

KR460

Auto Keratometer/Refractor

User's Guide

Reichert
Ophthalmic Instruments

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Introduction

Congratulations on your purchase of the Reichert KR460 Auto Keratometer/Refractor. The KR460 is a combination automatic keratometer/refractor which contains an auto alignment system with image processing technology to obtain accurate keratometer and/or refractor measurements of a patient's eyes.

This User's Guide is designed as a training and reference manual. We recommend you carefully read and follow the steps in this guide to ensure optimum performance from your new instrument.

Please retain this guide for your reference. This guide is designed for use with product catalog numbers 13970 (110 VAC) and 13971 (230 VAC). Additional copies can be obtained from your authorized Reichert Ophthalmic Instruments dealer, or our Customer Service Department which can be contacted directly at:

- Tel#: (716) 686-4500,
- Fax#: (716) 686-4555, or
- e-mail: info@reichert.com.

Warnings & Cautions

Reichert Ophthalmic Instruments is not responsible for the safety and reliability of this instrument when:

- Assembly, disassembly, repair or modification is made by unauthorized dealers or persons.
- Instrument is not used in accordance with this User's Guide.

WARNING: ANY REPAIR OR SERVICE TO THE KR460 MUST BE PERFORMED BY EXPERIENCED PERSONNEL OR DEALERS WHICH ARE TRAINED BY REICHERT OPHTHALMIC INSTRUMENTS SO THAT CORRECT OPERATION OF THE KR460 IS MAINTAINED.

WARNING: DO NOT REMOVE THE OUTSIDE COVERS OF THE UNIT OR ATTEMPT TO REPAIR ANY INTERNAL PARTS. REPAIR AND SERVICE OF THE UNIT MUST BE PERFORMED BY EXPERIENCED PERSONNEL OR DEALERS WHICH ARE TRAINED BY REICHERT OPHTHALMIC INSTRUMENTS.

CAUTION: MAKE SURE THAT THE VOLTAGE APPLIED TO THE UNIT IS THE SAME AS THE VOLTAGE WHICH IS GIVEN ON THE DATA PLATE NEXT TO THE INPUT CORD RECEPTACLE OR DAMAGE TO THE UNIT MAY OCCUR.

CAUTION: THIS INSTRUMENT HAS ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (ESDS) WHICH ARE SENSITIVE TO STATIC HIGH VOLTAGES STORED IN AND TRANSFERRED BY THE HUMAN BODY. OBSERVE CORRECT ESDS PRECAUTIONS OR PREMATURE MALFUNCTION OF THIS INSTRUMENT WILL OCCUR.

CAUTION: THIS INSTRUMENT MUST BE PLUGGED INTO AN OUTLET WITH AN EARTH GROUND WHICH IS CONNECTED TO THE RECEPTACLE OR DAMAGE TO THE UNIT MAY OCCUR. DO NOT DISABLE OR REMOVE THE GROUND PIN.

CAUTION: THIS INSTRUMENT IS NOT SUITABLE FOR USE IN THE PRESENCE OF FLAMMABLE ANESTHETIC MIXTURES, SUCH AS OXYGEN OR NITROUS OXIDE.

CAUTION: DO NOT USE SOLVENTS OR STRONG CLEANING SOLUTIONS ON ANY PART OF THIS INSTRUMENT OR DAMAGE TO THE UNIT MAY OCCUR.

CAUTION: USE OF ALCOHOL ON THE LIQUID CRYSTAL DISPLAY (LCD) MAY CAUSE DAMAGE TO THE DISPLAY.

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Instrument Setup

Great care has been taken to deliver your new KR460 Auto Keratometer/Refractor safely to you. The container and packaging was specially designed to transport this unit. Please retain the packaging for future use if transportation is required.

Unpacking Instructions

Please unpackage the instrument in the following manner: (Refer to Figures 1 thru 4)

The instrument is packaged in a shipping container to protect the instrument from damage during shipment. Inside the shipping container, is a box (inner box) which contains the unit and the accessories. Please read the User's Guide before operating the unit. A quick Reference Card is provided for your convenience and reference during operation of the unit.

1. Remove the Accessory Tray from the Inner Box.
2. Remove the accessories from the tray.
   - Power cord
   - Dust cover
   - Spare printer paper (2 rolls)
   - Cleaning cloth
   - Phillips-head screwdriver
   - Quick Reference Card
3. Remove the packaging material below the Accessory Tray that secures the unit. Lift the unit out of the Inner Box using the handle slots provided on the Cradle.
4. Unfold the Cradle and remove the plastic bag over the unit. Set the unit on a secure table.
5. Put the shipping materials in a safe place of storage so that if transportation is required in the future, the packaging wil be available.

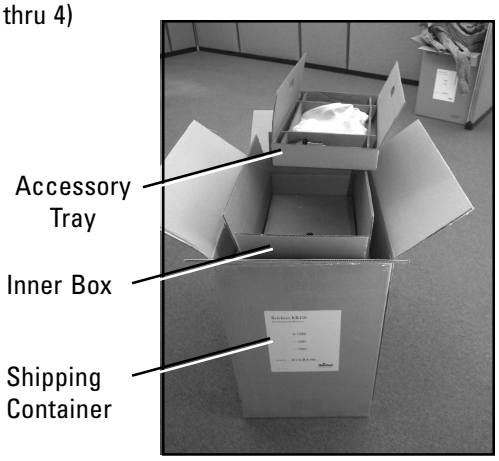


Figure 1, Shipping Container

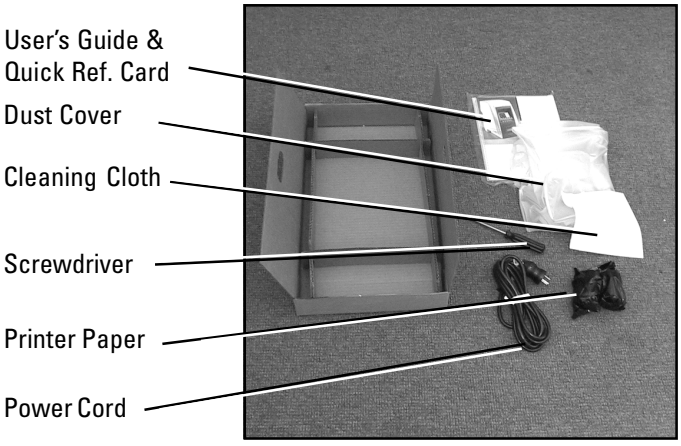


Figure 2, Instrument Components

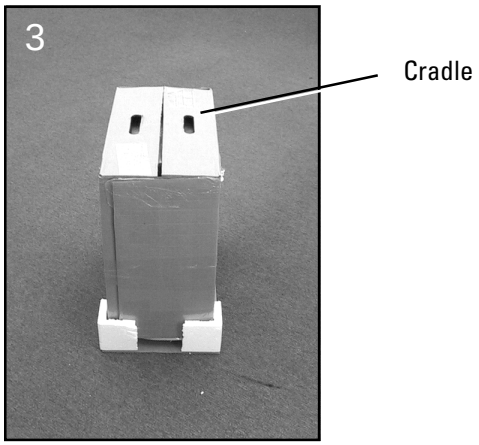


Figure 3, Instrument Cradle

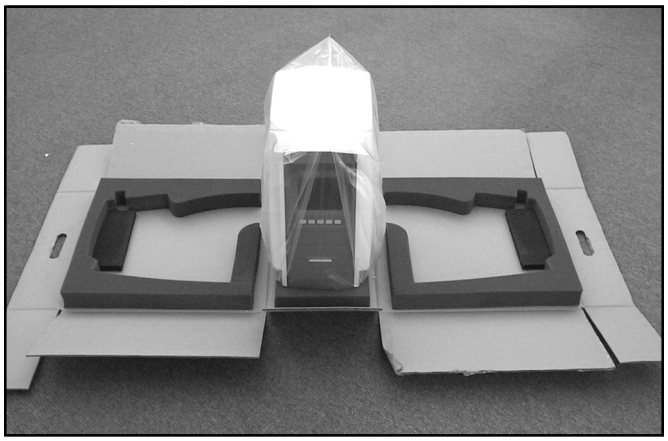


Figure 4, Instrument with Packaging

Instrument Setup (Continued)

Disengage Travel Lock

Disengage the Travel Lock located behind the Printer Door as follows:

- Open the Printer Door by pushing on the door above the printer paper slot. Refer to Figure 5.
- Remove the foam insert that secures the printer paper during shipment and store it with the packaging materials.
- Insert the Screwdriver (phillips-head) into the Travel Lock hole and locate travel lock screw. Refer to Figure 6.
- Turn the screw six full turns counterclockwise (the screw remains inside the Travel Lock hole).
- Remove the Screwdriver, align the printer paper through the paper slot and close the Printer Door.

Note: If at any time the unit is transported, the Travel Lock must be engaged prior to packaging the unit in the shipping box.

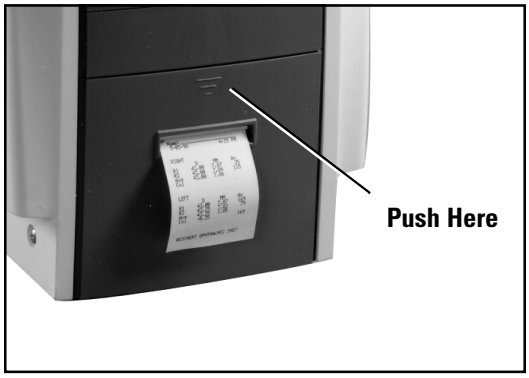


Figure 5, Opening Printer Door

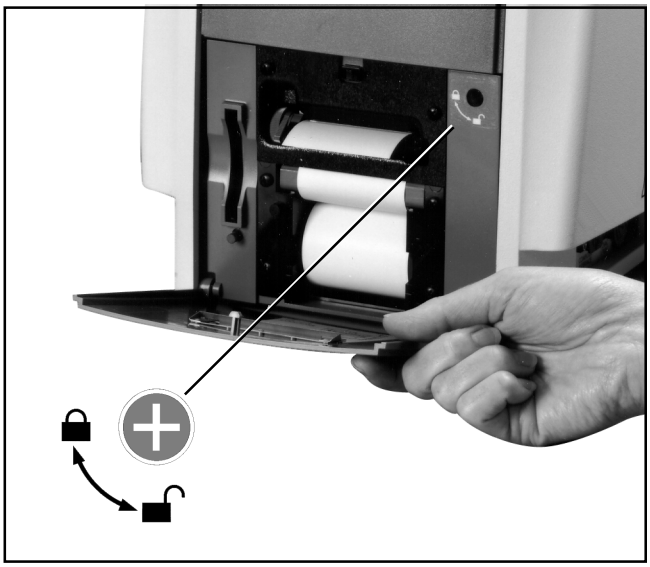


Figure 6, Travel Lock

Application of Input Power

CAUTION: MAKE SURE THAT THE VOLTAGE APPLIED TO THE UNIT IS THE SAME AS THE VOLTAGE WHICH IS GIVEN ON THE DATA PLATE NEXT TO THE INPUT CORD RECEPTACLE OR DAMAGE TO THE UNIT MAY OCCUR.

