INSTRUCTIONS FOR USE
Applanation tonometer

AT 900® D

Introduction
Thank you for choosing a HAAG-STREIT appliance. Provided you comply carefully with the regulations in this instructions for use, we can guarantee the reliable and unproblematic use of our product.

Purpose of use
The device is an accessory for Series 900 slit lamps and is used to measure intraocular eye pressure. Its adaptation options make it specially optimized for HAAG-STREIT slit lamps. However, this device can also be mounted on slit lamps from other suppliers.

Contraindication
There is no absolute contraindication for execution of the tonometry. Appropriate professional judgement and caution are necessary.

WARNING!
Read the instructions for use carefully before commissioning this product. It contains important information regarding the safety of the user and patient.

WARNING!
Applanation tonometry may only be conducted by appropriately trained and qualified medical personnel.
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1. **Safety**

**FORBIDDEN!**
Failure to comply with the instructions can result in material damage and pose a danger to users and patients.

**WARNING!**
These warnings must absolutely be complied with to guarantee safe operation of the device and to avoid any danger to users and to patients.

**NOTE!**
Important information: please read carefully.

1.1 **Areas of application of the device**
The users are ophthalmologists, optometrists, opticians, orthoptists or other trained specialists. The examination is performed in slightly darkened examination rooms.

1.2 **Ambient conditions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Transport: Temperature</th>
<th>from</th>
<th>to  +70 °C</th>
<th>Air pressure</th>
<th>from 500 hPa</th>
<th>to 1060 hPa</th>
<th>Relative humidity</th>
<th>from 10%</th>
<th>to 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage:</td>
<td>Temperature</td>
<td>from</td>
<td>−10 °C</td>
<td>to +55 °C</td>
<td>Air pressure</td>
<td>from 700 hPa</td>
<td>to 1060 hPa</td>
<td>Relative humidity</td>
<td>from 10%</td>
</tr>
<tr>
<td>Use:</td>
<td>Temperature</td>
<td>from</td>
<td>+10 °C</td>
<td>to +35 °C</td>
<td>Air pressure</td>
<td>from 800 hPa</td>
<td>to 1060 hPa</td>
<td>Relative humidity</td>
<td>from 30%</td>
</tr>
</tbody>
</table>

1.3 **Shipment and unpacking**

* Before you unpack the appliance, check whether the packaging shows traces of incorrect handling or damage. If this is the case, notify the transport company that has delivered the goods to you.
* Unpack the equipment together with a representative of the transport company. Make a report of any damaged parts. This report must be signed by you and by the representative of the transport company.
* Leave the device in the packaging for a few hours before unpacking it (condensation).

1.4 **Installation warnings**

**PROHIBITED!**
* Never use the device in potentially explosive environments where volatile solvents (alcohol, benzine, etc.) and combustible narcotics are in use.

**WARNING!**
* This device must not be modified without the permission of the manufacturer.
* Installation and repairs may only be performed by trained specialists.
* Any third-party device must be connected in compliance with the EN 60601-1 standard.

**WARNING!**
The optional magnet unit for automatic L/R detection may only be used with the AT 900 D. Other measuring devices, especially mechanical tonometers, may be affected by the strong magnetic field.

**NOTE!**
* When performing assembly on appliances from other manufacturers, the connecting dimensions of the various tonometer models are to be taken into account!
* Check: Are the connection parts properly positioned (tonometer on the slit lamp, measuring prisms)?

1.5 **Operation, environment**

**WARNING!**
Only original HAAG-STREIT Goldmann tonometer measuring prisms or the sterile TonoSafe disposable prisms from HAAG-STREIT may be used.

* Check the appliance for damage after it is unpacked. Return defective appliances in the appropriate packaging.
* Store packaging material carefully, so that it can be used for possible returns or when moving.
NOTE!
- This equipment may only be operated by qualified and trained personnel. The owner is responsible for their training.
- Measurement results must always be checked for plausibility.

1.6 Disinfection

NOTE!
The device does not need to be disinfected.

For more information on cleaning, please refer to the 'Maintenance' chapter.

1.6.1 Cleaning and disinfecting the measuring prism

WARNING!
Reusable measuring prisms are not shipped in disinfected condition and must be cleaned and disinfected before their first use in accordance with the separate instructions for use on the cleaning and disinfection of tonometer measuring prisms, contact glasses, and Desinset.

NOTE!
The instructions for use listed above, the brief instructions on disinfecting the tonometer measuring prisms and further information are available on our homepage www.HAAG-STREIT.com.

1.6.2 Visual inspection of the measuring prisms for damages

FORBIDDEN!
Never use damaged measuring prisms. The contact surface of the measuring prism must be inspected for contaminants or damage (scratches, cracks and sharp edges) prior to every use. This must be performed with a slit lamp microscope at 10x to 16x magnification.

