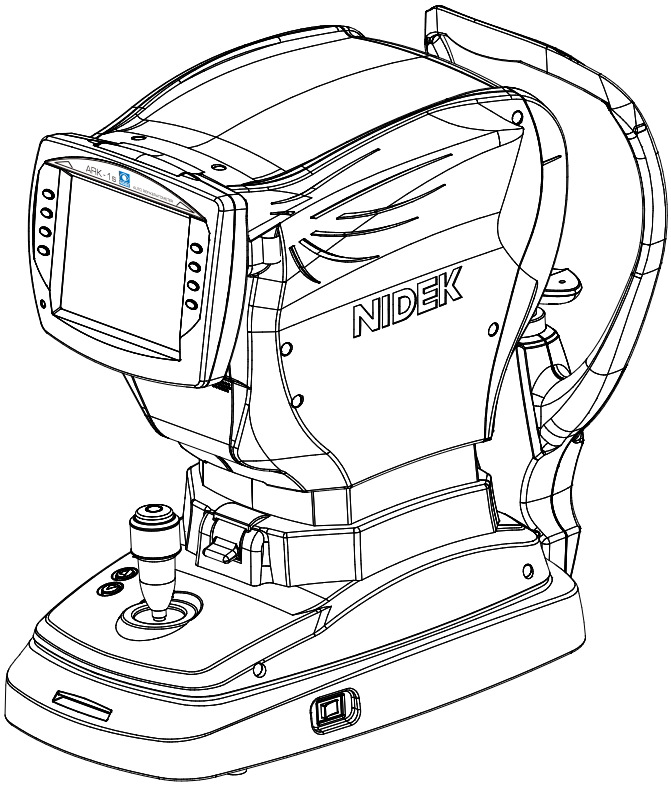
NIDEK

AUTO REF/KERATOMETER
ARK-1s

OPERATOR'S MANUAL



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

Original instructions

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Before Use

This Operator's Manual contains information necessary for the operation of the NIDEK AUTO REF/KERATOMETER ARK-1s.

This manual includes operating procedures, safety precautions, specifications, and information about accessories and maintenance. This manual is necessary for proper use. Especially, the safety precautions and operating procedures must be thoroughly understood prior to the operation of the device.

Keep this manual handy for reference.

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

IMPORTANT - READ CAREFULLY

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.

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

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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.

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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.

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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.

Table of Contents

1 SAFETY PRECAUTIONS

1.1 For Safe Use

⚠ **BEFORE USE, READ THIS MANUAL.**
The safety precautions and operating procedures must be thoroughly understood prior to operation of the device. The device complies with ISO 10342 subclause 4: 2010 (Ophthalmic instruments - Eye Refractometers) and ISO 10343 subclause 4: 2014 (Ophthalmic instruments - Ophthalmometers). The dioptric powers are indicated with reference wavelength λd = 587.56 nm.

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

1.2 Usage Precautions

Before use

⚠ WARNING

- If any serious device-related incident occurs, report it to NIDEK and the competent authority in the country where the user or patient, or both reside.
- Connect the power plug to a grounded outlet.

  Electric shock or fire may occur in the event of malfunction or power leakage.

⚠ CAUTION

- Do not use this device for any purposes other than the intended purpose.

  NIDEK is not responsible for accidents or malfunctions caused by misuse.
- Be sure to read the operator's manual prior to operation of the device to understand the safety precautions and operating procedures thoroughly. Use the accessories specified by NIDEK only.

  Use of the device outside the scope of this manual may cause adverse events.
- Do not modify the device and do touch the interior of the device.

  There are no parts within the device that requires servicing by the user other than printer paper.
- Install the device in an environment that meets the following conditions.

  The following conditions must be maintained during use.

  Ambient temperature: 10 to 35°C (50 to 95°F)

  Humidity: 30 to 90% (Non-condensing)

  Atmospheric pressure: 800 to 1,060 hPa

  A location with low dust

  A location not exposed to water

  A location with little external light

  A level and stable surface free from vibration and shock

  If the device is not installed and used under the above conditions, the reliability of measured results is impaired, and malfunction may result. In addition, there is a possibility of injury if the device receives shock and falls down.
- Avoid installing the device near sunny window or directly under a light.

  Intense light entering the measuring window may interfere with proper measurement.
- Avoid installing the device where it is exposed to direct air-conditioning flow.

  Changes in temperature may result in condensation inside the device or adversely affect measurements.
- Be sure to use a (HOSPITAL GRADE) power outlet which meets the power specification requirements.

  The device may not perform properly, or malfunction or fire may occur.

⚠ CAUTION

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

  The electrical safety may be lowered.

- Do not use a power cord other than the one provided. Also do not connect the provided power cord to any other device.

  Failure or fire may result.

- Do not place heavy objects on the power cord.

  A damaged power cord may cause fire or electric shock.

- Before connecting the cable, turn off the power switch and disconnect the power cord from the power outlet.

  Malfunction of the device may result.

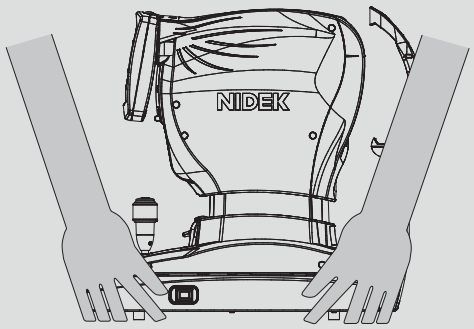
- Install the device so that the outlet that the mains plug is inserted into is easily accessible during use. In addition, ensure that the power cord can be disconnected without the use of any tool.

  Failure to do so may interfere with disconnecting the power from the input power source in case of an abnormality.

- Insert the plug into the connector according to the proper indication and orientation and do not apply undue force to make the connections.

- The device should be carried by two persons holding it at positions (A) and (B) (both right and left sides). Avoid lifting by the forehead rest or the main unit instead hold it by the bottom of the base.

  If only one person carries the device, or areas other than the base are used for lifting and the device falls, there is a possibility of injury or malfunction.



(A) (B)

During use

⚠ CAUTION

- Do not perform servicing or maintenance on the device during use.
- Before use, perform visual and operation checks. If abnormal conditions are encountered, stop using the device.

  If the device is used under abnormal conditions, intended results may not occur. Also unanticipated malfunctions or health hazards may occur due to improper measurement.

- Before and after use of the device, and before measuring each patient, clean the chinrest and forehead rest with clean gauze or absorbent cotton. If necessary, dampen a cloth with rubbing alcohol and gently wipe them off.

  If chinrest paper is used, remove one piece after each patient.

- Do not use a cloth that is overly dampened with rubbing alcohol to clean the forehead rest.

  Deterioration of the forehead rest may result.

- Take care not to catch hands or fingers in moving parts (measuring unit, main unit, and chinrest). Pay particular attention to the measuring unit as it moves in each direction during auto alignment. Be sure to also caution patients.

  Hands or fingers may be pinched and may result in injury.

- Keep the measuring window free of fingerprints and dust. Also confirm that it is not dirty before use.

  The measurement accuracy may decrease substantially.

⚠ CAUTION

- In the event of smoke or strange odors, immediately turn off the device and disconnect the power plug from the power outlet. After it is certain that the smoke has stopped, contact NIDEK or your authorized distributor.

  Use of the device under such abnormal conditions may cause fire or electric shock. In case of fire, use a dry chemical (ABC) extinguisher to extinguish the fire.

- Before measurement, explain the measurement purpose and method sufficiently to patients.
- Instruct the patient to look at the picture of a balloon with their eyes wide open. Start measurement after confirming that the instruction is properly followed by the patient. Be careful not to perform measurement while the device is misaligned to the patient's eye.

  Proper measurement may not be performed.

- When the patient comes off from the device after measurement, instruct the patient not to stand up while holding the chinrest support.

  The device may topple over resulting in injury.

- Never press on the LCD with a hard object such as a ball-point pen. Keep magnetic objects away from the LCD.

  Malfunction of the device may result.

- There may be a few dead or constantly-lit pixels on the LCD. This does not represent failure of the LCD; it is due to the structure of the LCD.
- Should the device fail, disconnect the power cord from the power outlet and contact NIDEK or your authorized distributor without touching the interior of the device.
- After a long period of disuse, check for any abnormality before use.
- 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.

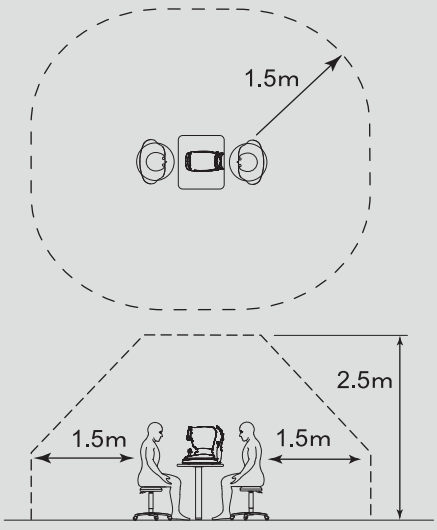
  Electric shock may result. Contact NIDEK or your authorized distributor for installing isolation transformers.

- When connecting to peripheral equipment such as a PC through LAN port via a medical facility network, insert or connect an isolation transformer between the medical electrical equipment and network devices (HUB etc.), or the network devices and other electrical equipment.

  Depending on the types or numbers of other electrical equipment connected to the network, electric shock or malfunction/failure of the electrical equipment may occur. For installation of the network isolation transformer, consult NIDEK or your authorized distributor.

- This device is classified as Group 1 set by ISO 15004-2: 2007 Light Hazard and conforms to the standard.
- Use devices that comply with IEC 60601-1 in the patient environment. If any device that does not comply with IEC 60601-1 is to be used, install the device outside the patient environment. For a generalized information system, use the device that complies with IEC 60950-1 or IEC 62368-1. For other devices, use any separation device that complies with IEC 60601-1 and keep sufficient distance between the device and patient environment.

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



After use

⚠ CAUTION

- This device uses a heat-sensitive printer paper. The paper degrades over time and the printed characters may become illegible. If glue containing organic solvents or adhesives such as on adhesive tape comes in contact with the printer paper, the printed characters may become illegible.

  To keep the printed data for a long period of time, make copies of the printouts or write down the measured results by hand.

- When the device is not in use, turn off the power switch and place the dust cover over the device.

  Dust may affect the measurement accuracy.

- Make sure that the power switch is turned off before connecting or disconnecting the power cord to or from the power outlet.

  If the power cord is connected or disconnected with the power switch on, device malfunction may occur.

- If the device is not to be used for a long time, disconnect the power cord from the power outlet.

- Maintain the surrounding temperature and humidity in the following ranges during transport and storage of the device.

  Ambient temperature: -10 to 55°C (14 to 131°F)

  Humidity: 10 to 95% (Non-condensing)

  Atmospheric pressure: 700 to 1,060 hPa

  A location with low dust

  A location not exposed to water

  A location not exposed to direct sunlight

- When transporting, set the mode to packing mode and pack the main unit in the specified packing material with the fixing lever unlocked. In addition, avoid vibration or shock to the device.

  Excessive vibration or shock may reduce the device reliability.

  Setting packing mode *"O Shutdown for transportation" (page 31)*

Maintenance

⚠ CAUTION

- 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 (and calibration if necessary) 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.

- Only service personnel trained by NIDEK can repair the device.

  NIDEK will not be responsible for accidents caused by improper servicing.

- Before performing maintenance, clean the surface of the device properly with a clean cloth dampened with rubbing alcohol.
- When sending the device back to NIDEK for repair or maintenance, clean the surfaces of the device (especially, the areas that come into contact with the patient) with a clean cloth dampened with rubbing alcohol.
- If the AR-measured results are substantially different from subjectively measured results, contact NIDEK or your authorized distributor to check whether the device needs measurement accuracy calibration.
- Do not use the device beyond its service life.

  Even with proper maintenance and check, after time, the device reliability or safety may become degraded and fail to achieve the target values.

Disposal

⚠ CAUTION

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

  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.

Connection to Network

⚠ CAUTION

- If the medical system is to be configured using an IT network, implement IT security measures with the network administrator, and check that the system operates properly.

  Virus infection, unauthorized access, or data tampering may result.

1.3 Labels and Symbols

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

	Indicates that the operator is advised to refer to the related instructions in the operator's manual.
	Indicates that the degree of protection against electric shock is of a Type B Applied Part. The applied parts are the forehead rest and chinrest. *"2.2.1 Device configuration" (page 11)*
	Indicates that the state of the power switch. When this symbol side of the switch is pressed down, power is not supplied to the device.
	Indicates that the state of the power switch. When this symbol side of the switch is pressed down, power is supplied to the device.
	Indicates that the device must be supplied only with alternating current.
	Indicates the date of manufacture.
	Indicates the manufacturer.
	Indicates that this product is to be disposed of in separate collection of electrical and electronic equipment in EU.
	Indicates an input terminal.
	Indicates an output terminal.
MD	Medical device
EC REP	EU Authorized Representative
SN	Serial number
CH REP	Swiss authorized representative

2 INTRODUCTION

2.1 Device Outline

- The NIDEK AUTO REF/KERATOMETER ARK-1s measures spherical, cylindrical refractive errors, and cylinder axis from the refractive status of the patient's eye. In addition, subjective test is performed with the built-in charts and lenses for subjective measurement.
- The keratometer measures the corneal curvature radius (corneal refractive power), principal meridian directions, and corneal cylindrical power.

2.1.1 Intended use

The AUTO REF/KERATOMETER ARK-1s is a medical device which measures objective, subjective refractive errors, and corneal curvature radius of the patient's eye. This device also offers retroillumination mode for observing the condition of the ocular media, and measures the amplitude of accommodation.

2.1.2 Intended patient population

- Age
  All ages except babies and infant
- Health condition
  Able to undergo an examination while seated
- Conditions - Visual function
  One or both eyes are normal or have disease.
  Eyes that have lost the visual function are not targeted.

2.1.3 Intended user profile

Ophthalmologist or nurse, clinical laboratory technician / OD, or optician

2.1.4 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.

2.1.5 Principles

Objective refractive error measurement

Fine measurement beams are projected on the fundus of the patient's eye by a projecting optical system and then the ring image obtained from the reflected beams is used for computation to determine the refractive errors (SPH, CYL, AXIS) of the patient's eye.

Subjective refractive error measurement

The chart for which the refraction distance is optically corrected and trial lens located in the line of the patient's eye allow the subjective refractive error measurement and visual acuity test. The spherical power of trial lenses is changed by adjusting the distance from the patient's eye.

Corneal curvature radius measurement

The image of the mire ring projected on the patient's cornea is captured and used for computation to determine the corneal curvature radius (refractive power) and the principal meridian directions.

Retroillumination mode

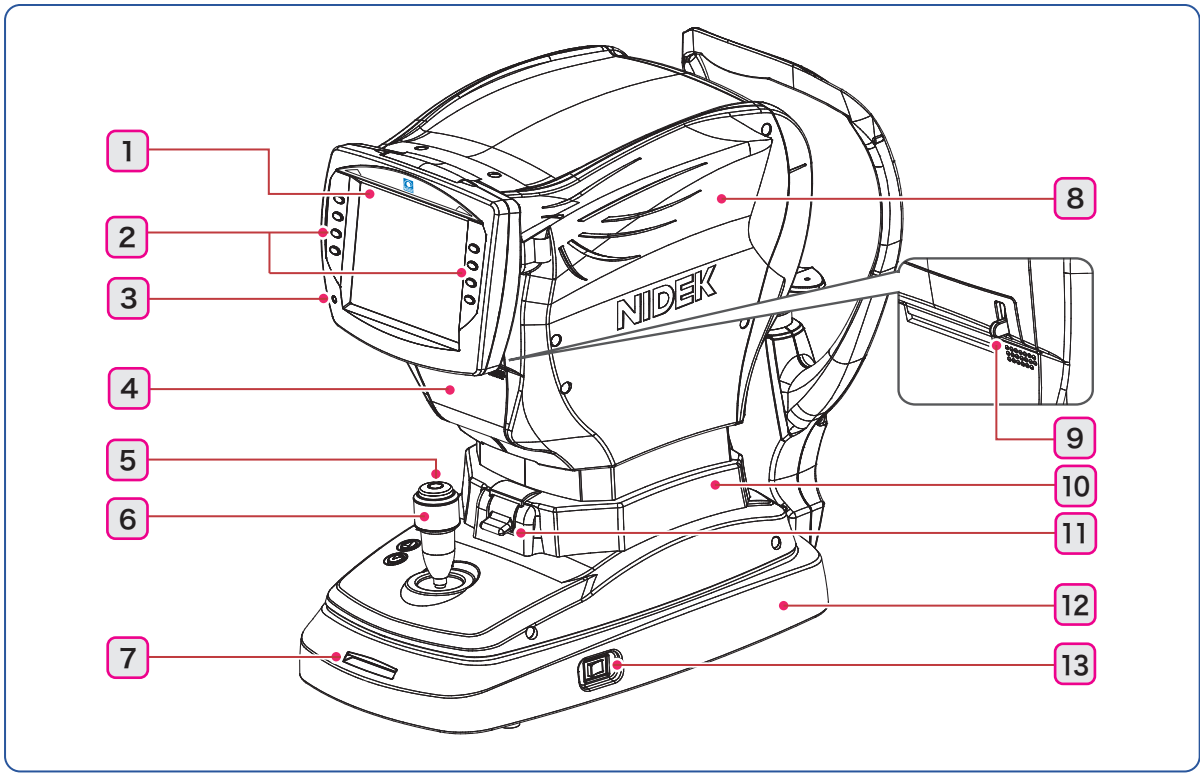
Light is shone into the eye and an image obtained by the reflected light from the fundus allows the condition of the ocular media to be observed.

Accommodation measurement

Continuous refractive error measurement based on the objective refractive errors taken of the patient's eye while fixated on a moving a chart allows accommodation to be determined.

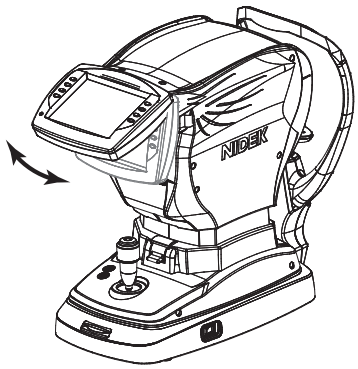
2.2 Configuration and Functions

2.2.1 Device configuration



1 LCD

6.5-inch color LCD. Pulling the bottom of the display panel provides an adjustable viewing angle.



2 Function buttons

Sets the device and switches the screen. Functions assigned to the function buttons are displayed by icons on the screen. *(page 14)*

3 Memory indicator

Indicates that measured data is being saved in memory. The indicator illuminates when data is being saved in memory. In sleep mode[*1], the indicator blinks.

4 Printer cover

*1. The device goes into sleep mode (LCD OFF) automatically to save power if no button has been pressed for a certain period of time with power on. The time that the device goes into sleep mode can be selected from 5 minutes, 10 minutes, 15 minutes, or NO (not enter sleep mode) by the “63. SLEEP” parameter. (The factory setting is 5 minutes.)

5 Start button

When the start button is pressed, measurement starts regardless of the alignment or focusing condition.

6 Joystick

Used for alignment and focusing. *(page 25)*

7 Eye Care card slot

An Eye Care card is inserted here. *(page 28)*

8 Measuring unit

9 Cover open lever

Lift this lever to open the printer cover.

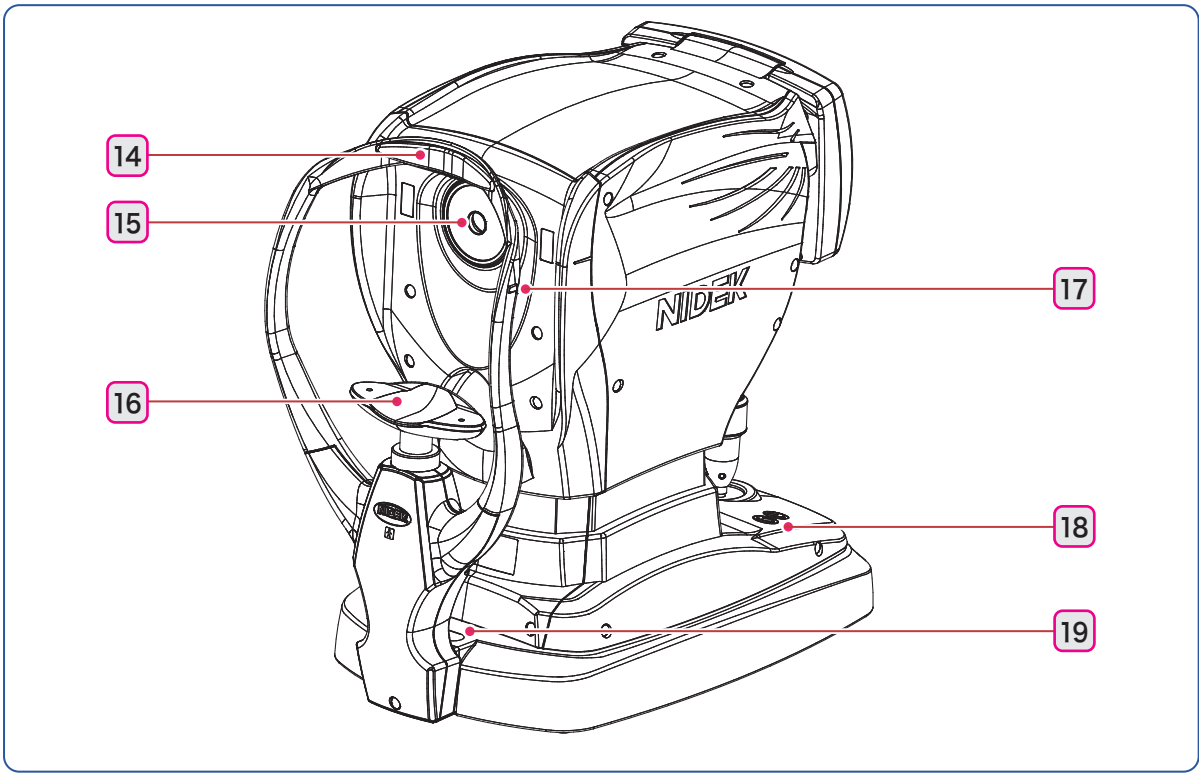
10 Main unit

11 Locking lever

Secures the main body to the base.

12 Base

13 Power switch



14 Forehead rest

15 Measuring window

16 Chinrest

17 Eye level marker

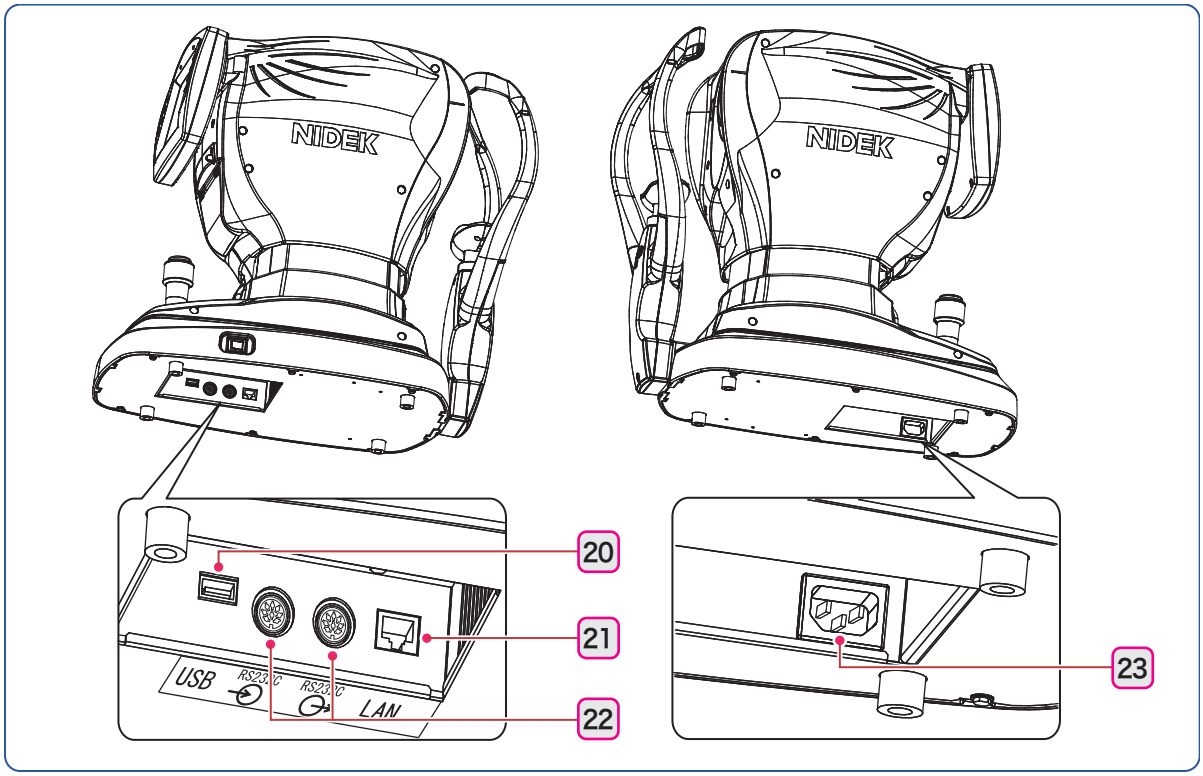
The height of the chinrest should be adjusted so that the patient's eye roughly aligns with this line.

18 Chinrest up/down button (▲ / ▼)

When the chinrest is at the highest (or lowest) mechanical limit, the limit indicator (or) is displayed on the screen.

19 PD window

An LED is provided to detect the PD value.



⚠ CAUTION

- Equipment connected to the analog or digital interfaces must be certified according to the representative appropriate national standards (such as 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 in doubt, consult the technical service department of your local representative.

20 USB port

The optional barcode scanner or magnetic card reader is connected here. *(page 69)*

21 LAN port

A LAN cable is connected here to export measured data to an external computer over a LAN connection.

22 RS-232C port

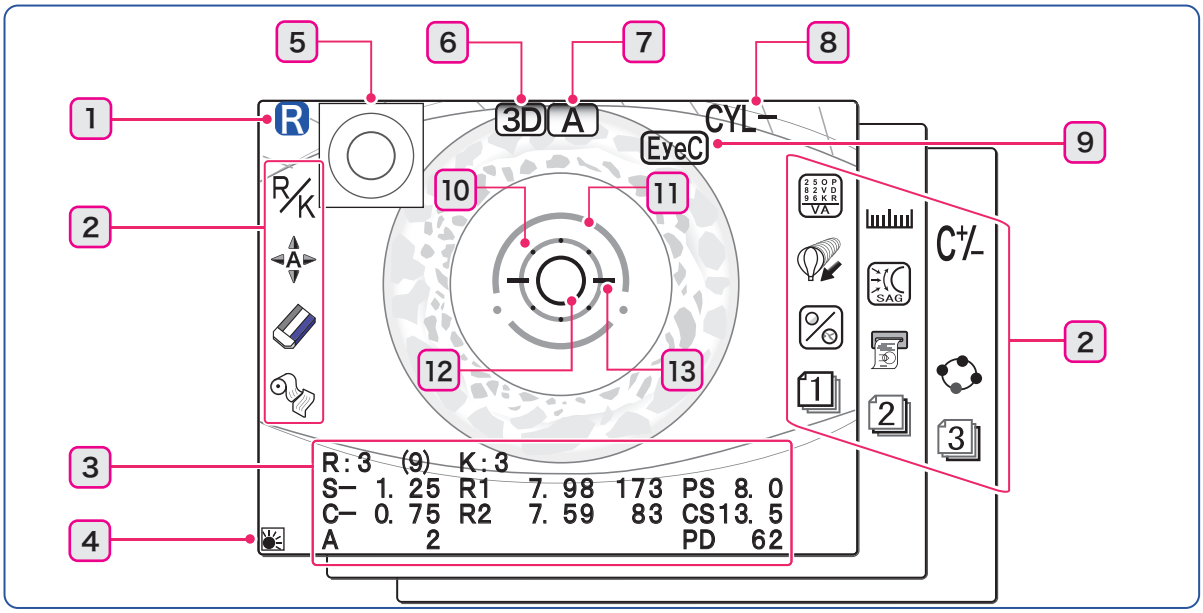
A communication cable is connected here to send/receive measured data to/from an optometry device or such.

23 Power inlet

2.2.2 AR/KM measurement screen description

The screen for AR (refractive error) and KM (corneal curvature radius) measurements is comprised of three pages.

The pages differ only in the function icons displayed to the right of each screen.



1 Patient's eye (R/L)

2 Function icons

The functions assigned to the function buttons on the right and left sides of the screen are displayed as icons.

R/K	Selects measurement mode (AR/KM, AR, or KM).
Auto	Selects auto tracking mode (3D, 2D, OFF) and auto shot mode (ON, OFF).
Clear	Holding down the button for about a second erases all the measured data.
Print	Pressing the button while the memory indicator is lit prints the measured results. Pressing the button while the memory indicator is not lit advances printer paper.
VA	Displays the corrected visual acuity measurement screen (SUBJECT). Holding down the button for about a second displays the uncorrected visual acuity measurement screen (VA TEST).
Accommodation measurement	Displays the accommodation measurement screen (ACCOMMODATION).
Ring image / retroil-lumination	Displays the ring image in full screen when a thumbnail of the ring image is displayed. Holding down the button for about a second displays the retroillumination image observation screen (RETRO ILLUMINATION).
1/2/3 Page switch	Switches the measurement screen among Page 1, Page 2, and Page 3.
CS/PS/PD	Switches from AR/KM measurement to CS/PS/PD measurement.
Sagittal	Displays the sagittal measurement screen (SAGITTAL).
Eye print	Prints the eye diagram of measured data.
C+/- CYL mode	Switches cylinder (cylindrical refractive error) mode.

