AUTO REF/KERATOMETER

OPERATOR'S MANUAL

（AR-900,ARK-900,AR-910,ARK-910）

CE

Ningbo Ming Sing Optical R & D Co., Ltd.

Please read this manual before use

This instrument is manufactured according to the IEC 60601-1:2012 Medical electrical equipment General requirements for basic safety and essential performance. The instrument must be grounded reliably. Please pay attention to the warning labels on the product and the instructions and review the files coming with the unit to prevent damage to the operator and other persons, or to other facilities.

ISO 9001,IOS 13485 certification—the product design and development, production and service process of Ningbo Ming Sing Optical R & D Co., Ltd (hereinafter referred to as MSOC). have passed ISO 9001,IOS 13485 certification. The IEC standard is applicable to this manual. Refractive power showed a reference wavelength of D = 546.07nm. Materials in direct contact with patients have been assessed by ISO 10993, and there is no risk of unacceptable.

Safety precautions and procedures must be thoroughly understood before using the equipment. The device complies with ISO 10342 ‘Ophthalmic instruments — Eye refractometers’ and ISO 10343 ‘Ophthalmic instruments — Ophthalmometers’. There are no user-serviceable parts inside the device except printer paper. If you encounter any problems or have questions about the instrument, please contact Ningbo Ming Sing Optical R & D Co., Ltd. or your authorized distributor.

This manual is also used as a training reference manual. In order to ensure the best performance of the new machine, it is recommended to carefully read and follow the steps in this guide. Please keep this manual as a reference for future communication with other users. If additional copies needed, or any questions about the instrument, please contact Ningbo Ming Sing Optical R & D Co., Ltd. or your authorized distributor.

The information contained in this manual has been confirmed before publication. Ningbo Ming Sing Optical R & D Co., Ltd. reserves the right to make changes to the

products contained in this manual without prior notice. Sold products are not subject to such changes.

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1. Introduction

The Auto ref/keratometer is used to measure spherical, cylinder, axial, PD, corneal radius and corneal diopter of the patient's eye.

1.1 Product Features and Use Scope

a) The classification of equipment according to the type of shock proof: class I, external power supply equipment;
b) The classification of equipment according to the degree of shock proof: B type;
c) The classification of equipment according to the ability to prevent liquid entry: ordinary equipment;
d) Application part of the equipment: chin rest, forehead rest;
e) The type of device power: single phase, network power supply: 100-240V～ 50/60Hz 75VA;
f) Equipment belongs to non AP or APG type;
g) The operation mode: continuous operation;
h) Equipment belongs to impermanent installation equipment.

1.2 Classification

The auto ref/keratomer is consist of optical imaging system, control system (software revision:V1) and a display.

AR-910 and ARK-910 model (software revision: V1) machine have the same appearance. ARK-910 is with corneal curvature measurement function,AR-910 without corneal curvature measurement function. As shown in below picture:

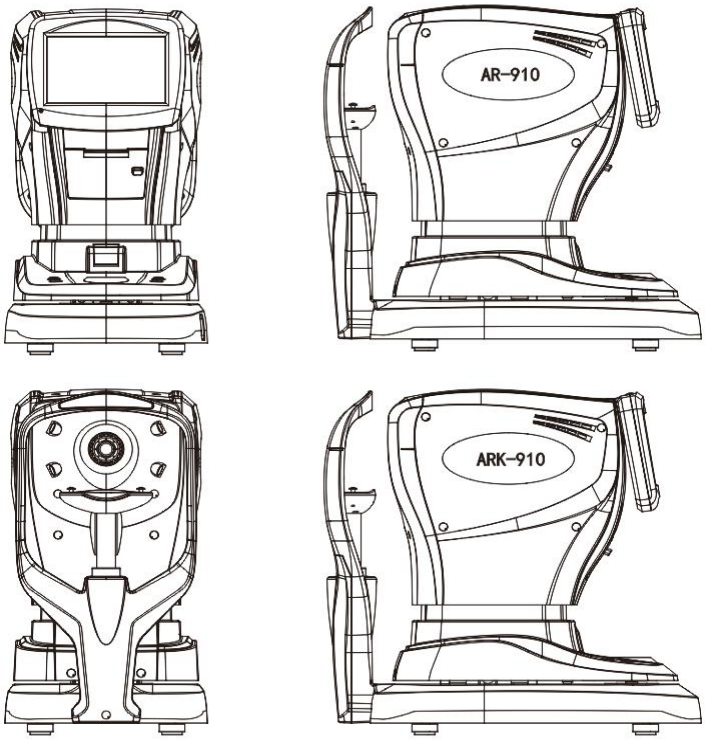


Fig 1. AR-910 and ARK-910

AR-900 and ARK-900 model (software revision: V1) machine have the same appearance. ARK-900 is with corneal curvature measurement function,AR-900 without corneal curvature measurement function. As shown in below picture:

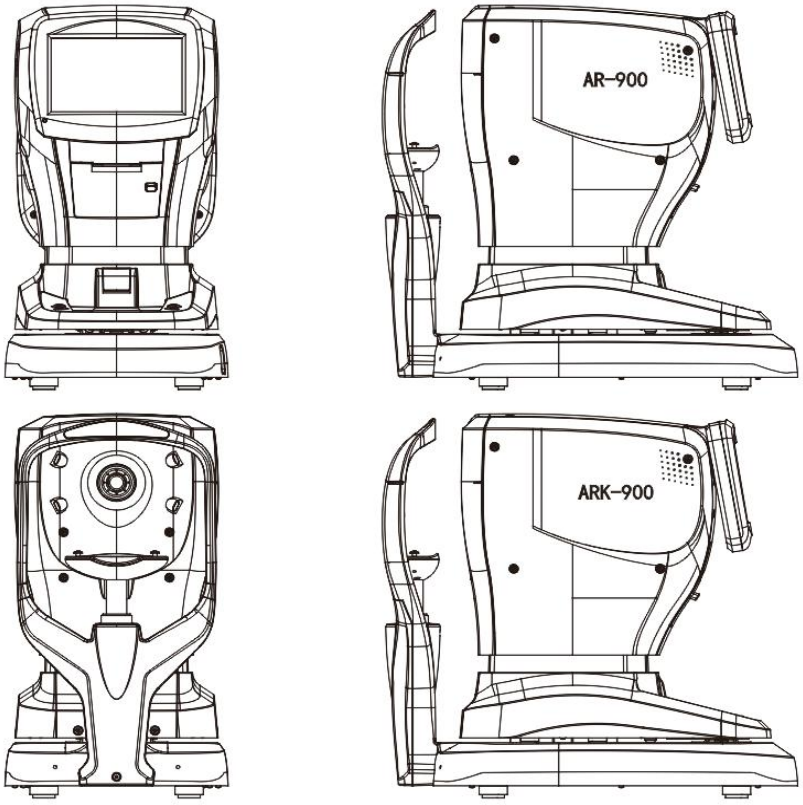


Fig 2. AR-900 and ARK-900

Storage and transport conditions:

Temperature:-40℃ - +55℃

Humidity:≤80%

Atmospheric pressure:700hPa - 1060hPa (transportation)

500hPa - 1060hPa (storage)

Working condition:

Temperature: 10℃ - 40℃

Humidity: ≤80%

Atmospheric pressure:760hPa - 1060hPa

CAUTION	If stored or used outside the specified temperature and humidity range, the system may not achieve the claimed performance.

Power supply:

Voltage: 100-240V～、50/60Hz

Input power: 75VA

Software operating environment:

Model: AR-910,ARK-910,AR-900,ARK-900

Software issuing version：V1

* Processor hardware platform based on ARM architecture (minimum configuration)

* Processor main frequency: 800MHz

* System memory: 256MB

* Memory: 256MB

Software naming rule:

Software version number includes 3 segments: A,B and C.

Segment A is the main version, indicating major update and upgrade of the software. Initial value is 1. When there is major upgrade, it will change to V2,V3,V4 for each major change.

Segment B is sub level version, indicating minor upgrade of the software. Initial version 0, will add 1 each time if there is a minor upgrade of the software.

Segment C is revise version, indicating the corrective upgrade for the software. Initial value 00000. Each time there is a correction, these 5 digit will change to the date of correction. E.g, if the software is constructed on Oct 8, 2012, then it will change to 21008.

1.3 Main Performance Index

Refractive measurement（AR measurement ）

Sphere（S）	-25.00 to +22.00 m^{-1} 0.12/0.25m^{-1} increment
Cylinder（C）	0 to ±10.00 m^{-1} 0.12/0.25m^{-1} increment
Axis（A）	0 to180º 1º increment
PD	10 to 85mm 1mm increment
Precision	Measurement precision should comply with standard ISO 10341：2012 ophthalmic instrument table 2: requirement for digital readout ARK.

Corneal curvature measurement（KR measurement）

Corneal Curvature Radius (ARK)	5 to 10mm 0.01mm increment
Corneal refractive(ARK)	33.75 to 67.50m^{-1} 0.12/0.25m^{-1} increment
Axis （A）	0 to180º 1º increment
Precision	KM measurement deviation should comply with ISO 10343 ： 2014 ophthalmic instrument—-Keratometer, type 2 requirement. Axis measurement deviation should comply with ISO 10343 ： 2014 ophthalmic instrument—-Keratometer chapter 4.3 requirement

Other Technical Specifications

Chin rest bearing weigh	2.5Kg
Overall noise	＜55dB（A）
Surface Temperature Rise	＜15℃

Light radiation	Comply with ISO 15004-2:2007 requirement
Environment	Comply with ISO 15004-1:2006 requirement
Electric safety	Comply with IEC 60601-1:2012 requirement
EMC	Comply with IEC 60601-1-2：2014 requirement
3D auto tracing	Comply with product requirement

Specification

Vertex distance（VD）	0/12/13.5/15mm
CYL sign	“ + ”、“ - ”、“±”
Data memory	Can save 10 measured values for each eye
Printer	Thermal printer
Power save mode	Auto change to power saving mode. 5min and 15 min optional
Monitor	7 inch color LCD touch screen
Auto tracing scope	Horizontal : 85mm Vertical: 30mm Front and back：40mm
Measuring unit moving range	Horizontal : 85mm Vertical: 30mm Front and back：40mm
Motorized chin rest moving range	Up and down：65mm

2. Safety precautions

2.1 Symbols

In this manual, signal words are used to designate the degree or level of safety alerting.

The definitions are as follows.

⚠ **WARNING**	Indicates a potentially dangerous situation, if not avoided, that could result in moderate or serious injury.
⚠ **CAUTION**	Indicates a potentially dangerous situation, if not avoided, that could result in minor injury or property loss.

Even situations indicated by CAUTION may result in serious injury under certain conditions.

Safety precautions must be strictly followed at all times.

2.2 Before Use

⚠ **CAUTION**

- The safety precautions and operating procedures must be thoroughly understood prior to operation of the device. Use the device for unintended use may cause machine malfunction or adverse events.
- Do not open shell and do not touch the interior of the device. This may cause electric shock or instrument failure.
- Install and use the device in an environment that meets the following conditions.

  Temperature：10℃ - 40℃

  Humidity：≤80%

  Atmospheric pressure：760hPa - 1060hPa

  A room with low dust and weak lighting

  A location free from vibration and shock

  ------ If the equipment is not installed under the above conditions, it may affect the accuracy of the measurement results. In addition, if the equipment is hit, it may be damaged.
- Avoid storage the device near water, poisonous gas or liquid. The device may

corrode or broken down.

- Avoid installing the device on ventilation path. Changes in temperature may result in condensation of vapor inside the device or affect measurements.
- Be sure to use the socket meet the device voltage. If the voltage is too low or too high, the device will not operate. The malfunction of the device may cause fire.
- To avoid electric shock, the device must be connected to supply power with grounding protection. Device malfunction or electricity leakage may cause fire.
- Do not overload the power socket, or it may cause fire.
- Insert the power plug into the socket firmly. Improper connections may cause fire.
- Never use a power strip or extension cable to supply the device with power. This may cause failures and fire.
- Do not use cables not comes with the device to connect power. It may cause device malfunction or fire.
- Do not place heavy objects on the power cord. A damaged power cord may cause fire or electric shock.
- Switch off the device and disconnect it from power before connecting cables. Or it may cause device malfunction.
- Make sure to turn off the device, unplug the power cord and the power cable, lock the head (with a lock sign) when moving the device, to avoid equipment falling that may cause injury or equipment damage.
- Use special packing to protect the device for transportation. Excessive vibration or shock can cause malfunction.
- When installing and operating the ARK, follow below EMC instructions (EMC):

  1. Do not use the device in conjunction with other electronic devices to avoid electromagnetic interference.

  2. The equipment can’t be used in the same room with other devices, including life support devices, other devices that have a significant impact on the lives of patients and the results of treatment and the measurement or treatment devices with small current.

