Righton

Hand Held Auto Refract-Keratometer

Retinomax K-plus 5

Instructions

September 2019

D057-2E

CAUTION: Please read this instruction manual before using the instrument.

This instruction manual is intended for users of the Righton Retinomax K-plus5.

It includes instructions on how to use the instrument, safety handling precautions, and specifications.
These instruments conform to the Japanese Industrial Standards (JIS) as well as the standards of the International Electrotechnical Commission (IEC).
Before using the instrument be sure to read the instructions carefully, and fully understand the operation procedures and safety instructions to ensure correct usage.
Also, please keep this manual near the main unit so that you can refer to it whenever necessary.
If you have any questions or comments, please do not hesitate to contact the dealer from whom you purchased the instrument.

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■Handling Precautions - Please first read for safety purposes.

<Caution Symbols Used in This Manual>

Righton products are manufactured with full attention to safety. However, these instruments can cause personal injury or equipment damage if used improperly or if the instructions are ignored. For your own safety, read this instruction manual carefully and thoroughly before using the instrument. Do not discard this manual, but keep it handy for easy reference.

This manual uses the following symbols to draw your attention to "important safety instructions." Be sure to follow the instructions marked with these symbols.

Symbol	Meaning
⚠	CAUTION: Indicates a potentially hazardous situation which, if not avoided, could result in injury or damage to the surrounding equipment.

⚠ **CAUTION 1. Intended product use**

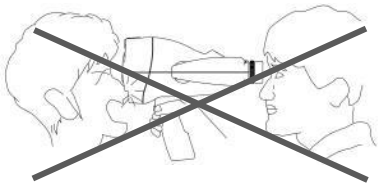
- Retinomax K-plus5 is only intended to be used for measuring refractive power, corneal curvature and pupil diameter. Do not use it for any other purpose.

⚠ **CAUTION 2. Do not disassemble**

- Never attempt to disassemble the product as it could cause a serious electric shock or equipment damage.

⚠ **CAUTION 3. Measuring operation**

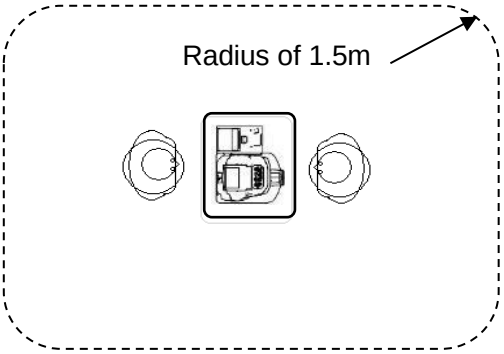
- When moving the main unit toward the patient or laterally in front of the patient, use care to avoid hitting the patient's face.

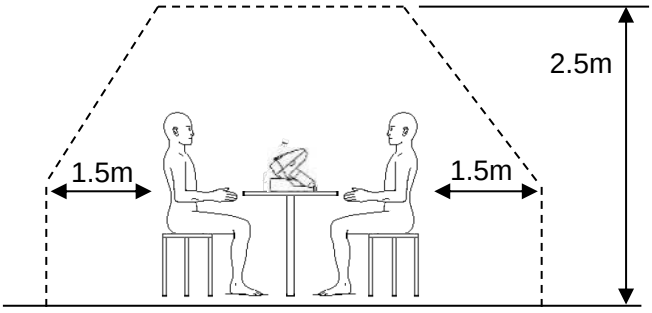


- Do not measure under environment if there are many people or strong lights around the patient where disturbing measurement, it may cause failure of measurement.

CAUTION **4. Installation and transport**

- Do not place the instrument and the peripheral equipment (PC, monitor) on an unstable location, such as a shaky table or inclined surface. It could be dropped or fall and cause injury.
- Hold the main unit using the grip. Do not hold it with the viewfinder or forehead rest.
- Place the station and printer in a well-ventilated location. Do not place thick cloth or paper under the station or printer, as it may prevent the release of heat during battery charging. Heat will accumulate internally, leading to the danger of fire or failure.
- The operating environment: Temperature 10ºC to 35ºC, relative humidity 30% to 85% (no condensation), atmospheric pressure 800-1060 hPa.
- This instrument does not meet the temperature requirements of ISO 15004-1 for using. Do not use this instrument in conditions where the temperature may rise above 35ºC or fall below 10ºC.
- Although the instrument is designed with dust protection, it should not be used in a dusty room.
- The best location for the instrument is a room equivalent to a semi-dark room. Do not expose the instrument to a bright window or illumination light
- Measurement space requirement is as follows. Follow requirement of IEC60601-1 if other type of instruments will be used.





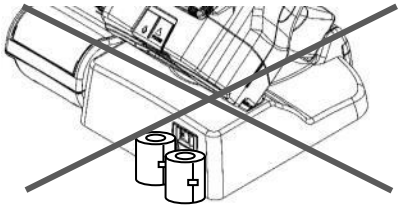
- The instrument conforms to the EMC standard (IEC60601-1-2:2014), but discharges weak radio waves. If the instrument in operation interferes with other equipment, such as a TV or radio, take appropriate action, such as increasing the distance between the instruments or changing each direction.

- This instrument is not waterproof. It should not be used or placed in a place where it can be exposed to liquid such as rainwater, beverages or chemicals.
- If dew condensation occurs, allow the dew to disappear before using the instrument.
- When transporting the instrument, protect against vibration and shock, preferably by placing the instrument in the optional carrying case or a packing box.

CAUTION **5. Other handling precautions**

- Make sure that the power cord is not damaged, broken, machined, exposed to excessive force (bend, pull, or twist), or twisted with other cords. Do not put heavy objects on, or apply heat to, the power cord, as the cord can be severed, possibly leading to a fire or electric shock. If the power cord is damaged, replace it.
- If dust accumulates on the metal part of the power plug, pull out the power plug and remove the dust. Dust or dirt can cause contact failure of the power plug, resulting in a fire.
- Connect the instrument to a grounding-type receptacle outlet in a manner that meets the power supply specifications. Improper connections can affect the performance, or even cause failure, leakage, shock, or fire.
- Fully insert the power plug. Insufficient insertion can cause a fire.
- When replacing the fuse in the station, be sure to turn off the power switch and pull out the power cord. Be sure to use the designated fuse. Use of an undesignated fuse can lead to electric shock or fire.
  Designated fuse: Littelfuse's time-lag fuse, ϕ5 x 20 mm
  250 V, 1.6 AH (021501.6XP)
- Never short-circuit the battery charging contacts of the main unit, station, or printer.
- Do not expose the connectors or battery charging contacts to your body or metal objects. If a contact is dirty, turn the power off and wipe the contact off with a dry, soft cloth.
- This product is precision optical equipment, containing a large number of electrical components. Handle with care, avoiding exposure to physical shock.
- Do not drop or bump the instrument. When handling the main unit, always use the supplied strap. Do not swing the main unit holding only the strap.
- If the instrument ceases to function, pull the power cord from the receptacle outlet, and without accessing the inside of the instrument, contact your dealer.
- Use the designated print roll. Use of an undesignated brand can lead to failure.
- Although printer cutter is located at not accessible place by finger, caution when changing the paper roll.
- Use accessory cable enclosed with the unit. (→See “1-1Instrument Overview, Components and Options”)

- Do not put any objects around power switch of the Station or the Printer to not disturbing emergency operation.

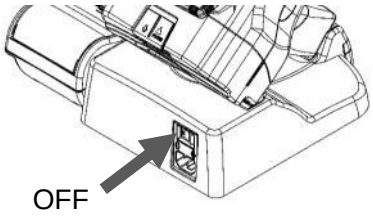


- Do not lean on the units.
- Please clean according to the specified method on the manual. If not follow, it may cause deterioration or damage to the unit. (See 7-4 Cleaning the Forehead Rest to 7-7 Cleaning appearance)
- Clean the forehead rest for every patient, if not, it may cause cross infection.
- For repair or maintenance, wipe the outer cover with cloth with alcohol for sterilization.
- When the device is return for maintenance or repair, clean the surface of the device (especially, forehead rest) with a cloth dampened with rubbing alcohol for disinfections.
- Accessory equipment connected to the analog and digital interfaces must be certified according to the appropriate national standards. Furthermore, all configurations shall comply with the IEC 60601-1. Anyone who connects additional equipment to the signal input part or signal output part is responsible for making sure that the system complies with the requirements of the IEC 60601-1.
- The operator must not touch the external instrument connected with this equipment and the patient simultaneously. Electrical shock can result.
- If in doubt, consult the technical service department or your local representative.

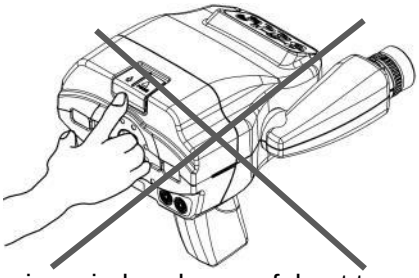
CAUTION **6. Transportation / Storage**

- The ambient conditions of transportation: Temperature -20ºC to 60ºC, relative humidity 10% to 95% (no condensation), atmospheric pressure 500-1060 hPa.
- The ambient conditions of storage in a packaged condition: Temperature -10ºC to 45ºC, relative humidity 10% to 85%(no condensation), atmospheric pressure 700-1060 hPa.
- This instrument does not meet the temperature requirements of ISO 15004-1 for storage. Do not store this instrument in conditions where the temperature may rise above 40ºC or fall below -10ºC.
- Select a storage area exposed to limited amounts of dust, free of vibration and shock.

- After use, turn off the power switch of the station and put on the dust cover.



- If you plan to put the instrument out of service for a long time, pull the power cord out from the receptacle outlet. Also, remove the batteries from the main unit and keep them for later use. There is a danger of fire if the power cord is left in the receptacle outlet for a long time or the battery is left unremoved for a long time.
- Make sure that when the batteries are in storage, their contacts are not touched by metals, etc. If they are short-circuited to a metal, heating or even a fire can occur.
- When the measurement window stained by dust, nose oil, and fingerprint, effect the results of the measurement. Therefore, please keep clean on the surface of measurement window. (Refer to the 7-5 Cleaning the Measurement Window.)



- To clean the measuring window, be careful not to make damage or broken of the window screen.
- Internal Battery

  For clock function, lithium battery is equipped, and if the battery is our, date and time setting is not work properly. To change the battery, ask for your distributor.

CAUTION 7. Battery pack

- You should use the RT-01XR battery pack, which uses our designated lithium ion battery. Use of any other battery pack voids the operation warranty.
- Carefully read the instructions shipped with the battery pack before using the battery pack.
- Never disassemble or modify the battery pack.
- To recharge the battery pack, always use the station or printer.
- Never short-circuit the terminal of the battery pack. Otherwise, heating may occur, leading to burn injury or a fire. Also, keep metals (coins, paper clips, etc.) away from contact with the terminal area.
- Do not use the battery pack of this product with any other product.

- When charging the battery pack, do not place any cover over the main unit, station, or printer. If a cover is used, the heat generated in the main unit, station, or printer during charging may cause fire. In addition, the service life of the battery pack will be reduced by the additional load due to such a cover.
- Do not expose the battery pack to an intense heat source or flames. Explosion, electrolyte leakage, or fire can occur.
- Do not leave the battery pack in a sun-heated car with the windows closed, or in any location that may be exposed to intense sunlight.
- Do not let the battery pack be exposed to strong impact or drop it.
- If the metal terminals of the battery pack are dirty, wipe them off with a dry, soft cloth.
- If you plan to put the instrument out of service for a week or longer, take the battery packs out of the main unit and printer.
- The battery pack is a consumable item. It can be recharged, but eventually wears out. When the battery pack is no longer usable, purchase a new one from your local dealer of the instrument.

CAUTION **8. Disposal instructions**

- Follow local regulations concerning disposal and recycling.
  For lithium ion batteries and lithium primary battery, in particular, observe the specific disposal methods stipulated by your local government.
  We recommend entrusting disposal to a designated industrial waste disposal firm.
- When disposing packaging, sort them by material, and then follow the local regulations and plans concerning disposal and recycling.

Symbol for separate collection in European countries

Products bearing this symbol must be collected separately.

The following rule is applicable only to users in European countries.

This product is designated as an item to be collected separately at an appropriate spot. Do not dispose of it as household waste.

For further information, contact the retailer or the local authorities responsible for waste management.

CAUTION **9. Information of EMC (Electro Magnetic Compatibility)**

1. Reorient or relocate the receiving device. Reorient or relocate the receiving device.
2. Increase the distance to the device.
3. Correct the device into an outlet on a circuit different from that to which the other device(s) are connected.
4. Consult the manufacturer or field service technician for assistance.

・In installation and operation of the device, observe the following instructions about EMC (electromagnetic compatibility):

1. Do not use the device simultaneously with other electronic equipment to avoid electromagnetic interference with the operation of the device.
2. Do not use the device near, on, or under other electronic equipment to avoid electromagnetic interference with the operation of the device.
3. Do not use the device in the same room with other equipment such as life-support equipment, other equipment that has major affects on the life of the patient and results of treatment, or other measurement or treatment equipment that involves small electric current.
4. Do not use the device simultaneously with portable and mobile radio frequency communication systems because it may have an adverse effect on operation of the device.
5. Do not use cables and accessories that are not specified for the device because that may increase the emission of electromagnetic waves from the device or the system and decrease the immunity of the device to electromagnetic disturbance.

■EMC (Electromagnetic Compatibility)

The Electromagnetic Compatibility Directive sets the essential requirements for electrical and electronic equipment that may disturb or even be disturbed by other equipment. The Retinomax K-plus5 complies with these requirements as tabled below. Follow the guidance on the tables for use of the device in the electromagnetic environment.

WARNING: The use of this equipment adjacent to or stacked with other equipment should be avoided because it could result improper operation.
If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.

WARNING: The use of accessories and cables other than those specified or provided by the RIGHT MFG. CO., LTD. of Retinomax K-plus5 could result in increased electromagnetic emissions or decreased electromagnetic immunity of Retinomax K-plus5 and result in improper operation.

(A)：Environments for Retinomax K-plus5

This device is applied for use in professional healthcare facility environment and home healthcare environment.

－Doctor's offices, clinics, medical facilities, hospital, optician's, etc.

(B) List of cables, Length of cables

Model name	Model No.	Length
Power cord 100V area	DDB20207	3.0m
Power cord 120V area (Hospital grade)	DDB20201-UL	3.0m
Power cord 120V area	DDB20202	3.0m
Power cord 240V area	DDB20203	3.0m
Power cord 240V area(China)	DDC20209	3.0m

(C)EMC (IEC60601-1-2:2014)

(1)Emission guidance

Retinomax K-plus5 is intended for use in the electromagnetic environment specified below. The customer or the user of the Retinomax K-plus5 should assure that they are used in such an environment.

Emissions test	**Basic EMC standard or test method**[*1]
Conducted and radiated RF EMISSION	CISPRE 11 Group 1 ClassB
Harmonic EMISSION	IEC61000-3-2[*2]
Voltage fluctuations and flicker	IEC61000-3-3[*2]

∗1: See “(A) Environments for Retinomax K-plus5” for information about the environments of INTENDED USE.

∗2: This test is not applicable in this environment unless the ME EQUIPMENT and ME SYSTEMS used there will be connected to the PUBLIC MAINS NETWORK and the power input is otherwise within the scope of the Basic EMC standard.

(2)Immunity guidance

Retinomax K-plus5 is intended for use in the electromagnetic environment specified below. The customer or the Retinomax K-plus5 should assure that they are used in such an environment.

・Enclosure port

Phenomenon	**Basic EMC standard or test method**	**IMMUNITY TEST LEVELS**
		Professional healthcare facility environment
Electrostatic discharge	IEC 61000-4-2	±8 kV contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air
Radiated RF EM fields[*1]	IEC 61000-4-3	10V/m[*6] 80 MHz – 2,7 GHz[*2] 80% AM at 1 kHz[*3]
Proximity fields from RF wireless communications equipment	IEC 61000-4-3	See (C)-(3) Test Specifications for ENCLOSURE PORT IMMUNITY to RF wireless communications equipment
Rated power frequency magnetic fields[*4][*5]	IEC 61000-4-8	30 A/m[*7] 50 Hz or 60 Hz

∗1: The interface between the PATIENT physiological signal simulation, if used, and the ME EQUIPMENT or ME SYSTEM shall be located within 0,1 m of the vertical plane of the uniform field area in one orientation of the ME EQUIPMENT or ME SYSTEM.

∗2: ME EQUIPMENT and ME SYSTEMS that intentionally receive RF electromagnetic energy for the purpose of their operation shall be tested at the frequency of reception. Testing may be performed at other modulation frequencies identified by the RISK MANAGEMENT PROCESS. This test assesses the BASIC SAFETY and ESSENTIAL PERFORMANCE of an intentional receiver when an ambient signal is in the passband. It is understood that the receiver might not achieve normal reception during the test.

∗3: Testing may be performed at other modulation frequencies identified by the RISK MANAGEMENT PROCESS.

∗4: Applies only to ME EQUIPMENT and ME SYSTEMS with magnetically sensitive components or circuitry.

∗5: During the test, the ME EQUIPMENT or ME SYSTEM may be powered at any NOMINAL input voltage, but with the same frequency as the test signal.

∗6: Before modulation is applied.

∗7: This test level assumes a minimum distance between the ME EQUIPMENT or ME SYSTEM and sources of power frequency magnetic field of at least 15 cm. If the RISK ANALYSIS shows that the ME EQUIPMENT or ME SYSTEM will be used closer than 15 cm to sources of power frequency magnetic field, the IMMUNITY TEST LEVEL shall be adjusted as appropriate for the minimum expected distance.

▪ Input a.c. power port

Phenomenon	Basic EMC standard or test method	IMMUNITY TEST LEVELS
		Professional healthcare facility environment
Electrical fast transients / bursts[∗1∗12∗15]	IEC 61000-4-4	±2 kV 100 kHz repetition frequency
Surges [∗1∗2∗10∗15] Line-to-line	IEC 61000-4-5	±0,5 kV, ±1 kV
Surges[∗1∗2∗10∗11∗15] Line-to-ground	IEC 61000-4-5	±0,5 kV, ±1 kV, ±2 kV
Conducted disturbances induced by RF fields[∗3∗4∗15]	IEC 61000-4-6	6 V [∗13] 0,15 MHz – 80 MHz 6 V[∗13] in ISM bands between 0,15 MHz and 80 MHz[∗14] 80% AM at 1 kHz[∗5]
Voltage dips [∗6∗16∗18]	IEC 61000-4-11	0% UT; 0,5 cycle[∗7] At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°[∗17] 0% UT; 1 cycle and 70% UT; 25/30 cycles[∗8] Single phase: at 0°
Voltage interruptions[∗6∗9∗15∗18]	IEC 61000-4-11	0% UT; 250/300 cycle[∗8]

∗1: The test may be performed at any one power input voltage within the ME EQUIPMENT or ME SYSTEM RATED voltage range. If the ME EQUIPMENT or ME SYSTEM is tested at one power input voltage, it is not necessary to re-test at additional voltages.

∗2: All ME EQUIPMENT and ME SYSTEM cables are attached during the test.

∗3: Calibration for current injection clamps shall be performed in a 150 Ω system.

∗4: If the frequency stepping skips over an ISM or amateur band, as applicable, an additional test frequency shall be used in the ISM or amateur radio band. This applies to each ISM and amateur radio band within the specified frequency range.

∗5: Testing may be performed at other modulation frequencies identified by the RISK MANAGEMENT PROCESS.

∗6: ME EQUIPMENT and ME SYSTEMS with a d.c. power input intended for use with a.c.-to-d.c. converters shall be tested using a converter that meets the specifications of the MANUFACTURER of the ME EQUIPMENT or ME SYSTEM. The IMMUNITY TEST LEVELS are applied to the a.c. power input of the converter.

∗7: Applicable only to ME EQUIPMENT and ME SYSTEMS connected to single-phase a.c. mains.

∗8: E.g. 10/12 means 10 periods at 50 Hz or 12 periods at 60 Hz.

∗9: ME EQUIPMENT and ME SYSTEMS with RATED input current greater than 16 A / phase shall be interrupted once for 250/300 cycles at any angle and at all phases at the same time (if applicable). ME EQUIPMENT and ME SYSTEMS with battery backup shall resume line power operation after the test. For ME EQUIPMENT and ME SYSTEMS with RATED input current not exceeding 16 A, all phases shall be interrupted simultaneously.

∗10: ME EQUIPMENT and ME SYSTEMS that do not have a surge protection device in the primary power circuit may be tested only at ± 2 kV line(s) to earth and ± 1 kV line(s) to line(s).

∗11: Not applicable to CLASS II ME EQUIPMENT and ME SYSTEMS.

∗12: Direct coupling shall be used.

∗13: r.m.s., before modulation is applied.

∗14: The ISM (industrial, scientific and medical) bands between 0,15 MHz and 80 MHz are 6,765 MHz to 6,795 MHz; 13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz. The amateur radio bands between 0,15 MHz and 80 MHz are 1,8 MHz to 2,0 MHz, 3,5 MHz to 4,0 MHz, 5,3 MHz to 5,4 MHz, 7 MHz to 7,3 MHz, 10,1 MHz to 10,15MHz, 14 MHz to 14,2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz and 50,0 MHz to 54,0 MHz.

∗15: Applicable to ME EQUIPMENT and ME SYSTEMS with RATED input current less than or equal to 16 A / phase and ME EQUIPMENT and ME SYSTEMS with RATED input current greater than 16 A / phase.

∗16: Applicable to ME EQUIPMENT and ME SYSTEMS with RATED input current less than or equal to 16 A / phase.

∗17: At some phase angles, applying this test to ME EQUIPMENT with transformer mains power input might cause an overcurrent protection device to open. This can occur due to magnetic flux saturation of the transformer core after the voltage dip. If this occurs, the ME EQUIPMENT or ME SYSTEM shall provide BASIC SAFETY during and after the test.

∗18: For ME EQUIPMENT and ME SYSTEMS that have multiple voltage settings or auto ranging voltage capability, the test shall be performed at the minimum and maximum RATED input voltage. ME EQUIPMENT and ME SYSTEMS with a RATED input voltage range of less than 25% of the highest RATED input voltage shall be tested at one RATED input voltage within the rage.

▪ Signal input/output parts port

Phenomenon	Basic EMC standard or test method	IMMUNITY TEST LEVELS
		Professional healthcare facility environment
Electrostatic discharge∗4	IEC61000-4-2	± 8 kV contact ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV air
Conducted disturbance by RF field∗1∗3∗5	IEC61000-4-6	6 V∗6 0,15 MHz – 80 MHz 6 V∗6 in ISM bands between 0,15 MHz and 80 MHz∗7 80% AM at 1 kHz∗2

∗1: SIP/SOPS whose maximum cable length is less than 3 m in length are excluded.

∗2: Testing may be performed at other modulation frequencies identified by the RISK MANAGEMENT PROCESS.

∗3: Calibration for current injection clamps shall be performed in a 150 Ω system.

∗4: Connectors shall be tested per 8.3.2 and Table 4 of IEC 61000-4-2:2008. For insulated connector shells, perform air discharge testing to the connector shell and the pins using the rounded tip finger of the ESD generator, with the exception that the only connector pins that are tested are those that can be contacted or touched, under conditions of INTENDED USE, by the standard test finger shown in Figure 6 of the general standard, applied in a bent or straight position.

∗5: If the frequency stepping skips over an ISM or amateur radio band, as applicable, an additional test frequency shall be used in the ISM or amateur radio band. This applies to each ISM and amateur radio band within the specified frequency range.

∗6: r.m.s., before modulation is applied.

∗7: The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6,765 MHz to 6,795 MHz; 13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz.
The amateur radio bands between 0,15 MHz and 80 MHz are 1,8 MHz to 2,0 MHz, 3,5 MHz to 4,0 MHz, 5,3 MHz to 5,4 MHz, 7 MHz to 7,3 MHz, 10,1 MHz to 10,15 MHz, 14 MHz to 14,2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz and 50,0 MHz to 54,0 MHz.

(3)**Test Specifications for ENCLOSURE PORT IMMUNITY to RF wireless communications equipment**

Test Frequency (MHz)	Band*1 (MHz)	Service*1	Modulation*2	Maximum power (W)	Distance (m)	IMMUNITY TEST LEVEL (V/m)
385	380－390	TETRA400	Pulse Modulation*2 18Hz	1.8	0,3	27
450	430－470	GMRS460 FRS460	FM*3 ±5kHz deviation 1kHz sine	2	0,3	28
710 745 780	704－787	LTE Band 13, 17	Pulse modulation*2 217Hz	0,2	0,3	9
810 870 930	800－960	GSM800/900, TETRA800, iDEN820, CDMA850, LTE Band 5	Pulse modulation*2 18Hz	2	0,3	28
1720 1845 1970	1700－1990	GSM1800; CDMA1900; GSM1900; DECT; LTE Band 1, 3, 4, 25; UMTS	Pulse modulation*2 217Hz	2	0,3	28
2450	2400-2570	Bluetooth, WLAN, 802.11 b/g/n, FRID 2450, LTE Band 7	Pulse modulation*2 217Hz	2	0,3	28
5240 5500 5785	5100－5800	WLAN 802.11 a/n	Pulse modulation*2 217Hz	0,2	0,3	9

NOTE: If necessary to achieve the IMMUNITY TEST LEVEL, the distance between the transmitting antenna and the ME EQUIPMENT or ME SYSTEM may be reduced to 1m. The 1m test distance is permitted by IEC61000-4-3.

∗1: For some services, only the uplink frequencies are included.

∗2: The carrier shall be modulated using a 50% duty cycle square wave signal.

∗3: As an alternative to FM modulation, 50% pulse modulation at 18Hz may be used because while it does not represent actual modulation, it would be worst case.

1. Overview

1-1 Instrument Overview, Components and Options

Retinomax K-plus5 is an objective hand held refractometer, designed to measure refractive power, corneal shape and pupil diameter.

This equipment is intended for use indoors by medical doctors, orthoptists, and optometrists.

The refractive power measurement examines the refractive condition of the patient's eye to measure the spherical diopter power, cylindrical power, and cylinder axis angle. During the corneal shape measurement, the corneal radius of curvature, principal meridian direction, and corneal astigmatism power are examined.

The pupil diameter measurement measures the pupil size in the horizontal and vertical directions.

This instrument consists of a main unit (Retinomax K-plus5), station (Retinomax station 5), and printer (Retinomax printer 5).

Device and printer could be carried with ease, and contains battery, make it easier to measure and print out in small spaces. The station has function to charge, and power supply, makes it chargeable for the battery and supplies to device and printer.

It also has a function to transfer the measured data to PC.

■ Components

● Main unit (1)

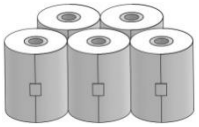
● Station (1)

● Printer (1)

● Battery pack (1)
(RT-01XR)

● Model eye (1)

● Print paper rolls (5)
(DXA30109)



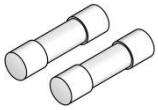
● Strap (1)
(DDB30005)

● Blower (1)

● Contact lens holder (1)

● **Fuses (2)**

(φ5 x 20 mm250 V, T1.6 AH (021501.6XP))



● **Power cord (1)**

● **Dust cover (1)**

● **Instruction manual (1)**

■ **Options**

● **Carrying case**

● **Battery pack**

1-2 Instrument Classification

<Classification as per 93/42EEC (MDD)>
Class IIa

<Protection type against electric shock>
Class I

This instrument is classified as equipment whose protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution, in that means are provided for the connection of the equipment to a protective earth conductor in the fixed wiring of the installation in such a way that accessible metal parts cannot become live in the event of a failure of the basic insulation. Always use the power cord shipped with the instrument. It must be connected to a receptacle outlet with a ground.