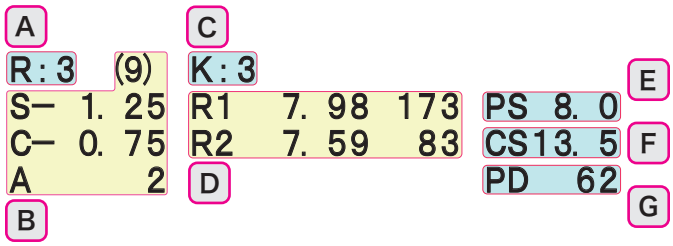
Parameter	Holding down the button for about a second displays the parameter setting screen.

Note

- With the parameter setting, the summary button can be displayed instead of the print button. Pressing the summary button displays the summary screen that shows various measurement values at the same time. *(page 66)*

3 Measured results display

The latest measured results are displayed.



E	PS: Pupil Size
F	CS: Corneal Size
G	PD: Pupillary Distance

A	R: Number of AR measurements	C	K: Number of KM measurements
B	AR latest values S: Spherical refractive error C: Cylindrical refractive error A: Cylinder axis * The number in parentheses indicates a confidence index.	D	KM latest values R1: Corneal curvature radius and axis angle in the flattest meridian direction R2: Corneal curvature radius and axis angle in the steepest meridian direction

Note

- KM latest values can be changed to “AVE, CYL” by the “12. KM DISPLAY” parameter.
  AVG: Average of R1 and R2
  CYL: Corneal cylindrical power and corneal cylinder axis angle

4 Heater indication

Displayed when the anti-fog heater of the measuring window is operating. The heater is activated or deactivated automatically.

5 Measurement ring image thumbnail

A thumbnail of the latest measurement ring image is displayed when AR measurement is performed. *(page 35)*

When the screen returns from the ring image full screen to the normal screen, no thumbnail is displayed.

6 Auto tracking icon

Indicates the setting of the auto tracking function (alignment in the up, down, left, and right, directions and focusing in the forward and backward direction). *(page 25)*

3D	Auto tracking in the forward-backward, side-to-side, and up-and-down directions becomes active.
2D	Auto tracking in the side-to-side and up-and-down directions becomes active.
(No icon)	Alignment and focusing are manually performed.

7 Auto shot icon

Indicates the setting of the auto shot function.

A	Measurement starts automatically as soon as alignment and focusing become optimum.
(No icon)	Pressing the start button starts measurement.

8 CYL mode

Indicates the selected cylinder mode (CYL+, CYL-, CYL±). *(page 25)*

9 Indication icon

An icon indicating the device or measurement status is displayed at the top of the screen.

CAT Cataract measurement mode icon	Indicates that the eye has been measured in cataract measurement mode.
EyeC Eye Care card icon	Displayed when an Eye Care card is inserted.
ID ID icon	Displayed when patient ID has been input with the barcode scanner or magnetic card reader. When an Eye Care card is not inserted, patient ID is displayed instead.
SAG Sagittal icon	Indicates that KM measurement has been performed and sagittal measurement is possible.

10 Minimum pupil diameter mark 

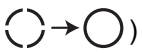
If the pupil diameter is smaller than this mark or eyelashes are on this mark, measurement may not be possible.

11 Mire ring 

Used as an alignment reference ring.

12 Target

Used as a guide to locate the patient's eye in the center of the screen. Align the target with the mire ring projected on the patient's eye.

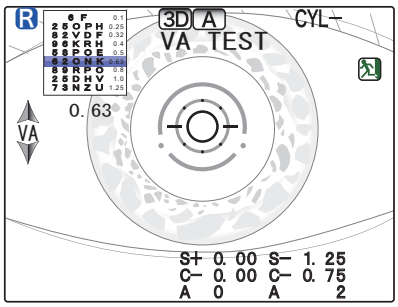
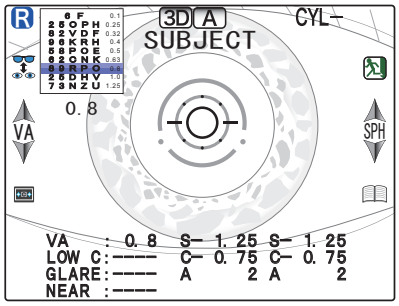
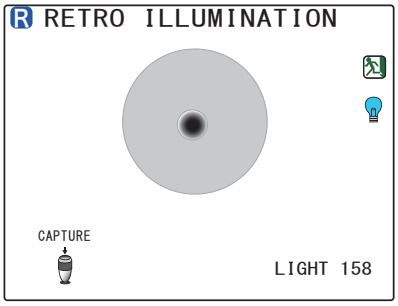
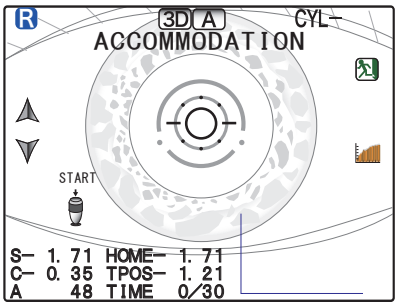
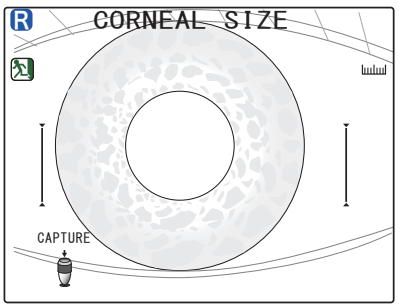
When the mire ring is detected, the indication changes. ()

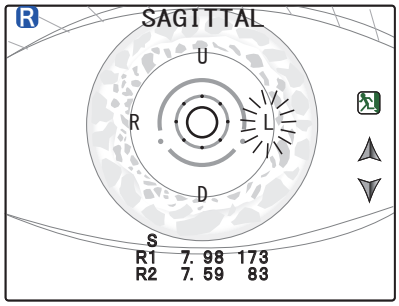
13 Focusing indicator

Indicates the distance between the measuring unit and the patient's eye. *(page 33)*

2.2.3 Other measurement screens

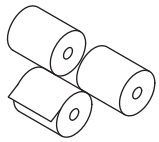
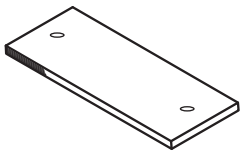
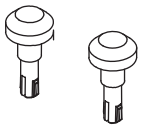
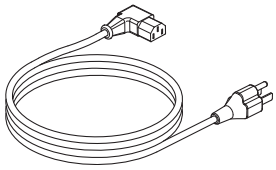
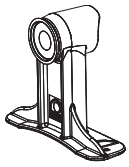
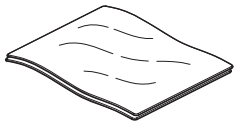
Various measurements can be performed by switching from the AR/KM measurement screen.

Uncorrected visual acuity measurement screen (VA TEST) To conduct the subjective uncorrected visual acuity test *(page 38)*	
Corrected visual acuity measurement screen (SUBJECT) To conduct the subjective corrected visual acuity test *(page 40)* VA: Corrected distance visual acuity, LOW C: Low contrast visual acuity, GLARE: Glare visual acuity, and NEAR: Near visual acuity can be tested.	
Retroillumination image observation screen (RETRO ILLUMINATION) To observe the retroillumination image *(page 49)*	
Accommodation measurement screen (ACCOMMODATION) To conduct accommodation measurement *(page 51)*	
Manual CS/PS/PD measurement screen To manually measure the Corneal Size (CS), Pupil Size (PS), or Pupillary Distance (PD) Corneal Size (CS) measurement *(page 53)* Pupil Size (PS) measurement *(page 55)* Pupillary Distance (PD) measurement *(page 57)*	

Sagittal measurement screen (SAGITTAL) To conduct sagittal measurement *(page 59)*	

2.3 Packed Contents

■ The following are included in the standard configuration. Check the contents before use.

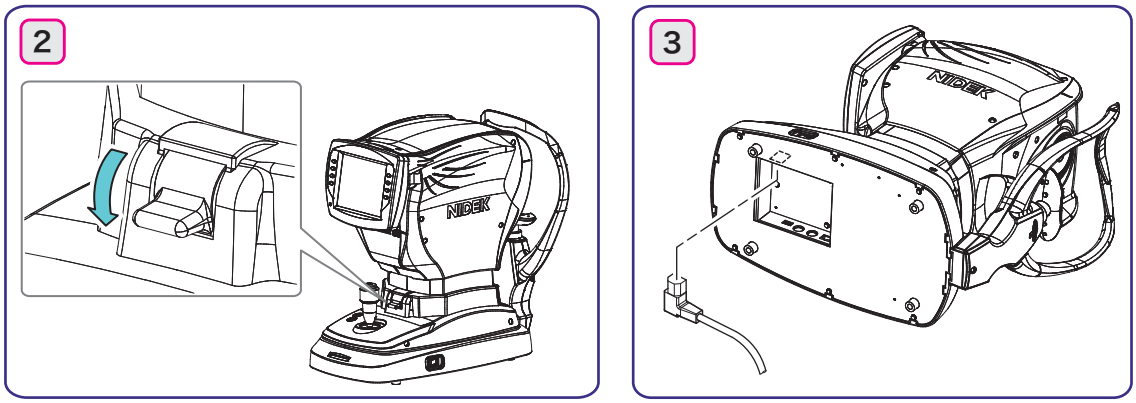
Part name	Quantity	Appearance
Printer paper	3 rolls	
Chinrest paper	1 pack	
Fixing pins for chinrest paper	2 units	
Magnetic forehead rest pad (The magnetic forehead rest pad does not come attached to the device and is included in the packed contents.)	1 unit	
Power cord	1 unit	
Spherical model eye / Contact lens holder (integral type)	1 set	
Dust cover	1 unit	
Operator’s manual	1 volume	

2.4 Before First Use

■ Place the device on a stable table and connect its power cord.

1 Place the main body on a stable table.

2 Pull the main unit fully to the side to which the device is to be laid down, lock the main unit to the base with the locking lever and lay the device down gently.



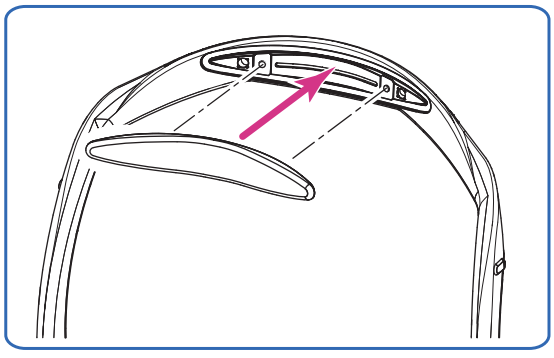
3 Connect the power cord to the power inlet.

4 Connect peripheral devices if necessary. *(page 68)*

5 Stand the device upright.

6 Attach the magnetic forehead rest pad to the device.

The magnetic forehead rest pad does not come attached to the device and is included in the packed contents. The magnetic forehead rest pad is attachable in the orientation as shown to the right.



7 Confirm that the power switch is turned off (◯) and plug the power cord into the power outlet.

⚠ WARNING

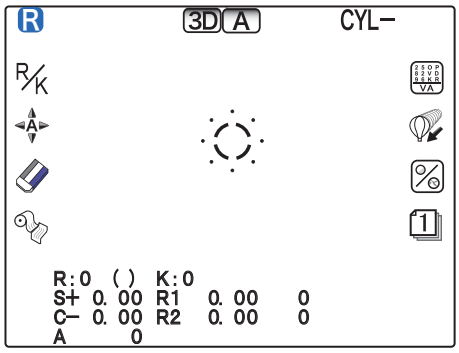
- Connect the power plug to a grounded outlet.
  Electric shock or fire may occur in the event of malfunction or power leakage.

8 Turn on (|) the power switch.

Wait until the measurement screen appears without any operation.

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

Initial screen



Measurement screen

Note

- When the device is used for the first time, the error message “OUT OF PAPER” appears indicating that no paper is loaded.

9 Set the printer paper. *(page 77)*

This completes the setup procedure.

Note

- Set the parameters as necessary or desired. *“4.6 Device Parameter Settings” (page 80)*

3 OPERATING PROCEDURE

3.1 Operation Flow

Device power ON

"3.2 Measurement Method" (page 24)
Turn on power to the device and change the parameter settings of the device if necessary.
Prepare the patient.

Measurement

"3.3 AR (refractive error) and KM (corneal curvature radius) Measurements" (page 32)
"3.4 Uncorrected Visual Acuity Measurement (UCVA)" (page 38)
"3.5 Corrected Visual Acuity Measurement (Subjective Refractive Error Measurement)" (page 40)
"3.5.1 Distance visual acuity measurement" (page 41)
"3.5.2 Near visual acuity measurement" (page 44)
"3.5.3 Contrast visual acuity / glare visual acuity measurement" (page 47)
"3.6 Retroillumination Image Observation" (page 49)
"3.7 Accommodation Measurement" (page 51)
"3.8 Manual Measurement" (page 53)
"3.8.1 CS (Corneal Size) measurement" (page 53)
"3.8.2 PS (Pupil Size) measurement" (page 55)
"3.8.3 PD (Pupillary Distance) measurement" (page 57)
"3.9 Sagittal Measurement" (page 59)

Printing

"3.11 Measured Value Printing" (page 63)
When transferring data to the connected devices
"3.13 Operation when Peripheral Devices are Connected" (page 68)

Device power OFF

"3.2.3 Device shutdown" (page 31)

To prescribe spectacle lenses or such for correction of visual acuity, the patient's vision is subjectively tested with reference to AR-measured data.

3.2 Measurement Method

1 Turn on (|) the power switch.

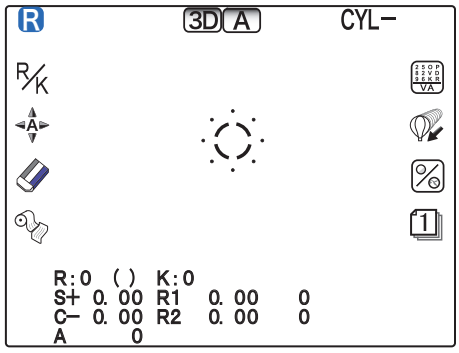
Wait until the screen switches to the measurement screen.

When the device is turned on, the measuring unit makes small forward-backward, side-to-side movements for initialization of auto tracking.

Note

- When the “61. WINDOW CHECK” parameter is set to “YES” or “DAY”, the check screen is displayed before the measurement screen is displayed. *(page 30)*

2 The measurement screen is displayed.



3 Perform checks before use.

Perform the following checks before use.

- No error message appears.
- The measuring window is clean.
- The main unit moves smoothly using the joystick.
- The chinrest moves up and down by pressing the chinrest up/down button.
- Printer paper is sufficient.

If any abnormality is found, stop using the device, then refer to *“4.1 Troubleshooting” (page 73)*.

4 Set the measurement conditions.

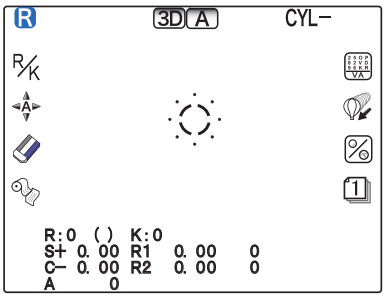
● Measurement mode

Press the R/K button for selection.

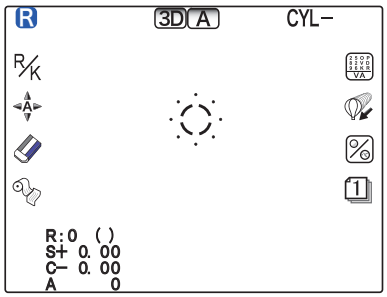
Measurement mode	Details of setting
AR/KM measurement mode	KM (corneal curvature radius) and AR (refractive error) measurements are successively taken.
AR measurement mode	Only AR (refractive error) measurement is taken.
KM measurement mode	Only KM (corneal curvature radius) measurement is taken.

When power is turned on, the measurement mode is set to the mode last used when power was turned off.

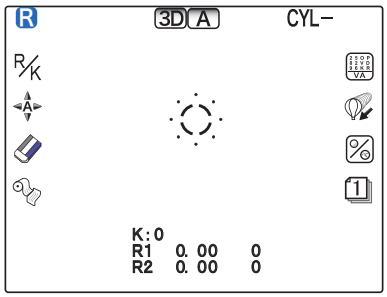
The measurement items corresponding to the selected measurement mode are displayed on the screen.



AR/KM measurement mode



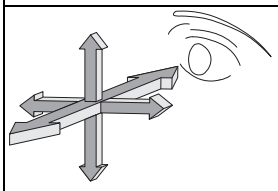
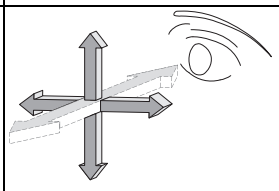
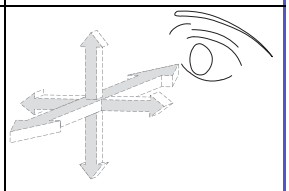
AR measurement mode



KM measurement mode

- Auto tracking function and auto shot function

Activation of auto tracking that automatically achieves alignment in the up-and-down, side-to-side directions and focusing in the forward-backward direction, and auto shot that starts measurement automatically is set by pressing the auto button.

	3D	2D	OFF
Auto tracking			
Alignment in the side-to-side and up-and-down directions	Auto	Auto	Manual
Focusing in the forward-backward direction	Auto	Manual	Manual

Auto shot	ON	Measurement starts automatically as soon as alignment and focusing become optimum.
	OFF	Pressing the start button starts measurement.

Note

- Selectable contents by pressing the auto button differ depending on the “62. TRACKING SW” parameter setting. *(page 80)*

- Parameter-set measurement conditions

Various conditions such as measurement, printing, and output can be set by the corresponding parameters.

“4.6 Device Parameter Settings” (page 80)

- CYL mode

The display format of the CYL value (cylindrical refractive error) is selected by pressing the CYL mode button.

Screen display	CYL mode	Details
CYL-	- reading	Indicates the cylindrical refractive error by - reading.

CYL+	+ reading	Indicates the cylindrical refractive error by + reading.
CYL±	Mix reading	Indicates the cylindrical refractive error by + reading when the refractive error is positive for any axis angle. Indicates the cylindrical refractive error by - reading in other cases.

Note

- Cylinder mode can be changed even after measurement.
- All saved data is printed out according to the CYL mode set at the time of printing.

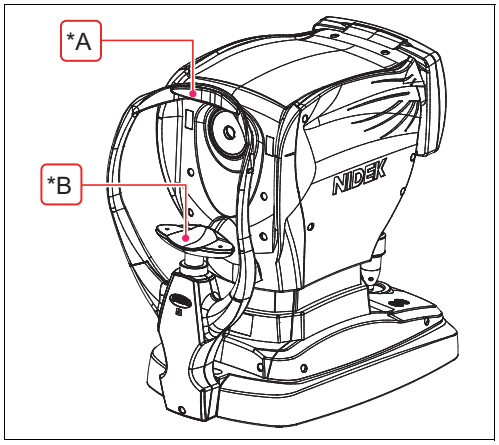
5 Prepare the patient.

1) If necessary, read the patient ID using the optional barcode scanner or magnetic card reader.*1

   Reading Patient ID *(page 70)*

2) Wipe the forehead rest (*A) and chinrest (*B) with clean absorbent cotton or gauze dampened with rubbing alcohol.

   When using the chinrest paper, remove one sheet of paper.



Note

- Reassure the patient before measurement by explaining the following.

  "This device measures your eye with infrared rays to find which kind of lens fits you. The infrared rays do no harm to your eyes."

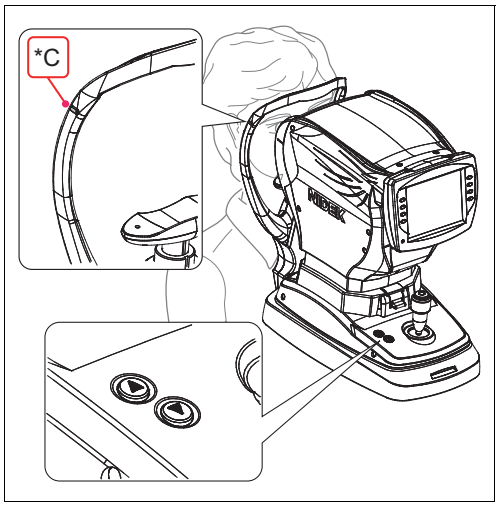
3) Instruct the patient to remove their glasses or contact lenses and sit on the chair.

4) Have the patient place their chin on the chinrest as far forward as possible with their forehead resting gently on the forehead rest.

5) Adjust the height of the chinrest with the chinrest up/down button (▲ / ▼) so that the patient's eyes are roughly aligned with the eye level marker (*C).

   Always look at the patient when moving the chinrest up or down.

   For rough height adjustment, have the patient move away from the forehead rest and chinrest.



*1. Patient ID may be read at any time prior to printing.

6 Start AR/KM measurement.

Details of AR/KM measurement *"3.3 AR (refractive error) and KM (corneal curvature radius) Measurements" (page 32)*

Note

- Instruct the patient not to blink during measurement. Additionally, instruct the patient to blink and open their eyes widely just before measurement to avoid measurement failure.
- Instruct the patient to open both eyes wide during measurement.

  Closing one eye may cause an unstable fixation and the other eye will not open widely enough.

7 Perform various measurements if necessary.

VA	Corrected visual acuity measurement *(page 40)* Uncorrected visual acuity measurement *(page 38)*
Accommodation measurement	Accommodation measurement *(page 51)*
Ring image / retroillumination	Retroillumination image observation *(page 49)*
CS/PS/PD	Manual CS/PS/PD measurement *(page 53)*
Sagittal measurement	Sagittal measurement *(page 59)*

8 Print the measured results.

Printing operation differs depending on the "31. PRINT" parameter setting.

AUTO	When measurement is complete, printing starts automatically.
MANUAL	Pressing the print button starts printing.
NO	Data is not printed. Pressing the print button saves data on the Eye Care card and exports data to the external connected devices.

Contents of printing *"3.11 Measured Value Printing" (page 63)*

Data in the device is automatically erased when the next measurement begins.

Note

- When the parameter is set to display the summary screen, press the summary button to display the summary screen. Confirm and print the measured values on the summary screen. *"3.12 Summary Display" (page 66)*

9 To measure the next patient, repeat from Step 5.

To finish measurement *"3.2.3 Device shutdown" (page 31)*

3.2.1 Eye Care card use

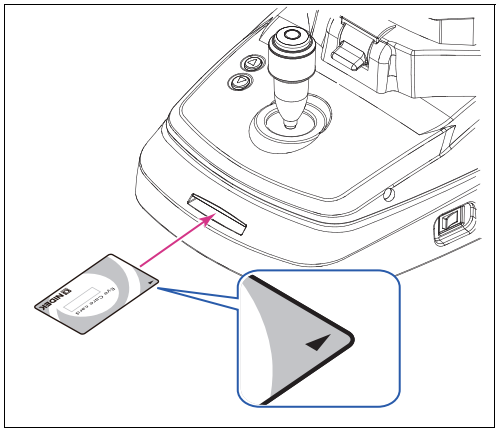
AR-measured data saved on the optional Eye Care card can be transferred to the RT, PC, or such.

Data is saved to the Eye Care card at the following times.

Eye Care card is inserted before measurement.	Saved upon printing.
Eye Care card is inserted after measurement.	Saved when the card is inserted.

1 Insert a card into the Eye Care card slot before measurement.

Insert the Eye Care card as far as it will go with the symbol (▼) pointing toward the device.



Confirm that the Eye Care card is properly inserted by referring to the Eye Care card icon (EyeC) on the screen.

Yellow display	Accessing Eye Care card
Blue display	Blank Eye Care card inserted
Blinking blue display	Eye Care card with data inserted
Blinking yellow display	Accessing Eye Care card failed Card may be damaged.

Note

- To compare vision with LM data using the vision comparison function in subjective measurement, insert an Eye Care card with the LM data measured by a lensmeter.
- When an Eye Care card containing LM data is inserted into the Eye Care card slot with the “76. LM DATA PRINT” parameter set to “YES”, the data is automatically printed.
- Both AR-measured and LM-measured data of one patient can be written to one Eye Care card. Either set of data may be written first. The data must be from the same patient.

2 Perform AR measurement as normal.

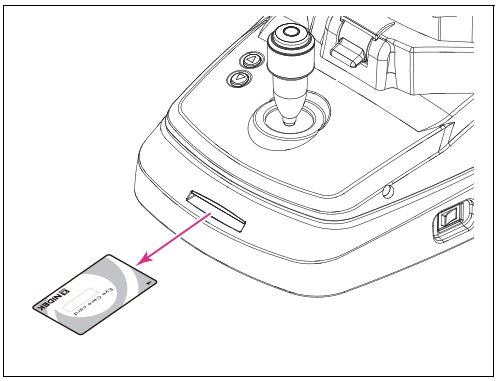
3 Print the measured results.

Data is saved on the card at the same time.

Note

- When printing is performed with an Eye Care card containing saved data inserted, the AR data is overwritten and saved.

4 Remove the Eye Care card.



⚠ CAUTION

- Be careful when handling the Eye Care card so that malfunction does not occur.

  Be sure not to eject the Eye Care card while it is being accessed (solid yellow display EyeC).
  Never bend or damage the card.
  Never let the IC terminal area (gold part) of the card get wet or dirty.
  Keep the card away from high temperature environments or static electricity.
  Do not press on the card too firmly with objects such as a pen when inscribing.

3.2.2 Checking the measuring window cleanliness at device start-up

It is possible to set the parameter whether or not to check the cleanliness of the measuring window before measurement.

Window check contents at device start-up differ depending on the “61. WINDOW CHECK” parameter setting.

DAY	The measuring window is checked at the first startup of the day.
YES	The measuring window is checked every startup.
NO	The measuring window is not checked.

An unclean measuring window has considerable influence on the measured results. In addition to visual inspection, this checking function should be used for measurement with a clean measuring window.

Note

- When checking the measuring window, be sure that its front is not blocked by objects or exposed to interference light.

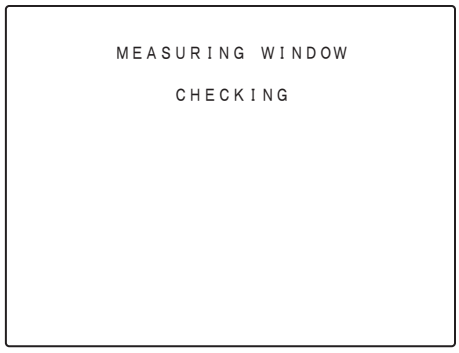
  Even if the window is not smudged, it may be determined that it is smudged due to objects or interference light.

- At device start-up, do not stand or put objects in front of the measuring window.

  If something is present in front of the measuring window within 1 m, the measuring window may not be properly checked for cleanliness.

1) “MEASURING WINDOW / CHECKING” is displayed and the measuring window is checked for cleanliness.

   Wait until a message appears.



2) A message appears.

   “WINDOW CHECK OK!”

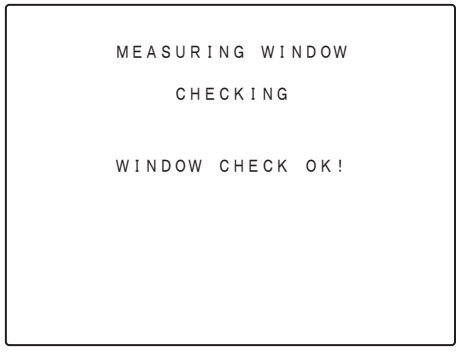
   The measuring window is clean.

   “CHECK MEASURING WINDOW”

   “CHECK MEASURING WINDOW” is printed out as displayed on the screen.

   Check that the measuring window is clean. If not, clean it.

3) At the completion of the check, the screen switches to the measurement screen.



Note

- To clean the measuring window *“4.8.1 Cleaning the measuring window” (page 99)*
- If “CHECK MEASURING WINDOW” appears due to soiling of the measuring window when the “61. WINDOW CHECK” parameter is set to “DAY”, cleanliness of the measuring window is checked again the next time the device power is turned on.

3.2.3 Device shutdown

○ Normal shutdown

1 To finish measurement, turn off (◯) the power switch.

Power may be turned off with any screen displayed.

2 Check the measuring window and clean the window if necessary. *(page 99)*

3 Clean the forehead rest and chinrest and place the supplied dust cover on the device.

Use clean gauze or absorbent cotton dampened with rubbing alcohol for cleaning.
Always keep them clean for the next use.

Note

- Be sure to place the dust cover on whenever the device is not in use.

○ Shutdown for transportation

Before the device is transported, put the device in packing mode. In packing mode, the measuring unit and chinrest are automatically set in the transport position (lowest position).

1 Turn off (◯) the power switch to shut off the device once.

2 While holding down the chinrest down button (▼), turn on (|) the power switch.

Hold down the chinrest down button until the “PACKING MODE” message appears on the screen.

3 When the “PACKING POSITION IS COMPLETED / SHUT DOWN PLEASE” message is displayed, turn off (◯) the power switch.

Ensure that the chinrest and measuring unit are at their lowest mechanical limits.

4 Pull the main unit fully to the side on which the main unit is to be laid down, fix the main unit with the locking lever and gently lay down the device, then disconnect the power cord, interface cable, and such.

5 Raise the device and flip up the locking lever to unlock the main unit.

6 Pack the device with the specified packing material.

3.3 AR (refractive error) and KM (corneal curvature radius) Measurements

■ Perform AR (refractive error) and KM (corneal curvature radius) measurements.

