NIDEK

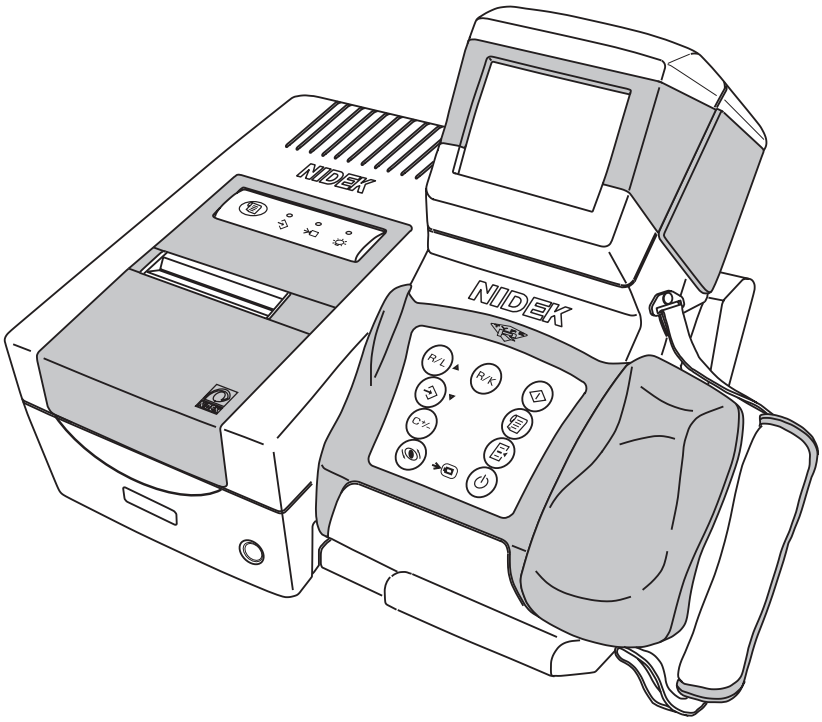
AUTO REF/KERATOMETER

# ARK-30

Type R

# OPERATOR'S MANUAL

CE
0123




NIDEK CO., LTD.

**⚠ BEFORE USE OR MAINTENANCE, READ THIS MANUAL.**

The Operator's Manual contains information necessary for the operation of the NIDEK AUTO REF/KERATOMETER Model ARK-30.
This manual includes operating procedures, cautions for safety, and specifications. The device complies with ISO 10342 (Ophthalmic instruments - Eye refractometers). IEC and UL standards are applied in this manual. The dioptric powers are indicated with reference wavelength λd = 587.56 nm. For correct use, this manual is needed. Especially, the cautions for safety and operating procedures must be thoroughly understood before using the device. Keep this manual handy to verify use whenever necessary.
There are no user-serviceable parts inside the device except the printer paper, fuse, and battery. If you encounter any problems or have questions about the device, contact your authorized distributor.


MEDICAL EQUIPMENT
UL2601-1
CAN/CSA C22.2
NO.601.1
20AT

WITH RESPECT TO ELECTRIC SHOCK, FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH UL2601-1/CAN/CSA C22.2 NO.601.1

(This applies only to the equipments whose power source is 100/120Vac.)

# *Table of Contents*

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# §1 INTRODUCTION

## 1.1 Outline of the Device

The NIDEK Auto Ref/Keratometer ARK-30 is an objective refraction measurement device that contains the functions for measuring refractive errors such as spherical power, cylindrical power, and cylinder axis and the functions for measuring corneal shapes such as the corneal curvature radius (corneal refractive power), angle of meridian, and corneal cylindrical power.
The measured value of refractive errors are mainly used as the reference of the lens prescription for correction of visual acuity in spectacle and contact lenses. The measured value of the corneal curvature is used for the prescription of visual acuity corrective lenses such as contact lenses. It is also used to observe the corneal curvature radius necessary for setting the refractive power of intraocular lens that will be implanted after cataract surgery and the change process of the postoperative corneal shape after corneal surgery.
This device is a hand-held type that allows children who cannot fix their head on the stationary chinrest and lying patients to be measured. As well as the compact station, the device can be easily moved, which makes the measurement possible in a sick room or operating room where the measurement is not possible with the stationary type.
The device consists of a measuring unit and a station. The station is provided with a power supply, a charger, and a printer to print the measured results. The measuring unit is provided with a color LCD monitor and a control panel, etc. to perform alignment and operation.
To make the measurements easier, an auto-shot function is available, which will start the measurement automatically when the patient's eye is aligned and focused.
The built-in RS-232C interface allows you to output data to a personal computer.

## 1.2 Indications for Use

The Model ARK-30 Auto Ref/Keratometer is a diagnostic device that is indicated for use in the automated measurement of refractive errors of the eye, and in the measurement of the corneal curvature of the eye.

## 1.3 Classifications

**[Classification under the provision of 93/42EEC (MDD)] Class IIa**

The ARK-30 is classified as a Class IIa device.

**[Form of protection against electrical shock] Class I**

The ARK-30 is classified as a Class I device. The Class I device is a device in which protection against electric shock does not rely solely on basic insulation. The Class I device includes additional safety precaution that provides for a connection of accessible conductive parts to a protective (earth) grounding conductor in the fixed wiring of the installation.
Use a power outlet which is equipped with a ground terminal.

**[Degree of protection against electrical shock] Type B applied part**

The ARK-30 is provided with a Type B applied part.
The Type B applied part provides an adequate degree of protection against electrical shock, particularly regarding the following:
- allowable leakage currents
- reliability of the protective earth ground connection (if applicable)

**[Degree of protection against liquid entry] IP20***[1]

The ARK-30 is classified as a normal device, as such provides only minimal protection against liquid intrusion.
Avoid splashing water or another liquid on or in the device.

**[Degree of protection against flammability]**

The ARK-30 is classified as a device not suitable to be used in a potentially flammable environment.
Do not operate the device near flammable type materials.

**[Method (s) of sterilization or disinfection recommended by the manufacturer]**

The forehead rest can be cleaned with a cloth dampened with rubbing alcohol as necessary.

**[Mode of operation]**

Classification of the ARK-30: Continuous operation

# 1.4 Symbol Information

This symbol on the device indicates that caution must be taken.
Refer to the operator's manual before use.

This symbol indicates that the degree of protection against electrical shock of the applied part is classified as a Type B applied part.

This symbol on the control panel indicates the start button for placing the device in the measurement mode.

This symbol on the control panel indicates the power button for turning the measuring unit on and off. Pressing the button turns the measuring unit on and off.

*1 In accordance with IEC 60529

This symbol on the station indicates that the power is on.

This symbol on the station indicates that the power is off.

This symbol on the control panel indicates the print button for transmitting the measured results to the station for printing out.
On the station, this symbol indicates the feed button for feeding the printer paper.

This symbol on the control panel indicates the parameter button for displaying the menu to change the settings on the screen.

This symbol on the control panel indicates the memory button to store the median values of the measured results.
On the station, the illuminated lamp for this symbol indicates that AR and KM data that will be outputted externally are being stored in memory.

This symbol on the control panel indicates the angle correction button for rotating the measuring optical axis 90°.

This is the symbol on the control panel and station. The lamp with this symbol flashes while the battery is being charged.

This symbol indicates the fuse rating.

This symbol indicates that the device must be supplied only with alternating current.

This symbol indicates the connection part that is suitable for direct current only.

This indicates the input part.

This indicates the output part.

This symbol on the station indicates that power is supplied to the station and the power switch is turned on when the lamp with this symbol is illuminated.

# §2 SAFETY

In this manual, a Signal Word is used to designate the degree or level of safety alerting. The definition is as follows:

⚠**CAUTION**: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage accident.

Even situations indicated by "⚠**CAUTION**" may result in serious injury under certain conditions. Safety precautions must be strictly followed at all times.

## 2.1 Cautions during Use

### ⚠CAUTION

- Do not modify or touch the inside of the device.
  This may result in an electric shock or a malfunction.

- Do not dismantle or modify the battery.
  Heat generation, explosion, or combustion may result.

- Never remove the power cord from the wall outlet by holding on to the cord.
  This may damage the cord and cause a short circuit or an electric shock. Grasp the plug then pull.

- Do not place heavy objects on the power cord to prevent damage to the power cord, and a fire or an electric shock.

- Immediately replace the power cord if the internal wires are exposed, the device power turns on or off when the power cord is moved, or the cord and/or plug becomes extremely hot.
  This may result in an electric shock or a fire.

- Do not use the device for other than the intended purpose.
  NIDEK will not be responsible for accidents or a malfunction caused by carelessness.

- Wipe between the prongs of the main plug with a dry cloth every once in a while.
  If dust settles between the prongs, the dust will collect moisture, and a short circuit or a fire may occur.

- Before measuring a patient, wipe the forehead rest with a clean cloth.
  If necessary, wipe the forehead rest with a cloth dampened with rubbing alcohol.

# ⚠CAUTION

- In the event of a malfunction, do not touch the inside of the device, but disconnect the power cord from the wall outlet and contact your authorized distributor.

- There may be cases where a measuring eye (R/L) is not detected correctly, depending on the shape of the patient's face.
  Change the setting by pressing the R/L selection button (R/L) if the indication of the measuring eye side is not correct.

- When moving the device with your hand, use the hand strap or neck strap (option). To move the device, be sure to hold the grip. Do not hold the hand strap only.
  Accidentally dropping the device may cause an injury or a malfunction.
  For a malfunction caused by dropping the device, the warranty is not valid. You must pay to repair the device.

- Bring the device to the patient's face after drawing out the forehead rest.
  The device may contact the patient's face.

- Keep the measuring window free of fingerprints and dust to prevent the measurement accuracy from decreasing.

- The date and time may deviate if the battery is removed from the measuring unit for more than 12 hours. In this situation, reset the date and time.

- The measured values of objective refractive power obtained by the ARK-30 are intended to be used as a reference of lens prescription for the correcton of visual acuity with spectacle or contact lenses. Manifest refraction must be used as the basis for the spectacle or contact lens prescription.

# ⚠CAUTION

- Information on the avoidance of overexposure to potentially hazardous optical radiation (ISO 15004: 1997)

  Spectrally weighted photochemical radiances $L_B$ and $L_A$ give a measure of the potential that exists for a beam of light to cause photochemical hazard to the retina. $L_B$ gives the measure for eyes in which the crystalline lens is in place. $L_A$ gives this measure either for eyes in which the crystalline lens has been removed (aphakes) and has not been replaced by a UV-blocking lens or for the eyes of very young children.

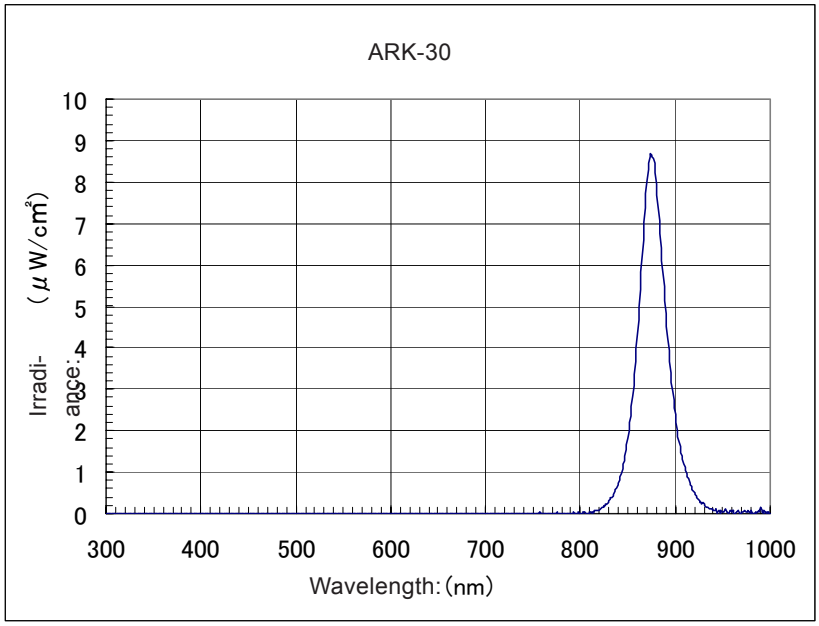
  The value stated for this ophthalmic device gives a measure of hazard potential when the device is operated at maximum intensity and maximum aperture. The values of $L^A$ or $L^B$ for the ARK-30 are sufficiently low as shown on the following page.

  The retinal exposure dose for a photochemical hazard is a product of the radiance and the exposure time. For instance, at a radiance level of 0.5 mW/(cm$^2$•sr), 480 min irradiation of the dilated (8 mm diameter) pupil would cause the retinal exposure dose level to attain the recommended exposure limit. If the value of radiance were reduced to 0.05 mW/(cm$^2$•sr), ten times that time (i.e. 4800 min) would be needed to reach the recommended limit. The recommended exposure dose is based on calculations arising from the American Conference of Governmental Industrial Hygienists (ACGIH) - Threshold Limit Values for Chemical Substances and Physical Agents (1995 - 1996 edition).

  The following page shows the graph of spectrum output for the ARK-30. Patients will be at low risk of acute optical radiation with the ARK-30. However, it is recommended that the intensity of light directed into the patient's eye be limited to the minimum level which is necessary for diagnosis. The total of the retinal exposure dose must be carefully watched for infants, aphakes and persons with diseased eyes who are at greater risk when other ophthalmic devices with a high level of radiance are used in conjunction.

# ⚠CAUTION

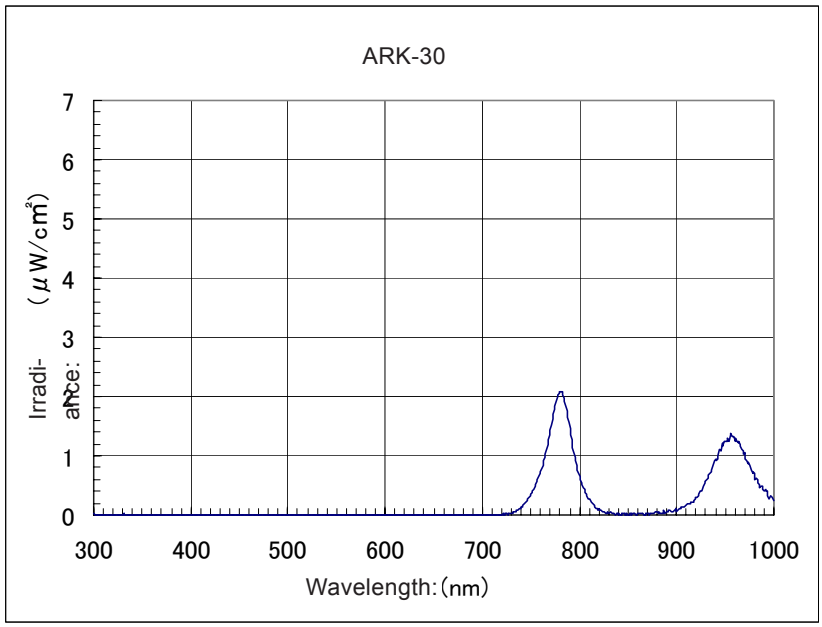
Spectrum output of all light source during AR measurement (maximum light intensity)




Spectrum irradiance

| | |
|---|---|
| *1 $L^A$ (μW/cm²/sr) 380 – 700 nm | 0.527 |
| *2 $L^B$ (μW/cm²/sr) 305 – 700 nm | 0.056 |

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




Spectrum irradiance

| | |
|---|---|
| *1 $L^A$ (μW/cm²/sr) 380 – 700 nm | 0.002 |
| *2 $L^B$ (μW/cm²/sr) 305 – 700 nm | 0.030 |

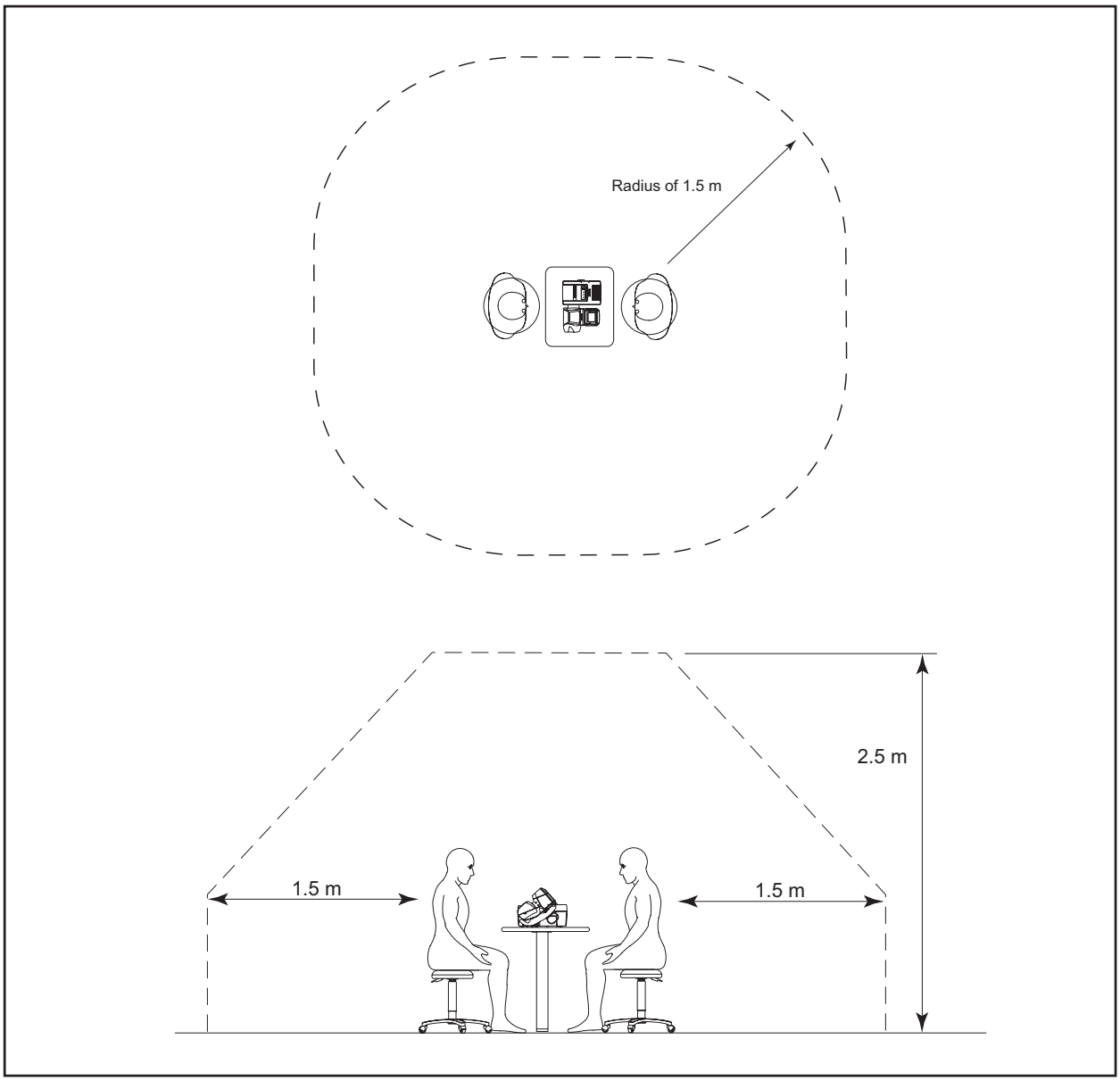
*1 $L^A$: Spectrally weighted photochemical aphakic source radiance

*2 $L^B$: Spectrally weighted photochemical phakic source radiance

**○ Patient environment**

The patient environment represents a space where there is a possibility of direct contact between the patient or the operator and third person.

When another type of device is used in the patient environment, use a device that complies with IEC 60601-1. If the devices that do not comply with IEC 60601-1 are used, it is necessary to use an isolating transformer to power the device or to connect the devices to additional protective grounding.



## 2.2 Storage

### ⚠CAUTION

- Store the device in a place that is dry and free from poisonous gas.

- The device must be maintained under the following conditions during transport and storage (packed condition).

  Environmental conditions
  Temperature: –20ºC to 60ºC
  Humidity: 10% to 95% (No condensation)
  A place with low dust
  A place not exposed to direct sunlight

## 2.3 Transport

### ⚠CAUTION

- Do not drag the cord or cables when moving the device to prevent an injury or a malfunction.

- Place the device in the shipping carton or optional carrying case when moving to another location. Do not use the carrying case if you ask the moving company to take care of the device.

  Excessive vibration or impact may cause a device malfunction.

## 2.4 Installation

### ⚠CAUTION

- Do not install the device near water.

  Keep water away from the device to prevent an electric shock or a malfunction.

- Install the device on a stable and level surface free from vibration and impact to prevent a malfunction or an injury caused by knocking over the device.

- For printing, wireless communication is performed using infrared beams from the measuring unit to the station. Install the device where the light-receiver window of the station is not exposed to intense light such as sunlight and illumination that contains infrared rays.

  If the intense external light comes into the light-receiver window, printing may not be performed correctly. Cut off sunlight with a curtain and turn off nearby illumination.

# ⚠CAUTION

- Install the device in an environment that meets the following conditions.

| | | |
|---|---|---|
| Conditions in use | Temperature: | 10ºC to 40ºC |
| | Humidity: | 30% to 75% (No condensation) |
| | Pressure: | 700 hPa to 1060 hPa |
| | A place with little dust | |
| | A place with little external light | |
| | A place free of vibration and impact | |

- This device complies with the limits for medical devices in IEC60601-1-2: 2001, EN60601-1-2: 2001, and Medical Device Directive 93/42/EEC. These limits are designed to provide reasonable protection against harmful interference in a standard medical installation. This device generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to other devices, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - Reorient or relocate the receiving device.
  - Increase the distance to the device.
  - Correct the device into an outlet on a circuit different from that to which the other device (s) are connected.
  - Consult the manufacturer or field service technician for assistance.

- In installation and operation of the device, observe the following instructions about EMC (electromagnetic compatibility):
  - Do not use the device simultaneously with other electronic equipment to avoid electromagnetic interference with the operation of the device.
  - Do not use the device near, on, or under other electronic equipment to avoid electromagnetic interference with the operation of the device.
  - 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.
  - 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.
  - 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.

- The Electromagnetic Compatibility Directive sets the essential requirements for electrical and electronic equipment that may disturb, or be disturbed by, other equipment. The ARK-30 complies with these requirements as tabled on pages 11-1 to 11-3. Follow the guidance in the tables for use of the device in an electromagnetic environment.

# 2.5 Wiring

## ⚠CAUTION

- Be sure to use a wall outlet which meets the requirements of the power specification.
  If the line voltage is too high or too low, the device may not give full performance. A malfunction or a fire may occur.

- Do not put many loads on one electrical outlet.
  A fire may occur.

- Insert the mains plug into a grounded wall outlet.
  An electric shock or a fire may occur in case of a device malfunction or power leakage.

- Securely connect the main plug into a wall outlet.
  A loose connection may cause a fire.

- Be sure to connect the interface cable, checking the symbols of input (IN: ⊖▸) and output (OUT: ⊖▸).
  Correct communications will not be possible.

# 2.6 After Use

## ⚠CAUTION

- If the device will not be used for a long time, disconnect the power cord from the wall outlet to prevent a fire.

- If the device will not be used for a long time, remove the battery from the device to prevent rust and deterioration of the battery.

- Store the battery with the contact away from metal.
  The contact is recessed to prevent easy contact. However, if the battery is stored with a metal necklace, etc., it may result in a short circuit, which may generate heat or a malfunction.

- When the device is not in use, turn off the power and put the dust cover on the device to prevent dust from affecting the measurement accuracy.

# 2.7 Maintenance and Checks

## ⚠CAUTION

- Use the specified fuses to replace the old ones to prevent a fire.
- Disassembly is not permitted except at NIDEK or your authorized distributor.
- Never use organic solvents such as paint thinner to wipe the exterior.
  This may ruin the surface.
- When charging and replacing the battery, use the specified battery and charger (station or measuring unit) only. In addition, do not put foreign matters such as metal into the battery slot to prevent a malfunction or a fire.
- Do not discharge the battery in other devices. Do not connect the positive and negative terminals with metal such as wire to prevent damage, deterioration, and shortened life-span of the battery.
- Do not dismantle or modify the battery to prevent heat generation, explosion, or combustion.
- Replace the printer paper with the specified paper only to prevent damage to the head.
- Before sending the device back to NIDEK for repair or maintenance, wipe the surface (especially the area that contacts the patient's skin) of the device with a clean cloth immersed in ethyl alcohol for disinfection.
- Contact NIDEK or your authorized distributor to check whether the device needs the measurement accuracy calibration if the AR-measured results are largely different from the subjective measurements.

# 2.8 Disposal

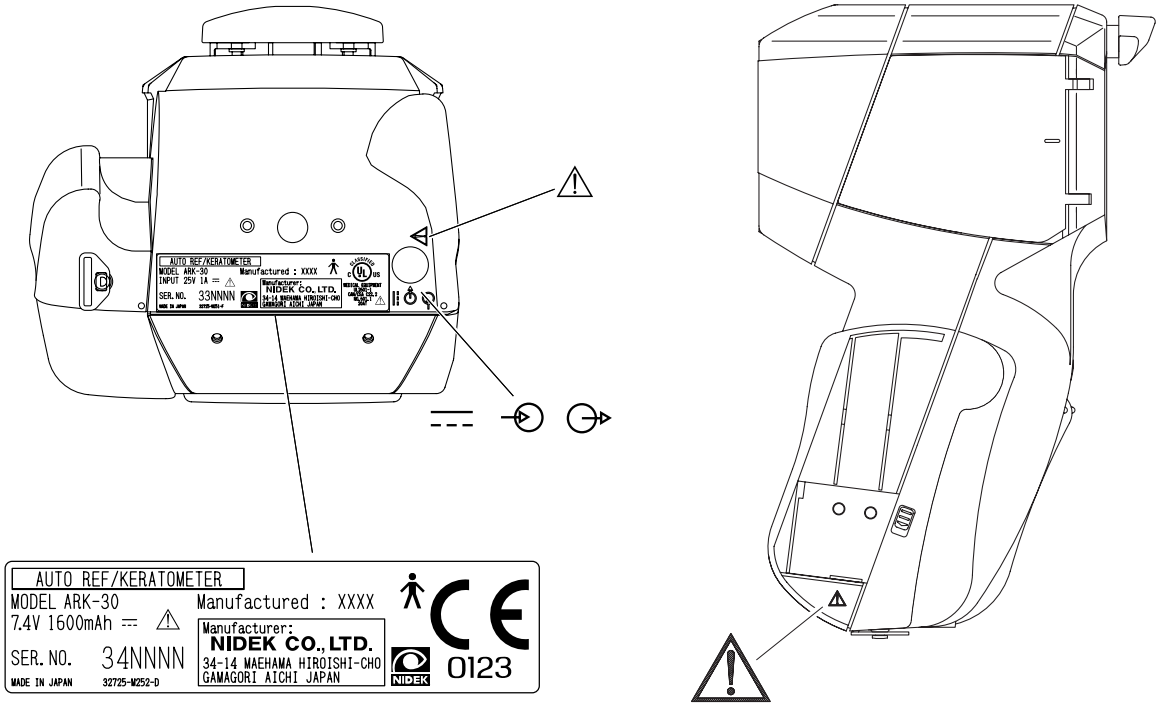
## ⚠CAUTION

- Follow local governing ordinances and recycling plans regarding disposal or recycling of device components.
  Especially the disposal method of lithium-ion batteries varies according to the government. A rechargeable lithium battery is used in the device. Follow the local governing ordinances and recycling plans when disposing of a board with lithium batteries.
- When disposing of packing materials, sort them by material and follow the local ordinances and recycling regulations.

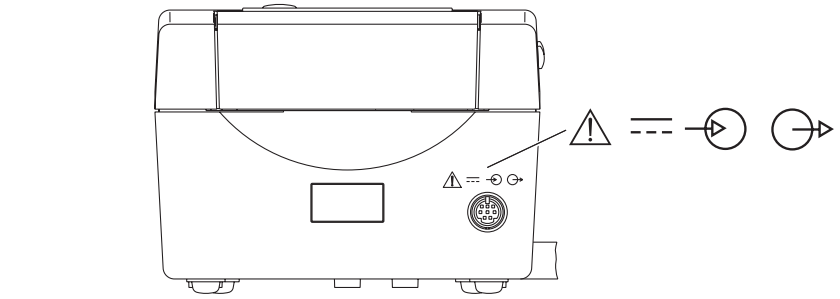
# 2.9 Labels

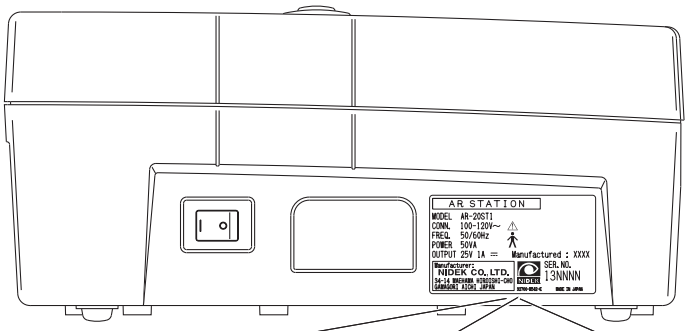
To catch the attention of the user, some labels and indications are provided on the device.

