

**USER MANUAL  
REFRACTION SYSTEM**

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**Chronos**



# INTRODUCTION

Thank you for purchasing the TOPCON REFRACTION SYSTEM Chronos.

## **INTENDED USE / INDICATIONS FOR USE**

The Chronos is intended to measure the following items: the eyeball's spherical refractive power, cylindrical refractive power and cylinder axial angle and besides, the human eye's corneal curvature radius, principal meridian direction and corneal refractive power. The Chronos is also intended to perform the subjective refraction visual acuity test.

## **FEATURES**

This instrument has the following features:

- It is possible to measure the refractive power and corneal shape and perform subjective measurement for both eyes at the same time.
- Simultaneous auto-alignment for both eyes enables the operator to carry out measurement under the optimal condition.

## **PURPOSE OF THIS MANUAL**

This manual outlines the Chronos, including operating procedures, troubleshooting, maintenance and cleaning.

Before using the instrument, carefully read the "DISPLAYS AND SYMBOLS FOR SAFE USE" and the "GENERAL SAFETY INFORMATION" to familiarize yourself with the features of the Chronos and use it efficiently and safely.

Always keep this User Manual at hand.

This manual does not explain how to operate a personal computer (PC) and Microsoft Windows. It is made on the assumption that the customers have knowledge enough about a personal computer and Microsoft Windows.

For operating a personal computer and Microsoft Windows, refer to the manual of each equipment.

**CAUTION :** Federal law restricts this device to the sale by or on the order of a physician.



Chronos is a trademark of TOPCON CORPORATION.

Microsoft Windows is a registered trademark or trademark of the U.S. Microsoft Corporation in U.S. and other countries.

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1. No part of this manual may be copied or reprinted, in whole or in part, without prior written permission.
  2. The contents of this manual are subject to change without prior notice and without legal obligation.
  3. The contents of this manual are correct to the best of our knowledge. Please inform us of any ambiguous or erroneous descriptions, missing information, etc.
  4. Original Instructions  
This manual was originally written in English.
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# DISPLAYS AND SYMBOLS FOR SAFE USE

To encourage safe and proper use and to prevent danger to the operator and others or potential damage to properties, warnings and cautions are placed on the instrument body and inserted in the user manual. We suggest that everyone understand the meaning of the following displays, icons and text before reading the "GENERAL SAFETY INFORMATION" and observe all listed instructions.

## DISPLAY

Display	Meaning
 <b>WARNING</b>	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or physical damage.
 <b>NOTE</b>	Useful functions to know. Paying attention to these will prevent the noted problems.

## SYMBOL

Symbol	IEC/ISO Publication	Description	Description (French)
	IEC 60417-5032	Alternating Current	Courant alternatif
	IEC 60417-5008	Off (power: disconnection from the mains)	Éteint (courant: coupure avec le secteur)
	IEC 60417-5007	On (power: connection to the mains)	Allumé (courant: raccordement sur le secteur)
	IEC 60878-02-02	Type B applied part	Partie appliquée du Type B
	ISO 7010-W001	General warning sign	Symbole d'avertissement général
	ISO 7010-M002	Refer to instruction manual/booklet	Voir le manuel/la brochure
	ISO 7000-2497	Date of manufacture	Date de fabrication
	ISO 7000-2498	Serial number	Numéro de série
	ISO 7000-3082	Manufacturer	Fabricant

# GENERAL SAFETY INFORMATION

## **WARNING**

### **Preventing Electric Shocks and Fire.**

To avoid fire and electric shock, install the instrument in a dry place free of water and other liquids.

To avoid fire and electric shock, do not put cups or other containers with liquids near the instrument.  
[If the spilled liquid enters the instrument, fire or electric shock may occur.]

To avoid electric shock, do not insert metal objects into any vents and/or slots.

Do not block the vent of the power supply unit. Do not place the power supply unit in a tightly-closed room.

[Radiation may be hindered to cause fire.]

To avoid fire in the event of an instrument malfunction, immediately turn OFF the power switch "○" and disconnect the power cord from the instrument if you see smoke coming from the instrument, etc.

Don't install the instrument where it is difficult to disconnect the power cord from the instrument. Ask your dealer for service.

[If the instrument is being used without taking remedial measures, fire may occur.]

It is not permitted to modify this instrument.

## **CAUTION**

### **Ensuring the Safety of Patients and Operators**

Do not put your fingers or others into the gap between the measuring head and drive base unit.

[If your finger is caught, you may be injured or the instrument may be damaged.]

Be careful not to hit the patient's eyes or nose with the instrument during operation.

[If the instrument hits the patient's eye or the patient's nose is caught by it, he/she may be injured.]

### **Preventing Electric Shock**

To avoid injury caused by electric shock, do not open the cover. Ask your dealer for service.

Do not touch the built-in printer under the condition that the printer cover is opened.

[The instrument may malfunction due to discharge of static electricity.]

# HOW TO USE THIS MANUAL

- Before using this instrument, be sure to read the cautions on P.1 to P.8.
- When you want to use this instrument first of all, read "BASIC OPERATIONS" on P.19 first.

## GENERAL MAINTENANCE INFORMATION

### USER MAINTENANCE

To ensure the safety and performance of the instrument, all maintenance work, unless specified in this manual, shall only be conducted by trained service engineers.

The following maintenance tasks may be done by the user.

For details, see the relevant part of this manual.

#### Cleaning the measuring lens/measuring mirror

The glass surface of the measuring lens/measuring mirror may be cleaned by the user. For details, see "Cleaning the measuring lens" and "Cleaning the measuring mirror" on page 25.

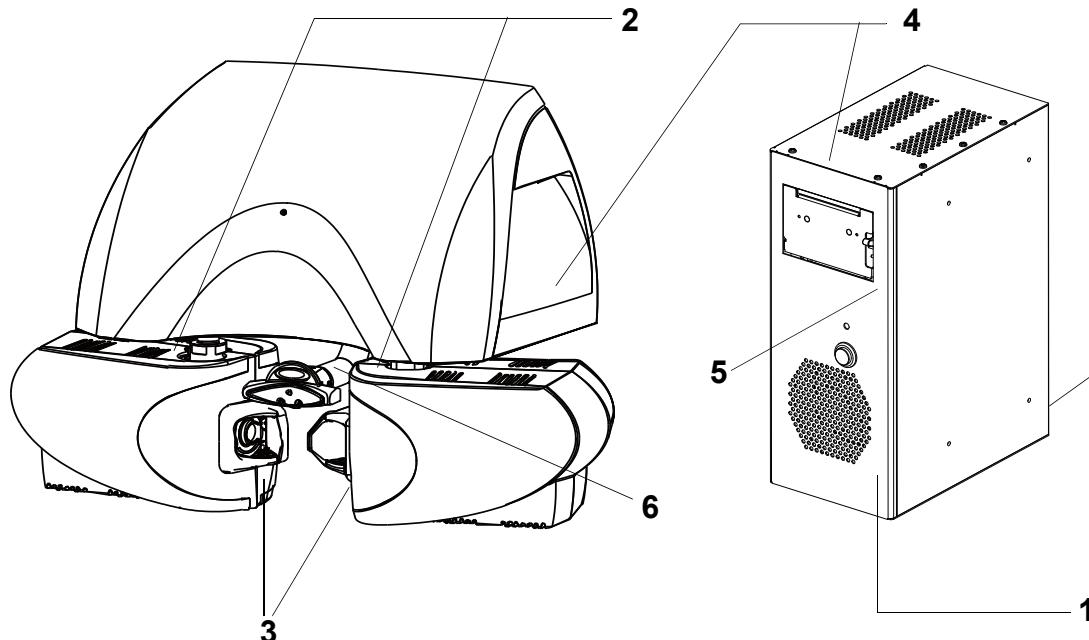
## DISCLAIMERS

- TOPCON shall not take any responsibility for damage due to fire, earthquakes, actions by third persons and other accidents, or damage due to negligence and misuse by the user and any use under unusual conditions.
- TOPCON shall not take any responsibility for damage derived from inability to properly use this instrument, such as loss of business profit and suspension of business.
- TOPCON shall not take any responsibility for damage caused from using this instrument in a manner other than that described in this User Manual.
- Diagnoses made shall be the responsibility of the user and TOPCON shall not take any responsibility for the results of such diagnoses.

# POSITIONS OF WARNING AND CAUTION INDICATIONS

To ensure safety, this machine provides warning displays.

Use the instrument correctly by observing the display instructions. If any of the following display labels are missing, contact your TOPCON dealer at the address listed on the back cover.

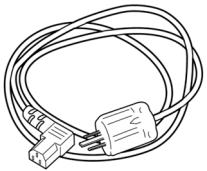
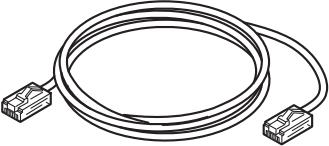


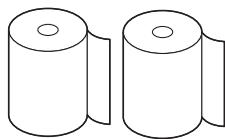
No.	Label	Meaning
1		<b>WARNING</b> Do not block the vent of the power supply unit. Do not place the power supply unit in a tightly-closed room. Radiation may be hindered to cause fire.
2		<b>CAUTION</b> Do not put your fingers or others into the gap between the measuring head and drive base unit. If your finger is caught, you may be injured or the instrument may be damaged.
3		<b>CAUTION</b> Be careful not to hit the patient's eye or nose with the instrument during operation. If the instrument hits the patient's eye or the patient's nose is caught by it, he/she may be injured.
4		<b>CAUTION</b> To avoid injury caused by electric shock, do not open the cover. Ask your dealer for service.
5		<b>CAUTION</b> Do not touch the built-in printer under the condition that the printer cover is opened. The instrument may malfunction due to discharge of static electricity.
6		Degree of protection against electric shock : TYPE B APPLIED PART

# STANDARD ACCESSORIES

Upon unpacking, make sure that all the following standard accessories are included.

Figures in ( ) are the quantities.