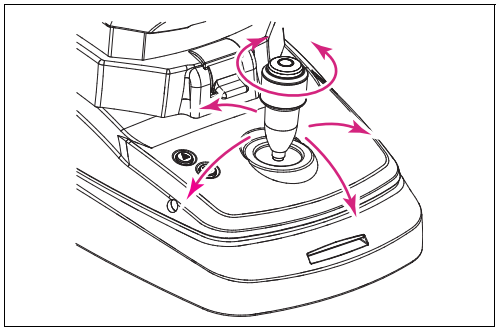
The measurement items of the measurement mode (AR/KM measurement, AR measurement, or KM measurement) specified by pressing the R/K R/K button are displayed on the screen.

1 Give the following instructions to the patient. “Look through the measuring window. You will see the picture of a balloon. Look at the center of it without straining”.

2 Manipulate the joystick to display the patient’s eye on the screen.

By manipulating the joystick right, left, forward, and backward, the main unit moves right, left, forward, and backward. By rotating the upper part of the joystick, the measuring unit moves up and down.

Adjust the measurement position with right, left, up and down movements and the focus with forward and backward movements.



Note

- Auto tracking or auto shot may not function on keratoconus or postoperative corneas.
  In such a case, turn off the auto tracking and auto shot functions before measurement.

3 Perform alignment and focusing.

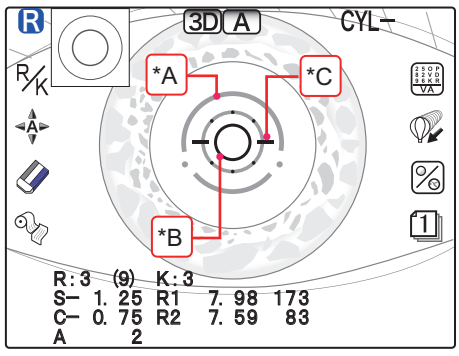
Manually align the device with the mire ring (*A) and bring the eye into focus.

The methods of alignment and focusing differ depending on the “62. TRACKING SW” parameter setting.

Setting contents “3.2 Measurement Method” (page 24)

Perform alignment by positioning the target within the mire ring reflected on the patient’s eye(*B).

Perform focusing according to the indication of the focusing indicator (*C) displayed on the screen.

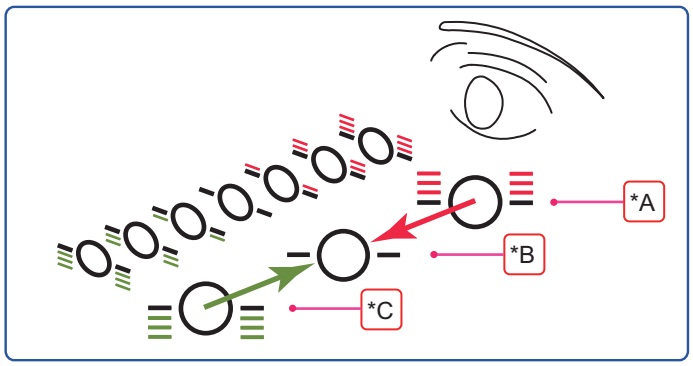


Note

- If eyelashes obstruct the minimum pupil diameter mark, correct AR measurement may not be possible. If the eyelid or eyelashes obstruct the mire ring, KM measurement may not be possible.
  In such cases, instruct the patient to open their eye wider.
  If the patient cannot open their eye wider, lift the patient’s lid, paying attention not to press against the eyeball.

- Focusing indicator display

For manual focusing, refer to the focusing indicator (-O-) and manipulate the joystick forward and backward for the optimum condition.



*A	Too close to the patient's eye
*B	Optimum focusing condition
*C	Too far from the patient's eye

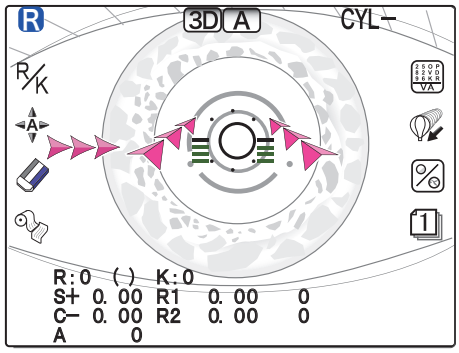
Note

- When the "67. MAN FOCUS DISP" parameter is set to "NO", the focusing indicator is not displayed in manual mode (auto tracking OFF + auto shot OFF).

- When alignment or focusing is not within the working range of auto tracking:

The limit indicator (red arrows) is displayed. Manipulate the joystick in the direction of the arrows.

Limit indicators are displayed in each direction of up/down (/), right/left (/), or forward/backward (/).



4 Measurement starts.

Measurement starts automatically when alignment in the up, down, right, left, and left directions and focusing in the forward-backward direction become optimum (when auto shot is on).

When the auto shot function is off, press the start button to start measurement.

Measurement is performed in the order of KM measurement and AR measurement.

Note

- The operator can start measurement by pressing the start button.

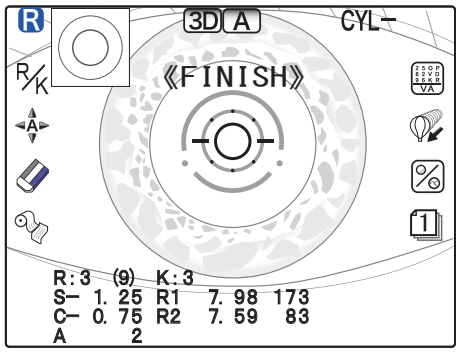
  Press the start button to start measurement when measurement has difficulty starting for patients who blink often.

Note

- When an error or error data appears, the cause may be one of the following. If errors appear again after repeating measurement, check whether:
  - The patient blinked during measurement.
  - The eyelid or eyelashes are on the minimum pupil diameter mark during AR measurement.
  - The eyelid or eyelashes are on the mire ring during KM measurement.
  - The patient's pupil is smaller than the minimum pupil diameter mark.
    Have the patient sit in a dark room for a while and wait until the pupil diameter becomes large enough for measurement.
  - Retinal reflection is extremely low due to an optical disease such as a cataract.
  - There is some unusual reflection on the cornea during measurement.
  - There is an extreme distortion on the cornea.
- If the device gets out of alignment and focus during measurement, the measurement is interrupted. If measurement is retried, the measured results are added to the former results and saved.
- The device can save up to 10 measurements each for the right and left eyes. If measurements exceed 10, the data is erased in order from the oldest.

5 Measurement finishes.

When the specified number of measurements is obtained, "<<FINISH>>" is displayed on the screen and measurement finishes.



- Number of AR measurements and KM measurements

The number of AR measurements differs depending on the "5. AI MODE[*1] " parameter setting.

AR measurement	AI MODE / YES	When the number of measurements specified by the "6. AR CONTINUE" parameter is performed and the data is stable (no variations), measurement automatically finishes.
	AI MODE / NO	When the number of measurements specified by the "6. AR CONTINUE" parameter is performed, measurement automatically finishes.

KM measurement	When the number of measurements specified by "14. KM CONTINUE" is performed, measurement finishes.

Note

- When the specified number of KM measurements is not obtained, "<<KM?>>" is displayed on the screen. When the start button is pressed, KM measurement stars again. As soon as the specified number of KM measurements is performed, "<<FINISH>>" is displayed on the screen.
- To continue the measurement, press the start button again. "<<FINISH>>" disappears and auto tracking starts again for measurement (except when the "91. SUBJECT START" is "AR(A)" or "RECALL(A)," or "31. PRINT" parameter is set to "AUTO").

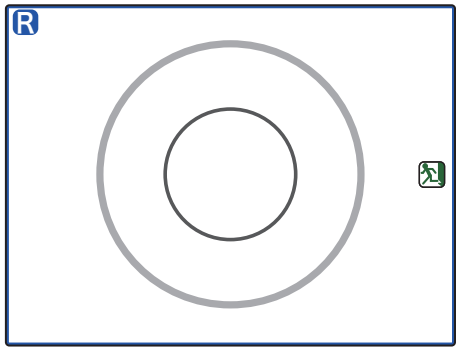
*1. In this mode, AR measurement automatically finishes as soon as the specified number of stable data sets and the median values are obtained.

- Full screen display of measurement ring image

A thumbnail of the measurement ring image is displayed when AR measurement is complete. If necessary, press the ring image / retroillumination button to switch to the full screen display.

Observe the size, shape, and such of the ring image.

After checking the ring image, press the return button to return to the measurement screen.



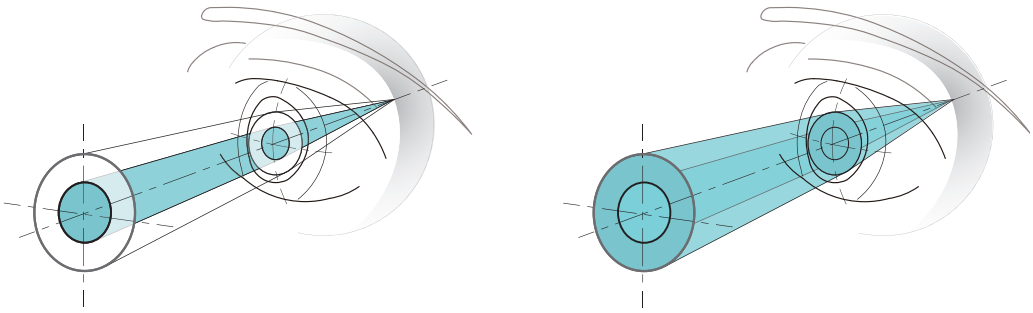
- Large area AR measurements

In the AR measurement process, AR central measurement (inner measurement ring) is performed concurrently with AR large area measurement (outer measurement ring).

Large area measured values are AR-measured values over a large range (approx. 6 mm in diameter). By referring to the large area measured values, the influence that a large pupil has on vision, such as at night, can be identified.

Large area measured values can be checked on the printed results and data contents can be set by the "47. L. DATA PRINT" parameter.

L. DATA	Large area measured values
L. DIFF	Differentiation between central measured values (normal AR values) and large area measured values



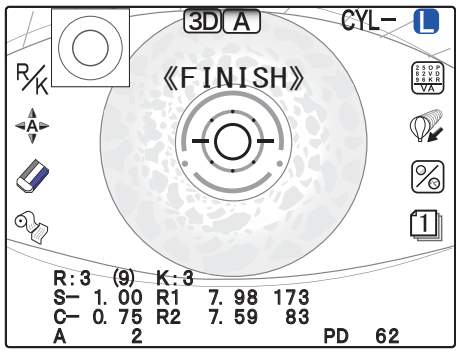
Central measurement　　Large area measurement

The above images are to illustrate the measurement range, not to explain the measurement principle.

Note

- If large area measured values have not been obtained due to a small pupil size, "NO DATA" is printed out instead of the measured values (L. DATA or L. DIFF).

6 Measure the other eye in the same manner.



Note

- Instruct the patient to close their eye before starting the next measurement.
  Let the eye rest to avoid measurement failure by blinking.

3.3.1 Error messages during AR or KM measurement

Error messages during AR measurement or KM measurement are displayed in the numeric fields of the measured values.

○ Error messages during AR measurement

Error message	Details and remedies
BLK (Error due to blinking)	Measurement failed due to blinking of the patient's eye or such. Instruct the patient not to blink or not to move the eye until measurement is complete. After the eye has stopped blinking, perform measurement again. This error also may occur when reflected light from the fundus is low.
ALM (Alignment error)	Alignment is not proper. Perform alignment and measurement again. In manual mode (auto tracking OFF + auto shot OFF), this message is not displayed.
+OVR (Outside SPH positive range error)	The sphere value is over the measurable limit of the + side.
-OVR (Outside SPH negative range error)	The sphere value is over the measurable limit of the - side.
COVR (Outside CYL range error)	The cylinder value is over the measurable limit.
CONF (Measured data confidence index error)	Low-confidence data is obtained. Measure the subject again. * When the "44. ERROR DATA" parameter is set to "NO".
S, C, A data displayed in yellow (Measured data confidence index error)	Low-confidence data is obtained. Measure the subject again. * When the "44. ERROR DATA" parameter is set to "YES".

○ Error messages during KM measurement

Error message	Details and remedies
BLK (Error due to blinking)	Measurement failed due to blinking of the patient's eye or such. Instruct the patient not to blink or not to move the eye until measurement is complete. After the eye has stopped blinking, perform measurement again.
ALM (Alignment error)	Alignment is not proper. Perform alignment and measurement again.
FAR (Focus error: Too far from the patient's eye)	Focusing is not proper. Perform focusing and measurement again.
NEAR (Focus error: Too close to the patient's eye)	Focusing is not proper. Perform focusing and measurement again.
+OVR (Outside corneal curvature radius positive range error)	The corneal curvature radius is too large and over the measurable limit.

-OVR (Outside corneal curvature radius negative range error)	The corneal curvature radius is too small and not within the measurable limit.
COVR (Outside CYL range error)	The cylinder value is over the measurable limit.

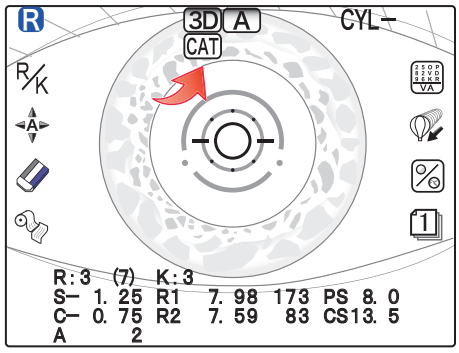
3.3.2 Cataract measurement mode

When measurement is not possible due to cataract or abnormal eyes during AR (refractive error) measurement, the device enters cataract measurement mode automatically.

In cataract measurement mode, measurement conditions are changed so that measurement results can be easily obtained.

When the device is placed in cataract measurement mode, " CAT " is displayed on the screen and then measurement starts.

The auto tracking and auto shot functions work in the same manner as in normal measurement mode.



Any of the following operations cancels cataract measurement mode:

- Switching the eye to be measured between the right eye and left eye.
- Pressing the clear button.
- Pressing the print button.

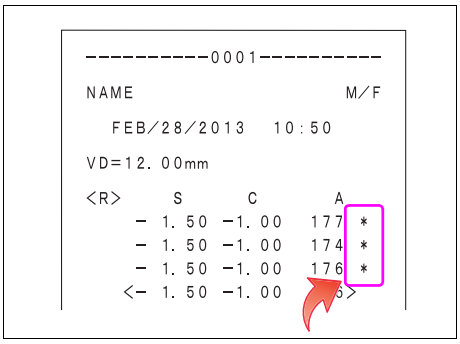
Note

- In cataract measurement mode, take note that measurement variations may occur more commonly in comparison with normal measurement mode.

○ Printout sample in cataract measurement mode

According to the "45. CAT MARK" parameter setting, "*" indicating that measurement has been taken in cataract measurement mode is printed as shown on the right.

The factory setting is "NO".

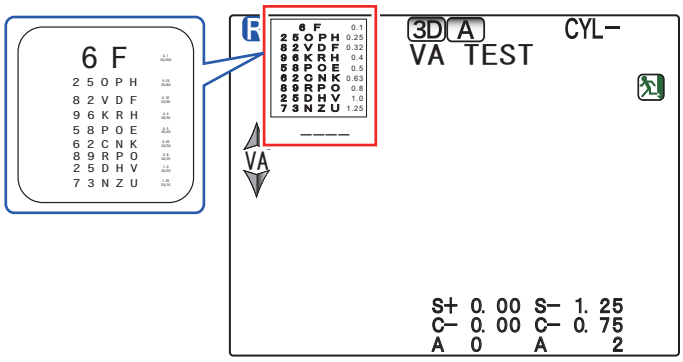


3.4 Uncorrected Visual Acuity Measurement (UCVA)

■ Uncorrected visual acuity measurement can be performed after AR measurement.

1 Hold down the VA button for about a second to display the uncorrected visual acuity measurement screen (VA TEST).

A VA chart (VA 0.1 to 1.25) is presented to the patient.



Note

- The chart to be initially displayed in the uncorrected visual acuity measurement screen (VA TEST) can be selected from “ALL: Full VA chart (VA 0.1 to 1.25)” or “AUTO: Single line VA chart for the VA value predicted” by the “98. UCVA CHART” parameter. (The factory setting is “ALL”.)

2 Bring the patient’s eye into focus.

Bring the patient’s eye into focus in the same manner as AR/KM measurement.

When a single line VA chart is presented (The “98. UCVA CHART” parameter is set to “AUTO”.), go to Step 5.

3 Ask the patient which is the smallest chart that they can identify.

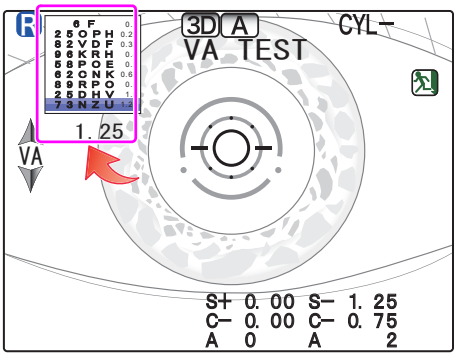
Confirm how far down they can read.

4 Present a single line VA chart.

Chart up	Uncorrected visual acuity measurement starts from VA 1.25.	7 3 N Z U
Chart down	Uncorrected visual acuity measurement starts from VA 0.1.	6 F

5 Ask the patient whether they can read the presented chart.

The presented chart is displayed on the screen.



6 According to the patient's response, press the chart up button or chart down button to change the VA chart.

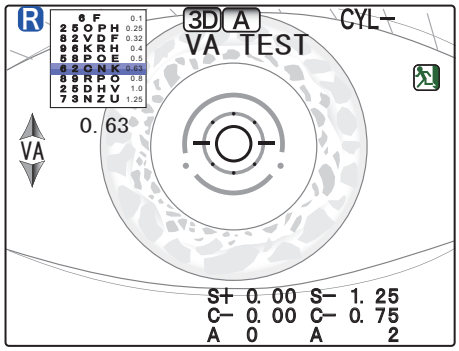


Chart up	The patient could not read the chart. A VA chart one level lower is presented.
Chart down	The patient could read the chart. A VA chart one level higher is presented.

7 Repeat Steps 5 to 6 to determine the limit of the VA value (uncorrected visual acuity: UCVA) that the patient can read.

To save the VA value lower than 0.1, press the chart up button with the VA chart set to 0.1. "<0.1" is displayed on the screen.

8 Switch the eye to be measured and perform uncorrected visual acuity measurement for the other eye in the same manner.

Note

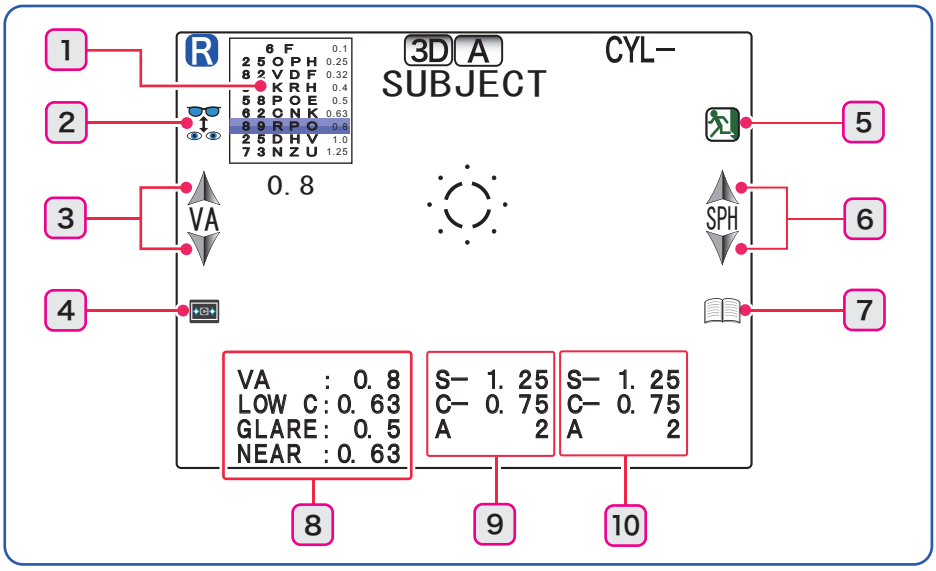
- Because the VA value is saved at the time of returning to the AR (AR/KM) measurement screen from the uncorrected visual acuity measurement screen (VA TEST), do not change the chart after determining the limit of the VA value.

9 Press the return button to exit from uncorrected visual acuity measurement mode and return to the AR (AR/KM) measurement screen.

The VA value of the displayed chart is saved as an uncorrected VA value (UCVA).

3.5 Corrected Visual Acuity Measurement (Subjective Refractive Error Measurement)

■ Subjective refractive error measurement and corrected visual acuity measurement can be performed based on the AR-measured values (or large area measured values[*1]).
For the CYL and AXIS values, AR-measured values (or large area measured values) are used.



1	The VA chart presented to the patient is displayed.	
2	Recall	Switches to the uncorrected eye condition (or LM data condition) for vision comparison.
3	Chart up Chart down	Changes the VA value of the chart to be presented.
4	Contrast/glare	Changes in the order of the low contrast VA test and glare VA test.
5	Return	Returns to the AR (AR/KM) measurement screen.
6	SPH up SPH down	Changes the SPH value of the corrective lens (subjective refractive error).
7	Near	Presents a chart in near visual acuity measurement mode. Addition power measurement is performed in near visual acuity measurement mode.
8	VA measured values - VA: Corrected distance visual acuity, LOW C: Low contrast visual acuity, GLARE: Glare visual acuity, and NEAR: Near visual acuity	
9	Corrective lens value (0.25 D increments, SPH value changeable)	
10	AR-measured (or large area measured) median values (or the latest values when the median values have not been obtained).	

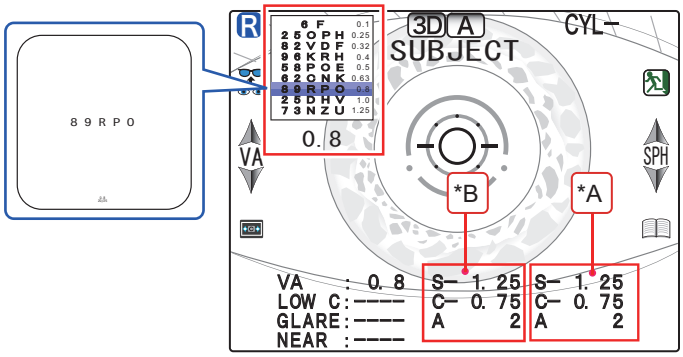
*1. Measured values to be used can be set by the “95. L. DATA SELECT” parameter.

3.5.1 Distance visual acuity measurement

1 Press the VA button to display the corrected visual acuity measurement screen.

The 0.8 VA chart is presented to the patient viewed with the corrective lens selected according to the AR-measured results[*1].

AR-measured values (*A) and corrective lens values (*B) (changeable) are displayed on the screen.



Note

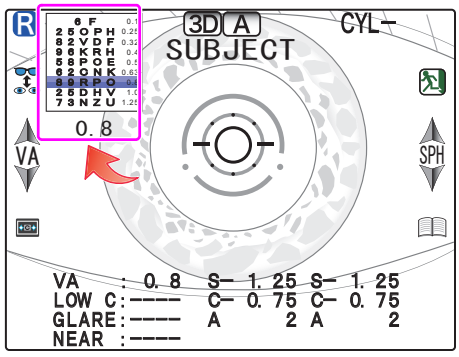
- To display the corrected visual acuity measurement screen automatically after AR measurement for both the right and left eyes, set the “91. SUBJECT START” parameter.

2 Bring the patient’s eye into focus.

Bring the patient’s eye into focus in the same manner as AR/KM measurement.

3 Ask the patient whether the presented chart can be read.

The presented chart is displayed on the screen.



4 According to the patient’s response, press the chart up button or chart down button to change the VA chart.

Chart up	The patient could not read the chart. A VA chart one level lower is presented.
Chart down	The patient could read the chart. A VA chart one level higher is presented.

Note

- When the “92. SUBJECT CHART” parameter is set to “ALL”, charts to be presented change as follows with button operation.

  Chart up button : ... →“0.25”→“0.1”→“<0.1”→“- - - - (All)”→“1.25”→“1.0”→ ...

  Chart down button : ... →“1.0”→“1.25”→“- - - - (All)”→“0.1”→“0.25”→ ...

*1. A chart to be initially displayed can be selected by the “92. SUBJECT CHART” parameter. (The default setting is the 0.8 VA chart.)

5 Repeat Steps 3 to 4 to determine the limit of the VA value that the patient can read.

To save the VA value lower than 0.1, press the chart up button with the VA chart set to 0.1. “<0.1” is displayed on the screen.

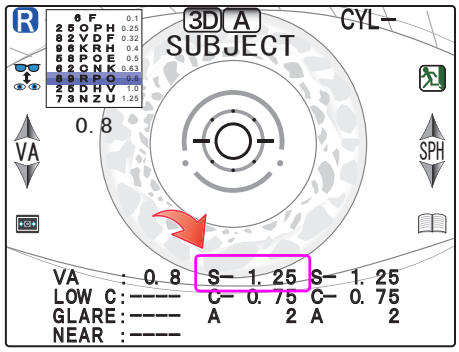
6 Change the corrective lens value if necessary and check the VA value.

- Changing the corrective lens

The SPH value of the corrective lens can be changed. Adjust the lens power to the most plus power that provides the best possible vision.

SPH up	Changes the SPH value by +0.25.
SPH down	Changes the SPH value by -0.25.

When the SPH has been changed, determine the limit of the VA value again.



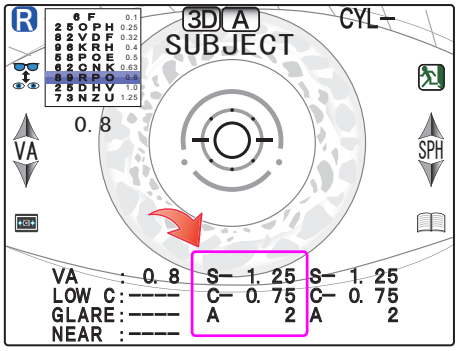
Note

- The SPH value of the changed corrective lens is the SPH value of subjective refractive error.

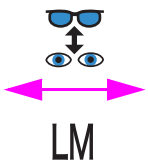
- Vision comparison function (during distance visual acuity measurement)

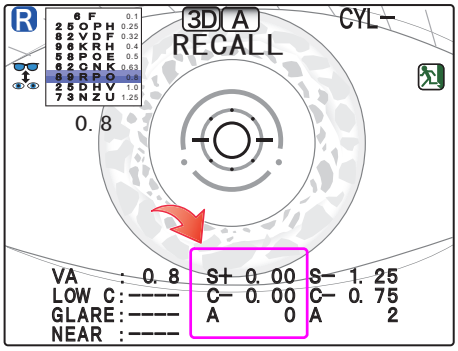
The vision of the distance VA chart with the corrected distance values and uncorrected vision (or vision corrected by LM data) are switched to check the vision difference.

Recall	When LM data is not contained The distance VA chart is viewed with an uncorrected eye.
LM Recall	When LM data is contained A lens for the distance vision as corrected with the patient’s own glasses is inserted and the distance VA chart is viewed at that distance power.



Corrected distance values





Uncorrected vision (0 D) or LM values

7 Perform near visual acuity measurement if necessary.

"3.5.2 Near visual acuity measurement" (page 44)

8 Switch the eye to be measured and perform corrected visual acuity measurement for the other eye in the same manner.

Note

- Because the VA value is saved at the time of returning to the AR (AR/KM) measurement screen from the corrected visual acuity measurement screen (SUBJECT), do not change the chart after determining the limit of the VA value.

9 Press the return button to exit from corrected visual acuity measurement mode and return to the AR (AR/KM) measurement screen.

The VA value of the displayed chart is saved as a corrected VA value (VA) and the corrective lens value is saved as a subjective refractive error.

3

○ Importing LM Data

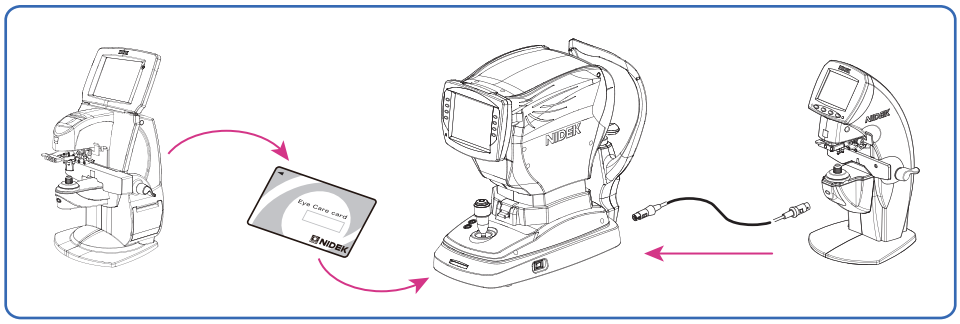
To present the vision with their glasses rather than that with uncorrected eyes using the vision comparison function, LM data needs to be imported before testing.

- Importing data using the Eye Care card

  Importing of LM data automatically starts as soon as an Eye Care card containing LM data written by the lensmeter is inserted into the Eye Care card slot of the device. *(page 28)*

- Importing data from a connected lensmeter

  When the print button (or data button) of the lensmeter is pressed after measurement using the lensmeter, the measured LM data is imported. *(page 68)*



Note

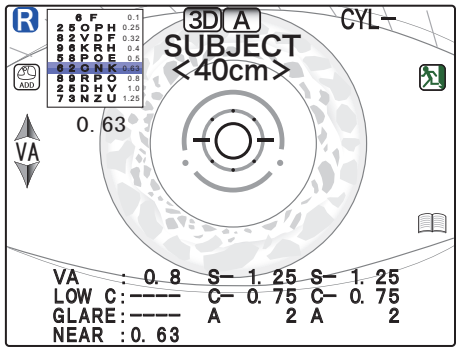
- The LM data on the Eye Care card is automatically erased under either of the following conditions:
  When LM data is transferred to an AUTO OPTOMETRY SYSTEM
  When LM data is overwritten (LM data is erased from card and new data is written)
- When saving LM data and AR-measured data on an Eye Care card, be careful not to mix data from a different patient.

