



PREMIUM IOL BIOMETRY
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HAAG-STREIT USA

LS900 Operating Procedures 91511 V2.0

Everything you wanted to know and more.....



LENSTAR 900 Recommended Operating Procedure

The LS-900 is a non-invasive, contact-free OLCR (optical low-coherence reflectometry) Biometer (Similar to “Time Domain” OCT). This guide is to assist you in creating an uncomplicated familiarity for your staff and the patient. The LS 900 is used to take measurements of the human eye to assist in calculations designed to help establish the suitable IOL power for implantation after removal of the natural crystalline lens.

The LS 900 measures:

1. Axial Length of the Eye
2. Keratometry
3. Corneal Thickness
4. Anterior Chamber depth
5. Lens thickness
6. Retinal thickness*
- * Assessed Automatically for the US Version
7. White-to-white distance
8. Pupil diameter
9. Eccentricity of the Visual Axis

Plausibility of measurements

You are recommended always to examine both the patient’s eyes.

The user should subject the measurement readings to extra scrutiny if there is a notable difference between the right and left eye. The following are classed as notable differences:

More than 1 diopter with respect to central corneal refractive power - > 0.18 mm difference with respect to the corneal curvature radius

More than 0.3 mm with respect to the axial length

More than 1 diopter with respect to emmetropic IOL refractory power

It is not necessary to dilate the patient’s pupil. You may use ambient lighting while taking the measurement.

General Precautions

Lenses with a dense cataract absorb and widely scatter the measuring beam, sometimes make it impossible to measure the length of the axis and lens thickness.

Place patient's chin on the chin rest, forehead against the top of the head strap. Next, instruct the patient to blink normally and to locate the red flashing light – explain that you will be taking 5 measurements and that you will instruct them as when to blink throughout the measurements.

- Press the black button on LS900 to view the patient's eye
- Line up the patient's first eye (you may occlude the fellow eye), locate the white flashing light within the cross hairs, press the black button again to magnify the image
- Ask patient to blink, pull the LENSTAR joystick back towards you (to avoid over focusing) and slowly move the LENSTAR forward until you locate the green circle. Ask patient to blink again and open their eye wide, quickly refocus, regain the green circle and press the black button again to start the measurement. Encourage the patient to keep their eye open until the green/white LED flash is complete. Once the measurement operation has been triggered, the display shows the user a progress indicator in the form of a clockwise-rotating grey circle. If the patient loses fixation, then the testing will stop until the patient regains fixation
- Once the green/white LED light flashes (at the end of the exam), instruct the patient to resume normal blinking. Instructing the patient not to move from the chin rest will keep you in better alignment for the next measurement. Repeat until you've taken 5 measurements

It is recommended to measure both eyes for comparison information.

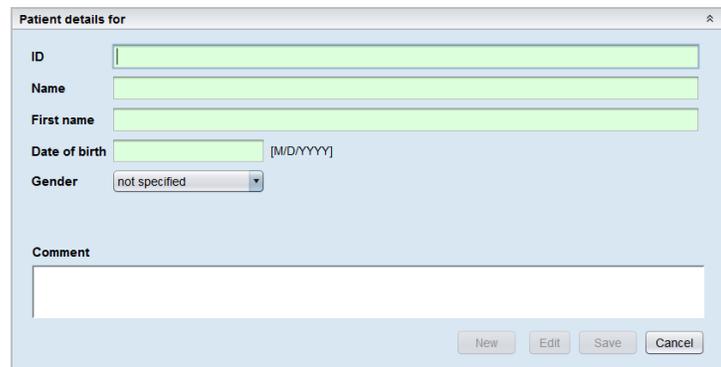


Double click on the EyeSuite icon located on your PC's desktop
New Patient



Click  on the right side of the page. (Located near the middle)

Enter the demographics into the green highlighted fields.



The form is titled "Patient details for" and contains the following fields:

- ID:
- Name:
- First name:
- Date of birth: [M/D/YYYY]
- Gender:
- Comment:

Buttons at the bottom: New, Edit, Save, Cancel

Click SAVE after demographics are filled in, this creates a patient file in the database

Existing Patient

- Enter a full or partial name in the SEARCH QUERY FIELD. All patients corresponding to the data entered will be displayed in the database field.
- Left –click to select a patient from the search list.
- You may edit or delete from this field as well.

Important: The deleted patient is removed from the list, but not from the database. A further operation is required to delete definitively the corresponding data.

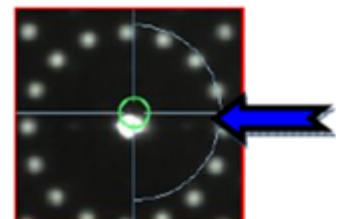
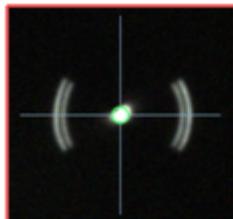


Click on the *Biometry* icon on the left side of the screen

- Follow the onscreen directions for the patient head placement.
- Press the capture button on the joystick to turn the camera on.
- Pull the LENSTAR device all the way back.
- Line the crosshairs with the central reflection from the cornea.
- Push the joystick forward to focus the keratometry reflections.
- Press the capture button again to magnify the corneal image.
- Once the green circle appears, press the capture button to start the capture process. A circle will trace on the inside of the inner keratometry dots noting that the capture process is underway. Once the circle has traced all the way around, a green/white LED flash will occur as the instrument photographs the eye for the white-to-white calculations. Advise the patient to blink following this flash.

Repeat these steps for a total of five scans on each eye.

Once complete and 5 scans have been captured, press the  button on the bottom right portion of the screen to move into the review phase of the software.





