

DIGITAL PORTABLE TONOMETER OF INTRAOCULAR PRESSURE
TROUGH THE EYELID

diaton®

Operation Manual

PART II
User's Guide

БИРМ.941329.003РЭ1

The present guide is represented by Part II of the operation manual (OM) for the diaton[®] digital portable tonometer of Intraocular pressure trough the eyelid and contains all data necessary for the correct tonometer use.

 **Attention!** To ensure that the results of IOP measurement with diaton[®] tonometer are reliable and that you can truly experience the true worth of all advantages of transpalpebral scleral tonometry **your effort, commitment and time are necessary to train and learn** how to use diaton[®] tonometer.

Carefully study the Operation Manual (OM) for the Tonometer and watch the tutorial video.

Carry out several tests on a test bench to check the tonometer operability strictly following all recommendations of the Operation Manual and paying attention so that your movements are not constrained when operating the tonometer.

Keep practicing your skills of performing tonometry measurements on the test bench until your movements become **automatic**.

The ability to operate the Tonometer with ease combined with consistent results with the test bench will ensure IOP measurement accuracy in your practice.

During the period when you are still mastering your tonometer user skills, you should choose patients without ophthalmic pathology in their medical history, preferably young patient.

As a measure of self-control of adherence to the IOP measuring methodology you can conduct comparison tests using Goldmann tonometer. In case of significant differences in the obtained results determine your mistakes related to diaton[®] tonometer usage according to Table 3. Introduce corrections into your IOP measuring procedure.

 **Attention! Since IOP measuring accuracy depends not only on the device accuracy but also on the nature and range of rhythmic and casual fluctuations of intraocular pressure, in some cases the difference in comparison with Goldman tonometer can reach 4 mm Hg.**

If it is difficult to carry out comparison tests with Goldman tonometer, the criteria defining your diaton[®] tonometer user skill **is your ability to obtain mean IOP result with minimum number of single measurements** (two or three). For detailed information see point 6.4.5.

Following the above-mentioned recommendations, you become the skilled user of diaton tonometer, get the necessary experience and can use diaton[®] in your practice.

diaton[®] tonometer is protected with Russian and USA patents for invention. It was awarded a Gold medal at the World Salon of Inventions in Brussels and in Geneva and is certified in Russia, member states of EC, the USA and other countries.

1 General Information

1.1 Ophthalmotometry is one of the leading methods used during screening examinations and examination of patients suffering from ocular hypertension, glaucoma or patients with suspected cases of glaucoma.

Before the first tonometers were invented, the intraocular pressure (IOP) would be evaluated approximately using the method of palpation the eyeball through the upper eyelid. The palpation method is still widely used in clinical practice. Using this method, a skilled ophthalmologist can approximately evaluate whether the IOP is normal, high, or low, can distinguish normotension from hyper- or hypotension. The palpation method is compromised by its subjectivity, uncertainty of the results in case of moderate fluctuations of IOP, but at the same time shows applicability of transpalpebral tonometry principle.

1.2 The eyeball is a spherical reservoir, filled with fluid and incompressible contents. IOP is caused by the influence of the elastic forces, arising in the eye coats when they are stretched.

IOP is a dynamic, continuously changing value. There are two distinguished types of IOP fluctuations — systemic and rhythmic fluctuations around a relatively constant level and momentary changes of casual nature caused by changes of tonus of the transpalpebral, orbicular, and, perhaps, the extraocular muscles. IOP fluctuations depend also on changes in blood filling of intraocular vessels and on exterior pressure exerted on the eyeball.

There are 3 types of rhythmic IOP fluctuations:

- Eye pulse with amplitude from 0.5 to 2.5 mm Hg;
- Respiratory waves (from 0 to 1 mm Hg),
- Hering-Traube waves or waves of the third order (from 0 to 2.5 mm Hg). The

rhythmic fluctuations of blood filling and casual changes of the muscle tonus explain the difference between results of IOP successive measurements during tonometry.

Statistically normal IOP varies from 9 to 21 mm Hg (15-16 mm Hg on average). This value is subject to daily and seasonal fluctuations. IOP value distribution in general population is asymmetrical and is shifted towards higher values. In middle aged patients the distribution asymmetry increases. More than 3% of healthy people have IOP above 21 mm Hg. The ophthalmotonus measurement accuracy in the ranges associated with normal and reasonably increased IOP is especially important for practicing physicians.

1.3 diaton[®] tonometer is a transpalpebral scleral tonometer employing the ballistic tonometry principle based on measurement of elastic reaction of the eye during single instant influence of the object with a defined weight free falling onto the eyelid covering the eye in the sclera area.