1.6.3 Reusable measuring prisms

WARNING!
How long can measuring prisms be used?
Due to the large number of variables to be considered (type and concentration of the disinfectant used, number of patients, handling, etc.) it is practically impossible to provide exact information on how often and/or how long a measuring prism can be used under safe conditions. The measuring prisms are stamped with an expiry date (YYYY-MM). They must not be used beyond this date. HAAG-STREIT recommends a maximum service life of two years before the expiry date. This service life applies under normal conditions of use, i.e. in compliance with the instructions contained in these instructions for use. The service life starts with the first use. The above-mentioned time periods do not apply to damaged measuring prisms; these must be immediately replaced.

Year:

<table>
<thead>
<tr>
<th>Year</th>
<th>Service life</th>
<th>Replace</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.6.4 Tonosafe

NOTE!
Tonosafe was developed to avoid the necessary cleaning and disinfection of measuring prisms from applanation tonometers. Tonosafe is a disposable applanation and optical duplication prism for Goldmann and Perkins applanation tonometers for single use. Additional details can be found in the separate instructions for use.
1.6.5 Monthly inspection of the device
The tonometer must be checked on a monthly basis in accordance with the 'Maintenance' chapter. A check will be absolutely necessary if external force is applied (e.g., striking or dropping the appliance).

NOTE!
If a repair is necessary, please contact your HAAG-STREIT representative.

1.7 Warranty and product liability
* The product should be treated as described in the "Safety" chapter. Improper handling can damage the product. This would void all warranty claims.
* Continued use of a product damaged by incorrect handling may lead to personal injury. In this case, the manufacturer accepts no liability.

1.8 Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Read the instructions for use attentively" /></td>
<td>General warning: Read the accompanying documentation</td>
</tr>
<tr>
<td><img src="image" alt="Disposal instructions. See &quot;Disposal&quot; section." /></td>
<td>Test symbol of CSA with approval for USA</td>
</tr>
<tr>
<td><img src="image" alt="European certificate of conformity" /></td>
<td>This appliance complies with the Directive 2002/95/EC (RoHS).</td>
</tr>
<tr>
<td>Year of production</td>
<td>Manufacturer</td>
</tr>
<tr>
<td>HS reference number</td>
<td>Serial number</td>
</tr>
<tr>
<td>LOT number</td>
<td>Product classification Type B</td>
</tr>
<tr>
<td>Expiry date (2017-10 = end of October 2017)</td>
<td>Must not be re-used</td>
</tr>
<tr>
<td>IPXO</td>
<td>Not protected against penetration from foreign bodies</td>
</tr>
</tbody>
</table>

2. Introduction
The applanation tonometer functions according to the 'Goldmann method': measurement of the pressure required to maintain a uniform applanation of the surface of the cornea. The precise measurement of the applanation surface is conducted with the slit lamp at 10x magnification. The pressure measurement is conducted on a slit lamp with the patient sitting down and is a routine test carried out as part of the standard slit lamp microscopy.

2.1 System components
The Applanation Tonometer AT 900 D system is composed of the following devices:
* Applanation Tonometer AT 900 D
* Bluetooth adapter (optional)
* PC or laptop

2.2 Bluetooth adapter (optional)
There is an optional Bluetooth adapter available to transfer the measured data directly to the patient management of the Eyesuite software. The activation of the Bluetooth function is described in Chapter 4.4. The description of the software installation can be found in the EyeSuite Setup Manual, the usage instructions for the Bluetooth adapter and the description of the error messages are included in the Help section of the software. The help can be opened via the F1 key or in the [?] - [Help] menu.

2.3 Overview
1. Measuring prisms (application part)
2. Sensor arm
3. Battery compartment lid
4. Battery compartment locking mechanism
5. Type plate (bottom side)
6. Function key
7. Insert for control weight
8. Digital display
9. Knob
10. Bluetooth adapter (optional)
3. Equipment assembly / installation

**WARNING!**
Installation, repairs and modifications may only be performed by trained specialists.

### 3.1 AT 900 D model R

A pivot is required for use of the Applanation Tonometer AT 900 D model R. It is assembled as follows:

1. Unscrew the mounting screw found at the top, on the microscope’s middle cylinder housing.
2. Leave the spring in the aperture.
3. Position and screw tightly the pivot for the tonometer.
4. Place the tonometer bearer arm on the pivot's pin and swivel the tonometer to the right until it snaps into position. The tonometer will remain in this position even when not in use.
5. The stop peg must be assembled (11) when using the BM 900 and BM 900 V and must be removed (12) when using the BC 900 or BD 900.

