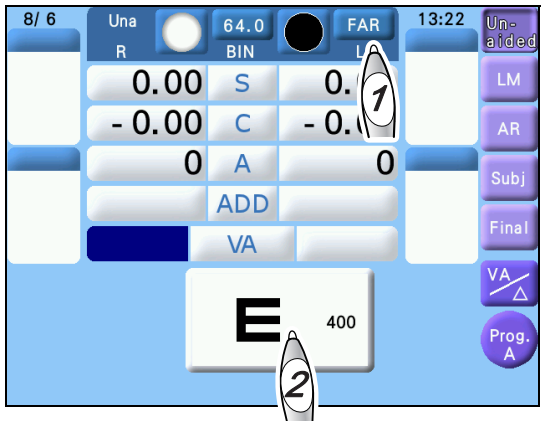
- When switched to Distance mode or Near mode, the refractor head moves for divergence or convergence. Before pressing FAR or NEAR, instruct the patient to keep their face away from the refractor head. After movement has been completed, start refraction with the patient's forehead touching the forehead rest.

3.7.1 To measure distance vision

1 If NEAR is displayed on the measurement screen, press the button to change it to FAR.

Distance mode is activated.

After the movement of the refractor head has been completed, start refraction with the patient's forehead touching the forehead rest.



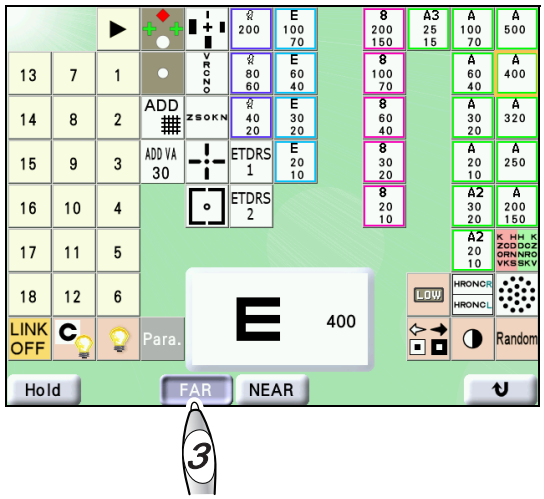
2 Press the chart display icon.

The chart operation screen is displayed.

Pressing (Left side) also displays the chart operation screen.

3 Press FAR on the chart operation screen.

Distance mode is activated and the background of the chart operation screen turns bluish green.

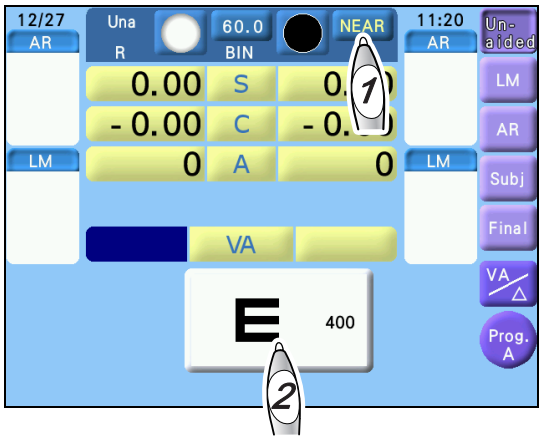


3.7.2 To measure near vision

1 If FAR is displayed on the measurement screen, press the button to change it to NEAR.

Near mode is activated.

After the movement of the refractor head has been completed, start refraction with the patient's forehead touching the forehead rest.



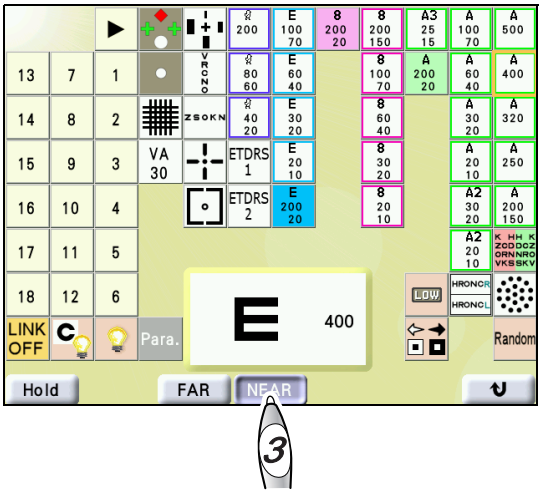
2 Press the chart display icon.

The chart operation screen is displayed.

Pressing (Left side) also displays the chart operation screen.

3 Press NEAR on the chart operation screen.

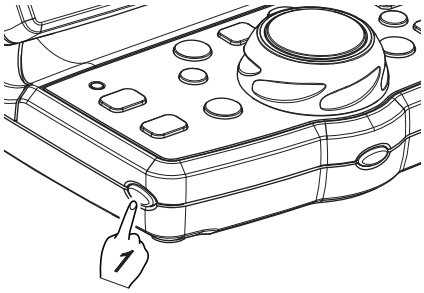
Near mode is activated and the background of the chart operation screen turns yellow.



3.8 Link Off Function

■ This function prevents auxiliary lenses or S (sphere) / C (cylinder) / A (axis) mode setting from being switched automatically when the chart is switched.

1 Press (Left side) to display the chart operation screen.

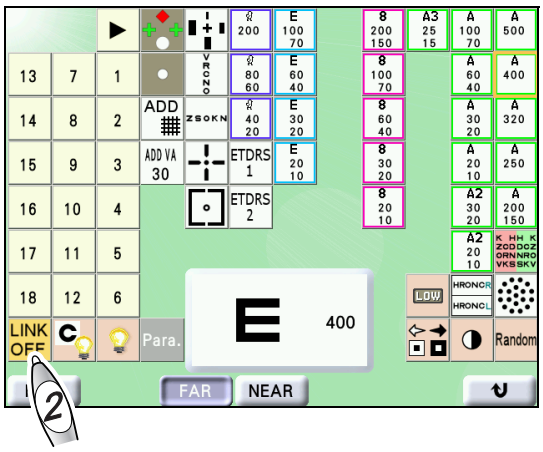


2 Press LINK OFF.

"LINK- OFF" is displayed in the upper right of the measurement screen, indicating that the link off function is enabled.

When the link off function is enabled, automatic insertion of the auxiliary lenses by pressing the chart switch buttons, S/C/A mode setting, and automatic visual acuity entry by pressing the mask buttons are not performed.

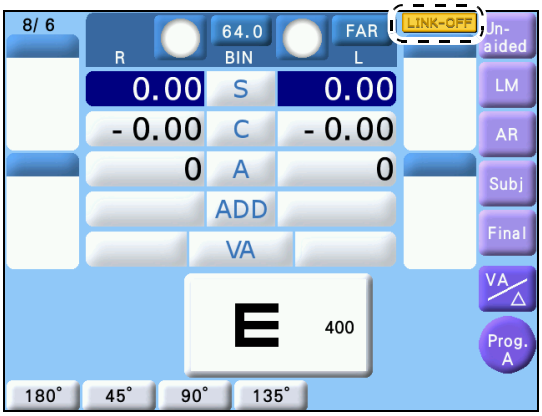
Pressing Prog. A or (Front) only changes charts.



Note

- Even if the device is turned off, the link off setting is retained.
- Even when the link off function is enabled, the link for ADD VA 30 or ADD functions.

Pressing LINK OFF on the chart operation screen again cancels the link off function and returns to the normal state.



3.9 Night Mode

■ This section explains how to switch between Day mode and Night mode and to import AR or LM night data.

Night mode is a mode in which subjective refraction is performed in a dark place, and the chart is presented with brightness for night vision.

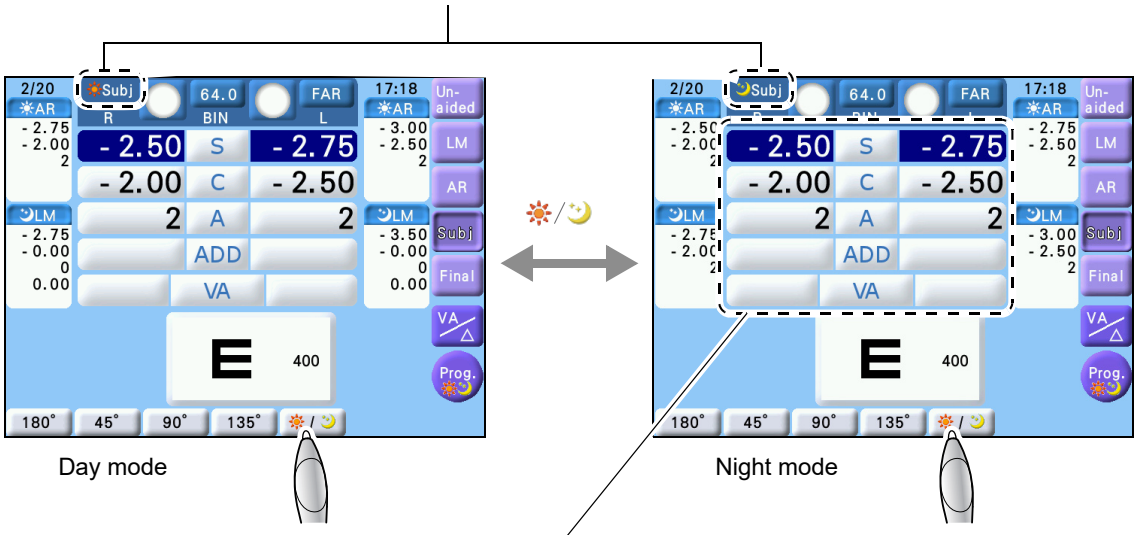
3.9.1 To switch between Day mode and Night mode

When the *" Display Day/Night switching button" (page 155)* parameter is set to "Yes", the function button " ☀/☽ " is displayed, which allows Day mode and Night mode to be switched.

When AR/LM night data is entered with day data using the Eye Care card, " ☀/☽ " is displayed regardless of the parameter setting.

When starting up or the displayed data is cleared, Day mode is automatically activated.

A mark (☀ or ☽) indicating Day mode or Night mode is displayed.



3.9.2 To import AR or LM night data

The following data can be imported as the reference used for measurement in Night mode.

- Night data measured by the ARK-10000 (V 2.13 or later) or OPD-Scan series
- AR large area measured data of ARK-1 series or AR-1 series
- Data obtained by measuring the patient's night vision glasses with a lensmeter

◆ To import AR night data with day data using Eye Care card

- Day data measured by a lensmeter, and day and night data measured by an auto refractometer can be saved to an Eye Care card together.

"3.2.3 To import data from Eye Care card" (page 45)

◆ To import LM night data using Eye Care card

- Day data and night data measured by an auto refractometer can be saved together to an Eye Care card.
- Day data and night data measured by a lensmeter cannot be saved together to an Eye Care card. Therefore, follow the procedure below to import LM night data.

1) Import day data to the TS-310.

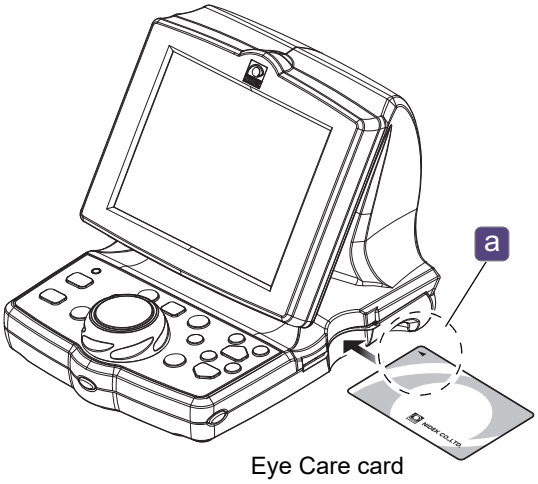
"3.2.3 To import data from Eye Care card" (page 45)

2) Remove the Eye Care card from the Eye Care card slot.

3) Press the function button [☼/☽] to put the TS-310 into Night mode.

4) Insert the Eye Care card to which LM night data is saved with the ▲ mark a side up.

LM night data is added to the TS-310 as the night data.



Eye Care card

3.9.3 To measure day/night vision

To perform night measurement continuously after day measurement, Program is provided in the standard program. For details, see the following.

"5.2 Refraction with Program Day/Night" (page 125)

1 Import day data and night data.

Subjective refraction mode for day vision is activated.

2 Perform subjective refraction based on the day data.

3 Press the function button [/].

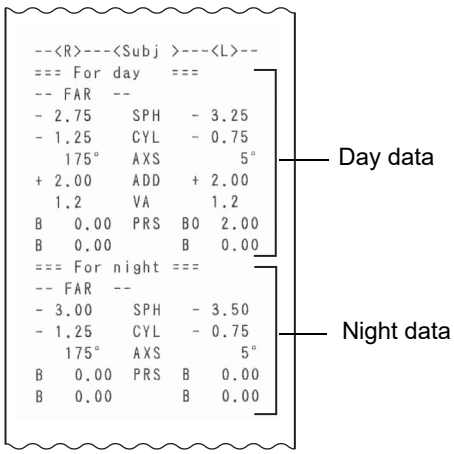
Subjective refraction mode for night vision is activated.

The program specified by the *" Program for imported Night data" (page 155)* parameter is automatically activated.

4 Make the environment suitable for night measurement, perform subjective refraction based on the night data, and then print measured data.

"For day" is printed above the day measured result, indicating that it is data of glasses to be used in bright places.

"For night" is printed above the night vision test result, indicating that it is data of glasses to be used in dark places.



3.10 Displaying Accommodation

■ This section explains how to check the accommodation measured by an auto refractometer during measurement.

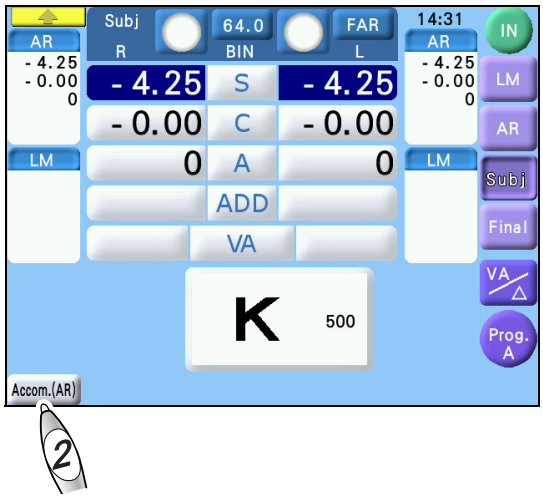
■ To display the accommodation, the following need to be performed in advance.

- Measure accommodation with an auto refractometer that is equipped with the accommodation measurement method and save the data with AR data to an Eye Care card.
- Import accommodation data with AR data from the Eye Care card.

1 Press Shift on the measurement screen.

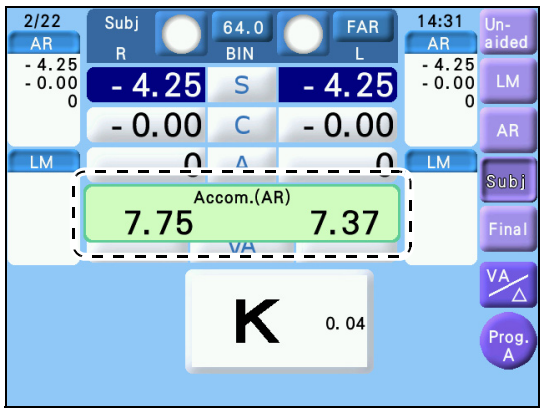
The function button Accom.(AR) is displayed.

When no measurement mode has been specified or no accommodation has been entered, Accom.(AR) is not displayed.



2 Press Accom.(AR).

The Accom.(AR) window appears.



Note

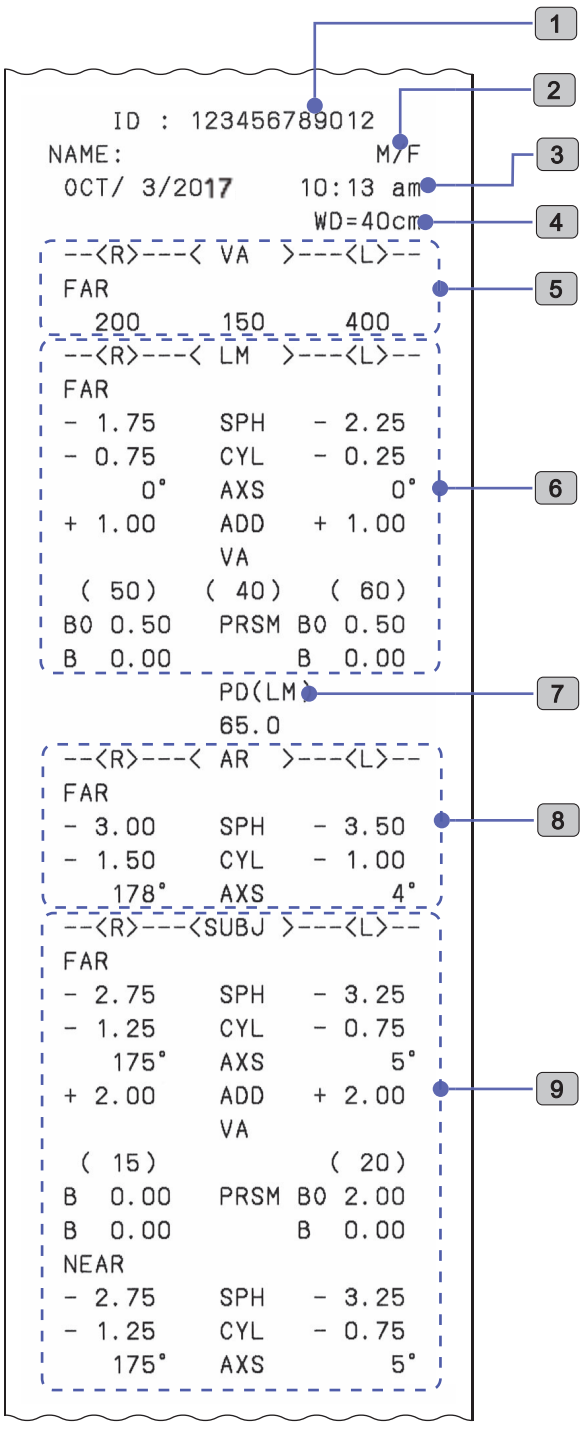
- Accommodation is included in the printout data. It cannot be changed.

3.11 Printing

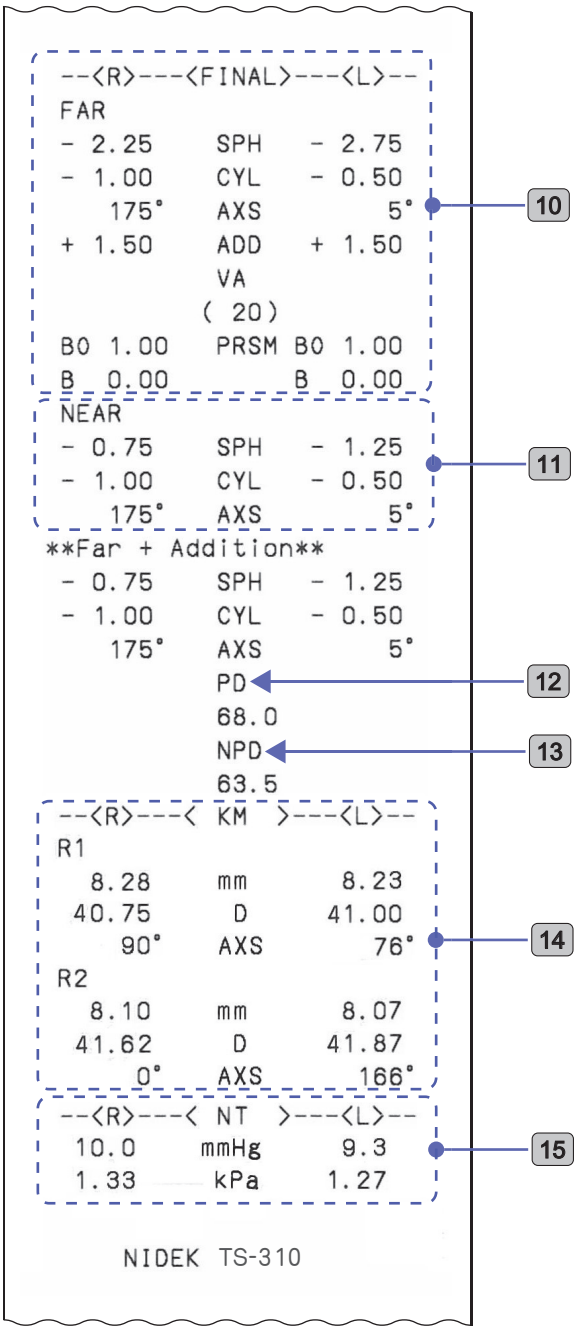
Pressing Print prints data.

- This device uses heat-sensitive printer paper. To save the print result, copy and save it.

◆ Sample printout



No.	Details
1	Patient ID No.
2	Space for patient's name and sex
3	Measurement date, measurement time
4	Near working distance (during measurement)
5	Unaided visual acuity values
6	LM values
7	LM PD
8	AR measured values
9	Subjective values



No.	Details
10	Prescription
11	Near power
12	Pupillary distance
13	Near pupillary distance Near pupillary distance corresponding to near working distance (during measurement)
14	KM measured values
15	Intraocular pressure

◆ Whether to print contact lens conversion data

The *" Print CL data" (page 153)* parameter selects whether the contact lens conversion value of the subjective data is printed together with the normal data.

◆ Whether to print trial lens data

The *" Print TL data" (page 153)* parameter selects whether the trial lens data is printed together with the normal data.

◆ Whether to clear data after printing

The *“ Clear after print” (page 153)* parameter selects whether the displayed data is automatically cleared after printing.

Even if the data on the control box touch screen is cleared after printing, all the data for the patient that was printed last is stored in the device and will not be cleared until the next printing is performed.

“5.8 Recalling Previous Data” (page 142)

◆ KM measurement

To print the diopter conversion value of KM measurement, set the “I/F Format” parameter of the ARK to “All”.

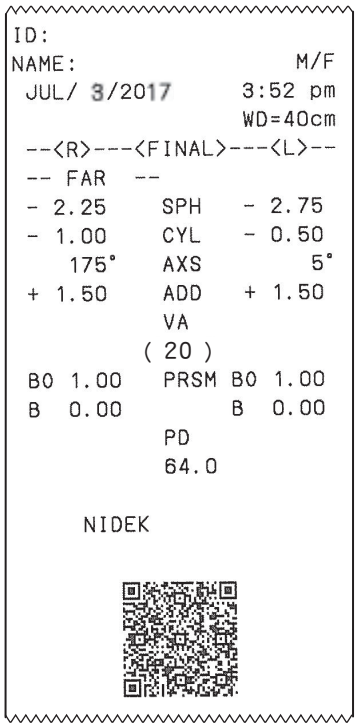
3.11.1 To print with QR code

The final data (subjective or prescription data) can be printed as a QR code.

◆ When the *“ QR code” (page 153)* parameter is set to “QR 1”

The final data and its QR code are printed.

Sample printout



◆ When the *“ QR code” (page 153)* parameter is set to “QR 2”

The QR code of the final data and all entered data are printed.

Note

- The QR code may not be readable when the paper is curled. Flatten out the paper and read it.
- For details on the QR code to be printed, contact NIDEK or your authorized distributor for the QR code manual.

Sample printout

```
 --<R>---<SUBJ >---<L>--
 -- FAR  --
 - 2.75    SPH   - 3.25
 - 1.25    CYL   - 0.75
    175°   AXS       5°
 + 1.25    ADD   + 1.25
           VA
  ( 15 )          ( 20 )
 B0 1.00   PRSM B0 1.00
 BU 0.50        BD 0.50
 -- NEAR --
 - 1.50    SPH   - 2.00
 - 1.25    CYL   - 0.75
    175°   AXS       5°
 --<R>---<FINAL>---<L>--
 -- FAR  --
 - 2.25    SPH   - 2.75
 - 1.00    CYL   - 0.50
    175°   AXS       5°
 + 1.50    ADD   + 1.50
           VA
         ( 20 )
 B0 1.00   PRSM B0 1.00
 B  0.00        B  0.00
 -- NEAR --
 - 0.75    SPH   - 1.25
 - 1.00    CYL   - 0.50
    175°   AXS       5°
**Far + Addition**
 - 0.75    SPH   - 1.25
 - 1.00    CYL   - 0.50
    175°   AXS       5°
           PD
           64.0
           NPD
           60.0

     NIDEK
```

4 REFRACTION

■ This chapter explains the detailed operating procedures for refraction.

● This manual includes the operations for chart types T, UK, M, P, and PhM. In general, this manual offers operational instructions for Type M, used in English-speaking countries, and Type T, used in non-English speaking countries. If there is a description such as Type PhM in the sentence, it means that the chart and operation are limited to the described type.

Chart type	Description
T	Mainly used chart and explanation of its operation
UK	Chart for the United Kingdom and explanation of its operation
M	Chart for the United States and explanation of its operation
P	Chart-1 for France and explanation of its operation
PhM	Chart-2 for France and explanation of its operation

⚠ CAUTION

- Clean the device before refraction. *"7.7 Cleaning" (page 173)*
- Instruct the patient not to touch the refractor head, control box tray, or main device when they sit or stand for refraction.
- When moving the refractor head up or down, have the patient keep their hands on their knees and maintain 20 cm or more between the refractor head and the patient's face. If hands become caught in the arm unit, release the refractor head vertical motion switch immediately to stop the movement.
  The refractor head may strike the patient's face or hands may become caught in the arm unit during movement.
- Instruct the patient not to push their forehead against the forehead rest and not to move away from the forehead rest during refraction. Refraction may not be properly performed.
- When the refractor head switches between the distance vision test and near vision test, the refractor head moves for divergence or convergence.
  Before performing a near vision test, instruct the patient to keep their face 20 cm or more from the refractor head. After the movement has been completed, start refraction with the patient's forehead touching the forehead rest.

4.1 Preparation before Refraction

- Before refraction, provide sufficient explanation of the purpose and method to the patient.
- The following explains the position adjustment of the refractor head, vertex distance adjustment, and pupillary distance adjustment.

4.1.1 To adjust the refractor head position

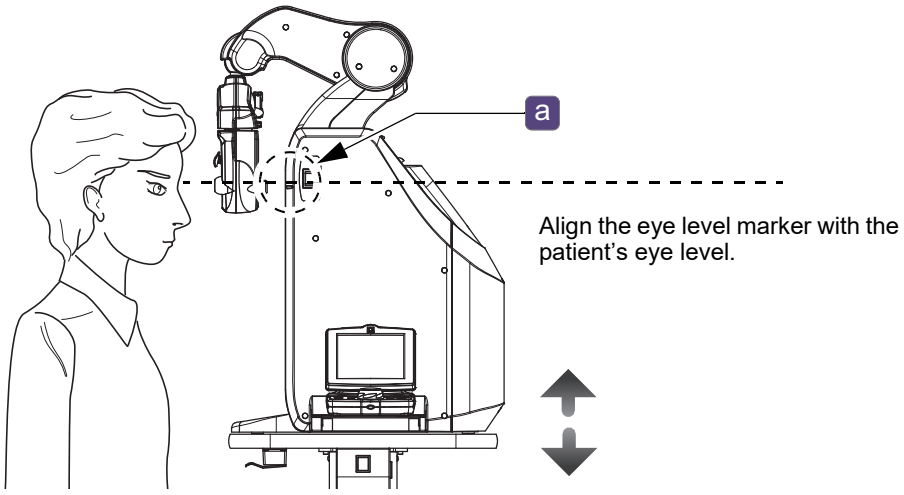
1 Instruct the patient to remove their glasses or contact lenses and sit on the chair.

Instruct the patient to keep their head away from the refractor head.

2 Press the down arrow of the refractor head vertical motion switch to lower the refractor head all the way to the bottom.

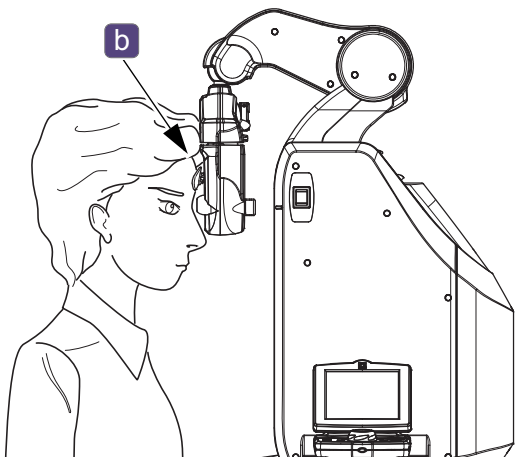
3 Align the refractor head with the patient's eye level.

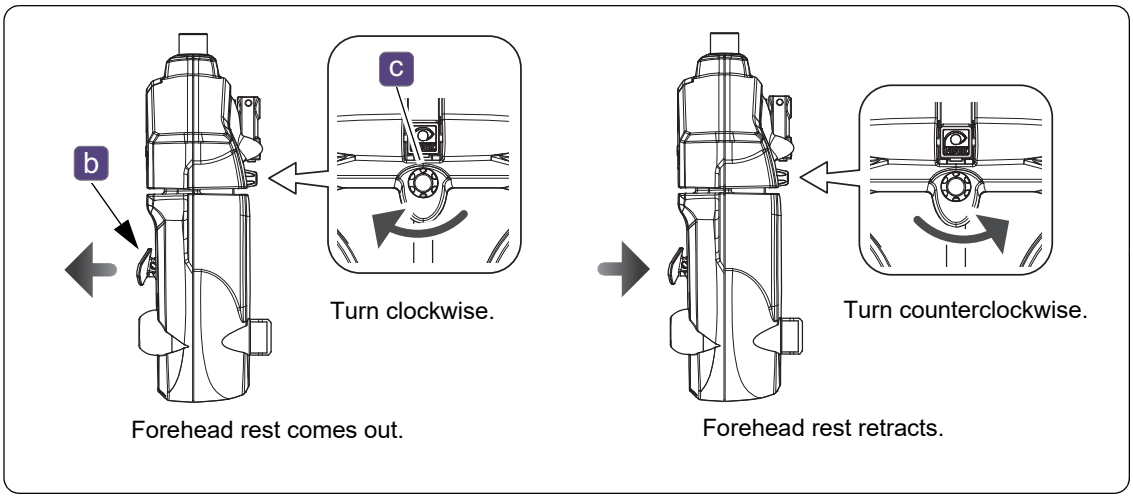
1) Instruct the patient to move their face toward the refractor head, paying attention not to contact it.
2) Press the up-and-down switch on the table to roughly align the eye level marker a with the patient's eye level.



4 Adjust the lengthwise position of the forehead rest.

1) Instruct the patient to look through the measuring windows and lean against the forehead rest b.
2) Turn the forehead rest adjustment knob c clockwise or counterclockwise to adjust the lengthwise position of the forehead rest.





4.1.2 To adjust vertex distance

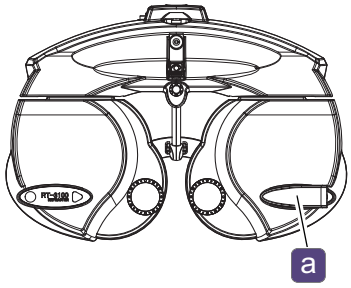
This section explains how to adjust the vertex distance (VD) for the right eye of the patient.

The following is an explanation from the state where positioning of the refractor head has been completed.

"4.1.1 To adjust the refractor head position" (page 70)

Note

- When adjusting with the left eye of the patient, attach the VD check adapter a (with double-sided adhesive tape) in advance to the right side as viewed from the operator.
- Once the VD check adapter is attached to the right or left, it cannot be repositioned. If the VD check adapter needs to be added to the opposite side, contact NIDEK or your authorized distributor.



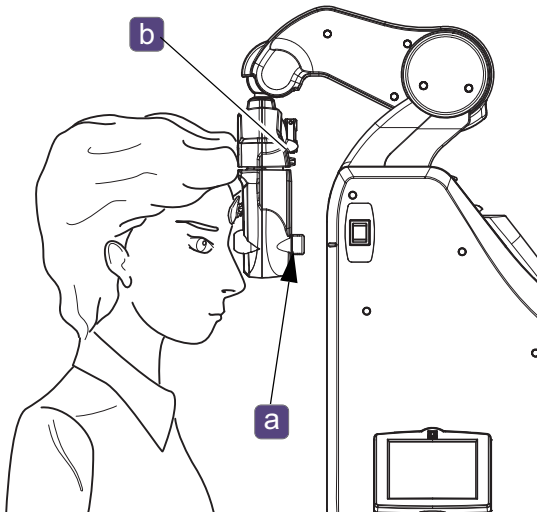
1 Look through the VD check adapter a on the left side as viewed from the operator.

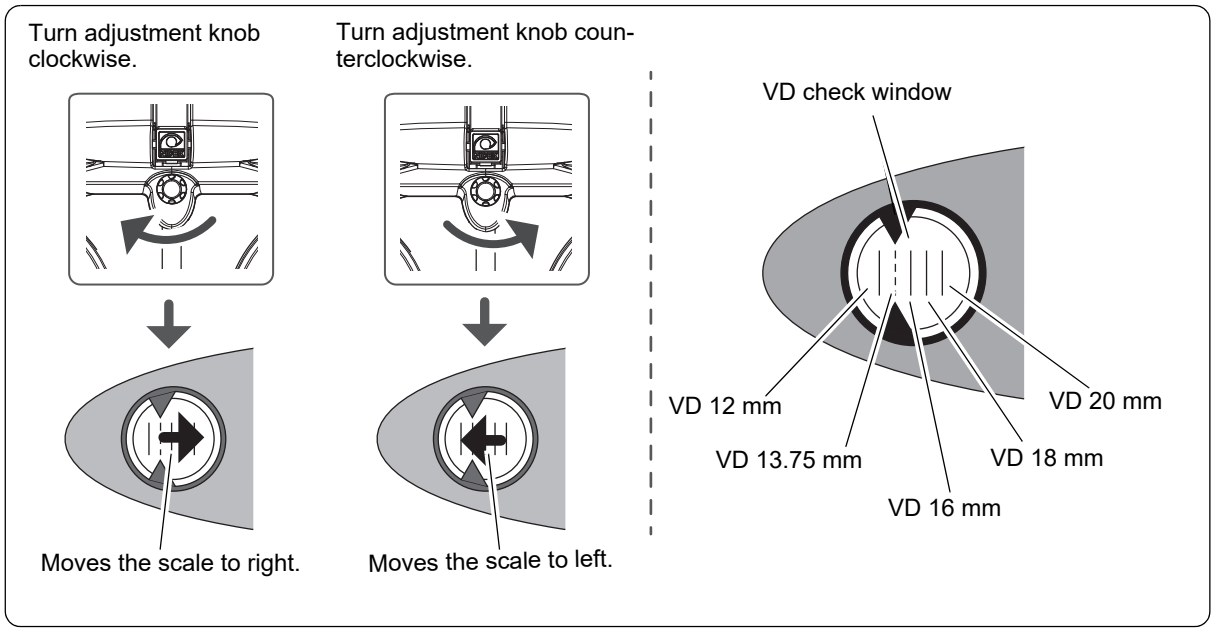
2 Check the vertex distance for the right eye of the patient.

3 Align the patient's corneal vertex to the desired VD marking with the forehead rest adjustment knob b.

4 Adjust the pupillary distance.

"4.1.3 To adjust pupillary distance"





4.1.3 To adjust pupillary distance

This section explains how to adjust the pupillary distance (PD).

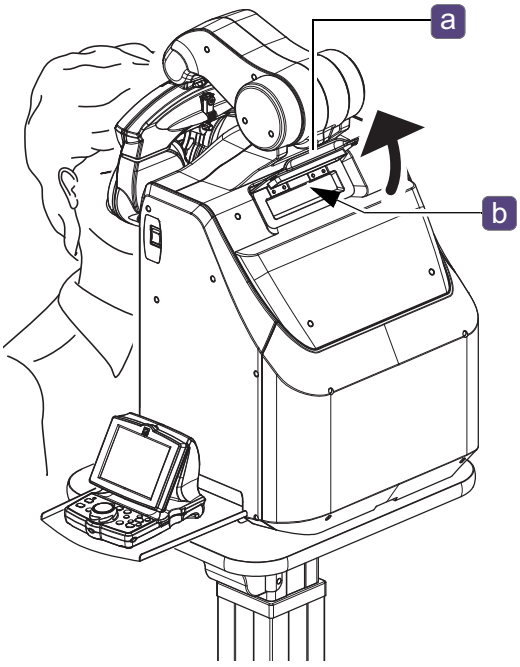
The following is an explanation from the state where positioning of the refractor head and vertex distance adjustment has been completed.

"4.1.1 To adjust the refractor head position"

"4.1.2 To adjust vertex distance"

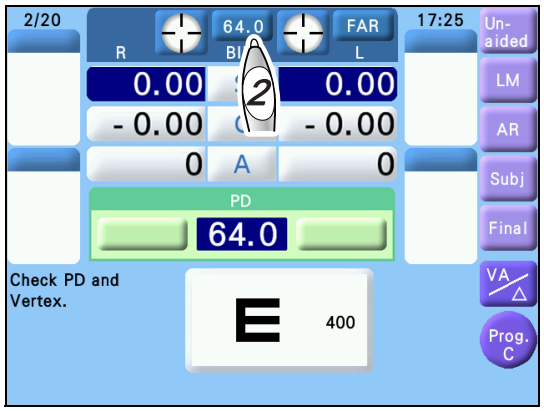
1 Lift open the cover a of the pupil position check window by hand and look into the pupil position check window b from the rear front.

- When both eyes are shifted to the right or left:
  Instruct the patient to move their head to the right or left.
- When one eye is shifted upward or downward:
  Instruct the patient to make both eyes level.



