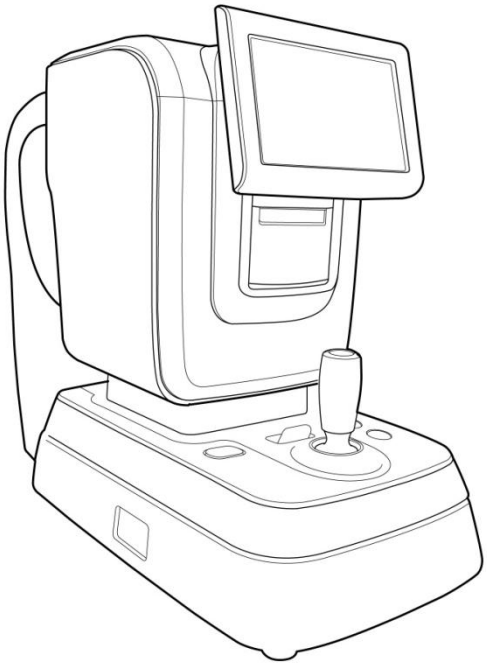
User's Manual

Auto Ref/Keratometer HRK-8000A



Huvitz

Pacing Progress toward People

IMPORTANT NOTICE

⚠ WARNING

Potential electromagnetic or other interference between medical equipments and other devices being operated together in the same environmental may expert an adverse influence on functioning of the medical equipment. Non-medical equipments not in compliance with the requirements of EN 60601-1 and EN 60601-1-2 should not be used together in the same environmental as the medical equipments.

This equipment has been tested and found to comply with the limits for medical devices in IEC 60601-1-2:2001. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation.

Power Cord

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 terminatesd with blade attachment plug(HAR) Type, NEMA 6-15P.

This product may malfunction due to electromagnetic waves caused by portable personal telephones, transceivers, radio-controlled toys, etc. Be sure to avoid having objects such as, which affect this product, brought near the product.

The information in this publication has been carefully checked and is believed

to be entirely accurate at the time of publication. HUVITZ assumes no responsibility, however, for possible errors or omissions, or for any consequences resulting from the use of the information contained herein.

HUVITZ reserves the right to make changes in its products or product specifications at any time and without prior notice, and is not required to update this documentation to reflect such changes.

Ver 1.0

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-689-3, Gumjeong-dong, Gunpoci, Gyeonggi-do,
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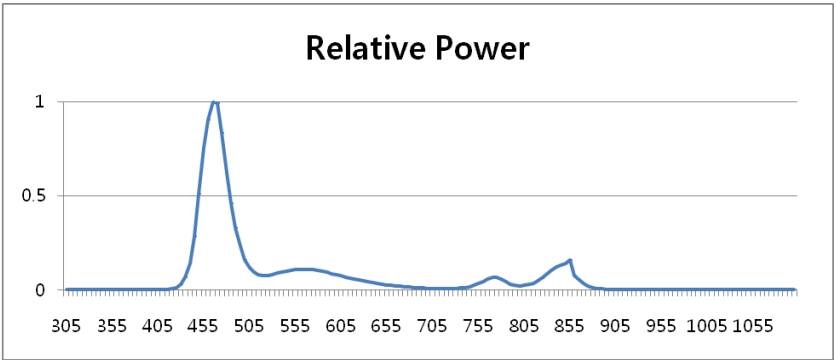
⚠ CAUTION

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 88 minutes.



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

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1. Introduction

1.1. Overview

Auto Ref/Keratometer HRK-8000A is the equipment to provide the information of Spherical, Cylindrical and Axis while measuring the refraction of examinee's eyes. Auto Ref/Keratometer HRK-8000A is the equipment that can measure the corneal curvature of examinee. In addition, it can measure PD (=distance in between pupils) and pupil size. Especially, as its peripheral (=corneal peripheral curvature) measurement is possible as measuring the corneal curvature of examinee, it is possible to know the information on the corneal peripheral curvature as well as the corneal core curvature, which enables the exact prescription for the examinee.

This equipment shall provide the optimal optometry information with Illumination (=observing illumination) to obtain an optimal figure of the eyes' state of examinee. CLBC (Contact Lens Base Curve) measurement is also a basic function of this product.

The HRK-8000A is provided with an Auto-tracking function and a motorized chinrest function.

Auto-tracking mechanism that automatically achieves alignment in the up/down, right/left direction and focusing.

A motorized up/down chinrest allows the operator to easily adjust the height of the chinrest.

1.2. Classificaiton

1) Classification of product :
   -. EU - Class IIa according to Annex IX (Rule 10) of the Medical Device Directive 93/42/EEC as amended by 2007/47/EC
   -. 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. Safety Information

2.1. Overview

Safety is everyone's responsibility. The safe use of this equipment is largely dependent upon the installer, user, operator, and maintainer. It is imperative that personnel study and become familiar with this entire manual before attempting to install use, clean, service or adjust this equipment and any associated accessories. It is paramount that the instructions contained in this manual are fully understood and followed to enhance safety to the patient and the user/operator. It is for this reason that the following safety notices have been placed appropriately within the text of this manual to highlight safety related information or information requiring special emphasis. All users, operators, and maintainers must be familiar with and pay particular attention to all Warnings and Cautions incorporated herein.

⚠ WARNING

"Warning" indicates the presence of a hazard that could result in severe personal injury, death or substantial property damage if ignored.

NOTE

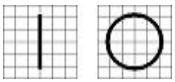
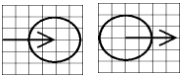
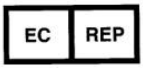
"Note" describes information for the installation, operation, or maintenance of which is important but hazard related if ignored.

⚠ CAUTION

"Caution" indicates the presence of a hazard that could result in minor injury, or property damaged if ignored.

2.2. Safety Symbol

The International Electrotechnical Commission (IEC) has established a set of symbols for medical electronic equipment which classify a connection or warn of any potential hazards. The classifications and symbols are shown below.

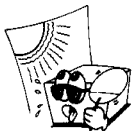
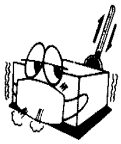
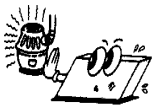
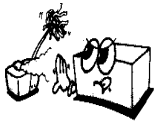
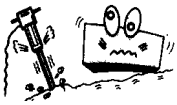
	I and O on power switch represent ON and OFF respectively.
	Type B Isolated patient connection.
	It indicates the connection of signal input/output.
	This symbol identifies a safety note. Ensure you understand the function of this control before using it. Control function is described in the appropriate User's or Service Manual.
	It indicates the year of manufacture and the manufacturer.
	Manufacturer
	Authorised Representative in the European Community

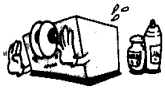
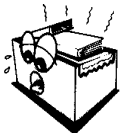
	Identifies the point where the system safety ground is fastened to the chassis. Protective earth connected to conductive parts of Class I equipment for safety purposes.
	Hot surface.
	Temperature Limitation
	Keep DRY
 UL60601-1 CAN/CSA C22.2 NO.601.1	 MEDICAL EUIPMENT WITH RESPECT TO ELECTRIC SHOCK FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH UL 60601-1, AND CAN/CSA C22.2 NO.601.1
	<u>Disposal of your old appliance</u> When this crossed-out wheeled bin symbol is attached to a product it means the product is covered by the European Directive 2002/96/EC. All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health. 4. For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service or the shop where you purchased the product.

	Alternating Current

2.3. Environmental Considerations

Please avoid the environment below for the operation and storage of the equipment.

	Where the equipment is exposed to water vapor. Don't operate the equipment with wet hands.
	Where the machine is exposed directly to the sunlight.
	Where the temperature changes frequently (Normal temperature for operation of the machine is at the range of 10°C ~ 40°C, and the humidity is at the range of 30%~75%.
	Where any heaters are at the close distance to the machine.
	Where the humidity is high and there are problems to the heat dissipation and/or ventilation.
	Where the equipment is subject to excessive shocks or Vibrations.

	Where the machine can be exposed to the chemical or flammable substances.
	Please keep the equipment out of dust and do not let inserted any metal parts such as coins, clips, etc.
	Do not disassemble or open the machine. The manufacture shall have no responsibility for any problems caused by these.
	Do not close the thermal ventilation outlet.
	Do not connect the AC power plug into the outlet while not putting the parts of machine together completely. It can harm the equipment.
	Do not pull the plug out of outlet while holding the cord.

For the normal operation of the machine, please keep the ambient temperature is 10℃ ~ 40℃, humidity is 30% ~ 75% and atmospheric pressure is 800 ~ 1060hpa. For the Transfortation of the machine, please keep the ambient temperature is -40℃ ~ 70℃, humidity is 10% ~ 95% and atmospheric pressure is 500 ~ 1060hpa. For the Storage of the machine, please keep the ambient temperature is -10℃ ~ 55℃, humidity is 30% ~ 75% and and atmospheric pressure is 700 ~ 1060hpa. Avoid environments where the equipment is exposed to excessive shocks or vibrations.

2.4. Safety Precaution

This equipment has been developed and tested in conformity with domestic & international safety standards and regulations, which guarantees the high stability of this product. This guarantees a very high degree of safety for this device. The legislator expects us to inform the user expressively about the safety aspects in dealing with the device. The correct handling of this equipment is imperative for its safe operation. Therefore, please read carefully all instructions before switching on this device. For more detailed information, please contact our Customer Service Department or one of our authorized representatives.

1. This equipment must not be used (a) in an area that is in danger of explosions and (b) in the presence of flammable, explosive, or volatile solvent such as alcohol, benzene or similar chemicals.

2. The device should neither be kept nor installed in the place with high humidity. For the optimal operation, the humidity should be at the range of 30%~75%. The machine should not be exposed to the place where water splashes, drips or sprays. Do not place containers containing fluids, liquids, or gases on top of any electrical equipment or devices

3. The equipment must be operated only by, or under direct supervision of properly trained and qualified person/s.

4. Modifications of this equipment may only be carried out by Huvitz's service technicians or other authorized persons.

5. Customer maintenance of this equipment may only be performed as stated in the User's Manual and Service Manual. Any additional maintenance may only be performed by Huvitz's service technicians or other authorized persons.

6. The manufacturer is only responsible for effects on safety, reliability, and performance of this equipment when the following requirements are fulfilled: (1) The electrical installation in the respective room corresponds to the specifications stated in this manual and (2) This equipment is used, operated and maintained according to this manual and Service Manual.

7. The manufacturer is not liable for damage caused by unauthorized tampering with the device(s). Such tampering will forfeit any rights to claim under warranty.

8. The equipment may only be used together with accessories supplied by Huvitz's. If the customer makes use of other accessories, use them only if there are usability under technical safety aspects has been proved and confirmed by Huvitz or the manufacturer of the accessory.

9. Only persons who have undergone proper training and instructions are authorized to install, use, operate, and maintain this equipment.

10. User's manual or service manual should be kept in the place where the persons in chare of operation and maintenance can access easily any time.

11. Do not force cable connections. If a cable does not connect easily, be sure that the connector (plug) is appropriate for the receptacle (socket). If you cause any damage to a cable connector(s) or receptacle(s), let the damage(s) be repaired by an authorized service technician.

12. Please do not pull on any cable. Always hold on to the plug when disconnecting cables.

13. This equipment may be used for the international application related to Refractometry and Keratometry according to this manual.

14. Before every operation, proceed with visual inspection on the equipment exterior to seek any mechanical damage(s) to ensure the proper functioning.

15. Do not obstruct any ventilation outlet for proper heat dissipation.

16. In case of any presence of smoke, spark or abnormal noise/smell from the machine, please power off immediately and pull out the plug.

17. External equipment intended for connection to signal input, signal output or other connectors, shall comply with relevant IEC Standard (e.g.,

IEC60950 for IT equipment and IEC60601-1 series for medical electrical equipment). In addition, all such combination-system-shall comply with the standard IEC60601-1 and/or IEC60601-1-1 harmonized national standard or the combination. If, in doubt, contact qualified technician or your local representative the operator should not touch the patient and accessible male parts of the SIP/SOP connectors simultaneously.

18. For 120 Volt applications, use only UL listed detachable power cord with NEMA configuration 5-15P type (parallel blades) plug cap. For 240 Volt applications use only UL listed detachable power supply cord with NEMA configuration 6-15Ptype (tandem blades) plug cap.

3. Characteristics

1. It is possible to measure the refractive power and corneal curvature with one(1) set of the machine: Refractometry and Keratometry

2. As the measurement range of refractive power is wide from-30D to +25D, it can measure the severe myopia.

3. As measuring the curvature, the minimum measurable pupil diameter is Ø2.0 mm.

4. The equipment can measure the peripheral part of cornea so that user can see the value of curvature and eccentricity of each point while consecutively measuring the curvature of peripheral part around cornea to the direction of 90° degree to the upper/below/right/left from the core of cornea.

5. The refractive error can be showed in the form of Zernike topographic map.

6. The fogging technique which is applied to the internal fixed target is to make the more accurate measurement possible while letting the eyes of patient at the natural and comfortable state.

7. It is possible to select the display type of Refractometry and Keratometry.

8. It is possible to measure the distance in between pupils (PD).

9. Through the illumination, the HRK-8000A can observe the eyes' condition of cataract patients or the scratches on the surface of contact lenses. It can store the two (2) images for each eye, and show the patients displaying them on the monitor screen.

4. Note for Use

1. Do not hit or drop the instrument. The instrument may be damaged by the strong impact. The impact may damage the function of this instrument. Handle it with care.

2. The precision of measurement can be affected when the machine is exposed to the direct sunlight or too bright indoor illumination. It is recommended to perform the measurement in the dark optometry room.

3. If you want to use it as connecting the device to other equipment, please follow the guidance of our local representative.

4. Sudden heating of the room in cold areas will cause condensation of vapor on the protective glass in the measurement window and on optical parts inside the instrument. In this case, wait until condensation disappears before performing measurements.

5. Make sure to keep the lens in examinee side is clean at all times. In case that it has become dirty by dusts or other substances, it can cause errors in the machine or affect the precision of measurement.

6. In case of any presence of smoke, smell or noise during the use of machine, please contact our local representative after plugging it off from the socket (outlet).

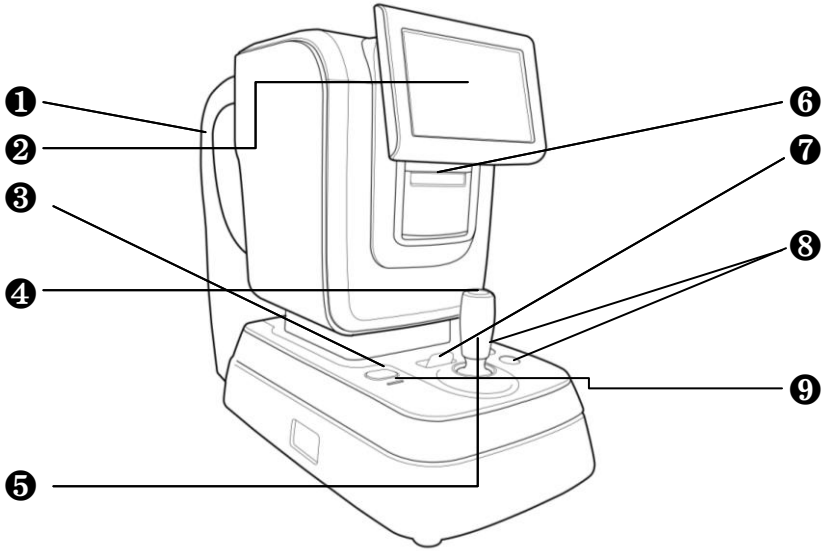
7. If you clean the surface of the equipment with organic solvents such as alcohol, thinner, benzene, etc, it can damage the machine. So, please do not use them.

8. In case of moving HRK-8000A, carry it holding the lower part of machine body with both hands as fixing the stage after switching the machine off all the time.

9. In case of no use of the machine for a long time, please put the dust cover on the device after powering and plugging off.