### 3.2 AT 900 D model T

The Applanation Tonometer is tucked into one of the holes on the horizontal guide plate over the slit lamp axis using the peg from the tonometer base.

### 3.3 AT 900 D model BQ

1. Assembly requires the small screwdriver and the 5 mm hexagonal Allen key.
2. Slide the slit lamp to the stop-piece against the examiner and lock the instrument base and the microscope arm in the middle position.
3. Swivel the illumination apparatus all the way to the left-hand side.
4. Disassemble the breath shield from the microscope arm.
5. Remove the cover screw located on the plain, right-hand surface of the microscope arm.
6. Bring the swiveling arm of the tonometer and the radial movement bearing towards one another in an elongated position.
7. Shore up the tonometer on the guide plate and tighten the mounting screw into the boring on the microscope arm. If there is no guide plate present: hold the tonometer in a horizontal position.
8. Loosen up the lock on the microscope arm and the instrument base, then reassemble the breath shield.

### 3.4 Magnet unit for automatic L/R detection

The magnet unit for the AT 900 D in combination with the EyeSuite Tonometry software makes it possible to display the intraocular pressure (IOP) and the information on the eye in which the pressure was measured.

**PROHIBITED**
The magnet unit may not be used with conventional mechanical Goldmann applanation tonometers, as the magnets can cause erroneous results with these instruments.

**NOTE!**
The magnet unit cannot be used with the attachment cart with rail for the Hruby lens. If you have this type of attachment cart affixed on your head rest, please remove it.

* For metal chin rests (13), screw the magnet unit directly into the rear, closer together holes on the chin rest using the knurled screws.
* For plastic chin rests (14), screw the two spacer sleeves into the provided threaded sockets on the chin rest first and then affix the magnet unit into the external holes on the spacer sleeves using the knurled screws.
* Check that you can still see the bottom side label (15) after assembly when you view the chin rest from below.

3.5 Which slit lamp with which tonometer

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>T</th>
<th>BQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD 900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP 900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BQ 900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX 900</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.6 Installation position of the tonometer

AT 900 D model R
Can be fitted on the peg on the microscope.

AT 900 D model T
Can be fitted on the guide plate on the swiveling peg for the microscope and illumination arm.

AT 900 D model BQ
Mounted on the microscope arm.

3.7 Description models

- The Applanation Tonometer AT 900 D Model R can be left on the slit lamp permanently. It is fastened to the microscope on a mounting base and swiveled in front of the microscope for the examination. The observation of the applanated surface is conducted monocularly – only through the left eyepiece.

- The Applanation Tonometer AT 900 D Model T is set on the guide plate over the slit lamp axis, for tonometry purposes. The instrument can be moved between two positions on the guide plate for observation through the right or left eyepiece.

The sensor arm with the measuring prism projects from the bottom side into the beam path of the microscope and the illumination.

- The Applanation Tonometer AT 900 D Model BQ has a working position and two resting positions. To set the correct angle of incidence of the illumination, the tonometer is swiveled and the illumination apparatus is positioned to the left of the tonometer bracket. The patient’s left and right eyes can be easily examined in this position (no 60° position). The applanated surface is observed monocularly through the right eyepiece of the stereo microscope.

4. Commissioning

4.1 Switching the device on and off

Switch the tonometer on by pressing the function key briefly. We recommend checking the display elements regularly to ensure they are functioning when switching the tonometer on. [8.8.8] appear shortly and then each individual LED segment lights up, following by the software version: a 3-digit number. At the same time, the red and green displays will flash alternately. If a display value appears after that, then the device is ready for use. The digital display lights up and displays the set tonometer value. The tonometer switches off automatically after 90 seconds if no adjustments are made. If the Bluetooth™ function is disabled (Section 5), the tonometer can also be switched off by pressing the function key.
4.2 Programming the settings

The display brightness, volume and Bluetooth function can be changed. Press the function key and hold it down for two seconds to access the programming mode. The functions can be set in the following order according to the following points:

1. Display brightness
2. Volume
3. Bluetooth function

4.3 LED indicator

The LED below the display value is used to check whether the measuring prism is within the permitted measuring range during measurement. It lights up red as long as the tonometer is not in contact with the cornea and changes to green as soon as the measuring prism makes good contact with the cornea. If the tonometer is too close to the eye, the color changes back to red and a warning tone alerts the user to the fact that he/she has gone outside of the measuring range and the sensor is in the safety distance. The measuring range is between 3 and 75 mmHg. Above the measuring range, the display shows [HI], below it [Lo].

4.4 Setting the display brightness

Hold the function key depressed for approx. 2 seconds. The display shows [- - -] (three dashes) and a signal sounds. Release the function key again. [br1] appears on the display, along with the brightness setting 1 to 3. The brightness is adjusted by pressing the function key briefly. We recommend leaving the device in the basic setting [br1] to ensure long battery life.