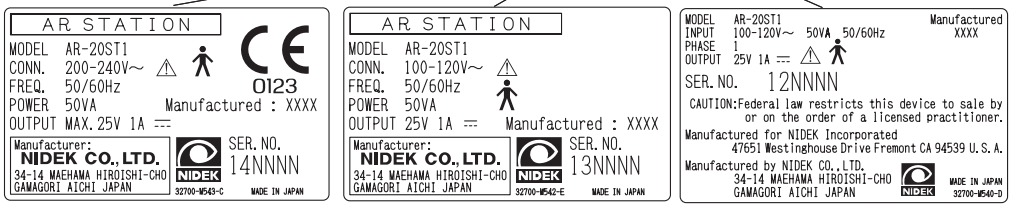
**[Measuring unit]**



**[Station]**

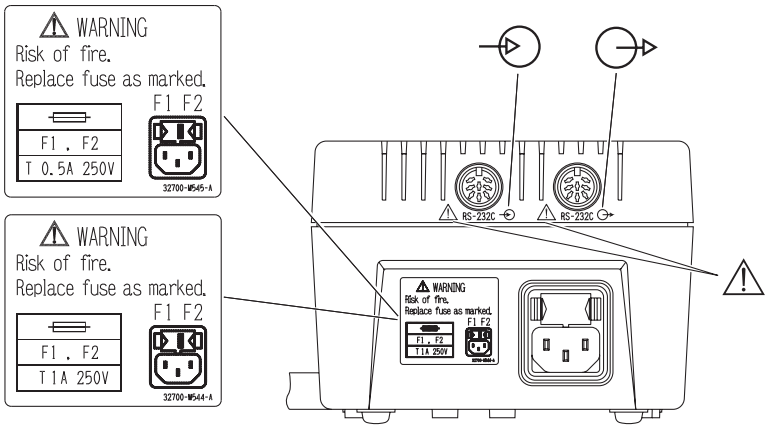




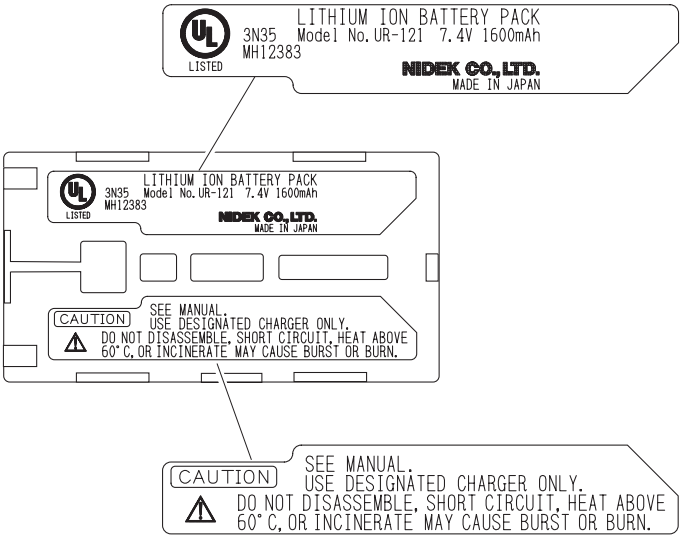




200-240 V range

100-120 V range

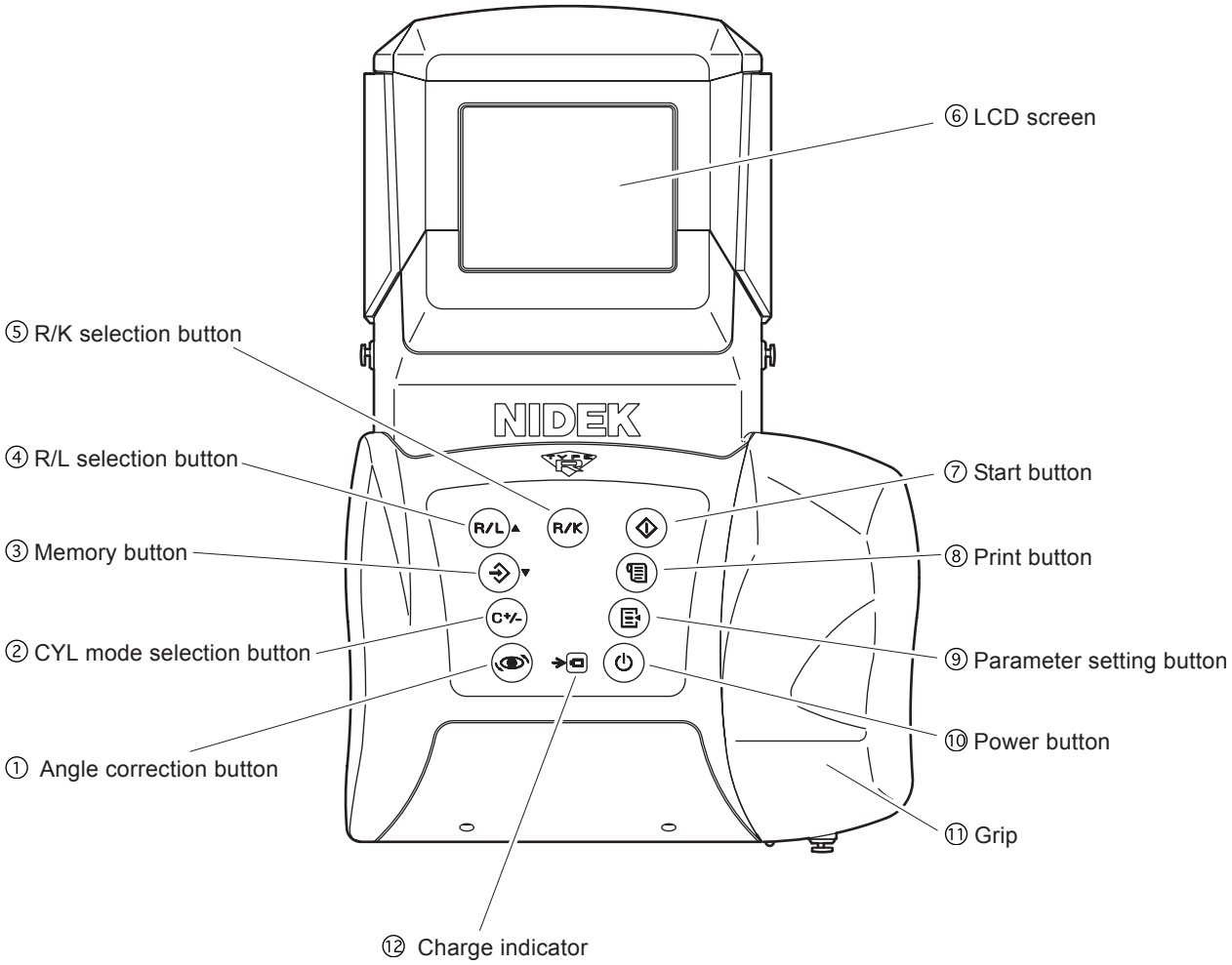


**[Underside of battery]**



# §3 CONFIGURATION

**[Measuring unit]**



### ① Angle correction button

Used to rotate the main body 90º when the patient is measured from the side.

This is used to measure a patient who is lying down.

When the parameter "41: SAGITTAL" is set to "YES", pressing this button starts the sagittal radius measurement.

### ② CYL mode selection button

Establishes the CYL mode of measured results. Pressing this button changes the mode in the order of CYL – → CYL + → CYL ± → CYL – → •••.

• CYL + (Plus reading)

Cylinder data is displayed by the + reading.

• CYL – (Minus reading)

Cylinder data is displayed by the – reading.

• CYL ± (Mix reading)

In the AR measurement, cylinder data is displayed by the + reading when the refractive error is positive for any axis angle. In other cases, cylinder data is displayed by the – reading.

In the KM measurement, cylinder data is displayed by the – reading.

See page 4-7 for details of the CYL mode.

### ③ Memory button

Stores the measured results in memory.

The memory function stores the measured results of 30 patients (60 eyes).

### ④ R/L selection button

Sets the measuring eye. Every time the button is pressed, the indication changes in the order of R (or L)→ <R>→ <L>→ L (or R)→ •••.

If alignment is performed in the AUTO mode, R (right-eye) or L (left-eye) will be identified automatically.

<R> (<L>) indicates that the right eye (left eye) has been manually set.

### ⑤ R/K selection button

Changes the measurement mode.

The mode changes in the order of R/K mode (Serial AR & KM measurements)→ R mode (AR measurement)→ K mode (KM measurement)→ R/K mode→ •••.

### ⑥ LCD screen

Displays the patient's eye, target, focusing indicator, measured values, and measurement count, etc.

The color of the characters and the background on the LCD screen can be selected from a combination of 28 kinds.

### ⑦ Start button

Places the device into the measurable state from standby.

### ⑧ Print button

Prints measured results, etc.

### ⑨ Parameter setting button

Used to change the settings of the device.

### ⑩ Power button

Turns the measuring unit on and off. Pressing this button turns on the power and vice-versa.

Turning the power on places the device into the standby mode.

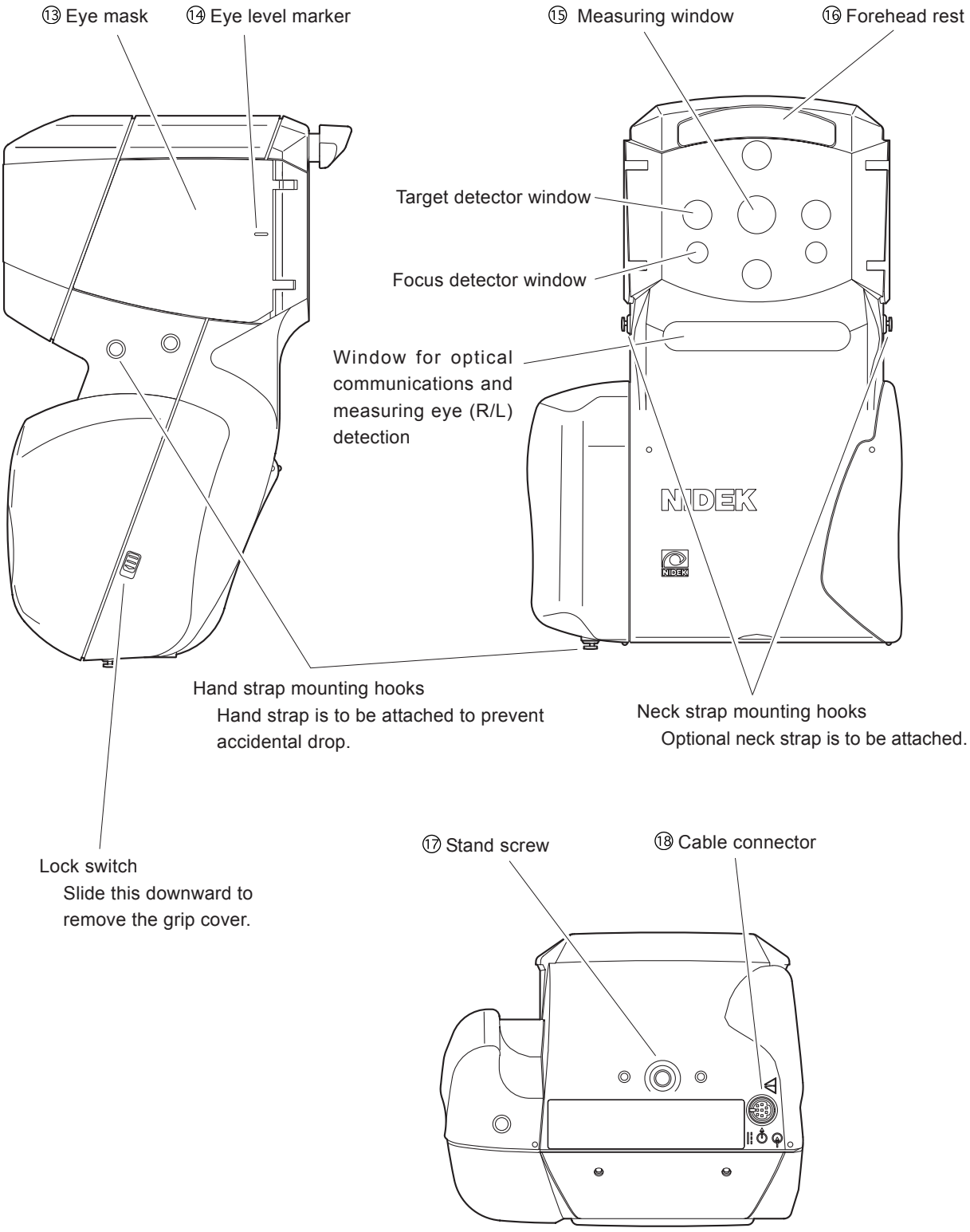
The position of the chart is initialized and the chart lamp lights up.

### ⑪ Grip

Used to hold the measuring unit. The battery holder is mounted inside. Open the cover to replace the battery.

### ⑫ Charge indicator

Flashes while the battery in the measuring unit is being charged.


⑬ Eye mask
⑭ Eye level marker
⑮ Measuring window
⑯ Forehead rest
Target detector window
Focus detector window
Window for optical communications and measuring eye (R/L) detection
NIDEK
Hand strap mounting hooks
Hand strap is to be attached to prevent accidental drop.
Neck strap mounting hooks
Optional neck strap is to be attached.
Lock switch
Slide this downward to remove the grip cover.
⑰ Stand screw
⑱ Cable connector

### ⑬ Eye mask

Open this mask to shield the patient's eye which is not measured.

This allows the patient to fixate his/her eye easier.

To avoid damage from impact, the eye mask is easily detached. To attach it, push lightly aligning the hinge part with the main body.

### ⑭ Eye level marker

A guide for the patient's eye level for measurements. It is located at both the front and back sides of the eye mask.

Adjust the measuring unit so that the center of the patient's eye is aligned with this line.

### ⑮ Measuring window

The patient looks at the chart through this window.

Keep this window clean. The measuring window checker allows automatic confirmation of cleanliness.

### ⑯ Forehead rest

Place it against the patient's forehead (top of eyebrow) to stabilize the position of the measuring unit.

The push-type lock forehead rest can be drawn out once it is pushed lightly.

Use the forehead rest so that the measuring unit will not contact the patient's face.

### ⑰ Stand screw

This screw secures the measuring unit to the portable stand (option).

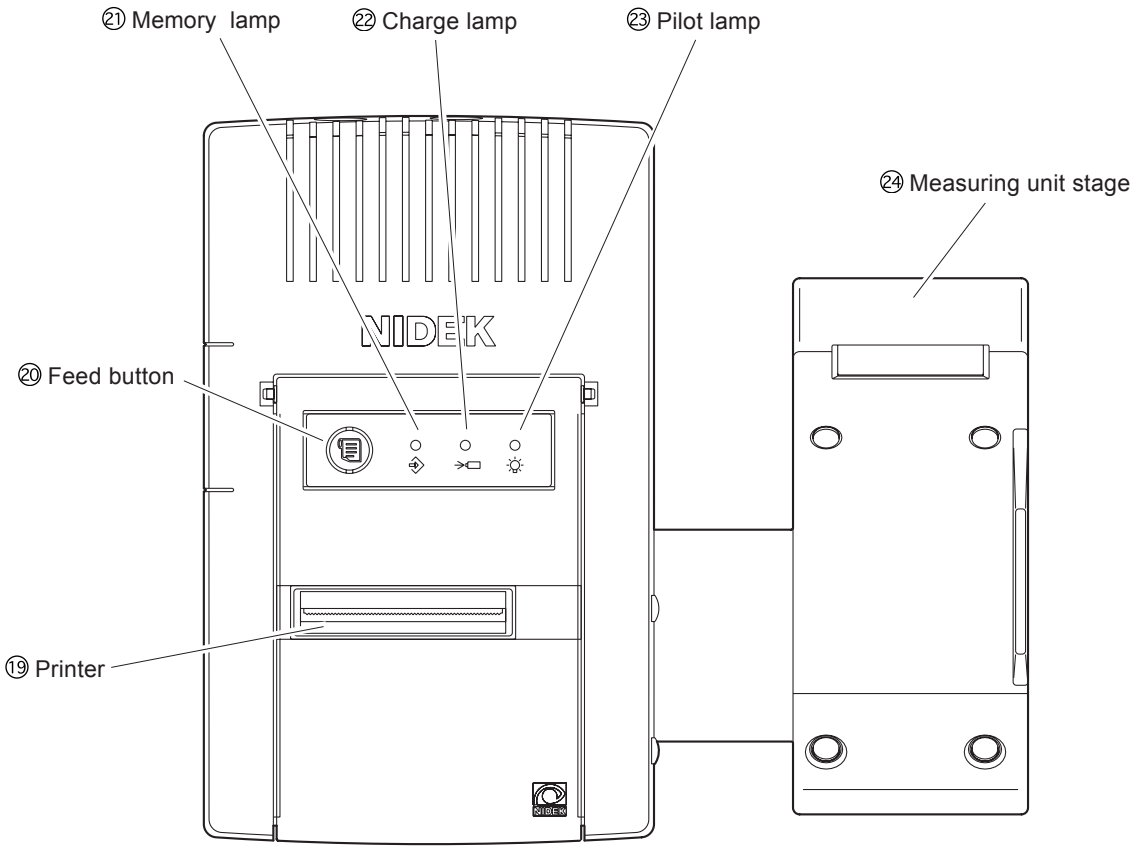
### ⑱ Cable connector

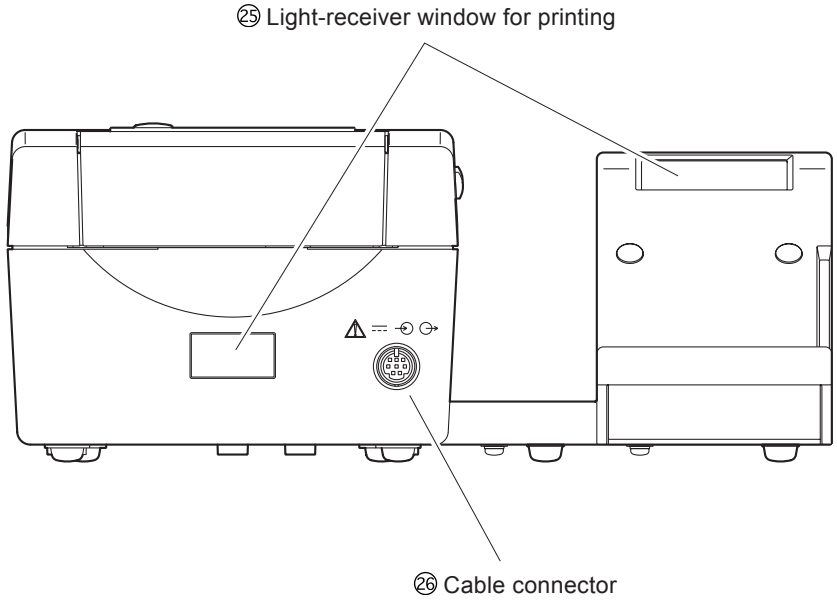
Connector for the cable when the measuring unit is used by deriving power from the station.

The battery can be recharged with the battery installed in the measuring unit.

Printing is possible by the connecting cable.

**[Station]**


㉑ Memory lamp
㉒ Charge lamp
㉓ Pilot lamp
㉔ Measuring unit stage
NIDEK
⑳ Feed button
⑲ Printer


㉕ Light-receiver window for printing
㉖ Cable connector

### ⑲ Printer

Prints measured results, etc.

### ⑳ Feed button ( )

Feeds the printer paper. While this button is pressed, the paper is fed.

### ㉑ Memory lamp ( )

Illuminates while data to be transmitted to an external computer, etc. is stored.

### ㉒ Charge lamp ( )

Flashes while the battery is being charged. This lamp stays illuminated after the charging is completed.

### ㉓ Pilot lamp ( )

Illuminates when the station is supplied with power and operating.

### ㉔ Measuring unit stage

The measuring unit is put on this stage when not in use.

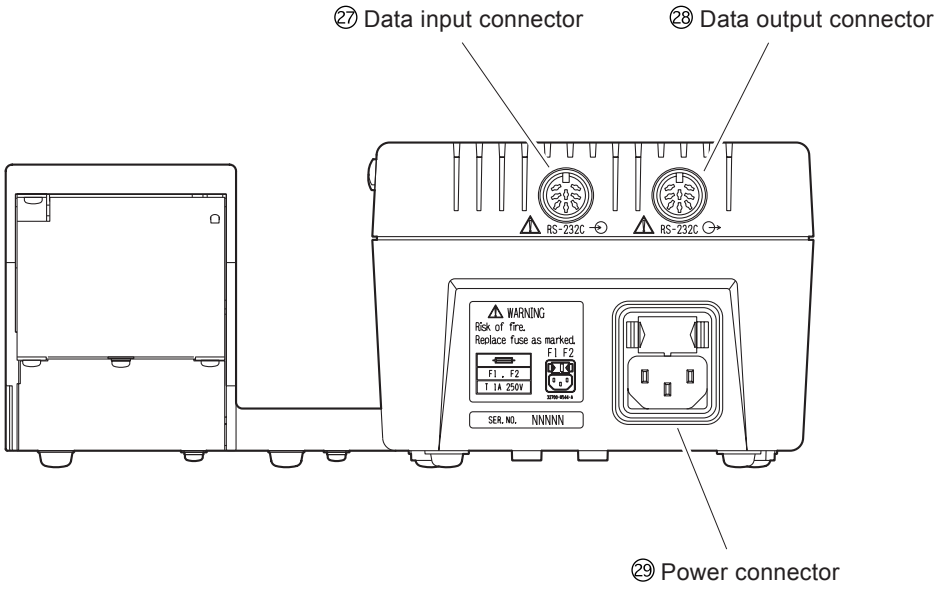
### ㉕ Light-receiver window for printing

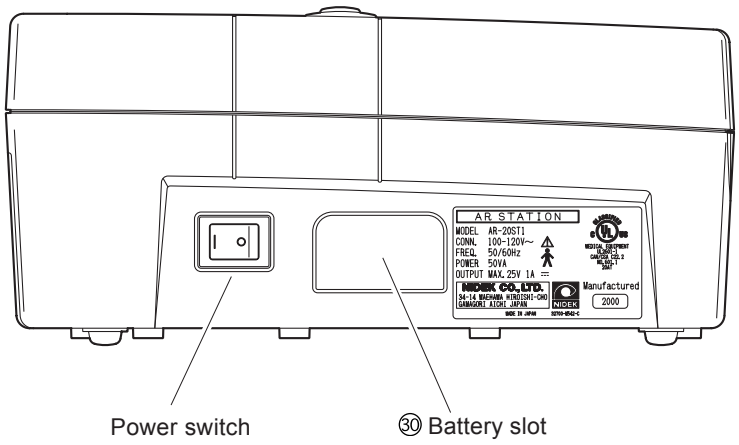
Receives the signal from the measuring unit during printing.

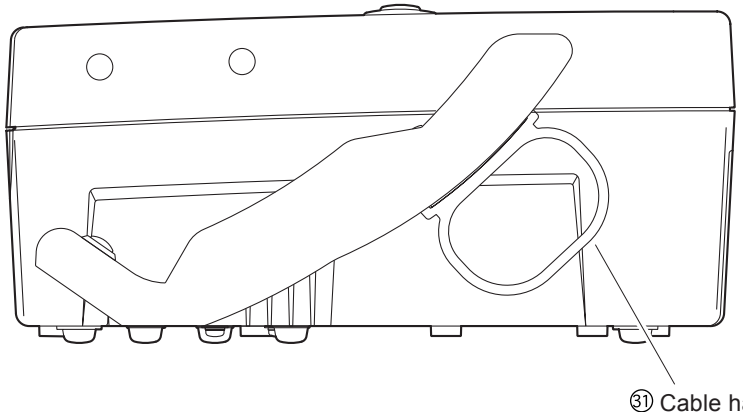
The communication distance between the measuring unit and station is within 1 meter.

### ㉖ Cable connector

Connector for the cable when the measuring unit is used by deriving power from the station.


㉗ Data input connector
㉘ Data output connector
RS-232C
RS-232C
WARNING
Risk of fire.
Replace fuse as marked.
F1 F2
F1 , F2
T 1A 250V
SER. NO. NNNNN
㉙ Power connector


AR STATION
MODEL AR-20ST1
CONNL 100-120V~
FREQ. 50/60Hz
POWER 50VA
OUTPUT MAX. 25V 1A
MADE IN JAPAN
Manufactured
2000
Power switch
㉚ Battery slot


㉛ Cable hanger

### ㉗ Data input connector*

The interface cable from a lensmeter imports measured values from the NIDEK's lensmeter.

The ARK-30 measured results are exported from the data output connector. The imported LM measured results are also exported from the data output connector.

### ㉘ Data output connector*

The interface cable exports measured values to an external computer.

### ㉙ Power connector

The supplied power cable is connected here.

This is the combination type with a fuse holder.

Use the specified fuses.

Spare fuses are mounted in the spare fuse holders inside the printer cover of the station.

### ㉚ Battery slot

The battery is inserted for recharge.

When the battery is inserted, charging will start automatically and the charge lamp (➔▭) will flash.

### ㉛ Cable hanger

When the cable is not in use, it is placed on this hanger.

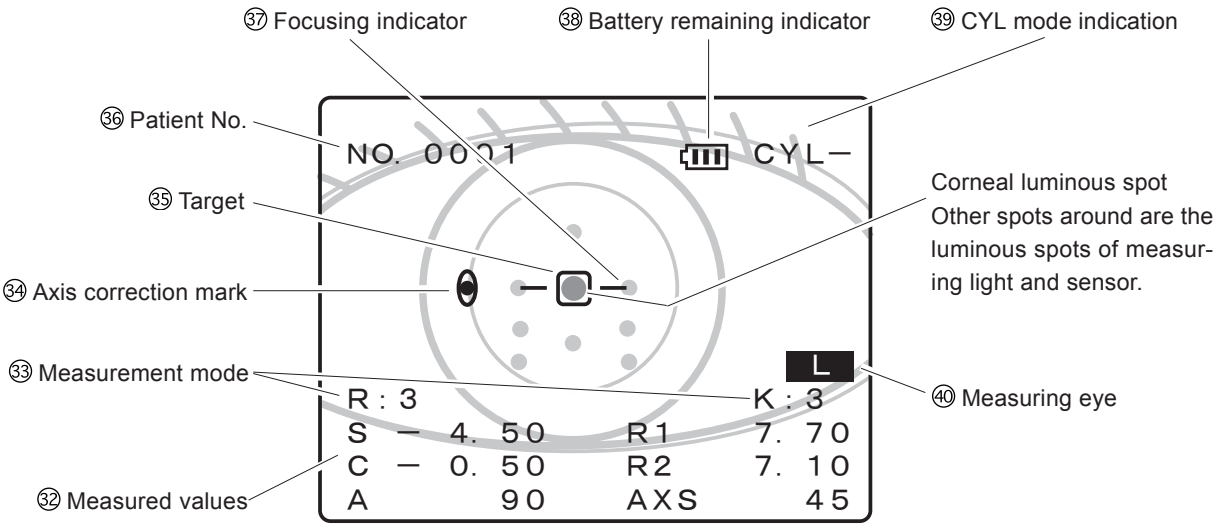
The hanger can be easily detached since it is attached by a magnet.

---

* Accessory equipment connected to the analog and digital interfaces must be certified according to the appropriate national standards (for example, UL1950 for Data Processing Equipment UL 2601-1 for Medical Equipment, and CSA C22.2 No. 601-1, EN 60601-1 and IEC 60601-1.) Furthermore, all configurations shall comply with the system standard 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 system standard IEC 60601-1. If in doubt, consult the technical service department or your local representative.

**[LCD screen]**

This is a sample measurement screen in the R/K mode.




### ㉜ Measured values

Displays the latest measured results. The indicated items vary according to the measurement mode (R/K mode, R mode, K mode).

### ㉝ Measurement mode

Indicates the selected measurement mode, R: AR measurement, K: KM measurement, R and K: R/K measurement. The figures shown on the right and left represent the number of measurements for each eye.

### ㉞ AXIS correction mark

This is shown when AXIS is corrected by 90º with the angle correction button (👁).

### ㉟ Target

Used to bring the patient's eye to the center of the measuring optical axis as a guide.

### ㊱ Patient No.

Displays the measured patient No. in a serial number.

The number is set in the parameter setting mode.

### ㊲ Focusing indicator

Indicates the distance between the measuring unit and the patient's eye. This is a guide for focusing.

### ㊳ Battery remaining indicator

Indicates the remaining charge amount of the battery installed in the measuring unit.

(▭) indicates that the battery is getting weak and the battery needs recharging.

### ㊴ CYL mode indication

Displays the established CYL mode.

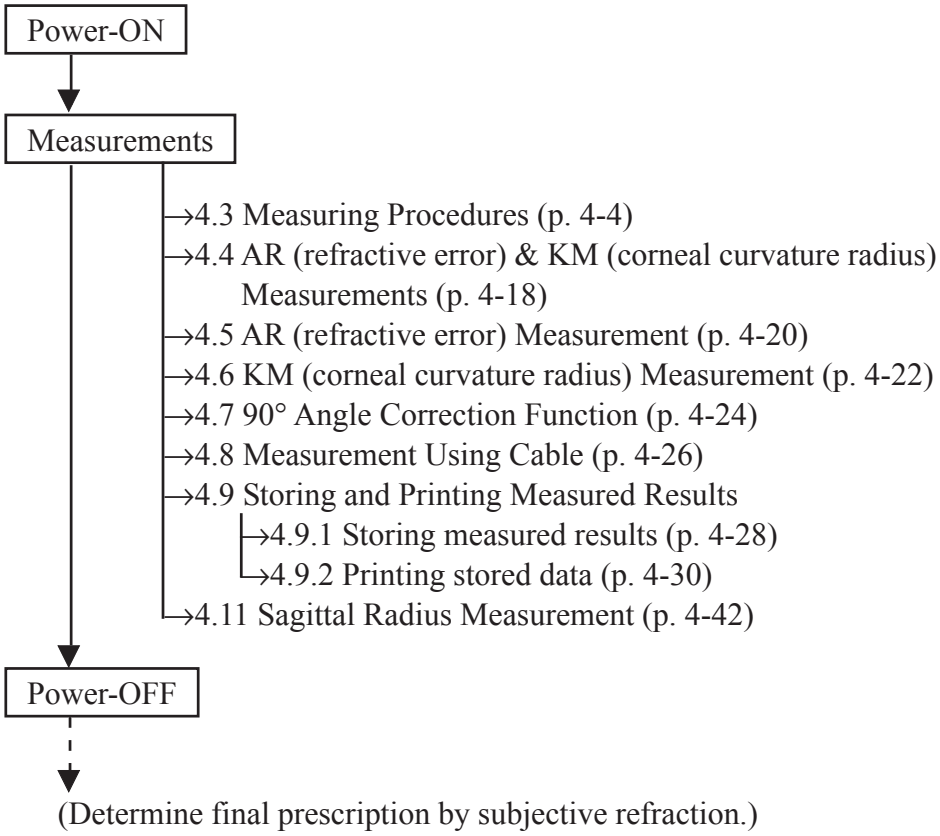
### ㊵ Measuring eye

Displays the right-side or left-side of the detected patient's eye.

