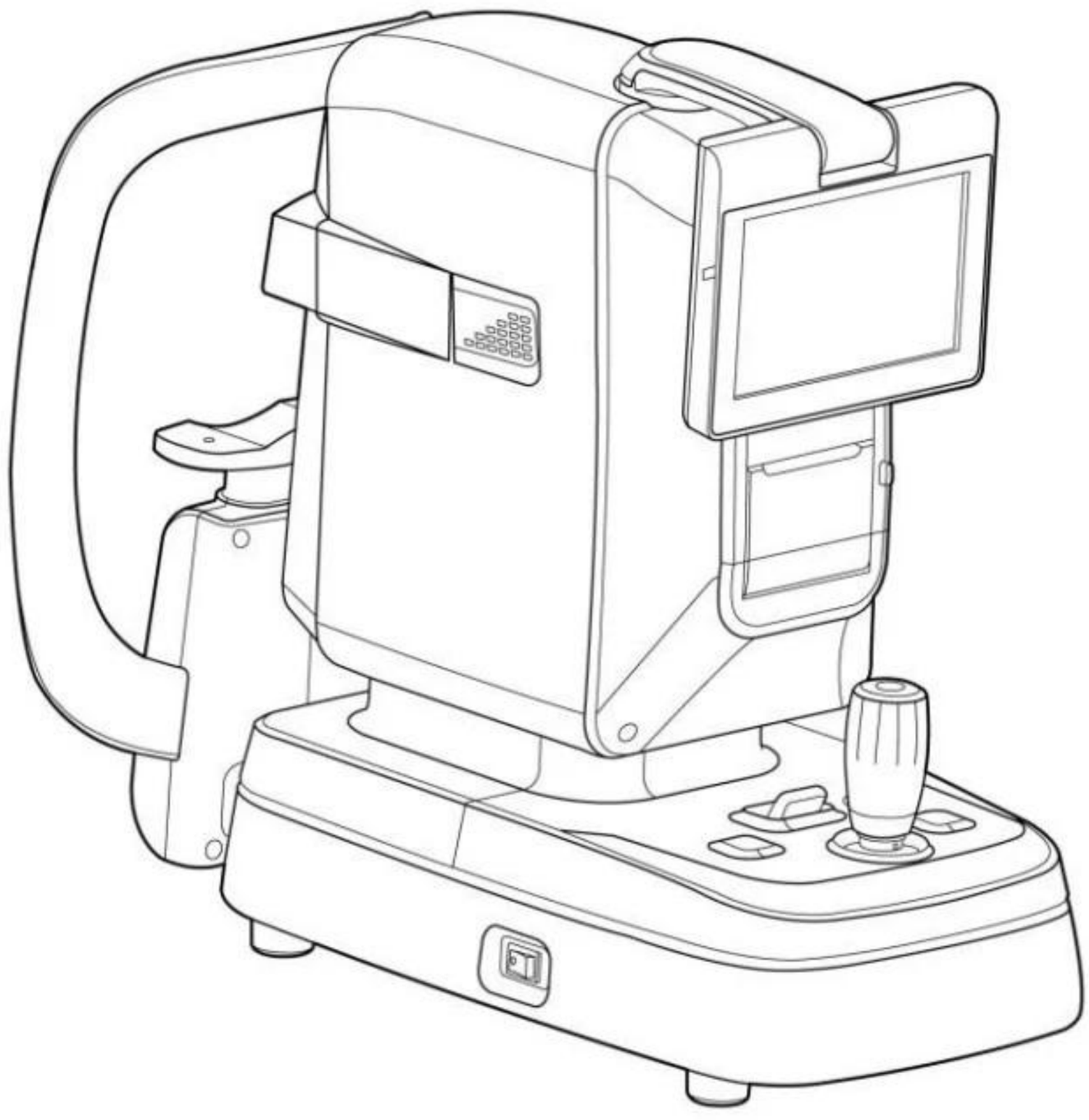
# User Manual

## Auto Ref/Keratometer HRK-9000A



Huvitz
Pacing Progress toward People

# Precautions

This product may malfunction due to the electromagnetic wave that is generated from mobile phone, two-way radio, machinery controlled wireless and others. Do not place any device that may affect this product nearby.

We believe that the contents of this user manual are accurate in overall since they were reviewed carefully. However, Huvitz does not assume any kind of responsibility for the latent mistake or omission that results from the use of information included in this user manual.

Huvitz has the right to make any kind of modification to this product or product specs anytime without prior notice and modification may not be renewed on this document.

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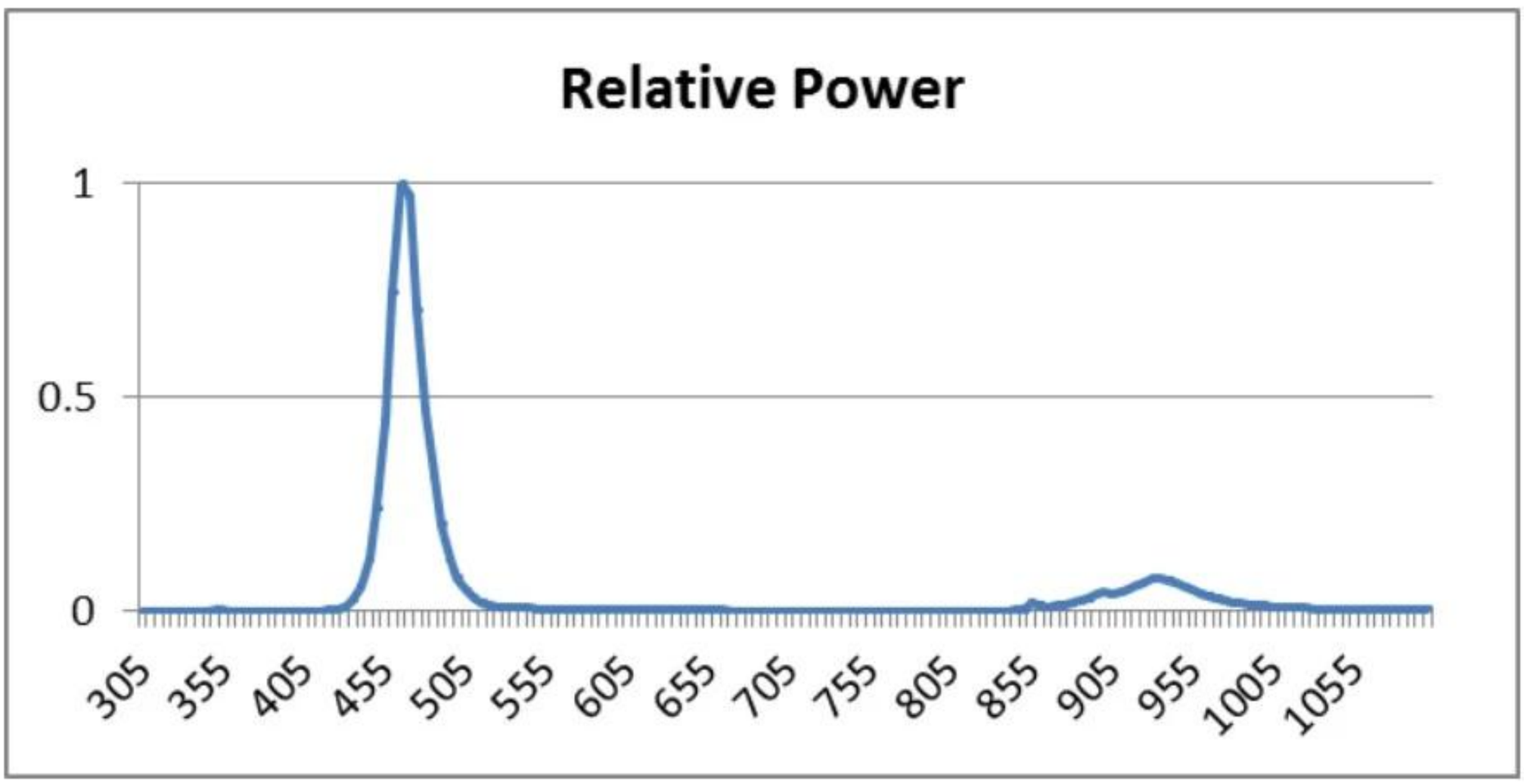
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**⚠ CAUTION**

Provision of information on the avoidance of light hazard from the optical device is required in ISO 15004-2:2007
“Ophthalmic instruments-Fundamental requirements and test methods”

The light emitted from this instrument is potentially hazardous. The longer the duration of exposure, the greater the risk of ocular damage. Exposure to light from this instrument when operated at maximum intensity will exceed the safety guideline after 33 minutes.




< Spectrum output of all light source during measurement (maximum light intensity) >

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# 1. Introduction

## 1.1. Intended Use

The Auto Ref/Keratometer HRK-9000A is intended to be used to measure the refractive power of the eye.

## 1.2. Equipment overview

Automatic eye examination refractive power measurement device, HRK-9000A is the equipment that measures refractive power of the test subject's eyeball to show Sphere (SPH), Cylinder (CYL) and Axis (AXS) information. Moreover, it can measure test subject's corneal curvature and PD (Purpillary Distance, distance between pupils) and pupil's size. In particular, it is possible to measure Peripheral Corneal Curvature separately when measuring corneal curvature, and it enables accurate prescription since it is possible to know the information of the cornea's center and periphery curvature individually.

Moreover, optimal eye examination information is provided depending on the state of test subject's eyes with the following other functions that are provided additionally.

- VA (Visual Acuity) test
- Color image observation
- Light observation with Retro-Illumination
- Abnormal curve state output via Zernike graph
- Tear film destruction time measurement

▪ Meibomian gland filming function

Automatic eye examination refractive power measurement device, HRK-9000A carries out automatic arrangement to the X-Y-Z axes (left and right/up and down/front and back) direction according to pupil to the location optimized for filming including pupil's automatic tracking function. Moreover, automatic chin rest adjustment function is provided to facilitate adjustment of the chin rest's height, up and down.

## 1.3. Grade classification and mentioned items

1) Classification of product :
   -. EU - Class I with a measuring function according to Annex IX (Rule 12) of the Medical Device Directive 93/42/EEC
   -. KFDA – Class II

2) Resistance against electric shock : Class I (earthed)

3) Protection class against electric : Type B

4) Protection against harmful ingress of water : Ordinary, IPX0

5) Degree of safety in the presence of a flammable anesthetics mixture with air or with oxygen or with nitrous oxide: Not suitable for use in the presence of a flammable anesthetics mixture with air or with oxygen or with nitrous oxide.

6) Mode of operation : Continuous

# 2. Information regarding safety

## 2.1. Introduction

Safety is everyone's obligation and responsibility. Safe use of this device is important for everyone involved - installers, users, operators and device managers. It is a must to study and to master this user manual individually prior to installing, using, cleaning, repairing or controlling this device and its accessories. It does not suffice to emphasize the importance of understanding the instructions found in this manual repeatedly in order to increase safety of patients or users. For this reason, the following safety warning chart is included at the adequate place on this manual in order to highlight information that requires special precaution or safety related information in particular. All the users or managers need to pay special attention in addition to mastering "WARNING" or "CAUTION" in the manual.

**⚠ WARNING**

"Warning" cautions against the existence of calamity that can cause severe personal injury, death or property loss in case of negligence.

**NOTE**

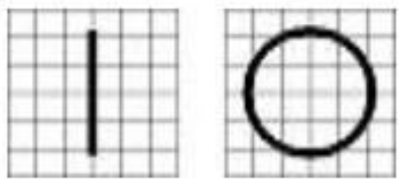
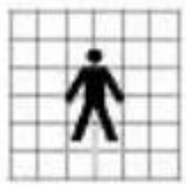
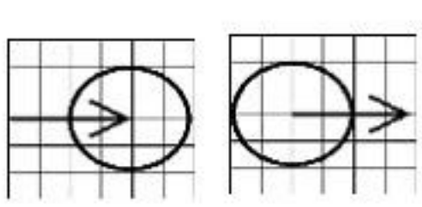
"Note" explains important information related to installation, operation and management, and failure to comply may lead to calamity in case of negligence.

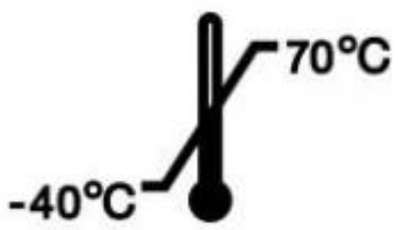
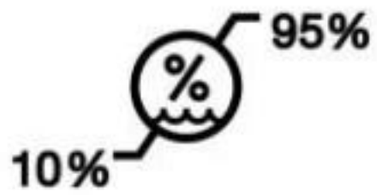
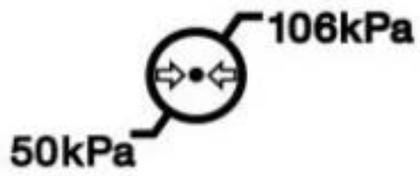
**⚠ CAUTION**

"Caution" informs of the matters related to calamity that can cause minor injury or property loss in case of negligence.

## 2.2. Safety indication

The International Electro technical Commission (IEC) announced the symbols that warn when connecting electric medical device's power or that warn against calamity that may occur. Classification and symbol are as follows.

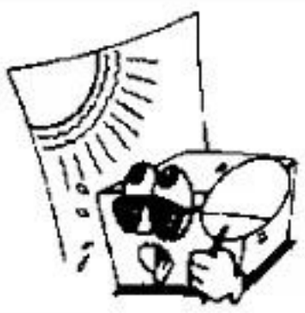
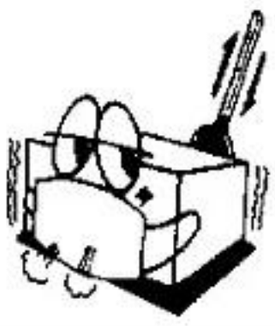
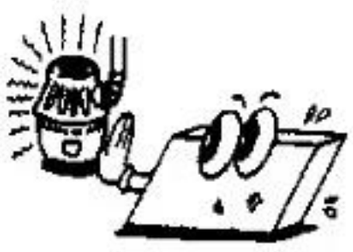
| | |
|---|---|
|  | Symbols I and O regarding power switch signify power connection and blocking, respectively. |
|  | Indicates Type B segregated patient connection. |
|  | Indicates signal input and output connection. |
|  | This symbol indicates safety precautions. Understand the related precautions thoroughly after reading the manual prior to using the device. |
|  | Consult instructions for use. |
|  | Indicates safety grounding point connected to the device's sash. Subject Class I device's conductive part to protective grounding for safety purpose. |
|  | Alternating Current |

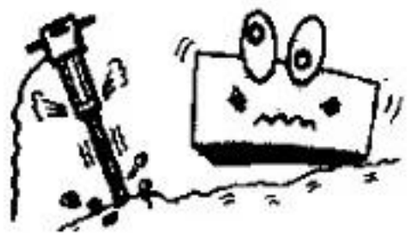
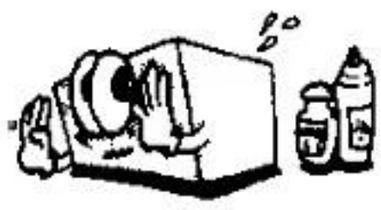
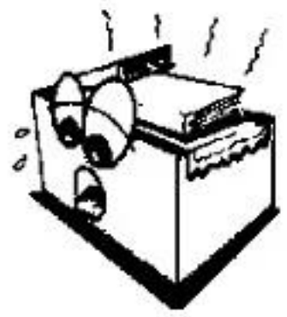
| | |
|---|---|
|  | Direct Current. |
|   | Serial Number |
|   | Humidity Limitation |
|   | Atmospheric Pressure Limitation |
|  | This side up |
|  | Fragile , handle with care |
|  | Do not use hand hooks |
|  | Keep DRY |
|   | Stacking Limit by Number |
|  | Keep away from sunlight |

| | |
|---|---|
| Huvitz | Huvitz Symbol |

## 2.3. Environment related matters

Avoid the following environment for operation and storage:

| | |
|---|---|
|  | Place where device comes directly into contact with moisture (do not operate the device with wet hand) |
|  | Place where device is exposed directly to sunlight. |
|  | Place with severe temperature change (temperature for normal operation ranges from 10°C to 40°C while humidity level ranges from 30% to 75%). |
|  | Place where hot device is close by. |
|  | Place where humidity level is high and there is a heat radiation related 어 problem |

| | |
|---|---|
|  | Place where device is exposed to severe shock or vibration |
|  | Avoid placing the device where it may come into contact with chemical substance or place where there is flammable gas |
|  | Be careful so that dust or metallic substance does not go into the inside of this device. |
|  | Do not disassemble or open the device. The manufacturer is not responsible for any problem that may result as such. |
|  | Do not block the heat radiation located at the device's upper part. |
|  | Do not connect the AC power code while the device's parts are not connected completely. This damages the device. |
|  | Do not pull out the power code while holding just the code. |

As for the environment when using the device, maintain temperature of 10 ~ 40 ℃, humidity level of 30 ~ 75 % and atmospheric pressure of 800 ~ 1060 hpa.
As for the environment when transporting the device, maintain temperature of -40 ~ 70 ℃, humidity level of 10 ~ 95 %, and atmospheric pressure of 500 ~ 1060 hpa.

As for the environment when storing the device, maintain temperature of –10 ~ 55 ℃, humidity level of 30 ~ 75 %, and atmospheric pressure of 700 ~ 1060 hpa.
Take precaution so that the device won't be subjected to excessive shock or vibration.

## 2.4. Prerequisites for safety

**⚠ BEFORE USE, READ THIS MANUAL**

The safety precautions and operating procedures must be thoroughly understood prior to operation of the device.

The device complies with ISO 10342 subclause 4: 2010 (Ophthalmic instruments – Eye Refractometers) and ISO 10343 subclause 4: 2009 (Ophthalmic instruments - Ophthalmometers). The dioptric powers are indicated with reference wavelength λd = 546.07 nm or λd = 587.56 nm

This device was developed and proven according to the domestic and international safety specs. This guarantees this device's high safety level. By law, a manufacturer is obligated to provide sufficient explanation of the matters pertaining to the device safety to device users. Likewise, compliance with the contents of this device's manual is mandatory for safety sake. Thus, read the instructions in the manual sufficiently and understand prior to turning on the power. For many more information, inquire the distributor where you purchased the device.

1. Do not store or install this device at the following places; (a) place that runs the risk of exploding, or (b) place that has volatile chemical substance such as alcohol benzene or inflammable and explosive material.

2. Do not store or install at a humid place. To ensure normal operation, humidity level should range between 30 and 75%. The device should not be exposed to a place where water splashes significantly, water falls off, or gets sprayed. Do not place the container with liquid or gas on top of the device.

3. This device should be operated by qualified personnel with sufficient training or under such personnel's supervision.

4. This device can be modified only by Huvitz's service technician or a person with comparable qualifications.

5. Device management by customer should be carried out as explained in the user or service manual. Management that requires more sophisticated skill set can be carried out only by Huvitz's service technician or a person with comparable qualifications.

6. Manufacturer assumes responsibility for this device's safety, reliability and performance only when the following conditions are satisfied: (1) When this device was installed at a viable space in accordance to this manual's regulations, and (2) when this device was used and maintained according to the procedure regulated in this manual or service manual.

7. Manufacturer does not take responsibility for the damage resulting from this device's unlawful modification. However, device's unlawful modification becomes a factor for losing the right to get warranty during the warranty period.

8. This device is utilized with the accessories provided by Huvitz. If consumer wants to use other manufacturers' accessories, safety of use must be proven and confirmed by Huvitz or by the accessories' manufacturer.

9. Only a person who completed adequate training or education program can install, operate and maintain this device.

10. Store user or service manual at a place that is readily accessible by the person who manages and uses this device.

11. Do not exert force on the cable connection. If cable does not get connected easily, then check whether connector (plug) is suitable for the socket. When connector or socket is damaged, qualified service technician needs to repair it.

12. Do not pull on the device's cable. Hold on the plug to take out to open up the

cable.

13. This device can be used according to this manual in relation to the refractive power, corneal curvature measurement and their application.

14. Always test the state of the device's external appearance and check whether it is functioning well before using the device.

15. Do not block device's hole for heat radiation.

16. Turn off the power immediately and take out the plug when there is smoke, spark, abnormal noise or smell.

17. IEC standard needs to be satisfied with in order to connect an outside device with input/output signal or other connector. (IT equipment is IEC 60950, and electric equipment for medical use is IEC 60601). Moreover, all the systems need to satisfy the safety requirement, IEC 60601-1-1 when it comes to the electric system for medical use. Person who connects outside device with input/output signal or other connector has the obligation to take responsibility in accordance to the IEC60601-1-1. Contact local technician or distributor if you have doubts.

18. This equipment may cause edge which is hazardous for other devices at the periphery. Wireless frequency may be generated or used, and energy may be released when the device is not installed or used according to the guideline. However, there is no guarantee that edge does not result when carrying out specific installation. If this device leads to hazardous interception on other device when the equipment is turned on/off, user needs to solve the interception issue by using one of the following measures.

- Change direction or relocate the receiver
- Distance between equipment is increased
- Connect the equipment with the socket of the circuit connected with other device and other circuit
- Ask manufacturing business or field service technician for help

19. When this equipment is connected to the Wireless Network AP, set the wireless security type to WPA2-PSK.
    - Access with applicable AP is not possible when other securities such as OPEN / WEP are set. (FDA recommended matter)
    - The Company is not responsible for the problem that may result when accessing with the wireless network that is not secured.

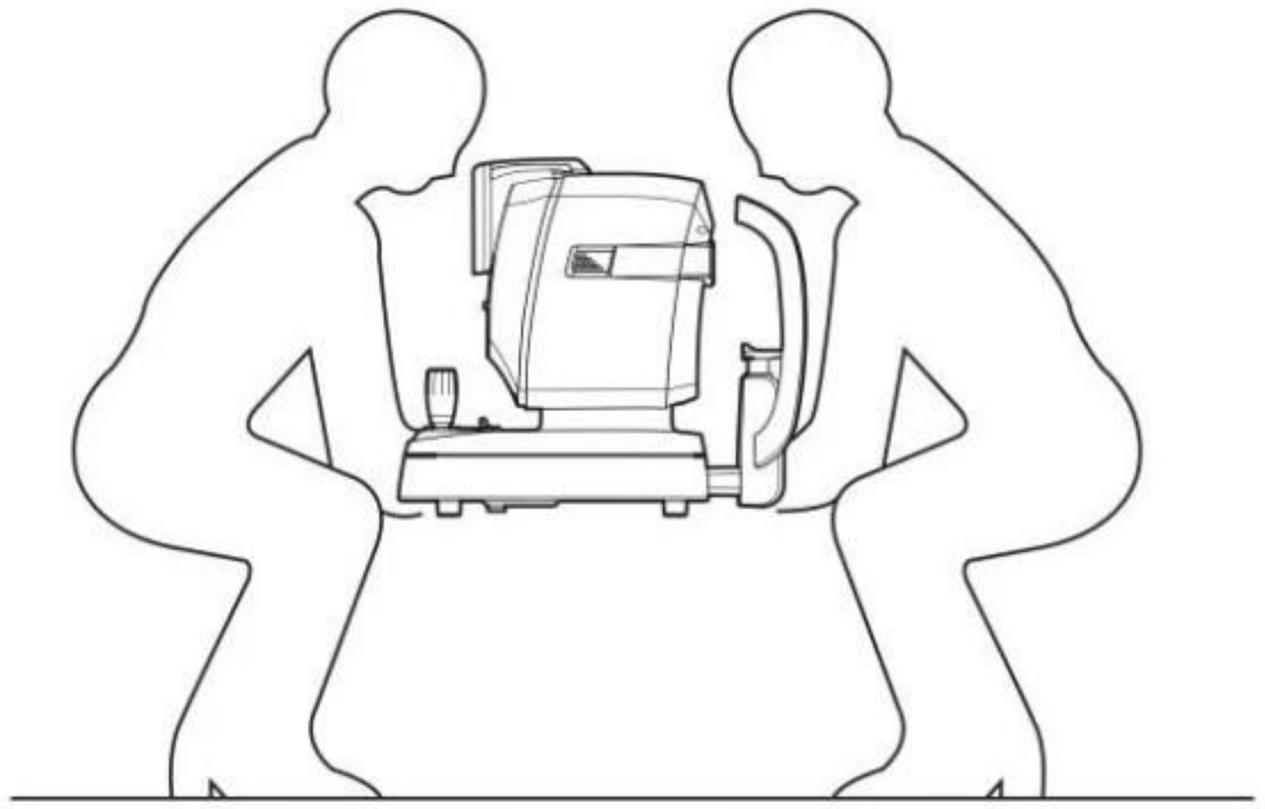
20. Secure open space within 10m when it comes to the location of the wireless AP (HUB) where this equipment is to be connected.
    - When the distance between this equipment and AP is over that of a specific distance, remove obstacle if there is obstacle, use Wireless Repeater or install additional AP (Wireless Hub) at nearby place.
    - If there is a wireless connection, contact local technician or distributor to receive help.

21. Refractive power measurement result and VA Test result may be different.
    - Refractive power measurement result and VA Test result may be different due to reasons such as the state of subject's eyeball and adjustment ability intervention.

22. To avoid electrocution, this device must be connected to the supply power along with protective grounding.

23. Do not place at a difficult location when separating cable when it comes to the device's placement.

24. When you carry this product, please hold on left and right bottom of the product. If you want the product to be installed on another place, please call A/S center.



## ⚠ CAUTION

For use of equipment in rated voltage less than 125Vac,minimum 6A,Type SJT or SVT , 18/3AWG,10A, max 3.0m long : One end with Hospital Grade Type, NEMA 5-15P Other end with appliance coupler. For use of equipment in rated voltage less than 250Vac,minimum 6A,Type SJT or SVT , 18/3AWG,10A, max 3.0m long : One end terminated with blade attachment plug(HAR) Type, NEMA 6-15P.

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provide with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

# 3. Characteristics

1. It is possible to carry out both refractive power and corneal curvature measurement with one machine.

2. It is possible to measure even the myopia since the refractive power measurement range is very broad ranging from –30 D to +25 D.

3. When measuring refractive power, it is possible to measure up to a minimum pupil diameter Ø2.0 mm.

4. Function for measuring Peripheral Corneal is provided to find out the curvature value and eccentricity of each point by measuring periphery curvature separately into the up/down/left/right direction from the cornea's center.

5. It is possible to check abnormal curve state with a graph of the Zernike map format.

6. Fog and mist technique that is applied to the internal fixation Target enables increasingly accurate measurement by ensuring natural and comforting feel for the patients' eyes.

7. Cornea measurement's marking form and cornea equivalence curve rate can be selected.

8. Distance between pupils (PD) measurement is enabled.

9. It is possible to observe the state of cataract patients' eyes or scratch on the contact lens surface through light observation with Retro-Illumination. It is possible to store up to two images of the left/right eyes in the memory. Stored image can be output on the monitor screen again to show to the patients.

# 4. Precautions during use

1. Handle with care since shock can damage the outside or the inside.

2. Precision measurement may be affected when the product is exposed to direct sunlight or too bright indoor illumination. It is recommended to measure at a dark eye examination room.

3. Get guidance at the place of purchase when using the device by connecting with other equipment.

4. When heating up the inside at a cold area all of the sudden, vapor may result on the object lens of the customer side and on the optical parts at the inside of the device. In this case, measure after waiting for the vapor to disappear.

5. Main the object lens from the customer side that is subjected to the test clean at all times. Error may result or precision measurement may be affected if tainted with dust or alien substance.

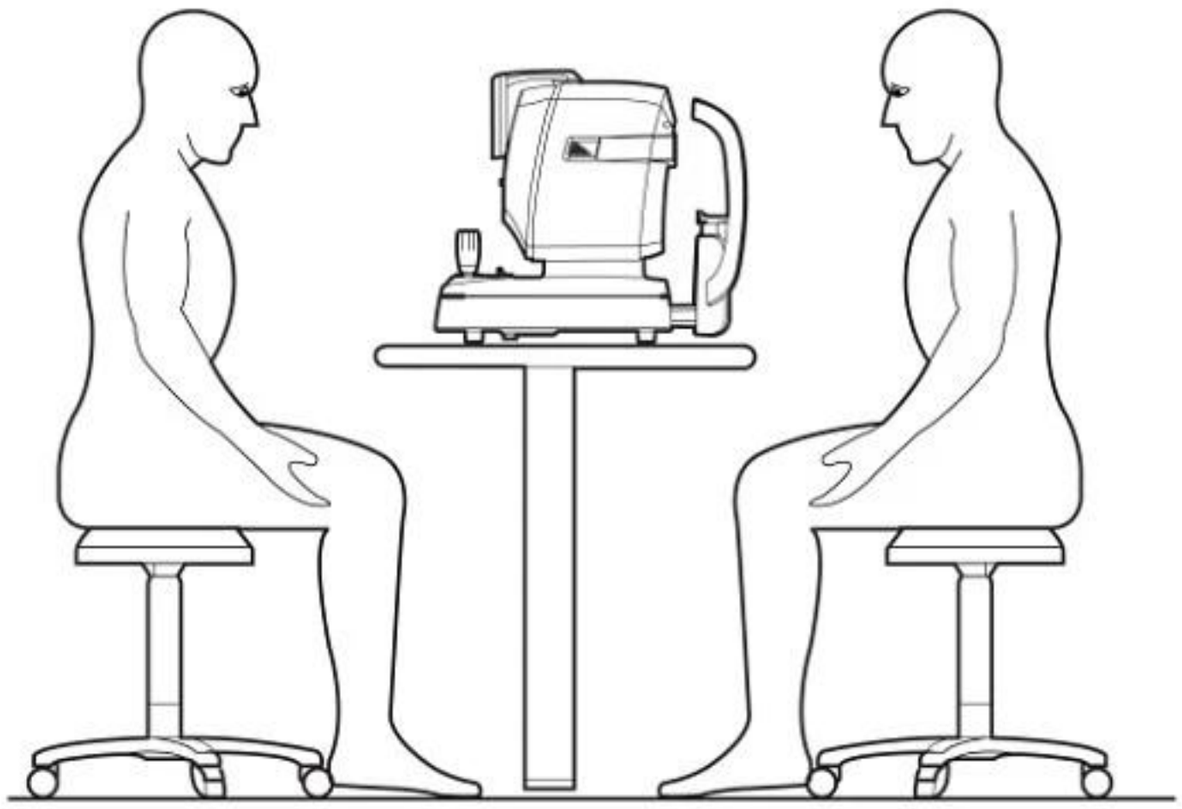
6. Take out the power plug to separate the power when there is smoke, smell or noise during use. Then, follow the instructions of the place of purchase.

7. Do not use alcohol, thinner, benzene and organic solvent to clean this equipment's surface since these may damage the equipment.

8. When moving the HRK-9000A, turn off the power switch always, and fixate the stage. Then, move by lifting up with lower part of the body with both hands.

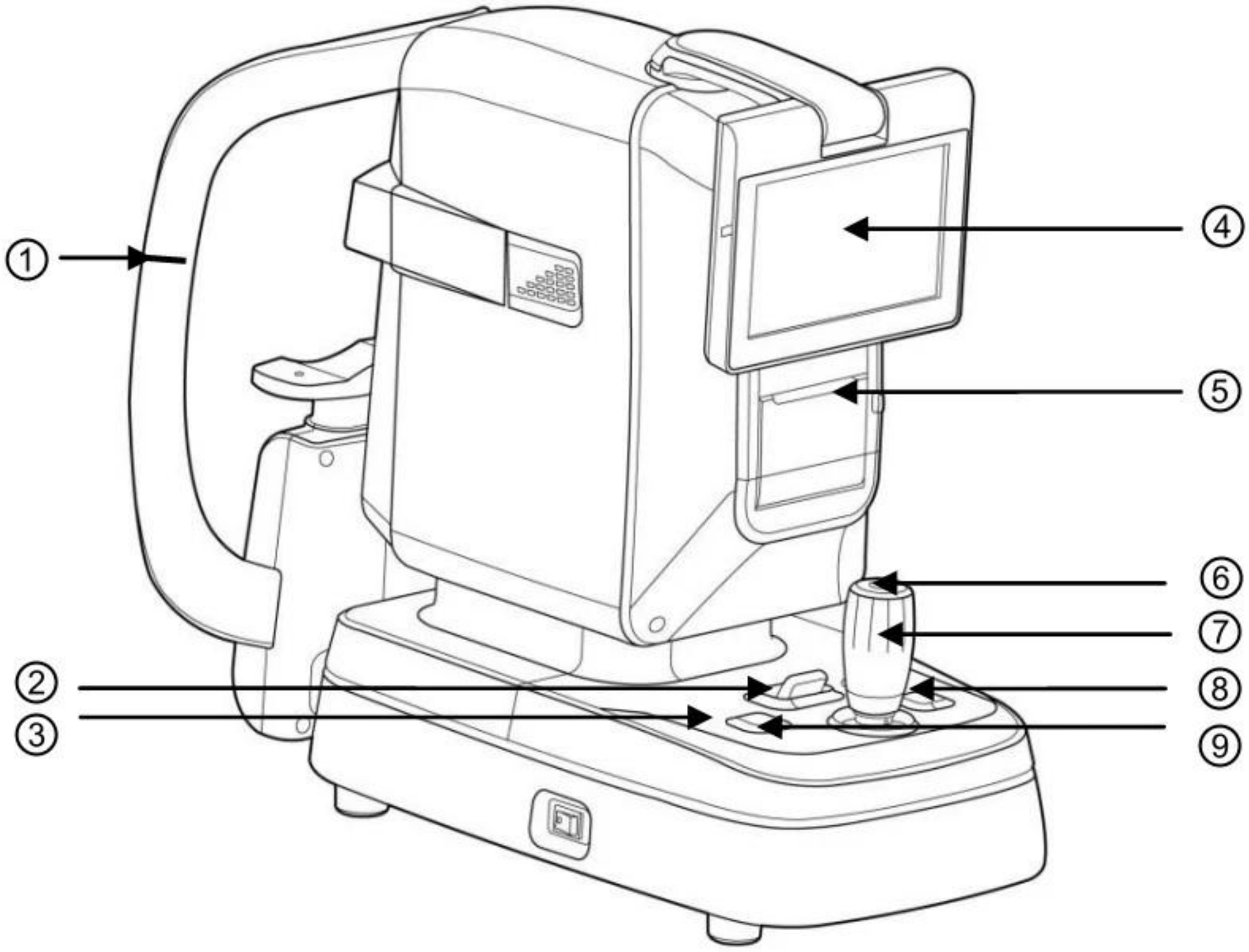
9. When HRK-9000A is not used for a long time, separate the power and cover it with the dust cover.