3. The device can't be used in conjunction with portable and mobile radio frequency communication devices because of their electromagnetic interference may adversely affect the operation of the device.

4. Don't use cables and accessories other than those specified by MSOC. These may increase the electromagnetic wave emitted by the device system and reduce the electromagnetic interference resistance of the device.

If there is a potential electromagnetic interference between the equipment and other equipment, shielding measures should be taken or the location of the device to be changed to reduce the possible interference.

2.3 During Use

⚠ **CAUTION**

- When the device not in use, please turn off the power and cover the device with dust cover. If the equipment is exposed for a long time, it may collect dust, which will affect the accuracy.
- Please check the device before the operation. If there is any abnormal, do not use it. Using the device under its abnormal conditions may affect the accuracy of the data, causing unexpected failures, diagnosis errors or hazard.
- Before measuring each patient, clean the chin rest and forehead rest with medical alcohol. If you use a chin rest paper,please replace a new one for each patient.
- Keep the measurement window free of fingerprints and dust, or else measurement accuracy may be decreased substantially.
- In the event of smoke or strange odors, immediately turn off and disconnect the device from power. After it is certain that the smoke has stopped, contact our company or your authorized distributor.
- Continuing to use the device under abnormal conditions may cause fire or electric shock. In case of fire, use a dry powder (ABC) fire extinguisher.
- Never press on the LCD with any hard objects such as a ball-point pen. Keep magnetic objects away from the LCD.

- Never operate on the LCD screen with wet hand. Water leaking inside of the device may cause malfunction.
- There may be a few dead or constantly-lit pixels on the LCD. This does not represent failure of the LCD. It is due to the LCD property.
- Only trained and qualified personnel can operate this instrument, or operate under their guidance.

2.4 After Use

⚠ **CAUTION**

- If the device is not in use for a long time, unplug the power cord. Dust many collect moisture that may cause short circuit or fire.
- Occasionally clean the pins of the power plugs with dry cloth. If the dust falls on the tip, water may be collected and resulting in a short circuit or fire.
- Do not unplug the power cable violently. It may damage the cable core and causing electric shock, short circuit or fire.
- Maintain the following environmental conditions during transport and storage of the device.

  Temperature：-40℃ - +55℃

  Humidity：≤80%

  Atmospheric pressure：700hPa - 1060hPa(transport),500hPa - 1060hPa(storage)

  A location with low dust

  A location not exposed to direct sunlight
- Special packing materials are used to protect the equipment during transportation. Excessive vibration or shock can cause malfunction.

2.5 Maintenance and check

⚠ **CAUTION**

- Do not wipe any part of the device with a solvent or a strong cleaning solution. Otherwise it may be damaged.
- Do not use organic solvents such as paint thinner to clean the outside of the

device. Otherwise it will damage the device surface.

- Avoid touching the optical components of the device to prevent performance degradation caused by fingerprints or grease stains on the lens set.
- Any repairs and services to this device must be carried out by personnel or dealers trained by our company. MSOC will provide circuit diagram, spare parts list, drawing and legend and calibration method or any other necessary material as per required.
- Adjustments must be made by the technical service personnel of our company or other authorized personnel.
- The battery of the device must be replaced by the technical service personnel of our company or other authorized personnel.
- When the device needs to be returned to the company for repair or maintenance, use a clean cloth dipped with alcohol to disinfection the device (especially the areas where contact with patients).
- When the AR measurement result is with big difference with the subjective measurement, please contact MSOC to check if the current device need to be calibrated for accuracy.

2.6 Disposal

⚠ **CAUTION**

- Follow local governing ordinances and recycling plans regarding disposal or recycling of device components.

  It is recommended to deal with industrial waste by the designated contractor.

  Deal with packaging material in accordance with local laws and regulations.

3. Configuration and Functions

3.1 Device configuration

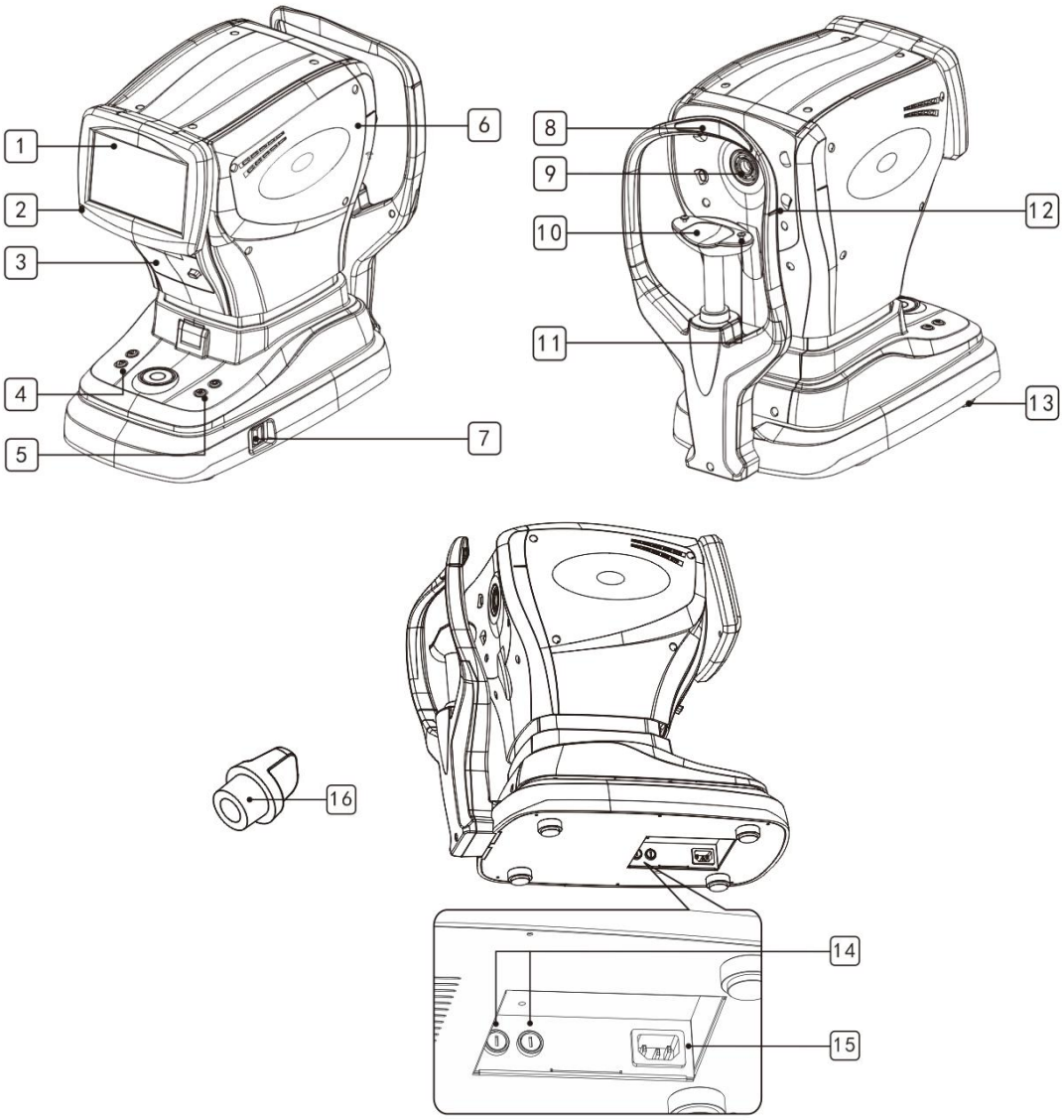


Fig 3. Device view

NO.	Description
1	**7 inch Color LCD touch display：** Display measurement results. The screen can be tilted.
2	**Power indicator:** When the device is working the indicator will light up.
3	**Printer：** Print the measurement result.
4	**Chin rest up/down button（ / ）：**

	Lifting and lowering the chin rest button.
5	**Printer re-set button**（  ）： Reset printing.
6	**Head：** Measuring functioning unit.
7	**Power switch：** Turn on or turn off the unit.
8	**Forehead rest：** Patient forehead leans here.
9	**Measuring window：** Measurement of the retinal imaging.
10	**Chin rest ：** Patient chin fixed here during measurement.
11	**Artificial eye fixing pin：** To fix the position of artificial eye and chin rest paper.
12	**Level marker：** Adjust the height of the measured eye.
13	**Foot：** Adjust the level of the unit.
14	**Fuse holder：** 2 fuses inside.
15	**Power inlet：** Connection to 100-240V～ 50/60Hz.
16	**Measurement window cover**

3.2 Accessories

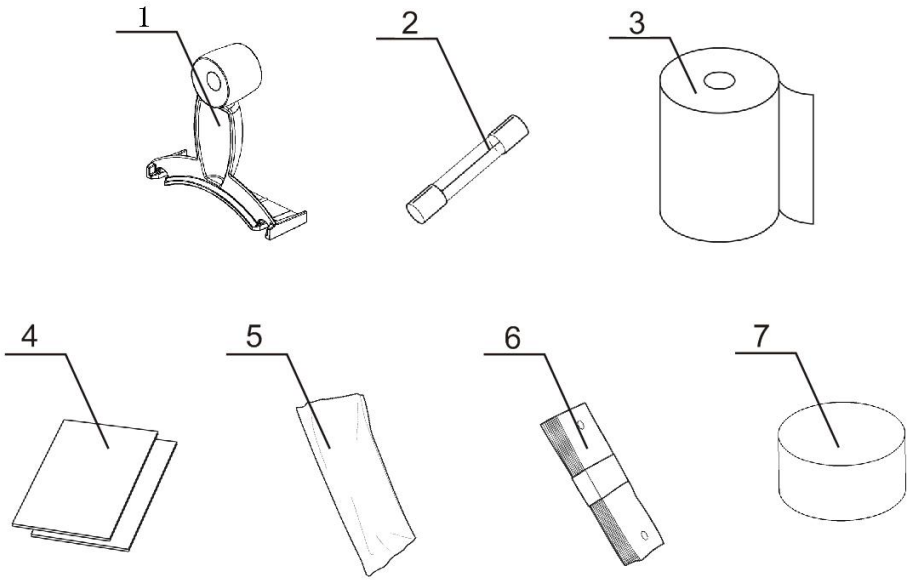


Fig 4.

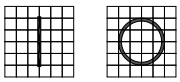
NO.	Description
1	**Artificial eye:** Use to check measurement accuracy;
2	**Fuse:** To prevent short circuit;
3	**Printing paper:** Display measurement result;
4	**Operator's manual:** Instructions for use of this device;
5	**Dust cover:** Cover the unit when it is not in use to proof dust;
6	**Chin rest paper:** Put on the chin rest during measurement. Replace a new one for each measurement;
7	**Level bubble:** Display instrument level.

⚠ WARNING

The instrument accessories are provided by our company, and the accessories of other manufacturers need to be verified and confirmed by MSOC before use.

