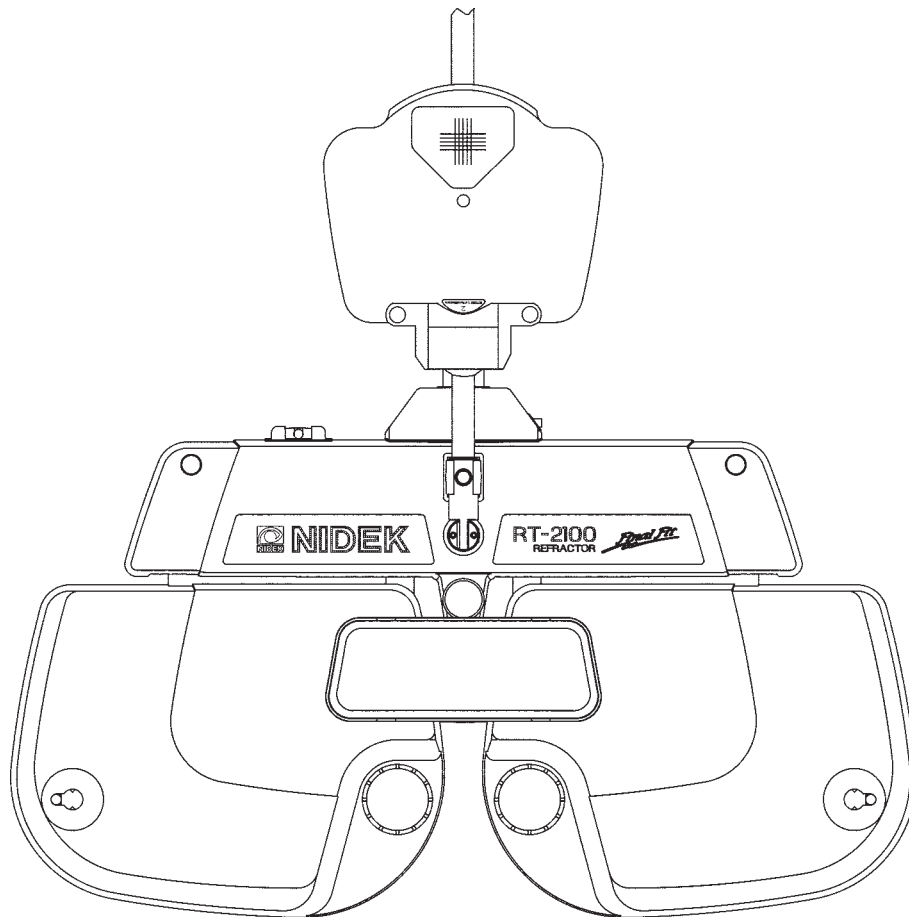


NIDEK
REFRACTOR
Model RT-2100
OPERATOR'S MANUAL



* Specifications are subject to change without notice for improvement.



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 **BEFORE USE, READ THIS MANUAL.**

This Operator's Manual contains the operating procedures, safety precautions and specifications for the RT-2100 when it is used in combination with the following chart presenting devices.

In this manual, JIS, IEC 60601 and UL standards are applied.

The refractor head complies with ISO 10341 (Ophthalmic instruments - Refractor heads).

The dioptric powers are indicated with a reference wavelength of 546.07 nm.

For correct use, it is necessary that the contents of this manual, in particular the safety precautions and operating procedures, are thoroughly understood before using the instrument.

Keep the manual handy for reference.

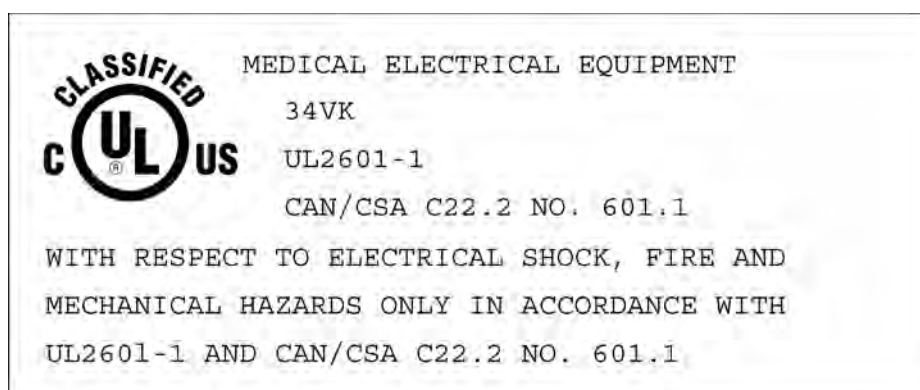
There are no user-serviceable parts inside the instrument except printer paper and fuses. Therefore, if you encounter any problems or have questions about the instrument during use, contact your authorized distributor.

*1 Chart presenting devices used in combination with the RT-2100

- NIDEK SPACE SAVING CHART SSC-300/SSC-330/SSC-350
- NIDEK CHART PROJECTOR CP-670/CP-690

*2 Figures of the control box and charts for CP-690 Type U are used in this manual.

*3 In this manual, visual acuity is represented by fractions (feet). For VA values represented by decimals or fractions (meters), see "Appendix. C Conversion table for VA values" at the back of this manual.



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

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§1 INTRODUCTION

1.1 Outline of the Instrument

The NIDEK REFRACTOR Model RT-2100 is a computerized refractor used for subjective refraction when connected to the NIDEK AUTO REFRACTOMETER (AR), AUTO REF/KERATOMETER (ARK) and AUTO LENSMETER (LM)*¹. The operator has a fully integrated refraction system that simplifies and speeds up refraction.

The RT-2100 includes a refractor head, a control box, a relay box and a printer.

The relay box serves as a link to the refractor head, control box and printer, and also functions as a communication link to the AR and/or LM.

The control box provides a display for viewing measurements. The control panel allows the operator to perform most operations from an integrated console by linking the refractor and the connected chart presenting device. Both instruments can be operated from the single control box.

Normally, the relay box and the printer are contained in the system table (not included in the RT-2100 package.)

1.2 Classifications

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

The RT-2100 is classified as a Class I instrument.

[Form of protection against electrical shock] Class I

The RT-2100 is classified as a Class I instrument. A Class I instrument is an instrument in which protection against electric shock does not rely solely on basic insulation. A Class I instrument includes additional safety precautions that provide for connection of accessible conductive parts to a protective (earth) grounding conductor in the fixed wiring of the installation.

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

The RT-2100 is classified as an instrument with a Type B applied part.

A 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)

*1 Connectable instruments

AR: NIDEK AR-20, ARK-30, AR-600, AR-600A, AR-660A, ARK-700, ARK-700A, ARK-760A, AR-800, AR-820, AR-860, ARK-900, AR-1000, AR-1100, AR-1200M, AR-1600, ARK-2000, ARK-9000, ARK-10000

LM: NIDEK LM-770, LM-820A, LM-870, LM-990, LM-990A

[Degree of protection against liquid entry] IP20

The RT-2100 is classified as a normal instrument, as such provides only minimal protection against liquid intrusion. The enclosure of the RT-2100 is not completely water proof. Avoid immersion of any kind.

[Degree of protection against flammability]

The RT-2100 is classified as an instrument not suitable to be used in a potentially flammable environment. Do not operate the instrument near flammable materials.

[Mode of operation]

Continuous operation

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

The RT-2100 does not have any parts to be sterilized or disinfected.

1.3 Symbol Information



This symbol on the instrument indicates that caution should be taken. Refer to the Operator's Manual before operating the instrument.



This symbol indicates that the instrument is classified as an instrument with a Type B applied part.



This symbol on the power switch indicates that the power is ON.



This symbol on the power switch indicates that the power is OFF.
















This symbol indicates the proper fuse rating of the device.



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

The symbols printed on the control box and shown on the display correspond to the symbols and those names defined in ISO 10341 (Ophthalmic instruments - Refractor heads) as shown in the following table.

Auxiliary lens	Marking		
	RT-2100	ISO10341	
Red maddox rod	 or 	MR	Maddox rods
Pinhole plate		PH or 	Pinhole
Occluder		BL or 	Occluder
PD check lens		CL or 	Cross line
Red filter		RF	Red filter
Green filter		GF	Green filter
Polarizing filter	 or 	PF	Polarization filter
Open aperture		OA	Open aperture
Lenses for retinoscope	RETI	RL	Retinoscopic lens

§2 SAFETY

The following safety precautions should always be followed.

In this manual, Signal Words are used to designate a degree or level of safety alerting. The definitions are as follows.

⚠ WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

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

Even cases mentioned in **⚠ CAUTION** may result in serious injury under certain conditions. Be sure to observe the instructions of **⚠ CAUTION**.

2.1 Operation

⚠ WARNING

- When moving the refractor head in front of or away from the patient, make sure that there are no obstacles in its path.
Inadvertent contact with a person or object could result in personal injury and/or damage to the instrument.

⚠ CAUTION

- Never disassemble or tamper with the inside of the instrument.
This may result in an electric shock or an instrument malfunction.
- Be sure to use an electrical current which meets the power specification requirements.
If the line voltage is too high or too low, it may affect the performance of the instrument and may start an electrical fire.
- Always remove the power cord from the wall outlet by holding the plug. Never pull on the cord.
This can damage the internal wires and may result in a short circuit, an electric shock or a fire.
- If the internal wires of the power cord are exposed, the power to the instrument will be inconsistent, or the plug will become extremely hot, indicating internal damage to the cord. If this occurs, remove the cord from the outlet immediately. After checking to see that no more smoke is being produced, contact your authorized distributor immediately.
If the instrument is not functioning normally, it may cause an electric shock or a fire.

CAUTION

- Do not crush or squeeze the power cord with heavy objects.
If the power cord is damaged, it may cause an electric shock or a fire.
- Clean between the prongs of the power plug using a dry cloth every couple of months.
If the prongs are exposed to moisture or excessive dirt, the instrument may short circuit or cause a fire.
- If you notice strange odors or smoke being emitted from the instrument, turn OFF the instrument, and disconnect the power cord immediately. After confirming that smoke is no longer being produced, contact your authorized distributor.
If the instrument is used under abnormal conditions, it may cause an electric shock or a fire.

NOTE

- Do not touch the measuring windows.
Dirt or fingerprints on the measuring windows may affect the accuracy of the refraction data.
- Be sure to wipe the forehead rest and face shields with a clean cloth and a diluted neutral detergent solution before each examination.

2.2 Storage

NOTE

- Do not store the instrument in a place where it may be exposed to moisture or toxic chemicals.
- Avoid storing the instrument in an area with excessive heat, humidity, or dust.
To preserve the appearance of the instrument, avoid direct exposure to sunlight.

2.3 Installation

WARNING

- The refractor head weights 6.7 kg. Make sure that the refractor's arm has been designed to bear the weight.
Before attaching the refractor head to the arm, impose weight on the arm, and confirm that the refractor head is stable during normal use.
- Be sure to secure the refractor head to the refractor arm with the set screw.
If the refractor head is dropped or falls, it could cause extensive damage and possible injury.

NOTE

- Store the instrument in the following conditions.
Temperature: 10 - 40 °C
Humidity: 30 - 85 %
A dust free environment
Minimal exposure to direct sunlight
An area free of vibration
- Be sure to level the refractor head before use.
If it is not level, the accuracy of the refraction data may be affected. Level the refractor head by turning the Leveling adjustment knob until the bubble is centered in the level.
- This instrument has been tested and found to comply with the limits for medical devices to the IEC 60601-1-2: 1993, EN60601-1-2: 1994, Medical Device Directive 93/42/EEC. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. This instrument 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 instrument does cause harmful interference to other devices, which can be determined by turning the instrument off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
 - Reorient or relocate the receiving device.
 - Increase the separation between the instruments.
 - Connect the instrument to an outlet on a circuit different from that to which the other device(s) are connected.
 - Consult the manufacturer or field service technician for help.

2.4 Wiring

CAUTION

- Be sure to use a (HOSPITAL GRADE) wall outlet equipped with a grounding terminal in order to avoid an electric shock or fire in the event of a power leak.
- Be sure the plug is securely in place in the wall outlet.
Insecure connections may affect the operation of the instrument or create a fire hazard.

2.5 After Use

CAUTION

- If the instrument will not be used for an extended period, disconnect the power plug from the wall outlet.
If the instrument is covered with dust and it takes on moisture, it may create a fire hazard. Always use the dust cover supplied with the instrument.

NOTE

- When the instrument is not in use, turn OFF the power switch and put the dust cover on.
If the instrument is not covered for an extended period, the accumulation of dust may affect the accuracy of the instrument.

2.6 Maintenance

NOTE

- Never use an organic solvent or abrasive solvent to clean the exterior of the instrument as it may ruin the appearance.
- When the instrument is sent back to NIDEK for repair or maintenance, wipe the surface (especially, the area where the patient's skin contacts) of the instrument with a clean cloth immersed in ethyl alcohol for disinfection.



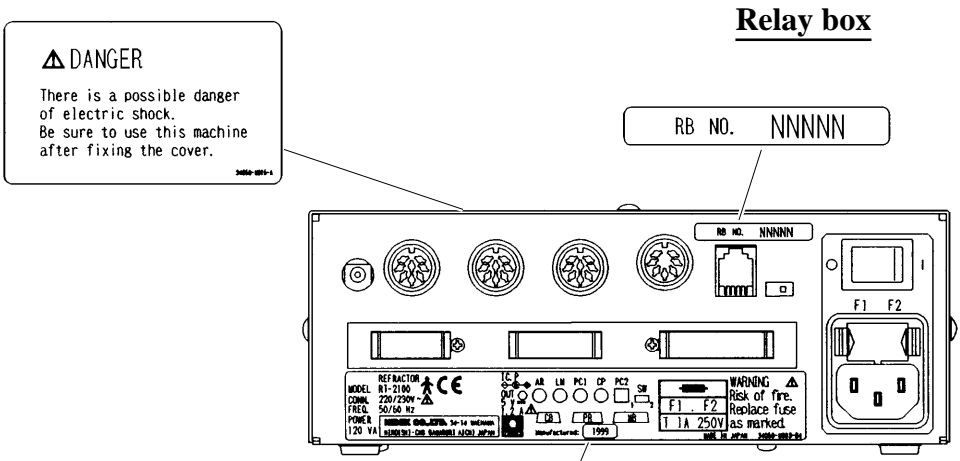
2.7 Disposal

NOTE

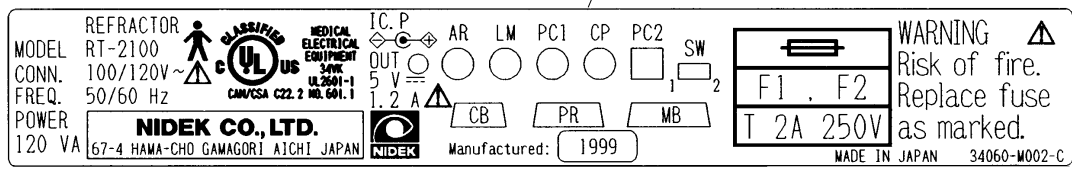
- Follow local governing ordinances and recycling plans regarding disposal or recycling of device components.
Especially the disposal method of lithium batteries varies according to the government. As the relay and control boxes have lithium batteries on the circuit boards, follow the local governing ordinances and recycling plans when disposing of a circuit board with lithium batteries.
- When disposing of packing materials, sort them by material and follow local governing ordinances and recycling plans.

2.8 Labels

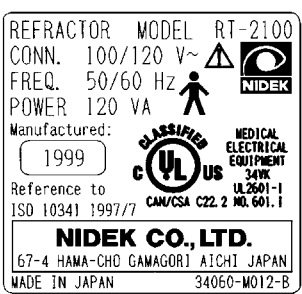
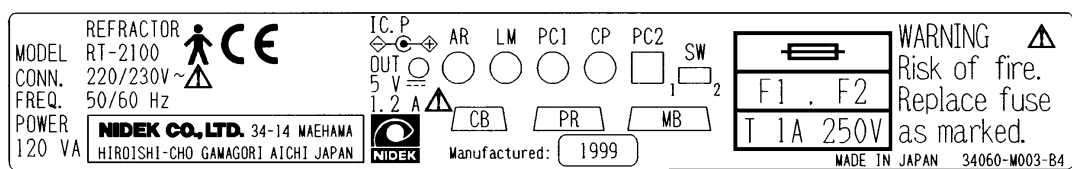
- Labels provide safety information about each part.



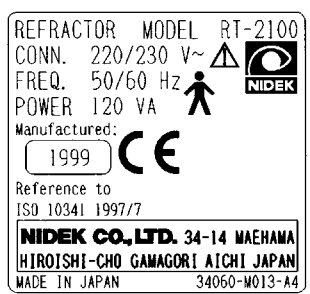
For 100V area



For 200V area

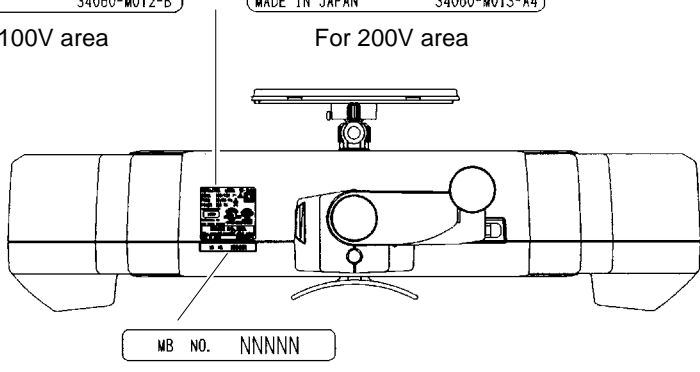


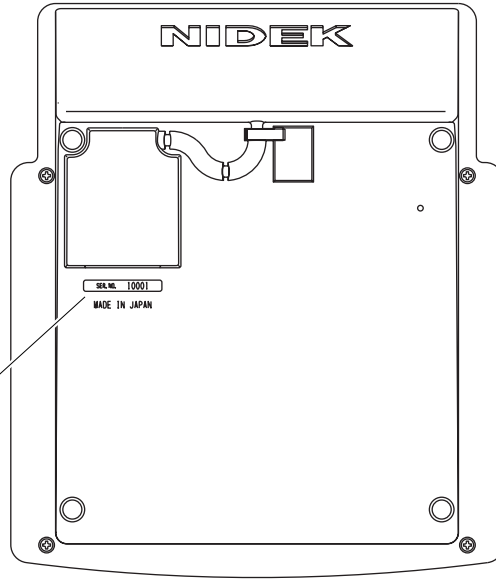
For 100V area



For 200V area

Refractor head





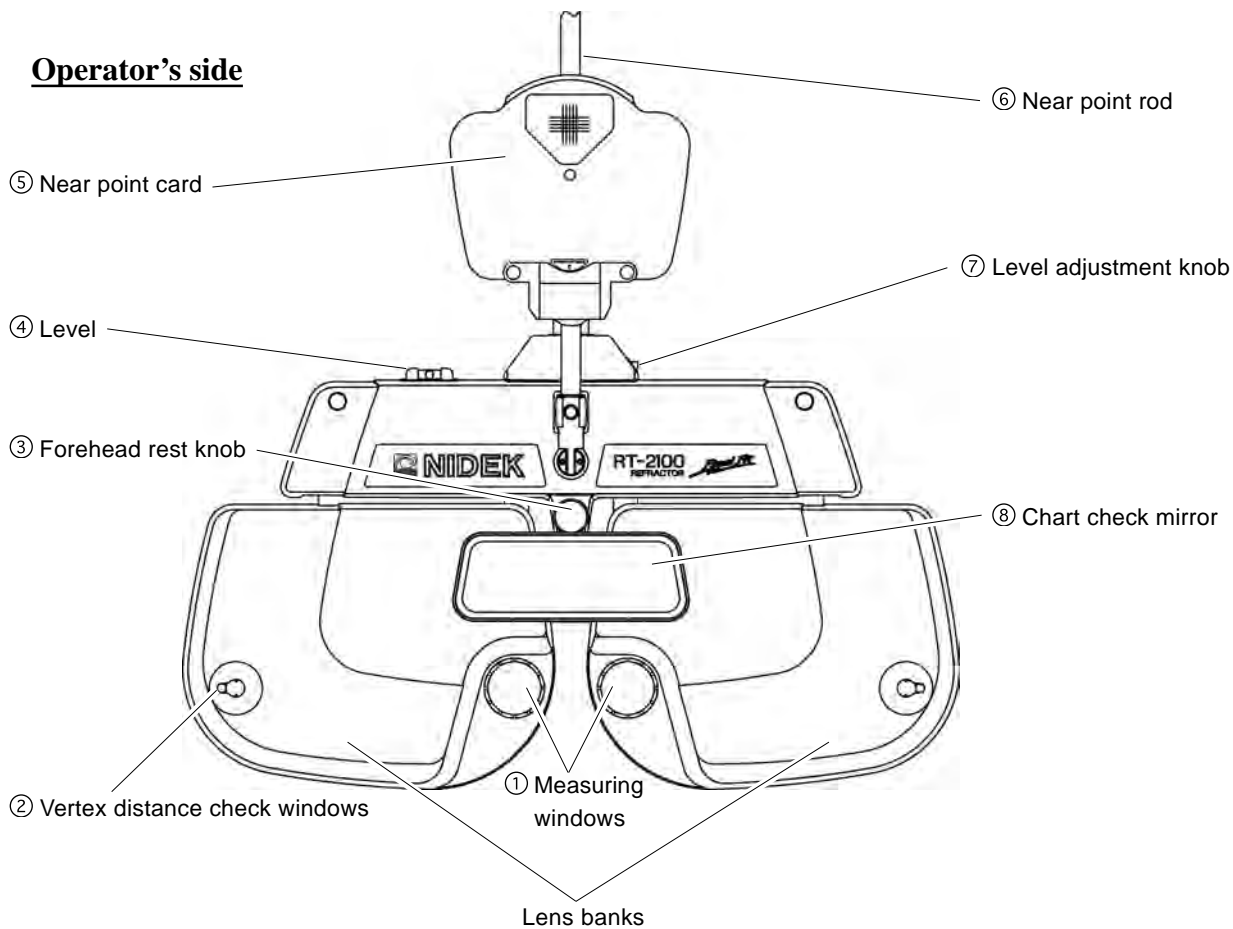
Control box

CB NO. NNNN

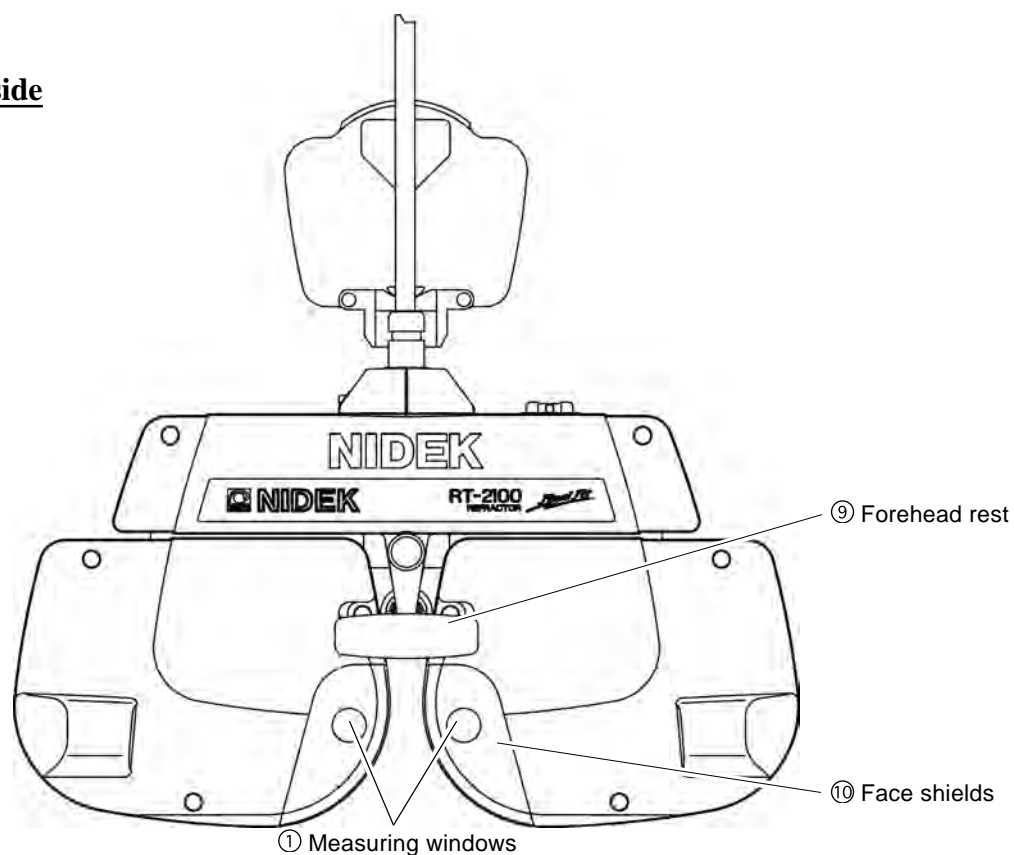


§3 CONFIGURATIONS

3.1 Refractor Head



Patient's side



① Measuring windows

Patients look at the chart through these windows.

② Vertex distance check windows

Used to check the patient's VD (the distance from a corneal vertex point to the lens).

The window has calibration markings of 12, 13.75, 16, 18 and 20 mm.

③ Forehead rest knob

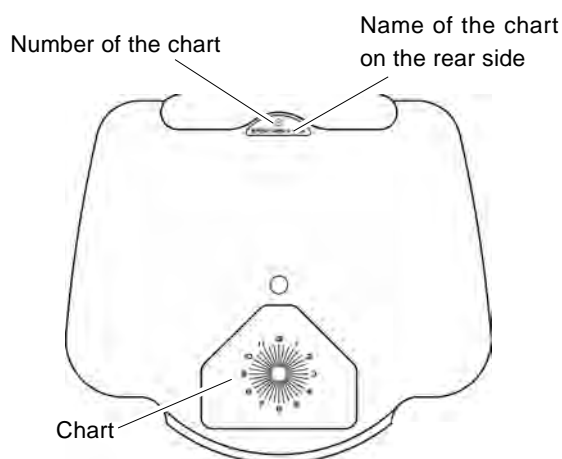
Used to move the forehead rest forward and backward in order to adjust the vertex distance (VD).

④ Level

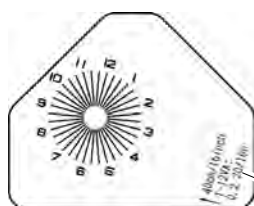
Used to verify that the refractor head is level. Turn the level adjustment knob until the air bubble is centered in the level.

⑤ Near point card

Used for Addition Power measurement.



The refracting distance is printed at the top of the card.

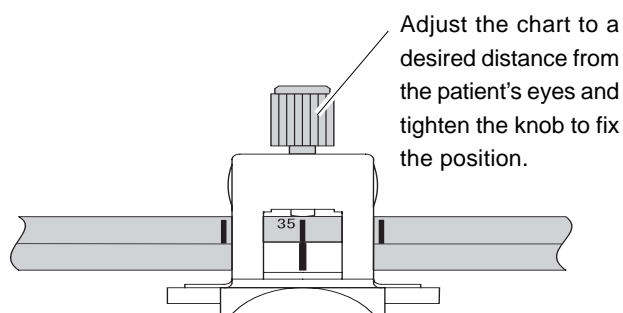


Explanation of the chart

⑥ Near point rod

The distances from the patient's eye to the near point card is marked in inches and centimeters.

- The black line at the near point card holder is aligned with the tick of the desired distance.
- The red number represents the power (diopter), the reciprocal of each distance in meters.



⑦ Level adjustment knob

Used to adjust the level of the refractor head. It can be inclined 2.5° toward the left or right at the maximum.

⑧ Chart check mirror

An operator confirms the selected chart with this mirror.

⑨ Forehead rest

Patient's forehead should touch the rest during measurement. Clean it before each measurement.

