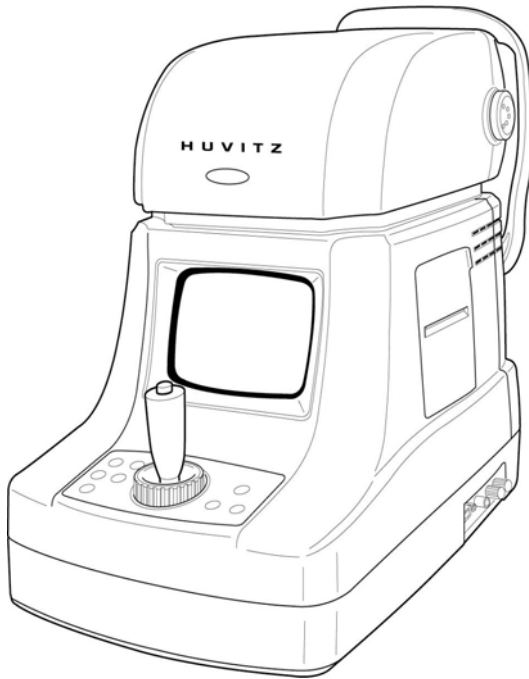


# Operator's Manual

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Auto Ref/Keratometer MRK-3100P



**Huvitz**  
Pacing Progress toward People

## IMPORTANT NOTICE

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.

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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.

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## **1. Introduction**

### **1.1. Outline of the instrument**

The Auto Ref/Keratometer MRK-3100P contains both a refractometer and keratometer. The refractometer measures the refractive power of the patient's eyes, and gives the spherical, cylindrical power and axis of the cylinder. The keratometer measures the corneal curvature, and gives the corneal refractive power, axis of the corneal meridian, and corneal cylindrical power.

The Auto Ref/Keratometer MRK-3100P contains retro-illumination mode and size mode. In retro-illumination mode, you can see the abnormal crystalline lenses, corneas, and scratches on the contact lens with the IR(infra-red) light that is reflected from the retina. In size mode, you can measure the size of pupil, cornea, and iris size by freezing the image.

Also the Auto Ref/Keratometer MRK-3100P contains CLBC(contact lens base curve) measurement mode, and PD(pupil distance) measurement function.

### **1.2. Classification**

Protection against electric shock: Class I

Applied Parts: Type B applied parts.

Protection against harmful ingress of water: Ordinary, IPX0

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.

Mode of operation: Continuous

### 1.3. Certification

 <p><b>UL60601-1</b> <b>CAN/CSA C22.2</b> <b>NO.601.1</b></p>	 <p><b>MEDICAL EQUIPMENT WITH RESPECT TO ELECTRIC SHOCK FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH UL 60601-1, AND CAN/CSA C22.2 NO.601.1</b></p>
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(This applies only to the instrument that has the certification symbol printed explicitly on the product label.)

## 2. Safety Information

### 2.1. Introduction

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**

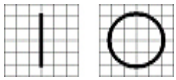




“Caution” indicates the presence of a hazard that could result in minor injury, or property damaged if ignored.



## 2.2. Safety Symbols



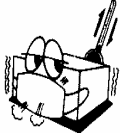
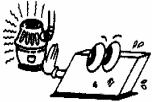
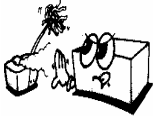
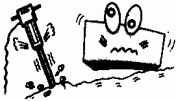
The International Electrotechnical Commission (IEC) has established a set of symbols for medical electronic equipment which classify a connection or warn of any potential hazards. The classifications and symbols are shown below.

### Save this instruction

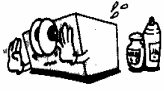


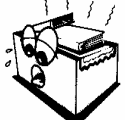


	<p>I and O on power switch represent ON and OFF respectively.</p>
	<p>Type B Isolated patient connection.</p>
	<p>This symbol identifies a safety note. Ensure you understand the function of this control before using it. Control function is described in the appropriate User's or Service Manual.</p>
	<p>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.</p>
	<p><u>Disposal of your old appliance</u></p> <ol style="list-style-type: none"> <li>1. 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.</li> <li>2. 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.</li> <li>3. The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health.</li> <li>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.</li> </ol>

## 2.3. Environment factors

**Avoid the following environments for operation or storage:**

	<p>Where the equipment is exposed to water vapor. Don't operate an equipment with a wet hand.</p>
	<p>Where the equipment is exposed to direct sunlight.</p>
	<p>Where the temperature changes extremely. Normal operating temperature range is from 10°C to 40°C, Humidity is from 30% to 75%.</p>
	<p>Where it is near the heat equipment.</p>
	<p>Where the humidity is extremely high or there is a ventilation problem.</p>
	<p>Where the equipment is subject to excessive shocks or vibrations.</p>

10 Auto Ref/Keratometer MRK-3100P -----

	<p>Where equipment is exposed to chemical material or explosive gas.</p>
	<p>Be careful not to be inserted dust, especially, metal.</p>
	<p>Don't disassemble the product or open. We aren't responsible for it for nothing.</p>
	<p>Be careful not to close the fan located on the lateral or back side of the equipment.</p>
	<p>Don't plug the AC power cord into the outlet before the connection between devices of the equipment is completed. This can generate the defect.</p>
	<p>Pull out the power cord with holding the plug, not the cord.</p>

Avoid places where the ambient temperature falls below 10°C or exceeds 40°C for normal operation, or below -10°C or exceeds 40°C (14°F-104°F) for transportation and storage. Humidity should be maintained between 30 and 75% for normal operation, transportation and storage. Avoid environments where the equipment is exposed to excessive shocks or vibrations.

## 2.4. Safety Precautions

This equipment has been developed and tested according to safety standards as well as national and international standards. 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. Do not put or use this device in humid rooms. Humidity should be maintained between 30 and 75% for normal operation. Do not expose the device to water splashes, dripping water, or sprayed water. 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 a properly trained and qualified person.
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,

## 12 Auto Ref/Keratometer MRK-3100P -----

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. This equipment may only be used together with accessories supplied by Huvitz's. If the customer makes use of other accessories, use them only if their safe 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. Keep the User's Manual and Service Manual in a place easily accessible at all times for persons operating and maintaining the equipment.
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, visually check the equipment for exterior mechanical damage(s) and for proper function.
15. Do not cover any ventilation grids or slits.
16. Immediately turn off and unplug any equipment that gives off smoke, sparks, strange noises, or odors.
17. Battery serving – Danger of explosion if battery is incorrectly replaced. Replace

only with the same or equivalent type recommended by the manufacture. Dispose of used batteries according to the manufacture's instructions.

18. Handle with care – High vacuum picture tube is dangerous to handle. Refer servicing to qualified personnel. "X-RAY WARNING: When picture tubes are operated at very high voltage and when personal exposure is prolonged at close range, special shielding precautions against x-ray radiation may be needed."
19. Instruction to the operator: Not to touch signal input, signal output or other connectors, and the patient simultaneously.
20. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - Reorient or relocate the receiving device.
  - Increase the separation between the equipment.
  - Connect the equipment into an outlet on a circuit different from that to which the other device(s) are connected. Consult
  - the manufacturer or field service technician for help.
21. External equipment intended for connection to signal input, signal output or other connectors, shall comply with relevant IEC standard (e.g., IEC 60950 for IT equipment and IEC 60601 series for medical electrical equipment). In addition, all such combination - systems - shall comply with the standard IEC 60601-1-1, Safety requirements for medical electrical systems. Any person who connects external equipment to signal input, signal output or other connectors has formed a system and is therefore responsible for the system to comply with the requirements of IEC60601-1-1. If, in doubt, contact qualified technician or your local representative.

### 3. Features

**1. Various Measurements Available**

Both Refractometry and Keratometry can be measured with this instrument.

**2. Wide Measurement Range**

Because the Auto Ref/Keratometer MRK-3100P model covers wide measurement ranges, from -25D to +22D, even an examinee with strong myopia can be measured.

**3. Minimum Pupil Diameter**

Refractometry can cover minimum pupil diameter up to Ø2.2mm.

**4. More Accurate Measurement**

You can measure more accurately because the fogging method of the eye fixation target makes the examinee's eye comfortable.

**5. Various Options**

You can select various options for displaying results of the measurement.

**6. Pupil Distance (PD)**

After finishing the measurement of both eyes, you can get the value of pupil distance.

**7. Easy Connection with Other Equipment**

This instrument is designed to connect to other equipment such as a VCR or TV monitor.

**8. Retro-Illumination**

The condition of cataracts and scratches on contact lenses can be observed in Retro-Illumination mode.

A maximum of two images for each eye can be stored in the memory and displayed in the monitor screen to be shown to the patients

**9. Software Option**

For connection to the computer, customer management software will be provided. Thus eyesight data and sales/repository data can be managed automatically.

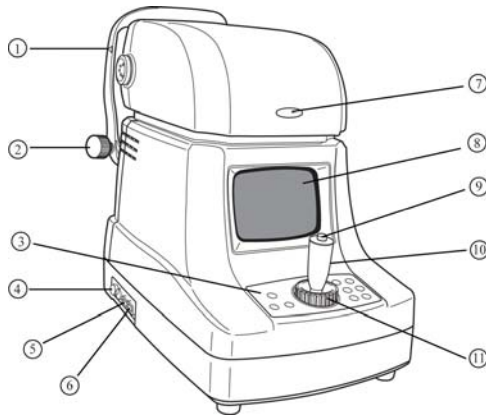


## 4. Notes for Using the Instrument

1. Do not hit or drop the instrument. The instrument may be damaged if it receives a strong impact. The impact can damage the function of this instrument. Handle it with care.
2. Install this instrument on a level, stabilized table with no vibration to keep it normal state.
3. Exposure to direct sunlight or very bright indoor lights can influence the results of measurements.
4. If you want to connect this with other equipment, consult the dealer.
5. 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.
6. Keep clean the objective glass of the examinee side. If it is stained with other substance, it may cause an error or inaccurate measurements.
7. Don't use organic solution such as thinner, benzene, etc. to clean the surface of this instrument. It may damage the instrument.
8. When moving the Auto Ref/Keratometer MRK-3100P, fix the stage, always check whether the power supply is off, and then lift the bottom of the unit with both hands.
9. There is a risk of explosion if an incorrect type of battery is used. Dispose used batteries according to the instructions.
10. Disconnect the power supply and consult the dealer in case of smoke, strange odors, or noise during operation.