This can be manually set by pressing the R/L selection button (R/L).

# §4 OPERATING PROCEDURES

## 4.1 Operation Flow



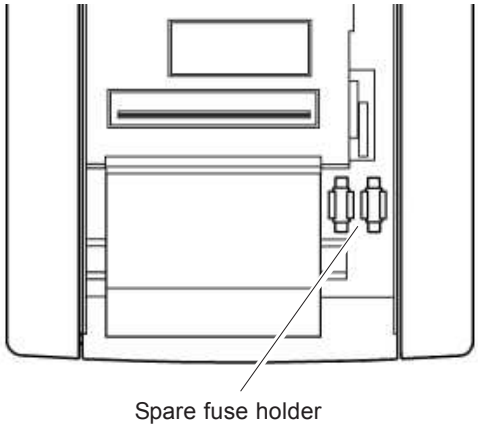

## 4.2 Before First Use

**1. Unpack the contents from the shipping carton and check them.**

The standard configuration contains the following items:

- Measuring unit
- Station
- Cable
- Power cord (with 2 and 3 prong conversion plug)
- Battery
- Dust cover
- Hand strap (Attached to the measuring unit)
- Spare printer paper (3 rolls)
- Spare fuse (2)
- Operator's manual (this book)

Spare fuses are mounted in the spare fuse holders inside the printer cover of the station.



**2. Put the station on a level surface such as a table and insert the power cord to the power connector.**

**3. Insert the power cord into the wall outlet after making sure that the power switch is off (½).**

**4. Turn the power switch on (○).**
After the station is initialized, a short beep is produced twice and the pilot lamp (☼) turns on.

## NOTE

- If abnormal conditions are encountered when the station is turned on (½), a short beep is produced and the lamp turns on to notify the operator.
  - ○When the printer paper is all gone:
    A beep is produced a few times and the pilot lamp (☼) flashes for about ten minutes.
    → Set the printer paper.
  - ○When the printer head is up:
    A beep is produced a few times and the charge lamp (➔▭) flashes for about ten minutes.
    → The lever on the printer must be flipped down.

**5. Charge the battery.**
See "8.3 Charging Battery" for details.
It takes 120 - 150 minutes to fully recharge the battery (Takes much longer if the battery is deteriorated.)

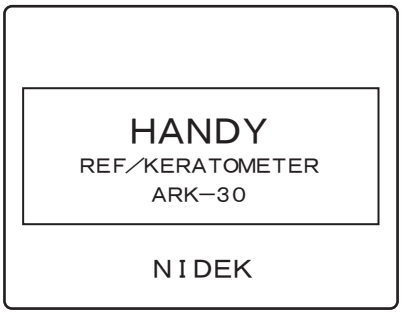
## NOTE

- The battery is shipped with a full-charge. However, the battery may be self-discharged if shipping takes a long time. It is recommended to recharge the battery before the first use.

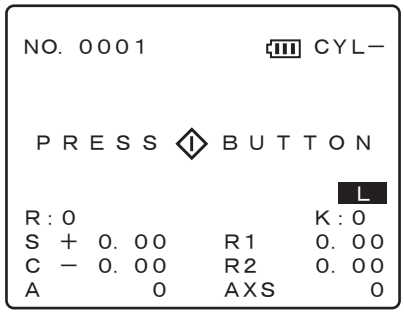
**6. After preparing the charged battery, install the battery into the measuring unit.**
See "8.2 Installing/Removing Battery" for details.
Attach the optional neck strap if available.
The hand strap and neck strap can be used at the same time.
See "8.4 Detaching/Attaching the Strap" for details.

**7. Press the power button ⏻ on the measuring unit control panel and make sure that the LCD screen illuminates.**

After "HANDY REF/KERATOMETER ARK-30"* appears, the initial screen is displayed.

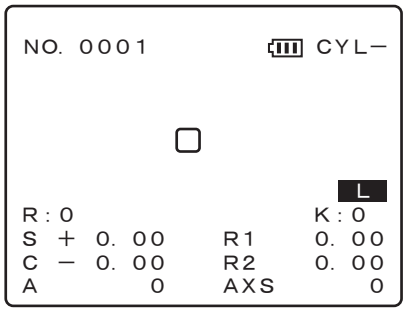



"PRESS ◈ BUTTON" appears in the center of the screen and the device goes into the standby mode.
In standby, the LCD screen is displayed, but the measuring mechanism is not running.




**8. Press the start button ◈ on the control panel.**

When "PRESS ◈ BUTTON" disappears, the measuring unit goes into the measurement mode.
The measurement mode is when the measurement mechanism is running and the measurement is ready to start.




**9. Make the measuring and printing settings according to your usage pattern.**

The settings can be changed anytime. Make the settings according to the usage.
See "6.1 Parameter Settings" for details.

This is all you have to do before use.

* "HANDY REF/KERATOMETER ARK-30" and "ARK-30 Type R" are nicknames. The official model name of this device is "AUTO REF/KERATOMETER ARK-30".

# 4.3 Measuring Procedures

This is the procedure when the measuring unit is operating on the battery. There is no need to turn on the station until printing measured results.
See "4.8 Measurement Using Cable" if the measuring unit is power-supplied from the station via the cable.

## ⚠CAUTION

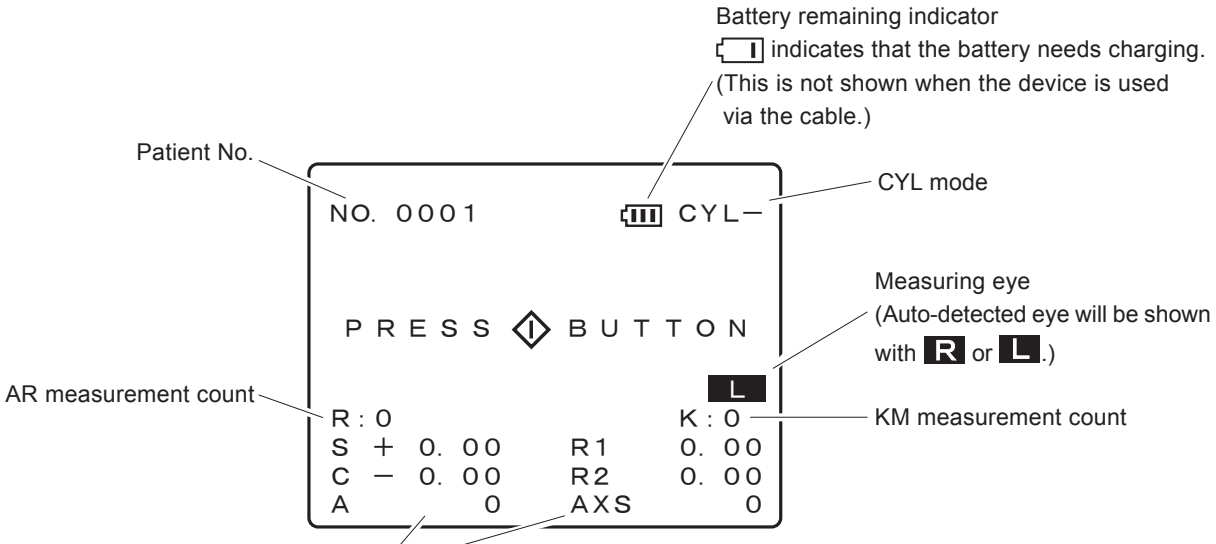
- When the device is used, use the hand strap or neck strap (option).
  Accidentally dropping the device may cause an injury or a malfunction.

**1. Press the power button ⏻ on the control panel.**

1) The LCD screen illuminates and "HANDY REF/KERATOMETER ARK-30" appears.

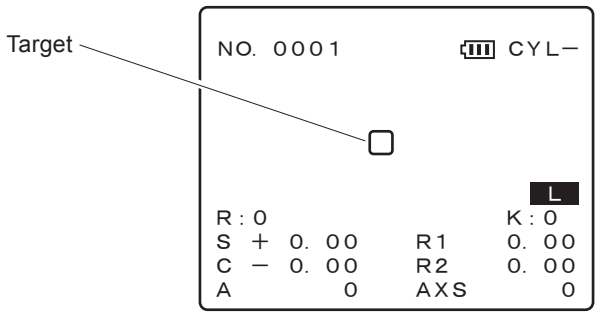
2) After about three seconds, a beep is produced twice and the initial screen is displayed. "PRESS ◈ BUTTON" appears in the center of the screen.

The screen displays the following: Patient No., Battery remaining indication, and CYL mode are shown in the upper part, and Measuring eye (auto detected R or L), Measurement count, and Measurement items (initial setting: R/K mode) are shown in the lower part.



**2. Press the start button ⟨◇⟩ on the control panel.**

"PRESS ◇ BUTTON" disappears and the measuring unit goes into the measurement mode*. The LCD screen is displayed as follows. The target is shown in the center.

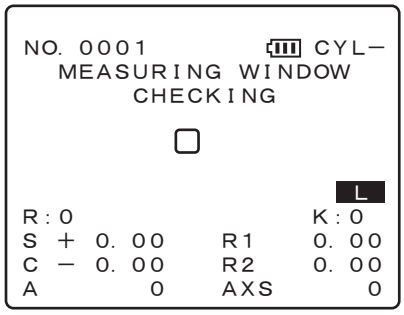



### ○ Checking the measuring window before use

Whether to check the measuring window cleanliness can be set by setting the parameter. An unclean measuring window will decrease the reliability of measurements. This checker as well as visual inspection should be used for measurements under clean conditions.

See "6. OTHER FUNCTIONS" for details.

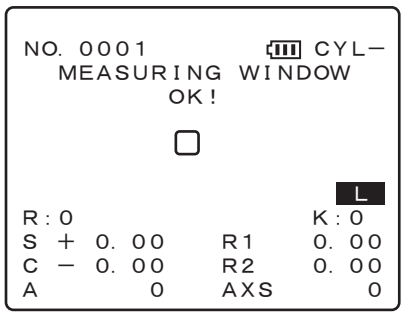
1) Press the start button in the standby status. "MEASURING WINDOW CHECKING" appears and the measuring window starts checking.
Wait until a message appears.




## NOTE

- When checking the measuring window, keep objects off the front of the measuring window. Even if the measuring window is clean, the message "NG!" may appear due to obstructing objects. The message also may appear when the window is checked with the measuring unit on the station or a table.

2) A message appears.
When "OK!" appears:
The measuring windos is clean. After the message diappears, the device goes into the normal measurement mode.
When "NG!" appears:
Turn the power off and check that the measuring window is clean. If not, clean it.



## NOTE

- The checker works only before the first measurement after the power has been turned on. Regardless of the message “OK!” or “NG!”, the checker does not work after the second measurement or later.

**3. Establish the measurement conditions, etc. according to your usage pattern.**

a. Parameter setting button (E)
See “6. Other Functions” for details.

## NOTE

- The following table includes the parameters related to the measuring procedure and measured results. Make the settings according to your usage pattern.
  If not necessary, there is no need to change the parameters as they are stored in the device.

* The underlined items indicate factory-settings.

| No. | Parameter | Description |
|---|---|---|
| 1 | STEP | 0.12D / 0.25D |
| 2 | VERTEX D. | 0 mm / 10.5 mm / 12 mm / 13.75 mm (default for N. Inc.) / 15 mm / 16.5 mm |
| 3 | KM UNIT | mm / D |
| 4 | KM DISP. | R1, R2 / AVE, CYL |
| 5 | AXIS STEP | 1° / 5° |
| 7 | AI MODE | YES / NO |
| 21 | AUTO IOL | YES / NO |
| 24 | REF. INDEX | 1.3375 / 1.336 / 1.332 |

* Power-saving function

There are two functions for power savings.

1. The device returns to standby when not operated for approximately one minute in the measurement mode.
2. When the parameter “23. AUTO OFF” is set to “10”, the light quantity of the LCD back light is reduced and the chart lamp goes out if the device is not operated for approximately three minutes after standby.
   Press the start button (◇) to place the device in the measurement mode.

b. CYL mode selection button (C+/-)

This is the button to change the indication of the cylinder value (cylindrical power).
CYL – .... Cylinder data is displayed by the – reading.
CYL + .... Cylinder data is displayed by the + reading.
CYL ± .... In the AR measurement, cylinder data is displayed by the + reading when the refractive error is positive for any axis angle. In other cases, cylinder data is displayed by the – reading.
In the KM measurement, cylinder data is displayed by the – reading.

| Screen indication | CYL– | CYL+ | CYL± |
|---|---|---|---|
| AR measurement | Minus reading | Plus reading | Mix reading |
| KM measurement | Minus reading | Plus reading | Minus reading |

* The mode can be changed even after the measurement.
* All stored data are printed in the mode when printing.

# NOTE

- Corneal cylindrical power (CYL) axis (AXIS) indication of KM measured values according to CYL mode

  **Minus reading**
  - For AVE, CYL indication, CYL (cylindrical power) is displayed by – and AXIS indicates the flattest meridian curvature radius direction.
  - For R1, R2 indication, AXIS indicates the flattest meridian curvature radius (R1) direction.

  **Plus reading**
  - For AVE, CYL indication, CYL (cylindrical power) is displayed by + and AXIS indicates the steepest meridian curvature radius direction.
  - For R1, R2 indication, AXIS indicates the steepest meridian curvature radius (R2) direction.

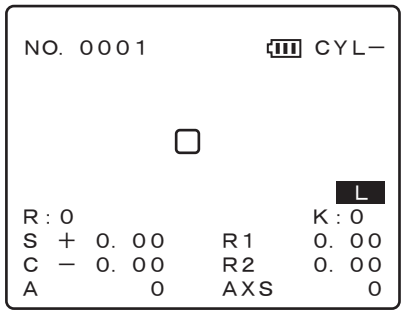
**4. Press the R/K selection button (R/K) to select a measurement mode.**

The R/K mode is the initial setting. Operation is not necessary when the eye is measured continuously in the R/K mode.

The measurement items corresponding to the selected measurement mode are displayed on the screen.

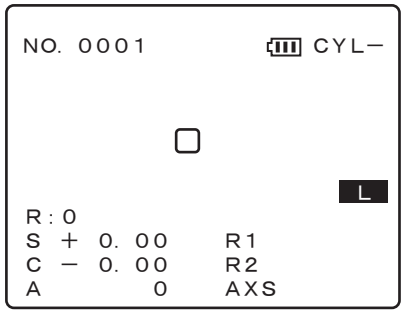
The mode changes in the order of R/K → R → K → R/K →•••.

R / K mode ••• AR & KM serial measurements



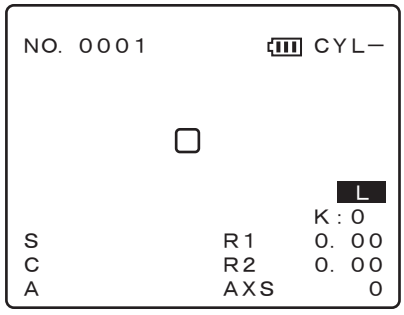

R mode ••• AR measurement

Values are not displayed for the KM measurement items.



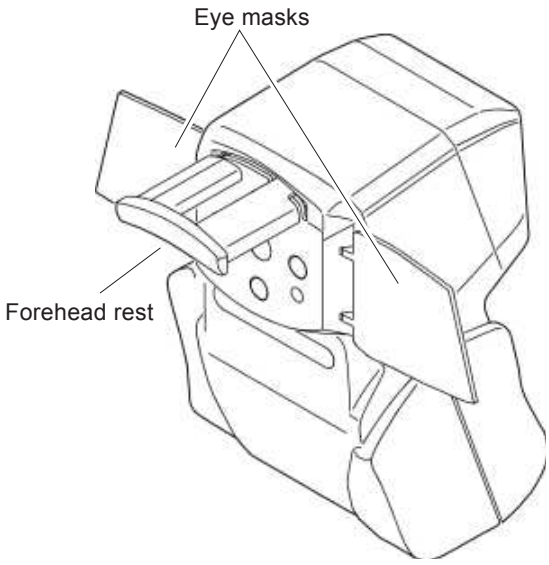

K mode ••• KM measurement

Values are not displayed for the AR measurement items.



**5. Prepare the patient and measuring unit.**

1) Draw out the forehead rest.
The push-type lock forehead rest can be drawn out once it is pushed lightly.
To prevent the forehead rest from popping out accidentally, you are recommended to perform alignment after drawing out the forehead rest.




2) Clean the forehead rest with a clean cloth such as a gauze.
If necessary, wipe with a cloth soaked in rubbing alcohol.

3) Open the eye mask.
Covering the idle eye with the eye mask stabilizes the other eye.

## NOTE

- The eye masks are configured to be detached by impact to prevent an injury or a device malfunction.
  If the mask is detached by impact, push it lightly to set, aligning the hinge part with the main body. (See "8.5 Attaching the Eye Mask".)

4) Instruct the patient to take off eye glasses or contact lenses and sit on a chair.
To measure a patient lying down, correct the CYL axis angle. See "4.7 90° Axis Correction Function" for details.

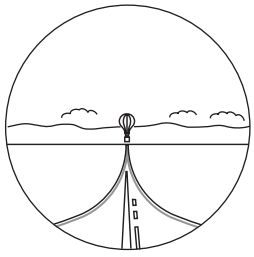
## NOTE

- Give the following explanation to help the patient relax before the measurement.
  "This device measures your eye with a weak infrared ray to find which kind of lens is suitable. The infrared ray does not harm your eyes."

**6. Perform alignment.**

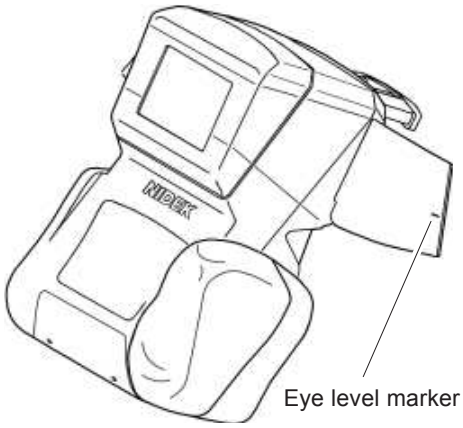
Confirm the luminous spots on the cornea on the LCD screen and perform alignment until the central corneal luminous spot is placed inside the target.

1) Instruct the patient, “Look through the measuring window. You will see a picture of a balloon, watch the center of it without straining.”



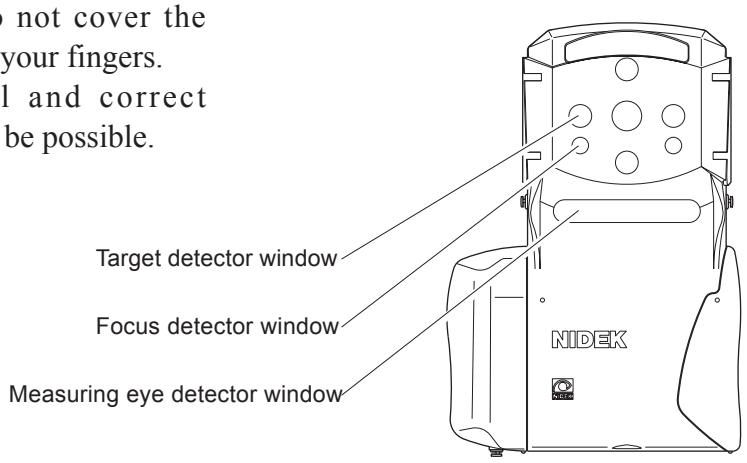
Scenic picture with balloon

2) Bring the measuring unit close to the patient’s eye and place the forehead rest against the forehead (top of eyebrow).
In this case, the eye level marker acts as a guide for the vertical position.

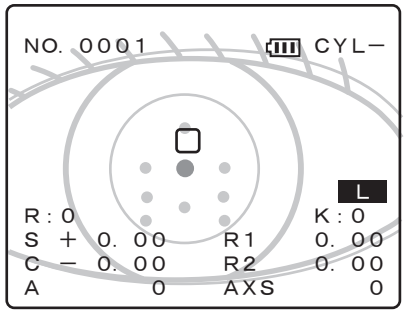



## NOTE

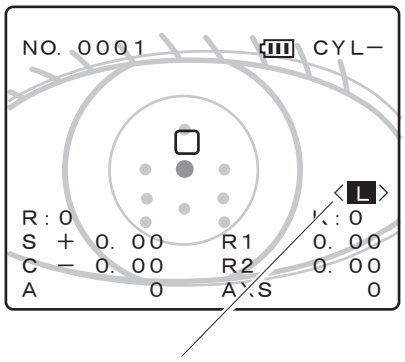
- When holding the measuring unit with your left hand too, do not cover the detection windows with your fingers.
  Detection will fail and correct measurement may not be possible.



3) Adjust the position of the measuring unit so that the patient's eye appears on the LCD screen.
Adjust the focus with back and forth movements (focus on the patient's eye).
Either side of the patient's eye may be measured first.



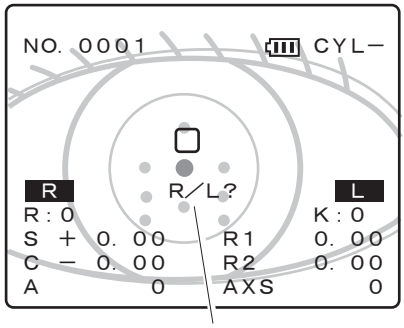

4) Make sure that the left-eye or right-eye indication of the measuring eye is properly shown.
Normally, the left eye or right eye is automatically detected, but detection may not occur properly depending on the condition of the measuring eye.
In this case, press the R/L selection button (R/L) to select the applicable eye.
When the manual setting is completed, the indication changes from **R**/**L** to <**R**>/<**L**>.




Indication of measuring eye
"< >" mark indicates the right eye or left eye has been specified manually.

# NOTE

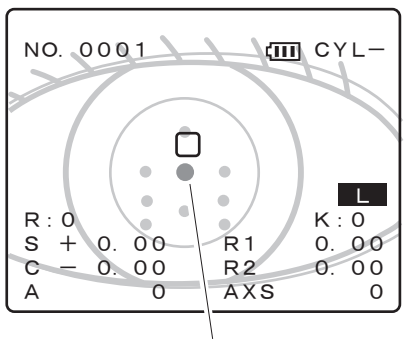
- **Error message function of R/L auto detection**
The R/L auto detection may not normally work under such a specific condition that the patient wears a gauze mask. In this situation, **R** and **L** flashes and "R/L?" is displayed for an error message.
The measurement does not start when the error message is displayed.




"R/L?" error message

If the R/L auto detection is normally performed by removing the mask, or R or L is manually set with the R/L selection button (R/L), the measurement can be started.

5) Perform fine alignment.
Adjust the position of the measuring unit until the corneal luminous spot is placed inside the target "□".

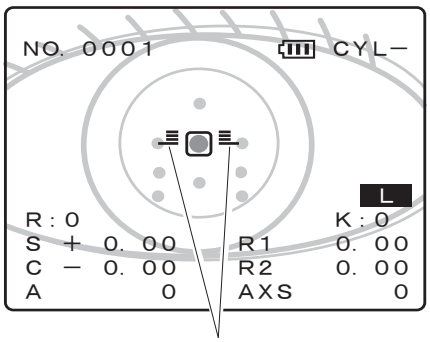



Corneal luminous spot on patient's eye

**7. Adjust the focus.**

When the corneal luminous spot is placed inside the target, the focusing indicator appears.
If the focusing indicator does not appear, it means that the eye is not positioned in the range of focus detection.

Adjust the focus, paying attention to keep the measuring unit horizontal to the patient and not to misalign the target. Tilt will cause an error in the AXIS value.



Focusing indicator

1) Move the measuring unit back and forth until the focusing indicator shows the best state "−□−".

Too close to the patient's eye.
The bar increases as the measuring unit is moving closer to the patient's eye (maximum four bars).

Move the measuring unit away from the patient's eye.

Best state.
One bar is shown on each side.

Bring the measuring unit close to the patient's eye.

Too far from the patient's eye.
The bar increases as the measuring unit is moving away from the patient's eye (maximum four bars).

## NOTE

- The measurement starts automatically when the eye is aligned in the horizontal and vertical directions and the eye is focused.
- The device may not measure correctly if the eyelashes are on the measuring ray bundle. In this situation, instruct the patient to open his/her eye wide. If the patient cannot open wide, lift the patient's lid, paying attention not to press against eyeball.
- When data exceeds the measurable limit, the following error code will appear. (Measurable range over error)
  Err + o ..... The spherical power is over the measurable limit of the + side.
  Err – o ..... The spherical power is over the measurable limit of the – side.
  Err c o ..... The cylindrical power is over the measurable limit.

**8. The measurement starts automatically when the eye is aligned and focused. (Auto-shot function)**

When the eye is aligned and focused, a beep will be produced to indicate that the measurement has started.

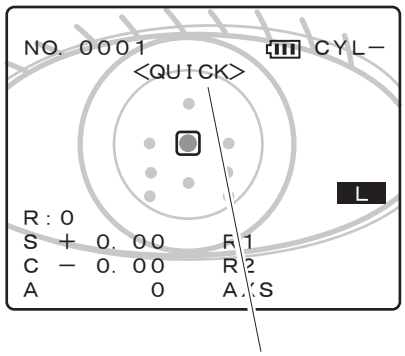
The measurement procedure differs according to the measurement mode. See the following for details

"4.4 AR (refractive error) & KM (corneal radius curvature) Measurements (R/K mode)"
"4.5 AR (refractive error) Measurement (R mode)"
"4.6 KM (corneal curvature radius) Measurement (K mode)"

**O QUICK measurement mode**

Normally, the best state for the measurement is automatically detected and then the measurement starts. However, accurate detection may not occur in the measurements for those who move their eyes vigorously, children, and those who have eye anomalies, etc. If the auto-shot function is not working, it is easier to make a measurement in the QUICK measurement mode. Press the start button ⟨◇⟩ again in the measurement mode to place the device in the QUICK measurement mode.

In the QUICK measurement mode, the KM measurement does not start but the AR measurement starts.
"<QUICK>" appears in the upper part of the screen, which represents that the QUICK measurement mode is set.
Adjust the position of the measuring unit until the central luminous spot of the cornea is placed inside the target and adjust the luminous spot to a sharp focus since the focusing indicator is not shown.
Press the start button ⟨◇⟩ again to cancel the QUICK measurement mode.
Take note that dispersions in the values of the QUICK measurement mode may be increased, compared to the normal measurement mode.




Indication of the QUICK measurement mode

* In the R/K mode, the KM measured values are not displayed.

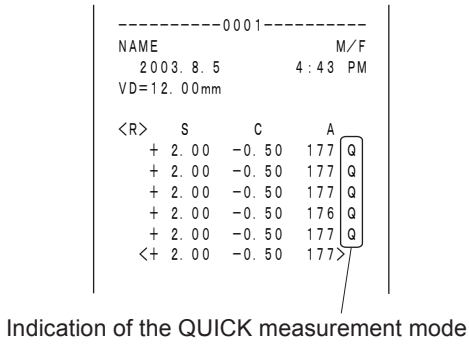
# NOTE

- In the QUICK measurement mode, measurement starts even if a luminous spot other than the corneal luminous spot is placed inside the target "□". In such a case, the measurement accuracy may decrease. Adjust the measuring unit so that the corneal luminous spot is placed inside the target.

- In the QUICK measurement mode, the fogging mode is automatically set to "HANDHELD" regardless of the setting of the "38. FOG MODE" parameter. See "6.1 Parameter Setting" for "FOG MODE".

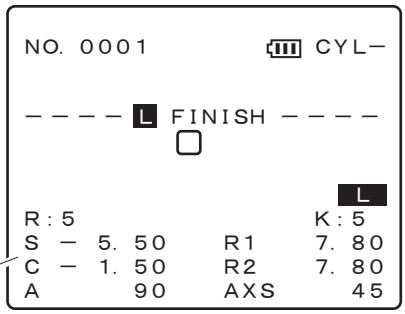
○ **Printout sample in QUICK measurement mode**

When printing is performed, "Q" that indicates measurement performed in QUICK measurement mode is shown to the right of data.




**9. When each eye is measured more than five times and the data is stable, "FINISH" appears and the measurement is completed. (For the AI mode)*1**

The latest values is displayed in the lower part of the screen with the measurement count.




## NOTE

- Press the start button (◇) to measure the same patient's eye again.
  "FINISH" will disappear and the device will return to the measurement mode.
- The device can store up to ten measurements for the left eye and right eye.
  If ten measurements are exceeded, the oldest data will be cleared in turn.

When the AI mode is set to NO, the latest values are displayed.
Determine whether or not to finish the measurement, judging from the measured values and measurement count.

*1 <AI mode>
This is a mode in which the measurement is automatically completed after five or more measurements if the data values are stable without variations in the AR & KM measurements.

**10. Start the measurement of the other eye in the same manner.**

Perform in the same manner from Step 6.

When the measuring unit is brought close to the patient's eye and the patient's eye is detected, the screen will change to the measurement mode.