See "8.1 Cleaning the Forehead Rest". (p. 8-1)

⑩ Face shields

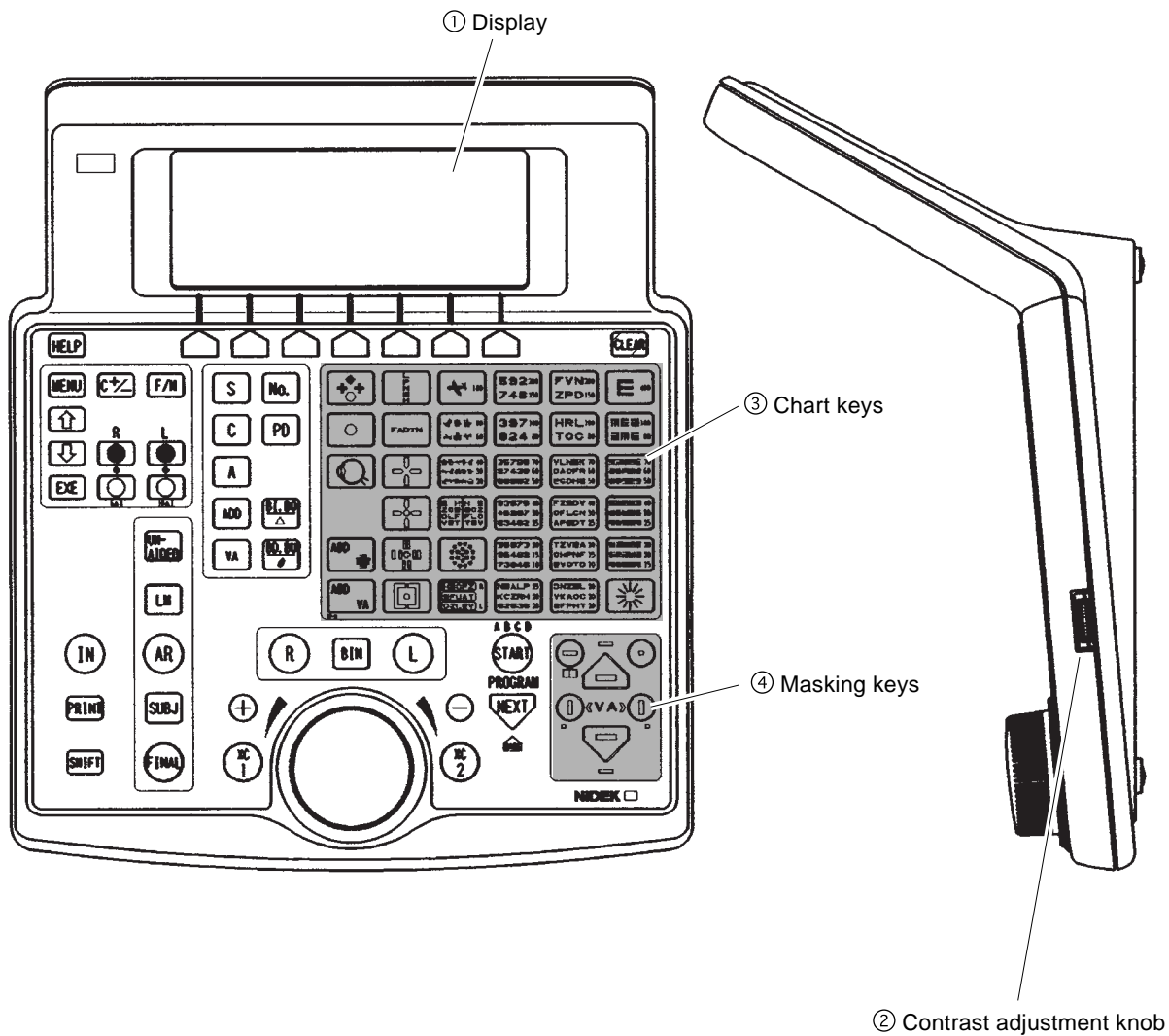
Patient's face touches the shields during measurement. Clean them before measurement. See "8.2 Cleaning the Face Shields". (p. 8-2)

3.2 Control Box

The blue colored keys are used for basic operation.

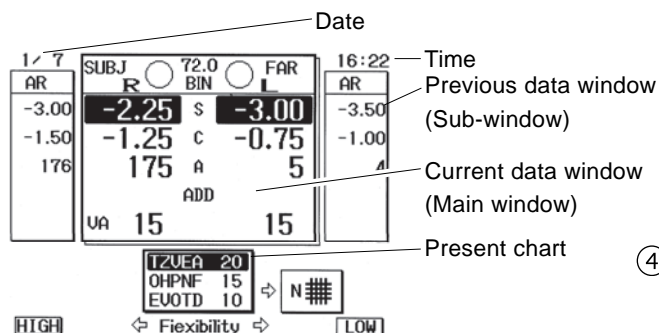
* Some switches function differently when they are used in conjunction with **SHIFT**.

In this manual, when you see instructions such as: “**SHIFT** + **START**”, it means “Press the **START** key while pressing the **SHIFT** key.”



① **Display**

Shows SPH, CYL, AXIS data and the chart that is being presented.



② **Contrast adjustment knob**

Used to adjust the contrast of the display.

③ **Chart keys**

Used to select charts.

④ **Masking keys**

Used to isolate any acuity line or letter on the chart that has been selected.

To remove the mask, press any of the chart keys.

VA (Visual Acuity) of the selected line or letter is shown at “VA” on the Main window of the display.



Used to isolate a horizontal line (letters of the same VA) on the VA chart.

• Used to move an isolation up and down after the mask has been applied.

• **SHIFT** + ⇒ A horizontal line mask will be applied to the top line of the chart.

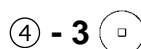
SHIFT + ⇒ A horizontal line mask will be applied to the bottom line of the chart.



Used to isolate a vertical line on the VA chart.

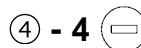
• Used to move the isolation to the right or left after the vertical line mask or a single letter mask has been applied.

• **SHIFT** + ⇒ Isolates a single letter at the lower-left or lower-right corner of a VA chart.



Used to isolate a single letter at the upper-right corner of a VA chart.

• **SHIFT** + ⇒ Isolates a single letter at the upper-left corner of a VA chart.

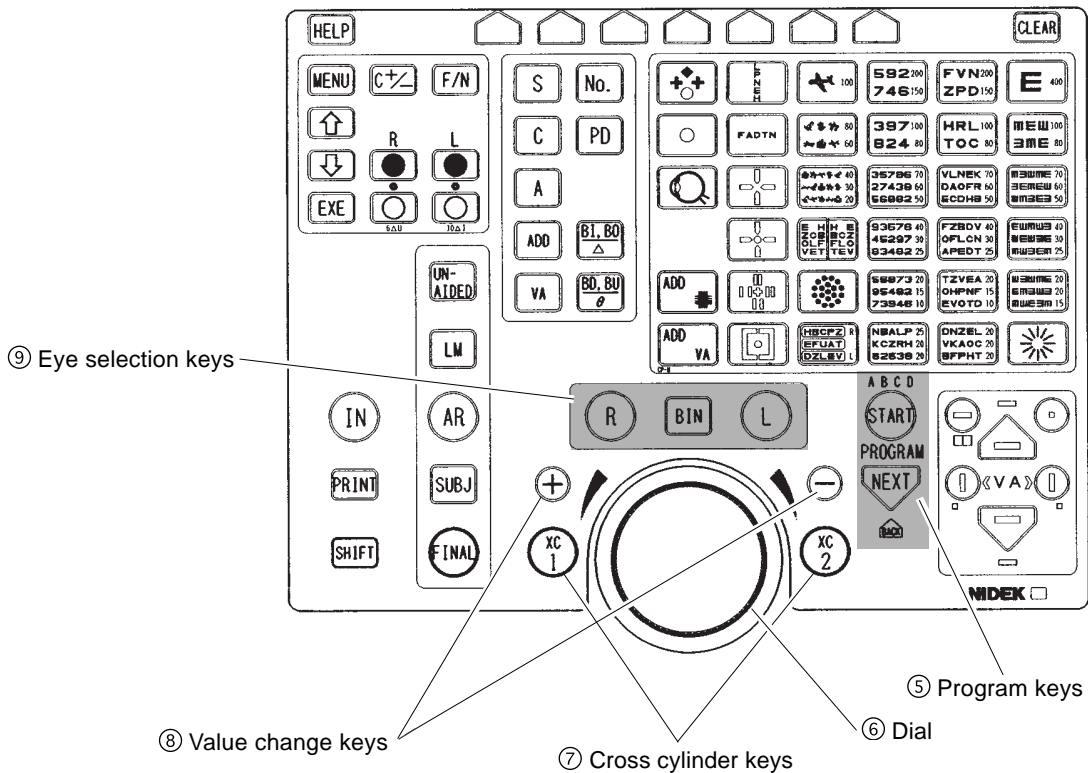


Used to isolate a middle line of a VA chart.

• **SHIFT** + ⇒ Adds the Red/Green filter to a VA chart that has been selected.

Again, **SHIFT** + ⇒ Releases the Red/Green filter.

Keys of Control Box





5 Program keys

For more information on using the programmed refraction sequence, see “4.5 Refraction with the Standard Program” (p. 4-12).



5 - 1

Starts a program.

- Press to start a programmed refraction sequence and activate the initial steps.
-  +  ⇒ Switches among program modes (A, B, C, D, E) in order.

5 - 2

Used to progress through each step of a programmed refraction sequence.


-  +  ⇒ Allows the user to go back to a previous step in the refraction program. (This key combination is inoperative while in the Final Fit mode.)

6 Dial

Changes any highlighted value.

Turn it clockwise ⇒ The value changes to the negative.


Turn it counterclockwise ⇒ The value changes to the positive.

The highlighted value changes by turning the knob while holding the  down.

7 Cross cylinder keys

Place a cross cylinder lens to refine axis or Cylindrical Power.


When it is pressed during binocular tests, the left measuring window is covered in order to allow testing of the right-eye only.


To perform the test with both windows open, press  of the covered-side window.

The 0.25 or 0.50 diopter lens should be selected in the “XC test” parameter of “Set parameter 1/5” screen prior to testing. A cross cylinder lens will be inserted as follows unless “Auto” is selected instead of “XC test” of “Set parameter 1/5”.

⑦ - 1 

- During axis refinement, the cross cylinder lens is inserted so that the minus axis is located at 45° from the minus axis position of the cylinder lens.
- During Cylindrical Power refinement, the cross cylinder lens is inserted so that the minus axis is located at 90° from the minus axis position of the cylinder lens.
- When using the Prism refinement mode (BI/BO), this switch can be pressed to clear out the values and start at zero in the right eye.

⑦ - 2 


- During axis refinement, the cross cylinder lens is inserted so that the minus axis is located at 135° from the minus axis position of the cylinder lens.
- During Cylindrical Power refinement, the cross cylinder lens is inserted so that the minus axis is located 0° from the minus axis position of the cylinder lens.
- When using the Prism refinement mode (BI/BO), this key can be pressed to clear out the values and start at zero in the left eye.
- Press this key while pressing  and the time display changes to the stopwatch display. This enables you to measure how long the test took and this function is sometime used for special tests to be carried out in a few seconds.

⑧ Value change keys

Provides the same function as the dial.

⑧ - 1 

A value increases by increments of 1 each time it is pressed.




⑧ - 2 


A value decreases by increments of 1 each time it is pressed.


⑨ Eye selection keys

Used to select right eye (R), left eye (L), or both eyes (BIN) for subjective measurements.

- The measuring window of the non-selected eye will automatically be covered. However, the occluder will not be inserted during binocular testing using prism lenses or polarizing filters.

-  +  or  ⇒ Specifies the dominant eye.


 will be shown next to R or L on the measurement screen to indicate the dominant eye.

⑨ - 1 

Leaves open or opens the right measuring window and leaves closed or closes the left measuring window. If a binocular testing chart is selected and binocular testing is desired, the left measuring window will not be covered and the right eye value is highlighted. In this situation, only right eye data can be adjusted.

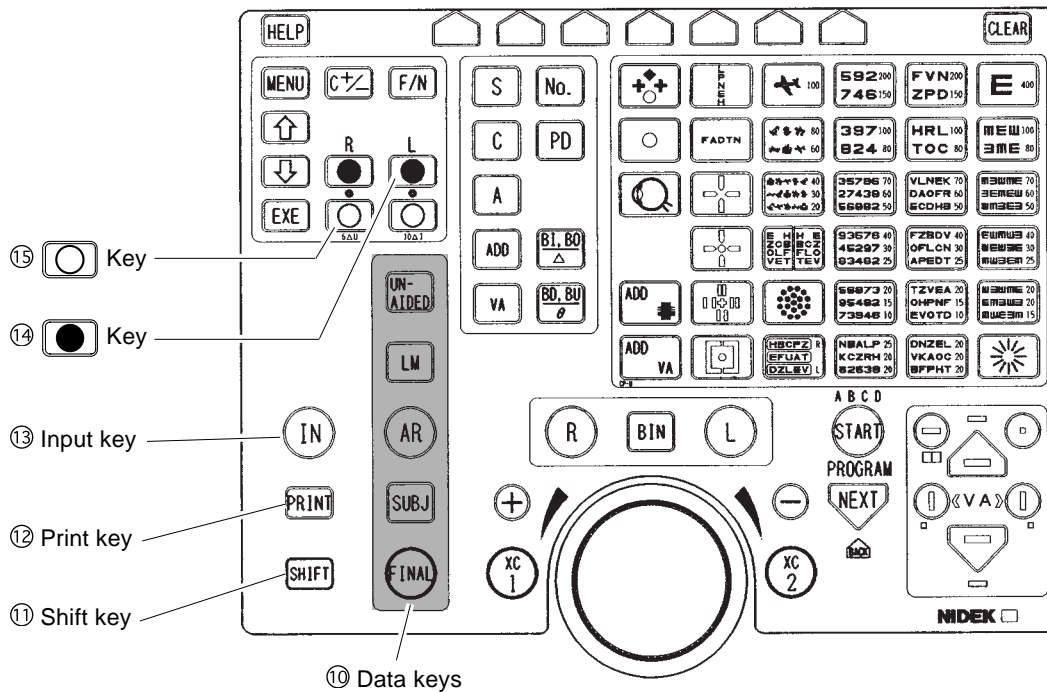
⑨ - 2 

Leaves open or opens the left measuring window and leaves closed or closes the right measuring window. If a binocular testing chart is selected and binocular testing is desired, the right measuring window will not be covered and the left eye value is highlighted. In this situation, only left eye data can be adjusted.

⑨ - 3 

Keeps or makes both measuring windows open. When changing values in this situation, data of both eyes can be changed to the same values with each adjustment.

Keys of Control Box



⑩ Data keys

Used to specify the field for receiving data or storing measurements.

Measurements in the specified field are shown on the main window.

The specified field will be indicated at the upper-left corner of the main window.

If one of the data keys is pressed without receiving data from an AR or LM, then the current measurements which have been on the main window, will be copied to the corresponding field to the selected data.

If one of these keys is pressed while holding **SHIFT** down, measurements on the screen will be copied to the corresponding field regardless of whether any data has been received and stored.

To enter data to the RT-2100, see “4.3 Entering Data” (p. 4-2)

⑩ - 1 UN-AIDED

Used to open the field for measuring unaided visual acuity. The corrective lens power in the refractor head will be set to 0 D.

⑩ - 2 LM

Used to open the field for receiving lensometry data.

⑩ - 3 AR

Used to open the field for receiving auto-refractometry or retinoscopic measurements.

⑩ - 4 SUBJ

Used to open the field for subjective refinement. When data is received from the AR or LM, this field will automatically open. The elapsed time starts to be measured from the point where any data is entered to the SUBJ field when the “Auto test time” parameter is set at “Yes”.

⑩ - 5 

Used to open the field for obtaining a final prescription and visual acuity.

The refined values are copied from the “SUBJ” field and are adjusted to determine final data.

 +  ⇒

This will automatically activate the Final Fit mode where Far Powers are automatically adjusted. (See “4.7.1 Auto adjustment of Far Powers”). (p. 4-24)

⑪ 



While holding down this key, indication increments change or modes change when the dial is turned or when a key is pressed.

⑫ 

Used to print out measurements or to export data to an external computer. See “5.2 Print-out” (p. 5-4)



⑬ 

Used to receive data from the LM or AR. Press the key and make sure that the data No. on the display is the same as the one on the printout from the LM or AR. Specify either

(, ) with the data keys.

⑭ 

Used to close the measuring windows. Used for monocular testing or cover testing.

 +  ⇒ Insert a pinhole plate with a diameter of 1 mm.

- The Focal depth of the eye becomes deeper.
- Can be used when visual acuity obtained with the corrective lenses is below expectations. If the pinhole improves the patient’s VA, the eye may have an irregular astigmatism.

⑮ 

Used to open the measuring window. Auxiliary lenses will be removed.

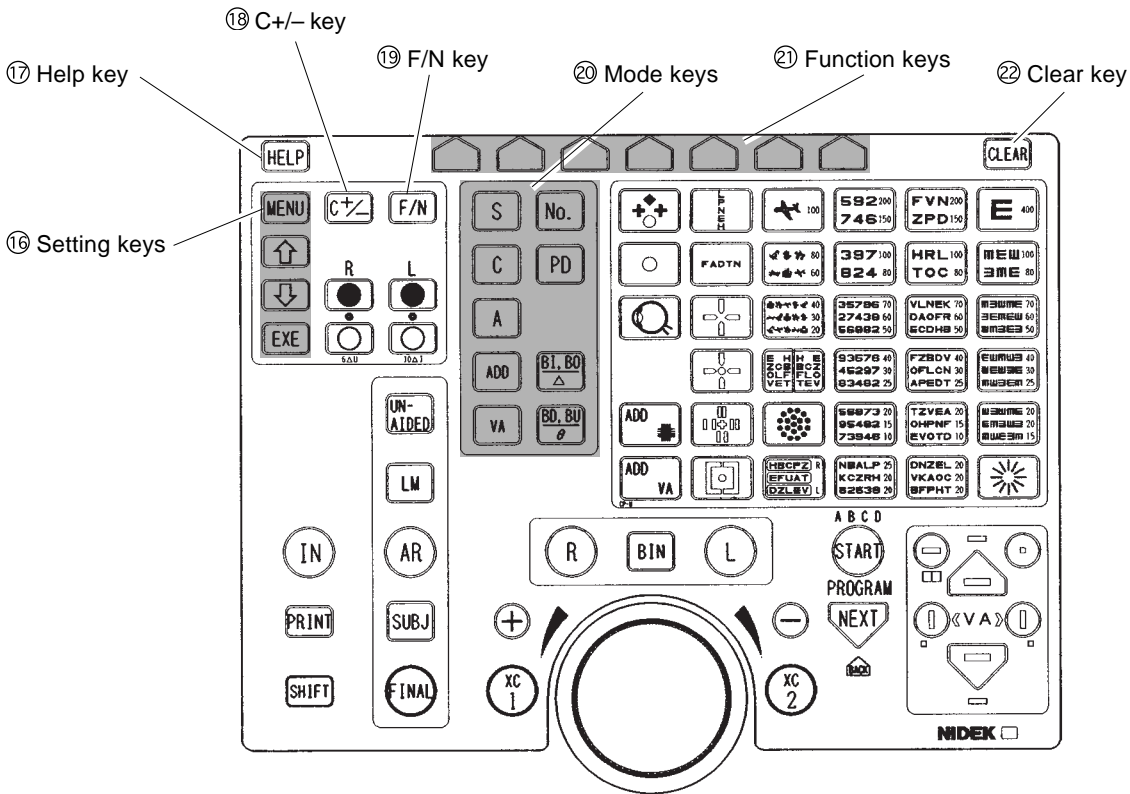
 + Right  ⇒

6 Δ base UP prism lens will be placed in the right measuring window. It appears to the patient that one chart is dissociated into the upper and lower parts. Used to detect horizontal phoria.

 + Left  ⇒

10 Δ base IN prism lens will be placed in the left measuring window. It appears to the patient that one chart is dissociated into the left and right parts. Used to detect vertical phoria.

Keys of Control Box



16 Setting keys

Used to open the field for changing parameter settings or programming refraction. See “§5 OTHER FUNCTIONS”. (p. 5-1)

16 - 1

Used to open the “Set up menu” screen.

16 - 2 ,

Used to select a menu option. These keys are also used to adjust the chart position when the SSC-300/SSC-330/SSC-350 is connected to the RT-2100. When programming, they are used to select the comments. See “5.1.2 Programming” (p. 5-2).

+ ⇒ *2

Makes the intensity of the glare lamp higher by one increment while the glare lamp is illuminated. The brightness, however, does not change when the lamp intensity is the highest even though these switches are pressed.

+ ⇒ *2

Makes the intensity of the glare lamp lower by one increment while the glare lamp is illuminated. The brightness, however, does not change when the lamp intensity is the lowest even though these switches are pressed.

16 - 3

Used to determine the selected menu options. If the RT-2100 interfaces with the SSC-300/SSC-330/SSC-350, this key is used to adjust the chart position. See “4.4 Initial Setups” (p. 4-11).

+ ⇒ *2

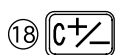
Turns the glare lamp ON/OFF.

17

Used to call up on-screen explanations and instructions for the selected chart.

To cancel, press the key again or press the function key which corresponds to .

*2 This function is available only when the optional glare lamp is attached to the connected SSC-330.



Switches Cylindrical Power to either + or -.





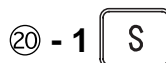
Switches to either the Distance (Far) mode or Near mode. The selected mode is indicated in the upper-right corner of the main window as “FAR” or “NEAR”.

- The system will automatically operate in the Far mode when the power is turned ON and after data is cleared.
- The Near mode is used after distance vision has been refined and Addition Power has been calculated in order to perform near vision function testing such as relative accommodation and horizontal or vertical phoria testing. When the Near mode is selected, both lens banks will converge to the preset working distance of 40 cm (variable) automatically.
- The ADD key will not work in the Near mode. The Near SPH value will be calculated by adding ADD value to the distance SPH value (distance SPH + ADD). It is also possible to transfer the distance SPH value alone into the Near mode by selecting the “SPH + ADD” option in the “SPH Far → Near” parameter.

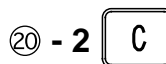
20 Mode keys

Selects the measurement field in which measurements are to be refined (or changed). Once the field is selected, a data field will be highlighted, indicating that changes can be made.

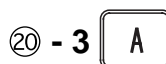
The measurement can be changed with the dial or  .



Places the system into the SPH mode which allows Spherical Power to be adjusted.



Places the system into the CYL mode which allows Cylindrical Power to be adjusted.






Places the system into the AXIS mode which allows the cylindrical axis to be adjusted.





Places the system into the ADD mode which allows the Addition Power to be adjusted.*³ Both lens banks will automatically converge to the preset working distance of 40 cm (variable). See the explanation of “Working dist. (WD)” parameter. (p. 5-13).

- When the “Preset ADD” parameter is set to “Yes”, the patient’s general age can be selected*⁴ and the expected spherical lens will be inserted and Addition Power will be displayed.
- Each time the key is pressed, a spherical lens with an Addition Power will be added or removed alternately and the lens banks will remain converged.

The reversed ADD indicator  on the main window will change to  and date indication will also change to “ADD-OFF” showing that the lens is removed.

By pressing  again, the Addition Power indicator will be highlighted and the addition power of the lens will be added.

*³ When the system is placed into the ADD mode during standard program (Program A) operation, ± 0.5 D cross cylinder lens (minus axis: 90°) will automatically be placed into the measuring windows. The ± 0.5 D cross cylinder lens will not be inserted when  is pressed during non-programmed measurement.

To insert the ± 0.5 D cross cylinder lens, press .

*⁴ The expected spherical lens with Addition Power will automatically be added according to the selected age. See “Appendix. D Preset Addition Power”.

After entering Addition Power, the working distance indications appear and the desired working distance can be selected with the corresponding function key.

The procedure for removing and setting Addition Power is the same as that for prism lenses. See “4.3.5.5 Removing and replacing prism lenses”. (p. 4-9)

It is possible to switch fields among LM, AR, SUBJ and FINAL on condition that the lens banks are converged in the ADD mode.

• **SHIFT** + **ADD**

Used to place the system in the mode which allows the values for NPC, NPA, NRA and PRA*⁵ to be entered.

For the procedures of each test, see “§6 METHOD OF SINGLE TESTS”. (p. 6-1)

②0 - 5 **VA**

Allows the user to manually enter visual acuity with the dial.

When AR or LM data has been entered and “UNAIDED” or “LM” field key is pressed, an expected VA chart will be presented.*⁶

②0 - 6 **No.**

Allows the user to select a patient ID No., which will be printed out and can be used as a communication ID for patient records in a PC.

See “5.2.1 Changing an ID No.”. (p. 5-6)

②0 - 7 **PD**

Displays PD measurement and allows the user to adjust the PD measurement in the refractor head.

Monocular PD (1/2 PD)*⁷ ⇒ Adjustments can be made after pressing either **R** or **L** while in the PD mode.

To exit from the mode ⇒ Press **PD** again.

②0 - 8 **BI, BO**
Δ

Allows the user to adjust base IN/OUT prism values for horizontal measurements. Either rectangular coordinates or absolute values for polar coordinates may be entered and adjusted. See “4.3.5 Setting prism lenses” for procedure for adjusting Prism Power. (p. 4-7)

②0 - 9 **BD, BU**
θ

Allows the user to adjust base UP/DOWN prism values for vertical measurements. Either rectangular coordinates or angle for polar coordinates may be entered.

②1 Function keys

Used to select functions displayed on the bottom of the main window.

②2 **CLEAR**

Clears all the data displayed in each field, on the measurement screen. To delete data in each field, press this key simultaneously with

UN-AIDED, **LM**, **AR**, **SUBJ** or **FINAL**.

*5 NPC: Near Point of Convergence
NRA: Negative Relative Accommodation

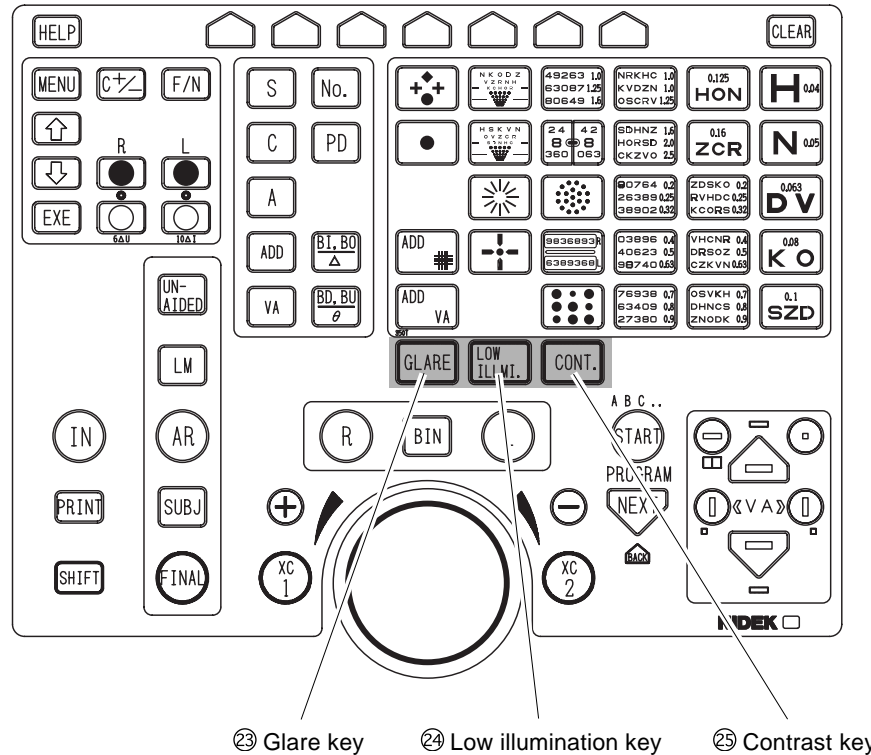
NPA: Near Point of Accommodation
PRA: Positive Relative Accommodation

*6 The expected VA chart will be presented only on condition that the parameter “Preset VA” is set to “1 letter” or “H. line”. For the type of the presented VA chart, see “Appendix. E Table for VA values as presented on charts”.

*7 Even when the monocular PD for only one eye is changed, both the left and right lens banks move concurrently.

Keys of Control Box

* Only when using the SSC-350 TYPE T/TCG in combination with the RT-2100



②③ Glare key ②④ Low illumination key ②⑤ Contrast key

The following keys are used only when the RT-2100 is used in combination with the SSC-350 TYPE T/TCG.

②③ **GLARE**

Turns ON or OFF the glare lamp. (Only the SSC-350 TYPE TCG)

②④ **LOW ILL.MI.**

Used to test at night.

Pressing the key switches between low light and standard light illuminations.

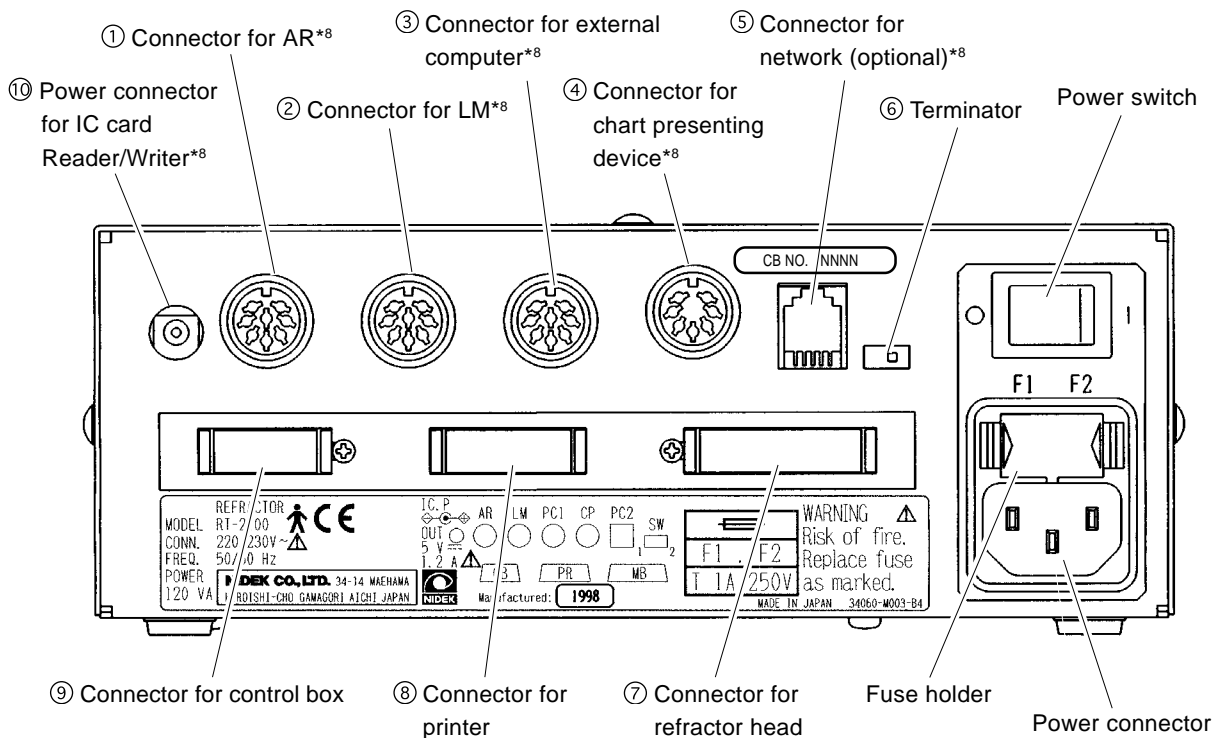
②⑤ **CONT.**

Selects the contrast of charts.