CAUTION: FOR CONTINUED PROTECTION AGAINST THE RISK OF FIRE, ANY REPLACEMENT OF DAMAGED FUSES MUST BE IN ACCORDANCE WITH THE FOLLOWING TYPE AND RATING.

(100/120 Volts use "T 0.63 AL 250V" fuses)
(220/240 Volts use "T 0.315 AL 250V" fuses)

6. After the unit is secure, plug in the instrument using the Power Cord which was contained in the Accessory Tray.
7. Press any Control Button below the operators screen as indicated on the instrument.
8. Read and fully understand the User's Guide and the Quick Reference Card before operating this instrument.

WARNING: DO NOT REMOVE THE OUTSIDE COVERS OF THE UNIT OR ATTEMPT TO REPAIR ANY INTERNAL PARTS. REPAIR AND SERVICE OF THE UNIT MUST BE PERFORMED BY EXPERIENCED PERSONNEL OR DEALERS WHICH ARE TRAINED BY REICHERT OPHTHALMIC INSTRUMENTS.

Instrument Setup (Continued)

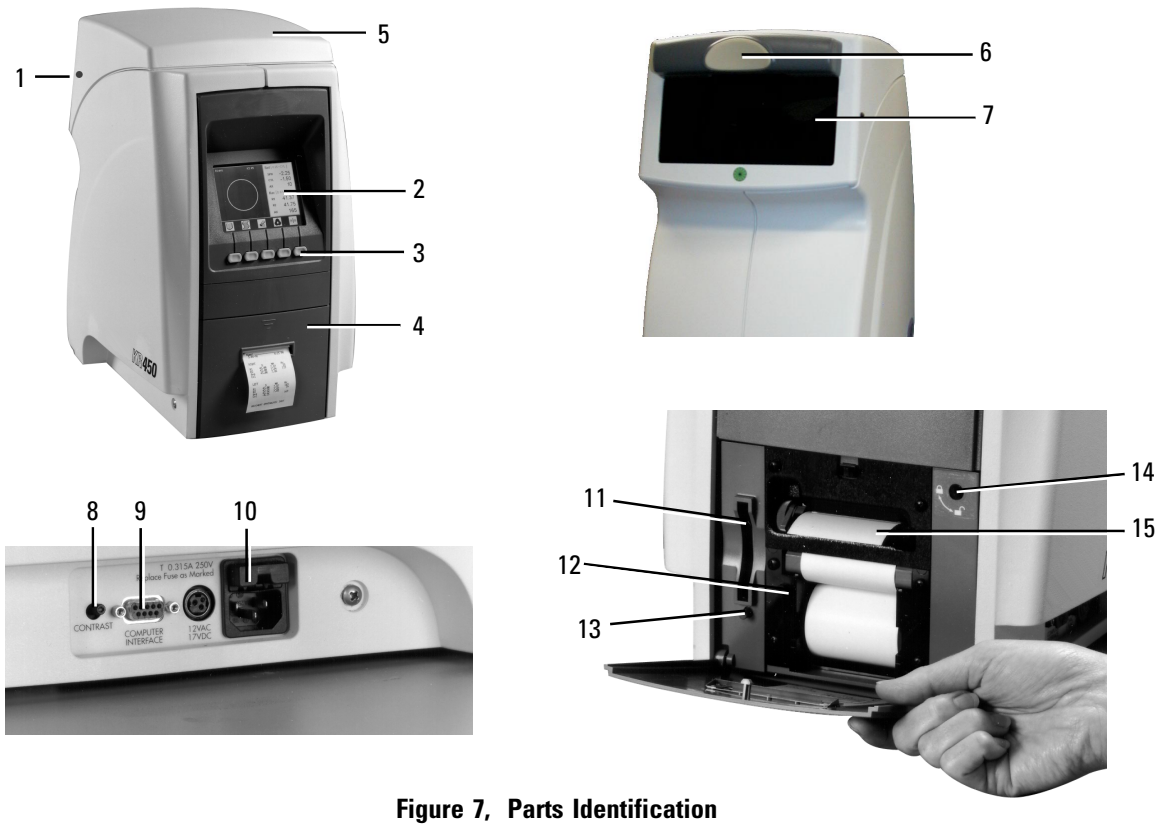


Figure 7, Parts Identification

Parts Identification

1. **Canthus Alignment Marks** (right and left side): Alignment mark which sets reference for vertical height of eye.
2. **Operator Display**: LCD Operators display providing measurement data.
3. **Control Buttons**: Buttons used to select the Icons displayed on the Operator Display.
4. **Printer Door**: Printer door (push to open) to access travel lock and printer paper.
5. **Headcover**: Outside top cover which provides access to the optical head assembly.
6. **Forehead Rest**: Alignment mechanism which moves right / left for correct patient positioning.
7. **Patient Window**: Window through which the patient observes the fixation target.
8. **Contrast Control**: Control knob which lightens/darkens the Operator Display.
9. **RS-232C Port**: Communication port which contains printer data.
10. **Main Power & Fuse Holder**: Connection point for input power and fuses. Press tab up to remove fuse holder.
11. **PC Card Slot**: Slot for installing PC Cards which contain upgrades / new options. After installation, the PC Card must remain installed.
12. **Printer Paper Advance Button**: Button for advancing the printer paper and setting the printer off-line/on-line.
13. **Reset button**: A push-button switch which when depressed performs a system reset (or hardware reboot) of the instrument.
14. **Travel lock**: Locking mechanism which secures the internal parts of the unit during shipment.
15. **Printer**: Thermal printer supplied with the unit.

Instrument Setup (Continued)

Icon Definition

The KR460 incorporates a user-friendly icon/menu-based operating system which will increase the speed of measurements, training and use. Below are the Icons which are used during the operation of this instrument.

Icon	Icon Description	
	**MODE**	Accesses secondary level menus such as setup and help.
	**MEASURE**	Initiates the measurement sequence.
	**CLEAR DATA**	Clears both right and left data on the Operator Display and in memory.
	**PRINT**	Sends the data to the printer.
	**REVIEW**	Accesses the review of keratometer and refractor data functions.
	**REVIEW RIGHT/LEFT**	Reviews the right and left eye data.
	**MIRE RING**	Displays the circular mire data.
	**ENHANCED MIRE**	Displays the enhanced mire data.
	**REFRACTION DATA**	Displays the right and left refraction measurements.
	**CONVERT D/MM**	Converts keratometric data from power (D) to radius of curvature (mm) or vice versa in the REVIEW mode.
	**CONVERT ZERO VERTEX**	Converts refraction data to zero vertex distance in the review mode.
	**SETUP**	Provides access to the default settings so that changes can be made.
	**HELP**	Displays help instructions.
	**SERVICE**	Displays service information.
	**TRAVEL LOCK**	Positions the instrument to the “park” position so that the travel lock can be engaged.
	**PERIPHERAL**	Accesses the Peripheral measurement mode.

Instrument Setup (Continued)

Default Settings

The KR460 has default settings which are set at the factory. A summary of these settings are given on the next page. A detailed definition/explanation of each setting is given on pages 11-15.

The following steps provide the details on how to customize the default settings.

How To Customize:

1. Press the button below the **MODE** icon.
2. Press the button below the **SETUP** icon.
3. Press the button below the **UP/DOWN ARROWS** icon to choose the appropriate **setup category** (e.g., Printout Setup).
4. Press the button below the **SELECT** icon to display the **parameters** and **settings** of the **setup categories**.
5. Press the button below the **UP/DOWN ARROWS** icon to move the cursor box to the desired **parameter**.
6. Press the button below the **SELECT** icon to activate the highlighted **parameter**.
7. Press the button below the appropriate **RIGHT/LEFT ARROWS** icon to move the cursor box to the desired **setting** for the **parameter**.
8. Press the button below the **SELECT** icon to activate the highlighted **setting**.
9. Press the button below the **RETURN** icon to step back thru the previous menus until the Main Menu is shown.

Icon	Icon Description	
	**MODE**	Accesses **setup categories** such as setup and help.
	**SETUP**	Provides access to the **parameters** so that the default **settings** can be modified.
	**RETURN**	Returns to preceding screen.
	**RIGHT ARROW**	Used in the setup menus to move right horizontally.
	**LEFT ARROW**	Used in the setup menus to move left horizontally.
	**UP ARROW**	Used in the setup menus to move up vertically.
	**DOWN ARROW**	Used in the setup menus to move down vertically.
	**SELECT**	Used in the setup menus to activate the new **parameter** or **setting**.

Instrument Setup (Continued)

Default Settings (Continued)

This instrument is sent from the factory with measurement, printer, communication, and miscellaneous parameters set to default settings. These settings can be changed to suit the needs of the individual operator/clinician. A summary of these settings are given below with the default selections shown in **bold** type. To customize these settings, follow the steps given on page 9, *Instrument Setup*, *Default Settings*.

Customized Options

This instrument has the following default settings:

Keratometer Setup: (page 11)

Units:	**Diopters**, MM
Diopters:	0.12, **0.25**
Readings:	**Single**, Avg(3)
Peripheral:	On, **Off**

Refractor Setup: (page 12)

Diopters:	0.01, **0.12**, 0.25
Cylinder:	**Minus(-)**, Plus(+), Mix(+/-)
Vertex:	0 12, 13.5, **13.75**, 15, 16.5
Reading:	**Single**, Avg(3), Avg(5)

Printout Setup: (page 13)

Auto Print:	Off, **On**
Data:	**All**, Avg
Graphics:	**No**, All, Mire, Eye
Date Format:	**MDY**, DMY, YMD
Time Format:	**AM/PM**, 24 HR
Date:	04/17/2000
Time:	05:00 PM
Printer:	**On**, Off
Practice:	Reichert

Communications Setup: (page 14)

Baud:	2400, 4800, 9600, **19200**
Parity:	**None**, Odd,Even
Data Bits:	7, **8**
Stop Bits:	**1**, 1.5, 2
Flow:	**None**, Xon/Xoff
Printer:	**On**, Off

Miscellaneous Setup: (page 15)

Language:	**Eng**, Fra, Deu, Esp, Por, Ita
Tone:	**On**, Off
Sleep:	5, **10**, 20, 90
Automeasure:	**On**, Off
Measure:	**K+R**, R only, K only

Note: Default settings are shown in **Bold** type.

Instrument Setup (Continued)

Keratometer Settings


Right

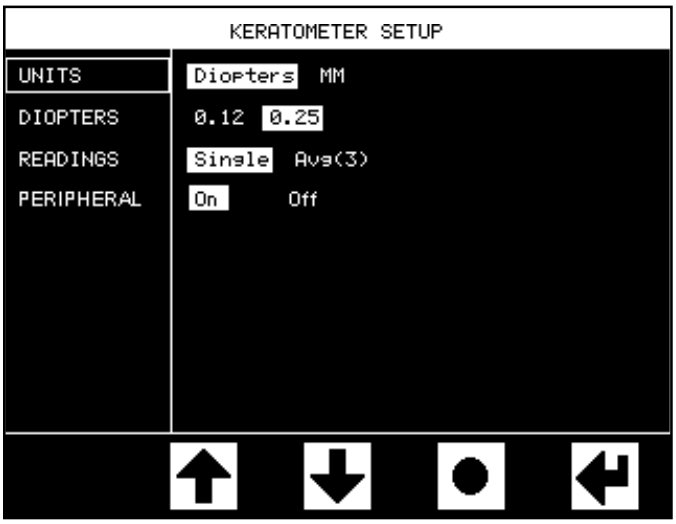

Left


Up


Down


Return


Select



The following changes can be made to the default settings to modify the keratometer parameters:

Parameters	*Settings*
UNITS	Choose diopters (D) or millimeters (mm).
DIOPTERS	Choose 0.12D or 0.25D rounding.
READINGS	Choose one measurement per eye (Single) or three measurements per eye with the average being shown Avg (3).
PERIPHERAL	Allows peripheral readings to be taken on patient's eye. This Option is either set to On or Off.

