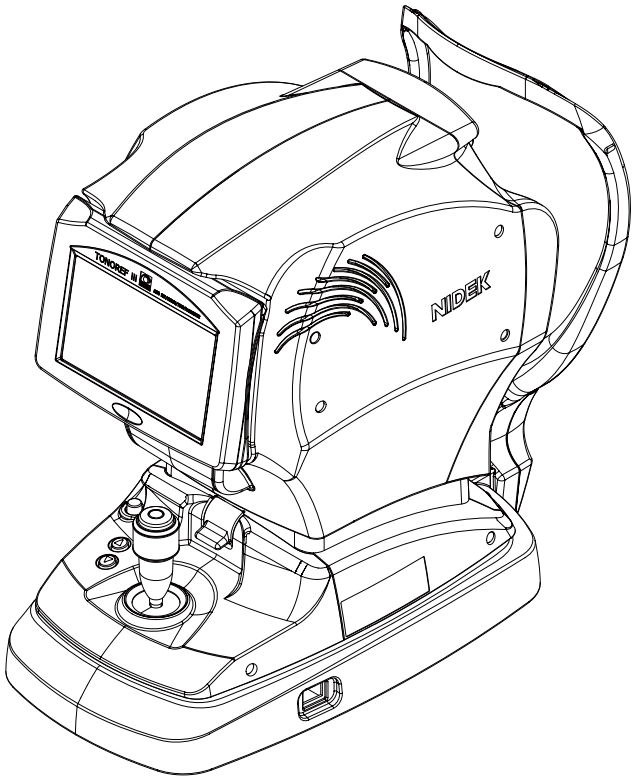
NIDEK

AUTO REF/KERATO/TONO/PACHYMETER

TONOREF III

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/KERATO/TONO/PACHYMETER TONOREF III.

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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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.

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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.

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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.

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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: 2010 (Ophthalmic instruments - Eye Refractometers), ISO 10343: 2009/2014 (Ophthalmic instruments - Ophthalmometers), and ISO 8612: 2009 (Tonometer). 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.
- Be sure to connect the power plug to a grounded outlet.

  Electric shock or fire may occur in the event of malfunction or power leakage.
- Never modify the device.

  Electric shock or malfunction may result.

⚠ CAUTION

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

  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.
- Use of the device is limited to doctors or persons qualified by the law of each country.

  Use of the device outside the scope of the specified use may result in adverse events and adverse device effects. NIDEK is not responsible for accidents or malfunctions caused by misuse.
- Do not touch the interior of the device.

  There are no parts within the device that require servicing by the operator 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.
- Never use a power strip or extension cable to supply the device with power.

  The electrical safety may be lowered.

⚠ CAUTION

- 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 may occur.

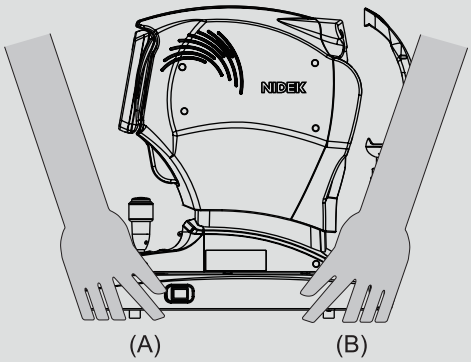
- Install the device so that the outlet that the mains plug is inserted into is easily accessible during use. In addition, ensure that the power cord can be disconnected without the use of any tool.

  Failure to do so may interfere with disconnecting the power cord 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.



During use

⚠ WARNING

- Before starting NT measurement, set the safety stopper for each patient to prevent the air nozzle from coming into contact with the patient's eye.

  If the air nozzle contacts the eye, the cornea may be hurt.

⚠ 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.
- Refrain from use on patients who have corneal disorder or its history.

  It has been reported that corneal bullae was caused due to the measurement.[*1]
- Take extra care when measuring the patients with the following symptoms.

  Acme phase of epidemic keratoconjunctivitis, poor fixation
- Before measurement, explain the measurement purpose and method sufficiently to the patients.
- 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 a stack of chinrest paper is on the chinrest, remove one sheet.
- Do not use a cloth that is overly dampened with rubbing alcohol to clean the forehead rest.

  The forehead rest will deteriorate.
- Caution should be taken when using the device for patients with infection.
- It has been reported that pachymetry values vary depending on whether the measurement method is ultrasonic or optical (used in this device) pachymetry. Be sure to evaluate the measurement value taking into consideration the correlations among various measurement results.
- When using the intraocular pressure correction function, set PARAM1 and PARAM2 beforehand.
- The results obtained from the intraocular pressure correction function are reference values, and should be used under the responsibility of the operator.
- Take care that the device does not come into contact with the patient's face during alignment or when switching the patient's eye between right and left.

  Injury may result.
- Do not put hands or fingers under the moving parts (measuring unit, main body, and chinrest). Pay particular attention to the measuring unit as it moves in each direction during auto alignment. Be sure to also caution the patients.

  Hands or fingers may be caught and injured.
- Keep the measuring window and the glass part of air nozzle free of fingerprints and dust. Also confirm that they are not soiled before use.

  The measurement accuracy may decrease substantially.

*1 For details, refer to the following.

- Goto, Shin, et al., Japanese Review of Clinical Ophthalmology, vol. 86, no. 6, pp. 1444-1446, 1992.

⚠ CAUTION

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

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

- Instruct the patient to look at the chart with their eyes wide open. Start measurement after confirming that the instruction is properly followed by the patient. Make sure that alignment remains correct during measurement.

  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.

  Malfunction of the device may result.

- There may be a few bright or dark dead 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.

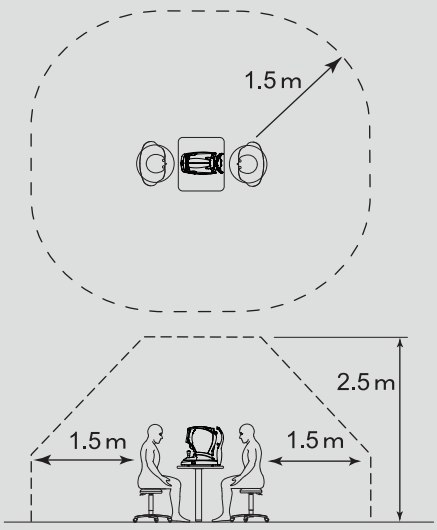
  Electric shock may result. Contact NIDEK or your authorized distributor for installing isolation transformers.

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

  Electric shock may result. For installation of the network isolation transformer, consult NIDEK or your authorized distributor.

- 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, use an isolation transformer or common protective grounding.

  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 will not be used for an extended period of time, disconnect the power cord from the power outlet.

- When transporting or storing the device, pack it. In addition, maintain the following environmental conditions.

  Ambient temperature: -30 to 60°C (-22 to 140°F) during transport
  -10 to 55°C (14 to 131°F) during storage

  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 device to packing mode and pack it using the specified packing materials without fixing the main unit with the locking lever. In addition, avoid vibration or bumps to the device.

  Excessive vibration or bumps may reduce the device reliability.

  Setting packing mode ↪ *"Shutoff before transporting the device" (page 37)*

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.

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

  Inappropriate disposal may contaminate the environment.

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

  Inappropriate disposal may contaminate the environment.

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 12)*
	Indicates the state of the power switch. When this symbol side of the switch is pressed down, power is not supplied to the device.
	Indicates 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 year 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 that this medical device incorporates a wireless communication module. Indicates that interference may occur in the vicinity of equipment marked with this symbol.
	Indicates an input terminal.
	Indicates an output terminal.
MD	Medical device
EC REP	EU Authorized Representative
SN	Serial number
UDI	Unique Device Identifier
REF	Catalog number

2 BEFORE USE

2.1 Device Outline

■ The NIDEK AUTO REF/KERATO/TONO/PACHYMETER TONOREF III measures objective refractive errors, corneal curvature radius, corneal thickness, and intraocular pressure of the patient's eye.

2.1.1 Intended use

The AUTO REF/KERATO/TONO/PACHYMETER TONOREF III is a medical device which measures objective refractive errors, corneal curvature radius, intraocular pressure, and corneal thickness 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 excluding babies and infants

Health condition

Able to sit in a chair

Able to answer the operator’s questions

Capable of eye fixation

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, optician shop clerk

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

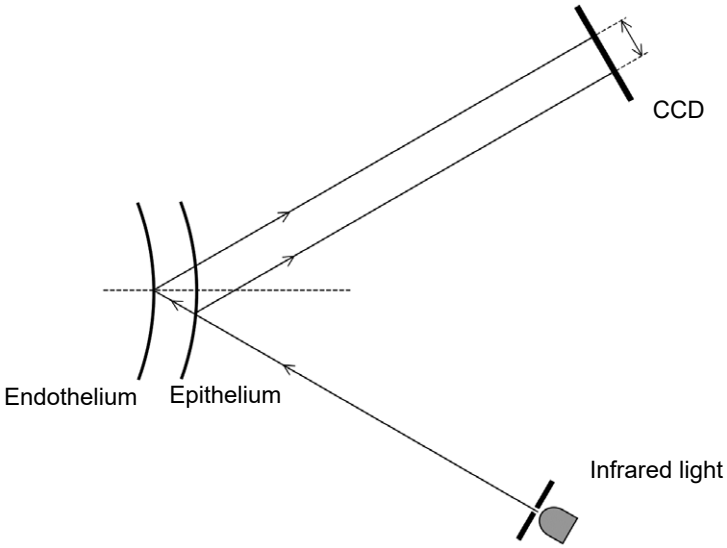
Fine measurement beams are projected on the fundus of the patient's eye by a projecting optical system and then the ring image obtained from the reflected beams is used for computation to determine the refractive errors (SPH, CYL, AXIS) of the patient's eye.

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.

Pachymetry

The corneal thickness is optically measured in a non-contact method. The corneal thickness measuring beam (infrared light) projected diagonally on the cornea is reflected from both the epithelial surface and endothelial surface. The different paths of reflected light are detected by the CCD. The corneal thickness is calculated from the distance between the paths of the epithelial reflection and endothelial reflection on the CCD.



Tonometry

Based on the Imbert-Fick principle (W = Pt × A), the intraocular pressure is calculated by dividing the amount of air pressure into the area of applanated surface.

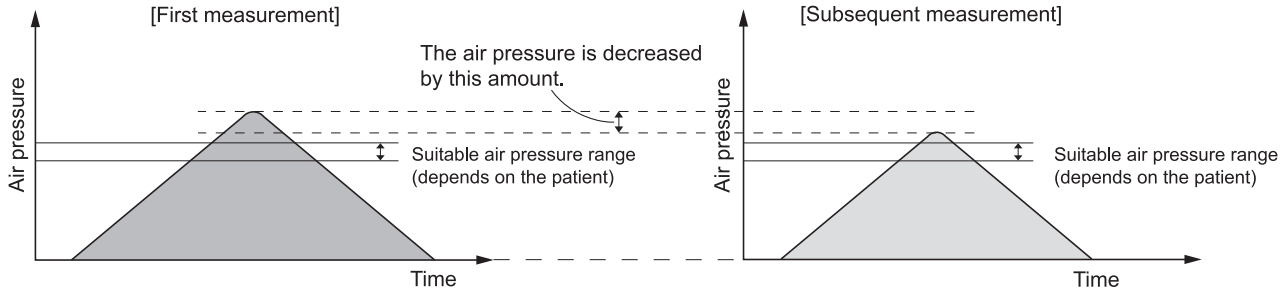
The device increases the air pressure puffed onto the cornea in proportion to time. The shape of the cornea changes gradually in the order of convex surface → applanated surface → concave surface. This change is optically detected and the device calculates the time required to make the pressed area flat after air is puffed on it. The air pressure used to make the cornea flat is calculated by time, and finally the intraocular pressure is obtained.

APC (Automatic Puff Control) function

When the measurement range is set to [APC40] or [APC60], in the first measurement, the automatic shutoff function, which stops puffing air as soon as the light reflected from the cornea is detected, activates in order to eliminate excessive puffing.

In subsequent measurements, the APC function activates to perform the measurement with the minimum air pressure based on the former measurement data.

As the patient's eye is protected from excessive air pressure, discomfort of the patient can be decreased and continuous measurements can be performed smoothly.

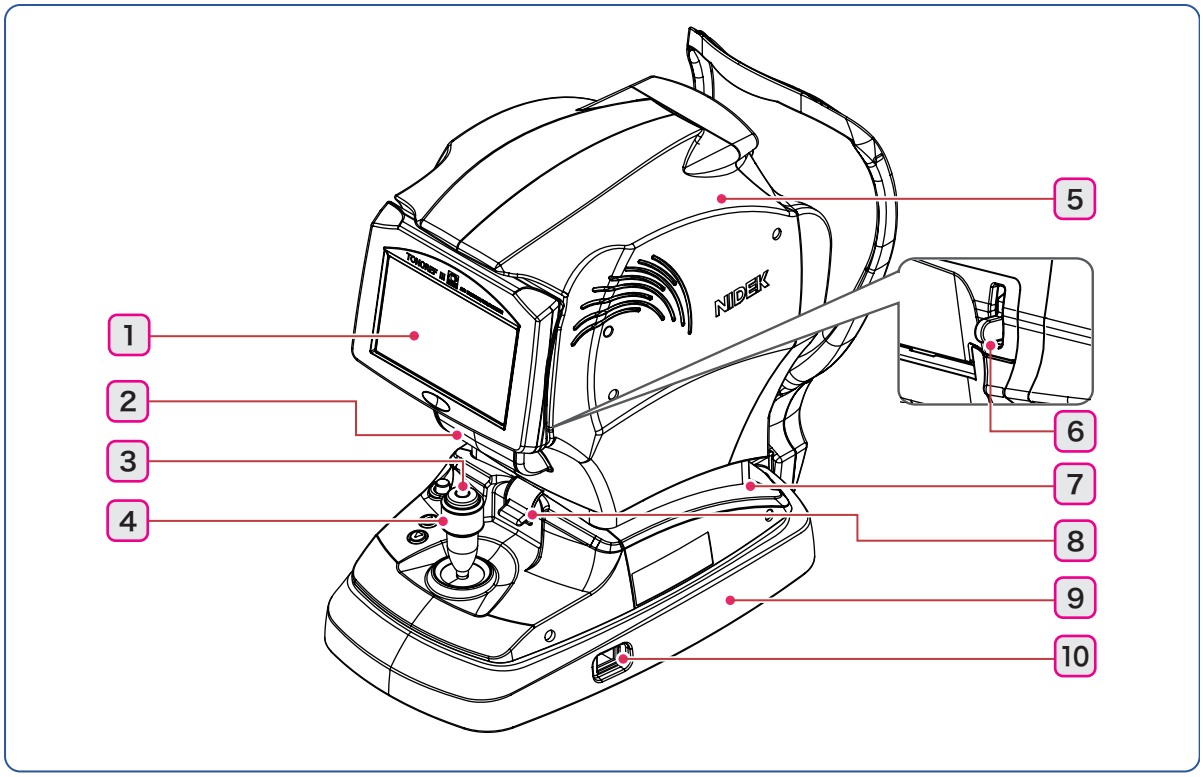


<Automatic shutoff function>

<APC function>

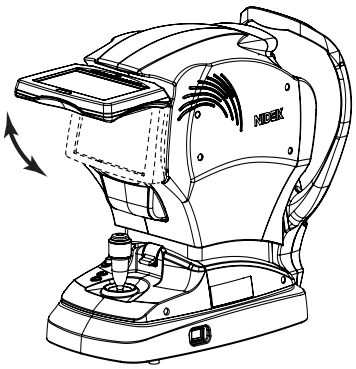
2.2 Configuration and Functions

2.2.1 Device configuration



1 Touch screen

Displays various operation screens and examination data.



7.0-inch color LCD. Pulling the bottom of the screen provides an adjustable viewing angle.

If the operator uses the device in a standing posture, tilt the screen at a suitable angle.

The screen is fastened to the original position by magnet.

2 Printer cover

3 Start button

When you press the start button, measurement starts regardless of the alignment or focusing condition.

4 Joystick

Used for alignment and focusing. *(page 30)*

5 Measuring unit

6 Cover open lever

To open the printer cover, pull up this lever.

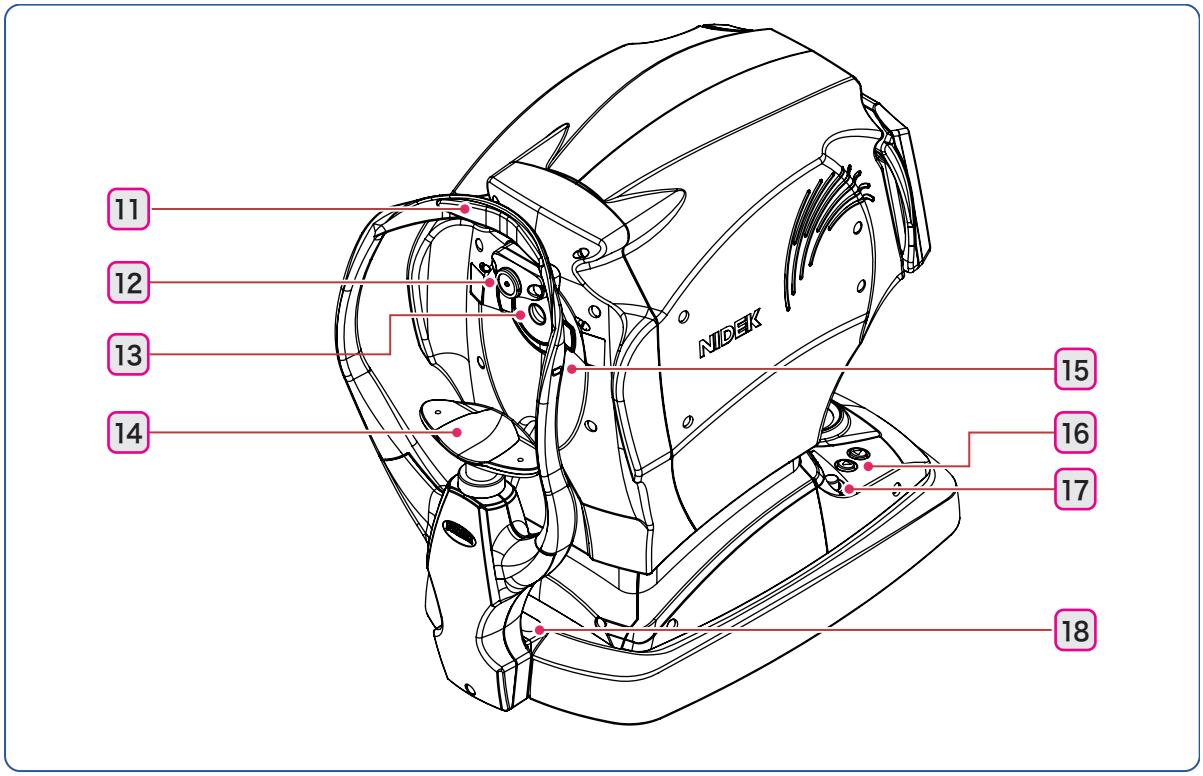
7 Main unit

8 Locking lever

Secures the main unit to the base.

9 Base

10 Power switch



11 Forehead rest

12 Air nozzle

Air is puffed out of the nozzle of the NT measuring unit.

In this operator's manual, the area containing the observation window around the air nozzle is referred to as the air nozzle.

Just before R/K (AR/KM) measurement, the air nozzle is automatically stored in the measuring unit.

13 Measuring window

14 Chinrest

15 Eye level marker

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

16 Chinrest up/down buttons (▲ / ▼)

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

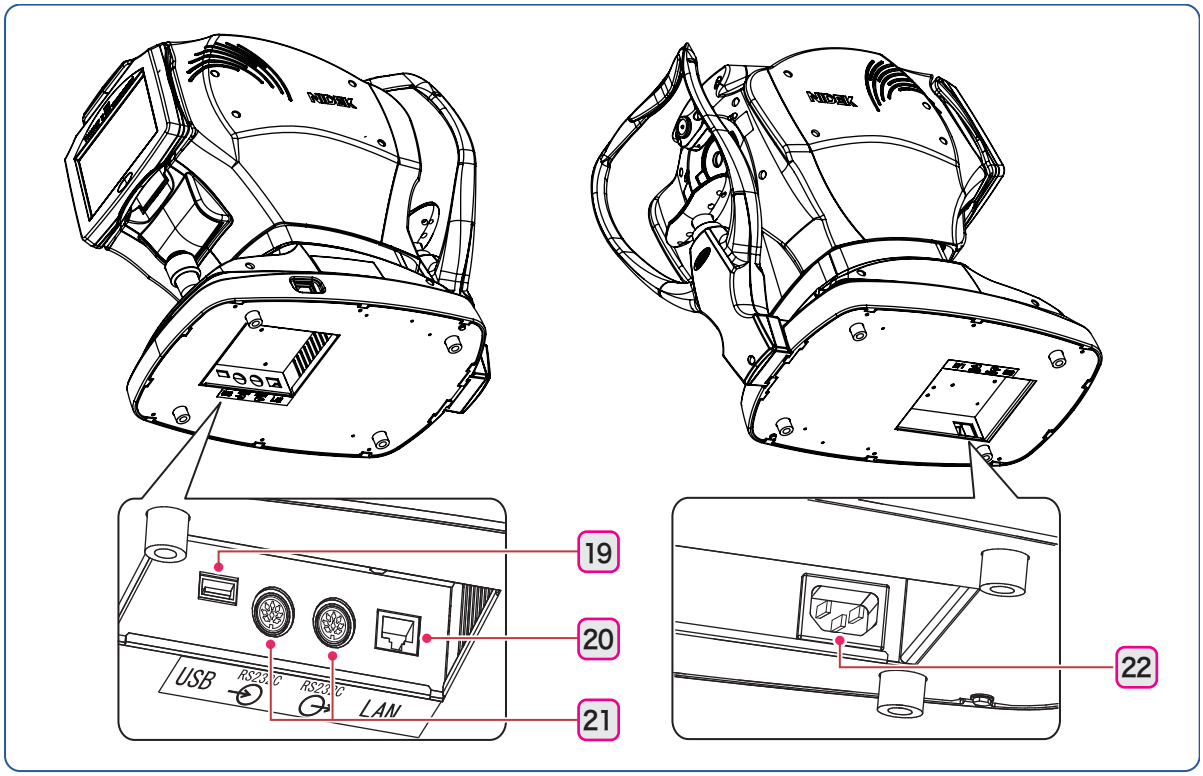
17 Safety stopper

Used to provide a safety space so that the air nozzle does not touch the patient's eye during the NT measurement.

Change the position of the stopper for each patient to set a proper amount of space for safety.

18 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 IEC 60601-1). Furthermore, all configurations must comply with the system standard IEC 60601-1. Anyone who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1. If you have any questions, contact NIDEK or your authorized distributor.

19 USB connector

The optional barcode scanner or magnetic card reader is connected here. *(page 73)*

20 LAN connector

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

21 RS-232C connector

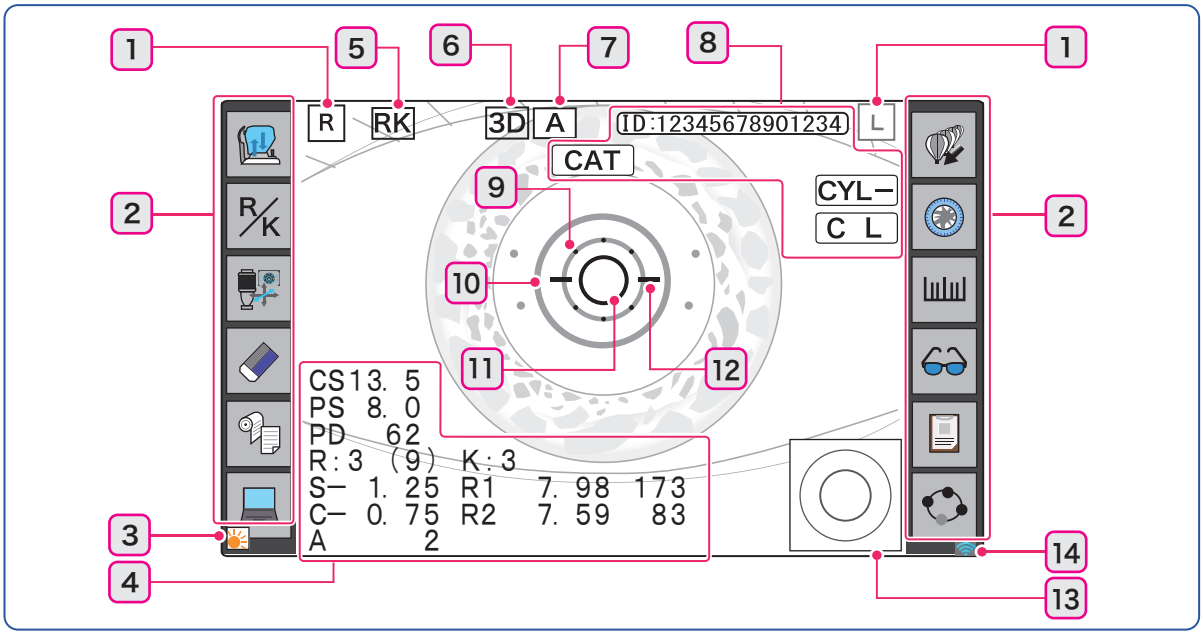
A communication cable is connected here to send/receive measured data to/from an optometry device or such.

22 Power inlet

2.2.2 Measurement screen description

○ R/K measurement screen

This screen is for AR (refractive error) and KM (corneal curvature radius) measurements.



1 Patient's eye ([R]/[L])

Indicates whether the eye being measured is right [R] or left [L] in light blue.

2 Function icons

Functions are operated by pressing their icons arranged on the right and left sides of the screen.

RKT	Selects measurement mode (RKT successive, RK individual, NT individual)
R/K [R/K]	Selects measurement contents (AR/KM, AR, or KM).
Auto	Selects auto tracking mode ([3D], [2D], OFF) and auto shot mode (A, QK, OFF).
Clear	Displays a message to confirm whether to clear data. Pressing [OK] in the message clears all the measured data.
Print	Prints the measured results. If there are no measured results, the printer paper is advanced blankly.
Measured value transmission	Transmits the measured values to the connected equipment.
Accommodation measurement	Displays the accommodation measurement screen.
Retroillumination image	Displays the retroillumination image observation screen.
CS/PS/PD	Each press switches from AR or KM measurement to CS → PS → PD measurement.
Vision comparison	Displays the vision comparison screen.

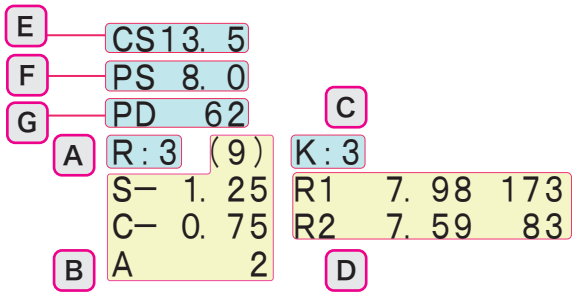
Summary	Displays the summary screen that shows various measurement values at the same time. *(page 69)*
Menu	Switches from the measurement screen to the [Settings] or [Maintenance] screen.

3 Heater indication

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

4 Measured results display

The latest measured results are displayed.



E	[CS]: Corneal Size
F	[PS]: Pupil 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 measured values can be changed to [AVG] and [CYL] by setting the parameter [MEASURE] > [KM] > [KM DISPLAY].
  - [AVG]: Average of [R1] and [R2]
  - [CYL]: Corneal cylindrical power and corneal cylinder axis angle

5 Mode icon

Indicates the setting of measurement mode.

R/K mode is indicated with RK and NT mode with NT.

When the two icons are displayed, R/K measurement and NT measurement are performed successively.

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 directions).

(page 30)

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 (the measurement starts automatically).

A	Auto shot	Measurement starts automatically when alignment and focusing are optimized.
QK	Quick Ref	The AR measurement starts with less strict conditions than in auto shot and takes less time. In other measurements, the quick ref works in the same manner as in auto shot.
(No icon)	Manual (OFF)	Pressing the start button starts measurement.

8 Indication icons

An entered patient ID or the status of the device or measurement is indicated at the top of the screen by the following icons.

ID:12345678901234 Patient ID	Displayed when a patient ID has been entered with the barcode scanner or magnetic card reader. The ID is a number with a maximum of 14 digits.
CYL mode	Indicates the selected cylinder mode ([CYL+], [CYL-], [CYL±]). *(page 91)*
CAT Cataract measurement mode icon	Indicates that the eye has been measured in cataract measurement mode. *(page 44)*
C L CL select icon	Displayed when the CL select function is selected. *(page 70)*

9 Minimum pupil diameter mark ( )

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

10 Mire ring ( )

Used as an alignment reference ring.