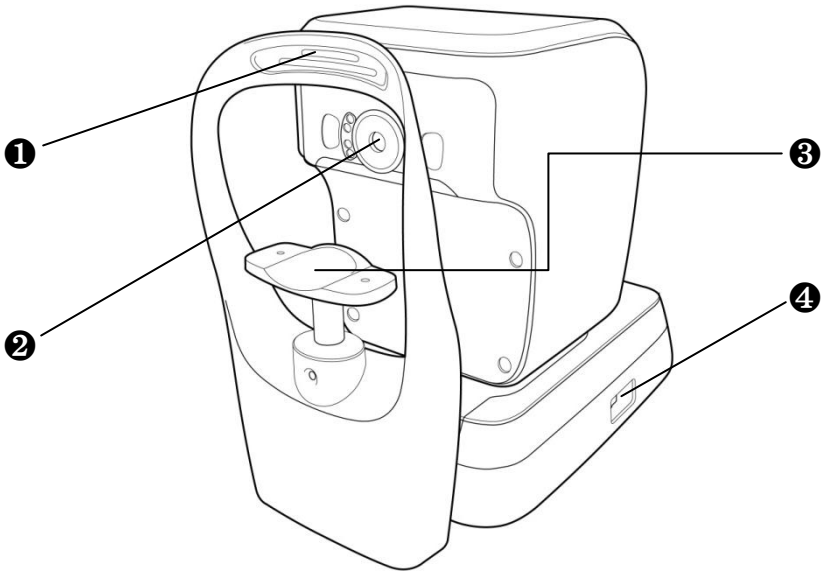
5. Names and functions of each part

5.1. Main parts



[Figure 5-1. Front]

1. Height Adjustment Mark: Adjusts the eyes' height of examinees
2. Display Monitor: Monitor for measurement
3. Print button : Button for printing of measuring results.
4. Measurement Button: Performing the measurement by pressing it after focusing.
5. Operation Lever: Adjusting the focus by moving to the directions of forward/backward, left/right, up and down.
6. Printer: Printing the measured results
7. Stage Fixing Lever: Fixing the stage
8. Chinrest up/down button: Move up or down the chinrest.
9. Operation Lamp : Indicates whether or not the electric power is on



[Figure 5-2. Back Section]

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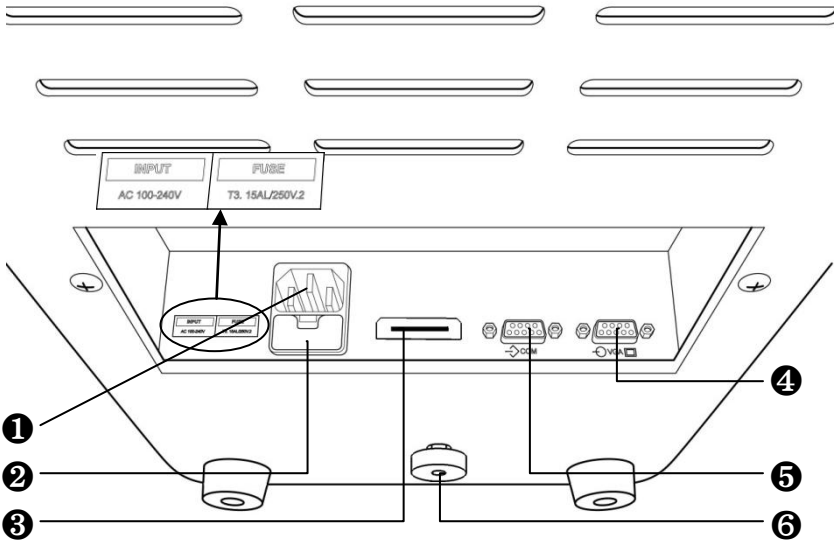
1. Forehead Rest: Preventing the vibration by fixing the forehead

2. Measuring Object Lens: Measuring the image imaging on the retina of eyes.

3. Chin Rest: Preventing the vibration by fixing the chin

4. Power Switch: Switch for power on/off

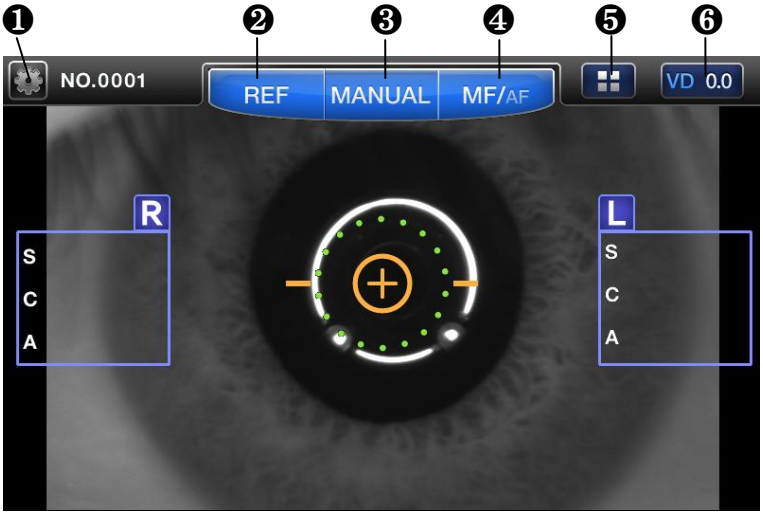


[Figure 5-3. Bottom Section]

1. **Power Supply Socket:** A socket connecting to exterior power plug
2. **Fuse Holder :** 250 V T3.15 AL
3. **HDMI Connector:** Connecting into the exterior monitor
4. **Exterior Monitor Connection Connector:** Connecting into the exterior monitor
5. **Serial Interface Connector:** A terminal connecting to the exterior equipment\
6. **Clamping Bolt:** Fixing the system stage

NOTE
As connecting to exterior monitor, noise can appear on the monitor owing to the length or kind of cable, and the quality of monitor.

5.2. Explanation on Switches in Front



[Figure 5-4. Front Section Switches]

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1. **(SETUP) Button:** A switch to change the User setup mode
2. **(MODE) Button:** A switch to change the mode (REF, KER, K&R, KER-P, CLBC) for measurement.
3. **(MANUAL) Button:** A switch to begin to perform the measurement manually or automatically.
4. **(MF/AF) Button:** A switch to change Auto Focus mode.
5. **(MENU) Button:** A switch to change the Illumination, Zernike, Size, Virtual Comparison, Color View, Display mode.
6. **(VD) Button:** To change the VD(Vertex Distance) value.

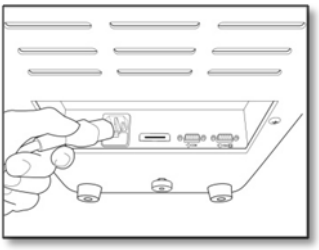
6. Installation of Equipment & Preparation of Measurement

1. Release of Lock on Stage Section

Unlock the clamping bolt at the button of the machine by rotating it counterclockwise, and change the stage fixing lever behind the joystick to the direction of UNLOCK.

2. Connection of Power Cable

- Put HRK-8000A on the table.
- Insert the power cable into power connector
  at the bottom of the main body.
- After checking that the power of the machine is off, insert the power plug into the AC outlet (socket).



[Figure 6-1. Connection of Power Cable]

3. Inserting Chin Rest Paper

- Pull out the pushing pins at left/right sides.
- Insert the pushing pins into the holes at left/right sides of the chin-rest paper.
- Stick the chin-rest paper inserted with the pushing pins onto the Chin-rest.

[Figure 6-2. Inserting Chin-rest Paper]

4. Installation of Printing Paper

Please refer to section 8.2 regarding the sequence of installation of printing paper.

5. Input of Message

Input the contents desirable to be printed such as name or address of hospital, etc in the memory of message editing monitor in advance at all times.

6. Check of Setup

As for setup of corneal vertex distance, indication of CYL, unit of SPH/CYL, indication type of corneal measurement, corneal equivalent curvature, date, etc, please check them in SETUP mode.

7. Transmission to Other Machines

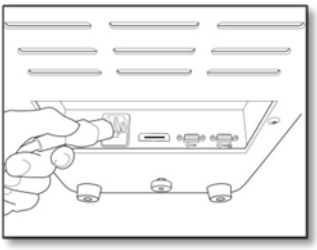
In case of transmitting the measured results to other machines, prepare other machines while connecting the cable into the interface connector of this machine.

The device conncected to Auto Ref/Keratometer(HRK-8000A) is Huvitz Digital Refractor, Lens meter and PC with a software supplied by 3th-party. The connect and communication settings can be different the con nected devices so refer to the manual of the conennceted device and please set up the transmission speed(BPS) and protocol(RS232) settings.

You can select the transmitting speed in the user's SETUP mode. Please contact to the agent where you bought this machine for details.

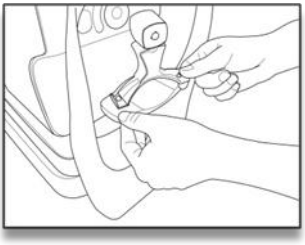
7. Exercise through Model Eye

1. Power On of Main Body
   - Connect the power plug appropriately as shown in the picture.
   - Let the power switch on.
   - Measuring screen appears as system check is completed.



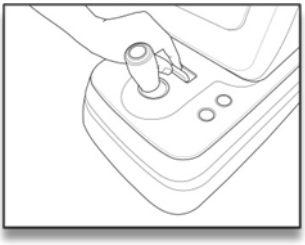
[Figure 7-1. Power Cable Connection]

2. Installation of Model Eye
   - As removing the chin-rest paper, insert the pushing pins after adjusting the lower hole of model eye to the hole of chin-rest.



[Figure 7-2. Model Eye Installation]

3. Convert the fixing lever
   - convert the stage fixing lever behind the joystick to the direction of UNLOCK.



[Figure 7-3. Release of Lock to Stage Section]

4. Change to K&R, REF Modes
   - If “K&R” or “REF” is not indicated on the monitor, Change a set to display one of two modes.

5. Adjustment of Position for Measurement & Focus

- Tilt the operation lever over the model eye until the mire image appear around the external alignment ring.
- Adjust so that the mire image shall come coincide the external alignment ring while watching the monitor.
- Adjust the focus so that the focus-adjustment focus symbol shall appear on the internal alignment ring.

1. Height Adjustment: Adjust it by rotating the operation lever or the chin-rest height adjustment lever.

2. Left/Right Adjustment: Adjust so that the mire image shall come coincide the external alignment ring by tilting the operation lever to the directions of left/right.

3. Focus Adjustment: Adjust the focus so that the focus-adjustment focus symbol shall appear on the internal alignment ring by tilting the operation lever forward/backward.

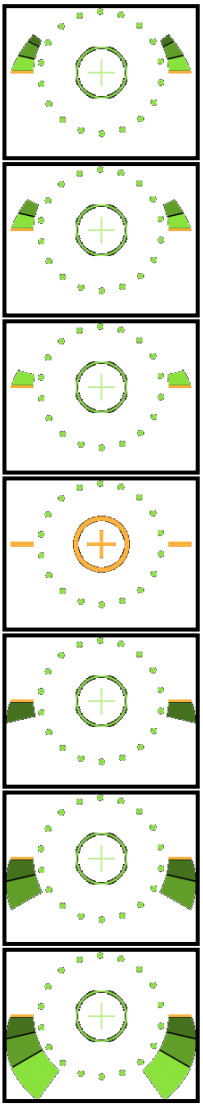
- Auto-tracking Function

Set then AF/MF mode for Auto-tracking Function.

1. Perform rough alignment and focusing by manipulating the joystick to place in the working range of auto-tracking.

2. When the device is placed within the working ranfe of auto-tracking, it automatically starts alignment and focusing.
   - The mark is displayed, when the main body is not within the working range of auto-tracking.

   - At that time, manipulrate the joystick or chinrest up/down button in the direction of the as Figures.

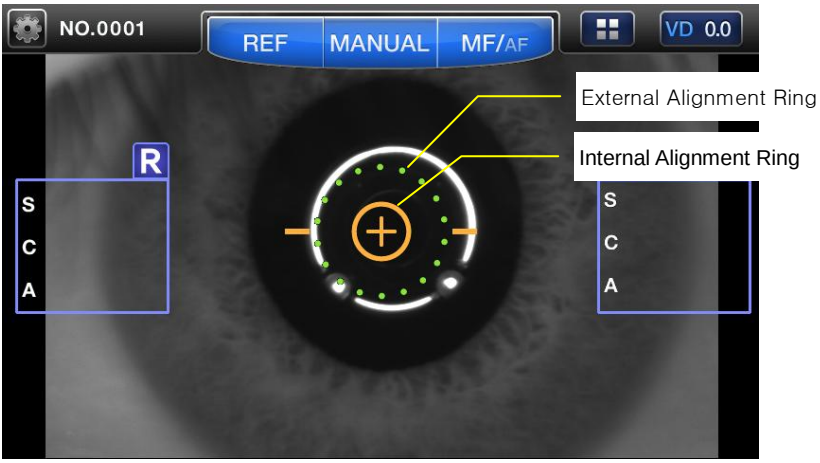


Too close to the patient's eye.

Optimum condition.

Too far from the patient's eye

<Focusing Indicator>



[Figure 7-4. Adjustment of Measuring Position & Focus]

6. Measurement

1. Manual Adjustment

① Adjust the focus and position of model eye as like in the procedure of adjusting measurement position & focus explained in the previous page.

② Push the measurement switch. In case that the measurement is not performed while the message of TRY AGAIN appears on the upper left side of the monitor, push the measurement switch again after repeating the procedure of (a).

③ Check whether diopter value is measured or not. In case that the measured value is not satisfactory, measure it with the same way and check it again.

2. Automatic Adjustment

① Push the MANUAL button which is top of monitor to set AUTO mode.

② Adjust the position and focus of model eye as like in like in the

procedure of adjusting measurement position & focus explained in the previous page.

③ It the focus is well adjusted as the mire image coincide with the external alignment ring and the focus-adjustment focus symbol appears on the internal alignment ring, then, the measurement starts automatically.

8. Measurement

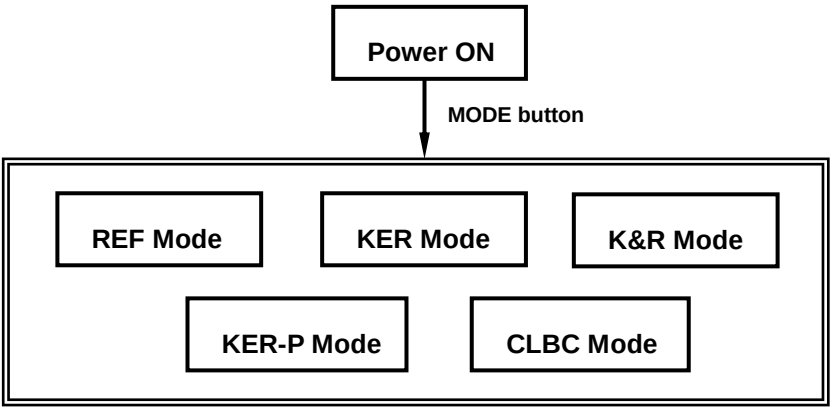
⚠ WARNING

If the following situations happen, contact to the agents of Huvitz after immediately pushing the power switch off, and pulling the power cord out of AC Power connection part.

- In case that smoke comes, or strange smell or sound is heard from the equipment.
- In case that liquid is poured to the machine, or metallic substance is inputted into the equipment.
- In case that the equipment is fallen down, or the exterior case of it is broken

NOTE

As the equipment does not operate for over 5 minutes while the power switch is at the state of "ON", the power saving mode is to be performed. If you push any buttons in the power saving mode, it is changed to the mode of measurement preparation.

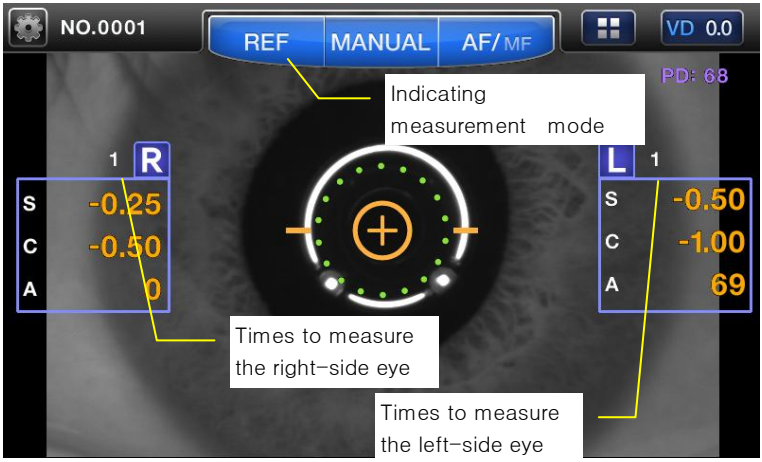


[Figure 8. Relation between button and measurement mode]

8.1. Refractometry (REF Mode)

It is the mode to measure the refractive power solely.

1. Let the power switch “ON”.
   - The measurement window as shown in the picture below appear on the screen of monitor as system check is completed.



[Figure 8-1-1. REF Mode Screen]

2. Check the measurement screen appeared on the monitor.

NOTE

● If the measurement screen as shown in the above picture does not appear on the monitor screen, let the power switch “ON” again in 10 seconds after switching it off. If the measurement screen continues not to appear either, please contact to the agents of Huvitz.