1.4 Advantages of ballistic transpalpebral measurement with diaton[®] tonometer.

1.4.1 During corneal tonometry it is very difficult to prevent the increase of tonus of the orbicular and palpebral muscles at the moment of the measurement in reactive patients, which leads to increased IOP. The ophthalmotone increase may be also connected with the blood pressure rising due to the tonometer being held close to the

open eye. diaton[®] tonometer is out of the patient field of vision.

1.4.2 It is well known that tears may contain pathogenic bacteria and viruses such as hepatitis B, herpes, adenoviruses, AIDS. However, the procedure of sterilization of the tonometer is far from being perfect. During tonometry with diaton[®] tonometer direct contact with the eyeball must be avoided.

1.4.3 Corneal tonometry is contraindicative in patients with conjunctivitis, erosions, ulcers, hypostasis and corneal opacity. With diaton[®] tonometer you can measure IOP in the majority of such cases.

1.4.4 Corneal tonometry cannot be performed without prior anesthesia, which often causes conjunctival irritation, short-term increase of IOP, hypostasis and maceration of corneal epithelium and sometimes allergic reactions. These adverse reactions during IOP measurement are eliminated with diaton[®] tonometer.

1.4.5 Transpalpebral tonometry provides the following:

- IOP tonometry without contact with the ocular mucous membrane;
- non-invasive safe daily IOP monitoring;
- reliable digital IOP values in case of severe ophthalmopathy with changes in the anatomy of the eyeball suitable for evaluation of IOP dynamics.

1.4.6 Scleral tonometry provides the following:

- IOP tonometry in case of corneal pathology;
- IOP tonometry after laser refractive surgery;
- high reliability of IOP measurements in case of changes in the thickness of cornea.

2 Application

diaton[®] digital portable tonometer of Intraocular pressure trough the eyelid (hereinafter referred to as tonometer) is intended for transpalpebral measurements of true intraocular pressure in adults and children without anesthesia.

Residual Risk



ATTENTION!

1 Do not put the tonometer on an open eye, sclera, or cornea. This may cause pain and damage to the sclera and cornea done by the tip and rod of the tonometer.

2 If the requirements for disinfection of the tip and rod are not met, there is a risk of viral and bacterial infections.

3 Design and Operation Principle

3.1 Operation Principle

Having chosen the dynamic (ballistic) method providing regulated mechanical stimuli for the purpose of intraocular pressure determination we managed to avoid the influence of the eyelid on the tonometry results. The problem is solved by means of compression of the eyelid in the area with the diameter of 1.5 mm to such an extent that the compressed area of the eyelid acts as the intermedium during the interaction of the falling rod with the eyelid.

In contrast to Goldman applanation tonometry, IOP measurements performed with the ballistic method are nearly instant. Due to this fact, diaton[®] tonometer readings are influenced mainly by rhythmic and casual fluctuations of ophthalmotone. As a rule, these fluctuations do not exceed 2-4 mm Hg **in case of normal or moderately increased IOP**, which must be considered during the use of the tonometer.

Reliability of IOP measurements performed with the tonometer **is ensured by strict adherence to the measuring methodology, mastered technique of transpalpebral scleral tonometry and sufficient practical user experience (not less than 50 people each month).**

3.2 Design Description

The appearance of the Tonometer is shown in Fig. 1. The Tonometer has a plastic body. The tip is intended to let the Tonometer rest on the eyeball through the upper eyelid during IOP measurement. The tip can freely move along the axis of the tonometer relative to its body (up to 3 mm). It provides permanent static load on the eye during IOP measurement. The tip can be rotated on its axis with force.