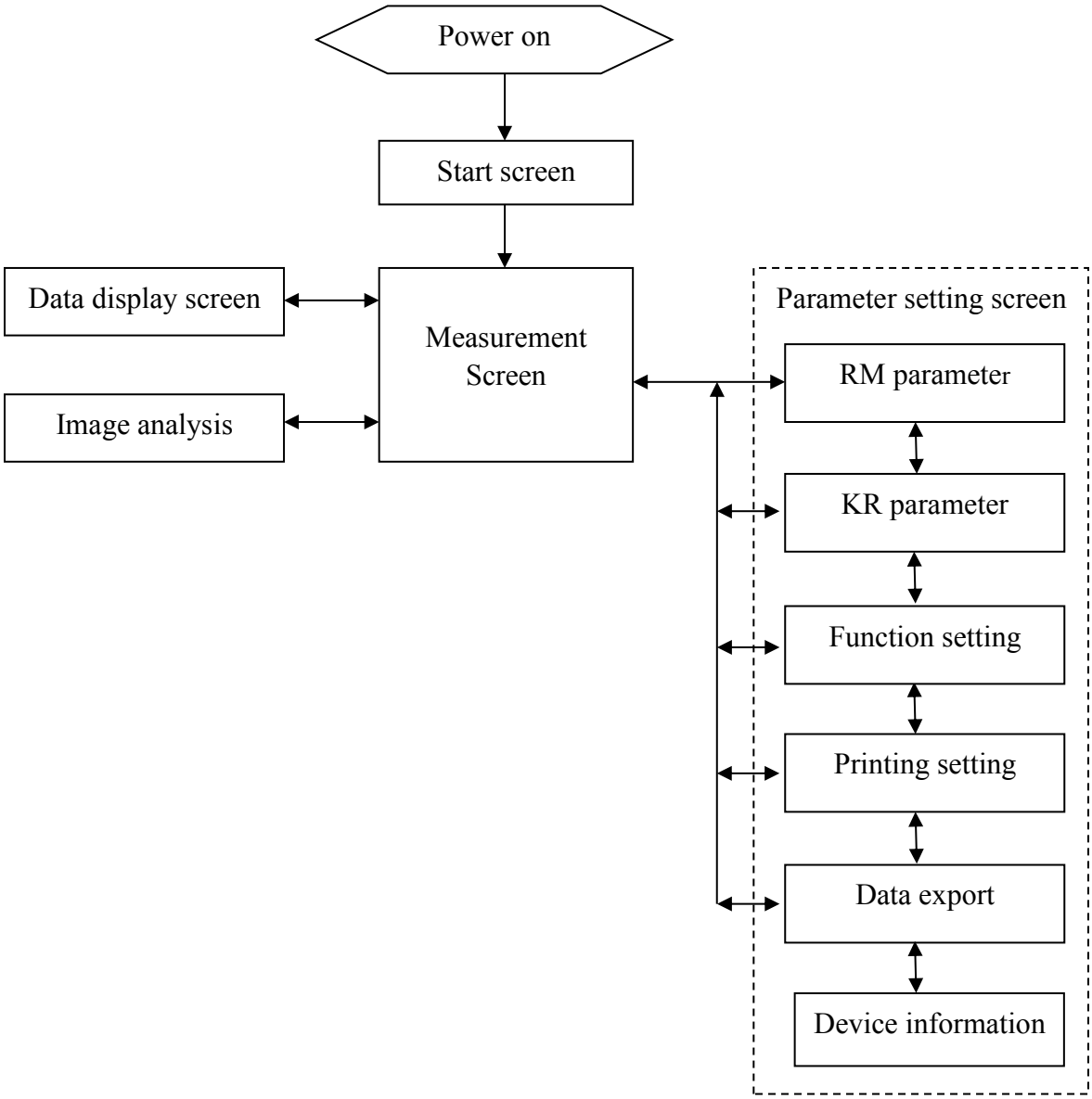
3.3 Symbols

The following symbols are applied to the device.

	Keep away from moisture.
	Type B electric shock protection.
	Warning, please read the operator's manual before operation.
	Device serial number.
	" | "and "O" respectively represent the power switch on and off.
	Alternating current.
	Fuse indication.
	3V CR1220 button battery.
	Chin rest up button.
	Chin rest down button.
	Reset button.
	Print button.
	Chin rest for patient put chin on during measurement. Bearing limit:2.5KG.

3.4 Operation Flow

The design block diagram of the software and user interface is shown below. Through the operating interface, the user can achieve the measurement, data display, image analysis, and modification of the parameters and functions.



Operation screen flow chart

Following is the introduction for several main screens in detail:

1. **Start screen**

Fig 5. Start screen

2. **Measurement screen**

As shown in picture below:

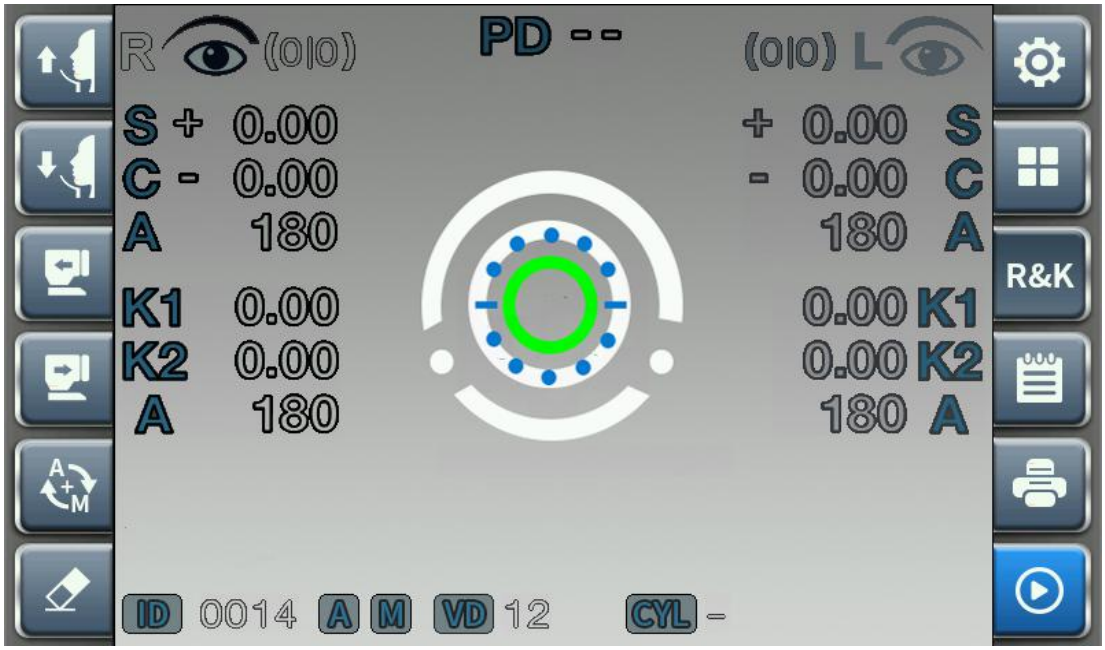


Fig 6. Measurement screen

The function of each button in the screen:

Symbol	Description
	**Setting:** Press this button to enter parameter setting screen. See “Settings”.
	**Other functions:** Press this button to enter or exit other measurement function screen. See”Other Functions”.
	**Measurement mode switch:** Press this button to switch between R measurement, K measurement and R&K measurement.
	**History data:** Press this button to show history data.
	**Print:** Press this button to print measurement result.
	**Measurement:** Press this button to start a measurement.
	**Clear:** Press this button to clear all the measurement records stored on the machine.
	**AUTO/MANUAL switch:** Press this button to switch between “Measurement (AUTO) / Focus (AUTO)”, “Measurement (AUTO) / Focus(MANU)”, “Measurement (MANUA) / Focus(AUTO)” and “MEAUSREMENT (MANU)/ Focus(MANU)” .
	**Measuring head move forward:** Press this button to push the measurement head move forward.
	**Measuring head move backward:** Press this button to push the measurement head move backward.

	**Chin rest up:** Press this button to lift up the chin rest.
	**Chin rest down:** Press this button to lower the button.

Definition of the icons on the screen:

Symbol	Description
	**Left eye measurement time count:** "L" means left. The first number is the refractive measurement count; the second number is the keratometer measurement count.
	**Right eye measurement time count:** "R" means right. The first number is the refractive measurement count; the second number is the keratometer measurement count.
	**PD result:** When both left and right eyes finish measurement and PD test and the measurement switch is on, the PD value will show. Or it will only shows "- -".
	**REF measurement result.**
	**KER measurement result.**
	**Patient ID.**
	**Focusing mode:** Auto focus (AUTO) / manual focus (MANU).
	**Measurement mode:** Auto measurement (AUTO) / manual measurement (MANU).
	**VD value：** "0"，"12"，"13.75"，"15".

CYL	**Cylinder sign:** “+”, “-”, “+/-”.

3.5 Setting screen

Press “setting” button in measurement screen to enter setting screen.

Fig 7. Setting screen

The functions of all the buttons:

Symbol	Description
R	Parameters of REF measurement;
K	Parameters of KER measurement;
	Function setting parameters;
	Printer setting parameters;
	Export setting parameters;

	Device information;
	Return to measurement screen.

Description of each function parameters:

① REF function parameters

Fig 8. REF function parameters-A

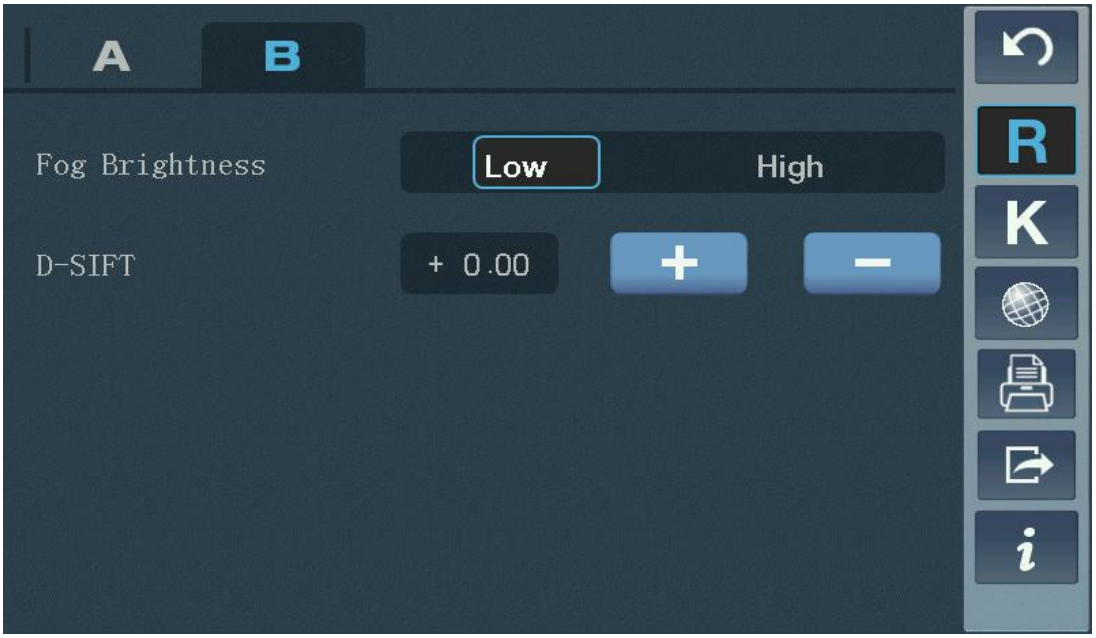


Fig 9. REF function parameters-B

NO.	Description
1	**RM Step:** 0.12D / 0.25D.
2	**VD(Vertex distance)：** 0 / 12 / 13.5 / 15.
3	**CYL(Cylinder notation)：** -/ + /MIX.
4	**Continuous measurement(# Measures)：** 1/3/5.
5	**(Fogging)：** one time / continuous.
6	**(Fog Brightness)：** Low/High.
7	**Compensation(D-SIFT)**

② KER function parameters

Fig 10. KER function parameters

NO./Symbol	Description
1	**Unit(Unit):** MM / D.
2	**Kr(Step):** 0.12D / 0.25D.
3	**Curvature(Index):** 1.332 / 1.336 / 1.3375.
4	**Continuous measurement(# Measures)：** 1/3/5.