3. Check the user Setup mode.

   Check and select the diverse functions relating to measurement including VD value or printing condition. Input the message wanted to be printed together with measurement data (refer to section user setup mode).

8.1.1. Manual Measurement Mode

As changing AF mode to the MF/AF mode, it changes to the manual measurement mode. If you select the MANUAL mode, the auto measurement function can be stopped. (refer to section user setup mode).

① Adjustment of Eye Height

- Let the examinee sit in front of the machine.

⚠ CAUTION

- Make sure that the examinee should not put his or her hands or fingers under chin-rest. The hands or fingers can get injured.
- For the prevention of infection, cleanse the forehead-rest with a solvent such as ethanol for every different examinee.
- To keep it clean, change the chin rest paper for every different examinee.

- Let the patient sit comfortably by adjusting the table or chair of electric machine.

- Let the patient put his or her face on chin-rest and his or forehead stick closely to the forehead-rest.

- Adjust the examinee's eye height to the height array indicator by rotating the height adjustment lever as shown in the picture.

[Figure 8-1-2. Eye Height Adjustment]

② Adjustment of Measurement Position and Focus

⚠ CAUTION

Do not insert your hands or fingers between stage and base. Also, make sure that the examinee should not put his or her hands or fingers there. Hands or fingers can get injured.

- Pull the body of equipment to the front of user by using the operation lever.

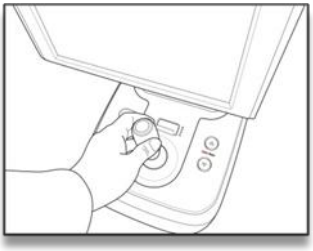
- Let the right-side eye of examinee appear at the center of monitor screen by slowly pushing and rotating the operation lever forward. At this time, let the Mire Image coincide with the external Alignment Ring.

- Ask the examinee to look at the internal fixed target.

- Adjust the focus so that the outline of Mire Image can be apparent. If the focus is adjusted appropriately, the focus symbol appears on the internal Alignment Ring.

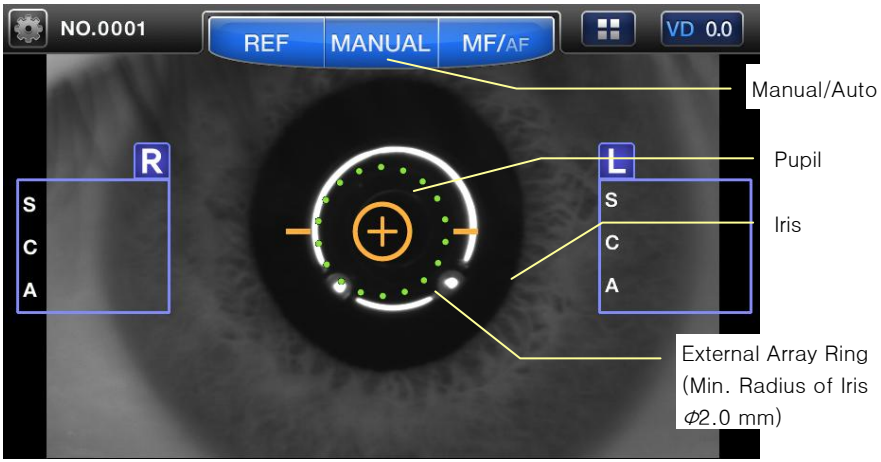
- Height Adjustment: Adjust it by rotating the operation lever or push the chin-rest button.

- Left/Right Adjustment: Move the operation lever left and right so that the external Alignment Ring is aligned with the Mire Image



[Figure 8-1-3. Height Adjustment]

- Focus Adjustment: Adjust it to the Mire Image by tilting the operation lever forward/backward



[Figure 8-1-4. REF Manual Mode Screen]

NOTE
● As it is not enough to adjust it by tilting the operation lever, adjust it by pushing the stage to the directions of left/right. ● As consecutively measuring the refractive power, there can be errors in the measured value with regard to the examinee to which the adjustment power easily intervenes. ● As the Mire Image and the external Alignment Ring can not keep the same axis during the consecutive measurement, the error can be caused for measurement.

③ Measurement

- Push the measurement button.

- If you stay while pushing the measurement button, the measurement is to be performed consecutively.

- As the measurement is completed, the measured result is to be indicated on the screen of monitor.

- In case of the consecutive measurement, the result of the previous measurement is indicated.

④ Repeated Measurement

- Measure repeatedly if necessary.

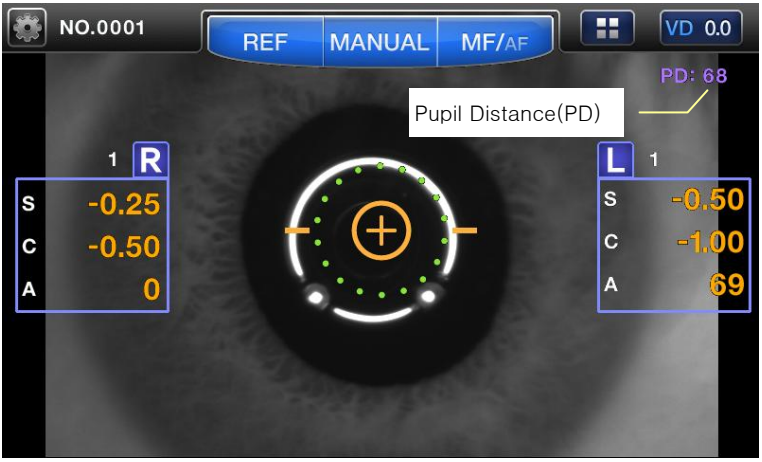
- The latest measured value is to be indicated every time new measurement is performed.

- It shall memorize the measured values by 99 times for each left/right eye(except for error). It can check last ten measure value in DISPLAY mode.

⑤ Measurement of Counter-side eye

- Measure the left-side eye by pushing the stage to the direction of right while holding the operation lever.

- As measuring the left/right eyes, the value of PD (Pupil Distance) is to be indicated on the monitor.



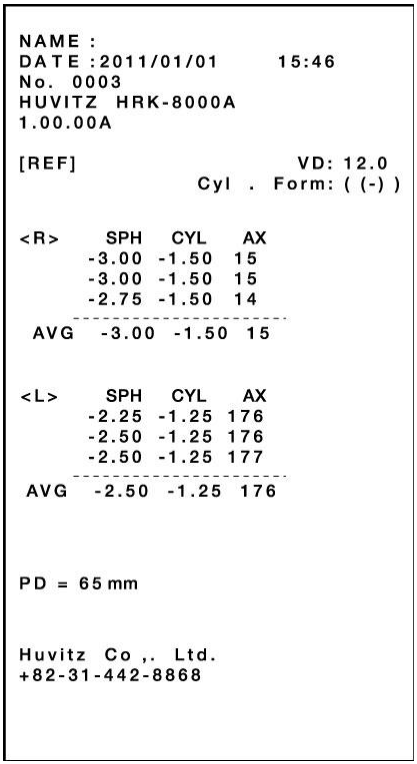
[Figure 8-1-5. Screen indicating the pupil distance]

⑥ Print

- Print the measured result by pushing the PRINT button.
- The contents selected in SETUP mode is to be printed.(Refer to section user setup mode)
- Pull the printing paper. (Auto Cutting)
- Put the name of examinee in the blank of NAME if necessary.

NOTE

- As it is printed, the values measured so far are to be removed.
- As a thermal printing record, the printed characters are easy to be faded away. Please make it copied if you want to keep it for a long time.



```
NAME :
DATE :2011/01/01      15:46
No. 0003
HUVITZ HRK-8000A
1.00.00A

[REF]                      VD: 12.0
                  Cyl . 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
       -2.50 -1.25 176
       -2.50 -1.25 177
      ----------------------
 AVG   -2.50 -1.25 176



PD = 65 mm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```

[Figure 8-1-6. Example of Print]

8.1.2. Auto Measurement Mode

As touching MANUAL button in Manual Measurement mode, it automatically changes to the Auto measurement mode.
As the condition of good array between the machine and the measured eye is reached, the measurement is to be performed automatically without pushing the Measurement button.

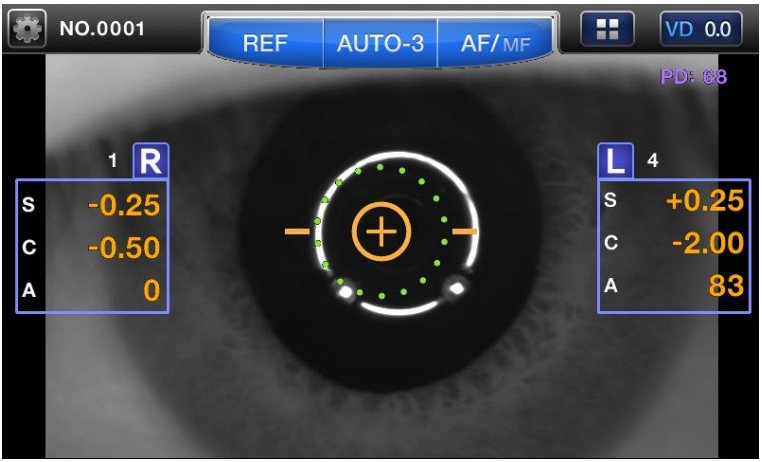
① Perform the ①, ② procedure of manual measurement mode.

② Measurement

- As the array and adjusting the focus is completed, the measurement is to be performed automatically.

- After the measurement of times (3 or 5 times) designated in user Setup mode is performed, the measured result appear on the screen of monitor.

- Maximum of 99 units of data is to be stored, and you can re-check last ten measure value in DISPLAY mode



[Figure 8-1-7. Screen indicating Auto Measurement Mode]

③ Measurement of Another Eye

- Measure the left eye according to the same procedure by moving the stage to the right side.

- As the measurement to both eyes is completed, the value of PD is to be indicated automatically on the screen of monitor.

④ Print

- Push the PRINT button in case that the measurement is conducted to the one eye only.

- In case of selecting the condition of A-Print as “ON” in Setup mode (refer to section user setup mode), the measured result is to be printed automatically as the measurement of both eyes is completed.

- The message selected in Setup mode is to be printed together with the measured data.

- As the message of TRY AGAIN happens, please refer to the explanation below.

In case of TRY AGAIN	Management
Poor position adjustment	Measure it after adjusting the exact position again.
As eyelid or eyelashes hide the pupil	Let the examinee open the eye wide, or measure it while pushing the upper eyelid of examinee upward.
As the pupil is smaller than Alignment Ring	This machine's measurable min radius of pupil is 2.0 mm. Though it is possible to measure in the bright place, make sure that the bright illumination or sunlight shall not shed directly on examinee's eye.
As the examinee has the disease such as cataract	The minor cataract can be measured in Retro-Illum mode. As errors are worried to happen by the scratch on cornea or turbidization of crystalline lens, measure it in Retro-Illum mode. Measure the corneal curvature of cataract patient not in K&R mode, but in KER mode.
As Mire Image looks as if it changed to tears	Measure after letting the examinee blink several times.
As Mire Image is not apparent because the cornea is dry	
As Mire Image has been transformed irregularly owing to strong negative astigmatism or corneal ailment.	Impossible to measure
As it exceeds the possible range of measurement	

8.2. Keratometry (KER Mode)

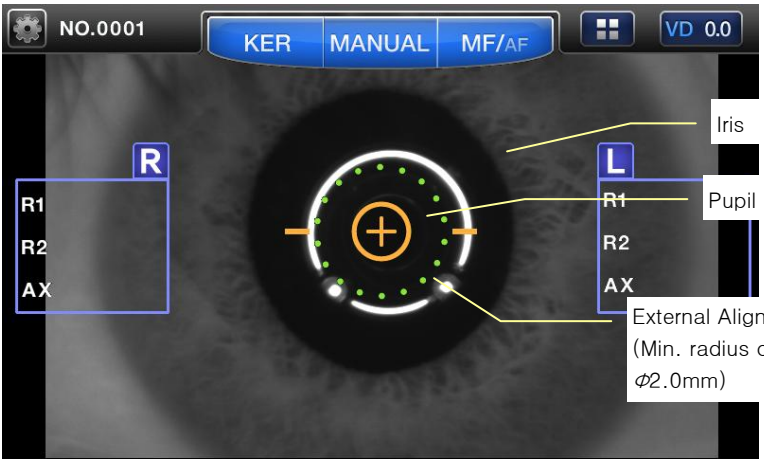
It is the mode to measure the corneal curvature solely.
Do not measure the base curve of hard contact lens in this mode. Please refer to CLBC mode in section 8.5 regarding the base curve of hard contact lens.

1. Check whether or not the screen of monitor is in measurement mode.
2. KER Mode Selection
   - You can see KER mode on the upper left side of the screen.

8.2.1. Manual Measurement Mode

① Perform the adjustment of array and focus as like in the procedure of section 8.1.1.

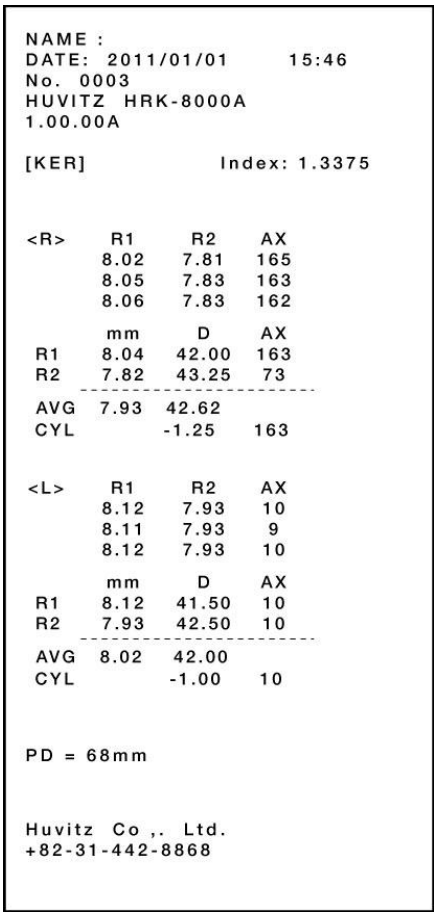
② Measurement
   - Push the measurement button.
   - The measurement continues to be performed as you keep pushing the measurement button.
   - As the measurement is completed, the measured result is to be indicated on the screen of monitor. In case of the consecutive measurement, the result of previous measurement is to be indicated.



[Figure 8-2-1. Screen indicating KER mode]

③ Perform the same 4, 5 procedure of section 8.1.1.

④ Print the measured result through the same 6 procedure of section 8.1.1.



```
NAME :
DATE: 2011/01/01      15:46
No. 0003
HUVITZ HRK-8000A
1.00.00A

[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 Print]

8.2.2. Auto Measurement Mode

As touching MANUAL button in Manual measurement mode, it is to be changed to Auto measurement mode. As the condition of good array between the machine and measured eye is reached, the measurement is to be performed without pushing the measurement button.

① Adjust the array and focus as like in procedure 2 of section 8.1.1

② The measurement is to be performed automatically as like in procedure 2 of section 8.1.2

③ Print the measured result as like in procedure 6 of section 8.1.1

8.3. Corneal Curvature / Refractive Power Measurement Mode (K&R Mode)

This is the mode to consecutively perform the measurement of corneal curvature and refractive power.

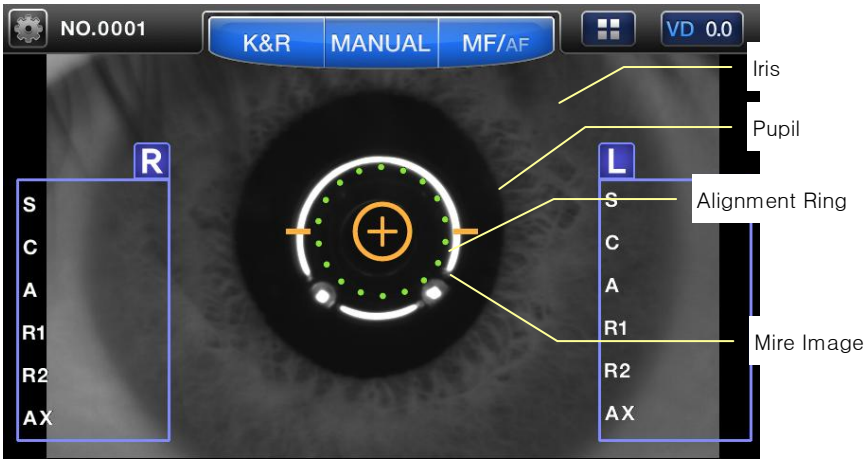
1. Check whether or not the measurement screen appears on the screen of monitor.
2. Set K&R measurement mode, You can see K&R mode on the upper left side of the screen.

