LENSTAR LS 900
Setting the standard in optical biometry
LENSTAR

Better clinical outcomes

The LENSTAR LS 900 provides multiple highly-accurate laser optic measurements of nine sections of the eyes - from the cornea to the retina in a single scan. With integrated formulas including; Hill-RBF, Barrett, Olsen, Haigis, Hoffer Q, Holladay, SKR/T, Masket, Modified Masket and Shammas, LENSTAR provides the user with the best possible IOL prediction.

Dual zone keratometry, with 32 measurement locations or topography measurement with the optional T-Cone, provides reliable and precise measurements for the K values, axis and astigmatism that are essential to the sophisticated positioning of toric lenses. The LENSTAR offers the optimal planning platform for superior refractive outcomes in cataract surgery.

The LENSTAR is available in two basic versions; LENSTAR Pro and LENSTAR Essential. The LENSTAR Pro features latest IOL calculation methodologies and more, for advanced technology IOL planning. LENSTAR Pro options include the T-Cone Toric Platform and EyeSuite IOL Toric Planner.

The LENSTAR Essential provides all basic functionalities of a stand-alone optical biometer for standard cataract care in a busy practice. As such, the LENSTAR Essential features the unique Automated Positioning System (APS) as a standard, allowing automatic measurement acquisitions at a single click. A LENSTAR Essential may be upgraded on site to a LENSTAR Pro at any time.
LENSTAR APS – Efficient & accurate for improved refractive outcomes

The Automated Positioning System of the LENSTAR APS assists the user during the measurement process with dynamic eye tracking. This feature is combined with LENSTAR’s superior measurement technology providing axial measurements of the entire eye, dual zone autokeratometry and optional topography for best IOL prediction in all eyes.

Reliable & easy to delegate, for clinical efficiency

LENSTAR APS improves the repeatability of measurements assisting the user with the fine alignment of the device and allows easy to delegate biometry for improved patient flow in your practice.

Convenience for both the user & the patient

With APS, taking biometry measurements has never been easier. Biometry with a single click on the joystick saves time and increases patient and user comfort.
IOL POWER CALCULATIONS

Get the IOL position right, every time

Estimating the post-operative IOL position is both the key aim and the challenge of any IOL calculation formula. With its unique concept of the C-Constant, the Olsen formula calculates the post-operative lens position as a fraction of the crystalline lens thickness and the Anterior Chamber Depth (ACD). This approach allows accurate calculation of the lens position independent of the corneal status of the eye. The lens position is then used to calculate the IOL power based on ray tracing.

IOL calculation for any patient

LENSTAR EyeSuite software provides the user with a comprehensive set of cutting-edge IOL calculation formulae for normal eyes. IOL power calculation in patients with prior RK, LASIK or PRK, presenting with no history, is easily achieved with the onboard Barrett True-K and Shammas No-History method. If the change in refraction is known, then the Barrett True-K with history, Masket and Modified Masket formulae may also be used.

More accuracy in toric IOL planning

The Barrett Toric Calculator is based on the Barrett Universal II formula and features a unique model of the human eye to predict the posterior radii of the cornea. Clinical data proves the effectiveness of the Barrett approach as compared to other toric calculation methodologies. In addition, EyeSuite IOL indicates an incision optimisation tool to further improve the refractive outcome of the procedure.
HILL-RBF CALCULATOR

Hill-RBF - excellent results on all eye lengths

The Hill-RBF Method is a purely data-driven IOL calculation technique incorporating pattern recognition based on artificial intelligence and sophisticated data interpolation. It works for all biconvex lenses between -5DS and +30DS and features a unique boundary model for improved accuracy and confidence, using a dataset of 12,419 eyes.

Improved accuracy

The Calculator finds the right pattern to lead to an accurate IOL prediction based on the following input parameters; Axial Length (AL), Anterior Chamber Depth (ACD) and Corneal Curvature (K). Combined with a boundary model, the Hill-RBF Method only provides a result if the respective prediction is accurate with a very high probability.

Dynamic learning process

Unlike the static theoretical formulae used for IOL calculation, the Hill-RBF Calculator is a totally new method. The Calculator boasts an adaptive, dynamic learning process where data is continuously updated. This means the higher the number of surgical outcomes entered, the better the overall depth of accuracy becomes.

Exclusive to LENSTAR

The Hill-RBF Calculator is exclusively licensed on the LENSTAR and is available on the current version of EyeSuite. All LENSTAR Pro users are given full access to it and LENSTAR Essential users can upgrade to Pro at any time.
**LENSTAR OPTIONS & UPGRADES**

### Topography for torics - match the axis

With the T-Cone optional topography add-on, the axis and astigmatism measurement of LENSTAR is extended with true 11-ring Placido topography. This additional data improves the efficacy and safety of toric IOL surgery, eliminating the risk of irregularities and allowing the user to double-check the axis location on the topography maps. The T-Cone is combined with the toric surgery planner for optimal planning of the intervention.