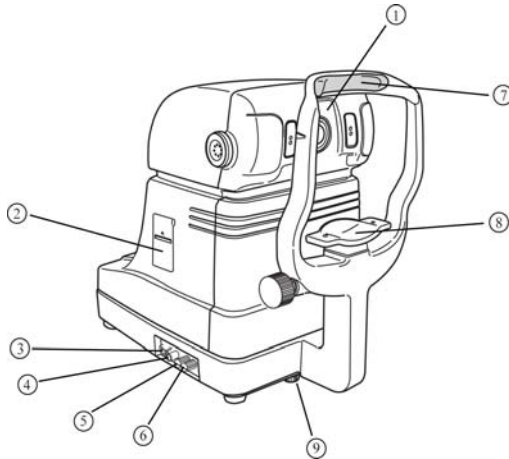
## 5. Configurations

### 5.1. Main Unit



[ Figure 1. Front View ]

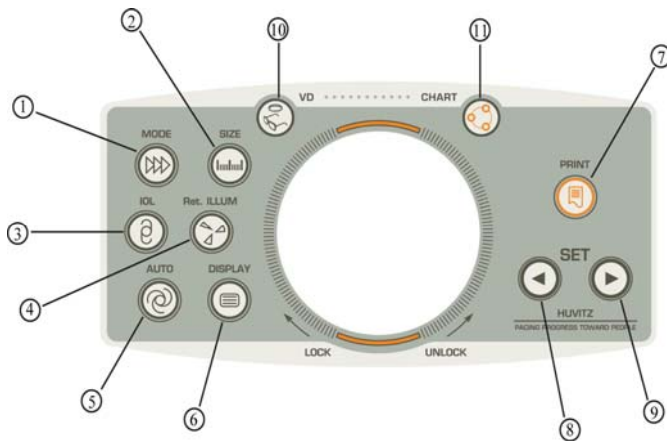
- 
1. **Height Adjustment mark** : Moving the height of chin rest up and down.
  2. **Height Adjustment lever**: Adjust the height of the examinee's eye to this mark.
  3. **Operation Panel** : There are several function buttons
  4. **Fuse** : Fuse which protects this instrument from the excess electric power or shock.
  5. **Power Supply Connector** : Connector for the power cable.
  6. **Power switch** : Switch for turning power ON or OFF.
  7. **Operation Lamp** : Indicate whether the power is ON or OFF.
  8. **Display Monitor** : Monitor that displays measurement results.
  9. **Measurement Button** : Press this button to start measurements.
  10. **Operation Lever** : Use this lever for alignment and focusing.
  11. **Stage Holding Dial** : Lock the stage to the base.



[ Figure 2. Side View ]

- 
1. **Measurement Window** : Window for the examinee to look into the target image for measurements.
  2. **Printer** : To print results of measurement.
  3. **Interface Connector** : Connector for external computer.
  4. **External Monitor Connector** : Connector for external monitor or VTR.
  5. **Brightness Adjuster** : Adjust the brightness of monitor.
  6. **Contrast Adjuster** : Adjust the contrast of monitor.
  7. **Forehead Rest** : Place the examinee's forehead against it to avoid shaking.
  8. **Chin Rest** : Place the examinee's chin on it to avoid shaking.
  9. **Clamping Bolt** : To lock the system stage to the base.

## 5.2. Operation Panel



[ Figure 3.Operation Panel ]

1. **MODE Button** : To change measurement mode.
2. **SIZE Button** : To measure the size of the cornea.
3. **IOL Button** : To measure the examinee's eyesight with cataract or intraocular lens(IOL).
4. **Ret. ILLUM Button** : To check the status of the cornea, crystalline lens and contact lens by freezing images obtained by retro-illumination.
5. **AUTO Button** : To switch manual or automatic measurement mode.
6. **DISPLAY Button** : To display the measured results.
7. **PRINT Button** : To print the measured results.
- 8, 9. **SET Button** : To change the display style of the measured results.
10. **VD Button** : To change the VD(Vertex Distance) value.
11. **CHART Button** : To select a chart from 3 charts(A,B and C type)

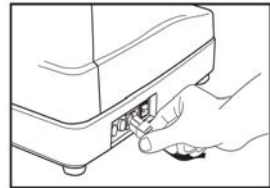
## 6. Installation and Preparation

### 1. Release stage lock

Fully turn the Clamping Bolt in the underneath cover beside the chin rest in the counterclockwise direction. And turn the stage holding dial in the lower part of the joystick in counterclockwise direction to release the stage lock.

### 2. Connection of the Power Cable

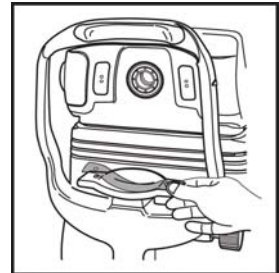
- Place the Auto Ref/Keratometer MRK-3100P on the table.
- Plug the power cable to the grounded 3-pin AC receptacle
- Connect the power supply after checking that the power switch is off.



[ Figure 4.  
Connection of the Power cable ]

### 3. Inserting Chin Rest Tissue

- Pull up the pressing pins in right and left part of the chin rest.
- Insert the pressing pin into the right/left hole of the chin rest tissue.
- Attach the chin rest paper with pressing pin to chin rest.



[ Figure 5.  
Inserting Chin Rest Tissue ]

**4. Printer Paper Setting**

See Section 10.1 to know the load sequence of the printer paper.

**5. Input Message**

Enter in advance the contents that you want to print such as hospital name, address, etc in the message editing window. See Section 9.3 to refer to the message input method.

**6. Checking the Setting**

Check the setting such as vertex distance of cornea, cylinder form, increment of sphere and cylinder, form of displaying results of keratometry, corneal equivalent refractive index, date, etc in the SETUP Mode window.

**7. Data Transfer to Other Instruments**

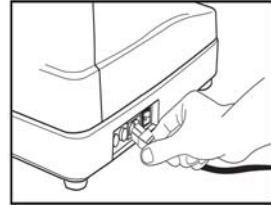
In the case of transferring the measured results to other instruments, first connect the cable to the interface connector of this instrument and then prepare the other instruments. For further information about it including networking with other Huvitz instruments such as CDR3100 and CLM 3100P etc., consult the dealer or the agent who/where you purchased this instrument.

## 7. Operations using Model Eye

Make sure the power cable is properly connected. For connection, see "connection of the power cable" as in Figure.

Press the power switch of the instrument to on.

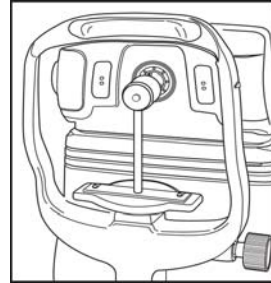
Confirm that the booting screen is displayed and then the measurement screen will be displayed in a few seconds.



[ Figure 6.  
Connection of the Power cable ]

- Attach the model eye

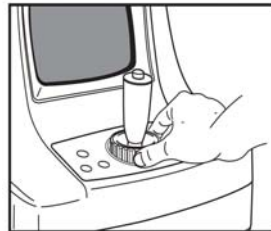
Remove the chin rest tissue and align the holes on the base of the model eye with the holes on the chin rest and insert pins.



[ Figure 7.  
Attach the Mode Eye ]

- Release the stage lock

Fully turn the Clamping Bolt underneath the cover beside the chin rest in the counterclockwise direction. And fully turn the stage holding dial in the lower part of the joystick in the counterclockwise direction to release the stage lock.




[ Figure 8.  
Release the Stage rock ]

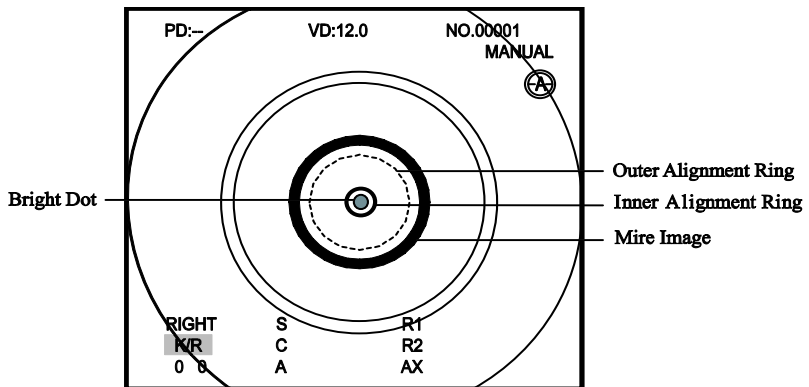
- Enter K/R or REF Mode.

If neither “K/R” nor “REF” are displayed on the monitor, press MODE button until either one is displayed.

- Adjust the position and focus the model eye

Operate laterally or turn the operation lever until the target model eye is in the center of the monitor screen and a bright dot appears near the Inner Alignment Ring. Place the Bright Dot in the center of Inner Alignment Ring. Focus the model eye to make the Bright Dot minimum size, and then the target symbol(  ) is appeared on the screen automatically if you set FOCUS option to be “ON” in Setup mode (See Section 9.3)

1. Adjustment of the height: turn the operation lever or turn the height adjustment lever of the chin rest.
2. Adjustment of the right and left: incline the operation lever right and left so that the Bright Dot is placed at the center of Inner Alignment Ring.
3. Adjustment of the focus: Incline the operation lever forward and backward to focus the Bright Dot.



[ Figure 9. Aligning the Model Eye ]



■ Measurement

1. Manual Start Mode

- ① Adjust the position and focus the model eye
- ② Press the Measurement button. At this point, if measurement is failed with messages like TRY AGAIN at the upper-left position of the window, repeat the procedure ① and press the Measurement button again.
- ③ Check whether diopter value is measured or not. Diopter value is recorded in the bottom area of the model eye image. If you are not satisfied with the measured value, measure in the same way and check again.

2. Auto Start Mode

- ① Press the AUTO button on the operation panel to do measurements in the auto start mode as being set in Setup Mode(See Section9.3)
- ② Adjust the position and focus on the model eye.
- ③ As soon as model eye is in focus properly, measurement starts automatically.
- ④ Execute the same procedures ② of manual measurement.

## 8. Measurement

### WARNING

If any of the following phenomena occur, immediately turn OFF the power, unplug the power cord from the AC receptacle, and contact a Huvitz distributor.