Instrument Setup (Continued)

Refractor Settings


Right

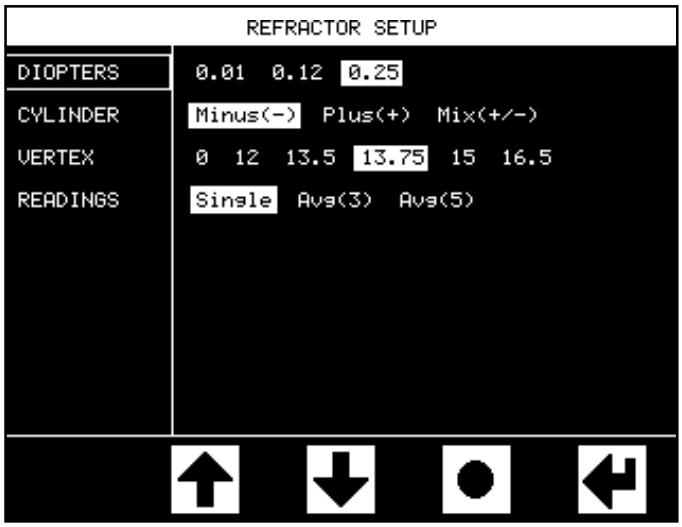

Left


Up


Down


Return


Select



The following changes can be made to the default settings to modify the refractor parameters:

Parameters	*Settings*
DIOPTERS	Choose 0.01D, 0.12D or 0.25D rounding.
CYLINDER	Choose Minus (-), Plus (+) or Mixed (+/-) cylinder mode.
VERTEX	Choose vertex distances of 0.0, 12.0, 13.5, 13.75, 15.0 or 16.5 millimeters.
READINGS	Choose one measurement per eye (Single), three measurements per eye with the average being shown Avg (3), or five measurements per eye with the average being shown Avg (5).

Instrument Setup (Continued)

Printout Settings


Right

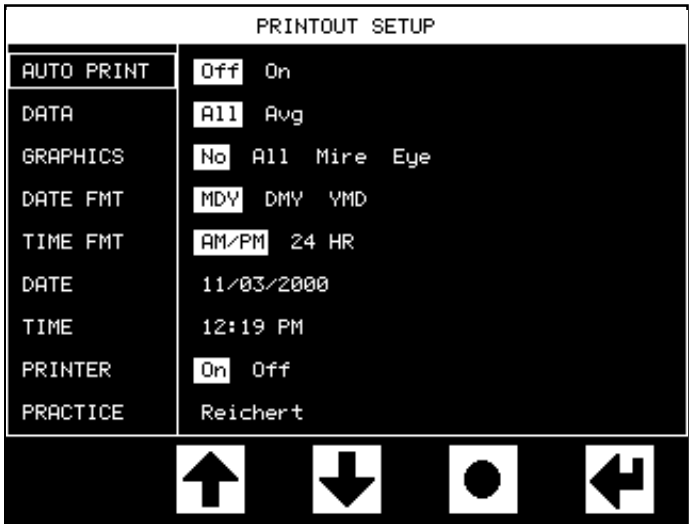

Left


Up


Down


Return


Select



The following changes can be made to the default settings to modify the printout parameters:

Parameters	*Settings*
AUTOPRINT	Automatically prints data after all patient measurements are completed.
DATA	Prints all measurement data (ALL) or only average values (Avg).
GRAPHICS	Permits the printing of: data only (No); all graphics and data (All); enhanced mire, mire ring, and data (Mire); or eye graphic and data (Eye).
DATE FMT	Choose the printed format: D=Day, M=Month, Y=Year
TIME FMT	Choose the time format.
DATE	Once you have selected the option to be changed, use the PLUS (+) or MINUS (-) buttons to increase or decrease the numbers, then press the SELECT button.
TIME	Change the time following the same instructions to change the date above.
PRINTER	Permits the printer to be turned on or off.
PRACTICE	Up to 30 characters (letters and numbers) can be printed at the end of the printout. Change characters using the PLUS and MINUS buttons to scroll through the alphabet. Once you have found the letter you require, press the button below the RIGHT or LEFT arrow to move horizontally to the next letter. To exit, press the button below the SELECT button, then the RETURN button.

Instrument Setup (Continued)

Communications Settings


Right

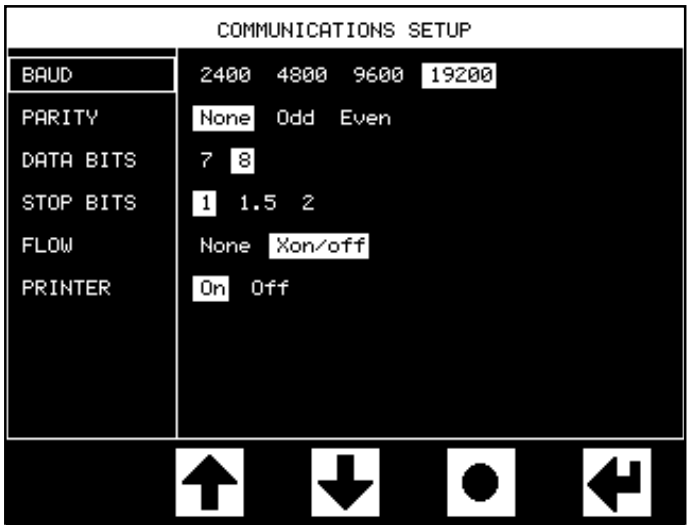

Left


Up


Down


Return


Select



The KR460 can transfer data to an external device, such as a computer, through the RS-232C serial port. Make changes to the Communications Setup settings to match those of the external device connected to the instrument.

The following changes can be made to the default settings to modify the communications parameters:

Parameters	*Settings*
BAUD	Serial transmission data rate, relates to bits per second (bps).
PARITY	Bits added to data transmission used to detect transmission errors. Either None, Even, or Odd are the selections.
DATA BITS	Number of bits which make up data transmission word. Usually 7 or 8 bits in length.
STOP BITS	Number of bits added to the end of the data transmission word to signal the end of transmission. Usually 1, 1.5, or 2 bits in length.
FLOW	The means used to control data transmission flow between the sender and the receiver. Often called handshaking. Can be either hardware or software controlled or none.
PRINTER	You can turn the printer off if you want to send data only to the RS-232C serial port.

Instrument Setup (Continued)

Miscellaneous Settings


Right

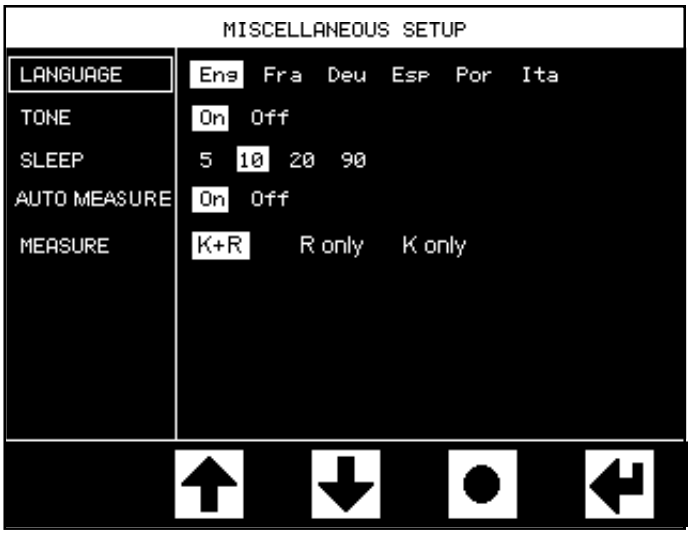

Left


Up


Down


Return


Select



The following changes can be made to the default settings to modify the miscellaneous parameters:

Parameters	*Settings*
LANGUAGE	Sets the language which is used on the operator screen.
TONE	The audible tone indicator can be turned either On or Off.
SLEEP	Choose an inactivity period of 5, 10, 20 or 90 minutes before the instrument goes to "sleep" (the screen goes blank when it goes to "sleep" - press any button to "wake" the unit).
AUTO MEASURE	Sets the instrument to automatically begin the measurement process (without pressing any buttons) once the patient is placed against the headrest assembly.
MEASURE	Sets instrument for keratometric and refraction readings (K & R). Choose "R only" for refraction readings only and "K only" for keratometric readings only.

Instrument Operation

Introduction

The KR460 is an advanced electronic keratometer/refractor which acquires precise data from the eye and contains an innovative automated alignment system which quickly aligns itself to the patient during the measurement process.

Special Features of the KR460

The KR460 has special features which are not available on other keratometer/refractors. The instrument features are: a PC Card Slot for installing upgrades at a remote location, self-calibration routines, and an auto alignment system. Additional features contained in this instrument are a translating headrest assembly with an integral L/R Detector, and a Travel Lock Assembly. A description of the special features of the KR460 are as follows:

Upgrade Installation

The operating system was designed to accept upgrade options without making it necessary to return the instrument to the factory. The access port is located behind the printer door and accepts a PC Card which is pre-programmed with the applicable upgrades. When the update is installed, the PC Card must remain installed into the unit (if it is removed, the instrument will revert to its original version of software).

Self-Calibration Procedure

This instrument contains software which periodically performs a calibration check of its software and hardware system. The self-calibration procedure is initiated immediately after the unit has power applied and after each eye is tested. This procedure maintains the measurement accuracy of the instrument.

Auto Alignment System

Our patented "hands-free" auto alignment technology in this instrument removes the necessity to adjust any joystick or chin rest. When the patient views the fixation target and sets their head against the headrest assembly, the auto alignment system recognizes the eye and then automatically aligns the measurement system to the apex of the eye.

Translating Right/Left Headrest Detector

Each instrument contains a headrest assembly which moves right / left. Integral within this headrest assembly is a right / left detector which automatically indicates which eye the instrument is measuring.

Travel Lock Assembly

A travel lock assembly is provided within the instrument to secure the positioning system during transportation.

To set the travel lock assembly, the instrument must first position itself in front of the locking mechanism. This is performed by pressing the button below the MODE icon, then the TRAVEL LOCK icon. After the locking mechanism is set into the “parked” position, the operator must use a phillips-head screwdriver and secure the travel lock (as indicated on page 34 of this manual). Once the travel lock is secure, the operational integrity of the instrument will be maintained during shipment.

