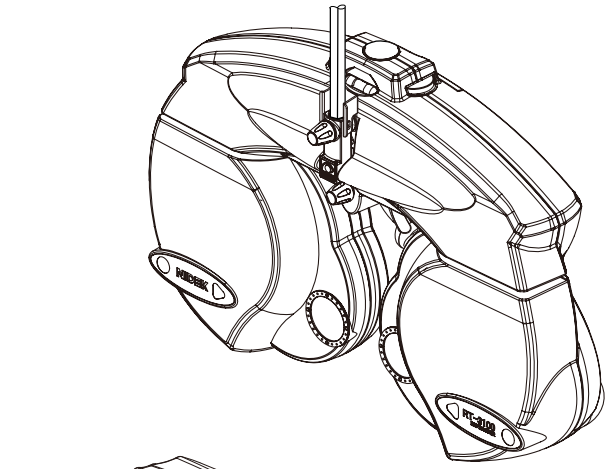
NIDEK

REFRACTOR

RT-3100

OPERATOR'S MANUAL



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

Original instructions

NIDEK CO., LTD.

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CE

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THIS AGREEMENT APPLIES TO THE NIDEK SOFTWARE AND ACCOMPANYING DOCUMENTS. PLEASE READ THIS AGREEMENT CAREFULLY AND THOROUGHLY BEFORE USING SOFTWARE.

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This SOFTWARE LICENSE AGREEMENT (this "Agreement") is an agreement between you, whether person or legal entity, and NIDEK CO., LTD., a Japanese corporation, ("NIDEK") for software (including but not limited to software linked dynamically or statically with other software) supplied by NIDEK or its designee pursuant to this Agreement, whether software alone or embedded software in a NIDEK hardware product, whether on disk or in read only memory, or on other media, or through an authorized website or network, and any accompanying documents or materials (including, but not limited to, operation manuals and electronic documents for such software, and other software for displaying or saving the data acquired from or through other NIDEK hardware product) (collectively, the "Software").

The Software and NIDEK hardware product (collectively, "NIDEK product") may include a third party's software which is linked, whether dynamically or statically, with the Software (the "Third-Party-Software"). The Third-Party-Software shall not be included in the definition of the "Software" in this Agreement. The rights and title of the Third-Party-Software belong to the third party, and the terms of use of the Third-Party-Software are set forth separately from this Agreement. The terms in this Agreement will not apply to the use of the Third-Party-Software except as expressly stipulated herein.

By using or installing the Software, you agree to be bound to the terms and conditions of this Agreement. If you do not agree with this Agreement, please do not use or install the Software and return the Software to the company from which you obtained the Software.

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1.1. Subject to the terms and conditions set forth in this Agreement, NIDEK grants to you, and you accept, a limited, non-transferable and non-exclusive license to use the Software.

1.2. Unless otherwise agreed in writing by NIDEK or its designee, the license is limited to using the Software on a single computer or a single NIDEK hardware product and if you replace such computer or NIDEK hardware product, you may not use the Software without a new license of the Software.

1.3. Notwithstanding the provision of 1.2, if you connect a single server computer with the Software installed to a plurality of client computers, you may use the Software on such client computers; provided, however, that the upper limit of the number of said client computers will be determined by NIDEK in writing separately and individually from this Agreement.

1.4. Notwithstanding the provision of 1.2, if NIDEK permits you to install the Software on a plurality of computers using one license key of the Software, you may install and use the Software on such computers up to the upper limit of the number determined by NIDEK in writing separately and individually from this Agreement.

1.5. The Software is only to be used for its intended purpose provided in the specifications, operation manual or related documents in accordance with applicable laws and regulations. If the Software is embedded software in a NIDEK hardware product, you will use such Software only as embedded software for the use of such NIDEK hardware product.

1.6. For the license of the Software granted in this Agreement, unless the license is granted by NIDEK or its designee explicitly free of charge, you will pay to NIDEK or its designee the price for the Software, or if the Software is embedded software in a NIDEK hardware product, the price for the NIDEK hardware product in which the Software is embedded.

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3.2. Unless otherwise permitted and other than the part specified by NIDEK in operation manuals or any accompanying documents for the Software, you may not analyze, reverse-engineer, decompile, disassemble or otherwise attempt to discover the source code of the Software.

3.3. You may not alter, reproduce, modify, translate, adapt, or divert the Software.

3.4. You may not remove, delete or change the copyright notice or other legends of the Software.

3.5. You may not sell, distribute, rent, license, sublicense, lease, assign or otherwise transfer the Software to third parties, or operate the Software for the benefit of third parties without prior written consent of NIDEK.

3.6. You may not create derivative works or cause or permit others to create derivative works based upon the Software without prior written consent of NIDEK.

3.7. You may not disclose operation manuals for the Software to any third party without prior written consent of NIDEK; provided, however, for the avoidance of doubt, the "third party" in this section will not include doctors, examiners, nurses, employees, patients and other persons who need to know the Software.

3.8. You may not use NIDEK’s trademarks or trade names without prior written consent of NIDEK.

4. CONDITIONS OF USE

4.1. You shall take necessary measures (including but not limited to antivirus software) to prevent failure of NIDEK product due to external factors; provided, however, that in the case where it is otherwise provided in the provisions of operation manuals for NIDEK product or other documents, you shall take such necessary measures to the extent not inconsistent with such provisions.

4.2. If you enter data into NIDEK product or obtain data by the use of NIDEK product, you shall obtain and save backup of such data.

5. EXPORT RESTRICTIONS

5.1. If you export or re-export, directly or indirectly, the Software, you must comply with applicable export laws and regulations of Japan and other countries, and obtain any licenses or approvals required by governmental authorities.

6. UPDATES

6.1. The Software and/or the Third-Party-Software may be, at NIDEK's own discretion, changed, updated or modified from time to time without any prior notice to you. If such changes, updates, and modifications are applied to the Software licensed to you under this Agreement, such changes, updates, and modifications will be deemed a constituent part of the Software, and the terms and conditions of this Agreement will apply to such changes, updates, and modifications.

6.2. NIDEK may, at its own discretion, make amendments to any provisions of this Agreement (the "Amendments"), if NIDEK deems that:

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.

7. TERMINATION

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.

8. NO WARRANTIES

8.1. NIDEK MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE SOFTWARE AND THE THIRD-PARTY-SOFTWARE, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT OF THIRD PARTY RIGHTS, INCLUDING, WITHOUT LIMITATION, THIRD PARTY INTELLECTUAL PROPERTY RIGHTS, ACCURACY, RELIABILITY OR AVAILABILITY, ABSENCE OF OR RECOVERY FROM ANY INTERRUPTION, ERROR-FREE OPERATION OR CORRECTION OF DEFECTS OR MALFUNCTIONS.

9. LIMITATION OF LIABILITY

9.1. EXCEPT OTHERWISE EXPRESSLY STIPULATED IN THIS AGREEMENT, IN NO EVENT WILL NIDEK BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, LOSS, CLAIMS OR COSTS WHATSOEVER, INCLUDING, WITHOUT LIMITATION, ANY LOST DATA, PROFITS, REVENUES, BUSINESS OPPORTUNITIES OR INFORMATION, LOSS OF USE OF ANY PRODUCT, PROPERTY OR EQUIPMENT, DOWNTIME COST , COST OF PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, OR ANY CLAIMS BY A THIRD PARTY, ARISING OUT OF OR RELATED TO THE USE OR INABILITY TO USE THE SOFTWWARE AND/ OR THE THIRD-PARTY-SOFTWARE, CHANGES, UPDATES OR MODIFICATIONS OF THE SOFTWARE AND/OR THE THIRD-PARTY-SOFTWARE, OR MAINTENANCE OR REPAIR SERVICE OF THE SOFTWARE IF ANY (collectively, the "DAMAGES"). THE ABOVE LIMITATIONS WILL APPLY REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT, STRICT PRODUCT LIABILITY, OR OTHERWISE, EVEN IF NIDEK IS NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES.

9.2. THE LIMITATIONS PROVIDED IN THE PROVISION OF 9.1. SHALL NOT APPLY IN THE CASE WHERE THE DAMAGES ARE ATTRIBUTABLE TO NIDEK OR NIDEK IS LIABLE FOR SUCH DAMAGES IN ACCORDANCE WITH THE LAWS. EVEN IN SUCH CASE, NIDEK SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, PUNITIVE OR SPECIAL LOSS OR DAMAGE. NIDEK'S TOTAL AGGREGATE LIABILITY FOR THE DAMAGES SHALL NOT EXCEED AN AMOUNT ACTUALLY PAID BY YOU FOR PURCHASE OF NIDEK PRODUCT; PROVIDED, HOWEVER, THAT THE LIMITATION OF THE AMOUNT SHALL NOT APPLY IN THE CASE WHERE THE APPLICABLE LAW PROHOBITS SUCH LIMITATION OR THE DAMAGES ARISING FROM NIDEK'S GROSS NEGLIGENCE OR WILLFUL MISCONDUCT.

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.

19. APPLICATION OF SOFTWARE LICENSE AGREEMENT

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.

Use this device properly and safely.

⚠ **BEFORE USE, READ THIS MANUAL.**

This operator's manual includes operating procedures, safety precautions, and specifications for the NIDEK REFRACTOR RT-3100 when it is used in combination with any of the NIDEK chart presenting devices*1. The dioptric powers are indicated with a reference wavelength of 546.07 nm.

The safety cautions and operating procedures must be thoroughly understood before using the device.

Keep this manual handy for verification.

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

***1 Connectable chart presenting devices**
- **Space saving chart SSC-300, SSC-330, SSC-350, SSC-370, SSC-100**
- **Chart projector CP-670, CP-690, CP-770, CP-9**
- **System chart SC-1700Pola, SC-2000, SC-1600, SC-1600Pola**

***2 For simplicity, examples of chart type used in this manual are for the CP-770M only. These examples are applicable to any other type unless specified otherwise.**

***3 This manual indicates the visual acuity by fractions (feet). Refer to "7.2 VA Conversion Table" (Page 135) for visual acuity represented by decimals (meters).**

Safety precautions

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, could result in death or serious injury.

⚠ **CAUTION** • Indicates a potentially hazardous situation which, if not avoided, might result in minor or moderate injury or property damage.

Even situations indicated by ⚠CAUTION might result in serious injury under certain conditions. Safety precautions must be strictly followed at all times.

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 secure the refractor head to the refractor arm.**
  If the refractor head is dropped or falls, injury or device failure may result.
- **Connect the power plug to a grounded outlet.**
  Electric shock or fire may result in the event of malfunction or power leakage.
- **Do not modify or touch the device. Do not touch anything inside the device.**
  This may result in electric shock or malfunction.

⚠ **CAUTION**

- **The safety precautions and operating procedures must be thoroughly understood before using the device.**
  Unintended use may cause unexpected malfunction or adverse experience.
- **Do not store the device in an area that is exposed to rain or water, or contains poisonous gas or liquid.**
- **Do not store the device in dusty, hot, humid places or in direct sunlight.**
- **When connections between units are removed for moving the device, and necessary to reconnect the units, contact NIDEK or your authorized distributor.**
- **Do not carry the device with the power cable and communication cable connected.**
  If the device falls, injury or device failure may result.
- **Install the device on a stable and level surface.**
  If the device falls, injury or device failure may result.
- **Never install the device in a place where it is exposed to water.**
  Contact with liquids may cause electric shock or device failure.

- **Install the device in an environment that meets the following conditions. The following conditions must be maintained during use.**

  Temperature: 10 to 35ºC (50 to 95ºF)
  Humidity: 30 to 85% (No condensation)
  Pressure: 800 to 1060 hPa
  Installation place: Interior
  No hazardous dust or smoke
  A dust-free place
  A place with little external light
  A place free from vibration and shock

- **Be sure to level the refractor head before use.**

  Failure to do so could affect the data accuracy. Level the refractor head by turning the leveling adjustment knob until the bubble is centered in the level.

- **Be sure to use a wall outlet which meets the power specification requirements.**

  If the line voltage is too high or too low, the device may not operate properly. Malfunction or fire may result.

- **Do not overload the electrical outlet.**

  Fire may result.

- **Fully insert the power plug into the outlet.**

  Imperfect connection may cause fire.

- **Never use a power strip or extension cable to supply the device with power.**

  The electrical safety may be lowered.

- **Do not use any power cord other than that equipped. Do not use the equipped power cord for purpose other than as intended.**

  Malfunction or fire may result.

- **Install the device in area where the outlet that the power plug is inserted into is easily accessible during use. In addition, ensure that the power cord can be disconnected without the use of a tool.**

  Otherwise, it may interfere with disconnecting of the power from the input power source in case of abnormality.

- **Do not place heavy objects on the power cord.**

  A damaged power cord may cause fire or electric shock.

- **Check the following before use:**

  The forehead rest is attached.
  The near point card is undamaged.
  The near point rod is securely fastened.
  The cover open button on the printer is undamaged.

During Use

⚠ WARNING • **When moving the refractor head, make sure that there are no obstacles in its path.**

If the arm is swung carelessly, it may bump against someone or something and injury or malfunction may occur. In addition, the near point rod may tilt over and injury may occur.

⚠ CAUTION • **Be sure to use the configurations specified by NIDEK.**

Using the components outside the operator's manual may cause unanticipated failure or adverse experience.

- **Do not perform servicing or maintenance on the device during use.**
- **Unplug the power cord and contact NIDEK or your authorized distributor if the internal wires are exposed, the table turns on or off when the power cord is moved, or the cord and/or plug are too hot to hold.**

  This may result in electric shock or fire.
- **Keep the measuring windows free of fingerprints and smudges.**

  Failure to do so could affect the data accuracy.
- **In the event of smoke or strange odors, immediately turn off the device and disconnect the power plug from the outlet. After you are positive that the smoke has stopped, contact NIDEK or your authorized distributor.**

  Continued use of the device under such abnormal conditions may cause fire or electric shock.
- **When the device is not in use, turn it off and put the dust cover over it.**

  If the device is not covered for an extended period, the accumulation of dust may affect the data accuracy.
- **Do not touch the touch-screen panel with anything other than the tip of a touch-screen pen.**

  Contact with a hard or sharp object such as a ball point pen may scratch the panel.
  In addition, although the tip of a touch-screen pen is covered with resin which is unlikely to scratch the panel, the panel may be scratched by strongly pressing the pen against the panel.
  Do not touch the panel with fingers. Doing so could decrease the panel sensitivity or make the panel dirty. It may affect the near vision test accuracy.
- **Perform the visual and operation checks before using the device. If any abnormality is found, do not use the device.**

  Continued use of the device under such abnormal conditions may affect the data accuracy. Unexpected malfunction or faulty diagnosis may induce unexpected health hazards.
- **Before each patient, always clean the patient's contact area (forehead rest and face shields) using disinfectant alcohol.**

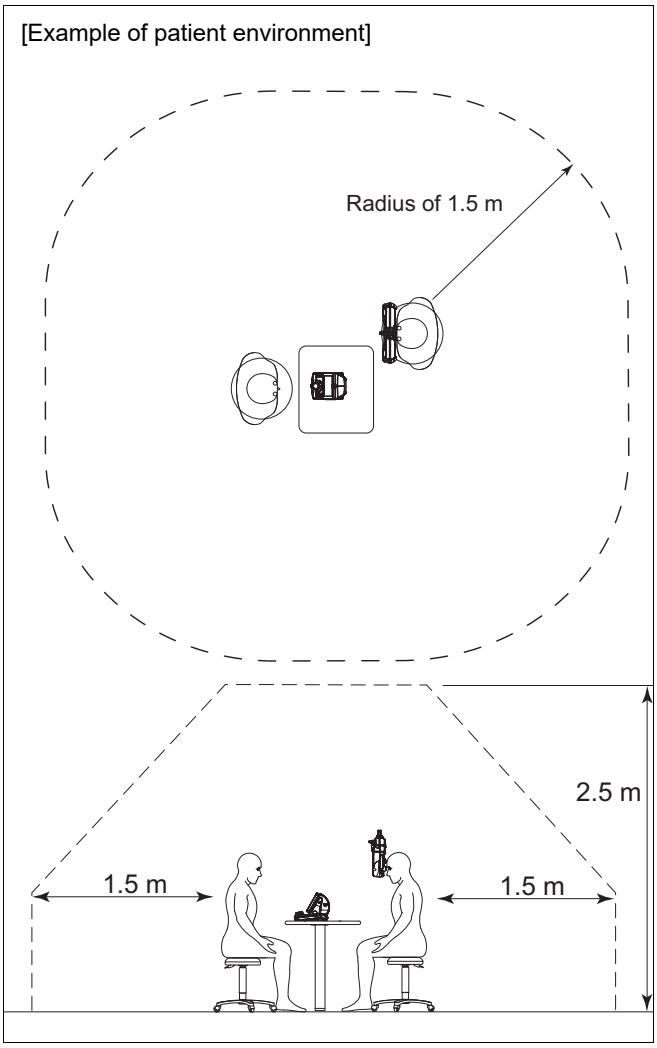
- **If the device fails, disconnect the power cord from the power outlet, then contact NIDEK or your authorized distributor without touching the interior of the device.**
- **Take care not to catch hands or fingers in moving parts.**
- **When connecting interface devices to the device, confirm the symbols, then connect them securely without applying unnecessarily great force.**
  Terminals or cables may become damaged.
- **Be sure to use only the printer paper (80620-00001) specified by NIDEK.**
  Other printer papers may cause improper printing and make the data unreadable.
- **Do not apply adhesive tape to the printed paper.**
  Printed characters may fade.
- **Do not look directly into the near point lamp.**
- **Confirm that the holder is securely fastened to the latch when the near point rod is in the raised position.**
  An improper fastening may cause the near point rod to fall resulting in injury.
- **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 IEC 62368-1), supply power to the device and computer through an isolation transformer.**
  Electric shock may result. Contact NIDEK or your authorized distributor for installing isolation transformers.

○ Patient environment

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.

[Example of patient environment]



After Use

⚠ CAUTION

- **After using the device, remove the near point rod from the device and store it in a customary place.**
  If the near point rod is not removed, it may tilt over and injury may occur.
- **If the device will not be used for the extended period, disconnect the power cable from the wall outlet.**
  Settled dust may collect moisture, and short circuit or fire may result.
- **Occasionally clean the prongs of the power plug with a dry cloth.**
  If dust settles between the prongs, it may collect moisture, and short circuit or fire may result.
- **Do not yank the power cord to disconnect it from an outlet.**
  This can damage the metal core of the cord and may result in electric shock, short circuit or fire.
- **Before carrying the device to another location, disconnect all the cords and cables.**

Maintenance

⚠ CAUTION

- **Only NIDEK service representatives or hospital personnel trained by NIDEK should attempt to modify or touch the inside of the device and/or upgrade the software.**
  NIDEK is not responsible for any accidents resulted from improper servicing.
- **When performing maintenance work, secure sufficient maintenance space.**
  Maintenance work in an insufficient space may result in injury.
- **When the device is sent back to NIDEK for repair or maintenance, wipe the surfaces (especially, the area where patients contact) of the device with a clean cloth dampened with ethyl alcohol for disinfection.**
- **Never use organic solvents such as a paint thinner to clean the exterior of the device.**
  It may ruin the surface of the device.
- **When cleaning the measuring window, be sure to remove any dust with a blower brush and wipe lightly with a soft cloth.**
  Wiping the window without removing dust may scratch the lens coating and impair measurement of the power or visual acuity.
- **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 of maintenance and preventive inspection, ask NIDEK or your authorized distributor. If the manager of this device cannot perform the maintenance and preventive inspection, contact NIDEK or your authorized distributor.

Note

- A pixel may be occasionally missing on the screen or a red, blue,or green pixel point may always be displayed.
  This does not represent a failure of the touch-screen panel; This is due to the manufacturing process of the liquid crystal display.

Disposal

⚠ **CAUTION**

- **Follow the local ordinances and recycling regulations regarding disposal or recycling of the components. The device contains the circuit board with a lithium battery mounted. Because the disposal method of lithium batteries varies according to the local government, follow the local governing ordinates and recycling plans when disposing of the circuit board with the lithium battery.**

  It is recommended to commission 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.

Table of Contents

1. BEFORE USE

1.1 Outline of Refractor

The NIDEK REFRACTOR Model RT-3100 is a computerized refractor used for subjective refraction with the NIDEK AUTO REFRACTOMETER (AR), AUTO REF/KERATOMETER (ARK), AUTO REF/KER/TONOMETER (RKT), or AUTO LENSMETER (LM) via Eye Care card.
The RT-3100 includes a refractor head, control box, and relay box.
The relay box not only connects the other two units, but also connects the Chart Presenting device or PC. The control box includes the key panel, display, and printer. The display is a touch-screen panel. The control box displays the data and can be used for almost all operations. In addition, the control box operates the refractor head and the connected chart presenting device. It allows the refractor and charts to be controlled together.
Normally, the relay box is installed on the system table (not included in the RT-3100 package.)

* In this operator's manual, the keys on the control box are indicated by key representations such as Shift or R. The touch keys on the touch panel other than chart keys are indicated by brackets such as [Subj.].
The touch panel chart keys are indicated by key representations such as A 400 .

1.2 Intended Use

The RT-3100 is a device that provides means of positioning spherical and cylindrical lenses, prisms, and other optical devices in front of the patient’s eyes to determine refractive error and binocular functions. It can also be combined with a device that optically presents charts for distance and near vision.

1.3 Intended Patient Population

- Age
  Except babies and infants (under 3 years old)
- Health condition
  Personnel who can sit on a chair and answer operator's questions
- Conditions - Visual function
  Single or both eyes are normal or have disease.
  Eyes that have lost the visual function are not targeted.
  Person who desires application of grasses or contact lenses

1.4 Intended User Profile

Any qualified personnel such as ophthalmologists, nurses, clinical laboratory technicians, or optometrists (irrespective of nationality, culture, or style of dress)

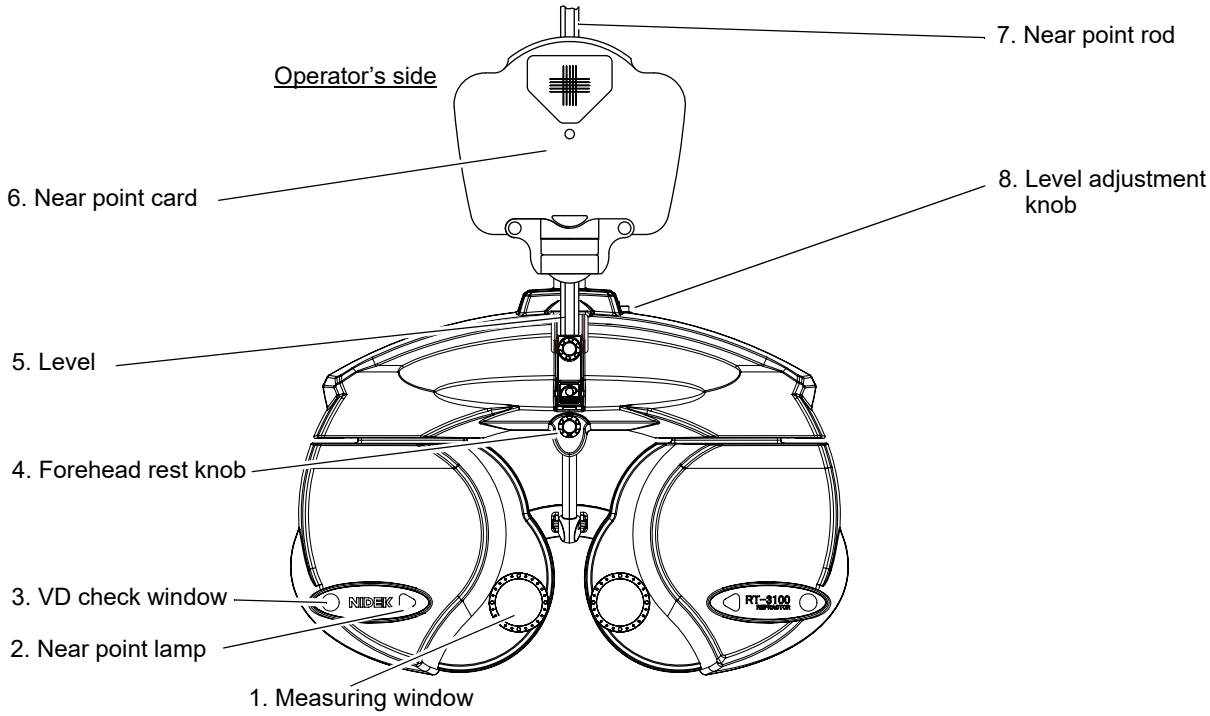
1.5 Intended Use Environment

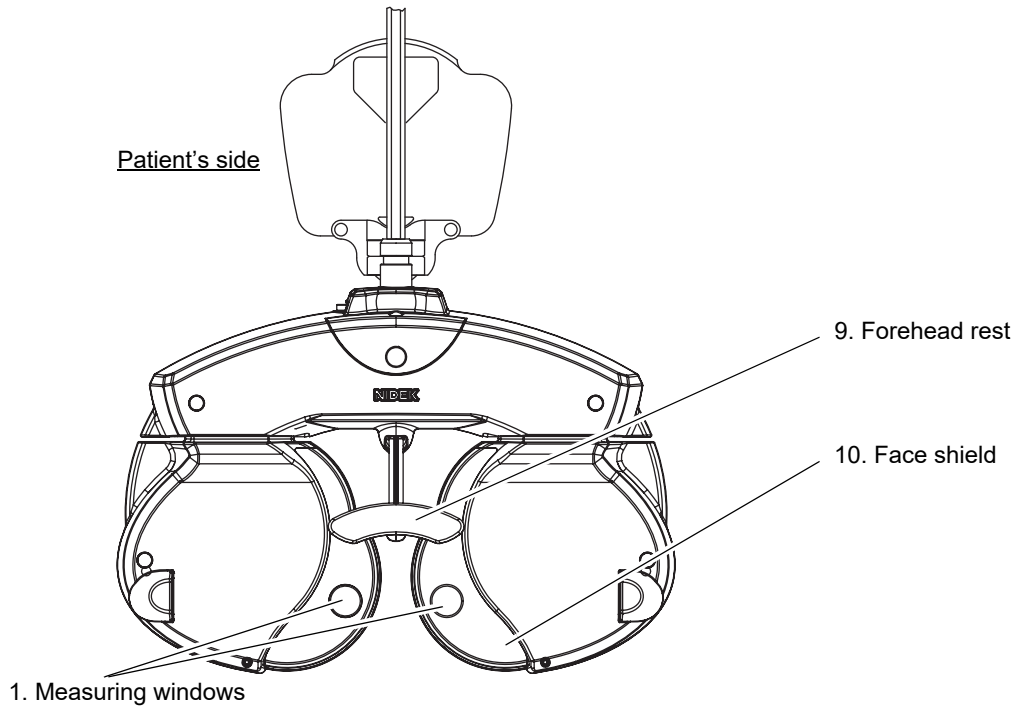
Medical facility or optical store

⚠ **CAUTION** • **If the device is used outside the specified use location, intended performance and security level cannot be maintained.**

1.6 Configuration

1.6.1 Refractor head





1. Measuring windows

The patient looks at any chart through these windows.

2. Near point lamp

Illuminates the near point card.

Pressing the left side key of the control box displays the chart control screen. Pressing  on the screen turns the lamp on or off.

3. VD check window

Used to check the patient's VD (vertex distance = distance from the corneal apex to the lens).

The windows have calibration marks of 12, 13.75, 16, 18, and 20 mm.

4. Forehead rest knob

Moves the forehead rest forward and backward in order to adjust the VD.

5. Level

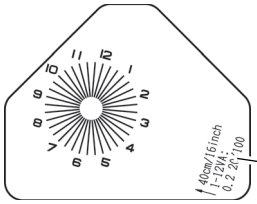
Used to confirm that the refractor head is level.

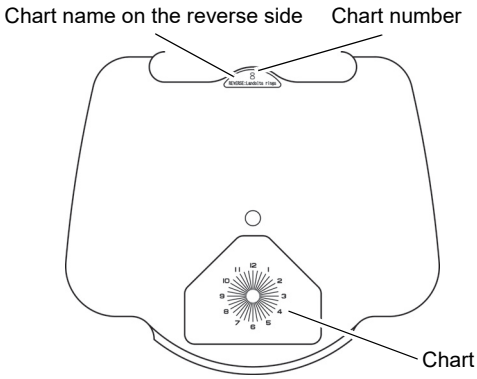
Turn the level adjustment knob until the air bubble is centered in the level.

6. Near point card

Used for near vision testing such as addition powers.

When the chart is shifted slightly to the left, the chart explanation is revealed.





For the chart on the near point card, see "7.3 Standard Programs" (Page 136).

Note

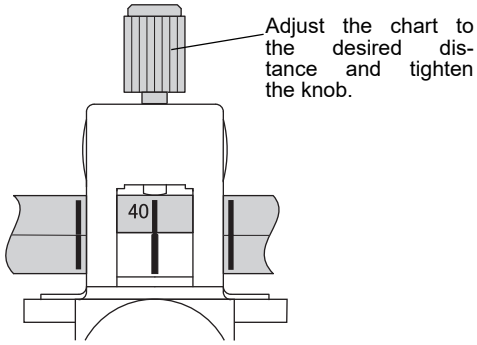
- When switching the near point chart, do not rotate the near point chart while pressing the chart window frame.

  The near point chart may be rubbed off and become difficult to be seen.

7. Near point rod

The distance from the patient's eye to the near point card is marked in inches and centimeters.

- Align the black line at the near point card holder with the desired distance scale.
- The number in red represents the power (diopter) corresponding to each distance in meters.
- Rotating the rod 180 degrees and inverting it up side down changes the scale from between centimeters and inches. See "1.9 Getting Started and Exiting" (Page 21).



8. Level adjustment knob

Adjusts the level of the refractor head.

The refractor head is tilted to a maximum of 2.5º to the left or right.

9. Forehead rest

The patient's forehead rests here during refraction. Clean it before each refraction.

See "5.2 Cleaning Forehead Rest" (Page 122).

10. Face shield

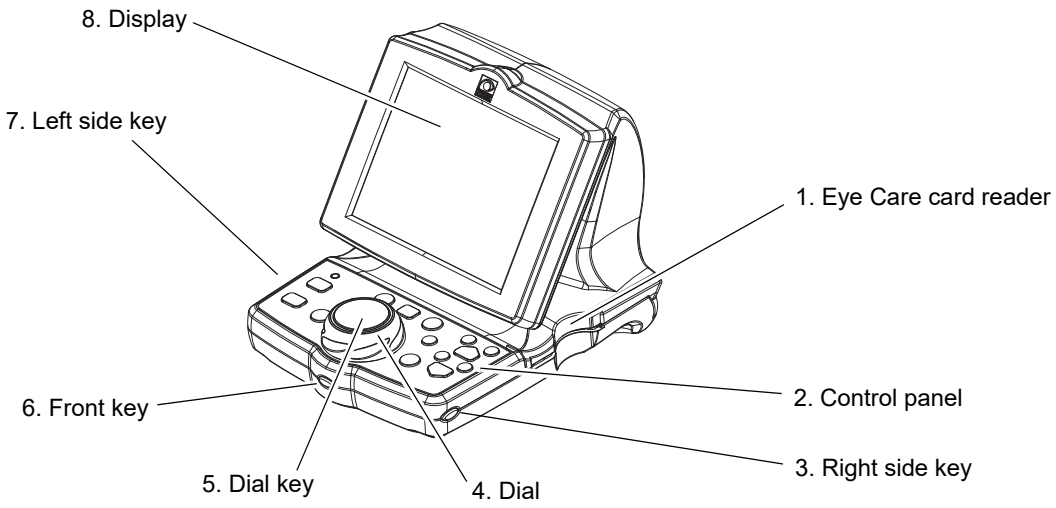
The patient's face touches here during refraction. Clean the face shields before each refraction.

See "5.3 Cleaning Face Shields" (Page 122).

Note

- The parts that contact the patient during refraction are composed of the following materials:
  Forehead rest: polypropylene
  Face shields: ABS resin

1.6.2 Control box



1. Eye Care card reader

Reads objective data (AR data) or past lensometry data (LM data) via an Eye Care card.

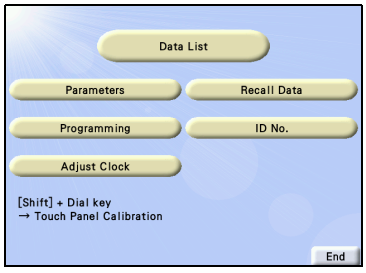
The specified optional Eye Care card is necessary. IC cards for the older model NIDEK IC card system (RT4IC-1) or commercial IC cards are not compatible.

2. Control panel

See “O Control panel” (page 10) for details.

3. Right side key

Displays the Main Menu screen.



4. Dial

Changes any measurement value.

The selected (highlighted) value can be changed.
When the dial is turned clockwise, the value changes to the negative.
When the dial is turned counterclockwise, the value changes to the positive.

Turn the dial while pressing Shift changes the increments. See page 72.