8.3.1. Manual Measurement Mode

① Perform the adjustment of array and focus as like in procedure 1, 2 of section 8.1.1.

② Measurement

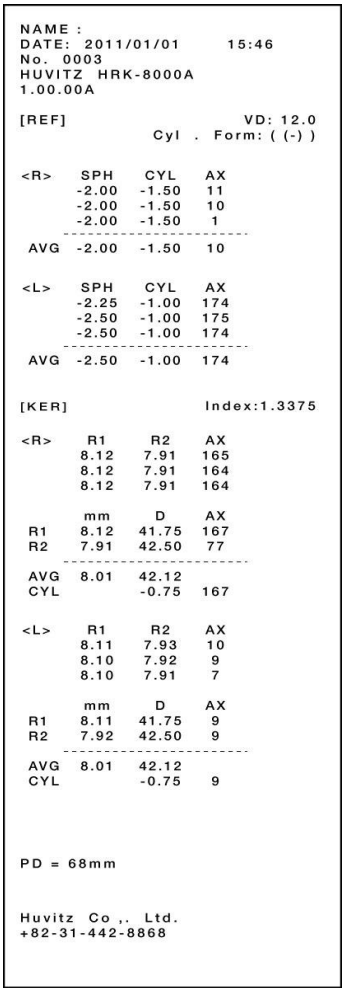
- Push the measurement button.
- As you keep pushing the measurement button, the measurement is to be performed consecutively.
- As the measurement is completed, the measured result is to be indicated on the screen of monitor.
- In case of consecutive measurement, the previous value is displayed.



[Figure 8-3-1. Screen indicating K&R Mode]

③ Perform the same procedure as like in procedure 4, 5 of section 8.1.1.