2 Adjust the pupillary distance of the patient if their eyes are not located to the right and left center of the PD check lenses.

1) Press 64.0 (PD).
   The PD check lenses are placed and the patient's eyes are illuminated.
2) Turn the dial to locate the pupil of the patient's eyes to the center of each PD check lens.



3 Press 64.0 (PD) again to exit from PD mode.

Note

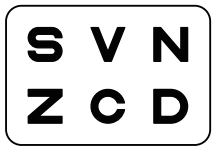
- Keep the cover of the pupil position check window always closed when not adjusting the pupillary distance.

4.2 Visual Acuity Test

■ This section explains the testing method of unaided visual acuity and visual acuity corrected by glasses.

4.2.1 To measure unaided visual acuity

Purpose	To measure the unaided visual acuity of the right, left, or both eyes.
Use chart	Letters, Numbers, Tumbling E, Landolt ring, Children, ETDRS style letters
Measurement method	To assess the minimum visual acuity at which the patient can read the chart.



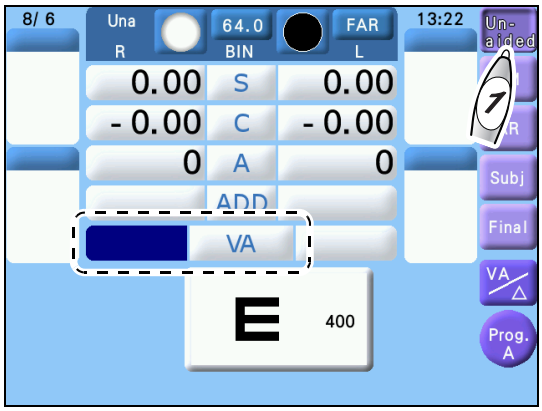
1 Press Un-aided.

Unaided visual acuity measurement mode is activated.

2 Press R to measure the unaided visual acuity of the right eye.

Determine the minimum visual acuity at which the patient can read the chart.

Press − or + to change the visual acuity value.



The visual acuity of the last presented chart is automatically displayed in the VA field.

"3.5 Presenting Charts" (page 51)

"♦ Distance and near visual acuity charts" (page 76)

3 Press L to measure the unaided visual acuity of the left eye.

Follow the same procedure as Step 2.

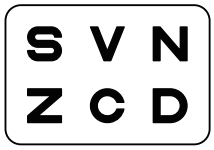
4 Press BIN to measure the unaided visual acuity of both eyes.

Both eyes are opened.

Follow the same procedure as Step 2.

4.2.2 To measure visual acuity corrected by glasses

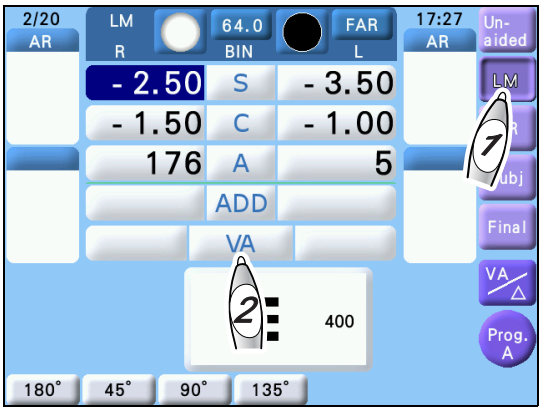
When LM data is imported, visual acuity corrected by glasses can be measured.

Purpose	To measure the visual acuity corrected by glasses of the right, left, or both eyes.	
Use chart	Letters, Numbers, Tumbling E, Landolt ring, Children, ETDRS style letters	
Measurement method	To assess the minimum visual acuity at which the patient can read the chart.	

1 Press LM .

LM measurement mode is activated.

According to the LM data, the corrective lenses are placed in the measuring windows.



2 Press VA .

The device enters the mode that allows the visual acuity to be entered using the dial.

3 Press R to measure the visual acuity corrected by glasses of the right eye.

Determine the minimum visual acuity at which the patient can read the chart.

Press or to change the visual acuity value.

The visual acuity of the last presented chart is displayed in the VA field.

"♦ *Distance and near visual acuity charts" (page 76)*

4 Press L to measure the visual acuity corrected by glasses of the left eye.

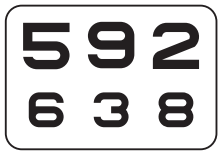
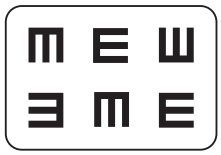
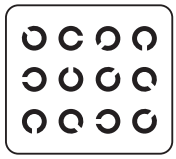
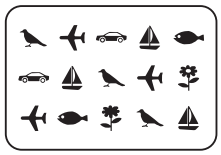
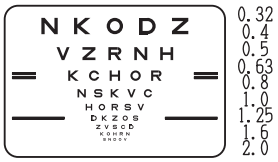
Follow the same procedure as Step 3.

5 Press BIN to measure the visual acuity corrected by glasses of both eyes.

Both eyes are opened.

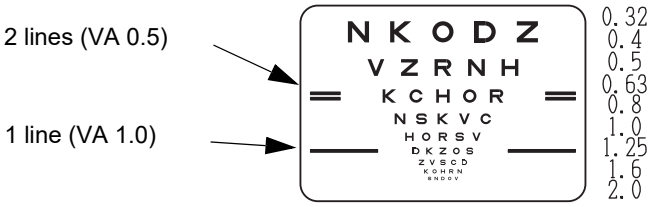
Follow the same procedure as Step 3.

◆ Distance and near visual acuity charts

Name	Example
Letters	
Numbers	
Tumbling E	
Landolt ring (Type UK)	
Children	
ETDRS style letters	

The ETDRS style letters[*1] have the following features compared with the conventional charts.

- The five letters of the same visual acuity value are presented in one line.
- The space between the letters of the same visual acuity value is equal to the width of the letters.
- The space between rows of different visual acuity value letters is equal to the height of the letters of the lower row.



*1. The ETDRS style letters: ETDRS (Early Treatment Diabetic Retinopathy Study), invented by ETDRS Research Group (that the USA acts as leader), is the chart for studying each eye treatment.

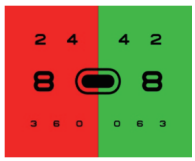
◆ Visual acuity conversion table

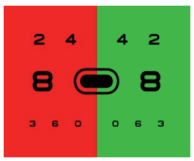
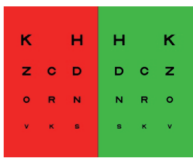
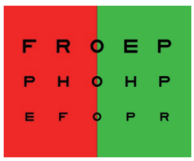
This manual includes the operations for chart types Type T, UK, M, P, and PhM. For visual acuity values, see the following visual acuity conversion table.

Decimal (Type T/P/PhM)	Fraction (meters) (Type UK)	Fraction (feet) (Type M)
0.03	6/200	
0.032		20/600
0.04	6/150	20/500
0.05	6/120	20/400
0.06	6/100	
0.063		20/320
0.08	6/75	20/250
0.1	6/60	20/200
0.125	6/48	
0.15		20/150
0.16	6/38	
0.2	6/30	20/100
0.25	6/24	20/80
		20/70
0.3	6/20	
0.32		20/60
0.4	6/15	20/50
0.5	6/12	20/40
0.6	6/10	
0.63		20/30
0.7		
0.8	6/7.5	20/25
0.9		
1.0	6/6	20/20
1.2	6/5	
1.25		
		20/15
1.5	6/4	
1.6		
2.0	6/3	20/10
2.5		

4.3 Spherical Refinement

4.3.1 Red-green test (Type T/UK/M/PhM)

Purpose	To refine the spherical power in the red-green test.	
Use chart	Red-green	
Ideal appearance	The letters on the red and green side appear equally sharp.	

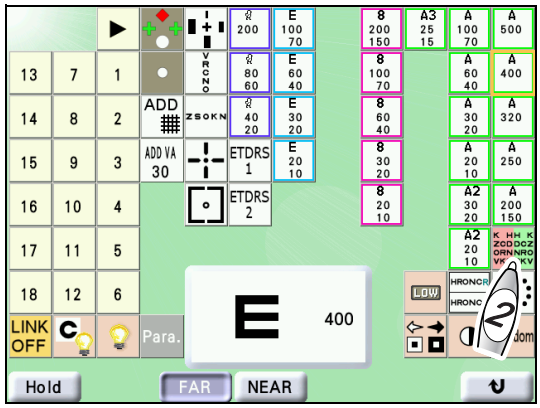
(Type T/UK)	(Type M)	(Type PhM)
		

1 Press (R) or (L) to select the eye to be measured.

2 Refine the spherical power in the red-green test.

Press FAR, then press  (Type T/UK),  (Type M), or  (Type PhM) on the chart operation screen to present the Red-green chart.

The measurement screen is displayed and Sphere mode is activated.

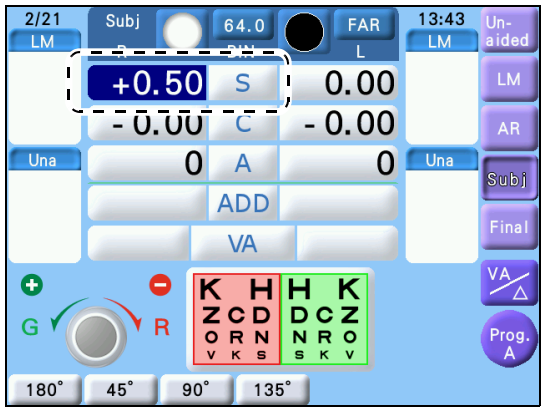


3 Add +0.50 D sphere to fog the patient's vision.

Turn the dial counterclockwise by two steps.

4 Turn the dial clockwise to reduce the fog until the letters on the red and green sides appear equally sharp.

Ask the patient, "Which is sharper, the red or the green?"



Adjust the following as necessary.

The letters on the red and green side appear equally sharp.	The procedure is complete.
The letters on the red side appear sharper.	Turn the dial clockwise.
The letters on the green side appear sharper.	Turn the dial counterclockwise.
The letters on the red and green sides do not appear equally sharp.	The green side should appear slightly sharper.

4.3.2 Cross grid test (Type T/P/PhM)

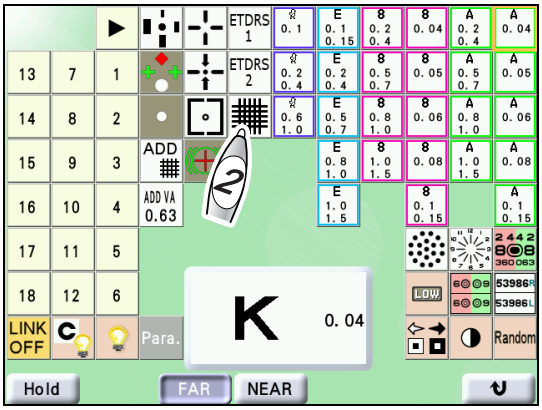
Purpose	To refine the spherical power in the cross grid test.	
Use chart	Cross grid	
Ideal appearance	The horizontal and vertical lines appear equally clear.	

1 Press R or L to select the eye to be measured.

2 Refine the spherical power in the cross grid test.

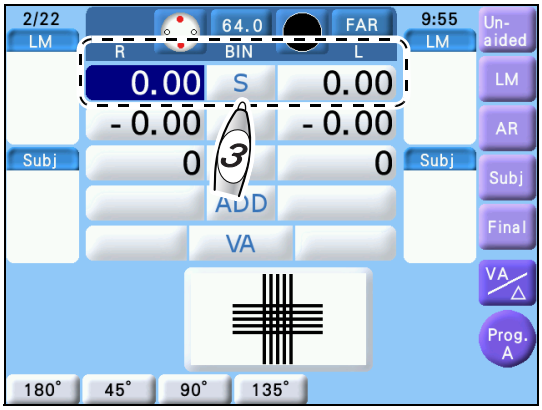
Press FAR, then press  on the chart operation screen to present the Cross grid chart.

The measurement screen is displayed and the ±0.50 D cross cylinder lens is placed.



3 Turn the dial clockwise or counterclockwise until the horizontal and vertical lines appear equally clear.

1) Press S of the eye to be measured.
2) Ask the patient, “Which lines are clearer, the horizontal lines or the vertical lines? or are they about the same?”
3) Turn the dial clockwise or counterclockwise one by one until they appear equally clear.

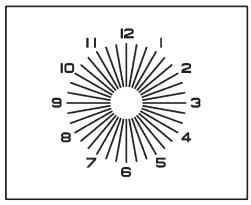


Adjust the following as necessary.

The horizontal and vertical lines appear equally clear.	The procedure is complete.
The horizontal lines appear clearer.	Turn the dial counterclockwise.
The vertical lines appear clearer.	Turn the dial clockwise.
The horizontal and vertical lines do not appear equally clear.	The horizontal lines should appear slightly clearer than the vertical lines.

4.4 Astigmatism Test

4.4.1 Astigmatism measurement with Astigmatism clock dial chart (Type T/UK/PhM)

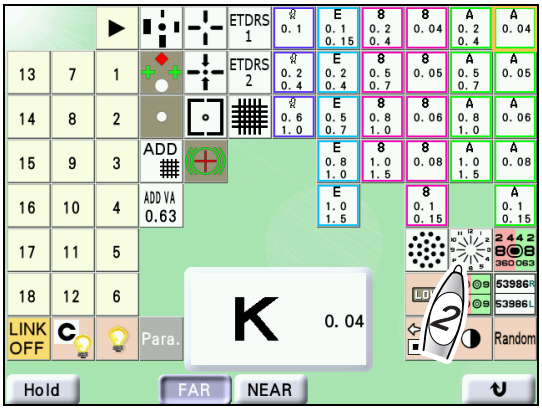
Purpose	To measure and refine the cylinder axis using the Astigmatism clock dial chart.	
Use chart	Astigmatism clock dial	
Ideal appearance	All bars appear equally clear.	

1 Press R or L to select the eye to be measured.

2 Present the Astigmatism clock dial chart.

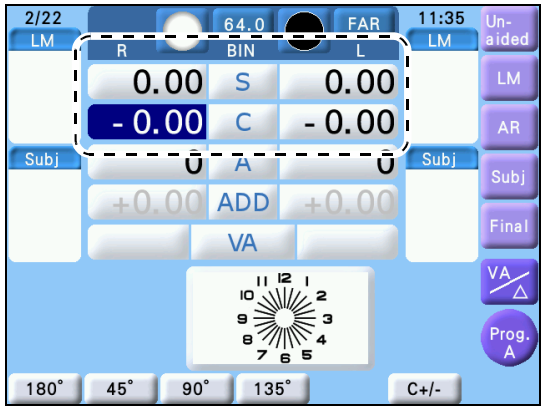
Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and Cylinder mode is activated.



3 Fog the vision until the visual acuity becomes about 0.1.

1) If the cylinder value is not 0, change it to 0.
2) Press the S numeric field of the eye to be measured to enter Sphere mode.
3) Turn the dial counterclockwise to add plus power.



4 Turn the dial clockwise to reduce the fog until the visual acuity becomes about 0.5.

The numbers (1 - 12) beside the bars correspond to the visual acuity of 0.5.

5 Measure the cylinder axis until all the bars appear equally clear.

Ask the patient, “Does any bar appear especially clearer than the others?” Adjust the following as necessary.

All the bars appear equally clear.	The procedure is complete.
One of the bars appears clearer.	Determine the direction of the minus cylinder axis by multiplying the smaller number (1 to 6) next to the clearer bar by 30°. ex.) When Bar 2 appears clearer: 2×30° = 60°

6 Set the axis of the minus cylinder lens to the value determined is Step 5.

Press the A numeric field of the eye to be measured and turn the dial.

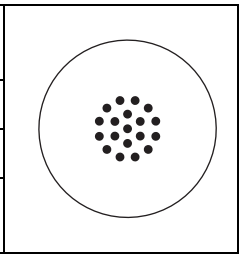
7 Add minus cylinder in 0.25 D increments until all the bars appear equally clear.

Press the C numeric field of the eye to be measured and turn the dial clockwise.

When adding the cylindrical power changes the clearer bar, follow the procedure below.

The clearer bar moves in the counterclockwise direction.	Turn the cylinder axis clockwise.
The clearer bar moves in the clockwise direction.	Turn the cylinder axis counterclockwise.

4.4.2 Astigmatism measurement with cross cylinder lens (Type T/UK/M/P)

Purpose	To measure and refine the cylinder axis and cylindrical power using the cross cylinder lens.	
Use chart	Dots	
Auxiliary lens	Cross cylinder lens	
Ideal appearance	Even if the cross cylinder lens is flipped, the clarity of dots does not change.	

1 Set the refractor according to the AR data and press R or L to select the eye to be measured.

2 Perform the red-green test.

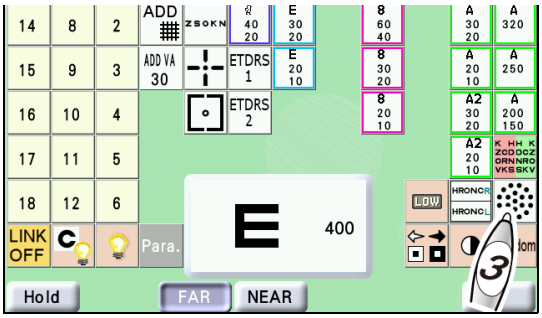
"4.3.1 Red-green test (Type T/UK/M/PhM)" (page 78)

3 Present the Dots chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and Axis mode is activated.

The cross cylinder lens (±0.25) is placed.



4 Measure the cylinder axis until Chart 1 and Chart 2 appear equally clear.

Present Chart 1 by pressing  and Chart 2 by pressing  , then ask the patient which is clearer.

Adjust the following as necessary.

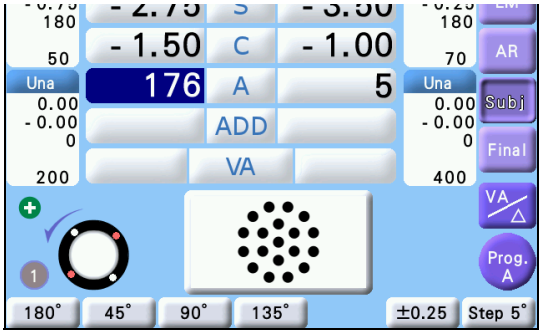


Chart 1 appears clearer.	• Turn the dial counterclockwise by one step. • Press ⊕.
Chart 2 appears clearer.	• Turn the dial clockwise by one step. • Press ⊖.

5 Press the C numeric field of the eye to be measured to enter Cylinder mode.

The axis of the cross cylinder lens is changed.

6 Measure the cylindrical power in the same manner of Step 4.

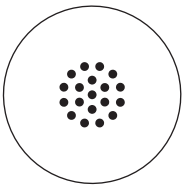
Note

- When the cylindrical power of the AR data is 0, astigmatism can be reconfirmed using the following procedure.

1) After performing the red-green test, measure the cylindrical power.
2) Set a cylindrical power of 0.25 D.
3) Check the vision in the order of axis 180°, 45°, 90°, and 135°. If the patient indicates that Chart 1 looks clearer for all axes, set the cylindrical power as 0. This is the end of the astigmatism test.

If the patient indicates that Chart 2 looks clearer for any axis, proceed to the cylinder axis measurement for the axis in which the patient indicated that Chart 2 was clearer.

4.4.3 Astigmatism measurement with cross cylinder lens (with and without method) (Type T/UK/M/P)

Purpose	To measure and refine the cylindrical power using the cross cylinder lens.	
Use chart	Dots	
Auxiliary lens	Cross cylinder lens	
Ideal appearance	The Dots chart appears clearer when the cross cylinder lens is removed.	

1 Measure the cylinder axis.

See Steps 1 to 4 of *"4.4.2 Astigmatism measurement with cross cylinder lens (Type T/UK/M/P)" (page 83)*.

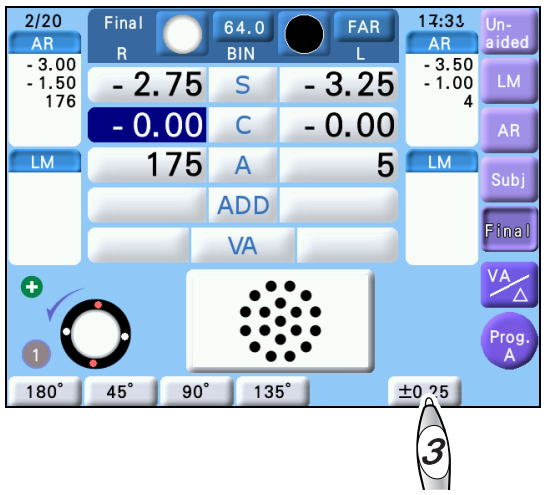
2 Press the C numeric field of the eye to be measured to enter Cylinder mode.

The axis of the cross cylinder lens is changed.

3 Press the function button [±0.25/○].

When the *" Cross cylinder (XC) test" (page 151)* parameter is set to "±0.25D/○", the direction does not need to be switched.

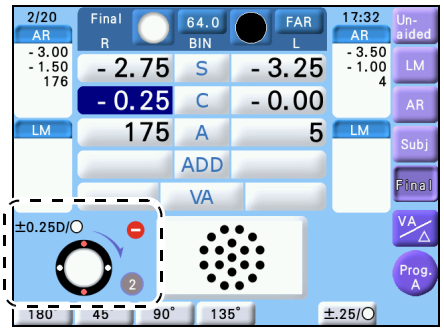
4 Turn the dial to refine the cylindrical power until the chart appears clearer when the cross cylinder lens is removed.



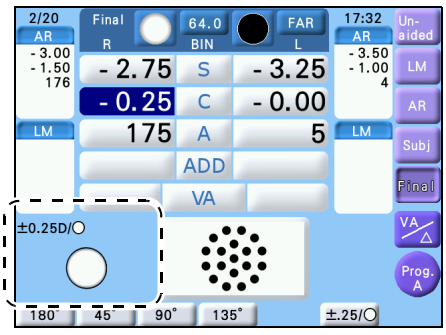
- When the chart appears clearer while the cross cylinder lens is placed

1) Turn the dial clockwise by one step.

2) Place or remove the cross cylinder lens by pressing  and turn the dial clockwise one by one until the chart appears clearer when the cross cylinder lens is removed.



When the cross cylinder lens is placed



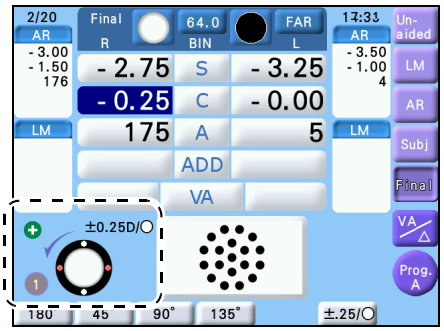
When the cross cylinder lens is removed

- When the chart appears clearer while the cross cylinder lens is removed

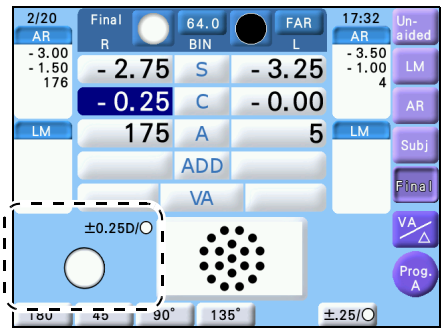
  When the chart appears clearer while the cross cylinder lens is removed, change the direction of the cross cylinder lens.

  1) Press  to change the direction of the cross cylinder lens.

  2) Place or remove the cross cylinder lens by pressing  and turn the dial counterclockwise one by one until the chart appears clearer when the cross cylinder lens is removed. When the chart appears clearer while the cross cylinder lens is removed, this measurement is complete.



When the cross cylinder lens is placed



When the cross cylinder lens is removed

Note

- Pressing the chart display icon for the Dots chart in Binocular mode enters R mode automatically and the left eye is occluded.
- In order to perform the astigmatism test with both eyes open, press the L auxiliary lens display button while holding Shift to open the left measuring window. Even if  ,  , [C], [A], or function button is pressed, both windows remain open.

4.5 Binocular Visual Function Test

Note

- Note that the rotary prism lenses are removed from the measuring windows when the already selected button is pressed again in Prism mode.

4.5.1 Binocular balance test

Purpose	To achieve equal appearance in both eyes.	
Use chart	Binocular balance	
Auxiliary lens	3ΔBD prism for the right eye and 3ΔBU prism for the left eye	
Ideal appearance	The letters on the upper and lower rows appear equally clear.	

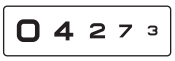
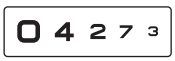
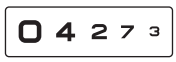
- (Type T/UK/P)

Appearance		
Right eye	Left eye	Ideal appearance
		 

- (Type M)

Appearance		
Right eye	Left eye	Ideal appearance
		 

- (Type PhM)

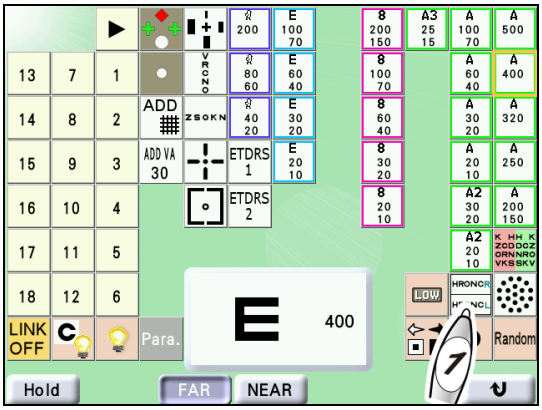
Appearance		
Right eye	Left eye	Ideal appearance
		 

1 Present the Binocular balance chart.

Press FAR, then press 53986R/35869L (Type T/UK/P), 53986R/35869L (Type M), or 53986R/35869L (Type PhM) on the chart operation screen.

The measurement screen is displayed and Sphere mode is activated.

The 3ΔBD prism is placed in the right measuring window and 3ΔBU in the left measuring window.

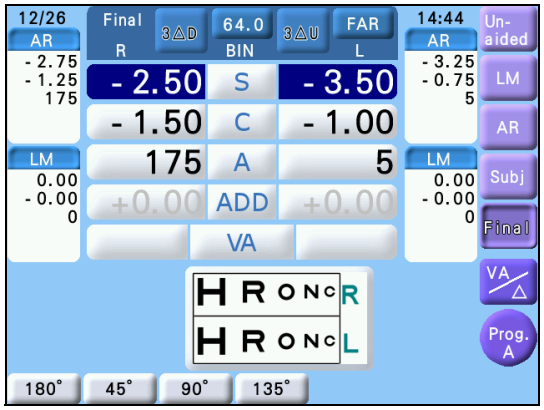


2 Fog the binocular vision.

Press BIN and turn the dial counterclockwise until the binocular visual acuity becomes about between 30 and 25.

The visual acuity of each letter on the chart is 50, 40, 30, 25, and 20 from the left to right.

If the patient cannot see the chart in two rows, the balance test cannot be performed. In this case, present the visual acuity chart with one eye occluded and repeat for the other eye to adjust the vision until it appears equal for the right and left eye.



3 Make adjustments until the upper and lower letters appear equally clear.

Ask the patient, “Which is clearer, the upper or the lower?”

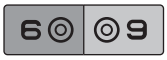
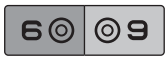
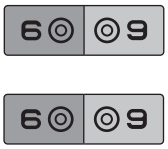
Adjust the following as necessary.

The upper letters appear clearer.	Press R and turn the dial counterclockwise to add +0.25 D sphere.
The lower letters appear clearer.	Press L and turn the dial counterclockwise to add +0.25 D sphere.
The upper and lower letters do not appear equally clear.	Determine with which eye the patient views the binocular balance chart more clearly while referring to the LM data or dominant eye.

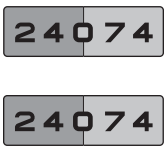
4.5.2 Binocular red-green test (Type T/UK/P/PhM)

Purpose	To measure and achieve accommodation balance (equalization) in both eyes.	
Use chart	Binocular red-green	
Auxiliary lens	3ΔBD prism for the right eye and 3ΔBU prism for the left eye	
Ideal appearance	All the numbers and symbols on the upper and lower rows appear equally sharp.	

- (Type T/UK/P)

Appearance		
Right eye	Left eye	Ideal appearance
		

- (Type PhM)

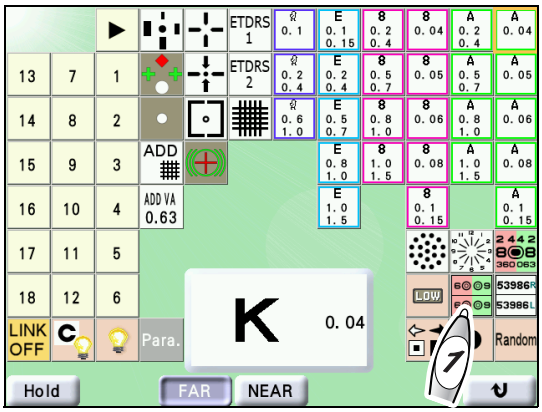
Appearance		
Right eye	Left eye	Ideal appearance
		

1 Present the Binocular red-green chart.

Press FAR, then press  (Type T/UK/P), or  (Type PhM) on the chart operation screen.

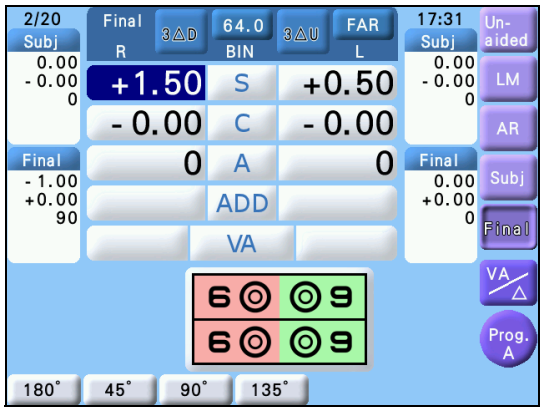
The measurement screen is displayed and Sphere mode is activated.

The 3ΔBD prism is placed in the right measuring window and 3ΔBU in the left measuring window.



2 Adjust the accommodation balance in both eyes.

As in the table below, ask the appearance of numbers and symbols. Adjust the following as necessary.



All the numbers and symbols on the upper and lower rows appear equally sharp.	Binocular balance is achieved.
The upper and lower numbers and symbols on the red side appear equally sharp.	
The upper and lower numbers and symbols on the red side appear equally sharp.	
The green side appears sharper for the upper row and the red side appears sharper for the lower row.	Press (R) and turn the dial counterclockwise to add +0.25 D sphere.
The red side appears sharper for the upper row and the green side appears sharper for the lower row.	Press (L) and turn the dial counterclockwise to add +0.25 D sphere.

4.5.3 Phoria test (Type T)

Purpose	To detect and correct horizontal and vertical phoria.	
Use chart	Phoria	
Auxiliary lens	Red filter for the right eye, green filter for the left eye, and rotary prism for both eyes	
Ideal appearance	A cross is seen.	

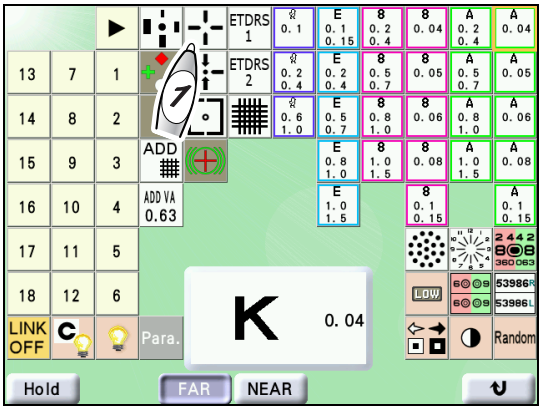
Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Phoria chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and BASE IN/OUT prism entry mode is activated.

The red filter is placed in the right measuring window and the green filter is placed in the left measuring window.



2 Ask the patient, “Can you see the four bars?”

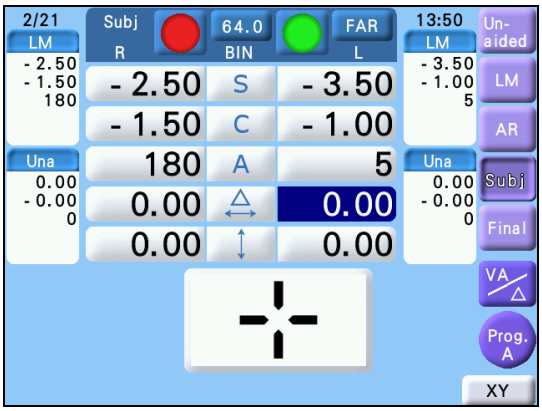
- Yes-> Testing can be continued.
- No-> Testing cannot be continued.

3 Ask the patient, “Do the vertical and horizontal bars form a cross at the center?”

- Yes-> Orthophoria
- No-> Heterophoria. Go to the next step.

4 Ask the patient, “Are the vertical bars shifted to the right or left?”

- Shifted to the right-> Esophoria
- Shifted to the left-> Exophoria
- Not horizontally shifted-> No horizontal phoria



5 Ask the patient, “Are the horizontal bars shifted upward or downward?”

- Shifted upward-> Right eye hyperphoria
- Shifted down-> Left eye hyperphoria
- Not vertically shifted-> No vertical phoria

6 Make adjustments until a cross is seen.

If a cross is not seen, adjust the following.

For fine adjustment, use ⊕ or ⊖ instead of the dial.

Heterophoria	Appearance	Procedure
Esophoria		Turn the dial clockwise to add the BO prism until the vertical bars are centered in the horizontal bars.
Exophoria		Turn the dial counterclockwise to add the BI prism until the vertical bars are centered in the horizontal bars.
Left eye hyperphoria		Press [↕]. Turn the dial clockwise until the horizontal bars are centered in the vertical bars. (Add the BU prism to the right eye and the BD prism to the left eye.)
Right eye hyperphoria		Press [↕]. Turn the dial counterclockwise until the horizontal bars are centered in the vertical bars. (Add the BD prism to the right eye and the BU prism to the left eye.)
Esophoria + Right eye hyperphoria		Correct the horizontal phoria in the same manner as for esophoria and the vertical phoria in the same manner as for right eye hyperphoria.
Esophoria + Left eye hyperphoria		Correct the horizontal phoria in the same manner as for esophoria and the vertical phoria in the same manner as for left eye hyperphoria.
Exophoria + Right eye hyperphoria		Correct the horizontal phoria in the same manner as for exophoria and the vertical phoria in the same manner as for right eye hyperphoria.
Exophoria + Left eye hyperphoria		Correct the horizontal phoria in the same manner as for exophoria and the vertical phoria in the same manner as for left eye hyperphoria.

4.5.4 Phoria with fixation test (Type T/UK/M/PhM)

Purpose	To detect and correct heterophoria by giving stimuli for fusion.	
Use chart	Phoria with fixation (Type T/M/PhM) Muscle (Type UK)	
Auxiliary lens	Red filter for the right eye, green filter for the left eye, and rotary prism for both eyes	
Ideal appearance	A cross is seen.	

- Phoria with fixation (Type T/M/PhM)

Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

- Muscle (Type UK)

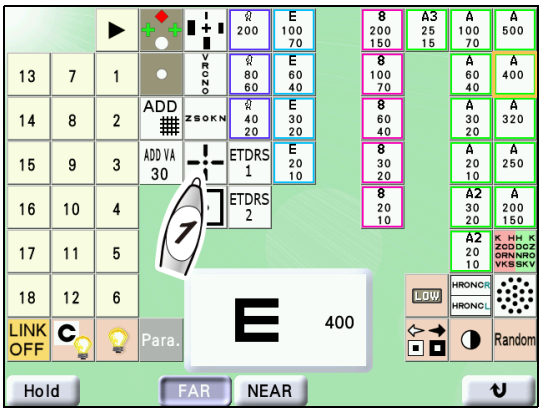
Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Phoria with fixation chart.

Press FAR, then press  (Type T/M/PhM) or  (Type UK) on the chart operation screen.

The measurement screen is displayed and BASE IN/OUT prism entry mode is activated.

The red filter is placed in the right measuring window and the green filter is placed in the left measuring window.

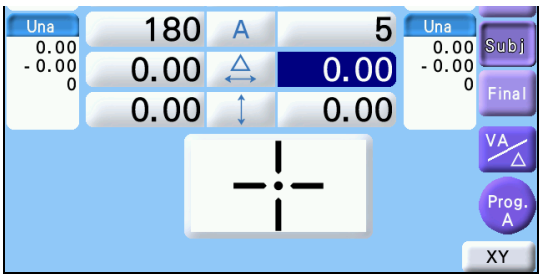


2 Ask the patient, “Can you see the four bars?”

- Yes-> Testing can be continued.
- No-> Testing cannot be continued.

3 Ask the patient, “Do the vertical and horizontal bars form a cross at the center?”

- Yes-> Orthophoria
- No-> Heterophoria. Go to the next step.



4 Ask the patient, “Are the bars vertically aligned?”

- Yes-> No horizontal phoria
- No-> Horizontal phoria

5 Ask the patient, “Is the top bar shifted to the right or left of the bottom bar?”

- Right-> Esophoria
- Left-> Exophoria

6 Ask the patient, “Are the bars horizontally aligned?”

- Yes-> No vertical phoria
- No-> Vertical phoria

7 Make adjustments until a cross is seen.

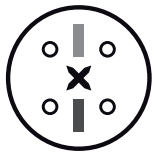
If a cross is not seen, adjust the following.

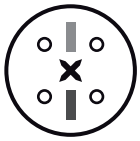
For fine adjustment, use ⊕ or ⊖ instead of the dial.