11 Target

Used as a guide to position 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 (→).

12 Focusing indicator

Indicates the distance between the measuring unit and the patient's eye. *(page 39)*

13 Measurement ring image thumbnail

A thumbnail of the latest measurement ring image is displayed when AR measurement is performed. *(page 41)*

The ring image is displayed in full screen when a thumbnail of the ring image is pressed.

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

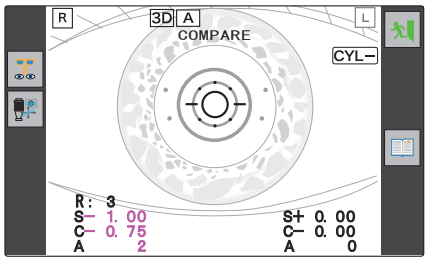
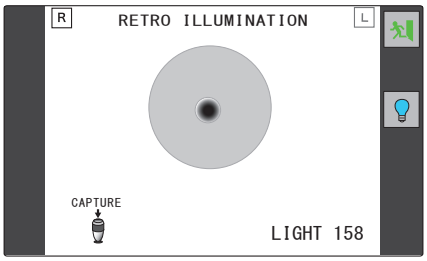
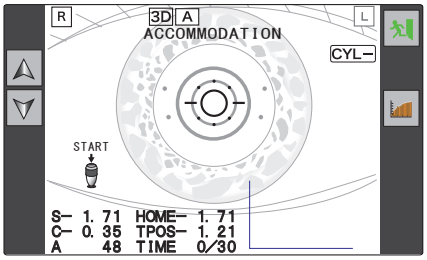
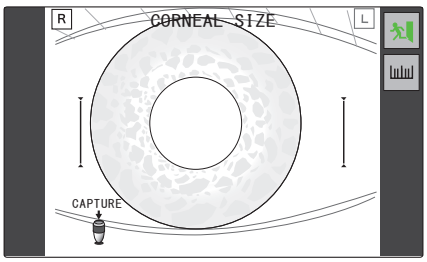
Pressing the same position displays the thumbnail again.

14 Wireless LAN indicator ()

 Blue	Connection is complete and communication is in progress.
 Gray	Connection failed.
 Gray?	Connection is being initialized.

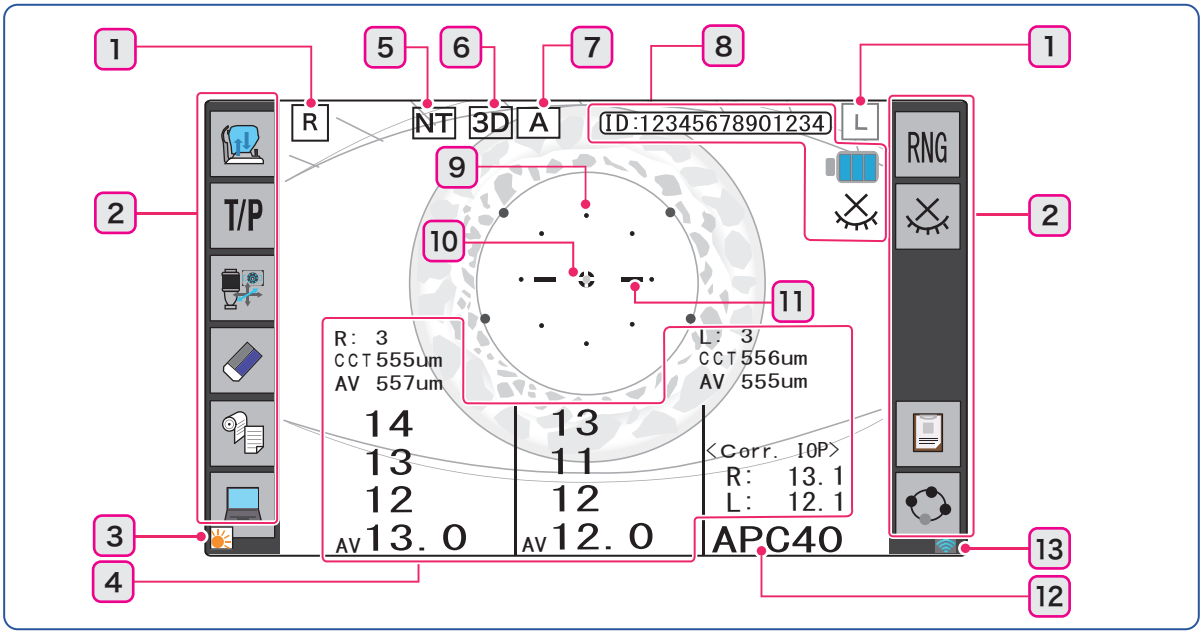
○ R/K measurement: Other measurement screens

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

Vision comparison screen Compares the vision corrected by AR data with uncorrected vision (or vision corrected by LM data). *(page 45)*	
Retroillumination image observation screen *(page 49)*	
Accommodation measurement screen Measures accommodation. *(page 51)*	
Manual CS/PS/PD measurement screen Manually measures the Corneal Size (CS), Pupil Size (PS), or Pupillary Distance (PD). Corneal Size (CS) measurement *(page 53)* Pupil Size (PS) measurement *(page 54)* Pupillary Distance (PD) measurement *(page 56)*	

○ NT measurement screen

This screen is for tonometry and pachymetry.



1 Patient's eye ([R]/[L])

2 Function icons

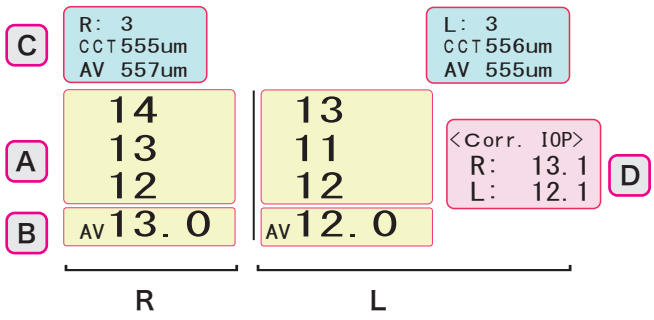
Functions are operated by pressing their icons arranged on the right and left sides of the screen.

RKT	Selects measurement mode (RKT successive, RK individual, NT individual)
T/P T/P	Selects measurement contents (tonometry/pachymetry, tonometry, pachymetry)
Auto	Selects auto tracking mode ([3D], [2D], OFF) and auto shot mode (ON, OFF).
Clear	Displays a message to confirm whether to clear data. Pressing [OK] in the message clears all the measured data.
Print	Prints the measured results. If there are no measured results, the printer paper is advanced blankly.
Measured value transmission	Transmits the measured values to the connected equipment.
RNG RNG	Changes the NT measurement range among [APC40], [APC60], [40], and [60].
Eyelid detection off	Activates or deactivates the eyelid detection mode.
Summary	Displays the summary screen that shows various measurement values at the same time. *(page 69)*
Menu	Switches from the measurement screen to the Settings screen.

3 Heater indication

4 Measured results display

The latest measured results are displayed.



A	NT measurement value Latest three measured values
B	[AV] Average intraocular pressure
C	Pachymetry value [R]: ([L]:) Number of right (left) eye measurements [CCT] Latest measured value [AV] Average value
D	Corrected intraocular pressure value Displayed when the intraocular pressure correction function is activated.

5 Mode icon

6 Auto tracking icon

7 Auto shot icon

8 Indication icons

An entered patient ID or the status of the device or measurement is indicated at the top of the screen by the following icons.

ID:12345678901234 Patient ID	Displayed when a patient ID has been entered with the barcode scanner or magnetic card reader. The ID is a number with a maximum of 14 digits.
Charge indicator	Indicates that the device is in standby mode after air puffing. While it is indicated, air is not puffed.
Eyelid detection off indication	While this icon is indicated on the screen, eyelid detection mode is deactivated.

9 Applanation area ( )

Shows the range in which air is puffed to the cornea.

10 Target ( )

Used as a guide to position the patient's eye in the center of the screen during NT measurement.

11 Focusing indicator

12 Measurement range

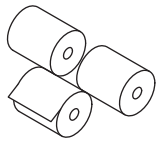
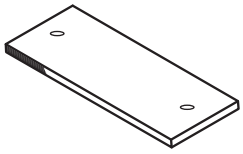
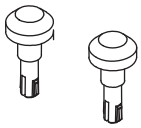
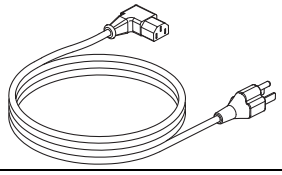
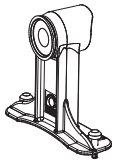
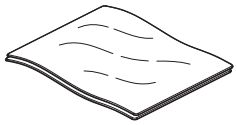
Indicates the set measurement range.

13 Wireless LAN indicator ( )

Blue	Connection is complete and communication is in progress.
Gray	Connection failed.
Gray?	Connection is being initialized.

2.3 Packed Contents

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

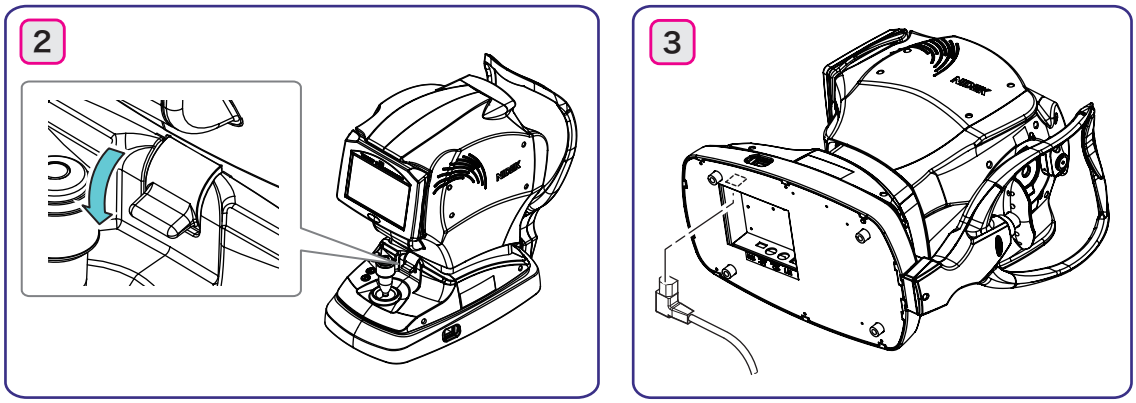
Part name	Quantity	Appearance
Printer paper	3 rolls	
Chinrest paper	1 pack	
Fixing pins for chinrest paper	2 units	
Magnetic forehead rest pad (The magnetic forehead rest pad does not come attached to the main body and is included in the packed contents.)	1 unit	
Power cord	1 unit	
Spherical model eye / 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.

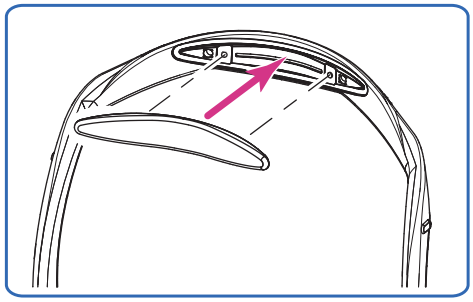
2 Move the main unit fully to the side on which the device will be laid, and fix the main unit with the locking lever. Then gently lay the device on its side.



3 Connect the power cord to the power inlet.

4 Attach the magnetic forehead rest pad to the main body.

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



5 Connect peripheral equipment as necessary. *(page 72)*

6 Stand the device upright.

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

⚠ WARNING

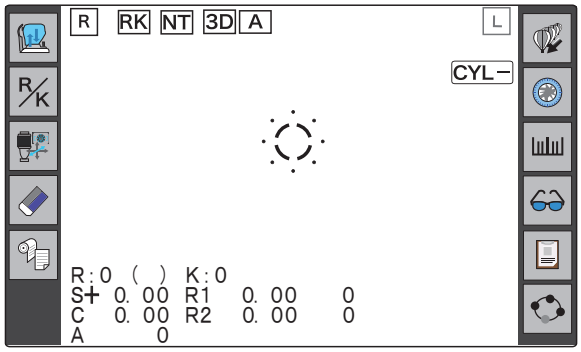
- Be sure to connect the power plug to a grounded outlet.
  Electric shock or fire may occur in the event of malfunction or power leakage.

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 printer paper is loaded.

9 Press [OK] in the message and load the printer paper. *(page 84)*

This completes the setup procedure.

Note

- Set the parameters as necessary or desired. *"4.6.1 Parameter settings" (page 89)*

3 OPERATING PROCEDURE

3.1 Operation Flow

Device power ON

“3.2 Measurement Procedures” (page 28)

Turn on power to the device and change the parameter settings of the device if necessary.

Conduct patient preparation.

Measurement

“3.3 AR (refractive error) and KM (corneal curvature radius) Measurements” (page 38)
“3.3.3 Measurement for patients with unstable fixation” (page 45)
“3.3.5 Retroillumination image observation” (page 49)
“3.3.6 Accommodation measurement” (page 51)
“3.3.7 Manual measurement” (page 53)
“O [CORNEAL SIZE] (CS) measurement” (page 53)
“O [PUPIL SIZE] (PS) measurement” (page 54)
“O [PUPIL DISTANCE] (PD) measurement” (page 56)
“3.4 NT Measurement: Tonometry and Pachymetry” (page 59)

Printing

“3.5 Measured Value Printing” (page 67)
* When transferring data to the connected devices
“3.7 Operation when Peripheral Devices are Connected” (page 72)

Device power OFF

“3.2.3 Finishing the measurements” (page 37)

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

3.2 Measurement Procedures

1 Turn on (|) the power switch.

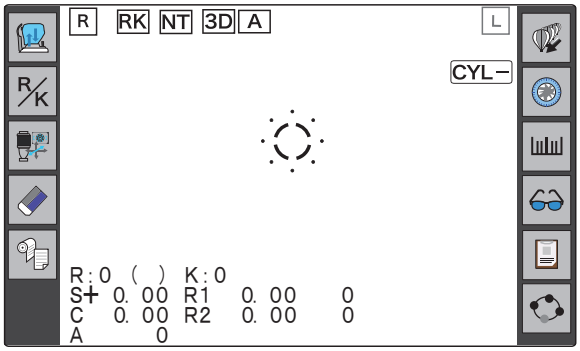
Wait until the screen switches to the measurement screen.

When the device is turned on, the measuring unit moves up and down, forward and backward, and right and left for initialization of auto tracking.

Note

- When the device is set to check the measuring window cleanliness or puffed air pressure by the parameters, the check screen is displayed before the measurement screen. *(page 33)*

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 when you operate the joystick.
- The chinrest moves vertically when you press the chinrest up/down buttons.
- Printer paper is sufficient.

If any abnormality is found, stop using the device, then refer to *"4.1 Troubleshooting" (page 79)*.

4 Set the measurement conditions.

● Measurement mode

Press  for selection.

Measurement mode	Screen indications	Details
RKT successive mode	RK NT	R/K and NT measurements are successively taken. After R/K measurement for both eyes, NT measurement starts.
R/K individual mode	RK	Only R/K measurement is taken.
NT individual mode	NT	Only NT measurement is taken.

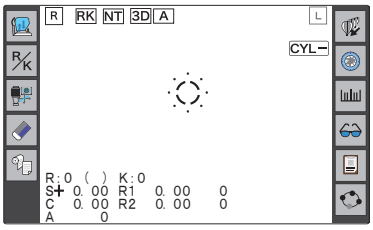
When the device is turned on, measurement mode is set to the mode last used when the device was turned off.

- R/K measurement contents

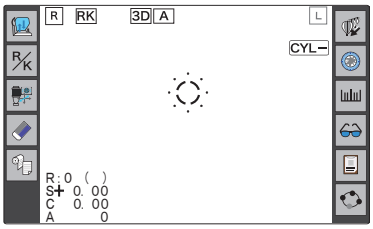
Press R/K for selection.

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

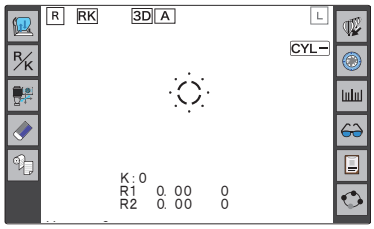
The measurement items corresponding to the selected measurement are displayed on the screen.



AR/KM measurement



AR measurement



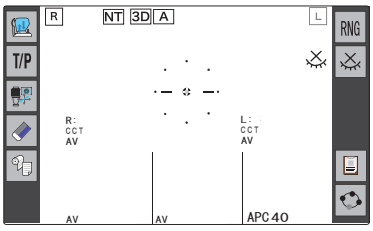
KM measurement

- NT measurement contents and range

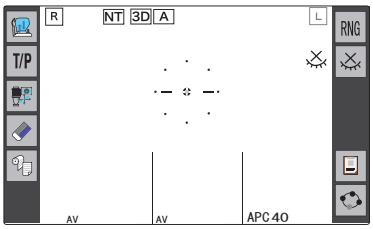
1) Press T/P for selection.

Measurement	Details
Tonometry/Pachymetry	Tonometry and pachymetry are successively taken.
Tonometry	Only tonometry is taken.
Pachymetry	Only pachymetry is taken.

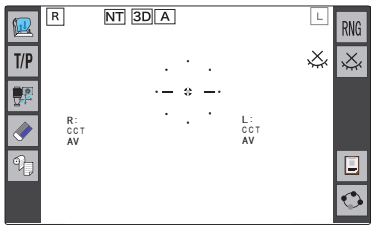
The measurement items corresponding to the selected measurement are displayed on the screen.



Tonometry/Pachymetry



Tonometry



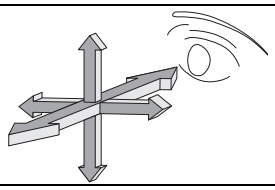
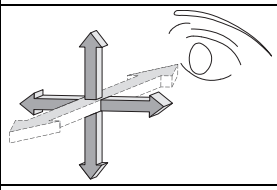
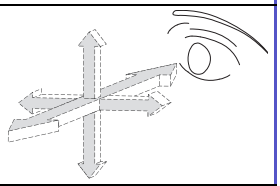
Pachymetry

2) Press RNG to select the desired tonometry range.

Measurement range	Guide for selection	Air pressure control
[APC40]	Normal	Air pressure peak is automatically controlled in the range of 1 to 40 mmHg.
[APC60]	Intraocular pressure is 40 mmHg or more.	Air pressure peak is automatically controlled in the range of 1 to 60 mmHg.
[40]	Intraocular pressure fluctuates substantially.	Air pressure peak is fixed in the range of 1 to 40 mmHg.
[60]	Intraocular pressure is 40 mmHg or more and it fluctuates substantially.	Air pressure peak is fixed in the range of 1 to 60 mmHg.

- Auto tracking function and auto shot function

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

	3D	2D	(No icon)
Auto tracking			
Alignment in the side-to-side and up-and-down directions	Auto	Auto	Manual
Focusing in the forward-backward directions	Auto	Manual	Manual

A : Auto shot	Measurement starts automatically when alignment and focusing are optimized.
QK : Quick Ref	AR measurement: Measurement starts with less strict conditions than in auto shot and takes less time. Other measurements: Same as in auto shot
No icon: OFF	Pressing the start button starts measurement.

Note

- Selectable contents by pressing  differ depending on the setting of the parameter [Others] > [TRACKING SW]. *(page 89)*

- Parameter-set measurement conditions

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

"4.6.1 Parameter settings" (page 89)

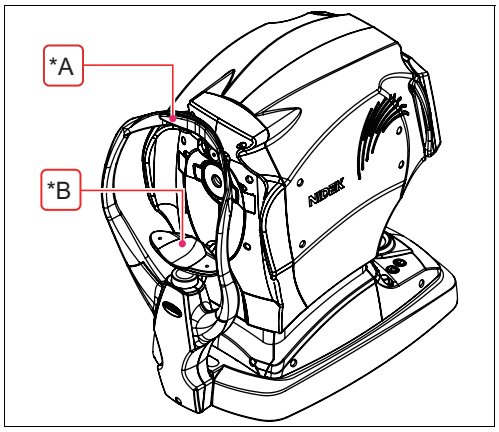
5 Conduct patient preparation.

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

   Entering patient ID *(page 74)*

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.
  - Before R/K measurement

    "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."
  - Before NT measurement

    "You may be surprised by air puffed into your eye, but do not worry. Please be patient and relax for a moment until I can measure your intraocular pressure three times per eye."

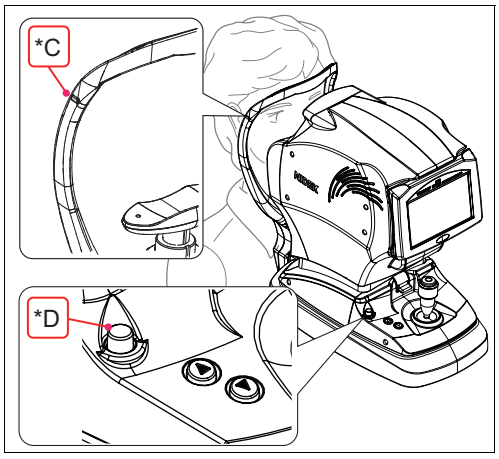
3) Instruct the patient to sit on the chair.

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

5) Adjust the height of the chinrest with the chinrest up/down buttons (▲, ▼) so that the patient's eyes are roughly aligned to 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.



When taking NT measurement, set the safety space between the patient's eye and air nozzle with the safety stopper (*D). (Follow Steps 6) to 8) below.)

⚠ WARNING

- Before measurement, be sure to set the safety stopper.
  The air nozzle may contact and hurt the cornea.

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

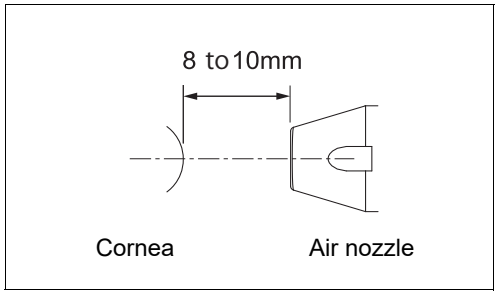
6) While pressing the safety stopper, operate the joystick so that the air nozzle slowly approaches the patient's cornea.*1

While the safety stopper is held down, [RTN TO ORG] blinks on the screen.

7) While watching from a side of the device, release the safety stopper when the space between the patient's eye and the air nozzle becomes 8 to 10 mm.

When the safety stopper locks the main unit, [RTN TO ORG] that was blinking on the screen disappears.

8) Gently move the joystick forward and backward to confirm that the main unit does not move toward the patient beyond the position locked in Step 7).



6 Take measurements according to the procedure of each measurement mode.

For each procedure, see the following.

R/K measurement: *"3.3 AR (refractive error) and KM (corneal curvature radius) Measurements" (page 38)*

NT measurement: *"3.4 NT Measurement: Tonometry and Pachymetry" (page 59)*

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 Print the measured results.

Printing operation differs depending on the settings of the parameter [PRINT] > [PRINT1] > [PRINT].

[AUTO]	When measurement is complete, printing automatically starts.
[MANUAL]	Press to start printing.
[NO]	Printing does not occur. Pressing just transmits data to the external connected devices.

Contents of printing *"3.5 Measured Value Printing" (page 67)*

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

Note

- When the parameter is set to display the summary screen, press to display the summary screen. Confirm and print the measured values on the summary screen. *"3.6 Summary Display" (page 69)*

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

To finish measurement *"3.2.3 Finishing the measurements" (page 37)*

*1. While the safety stopper is held down with the NT measurement screen displayed, the auto tracking and auto shot functions are deactivated.

3.2.1 Checking the measuring window cleanliness and puffed air pressure at start-up

It is possible to set whether to check the measuring window cleanliness and puffed air pressure at device start-up by the parameters.

Checked contents at device start-up differ depending on the settings of the parameters [OTHER] > [WINDOW CHECK] and [OTHER] > [PRESSURE CHECK].

[DAY]	Checks are conducted at the first start-up of the day.
[YES]	Checks are conducted every start-up.
[NO]	Checks are not conducted.

The soiled measuring window will adversely affect the reliability of measured results. It is recommended to use this window check function in addition to visual check to keep the measuring window always clean.

It is essential to maintain the correct puffed air pressure for the accurate tonometry. It is recommended to check the puffed air pressure before measurement.

Checks are conducted in the following order: “Check of puffed air pressure (40 mmHg and 60 mmHg)” → “Measuring window cleanliness check”.

The checks deactivated by the corresponding parameters are skipped.

Note

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

  Even if the window is not soiled, it may be detected to be soiled due to objects or interference light.

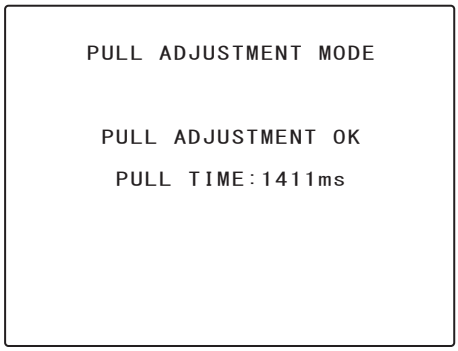
- At device start-up, make sure that there are no people or objects in front of the measuring window.

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

- When the parameter [OTHER] > [PRESSURE CHECK] is set to [DAY] or [YES], the piston pull time is automatically adjusted before the puffed air pressure is checked for the first time on the day.

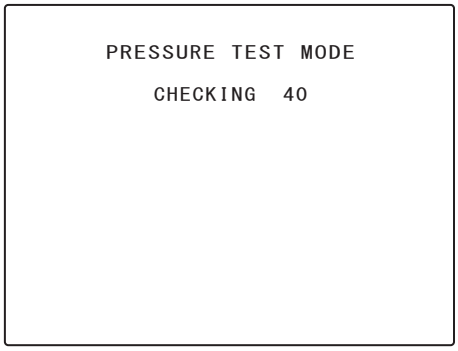
  This function adjusts the time it takes for the piston used to puff air to return from the pushed position to the original position so that the time falls within a specific range.

1) [PULL ADJUSTMENT MODE] is displayed and the duration of piston pull time is adjusted.



2) [PRESSURE TEST MODE / CHECKING 40] is displayed and the test for the puffed air of 40 mmHg is performed.

Wait until the check result message appears.



3) The check result message appears.

[PRESSURE TEST OK]

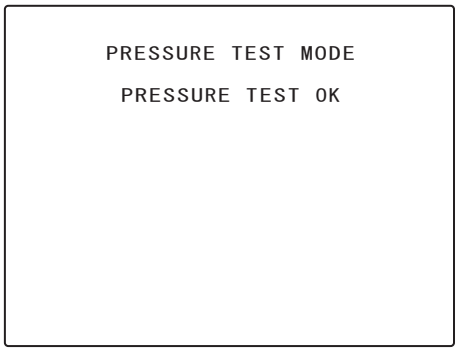
The air nozzle is clean.

[PRESSURE PEAK ERROR (40)]
[PRESSURE SLOPE ERROR (40)]
[NO PRESSURE UP (40)]

When all the checks are complete, the displayed message such as [PRESSURE PEAK ERROR (40)] is printed.

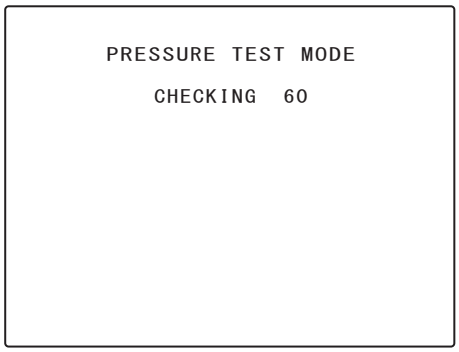
After all the checks are complete, display the NT measurement screen, then turn off power. Check the air nozzle cleanliness.

If it is soiled, clean it.



4) [PRESSURE TEST MODE / CHECKING 60] is displayed and the test for the puffed air of 60 mmHg is performed.

Wait until the check result message appears.



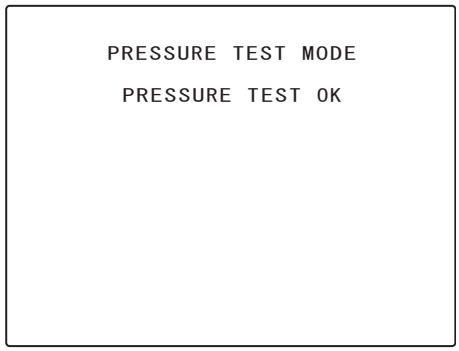
5) The check result message appears.