<Degree of protection against electric shock>
Type B Applied Part

The forehead rest of this instrument is a type B attachment.

Material: ABS resin

This instrument is equipped with a reliable safeguard against electric shock, as verified through testing in accordance with the applicable standard for patient leakage current.

<Protection against water and particle ingression>
IPX0

This instrument is not protected against the infiltration of water and other liquids. The instrument should not be exposed to liquids.

<Degree of safety for use in a flammable environment>

Retinomax K-plus5 is not designed to be used in a flammable environment. Do not use it in a flammable environment.

<Disinfection method approved by the manufacture>
If necessary, clean the forehead rest with soft cloth soaked with rubbing alcohol. Cleaning conducted by a process other than the one described above may cause deterioration or damage to the equipment.

<Operation mode>
Continuous operation

1-3 Symbols on the Instrument

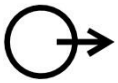
 : This symbol on the instrument indicates the need for caution.

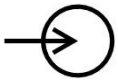
 : This symbol indicates the necessity if referring to the relevant part of the instruction manual before use.

 : This symbol indicates that the type of protection against electric shock for the applied part is type B

: This symbol indicates that has place where forehead rest has put and pull.

 : Represent a print paper outlet.

 : Represent an output.

 : Represent an input

 : Represent an output and input.

 : This symbol indicates the main unit and printer power switch.

 : This symbol on the station indicates the on position of power switch.

 : This symbol on the station indicates the off position of the power switch.

 : Represent a fuse.

 : Represent a connection suitable only for DC power.

 : The lamp indicated by this symbol on the station illuminates while the battery is charged.

: This symbol means this equipment is certified by UL (Underwriters Laboratories).

: This symbol means this equipment conforms to Medical Device Directive (93/42/EEC) in EU.

 : This symbol means the manufacturer.

: This symbol means the manufacture date.

 : This symbol means this equipment conforms to China RoHS (Management methods for Controlling pollution by Electronic Information Products).

 : This symbol means this equipment conform to WEEE directive (2012/19/EU) in EU.

: This symbol is designed to promote the recycling of used lithium ion battery in Japan.

 : This symbol is designed to promote the recycling of used batteries in Taiwan.

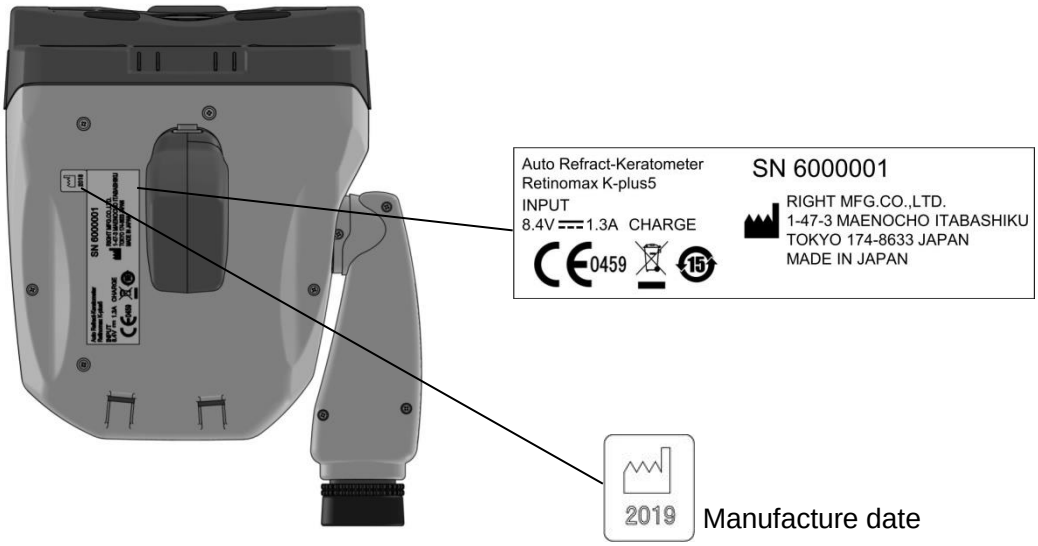
1-4 **Labels and Marks**

The product includes labels and marks to draw user's attention to important information and precautions.

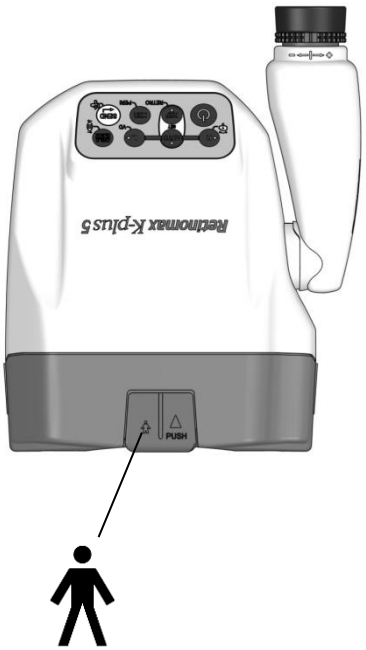
If you found some scratch or rack of words, please contact to dealer whom you purchased from.

●Main body

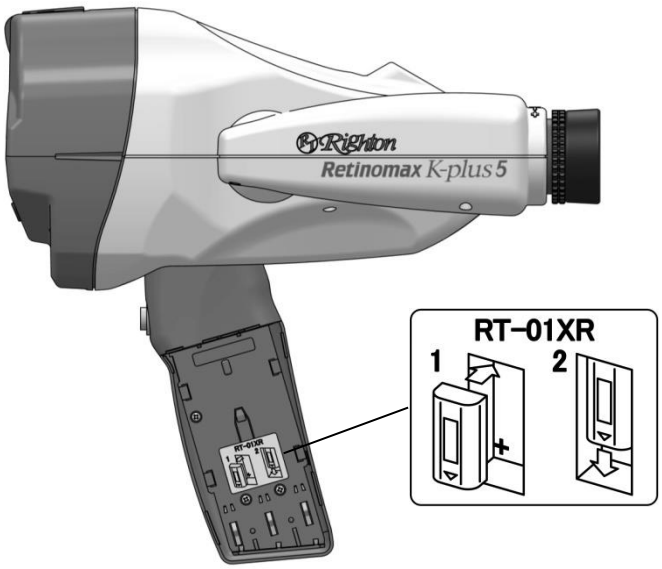
●Bottom



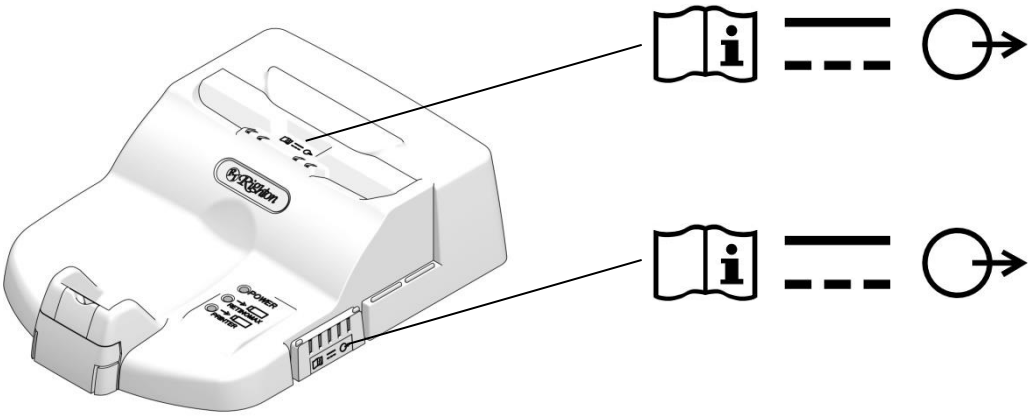
●Type B applied part



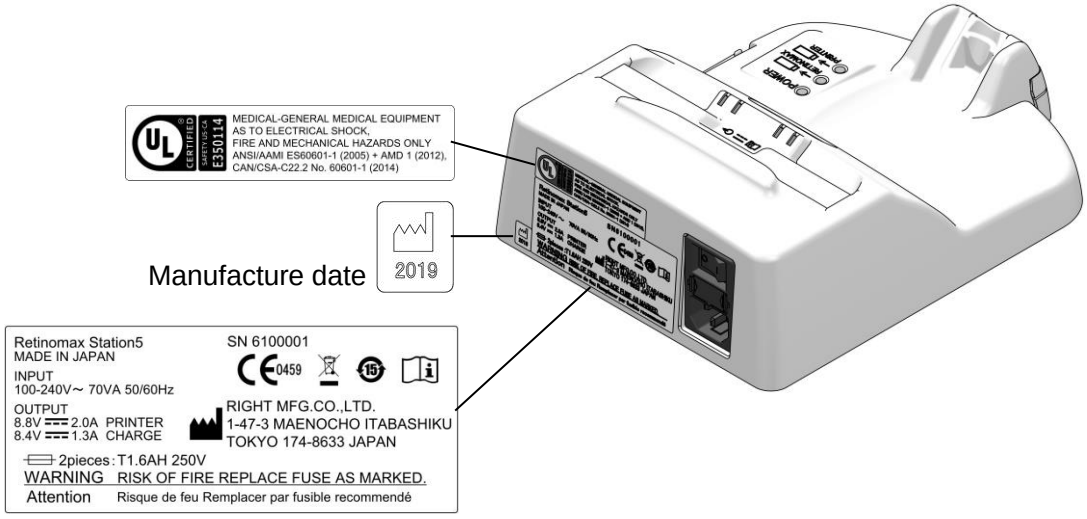
●Battery part



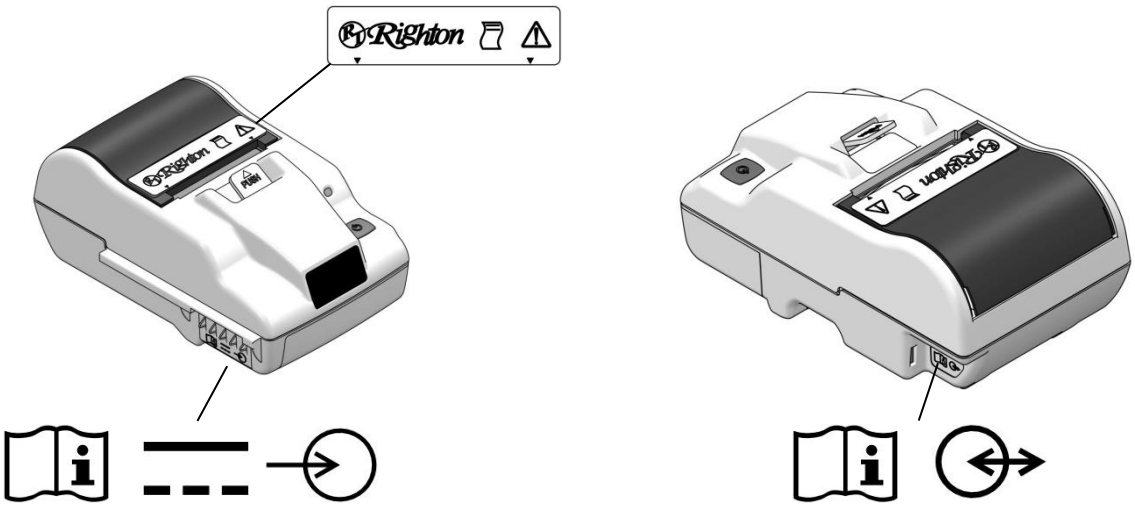
●Station

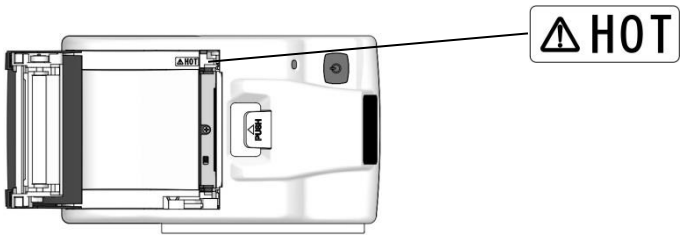


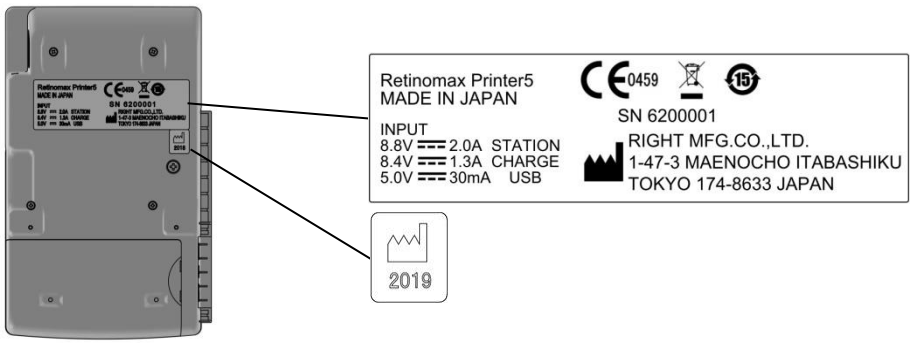
●Rear of the station



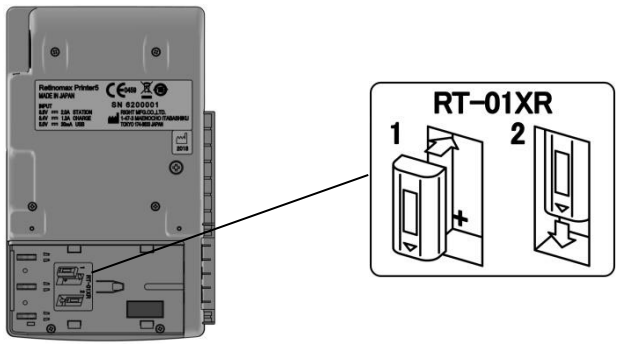
●**Printer**



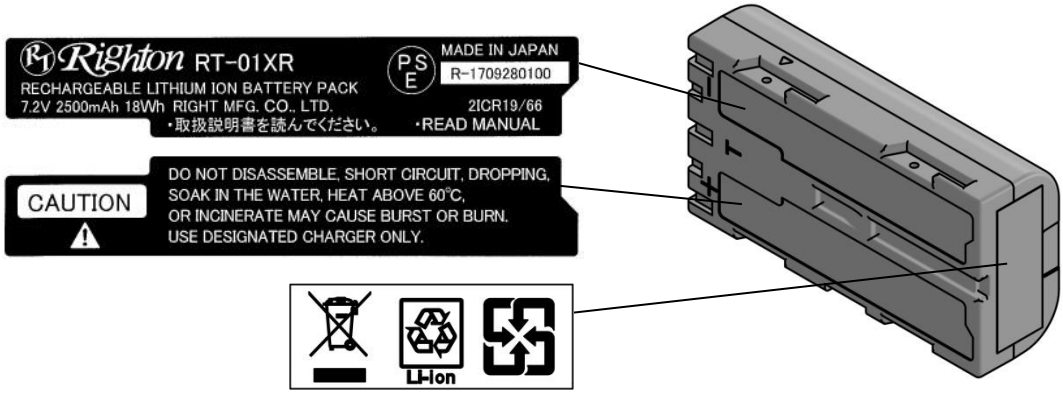




●Battery part

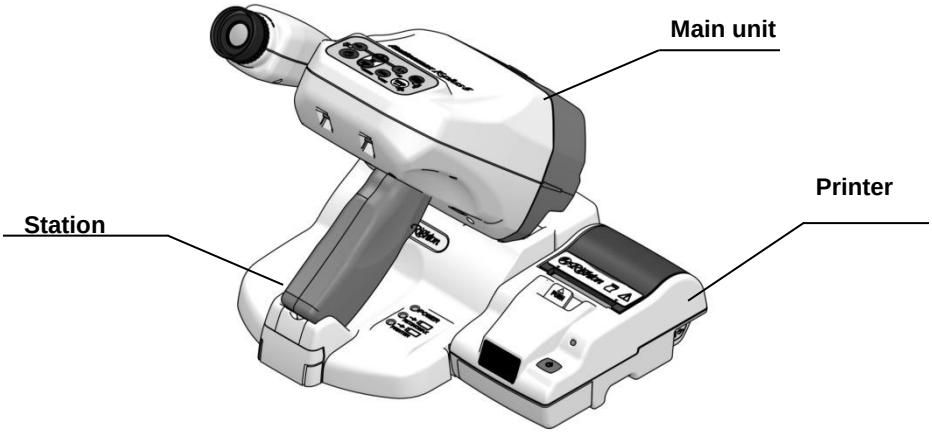


●Battery pack



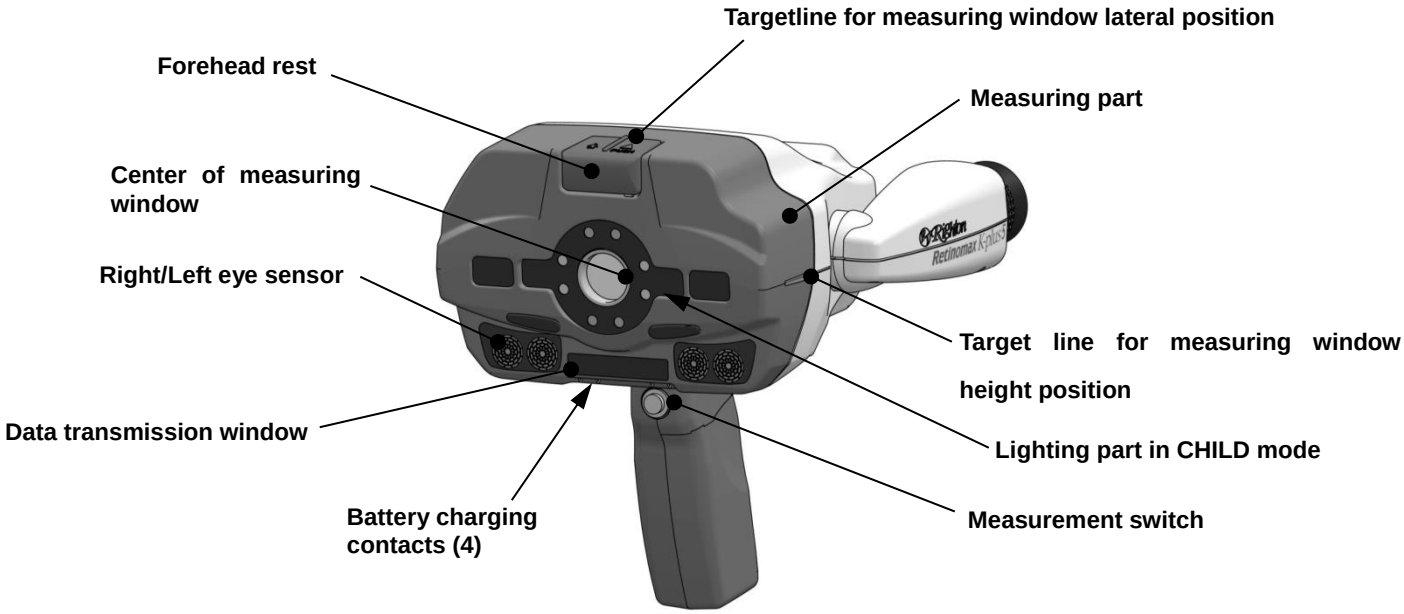
2. Name of parts

■ System configuration

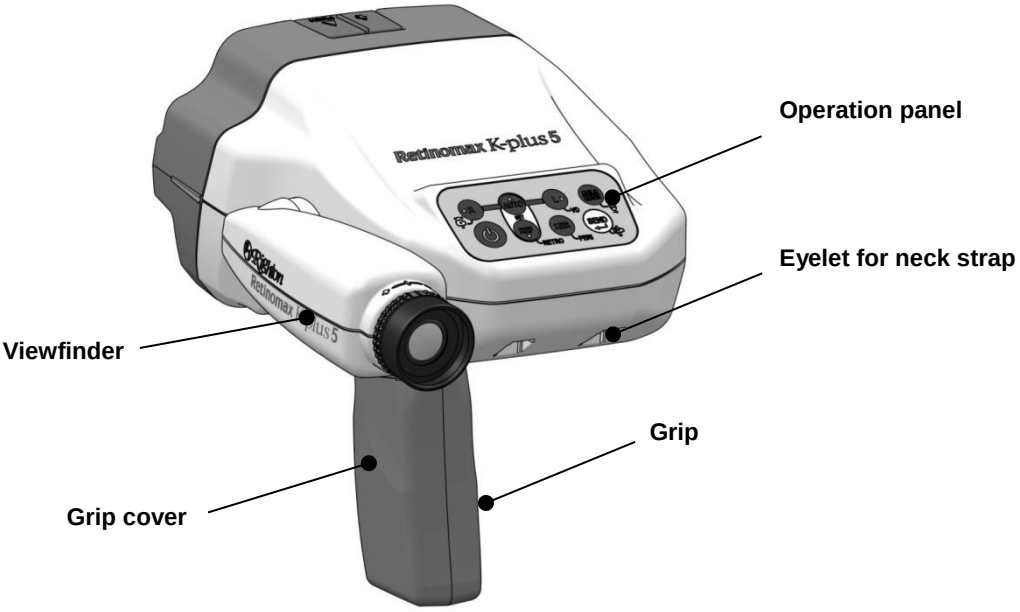


2-1 Main unit

● Patient side

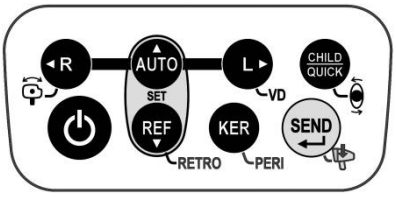


●Operator side



2-2 **Operation panel**

●Image of the operation panel



● Explanation and operation for main symbols

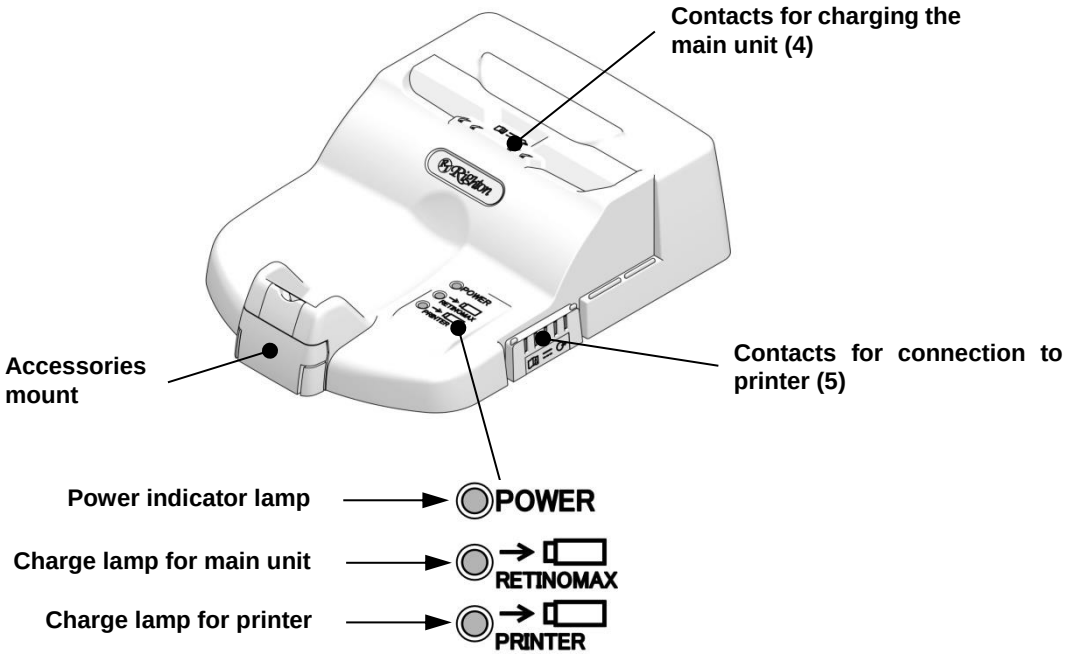
Symbol	Operation	Explanation
POWER 	Push	Turn the power on / off. Symbol will change depends on the battery pack's capacity. Green : capacity is over 50%. Orange : capacity is approximately 10 to 50%. Blinking with orange: capacity under approximately 10%. When the power is off, symbol turns off. Pressing in standby mode restore from standby mode.
	Hold down more than 2 sec in standby mode	Turn the power off.
REF 	Push	Perform REF measurement. Symbol turns on.

Symbol	Operation	Explanation
RETRO	REF Hold down 2 sec	Enter into Retroillumination mode. Hold down 2 sec again, goes back to measurement standby screen.
KER KER	Push	Perform KERATO measurement. Symbol turns on.
PERI	KER Hold down 2 sec	Enter into KERATO peripheral (PERI) measurement mode. Hold down 2 sec again, goes back to measurement standby screen.
AUTO AUTO	Push	Symbol turns on and eyes(right/left) are discriminated automatically. When push again or push ◄R or L►, switch to manual setting of right/left eyes discrimination and symbol turns off. Please select the right/left eye to observe with ◄R or L►.
R ◄R	Push	Switch to right eye measurement and symbol turns on. When push during AUTO lighting, switch to manual setting of right/left eyes discrimination.
L L►	Push	Switch to left eye measurement and symbol turns on. When push during AUTO lighting, switch to manual setting of right/left eyes discrimination.
Horizontal slope correction	◄R Hold down 2 sec	Horizontal correction function is on. Corrects the gap produced from slope of the device. Hold down again to release.
VD	L► Hold down 2 sec	Measure with VD=0. Hold down again to release.
CHILD / QUICK CHILD/QUICK	Push	Switch to CHILD mode and QUICK mode. Symbol is; blinking : CHILD mode lighting : QUICK mode
ANGLE	Refer to right section	Rotation correction function is on. After CHILD/QUICK hold down 2 sec, push measurement switch to select the angle and push SEND to determine. Selectable angle switches to 0°/45°/90°/135°/180°/-135°/-90°/-45°/0°….

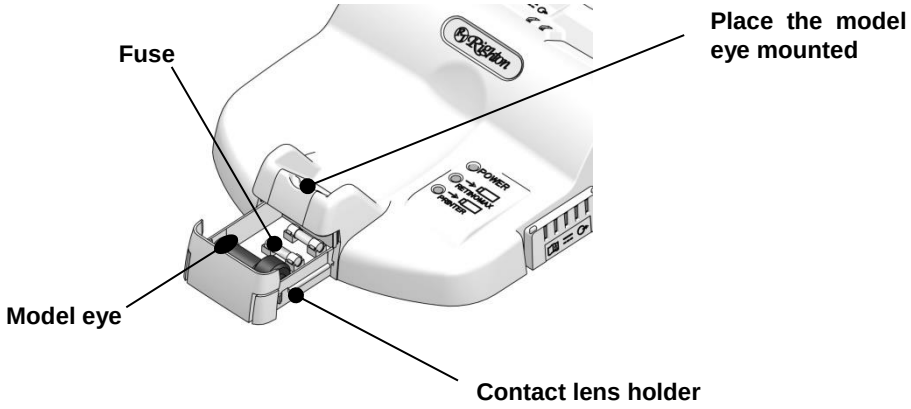
Symbol	Operation	Explanation
SEND 	Push	Transfer the measured data to the printer.
	Hold down 2 sec after completed measuring.	Perform a quick save when the memory function is off. Saves measured data for one eye and both eyes.
MEMORY 	 Hold down 2 sec	The symbol will light up and the memory function will be on. When measurement data is sent to the printer, it is automatically saved. Press and hold again for 2 seconds to turn off.
	Push  and  at the same time	Enters into the “Setup” menu enables to set up each setting. Move the cursor with  and decide with  .