10. When using this equipment under normal state, then the proper location is as shown below.



# 5. Name and function of each part

## 5.1. Key part




**[Figure 5-1. Front part]**

---

**1. Height arrangement sign**: indicates the height that the test subject's eyes should be placed

**2. Stage fixation lever**: for fixating stage

**3. Movement indicator lamp**: indicates whether the device power is turned on

**4. Display monitor**: indicates measurement screen and movement state

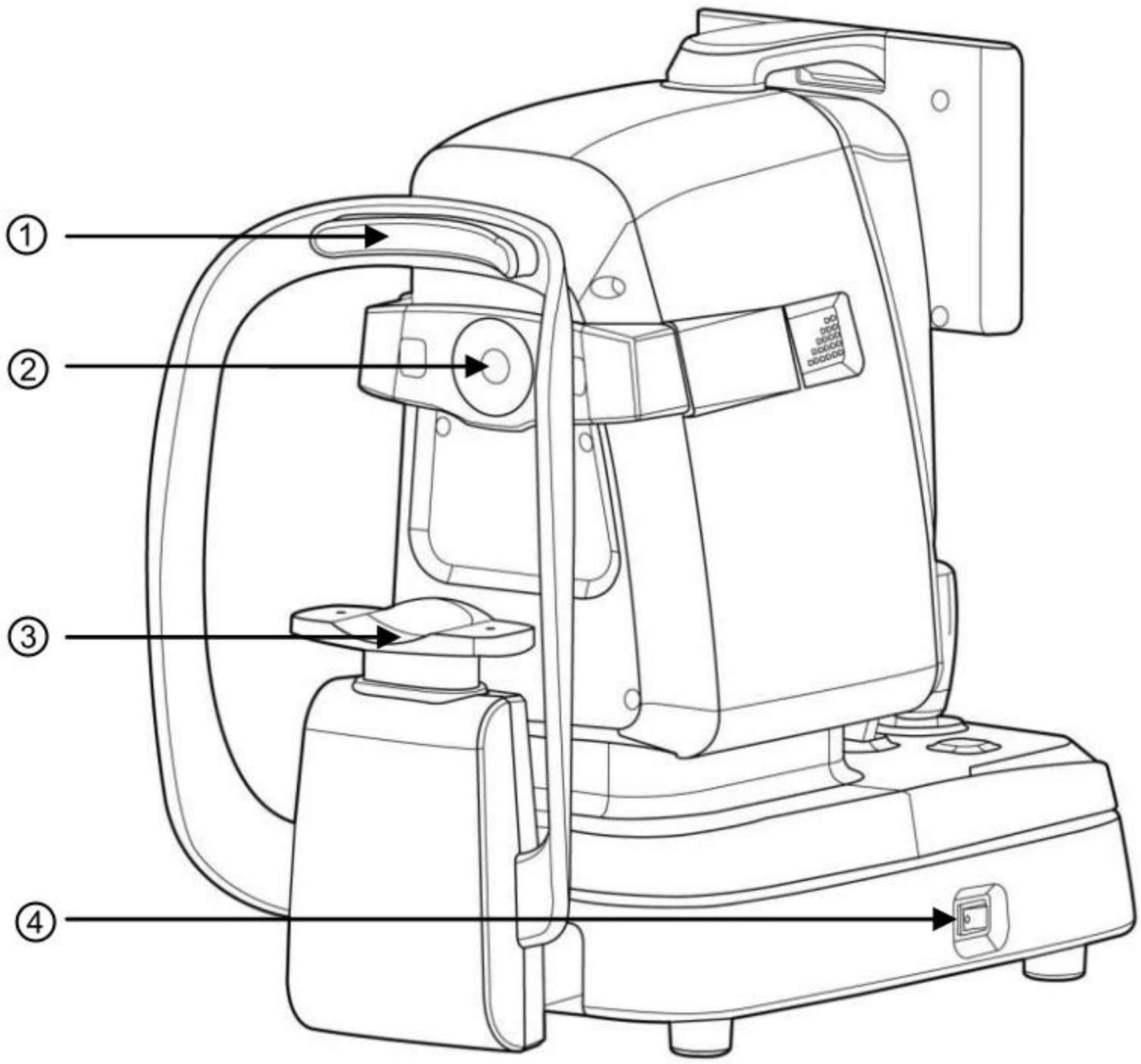
**5. Printer**: printer for printing out measurement results

**6. Measurement button**: button pressed on to measure

**7. Operation lever**: lever for moving object lens to the front and back, left and right, and up and down

**8. Chin support stand height adjustment button**: button for adjusting chin rest's height.

**9. Print button**: button for adjusting chin rest's height.




**[Figure 5-2. Back part]**

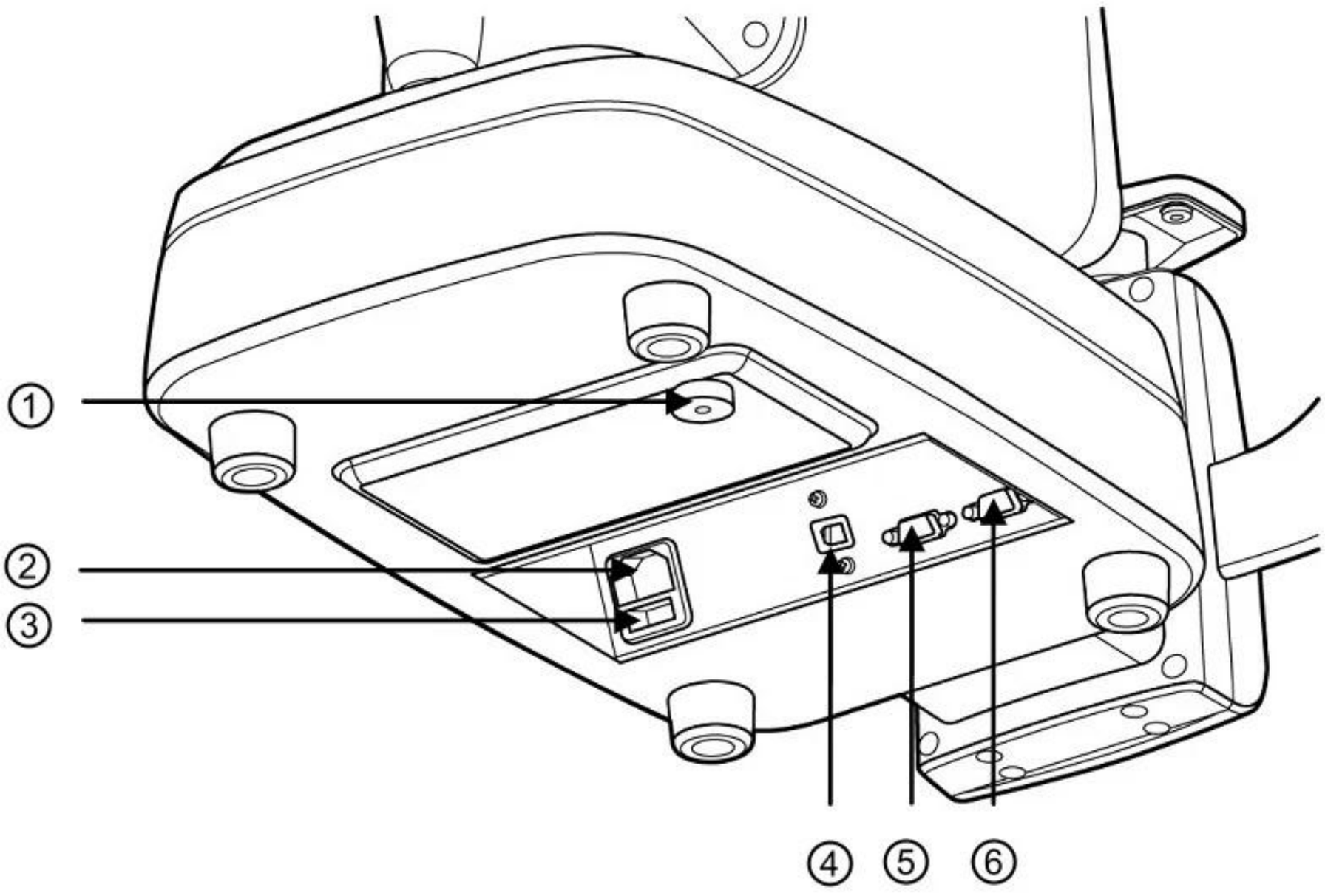
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**1. Forehead support stand:** location for placing the forehead to prevent test subject from moving the face (Type B attachment part)

**2. Measurement object lens**: object lens for measuring the image that is formed in the eye retina

**3. Chin support stand:** location for placing the chin to prevent test subject from moving the face (Chin support stand paper: Type B attachment part)

**4. Power switch:** switch for turning the power on or off




**[Figure 5-3. Lower part]**

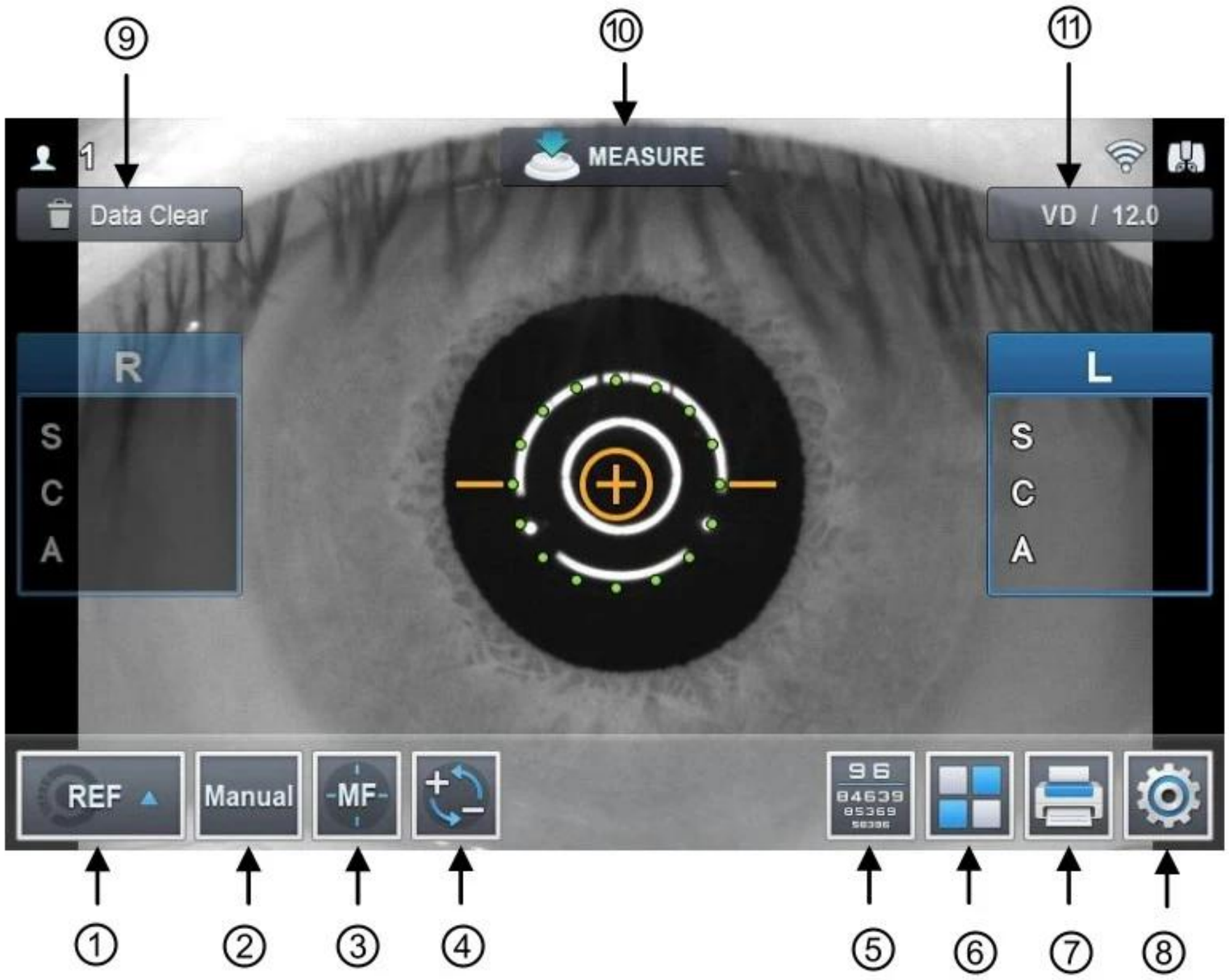
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1. **Clamping bolt:** Fixate system stage
2. **Power supply socket**: Socket that connects with the outside power plug
3. **Fuse holder**: 250V T3.15AL
4. **USB connector**: Connector for connecting the USB connector for communication
5. **Serial interface connector**: Connector for connecting outside device connector
6. **RGB connector:** Connector for connecting with the outside monitor of the RGB method

**NOTE**

Noise may appear on the screen when connecting with outside monitor due to the length and type of the cable, and monitor quality.
Use signal amplifier if the distance with the outside monitor is significant.

## 5.2. Main measurement screen button explanation




**[Figure 5-4. Front part's switch]**

---

1.  **(MODE) button:** Main measurement mode

   Button for modifying (REF, KER, K&R, KER-P, CLBC).

2.  **(MANUAL) button:** Button for selecting whether to carry out automatic measurement (number is frequency) (MANUAL, AUTO-3, AUTO-5, AUTO-A)

3.  **(AF) button:** Button for selecting whether to focus after tracking down the pupil automatically (MF: manual focus/AF: automatic focus)

4.  **(CYLINDER) Button:** Button that reverses cylinder value's sign (+ => -, - => +)

5. 

**(VA) button:** Button for converting the screen into the Visual Acuity test mode

6.  **(MENU) button:** Button for outputting the menu for converting to other measurement mode (COLOR VIEW, SIZE, ZERNIKE, RETRO-ILLUMINATION, TFBUT, MEIBO, DISPLAY MODE)

7.  **(PRINT) Button:** Button that prints measurement result.

8.  **(SETUP) button:** Button for converting to the user SETUP screen.

9. 

**(DATA CLEAR) Button:** Button that deletes measurement result.

10. 

**(MEASURE) Button:** Button that measures DATA.

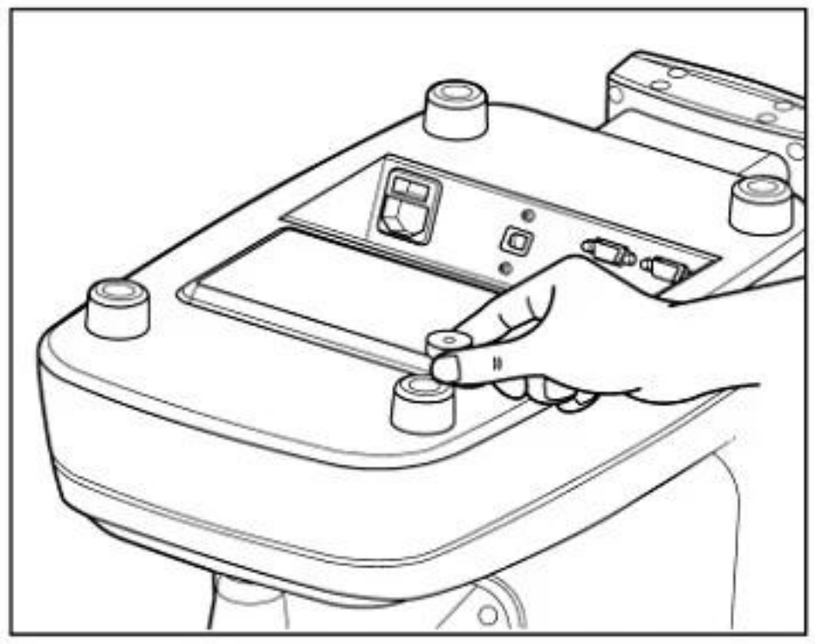
11. 

**(VD) button:** Button for converting VD to one of the following set up value (default value: 12.0) or 0.0

# 6. Equipment installation and preparation for measurement

### 1. Unlocking stage part's lock

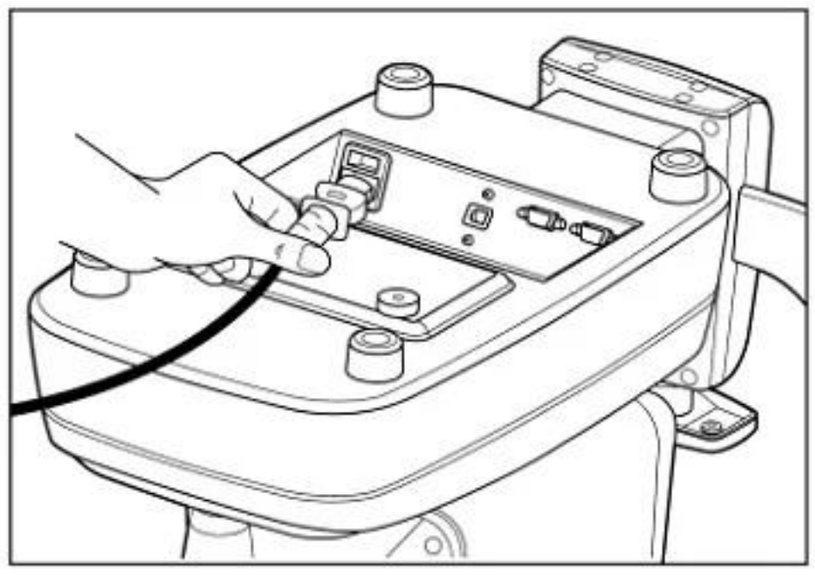
Loosen up the 'Clamping bolt' that is at the backside of this device's lower part by turning it to the counter clock-wise direction, and convert the stage fixation lever that is at the joystick's backside into the UNLOCK direction.



**[Figure 6-1. Unlocking stage part's lock]**

### 2. Access to the power cable

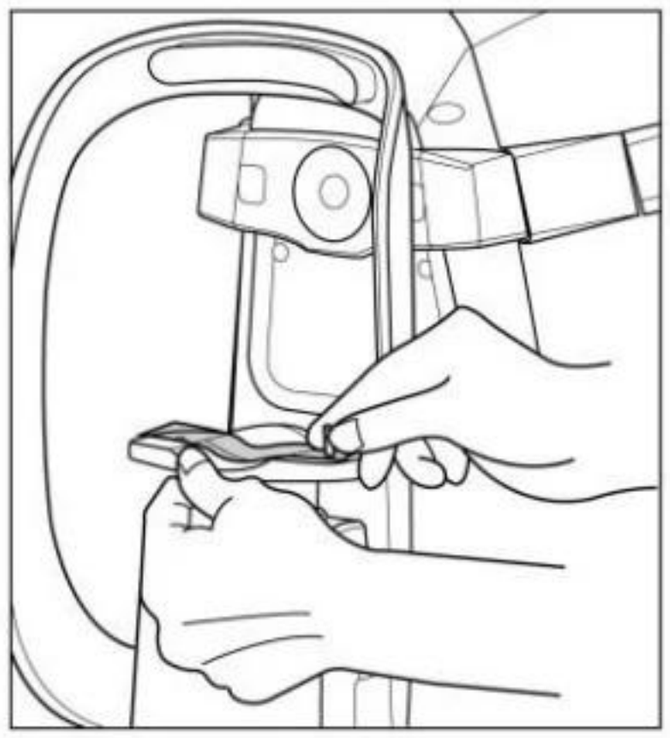
- Place HRK-9000A on a table.
- Put in the power cable into the power connector at the main body's lower part.
- Check to see whether the main body's power is turned off, and put in the power plug into the AC socket.



**[Figure 6-2. Access to the power cable]**

### 3. Fitting in the chin rest paper

- Pull out the pressing pin on the left and right sides.
- Fit in the pressing pin by putting it into the left and side holes of the chin rest paper.
- Attach the chin rest paper where pressing pin was fit in, onto the slip.



**[Figure 6-3. chin support stand paper]**

**4. Print page attachment**

Refer to “10.2 Replacing” part for print page attachment sequence.

**5. Message input at the time of measurement result output**

Input memory for the hospital name or address and other information that you want to print into the user SETUP menu. Refer to “9.3 user SETUP mode” part for message input method.

**6. Setting confirmation**

Check the setting of the marking form, cornea equivalence curve rate, date and others of the distance between corneal apex, astigmatism prescription indication, spherical prescription/astigmatism prescription unit, cornea measurement in the user SETUP mode menu.

**7. Transmission to other device**

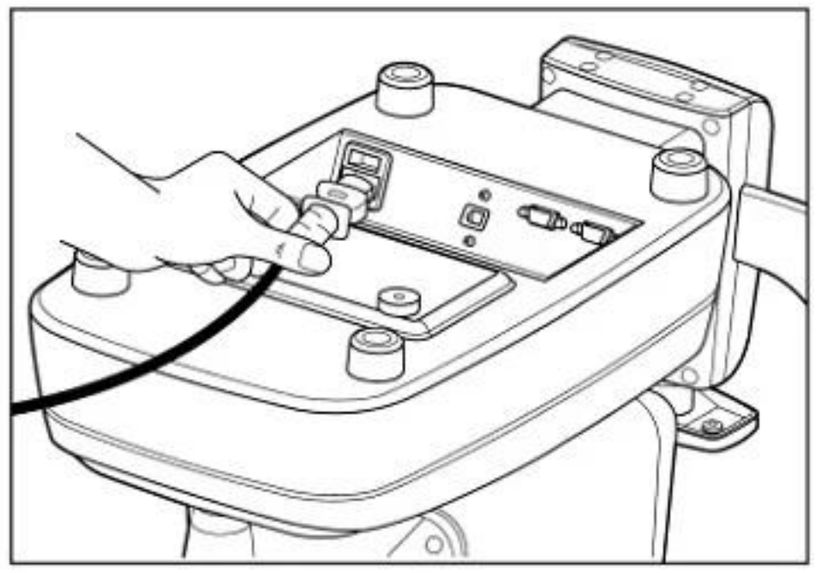
To transmit measurement result to other device via wired means, connect the cable to this device’s connector for serial interface, and prepare other device. Normally, equipment that gets connected to this eye examination device include the PC that has Huvitz’s digital reflector, lens meter and software for management provided by a third party built-in. As for the connection and communication setting method, it may be different depending on the equipment that gets connected. Thus, refer to the manual of the equipment that is connected to set up this eye examination device’s transmission speed (BPS) and protocol (RS232).

Refer to the ‘9.3 user SETUP mode’ for this eye examination device’s communication transmission speed and protocol. Ask the distributor where you purchased this device for details.

# 7. Practical training via Model Eye

## 1. Turning the main body's power ON

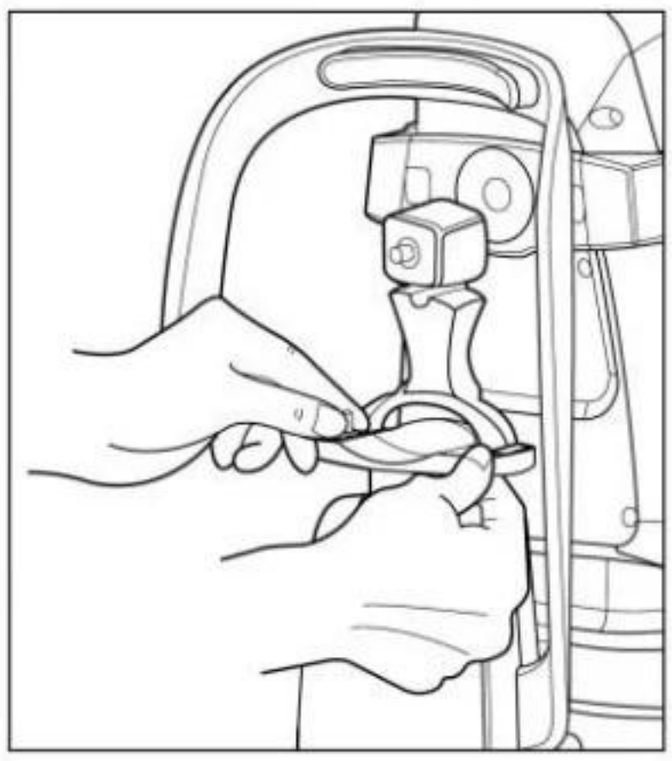
- Connect the power code appropriately as shown on the diagram on the side.
- Turn on the power switch.
- Axis measurement screen appears when system check is completed.



**[Figure 7-1. Connect power cable]**

## 2. Model Eye installation

Remove chin rest page, and fit in the pressing pin after aligning the hole at the Model Eye's lower part with chin rest's hole.



**[Figure 7-2. Model Eye installation]**

## 3. Unlocking stage part's lock

Convert the stage fixation lever at the joystick's backside towards the UNLOCK direction.



**[Figure 7-3. Unlocking stage part's lock]**

**4. Convert to K&R, REF mode.**

If the current measurement mode is not set as “K&R” or “REF” on the monitor, change the mode setting so that the device can operate with one of the two.

**5. Measurement location and focusing**

- Lean the operation lever towards the Model Eye until Mire Ring appears near the outer side arrangement ring.
- Focus so that the Mire Ring and outer side arrangement ring become the concentric circle while watching the monitor.
- Adjust the Mire Ring’s focus so that the inner side arrangement ring gets focused with the symbol for focusing.

1. Height adjustment: Turn the operation lever or adjust the chin rest’s height adjustment button.

2. Left and right adjustment: Lean the operation lever to the left and right and fit so that the outer side arrangement ring and Mire Ring become the concentric circle.

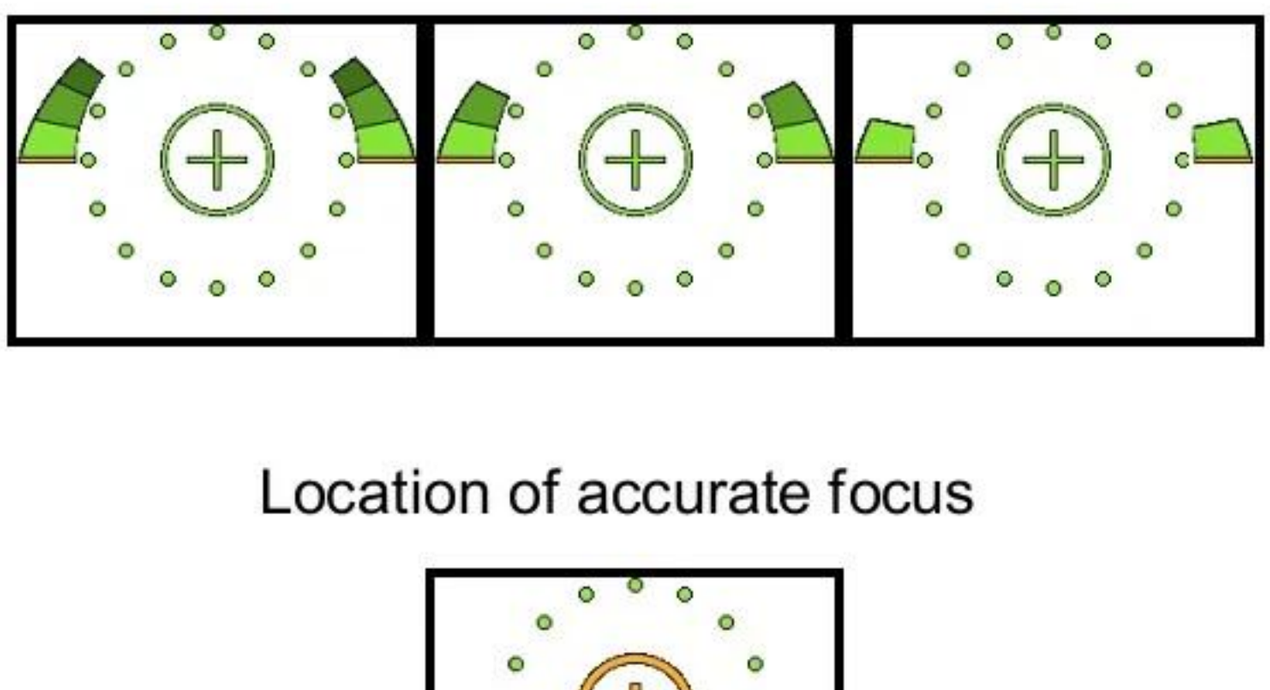
3. Focus adjustment: Adjust the focus so that the inner side arrangement ring becomes the symbol for focusing with the operation lever as the front and back.

- Automatic tracking function

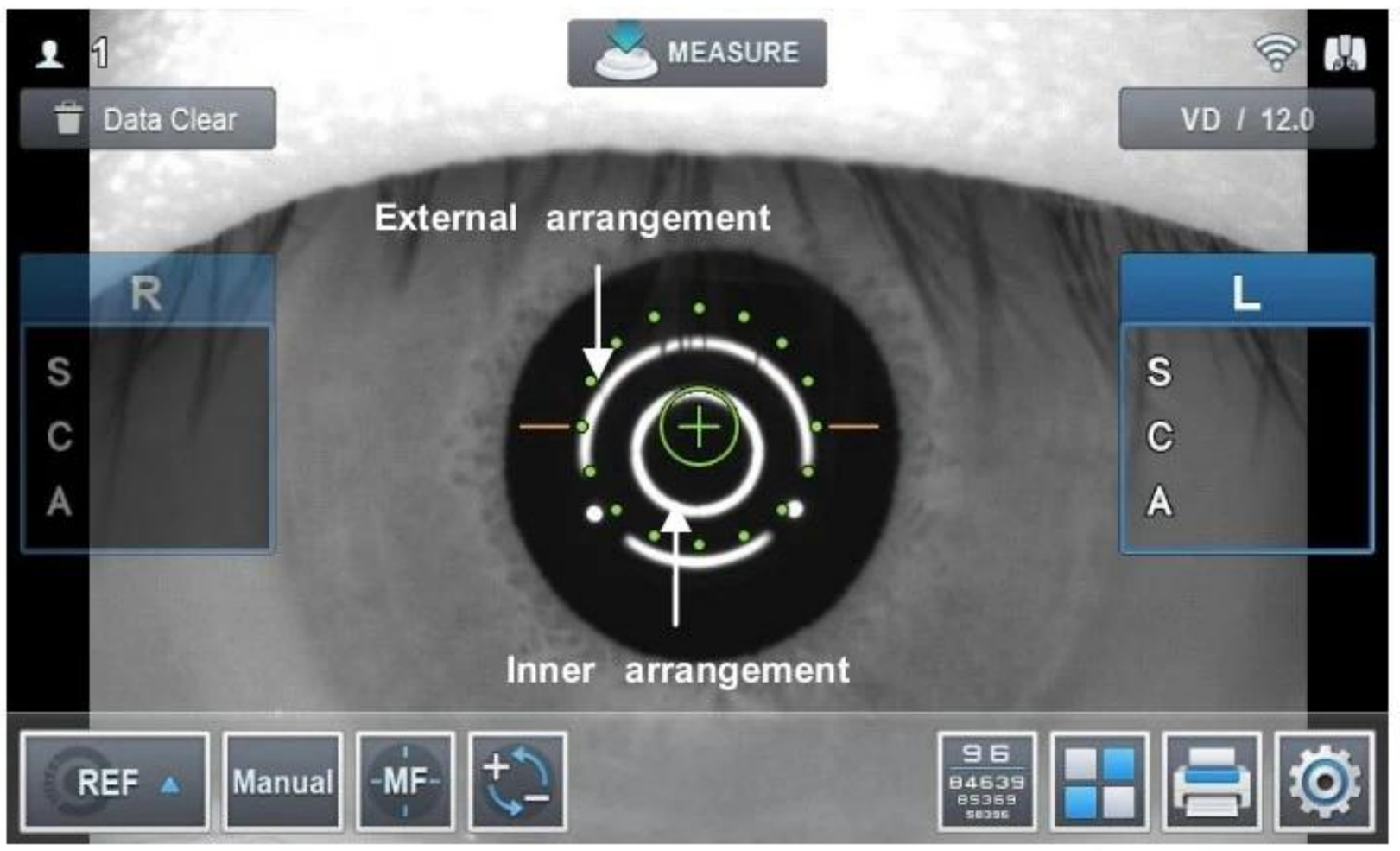
Set the AF mode as AF to use the automatic tracking function.

1. Use joystick to operate automatic tracking function, and move the main body so that the pupil is placed within the automatic tracking scope.

2. When the pupil is placed within the automatic tracking scope, adjust the measurement location and focus by arranging automatically so that the proper measurement can take place by tracking the pupil’s center automatically.




## <Focusing Indicator>




[Figure 7-4. Measurement location and focusing]

## 6. Measurement

1. Manual measurement

① Carries out measurement location and focusing process for Model Eye.
② Press on the measurement switch. If measurement does not take place while the TRY AGAIN message gets output on the screen's lower part once again, repeat the process of 1 and press on the measurement switch once again.
③ Check whether proper measurement is taking place after comparing the diopter value and actual value measured that are recorded on the Model Eye's left side or right side. If the measurement value is not satisfactory, measure and re-check using the same method.

2. Automatic measurement

① Set as AUTO mode by pressing on the MANUAL button located at the monitor's lower part.
② Carry out measurement location and focusing process for Model Eye.
③ Outer side arrangement ring and Mire Ring become the concentric circle, and measurement starts when the Mire Ring is clear, and when the inner side arrangement ring changes into symbol for focusing.

# 8. Measurement

1. Turn on the power switch.

   When system check is over, the following figure type of measurement screen appears on the monitor screen.

2. Check the measurement screen that appears on the monitor.

**NOTE**

- If the measurement screen that is shown below does not appear on the monitor screen, turn off the power and turn on the power switch on again after 10 seconds. If the measurement screen does not appear, contact the Huvitz's distributor.

3. Check the user Setup mode.

   Check and select various functions related to measurement including VD value or printer conditions. Print any message that you want to print along with the measurement data (refer to "user Setup mode" part).

**⚠ WARNING**

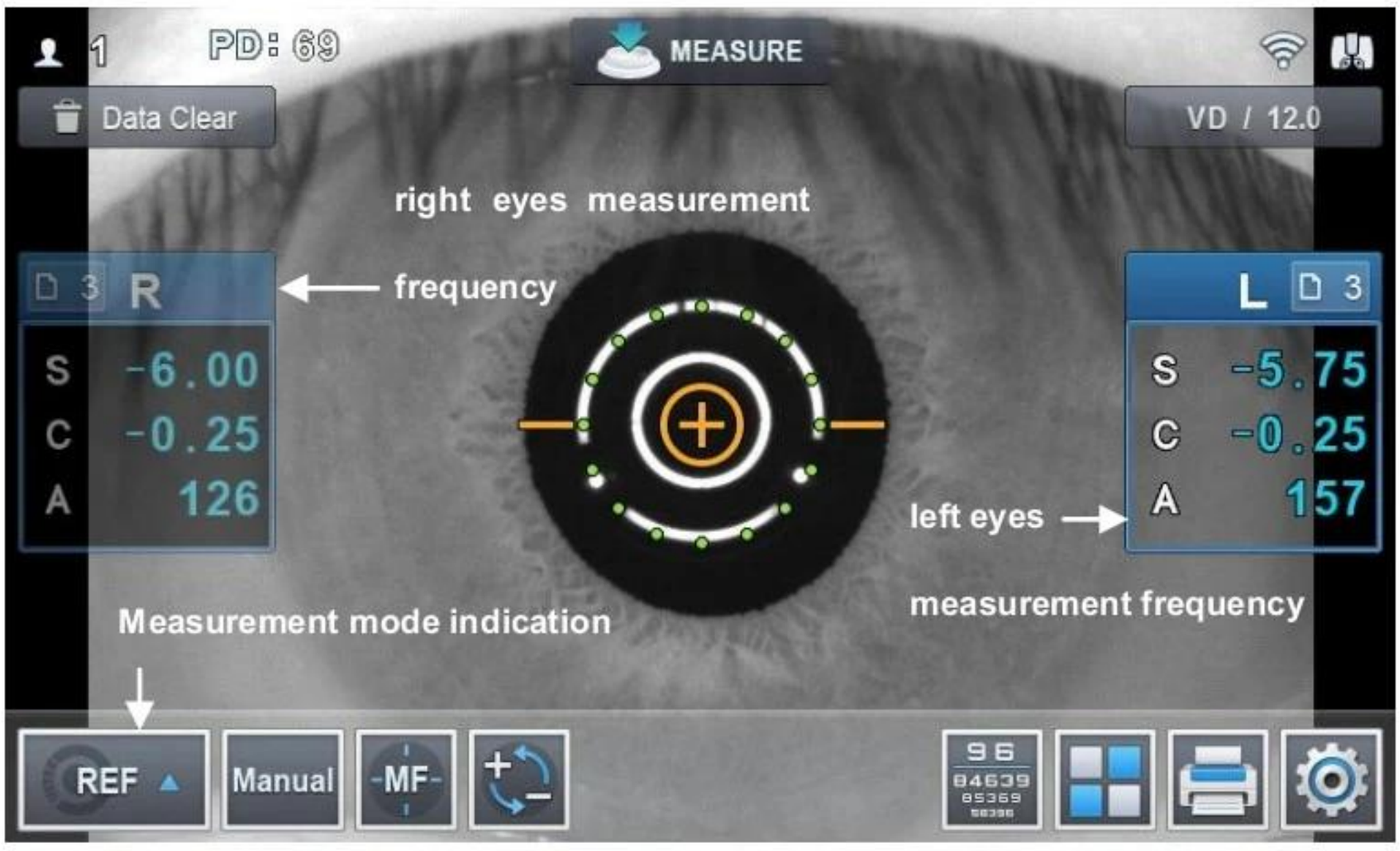
When the following type of situation results, turn off the power switch immediately. Then, contact the Huvitz's distributor after pulling out the power code from the AC power connection part.

- When smoke is detected from the equipment or when strange smell or sound is heard.
- When liquid was accidentally poured on the equipment or when a metallic material was dropped into the equipment
- When equipment was dropped or when external appearance was damaged

# 8.1. Refractive power measurement mode (REF mode)

This is the mode that measures refractive power by itself.

- REF mode selection: Set in a way that the measurement mode indicator section on the screen turns into “REF” mode.




[Figure 8-1. REF mode screen]

## 8.1.1. Manual measurement mode

Mode gets converted to manual measurement mode when you press on the Auto button while in the automatic measurement mode. It is possible to stop automatic measurement function when “Auto Measurement” category is selected as “OFF” while in the user Setup mode. (Refer to “user SETUP mode” part)

① Eye height adjustment.

- Have the test subject sit at the front part of the device.

**⚠ CAUTION**

- Do not have the test subject place his or her hand or finger on top of the chin rest's lower part. Hand or finger may get injured.
- Cleanse forehead rest with solvent such as ethanol every time the test subject changes to prevent infection.
- Replace chin rest paper every time the test subject changes to maintain cleanness.

- Adjust device's electric table or chair's height so that the patients can sit comfortably.

- Have the test subject place his or her face on the chin rest and have the front of the forehead attached close to the forehead rest .
- Turn the height adjustment lever so that the height of the test subject's eyes will be aligned with the height arrangement cover as shown on the figure.



**[Figure 8-1-1. eye height adjustment]**

② Measurement location and focusing

**⚠ CAUTION**

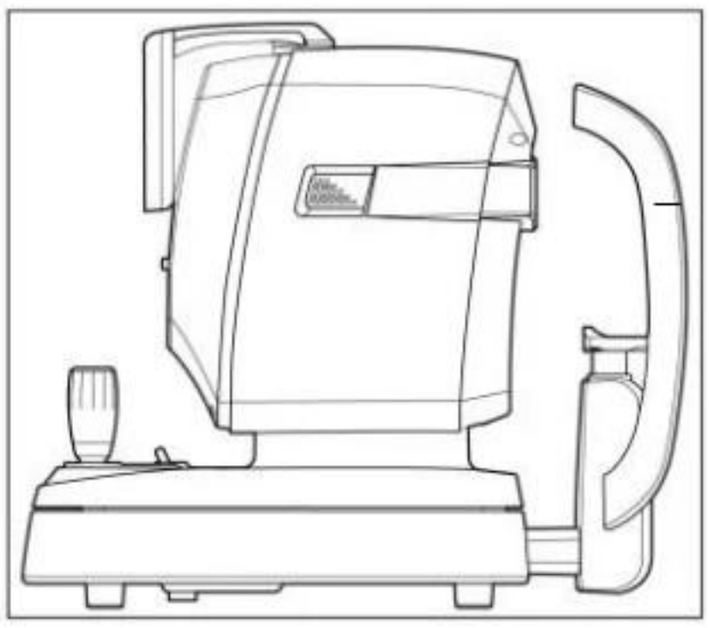
- Do not place your hand or finger in between stage and Base. Moreover, avoid having the test subject place his or her hand or finger either. Hand or finger may get injured.

- Use the operation lever to pull up the main body to the front of the user.

- Adjust to the left and right while pulling the operation lever to the front slowly so that the test subject's right eyes appear at the monitor screen's center. At this

time, ensure that the shining Mire Ring and outer side arrangement ring becomes concentric circle.

- Ask the test subject to watch the fixating target at the inside.