Pressing the key changes the contrast in the order of 25% → 12% → 6% → 100% (standard light illumination). (Only the SSC-350 TYPE TCG)

3.3 Relay Box

Normally, the relay box is contained in the system table.



① Connector for AR*⁸

Port to connect the relay box to an Auto-Refractometer or IC card Reader/Writer.

② Connector for LM*⁸

Port to connect the relay box to a lensmeter.

③ Connector for external computer*⁸

Port to connect the relay box to an external computer.

④ Connector for chart presenting device*⁸

Port to connect the relay box to a chart presenting device.

⑤ Connector for network*⁸

Port to connect the relay box to an external computer for networking.

⑥ Terminator

Used only when more than one refractor is used on a network. Normally, set at "1".

⑦ Connector for refractor head

Port to connect the relay box to the refractor head.

⑧ Connector for printer

Port to connect the relay box to the printer.

⑨ Connector for control box

Port to connect the relay box to the control box.

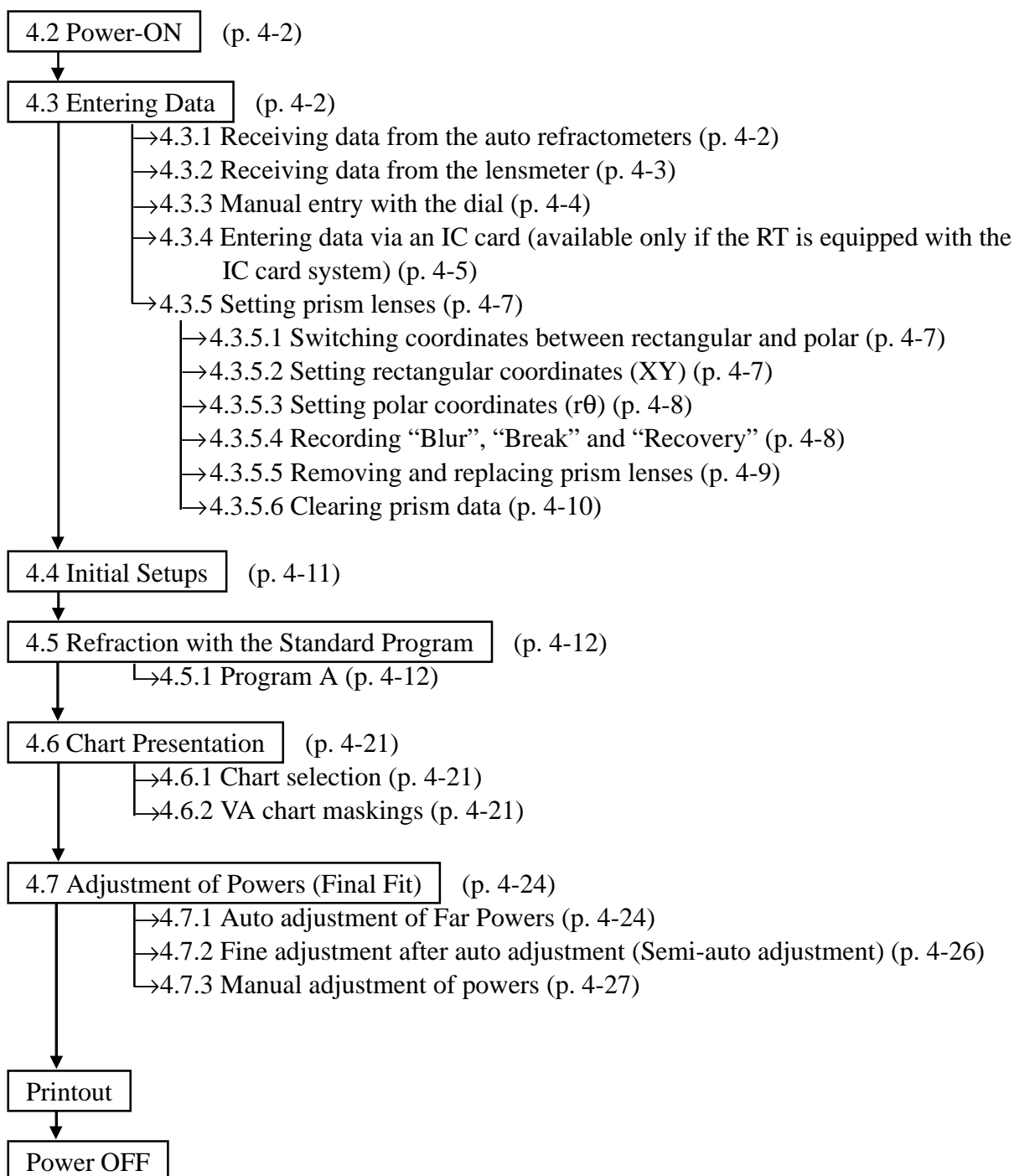
⑩ Power connector for IC card Reader/Writer*⁸

Port to connect IC card Reader/Writer to a power source.

*⁸ Accessory equipment connected to the analog and digital interfaces must be certified according to respective IEC standards (i. e. IEC 950 for data processing equipment and IEC 60601-1 for medical equipment). Furthermore all configurations shall comply with the system standard IEC 60601-1-1. Anyone who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of IEC 60601-1-1. If in doubt, consult NIDEK or your local representative.

§4 OPERATING PROCEDURE

4.1 Operation Flow



4.2 Power-ON

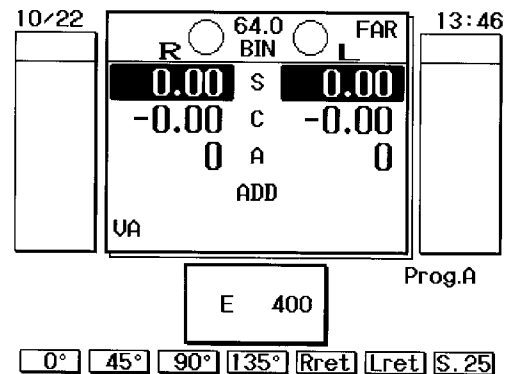
Turn ON the power switch of the RT-2100 and a chart presenting device (CP-670/CP-690 or SSC-300/SSC-330/SSC-350).

1. Power ON the connected chart presenting device.

2. Power ON the RT-2100.

Turn ON (|) the Power switch on the relay box.

The largest visual acuity (VA) chart will be presented.



4.3 Entering Data

Enter objective measurements and/or lensometry data.

4.3.1 Receiving data from the auto refractometers

When the RT-2100 interfaces with the NIDEK Auto Refractometer (AR) and/or Auto Ref/keratometer (ARK), the measured data will be automatically transferred to the RT-2100 by pressing the “Print” button of the AR/ARK. The RT-2100 stores data in the memory of the relay box. If the data is already in the memory, skip Steps 1 and 2 below.

1. Measure the patient’s eye with the AR/ARK.

See the AR/ARK operator’s manual.

2. After the measurement, press the “Print” button of the AR/ARK.

The measurements will be printed out and automatically stored in the relay box of the RT-2100. The received data is registered by numbers, which can be found at the top of the printout. To call up the stored data, use these numbers.

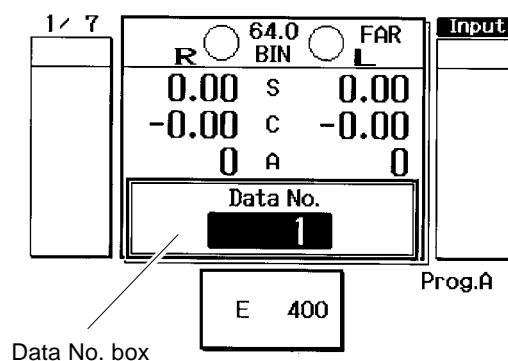
NOTE

- The maximum memory capacity is 9999 sequenced numbers. However, only the last 100 measurements will be memorized. Whenever the sequenced number exceeds 100, the data will be deleted beginning from the number 1.
- By connecting the optional memory box (RT6IF-80), the memory will be extended to hold up to the most recent 150 measurements.

3. Press **IN**.

The number of the last reading from either AR, ARK or LM will be shown on the display as "Data No."

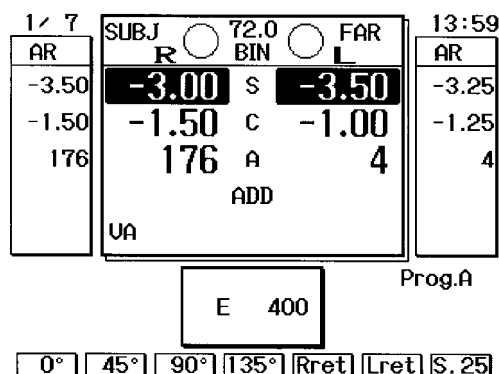
4. Using the dial, change the "Data No." to the patient's registration number. The number is found at the top of the patient's printout of the AR or ARK measurements.



5. Transfer the data to the RT-2100.

Press **AR**.

- The refractor will be automatically set according to the received data and the field for subjective refinement automatically opens. The elapsed time measurement from the point where any data is entered to the SUBJ field starts when the parameter "Auto test time" is set at "Yes". (Except when the elapsed time measurement has already been started.)
- The KM data of the ARK measurements will not appear on the main window, but will appear on the printout.



4.3.2 Receiving data from the lensmeter

When the NIDEK Lensmeter (LM) is interfaced with the RT-2100, the RT-2100 will automatically receive the data from the instrument when the "Print" button of the LM is pressed. Data will be stored in the memory of the relay box. If data is already in the memory, skip Steps 1 and 2.

1. **Measure the patient's glasses with the LM.**

See the Operator's Manual of the NIDEK Lensmeter (LM).

2. **After measurement, press the "Print" button of the LM.**

The measurements will be printed out and automatically stored in the relay box of the RT-2100. The received data will be registered by numbers, which will be found at the top of the printout. To call up the stored data, use these numbers.

NOTE

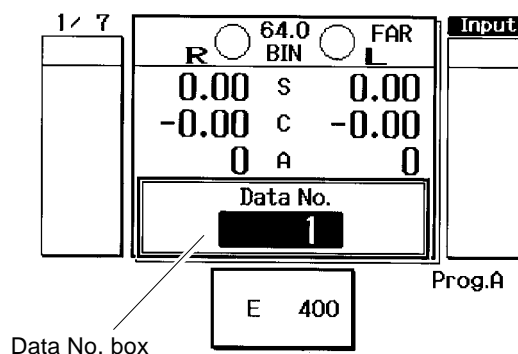
- The maximum memory capacity is 9999 sequenced numbers. However, only the last 100 measurements will be memorized. Whenever the sequenced number exceeds 100, the data will be deleted beginning from number 1.
- By connecting the optional memory box (RT6IF-80), the memory will be extended to hold up to the most recent 150 measurements.

3. Press **IN**.

The number of the last reading from either the AR, ARK or LM will be shown as “Data No.”.

4. Using the Dial, change the Data No. to the patient’s registration number.

The number is found at the top of the patient’s printout of the LM measurement.



5. Transfer the data to the RT-2100.

Press **LM**.

The refractor settings will be automatically changed according to the received data and the field for subjective refinement automatically opens. The elapsed time measurement from the point where any data is entered to the SUBJ field starts when the “Auto test time” parameter is set at “Yes”. (Except when the elapsed time measurement has already been started.)

4.3.3 Manual entry with the dial

Entering values in the Manual Mode:

1. Specify the field for entering data.

Specify with **LM** or **AR**.

2. Specify the eye/eyes for entering data.

Press **R** for the right eye, **L** for the left eye, and **BIN** for both eyes.

3. Specify the mode.

Specify by pressing one of **S**, **C**, **A**, **ADD**, **PD**.

4. Enter the value.

Turn the dial to change the value.

(Entering values in the preset mode)

Using the dial, data may be manually entered without changing the refractor settings when the system is placed in the preset mode.

1. Specify the field for entering data.

Specify with or .

2. Press .**3. Specify the mode.**

Specify by pressing one of , , , , .

The system will be placed in the preset mode.

4. Specify the eye/eyes for entering data.

Press for the right eye, for the left eye, and for both eyes.

5. Enter the value.

Turn the dial to change the value.

6. Repeat Steps 3 to 5 until all data entry is complete. Then press again.

The refractor settings will now be automatically changed according to the preset data.

NOTE

- When data is manually entered into the “LM” or “UNAIDED” field by turning the dial, it is necessary to select the starting data, “LM” or “AR” for the succeeding subjective refinement and then press .

4.3.4 Entering data via an IC card (available only if the RT is equipped with the IC card system)

By using the optional IC card Reader/Writer, data can be transmitted via IC card from the AR, ARK or LM to the RT-2100 without connecting them directly.

However, the IC card does not carry keratometry (KM) data.

**[Writing AR, ARK, or LM data to an IC card]****A. Writing without printing out:**

- 1. Measure the eye with the AR, ARK or measure the patient's glasses with the LM.**
- 2. Write data to an IC card.**
Insert the card into the IC card slot of the AR, ARK or LM. After the data is written on the card, the card will be ejected automatically.

B. Writing and printing out:

- 1. Insert the card into the IC card slot of the AR, ARK or measure the patient's glasses with the LM.**
Be sure to insert it before measurements.
- 2. Measure the eye with the AR, ARK, or LM.**
- 3. Press the "Print button" of the AR, ARK or LM.**
Data will be printed out.
After the data is written, the card will be ejected automatically.




[Reading AR, ARK, or LM data on the RT-2100]**A. When there is no data in the control box:**

When the mode is not shown in the upper-left corner of the main window, operate as follows.

- 1. Insert the card into the IC card slot of the system table.**
After the data is read into the field for receiving LM or AR data, the IC card will be ejected automatically. The data on the IC card will be cleared.

B. When there are some items of data in the control box:

When the mode is shown in the upper-left corner of the main window, operate as follows.

- 1. Insert the IC card into the IC card slot of the RT-2100.**
- 2. Press .**
- 3. Press either  or .**
After data is read into the field for receiving LM or AR data, the IC card will be ejected automatically. The data on the IC card will be cleared.

4.3.5 Setting prism lenses

4.3.5.1 Switching coordinates between rectangular and polar

Press the function key which corresponds to either \boxed{XY} or $\boxed{r\theta}$.

This key toggles between rectangular (XY) and polar coordinates (r θ).

e.g.: R-eye: 1.0 Δ BI, 1.0 Δ BU \Rightarrow 1.40 Δ , BASE 45°

L-eye: 2.0 Δ BO, 1.5 Δ BD \Rightarrow 2.50 Δ , BASE 323°

4.3.5.2 Setting rectangular coordinates (XY)

1. Press $\boxed{\frac{BI, BO}{\Delta}}$.

Rotary prism lenses will be placed in the measuring windows.

The Prism Power will be highlighted on the main window.

2. Enter base in/out Prism Power.

Prism Powers (0.5 Δ monocularly or 1.00 Δ binocularly) may be entered by turning the dial.

Turn the Dial clockwise \Rightarrow Power increases to the BO (BASE OUT) side.

Turn the Dial counterclockwise \Rightarrow Power increases to the BI (BASE IN) side.

3. Press $\boxed{\frac{BD, BU}{\theta}}$.

4. Enter base up/down Prism Power.

Prism Power (0.5 Δ monocularly or 1.00 Δ binocularly) may be entered by turning the dial.

Turn the Dial clockwise \Rightarrow L-eye: Power increases to the BD (BASE DOWN) side.

R-eye: Power increases to the BU (BASE UP) side.

Turn the Dial counter clockwise \Rightarrow L-eye: Power increases to the BU (BASE UP) side.

R-eye: Power increases to the BD (BASE DOWN) side.

Press \oplus or \ominus instead of the dial to change the power in 0.1 Δ increments monocularly and 0.2 Δ binocularly. Prism Power will change continuously while holding down the keys. (See p. 5-12)



To change the power in 2 Δ increments monocularly and 4 Δ binocularly, turn the dial while pressing $\boxed{\text{SHIFT}}$.

4.3.5.3 Setting polar coordinates (r θ)

1. Press .


Rotary prism lenses will be placed in the measuring windows.
The Prism Powers will be highlighted on the main window.

2. Change the prism absolute values.


Prism Powers (0.5 Δ monocularly or 1.00 Δ binocularly) may be changed by turning the dial.
Press  or  instead of the dial to change the prism in 0.1 Δ increments monocularly and 0.2 Δ binocularly.



3. Press .

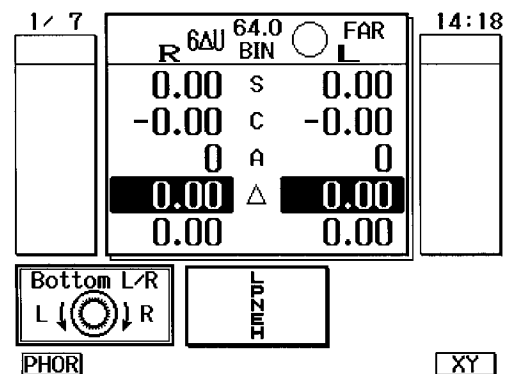
4. Change the prism base direction.

Rotate the dial to change the value (1° monocularly or 2° binocularly).
The power changes in 5° increments by turning the dial while pressing .

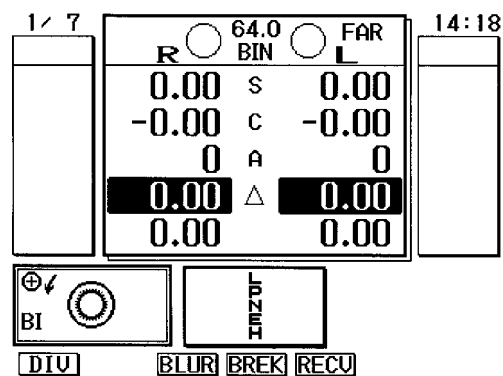
4.3.5.4 Recording “Blur”, “Break” and “Recovery”

When  is pressed and “Blur/Break/Recov.” of “Set parameter” has been set to “Yes”, the display on the right will appear and the system will be placed in the mode where the test to detect phoria is performed.

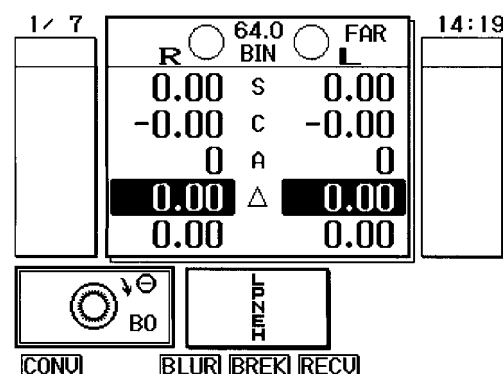
- When the function key which corresponds to  is pressed,  will appear on the display and the system will go into the mode where the negative-relative convergence (divergence) test is performed.
The measuring windows open and Prism Power is 0.00 Δ . It is possible to enter Blur, Break and Recovery values in this mode.



- When the function key which corresponds to **[DIV]** key is pressed, **[CONV]** will appear on the screen and the system will go into the mode where the positive relative convergence test will be performed. The measuring windows open and Prism Powers indicate “0.00 Δ”.



- When the function key which corresponds to **[CONV]** key is pressed, **[PHOR]** will appear on the screen and the system will go back to the mode for phoria testing. If the Prism Powers have been set in the test, they will be shown in the main window at this point.



- When a function key, which corresponds to **[BLUR]**, **[BREK]** and **[RECV]** is pressed, the key is highlighted and the base in/out Prism Powers are stored.



- When the function key which corresponds to the highlighted **[BLUR]**, **[BREK]** and **[RECV]** is pressed again, the stored power will be cleared and the function key will no longer be highlighted.

For the procedures of the tests and value entry, see “6.6.14 Negative relative convergence test” (p. 6-29) and “6.6.15 Positive relative convergence test” (p. 6-30).

4.3.5.5 Removing and replacing prism lenses

The rotary prism lenses can be instantly removed or set with a press of one key.

Press **[BT, BO]** or **[BD, BU]** again. While the rotary prism lenses are placed in the measuring windows:

- The rotary prism lenses will be removed from the measuring windows.
- The reversed indication  on the Main window will change to . The date indication will change to **[Δ - OFF]**, indicating the absence of rotary prism lenses.
- When **[BT, BO]** is pressed, the BI, BO, or PRISM value is changeable.
When **[BD, BU]** is pressed, the BD, BU or BASE value is changeable.

By pressing **[BT, BO]** or **[BD, BU]** again, the rotary prism lenses will be placed again.



4.3.5.6 Clearing prism data

Prism Power of the right eye and left eye can be cleared separately.

Press XC_1 \Rightarrow Prism Power of right eye will be cleared.

Press XC_2 \Rightarrow Prism Power of left eye will be cleared.

4.4 Initial Setups

1. Place the refractor head in front of the patient's eyes.

- 1) Clean the forehead rest, face shields, and measuring windows prior to testing a patient. See “§8 MAINTENANCE”. (p. 8-1)
- 2) Instruct the patient to lean against the forehead rest and look through the measuring windows.

2. Press **PD**.

The lenses for PD adjustment will be placed in the measuring windows and the front surface of the patient's eye will be illuminated.

3. Observe the patient's eyes from the operator's side.

Check to see that both the patient's left and right eyes are located in the center of each measuring window.

A. If eyes are not aligned horizontally, adjust the PD by turning the dial.

B. If eyes are not aligned vertically, attempt to reposition the patient. Instruct the patient to straighten his/her head.

NOTE

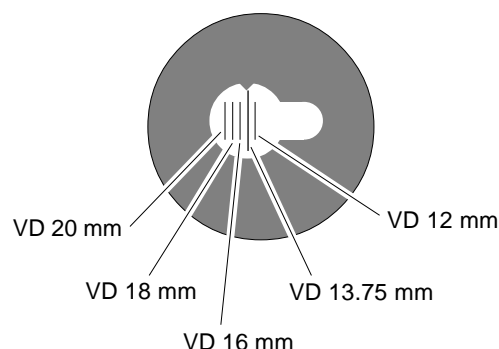
- Even when the monocular PD for only one eye is changed, both the left and right refractor heads move concurrently.

4. Adjust the vertex distance by turning the forehead rest knob.

- 1) Look through the VD check windows.

The windows are located on both sides of the refractor head for observation of the vertex distance. Align the longest line (13.75 mm mark) so that it appears in the “notch” of the window.

- 2) Turn the forehead rest knob until the apex of the patient's cornea is aligned with a desired calibration marking.



5. Press **PD** again.

The system will exit from the PD mode.

Adjust the chart position as follows only when the refractor (RT-2100) is secured to the NIDEK motorized arm.

Press **EXE**. The chart position will be adjusted according to the refractor's height.

4.5 Refraction with the Standard Program



With Program A, the system automatically calculates the subjective correction and final data.

4.5.1 Program A

Containing unaided and aided visual acuity tests, this program uses the Final Fit (Auto adjustment function) to automatically adjust a prescription to suit the patient.

1. Specify Program A at “Program” in the “Set parameter”.

See “5.5 Parameter Settings”. (p. 5-10)

It is also possible to specify the program with the  -  combinations.

2. Enter objective measurements (AR data) and lensometry (LM) data if any.

See “4.3 Entering Data”. (p. 4-2)

3. Instruct the patient to look at the presented chart through the measuring windows of the refractor.

Or occlude the left eye without using the refractor.

4. Perform the unaided visual acuity test.

Follow Steps 3 to 7 of “6.1 Unaided Visual Acuity Test” (p. 6-1)

5. Perform the aided visual acuity test.

See “6.2 Aided Visual Acuity Test” (p. 6-2).


6. Press .

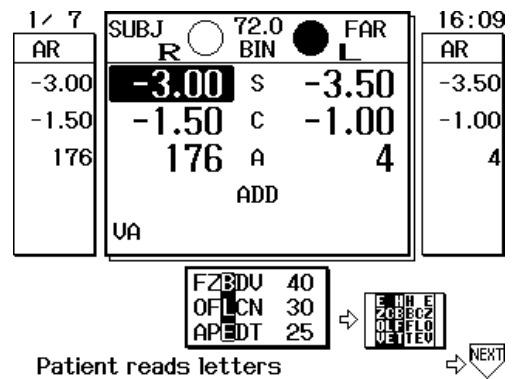
The field for performing subjective measurement will open.

7. Press .


An occluder will be placed in the left measuring window.

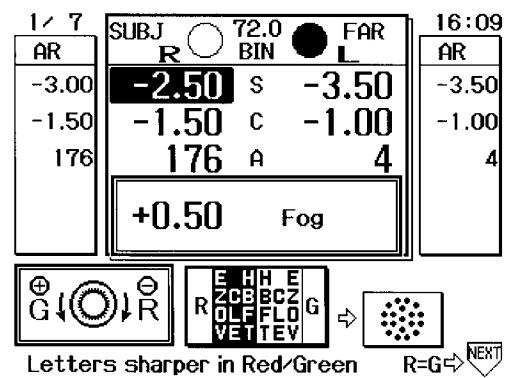
8. Start Program A.

- 1) Press .
- 2) Instruct the patient to read the chart.
If the patient can not read the letters, it is possible that the entered AR data is incorrect, or the patient has some abnormalities.



9. Perform the Red/Green test to refine Spherical Power.

- 1) Press .
Automatically SPH +0.50 D will be added to “fog” the vision. The Red/Green chart will be presented.
- 2) Turn the dial to release the “fog” one increment at a time until the sharpness of the letter on the red side and the green side appear equal.
Letters on the red side are sharper.
→ Turn the dial clockwise one increment.



- Letters on the green side are sharper.**
→ Turn the dial counterclockwise one increment.

NOTE

- Spherical refinement is performed, to bring the circle of least confusion onto the retina before performing the following XC test for cylindrical refinement.
If the patient cannot see the red and green sides equally, turn the dial until the green side is sharper.


10. Refine Cylindrical axis.

1) Press .

The dot chart will be presented.

A cross cylinder (XC) lens will be placed.

The type of the XC lens will be indicated as

,  and . The placed


XC lens can be switched to other types with the corresponding function key which is located just below the indication.

2) Refine Cylindrical axis with the cross cylinder lens.


- When specifying XC:

Ask a patient, “Which set of dots is clearer, chart 1 or chart 2 ?”


The chart 1 - presented by pressing 

The chart 2 - presented by pressing 

If chart 1 is clearer

→ Turn the dial counterclockwise one increment. (Or press )

If chart 2 is more clear


→ Turn the dial clockwise one increment.
(Or press )

Repeat the above processes until both charts appear equal.


- When specifying Auto XC:

Both chart 1 and chart 2 will be presented simultaneously. Each chart position is shown in the lower-left corner of the display.

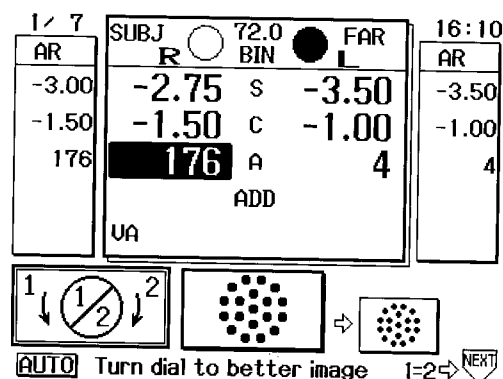
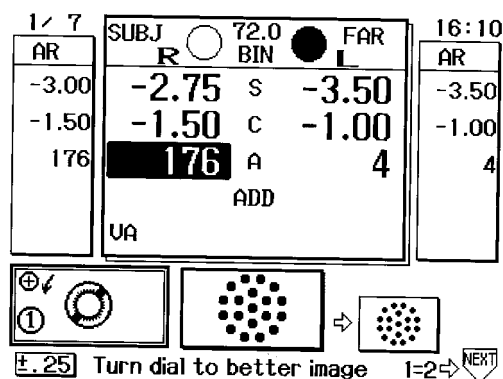
If chart 1 is clearer

→ Turn the dial counterclockwise one increment. (Or press )


If chart 2 is clearer

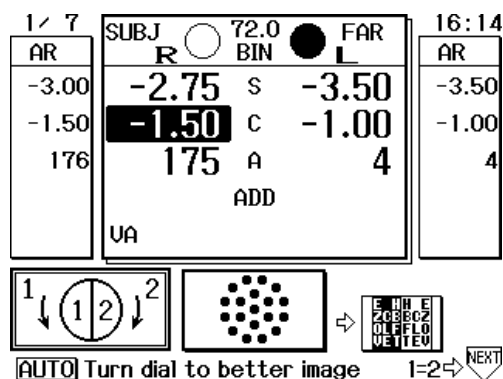
→ Turn the dial clockwise one increment.
(Or press )

Repeat the above processes until both charts appear equal.




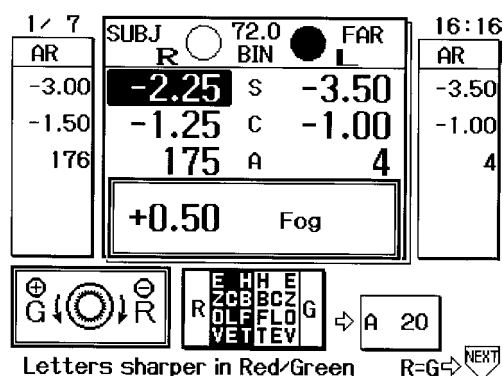
11. Refine Cylindrical Power.

- 1) Press .
The axis of the cross cylindrical lens (XC lens) will be shifted.
- 2) Refine Cylindrical Power with the XC lens. Follow the same procedure as 2) of Step 10.