- When there is smoke, an odd odor or abnormal sound.
- When liquid has been spilled into the instrument or metal objects are dropped into it through an opening.
- When the instrument has been dropped or damaged

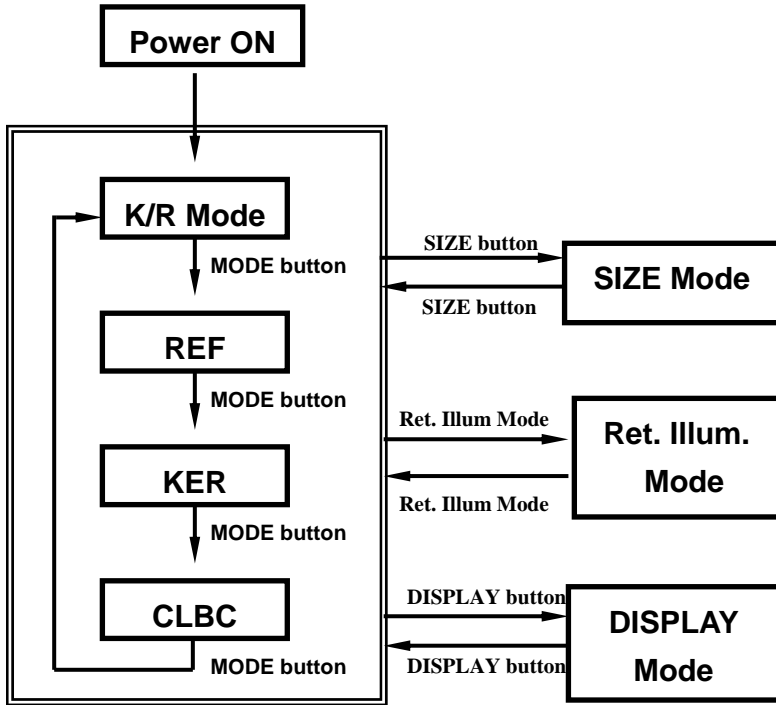
Modes are set as in the next Figure when the instrument is packaged by Huvitz. However, you can change the order of modes as you like in the Setup mode(See Section 9.3).

IOL button will be enabled at K/R mode and REF mode only. If the IOL button is pressed, IOL measurement will be performed. Press it again to return to the basic measurement mode.

During the refractometry reading, you can change the data according to the VD(Vertex Distance) value. By pressing the VD button, your specified VD value or 0 VD value are alternated.

### NOTE

When there has been no operation for 5 minutes, the power-saving mode of the instrument starts. Buzzer sounds when the instrument is entering or going out of this mode, and Ready lamp blinks. Press any one button in order to restore the function.



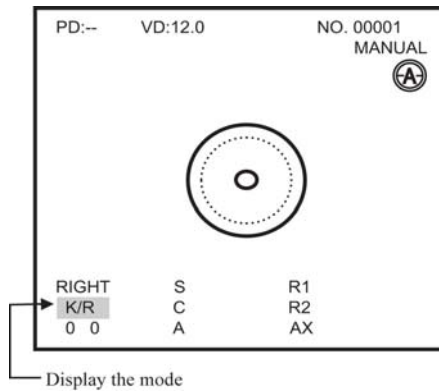
[ Figure 10. Relation between buttons and Modes ]

## 8.1. Simultaneous Keratometry and Refractometry Mode (K/R Mode)

In the K/R mode, keratometry is automatically performed before refractometry.

1. Turn the power "ON"

Initial checks of the instrument start automatically. When the checks are completed, the monitor screen will be shown as in the figure



[ Figure 11. Initial Display ]

2. Make sure the measurement screen is on

### NOTE

- If the monitor screen is not shown as in the above figure, turn the power “OFF” and turn it “ON” again after about 10 seconds.
- If the screen still doesn’t show up, then contact Huvitz distributor.
- If the image is unclear, adjust brightness or contrast by using adjusters (See section 5.1)

3. Check the settings

Check and change the settings concerning measurements including vertex distance and printing as required.

If you want to print message with the measured data, enter it.

4. Enter the K/R Mode

Press the MODE button until “K/R” is displayed on the lower left side of the display.

#### 8.1.1. Manual Start Mode

You can enter Manual Start Mode by pressing Auto Button from Auto Start Mode.

You can disable Auto Start Mode by setting the option of “AUTO START” to be “OFF” in Setup Mode (See Section 9.3)

- ① Adjust height of examinee’s eye.
  - Let the patient sit in front of the instrument.

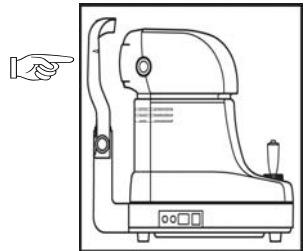
**CAUTION**

Ensure that the examinee has not placed his/her hand or fingers under the chin rest. Otherwise, hand or fingers may be hurt.

Wipe the forehead rest with ethanol or glutaraldehyde solution to disinfect it each time a different examinee uses it, in order to prevent infection.

Change the chin rest paper each time the examinee changes in order to keep the chin rest clean.

- Adjust the automatic instrument table or the chair height so that the patient can sit on the chair comfortably.
- Place his/her chin on the chin rest and let his/her forehead touch the forehead rest
- Turn the height adjustment lever for the eye of the examinee to be aligned with the height adjustment mark as indicated in the picture.



[ Figure 12. Height Adjustment Mark ]

② Perform alignment and focusing

**CAUTION**

Do not place your hand or fingers between the stage and base. Also ensure that the examinee does not place his/her hand or fingers there either. Otherwise, hand or fingers may be hurt.

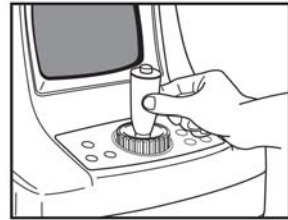
- Select the proper chart from 3 charts (type A, B and C) by pressing the Chart button on the keypad. Chart A can be chosen for normal eyes, Chart B can be used for young children whose attention is easily lost and Chart C can be used for eyes with cataracts or weak eyesight.

## NOTE


The measurement data of refractometry may be different in value according to the type of chart to be used since each chart has different brightness and size. Except for patients with cataract or weak eyesight, it would be better to choose type A chart.

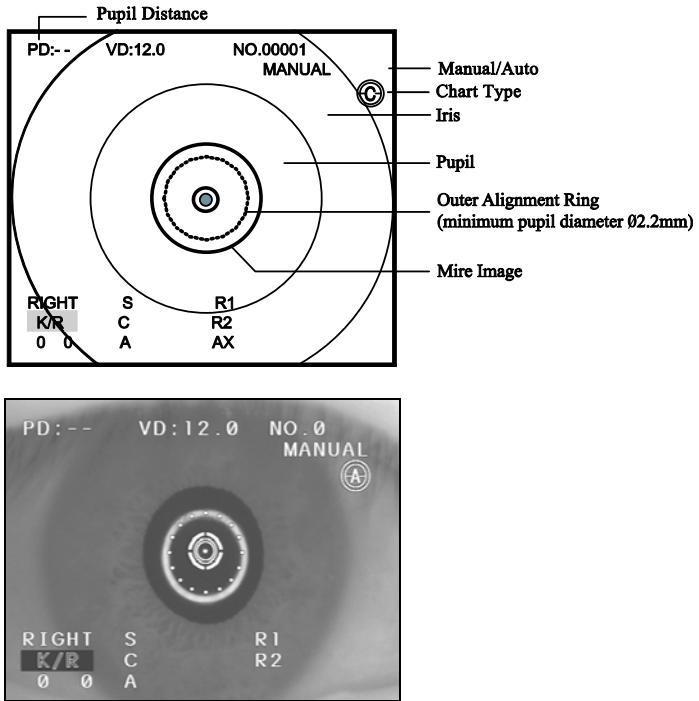
- Hold the operation lever and move the main body to the operator side.
- Slide laterally or turn the operation lever so that the right eye of the examinee is displayed on the center of monitor screen and the Mire
- Ring is concentric with the Outer Alignment ring.
- Ask the examinee to look at the image of the eye fixation target.
- Focus on the Mire Ring so that the Mire Ring image is displayed clearly.

- Adjustment of the height : turn the operation lever or turn the height adjustment lever of the chin rest.
- Adjustment of the right and left : Move the operation lever left and right so that the Outer Alignment Ring is aligned with the Mire Image.



[ Figure 13. Adjustment of the Height ]

- Adjustment of the focus : Move the operation lever forward to focus the Mire Image so that target symbol(  ) appears on the screen if you set its option to be "ON" in Setup mode (See Section 9.3).



[ Figure 14. K/R Mode Display ]

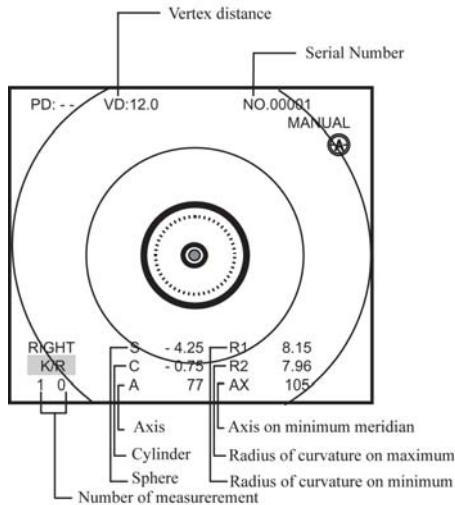
## NOTE

- Slide the stage forward/backward and right/left if you are unsatisfied with the operation lever control.
- If the Mire Image and pupil are not concentric, instruct the examinee to look at the image in the center of the chart picture. Otherwise, measurement error may occur due to aberration.



③ Measurement

- Press the Measurement button.
- Measurements will be continuously performed while the Measurement button is pressed.
- The measurement results will be displayed on the monitor.
- In the case of the continuous measurement, the results of the previous measurement will be displayed.
- When measurement results are displayed on the monitor, repeated pressing of (◀) or (▶) button cycles through each cornea measured results ( R1/R2/AX → K1/K2/AX → AR/CY/AX ).



[ Figure 15. K/R Display Information ]

## NOTE

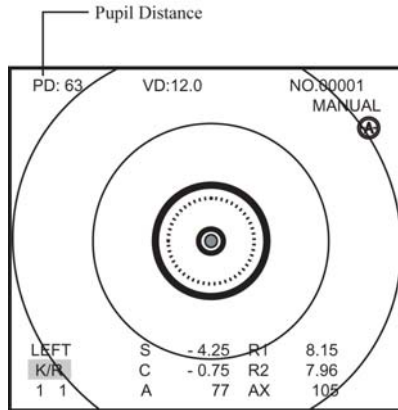
- During continuous refractometry, there are some measurement errors because of the accommodation of examinee's eye. Also continuous measurement in IOL mode may be worse because of the incomplete removing of the accommodation of examinee's eye.
- There can be errors if the Outer Alignment Ring and the pupil is unaligned.
- When the cornea or pupil is extremely deformed, measured values may be less reliable and the low reliability mark(#) will appear in the end of AXIS.

### ④ Repeated measurement

- Measurements could be performed repeatedly if necessary.
- The newest result will be displayed on the monitor for each repeated measurement.
- A maximum of 10 newest data items for both right and left eyes will be stored in memory except for error data. And the data can be shown in the display window using the "Display" button.


### ⑤ Measurement of the opposite eye.

- Slide the stage to the right side and measure the left eye.
- After both eyes are measured, pupil distance(PD) will be displayed on the monitor
- If the stage is slide back to the right side again, measured values will be erased.