Acceptable Standard Deviations

- Axial Length <0.100 mm
- Flat Meridian <0.250 D
- Steep Meridian <0.250 D
- Astigmatism <3.5 degrees

OD

23.67 mm	44.70 D
23.68 mm	44.73 D
23.68 mm	44.78 D
23.67 mm	44.85 D
23.67 mm	44.73 D

Summary

Axial length	23.67 mm	±0.004 mm
Cornea thickness	642 µm	±3.2 µm
Aqueous depth	3.19 mm	±0.004 mm
Lens thickness	3.75 mm	±0.143 mm
Flat meridian	44.59 D @ 175 °	±0.039 D
Steep meridian	44.93 D @ 85 °	±0.092 D
Astigmatism	0.34 D @ 85 °	±10.4 °

Please ask the patient to position the chin on the head rest in front of the device

Press the button to start a measurement

Axial Length <0.100

Flat Meridian <0.250

Steep Meridian <0.250

Astigmatism <3.5 degrees

OS

23.84 mm	44.29 D
23.87 mm	44.19 D
23.86 mm	44.23 D
23.86 mm	44.12 D
23.87 mm	44.21 D

Summary

Axial length	23.86 mm	±0.012 mm
Cornea thickness	633 µm	±2.1 µm
Aqueous depth	3.21 mm	±0.016 mm
Lens thickness	3.87 mm	±0.020 mm
Flat meridian	43.95 D @ 83 °	±0.052 D
Steep meridian	44.47 D @ 123 °	±0.100 D
Astigmatism	0.51 D @ 123 °	±5.3 °

*If there is <0.75 D of Cylinder, then it is difficult at times to have < 3.5 degrees of Standard Deviation on the Axis

*These measurements would still be acceptable as the patient would not be considered a toric IOL candidate.

*If the measurements are kept to these criteria, then there will be very little if any manual adjustment needed during the review process.

*Remember, to delete measurements simply right click on the measurement you wish to discard.



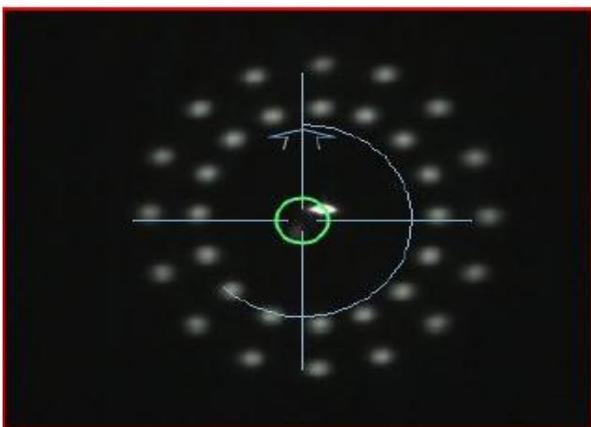
Measuring Too Close to the Eye

OD		Measuring started - focus	OS	
25.76 mm	43.58 D		⚠ 22.10 mm	⚠ ----
25.76 mm	43.58 D		⚠ 22.10 mm	⚠ ----
25.76 mm	43.58 D		⚠ 22.10 mm	⚠ ----
25.76 mm	43.58 D		⚠ 22.10 mm	⚠ ----
25.76 mm	43.57 D			
Summary			Summary	
<p>Axial length 25.76 mm ±0.001 mm</p> <p>Cornea thickness 593 µm ±1.2 µm</p> <p>Aqueous depth 2.88 mm ±0.000 mm</p> <p>Lens thickness 4.03 mm ±0.001 mm</p> <p>Flat meridian 43.58 D @ ---- ±0.005 D</p> <p>Sleep meridian 43.58 D @ ---- ±0.005 D</p> <p>Astigmatism 0.00 D @ ---- ----</p>			<p>Axial length 22.10 mm ±0.001 mm</p> <p>Cornea thickness ----</p> <p>Aqueous depth 4.16 mm ±0.003 mm</p> <p>Lens thickness ----</p> <p>Flat meridian ---- @ ----</p> <p>Sleep meridian ---- @ ----</p> <p>Astigmatism ---- @ ----</p>	

Measurements acquired too close to the eye will produce erroneously short measurements and very flat Keratometry measurements if any at all. The Keratometry dot reflections in the image screen will also be very blurry. There will also be a large variance between the Axial Length measurements.

Proper Focused Image

Too Close to Eye Image





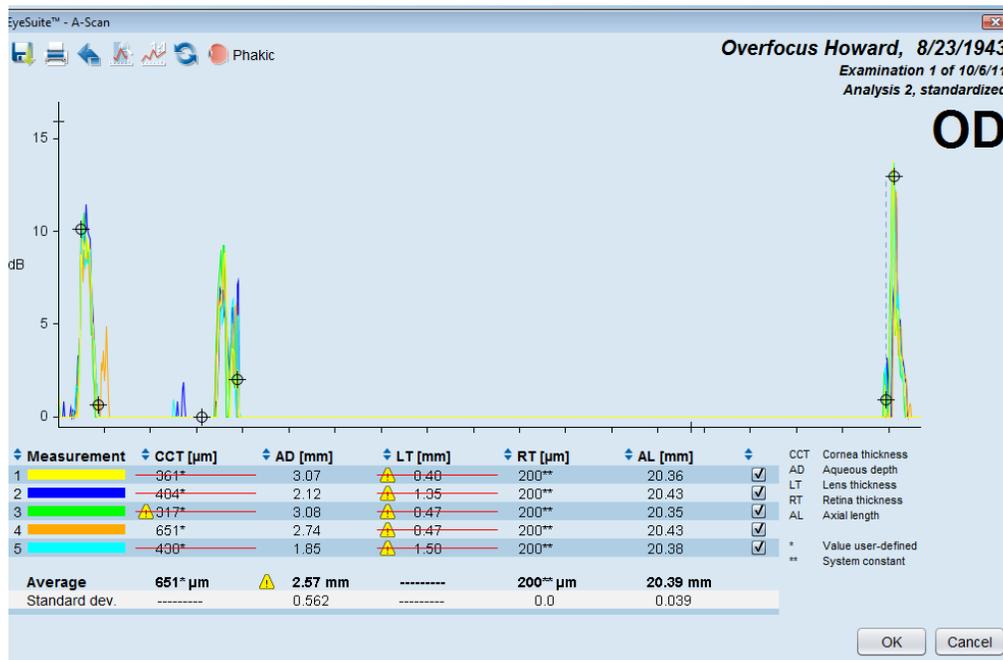
Measuring Too Close to the Eye A-Scan Appearance