### Toric Planner

The Toric Planner enables the user to optimise the incision location based on their individual SIA to achieve minimum residual astigmatism. Calculating the toric IOL with the Barrett Toric Calculator provides improved prediction accuracy, taking the effect of posterior cornea and lens design into account. Use of high-resolution images of the patient’s eye for the planning allows easy identification and localisation of anatomic landmarks for best transfer of the plan to surgery.

### Dense Cataract Measurement (DCM)

EyeSuite includes a state-of-the-art Dense Cataract Measurement (DCM) mode, that is automatically enabled if axial length is not achieved during testing. This allows 98.4% of cataracts to be measured using an optical, non-contact method.

Each of the measurements can be validated for efficacy and adjusted, if necessary, to ensure complete biometry accuracy.
Connectivity is key
Whether you use a Haag-Streit biometer, perimeter, or imaging system, you always use the same EyeSuite software. Intuitive and easy-to-use, EyeSuite utilises the same patient management, preferences, import/export functionality and backup process across all Haag-Streit devices. This simplifies your clinical processes by shortening the learning curve of your staff.

Open data interface
With EyeSuite software, LENSTAR is fully-networkable and allows real-time access to all data in a practice. Surgeons can check their biometry results and recalculate an IOL, even in the operating theatre.

EyeSuite’s open data interface, combined with LENSTAR’s separate PC, allows auto-population of the data fields in the 4th generation calculation formulae - such as Holladay 2. These not only save valuable staff time, they also eliminate the risk of transcription errors.

Service & support
With the demands on the NHS and private hospital eye clinics ever increasing and the need to limit equipment downtime, it is vital that you have a trusted service provider that you can call the minute you identify any performance issues.

The HS-UK Service Division is the only Haag-Streit authorised LENSTAR service centre in the UK. Offering Gold, Silver or Bronze service contracts, each is designed to give you full peace-of-mind and allows you to choose the contract that meets your individual needs.
LENSTAR TRAINING & EDUCATION

On-site training

Soon after a LENSTAR is installed, each customer is provided with an on-site training workshop, which is delivered to all key members of staff.

Workshops are usually facilitated by our Product Manager, an expert in both the operation and clinical applications of the LENSTAR system.

These workshops cover all the areas necessary to allow you to begin using your device effectively. This includes; setting-up and calibrating your system, entering and amending patient data, patient positioning, patient testing and result evaluation, as well as other functions such as data exporting, adding and editing IOL.

In addition, a quick user guide and short videos detailing each key area of device operation are available via the Haag-Streit UK website.

LENSTAR live events

For both users of the LENSTAR system and non-users who want to get more out of their biometry, we provide live interactive training events, UK-wide.

Delivered by experienced clinical speakers and product experts, these regional events give delegates the opportunity to pick up hints, tips and valuable information during clinical lectures and test simulation workshops. They also give attendees the chance to speak with industry leaders and gather important CPD points.

**National Institute for Heath & Care Excellence (NICE) Cataract Guidelines**

The National Institute for Health and Care Excellence (NICE) has recently published guidelines for the management of cataracts in adults. Several recommendations cited in these guidelines can be achieved with the use of the technology and software available in the Haag-Streit LENSTAR LS 900.

“**For people who have not had previous corneal refractive surgery, use one of the following to calculate the intraocular lens power before cataract surgery:**

- If the axial length is less than 22.00 mm, use Haigis or Hoffer Q.

- If the axial length is between 22.00 and 26.00 mm, use Barrett Universal II if it is installed on the biometry device and does not need the results to be transcribed by hand. Use SRK/T if not.

- If the axial length is more than 26.00 mm, use Haigis or SRK/T.”

LENSTAR’s EyeSuite software platform provides Haigis, Hoffer Q, Barrett, SRK/T as standard. If the axial length is more than 26.00 mm, use Haigis or SRK/T.

“**If people have had previous corneal refractive surgery, adjust for the altered relationship between the anterior and posterior corneal curvature. Do not use standard biometry techniques or historical data alone.”**

LENSTAR’s EyeSuite software also includes; Barrett True K, Masket, Modified Masket and Shammas No-history formulas for post-refractive surgery IOL power calculations. The optional T-Cone also allows topography to be measured concurrently to screen for corneal irregularity.