④ Print the measured result through the same procedure as like in procedure 6 of section 8.1.1.



```
NAME :
DATE: 2011/01/01      15:46
No. 0003
HUVITZ HRK-8000A
1.00.00A

[REF]                          VD: 12.0
                    Cyl . 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    8.01   42.12
 CYL           -0.75   9



PD = 68mm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[Figure 8-3-2. Example of Print]

⑤ Selection of Screen Indication Type

- In the measurement mode including the refractive power measurement, you can designate the sign of astigmatic refractive power in SETUP mode.

- Also, you can indicate the measured data of refractive power on the screen according to VD value in the measurement mode including the refractive power measurement.

- In the measurement mode including corneal curvature measure, you can designate the screen indication type (R1/R2/AX→K1/K2/AX→AR/CY/AX) in SETUP mode.

8.3.2. Auto Measurement Mode

As touching MANUAL button in manual measurement mode, it is to be changed to auto measurement mode.
As the condition of good array between the machine and measured eye is to be reached, the measurement is to be performed automatically without pushing the measurement button in Auto measurement mode.

Adjust the array and focus as like in procedure 2 of section 8.1.1.

The measurement is to be performed automatically as like in procedure 2 of section 8.1.2.

Print the measured result as like in procedure 6 of section 8.1.1.

8.3.3. Diverse Indications

	Kind	Name	Meaning of Signs	Measures
Measurement of Refraction	#	Indicating low reliability	Measured value of low reliability	Measure again
	+ OUT	Exceeding measurable range	SPH exceeds +25 D	Impossible to measure
	– OUT	Exceeding measurable range	SPH exceeds –30 D	
	C OUT	Exceeding measurable range	CYL exceeds ±12 D	
Measurement of Curvature	#	Indicating low reliability	Measured value of low reliability	Measure again
	+ OUT	Exceeding measurable range	Radius of curvature exceeds 13.0 mm	Impossible to measure
	– OUT	Exceeding measurable range	Radius of curvature is less than 5.0 mm	
	C OUT	Exceeding measurable range	Corneal astigmatism exceeds 15.00 D	

8.4. Keratometry Peripheral Measurement (KER-P Mode)

It is the mode to measure the curvature of part around cornea. Based upon the center of cornea, measure the curvature of part around cornea from the positions of up/down and left/right direction. It is to indicate the relative eccentricity while comparing the curvature of part around cornea with the curvature of corneal center.

NOTE

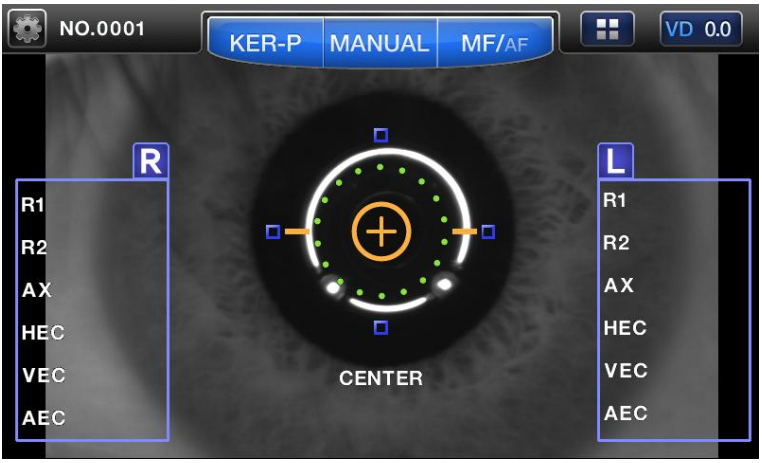
The eccentricity means how even the part around cornea is compared to the corneal center. Generally, human cornea has the highest curvature and the longer the distance from the corneal center is it gets more even. Consequently, in case of prescribing lens such as RGP with corneal center curvature only, the patient can feel uncomfortable while putting on the lens. It is possible to select the appropriate lens considering the characteristics of patient by using the eccentricity of part around cornea calculated in KER-P mode.

① Check whether or not the measurement screen appear on the screen of monitor.

② Set KER-P mode, You can see KER-P mode on the upper left side of the screen.

③ Measurement of Corneal Center

- The initial measurement position is the corneal center, and it is indicated as CENTER on the center bottom side of screen. The curvature measured in the corneal center is the same with the one measured in KER mode.



[Figure 8-4-1. Screen indicating KER-P mode]

In case of corneal center,

- R1 : Radius of curvature on maximum meridian
- R2 : Radius of curvature on minimum meridian
- AX : Axis on the radius of curvature on maximum meridian
- HEC : Eccentricity of horizontal direction in the entire eyeball
- VEC : Eccentricity of perpendicular direction in the entire eyeball
- AEC : Average eccentricity of the entire eyeball

④ Measurement of part around cornea

The direction of part around cornea which is measure at present is to be indicated at the bottom of measurement.
Four(4) boxes are to be indicated in up/down, left/right side of Mire Image. Each box indicates the proceeding state of measurement on part around cornea. If there is the measured result around part of cornea where the box is located, the inside of box is to be full with color: In case of no result, the box

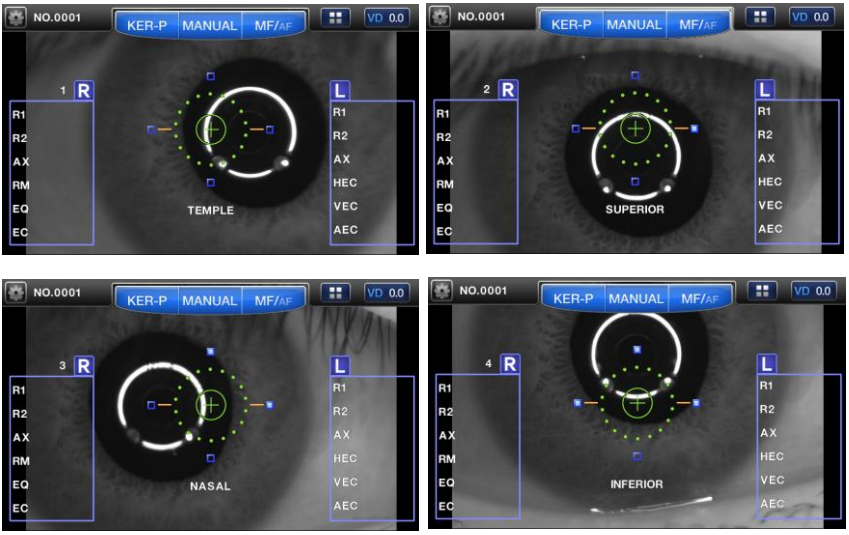
is to be indicated as an empty box. The relevant box indicated at the part around cornea which is measured now is to flicker.

Direction of part around cornea

- Superior (SUP) : Upside from corneal center
- Inferior (INF) : Downside from corneal center
- Temple (TEM) : To the temple of examinee from corneal center
- Nasal (NAS) : To the nose of examinee from corneal center

⑤ Sequence to measure the part around cornea

Measure it following the sequence of TEM -> SUP -> NAS -> INF
In case that the measurement in the direction of part around cornea becomes difficult, the direction lamp (guidance LED light) is to radiate in order to draw the examinee's sight around Mire ring actually. After the examiner shall ask the examinee to look at the light of direction lamp, then he or she can perform the measurement by adjusting the focus of Mire ring.



[Figure 8-4-2. Screen indicating KER-P Mode]

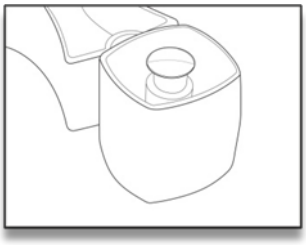
In case of part around cornea (SUP, INF, TEM, NAS),

- R1 : Radius of curvature on maximum meridian in periphery
- R2 : Radius of curvature on minimum meridian in periphery
- AX : Axis on the radius of curvature on maximum meridian in periphery
- RM : Average curvature in periphery
- EQ : Difference between diopter and corneal center
- EC : Eccentricity of periphery

8.5. Measurement of Contact Lens Base Curve(CLBC Mode)

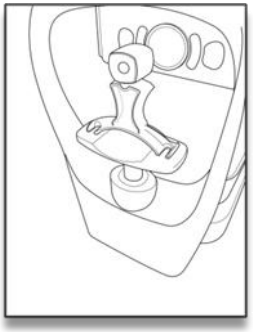
It is the mode to measure base curve of contact lens (concave surface).

1. Check whether or not the measurement screen appears on the screen of monitor.
2. Set CLBC mode, You can see CLBC mode on the upper left side of the screen.
3. Adhesion of Contact Lens
   - Put the surface of contact lens to be measured to the upward direction.
   - Contact lens is to be adhered by the surface tension.
   - Be careful lest contact lens should be adhered tilting. Also, make sure that air bubbles should not be generated behind contact lens.



[Figure 8-5-1. Adhesion of Contact Lens]

4. Sticking of Model Eye
   - Fix the model eye stuck with contact lens with pushing pin after taking the chin-rest paper away. Let contact lens directed to the measurement window.
5. Adjustment of Position and Focus
   - Let Mire image come into the center of external Alignment Ring by slowly pushing and rotating the operation lever.
   - Adjust the focus so that the outline of Mire Image can be seen most apparent. As the focus is adjusted, the focus symbol appears on the internal Alignment Ring.



[Figure 8-5-2. Adhesion of Model Eye]

6. Measurement

- Push the measurement button.
- As you keep pushing the measurement button, the measurement is to be performed consecutively.
- As the measurement is completed, the measured result is to be indicated on the screen of monitor.

NOTE
The measure result of astigmatic axis in base curve(concave surface) of contact lens has the difference of 90° compared with the measured value of astigmatic axis in the corneal curvature(convex surface).

[Figure 8-5-3. Screen indicating CLBC Mode]

Information on the display is below.

- R1 : Radius of curvature on maximum meridian
- R2 : Radius of curvature on minimum meridian
- RM : Average curvature
- K1 : Rrefractive power on minimum meridian
- K2 : Rrefractive power on minimum meridian
- KC : corneal astigmatism

7. Print

– Press Print button.

9. Other Modes

9.1. ILLUMINATION Measurement Mode (ILLUM Mode)

Illum measurement mode is the measuring function to use usefully in the following cases.

1. It is to examine the crystalline lens of patient who has the severe symptom of cataract or undergoes it, or to measure its refractive power.

   - Examine the degree of opacity of crystalline lens with the shape of light reflected from retina while changing intensity of light shed on the eye.
   - In case that the crystalline lens is not much in opacity, it is possible to measure the sight refractive power of eye as well while observing the shape reflected from retina.

2. In case there are scratches on retina, observe the scratches: or observe whether or not the penetration of light into IOL is uniform after the implantation surgery of IOL.

9.1.1. Adjustment of Array and Focus

① Perform the adjustment of array and focus according to procedure 1, 2 of section 8.1.1.

② As pushing ILLUM button after pushing button while selecting Illum mode, the Illumination measurement mode screen.

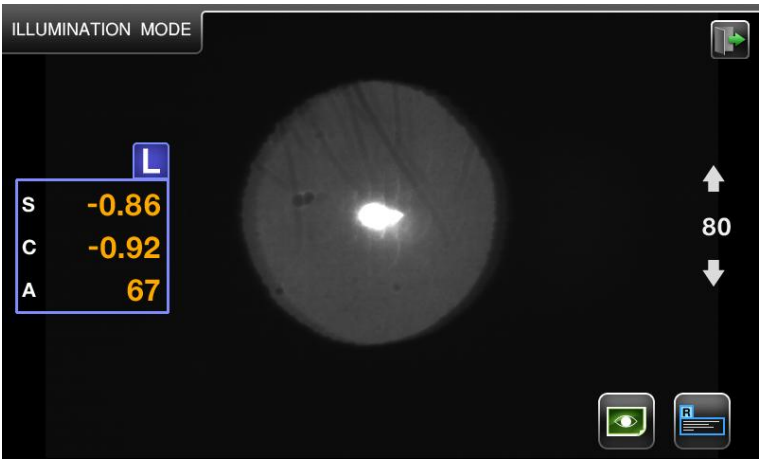
■ [Observe]

- As Illumination mode is to be selected by pushing ILLUM measurement button, [Observe] window is to appear on the screen together with Illumination image spread out reflected from retina.
- Diagnose the crystalline lens, opacity degree of cornea, and the degree of corneal scratches by observing the state of this Illumination image.

[Figure 9-1-1. Illumination Observation Window]

■ [Measure]

- If you push Measure button in [Observe] window, it is changed to [Measure] window.[Measure] window is to consecutively measure the sight refractive power, astigmatism and astigmatic angle, and to show them together with Illumination image on the screen at the same time.



[Figure 9-1-2. Illumination Measure Window]

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MEA : By using the joystick measurement button, you can store the observed Illumination image in memory while changing it as a static window.

: It is the button to change the window between [Observe] and [Measure].

: It is possible to divide the static window of Illum obtained by measurement button by two (2), and to show it by enlarging it for each left/right eye.

↑ Button: It is the button to increase the intensity of Ref LED for one (1) level.

30 : Ref LED Power display.

↓ Button: It is the button to decrease the intensity of Ref LED for one (1) level.

Measurement Mode Return: As pushing button, it is to finish Illumination mode, and to return to the ordinary measurement mode.

9.1.2. Observation on Illumination

① Adjustment of brightness of LED to measure refractive power
- In order to take a close look at Illumination image, change the intensity of LED to measure refractive power by one (1) level using ↓ button and ↑ button.

② Observation on Illumination Image
- Let LED to measure the refractive power to be at incidence to eye while avoiding the part of opacity in crystalline lens by using the operation lever. It is effective for observation on Illumination to let LED light be shed on part around pupil.

NOTE
In order to protect the patient's eyes, avoid examining the eyes over 30 seconds.

③ Stopping Image
- After adjusting the focus of image by using the operation lever, stop the image by pushing the measurement button. If the stopped screen is not satisfactory, stop the image again after returning to the original screen by pushing button.

④ Measuring Refractive Power and Stopping Image