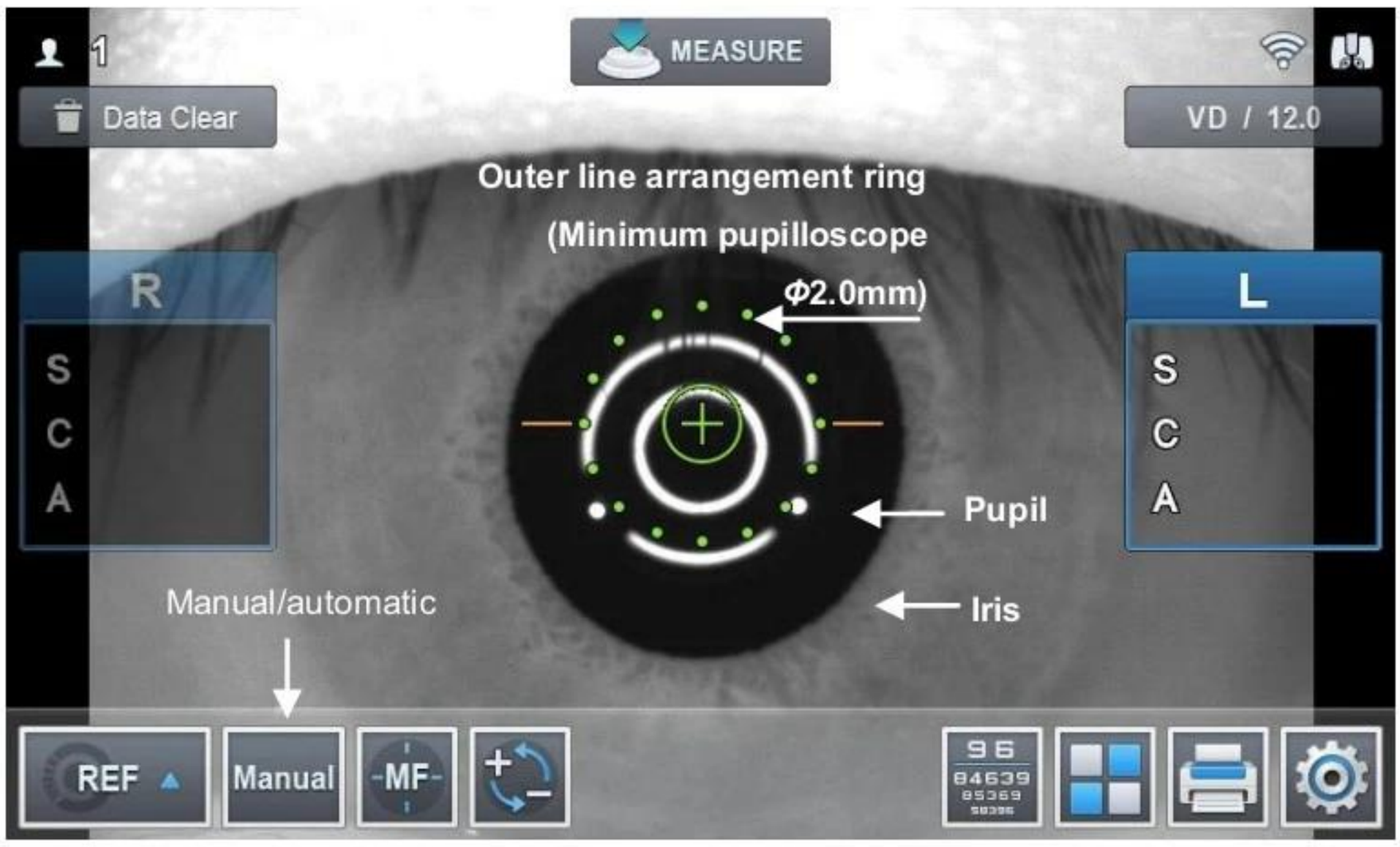
**[Figure 8-1-2. Height adjustment]**

- Adjust the focus so that the Mire Ring's outline becomes clear. When the focus is adequate, Circle symbol appears at the inner side arrangement ring.

- Height adjustment: Adjust by turning the operation lever or by pressing on the chin rest adjustment button.

- Left and right adjustment: Lean the operation lever to the left and right to adjust so that the outer side arrangement ring gets aligned to the Mire Ring's location.

- Focus adjustment: Lean the operation lever, front and back to adjust the focus so that the Mire Ring becomes clear.




**[Figure 8-1-3. REF manual measurement mode screen]**

**NOTE**

- If trying to adjust by leaning the operation lever is not sufficient, adjust by pushing the stage to the front, back, left and right.
- When carrying out refractive power measurement continuously, then there may be margin of error when it comes to measurement in case of the test subject that finds intervention of accommodation force easy.
- Measurement margin of error may result when the Mire Ring and outer side arrangement ring fails to maintain same axle during continuous measurement.

③ Measurement

- Press on the measurement button.

- Measurement is carried out continuously when measurement button is pressed on continually.

- Measurement result is indicated on the monitor when measurement is completed.

- Previous measurement result is indicated when carrying out continuous measurement.

④ Repetitive measurement

- Measure repeatedly according to need.

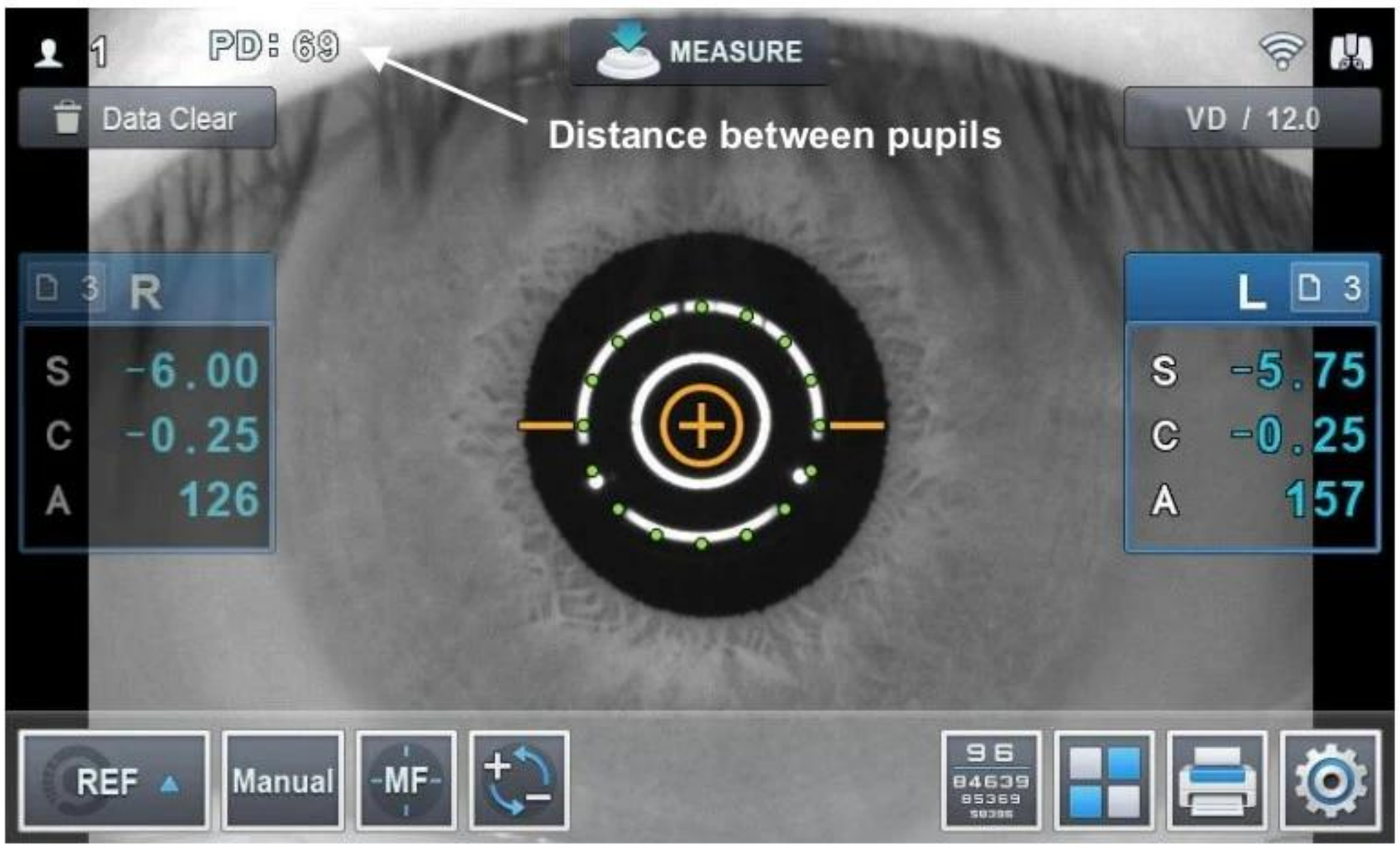
- The latest measurement value is indicated every time measurement takes place.

- Up to 10 measurement frequencies (excluding measurement failure) are indicated for each of the eyes on the left and right.
  It is possible to see up to the 10 latest measurement values on the DISPLAY mode's screen.

⑤ Measurement of the opposite eyes.

- Measures the left eyes while pushing the stage to the right side while holding the operation lever.

- PD value (distance between pupils, Pupillary Distance) gets indicated on the monitor when the left and right eyes are measured.




**[Figure 8-1-4. Screen indicating distance between pupils]**

⑥ Printing

- Print measurement result by pressing on the print button.

- Contents selected from the user Setup mode get printed. (Refer to “user Setup mode” part)

- Cut out the printing page.

- Input the test subject’s name in the name space according to need.

**NOTE**

- Value measured until now is removed when printing is carried out.
- Printed text changes in a light manner since print is a thermal record. Copy when you want to keep measurement data for a long time.

NAME :
HUVITZ HRK - 9000A
Ver 1.00.00
DATE : 2015/01/01 13:31
No. 0001

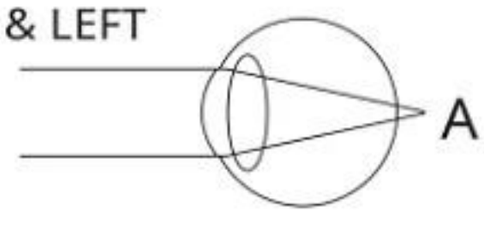
[REF] VD:12.00
C yl. Form: ( - )

| <R> | SPH | CYL | AX |
|---|---|---|---|
| | -3.00 | -1.50 | 15 |
| | -3.00 | -1.50 | 15 |
| | -2.75 | -1.50 | 14 |
| AVG | -3.00 | -1.50 | 15 |

| <L> | SPH | CYL | AX |
|---|---|---|---|
| | -2.25 | -1.25 | 176 |
| | -2.25 | -1.25 | 176 |
| | -2.25 | -1.25 | 177 |
| AVG | -2.50 | -1.25 | 176 |

PD = 68mm

RIGHT & LEFT




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+ 82-31-428-9100

**[Figure 8-1-5. Example of a printed page]**

## 8.1.2. Automatic measurement mode

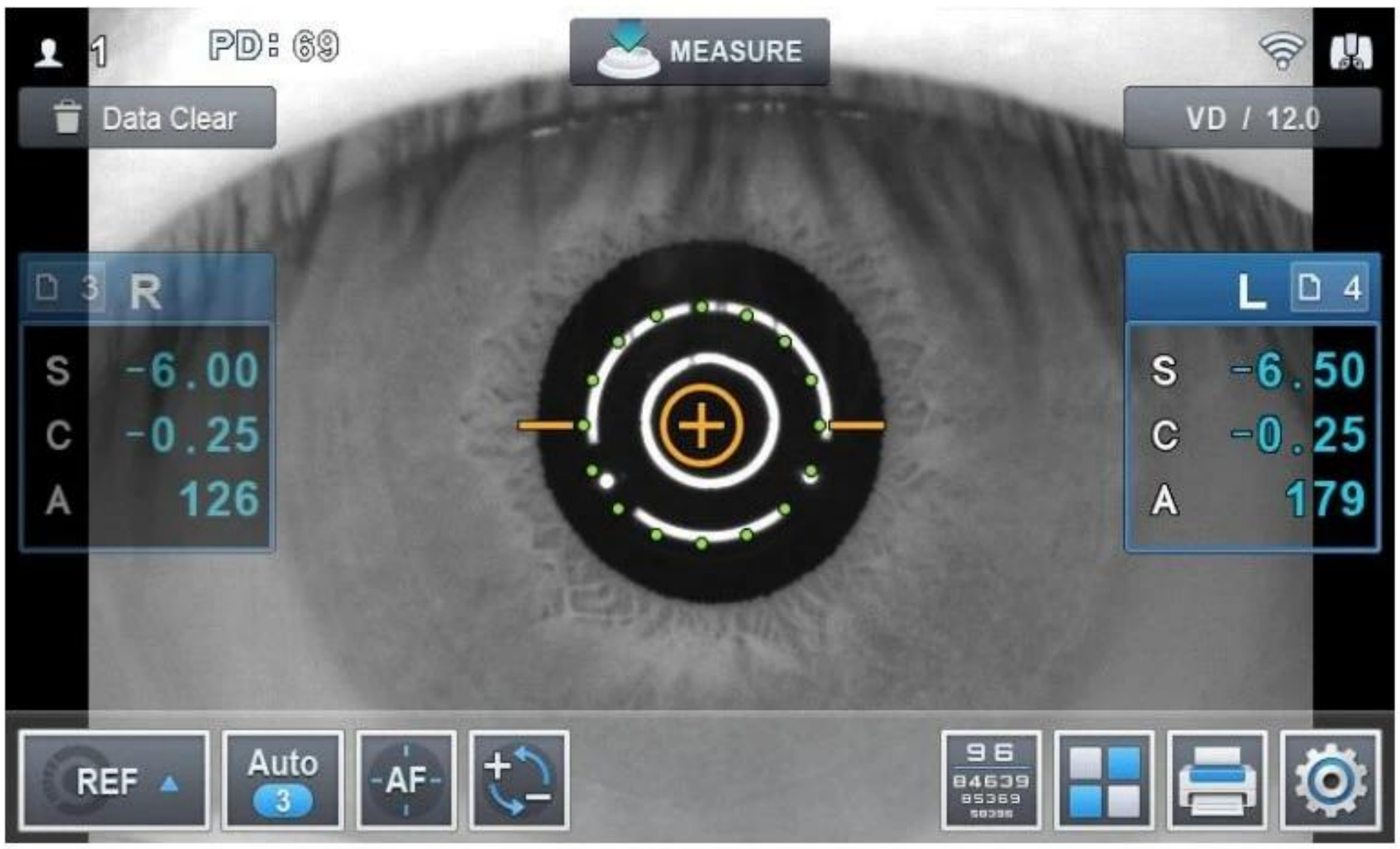
The mode gets converted to automatic measurement mode when MANUAL button is pressed on while in the manual measurement mode.

While in the automatic measurement mode, measurement is carried out automatically even when the measurement button is not pressed on when the state reaches a state in which arrangement in the device and measurement is realized effectively.

① (Eye height adjustment), (measurement location and focusing) process is carried out just like the manual measurement mode

② Measurement

- Measurement is carried out automatically when the location arrangement and focusing are completed.
- Value for new measurement result appears on the monitor screen after measurement takes place up to the frequency (possible to select among three, five and continuous) designated on the user Setup mode.
- Up to 99 measurement frequencies are indicated and it is possible to check the measurement values up to the latest 10 times once again in the Display mode.




**[Figure 8-1-6. REF automatic measurement mode indicator screen]**

③ Measurement of the other eye.

- Move the stage to the right side to measure the left eye using the same procedure.

- When the measurement of the two eyes is complete, PD value is indicated on the monitor screen automatically.

④ Printing

- Measurement result gets printed automatically when the measurement of the two eyes gets completed when the A-PRT category was selected as “ON” while in the user Setup mode.

- Print by pressing on the print button when only one eye was measured or when the A-PRT category was selected as “OFF”.

- Gets printed along with the message input while in the user Setup mode with the measurement data.

Refer to the following explanation when you see TRY AGAIN.

| When TRY AGAIN message appears | Measures |
|---|---|
| Defective location fitting | Arrange the pupil's location more accurately, and measure |
| When eyelids or inner eyelashes block the pupil | Measure by asking the test subject to open the eyes wide, or by pushing up the upper eyelids. |
| When the pupil is smaller than the Alignment Ring | minimum pupil diameter that this device can measure is 2.0 ㎜. It is possible to measure at a bright place as well, but ensure that the eyes for testing are not exposed directly to the bright illumination or solar light to prevent pupil's contraction. |
| When you have complication such as cataract | Some cataracts can be measured in the Retro-Illum mode. Measure in the Retro-Illum mode when you are concerned that the measurement error may result due to the cornea's scratch or eye lens's turbidity. Measure cataract patients' corneal curvature while at the KER measurement mode instead of the K&R measurement mode. |
| When the Mire Image is visible as tears | Measure after having the eyes flicker a number of times. |
| When mire Image is not clear since cornea is dry | |
| When Mire Image was modified in an irregular manner due to the strong irregular astigmatism or cornea complication | Cannot measure. |
| When measurement range is deviated from | |

## 8.2. Corneal curvature measurement mode (KER mode)

This is the mode for measuring the radius of cornea's curvature on its own.

- KER mode selection: Set so that the measurement mode indicator section on the screen becomes "KER" mode.

### 8.2.1. Manual measurement mode

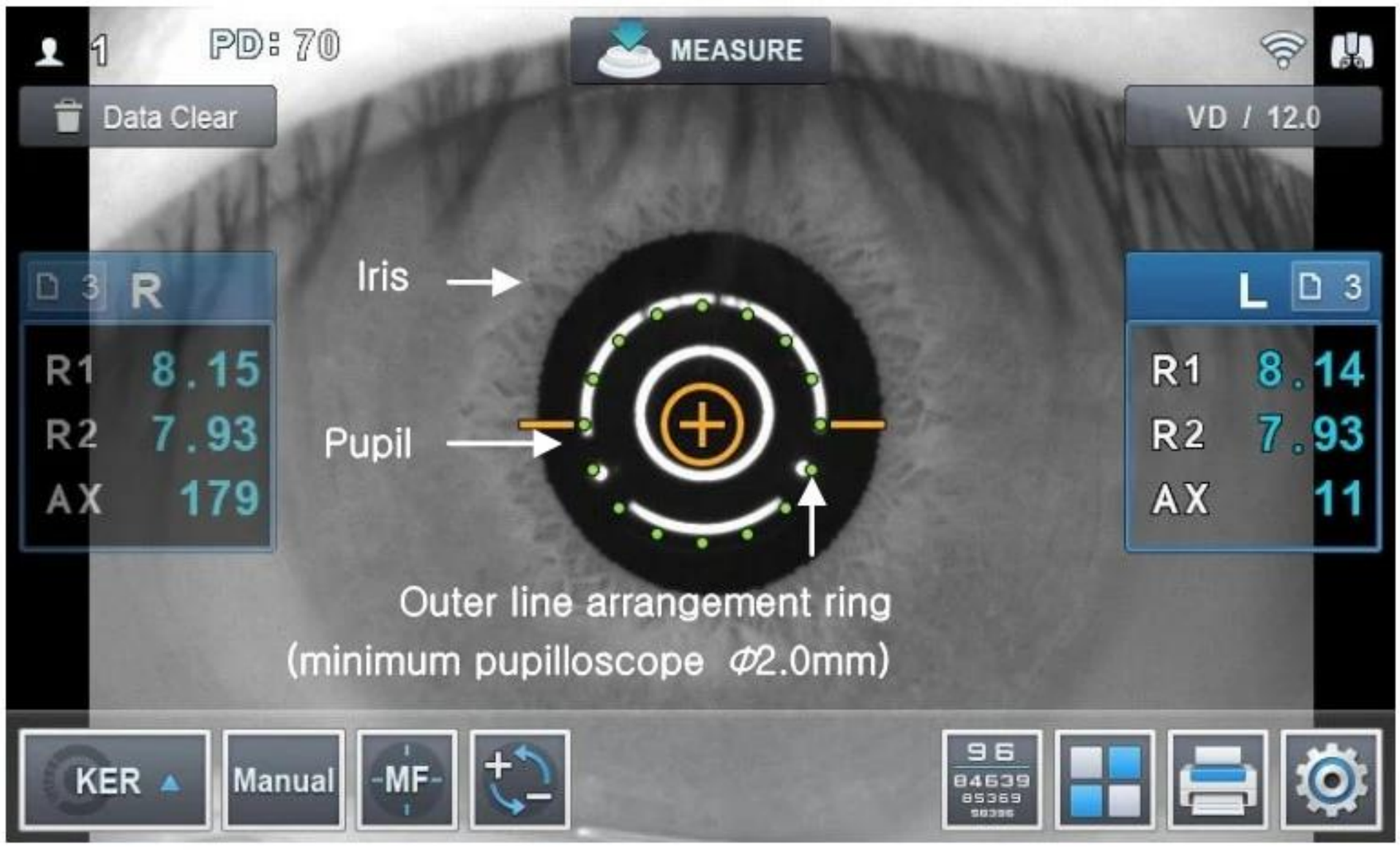
① Carry out the (eye height adjustment), (measurement location and focusing) process using the same method as that of the 8.1.1 refractive power measurement mode.

② Measurement

- Press on the measurement button.

- Measurement is carried out continuously when measurement button is pressed on continually.

- Measurement result is indicated on the monitor when measurement is completed. The most recent measurement result is indicated when continuous measurement is taking place.




**[Figure 8-2-1. KER mode indicator screen]**

③ Carry out the process using the same process as that of the (repetitive measurement), (measurement of the opposite eyes) in the 8.1.1 refractive power measurement mode.

④ Print the measurement result using the process that is like the (printing) process while at the 8.1.2 refractive power measurement mode.

NAME :
HUVITZ HRK - 9000A
Ver 1.00.00
DATE : 2015/01/03 15:03
No. 0012

[KER] Index: 1.3375

| <R> | R1 | R2 | AX |
|---|---|---|---|
| | 8.02 | 7.81 | 165 |
| | 8.05 | 7.83 | 163 |
| | 8.06 | 7.83 | 162 |

| | mm | D | AX |
|---|---|---|---|
| R1 | 8.04 | 42.00 | 163 |
| R2 | 7.82 | 43.25 | 73 |
| AVG | 7.93 | 42.62 | |
| CYL | | -1.25 | 163 |

| <L> | R1 | R2 | AX |
|---|---|---|---|
| | 8.12 | 7.93 | 10 |
| | 8.11 | 7.93 | 9 |
| | 8.12 | 7.93 | 10 |

| | mm | D | AX |
|---|---|---|---|
| R1 | 8.12 | 41.50 | 10 |
| R2 | 7.93 | 42.50 | 10 |
| AVG | 8.02 | 42.00 | |
| CYL | | -1.00 | 10 |

PD = 68mm

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**[Figure 8-2-2. Example of a printed page]**

## 8.2.2. Automatic measurement mode

The mode gets converted to automatic measurement mode when MANUAL button is pressed on while in the manual measurement mode. In case of automatic measurement mode, when the state reaches a state in which the arrangement in the device and measurement is realized effectively, measurement takes place automatically even when the measurement button is not pressed on.

① Location arrangement and focus are adjusted just like the (measurement location and focusing) while in the 8.1.2 refractive power measurement mode.

② Measurement takes place automatically using the same method as that of the (measurement) process while in the 8.1.2 refractive power measurement mode.

③ Measurement result is printed using a method that is same as that of the (printing) process while in the 8.1.2 refractive power measurement mode.

# 8.3. Continuous corneal curvature / refractive powermeasurement mode (K&R mode)

This is the mode for carrying out the corneal curvature measurement and refractive power measurement continuously.

- K&R mode selection: Set so that the measurement mode indicator section on the screen becomes “K&R” mode.

## 8.3.1. Manual measurement mode

① (Eye height adjustment), (measurement location and focusing) process is carried out just like the 8.1.1 refractive power measurement mode.

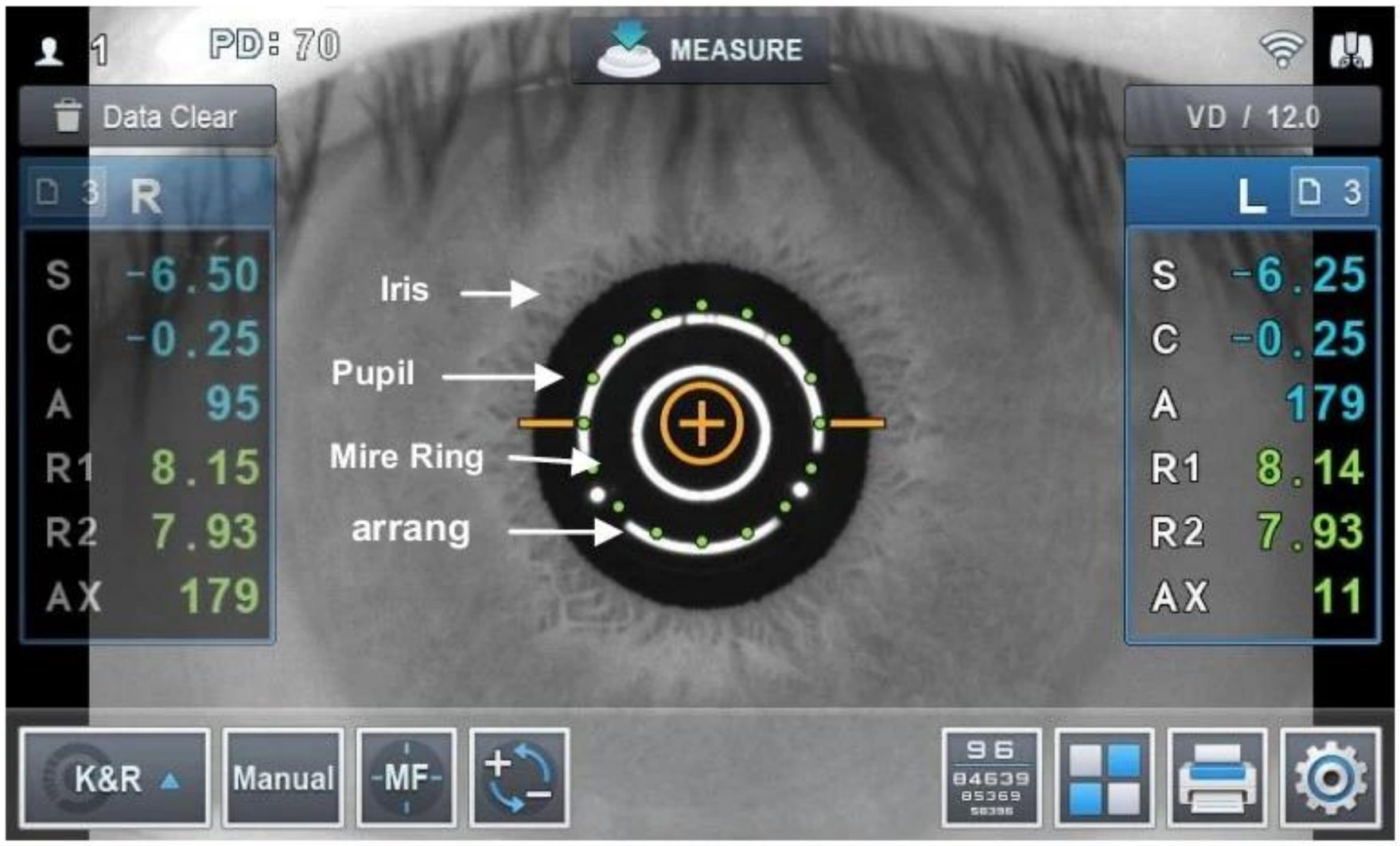
② Measurement

- Press on the measurement button.

- Measurement is carried out continuously when measurement button is pressed on continually.

- Measurement result is indicated on the monitor when measurement is completed.

- The most recent measurement result is indicated when continuous measurement is taking place.




[Figure 8-3-1. K&R mode indicator screen]

③ Operation process that is the same as that of the (repetitive measurement), (measurement of the opposite eyes) was executed in the 8.1.1 refractive power measurement mode.

④ Prints measurement result through the process that is the same as that of the (printing) in the 8.1.1 refractive power measurement mode.

NAME :
HUVITZ HRK - 9000A
Ver 1.00.00
DATE : 2015/01/03 11:31
No. 0003

[REF] VD:12.00
C yl. Form: ( - )

| <R> | SPH | CYL | AX |
|---|---|---|---|
| | -2.00 | -1.50 | 11 |
| | -2.00 | -1.50 | 10 |
| | -2.00 | -1.50 | 1 |
| AVG | -2.00 | -1.50 | 10 |

| <L> | SPH | CYL | AX |
|---|---|---|---|
| | -2.25 | -1.00 | 174 |
| | -2.50 | -1.00 | 175 |
| | -2.50 | -1.00 | 174 |
| AVG | -2.50 | -1.00 | 174 |

[KER] Index: 1.3375

| <R> | R1 | R2 | AX |
|---|---|---|---|
| | 8.12 | 7.91 | 165 |
| | 8.12 | 7.91 | 164 |
| | 8.12 | 7.91 | 164 |

| | mm | D | AX |
|---|---|---|---|
| R1 | 8.12 | 41.75 | 167 |
| R2 | 7.91 | 42.50 | 77 |
| AVG | 8.01 | 42.12 | |
| CYL | | -0.75 | 167 |

| <L> | R1 | R2 | AX |
|---|---|---|---|
| | 8.11 | 7.93 | 10 |
| | 8.10 | 7.92 | 9 |
| | 8.10 | 7.91 | 7 |

| | mm | D | AX |
|---|---|---|---|
| R1 | 8.11 | 41.75 | 9 |
| R2 | 7.92 | 42.50 | 9 |
| AVG | 8.02 | 42.12 | |
| CYL | | -0.75 | 9 |

PD = 68mm

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**[Figure 8-3-2. Example of a printed page]**

⑤ Screen indication format selection

- It is possible to designate symbol of astigmatism refractive power in the measurement mode that includes refractive power measurement. It is possible to designate in the user Setup mode. Moreover, it is possible to indicate Refractive power's measurement data following VD value in the measurement mode that includes refractive power measurement. It is possible to designate the desired VD value when VD button is pressed on continuously, and the ensuing measurement value gets indicated on the screen.

- It is possible to designate screen indication format (R1/R2/AX → K1/K2/AX → AR/CY/AX) in the user Setup mode when it comes to the measurement mode that includes corneal curvature measurement.

## 8.3.2. Automatic measurement mode

The mode gets converted to automatic measurement mode when MANUAL button is pressed on while in the manual measurement mode.
While in the automatic measurement mode, measurement is carried out automatically even when the measurement button is not pressed on when the state reaches a state in which arrangement in the device and measurement is realized effectively.

① Location arrangement and focus are aligned with the process that is the same as that of the (measurement location and focusing) of the 8.1.2 refractive power measurement mode.

② Measurement takes place automatically using the same process as that of the (measurement) of 8.1.2 refractive power measurement mode.

③ Prints measurement result value by carrying out the (printing) process of the 8.1.2 refractive power measurement mode.

## 8.3.3. All kinds of markings

| | Type | Denomination | Symbol's meaning | Coping method |
|---|---|---|---|---|
| Curve measurement | # | indicates low reliability | low reliability measurement value | re-measurement |
| | + OUT | measurement range exceeded | spherical prescription exceeds +25 D | impossible to measure |
| | - OUT | measurement range exceeded | spherical prescription exceeds –30 D | |
| | C OUT | measurement range exceeded | astigmatism prescription exceeds ± 12 D | |
| Curvature measurement | # | indicates low reliability | low reliability measurement value | re-measurement |
| | + OUT | measurement range exceeded | curvature radius exceeds 13.0 mm | impossible to measure |
| | - OUT | measurement range exceeded | curvature radius is 5.0 mm or less | |
| | C OUT | measurement range exceeded | cornea astigmatism exceeds 15.00 D | |

## 8.4. Peripheral Corneal measurement (KER-P mode)

This is the mode that measures cornea's center and periphery curvature separately. Periphery curvature is measured at the locations toward the up and down left and right direction using the cornea's center as the standard. Relative eccentricity is shown by comparing periphery curvature with the cornea center's curvature.

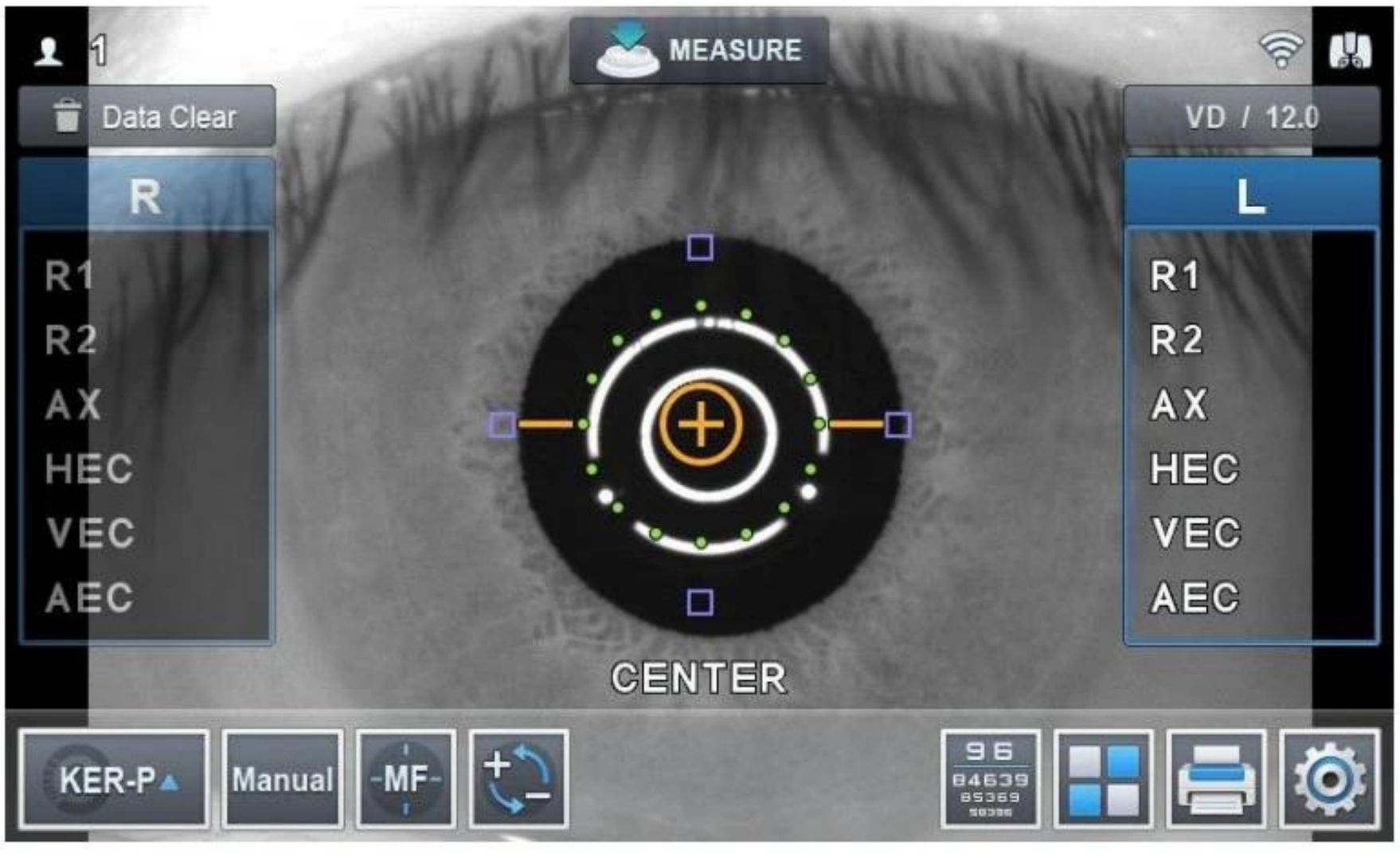
- KER-P mode selection: Set so that the measurement mode indicator section on the screen becomes "KER-P" mode.

**NOTE**

Eccentricity indicates how flatter Peripheral Corneal is when it comes to the cornea center. In general, curvature is the highest at the center when it comes to the human cornea while it flattens as it approaches the periphery. Accordingly, people may feel discomfort when lens such as RGP are prescribed merely by factoring in the cornea's center curvature. It is possible to select adequate lens by factoring in the patients' characteristics by utilizing the value of Peripheral Corneal's eccentricity obtained from KER-P mode.

① Cornea center measurement

- Cornea's center is the location for the first measurement, and it is indicated as CENTER at the lower part of the screen's midpoint. Curvature that is measured from the cornea center is the same as the curvature that is measured in the KER mode.




[Figure 8-4-1. KER-P mode indicator screen]

Contents indicated on the screen when measuring cornea's center

- R1: Curvature (major axis) at the cornea center
- R2: Curvature (minor axis) at the cornea center
- AX: Axis direction of the cornea center curved surface
- HEC: Eccentricity of the overall eyeball's horizontal direction
- VEC: Eccentricity of the overall eyeball's vertical direction
- AEC: Overall eyeball's average eccentricity

② Peripheral Corneal measurement

Periphery direction that is measured currently is indicated in the screen's lower part. Moreover, four boxes are indicated to the up and down, and left and right of the Mire Ring. Each box indicates the measurement progress status of the Peripheral Corneal that applies. Inside of the box is filled with color when there is a result measured at the periphery towards the direction where box is located. If there is no measured result, the box is indicated as an empty box. Box that

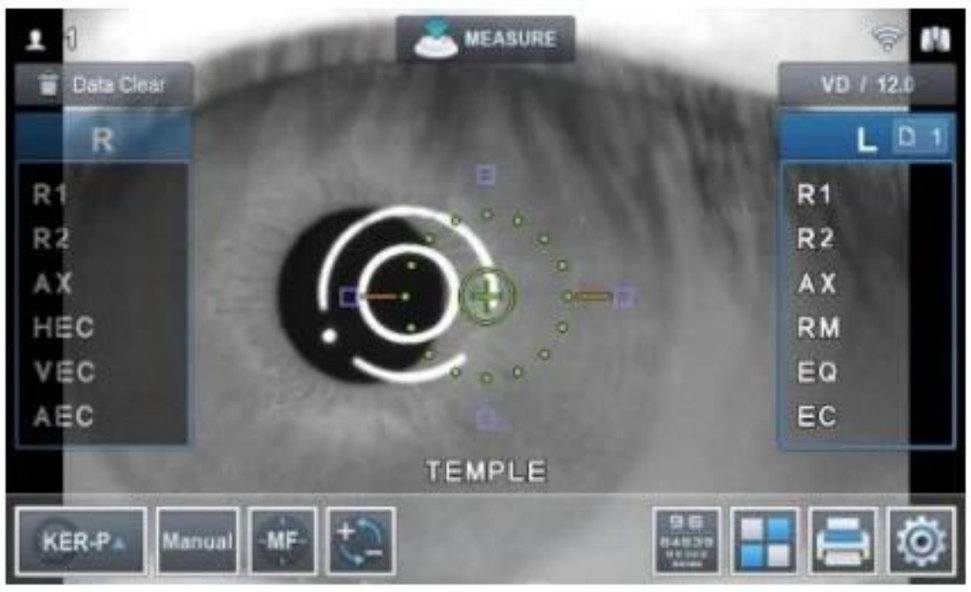
applies to the periphery location that is measured currently gets flickered.