5. Dial key

Switches the mode (S, C, A).

6. Front key

Used to forward to the next programmed refraction sequence.

Pressing the next chart icon on the screen also forward next programmed refraction sequence.

Shift + Front key ⇒ Returns to the previous sequence.

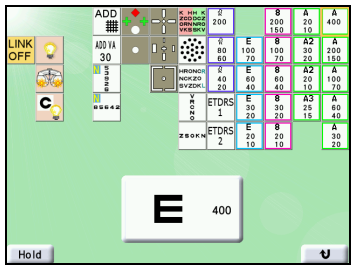
7. Left side key

Displays the chart control screen.

The chart control screen switches the chart or controls the chart such as near point lamp.

See "2.5.2 Program Day/Night" (Page 39).

Pressing the present chart icon on the screen also displays the chart control screen.



8. Display

Displays the data such as SPH (S), CYL (C), AXIS (A) and the presented chart.

The LCD display is a touch-screen panel.

For details, see “○ Display” (page 6).

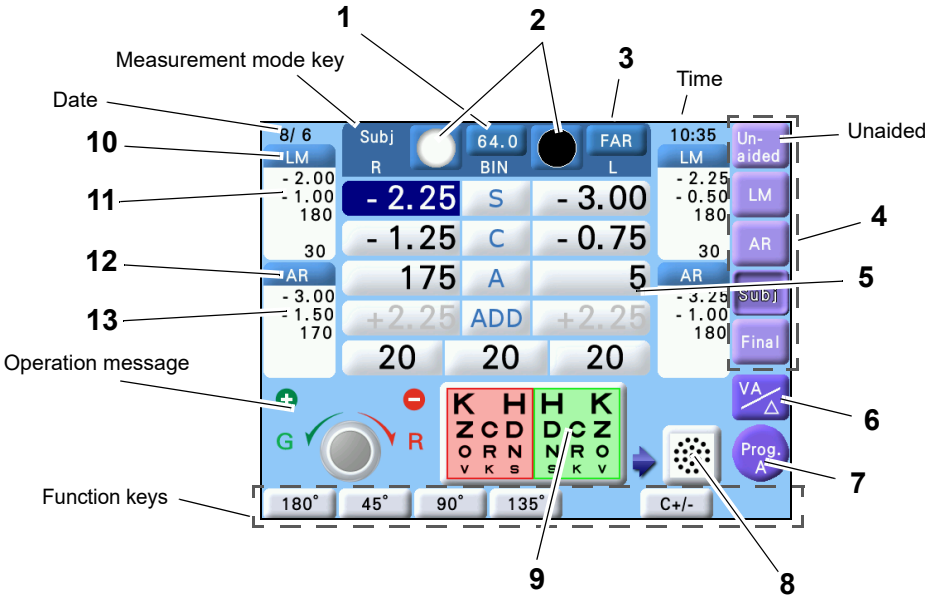
Note

- The materials that come into contact with the patient during refraction are as follows:

  Control panel, right/left side key, dial, dial key: ABS resin

  Display, power switch, general electrical component

○ Display



1. PD display and change key

Enters the mode to change the pupillary distance.

Monocular PD (1/2 PD) ⇒ Press the R or L side of the binocular PD field in PD mode ((R) or (L) in PD mode) to enter the value.

Leave the mode ⇒ Press the PD key again.

2. Auxiliary lens keys

Displays the current inserted auxiliary lenses.

Pressing this key displays the auxiliary lens selection screen.

Alternately pressing this key while pressing (Shift) opens/closes the measuring window.

3. Far or near mode key

Displays the current measurement mode (far or near mode).

When in far mode, the key indication is “FAR” and when in near mode, the key indication is “NEAR”.

Far mode is automatically selected when the power is turned on or after data is cleared.
Near mode is used to test the near visual function after far vision testing and addition power measurement. The refractor head converges to the working distance of 40 cm (variable) automatically in near mode.
The ADD key is not available in near mode. The near SPH values are calculated by adding the ADD values to the far SPH values and the lenses are set accordingly. It is also possible to use only the far SPH values in near mode when the SPH Far → Near parameter is set to SPH.

Note

- When the refractor head is converging, have the patient off his face temporarily from the refractor head.

4. Measurement mode keys

Used to specify the measurement mode.

The selected measurement mode data is displayed at the center of the screen. However, pressing [Subj] with no subjective value entered copies the data in AR or LM mode depending on the Preset power of the Subj parameter. The key selected is displayed in the upper-left corner of the screen.

Pressing a data key with an empty field copies the displayed data into that field. In addition, pressing any data key together with (Shift) copies the displayed data regardless of whether or not data is contained in that field.

See "2.2 Importing Data before Refraction" (Page 24) for data entry method.

4-1. [Unaided]

Measures the unaided visual acuity.

The corrective lens power in the refractor head is 0 D.

4-2. [LM]

Enters the lensometry (LM) data.

4-3. [AR]

Enters the data from an auto refractor or a retinoscope.

4-4. [Subj]

Used to obtain the full correction.

When the data is received from an auto refractometer or a lensmeter via an Eye Care card, this field opens automatically.

4-5. [Final]

Used to obtain the final prescription and best-corrected visual acuity.

Pressing this key copies the full correction data from the subjective data field and adjusts it to the final prescription.

5. Current data

Displays the data of the lens currently inserted in the refractor. Press other data fields to be changed as desired.

The numeric fields where change is possible are highlighted.
The value can be changed with the dial, (+), or (—).

5-1. [S]

Goes into SPH mode which allows spherical powers to be adjusted.

Pressing [S] enters both eye specifications of SPH mode.
Pressing the value S on the R side enters the right eye specifications of SPH mode.
Pressing the value S on the L side enters the left eye specifications of SPH mode.

5-2. [C]

Goes into CYL mode which allows cylindrical powers to be adjusted.

Pressing [C] enters both eye specifications of CYL mode.
Pressing the value C on the R side enters the right eye specification of CYL mode.
Pressing the value C on the L side enters the left eye specification of CYL mode.

5-3. [A]

Goes into AXIS mode which allows cylindrical axis to be adjusted.

Pressing [A] enters both eye specifications of AXIS mode.
Pressing the value A on the R side enters the right eye specification of AXIS mode.
Pressing the value A on the L side enters the left eye specification of AXIS mode.

5-4. [ADD]

Goes into ADD mode which allows addition powers to be adjusted.[*1]

The refractor head converges to the working distance of 40 cm (variable) automatically in near mode.
See the Working Dit. (WD) parameter (page 73).
Pressing [ADD] enters both eye specifications of ADD mode.
Pressing the value on the R side enters the right eye specification of ADD mode.
Pressing the value on the L side enters the left eye specification of ADD mode.

- Each time the key is pressed while the refractor head is in convergence, the addition powers may be added or removed. When the addition powers are removed, the highlight color for ADD on the screen changes and the time display switches to ADD-OFF. Pressing this key again returns the addition power indication to its original and the addition powers are added.

After addition power entry, the WD display appears to select the desired WD with the function key. When the WD is changed in prescription mode, the value is entered as the WD for prescription.

It is possible to switch the mode among [LM], [AR], [Subj], and [Final] in ADD mode.

Note

- When the refractor head is converging, have the patient off his face temporarily from the refractor head.

5-5. [VA]

This is in the bottom row in which, from right to left, right eye visual acuity, both eye visual acuity, left side visual acuity are entered.

Pressing each field goes into the mode to enter the visual acuity using the dial.

5-6. [△⇔]/[△]

Goes into the mode to enter the base in/out prism power in rectangular coordinates or prism absolute value in polar coordinates.

Pressing **[△⇔]** or **[△]** enters both eye specifications of Entering mode.
Pressing the value on the R side enters the right eye specification of Entering mode.
Pressing the value on the L side enters the left eye specification of Entering mode.

See "2.3 Setting Prism Lenses" (Page 29) for prism power entry.

***1. When ADD mode starts in a standard program, the ±0.5D cross cylinder lenses with –90° are set. However, when ADD mode starts by pressing (ADD) without the program, no lenses are set automatically. To set the ±0.5 D cross cylinder lenses, press [ADD ▦].**

5-7. [↕]/[θ]

Goes into the mode to enter the base up/down prism power in rectangular coordinates or prism base angle in polar coordinates.

Pressing **[↕]** or **[θ]** enters both eye specifications of Entering mode.

Pressing the value on the R side enters the right eye specification of Entering mode.

Pressing the value on the L side enters the left eye specification of Entering mode.

6. [VA/ △]

Switches between the VA/ADD display and the prism display.

7. Program start key ([Prog.A] to [Prog. ☼☽])

Displays the program mode currently specified and starts a program.

•Pressing this key again restarts the program from the beginning.

•Pressing this key while holding Shift switches the program among A, B, C, and ☼☽ .

Note

• [Prog. ☼☽] is displayed only when a chart presenting device with the night measurement function is connected.

8. Next chart

Used to display the chart forward next programmed refraction sequence.

•Pressing the front key also forward next programmed refraction sequence.

•Pressing this icon while holding Shift returns to the previous sequence.

9. Present chart

Used to display the chart currently being presented.

• Pressing this icon displays the chart control screen.

• Pressing the left side key of the control box also displays the chart control screen.

10. Display data setting button 1

Pressing this button displays the window specifying the items to be displayed in sub window 1.

11. Sub window 1

Displays the items specified with Display data setting button 1. When no item is specified, the measurement mode values set previously are displayed.

12. Display data setting button 2

Pressing this button displays the window specifying the items to be displayed in sub window 2.

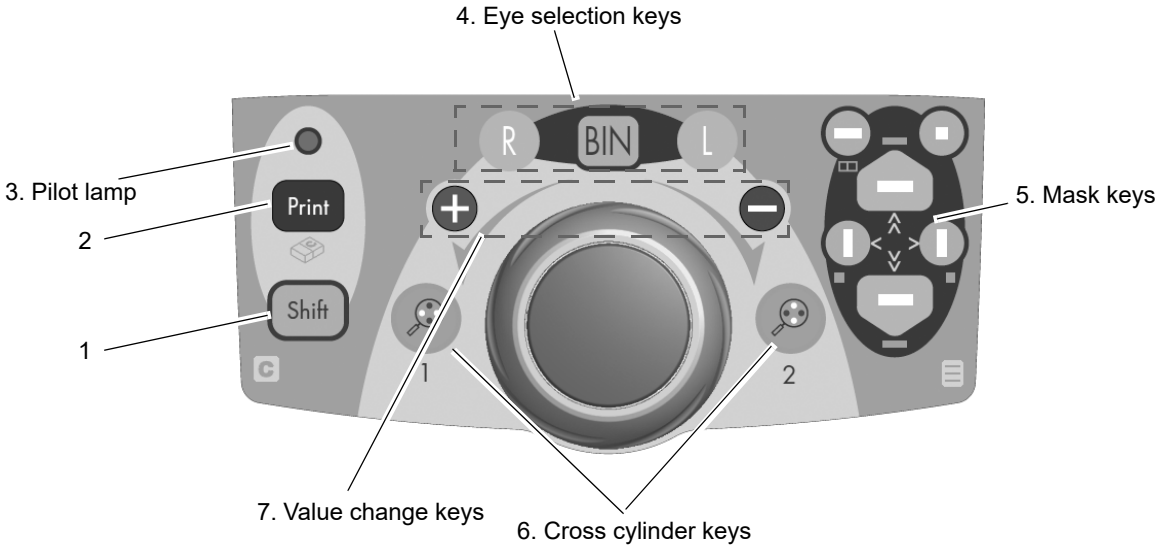
13. Sub window 2

Displays the items specified with the Display data setting button 2. When no item is specified, the measurement mode values set prior to previous ones are displayed. (When the item to be displayed is specified in sub-window 1, the measurement mode values set previously are displayed.)

○ Control panel

The basic keys are indicated in light blue.

* The functions of some keys change when they are pressed with Shift. In this manual, the indication Shift + ▭ means press ▭ while pressing Shift.



1. Shift

Pressing this key changes increments or mode when another key is pressed or the dial is turned.

2. Print

Prints the data or exports it to an external computer.

See "2.8 Printing" (Page 50).

This key is operative on the measurement screen only.

• Shift + Print ⇒ All the displayed data is deleted.

3. Pilot lamp

Lights up in blue while the RT-3100 is powered on.

4. Eye selection keys

Selects the right eye (R), left eye (L), or both eyes (BIN) for subjective refinement.

• The occluder is set automatically to the non-selected eye side.
However, it is not set during the binocular vision test with polarizing filters.

4-1. R

Opens the right measuring window and sets the occluder to the left. It is possible to enter any value for the right eye individually.

When the binocular vision test chart is selected, the left eye side is not occluded but data entry only for the right eye is also possible.

4-2. L

Opens the left measuring window and sets the occluder to the right measuring window. It is possible to enter any value for the left eye individually.

When the binocular vision test chart is selected, the right eye side is not occluded but data entry only for the left eye is also possible.

4-3. BIN

Opens the both measuring windows.

Data entry for both eyes is available.

5. Mask keys

Isolate any horizontal or vertical line or single letter on the chart.

Press any of the chart keys to cancel the mask functions.

The visual acuity of the isolated horizontal line or letter is shown in the VA field on the screen.

5-1. **or**

Isolates a horizontal line letters of the same visual acuity on the top or bottom line of the VA chart.

•This key also moves the isolation up and down when a horizontal line has been isolated.

• Shift + ⇒ Isolates the horizontal line on the top line of the chart.

• Shift + ⇒ Isolates the horizontal line on the bottom line of the chart.

5-2. > , **<**

Isolates a vertical line on the VA chart.

•This key also moves the isolation to the left or right when a vertical line or single letter has been isolated.

• Shift + > or < ⇒ Isolates a single letter in the lower-left or right corner on the chart.

5-3.

Isolates a single letter on the VA chart.

The letter in the upper-right corner of the chart is isolated.

• Shift + ⇒ Isolates a single letter in the upper-left corner of the chart.

5-4.

Isolate a horizontal line in the middle of the VA chart.

• Shift + ⇒ Applies the red-green filter on the VA chart.

• Shift + again ⇒ Releases the red-green filter.

6. Cross cylinder keys

Set a cross cylinder lens to measure the cylindrical axis or power.

When the key is pressed with both windows open, the left measuring window is occluded automatically.

Open the left measuring window by pressing the L side auxiliary lens with pressing Shift to perform the astigmatism test with both windows open.*2

***2. Both windows remain open by pressing (1), (2), [C], or [A] function key.**

6-1. 

- In cylindrical axis measurement, the cross cylinder lens is inserted so that its minus axis is located 45º from the minus axis position of the cylindrical lens.
- In cylindrical power measurement, the cross cylinder lens is inserted so that its minus axis is located 90º from the minus axis position of the cylindrical lens.
- Clears the prism data for the right eye in prism entry mode.

6-2. 

- In cylindrical axis measurement, the cross cylinder lens is inserted so that the minus axis is located at 135º from the minus axis position of the cylindrical lens.
- In cylindrical power measurement, the cross cylinder lens is inserted so that the minus axis is located at 0º from the minus axis position of the cylindrical lens.
- Clears the prism data for the left eye in prism entry mode.

7. Value change keys

Function the same as the dial.

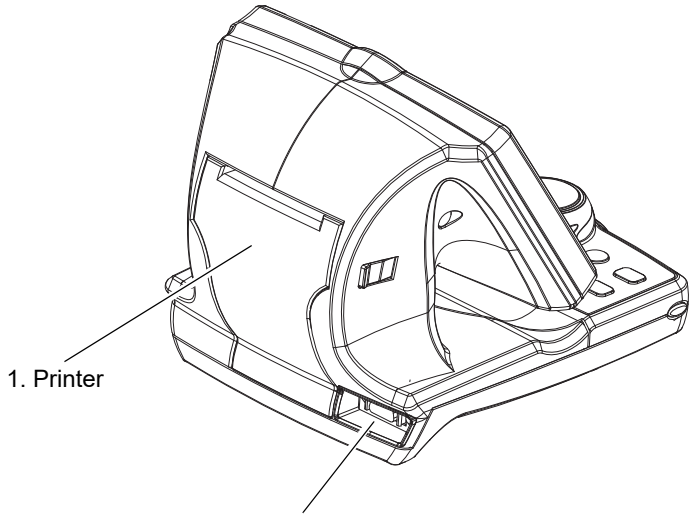
7-1. 

Increases the value positively in 1 increments.

7-2. 

Decreases the value negatively in 1 increments.

○ Rear side of the control box



1. Printer

A printer for printing measurement values is built-in.

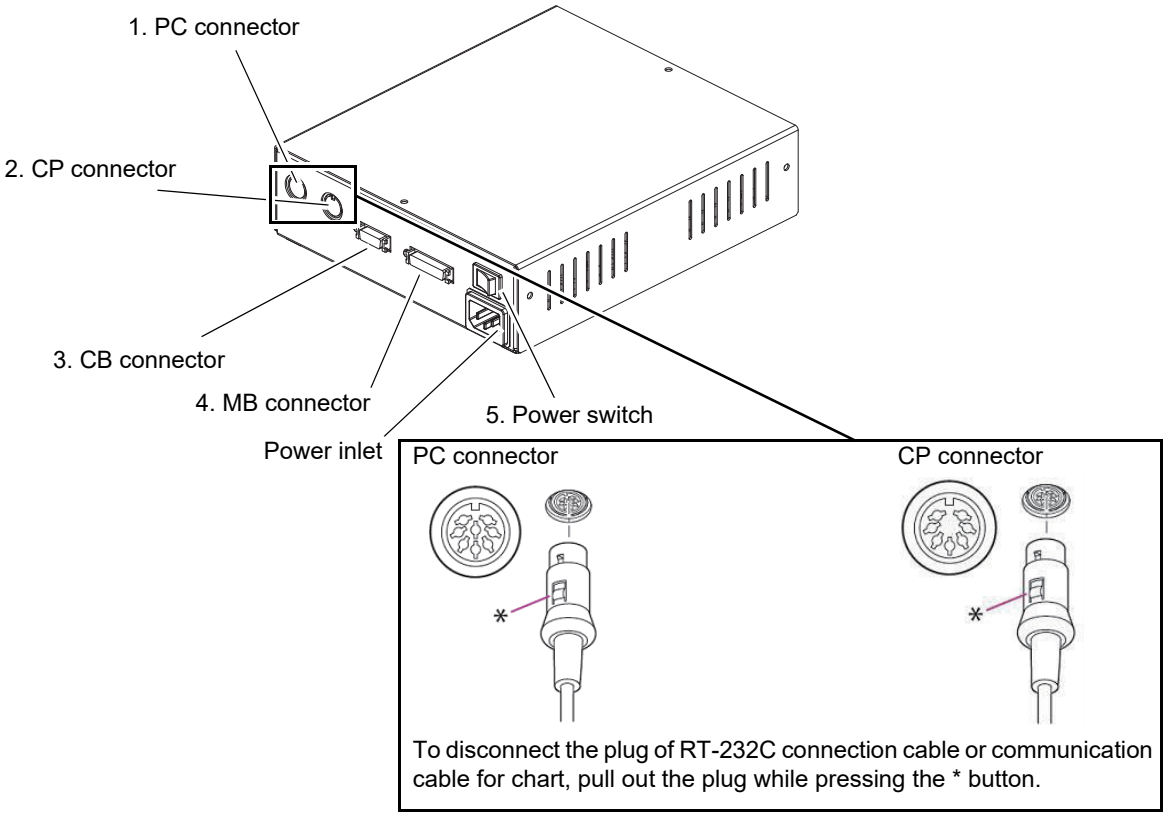
After printing, the paper is automatically cut with space left so that the paper remains in the printer but can be easily pulled free.

2. Communication port

This is a port to be connected to the Relay Box (RB).

1.6.3 Relay box

The relay box is normally installed in the system table.



1. PC connector[*3]

Connects to a computer or an auto refractometer (AR/ARK/RKT/OPD).

2. CP connector[*3]

Connects to a chart presenting device (CP).

3. CB connector

Connects to the control box (CB).

4. MB connector

Connects to the refractor head (MB).

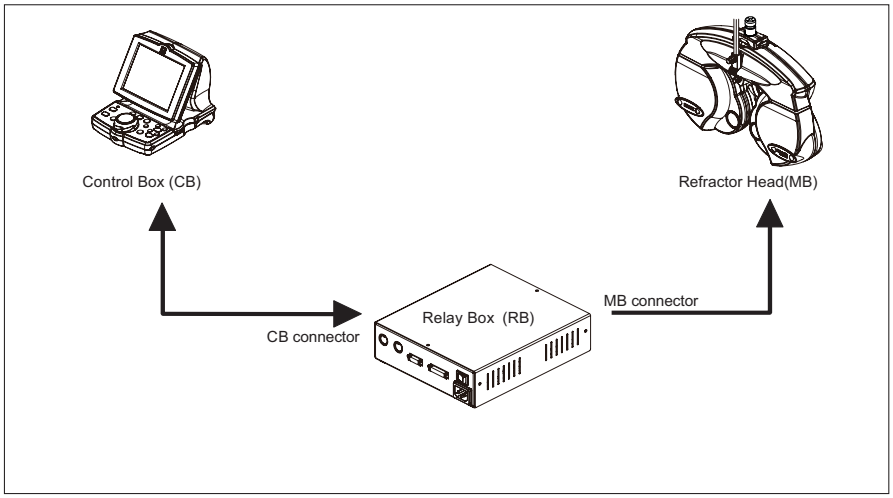
5. Power switch

Turns on/off power to the instrument.

***3 Equipment connected to the analog or digital interfaces must be certified according to the applicable international standards for safety (such as UL 60950-1 for Data Processing Equipment, UL 60601-1 for Medical Equipment, UL 62368-1 for Audio/Video, Information and Communication Technology Equipment, CSA C22.2 No. 601-1, EN 60601-1, and IEC 60601-1). Furthermore, all configurations shall 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.**

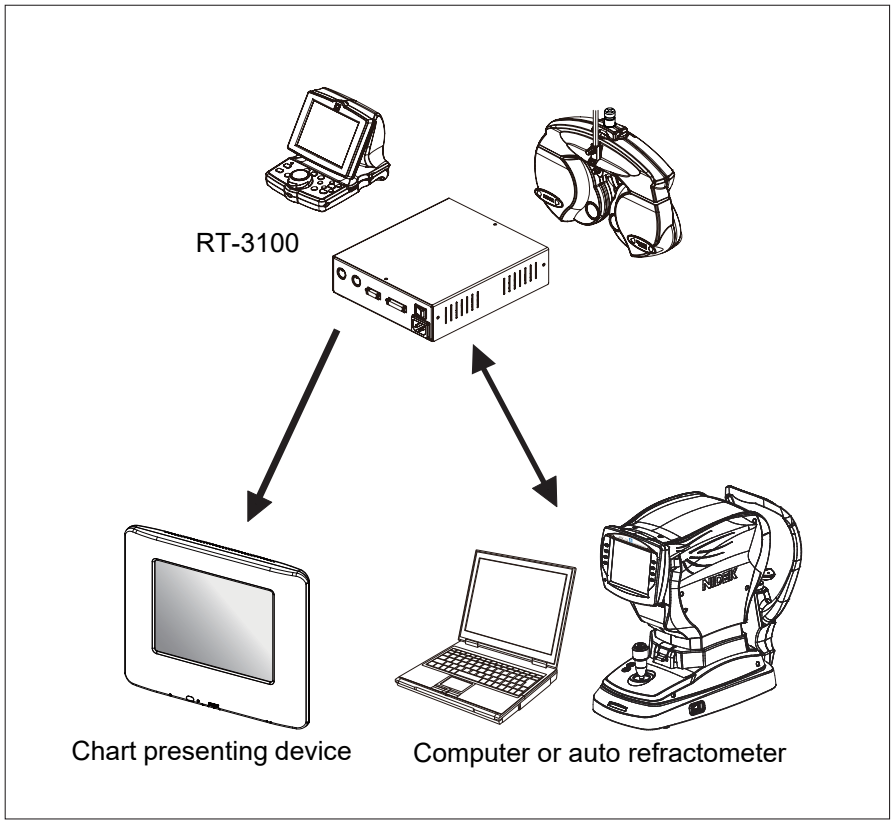
1.6.4 Connecting each unit

The diagram below indicates the configuration of the unit type (for installing the other company's table).



1.6.5 Connecting peripherals

This device can import data measured by an auto refractometer as objective data.
It can export measured data to a computer as well as import AR data and LM data from a computer.



Connecting device	Connection terminal	Function
NIDEK chart presenting device	CP connector	• Switches charts.
Computer	PC connector	• Imports AR data and LM data. • Exports measured data.
NIDEK auto refractometer	PC connector	• Imports AR data that is used for subjective refraction as objective data.

⚠ CAUTION

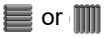
- **When connecting the RT-3100 to other devices, make sure that the cables do not pose a risk to the patient, operator, or others. Also when connecting, removing, or upgrading devices, make sure that there is no risk to the patient, operator, or others.**
- **When connecting a computer, use a computer compatible with CISPR32.**

1.7 Symbols

Cautionary labels are provided on the device.

	Indicates that the operator is advised to refer to the related instructions in the operator's manual.
	Indicates that the RT-3100 is classified as a device with a Type B applied part. * The applied parts is the forehead reset (see 9. in "1.6.1 Refractor head" (page 3)).
	Indicates that the RT-3100 must be supplied only with alternating current.
	Indicates the date of manufacture.
	Indicates the manufacturer.
	Indicates that this product shall be disposed of in a separate collection of electrical and electronic equipment in European Union.
	Indicates that power is not supplied to the instrument.
	Indicates that power is supplied to the instrument.
MD	Medical device
UDI	Unique Device Identifier
REF	Catalogue number
SN	Serial number
EC REP	EU Authorized Representative
CH REP	Swiss authorized representative

The symbols shown on the display correspond to the symbols and those names defined in ISO 10341 (Ophthalmic instruments - Refractor heads) as shown in the following table.

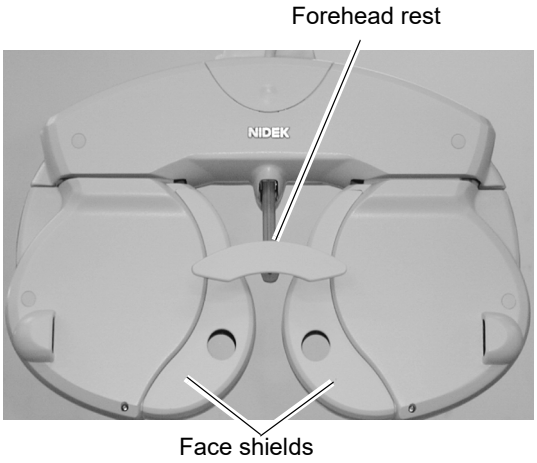
Auxiliary lens	**Marking**		
	RT-3100	**ISO 10341**	
Red maddox rod		MR	Maddox rods
Pinhole plate		PH or 	Pinhole
Occluder		BL or 	Occluder
PD check lens		CL or 	Cross line
Red filter		RF	Red filter
Green filter		GF	Green filter
Polarizing filter		PF	Polarization filter
Open aperture		OA	Open aperture
Lenses for retinoscope		RL	Retinoscope lens

1.8 Before First Use

1 Confirm that the power cord of the system table in which the RT-3100 is installed is connected into a wall outlet.

2 Attach the forehead rest on the refractor head.

See "5.2 Cleaning Forehead Rest" (Page 122) for attachment procedure.

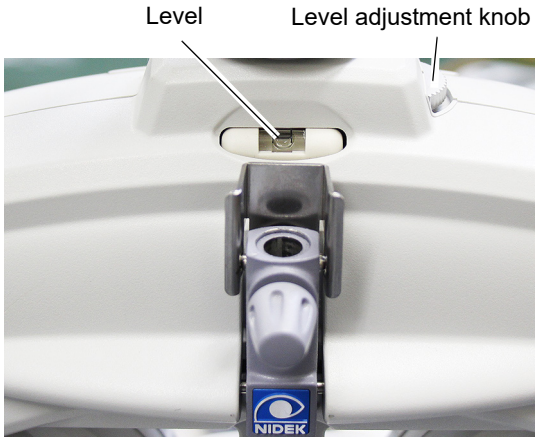


3 Attach the two face shields on the refractor head.

They are magnetic.

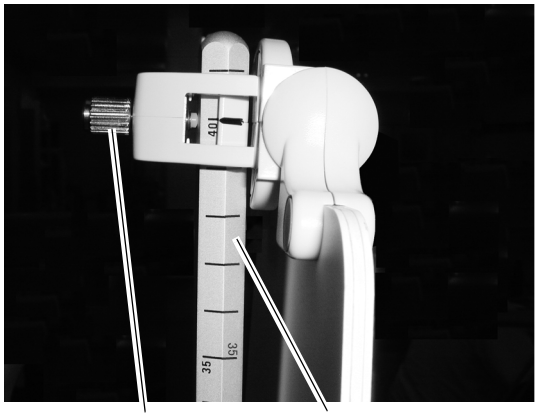
4 Confirm that the refractor head is level.

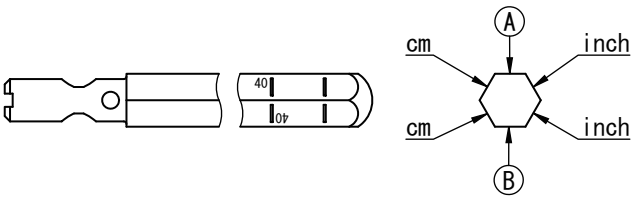
Turn the level adjustment knob until the air bubble is centered in the level.



5 Attach the near point rod to the near point card.

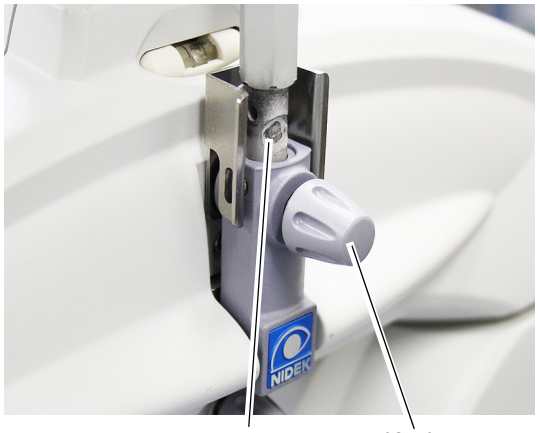
The scales are printed on the near point rod as shown in the diagram below. When centimeters are desired to be displayed on the left viewed from the front, insert the rod into the card with surface A facing the knob, to display centimeters on the right, face surface B to the knob, then lightly tighten the knob.





6 Attach the near point rod in the refractor head.

Two round indentations are located at the base of the near point rod. Insert the rod as far as possible with the round indentation on the opposite side of the near point card knob facing the knob. Tighten the knob.



7 Install the printer paper.

See "5.4 Replacing Printer Paper" (Page 123) for more details.

⚠ CAUTION • **Confirm that the near point rod is securely fastened.**

An improper fastening may cause the near point rod to fall resulting in injury.

1.9 Getting Started and Exiting

1.9.1 Getting started

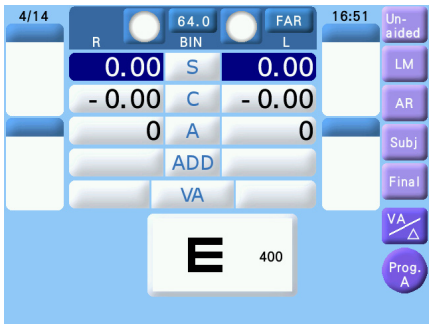
Turn on the RT-3100 and connected chart presenting device such as the SSC-330.

1 Turn on the connected chart presenting device.

2 Remove the dust cover from the refractor head and turn the system table on.

Turn on the power switch of the system table.

The lowest VA chart is presented.



3 Check the following before use.

Perform the following checks before use.

☐ The measuring windows are clean.

☐ The screen to the right appears without any error.

☐ The lowest VA chart is presented in the chart presenting device.

1.9.2 Restoring from power saving mode

If the RT-3100 is idle for about 15 minutes (variable) without any key operation, it goes into power saving mode. In this mode, the screen backlight and chart presenting device lamp go out.
The RT-3100 is restored from this mode by pressing any key.

1.9.3 Exiting

1 Turn the power off.

Turn the system table off.