3.5.2 Near visual acuity measurement

Near visual acuity measurement with vision corrected for distance vision, addition power measurement required for prescription of glasses for near vision, and visual acuity measurement with addition power can be performed.

1 Perform distance visual acuity measurement in the corrected visual acuity measurement screen.

2 Press the near button to enter near visual acuity measurement mode.



The working distance to the chart changes from the one for distance vision to 40 cm-equivalent. “<40cm>” is displayed in the upper middle of the screen.*1

The near VA chart is viewed with the corrective lens (ADD 0.00 D) used in distance visual acuity measurement.

To measure the addition power *(Step 6)*

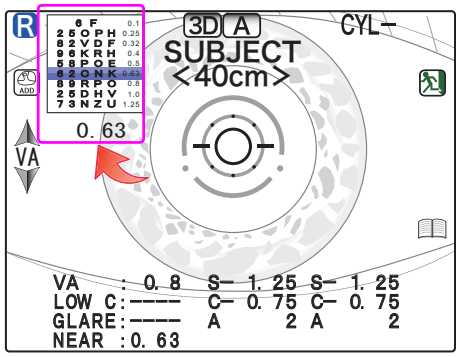
To conduct vision comparison *(page 46)*

To change the working distance *(page 46)*

Note

- A chart to be initially displayed when the screen is switched to near visual acuity measurement mode can be selected by the “93. NEAR CHART” parameter. (The default setting is the 0.63 VA chart.)
- When addition power is contained in LM data, pressing the near button adds the addition power automatically.

3 Switch charts in the same manner as distance visual acuity measurement to determine the limit of the VA value (NEAR) that the patient can read.



4 To finish near visual acuity measurement without any addition power (ADD), switch the eye to be measured and measure the other eye in the same manner.

To measure the addition power *(Step 6)*

5 Press the return button to exit from corrected visual acuity measurement mode and return to the AR (AR/KM) measurement screen.

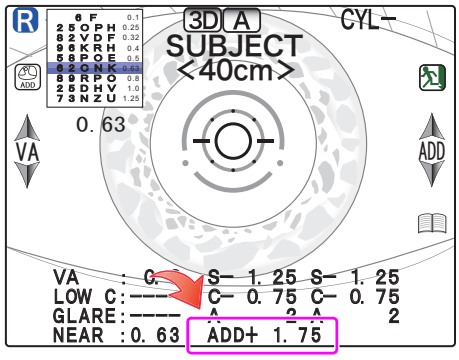
The VA value without any addition power (ADD +0.00) is saved.

To return to the corrected visual acuity measurement screen, press the near button.

*1. The near working distance can be set between 35 and 70 cm (5 cm increments) or 14 and 28 inches (2-inch increments) by the “56. WORKING D.” parameter.

6 Press the ADD button to display the addition power measurement screen.

The addition power of 1.75 D is added as the default setting.*1



7 Change the addition power if necessary.

ADD up	Changes the addition power by +0.25.
ADD down	Changes the addition power by -0.25.

According to the patient's age, starting from the addition power in the table below is recommended.

Predicted addition power	Age	45	50	55	60	65	70	75
	Addition power (D)	1.50	2.00	2.25	2.50	2.75	3.00	3.25
Recommended starting addition power	Age	to 45	to 50	to 55	to 60	to 65	to 70	71 to
	Addition power (D)	0.75	1.25	1.50	1.75	2.00	2.25	2.50

8 Determine the limit of the VA value in the same manner.

To conduct vision comparison *(page 46)*

9 Switch the eye to be measured and measure the other eye in the same manner.

Note

- When R or L of the eye to be measured is switched, the addition power of LM data is initially displayed. If no addition power is contained in LM data, the addition power that was used before switching is displayed.

10 Press the return button to exit from corrected visual acuity measurement mode and return to the AR (AR/KM) measurement screen.

The VA value with addition power (ADD) is saved.

To return to the corrected visual acuity measurement screen, press the near button.

Note

- Because of single eye measurement, measured values of addition power may be unstable for patients under 50 years old.

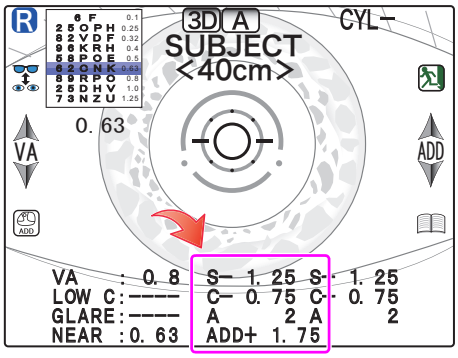
*1. The addition power added as the default setting can be changed by the "99: ADD SELECT" parameter. When addition power is contained in LM data, the addition power is added to the distance power of LM data.

○ Vision comparison function (during near visual acuity measurement)

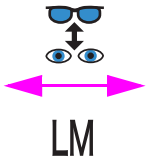
The vision of the near VA chart with the corrected distance values (or corrected near values with addition power) and uncorrected vision (or vision corrected by LM data) are switched to check the vision difference.

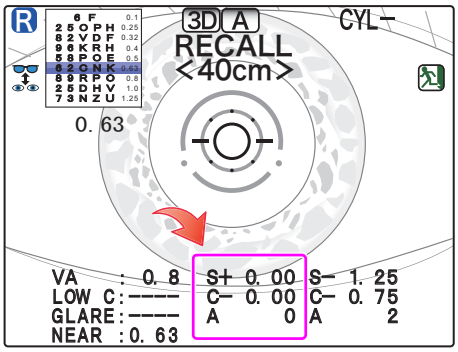
Setting the “96. NEAR RECALL” parameter to “YES” in advance displays the recall button (or LM) for vision comparison.

	Recall	When LM data is not contained The near VA chart is viewed with an uncorrected eye.
LM	Recall	When LM data is contained (no addition power) The distance power lens of LM data is inserted and the near VA chart is viewed with the distance power.
		When LM data is contained (with addition power) The addition power lens of LM data is inserted and the near VA chart is viewed with the addition power. If the second addition power (ADD2) is contained, the second addition power lens is inserted.



Corrected distance values and addition power





Uncorrected vision (0 D) or LM values

○ Changing the near working distance

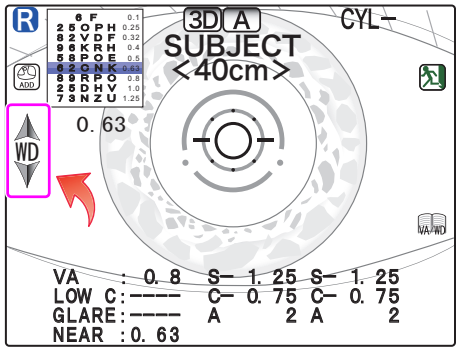
The near working distance can be changed during near visual acuity measurement.

Setting the “97. WD CHANGE” parameter to “YES” changes the near icon from to , which allows the near working distance to be changed.

Holding down the near button for about a second changes the icon as shown to the right indicating WD change mode.

Change the near working distance with the up button or down button. (5 cm increments)

Pressing the near button again exits from WD change mode.



Note

- When R or L of the eye to be measured is switched, the WD value set before switching is displayed.

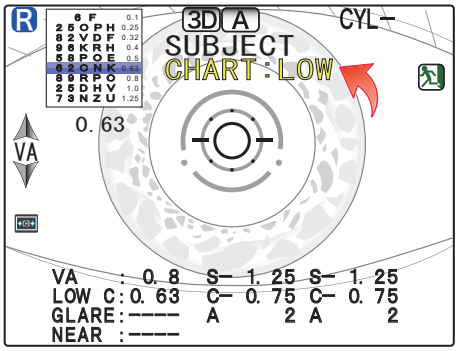
3.5.3 Contrast visual acuity / glare visual acuity measurement

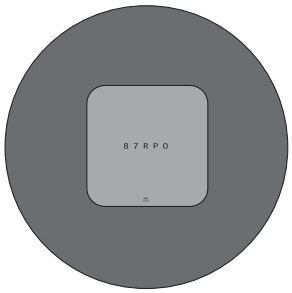
Reduced visual performance when a low contrast VA chart is viewed or dazzling light is shone to the eye can be checked.

1 Perform distance visual acuity measurement.

2 Press the contrast/glare button to display the contrast visual acuity measurement screen.

"CHART:LOW" is displayed on the screen and a chart[*1] is presented to the patient at a low contrast level.





3 In the same manner as distance visual acuity measurement, press the chart up button or chart down button to determine the limit of the VA value (LOW C) that the patient can read.

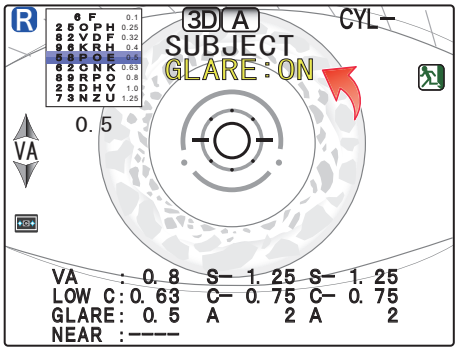
Other button operations

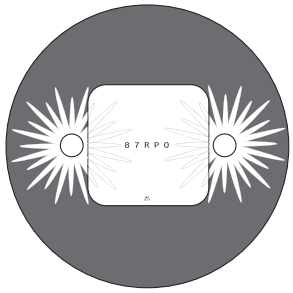
Contrast/glare	Confirms the contrast VA value (LOW C) and switches to the glare visual acuity measurement.
Return	Exits from corrected visual acuity measurement mode and returns to the AR (AR/KM) measurement screen.

*1. A chart to be initially displayed can be selected by the "100. GLARE CHART" parameter.

4 After the contrast visual acuity measurement is complete, press the contrast/glare button to display the glare visual acuity measurement screen.

"GLARE:ON" is displayed on the screen and a chart[*1] is presented to the patient with the right and left lamps illuminated.





5 In the same manner as distance visual acuity measurement, press the chart up or chart down button to determine the limit of the VA value (GLARE) that the patient can read.

Other button operations

Contrast/glare	Confirms the glare VA value (GLARE) and returns to the distance visual acuity measurement screen.
Return	Exits from corrected visual acuity measurement mode and returns to the AR (AR/KM) measurement screen.

6 After the glare visual acuity measurement is complete, press the contrast/glare button to return to the distance visual acuity measurement screen.

3.6 Retroillumination Image Observation

■ Whether opacity exists on crystalline lenses or vitreous body can be observed.

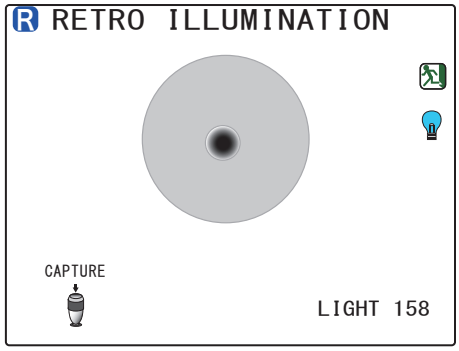
⚠ CAUTION

- Opacity indexes should be taken as a reference value.
  When images are captured under the following conditions, actual indexes may not be presented.
  - The border of a pupil is darkly displayed due to the alignment position.
  - The opacity is out of focus.
  - Bright spots of observation light reflected from the corneal vertex appear.

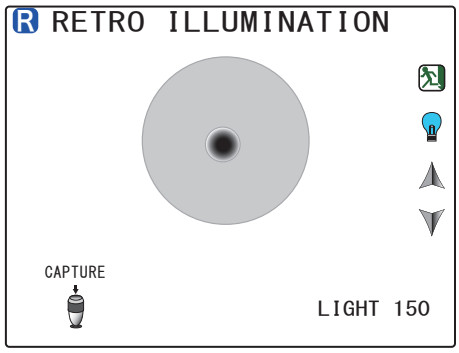
  Depending on the position of the opacity, correct pupil detection may not be possible resulting in the circle position indicating the 3 mm range in diameter to be deviated. Actual indexes may not be presented in such a case, either.

1 After KM measurement, hold down the ring image / retroillumination button for about a second to display the retroillumination image observation screen (RETRO ILLUMINATION).

The device enters retroillumination image observation mode. The auto tracking and auto focusing functions turn off and the light quantity (LIGHT) is automatically controlled.

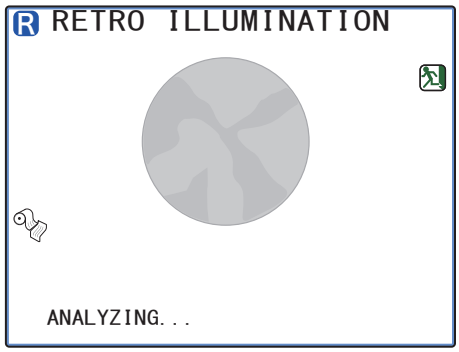


To change the light intensity manually, press the lamp button. As the light intensity automatic control is deactivated, change the light intensity with the displayed up button or down button.

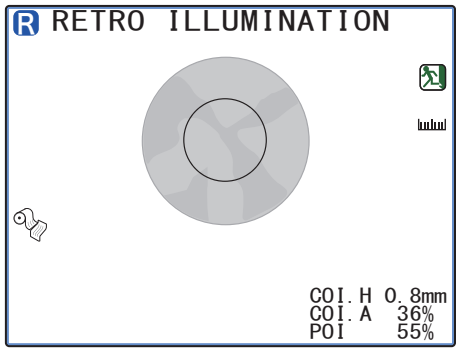


2 Manipulate the joystick so that the opacity is in focus and the corneal luminous spot is not prominent, and then press the start button for image capture.

The captured retroillumination image (still image) is displayed and the “ANALYZING...” message indicating that the opacity indexes are being calculated is displayed for a few seconds.



When analysis is complete, the opacity indexes for the center (COI. H, COI. A) and periphery (POI) and a circle indicating the 3 mm range in diameter are displayed.



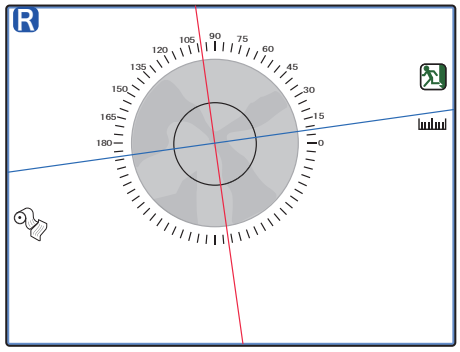
COI. H	Opacity size within a diameter of 3 mm of the center (vertical diameter): mm
COI. A	Opacity proportion within a diameter of 3 mm of the center: %
POI	Opacity proportion within the entire periphery: %

If the pupil of the image to be captured cannot be detected, “PS+OVER” or “PS-OVER” is displayed. Capture the image again.

When the pupil size is 3 mm or less in diameter, “----” is displayed in the opacity index POI for the periphery.

Pressing the start button before image capture returns to the Step 1 display.

Print	Prints the opacity indexes and retroillumination image only. Prints the opacity indexes and retroillumination images of the right eye and left eye when both eyes have been captured.
Return	Returns to the AR (AR/KM) measurement screen.
Scale	Shows or hides the angle scale and corneal cylinder axis. Corneal cylinder axis Red: Steepest meridian Blue: Flattest meridian When KM-measured values have not been obtained or the center of the retroillumination image cannot be detected, the scale icon is not displayed.



3 Switch the eye to be measured and perform retroillumination image observation for the other eye in the same manner.

Note

- To print the retroillumination image on the normal measured results, set the “57. RETRO IMAGE PRINT” parameter.

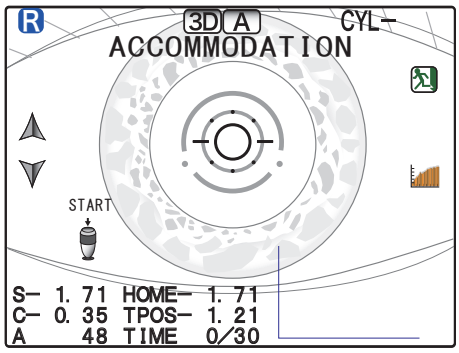
3.7 Accommodation Measurement

1 After AR measurement, press the accommodation measurement button to display the accommodation measurement screen (ACCOMMODATION).

The initial measurement conditions are “HOME (reference position) = SPH value” and “TPOS (initial position) = SPH value +0.50 D[*1]” (0.01 D increments each).

To change the reference position, use the up button or down button (0.25 D increments).

The 0.63[*2] VA chart is presented to the patient. Instruct the patient to begin and continue looking at the chart from the start of measurement. Measurement continues for a maximum of 30 seconds.

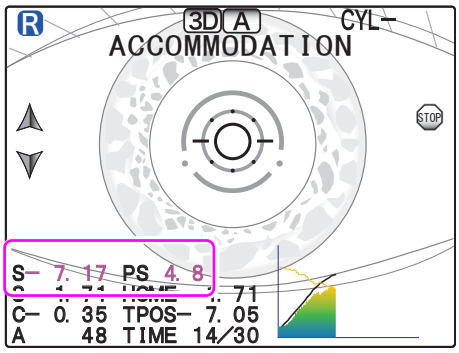


2 Manipulate the joystick to perform alignment and focusing of the patient’s eye.

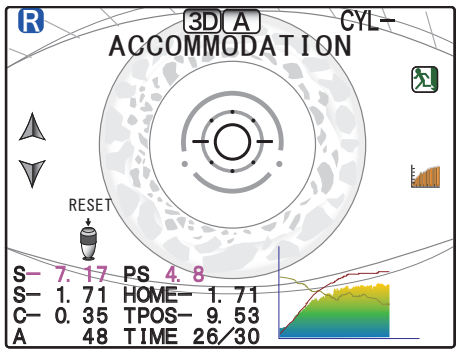
3 Press the start button on the joystick to start measurement.

With auto shot on, measurement does not start unless alignment and focusing are achieved.

While the chart is moved from the initial position, successive AR measurements are taken. If the patient’s eye cannot accommodate to the chart position (TPOS) for a continuous 6 seconds, measurement finishes. (The elapsed time is displayed in the TIME field.)



Once measurement starts, AR-measured values and the pupil size are successively displayed along with the graph. When measurement is complete, a beep sounds and the screen display stops updating.



STOP	Displayed during measurement. Press the corresponding button to interrupt measurement. “RESET” is displayed above the joystick icon. Pressing the start button resets the chart and returns to the pre-measurement condition.
Return	Returns to the AR (AR/KM) measurement screen.
Graph	Displays the graph display screen.

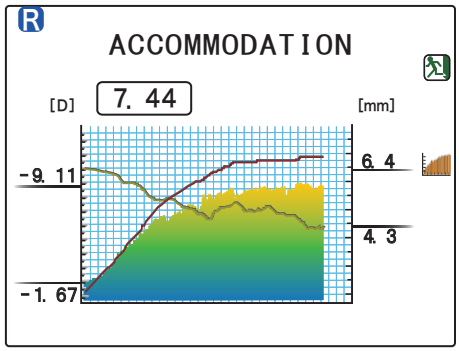
*1. The setting of TPOS (shift amount from SPH) can be set by the “132. T. POSITION” parameter.

*2. The chart presented to the patient can be changed by the “133. CHART” parameter.

4 Press the graph button to display the graph display screen.

The detailed graph, accommodation*1, maximum&minimum AR-measured values, and maximum&minimum pupil size values are displayed.

The horizontal axis indicates the elapsed time in one-second increments.



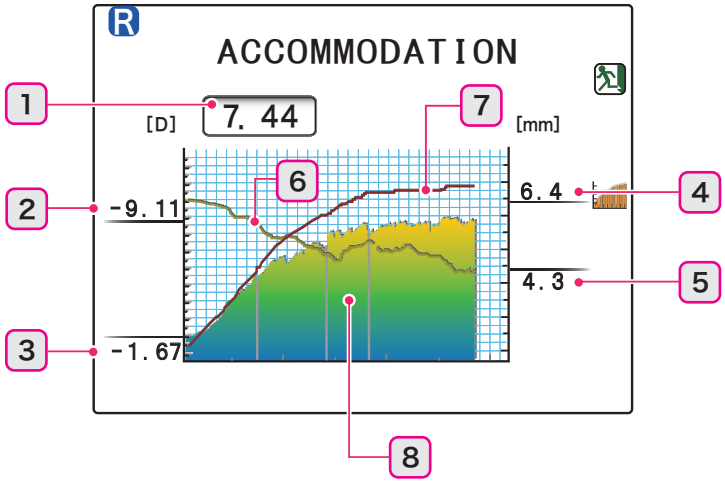
5 Press the graph button to return to the accommodation measurement screen.

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

Note

- "ACC (accommodation)", AR-measured "MIN (minimum value)", "MAX (maximum value)", pupil size "MIN (minimum value)", and "MAX (maximum value)" are printed out as measured results.
  The greatest minus AR-measured value indicates "MAX (maximum value)".
- To print the graph, set the "58. ACC GRAPH PRINT" parameter.

○ Graph display screen



1	Accommodation (D)
2	Maximum AR-measured value (D)
3	Minimum AR-measured value (D)
4	Maximum pupil size (mm)
5	Minimum pupil size (mm)
6	Pupil size graph
7	Graph indicating chart position (TPOS)
8	Graph indicating change in AR-measured values (Accommodation graph)

Note

- Graph display of pupil size and AR-measured values
  Interruptions on the graph indicate there were times that no measurement was obtained due to blinking, alignment error, or such during measurement.

*1. Accommodation increments is set by the "131. STEP" parameter independent from the display increments of the AR-measured values.

3.8 Manual Measurement

■ The Corneal Size (CS), Pupil Size (PS), and Pupillary Distance (PD) can be manually measured by looking at the eye image. Even if auto measurement[*1] is set, manual measurement is possible.

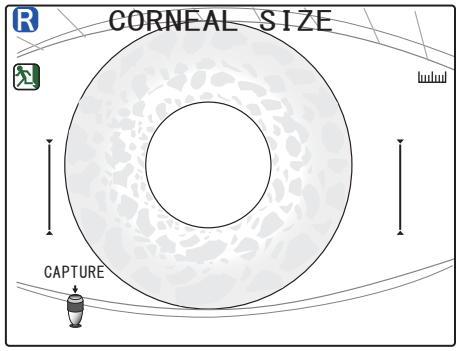
Note

- When the CS (Corneal Size) measurement, PS (Pupil Size) measurement, or PD (Pupillary Distance) measurement has been both manually and automatically performed, the manually measured value is used.

3.8.1 CS (Corneal Size) measurement

1 Press the CS/PS/PD button to enter CS measurement mode.

"CORNEAL SIZE" and guide lines are displayed on the screen.



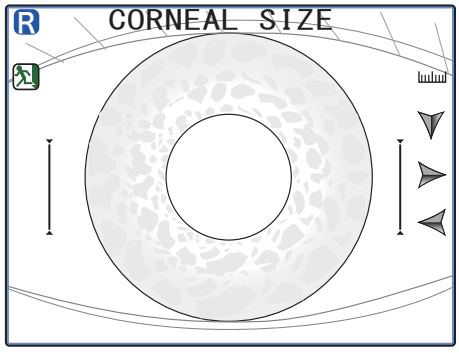
2 Manipulate the joystick to perform alignment and focusing of the patient's eye.

The auto tracking function is automatically turned off. Manually perform alignment and focus.

3 Press the start button to capture the image.

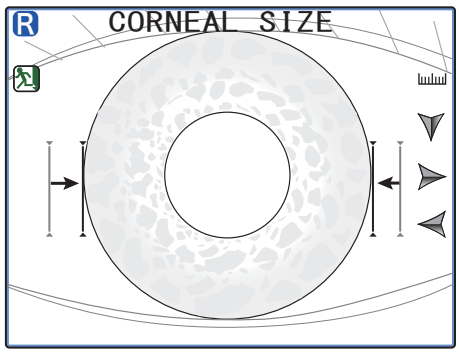
The screen switches from a live image to a still image.

After image capture, instruct the patient to rest comfortably.



4 Press the right button or left button to align the guide lines on the edge of the patient's cornea.

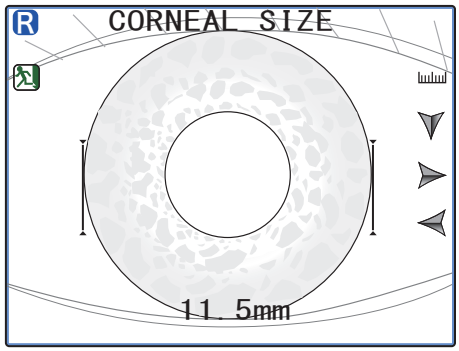
The guide line to be aligned is displayed in pink. Press the down button to change the selected guide line.



*1. Auto measurement is set by the "68. AUTO PD", "69. AUTO PS", or "70. AUTO CS" parameter.

5 Press the start button to confirm the measurement.

A CS value (0.1 mm increments) is displayed in the lower part of the screen.



6 Measure the other eye in the same manner.

Switching the eye to be measured displays the Step 1 screen display.

To perform PS (Pupil Size) measurement at the same time, press the CS/PS/PD button to switch to the PS measurement screen.

Note

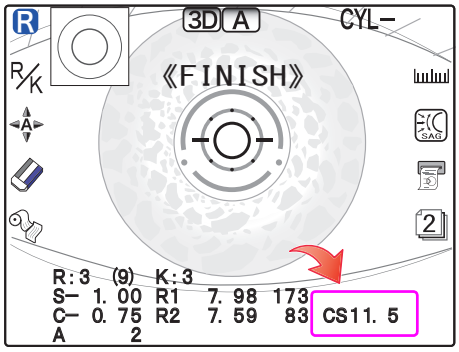
- When performing both CS (Corneal Size) measurement and PS (Pupil Size) measurement, switch the eye to be measured only after CS measurement and PS measurement of a single eye are complete.

  Only a single image capture is needed for each capture.
- When the “5. AI MODE” parameter is set to “YES” and the “31. PRINT” parameter is set to “AUTO”, perform manual CS measurement before AR and/or KM measurement to print the data together with AR- and/or KM-measured data.

7 Press the return button to exit from CS measurement mode.

The screen returns to the measurement screen.

The CS-measured value is displayed on the screen indicating the completion of CS measurement.



3.8.2 PS (Pupil Size) measurement

The following is the procedure to measure the Pupil Size (PS). When continuing PS (Pupil Size) measurement from CS (Corneal Size) measurement, start from Step 5.

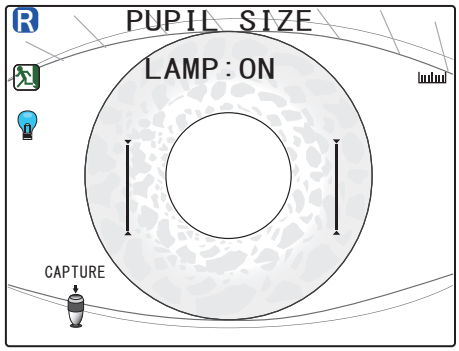
Note

- When the mode is switched to PS measurement mode while a still image is displayed on the CS (Corneal Size) measurement screen, the image displayed is still.
- To recapture the patient's eye after turning on or off the lamp button, press the start button twice.

  The screen switches to the Step 1 screen display.

1 Press the CS/PS/PD button to enter PS measurement mode.

"PUPIL SIZE" and guide lines are displayed on the screen.



2 When measuring the pupil size under reduced lighting, turn off the chart-illuminating lamp in the measuring window.

Press the lamp button to turn on or off the chart-illuminating lamp.

When the chart-illuminating lamp is not lit, "LAMP:OFF" is displayed.

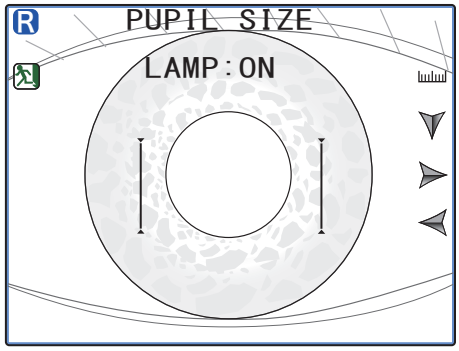
Instruct the patient not to look around and watch ahead without straining.

LAMP:ON	Measures the pupil size during AR measurement
LAMP:OFF	Measures the size of the pupil dilated in darkness

3 Manipulate the joystick to perform alignment and focusing of the patient's eye.

The auto tracking function is automatically turned off.

Manually operate the joystick to perform alignment and focusing according to the patient's eye.

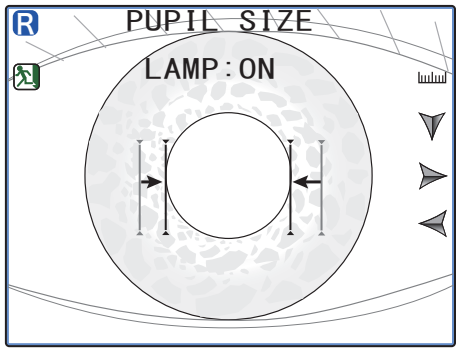


4 Press the start button to capture the image.

The screen switches from a live image to a still image. After image capture, instruct the patient to rest comfortably.

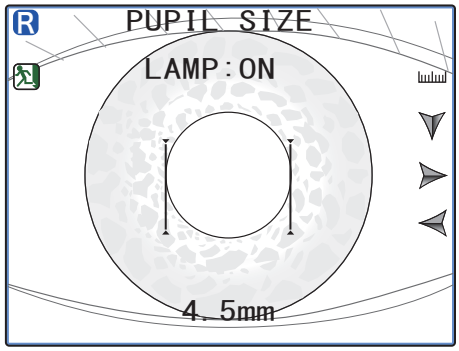
5 Press the right button or left button to align the guide lines on the pupil of the patient's eye.