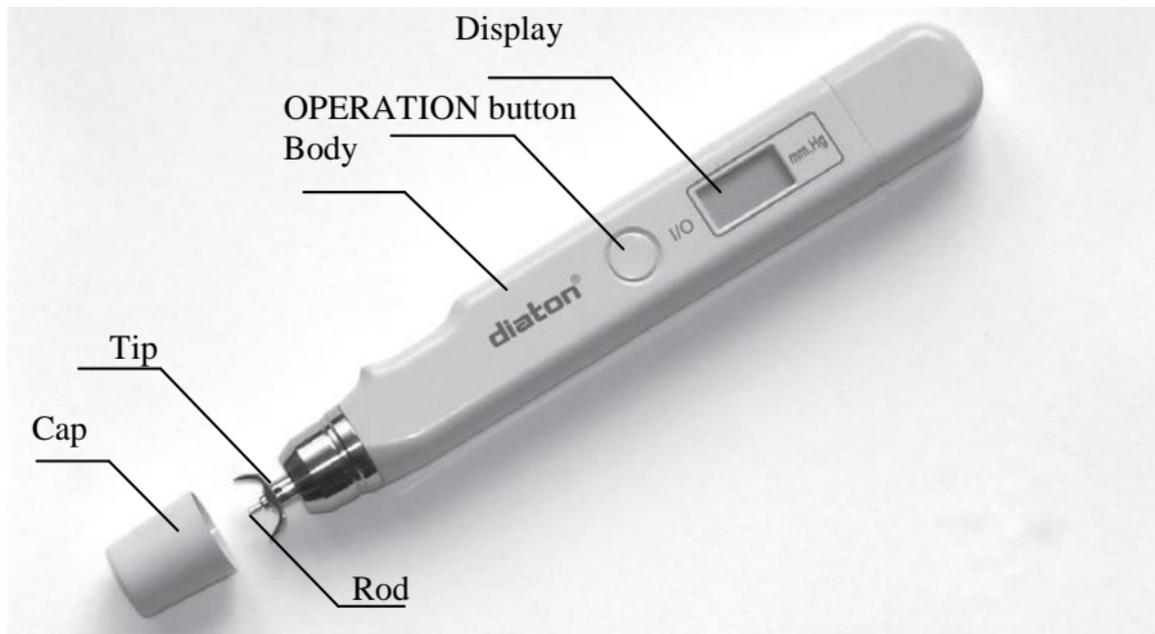


Figure 1. Appearance of the Tonometer



Figure 2. Tonometer in the Storage Case

For higher measurement accuracy, the tip is equipped with supports in the form of two protrusions that help to eliminate damping properties of the eyelid as well as to secure the position of the tonometer in relation to the eyeball during the measurement.

There is a freely moving rod inside the tonometer which at its fall interacts with the elastic surface of the eyeball through the eyelid.

The OPERATION button on the tonometer's body is designed to control the **operating modes** of the tonometer:

- switching ON and OFF;
- automated reading of mean IOP for several measurements (averaging).

The tonometer is switched ON by a single short press of the OPERATION button; the tonometer is switched OFF by pressing the same button twice, or by pressing the OPERATION button once, if no measurements have been taken or if the averaging mode has been used before the tonometer is switched OFF.

The **averaging** mode is enabled by pressing of the OPERATION button **once after** performing a **series** of 2 to 6 single IOP measurements. The maximum number of measurements in the series is not more than 6. To carry out **another** measuring **series** it is necessary **to switch the tonometer OFF and then back ON.**

The storage case has an in-built testing device (pressure control device) to control the operational integrity of the device (Figure 2).

The tonometry result appears on the display and is shown for 30 seconds followed by the tonometer switching OFF. The display has 4 digits: the leftmost digit is used for indication of auxiliary information, shown with “U”, “L”, “H”, “E”, and “A” symbols, the two rightmost digits are used to indicate the tonometry results (Figure 3) as well as the current number of single IOP measurements (symbols from “-1” to “-6”). Digital results of single IOP measurements are not displayed, but are automatically recorded in the tonometer memory storage.

Meanings of the auxiliary information symbols are shown in Table 1.

Table 1.

Symbol	Symbol meaning
“U”	Discharged battery
“L”	The tonometer deviates from the vertical position before the measurement at an angle of more than 4.5°
“H”	The rod mechanism is dirty. «H» symbol is generated when the tonometer position is true vertical.
from “-1” to “-6”	Current number of single IOP measurements
“E”	End of a series of 6 measurements
“A”	The averaging mode is ON



Figure 3. Mean Measurement Value Indication

“0000” symbol appears on the display immediately after switching the tonometer ON. If the symbol is flickering it is necessary to put the rod into the initial position (Point 5.2.5).

“U” symbol, displayed in the leftmost position after switching the tonometer ON or during its operation (Figure 4) shows that the battery is discharged to the minimum permissible level.



Figure 4. Battery Discharge Indication

The cap protects the rod mechanism of the tonometer from getting dirty.

The built-in **sound indicator of position (signaling indicator)** helps to control the vertical position of the tonometer directly before or during the measurement. Keeping the device in vertical position during tonometry ensures optimal rod movement, which **increases measuring accuracy**. An intermittent sound signal before a measurement indicates that the device deviates from the vertical position for more than 4.5° , at the same time the frequency of the sound signals increases as the tonometer is moved closer to the vertical position. **If there is no audible signal, the user can take the measurement** as the device is in vertical position. The sound indication goes silent when the tonometer deviates from the vertical position for more than 45° (including the horizontal position).

Description and meaning of all audible signals of the tonometer are shown in Table 2.

Table 2.