[PRESSURE TEST OK]

The air nozzle is clean.

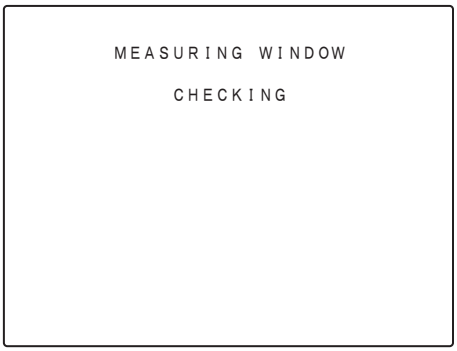
[PRESSURE PEAK ERROR (60)]
[PRESSURE SLOPE ERROR (60)]
[NO PRESSURE UP (60)]

Perform the procedure as in Step 2).



6) [MEASURING WINDOW / CHECKING] is displayed and the measuring window cleanliness is checked.

Wait until the check result message appears.



7) The check result message appears.

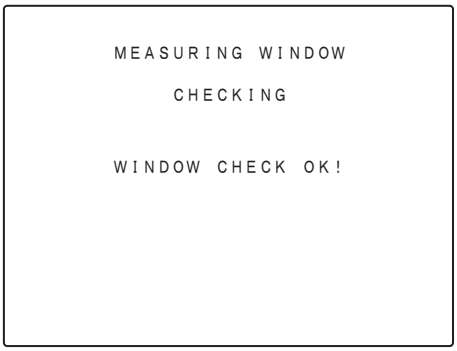
[WINDOW CHECK OK!]

The measuring window is clean.

[CHECK MEASURING WINDOW]

[CHECK MEASURING WINDOW] is printed as displayed on the screen.

Check the measuring window cleanliness. If it is soiled, clean it.



8) When all the checks are complete, the screen switches to the measurement screen.

Note

- Cleaning the measuring window and air nozzle *"4.8 Cleaning" (page 118)*
- If [CHECK MEASURING WINDOW] appears due to soiling of the measuring window when the parameter [Others] > [WINDOW CHECK] is set to [DAY], the measuring window cleanliness is checked again at the next device start-up.
- If [PRESSURE PEAK ERROR (##)], [PRESSURE SLOPE ERROR (##)], or [NO PRESSURE UP (##)] appears due to improper puffed air pressure when the parameter [Others] > [PRESSURE CHECK] is set to [DAY], the device checks the puffed air pressure again at the next device start-up.

3.2.2 Switching between R/K measurement and NT measurement

When switching from R/K measurement to NT measurement, move the main unit fully toward you by pulling the joystick.

■ RKT successive mode

Switching procedure differs depending on whether [CHANGE MODE] is set to [AUTO] or [MANUAL].

Setting [CHANGE MODE]: *"O [OTHER]" (page 98)*

[AUTO]

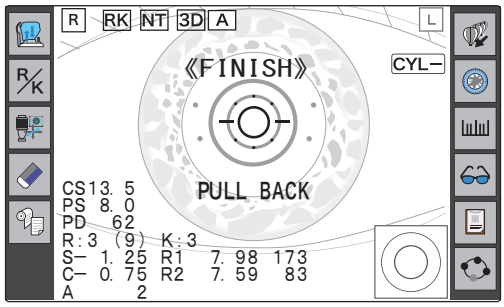
After R/K measurement, [PULL BACK] is displayed on the screen.

↓

1) Pull the main unit toward you.

   R/K measurement switches to NT measurement.

   [RK > > > NT] is displayed on the screen during switching.



[MANUAL]

1) After R/K measurement, pull the main unit toward you.

   [PRESS START->CHANGE] is displayed on the screen.

   ↓

2) Press the start button.

   R/K measurement switches to NT measurement.

Note

- Even when [AUTO] is set, pulling the main unit toward you displays [PRESS START ->CHANGE], therefore, switching can be conducted in the same manner as when [MANUAL] is set.

■ Switching from R/K individual mode to NT individual mode

1) Switch the mode with the function icon.

   The mode icon changes and [PULL BACK] is displayed on the screen.

   ↓

2) Pull the main unit toward you.

   R/K measurement switches to NT measurement.

   [RK > > > NT] is displayed on the screen during switching.

Note

- If any object is detected in front of the air nozzle while R/K measurement switches to NT measurement, [TOO CLOSE] is displayed and switching is canceled. Then the message on the screen automatically changes to [PRESS START->CHANGE].

  Pressing the start button after removing the object resumes switching.

- If the air nozzle is exposed to an intense light such as a spotlight or direct sunlight, [TOO CLOSE] may be displayed and switching cannot be conducted.

  Relocate or reorient the device or change the direction of the illumination so that the air nozzle is not exposed to the intense light.

3.2.3 Finishing the measurements

○ 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 118)*

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.

○ Shutoff before transporting the device

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

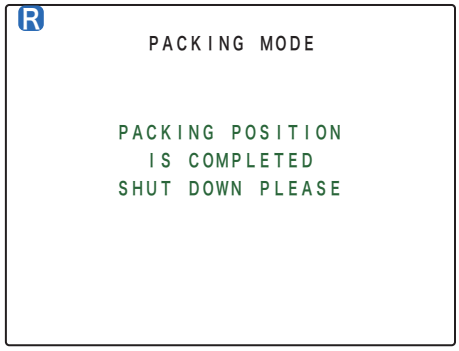
1 Turn off (◯) the power switch to shut off the device once.

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

Hold down the chinrest down button until [PACKING MODE] is displayed on the screen.

3 When [PACKING POSITION IS COMPLETED SHUT DOWN PLEASE] is displayed, turn off (◯) the power switch.

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



4 Move the main unit fully to the side on which the device will be laid, and fix the main unit with the locking lever. Gently lay the device, then disconnect the power cord, communication cable, and such.

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

6 Pack the device in the supplied packing material.

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

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

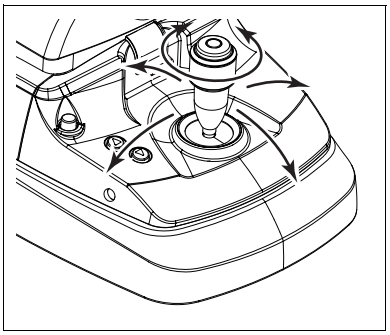
The measurement items of measurement mode (AR/KM measurement, AR measurement, or KM measurement) selected by pressing R/K are displayed on the screen.

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.

Moving the joystick right, left, forward, and backward moves the main unit of the device in the same directions. Rotating the joystick knob moves the measuring unit 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.

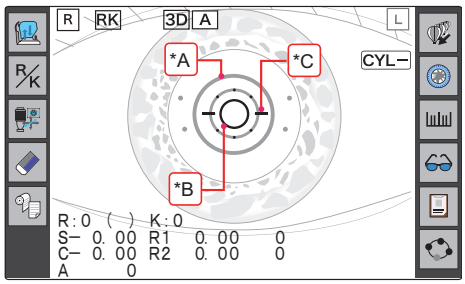
Manually align the device to the mire ring (*A) and bring the eye into focus.

The methods of alignment and focusing differ depending on the setting of auto tracking.

Setting contents “3.2 Measurement Procedures” (page 28)

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

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



Note

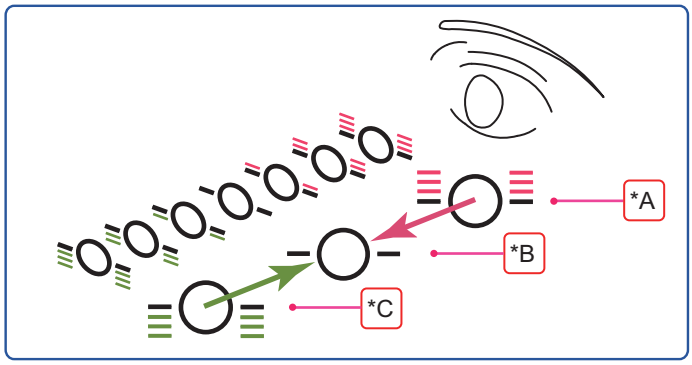
- If eyelashes obstruct the minimum pupil diameter mark, correct AR measurement may not be possible. If the eyelid or eyelashes obstruct the mire ring, KM measurement is not be possible.

  In such cases, instruct the patient to open their eye wider.

  If the patient cannot open their eye wider, lift their eyelid, paying attention not to press against the eyeball.

- Focusing indicator display

For manual focusing, move the joystick forward and backward until the focusing indicator shows the optimum condition (-O-).

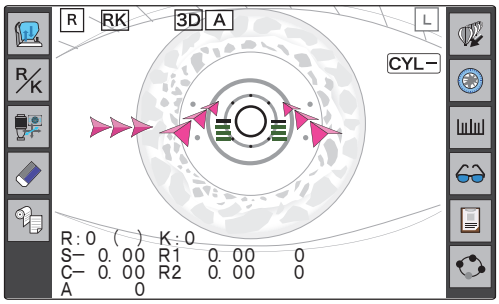


*A	Too close to the patient's eye
*B	Optimum focusing condition
*C	Too far from the patient's eye

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

The limit indicator (red arrows) is displayed. Move 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.

When auto shot is set to on, measurement starts automatically when alignment in the up, down, right, and left directions and focusing in the forward/backward direction are optimized.
When auto shot is set to off, press the start button to start measurement.

In AR/KM measurement mode, KM measurement and AR measurement are performed in that order.

Note

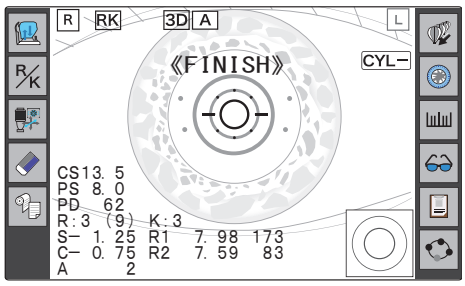
- The operator can start measurement by pressing the start button.
  Press the start button to start measurement when measurement has difficulty starting for patients who blink often.

Note

- When an error occurs for measured results and continues despite repeated measurements, the cause may be one of the following.
  - 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 darkened room until their pupils enlarge more and try measurement again.
  - 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 loses alignment and focus during measurement, the measurement is interrupted. If measurement is resumed, 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. After the 10th measurement, 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 setting of the parameter [MEASURE] > [AR] > [AM MODE*1].

AR measurement	[AM MODE / YES]	When measurements are performed for the number of times specified by the parameter [MEASURE] > [AR] > [AR CONTINUE] and the data is stable (least fluctuation), measurement automatically finishes.
	[AM MODE / NO]	When measurements are performed for the number of times specified by the parameter [MEASURE] > [AR] > [AR CONTINUE], measurement automatically finishes.

KM measurement	When measurements are performed for the number of times specified by the parameter [MEASURE] > [KM] > [KM CONTINUE], measurement automatically finishes.

*1. In AM mode, measurement automatically finishes when the specified number of stable data sets and the median values are obtained.

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. When the specified number of KM measurements is obtained, [<<FINISH>>] is displayed on the screen.
- To continue the measurement further, press the start button again. [<<FINISH>>] disappears and auto tracking starts again for measurement (except when the parameter [PRINT] > [PRINT1] > [PRINT] is set to [AUTO]). The measured values are added to the former results and saved.
  According to the selected measurement mode, the measurement to be repeated is as follows:

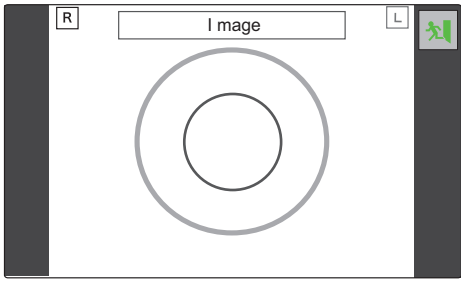
  AR/KM measurement mode and AR measurement mode: AR measurement only
  KM measurement mode: KM measurement only

● 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 thumbnail display to switch to the full screen display.

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

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



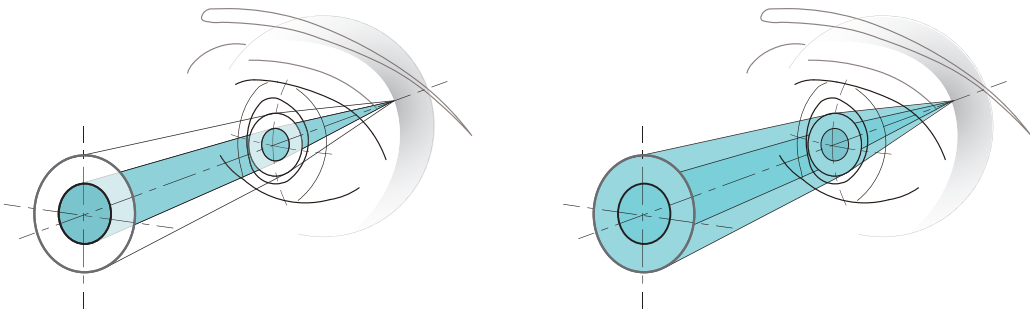
● Large area AR measurements

In the AR measurement process, AR central measurement (inner measurement ring) is performed concurrently with AR large area measurement (outer measurement ring) when the parameter [MEASURE] > [AR] > [L. DATA MEAS] is set to [YES].

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 large pupils have on vision, such as at night, can be taken into consideration.

Large area measured values can be checked on the printed results and data contents can be set by the parameter [PRINT] > [PRINT2] > [L. DATA PRINT].

[DIFF]	[L. DIFF]: Difference between central measured values (normal AR values) and large area measured values
[DATA]	[L. DATA]: Large area measured values
[DATA&DIFF]	[L. DATA]: Large area measured values [L. DIFF]: Difference between central measured values (normal AR values) and large area measured values



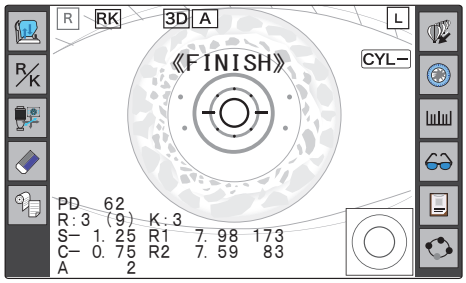
Central measurement　　Large area measurement

The above images illustrate the measurement ranges and do not explain the measurement principle.

Note

- If large area measured values have not been obtained due to a small pupil size, [NO DATA] is printed 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 eyes before starting the next measurement.
  Let the eyes rest to avoid measurement failure by blinking.

7 Perform other measurements as necessary.

Vision comparison	Vision comparison using corrective lens *(page 45)*
Accommodation measurement	Accommodation measurement *(page 51)*
Retroillumination image	Retroillumination image observation *(page 49)*
CS/PS/PD	Manual CS/PS/PD measurement *(page 53)*

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 with auto tracking and auto shot set to 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 parameter [MEASURE] > [AR] > [ERROR DATA] 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 parameter [MEASURE] > [AR] > [ERROR DATA] 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 alignment and measurement again.
[NEAR] (Focus error: Too close to the patient's eye)	Focusing is not proper. Perform alignment 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.

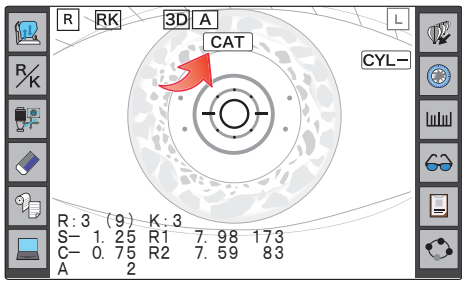
3.3.2 Cataract measurement mode

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 and left.
- Pressing 
- Pressing 

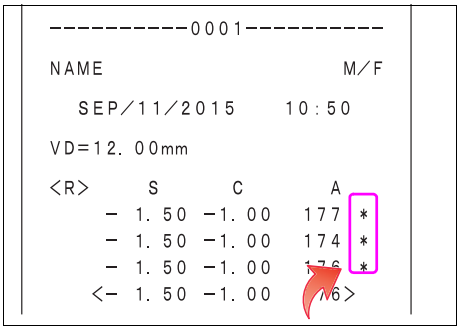
Note

- In cataract measurement mode, take note that the measurement results are more likely to fluctuate in comparison with normal measurement mode.

○ Printout sample in cataract measurement mode

By setting the parameter [PRINT] > [PRINT2] > [CAT MARK], "*" indicating that measurement has been taken in cataract measurement mode is printed to the right of the data.

The factory setting is [NO].



3.3.3 Measurement for patients with unstable fixation

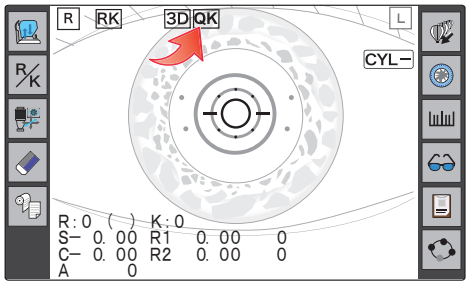
The auto shot function may not work properly for the patients such as children or those with unstable fixation. For such patients, use quick ref measurement mode so that AR measurement becomes more likely to succeed.

Note

- In quick ref measurement mode, take note that the measurement results are more likely to fluctuate in comparison with normal AR measurement mode.
- If the device loses alignment (the center of AR ring image is misaligned), up to 10 measurements are performed until proper AR ring image is obtained.

1 Press  to switch the mode to **QK**.

2 Perform alignment and focusing to start the measurement.



The auto tracking function works in the same manner as in normal measurement.

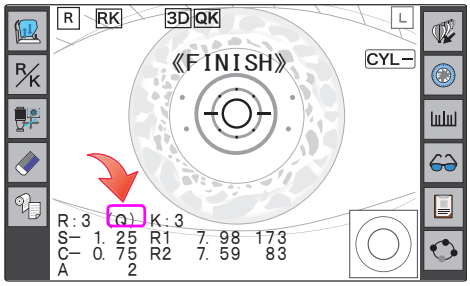
The measurement starts with less strict conditions for auto shot function in AR measurement.

The AR measurement takes less time than normal measurement.

3 Measurement finishes.

When the specified number of measurement values is obtained, [<<FINISH>>] is displayed on the screen and measurement finishes.

The field of confidence index shows “Q” indicating that the value was measured in quick ref measurement mode.



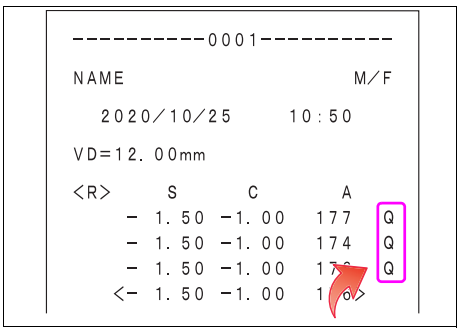
4 Measure the other eye.

Any of the following operations cancels quick ref measurement mode:

- Pressing 
- Pressing  on the summary screen

○ Printout sample in quick ref measurement mode

The letter “Q” is printed on the right side of the data to indicate that it was measured in quick ref measurement mode.



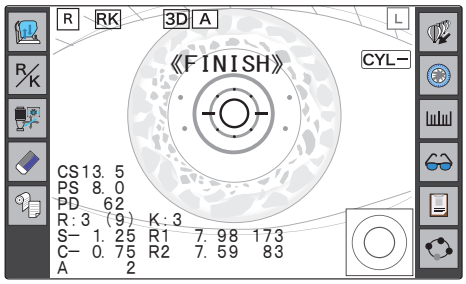
3.3.4 Vision comparison

■ The vision comparison function allows the patient to compare the current vision (uncorrected vision or that corrected by LM data) with the vision corrected by AR measurement (or large area measurement[*1]). By changing the distance to the chart, the patient can also experience the vision for near distance.

For comparison with the vision corrected by LM data, the power of the patient's glasses needs to be read by importing data from the LM beforehand.

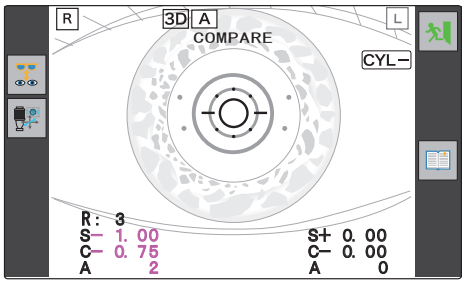
1 Perform AR measurement as normal.

Measure one eye or both eyes.



2 Press to have the patient experience the vision corrected by AR measurement.

The screen switches to the vision comparison screen. The patient sees a scenery chart with the vision corrected objectively.



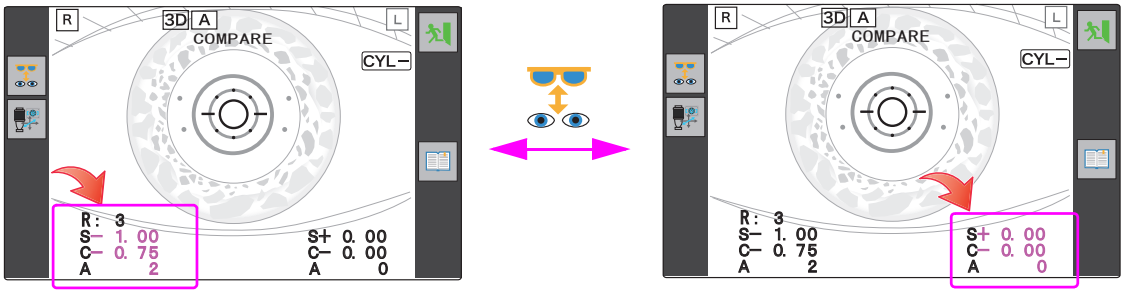
3 Press to switch between the vision of the distance VA chart corrected by AR measurement and the uncorrected vision (or vision corrected by LM data) to check the vision difference.

The [S], [C], and [A] values in the lower right field are displayed in pink indicating that the uncorrected vision (or vision corrected by LM data) is presented at the moment. The pink indications show which vision is presented at the moment.

Pressing toggles between AR measurement corrected vision and uncorrected vision (or vision corrected by LM data).

Recall	When LM data is not contained The distance VA chart is viewed with an uncorrected eye.
	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.

*1. Measured values to be used can be set by the parameter [COMPARE] > [L. DATA SELECT].



Corrected distance values

Uncorrected vision (0 D) or LM values

Note

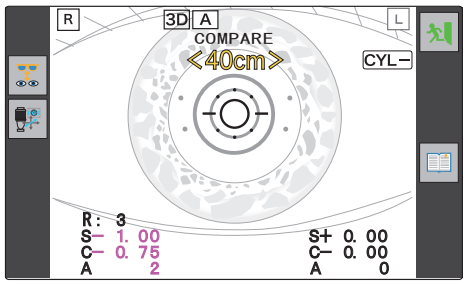
- Vision comparison must be performed with alignment and focusing optimized in the same manner as during measurement.
- If the patient's eye is hyperopic, the vision does not change as much as that of a myopic eye. This is because the patient can see the chart with accommodation even with an uncorrected eye.

4 If necessary, switch to the vision for near distance.

1) Press .

The working distance to the chart changes from the normal distance (5 m-equivalent) to 40 cm-equivalent.*1 [<40cm>] is displayed in the upper middle of the screen. Also, ADD is displayed.

Pressing again returns the working distance to the normal distance (5 m-equivalent) and ADD disappears.



2) Press to toggle the visions and check the vision difference.

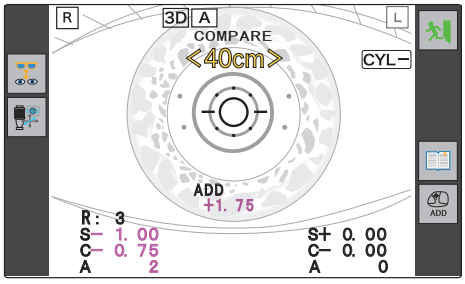
3) If necessary, switch to the vision with addition power.

Pressing ADD adds the addition power of 1.75 D*2 and [ADD+1.75] is displayed in the center of the screen.

Pressing ADD again clears the vision with the addition power.

4) Press ADD to toggle the visions and check the vision difference.

Pressing or cancels the addition power.



5 Press to finish vision comparison and return to the measurement screen.

6 Measure the other eye in the same manner.

When using the vision comparison function after AR measurement of both eyes, start it after alignment with the patient's eye.

*1. The near working distance to the chart can be set between 35 and 70 cm (5 cm increments) by the parameter [PRINT] > [PRINT3] > [WORKING D.].

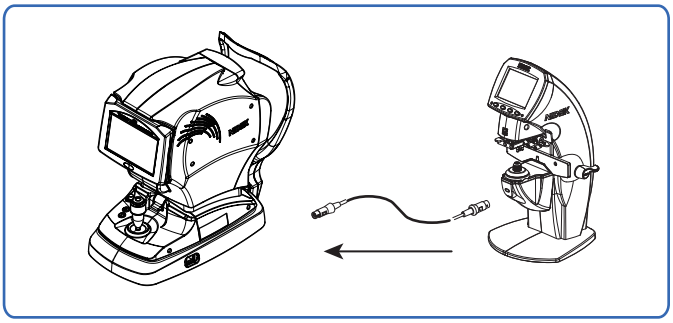
*2. The addition power can be selected from among "1.5 D", "1.75 D", or "2.0 D" by the parameter [COMPARE] > [ADD SELECT].

○ Importing LM Data

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

- 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 72)*



Note

- When LM data has been imported, LM is displayed to the lower right on the vision comparison screen.

3.3.5 Retroillumination image observation

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

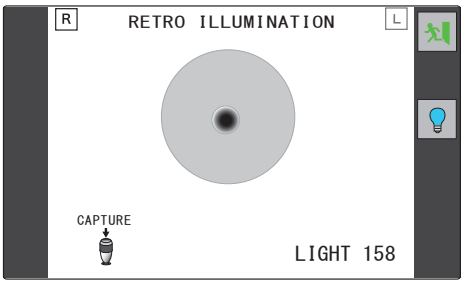
⚠ CAUTION

- Opacity indexes should be taken as reference values.
  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.

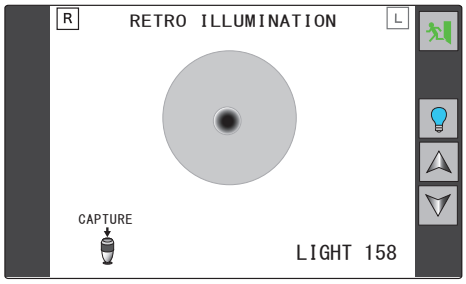
  Depending on the position of the opacity, correct pupil detection may not be possible resulting in the circle position indicating the 3 mm range in diameter to be deviated. Actual indexes may not be presented in such a case, either.

1 After KM measurement, press  to display the retroillumination image observation screen.

The device enters retroillumination image observation mode. The auto tracking and auto focusing functions are deactivated and the light intensity (SLD) is automatically controlled.

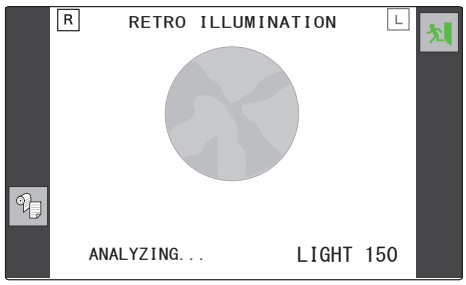


To change the light intensity manually, press  . As the light intensity automatic control is deactivated, change the light intensity with  (up) and  (down) displayed on the screen.

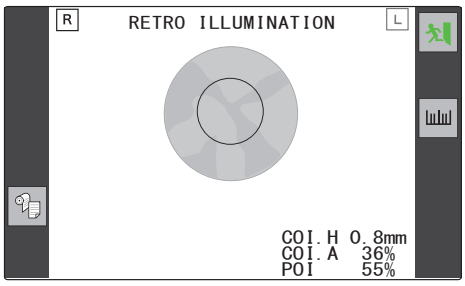


2 Manipulate the joystick so that the opacity is in focus and the alignment guide mark is not prominent. Press the start button to capture the image.

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.



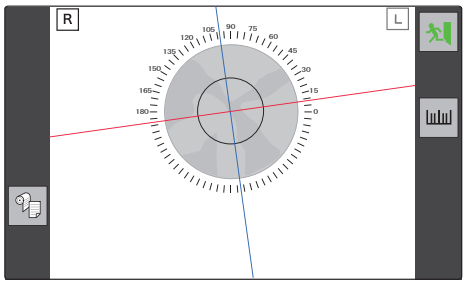
[COI. H]	Opacity size within a diameter of 3 mm in the center (vertical diameter): mm
[COI. A]	Opacity proportion within a diameter of 3 mm in the center: %
[POI]	Opacity proportion within the entire periphery: %

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 display as shown in Step 1.