Heterophoria	Appearance	Procedure
Esophoria		Turn the dial clockwise to add the BO prism until the bars appear vertically aligned.
Exophoria		Turn the dial counterclockwise to add the BI prism until the bars appear vertically aligned.
Left eye hyperphoria		Press [↕]. Turn the dial clockwise to add the BU prism to the right eye and BD prism to the left eye until the bars appear horizontally aligned.
Right eye hyperphoria		Press [↕]. Turn the dial counterclockwise to add the BD prism to the right eye and BU prism to the left eye until the bars appear horizontally aligned.
Esophoria + Right eye hyperphoria		Correct the horizontal phoria in the same manner as for esophoria and the vertical phoria in the same manner as for right eye hyperphoria.
Esophoria + Left eye hyperphoria		Correct the horizontal phoria in the same manner as for esophoria and the vertical phoria in the same manner as for left eye hyperphoria.
Exophoria + Right eye hyperphoria		Correct the horizontal phoria in the same manner as for exophoria and the vertical phoria in the same manner as for right eye hyperphoria.
Exophoria + Left eye hyperphoria		Correct the horizontal phoria in the same manner as for exophoria and the vertical phoria in the same manner as for left eye hyperphoria.

4.5.5 Mallet (horizontal phoria) test (Type PhM)

Purpose	To detect and correct horizontal phoria by giving stimuli for fusion.
Use chart	Mallet (horizontal phoria)
Auxiliary lens	Red filter for the right eye, green filter for the left eye, and rotary prism for both eyes
Ideal appearance	The two bars appear vertically aligned.

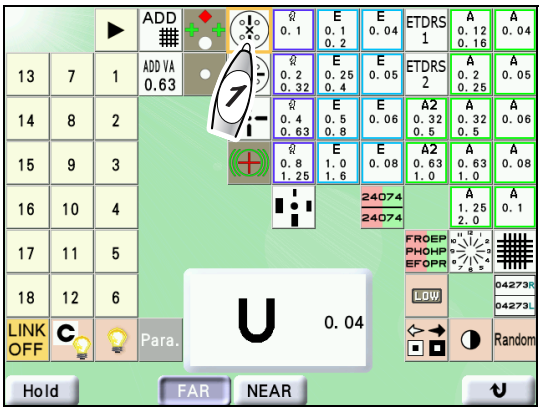


Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Mallet (horizontal phoria) chart.

Press FAR, then press  on the chart operation screen.

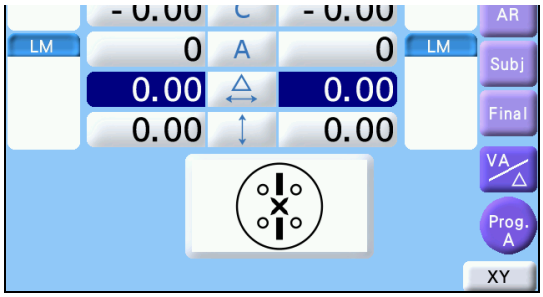
The measurement screen is displayed, the red filter is placed in the right measuring window, and the green filter is placed in the left measuring window.



2 Instruct the patient to look at the x mark in the center.

3 Ask the patient, “Can you see the two vertical bars?”

- Yes-> Testing can be continued.
- No-> Testing cannot be continued.



4 Ask the patient, “Are the two bars vertically aligned?”

- Yes-> Orthophoria
- No-> Heterophoria. Go to the next step.

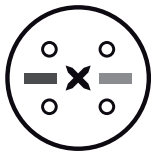
5 Ask the patient, “Is the top bar shifted to the right or left of the bottom bar?”

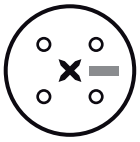
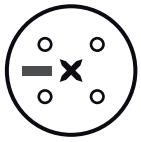
- Shifted to the right-> Esophoria
- Shifted to the left-> Exophoria

Shifted to the right-> Esophoria	Turn the dial clockwise until the two bars appear vertically aligned.
Shifted to the left-> Exophoria	Turn the dial counterclockwise until the two bars appear vertically aligned.

4.5.6 Mallet (vertical phoria) test (Type PhM)

Purpose	To detect and correct hyperphoria by giving stimuli for fusion.
Use chart	Mallet (vertical phoria)
Auxiliary lens	Red filter for the right eye, green filter for the left eye, and rotary prism for both eyes
Ideal appearance	The two bars appear horizontally aligned.

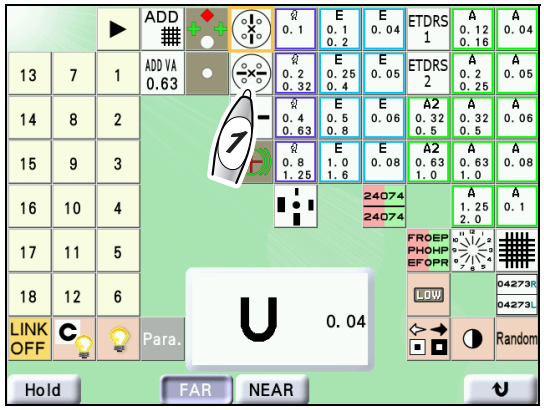


Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Mallet (vertical phoria) chart.

Press FAR, then press  on the chart operation screen.

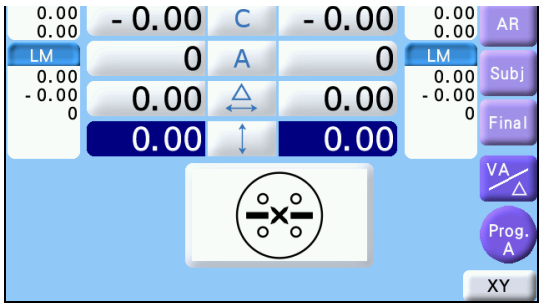
The measurement screen is displayed, the red filter is placed in the right measuring window, and the green filter is placed in the left measuring window.



2 Instruct the patient to look at the x mark in the center.

3 Ask the patient, “Can you see the two horizontal bars?”

- Yes-> Testing can be continued.
- No-> Testing cannot be continued.



4 Ask the patient, “Are the two bars horizontally aligned?”

- Yes-> Orthophoria
- No-> Heterophoria. Go to the next step.

5 Ask the patient, “Is the right bar shifted upward or downward?”

- Shifted upward-> Left eye hyperphoria
- Shifted downward-> Right eye hyperphoria

Shifted upward-> Left eye hyperphoria	Turn the dial clockwise until the two bars appear horizontally aligned. (Add the BU prism to the right eye and BD prism to the left eye.)
Shifted downward-> Right eye hyperphoria	Turn the dial counterclockwise until the two bars appear horizontally aligned. (Add the BD prism to the right eye and BU prism to the left eye.)

4.5.7 Von Graefe (horizontal phoria) test (Type M)

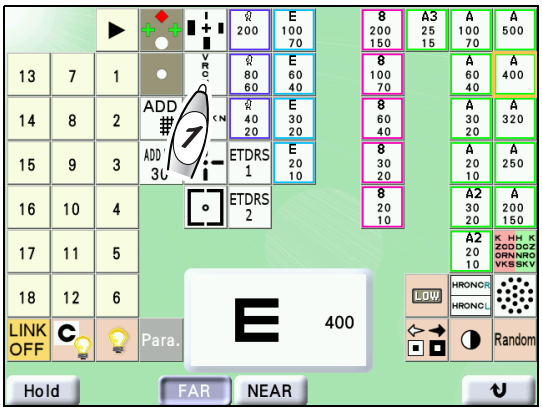
Purpose	To detect and correct horizontal phoria.	
Use chart	Vertical line	
Auxiliary lens	6ΔBU prism for the right eye and rotary prism for the left eye	
Ideal appearance	The two columns appear vertically aligned.	

Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Vertical line chart.

Press FAR, then press  on the chart operation screen.

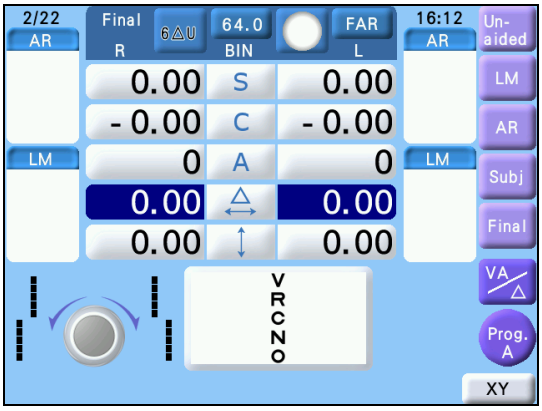
The measurement screen is displayed and the 6ΔBU prism is placed in the right measuring window. BASE IN/OUT prism entry mode for the left eye is activated.



2 Press the L auxiliary lens display button while holding Shift to occlude the left measuring window.

3 Press the L auxiliary lens display button again while holding Shift to open the left measuring window.

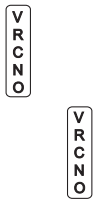
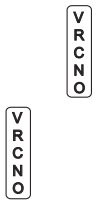
4 Ask the patient, “Can you see the two vertical columns? Are they vertically aligned?”



5 Make adjustments until the columns appear vertically aligned when the occluder is removed.

If the position is shifted, adjust the following. (Use the Flashing Technique described in Steps 2 and 3.)

For fine adjustment, use ⊕ or ⊖ instead of the dial.

Heterophoria	Appearance	Procedure
Esophoria (The upper column is shifted to the left.)		Add the BO prism to the left eye until the two columns appear vertically aligned. Turn the dial clockwise.
Exophoria (The upper column is shifted to the right.)		Add the BI prism to the left eye until the two columns appear vertically aligned. Turn the dial counterclockwise.

4.5.8 Von Graefe test (vertical phoria) (Type M)

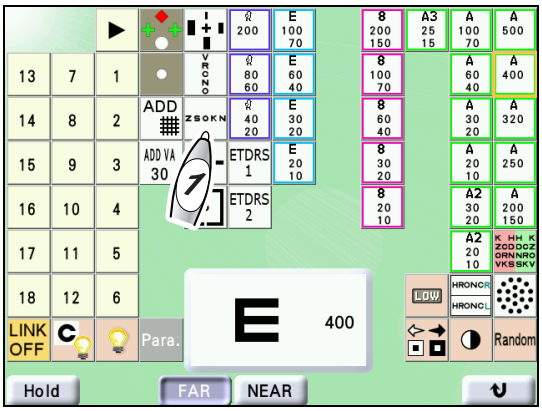
Purpose	To detect and correct vertical phoria.	ZSOKN ZSOKN
Use chart	Horizontal line	
Auxiliary lens	Rotary prism for the right eye and 10ΔBI prism for the left eye	
Ideal appearance	The two rows appear horizontally aligned.	

Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
ZSOKN	ZSOKN	ZSOKN ZSOKN

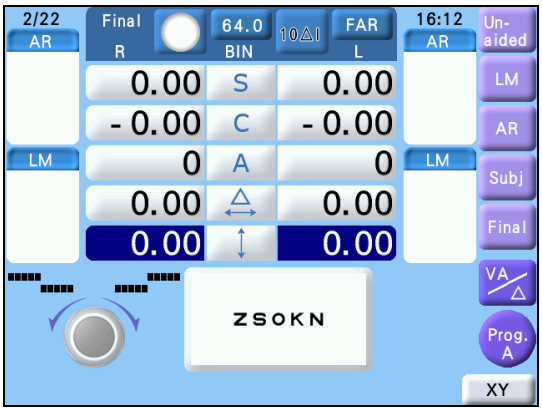
1 Present the Horizontal line chart.

Press FAR, then press ZSOKN on the chart operation screen.

The measurement screen is displayed and BASE UP/DOWN prism entry mode for the right eye is activated. The 10ΔBI prism is placed in the left measuring window.



2 Ask the patient, “Can you see the two horizontal rows? Are they horizontally aligned?”



3 Make adjustments until the rows appear horizontally aligned.

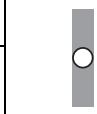
If the position is shifted, adjust the following.

For fine adjustment, use ⊕ or ⊖ instead of the dial.

Heterophoria	Appearance	Procedure
Right eye hyperphoria (The left row is higher.)	ZSOKN ZSOKN	Add the BD prism to the right eye until the two rows appear horizontally aligned. Turn the dial counterclockwise.
Left eye hyperphoria (The right row is higher.)	ZSOKN ZSOKN	Add the BU prism to the right eye until the two rows appear horizontally aligned. Turn the dial clockwise.

4.5.9 Maddox (horizontal phoria) test

Purpose	To detect and correct horizontal phoria.
Use chart	Fixation point
Auxiliary lens	Horizontal Maddox rod for the right eye and rotary prism for the left eye
Ideal appearance	A white spot is seen in the center.

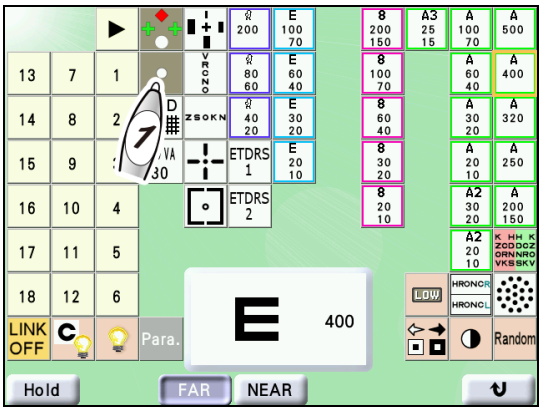


Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Fixation point chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and the horizontal Maddox rod is placed in the right measuring window. BASE IN/OUT prism entry mode is activated.

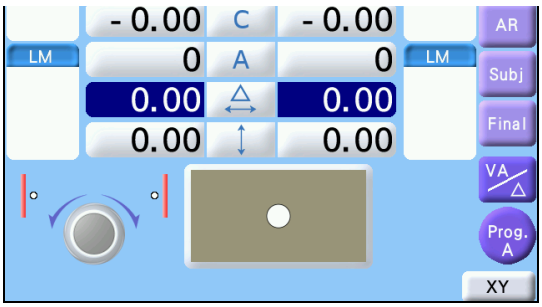


2 Make adjustments until the white spot is centered.

Ask the patient, “Is the white spot shifted to the right or left of the red rod? or is it on the red rod?”

If the white spot is horizontally shifted, adjust the following.

For fine adjustment, use ⊕ or ⊖ instead of the dial.



Heterophoria	Appearance	Procedure
Esophoria (The white spot is shifted to the left.)		Press L. Turn the dial clockwise to add the BO prism until the white spot appears to be completely within the red rod.
Exophoria (The white spot is shifted to the right.)		Press L. Turn the dial counterclockwise to add the BI prism until the white spot appears to be completely within the red rod.

4.5.10 Maddox (vertical phoria) test

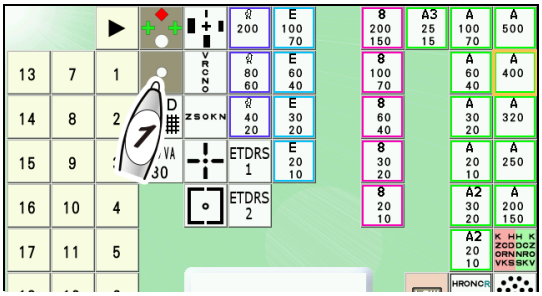
Purpose	To detect and correct vertical phoria.	
Use chart	Fixation point	
Auxiliary lens	Rotary prism for the right eye and vertical Maddox rod for the left eye	
Ideal appearance	A white spot is seen in the center.	

Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Fixation point chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and the horizontal Maddox rod is placed in the right measuring window. BASE IN/OUT prism entry mode is activated.



2 Press  again on the chart operation screen.

The measurement screen is displayed, the horizontal Maddox rod is removed from the right measuring window, and the vertical Maddox rod is placed in the left measuring window.

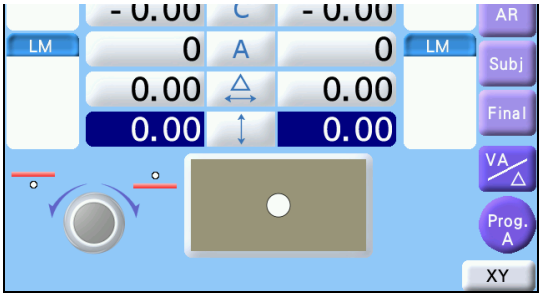
BASE UP/DOWN prism entry mode is activated.

3 Make adjustments until the white spot is centered.

Ask the patient, “Is the white spot shifted upward or downward? or is it on the red rod?”

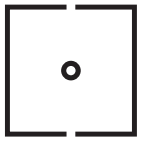
If the white spot is vertically shifted, adjust the following.

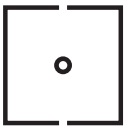
For fine adjustment, use  or  instead of the dial.



Heterophoria	Appearance	Procedure
Left eye hyperphoria (The white spot is shifted upward.)		Press R. Turn the dial clockwise to add the BU prism to the right eye until the white spot appears to be completely within the red rod.
Right eye hyperphoria (The white spot is shifted downward.)		Press R. Turn the dial counterclockwise to add the BD prism to the right eye until the white spot appears to be completely within the red rod.

4.5.11 Aniseikonia (vertical phoria) test (Type T/M/P)

Purpose	To detect aniseikonia and correct vertical phoria.	
Use chart	Vertical coincidence	
Auxiliary lens	Red filter for the right eye and green filter for the left eye	
Ideal appearance	• The right and left frames appear the same in size. • The right and left frames appear vertically aligned.	

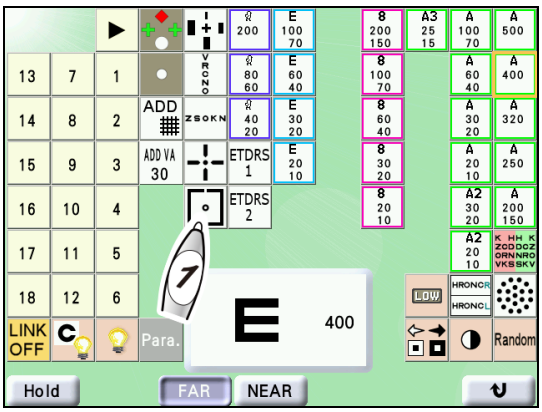
Appearance		
Right eye	Left eye	Binocular ideal (No aniseikonia, orthophoria)
		

◆ Aniseikonia detection

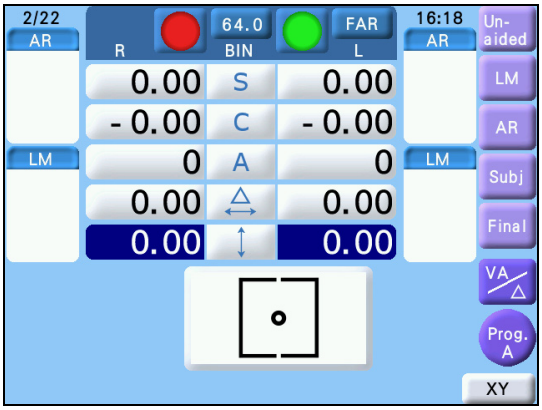
1 Present the Vertical coincidence chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed, the red filter is placed in the right measuring window, and the green filter is placed in the left measuring window.

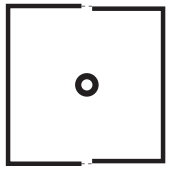


2 Ask the patient, “Can you see the frames with a dot in the center? Are the right and left frames the same in size?”



Ex.— 3.5% aniseikonia

The width of a line corresponds to 3.5% aniseikonia.



- When the aniseikonia is due to anisometropia (refractive power difference of 2.00 D or more between the right and left eyes), a spectacle lens prescription is suitable for axial anisometropia and contact lens prescription is suitable for refractive anisometropia.

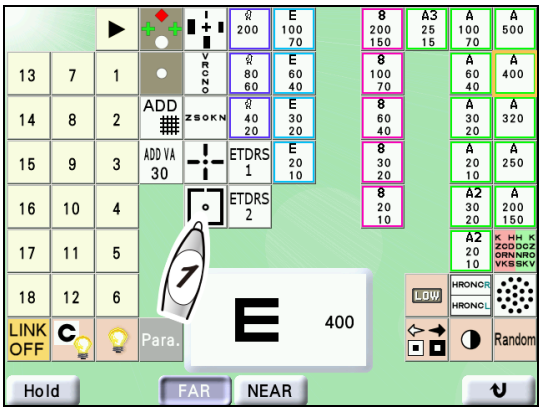
◆ Vertical phoria correction

1 Present the Vertical coincidence chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and BASE UP/DOWN prism entry mode is activated.

The red filter is placed in the right measuring window and the green filter is placed in the left measuring window.

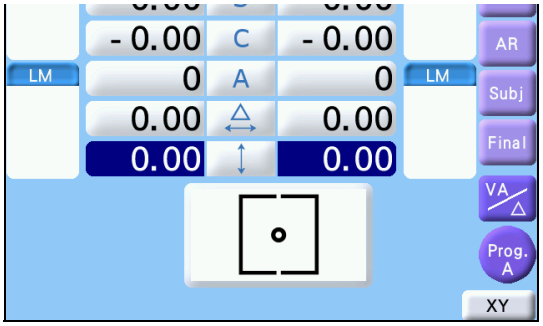


2 Align the right and left frames vertically.

Ask the patient, “Can you see the frames with a dot in the center? Are the right and left frames vertically aligned?”

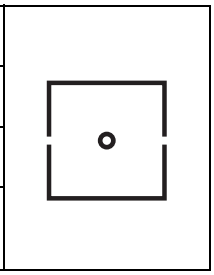
If the frames are vertically shifted, adjust the following.

For fine adjustment, use ⊕ or ⊖ instead of the dial.



Heterophoria	Appearance	Procedure
Right eye hyperphoria (The left frame is higher.)		Press BIN. Turn the dial counterclockwise to add the BD prism to the right eye and the BU prism to the left eye until the right and left frames appear vertically aligned.
Left eye hyperphoria (The right frame is higher.)		Press BIN. Turn the dial clockwise to add the BU prism to the right eye and the BD prism to the left eye until the right and left frames appear vertically aligned.

4.5.12 Aniseikonia (horizontal phoria) test (Type P)

Purpose	To detect aniseikonia and correct horizontal phoria.	
Use chart	Horizontal coincidence	
Auxiliary lens	Red filter for the right eye and green filter for the left eye	
Ideal appearance	• The upper and lower frames appear the same in size. • The upper and lower frames appear horizontally aligned.	

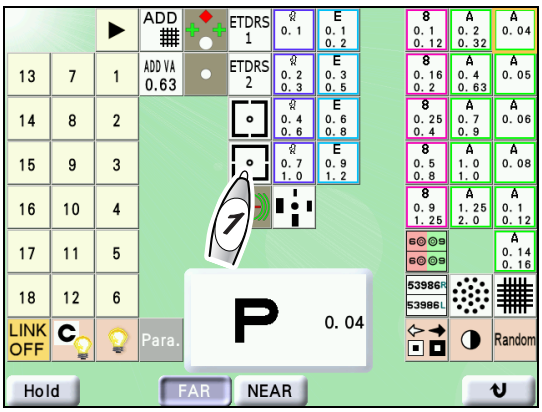
Appearance		
Right eye	Left eye	Binocular ideal (No aniseikonia, orthophoria)
		

◆ Aniseikonia detection

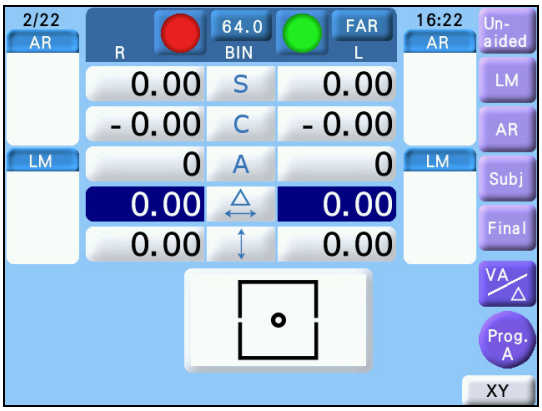
1 Present the Horizontal coincidence chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed, the red filter is placed in the right measuring window, and the green filter is placed in the left measuring window.

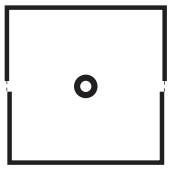


2 Ask the patient, “Can you see the frames with a dot in the center? Are the upper and lower frames the same in size?”



Ex.— 3.5% aniseikonia

The width of a line corresponds to 3.5% aniseikonia.



- When the aniseikonia is due to anisometropia (refractive power difference of 2.00 D or more between the right and left eyes), a spectacle lens prescription is suitable for axial anisometropia and contact lens prescription is suitable for refractive anisometropia.

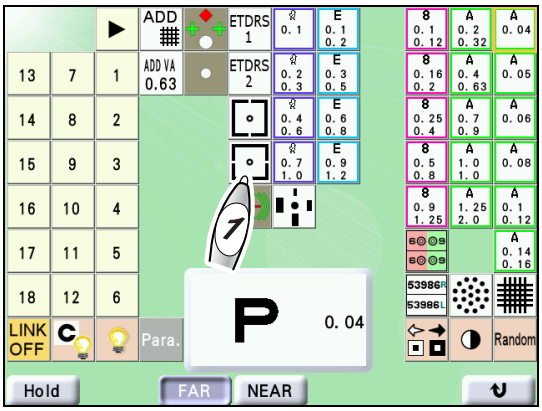
◆ Horizontal phoria correction

1 Present the Horizontal coincidence chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and BASE IN/OUT prism entry mode is activated.

The red filter is placed in the right measuring window and the green filter is placed in the left measuring window.

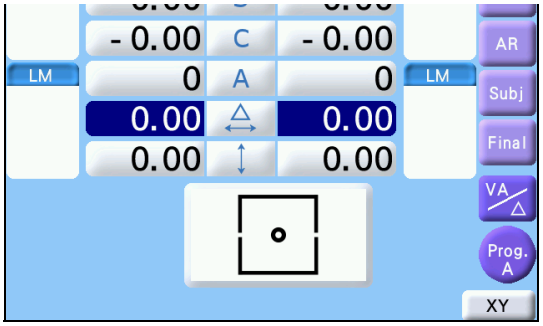


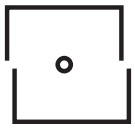
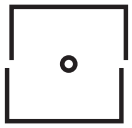
2 Align the upper and lower frames horizontally.

Ask the patient, “Can you see the frames with a dot in the center? Are the upper and lower frames horizontally aligned?”

If the frames are horizontally shifted, adjust the following.

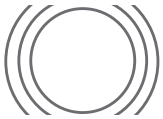
For fine adjustment, use ⊕ or ⊖ instead of the dial.



Heterophoria	Appearance	Procedure
Exophoria (The upper frame is shifted to the left.)		Press BIN. Turn the dial counterclockwise to add the BD prism to the right eye and the BU prism to the left eye until the upper and lower frames appear horizontally aligned.
Esophoria (The upper frame is shifted to the right.)		Press BIN. Turn the dial clockwise to add the BU prism to the right eye and the BD prism to the left eye until the upper and lower frames appear horizontally aligned.

4.5.13 Schober test (Type T/P/PhM)

Purpose	To correct heterophoria.	
Use chart	Schober	
Auxiliary lens	Red filter for the right eye, green filter for the left eye, and rotary prism for both eyes	
Ideal appearance	A cross is seen in the center.	

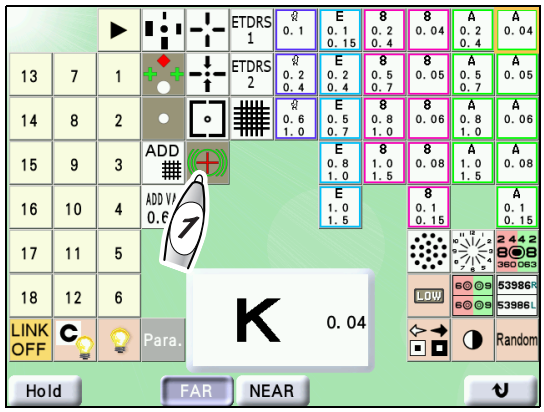
Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Schober chart.

Press FAR, then press  on the chart operation screen.

The measurement screen is displayed and BASE IN/OUT prism entry mode is activated.

The red filter is placed in the right measuring window and the green filter is placed in the left measuring window.



2 Ask the patient, “Can you see the green circles with a red cross?”

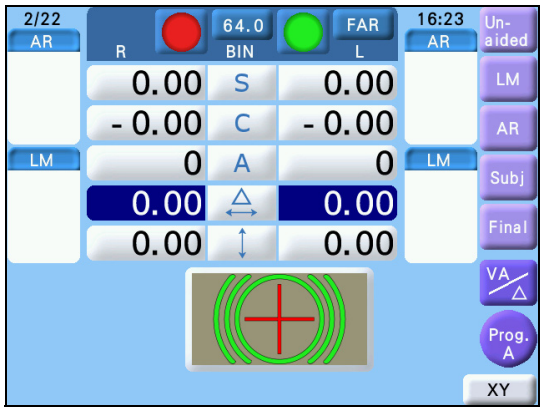
- Yes-> Testing can be continued.
- No-> Testing cannot be continued.

3 Ask the patient, “Is the cross in the center of the circle?”

- Yes-> Orthophoria
- No-> Heterophoria. Go to the next step.

4 Ask the patient, “Is the cross shifted to the right or left?”

- Shifted to the right-> Esophoria
- Shifted to the left-> Exophoria
- Not horizontally shifted-> No horizontal phoria

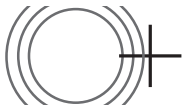
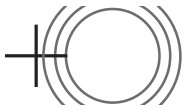


5 Ask the patient, “Is the cross shifted upward or downward?”

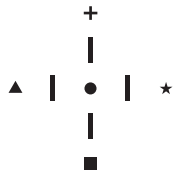
- Shifted upward-> Left eye hyperphoria
- Shifted downward-> Right eye hyperphoria
- Not vertically shifted-> No vertical phoria

If the position is shifted, adjust the following.

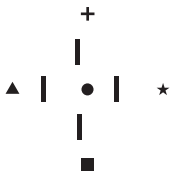
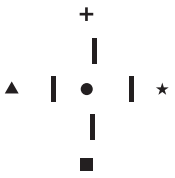
For fine adjustment, use ⊕ or ⊖ instead of the dial.

Heterophoria	Appearance	Procedure
Esophoria (The cross is shifted to the right.)		Turn the dial clockwise to add the BO prism until the cross is seen in the center of the circle.
Exophoria (The cross is shifted to the left.)		Turn the dial counterclockwise to add the BI prism until the cross is seen in the center of the circle.
Left eye hyperphoria (The cross is shifted upward.)		Press [↕]. Turn the dial clockwise to add the BU prism to the right eye and BD prism to the left eye until the cross is seen in the center of the circle.
Right eye hyperphoria (The cross is shifted downward.)		Press [↕]. Turn the dial counterclockwise to add the BD prism to the right eye and BU prism to the left eye until the cross is seen in the center of the circle.

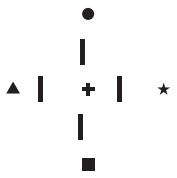
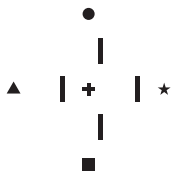
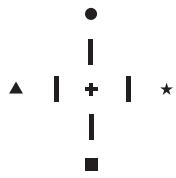
4.5.14 Stereo test

Purpose	To detect stereoscopic vision.	
Use chart	Stereo	
Auxiliary lens	Red filter for the right eye and green filter for the left eye	
Ideal appearance (Type T/UK/P/PhM)	The vertical bar with a cross appears closest and then in the order of the vertical bars with a star, square, and triangle.	
Ideal appearance (Type M)	The vertical bar with a circle appears closest and then in the order of the vertical bars with a star, square, and triangle.	

- (Type T/UK/P/PhM)

Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

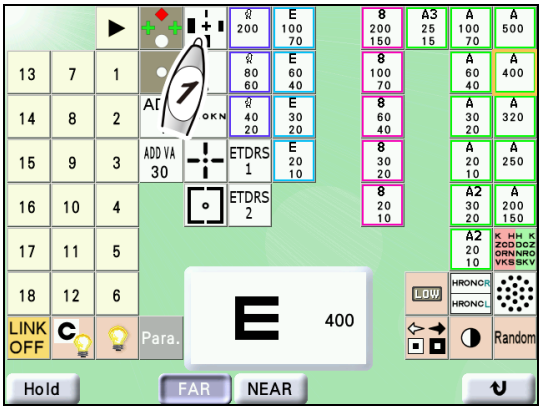
- (Type M)

Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
		

1 Present the Stereo chart.

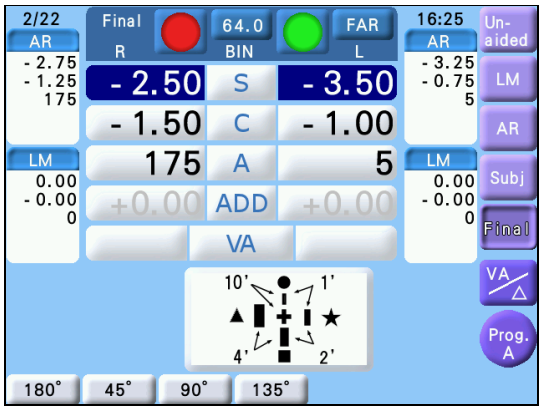
Press FAR, then press  (Type T/UK/P/PhM) or  (Type M) on the chart operation screen.

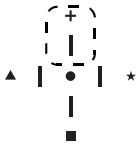
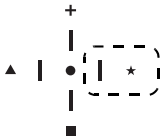
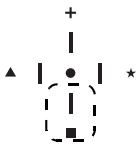
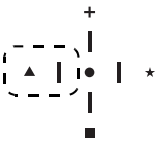
The measurement screen is displayed, the red filter is placed in the right measuring window, and the green filter is placed in the left measuring window.



2 Test whether the patient can see the four bars at different depths.

Ask the patient, “Do the vertical bar with a cross (Type T/UK/P/PhM) or circle (Type M) appear closest and then in the order of the vertical bars with a star, square, and triangle with respect to the circle (Type T/UK/P/PhM) or cross (Type M) in the center?”



Bar position		Stereoparallax from the center mark
Vertical bar with a cross (Type T/UK/P/PhM) Vertical bar with a circle (Type M)		10 minutes
Vertical bar with a star		11 minutes (The stereoparallax from the vertical bar with a cross is 1 minute.) (Type T/UK/P/PhM) (The stereoparallax from the vertical bar with a circle is 1 minute.) (Type M)
Vertical bar with a square		13 minutes (The stereoparallax from the vertical bar with a star is 2 minutes.)
Vertical bar with a triangle		17 minutes (The stereoparallax from the vertical bar with a square is 4 minutes.)

3 For patients who cannot see those bars stereoscopically, perform the binocular visual function test.

“4.5 Binocular Visual Function Test” (page 87)

Note

- If the corrected visual acuity and symptoms pose no problems and high-precision stereopsis (generally 1-minute difference) is perceivable, the presence of heterophoria is acceptable. If the depth difference between the upper and right bars can be seen, the stereoparallax is 1 minute. In this case, phoria test may be omitted.

4.5.15 Worth four dot test

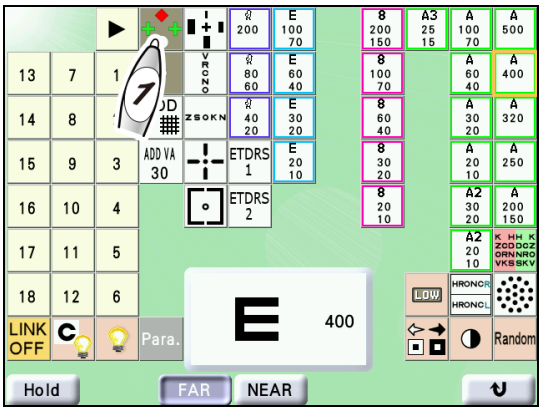
Purpose	To detect fusion or suppression.	
Use chart	Worth four dot	
Auxiliary lens	Red filter for the right eye and green filter for the left eye	
Ideal appearance	Red ◆, green ✚, and pink or red/green ● are seen.	

Appearance		
Right eye	Left eye	Binocular ideal (orthophoria)
 Red ◆, red ●	 Green ✚, green ●	 Red ◆, green ✚, and pink or red/green ●

1 Present the Worth four dot chart.

Press FAR, then press  on the chart operation screen.

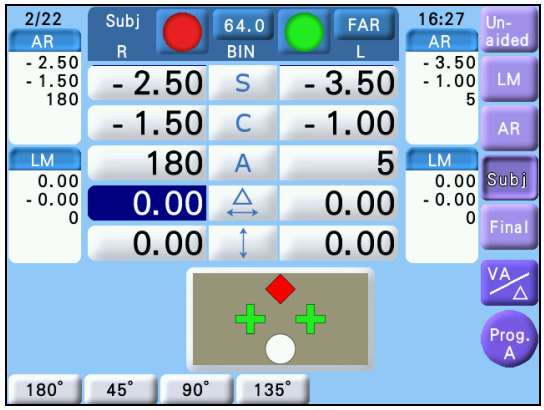
The measurement screen is displayed, the red filter is placed in the right measuring window, and the green filter is placed in the left measuring window.

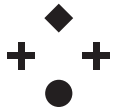
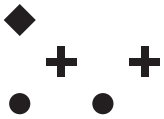
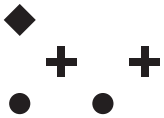


2 Make adjustments until red ◆, green ✚, and pink or red/green ● are seen.

Ask the patient, “How many bright spots can you see?” What colors are they?”

Adjust the following as necessary.