Description of the sound signal	Meaning of the sound signal
Single short signal	1) Tonometer is switching ON or OFF. 2) End of the single measurement (after falling of the rod)
Intermittent signal	Position indicating signal (deviation of the tonometer from the vertical position before the measurement at an angle of more than 4.5° but less than 45°)
Single long signal	Permission to enable the averaging mode to get a reliable result before finishing the series of 6 measurements if the operator's actions are correct
Two long signals	End of the series of 6 measurements. Permission to enable the averaging mode.

The user should pay attention to the sound signals and displayed information when using the tonometer.

4 Operating Restrictions

4.1 Safety Precautions

Implementation of a low-voltage power supply source guarantees safety when operating the tonometer. It is allowed to apply the tonometer **only through the eyelid** to measure IOP.

4.2 Indications for Use

The tonometer is indicated for use for the following:

- IOP measurements during mass screening of the population (e.g. military, navy, at enterprises, etc.);
- determination of the risk group patients with increased IOP during primary ophthalmology (optometric) and clinical observation for further examination;
- IOP measurements in case corneal tonometry is contraindicated (viral infections, allergic reactions, dry eye syndrome);
- non-invasive daily monitoring in the process of selection of an adequate medical treatment of hypotension;
- IOP measurements in patients with contact lenses (lenses are not taken out);
- IOP control in immobilized patients (e.g. in Residential Care Facilities for the Elderly);
- possibility to use in pediatrics (schools, children sport and recreational institutions);

- obtaining of digital IOP measurement result for the dynamic control of the patient's condition in cases of severe ophthalmopathy when the anatomy of the eyeball is changed;
- IOP control in patients suffering from glaucoma performed by a doctor at home;
- diagnostic device application by family doctors and general practitioners;
- invitations for cooperation from pharmaceutical companies – manufacturers of hypotensive drugs. During individual selection of effective drugs, their frequency of use, and estimation of possibility of co-use of several drugs of this company;
- IOP dynamic control in the patients of burn centers.

4.3 Contraindications

The tonometer is contraindicated for use in case of the following:

- pathobiology of the upper eyelid (inflammatory disease, cicatricial tissue, eyelid deformation);
- apparent sclera or conjunctiva pathologies (postoperative or posttraumatic) in the area of the tonometer rod impact occurring during the measurement (in the whole area of the circle of the established diameter).



ATTENTION! DO NOT TRY TO MEASURE YOUR OWN IOP YOURSELF.

5 Preparation for Use

ATTENTION!



If the Tonometer has been stored or transported at low temperatures it should be kept at room temperature for not less than three hours before switching on.

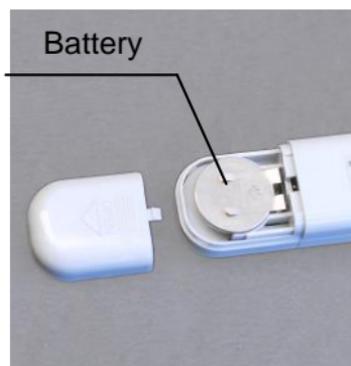
To cut the time of preparation for operation during cold seasons it is recommended to protect the tonometer from cooling (e.g. hold it in a jacket or overalls). In such case, the time of dwell of the tonometer at room temperature before switching ON should be not less than 5 minutes (the storage case cover must be opened). In such case it is necessary to check its operational readiness according to point 5.3.

5.1 Battery Installation

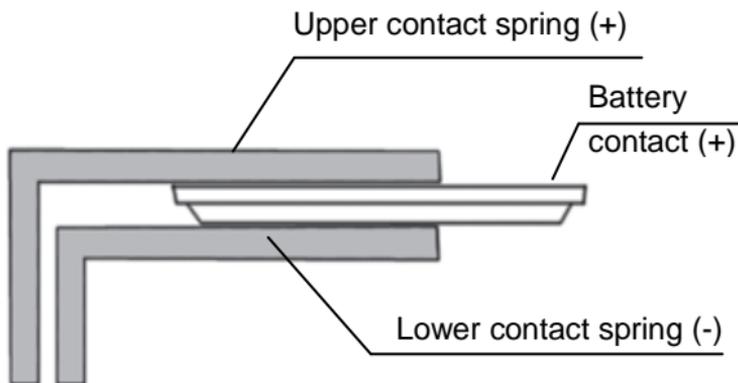
The battery installation is carried out as follows (Figure 5):

- take the tonometer out of the storage case;
- remove the cover of the battery compartment by slightly pressing on it and moving as shown by the arrow (Figure 5a);
- **press and hold** the OPERATION button;
- insert the battery between the lower and upper contact springs with the + contact facing up (Figure 5b);
- release the OPERATION button;
- close the cover.

