

IMPORTANT NOTICE

This product may malfunction due to electromagnetic waves caused by portable personal telephone, radio-controlled toys, etc. Please keep away any device that can influence this product.

The information in this manual is checked out carefully and is believed to be entirely accurate at the time of publication. However, MEDIZS Inc. takes no responsibilities of the results caused by default, omission, or misuse of it.

MEDIZS Inc. reserves the right to modify the product itself or specifications of the product without any prior notice, and is not required to update this documentation to reflect such changes.

Operation Manual ver 1.15 / 2015.10

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1. Introduction

1-1. Outline of product

DR13, Digital Reflector of MEDIZS, is enable subjective refraction test regarding visual accommodation of patient's eye or its function. Also, you can measure and check abnormal binocular vision such as muscle balance of the eyes, binocular balance, aniseikonia, fusion and stereo acuity. The subjective test is based on measurement results of Auto Ref/Keratometer in communication with DR 13. Optometrist could significantly reduce the time by tapping the control of iPad Application which has auto functions of DR 13.

Basic components of DR 13 are Refractor body, iPad-App and junction box. In the body of DR 13, there are more than 100 lenses. It could be operated by Automatic lenses loader and controlled through iPad application to control DR 13 via Bluetooth wireless connectors.

This iPad application to control DR 13 could not only control refractor body and chart projector, but receive the data from Ref/Keratometer(RK), Auto LensMeter(LM), and refraction program on your PC. It also has functions to send data by email and to print data (Printers only for iPad wireless printing).













Junction Box supplies DR 13 with power.

1-2. Features

- By using Tablet PC (iPad) via Bluetooth network, you can control SmartDR13, SmartCP11, and SmartLC13 wirelessly and receive measurement data from SmartRK11 and SmartLM14.
- Measurement data tested by RK11 and LM14 can be sent to Application (Smart MEDIZS) directly, and this data can be applied on DR13 (Digital Refractor) body, only by using Tablet PC.
- Smart MEDIZS application allows wireless refraction test, so that allowing users to control the body with wider and clearer screen. The wireless operation can offer more flexible workspaces.
- Through APP, measurement data from Ref/Keratometer(SmartRK11) can be applied to DR13's body automatically without lens operation, and App also offers PRESE function that put in lenses including auxiliary lens at once.
- New programs are always available thanks to easy and fast update of the programs, which uses USB and Serial Cables of the PC.
- All personal information or prescription of patients can be managed by using email function or can be obtained from printers for iPad wireless printing.
- The classification content of the instrument : DR 13
 - Protection against electric shock : Class I;
 - Protection against harmful ingress of water : Ordinary (IPX0);
 - Method of sterilization : Not applicable;
 - Stability of use in an Oxygen Rich Environment : Not suitable;
 - Mode of operation : Continuous operation.

2. Safety Information

2-1. Symbols marked on the instrument

Symbol	Description
	Type B Applied Part (Forehead rest)
	Protective earth (ground)
	Alternating Current
	Direct Current
	Caution
	Manufacturer
	Date of Manufacture
	Authorized Representative in the European Community
	Follow Operating Instructions
	Power off (separated with power source)
	Power on (connected with power source)
	Do not throw away the waste to inappropriate place

2-2. EU Countries

The following mark, the name & address of the EU Representative shows compliance of the instrument with Directive 93/42/EEC.



EU Representative:






CALMED INVEST Kft.










1182 Budapest, Fiume utca 3., Budapest, Hungary

2-3. Safety Instruction

If you see any warnings or cautions printed on the warning labels, follow the safety instructions in this manual. Ignoring such cautions or warnings while handling the product may result in injury or accident. Be sure to read and fully understand the manual before using this product.

Keep this manual in easy-to-access place.

 WARNING	It can strike a mortal blow if you are not careful. Death or a severe wound might occur to you or others.
 CAUTION	You can fall into a dangerous situation if you don't care. It could lead to a slight wound of you or others, or malfunction of this equipment.
NOTE	Significant information about installation, operation, basic safety and management of this equipment. Please read out this information to prevent misuse.
 WARNING	Use the device that meets the standard power requirements on the tablet. Unless, it could end up with a fire or an electric shock.
 WARNING	Please connect or separate the electric cables only after powering off. Besides, don't touch this equipment with wet hands. Unless, it could end up with an electric shock that accompanies death or severe wounds.
 WARNING	Please power the switch down and plug out power cables from the AC socket. And then ask the agent you bought this product about the following phenomenons. <ul style="list-style-type: none"> ● Smoke, smell, or a loud noise

	<ul style="list-style-type: none"> • When you spilled a fluid on this product, or when any metal was wedged into an opening • When you drop this product or when the outer case was broken
 WARNING	You must not disassemble or reconstruct this product. It could lead a fire or an electric shock. Be aware that high-voltage and other dangerous parts are installed in this equipment. To touch these parts can incur serious wounds
 WARNING	Please keep the temperature at 10°C~40°C and humidity at 30%~75% for normal operation.
 WARNING	DR13 shall be connected to the separate power supply as supplied by Medizs Inc. with type DR 13J identified.
 WARNING	Do not position the equipment to make it difficult to operate the disconnection device (Appliance coupler or separable plug)
 CAUTION	Grounding power cables are put in this equipment. Always connect them to the grounded AC socket, to reduce electric shock.
 CAUTION	The Ref. body of DR 13 is heavy, so a strong cable is needed to connect with it. If not, the REF.BODY might be damaged, or the tester might be hurt.
 CAUTION	If a visual acuity test is done in In the process of initialization of the Ref. body, the person under vision test might hurt. Please do a test only after the initialization is finished completely.
 CAUTION	You wish to be careful so that the dust or metal doesn't may enter The inside of instrument.
 CAUTION	Make a cable and don't pull out the power cable.

2-4. General safety information

1. An exposure to the direct sunlight or very bright indoor lights may influence on the result of accurate measurement. Recommend to use in appropriate test room.

2. A sudden heating of the room in cold areas will cause condensation on the protective glass in the monitor screen and on optical parts inside the instrument. In this case, just wait until condensation disappears before performing measurement.
3. This instrument is used with accessories from MEDIZS. If consumer would like to use the accessories from other manufactures, safety of accessories should be verified and identified by manufacturer or by MEDIZS.
4. Operation manual should be keep at the place where the user can easily access.
5. This instrument can be installed and maintained by the person who have completed training or education course.
6. When moving this instrument, please keep vibration or impact away from the equipment. It can bring some damage inside or outside of the instrument. Please carefully handle the instrument.
7. When moving equipment, fixes the stage, always keep power off, and then lift the bottom of the unit with both hands.
8. To connect this instrument with other relevant equipment, consult with the dealer about the way to make it.
9. In case there is smoke, strange odor or noise on working, disconnect the power supply and consult the dealer.
10. Don't use organic solution such as alcohol, thinner, benzene, etc. to clean the surface of this instrument. It may damage the instrument.
11. Do not disassemble or modify this instrument.
12. If you are not using this instrument a long time, disconnect the power supply and protect the unit with dust cover.
13. Do not pull on the cable of equipment.
14. Please check the condition of unit appearance before using the instrument.

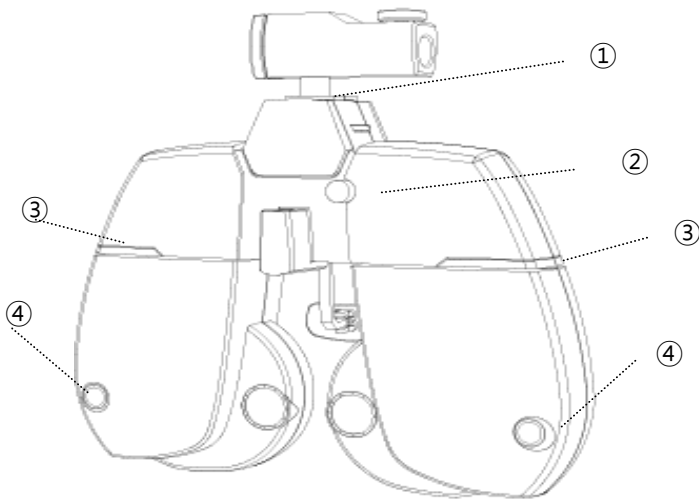
3. Note for using the instrument

- Electromagnetic waves discharged from mobile phones, radiotelegraphs, wireless toys can cause malfunction of this product. Please keep away any device that can influence this digital Refractor.
- All the information in this manual is checked out carefully and discerned as accurate one at the time of publication. However, MEDIZS Co., Ltd., takes no responsibilities of the results caused by default, omission, or misuse of it.
- MEDIZS Co., Ltd., has rights to modify the product itself or specifications of the product without any prior notice, as well as rights not to renew that modification on this manual.
- Users must operate this device strictly following user's manual or explanations on service manual. More management is available only to service technician of MEDIZS, or who is qualified to be in proportion to that position.
- Be careful not to load excessive shock or vibration on this product.
- Please be guided by the agent when you move this product or connect it with others.
- Outer lightning can influence the test result. Use it in a proper test room.
- Keep the lenses clean always, since dirty lenses can influence the test result. Please check the status of lenses essentially before use it.
- A shock can damage the inside and outside of the product. Handle with care, please.
- Please keep the temperature at 10°C~40°C and humidity at 30%~75% for normal operation. It must not be exposed to watery a place or where lots of water splashed. Do not put any container or product which contains liquid or gas, around this device.

4. Nominations and Functions of Each Parts

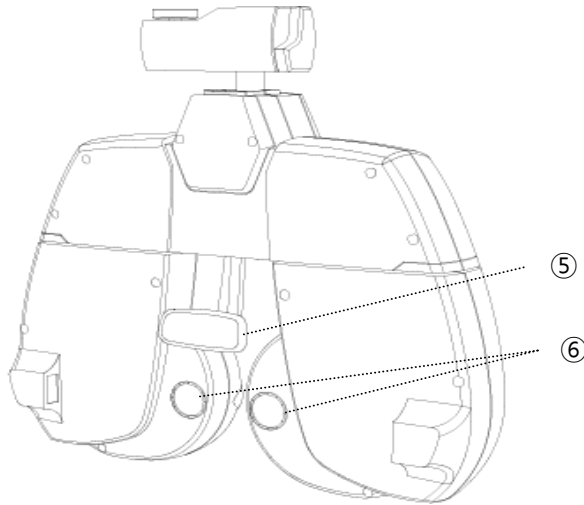
Basic components of DR 13 are Refractor body, iPad-App and junction box.
Explanation about each components and functions are following here

4-1. Front side of Body



[Fig 1] Front side of Body

4-2. Back side of Body



[Fig 2] Back side of Body

Name	Description
① Leveler	Inform whether the digital refractor maintains horizontality.
② Forehead Fixing Dial	Fasten the patient’s forehead to forehead rest with dial.
③ LED	Turn on when the digital refractor power on.
④ VD Test window	Confirm the patient’s VD
⑤ Forehead Prop	A plate to prop the patient’s forehead.
⑥ Test Window	The patient can view the chart through the lens.

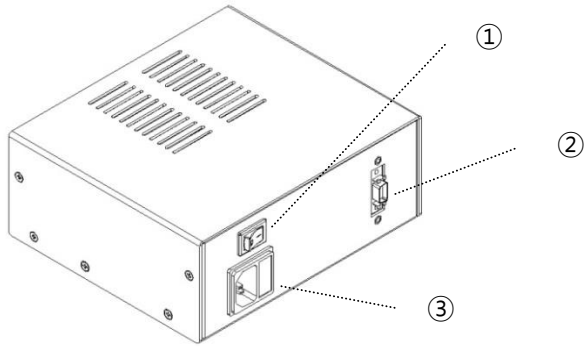
4-3. Control Pad (iPad-App)



[Fig. 3] Control Pad Application on iPad

Buttons or Controllers are changed according to the measurement circumstance. For detailed controlling method, please refer to explanation of each mode.