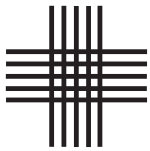


Determination	Appearance	Symptom
Fusion (four spots)		Red ◆ , green ✚ , and pink or alternate red/green ● are seen. However, if the patient has an obvious dominant eye: Right dominant eye-> Red ● Left dominant eye-> Green ●
Right eye suppression (three spots)		Two green ✚ and one green ● are seen.
Left eye suppression (two spots)		Red ◆ and red ● are seen.
Diplopia (five spots)		Red  and green  are seen at the same time.
Alternate suppression of five spots Right eye suppression and left eye suppression appear alternately.		Red  and green  appear alternately.

4.6 Addition (ADD) Test

■ This section explains how to measure the addition (ADD) required for the prescription of glasses for near vision with distance vision corrected and to measure visual acuity with addition.

◆ ADD measurement

Purpose	To measure the near addition for the right, left, or both eyes.	
Use chart	Cross grid	
Auxiliary lens	Cross cylinder lens	
Ideal appearance	Both the vertical and horizontal lines appear equally clear.	

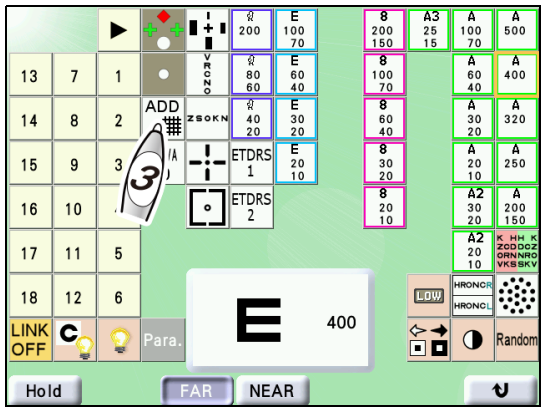
1 On the distance vision measurement screen, measure the distance vision correction values for the patient.

2 Press (R) or (L) to select the eye to be measured.

3 Select the Cross grid chart.

Press FAR, then press ADD on the chart operation screen.

The measurement screen is displayed and the Cross grid chart is displayed.

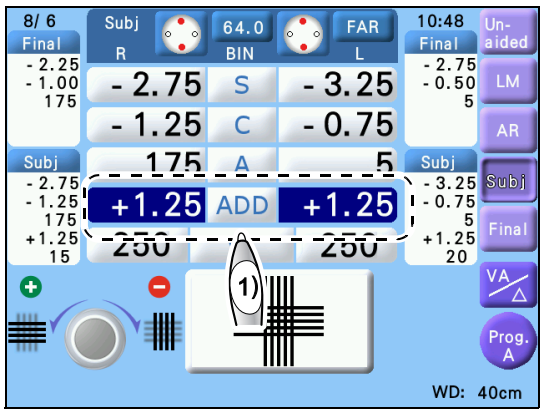


4 Instruct the patient to keep their head away from the refractor head.

When switched to ADD measurement, the refractor head moves for convergence.

5 Press ADD to measure the addition.

1) Change the addition as necessary.
2) Ask the patient, “Which lines are clearer, the horizontal lines or the vertical lines? or are they about the same?”
3) Turn the dial clockwise or counterclockwise one by one until the horizontal and vertical lines appear equally clear.



Adjust the following as necessary.

The horizontal and vertical lines appear equally clear.	The procedure is complete.
The horizontal lines appear clearer.	Turn the dial counterclockwise.
The vertical lines appear clearer.	Turn the dial clockwise.
The horizontal and vertical lines do not appear equally clear.	The horizontal lines should appear slightly clearer than the vertical lines.

6 Switch the eye to be measured and measure it in the same manner.

Note

- Pressing ADD allows an addition to be added or removed with the refractor head converged. When the addition is removed, the highlight color for ADD on the screen changes and the time display shows “ADD-OFF”.

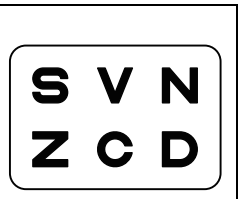
  Pressing ADD again returns the ADD indication to its original and the addition is added. With ADD mode set, LM, AR, Subj, and Final can be switched.

4.7 Near Vision Test

■ This section explains how to perform near visual acuity measurement and near visual function test after distance vision test and ADD measurement.

◆ Near visual acuity measurement

Purpose	To measure the near visual acuity for the right, left, or both eyes.
Use chart	Letters, Numbers, Tumbling E, Landolt ring, Children, ETDRS style letters
Measurement method	To assess the minimum visual acuity at which the patient can read the chart.



1 On the distance vision measurement screen, measure the distance vision correction values for the patient.

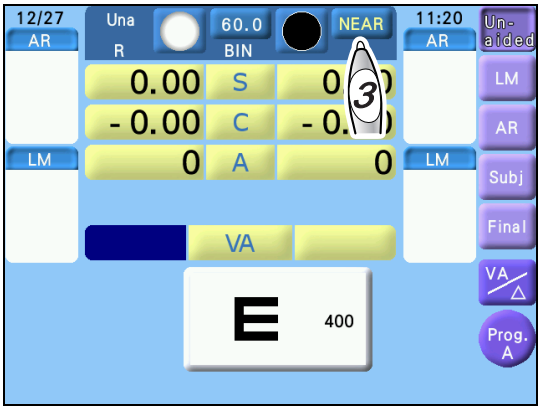
2 Instruct the patient to keep their head away from the refractor head.

When switched to the near vision test, the refractor head moves for convergence.

3 If FAR is displayed on the measurement screen, press the button to change it to NEAR.

Near mode is activated.

After the movement for convergence of the refractor head has been completed, start refraction with the patient's forehead touching the forehead rest.



4 Press R to measure the unaided visual acuity of the right eye.

Determine the minimum visual acuity at which the patient can read the chart.

Press − or + to change the visual acuity value.

The visual acuity of the last presented chart is displayed in the VA field.

"♦ *Distance and near visual acuity charts*" *(page 76)*

5 Press L to measure the unaided visual acuity of the left eye.

Follow the same procedure as Step 4.

6 Press BIN to measure the unaided visual acuity of both eyes.

Both eyes are opened.

Follow the same procedure as Step 4.

4.8 Trial Frame Refraction

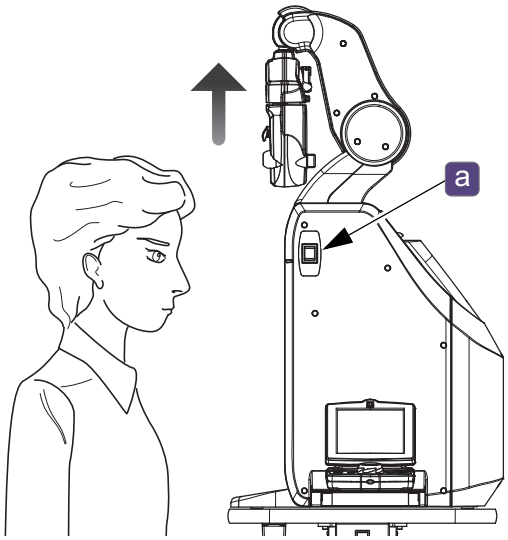
■ This section explains how to move the refractor head up and down during trial frame refraction.

⚠ CAUTION

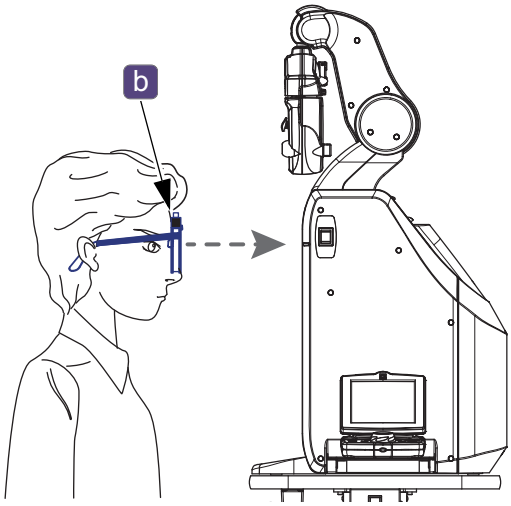
- When moving the refractor head up or down, have the patient keep their hands on their knees and maintain 20 cm or more between the refractor head and the patient's face. If hands become caught in the arm unit, release the refractor head vertical motion switch immediately to stop the movement.
  The refractor head may strike the patient's face or hands may become caught in the arm unit during movement.

1 Move the refractor head up so that the patient can look directly at the chart window.

1) Instruct the patient to keep their hands on their knees and maintain 20 cm or more between the refractor head and the patient's face.
2) Press the up arrow of the refractor head vertical motion switch a to raise the refractor head all the way to the top.



2 Perform refraction in a trial frame b looking through the chart window.



5 PROGRAMMED REFRACTION

■ This chapter explains refraction through the standard programs, Program A and Program Day/Night.

Explanations of the following operations and functions are provided in order to make full use of the device.

⚠ CAUTION

- Clean the forehead rest, face shields, and measuring windows before refraction.
  "7.7 Cleaning" (page 173)
- Instruct the patient not to touch the refractor head, control box tray, or main device when they sit or stand for refraction.
- When moving the refractor head up or down, have the patient keep their hands on their knees and maintain 20 cm or more between the refractor head and the patient's face. If hands become caught in the arm unit, release the refractor head vertical motion switch immediately to stop the movement.
  The refractor head may strike the patient's face or hands may become caught in the arm unit during movement.
- When the refractor head switches between the distance vision test and near vision test, the refractor head moves for divergence or convergence.
  Before performing a near vision test, instruct the patient to keep their face 20 cm or more from the refractor head.
  After the movement has been completed, start refraction with the patient's forehead touching the forehead rest.

5.1 Refraction with Program A

■ This section explains how to obtain prescription with Program A (The following is an example of the program).

The final prescription is obtained after the monocular full correction (subjective data) is stored.

The binocular balance test and the stereo test are performed in Final mode. Then the precise addition is measured in Subjective refraction mode.

◆ Refraction course with Program A (factory setting)

Order	Refraction item	Refraction details
<Subjective refraction mode>		
1	R (Right eye): AR value check	Check of whether the visual acuity of AR data is about 30
2	R: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
3	R: Cross cylinder test (cylinder axis)	Cylinder axis refinement with cross cylinder
4	R: Cross cylinder test (cylindrical power)	Cylindrical power refinement with cross cylinder
5	R: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
6	R: Check of best-corrected visual acuity (monocular full correction)	Best-corrected visual acuity with the most plus power using visual acuity chart
7	L (Left eye): AR value check	Check of whether the visual acuity of AR data is about 30
8	L: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
9	L: Cross cylinder test (cylinder axis)	Cylinder axis refinement with cross cylinder
10	L: Cross cylinder test (cylindrical power)	Cylindrical power refinement with cross cylinder
11	L: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
12	L: Check of best-corrected visual acuity (monocular full correction)	Best-corrected visual acuity with the most plus power using visual acuity chart
<Final mode>		
13	B (Both eyes): Balance test	Binocular balance test
14	B: Stereo test	Check of stereopsis
15	B: Visual acuity check and power refinement	Power refinement by intended use
<Check and test that are not included in program>		
16	Visual acuity check with final data	Check of the vision and visual acuity in a trial frame
17	Visual acuity check with LM data	Check of the visual acuity with imported LM data in the refractor
When performing near vision test <Subjective refraction mode>		
18	B: ADD measurement	ADD measurement with the Cross grid chart for near vision
When performing near vision test <Final mode>		
19	B: ADD check	ADD check with the Near visual acuity chart

◆ Refraction procedure

1 Import the AR data or LM data as necessary.

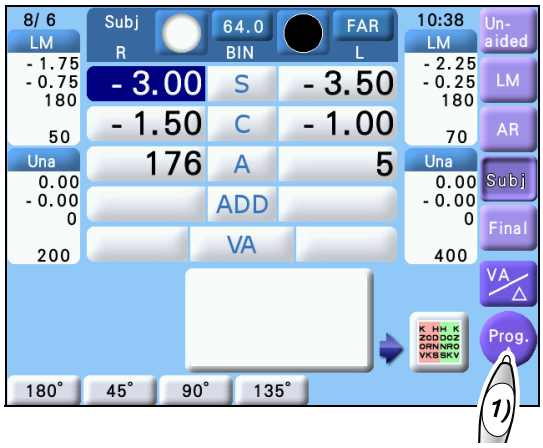
"3.2 Importing Data before Refraction" (page 42)

2 Make sure that Prog. A (Program A) is displayed on the screen.

If Prog. A is not selected, press the program selection button while holding Shift to change the button selection.

<Subjective refraction mode>

3 Start subjective refraction for the right eye.



1) Press Prog. A.

The left eye is occluded and Subjective refraction mode is activated.

2) Ask the patient whether they can read the presented chart (visual acuity of about 30 by auto refractometer value).

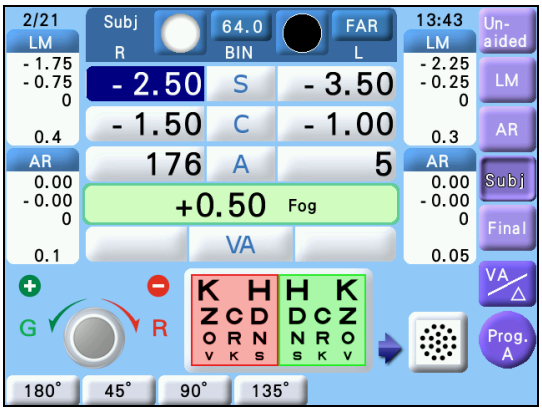
When the patient can read even one letter on the chart, go to the next red-green test.

4 Refine the spherical power in the red-green test.

"4.3.1 Red-green test (Type T/UK/M/PhM)" (page 78)

1) Press (Front).

The Red-green chart is presented and the +0.50 D sphere is added to fog the vision.



2) Turn the dial clockwise to reduce the fog gradually until the letters on the red and green sides appear equally sharp.

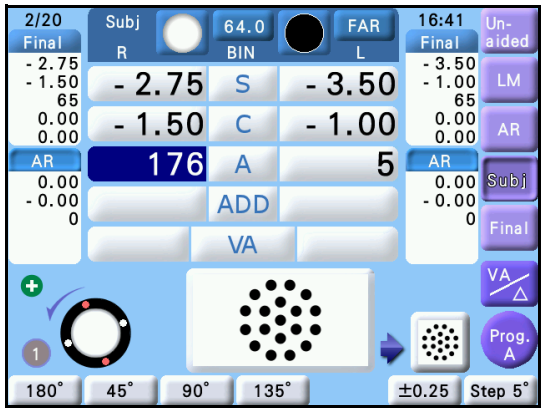
When the patient cannot see the red and green sides equally sharp, make the green side clearer slightly.

Adjust the following as necessary.

The letters on the red side appear sharper.	Turn the dial clockwise.
The letters on the green side appear sharper.	Turn the dial counterclockwise.
The letters on the red and green side appear equally sharp.	The procedure is complete.

5 Measure the cylinder axis.

"4.4.2 Astigmatism measurement with cross cylinder lens (Type T/UK/M/P)" (page 83)



1) Press (Front).

The cross cylinder lens (±0.25) is placed and the Dots chart is presented.

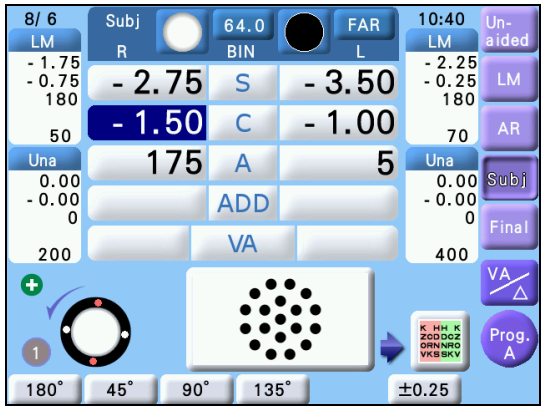
2) Measure the cylinder axis using the cross cylinder.

Present Chart 1 by pressing 1 and Chart 2 by pressing 2, then ask the patient which is clearer.

3) Repeat the above until both charts appear equally clear.

Chart 1 appears clearer.	Turn the dial counterclockwise by one step or press ⊕.
Chart 2 appears clearer.	Turn the dial clockwise by one step or press ⊖.
Chart 1 and 2 appear equally clear.	The procedure is complete.

6 Measure the cylindrical power.



1) Press (Front).

The axis of the cross cylinder lens is changed.

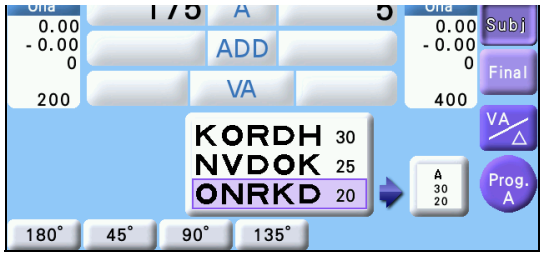
2) Measure the cylindrical power using the cross cylinder.

Follow the same procedure as 2) in *Step 5*.

7 Refine the spherical power in the red-green test in *Step 4* again.

8 Refine the lens power to the most plus power that provides the best-corrected visual acuity.

"4.2.1 To measure unaided visual acuity" (page 74)



1) Press (Front).

The visual acuity chart for visual acuity 20 is presented.

2) Press ⊖ or ⊖ to refine the lens power to the most plus power that provides the best-corrected visual acuity.

Ex.— Turn the dial counterclockwise to add +0.25 D sphere. If the chart appears blurred, turn back the dial clockwise by one step.

Note

- Instead of the procedure above, the following procedure is available.

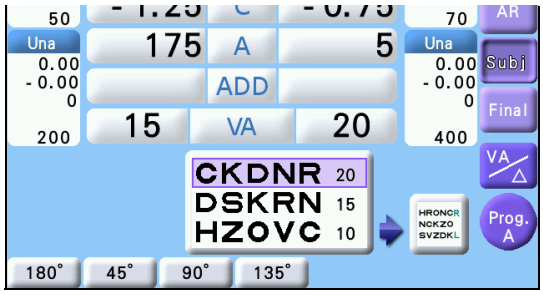
1) Add approximately +0.75 D sphere of fogging.
2) Present a visual acuity chart with which the visual acuity is decreased by a few increments.
3) When the patient can read the visual acuity chart, press ⊖ to increase the visual acuity. When they cannot read the chart, add -0.25 D sphere to release the fog and ask them to read it again.
4) Repeat the procedure to determine the best-corrected visual acuity with the most plus power.

❖ The spherical power for the right eye is perfectly refined.

9 Measure the left eye.

Follow the same procedure as 2) in *Step 3* to *Step 8*.

❖ The spherical power for the left eye is perfectly refined.



10 Press ⬭ (Front).

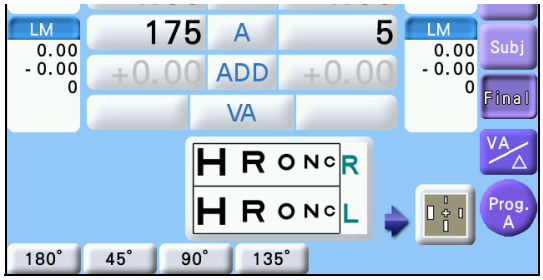
Three short beeps sound.

<Final mode>

11 Perform the binocular balance test.

"4.5.1 Binocular balance test" (page 87)

1) Press ⬭ (Front).
   The red-green filter is placed.
2) Make the upper and lower letters appear roughly equal.
   Ask the patient, "Which is clearer, the upper or the lower?"



Adjust the following as necessary.

The upper letters appear clearer.	Press R and turn the dial counterclockwise by one step.
The lower letters appear clearer.	Press L and turn the dial counterclockwise by one step.
The upper and lower letters appear equally clear.	The procedure is complete.
The upper and lower letters do not appear equally clear.	Determine with which eye the patient views the binocular balance chart more clearly while referring to the LM data or dominant eye.

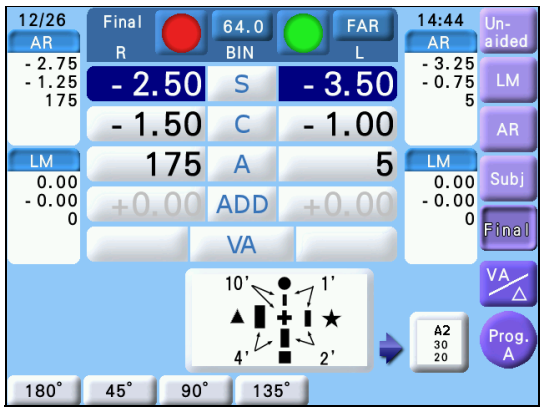
Note

- Binocular balance test can be performed with the Binocular red-green chart.
  "4.5.2 Binocular red-green test (Type T/UK/P/PhM)" (page 89)

❖ The spherical power for both eyes is perfectly refined.

12 Perform the stereo test.

"4.5.14 Stereo test" (page 109)

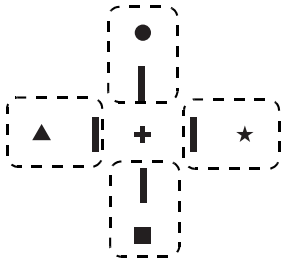


1) Press (Front).

   The Stereo chart is presented with the red filter placed in the right measuring window and the green filter placed in the left measuring window.

2) Test whether the patient can see the four vertical lines stereoscopically.

   Ask the patient, "Do the vertical bar with a circle appear closest and then in the order of the vertical bars with a star, square, and triangle with respect to the cross in the center?"



3) For patients who cannot see those bars stereoscopically, perform the binocular visual function test.

   "4.5 Binocular Visual Function Test" (page 87)

13 Refine the powers according to the intended use.

"4.2.1 To measure unaided visual acuity" (page 74)

1) Press (Front).

2) Press or to present the desired visual acuity chart.

3) Refine the lens power to the most plus power that provides the best-corrected visual acuity.

<Check and test that are not included in program>

14 Measure the visual acuity with prescription.

Raise the refractor head if necessary and then check the visibility and visual acuity in a trial frame.

"4.8 Trial Frame Refraction" (page 116)

1) Press R.

2) Press or to measure the visual acuity for the right eye.

3) Press L.

4) Press  or  to measure the visual acuity for the left eye.

5) Press BIN.

6) Press  or  to measure the visual acuity for both eyes.

15 Compare the patient's vision using the values of the patient's glasses and those of the prescription.

1) Press LM.

According to the LM data, the corrective lenses are placed in the measuring windows.

2) Examine which is better compared to Final.

16 When the near vision test is performed next, instruct the patient to keep their head away from the refractor head.

When switched to the near vision test, the refractor head moves for convergence.

17 Select whether to perform a near vision test.

1) Press  (Front).

A message for the near vision test appears.

2) Select whether to perform a near vision test.

- When performing a near vision test, press Yes.

  The refractor head moves for convergence and the Cross grid chart is displayed.
- When not performing a near vision test, press No.

  Program A is complete. Go to *Step 21*.

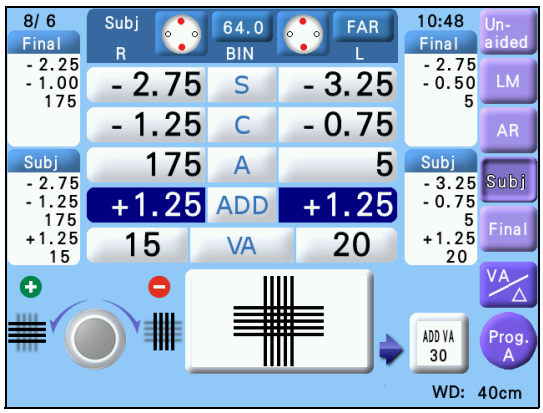
When performing near vision test <Subjective refraction mode>

18 Measure the addition.

"4.6 Addition (ADD) Test" (page 113)

1) Ask the patient, "Which lines are clearer, the horizontal lines or the vertical lines? or are they about the same?"

2) Turn the dial clockwise or counterclockwise one by one until they appear equally clear.



5

Adjust the following as necessary.

The horizontal lines appear clearer.	Turn the dial counterclockwise.
The vertical lines appear clearer.	Turn the dial clockwise.
The horizontal and vertical lines appear equally sharp.	The procedure is complete.
The horizontal and vertical lines do not appear equally clear.	The horizontal lines should appear slightly clearer than the vertical lines.

When performing near vision test <Final mode>

19 Measure the near visual acuity.

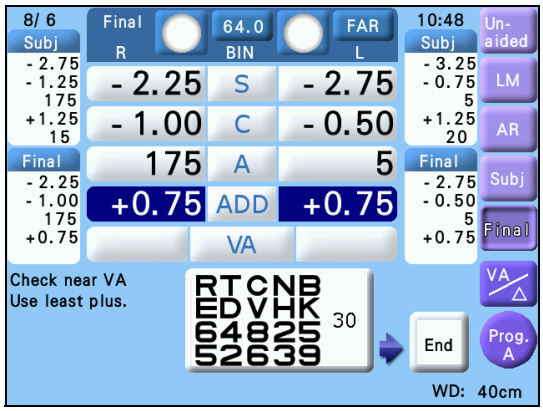
"4.7 Near Vision Test" (page 115)

1) Press (Front).

The near visual acuity chart is presented.

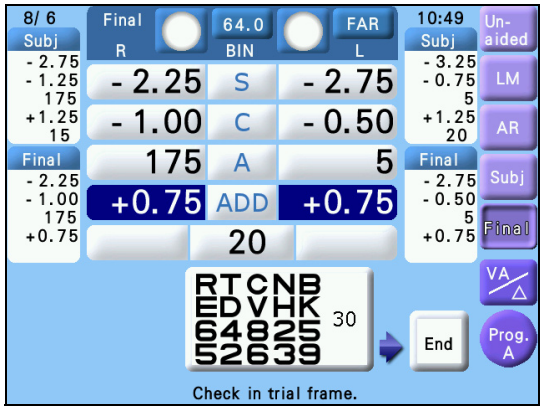
Set the values determined by adding or subtracting the ones adjusted in Step 14 to/from the addition measured in Step 18 as the addition for prescription.

2) Ask the patient whether they can read the letters of visual acuity 30.



20 Press (Front).

❖ Program A is complete.



21 Press Print to print the measured data.

22 Instruct the patient to keep their head away from the refractor head.

23 Raise the refractor head and test the final prescription in a trial frame.

Test the final prescription referring to the printed measurement data.

"4.8 Trial Frame Refraction" (page 116)

5.2 Refraction with Program Day/Night

■ This section explains how to obtain prescription with Program Day/Night.

◆ Refraction course with Program Day/Night (factory setting)

Order	Refraction item	Refraction details
Day <Subjective refraction mode>		
1	R: AR value check	Check of whether the visual acuity of AR data is about 30
2	R: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
3	R: Cross cylinder test (cylinder axis)	Cylinder axis refinement with cross cylinder
4	R: Cross cylinder test (cylindrical power)	Cylindrical power refinement with cross cylinder
5	R: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
6	R: Check of best-corrected visual acuity (monocular full correction)	Best-corrected visual acuity with the most plus power using visual acuity chart
7	L: AR value check	Check of whether the visual acuity of AR data is about 30
8	L: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
9	L: Cross cylinder test (cylinder axis)	Cylinder axis refinement with cross cylinder
10	L: Cross cylinder test (cylindrical power)	Cylindrical power refinement with cross cylinder
11	L: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
12	L: Check of best-corrected visual acuity (monocular full correction)	Best-corrected visual acuity with the most plus power using visual acuity chart
13	B: Balance test	Binocular balance test
14	B: Stereo test	Check of stereopsis
15	B: Check of best-corrected visual acuity and power refinement	Best-corrected visual acuity with the most plus power using visual acuity chart
16	B: ADD measurement	ADD measurement with the Cross grid chart for near vision
17	B: ADD check	ADD check with the Near visual acuity chart
Night <Subjective refraction mode>		
18	R: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
19	R: Cross cylinder test (cylinder axis)	Cylinder axis refinement with cross cylinder
20	R: Cross cylinder test (cylindrical power)	Cylindrical power refinement with cross cylinder
21	R: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
22	R: Check of best-corrected visual acuity (monocular full correction)	Best-corrected visual acuity with the most plus power using visual acuity chart

23	L: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
24	L: Cross cylinder test (cylinder axis)	Cylinder axis refinement with cross cylinder
25	L: Cross cylinder test (cylindrical power)	Cylindrical power refinement with cross cylinder
26	L: Red-green test	Spherical refinement with the Red-green chart (+0.5 D sphere for fogging)
27	L: Check of best-corrected visual acuity (monocular full correction)	Best-corrected visual acuity with the most plus power using visual acuity chart
28	B: Balance test	Binocular balance test
29	B: Stereo test	Check of stereopsis
30	B: Check of best-corrected visual acuity and power refinement	Best-corrected visual acuity with the most plus power using visual acuity chart
31	B: ADD measurement	ADD measurement with the Cross grid chart for near vision
32	B: ADD check	ADD check with the Near visual acuity chart

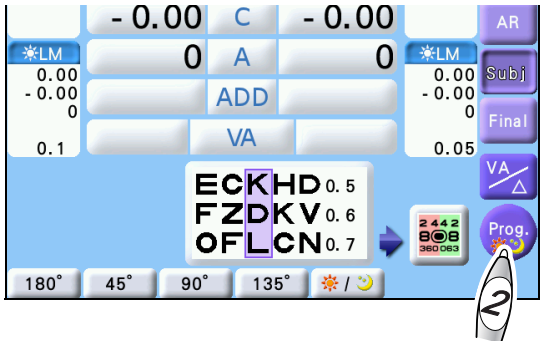
◆ Refraction procedure

1 Import AR data or LM data as necessary.

"3.2 Importing Data before Refraction" (page 42)

2 Make sure that Prog. (Program ☼/☽) is displayed on the screen.

If Prog. is not selected, press the program selection button while holding Shift to change the button selection.



Day <Subjective refraction mode>

3 Measure the binocular full corrective power and near addition for day vision in the same manner of Steps 4 to 9 of *"5.1 Refraction with Program A" (page 117)*.

4 Select whether to perform night measurement.

1) Press (Front).

A message for night measurement appears.

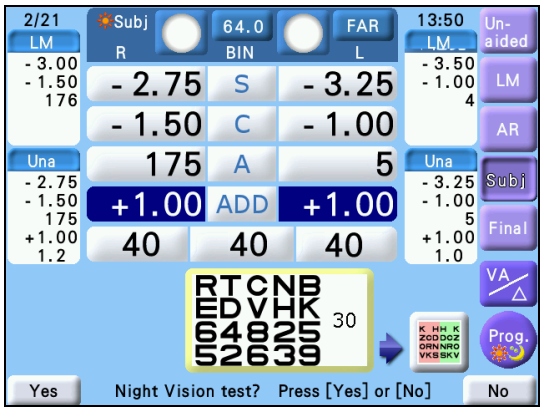
2) Select whether to perform night measurement.

- When performing night measurement, press Yes.

The chart is displayed at the brightness for night measurement.

- When not performing night measurement, press No.

Program Day/Night is complete. Go to *Step 7*.



Night <Subjective refraction mode>

5 Start subjective refraction for night vision.

Measure the binocular full corrective power and near addition for night vision in the same manner of 2) in *Step 4* through *Step 14* of *"5.1 Refraction with Program A" (page 117)*.

- Darken the room for night measurement. It is recommended to take time to adjust the patient's eye to the darkness.

6 When the binocular full corrective power for night vision is determined, press (Front).

7 Press Print to print the measured data.

8 Instruct the patient to keep their head away from the refractor head.

9 Raise the refractor head and test the final prescription in a trial frame.

Test the final prescription referring to the printed measurement data.

"4.8 Trial Frame Refraction" (page 116)

5.3 Programming

■ The two standard programs, Program A and Program Day/Night, are pre-written.

Programs B and C are available for user configuration. All of them may be edited.

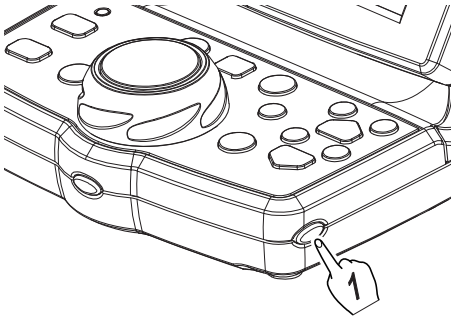
5.3.1 To clear programs

This section explains how to clear and rewrite all contents of the program.

To clear Program A or Program ☼☽, the *" Program A" (page 154)* or "*Program ☼☽" (page 154)* parameter needs to be set to "User".

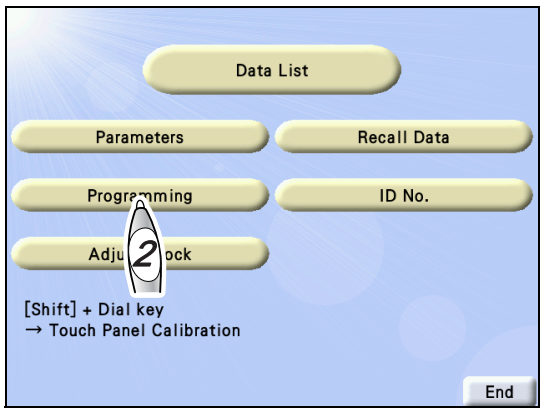
1 Display the main menu screen.

Press (Right side).



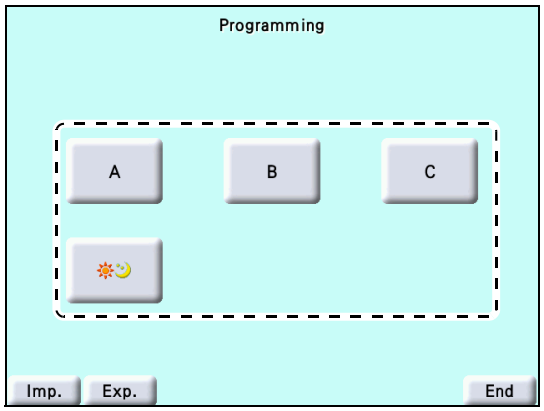
2 Press the Programming button.

The Programming screen is displayed.



3 Select a program to be cleared.

Press the desired button from among [A], [B], [C], and [☼☽].

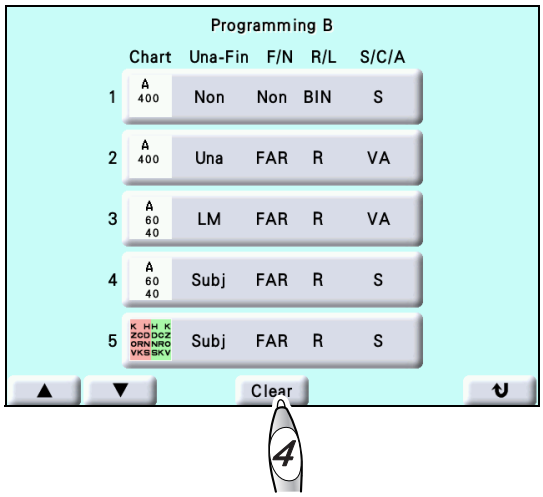


4 Press Clear .

A clear confirmation message appears.

5 Press Yes .

All contents in the selected program are cleared.



5.3.2 To edit programs

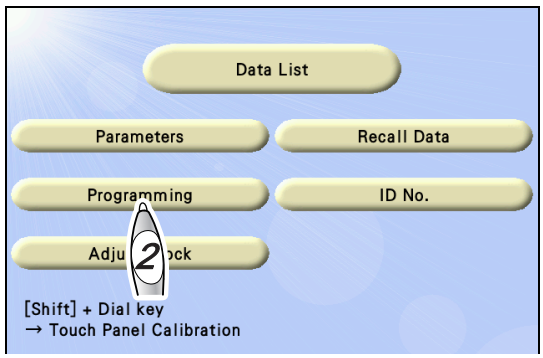
To edit Program A or Program ☼☽, the *" Program A" (page 154)* or *"Program ☼☽ " (page 154)* parameter needs to be set to "User".

1 Display the main menu screen.

Press (Right side).

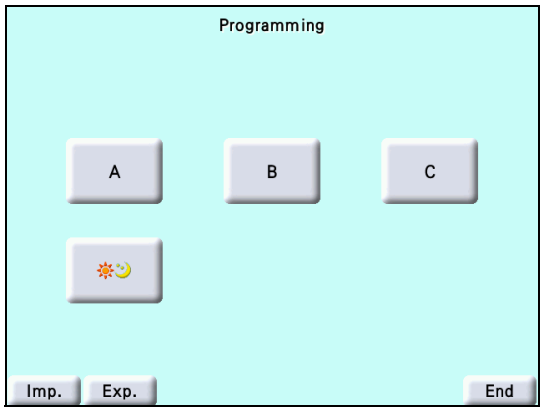
2 Press the Programming button.

The Programming screen is displayed.

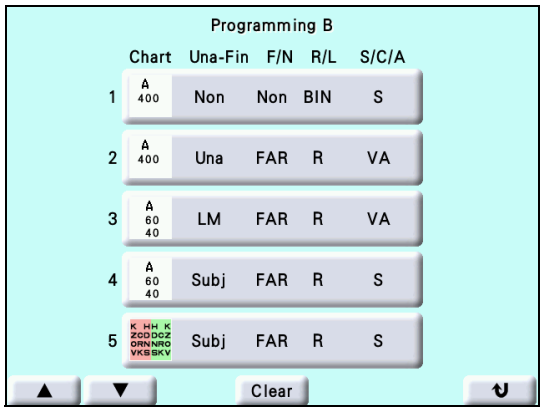


3 Select a program to be edited.

Press the desired button from among [A], [B], [C], and [☼☽].



The contents of the current program are displayed in a list (All programs are displayed blank if no program is written).



