REFRACTOR
RT-5100

OPERATOR’S MANUAL
Eye & Health Care

NIDEK CO., LTD.

NIDEK CO., LTD
(Manufacturer)
: 34-14, Maehama, Hiroishi-cho, Gamagori, Aichi 443-0038, Japan
Telephone: +81-533-67-6611
Facsimile: +81-533-67-6610

NIDEK CO., LTD
(Tokyo Office)
: 3F Sumitomo Fudosan Hongo Bldg., 3-22-5, Hongo,
Bunkyo-Ku, Tokyo 113-0033, Japan
Telephone: +81-3-5844-2641
Facsimile: +81-3-5844-2642

NIDEK INCORPORATED
(United States Agent)
: 47651 Westinghouse Drive, Fremont, California 94539, U. S. A.
Telephone: +1-510-226-5700
Facsimile: +1-510-226-5750

NIDEK S.A.
(EU Authorized Representative)
: Europarc 13, rue Auguste Perret, 94042 Créteil, France
Telephone: +33-1-49 80 97 97
Facsimile: +33-1-49 80 32 08

April 2012
34085-P902N
Printed in Japan
Use this device properly and safely.

⚠️ BEFORE USE, READ THIS MANUAL.

This operator’s manual includes operating procedures, safety precautions, and specifications for the NIDEK REFRACTOR RT-5100 when it is used in combination with any of the NIDEK chart presenting devices. The dioptric powers are indicated with a reference wavelength of 546.07 nm.

Cautions for safety and operating procedures must be thoroughly understood before using this device.

Keep this manual handy for verification.

If you encounter any problems or have questions about the device, please contact NIDEK or your authorized distributor.

*To use the functions described in this manual “only for Plus Package,” the optional 21 Point Exams Plus Package must be installed on the RT-5100.

*For simplicity, examples of chart type used in this manual are from CP-770M only. Any other type may be used unless specified otherwise.

*This manual indicates the visual acuity by fractions (feet). Refer to “8.3 VA Conversion Table” (Page 257) for visual acuity represented by decimals (meters).

“CAUTION! Federal Law (US) restricts this device to sale by or on the order of a properly licensed practitioner.”

Safety precautions

In this manual, signal words are used to designate the degree or level of safety alerting. The definitions are as follows:

⚠️ WARNING • Indicates a potentially hazardous situation which, if not avoided, may 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 accident.

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

Before Use

⚠️ WARNING • Be sure to secure the refractor head to the refractor arm.
If the refractor head is dropped or falls, injury or device failure may result.

⚠️ CAUTION • The safety precautions and operating procedures must be thoroughly understood before using the device.
Improper use may cause unexpected malfunction or unintended results.

• Do not store the device in an area that is exposed to rain or water, or contains poisonous gas or liquid.

• Do not store the device in dusty, hot, humid places and in direct sunlight.

• When connections between units are removed for moving the device, and necessary to reconnect the units, contact NIDEK or your authorized distributor.

• Install the device on a stable and level surface.
If the device falls, injury or device failure may result.

• Never install the device in a place exposed to water.

• Install the device in an environment that meets the following conditions.
The following conditions must be maintained during use.

- Conditions in use
  - Temperature: 10 to 35°C (50 to 95°F)
  - Humidity: 30 to 85% (No condensation)
  - Pressure: 800 to 1060 hPa
  - Installation place: Interior
  - No hazardous dust or smoke
  - A dust-free place
  - A place with little external light
  - A place free from vibration and shock

• Be sure to level the refractor head before use.
Failure to do so could affect the data accuracy. Level the refractor head by turning the leveling adjustment knob until the bubble is centered in the level.

• Be sure to use a wall outlet which meets the power specification requirements.
If the line voltage is too high or too low, the device may not operate properly. Malfunction or fire may result.

• Connect the power plug to a grounded outlet.
Electric shock or fire may result in the event of malfunction or power leakage.

• Do not overload the electrical outlet.
Fire may result.
• Fully insert the power plug into the outlet.
  Imperfect connection may cause fire.

• Never use a power strip or extension cable to supply the device with power.
  The electrical safety may be lowered.

• Do not use the power cord other than equipped. Do not use the equipped power cord for purpose other than intended.
  Malfunction or fire may result.

• Install the device in area where the outlet that the power plug is inserted into is easily accessible during use. In addition, ensure that the power cord can be disconnected without the use of a tool.
  Otherwise, it may interfere with disconnecting of the power from the input power source in case of abnormality.

• Do not place heavy objects on the power cord.
  A damaged power cord may cause fire or electric shock.

• This device has been tested and found to comply with the limits for medical devices to the IEC 60601-1-2: 2007.
  These limits are designed to provide reasonable protection against harmful interference in a standard medical installation.
  This device generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other devices in the vicinity.
  However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to other devices, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
    Reorient or relocate the receiving device.
    Increase the separation between the devices.
    Connect the device 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.

• The International Electrotechnical Commission sets the essential requirements for electrical and electronic equipment that may disturb, or be disturbed by, other equipment. The RT-5100 complies with these requirements as tabled in “9 EMC (ELECTROMAGNETIC COMPATIBILITY)” (Page 271). Follow the guidance in the tables for use of the device in an electromagnetic environment.
During Use

⚠️ **WARNING** • When moving the refractor head, make sure that there are no obstacles in its path.

If the arm is swung carelessly, it may bump against someone or something and injury or malfunction may occur.

⚠️ **CAUTION** • When installing and operating the device, observe the following instructions about EMC (electromagnetic compatibility):

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

• **Unplug the power cord and contact NIDEK or your authorized distributor if the internal wires are exposed, the table turns on or off when the power cord is moved, or the cord and/or plug are too hot to hold.**

This may result in electric shock or fire.

• **Keep the measuring windows free of fingerprints and smudges.**

Failure to do so could affect the data accuracy.

• **In the event of smoke or strange odors, immediately turn off the device and disconnect the power plug from the outlet. After you are positive that the smoke has stopped, contact NIDEK or your authorized distributor.**

Continued use of the device under such abnormal conditions may cause fire or electric shock.

• **When the device is not in use, turn it off and put the dust cover over it.**

If the device is not covered for an extended period, the accumulation of dust may affect the data accuracy.

• **Do not touch the touch-screen panel with anything other than the tip of a touch-screen pen.**

Contact with a hard or sharp object such as a ball point pen may scratch the panel. In addition, although the tip of a touch-screen pen is covered with resin which is unlikely to scratch the panel, the panel may be scratched by strongly pressing the pen against the panel.

Do not touch the panel with fingers. Doing so could decrease the panel sensitivity or make the panel dirty. It may affect the test accuracy.
• Perform the visual and operation checks before using the device. If any abnormality is found, do not use the device. Continued use of the device under such abnormal conditions may affect the data accuracy. Unexpected malfunction or faulty diagnosis may induce unexpected health hazards.

• Before each patient, always clean the patient's contact area (forehead rest and face shields) using disinfection alcohol.

• If the device fails, disconnect the power cord from the power outlet, then contact NIDEK or your authorized distributor without touching the interior of the device.

• Take care not to catch hands or fingers in moving parts.

• Do not modify or touch the device. Do not touch anything inside the device. This may result in electric shock or malfunction.

• When connecting interface devices to the device, confirm the symbols, then connect them securely without applying unnecessarily great force. Terminals or cables may become damaged.

• Be sure to use only the printer paper (80620-00001) specified by NIDEK. Other printer papers may cause improper printing and make the data unreadable.

• Do not apply adhesive tape to the printed paper. Printed characters may fade.
Patient environment

The patient environment is the volume of space in which contact can occur between the patient and any part of the device (including connected devices) or between the patient and any other person(s) touching the device (including connected devices).

Use devices that comply with IEC60601-1 in the patient environment. If any device that does not comply with IEC 60601-1 is to be used, use an isolating transformer or common protective grounding.
After Use

⚠️ **CAUTION** • If the device will not be used for a long time, disconnect the power cable from the wall outlet.
Settled dust may collect moisture, and short circuit or fire may result.

• Occasionally clean the prongs of the power plug with a dry cloth.
If dust settles between the prongs, it may collect moisture, and short circuit or fire may result.

• Do not pull the power cord to disconnect it from an outlet.
This can damage the metal core of the cord and may result in electric shock, short circuit or fire.

• Before carrying the device to another location, disconnect all the cords and cables.

Maintenance

⚠️ **CAUTION** • Only NIDEK service representatives or hospital personnel trained by NIDEK should attempt to modify or touch the inside of the device and/or upgrade the software.
NIDEK is not responsible for any accidents resulted from improper servicing.

• When performing maintenance work, secure sufficient maintenance space.
Maintenance work in an insufficient space may result in injury.

• When the device is sent back to NIDEK for repair or maintenance, wipe the surfaces (especially, the area where patients contact) of the device with a clean cloth dampened with ethyl alcohol for disinfection.

• Never use organic solvents such as a paint thinner to clean the exterior of the device.
It may ruin the surface of the device.

• When cleaning the measuring window, be sure to remove any dust with a blower brush and wipe lightly with a soft cloth.
Wiping the window without removing dust may scratch the lens coating and impair measurement of the power or visual acuity.

• The manager of this device must see that maintenance and inspection are performed every six months.
For details of the maintenance and inspection, contact NIDEK.
If maintenance and inspection cannot be performed by the customer, ask NIDEK or your authorized distributor to perform them.

💡 **Note** • A pixel may be rarely missing on the screen or a red, blue, or green pixel point may always be displayed.
This does not represent a failure of the touch-screen panel; This is due to the structure of the liquid crystal display.
Disposal

⚠️ CAUTION • Follow local governing ordinances and recycling plans regarding disposal or recycling of device components. The device contains the circuit board with a lithium battery mounted. Because the disposal method of lithium batteries varies according to the local government, follow the local governing ordinances and recycling plans when disposing of the circuit board with the lithium battery.