When operating the Tonometer, the battery compartment cover must be tightly closed.



a)



b)

Figure 5.



ATTENTION!

If the order of the battery installation mentioned above is not observed (e.g. the OPERATION button **is not pressed** before and during the battery installation), the tonometer may **fail to switch on**.

In such case act as follows:

- remove the battery;
- reinstall the battery not earlier than in 20 minutes strictly following the order of installation mentioned above (when installing the battery, the OPERATION button must be **pressed**).

5.2 Preparation for Measurement

5.2.1 Take the tonometer out of the storage case, remove the protective cap.

5.2.2 Take the tonometer in your hand, hold it vertically with its tip facing down as it is shown in Figure 6a).

The position of the tonometer does not depend on which hand you use – right or left. **The correct position** of the tonometer in the hand ensures the **measurement accuracy**.

5.2.3 Check the position of the tip supports: the tip supports must coincide with the level of the tonometer exterior side as it is shown in Figure 6a). If this is not the case, put the supports into initial position rotating the tip on its axis. Watch the tip position during measurement.



a)



b)



c)

Figure 6. Installation of the Rod into Initial Position

5.2.4 Check the position of the rod in the tonometer:

- the rod must be **inside the tonometer** (Figure 6b)) - **the initial position** of the rod for measurement;

- the rod can be seen in the tip area (Figure 6a)) – it is necessary to put it into the initial position (Point 5.2.5.).

5.2.5 If the rod can be seen in the tip area (Figure 6a)) **put the rod into the initial position:**

- hold the tonometer vertically with its tip facing down (Point 5.2.2);

- smoothly turn the tonometer to the position when its tip faces up as it is shown in Figure 6b). The rod must be fixed in the initial position;

- smoothly, without quick movements, return the tonometer in the position when its tip faces down. The rod must be fixed inside the tonometer and must not be seen in the tip area (Figure 6c)).

5.2.6 If the rod is put into the initial position (fixed inside the tonometer), press the OPERATION button holding the tonometer with its tip facing down. When switching the device on the “**0000**” symbol appears on the display and a short audible signal goes off. The tonometer is ready for operation.

If the tonometer is held with its tip facing down but not vertically, an intermittent audible alarm of the tonometer position indicator goes off. This is auxiliary information that helps to control the vertical position of the tonometer. When the tonometer gets into the position that is **true vertical the audible signal stops**.



ATTENTION!

If the rod is not in the initial position and the device is switched on, the “0000” symbol is **flickering on the display**. In this case, without switching the tonometer OFF (without pressing the OPERATION button), it is necessary to put the rod into the initial position (Point 5.2.5.). When the rod gets into the initial position, the flickering “0000” symbol on the display disappears. The tonometer is ready for operation. Information on the operational readiness of the tonometer (“0000” symbol) is kept on the display for 30 sec., then the tonometer switches OFF automatically. In this case, if necessary, switch the tonometer ON by single press of the OPERATION button.

If “U” symbol (Figure 4) is displayed after pressing the OPERATION button it is necessary to turn the tonometer OFF by a single press of the OPERATION button and to change the battery (Point 5.1). After changing the battery, prepare the tonometer for operation (Point 5.2).



Attention! If you press the OPERATION button and hold it for more than 2 sec. when the tonometer is switched on, the tonometer will successively switch to special operational modes. The display shows numeric values of these modes that are intended for adjustments and are not used during operation. Turn the tonometer off by a single press of the OPERATION button.

If, after switching the tonometer on, the display does not show the “0000” symbol but a numeric value of the special operational modes, it is necessary to press the OPERATION button and release it after reaching “0007” symbol. The tonometer will switch off automatically. After the next switching on, it will operate in normal operating mode.

5.3 Checking of Operational Readiness of the Tonometer.

The check of operational readiness of the tonometer is performed as follows:

- once a day before its operation;
- each time before IOP measurement taken not in hospital settings during cold seasons;
- if you have doubts as to the integrity of the tonometer.

5.3.1 Prepare the tonometer for measurements (Point. 5.2).

5.3.2 Validate the tonometer measurement readings using the pressure control device (pressure selector) that is in the storage case, check as follows (Figure 7):

- mount the tip supports into the bushing of the testing device (Figure 7a)) holding the tonometer **to a true vertical**, (**no audible signal** indicates the correct position of the tonometer);
- move the tonometer body smoothly down until the rod falls, which is accompanied by a short audible signal. The result of the operational check is displayed in two rightmost digit places (Figure 7b)).

The tonometer is considered **ready for work** if the received digital measurement

result is within **in the range of (20 ± 2) mm Hg** and there are no «L» or «H» **symbols** in the display leftmost digit places.