③ Function setting

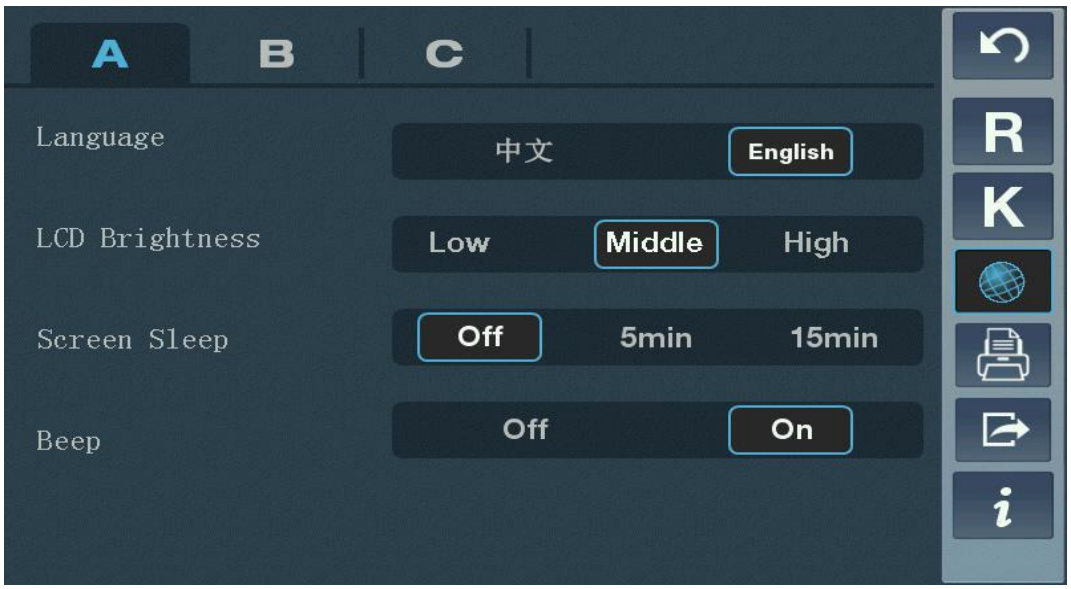


Fig 11. Function setting-A

Fig 12. Function setting-B

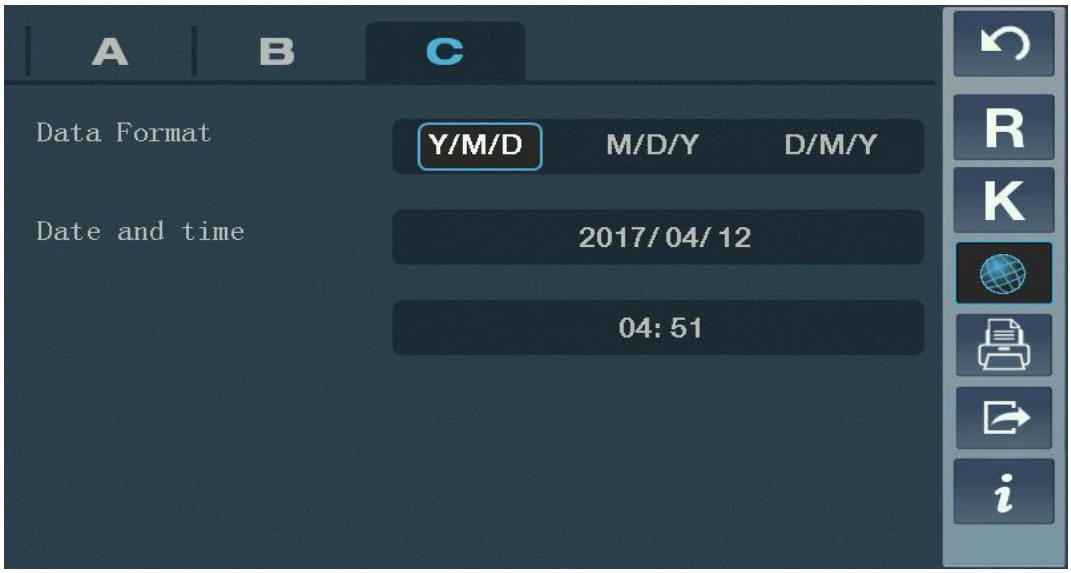


Fig 13. Function setting-C

NO./Symbol	Description
1	（**Language**）**:** English / Chinese;
2	（**LCD screen Brightness**）： Low/Middle/High;
3	（**Screen sleep**）**:** OFF / 5MIN / 15MIN;
4	（**Beeper**）**:** OFF / ON;
5	（**Reset Position**）： Left/Center/Right;
6	（**R/L Movement**）： Manual/Auto;
7	（**Default PD**）： 56-74， Increase or Decrease;
8	（**Jaw Position**）： Low/Middle/High;
9	（**Data Format**）： “Y/M/D”，“M/D/Y”，“D/M/Y”;
10	（**Data&Time**）： first lien: MM/DD/YY; second line: time;

④ Printer setting

Used to set up printing function, REF measurement data printing, K measurement data printing, PD data printing,header information and footer information, header information and footer information will print on the head and bottom of the ticket respectively.

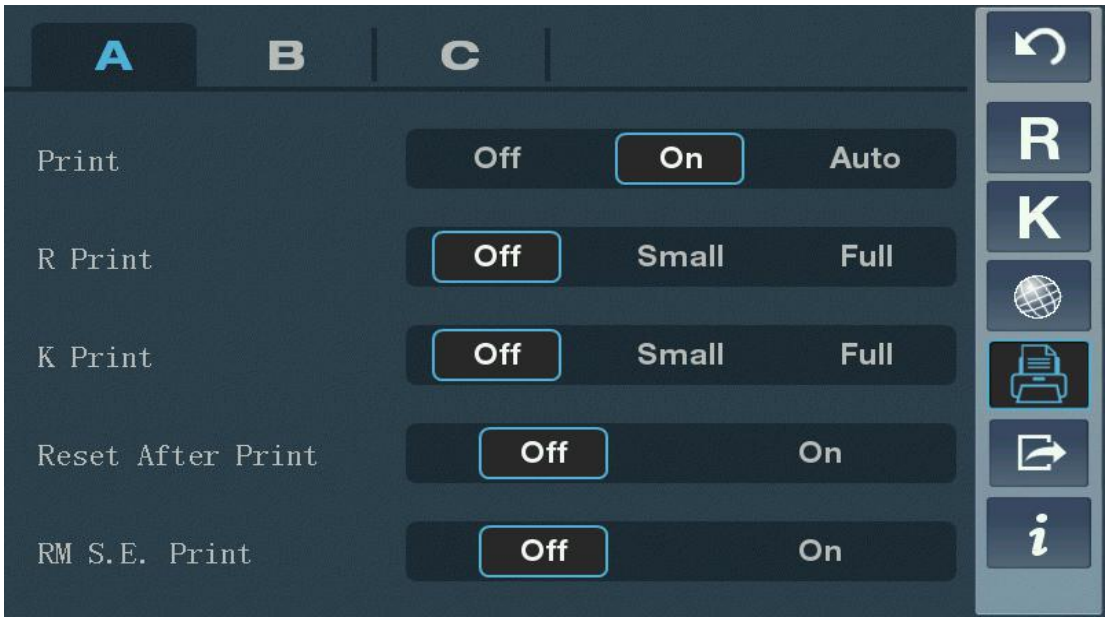


Fig 14. Printer setting-A

Fig 15. Printer setting-B

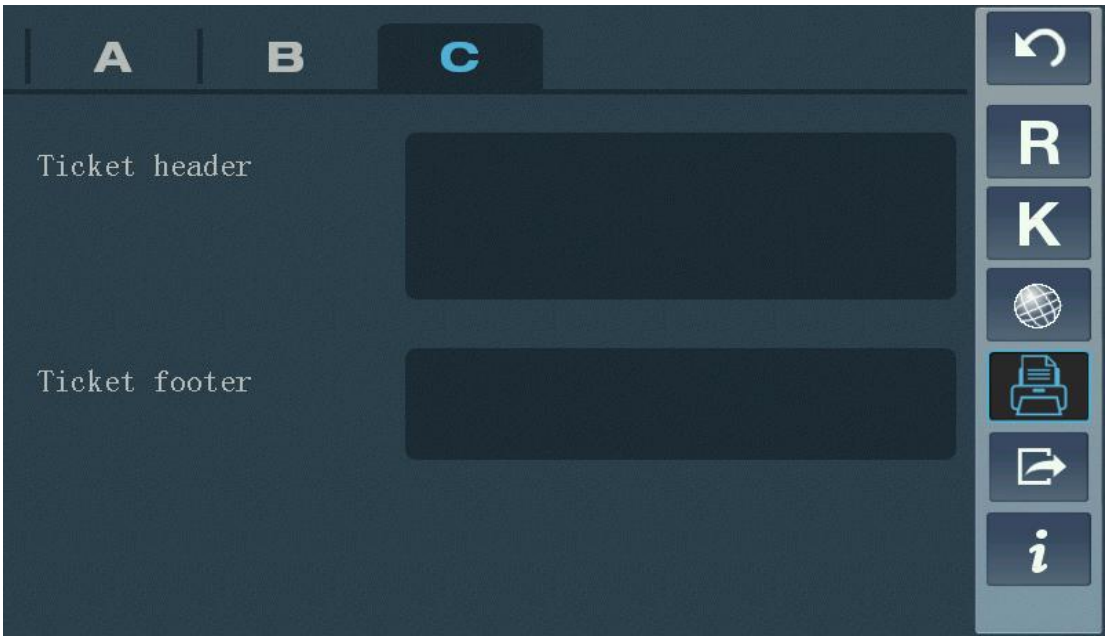


Fig 16. Printer setting-C

NO./Symbol	Description
1	（**Print**）：Off/On/Auto;
2	**R result**（**R print**）：Off/Small/Full;
3	**K result**（**K print**）：Off/Small/Full;
4	（**Reset After Print**）：Off/On;
5	（**RM S.E. Print**）：Off/On;
6	（**Right/Left Label**）:“R/L”，“OD/OS”;

7	**（Eye print）：** Off/On;
8	**（PD print）：** Off/On;
9	**（Ticket header）**
10	**（Ticket footer）**

⑤ Export setting

Setting the export method

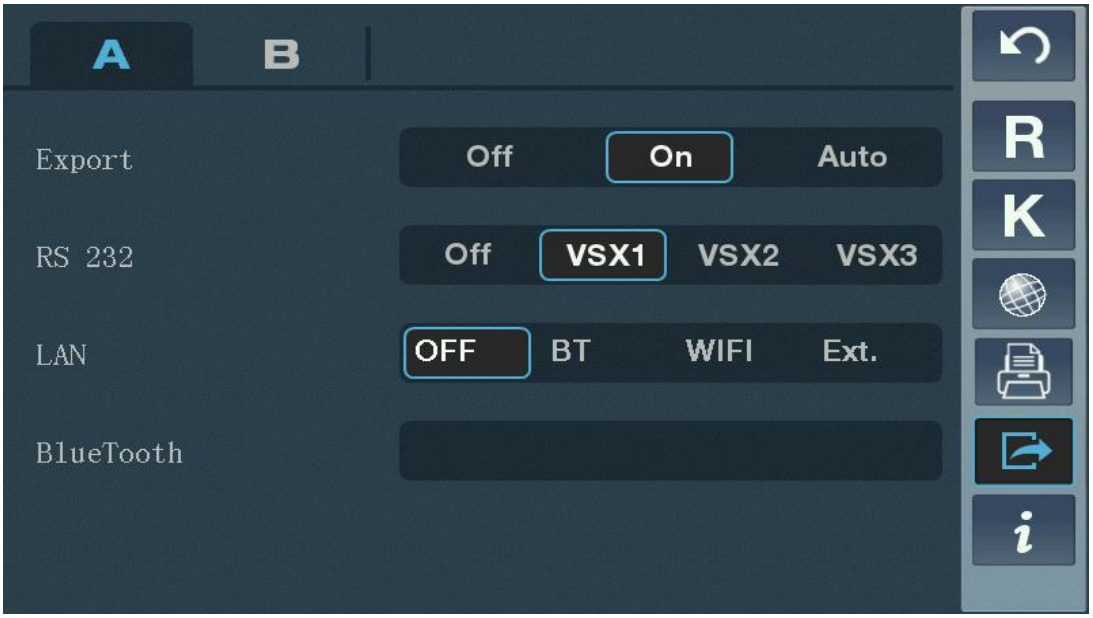


Fig 17. Export setting-A

Fig 18. Export setting-B

Symbol	Description
1	**（Export）：** Off/On/Auto;

2	**RS232**：Off/VSX1/VSX2/VSX3;
3	**LAN**：Off/ON;
4	（**Bluetooth**）：bluetooth name;
5	**WiFi**：WIFI name;
6	**Password**：input WIFI password;
7	**IP**：IP address;

⑥ Device information

Fig 19. Device information

Symbol	Description
1	 ：manufacture official account.
2	 ：execute reset the machine to ready for package.
3	**Mode**:Device model.
4	**ID**：Device ID.
5	**SN**：Software version.

Data display screen

Press the history data button in measurement interface to enter the measurement record screen:

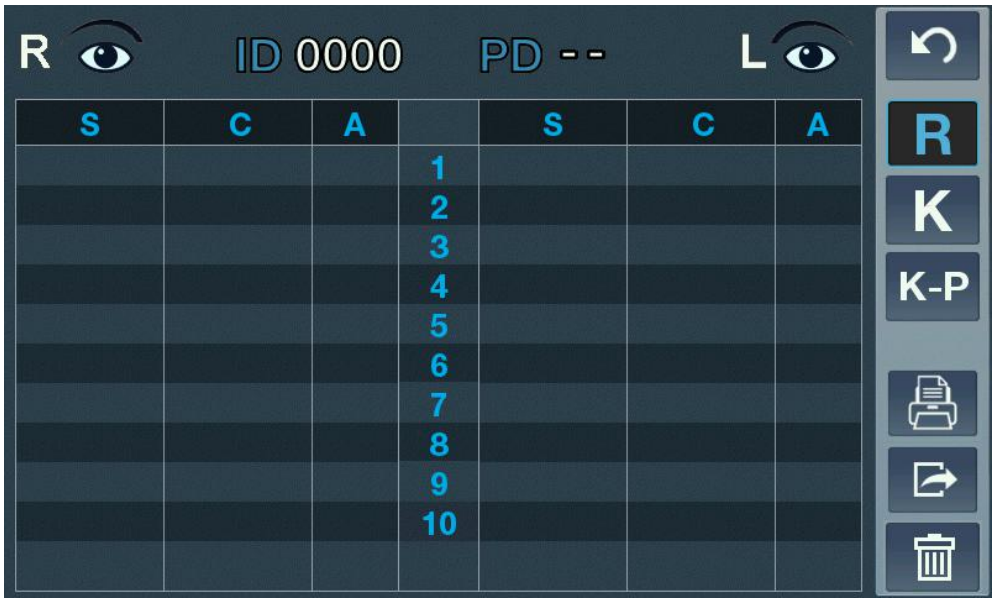


Fig 20. Data display screen

Definition of the buttons:

Symbol	Description
	Press this button to review the latest 10 sets of REF measurement data;
	Press this button to review the latest 10 sets of KER measurement data;
	Press this button to review the latest 5 sets of K-P measurement data ;
	Press this button to print REF and KER measurement result according to setting;
	Press this button to export REF and KER measurement result according to setting;
	Press this button to clear all the measurement data and the measurement process will be reset;
	Press this button to go back to measurement screen.