Print	Prints the opacity indexes and retroillumination image only. When both eyes have been captured, the opacity indexes and retroillumination images of the right and left eyes are printed.
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, is not displayed.



3 Switch the eye to be measured and observe its retroillumination image in the same manner.

Note

- To print the retroillumination image on the normal measured results, set the parameter [PRINT] > [PRINT3] > [RETRO IMAGE PRINT].

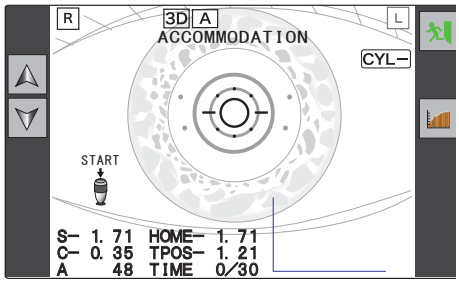
3.3.6 Accommodation measurement

1 After AR measurement, press to display the accommodation measurement screen.

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 (up) or (down) (0.25 D increments).

Instruct the patient to begin and continue looking at the chart from the start of measurement. Measurement continues for a maximum of 30 seconds.

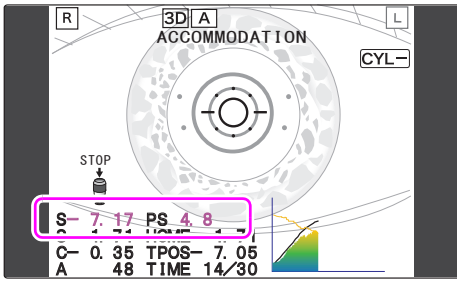


2 Manipulate the joystick to perform alignment and focusing of the patient’s eye.

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

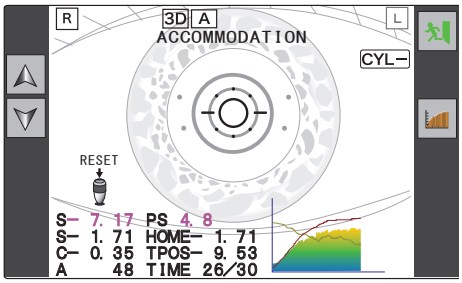
With auto shot set to on, measurement does not start unless alignment and focusing are achieved.

While the chart is moved from the initial position, AR measurement and Pupil Size measurement are successively taken. If the patient’s eye cannot accommodate to the chart position ([TPOS]) for 6 seconds, measurement finishes. (The elapsed time is displayed in the [TIME] field.)



Once measurement starts, AR and PS measured values are updated with time and displayed along with the graph.

During measurement, [STOP] is displayed above the joystick icon. Pressing the start button interrupts measurement and displays [RESET] above the joystick icon. Pressing the start button again resets the chart and returns to the pre-measurement state.



When measurement is complete, a beep sounds and the screen display is no longer updated.

[RESET] is displayed above the joystick icon. Pressing the start button can restart measurement.

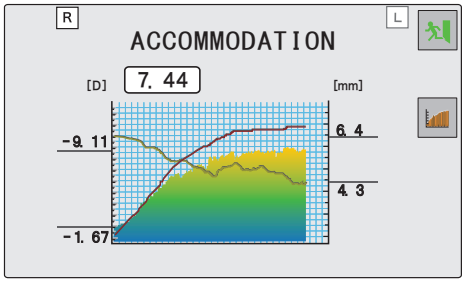
Return	Returns to the AR (AR/KM) measurement screen.
Graph	Switches to the graph display screen.

*1. The setting of TPOS (shift amount from SPH) can be set by the parameter [MEASURE] > [ACC] > [T. POSITION].

4 Press  to switch to the graph display screen.

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

The horizontal axis indicates the elapsed time in 1 second increments.



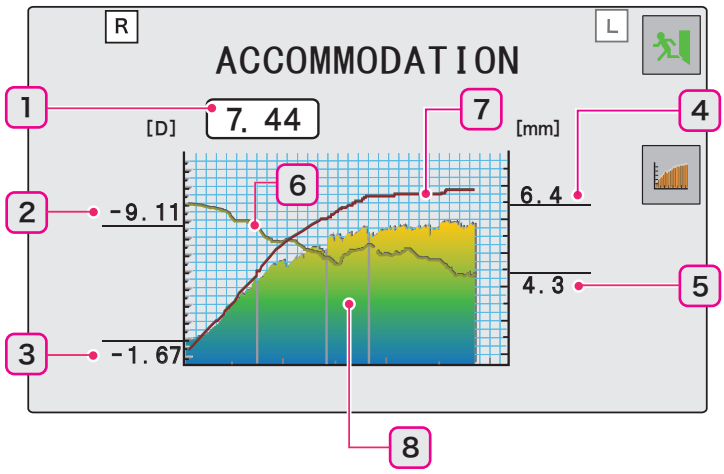
5 Press  to return to the accommodation measurement screen.

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

Note

- As measured results, [ACC] (accommodation), AR measurement [MIN] (minimum value), [MAX] (maximum value), pupil size [MIN] (minimum value), and [MAX] (maximum value) are printed.
  The greatest minus AR measured value is taken as [MAX] (maximum value).
- To print the graph, set the parameter [PRINT] > [PRINT3] > [ACC GRAPH PRINT].

○ 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 the change of 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 are set by the parameter [MEASURE] > [ACC] > [ACC STEP] separately from the display increments of the AR measured values.

3.3.7 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.

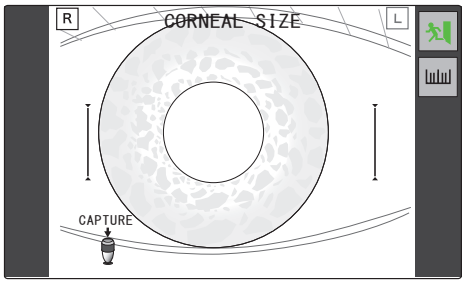
Note

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

○ [CORNEAL SIZE] (CS) measurement

1 Press to enter CS measurement mode.

[CORNEAL SIZE] and guide lines are displayed on the screen.



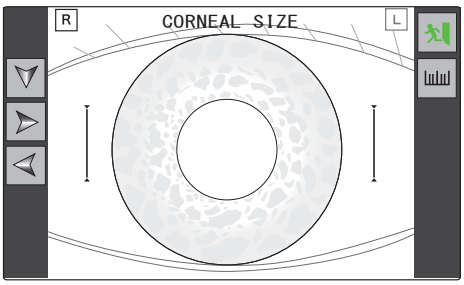
2 Manipulate the joystick to perform alignment and focusing of the patient's eye.

The auto tracking function is automatically deactivated. Manually perform alignment and focusing.

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.

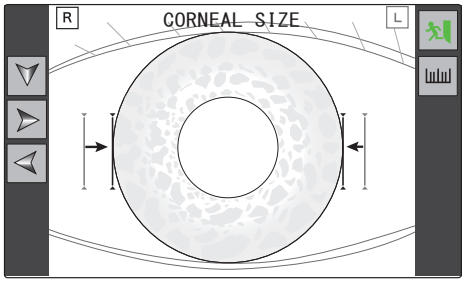


4 Press (right) or (left) to align the guide lines to the patient's cornea outline.

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

Note

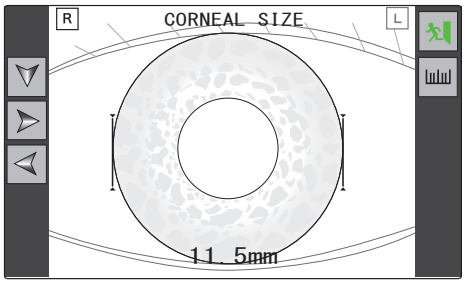
- The guide line can be selected and moved by touching and dragging.



*1. Auto measurements are set by the parameters [OTHER] > [AUTO PD], [OTHER] > [AUTO PS], and [OTHER] > [AUTO CS].

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 screen as shown in Step 1.

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

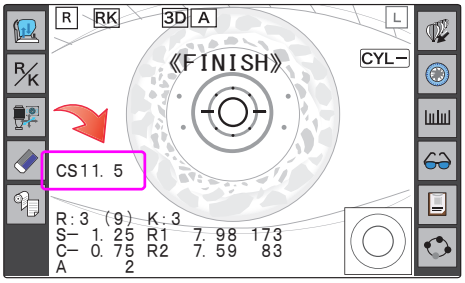
Note

- When performing both CS (Corneal Size) measurement and PS (Pupil Size) measurement, switch the eye to be measured after CS measurement and PS measurement for a single eye are complete.
  Only a single image capture is needed for each eye.
- When RK individual mode is selected and [PRINT] is set to [AUTO], perform manual CS measurement before AR and/or KM measurement to print the manual CS measured data together with AR and/or KM measured data.

7 Press to exit 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.



○ [PUPIL SIZE] (PS) measurement

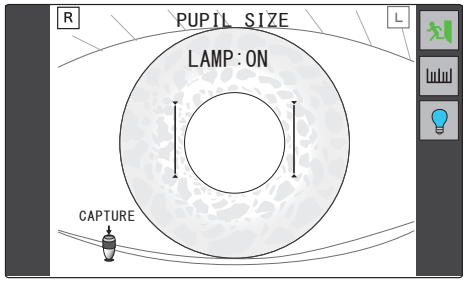
The following is the procedure to measure the Pupil Size (PS). When continuing Pupil Size measurement from Corneal Size measurement, start from Step 5.

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 while a still image is displayed, press the start button twice.
  The screen as shown in Step 1 is displayed.

1 Press to enter PS measurement mode.

[PUPIL SIZE] and guide lines are displayed on the screen.



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

Press 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 pupil which dilates in the dark.

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

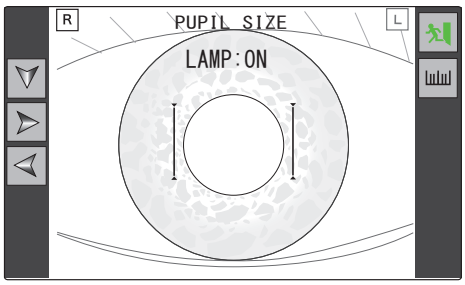
The auto tracking function is automatically deactivated.

Manually perform alignment and focusing.

4 Press the start button to capture the image.

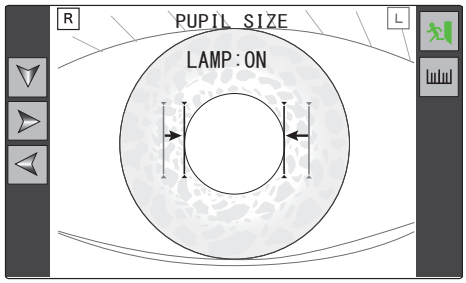
The screen switches from a live image to a still image.

After image capture, instruct the patient to rest comfortably.



5 Press (right) or (left) to align the guide lines to the patient's pupil.

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

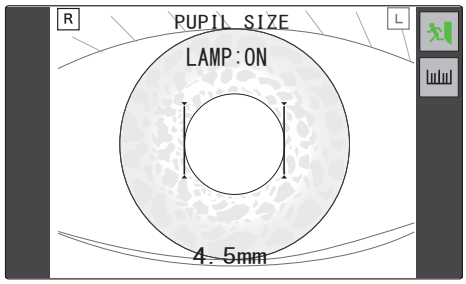


Note

- The guide line can be selected and moved by touching and dragging.

6 Press the start button to confirm the measurement.

A CS 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 screen as shown in Step 1.

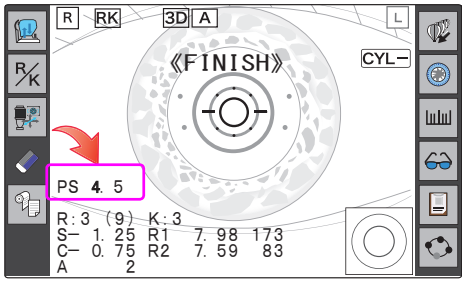
Note

- When [AM MODE] is set to [YES] and [PRINT] is set to [AUTO], perform manual PS measurement before AR and/or KM measurement to print the data together with AR and/or KM measured data.

8 Press to exit 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 to switch to the PD measurement screen.

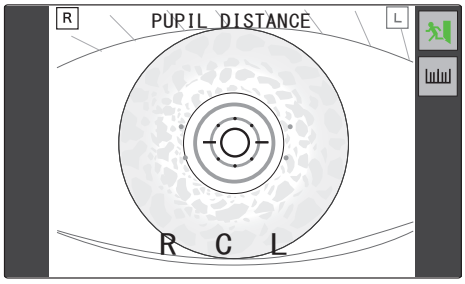
○ [PUPIL DISTANCE] (PD) measurement

Note

- In manual PD measurement, five measurements can be saved. The latest PD value is displayed on the measurement screen. Up to five PD measured values are printed in the order of measurement on the printed results.

1 Press to enter PD measurement mode.

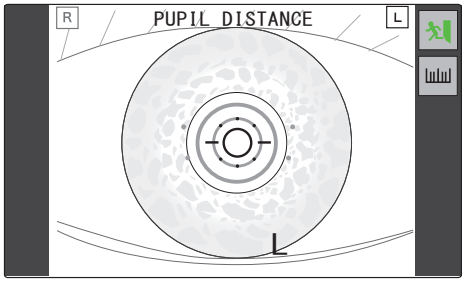
[PUPIL DISTANCE], [R], [C], and [L] are displayed on the screen.



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

3 Press the start button after the eye is in alignment, then repeat for the other eye.

Pressing the start button after alignment of the center (bridge) [C] allows monocular PD to be measured along with the binocular PD.



Note

- Make sure that the patient's head is not tilted before starting measurement.

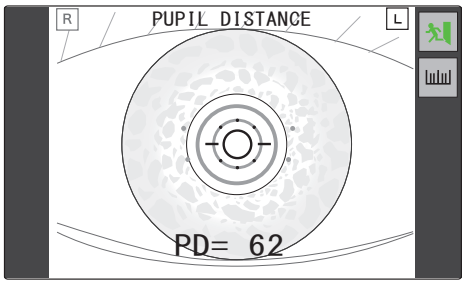
  To locate the exact center position, have the patient wear the frames with a mark in its center and bring the mark into focus.

- Each press of the start button hides [R] (right), [C] (center) and [L] (left) on the screen in that order, which indicates that the corresponding position has been detected. The detection of [C] may be skipped.

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

When [R] (right) and [L] (left) disappear, measurement is complete.

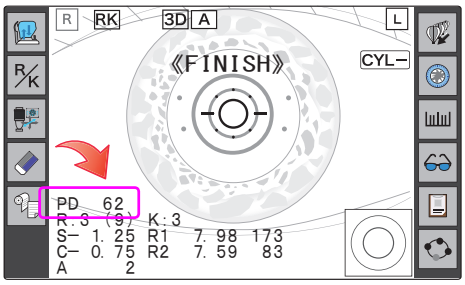
To measure the monocular PD, detect [C] (center) first.



5 Press  to exit PD measurement mode.

The screen returns to the measurement screen.

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



Note

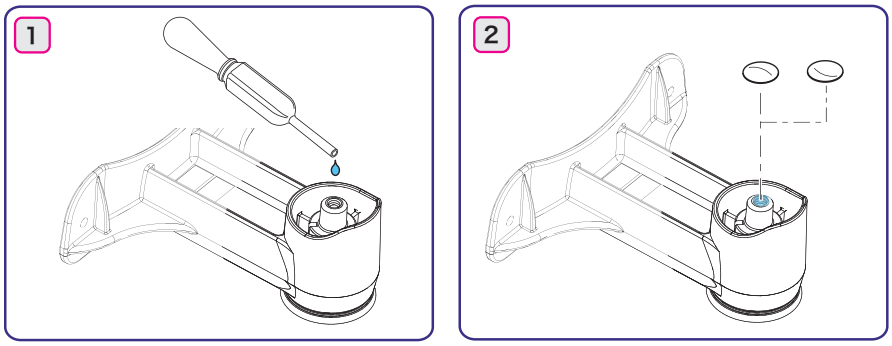
- When PD is measured with the parameter [PRINT] > [PRINT3] > [NEAR PD PRINT] set to [YES], the near PD is also printed according to the distance PD.

3.3.8 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 contact lens holder completely with water.



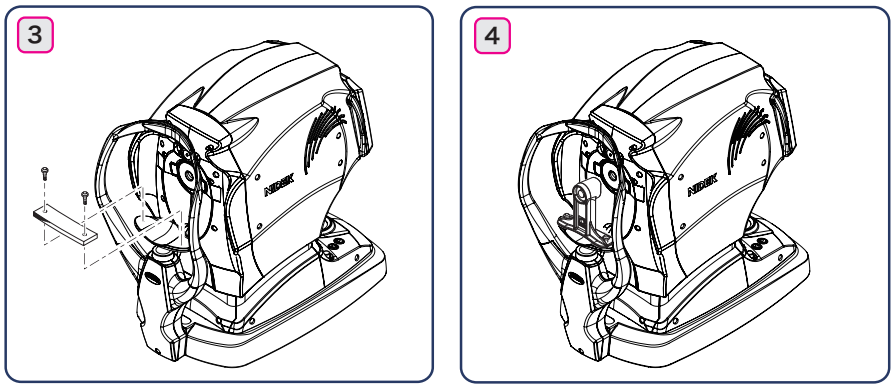
2 Place a contact lens on the contact lens holder with the surface to be measured facing upward.

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 should be read inversely.
- Soft contact lenses cannot be measured.

3.4 NT Measurement: Tonometry and Pachymetry

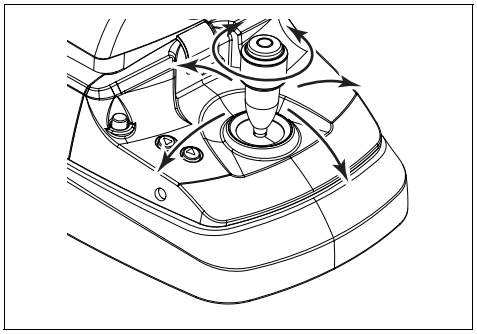
■ This section describes the procedures for tonometry and pachymetry.

The measurement items of measurement mode (tonometry/pachymetry, tonometry, or pachymetry) selected by pressing T/P are displayed on the screen.

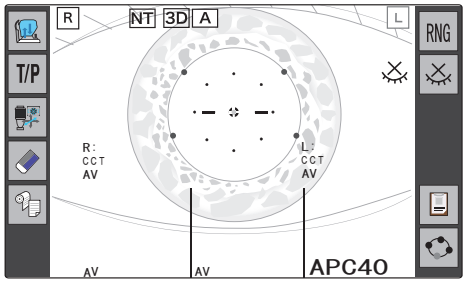
1 Manipulate the joystick to display the patient's eye on the screen.

Moving the joystick right, left, forward, and backward moves the main unit of the device in the same directions. Rotating the joystick knob moves the measuring unit up and down.

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



2 Instruct the patient to look at the fixation light (green spot) in the air nozzle.



3 Press RNG to select the desired measurement range.

Each press of the button switches the measurement range in the following order: [APC40] → [APC60] → [40] → [60] →[APC40]→...

When the device is turned on, [APC40] is set by default.

Measurement range	Guide for selection	Air pressure control
[APC40]	Normal	Air pressure peak is automatically controlled in the range of 1 to 40 mmHg.
[APC60]	Intraocular pressure is 40 mmHg or more.	Air pressure peak is automatically controlled in the range of 1 to 60 mmHg.
[40]	Intraocular pressure fluctuates substantially.	Air pressure peak is fixed in the range of 1 to 40 mmHg.
[60]	Intraocular pressure is 40 mmHg or more and it fluctuates substantially.	Air pressure peak is fixed in the range of 1 to 60 mmHg.

4 As necessary, press [Eyelid detection off] to activate or deactivate the mode.

Displayed	Eyelid detection mode is deactivated.
Not displayed	Eyelid detection mode is activated.

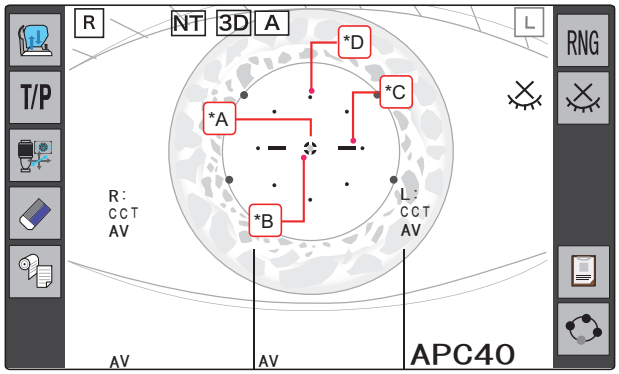
5 Perform alignment and focusing.

Focus the alignment point (*A) so that it appears clearly and align it to the target (*B).

The methods of alignment and focusing differ depending on the setting of auto tracking.

Setting contents "3.2 Measurement Procedures" (page 28)

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



Note

- Confirm that the eyelashes or eyelid is in the applanation area (*A) and the patient's eye is not watery.

  These factors cause measurement errors or decrease the accuracy of measurements.

  If the eyelashes or eyelid is in the applanation area, lift the patient's lid, paying attention not to press against the eyeball.

  If the eye is watery, have the patient blink their eyes or wipe tears.

- Select whether to blink or illuminate the fixation light by setting the parameter [MEASURE] > [NT] > [FIX LED BLINK] to [YES] or [NO].

- Focusing indicator display (page 39)

- When alignment or focusing is not within the working range of auto tracking (page 39)

6 Measurement starts.

When auto shot is set to on, measurement starts automatically when alignment in the up, down, right, and left directions and focusing in the forward/backward direction are optimized.

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

In tonometry/pachymetry mode, pachymetry and tonometry are performed in that order.

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.

- To obtain accurate measured data, measure wide-open, fixated eyes on condition that the patient is placed in a stable position.

- Air may be puffed while the eye is blinking. In this case, accurate measurement data cannot be obtained and the patient will feel uncomfortable.

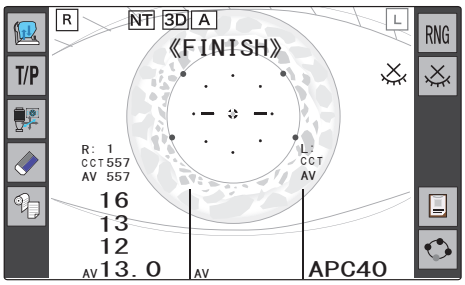
  Pull the joystick toward you so as not to start measurement until the eye stops blinking.

- If the alignment spot does not appear clearly due to corneal injury or such, the device may not start measurement even when alignment and focus are obtained.

  In such a case, press the start button to start measurement.

7 Measurement finishes.

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



- Number of tonometry and pachymetry

The number of tonometry differs depending on the setting of the parameter [MEASURE] > [NT] > [AM MODE*1].

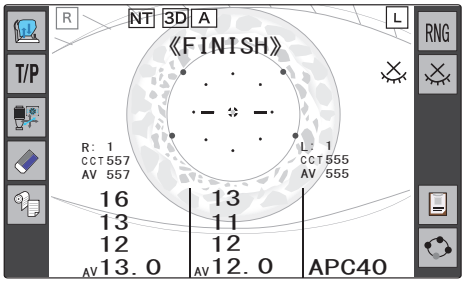
Tonometry	[AM MODE / YES]	When measurements are performed for the number of times specified by the parameter [MEASURE] > [NT] > [NT CONTINUE] and the data is stable (least fluctuation), measurement automatically finishes.
	[AM MODE / NO]	When measurements are performed for the number of times specified by the parameter [MEASURE] > [NT] > [NT CONTINUE], measurement automatically finishes.

Pachymetry	When measurements are performed for the number of times specified by the parameter [MEASURE] > [PACHY] > [PACHY CONTINUE], measurement automatically finishes.

Note

- When the specified number of measurements in pachymetry is not obtained, [<<PACHY?>>] is displayed on the screen. When the start button is pressed, pachymetry stars again. When the specified number of measurements is obtained, [<<FINISH>>] is displayed on the screen.
- To continue the measurement further, press the start button again. [<<FINISH>>] disappears and auto tracking starts again for measurement (except when the parameter [PRINT] > [PRINT1] > [PRINT] is set to [AUTO]).

8 Pull the main unit toward you and measure the other eye in the same manner.



Note

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

*1. In AM mode, measurement automatically finishes when the specified number of stable data sets is obtained.

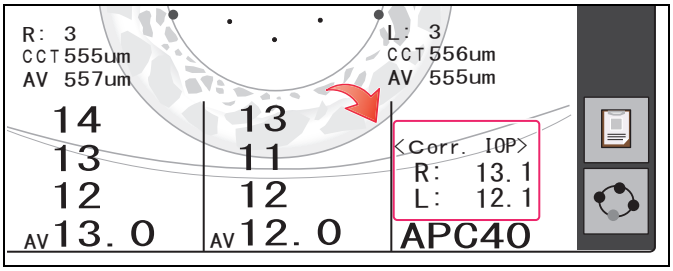
3.4.1 Intraocular pressure correction function

This function enables the device to obtain a corrected intraocular pressure value by recalculating the NT measurement value according to the pachymetry data (displayed on the screen as [CCT]: Central Corneal Thickness).

Activate the intraocular pressure correction function by setting the corresponding parameters beforehand. *“● [PACHY] (pachymetry)” (page 93)*

When using the intraocular pressure correction function, properly set [PARAM1] and [PARAM2] beforehand.

The obtained results (corrected intraocular pressure values) are reference values, and should be used under the responsibility of the operator.



○ Intraocular pressure correction formula

Intraocular pressure correction formula used in the TONOREF III is as shown below.

Refer to other documents for the correction factor to be used in the intraocular pressure correction formula below.

Use the obtained results as reference values.

Corrected intraocular pressure value = NT measured value + Intraocular pressure correction factor

Intraocular pressure correction factor = ([PARAM1] - Pachymetry value) × [PARAM2]

NT measurement value: Intraocular pressure value measured with the TONOREF III

Pachymetry value: Pachymetry value measured with the TONOREF III (μm)

[PARAM1]: Corneal thickness as a reference (300 to 800) (μm)

[PARAM2]: Correction amount adjustment factor (0.0001 to 1.0000)

3.4.2 Adjusting PISTON CONTROL

■ After tonometry, the device aspirates air to puff out for the next measurement. The following explains the function to adjust the time to aspirate air. The purpose of this function is to reduce the possibility of aspirating splattered tear droplets.

Due to the measurement principle, the device puffs air onto the cornea during tonometry. It is known that tears can be splattered at this time. Therefore, if the device aspirates air immediately after measurement, it may aspirate the splattered tears into the air nozzle. Delaying the time to aspirate air reduces the possibility of aspirating the tears.

Note

- Using this function delays aspiration, so the total measurement time becomes longer.

O Required parameter settings

It is necessary to set 2 parameters to use this function.

"4.6 Various Settings" (page 89)

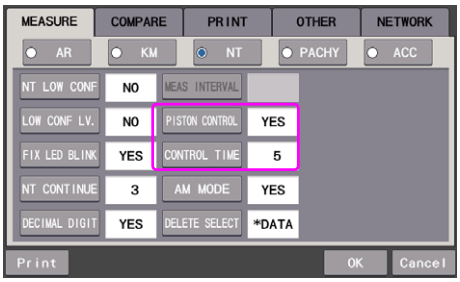
1) Set [MEASURE> NT > PISTON CONTROL] to "YES" on the settings screen.

   [MEAS INTERVAL] is deactivated, and [CONTROL TIME] is activated.

2) Set how many seconds to delay aspiration (1 to 10 seconds) with the parameter [MEASURE> NT> CONTROL TIME].

3) Press [OK].

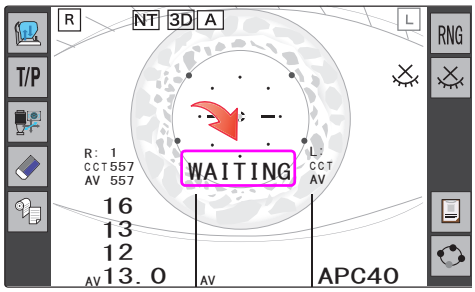
   With this procedure, aspiration is delayed by the number of seconds specified in Step 2).



O Screen display while the device is on standby for aspiration

After the air is puffed until air aspiration is complete, "WAITING" is displayed on the measurement screen.

While "WAITING" is displayed, measurement is not performed even if the start button is pressed.



3.4.3 Error messages during tonometry and pachymetry

Error messages during tonometry and pachymetry are displayed in the numeric fields of the measured values.