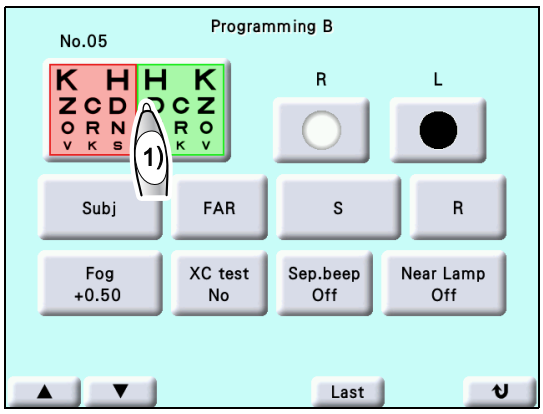
4 Select the step to be edited.

Selecting the step field to be edited displays the entry screen.

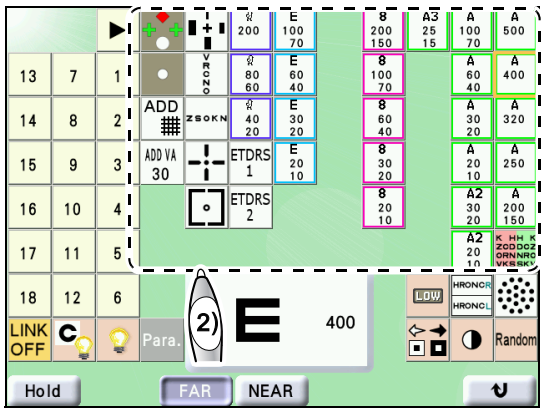
5 Select charts to be stored.

1) Press the chart icon on the upper left.

The chart operation screen is displayed.



2) Select charts to be stored.



6 Select the mode to work with when the selected chart is presented.

Select items to be included on the Programming screen.

- Specify auxiliary lenses and fog amount as necessary.
- To display the vertical line, horizontal line, single letter or apply the red-green filter, specify here.

● The following can be written.

- Charts (vertical line, horizontal line, single letter, or red-green filter)
- Low illumination, contrast change, black and white inversion
- Import data (Unaided to Final)
- Day/Night mode
- Distance/Near mode
- Change mode (Sphere, Cylinder, Axis, etc.)
- Eye to be measured (R, L, BIN)
- Auxiliary lens

- Cross cylinder test
- With or without beep sounds (Three beeps sounds at the end of each test.)
- Fog amount (Select [Fog] and turn the dial to enter the fog amount.)

7 When the current step is complete, press ▼ to go to the next step.

- For the final step, press ↵.
- To clear all subsequent steps, press Last.

8 Repeat Step 5 to Step 7 until the desired charts are written in the presentation order.

Up to 32 steps can be stored.

9 Press ↵ twice to exit from Programming mode.

Return to the Programming screen and press End to return to the measurement screen.

5.3.3 To check programs

By the following procedure, the charts are presented in the order written in the program.

1 Press Prog. A while holding Shift to select the desired program.

2 Press the selected program selection button to start the program.

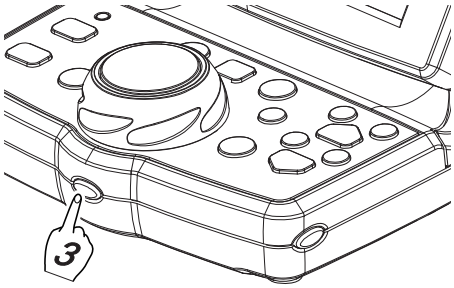
The first chart in the selected program is presented and the refractor head is set as programmed.

3 Press ⬭ (Front) to display the next chart.

Each time the button is pressed, the chart is presented in the programmed order and the refractor is set as programmed.

Pressing the next chart display icon also displays the next chart.

Pressing ⬭ (Front) while holding Shift returns to the previous chart.



5.3.4 To import or export programs

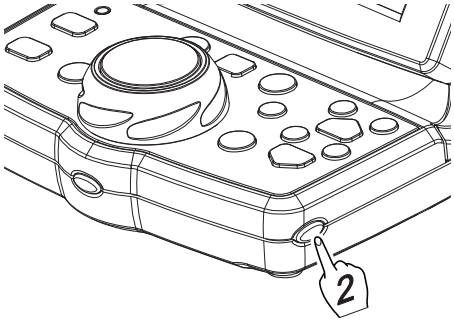
The contents of Programs A to C, and ☼☽ can be imported/exported from/onto the CF card (optional).

1 Insert the CF card into the control box as necessary.

"7.6 Inserting CF Card" (page 172)

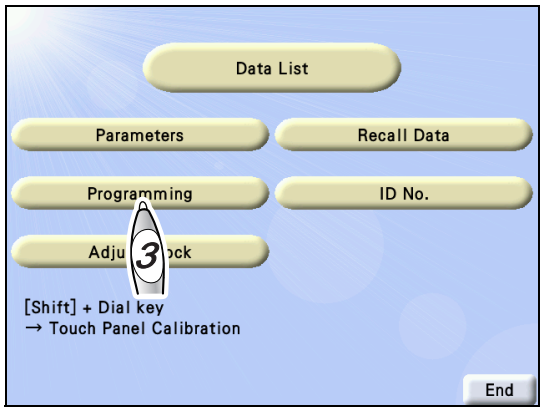
2 Display the main menu screen.

Press ⬭ (Right side).



3 Press the Programming button.

The Programming screen is displayed.

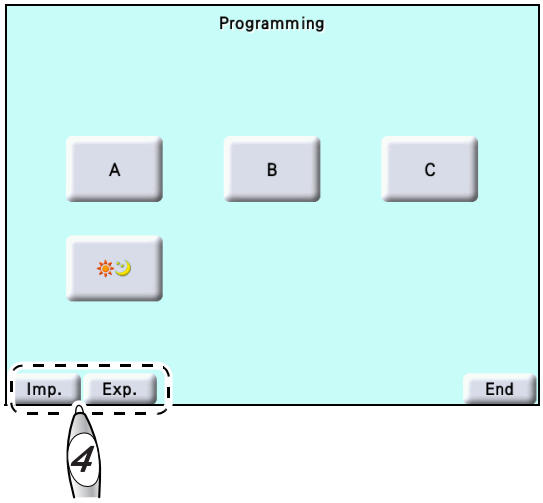


4 Import or export programs.

- To import programs

  Press Imp. . All contents of Programs A to C, and ☼☽ are imported from the CF card.
- To export programs

  Press Exp. . The current programs A to C, and ☼☽ are exported onto the CF card.



5.4 Displaying Data List

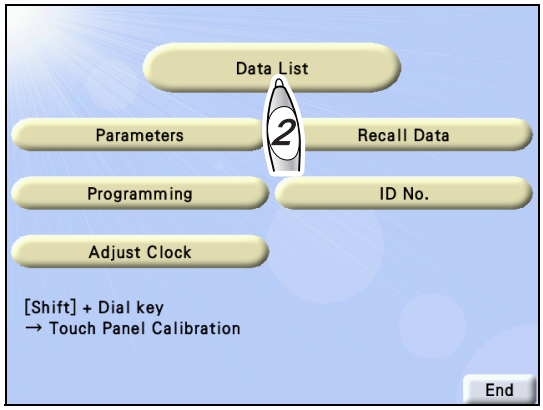
■ This section explains how to display and check the list of measured data.

1 Display the main menu screen.

Press (Right side).

2 Press the Data List button.

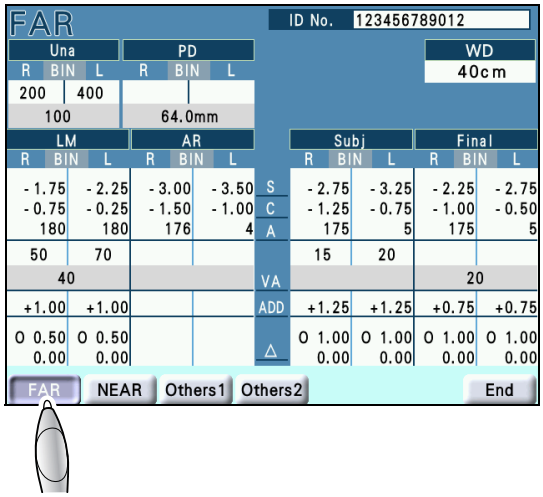
The Programming screen is displayed.



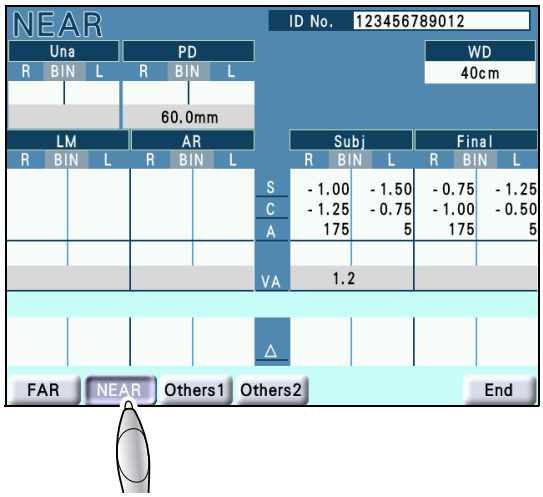
3 Select the desired list.

Select a function button.

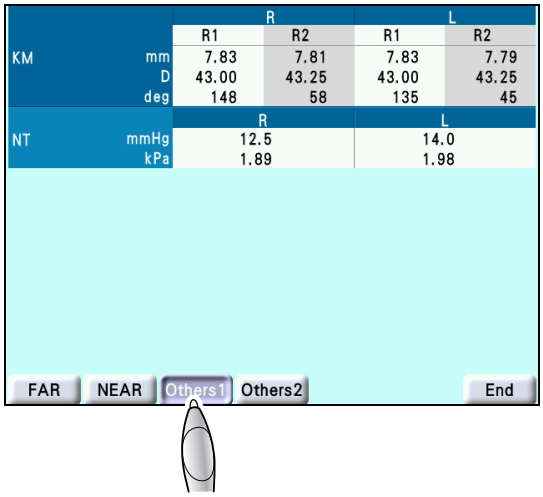
- **[FAR]**: Displays the list of distance data.



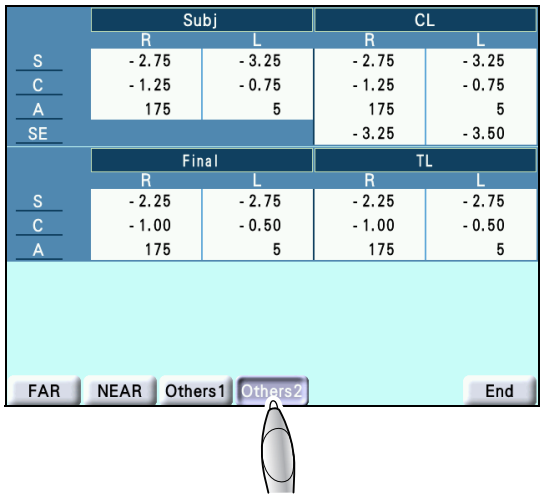
- **[NEAR]**: Displays the list of near data.



- **[Others1]**: Displays KM data, intraocular pressure data, and measured results of accommodation measured by an auto refractometer.



- **[Others2]**: Displays subjective data, contact lens conversion value[*1], prescription data[*2], and trial lens data.



- **[End]**: Returns to the normal measurement screen.

*1. The contact lens conversion value is the value that the subjective value is converted from VD (vertex distance) 12 mm to 0 mm.

*2. When the device has no final prescription, the subjective data is displayed.

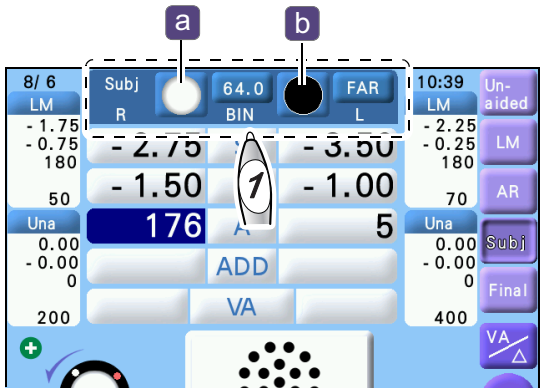
5.5 Placing Auxiliary Lenses

■ This section explains how to place auxiliary lenses.

1 Display the Auxiliary Lenses window.

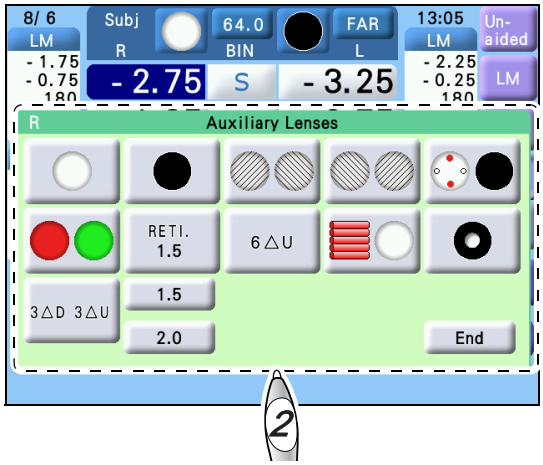
Press the R auxiliary lens display button a or L auxiliary lens display button b.

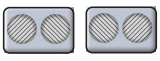
Pressing the above button while holding Shift switches the measuring windows to be opened or occluded.



2 Press the desired auxiliary lens button.

The measurement screen is displayed and the selected auxiliary lens is placed.



Auxiliary lens	Description
	Open aperture
	Occluder
	Polarizing filter (not used)
	Fixed cross cylinder lens for the right eye and occlusion for the left eye
	Red filter for the right eye and green filter for the left eye
	Spherical lens +1.5 D for retinoscope
	BASE UP 6Δ
	Horizontal Maddox rod for the right eye and open aperture for the left eye

	Open aperture for the right eye and vertical Maddox rod for the left eye
	Pinhole plate with a hole diameter of 2 mm
	BASE DOWN 3Δ for the right eye and BASE UP 3Δ for the left eye
	Selection button of spherical lens +1.5 D for retinoscope
	Selection button of spherical lens +2.0 D for retinoscope

◆ Linkage between charts and auxiliary lenses

The following explains the auxiliary lenses linked to the charts.

To link auxiliary lenses, set the *" Chart link" (page 155)* parameter to "Yes".

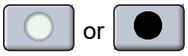
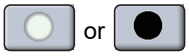
Chart	Auxiliary lens		Mode
	Right eye	Left eye	
Visual acuity chart			S
Astigmatism clock dial			C/A
Red-green			S
Dots			A/C (XC mode)
Binocular balance	Prism 3ΔBD 	Prism 3ΔBU 	S
Binocular red-green			
Phoria			Prism H/V
Phoria with fixation			
Muscle			
Mallet			
Vertical/Horizontal coincidence			Prism V
Stereo			–
Worth four dot			
Vertical line	Prism 6ΔBU 		Prism H
Horizontal line		Prism 10ΔBI	Prism V
Fixation point	Horizontal Maddox 	Vertical Maddox 	Prism H/V
Schober	Red filter 	Green filter 	

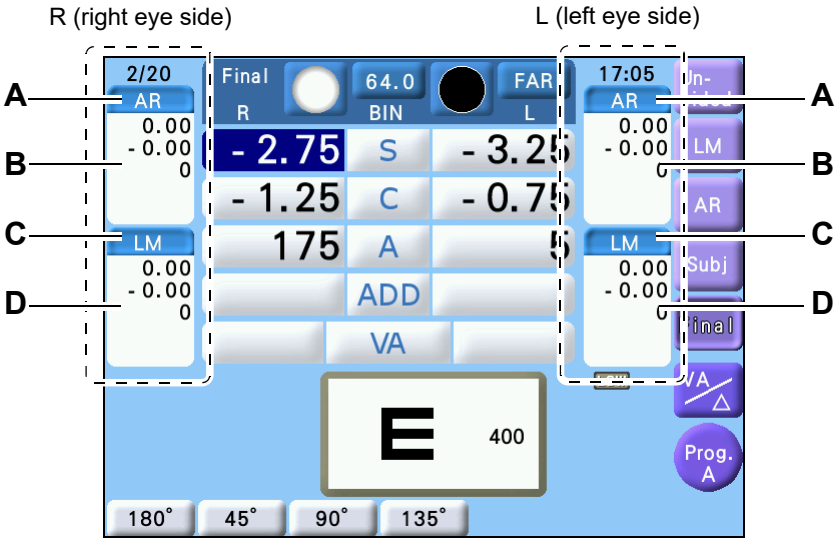
Chart	Auxiliary lens		Mode
	Right eye	Left eye	
Cross grid for near vision	Fixed cross cylinder lens  or 		ADD
Near visual acuity			

❖ Prism H indicates BASE IN/OUT prism (BI/BO) and V indicates BASE UP/DOWN prism (BU/BD).

5.6 Specifying Subwindow Display Data

■ This section explains how to specify items to be displayed in Subwindow 1 and 2.

- When no item is specified, the measured data previously set is displayed in Subwindow 1 and the measured data set prior to the previous one is displayed in Subwindow 2.
- If display items are specified in Subwindow 1, the measured data previously set is displayed in Subwindow 2.

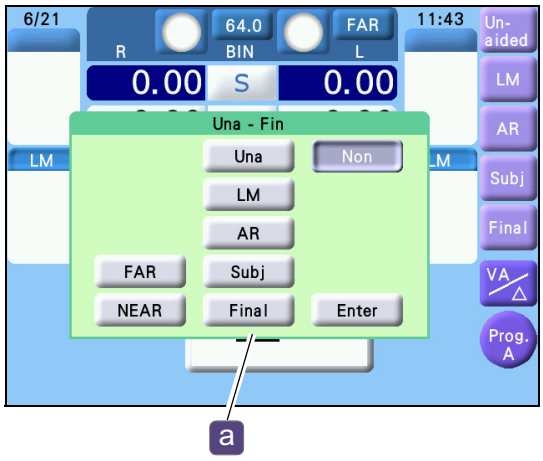


A: Display data setting 1 button
B: Subwindow 1
C: Display data setting 2 button
D: Subwindow 2

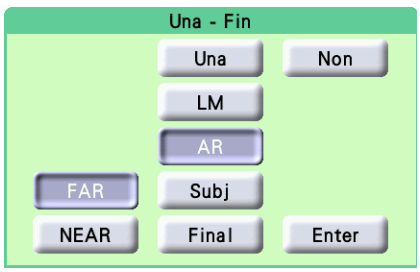
1 Press the display data setting button.

- Press the display data setting 1 button to specify items displayed in Subwindow 1.
- Press the display data setting 2 button to specify items displayed in Subwindow 2.

The Una-Fin window a appears.



2 Specify the items to be displayed in the sub-window in the Una-Fin window.



- [FAR]: Selects Distance mode.
- [NEAR]: Selects Near mode.
- [Una]: Selects unaided eye data.
- [LM]: Displays LM data.
- [AR]: Displays AR data.
- [Subj]: Displays subjective data.
- [Final]: Displays final data.

- [Non]: Clears the display data settings in the subwindow.
- [Enter]: Closes the Una-Fin window and displays the specified data.
- [Una], [LM], [AR], [Subj], [Final], [Non]: Closes the Una-Fin window and displays data specified in the subwindow.

Note

- Display data settings specified in the subwindow are retained once the device is turned off.

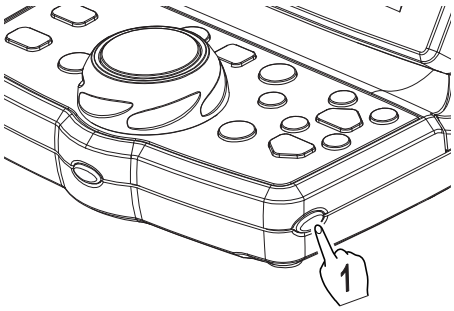
5.7 Changing Patient ID Number

■ This section explains how to change the patient ID number to be printed on the printing paper.

■ When the *" ID No." (page 156)* parameter is set to "Standard", up to 12 digits of ID number can be entered. When it is set to "Expanded", up to 20 digits can be entered.

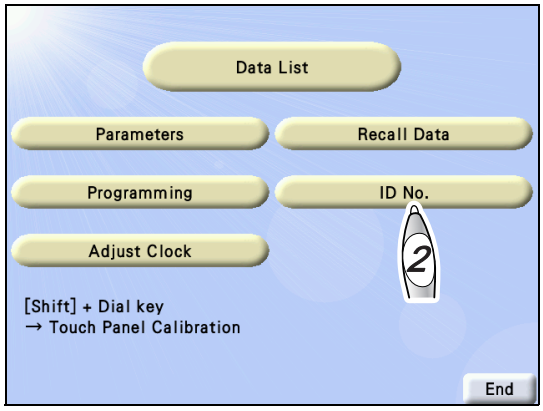
1 Press (Right side).

The main menu screen is displayed.



2 Press the ID No. button.

The numeric entry window appears.

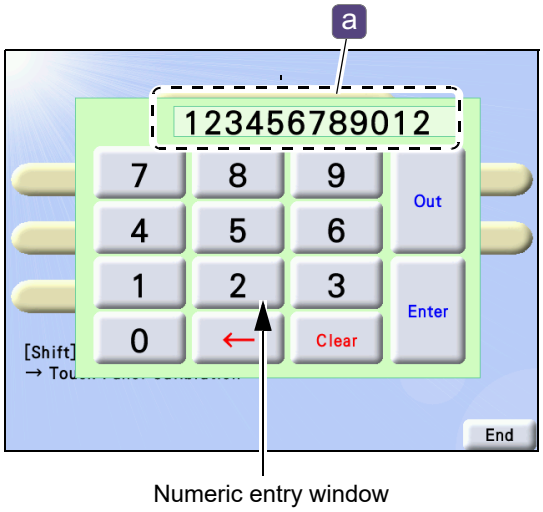


3 Enter the desired ID number a with the numeric keys.

To change the ID number, delete up to the digit to be changed by pressing the [←] button and then enter a new number.

4 Return to the normal measurement mode.

- Pressing the Enter or Out button stores the ID number.
- Pressing (Right side) does not store the ID number.



Numeric entry window

Note

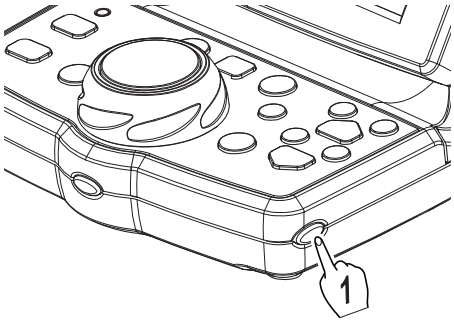
- When the *" PC port" (page 155)* parameter is set to "PC", press the Clear button to clear the ID number before entering the new ID number.

5.8 Recalling Previous Data

■ All data for the patient that was printed last is stored in the device until the next printing is performed. The following explains how to recall data.

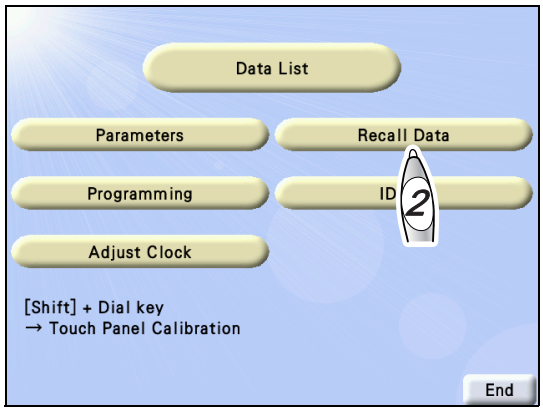
1 Press (Right side).

The main menu screen is displayed.



2 Press the Recall Data button.

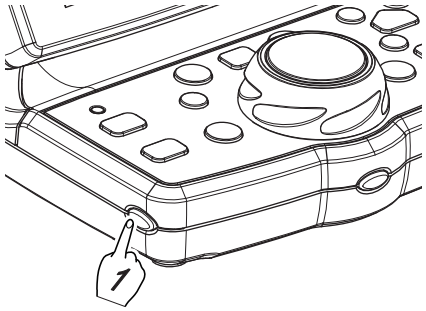
Data is recalled.



5.9 Displaying Images

■ This section explains how to display images in an SD card instead of charts.

1 Press (Left side) to display the chart operation screen.



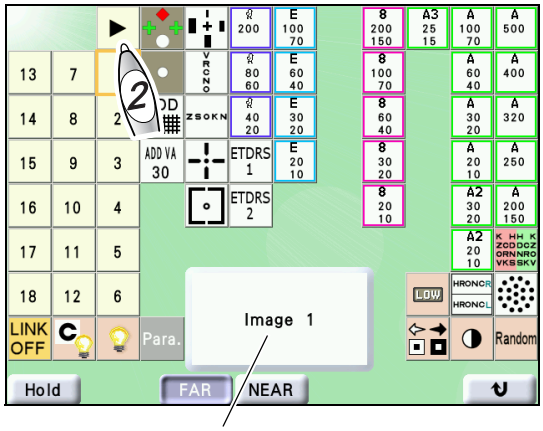
2 Press ▶.

The image is displayed as a slide show.

The function to display multiple images sequentially allows images to change every 5 seconds.

1 - 18 : Among images stored in the SD card[*1], the image corresponding to the number is displayed.

3 Press any chart button to finish the slide show of images.



Note

- There is a pause of a few seconds between pressing a button and displaying the image.
  The device does not respond to any operation from the control box during this time. However, this symptom is not an error.

*1. If you need to add images to the SD card, contact NIDEK or your authorized distributor.

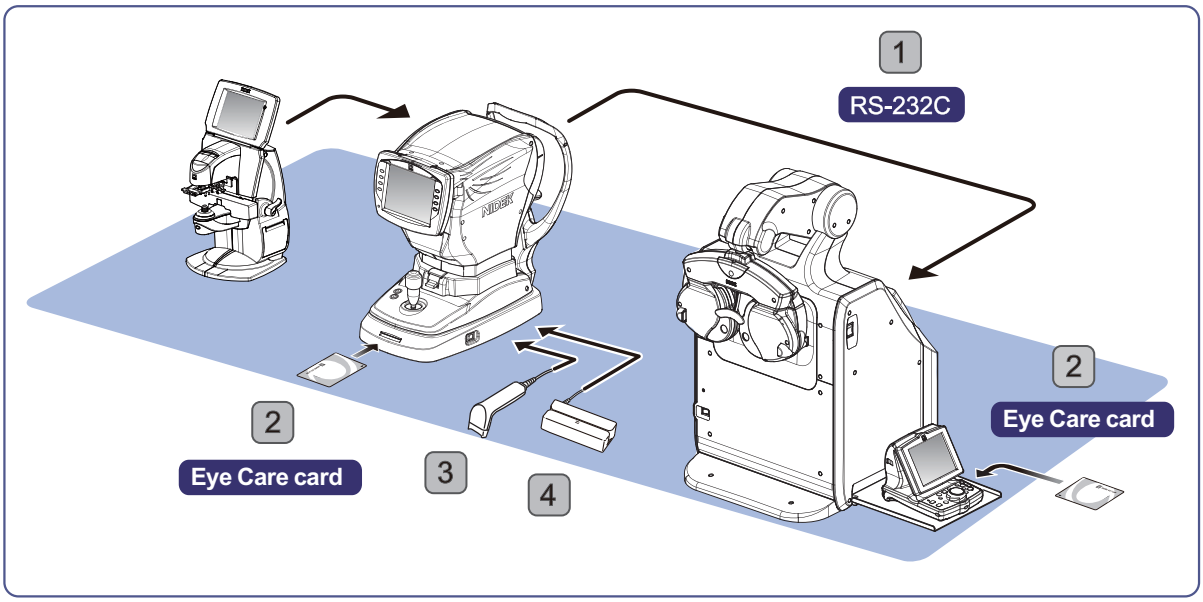
6 DEVICE CONNECTION AND PARAMETER SETTINGS

6.1 Connecting Peripheral Devices

■ If the connection between devices needs to be disconnected or reconnected, contact NIDEK or your authorized distributor.

6.1.1 To connect peripheral devices (Example 1)

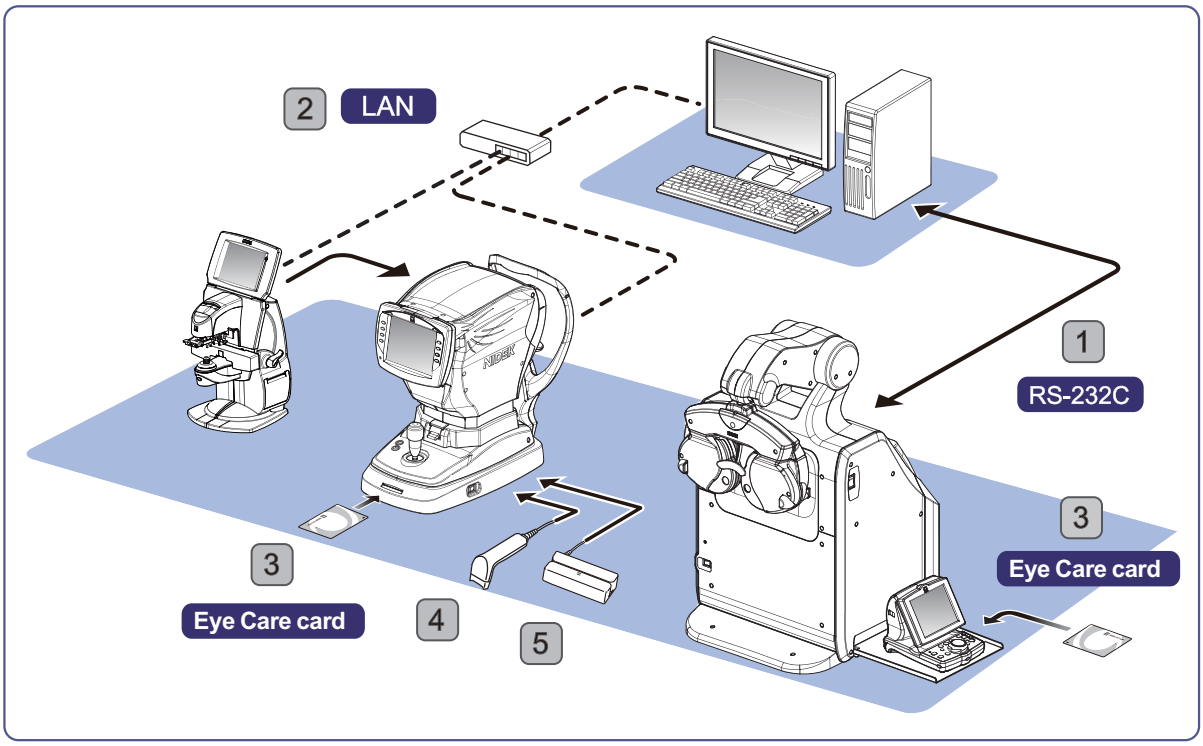
The following is an example of connecting this device with an auto refractometer or lensmeter using a communication cable (optional).



No.	Connection method / connecting device	Connection	Function
1	Communication cable (optional)	Communication connector	Exports AR and KM data. Used as AR data and LM data in the subjective refraction.
2	Eye Care card (optional)	Insert the Eye Care card into an auto refractometer or control box.	Exports AR and KM data. Used as AR data and LM data in the subjective refraction.
3	Barcode scanner	USB connector of auto refractometer	Imports patient ID.
4	Magnetic card reader		

6.1.2 To connect peripheral devices (Example 2)

The following is an example of connecting this device with a computer using a communication cable and connecting an auto refractometer and lensmeter by a LAN.



No.	Connection method / connecting device	Connection	Function
1	Computer Communication cable (optional)	Communication connector	Exports AR and KM data. Measured data is managed by database software such as NAVIS. Used as AR data and LM data in the subjective refraction.
2	Computer LAN cable	LAN connector	Exports AR and KM data. Measured data is managed by database software such as NAVIS.
3	Eye Care card (optional)	Insert the Eye Care card into an auto refractometer or control box.	Exports AR and KM data. Used as AR data and LM data in the subjective refraction.
4	Barcode scanner	USB connector of auto refractometer	Imports patient ID.
5	Magnetic card reader		

⚠ CAUTION

- Do not use devices other than the specified barcode scanner or magnetic card reader.
  IDs cannot be read correctly or device malfunction may result.
- Be sure to perform LAN connection via a network hub.
  Data communication may not be properly performed.
- Before connecting the device to the network (LAN connection), set parameters of the device and computer under supervision of your network administrator.
- When connecting the TS-310 with other devices, confirm that no harms will be caused to the patient, operator, or a third party. Confirm the above also after adding or removing a device to/from the network, or updating or upgrading a device.
- When connecting a computer, use a computer compatible with CISPR32.

6.1.3 To connect cables

The following is the connection method of the power cord, control box cable, and communication cable (optional) connected to this device.

⚠ CAUTION

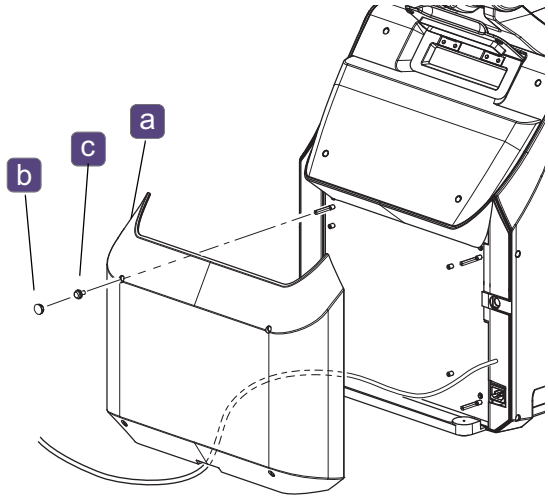
- Before connecting a communication cable, be sure to turn off each device.
  Connecting the cable with the power on may cause malfunction.
- Make sure that the plugs are securely inserted into the ports in the proper orientation. Do not connect them with excessive force.
  Damage to the ports or communication failure may result.

- Equipment connected to the analog or digital interfaces must be certified according to the representative appropriate national standards such as IEC 60601-1. Furthermore, all configurations must comply with the system standard IEC 60601-1. Anyone who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1. If you have any questions, contact NIDEK or your authorized distributor.

1 Turn off power to each device connected to the TS-310.

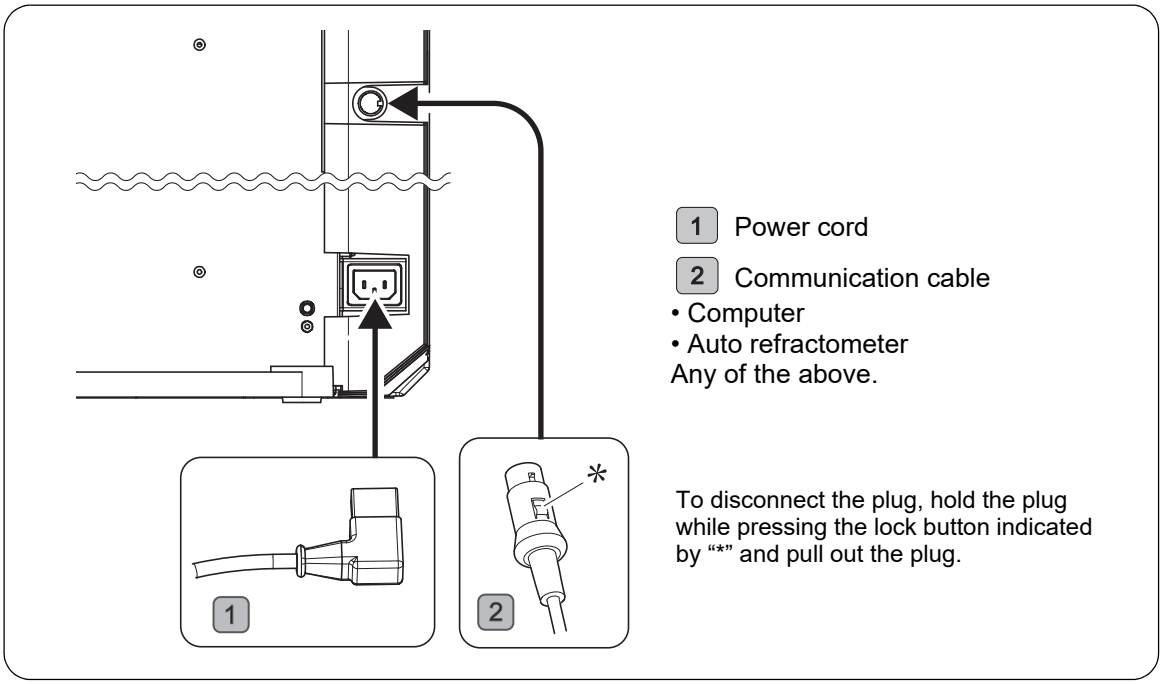
2 Remove the rear cover a.

1) Remove the caps b (n = 4) with a flatblade screwdriver.
2) Unscrew the screws c (n = 4) with a Phillips screwdriver and remove the rear cover.



3 Connect the power cord and communication cable (optional) as shown in the figure below.

Make sure that the plug is inserted into the connector in the proper orientation.



1 Power cord

2 Communication cable
- Computer
- Auto refractometer

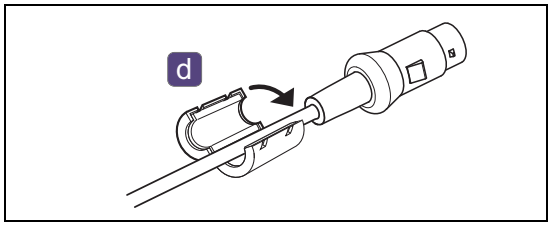
Any of the above.

To disconnect the plug, hold the plug while pressing the lock button indicated by "*" and pull out the plug.