The definition of icons:

Symbol	Description

ID	Patient ID.
PD	PD result. When both left and right eyes finish measurement and PD measurement switch is on, the PD value will show. Or it will only shows “- -”.

3.6 Other functions

Press the button of additional functions in the measurement screen to enter additional functions screen:

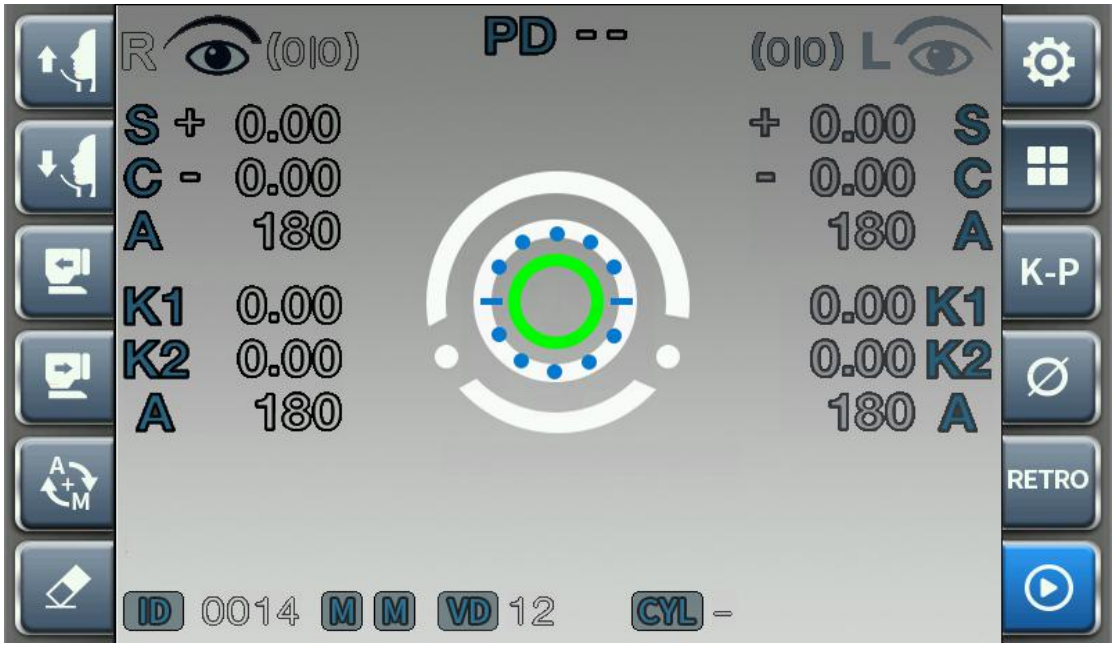


Fig 21. Other functions screen

Symbol	Description
	**Setting:** Press this button to enter parameter setting page. See “Settings”;
	**Other functions:** Press this button to enter or exit the other functions screen. See “other functions”;
	**K-P:** Press this button to measure peripheral K;
	**Pupil diameter measurement:** Press this button to measurement Pupil diameter;

	**RETRO:** Press this button to RETRO measurement;
	**Measure:** Press this button to start a measurement;
	**Clear:** Press this button to clear all the measurement records stored on the machine;
	**AUTO/MANUAL switch:** Press this button to switch between “Measurement (AUTO) / Focus (AUTO)”, “Measurement (AUTO) / Focus(MANU)”, “Measurement (MANUA) / Focus(AUTO)” and “MEAUSREMENT (MANU)/ Focus(MANU) ”.
	**Measuring head move forward:** Press this button to push the measurement head move forward;
	**Measuring head move backward:** Press this button to push the measurement head move backward;
	**Chin rest up:** Press this button to lift up the chin rest;
	**Chin rest down:** Press this button to lower the button.

Description of each function screens:

① K-P measurement

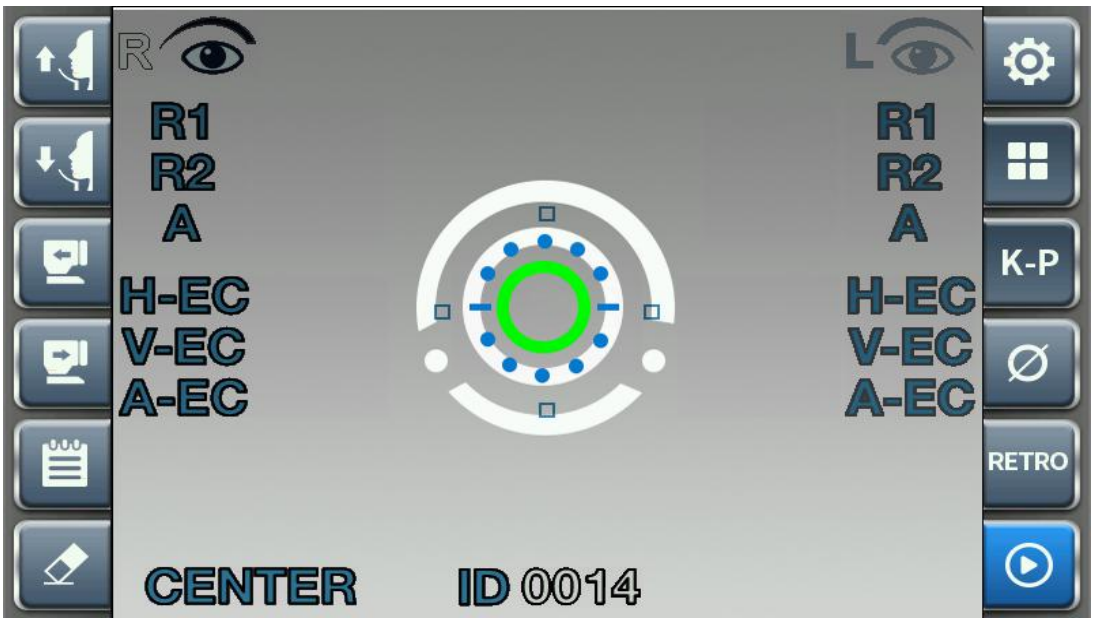


Fig 22. K-P measurement screen

Definitions of all the buttons in the screen:

Symbols	Description
	**Setting:** Press this button to enter parameter setting page. See “Settings”;
	**Other functions:** Press this button to enter or exit the other functions screen. See “other functions”;
	**K-P:** Press this button to measure peripheral K;
	**Pupil diameter measurement:** Press this button to measurement Pupil diameter;
	**RETRO:** Press this button to RETRO measurement;
	**Measurement button：** Press this button to start a measurement;
	**Clear:** Press this button to clear all the measurement records stored on the

	machine;
	**AUTO/MANUAL switch:** Press this button to switch between “Measurement (AUTO) / Focus (AUTO)”, ”Measurement (AUTO) / Focus(MANU)”, “Measurement (MANUA) / Focus(AUTO)” and “MEAUSREMENT (MANU)/ Focus(MANU) ”;
	**Measuring head move forward:** Press this button to push the measurement head move forward;
	**Measuring head move backward:** Press this button to push the measurement head move backward;
	**Chin rest up:** Press this button to lift up the chin rest;
	**Chin rest down:** Press this button to lower the button.

Definition of all the icons in the screen:

Symbols	Descriptions
	**Left eye：** “L” strands for left. When it lights up it means the unit is on left side ready to measure left eye;
	**Right eye：** “R” strands for right. When it lights up it means the unit is on right side ready to measure right eye;
	**Peripheral K measurement data**
	**Patient ID**

CENTER	The measurement data of the 4 directions of Peripheral K measurement

② Pupil diameter measurement

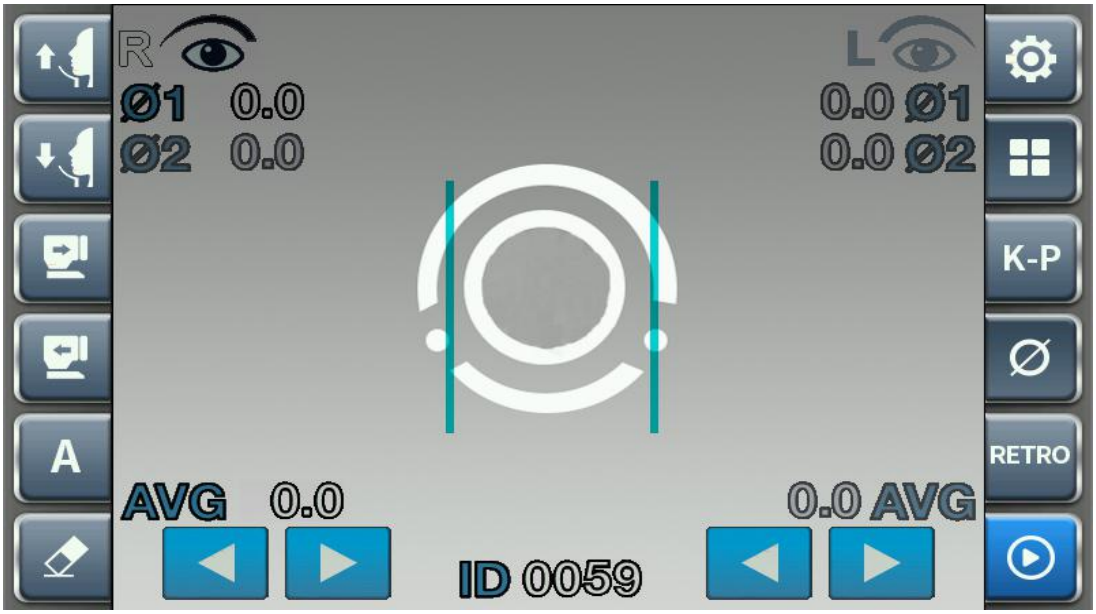


Fig 23. Pupil diameter measurement screen

Definition of all the buttons:

Symbols	Descriptions
	**Setting:** Press this button to enter parameter setting page. See “Settings”;
	**Other functions:** Press this button to enter or exit the other functions screen. See “other functions”;
	**K-P:** Press this button to measure peripheral K;
	**Pupil diameter measurement:** Press this button to measurement Pupil diameter;
	**RETRO:** Press this button to RETRO measurement;
	**Measure:** Press this button to start a measurement;

	**Clear:** Press this button to clear all the measurement records stored on the machine;
	**Pupil diameter measurement button:** Press this button to switch between pupil diameter 1 and pupil diameter 2;
	**Measuring head move forward:** Press this button to push the measurement head move forward;
	**Measuring head move backward:** Press this button to push the measurement head move backward;
	**Chin rest up:** Press this button to lift up the chin rest;
	**Chin rest down:** Press this button to lower the button;
	**Move to left:** Press this button to move the one side measurement scale to the left;
	**Move to right:** Press this button to move the one side measurement scale to the right.

Definitions of the icons:

Symbols	Description
	**Left eye:** “L” strands for left. When it lights up it means the unit is on left side ready to measure left eye;
	**Right eye:** “R” strands for right. When it lights up it means the unit is on right side ready to measure right eye;
	**Patient ID**
	Pupil diameter 1 measurement result

Ø2	Pupil diameter 2 measurement result
AVG	Average of all Pupil diameter results

③ RETRO measurement

Fig 24. RETRO measurement screen

Definition of all the buttons:

Symbols	Descriptions
	**Setting:** Press this button to enter parameter setting page. See “Settings”;
	**Other functions:** Press this button to enter or exit the other functions screen. See “other functions”;
	**K-P:** Press this button to measure peripheral K;
	**PD measurement:** Press this button to measurement PD;
	**RETRO:** Press this button to RETRO measurement;

	**Measure:** Press this button to start a measurement;
	**Clear:** Press this button to clear all the measurement records stored on the machine;
	**This is a blank button:**
	**Measuring head move forward:** Press this button to push the measurement head move forward;
	**Measuring head move backward:** Press this button to push the measurement head move backward;
	**Decrease brightness:** Press this button to lower RETRO lamp brightness;
	**Increase brightness:** Press this button to increase RETRO lamp brightness.