Periphery direction

- Superior (SUP): Upper side from the cornea's center
- Inferior (INF): Lower side from the cornea's center
- Temple (TEM): Towards the temple of the person subjected to measurement from the cornea's center
- Nasal (NAS): Towards the nose of the person subjected to measurement from the cornea's center

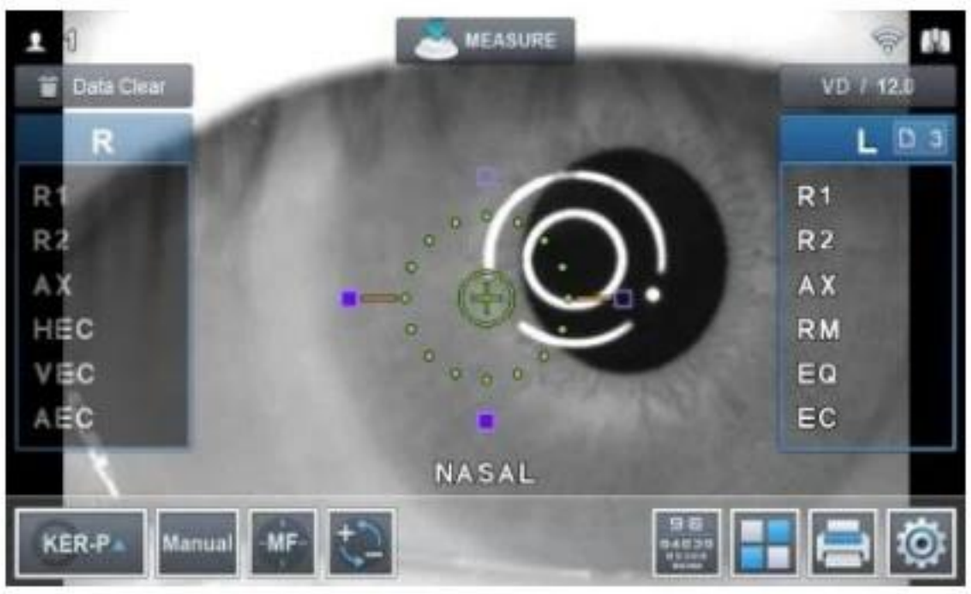
③ Periphery measurement sequence

Measurement is carried out in the following order; TEM → SUP → NAS → INF.
When measurement takes place from the Peripheral Corneal direction, indicator light (Guidance LED light) for catching test subject's attention gets emitted at the area near the Mire Ring in actuality. Measurement is carried out in line with the Mire Ring's focus after eye examiner requests that the test subject watch the light of the indicator light.















**[Figure 8-4-2. KER-P mode measurement screen]**

Contents indicated on the screen when measuring Peripheral Corneal (SUP, INF, TEM, and NAS)

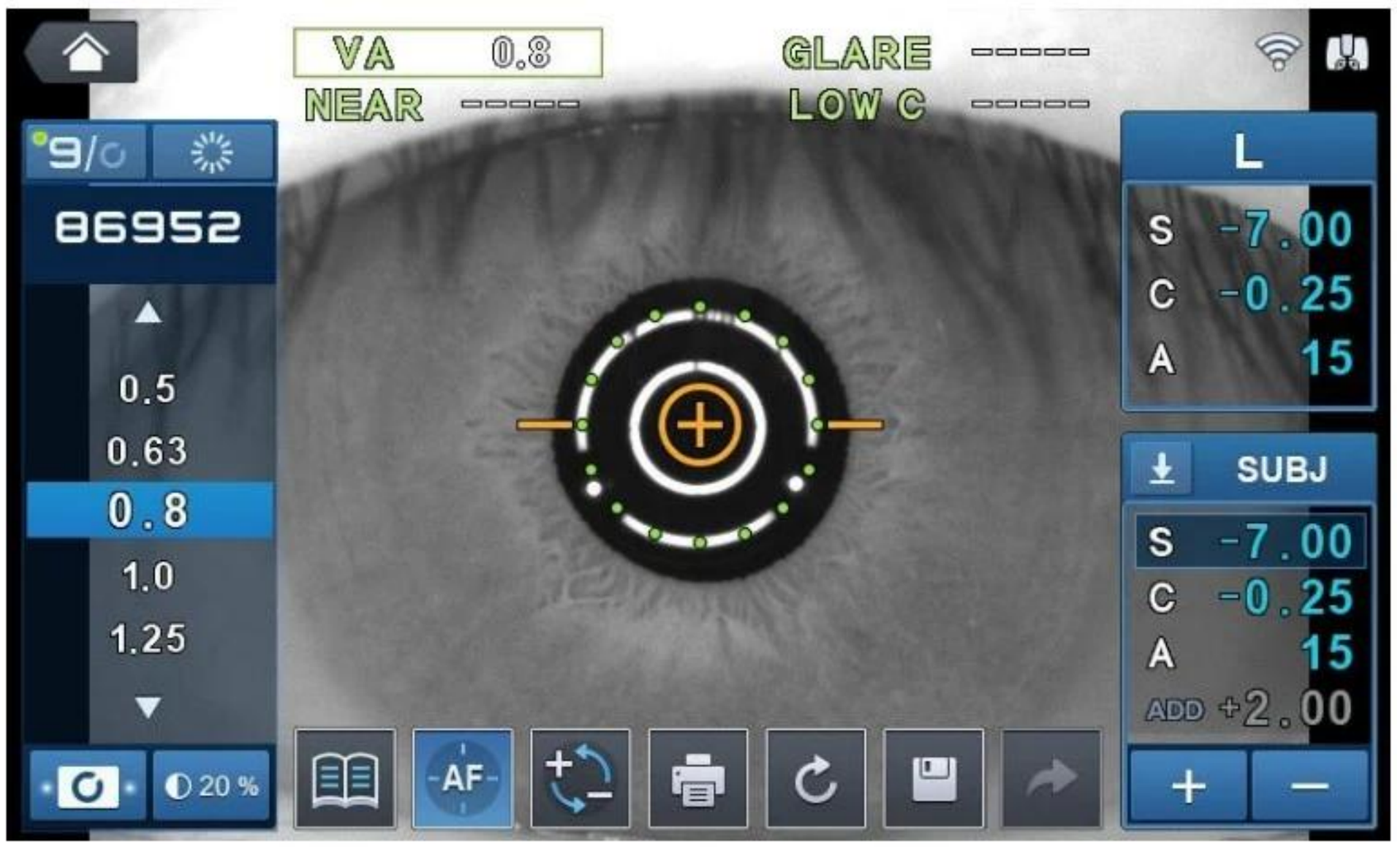
- R1: Curvature (major axis) at the Peripheral Corneal
- R2: Curvature (minor axis) at the Peripheral Corneal
- AX: Axis direction of the Peripheral Corneal curved surface
- RM: Average curvature at the Peripheral Corneal
- EQ: Difference between cornea center and diopter
- EC: Peripheral Corneal’s eccentricity

# 9. Other mode

## 9.1. Visual Acuity Test Mode

Visual Acuity Test Mode offers to measure refraction of an examinee subjectively by using a chart that can observe in the equipment. Refraction offers a function to immediately percept uncorrected vision, corrected vision using the lenses inserted in the equipment and vision changes from before and after the correction. It also offers a function to examine near-distance refraction, glare during contact lens use and refraction in low-contrast environment.

Button information on the screen are as the following.




**[Figure 9-1-1. Visual Acuity Test Mode Screen]**

Button information on the screen are as the following.



: Set chart type as number type.



: Set chart type as Landolt type.


: Set the chart type to radial chart type.


: Set LED ON/OFF for glare examination.



: Set brightness for low contrast examination.


: Set near distance chart examination mode ON/OFF.



: Set automatic tracking function ON/OFF.


: Apply by reversing cylinder value's sign.


: Print measurement result.


: Initialize current lens correction status.


: Save the currently applied refraction of correction lens.


: Load the saved refraction of correction lens and apply to current status.

 : Change lens status to fit examinee's REF measurement data.

 : Adjust lens status 1 step further than current setting.

 : Adjust lens status 1 step lesser than current setting.

## 9.1.1. Uncorrected Vision Measurement

① Press  button to convert to Visual Acuity Test mode.

② Perform (eye-level adjustment) and (measurement position and focus adjustment) in the same manner as in 8.1.1 Refraction Measurement Mode.

Activate automated tracking function using  button, and the machine will adjust focus by automatically tracking down the pupil.

③ The chart for examination is set at 0.8 by default. Data of the chart to be shown to the subject is indicated at the upper left side.

④ Confirm that examinee can read the current chart well.

Three types of charts are provided; number, Landolt and radial chart. Press on

the  or  button at the upper left side to convert two charts, and press on the radial chart button to select chart.

⑤ Adjust retraction level of the chart according to the answers of examinee.

-  : Adjust refraction of chart 1 step lower.

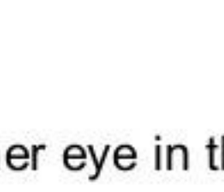
-  : Adjust refraction of chart 1 step higher.

⑥ Repeat the process from ③ to ⑤ until measuring the highest refraction level the examinee can read.

⑦ Measure refraction on the other eye in the same manner.

## 9.1.2. Corrected Vision Measurement

Refraction information measured on REF or K&R mode is necessary to measure corrected vision. Corrected vision on measured refraction can be measured through the below process, and errors from actual refraction can also be measured.

① First, measure examinee's refraction on REF or K&R mode, and convert to Visual Acuity Test Mode by pressing  button.

② Perform (eye-level adjustment) and (measurement position and focus adjustment) in the same manner as in 8.1.1 Refraction Measurement Mode.

Activate automated tracking function using  button, and the machine will adjust focus by automatically tracking down the pupil.

③ Apply the refraction information of the examinee on correction lens by pressing  button.

④ The chart for examination is set at 0.8 by default. Data of the chart to be shown to the subject is indicated at the upper left side.

⑤ Confirm that examinee can read the current chart well.

Three types of charts are provided; number, Landolt and radial chart. Press on the  or  button at the upper left side to convert two charts, and press on the radial chart button to select chart.

⑥ Adjust retraction level of the chart according to the answers of examinee.

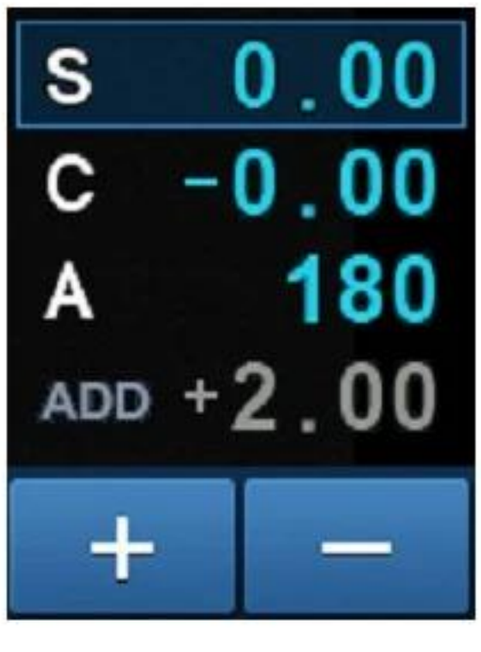
-  : Adjust refraction of chart 1 step lower.

-  : Adjust refraction of chart 1 step higher.

⑦ Repeat the process from ④ to ⑥ until measuring the highest refraction level the examinee can read.

⑧ Change refraction on correction lens as necessary. Refraction on correction lens can be adjusted using  buttons after selecting one among SPH (), CYL () and AXS ().

Current selection(SPH) are marked with a rectangle as the figure below.




⑨ After changing refraction, repeat the process from ④ to ⑥ to measure the highest refraction of the examinee.

⑩ Pressing  button will initialize the currently set refraction on correction lens. Examinee can immediately percept and compare corrected vision while wearing the correction lens and uncorrected vision.

⑪ Pressing  button will save the currently set refraction on correction lens on the memory. Saved refraction can be applied on correction lens again as

necessary by pressing  button.

⑫ Measure refraction on the other eye in the same manner.

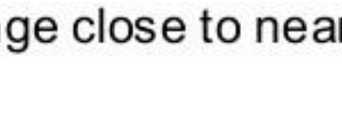
## 9.1.3. Other Examinations (Near Distance Refraction, Glare and Low Contrast Environment)

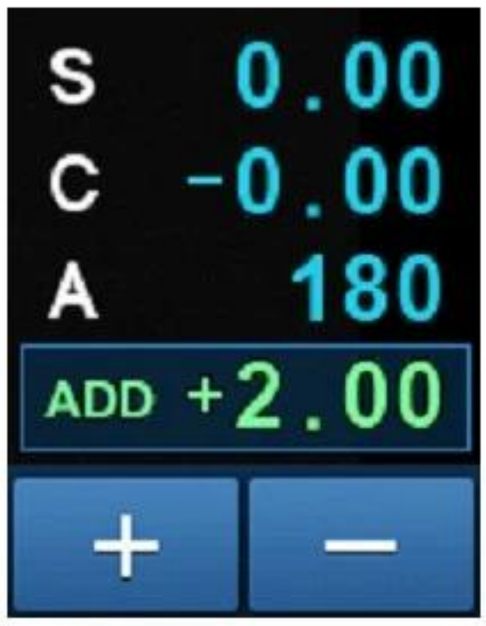
After completing measurement on refraction on corrected vision, additional tests such as near distance refraction, glare and low contrast environment can be conducted as necessary.

① Pressing  button will convert to near distance refraction measurement mode. Chart will change close to near distance environment in this mode.

 : Near distance measurement mode activated.

 : Near distance measurement mode deactivated.

- Near distance corrective lens' refractive index is modified depending on the need. Number of the near distance corrective lens' refractive index can be modified by using the  button. Currently selected category (ADD) is indicated in triangle as shown in the following diagram.




② Pressing  button will turn LED on and off for glare examination. LED are located on the left and right of the chart examinee sees. LED operation status can be checked through the status of images or buttons on the left and right of the chart status image on the upper left of the screen.




: LED on.




: LED off.

③ Pressing 

button will convert to low contrast environment test mode. Chart will change to have low contrast when low contrast environment mode is activated. Chart status can be checked through the status of the button.



: Low contrast environment is activated.



: Low contrast environment is deactivated.

## 9.2. Other menu mode

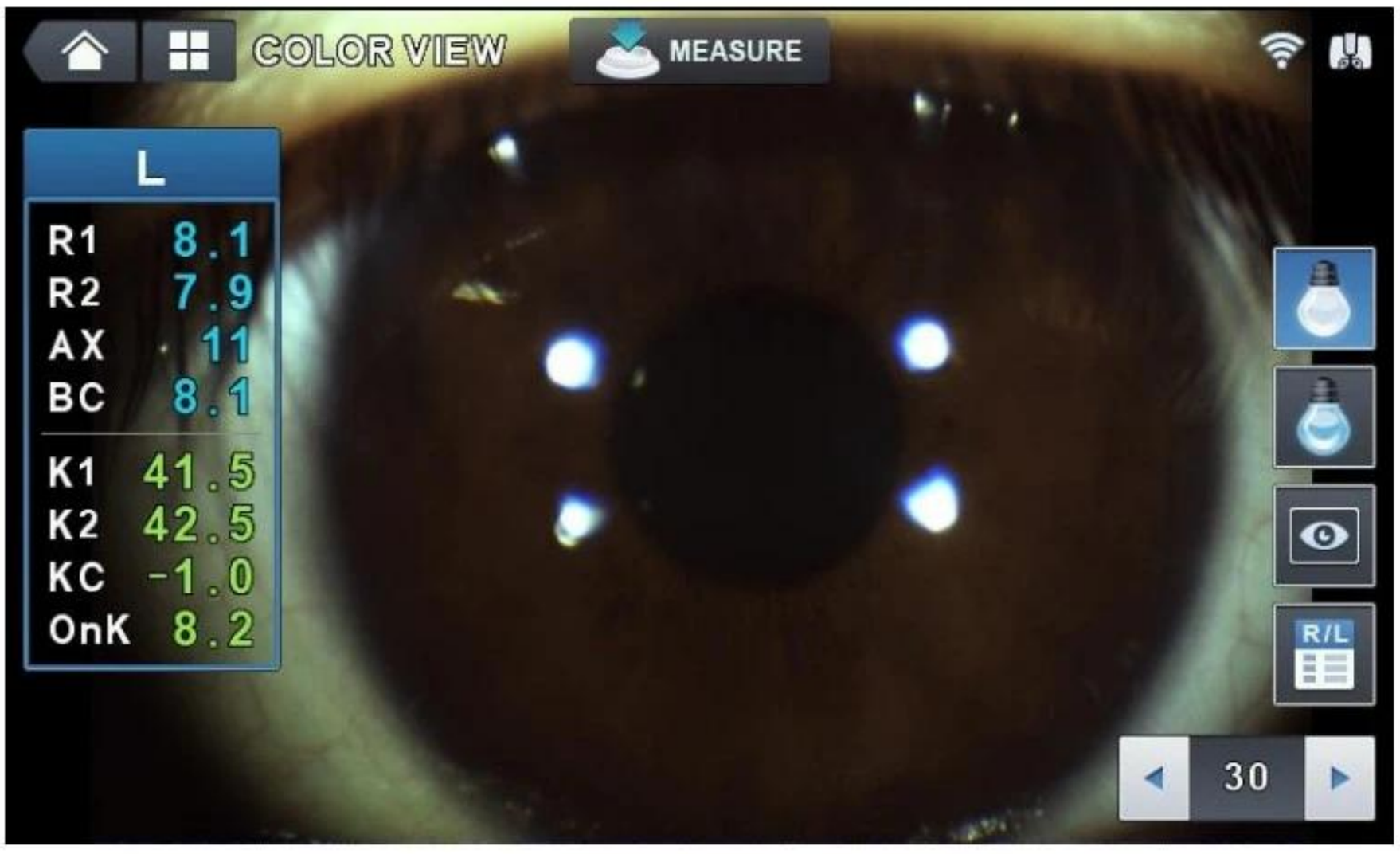
It is possible to convert to other mode by pressing on the  button in the main measurement mode.

Press on the  button in all other modes to end the current mode and to return to the main measurement mode.

Press on the  button in all other modes to end the current mode and to convert to other modes.

### 9.2.1. COLOR VIEW mode

This is the mode for observing with color screen by using Yellow Filter / White LED / Blue LED when it comes to the state when contact lens are worn by measuring cornea's curvature radius.



**[Figure 9-2-1. Color View mode indicator screen]**

Categories for the buttons that are indicated on the screen are as follows.

: Select Yellow Filter mode ON/OFF.

: Select White LED mode ON/OFF.

: Select Blue LED mode ON/OFF.

: Output filmed image on the screen (maximum LEFT 2, RIGHT 2)



: Indicates measurement DATA on the screen.

: Button that lowers stage of LED's brightness by one step



: Indicates current LED's brightness.

: Button that increases stage of LED's brightness by one step

① Press on the  button in the main measurement mode so that the COLOR VIEW MODE measurement screen appears as shown on the figure when the COLOR button is pressed on.

② Base value and OnK value are calculated automatically by using measurement value if the corneal curvature was measured in the KER mode.

③ Eyes' location and focus are adjusted by using operation lever to see the image of the subject of eye examination clearly.

④  and  are used to adjust the White LED to an adequate brightness.

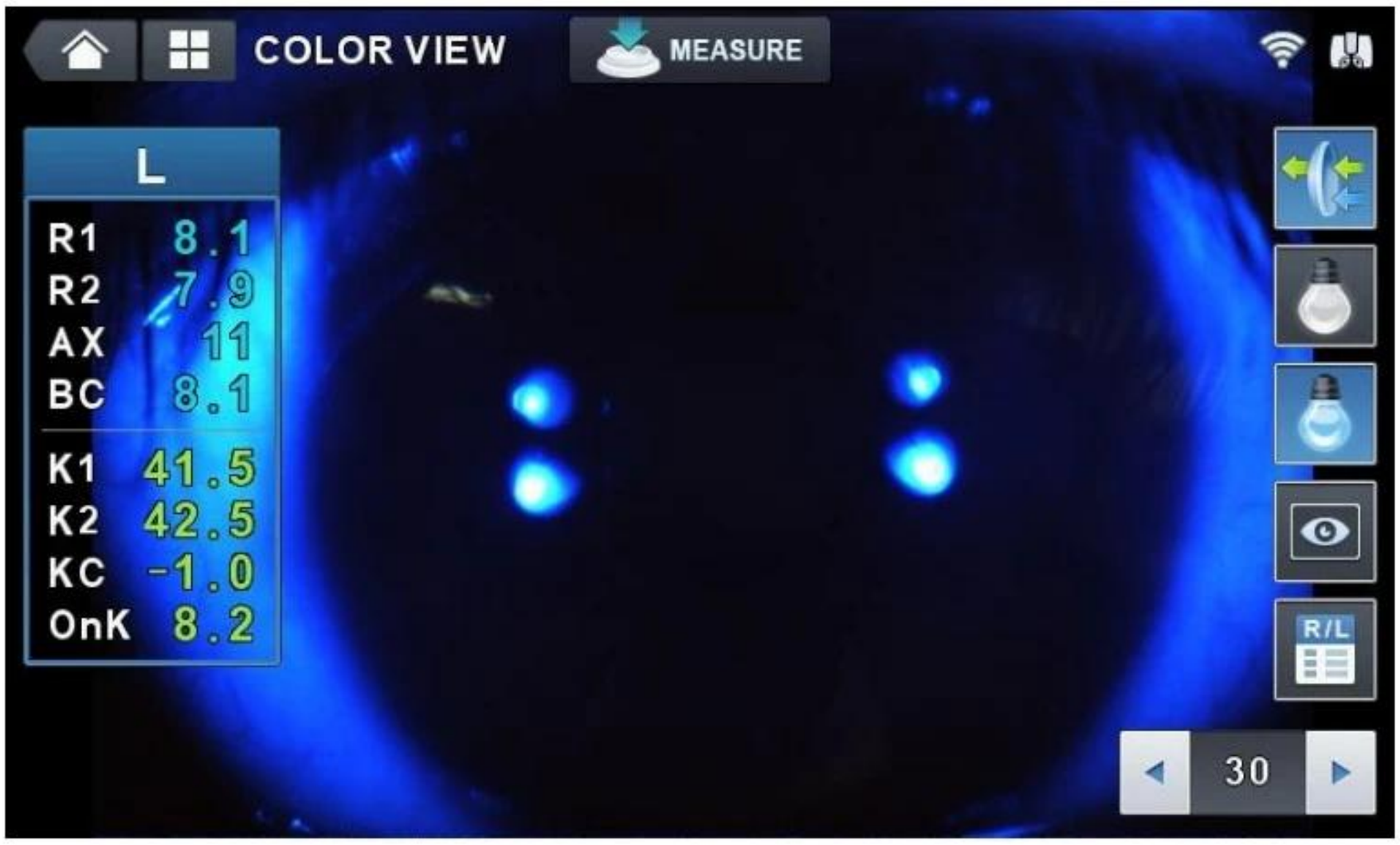
Categories of the data indicated on the screen are follows.

- R1 : Indicates corneal curvature's major axis
- R2 : Indicates corneal curvature's minor axis
- AX : Indicates corneal curvature's axis
- Base : Indicates contact lens' Base curve value
- K1 : Indicates corneal curvature's major axis as diopter
- K2 : Indicates corneal curvature's minor axis as diopter
- CYL : Indicates astigmatism power value
- Onk : Indicates contact lens' Onk prescription value

### 9.2.1.1. Yellow Filter

This is the function for observing the contact lens Fitting degree more clearly.

1. Press on the  button in the Color view mode.
2. Use  button and  button to adjust LED's brightness. Then, observe contact lens Fitting degree.

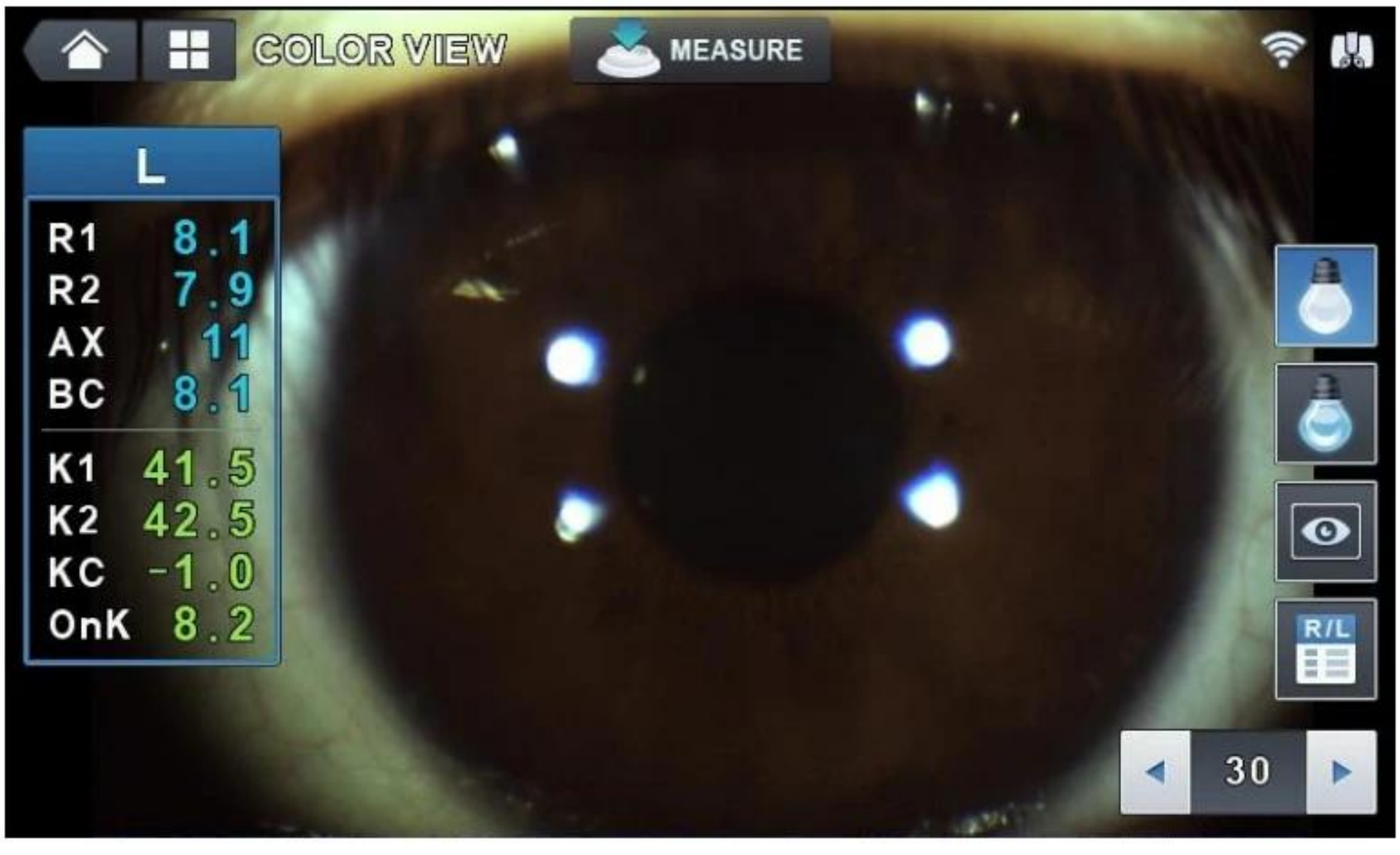



[Figure 9-2-1-1. Color View mode indicator screen (Yellow Filter)]

| NOTE |
| --- |
| Yellow Filter function is the function that uses S/W. |

### 9.2.1.2. White LED

This is the function that uses White LED illumination to observe with color image.

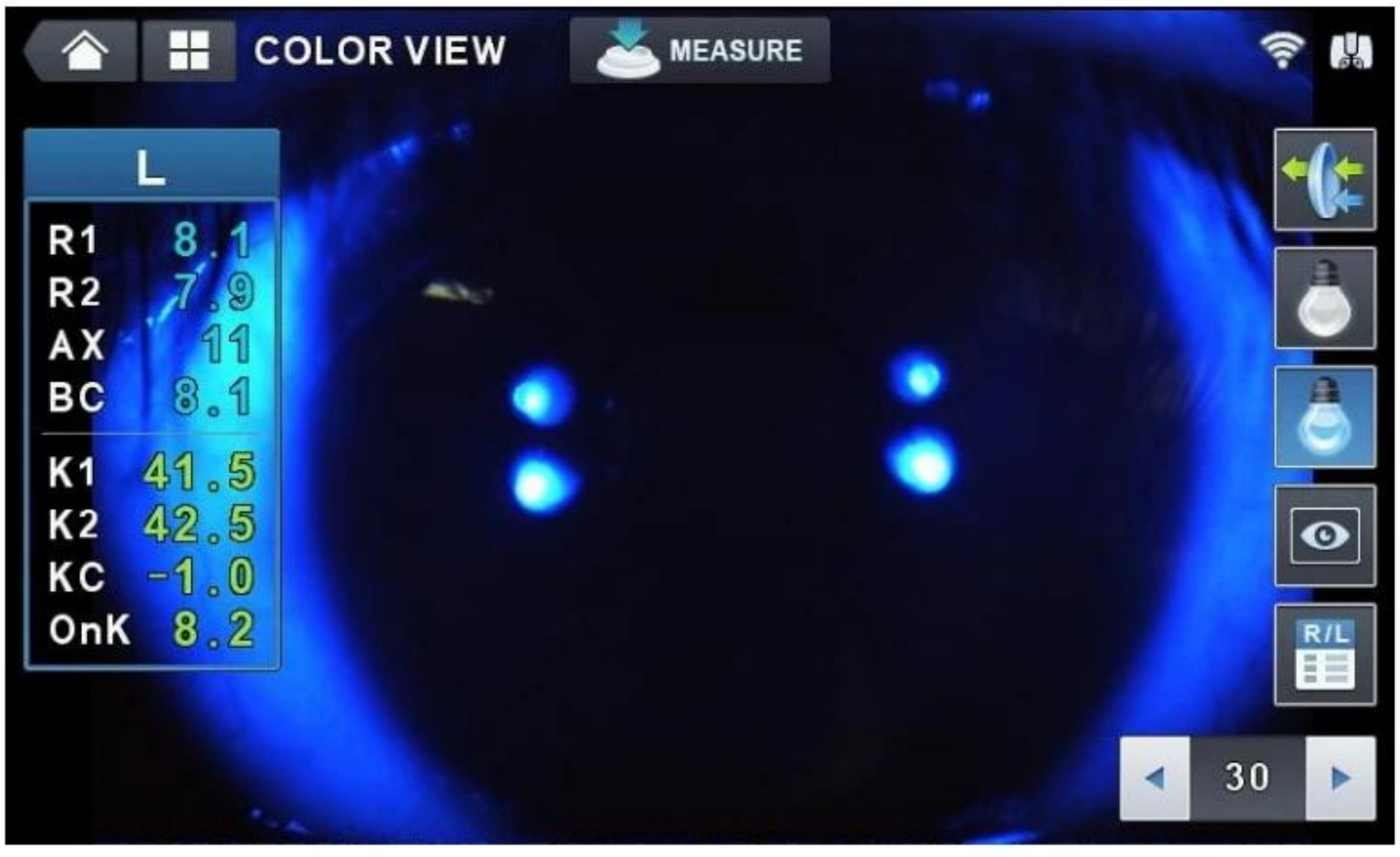



[Figure 9-2-1-2. Color View mode indicator screen (White LED)]

### 9.2.1.3. Blue LED

This is the function that observes cornea and contact lens Fitting degree by using fluorescence solution and Blue LED.

1. Wear contact lens after dyeing the eyes using fluorescence solution.
2. Press on the  button in the Color view mode, and use the operation lever to adjust eyes' location and focus.
3. Use  button and  button to adjust the Blue LED's brightness, and observe contact lens Fitting degree.




[Figure 9-2-1-3. Color View mode indicator screen (Blue LED)]

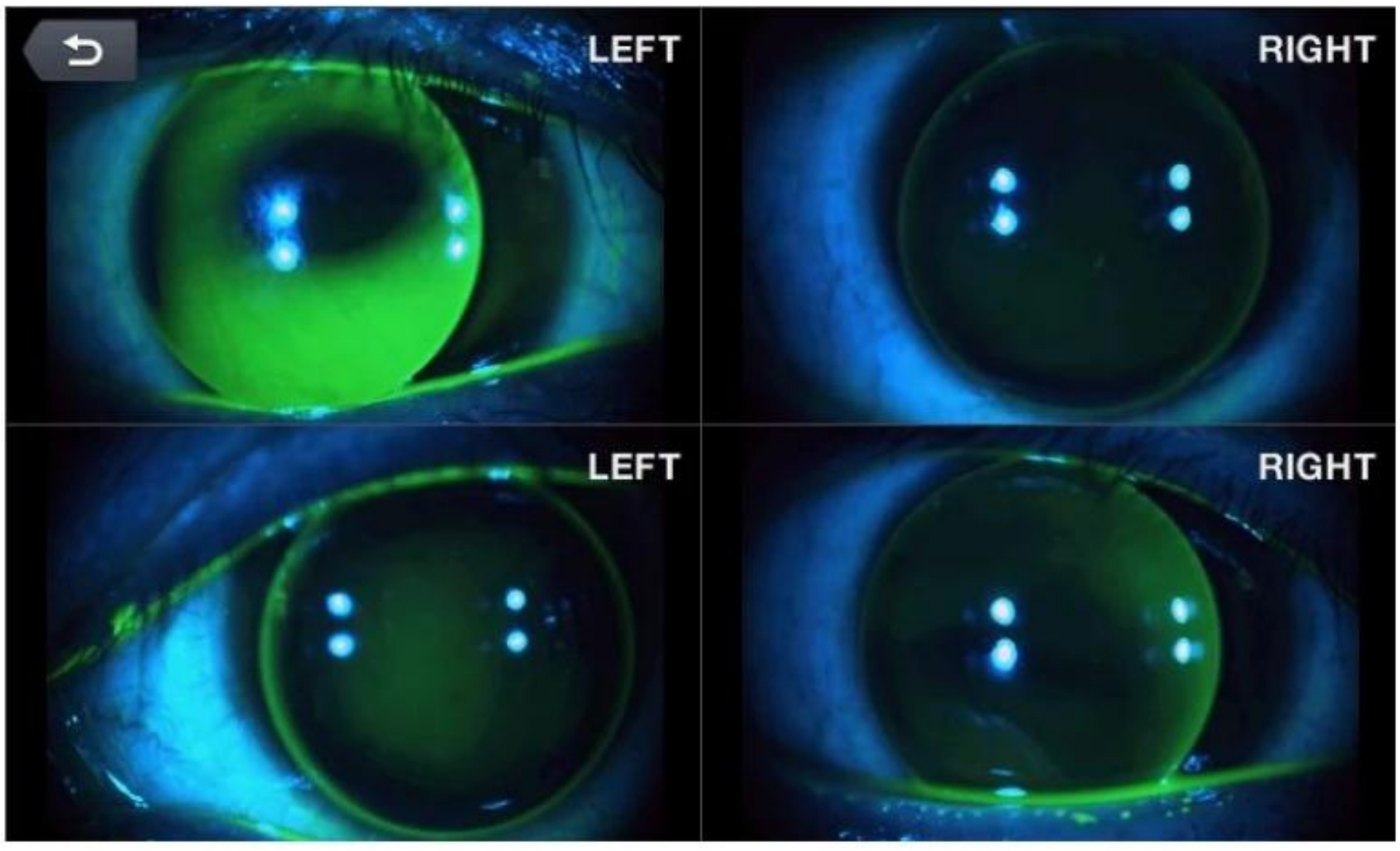
## 9.2.1.4. Returning to the measurement mode

Press on the  button in the Color View mode to return to the main measurement mode.

## 9.2.1.5. Capture screen

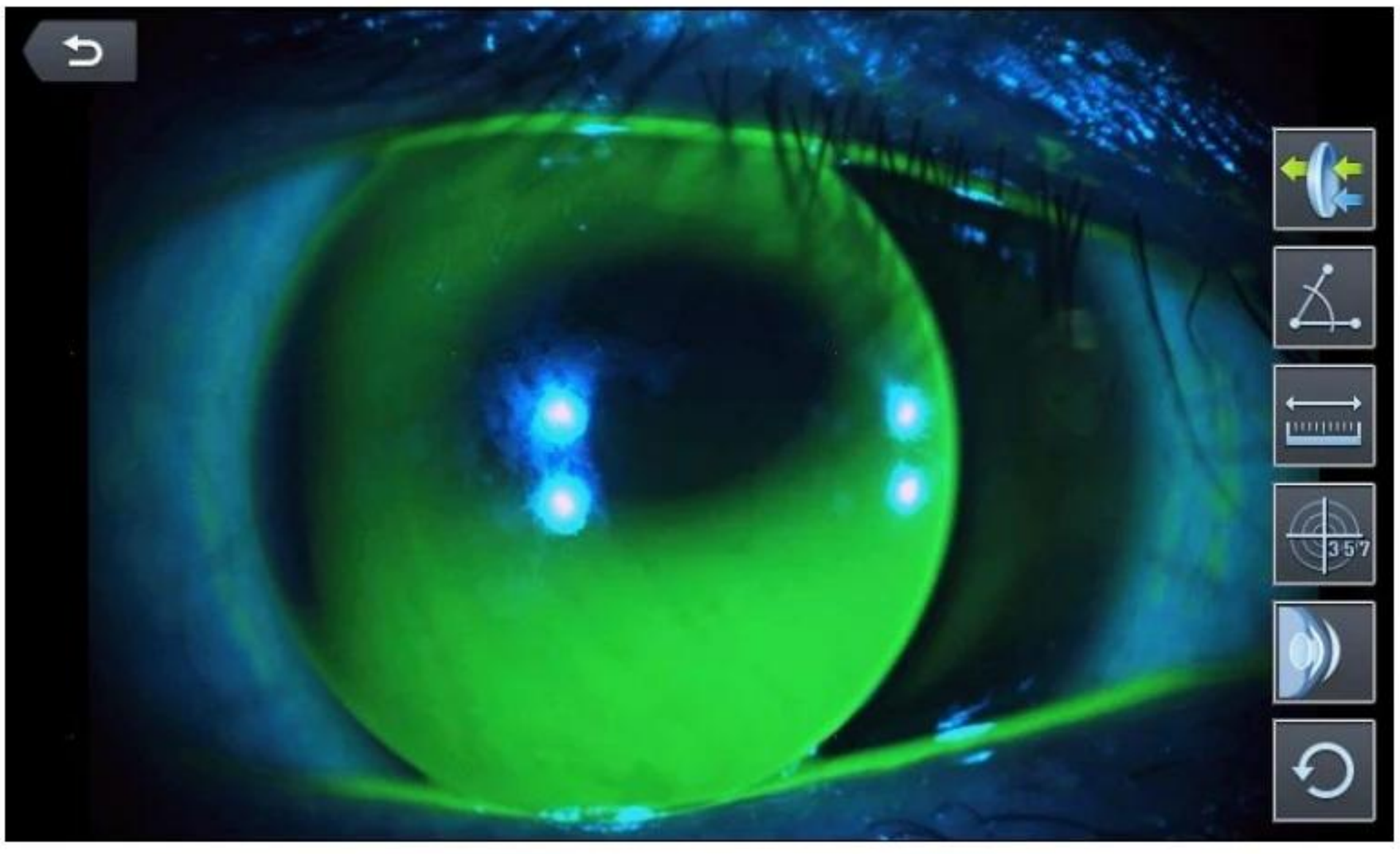
1. Captures the image of subject of eye examination by pressing on the measurement button (joystick) in the Color View mode.