It is recommended to commission the disposal to a designated industrial waste disposal contractor. Inappropriate disposal may contaminate the environment.

• When disposing of packing materials, sort them by material and follow local ordinances and recycling regulations.

Inappropriate disposal may contaminate the environment.
# Table of Contents

1. **BEFORE USE** ................................................................. 1
   1.1 Outline of the Refractor .................................................. 1
   1.2 Intended Use ............................................................. 1
   1.3 Connectable instruments .................................................. 1
   1.4 Configuration ............................................................ 2
      1.4.1 Refractor head ..................................................... 2
      1.4.2 Control box ....................................................... 4
      1.4.3 Relay box .......................................................... 16
      1.4.4 Connecting each unit .............................................. 17
   1.5 Labels ............................................................................. 18
   1.6 Before First Use ........................................................... 22
   1.7 Getting Started and Exiting ............................................. 24
      1.7.1 Getting started ....................................................... 24
      1.7.2 Restore from power saving mode ................................. 24
      1.7.3 Exiting ............................................................... 24

2. **OPERATING PROCEDURE** ............................................... 25
   2.1 Operation Flow ............................................................ 25
   2.2 Entering Data ............................................................. 26
      2.2.1 From an auto refractometer ...................................... 26
      2.2.2 From a lensmeter ................................................... 28
      2.2.3 Manual data entry with the dial ................................ 29
      2.2.4 From an Eye Care card ............................................ 30
      2.2.5 Entering day and night data ..................................... 32
      2.2.6 Entering day and night data from ARK-10000 or OPD Scan III ................................................... 33
   2.3 Setting Prism Lenses ..................................................... 37
      2.3.1 Switching between rectangular and polar coordinates .... 37
      2.3.2 Rectangular coordinates (XY) .................................... 37
      2.3.3 Polar coordinates (rq) ............................................. 37
      2.3.4 Removing rotary prism lenses .................................. 38
      2.3.5 Prism data clear .................................................... 38
      2.3.6 Prism data comparison .......................................... 38
   2.4 Preparation ............................................................... 39
   2.5 Standard Program Refraction .......................................... 40
      2.5.1 Program A ............................................................ 40
      2.5.2 Program Day/Night ................................................ 50
      2.5.3 Program #7 (only for Plus Package) ......................... 62
   2.6 Chart Presentation ...................................................... 69
      2.6.1 Chart selection .................................................... 69
      2.6.2 Visual acuity chart mask functions ............................ 70
2.6.3 Low illumination, glare lamp, and contrast functions (SSC series) ............... 73
2.6.4 Contrast function, Night mode, and Reverse function (SC series) ............... 76
2.7 Power Adjustment (Final Fit) ................................................. 78
2.7.1 Auto adjustment of far powers (with Program A) .................. 78
2.7.2 Auto adjustment of far powers (with Program B) ............... 79
2.7.3 Power adjustment without standard programs .................. 80
2.7.4 Fine adjustment after auto adjustment (Semi-auto adjustment) .... 81
2.7.5 Manual power adjustment ............................................. 81
2.8 Printing ...................................................................... 83
2.8.1 Printing 21 Point Exams result (only for Plus Package) .... 85

3. ADVANCED FEATURES ................................................. 89
3.1 Presenting Screen to Patient .................................................. 90
3.2 Data List .................................................................. 91
3.3 Displaying Refraction Diagram ...................................... 93
3.4 Presenting Near Chart ....................................................... 96
3.5 Range of Clear Vision ......................................................... 97
3.5.1 Changing power while checking the range of clear vision ... 102
3.6 Displaying Image Information for Explanation ...................... 104
3.6.1 Image information "About Eye" ...................................... 104
3.6.2 Image information "Vision" ........................................... 106
3.7 Setting Auxiliary Lenses ................................................... 107
3.8 Fog Function with Both Eyes Open .................................. 109
3.9 Specifying Sub Window Display Data ................................. 110
3.10 Changing ID No. ............................................................ 111
3.11 Age Input ................................................................ 112
3.12 Calling Up Data ............................................................ 113
3.12.1 Calling up measurement data ................................... 113
3.13 Link Off Function .......................................................... 114
3.14 Programming ............................................................... 115
3.14.1 Clearing programs ..................................................... 115
3.14.2 Programming .......................................................... 117
3.14.3 Operating programs ................................................... 120
3.14.4 Importing or exporting programs .................. 121
3.15 Entering Comments ....................................................... 122
3.16 Setting Time and Date ..................................................... 123
3.17 Controlling Backlight Brightness .................................... 125
3.18 Touch-screen Panel Calibration ...................................... 126
3.19 Parameter Settings ....................................................... 127
3.19.1 Parameter Settings.................................................................127
3.19.2 Writing/Reading parameter setting........................................138

3.20 Clearing Stored Data...............................................................139
3.21 Exporting Data to Computer....................................................139
3.22 Exporting Data to Eye Care Card..............................................140
3.23 Displaying Images (SC series)..................................................142

4. TEST METHOD.................................................................143

4.1 Visual Acuity Test.................................................................143
  4.1.1 Unaided Visual Acuity Test................................................143
  4.1.2 Aided Visual Acuity Test..................................................144
  4.1.3 Visual Acuity Test with Addition Powers................................145
  4.1.4 Visual Acuity Test using pin hole.......................................146
  4.1.5 Input method of the correct character and incorrect character........146
  4.1.6 VA measurement of day data in brightness for Night mode..........147

4.2 Astigmatism test.................................................................148
  4.2.1 Astigmatism test with astigmatism clock dial........................148
  4.2.2 Astigmatism test with cross cylinder lens.............................149
  4.2.3 Astigmatism power test with cross cylinder lens (the hold and remove cross cylinder testing method).........................150

4.3 Spherical Refinement..............................................................152
  4.3.1 Red-green test..............................................................152
  4.3.2 Cross grid test for far vision...........................................153

4.4 Binocular Visual Function Test................................................154
  4.4.1 Binocular balance test....................................................154
  4.4.2 Binocular red-green test................................................156
  4.4.3 Phoria test.................................................................157
  4.4.4 Phoria with fixation test................................................161
  4.4.5 Mallet test (horizontal phoria)........................................163
  4.4.6 Mallet test (vertical phoria)...........................................164
  4.4.7 Von Graefe test (horizontal phoria)...................................165
  4.4.8 Von Graefe test (vertical phoria)......................................167
  4.4.9 Maddox test (horizontal phoria).......................................169
  4.4.10 Maddox test (vertical phoria).........................................170
  4.4.11 Vertical coincidence test...............................................171
  4.4.12 Horizontal coincidence test..........................................173
  4.4.13 Schober test..............................................................175
  4.4.14 Stereo test...............................................................177
  4.4.15 Worth test.................................................................182
  4.4.16 Pointer test...............................................................183
  4.4.17 Double pointer test.....................................................184

4.5 Divergence Test.................................................................186

4.6 Convergence Test...............................................................188
4.7 Supravergence Test for Final Prescription (only for Plus Package) 190
4.8 Infravergence Test for Final Prescription (only for Plus Package) 191
4.9 Near Point of Convergence Test (NPC) 192
4.10 Near Point of Accommodation Test (NPA) 193
4.11 Negative Relative Accommodation Test (NRA) 194
4.12 Positive Relative Accommodation Test (PRA) 195
4.13 Visual Acuity Test by ETDRS chart 196

5. 21 Point Exams (only for Plus Package) 199

5.1 Switching for 21 Point Exams list (only for Plus Package) 199
5.2 21 Point Exams (only for Plus Package) 200
  5.2.1 #7 Subjective value 201
  5.2.2 #8 Horizontal phoria (Far), #13B Horizontal phoria (Near) 201
  5.2.3 Gradient AC/A 203
  5.2.4 #11 Divergence (Far), #17 Divergence (Near) 204
  5.2.5 #9,10 Convergence (Far), #16 Convergence (Near) 206
  5.2.6 #21 Negative relative accommodation (NRA) 208
  5.2.7 #20 Positive relative accommodation (PRA) 209
  5.2.8 #14A Cross cylinder (monocular) 210
  5.2.9 #15A Horizontal phoria (according to #14A) 211
  5.2.10 #14B Cross cylinder (binocular) 212
  5.2.11 #15B Horizontal phoria (according to #14B) 213
  5.2.12 #19 Accommodation with addition of minus lens 214
  5.2.13 #19 Near point of accommodation (NPA) 215
  5.2.14 Near Point of Convergence (NPC) 217
  5.2.15 #12A Vertical phoria (Far), #18A Vertical phoria (Near) 218
  5.2.16 #12B Supravergence (Far), #18B Supravergence (Near) 220
  5.2.17 #12B Infravergence (Far), #18B Infravergence (Near) 222

5.3 21 Point Exams Result (only for Plus Package) 224
  5.3.1 21 Point Data List 224
  5.3.2 Visual function analysis graph 227
  5.3.3 Comparison display with the Morgan’s criterion 232

5.4 Changing 21 Point Exams Setting (only for Plus Package) 233

6. MAINTENANCE 239

6.1 Troubleshooting 239
6.2 Cleaning Forehead Rest 240
6.3 Cleaning Face Shields 240
6.4 Replacing Printer Paper 241
6.5 Cleaning the Printer 243
6.6 Cleaning Measuring Windows ................................................................. 244
6.7 Cleaning Exterior ................................................................................. 244
6.8 Cleaning Eye Care card Reader ............................................................... 245
6.9 List of Replacement Parts ................................................................. 245

7. SPECIFICATIONS AND ACCESSORIES ........................................... 247

7.1 Classifications ......................................................................................... 247
7.2 Specifications ......................................................................................... 248
7.3 Standard Configuration ........................................................................... 250
  7.3.1 Standard configuration ........................................................................ 250
  7.3.2 Optional accessories ........................................................................ 250

8. APPENDIX ................................................................................................ 251

8.1 Descriptions of Power Adjustment ......................................................... 251
8.2 Linkage between Charts and Auxiliary Lenses ....................................... 256
8.3 VA Conversion Table .............................................................................. 257
8.4 Preset Addition Power ............................................................................ 258
8.5 Relational Table of Age and Accommodation ........................................ 259
8.6 Estimated Visual Acuity Table ............................................................... 260
8.7 Fog Amount in Binocular Balance ......................................................... 261
8.8 Standard Programs ................................................................................. 262
8.9 Near Point Chart (Standard) ................................................................. 267
8.10 Near Point Chart II ............................................................................... 269

9. EMC (ELECTROMAGNETIC COMPATIBILITY) ..................................... 271

10. INDEX ..................................................................................................... 275
1. BEFORE USE

1.1 Outline of the Refractor

The NIDEK REFRACTOR Model RT-5100 is a computerized refractor used for subjective refraction with the connected NIDEK AUTO REFRACTOMETER (AR), AUTO REF/KERATOMETER (ARK), AUTO REF/KER/TONOMETER (RKT), or AUTO LENSMASTER (LM).