## NOTE

- If the measurement fails, the following may be the main causes. Find the cause if the measurement fails again.
  a. Patient blinked during the measurement.
  b. Eye lid or eyelash is on or around the target.
  c. The patient's pupil is small.
  (Let the patient be in a dark room for a while and wait until the pupil diameter becomes large enough for the measurement.)
  d. Retinal reflection is extremely low due to an optical disease such as a cataract.
  e. There is an extreme distortion on cornea.

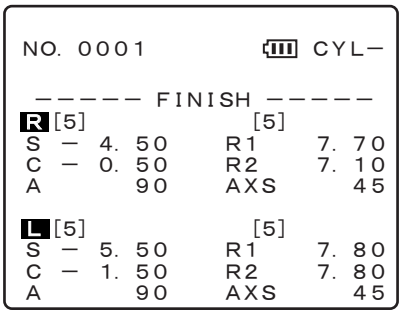
- Instruct the patient to close his/her eye before starting the next measurement.
  Let the eye rest to avoid a measurement failure by blinking.

When not measuring the other eye, skip to Step 11 and print the data out.

## NOTE

- When the parameter is not set to "AI mode", you are recommended to take about five shots of the AR measurement. If the measured results are not stable, take some additional shots.

When the measurement of both eyes is completed, the measured results (median values) will be displayed.
(The latest values are displayed when median values have not been obtained.)

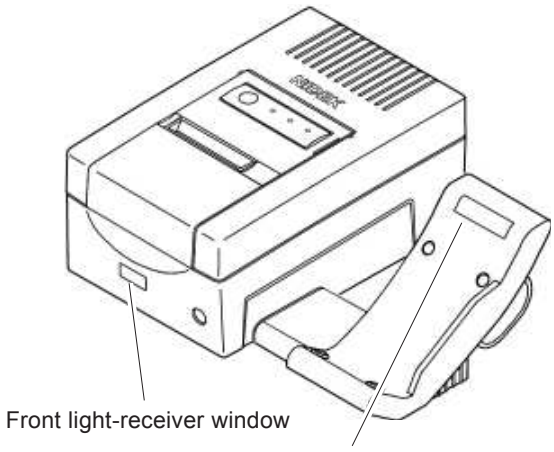


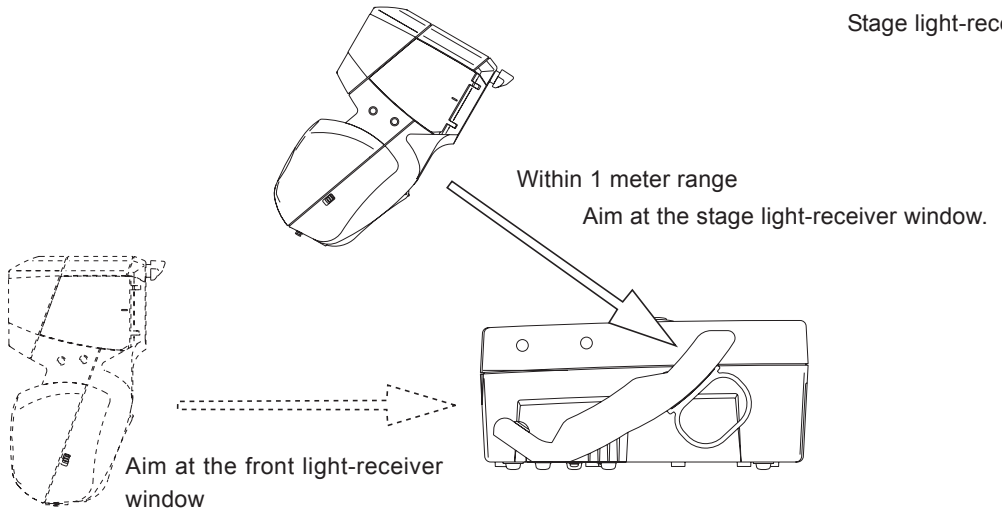

Screen after measurement of both eyes

**11. Print the measured results.**

Press the print button (), aiming the measuring window on the measuring unit at the light-receiver window on the station.
Or put the measuring unit onto the stage and press the print button ().
Before printing, make sure that the station turns on.

If holding the device, perform the operation within 1 meter.




Concurrently with the wireless communications, printing is performed by the station.
A maximum of ten measurements of both eyes in each KM and AR measurement can be printed.
After printing, the measuring unit goes into the standby mode.

## ⚠CAUTION

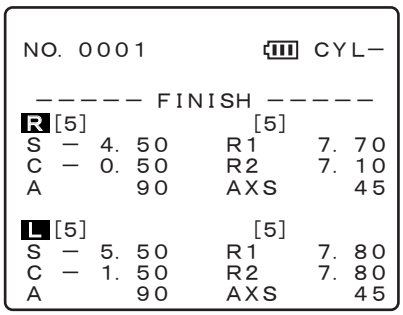
- When printing is performed with hand held (wireless communications), keep your hand away from the light-receiver window of the station.
  Proper printing may not be performed due to interference of optical communications.

## NOTE

- There are two light-receiver windows on the station, at the front and on the stage. Communications are possible by aiming the measuring unit at either side.
- The same data can be printed any number of times until the next eye is measured.
- When the parameter “PRINT” is set to “AUTO”, printing is performed by aiming the measuring unit at the station without pressing the print button ().

**12. After printing, press the start button ◇ to start the measurement continuously.**

The device displays the measured results in standby to save power.
When only one eye is measured, 0 is displayed for the value of the other eye side.




Pressing the start button ◇ is recommended when the next patient is ready.
Perform the procedure from Step 5 again.

## NOTE

- To measure another patient, be sure to start the measurement after printing or storing the median values in memory.

**13. To finish the operation, press the power button ⏻ to turn off the measuring unit.**

Turning off the power frequently to save the battery power is recommended except in the continuous measurement.
If the device is not used for a while, the power will turn off automatically through the auto-off function after three minutes without pressing the power button ⏻ (when the parameter "23: AUTO-OFF" is set to "YES").

**14. Place the measuring unit onto the stage of the station.**

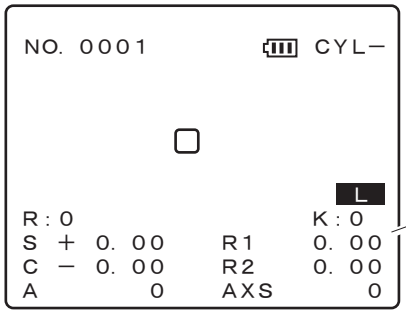
## NOTE

- Do not put the measuring unit onto a table, wagon, etc. other than the station.
  Accidentally dropping the measuring unit may cause an injury or a device malfunction.

**15. When the device will not be used any more, turn off the station and put the dust cover on the device.**

# 4.4 AR (refractive error) & KM (corneal curvature radius) Measurements (R/K mode)

This is a mode for the AR (refractive error) and KM (corneal curvature radius) measurements continuously.
When the R/K mode is selected by pressing the R/K selection button (R/K), the refractive error indications (S, C, A) and corneal curvature radius indications (R1, R2, AXS) are displayed on the screen.




As for KM measured values, the following can be set according to the parameter setting.
AVE: Average of R1 and R2 CYL: Corneal cylindrical power
AXS: Corneal cylinder axis angle

**1. Start the measurement.**

The measurement starts automatically when the eye is aligned in the horizontal and vertical directions and focused
The eye is measured in the following order:

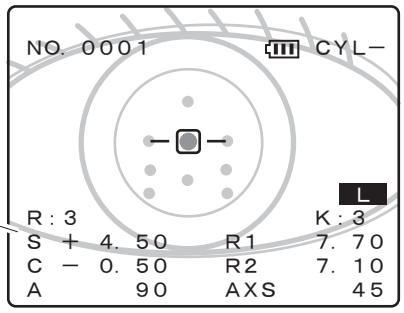
## NOTE

- Instruct the patient not to blink during the measurement. In addition, instruct the patient not to blink and open his/her eyes right before the measurement to avoid a measurement failure.
- Instruct the patient to open both eyes wide during the measurement.
  Closing one eye may cause an unstable fixation and the other eye will not open wide.

1) The KM measurement starts.
↓
2) A short beep is produced and then the KM measured values and measurement count is displayed.
↓
3) The chart is fogged.
↓
4) The AR measurement starts.
↓
5) A short beep is produced and the AR measured values and measurement count is displayed.
↓
6) After this, the device returns to Step 1) and the KM measurement and AR measurement are repeated when the eye is aligned and focused.
(In the second measurement or later, additional fogging is automatically performed only when the fogging condition of the patient eye could not be detected.)

When the parameter "AI MODE" is set to "YES", the measurement is automatically completed after five or more measurements if the data values are stable (small variations). When the parameter "AI MODE" is set to "NO", the measurement is repeated until the device goes out of alignment and/or focus.

Indication sample during the measurement
The latest values are displayed after three times of each AR measurement and KM measurement.




# NOTE

- When the device goes out of alignment and/or focus during the measurement, the measurement will be interrupted. If the measurement is performed again, the measured data is stored in addition to the previous measured results.

**2. Finish the measurement.**

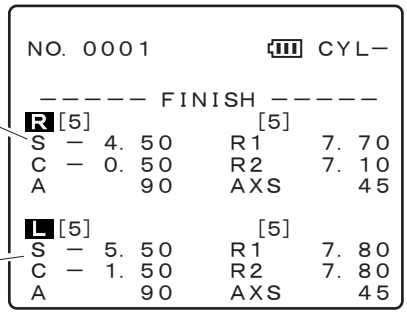
**○ When the parameter "AI MODE" is set to "YES", the measurement is automatically completed after more than five times for both eyes if the data values are stable (small variations).**

The median values and measurement count will be displayed on the screen.

Measured results of right eye

The median values of each measurement will be displayed.
(The latest values when the median values have not been obtained.)
The measurement count shows the number of data measured and stored.

Measured results of left eye




# NOTE

- Press the start button ⟨◇⟩ to measure again.
  "FINISH" will disappear and the device will be placed in the measurement mode.

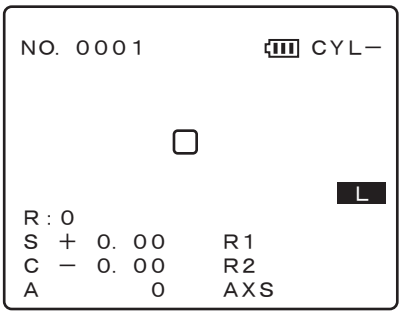
**○ If the parameter "AI MODE" is set to "NO", finish the measurement by moving the measuring unit away (out of alignment and/or focus) from the patient's eye.**

In this situation, "FINISH" does not appear, so determine whether or not to finish the measurement judging from the measurement count. The latest values are displayed on the screen.

If the values of three or more measurements are obtained, the median values are printed.

# 4.5 AR (refractive error) Measurement (R mode)

This is a mode for the AR (refractive error) measurement.
When the R mode is selected by pressing the R/K selection button (R/K), the following screen is displayed.




**1. Start the measurement.**
The measurement will start automatically when the eye is aligned in the horizontal and vertical directions and focused.
The eye is measured in the following order:

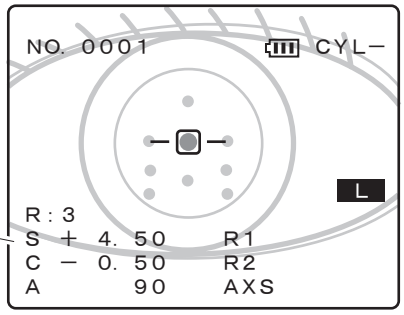
## NOTE

- Instruct the patient not to blink during the measurement. In addition, instruct the patient not to blink and open his/her eyes right before the measurement to avoid a measurement failure.
- Instruct the patient to open both eyes wide during the measurement.
  Closing one eye may cause an unstable fixation and the other eye will not open wide.

1) The chart is fogged.
   ↓
2) The AR measurement starts.
   ↓
3) A short beep is produced and then the AR measured values and measurement count are displayed.
   ↓
4) After this, the device returns to Step 1) and the AR measurement is repeated while the eye is aligned and focused.
   (In the second measurement or later, additional fogging is automatically performed only when the fogging condition of the patient eye could not be detected.)

When the parameter "AI MODE" is set to "YES", the measurement is automatically completed after five or more measurements if the data values are stable (small variations). When the parameter "AI MODE" is set to "NO", the measurement is repeated until the device goes out of alignment and/or focus.

Indication sample during the measurement
The latest values are displayed after three times of the AR measurement .




**2. Finish the measurement.**

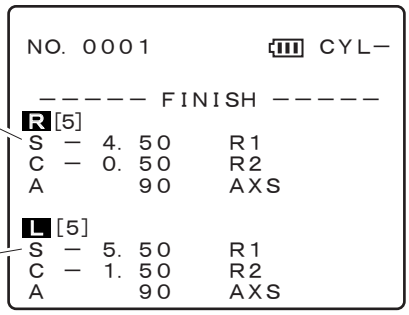
**O When the parameter "AI MODE" is set to "YES", "FINISH" appears and the measurement is automatically completed after five or more measurements if the data values are stable (small variations).**

The median values and measurement count are displayed on the screen.

Measured results of right eye

The median values of each measurement are displayed. (The latest values when the median values have not been obtained.)
The measurement count shows the number of data measured and stored.

Measured results of left eye




# NOTE

- Press the start button ⟨◇⟩ to measure again.
  "FINISH" disappears and the device goes into the measurement mode.

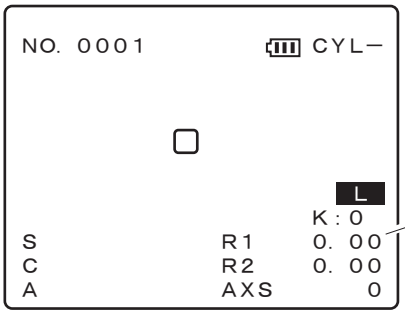
**O When the parameter "AI MODE" is set to "NO", finish the measurement by moving the measuring unit away (out of alignment and focus) from the patient's eye.**

In this situation, "FINISH" does not appear, so determine whether or not to finish the measurement judging from the measurement count. The latest values are displayed on the screen.

If the values of three or more measurements are obtained, the median values are printed.

# 4.6 KM (corneal curvature radius) Measurement (K mode)

This is a mode for the KM (corneal curvature radius) measurement.
When the K mode is selected by pressing the R/K selection button (R/K), the following screen is displayed.




As for KM measured values, the following can be set according to the parameter setting.
AVE: Average of R1 and R2 CYL: Corneal cylindrical power
AXS: Corneal cylinder axis angle

**1. Start the measurement.**

The measurement starts automatically when the eye is aligned in the horizontal and vertical directions and focused.
The eye is measured in the following order:

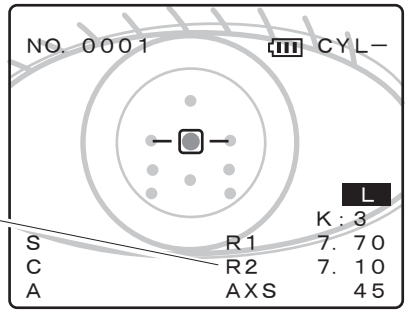
## NOTE

- Instruct the patient not to blink during the measurement. In addition, instruct the patient not to blink and open his/her eyes right before the measurement to avoid a measurement failure.
- Instruct the patient to open both eyes wide during the measurement.
  Closing one eye may cause an unstable fixation and the other eye will not open wide.

1) The KM measurement starts.
   ↓
2) A short beep is produced and then the KM measured values and measurement count are displayed.
   ↓
3) After this, the device returns to Step 1) and KM measurement is repeated while the eye is aligned and focused.

When the parameter "AI MODE" is set to "YES", the measurement is automatically completed after five or more measurements and the data is stable (small variations). If the parameter "AI MODE" is set to "NO", the measurement is repeated until the device goes out of alignment and/or focus.

Indication sample during the measurement
The latest values are displayed after three times of KM measurement.




**2. Finish the measurement.**

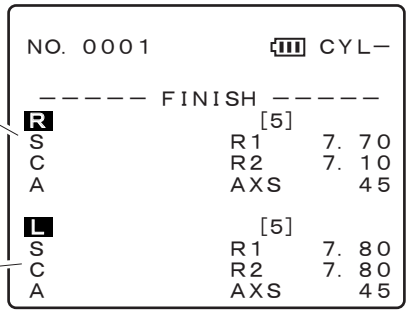
**O If that the parameter "AI MODE" is set to "YES", "FINISH appears and the measurement is automatically completed after five or more measurements and the data is stable (small variations).**

The median values and measurement count are displayed on the screen.

Measured results of right eye

The median values of each measurement are indicated. (The latest values when the median values have not been obtained.)
The measurement count shows the number of data measured and stored.

Measured results of left eye




# NOTE

- Press the start button ⟨◇⟩ to measure again.
  "FINISH" disappears and the device goes into the measurement mode.

**O When the parameter "AI MODE" is set to "NO", finish the measurement by moving the measuring unit away (out of alignment and focus) from the patient's eye.**

In this situation, "FINISH" does not appear, so determine whether or not to finish the measurement judging from the measurement count. The latest values are displayed on the screen.

If the values of three measurements or more are obtained, the median values are printed.

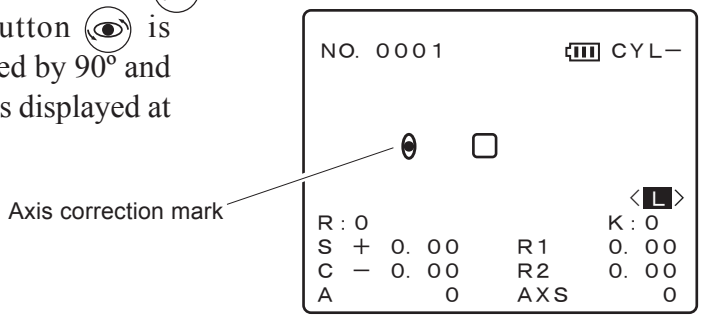
# 4.7 90º Angle Correction Function

This device is configured to display the cylinder axis indication properly when the patient's eye is measured while facing the device. If the measuring unit is tilted 90º to measure a patient who is lying down from the side, the angle of cylinder axis is corrected 90º.

## NOTE

- Do not use the forehead rest when the eye is measured from the side.
  Pressure may be applied to the idle eye.
  Closing the eye mask is recommended.

1. **Press the angle correction button (👁) before performing alignment in Step 6 of "4.3 Measuring Procedures".**
   The measurement either from the right side or left side is performed in the same way. When the eye is measured at the position of 180 degree (behind the patient), the measurement is possible without pressing the angle correction button (👁).
   When the angle correction button (👁) is pressed, the axis angle is corrected by 90º and the AXIS correction mark ( ◉ ) is displayed at the left of the screen center.




2. **Press the R/L selection button (R/L) to set the measuring eye.**
   Let the R/L indication on the LCD screen show the eye side to be measured.
   When the eye is measured from the side, the R/L auto-detection does not work. Press the R/L selection button (R/L) to specify R or L (displayed with <R>/<L>) manually.

3. **Start the measurement in the same manner with normal measurement.**
   Set the measuring unit so that it faces 90º against the patient.
   Place your left hand on the patient's face and measuring unit to stabilize the position of the measuring unit.

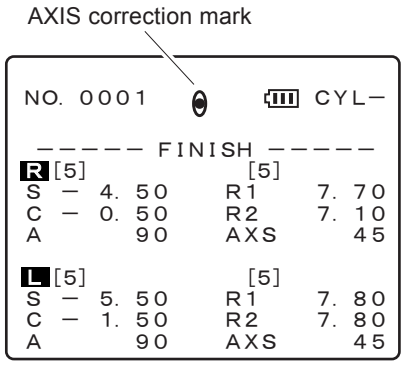
## ⚠CAUTION

- When bringing the measuring unit close to the patient's face, pay attention not to contact the patient's face.
  When the eye is measured without the forehead rest, the measuring unit may contact the face accidentally.

## NOTE

- When the other eye is measured without the angle correction after one eye has been measured with the angle correction, press the angle correction button to cancel the AXIS correction function.

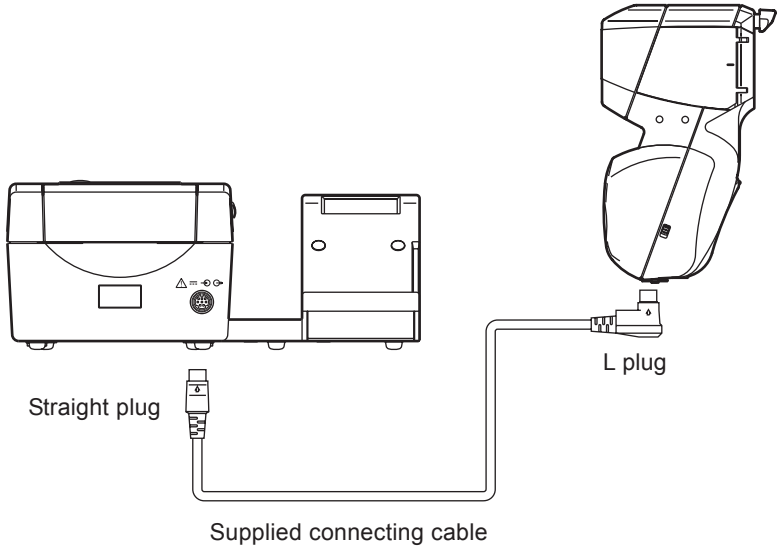
When the measured results are displayed, the AXIS correction mark is displayed at the right of the patient No.



# 4.8 Measurement Using Cable

The measuring unit is normally battery-operated. If the battery is getting weak, the measuring unit can be used by deriving power from the station via the supplied cable.
When the battery is installed in the measuring unit, the battery charging starts as soon as the measuring unit is turned off.

1. **Connect the straight plug of the cable to the connector on the station and connect the L plug on the measuring unit.**
   Align the plug with the connector and insert the plug.
   The straight plug and the L plug can be connected to each connector in reverse.




2. **Turn on the power switch (½) of the station.**

3. **Press the power button ⏻ on the measuring unit.**
   After "HANDY REF/KERATOMETER ARK-30" appears, the measuring unit goes into the standby mode.

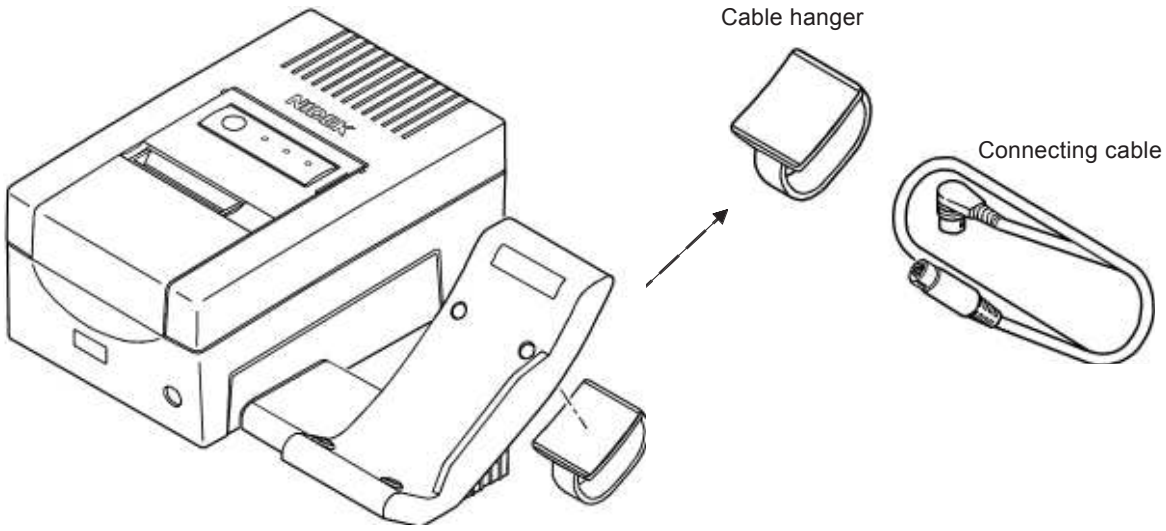
4. **In the following measurements, operate the device in the same manner as a battery-operated one.**

## NOTE

- When the device is used via the cable, there is no need to aim the measuring unit at the light-receiver window of the station when printing.

**5. After use, store the cable in the cable hanger.**

The cable hanger is attached to the rear side of the stage by a magnet. Take off the cable hanger and pass the cable through it. Then, set the cable hanger as it was.




## ⚠CAUTION

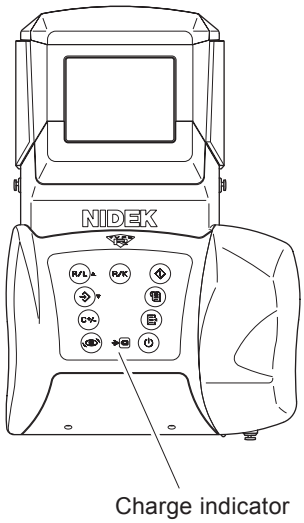
- Pay attention to the position between the station and measuring unit so as not to pull the station with the cable.
  Accidentally dropping the station may cause an injury or a device malfunction.

**○ When charging is performed with the battery installed in the measuring unit**

When the battery is installed in the measuring unit, charging starts as soon as the measuring unit is turned off. (In this case, do not turn off the station.)

During charging, the charge indicator (→ ⊏) on the lower side of the control panel flashes. It takes 120 - 150 minutes to fully recharge the battery (Takes much longer if the battery is deteriorated.)

When charging is completed, the charge indicator (→ ⊏) will stay illuminated.




## ⚠ CAUTION

- Do not remove the battery from the measuring unit when charging.
  A malfunction may result.

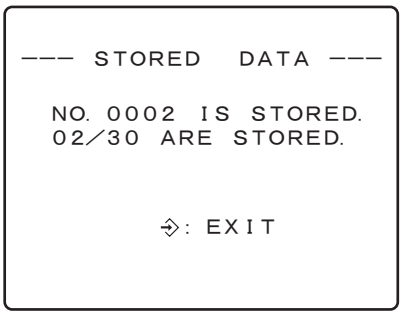
# 4.9 Storing and Printing Measured Results

## 4.9.1 Storing measured results

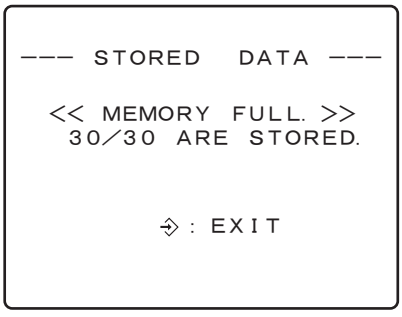
The data memory function allows you to store measured results of 30 patients (60 eyes). Median values and individual measured values (maximum ten times for each) can be stored in memory as measured results.
To make measurements continuously without printing every measurement, store the measured results. When the next eye is measured, the previous results will be cleared.
In this case, record the patient No. to keep the correspondence between the patient and data.
Storage of the measured results is possible either before or after printing.
The measured results in memory will be maintained even if the battery is fully discharged.

1. **Press the memory button (→) after the measurement ("FINISH" on the screen).**
   The measured results will be stored as well as the date, time, and patient No.
   **For the R/K mode**
   The measured results of refractive error measurement data of both eyes and measurement data of the corneal curvature are stored.
   **For the R mode**
   The measured results of refractive error measurement data of both eyes are stored.
   **For the K mode**
   The measured results of corneal curvature measurement data of both eyes are stored.

2. **"No. XXXX IS STORED. □/ 30 ARE STORED." appears.**
   "XXXX" represents the patient No. of the stored data.
   "□/ 30" represents the number of stored data and the number of maximum storage data (30 patients).
   The screen returns to the measured result indication. (can be returned by pressing the memory button (→).)




   If the number of stored data has reached the maximum (30), a beep is produced and "MEMORY FULL. 30/30 ARE STORED." appears. The data will not be stored.
   Perform the memory printing (printing of all stored data) and clear the measured results in memory, and then start the measurement and storage.



## NOTE

- Once the measured results are stored in memory with the memory button, pressing the memory button does not store data until the next measurement is completed. (so as not to store the same value.) In this situation, "□/30 ARE STORED." is displayed.
- In the sagittal radius measurement, measured results of 30 patients (60 eyes) cannot be stored in memory.

**○ Confirmation of the number of stored data**

To confirm the number of stored data, press the memory button in the state the measurement has not been completed. (The measurement count on the screen shows 0.)

"□/30 ARE STORED." appears. The screen returns to the original indication a few seconds later.

Pressing the memory button also returns to the original indication.

## NOTE

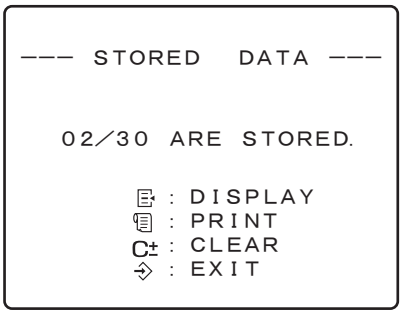
- Confirm the number of stored data after making sure that the measurement has not been completed. (The measurement count on the screen shows "0".)

  If the memory button is pressed when the measurement has already been completed and measured data are displayed, the measured results are stored. Only the accidentally stored data cannot be cleared.

## 4.9.2 Printing stored data

All data in memory can be printed. See "4.9.4 Confirming measured results in memory" for printing each data.

1. **Hold the memory button down until "□/30 ARE STORED." appears on the LCD screen (about two seconds).**




2. **Put the measuring unit onto the stage of the station and press the print button.**
The contents of all data displayed in "□/30" are printed.
Upon communicating, printing is performed from the station.
See "5. Printout" for details.