12. Perform the Red/Green test to refine Spherical Power.

- 1) Press .
Automatically SPH +0.50 D lens will be added to “fog” the vision. The Red/Green chart will be presented.
- 2) Turn the dial to release the “fog” one increment at a time until the sharpness of the letters on the red side and the green side appear equal.



Letters on the red side are sharper.

→ Turn the dial clockwise one increment.




Letters on the green side are sharper.

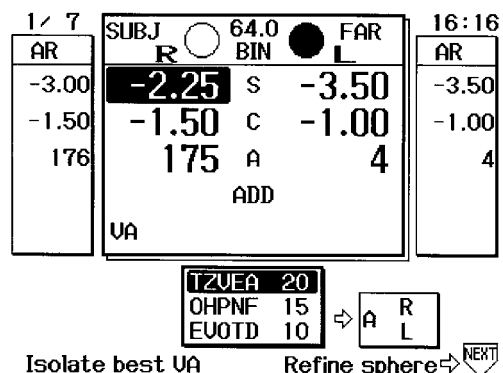
→ Turn the dial counterclockwise one increment.

NOTE

- If the patient cannot see the red and green sides equally, turn the dial until the red side appears sharper to avoid overminusing.

13. Adjust Spherical Power to the highest possible positive value with the best possible visual acuity.

- 1) Press .
The isolated 20/20 line will be presented.
- 2) Use  or  to check the best possible visual acuity.



4 - 16

- Adjust Spherical Power to the highest positive value with the best possible visual acuity. Turn the dial counterclockwise to add SPH +0.25 D. If the chart appears to blur, turn the dial clockwise one increment.

Subjective refinement of the right eye is complete.

14. Press (L).

The right measuring window will automatically be covered.

15. Follow the same procedure as Steps 8 to 13 to test the left eye.

Subjective refinement of the left eye is complete.

1/7 16:16
SUBJ R 64.0 BIN L FAR
AR -3.00 -2.25 S -3.00 AR -3.50
-1.50 -1.50 C -0.75 AR -1.00
176 175 A 5 AR 4
UA ADD
TZUEA 20
OHPNF 15 → A R
EVOTD 10 → L
Isolate best UA Refine sphere → NEXT

16. Perform the binocular balance test.

1) Press (NEXT).

Polarizing filters will be placed in the measuring windows;

Right eye 135° & left eye's 45°

When the visual acuity is 20 or better, positive power will be automatically added to SPH to "fog" the vision. (See the "Fog for Balance" parameter. [p. 5-13])

1/7 16:17
SUBJ R 72.0 BIN L FAR
AR -3.00 -1.75 S -2.50 AR -3.50
-1.50 -1.25 C -0.75 AR -1.00
176 175 A 5 AR 4
+0.50 Balance
HBCPZ R
EFUAT → 00 00
DZLEV L → 00 00
Add S +0.25 to best UA (R or L) R=L → NEXT

2) Adjust Spherical Power until the top and bottom lines appear equally clear.

The top line is clearer.

→ Press (R) and turn the dial counterclockwise one increment.

The bottom line is clearer.

→ Press (L) and turn the dial counterclockwise one increment.

Binocular balance is achieved when the patient can see both lines equally.


1/7 16:20
SUBJ R 72.0 BIN L FAR
AR -3.00 -1.75 S -2.50 AR -3.50
-1.50 -1.25 C -0.75 AR -1.00
176 175 A 5 AR 4
200 UNaid 400
50 LM 70
HBCPZ R
EFUAT → 00 00
DZLEV L → 00 00
Add S +0.25 to best UA (R or L) R=L → NEXT
Unaided and corrected VA are shown by pressing (R) or (L).

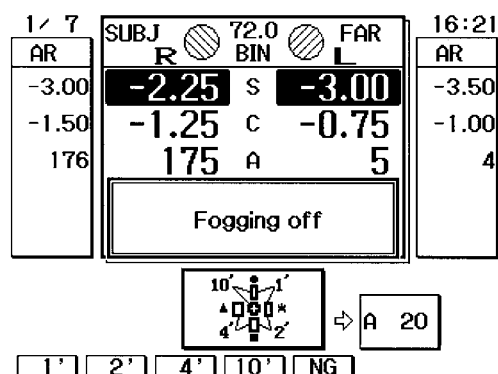
NOTE

- If the patient cannot see both lines equally, allow the dominant eye or the eye whose LM data is higher to see clearer.

Binocular refinement is now complete.

17. Perform the stereo test.




- 1) Press . Polarizing filters will be placed in both measuring windows. Polarization angle: Right eye 135° & left eye : 45° The stereo test chart will be presented. The fog which has been applied during the binocular balance test will automatically be released.






- 2) Confirm that the patient can see four sets of lines stereoscopically. Enter stereoparallax by pressing a corresponding function key. For a patient who cannot see those lines stereoscopically, perform the binocular function test as necessary. See "6.6 Binocular Vision Function Test". (p. 6-7) If a patient has stereoscopic vision with a high accuracy (normally 1') and has no symptoms of headache or eye strain, the patient's phoria is usually negligible. (If a patient can recognize the stereoscopic difference between the lines next to a circle and star, his/her stereoparallax is 1'.) In this case, it is possible to skip the phoria, negative relative convergence, and positive relative convergence tests.
 - * The stereo chart differs depending to the chart presenting device. See "6.6.10 Stereo test". (p. 6-25)

18. Adjust the power for spectacle correction.










NOTE

- When using the auto adjustment function, use the  -  combination after pressing . See "4.7 Adjustment of Powers" (p. 4-24).


- 1) Press .
- 2) Press  or  to present a desired visual acuity chart.
- 3) Adjust the correction to the highest positive power with the best possible visual acuity.

19. Check the visual acuity with the current correction (Final value for prescription).

If necessary, remove the refractor head and place the “FINAL” data in a trial frame to confirm that the patient has the best corrected visual acuity with this lens combination.


- 1) Press .
- 2) Check the visual acuity of the patient’s right eye.
Press  or  to change the isolated line.
- 3) Press .
- 4) Check the visual acuity of the patient’s left eye.
Press  or  to change the isolated line.
- 5) Press .
- 6) Check binocular visual acuity.
Press  or  to change the isolated line.

20. Compare the lensometry (LM) data with the FINAL data.

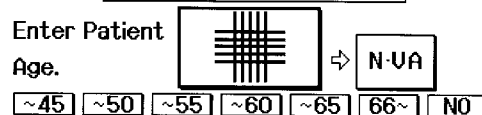
- 1) Press .
Lensometry data will be placed in the measuring windows.
Ask the patient, “Which lens is more clear and comfortable ?”

Program A is complete if a near vision test is unnecessary. Go to Step 24.

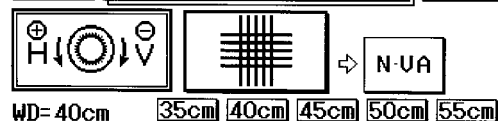
21. Measure Addition Power.

- 1) Press .
- 2) Enter the patient's age.
Select the patient's age with the function key.
(See Appendix. D.)
Be sure to set the "Preset ADD" parameter of "Set parameter" to "Yes" in advance.
The lens banks will be converged and fused cross cylinder lenses (minus axis 90°) will be placed in the measuring windows.
- 3) Pull down the near point rod and set the near point card at a desired distance (normally set at 40 cm).
- 4) Place the cross-grid chart on the near point card in front of the patient.

1/7	SUBJ	72.0	FAR	16:26
AR	R	BIN	L	AR
-3.00	-2.25	S	-3.00	-3.50
-1.50	-1.25	C	-0.75	-1.00
176	175	A	5	4
	ADD			
	UA	15		



1/7	SUBJ	72.0	FAR	16:26
AR	R	BIN	L	AR
-3.00	-2.25	S	-3.00	-3.50
-1.50	-1.25	C	-0.75	-1.00
176	175	A	5	4
	ADD			
	UA	15		




- 5) Ask the patient, "Which lines are sharper, the horizontal or vertical ones? Or are they about the same?"
The horizontal lines are sharper. → Turn the dial counterclockwise one increment until the sharpness of both lines appears equal.
The vertical lines are sharper. → Turn the dial clockwise one increment until the sharpness of both lines appears equal.
The sharpness of both lines are equal. → It is not necessary to change Addition Power.

NOTE

- If the patient cannot see the lines equally sharp, turn the dial until the horizontal lines appear a little sharper.

22. Test the patient's near vision.

- 1) Press . The fused cross cylinder lenses will be removed.
- 2) Reverse the near point card and place the letter chart in front of the patient.
- 3) Instruct the patient to read the smallest line possible.

The values displayed on the screen at this point will be recorded as the final data for the prescription.



Program A is now completed.

23. Print out the prescription.

Press .

24. Place the FINAL prescription lens in a trial frame if necessary.

1 / 7	FIN <input type="radio"/> 72.0 <input type="radio"/> FAR	16:27
AR	R <input type="radio"/> BIN <input type="radio"/> L	AR
-3.00	-2.25 S -3.00	-3.50
-1.50	-1.25 C -0.75	-1.00
176	175 A 5	4
15	+2.25 ADD +2.25	15
	UA 15	

Check near UA  30 ⇒ 

Use least plus

WD=40cm

4.6 Chart Presentation



4.6.1 Chart selection

To present a desired chart, press the key corresponding to the chart.
The selected chart will be displayed on the display of the control box.



4.6.2 VA chart masking

To use the mask, press one of the masking keys on the control box.

- **How to use the vertical line mask**

Press  or .

While the vertical line is isolated;

Press  or .

⇒ Isolation will move to the left or right.

If the isolation is on a column at one side of the chart, short beeps will sound and it will skip to the column of the other side of the chart when the key is pressed again.


Press  or .


⇒ Isolation moves up or down.


NOTE

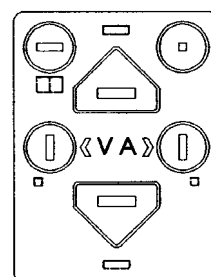
- For the chart with four columns on the SSC-300/330, the vertical isolated line can only be moved between the two columns in the middle.
- For the chart with five columns on the CP-670, the vertical isolated line can only be moved between the leftmost, middle and rightmost columns.

- **How to use the horizontal line mask**

Press . ⇒ Only the top line will be isolated.

Press . ⇒ Only the middle line will be isolated.



Press . ⇒ Only the bottom line will be isolated.




Masking keys







While a horizontal line is isolated;



Press  or . ⇒ Isolation will move up or down.

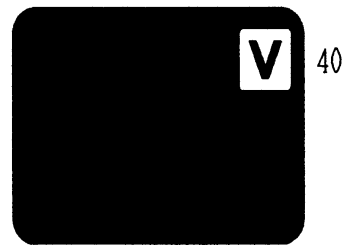
• **How to use the single letter mask**

Press .
⇒ Only the letter in the upper-right corner of the chart will be isolated.



Press  and .
⇒ Only the letter in the upper-left corner of the chart will be isolated.

Press  and .
⇒ Only the letter in the lower-left corner of the chart will be isolated.



Press  and .
⇒ Only the letter in the lower-right corner of the chart will be isolated.





While a single letter is isolated;

Press  or .
⇒ Isolation will shift to the left or right.



When the key last pressed is pressed again to shift it in the same direction with the isolation located on one side of the chart, short beeps will sound and it will skip to the other side of the chart.



Press  or .
⇒ Isolation moves up or down.

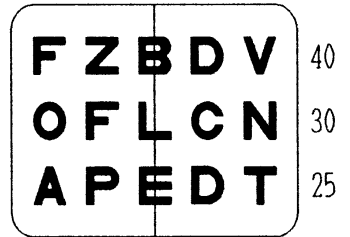
• **How to use the Red/Green filter**

Press  and .
Red/Green filter will cover the presented VA chart.

While the Red/Green filter is applied;

Press  or .
⇒ The presented VA chart will change to another.

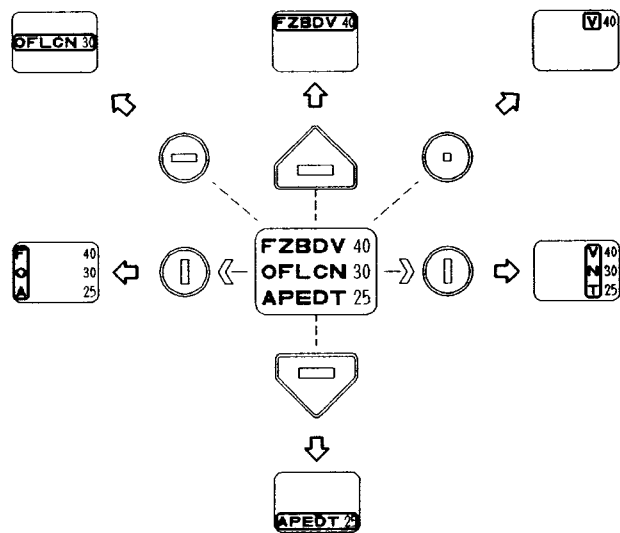
Press  and .
⇒ The filter will be released.



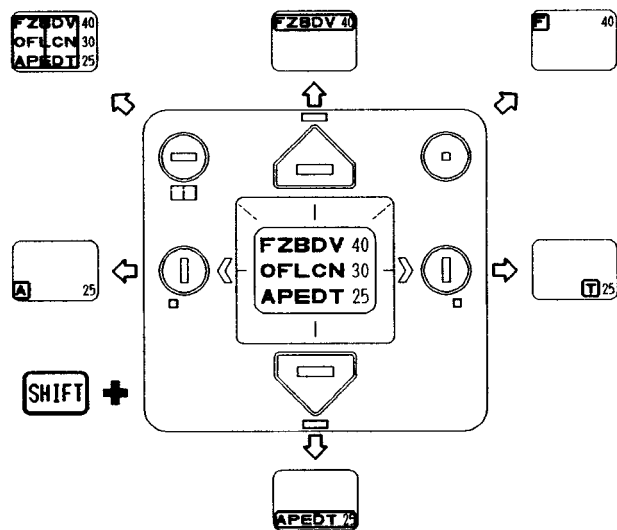
• **How to release the masks and filter**

By pressing any chart button, the applied mask or filter will be released.

**Chart presentations using each masking key
(When using masking keys only)**



**Chart presentations using each masking key
(When using **SHIFT** in combination with the masking keys)**



4.7 Adjustment of Powers (Final Fit)

This system provides an auto adjustment and a semi-auto adjustment function in which Spherical and Cylindrical Powers are adjusted to the values that are comfortable for patients. In auto adjustment, values are calculated from the subjective data, taking into consideration lensometry data, the patient's ability to adapt to correction (age), and the type of refractive error (myopia, hyperopia, astigmatism, oblique astigmatism, anisometropia).

In semi-auto adjustment, the operator can manually change the values calculated in auto adjustment.

In auto adjustment, the Final Fit is programmed to calculate much lower powers than an average prescription. This is done intentionally to avoid overminusing the patient. It is necessary, after auto adjustment, to perform semi-auto adjustment to ensure a proper final prescription.

NOTE

- Regard the values obtained in the Final Fit (auto adjustment function) only as a guide for determining a final prescription. The final prescription should be determined by the operator according to the patient's responses.
- When using the auto adjustment function, it is necessary to measure or enter the correct lensometry data or subjective data in advance. The Final Fit (auto-adjusted values) may be adjusted to an unsatisfactory prescription for a patient if one of the following conditions applies.
 - Subjective data is not correct.
 - The lensometry data has not been entered in the RT-2100.
 - Incorrect data has been entered.

4.7.1 Auto adjustment of Far Powers

1. After obtaining subjective refinements for both eyes, press **(FINAL)** while holding down **(SHIFT)**.

2. Check whether or not the patient wears spectacles.

If the patient does not wear spectacles;

Press the function key that corresponds to "No" and go to the next step.

1 / 7	SUBJ	72.0	FAR	16:22
AR	R	BIN	L	AR
-3.00	-2.25	S	-3.00	-3.50
-1.50	-1.25	C	-0.75	-1.00
176	176	A	4	4
Wear glasses?				
E 400				
YES	Please select			NO

Prog.A

If the patient wears spectacles;

- 1) Press the function key that corresponds to “Yes”. The system is now ready to receive lensometry data.
- 2) Manually enter lensometry data. See “4.3.3 Manual entry with the dial”. (p. 4-4)
- 3) Press **FINAL** while holding down **SHIFT**.
The field opens for entering the patient’s ability to adapt to a change in corrective lenses.

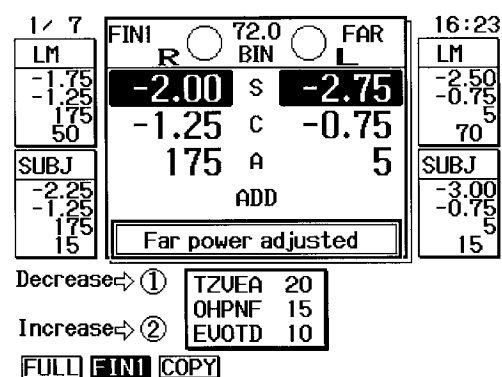
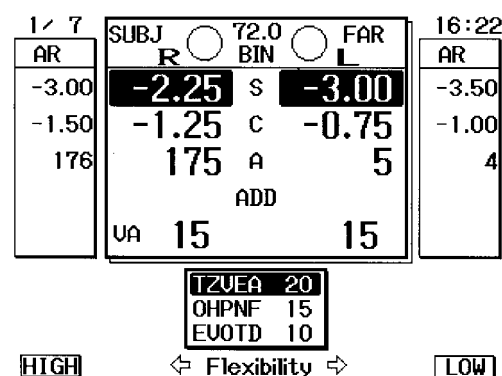
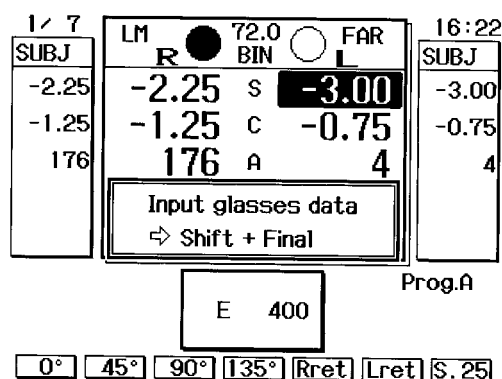
3. Select “HIGH” or “LOW” with the corresponding function key.

In this field, select whether or not to adjust the Spherical and Cylindrical Powers to lower values. If “LOW” is selected, the powers will be adjusted to 0.25 D lower ones than the ones adjusted with “HIGH”. (There are cases where the powers remain unchanged.)

If using age as a determining factor in a patient’s ability to adapt to change, use age 40 as the dividing line.

After the selection, calculations for auto adjustment start.

A bar graph will appear, while the Final Fit performs the calculations.



When calculations are complete, the adjusted powers will be displayed on the main window as Final data 1 “FIN 1” and corrective lenses will be placed in the measuring windows. The 20/20 to 20/10 chart will be presented automatically.

The lensometry (LM) and subjective data will be displayed in the left and right sub-windows, for comparison.

The subjective refinement is stored as “FULL”. To call up the data to the main window, press the function key that corresponds to **FULL** on the lower left of the display.

4.7.2 Fine adjustment after auto adjustment

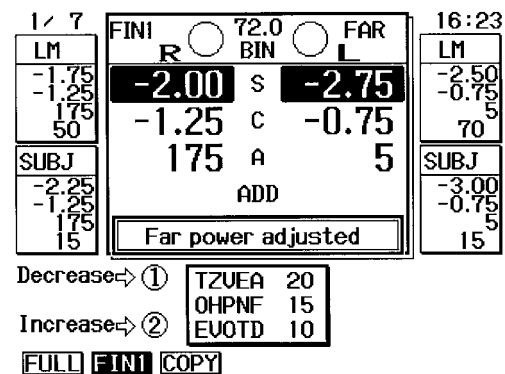
(Semi-auto adjustment)

Perform fine adjustment manually by using the semi-auto adjustment function after the auto adjustment of Far Powers.

NOTE

- In auto adjustment, the Final Fit is programmed to calculate the powers lower than an average prescription. This is done intentionally to avoid overminusing the patient. Therefore, it is necessary, after auto adjustment, to perform semi-auto adjustment to ensure the best acuity for the patient.

1. After auto adjustment, ask the patient whether he/she can see the chart clearly and comfortably with the lens combination of final data 1 (FIN 1).



2. Perform fine adjustment of the powers.

If the patient cannot read letters on a presented chart with the current lenses or the corrective lenses are too weak to correct the patient's vision → Press (XC 2).

If the patient feels that the lenses are too strong or he/she feels uncomfortable with those lenses. → Press (XC 1).

The powers are adjusted and are stored as new data, final data 2 (FIN 2).^{*9}

3. Repeat Steps 1 and 2 until the patient sees the chart comfortably and clearly.

Adjusted powers are stored as new data, final data 3 (FIN 3).^{*10}

^{*9} Refer to "Appendix. A Descriptions of power adjustment" for descriptions of how the powers are fine-adjusted by pressing (XC 1) or (XC 2).



^{*10} The RT-2100 stores up to five sets of (FIN) data. When storing any additional data, the RT-2100 will delete the final data 2 (FIN 2) and store additional data. The final data 3 (FIN 3) will be deleted next, and so on. The data stored as the final data 1 (FIN 1) (Auto-adjusted data) will not be deleted.

4.7.3 Manual adjustment of powers

It is possible for the operator to adjust powers manually without using the auto adjustment function.

To change each power or axis, select one mode by using S, C or A and change values with the Dial.

Example of manual adjustment:

- 1) To present a chart for the patient, press  or .
- 2) Adjust Spherical or Cylindrical Powers to the highest plus values while ensuring the patient is still able to read the chart.

Manual adjustment is also available after auto adjustment.

- **How to adjust data manually after auto adjustment**

- 1) Select the function key that corresponds to FIN1.
- 2) Press the function key that corresponds to COPY.
Data of the final data 1 FIN1 will be copied to the field of the final data 2 FIN2.
- 3) Manually adjust the copied data.
- 4) Switch between FIN1 and FIN2 to check with which correction the patient can see the best.

When adjusting the subjective data manually, select the function key that corresponds to FULL in Step 1).

4.8 After Use Care

1. Turn OFF the power switch of the refractor.
2. Place the dust cover over the refractor.

NOTE

- Put the dust cover on whenever the instrument is not in use.
Incorrect measurements may result if the presented chart is dusty.

§5 OTHER FUNCTIONS

5.1 Programming






The RT-2100 has five programs A, B, C, D and E.

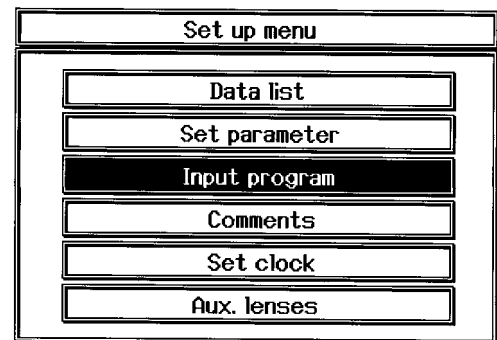
A standard course of refraction is factory-written into Program A. Program B, C, D and E are empty. All programs (A, B, C, D and E) are programmable.

5.1.1 Deleting programs


With this procedure, the entire contents of “A”, “B”, “C”, “D” or “E” will be cleared. Perform this when reprogramming the entire contents of the program.*¹¹

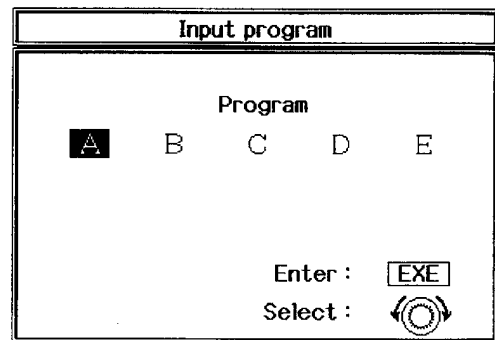
1. Select “Input program”.

- 1) Press .
- 2) Open the “Set up menu” screen.
Press .
- 3) Use  to move the cursor () to “Input program”.
- 4) Press .



2. Select the program to delete.

- 1) Select “A”, “B”, “C”, “D” or “E” with the dial.
- 2) Press .







3. Press , then clear.

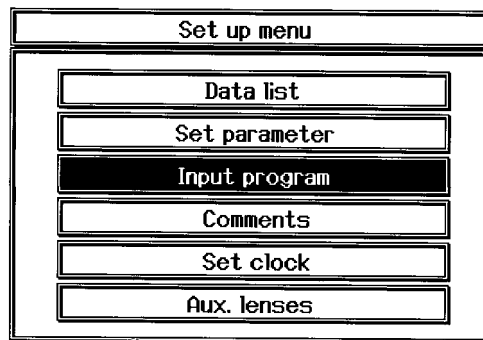
All contents in the selected program will be cleared.

*11 When reprogramming the entire content of Program A, it is necessary to set the “Program A” parameter of “Set parameter” to “User”.


5.1.2 Programming

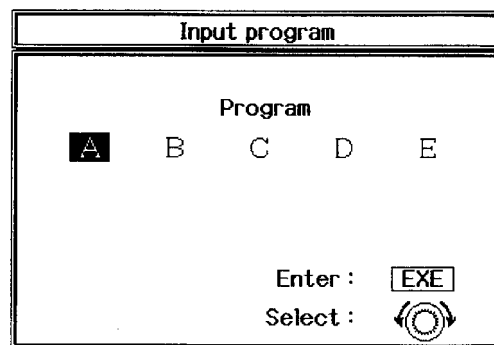
1. Select "Input program".

- 1) Open the "Set up menu" screen.
Press .
- 2) Use  key to move the cursor () to "Input program".
- 3) Press .



2. Select the program in which data will be written.














- 1) Select "A", "B", "C", "D" or "E" with the dial.
Please note that Program A is not programmable unless the "Program A" parameter is set at "User".
- 2) Press .



3. Select the desired charts for the chosen testing sequence.

- Set auxiliary lenses and the amount of "fogging" applied in the binocular balance test as necessary.
- Also set horizontal and vertical line masks, single letter mask, and the Red/Green filter here.

* The following items can be written into a program by pressing the respective keys below.

- Chart keysselect desired charts.
-  - select fields for data reception or measurement storage.
(The auto adjustment of Far Powers can be programmed by using the  -  combination.)
- sets the Far mode or Near mode.
- , ,  etc.select the modes whose data is to be refined (or changed).
- , ,  etc.select eyes to be tested. (If none are selected, they are not specified.)
- ,  etc.....set Auxiliary lenses.

- , set cross cylinder lenses.
- The dial after pressing sets the amount of fogging (In the binocular balance test, a certain positive power will automatically be added to SPH according to the patient’s VA unless the power is set with the dial.).
- , ... Programmed comments can be viewed by pressing these keys.
When a desired comment appears at the bottom of the screen, press to store the comment for viewing. (Comments are not programmed unless these keys are pressed.)

Programmable comments:

- Isolate best VA Refine sphere ⇒
- Turn dial to better image 1=2 ⇒
- Letters sharper in Red/Green R=G ⇒
- Add S +0.25 to best VA (R or L) R=L ⇒
- Turn dial to higher image R=L ⇒
- Turn dial to line up letters Even ⇒
- Patient reads letters ⇒
- Compare Old vs New ⇒
- Right, Left, About the same ⇒

NOTE

- To set cross cylinder lenses, press or .
- It is not possible to select the Auto XC lens or XC lens to be used during the test. To select the lens type, set it at the “XC test” parameter of “Set parameter” in the “Set up menu”. (See p. 5-12).
- It is possible to store up to 30 steps.
 - It is possible to set the “fog” with both eyes open in a program. Follow the procedure of “5.7 Fogging Function with Both Eyes Open”. (p. 5-19)

4. Store the selected chart.

Press .

* To set three short beeps which mark the limits of each test, press and at the same time.

5. Repeat Steps 3 and 4 until you have finished selecting all the charts in the desired order of presentation.

It is possible to store up to thirty steps. For tips in programming test sequence, see “Appendix. F Examples of Programming”.

6. Exit from the “Input program” mode.

Press to store the program.

5.1.3 Starting a programmed refraction

Follow the procedure below to present the charts in a programmed order.

1. Select an intended program in the “Set parameter” mode of “Set up menu”.

See “5.5 Parameter Settings” (p. 5-10). Or use the **SHIFT** - **START** combination to select a desired program.

2. Start the program.

Press **START**. The first chart in the program will be presented and the refractor condition will be set as programmed.

3. Present the next chart.

Press **NEXT**. Each time the key is pressed, the chart will be switched over to the next chart and the refractor will be set as programmed. Press the **SHIFT** - **NEXT** combination to go back to the previously presented chart.

5.2 Printout

The data is printed out by pressing **PRINT**.

Select the contents to be printed at the “Print” parameter in the “Set parameter” mode in advance (p. 5-14).

To only print data in a specific field only, press the key for the respective field (**UN-AIDED**, **LM**, **AR**, **SUBJ**, or **FINAL**) while pressing **PRINT**.

[ON/OFF of printing CL data (CL conversion value)]

It is possible to print out CL data, converted from the obtained subjective measurements. Select whether or not to print it at the “Print CL data” parameter in the “Set parameter” mode (p. 5-14).

[ON/OFF of data clear function after printout]

It is possible to automatically clear the data displayed on the screen after printout. Select whether to clear it or not at the “Print + clear” parameter in the “Set parameter” mode (p. 5-14).

By choosing the function, the data displayed on the main window will be cleared after printout. However, the last printed data for one patient will be stored in the system until the next printout is performed. See “5.6.2 Calling up the most recent data” (p. 5-18).

[KM measurements]

To print the keratometry (KM) measurements converted to diopters, it is necessary to set the parameter “I/F Format” of the ARK side at “All”.