The guide line to be aligned is displayed in pink. Press the down button to change the selected guide line.



6 Press the start button to confirm the measurement.

A PS value (0.1 mm increments) is displayed in the lower part of the screen.



7 Measure the other eye in the same manner.

Switching the eye to be measured displays the Step 1 screen display.

Note

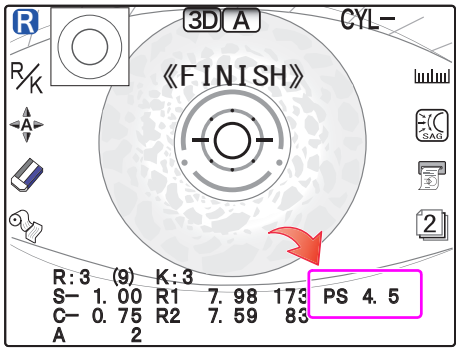
- When the "5. AI MODE" parameter is set to "YES" and the "31. PRINT" parameter is set to "AUTO", PS measurement must be performed before AR and/or KM measurement to print the data together with AR- and/or KM-measured data.

8 Press the return button to exit from PS measurement mode.

The screen returns to the measurement screen.

The PS-measured value is displayed on the screen indicating the completion of PS measurement.

To perform PD (Pupillary Distance) measurement at the same time, press the CS/PS/PD button to display the PD measurement screen.



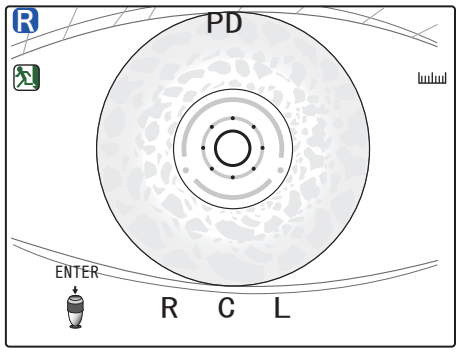
3.8.3 PD (Pupillary Distance) measurement

Note

- In manual PD measurement, five measurements can be saved. The latest PD value is displayed on the measurement screen. The measured PD values (five measurements at the maximum) are printed on the printed results in the order measured.

1 Press the CS/PS/PD button to enter PD measurement mode.

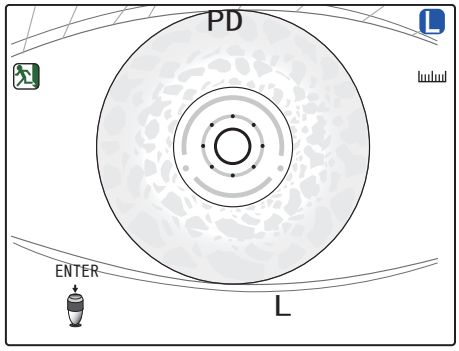
"PD", "R", "C", and "L" are displayed on the screen.



2 Instruct the patient not to move their head or eyes during measurement.

3 After each proper alignment of the right eye and left eye, press the start button.

Pressing the start button after proper alignment with the middle (bridge) of the PD allows monocular PD along with the binocular to be measured.



Note

- If the patient's head is tilted, straighten it before starting measurement.

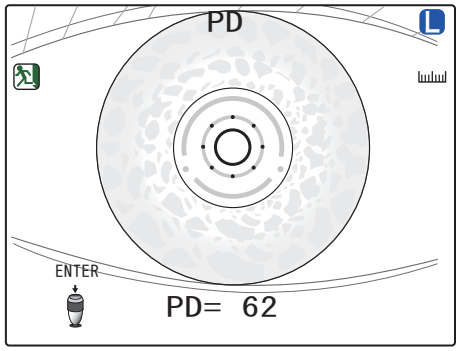
  To locate in the exact middle position, have the patient wear the frames marked in the middle and bring the mark in focus.

- "R" (Right), "C" (Center) or "L" (Left) on the LCD disappears in order by pressing the start button to indicate that detection of each position has been completed.

4 When measurement is complete, the measured PD is displayed on the screen.

When the R (Right) or L (Left) indication disappears, measurement finishes.

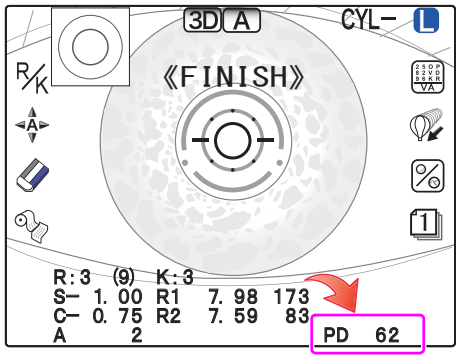
To measure the monocular PD, press the start button in the center (C).



5 Press the return button to exit from PD measurement mode.

The screen returns to the measurement screen.

The measured PD is displayed on the screen indicating the completion of measurement.



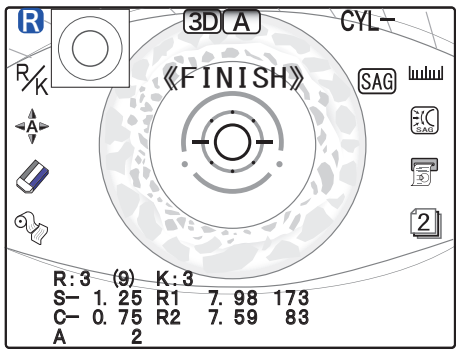
Note

- When PD is measured with the “55. NEAR PD PRINT” parameter set to “YES”, the near PD is printed out along with the distance PD.

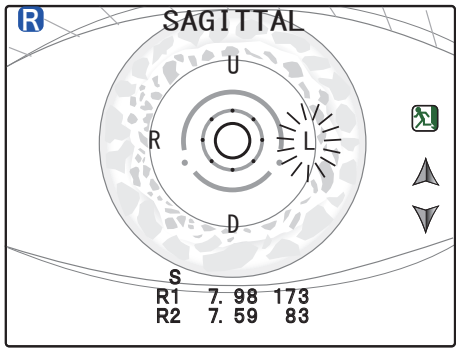
3.9 Sagittal Measurement

Set the “81. SAGITTAL” parameter to “YES” in advance. When the “31. PRINT” is set to “AUTO”, reset it to “MANUAL”.

1 As soon as KM-measured values are obtained, the SAG SAG icon is displayed. Press the SAG button to display the sagittal measurement screen.



Indications of “U (Up)”, “R (Right)”, “D (Down)”, and “L (Left)” are displayed on the screen. The blinking “L (Left)” indication shows the position of the illuminated fixation target viewed by the patient.



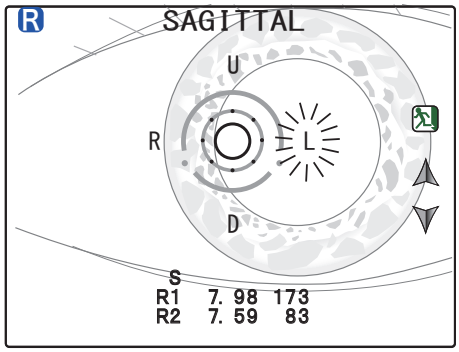
Note

- The latest KM-measured values are displayed on the screen.
- To exit from sagittal measurement mode, press the return button.

2 Instruct the patient to look at the green light on the left without moving their head.

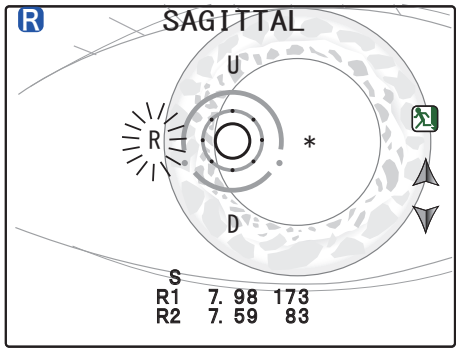
3 Manipulate the joystick up, down, right, or left to position the target within the mire ring.

4 Manipulate the joystick forward or backward until the mire ring is focused.



5 Press the start button to start measurement.

The sagittal radius of the left position is measured. “L” changes to “*” and then “R” starts blinking.



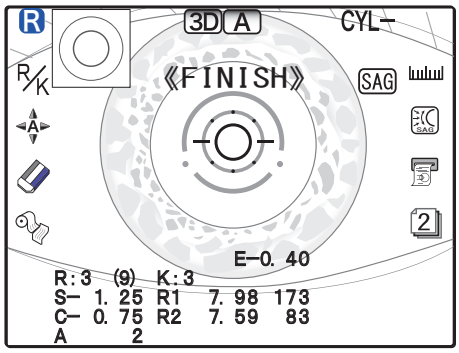
Note

- If the measurement is erroneous, “L” changes to “E”. In such cases, press the start button to start measurement again. If “E” remains after remeasurement, press the down button to proceed to measurement of the R side.

6 Instruct the patient to look at the green light on the right without moving their head and measure the right side in the same manner as the left.

7 Take measurements for D (Down) and U (Up) in the same manner.

When all the four measurements for a single eye are complete, the device returns to the AR/KM measurement screen (or KM measurement screen) and the eccentricity (E) value is displayed.



Note

- Throughout the measurement process, median values for each side (L, R, U or D) are obtained individually. The eccentricity data is obtained by calculation based on the four median values and KM data (either median or the latest data). When the “82. SAGIT AXIS” parameter is set to “AXIS”, these values will be converted for the angle of the steepest meridian which has been obtained during KM measurement.
- When “E” is displayed for a particular side, the value of the opposite side on the same meridian is used for the calculation of eccentricity.
- If the eccentricity is displayed as “E ERR”, press the SAG button to conduct sagittal measurement again. Taking remeasurement, however, clears the previous data.

8 Measure the other eye in the same manner.

It is possible to start binocular radius measurement after KM measurement of both eyes.

9 Press the print button to print the sagittal measurement results.

Note

- Before measuring another patient, be sure to press the print button to print data or press the clear button to erase data.

○ Sample printout

The following are sample printouts for the left eye and explanations of each data item.

● Sample printout 1

When the “83. SAGIT PRINT” parameter is set to “ALL”

```
----------0001----------
NAME                    M/F
  MAY/25/2013    4:10 PM
VD=12.00mm
REF.INDEX =1.3375
<L>       mm        D deg
<R1    7.79   43.32   10>
<R2    7.55   44.70  100>
<AVE   7.67   44.00     >
<CYL         - 1.38   10>
<SAGITTAL> FIX ANGLE=25
   SUP.    INF.    TEM.    NAS.
A 7.82   7.88   7.69   7.57
<TOPOMETRY OF CORNEA>
   SUP.    INF.    TEM.    NAS.
S 7.58   7.64   7.93   7.81
e+0.21 +0.36 +0.44 +0.17
 eh   = +0.34 Rh   =  7.84
 eV   = +0.30 Rv   =  7.59
 E    = +0.32 Ro   =  7.67
 ASTc= -1.38 dRo  = +0.24
 ASTp= -1.47 dAST= +0.09

     NIDEK    ARK-1s
```

< SAGITTAL > = Sagittal radius on each side
- SUP. = Superior side
- INF. = Inferior side
- TEM. = Temporal side
- NAS. = Nasal side

A = Axis of steepest meridian (KM measurement)
(FIX ANGLE = Fixation angle)
S = Sagittal data which the dRo value is added to or subtracted from sagittal radius values
e = Eccentricity values of each sagittal radius
eh = Eccentricity on horizontal meridian
ev = Eccentricity on vertical meridian
E = Total Eccentricity
ASTc = Corneal cylinder at the center
ASTp = Corneal cylinder at the periphery
Rh = Average of corneal curvature on horizontal meridian
Rv = Average of corneal curvature on vertical meridian
Ro = Average of corneal curvature at the center
dRo = Difference of corneal curvature between R1 and R2
dAST = Difference of corneal cylinder between the center and the periphery

● Sample printout 2

When the “83. SAGIT PRINT” parameter is set to “SHORT”

```
----------0001----------
NAME                    M/F
  MAY/25/2013    4:10 PM
VD=12.00mm
REF.INDEX =1.3375
<L>       mm        D deg
<R1    7.79   43.32   10>
<R2    7.55   44.70  100>
<AVE   7.67   44.00     >
<CYL         - 1.38   10>
<SAGITTAL> FIX ANGLE=25
   SUP.    INF.    TEM.    NAS.
A 7.82   7.88   7.69   7.57
                 E = +0.32

     NIDEK    ARK-1s
```

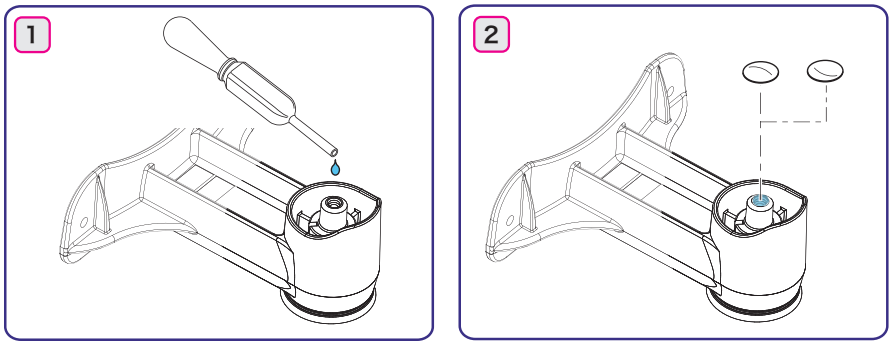
3.10 Contact Lens Measurement

■ To measure hard contact lenses, use the provided contact lens holder.

The contact lens holder is incorporated in the spherical model eye.

1 Fill the concave top of the contact lens holder with water.

Use a commercial pipette to fill the concave top of the CL holder completely with water.



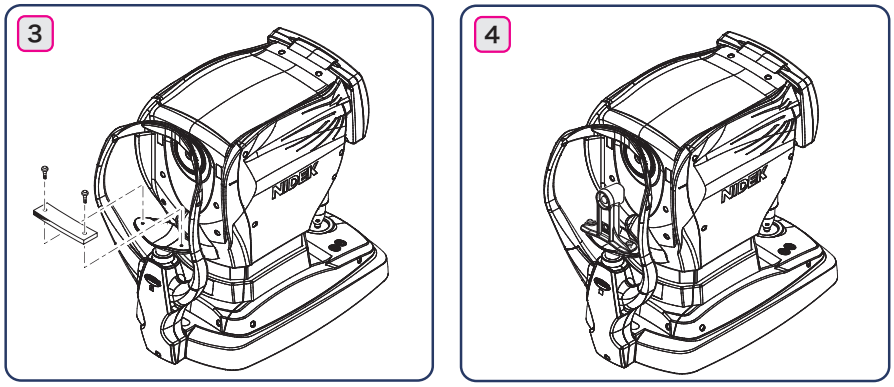
2 Place a contact lens on the contact lens holder with the surface to be measured facing upward.

When measuring the concave surface, place the lens with the concave surface up. Conversely, when measuring the convex surface, place the lens with the convex surface up.

Note

- Prevent any bubbles from forming. In addition, avoid water or dust to the measurement surface.

3 Remove the two fixing pins and the stack of chinrest paper from the chinrest.



4 Place the contact lens holder with the surface of the contact lens to be measured facing toward the measuring window and insert the fixing pins.

5 Select KM measurement mode and measure the contact lens in the same manner as KM measurement.

Note

- When the convex surface of a contact lens is measured, the axis angle can be read directly. When the concave surface is measured, however, the measured axis is reflected over the Y axis.
- Soft contact lenses cannot be measured.

3.11 Measured Value Printing

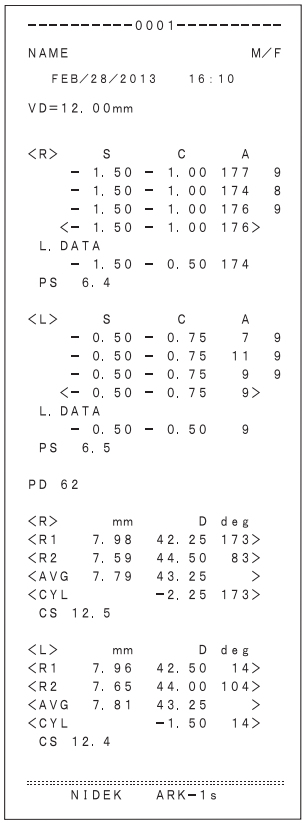
■ Measured values are printed out by pressing the print button after measurement.

The printing contents can be changed by parameter options “PRINT1” to “PRINT3”. Set the parameters as necessary or desired. *“4.6 Device Parameter Settings” (page 80)*

Note

- When the “31. PRINT” parameter is set to “AUTO”, printing starts automatically when measurement of both eyes is complete.
- When the RT or such is connected, printing and data communication are performed at the same time.

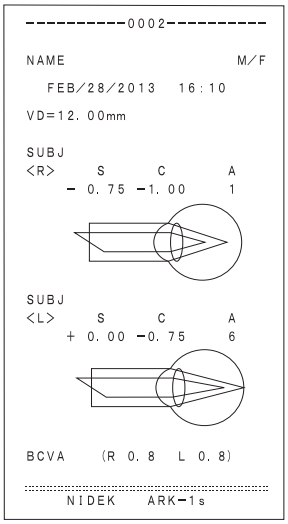
● Sample printout 1



```
----------0001----------
NAME                    M/F
  FEB/28/2013    16:10
VD=12.00mm

<R>     S       C       A
     - 1.50  - 1.00  177   9
     - 1.50  - 1.00  174   8
     - 1.50  - 1.00  176   9
   <- 1.50  - 1.00  176>
 L.DATA
     - 1.50  - 0.50  174
 PS   6.4

<L>     S       C       A
     - 0.50  - 0.75    7   9
     - 0.50  - 0.75   11   9
     - 0.50  - 0.75    9   9
   <- 0.50  - 0.75    9>
 L.DATA
     - 0.50  - 0.50    9
 PS   6.5

PD 62

<R>      mm       D deg
<R1    7.98   42.25 173>
<R2    7.59   44.50  83>
<AVG   7.79   43.25   >
<CYL          -2.25 173>
 CS 12.5

<L>      mm       D deg
<R1    7.96   42.50  14>
<R2    7.65   44.00 104>
<AVG   7.81   43.25   >
<CYL          -1.50  14>
 CS 12.4

     NIDEK    ARK-1s
```

Standard printing

A sample printout of AR/KM measurement with the print parameters set to default



```
----------0002----------
NAME                    M/F
  FEB/28/2013    16:10
VD=12.00mm

SUBJ
<R>     S       C       A
     - 0.75  -1.00     1
```



```
SUBJ
<L>     S       C       A
     + 0.00  -0.75     6
```

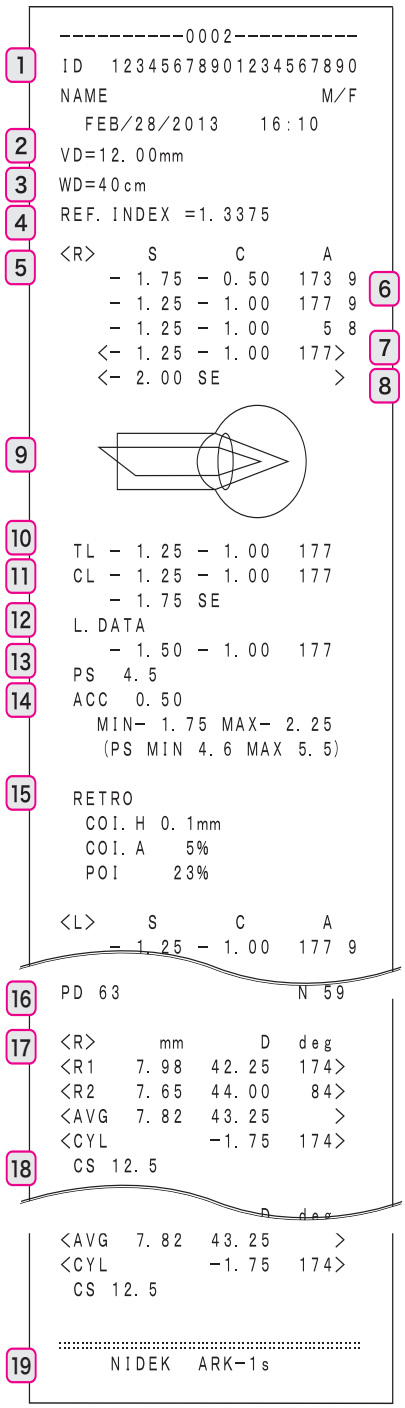


```
BCVA    (R 0.8  L 0.8)

     NIDEK    ARK-1s
```

Printing of eye diagram

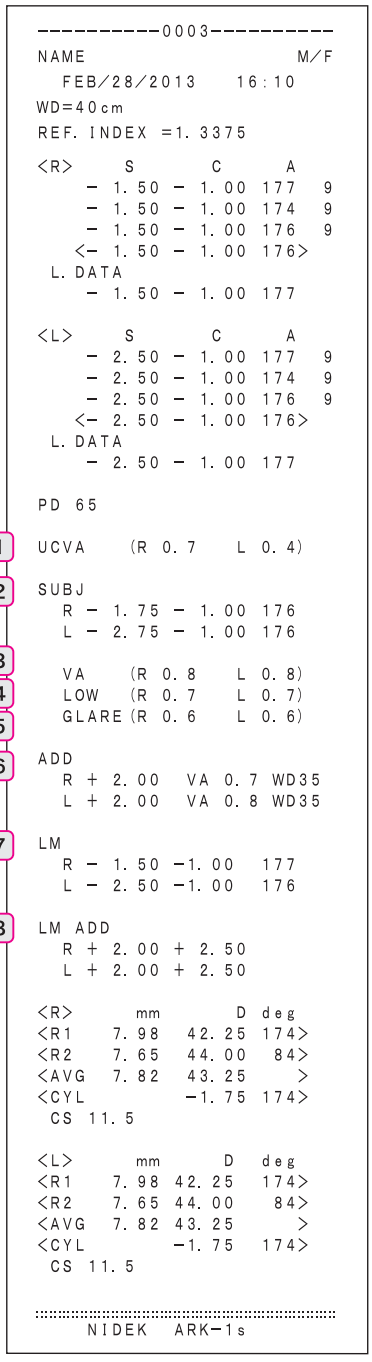
Pressing the eye print button prints the eye diagram based on the AR median values (or the latest values when median values have not been obtained) or the subjectively measured values when the subjective measurement has been performed.

● Sample printout 2



1	Patient ID Patient ID scanned by the optional barcode scanner or magnetic card reader
2	Vertex distance
3	Near working distance
4	Corneal refractive index
5	AR-measured values (center) S: Spherical refractive error C: Cylindrical refractive error A: Cylinder axis
6	Confidence index
7	AR median values
8	SE value
9	Printing of eye diagram
10	Trial lens data
11	Contact lens conversion value
12	AR large area measured values
13	PS (Pupil Size) measured value “(LAMP=OFF)” is printed out for PS measurement conducted with the chart-illuminating lamp off and “(LAMP=ON)” when the lamp is on.
14	Accommodation measured values MIN: AR-measured minimum value MAX: AR-measured maximum value (PS MIN: Pupil size minimum value, MAX: Pupil size maximum value) An accommodation graph is printed out depending on the “58. ACC GRAPH PRINT” parameter setting.
15	Retroillumination analysis values COI. H: Central Opacity Index Height COI. A: Central Opacity Index Area POI: Peripheral Opacity Index
16	PD (Pupillary Distance) Distance PD, monocular PD, near PD
17	KM median values R1: Flattest meridian R2: Steepest meridian deg: Corneal cylinder axis AVG: Average of R1 and R2 CYL: Corneal cylindrical error
18	CS (Corneal Size) measured value
19	Comments Characters and symbols can be freely entered.

- Sample printout 3



```
----------0003----------
NAME                    M/F
  FEB/28/2013    16:10
WD=40cm
REF. INDEX =1.3375

<R>     S        C       A
     - 1.50 - 1.00 177   9
     - 1.50 - 1.00 174   9
     - 1.50 - 1.00 176   9
   <- 1.50 - 1.00 176>
 L.DATA
     - 1.50 - 1.00 177

<L>     S        C       A
     - 2.50 - 1.00 177   9
     - 2.50 - 1.00 174   9
     - 2.50 - 1.00 176   9
   <- 2.50 - 1.00 176>
 L.DATA
     - 2.50 - 1.00 177

PD 65

1  UCVA    (R 0.7    L 0.4)

2  SUBJ
     R - 1.75 - 1.00 176
     L - 2.75 - 1.00 176

3    VA    (R 0.8    L 0.8)
4    LOW   (R 0.7    L 0.7)
5    GLARE (R 0.6    L 0.6)

6  ADD
     R + 2.00   VA 0.7 WD35
     L + 2.00   VA 0.8 WD35

7  LM
     R - 1.50 -1.00   177
     L - 2.50 -1.00   176

8  LM ADD
     R + 2.00 + 2.50
     L + 2.00 + 2.50

<R>       mm        D  deg
<R1    7.98   42.25  174>
<R2    7.65   44.00   84>
<AVG   7.82   43.25     >
<CYL          -1.75  174>
 CS 11.5

<L>       mm        D  deg
<R1    7.98   42.25  174>
<R2    7.65   44.00   84>
<AVG   7.82   43.25     >
<CYL          -1.75  174>
 CS 11.5

     NIDEK  ARK-1s
```

1	Uncorrected VA values
2	Subjective refractive error measured values An eye diagram is printed out depending on the “52. EYE PRINT” parameter setting.
3	Corrected distance VA values
4	Contrast VA values
5	Glare VA values
6	Near addition powers, near VA values, WD
7	LM values These are values of the patient’s own glasses measured by a lensmeter. When the following conditions are satisfied, printing is conducted. • The device is connected to a lensmeter and data is saved in the lensmeter or LM data has been imported from an Eye Care card. • Subjective refractive error measurement has been performed.
8	LM addition powers (ADD1, ADD2)

3.12 Summary Display

Various measured values can be displayed at the same time on the summary screen. In addition, measured data can be deleted at the measurement item level.

To print or export the measured values, press the print button in the summary screen.

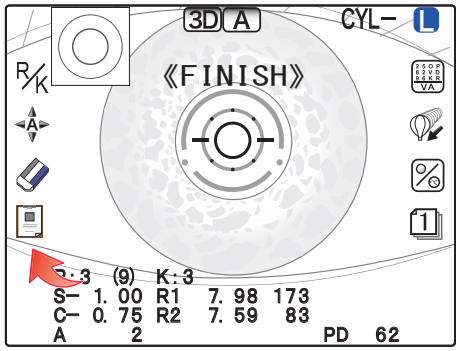
To display the summary screen, the “40. SUMMARY” parameter needs to be set to “YES”.

“4.6.2 Parameter tables” (page 82)

Note

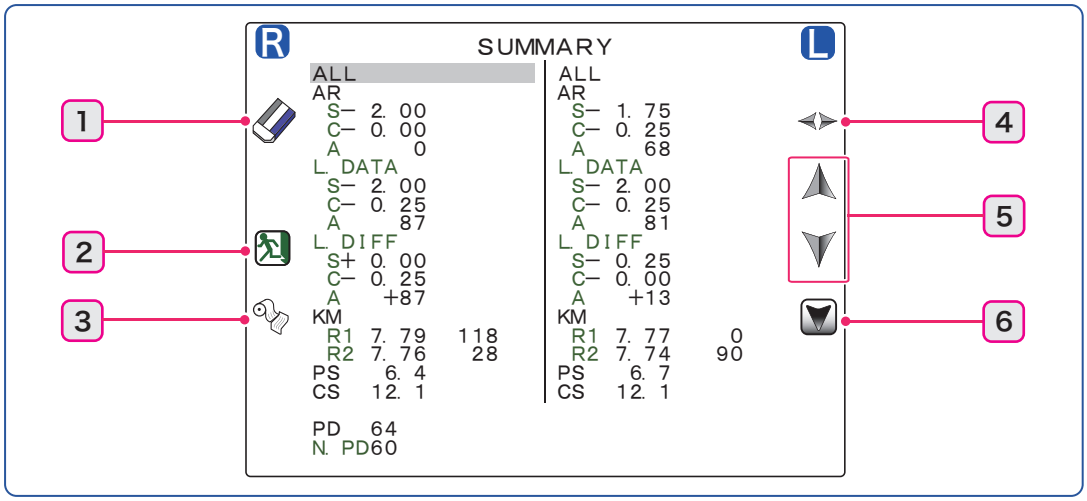
- The "AUTO" setting of the “31. PRINT” parameter does not function for displaying of the summary screen. After the measurement, press the summary button to display the summary screen.

1 After the measurement, press the summary button on the measurement screen to display the summary screen.



2 After confirming the measured values on the summary screen, delete or print the data as necessary.

○ Operation in the summary screen



1	Clear	Holding down the button for about a second erases the measured data of the selected measurement items. When “ALL” is selected, all the measured data of the selected eye (right or left) except for the PD value is erased.
2	Return	Returns to the measurement screen.

3	Print	Prints the measured results. When there is no measured data, long press of the print button (for about 1 second) advances the paper.
4	Right/Left	Switches the eye (with the cursor) between the right and left eyes.
5	Up/ Down	Selects (with the cursor) the upper or lower measurement item.
6	Next page	Displays the next screen page (to show other measured values).

Note

- The data export and data erasing functions operate when the print button is pressed as when the print button is pressed on the measurement screen.
- To erase all the measured data with a single operation, press and hold the erase button (for about 1 second) on the measurement screen.