Power cord (1) *	LAN cable (2)
	
Printer paper (2)	Control cable (1)



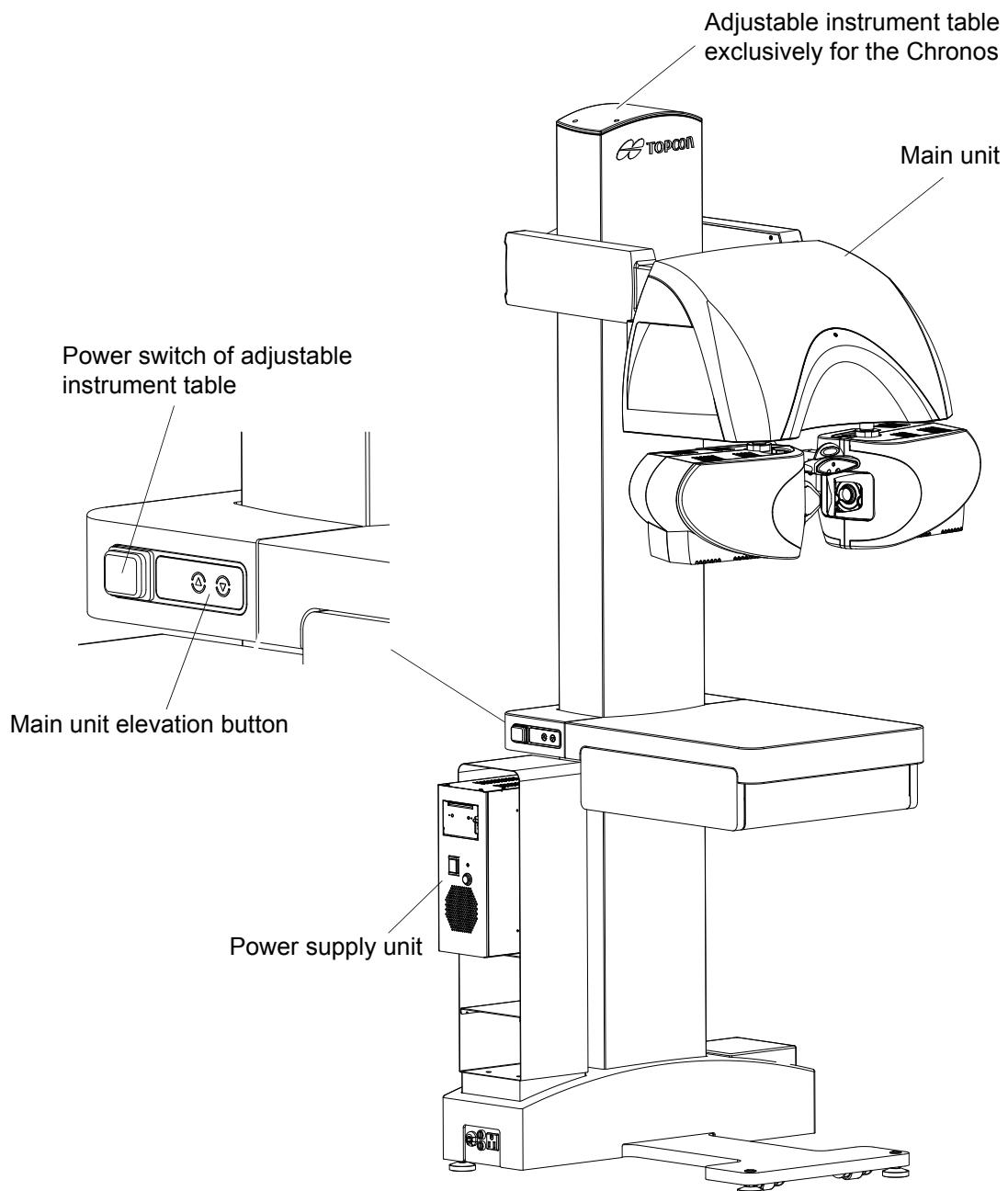
Setup manual/Simplified manual (1 each)

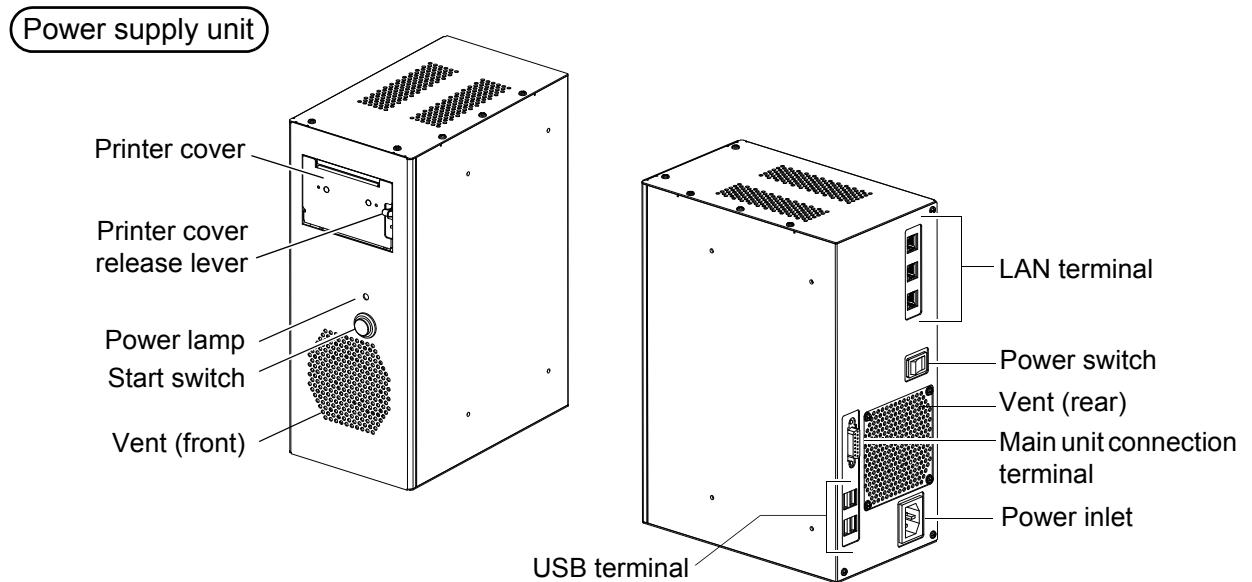
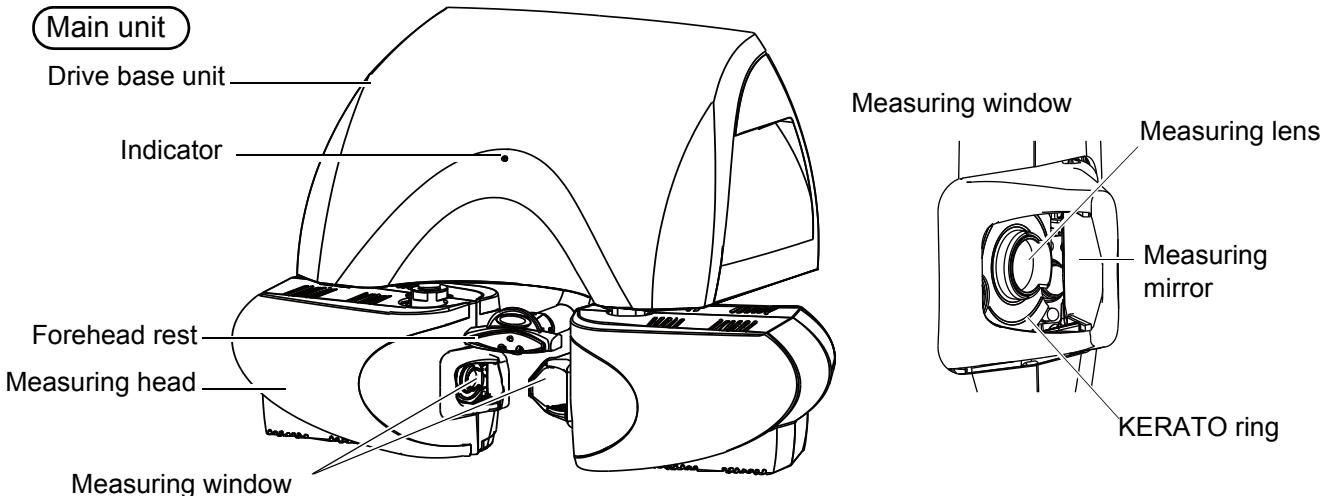


\* Sometimes two or more power cords are packed.

# SYSTEM DIAGRAM

## COMPONENT NAMES





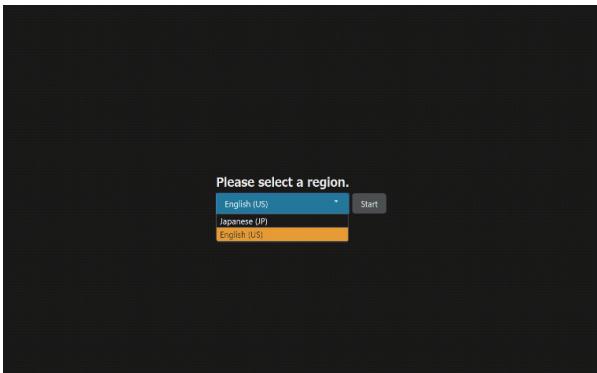
## **COMPOSITION OF PARTS WHICH CONTACT THE HUMAN BODY**

Forehead rest : Silicone rubber

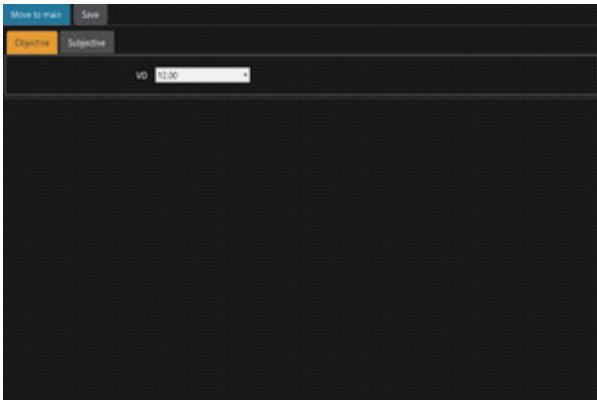
## NAME OF SCREEN

### Shift of screen

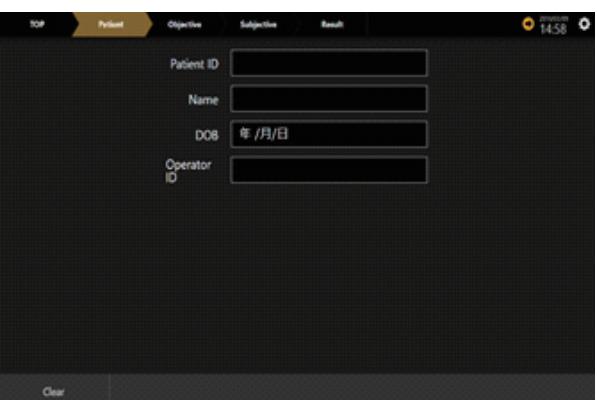
Region setting screen (only at initial start)