If the “L” symbol appears it is necessary to carry out the check once again (Points 5.2.5, 5.3.2) keeping the tonometer to a true vertical during the check.

If the «H» symbol appears or the measurement result value on the testing device differs from (20 ± 2) mm Hg, the tonometer is considered inoperative.

The repair procedures are mentioned in Point 6 of OM Part I.

5.3.3 Turn the tonometer OFF by a double press of the OPERATION button.

The testing device may be used to gain the minimum necessary experience in the correct positioning of the device, observation of the vertical position and confident handling of the tonometer ensures more accurate results when measuring IOP in real patients.



ATTENTION!

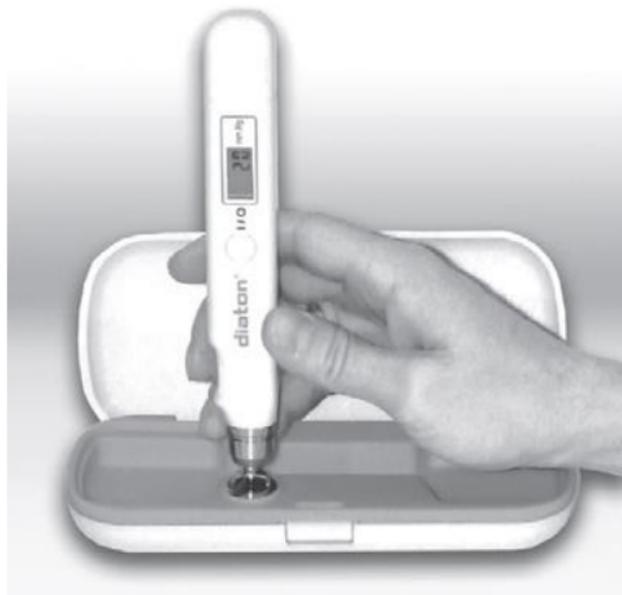
The «H» symbol may also appear in the following cases:

- instead of the «L» symbol when the device is significantly off the vertical line;
- the object under measurement (test-devices or patient's eyes) fails to stand still during the measurement;
- sudden dropping of the device body at the time when the rod is falling.

In these cases, repeat the measurement and carefully follow the instructions given in point 5.3.2 of the Operation Manual.



a)



b)

Figure 7. Checking of the Operational Integrity of the Tonometer

5.4 Disinfection Procedure

5.4.1 Holding the tonometer with the tip facing down disinfect the tip base and the lower part of the rod with a sterile piece of cloth damped with ethyl alcohol-based disinfectant solution nonreactive with metals. Make sure that the disinfection solution does not penetrate into the rod mechanism.

After the disinfection is done, wipe the tip and the lower part of the rod with a dry sterile piece of cloth. The disinfection of the tip base and the lower part of the rod should be performed before and after each measurement taken in patients.

5.4.2 Disinfection of the outer surfaces (with the exception of the tip and rod) of the tonometer body is carried out with a 3% hydrogen peroxide solution spiked with 0.5% detergent or with 1% chloramine solution.



ATTENTION!

The disinfectant solution **must not** get inside the tonometer.

It is prohibited to use absorbent cotton or other fibrous materials, fibers of which may get inside the tonometer during disinfection of the tip base and the rod.

6 IOP Measurement Procedure

6.1 Take the tonometer out of the case, remove the protective cap and disinfect the base of the tip and the lower part of the rod according to point 5.4.1.

Prepare the tonometer for measurement (Point 5.2.2 - 5.2.6).

6.2 IOP measurement is possible when the patient is in either of the following two positions:

- **sitting** position with the patient's head thrown back and lying **horizontally** on the head support. In case of lack of a head support the patient sits on the edge of a chair leaning against the chair throwing the head back into a horizontal position;

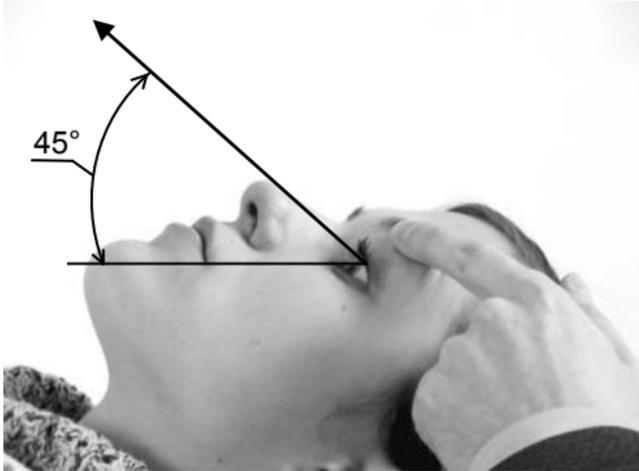
- **lying** position with the patient's head placed **horizontally** on the cushion or bolster of the couch (it is not allowed to throw the head back).