“**How effective are newer intraocular lens formulas (for example, Barrett, Olsen, T2) compared with standard formulas for phacoemulsification cataract operations on eyes without a history of corneal refractive surgery, especially for long and short axial lengths?”**

Haag-Streit Diagnostics works with a number of Internationally recognised key opinion leaders and have championed the Barrett and Olsen formulas. The most recent advance in IOL prediction, the Hill-RBF, was released outside the NICE consultation period but may give more accurate outcomes.
# Technical specifications

## LENSTAR LS 900

### Measured variables & modes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measurement range</th>
<th>Display resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corneal thickness</strong>&lt;sub&gt;CT&lt;/sub&gt;</td>
<td>300–800μm</td>
<td>1μm</td>
</tr>
<tr>
<td><strong>Anterior chamber depth</strong>&lt;sub&gt;ACD&lt;/sub&gt;</td>
<td>1.5–6.5mm</td>
<td>0.01mm</td>
</tr>
<tr>
<td><strong>Lens thickness</strong>&lt;sub&gt;LT&lt;/sub&gt;</td>
<td>0.5–6.5mm</td>
<td>0.01mm</td>
</tr>
<tr>
<td><strong>Axial length</strong>&lt;sub&gt;AL&lt;/sub&gt;</td>
<td>14–32mm</td>
<td>0.01mm</td>
</tr>
<tr>
<td><strong>White-to-white distance</strong>&lt;sub&gt;WTW&lt;/sub&gt;</td>
<td>7–16mm</td>
<td>0.01mm</td>
</tr>
</tbody>
</table>

### Keratometry<sup>K</sup>

- **Measurement range for radius**: 5–10.5mm
- **Display resolution**: 0.01mm
- **Measurement range for axis angle**: 0–180°
- **Display resolution**: 1°

### Pupillometry<sup>PD</sup>

- **Measurement range**: 2–13mm
- **Display resolution**: 0.01mm

### Measurement modes

- `Normal` eye
- `Aphakic` eye
- `Pseudophakic` eye
- `Silicone-filled` eye
- `Combination` of the above

### Laser safety

- Class 1 laser product

### Onboard IOL calculation formulas

- Hill-RBF Method
- Olsen, Barrett
- Universal II, Barrett True-K
- Barrett Toric Calculator*, Haigis, Hoffer Q
- Holladay 1, SRK/T, SRK II, Masket
- Modified Masket, Shammas No-History

### IOL calculation data interfaces

- Holladay IOL Consultant Professional Edition (Holladay 2 formula and Holladay toric calculator)<sup>9</sup>
- PhacoOptics (Olsen formula)<sup>10</sup>
- Okulix (Ray-Tracing by Prof. Preussner)<sup>11</sup>

### Electronic medical record system interfaces

- DICOM (SCU)
- EyeSuite Script Language
- GDT
- EyeSuite command line interface

---

*Barrett Toric Calculator is part of the optional EyeSuite IOL Toric Planner.

The above-mentioned measurement ranges are based on the standard settings of the device for automatic measurement and analysis.

---

## LENSTAR LS 900 Optical Biometer Indications for Use

The LENSTAR LS 900 Biometer is a non-invasive, non-contact OLCR (Optical Low Coherence Reflectometry) device. It is used for obtaining ocular measurements and performing calculations to assist in the determination of the appropriate power and type of IOL (intraocular lens) for implantation after removal of the natural crystalline lens following cataract removal.

**The LENSTAR LS 900 measures:**

- Axial eye length
- Corneal thickness
- Anterior chamber depth
- Aqueous depth
- Lens thickness
- Corneal curvature
- Radii for flat and steep meridian
- Axis of the flat meridian
- White-to-white distance
- Pupil diameter
WHAT OUR LENSTAR LS 900 USERS SAY...

“In my complex cataract and anterior segment clinic, the LENSTAR 900 stands out as the single most useful piece of equipment, achieving high levels of reliability even through dense cataracts. The integrated T-cone gathers and presents qualitative and quantitative data in a readily accessible format, without the risk of transcription errors inherent in all of the online surgical planners. Surgical planning is enhanced with EyeSuite software, allowing customised editing of incision placement and surgically-induced astigmatism.

In the toric planner, it is possible to assess at a glance the impact of IOL rotation and cylinder power on refractive astigmatism. The customised IOL printout permits both multi-formula and multi-IOL layout, or a combination of both, facilitating IOL selection and enhancing communication with the patient about confidence of refractive target, particularly in non-standard eyes.

The integrated Hill-RBF Calculator makes it easy to prospectively evaluate the performance of this ground-breaking method, allowing transition from previously utilised formulae with a view to enhancing accuracy of IOL selection.”

Peter Wilson
Consultant Ophthalmologist
Fife

“I work with consultants who demand better outcomes, we aren’t after 85% within 1D we want much more than that. The LENSTAR provides accurate and precise keratometry, which we need in order to aid our choice of premium IOLs. The K readings on LENSTAR are safer, it either measures or doesn’t if the patient isn’t fixating correctly.”