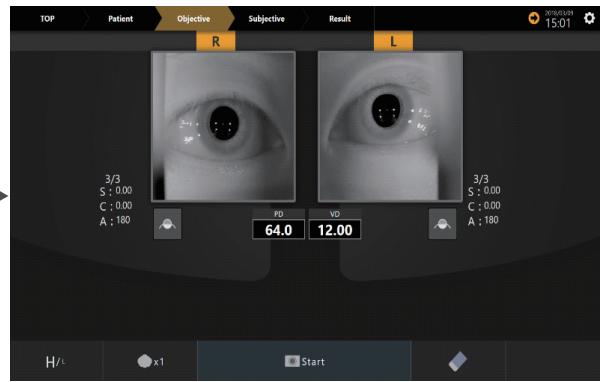
Details setting screen (only at initial start)



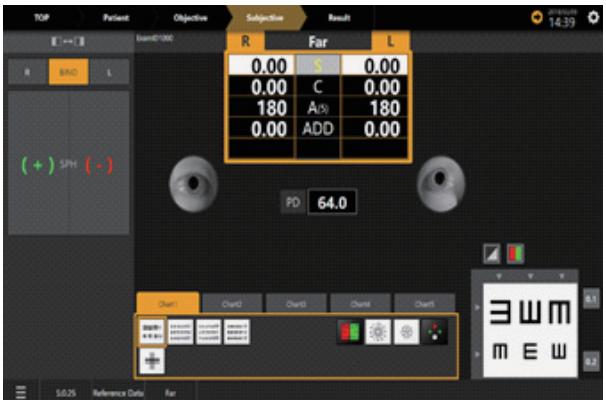
Patient information input screen



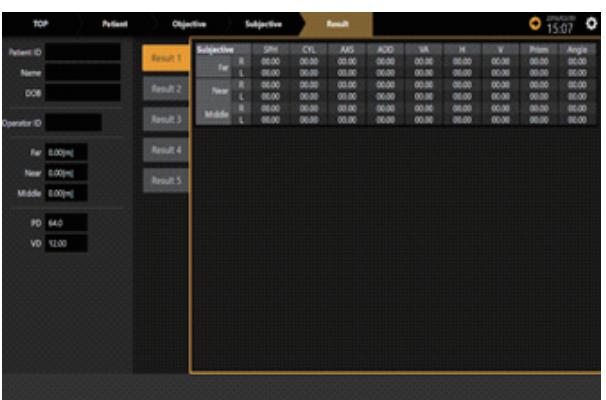
Objective measurement screen



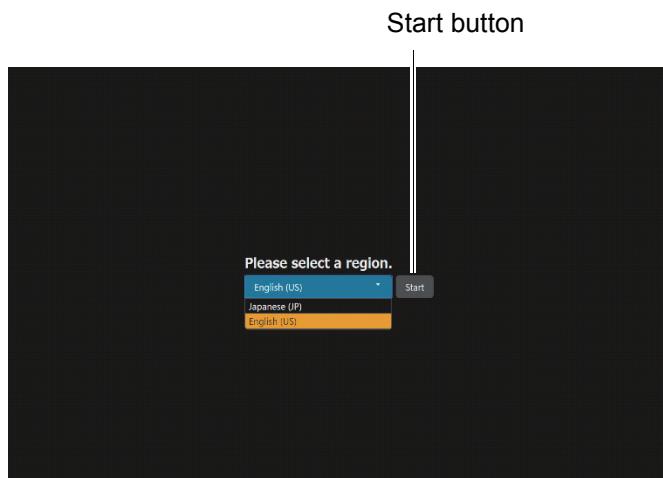
Subjective test screen



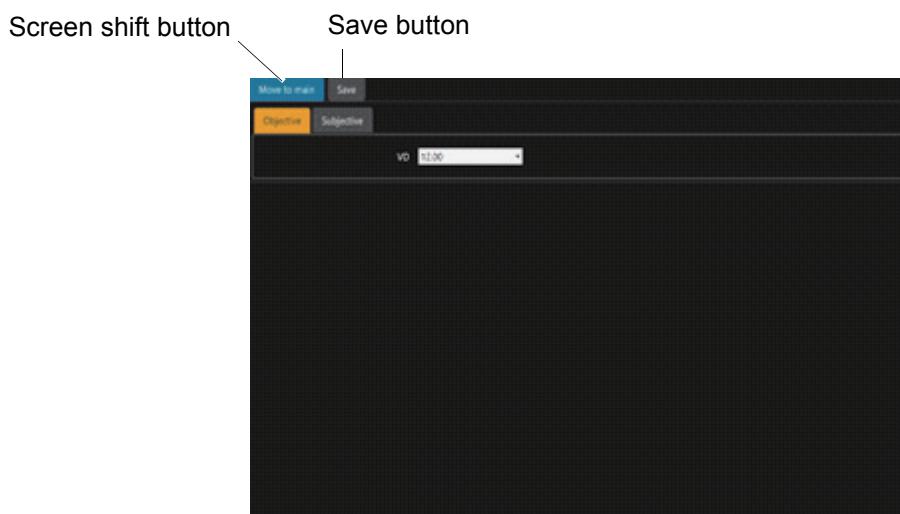
Output screen



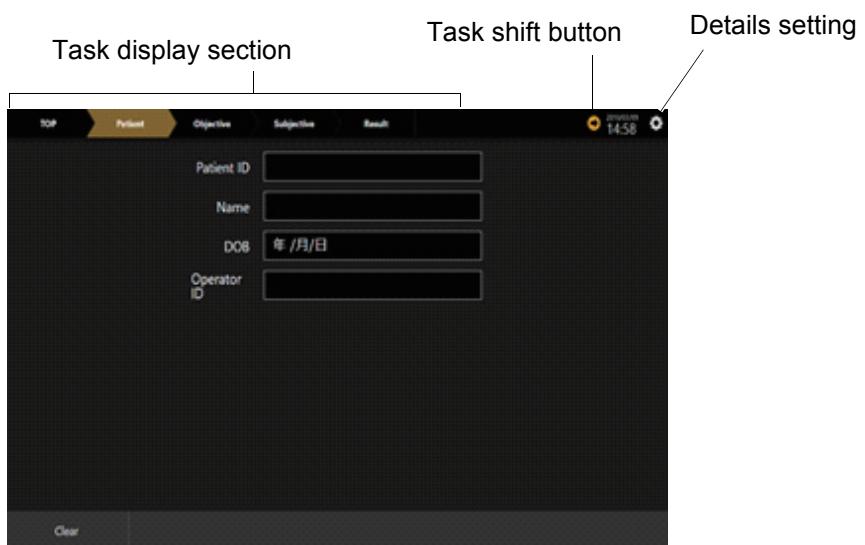
### Region setting screen (only at initial start)



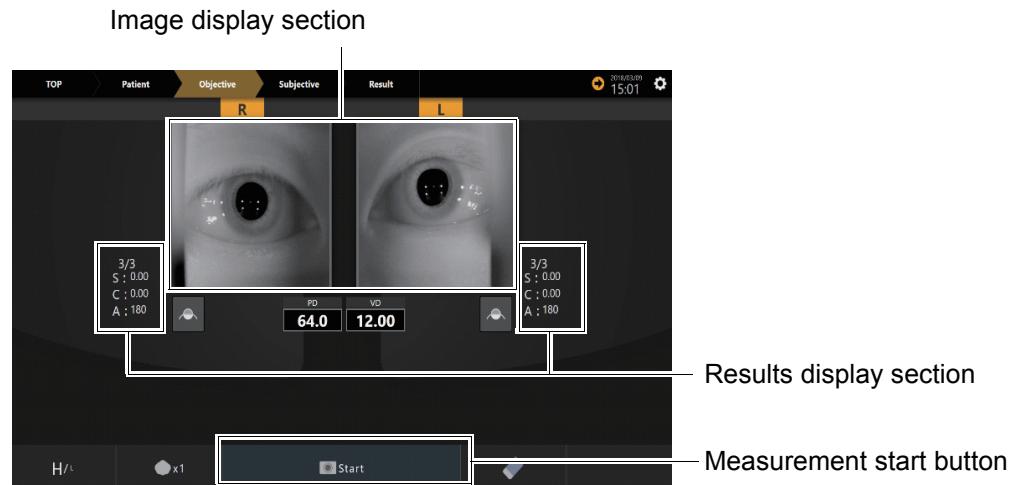
### Details setting screen (only at initial start)



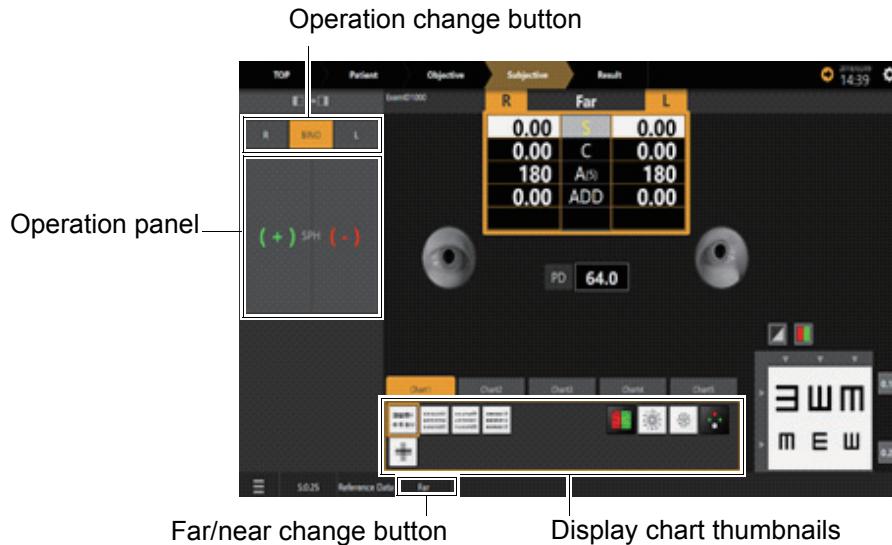
### Patient information input screen



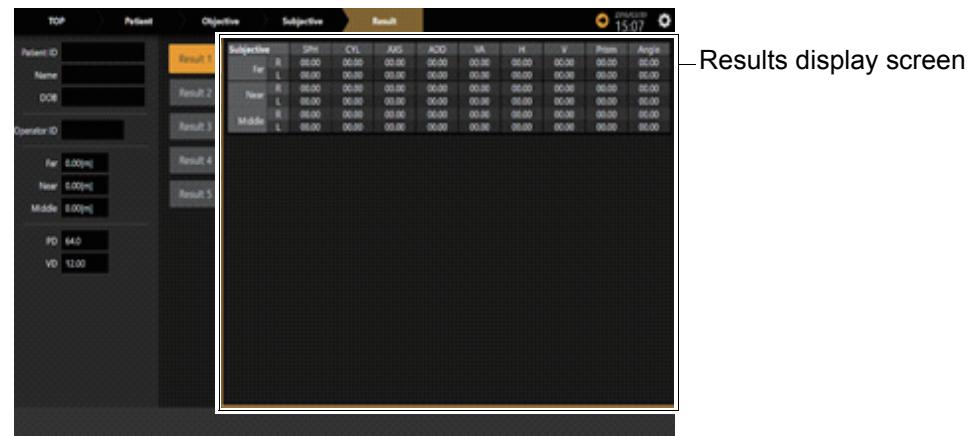
## Objective measurement screen



## Subjective test screen



## Output screen



# PREPARATIONS

## INSTALLING THE INSTRUMENT

- For installing the instrument, refer to the accompanying sheet "SETUP MANUAL".