○ Error messages during pachymetry

Error message	Details and remedies
[BLK] (Error due to blinking)	Measurement failed due to blinking or slight movement of the patient's eye. Instruct the patient not to blink or not to move the eye until measurement is complete. After the eye has stopped blinking or moving, perform measurement again.
[ALM] (Alignment error)	Alignment is not proper. Perform alignment and measurement again. In manual mode with auto tracking and auto shot set to off, this message is not displayed.
[APL] (Applanation error)	As the eye was not opened sufficiently, corneal applanation was not conducted properly. Instruct the patient to open their eyes wider. If the patient cannot do so, ask an assistant to lift the patient's eyelids using a cotton swab or such.
[OVR] (Outside the measurement range)	The intraocular pressure exceeds the preset measurement range. Switch the measurement range to [APC60] or [60] and perform the measurement again.
[PCE] (APC error)	The patient's eye cannot be measured with the air pressure controlled by the APC function due to substantial fluctuation in intraocular pressure. Switch the measurement range from [APC40] to [40] or from [APC60] to [60].
[TOO CLOSE]	The space between the patient's eye and air nozzle is 9 mm or less. Pull the joystick toward you to increase the space.
[NO SEARCH]	The alignment spot cannot be detected.
[CHECK THE EYE]	This error appears when five consecutive APL errors with measurement values occur. Check the condition of the patient's eye. This error does not appear when five consecutive APL errors without measurement values occur.
[OPEN THE EYE WIDER]	Although alignment is proper, the eyelid detection lights cannot be detected. Instruct the patient to open their eyes wider. This error occurs only when eyelid detection mode is activated.
PRS (Pressure error)	Puffed air pressure during measurement is abnormal. Check the air nozzle cleanliness. Check the puffed air pressure. *(page 33)*

○ Error messages during pachymetry

Error message	Details and remedies
[BLK] (Error due to blinking)	Measurement failed due to blinking or slight movement of the patient's eye. Instruct the patient not to blink or not to move the eye until measurement is complete. After the eye has stopped blinking or moving, perform measurement again.
[ALM] (Alignment error)	Alignment is not proper. Perform alignment and measurement again. In manual mode with auto tracking and auto shot set to off, this message is not displayed.
[Err] (Measurement error)	Measurement illumination intensity is not sufficient. Perform the measurement again.

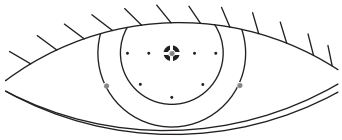
○ If the [CHECK THE EYE] error occurs

Check the condition of the patient's eye.

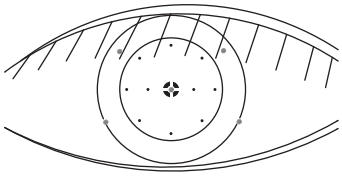
If the patient cannot open their eye wide or eyelashes are over the applanation area, the operator needs to help them open their eye wide.

If the eye is watery, have the patient blink their eyes or wipe tears.

This error is cleared when normal measured data is obtained.



Eyelid is over the applanation area.



Eyelashes are over the applanation area.

The APL error may occur consecutively even though the eye seems to be in normal conditions.

In such a case, set the parameter [MEASURE] > [NT] > [PACHY LOW CONF] to [YES]. The measured value is displayed with a "*" mark, which indicates low confidence data.

Even when a measurement error (APL or ALM) has occurred, the measurement may be performed and measured data may be displayed with the "*" mark. Such data is referred to as "low confidence data".

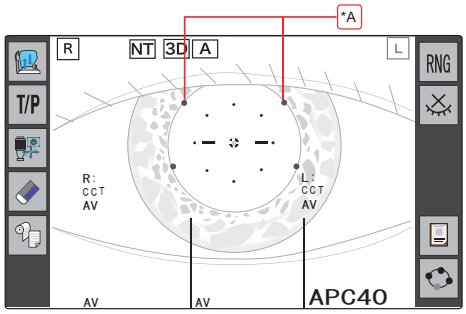
Low confidence data is cleared with the error message, however, it is also possible to display it with the "*" mark as the measured value by setting the corresponding parameter.

○ About eyelid detection mode

When eyelid detection mode is activated, eye-opening is checked by the eyelid detection lights (*A) as shown to the right. (When the eyelid is over the applanation area, the upper two detection lights disappear.)

The measurement automatically starts when the eyelid is opened wide and alignment and focus are obtained.

If eye-opening is insufficient, [OPEN THE EYE WIDER] is displayed and measurement does not start automatically.



3.5 Measured Value Printing

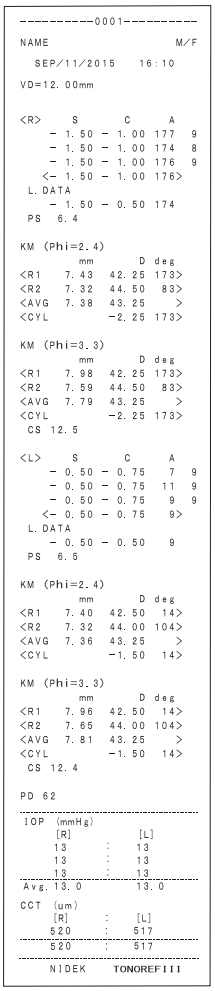
■ Measured values are printed by pressing after measurement.

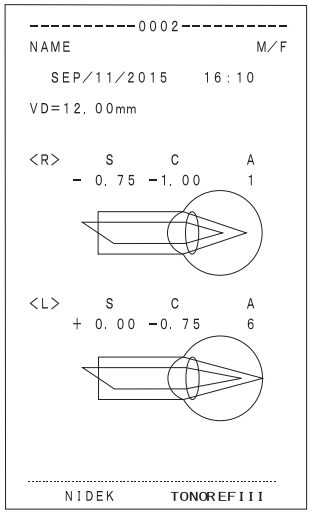
The printing contents can be changed by setting the parameters [PRINT] > [PRINT1] to [PRINT3]. Set the parameters as necessary or desired. *"4.6.1 Parameter settings" (page 89)*

Note

- When the parameter [PRINT] > [PRINT1] > [PRINT] is set to [AUTO], printing starts automatically when measurement for both eyes is complete.
- When the RT or such is connected, printing and data communication are performed at the same time.

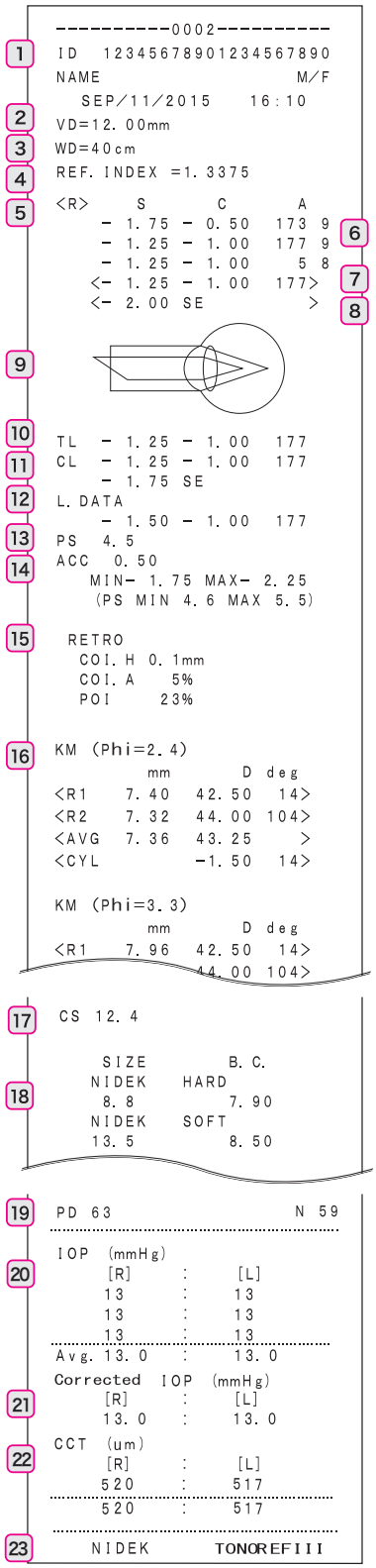
● Sample printout 1





Standard printing	Printing of eye diagram
A sample printout of AR/KM measurement and NT/P measurement with the print parameters set to default	Pressing prints the eye diagram based on the AR median values (or the latest values when median values have not been obtained).

● Sample printout 2



1	Patient ID Patient ID scanned by the optional barcode scanner or magnetic card reader or entered on the summary screen
2	Vertex distance
3	Near working distance
4	Corneal refractive index Printed in KM measurement mode with the parameter [PRINT] > [PRINT2] > [KM PRINT] set to [ALL] or [ALL(KM)]
5	AR measured value (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 When measurement is performed with the chart-illuminating lamp turned off during manual PS measurement, [LAMP=OFF] is printed, and [LAMP=ON] is printed wit the lamp turned on.
14	Accommodation measured values [MIN]: AR minimum measured value, [MAX]: AR maximum measured value ([PS MIN]: Pupil size minimum value, [MAX]: Pupil size maximum value) An accommodation graph is printed depending on the setting of the parameter [RINT] > [PRINT3] > [ACC GRAPH PRINT].
15	Retroillumination analysis values [COI. H]: Central Opacity Index Height, [COI. A]: Central Opacity Index Area POI: Peripheral Opacity Index A retroillumination image is printed depending on the setting of the parameter [PRINT] > [PRINT3] > [RETRO IMAGE PRINT].
16	KM median values R1: Flattest meridian, R2: Steepest meridian, [deg]: Corneal cylinder axis AVG: Average of R1 and R2, CYL: Corneal cylindrical error
17	CS (corneal size) measured value
18	CL select data When the CL select function is activated with (CL select), contact lens data for brands selected by the parameter [PRINT] > [PRINT3] > [CL List] is printed. For brands that have no lenses corresponding to KM measured values, only the brand names are printed. (In the B.C. field, "-----" is printed.)
19	Pupillary distance Distance PD, (Monocular PD), Near PD
20	Intraocular pressure values
21	Corrected intraocular pressure values
22	Corneal thickness
23	Comments Characters and symbols can be freely entered.

3.6 Summary Display

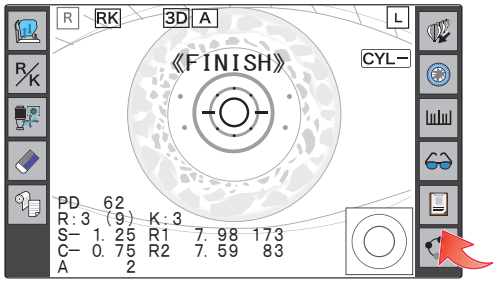
Various measured values can be displayed at the same time on the summary screen. In addition, measured data can be deleted at the measurement item level.

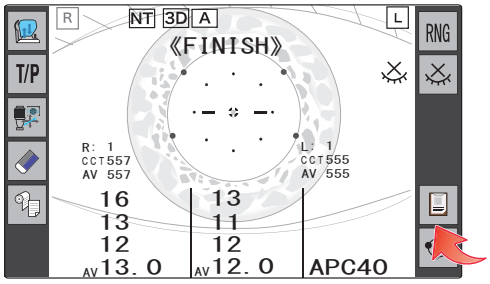
To print or export the measured values, press on the summary screen.

Note

- When the parameter [PRINT] > [PRINT1] > [PRINT] is set to [AUTO], the screen does not switch to the summary screen automatically. After measurement, press to display the summary screen.

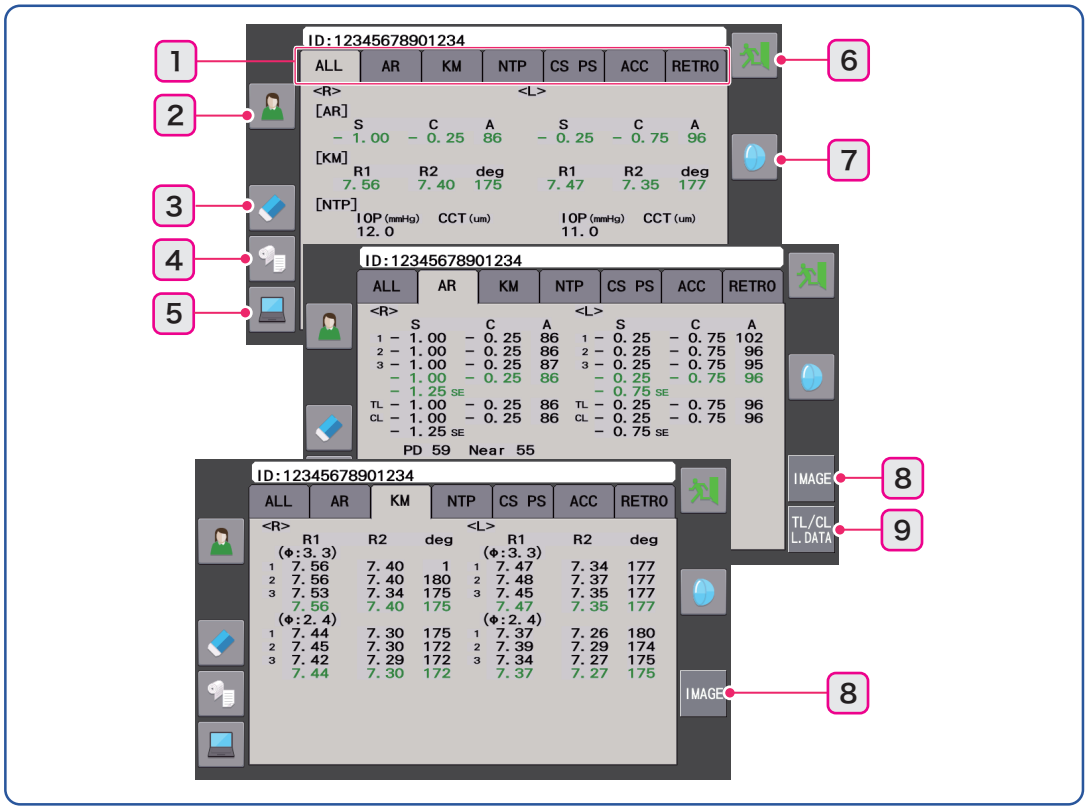
1 Press on the measurement screen to display the summary screen.





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

○ Operation on the summary screen



1	Measurement item tab	Selects the measurement item to be displayed. Touch the desired measurement item tab.
2	ID entry	Enters an ID number. Use the displayed on-screen keyboard. (A number with a maximum of 14 digits can be entered.) *(page 109)*
3	Clear	Clears the measured data of the selected measurement item. Press [OK] in the confirmation message to clear the data. When [ALL] is selected, all the measured data is cleared.
4	Print	Prints the measured results. Although all the measurement items are covered, the printed contents differ depending on the setting of the parameter [PRINT]. If there are no measured results, the printer paper is advanced blankly.
5	Data transmission	Transmits data to the external connected devices.
6	Return	Returns to the measurement screen.
7	CL select	CL select function (CL select data is printed along with KM measured values.) When the CL select function is activated, C L is displayed above the icon and on the AR/KM measurement screen.
8	IMAGE Image display	Displays the image captured during measurement.

9	TL/CL L. DATA Data display switching	AR measurement: Data display switching [L. DATA] (Large area measured values) ↓ ↑ [TL] (Trial lens data) / [CL] (Contact lens conversion value)

Displayed measurement items

[ALL]	AR median value, KM median value, average intraocular pressure, average corneal thickness
[AR]	AR measured value, pupillary distance (distance PD, near PD) Large area measured value ([L. DATA] and [L. DIFF]), measurement ring image Trial lens data and contact lens conversion value can be switched to large area measured value with TL/CL L. DATA. Display the measurement ring image with IMAGE.
[KM]	KM measured value, eye image Display the eye image with IMAGE.
[NTP]	Tonometry, Pachymetry
[CS PS]	CS (Corneal Size) measured value, PS (Pupil Size) measured value
[ACC]	Accommodation measurement value (AR measurement value [MIN]/[MAX], pupil diameter [MIN]/[MAX])
[RETRO]	Retroillumination analysis values ([COI.H], [COI.A], [POI])

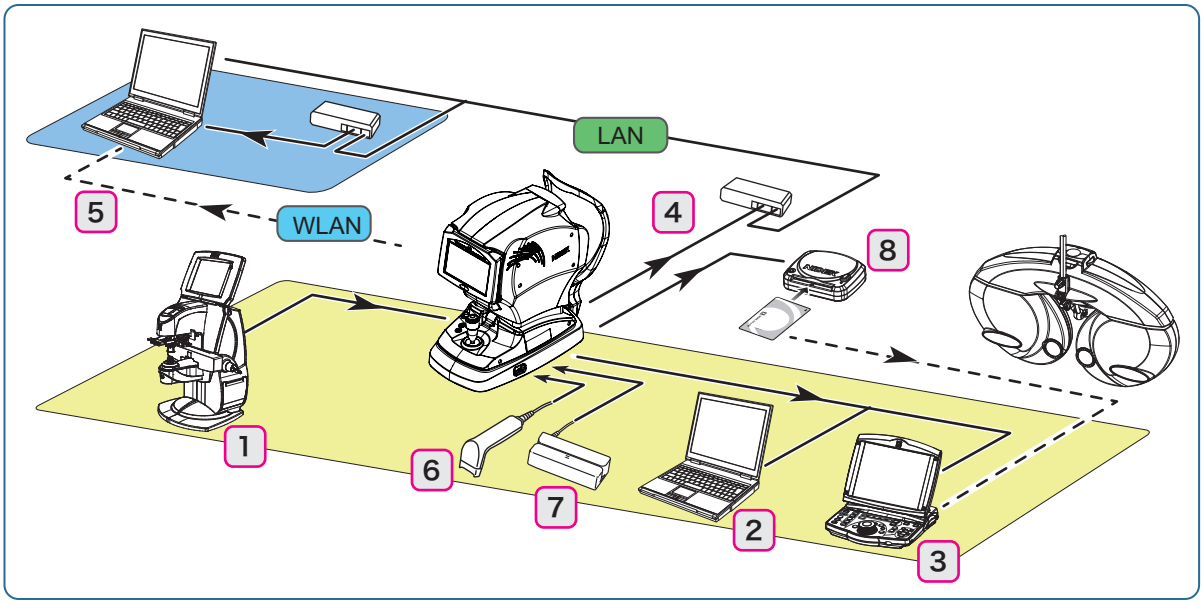
Note

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

3 Press to return to the measurement screen.

3.7 Operation when Peripheral Devices are Connected

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



	Connecting device	Connection terminal	Function
1	NIDEK lensmeter	RS-232C connector input (IN: ⊖)	LM data is imported and printed. It is exported to the RT at the same time.
	Connectable devices: LM-500, LM-600P, LM-970, LM-990A, LM-1000P, LM-1200, LM-1800P/PD		
2	Computer	RS-232C connector output (OUT: ⊖)	AR data 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. RT 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	Computer	LAN connector	AR data and KM data are exported. Measured data is managed by database software.
5		(WLAN: wireless LAN)*1	
6	Barcode scanner (optional)	USB connector	Patient ID is read.
7	Magnetic card reader (optional)		
8	EyeCa-RW2 (optional)	RS-232C connector output (OUT: ⊖)	AR data is exported. (Writing to the Eye Care card with the EyeCa-RW2) AR data is used as objective values in the subjective test by the RT via the Eye Care card.

*1. Depending on the radio laws of each country, the device may not incorporate the wireless LAN module.

⚠ CAUTION

- When connecting the TONOREF III with other devices, confirm that no harms will be caused to the patient, operator, or a third party. Confirm the above also after adding or removing a device to/from the network, or updating or upgrading a device.
- Never connect any equipment other than the optional barcode scanner, magnetic card reader, or EyeCa-RW2 to the device.

  ID cannot be read correctly, measured data cannot be exported, or device malfunction may result.
- When connecting a computer, use one that complies with CISPR 32.
- Be sure to establish LAN connection via a network hub.

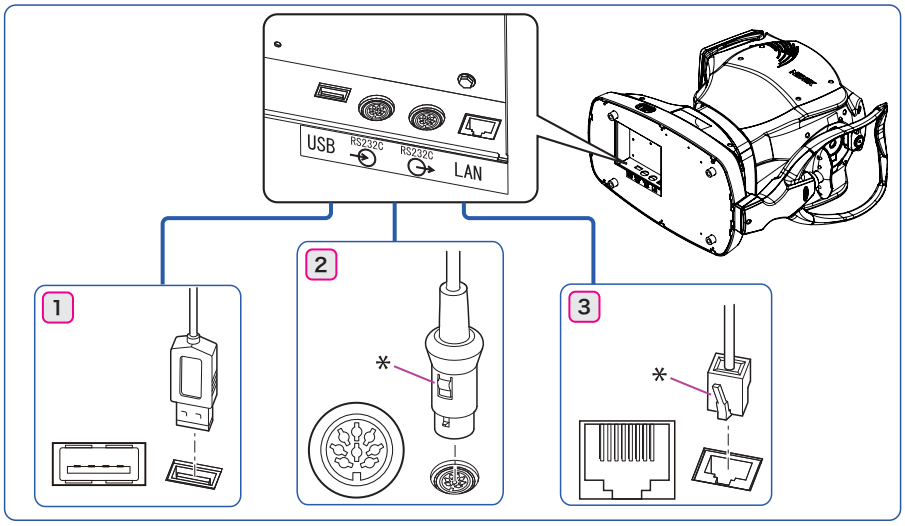
  Data communication may not be properly performed.

3.7.1 Device connecting procedure

⚠ CAUTION

- Before connecting the communication cable, be sure to turn off each device.

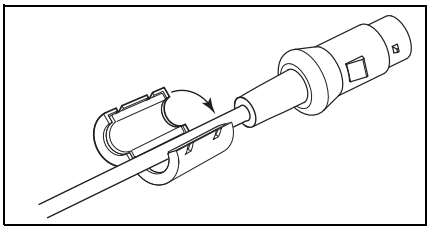
  Connecting the cable with the power on may cause malfunction.



Connect the cable with the device laid 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 the ferrite core (optional) near the plug of the communication cable connected to the device.



Note

- The RS-232C communication cable (optional) to be used differs depending on the connecting device. Contact NIDEK or your authorized distributor for details.
- Before network connection (LAN or WLAN), set parameters of the device and computer after consulting with the network administrator of the facility.

3.7.2 Operating procedure

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

TONOREF III parameter setting	NIDEK LM parameter setting
Maintenance [Serial Communication Settings] > [Baud-Rate]: 9600	Printer = AR print
Maintenance [Serial Communication Settings] > [Bit Length]: 8	RS-232C = NIDEK
Settings [NETWORK] > [SERIAL] > [I/F MODE]: [NIDEK]	Baud rate = 9600
Settings [NETWORK] > [SERIAL] > [LM DATA PRINT]: [YES]	Parity = Odd
For Maintenance, *"4.6.3 Maintenance" (page 101)*.	Data bits = 8
For Settings, *"4.6.1 Parameter settings" (page 89)*.	Stop Bits = 1

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

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

After measurement, press  .

1) Transmit data to the RT (or computer).
   When the device is connected to the RT, it receives data number (ID number) from the RT.
   When the device is connected to a computer, 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 Eye Care card (RS-232C connection)

1) Insert the Eye Care card into the EyeCa-RW2 connected to the device.
2) After measurement, press  .
   The measured data is printed and it is written to the Eye Care card at the same time.

For details, refer to the operator's manual for the EyeCa-RW2.

- Exporting data to the computer (LAN/WLAN)

1) After measurement, press  .
   The measured data is printed and it is transmitted to the computer at the same time.

Note

- On the summary screen, pressing  transmits data to the computer. *"3.6 Summary Display" (page 69)*

● Reading the patient ID with the barcode scanner or magnetic card reader

Note

- Read patient ID before printing the measured results.

  If patient ID is read with the printed measured data displayed, the device regards that data as the former patient's and clears it automatically.
- Read patient ID with R/K measurement screen or NT measurement screen displayed, and then make sure that the patient ID displayed on the screen is correct.

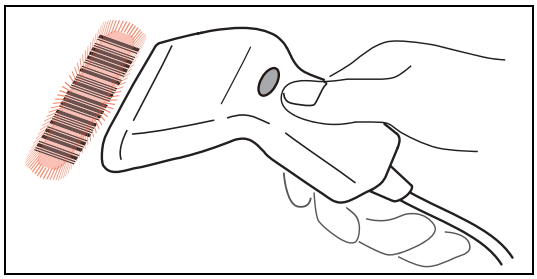
  Depending on the reading environment, patient ID may not be read correctly.
- The device regards the patient ID most recently entered before printing as the patient ID of the data to be printed.

  If an incorrect patient ID has been read, read the correct ID.
- A beep sounds when the device is turned on with the barcode scanner or magnetic card reader connected.

Barcode scanner

Place the scanner window over the barcode and press the trigger button.

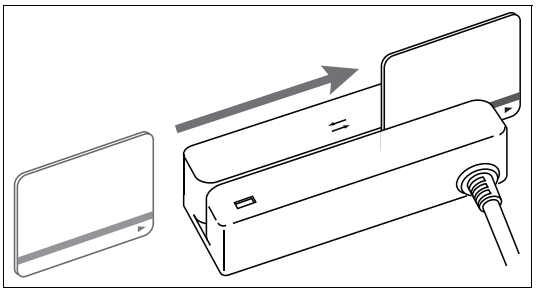
When the barcode has been read successfully, the confirmation LED lights up.



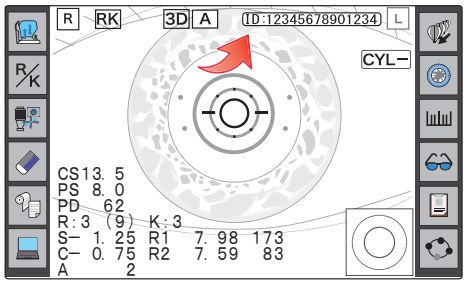
Magnetic card reader

Swipe the card through the magnetic card reader.

A beep sounds and the green LED goes out. When reading is complete, the LED lights up.



When the card has been read successfully, the device displays the ID number indicating that the patient ID has already been read.



Note

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

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

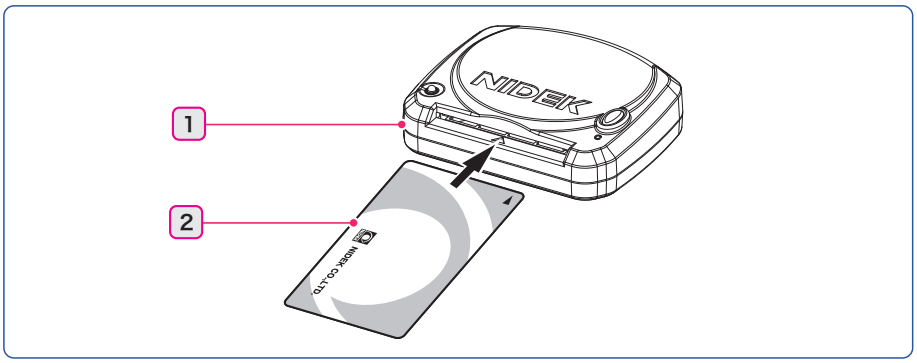
● Transferring data with the EyeCa-RW2

The procedure for writing data to the Eye Care card differs depending on whether the measured data is printed or not.

● When printing measured data

1) Insert the Eye Care card into the TONOREF III on condition that the TONOREF III has no measured data in the internal memory.

   The EyeCa-RW2 emits a short beep and the access indicator illuminates in green.



1	Access indicator
2	Eye Care card

2) Perform measurements.

3) Press  on the measurement screen.

   Follow the same procedure as normal printing.

   The access indicator turns orange and data is written to the Eye Care card.

   When writing is complete successfully, the EyeCa-RW2 emits a short beep and the access indicator blinks in green.

Printing measured value *(page 67)*

4) After confirming that the access indicator of the EyeCa-RW2 blinks in green, eject the Eye Care card.

Note

- Refer to the operator's manual for the EyeCa-RW2 for the other procedures.

● When not printing measured data

Set the parameter [PRINT] > [PRINT1] > [PRINT] to [MANUAL] or [NO] beforehand.

Setting parameters *(page 89)*

1) After measurements, insert the Eye Care card.

   The EyeCa-RW2 emits a short beep and the access indicator illuminates in green. The access indicator turns orange and data is written to the Eye Care card.

   When writing is complete successfully, the EyeCa-RW2 emits a short beep and the access indicator blinks in green.

2) After confirming that the access indicator of the EyeCa-RW2 blinks in green, eject the Eye Care card.

Note

- Never eject the Eye Care card while it is being accessed.

  While the card is being accessed, the access indicator is lit in orange.

  The access indicator blinks in orange when an error occurs. In this case, the card can be ejected.

  If the card is ejected while being accessed, data writing or reading will not be performed properly and the Eye Care card may be irreparably damaged.