Sample printout:

<pre> ID : 123456789012 NAME: AUG/ 8/1996 M/F Dominant Eye : R --<R>--< UA >--<L>-- FAR 200 150 400 --<R>--< LM >--<L>-- FAR - 1.75 SPH - 2.25 - 0.75 CYL - 0.25 + 1.00 ADD + 1.00 (50) (40) (60) BO 0.50 PRSM BO 0.50 B 0.00 B 0.00 --<R>--< AR >--<L>-- FAR - 3.00 SPH - 3.50 - 1.50 CYL - 1.00 176 AXS 4 --<R>--< SUBJ >--<L>-- FAR - 2.75 SPH - 3.25 - 1.25 CYL - 0.75 175 AXS 5 (15) UA (20) B 0.00 PRSM BO 2.00 B 0.00 B 0.00 Div x / 7.00/ 4.00 Conv 9.00/16.00/10.00 NEAR - 2.75 SPH - 3.25 - 1.25 CYL - 0.75 175 AXS 5 **Contact Lens** - 2.75 SPH - 3.25 - 1.25 CYL - 0.75 175 AXS 5 - 3.25 SE - 3.50 --<R>--< FINAL >--<L>-- FAR - 2.25 SPH - 2.75 - 1.00 CYL - 0.50 175 AXS 5 + 1.50 ADD + 1.50 (20) BO 1.00 PRSM BO 1.00 B 0.00 B 0.00 </pre>	<p>ID No.</p> <p>Patient's name & sex</p> <p>Date and time</p> <p>Working distance</p> <p>Dominant eye</p> <p>Unaided visual acuity</p> <p>LM measurement</p> <p>Objective refraction results (AR measurement)</p> <p>Subjective refinement results</p> <p>CL conversion value</p> <p>Prescription</p>	<pre> **Far + Addition** - 0.75 SPH - 1.25 - 1.00 CYL - 0.50 175 AXS 5 PD 62.0 NPD 58.0 **For Trial Lens** - 2.25 SPH - 2.75 - 1.00 CYL - 0.50 175 AXS 5 < NPC > 8cm 9.5MA 59.0Prism < NPA > BIN: 33cm 1.53D < NRA > BIN: +2.00/+1.75 < PRA > BIN: -2.25/-2.00 Fusion Check : 4(Fusion) Stereo Check : 1* Aniseikonia(U) : OK --<R>--< KM >--<L>-- R1 7.83 mm 7.83 43.00 D 43.00 148 AXS 135 R2 7.81 mm 7.79 43.25 D 43.25 58 AXS 45 Test time 10:14 NIDEK RT-2100 </pre>	<p>Near Powers</p> <p>Interpupillary Distance</p> <p>Near pupil distance</p> <p>Trial lens data</p> <p>Near Point of Convergence</p> <p>Near Point of Accommodation</p> <p>Negative Relative Accommodation</p> <p>Positive Relative Accommodation</p> <p>Fusion/Suppression</p> <p>Diplopia</p> <p>Stereoscopic vision</p> <p>Aniseikonia</p> <p>KM measurement</p> <p>Comment</p>
--	--	---	--

5.2.1 Changing an ID No.

Follow the procedure below to change the ID No. which will be printed out on the top of the printout.

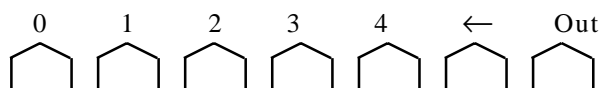
1. Press **No.**.

The box for receiving an ID No. appears.

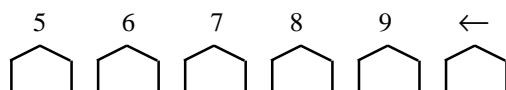
2. Enter a desired number with the function keys.

It is possible to enter up to twelve digits from 1 to 999999999999.

To change an ID No., delete the desired digit by pressing **←** and then input the new number.

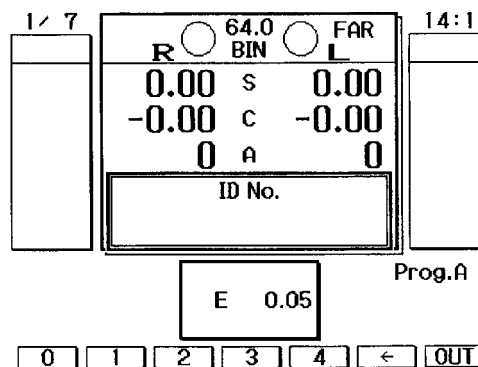


While pressing **SHIFT**,



3. Place the system back into the normal measurement mode.

Press **No.** again.



5.2.1.1 Outputting all the data displayed on the screen

All the data which is displayed on the screen is output to an external device.

1. Press **No.** to enter the ID No. entry mode.

2. Press the corresponding function key to **OUT**.

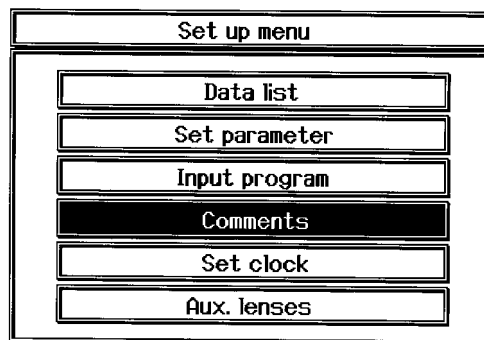
All the data which is being displayed on the screen will be output to an external device.

5.2.2 Entering comments for printout

It is possible to print out comments together with measured data. Up to two lines of forty-eight letters can be entered. Follow the procedure below to enter the comments.

1. Place the system into the mode which allows comments to be input.

- 1) Open the “Set up menu” screen.
Press **MENU**.
- 2) Move the cursor (█) to “Comments” with **↓**.
- 3) Press **EXE**.



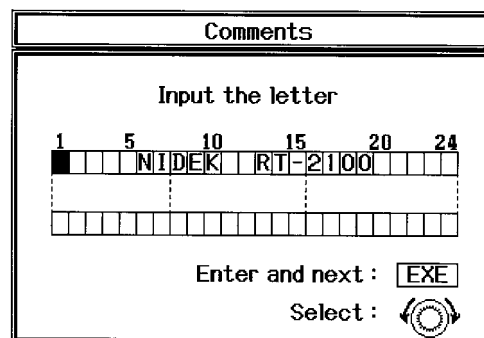
2. Move the cursor (█) to a square in which a letter is to be input.

Use **EXE** to move the cursor.

3. Select a letter.

By turning the dial counterclockwise, the letter to be entered changes horizontally in order, starting from the upper-left of the following table.

By turning the dial clockwise, the letter changes in reverse order.



	!	”	’	()	*	+	,	?	.	/	0	1	2	3	4	5	6	7	
8	9	:	;	<	=	>	?	A	B	C	D	E	F	G	H	I	J	K	L
M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[]	a	b	c	d	
e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
y	z																		

Table1 (Letter table)

4. Press **EXE** to enter the letter.

The cursor moves to the next square.

5. Repeat Steps 2 to 4 until completing an entry.

6. Place the system back into the normal measurement mode.

Press **MENU**.

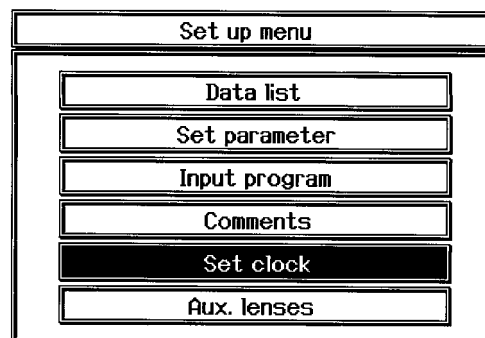
It is also possible to return to the measurement mode by pressing **EXE** while the cursor is placed at the last square.

5.2.3 Entering date and time

It is possible to print out the date and time when printing the measurement data. Follow the procedure below to set the internal clock of the system to the correct time.

1. Place the system into the setting mode which allows date and time to be entered.

- 1) Open the “Set up menu” screen.
Press **MENU**.
- 2) Move the cursor (█) to “Set clock” with **↓**.
- 3) Press **EXE**.
It is not possible to enter the “Set clock” mode when the elapsed time has already been measured.



2. Place the cursor (█) at the value to be changed.

Move the cursor with **EXE**.

3. Input the value.

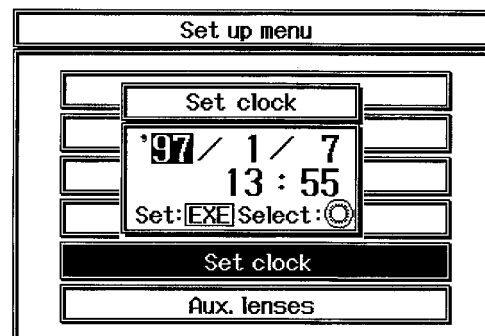
Change the number by turning the dial.

4. Repeat Steps 2 to 3 to set date and time.

5. Place the system back into the normal measurement mode.

Press **MENU**.

It is also possible to return to the measurement mode by pressing **EXE**, while the cursor is placed at “minute”.



5.3 Displaying a Data List

It is possible to display all measured data in tabular list form.

1. Select "Data list".

1) Open the "Set up menu" screen.
Press **MENU**.

2) Move the cursor (█) to "Data list".

3) Press **EXE**.

2. Select an intended data table with a function key.

FAR.....Used to display measurements obtained in Far mode.

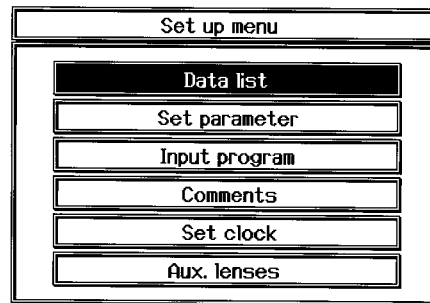
NEAR.....Used to display measurements obtained in Near mode.

SCA.....Used to display SPH, CYL, AXIS, ADD, Visual Acuity.

PRISM.....Used to display Prism Powers and "Blur", "Break" and "Recovery" data.

OTHER....Used to display the other measurement results.

END.....Used to return to the measurement mode.



FAR	SPH	CYL	AXS	ADD	UA
UNA R	—	—	—	—	200
L	—	—	—	—	150
LM R	-1.75	-0.75	0	+1.00	50
L	-2.25	-0.25	0	+1.00	40
AR R	-3.00	-1.50	176		
L	-3.50	-1.00	4		
SUB R	-2.75	-1.25	175		15
L	-3.25	-0.75	5		20
FIN R	-2.25	-1.00	175	+1.50	
L	-2.75	-0.50	5	+1.50	20

PD = 64.0mm ID No. :

FAR **NEAR** **SCA** **PRISM** **OTHER** **END**

FAR	BI/BO	BU/BD	BLUR	BREAK	RECOU
UNA R	—	—	—	—	—
L	—	—	—	—	—
LM R	0.00	0.00D			
L	1.00	0.00C			
AR R			D		
L			C		
SUB R	0.00D	0.50D		7.00	4.00
L	1.50	0.00C	9.00	16.00	10.00
FIN R	0.00	0.00D			
L	1.50	0.00C			

PD = 64.0mm ID No. :

FAR **NEAR** **SCA** **PRISM** **OTHER** **END**

FAR	ADD	ADD UA	NPC	8 cm
UNA R	—	—	NPA	B: 33 cm
L	—	—	R:	cm
LM R	+1.00	40	L:	cm
L	+1.00		NRA	B: +2.00/+1.75
AR R			R:	/
L			L:	/
SUB R			PRA	B: -2.25/-2.00
L			R:	/
FIN R	+1.50	30	L:	/
L	+1.50		Fusion:	
			4(Fusion)	
			Stereo: 1'	

Dominant eye: R Aniseikonia (U):OK (H):

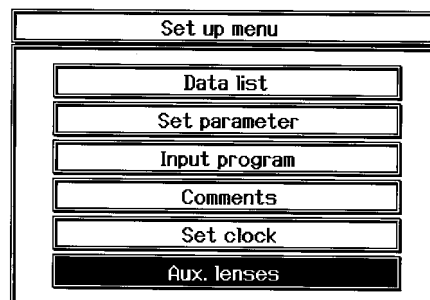
FAR **NEAR** **SCA** **PRISM** **OTHER** **END**

5.4 Setting Auxiliary lenses

Auxiliary lenses will automatically be placed according to a chart selected. To set other lenses in addition to these preset lenses, follow the procedure below.

1. Place the system into the setting mode which allows auxiliary lenses to be selected.

1) Open the "Set up menu" screen.
Press **MENU**.



- 2) Move the cursor (█) to "Aux. lenses".
- 3) Press **EXE**.

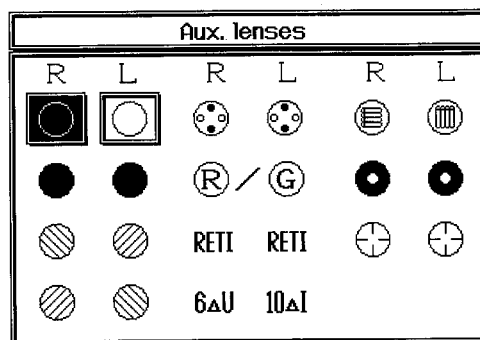
2. Select auxiliary lenses with the dial, **↑** or **↓**.

3. Press **EXE**.

The selected auxiliary lenses will be placed in the measuring windows.

4. Place the system back into the normal measurement mode.

Press **EXE** or **MENU** again.

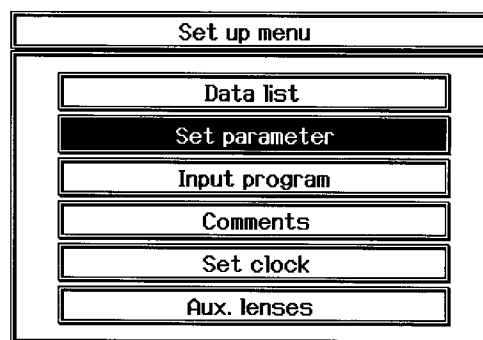


5.5 Parameter Settings

To view or change the parameter settings, follow the procedure below.

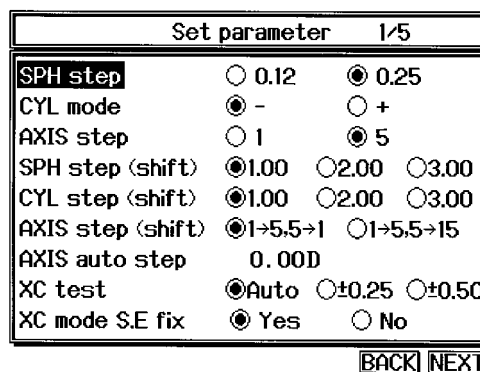
1. Place the system into the mode which allows parameter settings to be changed.

- 1) Open the "Set up menu" screen.
Press **MENU**.
- 2) Move the cursor (█) to "Set parameter" with **↓**.
- 3) Press **EXE**.



2. Select a parameter to be changed.

- 1) Select an on-screen prompt, "BACK" or "NEXT" to scroll through the parameter screens.
- 2) Move the cursor (█) to a desired parameter with **↑** or **↓**.



BACK **NEXT**

5 - 11

3. Change the settings with the dial.

● shows that the option is selected.

4. Change other parameter settings in the same manner as Steps 2 and 3.

5. Place the system back into the normal measurement mode.

Press .


[Parameter options and their settings]


Set parameter		1/5
SPH step	<input type="radio"/> 0.12 <input checked="" type="radio"/> 0.25	
CYL mode	<input checked="" type="radio"/> - <input type="radio"/> +	
AXIS step	<input type="radio"/> 1 <input checked="" type="radio"/> 5	
SPH step (shift)	<input checked="" type="radio"/> 1.00 <input type="radio"/> 2.00 <input type="radio"/> 3.00	
CYL step (shift)	<input checked="" type="radio"/> 1.00 <input type="radio"/> 2.00 <input type="radio"/> 3.00	
AXIS step (shift)	<input checked="" type="radio"/> 1→5,5→1 <input type="radio"/> 1→5,5→15	
AXIS auto step	0.00D	
XC test	<input checked="" type="radio"/> Auto <input type="radio"/> ±0.25 <input type="radio"/> ±0.50	
XC mode S.E fix	<input checked="" type="radio"/> Yes <input type="radio"/> No	





SPH step : 0.12, 0.25
 Factory setting: 0.25
 This allows the user to select either 0.12 D or 0.25 D.

CYL mode : -, +
 Factory setting: -
 This allows the user to select the cylinder direction, + or - during cylindrical refinement.

AXIS step : 1, 5
 Factory setting: 5
 This allows the user to select either 1° or 5° during axis refinement.

SPH step (Shift) : 1.00, 2.00, 3.00
 Factory setting: 1.00
 This allows the user to refine Spherical Power in increments of 1.00 D, 2.00 D, or 3.00 D during spherical refinement by pressing  while turning the dial.

CYL step (Shift) : 1.00, 2.00, 3.00
 Factory setting: 1.00
 This allows the user to refine Cylindrical Power in increments of 1.00 D, 2.00 D, or 3.00 D during cylindrical refinement by pressing  while turning the dial.

AXIS step (Shift) : 1 → 5, 5 → 1, 1 → 5, 5 → 15
 Factory setting: 1 → 5, 5 → 1
 This allows the user to select either 1° or 15° during axis refinement when the “AXIS step” parameter is set to “5”. This step is available by turning the dial while pressing .
 1 → 5, 5 → 1 ⇒ Axis changes in increments of 1° by turning the dial while pressing .
 1 → 5, 5 → 15 ⇒ Axis changes in increments of 15° by turning the dial while pressing .
 When the “AXIS step” parameter is set to “1”, Axis changes in increments of 5° by turning the dial while pressing .

AXIS auto step : 0.00 D - 2.00 D

Factory setting: 0.00 D

Axis auto step is used while detecting the AXIS using a cross cylinder lens. If the obtained Cylindrical Power is below the selected power, the AXIS step becomes 5°. If the obtained Cylindrical Power is over the selected power, the AXIS auto step value becomes 1°. The setting value changes in 0.25 D increments. If the AXIS auto step value is 0.00 D, the AXIS step remains unchanged regardless of any Cylindrical Power.

XC test : Auto, ±0.25, ±0.50

Factory setting: Auto

This allows the user to select Auto, ±0.25 or ±0.50 when in the cross cylinder mode.

Auto ⇒ ±0.25 D Auto XC lens

±0.25 ⇒ ±0.25 D XC lens

±0.50 ⇒ ±0.50 D XC lens

XC mode S.E fix : Yes, No

Factory setting: Yes

This allows the user to select whether or not to maintain spherical equivalency by adjusting Spherical Power during cross cylinder testing.

CYL mode S.E fix : Yes, No

Factory setting: No

This allows the user to select whether or not to maintain spherical equivalency by adjusting Spherical Power while refining Cylindrical Power.

Prism display : X/Y, rθ

Factory setting: X/Y

This allows the user to select X/Y or rθ.



X/Y ⇒ Rectangular coordinates

rθ ⇒ Polar coordinates

Set parameter	2/5	
CYL mode S.E fix	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Prism display	<input checked="" type="radio"/> X/Y	<input type="radio"/> rθ
Prism speed	<input type="radio"/> 1.0sec	<input checked="" type="radio"/> 0.7sec
Input prism	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Input fusion	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Blur/Break/Recov.	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Fog for balance	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Preset ADD	<input checked="" type="radio"/> Yes	<input type="radio"/> No
SPH Far↔Near	<input type="radio"/> SPH	<input checked="" type="radio"/> SPH+ADD

Prism speed : 1.0 sec, 0.7 sec

Factory setting : 0.7 sec

This allows the user to select the time between prism changes while holding down  or . The user can select either 1.0 or 0.7 seconds.

BACK NEXT

Input prism : Yes, No

Factory setting: No

This allows the user to select whether or not to enter Prism Power automatically when entering lensometry data from the LM (Lensmeter).

* When entering lensometry data from the LM-770, 820 or 870, be sure to set at “No”.

Input fusion : Yes, No

Factory setting: Yes

This allows the user to select whether or not to enter fusion diagnosis, suppression or diplopia, during the Worth test.

If the “Input fusion” parameter is set at “Yes”, the following message appears on the left of the chart indicator during the binocular balance test.

How many lines do you see?

2 → Prism test

3 → Balance test

Blur/Break/Recov. : Yes, No

Factory setting: Yes

This allows the user to select whether or not to enter the Blur, Break and Recovery values when the system is placed into the Prism mode.

Fog for Balance : Yes , No

Factory setting: Yes

This allows the user to select automatic “fog” (+ power) to make the patient’s vision 30 - 25 in the binocular balance test.

Preset ADD : Yes, No

Factory setting: Yes

This allows the user to select whether or not to provide the on-screen ADD guide with the patient’s age in the ADD mode. (ADD as a guide will be set at a rather low value for a patient’s age)

SPH Far ⇒ Near : SPH, SPH + ADD

Factory setting: SPH + ADD

This allows the user to select the way SPH is set when the Far mode is switched to the Near mode.

SPH ⇒ SPH in Far mode will be also used in Near mode.

SPH + ADD ⇒ ADD power will be added to SPH of the Far mode.

(-) Addition : Yes, No

Factory setting: No

This allows the user to select whether or not to enter the (-) addition while in the ADD mode.

Working dist. (WD) : 35 cm - 70 cm

Factory setting: 40 cm

This allows the user to select the working distance. The setting value changes in increments of 5 cm.

Set parameter		3/5
(-) Addition	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Working dist.(WD)	40cm	
Print CL data	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Print TL data	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Print+clear	<input checked="" type="radio"/> Yes <input type="radio"/> No	
Print	<input checked="" type="radio"/> All <input type="radio"/> W/o AR <input type="radio"/> U.S.F <input type="radio"/> Off	
Print list	<input checked="" type="radio"/> Yes <input type="radio"/> No	
Auto test time	<input checked="" type="radio"/> Yes <input type="radio"/> No	
Program	<input checked="" type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	

BACK **NEXT**

Print CL data : Yes , No

Factory setting: No

This allows the user to select whether or not to print out the data prescribed for a contact lens, which has been converted from the obtained subjective refinements, together with other data.

Print TL data : Yes, No

Factory setting: No

This allows the user to select whether or not to print out the TL data necessary for using trial lenses. If this parameter option is set to “Yes”, TL data converted from the final data will be printed out. If there is no final data in the system, TL data for subjective measurements will be printed out.

Print + clear : Yes, No

Factory setting: Yes

This allows the user to select whether or not to clear measurements after printout.

Print : All, W/o AR, U.S.F, Off

Factory setting: All

This allows the user to determine the data to be printed.

All ⇒ Print out all the data

W/o AR ⇒ Print out all the data except objective refraction results

U.S.F. ⇒ Print out unaided VA, subjective refinement results, final data.

Off ⇒ No data printed

Print list : Yes, No

Factory setting: Yes

If this is set at “Yes”, the user may immediately view all test results by pressing **PRINT**.

Press **PRINT** again to print out all test data after verifying all necessary tests have been performed. If any necessary test has not been performed, press the on-screen prompt **EXIT** to return to the measurement screen.

Auto test time : Yes, No

Factory setting: Yes

This allows the user to select whether or not to indicate and print an elapsed time from the point where any data has been entered to the SUBJ field. When this is set at “Yes”, the elapsed time from the data entry to SUBJ field, instead of the current time indication, is shown on the upper right of the display during refraction.

Program : A, B, C, D, E

Factory setting: A

This allows the user to select a desired program A, B, C, D or E for testing. To begin the selected program, press **START**.

Program A : Fix, User

Factory setting: Fix

Program A is preprogrammed before shipment. This allows the user to select the programmed test sequence or to reprogram for a desired sequence.

Set parameter		4/5
Program A	<input checked="" type="radio"/> Fix	<input type="radio"/> User
ADD SUBJ→FINAL	<input checked="" type="radio"/> Yes	<input type="radio"/> No
SUBJ start	<input checked="" type="radio"/> AR	<input type="radio"/> LM
Input Stereo	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Background	<input checked="" type="radio"/> White	<input type="radio"/> Black
Auto off	<input type="radio"/> No <input type="radio"/> 5min <input checked="" type="radio"/> 15min <input type="radio"/> 30min	
Beep sound	<input checked="" type="radio"/> High	<input type="radio"/> Low <input type="radio"/> Off
F.key for retino	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Lens for retino	<input checked="" type="radio"/> +1.5D	<input type="radio"/> +2.0D

ADD SUBJ → FINAL : Yes, No

Factory setting: Yes

By pressing in the "FINAL" mode in the state that there is ADD data in the "SUBJ" field, the data will be automatically corrected by subtracting the spherical equivalent and shown in the "FINAL" field. If there is no ADD data in the "SUBJ" field, this setting is ineffective.

Subj. start : AR, LM

Factory setting: AR

This allows the user to select data with which testing is started: AR or LM measurements. When only one of the two measurements has been entered, the refractor will be set with that data. This does not apply when the data has been manually entered with the dial.

Input Stereo : Yes, No

Factory setting: Yes

This allows the user to select whether or not to display the on-screen prompts for recording the stereoparallax, and to include the results in a printout.

Background : White, Black

Factory setting: White

This allows the user to select a screen background color of either white or black.

Auto off : No, 5 min, 15 min, 30 min

Factory setting: 15 min

This allows the user to select not to use the auto-off function, or to select the auto-off time. When a time of 5, 15, or 30 minutes is selected, the system will automatically perform the auto-off function.

While the auto-off function is activated, the backlight of the display and light source of the chart device will be shut off. To return the system to its original state, press any key.

Beep sound : High, Low, Off

Factory setting: High

This allows the user to adjust the tone volume of the keypad.

F key for retino : Yes, No

Factory setting: Yes

When the parameter is set to “Yes”, [R ret] and [L ret] function keys, are displayed on the main window’s bottom while the system is placed in the SPH mode. By pressing the keys, the lenses for the retinoscope can be set in the measuring windows.

Lens for retino : +1.5 D, +2.0 D

Factory setting: +1.5 D

This allows the user to select a +1.50 D or +2.00 D spherical lens for retinoscope testing.

+1.5 D: Distance between the system and retinoscope = 67 cm

+2.0 D: Distance between the system and retinoscope = 50 cm

F. key for fog/link : Yes, No

Factory setting: No

This is for selecting whether or not to activate the function keys specifying the “fog” and linkage OFF function when [SHIFT] is pressed. When the parameter is set at “Yes”, the function keys will appear only in SPH, CYL, AXIS or PRISM mode.

Chart link : Yes, No

Factory setting: Yes

This allows the user to select a NIDEK chart presenting device or other manufacturer’s chart presenting device.

Set parameter	5/5	
F.key for fog/link	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Chart link	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Preset UA	<input type="radio"/> 1 letter	<input checked="" type="radio"/> H. line <input type="radio"/> No
Connected AR	<input checked="" type="radio"/> AR	<input type="radio"/> ARK
Memory func.	<input checked="" type="radio"/> Yes	<input type="radio"/> No (Memory box)
Memory box data	<input checked="" type="radio"/> AR	<input type="radio"/> AR+LM
LM port (IC)	<input type="radio"/> AR	<input checked="" type="radio"/> LM
IC card R/W	<input type="radio"/> Yes	<input checked="" type="radio"/> No

Preset VA : 1 letter, H. line, No

Factory setting: H. line

This allows the user to select a single letter mask or horizontal line mask which is to be placed on the expected VA chart from the patient’s AR or LM data, during the unaided or aided visual acuity test.

1 letter ⇒ The expected VA chart with a single-letter isolated will be presented.

H. line ⇒ The expected VA chart with a horizontal-line isolated will be presented.

No ⇒ No VA chart will be presented.

Connected AR : AR, ARK

Factory setting: AR (AUTO REFRACTOMETER)

Select “ARK” only when the RT-2100 is interfacing with the ARK (auto ref/keratometer) and you want to enter keratometry data as well as AR data. The entered keratometry data only appears on the printout.

(Be sure to select “AR” when the RT-2100 and AR are interfacing through an optional memory box or AR data is entered into the RT-2100 via IC card Reader/Writer. Only AR data can be entered into the RT-2100 under the above conditions.)

[BACK] [NEXT]

Memory func. : Yes, No (Memory box)

Factory setting: Yes

This allows the user to select “No (Memory BOX)” if the RT-2100 is equipped with an optional memory box (RT6IF-80).

Memory box data : AR, AR + LM

Factory setting: AR

This allows the user to select which device data to read, when the RT-2100 is equipped with an optional memory box (RT6IF-80).

AR: Connected AR (auto-refractometer) only.

AR/LM: Connected LM (lensmeter) only, or both AR and LM.

LM port (IC) : AR, LM

Factory setting: LM

This allows the user to select the devices to be connected to the lensmeter connector of the relay box, when the RT-2100 is equipped with an IC card Reader/Writer.

IC card R/W : Yes, No

Factory setting: No


Set at “Yes” when the RT-2100 is equipped with an IC card Reader/Writer.

5.6 Recalling Data

5.6.1 Calling up final data



The system stores the most recent data found of the last fifty patients (final data obtained for each patient). Follow the procedure below to display this data for one patient.*¹²

1. Open the screen “Recall final data” to display the final data on the Display.

1) Press .

2) Press .

2. Select the desired data.

Press  or  to select the desired data.

3. Call up the data.

Press .

The subjective data will be called up.

Recall final data			1/5
Date	Time	ID No.	Data
			S C
★97/01/0816	289600010		0.00-0.00
97/01/0814	289600009		+1.00-0.00
97/01/0813	139600008		-0.50-0.50
97/01/0811	479600007		0.00-1.00
97/01/0810	249600006		+2.50-0.75
97/01/0719	519600005		-0.75-1.00
97/01/0717	409600004		+1.25-0.25
97/01/0716	579600003		-0.50-0.00
97/01/0715	539600002		-2.00-0.75
97/01/0715	109600001		-1.00-0.50

*¹² In cases where there is no data in the FINAL field, the data in the SUBJ field (Best correction) will be shown as final data. If there is no data in either field, AR data or LM data will be shown as final data in the order of AR → LM precedence.