4.5 Adjusting the volume

Hold the function key depressed for approx. 2 seconds. The display shows [- - -] (three dashes) and a signal sounds. Release the function key again. [Ld1-Ld3] appears on the display, followed by levels 1 to 6. The volume is adjusted by pressing the function key briefly.

4.6 Bluetooth™ function

Keep the function key depressed for approx. 2 seconds to switch to the Bluetooth™ function menu. Pressing the function key briefly switches the Bluetooth™ function on [bon] / off [boF]. This function can only be used together with the HAAG-STREIT Bluetooth™ adapter (102623) and the corresponding software. Detailed information can be found in the corresponding operating instructions. Disable the function [boF] if you do not require it, in order to avoid wasting the batteries’ power. Pressing the function key for more than two seconds returns you to the normal measuring mode. The normal measuring mode can also be reached by waiting until the device switches itself off and then switching it back on again.

4.7 Battery status

If [bAt] appears in the display instead of a numerical value when the device is switched on, then the batteries should be replaced immediately (4x commercially available 1.5V LR03 (AAA) batteries). You can continue measuring until the tonometer switches off automatically.

5. Operation
5.1 Measuring tips

NOTE!
Measurements of shortest-possible duration should be conducted on both eyes.

* This measurement can be repeated multiple times. Excited and anxious patients frequently have a higher inter-ocular pressure during the first measurement.
* In the first minute, however, tension drops as the patient realizes that tonometry does not produce any unpleasant sensations. With appropriate anesthesia and well-opened eyes, the patient does not feel anything.
* This is why a test measurement is first carried out on both eyes. The results are discarded and three further measurements are then conducted on each eye. The values are correct if the pressure has stabilized. If the correct procedure is used, the range of results will be of ± 0.5 mm Hg.
* A measurement that takes a longer time may result in some drying of the corneal epithelia in both eyes. A fluorescein-containing ring is formed on the eye that is being measured around the spots where the measuring prism makes contact with the cornea.
* On the other eye, irregular, ‘map-like’, fluorescein-containing dry patches are formed that prevent usable measurements from being taken. Extensive dryness disappears quickly without treatment. Visual acuity is affected by these slight epithelial defects.

WARNING!
Reusable measuring prisms must be cleaned and disinfected after every examination.

5.2 Astigmatism
* If the cornea is spherical, measurements can be taken on any meridian, but it is most convenient to measure on the 0° meridian.
* However, the choice of meridian is significant when measuring eyes with corneal astigmatism greater than 3 dioptres, since the flattened area is not circular, but elliptical.
* It has been calculated that, in cases of greater corneal astigmatism, a surface of 7.354 mm² (≈ 3.06 mm) is applanated if the measuring prism is at an angle of 43° (16) to the meridian of the greatest radius.

Example
If the corneal astigmatism measures:

- 6.5 mm / 30° = 52.0 dpt / 30° and
- 8.5 mm / 120° = 40.0 dpt / 120°

then the 120° graduation mark on the measuring prisms is set to the 43° mark (16) of the prism holder.

If, on the contrary, the measurements are:

- 6.5 mm / 30° = 40.0 dpt / 30° and
- 8.5 mm / 120° = 52.0 dpt / 120°

then the 30° graduation mark is set to the red 43° mark (16), meaning that simply the axis position of the largest radius is set to the red 43° mark (16).

5.3 How pressure is measured
The applanation tonometer functions according to the ‘Goldmann method’: measurement of the pressure required to maintain a uniform applanation of the surface of the cornea.

* The readings obtained are based on the assumption that a cornea with a ‘normal’ thickness is being measured; a different corneal thickness leads to changes in the measured IOP. A ‘normal’ corneal thickness is considered to fall within the range of 530 to 560 microns.
* If it is suspected that measuring results may be inaccurate, please conduct a functional verification in accordance with the ‘Maintenance’ chapter.

5.4 Preparing the patient

NOTE!
A smooth operation can only be guaranteed with the use of original HAAG-STREIT measuring prisms and Tonosafe. Should the measuring prism come into contact with the cornea without the correct pressure having been previously set, vibrations may occur in the sensor arm that could be unpleasant for the patient.

1. Anesthesia for both eyes.
2. Use fluorescein if necessary.
3. The correct eye height of the patient can be set via the chin rest.

5.4.1 Patient instructions
1. Press the head firmly against the chin and forehead rests and use a headband to fix the head’s position, if necessary.