2. Press on the  button to output filmed images on up to four screens on the DISPLAY screen.




[Figure 9-2-1-4. Color View mode - capture screen]

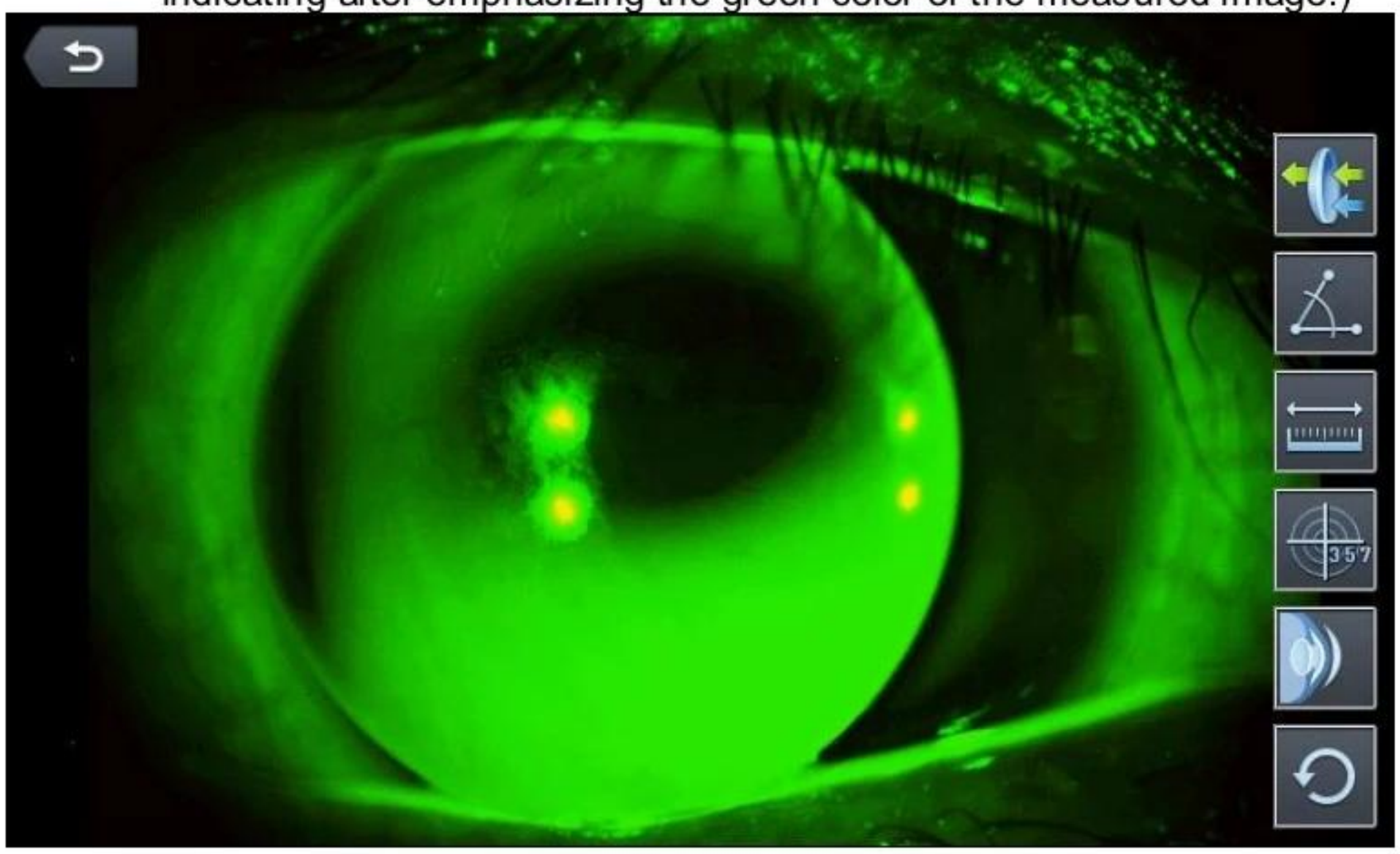
## 9.2.1.6. Capture image viewing screen




[Figure 9-2-1-5. Color View mode – captured image selection screen]

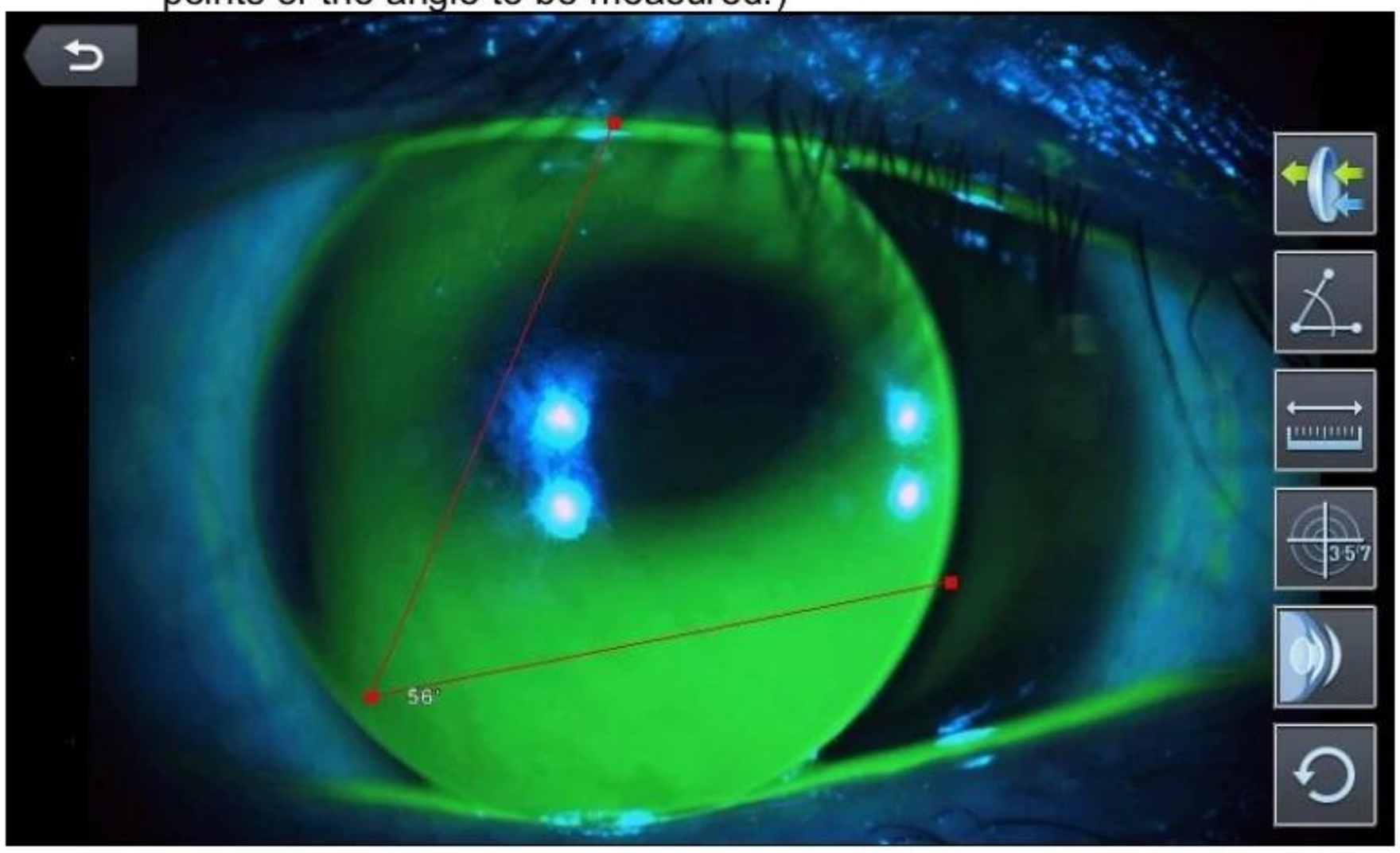


: Emphasizes the green of the measurement image. (It is possible to check the distribution state of the fluorescence solution easily by indicating after emphasizing the green color of the measured image.)





: Measures angle. (Measures angle by touching the screen with three points of the angle to be measured.)



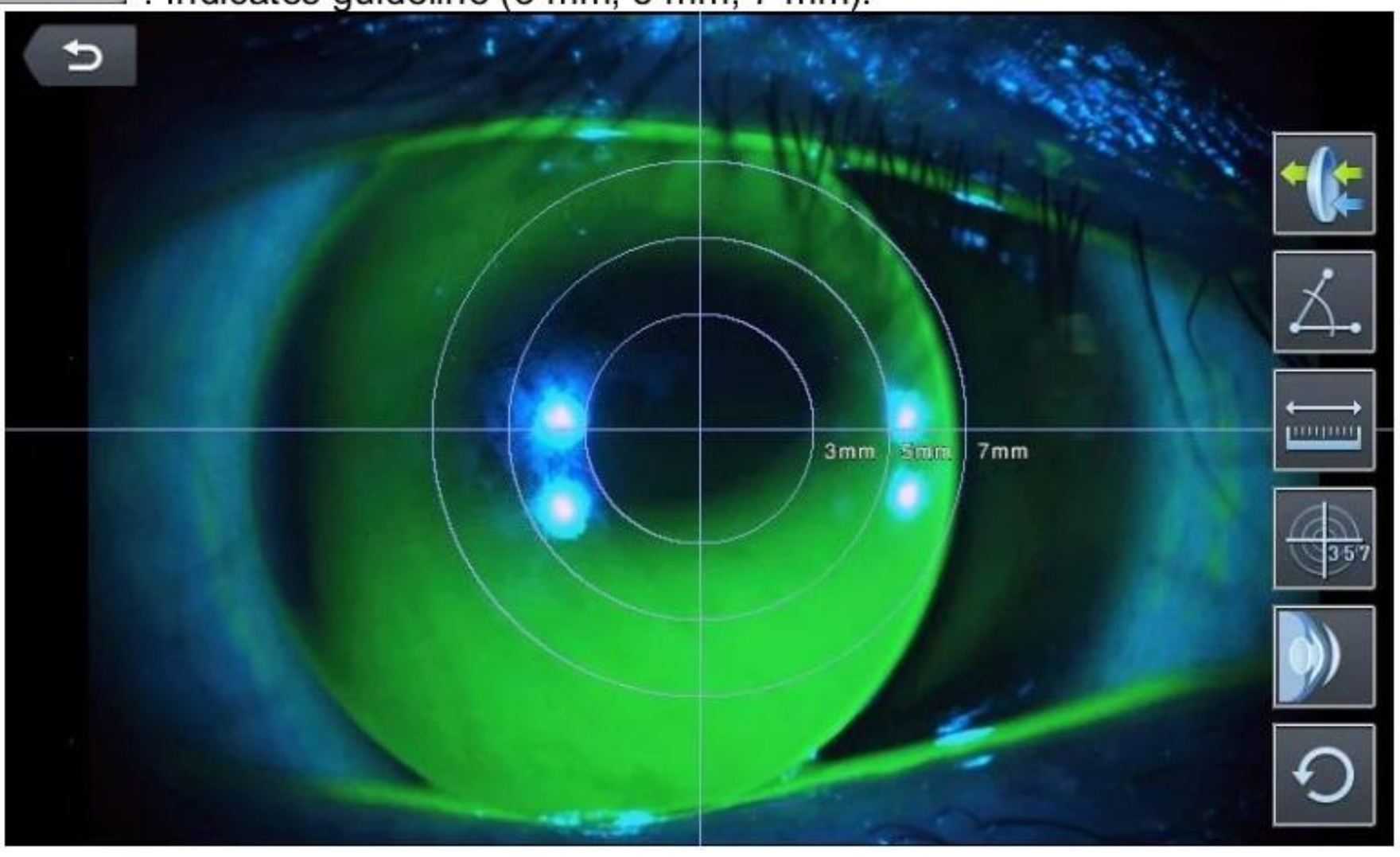


: Measures length. (Measures length by touching the screen with two points at the ends of the two sides when it comes to the length to be measured.)



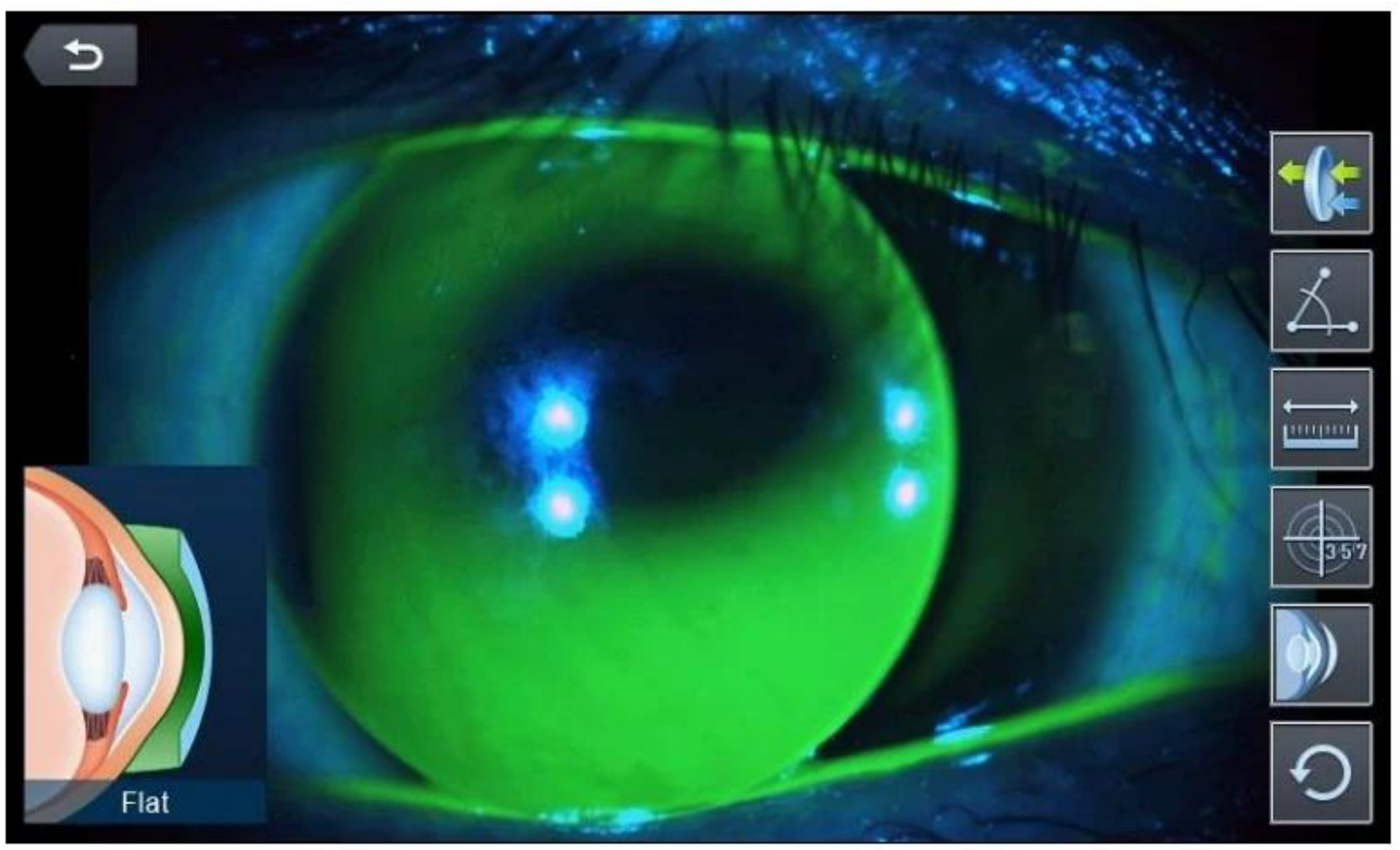


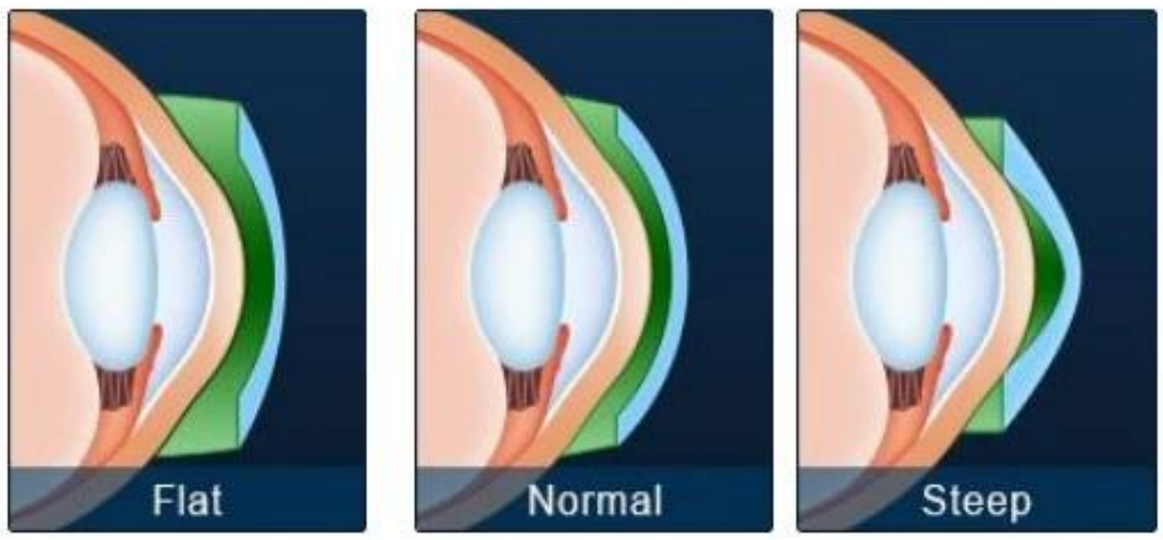

: Indicates guideline (3 mm, 5 mm, 7 mm).





: Indicates contact lens fitting state. (Automatically discerns out in stages whether cornea's curvature and contact lens' curvature is flat, normal or steep to indicate on the screen.)



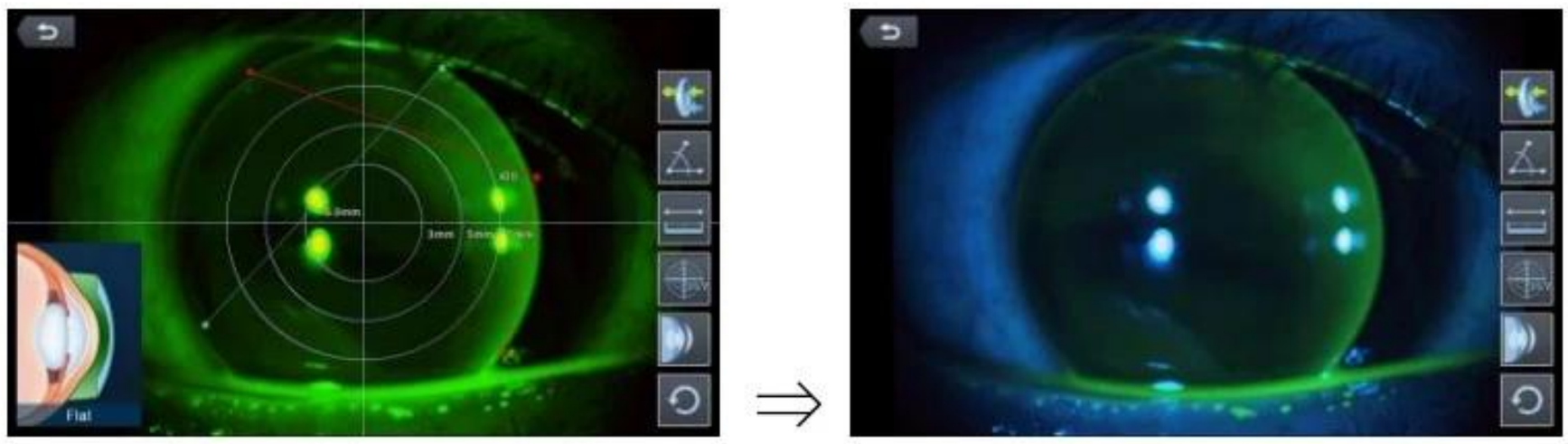




**[Figure 9-2-1-6. Flat, Normal, Steep icon screen]**



: Returning to the original state.

(Returns all that was indicated to the original state.)

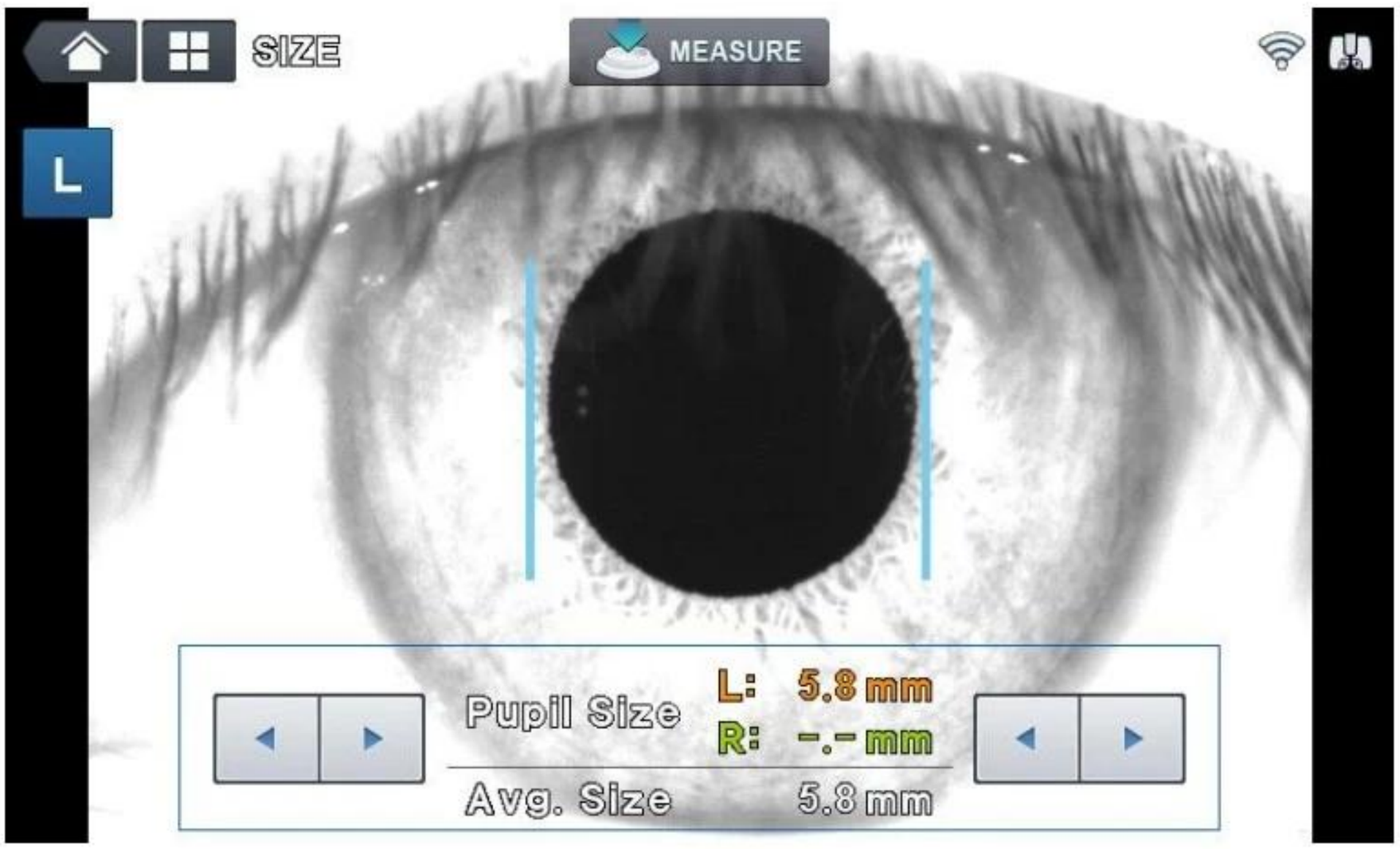



## 9.2.2. SIZE mode (pupil diameter measurement)

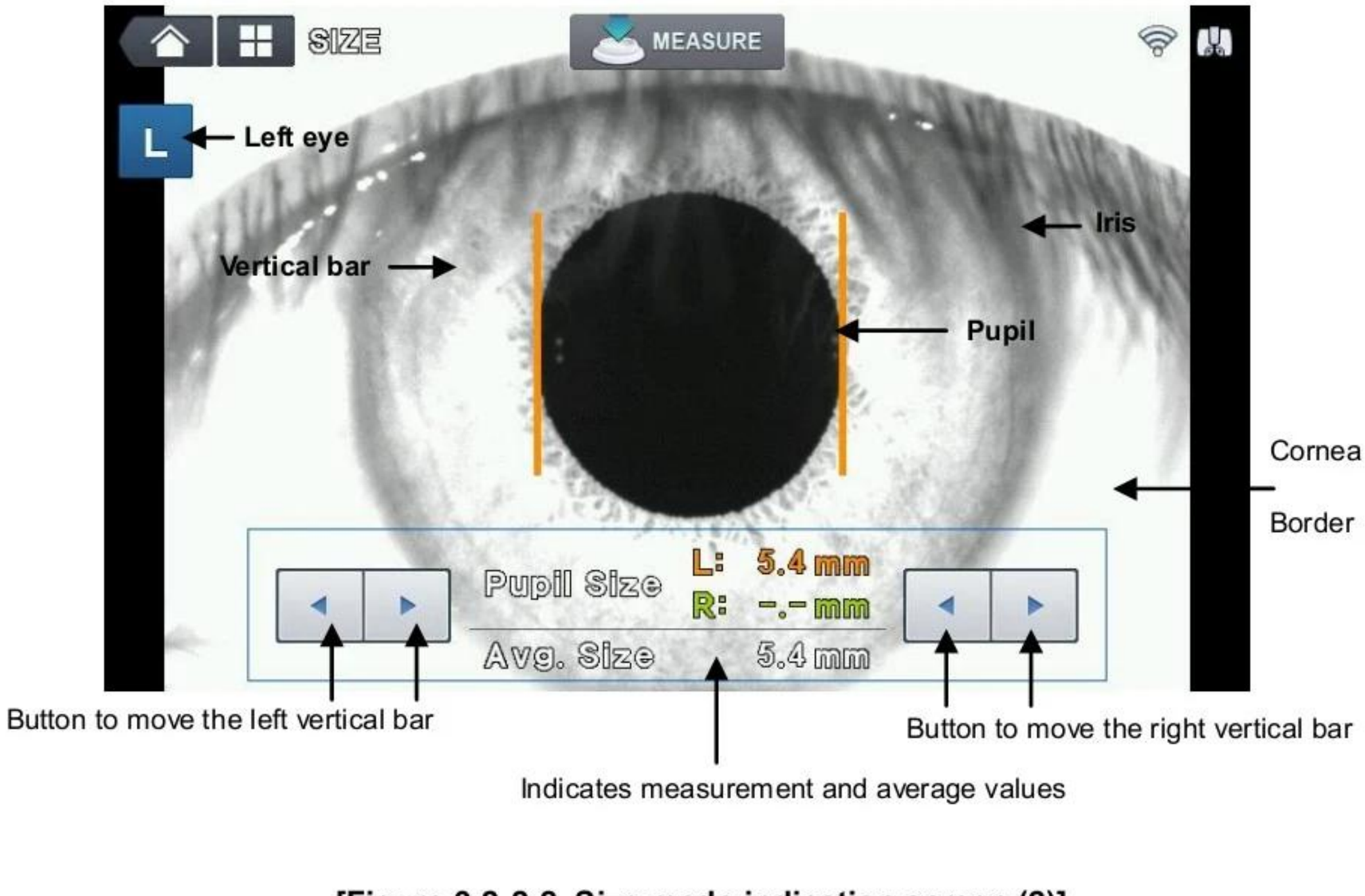
This is the mode that measures pupil's diameter.

1. Press on the  button in the main measurement mode. Then, SIZE mode gets selected when the SIZE button is pressed on.

2. Adjusts location and focus so that the image of the eyes to be measured can be clear.




**[Figure 9-2-2-1. Size mode indicator screen (1)]**




**[Figure 9-2-2-2. Size mode indication screen (2)]**

4. Measurement location and focusing

   - Ask the test subject to watch fixating target at the inside.
   - Move the operation lever to adjust the location so that the pupil is in between two vertical bars.
   - Focus is adjusted so that the cornea's corners are clearly visible.

| NOTE |
| --- |
| It is not possible to measure the pupil diameter accurately when focus is adjusted to the iris. |

5. Measurement

   - When the measurement button is pressed on, current state gets filmed and the screen is shown as a paused screen.

- Left  button and  button adjust the movement of the left bar while button of the right side  and  button adjust the movement of the right side bar.

- Measurement value is indicated on the monitor.

- Measurement value is saved automatically.

- Measured value gets indicated at the Pupil Size at the screen's center lower part. Average of the recent two measurement values is indicated in the "Avg Size" below.

- Stopped screen is undone when you press on the measurement button.

6. Measurement repetition

   - It is possible to measure up to two measurement values when the measurement is repeated. Repeat the operation of 2 ~ 5 when measuring again.

7. Measurement of the eye on the opposite side

   - Measure the eye on the opposite side using the same method after moving the stage to the opposite side.

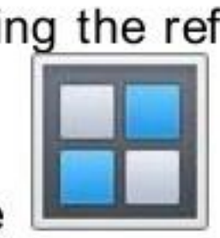
8. Measurement result output

   - Cornea diameter measurement result is output as the "[PUPIL SIZE]" category by the built-in printer.

## 9.2.3. ZERNIKE mode

Zernike mode shows pupil domain's Wave-front information. Some kind of landform is drawn that assumes leveling according to actual Wave-front's distortion degree (aberrations) that is measured from the test subject with myopia or hyperopia using the

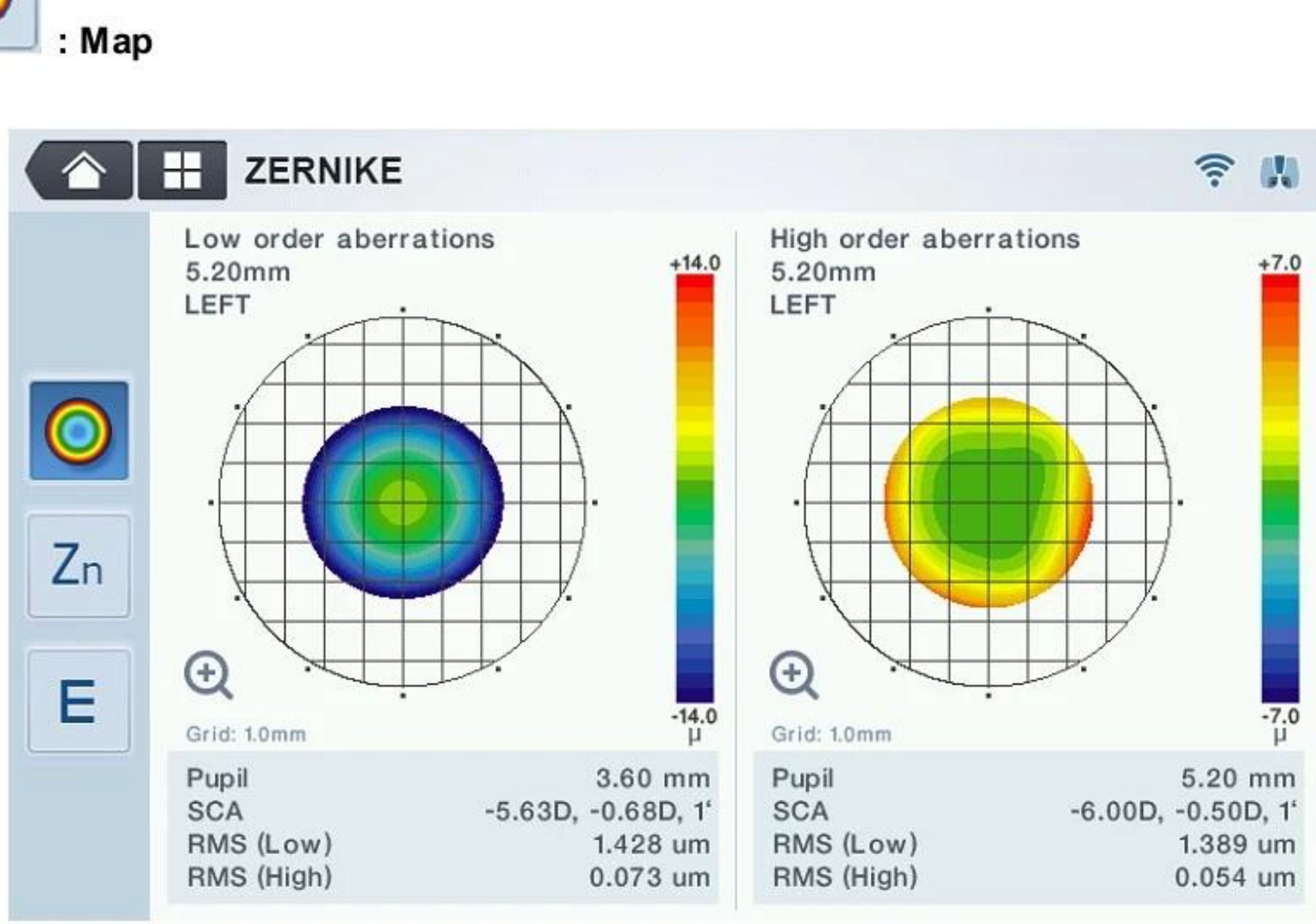
Wave-front as the standard when it is at the emmetropia.

After measuring the refractive power in the REF or K&R mode, press on the ZMODE button of the  button to convert to Zernike mode. Guidance message gets indicated as “Calculating…” during a few standby time in order to calculate the information.

### 9.2.3.1. Screen composition

It is possible to convert the information that is indicated through the three buttons on the screen’s left side.