## CONNECTING THE POWER CORD

 <b>WARNING</b>	Connect the power supply plug to a grounded AC 3-pin receptacle. When the power supply plug is connected to any other receptacle, it is not grounded and so electric leakage may cause fire or electric shock.
 <b>CAUTION</b>	<ul style="list-style-type: none"><li>• To avoid electric shock, do not handle the power supply plug with wet hand.</li><li>• Watch the destination written on the package of the accessory power cord and use the power cord for the area where the instrument is to be used. Using the power cord that is not applied to the commercial power supply may cause the trouble of the instrument.</li><li>• The power cord, which is the accessory of this instrument, cannot be used for any other product.</li></ul>

- 1 Make sure that the power switch of the instrument body is OFF.
- 2 Connect the power cord to the power inlet on the rear surface of the power supply unit.
- 3 Plug in the power cord at a grounded AC 3-pin receptacle.

## PREPARATION OF OPERATION CONTROLLER

As the controller of this instrument, a PC or a tablet PC that meets the specifications on the table shown below is necessary.

OS	iOS 10 or higher	
	Android 6.0 or higher	
Screen size (*1)	9 inches or more	
Aspect ratio/resolution (*2)	4 : 3	1024×768 or more
	16 : 10	1280×800 or more

- (\*1) If you select a smaller size screen than the recommended one, the touch panel operability may be lowered.
- (\*2) If you select any other aspect ratio or resolution except the recommended one, the image is displayed in a large or small size to be fit to the screen as keeping the recommended aspect ratio. Consequently a useless space is displayed at the upper, lower, right and left on the screen.

## **CONNECTING THE OPERATION CONTROLLER TO THE INSTRUMENT**

- In the case of Wi-Fi connection, enter the password written on Wi-Fi router and carry out setting.
- In the case of cable connection, connect the LAN cable to "LAN terminal" on the rear side of the power supply unit. Set the IP/subnet mask of the PC as follows:

IP address: 10.1.2.4

Subnet mask: (Fit it to the instrument's subnet mask. Default: 255.0.0.0)

## **START, CONNECTION AND SETTING OF BROWSER SOFTWARE**

- 1** Start the browser software, enter the address and connect it.

- Recommended browser: Chrome or Safari
- Address: xx.xxx.xx.xxx/topcon  
→ IP address (Default 10.1.2.3)



### **NOTE**

- When performing optometry by remote control via a facilities network, obtain an IP address for each of facilities and set the IP address/subnet mask on the setting screen.
- By registering the IP address and subnet mask to the custom folder, etc. of browser software, you can access the browser software more easily on the next use time and later.

- 2** When the browser is connected, "Region setting screen" appears. Select a language to be used and press "start button". (Only at initial start)

- 3** "Details setting screen" appears. (Only at initial start) Carry out a variety of settings and save the set data with "Save button".

- 4** After saving the settings, press "Screen shift button".

## **SETTING PRINTER PAPER**



### **CAUTION**

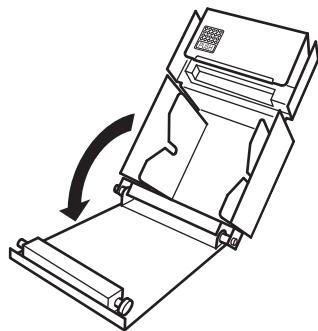
- Do not open/close the printer cover while the printer is operating. The printer may be out of order or you may be injured.
- While the printer is operating or when replacing the recording paper, do not touch the printer inside. You may be injured by an edge or metal part inside the printer.
- Use the specified printer paper. If any other paper is used, the printer may malfunction and the product cannot be used.



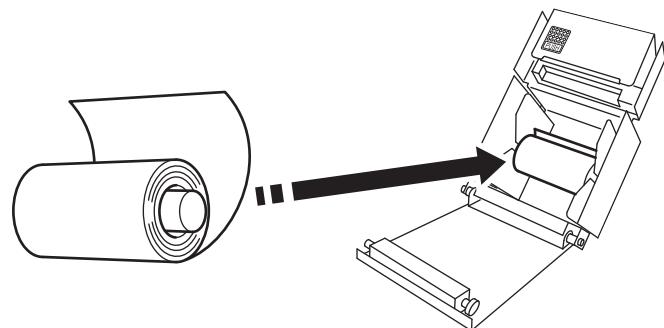
### **NOTE**

Front and back sides of paper are specified. If paper is set reversely, data are not printed.

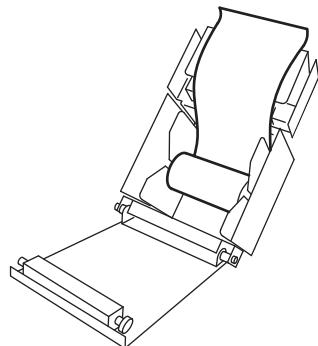
**1** Push the PUSH mark of the printer to open the cover.



**2** Set the printer paper to the printer shaft and fit the shaft to the printer.

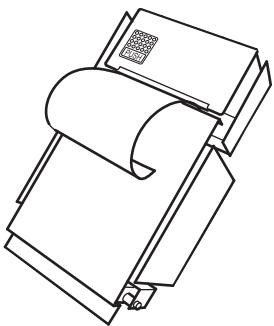


**3** Pull the end of the paper out of the ejector.



**NOTE** Pay attention to the direction of printer paper.

- 4** Close the cover. You can make sure that the cover is locked by a click sound.



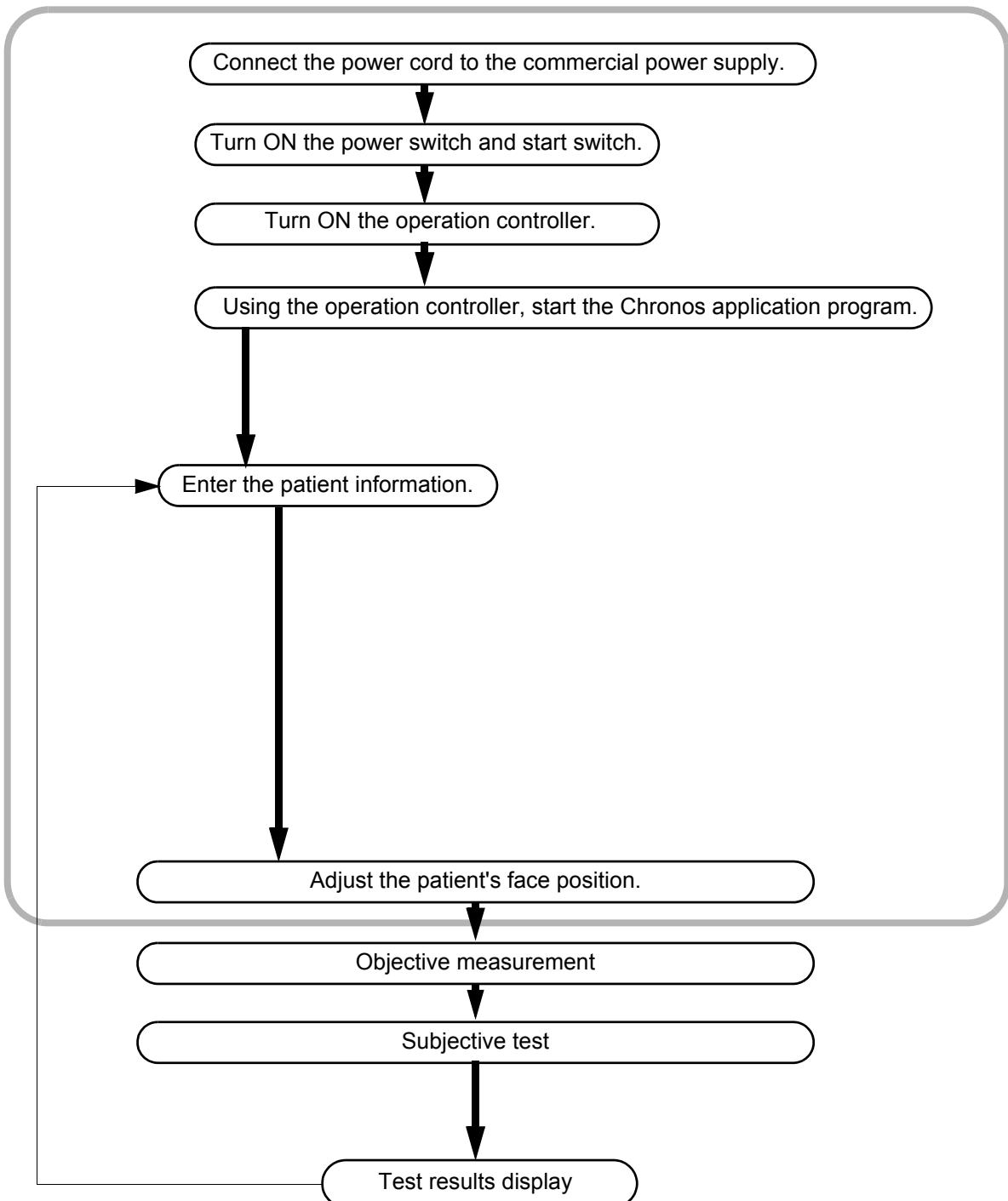
 **NOTE**

- Unless the printer cover is closed securely, printing cannot be done.
- Use the following printer paper of size 58mm.  
TP-50KJ-R (Nippon Paper Industries Co., Ltd.)  
Using any other paper except the above will cause the printing sound to be louder or the printed letters to be dimmed.
- If paper jamming has occurred, open the lower section and reset the paper.  
(For details, refer to "Printer paper jamming" on P.28.)