2 Clean the forehead rest and face shields.

3 Put the supplied dust cover on the refractor head.

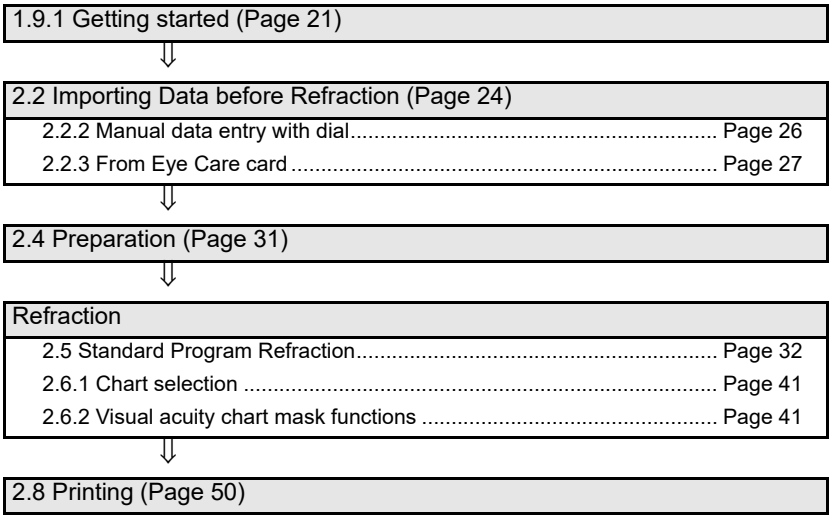
Note

- Be sure to put the dust cover on the refractor while it is not used.

  If optical parts become dirty, the chart viewability is impaired. It decreases the measurement accuracy.

2. OPERATING PROCEDURES

2.1 Operation Flow



2.2 Importing Data before Refraction

This section explains how to import data measured by an auto refractometer or lensmeter before refraction.

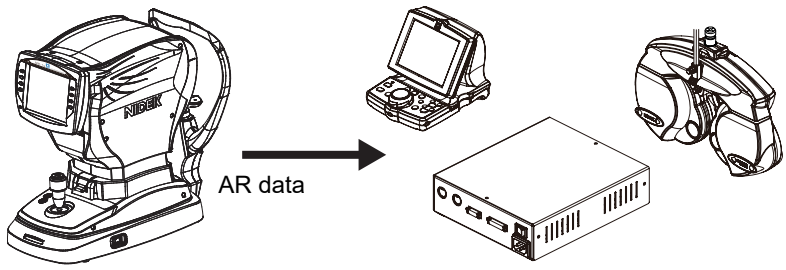
- Data measured by an auto refractometer is handled as objective (AR) data.
- Data measured by a lensmeter is handled as lensometry (LM) data.

Either data can be imported from an auto refractometer, EyeCare card (optional), or entered by dialing.

2.2.1 Data import from auto refractometer

The following explains how to import AR data from an auto refractometer connected to the PC connector.
For the operating procedure of an auto refractometer, refer to the operator's manual of the auto refractometer.

Connectable auto refractometer	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 III series RKT: RKT-7700, TONOREF II, TONOREF III



Auto refractometer RT-3100

Note

- Set the PC port parameter according to the auto refractometer connected.
  See "PC port" (Page 75).
- Set the PATIENT NO. parameter of the auto refractometer to "YES".
  Specify only when the above parameter is available depending on the auto refractometer model.
  For OPD-Scan III series, specify "YES" for AR/KM mode.
- Set the RT TYPE parameter of the auto refractometer to "5100".
  Specify only when the above parameter is available depending on the auto refractometer model.
- It is recommended to set the PRINT parameter of the auto refractometer to "MANUAL".

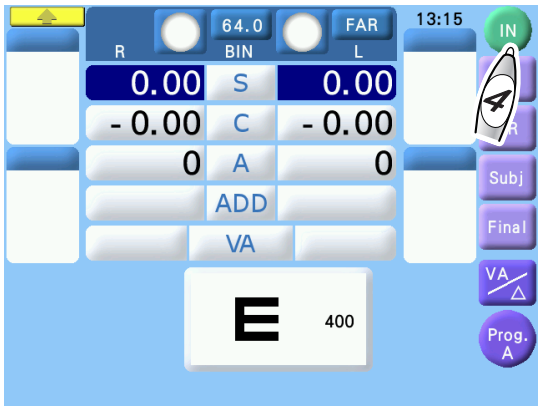
1 Measure the patient's eyes with an auto refractometer.

2 When measured data is obtained, press the print button on the auto refractometer.

Measured data is transferred to the memory of the control box upon printout. (Only one item of data can be stored.)

3 Press Shift.

[Un-aided] changes [IN]. (This indication does not change when the PC port parameter is set to "PC".)

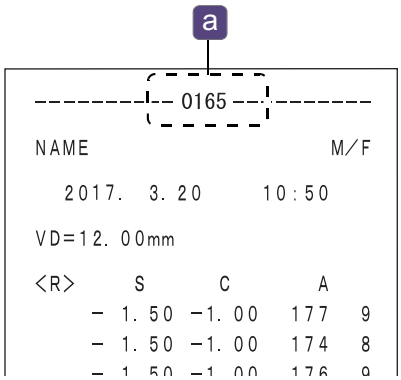


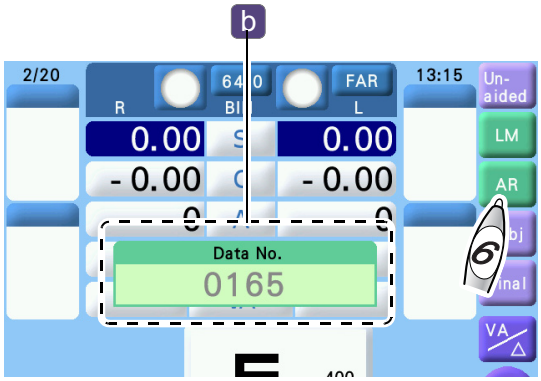
4 Press [IN].

Note

- 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 refractor clears temporarily stored data.

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

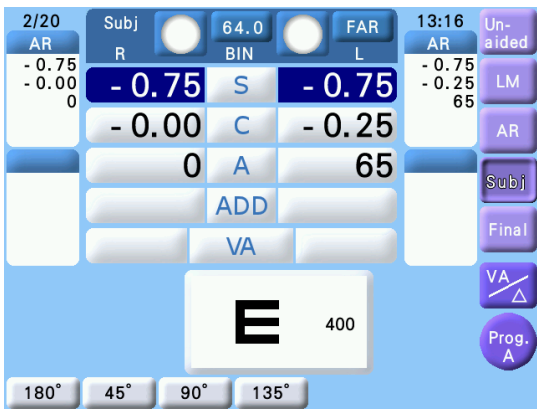




6 If the number is the same, press [AR].

AR data is imported and the device enters subjective refraction mode.

If the Preset power of Subj parameter (Page 74) is set to "LM" and data is already entered in the subjective data field, AR data is not automatically imported.

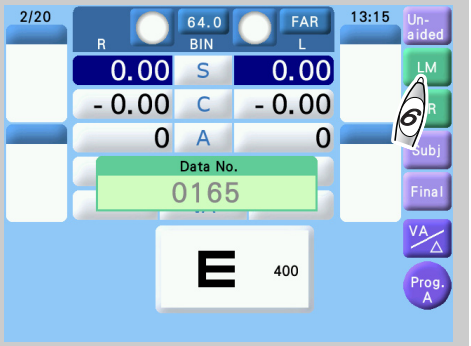


Note

- LM data can also be imported by connecting the lensmeter to the auto refractometer.

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

  To import LM data, press [LM] in Step 6.



2.2.2 Manual data entry with dial

Manual data entry is also available with the dial.

Note

- When the AR or LM data is entered with the dial, the subjective data field does not open automatically.

1 Specify the data to be entered.

Select [LM] or [AR].

2 Press the field in which it is desired to enter values.

The numeric field is highlighted in blue that indicates the numeric value can be entered.

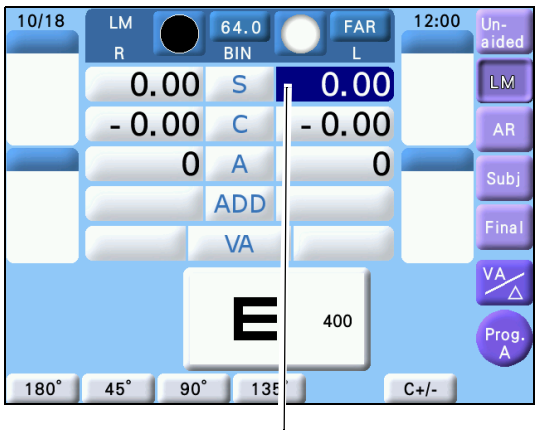
Press [S], [C], [A], or [ADD] to enter the value for both eyes.

3 Specify the mode.

Press the PD display and change key.

4 Enter the values.

Turn the dial to enter the values.



In the highlighted numeric field, a value can be entered.

2.2.3 From Eye Care card

The optional Eye Care card allows data to be entered without connecting an auto refractometer or lensmeter to the RT-3100.

Note

- Data measured by a lensmeter or auto refractometer in the Eye Care card is automatically cleared when imported into the RT-3100. Use the card with all data cleared by saving and importing data for each patient.
- 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.

○ Auto refractometer or lensmeter to Eye Care card

A. When printing the auto refractometer or lensmeter data is unnecessary:

1 Measure the patient's eye with the auto refractometer or measure the patient's glasses with the lensmeter.

2 Write the measured data to an Eye Care card.

Insert the card into the Eye Care card slot of the auto refractometer or lensmeter. The data is written to the card.

B. When printing the auto refractometer or lensmeter data is necessary:

1 Insert an Eye Care card.

Insert a card into the Eye Care card slot of the auto refractometer or lensmeter.

Be sure to insert it before starting measurement.

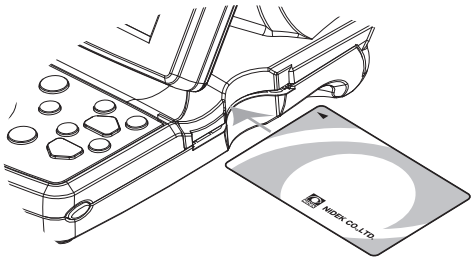
2 Measure the patient's eye with the auto refractometer or measure the patient's glasses with the lensmeter.

3 Press the print key of the auto refractometer or lensmeter.

The measured data is printed and then written to the Eye Care card.

○ Eye Care card to RT-3100

Insert an Eye Care card into the Eye Care card slot on the control box.



The measured data is read to the glass or objective field.

The data in the Eye Care card is cleared.

The refractor head is automatically set according to the measurement data and enters Subjective measurement mode. When both the autoref and lensmeter measurement values are written to the Eye Care card, the data is automatically input in the subjective field according to the Preset power of Subj parameter and enters Subjective measurement mode.

Note

- If measured data of both the lensmeter and auto refractometer are written on the Eye Care card, data is automatically imported in the subjective field according to the setting of the Preset power of Subj parameter (Page 74) and the device enters subjective refraction mode.
- Parameter setting according to the type of data imported from the Eye Care card is possible so that the specified program is automatically set.
  See “Program for imported WF data” to “Program for imported Night data” (Page 76).
- 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.
  See "2.10 Displaying Accommodation" (Page 56).

● Wave Front data entry

If data measured by the OPD-Scan III or ARK-10000 is Wave Front data, the data is imported instead of AR data. In this case, the indication “AR” on the screen or printout is displayed as “WF”.

To import and use Wave Front data, follow the procedure below.

1. Rewrite Program B or C to a program that supports Wave Front data.
2. Change the Program for imported WF data parameter setting to the supported program (see page 75).

● Night data entry

See "2.9.2 Importing AR/LM night data" (Page 54).

2.3 Setting Prism Lenses

2.3.1 Displaying prism values

When ADD or VA is displayed, press [VA/Δ] to go into prism entry mode.

2.3.2 Switching between rectangular and polar coordinates

1 Go into prism display mode.

2 Press [XY] or [rθ] on the screen.

This key toggles between rectangular (XY) and polar coordinates (rθ).

Ex.)

Right eye: 1.0ΔBI, 1.0ΔBU → 1.40Δ, BASE 45°

Left eye: 2.0ΔBO, 1.5ΔBD → 2.50Δ, BASE 323°

2.3.3 Rectangular coordinates (XY)

1 Press [△⇔] on the screen.

The rotary prism lenses are set in the refractor head.

The numeric field of △⇔ is highlighted in blue.

2 Enter base in/out prism powers.

Turn the dial to change the prism powers (in 0.5Δ increments).

Turn the dial clockwise ⇒ The powers increase to the BO (base out) side.

Turn the dial counterclockwise ⇒ The powers increase to the BI (base in) side.

3 Press [↕].

The numeric field of ↕ is highlighted in blue.

4 Enter base up/down prism powers.

Turn the dial to change the prism powers (in 0.5Δ increments).

Turn the dial clockwise ⇒ Left eye: The powers increase to the BD (base down) side.

Right eye: The powers increase to the BU (base up) side.

Turn the dial counterclockwise ⇒ Left eye: The powers increase to the BU (base up) side.

Right eye: The powers increase to the BD (base down) side.

It is also possible to change the prism powers in 0.1Δ increments with ⊕ or ⊖ instead of the dial.

Holding down either key changes the power continuously.

Turning the dial while pressing Shift changes the power in 2Δ increments.

2.3.4 Polar coordinates (rθ)

1 Press [△].

The rotary prism lenses are set in the refractor head.

The numeric field of △ is highlighted in blue.

2 Enter the prism absolute values.

Turn the dial to change the absolute values (in 0.5Δ increments).

It is also possible to change them in 0.1Δ increments with ⊕ or ⊖ instead of the dial.

Pressing either key changes the power continuously.

Turning the dial while pressing Shift changes the power in 2Δ increments.

3 Press [θ].

The numeric field of θ is highlighted in blue.

4 Enter the prism base angle.

Turn the dial to change the angle (in 1 increments).

Turning the dial while pressing Shift changes it in 5 increments.

2.3.5 Removing rotary prism lenses

The rotary prism lenses can be instantly removed with a single touch of any key.

1 Press the key whose numeric field is highlighted in blue from [△], [θ], [△⇔], or [↕] while the rotary prism lenses are set in the measuring windows. (When only single-eye numeric field is highlighted in blue, press the numeric field.)

The rotary prism lenses are removed from the measuring windows.

The highlight color on the screen changes and the time display changes to Δ-OFF. It indicates that the rotary prism lenses are removed.

When the rotary prism lenses are removed, the selected prism powers can be changed.

Pressing [△], [θ], [△⇔], or [↕] again allows the rotary prism lenses to be set.

2.3.6 Prism data clear

The prism powers of the right and left eyes can be cleared separately.

⇒ The prism power of the right eye is cleared.

⇒ The prism power of the left eye is cleared.

2.4 Preparation

1 Place the refractor head in front of the patient's eyes.

1) Clean the forehead rest, face shields, and measuring windows beforehand.

See "5 MAINTENANCE" (Page 121).

2) Instruct the patient to lean against the forehead rest and look through the measuring windows.

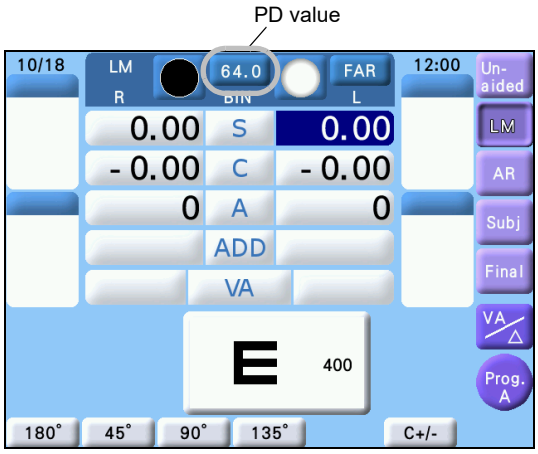
Note

- During refraction, be sure that the patient's forehead does not come away from the forehead rest.

  If the patient's forehead comes away from the forehead rest, proper refraction cannot be performed.

2 Press the PD value (ex.64.0).

The PD adjustment lenses are set in the measuring windows and the anterior segments of the patient's eyes are lighted.



3 Observe the patient's eyes from the operator's side.

Confirm that both eyes are located in the center of each measuring window.

A. When they are shifted horizontally: Turn the dial to adjust the pupillary distance (PD).

B. When either eye is shifted vertically: The patient's head is tilted. Instruct the patient to make the head level.

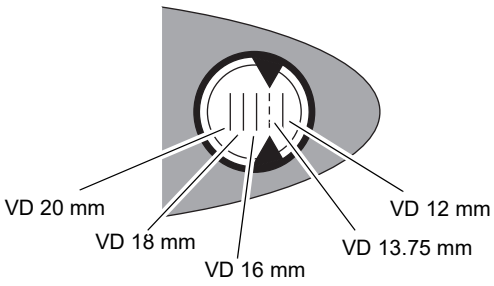
4 Adjust the vertex distance (VD).

1) Look through the VD check windows.

The windows are located on the both sides of the refractor head.

2) Align the patient's corneal vertex to the desired VD marking.

Turn the forehead rest knob.



5 Press the PD value again.

The PD adjustment lenses are removed from the measuring windows and the light goes off.

2.5 Standard Program Refraction

This section explains how to obtain distance full correction and prescription with Program A or Program .

The RT-3100 has four programs: A, B, C, and .

The standard program has already been written in Programs A and as factory setting. Programs B and C are available for user configuration. All of the programs can be edited.

See "7.3 Standard Programs" (Page 136) for all the test items in the standard programs.

Note

- Program is enabled only when the RT is connected with a chart presenting device equipped with the night measurement function.

2.5.1 Program A

The final prescription is obtained after the monocular full correction (subjective data) is stored. The binocular balance test and stereo test are performed in the final field. Then the precise addition power is measured with the cross grid for near vision in the subjective field.

1 Select Program A.

The program is switched by pressing Shift and program start key at the same time.

2 Read the objective data and lensometry data as necessary.

See "2.2 Importing Data before Refraction" (Page 24).

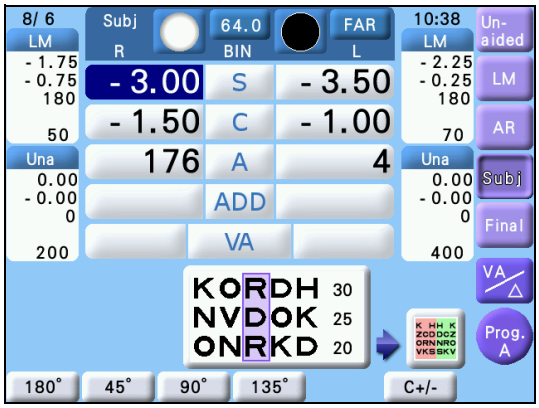
3 Start subjective refinement.

1) Press the program start key (Prog.A).

The left eye is occluded. The subjective refinement starts.

2) Confirm that the patient can read the presented chart.

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



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

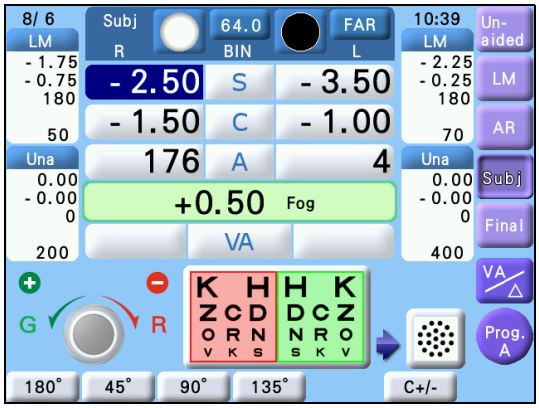
1) Press the front key.

   The SPH +0.50 D lens is automatically added to fog the vision. The red-green chart is presented.

2) Reduce fogging gradually until the sharpness of the letters on the red and green sides appears equal.

   Letters on the red side are sharper. → Turn the dial clockwise incrementally.

   Letters on the green side are sharper. → Turn the dial counterclockwise incrementally.



Note

- In this spherical refinement, circle of least confusion is maintained on the retina for the next cylindrical axis measurement with the cross cylinder. When the patient cannot see the red and green sides equally, make the green side sharper slightly.

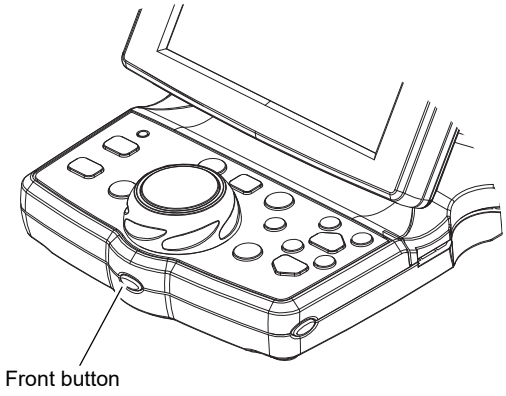
5 Measure the cylindrical axis.

1) Press the front key.

   The dots chart is presented.

   A cross cylinder lens (±0.25) is set.

2) Measure the cylindrical axis with the cross cylinder lens.



   Ask the patient which is sharper, chart 1 presented by pressing (1) or chart 2 presented by pressing (2).

   When chart 1 is sharper.

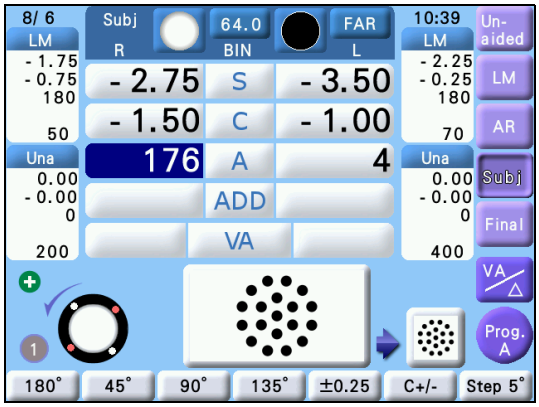
   → Turn the dial counterclockwise incrementally.

   (Also possible by pressing ⊕)

   When chart 2 is sharper.

   → Turn the dial clockwise incrementally.

   (Also possible by pressing ⊖)



   Repeat the above until the both charts appear equal.

6 Measure the cylindrical power.

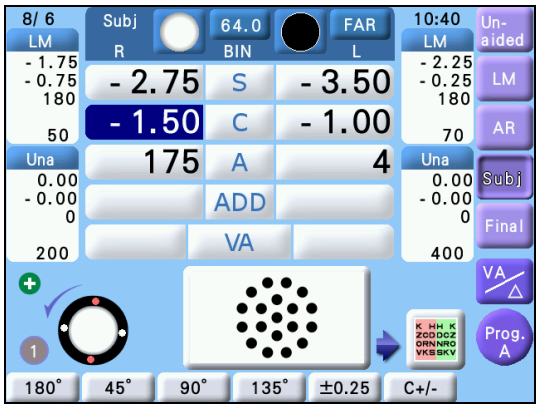
1) Press the front key.

   The dots chart appears.

   The cross cylinder lens axis changes.

2) Measure the cylindrical power with the cross cylinder lens.

   Follow the same procedure as 2) of Step 5.



7 Refine the spherical power with the red-green chart.

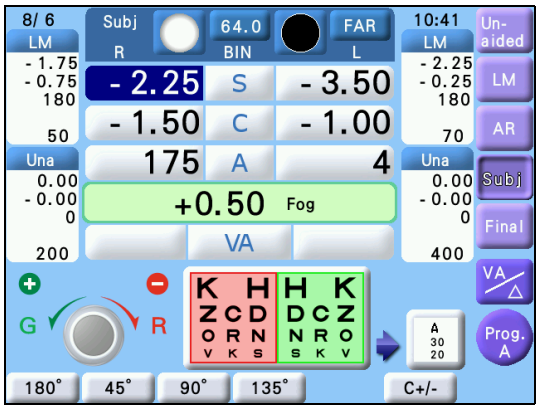
1) Press the front key.

   The SPH +0.50 D lens is automatically added to fog the vision. The red-green chart is presented.

2) Reduce fogging gradually until the sharpness of the letters on the red and green sides appears equal.

   Letters on the red side are sharper. → Turn the dial clockwise incrementally.

   Letters on the green side are sharper. → Turn the dial counterclockwise incrementally.



Note

- When the patient cannot see the red and green sides equally, make the red side sharper slightly. It avoids overcorrection.

8 Refine the spherical power as high as possible to achieve the best possible visual acuity.

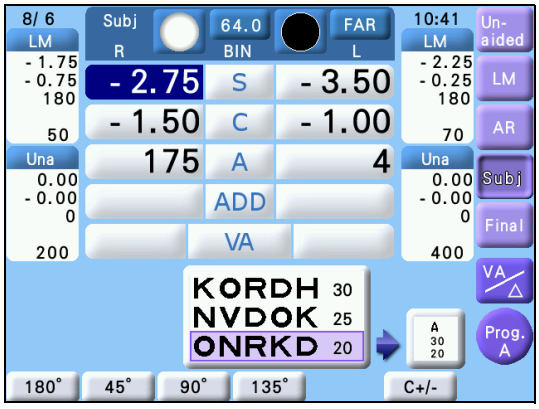
1) Press the front key.

   The isolated 20/20 line is presented.

2) Check the best possible visual acuity with ⊖ or ⊕.

3) Refine the spherical power as high as possible to achieve the best possible visual acuity.

   Turn the dial counterclockwise to add SPH +0.25 D. When the chart appears blur, turn the dial clockwise 1 increments.

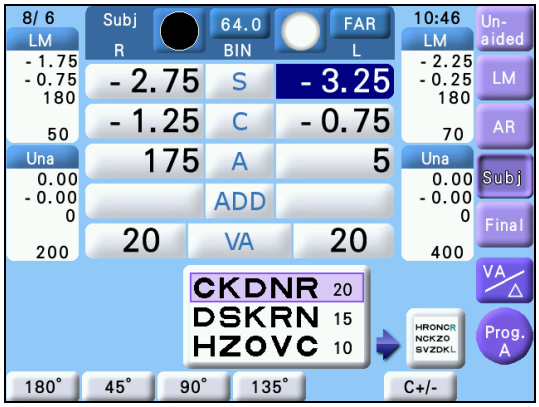


Note

- Instead of the above procedure, the best possible visual acuity can be determined as follows:
  1) Add approximately SPH +0.75 D of fogging.
  2) Present a visual acuity chart for which the visual acuity is decreased by a few increments.
  3) When the patient can read the VA chart, press ▭ to increase the visual acuity. When they cannot read the chart, add SPH -0.25 D to release the fogging and ask them to read it again.
  4) Repeat the procedure to determine the best possible visual acuity with the most plus power.

The spherical power for the right eye is perfectly refined.

9 Follow the same procedures as Steps 3 to 8 for the left eye.



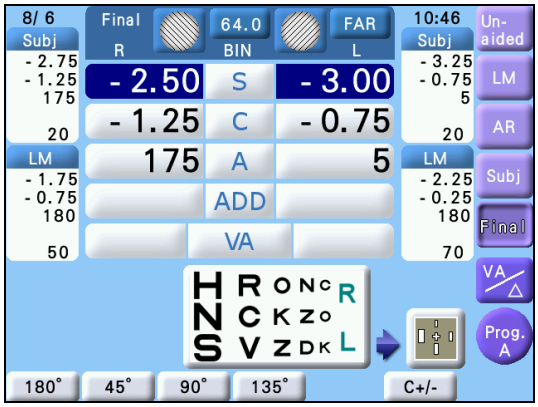
The spherical power for the left eye is perfectly refined.

10 Press the front key.

Three short beeps are audible.

11 Perform the binocular balance test.

1) Press the front key.

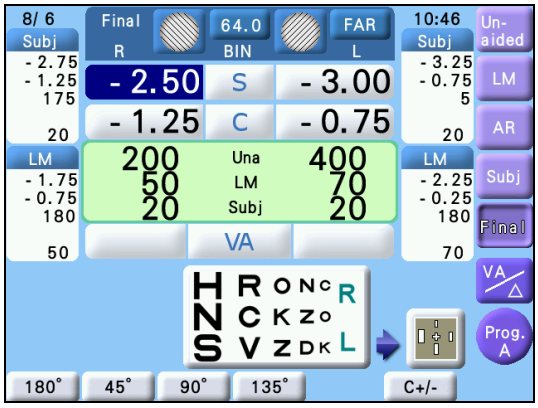


The polarizing filters are set in the measuring windows;

Right eye: 135º, Left eye: 45º

When the three lines chart is not displayed in three lines or the two lines chart is not displayed in two lines, the binocular balance test cannot be performed. In this case, present the VA chart and adjust the both eyes vision by covering the single eye.

2) Make the top and bottom lines appear equal.



The top line is sharper.

→ Press (R) and turn the dial counterclockwise incrementally.

The bottom line is sharper.

→ Press (L) and turn the dial counterclockwise incrementally.

When the patient can see them equally, the binocular vision is balanced.

Note

- Binocular balance test can be performed with the binocular red-green chart. See "4.5.2 Binocular red-green test" (Page 91).
- When the patient cannot see the top and bottom lines equally in the binocular balance test, determine with which eye they view the binocular balance chart more clearly while referring to the visual acuity with LM data or dominant eye.

The binocular spherical power is perfectly refined.

12 Perform the stereo test.

1) Press the front key.

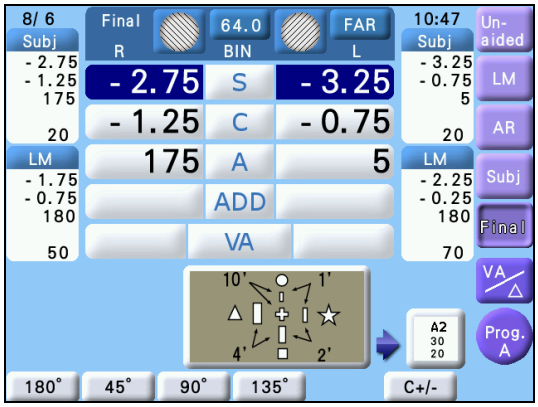
   The polarizing filters are set in the measuring windows.

   Right eye: 135º, Left eye: 45º

   The stereo test chart is presented.

2) Confirm that the patient can see four vertical lines stereoscopically.

   For a patient who can not see those lines stereoscopically, perform the binocular visual function test as necessary. See "4.5 Binocular Visual Function Test" (Page 89).



When the patient has stereoscopic vision with a high accuracy (normally 1′) and has no symptoms of headache or eye strain, his/her phoria is usually negligible. When the patient can recognize the stereoscopic difference between the top and right lines, his/her stereoparallax is 1′. In this case, it is considered that the phoria test is skipped.

13 Adjust the power for spectacle correction.

1) Press the front key.
2) Press  or  to present the desired visual acuity chart.
3) Adjust the correction to the highest plus power with the best possible visual acuity.

14 Check the visual acuity with the current correction (Final value for prescription).

If necessary, remove the refractor head and place the “FINAL” data in a trial frame to confirm that the patient has the best corrected comfortable visual acuity with this lens combination.

1) Press (R).
2) Check the visual acuity of the patient’s right eye.

   Press ⬭ or ⬭ to change the isolated line.
3) Press (L).
4) Check the visual acuity of the patient’s left eye.

   Press ⬭ or ⬭ to change the isolated line.
5) Press (BIN).
6) Check the binocular visual acuity.

   Press ⬭ or ⬭ to change the isolated line.

15 Compare the lensometry (LM) data with the FINAL data.

1) Press [LM].

   Lensometry data lenses will be set in the measuring windows.

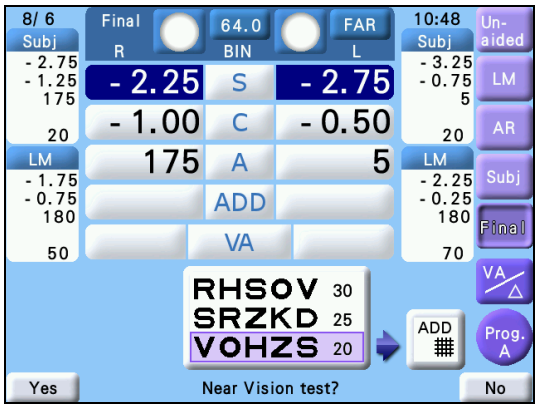
   Ask the patient, “Which lens is more clear and comfortable?”.

16 Select whether the near vision test is performed or not.

1) Press the front key.

   The “Near Vision test?” message appears.

2) Select whether the near vision test is performed or not.



   Perform the near vision test.

   → Select [Yes].

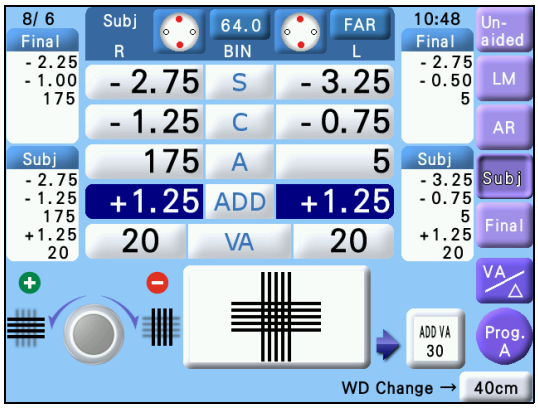
   The cross cylinder lenses are set and near point lamp lights up. The refractor head converges. When the refractor head is moving, keep the patient’s face away from the refractor head. When the conversion is finished, have the patient place their forehead on the forehead rest and view through the measuring windows.

   Cancel the near vision test.

   → Select [No]. Program A is finished. Go to Step 21.

17 Pull down the near point rod and set the near point card to the desired working distance (normally 40 cm).

18 Measure the addition powers.



1) Select the cross-grid chart on the near point card.