## NOTE

- The description to be printed depends on the settings of the parameters "14: AR PRINT" and "15: KM PRINT".
  "ALL" ..... Median values + Individual measured values
  "SHORT" .. Median values only

- When ten-time measured values of both eyes of 30 patients are stored, memory printing may not be performed because data is too large, depending on the setting of the parameter "14: AR PRINT", "15: KM PRINT", or "27: I/F FORMAT".
  In such a case, set the parameters "15: KM PRINT" and "27: I/F FORMAT" to "SHORT". It makes memory printing of all data of 30 patients possible.

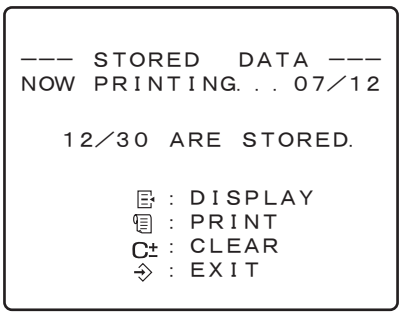
- In the CYL mode, all data with the present-displayed CYL mode is printed.

- For the memory printing (printing of all stored data), do not perform the hand-held wireless communication.
  Data cannot be transmitted correctly due to the large amount of data. When the measuring unit and station are connected via the cable, there is no need to put the measuring unit onto the station.

- Pressing the memory button returns to the measurement screen without printing.

**3. The number of data transmissions is counted on the LCD screen during printing.**

During the data transmission, "NOW PRINTING...□/□" is displayed and "□/□ ARE STORED." flashes.
"□/□" indicates "The number of data transmitted/The total number of data to be stored".
The sample on the right shows that 12 data are being transmitted and 7 of them have been transmitted.




**4. Make sure that the data transmission is completed for printing out.**

If "NOW PRINTING..." is not displayed, it means that the data transmission was completed. The measuring unit can be operated even while the station is printing.

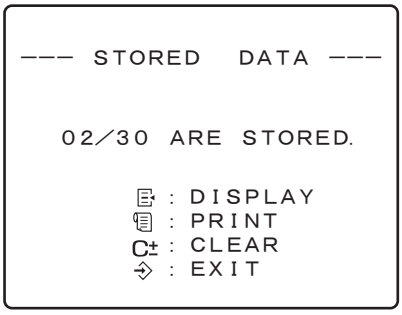
## NOTE

- The same printing can be performed any number of times until the stored data is cleared.
- When the RT, etc. is connected, printing and data transmission are performed at the same time.

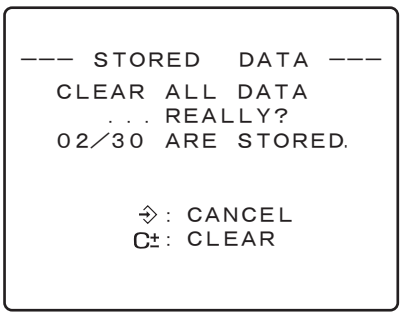
# 4.9.3 Clearing measured results in memory

To clear all of the measured result data in memory, follow the procedure below.

1. **Hold the memory button (⇨) down until "□/30 ARE STORED." appears on the LCD screen (about two seconds).**

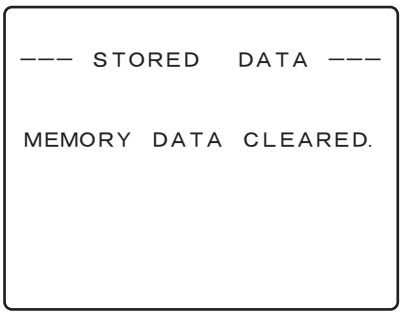



2. **Hold the CYL mode selection button (C+/-) down until "CLEAR ALL DATA ...REALLY? □/30 ARE STORED." appears on the LCD screen (about two seconds).**

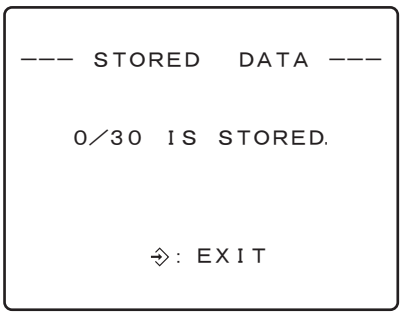



3. **Press the CYL mode selection button (C+/-) again.**
   All stored data is cleared and "MEMORY DATA CLEARED." appears.

   To cancel the data clear, press the memory button (⇨).
   The screen in Step 1 is displayed.



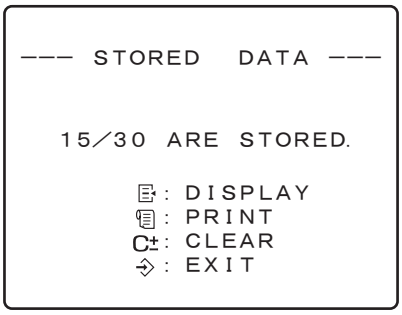

4. **After a while, "0/30 IS STORED." appears. Press the memory button (⇨) to return to the standby screen (display in blue).**



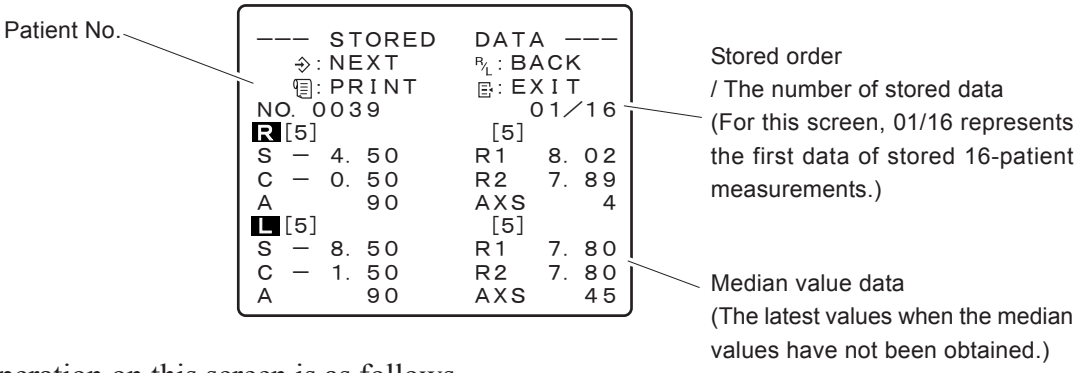
# 4.9.4 Confirming measured results in memory

To confirm the stored data, follow the procedure below. One data of the measured results on the screen can be printed while displayed.

1. **Hold the memory button down until "□/ 30 ARE STORED." appears on the LCD screen (about two seconds).**




2. **Press the parameter setting button.**
The stored median value data (The latest values when the median values have not been obtained) will be displayed.
To confirm the individual measured values, set the parameters "14: AR PRINT"and "15: KM PRINT" to "ALL" and then print it out.




The operation on this screen is as follows.

Memory button ..... Displays the next median value data.
R/L selection button ..... Displays the previous median value data.
Print button ..... Prints the data on the displayed screen.
Parameter setting button .... Exits from this screen and returns to the screen in Step 1.

## NOTE

- The description to be printed depends on the settings of the parameters "14: AR PRINT" and "15: KM PRINT".
  "ALL" ..... Median values + Individual measured values
  "SHORT" .. Median values only

# 4.10 Connection with External Devices

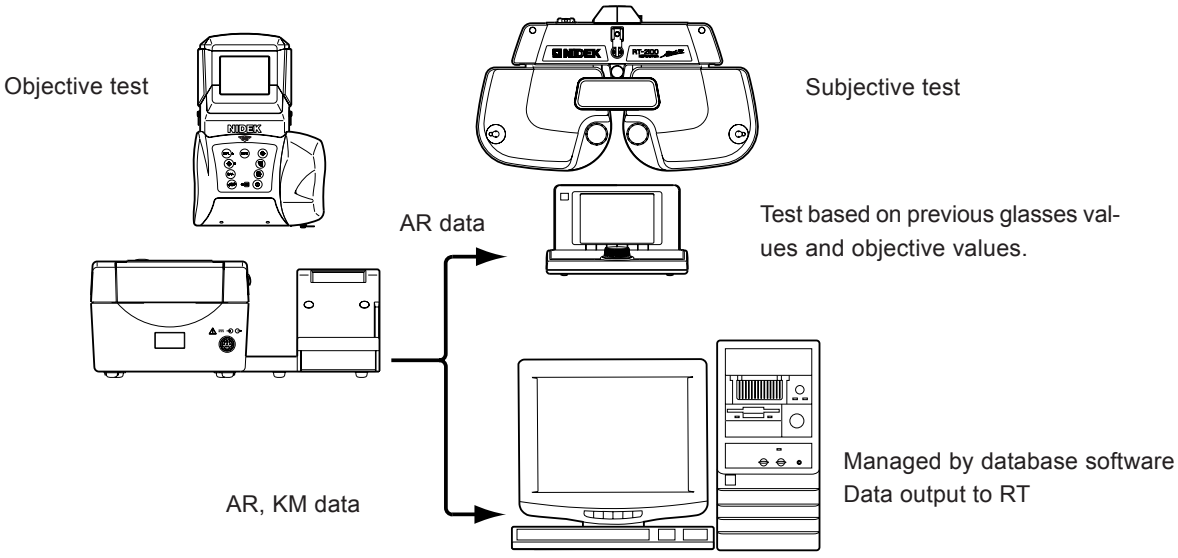
As an external device, the ARK-30 outputs data to the NIDEK motorized refractor (hereafter referred to as RT), computer, and IC card reader/writer, and inputs data from the NIDEK lensmeter (hereafter referred to as LM).

## ⚠CAUTION

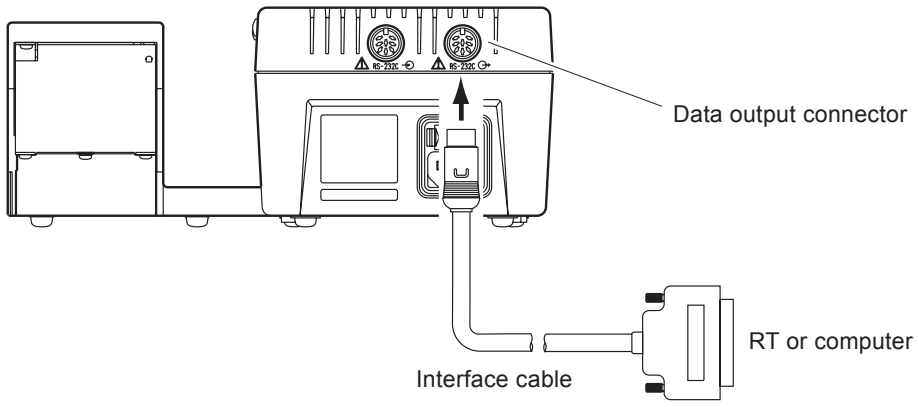
- When connecting the interface cable, be sure to turn off each device.
  Connecting the cable with the power on may cause a malfunction.

## 4.10.1 Output to the RT or computer

Any printed data can be output to the RT or a computer. AR data transmitted to the RT is used in subjective tests as objective measurement values. Data transmitted to a computer can be managed by database software for each system.




Data communications are performed by the RS-232C interface.
Connect the data output connector (⊖) on the station to the RT (or computer) via the optional interface cable.



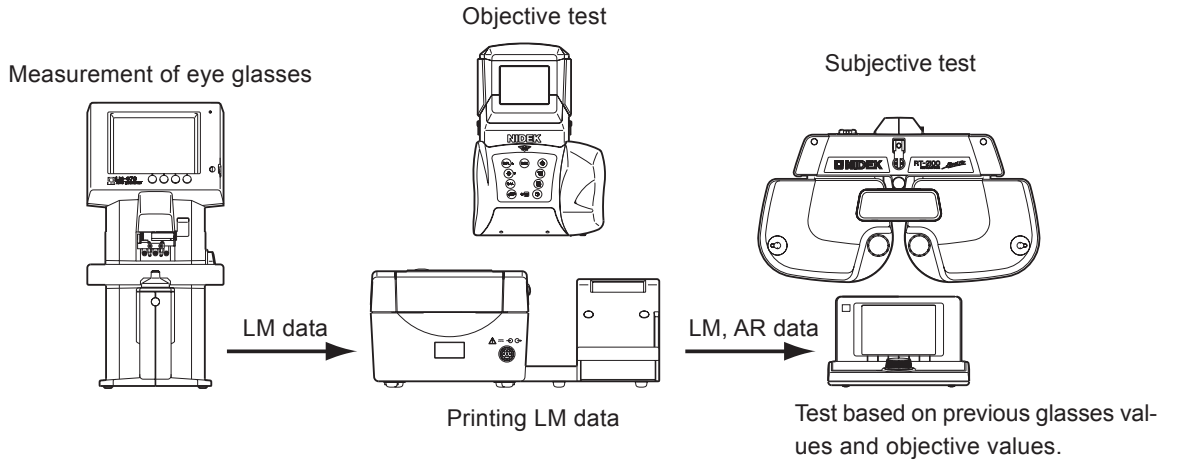
1. **After the measurement, press the print button on the measuring unit.**
   Perform the operation in the same manner as normal printing.

2. **The station automatically transmits data to the RT (or computer). When the ARK-30 is connected to the RT, the station receives the data No. (ID No.).**
   When the ARK-30 is connected to a computer, the station does not receive the data No. (ID No.).

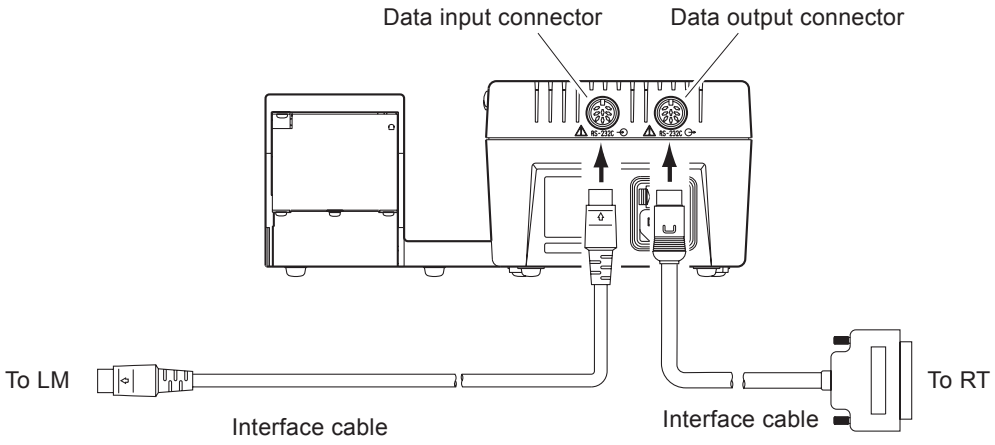
3. **Measured data will be printed.**
   When the device is connected to the RT, data No. (ID No.) is also printed.

# 4.10.2 Input from the LM

The ARK-30 prints the LM data by inputting the data measured with the LM and also outputs the LM data to the connected RT. (The lensmeter provided with this function is needed.)
The LM data transmitted to the RT is used in the subjective test as previous eyeglass values.




Connect the data input connector (⊖) on the station to the LM, and connect the data output connector (⊕) to the RT via the interface cables.




1. **After the lens measurement with the LM, press the print button on the LM.**

2. **The station receives data from the LM, prints the LM data, and transmits the data to the RT.**

# NOTE

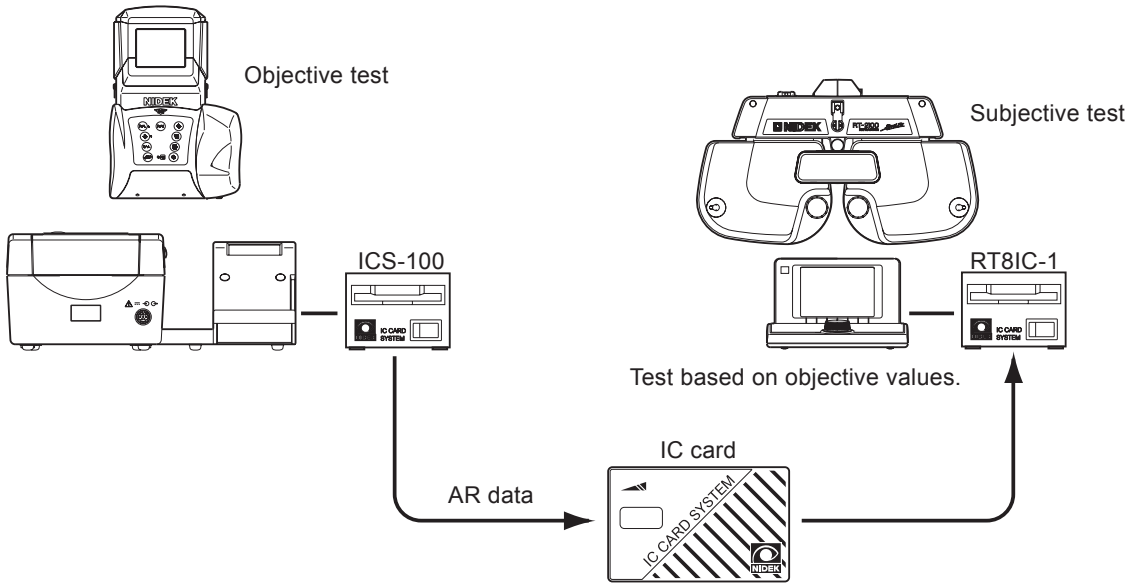
- When the device communicates with the LM, set the communication parameters of each device as follows:
  See the Operator's Manual for the setting method of each device.
  ○Parameter setting of ARK-30
  28: Baud Rate = 9600
  29: Bit Length = 8

  ○Setting of NIDEK lensmeter
  RS-232C = NIDEK
  Baud Rate = 9600
  Parity = Odd
  Data Bits = 8
  Stop Bits = 1

  When changing any setting of the ARK-30, perform printing.
  Upon printing, the parameter settings are transmitted to the station.

# 4.10.3 Output to the IC card Reader/Writer

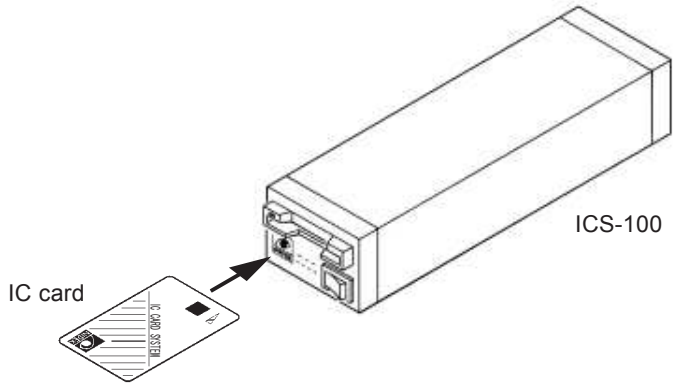
Measured data can be transmitted to the IC card.
Connect the data output connector (⊖▸) to the IC card Reader/Writer (ICS-100) via the interface cable.




There are two methods to transmit data to the IC card as follows: (Either method may be used. The difference is whether the IC card is inserted or not when the print button (📄) is pressed.)

**A. Inserting the IC card before the measurement**

1. **Insert the IC card into the IC card Reader/ Writer.**




2. **After the measurement, press the print button (📄) on the measuring unit.**
   Perform operation in the same manner as normal printing.

3. **AR data will be transmitted to the IC card and printed.**

4. **After the data is transmitted, the IC card is automatically ejected.**

**B. Inserting the IC card after the measurement**

1. **After the measurement, press the print button on the measuring unit.**
   Operate the device in the same manner as normal printing.

2. **The memory lamp ( ) lights up and the AR data is printed.**

3. **Insert the IC card into the IC card Reader/Writer.**
   The card may be inserted while the AR data is being printed.

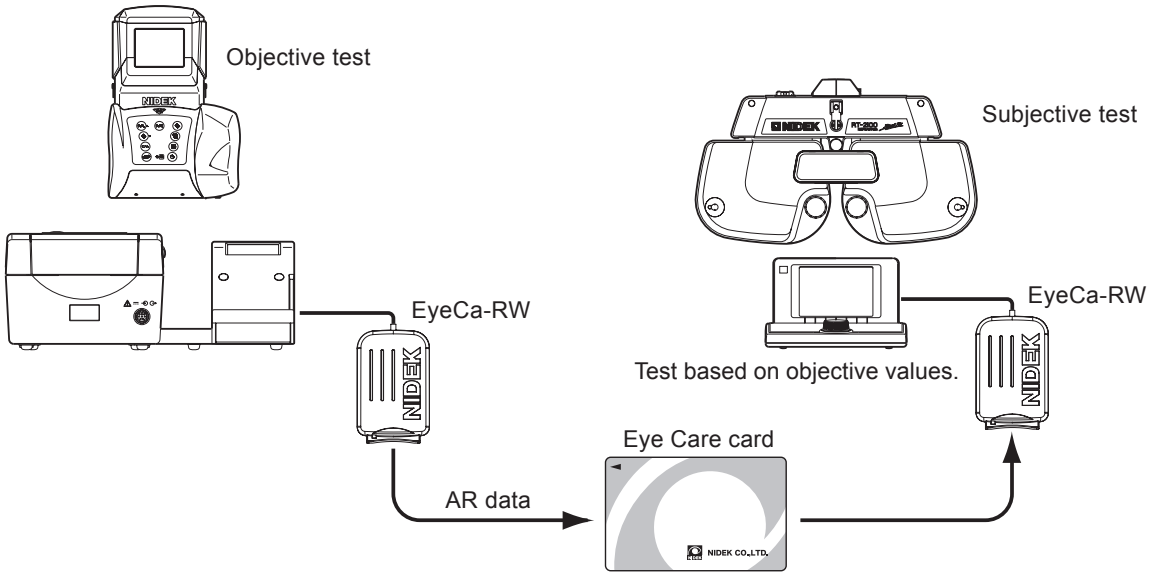
4. **The AR data is transmitted to the IC card and the IC card is automatically ejected after the data is transmitted.**
   If the IC card is inserted during printing, the printing is interrupted and the data is transmitted. After the data is transmitted, the printing resumes.

## NOTE

- Only the AR data can be transmitted via the IC card. The KM data cannot be transmitted via the IC card.

# 4.10.4 Output to the IC card Reader/Writer (EyeCa-RW)

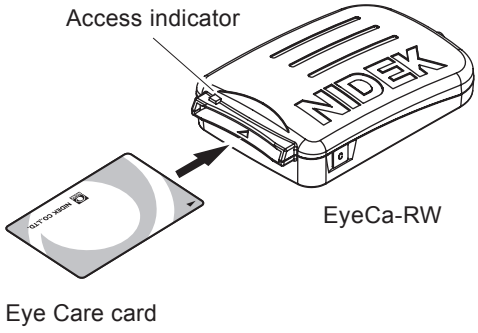
Measured data can be transmitted to the IC card (Eye Care card).
Connect the data output connector (⊖▸) to the IC card Reader/Writer (EyeCa-RW) via the interface cable.




There are two methods to transmit data to the Eye Care card; when measured data is printed and when measured data is not printed.

**A. When measured data is printed:**

1. **Insert the Eye Care card with no measured data in the ARK-30.**
   A short beep is produced and the access indicator illuminates in green.




2. **After the measurement, press the print button (🖹) on the measuring unit.**
   Perform operation in the same manner as the normal printing.
   The access indicator changes to the orange one, and the data is written to the Eye Care card.
   After the data has been written successfully, a short beep is produced and the access indicator flashes in green.

3. **After the access indicator of the EyeCa-RW has changed to the green flashing one, remove the Eye Care card.**

**B. When measured data is not printed:**

Set the parameter “PRINT” to “Manu.” or “NO” in advance.
See “6.1 Parameter Settings” for details.

1. **After measurement, insert the Eye Care card.**
   A short beep is produced and the access indicator illuminates in green. The access indicator changes to the orange one, and the data is written to the Eye Care card. After the data has been written successfully, a short beep is produced and the access indicator flashes in green.

2. **After the access indicator of the EyeCa-RW has changed to the green flashing one, remove the Eye Care card.**
   Data in the ARK-30 will be erased.

## NOTE

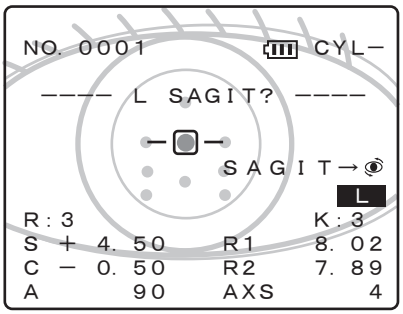
- See the Operator’s Manual supplied with the EyeCa-RW for the other procedures.

# 4.11 Sagittal Radius Measurement

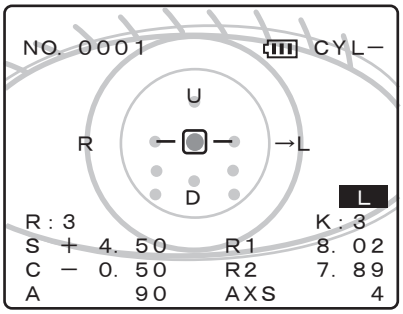
This measurement is not appropriate for Hand Held Measurement since the device shake disturbs the measurement. Use something to fix the patient's head such as the head rest of Slit Lamp, etc. Using the portable stand (option) is recommended.
Change the parameter settings of No.41, 42 and 43 for sagittal radius measurement. See "6.1 Parameter Settings" for the procedure.

1. **Put the patient's chin on the chin rest. Then ask him/her to put the forehead on the forehead rest.**
   The patient's head should be fixed to start this measurement.

2. **Start the KM measurement in the R/K mode or K mode.**
   When KM measurement has been made once or more, SAGIT→ is displayed on the screen.




3. **On condition that KM measurement has started, press the angle correction button .**
   The measuring mode changes to the Sagittal radius measurement mode: Indicators of L (Left), R (Right), U (Up), and D (Down) appear and the L blinks to show the position of the illuminated fixation lamp that the patient would see.



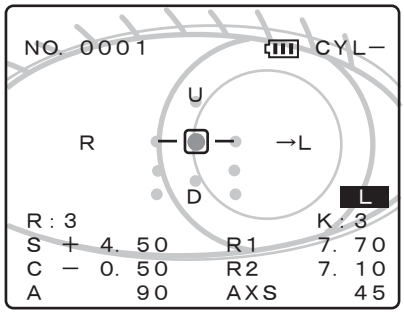

## NOTE

- The latest KM values are displayed on the LCD screen.

4. **Instruct the patient to look at the red light on the left side and not to move his/her head.**

**5. Adjust the position of the measuring unit until the corneal luminous spot is placed inside the target "□" and then perform focusing.**

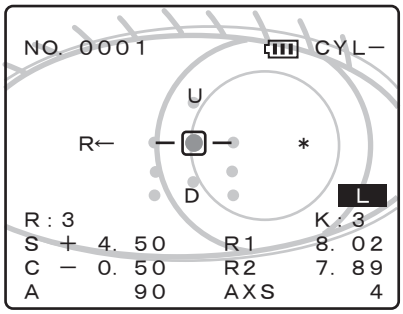
* Perform focusing until the focusing indicator is displayed in one line.




**6. Press the start button "◈".**

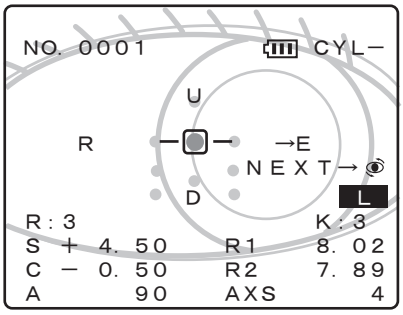
Sagittal radius of the right part of the cornea is measured.

"L" changes to "*" and then "R" starts blinking.

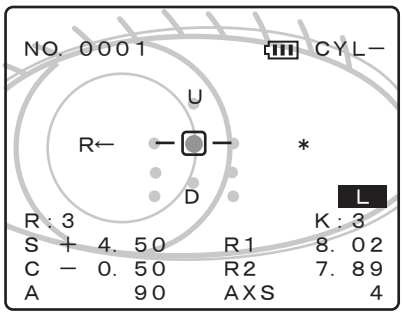



## NOTE

- If the measurement is erroneous, "L" changes to "E (Error)". In such a case, repeat the measurement by pressing the start button ◈. If "E" remains after repeating measurement, press the angle correction button 👁 to proceed to the "R" side.

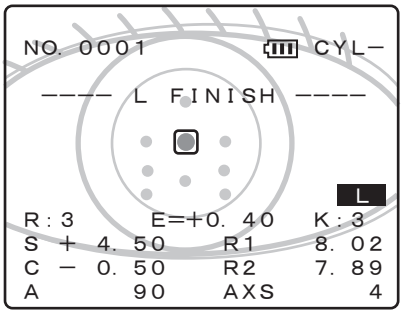



**7. Instruct the patient to look at the red light on the right side and repeat Steps 4 - 6 for the sagittal radius of the left eye.**




**8. Start measurements for D (Down) and U (Up) sides in the same manner.**

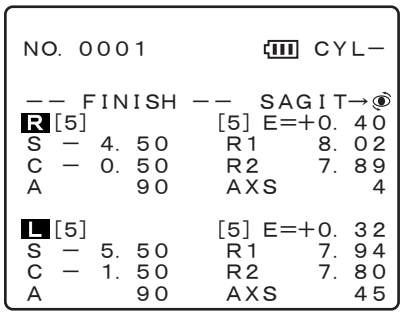
When all four measurements for a single eye are completed, eccentricity value (E=) appears and the mode returns to R/K mode or K mode.