1.  **: Map**



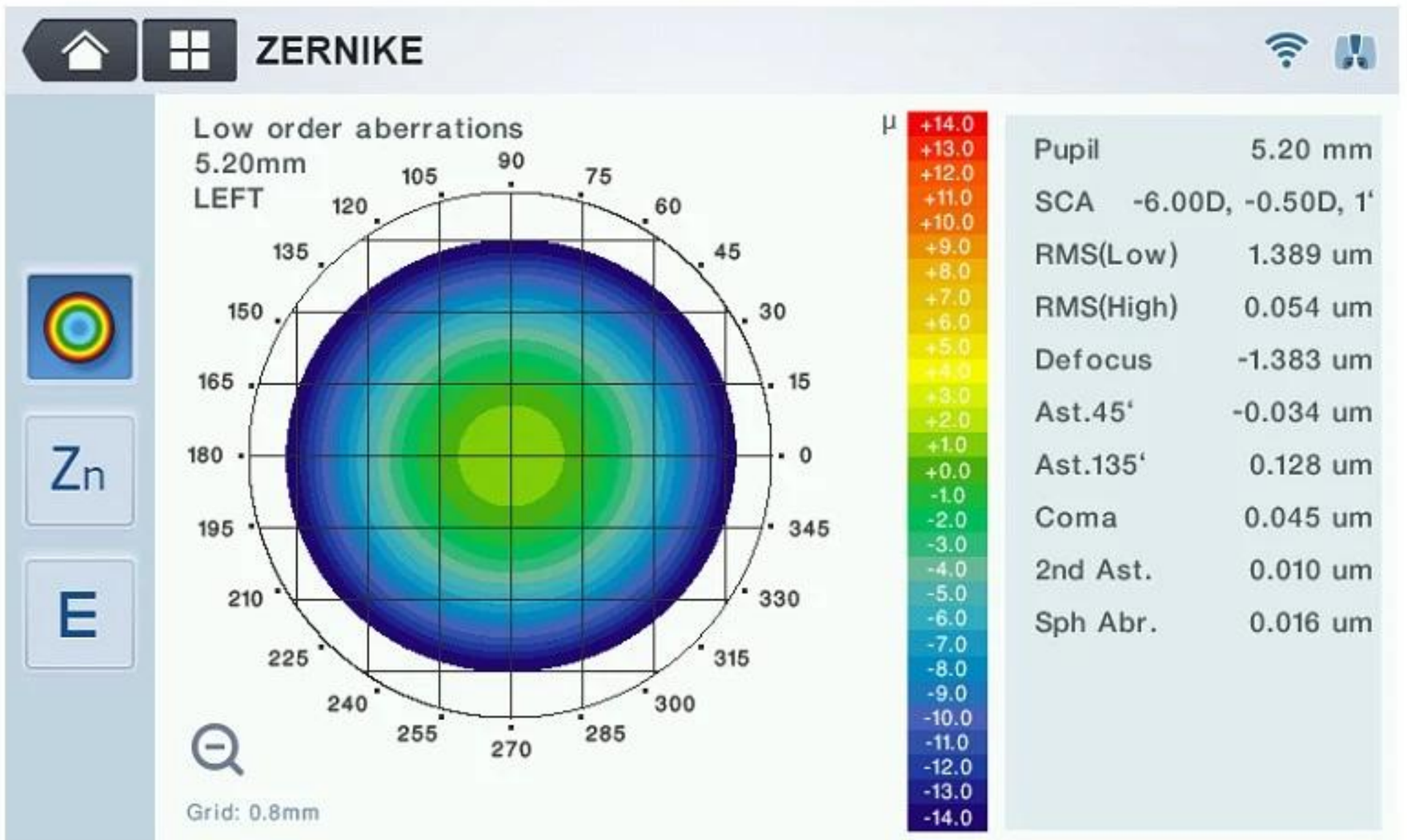

**[Figure 9-2-3-1. Zernike mode screen (Map)]**

Pupil domain indicated on the left and right of the screen is manifested as graph format

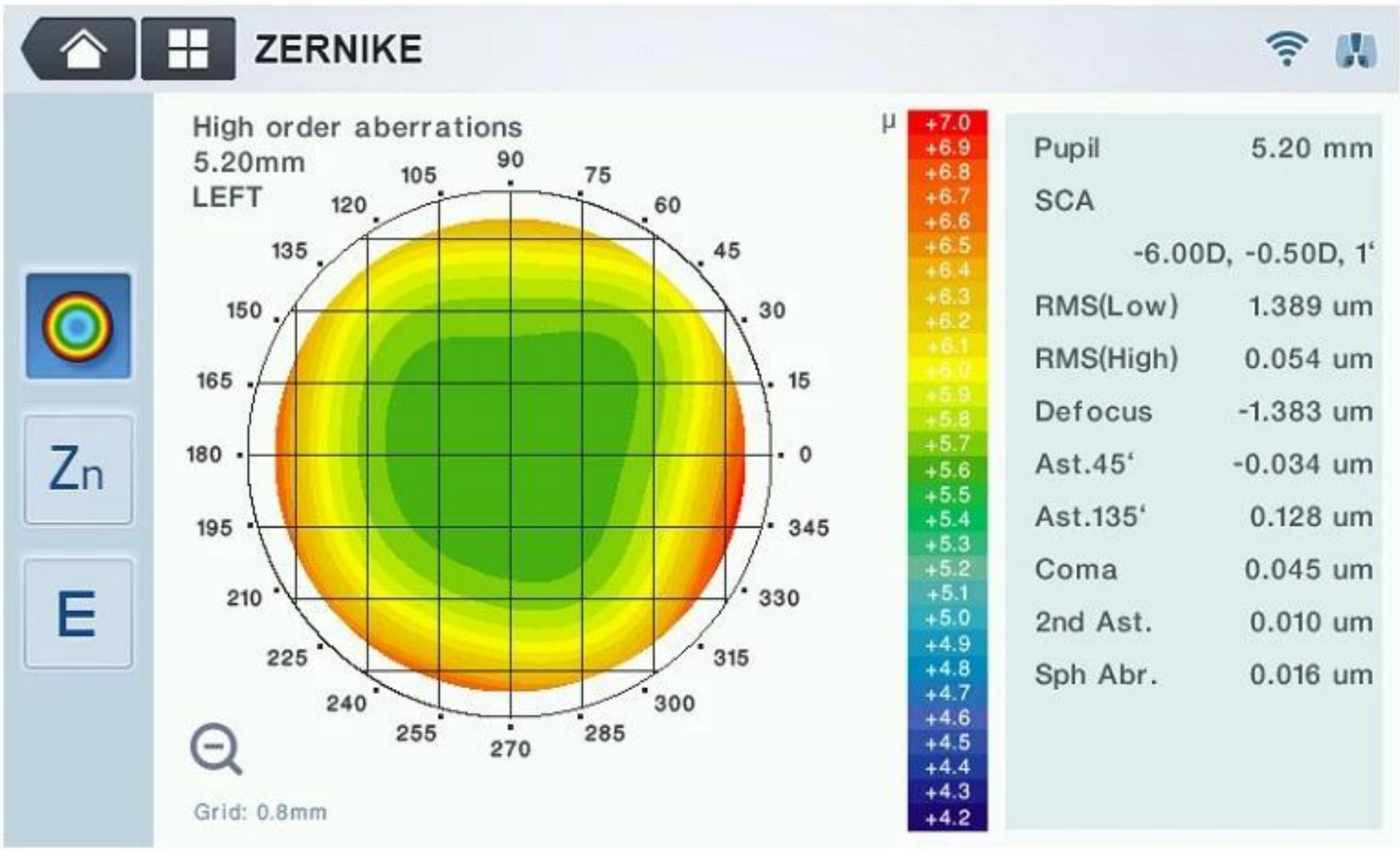
in which Wave-front's Low order aberrations and High order aberrations are expressed with colors. Information on the measurement domain is indicated on the screen's lower part. Result calculated on the pupil's narrow domain, wide domain is indicated separately on the left and right sides.

- Pupil : measurement domain. (example: 3.60 mm radius from the pupil's center)
- SCA : S=Spherical Aberration, C=Cylinder Aberration, A=Cylinder Axis
- RMS (Low) : aberrations (Low order aberrations' average)
- RMS (High) : aberrations (High order aberrations' average)

It is possible to see more detailed information when you touch the Wave-front aberrations graph.




**[Figure 9-2-3-2. Zernike mode screen (Map) – Low order]**




**[Figure 9-2-3-3. Zernike mode screen (Map) – High order]**

Graph on the left side of the screen indicated degree of Wave-front aberrations in the pupil domain in colors. Emmetropia, hyperopia and myopia are expressed in green, blue and red, respectively. Darker color is used when the eyes' abnormality is severe. When astigmatism is included, refractive power landform of the oval format is drawn towards the axis direction of astigmatism.

Map Level of the bar format on the graph's right side is the chart that show which color is used for certain value of Wave-front aberrations. Measured Wave-front aberrations' maximum and minimum values are indicated in micro meter (μm) unit. Wave-front aberrations in case of emmetropia is 0 and high Wave-front aberrations are assumed with the symbols of positive (+) and negative (-) each as the hyperopia and myopia are severe.

Information that is indicated additionally on the right side of the screen is as follows.

- Defocus : Defocus value
- Ast 45˚ : 45˚ astigmatism
- Ast 135˚ : 135˚ astigmatism
- Coma : Coma value

- 2nd Ast. : Definition of representative aberrations (secondary astigmatism)
- Sph Abr. : Definition of representative aberrations (spherical aberrations)
- RMS (Low) : Low order aberrations' average
- RMS (High) : High order aberrations' average

Graph gets amplified into the entire screen when you press on the "+" button at the lower part of the graph's right side, and the image returns to the original image when you press on the "-" button at the amplified image's lower part of the right side.

**2. Zn : Graph**



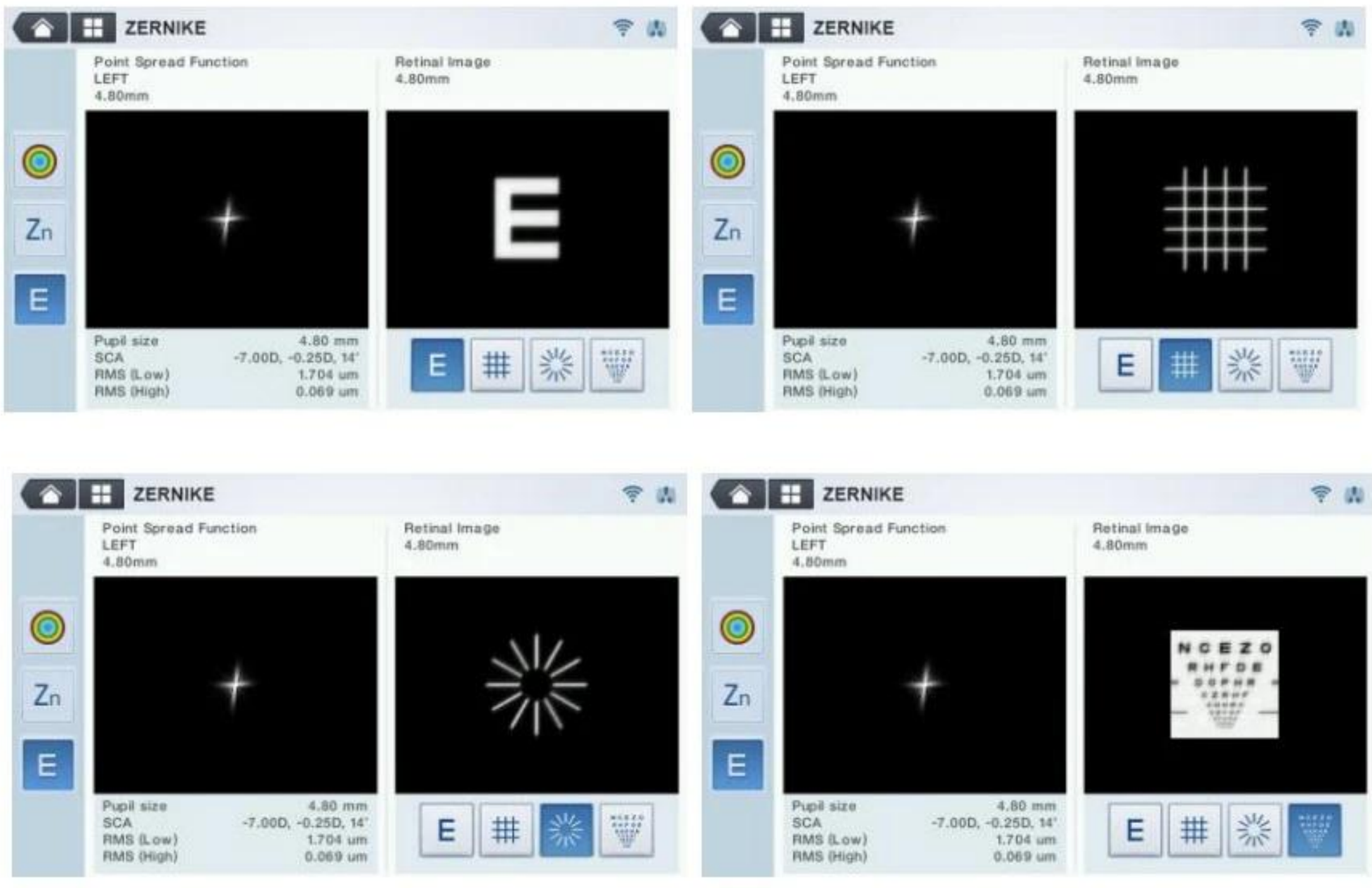

| ZNo. | Order | Radial | Name | Micron | Graph |
|---|---|---|---|---|---|
| 3 | 2 | -2 | Oblique Astigmatism | -0.035 | |
| 4 | 2 | 0 | Defocus | -1.703 | |
| 5 | 2 | 2 | Rule Astigmatism | 0.061 | |
| 6 | 3 | -3 | Oblique Trefoil | -0.038 | |
| 7 | 3 | -1 | Vertical Coma | -0.008 | |
| 8 | 3 | 1 | Horizontal Coma | -0.014 | |
| 9 | 3 | 3 | Horizontal Trefoil | 0.014 | |
| 10 | 4 | -4 | Oblique Quatrefoil | 0.014 | |
| 11 | 4 | -2 | Oblique 2nd Astigm. | -0.012 | |
| 12 | 4 | 0 | Spherical Aberration | 0.020 | |
| 13 | 4 | 2 | Rule 2nd Astigm. | 0.010 | |
| 14 | 4 | 4 | Horizontal Quadrafoil | 0.045 | |

**[Figure 9-2-3-4. Zernike mode screen (Graph)]**

Graph information that is indicated on the screen indicates categories of the measured Zernike coefficient by type such as Coma, Defocus and others. Distribution graph of coefficient values is shown by using percentage for the size of each value and the sum of the total coefficients. Zernike coefficient value is indicated as the micro meter (μm) unit.

### 3. E : PSF image

PSF Image is indicated on the screen's left side to make it easy to know how light of the point shape forms at the retina based on the measured refractive power, and it is indicated on the right side how visual target for testing gets twisted in order to help understand.




[Figure 9-2-3-5. Zernike mode screen (PSF image)]

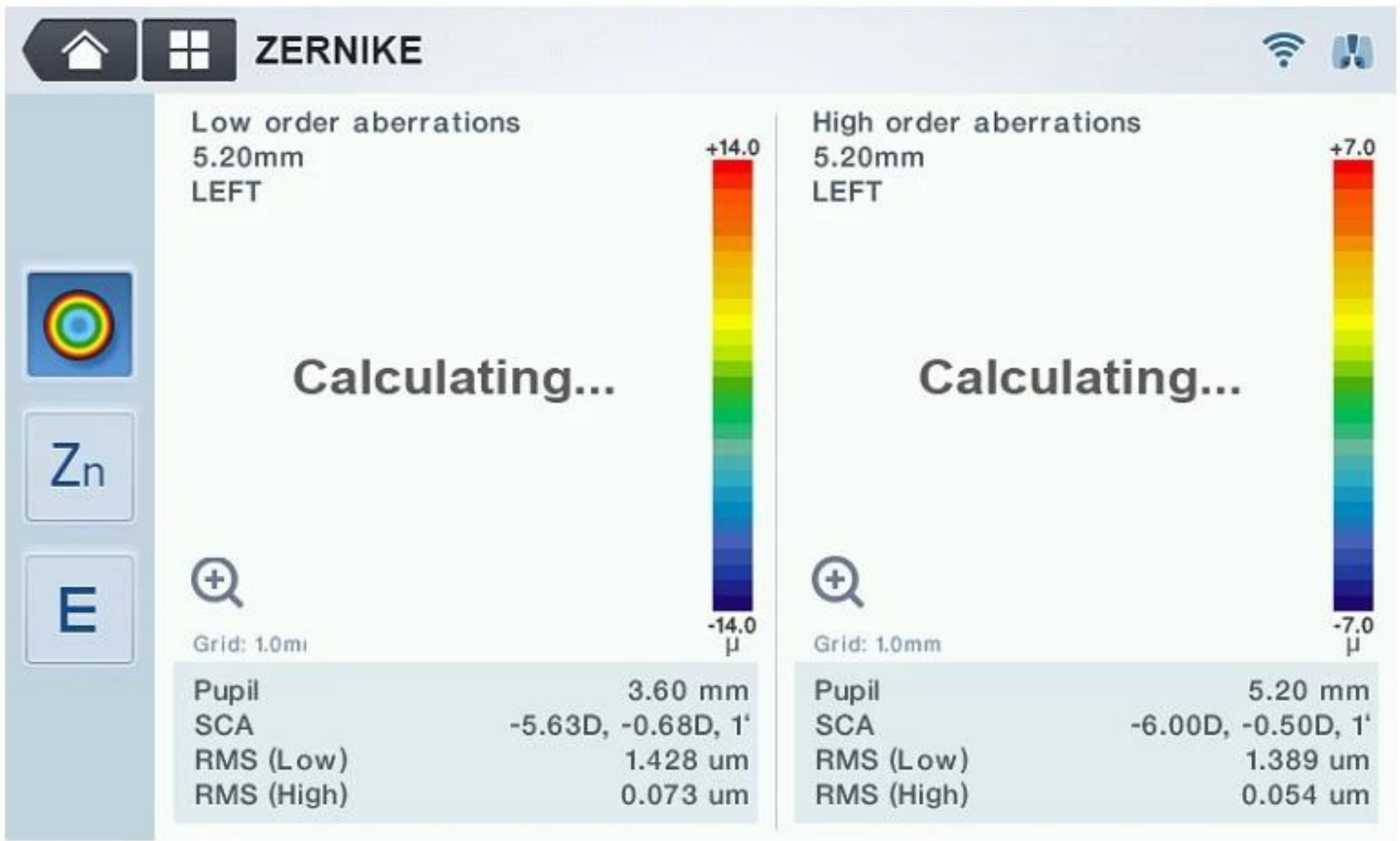
It is possible to modify the visual target for testing that is indicated on the screen using the following buttons.

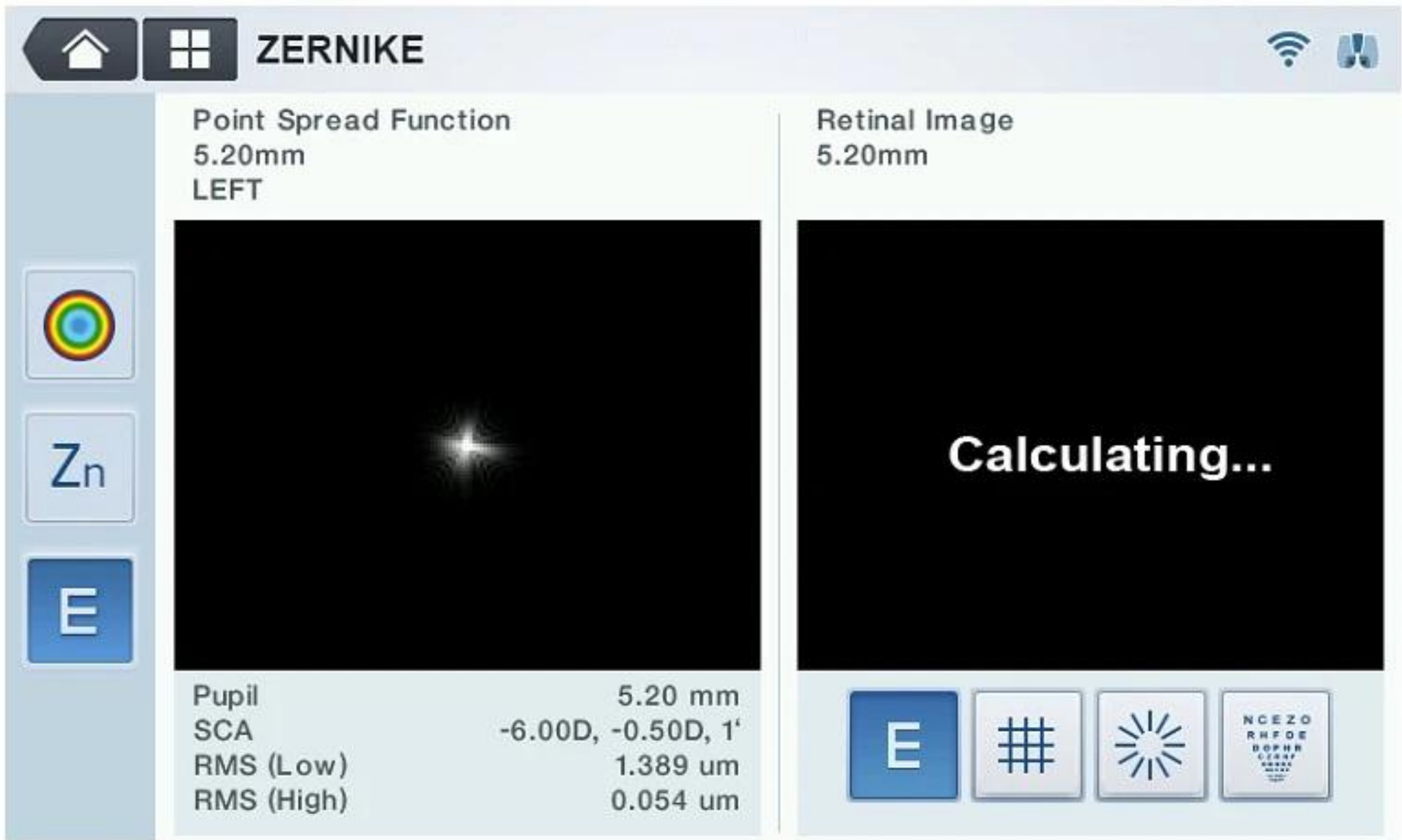
- E : E chart

-  : Lattice type of chart
-  : Radiation type of chart
-  : ETDRS chart

## 9.2.3.2. Screen conversion

When the stage is moved to the left and right using operation lever, graph, Zernike coefficients and PSF image get converted to the results that are gained from the applicable stage location.






[Figure 9-2-3-6. Zernike mode (Map, PSF image) screen conversion]

## 9.2.4. RETRO-ILLUMINATION mode

Retro-Illumination mode is the mode that can observe eye lens by using Retro-illumination method. It is possible to observe eye lens' state by observing the shape of the light that is reflected from the retina while changing the brightness of the light that is radiated onto the eyes through illumination.

It is possible to observe the human beings' eye lens with severe cataract symptom or that is being affected by the symptom or to measure the refractive power. Moreover, it is possible to test the eye lens' turbidity. When the eye lens are not very turbid, then it is possible to measure the eyes' refractive power at the same time while observing the shape that is reflected from the retina at the same time. Moreover, if there is a scratch on the cornea, it is possible to observe the light penetration and uniformity of the artificial eye lens after observing the scratch or after administering artificial eye lens (IOL) surgery.

### 9.2.4.1. Arrangement and focusing




[Figure 9-2-4-1. Retro-Illumination screen]

① The mode turns into the Retro-Illumination mode when the RETRO-ILL button is pressed on after pressing on the  button.

② (Eye height adjustment), (measurement location and focusing) process is carried out using the method that is the same as that of the 8.1.1 refractive power measurement mode.

③ Retro-illumination image appears on the screen after the illumination is turned on and after the radiated light gets reflected on the retina. It is possible to observe eye lens, cornea's turbidity and cornea's scratch information by observing this Retro-illumination image.

④ Measurement screen appears when  button is pressed on while on the

screen. Measurement screen show on the screen along with the Retro-illumination image by measuring eyes' refractive power, astigmatism and astigmatism continually at the current location.




**[Figure 9-2-4-2. Retro-Illumination measurement screen]**

Buttons of the Retro-Illumination mode that are indicated on the screen are as follows.




: Button that converts to indicate on the measurement screen.



: This is the button for seeing the Retro-Illumination image saved once again by using measurement button.



: Button for decreasing illumination's brightness




: Indicates current illumination's brightness

 : Button for increasing illumination's brightness

### 9.2.4.2. Retro-Illumination observation

① Adjusts brightness of the LED for refractive power measurement

- To see the image clearly, use  button and  button to change the LED brightness for refractive power measurement to an appropriate brightness.

② Observation of Retro-Illumination image

- Use the operation lever to incidence by avoiding the unclear part of the eye lens when it comes to the illumination that is indented with the eyes. Ensuring that the light gets indented near the pupil is effective for observing Retro-illumination image.

| NOTE |
| --- |
| Avoid eye examination that lasts over 30 seconds to protect the test subject's eyes. |

③ Saving the image

- Use operation lever to adjust the focus on the image, and save the image by pressing on the measurement button.

| NOTE |
| --- |
| Turbidity of the eye lens caused by cataract can lead to margin of error when it comes to the measurement value by causing aberrations due to the eccentricity. |

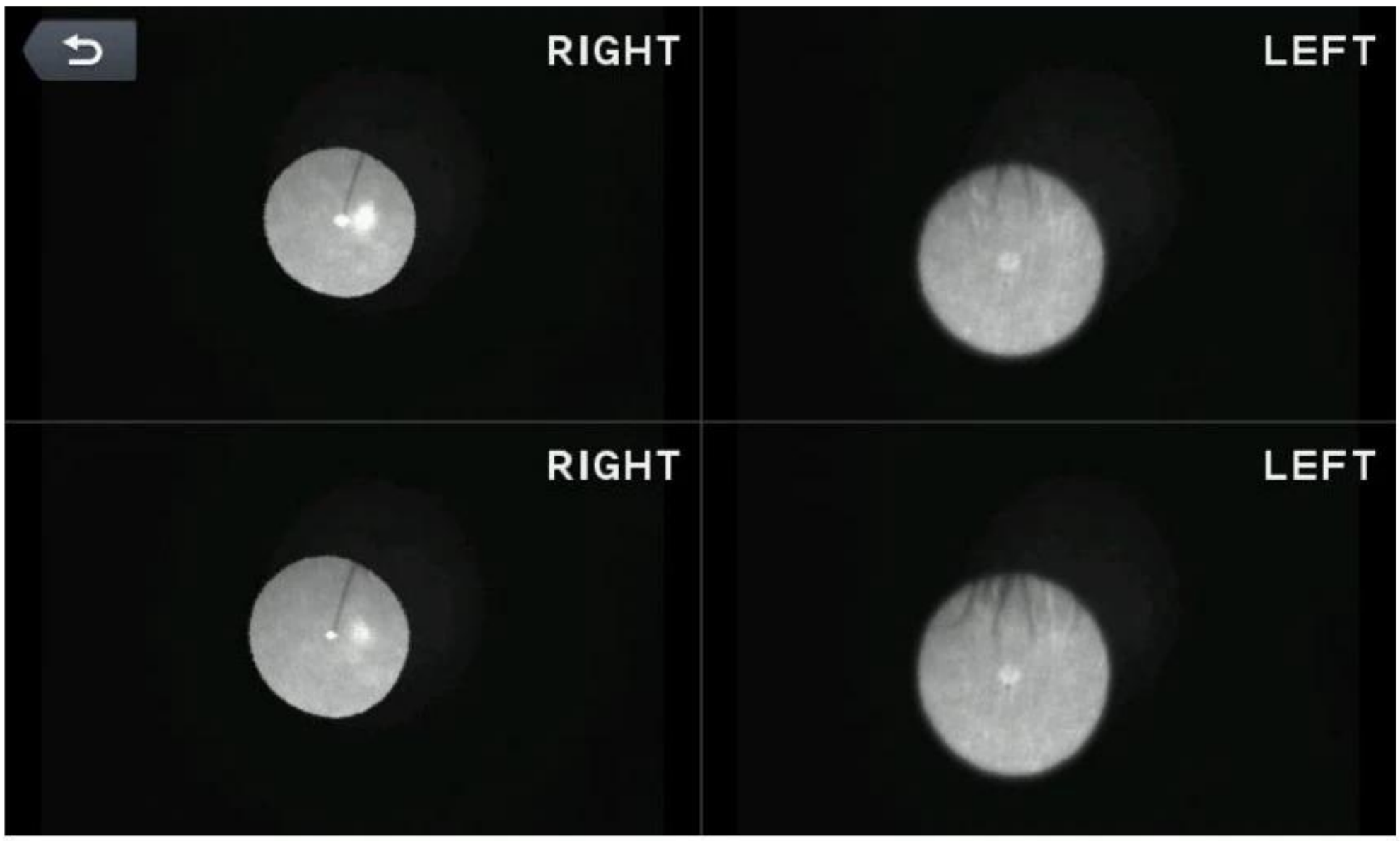
### 9.2.4.3. Saving

It is possible to save up to two images for the left and right eyes when it comes to the images saved by using measurement button.

### 9.2.4.4. Test for other eye

Saves the desired image for other eye as well.

### 9.2.4.5. Importing saved image




**[Figure 9-2-4-3. Screen indicating saved image]**

① Press on the  button to go into the Display mode in order to indicate the saved Retro-illumination image for the two eyes on the monitor screen once again.

② In the Display mode, each saved image is indicated on the screen and it is possible to indicate by amplifying the image when you touch a desired image.

③ The mode returns to the Display mode when the  button is pressed on while at the amplified screen.

④ The screen returns to the observation screen when the  button is pressed on in the Display mode.



**[Figure 9-2-4-4. screen indicating saved image (amplification)]**

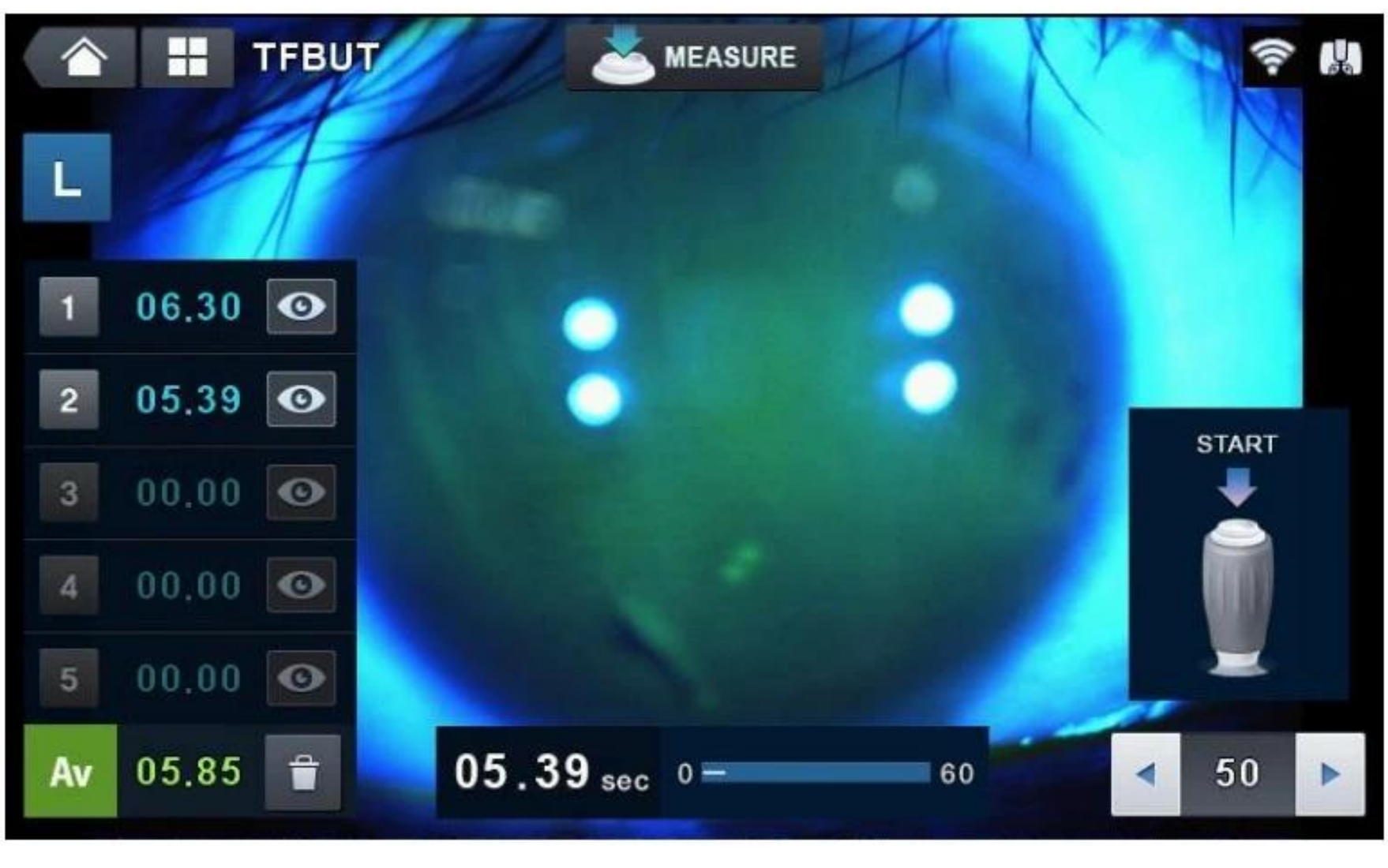
## 9.2.4.6. Returning to the main measurement mode

It is possible to return to the main measurement mode if you press on the  button while at the observation screen.

## 9.2.5 TFBUT measurement mode (Tear film break-up time)

This is the mode for measuring the time required until the dry part of the cornea's surface appears (tear film destruction time) after blinking the eyes.

The dry part is the normal phenomenon that results due to the evaporation and spread of the tears. Dry part starts to appear within 10 to 12 seconds in healthy eyes after blinking the eyes.




**[Figure 9-2-5-1. TFBUT measurement screen]**

Button information on the screen are as the following.


: Button that indicates the filmed image on the view all screen.


: Button for deleting measured data


: Button that lowers stage of LED's brightness by one step



: Indicates current LED's brightness.


: Button that increases stage of LED's brightness by one step

### 9.2.5.1. Tear film break-up time measurement

1. The mode turns into TFBUT measurement mode when TFBUT mode button is pressed on after pressing on the  button in the measurement mode.

2. Use fluorescence solution to dye test subject's eyes.

3. Adjusts eye height and focus to facilitate observation.

4. Have a test subject blink the eyes two or three times and have the subject stop blinking in order to observe dry part.

5. Start measuring time by pressing on the measurement button the moment test subject blinks the eyes for the last time.

6. Stop the time by pressing on the measurement button when the dry part starts the device while observing tear film of the cornea, dyed with fluorescence solution.

7. Measured time gets indicated on the screen, and up to five measurements are enabled. When measured a number of times, average time gets output together.

- When measured wrongly, it is possible to exclude wrongly measured measurement time from the average time. When the wrongly measured time is touched, red line is indicated on top of the measurement time. This time is excluded from the average time




### 9.2.5.2. Importing saved image

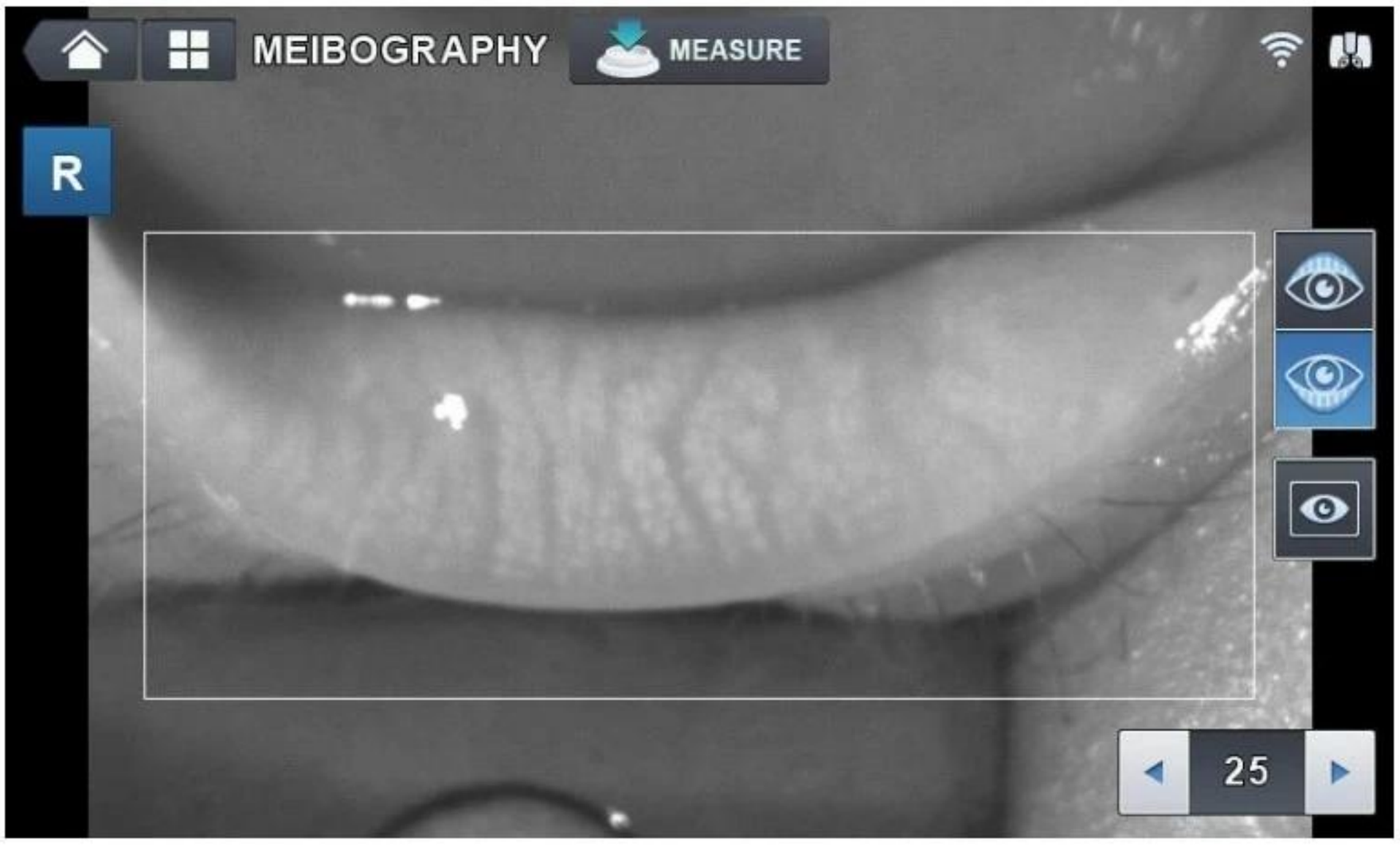
① Measurement time list is activated when measurement is completed.

② Press on the activated  button to indicate by amplifying the image.

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

### 9.2.6. Meibography mode

This is the mode that films the meibomian gland that is useful for the diagnosis of the xerophthalmia and that shows by emphasizing it.




[Figure 9-2-6-1. Meibography mode indicator screen]

Categories of the buttons that are indicated on the screen are as follows.