2) Ask the patient, "Which lines are sharper, the horizontal or vertical ones? Or are they about the same?"

   Horizontal lines → Turn the dial counter-clockwise incrementally until the lines appear equal.

   Vertical lines → Turn the dial clockwise incrementally until the lines appear equal.

   Same → It is not necessary to change the addition powers.

Note

- When the patient cannot see the horizontal and vertical lines equally, change the addition power so that the horizontal lines appear sharper than the vertical ones.

19 Check the near visual acuity.

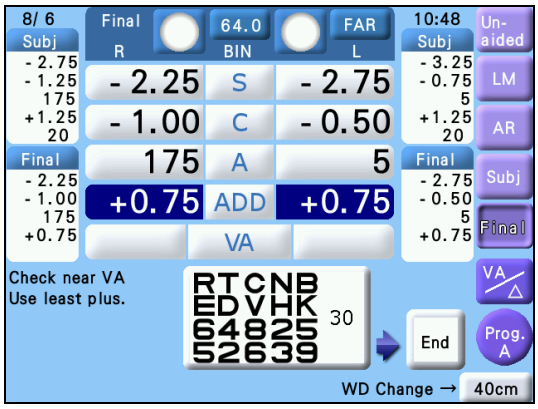
1) Press the front key.

   The cross cylinder lenses are removed.

   Set the values of the addition powers adjusted in Step 13 subtracted from the ones measured in Step 18 as the addition powers for prescription.

2) Reverse the near point card and place the visual acuity chart in front of the patient.

3) Confirm that the patient can read the letter whose visual acuity is 20/30.



20 Press the front key.

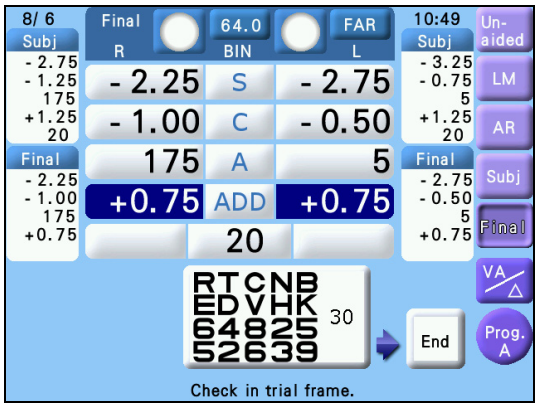
Program A is finished.

The near point lamp goes out.

21 Print the measured data.

Press Print .

22 Place the final prescription lens in a trial frame.



2.5.2 Program Day/Night

Program ☀☽ is a program to determine the day full correction based on the objective measurement data and then determine the night full correction based on the day full correction data.

Note

- To measure with Program ☀☽, a chart presenting device with the night measurement function (SSC-350 series, SSC-370 series, SC-1600, SC-1600Pola, or SSC-100) is required.
- In this explanation, the front button is pressed to proceed to the next step during program refraction. Pressing the next chart icon also allows to proceed to the next step.

1 Select Program ☀☽.

If "Prog.☀☽" is not selected for the program start button on the screen, press the program start button while holding Shift to change the button selection.

2 Read the objective data and lensometry data as necessary.

See "2.2 Importing Data before Refraction" (Page 24).

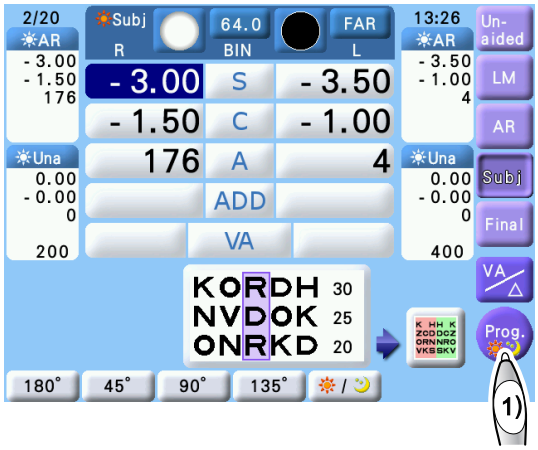
3 Start subjective refinement.

1) Press the program start button (Prog.☀☽).

   The left eye is occluded. The subjective refinement starts.

2) Confirm that the patient can read the presented chart.

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

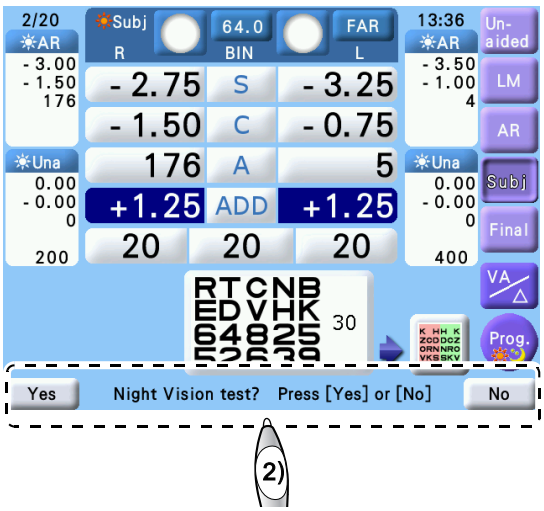


4 Measure the binocular full corrective power and addition power for day vision in the same manner of Steps 4 to 9 of "2.5.1 Program A" (Page 32).

5 Select whether to perform night measurement.

1) Press the front button.

A confirmation message appears asking if you want to perform night measurement.



2) Select [Yes] or [No].

- When performing night measurement-> Press [Yes].
  The visual acuity chart is displayed at the brightness for night vision.
- When not performing night measurement.-> Press [No].
  Program is finished. Go to Step 10.

6 Measure the binocular full corrective power for night vision in the same manner of Step 4 to Step 14 in "2.5.1 Program A" (Page 32).

Note

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

7 When the binocular full corrective power for night vision is obtained, press the front button.

Program is finished.

8 Print the measured data.

Press Print .

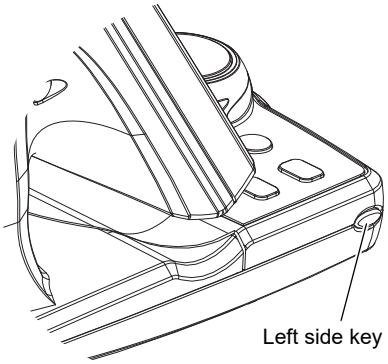
9 Place the final prescription lens in a trial frame.

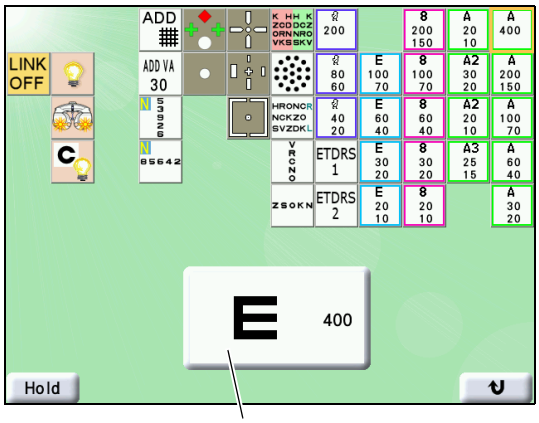
2.6 Chart Presentation

2.6.1 Chart selection

1 Press the left side key.

The chart control screen appears.





2 Press the desired chart key at the right of the screen to present the corresponding chart.

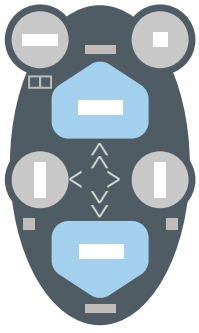
The selected chart appears.

The presenting chart can be checked in the chart display field at the center of the control box display.

Normally, the screen returns to the measurement screen at the time of selecting the chart. Pressing [Hold] beforehand holds the chart control screen. In this case, press the presenting chart icon or [↻] to return to the measurement screen.

2.6.2 Visual acuity chart mask functions

Press any mask key on the control box to use the mask functions.



Note

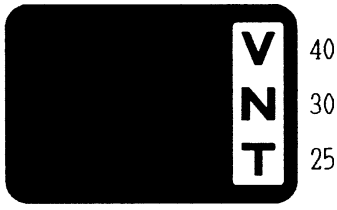
- The SC series displays the isolated segment in the center of the screen instead of isolating the chart with mask functions.

○ How to isolate a vertical line

Press (▯)< or >(▯).

When the vertical line is isolated:

- Press (▯)< or >(▯). ⇒ The isolation moves to the left or right. (When the same key is pressed again to continue



moving an isolation located at one end of the chart, short beeps are audible and the isolation moves to the opposite end of the chart.)

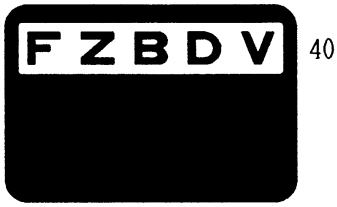
- Press ⊖ or ⊖. ⇒ The isolation moves up or down.

Note

- For charts with four columns on the SSC, the vertical isolated line is moved between only the two columns in the middle.

○ How to isolate a horizontal line

Press ⊖. ⇒ The top line is isolated.
Press ⊖. ⇒ The middle line is isolated.
Press ⊖. ⇒ The bottom line is isolated.



When the horizontal line is isolated:

- Press ⊖ or ⊖. ⇒ The isolation moves up or down.
- Press Ran-dom (only SC series). ⇒ The letter order is randomly rearranged at the same VA. When a single VA is displayed (low visual acuity etc.) for the cortical vision letter, vertical line letter, or single letter, the letter order is also randomly rearranged at the same VA.
- Press ⊖ (only SC series). ⇒ The letter order is randomly rearranged at the same VA.

Note

- The VA value is automatically entered. (Except for when Prism is displayed)

○ How to isolate a single letter

Press ▫.
⇒ The letter in the upper-right corner of the chart is isolated.
Press Shift + ▫.
⇒ The letter in the upper-left corner of the chart is isolated.
Press Shift + ▯<.
⇒ The letter in the lower-left corner of the chart is isolated.
Press Shift + >▯. ⇒ The letter in the lower-right corner of the chart is isolated.

When a single letter is isolated:

- Press ▯< or >▯. ⇒ The isolation moves to the left or right.
  (When the same key is pressed again to continue moving an isolation located at one end of the chart, short beeps are audible and the isolation moves to the opposite end of the chart.)
- Press ⊖ or ⊖. ⇒ The isolation moves up or down.

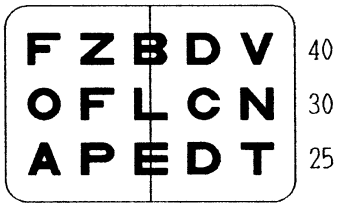
Note

- For the T type chart, there are two letter charts of 1.0 to prevent patient memorization. When the horizontal line or single letter isolation is moved to up or down, or the same visual acuity chart is selected twice or more, the two charts are presented alternately.
- The VA value is automatically entered. (Except for when Prism is displayed)

○ How to apply the red-green filter

Press Shift + ⊖.

The red-green filter is applied to the presented visual acuity chart.



While the red-green filter is applied;

- Press ⊖ or ⊖.
  ⇒ The visual acuity chart changes to another.
- Press Shift + ⊖. ⇒ The red-green filter is released.

○ How to release the mask and filter

Pressing any chart key releases the applied mask or filter.

Chart presentations with the mask keys (without Shift)

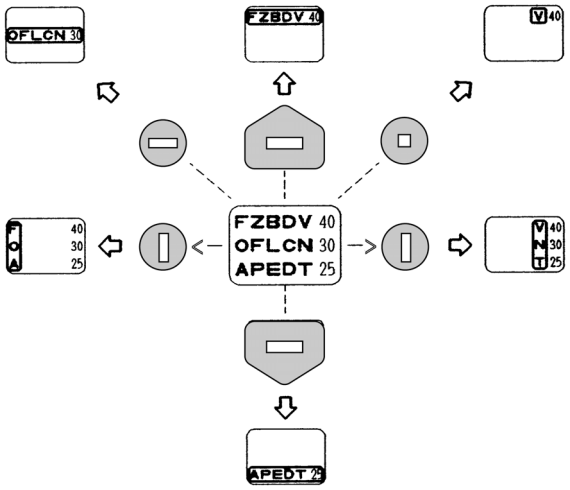
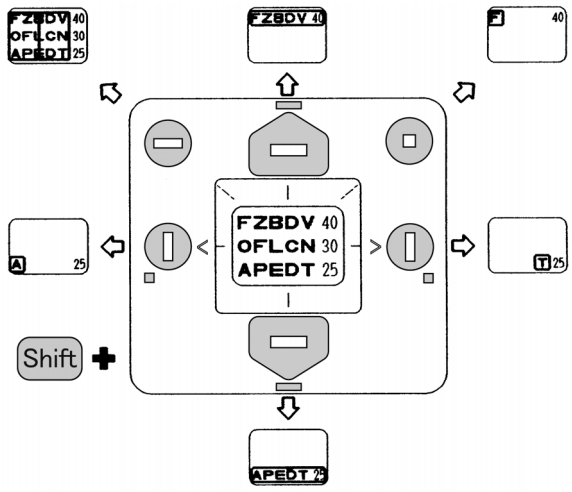
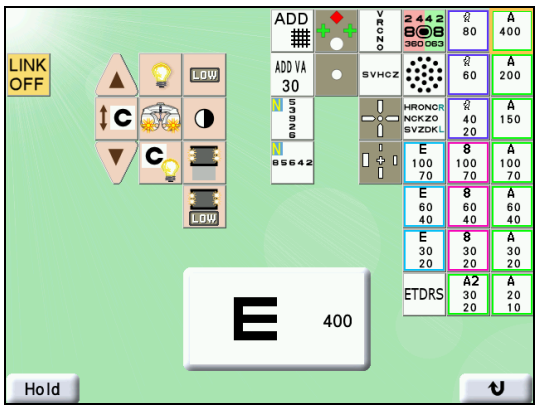


Chart presentations with the mask keys (also with Shift)



2.6.3 Chart lamp, near point lamp ON/OFF, and SSC chart position adjustment

The buttons on the left of the chart control screen can be used to turned on/off the chart lamp and the near point chart lamp. In addition, the SSC, chart presenting position can be adjusted.



: Turns off the chart lamp, display backlight, and near point lamp. Pressing any other button returns the lamp to the original state.

: Turns on or off the chart lamp.

: Turns on or off the near point lamp (near point chart lamp) equipped on the refractor head.

: With the patient placing their forehead on the forehead rest and viewing the SSC through the measuring windows, press this button to adjust the SSC chart presenting position automatically according to the measuring window height.

: Moves the SSC chart presenting position up.

: Moves the SSC chart presenting position down.

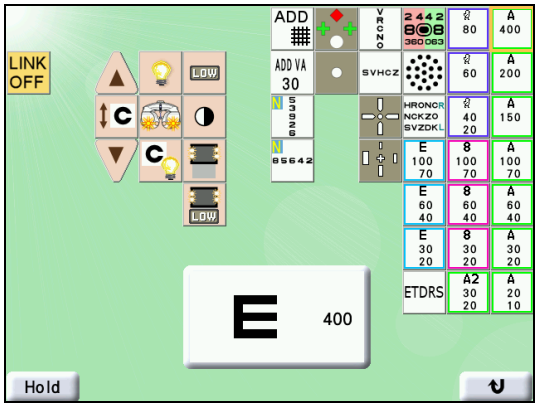
* , , are displayed only when connected to the SSC.

2.6.4 Low illumination, glare lamp, and contrast functions (SSC series)

When the SSC-350, SSC-350CG, SSC-330U (equipped with optional glare lamp), or SSC-370 is connected, the following functions are available.

	Low illumination	Glare lamp	Contrast
SSC-350T/M/ SSC-370T/UK/M	Available	Unavailable	Unavailable
SSC-370MG	Available	Unavailable	Unavailable
SSC-350TCG/MCG/ SSC-370MCG	Available	Available	Available
SSC-330U	Unavailable	Available	Unavailable

When the SSC-350, SSC-350CG, or SSC-370 series is connected, keys such as LOW are displayed on the left of the chart switching key. (Buttons of the function that is not equipped with the SSC used are not displayed.)



: Turns on or off the glare lamp.

The glare function makes it possible to test the visual acuity under dazzling conditions. This function can evaluate vision deterioration caused by decreased contrast when scattered light reaches the macular part of the eye due to opacity or irregularity of the lens.

is shown to the right of the displayed chart on the chart control screen when the glare lamp is turned on.

This button can also change the glare lamp luminance only for the SSC-350MCG, SSC-330U (equipped with optional glare lamp), SSC-370MCG, or SSC-370MG. For the SSC-350MCG and SSC-330U (equipped with optional glare lamp), pressing changes the luminance in the order of high luminance → medium luminance → low luminance → OFF. For the SSC-370MCG or SSC-370MG, pressing changes the luminance in the order of low luminance → medium luminance → high luminance → OFF.

: Switches between the low-light illumination and standard light illumination.

The low-light illumination function make it possible to test the visual acuity under night-time conditions. This function can test whether or not the subject can recognize the low-light chart for reference to diagnose light sense disturbance.

LOW is shown to the right of the displayed chart on the chart control screen when of the low-light illumination.

Note

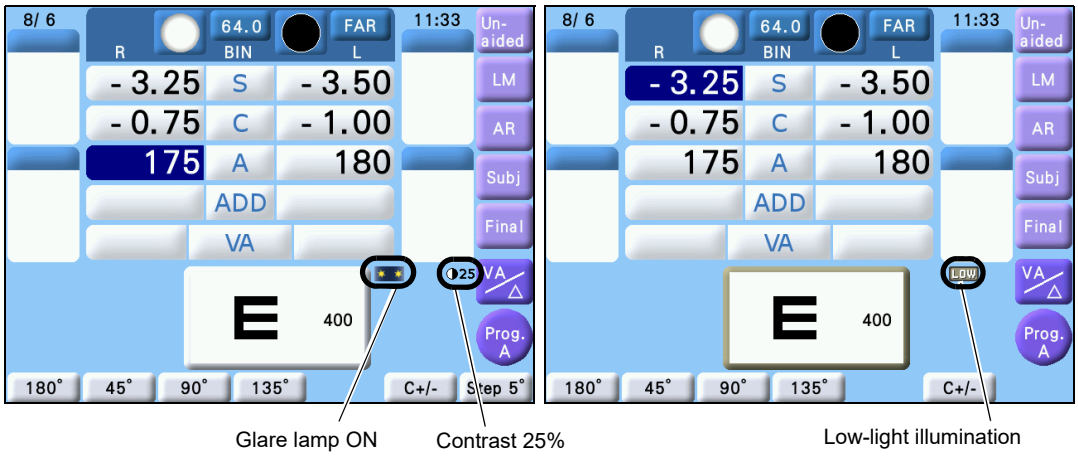
- The low illumination function can be used at any time during refraction.

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

The contrast function makes it possible to test the visual acuity under low-contrast conditions (25%, 12.5%, 6%). This function can evaluate the visual function according to contrast sensitivity, which is not measured in the standard test, and can observe changes with time.

◑25 is shown to the right of the displayed chart on the chart control screen when the contrast is 25%, ◑12 is shown when the contrast is 12.5%, and ◑6 is shown when the contrast is 6%.

:Turns the glare lamp on at high luminance when the low illumination function is enabled. (Only SSC-350MCG and SSC-370MCG/MG)

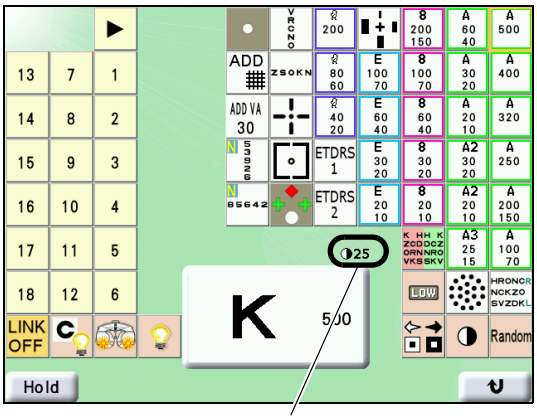


Note

- The glare lamp, and contrast functions are available at any time during refraction other than when in Near mode.
- The low illumination and contrast functions cannot be used at the same time.

2.6.5 Contrast function, Night mode, and reverse function (SC series and SSC-100)

When the SC series is connected, ◑ or ⇦■⇨ is displayed on the chart control screen as shown to the right.

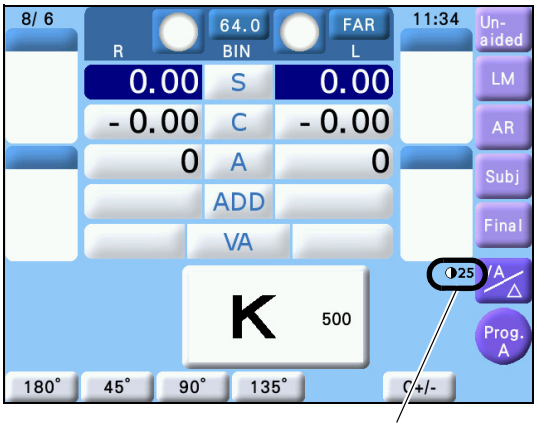


Contrast 25%

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

The contrast function makes it possible to test the visual acuity under low-contrast conditions (25%, 12.5%, 6%). This function can evaluate the contrast sensitivity visual function, which is not measured in the standard test, and can observe changes with time.

◑25 is shown to the right of the displayed chart on the chart control screen when the contrast is 25%, ◑12 is shown when the contrast is 12.5%, and ◑6 is shown when the contrast is 6%.

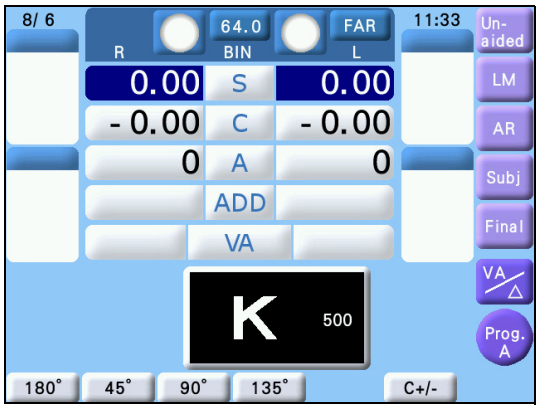


Contrast 25%

Note

- Contrast can be tested at any time during VA measurement.
- Contrast other than VA chart cannot be changed.

⇦■⇨:Inverses the VA chart each time pressed.

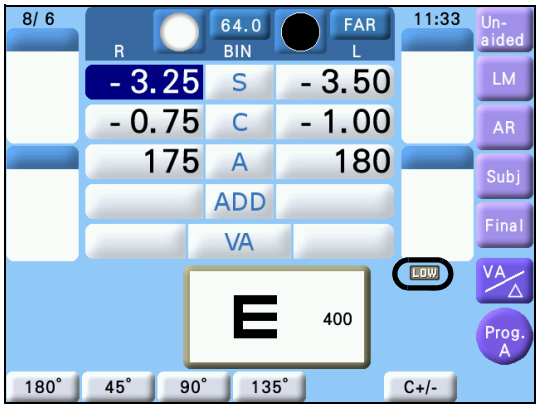


Note

- The inverted VA chart (white letters in black) is used for the special test such as amblyopia and VA value is a reference value.

: Switches between the low-light illumination and standard light illumination. (SC-1600, SC-1600Pola, and SSC-100 only)

The low-light illumination function makes it possible to test the visual acuity under night-time conditions. This function can test whether or not the subject can recognize the low-light chart for reference to diagnose light sense disturbance.



LOW is shown to the right of the displayed chart on the chart window when of the low-light illumination.

Note

- The low illumination function can be used at any time during refraction when in VA measurement.

○ Displaying contrast VA chart (SC-1700Pola Type G+, SC-1600Pola Type G+ only)

For the Type G+ chart of the SC-1700Pola, the chart with the same visual acuity can be presented in three contrast levels so that the contrast sensitivity can be compared.

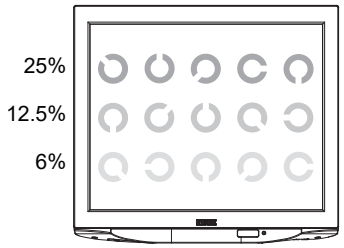
This is used for when visual acuity measurement is performed under low contrast conditions (25%, 12.5%, or 6%). It allows visual function evaluation by contrast sensitivity and highlights deterioration caused by age that is not readily apparent under normal visual acuity measurement.

Press the chart key to be displayed from 0.4 ccc to 1.6 ccc on the chart control screen.

The contrast VA chart appears.

Each contrast level is presented with 25% at the top, 12.5% in the middle, and 6% at the bottom.

Press or to change the visual acuity chart.



Note

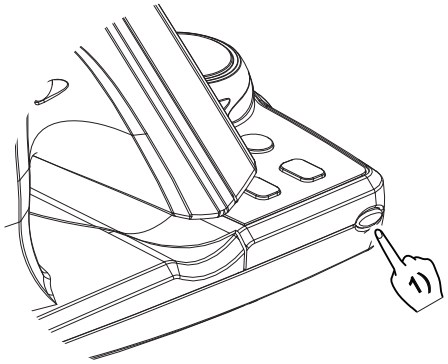
- In the contrast VA chart, the red-green filter cannot be applied and neither vertical/horizontal line isolation or single letter isolation can be displayed.

2.7 Link Off Function

This function prevents auxiliary lenses or mode (S/C/A) from being switched automatically when changing a chart.

1 Press the left side key.

The chart control screen appears.



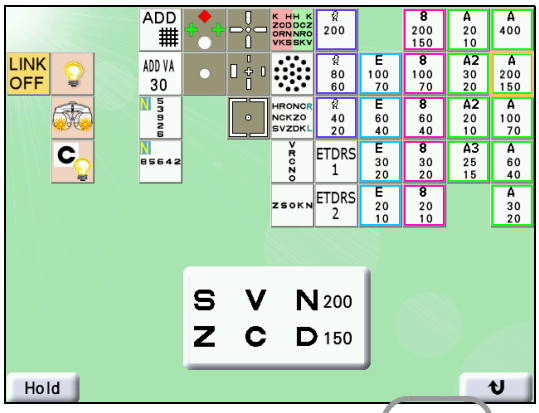
2 Press LINK OFF.

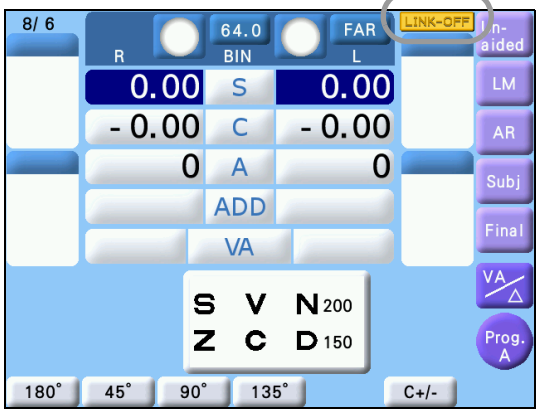
LINK-OFF is displayed on the current chart display and indicates that the link is turned off.

The link off function makes the following possible even when any chart key is pressed.

- The auxiliary lenses are not set automatically.
- The mode (S/C/A) is not switched.
- The visual acuity is not entered automatically when any mask key is pressed.

Pressing the program start key or front key switches the chart.





Note

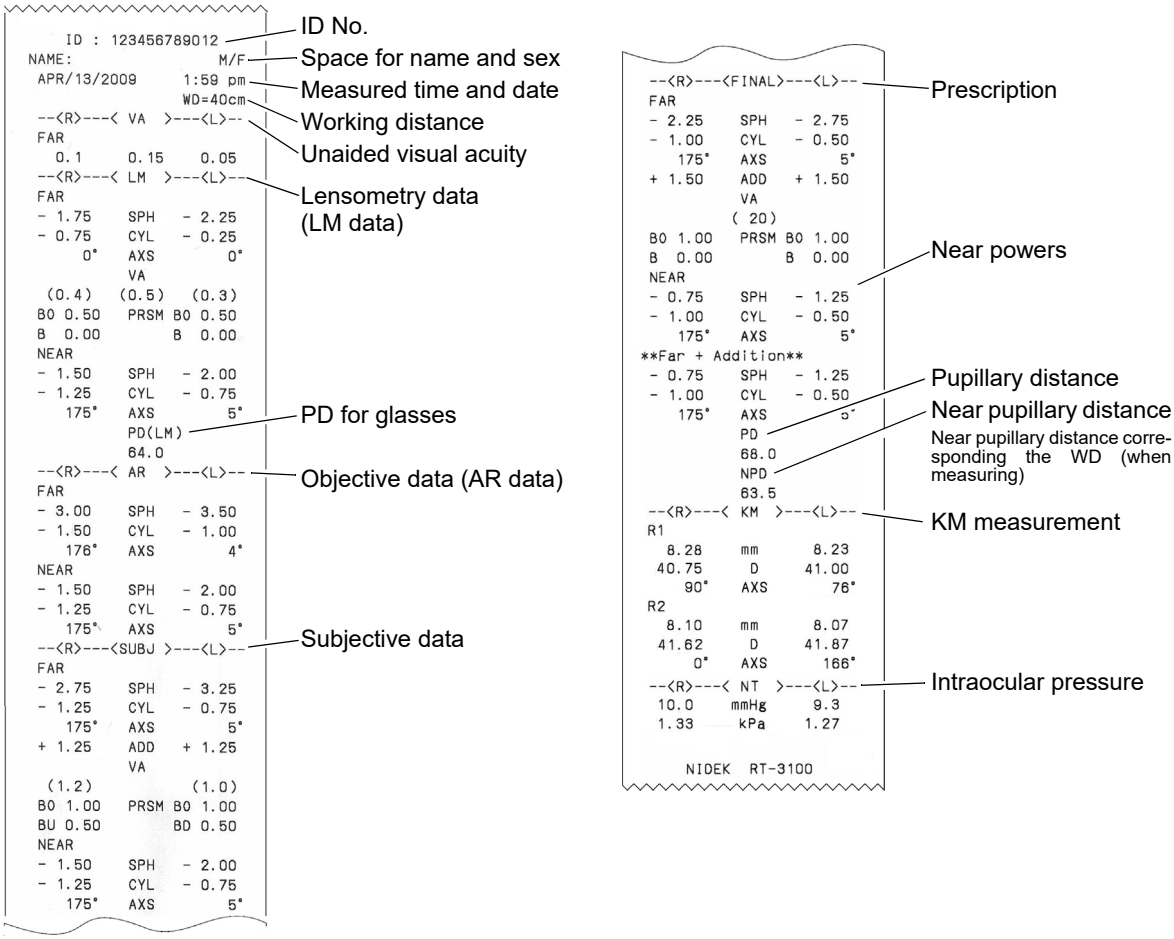
- The link off function is not canceled even when Shift + Print is pressed or the power is off and on.
- The linkage functions only when ADD VA or ADD is pressed in the link off function.

Pressing LINK OFF on the chart control screen again cancels the function.

2.8 Printing

The data is printed with (Print).

Printout sample:



Note

- The device uses thermal printer paper. When saving long term, save a copy of the printout.

  Thermal paper may become difficult to read due to age deterioration. If glue including an organic solvent or pressure sensitive adhesive adheres on the printer paper, the printing may become faded and difficult to read.

○ Whether the CL data (CL conversion value) is printed or not

The Print CL data parameter selects whether the CL conversion value of the subjective data is printed together with the normal data. See "3.9 Parameter Settings" (Page 71).

○ Whether the trial lens data is printed or not

The Print TL data parameter selects whether the trial lens (TL) data for the final prescription is printed together with the normal data. See "3.9 Parameter Settings" (Page 71).

○ Whether the data is cleared after printing

The Clear after print parameter selects whether the displayed data is cleared automatically after printing. See "3.9 Parameter Settings" (Page 71).

The last printed data for one patient will be stored in the system until the next printout is performed. See "3.5 Calling Up Most Recent Data" (Page 62).

○ KM measurement

To print the keratometry (KM) measurements converted to diopters, it is necessary to set the I/F Format parameter in the ARK to All.

2.8.1 Printing with QR code

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

○ When the QR code parameter is set to “QR1”, the final data and the QR code are printed. See Figure1.

○ When the QR code parameter is set to “QR2”, all entered data and QR code of final data are printed. See Figure 2.