[ Figure 16. Pupil Distance Display ]

⑥ Print

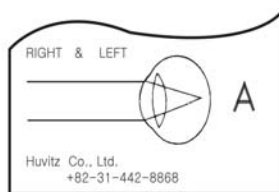
- Press the Print button.
- The selected data in the SETUP mode will be printed(See Section 9.3).
- If the printer is in operation, the printing icon() is displayed on the left middle part of the window.
- Hold the top left corner of printer paper and pull it diagonally to giving it a sharp tug to tear it off.
- Fill the name of the examinee in the NAME box if necessary.

**NOTE**

- Results will be erased after printing.
- It is recommended that a hard copy of the printouts be made if you wish to store it for a long time, because printouts on the thermal paper are apt to deteriorate.

⑦ The various display types

- During the refractometry reading, you can change the sign of the cylindrical power by pressing the left arrow key(◀).
- During the refractometry reading, you can change the data according to the VD value. By pressing the VD button, your specified VD value or 0 VD value are alternated.
- During the keratometry reading, you can change the display types by pressing the right arrow key(▶). Three types which are R1/R2/AX, K1/K2/AX, and AR/CY/AX are provided.



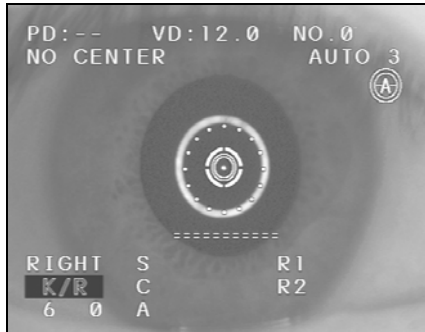
NAME:			
HUVITZ MRK-3100P			
DATE 2002/08/27			23:02
NO. 00009			
[REF]		VD: 12.0	
	Cyl.	Form: (-)	
<R>	SPH	CYL	AX
	-2.25	+0.00	
	-2.25	+0.00	
	-2.25	+0.00	
	-2.25	+0.00	
	-2.25	+0.00	
AVE	-2.25	+0.00	
<L>	SPH	CYL	AX
	-10.00	+0.00	
	-10.00	+0.00	
	-10.00	+0.00	
	-10.00	+0.00	
	-10.00	+0.00	
AVE	-10.00	+0.00	
PD = 63mm			
<KER>	index : 1.3375		
<R>	mm	D	AX
R1	7.97	42.25	
R2	7.97	42.25	
AVE	7.97	42.25	
CYL			
<L>	mm	D	AX
R1	7.96	42.50	
R2	7.96	42.50	
AVE	7.96	42.50	
CYL			

[ Figure 17. example of printout (K/R) ]

### 8.1.2. Auto Start Mode

You can enter Auto Start Mode by pressing the Auto Button from Manual Start Mode. You can disable Auto Start Mode by setting the option of "AUTO START" to be "OFF" in Setup Mode (See Section 9.3). In Auto Start Mode, the measurement starts automatically as it being set in Setup Mode (See Section 9.3) without pressing the measurement button when the alignment is done properly.

- ① Perform alignment and focusing
  - Select the proper chart from 3 charts (type A, B and C) by pressing the Chart button on the keypad.
  - Hold the operation lever and move the main body to the operator side.
  - Move laterally or turn the operation lever so that the right eye of the examinee is displayed on the center of monitor screen and the Mire Ring is concentric with the Outer Alignment ring.
  - Ask the examinee to look at the image of the eye fixation target.
  - Focus on the Mire Ring so that the Mire Ring image is displayed clearly.
  
- ② Measurement
  - When alignment and focusing are performed properly, measurement starts automatically.
  - After measurement is performed many times as being set in the Setup Mode, i.e, 3 or 5 times, the newest results will be displayed on the monitor screen.
  - A maximum of 10 newest data will be stored in the memory and it can be displayed in the screen by pressing the Display Mode.



③ Measurement of the Other Eye.

- Move the stage to the right side and measure the left eye.
- After both eyes are measured, pupil distance(PD) will be displayed on the monitor.

④ Print

- If you have measured only one eye, press Print button.
- If both eyes are measured, the results will be printed automatically if "A-PRINT" is set to "ON" in Setup Mode.
- The selected message in the SETUP mode and data will be printed (See Section 9.3).

**8.1.3. Various Messages**

	<b>Display</b>	<b>Name</b>	<b>Meaning</b>	<b>Remedy</b>
Refracto- metry	#	Mark of low confidence level	Measured value with low confidence level	Measure again
	+ OUT	Exceed measurement range	Sphere exceeds +22D	Impossible to measure
	- OUT	Exceed measurement range	Sphere exceeds -25D	
	C OUT	Exceed measurement range	Astigmatism exceeds $\pm 10D$ .	
Kerato- metry	#	Mark of low confidence level	Measured value with low confidence level	Measure again
	+ OUT	Exceed measurement range	Radius of curvature exceeds 10.2mm.	Impossible to measure
	- OUT	Exceed measurement range	Radius of curvature is smaller than 5.2mm.	
	C OUT	Exceed measurement range	Astigmatism exceeds 15.73D.	

See the following description when "TRY AGAIN" occurs.

<b>TRY AGAIN</b>	<b>Trouble Shooting</b>
Alignment is improper	Measure after aligning the pupil and focusing the Bright Dot properly.
When the eyelid or the eyelashes obstructs the pupil.	Instruct the examinee to open his or her eyes wide or slide eyelid upward and measure again.

When the pupil is smaller than the Outer Alignment Ring.	Even with the minimum pupil diameter of 2.2mm, it is possible to measure in the bright place. However, don't expose examinee's eyes to direct sunlight or too bright indoor lights in order to prevent the contraction of examinee's pupil.
When the examinee has some illness like cataracts.	If cataract is not severe, measurement can be performed in IOL mode.
The examinee with intraocular lens(IOL)	Measure in the IOL mode when there are some defects in the cornea or crystalline lens.
When the Mire Image is blurred because of tears.	Instruct the examinee to open and close his or her eyes several times and measure again.
When the Mire Image is not clear because the cornea is dry.	
When the Mire Image is odd shaped because of the Strong Irregular Astigmatism or corneal disease.	Impossible to measure.
To exceed measurement range.	



## 8.2. Refractometry(REF Mode)

Only refractometry can be performed in the REF mode.

1. Make sure the measurement screen is on.
2. Enter the REF Mode by pressing the MODE button until "REF" is displayed in the lower left side of the display.
3. Check the settings.

### 8.2.1. Manual Start Mode


You can enter Manual Start Mode by pressing Auto Button from Auto Start Mode.  
You can disable Auto Start Mode by setting the option of "AUTO START" to be "OFF" in Setup Mode (See Section 9.3).

- ① Perform alignment and focusing



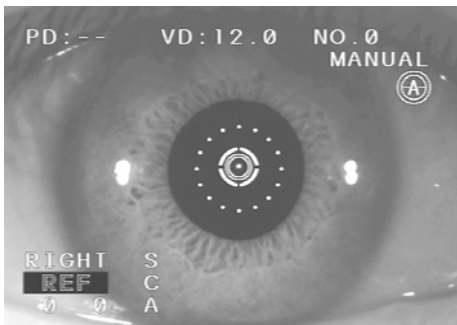
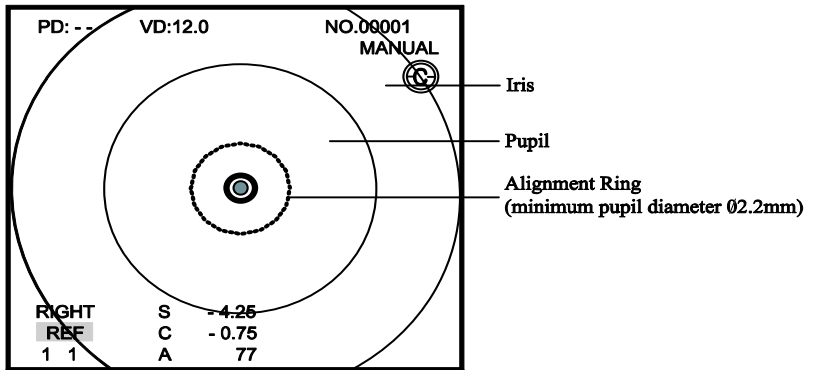
Do not place your hand or fingers between the stage and base. Also ensure that the examinee does not place his/her hand or fingers there either. Otherwise, hand or fingers may be injured.

- Hold the operation lever and move the main body to the operator side.

- Move laterally or turn the operation lever so that examinee's eye is displayed on the center of the monitor screen and luminous Bright Dot is on the center of the Inner Alignment ring.
- Ask the examinee to look at the image of the eye fixation target.
- Focus Bright Dot so that target symbol (  ) appears on the screen if you set FOCUS option to "ON" in Setup mode (see Section 9.3).

② Measurement

- Press the measurement button.
- Measurements will be performed continuously while the Measurement button is pressed.

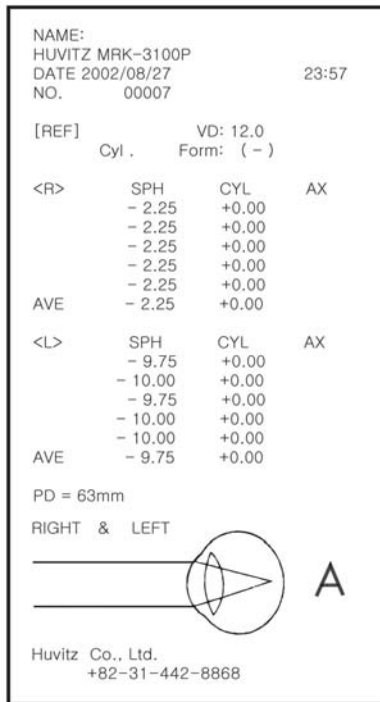


[ Figure 19. REF Mode Display ]

## NOTE

- During continuous refractometry, there are some measurement errors because of the accommodation of examinee's eye. Also continuous measurement in IOL mode may be worse because of the incomplete removing of the accommodation of examinee's eye.
- There can be errors if the Outer Alignment Ring and the pupil is unaligned.

- ③ Follow the same procedure③~⑤ in the Manual Start Mode of the simultaneous Keratometry and Refractometry mode (K/R Mode).
- ④ Print (See step⑥ of Section 8.1.1)



[ Figure 20. Example of printout (REF) ]

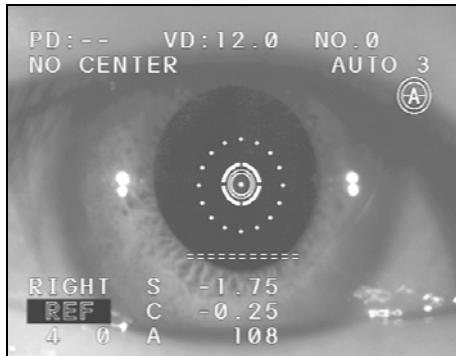
### 8.2.2. Auto Start Mode

You can enter Auto Start Mode by pressing Auto Button from Manual Start Mode.