2. The patient must look straight forward. If necessary, the small fixing light can be used to steady the eyes.

3. It is recommended that the patient be repeatedly reminded to keep his eyes open wide during the examination. It might be necessary for the examiner to keep the eye open by splaying the eyelids with thumb and index finger. This must be done without applying any pressure to the eye. In this case, the angle between the microscope and the illumination apparatus is reduced to approximately 10° for the models AT 900 D model T, whereby the light beam is guided through the prism body. A non-reflecting image should be attempted.

5.5 Preparing the tonometer

For all HAAG-STREIT slit lamps and tonometers

1. The eyepiece adjustment is to be checked before the examination.
2. Set the magnification to 10x.
3. Set the power supply/illumination potentiometer to the lowest setting.
4. Position the blue filter in the beam path of the slit lamp’s illumination apparatus and open the slit diaphragm fully.
5. Insert the disinfected measuring prism into the (0° position) holder on the sensor arm. For Tonosafe, see the separate instructions for use.
6. Snap the sensor arm into place so that the axes of the measuring prism and of the microscope align.
7. Switch on the tonometer and set a value between 5 and 10 mm.

5.5.1 AT 900 D model R and AT 900 D model BQ

1. Swing the illumination apparatus to the left.
2. Release the tonometer from the dwell position to the right of the microscope and swing it forward until it locks into the measuring position.
3. From the left, bring the illumination apparatus into contact with the tonometer bearer arm. This is the only illumination position in which both the patient’s left and right eyes can be easily examined (no 60° position). This arrangement facilitates the splaying of the patient’s eyelids, should this be necessary for measurement. The illumination of the applanated surface through the measuring prism is practically reflection-free.

5.6 Measuring correctly

1. Immediately before taking measurements, the patient should close his eyes briefly so that the cornea becomes sufficiently moistened with fluorescein-impregnated tear fluid.
2. By moving the slit lamp, the measuring prism comes into contact with the center of the cornea over the pupillary area. During contact, the cornea’s limbus takes on a bluish glow. This glow can be best observed with the naked eye from the opposite side of the illumination apparatus. When the limbus glows, stop moving the slit lamp immediately.
3. After contact is made, viewing is conducted through the microscope. The uniform pulsation of the two semicircular fluorescein bands, which could be of different sizes in drum setting 1 depending on the inter-ocular pressure, shows that the tonometer is in the right measuring position. Any necessary corrections are made using the slit lamp control lever, until the flattened surface is observed in the form of two semicircles of similar size in the middle of the visual field (16). Smaller changes in the depth of the slit lamp using the control lever do not affect the size of the semicircles.
4. The pressure on the eye is increased by turning the tonometer knob until the inner borders of both fluorescein bands just touch = correct setting (17). When the eye pulsates, both semi circles cross over each other. The width of the fluorescein band around the contact point of the measuring prism should be about 1/10 of the diameter of the applanation surface (0.3 mm).
5. Display value in mmHg.
NOTE!
If the tonometer is too close to the eye, the color of the LED changes to red and a warning tone alerts the user to the fact that he has left the measuring range and the sensor is in the safety distance.

5.7 Sources of error

Ocular images

Fluorescein band incorrect 1 – 2
Wrong distance to patient 3 – 9
Position too far to the right/left 5 – 9
Position too high/low 10 – 14
Incorrect pressure 15 – 18

Fluorescein band too wide (1)
The measuring prism was not dried after cleaning or the eyelids came into contact with the measuring prism during measurement.

The slit lamp must be pulled back and the measuring prism dried with a lint-free cloth (e.g., made of cellulose).

Fluorescein band too small (2)
The tear fluid has dried up during a prolonged measuring process.

Allow the patient to close his/her eyes a few times and then repeat the measurement.

5.7.1 Incorrect distance to the patient
No semicircular image, only center line is visible (3)
The measuring prism is not coming into contact with the cornea! If the patient draws his/her head back slightly, irregular pulsations will be caused because the measuring prism is touching the eye only intermittently. If the patient pulls back even further, the fluorescein rings will disappear completely.

Use a headband if necessary.

Only parts of both oversize semicircles are visible (4)
If the slit lamp is pushed too far against the patient, or if the patient moves toward the slit lamp, the sensor arm will push against a spring stop. The applanation surface is too large.

The image does not change when the measuring drum is turned. Pull the slit lamp back until the uniform pulsations of a correspondingly smaller surface show the correct measuring position and pressure changes immediately cause applanation surface changes.

5.7.2 Position too far to the right/left
Only part of the upper semicircle (5)
Measuring prism not centered on the eye, eye much too far to the right.

Using the control lever, move the slit lamp to the right.
5.7.3 Position too high/low

Only part of a semicircle in the upper half (10)
Measuring prism not centered on the eye; eye far too high.

Using the control lever, move the slit lamp upwards.

Complete circle in the upper half (11)
Measuring prism not centered on the eye; eye still too high.

Using the control lever, move the slit lamp upwards.