Definitions of the icons:

Symbol	Description
	**Left eye:** “L” strands for left. When it lights up it means the unit is on left side ready to measure left eye;
	**Right eye:** “R” strands for right. When it lights up it means the unit is on right side ready to measure right eye;
	RETRO lamp brightness. Initial value 60. Can be adjust by “LED+” “LED-” buttons;
	**Patient ID**
	Display area for RETRO results. On left and right side can show 3 results each.

4. Installation and measurement preparation

1. Unpack the Unit

Take the unit out of the packing box and place it on a flat work table;

Take off the dust cover;

Remove the tape used to fix the device.

2. Power cord connection

Place the device on a flat table;

Make sure the power switch is turned off. Then connect the power cord with the power inlet socket on the machine.

3. Chin rest paper

Pull out both sides artificial eye fixing pin;

Insert the artificial eye fixing pin into the holes on the chin rest paper;

Fix the chin rest paper onto the chin rest pad.

4. Printer paper

Refer to chapter 6.2.

5. Check Parameter Settings

Before measurement, please check each parameter settings carefully.

If needed, user can save hospital name, address info into the machine. Refer to chapter 3.5 for entering info.

 CAUTION	Before starting measurement, please check the machine settings with chapter 3.5 of this manual to confirm the parameters are correct. Different parameter settings may result in changes of measurement results.

5. Measurement

5.1 Operation method of touch Screen

All the operations can be done on the touch screen except for chin rest up and down, print button and clear button.

1. Under any mode, long press the forward and back word button on the left side of the screen, the measuring unit will keep moving forward or backward. The measuring unit will stop movement if stop pressing the button or after it reaches limit position.The specific position of the button is shown in Figure 5. Show.

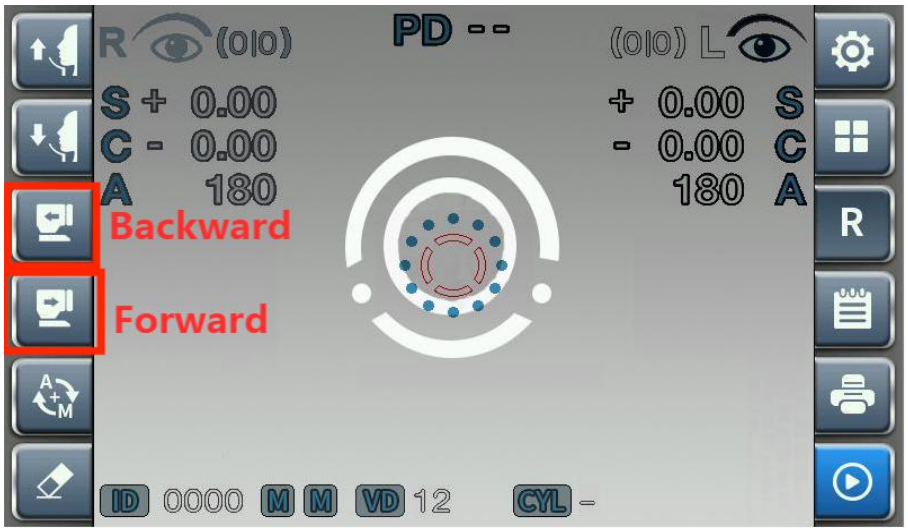


Fig 25.Buttons for measuring unit moving forward or backward

2. Under any mode, short press on the forward and backward button the measuring unit can move forward or back ward shortly.The specific position of the button is shown in Figure 5. Show.

3. Under any mode, long press on the top, bottom, left, right area of the touch screen in the measuring interface, the measuring unit will keep moving up/down/left/right until it reaches limit position or stops pressing. Please refer to Figure 6 below. **NOTE: the long press area should be within the measuring interface on the touch screen**.

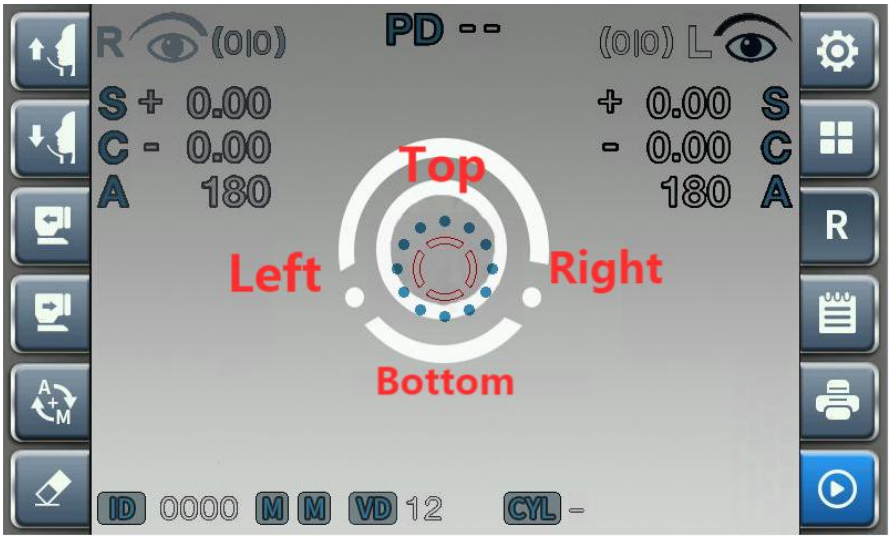


Fig 26. Area in the measuring interface for moving Top/Bottom/LEFT/RIGHT

4. Under any mode, short press on the top, bottom, left, right area of the touch screen in the measuring interface, the measuring unit will moving up/down/left/right for a short distance and stops immediately. Please refer to above Figure 6 .

5. Under auto focusing mode, double click on any position of the measuring interface the measuring unit will move to the clicked position and do auto focusing as shown in Figure 7.

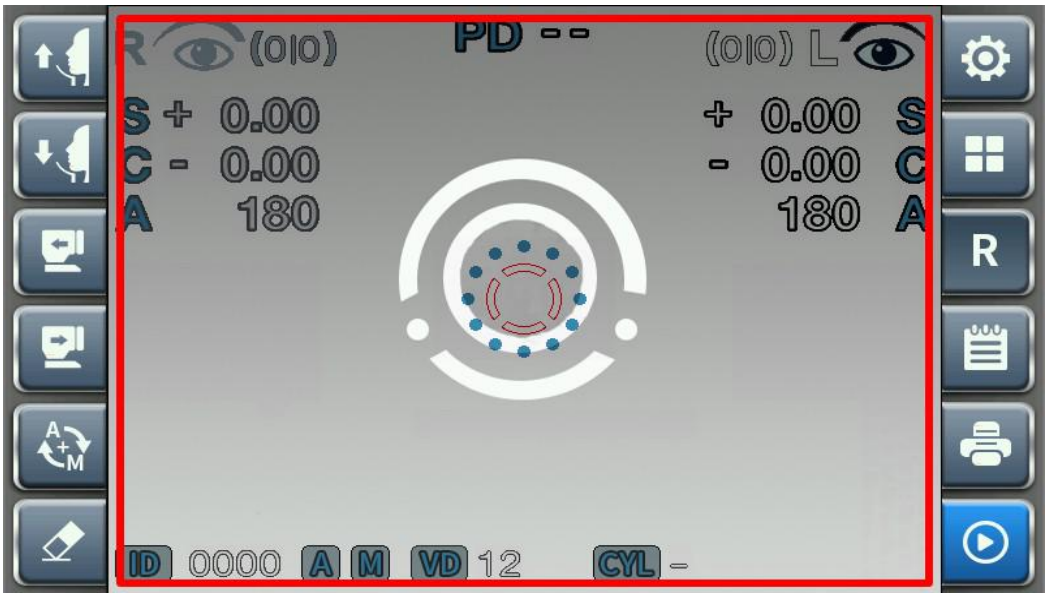


Fig 27. Area available for double click

6. Under any mode, press on the left or right eye icon in the interface to fast switch between left eye and right eye. Please see Figure 8.

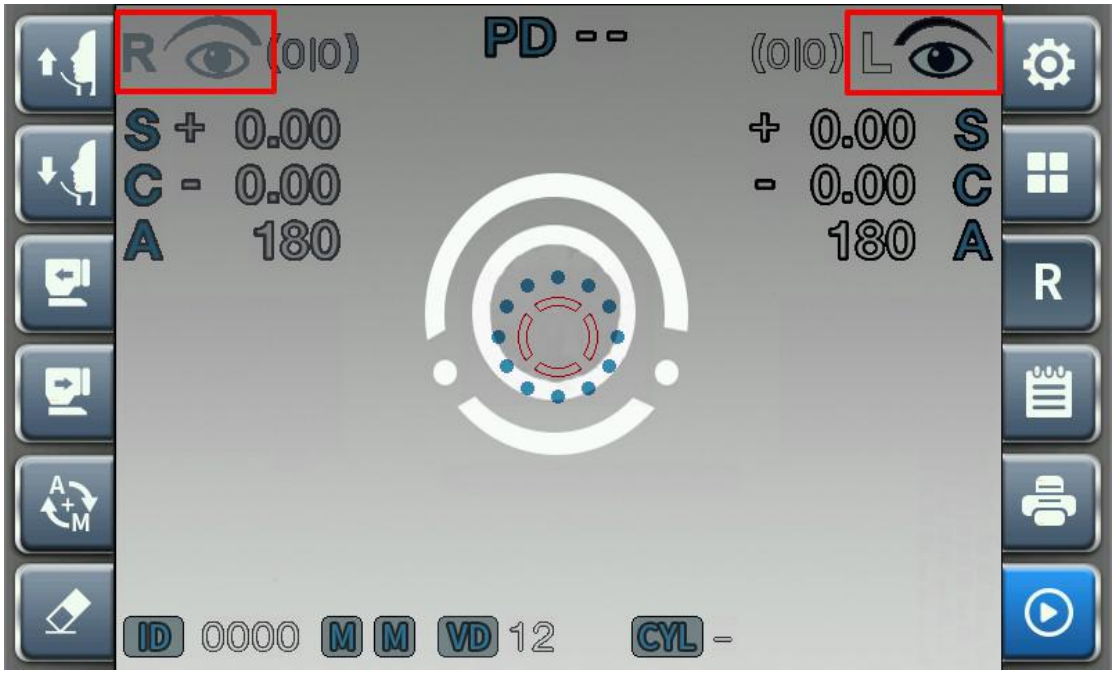


Fig 28. Left and right eye fast switch button

5.2 Artificial eye measurement

1. Turn on the power switch

Connect the power cord and turn on the power.

2. Place the artificial eye

Take away the chin rest paper, align and adjust the holes on the artificial eye base and the holes on the chin rest and plug in the fixing pins to fix the artificial eye onto the chin rest.

3. Measurement position adjustment and focusing

After put the artificial eye in place, press the head forward/backward button to adjust position until the artificial eye and the ring focus and most clear.