Stand behind the patient on his left side (if the device is in your right hand) or behind the patient on his right side (if the device is in your left hand).

ATTENTION!

 To avoid inaccurate IOP measurements in case of pathology of the cervical region of vertebral column the patient must be kept horizontal position **only** for a short time. Let the patient rest for several minutes in a free position between the measurements.

6.3 Set and fix the patient's eyes with the help of a test-object (e.g. the patient's finger or an object in a proper position) so that the line of sight is approximately at the angle of 45°, as it is shown in Figure 8a.



a)



b)

Figure 8. IOP Measurement in Patients

6.4 Measurement of Intraocular Pressure

6.4.1 Using a finger of a free hand stretch the patient's upper lid **without pulling it and pressing the eyeball** so that the edge of the upper lid **coincides with the corneal limbus** as it is shown in Figure 9b). To do this, slightly correct the patient's eyeball position according to the patient's anatomic peculiarities by moving the test object. Place the palm edge of the hand with the tonometer onto the patient's forehead (Figure 8b)). Make sure the tonometer is switched ON and the rod is in the initial position.

6.4.2 Move the tonometer tip close to the eyelid (Figure 9a)). Position the tonometer vertically until the intermittent audible signal stops. Place the tonometer tip in such a way that the front part of the tip is as close as possible to the front edge of the upper lid from which the eyelashes grow, but not touching the eyelashes (Figures 9b)). After that the tonometer must be kept **vertically (no sound signal indicates the correct position of the tonometer)**.

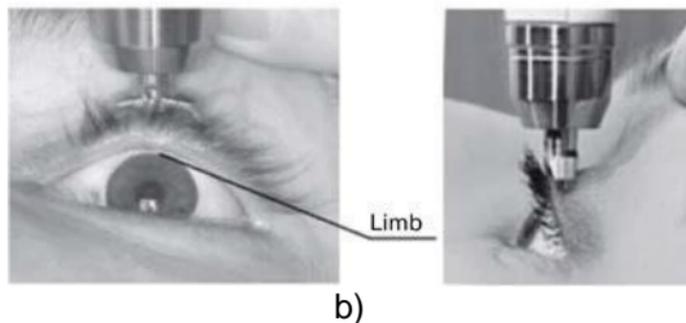
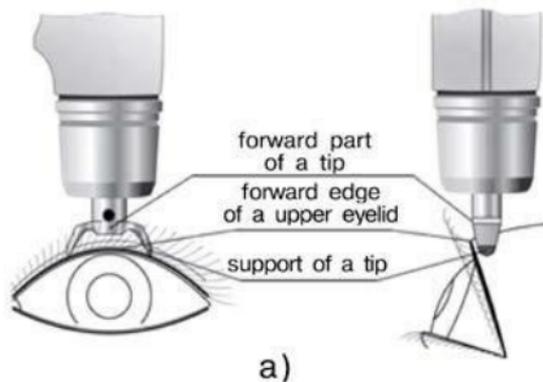


Figure 9. Placement of the Tonometer Tip on the Eyelid During IOP Measurement

The impact zone of the tonometer rod must be the part of sclera corresponding to **corona ciliaris within the circle area.**

6.4.3 Smoothly move the tonometer body down maintaining its vertical position (there should be no intermittent audible signal) until the rod falls on the eyelid, which is accompanied by a short audible signal.

 **ATTENTION!** Perform the measurements transpalpebrally **only on the sclera! Shifting of the eyelid to the cornea** during the measurement procedure **is prohibited.**

Do not press the eyeball with the tonometer. The current number of a single measurement is displayed and the numeric measurement result is recorded automatically in the tonometer memory storage. Remove the tonometer. Put the rod into the initial position (Point 5.2.5).

 **ATTENTION!** An interrupted sound signal indicates that the tonometer deviates from the vertical position at the moment of measurement, and in this case the displayed current number of individual measurements is accompanied by the “L” symbol appearing on the display. The following measurements should be taken keeping the tonometer vertical position.

If the “H” symbol appears on the display after the IOP measurement together with the current number of single measurements it, the tonometer rod mechanism is

dirty. In this case it is necessary to clean the rod mechanism according to the instructions of point 5.2 of OM Part I.

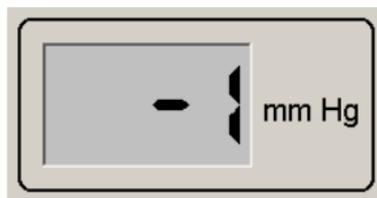
The tonometer display indications during the IOP measurement are shown in Figure 10.