5.7.4 Incorrect pressure

The outside borders of the fluorescein bands are in contact with each other (15)
Not enough pressure.

Increase the pressure slightly by rotating the knob on the tonometer.

Fluorescein bands are superimposed to form a band (16)
Pressure slightly too low.

Increase the pressure slightly more by rotating the knob on the tonometer.

Bands are no longer in contact (17)
Pressure is too high.

Lower the pressure by rotating the tonometer knob in the opposite direction.
Correct setting! (18)
The inside borders of the fluorescein bands are contacting each other.

6. Software / Help menu / Error messages
The software’s help section contains instructions and help for performing an examination and descriptions of the error messages. The help can be opened via the F1 key or in the [?] - [Help] menu.

**WARNING!**
The software must be installed by trained personnel in accordance with separate installation instructions.

6.1 Error messages on the tonometer display

<table>
<thead>
<tr>
<th>Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>€02</strong> The measurement is outside the permitted tolerances.</td>
<td>If one of these errors appears permanently, send the device to the corresponding service branch.</td>
</tr>
<tr>
<td><strong>€06</strong> The position of the sensor arm is defective.</td>
<td></td>
</tr>
<tr>
<td><strong>€07</strong> The minimum operating voltage has not been achieved; the device switches off.</td>
<td>Replace the dead batteries.</td>
</tr>
<tr>
<td><strong>€08</strong> Battery voltage too high. Correct battery type fitted.</td>
<td>Insert the correct batteries.</td>
</tr>
<tr>
<td><strong>€09</strong> to <strong>€14</strong> The tonometer electronics is defective.</td>
<td>If one of these errors appears permanently, send the device to the corresponding service branch.</td>
</tr>
</tbody>
</table>

7. Technical data
Generation of measuring force through leverage weight.

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 – 80 mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement deviation</td>
<td>The measurement deviation in the measuring prism is in the measuring range from 0 – 58.84 mN and amounts to a maximum of ±1.5% and to a minimum of ±0.49 mN of the nominal value.</td>
</tr>
<tr>
<td>Backlash width</td>
<td>≤0.49 mN</td>
</tr>
</tbody>
</table>

Net weight
- AT 900 D model R: 0.500 kg (without accessories)
- AT 900 D model T: 0.410 kg (without accessories)
- AT 900 D model BQ: 0.680 kg (without accessories)

Batteries
- 4 x LR03 (AAA) 1.5 V

Bluetooth
Contains TX IC: 1520A-LMX9838
Contains TX FCC ID: EDQLMX9B38

8. Maintenance

**WARNING!**
Installation, repairs and modifications may only be performed by trained specialists.

8.1 Maintenance
To guarantee a long service life, the device should be cleaned weekly as described and protected by the dust cover when not in use. We recommend having the device cleaned annually by an authorized service technician.
8.2 Cleaning
• The housing should only be cleaned with a dry cloth.
• Do not use any liquids, alcohol or corrosive substances.

8.3 Checking the tonometer AT 900 D
This check should be carried out once a month. If the check yields erroneous results, please check the following points:
1. Is the measuring prism properly positioned?
2. Is the control weight set correctly?
3. Repeat the check.
Defective equipment must be sent immediately to your HAAG-STREIT representative.

NOTE!
HAAG-STREIT offers a repair and service package. For further information, please contact your HAAG-STREIT representative directly.

<table>
<thead>
<tr>
<th>Test at 20 mm Hg</th>
<th>Test at 20 mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>A control weight is used for the check. The weight rod is engraved with five rings. The middle ring corresponds to 0 mmHg, the rings immediately to its left and right correspond to a value of 20 mmHg, and both outside scale rings have a value of 60 mmHg. One of the test position marks (20 or 60 mmHg) is set exactly to the index line on the holder. The weight is fitted on the feeler axis (a) so that the longer part points to the examiner.</td>
<td></td>
</tr>
</tbody>
</table>

**Check position 19.5**
The sensor arm must not move from the free-movement area toward the limit stop in the direction of the examiner before the display shows 19.5 mmHg or after the display shows 20.5 mmHg.

**Check position 20.5**
The sensor arm must not move from the free-movement area toward the limit stop in the direction of the patient before the display shows 20.5 mmHg or after the display shows 19.5 mmHg.
Test at 60 mm Hg
Set the weight rod to 60 on the scale so that the longer part points to the examiner.

Check position 59
The sensor arm must not move from the free‑movement area toward the limit stop in the direction of the examiner before the display shows 59.0 mmHg or after the display shows 61.0 mmHg.

Check position 61
The sensor arm must not move from the free‑movement area toward the limit stop in the direction of the patient before the display shows 61.0 mmHg or after the display shows 59.0 mmHg.