4-4. Junction Box



Name	Description
① Power switch	Switch for turning power ON and OFF
② Body Connector	Connect with DR13 body
③ Power Connector	Power supply connector

5. Installation and preparation

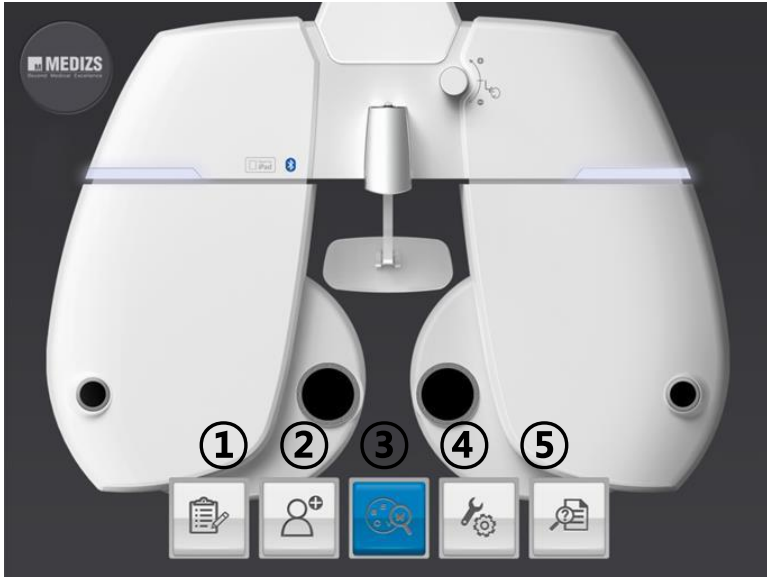
The most installation process of basic system is as below;

- 1) Check that all the basic components are.
- 2) Connect DR 13 Body and Junction Box with 8 pin cable, while junction box must be turned on.
- 3) After connecting power cable of junction box, ensure that each cable is properly connected.
- 4) Turn the power of junction box.
- 5) Turning on, DR 13 start initialization.
- 6) Download and install DR 13's application onto your iPad.
- 7) Before running App, turn Bluetooth on. From home screen choose Setting > Bluetooth.
- 8) In a while, Bluetooth name of DR 13 appears on the screen and pair DR 13 with iPad.
- 9) Run the App.
- 10) When running App for the first time, one Message appears. Tap 'OK' button, then go to the page of connecting Bluetooth.
- 11) Tap "ON" on Device ON/OFF.
- 12) If several devices appear, tap the Bluetooth name of device that you want to connect.
- 13) After setting and tapping "Operation Panel" button, you can see the screen that can control DR 13.
- 14) For further examination options and operating method, refer to the article 6 to 7.

6. Default Screen

DR 13 can be operated by Controller App of iPad. You can operate more easily and efficiently by using iPad to tap and slide the screen.

6-1. Main Screen



[Fig. 4] Main Screen

- | | |
|--|---|
| <p>① Data Chart:</p> <p>② Registration:</p> <p>③ Operation controller:</p> <p>④ Set up:</p> <p>⑤ Help guide:</p> | <p>View the list of patient's information and also search for the information of specific patient.</p> <p>Register new clients</p> <p>Appear screen to control DR 13.
You can choose manual or digital type after selecting on setting button.</p> <p>Set functions to fit your preferences</p> <p>Provide the manuals of other devices and the guide for each measurement way.</p> |
|--|---|

6-2. Data Chart

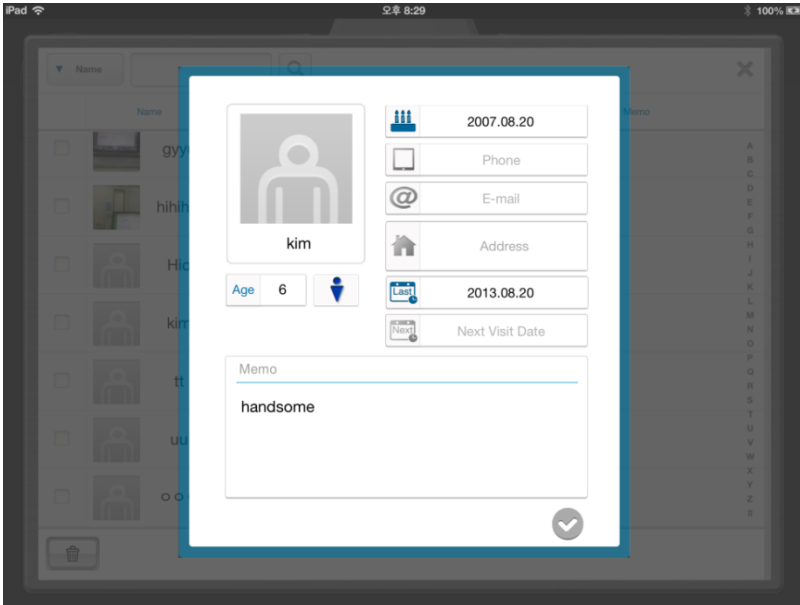
Data chart screen displays all clients by field name order. You can search name or phone number.

If you select each line as single or duplicate and click on the trash box button, you can delete data, and It is possible to amend data on detail screen by clicking each line. In case schedule of next visit is within one week, the date is blue color, if it is the day, its color is red.

	Name	Age	Last Visit Date	Next Visit Date	Memo
<input type="checkbox"/>	gyyu		2013.08.19		
<input type="checkbox"/>	hihihih	22	2013.08.19	2013.08.24	
<input type="checkbox"/>	Hio	0	2013.08.20	2013.08.21	Abccd
<input type="checkbox"/>	kim	6	2013.08.20		handsome
<input type="checkbox"/>	tt		2013.08.19		
<input type="checkbox"/>	uu	13	2013.08.19		
<input type="checkbox"/>	ooo	66	2013.08.14	2013.08.26	

[Fig 5] List of Date chart

If you touch each line longer, detail information view screen will be pop up, and then you can check and amend personal information of customer.



[Fig 6] Detail Information View of Client

If you touch each line shorter, you can see contents of previous prescription, present prescription, RK data and LM data. By clicking on [Read More] button as [Fig 7], you can see detail information of customer and amend them. Also, when you left and right slide screen under touching any point by a finger, you can read information of another client.

FAR	SPH	CYL	AXIS	PD	ADD	△	Unaided VA	Aided VA
OD (R)	0.00 D	0.00 D	0	32mm	0.00	0.00 BI	0.00 BU	0.00
OS (L)	0.00 D	0.00 D	0	32mm	0.00	0.00 BO	0.00 BU	0.00
ADD-VA		OD :		0.05	/	OS :	0.05	
Dominant Eye								
Stereo			Fusion			dots		
NPC		BLUR :		cm	/	RECOVERY :	cm	
NPA		OD :		cm	/	OS :	cm	OU : cm

[Fig 7] Detail Information View of Client

6-3. Registration

In registration, you can add information of new visiting clients, such as the name, age, picture and so on.

[Fig 8] Registration of new client

6-4. Operation controller

Display UI of controller depends on your preference of Digital or Manual. (Go to Set > PAGE 4 > Display UI and tap the check box). For each controller, refer to article 7 to 9.



[Fig 9] Display UI of Digital type



[Fig 10] Display UI of Manual type

6-5. Setting

When you tap [Setting] button, 5 options for setting is pop-up.



[Fig 11] Pop-up

6-5-1. Setting Menu

- ① Set Parameter:
You can view pages to let you set vary app options and other preferences to control DR 13.
- ② Set Program:
You can view pages to set and modify the program. For method to do that, refer to ② of 6-5-2.
- ③ Device Bluetooth:
You can view a page to setting Bluetooth devices of RK-11, CP-11 and DR 13.
- ④ Auto/ manual mode:
You can change auto or manual mode by one touch.
- ⑤ Set Information:
You can view a page to enter and check the information of Distributor and Store/Hospital.

⑥ Manufacturer & S/W:

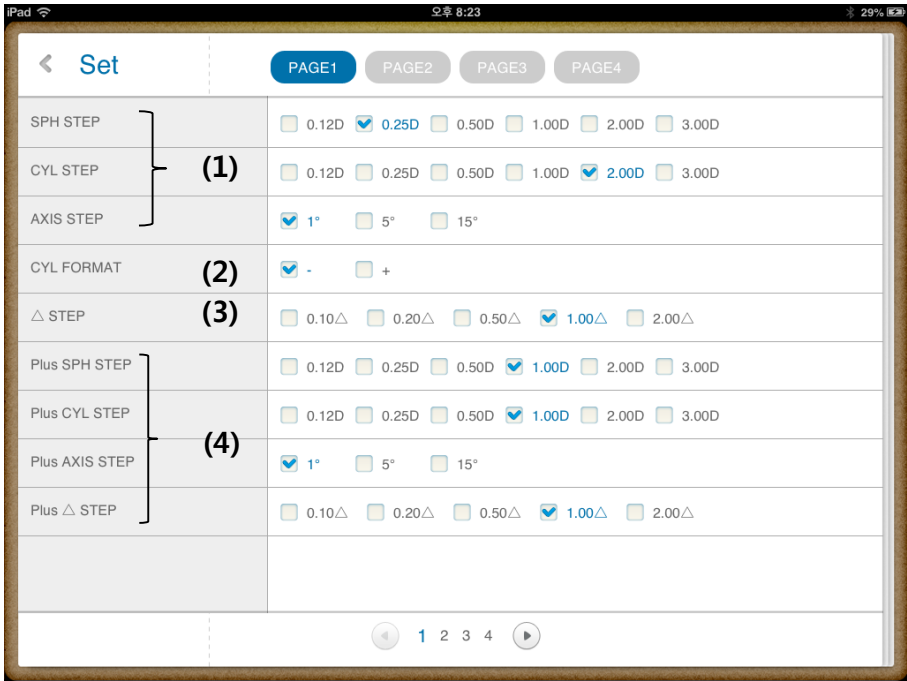
You can view information of S/W version and manufacturer.

6-5-2. Each Setting screen

① Displaying Parameter

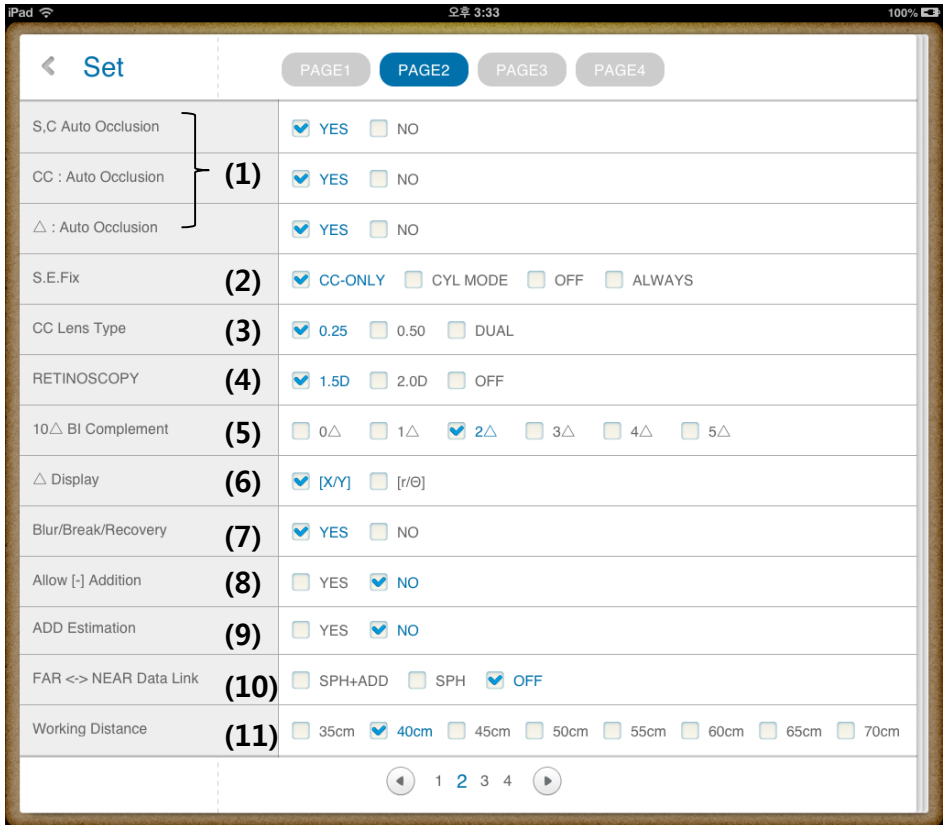
Parameter value setting menu is composed of total 4 pages.

Setting value on each page is as below.