2-3 **Station**

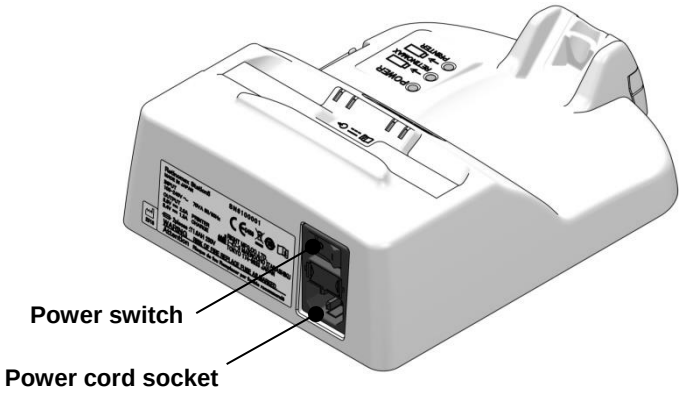
● Front



●Accessories mount



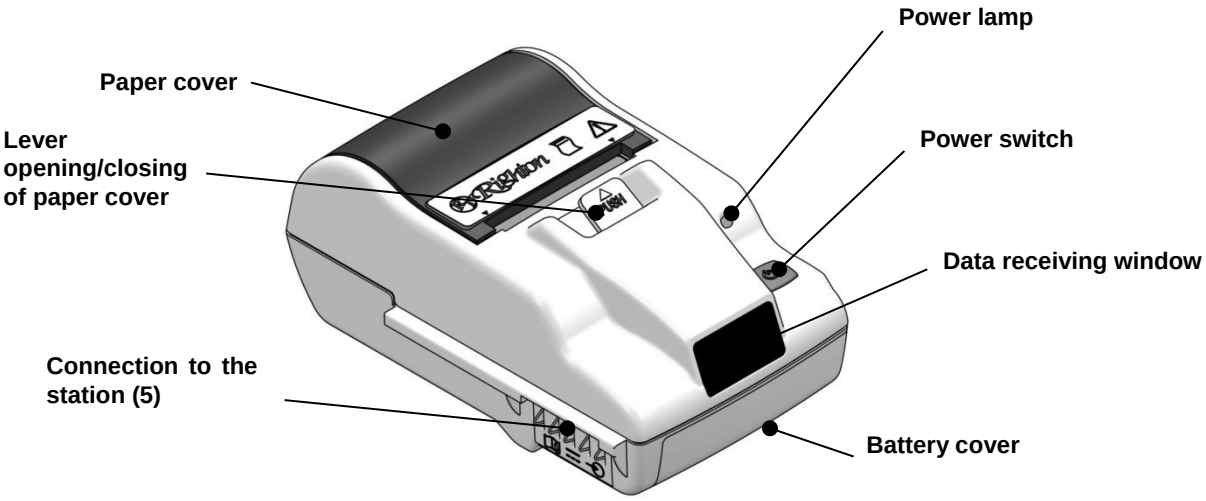
● Rear

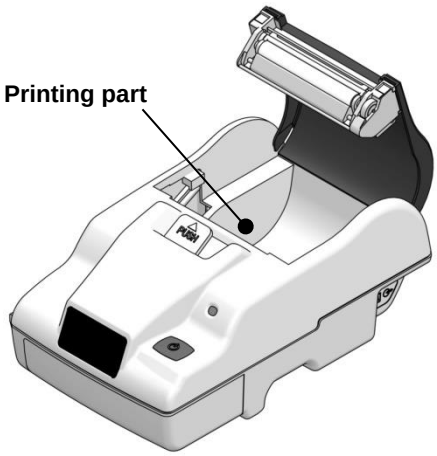


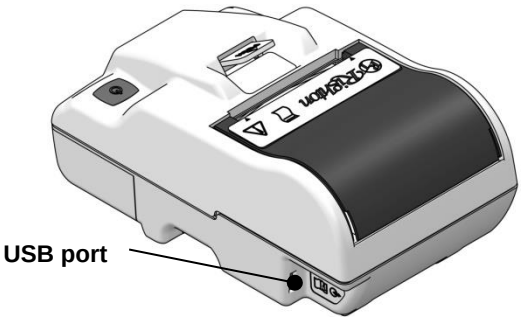
Power lamp lighting pattern

	OFF	ON	
		Charging	Completed charging
Power indicator lamp	OFF	Blue	Blue
Charge lamp for main unit	OFF	Orange	OFF
Charge lamp for printer	OFF	Orange	OFF

2-4 **Printer**







Indicating lamp lighting patterns

Situation	Indicator lamp
Power off	OFF
At battery driving: battery capacity more than 50%	Green
At battery driving: battery capacity approx. 10 to 50%	Orange
At battery driving: battery capacity less than approx. 10%	Orange (blinking)
Station suppling power	Blue
USB suppling power	Light blue
Receiving data	Pink
Error *Refer to the 8-3 Printer (Troubleshooting)	Pink (blinking)

Data can be output to the PC while USB power is being supplied, but it can not be printed. During battery operation, the lighting pattern will change depending on the capacity of the battery pack.

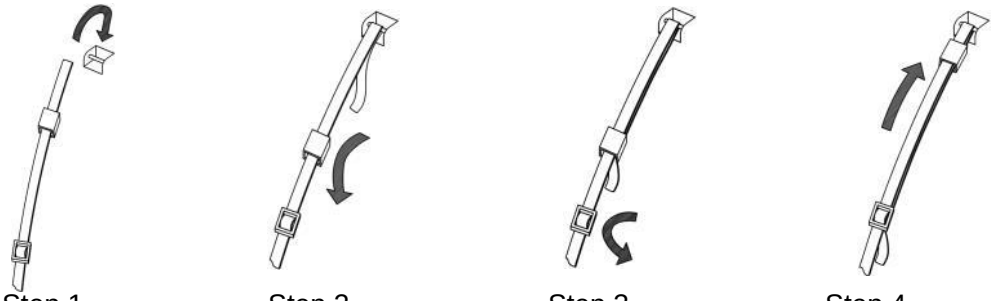
CAUTION

・There is a cutter on the printing part of the printer. Please be careful not to insert your finger into the print part when changing paper.

3. Setup

3-1 Attaching/Detaching the Strap

Attach the strap to the eyelets of the main unit.



Step 1 Step 2 Step 3 Step 4

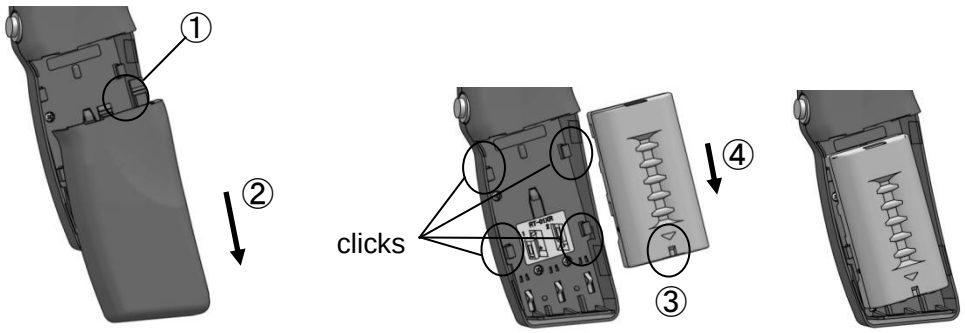
CAUTION

- When moving the instrument while it is in operation, hang it from your neck using the strap and hold the grip. Dropping the instrument may lead to injury or damage.
- Ensure that the strap is securely fastened.
- If the strap is damaged, replace it with a new one.

3-2 Installing and Removing the Battery Pack

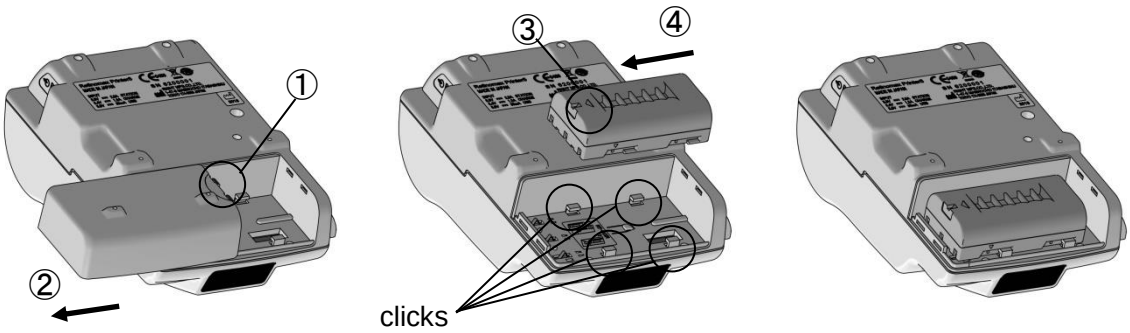
3-2-1 Main unit

1. Open the battery cover by pressing with your fingers near the top of the cover in direction ① and sliding in direction ②.
2. To make the indication ▽ of the battery pack to the direction of ③, fit in the battery pack with the clicks, slide the battery pack to ④ to install.
3. To remove the battery pack, slide it to reverse direction of ④
4. To close the grip cover, slide it in the opposite direction of ②. If the grip cover comes off, the screen will not be displayed even if the power is on. Please install it securely.



3-2-2 **Printer**

1. Turn the printer over.
2. Open the battery cover by pressing ① with your fingers and sliding in direction ②.
3. To make the indication ▽of the battery pack to the direction of ③, fit in the battery pack with the clicks, slide the battery pack to ④ to install.
4. To remove the battery pack, slide it to reverse direction of ④.
5. To close the battery cover, slide it in the opposite direction of ②.

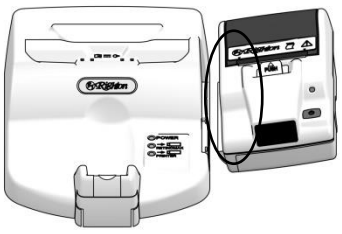


3-3 **Setting Up the Instrument**

1. Open the carton box, take out the main unit, the station, the printer and Accessories.
2. Place the Station on flat surface.
3. In the accessory case of the Station, put in model eye, contact lens holder and spare fuse.
4. Connect the power cord to AC inlet (use power cable enclosed).
5. Make sure that the power switch on the station is set to OFF (“○” side), and plug the power plug into a power outlet.
6. On the station, set the power switch to ON (“|” side). The power indicator lamp will light in blue.
7. Install the battery pack onto the main unit (refer to 3-2-1), and set in the Station, battery charge will start automatically.

   When using the battery pack for the first time, be sure to charge it. The battery pack is not charged at the time of purchase.
8. Set the Printer at the side of the Station.

   Setting printer is easily made to incline the Printer.



   If optional spare battery is purchased, set the battery pack in the Printer (refer to 3-2-2) for battery charge.
9. Install the print paper roll onto the printer (refer to 7-2 Replacing the Print Roll).

3-4 **Charging the Battery Pack**

Be sure to read the following precautions before starting charging.

- ■Handling Precautions -- Please first read for safety purposes.　Caution 7
- 3-4 Charging the Battery Pack　Charging precautions
- User Manual enclosed with the battery pack

■ Charging precautions

●When using the battery pack for the first time

- First charge the battery pack. The battery pack is not charged at the time of purchase.

●Charging

- When charging is complete, the battery pack and the grip of the main unit will be warm. This is normal.
- If the battery pack remains power in a level, the Station will not start charge.
- If the charge lamp of the station blinks during charging, it may be a charge stop due to room temperature or an abnormal charge. Refer to "8-2 Station" in "8. Troubleshooting" and check the blinking interval. If blinking interval is 3 seconds, charging stops due to the influence of room temperature. Check the room temperature and restart charging if it is between 10 °C and 35 °C. If interval is 0.5 second, it may be abnormal charging, please charge again. If blinking at 0.5 second intervals even if charging is performed again, replace the battery pack with another one. Still if it blinks at 0.5 second intervals, the station may be abnormal, please contact your dealer.
- The main unit or printer can be removed from the station and used before the charging is completed.

●Contacts

- The charging may fail if the contacts are dirty.
- Be careful not to touch the station contacts (recessed parts), main unit contacts (pins on the front of the main unit), and printer contacts (side pins). Also, do not touch the contacts (plates) of each battery pack.
- If the contacts are touched or dirty, turn off equipment, and wipe them clean with a dry cloth.

CAUTION

- Only use the RT-01XR battery pack, which is our designated lithium ion battery. Use of any other battery voids the operation warranty.
- The battery provided with Retinomax, Retinomax 2, Retinomax 3 cannot be use.
- Never disassemble or modify the battery pack.
- Never short-circuit the terminal of the battery pack. Otherwise, heating may occur, leading to burn injury or a fire. Also, keep metal objects (coins, paper clips, etc.) away from contact with the terminal area.

3-4-1 **Automatic Charging of the Main Unit**

To automatically charge the battery pack of the main unit, follow these steps:

1. See “3-3 Setting Up the Instrument”, on the station, set the power switch to ON (“|” side).
2. When the main unit is placed onto the station, the charge lamp lights with orange color.
   The station automatically checks the state of charge and decides whether the battery needs charging

   If charging is not needed→the lamp goes out.
   If it is needed→the lamp continues lighting with orange color.

   The main unit is turned off while charging.
3. When the charging is completed, the charge lamp for the main unit goes out.

- Check that a battery pack is in the main unit.
- When the main unit is connected to the station and the power is on, the station regularly check the state of charge. If the capacity becomes low due to natural discharge, the battery pack will be automatically recharged, keeping it above a certain level.
- Charging time varies depending on the age of the batteries, etc.

CAUTION

- Fit the main unit completely on the station. Otherwise, the contacts may not be connected and fail to charge the battery pack.

3-4-2 **Automatic Charging of the Printer**

To charge the battery pack in the printer automatically, follow these steps:

1. See 3-3 Setting Up the Instrument", on the station, set the power switch to ON ("|" side).

2. Connect the printer to the station, charging lamp lights with orange colour.

   The station automatically determines the capacity of the battery pack in the printer and decides whether the battery needs charging

   If charging is not needed→the lamp goes out.

   If it is needed→the lamp continues lighting with orange colour.

3. When the charging is completed, the charge lamp for the printer goes out.

- When the printer is connected to the station and the power is on, the station regularly check the state of charge. If the capacity becomes low due to natural discharge, the battery pack will be automatically recharged, keeping it above a certain level.
- Charging time varies depending on the age of the batteries, etc.

CAUTION

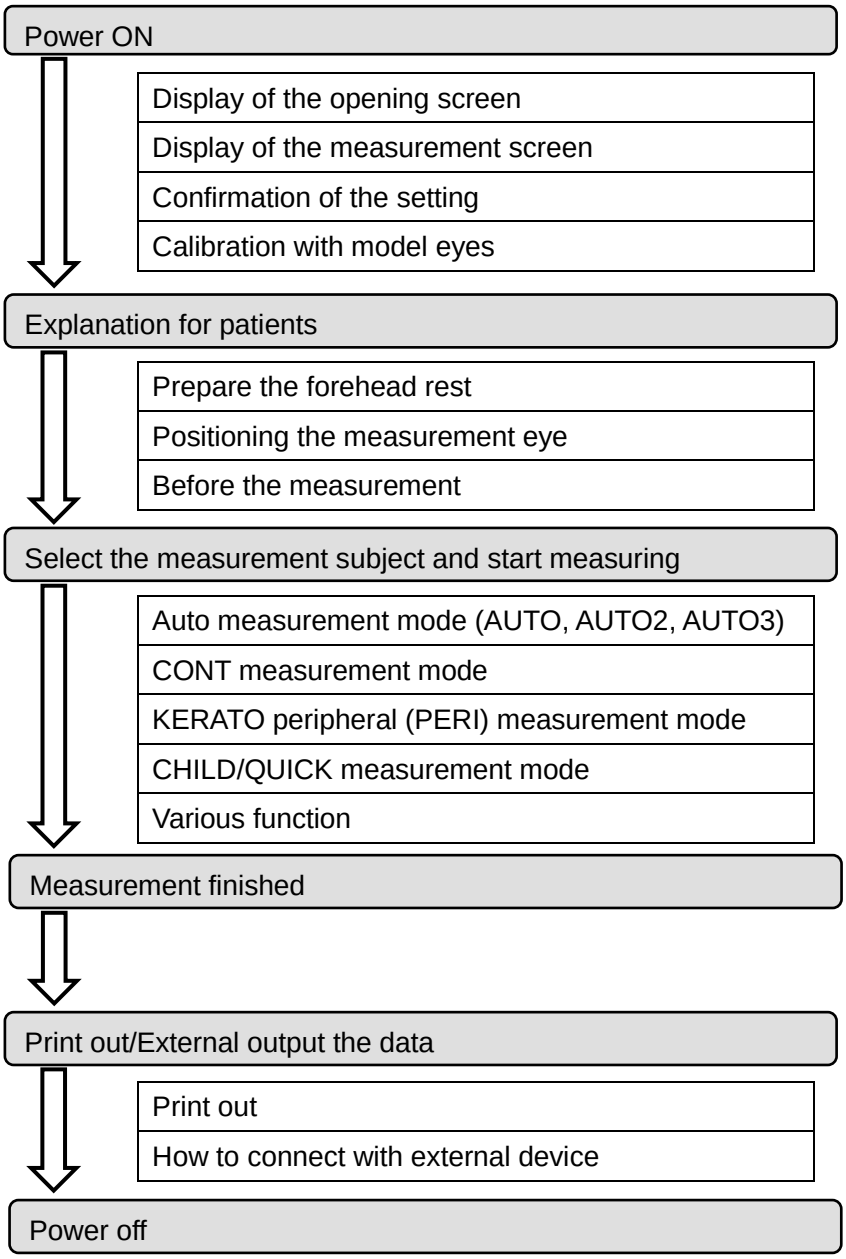
- When connecting the printer to the station, make sure to use the one provided with Retinomax 5 or Retinomax K-plus5.
- Do not use the printer provided with Retinomax, Retinomax 2, Retinomax 3.
- Place the station and the printer on a flat surface. If placed on an unstable place, the station and the printer may not connect properly.

3-4-3 **Charging a Spare Battery Pack**

Insert the battery pack you want to charge into the printer and charge it. See "3-2-2 Printer" for how to install the battery pack and "3-4-2 Automatic Charging of the Printer" for charging method.

4. Measurement

●Measurement Procedure



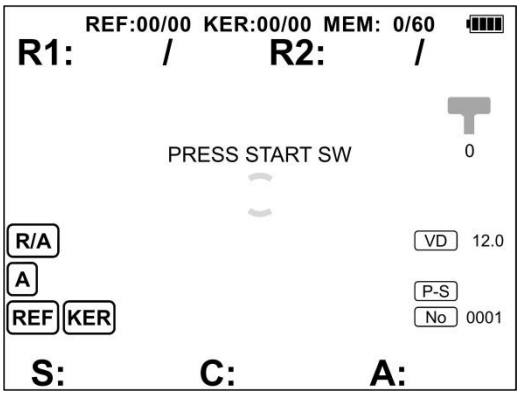
4-1 **Power on**

Press on the operation panel. The symbol turns on green and the opening screen appears in the viewfinder.

4-1-1 **Opening screen**

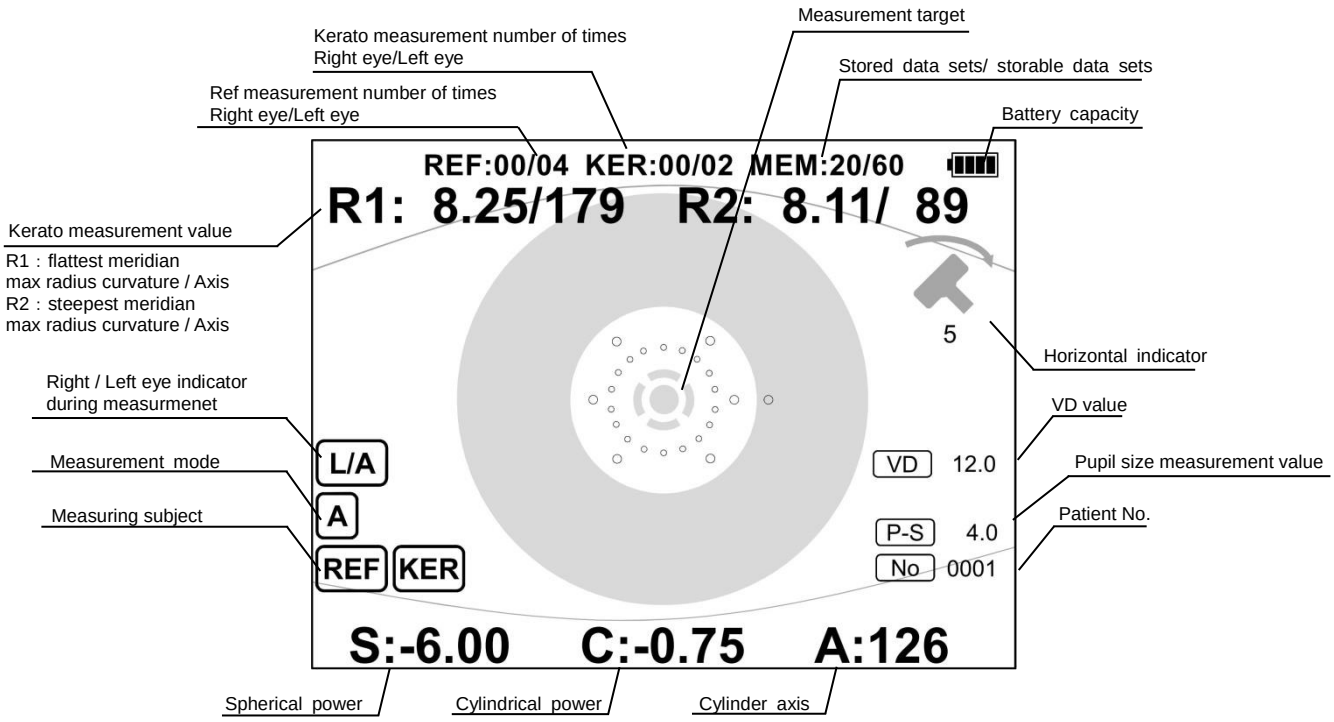
After displayed opening screen, measurement standby screen is displayed.

Opening screen



Measurement standby screen

4-1-2 **Measurement screen**



Reference and examples of measurement screen

Battery capacity

	More than 50%
	Less than 50%
	Less than 10%

Right / Left eye indicator during measurement

R/A	Right eye measurement by R/L eyes automatic discrimination
L/A	Left eye measurement by R/L eyes automatic discrimination
R/M	Right eye measurement by R/L eyes manual setting
L/M	Left eye measurement by R/L eyes manual setting

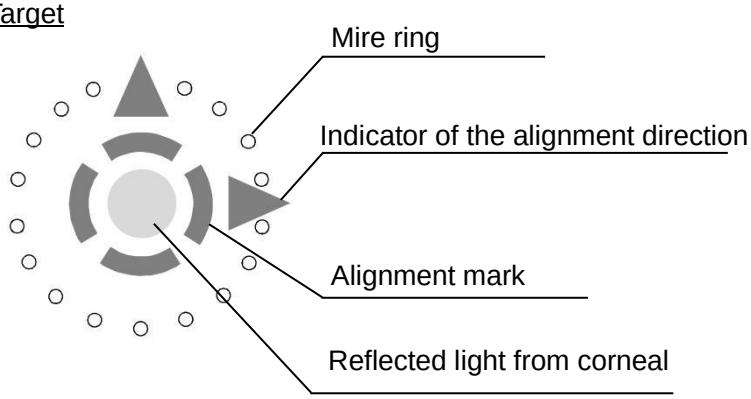
Measurement mode

A	AUTO mode
A2	AUTO2 mode
A3	AUTO3 mode
C	Continuous measurement (CONT) mode
CHD	CHILD mode
Q	QUICK mode
AQ	QUICK mode by AUTO QUICK function

Measurement subject

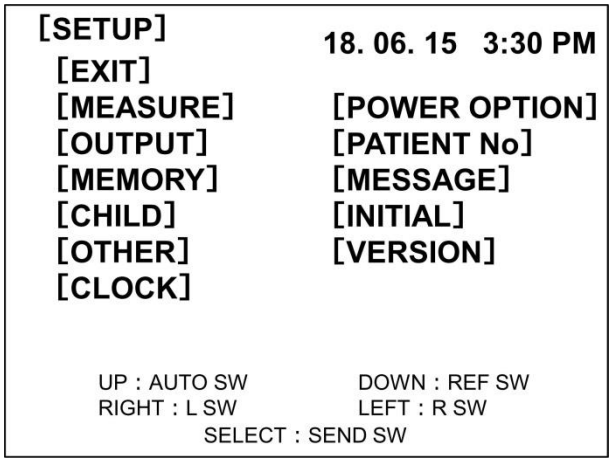
REF	REF measurement
KER	KERATO measurement
PER	KERATO peripheral (PERI) data has already been acquired

Target



4-1-3 **Setting conformation**

Confirm the setting with [SETUP]



Subjects	Setting contents
EXIT	Finish the [SETUP]
MEASURE	Change measurement setting
OUTPUT	Change output setting
MEMORY	Output and delete stored data
CHILD	Change CHILD mode setting
OTHER	Change other setting
CLOCK	Change time setting
POWER OPTION	Change power supply setting
PATIENT No	Set patient No.
MESSAGE	Input a message
INITIAL	Implement initialization
VERSION	Confirm the version

Initialization following. See ”5 Setting Up the Instrument”.

■MEASURE

TYPE	AUTO3
PS	ONE
CYL	―
VD	12.0
mm/D	mm
INDEX	1.3375
STEP	AUTO
KER	3
REF	5

■OUTPUT

■OUTPUT SETTING

OUTPUT	PRINT&USB
PRINT ID	1
USB FORMAT	PC

■OUTPUT FORMAT

REF	ALL
KER	REP
PS	ON
PERI	OFF
R cyl	OFF
MESSAGE	OFF
EYE	OFF

■CONT FORMAT

OUTPUT DATA	LAST5
REF	ALL
KER	REP
PS	ON
R cyl	OFF
MESSAGE	OFF

■MEMORY

OUTPUT NUMBER	LAST30
PRINT	—
USB	—
PRINT & USB	—
DELETE	—

■CHILD

MELODY	ON
LED	ON
CHART COLOR	ON

■OTHER

BUZZER	ON
ALIGN	OFF
CHART BRIGHTNESS	AUTO
LCD	80%
PARALLEL	ON
FOCUS ASSIST	ON
AUTO QUICK	OFF
AUTO START	ON

■CLOCK

DATE-FORM	120V area MDY 230V area DMY
TIME-FORM	120V area AM/PM 230V area 24H

■POWER OPTION

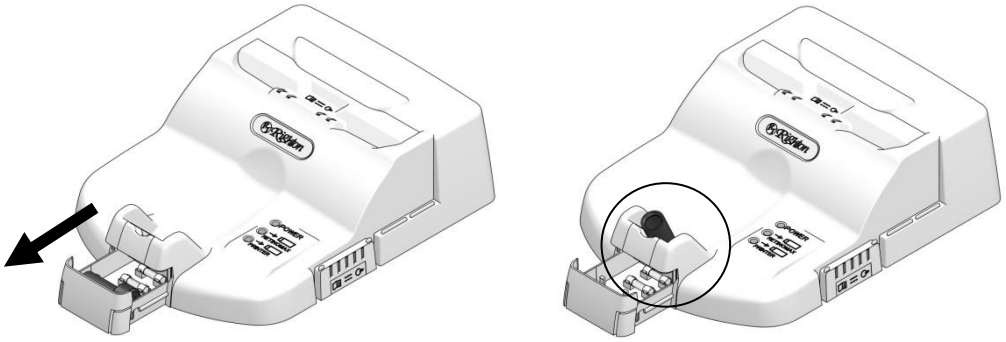
STAND-BY	3MIN
SHUT-DOWN	3MIN

■PATIENT No.