8.4 Changing the battery
1. Push the HAAG‑STREIT logo (HS) on the side of the digital display carefully downward and remove the battery lid by tilting it backward.
2. Pull the tab at the bottom of the battery compartment carefully. The batteries are released from the holder and can be easily removed.

WARNING!
• Pay attention to the polarity when inserting the batteries.
• Always replace all the batteries with new ones
• Only use type LR03 (AAA) batteries.
• Never mix old and new batteries.

3. Pay attention to the correct order as written in the compartment when inserting the batteries.
4. Once you have replaced the batteries, close the lid again carefully. Insert the centering tab at the bottom of the battery lid into the corresponding groove in the housing and close the lid by tilting it upward.
5. Gently press the lid upward against the housing and lock the battery compartment by pushing the HAAG‑STREIT logo back up again.

NOTE!
Dispose of used batteries properly.
A. Appendix

NOTE!

Order numbers are written in italics
An asterisk (*) shows that you should contact your HAAG-STREIT representative for further information.

A.1 Accessory original HAAG-STREIT measuring prism

The original HAAG-STREIT measuring prisms are made of PMMA and guarantee the best optical and mechanical quality. Reusable measuring prisms must be cleaned and disinfected after every examination. See Chapter ‘1.6.1, Cleaning and disinfecting the measuring prism’ and the separate instructions for use. HS art. no. 7220316

A.2 Accessory tonosafe

Tonosafe disposable prisms are a comfortable and effective solution to reduce the risk of cross-infection in patients. Tonomase is available in sterile packages with 5 supports and 100 disposable prisms. HS art. no. 7220345

HS art. no. 7220346 (USA)

B. Legal regulations

• HAAG-STREIT maintains a quality management system in accordance with EN ISO 13485. The device was developed and designed in observance of all the standards listed in section ‘EMC’.
• The tonometer AT 900 D is a Class I device with measurement function in accordance with Appendix IX of Directive 93/42/EEC. By affixing the CE mark we confirm that our device complies with the applicable standards and directives.
• You can request a copy of the declaration of conformity for the appliance from HAAG-STREIT at any time.

C. Classification

<table>
<thead>
<tr>
<th>Standard EN 60601-1</th>
<th>Applanation tonometer in accordance with protection class I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>Continuous operation</td>
</tr>
<tr>
<td>CE Directive 93/42/EEC</td>
<td>Class Im (measuring function)</td>
</tr>
<tr>
<td>FDA</td>
<td>Class II</td>
</tr>
</tbody>
</table>

D. Disposal

• Electrical and electronic devices must be disposed of separately from domestic refuse. This equipment was made available for sale after the 13th August 2005.
• For correct disposal, please contact your HAAG-STREIT representative.

E. Standards

<table>
<thead>
<tr>
<th>EN 60601-1</th>
<th>EN ISO 8612</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 60601-1-2</td>
<td>EN ISO 17664</td>
</tr>
<tr>
<td>EN ISO 15004-1</td>
<td></td>
</tr>
</tbody>
</table>
F. Information and manufacturer’s declaration regarding electromagnetic compatibility (EMC)

F.1 General
The Tonometer AT 900 D system fulfills the requirements on electromagnetic compatibility according to EN 60601-1-2. The instrument is built so that the generation and emission of electromagnetic interference is limited to the extent that other devices are not disturbed in their use in accordance with the regulations and so that it itself is suitably immune to electromagnetic interference.

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**WARNING!**
- In terms of EMC, electrical medical devices and systems are subject to special measures and must be installed in accordance with the EMC information contained in this instructions for use.
- Portable and mobile HF communication systems may interfere with electrical medical devices.

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**WARNING!**
- Connecting third-party systems to the same extension cable can compromise the system’s safety.
- Any third-party device must be connected in compliance with the EN 60601-1 standard.

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F.2 Emitted interference (standard table 1)

**Guidance and manufacturer’s declaration – electromagnetic emissions**
This product is intended for use in the electromagnetic environment specified below. The customer or the user of this product should assure that it is used in such an environment.

<table>
<thead>
<tr>
<th>Emission test</th>
<th>Compliance</th>
<th>Electromagnetic environment - guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF emissions CISPR 11</td>
<td>Group 1</td>
<td>This product uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.</td>
</tr>
<tr>
<td>RF emissions CISPR 11 Emission of harmonics according to EN 61000-3-2</td>
<td>Class B Not applicable</td>
<td>This product is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td>
</tr>
<tr>
<td>Voltage fluctuations / flicker emissions according to EN 61000-3-3</td>
<td>Not applicable</td>
<td></td>
</tr>
</tbody>
</table>
### F.3 Immunity (standard table 2)

**Guidance and manufacturer’s declaration – electromagnetic immunity**

This product is intended for use in the electromagnetic environment specified below. The customer or the user of this product should assure that it is used in such an environment.