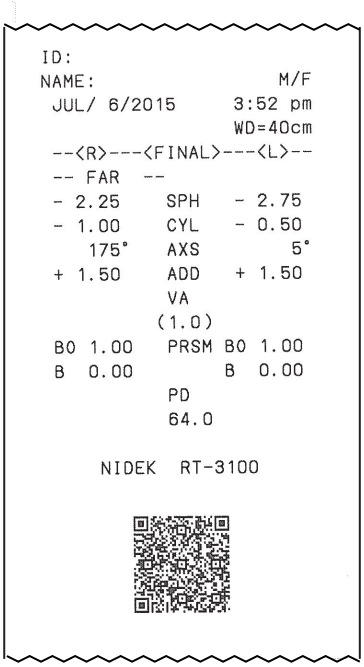


Figure 1

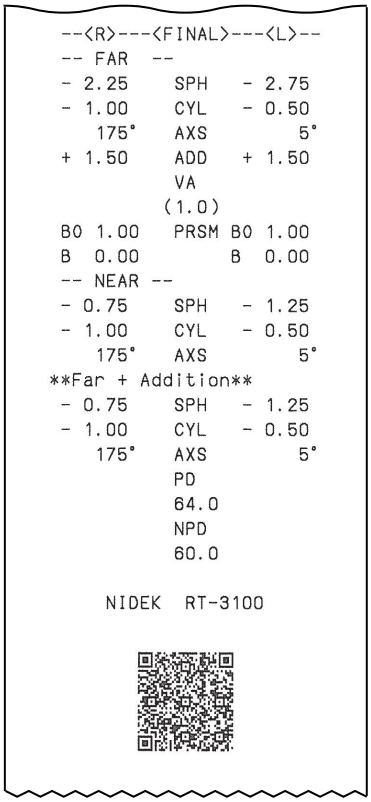


Figure 2

⚠ CAUTION • **If paper is rounded, QR code may not be identified. Smooth out paper before reading.**

Note

• For details of printed QR code, ask NIDEK or your authorized distributor for the QR code manual in which the specifications is described.

2.9 Night Mode

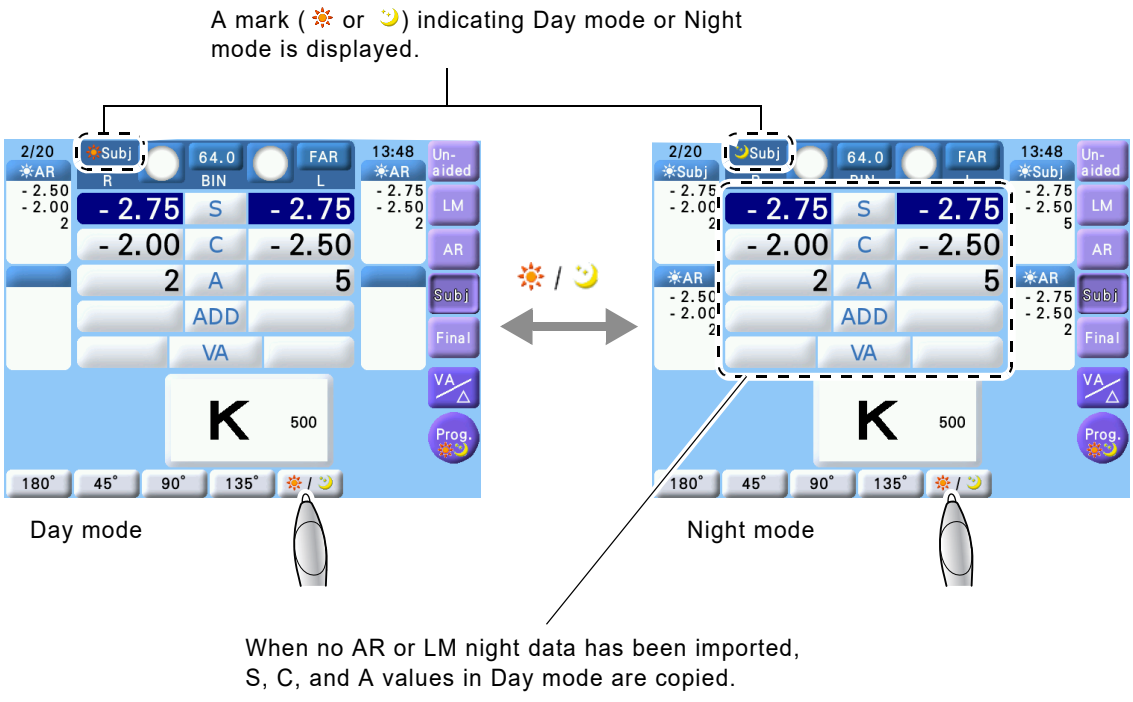
This section explains how to switch between Day mode and Night mode and to import AR/LM night data.
Night mode is a mode in which subjective refinement is performed in a dark place, and the chart is presented with brightness for night vision.

Note

- To measure in Night mode, a chart presenting device with the night measurement function (SSC-350 series, SSC-370 series, SC-1600, SC-1600Pola, or SSC-100) is required.

2.9.1 Switching between Day mode and Night mode

Pressing the function button [☼ / ☽] switches between Day mode and Night mode.
When the Display Day/Night switching button parameter is set to “Yes”, [☼ / ☽] is displayed.
When AR/LM night data is imported with day data using the Eye Care card, [☼ / ☽] is displayed regardless of the parameter setting.
In addition, when starting or the displayed data is cleared, Day mode is automatically activated.



2.9.2 Importing AR/LM night data

One of the following data can be imported as night data. The data is used as the starting value for the measurement in Night mode.

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

○Importing AR night data from auto refractometer connected via RS-232C cable

Day data and night data measured by an auto refractometer are imported together.
See "2.2.1 Data import from auto refractometer" (Page 24).

○Importing AR night data from Eye Care card

Day data and night data measured by an auto refractometer can be saved to an Eye Care card together and imported into the RT-3100.
See “○ Eye Care card to RT-3100” (Page 28).

○Importing LM night data from Eye Care card

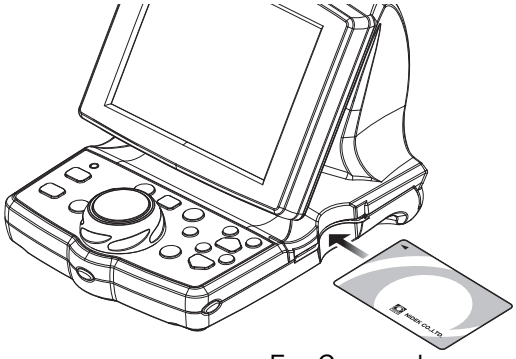
Day data and night data measured by a lensmeter cannot be saved together to an Eye Care card. Therefore, follow the procedure below to import LM night data obtained by measuring the patient’s night vision glasses with a lensmeter.

1) Import day data to the RT-3100.

   See “○ Eye Care card to RT-3100” (Page 28).

2) Remove the Eye Care card from the Eye Care card slot.
3) Press [/] to put the RT-3100 into Night mode.
4) Insert the Eye Care card to which LM night data is saved.

   LM night data is added to the RT-3100 as night data.



Eye Care card

Note

- LM data that is read together with AR data from the Eye Care card is imported as day data.
- LM data independently read from the Eye Care card is imported as day data when the RT-3100 is in Day mode, as night data when in Night mode.

2.9.3 Day/night measurement

This section gives a brief explanation of performing night measurement after day measurement.
To perform night measurement continuously after day measurement, Program is provided in the standard program. For details, see "2.5.2 Program Day/Night" (Page 39).

1 Import day data and night data.

The device enters subjective refraction mode for day vision.

2 Perform subjective refinement based on the day data.

3 Press [/].

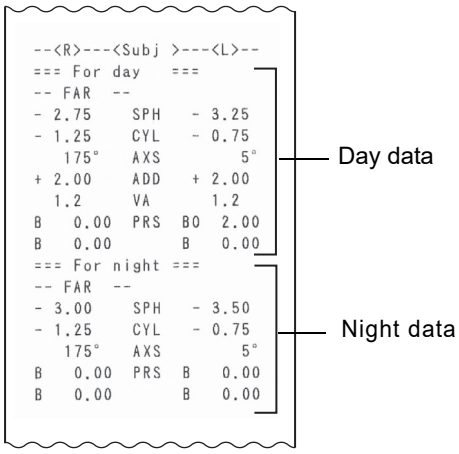
The device enters subjective refinement mode for night vision.

The program set by the Program for imported Night data parameter is automatically activated.

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

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

"For night" is printed above the night measurement result, indicating that it is data of glasses to be used in a dark place.



2.10 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.

(1) Measure accommodation with an auto refractometer that is equipped with the accommodation measurement method and import the data with AR data to the RT-3100.

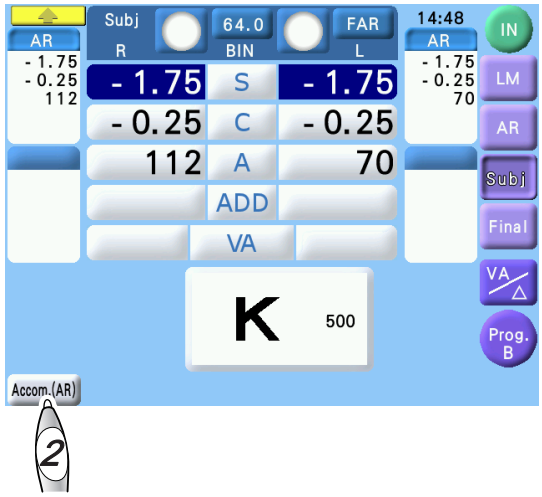
(2) Import the AR data as objective data that is displayed on the measurement screen.

See "2.2.1 Data import from auto refractometer" (Page 24) and "2.2.3 From Eye Care card" (Page 27).

1 Press Shift on the measurement screen.

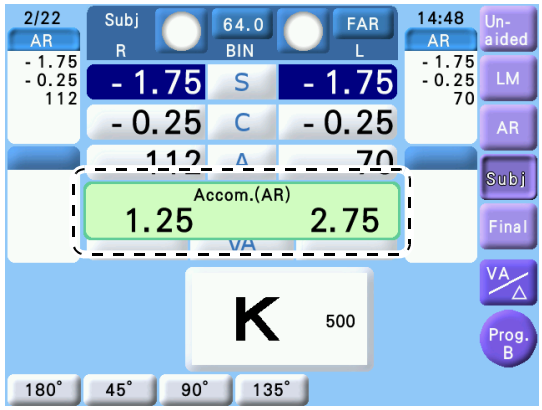
The function button [Accom.(AR)] is displayed.

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



2 Press the [Accom.(AR)] button.

The Accom.(AR) window appears.



Note

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

3. ADVANCED FEATURES

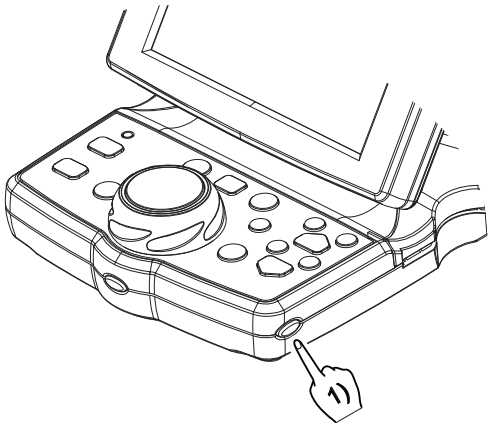
3.1 Data List

It is possible to show all measured data by a list.

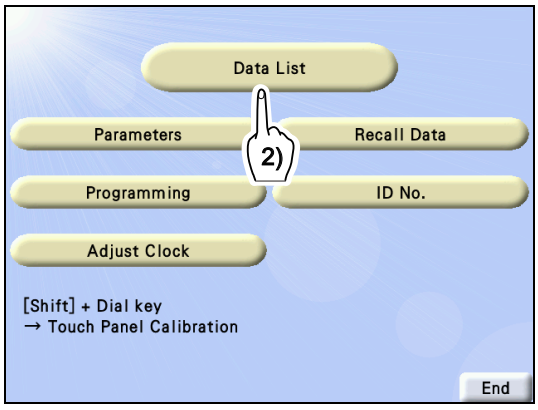
1 Select [Data List].

1) Call up the Main Menu screen.

Press the right side key.



2) Press [Data List].

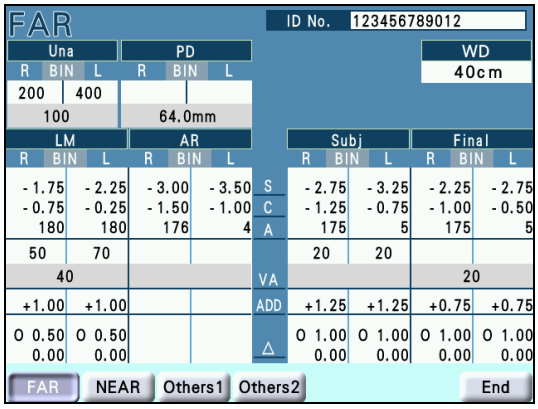


2 Select the desired data.

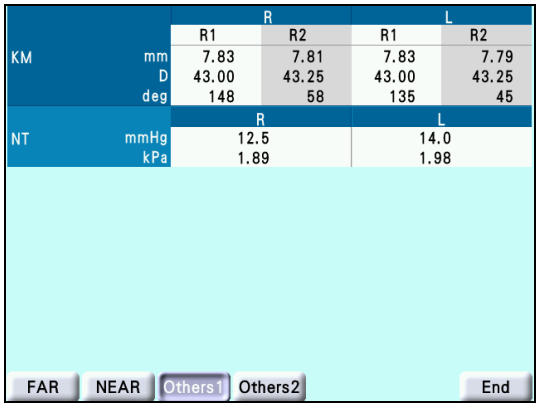
Select the data with the function key.

[FAR]... List of distance measurement data

[NEAR]...List of near measurement data



[Others1] displays Kerato data and intraocular pressure data.



[Others2] displays subjective data, contact lens conversion value[*4], prescription data[*5], and data for trial lens are displayed.

[End] returns to the normal measurement screen.

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

***5.** **When the RT-3100 has no final prescription, the subjective data is displayed.**

3.2 Setting Auxiliary Lenses

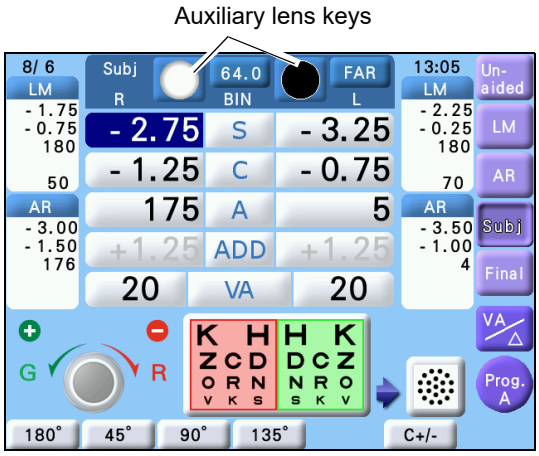
Auxiliary lenses are automatically set according to a selected chart. However, setting other lenses are also possible as follows:

* It is possible to switch the lens power for retinoscope (+1.5/+2.0) and to set the fog amount for both eyes open.

1 Open the auxiliary lens screen.

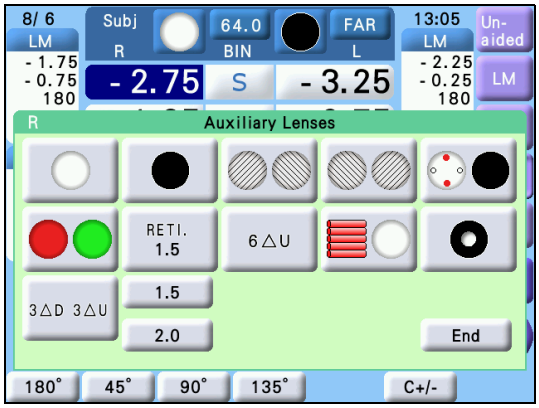
Press the auxiliary lens key at the top of the measurement screen.

Alternately pressing this key while pressing (Shift) switches the open/close of the measuring window.



2 Select the desired auxiliary lens with the corresponding key.

The selected auxiliary lenses are set in the refractor head and the screen returns to the main measurement screen.



[○]: Open aperture

[●]: Occluder

[▨]: Polarizing filters (Right eye: 45º, Left eye: 135º)

[▨]: Polarizing filters (Right eye: 135º, Left eye: 45º)

[◌●]: Right eye: Fixed cross cylinder lens, Left eye: Occluder

[●◌]: Right eye: Occluder, Left eye: Fixed cross cylinder lens

[●●]: Right eye: Red filter, Left eye: Green filter

[RETI 1.5]: Spherical lenses for retinoscope

The lens power is selectable with [1.5] and [2.0].

[1.5]/[2.0]: Selects the spherical lens power for retinoscope between +1.5D and +2.0D.

[6ΔU]: Base up prism of 6Δ

[10ΔI]: Base in prism of 10Δ

[▤○]: Right eye: Horizontal maddox rod, Left eye: Open aperture

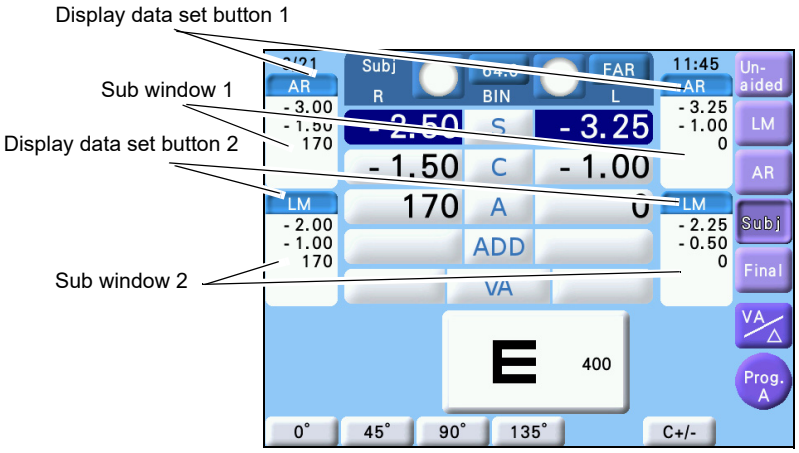
[○▥]: Right eye: Open aperture, Left eye: Vertical maddox rod

[◉]: Pinhole plate (ϕ 2 mm)

[3ΔD 3ΔU]: Base down prism of 3Δ in the right eye, base up prism of 3Δ in the left eye

3.3 Specifying Sub Window Display Data

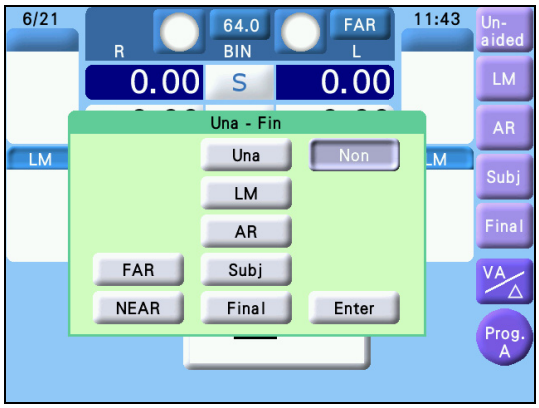
Items to be displayed in sub window 1 and 2 can be specified.
When no item is specified, the measurement data previously set in sub window 1 and measurement data set prior to previous one is displayed in sub window 2.



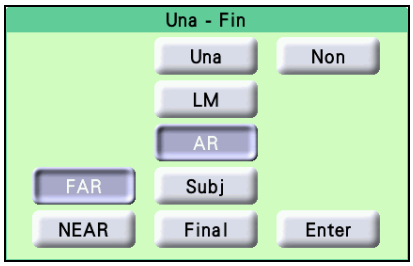
1 Press the display data set button.

When specifying the items to be displayed in sub window 1, press Display data set button 1, and when specifying the items to be displayed in sub window 2, press Display data set button 2.

"Una - Fin" window appears.



2 In the Una - Fin window, specify the items to be displayed in the sub window.



[FAR] : Selects Far mode.
[NEAR] : Selects Near mode.
[Una] : Selects Unaided data.
[LM] : Selects LM data.
[AR] : Selects AR data.
[Subj] : Selects Subj data.
[Final] : Selects Final data.
[Non] : Clears the sub window mode specification.
[Enter] : Closes the "Una - Fin" window and displays the specified data.

Pressing [Una], [LM], [AR], [Subj], [Final], or [Non] closes Una - Final window and displays the specified data in sub window.

Note

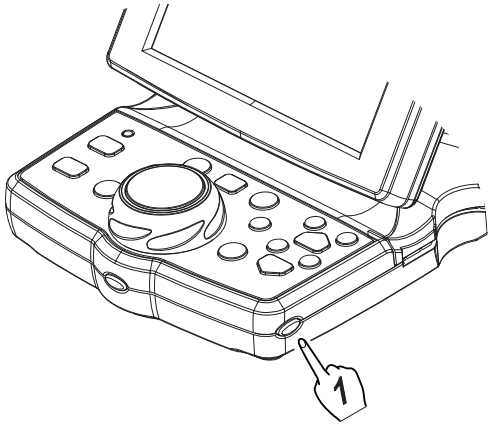
- The sub window display data setting is retained even if the power is turned off.

3.4 Changing ID No.

The ID No. can be changed.
However, when ID No. is inputted from a computer, ID No. is locked and cannot be changed. To change the ID No., press [Clear] to release the lock.

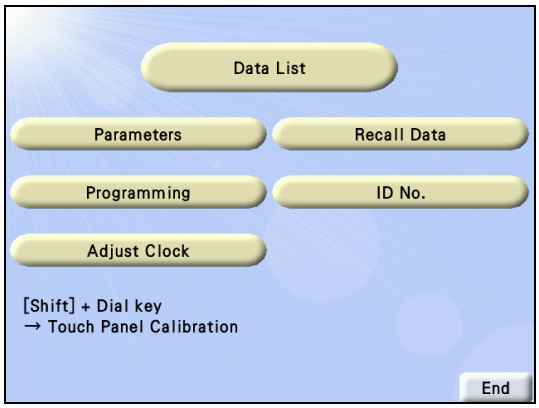
1 Press the right side key.

The Main Menu screen appears.



2 Press [ID No.].

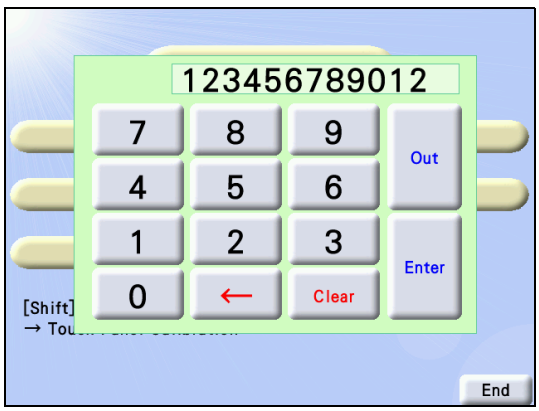
The numeric keypad appears.



3 Enter the desired number with the numeric keys.

The number can be entered up to 12 digits when “Standard” is selected, and up to 20 digits when “Expanded” is selected for the Parameter “ID No.”.

To change the ID No., delete the desired digit by pressing [←] and then enter a new number.



4 Return to the normal measurement screen.

Confirm the change. → Press [Enter].

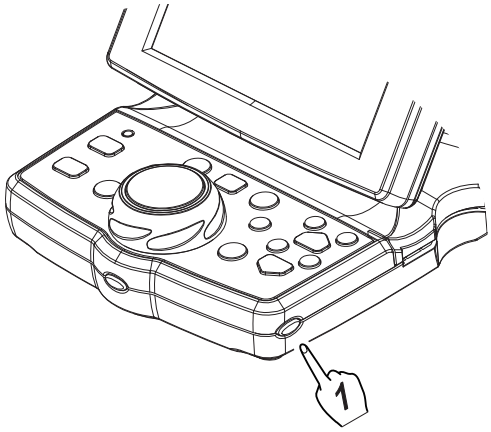
Cancel the change. → Press the right side key of the control box.

Confirm the change and export the data to a computer.
→ Press [Out] and then [Enter] or right side key of the control box.

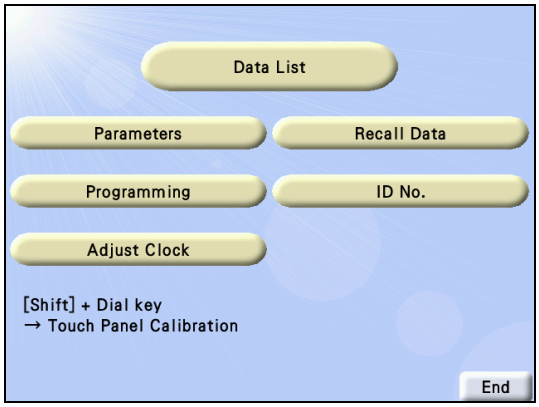
3.5 Calling Up Most Recent Data

When the display is cleared by printing, the last printed data is stored in the instrument. This data can be entered with the following procedure.

1 Press the right side key.



The Main Menu screen appears.



2 Press [Recall data].

The data will be called up on the display.

3.6 Programming

The RT-3100 has four programs: A, B, C, and ☼☽ .
The standard program has already been written in Program A and Program ☼☽ as factory setting. Program B and Program C are available for user configuration. All programs (A, B, C, and ☼☽) can be edited.
For the program operations, see "2.5 Standard Program Refraction" (Page 32).

Note

- Program ☼☽ is enabled only when the RT is connected with a chart presenting device equipped with the night measurement function.

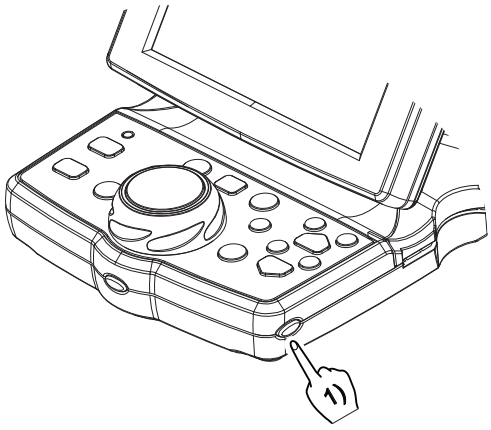
3.6.1 Clearing programs

The contents of each Program A, B, C, or ☼☽ are cleared. It is performed when each program is reprogrammed.
To clear Program A or ☼☽ , set the Program A or Program ☼☽ parameter to “User” beforehand (see page 74).

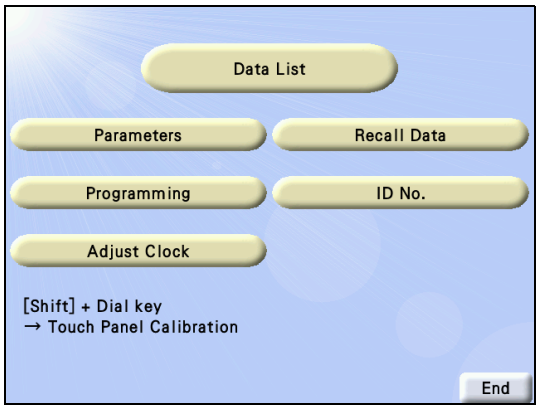
1 Display the Programming screen.

1) Press the right side key.

The Main Menu screen appears.

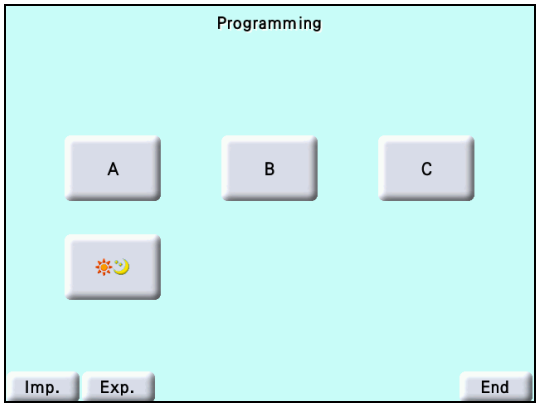


2) Press [Programming].



2 Select the program to be cleared.

Press [A], [B], [C], or ☀🌙.

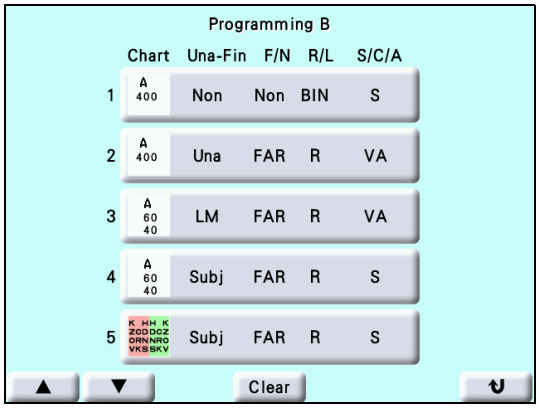


3 Press [Clear].

The confirmation message “Are you sure?” appears.

4 Press [Yes].

All contents of the selected program are cleared.



3.6.2 Programming

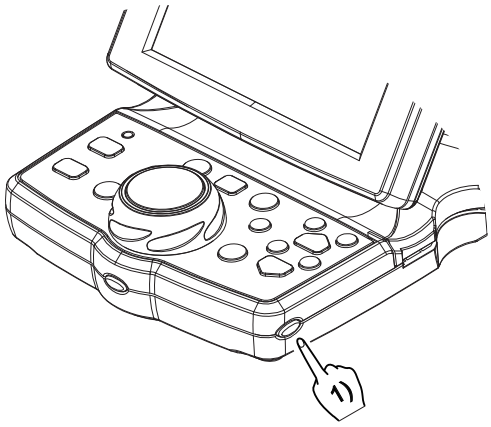
To program Program A or , set the Program A or Program parameter to User beforehand.

Note

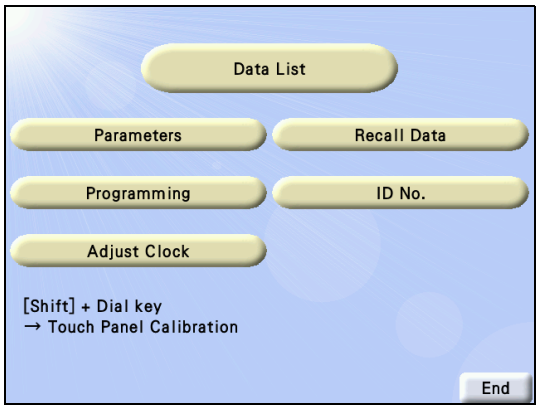
- Program is enabled only when the RT is connected with a chart presenting device equipped with the night measurement function.

1 Display the Programming screen.

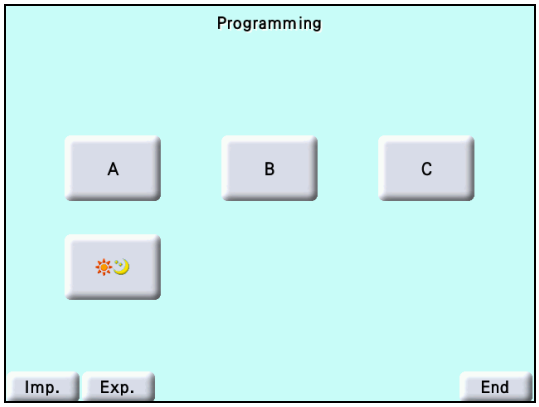
1) Press the right side key.



The Main Menu screen appears.



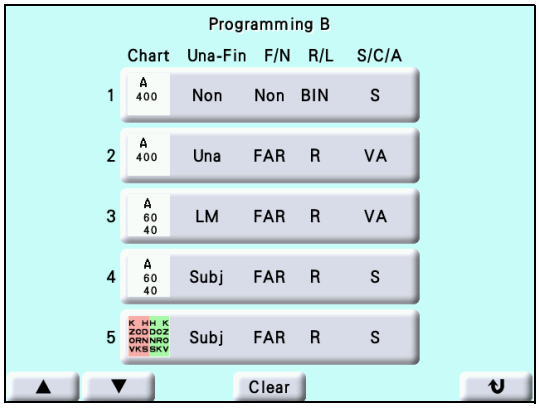
2) Press [Programming].



2 Select the program to be programmed.

Press [A], [B], [C], or ☀/☽.

The contents of the selected program are displayed. (When the program is empty, each step key is blank.)



3 Select the step key to be written or changed.

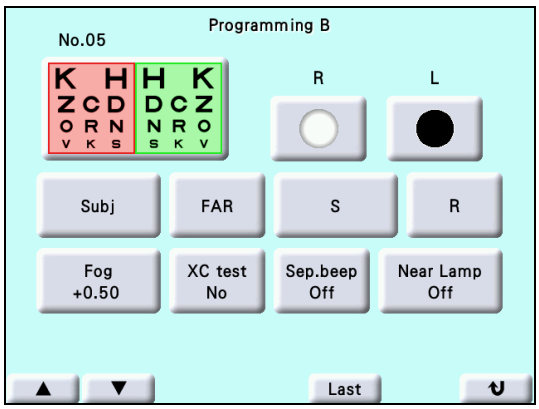
Pressing the desired key displays the input screen.

4 Select the desired chart to be programmed.

1) Press the chart icon at the upper-left.

   The chart control screen appears.

2) Select the chart to be stored with the chart key.



5 Select a mode to be set with the chart.

Press the desired items.

- Set the auxiliary lenses and fog amount.
- Also set the mask functions (horizontal and vertical lines, single letter) and the red-green filter.

The following items are programmable.