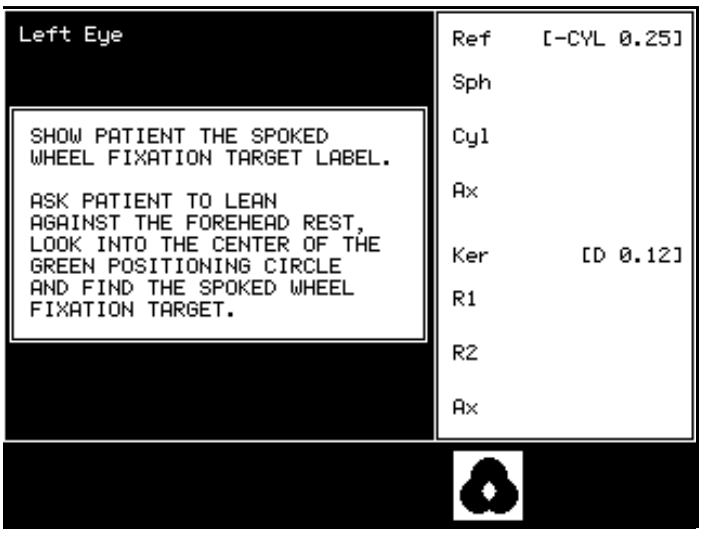
Initialization

Once input power is applied to the instrument, the KR460's screen will display a screen similar to that shown below. After the calibration check is complete, press any button to continue. You are now ready to start using the instrument.

Note: If you have forgotten to disengage the Travel Lock, disengage it. Refer to Figures 5 and 6.



After you press any button, the Operator Display will look similar to that shown below.



The KR460 features a fully automatic alignment system which enables the instrument to align itself to the apex of the patient's eye. This innovative system makes the measurement process quicker and more comfortable for the patient. This instrument is sent from the factory in this auto measurement mode (refer to the *Instrument Setup, Default Settings* section in this manual, for a description of the default settings. Perform the following steps to measure the patient's eye.



Figure 8, Right/Left Headrest Assembly

1. Move the headrest so that it is positioned for a right or left measurement. Refer to Figure 8.
2. Ask the patient to look for the green fixation target inside the positioning circle and then lean forward (continue to look at the fixation target) and place his/her forehead on the soft pad in the middle of the forehead rest. (Refer to Figure 9.)

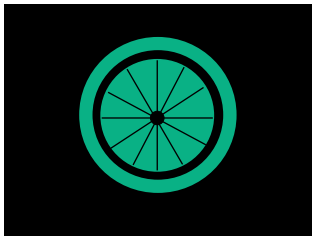


Figure 9, Positioning Circle and the Fixation Target

NOTE: If the patient has difficulty finding the green positioning circle, the patient may need to move up or down on the forehead rest. Use the canthus marks on the sides of the instrument to assist in vertical alignment.

3. Once the patient is leaning against the forehead rest, the instrument will begin the positioning process.

- The patient should be seated comfortably on the patient side of the instrument.
- The patient should be positioned in such a way which encourages him/her to lean forward with their chin as close to the instrument as possible. This will reduce the difficulties associated with misalignment and non-measurement of the eye (refer to Figures 10 & 11).



Figure 10 - Proper patient alignment (chin close to unit)



Figure 11 - Improper patient alignment (chin moved away from unit)

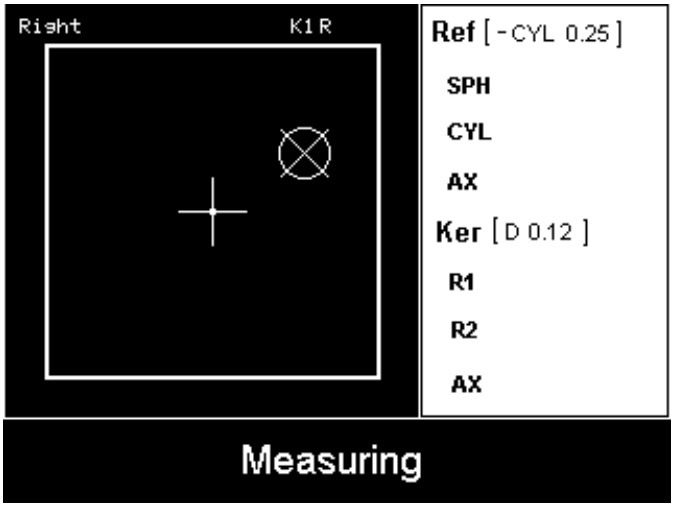
4. During the positioning process, the operator's screen will change and look similar to the one shown below. The measure icon and the "X" will move inside the larger box. This indicates that the patient is within the instrument's acquisition zone. The circle with the "X" will move toward the center of the box and align over the center alignment mark (+). Once the positioning system is aligned the measurement process will begin. During the measurement process the patient must remain as still as possible.

Note: If the circle on the screen is over the alignment mark in the center of the screen and the instrument does not start to measure, refer to the *Instrument Setup, Miscellaneous Settings* section in this manual and set the auto measure option to "On."

Note: If the instrument seems to have trouble acquiring the patient's eye during the measurement process (e.g., it keeps aligning but never takes a reading), it may be necessary to ask the patient to:

- **remain still and try not to move**
- **open his/her eyes wider, or**
- **tilt his/her head toward the window.**

5. After the completion of the first eye data, the instrument will display the data and then the instrument will give a "beep." At this time the patient to can move their forehead away from the instrument.




Mode


Measure


Clear Data


Print

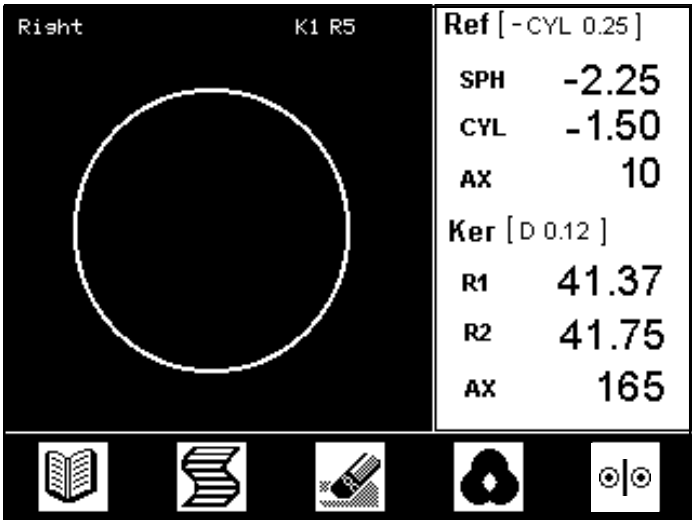

Review

6. There are several options available at this point:
   a. The Forehead Rest can be slid to the opposite side to continue taking measurements on the other eye.
   b. All data can be cleared and measurements can be taken again (press the button below the CLEAR icon).
   c. The eye data can be reviewed (press the button below the REVIEW icon).
   d. The data can be printed by pressing the button below the PRINT icon.

Note: The instrument will print out the data from both eyes if the button below the PRINT icon is selected after both eyes are measured.

   e. Go to the main menu (press the button below the MODE icon) then press the button below the SETUP menu and change the defaults (for printing or the number of measurements) for the data.

Note: Going to the SETUP menu will not erase the current measurement data.



Description of Measurement Data

The measurement data displayed on the screen for both the right and left eyes is as follows:

Refractor (Ref):

SPH represents the spherical power of the measured eye.

CYL represents the cylindrical power of the measured eye.

AX represents the axis of the cylinder

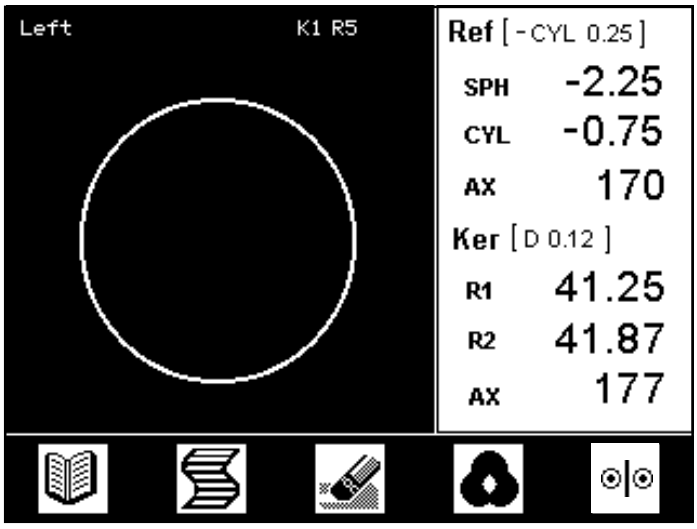
Keratometer (Ker):

R1 represents the maximum radius of curvature (“flattest” curve), lowest power meridian.

R2 represents the minimum radius of curvature (“steepest” curve), highest power meridian.

AX represents the axis of R1.

The screen also shows the cylinder mode and rounding mode for the refractor measurements, and the measurement mode and rounding mode for the keratometric measurements.




Review


Print


Review Right/Left


Mire Ring


Enhanced Mire



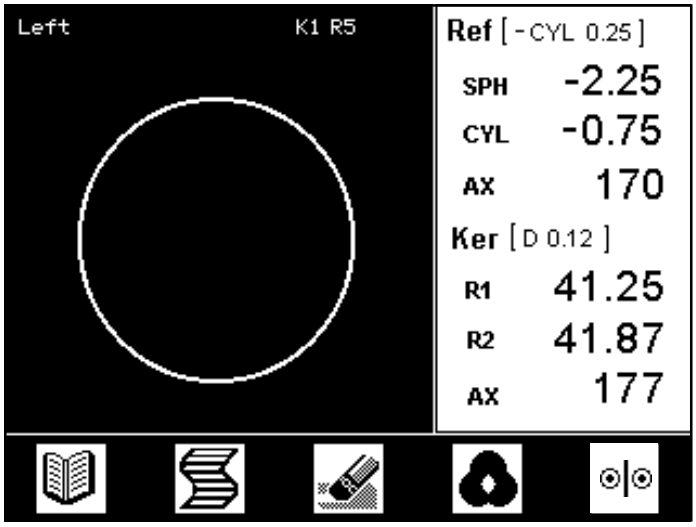
Convert


Refraction Data

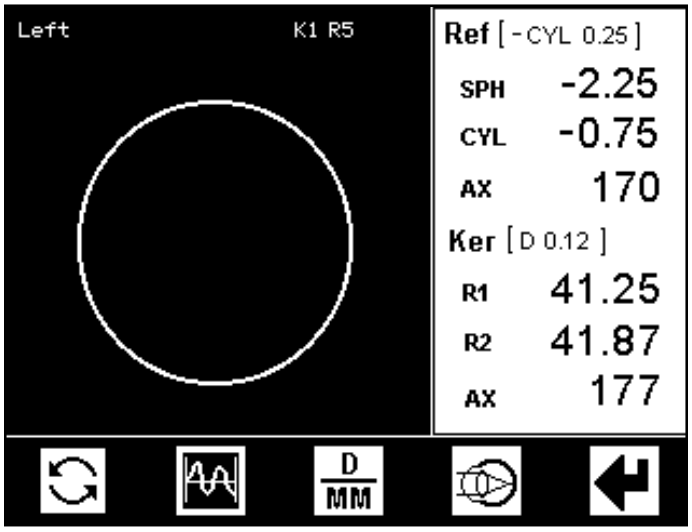

Return

Reviewing Keratometer and Refractor Data

Once the measurement process is complete you have the opportunity to review the measurement data for each eye.