No.	0001

4-1-4 **Measuring the Model Eye**

1. Open the accessory case, and place model eye.



2. Make sure setting with REF KER measurement, AUTO mode and VD12.00mm.
3. Implement model eye alignment, and start measurement.
   *See “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)” to be acknowledged how to measure.

CAUTION

- Do not expose the main unit to bright light.
  Exposure to light may lead to loss of measurement accuracy or failure of the measurement.

4. Compare the values measured with the model eye against the values (SPH, CYL, R1, R2) printed on the model eye. Confirm that the differences are within the following ranges:

SPH	: ±0.25 D	CYL	: ±0.25D
R1	: ±0.02mm	R2	: ±0.02mm

Make sure that the model eye and measurement window are not dirty.

If the surface of the measurement window becomes dirty with patients' nose grease or fingerprints or dust, the measurement results may be affected.

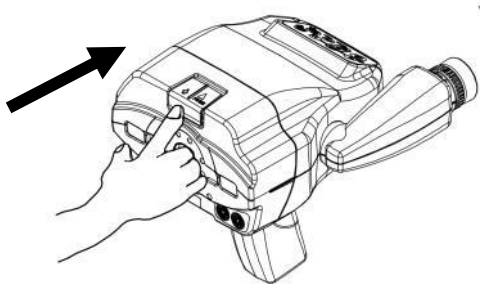
If the measured values are out of the above ranges,see "4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)" and check that your measurement procedure was correct. Then, retry the measurement.

Also check for dirt as described in "7-5 Cleaning the Measurement Window" and "7-6 Cleaning Model Eye". If dirty, perform cleaning. If the values still do not fall within the above ranges, contact your local dealer.

4-2 Preparation for patient

4-2-1 Prepare the forehead rest

When you equip the forehead rest, push the place until it make sound following diagram, automatically comes out. When you wanted to close it, push there until it makes sounds.



CAUTION

- If the patient moves frequently, especially a child, the case that injure their face, do not use forehead rest.

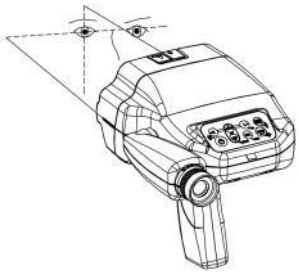
4-2-2 Positioning the measurement eye

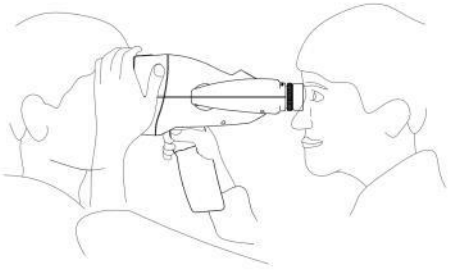
Make sure the position of the patient eye approximately.

- Vertical：Align to the target line for measuring window height position.
- Lateral：Align to the target line for measuring window lateral position.
- Back and forth：Position the measuring window approximately 50mm away from the eye.

Hold the patient’s head gently to facilitate anteroposterior positioning.

The positioning can be made still easier by bringing the forehead rest into contact with the patient's eyebrow.





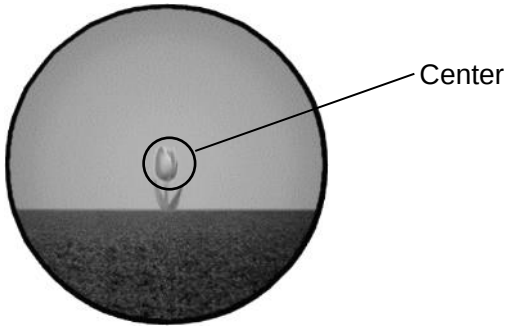
4-2-3 **Before the measurement**

Clean the forehead rest each patient with soft cloth soaked with rubbing alcohol.

Patients tend to be a little nervous, because they do not know what will happen to them, so it is best to try to relax and give them enough explanation.

Briefly explain the following:

- “This instrument automatically measures your eyes to determine the spectacle lenses that best suit you.”
- “Please look at the center in a relaxed manner.”
- “Try to keep your eye as still as possible.”



Example of a “tulip” fixation target

- When taking a measurement with 90° rotation or from the patient's vertex, the patient sees the fixation target rotated by 90° or 180°, respectively. In a measurement with 45° or 135° rotation, the patient sees the fixation target tilted diagonally.

CAUTION

- You may fail to find the eye through the LCD screen, and this can lead to the danger of having the main unit comes in contact with the patient.
- It is important to approximately align the main unit and the patient's line of sight before looking into the LCD screen.

4-3 **Measurement modes and start measuring**

This instrument offers three measurement subjects and three setting of measurement modes.

Measurement mode is selected form SETUP menu. See”5-1Measurement setup [MEASURE].

To select measurement subject, push REF and KER on the operation panel. The symbol lights with green while the subject is selected.

The operation of each measurement mode and subject is shown on the following table.

Measurement subject / Measurement mode	REF	REF KER	KER
A:Auto measurement mode See “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)”. Press the start switch once, place the bright spot within the alignment mark, and focus the mire ring. When the instrument judges that the measurement values are stable, the measurement will end automatically.	Start ↓ Fogging ↓ REF ↓ Auto stop	Start ↓ Fogging ↓ KERATO (Central) ← ×3 or ×5 ↓ REF ↓ REF ↓ REF ↓ Auto stop	Start ↓ Fogging ↓ KERATO ×3 or 5 (Central) ↓ Auto stop
A2:Auto measurement mode2 See “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)”. As same as Auto measurement mode, but, do Fog on each REF measurement.	Start ↓ Fogging ↓ REF ↓ Fogging ↓ REF · · ↓ Auto stop	Start ↓ Fogging ← ×3 or ×5 ↓ KERATO (Central) ↓ REF ↓ Fogging ↓ REF ↓ Fogging ↓ REF ↓ Auto stop	Start ↓ Fogging ↓ KERATO ×3 or 5 (Central) ↓ Auto stop
A3:Auto measurement mode3 See “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)”. As same as Auto measurement mode, but, fogging is shorter for easier measurement..	Start ↓ Fogging (short) ↓ REF ↓ REF · · ↓ Auto stop	Start ↓ Fogging (short) ↓ KERATO (Central) ← ×3 or ×5 ↓ REF ↓ REF ↓ REF ↓ Auto stop	Start ↓ Fogging ↓ KERATO ×3 or 5 (Central) ↓ Auto stop

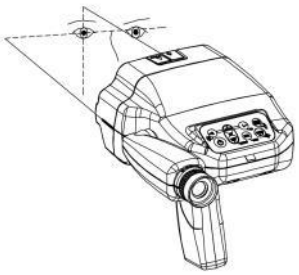
Measurement subject / Measurement mode	REF	REF KER	KER
C:Continuous measurement mode See “4-3-2 Continuous Measurement Mode (CONT)”. As with the automatic measurement mode, can be interrupted by a press of the start switch.	Start ↓ Fogging ↓ REF (Continuous measurement) ↓ Stop with pushing measurement switch	Start ↓ Fogging ↓ KERATO (Measure once) (central) ↓ REF (Measure once) ↓ Stop with pushing measurement switch	Start ↓ Fogging ↓ KERATO (Continuous measurement) (Central) ↓ Stop with pushing measurement switch

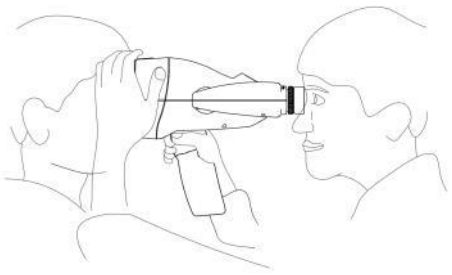
4-3-1 **Automatic measurement mode (AUTO, AUTO2, AUTO3)**

This enable you to REF, REF KER, KER measurement. The operation method of AUTO mode, AUTO2 mode and AUTO3 mode is the same.

1. Enter to [SETUP] with 

, select measurement mode “AUTO” , “AUTO2” or “AUTO3” with <TYPE> in [MEASURE].
   See ”5-1 Measurement setup [MENU-MEASURE]”
2. Select the measurement subject on the operation panel.
   See ”2-2 Operation panel”
3. Make patient relaxed by talking to them, and, position the patients eye approximately.
   See ”4-2-2 Positioning the measurement eye”





CAUTION

- Be careful not to allow the main unit to touch the patient's eyelashes.

4. When the 

is lighting, as you move the main unit closer to the patient, the automatic right/left eye discrimination function begins.
   A beep sounds to indicate that the measurement has changed from the patient's right eye to left eye, or vice versa.
   However, the right/left eye discrimination is unstable, and a continuous beep may sound. If you find it difficult to properly discriminate the right/left eyes, see “4-7-1 For Proper Measurement”.

- The beeping in the automatic right/left eye discrimination mode is turned off by setting the <BUZZER> to “OFF” at [OTHER] in [SETUP].

CAUTION

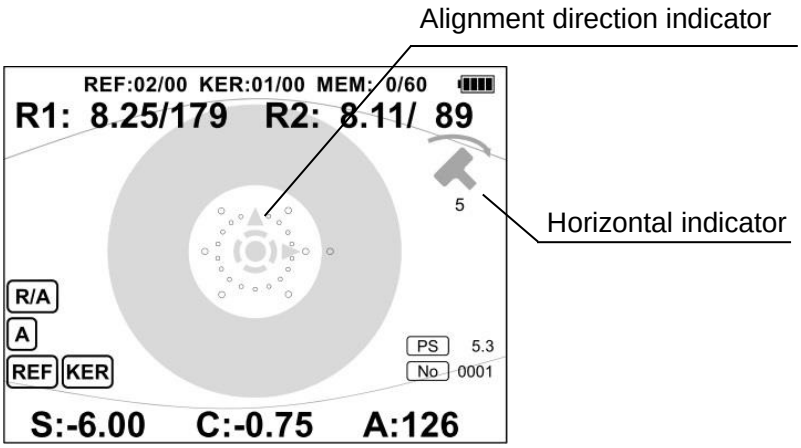
- When measurement, the case you make movement with the device right and left, not to hit forehead rest to patient's nose.
- It is safe that move it after separated from patient.

5. With the patient's eye positioned approximately, look into the screen during the measurement.
   When the patient's eye appears on the screen, align the image of the pupil to the center of the screen.
   Next, move the main unit back or forth until the image of the dots of the mire ring appears clearly.
6. Focus on the mire ring and put the alignment symbol in it.

CAUTION

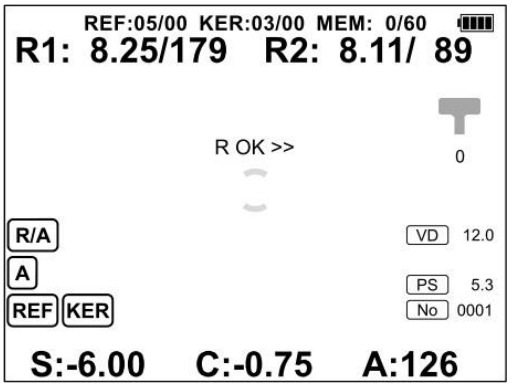
- You may fail to find the eye through the LCD screen, and this can lead to the danger that the main unit may come in contact with the patient. It is important to approximately align the main unit and the patient's line of sight before looking into the LCD screen.

7. When push the measurement switch, the measuring light turns on and the cornea reflected light is visible in the center of the mire ring. When the cornea reflected light enters the alignment mark and the alignment is correct, the alignment mark changes color from white to green and automatically started measuring.
   Select [OTHER] in [SETUP] and set <ALIGN> to "ON", the alignment direction indicator will be displayed. Moving the main body in the display direction makes it easier to acquire measurement values. Move the main body in the direction to be displayed to make it easier to obtain measured values.
   Select [OTHER] in [SETUP] and set <PARALLEL> to "ON", the horizontal indicator displays the tilt of the unit in 2° increments. When the horizontal level of the device is within ± 2°, the indicator icon turns green. Please keep green as possible and measure.
   If it is difficult to find the focus position of the mire ring, "4-4-3 Focus Assist Function" is enable to display the positional displacement in the anteroposterior direction.



REF KER measurement screen

8. The device judges the variation of the measurement data and it will automatically end when the measurement value becomes stable. If you want to finish the measurement in the middle of the measurement, press the measurement switch or switch the left/right eyes during measurement. When measurement of one eye is completed, it becomes as shown below.



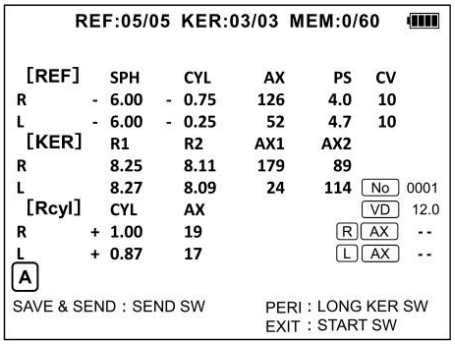
Completed one eye measurement

If you want to finish the measurement and send the data to printer, please press SEND.

Refer to "4-5 Printing" for the data transmission method, “4-5-2 Printing Examples” for the print example, and "5-2 OUTPUT Screen [OUTPUT]" for the printing settings.

If you want to measure the same eye again, press the measurement switch and implement measurement with the process from 3 to 8.

9. When you completed measuring the one eye, implement the other eye with 3 to 8 process.
10. If you completed measuring of both eyes, measurement data will be displayed again.



Completed both eyes measurement

11. When continue to perform the KERATO Peripheral (PERI) measurement, hold KER for 2 seconds. Refer to “4-3-3 Kerato Peripheral(PERI) Measurement” for the measurement method.
12. To print out the measurement results, aim the front side of the main unit toward the printer’s light receiving window, push SEND button. When the memory function is ON, the data is automatically memorized when the data is transferred. When the memory function is OFF, press and hold SEND for 2 seconds to save the data. For details on memory function, see "4-4-7 Storing data".
13. After completed transferring data, the case measure the other patient, push measurement switch and implement 3 to 10 process.

A black shadow develops if the pupil has a something that obstructs light during measurement (such as opacity in the crystal lens due to a cataract, scars in the eye, etc.)
If a black shadow is seen, we recommend performing the observation followed by Retroillumiation Mode and other ophthalmic examination such as using a slit lamp. (4-4-6 Retroillumination Mode)

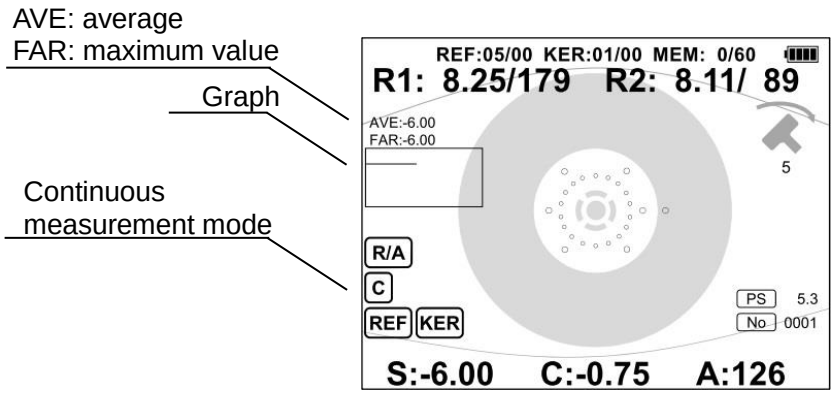
- To start the measurement again with the same patient’s eye to be examined, press the start switch again. From the measurement completion screen, return to the measurement standby state.
- Measured values are printed and output up to 5 times of the latest data on each side. If you measure more than 8 times, the oldest data will be erased in order.
- Compared with AUTO and AUTO2”, AUTO3’s shorter fogging is for easier measurement. AUTO3 is recommended to use for elderly people and children who cannot keep looking at target.

4-3-2 **Continuous Measurement Mode (CONT)**

In this mode, measurement is performed continuously without finishing automatically.

1. Enter [SETUP] with 

and set the measurement mode to “CONT” with <TYPE> in [MEASURE].
2. Select measurement subject on the operation panel (see “2-2 Operation Panel”).
3. Take a measurement using the same procedure of 3 to 10 as in the “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)”.
   During measurement, a graph of spherical equivalent power, spherical equivalent average (AVE), spherical equivalent maximum (FAR) are displayed on the left side of the screen.
   When the measurement item is KERATO, the graph is not displayed. Also, it cannot be shifted to KERATO Peripheral (PERI) measurement in continuous measurement mode.



Sample screen at measurement (CONT)

- In this mode, measurement does not end automatically.
- We recommend that the measurement be performed at least 5 times for each eye. Increase the number of measurement cycles further if the eye moves frequently or measurement values vary.

4. If you wanted to end the one eye measurement, press the measurement switch.
   Or, change to the other eye while measuring.
5. When completed measuring both eyes, moves on to screen completed measurement.
6. To print out the measurement results, aim the front side of the main unit toward the printer’s light receiving window, push 

. When the memory function is ON, the data is automatically memorized when the data is transferred.

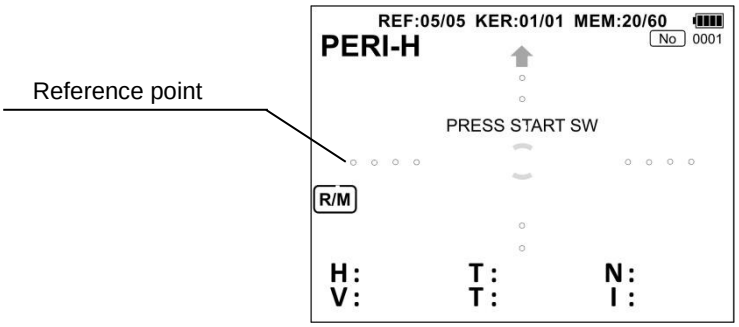
See "4-5 Printing" for the data transmission method, "4-5-2 Printing Examples" for the print example, and "5-2 OUTPUT Screen " for the printing settings.

When the memory function is off, hold down SEND for 2 seconds to save the data. For details on memory function, see "4-4-7 Storing data".

4-3-3 **KERATO Peripheral(PERI) Measurement**

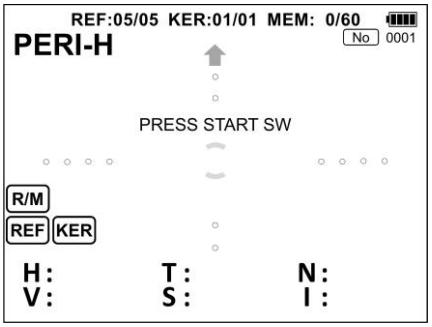
This mode measures the radius of curvature of the corneal periphery. This is implemented separately vertical measurement and lateral measurement.

1. Hold down KER for 2 seconds on REF KERATO or KERATO measurement completed screen or measurement standby screen is displayed to change to PERI measurement.



Measurement standby screen of PERI horizontal direction measurement

If change to PERI measurement after measureing REF KERATO or KERATO, REF and KER are displayed on measurement standby screen of PERI measurement, and indicates that REF KERATO measurement data has already been obtained.

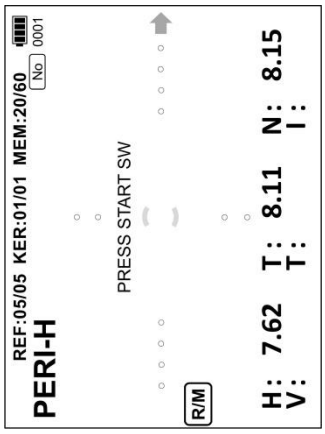


PERI measurement standby screen after REF KERATO measurement

2. At first, measure horizontal direction with arrow heading upper side, adjust the mire rings and alignment mark, press measurement switch.
3. Please put cornea reflected light inside the alignment mark.

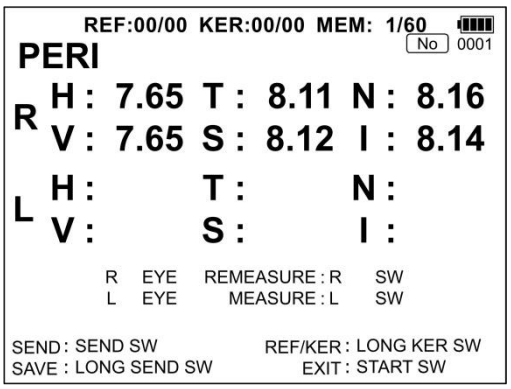
When the horizontal direction of the device is within ± 2°, the white reference point in the horizontal and vertical direction and the arrow turn green. Please keep green as possible and measure. When the measurement is started, measurement is continued until the measurement switch is pushed again.

4. Pressing the measurement switch again ends the measurement in the horizontal direction and shifts to the vertifal direction. The arrow rotates to 90°.
5. For vertical measurement rotate the main unit 90° so that the arrow points upward.
6. Besure that the arrow is at the position shown on the figure as follows and measure as same as horizontal direction.



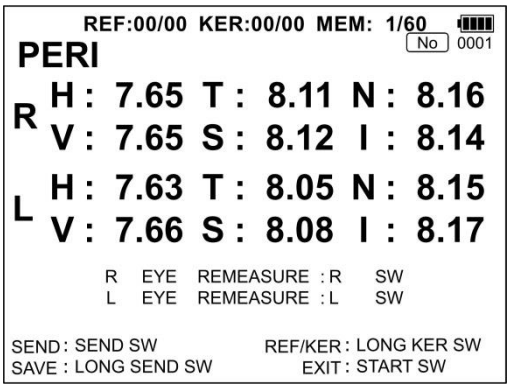
Measurement standby screen of PERI vertical direction measurement

7. When measurement of one eye is completed, measurement completed screen will be displayed. If you want to measure again or measure the other eye, press ◄R or L►.



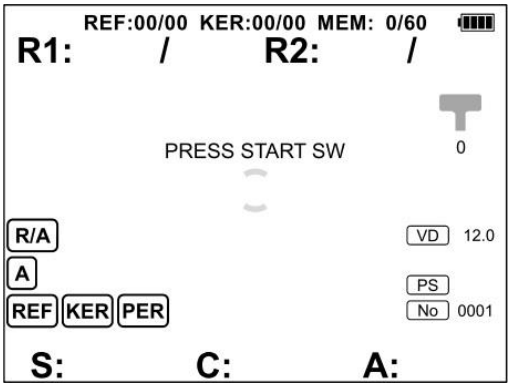
Completed PERI measurement (one eye)

8. If you completed measuring of both eyes, measurement data will be displayed as follows.



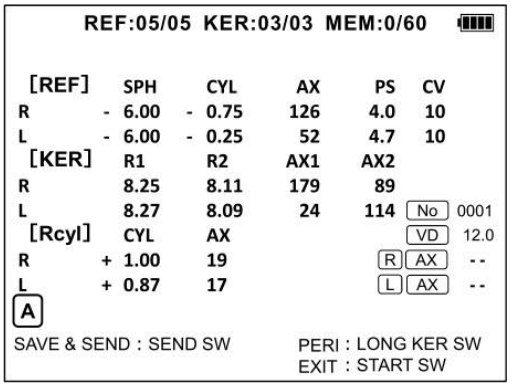
Completed PERI measurement (both eyes)

9. When continue to perform REF KERATO or KERATO measurement, hold KER for 2 seconds before printing. PER is displayed on REF KERATO or KERATO measurement standby screen, and indicates that KERATO peripheral (PERI) measurement data has already been obtained.



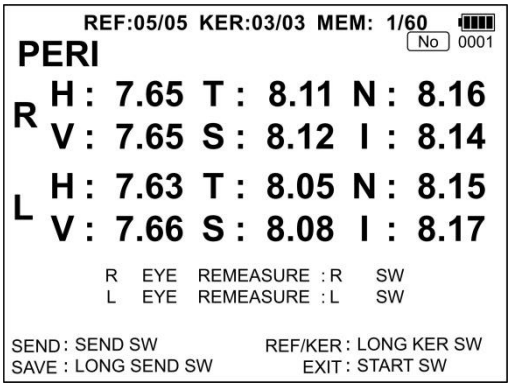
REF KERATO measurement standby screen after PERI measurement

10. The measurement completed screen is displayed after REF KERATO / KERATO measurement.



Completed REF KERATO measurement (both eyes)

11. Hold KER for 2 seconds on the measurement completed screen to display KERATO peripheral (PERI) measurement data.



Completed PERI measurment (both eyes)

12. To print out the measurement results, aim the front side of the main unit toward the printer's light receiving window, push SEND. When the memory function is ON, the data is automatically memorized when the data is transferred. Refer to "4-5 Printing" for the data transmission method, "4-5-2 Printing Examples" for the print example, and "5-2 OUTPUT Screen [OUTPUT]" for the printing settings. When the memory function is off, hold down SEND for 2 seconds to save the data. For details on memory function, see "4-4-7 Storing data."

- In KERATO peripheral (PERI) measurement, right/left discrimination is a manual operation.
- In KERATO peripheral (PERI) measurement, horizontal and rotation correction don't be operated. When measuring at the bedside etc., please align the direction of the arrow with the patient's head.

CAUTION

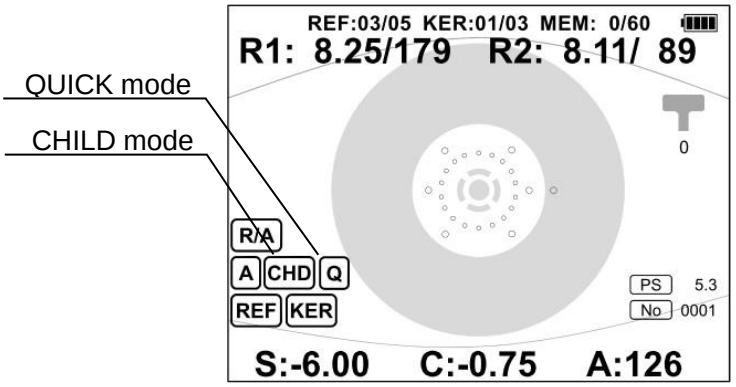
- Do not use the forehead rest during vertical measurement. There is a danger that it will hit the opposite eye of the patient.
- Vertical measurement may not be possible as the measuring beam is obstructed by eyelashes or upper eyelid. Ask the patient to open the eye wider before starting the measurement.

4-3-4 **CHILD/QUICK mode**

Press CHILD QUICK, the symbol will be blinking and goes on to CHILD mode. In CHILD mode, apply QUICK mode automatically in order to shorten the measurement time. Press CHILD QUICK again to goes on to QUICK mode, the symbol will be lighting and CHILD mode will be OFF.