The RT-5100 includes a refractor head, control box, relay box, and printer. The relay box is used for connecting not only the other three units but also the auto refractometer or lensmeter. The control box includes the key panel and display. The display is touch-screen panel. The control box allows the data to be displayed and almost all operations to be performed. In addition, the control box operates the refractor head and also connected chart presenting device. It allows the refractor and charts to be controlled together. Normally, the relay box and printer are installed in the system table (not included in the RT-5100 package.)

1.2 Intended Use

Instrument providing means of positioning spherical and cylindrical lenses, prisms and other optical devices in front of a subject’s eyes for purpose of determining refractive error and binocular functions.

* In this operator’s manual, the keys on the control box are indicated by key representations such as \( \text{Shift} \) or \( \text{R} \). The touch buttons on the touch panel other than chart buttons are indicated by brackets such as [Div.].

The touch panel chart buttons are indicated by button representations such as .

1.3 Connectable instruments

<table>
<thead>
<tr>
<th>Connectable Chart Presenting device</th>
<th>Space Saving Chart: SSC-330, SSC-350, SSC-370</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart Projector: CP-690, CP-770</td>
<td></td>
</tr>
</tbody>
</table>
1.4 Configuration

1.4.1 Refractor head

Operator's side

1. Measuring window
2. Near point lamp
3. VD check window
4. Forehead rest detection lamp
5. Forehead rest knob
6. Level
7. Near Point Chart
8. Near point rod
9. Level adjustment knob

Patient's side

10. Forehead rest
11. Face shield
1. Measuring window
1. Measuring window
   The patient looks at any chart through these windows.

2. Near point lamp
   Illuminates the Near Point Chart.
   The lamp lights up or goes out with [Near Lamp] on the window shown by pressing the left side switch.

3. VD check window
   Used to check the patient's VD (vertex distance = distance from the corneal apex to the lens).
   The windows have calibration markings of 12, 13.75, 16, 18, and 20 mm.

4. Forehead rest detection lamp
   Used to confirm that the patient's forehead contacts the forehead rest.
   When the forehead is away from the forehead rest, the lamp lights up.

5. Forehead rest knob
   Moves the forehead rest forward and backward in order to adjust the VD.

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

7. Near Point Chart, Near Point Chart II (Near Point Chart II is only for Plus Package)
   Used for near point test such as addition powers.
   When the chart is shifted to the left slightly, the chart explanation is indicated.

   ![Near Point Chart Diagram]

   For the chart on the Near Point Chart or Near Point Chart II, see "8.9 Near Point Chart (Standard)" (page 267) and "8.10 Near Point Chart II" (page 269).

   **Note**
   - When switching the Near Point Chart, do not rotate the Near Point Chart while pressing the chart window frame.
   - The Near Point Chart may be rubbed off and become difficult to be seen.

8. Near point rod
   The distance from the patient's eye to the Near Point Chart is marked in inches and centimeters.
   - Align the black line at the Near Point Chart holder with the scale of a desired distance.
   - The number in red represents the power (diopter) corresponding to each distance in meters.
   - Rotating the rod 180 degrees and inverting it up side down changes the scale from between centimeters and inches. See "1.6 Before First Use" (page 22).

9. Level adjustment knob
   Adjusts the level of the refractor head.
   The refractor head is tilted by 2.5° at maximum to the left or right.
10. Forehead rest
The patient's forehead touches here during refraction. Clean it before each refraction.
See “6.2 Cleaning Forehead Rest” (page 240).

11. Face shield
The patient's face touches here during refraction. Clean the face shields before each refraction.
See “6.3 Cleaning Face Shields” (page 240).

- Parts that come into contact with the patient during refraction are composed of the following materials:
  - Forehead rest: polypropylene
  - Face shields: ABS resin
  - Measuring window: clear glass
  - VD check window: acrylic resin
  - Near Point Chart: polyvinyl chloride
  - Near point rod, level adjustment knob: aluminum alloy

1.4.2 Control box

1. Eye Care card reader
Reads objective data (AR data) or past lensometry data (LM data) via an Eye Care card.
The optional Eye Care card is necessary. The IC card of the old-type NIDEK IC card system (RT4IC-1) or commercial IC card are not available.

2. Control panel
See “Control panel (page 9)” for details.
3. **Right side switch**
Displays the Other Settings window.
- \([C+/–]\): Switches the cylinder reading between + and –.
- \([ID No.]\): Changes the ID No. whose data is printed.
- \([Age]\): Displays the Age input window.

4. **Dial**
Changes any measurement value.
- The selected (highlighted) value can be changed.
- Turn it clockwise ⇒ The value changes to the negative.
- Turn it counterclockwise ⇒ The value changes to the positive.
- Turn the dial while pressing \(\text{Shift}\) changes the increment. See page 128.

5. **Dial switch**
Switches the mode (S, C, A, VA).
- The values of S, C, A, and/or VA selected or selection order varies depending on the Dial switch parameter setting.

6. **Left side switch**
Displays the Chart Controls window.
- \([\text{Lamp off}]\): Turns off the lamp of the chart, display backlight, or chart for near point. Pressing either button returns to the original status.
- \([\text{Ch.Lamp}]\): Turns on or off the lamp of the connected chart.
- \([\text{Near Lamp}]\): Turns on or off the near point lamp in the refractor head.
- \([\text{Link off}]\): Prevents auxiliary lenses or mode from being switched with a corresponding chart key. See “3.13 Link Off Function” (page 114).
- \([\text{Level}], [\uparrow], [\downarrow]\): Align the chart to the patient’s eye level when the SSC is connected.
- \([\text{Glare}], [\uparrow], [\downarrow]\): Appear only in the SSC-330U. Pressing [Glare] turns on or off the glare lamp. Pressing \([\uparrow]\) or \([\downarrow]\) controls the lamp intensity. The glare lamp condition icon appears above the program indication.

7. **Display**
Displays S(SPH), C(CYL), A(AXIS) data and the presented chart.
- The LCD display is touch-screen.

**Note**
- The materials composed of the parts that contact the patient during refraction are as follows:
  - Control panel, right/left side switch, dial, and dial switch: ABS resin
  - Display, power switch, and fuse holder: standard electrical component
BEFORE USE: Configuration

○ Display

1. **PD display and change key**
   Enters the mode changing the pupillary distance.
   
   Monocular PD (1/2 PD) ⇒ Enter by pressing monocular PD display part, R, or L with the PD mode.
   Leave the mode ⇒ Press the PD key again.

2. **Auxiliary lenses key**
   Displays the current inserted auxiliary lens.
   Pressing this key displays the Auxiliary selection screen.

3. **Far or near mode key**
   Displays the current measurement mode (far or near mode).
   When in far mode, the key indication is “FAR” and when in near mode, the key indication is “NEAR”.
   The background of the data turns white when in far point measurement mode and yellow when in near point measurement mode. Far mode is automatically selected when the power is turned on or after data is cleared.
   Near mode is used to test the near visual function after far vision testing and addition power measurement. The refractor head converges to the working distance of 40 cm (variable) automatically in near mode.
   The ADD key is not available in near mode. The near SPH values are calculated by adding the ADD values to the far SPH values. The appropriate lenses are placed. Only the far SPH values in near mode can also be used when the SPH Far → Near parameter is set to SPH.

4. **Chart buttons**
   Switches the chart.

5. **Current data**
   Displays the data of the lens currently inserted in the refractor. Press other data to be changed as desired.
   The numeric field where can be changed is highlighted.
   The value can be changed with the dial, R or L.
   The currently set power is displayed in black.
   ADD and Prism value become black when the value is set in the ADD measurement mode or Prism measurement mode.
BEFORE USE: Configuration

5-1.[S]
Goes into SPH mode which allows spherical powers to be adjusted.
- Pressing [S] enters the both eyes specifications of SPH mode.
- Pressing the value S on the R side enters the right eye specifications of SPH mode.
- Pressing the value S on the L side enters the left eye specifications of SPH mode.

5-2.[C]
Goes into CYL mode which allows cylindrical powers to be adjusted.
- Pressing [C] enters the both eyes specifications of CYL mode.
- Pressing the value C on the R side enters the right eye specification of CYL mode.
- Pressing the value C on the L side enters the left eye specification of CYL mode.

5-3.[A]
Goes into AXIS mode which allows cylindrical axis to be adjusted.
- Pressing [A] enters the both eyes specifications of AXIS mode.
- Pressing the value A on the R side enters the right eye specification of AXIS mode.
- Pressing the value A on the L side enters the left eye specification of AXIS mode.