To access the review functions, press the button under the REVIEW RIGHT/LEFT icon. The screen will change and look similar to the one below:



After entering the review screen, you now have the following choices (choosing the buttons from left to right):

1. Go to the opposite eye data screen and review the other eye data.
2. Go to the enhanced mire data screen.
3. Convert the keratometer data from diopters to mm, or mm to diopters.
4. Go to the refraction data screen and view both the right and left refraction data.
5. Return to the measurement screen.



Mire Ring



Review Right/Left



Convert



Enhanced Mire

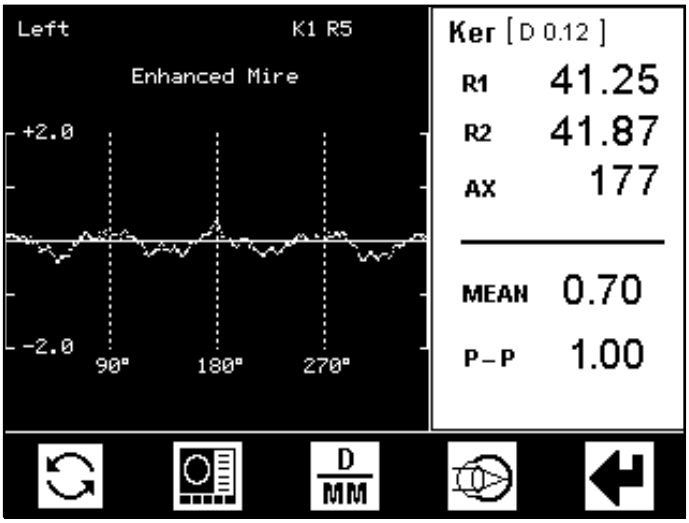
Keratometric Data

When entering the REVIEW screen, the circular mire data is displayed. In this mode, one eye refraction and the keratometer data is displayed (K + R mode) with the circular mire or, if the unit is in the K only mode, both the right and left data is displayed with a mire of the right or left eye. In the K + R mode, to change the mire from either left-to-right or right-to-left, press the REVIEW RIGHT/LEFT button. Right or Left is displayed in the upper left hand corner of the screen to indicate the mire ring being viewed.

To review the enhanced mire, press the button under the ENHANCED MIRE icon. (For further information, see the Enhanced Mire section below).

Enhanced Mire

To view the enhanced mire, press the button under the ENHANCED MIRE icon; the screen will change and look similar to the one below.



To alternate between the right and left eye, repeatedly press the button under the REVIEW RIGHT/LEFT icon.

The enhanced mire is a linear version of the circular mire. It shows, in detail, how the shape of the cornea is affected by localized imperfections in the region of the circular mire.

The zero reference line on the graph represents a best spherical and cylindrical fit to the circular mire. If there were no localized corneal imperfections around the circular mire, the resulting enhanced mire graph would lie on the reference line. A localized “flattening” of the cornea (a lessening of corneal power) has the opposite effect. The more localized imperfections on the cornea, the more deviations along the enhanced mire graph line.

The P-P (peak to peak) value represents the largest deviation between the highest and lowest points on the graph. This indicates the maximum localized defect on the cornea and helps with understanding the optical performance of the corneal surface.



Enhanced Mire



Refraction Data



Convert Zero Vertex

Enhanced Mire Data

The mean value provides an average of the absolute value of the deviation from the reference line. Minor deviations along the reference line are "normal." Larger deviations represent points of interest for diagnosis, tracking and characterization of unusual conditions.

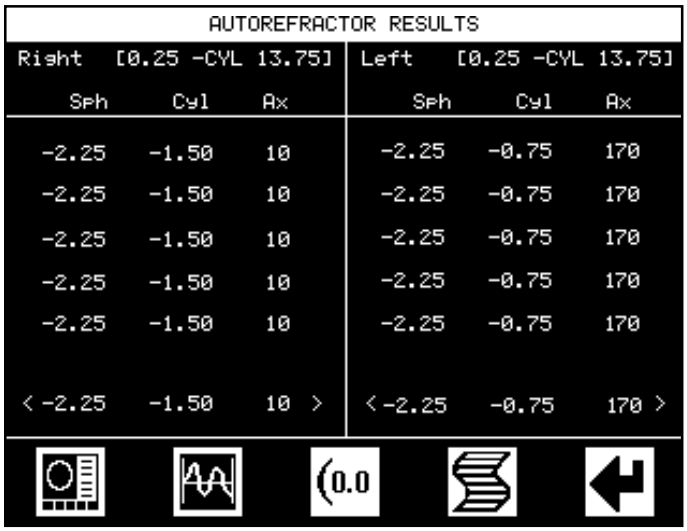
Both the P-P and the mean values can be used to track corneal changes over time. This is especially useful if a patient is known to have keratoconus or has undergone corneal surgery. These values, combined with the enhanced mire, may also help identify patients who may have difficulty wearing contact lenses because of localized irregularities on the corneal surface.

Converting Data

The CONVERT icon allows you to review the keratometric data on the screen in either millimeters (MM) or diopters (D). It does not effect the default in setup. When you print, both millimeters and diopters are printed.

Refraction Data

To view all of the refraction measurements, press the button under the REFRACTION DATA icon, the screen will change and look similar to the one below.



This screen shows all of the refraction measurements taken on both the right and left eye. The average reading for each eye is shown at the bottom.

Convert Zero Vertex

To convert the refracting data to a zero vertex distance, press the button under the CONVERT ZERO VERTEX icon.

Note: To return to the original vertex distance, press the RETURN, REVIEW, and then the REFRACTION DATA icons.

Printing Measurement Data



Print

To print the measurement data, press the button below the PRINT icon. There are various print options available. For example, you can print either numeric data, eye diagrams, or mire ring data. You can also print various combinations of numeric data, eye diagrams, or mires. Refer to the *Printout Settings* section on p. 13 for instructions on selecting desired options.

A sample of a printout showing numeric data, an eye diagram and mire ring and enhanced mire is shown below:

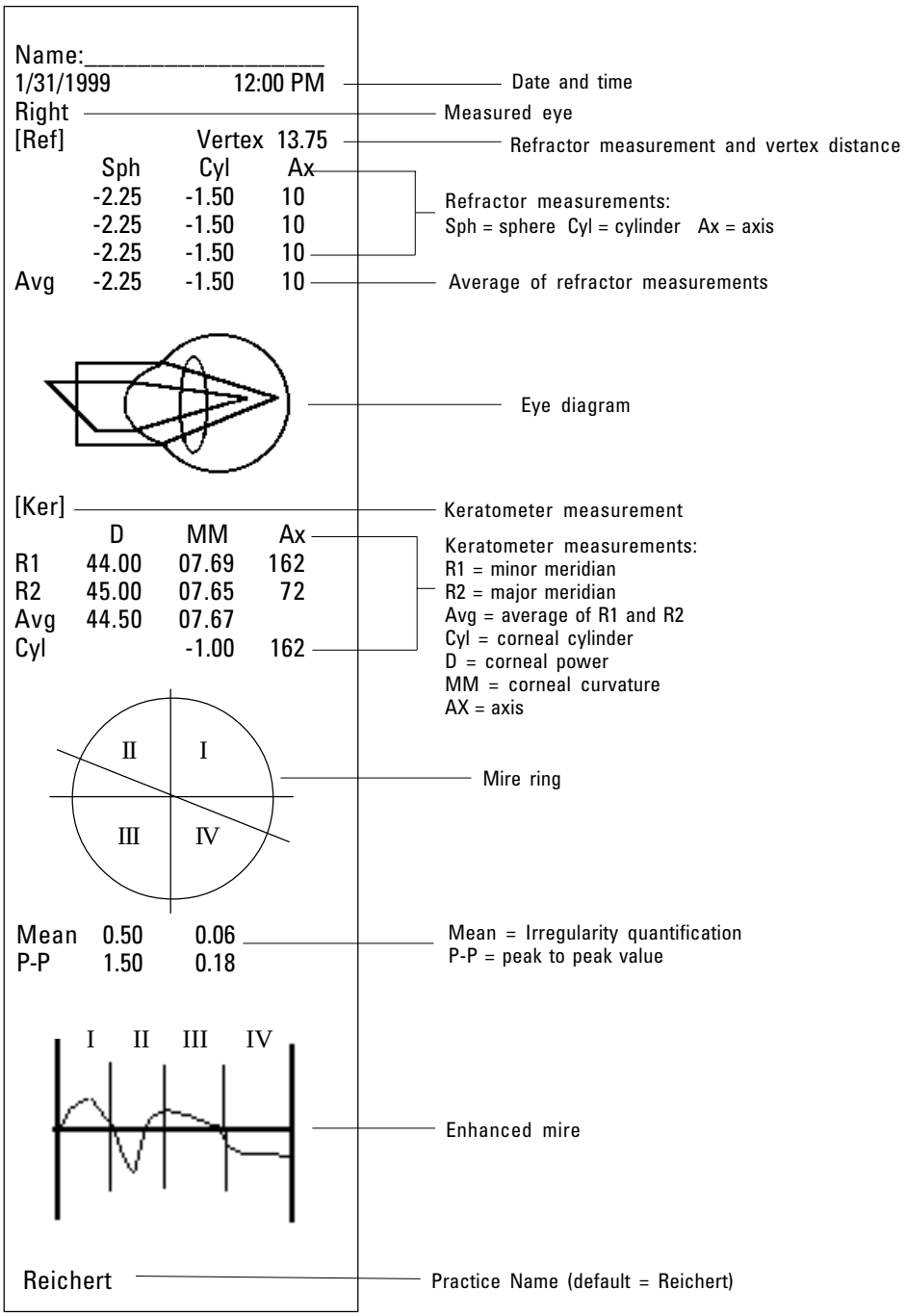


Figure 12, Sample Printout



Clear Data

Eye Diagram

This shows a graphical interpretation of the patient's refractive measurement and can be useful when talking to the patient about their refractive condition. There are six patterns which can be printed:

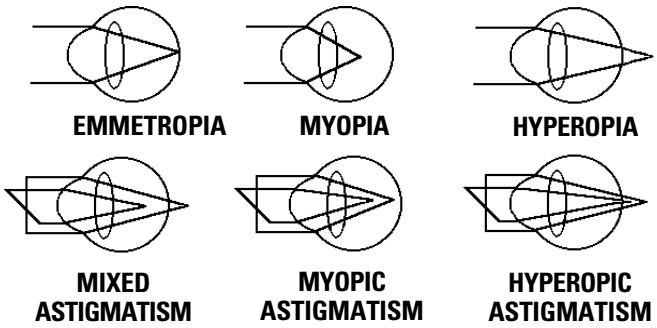


Figure 13, Sample Refractive Graphics

Mire Ring and Enhanced Mire Printout

Both the mire ring and enhanced mire can be printed. This is useful when you are tracking a patient's corneal condition over time. The line running through the mire ring represents the angle of corneal astigmatism. The numbered quadrants in the ring refer to the numbered quadrants along the enhanced mire line.

A sample of a printout showing a mire ring and enhanced mire data is shown below:

NOTE: All thermal paper printouts tend to fade over time. If you need a permanent record, make sure you write down the relevant data onto the patient's record.