Normal A-Scan



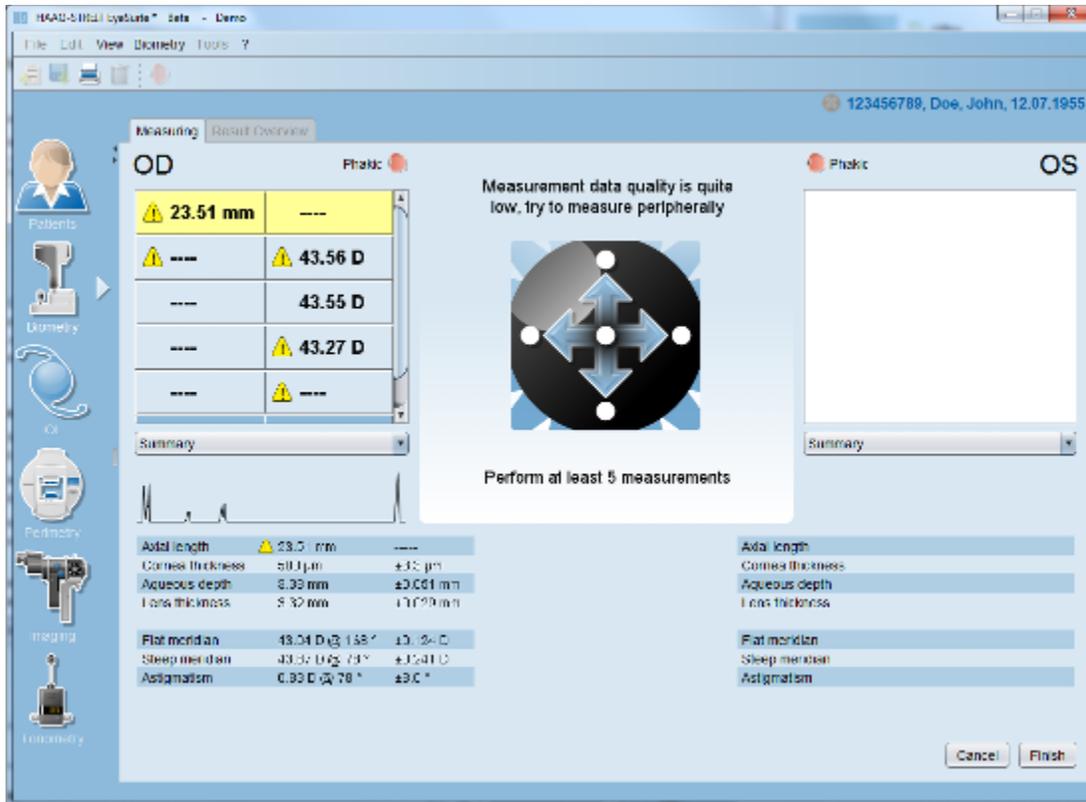
“Over Focused” A-Scan

*Note the lack of Corneal Spikes



Dense Cataract

The EyeSuite software features two A-Scan analysis modes. In the standard mode single A-scans are combined using digital signal processing to create one composite measurement result. In cases of dense nuclear and pronounced posterior subcapsular cataracts (PSC), it is possible that superimposing the 16 single scans will not be sufficient to create a good signal. In such cases EyeSuite switches to the second A-scan mode, Dense Cataract Measurement Mode (DCM), which uses all scans of the individual measurements and advanced digital signal processing to create a single A-scan.



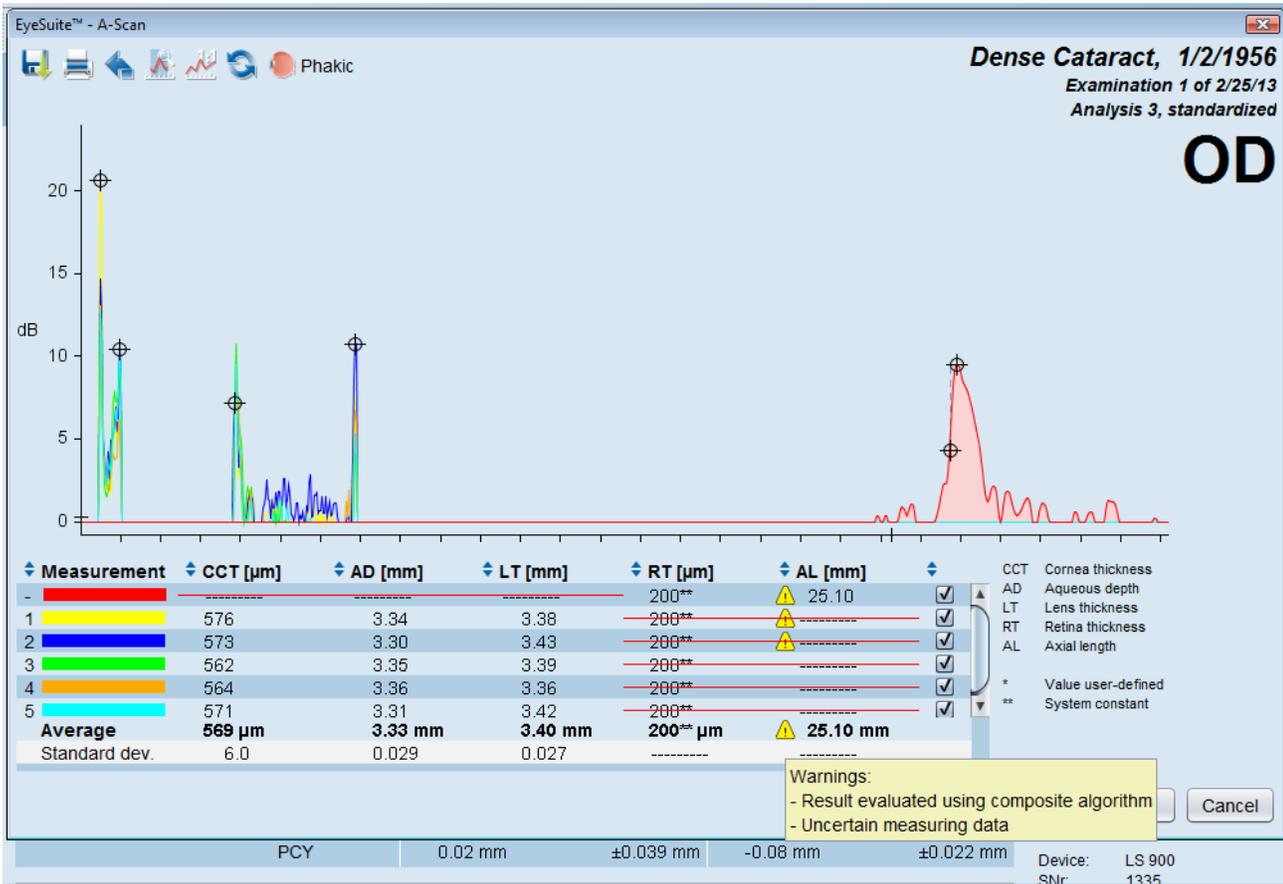
In DCM mode as well as in normal measurement mode it is recommended to perform five repetitive measurements. This way the DCM mode will have 80 single A-Scans for creating the composite signal. DCM mode is automatically engaged if there is no AL measurement available after three single measurements and is displayed in an additional line in yellow in the measurement overview. It is updated with every added single measurement.