● Erasing data on the Eye Care card

All the data on the Eye Care card is erased.

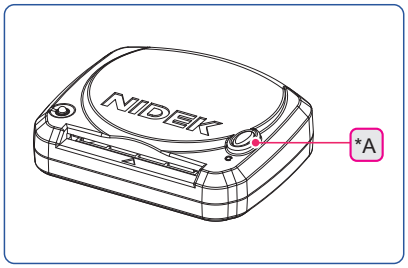
1) Press the clear switch*A of the EyeCa-RW2 for about a second.

   The EyeCa-RW2 emits a short beep and the access indicator blinks in green three times.

2) Insert the Eye Care card.

   The access indicator turns orange and all the data on the Eye Care card is erased.

   When the data has been erased, the EyeCa-RW2 emits a longer beep and the access indicator blinks in green.



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.

Symptom	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 measurement screen has suddenly changed to the initial screen.	• Sleep mode may have been activated. Touch the screen or 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 parameter [PRINT] > [PRINT1] > [PRINT] may be set to [NO]. Reset the parameter. *(page 95)*
The printer operates, however, printing is not possible.	• The printer paper may be loaded with the incorrect side up. Set it with the correct side up.
When power is turned on or  is pressed, [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. •  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 a tilted angle or the core of the roll may not be placed properly. Open the printer cover and make sure that printer paper is properly loaded.

Symptom	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  . • Room illumination may be reflecting on the cornea. Change the location and start measurement again. • The auto tracking function or auto shot function may not work for kerato-conus or recently-operated cornea. In such cases, turn off the auto tracking function and start measurement. • For patients who have severe eye nystagmus or who cannot fixate their eyes, the auto tracking function or auto shot 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 location 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 their eye wider, lift their eyelid, paying attention not to press against the eyeball. • The data may be beyond the measurable limit. R/K measurement • The pupil may be too small to be measured. Have the patient sit in a darkened room until their pupils enlarge more and try measurement again. NT measurement • The patient may not look at the fixation light. Instruct the patient to look at the fixation light.
[CHECK MEASURING WINDOW] is printed out at device start-up.	• Clean the measuring window. *(page 118)* • If the measuring window is not soiled, make sure that there are no people or objects in front of the measuring window at device start-up.
[PRESSURE PEAK ERROR], [PRESSURE SLOPE ERROR], or [CHECK MEASURING WINDOW] is printed out at device start-up.	• Clean the air nozzle. *(page 119)*

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 printed out or displayed on the screen, follow the suggestions in the cause and remedy column.

Notify NIDEK of the error code, message number, and serial number of your device so that NIDEK can offer appropriate service.

Error message	Cause and remedy
[No. 001 EEPROM error.]	• Loss of backup memory (EEPROM) data due to exogenous noise such as static electricity or malfunction of the electric circuit board is probable. • If the same error code is displayed again even after the device is turned off and on again, turn off power to the device and contact NIDEK or your authorized distributor.
[No. 002 Clock error.]	• Because the built-in battery has been discharged after about one month or longer of nonuse, the date and time settings may have become incorrect, or malfunction of 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 ERROR]	• 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.
⚠ [Out Of Paper]	• If the printer runs out of paper, load a new paper roll. 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.
[No. 201 Piston error.]	• Piston locking, solenoid position sensor malfunction, or cable breakage is probable. • Pressing the start button of the joystick while the piston error is displayed may release the locked piston because the piston is driven by a force stronger than usual. • If the same error code is displayed even when the start button is pressed, shut off the device and contact NIDEK or your authorized distributor.
[No. 601 USB device error.]	• The connected USB device 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.

[No. 031 Up/Down motor error.]	[No. 101 AR Sensor error.]
[No. 032 Right/Left motor error.]	[No. 111 Thermistor error.]
[No. 033 Back/Forth motor error.]	[No. 112 AR Prism motor error.]
[No. 034 Chin motor error]	[No. 121 Cylinder1 motor error.]
[No. 043 Printer error.]	[No. 122 Cylinder2 motor error.]
[No. 044 Printer Communication error.]	[No. 202 Charge error.]
[No. 053 Error related to the switchover to the R/K measuring unit.]	
[No. 054 Error related to the switchover to the NT measuring unit.]	
[No. 055 Error related to switchover of the measuring unit.]	

● Network communication

● RS232C

Error message	Cause and remedy
[No.011 to No.018 Communication error. (Output Port)]	• Errors related to data transmission • 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.
[No.021 to No.028 Communication error. (Input Port)]	• Errors related to data reception • Check whether the communication cable is properly connected to the input port. • Check whether the parameters related to communication are properly set.

● LAN

*1: Errors displayed when the wireless LAN is set

Error message	**Cause and remedy**
[No. 700 CIFS error.]	• Error related to Windows file sharing
[No. 900 CIFS error.]*1	
[No. 902 SSID error]*1	• Error related to SSID • Check the access point power supply, SSID name, security, and password.
[No. 703 Hardware error.]	• Error related to the IC board IC was reset due to electrostatic discharge or such. • If the same error code is displayed again even after the device is turned off and on again, turn off power to the device and contact NIDEK or your authorized distributor.
[No. 903 Network error.]*1	• Error related to the WLAN setting or WLAN module WLAN was reset due to electrostatic discharge or such. • If the same error code is displayed again even after the device is turned off and on again, turn off power to the device and contact NIDEK or your authorized distributor.
[No. 704 DHCP error.]	• Error related to DHCP The IP address cannot be obtained.
[No. 904 DHCP error.]*1	
[No. 750 Unable to access to the network.]	• 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.
[No. 751 Unable to write files to the PC.]	• The operator may have no write authority for the folder in the destination PC or no free space is left. • Give the operator write authority for the folder in the destination PC and free up space.
[No. 951 Unable to write files to the PC.]*1	

Error message	Cause and remedy
[No. 754 No PC under the computer name found in the network.] [No. 954 No PC under the computer name found in the network.]*1	• PC with the specified name does not exist. • Check the connection of the LAN cable / wireless LAN. Or check whether the specified PC name is correct.
[No. 756 Unable to logon to the PC.] [No. 956 Unable to logon to the PC.]*1	• The PC cannot be logged on (The domain name, user name, or password is not correct). • Check the domain name, user name, and password, and enter them correctly.
[No. 757 No shared folder found.] [No. 957 No shared folders found.]*1	• The shared folder does not exist in the PC (The name of the shared folder is not correct). • Check the folder name and whether the folder is set to be shared.
[No. 758 Network timeout.] [No. 958 Network timeout.]*1	• The PC did not finish the process in a specified time. • Check the connection of the LAN cable / wireless LAN, then send the data.
[No. 759 Unable to delete files on the PC.] [No. 959 Unable to delete files on the PC.]*1	• The data in the computer cannot be deleted. (Deletion was attempted for data with the read-only attribute.) • Disable write protection of the shared folder in the computer.
[No. 760 Initializing the network. Please retry.]	• Error indicating that the network is being initialized. (The initialization takes some time after the device start-up.) • Retry access to the network later.
[No.761 Access denied.]	• The file sharing setting of the PC is not proper. • Check the file sharing setting of the PC.
[No. 762 This account is invalid.]	• The account is invalid. (The user setting is improper.) • Check the network setting of the device.
[No. 763 Unable to read files on the PC.] [No. 963 Unable to read files on the PC.]*1	• Data cannot be read. • Check the setting of the PC.
[No. 766 The entered file name already exists. Unable to write the file to the PC.] [No. 966 The entered file name already exists. Unable to write the file to the PC.]*1	• Because a file with the same name exists in the PC, writing is not possible. • Change the file name or delete the file.
[No. 771 Network cable is not connected.]	• The LAN cable is not connected. • Connect the cable. Check the connection of the connector.
[No. 772 There is no response.] [No. 972 There is no response.]*1	• Error related to response The file is deleted within 5 seconds or not renamed. • Check whether the acquisition 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.

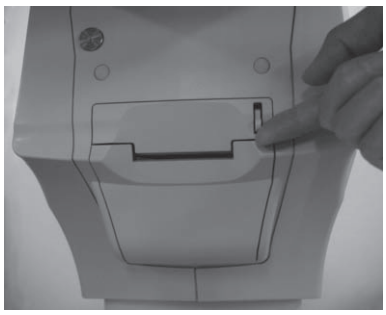
⚠ CAUTION

- When the printer paper is replaced after it has run out, the rest of the data is printed, however, the paper is not automatically cut. In such a case, be sure to reprint the data.
- 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.

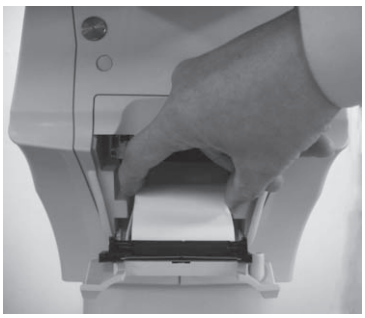
1 Pull the bottom of the touch screen to make it face up.

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

2-1



2-2

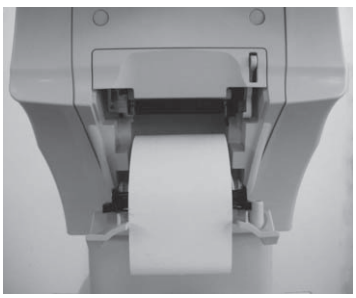


3 Insert a new printer paper roll.

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.

3



4

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.

4 Close the printer cover.

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

Note

- Confirm that the cover is securely closed.

  If the cover is insecurely closed, the auto cutter may not operate properly. In addition, when  is pressed, [ERROR] or [Out Of Paper] may appear and printing will not occur.

4.4 Chinrest Paper Attachment

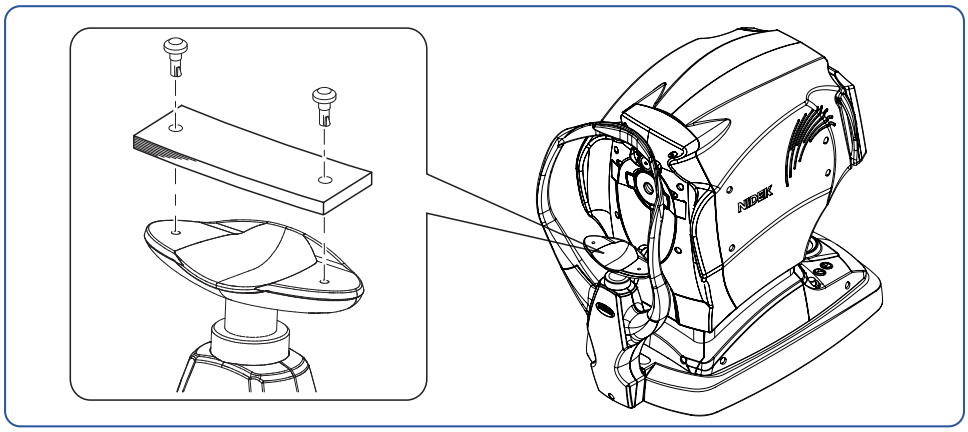
1 Remove the two fixing pins from the chinrest.

2 Take a suitable amount of chinrest paper out of the pack.

An entire pack of chinrest paper cannot be attached. Be sure to attach a stack with a thickness of 6 mm or 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.



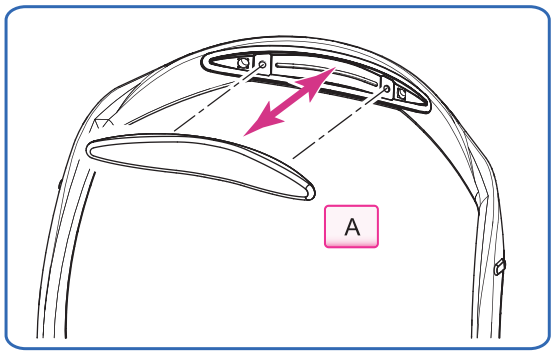
4 Attach the stack of chinrest paper onto the chinrest.

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

4.5 Forehead Rest Pad Replacement

■ Magnetic forehead rest pad (30611-1520)

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

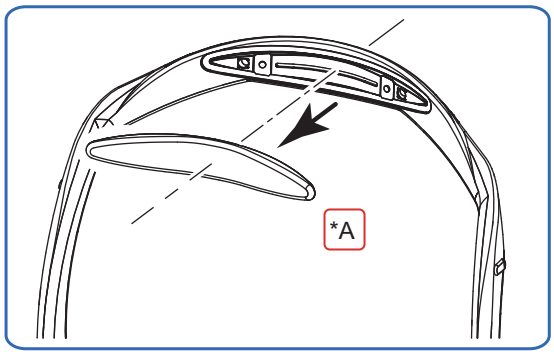


■ Forehead rest pad (15411-M752)

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

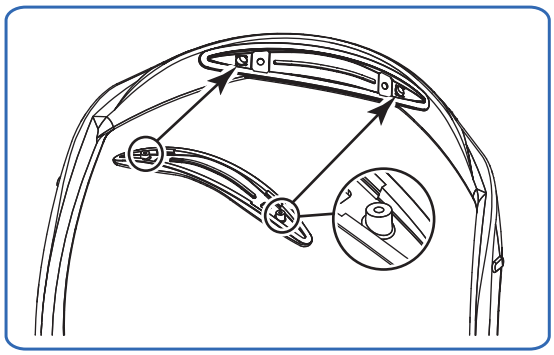
1 Remove the forehead rest pad or magnetic forehead rest pad (*A) from the frame.

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



2 Attach a new forehead rest pad.

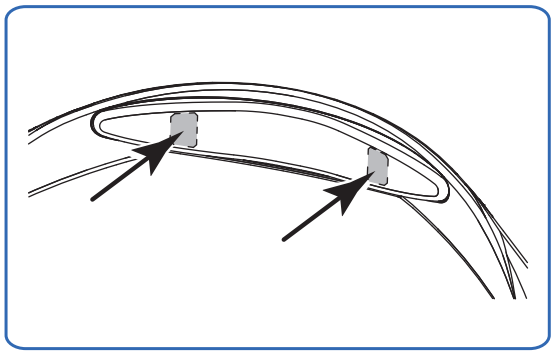
1) Align the clasps of the forehead rest pad to the holes in the frame.



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

   The forehead rest pad is locked by the fasteners.

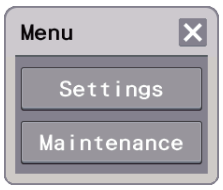
3) Confirm that the forehead rest pad is securely attached.



4.6 Various Settings

Various device parameter settings can be changed on the Settings and Maintenance screens.

1 Press to display the Menu window.



2 Select [Settings] or [Maintenance] depending on the desired parameter item.

[Settings]: measurements, printing, communication (data), and such

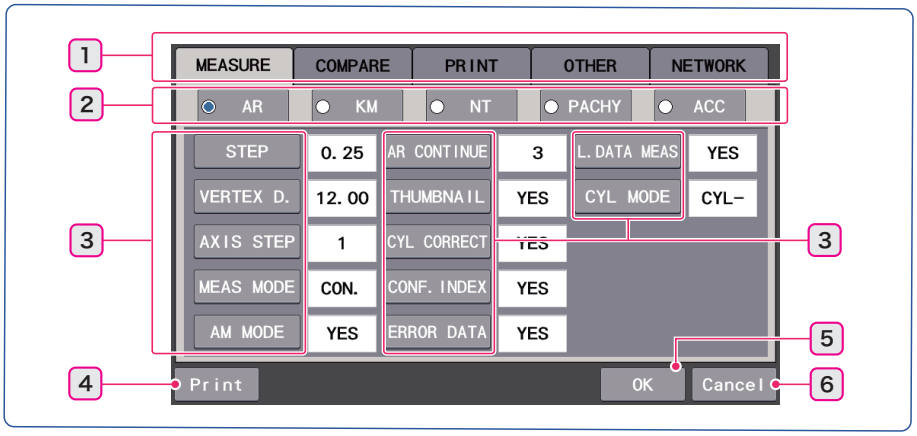
[Maintenance]: connections with external connected devices, date and time setting of the device, and such

4.6.1 Parameter settings

Change the parameter settings on the Settings screen.

1 Press the [Settings] button on the Menu window.

The [Settings] screen is displayed.



1	Major item select tabs	Major items: MEASURE, COMPARE, PRINT, OTHER, NETWORK
2	Medium item select radio buttons	Select medium items when they are on the screen.
3	Parameter setting buttons	Set various parameter items.
4	[Print]	Prints all the set parameters.
5	[OK]	Confirms the changed parameter setting and returns to the measurement screen.
6	[Cancel]	Cancels the changed parameter setting and returns to the measurement screen.

Note

- The parameter settings are retained even though the device is turned off.
- After changing parameter settings, do not turn off the device before pressing [OK]. Otherwise, parameter settings are not saved.

4.6.2 Parameter tables

Note

- Underlined options indicate factory settings.

○ [MEASURE]

● [AR] ([AR] measurement)

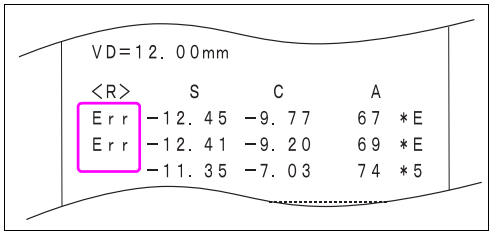
Parameter item	Setting contents
[STEP]	**[0.01] / [0.12] / [0.25]** Selects the display increments (diopter) of [SPH] or [CYL] for [AR] measurement.
[VERTEX D.]	**[0.00] / [10.50] / [12.00] / [13.75] / [15.00] / [16.50]** Selects the distance (mm) between the corneal vertex to the spectacle lens when the patient wears glasses.
[AXIS STEP]	**1 / 5** Selects the display increments (°) of [AXIS] for [AR] measurement.
[MEAS MODE]	**[CON.] / [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.
[AM MODE]	**[YES] / [NO]** Sets whether to use [AM] mode for [AR] measurement. **[YES]:** Measurements are taken for the number of times set by the [AR CONTINUE] parameter. When the median value is obtained, the measurement finishes. When the median value is not obtained, two additional measurements are taken. **[NO]:** When measurements are taken for the number of times set by the [AR CONTINUE] parameter, the measurement finishes.
[AR CONTINUE]	**3 to 10** (Default setting: 3) Sets the number of measurements to complete the measurement cycle (FINISH).
[THUMBNAIL]	**[YES] / [NO] / [LOW CONF]** Sets the thumbnail display of the measurement ring image. **[YES]:** A thumbnail of the measurement ring image is displayed to the lower right of the screen when AR measurement is complete. Pressing the thumbnail displays the ring image in full screen. **[NO]:** No thumbnail of the measurement ring image is displayed. **[LOW CONF]:** When the confidence index is 7 or less after [AR] measurement, a thumbnail of the measurement ring image is displayed.
[CYL CORRECT]	**[YES] / [NO]** Sets whether to present the chart with astigmatism correction.
[CONF. INDEX]	**[YES] / [NO]** Sets whether to print the confidence index. When [NO] is selected, the confidence index is not displayed on the measurement screen.
[ERROR DATA]	**[YES] / [NO]** Sets whether to display and print erroneous data of [AR] measurement.

Parameter item	Setting contents
[L. DATA MEAS]	**[YES]** / **[NO]** Sets whether to print large area measured values. Sets whether to include large area measured values into data transferred to the [RT]. **[YES]:** Large area measured values are printed. When the parameter [NETWORK] > [SERIAL] > [RT TYPE] is set to [5100], [AR] measured value and large area measured value are transferred at one time. When the parameter is set to [OLD], they are transferred in twice. **[NO]:** Large area measured values are not printed. They are not transferred to the [RT], either.
[CYL MODE]	**[CYL±]** / **[CYL-]** / **[CYL+]** Selects the display format of the CYL value (cylindrical refractive error). [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. In other cases, the CYL value is indicated by - reading. • Cylinder mode can be changed even after measurement. • All saved data is printed according to CYL mode set at the time of printing.

- Sample printout of erroneous data

  When [ERROR DATA] 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 [CONF. INDEX] is set to [YES], [E] is printed for erroneous data.

- [KM] ([KM] measurement)

Parameter item	Setting contents
[KM UNIT]	**[mm]** / **[D]** Selects the display unit of the corneal curvature radius between “corneal curvature radius (mm)” and “corneal refractive power (D)”.
[KM DISPLAY]	**[R1. R2]** / **[AVG. CYL]** Selects the measurement display between “R1 (flattest meridian) and R2 (steepest meridian)” and “AVG (averages of R1 and R2) and CYL (corneal cylindrical power)”.
[REF. INDEX]	**[1.3380]** / **[1.3375]** / **[1.3360]** / **[1.3320]** / **[1.3315]** Selects the corneal refractive index for [KM] measurement.
[KM CONTINUE]	**3 to 10** (Default setting: 3) Sets the number of measurements to complete the measurement cycle.
[KM STEP]	**[0.01]** / **[0.12]** / **[0.25]** Selects the display increments (diopter) of corneal refractive power (dioptric power converted from corneal curvature radius) for KM measurement.

Parameter item	Setting contents
[KM AREA]	**[3.3/ 2.4] / [3.3]** Measures corneal refractive powers in the specified areas. [3.3/2.4]: Diameter areas of 3.3 mm and 2.4 mm [3.3]: Diameter area of 3.3 mm

- [NT] (tonometry)

Parameter item	Setting contents
[NT LOW CONF]	**[YES] / [NO]** Selects whether to display low confidence data. **[YES]:** Displays low confidence data. This confidence data is saved. **[NO]:** Error message and low confidence data are displayed in yellow. They are cleared after some time.
[LOW CONF LV.]	**[YES] / [NO]** Selects whether to display low confidence data level when [NT LOW CONF] is set to [YES]. **[YES]:** Displays low confidence data level. The level is indicated with “*3” to “*1” beside low confidence data. The smaller the number is, the lower the confidence becomes. **[NO]:** Low confidence data is marked by “*” regardless of the level of confidence. However, the level is displayed in the LAN communication.
[FIX LED BLINK]	**[YES] / [NO]** Sets whether to blink the fixation light.
[NT CONTINUE]	**1 to 10** (Default setting: 3) Sets the number of measurements to complete the measurement cycle.
[DECIMAL DIGIT]	**[YES] / [NO]** Sets the measurement average value to either decimal point representation or integer representation. **[YES]:** Displays the average value to one decimal place. **[NO]:** Rounds off to the nearest integer.
[MEAS INTERVAL]	**[SHORT] / [NORMAL] / [LONG]** Sets the measurement interval**.** Deactivated when [PISTON CONTROL] is set to “ON”.
[PISTON CONTROL]	**ON / OFF** Selects whether to turn on the function to delay air aspiration after tonometry.
[CONTROL TIME]	**1 to 10** (Default setting: 5) Sets how many seconds to delay air aspiration after tonometry. Deactivated when [PISTON CONTROL] is set to “OFF”.

Parameter item	Setting contents
[AM MODE]	**[YES]** / **[NO]** Sets whether to use AM mode for NT measurement. **[YES]:** When measurements are taken the number of times set by the [NT CONTINUE] parameter and the data is stable (least fluctuation), measurement automatically finishes. Measurement continues until stable data is obtained. However, when [NT CONTINUE] is set to “1”, measurement finishes after one measured data item is obtained. **[NO]:** Regardless of the number set by the [NT CONTINUE] parameter, measurement does not automatically finish.
[DELETE SELECT]	**[*DATA]** / **[TIME]** Sets how to delete measured data. **[*DATA]:** When the number of measurements exceeds the number set by the [NT CONTINUE] parameter, the low confidence data sets marked with “*” are deleted in order from the lowest. **[TIME]:** When the number of measurements exceeds the number set by the [NT CONTINUE] parameter, the data sets are deleted in order from the oldest.

4

- [PACHY] (pachymetry)

Parameter item	Setting contents
[PACHY MEAS TIME]	**[QUICK]** / **[NORMAL]** / **[LONG]** Sets the measurement interval.
[PACHY CONTINUE]	**1 to 10** (Default setting: 1) Sets the number of measurements to complete the measurement cycle.
[PACHY LOW CONF]	**[YES]** / **[NO]** Selects whether to display low confidence data. **[YES]:** The level is indicated with “*3” to “*1” beside low confidence data. The smaller the number is, the lower the confidence becomes. This confidence data is saved. **[NO]:** Error message and low confidence data are displayed in yellow. This data is not saved.
[CORR. IOP]	**[YES]** / **[NO]** Sets whether to activate the intraocular pressure correction function. **[YES]:** The intraocular pressure correction function is activated. Tonometry data is corrected according to measured pachymetry data. It is necessary to set [PARAM1] and [PARAM2]. **[NO]:** The intraocular pressure correction function is deactivated.
[PARAM1]	**300 to 800** Can be set when [CORR. IOP] is set to [YES].
[PARAM2]	**[0.0001] to [1.000]** Can be set when [CORR. IOP] is set to [YES].

● [ACC] (accommodation measurement)

Parameter item	Setting contents
[ACC STEP]	**[0.01] / [0.12] / [0.25]** Sets the accommodation value increments (diopter) displayed on the accommodation measurement screen.
[T. POSITION]	**[0.0] / [+0.5] / [+1.0] / [+1.5] / [+2.0] / [+2.5] / [+3.0] / [+3.5] / [+4.0] / [+4.5] / [+5.0]** Selects the amount (diopter) by which the chart initial position is shifted from the SPH value in the plus direction at the start of accommodation measurement.

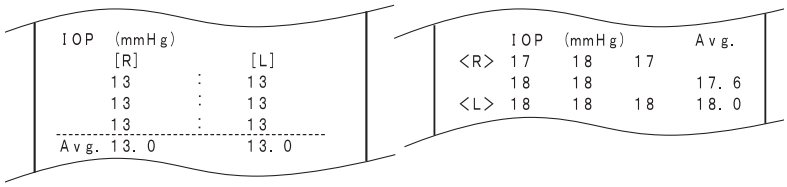
○ [COMPARE]

Parameter item	Setting contents
[ADD SELECT]	**[1.50] / [1.75] / [2.00]** Sets the addition power (diopter) while near vision is viewed.
[L. DATA SELECT]	**[YES] / [NO]** When [YES] is selected, large area measured values are used for the corrective lens to be used in the vision comparison function. When large area measured values are not obtained, [AR] measured values are used.

○ [PRINT]

● [PRINT1]

Parameter item	Setting contents
[PRINT]	**[MANUAL] / [AUTO] / [NO]** **[MANUAL]:** Pressing  starts printing. **[AUTO]:** Printing starts automatically when measurement is complete. **[NO]:** Printing does not occur. (Data communication occurs.)
[ECONO. PRINT]	**[YES] / [NO]** When [YES] is selected, printing occurs with reduced line-spacing to save printer paper.
[PRINT&CLEAR]	**[YES] / [NO]** Clears measured data automatically after printing. When [NO] is selected, the measured data is cleared when the next measurement is taken after printing.
[PRINT DENSITY]	**[LOW] / [MEDIUM] / [HIGH]** Density of printed text
[PATIENT NO.]	**[YES] / [NO]** Sets whether to print the patient number.
[SET PATIENT NO.]	**0001 to 9999** Sets the patient number in the range from 0001 to 9999.
[NAME PRINT]	**[YES] / [NO]** Sets whether to provide printing spaces for the patient's name and sex.
[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.
[PRINT COMMENT]	**[YES] / [NO]** Sets whether to print comments.
[COMMENT]	Up to 48 alphanumeric characters can be entered on the keyboard screen. (Default setting: NIDEK TONOREFIII)
[ARK 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 / KM value) and the left eye (AR value / accommodation value / retroillumination analysis 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), and KM values (right/left). **[R→L(B)]:** Printing occurs in the order of the right eye (AR value / KM value / accommodation value / retroillumination analysis value) and the left eye (AR value / KM value / accommodation value / retroillumination analysis value). **[AR→KM(B)]:** Printing occurs in the order of AR values (right/left), KM values (right/left), accommodation values (right/left), and retroillumination image analysis values (right/left).

Parameter item	Setting contents
[NT PRINT FORMAT]	**[V]** / **[H]** / **[NO]** **[V]**: Prints NT and PACHY measured values vertically. **[H]**: Prints NT and PACHY measured values horizontally. **[NO]**: NT and PACHY measured values are not printed.  **[V]** **[H]**
[AR/NT CUT]	**[YES]** / **[NO]** AR measured data and NT measured data are printed and cut separately.