＜CHILD mode＞

The case that measure infants and childs, sometime they dislike to be measured. This instrument contains function that make them pay attention by making sounds , lighting fixation chart in various colour and blinking with various colour. It functions, as aid, until them to be measured.

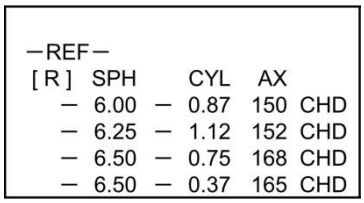


CHILD mode measurement

LED blinking, lighting the fixation chart and melody ON/OFF in CHILD mode can be set with CHILD mode setting screen [CHILD] in [SETUP]. See “5-4 CHILD mode screen [CHILD]”.

Perform the measurement in the same process as “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)” and “4-3-2 Continuous Measurement Mode (CONT)”.

When measuring in CHILD mode, “CHD” is displayed on the printed data.



−REF−

[R]	SPH		CYL	AX	
	− 6.00	−	0.87	150	CHD
	− 6.25	−	1.12	152	CHD
	− 6.50	−	0.75	168	CHD
	− 6.50	−	0.37	165	CHD

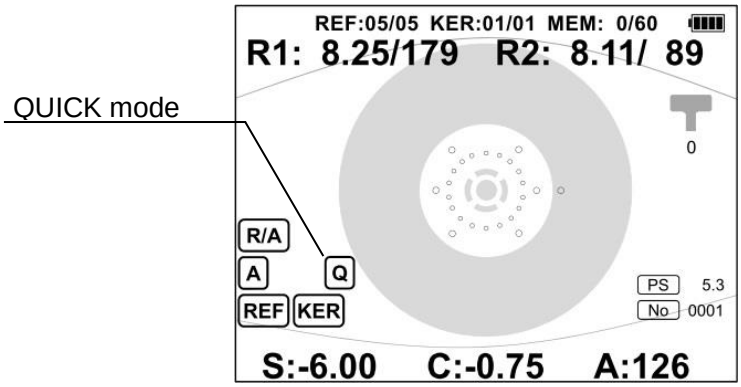
Printing example

- Use this function when you found it difficult to measure infants or children.
- When you sound the melody, buzzer will never ring.

＜QUICK mode＞

The “Quick Measurement Mode” allows a shortening of the time from the start of measurement to display the measurement value.

QUICK mode with short REF measurement time is useful in cases when measurement is difficult because of rapid eye movements due to nystagmus or if the patient is a child, or other reason.



QUICK mode measurement

Perform the measurement in the same process as “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)” and “4-3-2 Continuous Measurement Mode (CONT)”.

When measuring in CHILD mode, “Q” is displayed on the printed data.

−REF−

[R]	SPH		CYL	AX	
	− 6.00	−	0.87	150	Q
	− 6.25	−	1.12	152	Q
	− 6.50	−	0.75	168	Q
	− 6.50	−	0.37	165	Q

Printing example

- In the quick measurement mode, refractive measurement takes about half the ordinary time, but measurement values tend to vary more widely.
- In the quick measurement mode, the time taken for KERATO measurement and KERATO peripheral (PERI) measurement are not changed.

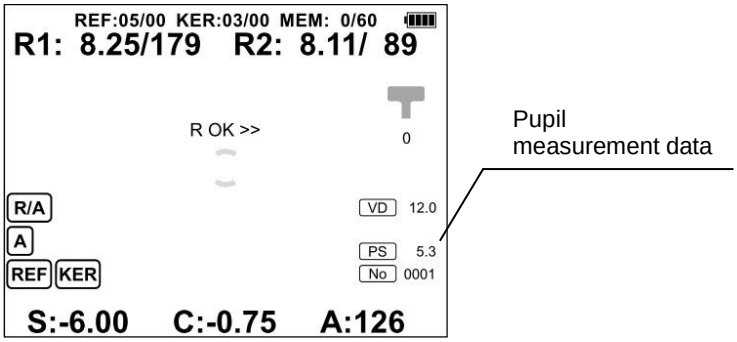
4-4 Various Functions

4-4-1 Pupil Diameter Measurement Function

This instrument is equipped with a pupil diameter measurement with REF measurement. The pupil diameter measurement can be performed when REF or REF KERATO mode.

1. Enter to [SETUP] with 

, set <PS> in [MEASURE] to “ONE” or “ALL”.
   - When the <PS> is “ONE”, pupil diameter is measured only once (first time) for each eye.
   - When the <PS> is set to “ALL”, the pupil diameter measurement is always performed after the REF measurement.
2. When the measurement started, pupil diameter measurement automatically started after each REF measurement. If measurement data obtained, measurement value will indicated in <PS> on the right side of the screen.



Pupil size measurement

   - The maximum values of pupil diameter both lateral and vertical directions are measured. If the pupil diameter less than 2.0mm, pupil diameter are displayed as “－－”.

     Figure indicates only lateral direction.

     Range of measurement : 2.0mm to 12.0mm

     Measurement step : 0.1mm

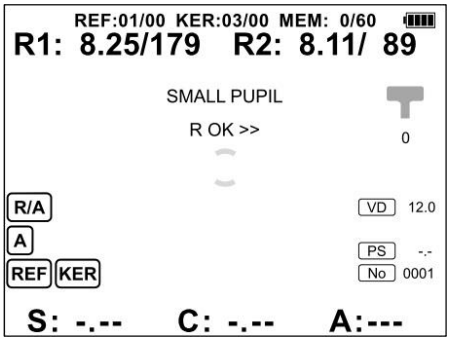
3. When the pupil diameter is 3.0mm or less, “SMALL PUPIL” will be indicated on the measurement screen. At this time, when <CHART BRIGHTNESS> with [OTHER] in [SETUP] is set to “AUTO”, the brightness of the fixation chart is automatically dimmed. See “5-5 OTHER Setting [OTHER]”

   By the fixation chart brightness, the character colour of PS will be changed as follows.

PS	PS : green	The fixation chart brightness is “HIGH”
	PS : red	The fixation chart brightness is “LOW”

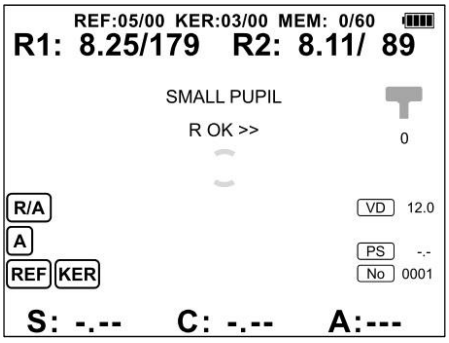
4. If the pupil diameter less than 2.3mm, REF measurement value is displayed as “－－”.

5. When < PS > is set to "ONE," if the pupil size measurement value is less than 2.3 mm, pupil size measurement is performed again, and if it is 2.3 mm or more, normal measurement is performed. Measure the pupil size 3 times and if all diameters are less than 2.3 mm, measurement of one eye is ended and an error display is made as follows.



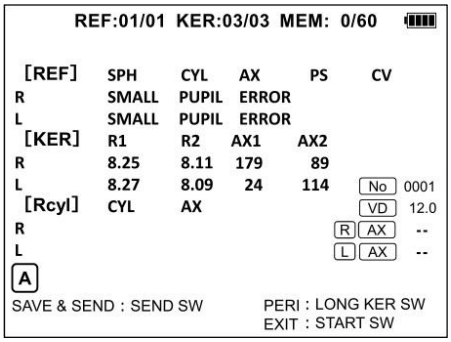
Error indication when data can’t be obtained
because the pupil size is less than 2.3 mm

6. When < PS > is set to "ALL," measurement is performed 5 times. The variation is judged from REF measurement value when the pupil size is 2.3 mm or more, and if stable data is obtained, the measurement will be completed. Measure the pupil size 5 times and if all diameters are less than 2.3mm, measurement of one eye is finished and the error display just as when <PS> is set to “ONE” is made.
If REF measurement count is set to “3”, measurement is done “3 times” not “5 times”. (Refer to “5-1 Measurement setup [MEASURE]”)



Error indication when data can’t be obtained
because the pupil size is less than 2.3 mm

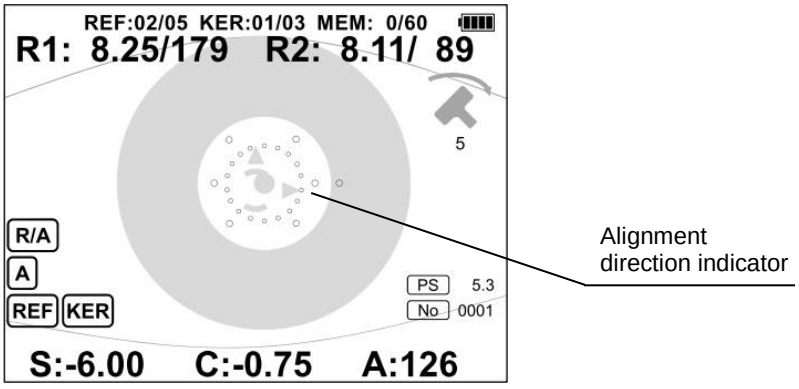
7. If REF measurement value cannot be obtained because the pupil size is less than 2.3mm, an error is displayed on measurement completed screen as follows.



Measurement completed screen when data can't be obtained because the pupil size is less than 2.3 mm

4-4-2 **Alignment Direction Indication Function**

The alignment direction indication function is used to indicate the direction for placing the refracted light from cornea within the alignment mark during the measurement.
Move the main unit in the indicated directions, and measurements will be obtained more easily.



Measurement screen when alignment is ON

1. Enter to [SETUP] with  , set <ALIGN> in [OTHER] to ON.
2. Start the measurement and indicator is displayed.
3. Moving the main unit in the indicated directions marks establishes proper alignment. When the direction marks are shown as seen in the figure above, proper alignment can be established by moving the main unit toward the upper right.

4-4-3 **Focus assist function**

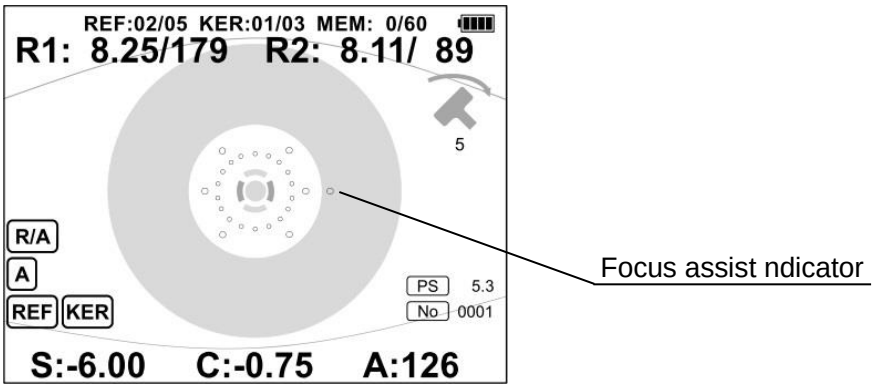
This function notices that the range between instrument and eye is too close or too distant from the focus position. It is convenience function if it is not used to focus on the mire ring or want to measure at the exact position.

1. Enter to [SETUP] with 

and setting with <FOCUS ASSIST> in [OTHER].

ON	Automatically measure when matched focus and alignment.
DISPLAY	Indicates focus. No auto measurement.
OFF	The function is OFF.

2. The indicator for focus assist will be displayed when it set “ON” or “DISPLAY.” According to the indication, move instrument to front-back direction, and focus the mire ring.



Measurement screen when focus assist is ON or DISPLAY

The display is made according to the distance between the device and the eye to be examined as follows.

<table>
<tr><td>setting</td><td colspan="7">Distance between the device and the eye
far ← → close</td></tr>
<tr><td rowspan="4">ON</td><td colspan="2">  </td><td>  </td><td>  </td><td>  </td><td colspan="2">  </td></tr>
<tr><td colspan="2">up and down: white</td><td>up and down: white</td><td>up and down: green</td><td>up and down: white</td><td colspan="2">up and down: white</td></tr>
<tr><td colspan="2"></td><td>right and left: blue</td><td>right and left: green</td><td>right and left: blue</td><td colspan="2"></td></tr>
<tr><td colspan="2">not measuring</td><td colspan="2">measuring</td><td colspan="3">not measuring</td></tr>
<tr><td rowspan="4">DISPLAY</td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>up and down: white</td><td>up and down: green</td><td>up and down: green</td><td>up and down: green</td><td>up and down: green</td><td>up and down: green</td><td>up and down: white</td></tr>
<tr><td></td><td></td><td>right and left: blue</td><td>right and left: green</td><td>right and left: blue</td><td></td><td></td></tr>
<tr><td>not measuring</td><td colspan="5">measuring</td><td>not measuring</td></tr>
<tr><td rowspan="4">OFF</td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>up and down: white</td><td>up and down: green</td><td>up and down: green</td><td>up and down: green</td><td>up and down: green</td><td>up and down: green</td><td>up and down: white</td></tr>
<tr><td>right and left: white</td><td>right and left: green</td><td>right and left: green</td><td>right and left: green</td><td>right and left: green</td><td>right and left: green</td><td>right and left: white</td></tr>
<tr><td>not measuring</td><td colspan="5">measuring</td><td>not measuring</td></tr>
</table>

- This is an auxiliary function to obtain measured value at a more accurate position such as those who are not good at focusing the mire ring and for training purpose.
- However the function is “ON” or “DISPLAY”, the examiner operates it, should be careful not to contact instrument to patient’s face.
- In AUTO3, the focus assist function is omitted, it makes easier to measure elderly people and children who cannot keep looking at chart

4-4-4 **Astigmatical power correction function**

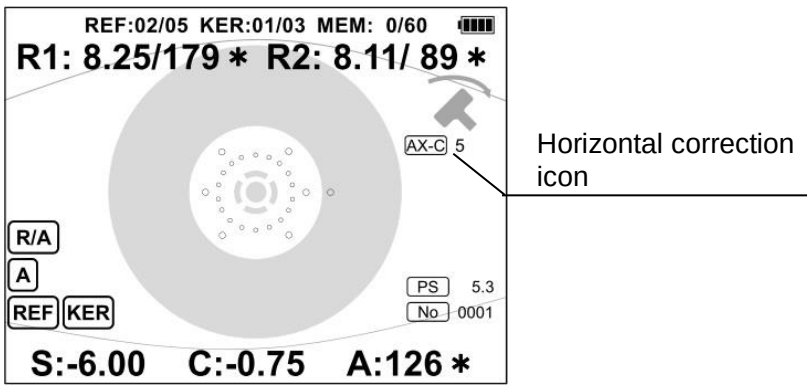
There are two functions “Horizontal correction function” and “Rotation correction function of Instrument”

(1) Horizontal correction function

This is a function when the normal measurement, correct the astigmatic axis (AX), KERATO axis and residual astigmatism axis corresponding to the instrument inclination.

1) At the measurement standby screen, hold down ◄R for 2 seconds.

2) “AX-C” is displayed next to horizontal indicator, and the measured value is corrected in 1° increments by the amount that the device is tilted. However, the horizontal indication display is displayed in 2° increments.



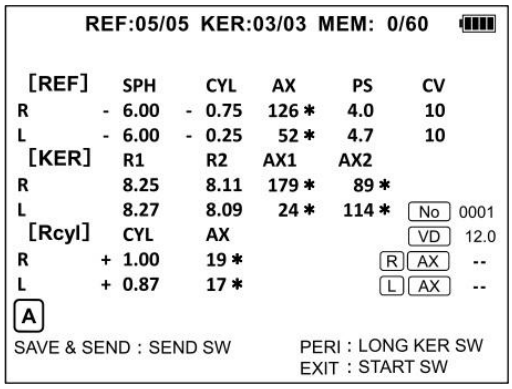
Measurement screen when horizontal correction is ON

3) When you wanted to release the auto correction, hold down ◄R for 2 seconds again.

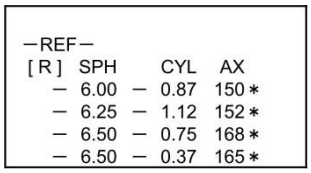
4) When tilted more than 90°, the automatic correction is canceled and the display "AX-C" disappears.

5) Enter to [SETUP] with AUTO SET REF and set <PARALLEL> in [OTHER] to “OFF”, the horizontal correction icon can be hidden. In that state, hold down ◄R for 2 seconds to display only “AX-C” and automatic correction is enabled.

6) When the angle is corrected by the horizontal correction function, the ＊ mark is displayed in AX value.



Measurement completed when horizontal correction is ON



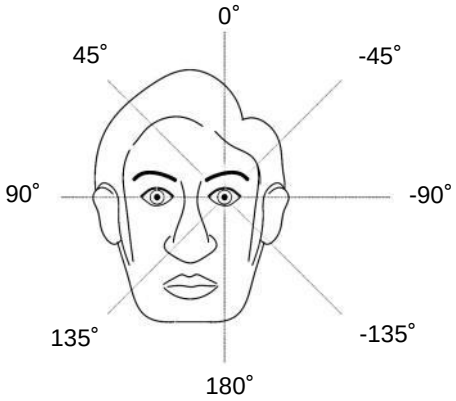
Printing example

- Horizontal correction never function when the rotation correction function (As well as the icon).
- When the KERATO peripheral (PERI) measurement mode, it never be function (As well as the icon).

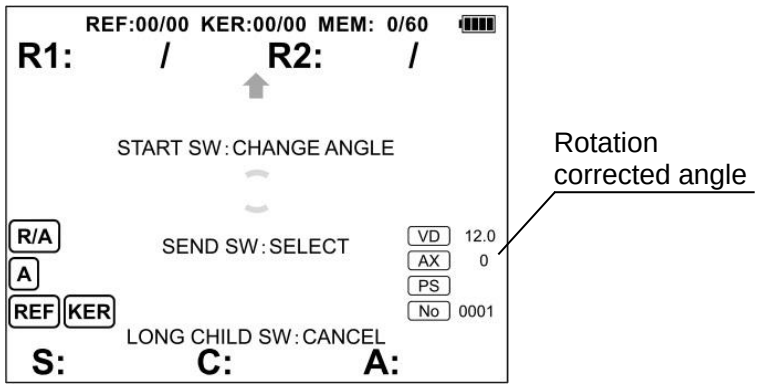
(2) Rotation Correction Function of Instrument

If you need to perform measurement from 45°, 90°, or 135° rotated position, as for bedside measurement, astigmatic axis (AX) must be set appropriately. The rotation correction function corrects the astigmatic axis, KERATO axis, and residual astigmatic axis automatically from the rotated position.

Set the automatic correction angle to suit the measuring position as illustrated bellow.

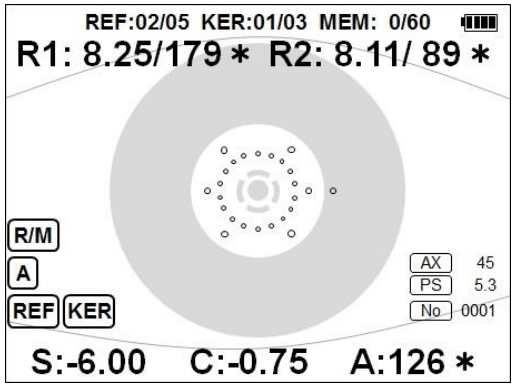


1. Hold down CHILD QUICK on the operation panel for 2 seconds. The blinking arrow is displayed on the measurement screen and shift to the rotation corrected angle select screen. Corrected angle is displayed with “AX ” on right side of the screen.
2. Press the measurement switch to change the rotation corrected angle. Each time you press that button, align the direction of the arrow with the patient’s head .
3. To be off rotation correction function, hold down CHILD QUICK for 2 seconds again.



Rotation corrected angle select screen

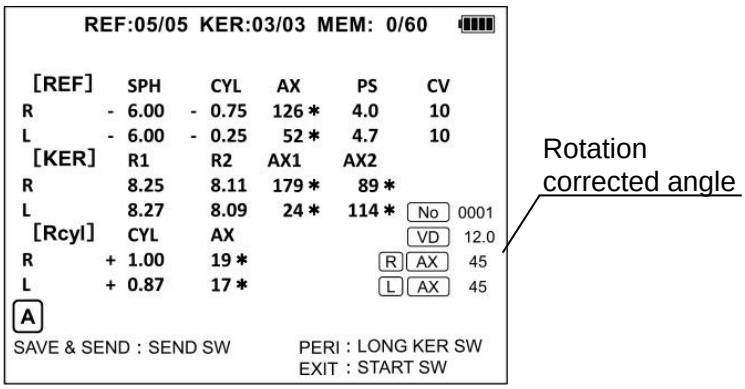
4. Push SEND, the arrow changes form blinking to lighting and completed to setting and goes to measurement standby mode. Push measurement switch, measurement starts.



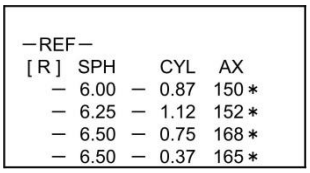
Measurement screen with rotation correction function

5. To release rotation correction function, hold down CHILD QUICK for 2 seconds again.

6. When the angle is corrected by rotation correction function, ＊ is displayed with AX value.
   Each corrected angle for right/left eye measurement is displayed on measurement completed screen.



Measurement completed screen with rotation correction function



Printing example

- When rotation correction function is on, the discrimination of eye right/left automatically set to manual.
- When the KERATO peripheral (PERI) measurement mode, it never be function (As well as the icon).

CAUTION

- Do not use forehead rest if rotation correction function is on. It possibly contact to the other eye or parts except forehead.

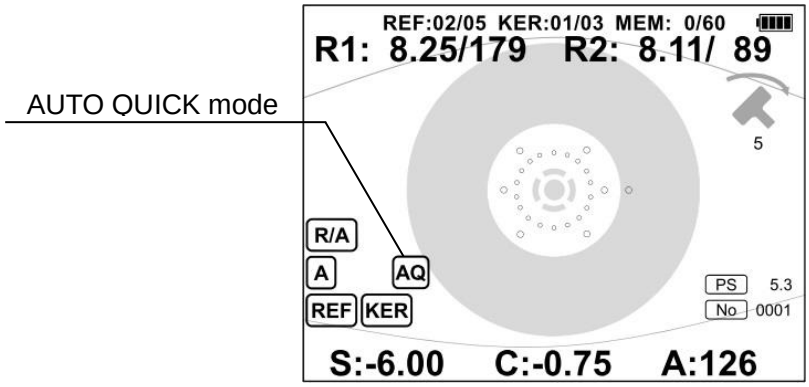
4-4-5 **Auto Quick Function**

Refractive measurements may be difficult to obtain due to rapid eye movements in patients with nystagmus or children, or for other reasons. In such a situation, AUTO QUICK mode automatically activates the quick measurement mode which requires less time for measurement.

This is effective at REF or REF KERATO measurement mode. Not for KERATO or KERATO peripheral (PERI) measurement mode.

1. Enter to [SETUP] with 

, set <AUTO QUICK> in [OTHER] to “ON.”
2. The case when the REF measurement cannot be executed after 6 seconds or REF KERATO measurement cannot be executed after 9 seconds, shift to QUICK mode automatically.
3. When switching to QUICK mode, "AQ" is displayed on the left side of the screen.



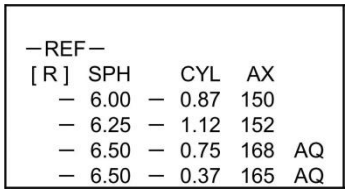
Measurement screen when switching to QUICK mode by AUTO QUICK mode

AUTO QUICK mode is only enable at “AUTO measurement mode (A)”, “AUTO measurement mode 2(A2)” and “AUTO measurement mode 3(A3)”. It is unable when “Continuous measurement mode (CONT).”

4. After entering QUICK mode by AUTO QUICK mode, it is automatically released under the following conditions

Condition	
1	Measurement of one eye ends.
2	Measurement suspended by pressing measurement switch.
3	The right/left eye discrimination is switched.

5. When shifting to QUICK mode by AUTO QUICK mode, “AQ” is printed on the measured data.



−REF−

[R]	SPH		CYL	AX	
	− 6.00	−	0.87	150	
	− 6.25	−	1.12	152	
	− 6.50	−	0.75	168	AQ
	− 6.50	−	0.37	165	AQ

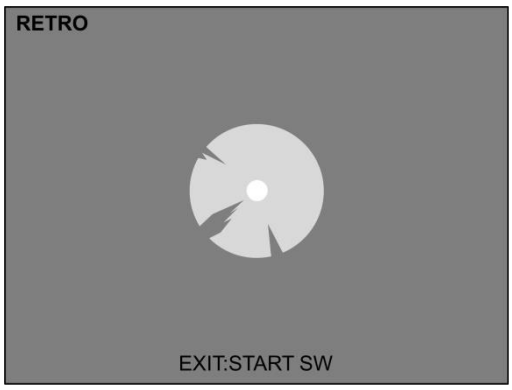
Printing example

- In the QUICK mode, refractive measurement takes about half the ordinary time, but measurement values tend to vary more widely.
- The quick measurement mode does not affect the length of KERATO measurement and KERATO peripheral (PERI) measurement.

4-4-6 **Retroillumination Mode**

In the case of "the measured value varies," "the reliability degree is low," etc., there may be foreign substances that obstruct measurement light such as opacity of the lens. For such patients, you can observe the optic media by using "retroillumination mode."

1. Hold down REF for 2 seconds to shift to retroillumination mode
2. Mire ring and background illumination (light illuminating the outer eye part such as the iris) lights. Then, position the patient eye to central.
3. Press the measurement switch, only measurement light is lighting and mire ring and background illumination are light out, only the central cornea reflected light and pupil can be seen. Any foreign objects, such as opacity in the crystal lens, that obstruct the measuring beam, appear as black shades on the screen.



Observation of optical media by retroillumination mode

- A better view may results by shifting the image off center. In particular, an opacity existing in the center can only be seen by projecting light off the opacity.
- Do not expose the patient's eye to external light (such as illumination from a fluorescent tube) as that may lead to deterioration of visibility.

4. Press the start switch to restore the condition given Step 2.
5. Press REF to return the measurement standby mode.

- When the retroillumination mode, not implement the judgement of right/left eye.

4-4-7 **Storing data**

This instrument stores data for 60 people (120 eyes).

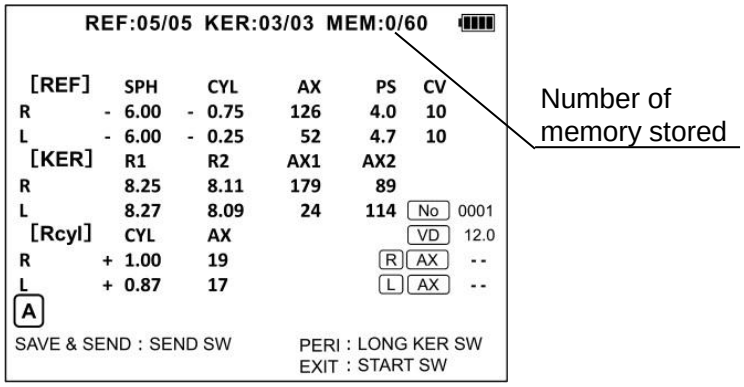
Storable items

Data which can be stored in the memory			
REF measurement value	Kerato measurement value	Value of pupil diameter	PERI measurement value
Dates	Patient No.	VD value	Measurement mode
CYL symbol	Residual astigmatism measyrement value		

(1) Memory function

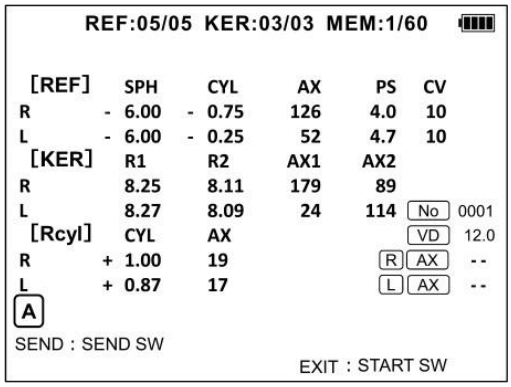
When the memory function is on, the transferred data to the printer automatically stored to the main unit.