Measurement items to be displayed

ALL	Selected to erase all the measurement items except for PD.
AR	AR median value, large area measurement value (L.DATA and L.DIFF) The trial lens data and contact lens conversion value are displayed at the end of the measured value.
KM	KM median value
PS	PS (pupil size) measured value
CS	CS (corneal size) measured value
PD	Pupillary distance (distance PD, near PD)
UCVA	Uncorrected VA measurement value
SUBJECT	Subjective measurement value (distance corrected VA value, contrast VA value, glare VA value, subjective refractive error, near addition power, near VA value)
ACC	Accommodation measurement value (AR measurement value MIN/MAX, pupil diameter MIN/MAX)
RETRO	Retroillumination analysis value (COI.H, COI.A, POI)

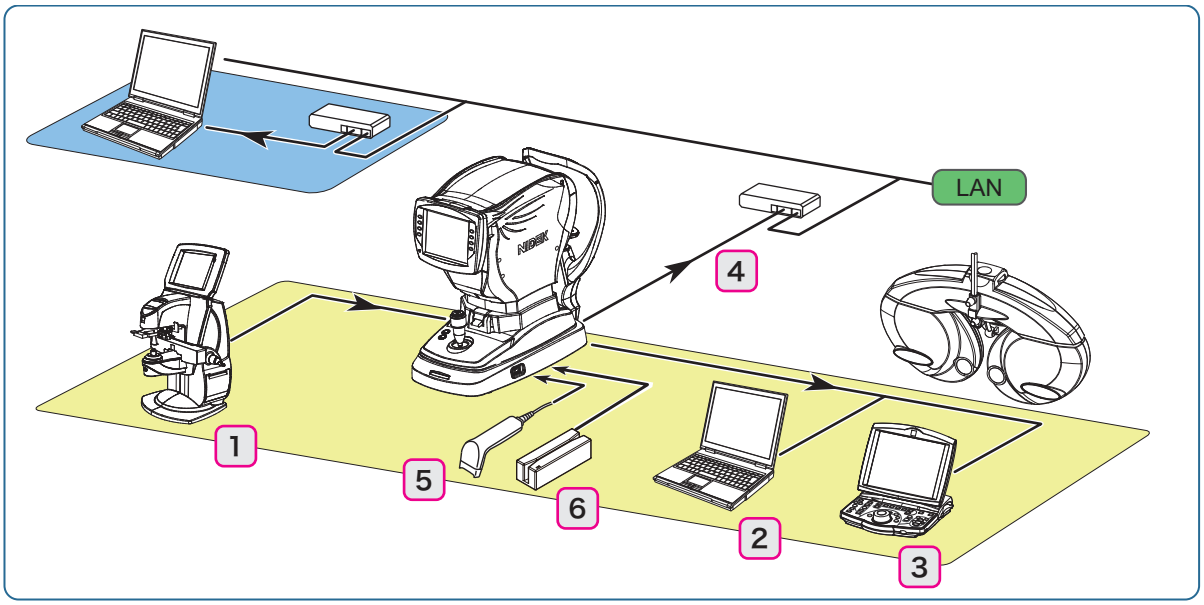
Note

- The measurement items that have not been measured become blank.

3 Press the return button to return to the measurement screen.

3.13 Operation when Peripheral Devices are Connected

■ The device can export data to an external device such as the NIDEK motorized refractor and PC. It can also import data from the NIDEK lensmeter.



	Connecting device	Connection port	Function
1	NIDEK lensmeter	RS-232C connector input (IN: ⊖)	LM data is imported and then printed while at the same time exported to the RT.
	Connectable devices: LM-500, LM-600/600P/600PD, LM-970, LM-990/990A, LM-1000/1000P, LM-1200, LM-1800P/1800PD		
2	PC	RS-232C connector output (OUT: ⊕)	AR and KM data are exported. Measured data is managed by database software.
3	NIDEK motorized refractor	RS-232C connector output (OUT: ⊕)	AR data is exported. AR data is used as objective values in the subjective test by the RT.
	Connectable devices: RT-1200 series, RT-2100 series, RT-5100 series		
4	PC	LAN port	AR data and KM data are exported. Measured data is managed by database software.
5	Barcode scanner (optional)	USB port	Patient ID is read.
6	Magnetic card reader (optional)		

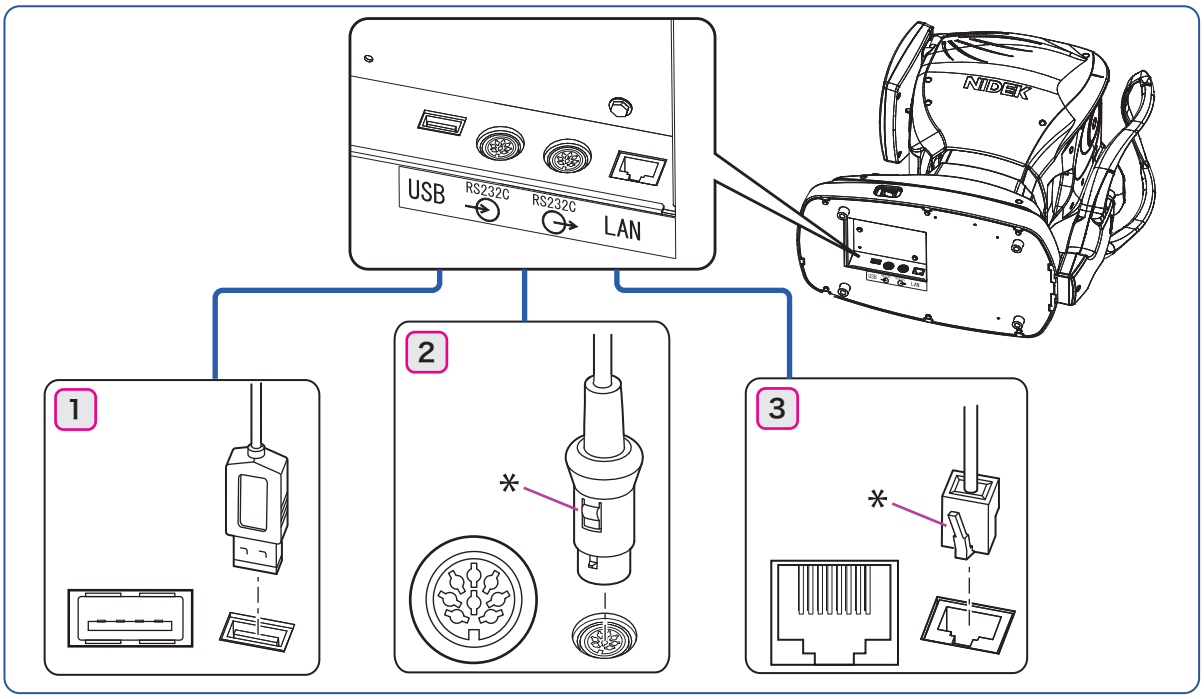
⚠ CAUTION

- Never connect devices other than the optional barcode scanner or magnetic card reader to the device.
  ID cannot be read correctly or device malfunction may result.
- Be sure to perform LAN connection via a network hub.
  Data communication may not be properly performed.

3.13.1 Device connecting procedure

⚠ CAUTION

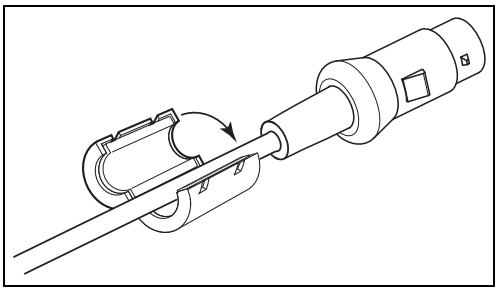
- Before connecting a communication cable, be sure to turn off each device.
  Connecting the cable with the power on may cause malfunction.



Connect the cable with the device on its side. Ensure that the plug is inserted into the connector in the proper orientation.

To disconnect the plug of the RS-232C cable (Number 2 above) or LAN cable (Number 3 above), hold the plug while pressing the button (or lock) indicated by "*" and pull out the plug.

Attach a ferrite core (optional) to the end of the communication cable connected to the device.



Note

- An RS-232C communication cable (optional) differs depending on the connecting device. Contact NIDEK or your authorized distributor for details.
- Before network connection (LAN connection), set parameters of the device and PC under confirmation of the network administrator of the facility.

3.13.2 Operating procedure

- Importing data from a lensmeter (LM) (RS-232C connection)

ARK-1s parameter setting	NIDEK LM parameter setting
73. BAUD-RATE = 9600	Printer = AR print
74. BIT LENGTH = 8	RS-232C = NIDEK
76. LM DATA PRINT = YES	Baud rate = 9600
	Parity = Odd
	Data bits = 8
	Stop bits = 1

1) After measurement by a lensmeter, press the print button.

- Exporting data to the RT (or PC) (RS-232C connection)

After measurement, press the print  button.

1) Transmit data to the RT (or PC).
   When the device is connected to the RT, it receives data number (ID number) from the RT.
   When the device is connected to a PC, it does not receive data number (ID number).
2) The measured data is printed.
   When the device is connected to the RT, the data number (ID number) is also printed.

- Exporting data to the PC (network connection [LAN])

After measurement, press the print  button.

The measured data is printed and data is transmitted to the PC.

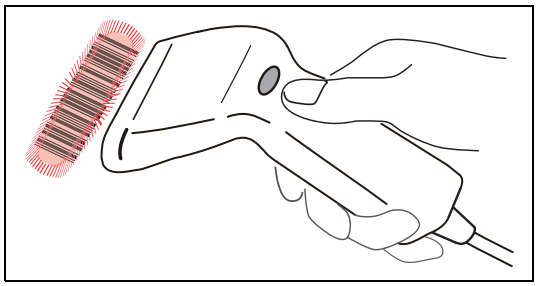
- Reading the patient ID with the barcode reader or magnetic card reader

Note

- Although patient ID can be read before or after measurement, read it before printing the measured results.
  If patient ID is read after measured data has been printed and is still displayed, the device considers the displayed data to be that of a former patient and erases it automatically.
- The device considers the latest patient ID read before printing to be the patient ID of the printed data.
  If an incorrect patient ID has been read, read the correct ID again.
- A beep sounds when the device is turned on with the barcode scanner or magnetic card reader connected.

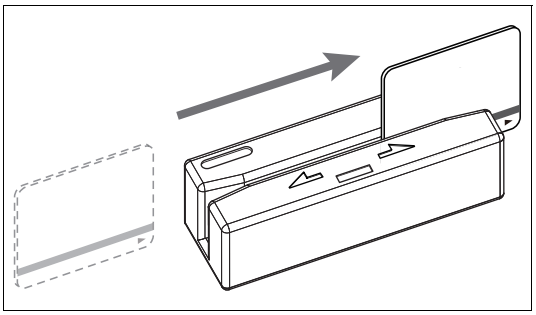
Place the scanner window over the barcode and press the trigger button. (Barcode scanner)

When the barcode has been read successfully, the confirmation LED lights up.



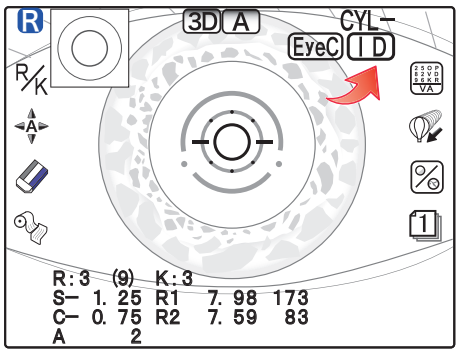
Swipe the card with the magnetic card reader. (Magnetic card reader)

A beep sounds and the green LED goes out. When the card has been read successfully, the LED lights up.



When the barcode has been read successfully, the device displays the ID [ID] icon indicating that the patient ID has been read.

When an Eye Care card is not inserted, the ID number is displayed instead of the ID [ID] icon.



Note

- For the barcode, use “CODE39”.
- Use a magnetic card utilizing a magnetic stripe format compliant with ISO 7811, AAMVA, CA DMV.
- For the patient ID, alphanumeric characters, spaces, “_” and “-” symbols can be used.

  Other symbols are not recognized by the device. All unrecognized symbols are converted to “~”.

4 DEVICE SETTINGS AND MAINTENANCE

4.1 Troubleshooting

■ Should the device function improperly, attempt to correct the problem according to the following table before contacting NIDEK or your authorized distributor.

When	Remedy
The LCD does not turn on.	• The power cord may not be correctly connected. Reconnect it securely. • Check whether proper voltage is applied to the power outlet. • The power switch may not have been turned on. Check the power switch.
The LCD does not turn on (not clear) even though power is on.	• The sleep function may have been activated. Press any button to exit from sleep mode.
The screen disappears suddenly.	• Sleep mode may have been activated. Press any button to exit from sleep mode.
The main unit cannot be moved laterally.	• The locking lever may be locked. Flip up the locking lever in front of the joystick.
Printing does not start.	• Check the printer paper. If the paper has been used up, load new printer paper. • The “31. PRINT” parameter may be set to “NO”. Reset the parameter.
The printer does operate, however, printed results cannot be obtained.	• The printer paper may be loaded with the incorrect side up. Set it with the correct side up.
When power is turned on or the print button is pressed, “ERROR” or “OUT OF PAPER” appears even though printer paper is loaded.	• Check whether the printer cover is securely closed. Open the printer cover and close it securely. • The print button may have been pressed too soon after the printer cover was closed. After the printer cover is closed, it takes time for the printer to be ready.
Printer paper does not feed properly.	• Printer paper may be loaded in tilted or the core of the roll may not be placed properly. Open the printer cover and make sure that printer paper is properly loaded.

When	Remedy
The auto tracking function or auto shot function does not work.	• The auto tracking function or auto shot function may not have been turned on. Turn them on with the auto  button. • Room illumination may be reflecting on the cornea. Change the location and try measurement again. • The auto tracking function or auto shot function may not work on some eyes such as keratoconus or recently-operated cornea. In such cases, turn off the auto tracking function and start measurement. • With patients who have substantial ocular ataxia or who cannot fixate their eyes, the auto tracking function may not work. In such cases, turn off the auto tracking function and start measurement. • If the device is installed in the vicinity of a window resulting in exposed to sunshine, light interference may adversely affect these functions. Change the installed position of the device and start measurement again.
“PD ERR” is displayed on the screen.	• Check whether the PD measuring window is not blocked.
A measurement error appears.	• The patient may have blinked during measurement. Instruct the patient not to blink and try measurement again. • The eyelid or eyelashes may obstruct measurement. Instruct the patient to open their eye wider. If the patient cannot open wider, gently lift the patient’s lid, paying attention not to press against the eyeball. • The pupil may be too small for measurement. Have the patient sit in a dark room for a while until the pupil enlarges enough and try measurement again. • The data may exceed the measurable limit.
The “CHECK MEASURING WINDOW.” message is printed out at device start-up.	• Clean the measuring window. *(page 99)* • If the measuring window is not dirty, make sure that the measuring window is not blocked at device start-up.

* If the symptom cannot be corrected by the above actions, contact NIDEK or your authorized distributor.

4.2 Error Messages and Remedies

■ If one of the following error codes is displayed on the screen or printed out, follow the suggestions in the cause and remedy column.

The error code, detailed indications and serial number of your device are helpful for proper servicing.

Error message	Cause and remedy
ERR001 EEPROM ERR	• Loss of backup memory (EEPROM) data due to exogenous noise such as static electricity or malfunction of the backup memory on the electric circuit board is probable. • If the same error code is displayed again even after the device is turned off and on again, shut off the device and contact NIDEK or your authorized distributor.
ERR002 CLOCK ERR	• Because the built-in battery has been discharged after about one month or longer of non-use, the date and time settings may have become incorrect, or malfunction of the electric circuit board or timer IC on the electric circuit board is probable. • If the same error code is displayed again even after the date and time have been reset in parameter setting mode, shut off the device and contact NIDEK or your authorized distributor.
PD ERR	• If the PD window is blocked, remove the obstacle. If dust settles on the PD window, dampen a cloth with rubbing alcohol and gently wipe the dust off. • Install the device in a location where the device is not exposed to external light. • Shut off the device and contact NIDEK or your authorized distributor.
ERR011 to ERR018 COM (OUT) ERR	• Check whether the communication cable is properly connected to the output port. • Check whether the parameters related to communication are properly set.
NO DATA	• No measured data to be transmitted exists. • Conduct communication after measurement.
ERR021 to ERR028 COM (IN) ERR	• Check whether the communication cable is properly connected to the input port. • Check whether the parameters related to communication are properly set.
OUT OF PAPER	• If the printer is short of paper, refill paper. If the printer cover is open, close it securely. • If the same error code is displayed even after replacement of printer paper roll, shut off the device and contact NIDEK or your authorized distributor.
ERR501 ICC POWER ERR	• Malfunction of the Eye Care card is probable. • Replace the Eye Care card and write data again.
ERR502 ICC HOLD ERR	• The card was removed during writing. • Insert the Eye Care card and write data again.
ERR503 ICC WRITE ERR	• Error related to an Eye Care card • Insert the Eye Care card and write data again.
ERR601 USB DEVICE ERR	• A USB device connected to the USB-A connector was not properly recognized. • Check the connecting cable for proper connection. • If the same error code is displayed even after another USB device is connected, shut off the device and contact NIDEK or your authorized distributor.

The following are errors related to the mechanism inside the device. Shut off the device and contact NIDEK or your authorized distributor.	
ERR031 TRACKING U/D ERR ERR032 TRACKING R/L ERR ERR033 TRACKING F/B ERR ERR034 CHIN MOTOR ERR ERR043 PRINT HARD ERR ERR044 PRINT CONNECT ERR	ERR101 AR SENSOR ERR ERR111 THERMISTOR ERR ERR112 AR MOTOR ERR ERR121 CYL1 ERR ERR122 CYL2 ERR ERR123 CHART ERR

- Network communication

Error message	Cause and remedy
ERR700 SMB ERR	• Error related to Windows file sharing
ERR703 NETWORK ERR	• Error related to the IC board IC was damaged by some cause such as electrostatic discharge. • If the same error code is displayed again even after the device is turned off and on again, shut off the device and contact NIDEK or your authorized distributor.
ERR704 DHCP ERR	• Error related to DHCP The IP address cannot be obtained.
ERR750 CAN'T ACCESS NET	• Error related to network access Enabling access to the network may require some time after the device start-up. • Check the connection of the LAN cable. Check that the set IP address and subnet mask are correct.
ERR751 CAN'T WRITE PC	• Write-protection is enabled or no free space is left. • Check whether write permission is granted to the destination folder in the PC and sufficient free space is left. • The file cannot be written because a file of the same name already exists. • Change the file name or delete the existing file.
ERR754 NO PC NAME	• PC with the specified name does not exist. • Check the connection of the LAN cable. Or check that the specified PC name is correct.
ERR756 CAN'T LOGON PC	• Logging on to the PC is not allowed. (The user name or password is incorrect.) • Check the user name and password and input correctly.
ERR757 NO SHARED FOLDER	• No shared folder exists in the PC. (The name of the shared folder is incorrect.) • Check the folder name and whether the folder is set to share.
ERR758 NETWORK TIMEOUT	• The PC did not finish the process in a specified time. • Send the data again.
ERR759 CAN'T DELETE PC	• The data cannot be deleted. (Deletion was attempted for data with the read-only attribute.) • Disable write-protection.
ERR760 NET INITIALIZING	• Network initialization occurs. (This may require some time after the device start-up.) • Retry access to the network later.
ERR761 ACCESS DENIED	• The file sharing setting of the PC is not proper. • Check the file sharing setting of the PC.
ERR762 ACOUNT DISABLED	• The account is disabled. (The user setting is not proper.) • Depending on the network configuration environment, “ERR756 CAN’T LOGON PC” may be displayed. • Check the network setting of the device.
ERR763 CAN’T READ PC	• Data cannot be imported. • Check the setting of the PC.
ERR771 NO NETWORK CABLE	• The LAN cable is not connected. • Check the connection of the cable. Check the connection of the connector.
ERR772 NO NETWORK ACK	• Acknowledge error The file is deleted within 5 seconds or not renamed. • Check whether the capture software on the PC is properly activated.

4.3 Printer Paper Replacement

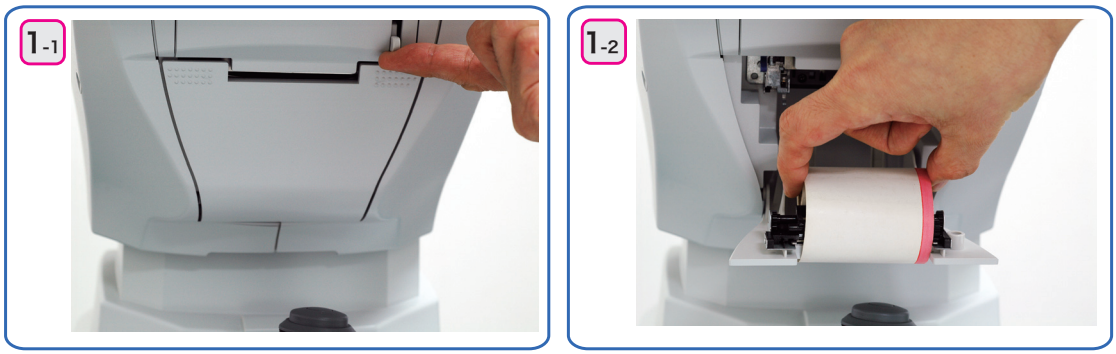
■ When a red line appears along the edge of the printer paper, it means that the paper is running short. In such a case, stop using the printer and replace the printer paper with a new roll.

⚠ CAUTION

- Be sure to use only the printer paper (80620-00001) specified by NIDEK.

  If printer paper other than those specified is used, the printer head may be damaged due to printing failure or paper jam.

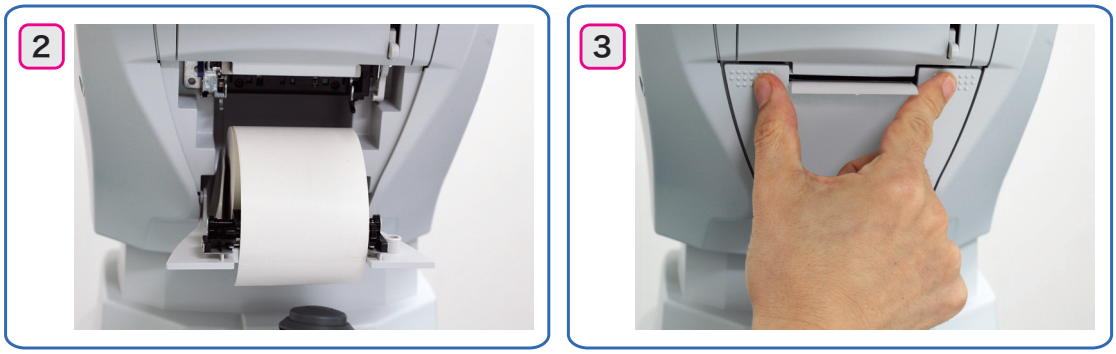
1 Pull up the cover open lever to open the printer cover and remove the remaining paper.



2 Insert a new printer paper roll.

Load the printer paper as shown in the picture below. If the roll is loaded with the paper upside down, printing is not possible.

Set printer paper so that its end extends from the cover.



Note

- Be sure that printer paper is not loaded in a tilted angle and that the core of the roll is properly placed.

  Printer paper may not be fed properly.

3 Close the printer cover.

Press the printer cover on both sides to close the cover securely.

Note

- Be sure that the cover is securely closed.

  If the cover is insecurely closed, the auto cutter may not operate properly. In addition, when the print button is pressed, “ERROR” or “OUT OF PAPER” may appear and printing will not occur.

4.4 Chinrest Paper Attachment

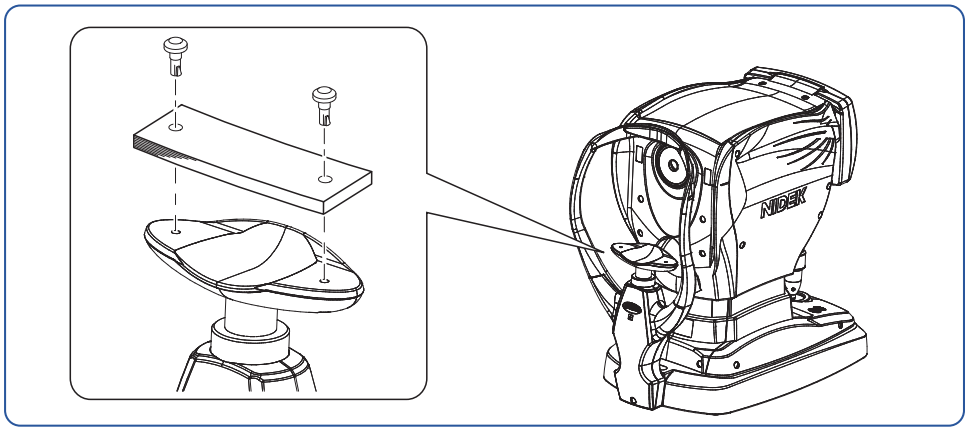
1 Remove the two fixing pins from the chinrest.

2 Remove a suitable number of chinrest papers from the pack.

An entire pack of chinrest paper cannot be attached. Attach a stack with a thickness of 6 mm of less.

3 Pass the fixing pins through the chinrest paper stack.

Pass the fixing pins through the holes on either side of the stack of paper.



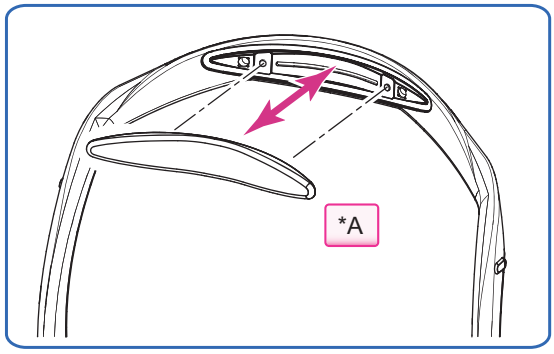
4 Attach the stack of chinrest paper onto the chinrest.

1) Insert the pin into the hole of the chinrest while holding both fixing pin and stack of paper.
2) Push the other pin into the hole of the chinrest.

4.5 Forehead Rest Pad Replacement

■ Magnetic forehead rest pad (30611-1520)

The forehead rest pad (*A) (made of ABS resin) included in the standard configuration is magnetically attachable. Attach or remove it in the orientation as shown to the right.

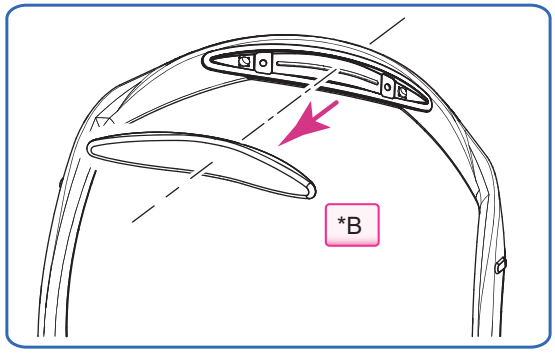


■ Forehead rest pad (15411-M752)

To replace with the softer, designated replacement, polyester elastomer forehead rest pad, use the procedure below.

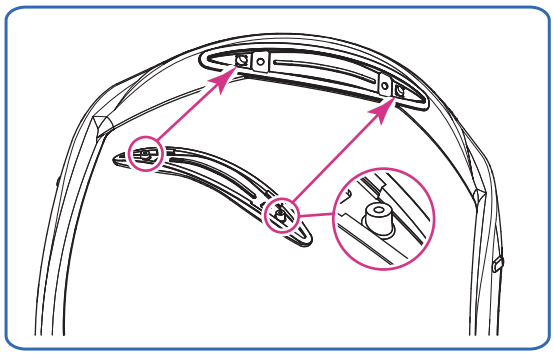
1 Remove the forehead rest pad (*B) from the frame.

Hold the edge of the forehead rest pad or magnetic forehead rest pad with two fingers and pull it out.



2 Attach a new forehead rest pad.

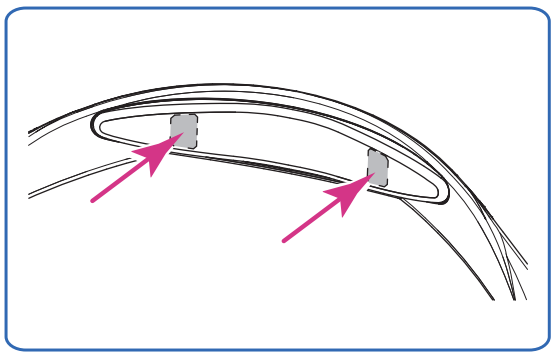
1) Align the clasps of the forehead rest pad to the holes in the frame.



2) Attach the forehead rest pad by pressing over the fastener positions on both sides.

The forehead rest pad is locked by the fasteners.

3) Confirm that the forehead rest pad is securely attached.



4.6 Device Parameter Settings

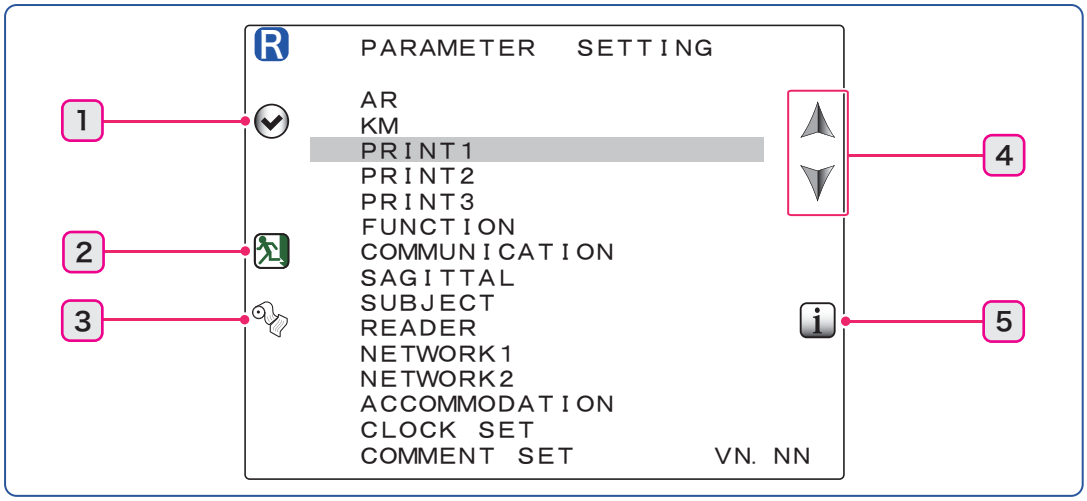
4.6.1 Setting parameters

Various device parameter settings can be changed in the parameter setting screen (PARAMETER SETTING).