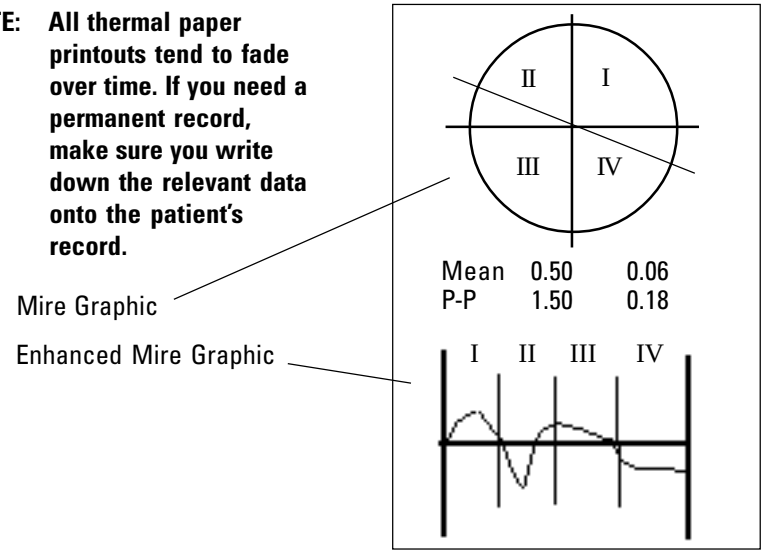


Figure 14, Sample Mire and Enhanced Mire Graphics

Clearing Data

If you decide not to make a printout, press the button under the CLEAR DATA icon. This will clear all data from the memory and the screen. The instrument is now ready for the next patient.

Peripheral Measurements



Peripheral



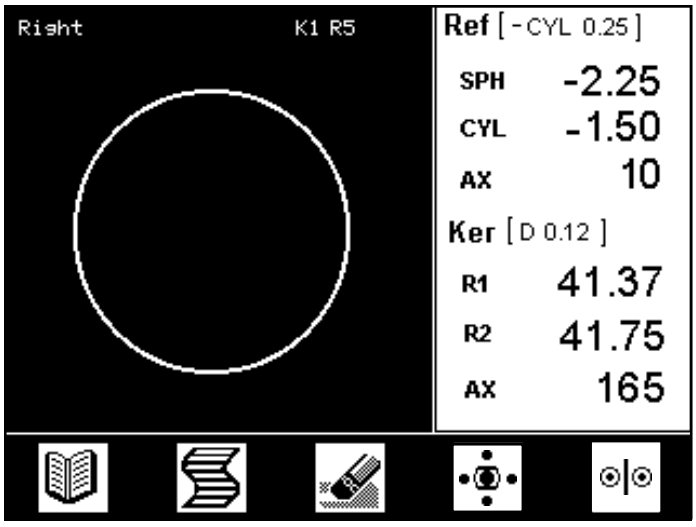
Measure

Peripheral measurements are measurements of the eye which are taken at selected points around the apex of the eye to help determine the shape of the cornea. The peripheral section of this instrument takes 4 measurements (superior, temporal, inferior, and nasal) which are equidistant from each other at 30 degrees from the apex.

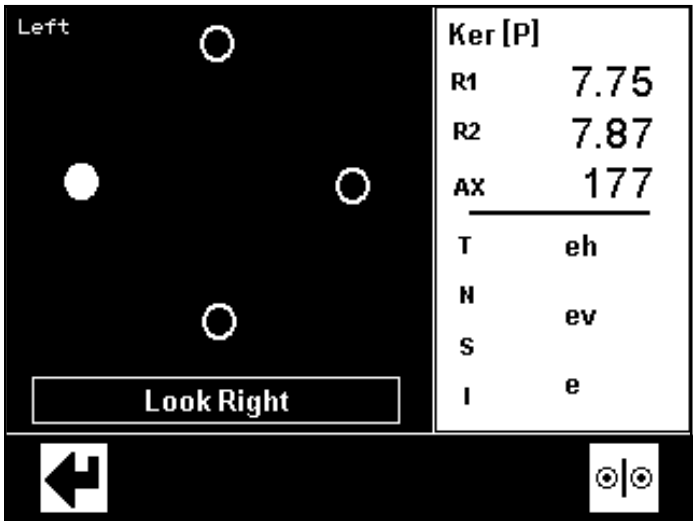
After both keratometer and refractor measurements are acquired (and the peripheral option is set "On") for one eye, the instrument will include the peripheral icon on the screen.

Perform the following steps to take a peripheral measurement:

1. Press the button below the PERIPHERAL icon to enter the peripheral mode.



2. Instruct the patient to look at the red light as directed on the screen with the eye that is being measured. After the patient is looking at the red light, press the button below the MEASURE icon; the unit will beep after the measurement is taken and the appropriate circle will be fully white. Repeat this step three more times until all peripheral measurements are taken.



Peripheral Measurements (Continued)


Mode

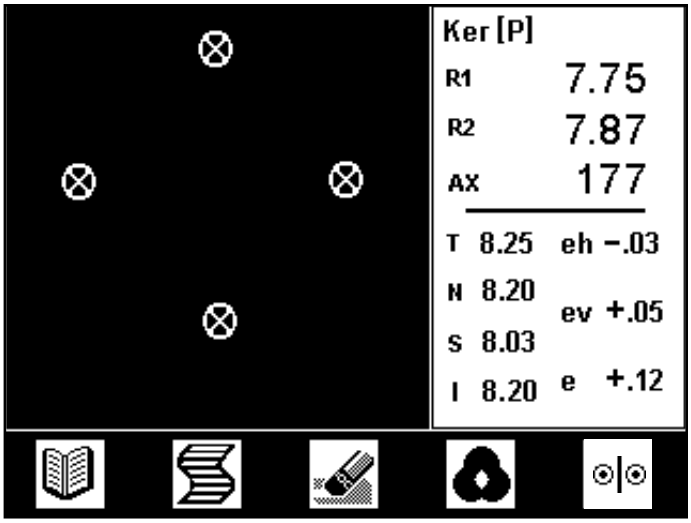

Measure


Clear Data


Print


Review

3. After all the measurements are taken, peripheral data will be displayed in the lower section of the screen as in the sample shown below.



The definitions of the peripheral data categories on the screen as follows:

T = Mire data at 30 degrees from the apex of the eye on the temporal side of the eye.
N = Mire data at 30 degrees from the apex of the eye on the nasal side of the eye.
S = Mire data at 30 degrees from the apex of the eye on the superior side of the eye.
I = Mire data at 30 degrees from the apex of the eye on the inferior side of the eye.
E = Eccentricity of the eye, average total.
eh= Eccentricity of the eye in the horizontal meridian.
ev= Eccentricity of the eye in the vertical meridian.

Additional data which is provided only on the printout is the following:

e = eccentricity values of each sagittal radius.
Rh = Average corneal curvature on the horizontal meridian.
Rv = Average corneal curvature on the vertical meridian.
Ro = Average corneal curvature at the center.
dRo = Difference of corneal curvature between R1 and R2.
dAST = Difference of corneal cylinder between the center and peripheral.
ASTc = Corneal cylinder at the center.
ASTp = Corneal cylinder at the periphery.

4. After the peripheral measurements are complete, there are several options available:
   a. the Forehead Rest can be slid to the opposite side to continue taking measurements on the other eye.
   b. all data can be cleared and measurements can be taken again. (press the button below the CLEAR DATA icon).
   c. the data can be printed (press the button below the PRINT icon).
   d. the eye data can be reviewed (press the button below the REVIEW icon).

Note: The instrument will print out the data from both eyes, if the button below the PRINT icon is selected after both eye data is acquired.

   e. the measurement defaults can be changed (for printing or the number of measurements) by going to the main menu (press the button below the MODE icon) and then to the SETUP mode.

Note: Going to the SETUP menu will not erase the current measurement data.

Introduction

The KR460 requires very little routine maintenance due to its advanced design. For instance, there are no bulbs or lamps to change.

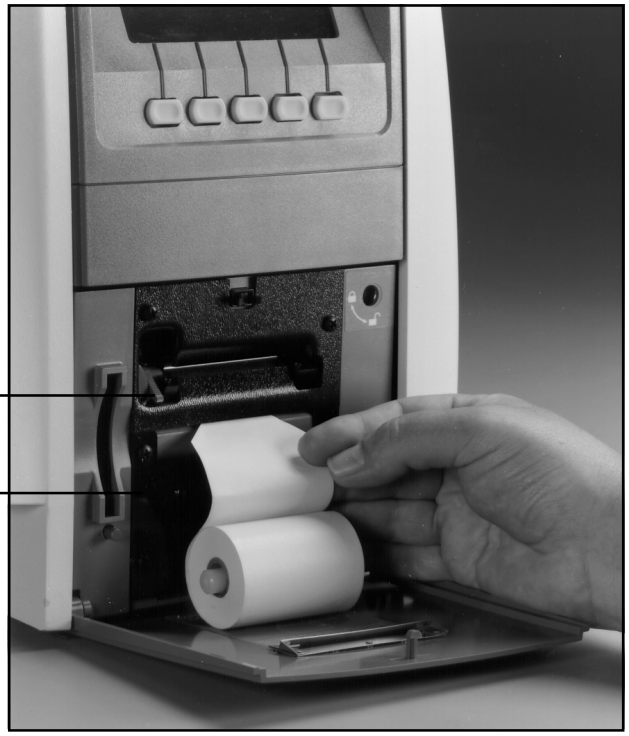
If you have questions relating to maintenance, contact your local dealer or our Customer Service Department directly at (716) 686-4500.

Patient Window

We recommend that you keep the patient window clean to avoid any measurement/ alignment problems. Use the cleaning cloth provided or a clean lens tissue. DO NOT USE ANY LIQUIDS SUCH AS ALCOHOL OR PROPRIETARY CLEANERS. Refer to *Cleaning* in this section of the manual.

Printer Paper

Instructions for changing printer paper can be found on the inside of the printer door. To order replacement thermal paper, call your local dealer and ask for Reichert printer paper (P/N 12441)



RAISE PAPER RELEASE LEVER AND REMOVE USED ROLL. CUT OR TEAR (DO NOT FOLD) END OF NEW ROLL INTO A POINT. FEED INTO LOWER SLOT AS SHOWN AND LOWER PAPER RELEASE LEVER. PRESS FEED SWITCH, PAPER WILL EXIT THROUGH UPPER SLOT. ALWAYS USE THERMAL PRINTER PAPER, CATALOG NO. 12441.

(Instructions found inside printer door)

Figure 15, Printer Paper Replacement

Forehead Rest

For hygienic reasons, wipe the forehead rest with a clean cloth or with a sterile wipe after each patient.

Fuses

Fuses are located above the power inlet (Refer to page 7, Item# 10). Only replace fuses with T 0.315 AL 250V (230V units) or T 0.63 AL 250V (115V units) as described on the power inlet panel.

An internal fuse is located on the main circuitboard inside the unit, replace with T 6.3 AL 250V model number 13970 and 13971. Replacement must be performed by qualified service personnel only.

PC Card

The PC card slot is located behind the printer door (Refer to page 7, Item# 11). Before removing or installing a PC card, disconnect the KR460 from the input power and follow the installation instructions on the PC card.