Axial length measurements acquired with the DCM mode are always marked with a warning triangle. This does not mean that the measurement is not correct, but it reminds the user that the result is based on very weak signals. The user is advised to always review the A-Scan for results based on DCM.

In DCM mode EyeSuite asks the user to take measurements slightly peripherally of the centre. Taking peripheral measurements increases the variability of the central corneal thickness measurement and should only be used in cases where there is no axial length measurement available even after six central measurements.



Dense Cataract Mode



***Note**

Single measurements can be deleted at any time and for whatever reason. This is done by left-clicking to select the corresponding measurement in the Overview table (causing the scan to be highlighted in dark blue), and then followed by right-clicking on the *Delete* option.

The measuring mode is used to adjust for previous crystalline lens removal or the presence of silicone oil. These settings should normally be established before the first measuring session. If this step is overlooked however, the measurement can still be evaluated later in *Results* view using the correct measuring mode. The measuring mode should not be altered while a series of measurement readings are being taken.

Click on the icon to open the A-Scan Measuring Mode selection window. The selection window is divided into:

- Cross-sectional view of the eye
- Aqueous depth menu item (not selectable)
- Lens menu item (selectable)
- Vitreous Body menu item (selectable)
- Ophthalmologic Description Menu item

Once all the measurements have been carried out, the process used to generate them must be ended. Press the close button, the screen will change to the *Results Overview tab*.

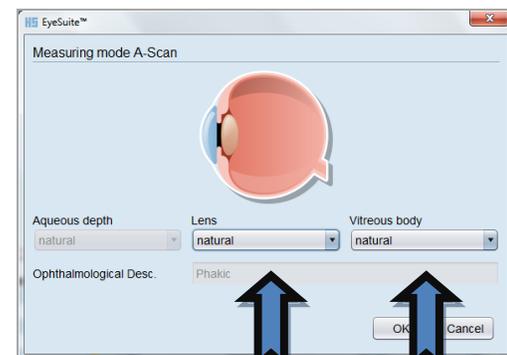
Measuring Modes and Individual Measurement viewing

- To change your measuring mode click the  icon located on the measuring screen. Then, under the lens option choose none (aphakia), default-IOL(unknown lens material), PMMA, acrylic, or silicone as your lens type. You can also change the vitreous body from natural to silicone oil filled.
- To view each individual measurement separately click the drop down list set to summary  located under the list of measurements (pictured below).



OD		Phakic
23.01 mm	44.67 D	
22.98 mm	44.63 D	
22.99 mm	44.70 D	
23.00 mm	44.71 D	
23.00 mm	44.73 D	

Summary



Gate Adjustment Quick Guide i6.0.1.1

On the examination overview screen, click on any of the axial length measurements for either eye.

Click on measured value opens the detail-view		OD Right Eye	OS Left Eye
Measuring mode	Mode	Phakic	Phakic
Axial length	AL	24.63 mm	24.59 mm
Cornea thickness	CCT	587 μ m	586 μ m
Aqueous depth	AD	3.51 mm	3.51 mm
Lens thickness	LT	3.66 mm	3.67 mm
Retina thickness	RT	200** μ m	200 μ m

The next screen will open up the complete A-Scan

- Placing your mouse over any of the will change the cursor to

allow for movement of the ”

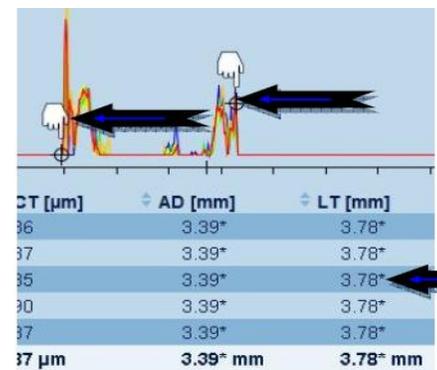
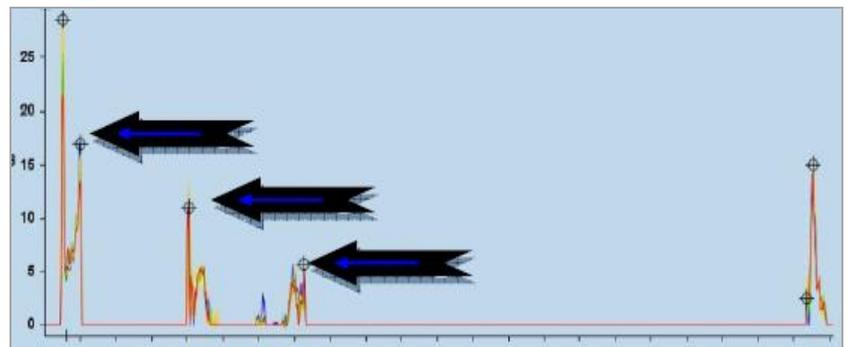
- Left click, hold, and drag mouse to adjust the position of the gate.