5-4.[ADD]
Goes into ADD mode which allows additional powers to be adjusted.*1
The refractor head converges to the working distance of 40 cm (variable) automatically in near mode.
- See the Working Dit. (WD) parameter (page 130).
- Pressing [ADD] enters the both eyes specifications of ADD mode.
- Pressing the value on the R side enters the right eye specification of ADD mode.
- Pressing the value on the L side enters the left eye specification of ADD mode.
  - Each time the key is pressed while the refractor head converges, the addition powers are added or removed.
  - When the addition powers are removed, the highlight color for ADD on the screen changes and the time display switches to ADD-OFF. Pressing this key again returns the addition power indication to its original and the addition powers are added.
  - After addition power entry, the WD display appears to select a desired WD with the function key. When the WD is changed with prescription mode, the value is entered as the WD for prescription.
  - The mode can be switched among [LM], [AR], [Subj], and [Final] in ADD mode.

5-5.[VA]
This is a field on the undermost and right eye visual acuity, both eye visual acuity, left side visual acuity are entered from the left.
Pressing the each field goes into the mode which allows the visual acuity to be entered using the dial.

5-6.[△]/[ ]
Goes into the mode which allows base in/out prism power in rectangular coordinates or prism absolute value in polar coordinates to be entered.
- Pressing [△] or [ ] enters the both eyes specifications of Entering mode.
- Pressing the value on the R side enters the right eye specification of Entering mode.
- Pressing the value on the L side enters the left eye specification of Entering mode.
See “2.3 Setting Prism Lenses” (page 37) for prism power entry.

5-7. [θ][ ]
Goes into the mode which allows base up/down prism power in rectangular coordinates or prism base angle in polar coordinates to be entered.
- Pressing [θ] or [ ] enters the both eyes specifications of Entering mode.
- Pressing the value on the R side enters the right eye specification of Entering mode.
- Pressing the value on the L side enters the left eye specification of Entering mode.

*1. When ADD mode starts in a standard program, the ±0.5D cross cylinder lenses with –90° are placed. However, when ADD mode starts by pressing ADD without the program, the lenses are not placed automatically. To place the ±0.5 D cross cylinder lenses, press .
6. Chart / 21 Point Exams switching button (only for Plus Package)
Switches the chart switching button to 21 Point Exams list display. Pressing the button again returns to the chart list display.

7. Display data setting button 1
Pressing this button displays the window specifying the items to be displayed in sub window 1.

8. Sub window 1
Displays the items specified with Display data setting button 1. When no item is specified, the measurement mode values set previously are displayed.

9. Display data setting button 2
Pressing this button displays the window specifying the items to be displayed in sub window 2.

10. Sub window 2
Displays the items specified with the Display data setting button 2. When no item is specified, the measurement mode values set prior to previous ones are displayed. (When the item to be displayed is specified in sub-window 1, the measurement mode values set previously are displayed.)

11. Page switching buttons (only for Plus Package)
Switches the page of 21 Point Exams buttons.

12. 21 Point Exams button (only for Plus Package)
Selects the Examination.
According to the selected exams, chart, auxiliary lens, and data input mode are changed.

13. List button (only for Plus Package)
List displays the 21 Point Exams result.

14. Visual function analysis graph button (only for Plus Package)
Displays the visual function analysis graph.

15. Morgan analysis button (only for Plus Package)
List displays the Morgan’s criterion, measurement value, and judgement result.
Control panel

The basic keys are indicated in light blue.

* The functions of some keys change when they are pressed with \( \text{Shift} \) + \( \text{Prog} \). In this manual, the indication such as \( \text{Shift} + \text{Prog} \) means to press \( \text{Prog} \) while pressing \( \text{Shift} \).

1. Data keys
Used to enter the data into the RT-5100 and measure each data.

The selected data is displayed at the center of the screen. Which key is selected is displayed in the upper-left corner of the screen.

Pressing the empty data key copies the previously displayed data into that field. However, pressing \( \text{Subj} \) while a subjective value is not entered, according to the Preset power of Subj 1 parameter, the data in AR or LM mode is copied.

In addition, pressing any data key with \( \text{Shift} \) copies the displayed data regardless of whether or not data is contained in that field.

See “2.2 Entering Data” (page 26) for data entry method.

1-1. \( \text{Unsided} \)
Measures the unaided visual acuity.

The corrective lens power in the refractor head is 0 D.

1-2. \( \text{LM} \)
Enters the lensesmeter (LM) data.

1-3. \( \text{AR} \)
Enters the data from an auto refractor or a retinoscope.
BEFORE USE: Configuration

1-4. (Subj)
Used to obtain the full correction.
When the data is received from an auto refractometer or a lensmeter, this field opens automatically.
The elapsed time from data entry is displayed in the subjective data field when the Operating timer parameter is set to Subj.

1-5. (Final)
Used to obtain the final prescription and best-corrected visual acuity.
Pressing this key copies the full correction data from the subjective data field and adjusts it to the final prescription.
Shift + Final ⇒ Goes into auto adjustment mode when the Shift + Final parameter is set to Final Fit. See “2.7.2 Auto adjustment of far powers (with Program B)” (page 79) and “2.7.3 Power adjustment without standard programs” (page 80).

2. (Shift)
The increment or mode changes when a key is pressed or the dial is turned with this key.

3. (Print)
Prints the data or exports it to an external computer.
See “2.8 Printing” (page 83).

4. (IN)
Enters the data from an auto refractometer or lensmeter.
Press this key and confirm that the data No. on the screen are the same with the print data No. of the auto refractometer or lensmeter. Specify the field that the data is entered with the data key such as LM, AR.

5. (Switches the measuring windows to be opened or occluded.

6. (Help)
Indicates the explanation about the present chart.
Press this key again or [End] to cancel the indication.
When this key is pressed during the standard program or program with sample instructions, the sample instructions for the test appear.

7. Mode keys
Select the mode whose data is changed.
Pressing any keys highlights the corresponding field to be changed.
The value in each mode can be changed with the dial, +, or –.

7-1. (S)
Goes into SPH mode which allows spherical powers to be adjusted.
BEFORE USE: Configuration

7-2. CYL
Goes into CYL mode which allows cylindrical powers to be adjusted.

7-3. AXIS
Goes into AXIS mode which allows cylindrical axis to be adjusted.

7-4. ADD
Goes into ADD mode which allows addition powers to be adjusted.2

The refractor head converges to the working distance of 40 cm (variable) automatically in near mode.

- When the Preset ADD parameter is set to Yes and the age is not input, the patient’s age can be selected.3
- Each time the key is pressed while the refractor head converges, the addition powers are added or removed.
- When the addition powers are removed, the highlight color for ADD on the screen changes and the time display switches to ADD-OFF. Pressing this key again returns the addition power indication to its original and the addition powers are added.

After addition power entry, the WD display appears to select a desired WD with the function button.

The mode can be switched among LM, AR, Subj, and Final in ADD mode.

- [Shift] + [ADD] ⇒
  Goes into the mode which allows the values for the near point of convergence (NPC), near point of accommodation (NPA), positive relative accommodation (PRA), or negative relative accommodation (NRA) to be entered. For each test procedures, see “4 TEST METHOD” (page 143).

7-5. VA
Goes into the mode which allows the visual acuity to be entered with the dial.

When the AR or LM data has been entered, press Un-sided or LM to present an estimated visual acuity (VA) chart.4

7-6. PD
Goes into the mode which allows the PD in the refractor head to be adjusted.

Monocular PD (1/2 PD) ⇒ Adjust the PD after pressing R or L in PD mode.

To exit from the mode ⇒ Press PD again.

7-7. PRIS
Goes into the mode which allows base in/out prism power in rectangular coordinates or prism absolute value in polar coordinates to be entered.

See “2.3 Setting Prism Lenses” (page 37) for prism power entry.

*2. When ADD mode starts in a standard program, the ±0.5D cross cylinder lenses with –90° are placed.
However, when ADD mode starts by pressing ADD without the program, the lenses are not placed automatically. To place the ±0.5 D cross cylinder lenses, press .

*3. The addition powers are preset according to the selected age. See “8.4 Preset Addition Power” (page 258).

*4. The estimated VA chart is not presented when the Preset VA parameter is set to No or the data has already been entered in the final field. See “8.6 Estimated Visual Acuity Table” (page 260).
BEFORE USE: Configuration

7-8.  
Goes into the mode which allows base up/down prism power in rectangular coordinates or prism base angle in polar coordinates to be entered.

8. Eye selection keys
Select the right eye (R), left eye (L), or both eyes (BIN) for subjective refinement.

- The occluder is placed automatically in the non-selected eye side. However, it is not placed during the binocular vision test with polarizing filters.

- \( \text{Shift} + \text{R} \) or \( \text{L} \) ⇒ Selects a dominant eye.
  The yellow and bold R or L indication at the top of the screen is displayed to indicate the dominant eye.

8-1.  \( \text{R} \)
Opens the right measuring window and places the occluder in the left one. Any value can be entered only for the right eye.
  When the binocular vision test chart is selected, the left eye side is not occluded but the data entry only for the right eye is also possible.

8-2.  \( \text{L} \)
Opens the left measuring window and places the occluder in the right measuring window. Any value can be entered only for the left eye.
  When the binocular vision test chart is selected, the right eye side is not occluded but the data entry only for the left eye is also possible.

8-3.  \( \text{BIN} \)
Opens the both measuring windows.
  The data entry for both eyes are available.

9.  \( \text{Menu} \)
Displays the Main Menu screen.

10.  \( \text{Clear} \)
Clears all displayed data. Press any data key such as \( \text{LM} \) or \( \text{AR} \) with this key, the corresponding field data is deleted individually.
  When the Clear confirmation parameter is set to Yes, the confirmation window is displayed before clearing data. It prevents data from being deleted by touching \( \text{Clear} \) accidentally.