Press the screen to adjust the head position to move up/down or left/right, until the green centering sign shows up as shown in below picture:

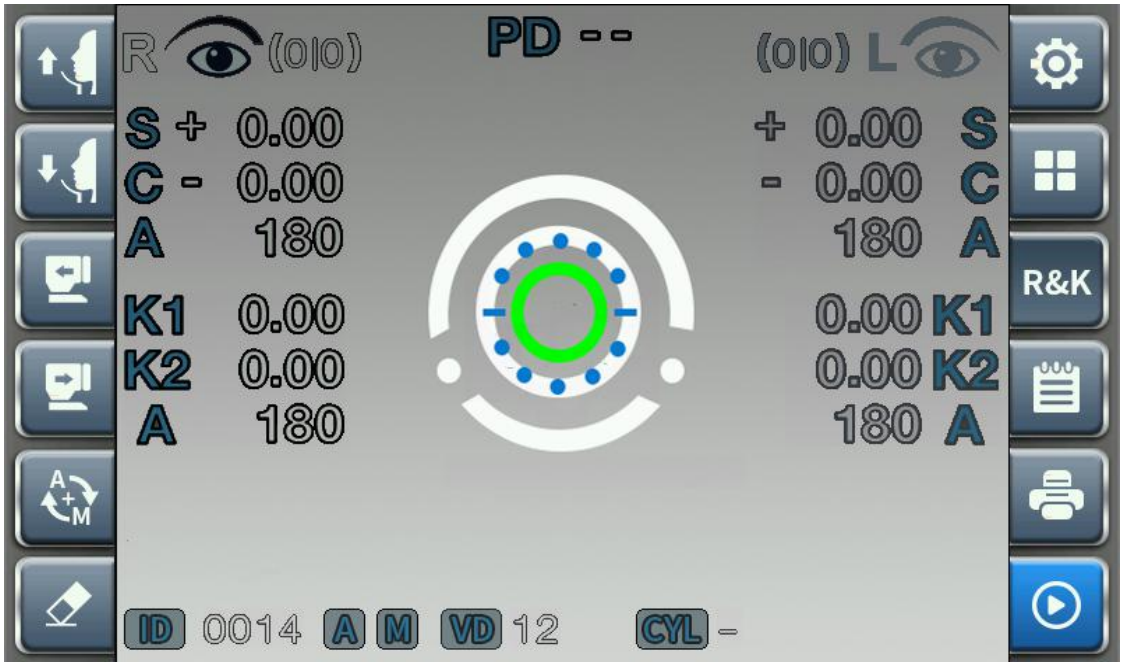


Fig 29. Focusing

A. Height adjust: press the chin rest up/down button or these  buttons in the measurement screen to adjust chin rest height.

B. Left/right adjust: press on the left or right side of the screen can move the machine head to the left or right or make the bright dot to move right or left.

C. Focus adjust: press the screen on the top, bottom, left or right or these 2 buttons in the measuring screen  to adjust focusing to make sure the focus sign clear on the bright dot.

4. Measurement

As described above, after adjusting focus with the artificial eye, press the measure button to start a test.

⚠ WARNING	If any of the following incidents shall happen, please turn off the power supply immediately, disconnect the AC power and contact MSOC distributor. ● If there is smoking, strange smell or noise coming out of the device. ●When liquid or metal objects get inside of the device. ●When the instrument is dropped or appearance is damaged.

⚠ CAUTION	When the machine is switched on, without any operations within 5 minutes the device will automatically get to the power saving mode. Press any button to activate the machine from power –saving mode.

5.3 Patient Measurement

1．Switch on the device

Connect the device to power supply and switch on.

2．Adjust position

Let the patient sit on the chair and put their chin on the chin rest and lean their forehead on the head rest.

Tell the patient to relax and look at the target.

3．Adjust measure position and focus

Press the head foreword/backward button until the focus ring is most clear.

Press on the left/right or up/down button on the screen until the green centering sign shows up. Adjusting and focusing method is the same as measuring artificial eye.

4．Start measurement

Press the start button to start measurement after position and focus adjustment.

⚠ CAUTION

- During the measurement process, the patient should keep their head steady and stare at the balloon image all the time to avoid measurement result change.
- The result measured by the ARK can not be the only basis to prescribe glasses for the patient. ARK measurement can only be reference for subjective refraction but not replace optometrist’s refraction and lens correction technique.

5.4 Auto Tracing

When the device is connected with power and under normal use, press this button  to switch measuring mode. When choosing auto measuring and auto focusing mode  it means auto tracing mode is on. After choosing auto tracing mode,

adjust the unit position to make sure the patient eye is within the image capture area. Then the device will start adjusting position to focusing and start measuring automatically. After left eye measurement is finished, the unit will automatically switch to right eye and finish the measurement.

1. If the patient eye is out of the measuring area, the unit will not able to auto tracing and focus.

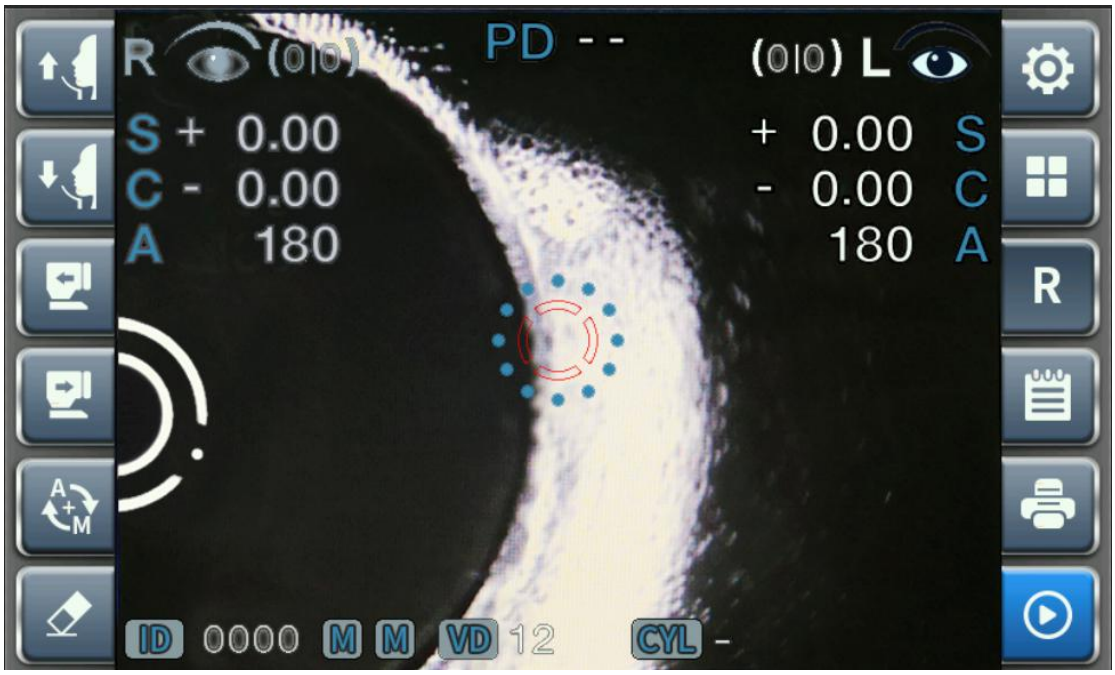


Fig 30. when the patient eye is out of the measuring area

When patient eye is out of the measuring area, the unit will not be able to auto tracing and auto focusing. The motor will stop any movement. Operator will need to manually by press on the touch screen to move the measuring unit to find the patient eye and then start auto tracing and measurement.

2. The patient eye is in the measuring area but auto tracing is not working

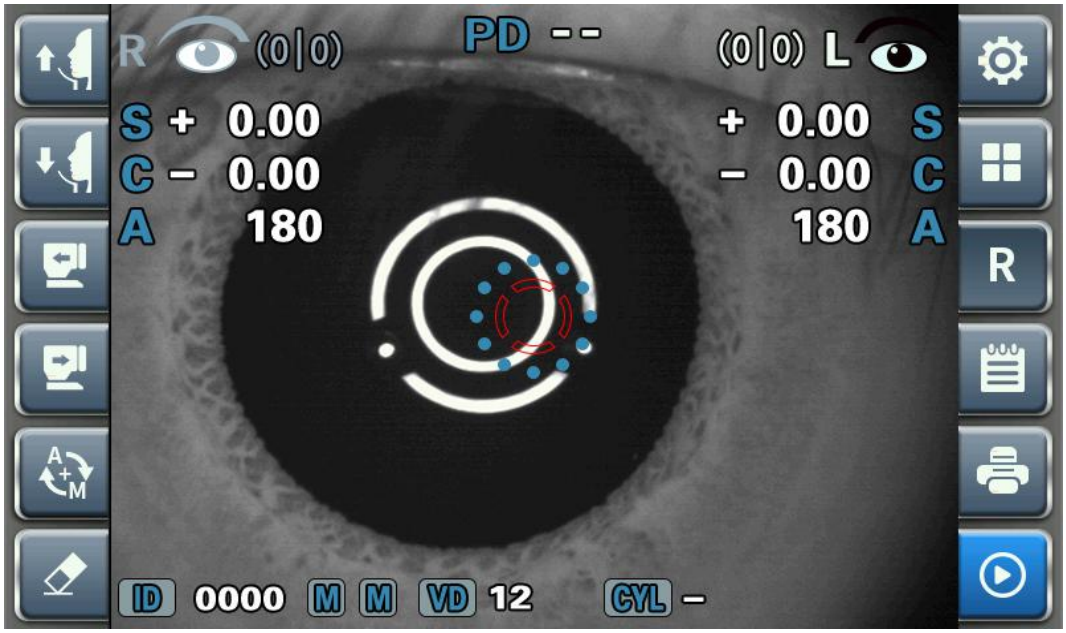


Fig 31. The patient eye is in the measuring area but auto tracing is not working

When the patient eye is within the measuring area but the device can not start auto tracing and focusing:

Check if auto tracing is on, press this button  to switch to auto mode  .

There is strong sunlight or strong indoor lighting that interfered auto tracing. Try change lighting condition or change device position and start again.

Auto tracing may not work for certain eye conditions, such as keratoconus or patient how recently done refractive surgeries. Under this condition, please press this button  to switch to manual mode  .

If a patient suffers from severe ocular ataxia, resulting in inability to fix vision, auto tracing may not working. Under this condition, please press this button  to switch to manual mode  .

Others

If auto tracing failure is not one of the above conditions, please contact your distributor. If the problem is still not solved, please contact MSOC.

5.5 K-P measurement

This is to measure the peripheral corneal curvature. Centered on corneal to measure the corneal curvature on the top, bottom, left and right around the corneal. It

is the relative eccentricity when comparing the curvature on the corneal axis and corneal center.

First press the other function button, choose K-P mode.

Adjust position and focusing. Refer to chapter 5.2 artificial eye measurement.

Measure corneal center

Press the measure button on the right of the screen to start measurement. The initial measuring position is the corneal center, and there will show CENTER on the screen left bottom corner. The result is the same as the result measured under KER mode

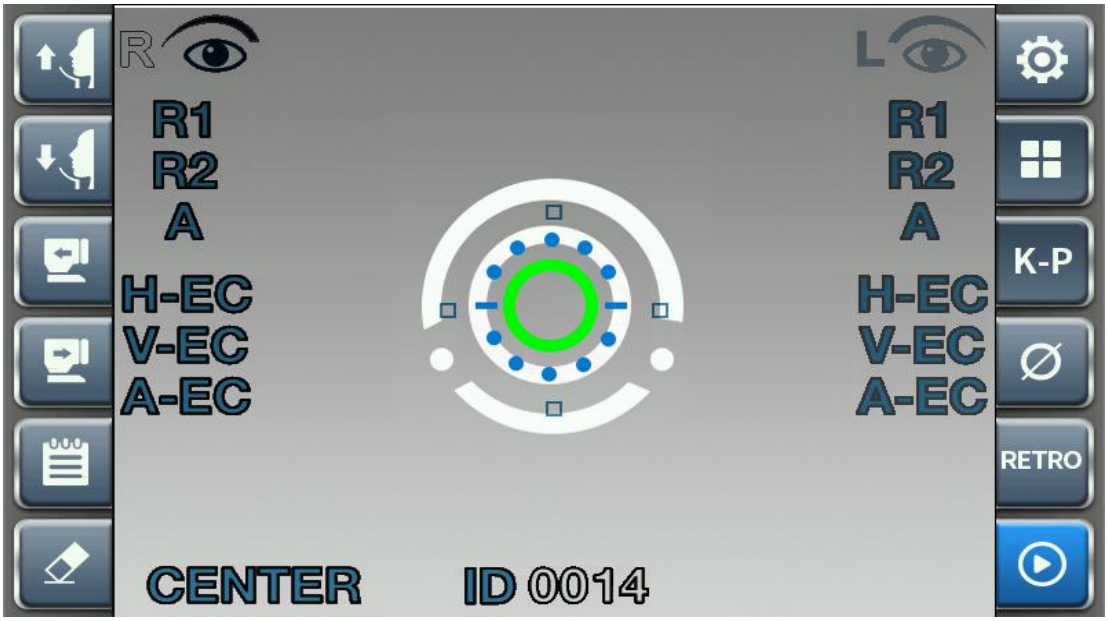


Fig 32. K-P measurement screen

4. Measure the corneal peripheral corneal curvature

The direction of the currently measured part around the cornea is marked in the lower left corner of the measurement mode.The 4 boxes around of the circle indicates sides of INF, SUP, NAS, and TEMP. The color of the boxes shows the measure process. If finished, the box will change to green solid box. If no result, the box will be green blank box. During measurement the box will keep blinking.