- Chart (including the mask functions)
- Night brightness, Contrast, Glare lamp (depends on the chart presenting device)
- Data to be entered (Unaided to Final)
- Far or near mode
- Data field (SPH, CYL, AXIS, VA)
- Eye to be measured (R, L, BIN)
- Auxiliary lenses
- Cross cylinder test
- With or without beep sounds (The beep sounds can be audible in the end of each test.)
- Fog amount (Press [Fog] and turn the dial to enter the fog amount.)
- Whether the near point lamp lights up or goes out

6 When the steps on the screen are programmed, go to the next page.

Press [▼].

When all steps are programmed, press [↻].

To clear the steps from the next to last for overwriting, press [Last].

7 Repeat Steps 4 to 6 until the desired charts are programmed in the presentation order.

It is possible to store up to 32 steps.

8 Exit from programming mode.

Press [↵] twice to return to the Programming screen and press [End] to return to the normal measurement screen.

3.6.3 Operating programs

The charts are presented in the programmed order.

1 Select the program to be used with (Shift) + program start key.

2 Start the program.

Press the program start key.

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

3 Present the next chart.

Press the front key (Next chart). Each time the key is pressed, the chart is presented in the programmed order and the refractor is set as programmed.

(Shift) + Front key (Next chart) ⇒ Returns to the previous chart.

3.6.4 Importing or exporting programs

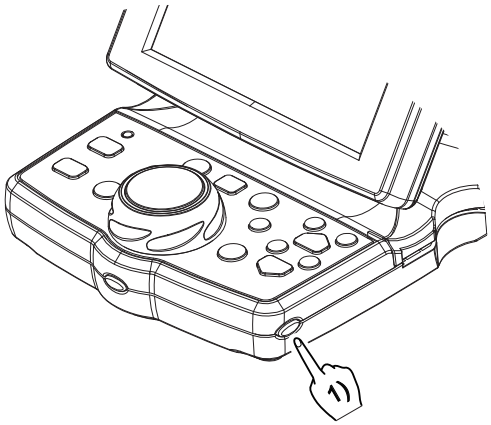
It is possible to import or export the contents of Program A to C, or from/to a CF card in the control box.
To use this function, the CF card must be set beforehand.
See "5.8 Setting CF Card" (Page 127) to set the CF card.

Note

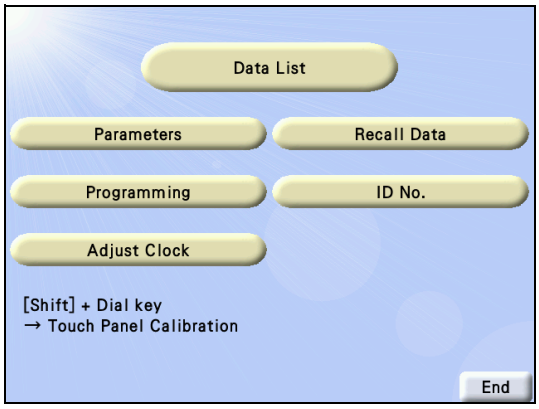
- Program is enabled only when the RT is connected with a chart presenting device equipped with the night measurement function.

1 Display the Programming screen.

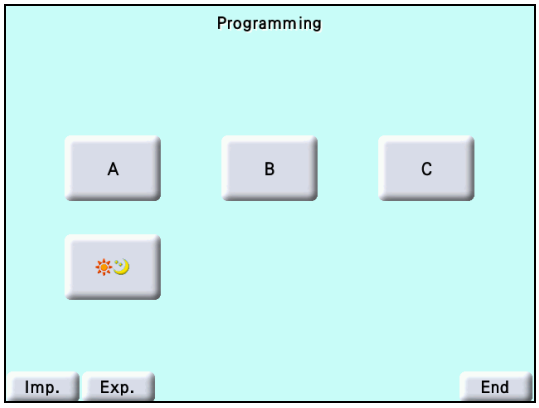
1) Press the right side key.



The Main Menu screen appears.



2) Press [Programming].



2 Pressing [Imp.] imports the programs in the CF card. When any program have never been to exported, the data to be imported does not exist.
Pressing [Exp.] exports the current programs to the CF card.

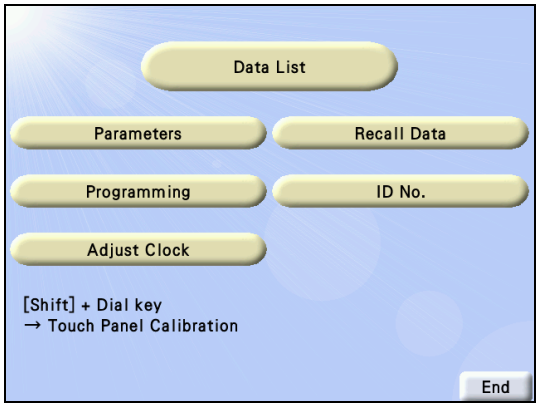
3.7 Setting Time and Date

The clock in the RT-3100 can be adjusted.

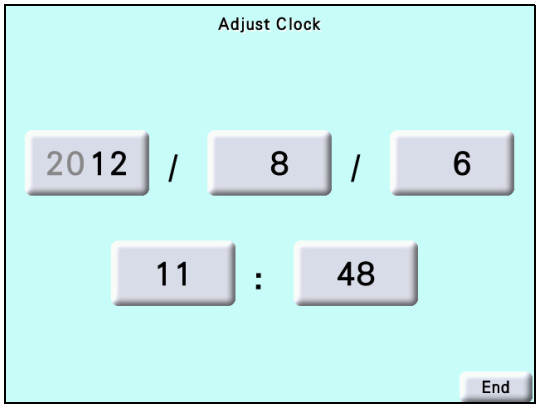
1 Display the Adjust Clock screen.

1) Press the right side key of the control box.

The Main Menu screen appears.



2) Press [Adjust Clock].



2 Press the item to be adjusted.

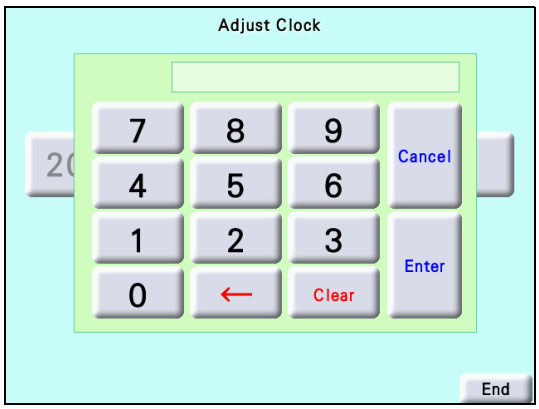
The numeric keypad appears.

3 Enter the desired number with the numeric keypad and press [Enter].

4 Repeat Steps 2 and 3 until the time and date are set.

5 Return to the normal measurement screen.

Press [End].

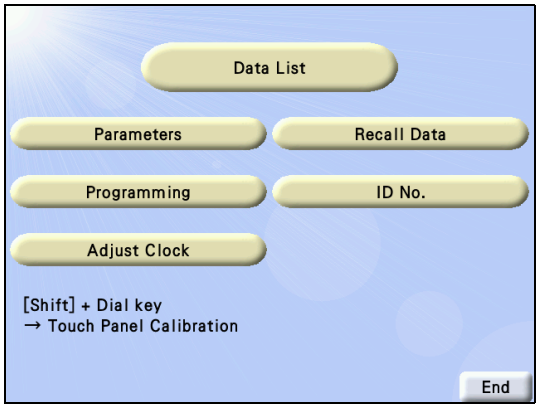


3.8 Touch-screen Panel Calibration

The touch-screen panel is calibrated.
When incorrect responses from the touch-screen panel are received, the detection point of the touch-screen panel may shift from the pressure point of the touch-screen pen. In this case, calibrate the touch-screen panel.

1 Press the right side key of the control box.

The Main Menu screen appears.



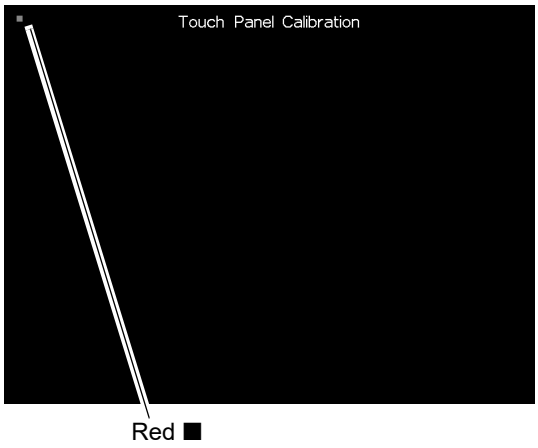
2 Press the dial key while holding (Shift) to display the Touch Panel Calibration screen.

.

3 Press the red ■ in the upper-left corner of the screen with the touch-screen pen.

Pressing here changes the color of ■ to blue.

4 Press the red ■ in the upper-right corner of the screen with the touch-screen pen.



5 Press the red ■ in the lower-left corner of the screen with the touch-screen pen.

6 Press the red ■ in the lower-right corner of the screen with the touch-screen pen.

When the four ■ in each corner of the screen are pressed, the “Completed the Touch Panel Calibration” message appears and the screen returns to the Main Menu screen.

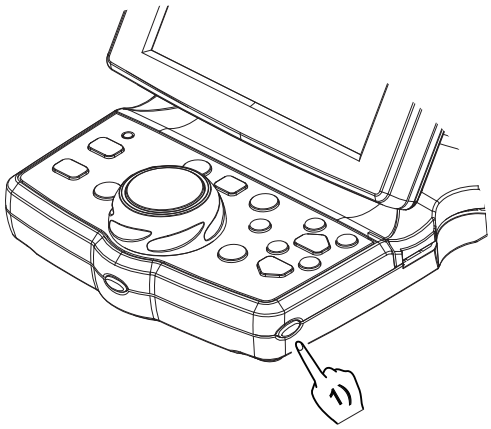
3.9 Parameter Settings

3.9.1 Setting parameters

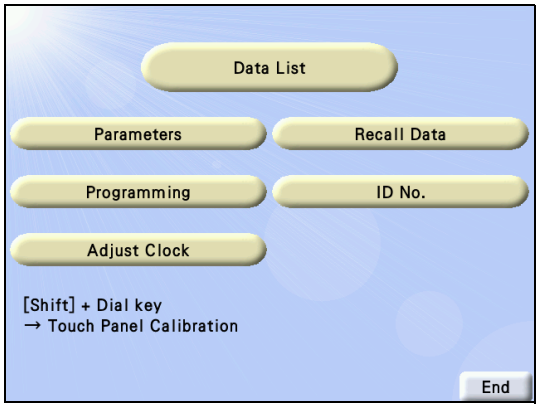
1 Display the Parameters screen.

1) Press the right side key.

The Main Menu screen appears.



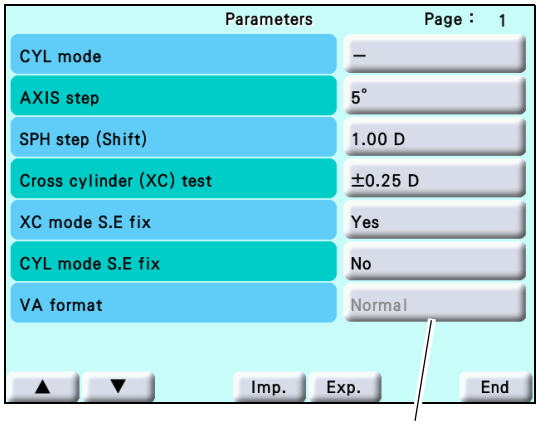
2) Press [Parameters].



2 Display the page in which the parameter to be changed is displayed with [▲] or [▼].

3 Pressing the setting field on the right side of the parameter to be changed toggles the setting.

In parameters such as SPH step with many options, when the setting field is pressed, the field is framed in green. At this time, select the option with the dial.



4 Change the other parameter settings in the same manner as Steps 2 and 3.

5 Return to the normal measurement screen.

Press [End].

○ Detailed parameter options

CYL mode: –, +

Factory setting: **–**

Setting for the cylinder reading. Selectable between + and –.

AXIS step: 1, 5

Factory setting: 5

Setting for the increment to adjust axis values. Selectable between 1 and 5.

SPH step (Shift): 0.50 D to 3.00 D

Factory setting: 1.00 D

Setting for the increment to adjust sphere values with (Shift).

Cross cylinder (XC) test: ±0.25 D, ±0.25 D/○

Factory setting:±0.25 D

Setting for the cross cylinder lens placed in the cross cylinder test.

±0.25 D ⇒ ±0.25 D cross cylinder lens

±0.25 D/○ ⇒Switches ±0.25 D cross cylinder lens and open alternately. (When in AXIS mode, the lens cannot be changed)

XC mode S.E fix: Yes, No

Factory setting: Yes

Selection of whether or not to adjust sphere values to maintain the spherical equivalency in the cross cylinder test.

CYL mode S.E fix: Yes, No

Factory setting: No

Selection of whether or not to adjust sphere values to maintain the spherical equivalency in normal cylindrical power refinement.

VA format: Normal, 5-mark record

Factory setting: Normal

Selection of the notation for near or distance vision.

* “5-mark record” is a notation of visual acuity value that is mainly used in China.

Prism display format: X/Y, rθ

Factory setting: X/Y

Setting for the prism display format.

X/Y ⇒ Rectangular coordinates

rθ ⇒ Polar coordinates

Input prism from LM: Yes, No

Factory setting: No

Selection of whether or not to enter the prism value automatically when LM data is imported from a lensmeter.

SPH Far → Near: SPH, SPH + ADD

Factory setting: SPH + ADD

Setting for the sphere values when far mode is switched to near mode.

SPH ⇒ The sphere values in far mode are also used in near mode.

SPH + ADD ⇒ The addition powers are added to the sphere values in far mode.

Working distance (WD): 35 cm to 70 cm

Factory setting: 40 cm

Setting for the working distance in 5 cm increments.

Print CL data: Yes, No

Factory setting: No

Setting for whether or not to print the CL conversion value of the subjective data together with other data.

Print TL data: Yes, No

Factory setting: No

Setting for whether or not to print trial lens (TL) data for the final prescription. When the RT-3100 has no final prescription, the TL data for subjective data is printed.

Clear after print: Yes, No

Factory setting: Yes

Setting for whether or not to clear measured data after printing.

Printer: On, Off

Factory setting: On

Setting for whether or not to print the data.

Date format for print: mm/dd/yyyy, dd/mm/yyyy, yyyy/mm/dd

Factory setting: mm/dd/yyyy

Setting for the data format to be printed.

mm/dd/yyyy ⇒ AUG/20/2008

dd/mm/yyyy ⇒ 20/ 8/2008

yyyy/mm/dd ⇒ 2008. 8.20

QR code: QR1, QR2, Off

Factory setting: Off

Selection of whether or not to print QR code and of data to be printed with QR code.

QR1 ⇒ The final data (subjective or prescription data) and the QR code are printed.

QR2 ⇒ All data is printed along with the final data QR code.

Program A: Fix, User

Factory setting: Fix

Selection of whether to use the default Program A or user-programmed one. Set the parameter to User when Program A is reprogrammed. It is possible to return to the default Program A by resetting to Fix and clearing the data or turning the device off and on (Data can be cleared by pressing Shift and Print at the same time in normal measurement mode).

Program : Fix, User

Factory setting: Fix

Selection of whether to use the default Program or user-programmed one. Set the parameter to User when Program is reprogrammed. It is possible to return to the default Program by resetting to Fix and clearing the data or turning the device off and on.

Adjust ADD Subj → Final: Yes, No

Factory setting: Yes

Selection of whether or not to include the addition power in the prescription data with respect to the difference between the subjective data and the S and C values for prescription data automatically when ADD is selected in the final field.

When there is no addition power data in the subjective field, this setting is not available.

Preset power of Subj: AR, LM

Factory setting: AR

When both AR and LM data are imported, the refractor head is initially set for subjective refinement for the selected setting.

The PD in the AR data is prioritized for use.

When only one of the two data is imported, the refractor is set with the imported data.

This function is not available for the data entered with the dial.

Copy LM/AR data when switching from Day to Night: Yes, No

Factory setting: No

Selection of whether or not to copy the day data to the night LM field or AR field that is not entered when Day mode is switched to Night mode.

Lens for Retino: +1.50 D, +2.00 D

Factory setting: +1.50 D

Setting for 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

Factory setting: 15 min

Selection of whether or not to use the power saving function. The setting time is also selectable.

The screen backlight and chart presenting device lamp go out in power saving mode. Press any key to restore from the mode.

Near lamp link: Yes, Other than grid, No

Factory setting: No

Yes ⇒ The near point lamp lights up automatically in ADD mode and near mode.

Other than grid ⇒ The near point lamp lights up automatically in ADD mode and near mode but the near point lamp goes out when selecting the cross grid chart for near vision.

No ⇒ The near point lamp does not light up automatically. When lighting up, it is necessary to press the left side key of the control box to light up the Near point lamp.

Beep sound: High, Low, Off

Factory setting: High

Setting for the beep sound tone sounded by pressing any key.

Brightness: 1 to 3

Factory setting: 3

Settings for the brightness of the display backlight.

Reducing the value darkens the display.

Chart link: Yes, No (Other than SC series)

Factory setting: Yes

Selection of whether or not to use the chart presenting device other than NIDEK.

Select No to use the chart presenting device other than NIDEK.

Chart link: Cable, Wireless 1 to 8, No (SC series)

Sets the communication method with the SC-series.

Cable ⇒ Connects the RT-3100 with the SC-series by cable.

Wireless 1 to 8 ⇒ Communicates with the SC series by an optional wireless unit. The number from 1 to 8 indicates the communication channel. Set the same channel in the Remote channel parameter of the SC series.

PC port: PC, Memory BOX, AR, ARK, RKT

Factory setting: PC

Selection of the device to be connected to the PC connector on the relay box.

PC ⇒ Connect a computer.

Memory box ⇒ Connect a memory box (optional).

AR ⇒ Connect an auto refractometer.

ARK ⇒ Connect an auto ref/keratometer (ARK) or OPD-Scan III series.

RKT ⇒ Connect the TONOREF (RKT).

If the setting is changed, turn off and on the device again.

Display Day/Night switching button: Yes, No

Factory setting: No

Selection of whether or not to import day/night data.

Program for imported WF data: A, B, C, , No

Factory setting: No

Selection of a program automatically set when Wave Front data is imported.

Program for imported AR data: A, B, C, , No

Factory setting: No

Selection of a program automatically set when AR measured data is imported by the method other than dialing.

Program for imported Night data: A, B, C, , No

Factory setting: No

Selection of a program automatically set when day data and night data are imported and the device is switched to Night mode.

System No.: Off, 1 to 10

Factory setting: Off

Indicates which device measured the data.

1 to 10: The number is printed on the top line of print result. It is also output to the PC when the data is output.

Off: The system number is not output.

I/F Mode: NIDEK, NIDEK 2

Factory setting: NIDEK

Selection of whether or not to increase the timeout limit for the communication between the RT and an external device. If the time-out occurs with the factory setting “NIDEK” due to the communication environment, select “NIDEK2”.

Communication sequence for PC: Type 1, Type 2

Factory setting: Type 1

Setting of the communication sequence with a computer.

If the setting is changed, turn the power off and on again.

ID No.: Standard, Expanded

Factory setting: Standard

Selection of the number of digits that can be input for the ID No.

Standard: 12 digits

Expanded: 20 digits

With this setting, the output format to the computer changes. For details, see the interface manual.

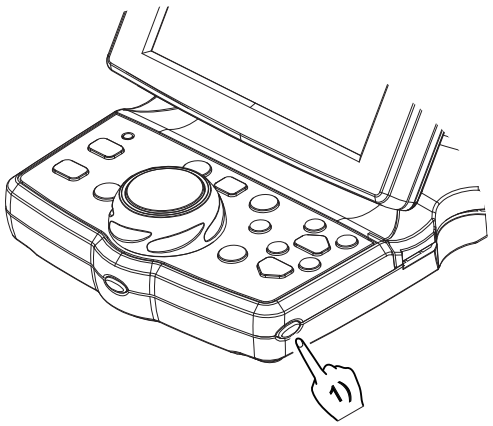
3.9.2 Importing or exporting parameters

It is possible to import or export the parameter settings from/to a CF card in the control box.
To use this function, the CF card must be set beforehand.
See "5.8 Setting CF Card" (Page 127) to set the CF card.

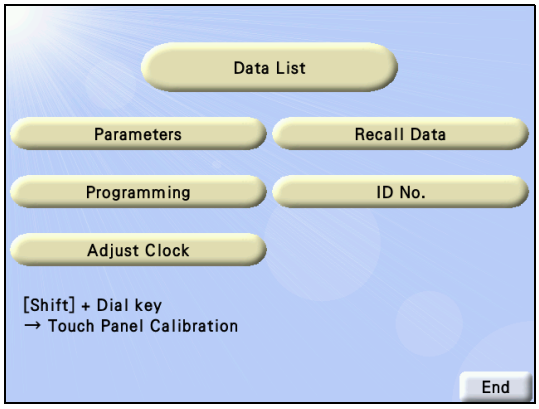
1 Display the Parameters screen.

1) Press the right side key.

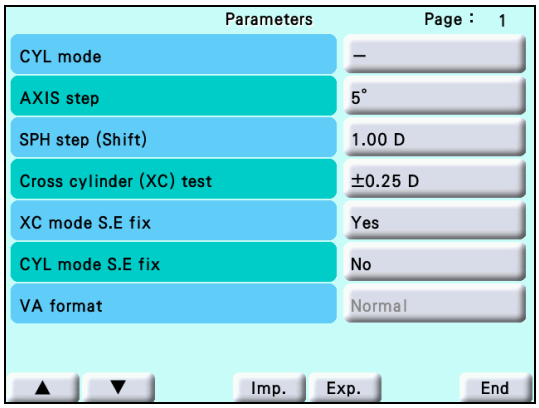
The Main Menu screen appears.



2) Press [Parameters].



2 Pressing [Imp.] imports the parameter settings in the CF card. When any parameter have never been to exported, the data to be imported does not exist.
Pressing [Exp.] exports the current parameter settings to the CF card.

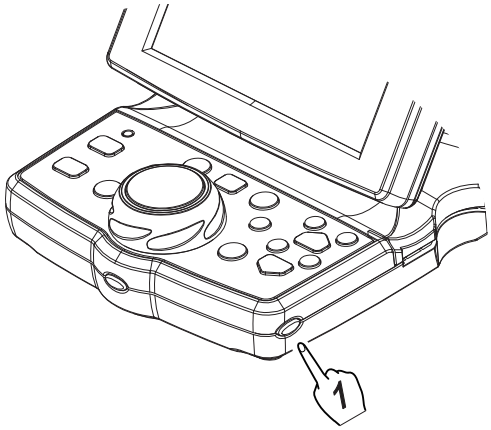


3.10 Exporting Data to Computer

Pressing [Print] exports the displayed data to a computer together with the printout. Exporting the data without printing is also possible with the following procedures.

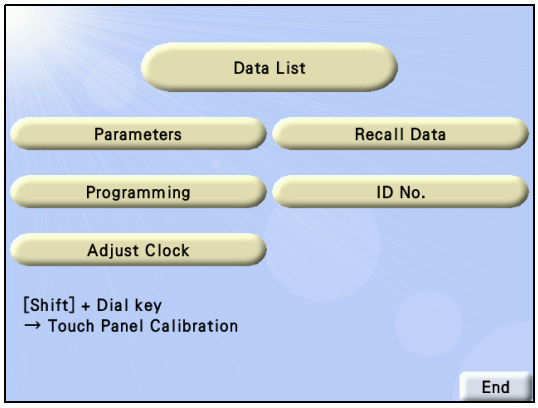
1 Press the right side key.

The Main Menu screen appears.



2 Press [ID No.].

The ID No. can be set.

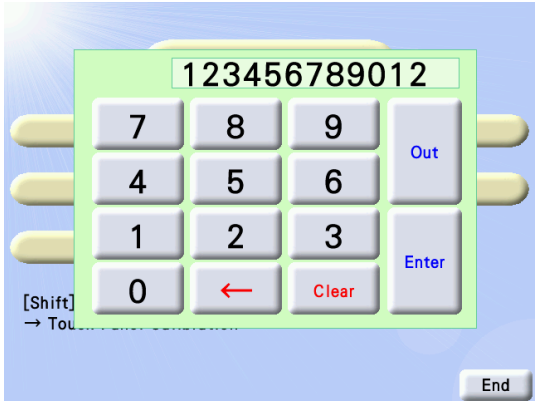


3 Check the ID No. and press [Out].

The data is exported.

4 Press the right side key of the control box.

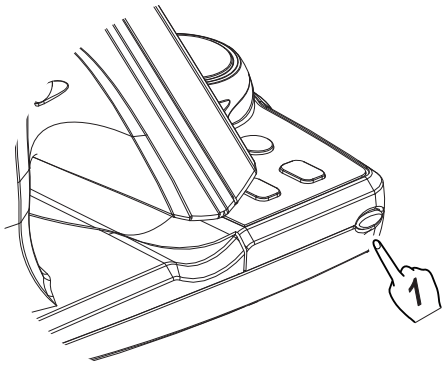
The screen returns to the measurement screen.



3.11 Displaying images (SC series and SSC-100)

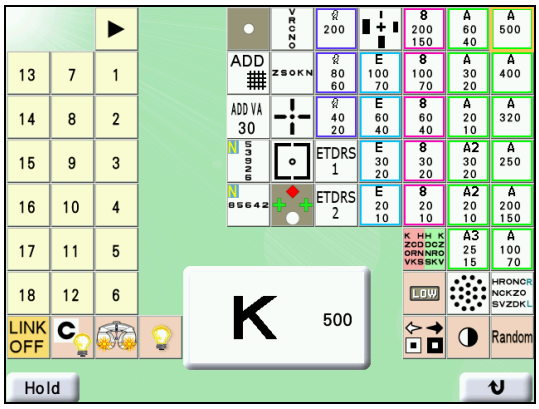
The images in the SC series can be displayed on the SC series LCD.

1 Press the Left side key to display the chart control screen.



2 Pressing the left side key of the control box displays the chart control screen.

The image operation keys such as ▶ are displayed in the left of the screen.

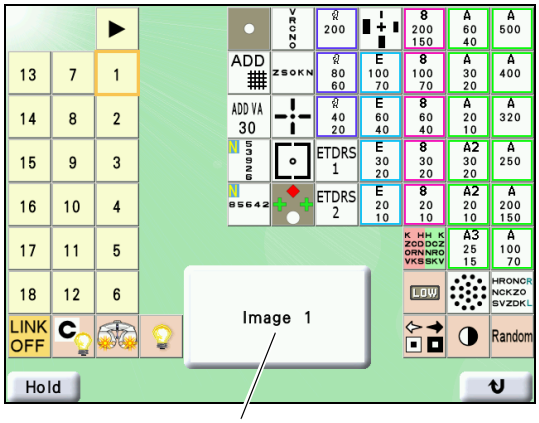


3 Pressing ▶ displays images in the SC series as a slide show.

A slide show is a looped display of a series of images.

The screen changes every 5 seconds.

1 to 18 : The images registered in the SC are displayed directly.

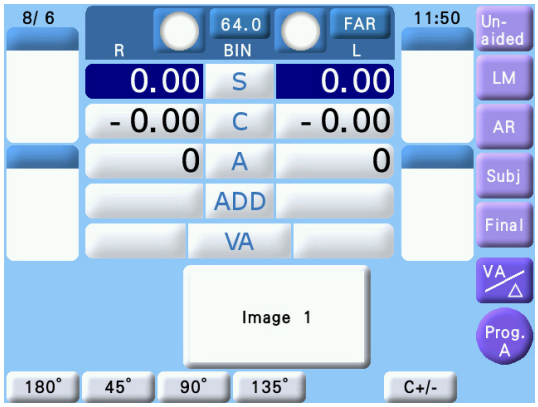


No. of the displayed image

4 Press any chart key to stop the slide show.

Note

- There is a pause of a few seconds between pressing any image operation key and display of the image. The SC series and SSC-100 cannot respond to any operation from the control box during this time. However, this is not an error.



4. TEST METHOD

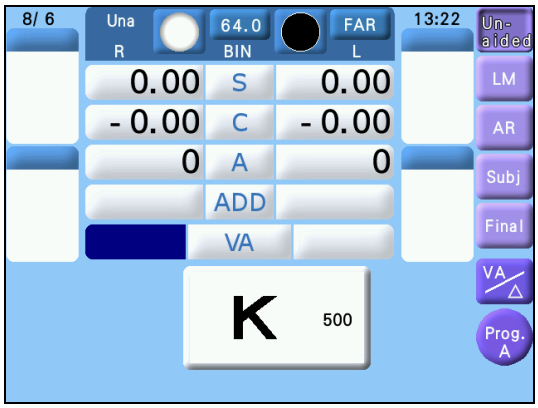
4.1 Unaided Visual Acuity Test

1 Press [Unaided].

The unaided visual acuity (VA) test starts.

2 Press (R).

The left measuring window is occluded.



3 Obtain the unaided VA for the right eye.

Obtain the best possible VA.

Change the chart with ⇦ or ⇨.

The VA of the last presented chart is in the VA field.

4 Press (L).

The left measuring window opens and the right one is occluded.

5 Obtain the unaided VA for the left eye.

Follow the same procedure as Step 3.

6 Press (BIN).

The both measuring windows open.

7 Obtain the binocular unaided VA.

Follow the same procedure as Step 3.

The unaided VA test is completed.

4.2 Aided Visual Acuity Test

It is possible to measure the aided VA when LM data is entered.

1 Press [LM].

The aided VA test starts.

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

2 Select [VA] to test the right, left, and binocular VA.

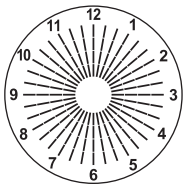
Follow the same procedures as Steps 2 to 7 of “4.1 Unaided Visual Acuity Test”.

4.3 Astigmatism Test

4.3.1 Astigmatism test with astigmatism clock dial

Chart: Astigmatism clock dial

Ideal appearance: The sharpness of all bars is equal.



[Procedure example]

1 Press (R) or (L) to occlude either measuring window.

2 Present the astigmatism clock dial chart.

Change the screen to the chart control screen and press . The RT-3100 goes into CYL mode.

When the cylinder value is not 0, change it to 0.

3 Fog the vision until the VA becomes about 20/200.

1) Press the numeric field of [S] on the measurement eye side to go into SPH mode.
2) Turn the dial counterclockwise and add positive lenses.

4 Reduce the fogging until the VA becomes about 20/40.*6

Turn the dial clockwise.

5 Ask the patient, “Does any bar appear especially sharper than the others? Or, are they about the same?”

All the bars appear equal. → No astigmatism. The test is completed.

One of the bars appears sharper. → Obtain the cylindrical axis in minus reading by multiplying the smaller number (1 to 6) next to the bar by 30º.

For example: When Bar 2 appears sharper: 2 × 30º = 60º

6 Set the axis of the minus cylindrical lens to the value obtained in Step 5.

Press the numeric field of [A] on the measurement eye side and turn the dial.

7 Add minus cylinder in 0.25 D increments so that all the bars appear equal.

Press the numeric field of [C] on the measurement eye side and turn the dial clockwise.

When adding the cylindrical power changes the sharper bar:

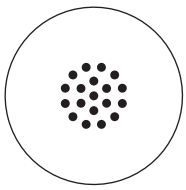
When the sharpest bar moves in the counterclockwise direction → Decrease the axis value.

When the sharpest bar moves in the clockwise direction → Increase the axis value.

***6. The numbers (1 - 12) beside the bars correspond to the VA of 20/40.**

4.3.2 Astigmatism test with cross cylinder lens

Use: Cylindrical axis and power refinement with the cross cylinder lens
Chart: Dots
Auxiliary lens: Cross cylinder lens
Ideal appearance: The sharpness of dots does not change even though the cross cylinder lens is flipped.



[Procedure example]

1 Set the refractor according to the AR data and occlude either measuring window.

2 Perform the red-green test.

When the patient can not see the red and green sides equally, make the red side sharper slightly.

See "4.4.1 Red-green test" (Page 87).

3 Present the dots chart.

Display the chart control screen and press  .

The RT-3100 goes into AXIS mode. The cross cylinder lens is set.

4 Measure the cylindrical axis.

See 2) of Step 5 of "2.5.1 Program A" (Page 32).

5 Go into CYL mode.

Press the numeric field of C on the measurement eye.

The axis of the cross cylinder lens changes.

6 Measure the cylindrical power.

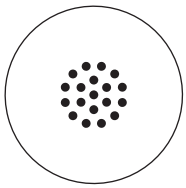
See 2) of Step 6 of "2.5.1 Program A" (Page 32).

Note

- When the cylindrical power is 0, it 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.

4.3.3 Astigmatism power test with cross cylinder lens (the hold and remove cross cylinder testing method)

Use: Cylindrical power refinement with the cross cylinder lens
Chart: Dots
Auxiliary lens: Cross cylinder lens
Ideal appearance: The dots chart when the cross cylinder lens is not set is seen sharper.