5.6.2 Calling up the most recent data

The last printed data of each patient is stored within the system until another printout is made. Follow the procedure below to call up the last data.

1. Press .

2. Press .

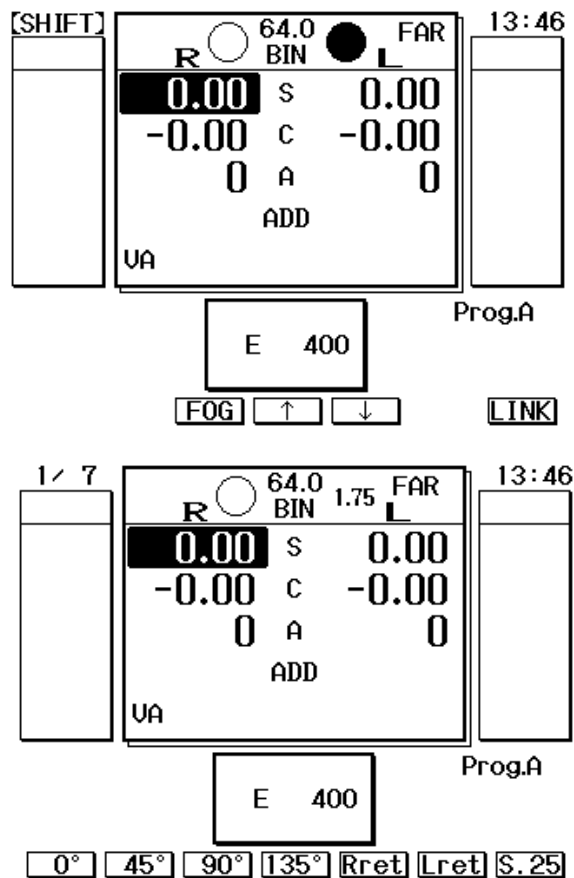
The data will be called up on the display.

5.7 Fogging Function with Both Eyes Open

When the **FOG** function key is pressed while the “SHIFT” key is pressed in the SPH, CYL, AXIS or PRISM mode on the condition that a single eye is specified, the already-set Spherical Power of “fog” will be introduced instead of an occluder. With this function, it is possible to test a single eye while both measuring windows are open.

Perform one of the following operations to clear the fogging condition. The occluder will be placed in the measuring window.

- Press the **FOG** function key.
- Press **CLEAR** or turn OFF the power once and turn it ON again.
- Press any chart key specifying auxiliary lenses other than “●” and “○”.
- Select any auxiliary lens by pressing “○” or “●” etc.



To change the spherical power for fogging, press the **↑** or **↓** function key while pressing **SHIFT** on condition that a spherical lens is placed in either measuring window. The range is from 0.00 D to +9.00 D.

Factory setting: +1.75 D

* It is possible to set the “fog” while both measuring windows are open in the program (See p. 5-2).

* The function key will not be available even though **SHIFT** is pressed if the “F. key for fog/link” parameter is not set at “Yes”.

5.8 Linkage OFF Function

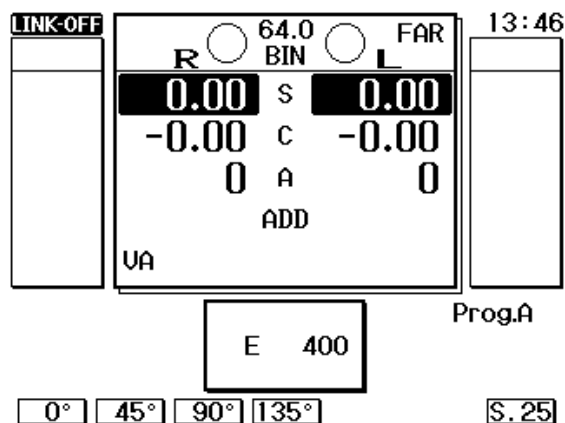
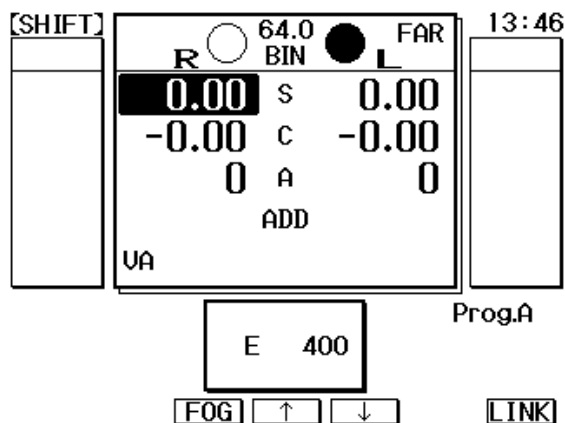
The linkage OFF function is to avoid auxiliary lenses and modes (SPH, CYL and AXIS) from being set in response to a corresponding chart key being pressed.

When the linkage is turned OFF, the corresponding auxiliary key and mode (SPH, CYL and AXIS), to the pressed chart key will not be set automatically, and a corresponding VA to the pressed mask key will not be shown automatically.

To turn OFF the linkage, press **CLEAR** while pressing **SHIFT** in SPH, CYL, AXIS or PRISM mode.

In addition, only the presented chart will be switched when **START** or **NEXT** is pressed.

To turn ON the linkage, press the **LINK** function key while pressing **SHIFT** again.



5.9 Clearing the Saved Data in Memory

All of the AR, ARK and LM data that are saved in the relay box are cleared.

1. Press **IN**.

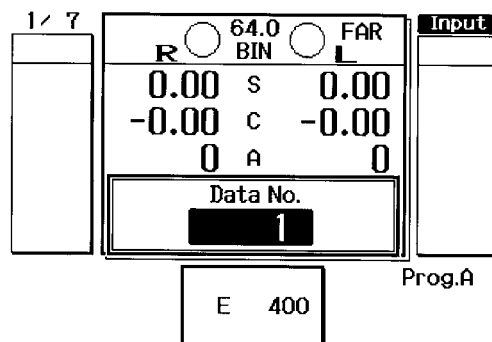
A Data No. of the data which was imported most recently from the AR, ARK, or LM will be shown in the Data No. box.

2. Change the Data No. to "0".

Turn the dial to change the Data No. to "0". (The data No. will be changed in increments of 100 by turning the dial while holding down **SHIFT**.)

3. Press **CLEAR**.

All the saved data of the AR, ARK, and LM in the relay box will be cleared.



§6 METHOD OF SINGLE TESTS

According to the chart presenting device, some of the letters and their order in the charts and keys described in this section have been changed.

6.1 Unaided Visual Acuity Test

1. Press .


The system will be placed in the mode to perform the unaided visual acuity test.

2. Press .

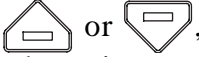
The left measuring window will be closed.

If the system has AR data entered, the expected VA chart will be presented automatically.*¹³ See “Appendix. E Table for VA values as presented on charts”.

1 / 8	UN- AIDED	72.0	FAR	16:32
SUBJ	R	BIN	L	SUBJ
-3.00	0.00	S	0.00	-3.50
-1.50	-0.00	C	-0.00	-1.00
176	0	A	0	4
	ADD			
	VA			



3. Test unaided visual acuity of the right eye.

By changing the chart with , obtain the best possible VA for the patient to read the chart. VA of the last presented chart will be highlighted.

4. Press .

The left measuring window will open and the right measuring window will be closed.

If the system has AR data entered, the expected VA chart will be presented automatically.*¹³

5. Test unaided visual acuity of the left eye.

Follow the same procedure as in Step 3.


6. Press .

Both measuring windows will open.

7. Test binocular visual acuity.

Follow the same procedure as in Step 3. The higher VA chart obtained from either eye will automatically be presented.

NOTE

- When testing with the ETDRS chart, it is impossible to change the chart and enter visual acuity as described in Step 3. (CP-690 TYPE M and SSC-350 TYPE T/TCG)
[How to enter visual acuity]
1) Press  to place the system in the VA mode.
2) Turn the dial to enter visual acuity.

The unaided visual acuity test is now completed.

*¹³ The expected VA chart will automatically be presented unless the “Preset VA” parameter is set to “No” and there is no data in the “FINAL” field.

6.2 Aided Visual Acuity Test

This allows the user to perform aided visual acuity testing. When lensometry data is entered, refine visual acuity aided by the patient's lensometry data.

1. Press .

The system will be placed in the mode for the aided visual acuity test.

The appropriate lenses as indicated by the lensometry data will be placed in the measuring windows.

2. Test the right, left and binocular visual acuity.

The expected VA chart from the received AR and lensometry data will be presented automatically.*¹⁴

Follow the same procedures as Steps 2 to 7 of "6.1 Unaided Visual Acuity Test". (p. 6-1)

*14 The expected VA chart will automatically be presented unless the "Preset VA" parameter is set to "No" and there is no data in the "FINAL" field.

6.3 Visual Acuity Test Aided with Addition Power

When the Addition Power of the patient is entered, it is possible to test the visual acuity aided by Addition Power.

1. Perform the Addition Power measurement.

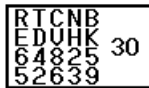
See Step 21 on page 4-19.

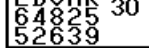
2. Pull down the near point rod, and place the near point card in front of the patient.

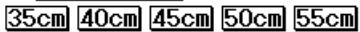
3. Press .

Check the patient's visual acuity (As for the checking procedure, see Step 22 on page 4-20).

1 / 7	SUBJ	<input type="radio"/> 72.0	<input type="radio"/> FAR	16:26
AR	<input checked="" type="radio"/> R	BIN	<input type="radio"/> L	AR
-3.00	-2.25	S	-3.00	-3.50
-1.50	-1.25	C	-0.75	-1.00
176	175	A	5	4
	+2.25	ADD	+2.25	
15	UA		15	15

Check near UA 

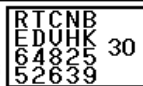
Use least plus 

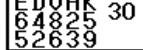
WD= 40cm 

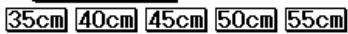
4. Press  again.

The mode for testing VA aided by Addition Power will be established.
If Addition Power has not been entered, the mode will never be established.






1 / 7	SUBJ	<input type="radio"/> 72.0	<input type="radio"/> FAR	16:26
AR	<input checked="" type="radio"/> R	BIN	<input type="radio"/> L	AR
-3.00	-2.25	S	-3.00	-3.50
-1.50	-1.25	C	-0.75	-1.00
176	175	A	5	4
	+2.25	ADD	+2.25	
15	ADD UA			15

Check near UA 





Use least plus 

WD= 40cm 

5. Measure the VA of the right, left and both eyes.

Press ,  or  to select an eye/eyes, and turn the dial to enter visual acuity. Entering visual acuity with the masking keys (such as  or ) is disabled.

NOTE

- When pressing , ,  or  in the middle of the above test mode, the mode switched to will be the testing mode of the aided VA with the selected power.

6.4 Cylinder Tests

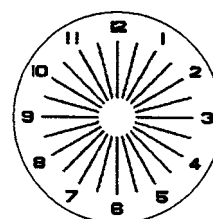
6.4.1 Cylinder test with astigmatism clock dial

Chart: Astigmatism clock dial

Ideal appearance of the chart: The darkness of all bars is equal.

[Procedure for one test example] This example is for a minus (−) cylinder only.

1. Press R or L to close either measuring window.



2. Press .

The system will be placed in the CYL mode. If CYL is not 0, change the value to 0.

3. Press and turn the dial counterclockwise to “fog” the patient’s vision.

4. Reduce the fog until the patient’s VA becomes around 20/40*¹⁵.

Turn the dial clockwise until the numbers on the clock dial chart are just visible.

5. Ask the patient, “Does any bar appear especially darker and sharper than the others, or are they about the same?”

All the bars appear equal. → The patient has no astigmatism. The test is now complete.

One of the bars appears darker. → Cylindrical axis is obtained by multiplying the smaller number next to the bar (1-6) by 30°.

e.g.: Bar 2 appears sharper.

$$2 \times 30^\circ = 60^\circ$$

6. Press and set the AXIS to the obtained value by using the dial.

7. Press and turn the dial clockwise in increments of 0.25 D to add CYL value until the darkness of all bars becomes equal.

If the position of the darkest bar changes when adding CYL value:

If the position of the darkest bar moves in the counterclockwise direction

→ Decrease the Axis value.

If the position of the darkest bar moves in the clockwise direction

→ Increase the Axis value.

*15 The numbers (1 - 12) beside the bars correspond to VA of 20/40.

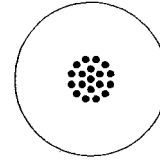
6.4.2 Cylinder test with XC lens

Use: Axis and Cylindrical Power refinement using the cross cylinder (XC) lens

Chart: Dots

Auxiliary lens: XC lens

Ideal appearance of the chart: Clearness of dots does not change even though the XC lens is reversed.



[Procedure for one test example]

1. Press **AR** to set the refractor condition with the AR data and then press **L** or **R** to close either measuring window.

2. Refine Spherical Power using the Red/Green chart, if desired.

If the patient cannot see Red and Green equally, make Green appear sharper.
See "6.5.1 Red/Green test".

3. Present the Dots chart.

Press .

The system will be placed in the AXIS mode. The cross cylinder lens will be set.

4. Refine Cylindrical axis.

See 2) of Step 10 of "4.5.1 Program A" (p. 4-14).


5. Place the system in the CYL mode.

Press **C**.

The axis of the cross cylinder lens changes.

6. Refine Cylindrical Power.

See 2) of Step 11 of "4.5.1 Program A" (p. 4-15).

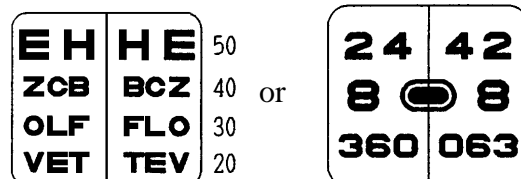
To perform the test with both windows open, press  of the closed window.

6.5 Spherical Refinements

6.5.1 Red/Green test

Chart: Red/Green

Ideal appearance of the chart: The sharpness of the letters on the red side and the green side appears equal.



[Procedure for one test example]

1. Press **(R)** or **(L)** to close either measuring window.
2. Press

6.5.2 Cross Grid test for far vision

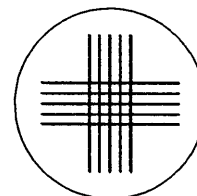
Use: Spherical refinement

Chart: Cross-grid


Applicable model: CP-690(670) TYPE T and F

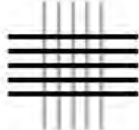
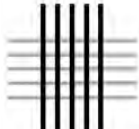
Auxiliary lens: ± 0.50 D cross cylinder lens (Fixed with the axis set at 90° .)

Ideal appearance of chart: The darkness of the horizontal and vertical lines is equal.



[Procedure for one test example]

1. Press **[SUBJ]**.
2. Press **(R)** or **(L)** to close either measuring window.
3. **Present the Cross-grid chart.**
Press .
 ± 0.50 D cross cylinder lens will be placed in the specified measuring window.
4. **Ask a patient, “Which lines are darker, the horizontal lines or vertical lines?”**
The horizontal lines and vertical lines appear equal. \Rightarrow Spherical Power is properly refined.
The horizontal lines are darker. \Rightarrow In the case of myopia, Spherical Power is overminused. In the case of hyperopia, Spherical Power is undercorrected.
The vertical lines are darker. \Rightarrow In the case of myopia, Spherical Power is underminused. In the case of hyperopia, Spherical Power is overcorrected.

Appearance of the chart	Refined Spherical Power	How to correct
① 	Myopia: overminused Hyperopia: undercorrected	Turn the dial counterclockwise one increment to add SPH + 0.25 D until the vertical and horizontal lines appear equally dark.
② 	Myopia: underminused Hyperopia: overcorrected	Turn the dial clockwise one increment to add SPH - 0.25 D until the vertical and horizontal lines appear equally dark.

6.6 Binocular Vision Function Test




6.6.1 Binocular balance test


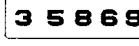
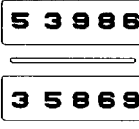
Use: Binocular balancing



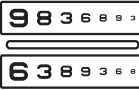
Chart: Binocular balance

Auxiliary lens: Right eye 135° & left eye 45° polarizing filters

Ideal appearance:

Right eye	Left eye	Binocular ideal
		 Sharpness of the top and bottom lines is equal.




Right eye	Left eye	Binocular ideal
		 Sharpness of the top and bottom lines is equal.

Right eye	Left eye	Binocular ideal
		 Sharpness of the top and bottom lines is equal.

Singularly, the right eye sees only the top and middle lines. The left eye sees only the bottom and middle lines.

[Procedure for one test example]

1. Present the binocular balance chart.

Press   or .

Polarizing filters will be placed in the measuring windows. The system will be placed in the SPH mode.

2. Press **BIN** and turn the dial counterclockwise to make binocular VA between 20/30 - 20/25, “fogging” the patient’s vision.

From the left respectively, the letters of this chart correspond to VA 20/50, 20/40, 20/30, 20/25, and 20/20.

3. Ask the patient, “In comparing the top and bottom lines only, which is clearer, or are they about the same?”

If the two lines are not equal, follow the steps below to refine:

Top line is clearer. → Press **R** and turn the dial counterclockwise to add SPH +0.25 D to the right eye.

Bottom line is clearer. → Press **L** and turn the dial counterclockwise to add SPH +0.25 D to the left eye.

Perform the above adjustment until the top and the bottom lines appear equal. If the patient is unable to see both lines equally after refining, allow the dominant eye to see clearer and document the dominant eye.

4. Turn the dial clockwise to cancel the “fogged” vision if present while in Step 2.



Press **BIN** and turn the dial clockwise.

* If the “Input fusion” parameter has been set at “Yes” of “Set parameter” in the “Set up menu”, the following message will appear on the left of the chart indication.

How many lines do you see?

2 → Prism test

3 → Balance test

In the case of  or , count the middle line as one line.

6.6.2 Polarized Red/Green test

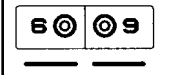

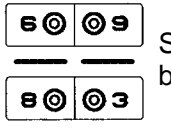
Use: To check binocular balancing (Balancing the accommodation of the right and left eyes)

Chart: Polarized Red/Green

Applicable model: CP-690(670) TYPE T, F, ISO and UK / SSC-330(300) TYPE T and UK

Auxiliary lens: Right eye 135° & left eye 45°, polarizing filters

Appearance:






Right eye	Left eye	Binocular ideal
		 Sharpness of the top and bottom lines is equal.

[Procedure for one test example]

1. Press to present the polarized Red/Green chart.

Polarizing filters will be placed in the measuring windows. The system will be placed in SPH mode.

2. Ask the patient how four numbers and double circles appear.

- Sharpness of all four  marks are equal. _____
- Sharpness of two  marks on the red side are equal. _____
- Sharpness of two  marks on the green side are equal. _____
- The top line is sharper on the green side, and the bottom line is sharper on the red side.
→ Press  and add SPH +0.25 D to the right eye. (Turn the dial counterclockwise.)
- The top line is sharper on the red side, and the bottom line is sharper on the green side.
→ Press  and add SPH +0.25 D to the right eye. (Turn the dial counterclockwise.)

Binocularly
well balanced*¹⁶

*16 In the case of (c), both powers are overcorrected even though well balanced.

Therefore, it is recommended to add plus power to both eyes until the chart appears as (a) or (b).

6.6.3 Phoria test



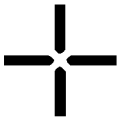
Use: To detect exophoria, esophoria, hypophoria and hyperphoria.

Chart: Phoria


Auxiliary lens: Right eye 135° & left eye 45° polarizing filters, rotary prism to both eyes

6.6.3.1 For CP-690(670) TYPE U / SSC-330(300) TYPE U


Appearance:

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

[Procedure for one test example]

1. Press  to present the phoria chart.

Polarizing filters will be placed in the measuring windows.

The system will be placed into the BASE (IN/OUT) prism mode. When  is pressed again, the prism base direction changes to BASE (UP/DOWN).

2. Ask the patient, “Can you see four bars ?”

Yes → Go to the next step of the test.

No → Impossible to continue the test.

3. Ask the patient, “Do they form a cross ?”

Yes → Orthophoria No → Heterophoria - Go to the next step of the test.

4. Ask the patient, “Do the vertical bars line up?”

Yes → The patient does not have exophoria or esophoria.

No → The patient does have exophoria or esophoria.

5. Ask the patient, “Is the top bar on the right or left of the bottom bar?”

Right → The patient has esophoria.

Left → The patient has exophoria.

6. Ask the patient, “Do the horizontal bars line up?”

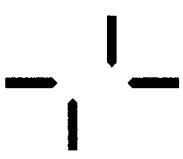
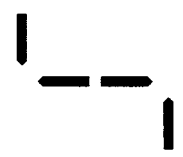
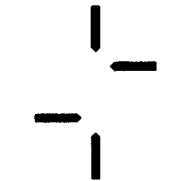



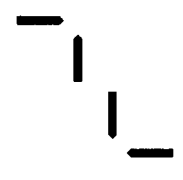
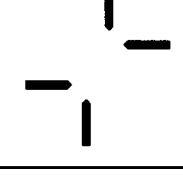
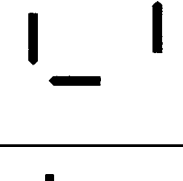
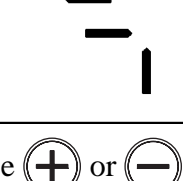
Yes → The patient has no hyperphoria or hypophoria.



No → The patient has hyperphoria or hypophoria.

NOTE

- Note that the rotary prism lenses will be removed from the measuring windows if the already selected switch is pressed again in the prism mode.




ex. When  is pressed in BASE (IN/OUT) prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① 	Esophoria	Turn the dial clockwise to add BO (base out) Prism Power until the vertical bars line up at the middle of the horizontal line.
② 	Exophoria	Turn the dial counterclockwise to add BI (base in) Prism Power until the vertical bars line up at the middle of the horizontal line.
③ 	Left eye hyperphoria	Press  . Turn the dial clockwise until horizontal bars line up at the middle of the vertical line. (Add BU [base up] Prism Power to the right eye and add BD [base down] to the left eye.)
④ 	Right eye hyperphoria	Press  . Turn the dial counterclockwise until the horizontal bars line up at the middle of the vertical line. (Add BD [base down] Prism Power to the right eye and BU [base up] to the left eye.)
⑤ 	Esophoria and right eye hyperphoria	Correct horizontal phoria as shown in ① and then correct vertical phoria as shown in ④.
⑥ 	Esophoria and left eye hyperphoria	Correct horizontal phoria as shown in ① and then correct vertical phoria as shown in ③.
⑦ 	Exophoria and right eye hyperphoria	Correct horizontal phoria as shown in ② and then correct vertical phoria as shown in ④.
⑧ 	Exophoria and left eye hyperphoria	Correct horizontal phoria as shown in ② and then correct vertical phoria as shown in ③.

* Use  or  instead of the dial for fine adjustment.


6.6.3.2 For CP-690(670) TYPE T and F / SSC-330(300) TYPE T

Appearance:

Right eye	Left eye	Binocular ideal
		 (Orthophoria)

1. Press  to present the phoria chart.

Polarizing filters will be placed in the measuring windows.

The system will be placed into the BASE (IN/OUT) prism mode. When  is pressed again, the prism base direction changes to BASE (UP/DOWN).

2. Ask the patient, “Can you see four bars ?”

Yes → Go to the next step of the test.

No → Impossible to continue the test.

3. Ask the patient, “Do vertical line and horizontal lines form a cross?”

Yes → Orthophoria

No → The patient has heterophoria. Go to the next step of the test .

4. Ask the patient, “Is the vertical line located near the left or right end of the horizontal line?”

Near right end → Esophoria

Near left end → Exophoria

The vertical line is not located near the left or right end of the horizontal line

→ The patient does not have exophoria or esophoria.

5. Ask the patient, “Is the horizontal line located near the top or bottom of the vertical bar?”

Top → The right eye has hyperphoria.

Bottom → The left eye has hyperphoria.

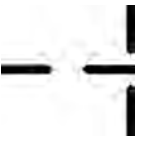
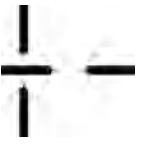
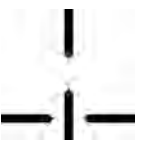






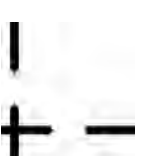
The horizontal line is not located near the top or bottom of the vertical line.



→ The patient does not have hypophoria or hyperphoria.

NOTE

- Note that the rotary prism lenses will be removed from the measuring windows if the already selected switch is pressed again in the prism mode.

ex. When  is pressed in BASE (IN/OUT) prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① 	Esophoria	Turn the dial clockwise to add BO Prism Power until the vertical line comes to the middle of the horizontal line.
② 	Exophoria	Turn the dial counterclockwise to add BI Prism Power until the vertical line comes to the middle of the horizontal line.
③ 	Left eye hyperphoria	Press  . Turn the dial clockwise until the horizontal line comes to the middle of the vertical line. (Add BU Prism Power to the right eye and add BD to the left eye.)
④ 	Right eye hyperphoria	Press  . Turn the dial counterclockwise until the horizontal line comes to the middle of the vertical line. (Add BD Prism Power to the right eye and add BU to the left eye.)
⑤ 	Esophoria and Right eye hyperphoria	Correct esophoria as shown in ① and then correct hyperphoria as shown in ④.
⑥ 	Esophoria and Left eye hyperphoria	Correct esophoria as shown in ① and then correct hyperphoria as shown in ③.
⑦ 	Exophoria and Right eye hyperphoria	Correct exophoria as shown in ② and then correct hyperphoria as shown in ④.
⑧ 	Exophoria and Left eye hyperphoria	Correct exophoria as shown in ② and then correct hyperphoria as shown in ③.

* Use  or  instead of the dial for fine adjustment.

6.6.4 Phoria with fixation test

Use: To detect heterophoria by giving stimuli for fusion

Chart: Phoria with fixation dot chart

Applicable model: CP-690(670) TYPE T, U, ISO and M / SSC-330(300) TYPE U / SSC-350
TYPE T and TCG

Auxiliary lens: Right eye 135° & left eye 45°, polarizing filters, binocular rotary prism

Appearance:

Right eye	Left eye	Binocular ideal
		(Orthophoria)
Right eye	Left eye	Binocular ideal
		(Orthophoria)
Right eye	Left eye	Binocular ideal
		(Orthophoria)

1. Press (or) to present the phoria with fixation dot chart.

Polarizing filters will be placed in the measuring windows.

The system will be placed into the BASE (IN/OUT) prism mode. When (or) is pressed again, the prism base direction changes to BASE (UP/DOWN).

2. Ask the patient, “Can you see four bars ?”

Yes → Go to the next step of the test.

No → Impossible to continue the test.

3. Ask the patient, “Do they form a cross ?”

Yes → Orthophoria

No → The patient has heterophoria. Go to the next step of the test.

4. Ask the patient, “Do the vertical bars line up?”

Yes → The patient does not have exophoria or esophoria.

No → The patient has exophoria or esophoria.

5. Ask the patient, “Is the top bar on the right or left of the bottom bar?”

Right → The patient has esophoria.

Left → The patient has exophoria.

6. Ask the patient, “Do the horizontal bars line up?”

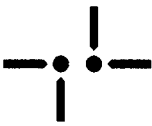



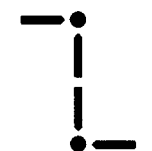


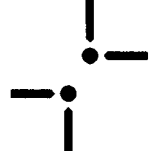
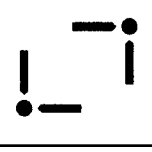
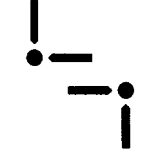
Yes → The patient has no hyperphoria or hypophoria.



No → The patient has hyperphoria or hypophoria.

NOTE

- Note that the rotary prism lenses will be removed from the measuring windows if the already selected switch is pressed again in the prism mode.

ex. When  is pressed in BASE (IN/OUT) prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① 	Esophoria	Turn the dial clockwise to add BO Prism Power until the vertical bars are in line.
② 	Exophoria	Turn the dial counterclockwise to add BI Prism Power until the vertical bars are in line.
③ 	Left eye hyperphoria	Press  . Turn the dial clockwise until the horizontal bars are in line. (Add BU Prism Power to the right eye and add BD to the left eye.)
④ 	Right eye hyperphoria	Press  . Turn the dial counterclockwise until both horizontal bars line up. (Add BD Prism Power to the right eye and add BU to the left eye.)
⑤ 	Esophoria and right eye hyperphoria	Correct horizontal phoria as shown in ① and then correct vertical phoria as shown in ④.
⑥ 	Esophoria and left eye hyperphoria	Correct horizontal phoria as shown in ① and then correct vertical phoria as shown in ③.
⑦ 	Exophoria and right eye hyperphoria	Correct horizontal phoria as shown in ② and then correct vertical phoria as shown in ④.
⑧ 	Exophoria and left eye hyperphoria	Correct horizontal phoria as shown in ② and then correct vertical phoria as shown in ③.

* Use  or  instead of the dial for fine adjustment.

6.6.5 Von Graefe test (for horizontal phoria)

Use: To detect horizontal phoria

Chart: Vertical line

Applicable model: CP-690(670) TYPE U and M / SSC-330(300) TYPE U [As for the other models, use the chart containing the minimum letter or a little bigger letter which can be read by the patient.]