- The gate representing the Epithelium (front of the cornea) cannot be moved. (All other gates as indicated by are moveable.) (Retinal thickness values are assessed automatically for the US version)

- Lens gates should be adjusted, if necessary, to the first lens spike on the scan as well as to the last spike on the scan regardless of color. (see properly marked lens diagram on next page)

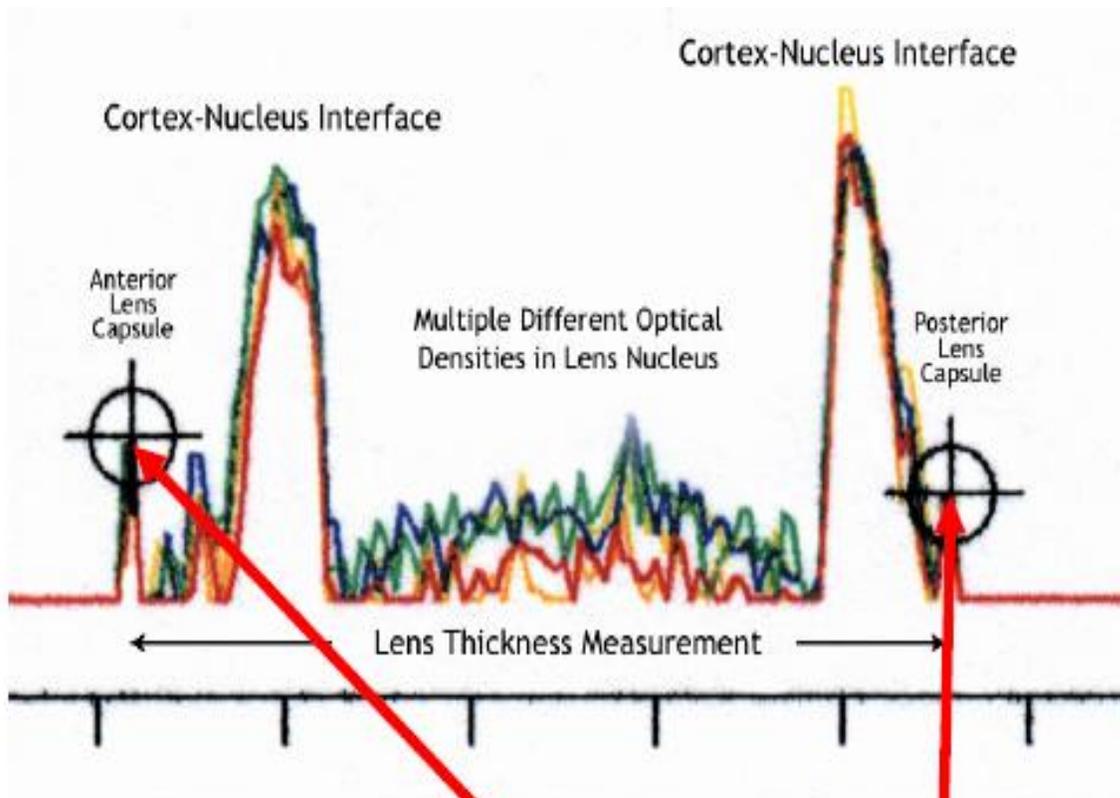
- By moving the gates the measurements will automatically change and be represented with an

asterisk as well as a noting the measurement has been manually adjusted.



Click “OK” at the bottom right portion of screen to save changes.

LENSTAR Lens Thickness Histogram

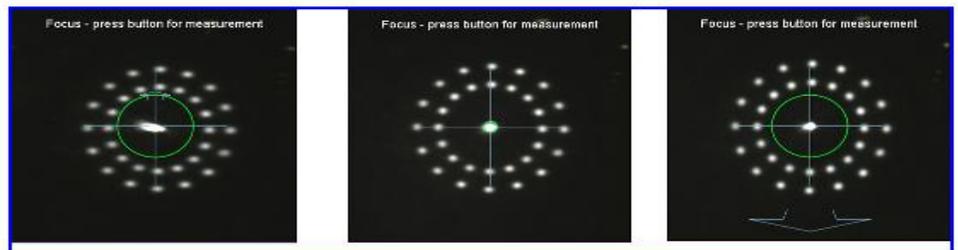


**Lens Gates should be placed on the Anterior and Posterior Lens Capsule*

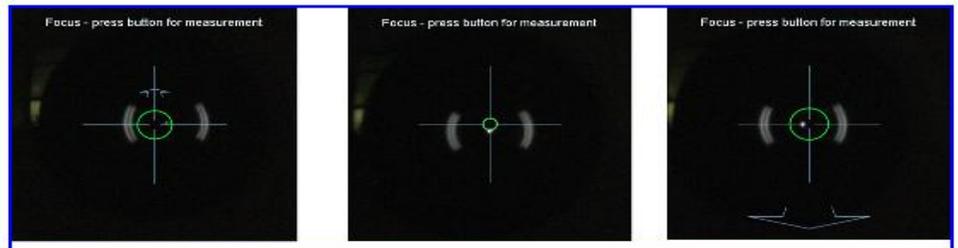


Keratometry

In LS 900 the keratometric power of the cornea is calculated using the locii of 32 measuring points reflected back from the cornea to an IR camera. Those 32 measuring points are arranged on two concentric rings (16 measuring points each) with a diameter of 2.3mm (outer ring) and 1.65mm (inner ring), respectively. Once captured, for every individual measuring point, the spherical equivalent is calculated.



Fine alignment with a LENSTAR up to serial number 1999



Fine alignment with a LENSTAR serial number 2000 or higher or an older LENSTAR unit that was converted

OD		Phakic
23.01 mm	44.67 D	
22.98 mm	44.63 D	
22.99 mm	44.70 D	
23.00 mm	44.71 D	
23.00 mm	44.73 D	
Summary		
Axial length	22.99 mm	±0.013 mm
Cornea thickness	550 µm	±1.1 µm
Aqueous depth	2.79 mm	±0.008 mm
Lens thickness	4.00 mm	±0.032 mm
Flat meridian	44.69 D @ ----	±0.040 D
Steep meridian	44.69 D @ ----	±0.040 D
Astigmatism	0.00 D @ ----	-----

Spherical Cornea “K’s”

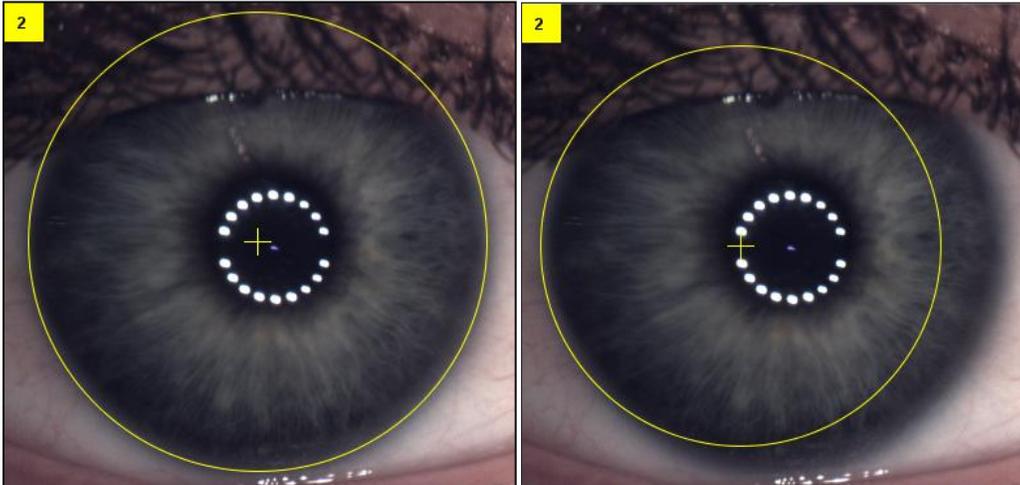
Corneas lacking astigmatism are considered spherical. They will have the same diopter power in all meridians “Flat” and “Steep”, or a very slight difference between the flat and steep axis.