1. Hold down SEND for 2 seconds on measurement standby screen, lights and memory function is on.
2. After measurement, when sending measurement data to the printer, the data is automatically stored in the main unit.



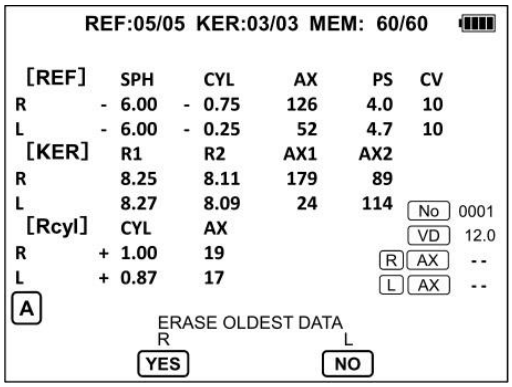
Measurement completed screen with memory function is on

3. If the data stored, the data added as above figure.



Measurement completed screen with the data is stored in the main unit

4. When you stored data with maximum storage, the buzzer sounds and switches to the screen below.



Data is stored when memory is maximum

5. Press ◄R, the oldest data is erased and the data is stored. Press L►, the data is not stored and sent to the printer.

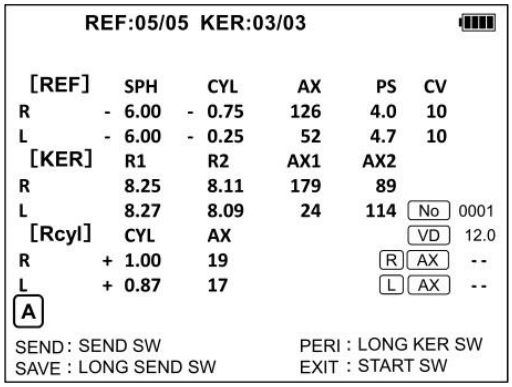
6. If you want memory function to be OFF, hold down SEND for 2 seconds on measurement standby screen again.

(2) Quick Saving

This function can manually save the measured data when the memory function is off.

1. Implement measurement with the memory function off.

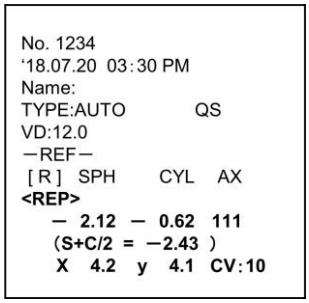
2. Hold down SEND for 2 seconds when the measurement one side eye or both eyes completed, memory function indication appears on the screen, and the storage added.



Measurement completed screen with memory function is off

3. After pressed the measurement switch, move on to measurement standby screen. The memory function indication disappears.

4. Printing the data stored by quick saving, “QS” is printed on the printing data.



Printing example

- When you wanted to store only one eye’s data, press SEND after measured one eye.
- The data never be stored repeatedly.

4-4-8 **Auto start function**

Auto measurement function, after measurement of an eye, measurement will start automatically when change to the other eye.

Enter to [SETUP] with AUTO SET REF, set <AUTO START> in [OTHER] to “ON”.

ON	Automatically measure when measurement eye is changed.
OFF	No automatically measure when measurement eye is changed. Press the measurement switch to start.

1. At the measurement standby screen, Press the measurement switch to start.
2. If measurement eye is changed to he other eye when you are measuring one side eye or finished, measurement is started automatically.

- If measurement data remains, measurement will not start automatically even if the eye is changed, and measurement completed screen is displayed.

4-5 **Printing**

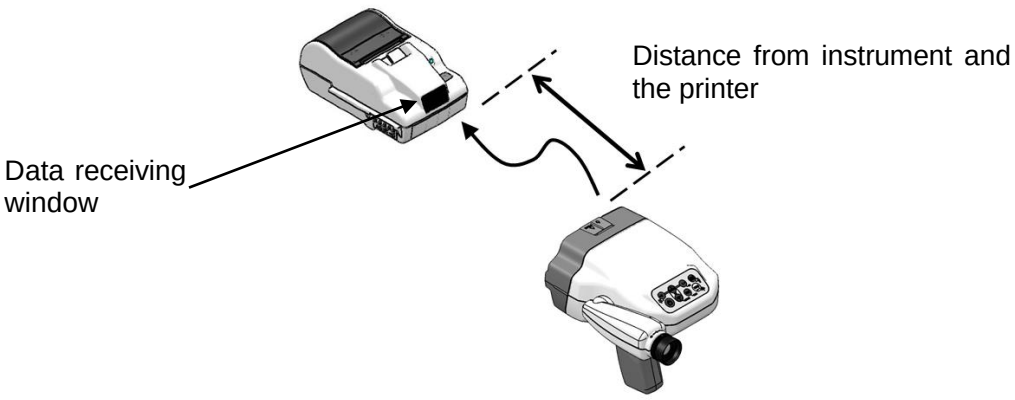
4-5-1 **Printing Procedure**

Print out the data transferring by IR rays from the instrument.

- If measurement mode is “CONT”, in case setting <OUTPUT DATA> in [OUTPUT] - [CONT FORMAT] with [SETUP] to “ALL”, an error will occur if data is transmitted while the main unit and the printer are separated by 50 cm or more. Be sure to transmit the distance between the main unit and the printer closed to less than 50cm. If <OUTPUT DATA> is set to “LAST5”, it can be transmitted even if it is more than 50cm apart.
- In the case of “transmitting stored data”, if <OUTPUT NUMBER> in [MEMORY] with [SETUP] is set to “LAST10”, “LAST30”, or “ALL”, an error occurs when the data is transmitted from 50cm or more apart. Be sure to transmit the distance between the main unit and the printer closed to less than 50cm. If <OUTPUT DATA> is set to “SELECT”, it can be transmitted even if it is more than 50cm apart.
- If an error occurs, bring the main unit closer to the printer and transmit again.

Measurement mode and data transmittable distance

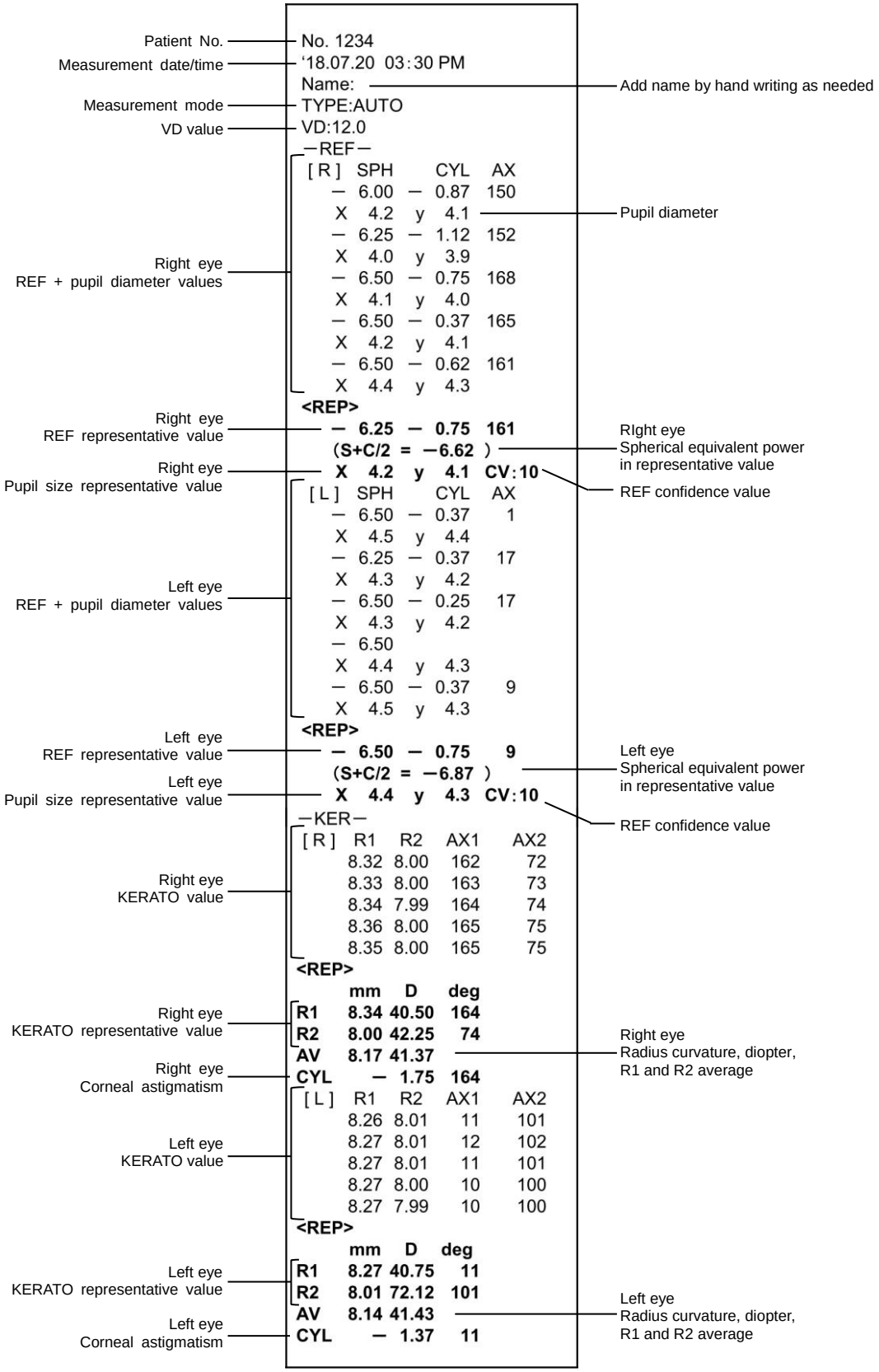
Measurement mode / Distance between main unit and printer	AUTO, AUTO2, AUTO3 CONT FORMAT “LAST5”	CONT FORMAT “ALL”
	Sending stored data “SELECT”	Sending stored data “LAST10・30”, “ALL”
Less than 50cm	○	○
50cm or more	○	×

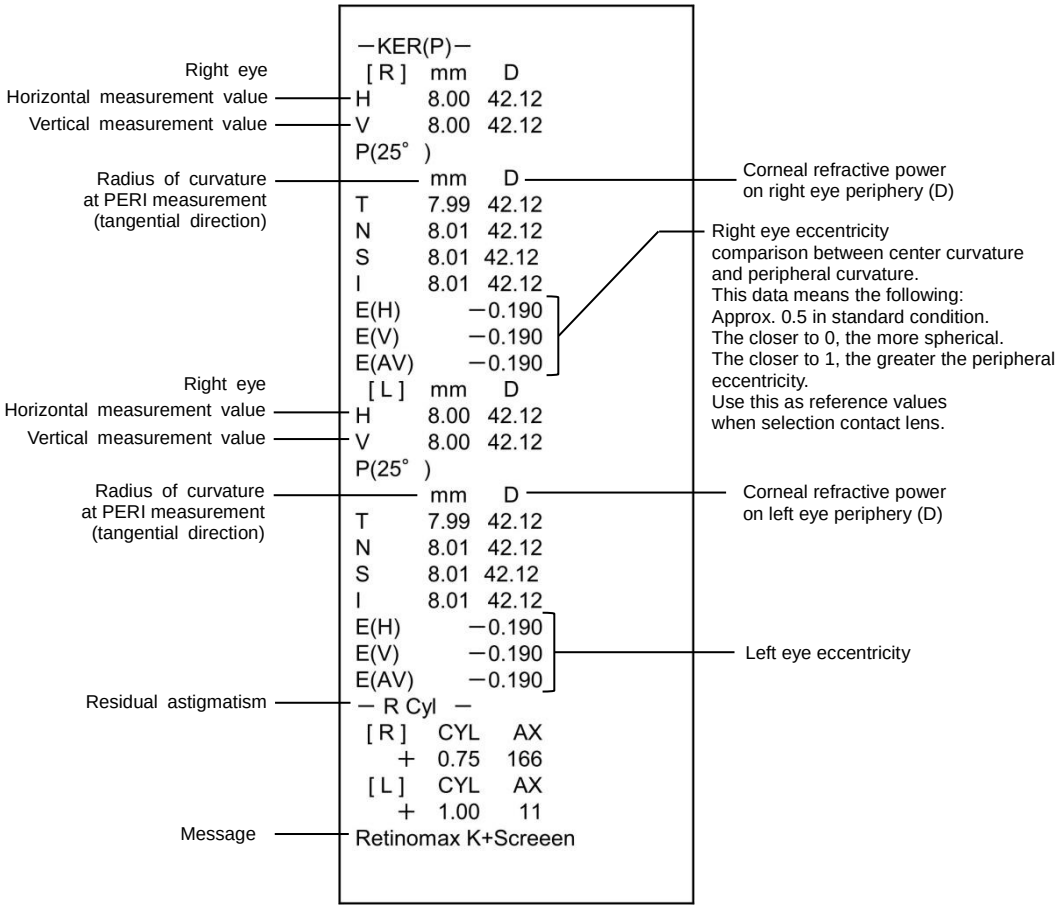


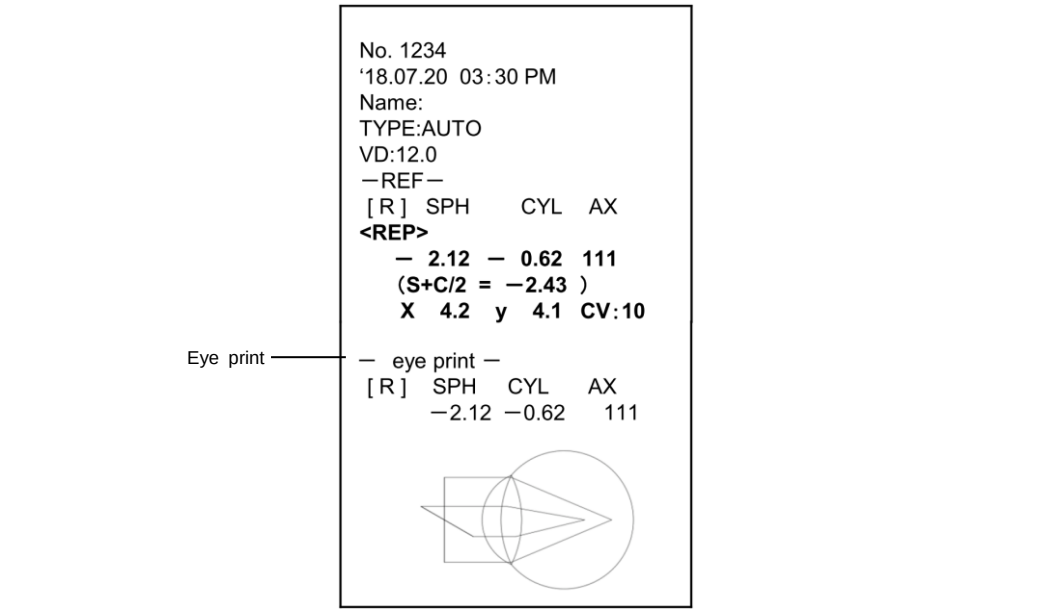
1. Set the print roll correctly (See “7-2 Replacing the Print Roll”)
2. Make sure the printer power on.
3. After the end of the measurement, press SEND toward the printers receiving window, the measurement data successfully transferred.
4. The printer discharges print paper showing the measured value after transfer.
   The print content is output according to the setting of "5-2 Output setting screen [OUTPUT]."

- The printer may fail to operate in the following situations:
  ◆The light from the main unit does not reach the printer when, for example, a person passes between the main unit and printer.
  ◆The printer is used at a place more than 6 m away from the main unit.
  ◆There is an angle of more than 45 degrees between the front side of the main unit and the data receiving window of the printer.
- In such cases, move near the printer and press SEND once again to send data. Printout can be made as many times as necessary before the next measurement starts.
- When measuring the next patient, be sure to make a printout before starting the measurement.
- Retinomax 5 series cannot be used with a printer provided for use with Retinomax, Retinomax 2, or Retinomax 3.
- If print paper runs out during printing, the indicator light blinks in pink. Replace the printing paper according to “7-2 Replacing the Print Roll”. After replacing printing paper, automatically reprint the data. After the indicator blinks in pink, data is deleted after 5 minutes without replacing the print paper.
  Please push SEND again and transmit measurement data.

4-5-2 **Printing Examples**







・The measured values are always printed in order from the right to the left eye, even when the left eye was measured first.

4-5-3 **Cutting off the printer paper**

Auto cutter is equipped on the printer and the paper is automatically cut.

Tear out the paper by pulling it toward you because the central of junction is still tied.

CAUTION

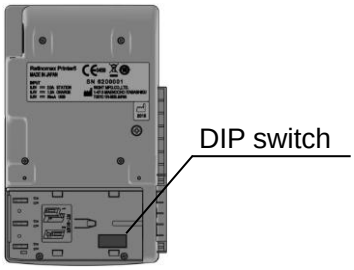
- If some trashes and chip from the paper on the thermal head or outlet of the printer, may cause printing error. Implement cleaning sometimes and keep their clean.

4-5-4 **Using Multiple Printers**

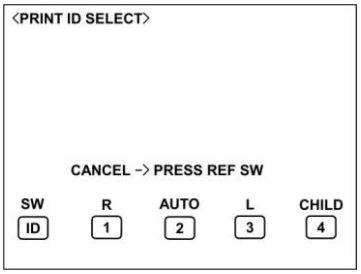
If two or more printers are available in the room, set the DIP switch of each printer as described below in order to avoid mutual interference.

To change the identification number of the printer, remove the battery cover and battery of the printer and operate the DIP switch. Please change the main unit identification number with <PRINT ID> in [OUTPUT SETTING], see “5-2-1 Output Setting [OUTPUT SETTING]”.

If <PRINT ID> is set to <SELECT>, the screen switches to the <PRINT ID SELECT> screen each time when data is transmitted. Please select the PRINT ID set for the printer you want to send.

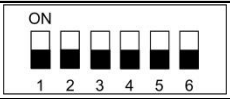
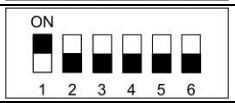
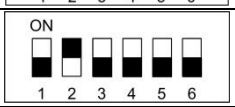
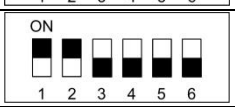


Bottom of the printer



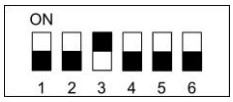
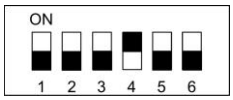
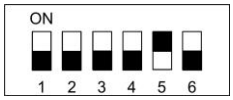
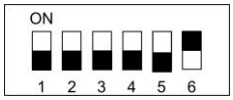
PRINT ID select screen

To change the identification number of the printer, operate the DIP switch according to the table below.

ID number	DIP switch of the printer setting	Operation method on the PRINT ID selection screen when the <PRINT ID> setting is “SELECT”
1		Press R button
2		Press AUTO button
3		Press L button
4		Press CHILD QUICK button

4-5-5 **Change Setting by DIP Switch**

The following settings are possible by operating the DIP switch.

<table>
<tr><th>DIP switch
of the printer setting</th><th colspan="2">Setting</th></tr>
<tr><td> 
</td><td colspan="2">Printer information is printed at power on.
Measurement data will not be received, so return it for normal use before using it.</td></tr>
<tr><td> 
</td><td colspan="2">Turn auto cut function off.</td></tr>
<tr><td> 
</td><td colspan="2">Disables errors when printing paper runs out.
Even if print paper runs out during printing, the indicator light not blinks in pink.</td></tr>
<tr><td rowspan="2"> 
</td><td colspan="2">Change the printing format.
Print REF value, KERATO value, PERI measurement value in the following order.</td></tr>
<tr><td><DIP switch off>
Right eye REF
Left eye REF
Right eye KERATO
Left eye KERATO
Right eye PERI
Left eye PERI</td><td><DIP switch on>
Right eye REF
Right eye KERATO
Left eye REF
Left eye KERATO
Right eye PERI
Left eye PERI</td></tr>
</table>

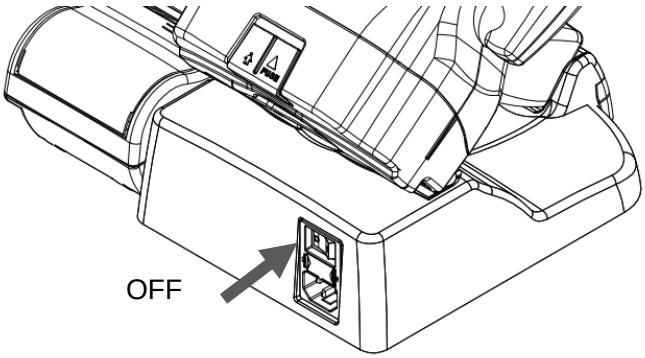
4-6 **Power Off**

After measurement, the main unit power off under the conditions following

- Press ⏻ during measurement or measurement standby
- Press ⏻ in [SETUP]
- Hold down ⏻ for 2 seconds with sub-menu in [SETUP]
- Hold down ⏻ for 2 seconds and release in standby mode
- Power off with the setting of Auto Power Off.
- Place the main unit to the station with power on.
- When the battery is low.

After use, turn off the power switch of the station and put the dustcover (accessory). Also, be sure to turn off the station at the end of the day's work.

After turning off the power of the main unit, please cover the main unit with a dust cover. When covering the dustcover, please restore forehead rest and LCD screen. It may get caught when dropping the dust cover and cause it to fall.
If not use for long time, remove power cable and also remove the battery pack from the main unit and the printer. If leave the power cable connected, the battery pack may deteriorated or cause of fire.

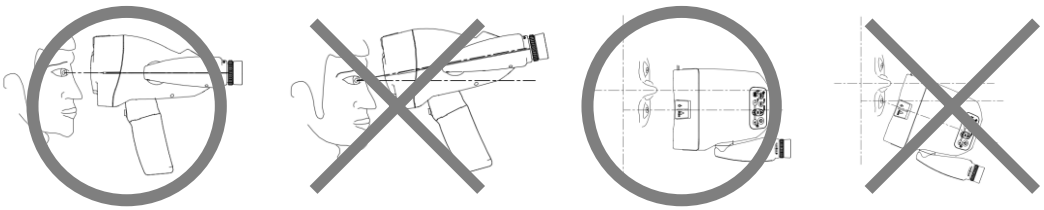


4-7 **The other**

4-7-1 **For Proper Measurement**

▼ If the right/left eyes are not properly discriminated

- To ensure proper operation of the automatic right/left eye discrimination, note the following:
  - When extending your hands between the patient's face and the main unit to stabilize the main unit, do not touch the right/left eye sensors.
    (See “2-1 Main unit”)
  - ake measurement squarely in front of the patient's face as shown below. The discrimination may fail if measurement is taken at an angle upward or sideways



- If you follow the above main unit but the right/left eye discrimination still does not work properly (for example, the measuring window is brought near the left eye, but the right/left eye indicator remains “R”), switch to the manual right/left eye discrimination.

The right/left eye discrimination can fail if:

- The patient is wearing a mask.
- The patient has a great deal of hair on either cheek.
- The face is small, in the case of a child or baby.

・Switching to manual eye discrimination is also required when taking measurement from above the head or at an angle sideways or upward.

● Switching from automatic right/left eye discrimination mode to manual mode.

・Pressing ◄R or L► AUTO to switch to manual mode (AUTO lights off).

・When you wanted to measure right eye, press ◄R and indicated right eye and ◄R symbol turns on.

・When you wanted to measure left eye, press L► and indicates left eye and L► symbol turns on.

If you want to restore the automatic right/left eye discrimination, press AUTO to return automatic discrimination and the symbol turns on.

4-7-2 **Auto fogging**

The auto fogging function minimizes the patient's eye accommodation. The instrument automatically enters the fogging state when measurement starts. Be sure to tell the patient to look at the fixation target. Auto fogging method is different in A mode, A2 mode, A3 mode and QUICK mode.

<A mode>

(1) Press the measurement switch and perform preliminary measurement 3 times. When data is obtained, a “beep” sound is made.

↓

(2) Fixation chart moves to the position where it is in focus.

↓

(3) Fixation chart moves far (Fogging). Fixation target appears blurred to the patient.

↓

(4) Obtain data for the set of REF measurement counts. When data is obtained, a “beep” sound is made. Fixation chart remains in fogging state, and the appears blurred to the patient.

↓

(5) If stable data is obtained, measurement is finished.

↓

(6) If the measured values are fluctuating, go back to (2), fixation chart moves to the position where it is in focus and moves again to the far side.

↓

(7) Obtain new data for 1 time.

↓

(8) Repeat movement of fixation chart and data obtainment for 1 time until the measured value is stabilized.

The main unit prints and output up to 5 times of data. If more than 5 data are obtained, the oldest data will be erased in order.

<A2 mode>

(1) Press the measurement switch and perform preliminary measurement 3 times. When data is obtained, a “beep” sound is made..

↓

(2) Fixation chart moves to the position where it is in focus.

↓

(3) Fixation chart moves far (Fogging). Fixation target appears blurred to the patient.

↓

(4) Obtain data for 1 time. When data is obtained, a “beep” sound is made. Fixation chart remains in fogging state, and the appears blurred to the patient.

↓

(5) After a data is obtained, fixation chart moves to the position where it is in focus again and moves again to the far side to obtain data for 1 time.

↓

(6) Move the fixation target and data for the set of REF measurement counts. Repeat movement of fixation chart and data obtainment finished if stable data is obtained.

↓

(7) If the measurement values are fluctuating, repeat movement of fixation chart and 1 data obtainment for 1 time until the measured value is stabilized.
The main unit prints and output up to 5 times of data. If more than 5 data are obtained, the oldest data will be erased in order.

<A3 mode, A mode QUICK>

A3 mode and QUICK mode in A mode, the measurement time is shortened by using different fogging method from ordinary A mode and A2 mode.

(1) Press the measurement switch and perform preliminary measurement 3 times. When data is obtained, a “beep” sound is made.

↓

(2) Fixation chart moves far (Fogging). Fixation target appears blurred to the patient.

↓

(3) Obtain data for the set of REF measurement counts. When data is obtained, a “beep” sound is made.

↓

(4) If stable data is obtained, measurement is finished.

↓

(3) Repeat data obtainment until the measurement value is stabilized.

The main unit prints and output up to 5 times of data up to 5 times of data. If more than 5 data are obtained, the oldest data will be erased in order.

In A2 mode, measurements are performed in the same way as in normal A2 mode even in QUICK mode.

4-7-3 **Representative value**

Representative values are median values of the measurement. The value indicated as <REP> in the printed data is the representative value. For example of printing, refer to “4-5-2 Print example.”