Auxiliary lens: 6 Δ BU to the right eye, rotary prism to the left eye

Appearance:

Right eye	Left eye	Binocular ideal
Right eye	Left eye	Binocular ideal

[Procedure for one test example]

1. Press or to present the vertical line chart.*¹⁷

6 Δ BU will be placed in the right measuring window.

The system will be placed into the BASE (IN/OUT) prism mode.

2. Press to close the left measuring window.

3. Press to open the left measuring window.

4. Ask the patient, “Can you see two circles with a column of letters in each of them? Do the letters line-up, like buttons on a shirt ?”

If they are not in line, add Prism Powers until they appear in line at the instant the occluder is removed. To correct, follow the procedure shown on the next page. (Use the “Flashing Technique” *¹⁸ as shown in Steps 2 and 3, if desired.)

*¹⁷ If the Vertical line chart is not provided on your chart presenting device:

- 1) Present the chart containing the minimum letter size or a little bigger letter which can be read by the patient.
- 2) Isolate the intended line or letter with an isolating mask.
- 3) Press .
- 4) Press and that corresponds to the right measuring window.
6 Δ BU prism will be placed in the right measuring window.


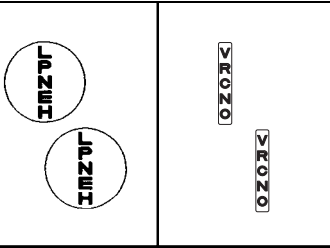

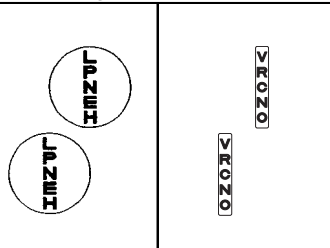
*¹⁸ Flashing Technique



Press to close the left measuring window, and subsequently press to open the left measuring window.

NOTE

- Note that the rotary prism lens will be removed from the measuring windows if the already selected switch is pressed again in the prism mode.

ex. When  is pressed in BASE (IN/OUT) prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① The upper column is on the left.	Esophoria	Press  . Turn the dial clockwise to add BO Prism Power until the two columns line up.
		
② The upper column is on the right.	Exophoria	Press  . Turn the dial counterclockwise to add BI Prism Power until the two columns line up.
		

* Use  or  instead of the dial for fine adjustment.

6.6.6 Von Graefe test (for vertical phoria)







Use: To detect vertical phoria

Chart: Horizontal line


Applicable model: CP-690(670) TYPE U and M / SSC-330(300) TYPE U [As for the other models, use the chart which includes the minimum letter or a little bigger letter which can be read by the patient.]

Auxiliary lens: Rotary prism to the right eye, 10 Δ BI to the left eye

Appearance:

Right eye	Left eye	Binocular ideal
		
Right eye	Left eye	Binocular ideal
		

[Procedure for one test example]

1. Press  or  to present the horizontal line chart.*¹⁹

10 Δ BI prism lens will be placed in the left measuring window.

The system will be placed into the BASE (UP/DOWN) prism mode.


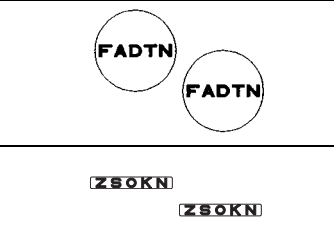

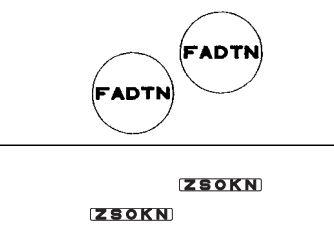
2. Ask the patient, “Can you see two circles with a row of letters in each of them? Are the letters in line, like headlights on a car?”



If they are not in line, add Prism Power, following the procedure shown in the table below.

NOTE




- Note that the rotary prism lens will be removed from the measuring window if the already selected switch is pressed again in the prism mode.

ex. When  is pressed in BASE (UP/DOWN) prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① The left row is higher.	Right eye hyperphoria	Press  . Turn the dial counterclockwise to add BD (base down) Prism Power to the right eye until the two rows of letters line-up.
		
② The right row is higher.	Left eye hyperphoria	Press  . Turn the dial clockwise to add BU Prism Power to the right eye until the two rows of letters line-up.
		

* Use  or  instead of the dial for fine adjustment.

*¹⁹ If the Horizontal line chart is not provided on your chart presenting device:

- Present the chart containing the minimum letter size or a little bigger letter which can be read by the patient.
- Isolate the intended line or letter with an isolating mask.
- Press .
- Press  and  that corresponds to the left measuring window. 10ΔBI prism will be placed in the left measuring window.

6.6.7 Vertical coincidence test



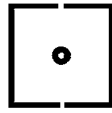
Use: To detect aniseikonia (image size difference) and to correct vertical phoria

Chart: Vertical coincidence

Applicable model: CP-690(670) TYPE T, U, F, ISO and M / SSC-330(300) TYPE T and U

Auxiliary lens: Right eye 135° & left eye 45° polarizing filters, binocular rotary prism

Appearance:


Right eye	Left eye	Binocular ideal
		

[Procedure for one test example]

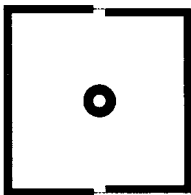
1. Press  to present the vertical coincidence chart.

Polarizing filters will be placed in both measuring windows.

The system will be placed into the BASE (UP/DOWN) Prism mode.

2. Ask the patient, “Can you see a square () with a dot in the center? Are the left frame and the right frame the same size, or is one smaller than the other?”

[Example]



3.5% aniseikonia

Width of one line corresponds to 3.5% aniseikonia

* The message “Sides equal?” appears on the left of the chart indication. It is possible to input the test result (Yes/No) with a corresponding function key or print it out with other data.


As a rule, when the aniseikonia is due to anisometropia (refractive power is greater than 2.00 D between the left and the right eyes), a spectacle lens prescription is suitable for axial anisometropia and contact lens prescription is suitable for refractive anisometropia.

[Procedure for one example to correct vertical phoria]

1. Press  to present the vertical coincidence chart.

Polarizing filters are placed in both measuring windows.

The system will be placed into the BASE (UP/DOWN) Prism mode.

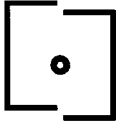
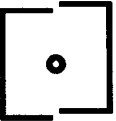
2. Ask the patient, “Can you see a square () with a dot in the center? Are the left and right frame aligned ?”

If they are not aligned, add Prism Power, following the procedure shown in the following table on the next page.

NOTE

- Note that the rotary prism lenses will be removed from the measuring windows if the already selected switch is pressed again in the Prism mode.

ex. When $\begin{matrix} \text{BD, BU} \\ \theta \end{matrix}$ is pressed in BASE (UP/DOWN) Prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① The left frame is higher. 	Right eye hyperphoria	Press BIN . Turn the Dial counterclockwise until the left and the right frames are aligned. (Add BD [base down] Prism Power to the right eye and BU [base up] Prism Power to the left eye.)
② The right frame is higher. 	Left eye hyperphoria	Press BIN . Turn the Dial clockwise until the left and right frames are aligned. (Add BU [base up] Prism Power to the right eye and BD [base down] Prism Power to the left eye.)

* Use \oplus or \ominus instead of the dial for fine correction.

6.6.8 Horizontal coincidence test

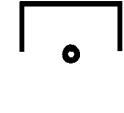

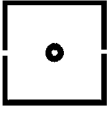
Use: To detect aniseikonia (image size difference) and to correct horizontal phoria

Chart: Horizontal coincidence

Applicable model: CP-690(670) TYPE F

Auxiliary lens: Right eye 135° & left eye 45° polarizing filters, binocular rotary prism

Appearance:

Right eye	Left eye	Binocular ideal
		

[Procedure for one example of detecting aniseikonia]

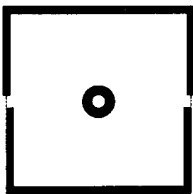
1. Press  to present the horizontal coincidence chart.

Polarizing filters will be placed in the both measuring windows.

The system will be placed into the BASE (IN/OUT) Prism mode.

2. Ask the patient, “Can you see a square () with a dot in the center? Are the top and bottom frames the same size? Or is one smaller than the other?”

[Example]



3.5% aniseikonia

Width of one line corresponds to 3.5% aniseikonia

* The message “Top and bottom equal?” appears on the left of the chart indication. It is possible to input the test result (Yes/No) with a corresponding function key or print it out with other data.


As a rule, when the aniseikonia is due to anisometropia (refractive power is greater than 2.00 D between the left and the right eyes), a spectacle lens prescription is suitable for axial anisometropia and contact lens prescription is suitable for refractive anisometropia.

[Procedure for one example to correct horizontal phoria]

1. Press  to present the horizontal coincidence chart.

Polarizing filters are placed in both measuring windows.

The system will be placed into the BASE (IN/OUT) Prism mode.

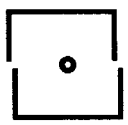

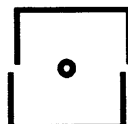

2. Ask the patient, “Can you see a square () with a dot in the center? Are the left and right frame aligned ?”



If they are not aligned, add Prism Power, following the procedure shown in the following table.

NOTE

- Note that the rotary prism lenses will be removed from the measuring windows if the already selected switch is pressed again in the Prism mode.

ex. When  is pressed in BASE (IN/OUT) Prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① The top frame is shifted to the left. 	Exophoria	Press  . Turn the dial counterclockwise until the top and bottom frames are aligned.
② The top frame is shifted to the right. 	Esophoria	Press  . Turn the dial clockwise until the top and bottom frames are aligned.

* Use  or  instead of the dial for fine adjustment.

6.6.9 Schober test

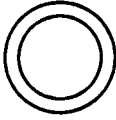

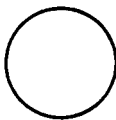
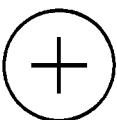
Use: To correct heterophoria

Chart: Schober



Applicable model: CP-690(670) TYPE T, F and ISO / SSC-330(300) TYPE T

Auxiliary lens: Red filter on the right eye, green filter on the left eye, binocular rotary prism



Appearance:

Right eye	Left eye	Binocular ideal
+		
Right eye	Left eye	Binocular ideal
+		

[Procedure for one example to correct horizontal phoria]

1. Press  (or ) to present the Schober chart.

The red filter will be placed in the right measuring window and the green filter in the left measuring window.

The system will be placed into the BASE (IN/OUT) Prism mode. When  (or ) is pressed again, the prism base direction will change to the BASE (UP/DOWN).

2. Ask the patient, “Can you see a green circle and a red cross?”

Yes → Go to the next step of the test.

No → Impossible to continue the test.

3. Ask the patient, “Is the cross in the center of the circle?”

Yes → Orthophoria

No → The patient has heterophoria. Go to the next step of the test.

4. Ask the patient, “Is the cross right or left of the center of the circle?”

Right → Esophoria

Left → Exophoria

It is located in the center. → The patient has no horizontal phoria.

5. Ask the patient, “Is the cross above or below the center of the circle?”

Upward → The left eye has hyperphoria.

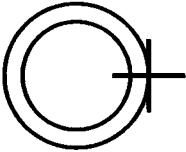
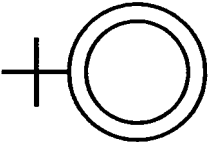
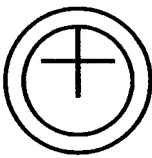

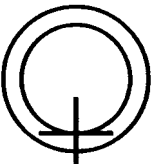

Downward → The right eye has hyperphoria.



It is vertically in the middle. → The patient has no vertical phoria.

NOTE

- Note that the rotary prism lenses will be removed from the measuring windows if the already selected switch is pressed again in the Prism mode.

ex. When  is pressed in BASE (IN/OUT) Prism mode, the rotary prism will be removed.

Appearance of chart	Type of phoria	How to correct phoria
① The cross is on the right. 	Esophoria	Turn the dial clockwise to add BO (base out) Prism Power until the cross comes to the center of the circle.
② The cross is on the left. 	Exophoria	Turn the dial counterclockwise to add BI (base in) Prism Power until the cross comes to the center of the circle.
③ The cross is above the center of the circle. 	Left eye hyperphoria	Press  . Turn the dial clockwise until the cross comes to the center of the circle. (Add BU [base up] Prism Power to the right eye and BD [base down] Prism Power to the left eye.)
④ The cross is below the center of the circle. 	Right eye hyperphoria	Press  . Turn the dial counterclockwise until the cross comes to the center of the circle. (Add BD [base down] Prism Power to the right eye and BU [base up] Prism Power to the left eye.)

* Use  or  instead of the dial for fine adjustment.

6.6.10 Stereo test

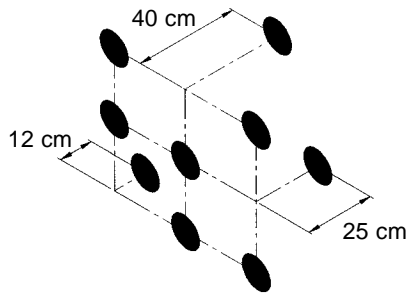
6.6.10.1 For SSC-350 TYPE T/TCG

Use: To detect stereoscopic vision

Chart: Stereo test

Auxiliary lens: None

Appearance:



1. Press  to present the stereo test chart.

2. Confirm that the patient can see the 9 black dots in the three lines and can see one of the three dots in each line further away.

Top line: Center dot --- about 40 cm away

Center line: Right dot --- about 25 cm away

Bottom line: Left dot --- about 12 cm away

Stereoparallax of each line is 3', 2' and 1' from top to bottom.

When "Input Stereo" in the parameter is set to "Yes", it is possible to enter the test result (40 cm, 25 cm, 12 cm or NG) with the function keys.

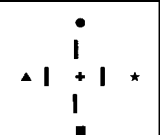
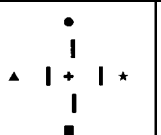
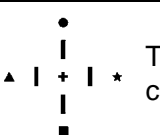
6.6.10.2 For the others

Use: To detect stereoscopic vision

Chart: Stereo test

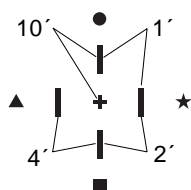
Auxiliary lens: Right eye 135° & left eye 45° polarizing filters

Appearance:

Right eye	Left eye	Binocular ideal
		 <p>The vertical bars appear closer than +○☆□△.</p>

The bar with the Δ mark appears closest, then bars with \square , \star , \circ marks appear further away in sequence.

The marks next to the bars may differ according to the type of chart.



Stereoparallax between + and the bar with \circ : 10'

Stereoparallax between the bar with \circ and the one with \star : 1'

Stereoparallax between the bar with \star and the one with \square : 2'

Stereoparallax between the bar with \square and the one with Δ : 4'

[Procedure for one test example]

1. Press  to present the stereo test chart.

Polarizing filters will be placed in the measuring windows.

2. Confirm that the patient can see four bars stereoscopically and can see them at different distances.

When “Input Stereo” in the parameter is set to “Yes”, it is possible to enter the test result (1’, 2’, 4’, 10’ or NG) with the function keys.

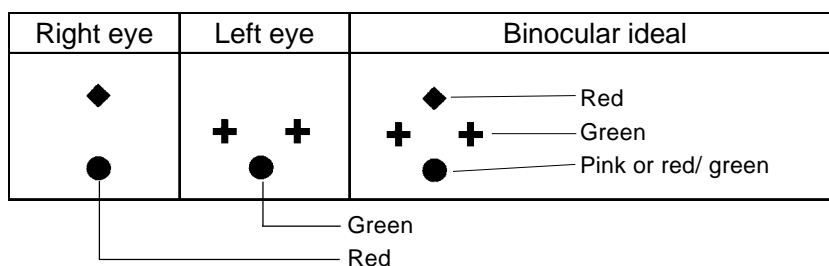
6.6.11 Worth test

Use: To detect fusion/suppression

Chart: Worth

Auxiliary lens: Red filter on the right eye and green filter on the left eye

Appearance:



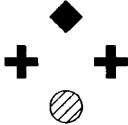


[Procedure for one test example]

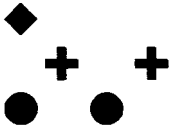


1. Present the worth chart.

Press .

The red filter will be placed in the right measuring window and green filter in the left measuring window.

2. Ask the patient, “How many bright spots can you see? What colors are they ?”

Appearance of chart	Diagnosis	Details
① Four spots 	Fusion	◇: Red, +: Green, ○: Pink or Red/Green alternately However, if a patient has an obvious dominant eye: ○: Red → The right eye is the dominant eye. ○: Green → The left eye is the dominant eye.
② Three spots 	Right-eye suppression	Two green + and ○ are seen.
③ Two spots 	Left-eye suppression	Red ◇ and ○ are seen.

Appearance of chart	Diagnosis	Details
④ Five spots at the same time 	Diplopia	Red \diamond and green + + are seen at the same time. 
⑤ Five spots However, ② and ③ are flashing alternately.	Alternating suppression	Red \diamond and green + + are flashing alternately. 

* If the “Input fusion” parameter has been set at “Yes” of “Set parameter” in the “Set up menu”, the test result of the above two, three, four or five spots can be recorded with the function keys and these results can be printed out.




6.6.12 Maddox test (for horizontal phoria)

Use: To detect horizontal phoria

Chart: Fixation

Auxiliary lens: Horizontal maddox rod on right eye, rotary prism on the left eye

Appearance:

Right eye	Left eye	Binocular ideal
		

[Procedure for one test example]





1. Press  to present the fixation chart.

The horizontal maddox rod will be placed in the right measuring window.

The system will be placed into the BASE (IN/OUT) Prism mode.

2. Ask the patient, “Is the white spot to the left, right or directly on the bar?”.

If the spot is to the left or right of the bar, align it on the bar, following the procedure below.

Appearance of chart	Type of phoria	How to correct
① The white spot is at the left of the red bar. 	Esophoria	Press  . Turn the dial clockwise to add BO (base out) Prism Power until the spot is aligned on the bar.
② The white spot is at the right of the red bar. 	Exophoria	Press  . Turn the dial counterclockwise to add BI (base in) Prism Power until the spot is aligned on the bar.



6.6.13 Maddox test (for vertical phoria)

Use: To detect vertical phoria

Chart: Fixation

Auxiliary lens: Rotary prism on right eye, vertical maddox rod on the left eye

Appearance:

Right eye	Left eye	Binocular ideal
○		

1. Press  to present the fixation chart.

The horizontal maddox rod will be set in the right measuring window.

The system will be placed into the BASE (IN/OUT) Prism mode.



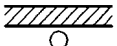

2. Press  again.



The maddox rod will be removed from the right measuring window and a vertical maddox rod will be placed in the left measuring window.

The system will be placed into the BASE (UP/DOWN) Prism mode.


3. Ask the patient, “Is the spot above, below, or directly on the bar?”

If the spot is above or below the bar, align it on the bar, following the procedures below.

Appearance of chart	Type of phoria	How to correct
<p>① The white spot is over the red bar.</p> 	Left-eye hyperphoria	Press  . Turn the dial clockwise to add BU (base up) Prism Power until the spot is aligned on the bar.
<p>② The white spot is under the red bar.</p> 	Right-eye hyperphoria	Press  . Turn the dial counterclockwise to add BD (base down) Prism Power until the spot is aligned on the bar.

* Use  or  instead of the dial for fine adjustment.

*20 If the vertical line chart is not provided on your chart presenting device:

- 1) Present the chart which includes the minimum letter size or a little bigger letter which can be read by the patient.
- 2) Isolate the intended line or letter with an isolating mask.
- 3) Press  .

6.6.14 Negative relative convergence test

















Use: To test divergence ability of the eye

Chart: Vertical line


Applicable model: CP-690(670) TYPE U and M / SSC-330(300) TYPE U [As for the other models, use the chart containing the minimum letter or a little bigger letter which can be read by the patient.]

Auxiliary lens: Rotary prism in both measuring windows

Check to make sure that the “Blur/Break/Recov.” parameter of “Set parameter” has been set to “Yes” in advance.

1. Press  or  to present the vertical line chart.*²⁰
6 Δ BU dissociation prism will be placed in the right measuring window.
The system will be placed into the BASE (IN/OUT) Prism mode.
2. Press the  function key which places the system in the negative relative convergence mode.
The 6 Δ BU dissociation prism will be removed from the right measuring window and both windows become open.
Indications of , ,  and  will be displayed.
3. Turn the dial counterclockwise (or press ) to add BI Prism Power to both eyes.
4. Press the  function key which corresponds to the point where a patient responds when the chart appears to blur.
The Prism Power is stored as “Blur”. The indication , showing the Prism Power has been entered, will be highlighted. When the function key  is pressed again, the entered Prism Power will be cleared.
(In Far mode, the chart seldom appears to blur. Skip Step 5 and go to the next step.)
5. Press the  function key which corresponds to where the patient responds when the chart appears dissociated (split in two).
The Prism Power is stored as “Break”. The indication , showing the Prism Power has been entered, will be highlighted.
When the function key of  is pressed again, the entered Prism Power will be cleared.
6. Turn the dial clockwise (or press ) to reduce BI Prism Power from both eyes until the patient responds when the chart appears as one again. At that point, press the  function key to store the Prism Power as “Recovery”.

* When performing the test in Near mode, press  and place the system in Near mode.

* When performing this test following the von Graefe test, the Prism Powers for correcting horizontal or vertical phoria will be stored and cleared by pressing . Then the system will be placed into the “DIV” mode.

6.6.15 Positive relative convergence test

















Use: To test convergence ability of the eye

Chart: Vertical line

Applicable model: CP-690(670) TYPE U and M / SSC-330(300) TYPE U [As for the other models, use the chart which includes the minimum letter or a little bigger letter which can be read by the patient.]

Auxiliary lens: Rotary prism in both measuring windows

Check to make sure that the “Blur/Break/Recov.” parameter of “Set parameter” has been set to “Yes” in advance.

1. Press  or  to present the vertical line chart.*²⁰
6 Δ BU dissociation prism will be placed in the right measuring window.
The system will be placed into the BASE (IN/OUT) Prism mode.
2. Press the  function key twice which places the system in the positive relative convergence mode.
The 6 Δ BU dissociation prism will be removed from the right measuring window and both windows become open.
Indications of , ,  and  will be displayed.
3. Turn the dial clockwise (or press ) to add BO Prism Power to both eyes.
4. Press the  function key which corresponds to the point where a patient responds when the chart appears to blur.
The Prism Power is stored as “Blur”. The indication , showing the Prism Power has been entered, will be highlighted. When the function key  is pressed again, the entered Prism Power will be cleared.
(In Far mode, the chart seldom appears to blur. Skip Step 5 and go to the next step.)
5. Press  function key at the point where the patient responds when the chart appears disassociated (split in two).
The Prism Power is stored as “Break”. The indication , showing the Prism Power has been entered, will be highlighted.
When the function  key is pressed again, the entered Prism Power will be cleared.
6. Turn the dial counterclockwise (or press ) to reduce BO Prism Power from both eyes until the patient responds that the chart appears as one again. At that point, press the  function key to store the Prism Power as “Recovery”.

* When performing the test in Near mode, press  and place the system in Near mode.

6.6.16 Near point of convergence test

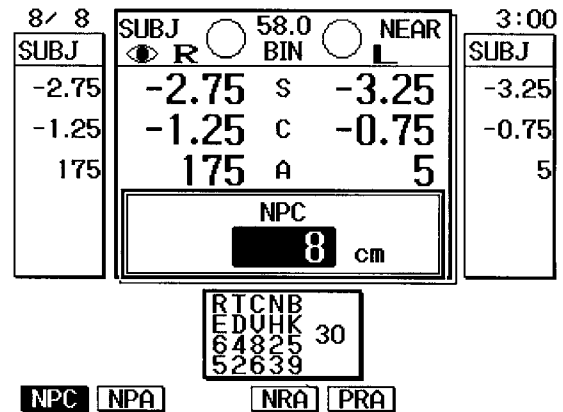
The refractor is not necessary for performing this test. Let a patient wear his/her spectacles if he/she always wears them.

Use: To measure the critical point of convergence

Chart: Fixation chart or ends of pencils or pens which cause double vision easily.

- Press **ADD** while holding down **SHIFT**, **NPC**, **NPA**, **NRA** and **PRA**, which correspond to the function keys are displayed. The system will be placed into the Near point of convergence test mode.

* Or press **F/N** to place the system in the Near mode and then use the **ADD** and **SHIFT** combination to place the system in the Near point of convergence test mode.



- Gradually bring the fixation chart or an end of a pen closer to the patient's eye and measure the distance from the chart to the root of the nose (posterior surface of the lens) at the point where the image appears dissociated (split in two).
- Enter the distance with the dial, **+** or **-** keys.

It is possible to enter the distance in the 1 to 100 cm range in 1cm increments.

* The system automatically calculates meter angle and Prism Power and prints them.

e.g. Enter 7cm as the distance.

When PD = 64 cm,

$$MA = 1/(0.07 + 0.025) = 10.5$$

$$\Delta = 10.5 \times 6.4 = 67.2$$

NPC = 7 cm: 10.5 MA, 67.2 Δ

- Press a mode switch such as **S**, **C** and **A** etc. to exit the test mode.

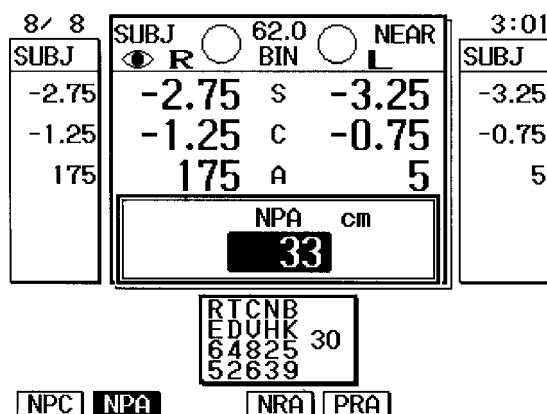
6.6.17 Near point of accommodation test

Use: To measure accommodation

Chart: The letter chart of the lowest VA that the patient can read correctly at the position of 40 cm away from the near point card

Check to make sure that the “SPH Far ⇒ Near” parameter of “Set parameter” is set to “SPH + ADD”.

1. Press **ADD** while holding down **SHIFT**.
(Skip this step when performing the test following “6.6.16 Near point of convergence test”).
2. Press the function key that corresponds to the **NPA** indication.
Both measuring windows become open.*²¹
3. Gradually bring the chart closer to the patient’s eye and measure the distance from the chart to the root of the nose at the point where the image appears blurry.
4. Enter the distance with the dial, **+** or **-**.
It is possible to enter the distance in the 1 to 100 cm range in 1cm increments.



* The system automatically calculates accommodation power from the entered value and outputs it on a printout.

e.g. If Addition Power was entered in the “SUBJ” field

Enter 33 cm as the distance. ADD = +2.0 D,

Accommodation power = $1/0.33 - (+2.0) = 3 - 2 = 1$ D

NPA = 33 cm: 1 D

*²¹ By closing the left or right measuring window with **L** or **R**, it is possible to measure the near point of accommodation for either eye.

6.6.18 Negative relative accommodation test

Use: To measure negative relative accommodation, while both eyes are converged to the fixed working distance

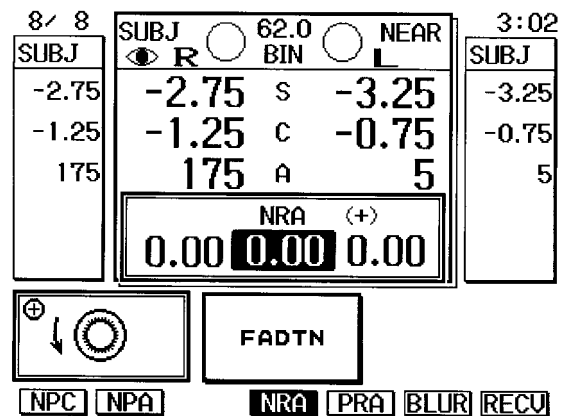
Chart: Letter chart of a horizontal line (20/20) presented at 40 cm away from the patient's eye

Check to make sure that the "SPH Far \Rightarrow Near" parameter of "Set parameter" is set to "SPH + ADD".

1. Press **ADD** while holding down **SHIFT**.
(Skip this step when performing the test following "6.6.17 Near point of accommodation test").

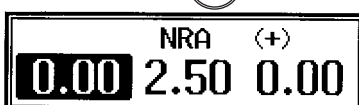
2. Press the function key that corresponds to the **NRA** indication.

Both measuring windows will become open*22 and **BLUR** and **RECV**, which correspond to the function keys will be additionally displayed.

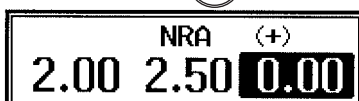



*22 By closing the left or right measuring window with **(R)** or **(L)**, it is possible to measure the negative relative accommodation for either eye.

When pressing **(R)**, the display on the Main window will change as follows.



When pressing **(L)**, the display on the Main window will change as follows.



3. Gradually turn the dial counterclockwise (or press ) and press the function key of **BLUR** at the point where the image appears blurry.

The **BLUR** indication is reversed, showing that the value has been stored.

4. Gradually turn the dial clockwise (or press ) and press the function key for **RECV** at the point where one image appears clearly again.

The **RECV** indication is reversed, showing that the value has been stored.

5. Press the function key for **BLUR** or **RECV** again to clear the stored data and return the reversed indication to the normal one.

6.6.19 Positive relative accommodation test

Use: To measure positive relative accommodation, while both eyes are converged to a fixed working distance

Chart: Letter chart in a horizontal line (20/20) presented 40 cm away from the patient's eye.