11. Mask keys
  Isolate any horizontal or vertical line or single letter on the chart.
  Press any of the chart keys to cancel the mask functions.
  The visual acuity of the isolated horizontal line or letter is shown in the VA field on the screen.
11-1.  or
Isolates a horizontal line (same visual acuity letters) on the top or bottom line of the VA chart.
• This key also moves the isolation up and down when the horizontal line has been isolated.
  • (Shift) +  ⇒ Isolates the horizontal line on the top line of the chart.
  • (Shift) +  ⇒ Isolates the horizontal line on the bottom line of the chart.

11-2. ,
Isolates a vertical line on the VA chart.
• This key also moves the isolation to the left or right when the vertical line or single letter has been isolated.
  • (Shift) +  or  ⇒ Isolates a single letter in the lower-left or right corner on the chart.

11-3.
Isolates a single letter on the VA chart.
The letter in the upper-right corner of the chart is isolated.
  • (Shift) +  ⇒ Isolates the single letter in the upper-left corner of the chart.

11-4.
Isolate a horizontal line in the middle of the VA chart.
  • (Shift) +  ⇒ Applies the red-green filter on the VA chart.
  • (Shift) again ⇒ Releases the red-green filter.

12. Pilot lamp
Lights up in blue while the RT-5100 is turned on.

13. Program keys
See “2.5 Standard Program Refraction” (page 40) for programmed refraction.

13-1.  
Starts a program.
The elapsed time from program start is measured and displayed in the upper right field on the display when the Operating timer parameter is set to “Prog.”
• Pressing this key again restarts the program.
  • (Shift) +  ⇒ Switches the program between A, B, C, D, E, and #7. (#7 is only for Plus Package)

13-2.  
Used to forward next programmed refraction sequence.
  • (Shift) +  ⇒ Returns to the previous sequence.
14. Cross cylinder keys
Place a cross cylinder lens to measure the cylindrical axis or power. When the key is pressed with both eyes open, the left measuring window is occluded automatically.

Open the left measuring window with to perform the astigmatism test with both eyes open.*5 The cross cylinder lens to be inserted can be selected with the Cross cylinder (XC) test parameter. When the parameter is set to ±0.25 or ±0.50, the cross cylinder lens is inserted as follows:

14-1. • In the cylindrical axis measurement, the cross cylinder lens is inserted so that the minus axis is located at 45° from the minus axis position of the cylindrical lens.
• In the cylindrical power measurement, the cross cylinder lens is inserted so that the minus axis is located at 90° from the minus axis position of the cylindrical lens.
• Clears the prism data for the right eye in prism entry mode.

14-2. • In the cylindrical axis measurement, the cross cylinder lens is inserted so that the minus axis is located at 135° from the minus axis position of the cylindrical lens.
• In the cylindrical power measurement, the cross cylinder lens is inserted so that the minus axis is located at 0° from the minus axis position of the cylindrical lens.
• Clears the prism data for the left eye in prism entry mode.

• switches the time display to the refraction elapsed time. When the refraction elapsed time has already been selected, the time is cleared and start the count again.

15. Value change keys
Functions as the same as the dial.

15-1. Increases the value to the positive side in increments of one.

15-2. Decreases the value to the negative side in increments of one.

*5. The both windows remain open by pressing , , Auto, ±.25, or ±.50 function key.
○ Rear side of the control box

1. CF card slot
   It is used to update the software and importing or exporting programs.
   Do not touch here because the CF (CompactFlash) card in which image data is stored is inserted.

2. IR receiver
   This is not used.

3. USB connector
   This is not available.
   Do not connect to the connector.
1.4.3 Relay box

The relay box is installed in the system table normally.

1. AR connector*6
   Connects to an auto refractometer (AR) or optional memory box.

2. LM connector*6
   Connects to a lensmeter (LM).

3. PC connector*6
   Connects to a PC.

4. AUX connector*6
   Auxiliary (AUX) communication connector (This is not available.)

5. CP connector*6
   Connects to a chart presenting device (CP).

6. LAN connector*6
   Connector for LAN connection (This is not available.)

7. MB connector
   Connects to the refractor head (MB).

8. PR connector
   Connects to a printer (PR).

9. CB connector
   Connects to the control box (CB).

10. USB connector
    This is not available.

*6. Accessory equipment connected to the analog and digital interfaces must be certified according to respective IEC standards (i.e. IEC 60950-1 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 authorized distributor.
1.4.4 Connecting each unit

The diagram below indicates the configuration of the unit type (for installing the other company’s table).

For the stand type and dedicated table type, refer to the manual of the stand and table.
### 1.5 Labels

Cautionary labels are provided on the device.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔴</td>
<td>Indicates that caution must be taken. Refer to the operator’s manual before use.</td>
</tr>
<tr>
<td>📚</td>
<td>Indicates that the operator must refer to the related instructions in the operator’s manual prior to operation.</td>
</tr>
</tbody>
</table>
| ⚠️ | Indicates that the degree of protection against electric shock is of a Type B Applied Part.  
   - The applied parts is the forehead rest (see 10. in “1.4 Configuration” (page 2)). |
| ⚠️ | Indicates that when the switch is pressed to this symbol side, power is not supplied to the device. |
| ⚡ | Indicates that when the switch is pressed to this symbol side, power is supplied to the device. |
| ⚥ | Indicates that the RT-5100 must be supplied only with alternating current. |
| 📅 | Indicates the date of manufacture. |
| 🏭 | Indicates the manufacturer. |
| ⚠️ | Indicates that this product shall be disposed of in a separate collection of electrical and electronic equipment in EU. |
<Refractor Head>

For countries other than the USA and Canada

<Control Box>

For countries other than the USA and Canada

For the USA and Canadian market

For CE and other countries

CE marking
Indicates that the product conforms fully to the requirements of the Medical Device Directive (93/42/EEC).
The RT-5100 is classified as a Class IIa according to the Medical Device Directive.
<Rear side of the Control Box>

For the USA and Canadian market

<Relay Box>

For the USA and Canadian market

For CE and other countries

See “1.4.3 Relay box” (page 16).
The symbols 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.

<table>
<thead>
<tr>
<th>Auxiliary lens</th>
<th>Marking</th>
<th>RT-5100</th>
<th>ISO 10341</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red maddox rod</td>
<td></td>
<td>MR</td>
<td>Maddox rods</td>
</tr>
<tr>
<td>Pinhole plate</td>
<td>⬤</td>
<td>PH or</td>
<td>Pinhole</td>
</tr>
<tr>
<td>Occluder</td>
<td>⬤</td>
<td>BL or</td>
<td>Occluder</td>
</tr>
<tr>
<td>PD check lens</td>
<td>🔐</td>
<td>CL or</td>
<td>Cross line</td>
</tr>
<tr>
<td>Red filter</td>
<td>⬤</td>
<td>RF</td>
<td>Red filter</td>
</tr>
<tr>
<td>Green filter</td>
<td>⬤</td>
<td>GF</td>
<td>Green filter</td>
</tr>
<tr>
<td>Polarizing filter</td>
<td>⬤</td>
<td>PF</td>
<td>Polarization filter</td>
</tr>
<tr>
<td>Open aperture</td>
<td>⬤</td>
<td>OA</td>
<td>Open aperture</td>
</tr>
<tr>
<td>Lenses for retinoscope</td>
<td>🔐</td>
<td>RL</td>
<td>Retinoscope lens</td>
</tr>
</tbody>
</table>
1.6 Before First Use

1 Confirm that the power cord of the system table in which the RT-5100 is installed is connected into the wall outlet.

2 Attach the forehead rest on the refractor head.
   See “6.2 Cleaning Forehead Rest” (page 240) for attachment procedure.

3 Attach the two face shields on the refractor head.
   They are magnetic.

4 Confirm that the refractor head is level.
   Turn the level adjustment knob until the air bubble is centered in the level.

5 Attach the near point rod on the Near Point Chart.
   The scales are printed on the near point rod as shown in the diagram below. When centimeters are desired to be displayed on the left viewed from the front, insert the rod into the card with surface A facing the knob, to display centimeters on the right, face surface B to the knob, then lightly tighten the knob.
6 Attach the near point rod in the refractor head.

Two round indentations are located at the base of the near point rod. Insert the rod as far as possible with the round indentation on the opposite side of the Near Point Chart knob facing the knob. Tighten the knob.

7 Install the printer paper.

See “6.4 Replacing Printer Paper” (page 241) for more details.

☐ For the unit or stand type of the RT-5100

In the unit or stand type, three ferrite cores are provided. When the RT-5100 is connected to external devices such as an auto refractometer or a lensmeter, attach the ferrite core in the position of 10 mm from the RT-5100 relay box side of each communication cable.

Note

- Attaching the ferrite cores is not necessary for the RT-5100/system table set. The ferrite cores have already been attached.
1.7 Getting Started and Exiting

1.7.1 Getting started

Turn on the RT-5100 and connected chart presenting device such as the SSC-330.

1 Turn on the connected chart presenting device.

2 Remove the dust cover from the refractor head and turn the system table on.
   Turn the power switch of the system table on.
   The lowest VA chart is presented.

3 Check the following before use.
   Perform the following checks before use.
   - The measurement windows are clean.
   - The screen to the right appears without any error.
   - The lowest VA chart is presented in the chart presenting device.

1.7.2 Restore from power saving mode

The RT-5100 is not operated for about 15 minutes (variable) without any key operation, it goes into power saving mode. In this mode, the screen backlight and chart presenting device lamp go out. The RT-5100 restores from the mode by pressing any key.