[Procedure example]

1 Detect the cylindrical axis in the same manner of procedures 1 to 4 of "4.3.2 Astigmatism test with cross cylinder lens" (Page 84). See "2.5.1 Program A" (Page 32).

2 Enter CYL mode.

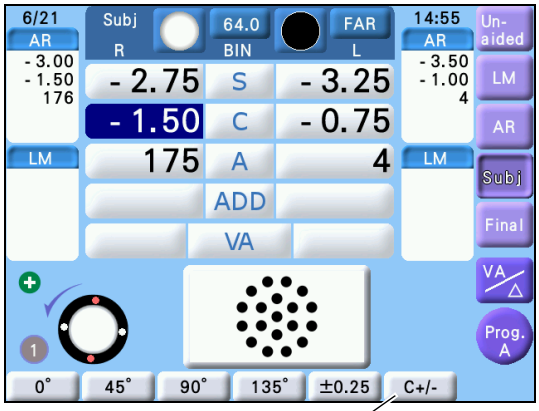
Press the C value on the same side that is testing the cylinder axis.

The cross cylinder lens axis is changed.

3 Press the cross cylinder lens switching button to set "±0.25/ ○ ".

When the Cross cylinder parameter setting is "±0.25D/ ○ ", the cross cylinder lens does not need to be switched.

A +/- 0.25 D cross cylinder lens is held with its minus cylinder axis aligned with AXIS.



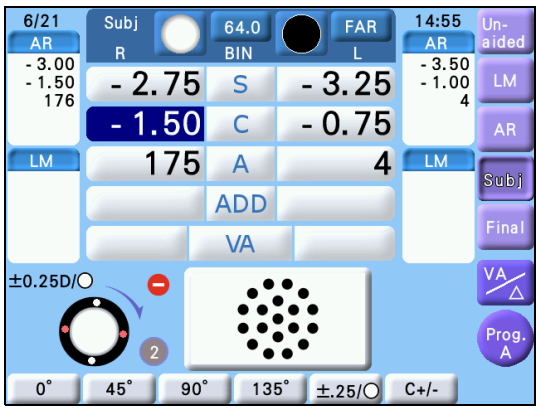
Cross cylinder lens switching button

4 Press (2) to hold and remove the cross cylinder lens and ask the patient which is sharper. Adjust the cylindrical power by turning the dial until the chart is seen sharper when the cross cylinder lens is removed.

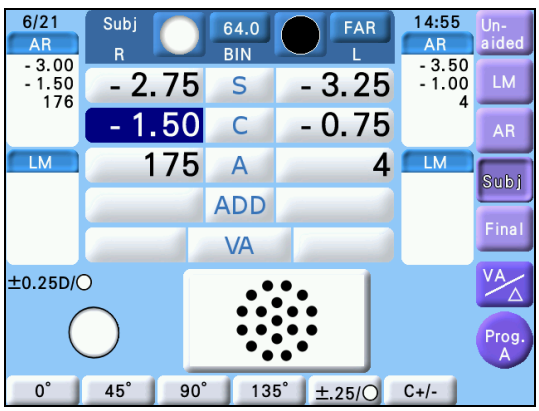
(1) When the chart is seen sharper while the cross cylinder lens is held

1) Turn the dial to the right by 1 step.

2) Press (2) to hold and remove the cross cylinder lens while turning the dial to the right by 1 step until the chart is seen sharper when the cross cylinder lens is removed.



When the cross cylinder lens is held



When the cross cylinder lens is removed

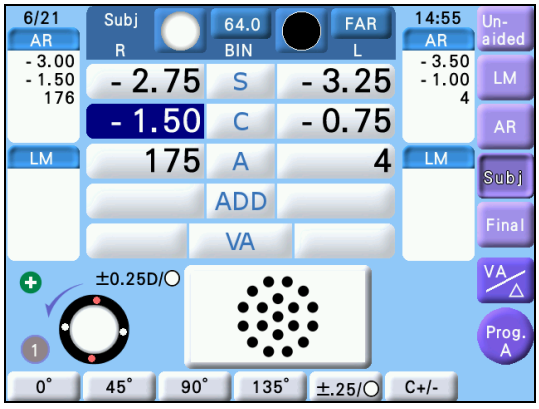
3) When the chart is seen sharper when the cross cylinder lens is removed, this test is finished.

(2) When the chart is seen sharper when the cross cylinder lens is removed

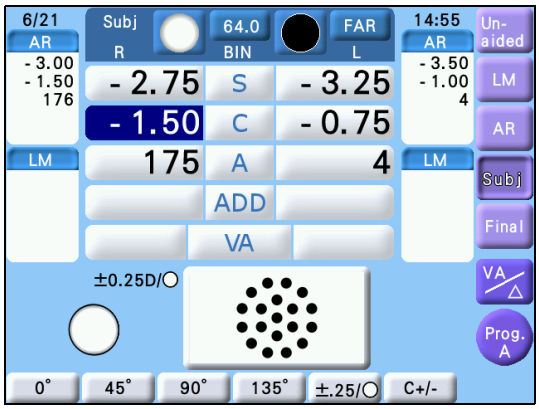
When the chart is seen more sharply when the lens is removed at first attempt, change the direction of the cross cylinder lens and make adjustments. (If the chart is seen more sharply without the cross cylinder lens after turning the dial to the right in Procedure (1), the test is finished.)

1) Press  to change the direction of the lens.

2) Press  to insert and remove the cross cylinder lens while turning the dial to the left by 1 step until the chart is seen sharper when the cross cylinder lens is removed.



When the cross cylinder lens is held



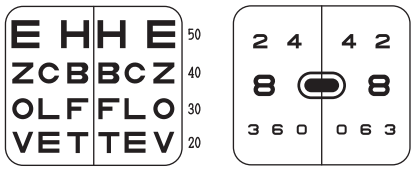
When the cross cylinder lens is removed

3) When the chart is seen sharper when the cross cylinder lens is removed, this test is finished.

4.4 Spherical Refinement

4.4.1 Red-green test

Chart: Red-green
Ideal appearance: The sharpness of the letters on the red and green sides appears equal.



[Procedure example]

1 Press (R) or (L) to occlude either measuring window.

2 Present the red-green chart.

Display the chart control screen and press or .

The RT-3100 goes into SPH mode.

3 Fog the vision.

Turn the dial counterclockwise 2 increments to add SPH + 0.50 D.

4 Reduce fogging gradually until the sharpness of the letters on the red and green sides appears equal.

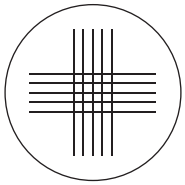
Turn the dial clockwise.

The letters on the red side are sharper. → Turn the dial clockwise.

The letters on the green side are sharper. → Turn the dial counterclockwise.

4.4.2 Cross grid test for far vision

Use: Spherical refinement
Chart: Cross-grid
Applicable model: CP series types T, P, F, and PhM
Auxiliary lens: ±0.50 D cross cylinder lens (Fixed with the axis set at 90º.)
Ideal appearance: The sharpness of the horizontal and vertical lines appears equal.



[Procedure example]

1 Press [Subj].

2 Press (R) or (L) to occlude either measuring window.

3 Present the cross-grid chart.

Display the chart control screen and press .

The cross cylinder lens of ±0.50 D is set in the specified measuring window.

4 Ask a patient, “Which are sharper, the horizontal or vertical line?”

The horizontal and vertical lines appear equal. → The spherical power is properly refined.

The horizontal lines are sharper. → In the case of myopia, the spherical power is overminused. In the case of hyperopia, the spherical power is undercorrected.

The vertical lines are sharper. → In the case of myopia, the spherical power is underminused. In the case of hyperopia, the spherical power is overcorrected.

4.5 Binocular Visual Function Test

4.5.1 Binocular balance test

Use: To adjust the accommodation balance if necessary when the best possible visual acuity is equal in the right and left eyes.

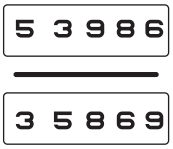
Chart: Binocular balance

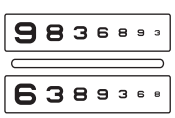
Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters

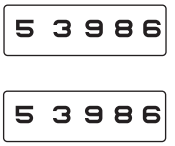
(SC-2000, SC-1600, SSC-100: 3ΔBD to the right eye, 3ΔBU to the left eye)

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 The sharpness of the top and bottom lines is equal.

Right eye	Left eye	Binocular ideal
		 The sharpness of the top and bottom lines is equal.

Right eye	Left eye	Binocular ideal
		 The sharpness of the top and bottom lines is equal.

Right eye	Left eye	Binocular ideal
		 The sharpness of the top and bottom lines is equal.

Right eye	Left eye	Binocular ideal
		 The sharpness of the top and bottom lines is equal.

[Procedure example]

1 Present the binocular balance chart.

Display the chart control screen and press  ,  ,  ,  , or  .

The polarizing filters are set in the measuring windows. (The prisms are set for the SC-2000, SC-1600, and SSC-100.)

The RT-3100 goes into SPH mode.

2 Fog the binocular vision.

Press (BIN) and turn the dial counterclockwise so that the binocular VA becomes between 20/30 and 20/25.

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

3 Ask the patient, “Which is sharper, the top or bottom line?”

The top line is sharper. → Press (R) and add SPH +0.25 D. (Turn the dial counterclockwise.)

The bottom line is sharper. → Press (L) and add SPH +0.25 D. (Turn the dial counterclockwise.)

The top and bottom lines should appear equal. When the patient can not see them equally, select which eye is seen sharper according to the LM data or dominant eye for that determine either eye.

4 Clear fogging applied in Step 2.

Press (BIN) and turn the dial.

4.5.2 Binocular red-green test

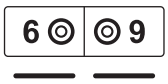
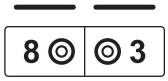
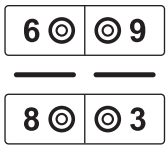
Use: To check equality of accommodation in both eyes

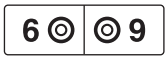
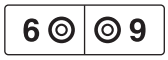
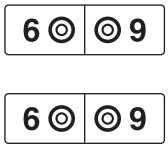
Chart: Binocular red-green

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters

(SC-2000, SC-1600, SSC-100: 3ΔBD to the right eye, 3ΔBU to the left eye)

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 The sharpness of the top and bottom lines is equal.

Right eye	Left eye	Binocular ideal
		 The sharpness of the top and bottom lines is equal.

[Procedure example]

1 Present the binocular red-green chart.

Display the chart control screen and press  or  .

The polarizing filters are set in the measuring windows. (The prisms are set for the SC-2000, SC-1600, and SSC-100.)

The RT-3100 goes into SPH mode.

2 Ask the patient, “How do the four numbers and double circles appear?”.

(a) The sharpness of all four double circles are equal.

(b) The sharpness of two double circles on the red side are equal.

(c) The sharpness of two double circles on the green side are equal.

→ Binocularly well balanced[*7]

(d) The top line is sharper on the green side and the bottom line is sharper on the red side.

→ Press (R) and add SPH +0.25 D. (Turn the dial counterclockwise.)

(e) The top line is sharper on the red side and the bottom line is sharper on the green side.

→ Press (L) and add SPH +0.25 D. (Turn the dial counterclockwise.)

***7. In the case of (c), the both powers are overcorrected even though well balanced. Therefore, it is recommended to add positive powers to the both eyes until the chart appears as (a) or (b).**

4.5.3 Phoria test

Use: To detect exophoria, esophoria, hypophoria, and hyperphoria
Chart: Phoria
Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters, binocular rotary prism
(SC-2000, SC-1600, SSC-100: Red filter on the right eye, green filter on the left eye, binocular rotary prism)

○ Type U

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

[Procedure example]

1 Present the phoria chart.

Display the chart control screen and press  .

The polarizing filters are set in the measuring windows.

The base in/out prism powers can be entered.

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

Yes → Go to the next step.

No → Impossible to continue the test.

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

Yes → Orthophoria

No → Heterophoria - Go to the next step.

4 Ask the patient, “Do the vertical bars line up?”

Yes → No esophoria nor exophoria

No → Esophoria or exophoria

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

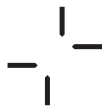
Right → Esophoria

Left → Exophoria

6 Ask the patient, “Do the horizontal bars line up?”

Yes → No hyperphoria nor hypophoria

No → Hyperphoria nor hypophoria

Appearance of chart	Phoria	Correction
<1> 	Esophoria	Turn the dial clockwise to add the BO prism powers until a cross is formed.
<2> 	Exophoria	Turn the dial counterclockwise to add the BI prism powers until a cross is formed.
<3> 	Left eye hyperphoria	Press [⇕]. Turn the dial clockwise until a cross is formed. (Add BU to the right eye and BD to the left eye.)
<4> 	Right eye hyperphoria	Press [⇕]. Turn the dial counterclockwise until a cross is formed. (Add BD to the right eye and BU to the left eye.)
<5> 	Esophoria + Right eye hyperphoria	Correct the horizontal phoria in the same manner as for <1> and the vertical phoria in the same manner as for <4>.
<6> 	Esophoria + Left eye hyperphoria	Correct the horizontal phoria in the same manner as for <1> and the vertical phoria in the same manner as for <3>.
<7> 	Exophoria + Right eye hyperphoria	Correct the horizontal phoria in the same manner as for <2> and the vertical phoria in the same manner as for <4>.
<8> 	Exophoria + Left eye hyperphoria	Correct the horizontal phoria in the same manner as for <2> and the vertical phoria in the same manner as for <3>.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△⇔] is pressed with in/out prism is selected, the rotary prism lenses are removed.
- Use ⊕ or ⊖ instead of the dial for fine adjustment.
- When adding prism power, the prism power can be added in half steps by adding the prism power for a single-eye only, rather than for both eyes.
  Dial 1.0 Δ → 0.5 Δ
  ⊕, ⊖ 0.2 Δ → 0.1 Δ

○ Types G, T, and F

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

[Procedure example]

1 Present the phoria chart.

Display the chart control screen and press  .

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-1600, SC-2000, and SSC-100.)

The base in/out prism powers can be entered.

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

Yes → Go to the next step.

No → Impossible to continue the test.

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

Yes → Orthophoria

No → Hyperophoria - Go to the next step.

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

Right → Esophoria

Left → Exophoria

The vertical line is in the center. → No exophoria nor esophoria

5 Ask the patient, “Is the horizontal bar shifted up or down?”

Up → Right eye hyperphoria

Down → Left eye hyperphoria

The horizontal line is in the center. → No hyperphoria nor hypophoria

Appearance of chart	Phoria	Correction
<1> 	Esophoria	Turn the dial clockwise to add the BO prism powers until a cross is formed.
<2> 	Exophoria	Turn the dial counterclockwise to add the BI prism powers until a cross is formed.
<3> 	Left eye hyperphoria	Press [⇕]. Turn the dial clockwise until a cross is formed. (Add BU to the right eye and BD to the left eye.)
<4> 	Right eye hyperphoria	Press [⇕]. Turn the dial counterclockwise until a cross is formed. (Add BD to the right eye and BU to the left eye.)
<5> 	Esophoria + Right eye hyperphoria	Correct the horizontal phoria in the same manner as for <1> and the vertical phoria in the same manner as for <4>.
<6> 	Esophoria + Left eye hyperphoria	Correct the horizontal phoria in the same manner as for <1> and the vertical phoria in the same manner as for <3>.
<7> 	Exophoria + Right eye hyperphoria	Correct the horizontal phoria in the same manner as for <2> and the vertical phoria in the same manner as for <4>.
<8> 	Exophoria + Left eye hyperphoria	Correct the horizontal phoria in the same manner as for <2> and the vertical phoria in the same manner as for <3>.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△⇔] is pressed with in/out prism is selected, the rotary prism lenses are removed.
- Use ⊕ or ⊖ instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.
  Dial 1.0 Δ → 0.5 Δ
  ⊕, ⊖ 0.2 Δ → 0.1 Δ

4.5.4 Phoria with fixation test

Use: To detect heterophoria by giving stimuli for fusion

Chart: Phoria with fixation

Applicable model:CP series types T, U, ISO, and M/SSC-330 (300) type U/SSC-350 types T and TCG/SC series types T, M, and UK

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters, binocular rotary prism

(SC-2000, SC-1600, SSC-100: Red filter on the right eye, green filter on the left eye, binocular rotary prism)

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

[Procedure example]

1 Present the phoria with fixation chart.

Press  or  .

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-2000, SC-1600, and SSC-100.)

The base in/out prism powers can be entered.

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

Yes → Go to the next step.
No → Impossible to continue the test.

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

Yes → Orthophoria
No → Heterophoria – Go to the next step.

4 Ask the patient, “Do the vertical bars line up?”

Yes → No exophoria nor esophoria
No → Exophoria or esophoria

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

Right → Esophoria
Left → Exophoria

6 Ask the patient, “Do the horizontal bars line up?”

Yes → No hyperphoria nor hypophoria
No → Hyperphoria or hypophoria

When a cross is not formed, correct it as follows:

Appearance of chart	Phoria	How to correct phoria
<1> 	Esophoria	Turn the dial clockwise to add the BO prism powers until a cross is formed.
<2> 	Exophoria	Turn the dial counterclockwise to add the BI prism powers until a cross is formed.
<3> 	Left eye hyperphoria	Press [⇕]. Turn the dial clockwise until a cross is formed. (Add BU to the right eye and BD to the left eye.)
<4> 	Right eye hyperphoria	Press [⇕]. Turn the dial counterclockwise until a cross is formed. (Add BD to the right eye and BU to the left eye.)
<5> 	Esophoria + Right eye hyperphoria	Correct the horizontal phoria in the same manner as for <1> and the vertical phoria in the same manner as for <4>.
<6> 	Esophoria + Left eye hyperphoria	Correct the horizontal phoria in the same manner as for <1> and the vertical phoria in the same manner as for <3>.
<7> 	Exophoria + Right eye hyperphoria	Correct the horizontal phoria in the same manner as for <2> and the vertical phoria in the same manner as for <4>.
<8> 	Exophoria + Left eye hyperphoria	Correct the horizontal phoria in the same manner as for <2> and the vertical phoria in the same manner as for <3>.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△⇔] is pressed with in/out prism is selected, the rotary prism lenses are removed.
- Use ⊕ or ⊖ instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.
  Dial 1.0 Δ → 0.5 Δ
  ⊕, ⊖ 0.2 Δ → 0.1 Δ

4.5.5 Mallet test (horizontal phoria)

Use: To detect heterophoria by giving stimuli for fusion

Chart: Mallet (vertical bars)

Applicable model: CP-770 type PhM, CP-9 type PhM, SC series type PhM

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters, binocular rotary prism

(SC-2000, SC-1600, SSC-100: Red filter on the right eye, green filter on the left eye, binocular rotary prism)

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

[Procedure example]

1 Present the Mallet chart (vertical bars).

Display the chart control screen and press ⊛.

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-2000, SC-1600, and SSC-100.)

The base in/out prism powers can be entered.

2 Patient focuses on the center X.

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

Yes → Go to the next step.
No → Impossible to continue the test.

4 Ask the patient, “Do the vertical bars line up?”

Yes → Orthophoria (No exophoria nor esophoria)
No → Exophoria or esophoria – Go to the next step.

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

Right → Esophoria → Turn the dial clockwise to add the BO prism power until the two bars line up.

Left → Exophoria → Turn the dial counterclockwise to add the BI prism powers until the two bars line up.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△⇔] is pressed with in/out prism is selected in the base in/out prism, the rotary prism lenses are removed.
- Use ⊕ or ⊖ instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.

Dial	1.0 Δ → 0.5 Δ
⊕, ⊖	0.2 Δ → 0.1 Δ

4.5.6 Mallet test (vertical phoria)

Use: To detect heterophoria by giving stimuli for fusion
Chart: Mallet (horizontal bars)
Applicable model: CP-770 type PhM, CP-9 type PhM, SC series type PhM
Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters, binocular rotary prism
(SC-2000, SC-1600, SSC-100: Red filter on the right eye, green filter on the left eye, binocular rotary prism)
Ideal appearance:

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

[Procedure example]

1 Present the Mallet chart (horizontal bars).

Display the chart control screen and press  .

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-2000, SC-1600, and SSC-100.)

The base up/down prism powers can be entered.

2 Patient focuses on the center X.

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

Yes → Go to the next step.
No → Impossible to continue the test.

4 Ask the patient, “Do the horizontal bars line up?”

Yes → Orthophoria (No hyperphoria nor hyperphoria)
No → Hyperphoria or hypophoria– Go to the next step.

5 Ask the patient, “Is the right bar shifted to the up or down?”

Up → Left eye hyperphoria: Turn the dial clockwise until the two bars line up.
(Add BU to the right eye and BD to the Left eye.)

Down → Right eye hyperphoria: Turn the dial counterclockwise until the two bars line up.
(Add BD to the right eye and BU to the Left eye.)

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [] is pressed with in/out prism is selected, the rotary prism lenses are removed.
- Use  or  instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.

Dial	1.0 Δ → 0.5 Δ
	0.2 Δ → 0.1 Δ

4.5.7 Von Graefe test (horizontal phoria)

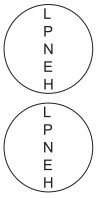
Use: To detect horizontal phoria

Chart: Vertical line

Applicable model: CP series types U and M/SSC-330 (300) type U/SSC-350 type M/SC series type M [For the other types, use the highest VA letter chart or the letter chart which is little higher than the patient's VA.]

Auxiliary lens: 6ΔBU to the right eye, rotary prism to the left eye

Ideal appearance:

Right eye	Left eye	Binocular ideal
		

Right eye	Left eye	Binocular ideal
		

[Procedure example]

1 Present the vertical line chart.

Display the chart control screen and press [ ] or [ ]. For the near point, press [ ] and set the chart manually.

6ΔBU is set in the right measuring window.

The base in/out prism powers can be entered.

2 Press (Shift) together with the Auxiliary lenses icon on the L side to cover the patient's left eye.

3 Press (Shift) together with the Auxiliary lenses icon on the L side to change the screen to remove the cover on the left eye.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△↔] is pressed with in/out prism is selected, the rotary prism lenses are removed.

Appearance of chart	Phoria	Correction
<1> The upper column is on the left.	Esophoria	Turn the dial clockwise to add the BO prism powers until the two columns line up.
<2> The upper column is on the right.	Exophoria	Turn the dial counterclockwise to add the BI prism powers until the two columns line up.

Use ⊕ or ⊖ instead of the dial for fine adjustment.

4.5.8 Von Graefe test (vertical phoria)

Use: To detect vertical phoria

Chart: Horizontal line

Applicable model: CP series types U and M/SSC-330 (300) type U/SSC-350 type M/SC series type M [For the other types, use the highest VA letter chart or the letter chart which is little higher than the patient's VA.]

Auxiliary lens: Rotary prism to the right eye, 10ΔBI to the left eye

Ideal appearance:

Right eye	Left eye	Binocular ideal
		

Right eye	Left eye	Binocular ideal
		

[Procedure example]

1 Present the horizontal line chart.

Display the chart control screen and press FADTN or ZSOKN. For the near point, press N 85642 and set the chart manually.

10ΔBI prism lens is set in the left measuring window.

The base up/down prism powers can be entered.

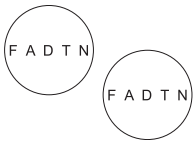
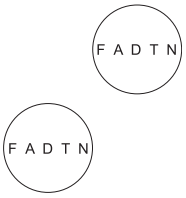
2 Ask the patient, "Can you see two circles with a row of letters in each of them? Do the letters line-up, like headlights on a car?"

When they are not in line, correct them as follows:

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.

  ex. When [△↔] is pressed with in/out prism is selected, the rotary prism lenses are removed.

Appearance of chart	Phoria	Correction
<1> The left row is higher.   	Right eye hyperphoria	Turn the dial counterclockwise until the two rows line up.
<2> The right row is higher.   	Left eye hyperphoria	Turn the dial clockwise until the two rows line up.

Use ⊕ or ⊖ instead of the dial for fine adjustment.

4.5.9 Maddox test (horizontal phoria)

Use: To detect horizontal phoria

Chart: Fixation

Auxiliary lens: Horizontal maddox rod to the right eye, rotary prism to the left eye

Ideal appearance:

Right eye	Left eye	Binocular ideal
		

1 Present the fixation chart.

Display the chart control screen and press  .

The horizontal maddox rod is set in the right measuring window.

The base in/out prism powers can be entered.

2 Ask the patient, “Is the white spot shifted to the left or right? Or, it is overlaid on the red bar?”

When the spot is shifted to the left or right, correct it as follows:

Appearance of chart	Phoria	Correction
<1> The white spot is at the left of the red bar. 	Esophoria	Press (L). Turn the dial clockwise to add the BO prism power until the spot is overlaid on the bar.
<2> The white spot is at the right of the red bar. 	Exophoria	Press (L). Turn the dial counterclockwise to add the BI prism power until the spot is overlaid on the bar.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△⇔] is pressed with in/out prism is selected, the rotary prism lenses are removed.
- Use (+) or (−) instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.

Dial	1.0 Δ → 0.5 Δ
(+), (−)	0.2 Δ → 0.1 Δ

4.5.10 Maddox test (vertical phoria)

Use: To detect vertical phoria
Chart: Fixation
Auxiliary lens: Rotary prism to the right eye, vertical maddox rod to the left eye
Ideal appearance:

Right eye	Left eye	Binocular ideal
○	▬	▬○

1 Present the fixation chart.

Display the chart control screen and press [◦].

The horizontal maddox rod is set in the right measuring window.

The base in/out prism powers can be entered.

2 Press [◦] again.

The maddox rod is removed from the right measuring window and the vertical maddox rod is set in the left measuring window.

The base up/down prism powers can be entered.

3 Ask the patient, “Is the white spot above or below the red bar? Or, it is overlaid on the red bar?”

When the spot is shifted upward or downward, correct it as follows:

Appearance of chart	Phoria	Correction
<1> The white spot is above the red bar. ○ ▬	Left eye hyperphoria	Press (R). Turn the dial clockwise to add the BU prism power until the white spot is overlaid on the red bar.
<2> The white spot is below the red bar. ▬ ○	Right eye hyperphoria	Press (R). Turn the dial counterclockwise to add the BD prism power until the white spot is overlaid on the red bar.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [↕] is pressed with up/down prism is selected, the rotary prism lenses are removed.
- Use (+) or (−) instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.

Dial	1.0 Δ → 0.5 Δ
(+), (−)	0.2 Δ → 0.1 Δ

4.5.11 Vertical coincidence test

Use: To detect aniseikonia and to test vertical phoria

Chart: Vertical coincidence

Applicable model:CP series types T, U, P, F, ISO, and M/SSC-330 (300) types T and U/SC series types G, T, M, and P

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters, binocular rotary prism
(SC-2000, SC-1600, SSC-100: Red filter on the right eye, green filter on the left eye)

Ideal appearance:

Right eye	Left eye	Binocular ideal
		

○ Aniseikonia detection

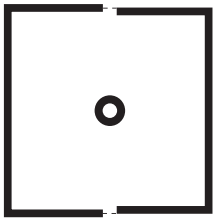
1 Present the vertical coincidence chart.

Display the chart control screen and press  .

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-1600, SC-2000, and SSC-100.)

2 Ask the patient, “Can you see a square with a dot in the center? Are the left and right frames the same size? Or, is one smaller than the other?”

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 left and right eyes), a spectacle lens prescription is suitable for axial anisometropia and contact lens one is suitable for refractive anisometropia.

○ Vertical phoria test

1 Present the vertical coincidence chart.

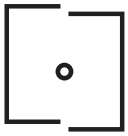
Display the chart control screen and press [◎].

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-2000, SC-1600, and SSC-100.)

The base up/down prism powers can be entered.

2 Ask the patient, “Can you see a square with a dot in the center? Are the left and right frames aligned? Or, is one higher than the other?”

When they are not aligned, correct them as follows:

Appearance of chart	Phoria	Correction
<1> The left frame is higher. 	Right eye hyperphoria	Press BIN. Turn the dial counterclockwise until the left and right frames are aligned. (Add BD to the right eye and BU to the left eye.)
<2> The right frame is higher. 	Left eye hyperphoria	Press BIN. Turn the dial clockwise until the left and right frames are aligned. (Add BU to the right eye and BD to the left eye.)

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [↕] is pressed with up/down prism is selected, the rotary prism lenses are removed.
- Use ⊕ or ⊖ instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.
  Dial 1.0 Δ → 0.5 Δ
  ⊕, ⊖ 0.2 Δ → 0.1 Δ

4.5.12 Horizontal coincidence test

Use: To detect aniseikonia and to test horizontal phoria

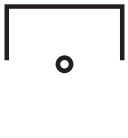
Chart: Horizontal coincidence

Applicable model: CP series types P and F/SC series type P/SC-1600Pola G+

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters, binocular rotary prism

(SC-2000, SC-1600, SSC-100: Red filter on the right eye, green filter on the left eye)

Ideal appearance:

Right eye	Left eye	Binocular ideal
		

○ Aniseikonia detection

1 Present the horizontal coincidence chart.

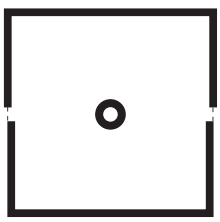
Display the chart control screen and press  .

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SSC-100, SC-2000, SC-1600, and SSC-100.)

The base in/out prism powers can be entered.

2 Ask the patient, “Can you see a square with a dot in the center? Are the top and bottom frames the same size? Or, is one smaller than the other?”

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 one is suitable for refractive anisometropia.

○ Horizontal phoria test

1 Present the horizontal coincidence chart.

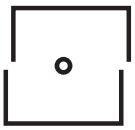
Display the chart control screen and press .

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-2000, SC-1600, and SSC-100.)

The base in/out prism powers can be entered.

2 Ask the patient, “Can you see a square with a dot in the center? Are the top and bottom frames aligned? Or, is one to the left or right of the other?”

When they are not aligned, correct them as follows:

Appearance of chart	Phoria	Correction
<1> The top frame is shifted to the left. 	Exophoria	Press BIN. Turn the dial counterclockwise until the top and bottom frames are aligned.
<2> The top frame is shifted to the right. 	Esophoria	Press BIN. Turn the dial clockwise until the top and bottom frames are aligned.

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△⇔] is pressed with in/out prism is selected, the rotary prism lenses are removed.
- Use ⊕ or ⊖ instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.

Dial	1.0 Δ → 0.5 Δ
⊕, ⊖	0.2 Δ → 0.1 Δ

4

4.5.13 Schober test

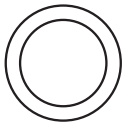
Use: To test heterophoria

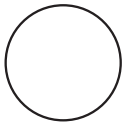
Chart: Schober

Applicable model: CP series types T, P, and F, and ISO/SSC-330 (300) type T/SC series types G, T and P

Auxiliary lens: Red filter on the right eye, green filter on the left eye, binocular rotary prism

Ideal appearance:

Right eye	Left eye	Binocular ideal
		

Right eye	Left eye	Binocular ideal
		

[Procedure example]

1 Present the Schober chart.

Display the chart control screen and press  or  .

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

The base in/out prism powers can be entered.

2 Ask the patient, “Can you see a green circle and red cross?”

Yes → Go to the next step.

No → Impossible to continue the test.

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 left or right?”

Right → Esophoria

Left → Exophoria

The cross is in the center. → No horizontal phoria

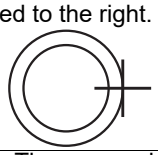
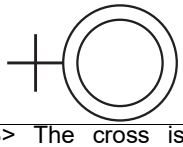
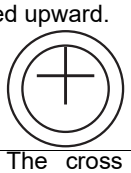
5 Ask the patient, “Is the cross shifted upward or downward?”

Upward → Left eye hyperphoria

Downward → Right eye hyperphoria

The cross is in the center. → No vertical phoria

When the cross is shifted from the center, correct it as follows:

Appearance of chart	Phoria	Correction
<1> The cross is shifted to the right. 	Esophoria	Turn the dial clockwise to add the BO prism powers until the cross comes to the center of the circle.
<2> The cross is shifted to the left. 	Exophoria	Turn the dial counterclockwise to add the BI prism powers until the cross comes to the center of the circle.
<3> The cross is shifted upward. 	Left eye hyperphoria	Press [⇕]. Turn the dial clockwise until the cross comes to the center of the circle. (Add BU to the right eye and BD to the left eye.)
<4> The cross is shifted downward. 	Right eye hyperphoria	Press [⇕]. Turn the dial counterclockwise until the cross comes to the center of the circle. (Add BD to the right eye and BU to the left eye.)