Press the measure button to start a measurement. Press once for measurement of each direction. When a measurement is finished all the boxes will become solid boxes

The directions around the corneal:

- SUPERIOR（SUP）： from corneal center up;

- INFERIOR（INF）： from corneal center down;

- Temporal（TEM）： from corneal center to the temporal side;

- NASAL（NAS）： from corneal center to the nasal side;

5. Measure Sequence

The measurement will proceed in the order of TEM-> SUP-> NAS-> INF. To make the measurement easier, there are lamps on the device to guide the patient. After telling the patient to look at the lamps, user can also adjust the device to focus.

5.6 RETRO measurement

It is to check the crystalline lens of the patients who have cataract symptoms or actually suffer from cataract. It check the opacity of the lens by changing the light intensity going into the eye, together with the shape of light reflected from the retina.

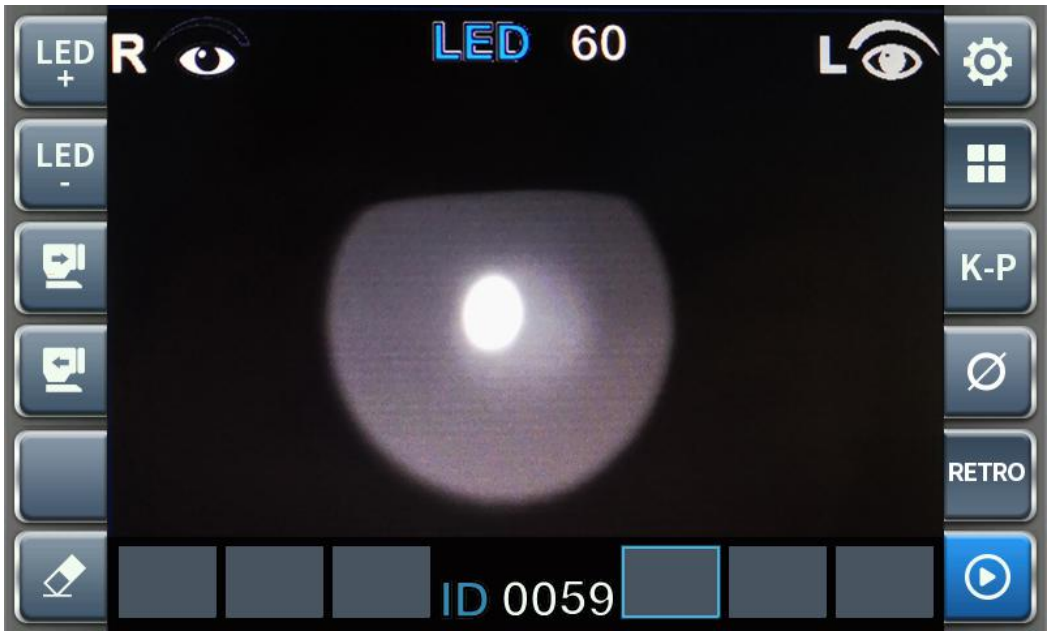


Fig 33. RETRO measurement screen

1. Adjust the brightness of LED

· Click button LED+ and button LED- to adjust the brightness of LED.

2. Observation of retro illumination image

· Place the device in front of the patient eye(right or left).

· Use the buttons to center and focus properly.

· In order to protect the patient’s eyes,avoid examining the eyes over 30 seconds.

3. Acquire an image

· Press on the measurement button on the left bottom corner to save the measuring image.

The image will be saved under the select box of the current eye. Because the camera continues to work after each image capture, so it can capture several images continuously.

·If more than 3 images are captured for 1 eye, then the first image will be deleted, and the second image becomes the first and the third becomes the second and the latest on becomes the third.

4. Review the image

·Click on the needed image.

· To return to live camera, press the measurement button or press the RETRO image on the blank box.

5. Delete an image

· select the image by pressing on it.

· press on delete button.

If there is an image after the deleted one,the images will be translated to avoid empty box image.

6. Self-diagnosis and maintenance

6.1 Troubleshooting

When there is problem with the device, please try below methods first:

Symptoms	Method
Turning on power switch, the machine has no response.	·Make sure the power plug is connected to the power inlet. ·Make sure the fuse is installed and not broken.
The screen stops showing images suddenly	·The device has entered the screen saver mode. Press any button to return to normal display state.
Button failure	·There may be an abnormality. Please try to restart the machine.
Printing button does not work	·please replace the printer paper Make sure printer paper is installed correctly

If you can't solve the problem according to the table, please contact your distributor.

6.2 Replacing printer paper

When a red line appears along the printer paper, please replace the new printer paper.

① open the printer cover.

② take out the printer paper shaft with the empty paper roll.

③ Put on a new roll of printer paper.

④ After install back the printer paper, leave a short piece of the paper out.

⑥ slide the paper out through the cover and install the cover back.

6.3 Cleaning and disinfection

Make sure to turn off the power before cleaning and disinfecting.

Cleaning:

① Keep the product clean. Don't use strong volatile solvents, diluents or benzene as cleaning agent.

② Wipe the product with a soft cloth dipped in soapy water.

③ When wipe the lens and the mirror, firstly blow off the dust on the surface and then wipe with a soft dry cloth.

⚠ WARNING	●Do not spray the liquid into the device, otherwise it will broken down the device. ●Alcohol and acetone are forbidden. Strong solvents can cause damage.

Disinfection:

① Before measure each patient, the area contacting the patients should be cleaned and disinfected with medical alcohol (Forehead rest and chin rest). If you use the chin rest paper, replace a new chin rest paper for each patient.

6.4 Replacing the fuse

① Turn off the power and unplug the power cord.

② Open the fuse cover in the power socket, the Auto ref/keratometer has two fuses, please see “14.Fuse holder”.

③ Take the broken fuse.

④ Install the new fuse.

⚠ WARNING	The Auto ref/keratometer uses F2AL250V fuse.

6.5 Site Change

① Turn off the power and unplug the power cord.

② Rotate clockwise to tighten and lock the plug screws in figure 5.

③ When moving the device, hold the product base and maintain the level.

⚠ WARNING	When moving the product or changing site, make sure to lock the plug screw.

6.6 Preventive inspection and maintenance

①Adjust the level of the instrument with a horizontal bubble. Set the measurement

sphere step to 0.12D. Then measure according to the steps of the 5.2 artificial eye measurement in this manual. When the measurement results do not meet the requirements, report to after-sales service department of our company or local distributor to re-calibrate.

②General technical inspection must all meet:

·The overall installation of the equipment should be firm, without obvious loosening, and the chin rest should be able to rise and fall smoothly;

·Display screen is clear imaging, complete and stable display without flicker;

·Print function can run normally;

·The automatic eye tracking function can operate normally.

③ When the device shows any non-conformity, must report after-sales service department of our company or local distributor to re-calibrate or repair.

④ Once every six months.

⑤ The maintenance shall be carried out at least once a month according to the requirements of cleaning in the section 6.3 in this manual.

6.7 Scrap

⚠ CAUTION	① The disposal of scrap products and accessories need to comply with the relevant laws and regulations of local government. The product or lithium battery scrap, especially lithium batteries may cause pollution to the environment. ② The disposal of waste packaging material shall comply with the relevant laws and regulations of the local government.

7. Dimensions and other instructions

7.1 Dimensions and Contraindications

Dimension

Body: 487mm×262mm×467mm Net weight17.2kg

Power: 100-240V～ 50/60Hz，75VA

Contraindication: None

7.2 Service life

8 years

7.3 Disclaimer

The manufacturer shall be responsible for the safety, reliability and performance of the product if meet the following conditions:

（1）Install according to the instruction manual.

（2）Use and maintain according to the instruction manual and service manual.

The manufacturer shall not be held responsible for any problems caused by the alteration of the instrument without permission. The altered instrument will not be within the scope of the manufacturer's commitment.

8. After-sales service

If there are problems during use the machine and still not resolved after communication with the distributor. Please fill the table according to the following requirements and submit to the agents of our company.

① Product model：AR-910,ARK-910,AR-900,ARK-900

② Serial number: The number and text recorded on the label.

③ Problem Description: A detailed description of the problem.

9.Main Specifications

Measurement	
VD	0，12，13.5，15mm
Spherical power（S）	-25.00— +22.00 m^{-1} （0.12/0.25D STEP）
Cylindrical power（C）	0.00— ±10.00 m^{-1} （0.12/0.25D STEP）
Cylinder axis（A）	0—180°（1°）
Astigmatism symbol（CYL：）	“-”，“+”，“±”
PD	10～85 mm
Corneal curvature radius：（ARK）	5mm - 10mm（0.01mm step）
Corneal refractive power：（ARK）	67.50 m^{-1} - 33.75 m^{-1}（0.12 m^{-1}/0.25 m^{-1}）
Data storage	
Can store 10 measurement results for each eye at the maximum	
Hardware	
Printer	Thermal printer
Power saving mode	5 minutes or 15 minutes optional, automatic power saving mode
Display	7 inch color LCD
Voltage, frequency	100-240V～，50/60Hz
Power	75VA
Chin rest bearing	2.5kg

10.EMC

Special precautions for electromagnetic compatibility are required for this equipment. And must be installed and used in accordance with the electromagnetic compatibility information specified in this manual.

Portable and mobile radio frequency communications equipment may have an impact on the device.

You must use the cable and accessories provided by this equipment. Cable information is as follows:

Cable name	Model	Length
Power cord	/	2.1m

Except for the power cable(adaptor) which is sold as interior spare parts, using of non-specified accessories and cables may increase device or system emit or reduce device immunity to other interference.

The equipment or system should not be used or stacked with other equipment. If it is necessary to be close or stacked use, it should be verified that it can normally operate in its configuration.

The basic performance is normal operation:

Name	Specific description
Normal operation	The device can run normally during the test.

Guidance and manufacturer's declaration - electromagnetic emissions The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions GB 4824	Group 1	The device uses RF energy only for its internal function. Therefore, its radio frequency emission is very low, and the possibility of interference to nearby electronic equipment is very small.
RF emissions GB 4824	Class A	The equipment is suitable for use in all facilities, including household and public low-voltage power supply network that supplies buildings for domestic purposes.
Harmonic emissions GB 17625.1	Class A	

Voltage fluctuations/ Flicker GB 17625.2	Comply	

Guidance and manufacturer's declaration - electromagnetic immunity The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.			
Immunity test	**IEC60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic Discharge （ESD） GB/T 17626.2	±6kV contract ±8kV air	±6kV contract ±8kV air	Floor 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 GB/T 17626.4	±2kV for power supply cable ±1 kV for input/output cable	±2kV for power supply cable Not applicable	Mains power quality should be that of a typical commercial or hospital environment quality.
Surge GB/T 17626.5	±1kV Line to line ±2kV Line to ground	±1kV Line to line ±2kVLine to ground	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 GB/T 17626.11	< 5% UT，for 0.5 cycle(> 95% dip in UT) 40% UT，for 5 cycles (60% dip in UT) 70% UT，for 25 cycles (30% dip in UT) < 5% UT，for 5 sec (> 95% dip in UT)	< 5% UT，for 0.5 cycle(> 95% dip in UT) 40% UT，for 5 cycles (60% dip in UT) 70% UT，for 25 cycles (30% dip in UT) < 5% UT，for 5 sec (> 95% dip in UT)	Mains power quality should be that of a typical commercial or hospital environment. If the user of the device requires continued operation during power mains interruptions, it is recommended that the device be powered from an uninterruptible power supply or a battery.
Power frequency （50/60Hz） GB/T 17626.8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical

			commercial or hospital environment.
NOTE：UT is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacturer's declaration - electromagnetic immunity The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.			
Immunity test	**IEC60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Radio frequency conduction GB/T 17626.6 Radiated RF GB/T 17626.3	3 V（Effective value） 150kHz - 80MHz 3 V/m 80MHZ - 2.5GHZ	3 V（Effective value） 3 V/m	The distance between portable and mobile radio frequency communication equipment and any part of the equipment should not be closer than the recommended isolation distance, including cables, the distance is calculated by a formula corresponding to the frequency of the transmitter. **Recommended separation distance** d =1.2 $\sqrt{(P)}$ 150kHz-80MHz d =1.2 $\sqrt{(P)}$ 80MHz-800MHz d =2.3 $\sqrt{(P)}$ 800MHz-2.5GHz 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 determined 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: 

NOTE1： At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE2： 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 device is used exceeds the applicable RF compliance level above, the device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the device.

b.Between the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended separation distances between portable and mobile RF communications equipment and the device

The device is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the device 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 - 80MHz $d = 1.2\sqrt{(P)}$	80MHz - 800MHz $d = 1.2\sqrt{(P)}$	800MHz - 2.5GHz $d = 2.3\sqrt{(P)}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1: At 80 MHz and 800 MHz, the separation distance 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.

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