Confidence value (CV) is printed as the representative value. The smaller the variation, the closer confidence value is to 10.

4-7-4 **REF Confidence Value**

Confidence Value indicates the variation between measurement results. Only when the measurement is performed more than 3 times, “CV: ○○” will be indicated on the measurement completion screen and printed on the data result. For example of printing, refer to “4-5-2 Print example.” If measurement is performed less than 3 times, “－” is indicated.

Please use the following as a guide for confidence value.

- 10~8 :Low variation.
- 7~1,E :High variation. Care is needed in interpreting the measurement results. Please measure again with focus assist function or confirm the variation of measurement value with CONT mode.

If measured values vary widely, such as in refractive measurement, and you want to select one from among them, note the following tips:

- The patient may not staring central of the target.
- Eyelashes are hanging over the pupil.
- The patient’s pupil size is small.
- Eye disease such as turbidity of the optical media.
- If only SPH value vary widely, the patient's eye may be accommodating. Measure the same eye once again.
- When CYL indicates weak astigmatism (below 0.5D), AX tends to be somewhat unstable.

In the above cases, the confidence level is typically low.

If eyelashes or pupil size are the cause, correct the problem and retry the measurement.

4-7-5 **Standby mode and Auto power off**

If measurement is not performed, if the switch operation is not performed for a certain time, it will automatically shift to the standby mode. Furthermore, the power turns off automatically when a certain time passes in standby mode.

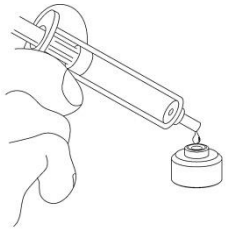
To return from the standby mode, press the measurement switch or .

It is possible to edit time to shift to standby mode and to turn off the power with [POWER OPTION] in [SETUP]. (See ”5-7 POWER Screen [POWER OPTION]”)
It never switch to standby mode during measurement.

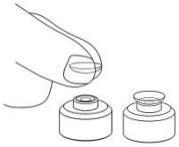
4-7-6 **Measurement of Contact Lens**

This instrument enables you to measure hard contact lens base curvature. Soft contact lens can’t be measured.

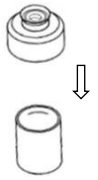
1. Drip water onto the hard contact lens holder shipped with the instrument.



2. Set the lens on the hard contact lens holder. (Direct the front or rear side of the lens—whichever to be measured—toward the measuring window of the main unit.)



3. Insert the contact lens holder to the edge of the model eye with the lens shipped with the instrument.



Perform the measurement using the usual keratometric measurement method.
See “4-3-1 Automatic measurement mode (AUTO, AUTO2, AUTO3)”

4-7-7 **Failure of KERATO measurement**

If KERATO measurement cannot performed, check for obstructions of the measuring beam by eyelashes or the upper eyelid.

Lift the upper eyelid, or otherwise correct the cause so that the measuring beam is not obstructed.

During REF KERATO or KERATO measurement, bright spots for KERATO measurement are reflected on the patient's cornea and can be seen on the screen through LCD screen. If any of these spots cannot be seen, or looks chipped or blurred, the measuring beam is blocked. Causes include interference by eyelashes or the upper eyelid, blinking, and corneal lesion.

If KERATO peripheral (PERI) measurement fails on the nose side (N), it is possible that the patient's face is not directed squarely to the front and the nose is obstructing the measuring beam. Check for this.

4-7-8 **Measurement of IOL eyes**

This instrument can measure an IOL (intraocular lens) implanted eye in the same process as the normal eye without any special switch setting. Depending the type of IOL or the condition of the IOL eye, the reflecting light from the IOL may disable the measurement, lead to a degradation of the confidence value of measured values, or result in larger measurement errors.

- If it is difficult to obtain measurements, using the Quick Mode may make the measurement easier.
- If the auto quick function is set beforehand, it automatically changes to “Quick Mode” (See “4-4-5 AUTO QUICK Mode”) only when the measurement is difficult to perform, thus allowing you to perform measurement.

4-7-9 **If measured values are not obtained**

Normally, measured values should be displayed when they are obtained. If they are not obtained even when the instrument is aligned, there may be an unusual condition. Here are some workarounds.

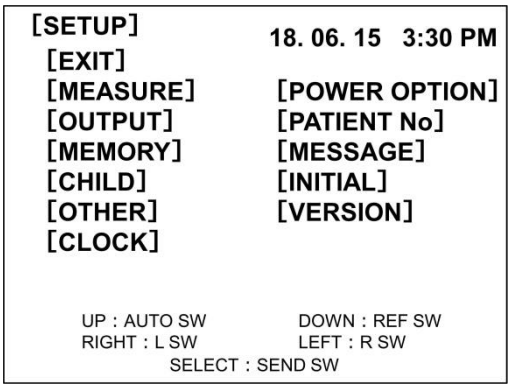
- For a patient with drooping eyelashes, the eyelashes must not be within the outer contours of the alignment mark on the screen in the viewfinder. Ask the patient to open the eye wider, and if eyelashes are still drooping, you may have an assistant or the patient lift the upper eyelid lightly with a fingertip.
- Measurement may be impossible if the patient has an eye disease such as cataract; opacity in the cornea, crystal lens, or vitreous body; or retinal detachment.

- Measurement cannot be made if <SPH+CYL> is out of the measurement range of -20D to +23D, or if <CYL> is out of the measurement range of 0D to ±12D.
- Measuring an eye with a contact lens

  Measurements can usually be obtained. However, if the contact lens is not properly fitted, correct values may not be obtained. Dirt or scratch on the contact lens may hinder measurement.

5. Setting Up the Instrument

At measurement screen,pressing both of AUTO SET REF and, moves onto SETUP screen andpossible to edit each of setting.



EXIT	Moves to the measurement screen.
MENU-MEASURE	To 5-1 Measurement setup [MEASURE]
MENU-OUTPUT	To 5-2 OUTPUT Screen [OUTPUT]
MENU-MEMORY	To 5-3 Memory screen [MEMORY]
MENU-CHILD	To 5-4 CHILD mode screen [CHILD]
MENU-OTHER	To 5-5 OTHER Setting [OTHER]
MENU-CLOCK	To 5-6 CLOCK Screen [CLOCK]
POWER OPTION	To 5-7 POWER Screen [POWER OPTION]
PATIENT No	To 5-8 Patient Number Setup [PATIENT No]
MESSAGE	To 5-9 MESSAGE Screen [MESSAGE]
INITIAL	To 5-10 INITIALIZING Screen [INITIAL]
VERSION	To 5-11 VERSION confirmation [VERSION]

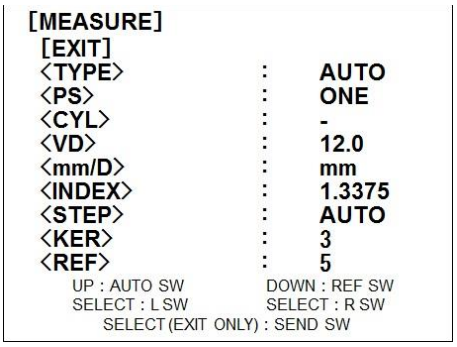
■Select items: during focusing on the items, the characters switch to yellow color.

With AUTO, REF, ◄R, L►, select items on the screen.

Press SEND to enter into sub menu and select setting items. In sub-menu, select setting items with AUTO, REF and change setting with ◄R, L►. Select “EXIT” and press SEND in sub-menu, the content stored and goes back to previous screen. Select “EXIT” and press SEND in [SETUP] to retrun to measurement standby screen.

5-1 **Measurement setup [MEASURE]**

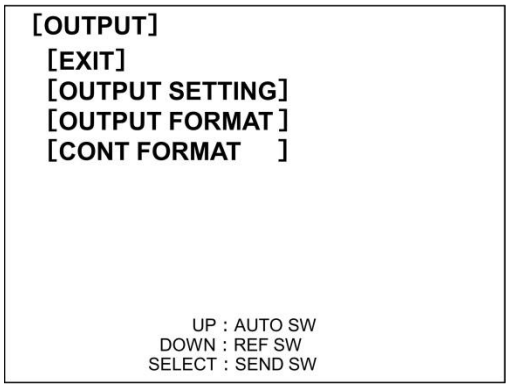
Use this screen to configure setting that work during measurement.



Item	Selection	Setting
EXIT	-	Back to the [SETUP] screen.
TYPE	AUTO	Switches to Auto mode.
	AUTO2	Switches to Auto2 mode.
	AUTO3	Switches to Auto3 mode.
	CONT	Switches to continuous measurement mode.
PS	ONE	Measuring the pupil diameter once with REF measurement.
	ALL	Measurement the pupil diameter each time with REF measurement.
	OFF	Not measuring the pupil diameter.
CYL	MIX	Without CYL measurement value conversion.
	-	Converts CYL value to minus.
	+	Converts CYL to plus.
VD	12.0	Sets corneal vertex distance (VD) in mm.
	13.5	
	13.75	
	15.0	
	16.0	
mm/D	mm	Indicates radius of cornea in mm.
	D	Indicates radius of cornea in Diopter.
INDEX	1.3375	Corneal refractive index value to be used when converting cornea curvature to Diopter.
	1.332	
	1.336	
STEP	AUTO	Display the measurement value in 0.12D steps if measurement value within ±3D. The other displays in 0.25 steps.
	0.12	Display the measurement value in 0.12D steps
	0.25	Display the measurement value in 0.25D steps
KER	3	Measure KER 3 times.
	5	Measure KER 5 times.
REF	3	Measure REF 3 times.
	5	Measure REF 5 times.

5-2 **OUTPUT Screen [OUTPUT]**

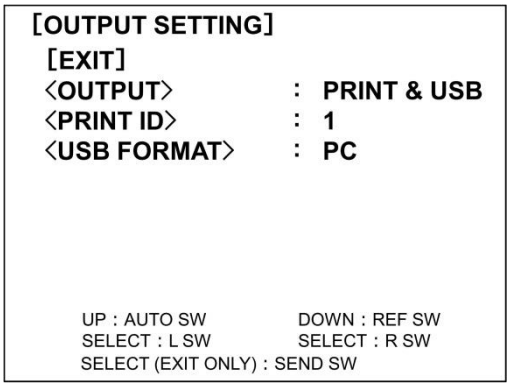
Use this screen to configure external output setting.



EXIT	Back to [SETUP] screen.
OUTPUT SETTING	To ”5-2-1 Output setting [OUTPUT SETTING]”
OUTPUT FORMAT	To ”5-2-2 Output format [OUTPUT FORMAT]”
CONT FORMAT	To ”5-2-3 Output format of CONT measurement [CONT FORMAT]”

5-2-1 **Output setting [OUTPUT SETTING]**

Make settings related to data output from the printer when sending data from the main unit to the printer. Also, set the printer's PRINT ID.



Item	Selection	Setting
EXIT	-	Back to the [OUTPUT] screen.
OUTPUT	PRINT ONLY	Implement print only.
	PRINT & USB	Implement printing and transferring data to PC via USB.
	USB ONLY	Implement only transferring the data to PC via USB.
PRINT ID	1	Set the printer ID No.
	2	
	3	
	4	
	SELECT	Select PRINT ID No. before transferring the data.
USB FORMAT	PC	Output the ASCII format data to PC.
	CSV	Output the CSV format data to PC.
	RK STD	Output the RK STD format data to PC. Output regardless of “OUTPUT FORMAT (refer to 5-2-2)” setting. REF: Measurement data (maximum is 8) and representative value. Output the confidence value KER: Measurement data (maximum is 8) and representative value. PS: Measurement data (maximum is 8) and representative value. PERI: Output the representative value R cyl: Output the representative value MESSAGE cannot be output.
	Retinomax3	Output the Retinomax3 format data to PC according to “OUTPUT FORMAT(refer to 5-2-2)”

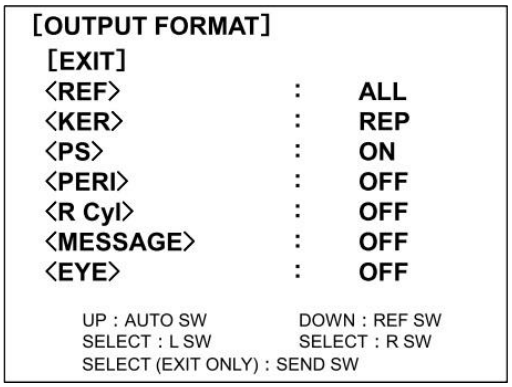
- “R cyl”, “MESSAGE”, “confidence value” cannot be output in Retinomax3 format.
  If want to output, changing the “PC” or “CSV”.
  However, it is not Retinomax3 format. For more details, contact to your dealer.
- Communication settings are different by “USB FORMAT” setting.

Selection	USB FORMAT	
	PC, CSV, RK STD	Retinomax3
Baud rate	115,200bps	9,600bps
Data	8bit	8bit
Parity	none	none
STOP	1bit	2bit
flow control	none	hardware(CTS/RTS)

- For more details, contact to your dealer.

5-2-2 **Output format [OUTPUT FORMAT]**

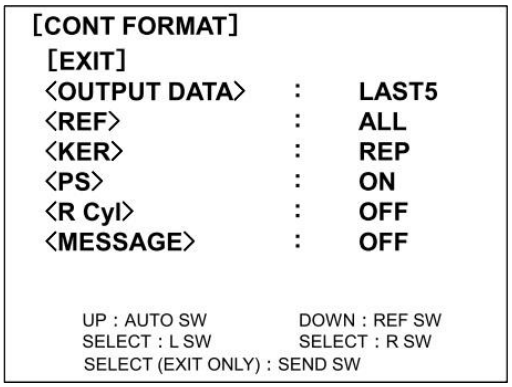
Set the format of the data output from the printer.



Item	Selection	Setting
EXIT	-	Back to [OUTPUT]
REF	ALL	Output all of measurement data(maximum is 8) and representative value
	REP	Output only representative value
	OFF	Not output REF value
KER	ALL	Output all measurement data(maximum is 8) and representative value
	REP	Output only representative value
	OFF	Not output KER value
PS	ON	Output pupil diameter
	OFF	Not output pupil diameter
PERI	ON	Output PERI value
	OFF	Not output PERI value
R cyl	ON	Output residual astigmatism (lens astigmatism)
	OFF	Not output residual astigmatism (lens astigmatism)
MESSAGE	ON	Output message
	OFF	Not output message
EYE	ON	Output eye print (Not output to the PC.)
	OFF	Not output eye print

5-2-3 **Output format of CONT measurement [CONT FORMAT]**

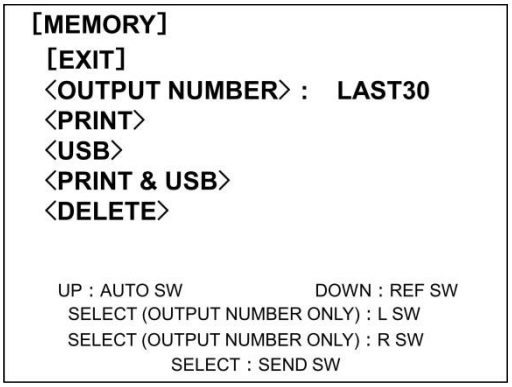
This enables you to output in different contents from the normal CONT measurement.



Item	Selection	Setting
EXIT	-	Back to the [OUTPUT]
OUTPUT DATA	LAST5	The last 5 data of REF measurement values are output.
	ALL	Output all REF measurement values. Up to 100 data can be output.
REF	ALL	Output REF measurement value and representative value set with [OUTPUT DATA] are output.
	REP	Output only representative value
	OFF	Not output REF value
KER	ALL	Output all measurement data(maximum is 8) and epresentative value
	REP	Output only representative value
	OFF	Not output KER value
PS	ON	Output pupil diameter
	OFF	Not output pupil diameter
R cyl	ON	Output residual astigmatism (lens astigmatism)
	OFF	Not output residual astigmatism (lens astigmatism)
MESSAGE	ON	Output message
	OFF	Not output message

5-3 **Memory screen [MEMORY]**

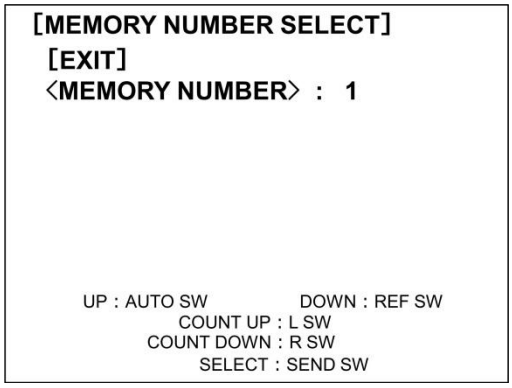
It sends data stored in the main unit to the printer and prints out / outputs to the PC. Also enable to erase stored data.



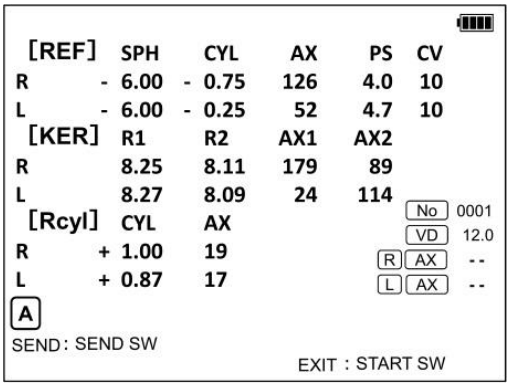
Item	Selection	Setting
EXIT	-	Back to [SETUP] screen.
OUTPUT NUMBER	ALL	Transfer all stored data.
	LAST 10	Transfer 10 latest person's data at maximum.
	LAST 30	Transfer 30 latest person's data at maximum.
	SELECT ∗1	Transfer data which selected.
PRINT	—	Printout the data stored. The number of transfer depends on which you set at <OUTPUT NUMBER>.
USB	—	Output data stored by USB. The number of transfer depends on which you set at <OUTPUT NUMBER>.
PRINT & USB	—	Output data by printing and USB. The number of transfer depends on which you set at <OUTPUT NUMBER>.
DELETE ∗2	—	Delete the data.

∗1 Stored data can be selected before transferring by setting at SELECT, <PRINT>, <USB>, <PRINT & USB>.

1) Stored data can be selected when the screen indicated [MEMORY NUMBER SELECT].



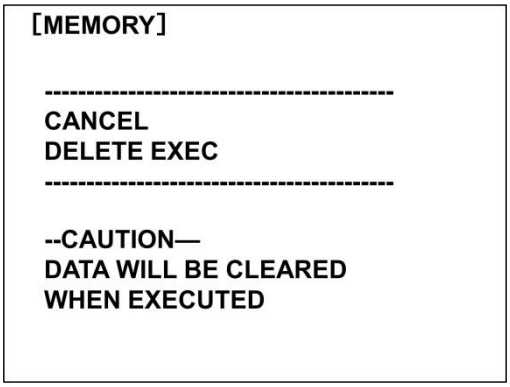
2) After select the data, screen indicates measurement completed when you press SEND.



3) The data transferred when you press SEND again.

4) When you press the masurement switch, it goes back to [MEMORY NUMBER SELECT].

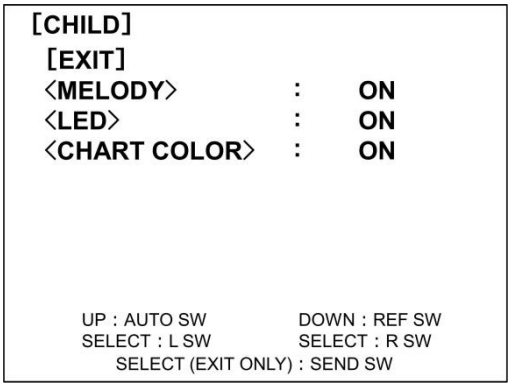
∗2 After selected <DELETE>, screen indicates confirmation.



If selected "DELETE EXEC" and press SEND, only the measurement data will be deleted.

5-4 **CHILD mode screen [CHILD]**

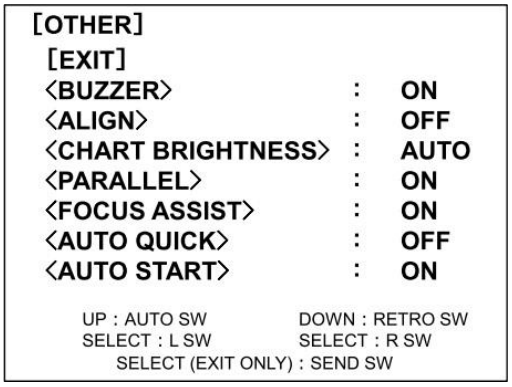
Implement setting of CHILD mode.



Item	Selection	Setting
EXIT	-	Back to [SETUP] screen
MELODY	ON	Melody is made at CHILD mode
	OFF	Melody isn't made at CHILD mode
LED	ON	LED at peripheral measurement window light at CHILD mode
	OFF	LED at peripheral measurement window doesn't lights
CHART COLOR	ON	Varies color of fixation target background at CHILD mode
	OFF	The color of fixation target background never changes at CHILD mode

5-5 **OTHER Setting [OTHER]**

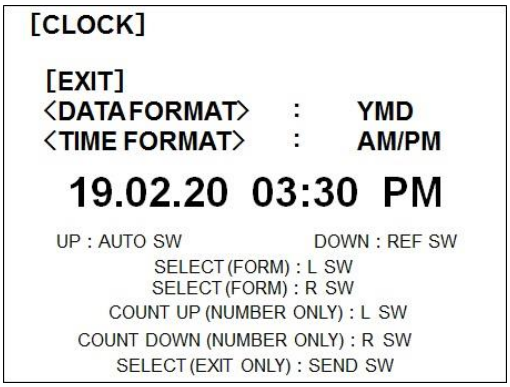
This setting effects while you measuring.



Item	Selection	Setting
EXIT	-	Back to [SETUP] screen
BUZZER	ON	Enable buzzer beeps in operating and measuring
	OFF	Disable buzzer beeps
ALIGN	ON	Displays the alignment direction marks
	OFF	Disappears the alignment direction marks
CHART BRIGHTNESS	HIGH	Brighton the fixation target
	LOW	Darken the fixation target
	AUTO	Brightness of target automatically changes If pupil diameter is over Φ3mm→HIGH Within Φ3mm→LOW
LCD	5～100%	Adjust intensity of the LCD
PARALLEL	ON	Display the horizontal indicator
	OFF	Not display the horizontal indicator
FOCUS ASSIST	ON	Display focus assist icon Measurement is performed only when the focus is correct
	DISPLAY	Only display focus assist icon
	OFF	Disable focus assist function
AUTO QUICK	ON	Enable AUTO QUICK mode
	OFF	Disable AUTO QUICK mode
AUTO START	ON	Enable AUTO START mode
	OFF	Disable AUTO START mode

5-6 **CLOCK Screen [CLOCK]**

Set time of the internal clock.

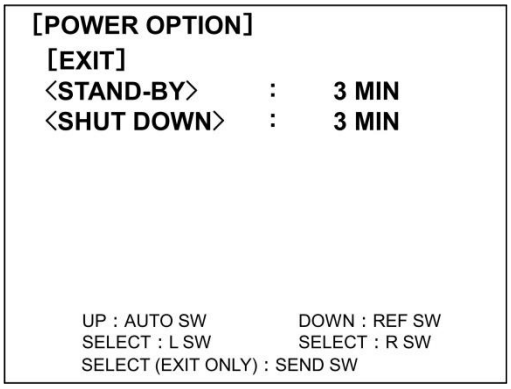


Item	Selection	Setting
EXIT	-	Back to [SETUP] screen
DATE-FORM	YMD(year/month/day)	Changes the date print format.
	MDY(month/day/year))(D)	
	DMY(day/month/year)	
TIME-FORM	AM/PM(12-hour system)(D)	Changes the time print format.
	24-hour system	

Select the year, month, day, hour, minute with the AUTO and REF, and make the respective settings with the ◄R and L►.

5-7 **POWER Screen [POWER OPTION]**

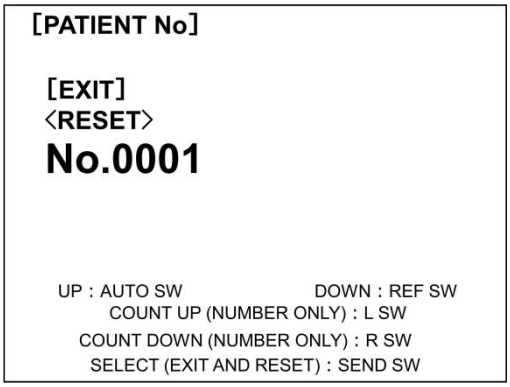
Set the time to enter standby mode and the time to turn off automatically.



Item	Selection	Setting
EXIT	-	Back to [SETUP] screen
STAND-BY	1～9、NEVER	Set time to switch into standby mode Press L button to add 1minute Press R button to minus 1 minute
SHUT DOWN	1～9、NEVER	Set time to shut down from standby mode Press L button to add 1 minute Press R button to minus 1 minute

5-8 **Patient Number Setup [PATIENT No]**

Use this screen to set the patient number. The valid range is from 0001 to 9999.

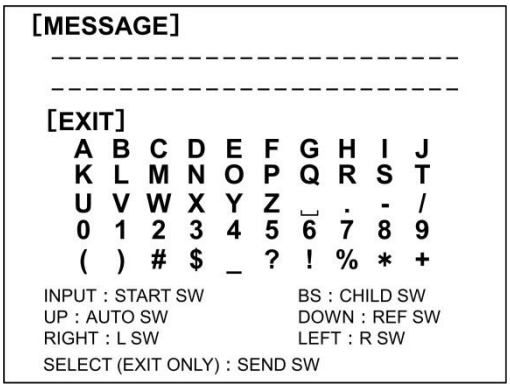


Item	Selection	Setting
EXIT	-	Back to the [SETUP] screen
0001	1～9	Sets the 1st digit L key adds one R key subtracts one
0010	1～9	Set the 10th digit. L key adds one R key subtracts one
0100	1～9	Sets 100th digit. L key adds one R key subtracts one
1000	1～9	Sets 1000th digit. L key adds one R key subtracts one
RESET	-	SEND key resets the number to 0001

The factory default is 0001. When outputting data after measuring, the patient No. automatically increments by "1".

5-9 **MESSAGE Screen [MESSAGE]**

This screen adds a message to the end of the printout. Move to the message input screen. The message can be as long as 24 characters by 2 lines, or 48 characters in total.



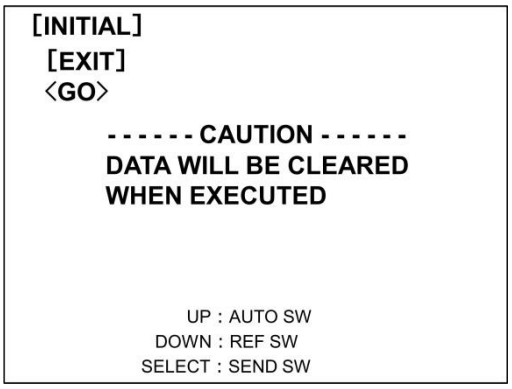
How to enter and set a message

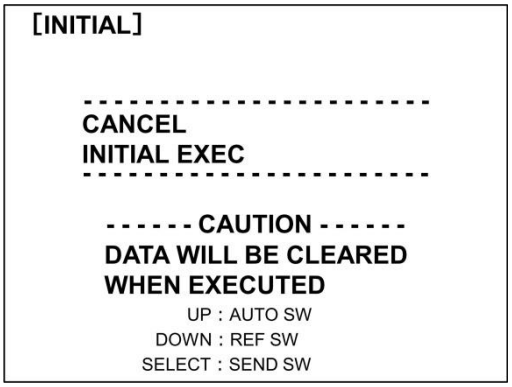
Button	Operation
◄R, AUTO, REF, L►	Move the cursor relative position
Measurement switch	Enter the character at the cursor
CHILD QUICK	Delete the previously entered character
SEND	Press it after selected [EXIT], the entered message memorized and back to [SETUP] menu

5-10 **INITIALIZING Screen [INITIAL]**

If you select [INITIAL] at [SETUP] screen, message appears on the screen. When you selected “GO,” confirmation message on the screen. Press “INITIAL EXEC,” initialize all data in the [SETUP] and clears memory. After completed, “FINISHING INITIALIZATION” on the screen in 3 sec, and goes back to [SETUP] screen.