# BASIC OPERATIONS

## FLOW OF OPERATION

Basic operation flow of this instrument is mentioned below.



## PREPARATION BEFORE MEASUREMENT

### Turn on the power.

- 1** Connect the power cord plug to the commercial power supply (grounded AC 3-pin receptacle). For connection, refer to "CONNECTING THE POWER CORD" on P.15 of this manual.
- 2** Turn ON **[POWER SWITCH]**.
- 3** Turn ON **[START SWITCH]**.
- 4** Turn ON the operation controller (PC or tablet PC).
- 5** Start the browser and connect it to the Chronos application software.

### Input of patient information

- 1** On "Patient information input screen", enter the patient ID/name/birth date/operator ID.

### Select the optometry work flow.

- 1** Press "Task shift button" to shift to "Objective measurement screen".

## Adjustment of the patient's face position



- Be careful not to let the patient touch this instrument during operation. The patient's hand may be caught by the cover to injure him/her.  
\*Please instruct the patient not to touch the instrument.
- Be careful not to hit the patient's eye or nose with the instrument during operation. If the instrument hits the patient, stop the test. If you are using the instrument in this status, the patient may be injured.
- When adjusting the height of the adjustable instrument table on which this instrument is mounted, perform the adjustment at the position where you see both the patient and the instrument well simultaneously. If you adjust the height at a position that may be a dead angle due to the instrument, the instrument may hit the patient to injure him/her.
- While the patient places his/her face on the instrument, do not perform presetting. The patient may be injured.
- Before using an adjustable instrument table, read its user manual carefully and fully understand the operation and cautions.



### NOTE

- Adjust the height of the adjustable instrument table to prevent the patient from being uncomfortable. Unless it is adjusted properly, correct measured values cannot be obtained from time to time.
- When the patient ID is not registered, the instrument assigns "Patient No." automatically according to the order of the examined patients and displays the IDs.

1

Wipe away dust from the forehead rest.

2

Let the patient take a seat in front of the instrument.

3

Adjust the seat height so that the patient can be comfortable. Using "Main unit elevation button" of the adjustable instrument table, adjust the height of the main unit.

4

Let the patient place his/her forehead on the forehead rest.

# TEST



## CAUTION

- When adjusting the focus of the patient's eye, adjust the position as checking the measuring head position. The measuring head may hit the patient's face to cause an injury.
- Do not put hands between the main unit and the measuring head.
  - \* Please instruct the patient not to put his/her hand between them. When the measuring head moves, his/her hand may be pinched to cause an injury.

- This chapter will explain the optometry according to the optometry program operation.
- The test program is different between the selected courses. (This manual will explain the detailed test course.)

## Objective measurement

**1**

On "Objective test screen", press "Measurement start button". Auto-alignment starts. Check the alignment/measurement operation on the image display section.

**2**

When auto-alignment is completed, objective measurement (REF and KERATO measurements) is automatically performed.

**3**

The test results are displayed.

## Subjective test

**4**

Press "Task shift button" to shift to "Subjective measurement screen".

**5**

Select far or near vision with "Far/near change button".

The optical head moves and the main unit moves to the far/near vision distance which has been set on the details setting screen.

**6**

Select a chart to be used for the test from "Display chart thumbnails".

**• When the spherical power measurement chart is selected:**

- Change left eye only/both eyes simultaneously/right eye only with "Operation change button".
- Change the spherical power with the (+)/(-) buttons on "Operation panel".

**• When the astigmatism measurement chart is selected:**

- Change the cylinder power/cylinder axis with "Axis/refractive power change button".
- Change left eye only/both eyes simultaneously/right eye only with "Operation change button".
- Change the cylinder power/cylinder axis with the (+)/(-) buttons on "Operation panel".

## Output

7

Press "Task shift button" to shift to "Output screen".

8

Press "Task shift button" again, and "Patient information input screen" appears again.

## HOW TO FINISH

1

Finish the browser.

2

Turn off the power switch of the operation controller (PC or tablet PC).



### NOTE

When an external connection device is connected to the external input/output terminal, turn OFF the external connection device (when equipped with the power switch).

3

Turn OFF the **POWER SWITCH** on the power supply unit.



### NOTE

Turn OFF the start switch first and then power switch. If not, the instrument may malfunction.

# MAINTENANCE

## DAILY CHECKUPS

### User maintenance items

Item	Inspection time	Contents
Inspection	Before using	<ul style="list-style-type: none"><li>• The instrument must operate correctly.</li><li>• The measuring window must be free of dirt or flaw, etc.</li></ul>
Cleaning	When the part is stained	<ul style="list-style-type: none"><li>• Measuring window</li><li>• Cover, etc.</li></ul>
Replacement	As required	<ul style="list-style-type: none"><li>• Printer paper</li></ul>

### Manufacturer maintenance items

Item	Inspection time	Contents
Cleaning each part	At least every 12 months	<ul style="list-style-type: none"><li>• Cleaning the external parts</li><li>• Cleaning the optical system</li><li>• Cleaning the power supply unit</li></ul>
Operation check	At least every 12 months	<ul style="list-style-type: none"><li>• Operation of the instrument</li><li>• Operation of switches</li></ul>
Accuracy check	At least every 12 months	<ul style="list-style-type: none"><li>• </li></ul>

### Management after using

- After using, clean the instrument according to "CLEANING" on and after P.25.
- Dust is a formidable foe to the instrument. When not in use, cover the instrument with the dust cover.
- When not in use, turn off the power switch.

## **CLEANING**

### **Cleaning the parts which come into contact with the patient**

When the forehead rest is stained, prepare a tepid solution of neutral detergent for kitchenware. Moisten a cloth with the aforementioned solution and wring it thoroughly. Then, wipe the forehead rest with the cloth.

### **Cleaning KERATO ring and external cover**

 <b>NOTE</b>	To prevent the plastic parts of the instrument body from discoloring and deteriorating, do not use volatile solvents for cleaning, including benzine, thinner, ether, gasoline, chemical dust cloth, etc.
---	---

- 1** When the KERATO ring and external cover become stained, clean with an accessory monitor cleaner or a dry soft cloth.
- 2** If the KERATO ring and external cover are badly stained, prepare a tepid solution of neutral detergent for kitchenware. Moisten a cloth with the aforementioned solution and wring it thoroughly. Then, wipe the ring and cover with the cloth.

### **Cleaning the measuring lens**

- When the measuring lens is stained with dust and dirt:  
Blow away dust/dirt with a blower.
- When the measuring lens is stained with fingerprint or oil:  
Blow away dust/dirt with a blower. Apply camera lens cleaner a little to a clean gauze and wipe the lens with it lightly.

### **Cleaning the measuring mirror**

To check stain, darken the room. Illuminate the measuring mirror with a flashlight, etc. and watch it from the diagonally front position to check stain easily.

- Dust and dirt adhered to the surface  
Blow them off using a blower.  
Be careful to prevent the blower end from touching the measuring mirror.
- When the stain is simple such as dust, tears or saliva:
  - 1** Breathe toward the measuring mirror and wipe it with a lens cleaning paper carefully.
  - 2** If your lens cleaning paper is dirty, replace it with a clean one and repeat step **1**.
  - 3** Repeat steps **1** and **2** until no stain is seen on the lens.

- When the stain is persistent:

- 1** Moisten a lens cleaning paper with reagent ethanol properly. Wipe the measuring mirror with the lens cleaning paper by rubbing lightly.
- 2** If your lens cleaning paper is dirty, replace it with clean one and repeat step **1**.
- 3** Repeat steps **1** and **2** until no stain is seen on the measuring mirror.



### NOTE

- Don't use the following methods because the measuring mirror can be damaged.
  - Wiping the mirror by grasping with fingernails
  - Using a lens cleaning paper wound around a hard tool (for example, a metallic tool)
- Use a soft lens cleaning paper without fiber.
  - For example, BEMCOT (Asahikasei)
- Don't let any strong-alkaline liquid adhere to the measuring mirror.  
If such liquid adheres to the mirror, immediately wipe it off.
- If it is difficult to remove a stain from the measuring mirror, contact your dealer or TOPCON (see the back cover).

# BEFORE REQUESTING SERVICE

## TROUBLESHOOTING



### WARNING

To avoid electric shock, do not attempt disassembling, rebuilding and/or repairs on your own. Do not open the cover.  
Ask your dealer for repairs.

When an error is encountered, review the Check List below.

If, after following the instructions below, you still cannot restore the instrument to a normal condition or if the problem does not fall into any of the categories below, contact your dealer or TOPCON (see the back cover).

Check List

Problem	Condition	Check	Page
The power of the instrument is not turned on.	_____	The power cord plug is not connected to the outlet. Connect it.	
		The power cord is not connected to the instrument. Connect it.	
The measuring head does not operate normally.	• Although the power is ON, the measuring head does not operate.	The cable of the measuring head is not connected. Connect it.	20
	_____	Do not operate the measuring head forcefully but contact your dealer or TOPCON.	
Printing is not performed.	• Paper is conveyed but data is not printed.	Check the paper rolling direction. If it is wrong, set the paper correctly.	16
	• Paper is not conveyed.	When "No paper" is displayed on the control panel, supply paper.	16

## Printer paper jamming



### CAUTION

- Do not open/close the printer cover while the printer is operating. The printer may be out of order or you may be injured.
- When printer paper jamming or any other trouble occurs, turn off the power before performing any work. If you work while the instrument is powered, you may be injured.
- Do not touch the printer inside. You may be injured by an edge or metal part inside the printer. The instrument may malfunction due to discharge of static electricity.



### NOTE

If paper jams inside the printer, printing is not done. If you are using the printer in this status, the printer may malfunction.

- 1 Turn off the power, open the printer cover and turn down the cover completely.
- 2 Do not pull the printer paper forcedly. Remove the jammed paper.
- 3 Reset the printer paper. (Refer to "SETTING PRINTER PAPER" on P.16.)