Cleaning

Clean external surfaces of this instrument using a clean, soft cloth moistened with a mild detergent solution (1 cc of liquid dish soap to one liter of clean filtered water (e.g., filtered below 5 microns)).

Clean the Patient Window and the Operator Display using a clean, soft cloth moistened with a mild detergent solution (1 cc of liquid dish soap to one liter of clean filtered water (e.g., filtered below 5 microns)).



CAUTION: DO NOT USE ALCOHOL OR DAMAGE TO THE SURFACE OF THE PATIENT WINDOW MAY OCCUR AND CAUSE MEASUREMENT DIFFICULTY.

Mounting to Instrument Stand Arm

The KR460 can be installed on a table top or instrument stand arm. For instrument stand arm installation, follow the instructions below:



CAUTION: MAKE SURE THE TRAVEL LOCK IS ENGAGED TO PREVENT DAMAGE TO INTERNAL MECHANISMS.

Mounting to Instrument Stand Arm (Continued)

- Engage the Travel Lock (refer to page 34 and 35)
- Carefully lay the instrument on its side.
- Attach the adapter (Catalog No. 12418) to the base plate with the three screws provided.

CAUTION: IF REPLACEMENT SCREWS ARE USED, DO NOT USE SCREWS LONGER THAN 1 INCH OR 2.5 CM, AS THIS COULD CAUSE DAMAGE TO INTERNAL COMPONENTS.

- Insert the adapter post into the mounting hole of the stand arm.
- Turn the knob on the instrument arm until the post is stable, The instrument should swivel freely.
- Disengage the KR460's travel lock (see p. 6 for instructions).
- Plug the power cord into the instrument and then into the stand arm outlet.

CAUTION: TO PREVENT DAMAGE OCCURRING TO THE INTERNAL MECHANISMS, ENSURE THE TRAVEL LOCK IS DISENGAGED BEFORE CONNECTING THE INSTRUMENT TO A POWER OUTLET.

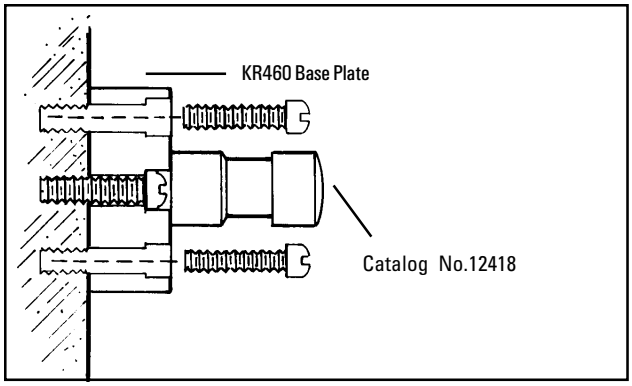


Figure 16, Instrument Mounting Adapter

Troubleshooting

Help Screens


Mode


Help


Up

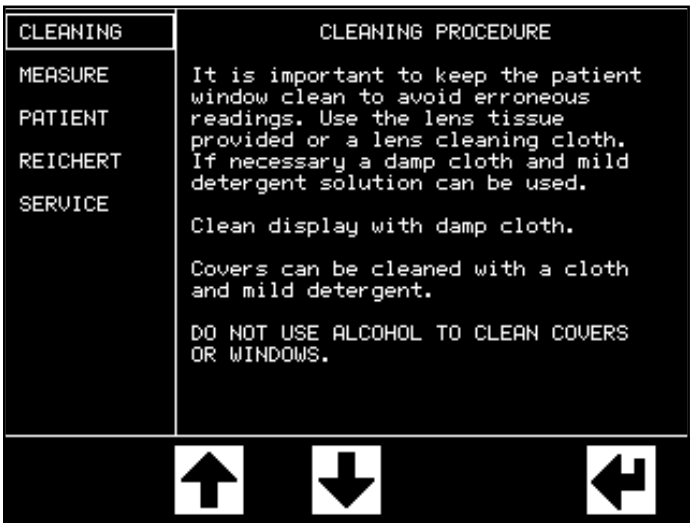

Down


Return

The KR460 includes HELP screens, which provide useful information and tips on its operation. These screens are intended to be used as a quick reference to a selection of operations.

To access the HELP menu, press the button below the MODE icon. The screen will change and look similar to that below:





Troubleshooting (Continued)

Troubleshooting Chart

The following chart provides details of common problems and solutions for the KR460.

MESSAGE/IRREGULARITY		REMEDY
MEASUREMENT	"Low Confidence Reading."	Refer to "Low Confidence Readings" in this section.
	Incomplete Mire shown.	Refer to "Incomplete Mire" in this section.
	Instrument continually aligns — does not take reading.	Go to the Setup mode and set the Auto Measure option (in the Misc. menu) to On.
PRINTER	Will not print.	Out of paper. Printer not turned on in setup (see p. 13).
	Paper jams in printer.	See instructions on inside of printer door.
	Mires/graphics will not print.	Mire/eye not selected in print setup (see p. 13).
OTHER	No power.	Check fuses and/or power outlet/ power cord.
	Screen blank.	Adjust contrast control. Instrument in "sleep" mode, push any grey button. Check fuses. Check power outlet.
	Clock/date incorrect.	Change settings in setup (see p. 13).
	Instrument "locks up."	Press red reset button (See p. 7, Item 13 for location).

If problems still persist, contact your local dealer or Reichert as shown in the *Introduction* section of this manual.

NOTE: Circuit diagrams, component parts list descriptions and calibration instructions are available only to the qualified personnel.

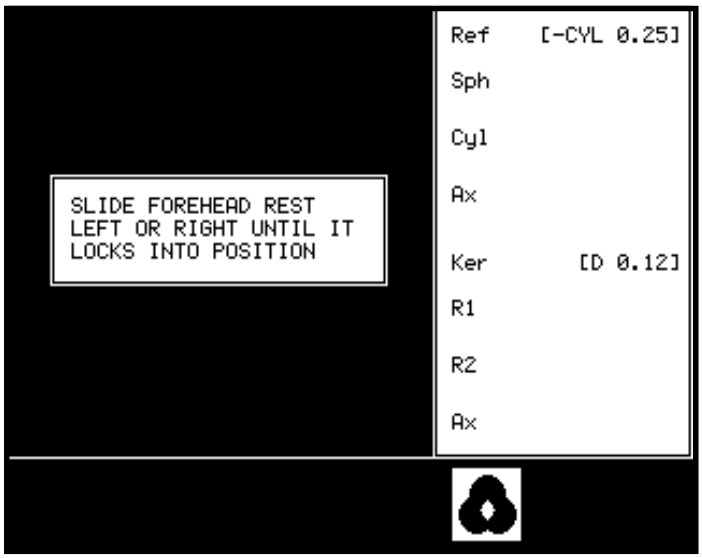
Troubleshooting (Continued)

Engaging the Travel Lock


Mode


Travel Lock

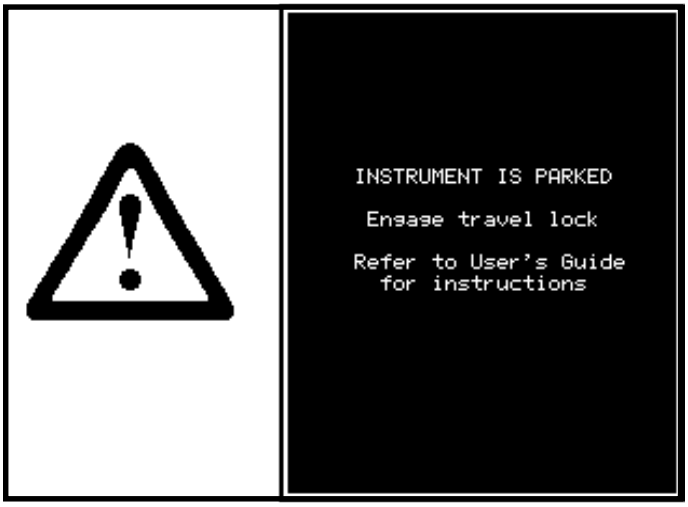
If it is necessary to ship the instrument to another location, engage the travel lock as follows:



Press the button below the MODE icon. The MODE icon can be found on most operating screens. The screen will change and look similar to the one below:



Now press the button below the TRAVEL LOCK icon — you will hear the instrument's motors moving and position into the "parked" position. The screen will also change (as shown in the following screen) to indicate the instrument is in the "parked" position.



Once the instrument is "parked," you can engage the Travel Lock. Perform the following steps to engage the Travel Lock (for illustrations of the Travel Lock and packaging, refer to the *Instrument Setup* section in this manual):

1. Open the Printer Door by pushing on the door above the printer paper slot.
2. Insert the phillips head screwdriver into the hole of the Travel Lock and locate the screw inside the Travel Lock.
3. Push the screw in and turn it four full turns clockwise (or until it is hand-tight).
4. Remove the screwdriver, align the printer paper through the paper slot and close the door.

If transportation of the instrument is required, you can now disconnect the instrument from the power outlet and repackage the instrument.

Troubleshooting (Continued)

Low Confidence Readings

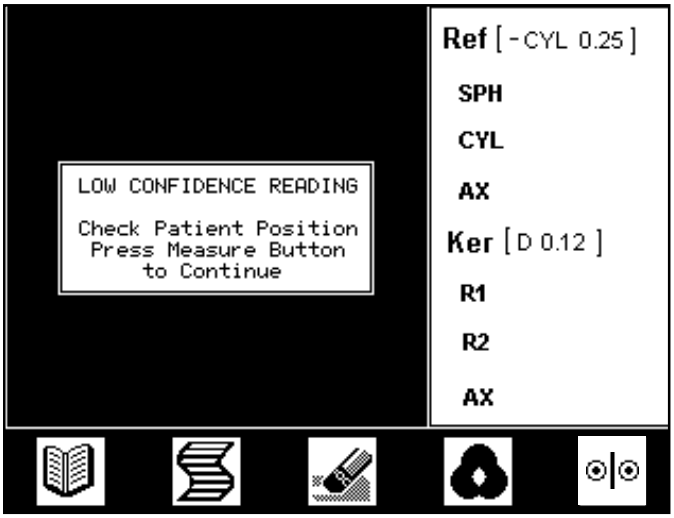


Measure



Clear Data

During the measurement process, the KR460 may display a condition referred to as a "Low Confidence Reading." This condition occurs when the instrument is not sure that it took an accurate reading. Rather than display data which is erroneous, the display will change to that shown below:



Conditions which may cause a low confidence reading are:

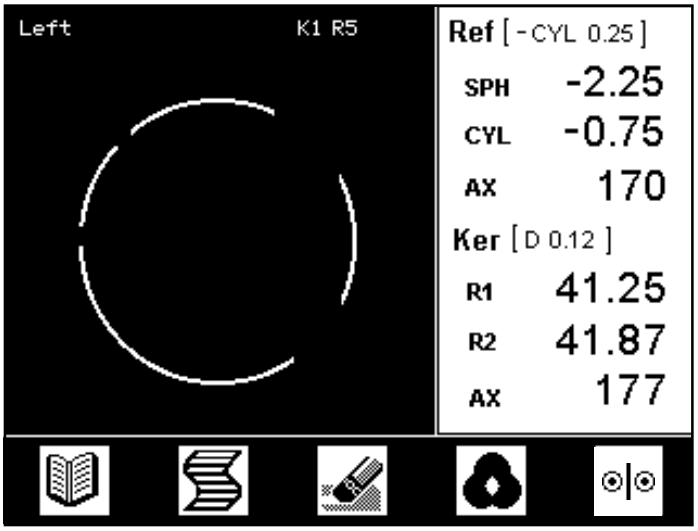
1) Patient moves away from instrument before measurement process is complete.
2) Patient may be squinting.
3) Patient may have "drooping" eyelids.
4) Patient eyelashes may be interfering with the alignment system.
5) Patient may have dry eyes.