1.7.3 Exiting

1 Turn the power off.
   Turn the system table off.

2 Clean the forehead rest and face shields.

3 Put the supplied dust cover on the refractor head.

- Be sure to put the dust cover on the refractor while it is not used.
  If optical parts become dirt, the chart viewability becomes worse. It decreases the measurement accuracy.
## 2. OPERATING PROCEDURE

### 2.1 Operation Flow

<table>
<thead>
<tr>
<th>Section</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7.1</td>
<td>Getting started (Page 24)</td>
</tr>
<tr>
<td>2.2</td>
<td>Entering Data (Page 26)</td>
</tr>
<tr>
<td>2.2.1</td>
<td>From an auto refractometer</td>
</tr>
<tr>
<td>2.2.2</td>
<td>From a lensmeter</td>
</tr>
<tr>
<td>2.2.3</td>
<td>Manual data entry with the dial</td>
</tr>
<tr>
<td>2.2.4</td>
<td>From an Eye Care card</td>
</tr>
<tr>
<td>2.2.6</td>
<td>Entering day and night data from ARK-10000 or OPD Scan III</td>
</tr>
<tr>
<td>2.4</td>
<td>Preparation (Page 39)</td>
</tr>
<tr>
<td>2.5</td>
<td>Standard Program Refraction (Page 40)</td>
</tr>
<tr>
<td>2.6.1</td>
<td>Chart selection (Page 69)</td>
</tr>
<tr>
<td>2.6.2</td>
<td>Visual acuity chart mask functions (Page 70)</td>
</tr>
<tr>
<td>2.7</td>
<td>Power Adjustment (Final Fit) (Page 78)</td>
</tr>
<tr>
<td>2.7.1</td>
<td>Auto adjustment of far powers (with Program A) (Page 78)</td>
</tr>
<tr>
<td>2.7.2</td>
<td>Auto adjustment of far powers (with Program B) (Page 79)</td>
</tr>
<tr>
<td>2.7.3</td>
<td>Power adjustment without standard programs (Page 80)</td>
</tr>
<tr>
<td>2.7.4</td>
<td>Fine adjustment after auto adjustment (Semi-auto adjustment) (Page 81)</td>
</tr>
<tr>
<td>2.7.5</td>
<td>Manual power adjustment (Page 81)</td>
</tr>
<tr>
<td>2.8</td>
<td>Printing (Page 83)</td>
</tr>
</tbody>
</table>
2.2 Entering Data

Enter objective (AR) and/or lensmeter (LM) data.

2.2.1 From an auto refractometer

When the RT-5100 interfaces with one of the NIDEK auto refractometers, the measured data will be automatically transferred to the RT-5100 by pressing the Print button of the auto refractometer. The RT-5100 stores the data in the memory of the relay box. When the data is already in the memory, skip Steps 1 and 2.

1 Measure the patient’s eye with the auto refractometer.
   See the corresponding operator’s manual.

2 After the measurement, press the Print button of the auto refractometer.
   The measured data is printed and automatically stored in the memory of the RT-5100 relay box.
   The number at the top of the printout is called data No. The number is necessary to call up the stored data.

   • When connecting the RT-5100 to the auto ref/keratometer (ARK), set the AR port parameter to ARK. When connecting the RT-5100 to the auto ref/keratonometer (RKT), set the AR port parameter to RKT. When connecting the RT-5100 to the ARK-10000 (V2.11 or later) or OPD-Scan III, set the AR port or LM port (port that the ARK-10000 is connected) parameter to WF (OPD).
   • When entering day and night data from the ARK-10000 or OPD-Scan III, see “2.2.6 Entering day and night data from ARK-10000 or OPD Scan III” (page 33).

   • The maximum data count is 9999. However, only the last 150 measurements are retained. Whenever the data count exceeds 150 measurements, the prior data up to the start of those 150 measurements are deleted.
3 Press \( \text{ON} \).
   The last data No. read from an auto refractometer or a lensmeter appears on the screen.

4 Set the data No. at the top of the printout.
   Change the data No. with the dial.

5 Enter the data.
   Press \( \text{AR} \).
   The refractor head is automatically set depending on the selected data. The subjective refinement starts.
   If the Preset power of Subj 1 parameter is LM and the subjective data has already been entered, even if AR data is later entered, the subjective data remains unchanged.
   The elapsed time from data entry start in the subjective data field is displayed when the Operating timer parameter is set to Subj. (Except when the elapsed time indication has already started.)
   The keratometory data from the ARK or intraocular pressure from the RKT is displayed in only the data list. They are printed together with the other data.
   When the parameter “AR port” or “LM port” is set to WF(OPD), the RT-5100 operates as follows.
   • When the Wave Front data is entered, the program becomes the program set in the “Program for WF data imported from OPD” automatically.
     When the AR (ARK) data is entered, the program becomes the program set in the “Program for AR data imported from OPD” automatically.
     If either program is running, the program cannot be switched when the Wave Front data is entered.
   • When the Wave Front data is entered, AR is changed to WF on the display and in the print contents.
   *To enter and use the Wave Front data, rewrite the program set in the “Program for WF data imported from OPD” parameter so that it is compatible with Wave Front data.
2.2.2 From a lensmeter

When the RT-5100 interfaces with one of the NIDEK lensmeters, the measured data is automatically transferred to the RT-5100 by pressing the Print button of the lensmeter. The RT-5100 stores the data in the memory of the relay box. When the data is already in the memory, skip Steps 1 and 2.

1 Measure the patient's glasses with the lensmeter.
   See the corresponding operator's manual.

2 After the measurement, press the Print button of the lensmeter.
   The measured data is printed and automatically stored in the memory of the RT-5100 relay box.
   The number at the top of the printout is called a data No. The number is necessary to call up the stored data.

   • The maximum data count is 9999. However, only the last 150 measurements are retained.
   Whenever the data count exceeds 150 measurements, the prior data up to the start of those 150 measurements are deleted.

3 Press \textsuperscript{IN}. The last data No. read from an auto refractometer or a lensmeter appears on the screen.

4 Set the data No. at the top of the printout.
   Change the data No. with the dial.

5 Enter the data.
   Press \textsuperscript{LM}. The refractor head is automatically set depending on the selected data. The subjective refinement starts.

   If the Preset power of Subj 1 parameter is AR and the subjective data has already been entered, even if LM data is later entered, the subjective data remains unchanged.

   The elapsed time from data entry start in the subjective data field is displayed when the Operating timer parameter is set to Subj. (Except when the elapsed time indication has already started.)
2.2.3 Manual data entry with the dial

Manual data entry is also available with the dial.

- When the AR or LM data is entered with the dial, the subjective data field does not open automatically.
  
  The subjective refinement starts with the data when Subj is pressed. Select the start values with AR or LM as necessary and press Subj to open the subjective data field.

1. Specify the data to be entered.
   Select LM or AR.

2. Specify the eye side.*7
   Select R for the right eye, L for the left eye, or BIN for both eyes.

3. Specify the mode.*7
   Select S, C, A, ADD, or PD.

4. Enter the values.
   Turn the dial to enter the values.

*7. Pressing the field desired to be entered the value on the screen can also be specified the item.
   Pressing the numeric field highlights in blue indicating value can be entered.
   Pressing [S], [C], [A], or [ADD] can be entered the both eye data.
   Pressing the PD button can be entered the PD value.

The highlighted numeric field can be entered the value.
2.2.4 From an Eye Care card

The optional Eye Care card allows the data to be entered without connecting the autorefractometer or lensmeter to the RT-5100.

- Auto refractometer or lensmeter → Eye Care card
  
  A. When it is unnecessary to print the auto refractometer or lensmeter data:
  
  1. Measure the patient’s eye with the auto refractometer or measure the patient’s glasses with the lensmeter.
  
  2. Write the measured data to an Eye Care card.
     
     Insert the card into the Eye Care card slot of the auto refractometer or lensmeter. The data is written to the card.

  B. When it is necessary to print the auto refractometer or lensmeter data:
  
  1. Insert an Eye Care card.
     
     Insert the card into the Eye Care card slot of the auto refractometer or lensmeter.
     
     Be sure to insert it before measurement.
  
  2. Measure the patient’s eye with the auto refractometer or measure the patient’s glasses with the lensmeter.
  
  3. Press the Print button of the auto refractometer or lensmeter.
     
     The measured data is printed and then be written to the Eye Care card.

- Eye Care card → RT-5100
  
  1. Insert an Eye Care card into the Eye Care card reader of the control box.
     
     The measured data is automatically read in the AR or LM data field.
     
     The data in the Eye Care card is cleared.

- RT-5100 → Eye Care card
  
  *The parameter setting “Write to Eye Care card” needs to be “Yes”.

  1. Insert an Eye Care card.
Measure the patient's eye with the RT-5100. (The data needs to be input either of unaided/glass/objective/subjective/prescription.)

For the data writing procedure from the RT-5100 to the EyeCare card, see "3.22 Exporting Data to Eye Care Card" (page 140).

The data is written to an Eye Care card when either of the following is performed.

Press Print to print the measurement result.

Press the right side switch and press the "ID No.", then press "Out".

**Note**

- When the Data clear confirmation by the EyeCare card insertion parameter is set to Yes, if data is read from Eye Care card with the measurement data displayed, a window is displayed asking whether or not to read the Eye care card data after clearing the displayed data.

  **Clear + input →** Clear all of the displayed data and read the data in the Eye Care card.

  **Overwrite →** Overwrite with the data in the Eye Care card without clearing the data displayed. Any items in the displayed data not included in the Eye Care card data remain as is. (However, for the Subjective field, follow the Preset power of Subj 1 parameter setting.)
2.2.5 Entering day and night data

When the Display the Day/Night switching button parameter is set to Yes, is displayed and night data can be input separately from day data.

* Day data is measurement data for bright environment and night data is measurement data for dark environment.