- As pushing Measure button in [Observe] window, it is to be changed to [Measure] window. At this time, as pushing Mode button again, [Observe] window is to return. Position the bright dot which indicates LED light to shed on the eye so that it can avoid the part of opacity of pupil by using the operation lever, and stop the image and the measured value by pushing the measurement button after well adjusting the focus of image appeared on the screen. If the stopped image is not satisfactory, stop the image again after returning to [Measure] window by pushing button.

NOTE
The opacity of crystalline lens caused by cataract can lead in errors of measured value while causing the aberration by the decenteredness.

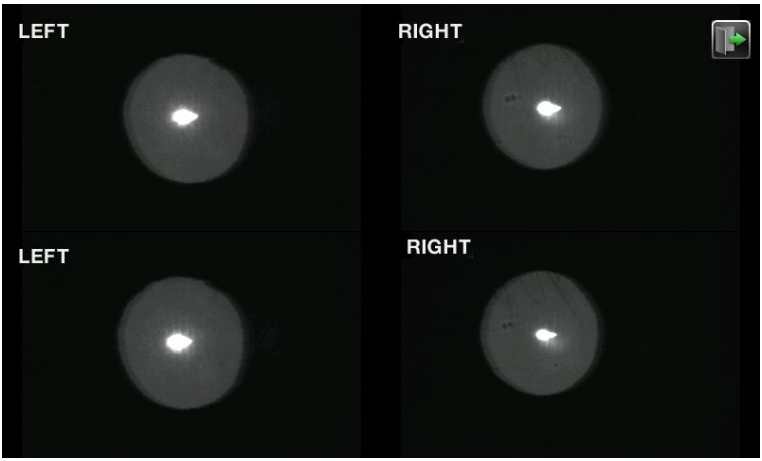
9.1.3. Storage

If you want to store the stopped image in memory, push the measure button. You can store max of two (2) images for each eye. If you want to return to [Observe] or [Measure] window, please push button.

9.1.4. Examination on the other eye

Perform the examination on the other eye and the storage of its image by the same way.

9.1.5. Call for Stored Image



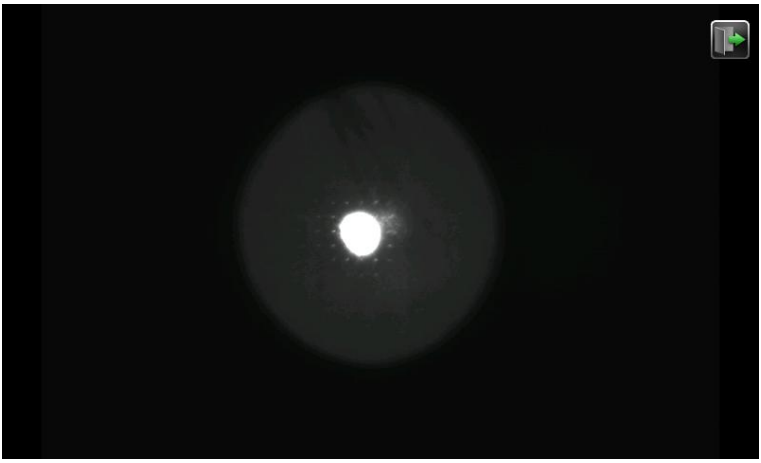
[Figure 9-1-3. Window indicating Stored Image]

① In order to call the stored Ret-Illumination image for two eyes on the screen of monitor, enter Display mode by pushing button.

② For magnify image which is save in DISPLAY mode by touch it.

③ As pushing button, it shall return from the enlarged window to the Display window.

④ As pushing button in Display window, it is to return to [Measure] window.



[Figure 9-1-4. Window indicating stored image(enlarged)]

9.1.6. Return to measurement mode

As pushing button in [Observe] or [Measure] window, you can return to [REF], [KER], [K&R], [KER-P] or [CLBC] measurement mode.

9.2. ZERNIKE Mode

Zernike Mode indicates the distribution of refractive power in pupil area. Based upon the wavefront of emmetropes, Z-Map is drawn as a kind of topographical map having the elevation according the degree of distortion(aberration) of wavefront come from myopia or hypermetropia. Zernike mode is to measure the refractive power in REF or K&R mode, and you can see it by pushing button to ZMODE button.

9.2.1. Composition of Window

1. : Map

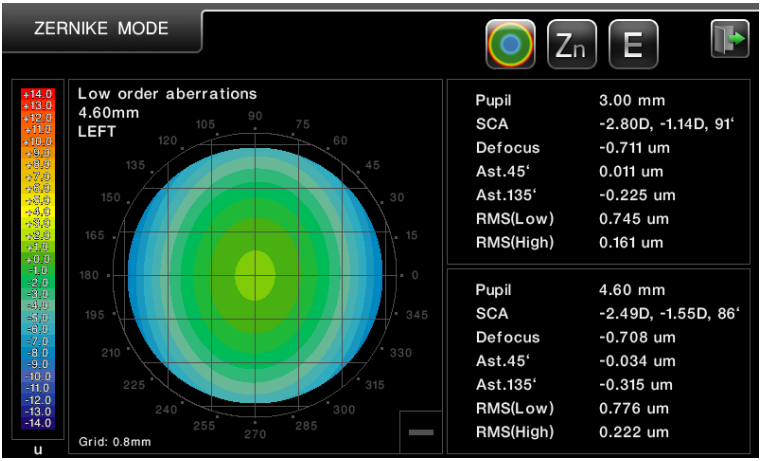
[Figure 9-2-1. Zernike mode Window (Map)]

Map information items indicated on bottom of window are as follows

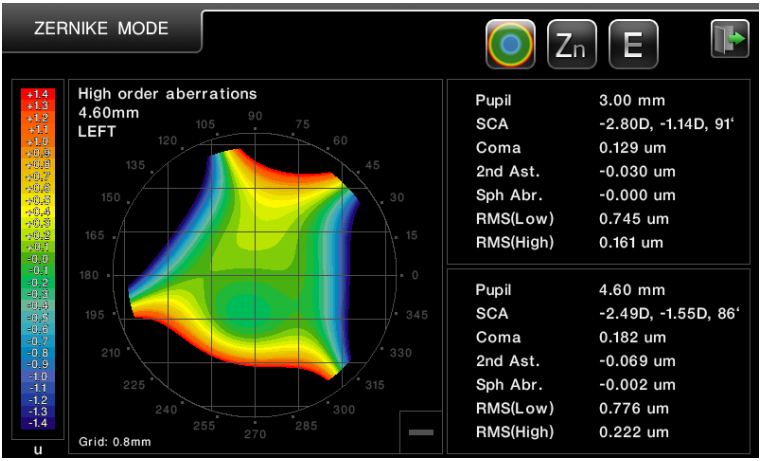
- Pupil : measurement range. (3.00 mm radius from the center of the pupil)
- : measurement range. (4.60 mm radius from the center of the pupil)
- SCA : S=Spherical Abberation, C=Cylinder Abberation,

A=Cylinder Axis

- RMS(Low) : aberration (low order aberration average)
- RMS(High) : aberration (high order aberration average)



[Figure 9-2-2. Zernike mode Window (Map)]



[Figure 9-2-3. Zernike mode Window (Map)]

Map Level on the left side in window is the aberration value of wavefront, and it is the color table to draw map. The max and min value of the aberration of measured wavefront is indicated by the unit of micrometer(um). The wavefront aberration of emmetropes is 0, and the severer the myopia and hypermetropia is, it is to have higher wavefront aberration of (+) and (−) sign respectively.

By using the color table defined in Map Level, the map in the center of window is to be drawn according to the areal wavefron aberration(refractive power) within pupil area. Emmetropes is as in green, hypermetropia is as in blue, and myopia is indicated as in red: the severer the abnormality of eye is, the thicker their colors become. In case including astigmatism, the refractive power topography of oval type is to be drawn to the direction of astigmatic axis.

Map at the bottom right of the image “+” button is pressed, the Map image is magnified, magnified in the lower right portion of Map Images “−“ button to return to the original image.

Map information items indicated on bottom of window are as follows

- Defocus : defocus
- Ast 45° : 45° Astigmatism
- Ast 135° : 135° Astigmatism
- Coma : Coma
- 2nd Ast. : representation aberration definition (2nd Astigmatism)
- Sph Abr. : representation aberration definition (Spherical Aberration)
- RMS(Low) : aberration (low order aberration average)
- RMS(High) : aberration (high order aberration average)

2. : Graph

[Figure 9-2-4. Zernike mode Window (Graph)]

The graph shows coefficients of individual aberration compoments included in a group. (combination of aberration components). A side-by-side display of the preoperative and postoperative coefficient graphs tells differences in each aberration component.

3. : PSF image

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

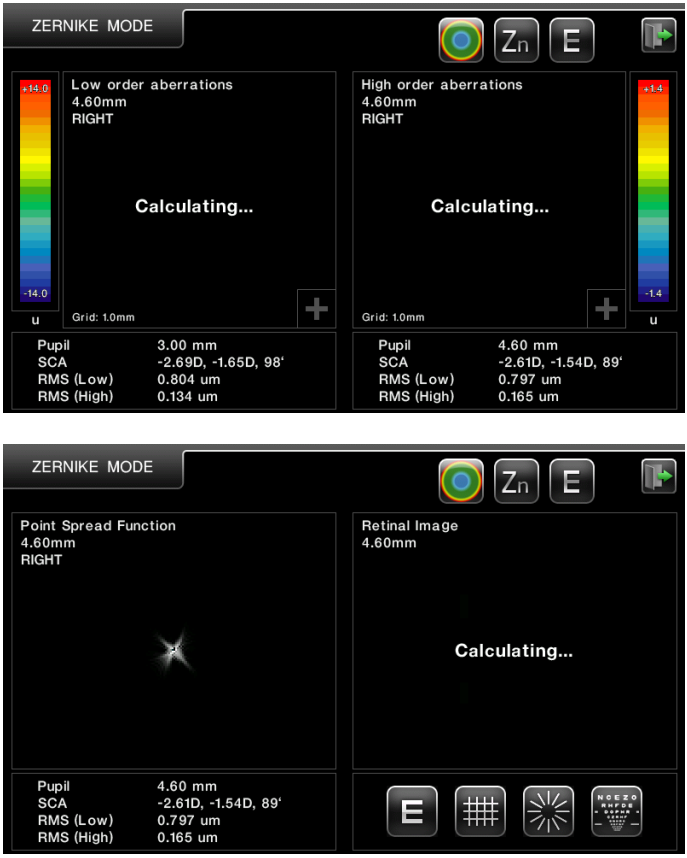
PSF image information items indicated on bottom of window are as follows

- : E type chart
- : Grid type chart
- : Radiation type chart
- : ETDRS type chart

9.2.2. Change of Window

As changing the measurement position of examinee to left or right side by moving the joystick, the map is to changed again as a result obtained in the measured direction.

As the map is drawn for the first time, the guide message is to be indicated as “Calculating…” for some time of standby for calculation.



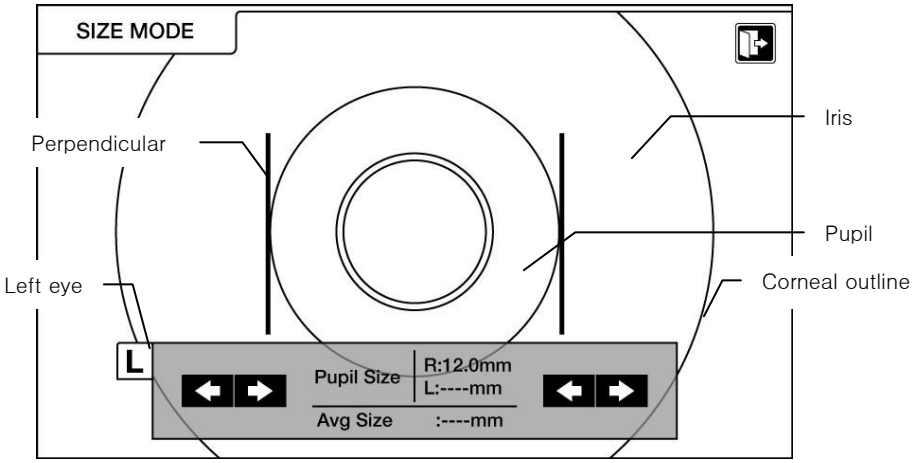
[Figure 9-2-6. Zernike mode (Map, PSF image) Window Change]

9.3. Measurement of Corneal Radius(SIZE Mode)

It is the mode to measure the corneal radius.

1. Check the measurement window on the screen of monitor.
2. Adjust the position and focus so that the image of eye to be measured can be seen apparently.
3. Push SIZE button after pushing button while selecting SIZE measurement mode.

[Figure 9-3-1. Window indicating Size Mode (1)]



[Figure 9-3-2. Window indicating Size Mode (2)]

4. Adjustment of measurement position and focus

- Ask the examinee to look at the internal fixed target.
- Adjust the position so that the pupil shall be in between two(2) perpendicular bars by moving the operation lever.
- Adjust the focus so that the corneal corner can be seen apparently.

NOTE
As adjusting the focus on the iris, it is impossible to measure the radius of pupil exactly.

5. Measurement

- As pushing the measurement button, the window shall be stopped.
- button and button in the left is to adjust the movement of left bar, and button and button in right side is to adjust the movement of right bar.

- Move the relevant bar to left/right sides by pushing button or button.

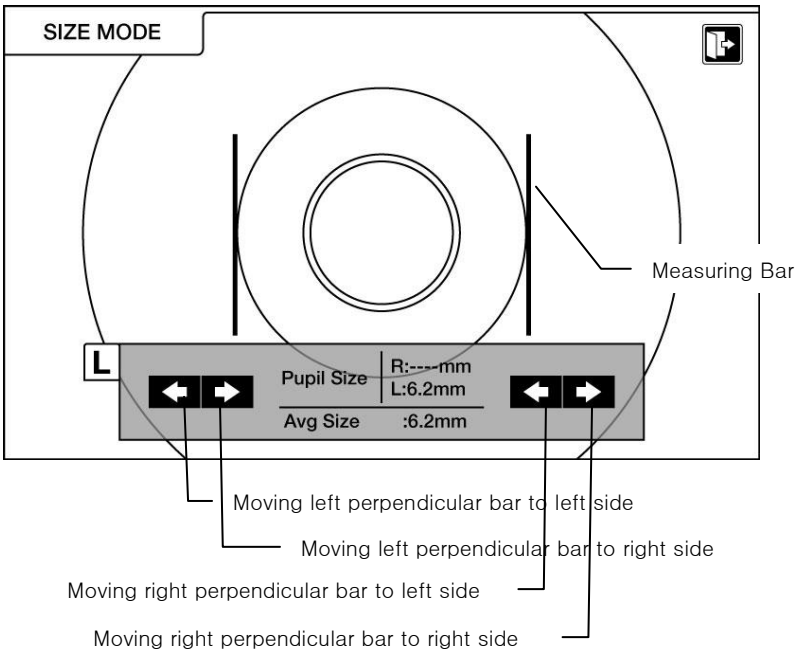
- The measured value shall be indicated on the screen of monitor.

- Store the measured value by pushing the measurement button.

- Measured pupil size “R” or “L”show in bottom-center of display. Measured Average value AVG SIZE show in next.

- As pushing Measure button, the stopped window is cancelled.

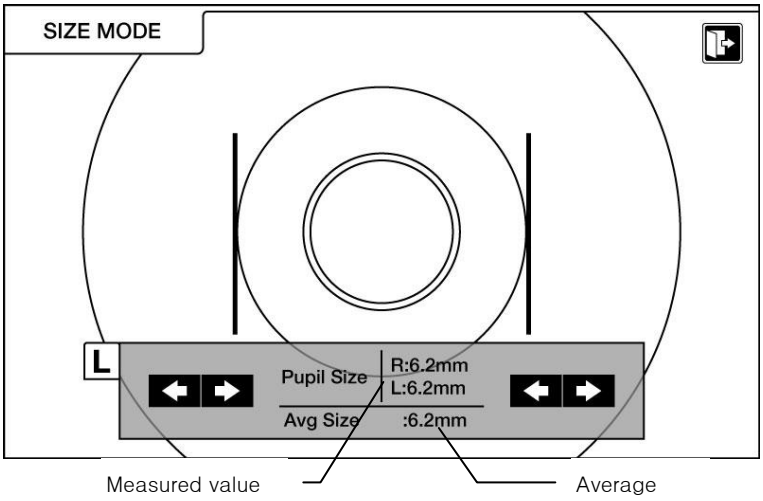
-



[Figure 9-3-3. Window indicating Size Mode Measurement]

6. Repetition of Measurement

- Repeat the measurement in the entry of measured value as many times as you need. Repeat the procedure of 2~4 as performing the measurement again.



[Figure 9-3-4. Window indicating repletion of Size Mode Measurement]

7. Measurement of the other eye

- Move stage to opposite side, then change Pupil size "R" to "L" or "L" to "R". You can measure opposite side eyeball in the same way.

8. Printout of Measured Result

- The measured result of corneal radius is to be printed out as the item of "[CORNEAL SIZE]" in the built-in printer.

9.4. VIRTUAL COMPARISON Mode

A Virtual comparison Function allows the patient to compare the current uncorrected eye view with the corrected view
By changing the distance to the chart, the patient can experience the virtual comparison.

1. Perform AR measurement.

2. As touching COMP button after touching button.

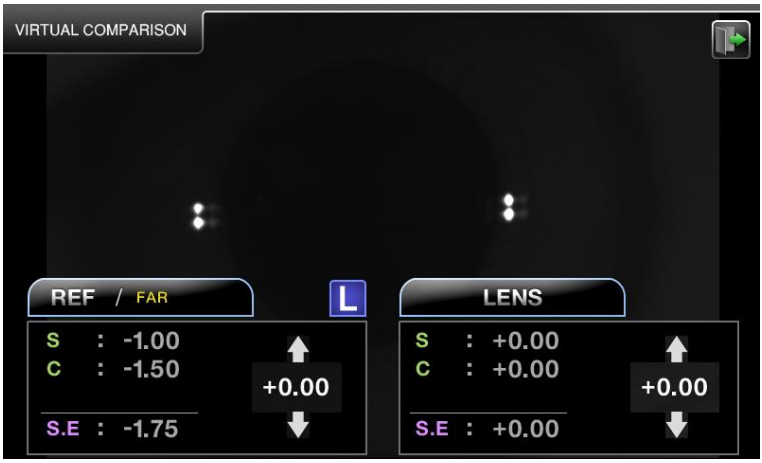
3. To check the visual acuity with progressive prescription, touch the 'FAR' button in the REF/FAR mode, that switches it to REF/NEAR(40 mm) mode and shows add power in the data display area. Touching the add power toggles the progressive prescription check mode.
Touching the area 'NEAR(40 mm)' on the display returns to REF/FAR mode.

.

4. Press the button to finish the virtual comparison function and return to the measurement screen.

5. Measure the other eye in the same manner.

6. When finishing the measurement, print the data out.



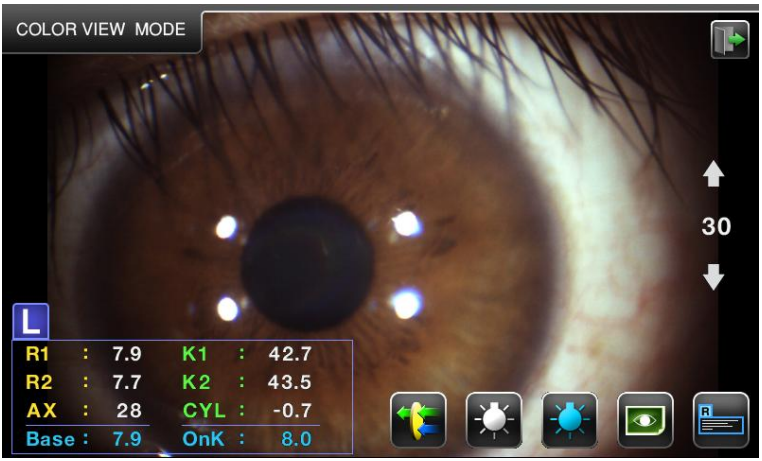
[Figure 9-4-1. Display of VIRTUAL COMPARISON Mode]

The item of Data information which are indicated in screen.

- REF/FAR or NEAR(40 mm) : HRK-8000A DATA
- LENS : Lensmeter DATA
- S (Spherical) : Spherical data.
- C (Cylinder) : Cylinder data.
- S.E : Spherical Equivalent data.
- ↑, ↓ : Down or Up of Shift data

9.5. COLOR VIEW MODE

Measures the radius of curvature of the cormea and see the condition which wears contact lens in White LED / Blue LED / Yellow Filter mode.



[Figure 9-5-1. Display of Color View mode]

The item of Data information which are indicated in screen.

- R1 : Radius of curvature on maximum meridian
- R2 : Radius of curvature on minimum meridian
- Ax : Axis on the radius of curvature on maximum meridian
- Base : Contact lens Base curve data.
- K1 : Refractive power on minimum meridian
- K2 : Refractive power on maximum meridian
- Cyl : Cylinder data.
- Onk : Contact lens Onk data

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: Select to Yellow Filter.

: Select to White LED.

: Select to Blue LED.

: capture image displayed on the screen.
(maximum LEFT 2, RIGHT 2)

: Measurement data displayed on the screen.

↑ button : Up of LED Power

30 : Indicates current LED.

↓ button : Down of LED Power

9.5.1. White LED

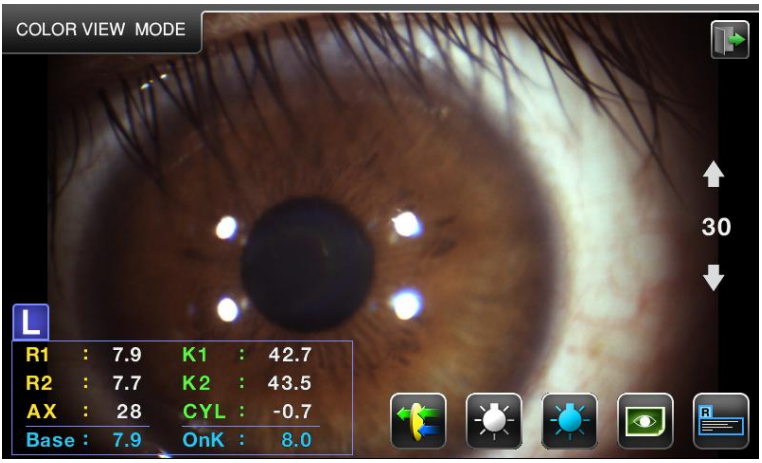
It is the function to observe of the patient eye by using White LED lighting in the color image.

1. After when pressing buttons in measure mode, presses COLOR buttons then COLOR VIEW MODE screen appear.

2. If the corneal curvature is measured in the KER mode, the Base and On-K value will automatically calculate.

3. To view clear image of the patient eye, fix the position and focus of the patient eye using operation lever.

4. ↓ button and ↑ button regulate White LED of the proper brightness.



[Figure 9-5-3. Display of Color View mode (White LED)]

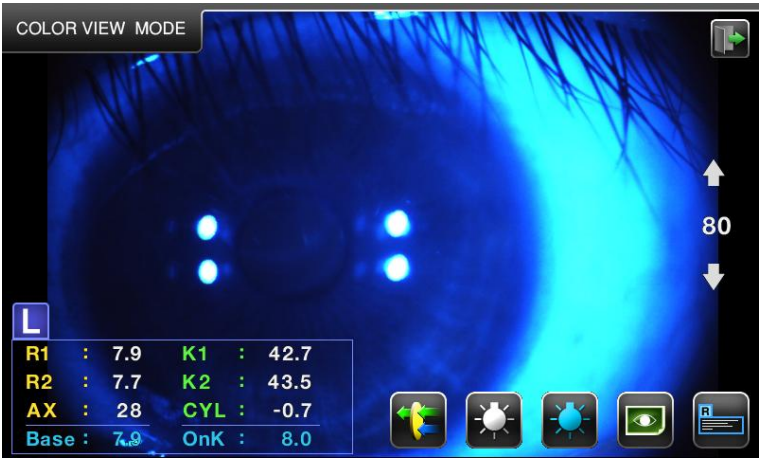
9.5.2. Blue LED

It is the function to observe the level of the fitness of contact lens with the patient eye using Blue LED and fluorescent solution.

1. Put in the fluorescent solution into the patient eye and wear the contact lens.

2. Press button in color view mode, fix the position and focus of the patient eye focus of the patient eye using operation lever.

3. Adjust the Blue LED intensity using ↓ and ↑ button, and observe fitness level of the contact lens with the patient eye.



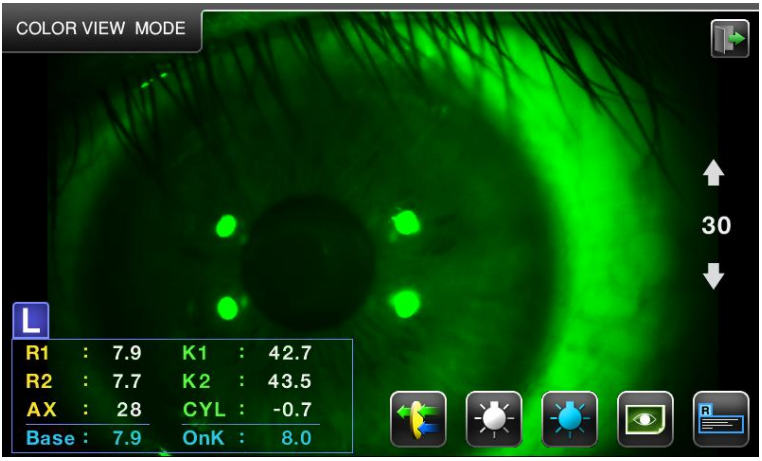
[Figure 9-5-4. Color View mode screen (Blue LED)]

9.5.3. Yellow Filter

The operator can see the level of the fitness of contact lens more clearly and definitely with this function.

1. Perform the same procedure as like in procedure 2, 3 of section 9.5.2 and press the button.

2. Adjust the brightness using ↓ and ↑ button, and observe fitness level of the contact lens with the patient eye.



[Figure 9-5-2. Display of Color View mode (Yellow Filter)]