## NOTE

- In the serial measurement, median values for each side (L, R, U and D) are obtained individually, and the eccentricity data is obtained by calculation on the basis of the median values for the 4 sides and KM measurement (either median or the latest). When Sagit Axis parameter is set to "AXIS", these values are converted for the angle of the steepest/flattest meridian which has been obtained in KM measurement.
- Concerning the side at which "E" is displayed, the value of the opposite side on the same meridian is used for the calculation of eccentricity.
- If the eccentricity is displayed as "E = Err", press the angle correction button to repeat measurement.
- If median values of the AR measurement or KM measurement are not obtained when the sagittal measurement has been completed, "---- L AR?KM? ----" appears instead of "---- L FINISH ----". Press the start button to continue measurement for median values.

**9. Repeat the same procedure for the right eye.**
It is possible to start binocular sagittal radius measurement after KM measurements for both eyes have been completed.




**10. Press the print button to print the Sagittal Radius measurement.**
Results in the sagittal measurement are not stored in memory for 30 patients (60 eyes) data. Store the results by printing.

## NOTE

- When measuring an additional patient, be sure to press the print button beforehand to print and clear data.
- In the sagittal radius measurement, measured results of 30 patients (60 eyes) cannot be stored in memory

* The following are sample printouts for the left eye and explanations of each data.

**< Sample printout 1 >**

* This is the printout for when the parameter "43: Sagit Print" is set to "Short".

```
----------0001----------
NAME                   M/F
  AUG/ 5/2003    4:43 PM
VD=12.00mm

<L>     mm       D  deg
<R1   8.02   42.00     4>
<R2   7.89   42.75    94>
<AVE  7.96   42.50      >
<CYL         -0.75     4>
<SAGITTAL> FIX ANGLE=25
  SUP.   INF.   TEM.   NAS.
A 8.13   8.11   8.09   7.96
                E = +0.40

      NIDEK  ARK-30
```

**< Sample printout 2 >**

* This is the printout for when the parameter "43: Sagit Print" is set to "All".

```
----------0001----------
NAME                   M/F
  AUG/ 5/2003    4:43 PM
VD=12.00mm

<L>     mm       D  deg
<R1   8.02   42.00     4>
<R2   7.89   42.75    94>
<AVE  7.96   42.50      >
<CYL         -0.75     4>
<SAGITTAL> FIX ANGLE=25
  SUP.   INF.   TEM.   NAS.
A 8.13   8.11   8.09   7.96
<TOPOGRAPHY OF CORNEA>
  SUP.   INF.   TEM.   NAS.
S 8.00   7.98   8.22   8.09
e+0.39 +0.35 +0.52 +0.31
 eh   = +0.43 Rh   =  8.11
 ev   = +0.37 Rv   =  7.96
 E    = +0.40 Ro   =  7.96
 ASTc= -0.70 dRo  = +0.13
 ASTp= -0.85 dAST= +0.15

      NIDEK  ARK-30
```

< SAGITTAL > = Sagittal radius on each side
SUP. = Superior side
INF. = Inferior side
TEM. = Temporal side
NAS. = Nasal side

A = Axis of Steepeset meridian (of KM measurement)
(F = Fixation Angle)
S = Sagittal data which the dRo value is added to or reduced from Sagittal Radius values
e = Eccentricity values of each Sagittal radius
eh = Eccentricity on horizontal meridian
ev = Eccentricity on vertical meridian
E = Total Eccentricity
ASTc = Corneal cylinder in the center
ASTp = Corneal cylinder at the periphery
Rh = Average of corneal curvature on horizontal meridian
Rv = Average of corneal curvature on vertical meridian
Ro = Average of corneal curvature in the center
dRo = Difference of corneal curvature between R1 and R2
dAST = Difference of corneal cylinder between the center and the peripheral

# §5 PRINTOUT

## 5.1 Printing Measured Values

1. **When all measurements are completed, press the print button (🖹) while aiming the rear side of the measuring unit (measuring window) at the light-receiver window on the station.**
   Measured data is printed.
   The communication distance between the measuring unit and the station should be 1 meter or less. You may aim the measuring unit either at the main body or stage of the station. Printing can be performed in the state that the measuring unit is placed on the stage.
   If the parameter "PRINT" is set to "AUTO", printing is performed automatically by aiming the measuring unit at the station without pressing the print button (🖹).

### NOTE

- Do not touch the printer paper during printing.
  This may cause text to be lost and light printed.
- Measured data can be printed any number of times while the measured results are stored in memory.
- After printing, the previous data is automatically cleared when the next measurement is started.
- While the feed button (🖹) on the station is held down, the printer paper is fed.

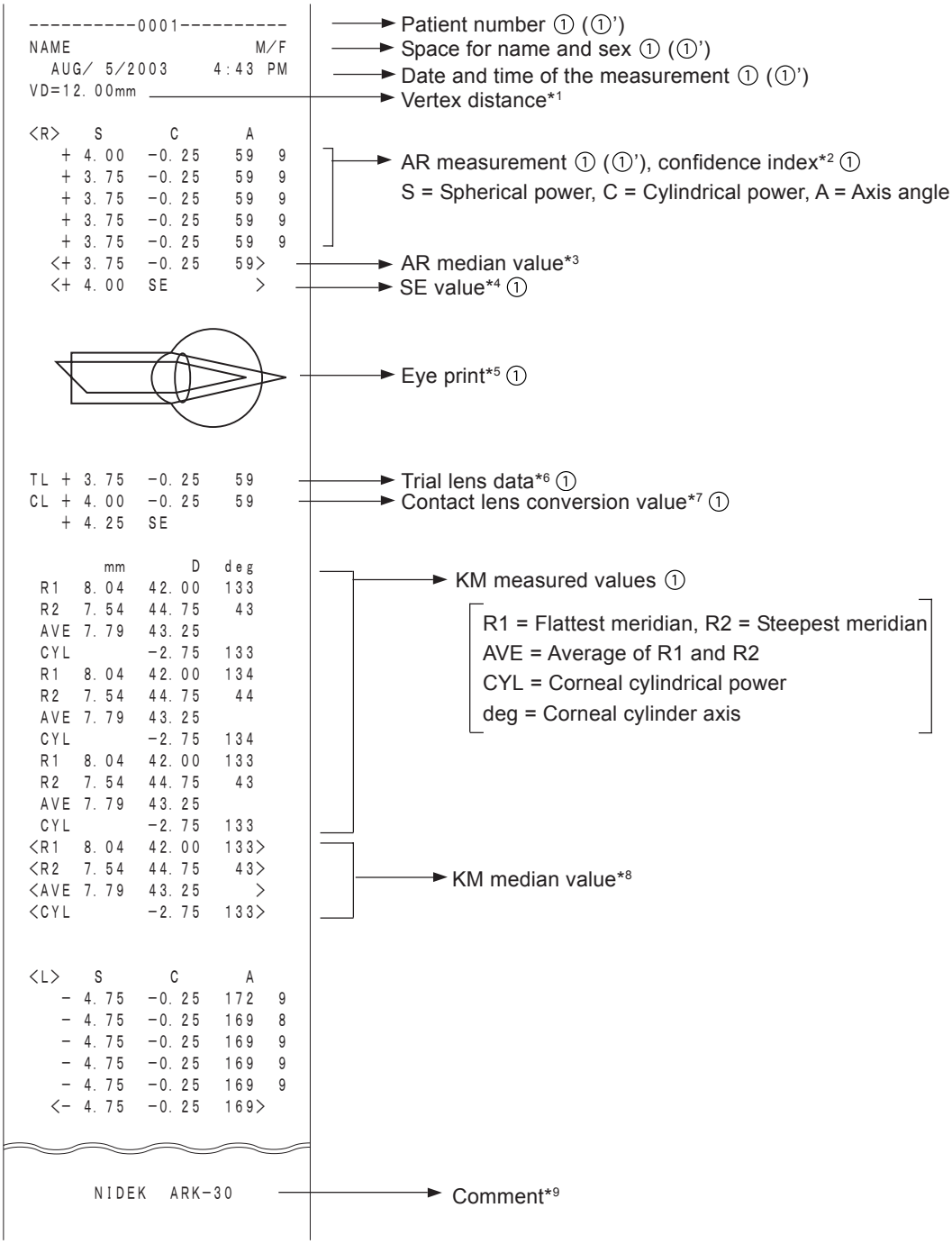
**<Printout sample 1>**

```
----------0001----------
NAME                    M/F
  AUG/ 5/2003     4:43 PM
VD=12.00mm

<R>    S       C       A
    + 4.25  -0.25    59
    + 4.25  -0.25    59
    + 4.25  -0.25    59
    + 4.25  -0.25    59
    + 4.25  -0.25    59
   <+ 4.25  -0.25    59>

         mm       D  deg
<R1   8.05   42.00  133>
<R2   7.54   44.75   43>
<AVE  8.05   42.00     >
<CYL         -2.75  133>

<L>    S       C       A
    + 4.75  -0.25   172
    + 4.75  -0.25   169
    + 4.75  -0.25   169
   <+ 4.75  -0.25   169>

         mm       D  deg
<R1   8.04   42.00  133>
<R2   7.54   44.75   43>
<AVE  7.79   43.25     >
<CYL         -2.75  133>

       NIDEK  ARK-30
```

### NOTE

- Printout sample 1 shows the printout when the parameter "PRINT" is factory-set. (standard printing)

**<Print sample 2>**



## NOTE

- The contents on the previous page are printed when the parameter "9: PRT FORMAT" is set to "R→L" and printing is performed in the order of right-eye measured value→ left-eye measured value.
  Printing can be performed in the order of AR measured value→ KM measured value by setting the parameter to "R→K".

- ① behind the description on the previous page shows that it is possible to select whether or not to print the content in the parameter setting.
  The content of (①') is factory-set to be printed.

---

*1 <Vertex distance>
The distance between the corneal vertex to the posterior surface of the spectacle lens.

*2 <Confidence index>
One of 6 steps (9, 8, 7, 6, 5, or E) is printed. "E" stands for error data.

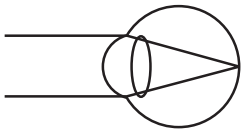
*3 <AR median value>
Printed when more than three measured values (without error or error data) are in memory.

*4 <SE (Spherical Equivalent) value>
Calculated for the AR median values (or the latest value when the AR median values have not been obtained) and CL conversion values.

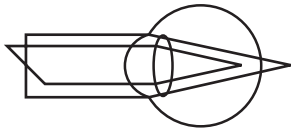
*5 <Eye print>

Tells graphically the patient's refractive status based on the median values. The eyeprint has eight patterns.

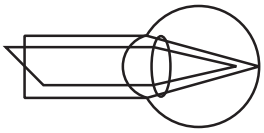
• Emmetropia



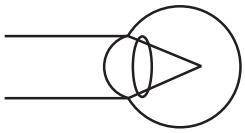
• Astigmatism



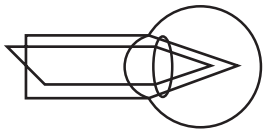
• Simple myopic astigmatism



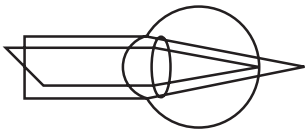
• Myopia



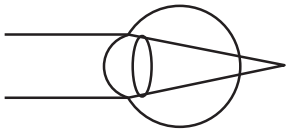
• Myopic astigmatism



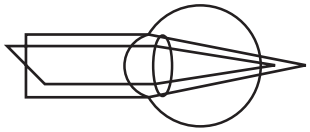
• Simple hyperopic astigmatism



• Hyperopia



• Hyperopic astigmatism



*6 <Trial lens data>

Based on the AR median values, these are the values that were converted automatically from the cylinder values so that the spherical values for the trial lens will become smaller.

*7 <CL conversion value>

In relation to the AR median values, these are the values that were converted into CL values with the vertex distance (VD) as "0" mm.

*8 <KM median value>

Printed when more than three KM measured values (without error data) are in the memory.

*9 <Comment>

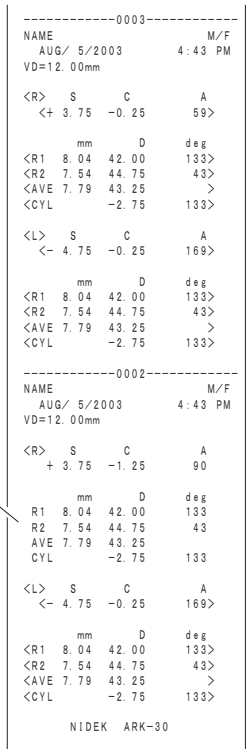
Desired letters and symbols can be entered. See "6.3 Entering Comments" for details.

# 5.2 Other Prints

## 5.2.1 Printout sample of stored data

The printout on the right shows the sample when the memory printing is performed as described in “4.9.2 Printing stored data”. All of the data in memory is printed.

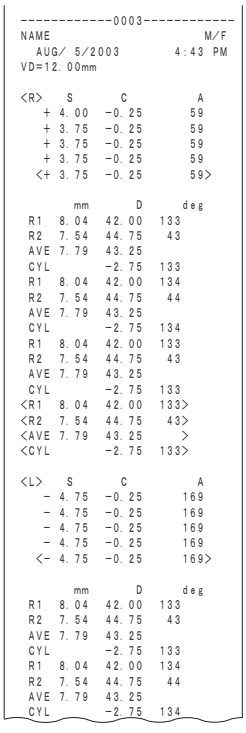
- **Parameter “14: AR PRINT” or “15: KM PRINT” is set to “SHORT”:**
  Only median values are printed.



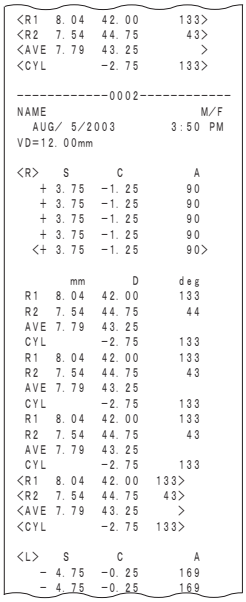
```
------------0003------------
NAME                      M/F
  AUG/ 5/2003         4:43 PM
VD=12.00mm

<R>    S       C          A
  <+ 3.75   -0.25        59>

         mm        D      deg
<R1   8.04    42.00      133>
<R2   7.54    44.75       43>
<AVE  7.79    43.25        >
<CYL          -2.75      133>

<L>    S       C          A
  <- 4.75   -0.25        169>

         mm        D      deg
<R1   8.04    42.00      133>
<R2   7.54    44.75       43>
<AVE  7.79    43.25        >
<CYL          -2.75      133>

------------0002------------
NAME                      M/F
  AUG/ 5/2003         4:43 PM
VD=12.00mm

<R>    S       C          A
   + 3.75   -1.25         90

         mm        D      deg
 R1   8.04    42.00      133
 R2   7.54    44.75       43
 AVE  7.79    43.25
 CYL          -2.75      133

<L>    S       C          A
  <- 4.75   -0.25        169>

         mm        D      deg
<R1   8.04    42.00      133>
<R2   7.54    44.75       43>
<AVE  7.79    43.25        >
<CYL          -2.75      133>

      NIDEK  ARK-30
```

The value without < > indicates that the AR median values have not been obtained.
(When the measured data is two or less, the latest values will be printed.)

- **Parameter “14: AR PRINT” or “15: KM PRINT” is set to “ALL”:**
  Median values and individual measured values are printed.



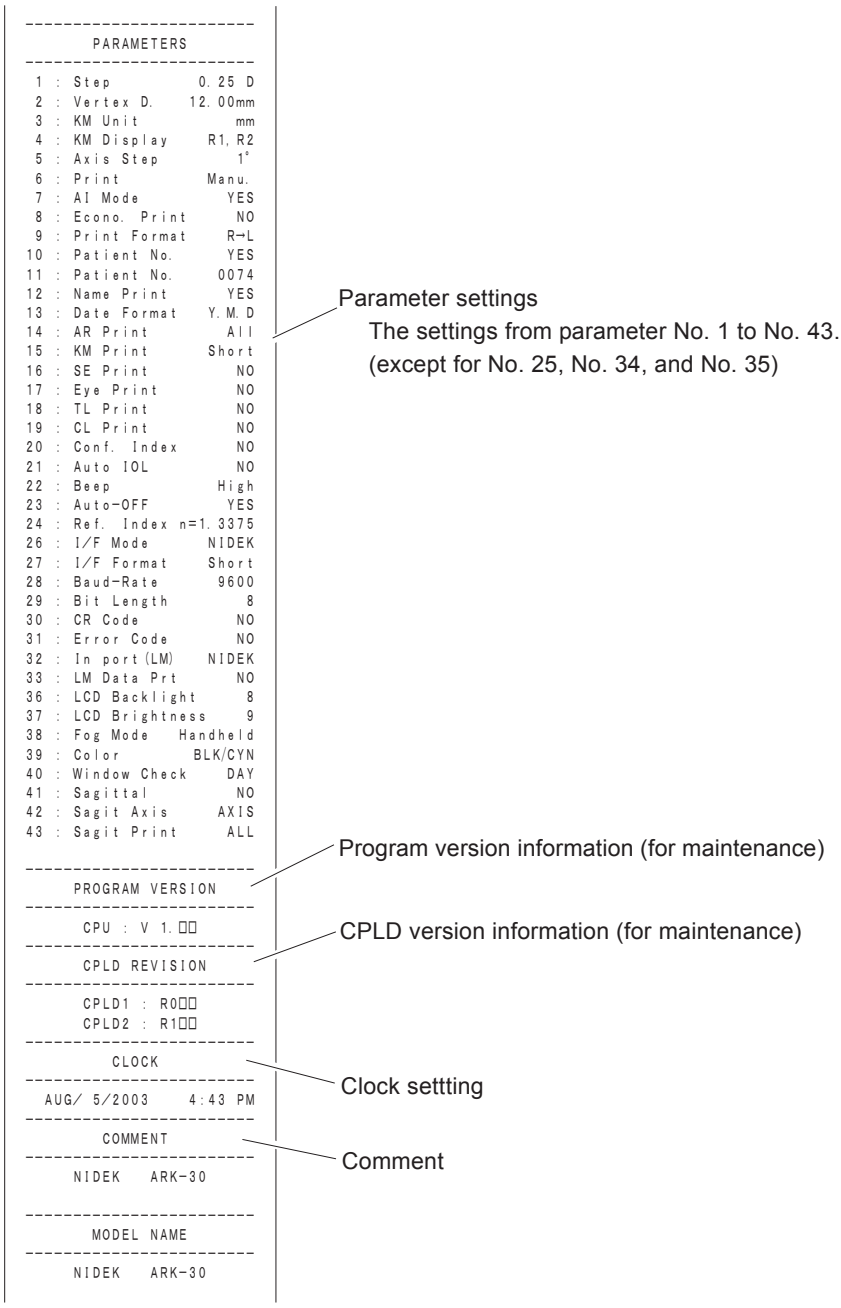
```
------------0003------------
NAME                      M/F
  AUG/ 5/2003         4:43 PM
VD=12.00mm

<R>    S       C          A
   + 4.00   -0.25        59
   + 3.75   -0.25        59
   + 3.75   -0.25        59
   + 3.75   -0.25        59
  <+ 3.75   -0.25        59>

         mm        D      deg
 R1   8.04    42.00      133
 R2   7.54    44.75       43
 AVE  7.79    43.25
 CYL          -2.75      133
 R1   8.04    42.00      134
 R2   7.54    44.75       44
 AVE  7.79    43.25
 CYL          -2.75      134
 R1   8.04    42.00      133
 R2   7.54    44.75       43
 AVE  7.79    43.25
 CYL          -2.75      133
<R1   8.04    42.00      133>
<R2   7.54    44.75       43>
<AVE  7.79    43.25        >
<CYL          -2.75      133>

<L>    S       C          A
   - 4.75   -0.25        169
   - 4.75   -0.25        169
   - 4.75   -0.25        169
   - 4.75   -0.25        169
  <- 4.75   -0.25        169>

         mm        D      deg
 R1   8.04    42.00      133
 R2   7.54    44.75       43
 AVE  7.79    43.25
 CYL          -2.75      133
 R1   8.04    42.00      134
 R2   7.54    44.75       44
 AVE  7.79    43.25
 CYL          -2.75      134
```



```
<R1   8.04    42.00      133>
<R2   7.54    44.75       43>
<AVE  7.79    43.25        >
<CYL          -2.75      133>

------------0002------------
NAME                      M/F
  AUG/ 5/2003         3:50 PM
VD=12.00mm

<R>    S       C          A
   + 3.75   -1.25         90
   + 3.75   -1.25         90
   + 3.75   -1.25         90
   + 3.75   -1.25         90
  <+ 3.75   -1.25         90>

         mm        D      deg
 R1   8.04    42.00      133
 R2   7.54    44.75       44
 AVE  7.79    43.25
 CYL          -2.75      133
 R1   8.04    42.00      133
 R2   7.54    44.75       43
 AVE  7.79    43.25
 CYL          -2.75      133
 R1   8.04    42.00      133
 R2   7.54    44.75       43
 AVE  7.79    43.25
 CYL          -2.75      133
<R1   8.04    42.00      133>
<R2   7.54    44.75       43>
<AVE  7.79    43.25        >
<CYL          -2.75      133>

<L>    S       C          A
   - 4.75   -0.25        169
   - 4.75   -0.25        169
```

# 5.2.2 Printout sample of parameter

Pressing the print button on the parameter setting screen prints the present Parameter settings, Program version, CPLD version, Clock setting, and Comment.
See “6.1 Parameter Settings”.



```
------------------------
       PARAMETERS
------------------------
 1 : Step          0.25 D
 2 : Vertex D.    12.00mm
 3 : KM Unit           mm
 4 : KM Display     R1,R2
 5 : Axis Step         1°
 6 : Print          Manu.
 7 : AI Mode          YES
 8 : Econo. Print      NO
 9 : Print Format     R→L
10 : Patient No.      YES
11 : Patient No.     0074
12 : Name Print       YES
13 : Date Format    Y.M.D
14 : AR Print         All
15 : KM Print       Short
16 : SE Print         NO
17 : Eye Print        NO
18 : TL Print         NO
19 : CL Print         NO
20 : Conf. Index      NO
21 : Auto IOL         NO
22 : Beep           High
23 : Auto-OFF         YES
24 : Ref. Index n=1.3375
26 : I/F Mode       NIDEK
27 : I/F Format     Short
28 : Baud-Rate       9600
29 : Bit Length         8
30 : CR Code          NO
31 : Error Code       NO
32 : In port(LM)    NIDEK
33 : LM Data Prt      NO
36 : LCD Backlight     8
37 : LCD Brightness    9
38 : Fog Mode   Handheld
39 : Color        BLK/CYN
40 : Window Check     DAY
41 : Sagittal         NO
42 : Sagit Axis      AXIS
43 : Sagit Print      ALL

------------------------
     PROGRAM VERSION
------------------------
      CPU : V 1.□□
------------------------
      CPLD REVISION
------------------------
      CPLD1 : R0□□
      CPLD2 : R1□□
------------------------
         CLOCK
------------------------
  AUG/ 5/2003    4:43 PM
------------------------
        COMMENT
------------------------
     NIDEK   ARK-30

------------------------
       MODEL NAME
------------------------
     NIDEK   ARK-30
```

Parameter settings
The settings from parameter No. 1 to No. 43.
(except for No. 25, No. 34, and No. 35)

Program version information (for maintenance)

CPLD version information (for maintenance)

Clock settting

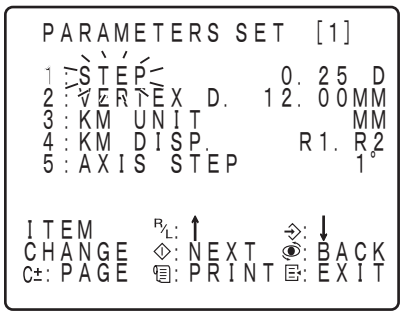
Comment

# §6 OTHER FUNCTIONS

## 6.1 Parameter Settings

The ARK-30 is equipped with the function to change the parameter settings of the device according to the operator's needs. The method for confirming or changing each parameter setting is described in the following section.

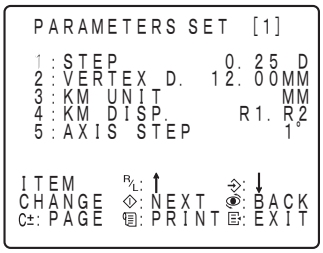
1. **Press the parameter setting button (E).**
   The LCD screen displays "PARAMETERS SET [1]", the parameters, and the settings. "STEP" of "1: STEP 0.25D" flashes, which means that the parameter "1: STEP" can be changed.



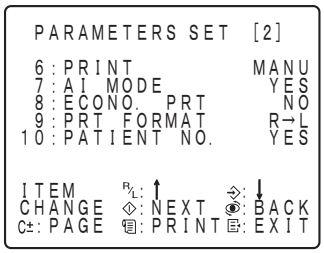

PARAMETERS SET [1]
(No.1 - No.5)

2. **Select the applicable parameter by referring to the parameter table on pages 6-3 to 6-7.**
   Move the flashing cursor to the desired parameter with the buttons.
   R/L selection button (R/L)▲ .. Moves the flashing cursor upward.
   Memory button (→)▼ ..... Moves the flashing cursor downward.

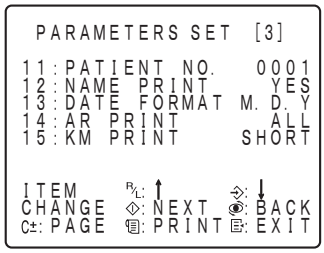
   Pressing the CYL mode selection button (C+/-) switches the screen to the next page.
   The PARAMETERS SET screen has nine pages in total and 43 parameters.
   PARAMETERS SET [1] (No. 1 - No. 5)→ PARAMETERS SET [2] (No. 6 - No.10)→…
   → PARAMETERS SET [9] (No.41 - No.43)→ PARAMETERS SET [1] (No. 1 - No. 5)→…



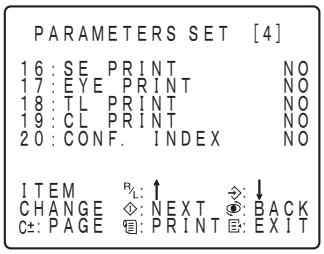

PARAMETERS SET [1]



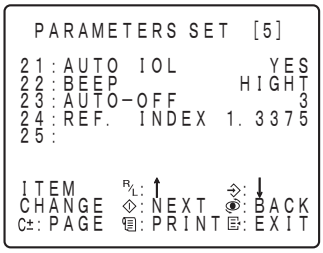

PARAMETERS SET [2]



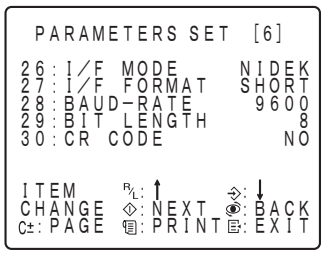

PARAMETERS SET [3]



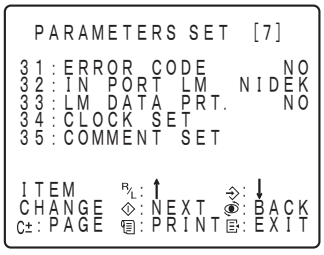

PARAMETERS SET [4]



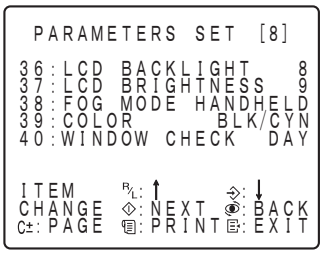

PARAMETERS SET [5]



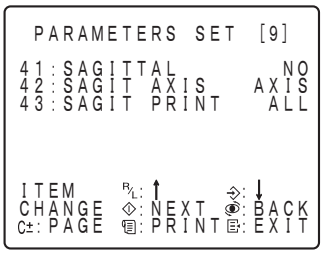

PARAMETERS SET [6]



PARAMETERS SET [7]



PARAMETERS SET [8]



PARAMETERS SET [9]

**3. Change the setting by pressing the start button ◇ or angle correction button 👁.**

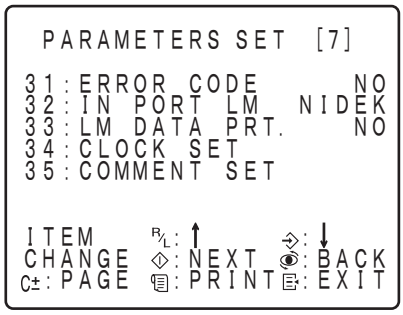
Start button ◇ ..... Changes the setting.
Angle correction button 👁 ..... Reverses the setting.

Pressing the button changes the setting as explained in the parameter table on pages 6-3 to 6-7. Select the applicable setting.

## NOTE

- In the parameter table, the underlined items indicate factory-settings.
- Factory-settings differ in some areas or countries.

Select "34: CLOCK SET (setting of date and time) or "35: COMMENT SET (setting of comment) and press the start button ◇ to go into each setting mode.
See "6.2 Setting Date and Time" or "6.3 Entering Comments" for details.




**4. Repeat Steps 2 - 3 to change the setting.**

**5. When all settings are selected, press the parameter setting button 📝 to exit from the parameter setting.**

The parameter settings are stored.

## NOTE

- Parameter settings are stored in memory even if the power button ⏻ or power switch is turned off.
- Do not turn off the measuring unit before pressing the parameter button 📝. Otherwise, the parameter settings will not be saved.
- Pressing the print button 🖹 will print the parameter settings out any time.

**Parameter table**

<Parameter table 1> * The underlined items indicate factory-settings.

| No. | Parameter | Description |
|---|---|---|
| 1 | STEP | 0.12D / 0.25D |
| 2 | VERTEX D. | 0 mm / 10.5 mm/ 12 mm / 13.75 mm / 15 mm / 16.5 mm |
| 3 | KM UNIT | mm / D |
| 4 | KM DISP | R1, R2 / AVE, CYL |
| 5 | AXIS STEP | 1° / 5° |
| 6 | PRINT | MANU. / AUTO / NO |
| 7 | AI MODE | YES / NO |
| 8 | ECONO PRT | YES / NO |
| 9 | PRT FORMAT | R→L / R→K |
| 10 | PATIENT NO. | YES / NO |

**[Item No.1] STEP: 0.12D / 0.25D**

The indication step for SPH and CYL data of the AR measurement, as well as the step of corneal refractive power measurements (permitting the corneal curvature radius to be converted to refractive power).