# SPECIFICATIONS & PERFORMANCE

Objective measurement	
Refraction measurement range	
Spherical refractive power	-25D to +22D
Cylindrical refractive power	0D to ±10D
Cylinder axial angle	1° to 180°
Corneal curvature measurement range	
Corneal curvature radius	5.00mm to 10.00mm
Corneal refractive power	67.50D to 33.75D (Conversion value when the corneal refractive ratio is 1.3375)
Corneal cylinder power	0D to ±10D
Corneal cylinder axial angle	1° to 180°
Minimum measurement unit	
Spherical/cylindrical refractive power	0.12/0.25D
Cylinder axial angle	1°
Display of measured value	Displayed on the monitor screen.
Minimum measurable pupil diameter	φ2.0mm
Target fixation	Auto fog method
Sighting	Displayed on the tablet PC screen.
Alignment	Simultaneous auto-alignment of both eyes
PD measurement range	50mm to 80mm
Minimum PD measurement unit	1mm
Subjective measurement	
Refraction measurement range	
Spherical refractive power	-18D to +18D
Cylindrical refractive power	-9.09D to +7.14D (when spherical refractive power is 0D)
Cylinder axial angle	1° to 180°
Minimum measurement unit	
Spherical/cylindrical refractive power	0.25D
Cylinder axial angle	1°
Test distance	400mm to 6096mm
Display of measured value	Displayed on the tablet PC screen.
Record of measured value	Printer
Measuring head movement	
Right-and-left direction	PD50mm to 81mm
Up-and-down direction	Down 15mm to Up 10mm
Back-and-forth direction	Forward 10mm to backward 14.8mm
Measuring head rotary angle	Convergence 2° to Divergence 7.5° (Eyeball torsion axis center)

\* The design as well as specifications are subject to change without prior notice for the improvement.

# **GENERAL INFORMATION ON USAGE AND MAINTENANCE**

## **INTENDED PATIENT POPULATION**

Patients undergoing examination with this instrument must be able to follow instructions including:

- Being able to position their face appropriately in the forehead rest.
- Keep the eye open as instructed by the examiner.
- Understand and follow instructions when undergoing examination.

## **INTENDED USER PROFILE**

The Chronos is an electric instrument for medical use. Use it according to instructions of ophthalmologists.

## **ENVIRONMENTAL CONDITIONS FOR USE**

Temperature : 10°C - 35°C

Humidity : 30% - 90% (without dew condensation)

Pressure : 800hPa - 1060hPa

## **STORAGE, USAGE PERIOD**

### 1. Environmental conditions (without package)

\*Temperature : 10°C - 40°C

Humidity : 10% - 95% (without dew condensation)

Pressure : 700hPa - 1060hPa

\* THIS INSTRUMENT DOES NOT MEET THE TEMPERATURE REQUIREMENTS OF ISO 15004-1 FOR STORAGE. DO NOT STORE THIS INSTRUMENT IN CONDITIONS WHERE THE TEMPERATURE MAY RISE ABOVE 40°C OR FALL BELOW 10°C.

### 2. When storing the instrument, ensure that the following conditions are met:

- (1) The instrument must not be splashed with water.
- (2) Store the instrument away from environments where air pressure, temperature, humidity, ventilation, sunlight, dust, salty/sulfurous air, etc. could cause damage.
- (3) Do not store or transport the instrument on a slanted or uneven surface or in an area where it is subject to vibrations or instability.
- (4) Do not store the instrument where chemicals are stored or gas is generated.

### 3. Normal life span of the instrument:

8 years from delivery providing regular maintenance is performed [TOPCON data]

## **ENVIRONMENTAL CONDITIONS FOR PACKAGING IN STORAGE**

Temperature : -20°C - 50°C  
Humidity : 10% - 95%  
Pressure : 700hPa - 1060hPa

## **ENVIRONMENTAL CONDITIONS FOR PACKAGING IN TRANSPORTATION**

Temperature : -40°C - 70°C  
Humidity : 10% - 95%  
Pressure : 700hPa - 1060hPa

## **ELECTRIC RATING**

Source voltage : AC100-  
Frequency : 50-60Hz  
Power input : 110-120VA

## **DIMENSIONS AND WEIGHT**

### **Main unit**

Dimensions : 655.7 - 698.7mm (W) × 291.8mm (D) × 436.5 - 466.5mm (H)  
Weight : 18kg

### **Power supply unit**

Dimensions : 117mm (W) × 197mm (D) × 276mm (H)  
Weight : 3.9kg

## **SYSTEM CLASSIFICATION**

**Types of protection against electric shocks:** This instrument is classified as Class I equipment.

Class I equipment does not depend only on basic insulation for protection against electric shocks, but also provides a means of connection to a protective earth system of facilities so that metal parts that come into contact do not become conductive while the basic insulation is in failure.

### **Degree of protection against electric shocks: Type B applied part**

Type B applied part is the applied part complying with the specified requirements of the Standard IEC 60601-1 to provide protection against electric shock, particularly regarding allowable LEAKAGE CURRENT.

### **Degree of protection against harmful ingress of water: IPX0**

The Chronos has no protection against ingress of water. (The degree of protection against harmful ingress of water defined in IEC 60529 is IPX0.)

**Classification according to the method(s) of sterilization or disinfection recommended by the manufacturer: not applicable.**

The Chronos has no part to be sterilized or to be disinfected.

**Classification according to the degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide: Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.**

The Chronos should be used in environments where no flammable anesthetics and/or flammable gases are present.

**Classification according to the mode of operation: Continuous operation.**

Continuous operation is the operation under normal load for an unlimited period, without the specified limits of temperature being exceeded.

**Classification of LED products: Class 1 (Complying with IEC 60825-1:2001)**

Class 1 equipment is safe under the reasonably foreseeable operating condition and is the safe LED product for eyes whenever light is condensed by any type of optical system (lens, telescope, etc.).

## **BASIC OPERATION PRINCIPLE**

The right and left measuring heads project the refraction measuring ring of the near infrared light to the patient's eye retina and the image reflected by the retina is received by the CCD camera. Arithmetic processing is performed for the received image to calculate the spherical/cylindrical power and axial angle. The anterior segment image received by the CCD camera is displayed on the PC monitor.

Placido ring is projected to the cornea and the image reflected by the cornea surface is received by the CCD camera. Arithmetic processing is performed for the received image to measure the curvature radius and calculate the principal meridian direction and corneal refractive power.

By detecting the corneal apex, the measuring heads are automatically aligned with the patient's eye. The chart inside the measuring heads is presented through the optical system that corrects the patient's eye dioptric power and consequently subjective measurement is performed.

## **CHECKPOINTS FOR MAINTENANCE**

1. Periodically inspect the instrument and its parts.
2. Before using the instrument again after a long period of inactivity, make sure that it operates safely and normally.
3. Be careful not to stain the measuring window with fingerprints, dirt, etc., in order to perform correct measurement.
4. If the measuring window is soiled, clean it according to "\*\*\*\*" on page \*\* of this manual.

## **DISPOSAL**

When disposing of Chronos parts, follow the local regulations for disposal and recycling.



### **NOTE**

This symbol is applicable for EU member countries only.

To avoid potential damage to the environment and possibly human health, this instrument should be disposed of (i) for EU member countries - in accordance with WEEE (Directive on Waste Electrical and Electronic Equipment), or (ii) for all other countries, in accordance with local disposal and recycling laws.

This Product Contains a coin cell.

You cannot replace batteries by yourself. When you need to replace and/or dispose batteries, contact your dealer or TOPCON listed on the back cover.



#### **EU Battery Directive**

This symbol is applicable for EU members states only.

Battery users must not dispose of batteries as unsorted general waste, but treat properly.

If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration.

This will be indicated as follows:

Hg: mercury(0.0005%), Cd: cadmium(0.002%), Pb: lead(0.004%)

These ingredients may be seriously hazardous to human and the global environment.

This product contains a CR Lithium Battery which contains Perchlorate Material-special handling may apply.

See <http://www.dtsc.ca.gov/hazardouswaste/perchlorate/>

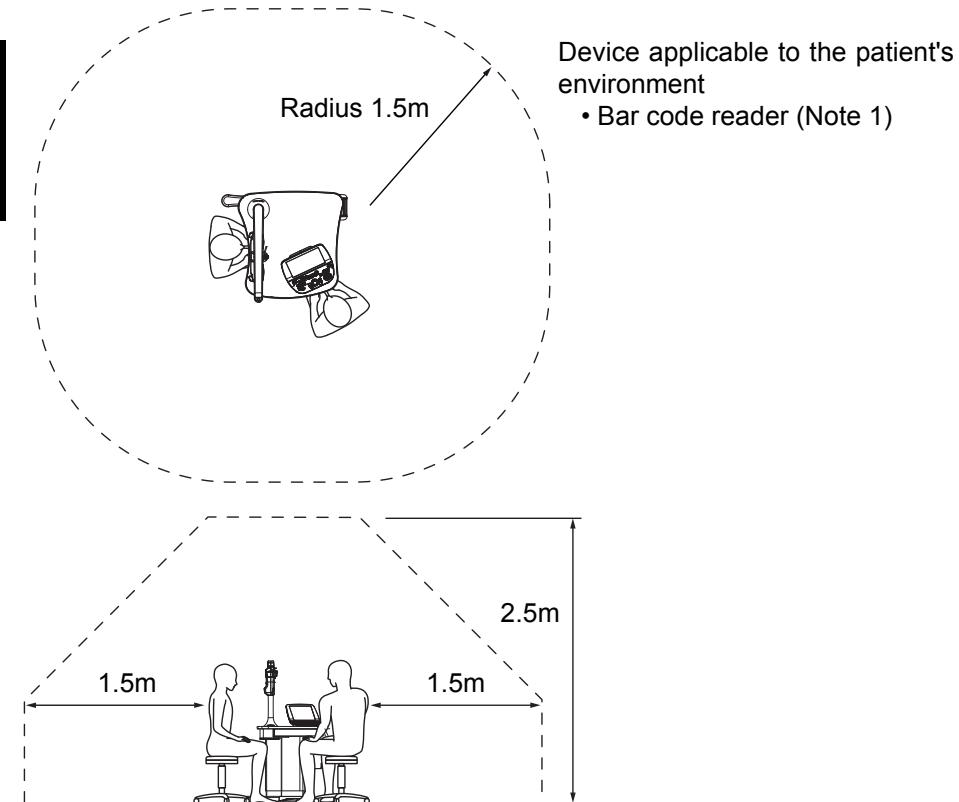
Note: This is applicable to California, U.S.A. only

## PATIENT'S ENVIRONMENT

When the patient or inspector may touch the devices (including the connecting devices) or when the patient or inspector may touch the person that comes into contact with the devices (including the connecting devices), the patient's environment is shown below.

In the patient's environment, use the device conforming to IEC60601-1. If you are compelled to use any device not conforming to IEC60601-1, use an insulation transformer or the common protective earth system.

Do not use the power strip in the patient's environment. Connect the power supply of the device to the commercial power supply.



Note 1: Use a bar code reader conforming to IEC60950-1.



- Do not connect the additional table tap or extension cord to the system.
- Do not connect a device which is not specified as a part of the system.