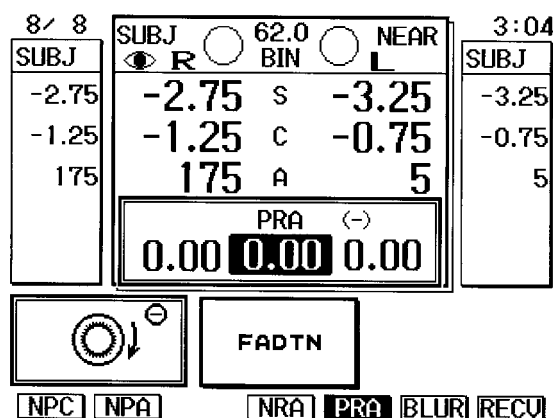
Check to make sure that the "SPH Far \Rightarrow Near" parameter of "Set parameter" is set to "SPH + ADD".

1. Press **ADD** while holding down **SHIFT**.
(Skip this Step when performing the test following "6.6.18. Negative relative accommodation test").

2. Press the function key that corresponds to the **PRA** indication.



Both measuring windows will become open*22 and **BLUR** and **RECV**, which correspond to the function keys will be additionally displayed.

3. Follow the same steps as Steps 3 to 5 of "6.6.18 Negative relative accommodation test".



§7 COMMON PROBLEMS AND SOLUTIONS

Should any problems occur during normal operation of the RT-2100, please check the following problems and possible solutions before calling for repair.

Problems	Possible solution
The refractor does not "TURN ON" even though the power switch is set to ON.	Confirm that the power cord is connected to a wall outlet and that power is supplied to this outlet.
The display is "Blank".	Turn the contrast adjustment knob. (p. 3-4)
The display and presented chart suddenly goes "BLANK".	The Auto OFF function of the system may be activated. Press any key to restore the display.
None of the keys on the control box function.	An abnormal condition may have occurred such as a power surge. Turn OFF the power switch and then back ON to reset the instrument.
Printer paper does not exit the printer even after pressing  .	The printer paper may be out. Replace the printer paper. See "8.3 Replacing the Printer Paper" (p. 8-2). Also, check that the "Print" parameter of "Set parameter" is set to "ON".
Nothing appears on a printout even after pressing  button.	Check that the printer paper is loaded with the correct side "Up".

* If any of the above do not solve the particular problem, contact your authorized distributor.

§8 MAINTENANCE

8.1 Cleaning the Forehead Rest

NOTE

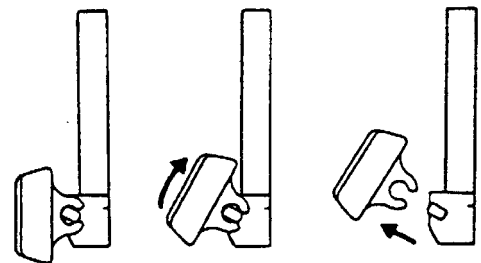
- If the instrument is sent back to NIDEK for service, it will be cleaned as described in 8.1, 8.2, 8.4 and 8.5. Furthermore, dust and dirt on the internal optical parts will be removed, and the appearance and all of the internal parts of the instrument will be in good condition.

Always clean the forehead rest before each refraction.

1. Remove the forehead rest.

- 1) Tilt the forehead rest upward.
- 2) Pull it upward to remove it.

The forehead rest can also be cleaned while it is attached to the refractor head.



⚠ WARNING

- Before detaching the forehead rest or attempting to clean the still attached forehead rest, make sure the refractor head is securely locked so that it does not move. If not, it can move and hit somebody, which may cause an injury.
- Pay attention not to lose the forehead rest if you detach it to clean.

2. Wipe the forehead rest with a clean cloth and a diluted neutral detergent solution.

NOTE

- After washing, be sure to wipe it dry completely. If not, the metal area around the forehead rest may rust.

8.2 Cleaning the Face Shields

Always clean the face shields before each refraction.

1. Remove the face shields from the refractor head.

The face shields can be easily detached since they are fixed by magnets.

The face shields can also be cleaned while they are attached to the refractor head.

WARNING

- Before detaching the face shields or attempting to clean the still attached ones, make sure that the refractor head is securely locked so that it does not move.
If not, the refractor head can move and hit somebody, which may cause an injury.
- Pay attention not to lose the face shields if you detach them to clean.

2. Wipe the face shields with a clean cloth and a diluted neutral detergent solution.


NOTE

- Do not use a neutral detergent to wipe the inner surface of the face shield.
When the inner surface is wet, it may rust.

8.3 Replacing the Printer Paper

When a red line appears on the edge of the printer paper, this indicates that the paper is about to run out. When this red line appears, immediately stop using the printer and replace the printer roll with a new one.

WARNING

- Do not press  without the printer paper in the printer.
This may cause irreparable damage to the printer head.

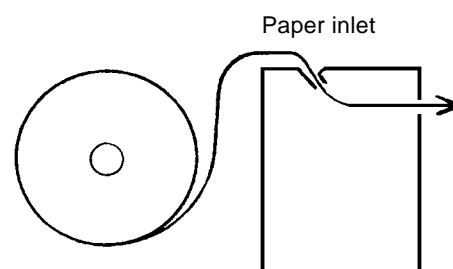
1. Push on the center part of the printer to release the printer from its housing. Pull the printer out of its housing carefully.
2. Remove the used printer paper roll.
3. Remove the printer paper roller shaft from the used paper roll.
4. Insert the shaft into a new paper roll.



Paper roller shaft



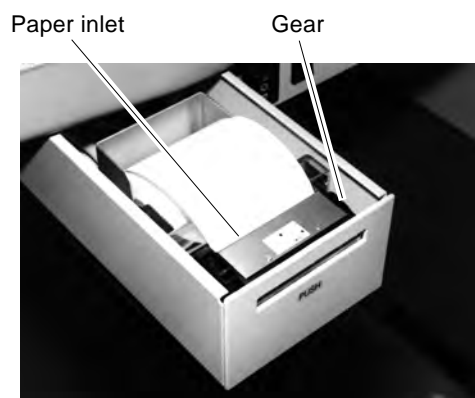
5. Insert the end of the paper into the paper inlet as shown on the right.



NOTE

- Ensure that the printer paper is inserted into the paper inlet with the correct side up. If not, a printout will not be obtained and may result in a loss of data.

6. Turn the gear by using your thumb to rotate the gear until the end of the paper is coming out of the housing.
7. Return the printer to its original position in the refraction table carefully.





8.4 Cleaning the Measuring Windows

Fingerprints, oil from eyelashes and dust on the measuring windows can affect the efficiency and the accuracy of the refraction. Be sure to check the windows before each refraction. If the windows are dirty or smudged, wipe them with a clean, soft cloth or cotton swab.

8.5 Cleaning the Exterior

When the covers or panels of the instrument become dirty, wipe these areas with a clean soft cloth and a mild diluted neutral detergent.

NOTE

- Never use an organic type solvent such as paint thinner to clean the instrument or any of its components, as this may result in irreparable damage to the surface of the instrument.

8.6 Replacement Part No. for Printer Paper

Article	Order Number
Printer paper	80620-00001

§9 SPECIFICATIONS

○ Measuring range

Sphere:	-29.00 - +26.75 D -19.00 - +16.75 D (XC test, Prism test) (0.12 D/0.25 D/1 D/2 D/3 D increments)
Cylinder:	0.00 - ±8.75 D (0.25 D/1 D/2 D/3 D increments)
Axis:	0 - 180° (1°/5°/15° increments)
PD:	48 - 80 mm (In distance mode, 0.5 mm/1 mm increments) 50 - 74 mm (For near working distance set at 35 cm, 0.5 mm/1 mm increments) 54 - 80 mm (Far PD at which both lens banks can converge)
Rotary prism lens:	0 - 20 Δ (0.1 Δ/0.5 Δ/2 Δ increments)
Cross cylinder lens:	±0.25 D Cross cylinder lens ±0.50 D Cross cylinder lens ±0.25 D Auto-cross cylinder lens

○ Auxiliary lenses

- : Occluder
- ⦿ : Pinhole plate (φ 1 mm)
- ⦶ : Red maddox rod (Right eye: horizontal)
- ⦶ : Red maddox rod (Left eye: vertical)
- Ⓡ / Ⓢ : Red/Green filter
(Right eye : red, Left eye: green)
- ⦶ / ⦶ : Polarizing filters
(Right eye: 135° , Left eye: 45°)
- ⦶ / ⦶ : Polarizing filters
(Right eye: 45° , Left eye: 135°)
- 6ΔU : Dissociation prism (Right eye: 6 Δ BU)
- 10ΔI : Dissociation prism (Left eye: 10 Δ BI)
- ⊕ : PD check lens
- ⦿ : ±0.50 D fixed cross cylinder lens
(fixed with the axis set at 90°)
- RETI: Lenses for retinoscope (+1.5 D/+2.0 D)

Refraction distance for**near vision :** 350 - 700 mm (50 mm increments)**Visual field:** 32° (dia. 30 mm)**○ Dimensions and net weight**

Main body: 455 (W) × 141 (D) × 329 (H) mm 6.7 kg

Control box: 220 (W) × 256 (D) × 142 (H) mm 1.2 kg

Relay box: 194 (W) × 227 (D) × 72 (H) mm 3.5 kg

Printer

(For the refraction table): 94 (W) × 204 (D) × 62 (H) mm 1.4 kg

(For the stand): 94 (W) × 216 (D) × 61 (H) mm 1.4 kg

○ Power source and consumptionPower source*²⁴: A. AC 100 V/120 V (±10 %) 50/60 Hz
B. AC 220 V/230 V (±10 %) 50/60 Hz

Power consumption: 120 VA

○ Environmental condition

Temperature: +10 to +40 °C (In usage)

-20 to +60 °C (In storage/Transference)

Humidity: 30 to 85 % (In usage)

10 to 95 % (In storage/Transference)

* Specifications are subject to change without prior notice for improvement.

*24 The electrical rating, A or B for the instruments is factory-configured.

§10 ACCESSORIES

10. 1 Standard Accessories

Refractor head	1
Control box	1
Relay box	1
Printer	1
Operator's Manual	1
Near point card and near point rod	1 each
Face shield	1
Forehead rest	1
Power cord	1
Dust cover	1
Spare printer paper	3 rolls
Spare fuses	2

APPENDIX. A *Descriptions of power adjustment*

Auto adjusted or Semi-auto adjusted values are obtained according to refractive error type.

[Auto adjustment] explains how the Final Fit is obtained after the binocular balance test.

[Semi-auto adjustment] explains Semi-auto adjustment performed after the Final Fit (Auto adjustment) accomplished by pressing $\textcircled{\text{XC} \ 2}$ or $\textcircled{\text{XC} \ 1}$ according to the patient's response.

In auto adjustment, the Final Fit is programmed to calculate lower powers than an average prescription. This is intended to avoid overminusing the patient. Therefore, it is necessary, after auto adjustment, to perform semi-auto adjustment to ensure best visual acuity.

In this section, the SUBJ data should be regarded as refined powers.

1 Myopia

A myopic eye applies to either of the following cases;

- Spherical Powers of both eyes are negative.
- Spherical Power of one eye is negative and the other eye is 0 D.

1.1 When there is no Lensometry Data in the Refractor

The following adjustments are for patients with no prior experiences with prescription glasses:

[Auto adjustment]

- The Final Fit reduces a certain power from both Spherical Powers.
- The Final Fit automatically adjusts right and left Spherical Powers so that the difference between both powers is within 0.75 D.

[Semi-auto adjustment]

$\textcircled{\text{XC} \ 2}$ ⇒ The Final Fit adds -0.25 D to Spherical Powers.

The Final Fit can adjust Spherical Powers within a range not exceeding the SUBJ Spherical Powers. If Spherical Powers exceed the SUBJ data, short beeps will be heard and Spherical Powers will not change.

$\textcircled{\text{XC} \ 1}$ ⇒ The Final Fit reduces -0.25 D from Spherical Powers.

The Final Fit can adjust Spherical Powers within a range in which they do not exceed 0 D. If they exceed 0 D, short beeps will be heard and Spherical Powers will not change.

* If there is a difference between right and left Spherical Powers, there are cases in which the Final Fit will adjust Spherical Powers only up to -0.25 D. This is because a patient may not adjust to a lens of 0 D.



1.2 When there is Lensometry Data in the Refractor

The following adjustments are for a patient with lensometry data;

[Auto adjustment]

- The Final Fit reduces a certain power from both Spherical Powers.
- If the lensometry data is overcorrected, the SUBJ data remains unchanged.
- The Final Fit automatically adjusts right and left Spherical Powers so that the difference between both powers is within 0.75 D. However, if there is a large difference between right and left lensometry powers, the difference between the Final Fit (Auto adjusted) right and left Spherical Powers may exceed 0.75 D.
- The Final Fit adjusts the SUBJ Spherical Powers so that the amount increased from lensometry data is within 0.75 D. However, if there is a large difference between right and left Spherical lensometry powers, there are cases in which the Final Fit adjusts both Spherical Powers keeping the difference of 0.75 D or more.

[Semi-auto adjustment]

-  ⇒ The Final Fit adds –0.25 D to Spherical Powers.
The Final Fit can adjust Spherical Powers within a range not exceeding the SUBJ Spherical Powers. However, only when a patient’s vision has improved, the Final Fit adjusts the powers within a range not exceeding the lensometry data.
-  ⇒ Same as [semi-auto adjustment] of “1.1 When there is no Lensometry Data in the Refractor” (p. A-1).

2 Hyperopia

A hyperopic eye applies to either of the following cases;



- Spherical Powers of both eyes are positive.
- Spherical Power of one eye is positive and the other power is 0 D.

2.1 When there is no Lensometry Data in the Refractor

[Auto adjustment]

- The Final Fit leaves the SUBJ data as it is.
- The Final Fit automatically adjusts right and left Spherical Powers so that the difference between both powers is within 0.75 D.

[Semi-auto adjustment]

-  ⇒ The Final Fit adds –0.25 D to Spherical Powers.
The Final Fit can adjust Spherical Powers within a range in which they are not negative.
-  ⇒ This key does not function when there is no lensometry data.

2.2 When there is Lensometry Data in the Refractor

[Auto adjustment]

- The Final Fit leaves the SUBJ data as it is.
- The Final Fit automatically adjusts right and left Spherical Powers so that the difference between both powers is within 0.75 D. However, if there is a large difference between right and left lensometry powers, the difference between the Final Fit right and left Spherical Powers may exceed 0.75 D.

[Semi-auto adjustment]



⇒ The Final Fit adds -0.25 D to Spherical Powers.

The Final Fit can adjust Spherical Powers within a range in which they are not negative.



⇒ This key does not function unless the lensometry data is larger in the positive than the SUBJ data.

However, the Final Fit can adjust Spherical Powers within a range not exceeding the lensometry data.

3 Astigmatism

An astigmatic eye applies to patients with an AXIS of $165^\circ - 180^\circ$, $0^\circ - 15^\circ$, or $75^\circ - 105^\circ$.

3.1 When there is no Lensometry Data in the Refractor

[Auto adjustment]

- The Final Fit reduces a certain power from both Cylindrical Powers.
- The Final Fit automatically adjusts right and left Cylindrical Powers so that the difference between both powers is within 0.75 D.

[Semi-auto adjustment]



⇒ The Final Fit adds -0.25 D to Cylindrical Powers.

The Final Fit can adjust Cylindrical Powers within a range not exceeding the SUBJ Cylindrical Powers. If Cylindrical Powers exceed the SUBJ data, short beeps will be heard and Cylindrical Powers will not change.



⇒ The Final Fit reduces -0.25 D from Cylindrical Powers.

The Final Fit can adjust Cylindrical Powers within a range in which they do not exceed 0 D. If they exceed 0 D, short beeps will be heard and Cylindrical Powers will not change.

* If there is a large difference between right and left Cylindrical Powers, there are cases in which the Final Fit can adjust Cylindrical Powers only within a range in which they do not exceed -0.25 D. This is because a patient may not adjust to a lens of 0 D.



3.2 When there is Lensometry Data in the Refractor

The following adjustments are for a patient with lensometry data;

[Auto adjustment]

- The Final Fit reduces a certain power from both Cylindrical Powers.
- If the lensometry data is overcorrected, the SUBJ data remains unchanged.
- The Final Fit automatically adjusts right and left Cylindrical Powers so that the difference between both powers is within 0.75 D. However, if there is a large difference between right and left lensometry powers, the difference between the Final Fit right and left Cylindrical Powers may exceed 0.75 D.
- The Final Fit adjusts the SUBJ Cylindrical Powers so that the amount increased from lensometry data is within 0.75 D. However, if there is a large difference between right and left Cylindrical lensometry powers, there are cases in which the Final Fit adjusts both Cylindrical Powers keeping the difference of 0.75 D or more.

[Semi-auto adjustment]

-  ⇒ The Final Fit adds -0.25 D to Cylindrical Powers.
The Final Fit can adjust Cylindrical Powers within a range not exceeding the SUBJ Cylindrical Powers. However, only when a patient's vision has improved, the Final Fit adjusts the powers within a range not exceeding the lensometry data.
-  ⇒ Same as [Semi-auto adjustment] of "3.1 When there is no Lensometry Data in the Refractor" (p. A-3).

4 Oblique Astigmatism

The Final Fit considers a patient whose AXIS is $16^\circ - 74^\circ$ or $106^\circ - 164^\circ$ to have oblique an astigmatism.

4.1 When there is no Lensometry Data in the Refractor

[Auto adjustment]

- If the patient has slight astigmatism in both eyes, the Final Fit adjusts both Cylindrical Powers to 0 D. (e.g. C: -0.25 D, -0.50 D)
- If Cylindrical Power of either eye is over -0.50 D, the Final Fit reduces a certain power from both Cylindrical Powers. The Final Fit automatically adjusts right and left Cylindrical Powers so that the difference between them is within 0.75 D.

[Semi-auto adjustment]

XC
2

⇒ The Final Fit adds -0.25 D to Cylindrical Powers.

The Final Fit can adjust Cylindrical Powers within a range not exceeding the SUBJ Cylindrical Powers.

XC
1

⇒ The Final Fit adjusts Cylindrical Powers or Axes in the following order:

- Reduces -0.25 D from Cylindrical Powers.
- Changes AXIS values to either 90° or 180° (to whichever AXIS is closer).
- Reduces a certain power from Cylindrical Powers and changes the AXIS angle.

* If there is a difference between right and left Cylindrical Powers, there are cases in which the Final Fit will adjust Cylindrical Powers only up to -0.25 D. This is because a patient may not adjust to a lens of 0 D.

4.2 When there is Lensometry Data in the Refractor

The following describes each adjustment when the lensometry data has been entered in the system.

[Auto adjustment]

- The Final Fit reduces a certain power from both Cylindrical Powers.
- If the lensometry data is overcorrected, the SUBJ data remains unchanged.
- The Final Fit automatically adjusts right and left Cylindrical Powers so that the difference between both powers is within 0.75 D. However, if there is a large difference between right and left lensometry powers, the difference between Final Fit right and left Cylindrical Powers may exceed 0.75 D.
- The Final Fit adjusts the SUBJ Cylindrical Powers so that the amount increased from lensometry data are within 0.75 D. However, if there is a large difference between right and left Cylindrical lensometry powers, there are cases in which the Final Fit adjusts both Cylindrical Powers keeping the difference of 0.75 D or more.

[Semi-auto adjustment]

Same as [Semi-auto adjustment] of “1.1 When there is no Lensometry Data in the Refractor”. (p. A-1)

5 Myopia/Hyperopia and Astigmatism in Combination

The Final Fit adjusts Spherical and Cylindrical Powers respectively as described in “1 Myopia” to “4 Oblique Astigmatism”.

6 Anisometropia

The Final Fit assumes that the difference between left and right powers must be within 0.75 D. If the patient has a difference of 1 D or more, the Final Fit recognizes that the patient has anisometropia and gradually adjusts the higher power closer to the lower power as described in “1 Myopia” to “4 Oblique Astigmatism”.

If the lensometry data has been entered in the refractor, the Final Fit adds 0.75 D to the higher power of the Final Fit data to adjust it closer to the SUBJ data.

7 If a Patient has Hyperopic and Myopic Eyes

In this case, auto adjustment will not be performed, and the message “Dominant far: + S → 0 Dominant near: – S → 0” appears.

If right and left powers are low, it may not be necessary to adjust the powers. In most cases, adjusting powers for spectacle use is recommended.

If a patient’s main use for glasses is for distance correction (priority far), bring the positive Spherical Power to “0”. If a patient’s main use for glasses is for near correction (priority near) bring the negative Spherical Power to “0”.

e.g. SPH R +1.00 D, L –1.00 D, To correct the powers for distance:

Press .

Press .





































Then turn the dial clockwise, adding –0.25 D until best VA is obtained.

The above adjustment should be performed manually by the operator.

Copy the SUBJ data into the FINAL field before performing the adjustments described above. Compare SUBJ to FINAL data to determine final correction.

APPENDIX. B *Linkage between charts and auxiliary lenses*

Charts and auxiliary lenses are mechanically linked when the “Chart link” parameter is set to “Yes”. The linkage between a chart and its corresponding auxiliary lenses are shown in the table below.

Chart	Auxiliary lens		Mode
	Right eye	Left eye	
VA chart		or 	S
Astigmatism clock dial		or 	C/A
Red/Green		or 	S
Dots		or 	A/C (XC mode)
Binocular balance	 Polarizing lenses		S
Polarized Red/Green	 Polarizing lenses		S
Phoria	 Polarizing lenses		Prism H/V
Phoria with fixation	 Polarizing lenses		Prism H/V
Coincidence horizontal	 Polarizing lenses		Prism H
Coincidence vertical	 Polarizing lenses		Prism V
Stereo test	 /  Polarizing lenses	 / 	—
Worth	Red filter 	Green filter 	—
Vertical line	6 Δ BU prism		Prism H
Horizontal line		10 Δ BI prism	Prism V
Fixation	Horizontal maddox  / 	 /  Vertical maddox	Prism H/V
Schober	Red filter 	Green filter 	Prism H/V
Cross grid for near vision	Fixed cross cylinder lens		ADD
VA chart for near vision			ADD

* “/” shows that the lens on the left side is set in the measuring window when the chart is presented for the first time. The lens on the right side is placed when the chart is presented for the next time. The placed lens is switched alternately.

* “H” shows base in and base out prism lenses (BI/BO), and “V” shows base up and base down prism lens (BU/BD).

* In the SSC-350 TYPE T/TCG, the auxiliary lenses corresponding to the stereo test are the open aperture.

APPENDIX. C Conversion table for VA values

Decimal	Fraction (feet)	Fraction (meters)
0.04		
0.05	20/400	6/120
0.063		
0.1	20/200	6/60
0.125		6/48
0.15	20/150	
0.16		6/38
0.2	20/100	6/30
0.25	20/80	6/24
	20/70	
0.3		6/20
0.32	20/60	
0.4	20/50	6/15
0.5	20/40	6/12
0.6		6/10
0.63	20/30	
0.7		
0.8	20/25	6/7.5
0.9		
1.0	20/20	6/6
1.2		6/5
1.25		
	20/15	
1.5		6/4
1.6		
2.0	20/10	6/3
2.5		

APPENDIX. D *Preset Addition Power*

As shown in the following table, the preset Addition Power as a guide is set at a rather lower value by 3 increments (0.75 D). If the patient sees the cross grid chart aided by the Addition Power, responses that the horizontal lines are sharper is expected. Turn the dial counterclockwise by one increment until the vertical and horizontal lines appear equally sharp.

Age	Expected ADD power	RT-2100	
		Age	Preset ADD power (D)
45	1.50	- 45	0.75
50	2.00	- 50	1.25
55	2.25	- 55	1.50
60	2.50	- 60	1.75
65	2.75	- 65	2.00
70	3.00	66 -	2.25
75	3.25		

APPENDIX. E *Table for VA values as presented on charts*

The following table shows a relationship between input AR data (SPH + CYL) and the expected VA values on the chart which will be presented when the system is placed into the modes for testing unaided VA.

Input objective powers (S + C)	Presented VA chart		
	Decimal	Fraction (feet)	Fraction (meters)
-4.25 -	0.05	20/400	6/120
-2.25 - -4.00	0.1	20/200	6/60
-2.00	0.2	20/100	6/30
-1.75	0.3	20/60	6/20
	0.32		
-1.50	0.4	20/50	6/15
-1.25	0.5	20/40	6/12
-1.00	0.6	20/30	6/10
	0.63		
-0.75	0.7	20/25	6/7.5
-0.50	0.8		
-0.25	0.9	20/20	6/6
0	1.0		

* Some of VA values on some charts may not be in accordance with the values shown in the above table.

APPENDIX. F *Examples of Programming*

The following is an example of a program which calculates the subjective data and prescription. The keys may differ according to the chart presenting device.

A. Unaided visual acuity test:

Press .

The UNAIDED field will be selected.
(VA mode will automatically be specified.)

Press .

The above setting will be stored.

B. Aided visual acuity test:

Press .

The LM field will be selected. (SPH mode will automatically be specified.)

Press .

The system will be placed into the VA mode.

Press .

The above setting will be stored.

C. Subjective refraction:

1) Perform the Red/Green test to refine the Spherical Power of the right eye.

Press .

The SUBJ field will be selected. (SPH mode will automatically be specified.)


Press .

The Red/Green chart will be selected.

Press .

The right eye will be specified.

Press  three times.

The comment “Letters sharper in Red/Green R=G ⇒ ” will be stored.

Press .


The above setting will be stored.

2) Refine Cylindrical axis.

Press .

The Dot chart will be selected. (The system will automatically be placed into the AXIS mode and a cross cylinder lens will be placed in the right measuring window.)

Press  twice.

The comment “Turn dial to better image 1=2 ⇒ ” will be stored.

Press .


The above setting will be stored.

3) Refine Cylindrical Power.

Press .

The Dot chart will be selected. (The system will automatically be placed into the CYL mode and a cross cylinder lens will remain in the right measuring window.)

Press  twice.

The comment “Turn dial to better image 1=2 ⇒ ” will be stored.

Press .

The above setting will be stored.

4) Perform the Red/Green test to refine Spherical Power.


Press .

The Red/Green chart will be selected.
(The system will be placed into the SPH mode.)

Turn 'O by two steps

SPH +0.50 D will be added to apply "fog".

Press  three times.

The comment "Letters sharper in Red/Green R=G ⇒ 

Press .

The above setting will be stored.

5) Adjust Spherical Power to the highest positive power with the best possible VA.


Press .

The VA chart will be selected.

Press .

The top line will be isolated.

Press .

The comment "Isolate best VA Refine sphere ⇒ 

Press  and .

Three short beeps and the above setting will be stored.

6) Perform the Red/Green test to refine the Spherical Power of the left eye.


Press .

The Red/Green chart will be selected.

Press .

The left eye will be specified.

Press  three times.

The comment "Letters sharper in Red/Green R=G ⇒ 

Press .


The above setting will be stored.

7) Refine Cylindrical axis.

Press .

The Dot chart will be selected. (The system will automatically be placed into the AXIS mode and cross cylinder lens will be inserted in the left measuring window.)

Press  twice.

The comment "Turn dial to better image 1=2 ⇒ 

Press .


The above setting will be stored.

8) Refine Cylindrical Power.

Press .

The Dot chart will be selected. (The system will automatically be placed into the CYL mode and cross cylinder lens will remain in the left measuring window.)

Press  twice.

The comment "Turn dial to better image 1=2 ⇒ 

Press .

The above setting will be stored.

F - 3

9) Perform the Red/Green test to refine Spherical Power.


Press .

The Red/Green chart will be selected.
(The system will be placed into the SPH mode.)

Turn  by two steps.

SPH +0.50 D will be added to apply "fog".


Press  three times.

The comment "Letters sharper in Red/Green R=G ⇒ 

Press .

The above setting will be stored.

10) Adjust Spherical Power to the highest positive power with the best possible VA.


Press .

The VA chart will be selected.

Press .

The top line will be isolated.

Press .

The comment "Isolate best VA Refine sphere ⇒ 

Press  and .

Three short beeps and the above setting will be stored.

11) Perform the Binocular balance test.

Press .

The FINAL field will be selected.


Press .

The binocular balance chart will be selected.
(The polarizing filters (Right eye: 135°, Left eye 45°) will be placed in both measuring windows.)

Press .

Both eyes will be specified.

Press  four times.

The comment "Add S +0.25 to best VA (R or L) R=L ⇒ 

Press .

The above setting will be stored.

12) Perform the Stereo test.

Press .

The Stereo test chart will be selected.

Press .

The above setting will be stored.

13) Perform auto adjustment.

Press  and .

The auto adjustment function (Final Fit) will be selected.

Press  and .

Three short beeps and the above setting will be stored.

14) Measure ADD power.

Press .

The SUBJ field will be selected.

Press .

The ADD mode will be specified.

(The system will automatically be placed into the ADD mode and ± 0.50 D fixed cross cylinder lenses will be placed in both measuring windows.)

Press .

The above setting will be stored.

The Addition Power measurement can be performed in the FINAL field. However, it is recommended to perform the test in the SUBJ field to obtain more accurate addition powers. This is because that if the Cylindrical Power in the FINAL field is different from the one in the SUBJ field, which may affect the appearance of the cross grid chart during the test.

15) Test the patient's near vision.

Press .

The FINAL field will be specified.

Press .


(± 0.50 D fixed cross cylinder lenses will be removed from the both measuring windows.)

Press .

The above setting will be stored.

Return the system to the FINAL field. If the Spherical and Cylindrical Powers in the FINAL field are different from the ones in the SUBJ field, the Addition Power obtained in Step 14) will automatically be adjusted. (See the "ADD SUBJ \rightarrow FINAL" parameter on p.5-15.)

16) Exit from "Input program" mode.

Press . The system will be exit from the "Input program" mode.