<table>
<thead>
<tr>
<th>Immunity test standard</th>
<th>EN 60601 test level</th>
<th>Compliance level</th>
<th>Electromagnetic environment – guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic discharge (ESD) EN 61000-4-2</td>
<td>± 6 kV contact ± 8 kV air</td>
<td>± 6 kV contact ± 8 kV air</td>
<td>Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.</td>
</tr>
<tr>
<td>Electrical fast transient / burst EN 61000-4-4</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Mains power quality should be that of a typical commercial or hospital environment.</td>
</tr>
<tr>
<td>Surge EN 61000-4-5</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Mains power quality should be that of a typical commercial or hospital environment.</td>
</tr>
<tr>
<td>Voltage dips, short interruptions and voltage variations on power supply lines EN 61000-4-11</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Mains power quality should be that of a typical commercial or hospital environment. If the user of this product requires continued function even in the event of interruptions in the energy supply, this product should be powered from an uninterruptible power supply or a battery.</td>
</tr>
<tr>
<td>Power frequency (50/60Hz) magnetic field EN 61000-4-8</td>
<td>3 A/m</td>
<td>0.3 A/m</td>
<td>Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.</td>
</tr>
</tbody>
</table>

**NOTE:** $U_{\text{ref}}$ the AC mains voltage prior to application of the test level.
F.4 Immunity for non-life support devices (standard table 4)

Guidance and manufacturer’s declaration – electromagnetic immunity

This product is intended for use in the electromagnetic environment specified below. The customer or the user of this product should assure that it is used in such an environment.

Electromagnetic environment – guidance

Portable and mobile RF communications equipments should be used no closer to any part of this product, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.

| Immunity test standard | EN 60601 test level | Compliance level | Recommended distance (d):
|------------------------|---------------------|------------------|------------------------|
| Conducted RF EN 61000-4-6 | 3 Vrms 150 kHz – 80 MHz | 3 Vrms | \(D = 1.2 \sqrt{P}\)
| Radiated RF EN 61000-4-3 | 3 V/m 80 MHz – 2.5 GHz | 3 V/m 80 MHz – 800 MHz | \(D = 1.2 \sqrt{P}\) 80 MHz – 800 MHz
|                        |                     |                  | \(D = 2.3 \sqrt{P}\) 800 MHz – 2.5 GHz

Where \(P\) is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and \(D\) is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol:

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

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

a. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which this product is used exceeds the applicable RF compliance level above, this product should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating this product.

b. Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.

c. Possible shorter distances outside the ISM bands do not contribute to improved application in this table.
### F.5 Safe distances for non-life-supporting devices (standard table 6)

Recommended safe distances between portable and mobile HF communication devices and this device.

This product is designed to be operated in an electromagnetic environment in which radiated HF interference is controlled. The customer or user of this product can help to prevent electromagnetic interference by maintaining minimum distances between portable and mobile HF communication systems (transmitters) and this product, as recommended below in accordance with the maximum output of the communication system.

<table>
<thead>
<tr>
<th>Nominal output of the transmitter (W)</th>
<th>150 kHz – 80 MHz</th>
<th>80 MHz – 800 MHz</th>
<th>800 MHz – 2.5 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>0.12</td>
<td>0.12</td>
<td>0.23</td>
</tr>
<tr>
<td>0.1</td>
<td>0.38</td>
<td>0.38</td>
<td>0.73</td>
</tr>
<tr>
<td>1</td>
<td>1.2</td>
<td>1.2</td>
<td>2.3</td>
</tr>
<tr>
<td>10</td>
<td>3.8</td>
<td>3.8</td>
<td>7.3</td>
</tr>
<tr>
<td>100</td>
<td>12</td>
<td>12</td>
<td>23</td>
</tr>
</tbody>
</table>

For transmitters with a nominal output not listed in the table above, the distance $D$ can be calculated in meters (m) using the equation for the respective column, in which $P$ is the nominal output of the transmitter in watts (W) according to the specifications of the transmitter manufacturer.

**NOTE 1:** At 80 MHz and 800 MHz the higher frequency applies.

**NOTE 2:** To calculate the recommended safe distance of transmitters in the frequency range of 80 MHz to 2.5 GHz an additional factor of $\frac{10}{3}$ was used to reduce the probability of a mobile/portable communication device causing interference if inadvertently brought into the patient area.

**NOTE 3:** These guidelines may not apply in all situations. Electromagnetic wave propagation is influenced by absorption and reflection of buildings, objects and people.
Should you have any further questions, please contact your HAAG-STREIT dealer at:

http://www.haag-streit.com/contact/contact-your-distributor.html