1 Hold down the parameter button for about a second to display the parameter setting screen.

2 Press the up button or down button to select a parameter to be changed and then press the enter button to display the next screen.

○ Parameter setting screen operation



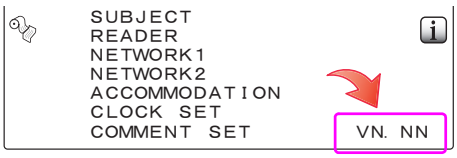
1	Enter	Displays the next screen of the selected parameter option.
2	Return	Saves parameter settings and returns to the measurement screen.
3	Print	Prints all parameter setting contents.
4	Up/ Down	Moves the current parameter selection up or down.
5	Information	Displays the information screen (INFORMATION) that shows license information of JPEG or MD4.

AR to ACCOMMODATION	Displays the parameter details screen. *(Step 3)* or later
CLOCK SET	Displays the clock setting screen (CLOCK SET) to set the date and time to be printed. *(page 95)*
COMMENT SET	Displays the comment setting screen (COMMENT SET) to set comments to be printed. *(page 96)*

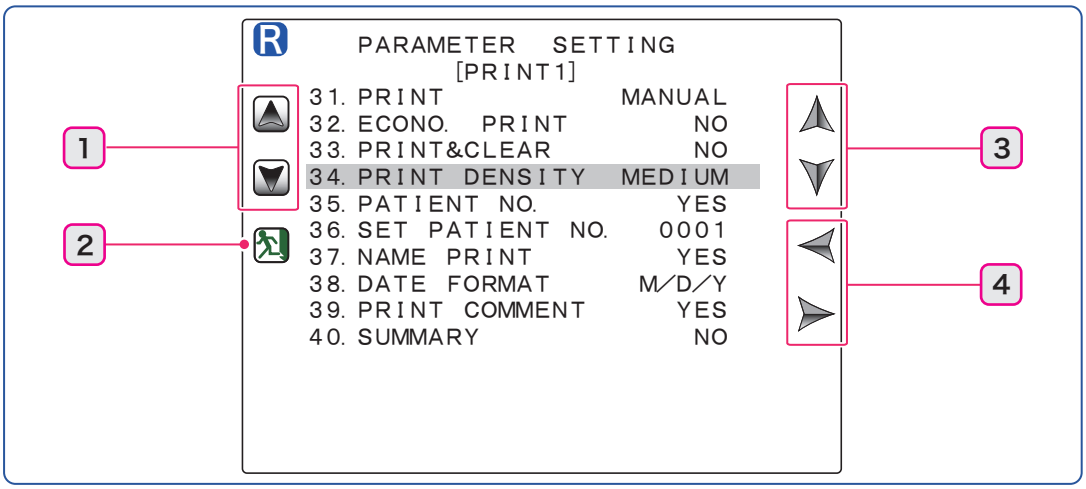
3 Select the desired parameters in the parameter details screen and change the setting contents.

Note

- The program version of the device is displayed at the bottom right of the parameter setting screen.



○ Parameter details screen operation



1	Page up Page down	Returns or advances the screen a single page. The parameter details screens of AR to NETWORK2 are displayed.
2	Return	Returns to the parameter setting screen.
3	Up/ Down	Moves the current parameter selection up or down.
4	Right/ Left	Returns or advances the parameter setting a single content. For parameters to be set by displaying the next screen, the enter icon is displayed instead.

4 To finish all parameter settings, press the return button to return to the parameter setting screen.

5 Press the return button to return to the measurement screen.

Note

- The parameter settings are maintained in memory even though the device is turned off.
- After changing parameter settings, do not turn off the device before pressing the return button.

  Otherwise, parameter settings are not saved.

4.6.2 Parameter tables

Note

- Underlined options indicate factory settings.

● AR (AR measurement)

Parameter option	Setting contents
1. STEP (AR measurement increments)	**0.01D / 0.12D / <u>0.25D</u>** Selects the display increments of SPH or CYL for AR measurement.
2. VERTEX D. (Vertex distance)	**0.00mm / 10.50mm / <u>12.00mm</u> / 13.75mm / 15.00mm / 16.50mm** Selects the distance between the corneal vertex to the spectacle lens when the patient wears glasses.
3. AXIS STEP (Axis increments)	**<u>1°</u> / 5°** Selects the display increments of AXIS for AR measurement.
4. MEAS MODE (Measurement mode)	**<u>CON.</u> / NOR.** Selects the manner of fogging for AR successive measurement. **CON.**: The scenery chart is fogged only once at the start of measurement. **NOR.**: The scenery chart is fogged every measurement.
5. AI MODE (AI mode)	**<u>YES</u> / NO** Sets whether AI mode is used for AR measurement. **YES**: When the number of measurements specified by the “6. AR CONTINUE” parameter is performed and the median values have been obtained, measurement finishes (FINISH). When the median values have not been obtained, additional measurement is performed. **NO**: When the number of measurements specified by the “6. AR CONTINUE” parameter is complete, measurement finishes (FINISH).
6. AR CONTINUE (AR successive measurement)	**3 to 10** (The default setting is 3.) Sets the number of measurements to complete the measurement cycle (FINISH).
7. AR THUMBNAIL (AR thumbnail display)	**<u>YES</u> / NO / LOW CONF** Sets the thumbnail display of the measurement ring image. **YES**: A thumbnail of the measurement ring image is displayed to the upper left of the screen when measurement is complete. Pressing the ring image / retroillumination  button displays the ring image in full screen. **NO**: A thumbnail of the measurement ring image is not displayed. Pressing the ring image / retroillumination  button displays a thumbnail of the measurement ring image. Pressing the button again displays the ring image in full screen. **LOW CONF**: When the confidence index is 7 or lower after AR measurement, a thumbnail of the measurement ring image is displayed.
8. CYL CORRECT (CYL correction)	**<u>YES</u> / NO** Sets whether the chart is presented with astigmatism correction.

● KM (KM measurement)

Parameter option	Setting contents
11. KM UNIT (Display unit of corneal curvature radius)	**mm / D** Selects the display unit of the corneal curvature radius from “corneal curvature radius (mm)” or “corneal refractive power (D)”.
12. KM DISPLAY (Corneal curvature radius measurement display)	**R1. R2 / AVG. CYL** Selects the measurement display from “R1 (flattest meridian) and R2 (steepest meridian)” or “AVG (averages of R1 and R2) and CYL (corneal cylindrical power)”.
13. REF. INDEX (Corneal refractive index)	**1.3380 / 1.3375 / 1.3360 / 1.3320 / 1.3315** Selects the corneal refractive index for KM measurement.
14. KM CONTINUE (KM successive measurement)	**3 to 10** (The default setting is 3.) Sets the number of measurements to complete the measurement cycle (FINISH).
15. KM STEP (KM increments)	**0.01D / 0.12D / 0.25D** Selects the display increments of corneal refractive power (dioptric power converted from corneal curvature radius) for KM measurement.

● PRINT1 (Print setting 1)

Parameter option	Setting contents
31. PRINT (Printing)	**MANUAL / AUTO / NO** **MANUAL**: Pressing the print button starts printing. **AUTO**: Printing starts automatically when measurement is complete. **NO**: Printing does not occur. (Data communication occurs.)
32. ECONO. PRINT (Economical printing)	**YES / NO** When “YES” is selected, printing occurs with reduced line-spacing to save printer paper.
33. PRINT&CLEAR (Erasing of data after printing)	**YES / NO** Erases measured data automatically after printing. When “NO” is selected, the measured data is erased when the next measurement is performed after printing.
34. PRINT DENSITY (Density of printed text)	**LOW / MEDIUM / HIGH** Density of printed text
35. PATIENT NO. (Printing of patient number)	**YES / NO** Sets whether to print the patient number.
36. SET PATIENT NO. (Setting of patient ID)	**0001 to 9999** Sets the patient number in the range from 0001 to 9999. Pressing the left button at the beginning resets the counter to 0001.
37. NAME PRINT (Printing of name)	**YES / NO** Sets whether to provide printing spaces for the patient’s name and sex.
38. DATE FORMAT (Date format)	**Y/M/D / M/D/Y / D/M/Y / NO** **Y/M/D**: Year, Month, Day **M/D/Y**: Month, Day, Year **D/M/Y**: Day, Month, Year **NO**: Date is not printed.
39. PRINT COMMENT (Printing of comments)	**YES / NO** Sets whether to print comments.

Parameter option	Setting contents
40. SUMMARY (Summary display)	**YES / <u>NO</u>** Display of the summary screen When “YES” is selected, the summary button to display the summary screen is displayed instead of the print button.

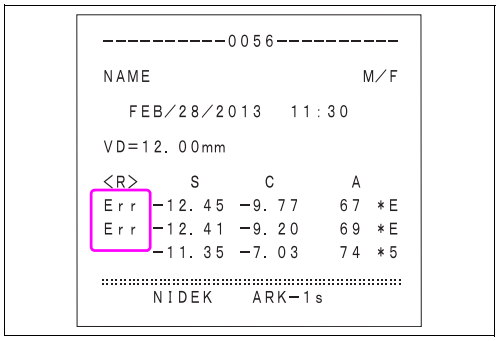
- PRINT2 (Print setting 2)

Parameter option	Setting contents
41. AR PRINT (Print format of AR data)	**<u>ALL</u> / SHORT** Selects the print format of AR data. **ALL**: All data and median values are printed. **SHORT**: Only median values are printed.
42. KM PRINT (Print format of KM data)	**ALL / ALL(KM) / <u>SHORT</u>** Selects the print format of KM data. **ALL**: All data, median values, and corneal refractive index are printed. **ALL(KM)**: In KM measurement mode, median values and corneal refractive index are printed. In other mode, only median values are printed. **SHORT**: Only median values are printed.
43. CONF. INDEX (Printing of confidence index)	**<u>YES</u> / NO** Sets whether to print the confidence index. When “NO” is selected, the confidence index is not displayed on the measurement screen, either.
44. ERROR DATA (Erroneous data)	**<u>YES</u> / NO** Sets whether to display and print erroneous data of AR measurement.

- Sample printout of erroneous data

When the “44. ERROR DATA” parameter is set to “YES” and the measured results are erroneous, the measured values are displayed in yellow on the screen.

In addition, the printed measured data is preceded by “Err”.



Note

- When the “43. CONF. INDEX” parameter is set to “YES”, “E” is printed out as a confidence index.

45. CAT MARK (Cataract indication)	**YES / <u>NO</u>** Sets whether to print “*” representing that measurement has been performed in cataract measurement mode.
46. ERROR PRINT (Error print)	**YES / <u>NO</u>** Selects whether to print failed AR data.
47. L. DATA PRINT (AR large area measured data)	**<u>DATA</u> / NO / DIFF / DATA&DIFF** Sets the print contents of large area measured values for AR measurement. **DATA**: The large area measured values (L. DATA) are printed. **NO**: Only the central measured values (normal AR values) are printed. (Large area measured values are not printed.) **DIFF**: The differentiation (L. DIFF) between the central measured values (normal AR values) and large area measured values is printed. **DATA&DIFF**: Both the contents of "DATA" and "DIFF" are printed.

48. PRINT FORMAT (Print format)	**R→L / AR→KM / R→L(B) / AR→KM(B)** **R→L**: Printing occurs in the order of the right eye (AR value / accommodation value / retroillumination analysis value / subjectively measured value / KM value) and left eye (AR value / accommodation value / retroillumination analysis value / subjectively measured value / KM value). **AR→KM**: Printing occurs in the order of AR value (right), accommodation value (right), retroillumination analysis value (right), AR value (left), accommodation value (left), retroillumination analysis value (left), subjectively measured value (right/left), and KM value (right/left). **R→L(B)**: Printing occurs in the order of the right eye (AR value / KM value / accommodation value / retroillumination analysis value / subjectively measured value) and left eye (AR value / KM value / accommodation value / retroillumination analysis value / subjectively measured value). **AR→KM(B)**: Printing occurs in the order of AR value (right/left), KM value (right/left), accommodation value (right/left), retroillumination analysis value (right/left), and subjectively measured value (right/left).

- PRINT3 (Print setting 3)

Parameter option	Setting contents
51. SE PRINT (Printing of median values)	**YES / NO** Sets whether to print SE values based on the median values (or the latest values when the median values have not been obtained).
52. EYE PRINT (Printing of eye diagram)	**YES / NO** Sets whether to print eye diagrams.
53. TL PRINT (Printing of trial lens data)	**YES / NO** Sets whether to print trial lens data based on the AR median values (or the subjectively measured values when the subjective measurement has been performed or the latest values when the median values have not been obtained).
54. CL PRINT (Printing of contact lens conversion data)	**YES / NO** Sets whether to print contact lens conversion values based on the AR median values (or the subjectively measured values when the subjective measurement has been performed or the latest values when the median values have not been obtained) and SE value based on the conversion values. **YES**: Conversion values and SE value are printed. **NO**: Conversion values and SE value are not printed.
55. NEAR PD PRINT (Printing of near PD)	**YES / NO** Sets whether to print the near PD value.
56. WORKING D. (Near working distance)	**35cm to 70cm** (5 cm increments) (The default setting is “40cm”.) **14inch to 28inch** (2-inch increments) (The default setting is “16inch”.) Sets the near working distance referred to for calculation of near PD. The setting is also used as the near working distance during the vision comparison function.
57. RETRO IMAGE PRINT (Printing of retroillumination image)	**YES / NO** Sets whether to print the retroillumination image.
58. ACC GRAPH PRINT (Printing of accommodation graph)	**YES / NO** Sets whether to print the accommodation graph.

● FUNCTION (Various functions)

Parameter option	Setting contents
61. WINDOW CHECK (Measuring window check function)	**YES / <u>NO</u> / DAY** Sets whether to automatically check the measuring window for soiling. **DAY**: The measuring window is checked at the first startup of the day. **YES**: The measuring window is checked every startup. **NO**: The measuring window is not checked.
62. TRACKING SW (Tracking button)	**<u>NORMAL</u> / ALL** Selects the type of the auto tracking function (3D/2D/OFF) and auto shot function (ON/OFF) by pressing the auto  button. **NORMAL**: Select from “3D/ON”, “3D/OFF”, or “OFF/OFF”. **ALL**: Select from “3D/ON”, “3D/OFF”, “2D/ON”, “2D/OFF”, “OFF/ON”, or “OFF/OFF”.
63. SLEEP (Sleep time)	**<u>5MIN</u> / 10MIN / 15MIN / NO** Selects the time to enter sleep mode when the device has not been used.
64. BEEP (Beep sound)	**<u>LOW</u> / HIGH / NO** Selects the pitch of the beep sound (electronic sound) produced during measurement or such.
65. LCD BRIGHTNESS (Brightness of LCD)	**LOW / <u>MEDIUM</u> / HIGH** Sets the brightness of the LCD.
66. ICON OFF (Icon display)	**<u>YES</u> / NO** Sets whether to display function icons on the measurement screen. **YES**: Function icons are not displayed during measurement. Function icons are automatically displayed when measurement is complete. Function icons are displayed after a specified period of time or function button is pressed. **NO**: Function icons are always displayed.
67. MAN FOCUS DISP (Manual focusing indicator display)	**<u>YES</u> / NO** Sets whether to display the focusing indicator in manual mode (auto tracking OFF + auto shot OFF).
68. AUTO PD (Automatic PD measurement)	**<u>YES</u> / NO** Sets whether to measure the Pupillary Distance (PD) automatically for AR measurement.
69. AUTO PS (Automatic PS measurement)	**<u>YES</u> / NO** Sets whether to measure the Pupil Size (PS) automatically for AR measurement.
70. AUTO CS (Automatic CS measurement)	**<u>YES</u> / NO** Sets whether to measure the Corneal Size (CS) automatically for AR measurement.

● COMMUNICATION (RS-232C communication function)

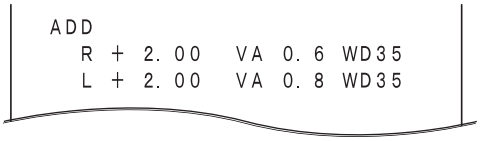
Parameter option	Setting contents
71. I/F MODE (Communication mode)	**<u>NIDEK</u> / NIDEK2 / NCP10** Communication setting of connected device **NIDEK**: Communication with a NIDEK-brand product **NIDEK2**: Communication with a NIDEK-brand product (extended timeout period) **NCP10**: Communication with a NCP10-compliant device NIDEK2 is a communication mode whose timeout period is extended over that of the NIDEK setting. Set the mode to NIDEK2 when timeout occurs for a communication environment using the NIDEK setting.

Parameter option	Setting contents
72. I/F FORMAT (Communication format)	**ALL / SHORT** Selects the format of data to be transmitted. **ALL**: All data are transferred. **SHORT**: Only median values are transferred.
73. BAUD-RATE (Baudrate)	**9600 / 4800 / 2400 / 1200** Selects the bit transfer rate for communication.
74. BIT LENGTH (Bit length)	**7 / 8** Selects the bit number of a single character used for communication.
75. CR CODE (CR code)	**YES / NO** Sets whether to attach CR (carriage return) code at the end of data to be transmitted.
76. LM DATA PRINT (Printing of LM communication data)	**YES / NO** Sets whether to print the data imported from the connected lensmeter using the built-in printer of the device. When “YES” is selected, the data is printed from the device printer by pressing the print button of the lensmeter. (A lensmeter provided with this function is required.) In addition, when an Eye Care card containing LM data is inserted into the Eye Care card slot, the data is automatically printed.
77. RT TYPE (RT to be connected)	**5100 / OLD** Selects the type of the RT to be connected. **5100**: RT-5100 series **OLD**: Prior RT series
78. L. DATA (Large area data)	**YES / NO** Sets whether to include the large area measured values into data transferred to the RT. With this parameter set to “YES”, when “5100” is selected for the “77. RT TYPE” parameter, AR-measured values and large area measured values are transmitted in a batch. When “OLD” is selected, data is transmitted in two batches. When “OLD” is selected for the “77. RT TYPE” parameter, this parameter is automatically set to “NO”. When “OLD” is selected, this parameter is set to “YES”.

- SAGITTAL (Sagittal measurement function)

Parameter option	Setting contents
81. SAGITTAL (Sagittal measurement)	**YES / NO** Sets whether to conduct sagittal measurement after KM measurement. When “YES” is selected, the SAG  icon is displayed in the AR/KM measurement screen.
82. SAGIT AXIS (Sagittal cylinder axis)	**AXIS / FIX** Sets whether to convert the sagittal measurement for the axis of the steepest meridian which has been obtained by KM measurement. **AXIS**: Converted to axis value of KM measurement **FIX**: Measured values are used.
83. SAGIT PRINT (Printing of sagittal data)	**ALL / SHORT** Selects the format of sagittal measured data to be printed. **ALL**: All data are printed. **SHORT**: Only sagittal curvature values and the total eccentricity are printed.

● SUBJECT (Subjective measurement function)

Parameter option	Setting contents
91. SUBJECT START (Corrected visual acuity measurement screen display)	**AR(M) / AR(A) / RECALL(M) / RECALL(A)** Selects the screen display in which corrected visual acuity measurement is started. **AR(M)**: The distance corrected visual acuity measurement screen is displayed with button operation. **AR(A)**: After AR measurement of both eyes, the distance corrected visual acuity measurement screen is automatically displayed. **RECALL(M)**: The recall screen for distance vision is displayed with button operation. **RECALL(A)**: After AR measurement of both eyes, the recall screen for distance vision is automatically displayed.
92. SUBJECT CHART (Corrected visual acuity measurement chart)	**ALL / 0.1 / 0.25 / 0.32 / 0.4 / 0.5 / 0.63 / 0.8 / 1.0 / 1.25** **ALL / 200 / 80 / 60 / 50 / 40 / 30 / 25 / 20 / 16** VA value of chart to be initially displayed for corrected visual acuity measurement of the new patient's eye
93. NEAR CHART (Near visual acuity chart)	**ALL / 0.1 / 0.25 / 0.32 / 0.4 / 0.5 / 0.63 / 0.8 / 1.0 / 1.25** **ALL / 200 / 80 / 60 / 50 / 40 / 30 / 25 / 20 / 16** VA value of chart to be initially displayed for near visual acuity measurement of the new patient's eye
94. VA DISPLAY (VA display unit)	**DEC. / FRAC.** Selects the display unit of visual acuity from "DEC." (decimal display) or "FRAC." (fraction display). For the fraction display, numerator 20 is omitted and only the denominator is displayed.
95. L. DATA SELECT (Corrective lens data)	**YES / NO** When "YES" is selected, large area measured values are used for the corrective lens to be used in corrected visual acuity measurement. When large area measured values are not obtained, AR-measured values are used.
96. NEAR RECALL (Vision comparison function in near visual acuity measurement mode)	**YES / NO** Sets whether to use the vision comparison function during corrected near visual acuity measurement.
97. WD CHANGE (Change of near working distance)	**YES / NO** Sets whether to enable button operation to change WD during corrected near visual acuity measurement. When "YES" is selected, the near icon changes from  to  indicating that WD is changeable. In addition, the WD value measured at the printed near addition power and near VA value is printed. However, if the default setting (set by the "56. WORKING D." parameter) has not been changed, it is not printed out. 
98. UCVA CHART (Uncorrected visual acuity measurement chart)	**ALL / AUTO** Chart to be initially displayed in the uncorrected visual acuity measurement screen **ALL**: A full VA chart (VA 0.1 to 1.25) is presented. **AUTO**: A single line VA chart predicted from SPH and CYL values of AR measurement is presented.

- Chart to be initially displayed (when “AUTO” is selected)

  The measurement starting chart of uncorrected visual acuity measurement is calculated from AR values. When cylindrical power is contained, -CYL is added to the spherical power.

  When no AR data is contained, a full VA chart (VA 0.1 to 1.25) is displayed. AR measurements in the table are values converted into 0.25 increments.

AR measured value (D)	Chart to be presented (Decimal display)	Chart to be presented (Fraction display)
-0.25 ≤	1.25	16
-0.50	1.0	20
-0.75 to -1.00	0.8	25
-1.25	0.63	30
-1.50	0.5	40
-1.75	0.4	50
-2.00	0.32	60
-2.25 to -3.00	0.25	80
-3.25 ≥	< 0.1	> 200

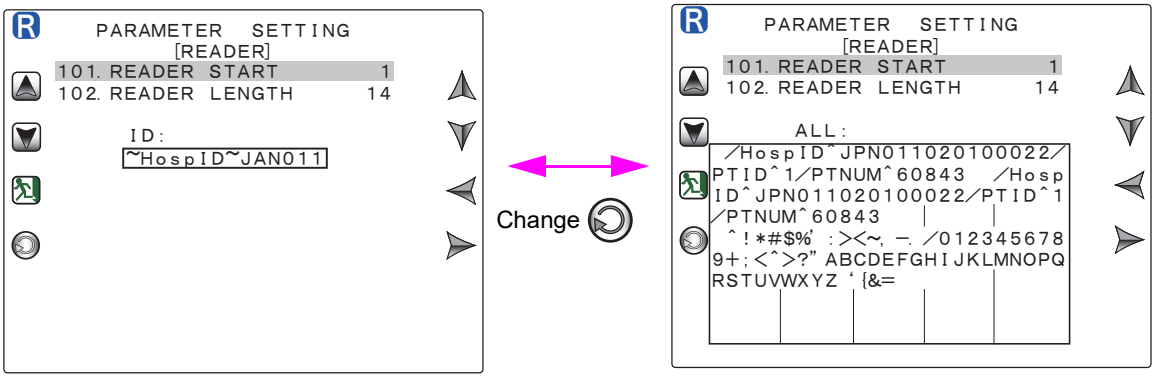
99. ADD SELECT (Addition power)	**0.25D / 0.50D / 0.75D / 1.00D / 1.25D / 1.50D / <u>1.75D</u> / 2.00D** Selects the addition power added by pressing the ADD button in near vision measurement mode.
100. GLARE CHART (Glare chart)	**<u>CHANGE</u> / STAY** Chart to be presented when the screen switches to the contrast/glare visual acuity measurement. **CHANGE**: A VA chart one level lower is presented **STAY**: A VA chart at the same level is presented.

- READER (Barcode scanner / Magnetic card reader function)

Parameter option	Setting contents
101. READER START (Position to start reading)	**<u>1</u> to 250** Sets the position to start reading ID when the magnetic card reader is used. Control codes are included in the number of characters. Set “1” when the barcode scanner is used.
102. READER LENGTH (Length of reading)	**1 to <u>14</u>** Sets the length of data to be read as ID when the magnetic card reader is used. This reads the set length of data or reads up to the return code. Control codes are not included in the number of characters. Set “14” when the barcode scanner is used.

- Checking the setting conditions in the ID field

  When a barcode is read by the barcode scanner after setting, the read results under the set conditions are displayed in the ID field. If anything other than alphanumeric characters, space, minus sign, or underbar is entered, ~ (tilde) is displayed. Control codes are not displayed.



Normal display

All data display

Pressing the change button displays all data including digits other than the set digits. Pressing the change button again returns to the original display.

- NETWORK 1 (LAN communication function 1)

Parameter option	Setting contents
111. NETWORK (Network connection)	**NO / YES / ACK** Sets whether to connect a network (LAN). **NO**: Network communication does not occur. **YES**: Network communication occurs. **ACK**: Network communication occurs (Response returned). After the receiver receives data, the file is deleted or renamed. If the file is not deleted within 5 seconds, an error occurs.
112. DHCP (DHCP connection)	**YES / NO** Sets whether to turn on DHCP connection. When the DHCP server is provided, IP is automatically assigned. To enable the setting, restart the device after returning to the measurement screen.
IP (IP address)	**0 to 255. 0 to 255. 0 to 255. 0 to 255** (The default setting is 192.168. 0. 30.) Input the IP address. When the “112. DHCP” parameter is set to “YES”, this parameter cannot be changed. (The subnet mask obtained from the DHCP server is displayed. When “0. 0. 0. 0” is displayed, IP has not been obtained from the DHCP).
MASK (Subnet mask)	**0 to 255. 0 to 255. 0 to 255. 0 to 255** (The default setting is 255.255.255. 0.) Input the subnet mask. When the “112. DHCP” parameter is set to “YES”, this parameter cannot be changed. (The subnet mask obtained from the DHCP server is displayed. When “0. 0. 0. 0” is displayed, IP has not been obtained from the DHCP). To enable the setting, restart the device after returning to the measurement screen.
GATE (Default gateway)	**0 to 255. 0 to 255. 0 to 255. 0 to 255** (The default setting is 0. 0. 0. 0) When the “112. DHCP” parameter is set to “YES”, this parameter cannot be changed. (The default gateway obtained from the DHCP server is displayed. When “0. 0. 0. 0” is displayed, the default gateway has not been obtained from the DHCP). To enable this setting, restart the device after returning to the measurement screen. The default gateway is necessary when exporting data to a location outside the network. When exporting data to the connected network, the default gateway setting is not necessary.
113. USER (User name)	A user name can be input up to 20 digits. (Default setting: GUEST) Input the user name of the connected PC.
114. PASSWORD (Password)	A password can be input up to 20 digits. (Default setting: No password) Input the login password for the user name of the connected PC.
115. DOMAIN (Domain name)	A domain name can be input up to 48 digits. (Default setting: WORKGROUP) Input the domain name (or workgroup name) of the connected PC.
116. PC NAME (PC name)	A PC name can be input up to 17 digits. (Default setting: PC) Input the PC name (or IP address) on the connected PC. To output data to the outside of the network, input the IP address of the destination computer for PC NAME in addition to the default gateway.
117. FOLDER (Shared folder name)	A shared folder name can be input up to 20 digits. (Default setting: DATA) Input the shared folder name of the connected PC to which measured data is exported.

Note

- LAN connection can be established with permission from the network administrator of the facility.
- Before connecting the network, obtain the following information from the network administrator of the facility.
  1. DHCP can be set to ON.
  2. TCP/IP (IP address of this device, subnet mask), default gateway (only when necessary)
  3. File shared name / user name, password, domain
  4. Folder setting and name in the PC in which measured data is to be saved
- After setting and changing the network function, return to the measurement screen once then reboot (power off and on) the device.
  The settings become active after rebooting.

● NETWORK 2 (LAN communication function 2)

Parameter option	Setting contents
121. RING IMAGE (Ring image export)	**NO / LOW CONF / YES** Sets whether to export the image data (JPEG) of a ring image when LAN connection is established. **NO**: Image data is not transmitted. **LOW CONF**: When the confidence index is 7 or lower, image data is transmitted. **YES**: Image data is transmitted.
122. RETRO IMAGE (Retroillumination image export)	**YES / NO** Sets whether to export the image data (JPEG) of a retroillumination image when LAN connection is established.
123. ACC GRAPH (Accommodation graph output)	**YES / NO** Sets whether to export the image data (JPEG) of an accommodation graph when LAN connection is established.