You can disable Auto Start Mode by setting the option of "AUTO START" to "OFF" in Setup Mode (See Section 9.3)

In Auto Start Mode, measurements start automatically as being set in Setup Mode(See Section 9.3) without pressing measurement button when the alignment is done properly.

- ① Perform alignment and Focusing (See Step① in Section 8.1.2)
- ② Measurement starts automatically (See Step② in Section 8.1.2)



[ Figure 21. Auto Start in REF Mode ]

- ③ Results will be printed automatically (See Step④ in Section 8.1.2).

### 8.3. Keratometry (KER Mode)

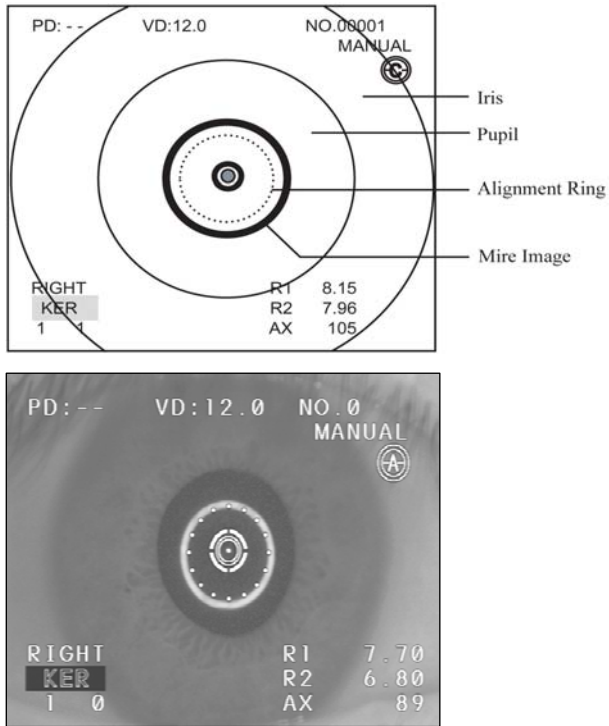
Only the curvature of the cornea can be measured in KER Mode.

Don't measure the base curve of contact lens in this mode. See Section 8.4 to refer to the contact lens base curve measurement mode.

1. Make sure the measurement screen is on.
2. Enter KER Mode by pressing the MODE button until "KER" is displayed in the lower left side of the display.
3. Check the settings.

#### 8.3.1. Manual Start Mode

- ① Perform alignment and Focusing (See Step ① and ② of Section 8.1.1)
- ② Measurement
  - Press the Measurement button.
  - Measurement will be continuously performed while the Measurement button is pressed.
  - The measurement results will be displayed on the monitor.
  - In the case of continuous measurement, the results of the newest measurement will be displayed.
  - When measurement results are displayed on the monitor, repeated pressing of (◀) or (▶) button cycles through each cornea measured results (R1/R2/AX → K1/K2/AX → AR/CY/AX ).



[ Figure 22. KER Mode Display ]

- ③ Follow the same procedure ④~⑤ of the simultaneous Keratometry and Refractometry(K/R Mode)
- ④ Print (See Step⑥ in Section 8.1.1)



[ Figure 23. Example of printout (KER) ]

### 8.3.2. Auto Start Mode

You can enter Auto Start Mode by pressing Auto Button from Manual Start Mode.

You can disable Auto Start Mode by setting the option of "AUTO START" to "OFF" in Setup Mode (See Section 9.3).

In Auto Start Mode, measurement starts automatically as being set in Setup Mode(See Section 9.3) without pressing measurement button when the alignment is performed properly.

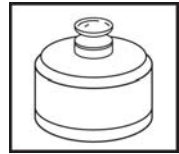
- ① Perform alignment and Focusing (See Step① of Section 8.1.2)
- ② Measurements start automatically (See Step② in Section 8.1.2)
- ③ Print (See Step④ in Section 8.1.2)

## 8.4. Contact Lens Base Curve(CLBC) Measurement mode

Base curve (posterior curve) of hard contact lens can be measured in the CLBC mode.

1. Make sure the measurement screen is on.
2. Enter CLBC Mode  
Press the MODE button until "CLBC" is displayed on the lower left side of the display.
3. Attach Contact Lens.

Fill water in the concave section of contact lens holder and paste the contact lens to the holder with the concave surface upward. The contact lens adheres by surface tension. Take care that the contact lens is not attached inclined and bubbles are not allowed in between. Also keep the measured lens surface free of water drops.



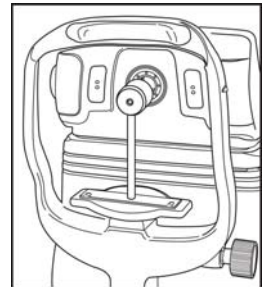
[ Figure 24. Attach Contact Lens ]

4. Attach Keratometry Model Eye.

Remove the chin rest paper. Insert the model eye into chinrest tissue pins to place the contact lens to face the measurement window.

5. Alignment and Focusing

Turn the operation lever so that the Mire Image is concentric with the Outer Alignment Ring looking at the monitor. Focus on the contact lens for the Mire Image to be displayed clearly on the monitor.



[ Figure 25. Attach Model Eye ]

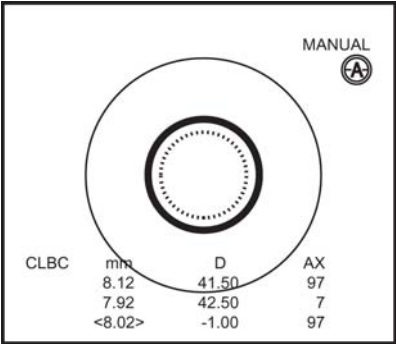


6. Measurement

Press the Measurement button. Measurement will be continuously performed while the Measurement button is pressed. Measurement results will be displayed on the monitor.

**NOTE**

The axial angle of the base(concave) curve of contact lens is reversed from the normal(convex) corneal curvature measurement.



[ Figure 26. CLBC Mode Display ]

7. Print

Press the PRINT button.

## 8.5. Intraocular Lens(IOL) Measurement Mode

In the case of eye with IOL reflecting light from its surface, cataracts with unclear crystalline lens, and small pupils, there can be some errors in the result of refractometry. Press the IOL button to measure in such cases. If the examinee's cataract is advanced, measure and observe the eye in Retro-Illum mode (See Section 8.6).

1. Make sure the measurement screen is on.
2. Enter the K/R mode or REF mode  
Press MODE button until "K/R" or "REF" is displayed on the lower left side of the display.
3. Follow the procedure ① of Section 8.2.1
4. Enter the IOL mode  
Press the IOL button.
5. Measurement

Press the Measurement button. Measurements will be performed continuously while the Measurement button is pressed. During the measurement, "I" mark will be displayed before "C" character.

### NOTE

If measurement is performed after switching the IOL switch ON/OFF, the previous data will be erased.

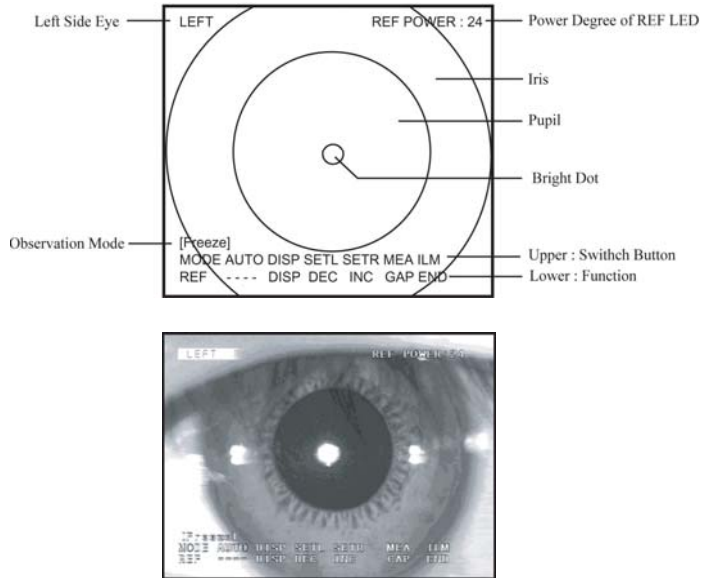
## 8.6. Ret. ILLUM Measurement Mode

Retro. Illum Measurement Mode is useful in the following case.

1. In this mode, not only can eye with cataract or scratches on its cornea be diagnosed, but also its refraction power can be measured automatically. The pattern of illumination reflected from the retina is used to test the opacity of crystalline lens of cataract eye or the scratches on the cornea with the variation of the Ref LED power.  
If the opacity of crystalline lens is not severe, the measurement of refraction power is possible when the six illumination points reflected from the retina are bright and symmetric.
2. A flaw in the intraocular lens and the scratches on contact lens can also be monitored in this mode

### 8.6.1. Alignment and Focusing

- ① Perform alignment and focusing (See section Step ①, ② of Section 8.1.1)
- ② Selection of Ret-ILLUM measurement mode  
Press Ret. Illum button to display [Freeze] window



[Figure 27. Retro-Illum. Freeze window ]

■ [Freeze] window

When Ret. ILLUM button is pressed, [Freeze] window is displayed with the image pattern of illumination backscattered from the retina.

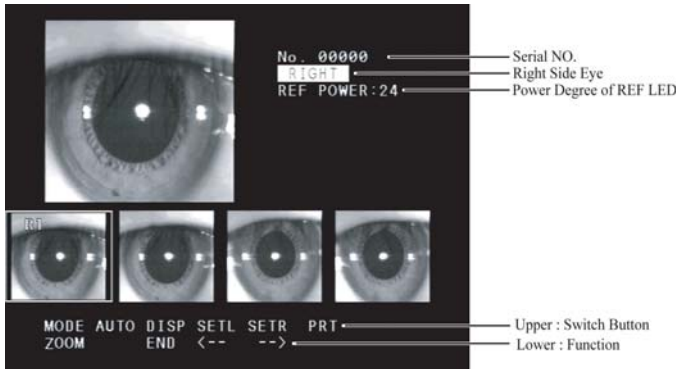
With this retro-illumination image in this window, the opacity of crystalline lens or the scratches on the cornea can be examined.

<Operation Menu>

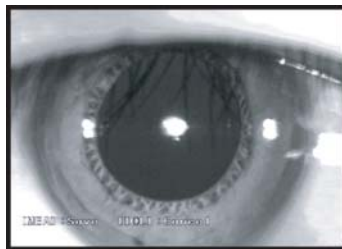
MEA : Pressing MEA button will capture the retro-illumination image to save in the Memory

MOD : Pressing MOD button will change the window from [Freeze] to [Freeze/Ref] and vice-versa

DISP : Two retro-illumination images for each eye that were captured and saved by MEA button can be displayed simultaneously by pressing DISP button. Each image in DISP window can be selected by pressing SETL or SETR button and expanded by pressing MODE button as in Fig. Below. Moreover, the expanded image can be printed. Using Mode button, DISP window will be returned.