[Fig 12] Parameter setting 1 page

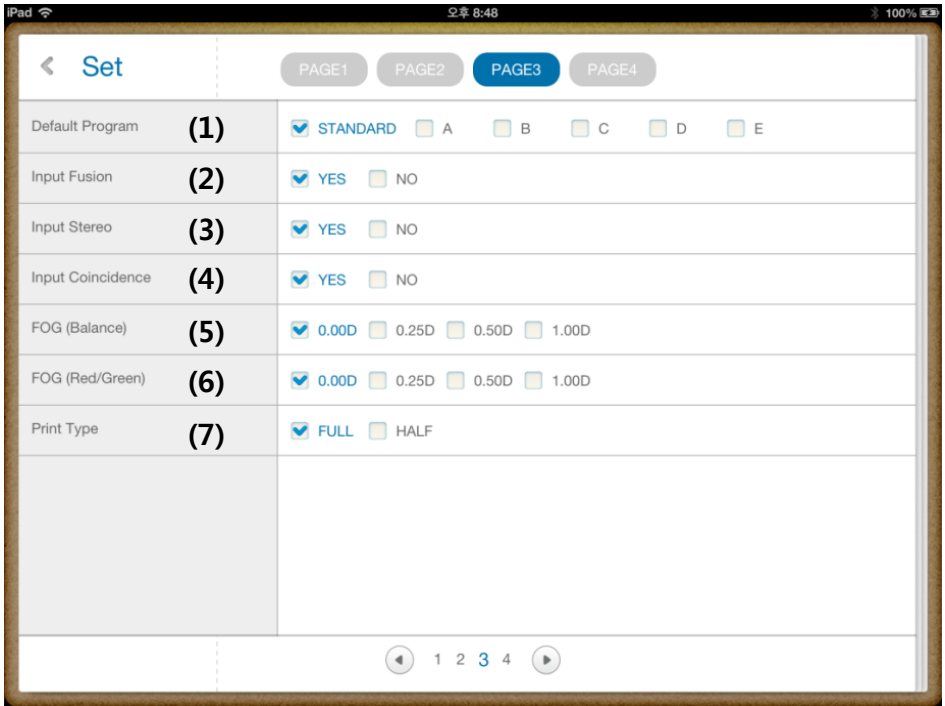
1. Set variation step of SPH, CYL, AXIS
2. Set the display of CYL as - or +.
3. Set the Prism lens variation measure
4. Set variation measure by using +/- button when want to increase or decrease as large measure



[Fig 13] Parameter setting 2page

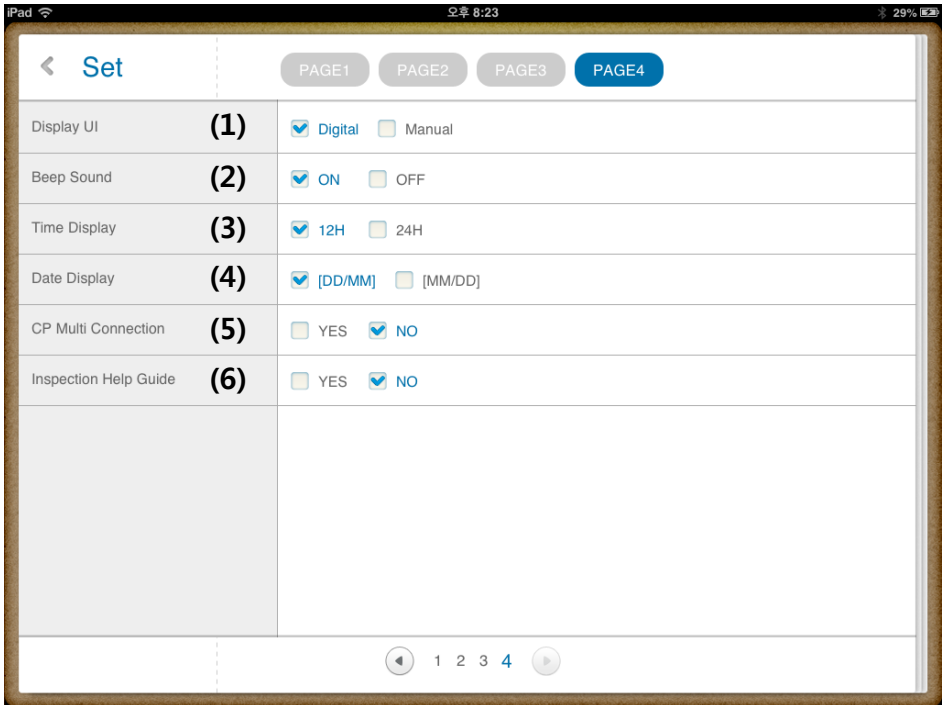
- (1) Automatically close the test window, in case of quickly changed SPH, CYL, CC lens.
- (2) Spherical equivalent Fix
- (3) Cross cylinder type on Clock Dial when selecting the chart.
- (4) Set lens diopter for retinoscopy
- (5) Set additional diopter to input 10D BI separation prism
- (6) Prism display
- (7) Blur/Break/Recovery
- (8) ADD addition
- (9) Set the ADD according to age.
- (10) ADD on FAR/Near mode (SPH+ADD : Add ADD to SPH, SPH : only SPH , OFF)

(11) Working distant



[Fig 14] Parameter setting 3page

- (1) Automatically start according to default program
- (2) Set whether input Worth-4-Dots inspection result or not
- (3) Input Stereo value
- (4) Input Coincidence value
- (5) Fogging value on both eyes balance test
- (6) Fogging value on Red /Green test
- (7) In case print prescription, set paper size whether the paper size is whole size(A4) , or half or whole size. (1/2 of A4)

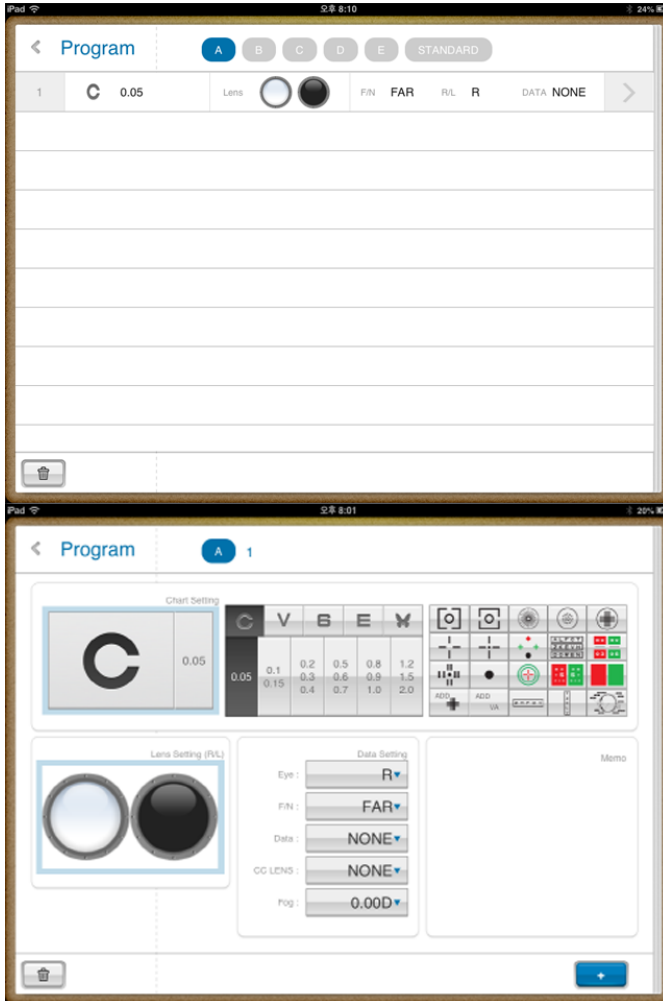


[Fig 15] Parameter setting 4 page

- (1) Digital /Manual mode
- (2) Beep sound
- (3) Time display
- (4) Date Display
- (5) CP Multi connection
- (6) Set the inspection Help guide on controller screen

② Program setting screen

On program registration screen, there is list of A~E each program set. Each program set has a chart and auxiliary lens and another option. If select relevant program, the page will be changed to screen that can set details.



[Fig 16] Program list and detail display

On detail display, you can select chart and chart and auxiliary lens and other options, if you click on '+' button, you can add program.

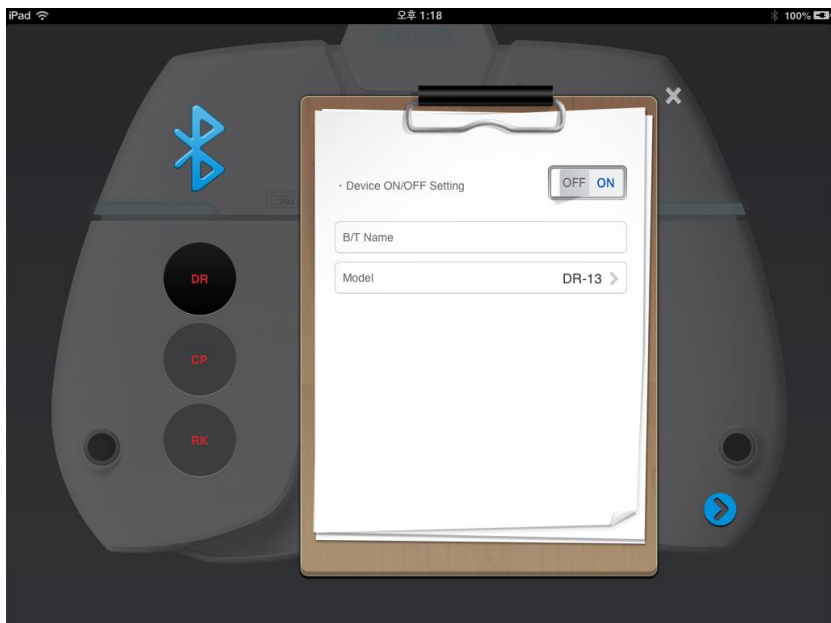
Trash box button can delete selected program.

After setting, can move to previous page by < button which is located in left upper end

③ Bluetooth Setting

This page sets Bluetooth connection of each DR, CP, RK.

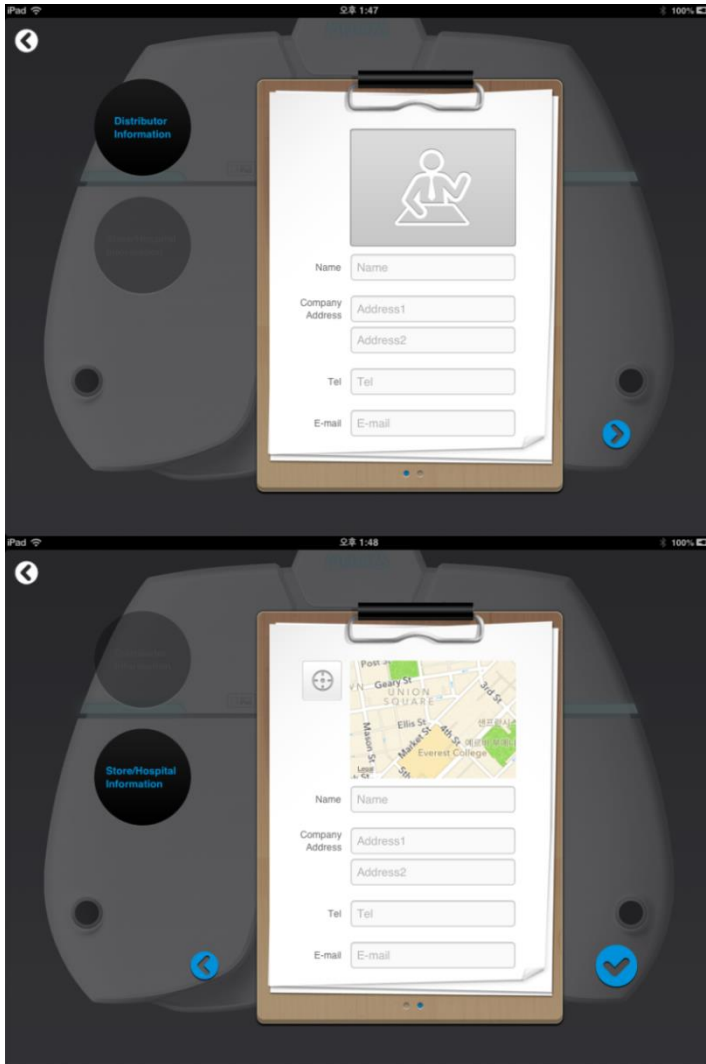
If our device connects with ipad on Bluetooth tap of ipad setting menu, you can set whether control the device or not on Smart DR13 App.



[Fig 17] Bluetooth setting screen

④ Basic information setting

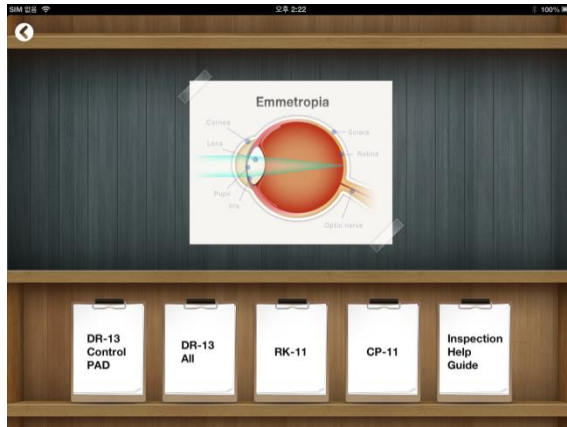
On Basic information setting display, you can see A/S engineer information and input data of optician's shop or clinic information where is using this machine.



[Fig 18] Basic information setting screen

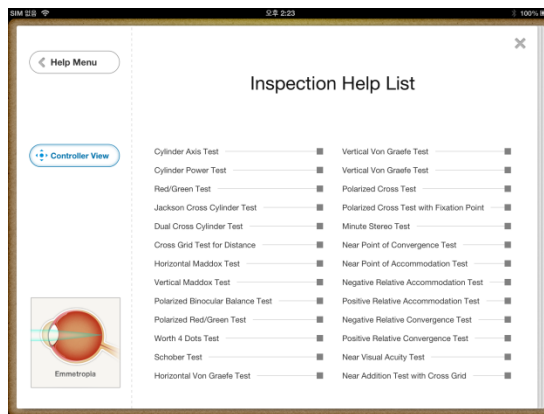
6-6. Help Guide

Help guide organizes Manual of DR 13 control PAD, All equipment of Medizs Inc., and Inspection Help List for DR 13.