6.4.4 Keeping the eyelid in the same position take several IOP measurements for the same eye (points 5.2.5, 6.4.1-6.4.3) until a single long signal or two long audible signals are heard.

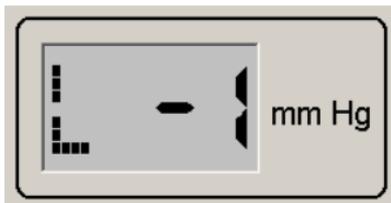
6.4.5 The single long audible signal which allows to enable the averaging mode for the IOP measurement results indicates that your actions during the IOP measurements were correct. Press the OPERATION button once. **Symbol «A» and the mean IOP value** are displayed **in non-flickering mode**. The result is **reliable**, the IOP measurement of the eye under examination is finished.



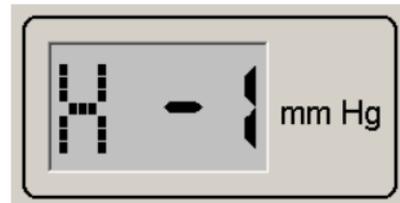
Initially, before the measurement



After a correct measurement



After the measurement, the tonometer deviates from the vertical line



After the measurement, the tonometer rod mechanism is dirty

Figure 10. The Indications on the Display of the Tonometer During IOP Measurement

When the two long audible signals are heard, the “E” symbol and the current number of measurements (-6) are displayed simultaneously. Press the OPERATION button once. Three sets of data can be displayed:

- symbol «**A**» and the mean IOP value in non-flickering mode. The result is **reliable**, the IOP measurement of the eye under examination is finished;

- symbol «**A**» in flickering mode and the mean IOP value in flickering mode. Such result should be considered as **approximate**, but if IOP is equal to or less than 19 mm Hg., it may be considered as reliable.

It is recommended to let the patient rest for several minutes in a **sitting** position and perform remeasurement of IOP for the eye under examination (Points 5.2.5, 5.2.6, 6.2, 6.3, 6.4.1 - 6.4.5);

- symbol «**A 00**» in a flickering mode. The result is considered **erroneous**. In this case it is recommended to let the patient rest for several minutes in a **sitting** position and to carry out perform remeasurement of IOP following the procedural instructions given in points 5.2.5, 5.2.6, 6.2, 6.3, 6.4.1 - 6.4.5.

6.4.6 Register the mean value of the IOP measurement in the patient chart. Switch the tonometer OFF by a single press of the OPERATION button.



ATTENTION!

After enabling the averaging mode for several measurement results or after carrying out of a series of six simultaneous measurements, a new series of measurements may be carried out only after switching the tonometer OFF and switching it back ON.

6.4.7 Measure the IOP of the other eye (Points 5.2.5, 5.2.6, 6.2, 6.3, 6.4.1-6.4.6).

6.4.8 Disinfect the base of the tip and the lower part of the rod according to point 5.4.1.

Put on the protective cap, put the tonometer in the storage case, and close the cover.



ATTENTION!

Before the first IOP measurements taken with the tonometer it is recommended to demonstrate the patient that the tonometer does not cause pain during operation, for instance on the patient's finger pad.

6.5 Possible Errors during IOP Measurements

Erroneous IOP measurements obtained with the tonometer are mainly connected with **nonobservance of the tonometry procedural instructions** and with **inadequate experience** of the user.

Possible mistakes and results obtained at such mistakes are shown in Table 3.

Table 3.

Mistakes during IOP Measurements	Measurements result
<p>Incorrect position of the patient:</p> <ul style="list-style-type: none"> - non-horizontal head position - patient's neck compression because of a tight collar - long-lasting head lag in case of the spine pathology of the cervical region of vertebral column 	<p>Erroneously low IOP Erroneously high IOP Erroneously high IOP</p>
<p>Incorrect position of the tonometer:</p> <ul style="list-style-type: none"> - the tip is not placed accurately against to the lid front edge within the area of the cartilage, and is more than 1 mm behind it - the tip is placed beyond the boundaries of the cartilage - non-vertical position of the tonometer 	<p>Moderately erroneously low IOP</p> <p>Erroneously low IOP Erroneously low IOP</p>
<p>Incorrect position of the eyelid:</p> <ul style="list-style-type: none"> - the edge of the eyelid overlaps the cornea - the edge of the eyelid is above the corneal limbus - lid eversion as a result of intensive pulling 	<p>Erroneously low IOP Erroneously low IOP Erroneously low IOP</p>

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