: Button for modifying to the upper eyelid filming mode


: Button for modifying to the lower eyelid filming mode


: Button for indicating and analyzing filmed image

## 9.2.6.1. Meibogryphy measurement

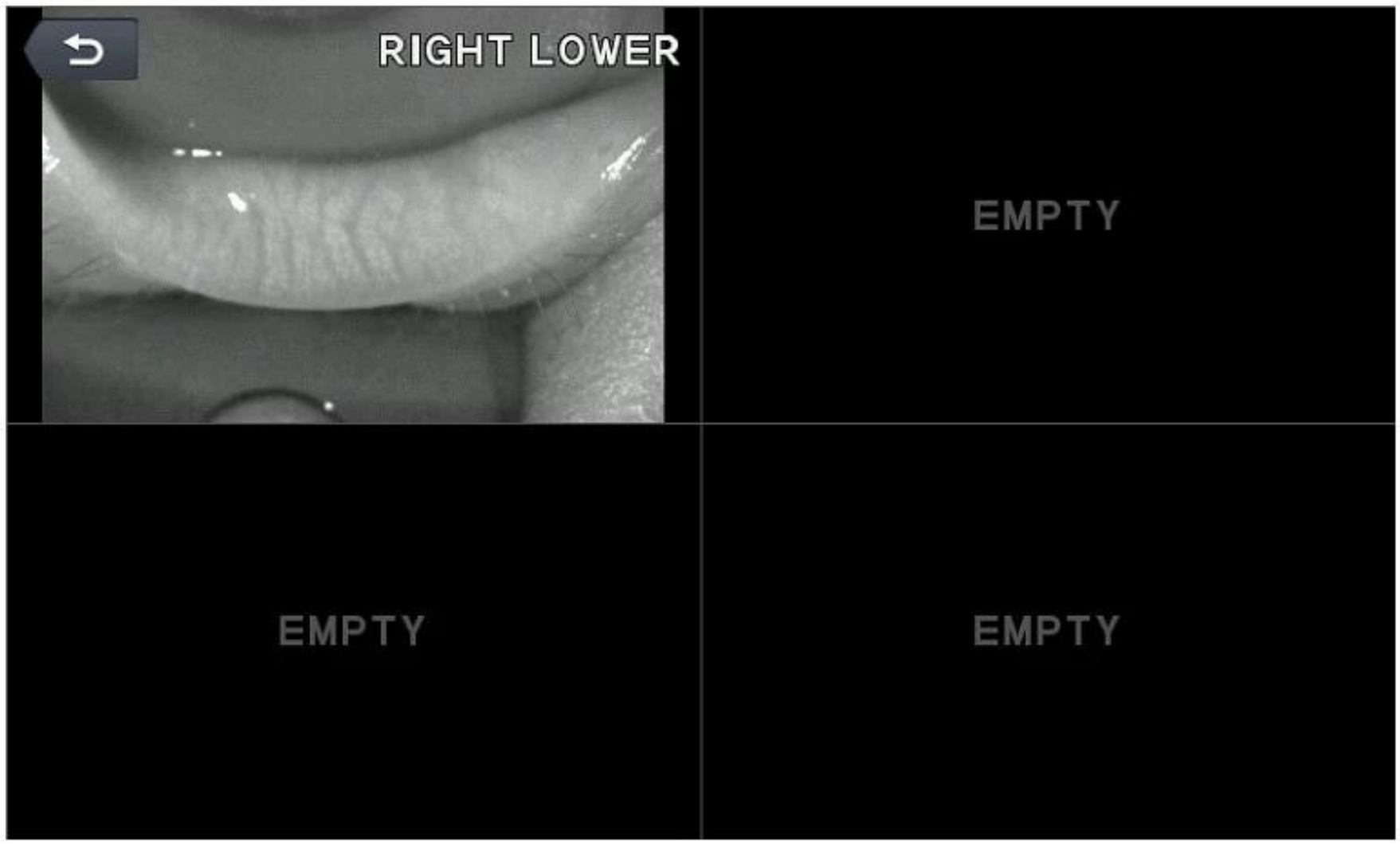
① The following MEIBOGRYPHY MODE screen appears when Meibo button is pressed on after pressing on the  button in the measurement mode.

② Select the direction (up or down) of the eyelids where the meibomian gland to be measured is located.

③ Use joystick button to film meibomian gland. (Possible to film up to four pages)

## 9.2.6.2. Filming result selection screen

1. Press on the joystick button at the Meibography mode to film test subject's meibomian gland.
2. Press on the  button to output four recently filmed images on the DISPLAY screen.




**[Figure 9-2-6-2. Meibography filming result selection screen]**

Categories of the buttons that are indicated on the screen are as follows.

UPPER/LOWER: Indicates the direction of the eyelids where filmed meibomian gland is located.

1. Press on the  button on the screen that filmed meibomian gland and the four images filmed recently are output on the DISPLAY screen.

## 9.2.6.3. Meibomian gland emphasis and analysis result screen




**[Figure 9-2-6-3. Meibography View mode – emphasis and analysis result screen]**

Categories of the buttons that are indicated on the screen are as follows.

 : This is the screen that shows the filmed image on the screen by amplifying.

 : This is the screen that emphasizes and indicates only the part that applies to the meibomian gland among the eyelid domain.

1. Pressing on the  button analyses filmed image, and only part that applies to the meibomian gland among the eyelid domain is emphasized brightly and indicated on the screen.

2. Pressing on the  button indicates the original copy image on the screen.

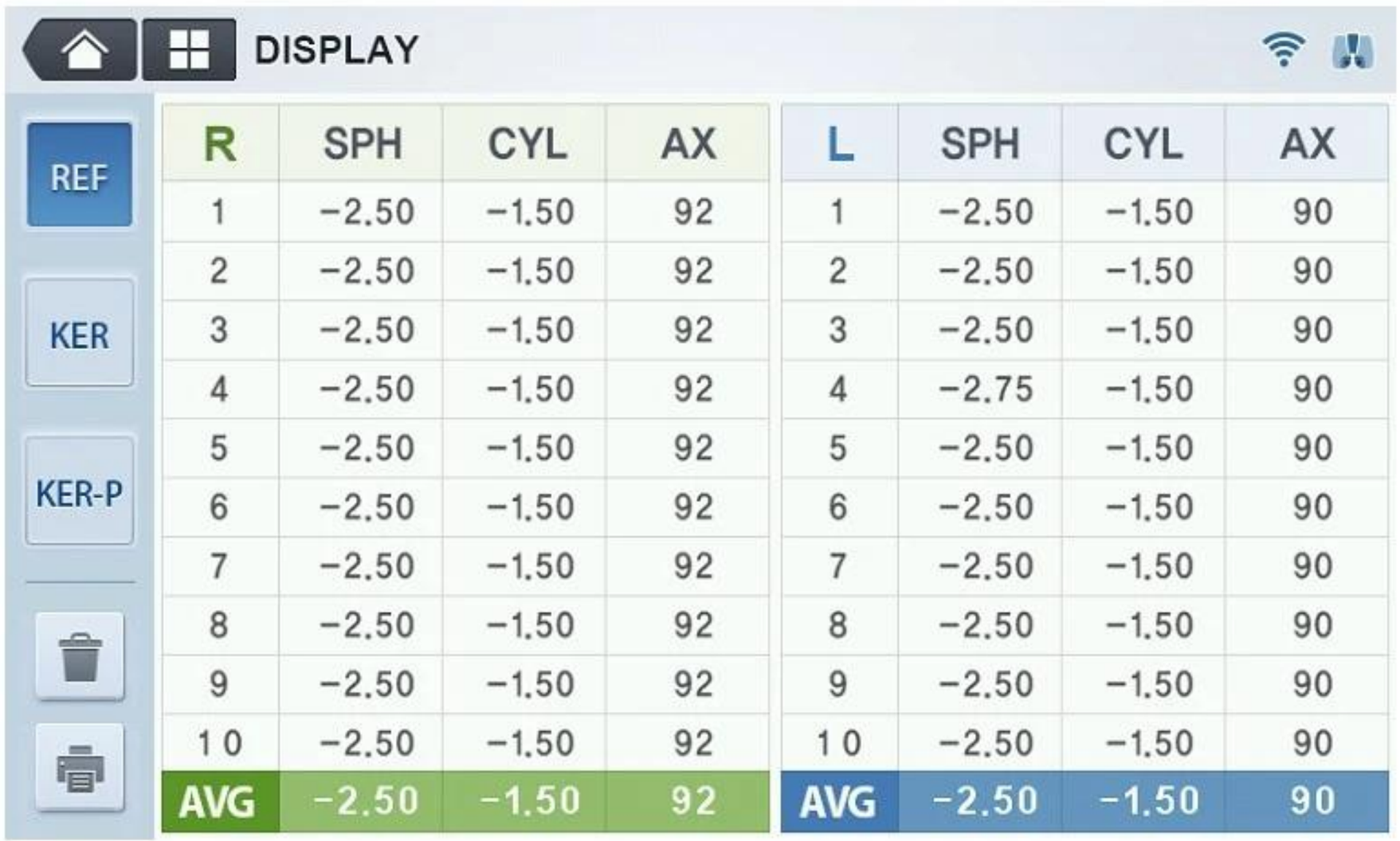
## 9.2.7. DISPLAY mode

It is possible to see the measurement results that are saved in the memory (up to 10 for the left and right eyes).

The mode changes into the DISPLAY mode when the DISP button is pressed on after pressing on the  button at the main measurement mode. It is possible to convert even when the measured value indicated on the screen's left and right sides is touched after measuring refractive power.

**NOTE**

- Page changes when the REF button or KER button is pressed on in case of the K&R mode.
- Measurement result that is saved in the memory when pressing on the PRINT button is printed out via built-in printer, and the result is deleted completely for the new measurement.




| R | SPH | CYL | AX | L | SPH | CYL | AX |
|---|---|---|---|---|---|---|---|
| 1 | −2.50 | −1.50 | 92 | 1 | −2.50 | −1.50 | 90 |
| 2 | −2.50 | −1.50 | 92 | 2 | −2.50 | −1.50 | 90 |
| 3 | −2.50 | −1.50 | 92 | 3 | −2.50 | −1.50 | 90 |
| 4 | −2.50 | −1.50 | 92 | 4 | −2.75 | −1.50 | 90 |
| 5 | −2.50 | −1.50 | 92 | 5 | −2.50 | −1.50 | 90 |
| 6 | −2.50 | −1.50 | 92 | 6 | −2.50 | −1.50 | 90 |
| 7 | −2.50 | −1.50 | 92 | 7 | −2.50 | −1.50 | 90 |
| 8 | −2.50 | −1.50 | 92 | 8 | −2.50 | −1.50 | 90 |
| 9 | −2.50 | −1.50 | 92 | 9 | −2.50 | −1.50 | 90 |
| 10 | −2.50 | −1.50 | 92 | 10 | −2.50 | −1.50 | 90 |
| AVG | −2.50 | −1.50 | 92 | AVG | −2.50 | −1.50 | 90 |

**[Figure 9-2-7-1. data measurement result]**

Categories of the buttons that are indicated on the screen are as follows.



/


: This is the screen that shows Refractometry measurement result.



/


: This is the screen that shows Keratometry measurement result.



/


: This is the screen that shows Ker-p measurement result.


: Button for deleting saved DATA and that returns to the measurement mode.


: Button for printing saved DATA.

1. Refractometry measurement result

   - Indicates the latest 10 measurement results (refractive power).

2. Keratometry, Keratometry-p measurement result

   - Indicates the latest 10 measurement results (cornea curvature value).

## 9.3. User SETUP mode

It is possible to adjust various setups related to the measurement, printer output and others. You can go into the user SETUP mode by pressing on the  (SETUP MODE) button in the main measurement screen. User SETUP mode is comprised of two pages, and each page gets classified into various tabs once again.

**[Method for changing page]**

-  : Moves to the previous page.
-  : Moves to the next page.

**[Method for changing contents]**

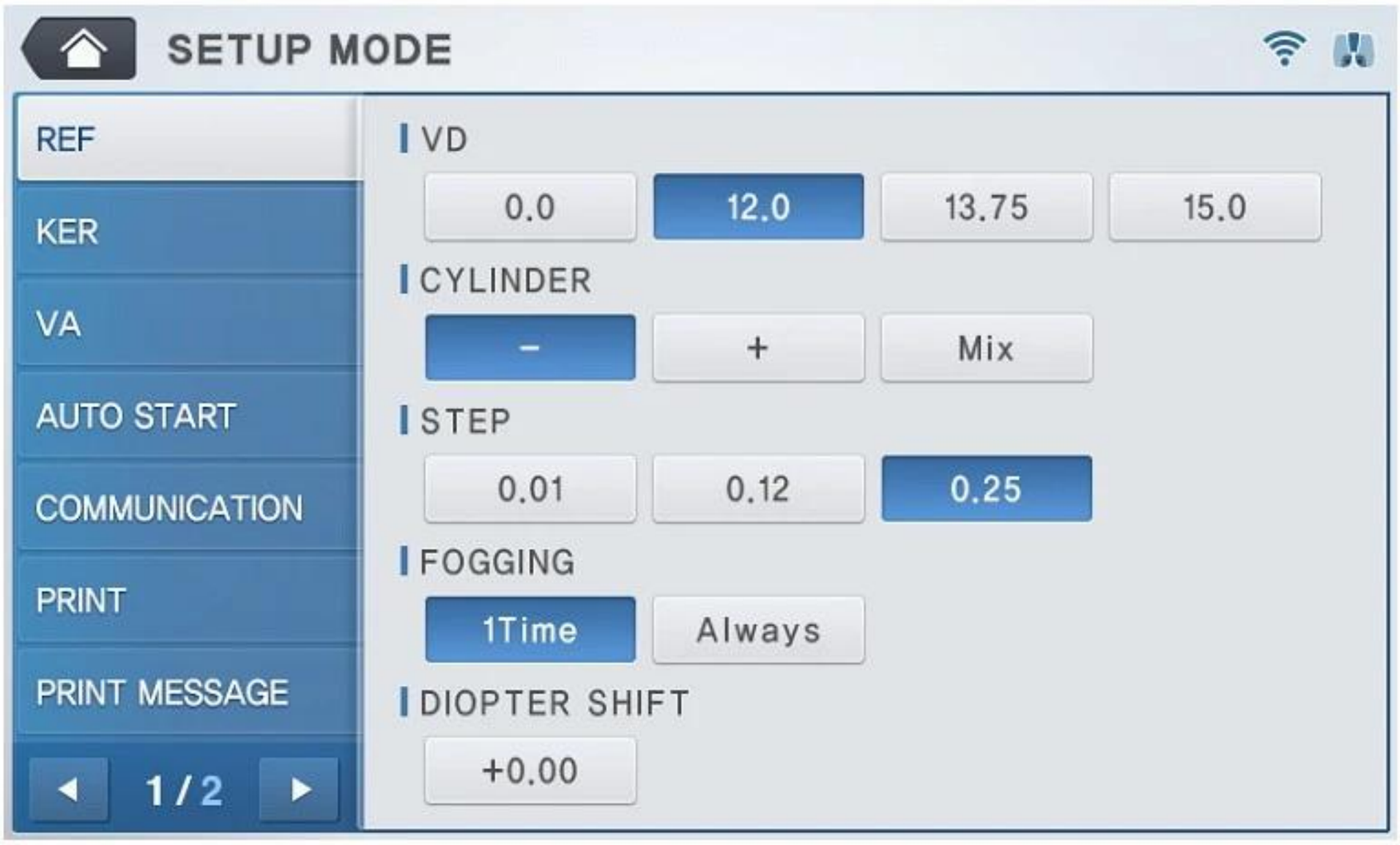
- It is possible to select the desired tab to indicate the set value on the screen, and to change the setting by touching on the category to be modified.

**NOTE**

Some need to be modified by using a different method. This setting modification procedure is instructed below the explanation for each category.

**[Method for entering into the measurement mode]**

- Press on the  button to save the contents automatically, and the mode returns to the main measurement mode.




**[Figure 9-3-1. Setup mode information (page 1/2)]**

**[Contents of the category]: 1/2 Page**

1. **REF (cornea measurement)**

   - **VD (0.0/12.0/13.75/15.0)**
     **:** Distance between corneal apex and corrective lens

   - **CYLINDER (-/+/Mix)**
     **:** Astigmatism marking form

   - **STEP (0.01/0.12/0.25)**
     **:** Unit for indicating spherical prescription and astigmatism prescription

   - **FOGGING (1Time/Always)**
     **:** Select whether to carry out the mist execution frequency once or every time when carrying out continuous measurement

   - **DIOPTER-SHIFT (0.00)**
     **:** Set up the applicable value to correct the diopter measurement value
     **(Scope:** -5.00 ~ +5.00)

## 2. KER (curve measurement)

- **mm/D (mm/D/AVG)**
  **:** cornea measurement의 marking form

| | | |
|---|---|---|
| mm | R1 ····· | major axis radius |
| | R2 ····· | minor axis radius |
| | AX ····· | major axis's angle |
| D | K1 ····· | minimum cornea refractive power |
| | K2 ····· | maximum cornea refractive power |
| | AX ····· | minimum cornea refractive power's angle |
| AVG | AR ····· | average curvature radius |
| | CY ····· | cornea astigmatism prescription |
| | AX ····· | cornea astigmatism's angle |

- **STEP (0.05/0.12/0.25)**
  **:** Unit for indicating cornea refractive power and cornea astigmatism prescription

- **INDEX (1.332/1.336/1.3375)**
  **: Selection of** cornea equivalence's refractive power

## 3. VA (Visual Acuity Test)

- **AXIS STEP (1 / 5 step)**
  **:** select step to adjust axis

- **DISPLAY UNIT (Dec. / Frac.)**
  **:** Select expression of chart as Decimal number or 20/20 Fraction system

- **LOW CONTRAST RATIO (5 ~ 95 %)**
  **:** The brightness of low contrast chart (Express as the ratio standard chart brightness)
- **NEAR DISTANCE (40cm, 33cm)**

: Select near test working distance.

- **NEAR ADD (0.25~2.00)**
  : Set initial add power value when near testing. (Increases or decreases to 0.25~2.00 with 0.25step)

**4. AUTO START (automatic function)**

- **AUTO MEASUREMENT**
- **(Off/On (3)/On (5)/On (A))**
  : Select whether to use the automatic measurement function when the arrangement and focus are correct

  ON (3) Measure three times in a row

  ON (5) Measure five times in a row

  ON (A) Continue to measure

  OFF automatic measurement function is not used

- **AUTO TRACKING (Off/On)**

  **:** Select whether to use automatic tracking function or not

**5. COMMUNICATION (setting up the communication with other device)**

- **BPS (9600/57600/115200)**

  **:** Select data transmission speed with other device

  (9600, 57600, 115200bps)

- **RS232 PROTOCOL (Off/V1/V2/Ext)**

  **:** Setting up the transmission method (other equipment method and Version)

- **MODE (Std/Avg/Misc)**

: Data format setting for transmission method.

**6. PRINT (printing setting)**

- **AUTO PRINT (Off/On)**: When measurement takes place in automatic measurement mode, measurement result is printed automatically when the measurement is completed in sequence for the left and right eyes.

- **REF. PRINT (Off/Std/Avg):** Built-in printer output form for the Refractometry measurement result

  Off: Did not get output.

  Std: Outputs only the most recent 10 measurement results and average values.

  Avg: Outputs only the average value.

- **KER. PRINT (Off/Std/Avg):** Built-in printer output form for Keratometry measurement result

  Off: Did not get output

  Std: Outputs only the most recent 10 measurement results and average values.

  Avg: Outputs only the average value.

- **EYE IMAGE (Off/On):** Selects output of the eyeball and curve figures following REF measurement result

  Off: Did not get output

On: Selects output of the eyeball and curve figures following Refractometry measurement result

- **R. CYL (Off/On):** Selects remaining astigmatism output.

**7. PRINT MESSAGE**

: Inputs message to be output along with measurement data at the time of printing.

Can input the contents up to two lines.

- **MESSAGE:** text input




**[Figure 9-3-2. Setup mode information (page 2/2)]**

**[Contents of the category]: 2/2 Page**

**8. DATE & TIME**

- **DISPLAY (YMD/MDY/DMY):** year/month/day marking form setting

  YMD: year/month/day

  MDY: month/day/year

  DMY: day/month/year

- **DATE:** Modification of the setting for date (year/month/day)

  (Scope: Y = 00 ~ 99, M = 01 ~ 12, D = 01 ~ 31 (1 ~ 28 when the M is February))

- **TIME:** modify setting for time (hour/minute/second)

  (Scope: H = 00 ~ 23, M = 00 ~ 59, S = 00 ~ 59)

## 9. PATIENT NUMBER (serial number)

- **COUNT (Off/On)**

  **:** select whether to use the serial number or not

- **NO.**

  **:** Serial number selection

  (Scope: 0 ~ 9999)

## 10. DISPLAY

- **EXT. OUTPUT (Off/On)**

  **:** select whether to use external display output

- **EXT. OUTPUT RATIO (4:3 / 16:9 / 5:4 / 16:10)**

  **:** Select resolution of external display output

- **LCD BRIGHTNESS (10 ~ 100%)**
  **:** Adjust brightness of LCD display

- **LCD COLOR TEMPERATURE (COOL ~ WARM)**
  **:** Adjust color temperature of LCD display

## 11. WIFI (wireless communication setting)

- **WIFI (Off/On):** Selects whether to use the data transmission function with phoropter through WiFi

- **TRANSFER TYPE (Auto/Manual):** setting for the transmission method when transmitting data.

  Auto: Method for transmitting all the data with phoropter that was selected for use without asking the user.

  Manual: Method that transmits data with the user selecting the desired phoropter in person and that outputs the phoropter selected for use prior to the data transmission

- **AP ID:** Directly input the AP SSID to use for WiFi communication

  SCAN: Outputs the AP list that enables current connection by pressing on the SCAN button and outputs the POPUP screen that can select one of them

- **AP PASSWORD:** input AP's password

VERIFY: test whether it is possible to connect to the AP by using the currently input password

**⚠ CAUTION**

Wireless AP to be connected to this device should be set to WPA2-PSK when it comes to the security setting. Access may be restricted in case of the AP that is set to other wireless security.
The Company is not responsible for the problem that may result when accessing with the AP with unset security.

**12. HDR IP 1 ~ 2 (IP address of HDR)**

- **IP ADDRESS 1 ~ 10 :** Sets up the phoropter to connect
- ☑: Select whether to use the phoropter of this information (possible up to four)

ROOM: Input the name of the phoropter to indicate

IP ADDRESS: Input phoropter's IP address

**⚠ CAUTION**

IP of the HDR that this device wants to access to needs to use the static allocation IP Address that does not use the DHCP.
Access may not take place when DHCP function is used to try to access the device that uses allocated IP.

**13. ETC (other setting)**

- **LANGUAGE (English):** Selects the language that is indicated on the screen and printer output door.

- **BEEP SOUND VOLUME (Off/Low/Mid/High):** Sets up the Beep sound output to small, average and large.

- **INITIAL MODE (REF/KER/K&R):** selection of initial measurement mode.

- **SLEEP MODE (Off/3min/5min/10min):** Sets up the time required for entering into the power-saving mode

## 9.4. Measurement Data Transmission using WiFi

Measurement data can be transmitted to Huvitz Co. Ltd, phoropter using a WiFi network. Data can be transmitted without direct data cable connection using this function. Thus, it does not require any additional installations or take up installation spaces as it uses wireless network. Therefore, operations such as to install two equipment in different rooms on different floors are possible.

Maximum 10 phoropters can be registered, and up to four phoropters can be selected and used concurrently. Refraction data can be transmitted to all connected phoropters or to selected phoropters according to user settings.

Transmittable data are as the following.

- Serial number of examinee.
- Refractometry data on both eyes
- Keratometry data on both eyes
- Pupillary distance (PD)

### 9.4.1. WiFi Environment Setting

① Set the Access Point (AP) to provide WiFi network.

AP setting can vary in different manufacturers. Thus, set as the below referring to manual of each product.

- Use Protocol: IEEE802.11b 2.4GHz WiFi
- IP Assignment Mode: DHCP
- Encryption Method: WPA2-PSK
- AP SSID: A name to distinguish AP. Set as you like.
- AP PASSWORD: Password. Set as you like.

After setting, please remember the AP SSID and AP PASSWORD to connect to WiFi network.

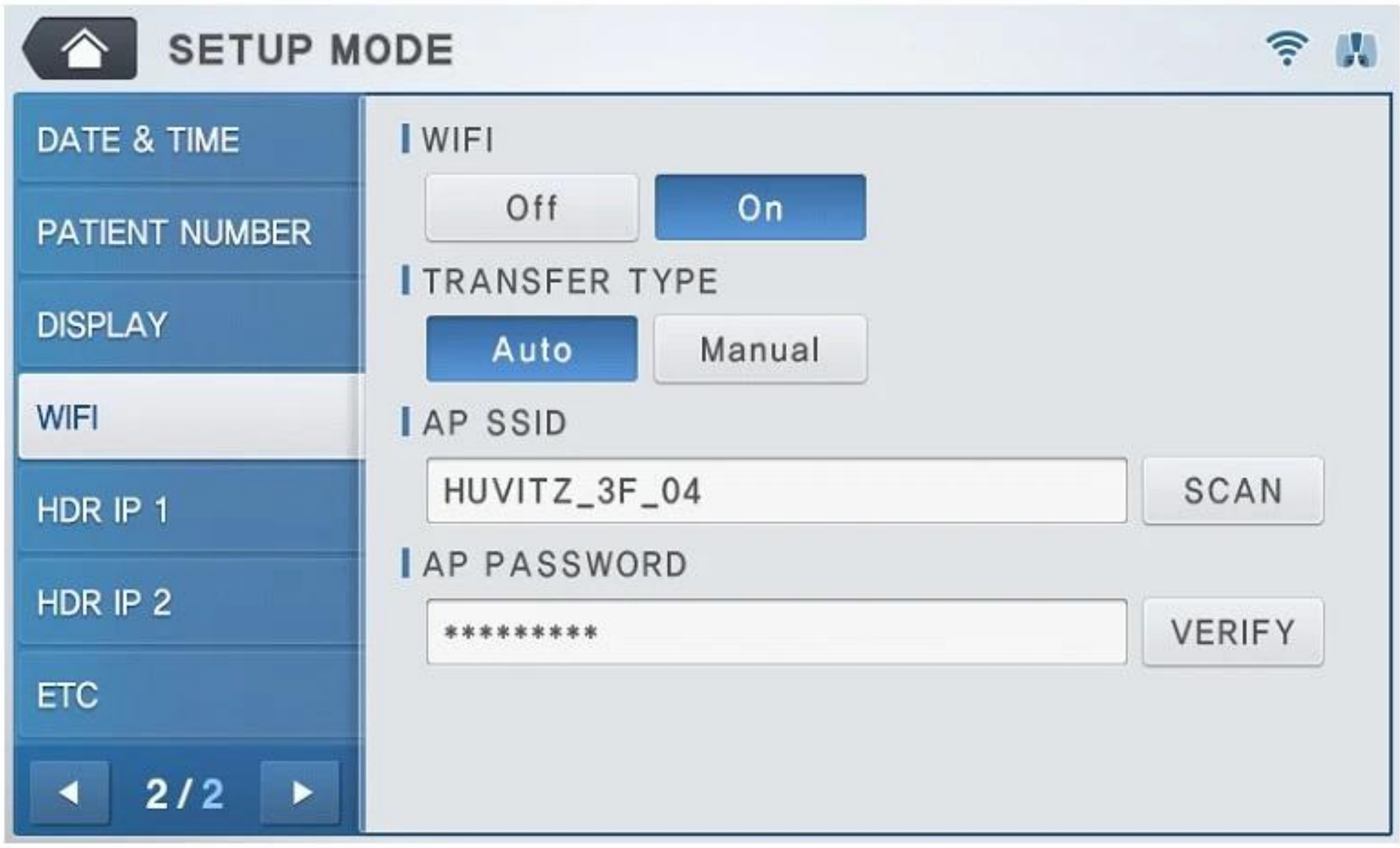
② WiFi Network Setting for Phoropter

Set up environment to connect to AP set on ① by referring to the manual of a phoropter. After setting up the environment, please remember the assigned IP address.

**⚠ CAUTION**

Use the static allocation IP Address that does not use the IP of the HDR that this device wants to access.
When trying to access the device that uses the allocated IP by using DHCP function, access may not take place.

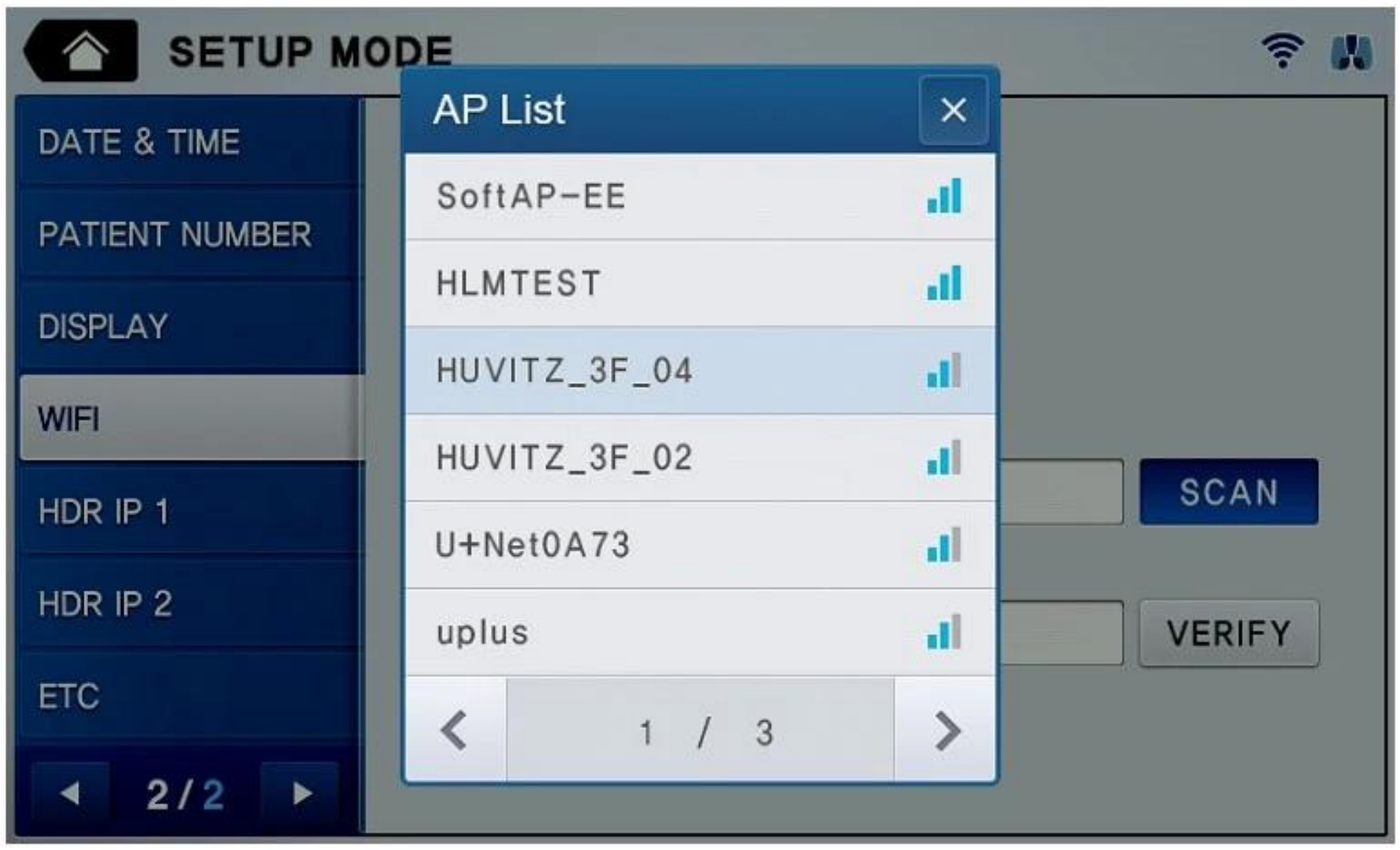
③ WiFi Network Setting for ref/keratometer




**[Figure 9-4-1. WiFi Network Setting Screen]**

1. Convert to User SETUP Mode, and select WIFI on page 2.
2. Turn on WiFi to use transmission function.

3. Set TRANSFER TYPE to set up data transmission method. (Refer to 9.4.3)
4. Press on the AP SSID entry window to enter SSID. When SSID is not known, press SCAN button on the right to select from available AP SSID.




**[Figure 9-4-2. WiFi AP Scan Result Screen]**

5. Press on the AP PASSWORD entry window to enter password. Press VERIFY button on the right to confirm the password. Password verification takes up less than 10 seconds, and the result will be shown on the screen.




[Figure 9-4-3. WiFi AP Password Verification Result Screen]

④ Phoropter Connection Setting for ref/keratometer




[Figure 9-4-4. WIFi Phoropter Connection Setting Screen]

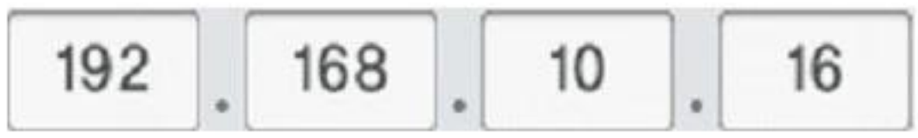
1. Convert to User SETUP Mode, ad select HDR IP 1 on page 2.

2. Enter information for phoropter to connect on each field.

-  : Select if phoropter will use the data transmission function.

- 

: Enter a name for the phoropter.

- 

:

Enter the IP address of the phoropter. (Refer to ②.)

If there are more than six phoropters to enter, additional phoropters can be entered under HDR IP 2 Menu. Maximum 10 of phoropters can be registered. Up to four phoropters can be selected to use the transmission function concurrently

## 9.4.2. Check WiFi Network Status

Current WiFi network status can be checked through the icons on the upper right of the screen.

(1)  : Connected to AP normally.

(2)  : Not connected to AP.

(3)  : AP connection process is in progress.

(4)  : Connected to all selected phoropters normally.

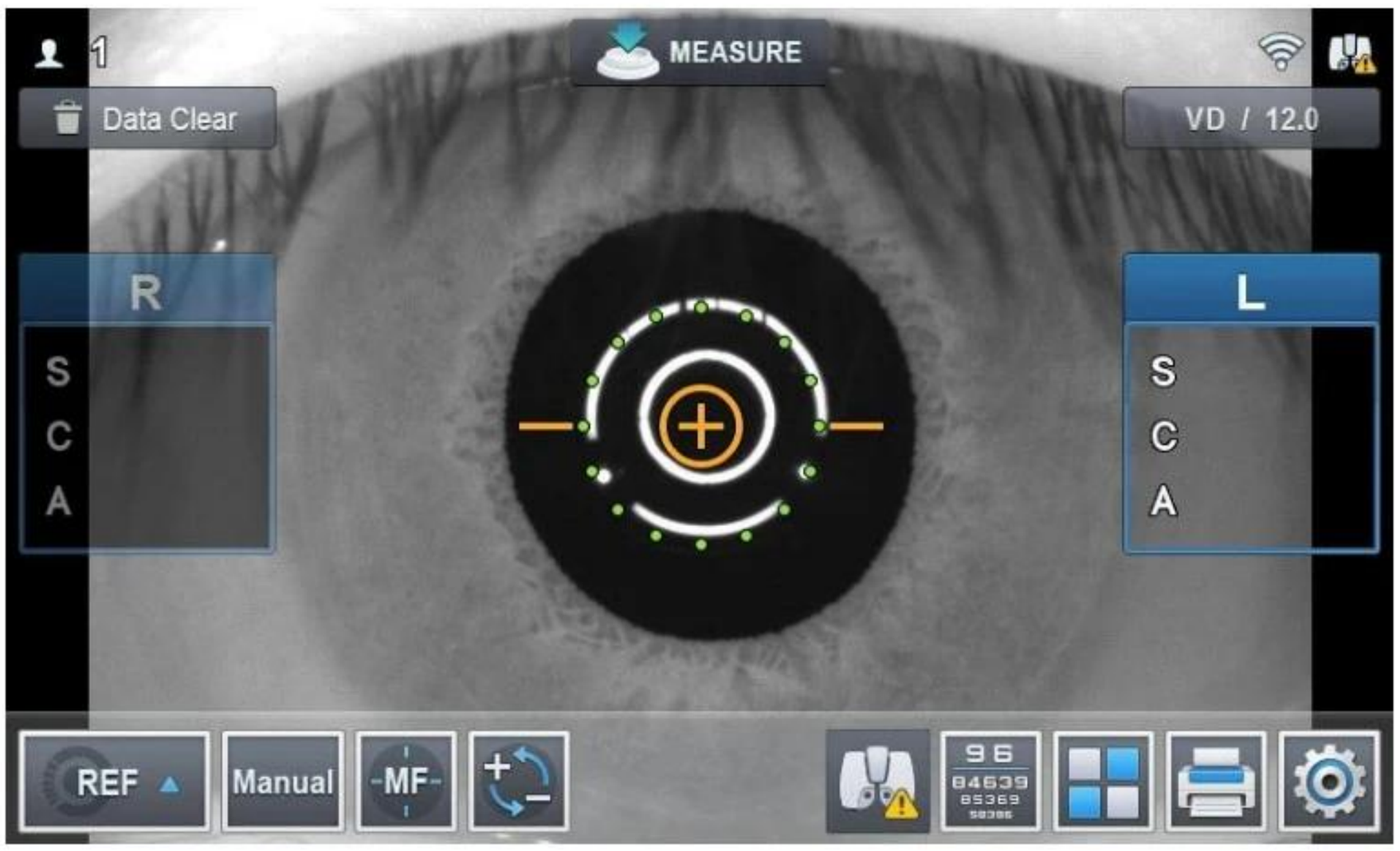
(5)  : Connection failure to one or more selected phoropters.

(6)  : Phoropter connection process is in progress.

For user convenience, the machine will operate to make attempts to connect to AP automatically while the power is on if it is not connected to AP. Thus, user does not have to go through the AP connection process.

Also, the machine is set to make attempts to connect to all selected phoropters one by one automatically after connecting to AP.

If there is a phoropter connection failure after automated connection attempt or if there is a connection error during operation,  button will appear on the bottom of the main measurement mode screen.




**[Figure 9-4-5. Phoropter Connection Error Screen]**

Pressing the button will bring up the phoropter connection status screen.

**CAUTION**

When the distance with the wireless AP is far, or if there is an obstacle between AP and this device, access may be unstable.
Increasingly effective communication is enabled when the AP is installed additionally at a near place or when the AP is moved to a closer place.

**⚠ CAUTION**

When the upper network's DHCP function is used due to the nature of the AP's DHCP movement, AP's IP re-allocation movement may result, and thus network connection may be unstable during random period.




**[Figure 9-4-6. Phoropter Connection Status Screen]**

Status of each phoropter will be shown graphically on the four windows. Under the windows are the names of phoropters set by user. Graphic indications are described below.

(1)  : Connected to phoropter normally.

(2)  : Not connected to phoropter.

(3)  : Data transmission is complete. (At times of data transmission)

(4)  : Data transmission was unsuccessful. (At times of data transmission)

(5) 

: There is not a phoropter selected.

If there is a connection error and the current status is on (2), try connecting again by pressing on the phoropter window. Connection takes up to 10 seconds depending on the environment, and the icon will change to (1) if the connection attempt was successful.