White to White

The white to white distance reading is merely an indirect measurement of the inner lateral dimensions of the anterior ocular section. It therefore provides only approximate indications of the actual inner lateral dimensions of the anterior ocular section and the size of the implant used. The White to White measurement is captured using a flash of light at the end of the capturing process. This flash produces a “Red-Free” image for use in the calculation of White to White Measurements. (It is advised to instruct patients to blink after the flash as this indicates the end of the exam.) The images are available for printing either as a small thumbnail type image containing all of the captured images, or as a single large image.

Normal White-to-White

Abnormal White-to-White



Values

- Diameter of the evaluated white-to-white distance (horizontal expansion is the decisive factor in this respect)
- Distance in a horizontal direction from the center of the iris to the center of the reflected measuring beam (Apex)
- Distance in a vertical direction from the center of the iris to the center of the reflected measuring beam (Apex)

If the mouse pointer is in the screen section, you can move the image by clicking and holding down the right mouse button.

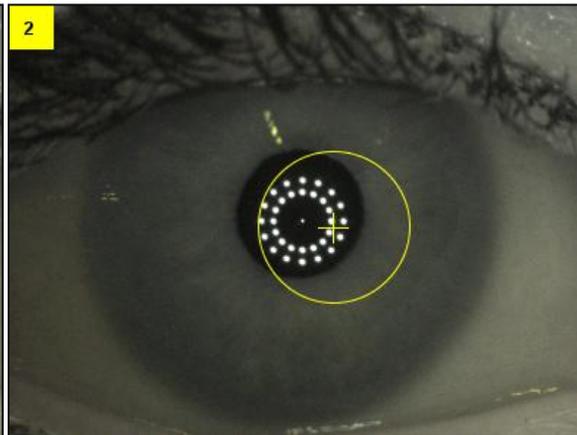
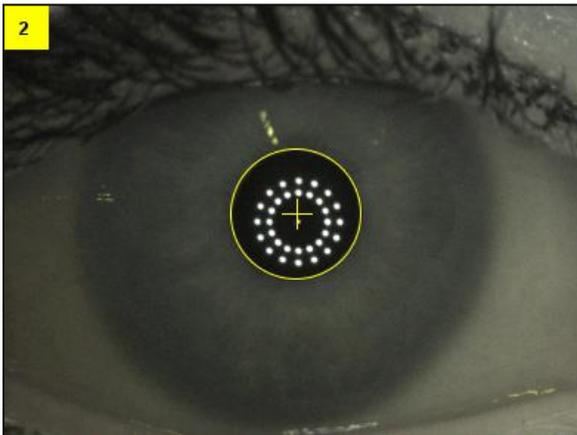
Pupillometry

The pupil appears on the screen. The pupil diameter evaluated by the software is marked with a circle. The centre of the pupil is also marked with a cross. The table list 3 values

- The pupil diameter evaluated by the software
- The horizontal distance between the center of the pupil and the center of the reflected measuring beam (Apex)
- The vertical distance between the center of the pupil and the center of the reflected measuring beam (Apex)

Normal Pupillometry

Abnormal Pupillometry



EyeSuite Biometry IOL Entry Quick Guide i6.0.1.1



From the Haag-Streit EyeSuite Main Screen Select “IOL IOL Editor”

Click on the located in the top left of the “IOL Editor” window
Enter the Manufacturer and Model Name

Manufacturer	Alcon
Model	SN60WF

Click on the right side of the page to enter IOL Power and Increment

Now Enter the IOL Information:

- The majority of IOL’s only have a “Main Range”
- Be sure to enter the increment for the lenses (ie, .25D, .5D, 1D)
- If there is a Lower or Upper Range, be sure to enter the data in the respective field by clicking on the plus sign to add the lower and upper ranges
- [Refer to the Manufacturer of the lens for the proper Range and Increment information](#)

Click on the Calculation Tab at the top of the page to enter the Constants



Use the dropdown arrow to select the constant

To enter several Constant Values press the after each entry and then select the constant to be entered

revision shown: Version 2 go back to this revision

Spherical calculation constants

Constant	Device	from [D] incl.	to [D]	value	
Haigis A0	optical	-10.00	40.00	-	+
Haigis A1	optical	-10.00	40.00	-	-
Haigis A2	optical	-10.00	40.00	-	-
Hoffer Q pACD	optical	-10.00	40.00	-	-
Holladay SF	optical	-10.00	40.00	-	-
Manufacturer A	optical	-10.00	40.00	-	-
Olsen ACD	optical	-10.00	40.00	-	-
Olsen AR	optical	-10.00	40.00	-	-
Olsen LT	optical	-10.00	40.00	-	-
Olsen N	optical	-10.00	40.00	-	-
Olsen PR	optical	-10.00	40.00	-	-
Olsen SA	optical	-10.00	40.00	-	-
SRK-II A	optical	-10.00	40.00	-	-

Guidance
Define spherical constants values for this IOL.