David Sculfor
Consultant Optometrist & Head of Optometry
Buckinghamshire

“The LENSTAR is straightforward to learn and use but while it has to be used intelligently, it’s difficult to take a wrong measurement. It only takes seconds to carry out basic quality checks on axial length and k readings, and it’s very configurable from a basic setup through to detailed individualised toric planning for specific surgeons.

Regular software updates provide access to the latest formulas and T-cone allows you to screen patients for subtle corneal irregularities, which is increasingly important for premium IOLs.”

Sathish Srinivasan
Joint Clinical Director & Consultant Corneal Surgeon
Ayrshire

“Understandably I did a lot of research into which biometry machine to purchase for my new clinic and ultimately decided on the LENSTAR from Haag-Streit. The LENSTAR has been instrumental in helping us achieve outstanding outcomes for our cataract and refractive lens replacement patients.

The LENSTAR comes with all of the fourth generation biometry formulae and we have particularly benefited from using the Barrett, Hill-RBF and Olsen formulae.

Finally, the ability of the LENSTAR to provide us with a toric lens calculation and implantation plan has taken the human error out of generating treatment plans. This in turn has allowed us to increase the proportion of patients who can benefit from toric lens implantation.”

James Ball
Consultant Ophthalmic Surgeon
Yorkshire

“I like the LENSTAR device as I feel that the double ring provides more measurement points for central keratometry, which is critical in biometry. Moreover, the new EyeSuite software has all the latest generation formulas (Barrett and Hill-RBF) integrated into the software making it easier for surgeons to calculate and avoid transcription errors.”

Craig Macdonald
Head of Clinical Services
Edinburgh

“Understandably I did a lot of research into which biometry machine to purchase for my new clinic and ultimately decided on the LENSTAR from Haag-Streit. The LENSTAR has been instrumental in helping us achieve outstanding outcomes for our cataract and refractive lens replacement patients.

The LENSTAR comes with all of the fourth generation biometry formulae and we have particularly benefited from using the Barrett, Hill-RBF and Olsen formulae.

Finally, the ability of the LENSTAR to provide us with a toric lens calculation and implantation plan has taken the human error out of generating treatment plans. This in turn has allowed us to increase the proportion of patients who can benefit from toric lens implantation.”

James Ball
Consultant Ophthalmic Surgeon
Yorkshire

“I work with consultants who demand better outcomes, we aren’t after 85% within 1D we want much more than that. The LENSTAR provides accurate and precise keratometry, which we need in order to aid our choice of premium IOLs. The K readings on LENSTAR are safer, it either measures or doesn’t if the patient isn’t fixating correctly.”

David Sculfor
Consultant Optometrist & Head of Optometry
Buckinghamshire

“The LENSTAR is straightforward to learn and use but while it has to be used intelligently, it’s difficult to take a wrong measurement. It only takes seconds to carry out basic quality checks on axial length and k readings, and it’s very configurable from a basic setup through to detailed individualised toric planning for specific surgeons.

Regular software updates provide access to the latest formulas and T-cone allows you to screen patients for subtle corneal irregularities, which is increasingly important for premium IOLs.”

Sathish Srinivasan
Joint Clinical Director & Consultant Corneal Surgeon
Ayrshire

“We aren’t after 85% within 1D we want much more than that. The LENSTAR provides accurate and precise keratometry, which we need in order to aid our choice of premium IOLs. The K readings on LENSTAR are safer, it either measures or doesn’t if the patient isn’t fixating correctly.”

Craig Macdonald
Head of Clinical Services
Edinburgh

“I like the LENSTAR device as I feel that the double ring provides more measurement points for central keratometry, which is critical in biometry. Moreover, the new EyeSuite software has all the latest generation formulas (Barrett and Hill-RBF) integrated into the software making it easier for surgeons to calculate and avoid transcription errors.”

David Sculfor
Consultant Optometrist & Head of Optometry
Buckinghamshire

“We aren’t after 85% within 1D we want much more than that. The LENSTAR provides accurate and precise keratometry, which we need in order to aid our choice of premium IOLs. The K readings on LENSTAR are safer, it either measures or doesn’t if the patient isn’t fixating correctly.”

Craig Macdonald
Head of Clinical Services
Edinburgh

“I like the LENSTAR device as I feel that the double ring provides more measurement points for central keratometry, which is critical in biometry. Moreover, the new EyeSuite software has all the latest generation formulas (Barrett and Hill-RBF) integrated into the software making it easier for surgeons to calculate and avoid transcription errors.”

David Sculfor
Consultant Optometrist & Head of Optometry
Buckinghamshire