## REQUIREMENTS FOR THE EXTERNAL DEVICE

The external device connected to the analog and digital interfaces must comply with the respective IEC or ISO standards (e.g. IEC 60950 for data processing equipment and IEC 60601-1 for medical equipment).

Anybody connecting additional equipment to medical electrical equipment configures a medical system and is therefore responsible that the system complies with the requirements for medical electrical systems. Attention is drawn to the fact that local laws take priority over the above mentioned requirements. If in doubt, contact your dealer or TOPCON(see the back cover).

## **ELECTROMAGNETIC COMPATIBILITY**

This product conforms to the EMC Standard(IEC 60601-1-2 Ed.3.0: 2007, IEC 60601-1-2 Ed.4.0: 2014).

If there is electromagnetic jamming that is higher than IEC 60601-1 test level, the following troubles may occur as loss/deterioration of basic performance caused by electromagnetic jamming:

- Measured value reliability is lowered or measurement cannot be performed;
- Alignment is not correctly completed;
- The values in the output data are not correct;
- Patient ID is not correctly displayed.

- a) MEDICAL ELECTRICAL EQUIPMENT needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the ACCOMPANYING DOCUMENTS.
- b) Portable and mobile RF communications equipment can affect MEDICAL ELECTRICAL EQUIPMENT.
- c) The use of ACCESSORIES, transducers and cables other than those specified, with the exception of transducers and cables sold by the manufacturer of the EQUIPMENT or SYSTEM as replacement parts for internal components, may result in increased EMISSIONS or decreased IMMUNITY of the EQUIPMENT or SYSTEM.
- d) The EQUIPMENT or SYSTEM should not be used adjacent to or stacked with other equipment. IF adjacent or stacked use is necessary, the EQUIPMENT or SYSTEM should be observed to verify normal operation in the configuration in which it will be used.
- e) The use of the ACCESSORY, transducer or cable with EQUIPMENT and SYSTEMS other than those specified may result in increased EMISSION or decreased IMMUNITY of the EQUIPMENT or SYSTEM.

<b>Guidance and manufacturer's declaration - electromagnetic emissions</b>		
The Chronos is intended for use in the electromagnetic environment specified below. The customer or the user of the Chronos should assure that it is used in such an environment.		
<b>Emissions test</b>	<b>Compliance</b>	<b>Electromagnetic environment - guidance</b>
RF emissions CISPR 11	Group 1	The Chronos uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The Chronos is suitable for use in all establishments excluding domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC61000-3-2	Not applied	
Voltage fluctuations/ flicker emissions IEC61000-3-3	Not applied	

Guidance and manufacturer's declaration - electromagnetic immunity				
The Chronos is intended for use in the electromagnetic environment specified below. The customer or the user of the Chronos should assure that it is used in such an environment.				
Immunity test		IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	IEC60601-1-2 Ed3.0	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
	IEC60601-1-2 Ed4.0	±8 kV contact ±15 kV air	±8 kV contact ±15 kV air	
Electrical fast transient/burst IEC 61000-4-4	IEC60601-1-2 Ed3.0	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
	IEC60601-1-2 Ed4.0	±2 kV for power supply lines ±1 kV for input/output lines Cyclic frequency 100kHz	±2 kV for power supply lines ±1 kV for input/output lines Cyclic frequency 100kHz	
Surge IEC 61000-4-5	IEC60601-1-2 Ed3.0	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
	IEC60601-1-2 Ed4.0	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	IEC60601-1-2 Ed3.0	<5% $U_t$ (>95% dip in $U_t$ ) for 0.5 cycle 40% $U_t$ (60% dip in $U_t$ ) for 5 cycles 70% $U_t$ (30% dip in $U_t$ ) for 25 cycles <5% $U_t$ (>95% dip in $U_t$ ) for 5 sec	<5% $U_t$ (>95% dip in $U_t$ ) for 0.5 cycle 40% $U_t$ (60% dip in $U_t$ ) for 5 cycles 70% $U_t$ (30% dip in $U_t$ ) for 25 cycles <5% $U_t$ (>95% dip in $U_t$ ) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user or the Chronos requires continued operation during power mains interruptions, it is recommended that the Chronos be powered from an uninterruptible power supply or battery.
	IEC60601-1-2 Ed4.0	0% Ut for 0.5 cycles 0, 45, 90, 135, 225, 270, 315° 0% Ut for 1 cycle 0° 70% Ut for 25/30 cycles 0% Ut for 250/300 cycles (for 5 seconds)	0% Ut for 0.5 cycles 0, 45, 90, 135, 225, 270, 315° 0% Ut for 1 cycle 0° 70% Ut for 25/30 cycles 0% Ut for 250/300 cycles (for 5 seconds)	
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	IEC60601-1-2 Ed3.0	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
	IEC60601-1-2 Ed4.0	30 A/m	30 A/m	

NOTE  $U_t$  is the a.c. mains voltage prior to application of the test level.

<b>Guidance and manufacturer's declaration - electromagnetic immunity</b>				
The Chronos is intended for use in the electromagnetic environment specified below. The customer or the user of the Chronos should assure that it is used in such an environment.				
<b>Immunity test</b>	<b>IEC 60601 test level</b>	<b>Compliance level</b>	<b>Electromagnetic environment-guidance</b>	
IEC60601-1-2 Ed3.0	Conducted RF IEC 61000-4-6  Radiated RF IEC 61000-4-3	3 Vrms 150kHz to 80MHz  3 V/m 80MHz to 2.5GHz	3 V  3 V/m	<p>Portable and mobile RF communications equipment should be used no closer to any part of the Chronos, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p><b>Recommended separation distance</b></p> $d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P} \quad 80\text{MHz to } 800\text{MHz}$ $d = 2.3\sqrt{P} \quad 800\text{MHz to } 2.5\text{GHz}$ <p>where <math>P</math> is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and <math>d</math> is the recommended separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,<sup>a</sup> should be less than the compliance level in each frequency range.<sup>b</sup></p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 

IEC60601-1-2 Ed4.0	Conducted RF IEC 61000-4-6	3 Vrms 150kHz to 80MHz  10 V/m 80MHz to 2.7GHz	3 Vrms 150kHz to 80MHz  10 V/m 80MHz to 2.7GHz	Portable and mobile RF communications equipment should be used no closer to any part of the Chronos, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
	Radiated RF IEC 61000-4-3	Proximity electromagnetic site from radio communications equipment <sup>c)</sup>	Proximity electromagnetic site from radio communications equipment <sup>c)</sup>	<p><b>Recommended separation distance</b></p> <p>In the fourth edition, the equation "<math>d = \frac{6}{E}\sqrt{P}</math>" is used for separation distance. The coefficient is different from the equations in the second and third editions, "<math>d = \frac{3.5}{E}\sqrt{P}</math>" for less than 800MHz and "<math>d = \frac{7}{E}\sqrt{P}</math>" for 800MHz or more. So the recommended separation distance is changed.</p> <p>In the above equation, P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, d is the recommended separation distance in meters (m), and E is the radiation electromagnetic site level in volt/meters (V/m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, <sup>a</sup> should be less than the compliance level in each frequency range. <sup>b</sup></p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

- <sup>a</sup> Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Chronos is used exceeds the applicable RF compliance level above, the Chronos should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Chronos.
- <sup>b</sup> Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [V<sub>1</sub>] V/m.
- <sup>c</sup> The proximity electromagnetic site of radio communications equipment is shown in the table below.

Test frequency [MHz]	Band [MHz]	Equipment	Modulation	Maximum output (W)	Distance (m)	Immunity test value [V/m]
385	380-390	TETRA 400	Pulse modulation 18Hz	1.8	0.3	27
450	430-470	GMRS 460 FRS 460	FM ±5kHz 1kHz sine	2	0.3	28
710						
745	704-787	LTE Band 13, 17	Pulse modulation 217Hz	0.2	0.3	9
780						
810						
870	800-960	GSM 800/900 TETRA 800 iDEN820 CDMA850 LTE Band 5	Pulse modulation 18Hz	2	0.3	28
930						
1720						
1845						
1970	1700-1990	GSM 1800 CDMA1900 GSM 1900 DECT LTE Band 1,3,4,25 UMTS	Pulse modulation 217Hz	2	0.3	28
2450	2400-2570	Bluetooth WLAN 802.11 b/g/n RFID 2450 LTE Band7	Pulse modulation 217Hz	2	0.3	28
5240						
5500	5100-5800	WLAN 802.11 b/g/n	Pulse modulation 217Hz	0.2	0.3	9
5785						

<b>Recommended separation distance between portable and mobile RF communications equipment and the Chronos</b>				
<b>Rated maximum output power of transmitter W</b>	<b>Separation distance according to frequency of transmitter m</b>			
	IEC60601-1-2 Ed3.0			IEC60601-1-2 Ed4.0
	<b>150kHz to 80MHz</b> $d = 1.2\sqrt{P}$	<b>80MHz to 800MHz</b> $d = 1.2\sqrt{P}$	<b>800MHz to 2.5GHz</b> $d = 2.3\sqrt{P}$	<b>80MHz to 2.7GHz</b> $d = 0.6\sqrt{P}$
	0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73	0.19
1	1.2	1.2	2.3	0.6
10	3.8	3.8	7.3	1.9
100	12	12	23	6

For transmitters rated at a maximum output power not listed above, the recommended separation distance  $d$  in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where  $P$  is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

## **SAFETY OF LED PRODUCTS**



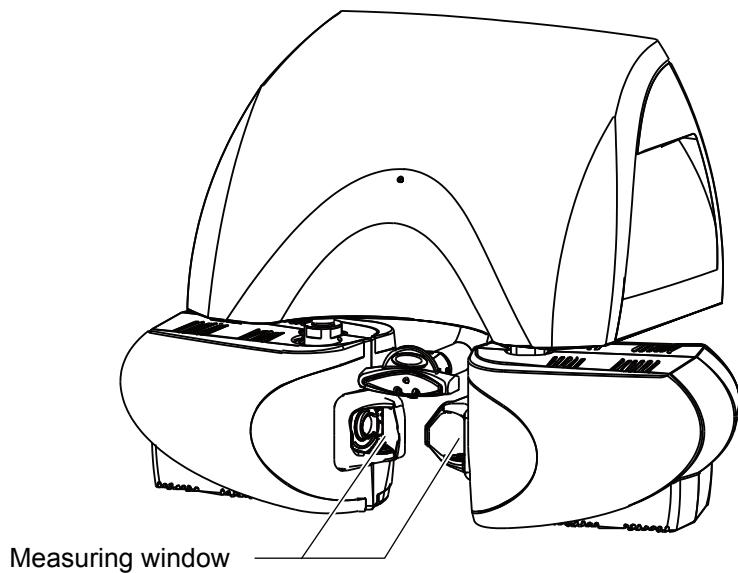
### **CAUTION**

If you use the instrument by the method not described in this manual, dangerous light may be emitted. Do not remove the cover. The high intensity LED light is emitted.