Now enter the information for the Formula: constants entered are accepted in the following ranges:

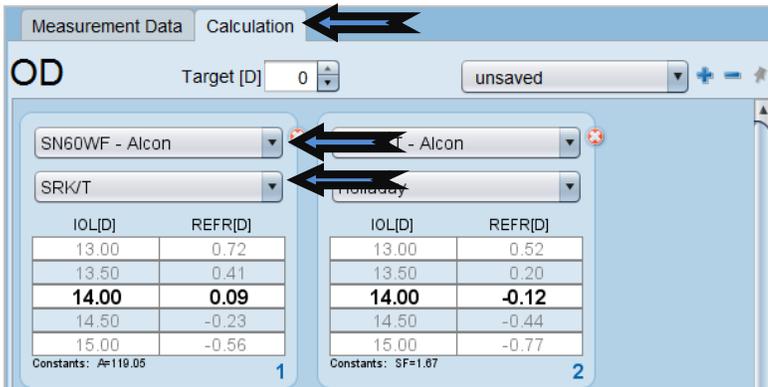
IOL constant	Allowed range	Used in
Manufacturer A	+100 ... +132	not used in any calculation
Haigis A0, A1 and A2	-10 ... +10	Haigis formula
Hoffer Q pACD	-6 ... +20	Hoffer Q formula
Holladay SF	-10 ... +20	Holladay I formula
SRK/T A	+100 ... +132	SRK/T formula
SRK II A	+100 ... +132	SRK II formula
Shammas No-History A	+100 ... +132	Shammas Post-Lasik formula
Olsen ACD	+2 ... +7	Olsen formula
Olsen AR	-1000 ... +1000	Olsen formula
Olsen LT	0 ... +10	Olsen formula
Olsen N	+1.360 ... +2	Olsen formula
Olsen PR	-1000 ... +1000	Olsen formula
Olsen SA	-0.4 ... +0.1	Olsen formula

- If the lens has multiple ranges, be sure to enter the formula value for each corresponding range.

Finally press "OK" at the bottom

IOL Configuration Quick Guide Version i6.0.1.1

From the Haag-Streit EyeSuite *IOL Calculation* screen
Click on the Calculation Tab

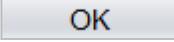


Select the Lenses and Formulas you wish to set for the Physician/Configuration page

Multiple Lens/Formula Combinations can be saved to each configuration
Six combinations per eye per page will print,
more than six combinations will result in additional pages printed

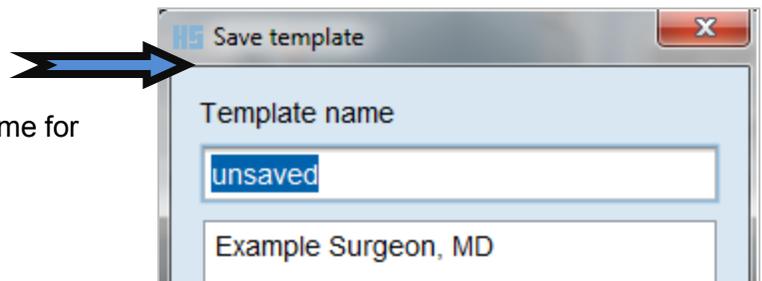
Then Click on the  "+" button.

At the "Save Template" Screen, Type the desired name for the new Template.

Then press the  OK Tab at the bottom

This saved Template configuration will now be available in the template drop-down menu.

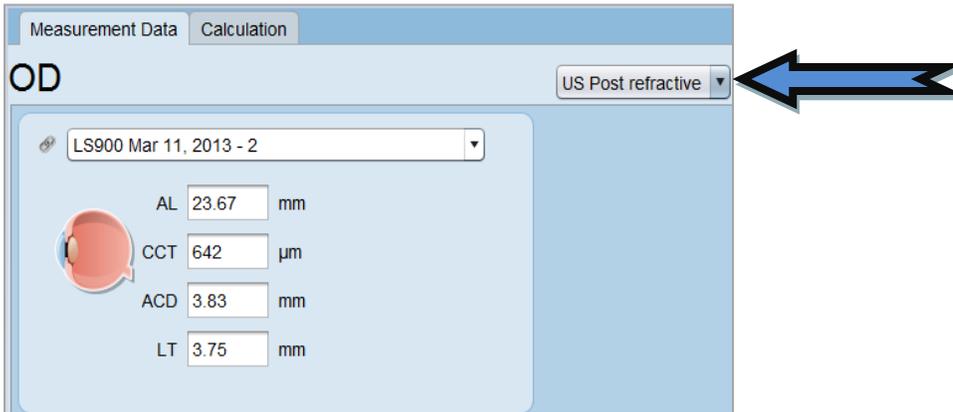
To delete a configuration page simply select the desired Template Name and then press the  "-" button



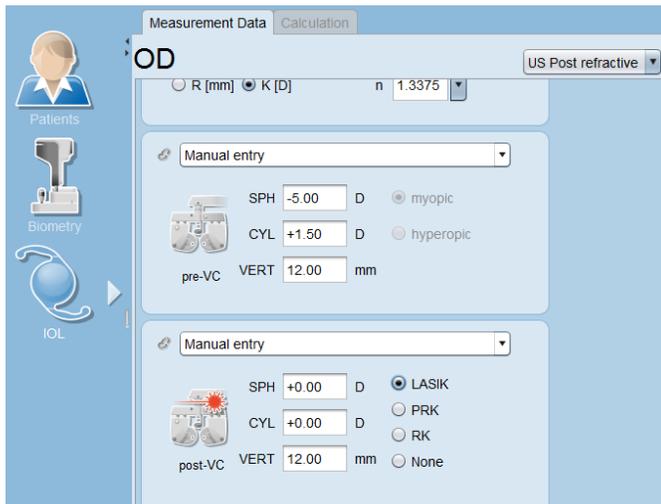
Post-Refractive IOL Calculation Quick Guide Version i6.0.1.1

From the *Measurement Data* screen

Click on the *US* dropdown field and select *US Post refractive*

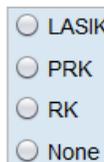


Two additional sections will appear on the *Measurement Data* screen



Continue by entering the preoperative refraction and the vertex in the pre VC (vision correction) fields.

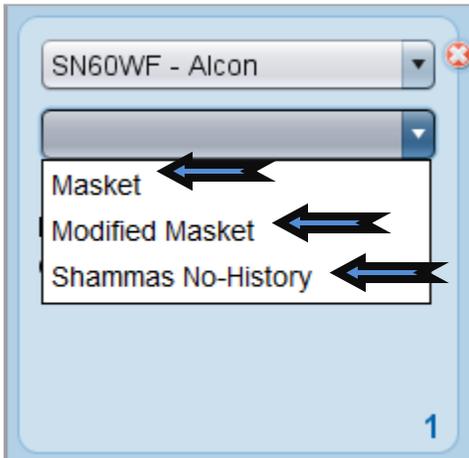
Then enter the postoperative refraction and vertex in the post VC (vision correction) fields.