● [PRINT2]

Parameter item	Setting contents
[AR PRINT]	**[SHORT] / [ALL]** Selects the print format of AR measured data. **[SHORT]:** Only median values are printed. **[ALL]:** All data and median values are printed.
[KM PRINT]	**[SHORT] / [ALL] / [ALL(KM)]** Selects the print format of KM measured data. **[SHORT]:** Only median values are printed. **[ALL]:** All data and median values are printed. **[ALL(KM)]:** In KM measurement mode, all data and median values are printed. In other modes, only median values are printed.
[CAT MARK]	**[YES] / [NO]** Sets whether to print "*" representing that measurement has been taken in cataract measurement mode.
[SE PRINT]	**[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).
[ERROR PRINT]	**[YES] / [NO]** Selects whether to print failed AR data.
[EYE PRINT]	**[YES] / [NO]** Sets whether to print eye diagrams.
[TL PRINT]	**[YES] / [NO]** Sets whether to print trial lens data based on the AR median values (or the latest values when the median values have not been obtained).
[CL PRINT]	**[YES] / [NO]/ [AUTO]** Sets whether to print contact lens conversion values based on the AR median values (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. **[AUTO]:** Conversion values and SE value are printed when the CL select function is activated. They are not printed when the CL select function is deactivated.
[L. DATA PRINT]	**[DIFF] / [DATA] / [DATA&DIFF]** Sets the print contents of large area measured values for AR measurement. **[DIFF]:** The differentiation [L. DIFF] between central measured values (normal AR values) and large area measured values is printed. **[DATA]:** Large area measured values [L. DATA] are printed. **[DATA&DIFF]**: Both the contents of [DATA] and [DIFF] are printed.

● [PRINT3]

Parameter item	Setting contents
[NEAR PD PRINT]	**[YES] / [NO]** Sets whether to print the near PD value.

Parameter item	Setting contents
[WORKING D.]	**35 to 70 cm** (5 cm increments) (Default setting: 40 cm) **14 to 28 inch** (2 inch increments) The indication of [WD Unit] is toggled between [cm] and [inch]. Sets the near working distance referred to for calculation of near PD. The setting is also used as the near working distance for the vision comparison function.
[RETRO IMAGE PRINT]	**[YES] / [NO]** Sets whether to print the retroillumination image.
[ACC GRAPH PRINT]	**[YES] / [NO]** Sets whether to print the accommodation graph.
[CL Settings]	Up to 10 contact lens data items (No. 1 to No. 10) can be registered. Press the [CL Settings] button to display the lens setting screen for registration. *(page 114)*
[CL List]	Displays lists of the registered contact lenses. *(page 115)*

○ [OTHER]

Parameter item	Setting contents
[WINDOW CHECK]	**[DAY] / [YES] / [NO]** Sets whether to automatically check the measuring window cleanliness. **[DAY]:** The measuring window is checked at the first start-up of the day. **[YES]:** The measuring window is checked every start-up. **[NO]:** The measuring window is not checked.
[TRACKING SW]	**[NORMAL] / [ALL]** Selects the type of the auto tracking function ([3D]/[2D]/OFF) and auto shot function (ON/OFF) by pressing  . **[NORMAL]:** Select from among [3D/ON], [3D/OFF], or [OFF/OFF]. **[ALL]:** Select from among [3D/ON], [3D/OFF], [2D/ON], [2D/OFF], [OFF/ON], or [OFF/OFF].
[SLEEP]	**[NO] / [5MIN] / [10MIN] / [15MIN]** Selects the length of idle time for the device to automatically display the initial screen (auto-sleep function).
[BEEP]	**[NO] / [LOW] / [HIGH]** Selects the pitch of the beep (electronic sound) produced during measurement or such.
[LCD BRIGHTNESS]	**[LOW] / [MEDIUM] / [HIGH]** Sets the brightness of the LCD.
[PRESSURE CHECK]	**[DAY] / [YES] / [NO]** Sets whether to automatically check the puffed air pressure during tonometry. **[DAY]:** The puffed air pressure is checked at the first start-up of the day. **[YES]:** The puffed air pressure is checked every start-up. **[NO]:** The puffed air pressure is not checked.

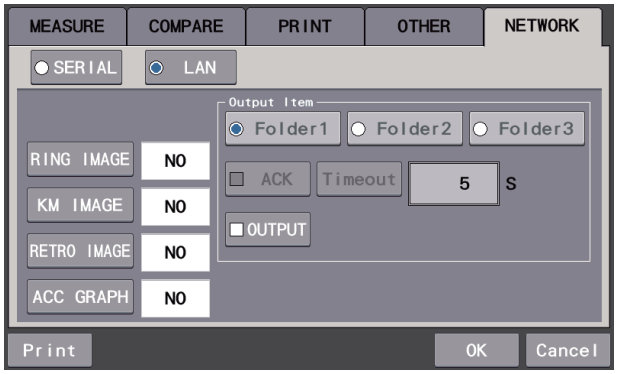
Parameter item	Setting contents
[CHANGE MODE]	**[MANUAL] / [AUTO]** Sets the method to switch from R/K measurement to NT measurement in RKT successive mode. **[MANUAL]:** After R/K measurement, pulling the main unit fully toward you and pressing the start button switch to NT measurement. **[AUTO]:** After R/K measurement, pulling the main unit fully toward you with [PULL BACK] displayed on the screen automatically switches to NT measurement.
[TOO CLOSE BEEP]	**[YES] / [NO]** Sets whether to produce a beep when the [TOO CLOSE] error occurs.
[AUTO PD]	**[YES] / [NO]** Sets whether to measure the Pupillary Distance (PD) automatically for AR measurement.
[AUTO PS]	**[YES] / [NO]** Sets whether to measure the Pupil Size (PS) automatically for AR measurement.
[AUTO CS]	**[YES] / [NO]** Sets whether to measure the Corneal Size (CS) automatically for KM measurement.

○ [NETWORK]

● [SERIAL]

Parameter item	Setting contents
[I/F MODE]	**[NIDEK] / [NIDEK2] / [NCP10]** Selects the device to communicate with. **[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] offers the same settings as [NIDEK] with an extended timeout period. In the communication environment where timeout occurs with [NIDEK] setting, select [NIDEK2].
[I/F FORMAT]	**[SHORT] / [SHORT2] / [ALL]** Selects the format of data to be transmitted. **[SHORT]:** Only median values are transmitted. **[SHORT2]:** Data transmission format that is used when the device is connected with the EyeCa-RW2 **[ALL]:** All data are transmitted.
[LM DATA PRINT]	**[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.)
[RT TYPE]	**[5100] / [OLD]** Selects the type of the RT to be connected. **[5100]:** RT-5100 series **[OLD]:** Prior RT series

● [LAN]



Parameter item	Setting contents
[RING IMAGE]	**[YES] / [NO] / [LOW CONF]** Sets whether to output the image data (JPEG) of a ring image when LAN connection is established. **YES:** Image data is transmitted. **NO:** Image data is not transmitted. **LOW CONF:** When the confidence index is 7 or less, image data is transmitted.
[KM IMAGE]	**[YES] / [NO]** Sets whether to output the image data (JPEG) of KM measurement when LAN connection is established.
[RETRO IMAGE]	**[YES] / [NO]** Sets whether to output the image data (JPEG) of retroillumination image when LAN connection is established.
[ACC GRAPH]	**[YES] / [NO]** Sets whether to output the image data (JPEG) of accommodation graph when LAN connection is established.
[Output Item]	Selects the folder to which data is output. Following settings are available for each output destination (Folder1 to Folder3).
[OUTPUT]	☐ **Unchecked** / ☑ **Checked** Sets whether to output data (checked) or not (unchecked) when LAN connection is established.
[ACK]	☐ **Unchecked** / ☑ **Checked** Sets whether to wait (checked) or not (unchecked) for a response from the computer indicating that it has received the output data within the time specified in the [Time-out] field. If no response is received even when [ACK] is checked, an error message is displayed. The ACK parameter is active only when [OUTPUT] is checked.

Parameter item	Setting contents
[Timeout]	**1 to 5 to 120** Specifies time (seconds) for the device to wait for a response from the computer indicating that it has received the output data. If the device does not receive the response from the computer within the specified time, an error message is displayed. The Timeout parameter is active only when [OUTPUT] is checked.

4.6.3 Maintenance

Change connections with external connected devices, date and time setting of the device, and such on the [Maintenance] screen.

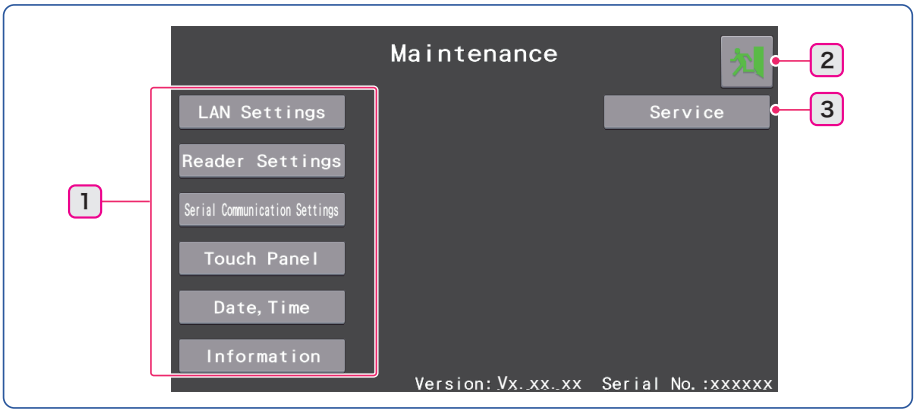
When using the screen keyboard for settings, *"4.6.4 On-screen keyboards" (page 109)*.

Note

- The parameter settings are retained even though the device is turned off.
- After changing parameter settings, do not turn off the device before pressing [OK].
  Otherwise, parameter settings are not saved.
- Underlined options indicate factory settings.

1 Press the [Maintenance] button on the Menu window.

The [Maintenance] screen is displayed.

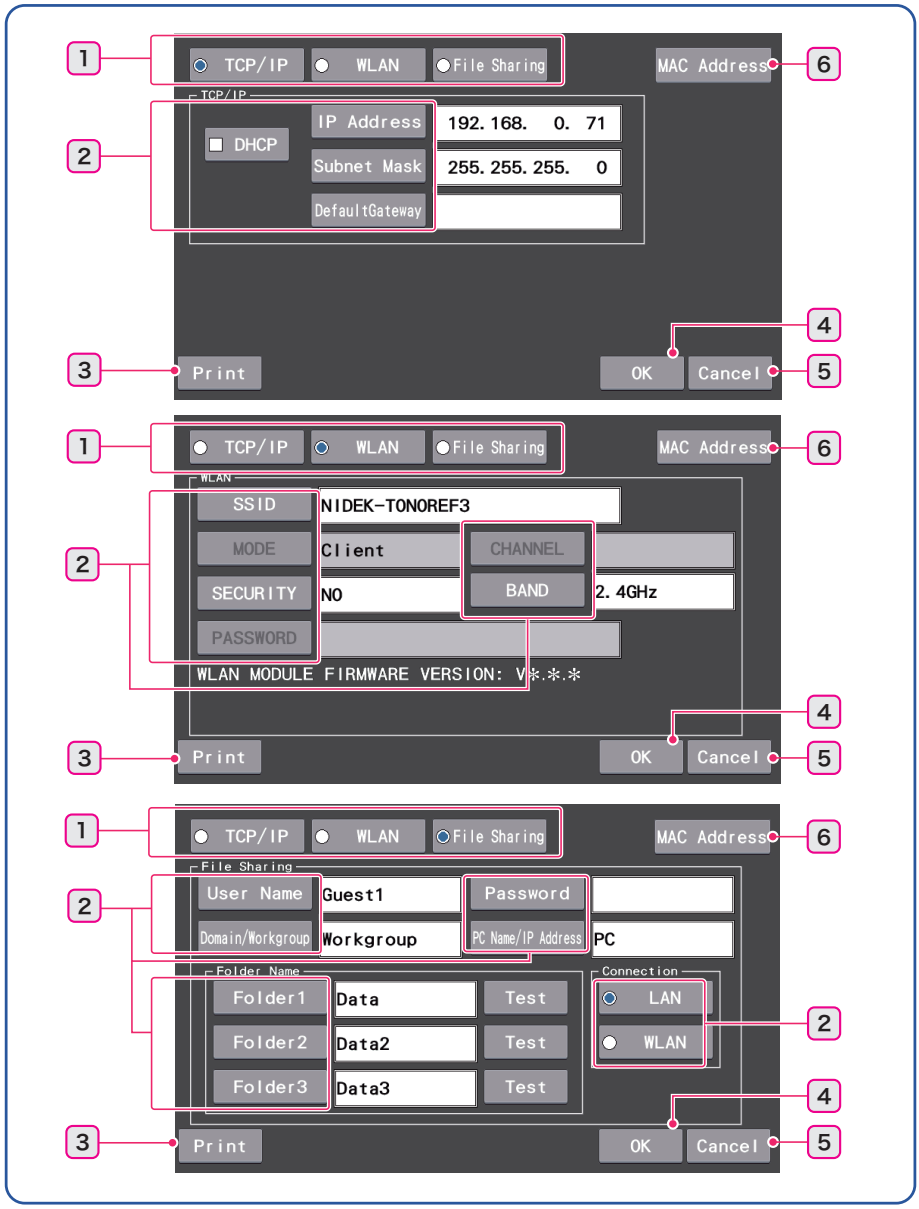


1	Maintenance item select button	Connections with external connected devices, touch screen setting, date and time setting of the device, and such
2	Return	Returns from the [Maintenance] screen to the measurement screen.
3	Service	This button cannot be used by the operator. It is for use by service personnel only.

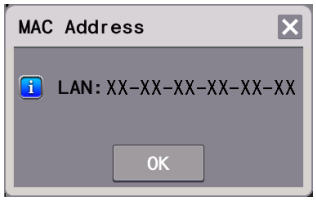
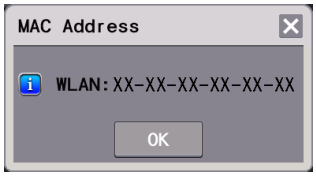
○ [LAN Settings]

Set the LAN connection.

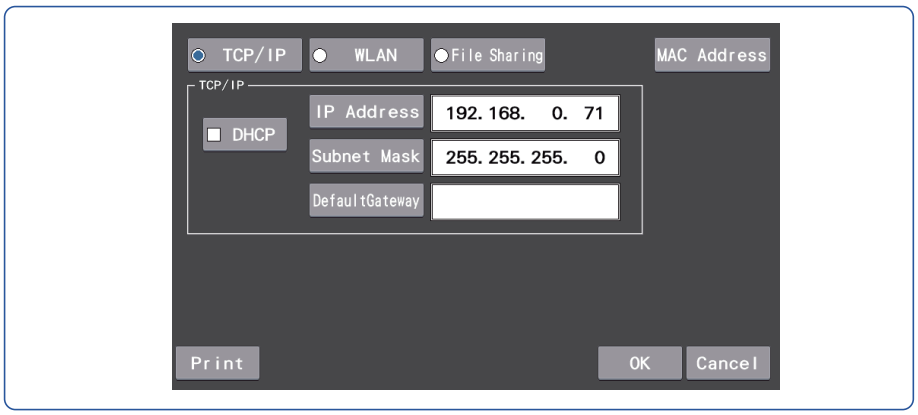
1) Press the [LAN Settings] button on the [Maintenance] screen.
The [LAN Settings] screen is displayed.



1	LAN setting radio buttons	Select the LAN setting items.
2	Setting item buttons	Various settings, setting tests, LAN connection selection
3	[Print]	Prints the items set on the [LAN Settings] screen. The changed settings can be confirmed before they are put into effect.
4	[OK]	A message prompting the operator to restart the device appears. [To Setting is reflected, Restart.] Pressing [OK] in the message returns to the [Maintenance] screen. If the device is not restarted, settings are not put into effect.
5	[Cancel]	Cancels the changed parameter settings and returns to the [Maintenance] screen.

6	[MAC Address]	Displays the MAC address for the wired LAN (LAN) or wireless LAN (WLAN) (LAN or WLAN depends on the setting in “Connection”).   It may take a few seconds until the [MAC Address] dialog box is displayed.

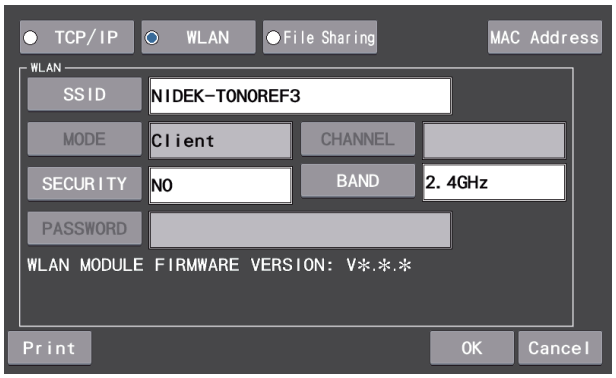
● [TCP/IP]



Parameter item	Setting contents
[DHCP]	☐ **Unchecked** / ☑ **Checked** Sets whether to turn on the DHCP connection. Each press of the [DHCP] button switches between ON (checked) and OFF (unchecked). **Unchecked**: OFF **Checked:** ON. When the DHCP server is provided, IP is automatically assigned.
[IP Address]	**0 to 255**. **0 to 255**. **0 to 255**. **0 to 255** (Default setting: 192.168. 0. 70) Enter the IP address. When [DHCP] is ☑ (checked), this parameter cannot be changed. (IP obtained from the DHCP server is displayed. If [0. 0. 0. 0] is displayed, IP has not been obtained from the DHCP server.)
[Subnet Mask]	**0 to 255. 0 to 255. 0 to 255. 0 to 255** (Default setting: 255.255.255. 0) Enter the subnet mask. When [DHCP] is ☑ (checked), this parameter cannot be changed. (The subnet mask obtained from the DHCP server is displayed. If [0. 0. 0. 0] is displayed, the subnet mask has not been obtained from the DHCP server.) To put the setting into effect, return to the measurement screen, then restart the device.
[Default Gateway]	**0 to 255**. **0 to 255**. **0 to 255**. **0 to 255** Enter the default gateway. When [DHCP] is ☑ (checked), this parameter cannot be changed. (The default gateway obtained from the DHCP server is displayed.) To put the setting into effect, return to the measurement screen, then restart the device. The default gateway is necessary when exporting data outside the network. The default gateway needs not be set when exporting data inside the network.

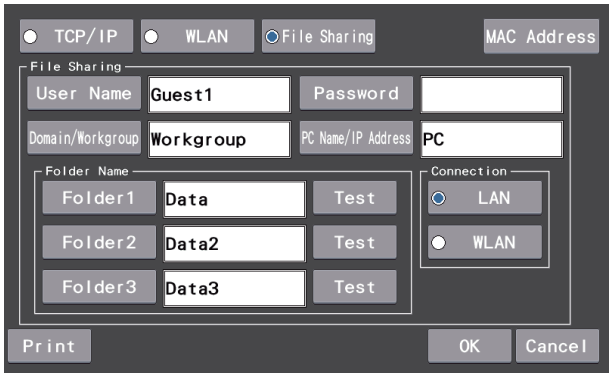
- [WLAN]

  Depending on the radio laws of each country, the device may not incorporate the wireless LAN module.



Parameter item	Setting contents
[SSID]	Sets [SSID] to identify the wireless LAN. Up to 32 alphanumeric characters can be entered.
[MODE]	**Client** Display of the wireless LAN operation mode Cannot be changed.
[CHANNEL]	Cannot be set.
[SECURITY]	**WPA-PSK / WPA2-PSK / WPA-PSK/WPA2-PSK Auto / WEP64 ASC / WEP64 HEX / WEP128 ASC / WEP128 HEX / NO** Sets an encryption scheme for the wireless LAN.
[BAND]	**2.4GHz / 5GHz / Auto** Sets a band. • When “Auto” is set, the frequency band of the specified SSID is automatically selected. When frequency bands are given the same SSID, a band with a greater field strength is automatically selected.
[PASSWORD]	Sets a password for use of wireless LAN encryption (Default setting: No password) The saved password cannot be confirmed. The number of characters to be entered differs depending on the setting of wireless LAN encryption scheme. WPA-PSK / WPA2-PSK: 8 to 63 characters WEP64 ASC: 5 characters WEP64 HEX: 10 characters WEP128 ASC: 13 characters WEP128 HEX: 26 characters

● [File Sharing]



Parameter item	Setting contents
[User Name]	Up to 48 characters can be entered. (Default setting: GUEST) Enter the user name of the connected computer.
[PASSWORD]	Up to 48 characters can be entered. (Default setting: No password) Enter the login password for the user name of the connected computer.
[Domain/Workgroup]	Up to 48 characters can be entered. (Default setting: [Workgroup]) Enter the domain name (or workgroup name) of the connected computer.
[PC Name/IP Address]	Up to 48 characters can be entered. (Default setting: PC) Enter the computer name (or IP address) of the connected computer. To export data outside the network, enter the IP address of the connected computer as well as the default gateway *(page 103)*.
[Folder Name]	
[Folder1]	Up to 48 characters can be entered. (Default setting: [Data]) Enter the shared folder name in the connected computer to which measured data is exported.
[Folder2]	Up to 48 characters can be entered. (Default setting: [Data2]) Enter the shared folder name in the connected computer to which measured data is exported.
[Folder3]	Up to 48 characters can be entered. (Default setting: [Data3]) Enter the shared folder name in the connected computer to which measured data is exported.
[Connection]	**[LAN] / [WLAN]** Selects a wired LAN or a wireless LAN. **[LAN]:** wired LAN **[WLAN]:** wireless LAN

Note

- LAN connection can be established with permission from the network administrator of the facility.
- Before LAN connection, 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. Shared file name in the computer (user name, password, domain)
  - 4. Setting and name of the folder in the computer to which measured data is to be saved
- After changing the network function settings, press the [OK] button, then restart (turn off and on) the device.

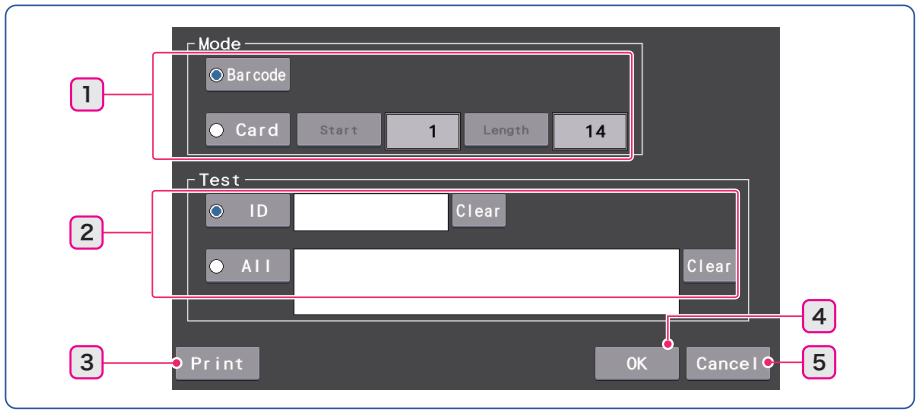
  Restarting the device puts the settings into effect.

○ [Reader Settings]

Set the barcode scanner or magnetic card reader.

1) Press the [Reader Settings] button on the [Maintenance] screen.

   The [Reader Settings] screen is displayed.



1	Mode select radio buttons	Selects the reader to be connected.
2	Reading test	Selects the contents to be read, displays or clears the read results.
3	[Print]	Prints the items set on the [Reader Settings] screen. The changed settings can be confirmed before they are put into effect.
4	[OK]	A message prompting the operator to restart the device appears. [To Setting is reflected, Restart.] Pressing [OK] in the message returns to the [Maintenance] screen. If the device is not restarted, settings are not put into effect.
5	[Cancel]	Cancels the changed parameter settings and returns to the [Maintenance] screen.

● READER (Barcode scanner / Magnetic card reader function)

Parameter item	Setting contents
[Mode]	**[Barcode] / [Card]** Selects the barcode scanner or magnetic card reader (Card). Selecting [Card] activates [Start] and [Length].

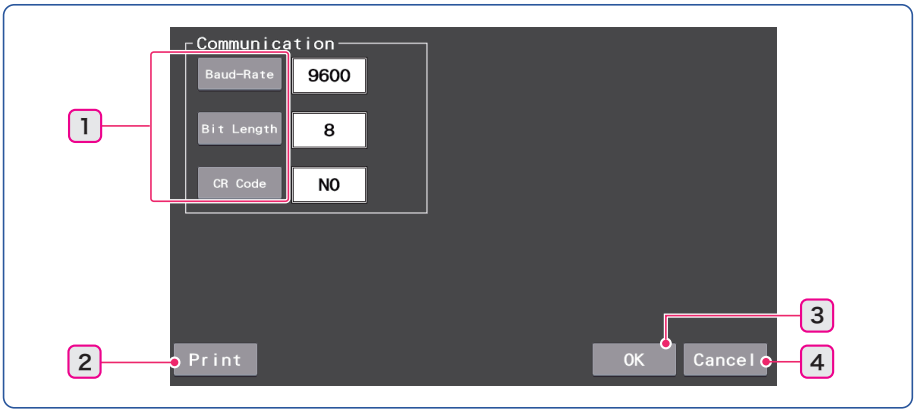
Parameter item	Setting contents
[Start]	**1 to 250** Sets the position to start reading ID when the magnetic card reader is used. Control codes are included in the number of characters. When the barcode scanner is used, this parameter is deactivated.
[Length]	**1 to 14** Sets the length of data to be read as ID when the magnetic card reader is used. Reads the set length of data or reads up to the return mark (↓). Control codes are not included in the number of characters. When the barcode scanner is used, this parameter is deactivated.
[Test]	**[ID] / [All]** Conducts reading test with the barcode scanner or magnetic card reader connected. The contents to be read are selected. **[ID]:** The ID is read. **[All]:** All data is read. For anything other than alphanumeric characters, space, minus sign, or underbar, "~" (tilde) is displayed. Control codes are not displayed. When the barcode scanner is connected, the same indication is displayed in the [ID] and [All] fields. (The return mark (↓) is also displayed in the [All] field.) Pressing the [Clear] button clears the read results.

○ [Serial Communication Settings]

Sets the serial communication (RS232C).

1) Press the [Serial Communication Settings] button on the [Maintenance] screen.

The [Serial Communication Settings] screen is displayed.



1	Setting items	Selects the serial communication item.
2	[Print]	Prints the items set on the [Serial Communication Settings] screen. The changed settings can be confirmed before they are put into effect.
3	[OK]	A message prompting the operator to restart the device appears. [To Setting is reflected, Restart.] Pressing [OK] in the message returns to the [Maintenance] screen. If the device is not restarted, settings are not put into effect.
4	[Cancel]	Cancels the changed parameter settings and returns to the [Maintenance] screen.

Parameter item	Setting contents
[Baud-Rate]	**9600 / 4800 / 2400 / 1200** Selects the bit transfer rate for communication.
[Bit Length]	**7 / 8** Selects the bit number of a single character used for communication.
[CR Code]	**[YES] / [NO]** Sets whether to add the CR code to the end of data to be transferred.

○ [Touch Panel]

Performs the touch panel calibration. *"4.6.6 Touch panel calibration" (page 112)*

○ [Date, Time]

Set the date and time of the device. *"4.6.7 Setting the date and time" (page 113)*

○ [Information]

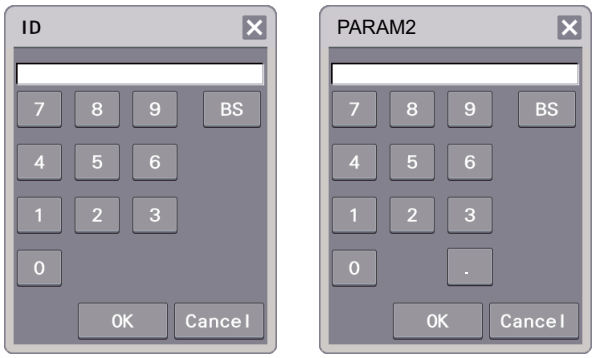
This is the license information regarding the JPEG format used for image compression and MD4 used for verification of data.

1) Press the [Information] button on the [Maintenance] screen.
   The [Information] screen is displayed.
2) Press the [OK] button.
   The screen returns to the [Maintenance] screen.

4.6.4 On-screen keyboards

This section describes the operating procedures of the on-screen keyboards displayed for ID entry, CL settings, various parameter settings, and maintenance settings.