**[Item No.2] VERTEX D.: 0 mm / 10.5 mm / 12 mm / 13.75 mm / 15 mm / 16.5 mm**

The distance between the corneal vertex to the posterior surface of the spectacle lens when the patient wears glasses.

* "13.75 mm" for the default of devices destined for NIDEK INCORPORATED.

**[Item No.3] KM UNIT: mm / D**

Selection of whether to display the corneal curvature radius (mm) or corneal refractive power (D).

**[Item No.4] KM DISP: R1, R2 / AVE, CYL**

Selection of the KM measurement display between R1 (flattest meridian) & R2 (steepest meridian), and AVE (average of R1 and R2) & CYL (corneal cylindrical power).

**[Item No.5] AXIS STEP: 1º / 5º**

The indication step of the AXIS data for the AR measurement.

**[Item No.6] PRINT: MANU. / AUTO / NO**

The method to start printing.

MANU. ....Printing is started by pressing the print button (🖹).

AUTO .....Printing is automatically started after the measurement is completed. (Only active when the AI mode parameter is set to "YES".)

NO .....Printing is not performed.

**[Item No.7] AI MODE: YES / NO**

Selection of whether or not to use the AI mode. When "YES" is set, the measurement is automatically completed after five or more measurements and the data values are stable without variations.

**[Item No.8] ECONO PRT: YES / NO**

Selection of whether or not to use the economical print function.

When "YES" is set, printing is performed with narrow line-spacing to save the printer roll.

**[Item No.9] PRT FORMAT: R® L / R® K**

The printing format of the measurement results. (See "5. Printout".)

The following is the order of printing.

R→L. ... Right-eye AR value→Right-eye KM value→Left-eye AR value→Left-eye KM value

R→K ... Right-eye AR value→ Left-eye AR value→ Right-eye KM value→Left-eye KM value

**[Item No.10] PATIENT NO.: YES / NO**

Selection of whether or not to print the patient No.

<Parameter table 2> * The underlined items indicate factory-settings.

| No. | Parameter | Description |
|---|---|---|
| 11 | PATIENT NO. | 0001 to 9999 |
| 12 | NAME PRINT | YES / NO |
| 13 | DATE FORMAT | Y.M.D / M.D.Y / D.M.Y / NO |
| 14 | AR PRINT | ALL / SHORT |
| 15 | KM PRINT | ALL / SHORT |
| 16 | SE PRINT | YES / NO |
| 17 | EYE PRINT | YES / NO |
| 18 | TL PRINT | YES / NO |
| 19 | CL PRINT | YES / NO |
| 20 | CONF. INDEX | YES / NO |

**[Item No.11] PATIENT NO.: 0001 to 9999**

The setting for the patient number.

Start button ◈ ..... Increases the patient No.

Angle correction button ◉ ..... Decreases the patient No.

(If pressed first, the setting will be reset to "0001".)

**[Item No.12] NAME PRINT: YES / NO**

Selection of whether or not to provide spaces for writing the patient's name and sex.

**[Item No.13] DATE FORMAT: Y.M.D / M.D.Y. / D.M.Y / NO**

The format for printing the date.

Y.M.D ..... Year, Month, Date

M.D.Y ..... Month, Date, Year

D.M.Y ..... Date, Month, Year

NO ..... No printing

**[Item No.14] AR PRINT: YES / NO**

The print format for the AR measured results.

ALL ..... All data and median values are printed.

SHORT ..... Only the median values are printed.

**[Item No.15] KM PRINT: YES / NO**

The print format for the KM measured results.

ALL ..... All data and median values are printed.

SHORT ..... Only the median values are printed.

**[Item No.16] SE PRINT: YES / NO**

Selection of whether or not to print the SE values, which are based on the AR median values (or the latest values when the median values have not been obtained).

**[Item No.17] EYEPRINT: YES / NO**

Selection of whether or not to print the eye print.

**[Item No.18] TL PRINT: YES / NO**

Selection of whether or not to print the trial lens data, which is based on the AR median values.

**[Item No.19] CL PRINT: YES / NO**

Selection of whether or not to print the CL conversion values, which are based on the AR median values, and SE values of the CL conversion values.

**[Item No.20] CONF. INDEX: YES / NO**

Selection of whether or not to print the confidence index.

<Parameter table 3> * The underlined items indicate factory-settings.

| No. | Parameter | Description |
|---|---|---|
| 21 | AUTO IOL | YES / NO |
| 22 | BEEP | HIGH / LOW / NO |
| 23 | AUTO-OFF | 3 / 10 |
| 24 | REF. INDEX | 1.3375 / 1.336 / 1.332 |
| 25 | Unassigned | |
| 26 | I/F MODE | NIDEK |
| 27 | I/F FORMAT | ALL / SHORT |
| 28 | BAUD-RATE | 9600 / 4800 / 2400 / 1200 |
| 29 | BIT LENGTH | 7 / 8 |
| 30 | CR CODE | YES / NO |

**[Item No.21] AUTO IOL: YES / NO**

Selection of whether or not to use the Auto IOL mode. When "YES" is set, the IOL mode automatically turns on if the measurement cannot be started due to reflected light other than the corneal luminous spots on the IOL-implanted eye, etc. In the IOL measurement mode, the measured results are easy to obtain by changing the measurement conditions to measure the IOL-implanted eyes. (See the description on page 6-7.)

**[Item No.22] BEEP: HIGH / LOW / NO**

Selection of the beep tone that is produced during the measurement.

**[Item No.23] AUTO-OFF: 3 / 10**

Setting the auto-off function. The power automatically turns off if any button is not pressed for a certain period time when the power is on. The certain period time can be selected from either 3 (minutes) or 10 (minutes). The power turns off after a beep is produced for about one minute (at the interval of two seconds) when the auto-off function reaches its set time in a state that data has not been printed or whose measured results have not been stored in memory after the measurement is finished (FINISH). If necessary, save the data by printing or storing the measured results.

**[Item No.24] REF. INDEX: 1.3375 / 1.336 / 1.332**

Selection of the corneal refractive index.

**[Item No.26] I/F MODE: NIDEK**

Setting the device that the ARK-30 communicate with.

NIDEK ..... Communication with a NIDEK-brand device

**[Item No.27] I/F FORMAT: ALL / SHORT**

The format of the data to be transmitted.

ALL ..... All data are transferred.

SHORT ..... Restricted data is transmitted.

**[Item No.28] BAUD-RATE: 9600 / 4800 / 2400 / 1200**

Selection of the baud-rate (bit transmission speed) for communication.

**[Item No.29] BIT LENGTH: 7 / 8**

The bit numbers for a single character used for communication.

**[Item No.30] CR CODE: YES / NO**

Selection of whether or not to attach a CR (carriage return) code at the end of the transmission data.

<Parameter table 4>

* The underlined items indicate factory-settings.

| No. | Parameter | Description |
|---|---|---|
| 31 | ERROR CODE | YES / NO |
| 32 | IN PORT LM | NIDEK |
| 33 | LM DATA PRT. | YES / NO |
| 34 | CLOCK SET | Enters the setting mode of date and time. |
| 35 | COMMENT SET | Enters the setting mode of comment. |
| 36 | LCD BACKLIGHT | 1 - 9 (Factory setting: 8) |
| 37 | LCD BRIGHTNESS | 1 - 9 (Factory setting: 9) |
| 38 | FOG MODE | HANDHELD / STAND |
| 39 | COLOR | BLK/CYN (Choose from 28 kinds in all.) |
| 40 | WINDOW CHECK | DAY / YES / NO |

**[Item No.31] ERROR CODE: YES / NO**

Selection of whether or not to display an error message.

**[Item No.32] IN PORT LM: NIDEK**

Setting related to the lensmeter to be connected to the data input connector. Never change the setting.

**[Item No.33] LM DATA PRT.: YES / NO**

Selection of whether or not to print the communication data from the lensmeter connected to the data input connector by the built-in printer of the ARK-30.

When the parameter is set to "YES", the data is printed from the ARK-30 printer by pressing the print button of the lensmeter. (The lensmeter provided with this function is needed.) See the Operator's Manual of the lensmeter for details.

**[Item No.34] CLOCK SET**

Setting the time of the internal clock. See "6.2 Setting Date and Time" for details.

**[Item No.35] COMMENT SET**

Setting the comment for printout. See "6.3 Entering Comments" for details.

**[Item No.36] LCD BACKLIGHT: 1 - 9**

Brightness of the backlight on the LCD screen. The available setting is 1 - 9. Increased number will brighten the intensity of the backlight.

**[Item No.37] LCD BRIGHTNESS: 1 - 9**

Brightness of the indications of the LCD screen. The available setting is 1 - 9. Increased number will brighten and sharpen the LCD indications. Set it to 9 usually.

**[Item No.38] FOG MODE: HANDHELD / STAND**

Setting the fogging mode. HANDHELD and STAND are alternatives.

HANDHELD allows a quick measurement by reducing the time starting the AR measurement, compared to STAND.

HANDHELD should be selected for the hand-held use. STAND should be selected if focusing is stable by using a portable stand.

# NOTE

- If the backlight of the LCD screen is brightened with the parameter No.36: LCD BACKLIGHT, it will shorten the useful time of the battery.
  Setting the parameter to the minimum value (darken the backlight) within the range that the screen can be legible will extend the useful time of the battery.

**[Item No.39] COLOR: BLK / BLU / RED / VIO / GRN / CYN / YEL / WHT**

Color setting of the characters and the background on the LCD screen. They can be selected from a combination of 28 kinds. The following table indicates the color abbreviations.

| BLK | BLU | RED | VIO | GRN | CYN | YEL | WHT |
|---|---|---|---|---|---|---|---|
| Black | Blue | Red | Violet | Green | Cyan | Yellow | White |

**[Item No.40] WINDOW CHECK: DAY / YES / NO**

Selection of whether or not to automatically check the measuring window for cleanliness. Pressing the start button starts automatically checking the measuring window for cleanliness and the message “OK!” or “NG!” appears.

- DAY ..... The measuring window is checked at the first startup of the day (when the start button is pressed.)
- YES ..... The measuring window is checked at every startup (when the start button is pressed).
- NO ..... The measuring window is not checked.

<Parameter table 5>

* The underlined items indicate factory-settings.

| No. | Parameter | Description |
|---|---|---|
| 41 | SAGITTAL | YES / <u>NO</u> |
| 42 | SAGIT AXIS | <u>AXIS</u> / FIX |
| 43 | SAGIT PRINT | <u>ALL</u> / SHORT |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**[Item No.41] SAGITTAL: YES / NO**

Selection of whether or not to measure Sagittal radius after KM measurement in R/K or K mode.

**[Item No.42] SAGIT AXIS: AXIS / FIX**

Selection of whether or not to convert the sagittal radius measurement for the axis of the steepest /flattest meridian which has been obtained in KM measurement. To convert data, choose AXIS.

**[Item No.43] SAGIT PRINT: ALL / SHORT**

Selection of the print format of sagittal radius measurement.

ALL. ..... All data is printed.

SHORT ..... Only sagittal radius vaue and the total eccentricity are printed.

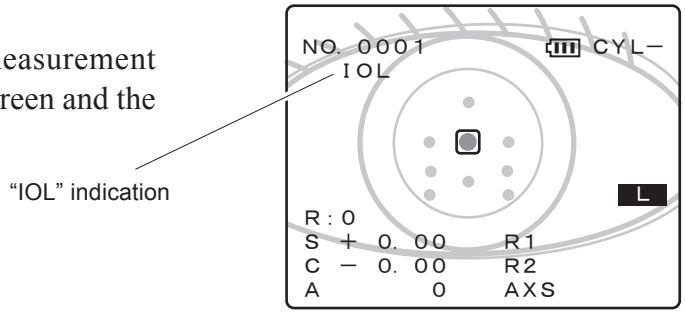
## NOTE

- Factory-settings may differ in areas or countries.

### O Auto IOL measurement mode

The IOL measurement mode will automatically turn on when the measurement cannot be started due to reflected light other than the corneal luminous spots or abnormalities on the IOL-implanted eye, etc. Set the parameter "21: AUTO IOL" to "YES" to enable the Auto IOL measurement mode.

When the device is in the IOL measurement mode, "IOL" is displayed on the screen and the device operates as follows:




1) Even if abnormal reflected light is detected, the measured results can be obtained by changing its criteria.

2) If the auto-shot function does not work, the measured results are easy to obtain by changing the auto-shot criteria.
   - The measurement starts if the central luminous spot of the cornea is placed inside the target "□".
   - Adjust the position of the measuring unit until the central luminous spot of the cornea is placed inside the target and adjust the luminous spot to a sharp focus since the focusing indicator is not shown.
   - The KM measurement does not start but the AR measurement starts.

When the measuring eye is switched between the left and right or printing is performed by pressing the print button (🖹), the IOL measurement mode is canceled.

## NOTE

- In the IOL measurement mode, measurement starts even if a luminous spot other than the corneal luminous spot is placed inside the tartget "□". In such cases, the measurement accuracy may decrease. Adjust the measuring unit so that the corneal luminous spot is placed inside the target.

- In the IOL measurement mode, take note that variations of the measured results may increase, in comparison to the normal measurement mode.

- The device may be placed in the IOL measurement mode even if the eyelid or eyelash is on or around the target.
  In this situation, cancel the IOL measurement mode by instructing the patient to open his/her eye wide. Then, measure the eye again.

- For 2) above, the IOL measurement mode is canceled and the normal measurement starts when all luminous spots of the cornea are detected and the auto-shot function starts working normally.

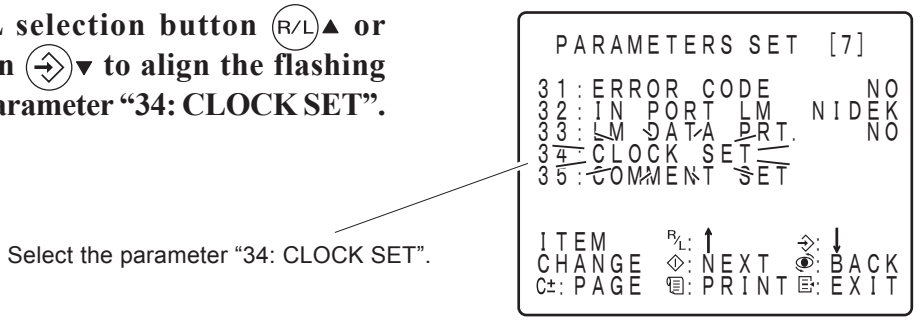
# 6.2 Setting Date and Time

The following section explains how to set the date and time.

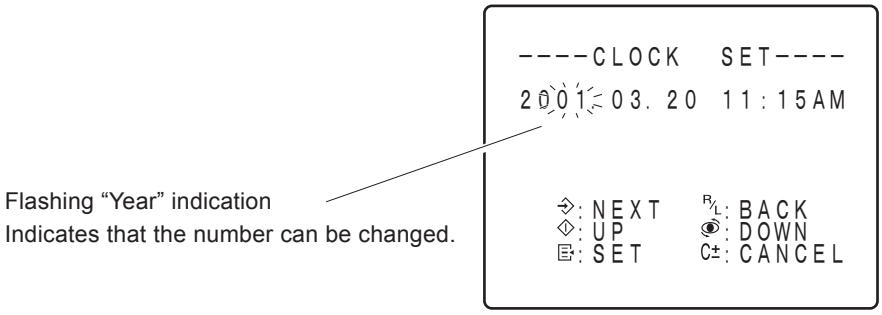
1. **Press the parameter setting button (E).**
   The LCD screen displays "PARAMETERS SET [1]", the parameters and the settings.

2. **Press the CYL mode selection button (C+/-) to change the screen to "PARAMETERS SET [7]".**

3. **Press the R/L selection button (R/L)▲ or memory button (→)▼ to align the flashing cursor on the parameter "34: CLOCK SET".**




4. **Press the start button (◇) to enter the mode for setting the date and time.**
   "CLOCK SET", year, month, date, time, minutes, and seconds are displayed with the year (two decimal places) flashing.
   The flashing indicates that the number can be changed.




## NOTE

- The clock function does not work while the date and time are being set. The clock starts working when you exit from the setting mode for the date and time.

5. **Press the memory button (→)▼ or R/L selection button (R/L)▲ to select the desired item. The selected item will flash.**
   The order of selection is as follows.
   When the memory button (→)▼ is pressed:
   "Year" → "Month" → "Date" → "Time" → "Minute" → "Year" →••••••
   When the R/L selection button (R/L)▲ is pressed:
   "Year" → "Minute" → "Time" → "Date" → "Month" → "Year" →••••••

6. **Press the start button ◇ or angle correction button 👁 to change the value.**
   Start button ◇ ..... Increases the number.
   Angle correction button 👁 ..... Decreases the number.

   "Time" shown is a 12-hour format. The indication switches automatically between AM and PM.

7. **Repeat Steps 5 - 6 to set the date and time.**

8. **When all settings are completed, press the parameter setting button ▤ to exit from the setting mode.**
   Pressing the parameter setting button ▤ sets the date and time and starts the internal clock function at the same time.
   To cancel the setting of the date and time, press the CYL mode selection button C+/-. You will exit from the setting mode.

## NOTE

- The date and time may deviate if the battery is removed from the measuring unit for more than 12 hours. In this situation, reset the date and time.

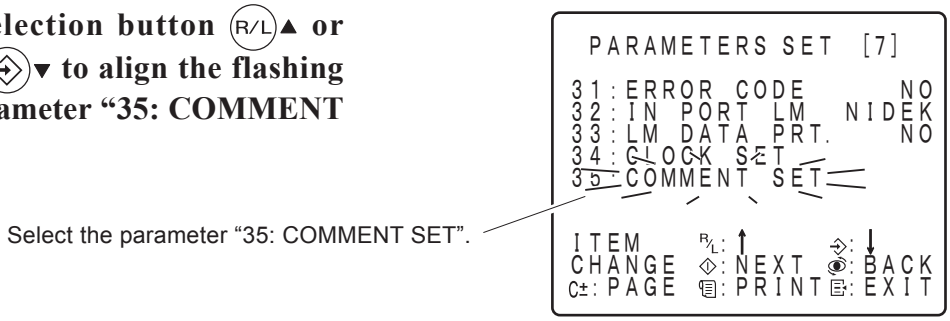
# 6.3 Entering Comments

The comment that you want to print out can be changed (The initial setting is "NIDEK ARK-30"). The comment entered can be checked by printing out the parameter setting list with the print button in the parameter setting mode.

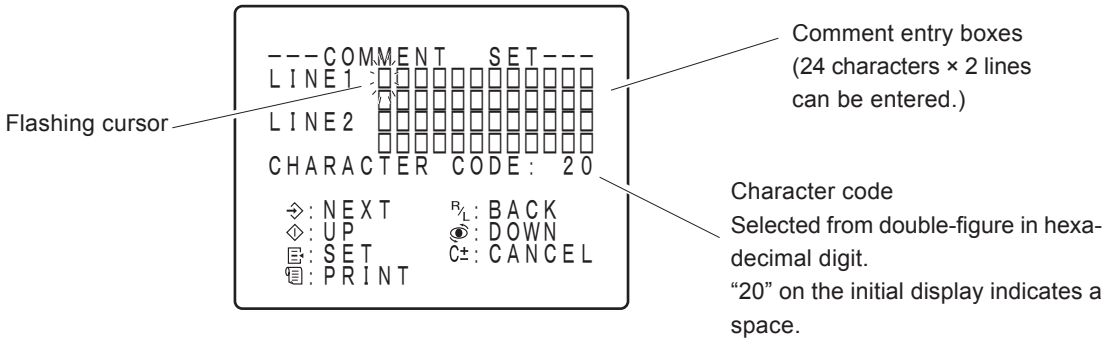
1. **Press the parameter setting button.**
   The LCD screen will show "PARAMETERS SET [1]", the parameters and settings.

2. **Press the CYL mode selection button to change the screen to "PARAMETERS SET [7]".**

3. **Press the R/L selection button ▲ or memory button ▼ to align the flashing cursor on the parameter "35: COMMENT SET".**

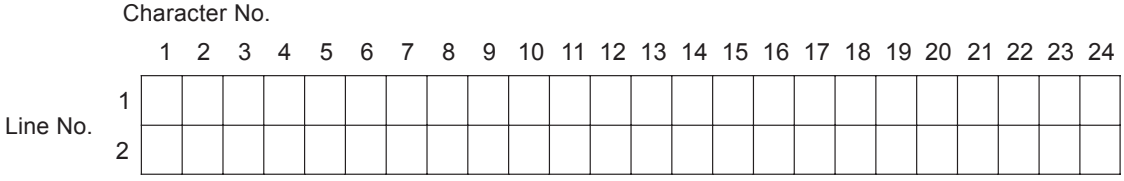



4. **Press the start button to enter the setting mode.**
   On the LCD screen, "COMMENT SET", Comment entry box, and Character code are displayed with the upper left box flashing.
   The flashing box indicates that the position where a letter can be entered. The character code displayed on "CHARACTER CODE" represents the present character code which is entered in the box.




## NOTE

- Up to 24 characters can be entered in a line. Two lines are available for a total of 48 characters.



**5. Press the memory button ▼ or R/L selection button ▲ to move the flashing cursor to the applicable box.**

Memory button ▼ ..... Moves the flashing cursor to the right.
R/L selection button ▲ ..... Moves the flashing cursor to the left.

Pressing the button when the cursor is at the right end will move it to the left end of the lower (or upper) line.

**6. Press the start button or angle correction button to change the character code.**

Start button ..... Increases the character code.
Angle correction button ..... Decreases the character code.

Select "20 (space)" to delete the character (no character).
The following characters and symbols can be entered.

First digit of character code

| Second digit of character code | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | b |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Space | 0 | ケ | P | ◇ | p | ■ | 一 | タ | ミ |
| 1 | ! | 1 | A | Q | a | q | 。 | ア | チ | ム |
| 2 | ” | 2 | B | R | b | r | 「 | イ | ツ | メ |
| 3 | # | 3 | C | S | c | s | 」 | ウ | テ | モ |
| 4 | $ | 4 | D | T | d | t | 、 | エ | ト | ヤ |
| 5 | % | 5 | E | U | e | u | ・ | オ | ナ | ユ |
| 6 | & | 6 | F | V | f | v | ヲ | カ | ニ | ヨ |
| 7 | ’ | 7 | G | W | g | w | ァ | キ | ヌ | ラ |
| 8 | ( | 8 | H | X | h | x | ィ | ク | ネ | リ |
| 9 | ) | 9 | I | Y | i | y | ゥ | ケ | ノ | ル |
| A | * | : | J | Z | j | z | ェ | コ | ハ | レ |
| b | + | ; | K | [ | k | { | ォ | サ | ヒ | ロ |
| c | , | < | L | ¥ | l | \| | ャ | シ | フ | ワ |
| d | - | = | M | ] | m | } | ュ | ス | ヘ | ン |
| E | . | > | N | ↑ | n | → | ョ | セ | ホ | ゛ |
| F | / | ? | O | ↓ | o | の | ッ | ソ | マ | ° |

**7. Repeat Steps 4 - 6 to enter the characters.**

To confirm the present set description while a comment is being set, press .
Only comment will be printed.

```
----------------------
COMMENT
----------------------
NIDEK    ARK-30
```

**8. When the characters are entered, press the parameter setting button to exit from the setting mode.**

Pressing the parameter setting button stores the comment in memory.
To cancel the comment, press the CYL mode selection button . You will exit from the setting mode.
To reenter a comment, press the power button to turn off the power, then turn the power on again. Then start from Step 1.

# §7 TROUBLESHOOTING GUIDE

In the event that the device does not work correctly, correct the problem according to the following table before contacting your authorized distributor.

| Symptom | Action |
|---|---|
| The LCD screen does not turn ON. | • Check that the battery is properly installed.<br>• Battery may need charging. Check the battery. |
| The screen disappears suddenly. | • The auto-off function may be working.<br>Press the power button.<br>• Battery may need charging. Check the battery. |
| Printing cannot be carried out. | • Check the paper. Install a new roll if empty.<br>• The parameter "6: PRINT" may be set to "NO".<br>Set the print format again.<br>• In wireless operation, the measuring unit may be distant from the station.<br>Press the print button within 1 meter from the station. |
| The printer does work, however, printout cannot be obtained. | • Printer paper may be installed upside down.<br>Install the printer paper correctly. |
| The auto-shot function does not work. | • Sunlight and room illumination may be reflecting on the cornea.<br>In this situation, cut off those lights or change the direction of the patient and try the measurement again.<br>• For those who cannot fix their eyes, measure the eyes in the QUICK measurement mode.<br>• The auto-shot function may not work on eyes with keratoconus or a cornea with a recent operation.<br>Set the parameter "21: AUTO IOL" to "YES" and try the measurement again. |
| The date and time is not correct. | • Battery may need charging.<br>Install the charged battery in the measuring unit and set the date and time again. |
| The eye cannot be measured. | • Patient may have blinked during measurement.<br>Instruct the patient not to blink and try the measurement again.<br>• Eyelid or eyelash may be in the way.<br>Instruct the patient to open his/her eye wide. If they cannot, then lift the eyelid, being careful not to press your finger against the eye ball.<br>• The pupil may be too small. Have the patient sit in a dark room for a while until the pupil opens enough and try the measurement again.<br>• Data may exceed the measurable limit. |

If the problem still cannot be solved, then contact your authorized distributor.

# §8 MAINTENANCE

## 8.1 Replacing Printer Roll

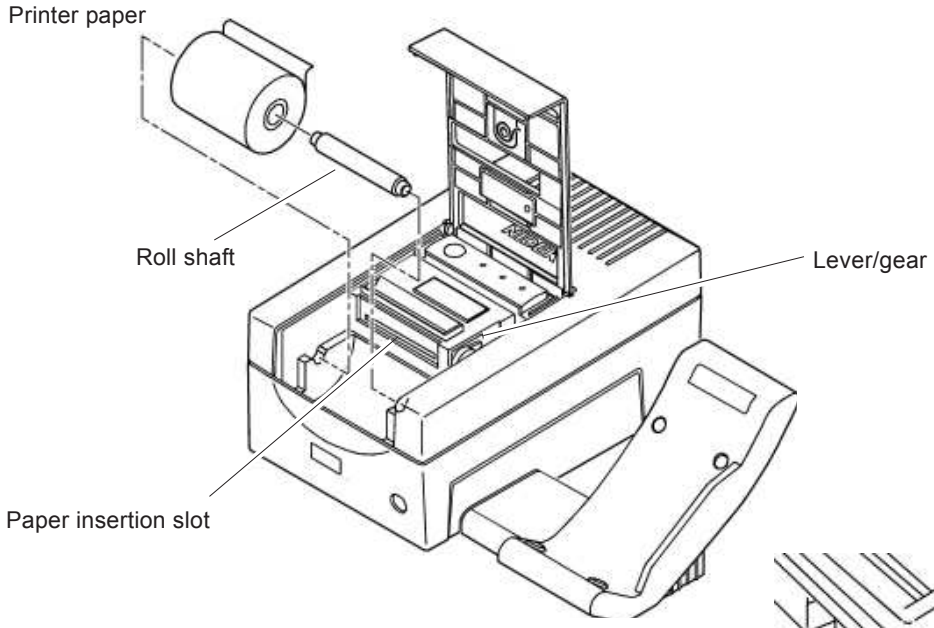
When a red line appears on the side of the printer paper, it means that the paper is running short. Stop using the printer and replace the roll.

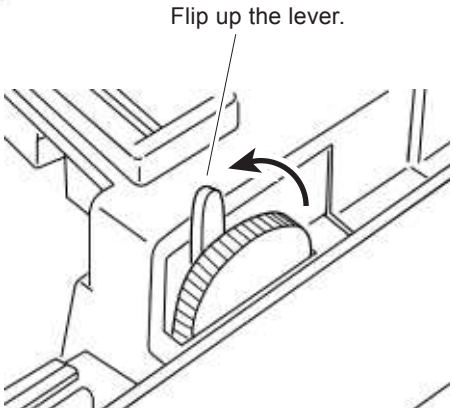
### NOTE

- Do not run the printer without paper.
  It may ruin the printer head.
- Do not pull the paper in the printer forcefully.
  This may cause a printer malfunction. Be sure to use the feed button to feed the paper.

**1. Open the printer cover of the station.**

**2. Flip up the lever on the right side (Moves the printer head up) and turn the gear backwards to rewind the paper.**




**3. Take out the used paper roll and remove the roll shaft.**

**4. Insert the shaft into a new paper roll.**

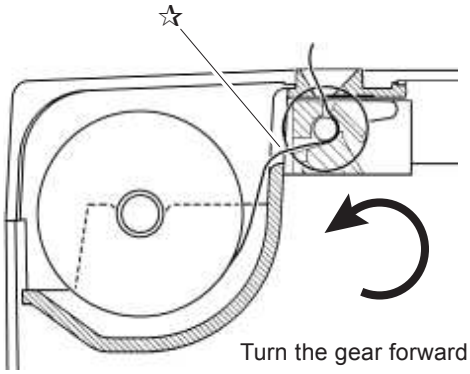
**5. Set the roll into the printer housing.**
If the roll is set upside down, the text will not be printed on the paper. The rear side of the printer cover has the symbol that shows the proper direction for installing the roll.
Install the roll according to the symbol.

This symbol shows how to install the roll.

**6. Cut the end cleanly and pass the paper through the insertion slot as illustrated on the right.**

## NOTE

- When the paper reaches the ☆ mark, turn the gear on the right forward to feed the paper.




Turn the gear forward.