Note

- The rotary prism lenses are removed from the measuring windows when the already selected key is pressed again in prism mode.
  ex.When [△⇔] is pressed with in/out prism is selected, the rotary prism lenses are removed.
- Use ⊕ or ⊖ instead of the dial for fine adjustment.
- When adding the prism power, the prism power can be added in half step by adding the prism power for single-eye compared to both eyes.
  Dial 1.0 Δ → 0.5 Δ
  ⊕, ⊖ 0.2 Δ → 0.1 Δ

4

4.5.14 Stereo test

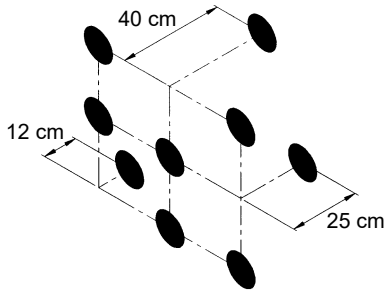
○ Stereo test for SSC-350 types T and TCG

Use: To detect stereoscopic vision

Chart: Stereo

Auxiliary lens: None

Ideal appearance:



1 Present the stereo chart.

Display the chart control screen and press .

2 Confirm that the patient can see the nine black dots arrayed in three lines with one dot from each line at a different depth.

Top line: Center dot ..... About 40 cm away

Center line: Right dot..... About 25 cm away

Bottom line: Left dot..... About 12 cm away

The stereoparallax of each line is 3′, 2′, and 1′ from the top to bottom.

○ Stereo test (triangle test) for SC-1700Pola Type G+

Use: To detect exophoria and esophoria

Chart: Stereo triangle

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters

Ideal appearance:

Right eye	Left eye	Binocular ideal
▼ ● ▲	▼ ● ▲	▼ ● ▲ The upper and lower triangles appear closer than the central circle.

1 Present the stereo triangle chart.

Press .

The polarizing filters are set in the measuring windows (right eye 135º, left eye 45º).

2 Confirm that the upper and lower triangles appear to the patient to be closer.

The stereoparallax is 10' 30" (when the refraction distance is 5 m and the PD value is 60 mm, the upper and lower triangles appear to be about 101 cm closer to the patient).

The test result OK or NG can be entered by the function button.

3 Press [ ] again.

The direction of the polarizing filters changes (right eye 45º, left eye 135º).

4 Confirm that the upper and lower triangles appear to the patient to be farther away.

They appear to be about 171 cm away from the patient (when the PD is 60 mm).

5 Repeat Steps 1 to 4 to alternate the triangle appearance.

Only pop-out is slow. → Exophoria tendency

Only recession is slow. → Esophoria tendency

Both pop-out and recession are slow. → Vertical phoria tendency

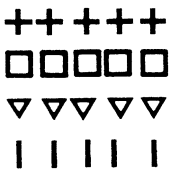
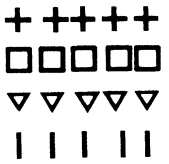
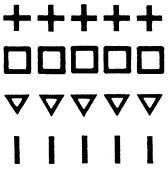
○ Precise four-line stereo test for SC-1700Pola Type G+

Use: To detect stereoscopic vision

Chart: Stereo four lines

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters

Ideal appearance:

Right eye	Left eye	Binocular ideal	
			The plus mark second from the left, square fourth from the left, triangle third from the left, and bar fourth from the left appear closer than the other shapes.

1 Present the stereo four lines chart.

Press [ ].

The polarizing filters are set in the measuring windows.

2 Confirm that one of the shapes in each row appears to the patient to be closer.

The stereo parallaxes are 4', 2', 1', 40" from the top.

The test result 40", 1', 2', 4', or NG can be entered by the function button.

○ Stereo balance test for SC-1700Pola Type G+

Use: To test prevalency of the eye
Chart: Stereo balance
Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters
Ideal appearance:

Right eye	Left eye	Binocular ideal	
			The upper and lower triangles appear closer than the central circle.

1 Present the stereo balance chart.

Press  .

The polarizing filters are set in the measuring windows (right eye 135º, left eye 45º).

2 Confirm that the upper and lower triangles appear to the patient to be closer.

The stereoparallax is 13’ 45” (when the refraction distance is 5 m and the PD value is 60 mm, the upper and lower triangles appear to be about 125 cm closer to the patient).

3 Press  again.

The direction of the polarizing filters is reversed (right eye 45º, left eye 135º).

4 Confirm that the upper and lower triangles appear to the patient to be farther away.

They appear to be about 250 cm away from the patient (when the PD is 60 mm).

5 Check the displacement between the upper and lower triangles and the central circle.

Displacement of pop-out > Displacement of recession → Exophoria tendency

Displacement of pop-out < Displacement of recession → Esophoria tendency

Displacement of pop-out = Displacement of recession → Vertical phoria tendency

Note

- When viewing the merged triangles, displacement to the first (inside), second (thin), or third (outside) lines indicates a prevalence of the corresponding eye by 20%, 60%, and 100% respectively.

○ Stereo test for other types

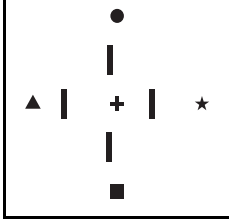
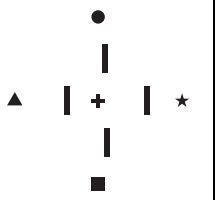
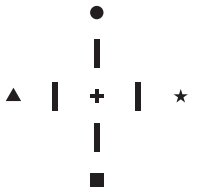
Use: To detect stereoscopic vision

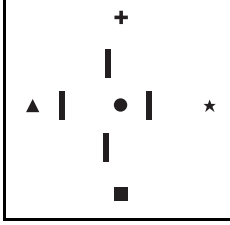
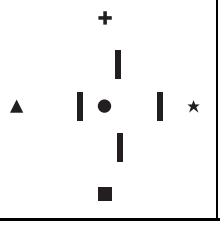
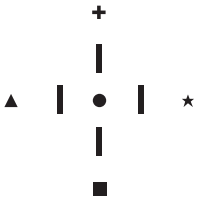
Chart: Stereo

Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters

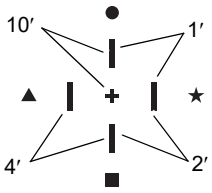
(SC-2000, SC-1600, SSC-100: Red filter on the right eye, green filter on the left eye)

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 The vertical bars appear closer than the shapes.

Right eye	Left eye	Binocular ideal
		 The vertical bars appear closer than the shapes.

The bar with the triangle appears closest and then in the order of the square, star, and circle.



Stereoparallax between the plus mark and the bar with the circle: 10′

Stereoparallax between the bar with the circle and the one with the star: 1′

Stereoparallax between the bar with the star and the one with the square: 2′

Stereoparallax between the bar with the square and the one with the triangle: 4′

1 Present the stereo chart.

Display the chart control screen and press or .

The polarizing filters are set in the measuring windows. (The red and green filters are set for the SC-2000, SC-1600, and SSC-100.)

2 Confirm that the patient can see four bars stereoscopically and can see them at a different depth.

4.5.15 Worth test

Use: To detect fusion and suppression

Chart: Worth

Auxiliary lens: Red filter on the right eye and green filter on the left eye

Ideal appearance:

Right eye	Left eye	Binocular ideal
◆ and ● : Red	✚ and ● : Green	Red / Green / Pink or Red/Green

1 Present the worth chart.

Display the chart control screen and press .

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

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

Appearance of chart	Symptom	Correction
<1> Four spots	Fusion	◆ : Red, ✚ : Green, ● : Pink or Red/Green alternately However, when the patient has an obvious dominant eye, Right dominant eye → ● : Red Left dominant eye → ● : Green
<2> Three spots	Right eye suppression	The two green ✚ and ● are seen.
<3> Two spots	Left eye suppression	The red ◆ and ● are seen.
<4> Five spots at the same time	Diplopia	The red ◆ ● and green ✚ ✚ ● are seen at the same time.
<5> Five spots <2> and <3> blink alternately.	Alternate suppression	The red ◆ ● and green ✚ ✚ ● blink alternately.

4.6.16 Pointer test

Use: To measure cyclophoria
Chart: Pointer
Applicable model: SC-1700Pola TypeG+
Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 (No fixation disparity)

1 Present the pointer chart.

Press  .

The polarizing filters are set in the measuring windows.

2 Ask the patient, “Can you see the upper and lower hands and scales?”

Yes → Testing can be continued.

No → Testing cannot be continued.

3 Ask the patient, “Do the upper and lower hands point to the middle of the scale?”

Yes → No fixation disparity

No → Phoria. Continue testing.

4 Ask the patient, “Are the upper and lower hands at an angle?”

Yes → Functional cyclophoria or optical cyclophoria

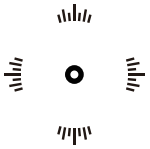
No → Esophoria or Exophoria

Appearance of chart	**Phoria**	**Correction**
Hands at an angle 	Functional cyclophoria or optical cyclophoria	Functional cyclophoria or optical cyclophoria is suspected but further examination cannot be performed in this testing.
Hands shifted to right 	Esophoria	Turn the dial clockwise until the hands point to the middle of the scale to add the BO prism powers.
Hands shifted to left 	Exophoria	Turn the dial counterclockwise until the hands point to the middle of the scale to add the BI prism powers.

4.6.17 Double pointer test

Use: To test fixation disparity
Chart: Double pointer
Applicable model: SC-1700Pola Type G+
Auxiliary lens: Right eye 135º, left eye 45º, polarizing filters

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 (No fixation disparity)

1 Present the double pointer chart.

Press  .

The polarizing filters are set in the measuring windows.

2 Ask the patient, “Can you see the upper, lower, left, and right hands and scales?”

Yes → Testing can be continued.

No → Testing cannot be continued.

3 Ask the patient, “Do the upper, lower, left, and right hands point to the middle of the scale?”

Yes → No fixation disparity

No → Phoria. Continue testing.

4 Ask the patient, “Are the upper, lower, left, and right hands at right angles?”

Yes → Horizontal/vertical phoria or functional cyclophoria. Continue testing.

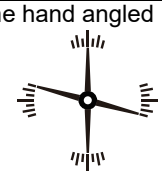
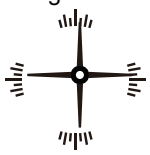
No → Optical cyclophoria

5 Ask the patient, “Are the upper, lower, left, and right hands at angles?”

Yes → Funtional cyclophoria or optical cyclophoria

No → Horizontal or vertical phoria

Appearance of chart	**Phoria**	**Correction**
Both hands angled uniformly 	Functional cyclophoria	This function of extraocular muscle is suspected. Correction with glasses is not possible.

One hand angled 	Optical cyclophoria	This may occur at the time of oblique astigmatism correction or due to optical cause. • Reduce the cylindrical power. • Bring the cylindrical axis close to the horizontal or vertical direction.
Hands shifted to upper right 	Esophoria + Left eye hyperphoria	Horizontal phoria: Turn the dial clockwise until the vertical hands point to the middle of the scale to add the BO prism powers. Vertical phoria: Press [↕]. Turn the dial clockwise until the horizontal hands point to the middle of the scale.

5. MAINTENANCE

5.1 Troubleshooting

In the event that the RT-3100 does not work correctly, check the problem according to the following table before contacting your authorized distributor.

Symptom	Action
The refractor does not start even though the power is turned on.	• Confirm that the power cord is connected to a wall outlet. • Confirm that the system table is turned on.
The display and presented chart disappear suddenly.	• The RT-3100 goes into power saving mode. Press any key to restore the display (see Page 21).
None of the keys on the control box function.	• Any abnormalities occurs. Turn the main switch of the system table off and then turn it on again.
Pressing (Print) does not print the result.	• Replace the printer paper (see Page 123). • Confirm that the Printer parameter is not set to No. • Confirm that the printer paper is set with the correct side up.
Incorrect responses from the touch-screen panel are received.	• Calibrate the touch-screen panel (see Page 70).
“Setup data is initialized.” is displayed.	• The internal battery is low. This message is displayed when the RT-3100 is not used for an extended period. When this message is displayed, the refraction program and parameters may be reset to their defaults and the language settings and the chart model may be changed. →Leave the power on for several hours for charging and contact NIDEK or your authorized distributor.
Data cannot be read even though the Eye Care card is inserted.	• When an auto ref/keratometer or such has no AR measurement data, data cannot be read. • When the right or left was not specified by the lensmeter, data cannot be read. • The contact of the Eye Care card reader may be dirty and in need of cleaning. See “5.9 Cleaning Eye Care Card Reader”. • When any error occurs while data is written with an auto refractometer or lensmeter, clean its card reader and rewrite the data to the Eye Care card.

If the symptom cannot be corrected with the above actions, contact your authorized distributor.

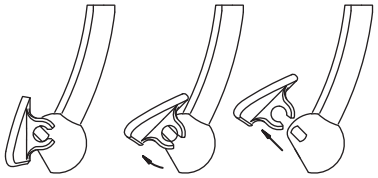
5.2 Cleaning Forehead Rest

Clean the forehead rest before each refraction.

⚠ **WARNING** • **Be sure to secure the refractor head before removing or attaching the forehead rest.**
If the refractor head is moved unintentionally, it may strike someone or something and injury may occur.

1 Remove the forehead rest.

1) Tilt the forehead rest upward.
2) Pull it at an angle.



2 Wipe the forehead rest with a clean cloth.

For persistent grime, wash the forehead rest with dilute neutral detergents.

Note
- After cleaning, be sure to dry the forehead rest with a dry cloth as necessary.
  It protects the forehead rest from rust.

3 Attach the forehead rest in the original position.

Insert the forehead rest at an angle.

5.3 Cleaning Face Shields

Clean the face shields before each refraction.

⚠ **WARNING** • **Be sure to secure the refractor head before removing or attaching the face shields.**
If the refractor head is moved unintentionally, it may strike someone or something and injury may occur.

1 Remove the face shields from the refractor head.

The face shields can be easily removed as they are fixed by magnets.

2 Wipe the face shields with a clean cloth.

For persistent grime, soak a cloth in a dilute neutral detergent, wring well, and wipe. Finally wipe with a dry, soft cloth.

Note
- Do not wipe the inner surface of the face shields with neutral detergents.
  Doing so could make the inner surfaces rust.

3 Attach the face shields in the original position.

5.4 Replacing Printer Paper

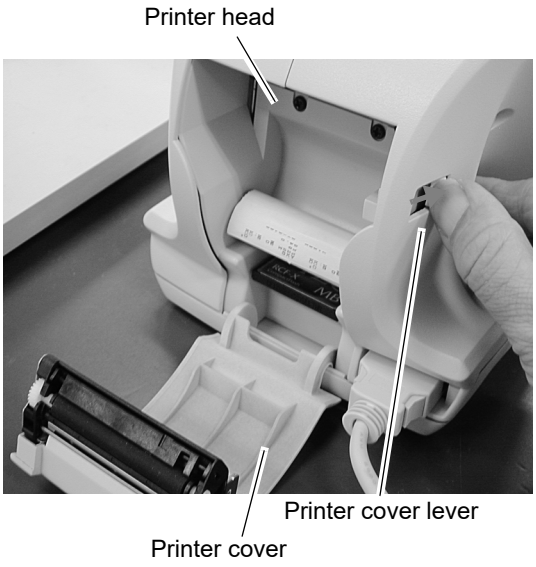
When a red line appears on the side of the printer paper, it means that the paper is running short. In such a case, replace the roll with a new one as soon as possible.

Note

- Do not pull the printer paper forcefully.
  Doing so could cause malfunction of the printer.

1 Slide the printer cover lever to open the printer cover.

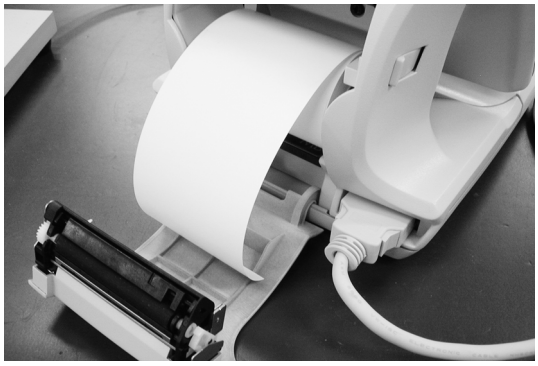
2 Remove any remaining printer paper.



⚠ **WARNING** • **When replacing the printer paper, be sure not to touch the printer head on the upper part inside the printer paper holder.**
The printer head can get very hot and cause burns.

3 Set the printer paper as shown in the figure to the right.

When the roll is set upside down, the data is not printed correctly.

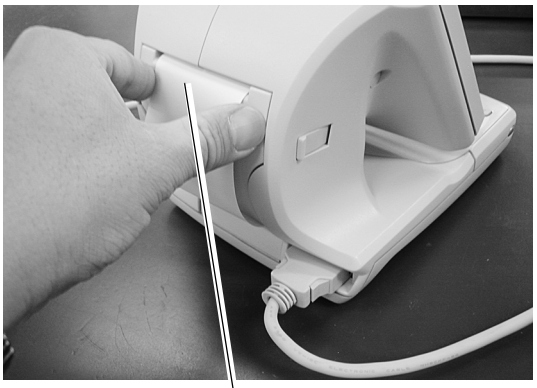


Note

- Be sure to take up any slack in the printer paper.
  Failure to do so could cause printer failure.
- Check that the printer paper is set straight and the core of the roll paper is not misaligned.
  The printer paper may not feed properly.

4 Pass the paper through the paper outlet and close the paper cover.

Press the both top sides of the paper cover to close the cover.



Paper outlet

Note

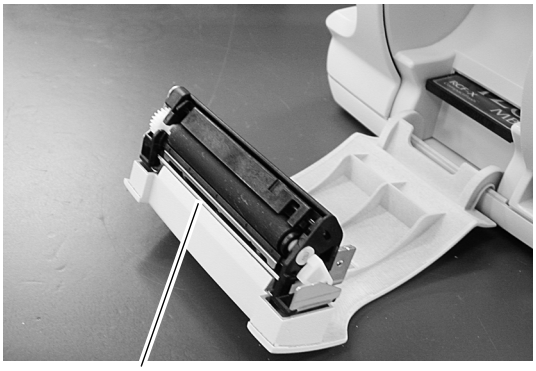
- Check that the cover is closed securely.

  If the cover is closed incompletely, the auto-cutter may not operate properly.

5.5 Cleaning Printer

Following an extended period of use, the paper feed on the printer auto-cutter becomes dirty due to cutting residue.
If left as is, failure of the auto-cutter may occur. So perform cleaning of the printer.

1 Open the printer cover to remove the printer paper.



2 Put the nozzle of an electric vacuum cleaner on the auto-cutter to vacuum the residue.

Do not blow the residue. It may cause failure due to the residue becoming attached to the internal operation mechanism.

3 Set the printer as it was.

5.6 Cleaning Measuring Windows

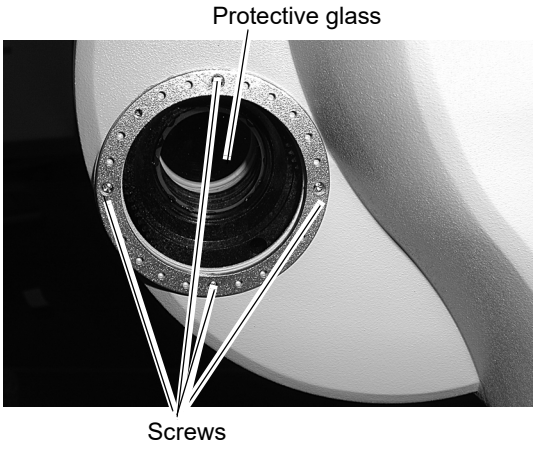
Fingerprints, oil from eyelashes, or dusts on the measuring windows affect the measurement accuracy.
Be sure to check the windows before each refraction. When the windows are dirty, remove any dust on the measuring window with a blower brush. For more persistent stains, lightly wipe with a clean and soft cloth.

Be sure to wipe lightly so as not to scratch the glass of the measuring window.

If condensation forms inside the measuring windows, remove the protective glasses and wipe the inside.

The protective glasses of the operator and patient sides are removed by unscrewing the four screws with a precise screwdriver.

Remove the face shields before removing the patient's side protective glasses.



Note

- Attach the protective glasses with the screws just after cleaning.
  Failure to do so could allow dusts to be settled inside the RT-3100. It may affect the viewability or cause malfunction.

5.7 Cleaning Exterior

When the cover or panel becomes dirty, clean it with a soft cloth.
For persistent grime, soak the cloth in a neutral detergent, wring well, and wipe. Finally dry with a soft, dry cloth.

Note

- Never use an organic solvent such as paint thinner.
  It may ruin the surface of the refractor.

5.8 Setting CF Card

When writing programs or parameter settings to the CF card, or reading the saved settings, set the CF card into the control box beforehand.

Note

- The CF card must be formatted with FAT or FAT32.

1 Turn off the power switch on the system table and turn off the refractor.

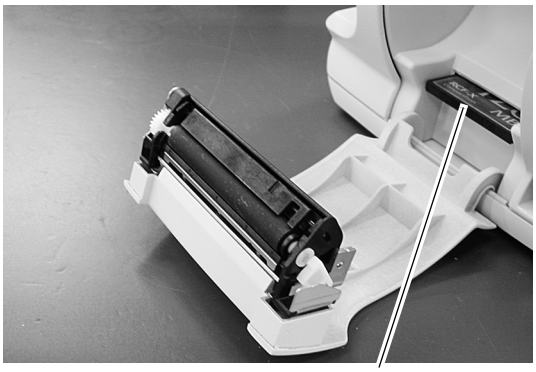
2 Open the printer cover to remove the printer paper.
See "5.4 Replacing Printer Paper" (Page 123).

3 Remove the printer paper.

4 Insert or remove the CF card to/from the CF card port.

5 Restore the printer paper.

6 Close the printer cover.



CF card

5.9 Cleaning Eye Care Card Reader

After the device is used for an extended period of time, grime may become adhered to the contact of the Eye Care card reader.

When the Eye Care card is used for data communication between devices, clean the Eye Care card reader with the contact cleaner (optional part No.: 34086-7110) as necessary.

Also, clean the contact of the Eye Care card with a soft cloth as necessary. (For persistent grime, soak the cloth in a dilute neutral detergent, wring well, and wipe. Finally, dry with a soft, dry cloth.)

Note

- Be sure to turn off power to the device before cleaning.
- For usage of the contact cleaner, refer to its “Directions for Use”.
- The Eye Care card reader contacts are on the lower surface. Repeatedly insert the contact cleaner with the wiper part (cloth-attached surface) facing downward several times to clean the reader contacts.

5.10 Retightening Near Point Chart Holder

When the near point rod is operated frequently for a long period of time, the near point chart holder may become loose and the near point rod may rattle. In such a case, retighten the screw on the near point chart holder with the procedure below.

1 Lower the near point rod.

2 If the screw is loose, tighten it with a hexagonal wrench (2.5 mm).

3 Raise the near point rod back to the vertical position.

5.11 List of Replacement Parts

Part name	Part number	Remarks
Printer paper	8062000001	

6. SPECIFICATIONS AND ACCESSORIES

6.1 Classifications

- **Protection against electrical shock: Class I ME equipment**
- **Protection against electrical shock (applied part): Type B applied part**
- **Protection against harmful ingress of water or particulate matter: IPX0**
- **Method(s) of sterilization: ME equipment that does not contain any part that needs sterilization**
- **Suitability for use in an oxygen rich environment: ME equipment that is not intended for use in an oxygen rich environment**
- **Mode of operation: Continuous operation**

6.2 Specifications

○ Measurable range

• Spherical power	–19.00 to +16.75 D (in 0.25 D/0.5 D to 3.0 D increments)
• Cylindrical power	0.00 to ±6.00 D (in 0.25 D/1 D increments)
• Cylindrical axis	0 to 180º (in 1º/5º increments)
• Pupillary distance	48 to 80 mm (Far mode) 50 to 74 mm (Near working distance of 35 cm) 54 to 80 mm (Far PD possible for 100% convergence)
• Prism	0 to 20Δ (in 0.1Δ/0.5Δ/2Δ increments)

○ Refractor head

• Auxiliary lens	Cross cylinder lens (±0.25 D) Occluder Pinhole plate (ϕ2 mm) Red-green filter (Right eye: red, Left eye: green) Polarizing filters (Right eye: 135º/Left eye: 45º, Right eye: 45º/Left eye: 135º) Fixed cross cylinder lens (±0.50 D) Spherical lenses for retinoscope (+1.5 D / +2.0 D) Red maddox rod (Right eye: horizontal, Left eye: vertical) Dissociation prism (Right eye: 6ΔBU, Left eye: 10ΔBI) Dissociation prism (Right eye: 3ΔBD, Left eye: 3ΔBU)
• Visual field	40º (VD = 12 mm) 39º (VD = 13.75 mm)
• Refraction distance for near vision	350 to 700 mm (Selectable in 50 mm increments)
• Forehead rest adjustment range	14 ±2 mm
• Vertex distance marking	12 mm, 13.75 mm, 16 mm, 18 mm, 20 mm
• Level adjustment	±2.5º

○ Control box

• Display	Dot-matrix screen, color LCD (5.7-inch) with touch panel
• Printer	Built-in
• Eye Care card Reader/Writer	Built-in

○ Power specifications

• Power source	AC 100 to 240 V (±10%)
• Frequency	50/60 Hz
• Power consumption	80 VA

○ Dimensions

- Refractor head 355 (W) × 100 (D) × 276 (H) mm (excluding bracket)
- Control box 160 (W) × 209 (D) × 165 (H) mm
- Relay box 194 (W) × 227 (D) × 61 (H) mm

○ Mass

- Refractor head 3.5 kg
- Control box 1.7 kg
- Relay box 2.0 kg

○ Environmental conditions (During transport and storage)

- Temperature –10 to 55°C (14 to 131°F)
- Humidity 10 to 85% (Non-condensing)
- Pressure 700 to 1060 hPa (during storage), 500 to 1060 hPa (during transport)

○ Environmental conditions (During use)

- Temperature 10 to 35°C (50 to 95°F)
- Humidity 30 to 85% (Non-condensing)
- Pressure 800 to 1060 hPa
- Installation location Indoors

○ Other

- Expected service life (defined by manufacturer)
  8 years from the date of initial operation
  * Proper maintenance is necessary.
- Packing unit 1 unit

6.3 Standard Configuration

6.3.1 Standard accessories

• Refractor head	•1 unit
• Control box	•1 unit
• Relay box	•1 unit
• Near point card	•1 unit
• Near point rod	•1 unit
• Forehead rest	•1 unit
• Face shield	•1 unit
• Touch-screen pen	•1 unit
• Dust cover	•1 unit
• Communication cable (MB - RB)	•1 unit
• Communication cable (CB - RB)	•1 unit
• Printer paper	•3 rolls
• Power cord	•1 unit
• Hexagonal wrench (2.5 mm)	•1 unit
• Operator’s manual	•1 volume

6.3.2 Optional accessories

- Eye Care card – a set of five cards
- EyeCa-RW2 (Eye Care card reader/writer)
- Memory box
- Refractor head tilt unit
- Space Saving Chart SSC-100

7. APPENDIX

7.1 Linkage between Charts and Auxiliary Lenses

The following table shows the auxiliary lenses linked to the charts when the Chart link parameter is set to Yes.

Chart	Auxiliary lens		Mode
	Right eye	Left eye	
VA charts	○ or ●		S
Astigmatism clock dial	○ or ●		C/A
Red-green	○ or ●		S
Dots	○ or ●		A/C (XC mode)
Binocular balance	Polarizing filters *1		S
Binocular red-green	Polarizing filters *1		S
Phoria	Polarizing filters *2		Prism H/V
Phoria with fixation	Polarizing filters *2		Prism H/V
Vertical coincidence Mallet (horizontal bars)	Polarizing filters *2		Prism V
Horizontal coincidence Mallet (vertical bars)	Polarizing filters *2		Prism H
Stereo	/ Polarizing filters / *2		—
Worth	Red filter	Green filter	—
Vertical line	6ΔBU prism	○	Prism H
Horizontal line	○	10ΔBI prism	Prism V
Fixation	Horizontal maddox / ○	○ /Vertical maddox	Prism H/V
Schober	Red filter	Green filter	Prism H/V
Cross grid for near vision	Fixed cross cylinder lens ○ or ●		ADD

Chart	Auxiliary lens		Mode
	Right eye	Left eye	
VA chart for near vision	○		ADD

* The slash “/” indicates that the auxiliary lens changes alternately each time the chart key is pressed. The lens on the right side is set in the first press of the chart key.
* The Prism H indicates base in/out prism (BI/BO) and V indicates base up/down prism (BU/BD).
* In the SSC-350 type T and TCG, the auxiliary lenses corresponding to the stereo test are open.

*1 The auxiliary lenses (3ΔBD to the right, 3ΔBU to the left eye) are inserted when the SC-2000, SC-1600, or SSC-100 is connected.

*2 The auxiliary lenses (red filter on the right, green filter on the left) are inserted when the SC-2000, SC-1600, or SSC-100 is connected.

7.2 VA Conversion Table

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

7.3 Standard Programs

The RT-3100 has four programs: A, B, C, and ☼☽ , which can be programmed by the user.
The following standard programs have already been written in Program A and Program ☼☽ as factory setting.

○ Program A

The final prescription is obtained after the monocular full correction (subjective data) is stored. The binocular balance test and stereo test are performed in the final field. Then the precise addition power is measured with the cross grid for near vision in the subjective field.

<Subjective field>

1. R: AR data check	Check that the VA is about 20/30 in the AR data.
2. R: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
3. R: Cross cylinder test (axis)	Measure the cylindrical axis with the cross cylinder lens.
4. R: Cross cylinder test (power)	Measure the cylindrical power with the cross cylinder lens.
5. R: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
6. R: Best possible VA check (monocular full correction)	Best possible VA on the chart with most plus power
7. L: AR data check	Check that the VA is about 20/30 in the AR data.
8. L: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
9. L: Cross cylinder test (axis)	Measure the cylinder axis with the cross cylinder lens.
10. L: Cross cylinder test (power)	Measure the cylindrical power with the cross cylinder lens.
11. L: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
12. L: Best possible VA check (monocular full correction)	Best possible VA on the chart with most plus power

<Final field>

13. B: Binocular balance test	Test the binocular balance.
14. B: Stereo test	Check the stereoscopic vision.
15. B: Power adjustment	Power adjustment depending on the purpose

<Subjective field>

16. B: Addition power measurement	Measure the addition power with the cross grid chart for near vision

<Final field>

17. B: Addition power check	Check the addition power with the near VA chart.

○ Programs B and C: Empty

○ Program ☼☽: Day/Night measurement

☼☽ (Day/Night measurement course) is a course performing night measurement after day measurement.
The Day course is a course to achieve the best possible visual acuity with the most plus power based on the objective measurement data. The Night course is a course to achieve the best possible visual acuity with the most plus power for night vision based on the full correction value for daytime vision.
It is necessary to enter the objective and subjective (copied from the objective) data with an auto refractometer before using Program ☼☽.

<For Day>

1. R: AR data check	Check that the VA is about 20/30 in the AR data.
2. R: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
3. R: Cross cylinder test (axis)	Measure the cylinder axis with the cross cylinder lens.
4. R: Cross cylinder test (power)	Measure the cylindrical power with the cross cylinder lens.
5. R: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
6. R: Best possible VA check (monocular full correction)	Best possible VA on the chart with the most plus power
7. L: AR data check	Check that the VA is about 20/30 in the AR data.
8. L: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
9. L: Cross cylinder test (axis)	Measure the cylindrical axis with the cross cylinder lens.
10. L: Cross cylinder test (power)	Measure the cylindrical power with the cross cylinder lens.
11. L: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
12. L: Best possible VA check (monocular full correction)	Best possible VA on the chart with the most plus power
13. B: Binocular balance test	Test the binocular balance.
14. B: Stereo test	Check of stereophonic vision
15. B: Power adjustment	Power adjustment depending on the purpose
16. B: Addition power measurement	Measure the addition power with the cross grid chart for near point
17. B: Addition power check	Measure the VA in the addition power with the near VA chart

<For Night>

18. R: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
19. R: Cross cylinder test (axis)	Measure the cylinder axis with the cross cylinder lens.
20. R: Cross cylinder test (power)	Measure the cylindrical power with the cross cylinder lens.
21. R: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
22. R: Best possible VA check (monocular full correction)	

	Best possible VA on the chart with the most plus power
23. L: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
24. L: Cross cylinder test (axis)	Measure the cylinder axis with the cross cylinder lens.
25. L: Cross cylinder test (power)	Measure the cylindrical power with the cross cylinder lens.
26. L: Red-green test	Spherical refinement with the red-green chart (fog + 0.5)
27. L: Best possible VA check (monocular full correction)	
	Best possible VA on the chart with the most plus power
28. B: Binocular balance test	Test the binocular balance.
29. B: Stereo test	Check of stereophonic vision.
30. B: Best possible VA check power adjustment	
	Best possible VA on the chart with the most plus power

8. 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

O Specified accessories

Part name
Memory box

OSpecified cable

Part name	Cable Shielded	Ferrite Core	Length (m)
Power cord	No	No	2.5
Communication cable (MB - RB)	Yes	No	7.0
Communication cable (CB - RB)	Yes	No	5.0

OEssential performance

Measurement of subjective refractive power

◆ 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

9. INDEX