○ Numeric keypad



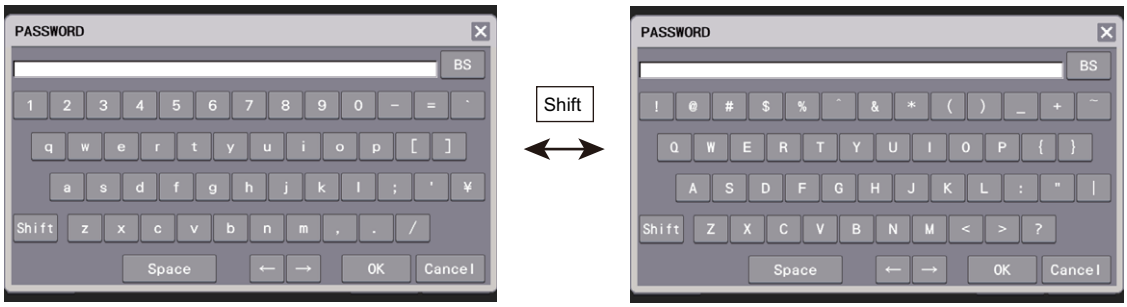
Depending on the entry item, the keypad has the [−] (minus) key or [.] (decimal point) key.

[BS]	Deletes a character on the left of the cursor. If characters are selected, the selected characters are deleted.

Note

- When the on-screen keyboard is displayed to edit the entered contents, all the contents are selected (highlighted). Pressing the [BS] button or entering a character deletes all the highlighted contents. To partly change the entered contents, place a text cursor by pressing the entry field.

○ Keyboard for entering alphanumeric characters and symbols



[BS]	Deletes a character on the left of the cursor. If characters are selected, the selected characters are deleted.
[Shift]	Changes the symbols and toggles the alphabetic characters between upper and lower case letters.
[Space]	Enters a space.
[←] / [→]	Moves the cursor to right or left by one position.

Note

- When the on-screen keyboard is displayed to edit the entered contents, all the contents are selected (highlighted). Pressing the [BS] button or entering a character deletes all the highlighted contents. To partly change the entered contents, place a text cursor by pressing the entry field or pressing either arrow button.

○ Keyboard for entering alphanumeric characters

[BS]	Deletes a character on the left of the cursor. If characters are selected, the selected characters are deleted.
[Shift]	Toggles the alphabetic characters between upper and lower case letters.
[Space]	Enters a space.
← / →	Moves the cursor to right or left by one position.

Note

- When the on-screen keyboard is displayed to edit the entered contents, all the contents are selected (highlighted). Pressing the [BS] button or entering a character deletes all the highlighted contents. To partly change the entered contents, place a text cursor by pressing the entry field or pressing either arrow button.

4.6.5 Network communication function

○ Wireless LAN

Depending on the radio laws of each country, the device may not incorporate the wireless LAN module.

⚠ CAUTION

- The wireless LAN module incorporated in this device conforms to the regional regulations of Japan, the USA, and Canada, and the RE Directive. When using the wireless LAN, follow the radio law of respective countries.
- Even in the countries or regions where the wireless LAN module incorporated in this device is approved by the governing bodies, depending on the installation location or use environment (especially in a location where other medical devices are present such as an operating room or ICU), the wireless function may be impaired. Follow the guidelines determined by medical institutions or optician facilities where the device is to be used.
- Data handled via the wireless LAN is controlled by patient numbers and IDs. Information that would personally identify an individual is not included. For security, follow the guideline determined by each facility where the device is to be used.

○ Confirming network communication function

Confirm that network communication functions properly.

1) To set a wired LAN, connect the device and computer by a LAN cable.
2) Confirm that the computer to be connected is turned on.
3) Check the LAN setting of the device. *"O [LAN Settings]" (page 102)*
4) Press the [Test button] to check the network communication.

   A message is displayed accompanied by a beep.

Communication has been successful.

Error has occurred.

If an error message is displayed, take a remedy accordingly for the error.

"4.2 Error Messages and Remedies" (page 81)

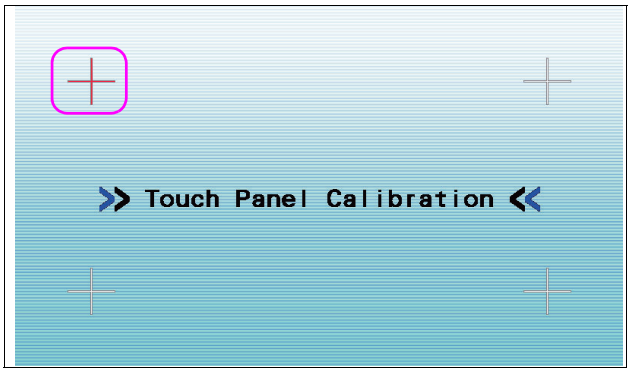
4.6.6 Touch panel calibration

If the response does not correspond to the position touched on the touch panel, perform the touch panel calibration.

1 Press the [Touch Panel] button on the Maintenance screen to start calibration.

2 The screen is switched, the [Touch Panel Calibration] message appears in the center of the screen, and cross marks are displayed in the four corners of the screen. Touch the center of the red cross mark in the upper left corner.

Touch and hold the mark for about 1 second.

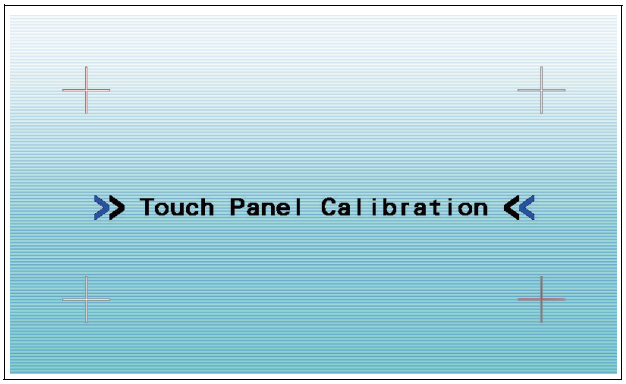


3 The cross mark in the upper right corner turns red. Touch the center of the red cross mark.

4 Touch the centers of the cross marks displayed in the lower left and lower right corners in the same manner.

When you touch the center of the cross mark in the lower right corner, the calibration is complete.

The screen returns to the Maintenance screen.



4.6.7 Setting the date and time

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

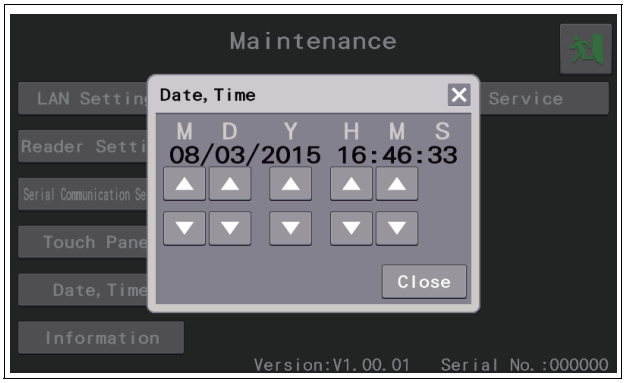
○ Battery recharging

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

In 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 Press the [Date, Time] button on the [Maintenance] screen.

The [Date, Time] window is displayed.



2 Set the date and time on the [Date, Time] window.

▲ / ▼	Increases or decreases the numeric value of the selected item.

3 After setting, press the [Close] button to complete the setting.

Pressing the [Close] button updates the internal clock to the set date and time and then returns to the Maintenance screen.

4.6.8 CL select function for CL brand registration and print selection

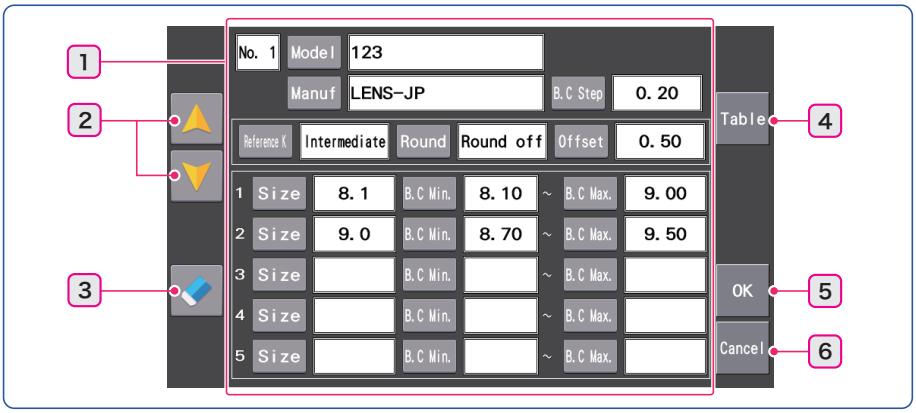
The CL select function allows printing contact lens size and base curve based on KM measured values. Up to 10 contact lens brands can be registered. In addition, brands to be printed can be selected.

○ [CL Settings]

Register contact lenses. Also, edit or clear the registered lens information.

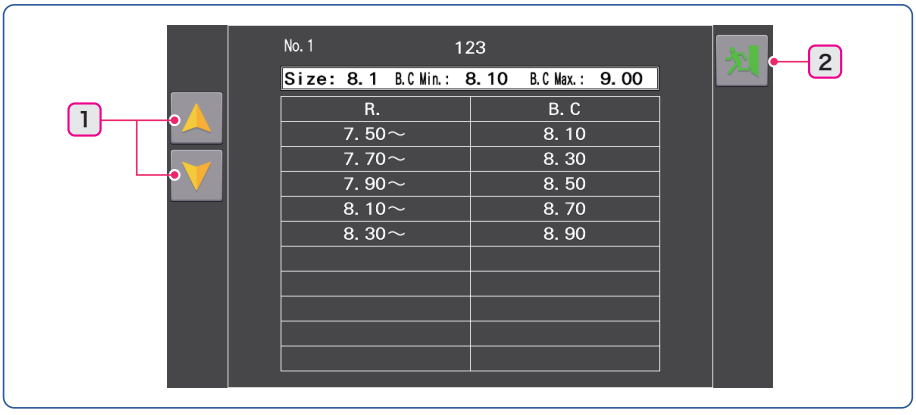
1) Select the parameter [Print] > [Print3] > [CL Settings].

The lens setting screen for No.1 is displayed.



1	CL setting item	Entry and edition of lens information such as lens name
2	/	Switches the lens setting screens for No.1 to No.10 by page.
3	Clear	Clears all information displayed on the lens setting screen.
4	[Table]	Displays tables for each size (1 to 5) based on the entered information.
5	[OK]	Confirms the entered setting and returns to the [Settings] screen.
6	[Cancel]	Cancels the entered setting and returns to the [Settings] screen.

- Example of table display



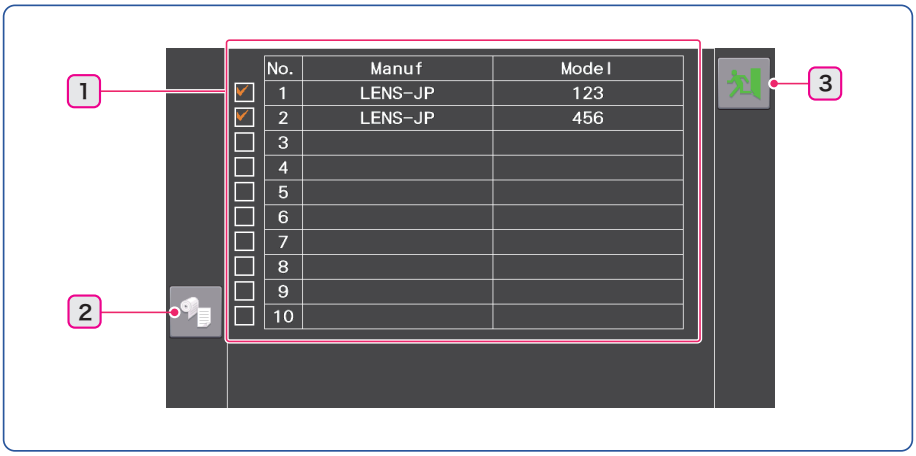
1	/	Switches the table page for each size (1 to 5).
2	Return	Returns to the lens setting screen.

○ [CL List]

Select brands to be printed from among the registered contact lenses.

1) Select the parameter [Print] > [Print 3] > [CL List].

The CL brand list is displayed.



1	Print selection	☑ **Checked /** ☐ **Unchecked** Selects brands to be printed. **Checked:** Selected **Unchecked:** Not selected A check mark is entered and removed by pressing ☑.
2	Print	Prints the CL brand list.
3	Return	Saves the setting and returns to the [Settings] screen.

2) Put the check mark ☑ for the brand to be printed.

The checked brands are marked by "*" on the printed CL brand list.

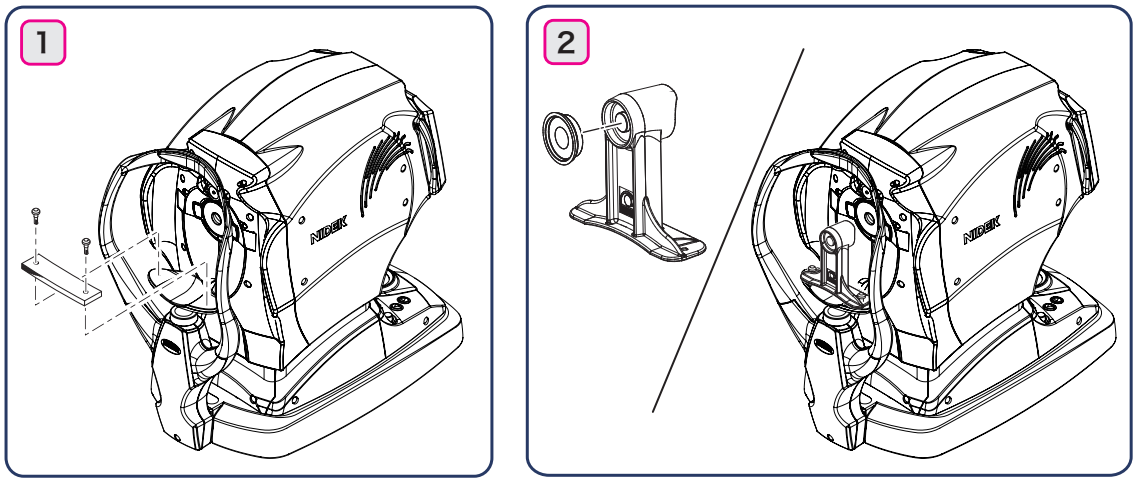
3) After changing the setting, press to save the setting and return to the [Settings] screen.

```
---------------------
      CL  LIST
---------------------
1:LENS-JP     123   *
2:LENS-JP     456   *
```

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 to the eye level marker with the chinrest up/down buttons ▲, ▼.

4 Set the parameter [MEASURE] > [AR] > [STEP] to “0.01 D”.

Setting parameters *(page 89)*

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

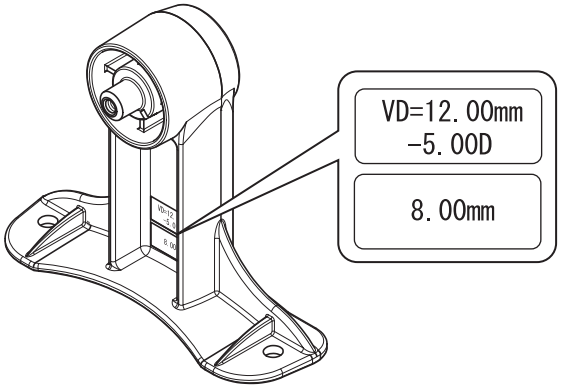
⚠ CAUTION

- If the measured results differ substantially from the values indicated on the model eye, ask NIDEK or your authorized distributor for calibration.

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 VD value (vertex distance) is set to a value other than “12.00 mm”, set the parameter [MEASURE] > [AR] > [VERTEX D.] to “12.00 mm” before conducting AR measurement.
- Keep fingers off the lens surface of the spherical model eye. For persistent 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, dry cloth. For persistent stains, soak the cloth in a neutral detergent, wring well, and wipe. Finally dry with a soft, dry cloth.

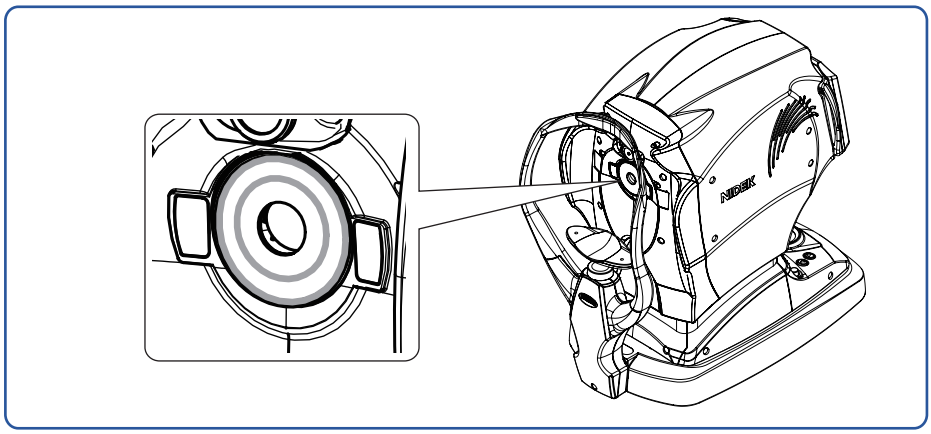
⚠ CAUTION

- Never use an organic solvent such as paint thinner or alcohol for the cover or panel.
- Lightly wipe the exterior of the LCD. Do not press the LCD using an object with a hard tip. 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.
  Water may leak into the interior of the device resulting in malfunction.

4.8.1 Cleaning the measuring window

If fingerprints or dust adheres to the measuring window, the reliability of the measured values is impaired substantially. Check the measuring window cleanliness before use, and clean it if it is soiled. Only clean it when the [CHECK MEASURING WINDOW] message is displayed at device start-up or the lens is visibly soiled.

1 Use a blower to blow off any dust from the measuring window.



2 Wrap lens cleaning paper around a thin stick (or use a cotton swab), moisten it with alcohol, and wipe the lens of the measuring window.

Note

- Do not use a stick made of metal or other hard material which may damage glass.
- Gently wipe the lens of the measuring window circularly from the center to periphery.

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

4 Check if the window is cleaned. If any part remains soiled, clean the window again with new cleaning paper.

Note

- When the parameter [OTHER] > [WINDOW CHECK] is set to [YES] or [DAY], the measuring window cleanliness is checked at device start-up.

4.8.2 Cleaning the air nozzle

If fingerprints or dust adheres to the air nozzle, the reliability of the measured values is impaired substantially. Check the air nozzle cleanliness before use, and clean it if it is soiled.

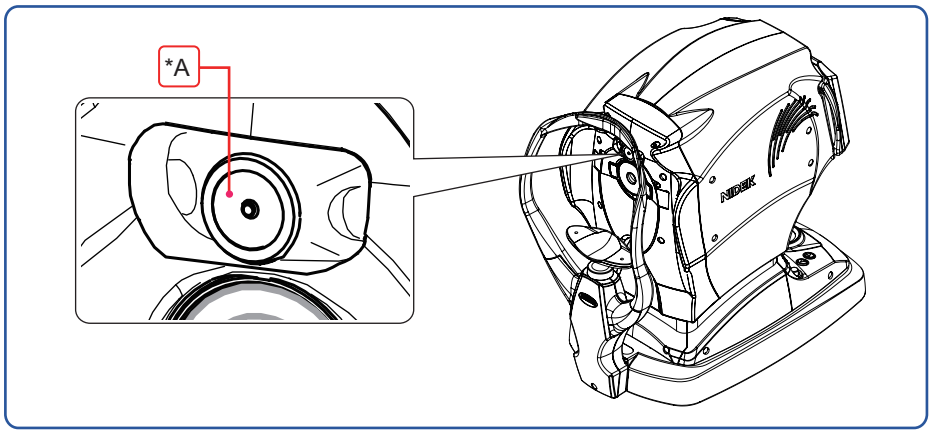
⚠ CAUTION

- Caution should be taken when using the device for patients with infection.

Note

- Be sure not to let dust or foreign particles into the air nozzle during cleaning.

1 View the air nozzle glass (*A) slightly at an angle to check for dust or dirt.



2 Use a blower to blow off any dust.

3 Wipe the glass using a cotton swab dampened with alcohol.

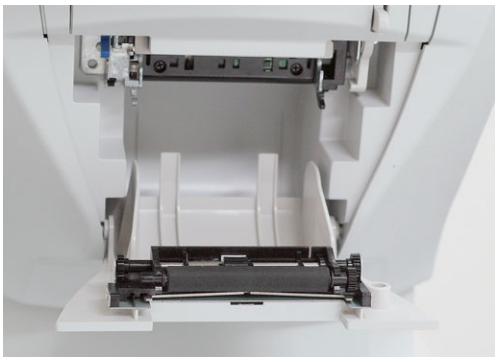
Note

- Gently wipe the glass circularly from the center to periphery.

4 Check the glass for dust or dirt again.

4.8.3 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 Load the printer paper as before.

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 (VD = 12 mm) (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>• Corneal curvature radius 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 range is in accordance with Code A, ISO 10343 and the measuring accuracy in accordance with Code 2, ISO 10343.</td></tr>
<tr><td>• Pupillary distance measurement</td><td colspan="2">30 to 85 mm (1 mm increments)
(For near vision: 28 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>
<tr><td>• Accommodation measurement</td><td colspan="2">0 to 10.00 D (0.01/0.12/0.25 D increments)</td></tr>
</table>

• Tonometry	Measurement range	1 to 60 mmHg (1 mmHg increments)
	Measurement accuracy	1 to 29 mmHg: ±1.5 mmHg 30 to 60 mmHg: ±2.5 mmHg (with the NIDEK model eye)
	Measurement range	APC40, APC60, 40, 60
	Working distance	11 mm
• Pachymetry	Measurement range	300 to 800 µm (1 µm increments)
	Measurement accuracy	±10 µm
• Other functions	Observation/Display method	7.0-inch color LCD with touch panel
	Printer	Thermal line printer with auto cutter
	Interface connectors	RS-232C: 2 ports USB: 1 port LAN: 1 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) × 505 (H) mm
	Mass	22 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, packed condition)	Temperature	-30 to 60°C (-22 to 140°F) during transport -10 to 55°C (14 to 131°F) during storage
	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	

Wireless LAN*1		
• Standard	IEEE 802.11 a/b/g/n	
• Center frequency	2.4 GHz: 2,412 to 2,472 MHz (varies depending on the region or country) 5 GHz: 5,180 to 5,320 MHz, 5,500 to 5,700 MHz, 5,745 to 5,825 MHz (varies depending on the region or country)	
• Modulation method	Orthogonal frequency-division multiplexing (OFDM) Direct-sequence spread spectrum (DS-SS and CCK)	
• Effective radiated power	5.69 mW	
• Link speed	IEEE 802.11 n IEEE 802.11 a/g IEEE 802.11 b	6.5 to 150 Mbps 6 to 54 Mbps 1 to 11 Mbps
• Access method	Infrastructure mode (client)	
• Security	WPA, WAP2, WEP (64/128 bits)	
• Certification	The wireless LAN module incorporated in this device is certified in accordance with the requirements stipulated by the following regulations and organizations. Radio law (Japan), FCC (U.S.A.), Industry Canada (Canada), 2014/53/EU Radio Equipment Directive (EU)	
Accessories		
• 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	EyeCa-RW2 Eye Care card Barcode scanner Magnetic card reader Communication cable (RS-232C) Communication cable (LAN)	

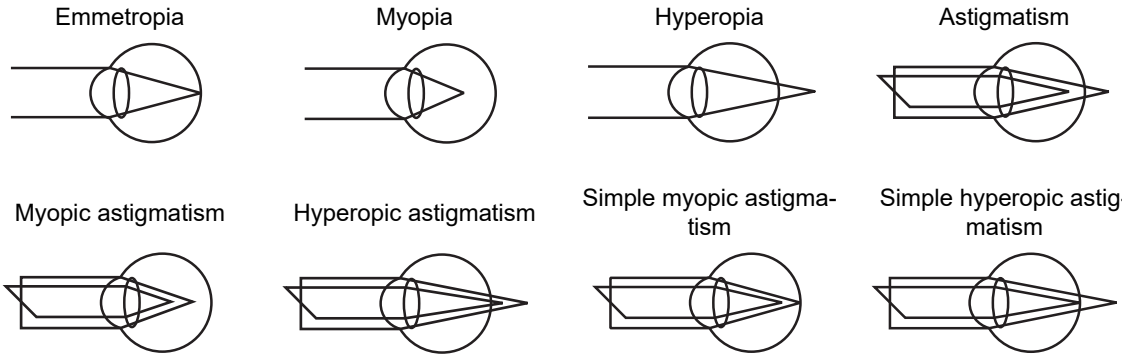
*1. Depending on the radio laws of each country, the device may not incorporate the wireless LAN module.

5.2 Glossary and Abbreviations

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

○ Glossary

Term	Details
AM mode	Measurement automatically finishes after the specified number of measurements if the data is stable without fluctuation. For AR measurement: If unstable data is included, two additional measurements are taken and then measurement finishes. For NT measurement (tonometry): Measurement continues until stable data is obtained. However, when [NT CONTINUE] is set to “1”, measurement finishes after one measured data item is obtained.
APC	A normal NT measurement (tonometry) is performed initially. However, in the subsequent measurements, the air pressure is automatically reduced to the minimum necessary amount for the patient’s comfort.
AR median values	The Spherical Equivalent (SE) value is obtained from individual 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.
CL select	This function allows contact lens size and base curve selected automatically based on KM measured values to be printed by brand. The data is a guide when using contact lenses.
CL select data	CL select data is contact lens size and base curve for each selected brand, which is based on KM measured data. The data is a guide when using contact lenses.
CS	Abbreviation of Corneal Size
KM median values	The median value of measurements which are arranged in order by the computer. If the measured data is two values or less, then the latest value is selected.
PD	Abbreviation of Pupillary Distance
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) and contact lens conversion values.
Printing of eye diagram	Prints the 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). There are eight eye diagram patterns.



Term	Details
Applanation	To flatten the cornea by pressing it with air pressure.
Safety space	The space maintained by the safety stopper so that the tip of the air nozzle does not come into contact with the patient's cornea. Normally, it is set to 8 to 10 mm.
Fogging	Blurs the patient's view to prevent focus in order to eliminate accommodation for AR measurement.
Auto shot	This function automatically starts measurement when alignment and focusing are optimized.
Auto tracking, auto focusing	This function automatically controls up, down, right, and left movements for alignment and forward and backward movements for focusing.
Vertex Distance (VD)	The distance between the corneal vertex to the posterior surface of spectacle lenses.
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 in AR measurement.
Quick Ref measurement mode	AR measurement mode for patients with unstable fixation. The measurement duration is shorter than in normal measurement mode. However, the measurement results are more likely to fluctuate.
Near working distance	Distance when viewing the near target through reading glasses or bifocals.
Near PD	PD for a near working distance of 40 cm (factory setting). Used for prescriptions of reading glasses or bifocals.
Automatic shutoff function	When NT measurement (tonometry) is finished, this function activates to stop puffing air to eliminate extra puffing. This function reduces discomfort and stimuli during measurements.
Comments	Characters and symbols can be freely entered. Up to 24 characters per line with a maximum of two lines can be entered.
Contact lens conversion value	CL values converted from the AR median values (the latest values when the median values have not been obtained) taking the vertex distance (VD) to be 0 mm.
Minimum pupil diameter mark	Indicates the minimum measurable pupil size in AR measurement.
Confidence index	The confidence index is displayed in six levels (9, 8, 7, 6, 5 or E) in AR measurement. The lower the confidence index, the larger the influence of irregular astigmatism. "E" indicates erroneous data. Measured data obtained in cataract measurement mode is marked with the preceding "*" symbol.

Term	Details
Sleep mode	After the preset idle time, the display automatically dims and alternates between the initial screen and a blank screen. Power consumption is reduced. Pressing any button reactivates the device.
Measurement range	The range in which NT measurement (tonometry) can be taken. To take the most accurate measurement according to each patient's intraocular pressure and its fluctuation, there are four types of range: [APC40], [APC60], [40], and [60]. Normally, select [APC40] or [APC60].
Low confidence data	Measured data marked with the “*” symbol in NT measurement (tonometry), which is displayed when a measurement was taken although a measurement error (APL or ALM) occurred. As the confidence of the measurement data is low, it is called “low confidence data”.
Puff	To burst air onto the cornea of the patient’s eye for NT measurement (tonometry) or to blow out air. The pressure necessary for applanation is called “puffed air pressure”.
Trial lens data	Values that are 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).
Eyelid detection mode	In this mode, eyelid opening state is constantly checked. Measurement is taken only when the eye is opened wide enough. Normally, it is recommended to take measurements in this mode.
Limit indicator	When the measuring unit moves out of the working range of auto tracking, the limit indicator (arrows) is displayed on the screen.

○ Abbreviations

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

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
- Non-contact tonometry measurement function
- Pachymetry 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