Note

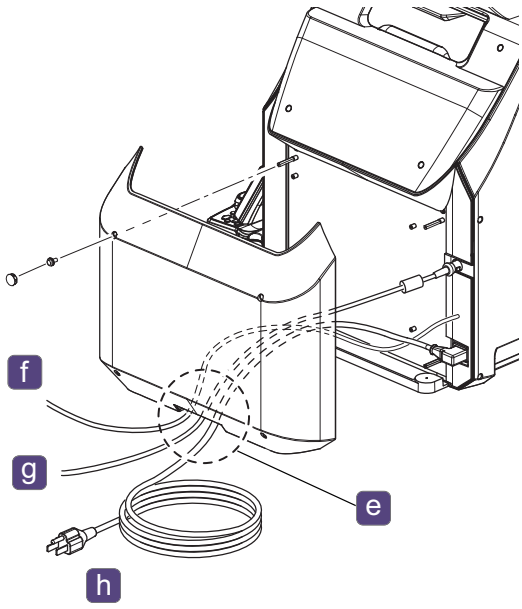
- The communication cable to be used differs depending on the connecting device. For details, contact NIDEK or your authorized distributor.

4 Attach the ferrite core d near the plug of the communication cable.



5 With the power cord passed through the notch e of the rear cover, reattach the rear cover.

6 Connect the cable f to the control box in the correct orientation.



7 Connect the communication cable g to the connector of the target device if necessary.

8 Plug the other end of the power cord h firmly into the power outlet.

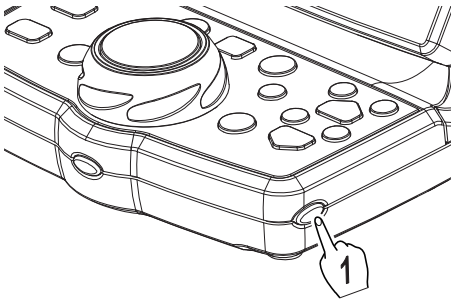
6.2 Setting Parameters (Refractor)

6.2.1 To change parameter settings (refractor)

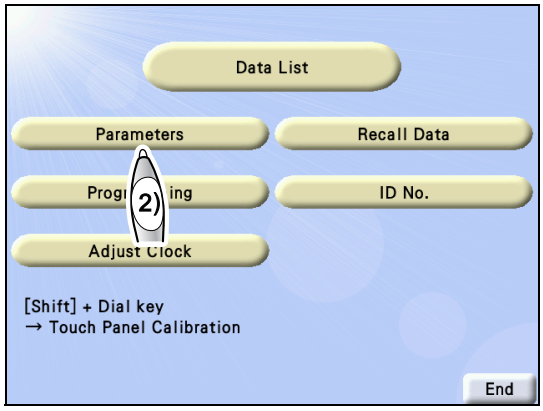
The control box allows the refractor parameters to be changed.

1 Display the Parameters screen.

1) Press (Right side).
The main menu screen is displayed.



2) Press the Parameters button.
The Parameters screen is displayed.

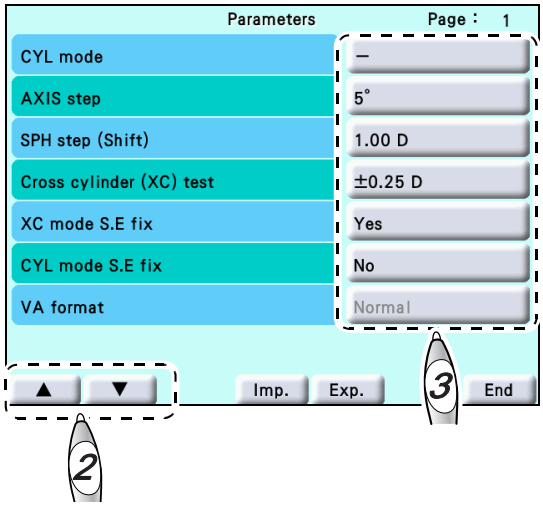


2 With ▲ or ▼, display the page on which the parameter to be changed is displayed.

3 Press the setting field on the right side of the parameter to be changed to change the parameter settings.

4 As necessary, change the parameter settings in the same procedure as in Step 2 to 3.

5 Press End to return to the measurement screen.



Note

- Even if the device is turned off, the parameter settings are retained.
- After changing parameter settings, do not turn off the device before pressing End. Otherwise, parameter settings are not stored.

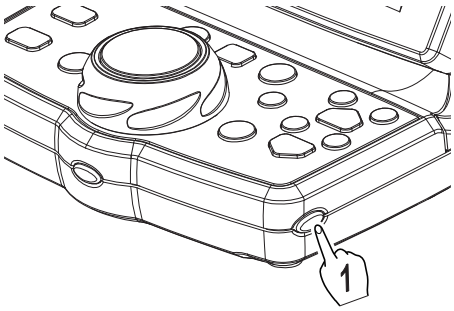
6.2.2 To import or export parameter settings

Import or export parameter settings from/to the CF card.

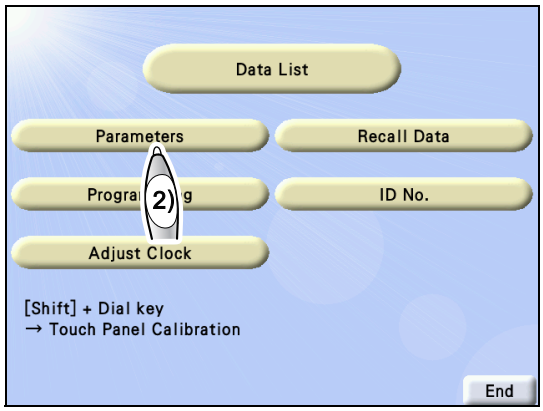
1 Insert the CF card into the control box.

2 Display the Parameters screen.

1) Press (Right side).
The main menu screen is displayed.

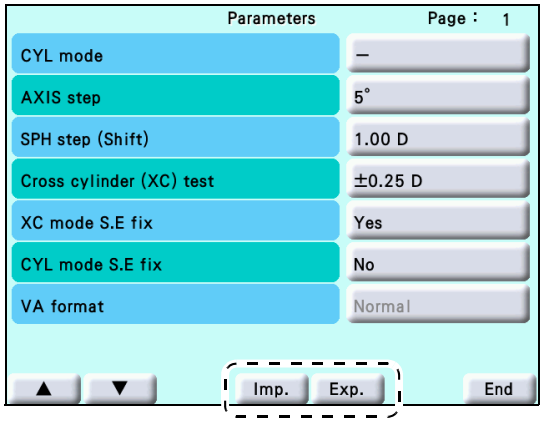


2) Press the Parameters button.



3 Import or export parameter settings.

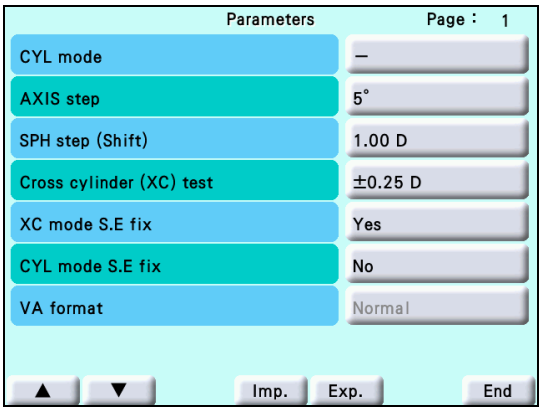
- [Imp.]: Imports the parameter settings written on the CF card. However, if data has never been exported, there is no data to import.
- [Exp.]: Exports the current parameter settings to the CF card.



◆ Parameters and setting options

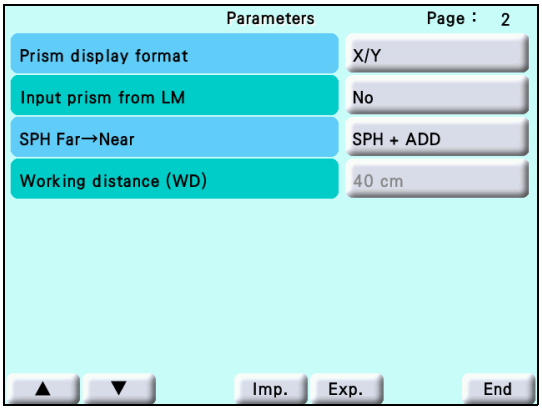
Setting options with brackets [ ] indicate factory settings. If the unit of a numeric value is not specified, it is (mm).

Page 1



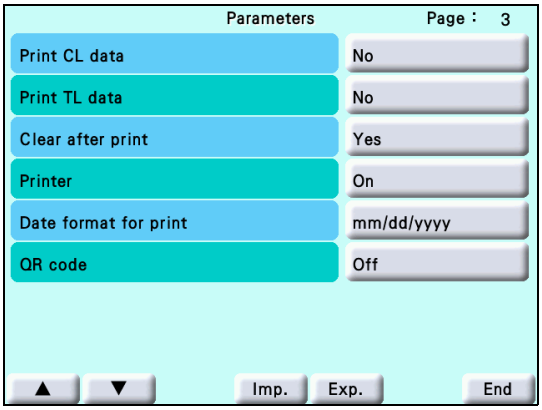
Parameter	Setting options
CYL mode	[-], +
	Cylinder reading sign Selects the cylinder reading sign from plus reading or minus reading.
AXIS step	1°, [5°]
	Selects the increments during axis refinement.
SPH step (Shift)	0.50 - 3.00 D, [1.00 D]
	Selects the increments while holding Shift during sphere refinement.
Cross cylinder (XC) test	[±0.25 D], ±0.25 D/○
	Selects the cross cylinder lens placed in Cross cylinder mode. • ±0.25 D-> ±0.25 D flipped cross cylinder lens • ±0.25 D/○-> Switches between flipped cross cylinder lens and open aperture (cannot be changed in Axis mode).
XC mode S.E fix	[Yes], No
	Selects whether to correct the sphere in order to retain the spherical equivalent value in Cross cylinder mode.
CYL mode S.E fix	Yes, [No]
	Selects whether to correct the sphere in order to retain the spherical equivalent value in normal Cylinder mode.
VA format	[Normal], 5-mark record
	Selects the notation for near or distance vision. * “5-mark record” is a notation of visual acuity value that is mainly used in China.

Page 2



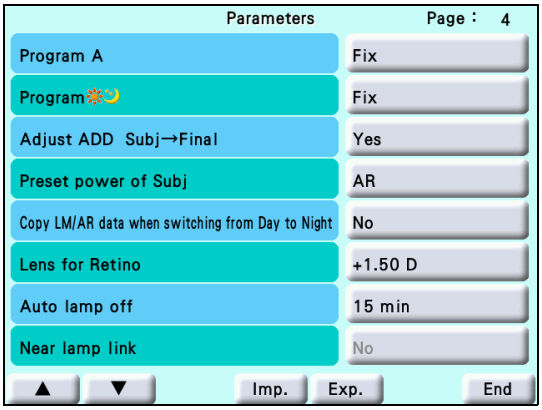
Parameter	Setting options
Prism display format	[X/Y], rθ
	Selects the prism display format. X/Y-> Rectangular coordinates, rθ-> Polar coordinates
Input prism from LM	Yes, [No]
	Selects whether to include prism values when LM data is imported from a lensmeter.
SPH Far→Near	SPH, [SPH+ADD]
	Selects a sphere value when Distance mode is changed to Near mode. • SPH-> The distance sphere value is used as it is as the near sphere value. • SPH+ADD-> The value obtained by adding the addition to the distance sphere value is the near sphere value.
Working distance (WD)	40 cm (fixed)

Page 3



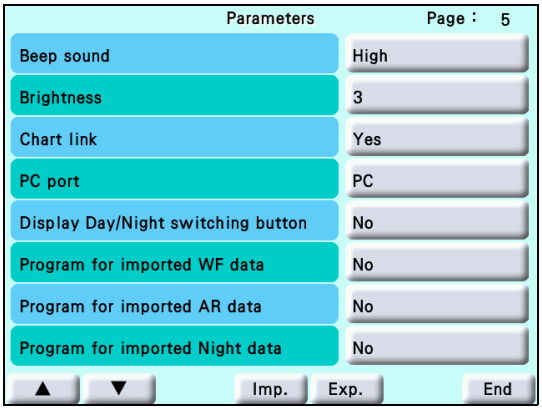
Parameter	Setting options
Print CL data	Yes, [No]
	Selects whether to print the contact lens conversion value of the subjective data together with the others.
Print TL data	Yes, [No]
	Selects whether to print the trial lens data based on the final data. When the device has no final data, the trial lens data is printed based on the subjective data.
Clear after print	[Yes], No
	Selects whether to clear measured data after printing.
Printer	[On], Off
	Selects whether to print the results.
Date format for print	[mm/dd/yyyy], dd/mm/yyyy, yyyy/mm/dd
	Selects the date format to be printed. • mm/dd/yyyy: JUL/20/2017 • dd/mm/yyyy: 20/ 7/2017 • yyyy/mm/dd: 2017. 7.20
QR code	QR 1, QR 2, [Off]
	Selects whether to print QR code as well as selects data to print with QR code. • For QR 1, the subjective data or final data and its QR code are printed. • For QR 2, the QR code of the final data and all data are printed.

Page 4



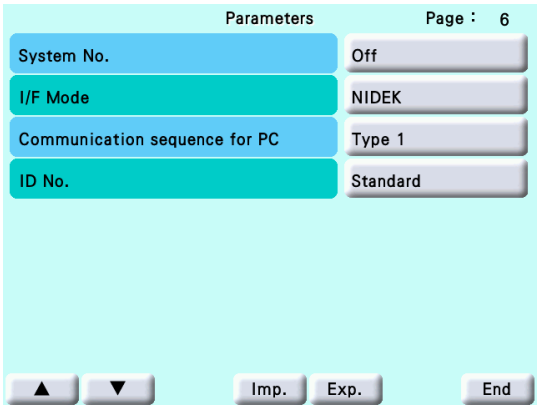
Parameter	Setting options
Program A	[Fix], User
	Selects whether to use the pre-written standard program A or the program edited by the user. To edit the standard program, select “User”. Resetting to “Fix” and clearing data or turning off and on the device returns to the standard program.
Program	[Fix], User
	Selects whether to use the pre-written standard program or the program edited by the user. To edit the standard program, select “User”. Resetting to “Fix” and clearing data or turning off and on the device returns to the standard program.
Adjust ADD Subj→Final	[Yes], No
	Selects whether to automatically set the addition obtained by the difference between S and C values of the subjective data and final data to final data by pressing ADD in Final mode. When the subjective data does not include addition, this setting is disabled.
Preset power of Subj	[AR], LM
	Selects the data to be used initially for subjective refraction when data is entered in both the AR and LM fields. AR values are used for the pupillary distance. If only monocular data is entered, the data is used. Entry using the dial does not function.
Copy LM/AR data when switching from Day to Night	Yes, [No]
	Selects whether to copy the day measurement data to the unentered night LM value and night AR value fields when Day mode is switched to Night mode.
Lens for Retino	[+1.50 D], +2.00 D
	Selects the spherical lens for retinoscope. Distance between the refractor head and retinoscope • +1.50 D: 67 cm • +2.00 D: 50 cm
Auto lamp off	Off, 5 min, [15 min], 30 min
	Selects whether auto light off mode is enabled or disabled and the time setting that the device goes into auto light off mode when the device is idle.
Near lamp link	No (fixed)

Page 5



Parameter	Setting options
Beep sound	[High], Low, Off
	Selects the tone of a buzzer that sounds when a button is pressed.
Brightness	1 - [3]
	Sets the backlight brightness of the control box touch screen. Decreasing the number makes it darker.
Chart link	[Yes], No
	Do not change the setting.
PC port	[PC], Memory BOX, AR, ARK, RKT
	Selects the device connected to the communication connector. To change the setting, turn off and on the TS-310.
Display Day/Night switching button	Yes, [No]
	Selects whether to import day/night data.
Program for imported WF data	A, B, C, , [No]
	Selects a program automatically set when Wave Front data is imported from the Eye Care card.
Program for imported AR data	A, B, C, , [No]
	Selects a program automatically set when AR data is imported from the Eye Care card.
Program for imported Night data	A, B, C, , [No]
	Selects a program automatically set when day data and night data are imported from the Eye Care card and the device is switched to Night mode.

Page 6



Parameter	Setting options
System No.	[Off], 1-10
	Sets the print number to determine which device was used for refraction when multiple units were used. • Off: No number is printed. • 1 to 10: The number is printed at the top of the print result.
I/F Mode	[NIDEK], NIDEK2
	Selects whether to extend the timeout during external communication with devices such as an auto refractometer or ref/keratometer. Select “NIDEK2” in the communication environment where timeout occurs with the factory setting (NIDEK).
Communication sequence for PC	[Type1], Type2
	Selects a communication sequence for communication with a computer. To change the setting, turn off and on the TS-310.
ID No.	[Standard], Expanded
	Selects the number of characters that can be entered for ID number. • Standard: 12 digits • Expanded: 20 digits The output format to a computer varies with this setting. For details, refer to the interface manual.

6.3 Setting Parameters (Chart)

■ The following explains parameter settings related to charts.

6.3.1 To change parameter settings (chart)

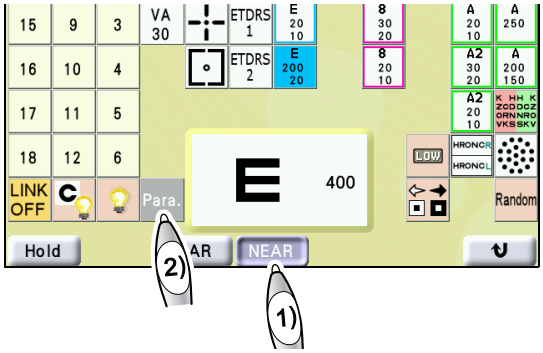
1 Display the Parameter screen.

1) Press NEAR on the chart operation screen.

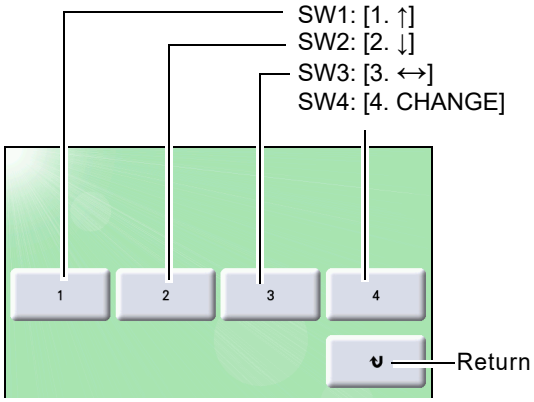
2) Press Para..

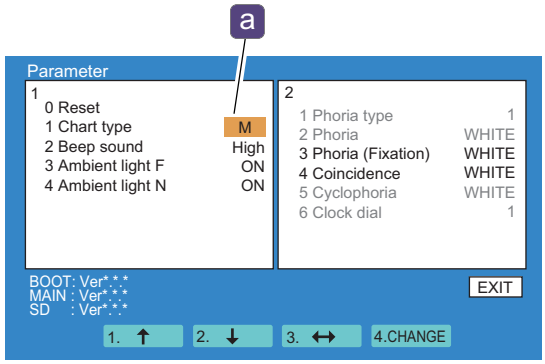
The parameter setting button window appears on the control box touch screen.

The Parameter screen is displayed in the chart window.



2 Press the parameter setting buttons (SW1, SW2, SW3) below to move the cursor a to the parameter to be changed.





Parameter screen

3 Press SW4: [4. CHANGE] to confirm the selection.

4 As necessary, change the other parameter settings in the same procedure as in Steps 2 to 3.

5 Press ↻ to exit from the Parameter screen.

The screen returns to the chart operation screen.

Note

- When the Parameter screen is exited to return to the chart display, the displayed content of the chart and control box may differ. When the next chart is selected, the displayed content matches.

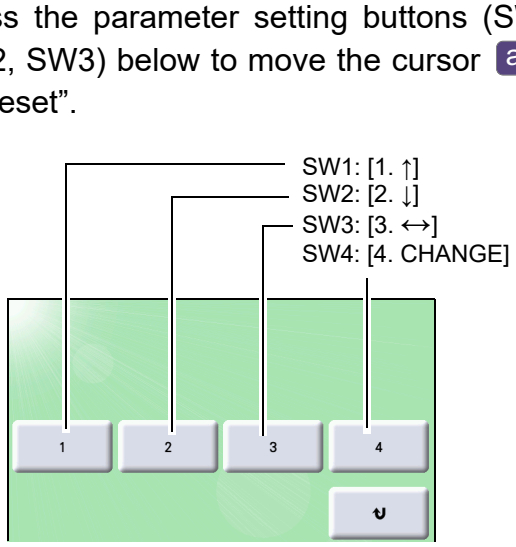
6.3.2 To reset parameter settings to default

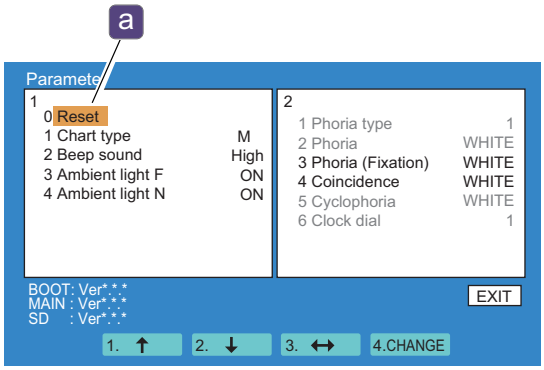
The following explains how to reset the chart type setting to the factory setting.

1 Press Para. on the chart operation screen.

The Parameter screen is displayed.

2 Press the parameter setting buttons (SW1, SW2, SW3) below to move the cursor a to "0 Reset".





3 Press SW4: [4. CHANGE].

4 A message appears. Press SW1: [Yes] to confirm the selection.

The parameter settings are reset to the factory settings.

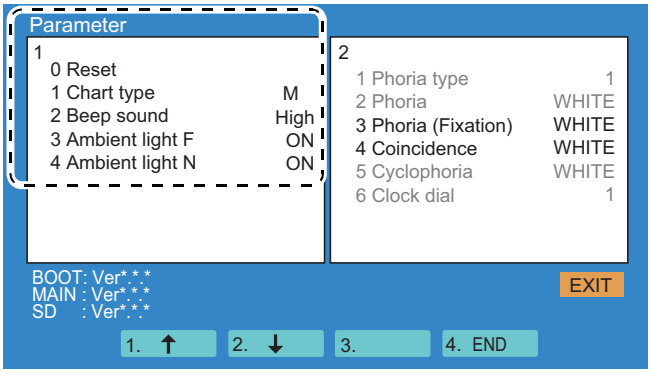
◆ Parameters and setting options

Note

- Depending on the chart type, there are some parameters that are hidden or displayed in gray and cannot be used.
- The setting options for “1 Chart type” and “6 Clock dial” cannot be changed at the same time.
  In this case, exit from the Parameter screen, display the Parameter screen again, and then change the setting of the “6 Clock dial” parameter.

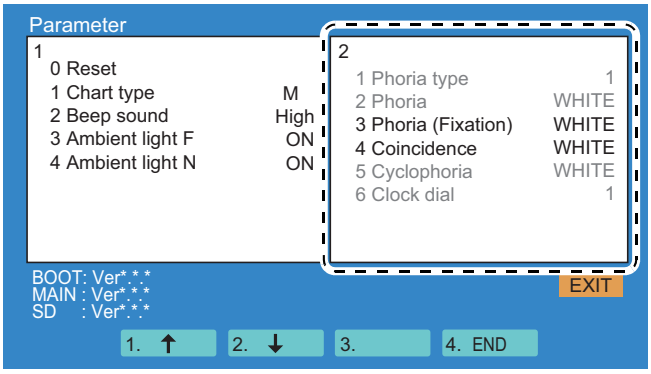
Setting options with brackets [ ] indicate factory settings.

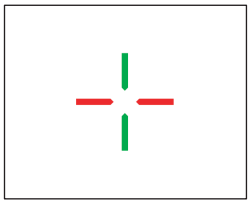
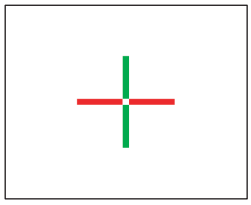
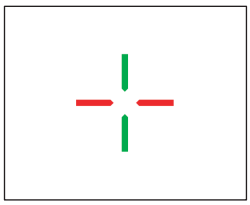
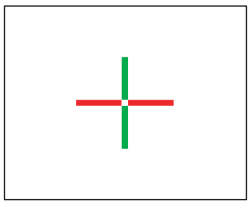
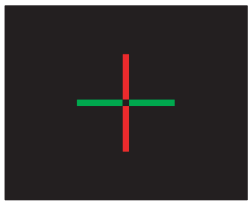
1 (Left column)

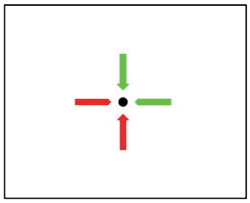
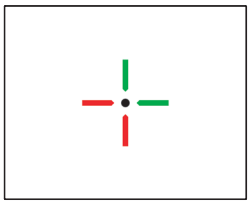
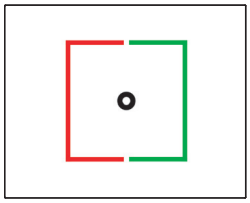
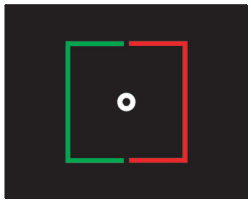
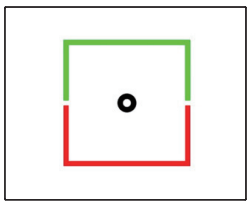


Parameter	Setting options
0 Reset	Resets the chart type setting to the factory setting. *“6.3.2 To reset parameter settings to default” (page 158)*
1 Chart type	A, T, UK, M, P, PhM, C (Factory setting: Not specified)
	Selects a chart type. Select the same chart type as that of the control box.
2 Beep sound	[High], Low, off
	Selects the beep sound when a chart is activated.
3 Ambient light F	[ON], OFF
	Selects between ON and OFF of the surface light emitting panel during distance vision measurement.
4 Ambient light N	[ON], OFF
	Selects between ON and OFF of the surface light emitting panel during near vision measurement.

2 (Right column)



<table>
<tr><th>Parameter</th><th>Setting options</th></tr>
<tr><td rowspan="3">1 Phoria type
(Type T)</td><td colspan="2">[1], 2
Selects a chart type.</td></tr>
<tr><td>Phoria type 1</td><td>Phoria type 2</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td rowspan="6">2 Phoria
(Type T)</td><td colspan="2">[WHITE], BLACK
Selects the background color.</td></tr>
<tr><td colspan="2">Phoria type 1</td></tr>
<tr><td>WHITE</td><td>BLACK</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Phoria type 2</td></tr>
<tr><td>WHITE</td><td>BLACK</td></tr>
<tr><td>  </td><td>  </td></tr>
</table>

<table>
<tr><th>Parameter</th><th colspan="2">Setting options</th></tr>
<tr><td rowspan="6">3 Phoria (Fixation)</td><td colspan="2">[WHITE], BLACK
Selects the background color of the 3 Phoria (Fixation)-1 chart.</td></tr>
<tr><td>WHITE
(Type T)</td><td>BLACK
(Type T)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">[WHITE], BLACK
Selects the background color of the 3 Phoria (Fixation)-2 chart.</td></tr>
<tr><td>WHITE
(Type M/PhM)</td><td>BLACK
(Type M/PhM)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td rowspan="6">4 Coincidence</td><td colspan="2">[WHITE], BLACK
Selects the background color of the 4 Coincidence (vertical phoria) chart.</td></tr>
<tr><td>WHITE
(Type T/M/P)</td><td>BLACK
(Type T/M/P)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">[WHITE], BLACK
Selects the background color of the 4 Coincidence (horizontal phoria) chart.</td></tr>
<tr><td>WHITE
(Type P)</td><td>BLACK
(Type P)</td></tr>
<tr><td>  </td><td>  </td></tr>
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<tr><th>Parameter</th><th colspan="2">Setting options</th></tr>
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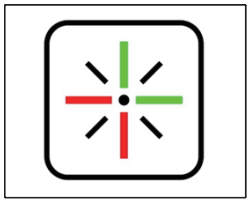
<tr><td>  </td><td>  </td></tr>
<tr><td rowspan="3">5 Mallet
(vertical phoria)
(Type PhM)</td><td colspan="2">[WHITE], BLACK
Selects the background color of the Mallet (vertical phoria) chart.</td></tr>
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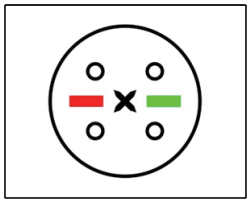
<tr><td>  </td><td>  </td></tr>
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(Type PhM)</td><td colspan="2">[WHITE], BLACK
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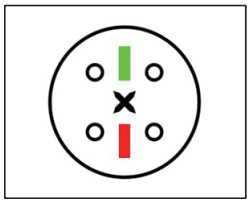
<tr><td>  </td><td>  </td></tr>
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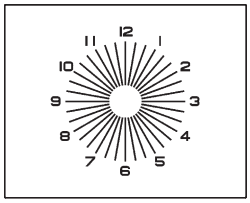
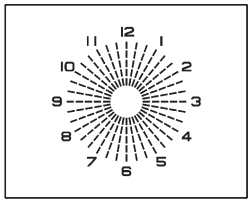
<tr><td>  </td><td>  </td></tr>
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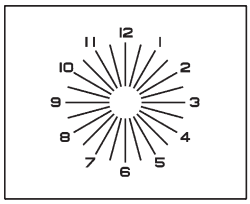
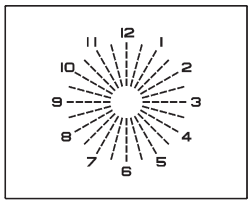
<tr><td>  </td><td>  </td></tr>
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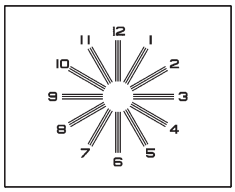
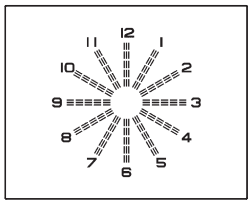
<tr><td>  </td><td>  </td></tr>
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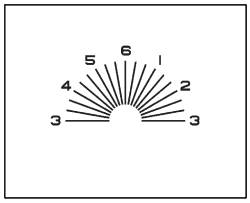
<tr><td>  </td><td></td></tr>
</table>

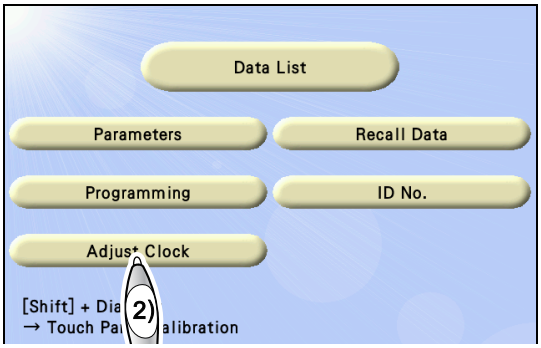
6.4 Setting Date and Time

■ Here is the procedure for setting the date and time of the control box.

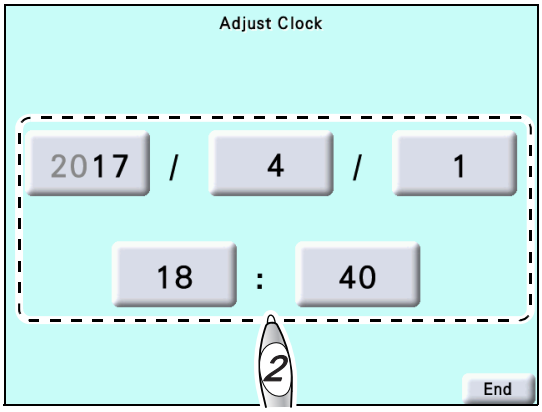
1 Display the Adjust Clock screen.

1) Press (Right side) to display the main menu screen.

2) Press the Adjust Clock button.
The Adjust Clock screen is displayed.

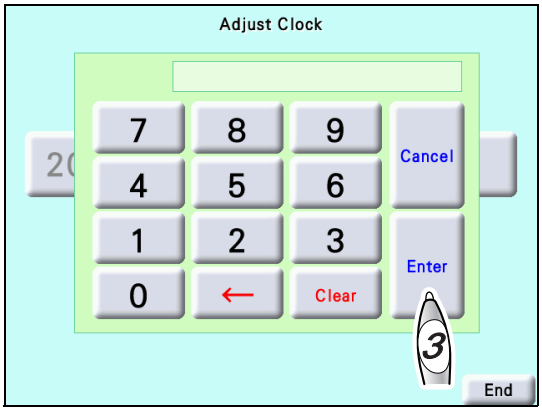


2 Press the item to be changed.
A numeric keypad appears.



3 Enter the desired number using the numeric keypad and press the Enter button.

4 Press End to return to the normal measurement.



Note

- For battery recharging
  This device uses a rechargeable lithium battery for the date and time display function. When the device is operated for the first time after unpacking or when the device has not been operated for a long period of time (about one month), the battery may have become discharged, and the date and time settings may become incorrect. In this case, turn on the device and leave it on to recharge the battery. The battery needs 24 hours for a full charge. If the device is used for 8 hours a day, the device needs to be kept on for three days before the battery is fully recharged. Once the battery is fully recharged, the device operates normally for daily use. (The lithium battery is not user replaceable.)

7 MAINTENANCE

7.1 Troubleshooting

If the device functions improperly, attempt to correct the problem according to the following table before contacting NIDEK or your authorized distributor.

Symptom	Remedy
Even if the power switch is turned on, the device is not activated.	• Make sure that the power plug is connected to a power outlet.
The message “Setup data is initialized.” appears.	• The built-in battery power is low. The message may appear if the device has not been used for an extended period of time. Refraction programs and parameters may return to their initial settings and display language and chart model setting may change. For charging, leave the power on for several hours. If the symptom is not improved, contact NIDEK or your authorized distributor.
The control box touch screen and chart suddenly disappear.	• The device may have gone into auto light off mode. Press any button to recover from light off mode.
No button works.	• Turn off and on the power switch.
Even if Print is pressed, printing does not start.	• Make sure that the printer paper is not upside down. • Replace the printer paper. *“7.5 Replacing Printer Paper” (page 170)* • Make sure that the *“ Printer” (page 153)* parameter is not set to “No”.
The reaction of the touch screen is bad, or it responds at misaligned positions.	• Adjust the detection position of the touch screen. *“7.4 Calibrating the Touch Screen” (page 169)*
Data is not read when an Eye Care card is inserted.	• Reading is not possible when no AR data from devices such as an auto ref/keratometer is present. • Reading is not possible when right or left is not specified by a lensmeter. • The contact of the Eye Care card reader may be dirty. Clean the contact. • If an error occurs when data is being written by an auto refractometer or lensmeter, clean the card reader part.
The vision is blurry for the distance chart or near chart.	• Clean the measuring windows of the refractor head. *“7.7.5 To clean the measuring windows” (page 176)* • Clean the chart window. *“7.7.2 To clean the chart window and pupil position check window” (page 174)* • If the vision does not become clear even after cleaning as described above, internal cleaning is necessary. Contact NIDEK or your authorized distributor.

❖ If the symptom is not corrected by the above actions, contact NIDEK or your authorized distributor.

7.2 Error Messages and Remedies

◆ Error messages and remedies (for refractor)

When an error occurs in the refractor, one of the following messages is displayed on the control box touch screen. Follow the suggestions in the cause and remedy column.

Error message	Cause and remedy
Communication Error CB-MB	• Communication error between the control box and refractor head. • Turn off the device and contact NIDEK or your authorized distributor.
No data !!	• Data to be imported does not exist in the Eye Care card.
Chart doesn't work.	• The chart may have tried to be changed while it was operating.
No print paper.	• If the printer is short of paper, refill paper. *"7.5 Replacing Printer Paper" (page 170)*
Printer cover is open.	• If the printer cover is open, close it securely.
Printer Error.	• The printer is not operating properly. • Turn off the device and contact NIDEK or your authorized distributor.
Setup data is initialized.	• The contents stored in the control box have been erased or changed due to some causes such as battery failure. • Turn off the device and contact NIDEK or your authorized distributor.
Eye Care card -- Read Error !!	• Data in the Eye Care card cannot be read. • Check the orientation of the Eye Care card. • Malfunction of the Eye Care card is probable. Replace the card.
CF card -- Read Error !!	• Refraction programs cannot be imported. • The CF card is not inserted or there is no data in the CF card.
CF card -- Write Error !!	• Refraction programs cannot be exported. • The CF card is not inserted or there is insufficient free space on the CF card.
Error: XX Y	• XX Y indicates the information about the sensor causing the error. Contact NIDEK to request repair.

❖ If the symptom is not corrected by the above actions, contact NIDEK or your authorized distributor. Notify NIDEK of the error message and symptom as well as serial number of your device so that NIDEK can offer appropriate service.

◆ Error messages and remedies (for chart)

When an error occurs in the chart or such, one of the following messages is displayed on the chart window. Follow the suggestions in the cause and remedy column.