[Fig 19] Help Guide Screen

In Inspection Help Guide, there are visual testing guides for each inspection. Tap the [Controller View] button on the left side, and then you can view the screen to describe functions of controllers on Digital UI.



[Fig 20] Inspection Help Guide Screen



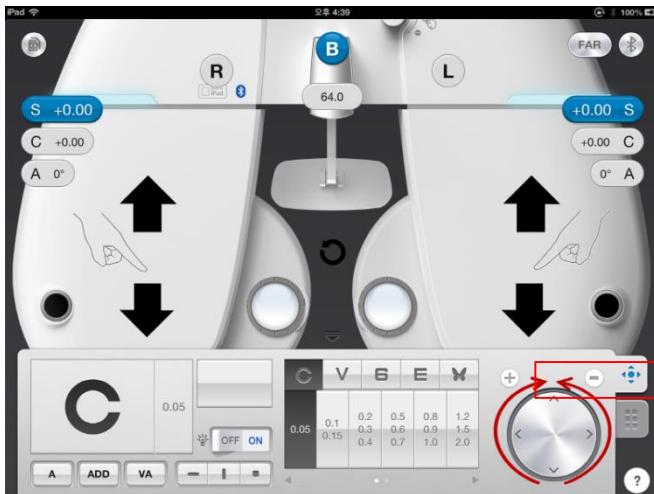
[Fig 21] Controller View Screen

7. Operation Panel

iPad App of DR 13's Operation Panel offer you to control data more simply and easily by tapping or swiping on the screen. On this article, you can learn methods of controlling data in each case.

7-1. Basic Data Operation

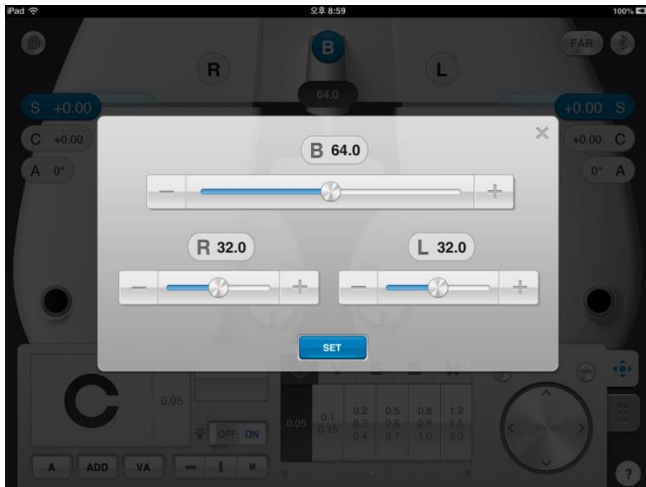
To adjust basic data such as SPH, CYL, and AXIS, tap the button among S, C or A. Then adjust the value by tapping "+/-" button on the lower right end of operation panel. This (Plus) steps of adjusting value can be set on setting > set parameter, page 1. You can also adjust fastidious value of the steps by swiping up and down over the right or left part of screen, or by turning the dial on the lower right end of operation panel.



[Fig 22] Basic Data Operation

7-2. PD value operation

When you adjust the PD value, tap the button indicated PD value to display a pop-up to control PD value. You can check changing PD values of DR 13's body while you touch the slide point on the bottom of R, L or B and drag it. To set the value, you must tap the [SET] button. If you tap the [X] button and the pop-up disappear, DR 13's body returns PD value before changing it.



[Fig 23] Pop-up to control PD value

7-3. Received Data and Prescription

When RK-11 and iPad are connected and you print testing result from RK-11, a numbered badge appears on the upper right icon on the operation panel screen. When you tap the icon, you can see received data from RK-11 and type the patient's information.



[Fig 24] Notification of Received Data from RK-11

iPad 4:33 100%

RK LM

	RIGHT			LEFT			PD
	SPH	CYL	AXIS	SPH	CYL	AXIS	
1	6.00	6.00	6	7.00	7.00	7	0
2	4.00	4.00	4	5.00	5.00	5	0
3	2.00	2.00	2	3.00	3.00	3	0

Trash icon | User icon

iPad 4:23 100%

RK LM Load

VD : 5.00mm Date & Time : (null)

REF	SPH	CYL	AXIS	PD
OD	4.00 D	4.00 D	4	0mm
OS	5.00 D	5.00 D	5	
KER	R1	R2	AXIS	
OD	4.00mm	4.00mm	4	
OS	5.00mm	5.00mm	5	


1 2 3

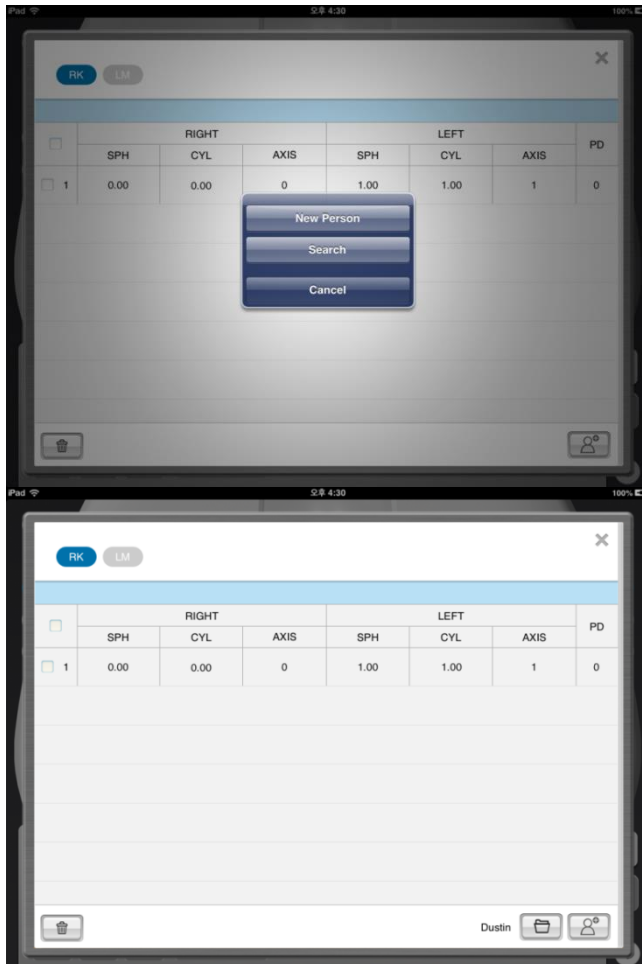
Trash icon | User icon

[Fig 25] List View and Detailed View (Received data)

Select one line on the data list, then you can see detail data of selected line.



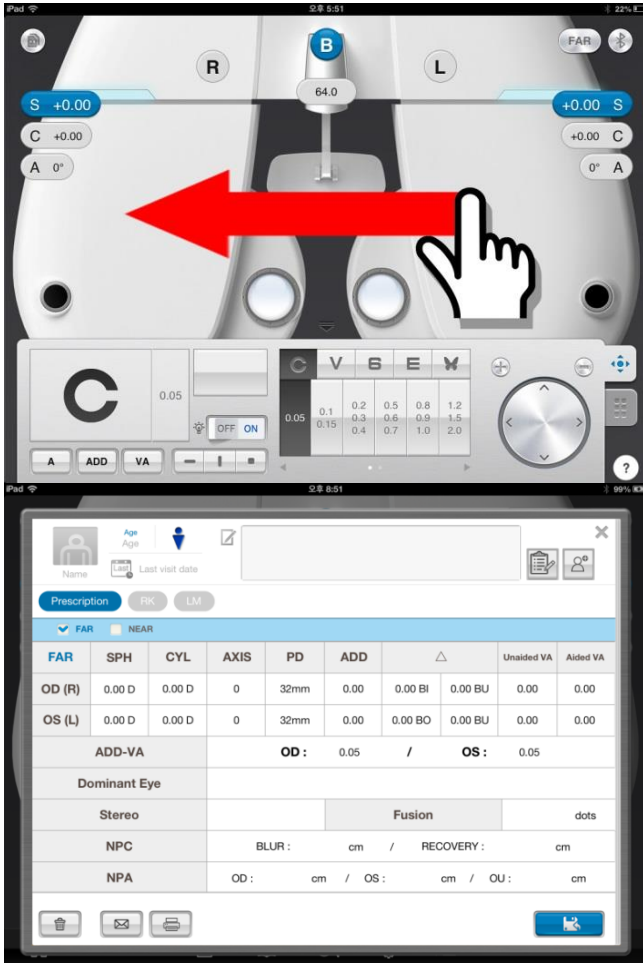
To save received data, touch the  button on bottom right side of screen. Then bellow pop-up appears on the screen. If the testee is first visitor, touch 'New Person' button and input that testee's information. If you have the record of that testee, touch 'Search' button and select applicable record.







[Fig 26] Input measurement data

After selecting applicable personal record, testee's name and 'Save' button appears on bottom right side of the screen.

After finishing subjective test by DR 13, you can check the prescription for current testee. Touch empty space on upper side of OP area with one finger and slide from the right to the left.



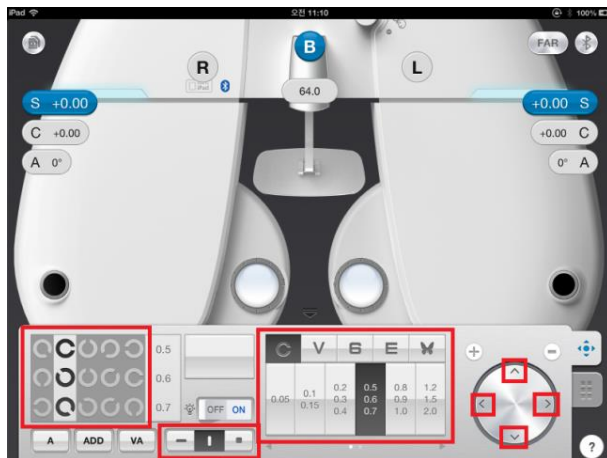
[Fig 27] Pop-up Prescription and changing the data

 button is to erase testee's prescription,  button is to convert the prescription to PDF format and send it by Email, and  button is to print the prescription (Printer should have wireless communication function).  button is to save prescription in iPad. After saving, you can review saved prescription later.

7-4. Chart Control

When iPad and CP-11 are connected, you can control the Chart Projector by operation control. Basically, you can select the chart images by tapping each image which appears on the screen or by tapping right and left and top and bottom side of the dial. And you can use the Horizontal / Vertical mode or Single mode after setting to tap -, |, • button on the bottom side of the operation panel.

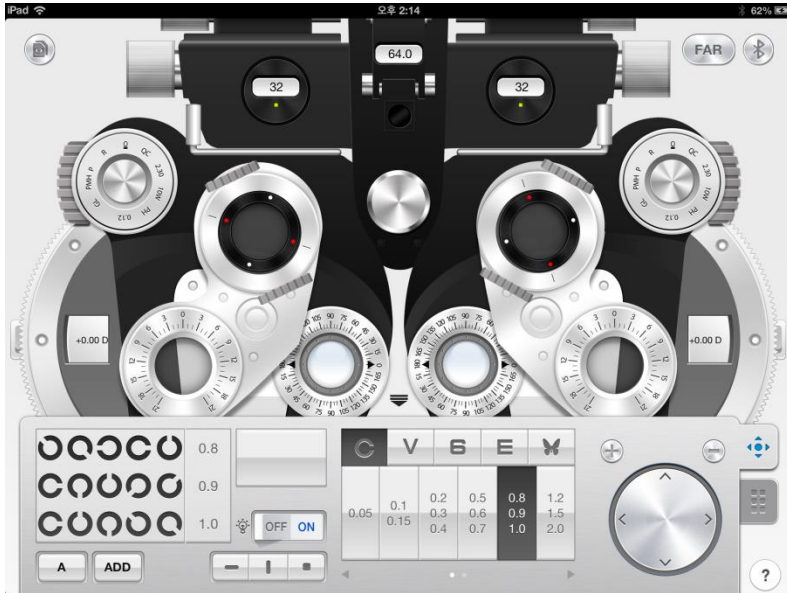
Additional chart appears when you swipe over the window of General chart. You can return the general chart by swiping from left to right over the window of additional chart.