Select the appropriate type of refractive procedure

***Note: If preoperative refraction data is not provided you will only have access to the Shammas No-History Formula. Masked and Modified Masked will NOT be available.**

Click **Calculation** tab then choose the post-refractive formula in which you would like to utilize.



The **Masket**, **Modified Masket**, and **Shammass No-History** formulas all need predefined **A-constants** for them to be utilized.

Masket and **Modified Masket** utilizes the optical **Hoffer Q** and optical **Holladay SF** **A-constants** for its operation.

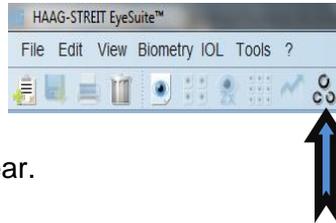
Shammass No-History Formula utilizes the optical **SRK-T** **A-constant** for its operation.

****Please see page 16 for instructions to store formula A-constants into the Eyesuite software for IOL calculations.**

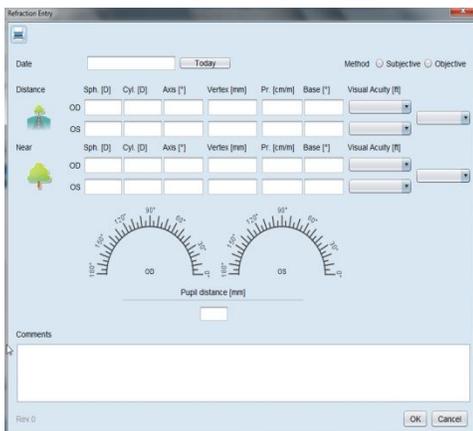
***Note:** If preoperative refraction data is not provided you will only have access to the **Shammass No-History** formula. **Masket** and **Modified Masket** will **NOT** be available. Under the **US Post refractive** feature you will not have access to the **Haigis**, **Hoffer Q**, **Holladay**, or **SRK/T** formulas.

Refractive Dialog Quick Guide 6.0.1.1

Click  located at the top tool bar

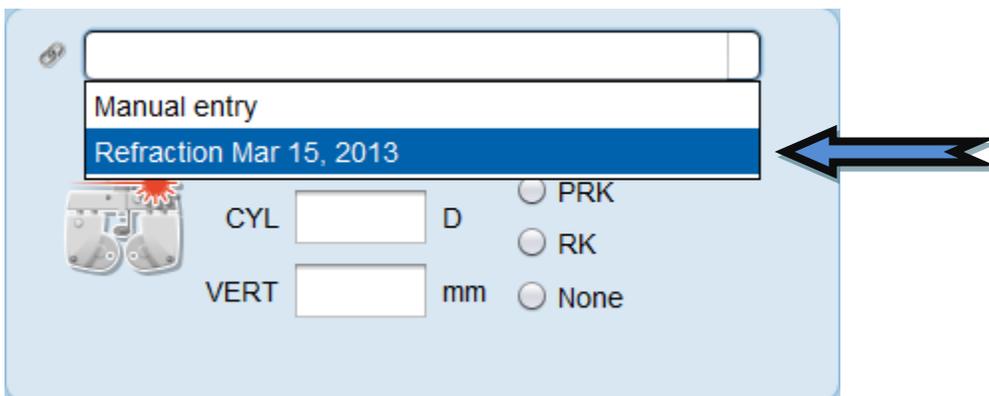


The *Refractive Dialog* screen will appear.



Here you can enter in a distance refraction, near refraction, distance and near vision acuities, and the method of refraction (subjective, objective).

The stored patient's refraction in the *Refractive Dialog* screen can be imported into the *Measurement Data* screen for post-refractive patients. You can do this by choosing the entered refraction in the in the *US Post Refractive* section. You can also choose *Manual entry* and input the data in the appropriate fields.



Service Functions

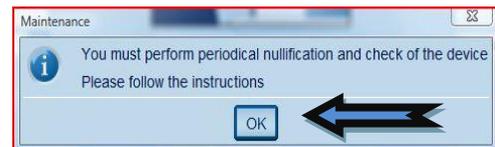
The software automatically reminds the user at regular (i.e. weekly) intervals of the need to correct the null balance. The user is guided through an intuitive three-stage process.

LENSTAR Nullification/ Test Measurement Quick Guide

Once every week the LENSTAR will need to undergo nullification and a test measurement procedure utilizing the test measurement eye, this can be found in the drawer on the right side of the LENSTAR table.

The EyeSuite software will prompt the user through the steps.

Press the “OK” Button at the prompt.



The first process is to make sure the measurement beam is emitted without any return interference. Make sure that there is nothing in front of the LENSTAR that could reflect light.

The process takes about 15 seconds.

After successful completion you should receive a green check mark noting success.

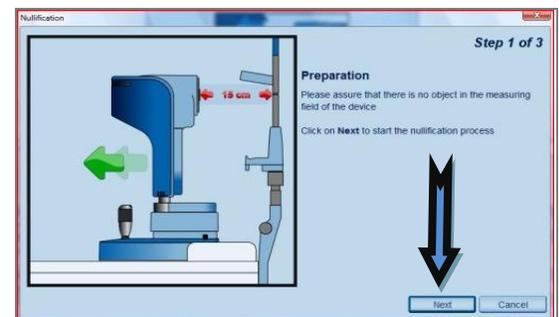
On the screen with the GREEN check mark select “OK” to continue to second step.

The next step will require the use of the test measurement device found in the LENSTAR table drawer. Remove the eye occluders and place the test measurement device onto the head rest as pictured on the computer screen. Make sure that the measurement device is below the forehead rest and push both sides up as far as they will go in order to make sure the device is resting against the bottom of the forehead strap. This will also allow the device to be perfectly horizontal in the headrest.

Then select **Next** on the screen.

Align the LENSTAR with the test measurement device exactly as a patient would be imaged. Once you see the green circle press the button on the joystick of the LENSTAR.

After successful completion you should receive a green check mark noting success.



If a **YELLOW** caution triangle appears at the end of either step of testing. Make sure the above steps are repeated to try again. If problem persists please contact LENSTAR Support at: **1-888-695-3678**

*The Test Measurement device should remain with the LENSTAR at all times as it is made specifically for your instrument and is not interchangeable.