To continue the measurement process, reposition the patient and ask them to blink and open their eyes wider. Press the button under the MEASURE icon. If you do not want to continue, press the button under the CLEAR DATA icon (erases both right and left data) to return to the initial measurement screen and repeat the measurement process.

Troubleshooting (Continued)

Incomplete Mires

After acquiring a measurement, the mire ring image may look incomplete or broken as shown below:

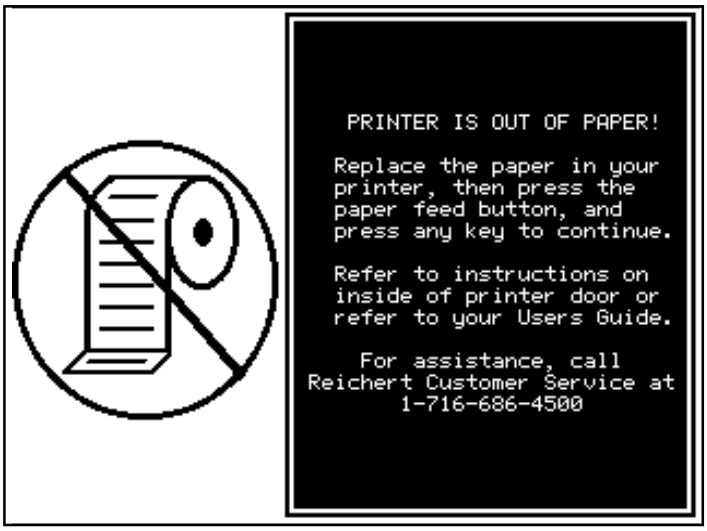


There are many reasons for this, such as patient eyelashes obstructing the instrument or a dry eye which gives a lower reflective surface to measure. The numerical data associated with this mire will be very accurate due to the advanced image processing technique used to measure the cornea.

If you want to remeasure the eye, press the button below the CLEAR DATA icon and repeat the measurement process for that eye.

NOTE: For technical reasons, there will always be a very small break in the mire, on the left-hand side of the ring.

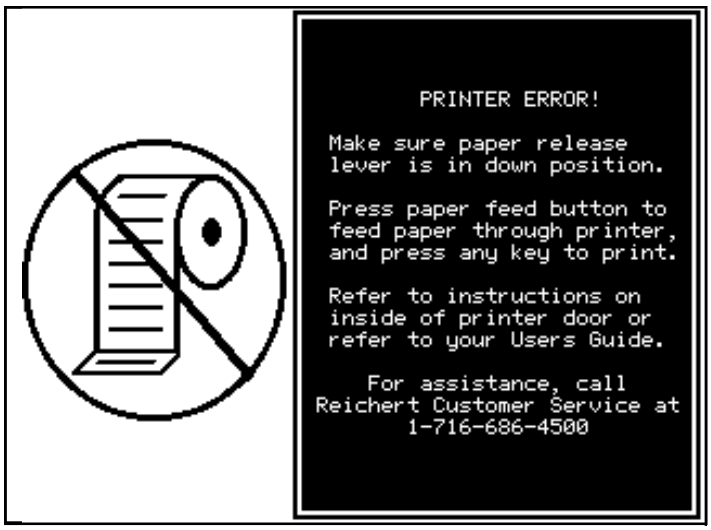
If your printer is out of paper, the following message will appear:



Instructions for changing printer paper are located on the inside of the printer door (refer to the *Maintenance* section of this manual).

Note: If the printer paper runs out before printing all the measurement data, the data will be stored. Once the printer paper is replaced, a complete print out of all measurement data will start.

Note: After replacing printer paper, if you do not lower the paper release lever, follow the instructions on the screen. The following screen will appear:



Appendix A - General Specifications

Keratometer

Radius of Curvature:	5.5 mm thru 10 mm (0.01 mm steps)
Corneal Power:	33.75D thru 61.25D (0.12D, 0.25D steps)
Cylinder:	0 thru 10.00D
Axis:	0^0 thru 180^0 (1^0 steps)
Peripheral	4 points at 30^0 from apex

Refractor

Sphere	-18.00D thru +18.00D (0.01D, 0.12D, 0.25D steps)
Cylinder	0 thru 10.00D
Axis	0^0 thru 180^0 (1^0 steps)

Physical Data

Height:	17.0 in. (43 cm)
Width:	9.5 in. (24 cm)
Depth:	13.5 in. (34 cm)
Weight, unpacked:	32 lbs. (14.5 kg)

Electrical Data

Voltage (nominal)	100/120 VAC (Model 13970) 220/240 VAC (Model 13971) 12 VAC, 17 VDC (Model 13916 External Transformer)
Current	100/120 VAC @ 1.0 Amp max. 220/240 VAC @ 0.5 Amps max. 12 VAC or 17 VDC @ 3.0 Amps max
Frequency	50/60 Hz

Transportation & Storage

This instrument can withstand the following conditions while packed for transportation or storage:

- an atmospheric pressure range of 760 mmHg (101 kPa) thru 528 mmHg (70.4 kPa)
- an ambient temperature range from, -4 °F (-20°C) thru +140 °F (+ 60°C)
- a relative humidity range of 10% thru 90%

Note: Operating conditions are recommended from +50 °F (10 °C) thru +104 °F (40 °C) at a relative humidity of 40% thru 90%.

Note: The above extreme high or low storage conditions should not exceed 15 weeks.

Disposal

This product does not generate any environmentally hazardous residues. At the end of product life, follow local laws and ordinances regarding proper disposal of this equipment.

Appendix A - General Specifications (Continued)

Classification

The KR460 is classified as Class 1 Equipment
Class 1 Equipment is equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in that means are provided for the connection of the equipment to a protective earth conductor in the fixed wiring of the installation in such a way which accessible metal parts cannot become live in the event of a failure of the basic insulation.

The KR460 is classified as Class B Equipment
Class B Equipment provides an adequate degree of protection against electrical shock, particularly regarding allowable leakage currents and reliability of the protective earth connection.

The KR460 is classified as IPX0 Equipment
IPX0 Equipment is ordinary equipment enclosed without protection against ingress of water.

The KR460 is not suitable for use in the presence of flammable anesthetic mixtures with air or with oxygen or nitrous oxide.

According to the mode of operation, the KR460 is a Continuous Operation instrument.

Symbol Information

The following symbols appear on the instrument:



CAUTION - Indicates that important operating and maintenance instructions are included in this User's Guide.



Type B Product Classification
Class 1 Equipment, Continuous Operation



Alternating Current



Protective Earth

Ordering Information - Accessories

Catalog	***Description***
12418	Instrument stand adapter mount
12430-273	Cleaning Cloth
12441	Printer paper
13916	External power supply universal input, 16 VDC out @ 0.0 to 3.12 amps Note: This power supply is medically approved to UL2601-1, IEC60601-1 and CSA C22.2 NO. 601.1 standards
13920-084	Dust Cover
13970-104	KR460 Quick Reference Card

To order any of these accessories, contact your local authorized Reichert dealer.

Other Reichert Products

To complement your KR460 Automated Keratometer/Refractor, we invite you to take a look at the other products made by our company:

Keratometer
LENSCHEK™ Advanced Logic Lensometer®
LongLife™ Project-O-Chart
Selectra™ Project-O-Chart
Phoroptor® Refracting Instrument
XCEL® Slit Lamps
AT550 Auto Non-Contact Tonometer
AR360 Auto Refractor
AP250 Auto Projector

To order any of these products, contact your local authorized Reichert dealer.

Notes

Warranty

This product is warranted by Reichert Ophthalmic Instruments, a division of Leica Microsystems Inc. ("Reichert") against defective material and workmanship under normal use for a period of one year from the date of invoice to the original purchaser. (An authorized dealer shall not be considered an original purchaser.) Under this warranty, Reichert's sole obligation is to repair or replace the defective part or product at Reichert's discretion.

This warranty applies to new products and does not apply to a product which has been tampered with, altered in any way, misused, damaged by accident or negligence, or which has the serial number removed, altered or effaced. Nor shall this warranty be extended to a product installed or operated in a manner not in accordance with the applicable Reichert instruction manual, nor to a product which has been sold, serviced, installed or repaired other than by a Reichert factory, Technical Service Center, or authorized Reichert Ophthalmic Instruments Dealer.

Lamps, bulbs, charts, cards and other expendable items are not covered by this warranty.

All claims under this warranty must be in writing directed to the Reichert factory, Technical Service Center, or authorized instrument dealer making the original sale and must be accompanied by a copy of the purchaser's invoice.

This warranty is in lieu of all other warranties implied or expressed. All implied warranties of merchantability or fitness for a particular use are hereby disclaimed. No representative or other person is authorized to make any other obligations for Reichert. Reichert shall not be liable for any special, incidental, or consequent damages for any negligence, breach of warranty, strict liability or any other damages resulting from or relating to design, manufacture, sale, use or handling of the product.

PATENT WARRANTY

If notified promptly in writing of any action brought against the purchaser based on a claim that the instrument infringes a U.S. Patent, Reichert will defend such action at its expense and will pay costs and damages awarded in any such action, provided that Reichert shall have sole control of the defense of any such action with information and assistance (at Reichert's expense) for such defense, and of all negotiation for the settlement and compromise thereof.

PRODUCT CHANGES

Reichert reserves the right to make changes in design or to make additions to or improvements in its products without obligation to add such to products previously manufactured.

CLAIMS FOR SHORTAGES

We use extreme care in selection, checking, rechecking and packing to eliminate the possibility of error. If any shipping errors are discovered:

1. Carefully go through the packing materials to be sure nothing was inadvertently overlooked when the unit was unpacked.
2. Call the dealer you purchased the product from and report the shortage. The materials are packed at the factory and none should be missing if the box has never been opened.
3. Claims should be filed within 30 days.

CLAIMS FOR DAMAGES IN TRANSIT

Our shipping responsibility ceases with the safe delivery in good condition to the transportation company. Claims for loss or damage in transit should be made promptly and directly to the transportation company.

If, upon delivery, the outside of the packing case shows evidence of rough handling or damage, the transportation company's agent should be requested to make a "Received in Bad Order" notation on the delivery receipt. If within 48 hours of delivery, concealed damage is noted upon unpacking the shipment and no exterior evidence of rough handling is apparent, the transportation company should be requested to make out a "Bad Order" report. This procedure is necessary in order for the dealer to maintain the right of recovery from the carrier.

Reichert Ophthalmic Instruments
A Division of Leica Microsystems Inc.
PO Box 123
Buffalo, New York USA 14240-0123
Telephone 716-686-4500
Fax 716-686-4545
e-mail: info@reichert.com
www.reichert.com
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