Error message	Cause and remedy
SD Card not found	• No SD card is inserted. • Insert the provided SD card again.
Slide List not found	• Image data cannot be read. No image data is in an SD card or the file name may be inappropriate.
ERROR:image surface	• Failure of SVG processing software initialization when an SVG image is displayed
ERROR:data create	• Failure of data creation when an SVG image is displayed
ERROR:parse buffer	• Failure of buffer analysis when an SVG image is displayed
ERROR:data close	• Failure to close the SVG structure after an SVG image is displayed
ERROR:render	• Failure to draw image data (chart) when an SVG image is displayed
ERROR:file open error	• No file necessary for application operation exists on the SD. • Failure to open the file necessary for application operation
ERROR:file name error	• Inappropriate name of file necessary for application operation
ERROR:file size over	• Inaccurate file size when reading
ERROR:Motor initialization failed	• Initialization failure of the stepping motor
Error beeps	• Timeout of the refractor head vertical motion switch • Recovery method Press the refractor head vertical motion button in the opposite direction to the movement at the time of an error and make sure that the arm unit moves normally. Then, press the refractor head vertical motion button in the same direction and make sure that the arm unit moves normally.

❖ If the symptom is not corrected by the above actions, contact NIDEK or your authorized distributor. Notify NIDEK of the error message and symptom as well as serial number of your device so that NIDEK can offer appropriate service.

7.3 Periodical Inspection

Perform periodical inspection of the device once a year according to the following inspection item list.

For details of maintenance and inspection, contact NIDEK. If periodical inspection cannot be performed by the user, request assistance from NIDEK.

⚠ CAUTION

- Only service personnel trained by NIDEK are allowed to disassemble or repair the device.

  NIDEK assumes no responsibility for any adverse events resulting from improper servicing.
- Before maintenance and inspection of this device, properly disinfect the appearance of the device.
- If the AR-measured results differ substantially from subjectively measured results, contact NIDEK or your authorized distributor to ask if calibration of measurement accuracy is necessary.
- With the expected service life as a guide, consider planned replacement of the device.

  If the expected service life of the device is exceeded, even with proper maintenance and inspection, the device reliability or safety may become degraded and fail to achieve the target values.

Inspection items	
Appearance	ID label, labels, stains, scratches, LCD (scratches etc.), cover failures
Safety	Enclosure leakage current, earth leakage current, protective grounding connection, power cord, etc.
Main device	Power switch, pilot lamp, refractor head vertical motion switch, LCD touch screen
Refractor head	VD check adapter, auxiliary lenses, cross cylinder, forehead rest adjustment knob, forehead rest, pupillary distance, face shields, horizontal adjustment, fastening of refractor head
Control box	Pilot lamp, LCD touch screen, mask buttons, dial, dial button, numeric entry buttons, patient's eye selection buttons, shift button, print button, cross cylinder switching buttons, front button, left side button, right side button, Eye Care card reader, CF card
Manuals	Software version, Operator's Manual, Installation Manual
Environment	Installation location, temperature, humidity, voltage, frequency
Other	Performance and measurement If there is a problem other than the above inspection items, take appropriate measures or contact NIDEK.

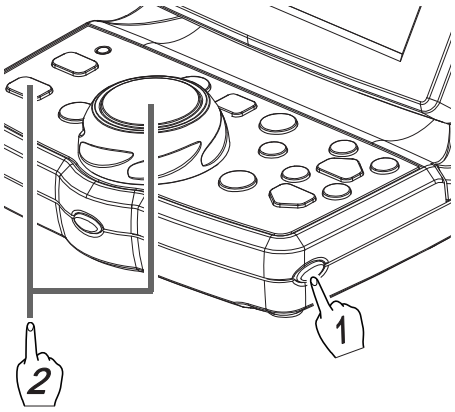
7.4 Calibrating the Touch Screen

■ The following is a calibration procedure when the touch screen detection position is misaligned.

If the reaction of the touch screen is bad or it responds at misaligned positions, the detection position may be misaligned.

1 Press (Right side).

The main menu screen is displayed.

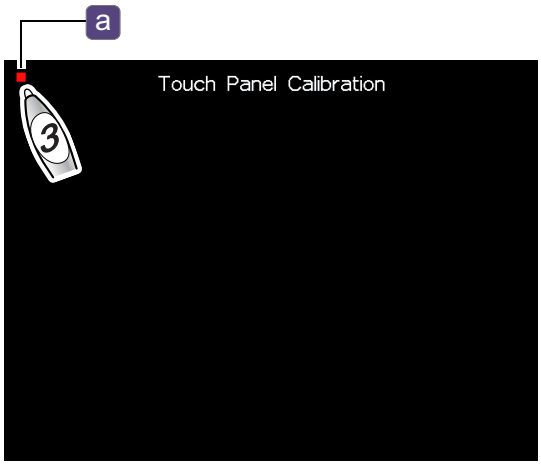


2 Press the dial button while holding Shift.

The Touch Panel Calibration screen is displayed.

3 Press the red square a in the upper left corner.

The red square changes into a blue square.



4 Press the red square in the upper right corner.

The red square changes into a blue square.

5 Press the red square in the lower left corner.

The red square changes into a blue square.

6 Press the red square in the lower right corner.

After all four corners are complete, a message appears and the main menu screen is displayed.

7.5 Replacing Printer Paper

When a red line appears along the edge of the printer paper, it means that the paper is running short. When this occurs, stop using the printer and replace the printer paper with a new roll.

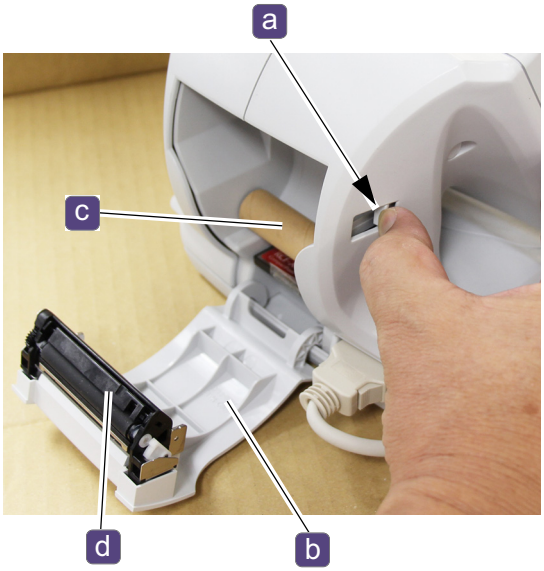
⚠ CAUTION

- Do not attempt to print without printer paper loaded.
- When replacing the printer paper, do not touch the printer head on the printer cover d.
  Because the printer head immediately after printing is hot, burns may result.
- Be sure to use only the printer paper (part number: 8062000001) specified by NIDEK.
  If printer paper other than those specified is used, the printer head may be damaged due to printing failure or paper jam.

1 Open the printer cover of the control box.

Slide the printer cover lever a on the side to open the printer cover b.

2 Remove the used printer paper roll c.



3 Install a new printer paper roll in the same orientation as shown to the right.

- If the roll is loaded with the paper upside down, printing is not possible.
- Make sure that there is no slack in the printer paper. Printing failure may result.
- Make sure that printer paper is not loaded in a tilted angle and that the core of the roll is properly placed.
  Printer paper may not be fed properly.
- Do not use strong force to pull the printer paper threaded through the printer.

4 Close the printer cover so that a short length of printer paper extends from the cover.

5 Press the printer cover on both sides to close the cover securely.

Note

- Make sure that the cover is securely closed.
  If the cover is insecurely closed, the auto cutter may not operate properly.
  In addition, when Print is pressed, an error may appear and printing will not occur.

7.6 Inserting CF Card

When exporting programs or parameter settings or importing saved settings to/from the CF card (optional), insert the CF card in the control box beforehand.

Note

- CF cards formatted to FAT or FAT32 can be used.

1. Turn off the power switch.
2. Open the printer cover and remove the printer paper roll.

   "7.5 Replacing Printer Paper" (page 170)
3. Insert the CF card a into the slot.

   To remove the CF card, pull it out.
4. Reload the printer paper.

7.7 Cleaning

■ This section explains how to clean the main device, chart window, pupil position check window, forehead rest, face shields, measuring windows, printer, and Eye Care slot.

7.7.1 To clean the main device

⚠ CAUTION

- Do not use organic solvents such as paint thinner or alcohol to clean the main device.
- Do not use a sponge or cloth soaked in water.

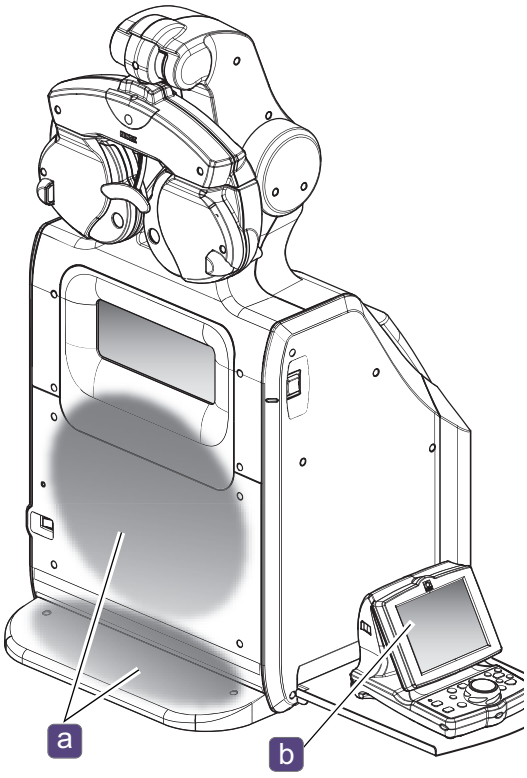
1 Press the up arrow of the refractor head vertical motion switch to raise the refractor head all the way to the top, then turn off the power switch.

2 Wipe the main device with a soft cloth.

For severe stains, soak the cloth in a neutral detergent, wring well, and wipe. Finally dry with a soft, dry cloth.

3 Wipe the front cover part a frequently, because it is easily soiled by the examination response.

4 Lightly wipe the control box touch screen b with a soft cloth.



7.7.2 To clean the chart window and pupil position check window

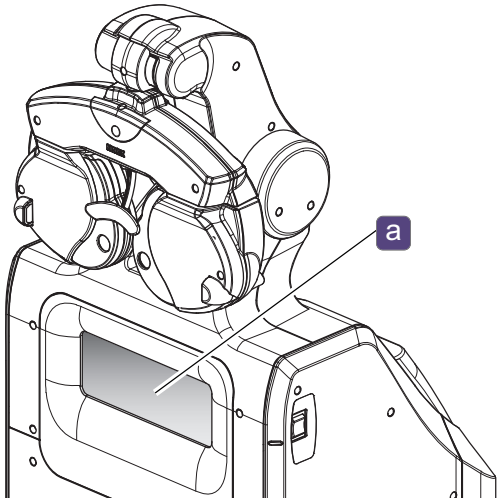
- Accurate visual acuity measurement cannot be performed if the chart window or pupil position check window is dirty. Be sure to check the windows before refraction. Clean them if necessary.
- Before cleaning the chart window or pupil position check window, remove any dust on the window with a blower brush.
- Do not clean using a cloth moistened with detergent or such.
  Wiping marks may be left or the surface coating may be damaged.

◆ Chart window

1 Press the up arrow of the refractor head vertical motion switch to raise the refractor head all the way to the top, then turn off the power switch.

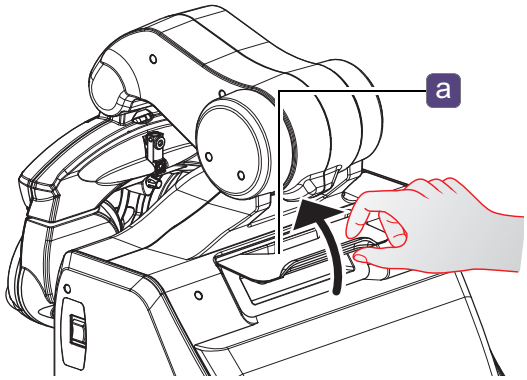
2 Blow off the dust on the chart window a with a blower.

3 Lightly wipe off the dirt with a dry, soft cloth.



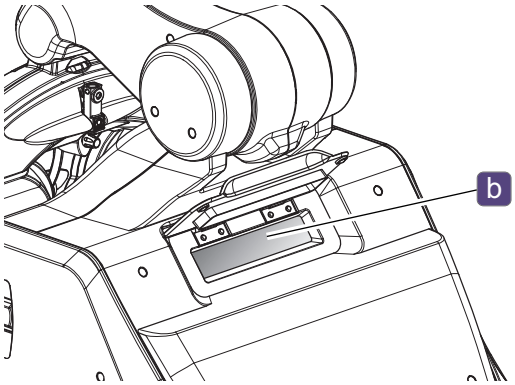
◆ Pupil position check window

1 Lift open the cover a of the pupil position check window by hand.



2 Blow off the dust on the pupil position check window b with a blower.

3 Lightly wipe off the dirt with a dry, soft cloth.



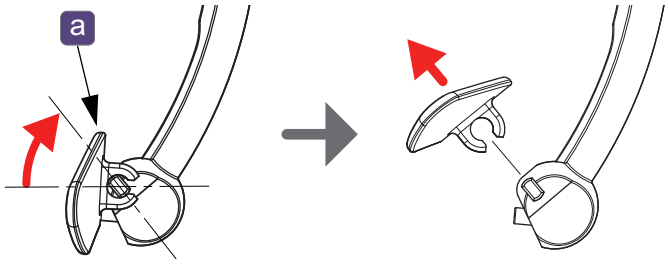
7.7.3 To clean the forehead rest

⚠ CAUTION

- Clean the forehead rest using a cloth dampened with rubbing alcohol before refraction.

1 Remove the forehead rest a.

1) Tilt the forehead rest upward.
2) Pull the forehead rest at an angle to remove it.



2 For severe stains, dampen the cloth with a neutral detergent, wring well, and wipe. Finally dry with a soft, dry cloth.

3 Clean the forehead rest using a cloth dampened with rubbing alcohol before refraction.

4 Press the forehead rest at an angle from above to reattach it.

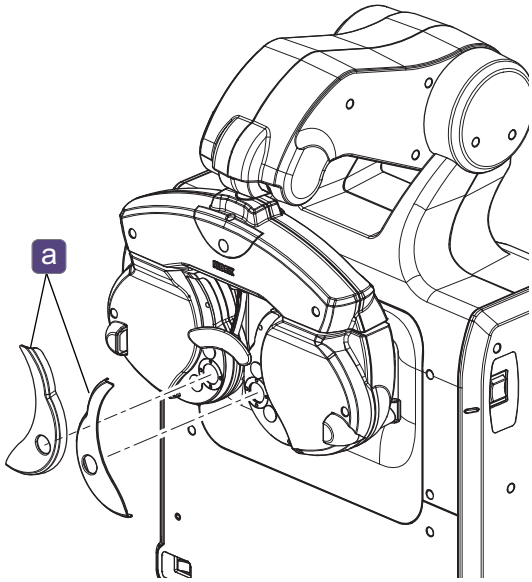
7.7.4 To clean the face shields

⚠ CAUTION

- Clean the face shields using a cloth dampened with rubbing alcohol before refraction.
- Do not wipe the inside of the face shield with neutral detergent.
  If the inside is moistened, it may rust.

1 Remove the two face shields a.

The face shields are magnetically held to the refractor head.



2 For severe stains, dampen the cloth with a neutral detergent, wring well, and wipe. Finally dry with a soft, dry cloth.

3 Clean the face shields using a cloth dampened with rubbing alcohol before refraction.

4 Reattach the face shields.

7.7.5 To clean the measuring windows

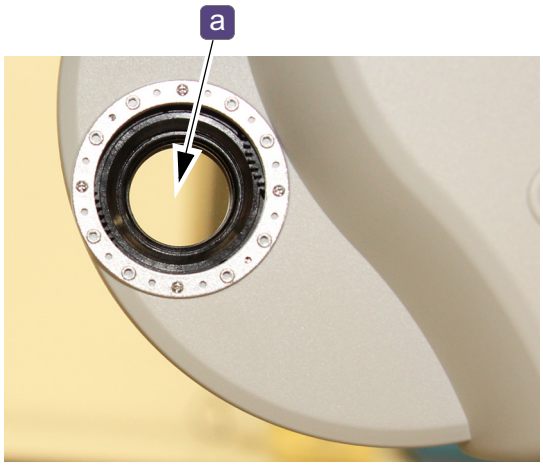
⚠ CAUTION

- Before cleaning the measuring windows, remove any dust on the window with a blower brush.
  Wiping the window with dust on may scratch the glass of the measuring window.
- If the measuring window is dirty with fingerprints, eyelash oil, or dust, accurate visual acuity measurement cannot be performed. Be sure to check the measuring windows before refraction. Clean them if necessary.
- Clean the measuring windows on the patient side using a cloth dampened with rubbing alcohol before refraction.
- Do not clean using a cloth moistened with detergent or such.
  Wiping marks may be left or the surface coating may be damaged.

1 Blow off the dust on the measuring windows with a blower.

2 For severe stains, lightly wipe with a soft cloth that does not scratch the protective glass a.

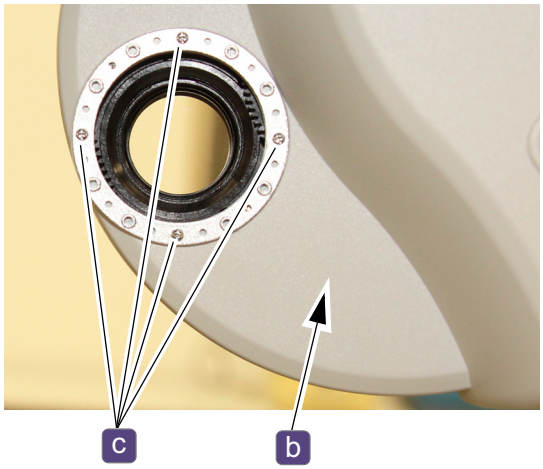
3 Clean the measuring windows on the patient side using a cloth dampened with rubbing alcohol before refraction.



- When the inside of the measuring window becomes dirty

  If the inside of the measuring window becomes dirty due to condensation or such, remove the protective glass on the patient side and wipe the inside.

  1) Remove the face shield b before removing the protective glass.
  2) Unscrew the set screws c (n = 4) with a Phillips precision screwdriver and remove the protective glass.
  3) Reattach the protective glass after cleaning and fasten it with the set screws removed earlier.



- Reattach the protective glass immediately after cleaning.
  Leaving it removed may allow dust to enter.

7.7.6 To clean the printer

1 Open the printer cover and remove the printer paper roll.

"7.5 Replacing Printer Paper" (page 170)

2 Apply the nozzle of a vacuum cleaner to the auto cutter a to remove paper residue.

Do not blow off paper residue with a blower. If paper residue settles on the internal working structure, malfunction may result.

3 Reload the printer paper.

7.7.7 To clean the Eye Care card slot

- Before cleaning the Eye Care card slot, be sure to turn off the device.
  Cleaning while power is on may cause malfunction.

Dirt may adhere to the contact area of the Eye Care card slot.

When using the Eye Care card for data communication between devices, clean the Eye Care card slot using a contact cleaner (optional).

If necessary, wipe the contact surfaces of the Eye Care card with a soft cloth.

Note

- For details on how to use the contact cleaner, refer to the instructions for use included with the contact cleaner.
- The contact surfaces of the Eye Care card slot is on the bottom. Cleaning is possible by inserting and removing the card several times with the wiper face (face with woven fabric) of the contact cleaner facing downward.

7.8 Consumable List

Part name	Part number
Printer paper	8062000001
Contact cleaner (optional)	34086-7110

8 SPECIFICATIONS AND TECHNICAL INFORMATION

8.1 Specifications

Chart		
Chart (For distance/near)	• Chart presentation method	• For distance: The chart displayed on the LCD appears to be presented 5 m in front of the patient via a concave mirror. • For near: The chart displayed on the LCD appears to be presented 40 cm in front of the patient by reflection via a flat mirror.
	• Measurement distance	• For distance: 5 m • For near: 40 cm (The viewing angle is in the horizontal direction appearing to be at 5 m.)
	• Chart details	See *"8.2 Chart List" (page 183)*.
	• Chart accuracy	• For Landolt rings, the visual acuity values 0.04 up to 1.6 are within ±5% of the standard value whereas the visual acuity values greater than 1.6 to 2.0 are within ±10% of the standard value.
	• Chart background brightness	• Standard setting is 80-320 cd/m^2 when a standard chart is presented • 10 cd/m^2 during night measurement (central brightness)
	• Unevenness of chart background brightness	Less than 30%
	• Correlated color temperature of chart background (for distance)	6500 K
	• Chart contrast	The contrast (C) between the standard chart black character (Bb) and the white background (Bw) is 74% or greater.

Other functions	• Contrast function	The contrast change function is available for visual acuity charts including ETDRS among 100% (normal), 25%, 12.5%, and 6%.
	• Black and white inversion	The black and white inversion function is available for visual acuity charts including ETDRS.
	• Random display function	Three types of random presentation are possible in addition to normal chart presentation when a horizontal line is displayed.
	• Central presentation function	A vertical line, horizontal line, or single letter is presented in the center of the screen.
	• Slide function	Display of images written to SD memory card
	• Visual acuity notation	Decimal, fraction (20 feet), fraction (6 m)
	• Night function	Chart presentation at background brightness of 10 cd/m^2 (central brightness)
	• Switching of presenting chart	The control box allows charts to be changed. When the chart is switched with the control box between the distance chart and near chart, the position of the LCD is automatically switched between distance and near.
	• Adjustment for chart presentation height	Vertical movement of the table by pressing the up/down switch, or of the chair on which the patient sits
	• Refractor head vertical motion mechanism	Holds the refractor head, raises and lowers the refractor head in front of the patient, and has a self-locking function to prevent falling.
	• Forehead rest	Easily detachable for replacement Forehead rest adjustment range: 12 mm or more
Communication	Communication method	• Communication with AR/ARK/RKT/LM series, computer, or such using a dedicated cable • Communication with AR/ARK/RKT/LM series using an Eye Care card *"6.1.1 To connect peripheral devices (Example 1)" (page 145)* *"6.1.2 To connect peripheral devices (Example 2)" (page 146)*

Refractor head	
Sphere	-19.00 to +16.75 D (0.25 D / 0.5 to 3 D increments)
Cylinder	0.00 to ±6.00 D (0.25 D / 1 D increments)
Axis	0 to 180° (1°/5° increments)
Pupillary distance	48 to 80 mm 54 to 80 mm (100% convergence possible PD)
Prism	0 to 20Δ (0.1Δ/0.5Δ/2Δ increments)

Dimensions and mass		
Dimensions	The refractor head vertical motion unit is at the bottom.	446 (W) × 519 (D) × 763 (H) mm * Control box excluded.
	The refractor head vertical motion unit is at the top.	446 (W) × 487 (D) × 907 (H) mm * Control box excluded.
Mass	32 kg ±10% (refractor head and control box included)	
Power supply specifications		
Voltage	100 to 240 V AC * The voltage fluctuation does not exceed ±10% of the nominal voltage.	
Frequency	50/60 Hz	
Power consumption	Max. 130 VA	
Environmental conditions (during use)		
Installation location	Interior (Make sure that no interference light such as direct sunlight or spot light shines on the chart window front. No harmful dust or smoke.)	
Temperature	5 to 40°C (41 to 104°F)	
Humidity	30 to 90% (non-condensing)	
Atmospheric pressure	800 to 1,060 hPa	
Environmental conditions (during storage, unpacked condition)		
Temperature	-10 to 55°C (14 to 131°F) (during storage)	
Humidity	10 to 95% (non-condensing)	
Atmospheric pressure	700 to 1,060 hPa (during storage)	
Environmental conditions (during transport, packed condition)		
Temperature	-30 to 60°C (-22 to 140°F) (during transport)	
Humidity	10 to 95% (non-condensing)	
Atmospheric pressure	500 to 1,060 hPa (during transport)	
Other		
Expected service life (defined by manufacturer)	8 years from the date of initial operation * Proper maintenance is necessary.	
Unit per package	1 unit	
Classifications		
Protection against electric shock	Class I ME equipment	
Protection against electric shock (applied parts)	Type B applied part	

Protection against harmful ingress of water or particulate matter	IPX0
Suitability for use in an oxygen rich environment	The device is not intended for use in an oxygen rich environment.
Method(s) of sterilization	The device does not have any part to be sterilized.
Mode of operation	Continuous operating device

Accessories	
Standard accessories	Forehead rest, face shields, VD check adapter, touch screen pen, printer paper (3 rolls), dust cover, power cord, cover plate, cap, screw, hexagonal wrench, Phillips screwdriver, operator's manual
Optional accessories	• Eye Care card (5 sheets per set) • Communication cable (1.5, 5, 10, 15 m for connection with an auto refractometer) • Communication cable (5, 10, 15 m for connection with a computer) • Control box tray • Memory box (only for where it is available)

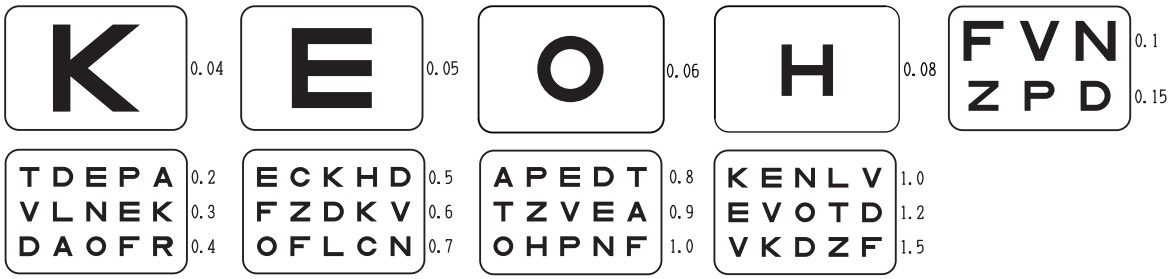
8.2 Chart List

The visual acuity values next to a chart are not presented to the patient.

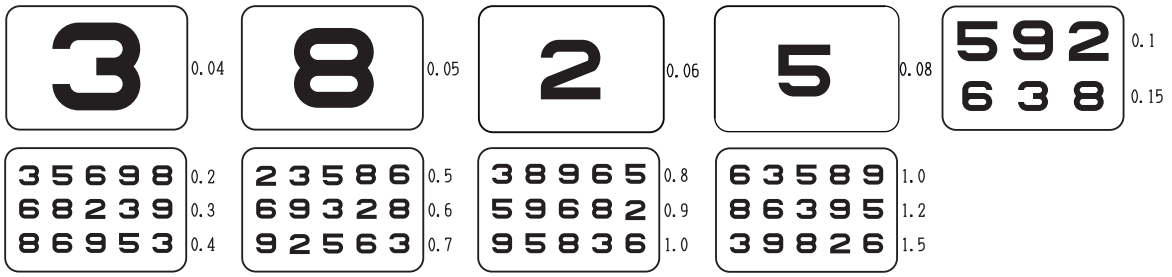
◆ Chart list - Type T

- Distance and near visual acuity charts

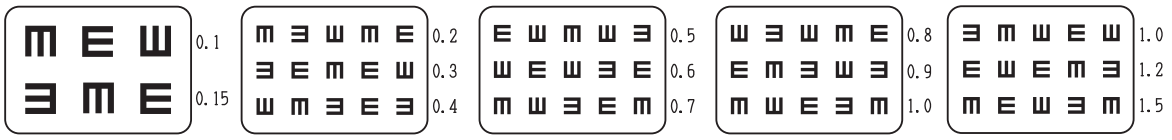
Letters



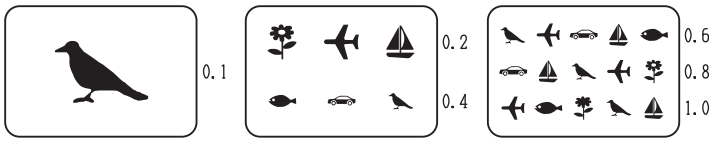
Numbers



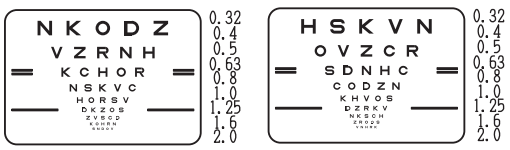
Tumbling E



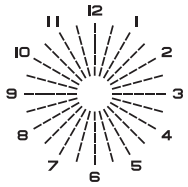
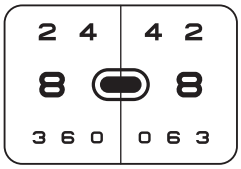
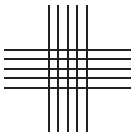
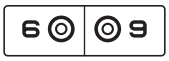
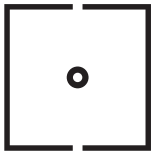
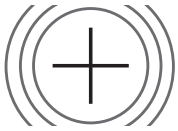
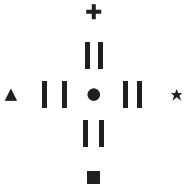
Children



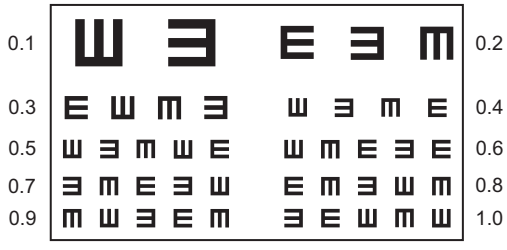
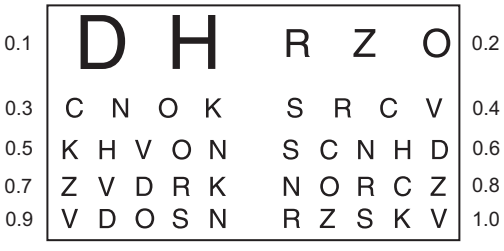
ETDRS style letters

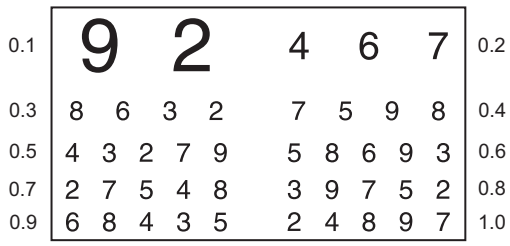
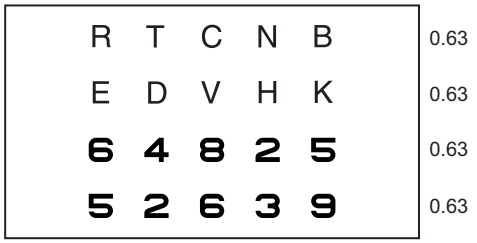
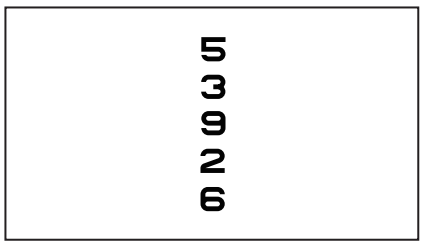
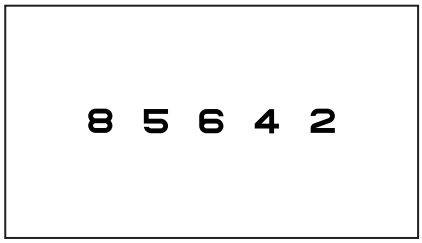
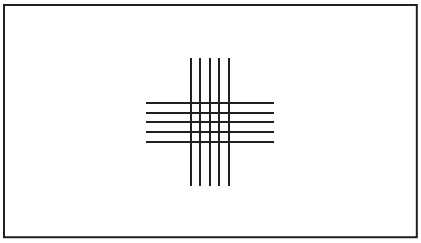


- Distance and near special charts

Astigmatism clock dial	Dots	Red-green	Cross grid
			
Binocular balance	**Duochrome balance**	**Phoria**	**Phoria with fixation point**
			
Vertical coincidence	**Schober**	**Stereo**	**Worth four dot**
			
Fixation point			
			

- Near visual acuity charts

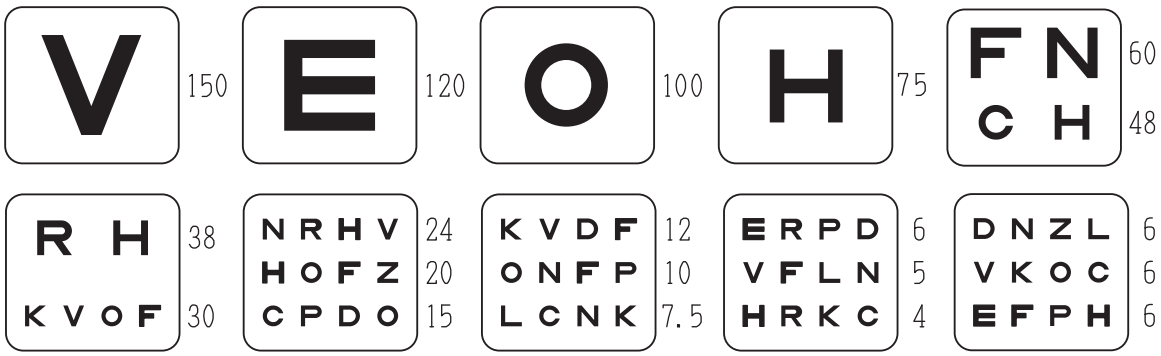
Tumbling E	Letters
	

Numbers	Letters and Numbers
	
Binocular balance	Binocular balance
	
Cross grid	
	

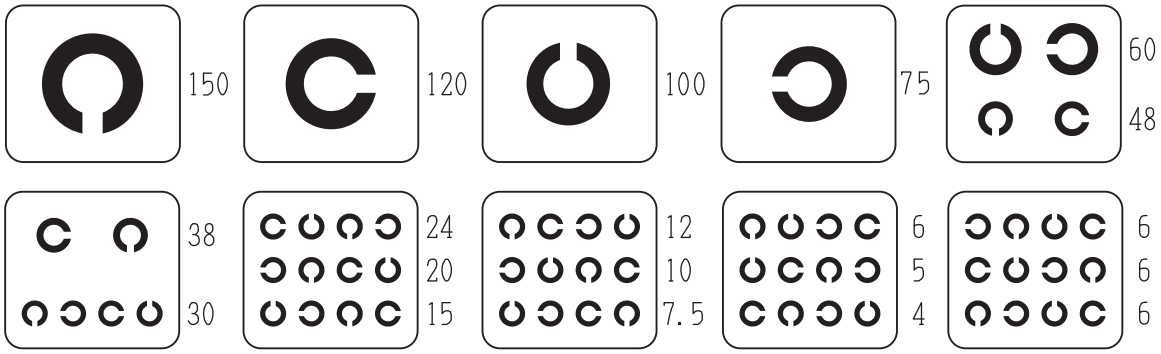
◆ Chart list - Type UK

- Distance and near visual acuity charts

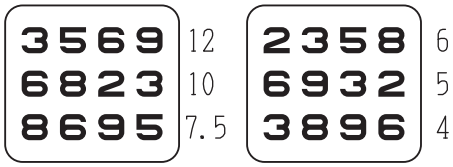
Letters



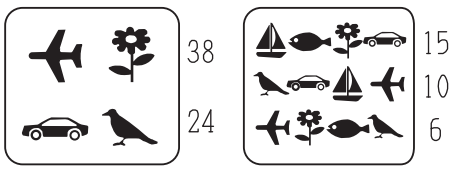
Landolt ring



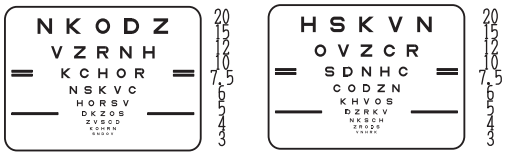
Numbers



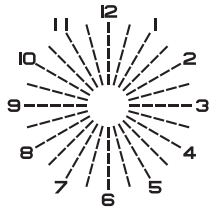
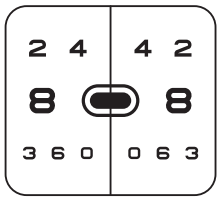
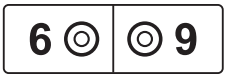
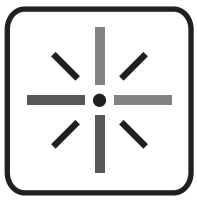
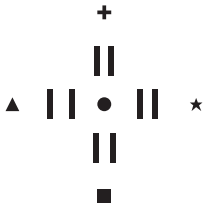
Children



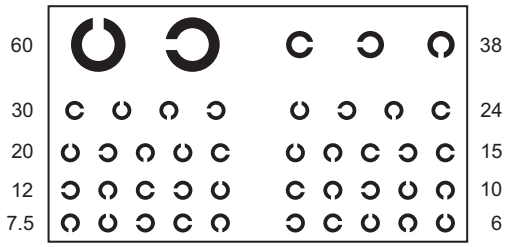
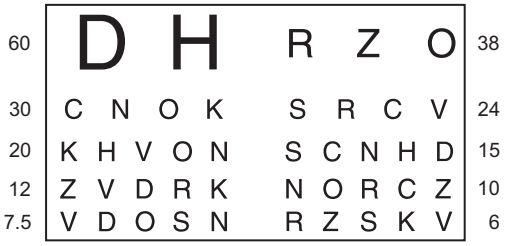
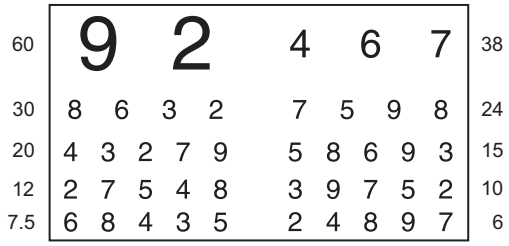
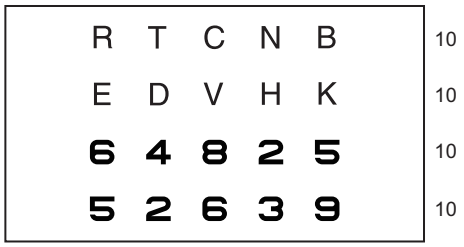
ETDRS style letters