[Fig 28] Control to select the visual chart

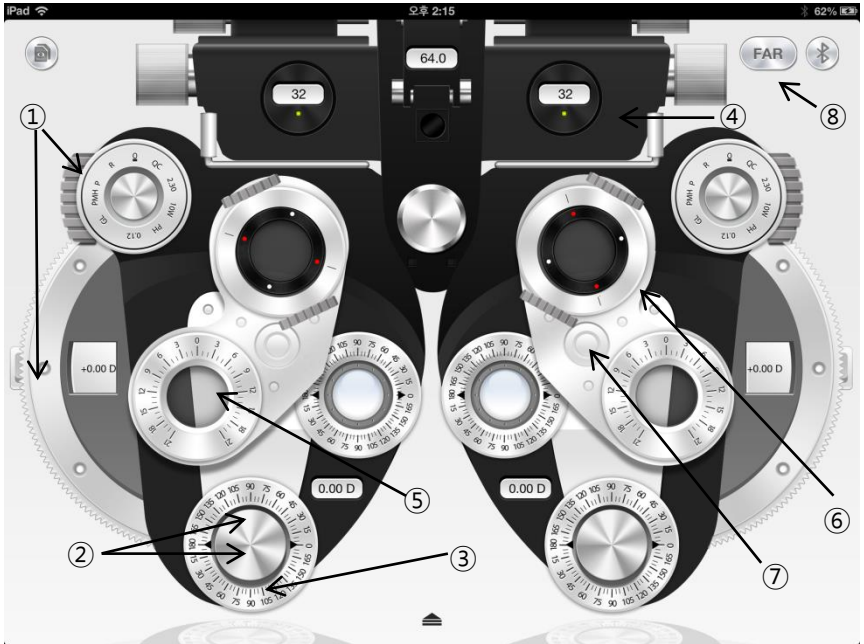
8. Manual Mode Control

Smart DR13 provides Manual mode that can deliver realistic experience to operators who previously use only manual phoropter and unfamiliar with digital refractor. On this article, you can learn methods of controlling data on manual phoropter mode.



[Fig 29] Manual Mode Screen

8-1. Control method of each data



[Fig 30] Manual Mode Screen

- ① Control SPH: You can control the sphere power by tapping or swiping the wheel with sphere wheel or aperture control button on both sides. Moving strong sphere control is available by tapping upper or lower side of aperture control lens button
- ② Control CYL: You can control cylinder power by tapping upper or lower side of the cylinder lens dials button (inner knob) on the bottom of the screen.

- ③ Control AXIS: You can control Axis by turning the cylinder axis rotation sleeve button (outer knob) clockwise or counterclockwise, keeping on touching the button.
- ④ Control PD distance: You can adjust PD distance by swiping right or left on the area of convergence levers.
- ⑤ Control Risley Prism: You can control rotary prism power after tapping prism lens window and then tapping upper or lower side of prism button. BU/BD mode or BI/BO mode can be changed by tapping lens window while the lens still set.
- ⑥ Control Jackson Cross cylinder: Please refer to ⑤. Tap the JCC lens window and set the lens. You can rotate the lens and control cylinder axis in same way to ③ control Axis.
- ⑦ You can reset the lens by tapping the circle of joint when Risley prism or Jackson cross set.
- ⑧ Control Convergence lever: You can set all near tests by tapping Near/Far button on the top right.

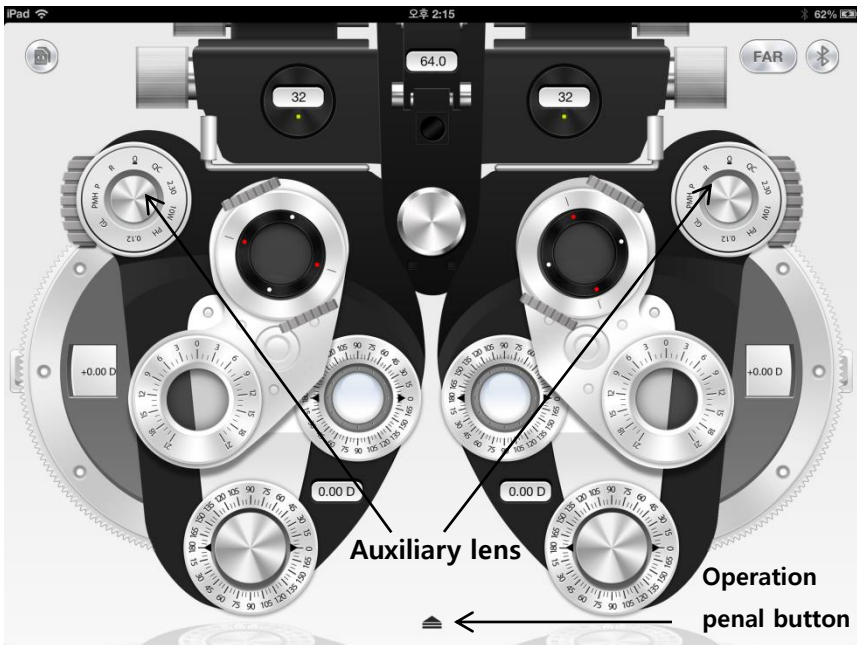


[Fig 31] Set the Risley prism (left) and the Jackson cross cylinder (Right)

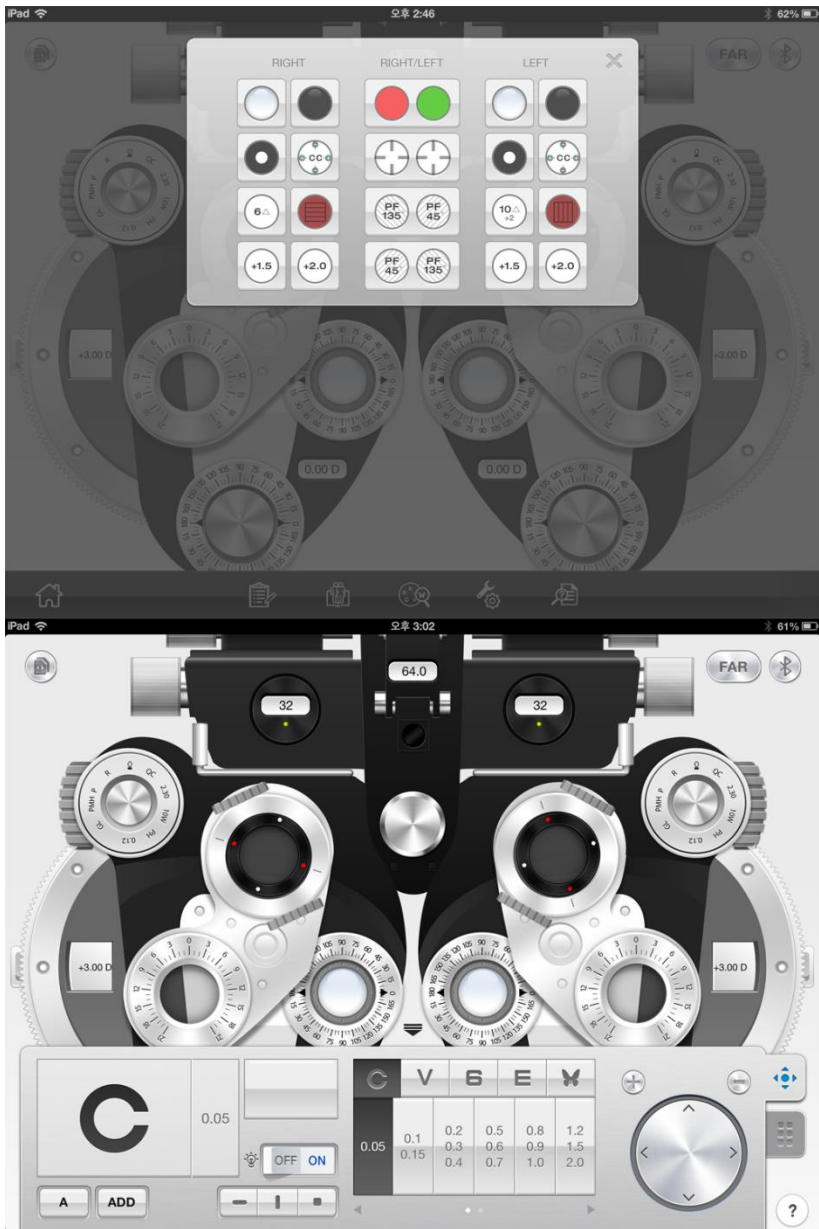
8-2. Use of Auxiliary lens and operation penal of CP

You can select the auxiliary lens by tapping the inner dial area of aperture control and then the auxiliary lens window appears.

Operation penal of CP appears when you tap the triangle-shaped button on the lower side. If you tap the button again, the operation penal will disappear below.



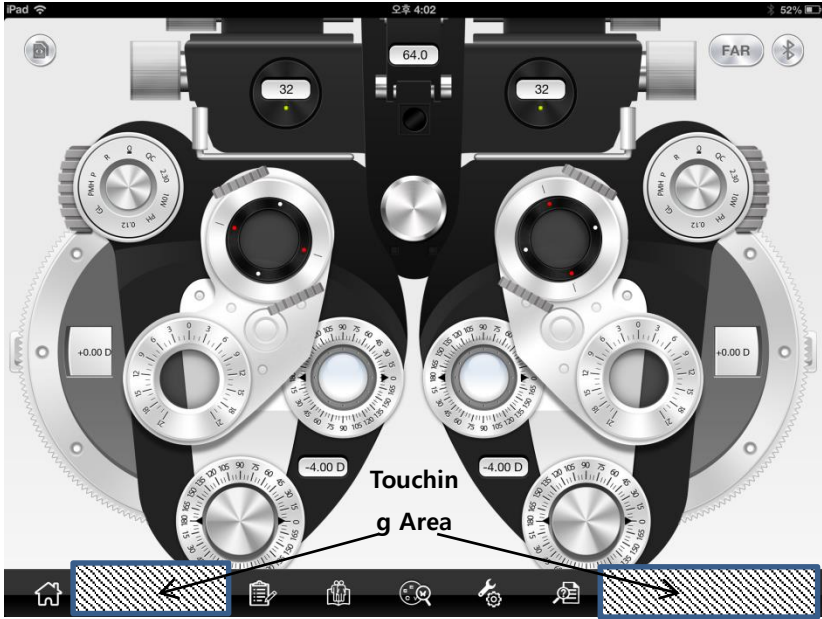
[Fig 32] Select the auxiliary lens and CP Operation penal button



[Fig 33] Pop-up selecting Auxiliary lens and CP Operation penal

8-3. Open the Manu Bar

Manu bar is hidden at the lower side for using wider screen. If you tap the both sides of the bottom, the menu bar appears or disappears.

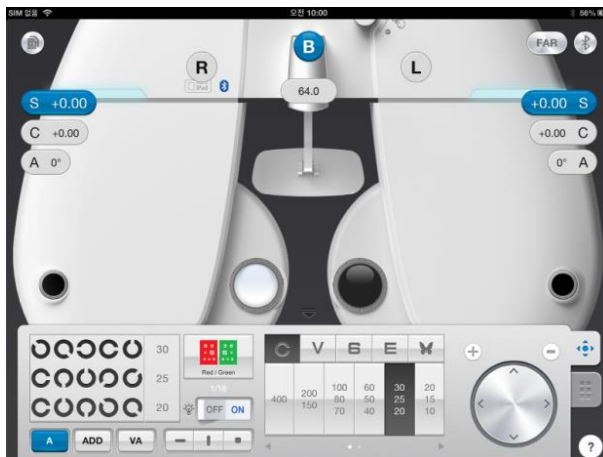


9. Basic Program and Functions

DR 13 allows a more convenience and more prompt visual acuity test with a System-defined program, 5 User-defined programs and maximum 30 steps. Various tests are available through the system-defined program of DR 13. Therefore, on the chapter, let's go through the System-Defined Program from beginning to end, and grasp DR basic operation and its running method at the same time.

9-1. Start System-Defined Basic Program

Power on the junction box of DR 13 and wait until the system initialization is over. When you check the Bluetooth connection on iPad App, tap the operation panel icon. By touching [A] icon on the bottom left side for a while, you can choose a Set program. [STANDARD] has System-Defined Program arranged. On this button, the name of setting program is indicated. Under the window of the next chart, a indication of "current step / total step" appear in numbers. To switch to another step, either swipe left/right over the chart window or tap the next chart.



[Fig 34] Select and Run STANDARD Program

9-1-1. Adjustment of the SPH-CYL-AXIS Value (Right)

Step 1 of the System-Defined Program is basically to adjust the value of SPH-CYL-AXIS for right eye. When step 1 start, [S] and [R] button are selected automatically and the test of right eye is started. To adjust SPH fit for the patient's statue, you can tap "+/-" button or turn the dial on the lower right end of operation panel, or swipe up and down over the right or left part of screen. With these methods, you can adjust the CYL or AXIS value on selecting [C] or [A] button. After all the adjustment is over and the best vision of the patient's Monocular comes out, go on to the next step.



[Fig 35] Adjustment of the SPH-CYL-AXIS Value

9-1-2. Red/Green Balance Test for Monocular

The 2nd step of the System-Defined Program is to revise the value of SPH for the right eye more elaborately, based on the result of 1st step SPH-CYL-AXIS test. After questioning the patient with which letter does he sees more clearly, between the letter in green background and red background respectively. When he says the letter in green background is clearer, turn the dial in + direction (counterclockwise) because that is over revised. While one in the red background in – direction (clockwise), because that is not revised. Continue this until the patient says that he sees both letters with similar clarity.