Note • To measure in Night mode, a chart presenting device with Night measurement function (SSC-350/SSC-370/SC-1600/SC-1600 Pola) is necessary.

By pressing , Day/Night mode can be alternated for data input.

When no data is input for the specified mode, the S/C/A values displayed before pressing are copied. However, when the subjective mode in which no data input has been specified, the Preset power of Subj 1 parameter setting is prioritized. (For the Day mode, the day AR value or LM value is copied. For the Night mode, the night AR value or LM value is copied.) In addition, when starting or the displayed data is cleared, the mode is Day mode.

Switching among Unaided and Final in Day/Night mode
Pressing , in Day mode or Night mode switches the data selection mode from among those Unaided to Final modes. When nothing is input for the specified mode, the S/C/A values displayed before pressing are copied. However, when the subjective mode whose data is not input is specified, the Subjective start value 1 parameter setting is prioritized.

Input data to Night mode from AutoRef/Lensmeter
In Night mode, input data from an auto refractometer or lensmeter according to the procedures in "2.2.1 From an auto refractometer" (page 26) and "2.2.2 From a lensmeter" (page 28).
2.2.6 Entering day and night data from ARK-10000 or OPD Scan III

Night data as well as day data can be entered simultaneously from the ARK-10000 (V2.13 or later) or OPD-Scan III.

* Day data is measurement data for bright environment and night data is measurement data for dark environment.

### When calling up data from the ARK-10000 connected with a cable

When entering day data only, see "2.2.1 From an auto refractometer" (page 26).

* For detailed procedure for transferring data from the ARK-10000 to the RT-5100, refer to the ARK-10000 Operator's Manual.

### Note

- When the Display the Day/Night switching button parameter is set to No, if night data is input, is displayed in the function buttons and Night/Day mode can be switched.

1 Measure the patient's eye with the ARK-10000 in ARK/CT mode. Refer to the ARK-10000 Operator's Manual.

2 After the measurement, press the print button of the ARK-10000.

3 The HD EXAM dialog box appears. Press [Send both data].

   The measured data is printed and automatically stored in the memory of the RT-5100 relay box.

   The number at the top of the printout is a called data No. The number is necessary to call up the stored data.

### Note

- The maximum data count is 9999. However, only the last 150 measurements are retained. Whenever the data count exceeds 150 measurements, the prior data up to the start of those 150 measurements are deleted.

4 Press .

   The last data No. read from an auto refractometer or a lensmeter appears on the screen.

5 Set the data No. at the top of the printout.

   Change the data No. with the dial.
6 Enter the data. Press (AR).

The refractor head is automatically set depending on the day data. The subjective refinement starts.

🌟 is displayed next to the Measurement mode display as the indication of day data.

When the day data is the Wave Front data, the program becomes the program set in “Program for WF data imported from OPD” parameter automatically. When the day data is the AR median value, the program becomes the program set in “Program for AR data imported from OPD” parameter automatically. If either program is running, the program cannot be switched when the Wave Front data is entered.

*To enter and use the Wave Front data, rewrite the program set in the “Program for WF data imported from OPD” so that it is compatible with the Wave Front data.

7 Perform the subjective refinement based on the day data.

8 Press 🌟/😍 function button.

The refractor head is automatically set depending on the night data. The subjective refinement starts.

🌙 is displayed next to the Measurement mode display as the indication of night data.

The program automatically switches to that set by “Program for Night data imported from OPD” parameter.

If the program is running, the program cannot be switched when the night data is entered.

9 Prepare an environment suitable for night measurement. Perform the subjective refinement based on the night data and print the measured result.

For day data, “For day” is indicated on the printout, showing that the data is for glasses used in bright environments. See “O When printing day/night data (page 84)”.

For night data, “For night” is indicated on the printout, showing that the data is for glasses used in dark environments.

The data is cleared.
**When calling up data from the OPD-Scan III connected with a cable**

When entering day data only, see "2.2.1 From an auto refractometer" (page 26).

* For detailed procedure of transferring data from the OPD-Scan III to the RT-5100, refer to the OPD-Scan III Operator’s Manual.

1. Measure the patient’s eye with the OPD-Scan III in OPD/CT mode.
   
   For details, refer to the OPD-Scan III Operator’s Manual.

2. When the measured data is obtained, press the Verified and Save buttons of the OPD-Scan III.
   
   The measured data is printed and automatically stored in the memory of the RT-5100 relay box.
   
   The number at the top of the printout is called a data No. The number is necessary to call up the stored data.

3. Perform the subjective refinement as with the procedures of Steps 4 and later in “When calling up data from the ARK-10000 connected with a cable (page 33)”.

**Note**

- Set the AR port parameter to “WF(OPD)”.
- On the Communication tab in the OPD-Scan III Settings screen, set “Connection Device” to “RT-5100 Support” then check “Send HD Exam Data”.
- On the Settings screen in the Measurement tab of the OPD-Scan III, check “RS232C Connection” in the Option field.
- Perform Steps 1 and 2 with the OPD-Scan III, and Steps 3 and later with the RT-5100.

**Note**

- The maximum data count is 9999. However, only the last 150 measurements are retained.
  
  Whenever the data count exceeds 150 measurements, the prior data up to the start of those 150 measurements are deleted.
**When calling up data from the ARK-10000 and OPD-Scan III via Eye Care card**

The optional Eye Care card allows day and night data to be entered without connecting the ARK-10000 and OPD-Scan III directly to the RT-5100. When entering day data only, see "2.2.4 From an Eye Care card" (page 30).

* For detailed procedure for transferring data from the ARK-10000 or OPD-Scan III to the Eye Care card, refer to the ARK-10000 or OPD-Scan III Operator’s Manual.

1. **Measure the patient’s eye with the ARK-10000 in ARK/CT mode. Write the measured data to the Eye Care card.**
   - Or measure the patient’s eye with the OPD-Scan III in OPD/CT mode and write the measured data to the Eye Care card.
   - For details, refer to the ARK-10000 or OPD-Scan III Operator’s Manual.

2. **Insert the Eye Care card into the Eye Care card reader of the control box.**
   - The measured data is automatically read from the Eye Care card to the control box. The day data is entered in the AR field.
   - The data in the Eye Care card is cleared.
   - The refractor head is automatically set depending on the day data. The subjective refinement starts.

   ![Note]
   - Set the AR port parameter or the LM port parameter to "WF(OPD)".
   - On the ARK-10000 Settings screen, check “Send HD Exam data” and “Use Eye Care Card”.
   - On the Communication tab in the OPD-Scan III Settings screen, set “Connection Device” to “EyeCareCard” then check “Send HD Exam data”. On the Settings screen in the Measurement tab of OPD-Scan III, check "RS232C connection” in the Option field.

3. **Perform the subjective refinement by the same procedure as Steps 7 and later in "When calling up data from the ARK-10000 connected with a cable".**
2.3 Setting Prism Lenses

2.3.1 Switching between rectangular and polar coordinates

1. Press → or ↓ to go into prism entry mode.
   Pressing the prism field on the screen also goes into prism entry mode.

   This key toggles between rectangular (XY) and polar coordinates (rθ).
   Ex.)
   Right eye: 1.0ΔBI, 1.0ΔBU → 1.40Δ, BASE 45°
   Left eye: 2.0ΔBO, 1.5ΔBD → 2.50Δ, BASE 323°

2.3.2 Rectangular coordinates (XY)

1. Press → or [▲] on the screen.
   The rotary prism lenses are placed in the refractor head.
   The prism powers are highlighted in the central screen.

2. Enter base in/out prism powers.
   Turn the dial to change the prism powers (in increments of 0.5Δ).
   Turn the dial clockwise ⇒ The powers increase to the BO (base out) side.
   Turn the dial counterclockwise ⇒ The powers increase to the BI (base in) side.

3. Press → or [▼] on the screen.

4. Enter base up/down prism powers.
   Turn the dial to change the prism powers (in increments of 0.5Δ).
   Turn the dial clockwise ⇒ Left eye: The powers increase to the BD (base down) side.
   Right eye: The powers increase to the BU (base up) side.
   Turn the dial counterclockwise ⇒ Left eye: The powers increase to the BU (base up) side.
   Right eye: The powers increase to the BD (base down) side.

The prism powers can also be entered in increments of 0.1Δ with + or − instead of the dial.
Pressing either key changes the power continuously. See page 129.
Turning the dial while pressing Shift changes the power in increments of 2Δ.

2.3.3 Polar coordinates (rθ)

1. Press → or [▲] on the screen.
   The rotary prism lenses are placed in the refractor head.
   The prism powers are highlighted in the central screen.
2 Enter the prism absolute values.
   Turn the dial to change the absolute values (in increments of 0.5°Δ).
   The prism absolute values can also be changed in increments of 0.1°Δ with 
   \( \uparrow \) or \( \downarrow \) instead of the dial.
   Pressing either key changes the power continuously. See page 129.
   Turning the dial while pressing \( \text{Shift} \) changes the power in increments of 2°Δ.

3 Press \( \theta \) or \( [\theta] \) on the screen.

4 Enter the prism base angle.
   Turn the dial to change the angle (in increments of 1°).
   Turning the dial while pressing \( \text{Shift} \) changes it in increments of 5°.

2.3.4 Removing rotary prism lenses

The rotary prism lenses can be instantly removed with a single touch of any key.
For the 21 Point Exams of Plus Package, the rotary prism can be removed only when the exams are
#8 H.Phoria(F), #13B H.Phoria(N), #12A V.Phoria(F), and #18A V.Phoria(N).

1 Press \( \Delta \) or \( \theta \) again while the rotary prism lenses are placed in the measuring
   windows.*8
   The rotary prism lenses are removed from the measuring windows.
   The highlight color on the screen changes and the time display changes to \( \Delta \)-OFF. It indicates
   that the rotary prism lenses are removed.