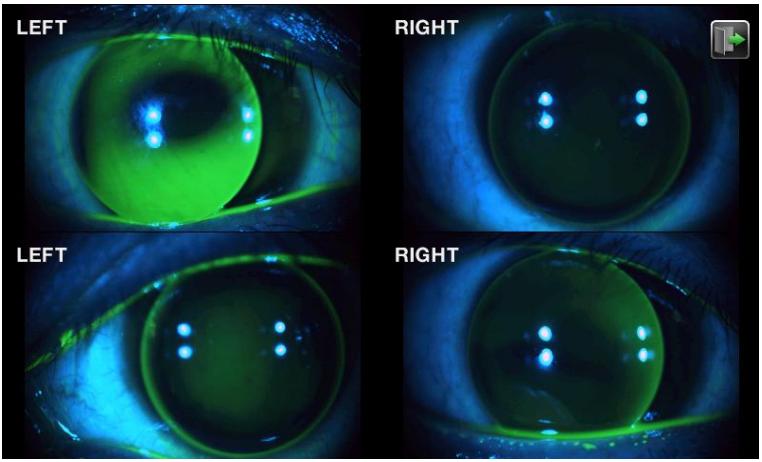
NOTE
The Yellow Filter function is the function which uses S/W.

9.5.4. Capture Screen

1. After when pressing buttons in measure mode, presses COLOR buttons then COLOR VIEW MODE screen appear.

2. Press measurement button (joystick) to capture the image of examinee.

3. button is pressed, capture image is displayed on the screen. (Max LEFT 2, RIGHT 2)

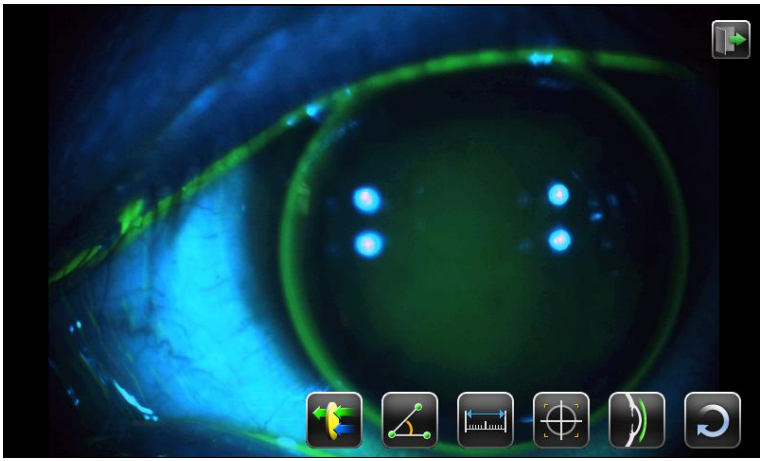


[Figure 9-5-5. Color View mode - capture screen]

9.5.5. Selected Capture Screen

1. Select one of the captured images (LEFT2, RIGHT2) as like section 9.5.4.

2. Selected image is displayed on the screen.



[Figure 9-5-6. Color View mode – selected capture image]

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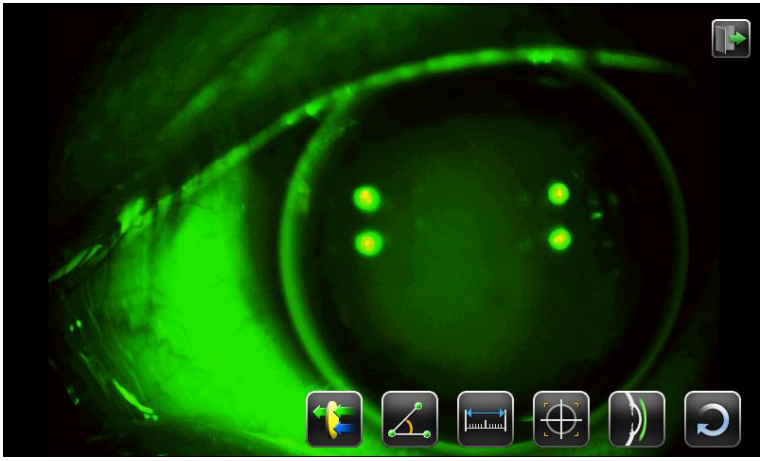
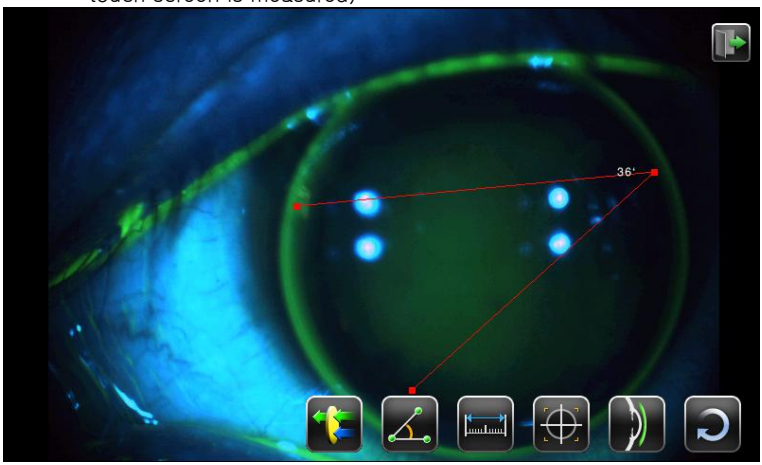
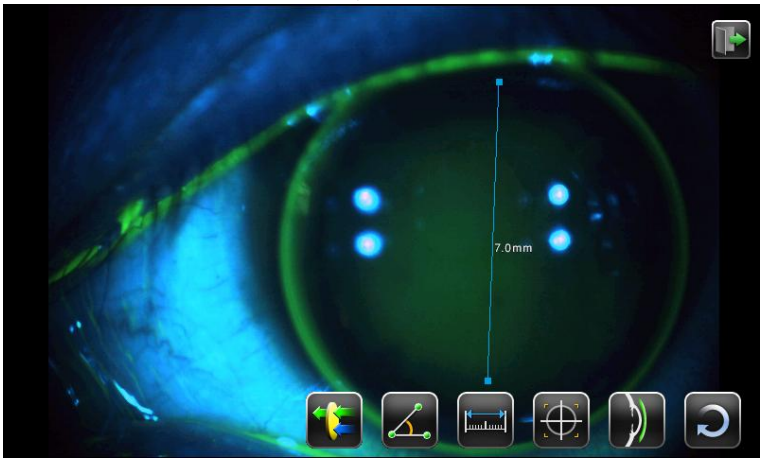
- : Emphasizing the green contrast of the measurement image. (Check more easily with contrast emphasis of the measurement image.)



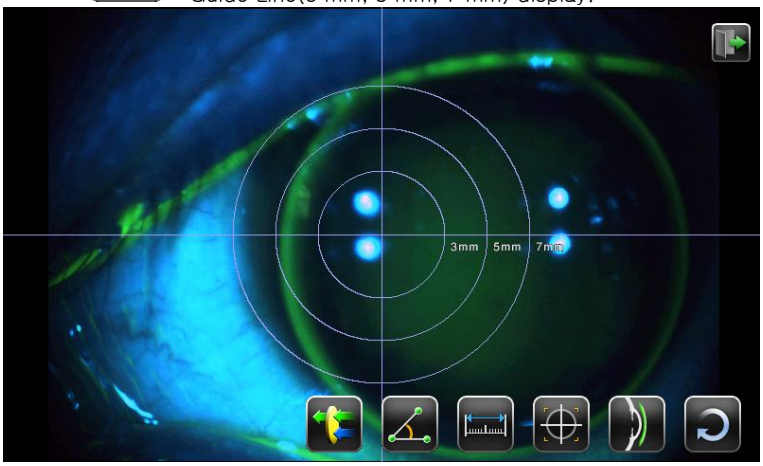
- : Angle measurement. (The angle of three points on the touch screen is measured)



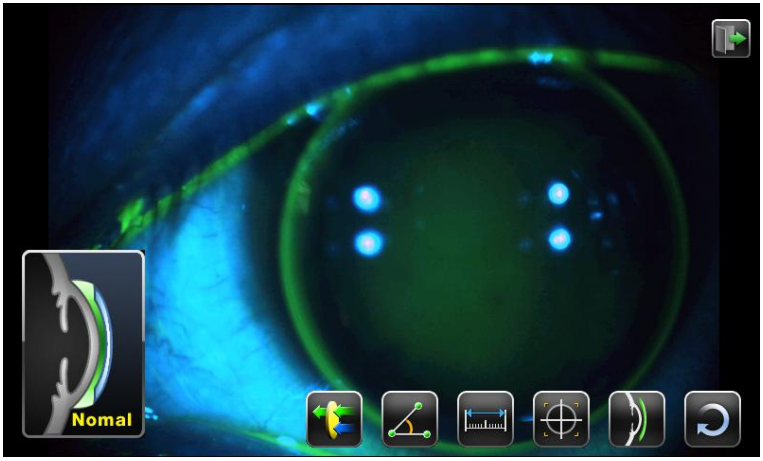
- : Length measurement. (The length of two points on the touch screen is measured.)



- : Guide Line(3 mm, 5 mm, 7 mm) display.

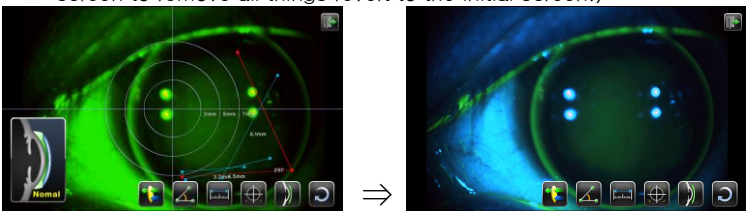


- : fitting state display. (The curvatures of the cormea and the contact lens displayed in screen. Automatically which are flat or normal or steep)



[Figure 9-5-7. Flat, Normal, Steep icon screen]

- : Reverting to the previous screen. (Displayed on the LCD screen to remove all things revert to the initial screen.)



9.5.6. Return to measure mode.

Presses button in Color View mode then turns back [REF], [KER], [K&R], [KER-P] or [CLBC] mode.

9.6. DISPLAY Mode

You can see the measured results (Max ten(10) units of data) stored in memory in this mode. As pushing DISPLAY mode in the measurement mode, it changes to DISPLAY Mode. It returns to the measurement mode as pushing button again.

NOTE

- In case of K/R mode, the page changes as pushing REF button or KER button.
- As pushing print button, the measured result stored in memory is to be printed out through the built-in printer, and it is removed completely for the new measurement.

1. Measured Result of Refractometry

   - It indicates the latest measured result of max amount of ten(10) times(refractive power of left/right eyes). As pushing button, the stored data is to be removed and returns to the measurement mode.

[Figure 9-6-1. Measured Result of Refractory]

2. Measured Result of Keratometry

- It indicates the latest measured result of max amount of ten(10) times(refractive power of left/right eyes). As pushing button, the stored data is to be removed and returns to the measurement mode.

[Figure 9-6-2. Measured Result of Keratometry, Ker-p, CLBC]

9.7. User SETUP Mode

It is to perform many setups relating to measurement, print-out, etc. As pushing (SETUP MODE) button, it enters USER SETUP mode.

[How to change page]

- Select the wanted page while pushing button.
- : it is to enter the previous page.
- : it is to enter the next page.

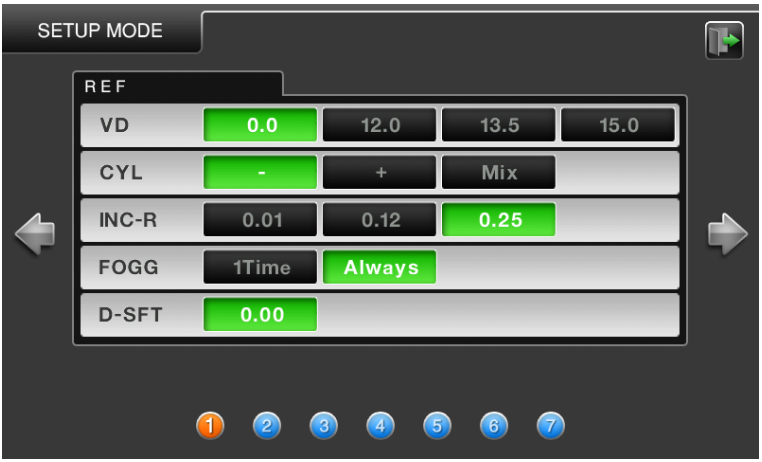
[How to change content]

- If you want to change, then touch it. .

NOTE
You should change some contents in other way. The procedure of relating setup change is to be ordered under the explanation on each item.

[How to enter the measurement mode]

- Push button, save automatically and return to measure mode.

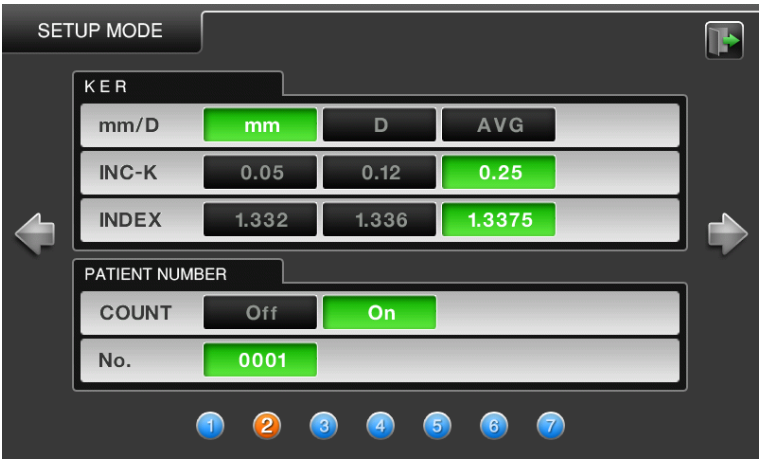


[Figure 9-7-1. Setup Mode Information (page 1)]

[Content of Item] : 1/7Page

REF (Refractometry measurement)

- VD : Corneal Vertex Distance
- CYL : Astigmatism Indication Type
- INC-R : Indication Unit of SPH and CYL
- FOGG : The number of times fogging system in continuous measure mode.
- D-SFT : Data Shift
  (range : -5.00 ~ +5.00)



[Figure 9-7-2. Setup Mode Information (page 2)]

[Content of Item] : 2/7 Page

KER (Keratometry measurement)

- mm/D : Indication Type of Corneal Measurement
  - mm
    - R1 ····· Radius of curvature on maximum meridian
    - R2 ····· Radius of curvature on minimum meridian
    - AX ·····Axis on the radius of curvature on maximum meridian
  - D
    - K1 ·····Refractive power on minimum meridian
    - K2 ·····Refractive power on maximum meridian
    - AX ·····Axis on minimum meridian
  - AVG
    - AR ·····Average radius of curvature
    - CY ····· Corneal astigmatism
    - AX ····· Axis of Corneal astigmatism

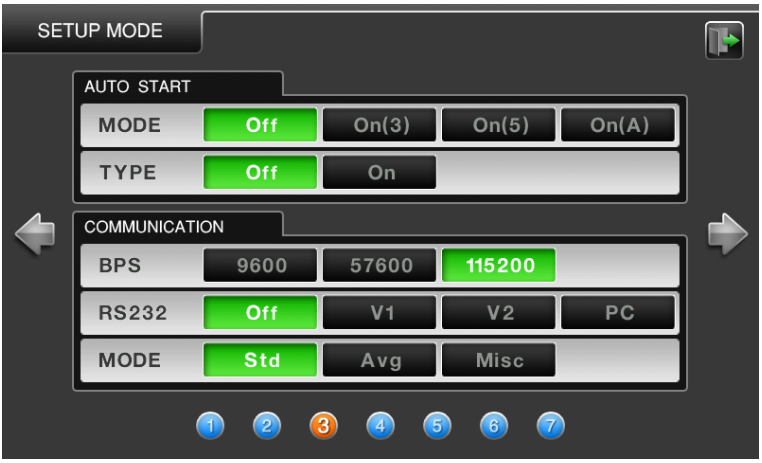
- INC-K : Increment of corneal power and astigmatism

- INDEX : Corneal equivalent refractive index

PATIENT NUMBER (Setup of Serial Number)

- COUNT : Selection whether or not to use serial number

- NO. : Setup of Serial Number
  (range : 0 ~ 9999)



[Figure 9-7-3. Setup Mode Information (page 3)]

[Content of Item] : 3/7 Page

AUTO START (Output format)

- MODE : Select of AUTO MODE
  It is to measure in AUTO START Mode consecutively three(3) times only.
  It is to measure in AUTO START Mode consecutively five(3) times only.
  It is to measure in AUTO START Mode consecutively

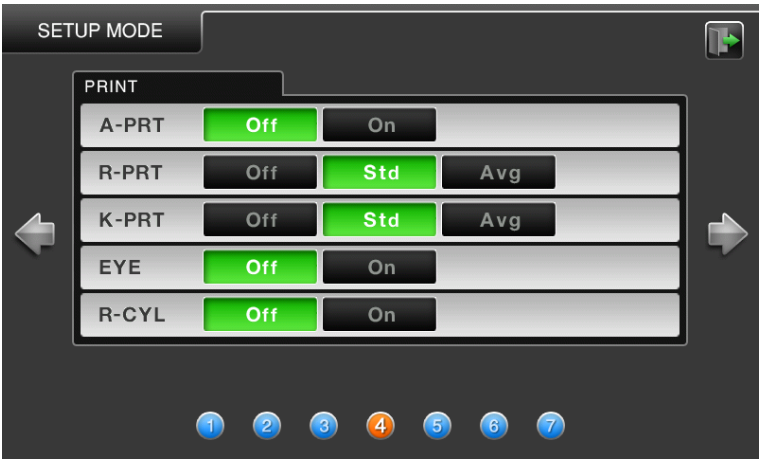
- TYPE : You can select “ON” or ”OFF” of AUTO START MODE.

COMMUNICATION (Setup for communication to other machines)

- BPS : Select the one among 9600, 57600, and 112500bps as its data transfer rate.

- RS232 : Setup of transmission method(method and version of other equipment)

- MODE : Data format setup of transmission method .



[Figure 9-7-4. Setup Mode Information (page 4)]

[Content of Item] : 4/7 Page

PRINT (Print Setup)

- A-PRT : In case of measuring in AUTO START Mode, it is to print out the measured result automatically as the each measurement to left/right eyes is completed one after the other.

- R-PRT : Refractometry -Output type of built-in printer for the measured result of Refractometry

  Off : It is not to be printed out.

  Std : The measured result & average value of max ten(10) times are to be printed out.

  Avg : Only average value is to be outputted printed out.

- K-PRT : Output type of built-in printer for the measured result of Keratometry

  Off : It is not to be printed out.

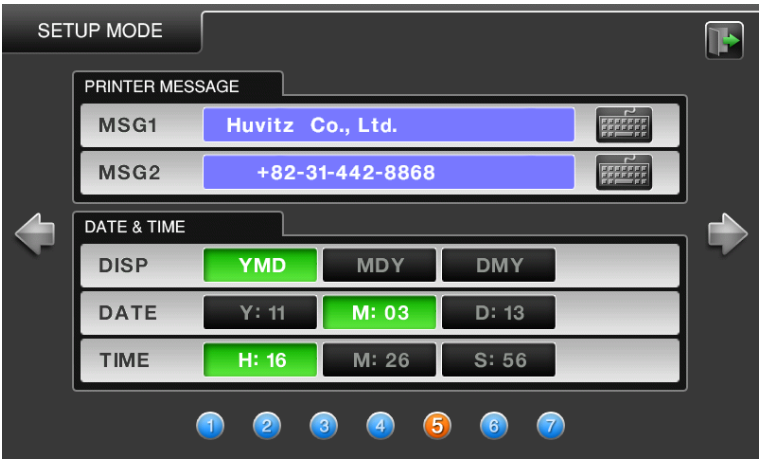
  Std : The measured result & average value of max ten(10) times are to be printed out.

  Avg : Only average value is to be outputted printed out.

- EYE : Off : It is not to be printed.

  On : Pictures of eye & refraction according to the measured result of Refractometry is to be outputted

- R-CYL : Select of remainder astigmatism output.



[Figure 9-7-5. Setup Mode Information (page 5)]

[Content of Item] : 5/7 Page

PRINT MESSAGE (Input the measured data and message to be outputted through printer by using the function of internal printer message input. It can print characters on two(2) lines.)

- MSG1 : Character input for the first line.

- MSG2 : Character input for the second line

DATE & TIME

- DISP : Setup of indication sequence of year/month/date

  YMD : Year/Month/Date

  MDY : Month/Date/Year

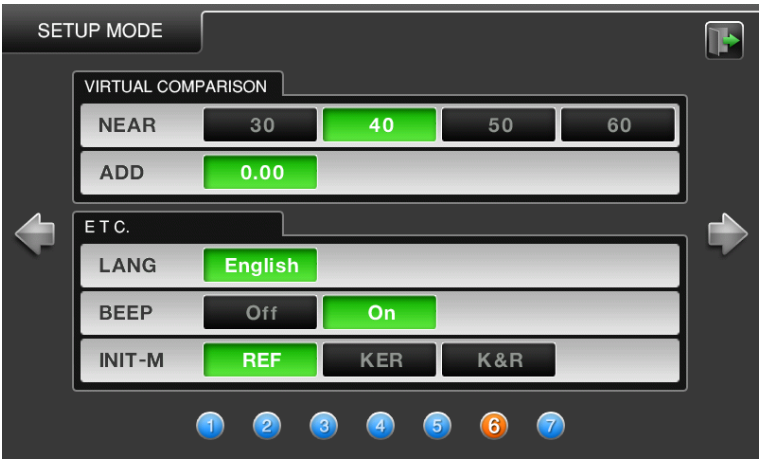
  DMY : Date/Month/Year

- DATE : Setting of date(year/menth/date)

  (range : Y = 00 ~ 99 , M = 01 ~ 12, D = 01 ~ 31)

- TIME : Setting of time(hour/minute/second)

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



[Figure 9-7-6. Setup Mode Information (page 6)]

[Content of Item] : 6/7 Page

VIRTUAL COMPARISON

- NEAR : The near working distance of the chart can be set.

- ADD : The addition power can be set.

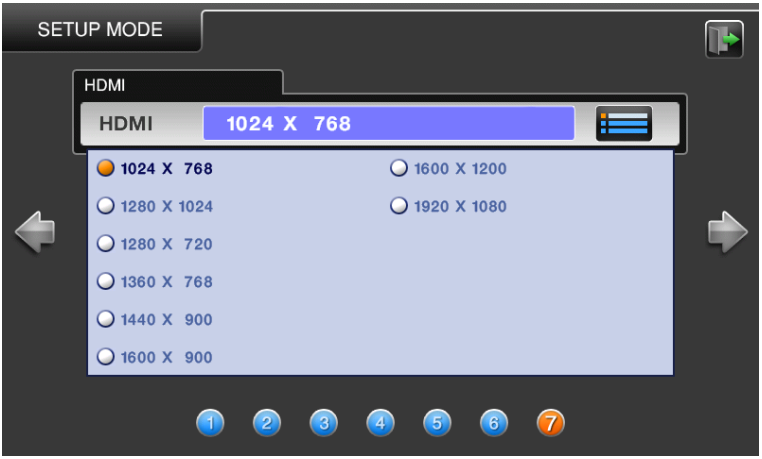
  (range : -5.00 ~ +5.00)

ETC. (Other Setup)

- LANG : You can select the language characters indicated on the screen and the print output.

- BEEP : Setup of Beep sound.

- INIT-M : Select of initial mode.

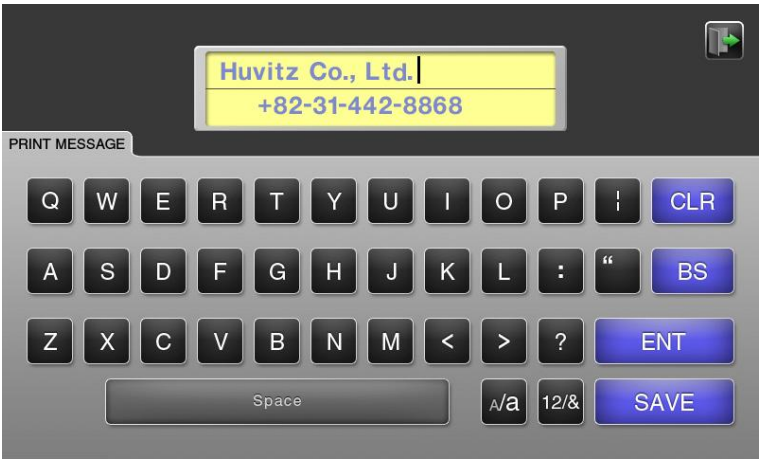


[Figure 9-7-7. Setup Mode Information (page 7)]

[Content of Item] : 7/7 Page

HDMI

- HDMI : Connecting into the exterior monitor.
- 1024 X 768, 1280 X 1024, 1280 X 720, 1360 X 768, 1440 X 900, 1600 X 900, 1600 X 1200, 1920 X 1080



[Figure 9-7-8. Other (Character) Input]

- Character Input -

CLR (Clear) : Erase of line.

BS (Back Space) : Erase of text.

ENT (Enter) : Change of line.

SAVE : Save of information.

[Figure 9-7-9. Other (Number) Input]

- Number Input -

range : Minimum ~ Maximum range which is possible of input. (If it will escape a range then will not save and displayed warning message "Out of Range!")

: Erase of number.

: Erase of All numbers.

: Save number and exit number input mode.

9.8. Power saving Function

The power saving function begins to operate if you do not operate the machine at all for five(5) minutes or so. It is to return to the measurement mode as pushing any button optionally in saving mode.

10. Self diagnosis & Maintenance

10.1. Before calling for serviceman

In case that abnormality happens or the machine operates abnormally, a warning sign is to be indicated. In this case, perform the settlements below.
If the machine does not return to the normal condition in spite of the measures below, contact to the agent where you bought the machine after switching the power off.

① As the power switch is on

Message	Cause	Method of settlement
Motor Error	Internal abnormality for the equipment	Re-input the power in 10 seconds after switching it off. In case that the message is indicated again, contact our sales representative.
EEPROM Error		
EEPROM Data Error		
System Error		
Clock Error		
INVALID SETUP DATA – REF	Abnormality in the internal data for Refractometry	Please contact our sales representative.
INVALID SETUP DATA – KER	Abnormality in the internal data for Keratometry	Please contact the selling agent.

② Messages during measurement

Message	Cause	Method of Settlement
TRY AGAIN	Refer to page 15	Refer to page 15
	Objective glass in the measurement window is polluted	Clean the glass
+ OUT	Sphere of examinee's eye exceeds +25 D	Impossible to measure
	Curvature radius of examinee's eye exceeds 13.0 mm	
	Object lens within measurement window is polluted	Clean the glass
- OUT	Sphere of examinee's eye exceeds -30 D	Impossible to measure
	Curvature radius of examinee's eye is less than 5.0 mm	
	Objective glass in measurement window is polluted	Clean the glass
C OUT	Astigmatism of examinee's eye exceeds 12 D	Impossible to Measure
	Corneal astigmatism of examinee's eye exceed 15 D	
	Object lens within measurement window is polluted	Clean the glass

③ Message as printing

Message	Cause	Method of settlement
CHECK PAPER	-There is no printer paper or lever is not closed.	Install printer paper or close the lever.

10.2. Replacement

10.2.1. Printer paper

As red line appears on the paper, immediately change the print paper with new one.

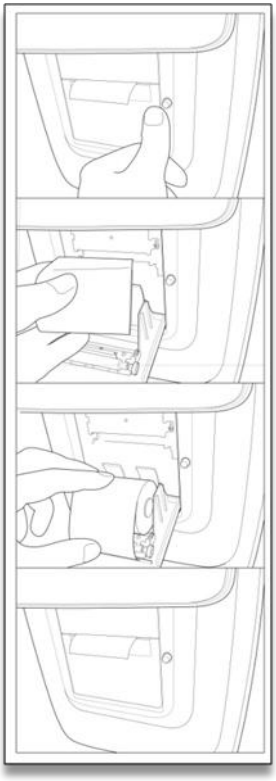
① Presses the button in the printer side, open the cover.

② Cut the paper inserted in the printer, and take it away from paper roll.

③ Put the new paper inserted into the printer case.

④ Fix the paper onto the printer. At this time, adjust the length of paper so that it can come out from the paper outlet of the printer cover.

⑤ Close the cover after inserting the end of paper into the hole of cover gap.



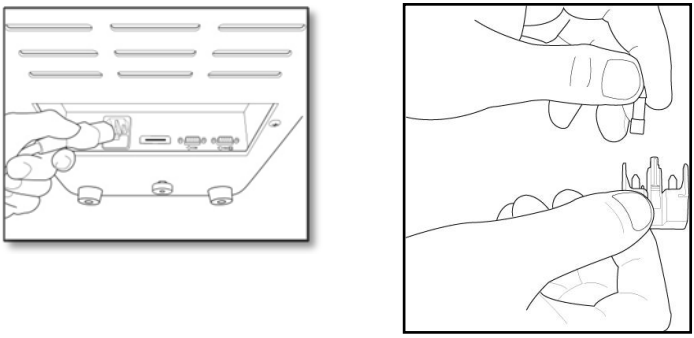
[Figure 10-1. Changing printer paper]

10.2.2. Chin rest paper

① Pull two(2) pins out of the chin-rest.