[ Figure 28. Retro-Illum. Display ]



[Figure 29. Retro-Illum. Display (Zoom) ]

SETL : Decrease by 1 step of Ref LED Power

SETR : Increase by 1 step of Ref LED Power

ILM : Pressing Ret. Illum button will end Ret. Illum measurement mode to return to the previous measurement mode

■ [Freeze/ Ref] window

In [Freeze] window, pressing Mode button will open [Freeze/Ref] window in which refraction power of eye can be measured and displayed automatically with the retro-illumination image reflected from the retina.

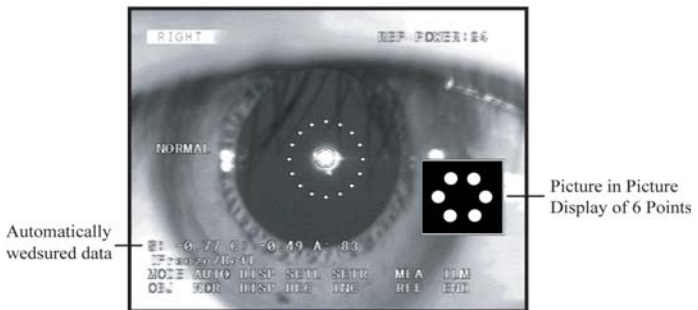
<Operation Menu>

MEA : Pressing MEA button will capture the retro-illumination image and the measured refraction power of eye to save in the memory

MOD : Pressing MOD button will change the window from [Freeze/Ref] to [Freeze] and vice-versa

AUTO: When Model Eye is tested, pressing AUTO button lets another small window appear, in which 6 bright circular spots are displayed.

If those 6 spots are bright and symmetrically located in this window, its measured value of refraction power is reliable. Therefore, when the eye with cataract is measured, it would be better to pop up this small window and align the instrument to let 6 points appear more bright and symmetric.



[Figure 30. 6 Point Display ]

DISP : Two retro-illumination images for each eye that were captured and saved by MEA button can be displayed simultaneously by pressing DISP button. Each image in DISP window can be selected by pressing SETL or SETR button and expanded by pressing MODE button.

Moreover, the expanded image can be printed by PRINT button. Using Mode button, DISP window will be returned.

SETL : Decrease by 1 step of Ref LED Power

SETR : Increase by 1 step of Ref LED Power

ILM : Pressing Ret. Illum button will end Ret. Illum measurement mode to return to the previous measurement mode

### 8.6.2. Observation

- ① Adjust the brightness of refractometry LED

Press SETL or SETR button to change the power of refractometry LED by step 1 for each in order to see the image clearly.

- ② Observe The Image

Position the light to be retro-reflected from the cornea to the section that is not opaque by using the operation lever. If the light is directed at the edge of the pupil, it will be more efficient to observe the image.

#### NOTE

For safety of examinee's eye, avoid observation for more than 30 seconds

③ Capture The Image (Freeze Window)

After the image is focused, press measurement button to capture the image. If the image is not good, press IOL switch to return to [Freeze] window and try again.

④ Measure The Refraction and Capture The Image (Freeze/Ref Window)

Press Mode button to enter the [Freeze/Ref] window in [Freeze] window.

Pressing the Mode button will return to [Freeze] window.

After the image is focused by positioning the Bright Dot to the section that is not opaque, press the measurement button to capture the image and the measured refraction. If the image is not good, press IOL switch to return to [Freeze/Ref] window and try again.

## NOTE

- In alignment and focusing process, after popping up a small window by pressing AUTO button, align and focus this instrument for 6 dots in the small window to be more bright and symmetric in order to increase the reliability of measurements of refraction(See Section 8.6.1).
- Measurement errors may occur due to aberration generated by the eccentricity or due to influence of opacity.

### 8.6.3. Store

To store the image into memory, press measurement button. A maximum of two images can be stored for each eye. Press IOL switch in order to return to [Freeze] or [Freeze/Ref] window without storing the image



#### **8.6.4. Observation of the opposite eye**

Observe and store the image of the opposite eye.

#### **8.6.5. Displaying of Saved Images**

- ① Press DISP button to enter image display mode in order to display the stored images of both eyes.
- ② Each image in DISP window can be selected by pressing SETL or SETR button and expanded by pressing MODE button. Moreover, the expanded image can be printed.
- ③ Using Mode button, DISP window will be returned.

#### **8.6.6. Return to the measurement mode**

In [Freeze] or [Freeze/Ref] window, pressing Ret. Illum button will return to the measurement mode, such as [K/R], [KER], [REF] or [CLBC] measurement mode

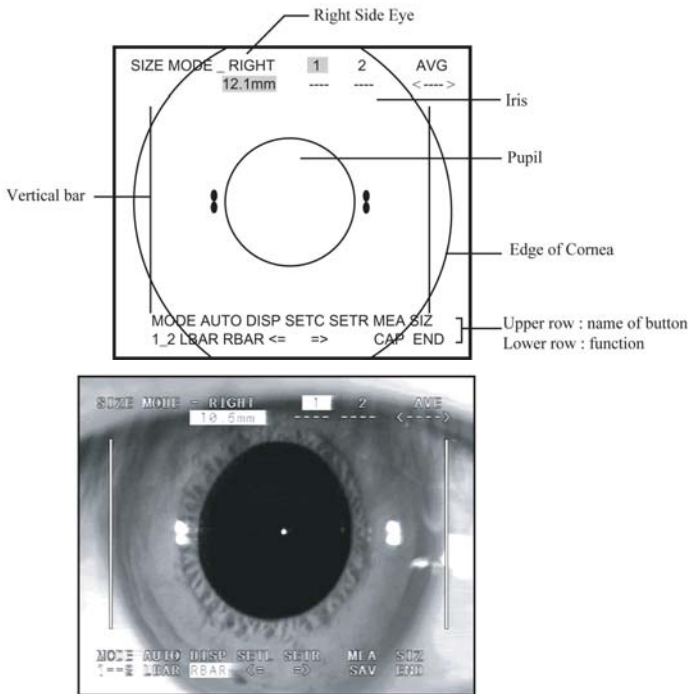
## 9. Other Measurement Modes

### 9.1. Cornea Diameter Measurement (SIZE Mode)

Diameter of cornea can be measured in the SIZE mode for prescribing a pair of contact lens.

1. Make sure the measurement screen is on.
2. Focus the target eye.
3. Enter the SIZE mode.

Press the SIZE button in the Measurement MODE.



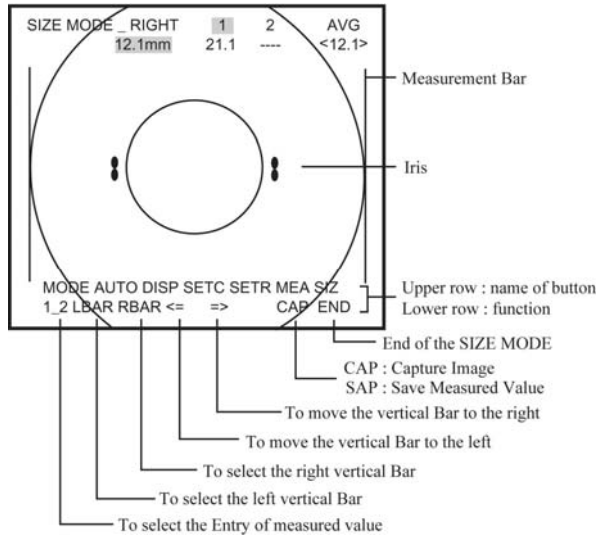
[ Figure 31. Size Mode Display ]

4. Positioning and Focusing

- Ask the examinee to look at the target image of the eye fixation chart.
- Control operation lever to align the pupil between the two vertical Bar.
- Focus on the edge of the cornea so that the edge of the cornea is displayed clearly. If you focus on the iris, the pupil diameter cannot be measured accurately.

5. Measurement

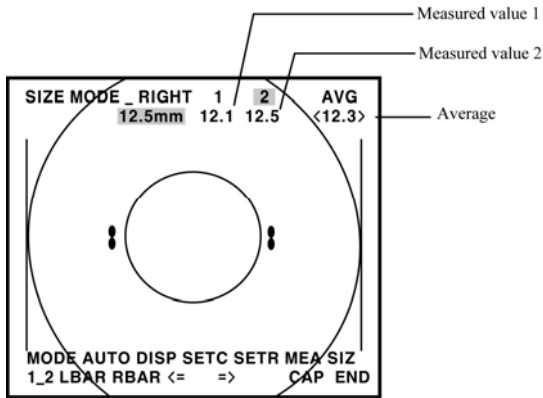
- Press the measurement button to freeze the window.
- Press the AUTO button or the DISPLAY button to select the vertical R-bar or L-bar you want to move.
- Press the SETL(◀) button or the SETR(▶) button to move the selected vertical bar.
- The Measured value will be displayed on the monitor. Save the measured value by pressing Measurement button.
- Measured value is shown under "1" as well as "AVG" on the top of the window.
- If the MODE button is pressed, freezed window is released and "2" will be selected on top of the window in the white bar. Pressing the MODE button enables the selection of "1" or "2" in turn. In case there are some mistakes in the previous "1" measurement, "1" can be selected again.



[ Figure 32. Size Mode Information ]

6. Repeated Measurement

- Repeat the measurement of the Entry 1 or 2 if necessary.
- Repeat procedures 2 ~ 3 again.



[ Figure 33. Size Mode Display with Measurement ]

7. Measure the opposite eye

Slide the stage with the operation lever to the other side. And measure the other eye in the same way.

8. Print

Press Print button

The result of cornea diameter will be printed as "[CORNEAL SIZE]" item.

## 9.2. DISPLAY Mode

The stored data (maximum 10 data for each eye) can be displayed in this mode. To enter the DISPLAY mode, press the DISPLAY button in the Measurement Mode. If you press the DISPLAY button again, the mode will be returned to the Measurement Mode.

### NOTE

- If there is any Keratometry data, pressing the ◀ button or the ▶ button yields the next page.
- Press the PRINT button to print out the stored data. And the data will be erased for the next measurement.

#### 1. Measured Result of Refractometry

Maximum of 10 newest data items of the refractometry for both right and left eyes will be displayed. "PAGE 1/2" won't be shown on top of the window in the REF mode.