● ACCOMMODATION (Accommodation measurement)

Parameter option	Setting contents
131. STEP (Accommodation increments)	**0.01D / 0.12D / 0.25D** Selects the accommodation increments displayed in the accommodation measurement screen.
132. T. POSITION (Chart initial position)	**0.0D / +0.5D / +1.0D / +1.5D / +2.0D / +2.5D / +3.0D / +3.5D / +4.0D / +4.5D / +5.0D** Selects the amount by which the chart initial position is shifted from the SPH value in the plus direction at the start of accommodation measurement.
133. CHART (Accommodation measurement chart)	**0.1 / 0.25 / 0.32 / 0.4 / 0.5 / 0.63 / 0.8 / SCENE** **200 / 80 / 60 / 50 / 40 / 30 / 25 / SCENE** Chart to be presented to the patient during accommodation measurement.
134. VA DISPLAY (Chart display unit)	**DEC. / FRAC.** Selects the display unit of the chart presented to the patient during accommodation measurement.

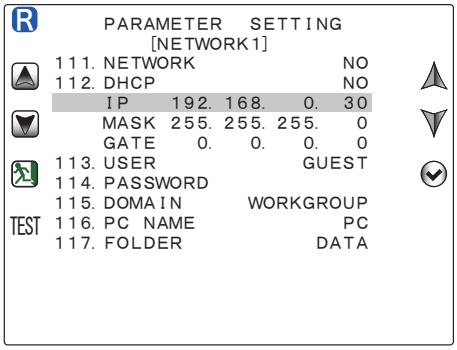
4.6.3 Setting and confirming the network communication function (LAN)

Set the “IP” through “117. FOLDER” parameters necessary for connection to a computer via a network (LAN) according to the procedure below.

○ Setting “IP”, “MASK”, “GATE”

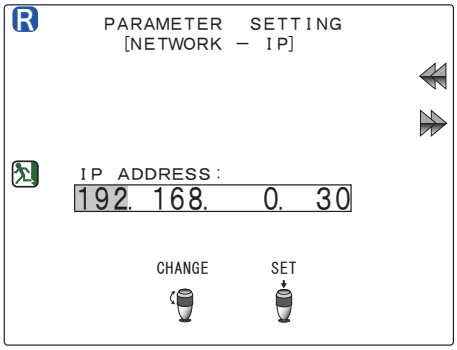
The input procedure for the “IP” parameter is described below. The procedures for the “MASK” and “GATE” parameters are the same.

1 Select the “IP” parameter in the NETWORK 1 screen.



2 Press the enter button to display the IP address setting screen.

The IP address setting screen is displayed.



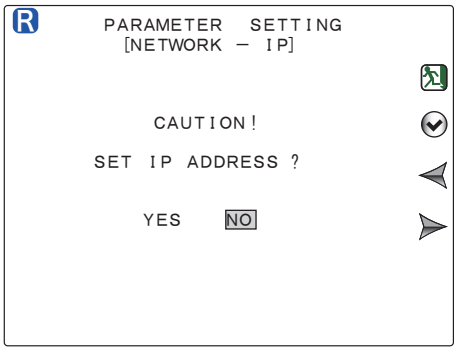
3 Change the IP address.

Forward movement / Backward movement or pressing the start button	Moves the cursor to the right or left. Pressing the start button moves the cursor to the right.
Rotating the upper part of the joystick	Increases/decreases the numeric value.

4 After setting, press the return button.

A message to confirm the setting is displayed. Select YES or NO.

Select YES or NO by pressing the / button or rotating the joystick.



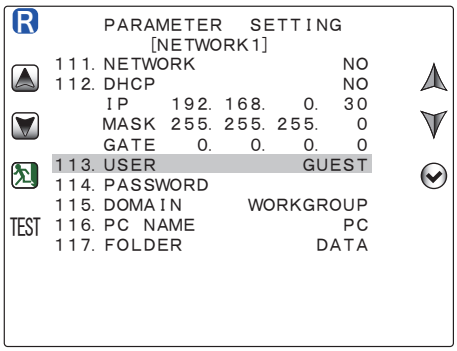
5 Press the enter button or start button to determine YES or NO.

The screen returns to the network screen. To return to the IP address input screen, press the return button.

○ Inputting “113. USER” to “117. FOLDER”

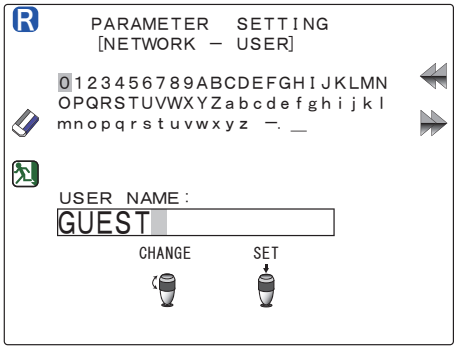
The input procedure for the “113. USER” parameter is described below. The procedure for the “114. PASSWORD” to “117. FOLDER” parameters is the same.

1 Press the up button or down button to select “113. USER”.



2 Press the enter button to display the user name setting screen.

The screen changes to the user name setting screen.



3 Change the user name.

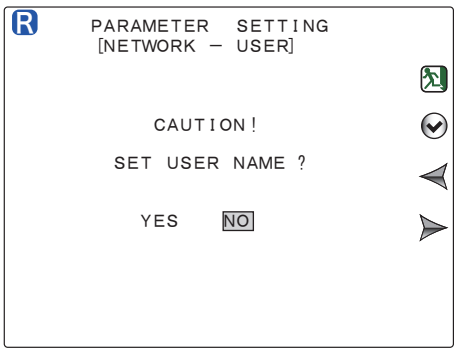
User name can be input up to 20 digits. (In the parameter details screen, the first 11 characters are displayed.)

Forward movement / Backward movement	Moves the character to be input (cursor) in the character list field to the right or left.
Rotating the upper part of the joystick	Moves the cursor in the input field to the right or left.
Pressing the start button	Determines the character to be input and moves the cursor to the next position in the character list field.
Clear	Erases the character at the cursor position in the character list field.

4 After setting, press the return button.

A message to confirm the setting is displayed. Select YES or NO.

Select YES or NO by pressing the / button or rotating the joystick.



5 Press the enter button or start button to determine YES or NO.

The screen returns to the network screen. To return to the user name setting screen, press the return button.

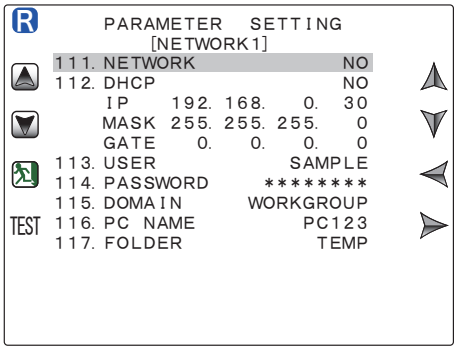
○ Confirming network communication

Confirm that network communication occurs properly.

1) After connecting the device using a LAN cable, make sure that the PC to be connected is turned on.

2) Press the TEST button to check network communication.

   A message is displayed for 2 seconds accompanied by a beep.



Communication successfully completed.

Error occurred.

When an error message is displayed, take remedies according to the message.

"4.2 Error Messages and Remedies" (page 75)

4.6.4 Setting the date and time

If the date and time of the printout are incorrect, set the correct date and time.

Note

- If the device has not been turned on for about 3 weeks, the date and time may become incorrect.

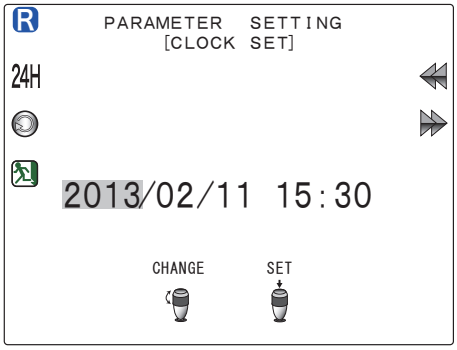
○ Battery recharging

This device uses a rechargeable lithium battery for the date and time display function. When the device is operated for the first time after unpacking or when the device has not been operated for a long time (approximately one month), the battery may have become discharged, and the internal clock may go incorrect.

In such a case, turn on the device and leave it on to recharge the battery. The battery needs 24 hours for a full charge. If the device is used for 8 hours a day, the device needs to be kept on for three days before the battery is fully recharged. Once the battery is fully recharged, the device operates normally for daily use. (The lithium battery is not user replaceable.)

1 Select “CLOCK SET” on the parameter setting screen and press the enter button.

The CLOCK SET screen is displayed.



2 Set the date and time on the CLOCK SET screen.

Forward movement / Backward movement or pressing the start button	Moves the cursor to the right or left. Pressing the start button moves the cursor to the right.
Rotating the upper part of the joystick	Increases/decreases the numeric value.

To change the display format of the date and time:

24H/AM/PM	Changes the time format between the 24-hour and 12-hour.
Change	Changes the date format (Y/M/D, M/D/Y, D/M/Y)

3 After setting, press the return button.

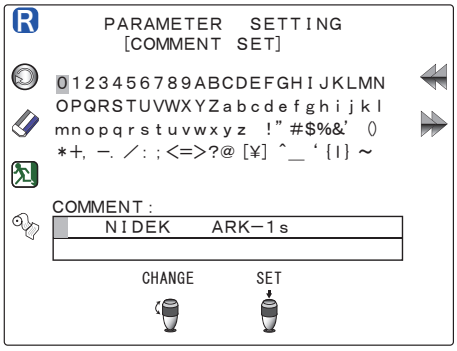
Pressing the return button updates the internal clock to the set date and time and then returns to the parameter setting screen.

4.6.5 Entering comments

Comments to be printed can be changed. (The default setting is “NIDEK ARK-1s”.)

1 Select “COMMENT SET” on the parameter setting screen and press the enter button.

The COMMENT SET screen is displayed.



2 Enter desired comments on the COMMENT SET screen.

In the input field, the currently entered comments are displayed. Up to 24 characters per line with a maximum of two lines can be input.

After moving the cursor in the character list field to the desired character, press the start button to confirm its entry.

Forward movement / Backward movement	Moves the character to be input (cursor) in the character list field to the right or left.
Rotating the upper part of the joystick	Moves the cursor in the input field to the right or left.
Pressing the start button	Determines the character to be input and moves the cursor to the next position in the character list field.
Reset	Holding down the button for about a second resets comments to its default.
Clear	Erases the character at the cursor position in the character list field.
Print	Test prints the comments only.

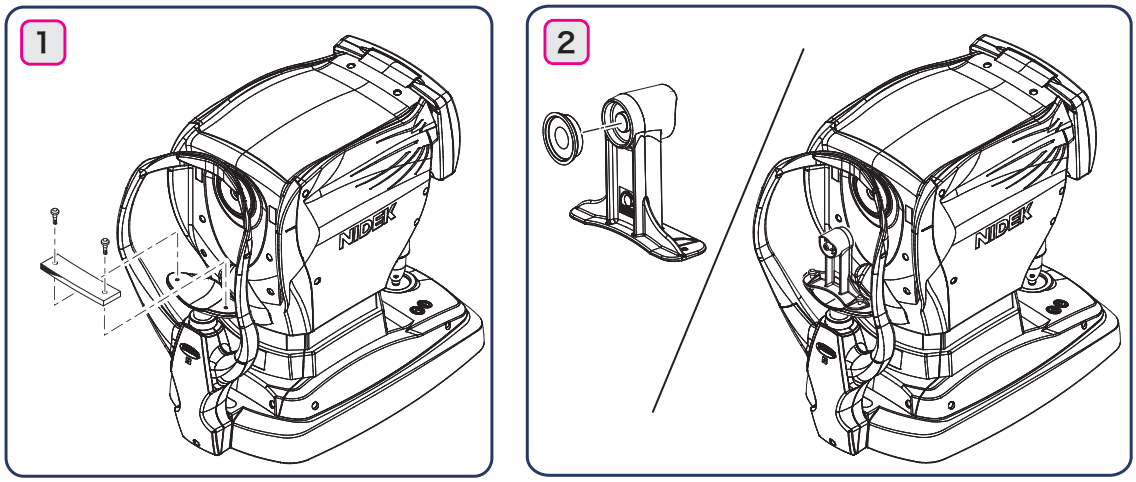
3 After setting, press the return button.

Pressing the return button saves the comments and returns to the parameter setting screen.

4.7 AR/KM Measurement Accuracy Check

■ To check the accuracy of measured data, use the provided spherical model eye. The spherical model eye is incorporated with a contact lens holder.

1 Remove the two fixing pins and the stack of chinrest paper from the chinrest.



2 Remove the cap from the spherical model eye and put the model eye on the chinrest with its lens toward the measuring window and then insert the fixing pins.

Check the lens surface of the model eye for soiling.

3 Align the level of the spherical model eye with the eye level marker by operating the chinrest up/down ▲/▼ button.

4 Set the “1. STEP” parameter to “0.01D”.

Setting Parameters *(page 80)*

5 Perform AR and KM measurements in the same manner as normal AR and KM measurements.

⚠ CAUTION

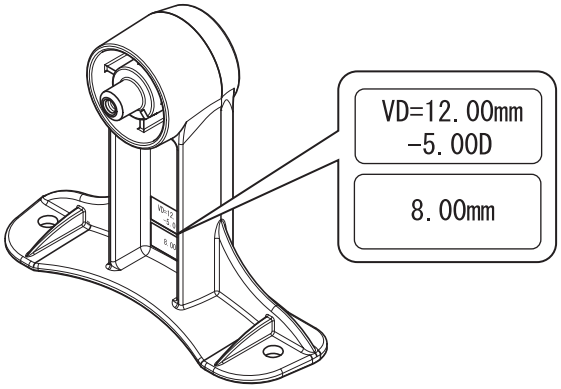
- If the measured result is higher than the value indicated on the model eye, contact NIDEK or your authorized distributor.

Note

- Always store the model eye with its cap on.

  If the lens surface is soiled or flawed, measurement accuracy cannot be properly checked.

- Values marked on the labels of the spherical model eye



VD value
Diopter (Unit: D)

Corneal curvature radius (Unit: mm)

Note

- When the vertex distance is set to a value other than “12.00mm”, set the “2. VERTEX D.” parameter to “12.00mm” before conducting AR measurement.
- Keep fingers off the lens surface of the spherical model eye. For severe stains, wipe the area with gauze dampened with alcohol.

4.8 Cleaning

■ When the cover or panel of the device becomes dirty, clean it with a soft cloth. For severe stains, soak the cloth in a neutral detergent, wiring well, and wipe. Finally dry with a soft, dry cloth.

⚠ CAUTION

- Never use an organic solvent such as paint thinner or alcohol.
- Lightly wipe the exterior of the LCD. Do not press the LCD using an object with a hard tip and keep magnetic objects away from the LCD.

  It may damage the surface of the LCD. Device malfunction may also result.
- Never use a sponge or cloth soaked in water.

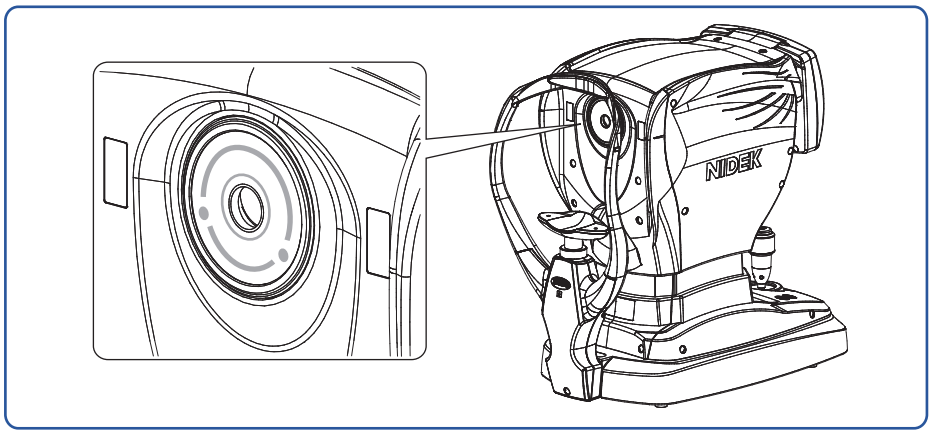
  The water may leak into the inside of the device and cause device failure.

4.8.1 Cleaning the measuring window

When the measuring window gets fingerprints or dust on it, the reliability of the measured values is impaired substantially. Check for dirt on the measuring window before use, and then clean it if it is dirty.

Only clean it when the “CHECK MEASURING WINDOW.” message is displayed or the lens is visibly soiled.

1 Blow off any dust on the measuring window with a blower.



2 Wrap lens cleaning paper around a thin stick such as a chopstick (or cotton swab) and wipe the lens of the measuring window with a material moistened with alcohol.

Note

- Use a thin stick that will not scratch glass lenses.
- Wipe lightly from the center of the measuring window to the outside in a circular motion.

3 Wipe off the glass of the mire ring around the measuring window using gauze or such dampened with alcohol.

4 Check if the window is cleaned using a penlight. If soiled areas remain, clean the window again with new cleaning paper.

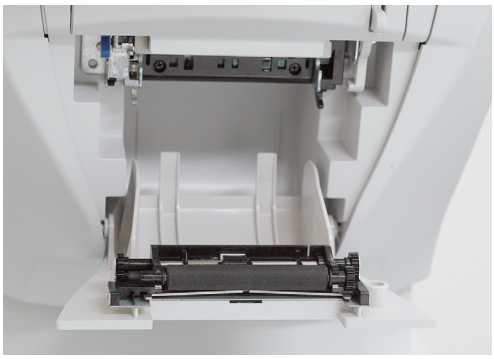
Note

- When the “61. WINDOW CHECK” parameter is set to “YES” or “DAY”, the measuring window is checked for cleanliness at device start-up.

4.8.2 Cleaning the printer

After repeated usage, the paper slot of the auto cutter of the printer may become soiled with powdery paper residue. If paper residue settles, malfunction of the auto cutter may result.

1 Open the printer cover and remove the printer paper roll.

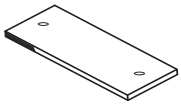


2 Apply the nozzle of a vacuum cleaner to the auto cutter to remove paper residue.

Never blow off paper residue with a blower. If paper residue settles on the internal working structure, malfunction may result.

3 Supply the printer paper as it was.

4.9 Consumable List

Part name	Part number	Note
Printer paper	80620-00001	Width 58 mm, Length 25 m 
Chinrest paper	32903-M047	1 pack 
Magnetic forehead rest pad	30611-1520	1 unit Made of ABS resin 
Forehead rest pad	15411-M752	1 unit Made of polyester elastomer 

5 SPECIFICATIONS AND TECHNICAL INFORMATION

5.1 Specifications

<table>
<tr><td>• Objective refractive error measurement</td><td>Sphere</td><td>-30.00 to +25.00 D (VD = 12 mm) (0.01/0.12/0.25 D increments)</td></tr>
<tr><td></td><td>Cylinder</td><td>0 to ±12.00 D (0.01/0.12/0.25 D increments)</td></tr>
<tr><td></td><td>Axis</td><td>0 to 180° (1°/5° increments)</td></tr>
<tr><td></td><td>Minimum measurable pupil diameter</td><td>2 mm in diameter</td></tr>
<tr><td></td><td colspan="2">Accuracy: The accuracy specifications are based on the results of eye model testing performed in accordance with ISO10342, Ophthalmic Instruments- Eye Refractometers.
<table>
<tr><th>Criterion</th><th>Measurement range</th><th>Maximum scale interval</th><th>Test device[a]</th><th>Tolerance</th></tr>
<tr><td rowspan="2">Spherical vertex power</td><td rowspan="2">–15 D to +15 D (Maximum meridional vertex power)</td><td rowspan="2">0.25 D</td><td>0 D, ±5 D, ±10 D</td><td>±0.25 D</td></tr>
<tr><td>±15 D</td><td>±0.50 D</td></tr>
<tr><td>Cylindrical vertex power</td><td>0 D to 6 D</td><td>0.25 D</td><td rowspan="2">Sph: approx. 0 D
Cyl: –3 D
Axis: 0° 90°</td><td>±0.25 D</td></tr>
<tr><td>Cylinder axis[b] for cylinder power</td><td>0° to 180°</td><td>1°</td><td>±5°</td></tr>
<tr><td colspan="5">a The refractive error of the test device shall not differ by more than 1.0 from the nominal value above.
b Cylinder axis shall be indicated as specified in ISO8429.</td></tr>
</table></td></tr>
<tr><td>• Subjective refractive error measurement</td><td>Visual acuity measurement</td><td><0.1 / 0.1 / 0.25 / 0.32 / 0.4 / 0.5 / 0.63 / 0.8 / 1.0 / 1.25
<20/200 / 20/200 / 20/80 / 20/60 / 20/50 / 20/40 / 20/30 / 20/25 / 20/20 / 20/16</td></tr>
<tr><td></td><td>Sphere</td><td>-20.00 to +20.00 D (VD = 12 mm) (0.25 D increments)</td></tr>
<tr><td></td><td>Cylinder</td><td>0 to ±8.00 D (Max.) (0.25 D increments)</td></tr>
<tr><td></td><td>Axis</td><td>0 to 180° (1°/5° increments)</td></tr>
<tr><td></td><td>Near addition power</td><td>0 to +9.75 D (0.25 D increments)</td></tr>
<tr><td>• Keratometry measurement</td><td>Corneal curvature radius</td><td>5.00 to 13.00 mm (0.01 mm increments)</td></tr>
<tr><td></td><td>Corneal refractive power</td><td>25.96 to 67.50 D (n = 1.3375) (0.01/0.12/0.25 D increments)</td></tr>
<tr><td></td><td>Corneal cylindrical power</td><td>0 to ±12.00 D (0.01/0.12/0.25 D increments)</td></tr>
<tr><td></td><td>Corneal cylinder axis</td><td>0 to 180° (1°/5° increments)</td></tr>
<tr><td></td><td colspan="2">The measuring accuracy is in accordance with Type B, ISO 10343.</td></tr>
<tr><td>• Pupillary distance measurement</td><td colspan="2">30 to 85 mm (1 mm increments)
(For near vision: 28 mm to 80 mm when the near working distance is 40 cm)</td></tr>
<tr><td>• Corneal size measurement</td><td colspan="2">10.0 to 14.0 mm (0.1 mm increments)</td></tr>
<tr><td>• Pupil size measurement</td><td colspan="2">1.0 to 10.0 mm (0.1 mm increments)</td></tr>
</table>

• Accommodation measurement	0 to 10.00 D (0.01/0.12/0.25 D increments)	
• Other functions	Observation/Display method	6.5-inch color LCD
	Printer	Thermal line printer with auto cutter
	Interface connectors	RS-232C: Two ports USB: One port LAN: One port
• Power input	Voltage, frequency	AC 100 to 240 V ±10% 50/60 Hz
	Power consumption	100 VA
• Dimensions and mass	Dimensions	260 (W) × 495 (D) × 457 (H) mm
	Mass	20 kg
• Environmental conditions (during use)	Temperature	10 to 35°C (50 to 95°F)
	Humidity	30 to 90% (Non-condensing)
	Atmospheric pressure	800 to 1,060 hPa
	Installation location	Indoors
	Others	A well ventilated place free from hazardous particles, smoke, or fumes
• Environmental conditions (during transport and storage)	Temperature	-10 to 55°C (14 to 131°F)
	Humidity	10 to 95% (Non-condensing)
	Atmospheric pressure	700 to 1,060 hPa
• Others	Expected service life (defined by manufacturer)	8 years from the date of initial operation * Proper maintenance is necessary.
	Packing unit	1 unit
• Classifications	Protection against electrical shock: Class I ME equipment, 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	
Accessories		
• Standard accessories	Printer paper (3 rolls), Power cord, Dust cover, Chinrest paper, Fixing pins for chinrest paper (2 units), Operator's manual, Spherical model eye / Contact lens holder (integral type)	
• Optional accessories	Eye Care card Barcode scanner Magnetic card reader Communication cable	

5.2 Glossary and Abbreviations

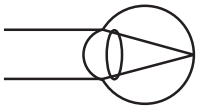
■ The following terms and abbreviations are used in the device and operator's manual.

○ Glossary

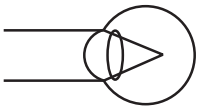
Term	Details
AI mode	For AR measurement, measurement automatically finishes after the specified number of measurements if the data is stable without variations. If unstable data is included, two additional measurements are taken and then measurement finishes.
AR median values	The Spherical Equivalent (SE) value is obtained from respective data. The median SE value is obtained when the values are arranged in order by the computer. The SPH median value is calculated by the following equation based on the obtained median values. SPH median value = (Median SE value) – (Median CYL value / 2) The CYL and AXIS median values are taken to be the median values when arranged in order. If the measured data is two values or less, then the latest value is selected.
Auto shot	This function automatically starts measurement as soon as alignment and focusing become optimum.
Auto tracking, auto focusing	A function that automatically controls up, down, right, and left movements for alignment and forward and backward movements for focusing.
Cataract measurement mode	If abnormal optical reflection is detected or the auto shot function does not work, measurement criteria is changed automatically so that even cataract or abnormal eyes can be measured.
Comments	Characters and symbols can be freely entered. Up to 24 characters per line with a maximum of two lines can be input.
Confidence index	The confidence index is displayed in six levels (9, 8, 7, 6, 5 or E). The lower the confidence index, the larger the influence of irregular astigmatism. E is erroneous data. Measured data obtained in cataract measurement mode is marked with the preceding "*" symbol.
Contact lens conversion value	The value from which the AR median values (the latest values when the median values have not been obtained) are converted into CL values, with the vertex distance (VD) at 0 mm.
CS	Abbreviation of Corneal Size
Fogging	Blurs the patient's view to prevent focus in order to eliminate accommodation.
KM median values	The median value of measurements which are arranged in order in the computer. If the measured data is two values or less, then the latest value is selected.
Limit indicator	When the measuring unit moves out of the working range of auto tracking, the limit indicator (arrows) is displayed on the screen.
Minimum pupil diameter mark	Indicates the minimum measurable pupil size.
Near PD	PD for a near working distance of 40 cm (factory setting). Used for prescriptions of reading glasses or bifocals.
Near working distance	Distance when viewing the near target through reading glasses or bifocal glasses.
PD	Abbreviation of Pupillary Distance

Term	Details
Printing of eye diagram	Eye diagram of refractive status of the patient's eye based on the AR median values (or the latest values when the median values have not been obtained) or the subjective measured values when the subjective measurement has been performed. There are eight eye diagram patterns.

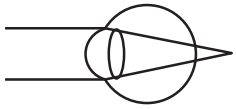
Emmetropia



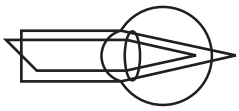
Myopia



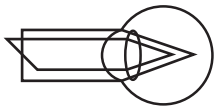
Hyperopia



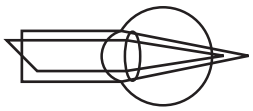
Astigmatism



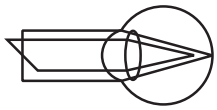
Myopic astigmatism



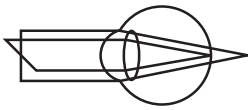
Hyperopic astigmatism



Simple myopic astigmatism



Simple hyperopic astigmatism



Term	Details
PS	Abbreviation of Pupil Size
SE (Spherical Equivalent) value	The value that is 1/2 of the cylindrical error added to the spherical error. Calculated for the AR median values (the latest values when the median values have not been obtained), subjective measured values, and CL conversion values.
Sleep mode	After the preset time of non-actuation, the screen automatically shuts off to save power consumption. Pressing any button restores the screen to the ON condition.
Trial lens data	These are the values that were converted automatically from the cylinder values so that the sphere values for the trial lens become smaller based on the AR median values (the latest values when the median values have not been obtained).
Vertex distance	The distance between the corneal vertex to the posterior surface of spectacle lenses

○ Abbreviations

AI	Artificial Intelligence	MD4	Message Digest Algorithm 4
CA DMV	California Department of Motor Vehicles	NCP10	Nidek Communication Protocol - 10
CL	Contact Lens	NTSC	National Television System Committee
COI. H	Central Opacity Index - Height	POI	Peripheral Opacity Index
COI. A	Central Opacity Index - Area	RF	Radio Frequency
DHCP	Dynamic Host Configuration Protocol	SE	Spherical Equivalent
EEPROM	Electrically Erasable Programmable Read-Only Memory	UCVA	Uncorrected Visual Acuity
EMC	Electro-Magnetic Compatibility	USB	Universal Serial Bus
IC	Integrated Circuit	VA	Visual Acuity
ID	Identification	VD	Vertex Distance
IP	Internet Protocol	WD	Working Distance
JPEG	Joint Photographic Experts Group		

5.3 EMC (Electromagnetic Compatibility)

The device is suitable for use in stores and hospitals except for near active HF surgical equipment and RF shielded rooms with an ME system for magnetic resonance imaging, where the intensity of electromagnetic disturbances is high, electrophysiology laboratories, or areas where short-wave therapy equipment is used.

⚠ WARNING

- Do not use the device near, on, or under other electronic equipment or electromagnetic disturbance sources. Otherwise, it could result in improper operation. If such use is necessary, the device and the other equipment should be observed to verify that they are operating normally.
- Use of accessories, cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and cause improper operation.
- Portable RF communications equipment (including peripherals such as antenna cables and external antennas) or electromagnetic disturbance sources as shown below should be used no closer than 30 cm (12 inches) to any part of the device, including the specified or provided cables. Otherwise, degradation of the performance of this equipment could result.

  The following are examples of electromagnetic disturbance sources:
  - Induction cooking appliance and ovens
  - RFID readers
  - Electronic article surveillance (EAS) systems
  - Sponge detection systems
  - Equipment used for position detection (e.g. in catheter labs)
  - Wireless power transfer charging systems for electrical vehicles

○ Specified cable

Part name	Cable Shielded	Ferrite Core	Length (m)
Power cord	No	No	2.5

○ Essential performance

- Objective refraction function
- Keratometry measurement function

◆ 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