[Fig 36] Red/Green Balance Test for Monocular

9-1-3. Cross Cylinder Test with Dots Chart (AXIS)

The 4th step of the System-Defined Program is to revise the value of AXIS for the left eye more elaborately, based on the result of 1st step SPH-CYL-AXIS test. In case of Jackson Cross Cylinder Test, ask the patient with which eye he looks more clearly, while pressing number [1] and [2] buttons alternately. When he says number [1], turn the dial in + direction (counterclockwise), while number [2] in – direction (clockwise). Continue this until the patient answers that he sees both with similar clarity.



[Fig 37] Cross Cylinder Test (AXIS)

9-1-4. Cross Cylinder Test with Dots Chart (CYL)

The 3rd step of the System-Defined Program is to revise the value of CYL for the right eye more elaborately, based on the result of 1st step SPH-CYL-AXIS test. In case of Jackson Cross Cylinder Test, ask the patient with which eye he looks more clearly, while pressing number [1] and [2] buttons alternately. When he says number [1], turn the dial in + direction (counterclockwise), while number [2] in - direction (clockwise.) Continue this until the patient answers that he sees both with similar clarity.



[Fig 38] Cross Cylinder Test (CYL)

9-1-5. Check the Power of Glasses for Right Eye

After the test of right eye is over, check again the power of glasses for right eye. If necessary, use a mask for the test.



[Fig 39] Check the Power of Glasses for Right Eye

9-1-6. Adjustment of the SPH-CYL-AXIS Value (Left)

6th step of the System-Defined Program is basically to adjust the value of SPH-CYL-AXIS for left eye.



[Fig 40] Adjustment of the SPH-CYL-AXIS Value (Left)

9-1-7. Cross Cylinder Test with Dots Chart (AXIS)

7th step of the System-Defined Program is to revise the value of AXIS for the left eye more elaborately, based on the result of 6th step SPH-CYL-AXIS test. Please refer to the article 9-1-3 Cross Cylinder Test Dots Chart (AXIS) for a detail explanation.



[Fig 41] Cross Cylinder Test (AXIS)

9-1-8. Cross Cylinder Test with Dots Chart (CYL)

8th step of the System-Defined Program is to revise the value of CYL for the left eye more elaborately, based on the result of 6th step SPH-CYL-AXIS test. Please refer to the article 9-1-4 Cross Cylinder Test Dots Chart (CYL) for a detail explanation.



[Fig 42] Cross Cylinder Test (CYL)

9-1-9. Red/Green Balance Test for Monocular

9th step of the System-Defined Program is to revise the value of SPH for the left eye more elaborately, based on the result of 6th step SPH-CYL-AXIS test. Please refer to the article 9-1-9 Red/Green Balance Test for Monocular for a detail explanation.



[Fig 43] Red/Green Balance Test for Monocular

9-1-10. Check the Power of Glasses for Left Eye

After the test of left eye is over, check again the power of glasses for left eye. If necessary, use a mask for the test.



[Fig 44] Check the Power of Glasses for Left Eye

9-1-11. Check the Power of Glasses for the Binocular

After the tests of Binocular are over, check again the power of glasses for Binocular. If necessary, use a mask for the test.



[Fig 45] Check the Power of Glasses for the Binocular

9-1-12. Far Distance Horizontal/Vertical Unequal Coincidence (Aniseikonia)

Process a test using Horizontal/Vertical Unequal Coincidence (Aniseikonia) chart in the middle of binocular visual acuity test. Test Heterophoria following the guidance, and do Coincidence (Aniseikonia) Test if necessary, and then record the result. Please refer to the article 10-14. Horizontal Coincidence(Aniseikonia) Test and 10-15. Vertical Coincidence (Aniseikonia) Test, for a detail explanation.



[Fig 46] Far Distance Horizontal/Vertical Unequal Coincidence

9-1-13. Near Distance Cross Grid Test

Check the controlling power on Near Distance Mode by Cross Grid. Add or deduct the value of ADD following the guidance. Please refer to the article 10-25 Near Distance Addition Test Using Cross Grid (Near ADD) for detail information.



[Fig 47] Near Distance Cross Grid Test

9-1-14. Near Vision Test with Addition (Near VA with ADD)

Test the Near Vision with Addition. Please refer to the article 10-24 Near Vision with ADD, for detail information.



[Fig 48] Near Distance Cross Grid Test

9-1-15. Near Vertical Von Graefe Test

Test the Near Vertical Von Graefe. Test Heterophoria following the guidance. Please refer to the article 10-13 Vertical Von Graefe Test for detail information.



[Fig 49] Near Vertical Von Graefe Test

9-1-16. Near Horizontal Von Graefe Test

Test the Near Horizontal Von Graefe. Test Heterophoria following the guidance. Please refer to the article 10-12 Horizontal Von Graefe Test for detail information.



[Fig 50] Near Horizontal Von Graefe Test

10. Unit Test

10-1. Cylinder Axis Test

- Purpose: Obtain maximum revised circumference degrees by 30 degrees' unit for Monocular, using Clock Dial, Subjective test.
- Chart: Clock Dial
- Auxiliary Lens: None
- Objective: All the lines must be seen as equally.
- Operation Sequence
 1. Tap [R] or [L] button to choose the eye for test.



2. Tap Clock Dial button to change it into distorted vision test mode.



3. Tap [S] button to change it to Spherical Power mode, and add Fogging until the line of Clock Dials seen equally.
4. Question the patient like, "In which hour direction of line is seen the thickest or the darkest?"
5. When the patient says all the lines are seen equally, he is determined not to have distorted vision. If a certain bar is seen thicker, multiply 30 by the number seen by that bar, and then tap [A] button to fix the distorted vision test.

10-2. Cylinder Power Test

- Purpose: Obtain maximum revised circumference degrees for monocular, using Clock Dial, Subjective test.
- Chart: Clock Dial
- Auxiliary Lens: None
- Objective: All the lines must be seen as equally.
- Operation Sequence
 1. This test must be performed only after fixing the cylinder axis
 2. Tap [R] or [L] button to choose the eye for test.



3. Tap Clock Dial button to change it into distorted vision test mode.



4. Tap [C] button to change Cylinder Power Mode.
5. Turn the dial in (-) direction, until all the lines are seen equally.

When the location of the line which is seen the thickest is changed, the axis must be adjusted.

 - When the thickest seen line moves counterclockwise, deduct the AXIS value.
 - When the thickest seen line moves clockwise, add the AXIS value.

10-3. (Monocular) Red/Green Test

- Purpose: Check the maximum revised Spherical Refractive Power for monocular by Red/Green Test Chart, using the principle of chromatic aberration, Subjective test.
- Chart: Red/Green Chart
- Auxiliary Lens: None
- Objective: Letters on Red and Green Charts must be seen equally and clearly.
- Operation Sequence

1. Tap [R] or [L] button to choose the eye for test.



2. Tap Red/Green Chart button to change it into Red/Green Test Mode.



3. Question the patient that which of green and red is seen more clearly or more thickly, and check whether both of them are seen equally.
4. If red one is seen more clearly or both of them are seen clearly, try to add $-0.25D$.
5. If green one is seen more clearly, try to add $+0.25D$.
6. Repeat the above 4 and 5 until the green one is seen more clearly with minimum (-) refractive power, or add until both are seen equally.
7. Remove Red/Green Chart and check the visual acuity again.
 - If the red letter is seen clearly, turn the dial clockwise (in - direction.)
 - If the green letter is seen clearly, turn the dial counterclockwise (in + direction.)

※ Attention

- In case of distorted vision, this test is not available for the normal visual acuity above 1.0 or an accurate visual acuity test.
- Sometimes a patient does not respond to this test. In some cases, a patient cannot compare the black letters in red and green background respectively, and cannot react following his preference.
- If a corrected vision of a patient is 1.0, you must ask him whether he is able to see well "29 in red and 92 in green." In case a corrected vision is low, ask him to read the bigger letter on the upper side.

10-4. Jackson Cross Cylinder Test

- Purpose: Subjective test, revise maximum circumference refractive power and axis for Monocular, using Jackson Cross Cylinder.
- Chart: Dot-Group Chart
- Auxiliary Lens: Cross Cylinder Lens (0.25 / 0.50)
- Objective: The Dot-Group Chart must be seen as same, although the Cross Cylinder is crossed.
- Operation Sequence
 1. Tap (R) or (L) to choose the eye for test.



2. Tap Dot-Group Chart button to move on to Cross Cylinder Test Mode.



3. Select Auxiliary Lens on option controller
4. When you choose between [CC 0.25] and [CC 0.50], [1] and [2] button appear at the bottom.

5. Adjust the value of C and A until both of letters become clear, tapping number [1] and number [2].

10-5. Dual Cross Cylinder Test

- Purpose: Subjective test, revise maximum circumference refractive power and axis for Monocular, using Dual Cross Cylinder.
- Chart: Dot-Group Chart
- Auxiliary Lens: Dual Cross Cylinder Lens (DUAL)
- Objective: Separated two Dot-Group Chart must be seen equally.
- Operation Sequence

1. Tap (R) or (L) button to choose the eye for test.



2. Tap Dot-Group Chart to move on to Cross Cylinder Mode.
3. Select the option control tap, and tap [CC dual] button to change it into Dual Cross Cylinder Mode.




4. From the patient's view, the Dot-Group Chart is separately shown divided as two.
 - If the left one is seen clearly, turn the dial counterclockwise (+ direction.)
 - If the right one is seen clearly, turn the dial clockwise (- direction.)
 - If the patient says there is no difference, finish the test.

10-6. Horizontal Maddox Rod Test

- Purpose: Subjective test do Horizontal Heterophoria in the way of Maddox Rod.
- Chart: Maddox Chart
- Auxiliary Lens: Horizontal Maddox for right eye, Rotating Prism for left eye.
- Objective: The vertical bar seen from the right eye and the Maddox Chart seen from the left eye must be united.
- Operation Sequence




1. Tap Maddox Chart  to choose Horizontal Maddox Rod Test Mode.
2. At this time, tap [Horizontal Prism] button to change it into Horizontal Maddox Rod Test Mode.
3. Turn the dial until the line and the dot unite as one.
 - If the line locates on the right side of the dot, turn the dial clockwise. (- direction) (Esophoria)
 - If the line locates on the left side of the dot, turn the dial counterclockwise (+ direction.) (Exophoria)
 - If the line and the dot are seen untidily, that is an orthophoria.

10-7. Vertical Maddox Rod Test

- Purpose: Subjective test, to the Vertical Heterophoria in the way of Maddox Rod.
- Chart: Maddox Chart
- Auxiliary Lens: Rotating Prism for right eye, Vertical Maddox for left eye.
- Objective: The horizontal bar seen with the left eye and the Maddox Chart seen with the right eye must be united.
- Operation Sequence




1. Tap Maddox Chart  to choose the Horizontal Maddox Rod Test Mode
2. At this time, tap [Vertical Prism] button to change it into Vertical Maddox Rod Test Mode.
3. Turn the dial until the line and the dot are united as one.
 - If the line locates over the dot, turn the dial clockwise (- direction.) (Hypophoria)
 - If the line locates under the dot, turn the dial counterclockwise (+ direction.) (Hyperphoria)
 - If the line and the dot are seen as united, that is an orthophoria.

10-8. Binocular Balance Test at Polarized Light

- Purpose: Subjective test, keep the binocular balance against maximum revised value of Monocular
- Chart: Binocular Balance Chart at Polarized Light
- Auxiliary Lens: Polarized Light Filter with 135 degrees for right eye, and with 45 degrees for left eye.
- Objective: The upper line seen with the right eye and the lower line seen with the left eye must be seen equally and clearly.
- Operation Sequence



1. Tap  the Chart of Binocular Balance Test at Polarized Light, to enter the Binocular Balance Test at Polarized Light Mode.
2. Tap [B], the Binocular button, to open Binocular field and add Fogging to about 0.5D, and then loosen the interrupted accommodation.
3. Ask the patient which line between the upper and lower is clearer.
 - If the upper line is seen clearly, press [R] button and turn the dial counterclockwise, to increase the right side SPH value.
 - If the lower line is seen clearly, press [L] button and turn the dial clockwise, to increase the left side SPH value.
 - When both of upper and lower sheet are seen equally and clearly, finish the test.

※ Attention

- If a corrected vision is below 0.4, sometimes it is hard to discern because the Chart is seen blurred. At this time, cover the more blurry side firstly, and then open it again. If there is any difference in the

patient's vision, his Binocular have function, while no difference no function.

- If a patient has a dominant eye and the difference is more than 0.25D, the dominant eye sees well. Therefore, you can skip this test.

10-9. Polarized Light Red/Green Test

- Purpose: Subjective test, keep the balance of Monocular and Binocular simultaneously against the maximum revised value for single.
- Chart: Polarized Light Red / Green Chart
- Auxiliary Lens: Polarized Filter with 135 degrees for right eye, and with 45 degrees for left eye
- Objective: The upper line seen with the right eye and the lower line seen with the left eye must be seen equally well. In addition to, in the upper line seen with the right eye, the letters in red and green background respectively, must be seen as the same, as well as the letters in the red and green backgrounds in the lower line seen with the left eye.
- Operation Sequence
 1. Enter to the test mode by tapping Polarized Red / Green Test Chart.