Class of LED products	Class 1
LED products (infrared light)	<b>Anterior segment observation LED (for XYZ alignment)</b> LED emitting port   $\phi 5$ Output on cornea   $24.7\mu\text{W}/\text{cm}^2$ Wavelength   950nm Full width at half maximum   50nm Beam divergence ( $2\theta$ )   Parallel Pulse width   CW <b>XY LED (for XY alignment)</b> LED emitting port   $\phi 8$ Output on cornea   $24.7\mu\text{W}/\text{cm}^2$ Wavelength   950nm Full width at half maximum   50nm Beam divergence ( $2\theta$ )   Parallel Pulse width   CW <b>KERATO LED (for measuring cornea curvature)</b> LED emitting port   Placido ring Output on cornea   $86.4\mu\text{W}/\text{cm}^2$ Wavelength   950nm Full width at half maximum   50nm Beam divergence ( $2\theta$ )   180 deg. (=3.14rad) Pulse width   CW
LED light source (infrared light)	<b>Anterior segment observation LED (for XYZ alignment)</b> Class of LED products   Class 1 Output   4mW (CW) Wavelength   950nm Full width at half maximum   50nm Beam divergence ( $2\theta$ )   80 deg. (=1.40rad) <b>XY LED (for XY alignment)</b> Class of LED products   Class 1 Output   6mW (CW) Wavelength   950nm Full width at half maximum   50nm Beam divergence ( $2\theta$ )   12 deg. (=0.21rad) <b>KERATO LED (for measuring cornea curvature)</b> Class of LED products   Class 1 Output   14mW(CW) Wavelength   940nm Full width at half maximum   50nm Beam divergence ( $2\theta$ )   120 deg. (=2.09rad)

Class of LED products	Class 1	
LED products (white)	<b>Fixation LED (for fixation target)</b>	
	LED emitting port	Φ6
	Output	61.7nW/cm <sup>2</sup>
	Wavelength (Centroid)	530nm
	Beam divergence (2θ)	Parallel
	Pulse width	CW
LED light source (white)	<b>Fixation LED (for fixation target)</b>	
	Class of LED products	Class 1
	Output	0.08nW (CW)
	Wavelength (Centroid)	530nm
	Beam divergence (2θ)	1.05rad
SLD products	<b>REF M SLD (for measurement)</b>	
	LED emitting port	0.031cm <sup>2</sup>
	Output	3225μW/cm <sup>2</sup>
	Wavelength (Centroid)	875nm
	Beam divergence (2θ)	Parallel
	Pulse width	CW
SLD light source	<b>REF M SLD (for measurement)</b>	
	Class of LED products	Class **
	Output	30mW (CW)
	Wavelength (Centroid)	875nm
	Beam divergence (2θ)	H:11deg (0.19rad) V:36deg (0.63rad)

\* LED light is emitted from the measuring window.



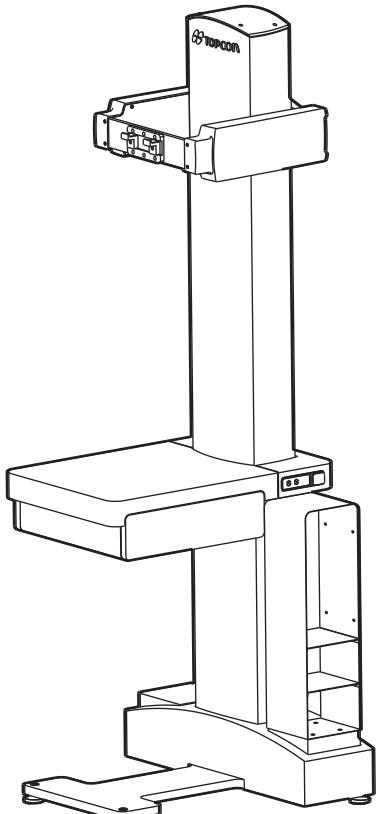
# REFERENCE DATA

## OPTIONAL ACCESSORIES

- Adjustable instrument table exclusively for Chronos  
By using this table, you can change the instrument height freely. So you can perform measurement easily.

### Specifications

- Size ..... 117 (W) × 596.5 (D) × 1747 (H) mm
- Weight ..... Approx. 94.8kg
- Power supply input (rated voltage)..... 750VA (AC240V)





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When calling please give us the following information about your unit:

- Model name: Refraction System Chronos
  - Serial No.: Shown on the rating plate on the right side of the power unit
  - Period of use: Please inform us of the date of purchase.
  - Defective condition: Please provide us with as much detail as possible on the problem.
- 

REFRACTION SYSTEM  
Chronos

USER MANUAL

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75-1 Hasunuma-cho, Itabashi-ku, Tokyo, 174-8580 Japan.

## REFRACTION SYSTEM

# Chronos

### TOPCON MEDICAL SYSTEMS, INC.

111 Bauer Drive, Oakland, NJ 07436, USA Phone:+1-201-599-5100 Fax:+1-201-599-5250 [www.topconmedical.com](http://www.topconmedical.com)

### TOPCON CANADA INC.

110 Provencher Avenue, Boisbriand, QC J7G 1N1 CANADA Phone:+1-450-430-7771 Fax:+1-450-430-6457 [www.topcon.ca](http://www.topcon.ca)

### **EC REP TOPCON EUROPE MEDICAL B.V. (EU Importer)**

(European Representative)(European Sole Sales Company)

Essebaan 11; 2908 LJ Capelle a/d IJssel; P.O.Box145; 2900 AC Capelle a/d IJssel; THE NETHERLANDS  
Phone:+31 -(0)10-4585077 FAX:+31 -(0)10-4585045 Email: [medical@topcon.nl](mailto:medical@topcon.nl); [www.topcon.eu](http://www.topcon.eu)

#### ITALY OFFICE

:Viale dell' Industria 60; 20037 Paderno Dugnano; (Milano), ITALY Phone:+39-02-9186671 Fax:+39-02-91081091 E-mail: [info@topcon.it](mailto:info@topcon.it); [www.topcon.it](http://www.topcon.it)

#### DANMARK OFFICE

:Praestemarksvej 25; 4000 Roskilde, DANMARK Phone:+45-46-327500 Fax:+45-46-327555 E-mail: [topcon@topcondanmark.dk](mailto:topcon@topcondanmark.dk) [www.topcondanmark.dk](http://www.topcondanmark.dk)

#### IRELAND OFFICE

:Unit 276, Blanchardstown; Corporate Park 2 Ballycoolin Dublin 15, IRELAND Phone:+353-18975900 Fax:+353-18293915 E-mail: [medical@topcon.ie](mailto:medical@topcon.ie); [www.topcon.ie](http://www.topcon.ie)

### TOPCON DEUTSCHLAND MEDICAL G.m.b.H.

Hanns-Martin-Schleyer Strasse 41; D-47877 Willich, GERMANY Phone:+49-(0)2154+8850 Fax:+49-(0)2154-885177 E-mail: [med@topcon.de](mailto:med@topcon.de); [www.topcon.de](http://www.topcon.de)

### TOPCON ESPAÑA S.A.

HEAD OFFICE:Frederic Mompou 4 Esc. A Bajos 3, 08960 Sant Just Desvern Barcelona, Spain Phone:+34-93-4734057 Fax:+34-93-4733932 E-mail: [medica@topcon.es](mailto:medica@topcon.es); [www.topcon.es](http://www.topcon.es)

### TOPCON S.A.R.L.

BAT A1 3 route de la révolte 93206 SAINT DENIS CEDEX, FRANCE Phone:+33 1 49 21 23 23 Fax:+33 1 49 21 23 24 E-mail:[topcon@topcon.fr](mailto:topcon@topcon.fr); [www.topcon.fr](http://www.topcon.fr)

### TOPCON SCANDINAVIA A.B.

Neongatan 2; P.O.Box 25; 43151 Mölndal, SWEDEN Phone:+46-(0)31-7109200 Fax:+46-(0)31-7109249 E-mail:[medical@topcon.se](mailto:medical@topcon.se); [www.topcon.se](http://www.topcon.se)

### TOPCON ( GREAT BRITAIN ) LTD.

Topcon House, Kennet Side, Bone Lane, Newbury, Berkshire RG14 5PX United Kingdom  
Phone:+44-(0)1635-551120 Fax:+44-(0)1635-551170 E-mail:[info@topcon.co.uk](mailto:info@topcon.co.uk); [www.topcon.co.uk](http://www.topcon.co.uk)

### TOPCON POLSKA Sp. z o. o.

ul. Warszawska 23; 42-470 Siewierz, POLAND Phone:+48-(0)32-6705045 Fax:+48-(0)32-6713405 [www.topcon-polska.pl](http://www.topcon-polska.pl)

### TOPCON SINGAPORE MEDICAL PTE. LTD.

1 Jalan Kilang Timor, Pacific Tech Centre #09-01 Singapore 159303 Phone:+65-68720606 Fax:+65-67736150 [www.topcon.com.sg](http://www.topcon.com.sg)

#### TOPCON SINGAPORE REPRESENTATIVE OFFICE IN INDONESIA

Level 38, Tower A, Kota Kasablanka unit GH-04, Jl. Casablanca, Kav 88, Jakarta, Indonesia 12870 Phone:+62-21-2963-8004

### TOPCON INSTRUMENTS ( MALAYSIA ) SDN.BHD.

No. D1, (Ground Floor), Jalan Excella 2, Off Jalan Ampang Putra, Taman Ampang Hilir, 55100 Kuala Lumpur, MALAYSIA Phone:+60(0)3-42709866 Fax:+60(0)3-42709766

### TOPCON INSTRUMENTS ( THAILAND ) CO.,LTD.

77/162 Sinnathorn Tower, 37th Floor, Krungthoburi Rd., Klongtontai, Klongsarn, Bangkok 10600,THAILAND Phone:+66(0)2-440-1152~7 Fax:+66-(0)2-440-1158

## Manufacturer



75-1 Hasunuma-cho, Itabashi-ku, Tokyo, 174-8580 Japan.

Phone: 3-3558-2520 Fax: 3-3960-4214 [www.topcon.co.jp](http://www.topcon.co.jp)