63		RIGHT			REF PD: --			LEFT			PAGE 1/2	
		SPH	CYL	AX	SPH	CYL	AX	SPH	CYL	AX	VD: 12.0	
Measured value of Refractometry	1	-10.00	+0.00		-14.75	+0.00						
	2	-10.00	+0.00		-14.75	+0.00						
	3	-10.00	+0.00		-14.75	+0.00						
	4	-10.00	+0.00		-14.75	+0.00						
	5	-10.00	+0.00		-14.75	+0.00						
	6	-10.00	+0.00		-14.75	+0.00						
	7	-10.00	+0.00		-14.75	+0.00						
	8	-10.00	+0.00		-14.75	+0.00						
	9	-10.00	+0.00		-14.75	+0.00						
	10	-10.00	+0.00		-14.75	+0.00						
Average	AV	-10.00	+0.00		-14.75	+0.00						

[ Figure 34. Result of Refractometry ]

2. By pressing the VD button, you can change the display type of refractometry data according to the VD value

3. Measured Result of Keratometry

A maximum of 10 newest data items of the keratometry for both right and left eyes will be displayed.

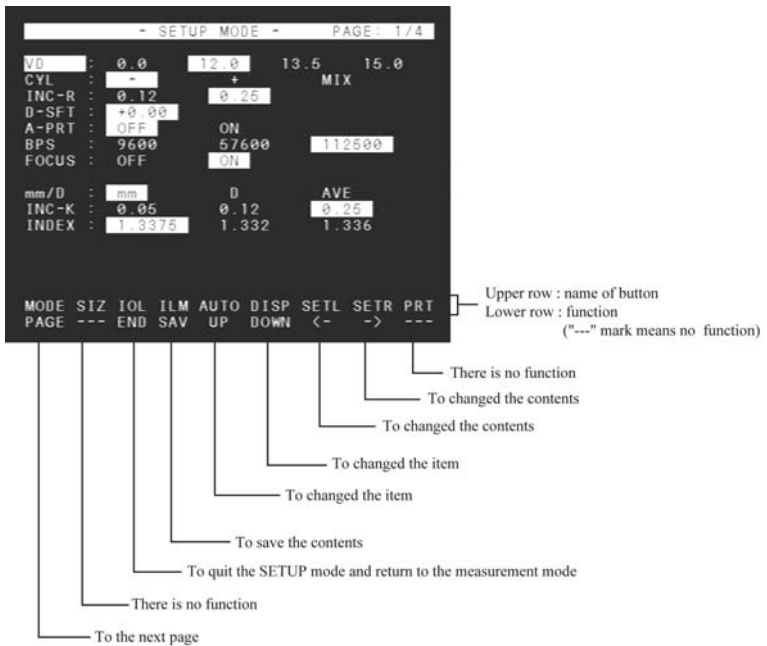
DISPLAY MODE		KER			PAGE 2/2		
63	RIGHT AR	CY	PD:-- AX	LEFT AR	CY	AX	
Measured value of Keratometry	1	7.96	0.00	7.97	0.00		
	2	7.96	0.00	7.97	0.00		
	3	7.96	0.00	7.97	0.00		
	4	7.96	0.00	7.97	0.00		
	5	7.96	0.00	7.97	0.00		
	6	7.96	0.00	7.97	0.00		
	7	7.96	0.00	7.97	0.00		
	8	7.96	0.00	7.97	0.00		
	9	7.96	0.00	7.98	0.00		
	10	7.96	0.00	7.97	0.00		
Average	AV	7.96	0.00	7.97	0.00		

[ Figure 35. Result of Keratometry ]

### 9.3. User SETUP Mode

Change all the settings about measurements, printouts etc.  
 Press the MODE button for a few second.

#### 1. Refractometry/Keratometry



[ Figure 36. Setup Mode Information (page 1) ]



**[How to Change the Page.]**

Press MODE button to move to the next page.

**[How to Change the Item.]**

Pressing the AUTO button brings the cursor to upper item and pressing the DISPLAY button moves the cursor to the lower item.

**[How to Change the Contents]**

If you press the ◀ button or the ▶ button, contents will be changed. The selected content will be shown in reverse highlighted characters.

<b>NOTE</b>
There are some contents changed in an other way. And such procedures will be instructed with the description under each item.

**[How to Store the Contents]**

Press the ILM button to save the contents.

**[How to Enter the Measurement Mode]**

Press the IOL button to quit the SETUP mode and enter the Measurement mode.

**[Items]**

**VD**                      Vertex distance


**CYL**                    Cylinder form

**INC-R**                Increment of sphere and cylinder

**D-SFT**                Diopter Shift of Sphere  
                          Press the ◀ button or the ▶ button to change the value of sphere by 0.12.

**A-PRT** In AUTO START mode, the measurement data is printed out automatically as soon as measurements about right and left eye are performed one after the other.

**BPS** Choose the rate of data transmission from 9600, 57600 and 112500bps.

**FOCUS** Option of displaying target symbol(  which appears when focusing of target is attained in the measurement mode.

**mm/D** Form of displaying result of keratometry

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

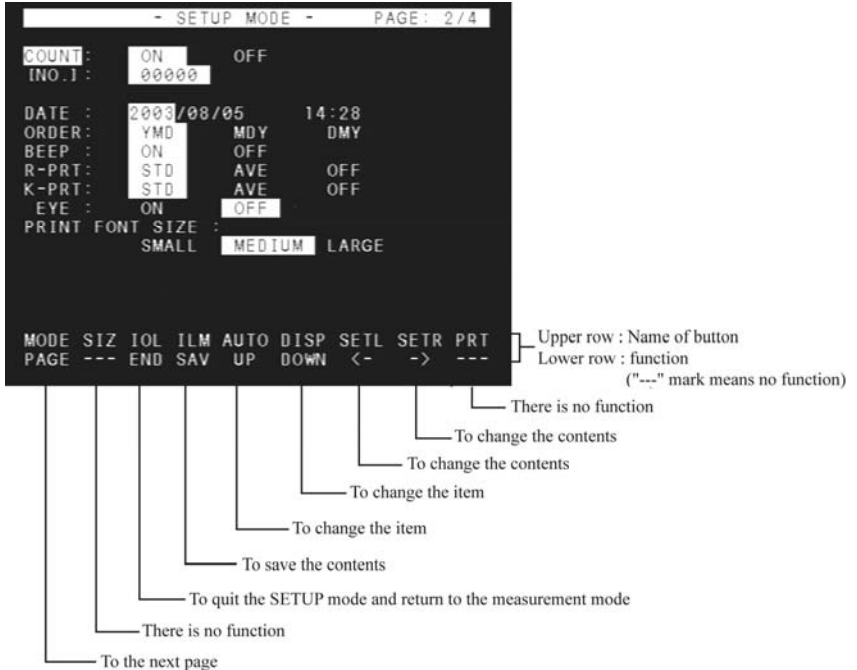
D	K1	.....	Refractive power on minimum meridian
	K2	.....	Refractive power on maximum meridian
	AX	.....	Axis on minimum meridian

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

2. Serial Number, Time and Print Format



[ Figure 37. Setup Mode Information (page 2) ]

**[How to Change the Page]**

Press MODE button to move to the next page.

**[How to Change the Item]**

Pressing the AUTO button brings the cursor to upper item and pressing the DISPLAY button moves the cursor to the lower item.

**[How to Change the Contents]**

If you press the ◀ button or the ▶ button, contents will be changed. The selected content will be shown in reverse highlighted characters.

## NOTE

There are some contents changed in an other way. And such procedures will be instructed with the description under each item.

### [How to Save the Contents]

Press the ILM button to save the contents.

### [How to Enter the Measurement Mode]

Press the IOL button to quit the SETUP mode and enter the Measurement mode.

### [Items]

**COUNT** To select whether the serial number is used or not.

**[NO.]** Setting of the serial number

Function characters under 'PRT' will be changed from "---" to "RST".  
But "---" will be displayed again if the item changes. Serial number will be set to "0" if pressing the PRINT button. Pressing the ◀ button or the ▶ button decrease or increase Serial number by "1".

**DATE** Time and date

Function character under 'PRT' will be changed from "---" to "+1".  
But "---" will be displayed again if the item changes. Pressing the ◀ button or the ▶ button renders the selected part to be changed.  
The selected part will be increased by "1" if the PRINT button is pressed, decreased by "-1" if the CHART button is pressed.

1981 ~ 2080 : Year

01 ~ 12 : Month

01 ~ 31 : Day

00 ~ 23 : Hour

00 ~ 59 : Minutes

**ORDER** Sequence of displaying the date

- YMD : Year/Month/Day
- MDY : Month/Day/Year
- DMY : Day/Month/Year

**BEEP** To select "ON" or "OFF" of beep

- R-PRT : Result of Refractometry to be printed out
- STD : A maximum of the 10 newest measurement data and its average value for each eye.
- AVE : Average values only
- OF F : Not printed.

**K-PRT** Result of Keratometry to be printed out

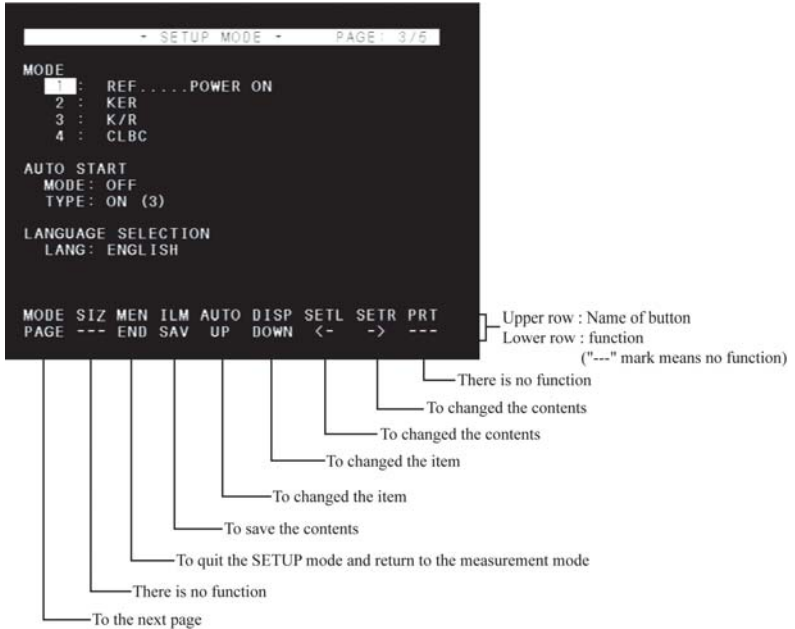
- STD : A maximum of the 10 newest measurement data and its average value for each eye.
- AVE : Average values only
- OFF : Not printed.

- EYE**
- ON : A sketch of eyeball and refraction diagram to the results of Refractometry are printed.
  - OFF : Not printed.

**PRINT FONT SIZE**

- Size of the letter to be print out
- SMALL : Half size font is used.
  - MEDIUM : Normal size font is used.
  - LARGE : Double size font is used.

### 3. Customized Measurement Mode



[Figure 38. Setup Mode Information (page 3) ]

#### [How to Change the Page.]

Press MODE button to move to the next page.