2. Question the patient, which one he can see more clearly, between the red letter and green letter upside.
3. Tap [R] button and turn the dial in clockwise (- direction,) if the left letter is clear, while in counterclockwise (+ direction) in case of right one.
4. Tap [L] button and turn the dial in clockwise (- direction,) if the left letter is clear, while in counterclockwise (+ direction) in case of right one.

5. Question the patient, which one he can see more clearly, between the red letter downside and the green letter upside.
6. Tap [R] and turn the dial in clockwise (- direction,) if the left letter is clear, while in counterclockwise (+ direction) in case of right one.
7. Tap [L] and turn the dial in clockwise (- direction,) if the left letter is clear, while in counterclockwise (+ direction) in case of right one.
8. Balance Binocular.
9. If the upper line is seen clearly, tap [R] and turn the dial counterclockwise (+ direction) to increase the value of the right side SPH.
10. If the lower line is seen clearly, tap [L] and turn the dial counterclockwise (+ direction) to increase the value of the left side SPH.
11. Repeat this until both of upper and lower lines are seen clearly.

10-10. Worth 4 Dots test






- Purpose: Operate suppression test during subjective test. You can find out whether there is internal/external Heterophoria during this test.
- Chart: Worth 4 Dot chart
- Auxiliary lens: Red filter (for right eye), green filter (for left eye)
- Objective: Checkup how many dots are seen. In normal case, it is 4.
- Operation sequence
 1. Press worth 4 Dot chart to enter suppression test mode.



2. Ask the patient how many lights he sees.
 - If he says 4dots, the patient's fusion is normal.
 - If he says 2dots, the patient is using right eye only and the

suppression is occurring on left eye.

- If he says 3dots, the patient is using left eye only and the suppression is occurring on right eye.
- If he sees 5 dots, it is Diplopia. If the red dot is on the right side of green dot, the patient has internal Strabismus/internal Heterophoria. While the red dot in on the left side of green dot, he has external Strabismus/external Heterophoria.
- In case that the patient see5 dots, and 3 dots and 2 dots appear alternatively, it is alternative suppression of right/left eye.

Chart shape	Meaning	Description
	Fusion	2 green dots on left/right side, 1 red dot (upside), and the dot (bottom side) are seen alternatively, or seen as white or as light red, these cases are OK.
	Right eye Suppression	Seen 3 green dots only, it is right eye suppression.
	Left eye Suppression	Seen 2 red dots only, it is left eye suppression
	Heterophoria	Seen 2 red dots and 3 green dots, it is Heterophoria
	Alternative Suppression	What the patient sees is unstable and 2red dots and 3 green dots appear alternatively, it is alternative Suppression

10-11. Schober Test





- Purpose: Operate Heterophoria test in a way of Schober during subjective test.
- Chart: Schober chart
- Auxiliary Lens: Red filter (for right eye), Green filter (for left eye), Rotary prism (for binocular)
- Objective: The cross seen with the right eye must be in the center of the circle seen with the left eye.
- Operation sequence
 1. Ask the patient, "Do the red cross locate in the circle?" If the answer is 'Yes', there is no Heterophoria. If the answer is "No", it is Heterophoria so go on to next test.
 2. Question the patient as following;

"Is the cross on the left side or on the right side of the circle?"

 - On the left side: External Heterophoria, Turn the dial counterclockwise (+ direction) to increase BI prism, until the cross located in the center of circle.
 - On the right side: Internal Heterophoria, Turn the dial clockwise (- direction) to increase BO prism, until the cross located in the center of circle.
 3. Question the patient as following;

"Is the cross on upside or bottom side of circle?"

 - On upside: Upside Heterophoria of left eye, press vertical prism button and turn the dial clockwise (- direction) until the cross located in the center of circle.
 - On bottom side: Upside Heterophoria of right eye, press vertical prism button and turn the dial counterclockwise (+direction) until the cross located in the center of circle.
 4. After the test, press [OK] button to save the result, or press [CANCEL] button to delete the result.

Chart shape	Heterophoria type	Correction of Heterophoria
	Esophoria	Turn the dial clockwise (-direction) to increase BO prism, until the cross located in the center of circle.
	Exophoria	Turn the dial counterclockwise (+direction) to increase BI prism, until the cross located in the center of circle.
	Left Hyperphoria	Press vertical prism button and turn the dial clockwise (-direction) until the cross located in the center of circle.
	Right Hyperphoria	Press vertical prism button and turn the dial counterclockwise (+direction) until the cross located in the center of circle.

10-12. Horizontal Von Graefe Test

- Purpose: Operate horizontal heterophoria test in a way of Von Graefe during subjective test.
- Chart: Horizontal Von Graefe chart
- Auxiliary Lens: 6 Δ BU prism for right eye, rotary prism for left eye
- Objective: The upper vertical line and the lower vertical line should be arranged as one straight line.
- Operation sequence
 1. Select horizontal Von Graefe chart.



2. After entering in horizontal Heterophoria test mode, ask the patient whether the vertical bars are located as one straight line.
If the answer is yes, there is no heterophoria
If the answer is no, it is heterophoria.
3. In case of heterophoria, ask the patient which vertical bar is more on the left.
 - In case that upper vertical bar is more on the left: "Esophoria"
Turn the dial clockwise to increase BO prism, until the vertical bars are arranged as one straight line.
 - In case that lower vertical bar is more on the left : "Exophoria"
Turn the dial counterclockwise to increase BI prism, until the vertical bars are arranged as one straight line.
4. When the test is over, press [OK] button to save the result, or press [CANCEL] button to delete the result.

10-13. Vertical Von Graefe Test

- Purpose: Operate vertical Heterophoria test in a way of Von Graefe during subjective test.
- Chart: Vertical Von Graefe chart
- Auxiliary Lens: Rotary prism for right eye, 10Δ BU prism for left eye
- Objective: Left horizontal line and right horizontal line should be arranged as one straight line in the middle.
- Operation sequence



1. Select vertical Von Graefe chart.
2. After entering in vertical Heterophoria test mode, ask the patient whether horizontal bars are located as one straight line.
If the answer is yes, there is no Heterophoria.
If the answer is no, it is Heterophoria.
3. In case of Heterophoria, ask the patient whether the right-bar is higher or the left-bar is higher than another one.
 - In case that right bar is lower: "Right Hyperphoria". Turn the dial counterclockwise to increase BD prism, until two horizontal bars are arranged as one straight line.
 - In case that left bar is lower: "Left Hyperphoria". Turn the dial clockwise to increase BU prism, until two horizontal bars are arranged as one straight line.
4. When the test is over, press [OK] button to save the result, or press [CANCEL] button to delete the result.

10-14. Horizontal Coincidence (Aniseikonia) Test

- Purpose: Operate Aniseikonia and horizontal Heterophoria test by coincidence (Aniseikonia) chart during subjective test.
- Chart: Horizontal coincidence (Aniseikonia) chart
- Auxiliary Lens: Polarized filter with 135 degrees (for right eye), and 45 degrees (for left eye)
- Objective: The upper half of the square seen with the right eye and the lower half of the square seen with the left eye must be arranged as a regular square, and the fixation should be the center of square.
- Operation sequence
 1. Press Aniseikonia chart to enter horizontal Heterophoria test mode.



2. Ask the patient whether he can see the square and dot, and if yes, ask whether upper/lower half of square are arranged straightly.
 - In case that the upper half of square is more on right side than the lower half of square: "Esophoria", turn the dial clockwise to increase BO prism, until the upper/lower half of square is arranged straightly.
 - In case that the upper half of square is more on left side than the lower half of square: "Exophoria", turn the dial counterclockwise to increase BI prism, until the upper/lower half of square is arranged straightly.
3. When the test is over, press [OK] button to save the result, or press [CANCEL] button to delete the result.
4. If necessary, ask the patient additional question as following
 - "Is the dot located in the center of square?", "two half of square have same size?" If the size is same, there is no

coincidence. Press [OK] button. If the size is different, it is coincidence. Press [NG] button.

10-15. Vertical Coincidence (Aniseikonia) Test

- Purpose: Operate Aniseikonia and vertical Heterophoria with coincidence chart during subjective test.
- Chart: Vertical Coincidence (Aniseikonia) chart
- Auxiliary Lens: Polarized filter with 135 degrees (for right eye), and 45degrees (for left eye)
- Objective: The right half of the square seen with right eye and the left half of the square seen with the left eye must be arranged as a regular square, and the fixation should be the center of square.
- Operation sequence
 1. Press coincidence (Aniseikonia) chart to enter horizontal Heterophoria mode.




2. Ask the patient whether he can see the square chart, if yes, ask whether that up/down side of square chart is arranged straightly.
 - If the left half square chart is tilted toward upside: "Upside Heterophoria of right eye". Turn the dial counterclockwise to BD prism, until the left and right half square are arranged straightly.
 - If the right half square chart is tilted toward upside: "Upside Heterophoria of left eye". Turn the dial clockwise to increase PU prism, until the left and the right half square are arranged straightly.
3. As a final check, ask the patient whether he can see the dot in the middle and the square chart, and whether the size of upper/lower square is of same.
 - If the size of the left/right square is same, there is no Aniseikonia. Press 'OK' button.

- If the size of the left/right square is different, it is Aniseikonia. Press 'NG' button.

10-16. Phoria Test without Fixation







- Purpose: Operate Heterophoria test in a way of Pola Cross without Fixation during subjective test.
- Chart: Polarized Cross Chart without Fixation
- Auxiliary Lens: Polarized filter with 135 degrees (for right eye), and 45 degrees (for left eye)
- Objective: The vertical bar seen with the right eye and the horizontal bar seen with the left eye are united and seen as cross.
- Operation sequence



1. Press Pola Cross chart without Fixation  to enter Heterophoria mode.
2. Ask the patient, "Does it seem like a cross?"
 - If the answer is "Yes", there is no Heterophoria. Test done.
 - If the answer is "No", it is Heterophoria. Go on to the next test.
3. Start with horizontal heterophoria test. Ask the patient as following.
4. "Does the (|) shape located on the left side of (--) shape, or the right side of it?"
 - Located on left: "Exophoria". Turn the dial counterclockwise to increase BI prism. When the cross is seen well, finish the test.
 - Located on right: "Esophoria". Turn the dial clockwise to increase BO prism. When the cross is seen well, finish the test.
5. After horizontal heterophoria test, start the vertical heterophoria test. Ask the patient as following.
6. "Does the (|) shape located upside of the (--) shape, or downside

of it?


- Located upside: "Left Hyperphoria". Turn the dial clockwise to increase BU prism. When the cross is seen well, finish the test.
- Located downside: "Right Hyperphoria". Turn the dial counterclockwise to increase BD prism. When the cross is seen well, finish the test.

Chart Shape	Heterophoria Type	Description
	Esophoria	1. Turn the dial clockwise until the vertical chart of the cross becomes a cross shape, to increase BO prism.
	Exophoria	2. Turn the dial clockwise until the vertical chart of the cross becomes a cross shape, to increase BI prism.
	Left.Hyperphoria (Right.Hypophoria)	3. On vertical prism mode, turn the dial clockwise until the horizontal bar came on middle of vertical bar
	Right.Hyperphoria (Left.Hypophoria)	4. On vertical prism mode, turn the dial counterclockwise until the horizontal bar came on middle of vertical bar.
	Exophoria + Right.Hyperphoria	5. Correct the horizontal heterophoria like 2), and correct the vertical heterophoria like 4).
	Esophoria + Left.Hyperphoria	6. Correct the horizontal heterophoria like 1), and correct the vertical heterophoria like 3).


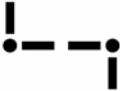






10-17. Phoria Test with Fixation

- Purpose: Operate Heterophoria test in a way of Pola Cross with Fixation during subjective test.
- Chart: Polarized Cross with Fixation
- Auxiliary Lens: Polarized filter with 134 degrees (for right eye), and 45 degrees (for left eye)
- Objective: The cross on the right upper side in 2 directions seen with the right eye and the cross on the left lower side in 2 directions seen with the left eye are united and seen as one.
- Operation sequence



1. Press Pola Cross chart with Fixation  to enter Heterophoria test mode.
2. Ask the patient, "Does it seem like a cross?"
 - If the answer is "Yes", there is no Heterophoria. Test done.
 - If the answer is "No", it is Heterophoria. Go on the next test.
3. Start with horizontal Heterophoria. Ask the patient as following.
4. Does the "└" shape located on the left side of the "┐" shape, or the right side of it?
 - Located on left: "Exophoria". Turn the dial counterclockwise to increase BI prism. When the cross is seen well, finish the test.
 - Located on right: "Esophoria". Turn the dial clockwise to increase BO prism. When the cross is seen well, finish the test.
5. After horizontal Heterophoria test, start with vertical Heterophoria. Ask the patient as following.
6. Does the "┌" shape located upside of the "└" shape, or downside of it?
 - Located upside: "Left Hyperphoria". Turn the dial clockwise to increase BU prism. When the cross is seen well, finish the test.