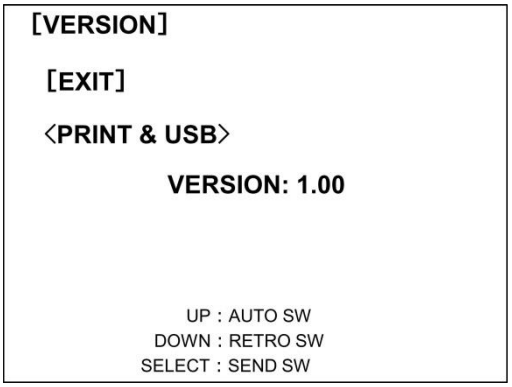
If you do not implement it, press “CANCEL” and goes back to [SETUP] screen.





5-11 **VERSION confirmation [VERSION]**

[VERSION] can check the software version. Select <PRINT & USB>, the main unit toward to the printer and press SEND to print the software version of the main unit and the software version of the printer. Select [EXIT] to return to [SETUP].



6. Connecting to external instruments

The main unit and the printer have USB connectors for linking to external equipment. Measurement results can be sent via these connectors to external equipment such as a commercially available PC.

6-1 Wireless transmission to the Remote Vision RV-II

When Remote Vision RV-II is used, it can receive data wirelessly using the infrared communication feature of the instrument. Press SEND by confront with receiving window and transmission window.

During the communication, make sure that there is nothing to disturb.

If there were something disturbs the communication, adjust the range and angle between Retinomax K-plus5 and Remote Vision RV-II, the case of environment they positioned.

In order to wirelessly transmit to RV-II, it is necessary to upgrade RV-II. When upgrading RV-II, please contact your dealer

6-2 Connecting to Computer via USB

Connect to computer with USB cable (A – micro B connector).

Utilize the micro B connector on the instrument's side.

When you output data to computer, see "5-2-1 Output setting [OUTPUT SETTING]," set [OUT PUT] to "PRINT & USB" or "USB ONLY."

And, communication settings are different by [USB FORMAT] of "5-2-1 Output setting [OUTPUT SETTING]". Setup the list that necessary to external communication following.

Selection	USB FORMAT	
	PC, CSV, RK STD	Retinomax3
Baud rate	115,200bps	9,600bps
Data	8bit	8bit
Parity	none	none
STOP	1bit	2bit
flow control	none	hardware(CTS/RTS)

*Connecting cable sales at market. Utilize the size within 3 meter.

For more details on this interface, contact to your dealer.

CAUTION

- If a failure occurs in the USB port on the PC side, data may not be received. Please reconnect on the PC.

7. Maintenance

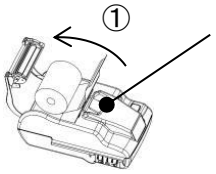
7-1 Checking the Measurement Accuracy

Check the measurement accuracy every time before using the equipment using the model eye provided. For the measurement method using model eye and the accuracy check method, see “4-1-4 Measuring the Model Eye.”

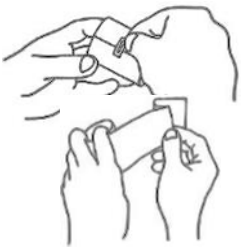
7-2 Replacing the Print Roll

When the print paper nears the end of the roll, red lines appear on both edge of the paper. This indicated that it is time to replace the paper roll. The print paper should be one designated by the manufacturer.

1. Push the release lever on the printer and open the paper cover (①)

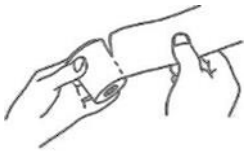


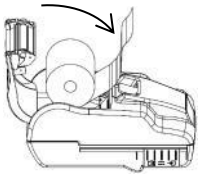
2. Remove the remaining print roll.
3. Remove the shipping tape from the new print roll.
4. Put a crease slightly past the peel mark.
5. Gently cut the paper along the crease.

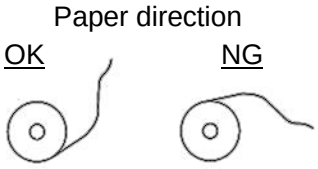


Cutting out the paper as shown on the right prevents accidental printing on the peel mark. Also the paper is easier to install.

6. Set the roll along the guide, as shown below, and press down the print roll as you close the paper holder cover.







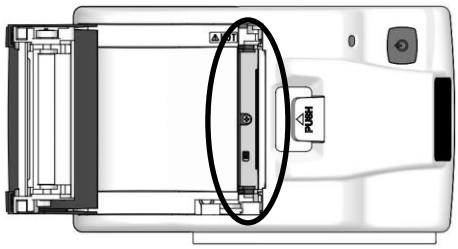
7. If you set the roll with power on, extra paper automatically cut. When the power off, the extra paper will not cut. If you press and hold the power switch for 3 seconds to turn on, the extra paper automatically cut.
8. Verify that the printer paper comes straight out.
   If it comes out askew, remove the paper holder cover and set the roll again.

CAUTION

- Do not set the print roll upside down, as this makes printing impossible.
- Once the roll is set in place, do not force the paper out. Damage to the printer may occur.

CAUTION

- Printer cutter is located in the place person never be touched, it is equipped with metal, careful not to be injured when replacing print paper.
- Do not touch the printer head when replacing the print paper. The printer head may be hot surface.



7-3 Replacing the Fuses

CAUTION

- Before checking or replacing the fuses, be sure to turn off the power switch and remove the power cord from the receptacle outlet.
- Only use fuses as specified below. Other fuses must NOT be used.
- For spare fuses, contact your local dealer.

  Littelfuse's time-lag fuse, ϕ5 x 20 mm

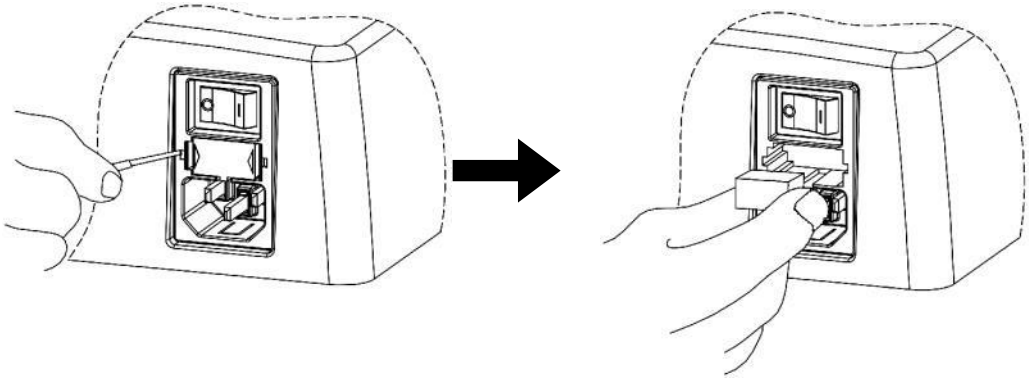
  250V/T1.6AH (021501.6XP)

If the power lamp does not light up when the power switch of the station is set to ON (“I” position), the fuses may have blown.

Remove the fuse holder by applying a small flat-blade screwdriver or other tool to the tabs on both sides of the fuse holder.

Remove the two fuses from the fuse holder and check if they have blown. Replace the fuses if blown.

Spare fuses are in the accessory case. See “2-3 Station”.



7-4 Cleaning the Forehead Rest

Cleaning should be done before the measurement. Clean the forehead rest with soft cloth, etc. soaked with rubbing alcohol.

7-5 Cleaning the Measurement Window

The measuring window has dust-proof glass. If any dust on the glass is visible from the patient side, blow off the dust three to four times using the blower provided. If the dust cannot be removed, wipe off using a lens cleaning solution or absolute alcohol (commercial product).

CAUTION

- Do not put heavy pressure on the dust-proof glass during wiping since the glass is thin and easily broken.

7-6 Cleaning Model Eye

When correct measured values cannot be obtained with the model eye, its lens surface may have been contaminated by dust or fingerprints. In this case, gently wipe the lens surface using a soft, clean cotton cloth (such as gauze) moistened slightly with lens cleaning solution or ethyl alcohol for disinfections, being careful not to scratch the surface.
(Do not use a handkerchief or absorbent cotton.)

CAUTION

- Even a microscopic scratch on the lens surface of the model eye can reduce the accuracy of its measurement. Do not bump or throw any harm objects against the model eye as this may cause damage.

7-7 Cleaning appearance

If the appearance stained, wipe off with soft cloth, or the case that stubborn stains on the appearance, wipe off lightly with gauze moistened slightly with diluted neutral detergent.
As protection, utilizing dustcover on the instrument after measurement is recommended.

CAUTION

- Do not use organic solvent (alcohol, ether, paint thinner, etc.) on painted surfaces, plastic components, and printed surfaces. It may cause discoloration, or peeling of printed characters.

7-8 **List of Consumable and Maintenance Parts.**

Part name	Part number	Remarks
Print paper rolls(5)	DXA30109	Width 58mm Diameter 48mm
＜Fuses＞ Littlefuse's time-lug fuses	021501.6XP	Rating 250V 1.6A Size φ5×20mm
Battery pack	RT-01XR	Lithium ion battery

7-9 **Lifetime of the instrument**

Lifetime of this instrument is 8 years except consumable parts and the parts has expiration date. It varies depends on their environment, and using condition. Please contact to dealer or our company about maintenance.

8. Troubleshooting

Check with following table before calling for repair.

8-1 Main unit

Phenomenon	Check point	Cause and action
The power lamp does not light when Retinomax is turned on. The monitor screen does not turn on.	Is Retinomax immediately afterwards purchase? Or iIs Retinomax used for a long period of time?	The battery pack is not charged when purchased. It may be fully discharged if Retinomax is not used for a long time. Charge the battery pack.
	Is the main unit set on the station?Is the main unit charging?	When put on the station and start charging, the power turns off.
The screen switches off automatically.	Does the power symbol lighting?	The instrument is possibly in the Standby mode. See “4-7-5 Standby mode and Auto power off”..
	Is the grip cover equipped properly?	This screen switches off automatically when the grip cover came out. Equip the grip cover properly.
The power switches off automatically.	Has the main unit been left inoperative for a long time?	The Auto power off is possibly working. See “4-7-5 Standby Mode and Auto Power off”..
	Does the power symbol has been blinking with the colour orange?	The case that battery being low, instrument automatically switches off. Charge the battery.
	Are the batteryAre the batteries charging contacts (4 places) dirty? (See “2-1 Main Unit”)	Turn the power off, and clean the pins both on the main unit and the station sides.
	Is the main unit set on the station?Is the main unit charging?	When put on the station, the power turns off.When put on the station and start charging, the power turns off.
Charging is not started even if the main unit is set on the station.	Is the main unit set firmly in the station?	Set main unit firmly in the station.
	Is the contact (4 places) dirty?	If touching the contacts (4 places) or getting dirty, wipe it off with a dry cloth.
The battery pack cannot be installed.	Is the battery pack in the correct orientation?	Check to make sure the battery pack is correctly installed. (See 3-2 Installing and Removing the Battery Pack)
Refractive measurement cannot be made. Refractive measurements vary widely.	Is the measurement out of range?	If S and C are out of measurement range, measurement can not be performed.
	Is there foreign matter in the pupil that obstructs light?	Check in the retroillumination mode. (See “4-4-6 Retroillumination Mode”)
	Does the patient staring at central of the target?	Give them an explanation to stare at central.
	Is the VD value suitable?	Set the VD value.
	Does not the patient small pupil?	Make sure by measuring small pupil test. When the pupil diameter is less than φ2.3 mm, the measurement result is not displayed.
KERATO measurement cannot be made. KERATO measurements vary widely.	Is there interference from external light?	Darken the room. Do not face the window during measurements.
	Is the eyelid interfering with measurements?	Raise the eyelid.

Phenomenon	Check point	Cause and action
Nothing prints.	Is the printer switched on?	If the printer switched off, nothing prints. Power on.
	Are you using the designated print roll?	Use the designated print roll.
	Is the paper holder cover open?	Close the paper holder cover.
	Is the paper roll inserted upside down?	Set the print roll correctly. (See “7-2 Replacing the Print Roll”)
	Is the printer set to output?	The printer is possibly not set to printout. Make sure the setting. See ”5-2 OUTPUT Screen .”

●Error message

If the following message is displayed and repeated again even after the equipment is turned off and on again, shut off the equipment and contact the dealer where you purchased the equipment.

Message	Cause
FOG ERROR	Initialization time of the fogging doesn’t finish in time. Malfunction of the fog motor and breaking of wire.
MEMORY ERROR	Error in the backup memory.
LOW BATTERY	The error of clock function (RTC). The built-in battery (Lithium primary battery) is exhausted.

8-2 **Station**

Phenomenon	Check point	Cause and action
The charge lamp flashes during charging.	Long (Flashes lights 3 sec, off 0.5 sec)	Preservation function works when the battery thermal has increased or decreased. Check the temperature in the room (10°C to 35 °C). When the temperature decreased (10°C to 35 °C), restarts charging.
	Short (Flashes each of 0.5 sec)	Re-connect the main unit or the printer regarding flow following. If you considered it were defect, contact to the dealer.

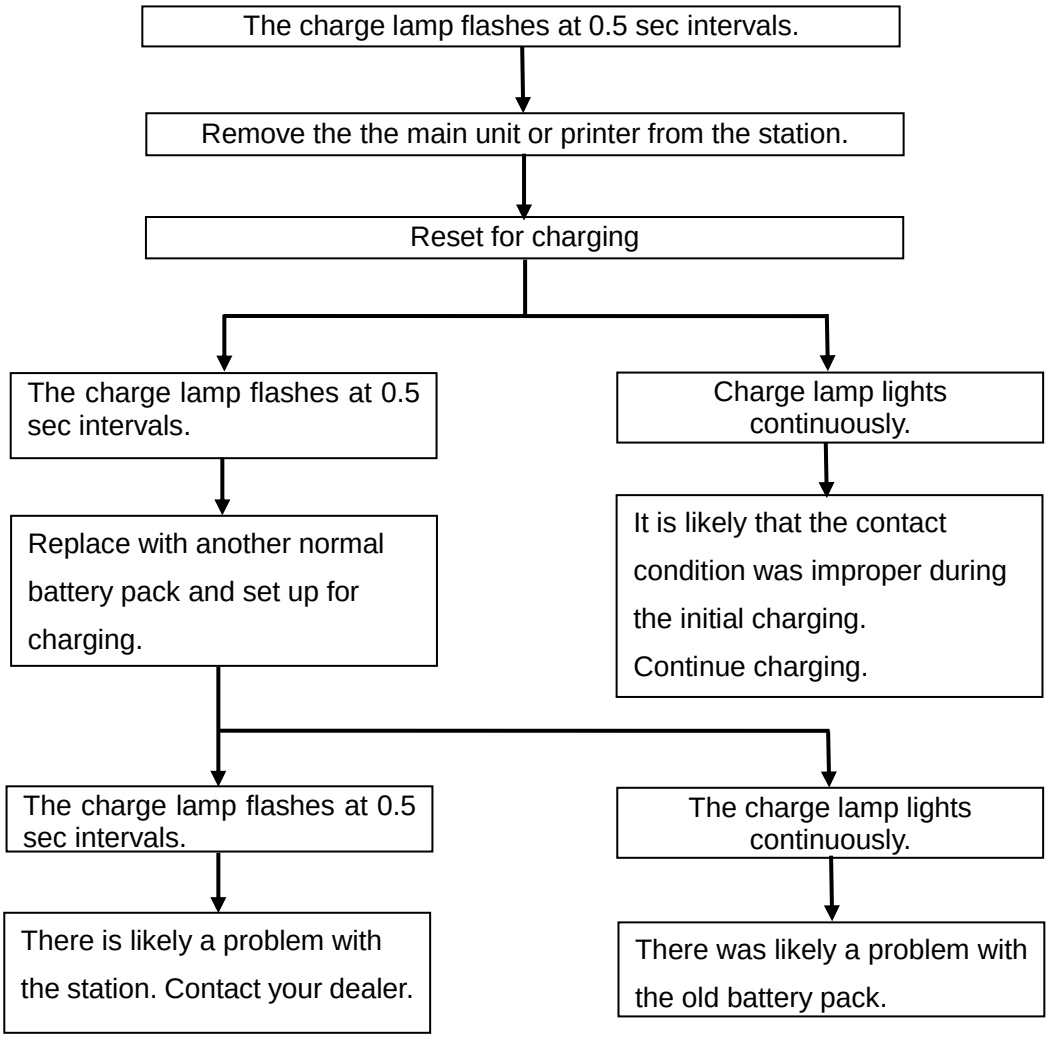
●Check Flashing of the Charging Lamp

The case that charging lamp flashes while it charging, defective of charging is considered.

The procedure to make sure following:

The case that charging lamp flashes while it charging, defective of charging is considered.

The procedure to make sure following:

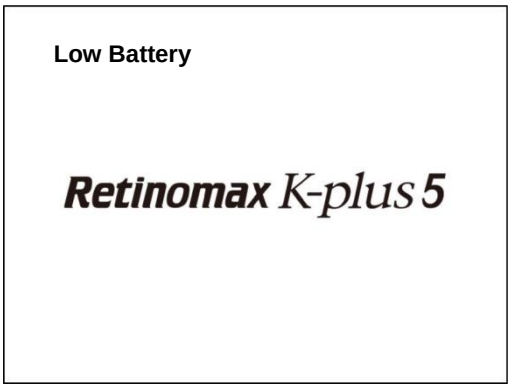


8-3 **Printer**

Phenomenon	Check point	Cause and action
The printer connected to the station does not turn on when the printer power switch is flipped on.	Is the printer correctly connected to the station?	Correct the connection. (See “3-4-2 Automatic Charging of the Printer.”)
	Is the contact (5 places) dirty?	If touching the contacts (5 places) or getting dirty, wipe it off with a dry cloth.
	Is the station in a power-off state?	The printer will not operate if the station is not turned on. Turn on the station.
The battery pack is set in the printer, but the power lamp does not light when the power switch is set to on.	Is the battery pack in the correct orientation?	Check that the battery pack is correctly installed. (See “3-2 Installing and Removing the Battery Pack.”)
	Is the lamp disappeared after 5 sec when it blinked with orange?	Recharge the battery pack. See “3-4 Charging the Battery Pack”
When the printer power lamp flashed pink colour	Is the paper holder cover open?	Close the paper holder cover.
	Is the print roll set correctly?	Set the print roll correctly. (See “7-2 Replacing the Print Roll”)
	Was the measurement data printed when it transmitting? Or, was it transferred to computer?	Confront instrument transmission window with the printer’s receiving window and transfer again.
The printer does not receive measurement data sent from the main unit.	Are there any obstacles between the main unit and printer?	Remove the obstacles, or move to a location free of obstacles.
	Is the printer too far away from the main unit?	Data can be transmitted to a location within 6 meters from the printer and with an angle of less than 45 degrees between the front side of the main unit and the light receiving window of the printer. And, if the mode were ”CONT” or “Transmitting from Memory function”, it cannot transfer over range of 50cm. See ”4-5-1 Printing Procedure.”
	Is the ID number of the printer same as that of the main unit?	Match the ID numbers by checking the OUTPUT screen and the DIP switch in the printer. (See “4-5-4 Using Multiple Printers”)
Characters are crowded on the print paper. The paper does not come out properly.	Is the print roll set correctly?	Set the print roll correctly. (See “7-2 Replacing the Print Roll”)
	Are there red lines on the edges of the print paper?	Replace the print roll. (See “7-2 Replacing the Print Roll”)
Cannot connect to external devices.	Is the communication setting of this unit and the external device correct?	Make sure the setting of each devices. (See “6 Connecting to external instruments”)
Cannot send the data to RV-II.	Are there anything to interfere the connection between devices? (The case that connecting with IR to the RV-II.)	Make sure there are nothing to interfere the communication.

・Built in Battery

This instrument houses a lithium primary battery. If the battery exhausted, the date&time varies. If the display as shown in the figure following appears, please contact to the dealer where you purchased the equipment.



Display if Built-in Battery exhausted

9. Main Specifications

＜**Name**＞ Hand Held Auto Refract-Keratometer

Retinomax K-plus5

＜**Measurement Function**＞

▼ **Refractive measurement**

Measurement range	S+C: －20Dp to +23Dp (VD=12)
	C : 0Dp to ±12Dp
	A : 0° to 180°
Measurement step	S,C : AUTO (±3Dp: 0.12/or the other is 0.25)/0.12/0.25
	A : 1°
Min. pupil size	φ2.3mm
Measurement wavelength	840 to 900nm
Corneal vertex distance	12/13.5/13.75/15/16/0

▼ **Kerato measurement**

Measurement range	Curvature	5.0mm to 15.0mm
		(67.5D to 22.5D INDEX=1.3375)
	Corneal astigmatism	0D to ±12D (R5.00 to R13.00mm)
		0D to ±7D (R13.01 to R15.00mm)
	Corneal astigmatism axis	0° to 180°
Measurement step	Curvature	0.01mm
	Corneal astigmatism	0.12Dp
	Astigmatism axis	1°
Measurement area	Center	φ3.2mm (at R8mm)
	Peripheral	φ6.8mm (at R8mm)
Measurement light wavelength		805nm

▼ **Residual astigmatism measurement**

Measurement range	Residual astigmatism	0 to ±12Dp
	Residual astigmatism axis	0 to 180°
Min. step	Residual astigmatism	0.12Dp
	Residual astigmatism axis	1°
Measurement area	Center	φ3.2mm (at R8mm)

▼ **Pupil size measurement**

Measurement range	2.0mm to 12.0mm
Measurement step	0.1mm

＜**Other Functions>**

- ▼ Automatic right/left eye detector
- ▼ Alignment direction indication
- ▼ Focus assist function
- ▼ Automatic astigmatism axis correction function
- ▼ Auto Quick
- ▼ Auto fixation chart brightness switching
- ▼ Power saving function
- ▼ CHILD mode
- ▼ Retroillumination mode
- ▼ Memory function
- ▼ Astigmatism axis rotation function
- ▼ Continuous measurement mode
- ▼ Auto start function

＜**Measurement Time**＞

REF only measurement(from display to display)	0.124 sec
REF/KERATO measurement(from display to display)	0.385 sec

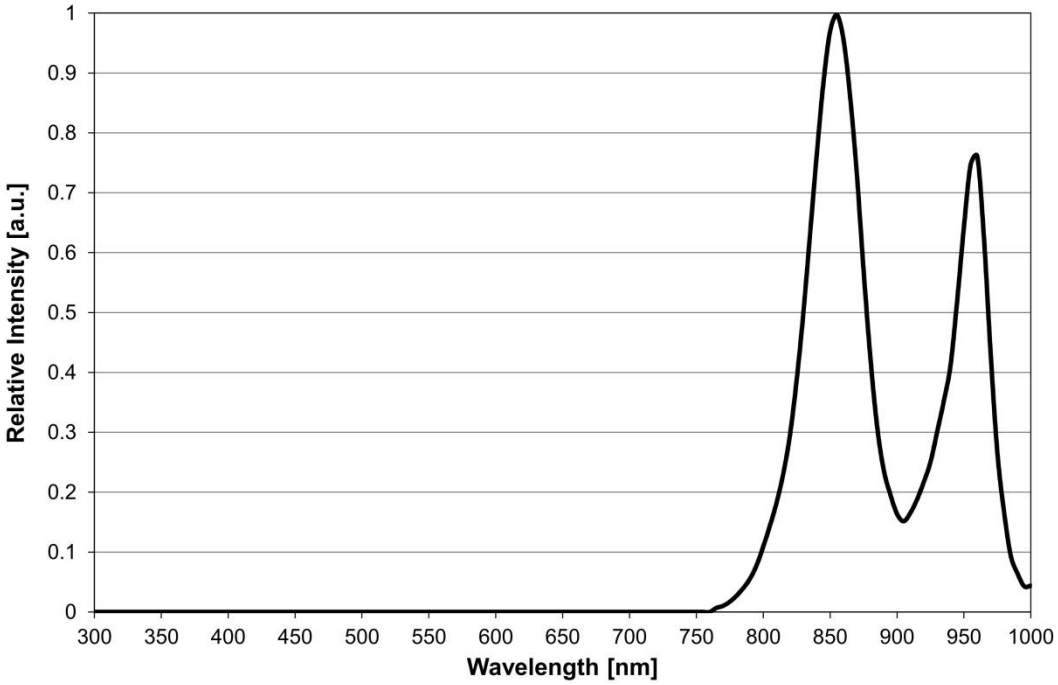
＜**Other**＞

▼ **Main body**

Main body dimension	W191mm×D242mm×H223mm
Weight	950g (With battery) 850g (Without battery)
Power source	Charging DC8.4V / 1.3A
Real time clock	Built-in real time clock for printing of year/month/day/time/minute
Monitor	0.195 inch viewfinder color VGA
External output	Communication to Retinomax Printer5 via infrared (max.6m)
Fixation chart	Tulip, Bear, Firework (factory option)
Fixation chart lighting	2 level adjustable luminance
Alignment target	18 point dot LED,φ2.6mm (at R8mm)

MAIN LED peak central wavelength	870nm
KERATO LED peak central wavelength	805nm
Strength of emission	2.29μW/cm^2

Spectrum output of all light source during measurement



▼ **Station**

Dimensions	W 180mm×D 244mm×H 74mm
Weight	790g
Input power	100－240V　50/60Hz(No voltage switch)
Power consumption	Max. 70VA
Charging battery	Auto
Charging time	3 hours

▼ **Printer**

Dimension	W 103mm×D 167mm×H 74mm
Weight	450g (With battery) 350g (Without battery)
Print paper width	58mm
Eye print diagram	Possible
Drive	Powered from the station (when docked with the station) Battery drive(when separated from the station and a battery pack is installed. USB supply from the computer(when separated from the station and without battery)　∗Only data communication.
Power source	Input: DC8.8V 2.0A Charging: DC8.4V 1.3A USB: DC5.0V 30mA
Input	IR communication
Output	USB

▼ **Battery pack**

Battery	Lithium ion battery RT-01XR
Nominal voltage	DC7.2V
Nominal capacity	2500mAh
Weight	Approx. 100g
Dimensions	W 37.6mm×D 71.6mm×H20.3mm

Retinomax K-plus5 Device identifier

Voltage(V)	Chart	UDI-DI
120	Tulip	4580606430778
	Fireworks	4580606430815
	Bear	4580606430853
220/240	Tulip	4580606430785
	Fireworks	4580606430822
	Bear	4580606430860
220(CH)*	Tulip	4580606430792
	Fireworks	4580606430839
	Bear	4580606430877

*CH：Delivery for china