#### [How to Change the Item.]

Pressing the AUTO button brings the cursor to upper item and pressing the DISPLAY button moves the cursor to the lower item.

#### [How to Change the Contents]

If you press the ◀ button or the ▶ button, the contents will be changed. The selected content will be shown in reverse highlighted characters.

**[How to Store the Contents]**

Press the ILM button to save the contents.

**[How to Enter the Measurement Mode.]**

Press the IOL button to quit the SETUP mode and enter the Measurement mode.

**[Items]**

**MODE** Assigns measurement order of Mode of "REF, KER, K/R, CLBC".

- 1 : First mode that is displayed when power is turned ON. It cannot be set to "OFF".
- 2~4 : Second modes and after.  
Assign First Measurement Mode and after.

**AUTO START** : Switch "ON" or "OFF" of AUTO START Measurement mode

**MODE** : After moving the icon to this item by AUTO button or DISPLAY button, set it to "ON" or "OFF" by SETL or SETR button

**TYPE** : ON(A) Continuously measure in AUTO START if the condition of alignment and focusing is acceptable.

ON(3) Measure only 3 times in AUTO START mode if the condition of alignment and focusing is acceptable.

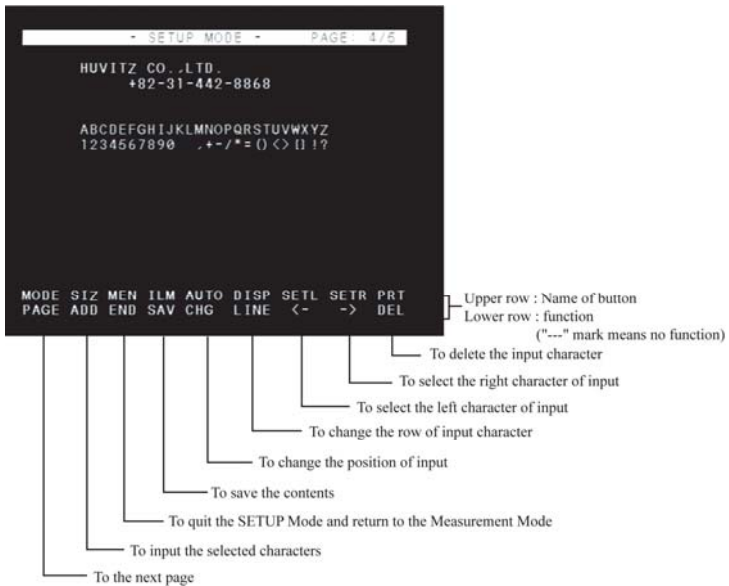
ON(5) Measure only 5 times in AUTO START mode if the condition of alignment and focusing is acceptable.

**LANG** : The character language can be chosen among several languages supported by this instrument such as English, Chinese, Spanish, Germany and French. After moving the icon to this item by pressing AUTO button or DISPLAY button, one language can be chosen by ◀ or ▶ button.



[Figure 39. Example of Language Selection ]

4. Messages for Internal Printer





**[Figure 40. Setup Mode Information (page 4) ]**

Enter a message to be printed out with the results of measurement using the internal printer in this window.

You can print a messages of 26 characters × 2 lines.

**[How to Change the Page]**

Press MODE button to move to the next page.

**[Position Cursor]**

The cursor blinking in the upper area indicates the input position.

Press the AUTO button to change the row of the blinking cursor.

**[Character Cursor]**

The selected characters by the character cursor will make a message. Press the DISPLAY button to change the row of the character cursor. Pressing “◀” button or “▶” button moves the position of the cursor to the right or left.

**[Input of Messages]**

Press the SIZE button to add the selected characters in the position of the blinking cursor.

**[Deletion of Messages]**

If you press the PRINT button, the character in front of the blinking cursor will be deleted.

**[How to Save the Contents]**

Press the ILLUM button to save the contents.

**[How to Enter the Measurement Mode]**

Press the IOL button to quit the SETUP mode and enter the Measurement mode.

## **9.4. Power Saving Mode**

If you keep this instrument idle for about 5 minutes in the measurement mode, it will turn into the power saving mode. READY LED will blink in the power saving mode. Press any button to resume the Measurement Mode.

## 10. Maintenance

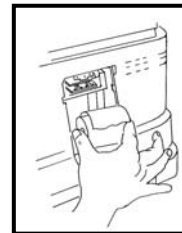
### 10.1. Replacing Printing Paper

Replace the roll of printing paper as soon as possible after the red line appears on the paper.

- ① Open the printer cover.
- ② Cut off the paper that has been fed through the printer and pull it out.
- ③ Take off the locking shaft by pulling out its handle.
- ④ Remove the roll of paper together with the rotating shaft and take the shaft out of the roll
- ⑤ Insert the shaft into a new roll.
- ⑥ Load the roll of paper into the printer case.

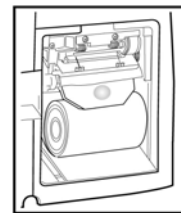


[ Figure 41.  
Open the printer cover ]



[ Figure 42.  
Road the Paper roll ]

- ⑦ Push the paper in the slot of the printer and lock it by locking shaft taking care of the roll direction of paper. Pull out of the paper top 7~8 cm.



[ Figure 43.  
Lock the Locking shaft ]

- ⑧ Pull out the end edge of the paper from the printer cover slot and close the cover.



[ Figure 44.  
Close the printer cover ]



## INFORMATION

Use a thermal printing paper of the width 57mm and the diameter of roll 50mm.

## 10.2. Replacing Fuse

- ① Turn off and disconnect the power cord.
- ② Pull out the fuse holder(See section 4.1)
- ③ Replace old fuse(s) with new one(s).
- ④ Re-install the fuse holder.



## INFORMATION

Use 250V, T3.15AL fuse for the Auto Ref/Keratometer MRK-3100P.

### 10.3. Replacing Chin Rest Tissue

- ① Pull out the two pins on the chin rest.
- ② Insert the pins into the holes on the chin rest tissue. More than 50 sheets of paper can be attached.
- ③ Insert the pins straight into the holes on the chin rest.

### 10.4. Components to Be Replaced by Service Person

Following components are apt to become worn out or to deteriorate due to the characteristics of its material and structure. These components are not replaceable by the user. If these components are found to be worn out or deteriorate, contact local distributor for replacement.

- Backup batteries for the clock and data
- Cathod-ray tube in the monitor

### 10.5. Cleaning

- ① Basically, keep this instrument clean. Don't use volatile cleaners, thinner or benzene, etc.
- ② Polish each part with a dry cloth containing detergent solution.
- ③ When cleaning lens or glass of this instrument, clean it using a soft and dry tissue after removing dirt or other materials on the lens by wind blower.

## 10.6. Storage

If you leave the Auto Ref/Keratometer MRK-3100P without using it for long periods, disconnect the power supply and protect the unit with dust cover.

## 10.7. Moving the Instrument

- ① Turn OFF the power switch.
- ② Disconnect the power cable.
- ③ Close the stage holding dial in the clockwise direction.
- ④ Move this machine holding the lower part of the main body to keeping it horizontal.

## 10.8. 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. Troubleshooting

Warning messages will be displayed on the monitor if some problems occur. It might be operation errors or problems of the machine.

In this case, refer to the following instructions.

If the function is still not salvaged or recovered, disconnect the power supply and consult the dealer.

### 11.1. Message When Power On.

Message	Cause	Remedy
Motor Error	Internal error	Turn OFF the power switch and turn on again after 10 seconds. If the message appears again, consult the dealer.
EEPROM Error		
EEPROM Data Error		
System Error		
Clock Error		
INVALID SETUP DATA – REF	Internal Setup Data for Refractometry is invalid.	Consult the dealer.
INVALID SETUP DATA – KER	Internal Setup Data for Keratometry is invalid.	Consult the dealer.

## 11.2. Message On Measuring

Message	Cause	Remedy
TRY	See Section 8.1.3	See Section 8.1.3
AGAIN	Objective glass in the measurement window is dirty.	Clean the glass
+ OUT	Sphere of examinee's eye is over +22D.	Impossible to measure
	Radius of curvature is over 10.2mm.	
	Objective glass in the measurement window is dirty	Clean the glass
- OUT	Sphere of examinee's eye is over -25D.	Impossible to measure
	Radius of curvature is under 5.0mm.	
	Objective glass in the measurement window is dirty	Clean the glass
C OUT	Astigmatism is over 10D.	Impossible to measure
	Corneal stigmatism is over 15D.	
	Objective glass in the measurement window is dirty.	Clean the glass

## 11.3. Message On Printing

Message	Cause	Method to deal with
PRINTER PAPER EMPTY	No printing paper	Load roll of printing paper.



## 12. Specifications

Modes	
Continuous Keratometry and Refractometry(K/R Mode)	
Refractometry(REF Mode)	
Keratometry(KER Mode)	
Contact Lens Base Curve Measurement(CLBC Mode)	
Refractometry	
Vertex Distance(VD)	0.0, 12.5, 13.5, 15.0
Sphere Power(SPH)	-25.00 ~ +22.00D (at the vertex distance of 12mm)
Cylinder Power(CYL)	Increments selectable between 0.12 and 0.25D 0.00 ~ ±10.00D
Axis(AX)	1 ~ 180° (Increments: 1°)
Cylinder Form	-, +, MIX
Pupil Distance(PD)	10 ~ 85mm
Minimum Pupil Diameter	Ø2.2mm
Keratometry	
Radius of Curvature	5.0 ~ 10.2mm (Increments: 0.01mm)
Corneal Power	33.00 ~ 67.50D (Increments: 0.05/0.12/0.25D) (when cornea equivalent refractive index is 1.3375)
Corneal astigmatism	0.00 ~ -15.00D (Increments: 0.05/0.12/0.25D)
Axis	1 ~ 180° (Increments: 1°)
Corneal Diameter	2.0 ~ 14.0mm (Increments: 0.1mm)

Memory of Data	
10 measured value for each right and left eye	
Hardware Specification	
Internal Printer	Uses thermal line printer
Monitor	6-inch monochrome monitor
Power Input	100-240V~, 50/60Hz, 1A
Power Consumption	Approximately 100VA
Fuse	250V T3.15AL
Size	300(W) × 500(D) × 430(H) mm
Weight	Approximately 20kg

### 13. Components List

Auto Ref/Keratometer MRK-3100P Main Unit .....	1
Power Cable .....	1
Model eye .....	1
Chin Rest Paper .....	about 100 sheets
Printing Paper .....	2 rolls
Blower .....	1
Dust Cover .....	1
Operator's Manual .....	1

## 14. 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 Huvitz or local distributor for service with the following information:

- Name of the instrument: Auto Ref/Keratometer MRK-3100P
- 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:** [mrk-support@huvitz.com](mailto:mrk-support@huvitz.com)