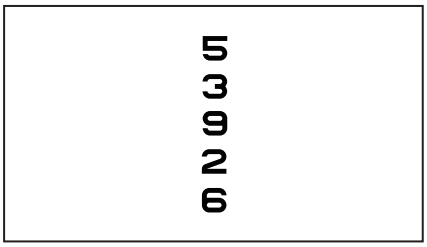
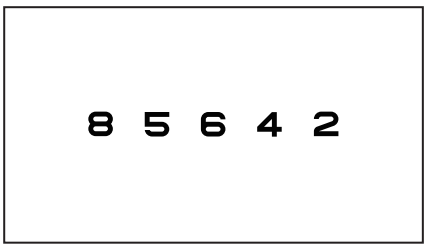
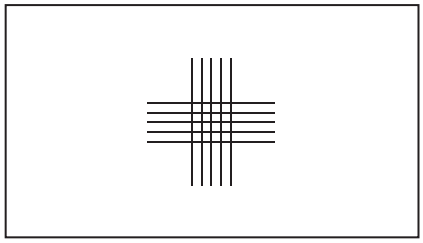


● Distance and near special charts

Astigmatism clock dial	Dots	Red-green	Binocular balance
			
Duochrome balance	**Muscle**	**Stereo**	**Worth four dot**
			
Fixation point			
			

● Near visual acuity charts

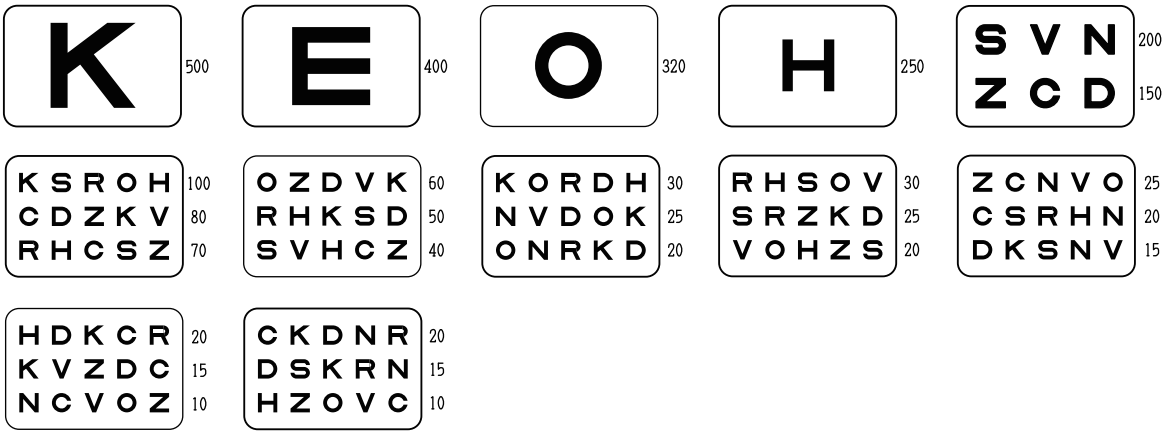
Landolt ring	Letters
	
Numbers	**Letters and Numbers**
	

Binocular balance	Binocular balance
 10	 10
Cross grid	
	

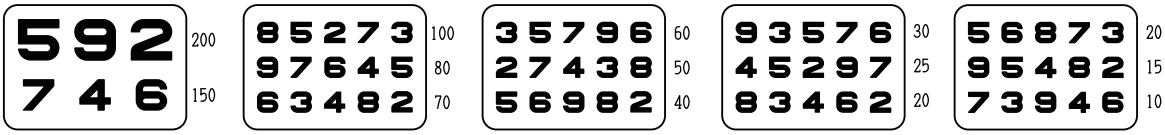
◆ Chart list - Type M

- Distance and near visual acuity charts

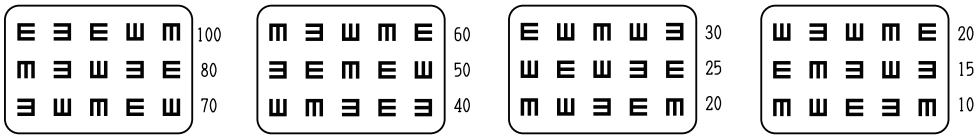
Letters



Numbers

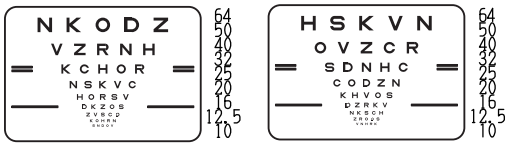


Tumbling E

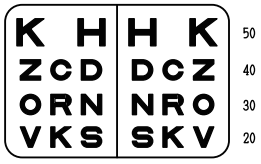
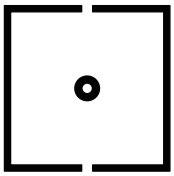
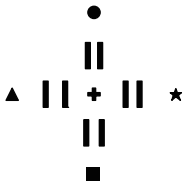
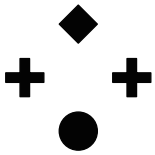


Children

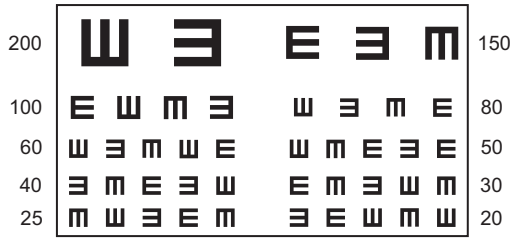
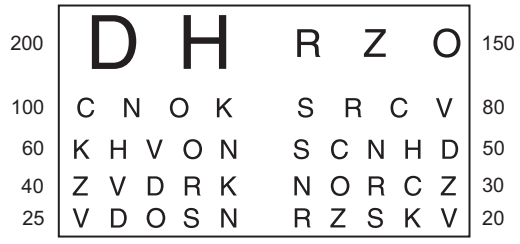
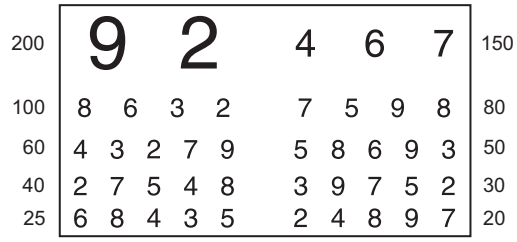
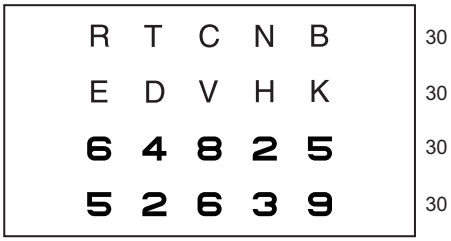
ETDRS style letters

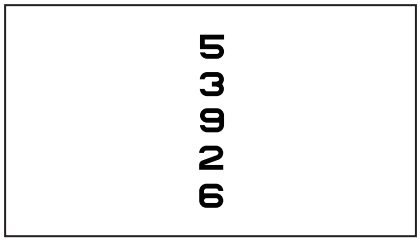
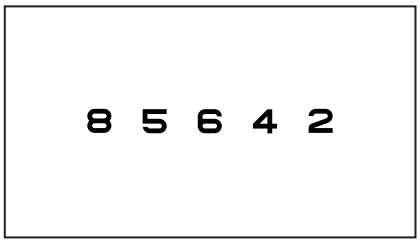
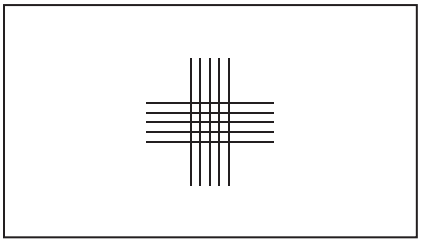


- Distance and near special charts

Dots	Red-green	Binocular balance	Phoria with fixation point
			
Vertical line	**Horizontal Line**	**Vertical coincidence**	**Stereo**
			
Worth four dot	**Fixation point**		
			

- Near visual acuity charts

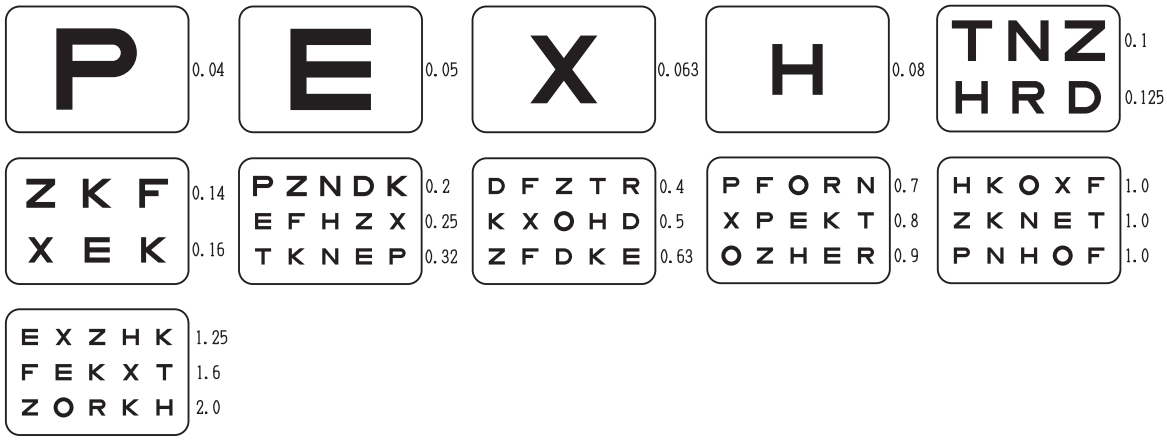
Tumbling E	Letters
	
Numbers	**Letters and Numbers**
	

Binocular balance	Binocular balance
 30	 30
Cross grid	
	

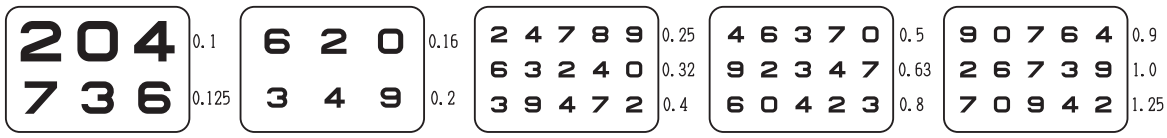
◆ Chart list - Type P

- Distance and near visual acuity charts

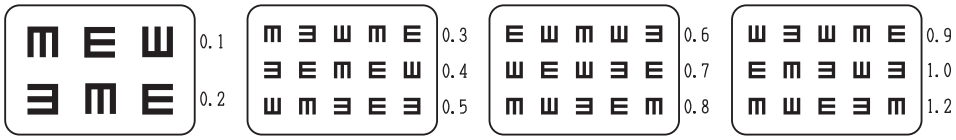
Letters



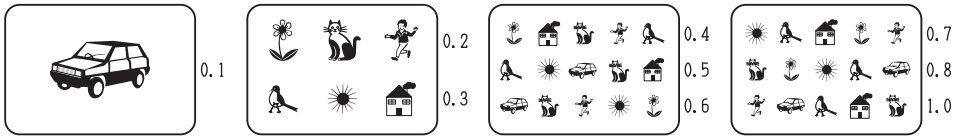
Numbers



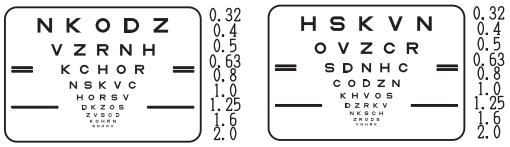
Tumbling E



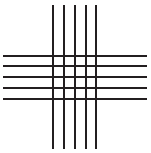
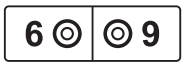
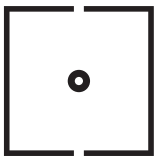
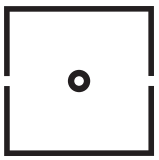
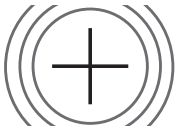
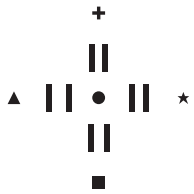
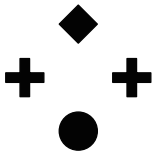
Children



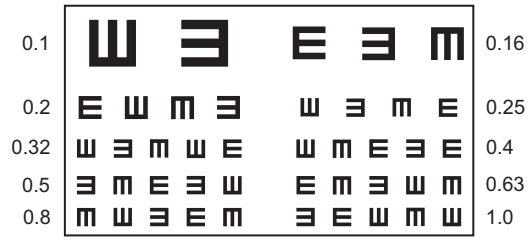
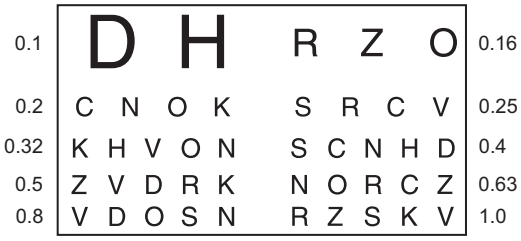
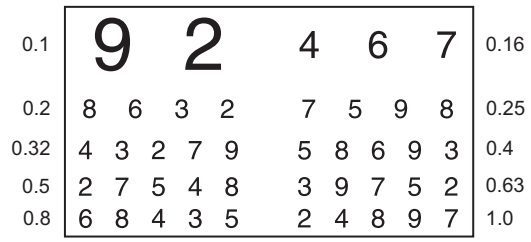
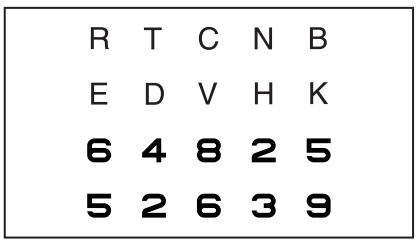
ETDRS style letters

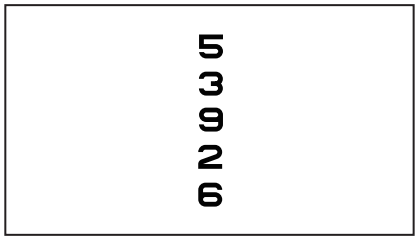
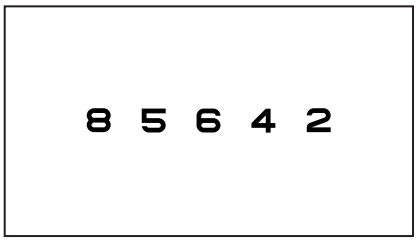
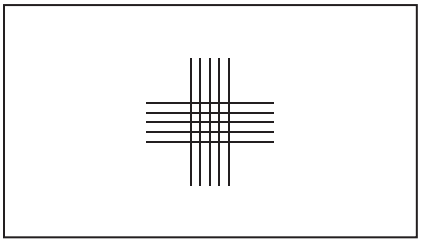


● Distance and near special charts

Dots	Cross grid	Binocular balance	Duochrome balance
			
Vertical coincidence	**Horizontal coincidence**	**Schober**	**Stereo**
			
Worth four dot	**Fixation point**		
			

● Near visual acuity charts

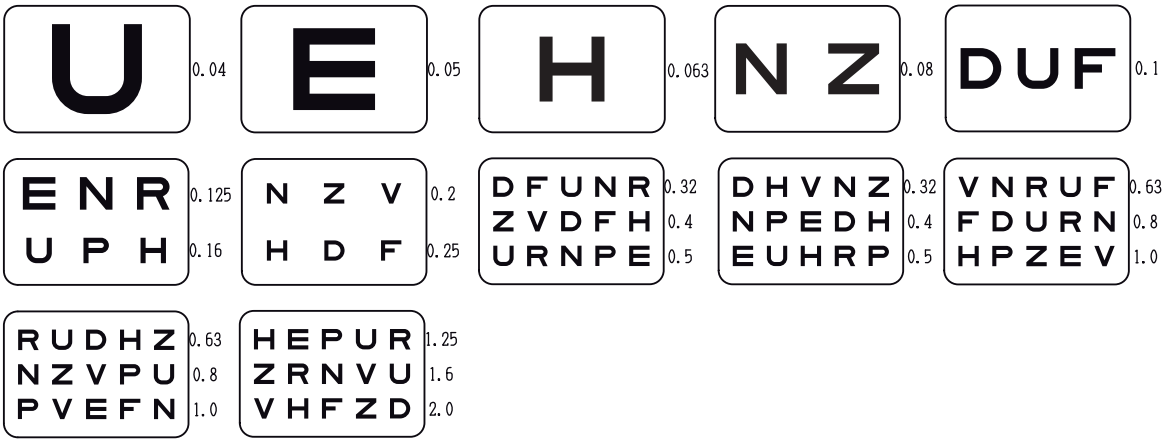
Tumbling E	Letters
	
Numbers	**Letters and Numbers**
	

Binocular balance	Binocular balance
 0.63	 0.63
Cross grid	
	

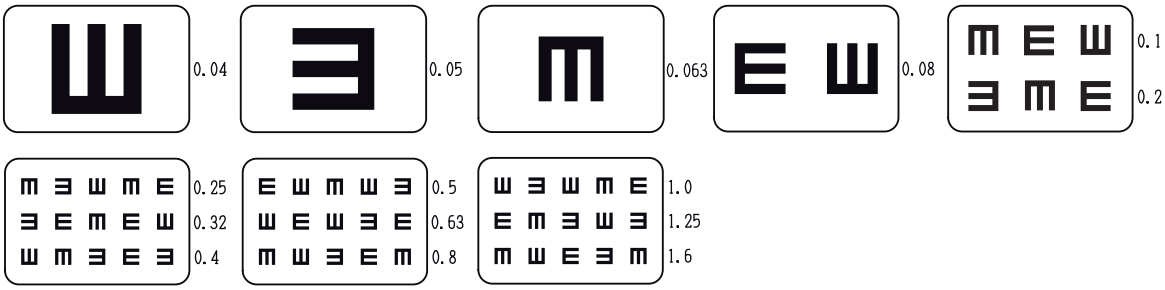
◆ Chart list - Type PhM

- Distance and near visual acuity charts

Letters

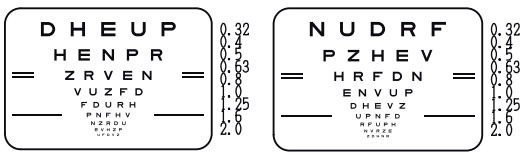


Tumbling E

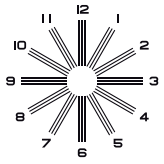
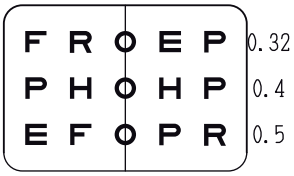
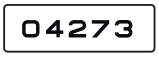
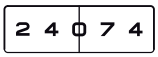
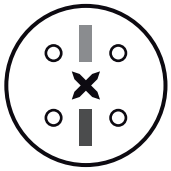
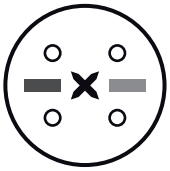
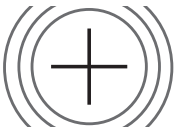
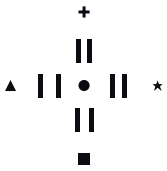


Children

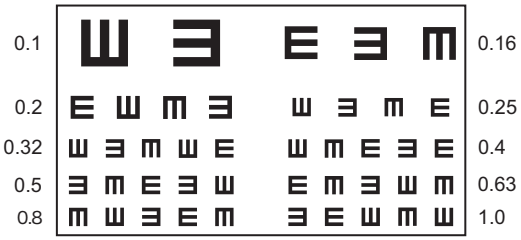
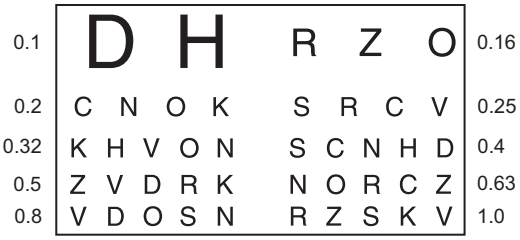
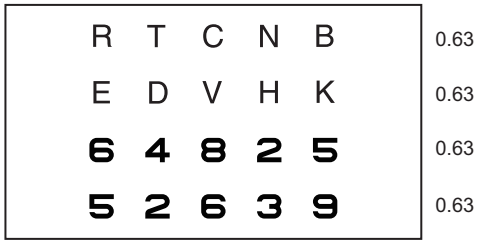
ETDRS style letters

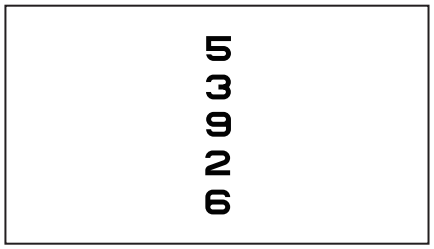
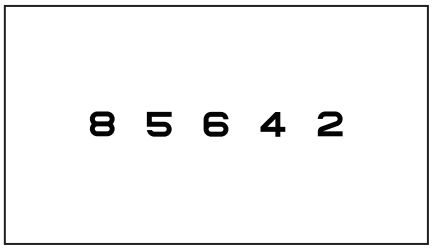
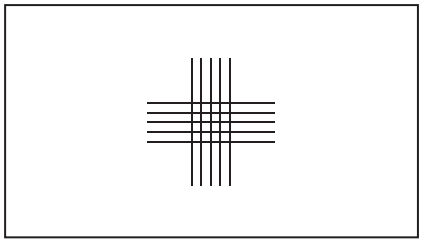


- Distance and near special charts

Astigmatism clock dial	Red-green	Cross grid	Binocular balance
			
Duochrome balance	**Phoria with fixation point**	**Mallet (horizontal phoria)**	**Mallet (vertical phoria)**
			
Schober	**Stereo**	**Worth four dot**	**Fixation point**
			

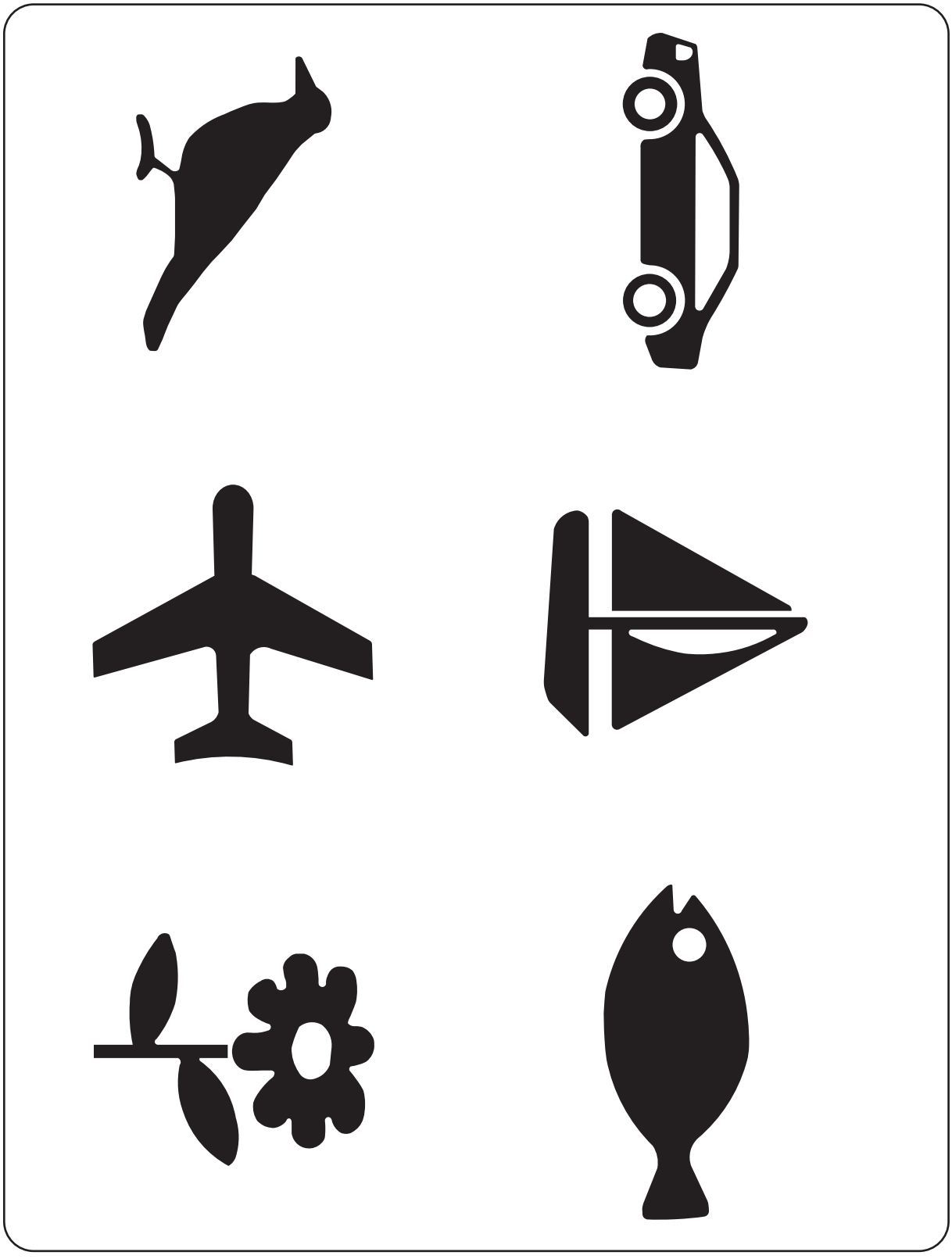
- Near visual acuity charts

Tumbling E	Letters
	
Letters and Numbers	
	

Binocular balance	Binocular balance
 0.63	 0.63
Cross grid	
	

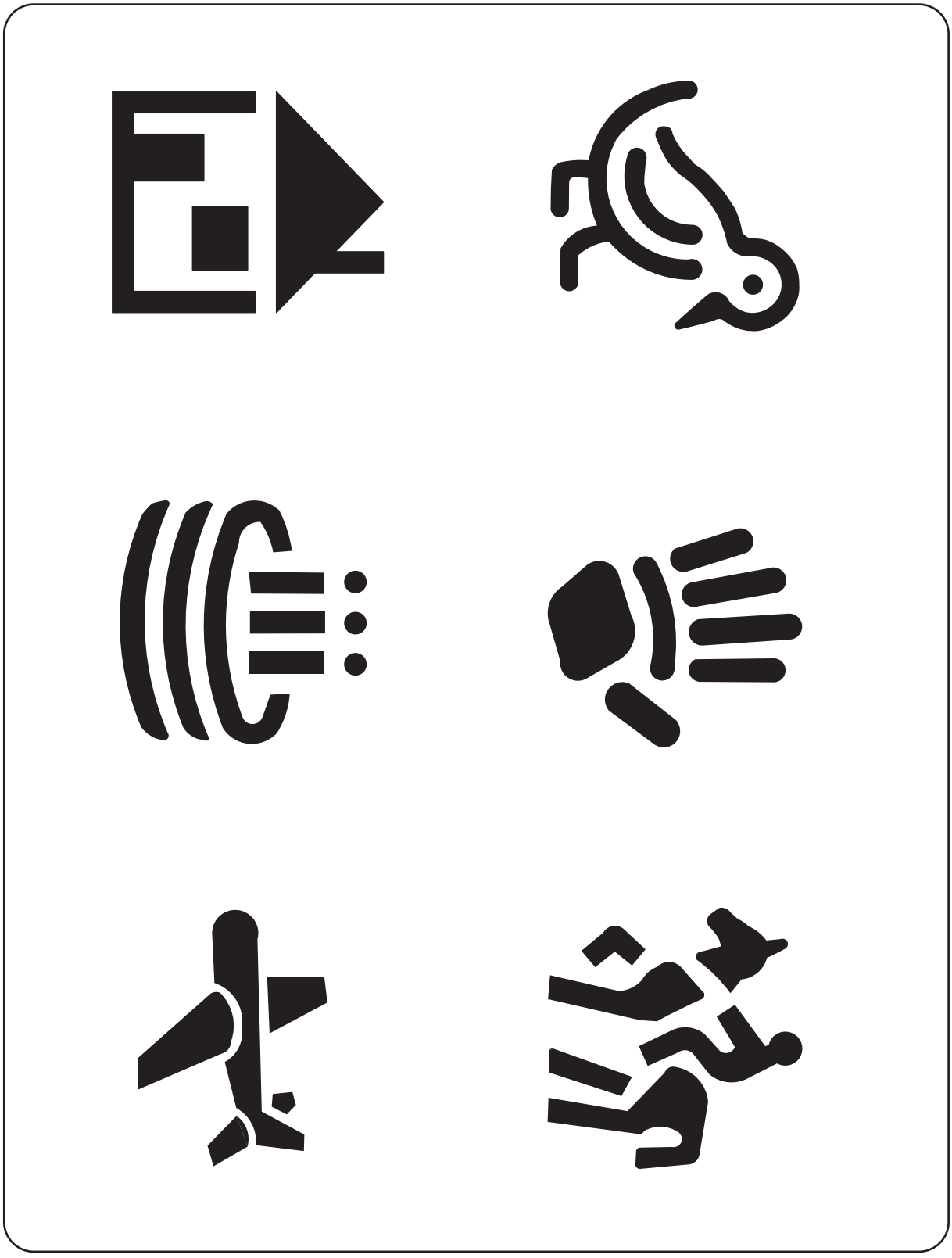
◆ Children Chart Samples (Type T/UK)

Copy this page and use it when testing the visual acuity of children. For very young children, have the patient point to the illustration that they see on the screen.



◆ Children Chart Samples (Type M)

Copy this page and use it when testing the visual acuity of children. For very young children, have the patient point to the illustration that they see on the screen.



◆ Children Chart Samples (Type P/PhM)

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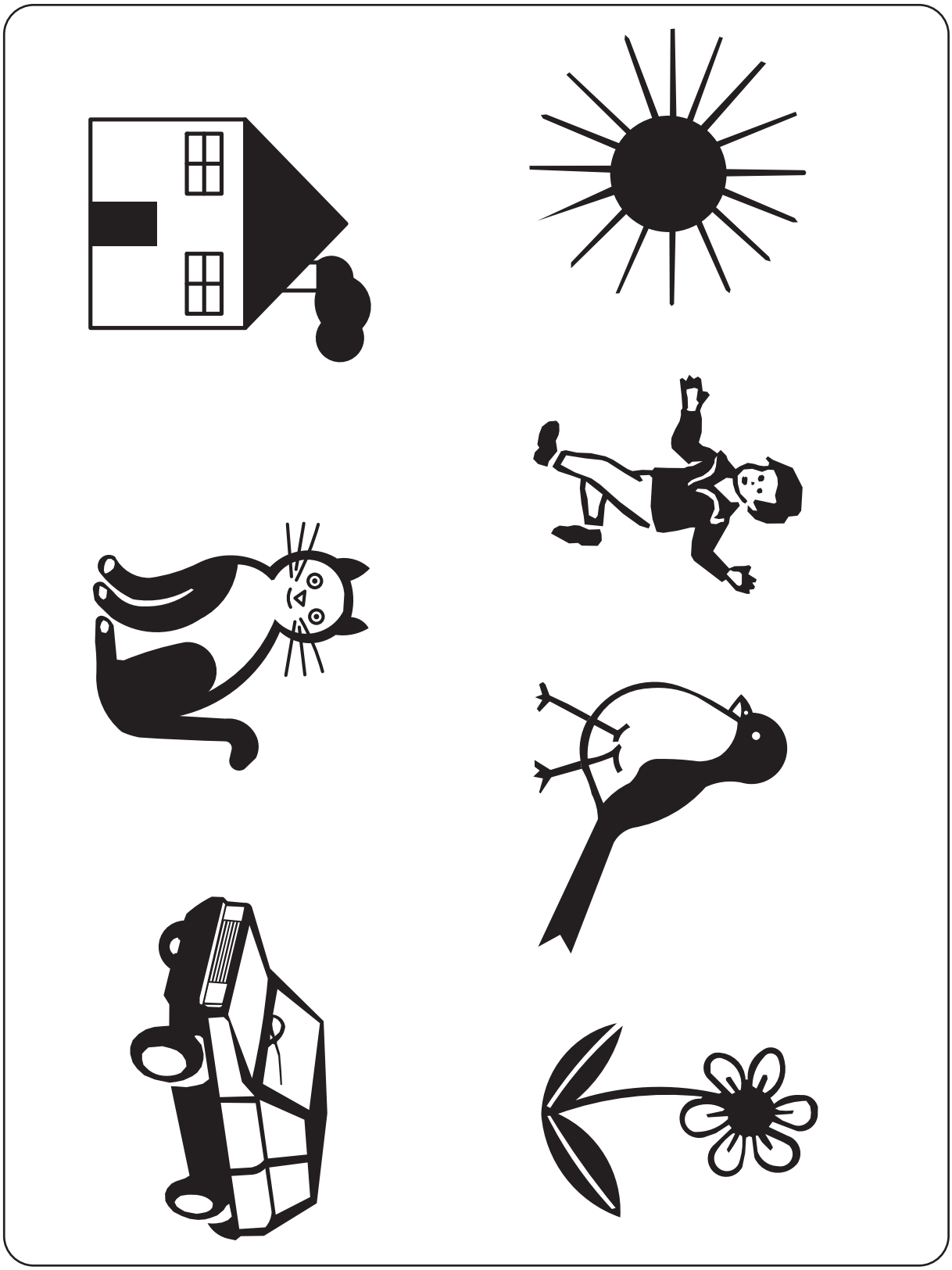

8.3 EMC (Electromagnetic Compatibility)

■ The device is suitable for use in stores and hospitals except for near active HF surgical equipment and RF shielded rooms with an ME system for magnetic resonance imaging, where the intensity of electromagnetic disturbances is high, electrophysiology laboratories, or areas where short-wave therapy equipment is used.

⚠ WARNING

- Do not use the device near, on, or under other electronic equipment or electromagnetic disturbance sources. Otherwise, it could result in improper operation. If such use is necessary, the device and the other equipment should be observed to verify that they are operating normally.
- Use of accessories, cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and cause improper operation.
- Portable RF communications equipment (including peripherals such as antenna cables and external antennas) or electromagnetic disturbance sources as shown below should be used no closer than 30 cm (12 inches) to any part of the device, including the specified or provided cables. Otherwise, degradation of the performance of this equipment could result.
  The following are examples of electromagnetic disturbance sources:
  - Induction cooking appliance and ovens
  - RFID readers
  - Electronic article surveillance (EAS) systems
  - Sponge detection systems
  - Equipment used for position detection (e.g. in catheter labs)
  - Wireless power transfer charging systems for electrical vehicles

◆ Specified accessories

Part name
Memory Box
Memory Box AC adapter

◆ Specified cables

Part name	Cable shielded	Ferrite core	Length (m)
Power cord	No	No	2.5
Communication cable	Yes	Yes	15.0

◆ Essential performance

- None

◆ Compliance for Emission Standard

Phenomenon	Product family standard	Compliance
Conducted and radiated RF emissions	CISPR 11	Group 1 Class B
Harmonic distortion	IEC 61000-3-2	*1
Voltage fluctuations and flicker	IEC 61000-3-3	*2

* 1 For the regions where the rated voltage is 220 V to 240 V, this device complies with this standard.
* 2 For the regions where the rated voltage (line to neutral) is 220 V to 250 V, this device complies with this standard.

◆ Test specifications for enclosure port immunity to RF wireless communications equipment

Test frequency (MHz)	Band (MHz)	Service	Modulation	Immunity test level (V/m)
385	380 to 390	TETRA 400	Pulse modulation 18 Hz	27
450	430 to 470	GMRS 460, FRS 460	FM ±5 kHz deviation 1 kHz sine	28
710	704 to 787	LTE Band 13, 17	Pulse modulation 217 Hz	9
745				
780				
810	800 to 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation 18 Hz	28
870				
930				
1720	1700 to 1990	GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS	Pulse modulation 217 Hz	28
1845				
1970				
2450	2400 to 2570	Bluetooth WLAN 802.11 b/g/n RFID 2450 LTE Band 7	Pulse modulation 217 Hz	28
5240	5100 to 5800	WLAN 802.11 a/n	Pulse modulation 217 Hz	9
5500				
5785				

◆ Compliance for Immunity Standard

Phenomenon	Basic EMC standard	Immunity test levels
Electrostatic discharge	IEC 61000-4-2	±8 kV contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air
Radiated RF electromagnetic field	IEC 61000-4-3	10 V/m 80 MHz - 2.7 GHz 80% AM at 1 kHz
Proximity fields from RF wireless communications equipment	IEC 61000-4-3	See “Test specifications for enclosure port immunity to RF wireless communications equipment”.
Electrical fast transients / bursts	IEC 61000-4-4	Input power port ±2 kV 100 kHz repetition frequency
		Signal input/output parts port ±1 kV 100 kHz repetition frequency
Surges Line-to-line	IEC 61000-4-5	Input power port ±0.5 kV, ±1 kV
Surges Line-to-ground		Input power port ±0.5 kV, ±1 kV, ±2 kV Signal input/output parts port ±2 kV
Conducted disturbances induced by RF fields	IEC 61000-4-6	3 V 0.15 MHz – 80 MHz 6 V in ISM and amateur radio bands between 0.15 MHz and 80 MHz 80% AM at 1 kHz
Rated power frequency magnetic fields	IEC 61000-4-8	30 A/m 50 Hz or 60 Hz
Voltage dips	IEC 61000-4-11	0% U_T; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°
		0% U_T; 1 cycle and 70% U_T; 25/30 cycles Single phase: at 0°
Voltage interruptions	IEC 61000-4-11	0% U_T; 250/300 cycles

8.4 Software License

License information of the open source software (OSS) used in this product can be found at the following URL.

https://www.nidek-intl.com/aboutus/entry-4840.html/

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