- Located downside: "Right Hyperphoria". Turn the dial counterclockwise to increase BD prism. When the cross is seen well, finish the test.

Chart shape	Heterophoria Type	Description
	Esophoria	1. Turn the dial clockwise until the vertical chart of the cross becomes a cross shape, to increase BO prism.
	Exophoria	2. Turn the dial clockwise until the vertical chart of the cross becomes a cross shape, to increase BI prism.
	Left. Hyperphoria	3. Turn the dial clockwise until the horizontal cross chart becomes a cross shape.
	Right. Hyperphoria	4. Press [BDBU]. Turn the dial until the horizontal cross chart becomes a cross shape.
	Esophoria + Right. Hyperphoria	5. Correct the horizontal heterophoria like 1), and correct the vertical heterophoria like 4).
	Esophoria + Left. Hyperphoria	6. Correct the horizontal heterophoria like 1), and correct the vertical heterophoria like 4).
	Exophoria + Right. Hyperphoria	7. Correct the horizontal heterophoria like 2), and correct the vertical heterophoria like 4).
	Exophoria + Left. Hyperphoria	8. Correct the horizontal heterophoria like 2), and correct the vertical heterophoria like 3).

10-18. Minute Stereo Acuity Test

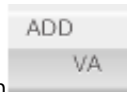
- Purpose: operate the minute stereo acuity test during subjective test.
- Chart: Minute Stereo Vision Chart
- Auxiliary Lens: polarized filter with 135 degree (for right eye), and polarized filter with 45 degree (for left eye)
- Objective: With fixation as a center, it must be seen as rotating clockwise and as embossed.
- Operation sequence

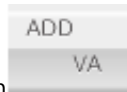


1. Press minute stereo vision chart  and select minute stereo vision test mode.
2. Ask the patient, "How do you see the bars, with the fixation as a center, from 12 to, 3, 6 and 9 o'clock direction? (clockwise)
 - All the bars look like flat (including central fixation): The patient does not have the capability of stereo vision. Press 'NG' button.
 - The bars at 12 and 3 o'clock look like cubic: The patient can perceive to 1 arc minute. Press [1°] button and setup it.
 - The bars at 3 and 6 o'clock look like cubic: The patient can perceive to 2 arc minute. Press [2°] button and setup it.
 - The bars at 6 and 9 o'clock look like cubic: The patient can perceive to 4 arc minute. Press [4°] button and setup it.
 - The bars at 12 and central Fixation look like cubic: The patient can perceive to 10 arc minute. Press [10°] button and setup it.

10-19. Near Point of Convergence Test

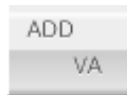
- Purpose: measure the minimum point on which the convergence is available.
- Chart: near point chart
- Auxiliary Lens: None
- Objective: Measure the value of BREAK and RECOVERY.
- Operation sequence

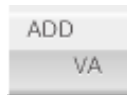


1. Press [ADD VA] button , and press [NPC] button on option controller to enter the near point convergence test mode.
2. Adjust the location of near point chart as the patient can verify it.
3. Moving near vision chart or ballpoint pen close to the patient, find out the point where the end of ballpoint pen or the chart is divided. And record the distance in 'BREAK' item
4. Vice versa, while pulling near vision chart or ballpoint pen away from the patient, find out the point where they are united as one. Record the distance in 'RECOVERY' item.

10-20. Near Point of Accommodation Test

- Purpose: measure the near point of accommodation during subjective test.
- Chart: Near Point Chart
- Auxiliary Lens: None
- Objective: Measure the near point of accommodation for left, right and binocular.
- Operation sequence



1. Press [ADD VA] button , and press [NPA] button on option controller to enter near point of accommodation test mode.
2. Adjust the location of near point chart as the patient can verify it.
3. Press [R], [B], [L] button to select the eye for test.
4. Moving near vision chart or ballpoint pen close to the patient, find out the point where the end of ballpoint pen or the chart is blurred. And record the distance in left, right and binocular.

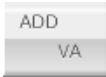
10-21. Negative Relative Accommodation Test

- Purpose: Measure the Accommodation with negative convergence during subjective test.
- Chart: Near Vision Chart
- Auxiliary Lens: None
- Objective: measure the value of BREAK and RECOVERY for left, right and binocular.
- Operation sequence



1. Press [ADD VA] button.
2. Adjust the location of near vision chart as the patient can verify it.
3. Press [R], [B], [L] button to select the eye for test.
4. On option control screen, press [NRA] button and then adjust the value of [BLUR] to find the blurred point.
5. Adjust the value of [RECOVERY] and find the clear point.
6. After the test, press [OK] to save.
7. If you want to clear the test result, press [CANCEL] or [x] button.

10-22. Positive Relative Accommodation

- Purpose: operate positive convergence accommodation test during subjective test.
- Chart: Near Vision Chart
- Auxiliary Lens: None
- Objective: Measure the value of BREAK and RECOVERY for left, right and binocular.
- Operation sequence
 1. Hang near vision chart on the bar.
 2. Change SPH value and search the blurred point.
 3. After finding blurred point, press [ADD VA] button  and [PRA] button on option controller.
 4. Input the value on [Blur] and touch [Save] button.
 5. Adjust SPH value and search the recovery point. Same as blur, input the value on [Recovery] and touch [Save] button.

10-23. Positive Relative Convergence

- Purpose: operate Positive Relative Convergence test during Subjective test
- Chart: Near Vision Chart
- Auxiliary Lens: None
- Objective: measure the value of BLUR, BREAK, and RECOVERY
- Operation sequence



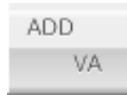
1. Select horizontal Von Graefe chart and then adjust ΔX value to search blurred point.
2. After finding blurred point, touch [PRC] button on option controller and then input the value on [Blur] and save it.
3. Change ΔX value again and search the break point. After finding, input the value on [Break] and save it.
4. Readjust ΔX value in reverse to search recovery point. After finding, input the value on [Recovery] and save it.

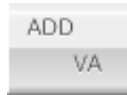
10-24. Near Vision with Addition

- Purpose: Test of Near Vision with Addition
- Chart: Near Vision Chart
- Auxiliary Lens: None
- Objective: Test the Near Vision with Addition, for left, right and binocular.
- Operation Sequence
 1. Press R/B/L buttons to select the eye for test.
 2. Press 'ADD-VA' button. (Lower the Near Vision Chart.)
 3. ADD-VA data controller is appeared.
 4. Adjust the value by dial or finger gesture and then proceed the test.

10-25. Near Addition Test using Cross Grid (Near ADD)

- Purpose: Correct Near Addition according to Accommodation, using Cross Grid.
- Chart: Near Vision Chart (Cross Grid)
- Auxiliary Lens : None
- Objective: Make the clarity and thickness of horizontal/vertical lines equally, similar with Far Vision Cross Grid Test.
- Operation Sequence



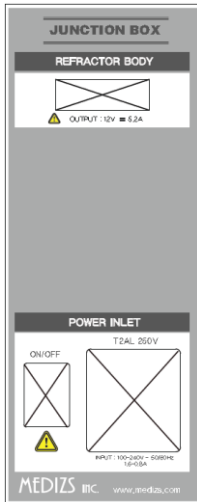
1. Press [ADD #] button  to drop the Near Vision Cross Grid chart at the place of about 40cm.
2. Press R/B/L button to select the eye for test.
3. Adjust the ADD value until the thickness or clarity of horizontal/vertical line becomes equal.
 - When the vertical line is seen clearly, turn the dial clockwise (- direction)
 - When the horizontal line is seen clearly, turn the dial counterclockwise (+ direction.)

11. Service Information and Maintenance

If any problems that you cannot solve has caused, please contact the selling distributor. Referring name plate or system information on setup menu, please note below information to the distributor.

1. Information





- ◆ Model Name : DR13
- ◆ Serial Number: 7-digit characters indicated on the name plate
- ◆ Symptom: Please describe it in detail for prompt repair.

2. Spare part supplying for maintenance

Spare part of this instrument would be supplied for 6 years from the discontinuance of manufacturing.

Upon request, circuit diagrams, component part lists, descriptions, calibration instructions, or other information will be provided to assist service personnel to repair parts of the equipment that are designated by MEDIZS as repairable by service personnel.

3. Disposal of the instrument



This instrument incorporates a lithium battery, which may pollute the environment. Please contact a professional waste disposal company or distributor before disposing of the instrument. And the product which the life finishes (DR13, SMPS Junction Box) wishes to request a consultation to the selling agency.

4. Cleaning

- ◆ Basically, keep this instrument clean. Don't use volatile object, thinner or benzene, etc.
- ◆ Polish each part with a dry cloth containing detergent solution.

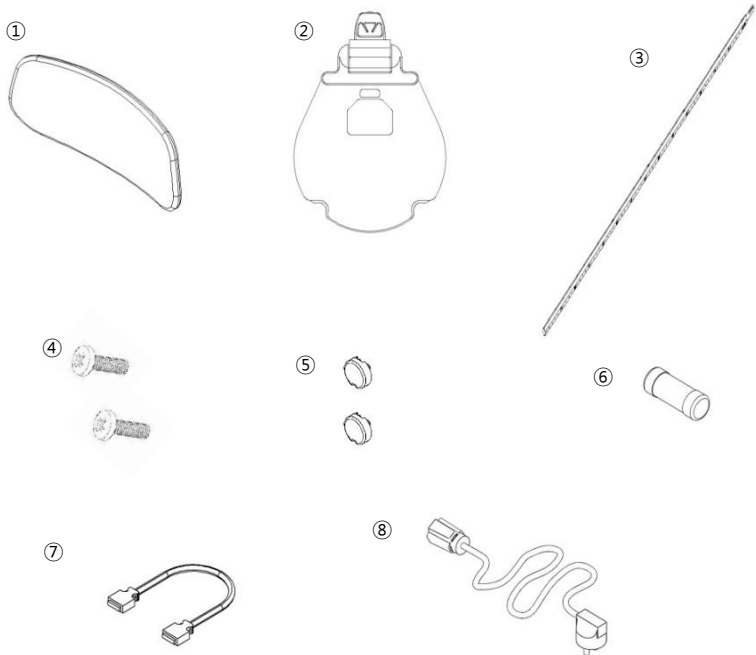
5. Environmental requirements.

- ◆ Operation : +10 to +40 °C, 30 to 75% r.h., 70 to 106 kPa
- ◆ Storage &Transportation : -10 to +55 °C, 10 to 95% r.h., 50 to 106 kPa

12. Specifications

Measurement Range	
Spherical Lens	<ul style="list-style-type: none"> -29.00 ~ +26.75D (0.12 / 0.25 / 0.5 / 1 / 2 / 3D increments) -19.00 ~ +16.75D (Cross cylinder, Prism)
Cylinder Lens	<ul style="list-style-type: none"> 0.00 ~ ±8.75D (0.25 / 5 / 1 / 2 / 3D increments)
Cylinder Axis	<ul style="list-style-type: none"> 0 ~ 180° (1 / 5 / 15 / 30 / 45° increments)
PD (Pupil Distance)	<ul style="list-style-type: none"> 48 ~ 80mm (In distance mode 0.5 / 1.0 mm increments) Near PD 50 ~ 74mm (Near working distance : 30~70cm)
Rotary Prism	<ul style="list-style-type: none"> 0 ~ 20△ (0.1 / 0.2 / 0.5 / 1 / 2△ increments)
Cross Cylinder Lens	<ul style="list-style-type: none"> ±0.25D, ±0.50D, ±0.25 Dual Cross Cylinder Lens
Retinoscope	<ul style="list-style-type: none"> +1.5D, +2.0D
Auxiliary Lenses	
Pin Hole Lens	Φ2mm
Moddox Rod	Right eye (Red, Horizontal), Left eye (Red, Vertical)
Red/Green Filter	Right eye (Red), Left eye (Green)
Polarizing Filter	Right eye (135°, 45°), Left eye (45°, 135°)
Split (dissociation) Prism	Right eye (6△BU), Left eye(10△BI)
Fixed Cross Cylinder Lens	±0.50D (Fixed with the Axis set at 90°)
Vision Field	40° (at VD: 12mm)
Dimensions	
Main Body	336(W) * 90(D) * 295/358 with bracket (H) mm / 4kg
Junction Box	92(W) * 32(D) * 61(H) mm / 500g
Power Supply	AC 100 ~ 240V, 50 / 60 Hz (Free Voltage)
Power Consumption	130VA
Controller	
iPAD All Products, iPAD mini	
Interface	Bluetooth

13. Components



Description	Quantity
1. Forehead Pedestal	1
2. Near Vision Chart	1
3. Near Vision Stick	1
4. Screw bolt	2
5. Screw cap	2
6. Fuse	1
7. Data cable	1
8. Power Cable	1