② Push the pins into the holes of chin-rest paper. You can put 50 sheets of it on.
③ Insert the pins into each one of two(2) holes in the chin-rest.

10.2.3. Replacing Fuse

① Turn off and raise the HRK-8000A with two arm carefully.
② Remove the Power cord
③ Pick the fuse holder out from the Power inlet
④ Exchange the fuses
⑤ Insert the fuse folder



[Figure 10-2. Replacing Fuse]

INFORMATION

Use 250V, T3.15AL fuse for the Auto Ref/Keratometer HRK-8000A.

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.

10.4. As changing the installation place of the equipment

① Off the power switch of main body.
② Take the power connection cable apart.
③ Lock the clamping bolt by rotating it clockwise.
④ Move it while maintaining the horizontality of it by holding the bottom of the main body.

10.5. Disposal

NOTE
To dispose the instrument, accessories, and components, follow local governing ordinances and recycling plans regarding disposal or recycling of instrument or device components. Especially a lithium battery may pollute the environment if the instrument or a lithium battery is abandoned. When disposing packing materials, sort them by the materials and follow local governing ordinances and recycling plans.

11. Service Information

Repair: If the problem is not solved in spite of the settlement according to the contents of chapter 10, please contact to Huvitz's agent with the information on the following items.

① Name of Equipment Type : HRK-8000A
② Typical No. of Equipment : Typical number consisted of 8 digits and characters written on its name plate
③ Explanation on its symptom : Description in details

Supply of parts required for repair:

④ The preservation period of parts required for repair of this machine is by eight (8) years after stopping to produce the product.

Parts to be repaired by qualified service manpower :

⑤ Parts below are consumable in their characteristics, or the quality of them shall de degraded after the long time use. User should not replace them by him or herself. Please contact to Huvitz's agent for the replacement if these parts are consumed enough or degraded by the long time use.
⑥ Back-up battery for clerk and data

⚠ CAUTION

As this machine use lithium battery, the reckless abandon of the machine itself or the lithium battery can cause the environmental pollution. Please contact to the professional waste disposal company.

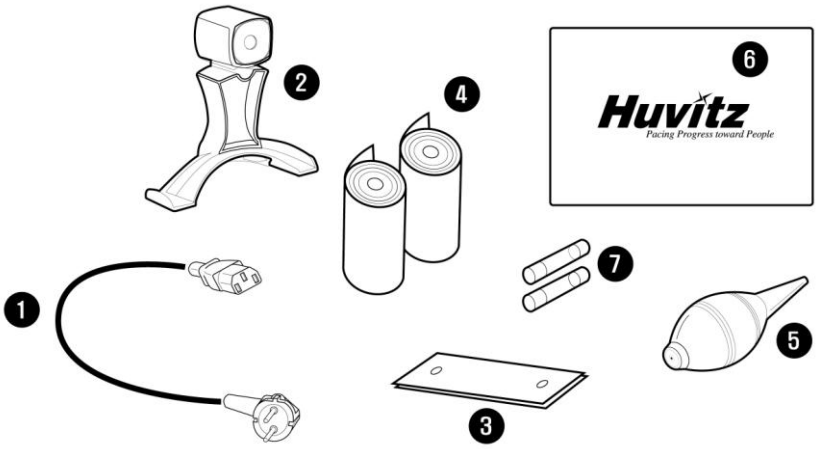
12. Main Specifications

Measurement Mode	
Continuous Keratometry & Refractometry (K/R Mode)	
Refractometry (REF Mode), Keratometry (KER Mode)	
Keratometry Peripheral (KER-P Mode)	
Base Curve of Contact Lens(CLBC Mode)	
Refractometry	
Vertex Distance(VD)	0.0, 12, 13.5, 15.0
SPH	− 30.00 ~ +25.00 D (In case of VD = 12 mm)
CYL	0.00 ~ ± 12.00 D (0.12/0.25 D Unit)
Axis(AX)	1 ~ 180° (1° Unit)
Cylinder Form	−, +, MIX
Pupil Distance(PD)	10 ~ 85 mm
Minimum pupil diameter	Ø2.0 mm
Keratometry	
Radius of Curvature	5.0 ~ 13.0 mm (0.01 mm Unit)
Corneal Power	33.00 ~ 67.50 D (In case that the corneal equivalent refractive power is 1.3375, 0.05/0.12/0.25 D Unit)
Corneal Astigmatism	0.0 ~ − 15.00 D (Increments: 0.05/0.12/0.25 D)
Axis	1 ~ 180° (1° Unit)
Corneal diameter	2.0 ~ 13.0 mm (0.1 mm Unit)

Working range of auto-tracking	
Up & Down	± 15 mm
Right & Left	± 5 ± 2 mm
Back & Forth	± 5 ± 2 mm
Working range of auto-shooting	
Up & Down	± 0.13 mm or less
Right & Left	± 0.13 mm or less
Back & Forth	± 0.5 mm or less
Movable range of horizontal direction(by joystick)	
Up & Down	30 mm or more
Right & Left	92 mm or more
Back & Forth	38 mm or more

Data Storage	
Measured value of ten(10) times amount for each left/right eye	
Hardware specification	
Built-in printer	Line printer of heat printing type
Power saving function	As stopping to measure for about 5 minutes, the main power is shut. It returns as pushing buttons.
Monitor	7.0" TFT LCD with touch screen
Electrical Power	AC100 ~ 240 V, 50/60 Hz
Current	1 A

13. Accessories



[Figure 13-1. Accessories]

1. Power Cable(AC 220 V / 60 Hz Power plug or other)·····1 unit
2. Model Eye (Sph – 5.0 D ~ – 5.5 D)·····1 unit
3. Chin Rest Paper(100 sheets)····· 1 bundle
4. Printer Paper·····2 rolls
5. Wind-blower·····1 unit
6. Dust Cloth·····1 piece
7. Fuse(250 V / 3.15 A)·····2 units

⚠ WARNING

For continued protection against risk of fire replace only with same type & rating of fuse.

- Fuse (250 V T3.15 AL)

14. EMC Information

14.1 Guidance and manufacturer's declaration – electromagnetic emissions

The EUT is intended for use in the electromagnetic environment specified below. The customer or the user of the EUT should assure that it is used in such an environment.		
Immunity test	**Compliance**	**Electromagnetic environment –guidance**
RF Emissions CISPR 11	Group 1	The EUT uses RF energy only for its internal function. 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 EUT is suitable for use in ail establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ Flicker emissions IEC 61000-3-3	Complies	

14.2 Guidance and manufacturer's declaration – electromagnetic immunity

The EUT is intended for use in the electromagnetic environment specified below. The customer or the user of the EUT should assure that it is used in such an environment.			
Immunity test	**IEC 60601 Test level**	**Compliance level**	**Electromagnetic environment –guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6kV Contact ±8kV air	±6kV Contact ±8kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2kV for power supply lines ± 1kV for input/output lines	±2kV for power supply lines ± 1kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1kV differential mode ±2kV common mode	±1kV differential mode ±2kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines	<5% U_T (>95% dip in U_T) for 0.5cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T	<5% U_T (>95% dip in U_T) for 0.5cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T	Mains power quality should be that of a typical commercial or hospital environment. If the user of the EUT image intensifier require continued operation during power mains interruptions,

IEC 61000-4-11	(30% dip in UT) for 25 cycle <5% UT (<95% dip in UT) for 5 s	(30% dip in UT) for 25 cycle <5% UT (<95% dip in UT) for 5 s	it is recommended that the EUT image intensifier be Powered from an uninterruptible power supply or a battery.
Power frequency (50/60Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels character ristic of a typical location in a typical commercial or hospital environment.
NOTE UT is the a.c. mains voltage prior to application of the test level.			

14.3 Guidance and manufacturer's declaration – electromagnetic immunity

The EUT is intended for use in the electromagnetic environment specified below. The customer or the user of the EUT should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80MHz	3 Vrms 150 kHz to 80MHz	Portable and mobile RF communications equipment should be used no closer to any part of the EUT, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5GHz	3 V/m 80MHz to 2.5GHz	**Recommended separation distance** $d = [\frac{3,5}{V_1}]\sqrt{P}$ $d = [\frac{3,5}{E_1}]\sqrt{P}$ 80 MHz to 800 MHz $d = [\frac{7}{E_1}]\sqrt{P}$ 800 MHz to 2,5 GHz 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).

			Field strengths from fixed RF transmitters, as deter-mined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol :

NOTE 1) At 80MHz and 800MHz, 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.

[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 EUT is used exceeds the applicable RF compliance level above, the EUT should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the EUT.

[b] Over the frequency range 150kHz to 80MHz, field strengths should be less than [V_1] V/m.

14.4 Recommended separation distances between portable and mobile RF communications equipment and the EUT

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

Rated maximum output power of transmitter [W]	Separation distance according to frequency of transmitter [m]		
	150kHz to 80MHz $d = [\frac{3,5}{V_1}]\sqrt{P}$	80MHz to 800MHz $d = [\frac{3,5}{E_1}]\sqrt{P}$	800MHz to 2.5GHz $d = [\frac{7}{E_1}]\sqrt{P}$
	V_1=3Vrms	E_1=3V/m	E_1=3V/m
0.01	0.116	0.1166	0.2333
0.1	0.368	0.3687	0.7378
1	1.166	1.1660	2.3333
10	3.687	3.6872	7.3785
100	11.660	11.6600	23.333

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (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 80MHz and 800MHz, the separation distance for 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.

14.5 Immunity and Compliance Level

Immunity test	IEC 60601 Test Level	Actual Immunity Level	Compliance Level
Conducted RF IEC 61000-4-6	3Vrms 150kHz to 80MHz	3Vrms	3Vrms
Radiated RF IEC 61000-4-3	3Vrms 80MHz to 2.5GHz	3V/m	3V/m

14.6 Guidance and manufacturer's declaration – electromagnetic immunity

The EUT is intended for use in the electromagnetic environment specified below. The customer or the user of the EUT should assure that it is used in such an electromagnetic environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80MHz	3 Vrms 150 kHz to 80MHz	The EUT must be used only in a shielded location with a minimum RF shielding effectiveness and, for each cable that enters the shielded location with a minimum RF shielding effectiveness and, for each cable that enters the shielded location
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5GHz	3 V/m 80MHz to 2.5GHz	Field strengths outside the shielded location from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than 3V/m.[a] Interference may occur in the vicinity of equipment marked with the following symbol:

NOTE 1) These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.
NOTE 2) It is essential that the actual shielding effectiveness and filter attenuation of the shielded location be verified to assure that they meet the minimum specification.

[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 outside the shielded location in which the EUT is used exceeds 3V/m, the EUT should be observed to verify normal operation.
If abnormal performance is observed, additional measures may be necessary, such as relocating the EUT or using a shielded location with a higher RF shielding effectiveness and filter attenuation.

15. Service Information

If the instrument appears malfunctioning, before calling a customer service, it is highly recommended to check the instrument according to the troubleshooting procedure in section 11 of this manual.

If any problem persists or the instrument is damaged or malfunctioning, contact Huvtiz or local distributor for service with the following information:

- Name of the instrument: Auto Ref/Keratometer HRK-8000A
- Serial number of the instrument: refer to the 9-digit number on its product label or name plate
- Descriptions of Problem: In detail

Date of Purchase: _____

Dealer's Name: _____

Dealer Address: _____

Dealer Phone No.: _____

Model No.: _____

Serial No.: _____

(※ Huvitz recommends customers to fill up the following form after purchase and retain this manual as a permanent record of purchase.)

Write us at:

HUVITZ Co., Ltd.

Huvitz B/D, 689-3 Geumjeong-dong

Gunpo-si Gyeonggi-do, South Korea

435-862

Tel: +82-31-442-8868

Fax: +82-31-442-8619

URL:http://www.huvitz.com

e-mail: info@huvitz.com