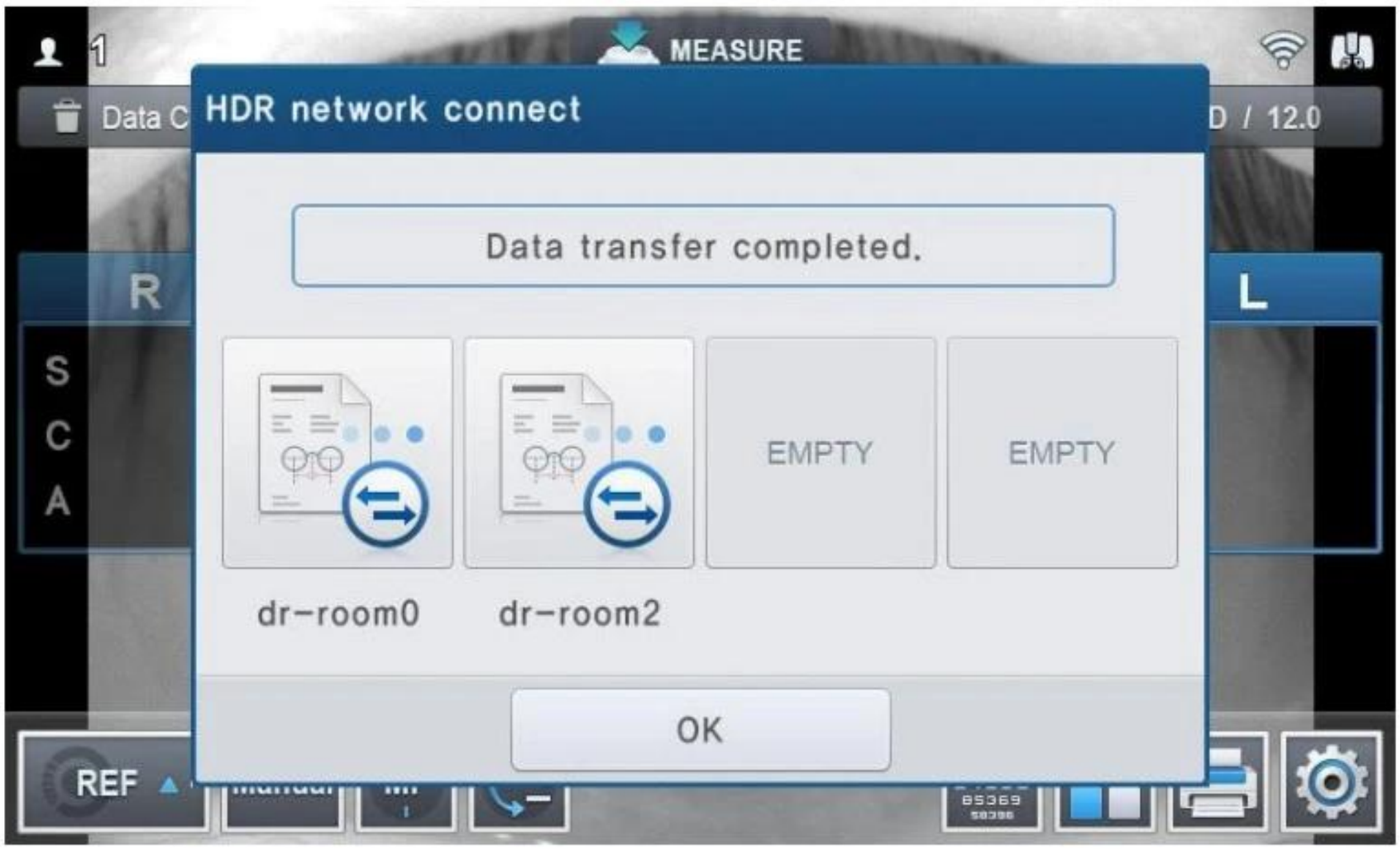
Turn off the status screen by pressing OK button on the bottom.

## 9.4.3. Measurement Data Transmission

After measuring refraction data of an examinee, the data can be transmitted to a phoropter through WiFi by pressing Print button on the front. Operations can vary depending on the TRANSFER TYPE set on the User SETUP.

① If it was set to AUTO

The data will be transmitted to all phoropters selected currently. After transmission, status screen (refer to 9.4.2) will appear, and user can confirm the transmission result through the graphical indications of phoropters (refer to 9.4.2).




**[Figure 9-4-7. Transmission Complete on AUTO Mode]**

After confirming the result, press OK to turn off the status screen.

If there are connection errors on one or more phoropters, the setting will be converted to MANUAL without transmitting the data.

② If it was set to MANUAL

The data will not be transmitted immediately, and current phoropter connection status screen will appear.

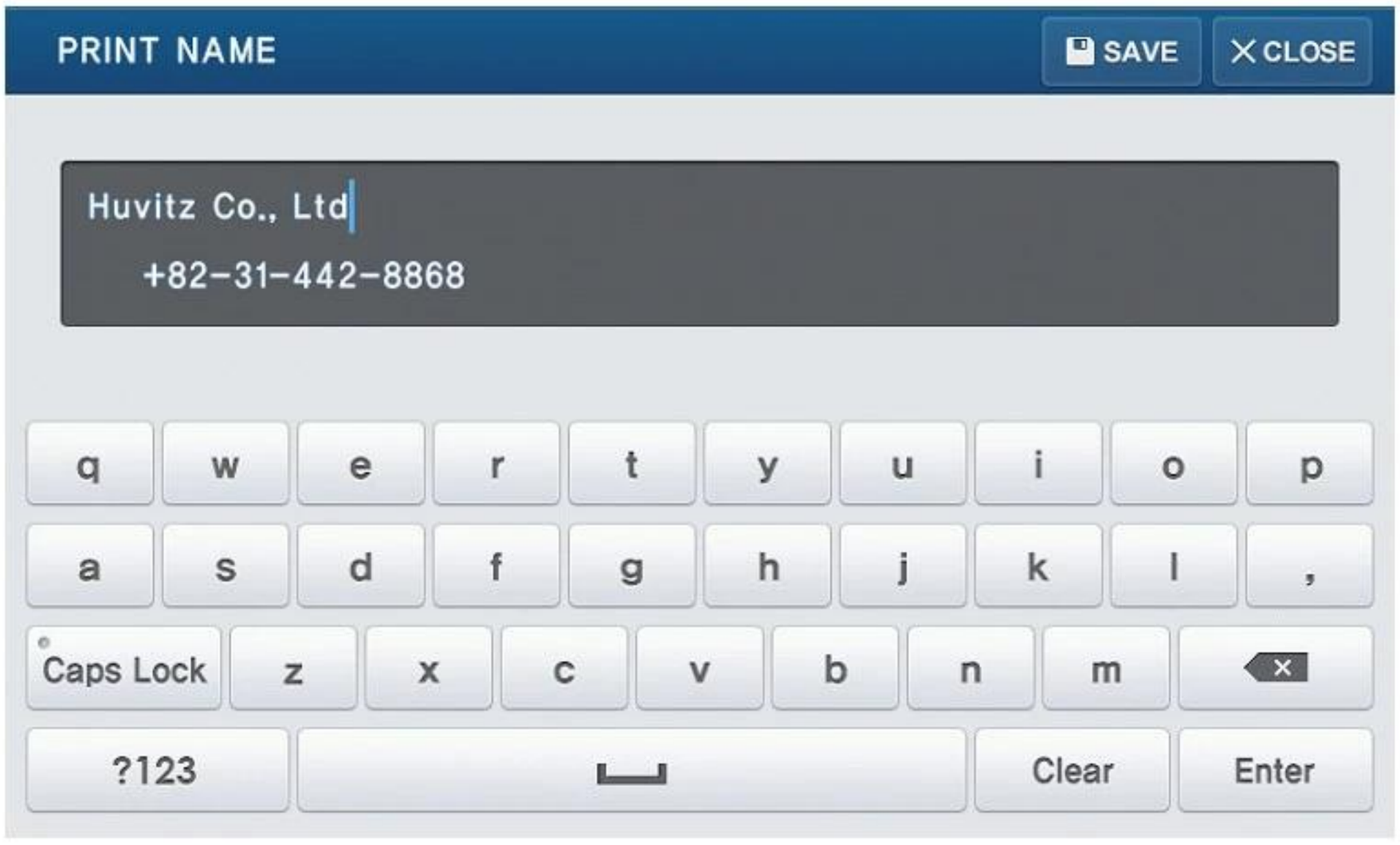



**[Figure 9-4-8. Current Phoropter Connection Status Screen on MANUAL Mode]**

Transmit data to a phoropter of user's choice by pressing on the phoropter window. If the phoropter is not connected, try to reconnect by pressing the window as shown in 9.4.2. After connecting to the phoropter, press on the window once again to transmit the data.

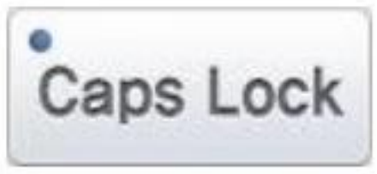
After completing the data transmission to the phoropter of user's choice, turn off the status screen by pressing OK button.

## 9.5. Input method

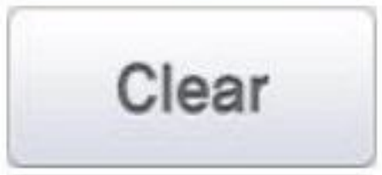



**[Figure 9-5-1. other (text) input]**

[Text input]




: Converts capital letter/small letter input mode.




: Deletes all the input texts.



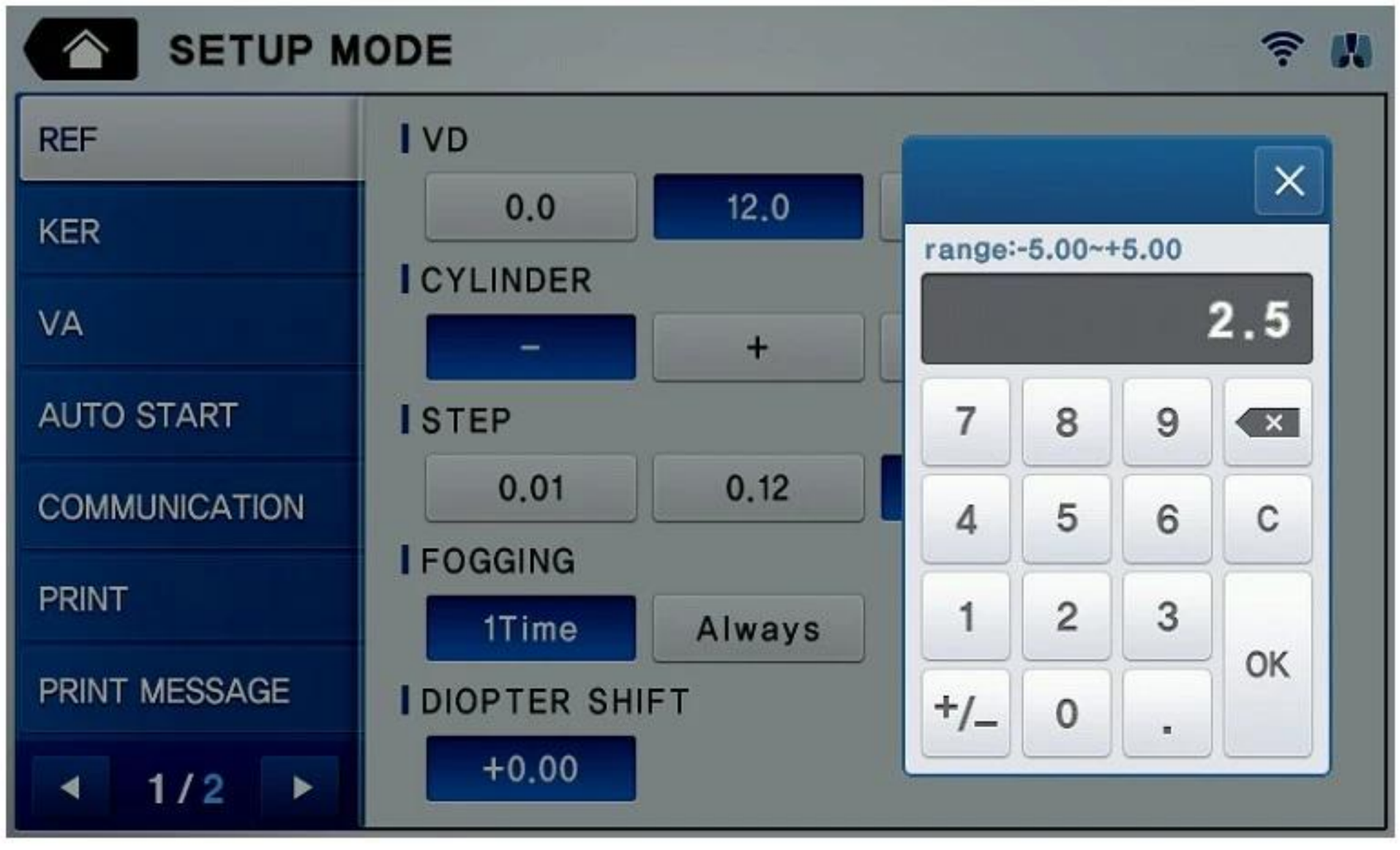
: (Back Space) deletes only one letter in front of the cursor.




: Converts the space in between the first and second lines.




: Saves input text.




[Figure 9-5-2. other (number) input]

[Number input]

Range: Minimum ~ maximum scope that can be input
(Does not get saved when the scope is deviated from, and the warning message, “Out of Range!” appears.)


: Deletes the last number.


: Deletes all the numbers.


: Saves number and exists number input mode.

## 9.6. Power saving function

Power-saving function gets activated when you do not operate any function during three minutes (default). The mode returns to the measurement mode when you press on any button or touch the screen during the power-saving mode. It is possible to modify the power-saving time when you select the “SLEEP MODE” on the user SETUP mode.

# 10. Self-diagnosis and maintenance/repair

## 10.1. Prior to calling a serviceman

Warning appears on the screen when there is a problem or when this device malfunctions. Take the following measures in case of the following.
Contact a sales distributor after turning off the power when the device does not resume normal operation even after taking the following measures.

① When power switch is turned on

| Message | Root causes | Measures |
|---|---|---|
| Motor Error | Abnormality at the inside of the device | Turn off the power and turn the power on after 10 seconds. Contact a sales distributor when the warning message appears again |
| EEPROM Error | | |
| EEPROM Data Error | | |
| System Error | | |
| Clock Error | | |
| INVALID SETUP DATA – REF | Abnormality of the internal data for Refractometry | Contact a sales distributor |

| | | |
|---|---|---|
| INVALID SETUP DATA<br>- KER | Abnormality of the internal data for Keratometry | Contact a sales distributor |

② Message during measurement

| Message | Root causes | Measures |
|---|---|---|
| TRY AGAIN | Refer to Page 15 | Refer to Page 15 |
| | Contamination of the object lens on the measurement screen | Clean the object lens |
| + OUT | Spherical prescription of the eye for testing exceeds +25 D | Impossible to carry out measurement |
| | Curvature radius of the eye for testing exceeds 13.0 mm | |
| | Contamination of the object lens on the measurement screen | Clean the object lens |
| - OUT | Spherical prescription for the eye for testing exceeds –30 D | Impossible to carry out measurement |
| | Curvature radius of the eye for testing is less than 5.0 mm | |
| | Contamination of the object lens on the measurement screen | Clean the object lens |
| C OUT | Astigmatism of the eye for testing exceeds 12 D | Impossible to carry out measurement |

| | | |
|---|---|---|
| | Cornea astigmatism of the eye for testing exceeds 15 D | |
| | Contamination of the object lens on the measurement screen | Clean the object lens |

③ Message when printing

| Message | Root causes | Measures |
|---|---|---|
| CHECK PAPER | There is no printer page or the lever is not shut. | Add on printer page or close the lever. |

## 10.2. Replacing

### 10.2.1. Printer page

Replace the paper for the printer immediately when red line appears on the paper.

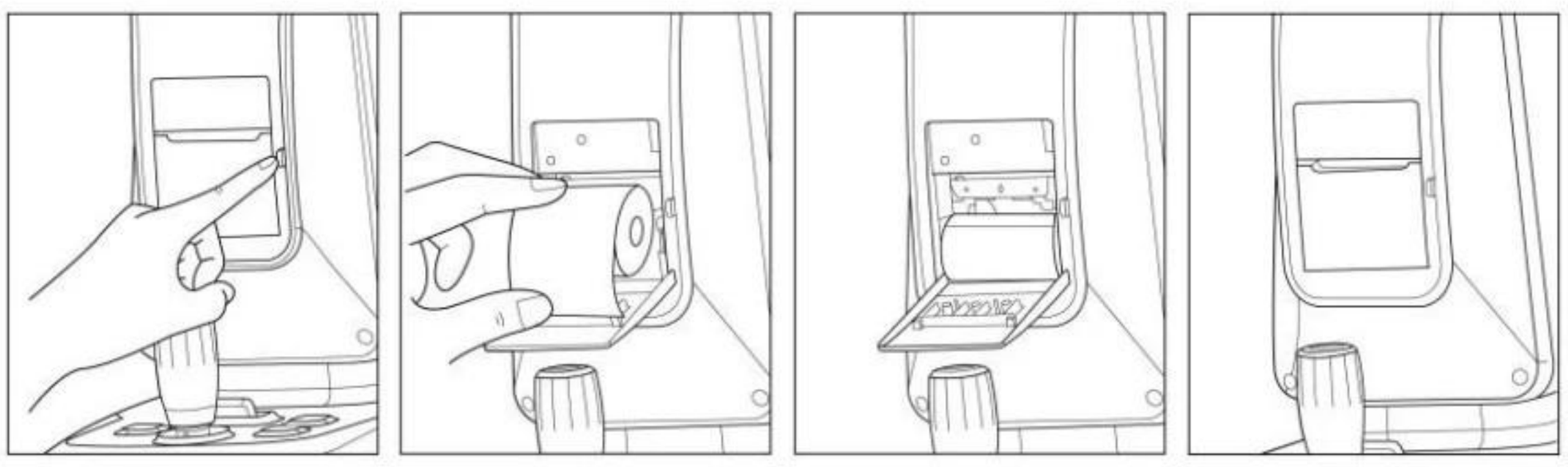
① Open the cover by pressing on the button located next to the printer.

② Cut the paper that is stuck in the printer and take out the paper roll to the outside.

③ Put in new paper roll into the printer case.

④ Fixate the paper by pushing it into the printer. At this time, adjust the length to a degree that can be discharged as the paper gets fit into the paper discharge hole of the cover.

⑤ Close the cover after fitting in the ends of the paper to the hole that lies in between the covers.



**[Figure 10-1. Printer paper replacing]**

## 10.2.2. Chin rest paper

① Take out two pins from the chin rest.

② Push in the pin into the hole that is found on the chin rest paper. It is possible to mount over 50 pages.

③ Fit in a pin in each of the two holes of the chin rest.

## 10.3. Cleaning Equipment

① The equipment should be kept as clean basically. Do not use the solvents such as strongly volatile substance, thinner, benzene, etc.

② Put some soapy water to the soft cloth, and twist the water out of the cloth. Then, polish each part of the equipment.

③ As polishing the parts of lens or glass, get rid of dusts on the surface of lens with wind-blower and use a dry cloth.

④ Always keep it clean for a patient to use chinrest paper in chin rest, to clean it often in head rest.

⑤ Always clean the patient contact parts (such as chin rest and head rest) and Hand-washing (Operator: such as an iodophor or chlorhexidine gluconate) prior to disinfection.

⑥ When using an FDA or CE-cleared (as appropriate) disinfecting agent, carefully follow the instructions provided the manufacturer of the product.

⑦ For low-level disinfection(normally), the patient contact parts may be wiped with any of the following low level disinfectants

Methods to disinfect to HRK-9000A are as below:

- Dry heat
- Mechanical cleaning with disposable wipe / sterile gauze
- Wipe with gauze soaked in alcohol or chemicals like hydrogen peroxide and Merthiolate
- Soaking in chnicals like 70% isopropyl alcohol, 1:1000 Merthiolate, 3% hydrogen peroxide and 1:10 diluted house hold bleach(sodium hypochlorite)

| Solution | Manufacturer | Cleaner/ Disinfectant | Active ingredient | Cleared/Approved for use in |
|---|---|---|---|---|
| Alkazyme | Alkapharm | Cleaner | Proteolyticenzyme, Quat, Ammonia | Europe |
| Klenzyme | Steis/Calgon Corp. | Cleaner | Enzymes | USA & Europe |

⑧ For high-level disinfection(if needed), the patient contact parts may be wipe using one of the following disinfection agents:

| Solution | Manufacturer | Cleaner/ Disinfectant | Active ingredient | Cleared/Approved for use in |
|---|---|---|---|---|
| Cidex OPA | Adavaced Sterilization Product | Disinfectant | Orthophtalade-hyde | USA & Europe |

## 10.4. When moving equipment installation place

① Turn off the main body's power switch.

② Separate power connection cable.

③ Lock by turning the Clamping bolt into the clockwise direction.

④ Move while maintaining horizontal balance while holding the lower part of the main body.

# 11. Information needed for servicing

Repair: Contact the Huvitz's distributor after preparing the information on the following matters when the problem is not resolved even after taking the measures described on Page 10.

- equipment name: HRK-9000A
- equipment's serial number: number on the name plate that is comprised of eight numbers and letters
- explanation of the symptom: detailed explanation
-

**Year/month/day purchased:** _____

**Client name:** _____

**Client address:** _____

**Client contact number:** _____

**Model number:** _____

**Serial number:** _____

Supply of parts needed for repair:

- Parts needed to repair this device are kept for eight years after the product production is discontinued.

Parts that the service personnel need to repair:

- The following parts are consumables by nature and quality tends to decrease after using for a long time. But the user must not replace it in person. When the parts are consumed or deteriorated due to long time use, contact the Huvitz's distributor for replacement.
- Back-up battery for clock and data

Contact the Huvitz's service department directly by referring to the address and telephone numbers below if you cannot contact the distributor where you purchased the product.

# Huvitz Co., Ltd. contact numbers

**address :**

Huvitz Co., Ltd.

298-29, Gongdan-ro, Gunpo-si,

Gyeonggi-do, 435-862, Korea

**Tel**: 031-428-9100 (main)

**Fax**: 031-477-9022 (C/S)

**e-mail: svc@huvitz.com**

**www.huvitz.com**

Manufacturer: Huvitz Co., Ltd.

16-17(Hogye-dong), 91-beongil, LS-ro,

Dongan-gu, Anyang-si, Gyeonggi-do,

431-848, Korea

**Tel:** 031-428-9100

**Fax:** 031-477-8618

# EU Representative

**Medical Device Safety Service GmbH (MDSS)**

Schiffgraben 41, 30175 Hannover,

Germany

**Tel**: +49-511-62628630

**Fax**: +49-511-62628633

**CAUTION**

Environment pollution may result when the device or lithium battery is discarded recklessly since this device uses lithium battery. To discard, outsource to a specialized waste disposal company.

# 12. Key specs

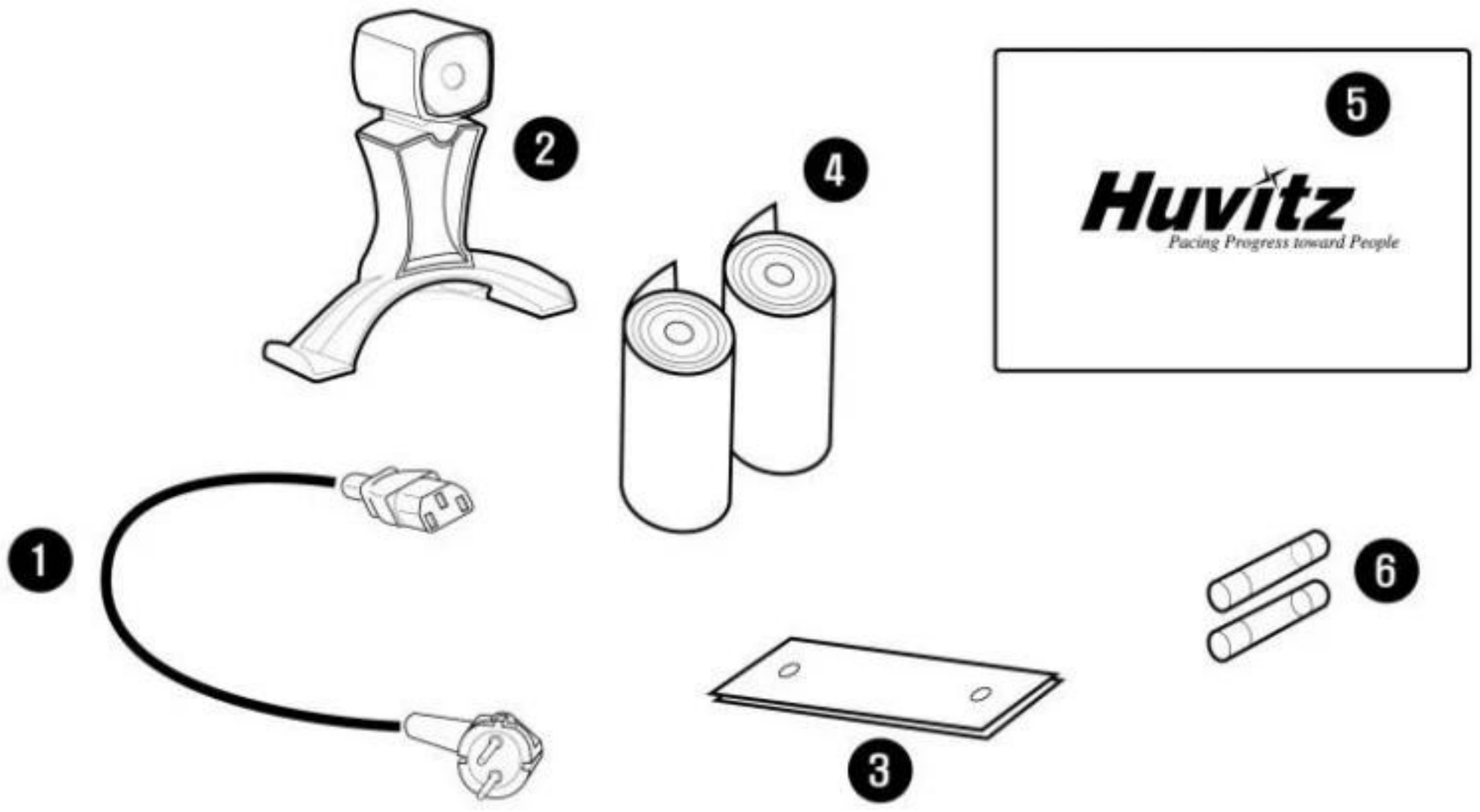
| | |
|---|---|
| Measurement mode | |
| Cornea/curve continuous measurement (K/R mode) | |
| Curve measurement (REF mode), cornea measurement (KER mode) | |
| Cornea periphery measurement (KER-P mode) | |
| Curve measurement | |
| Distance between vertex of cornea (VD) | 0.0, 12, 13.75, 15.0 |
| Spherical prescription (SPH) | -30.00 ~ +25.00 D (in case of VD = 12 mm) |
| Astigmatism prescription (CYL) | 0.00 ~ ±12.00D (0.12/0.25 D unit) |
| Astigmatism axis angle (AX) | 0 ~ 180° (1° unit) |
| Astigmatism indication | -, +, MIX |
| Pupil distance (PD) | 10 ~ 85 mm |
| Minimum pupil diameter that can be measured | Ø2.0 mm |
| The accuracy specifications are based on the results of eye model testing preformed in accordance with ISO10342 | |
| Cornea measurement | |
| Corneal curvature radius | 5.0 ~ 13.0 mm (0.01 mm unit) |

| | |
|---|---|
| Cornea refractive power | measurement unit: 25.96D~67.50D<br>(cornea equivalence's refractive power: 1.3375)<br>indication unit: 0.05/0.12/0.25D unit |
| Cornea astigmatism prescription | 0.0 ~ -15.00 D<br>(Increments: 0.05/0.12/0.25 D) |
| Cornea astigmatism axis angle | 0 ~ 180° (1°/ 5° unit) |
| Cornea diameter measurement | 2.0 ~ 14.0 mm (0.1 mm unit) |
| The measuring range is in accordance with Code A, ISO 10343 and the measuring accuracy in accordance with Code 2, ISO 10343.) | |
| Eyesight measurement (VA) | |
| Eyesight measurement | < 0.1 / 0.25 / 0.32 / 0.4 / 0.5 / 0.63 / 0.8 / 1.0 / 1.25<br>< 20/200 / 20/80 / 20/60 / 20/50 / 20/40 / 20/30 / 20/25 / 20/20 / 20/16 |
| Spherical prescription (SPH) | -22.00 ~ +22.00 D (in case of VD = 12 mm)<br>(Increments: 0.25 D) |
| Astigmatism prescription (CYL) | 0 ~ ±10.00 D (Increments: 0.25D) |
| Astigmatism axis angle (AX) | 0 ~ 180° (1°/5° unit) |
| Near add power (ADD) | 0 - +10 D (Increments: 0.25D) |
| Wireless I/F | |
| Protocol | IEEE802.11b 2.4GHz WiFi |
| Security mode | WPA2-PSK |
| IP configuration | DHCP mode |

| | |
|---|---|
| Auto travel distance | |
| Up and down | ± 15 mm (± 3 mm) |
| Left and right | ± 5 mm (± 2 mm) |
| Front and back | ± 5 mm (± 2 mm) |
| Automatic tracking scope | |
| Up and down | ± 5 mm |
| Left and right | ± 5 mm |
| Front and back | ± 5 mm |
| Chin rest travel distance | |
| Up and down | 60 mm (± 3 mm) |
| Data memory | |
| 10 session worth of measurement values for each of the eyes on the left and right | |
| Interface | |
| RS-232C | (in/Out) |
| USB | One port : For service |
| WiFi | For communication with HDR-9000 |
| Ext. VIDEO | Analog RGB |
| Hardware specs | |
| Built-in printer | Thermoelectric line printer/Auto Cutting |

| | |
|---|---|
| power-saving function | Key power is blocked when the measurement is stopped up the set time. Recovered when pressing on the button or when the screen is touched. |
| Monitor | 85 Tiltable 7” Color LCD IPS Panel (800*480)<br>Resistive Touch panel |
| Power consumption | 100-240 Vac 1.0-0.6A 50/60Hz |

# 13. Accessories




**[Figure 13-1. Accessories]**

1. Power cable (AC 220 V / 60 Hz power code, 1.5m) ·····1

2. Model Eye ·····1

(SPH: –2.50D~-2.75D, CYL: -1.25D~-1.50D, R1: 7.95~8.00, R2: 7.78~7.83)

3. Chin rest paper (100 pages) ····· 1 page

4. Printer page ·····2 rolls

5. Dust cover ·····1

6. Fuse (250 V / 3.15 A) ·····2

**⚠ WARNING**

Fuse must be replaced with the fuse of the same type and grade to prevent fire. • Fuse (250 V T3.15 AL)

# 14 EMC Informations

Manufacturer announcement – electromagnetic waves trouble

| Electromagnetic waves trouble | | |
|---|---|---|
| HRK-9000A should be used in the below mentioned electromagnetic wave environment. HRK-9000A purchaser or user needs to confirm whether HRK-9000A is used in this type of environment. | | |
| **Trouble test** | **Question of appropriateness** | **Electromagnetic wave environment - guideline** |
| RF emissions CISPR 11 | Group 1 | The HRK-9000A uses RF energy only for its internal functions. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. |
| RF emissions CISPR 11 | Class B | The HRK-9000A is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply grid that supplies buildings used for domestic purposes. |
| Harmonic emissions IEC 61000-3-2 | Class A | |
| Voltage fluctuations/flicker IEC 61000-3-3 | Complies | |

Manufacturer announcement – electromagnetic waves tolerance

| **electromagnetic waves tolerance** | | | |
|---|---|---|---|
| HRK-9000A is to be used in the below designated electromagnetic wave environment. HRK-9000A customer and user need to guarantee that the HRK-9000A will be used in this type of environment. | | | |
| **Tolerance test** | **IEC 60601 test level** | **Appropriateness level** | **Electromagnetic wave environment - guideline** |
| Electrostatic discharge(ESD)<br>IEC 61000 - 4 - 2 | contact ±6 kV<br>in the air ±8 kV | contact ±6 kV<br>in the air ±8 kV | Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %. |
| Electric rapid transients/bust<br>IEC 61000 - 4 - 4 | power supplying line ±2 kV<br>input/output line ±1 kV | power supplying line ±2 kV<br>input/output line ±1 kV | Mains power quality should be that of typical commercial or hospital environments. |
| Surge<br>IEC 61000 - 4 - 5 | between lines ±1 kV<br>between line and grounding ±2 kV | differential mode ±1 kV<br>common mode ±2 kV | Mains power quality should be that of typical commercial or hospital environments. |
| Voltage dip, instantaneous interruption, voltage fluctuation at the power input line<br>IEC 61000 - 4 - 11 | For 0.5 cycle < 5 %*UT*(*UT's* > 95 % decrease)<br>For 5 cycle 40 %*UT*(*UT's* 60 % decrease)<br>For 25 cycle 70 %*UT*(*UT's* 30 % decrease)<br>For 5 seconds < 5 %<br>*UT*(*UT's* > 95 % decrease) | For 0.5 cycle < 5 %*UT*(*UT's* > 95 % decrease)<br>For 5 cycle, 40 % *UT*(*UT's* 60 % decrease)<br>For 25 cycle, 70 %*UT*(*UT's* 30 % decrease)<br>For 5 seconds, < 5 %<br>*UT*(*UT's* > 95 % decrease) | Mains power quality should be that of typical commercial or hospital environments. If the user of the HRK-9000A requires continued operation during power mains interruptions, it is recommended that the HRK-9000A be powered from<br>an uninterruptible power supply or a battery. |
| Power frequency magnetic field (50/60 Hz)<br>IEC 61000 - 4 - 8 | 3 A/m | 3 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |
| Other *UT* is the a.c. power voltage for before approving the test level. | | | |

| **Electromagnetic waves tolerance** |
|---|

| HRK-9000A is to be used in the below mentioned electromagnetic wave environment. HRK-9000A purchaser or user needs to confirm whether HRK-9000A is sued at this environment. | | | |
|---|---|---|---|
| **Tolerance test** | **IEC 60601 test conditions** | **Appropriateness level** | **Electromagnetic wave environment - guideline** |
| Conductivity RF electromagnetic field<br>IEC 61000 - 4 - 6<br><br>Radioactivity RF electromagnetic field tolerance<br>IEC 61000 - 4 - 3 | 3 Vrms<br>150 kHz～80 MHz<br><br>3 V/m<br>80 MHz～2.5 GHz scope | 3 Vrms<br><br>3 V/m | Portable and mobile RF communications equipment should be used no closer to any part of the HRK-9000A, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.<br><br>Recommended separation distance<br>$d = 1.2\sqrt{P}$<br><br>$d = 1.2\sqrt{P}$ 80 MHz～800 MHz<br>$d = 2.3\sqrt{P}$ 800 MHz～2.5 GHz<br>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).<br>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,a should be less than the compliance level in each frequency range.b<br>Interference may occur in the vicinity of equipment marked with the following symbol.<br> |
| Note 1: At 80 MHz and 800 MHz, the separation distance of the higher frequency range applies.<br>Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people. | | | |
| a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic | | | |

environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the HRK-9000A is used exceeds the applicable RF compliance level above, the HRK-9000A should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the HRK-9000A.
b
Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

**Recommended separation distances between portable and mobile RF communications equipment and the HRK-9000A**

The HRK-9000A is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the HRK-9000A can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the HRK-9000A as recommended below, according to the maximum output power of the communications equipment.

| **Rated maximum output power of transmitter W** | **Separation distance suitable for transmitter frequency** | | |
|---|---|---|---|
| | 150 kHz ~ 80 MHz $d = 1.2\sqrt{P}$ | 80 kHz ~ 800 MHz $d = 1.2\sqrt{P}$ | 800 MHz ~ 2.5 GHz $d = 2.3\sqrt{P}$ |
| 0.01 | 0.12 | 0.12 | 0.23 |
| 0.1 | 0.38 | 0.38 | 0.73 |
| 1 | 1.2 | 1.2 | 2.3 |
| 10 | 3.8 | 3.8 | 7.3 |
| 100 | 12 | 12 | 23 |

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.
Note 1: At 80 MHz and 800 MHz, the separation distance of the higher frequency range applies.
Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

**Electromagnetic waves tolerance**

HRK-9000A is to be used at the electromagnetic wave environment designated below. HRK-9000A customer and user need to guarantee that the HRK-9000A will be used at this environment.

| **Tolerance test** | **IEC 60601 testing conditions** | **Appropriateness level** | **Electromagnetic wave environment - guideline** |
|---|---|---|---|
| Conductivity RF electromagnetic field<br>IEC 61000 - 4 - 6 | 3 Vrms<br>150 kHz ~ 80 MHz | 3 Vrms<br>150 kHz ~ 10 MHz | HRK-9000A has minimum RF shield effect. As for each cable that comes into the shielded location, it should |

| | | | |
|---|---|---|---|
| | | | be used only at the shielded location; 80 dB at 10 MHz～20 MHz frequency range, frequency range of 100 dB, 80 MHz～100 MHz at 20 MHz～80 MHz frequency range. Minimum value at the 20 MHz that has 80 dB minimum RF filter decrease is 100 dB. Minimum value at 80 MHz is 80 dB. This is fixation RF transmitter that is determined through electromagnetic wave environment field inspection. Electric intensity at the outside of the shielded location should be 3 V/m or less a. Trouble may result near the medical device where the following symbol is indicated. |
| Radioactivity RF electromagnetic field tolerance IEC 61000 - 4 - 3 | 3 V/m 80 MHz～2.5 GHz | 3 V/m 100 MHz～2.5 GHz | |
| Other 1 This guideline cannot be applied to all situations because diffusion of electromagnetic waves are affected by absorption and reflection by structure, object and human beings. Other 2 It is important to verify and to confirm whether actual shield effect and filter decrease of the shielded location satisfy the minimum specs. | | | |
| It is not easy to carry out precise theoretical forecasting when it comes to the electric intensity that results from the fixation transmitter such as a wireless phone(vehicle phone/phone with no code)'s base station, land mobile wireless, amateur wireless, AM and FM broadcast, TV broadcast. In order to evaluate the electromagnetic wave environment with fixation RF transmitter, field inspection is required. If the electric intensity used by the HRK-9000A that is measured at the outside of the shielded location exceeds 3 V/m, then it is necessary to observe and verify whether HRK-9000A operates normally. If abnormal operation is observed, then re-place HRK-9000A or use other shielded location that has increasingly higher RF shield effect and filter decrease. Likewise, other additional measures may be needed. | | | |