**7. Flip the lever down and close the printer cover.**

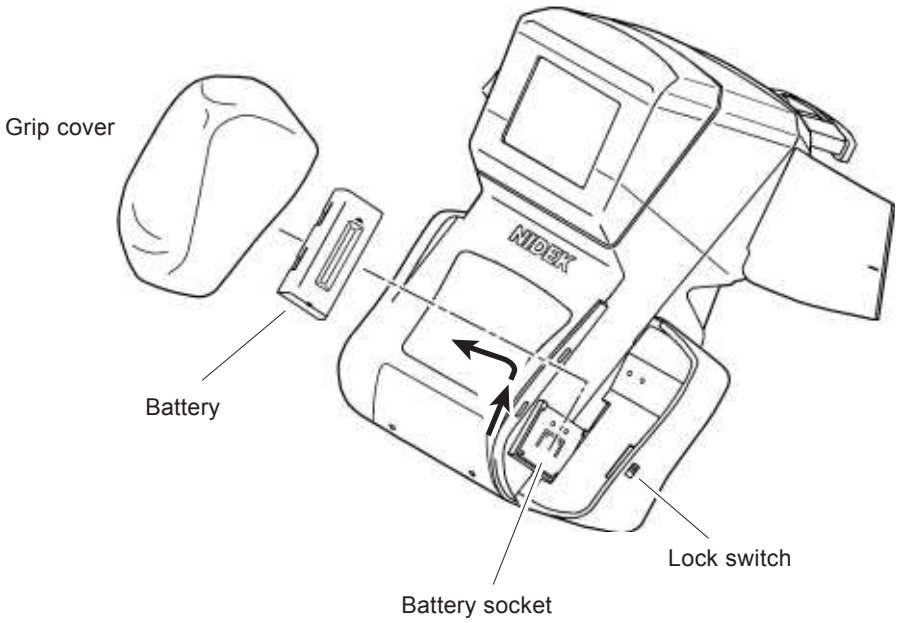
# 8.2 Installing/Removing Battery

The battery needs recharging if the "▭" symbol appears.
If data has not been printed, remove the battery after printing. The stored data will be maintained in memory even if the battery is removed.

1. **Press the power button ⏻ to turn off the measuring unit.**

2. **Remove the grip cover.**
   Pull the cover toward you and remove it while pressing the lock switch on the side of the grip downward.

3. **Remove the battery.**
   Slide the battery in the direction of the arrows as illustrated below to remove from the socket.




4. **Prepare the fully recharged battery.**

5. **Insert the charged battery in the socket.**
   Insert the battery, aligning the battery with the guide of the socket.

6. **Attach the cover on the grip.**

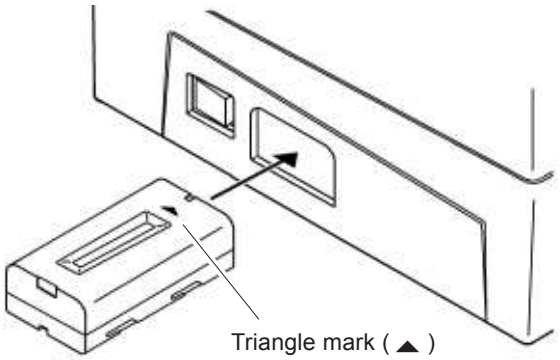
# 8.3 Charging Battery

Insert the used battery into the battery slot on the left side of the station and recharge the battery.

## ⚠ CAUTION

- The battery has its useful life. If you notice that the battery needs to be recharged more frequently, then this is an indicator that the battery needs to be replaced.
- Any abnormalities such as an odor, excessive heat, discoloration, deformation, etc. that are noticed during usage, charging or storage of the battery may indicate a defective device or/and battery. Stop using the device and contact your authorized distributor.

1. **Turn ON (½) the power switch of the station.**
2. **Insert the battery into the slot on the left side of the station.**
   Insert the battery with its triangle mark (▲) pointing toward the station.




3. **The battery is automatically charged and the charge lamp (➔▭) flashes.**
   It takes 120 - 150 minutes to fully recharge the battery (Takes much longer if the battery is deteriorated.)
4. **When the charging is completed, the charge lamp (➔▭) stays illuminated.**

## ⚠ CAUTION

- When charging is not completed even after the specified time, or the charge lamp flashes faster than normal (twice per second), remove the battery from the slot once and turn the power off and on and then reinstall the battery into the slot.
  Heat, explosion, and combustion may occur if the battery is left under the condition.
  If the charging is not completed normally yet, replace the battery.

**5. Remove the battery from the slot.**

## ⚠ CAUTION

- When charging and replacing the battery, use the specified battery and charger (station or measuring unit) only. In addition, do not put foreign matters such as metal into the battery slot to prevent a malfunction or a fire.
- Do not discharge the battery in other devices. Do not connect the positive and negative terminals with metal such as wire to prevent damage, deterioration, and shortened life-span of the battery.
- Do not dismantle or modify the battery to prevent heat generation, explosion, or combustion.

## NOTE

- Even while the battery is being charged, the station still can be operated.
- See “4.8 Measurement Using Cable” for details on charging with the battery installed in the measuring unit.

# 8.4 Attaching/Detaching the Strap

## ⚠ CAUTION

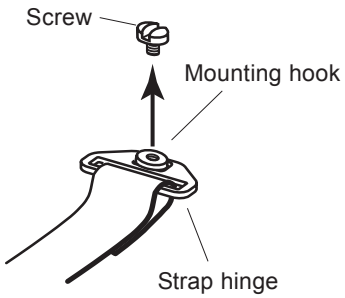
- When moving the device with your hand, use the hand strap or neck strap (option). To move the device, be sure to hold the grip. Do not hold the hand strap only.
  Accidentally dropping the device may cause an injury or a device malfunction.
  For a malfunction caused by dropping the device, the warranty is not valid. You must pay to repair the device.

The device is shipped with the hand strap attached. Follow the procedure below to attach and detach the hand strap or optional neck strap.

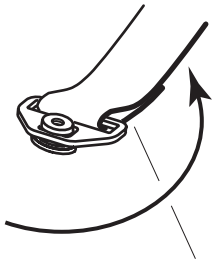
### O Detaching the hand strap

Remove the screw from the hook and rotate the strap hinge about 180º and detach it raising.

1) Remove the screw from the mounting hook with a coin or other tools.

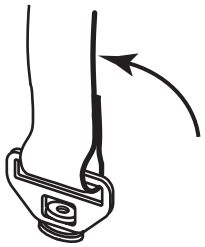



2) Rotate the strap hinge as illustrated below.

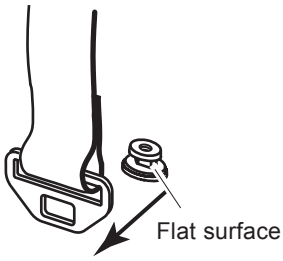


Align the strap hinge to the opposite side of the flat surface of the hook.

3) Raise the strap hinge.



4) Detach the strap hinge from the hook.



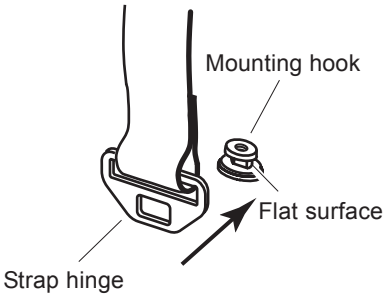

## NOTE

- Be careful not to lose the removed screw.
  After detaching the strap, tightening the removed screw is recommended.

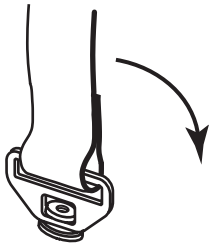
## O Attaching the strap

Align the raised strap hinge to the mounting hook and put it down and then rotate 180º. Next, mount the screw so that the strap hinge will not be detached. Tighten the screw securely.

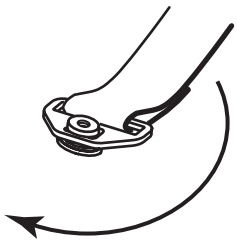
1) From the flat surface of the mounting hook, align the raised strap hinge to the hook.



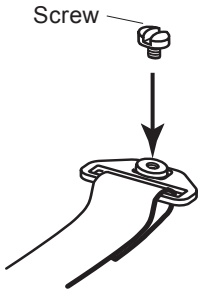

2) Put the hinge to the opposite side.



3) Rotate 180º.

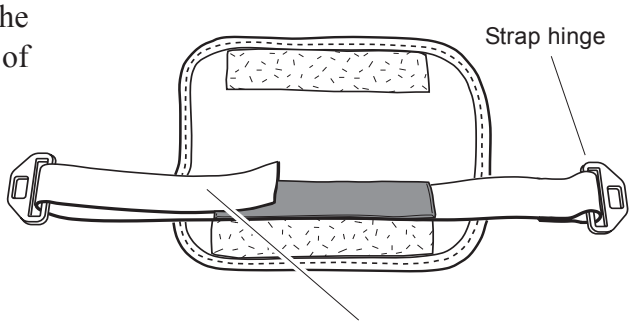


4) Tighten the screw in the mounting hook with a coin or other tools.




## O Adjusting the hand strap

To adjust the length of the hand strap, open the pad and adjust the position in which the end of the strap is attached to the Velcro fastener.

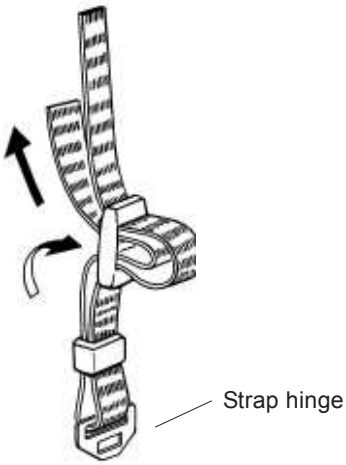



The length of the strap can be adjusted with the Velcro fastener.

## O Attaching the neck strap (option)

Pass the strap through the backle so that the strap end comes inside.
The strap may be detached if passed improperly.

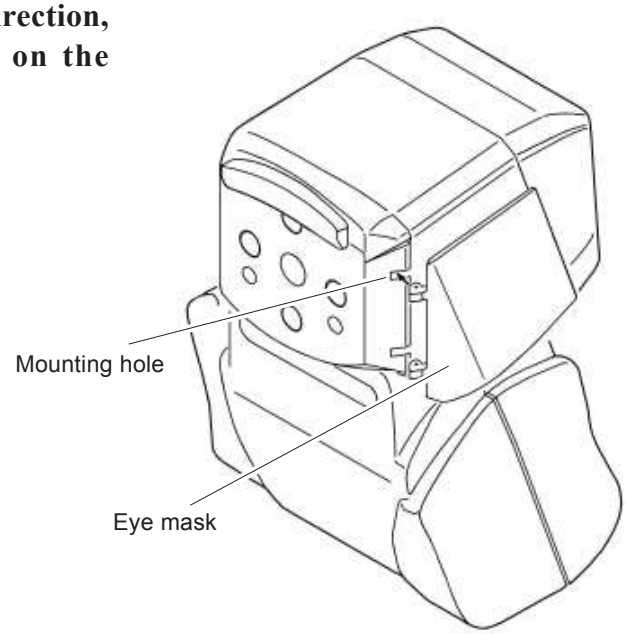
Adjust the length of the strap so that the measuring unit is positioned above the waist.



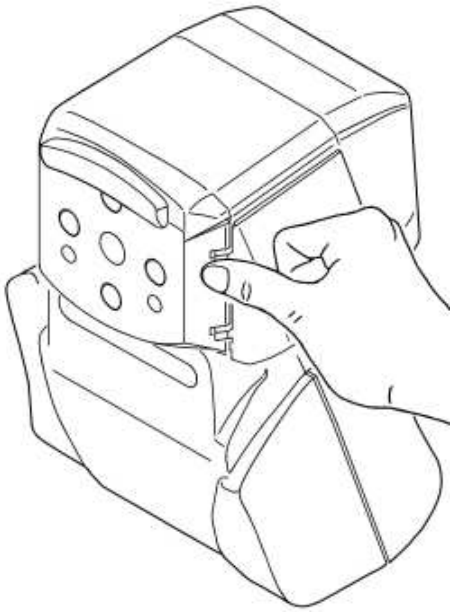
# 8.5 Attaching the Eye Mask

The eye masks will become detached if you bump against them to prevent an injury and device damage.
The following section explains how to reattach the eye mask.

1. **With the eye mask in the closed direction, align the hinges with the holes on the measuring unit.**




2. **Push the hinges into the holes with your thumb.**



# 8.6 Replacing Fuses

If the device does not work even though the power switch is on, the fuses may be burnt out. Replace the fuses with the ones that are supplied with the device.
Spare fuses are installed in the spare fuse holders inside the printer cover of the station.

## ⚠ CAUTION

- Use only the specified fuses to prevent a fire.
  (Fuse rating: AC 100 to 120V→T1A 250V, AC 200 to 240V→T0.5A 250V)

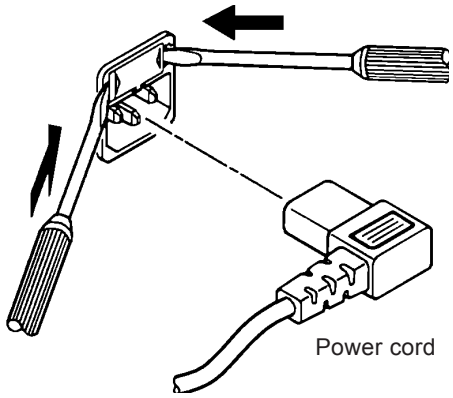
1. **Turn OFF (○) the power switch on the station and disconnect the power cord from the wall outlet.**

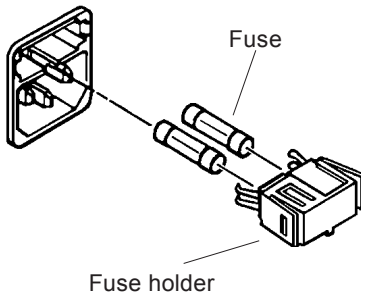
2. **Disconnect the power cord from the power connector.**

3. **Push in and hold the hooks on the left and right sides with a thin flatblade screwdriver and pull out the fuse holder.**

4. **Remove the used fuses and replace them with new ones.**

5. **Install the removed parts in the reverse order.**




## ⚠ CAUTION

- If fuses burn out frequently, do not touch the inside of the device but contact your authorized distributor.
  If you touch the inside of the device, you may receive an electrical shock.

# 8.7 Cleaning the Measuring Window

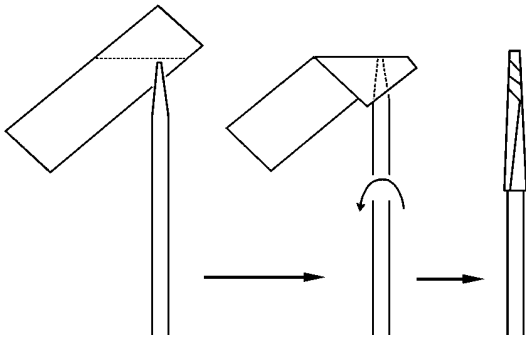
Fingerprints or dust on the measuring window will decrease the reliability of the measurements. Be sure the window is always clean.

1. **Blow off dust on the measuring window with a blower.**

2. **Lightly soak lens cleaning paper in alcohol, then wrap it around a thin object such as a chopstick (or cotton swab). Use this to clean the glass of the measuring window.**
   Use a thin stick that will not damage the glass. (Never use a hard object such as metal.)

   Wipe lightly from the center of the measuring window to the outside in a circular motion.
   Do not allow the alcohol to contact the sensor or cover.

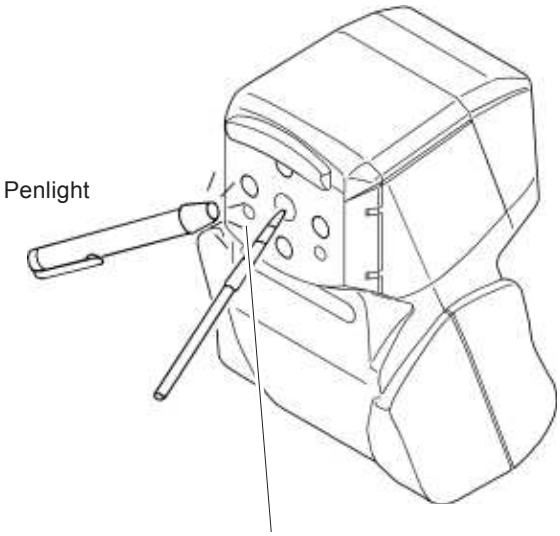
   Do not allow the alcohol to contact the sensor or cover.



Wrap cleaning paper around the tip.

3. **Make sure the window is clean with a penlight. If not, clean it again with a new piece of cleaning paper.**

   Move the penlight at different angles to get a good view of the window.




Do not allow the alcohol to contact the sensor window.
The sensor window can be cleaned with dry cleaning paper.

# 8.8 Cleaning Exterior

When the cover or panel of the device becomes dirty, wipe with a soft cloth. For stubborn stains, immerse the cloth in a neutral detergent, wring well, and wipe. Finally wipe with a dry and soft cloth.

## NOTE

- Never use an organic solvent such as paint thinner.
  It may ruin the surface of the device.

# 8.9 Lists of Replacement Parts

| Item | Order Number | Description |
|---|---|---|
| Printer roll | 80620-00001 | Width 58 mm, Length 25 m |
| Battery | 80416-00014 | Litium-ion battery, UR-121 |
| Fuse | 80402-02039 | T1A 250V 5 × 20mm |
| Fuse | 80402-02041 | T0.5A 250V 5 × 20mm |

* Always keep a spare fuse and printer paper roll in stock.

# §9 SPECIFICATIONS

## Measuring unit

### ○ Measurement of refractive error (AR measurement)

- Spherical power (S)
  - Measurable range: –20.00 D to +22.00 D (V.D.=12 mm)
  - Indication steps: 0.12 D / 0.25 D
- Cylindrical power (C)
  - Measurable range: 0 D to ±12.00 D
  - Indication steps: 0.12 D / 0.25 D

[Accuracy*1]

| Criterion | Measuring range | Deviation from the nominal value |
|---|---|---|
| Spherical and cylindrical vertex | 0.00 to ± 10.00 D | ± 0.25 D |
| | ＞10.00 D (absolute) | ± 0.50 D |

- Cylinder axis (A)
  - Measurable range: 0° to 180°
  - Indication steps: 1° / 5°

[Accuracy*1]

| Criterion | | Deviation from the nominal value of the ARK |
|---|---|---|
| Cylinder axis for cylidrical power | 0.25 D to 0.50 D | ± 10° |
| | ＞0.50 D to 3.00 D | ± 5° |
| | ＞3.00 D | ± 3° |

*1 The accuracy specifications are based on the results of eye model testing performed in accordance with ISO 10342: 1997, Ophthalmic Instruments-EyeRefractometers.

* Cylinder axis shall be indicated as specified in ISO 8429.

- Minimum pupil diameter measurable: 2.6 mm in diameter
- Vertex distance: 0 mm/ 10.5 mm/ 12 mm/ 13.75 mm/ 15 mm/ 16.5 mm
- Relaxation of accommodating eye: Auto-fogging system

### ○ Measurement of corneal curvature (KM measurement)

- Corneal curvature radius (R1, R2, AVE)
  - Measurable range: 5.00 mm to 13.00 mm
  - Indication step: 0.01 mm
- Corneal refractive power (R1, R2, AVE)
  - Measurable range: 25.96 D to 67.50 D (n=1.3375)
  - Indication steps: 0.12 D / 0.25 D
  - Corneal refractive index: n = 1.3375 / 1.336 / 1.332
- Corneal cylindrical power (CYL)
  - Measurable range: 0 D to ±12.00 D
  - Indication steps: 0.12 D / 0.25 D

- Corneal cylinder axis (AXIS)
  - Measurable range: 0° to 180°
  - Indication steps: 1° / 5°
- KM measurable area: 3.3 mm diameter on cornea (for corneal curvature radius of 7.7 mm)

### O Sagittal radius measurement

- Measurable angle: 25º each from the center (up, down, temporal side, nasal side)
- Sagittal radius measurement
  - Measurable range: 5.00 mm to 10.00 mm
  - Indication step: 0.01 mm
- Eccentricity [E]
  - Measurable range: –4.10 to +2.05

### O Measuring time

- Measurement of refractive power: 0.2 seconds
- Measurement of corneal curvature radius: 0.1 seconds

### O Chart

Scenery chart

### O Observation and indications

2.5 inch color LCD monitor

### O Auto start

The measurement starts automatically when the eye is aligned and focused.

### O Designation of left/right side

Auto / Manual

### O Axis correction

Manual selection (90°)

### O Dimension and weight

140 (W) × 130 (D) × 207 (H) mm,
Approximately 980 g (including battery)

## Station unit

### O Printer unit

- Printer: Thermal line printer (Print speed: 25.4 mm/s)
- Paper width: 58 mm, roll paper
- Transmission system: Infrared (IR) interface (Transmission distance: within approximately 1 meter)
- Interface: RS-232C

### O Battery-charging unit

- Battery: Lithium-ion battery (7.4 V 1600 mAh)
- Battery charge: Inserted in the station (Approximately 120 to 150 minutes)

* The measuring unit can be used during charging.
Connected between the measuring unit and the station via the supplied cable.(Approximately 120 to 150 minutes)

* The measuring unit can be used during charging.

## O Power source

- Input — AC 100 to 120 V ±10% 50/ 60 Hz
  AC 200 to 240 V ±10% 50/ 60 Hz
- Power consumption — 50 VA

## O Dimensions and weight

- Station alone — 249 (W) × 220 (D) × 102 (H) mm 2.5 kg
- Station + measuring unit — 284 (W) × 220 (D) × 216 (H) mm 3.5 kg

## O Printout

- M/D/Y of measurement, Time of Measurement, Patient No.
- Vertex distance
- Measured value of refractive error (AR measurement)
  Ten-time memory for left and right eyes:
  Median value
  (when the eye is measured three times or more)
  Latest value
  (when the eye is measured twice or less)
- Measured value of corneal curvature (KM measurement)
  Ten-time memory for left and right eyes:
  Median value
  (when the eye is measured three times or more)
  Latest value
  (when the eye is measured twice or less)
- Contact lens conversion value
- SE (Spherical Equivalent) value
- Optimum value of trial lens
- Eye print

## O Interface

- Interface which complies with RS-232C standard
  Outputs all data except eye print which can be printed.

## O Environmental conditions (in transference and storage)

- Temperature — –20ºC to 60°C
- Humidity — 10% to 95% (No condensation)

## O Environmental conditions (in use)

- Temperature — 10ºC to 40°C
- Humidity — 30% to 75% (No condensation)
- Pressure — 700 hPa to 1060 hPa

# §10 ACCESSORIES

## 10.1 Standard Accessories

Fuse ..... 4 pcs. (Two for station, spare fuses are mounted in the spare fuse holders inside the printer cover of the station.)
Printer paper ..... 4 rolls (One for station)
Power cord ..... 1 pc.
Dust cover ..... 1 pc.
Battery ..... 1 pc.
Cable ..... 1 pc. (Measuring unit ↔ Station)
Hand strap ..... 1 pc. (Attached to the measuring unit)
Operator's manual ..... 1 pc.

## 10.2 Optional Accessories

Carrying case
Portable stand
IC card Reader/Writer
Neck strap (Standard equipment for the US market only)

# §11 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 ARK-30 complies with these requirements as tabled below. Follow the guidance on the tables for use of the device in the electromagnetic environment.

**EMC (IEC 60601.1.2:2001)**

| **Guidance and manufacturer's declaration - electromagnetic emissions** | | |
|---|---|---|
| The ARK-30 is intended for use in the electromagnetic environment specified below. The customer or the user of the ARK-30 should assure that it is used in such an environment. | | |
| **Emissions test** | **Compliance** | **Electromagnetic environment - guidance** |
| RF emissions<br>CISPR 11 | Group 1 | The ARK-30 uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. |
| RF emissions<br>CISPR 11 | Class B | The ARK-30 is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. |
| Harmonic emissions<br>IEC 61000-3-2 | Class A | |
| Voltage fluctuations/Flicker emissions IEC 61000-3-3 | Complies | |

| **Guidance and manufacturer's declaration – electromagnetic immunity** | | | |
|---|---|---|---|
| The ARK-30 is intended for use in the electromagnetic environment specified below. The customer or the user of the ARK-30 should assure that it is used in such an environment. | | | |
| **Immunity test** | **IEC 60601 test level** | **Compliance level** | **Electromagnetic environment - guidance** |
| Electrostatic Discharge (ESD)<br>IEC 61000-4-2 | ±6kV contact<br>±8kV air | ±6kV contact<br>±8kV air | Floor should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. |
| Electrical fast transient/burst<br>IEC 61000-4-4 | ±2kV for power supply lines<br>±1kV for input/output lines | ±2kV for power supply lines<br>±1kV for input/output lines | Mains power quality should be that of a typical commercial or hospital environment. |
| Surge<br>IEC 61000-4-5 | ±1kV for power supply lines<br>±2kV for input/output lines | ±1kV for power supply lines<br>±2kV for input/output lines | Mains power quality should be that of a typical commercial or hospital environment. |
| Voltage, dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11 | $<5\%\ U_T$<br>($>95\%$ dip in $U_T$)<br>for 0,5 cycle<br>$40\%\ U_T$<br>(60% dip in $U_T$)<br>for 5 cycles<br>$70\%\ U_T$<br>(30% dip in $U_T$)<br>for 25 cycles<br>$<5\%\ U_T$<br>($>95\%$ dip in $U_T$)<br>for 5 sec | $<5\%\ U_T$<br>($>95\%$ dip in $U_T$)<br>for 0,5 cycle<br>$40\%\ U_T$<br>(60% dip in $U_T$)<br>for 5 cycles<br>$70\%\ U_T$<br>(30% dip in $U_T$)<br>for 25 cycles<br>$<5\%\ U_T$<br>($>95\%$ dip in $U_T$)<br>for 5 sec | Mains power quality should be that of a typical commercial or hospital environment. If the user of the ARK-30 requires continued operation during power mains interruptions, it is recommended that the ARK-30 be powered from an uninterruptible power supply or a battery. |
| Power frequency (50/60Hz) magnetic field<br>IEC 61000-4-8 | 3 A/m | 3 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |
| NOTE $U_T$ is the a.c. mains voltage prior to application of the test level. | | | |

| Guidance and manufacturer's declaration - electromagnetic immunity | | | |
|---|---|---|---|
| The ARK-30 is intended for use in the electromagnetic environment specified below. The customer or the user of the ARK-30 should assure that it is used in such an environment. | | | |
| **Immunity test** | **IEC 60601 test level** | **Compliance level** | **Electromagnetic environment - guidance** |
| Conducted RF<br>IEC 61000-4-6<br><br>Radiated RF<br>IEC 61000-4-3 | 3Vrms<br>150kHz to 80MHz<br><br>3V/m<br>80MHz to 2.5GHz | 3Vrms<br>($V_1$=3)<br><br>3V/m<br>($E_1$=3) | Portable and mobile RF communications equipment should be used no closer to any part of the ARK-30, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.<br>Recommended separation distance<br>$d=1.2x\sqrt{P}$<br>$d=1.2x\sqrt{P}$ 80MHz to 800MHz<br>$d=2.3x\sqrt{P}$ 800MHz to 2.5GHz<br>where $P$ is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and $d$ is the recommended separation distance in metres (m).<br>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b]<br>Interference may occur in the vicinity of equipment marked with the following symbol:<br>  |
| NOTE 1 At 80MHz and 800MHz, the higher frequency range applies.<br>NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people. | | | |
| a. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the ARK-30 is used exceeds the applicable RF compliance level above, the ARK-30 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the ARK-30.<br>b. Over the frequency range 150kHz to 80MHz, field strengths should be less than 3V/m. | | | |

**Recommended separation distances between portable and mobile RF communications equipment and the ARK-30**

The ARK-30 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the ARK-30 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the ARK-30 as recommended below, according to the maximum output power of the communications equipment.

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

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

# APPENDIX. A GLOSSARY

**•AI mode**

In this mode, the measurement is automatically completed after five or more measurements if the data values are stable without variations in the AR measurement. When unstable data is included, additional measurements are necessary until stable data is obtained.

**• AR median value, KM median value**

The intermediate value of the measurements which are put in order in the computer. The latest value is selected when the measured data is two or less.

**• Auto IOL**

When the measurement cannot be started due to reflected light other than corneal luminous spots or abnormalities on the IOL-implanted eye, etc., the IOL measurement mode will automatically turn on.
In the IOL measurement, measured results are easy to obtain by changing the measurement conditions so that the IOL-implanted eyes can be measured.

**• Auto-shot**

This function automatically starts the measurement as soon as the eye is aligned and focused.

**• Comment**

Desired characters and codes can be entered. Up to 24 characters/line and a maximum of two lines can be entered.

**• Contact lens conversion value**

The value that the AR median values (The latest values when the median values have not been obtained) are converted into CL values, with the vertex distance (VD) at “0” mm.

**• Eye print**

Tells graphically the patient’s refractive status based on the AR median values (The latest values when the median value have not been obtained).

**• Measurable range over error**

When the data exceeds the measurable limit, the following error code appears.
Err + o ..... The spherical power is over the limit in the “+” direction.
Err – o ..... The spherical power is over the limit in the “–” direction.
Err c o ..... The cylindrical power is over the limit.

**• SE value (Spherical Equivalent)**

The value that is 1/2 of the cylinder value is added to the sphere value. Calculated for the AR median values (The latest values when the median values have not been obtained) and CL conversion values.

**• Trial lens data**

Based on the AR median values, these are the values that were converted automatically from the cylinder values so that the spherical values for the trial lens will become smaller.

**• Vertex distance**

The distance between the corneal vertex to the posterior surface of the spectacle lens.

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