   When the rotary prism lenses are removed, the selected prism powers can be changed.
   Pressing \( \Delta \) or \( \theta \) again allows the rotary prism lenses to be placed.

   * Note

   For Plus Package, the prism power is displayed in gray when the mode is other than prism
   mode and the rotary prism is not set.
   For example, if \( s \) is pressed, the rotary prism is removed. When inserting the prism again, press
   \( \Delta \) or \( \theta \).

2.3.5 Prism data clear

The prism powers of the right and left eyes can be cleared separately.
   \( \Rightarrow \) The prism power of the right eye is cleared.
   \( \Rightarrow \) The prism power of the left eye is cleared.

2.3.6 Prism data comparison

When comparing the view of LM, AR, Subj, and Final value with the prism power inserted, press
\( \text{LM} \), \( \text{AR} \), \( \text{Subj} \), or \( \text{Final} \) with the prism power inserted. In addition, for Plus Package, rotary prism
is not set when the mode is other than prism mode, \( \text{LM} \), \( \text{AR} \), \( \text{Subj} \), or \( \text{Final} \) must be pressed
with the Prism mode (Prism field is highlighted).

*8. Pressing any of the \( \{\Delta\} \), \( \{\theta\} \), \( \{\Delta\} \), or \( \{\theta\} \) keys whose numeric field is highlighted in blue while the rotary prism lenses
are placed in the measuring windows also removes the rotary prism lenses. (When only single-eye numeric field is high-
lighted in blue, press the numeric field.) Pressing the key again allows the rotary prism lenses to be placed back.
2.4 Preparation

1. Place the refractor head in front of the patient’s eyes.
   1) Clean the forehead rest, face shields, and measuring windows beforehand.
      See “6 MAINTENANCE” (page 239).
   2) Instruct the patient to lean against the forehead rest and look through the measuring windows.
      Confirm that the forehead detection lamp goes out. When it lights up, the patient’s forehead is away from the forehead rest.

   • The forehead rest is for positioning the patient’s forehead. Be careful that the patient does not push against the forehead rest.
   • If the forehead rest is pressed against too strongly, the support of the forehead rest may be broken.
   • If the forehead rest is set too far to the patient side, the patient may force his/her forehead against the forehead rest to approach the measuring window and the support may be broken. If the forehead rest is too far to the patient side, before the patient positions his/her forehead, retract the forehead rest with the forehead rest adjustment knob.

2. Press \( \text{PD} \).
   The PD adjustment lenses are placed in the measuring windows and the anterior segments of the patient’s eyes are lighted.

3. Observe the patient’s eyes from the operator’s side.
   Confirm that both eyes are located in the center of each measuring window.
   A. When they are shifted horizontally: Turn the dial to adjust the pupillary distance (PD).
   B. When either eye is shifted vertically: The patient’s head is tilted. Instruct the patient to make the head level.

4. Adjust the vertex distance (VD).
   1) Look through the VD check windows.
      The windows are located on the both sides of the refractor head.
   2) Align the patient’s corneal vertex to a desired VD marking.
      Turn the forehead rest knob.

5. Press \( \text{PD} \) again.
   The PD adjustment lenses are removed from the measuring windows and the light goes off.
2.5 Standard Program Refraction

The RT-5100 includes two standard programs (Programs A and B) for full-corrected far value and prescription. See "8.8 Standard Programs" (page 262) for all test items in the standard programs. For Plus Package, standard program #7 obtaining full-corrected far value is equipped other than programs A and B.

In this manual, standard program A and standard program #7 are presented as an example.

2.5.1 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.

Pressing Help during the program shows sample instructions to the patient. (The instruction may not appear depending on the test. At this time, the normal help screen appears.)

1 Select Program A.
   The program is switched with Shift + Prog.

2 Press Prog.
   Program A starts.

3 Enter the AR data.

   1) Measure the patient’s eye with an auto refractometer and print the result.

   2) Press IN.
      Confirm that the data No. is the same as the print data No. of the auto refractometer.
      See "2.2.1 From an auto refractometer" (page 26).
3) Press **AR**.

The AR data appears in the subjective and AR data fields.

The unaided visual acuity test for the right eye starts.

When the AR data is measured with the auto refractometer not connected to the RT-5100, press **AR**, enter the data manually, press **Subj** and **Add**. See "2.2.3 Manual data entry with the dial" (page 29).

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

Or occlude the left eye without the refractor.

5) Measure the unaided visual acuity.

Refer to Steps 3 to 7 in "4.1.1 Unaided Visual Acuity Test" (page 143).

6) Press **LM**.

7) Confirm that the patient has his/her glasses.

Without glasses
   → Select [No] and go to Step 10.

With glasses
   → Select [Yes] and go to Step 8.

8) Enter the LM data.

1) Measure the patient’s glasses with a lensmeter and print the result.

2) Press **LM**.

   Confirm that the data No. is the same as the print data No. of the lensmeter.

   See "2.2.2 From a lensmeter" (page 28).

When the LM data is measured with the lensmeter not connected to the RT-5100, enter the data manually and press **LM**. Refer to Steps 2 to 4 in "2.2.3 Manual data entry with the dial" (page 29).
The aided visual acuity test starts and a chart is presented.

9 Measure the aided visual acuity.
   Refer to Step 2 in "4.1.2 Aided Visual Acuity Test" (page 144).

10 Start subjective refinement.

   1) Press \[\text{\textbullet}\].

      The left eye is occluded. The subjective refinement starts.

   2) Confirm that the patient can read the presented chart.

      When the patient can read even one letter on the chart, go to the next red-green test.

11 Refine the spherical power with the red-green test.

   1) Press \[\text{\textbullet}\].

      The SPH +0.50 D lens is automatically added to fog the vision. The red-green chart is presented.

      When the cylindrical power is 0.00, the message whether the cross cylinder test is skipped or not appears. When the skip is selected, Steps 11 to 13 are skipped and the red-green test starts in Step 14.

   2) Reduce fogging gradually until the sharpness of the letters on the red and green sides appears equal.

      Letters on the red side are sharper. \[\text{Turn the dial clockwise by increments of one.}\]
Letters on the green side are sharper. → Turn the dial counterclockwise by increments of one.

**Note**  
• In this spherical refinement, circle of least confusion is maintained on the retina for the next cylindrical axis measurement with the cross cylinder. When the patient cannot see the red and green sides equally, make the green side sharper slightly.

**12 Measure the cylindrical axis.**

1) Press \( \bigcirc \).  
The dots chart is presented. 
A cross cylinder lens is placed. The cross cylinder lens type is switched between [Auto], \([-0.25]\), and \([-0.50]\). 
When the cylindrical axis is 0.25 or less, the same cylindrical power measurement as Step 13 starts before the cylindrical axis measurement.\(^9\) 
When the cylindrical power is 0.00 in the cylindrical power measurement, Steps 12 and 13 are skipped.

2) Measure the cylindrical axis with the cross cylinder lens. 

**Flipped cross cylinder:**  
Ask the patient which is sharper, chart 1 presented by pressing \( \bigcirc \) or chart 2 presented by pressing \( \bigcirc \).

**When chart 1 is sharper.**  
→ Turn the dial counterclockwise by increments of one.  
(Also possible by pressing \( \bigcirc \))

**When chart 2 is sharper.**  
→ Turn the dial clockwise by increments of one.  
(Also possible by pressing \( \bigcirc \))

Repeat the above until the both charts appear equal.

\(^9\). When the Intelligent XC parameter is set to Yes (factory setting), the order or measurement type changes depending on the CYL value (cylindrical power). See "3.19 Parameter Settings" (page 127) for details.
**OPERATING PROCEDURE:** Standard Program Refraction

**Auto cross cylinder:**
Charts 1 and 2 are presented simultaneously. Both chart positions appear in the lower left corner of the screen.

**When chart 1 is sharper.**
→ Turn the dial counterclockwise by increments of one.
(Also possible by pressing \(\uparrow\).)

**When chart 2 is sharper.**
→ Turn the dial clockwise by increments of one.
(Also possible by pressing \(\downarrow\).)
Repeat the above until the both charts appear equal.

**13 Measure the cylindrical power.**

1) Press \(\uparrow\). The cross cylinder lens axis changes.

2) Measure the cylindrical power with the cross cylinder lens.
Follow the same procedure as 2) of Step 12.

on the chart, go to the next red-green test.

**14 Refine the spherical power with the red-green test.**

1) Press \(\downarrow\).
The SPH +0.50 D lens is automatically added to fog the vision. The red-green chart is presented.

2) Reduce fogging gradually until the sharpness of the letters on the red and green sides appears equal.
Letters on the red side are sharper. → Turn the dial clockwise by increments of one.
Letters on the green side are sharper. → Turn the dial counterclockwise by increments of one.

**Note**
• When the patient cannot see the red and green sides equally, make the red side sharper slightly. It avoids overcorrection.
15 Refine the spherical power as high as possible to achieve the best possible visual acuity.

1) Press .
   The isolated 20/20 line is presented.

2) Check the best possible visual acuity with or .

3) Refine the spherical power as high as possible to achieve the best possible visual acuity.
   Turn the dial counterclockwise to add SPH +0.25 D. When the chart appears blur, turn the dial clockwise by increments of one.

The spherical power for the right eye is perfectly refined.

16 Follow the same procedures as Steps 10 to 15 for the left eye.

The spherical power for the left eye is perfectly refined.

17 Press .
   Three short beeps are audible.

18 Perform the binocular balance test.

1) Press .
   The polarizing filters are placed in the measuring windows;
   Right eye: 135°, Left eye: 45°
   In the visual acuity of 20/20 or better, the vision is fogged automatically for easy balance test when the Fog for binocular balance parameter is set to Yes.