Perkins Mk3

Hand-Held Applanation Tonometer

Instruction Manual

Please read these instructions before using the equipment.
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1. Introduction

We would like to thank you for your decision to purchase this CLEMENT CLARKE product.

If the instructions in this manual are carefully followed, we are confident that this product will give you reliable and trouble-free usage.

We will be forced to disclaim any warranty and liability if the instrument is altered in any way or if routine maintenance is neglected or not carried out according to factory specifications.

Only original CLEMENT CLARKE accessories are to be used to ensure continued reliability of the instrument.

Following the popular Mark 2 Perkins tonometer, comes the technically advanced and well designed Mark 3 model. Its improved LED illumination and convenience are some of the many features which maintain the reputation of Perkins hand-held instruments in the forefront of tonometry.

Because the Perkins tonometer is capable of being used in all positions, the mass of the Goldmann doubling prism must be controlled accurately. Only HAAG-STREIT prisms should be used or the disposable Tonosafe prism can be used to prevent cross-infection. Any other prisms may give a false reading if used in the Perkins tonometer.

1.1 Technical Description

A pair of spiral wound flat springs connected in series are progressively tensioned by rotation of the operator’s calibrated thumb-wheel. The resulting force stored in the spring is transmitted through a balanced arm to the applanation doubling prism or the Tonosafe prism mounted at its end.

The tonometer is fitted with two cobalt blue LEDs, (wavelength 450-490nm) to provide illumination. These are powered by a 3.6V, 280 mAh Ni-Mh rechargeable battery. The LED meets the requirements for a Class 1 LED product to IEC/EN 60825-1 (2001) under normal operating conditions and those of single fault failure.

The battery charger conforms to Class II insulation and has also been tested to EN60601 and UL60601-1.

⚠️ This equipment is designed and manufactured to be as safe as is reasonably practicable when installed and used correctly by persons qualified to do so in accordance with the manufacturer’s instructions. Any misuse, incorrect assembly or installation could result in the equipment becoming unsafe. It must not be repaired except by competent persons under the manufacturer’s instructions.
1. Introduction - continued

1. 2a Indications for use
The Perkins Mk3 Tonometer is used to measure intraocular Pressure (IOP) which is the fluid pressure inside the eye.

1. 2b Purpose for use
The Perkins Mk3 Tonometer is an essential tool used in the global examination of all eye check-ups and specifically for a glaucoma examination, these tests together give a complete picture of the patient’s ocular health and are therefore important in understanding the risks of developing and/or controlling diseases such as cataracts, macular degeneration, or glaucoma. The following tests make up a glaucoma examination:

• medical and ocular history
• visual acuity testing
• refraction to measure the glasses or lens correction
• tonometry testing for IOP

1. 3 Brief Description of the Appliance
The Applanation Tonometer functions according to the “Goldmann” method:

The measuring of the pressure required to maintain a uniform applanation of the surface of the cornea.

• The intraocular pressure in mm Hg is found by multiplying the drum reading by ten.
• Scleral-rigidity is not to be taken into account as the small volumetric displacement of 0.56 mm³ increases the intraocular tension by about 2.5% only.

Hospital and Optician use only

⚠️ Caution: Federal Law restricts this device to sale by or on the order of a physician.

⚠️ Caution: Massage effect DOES occur if repeated measurement occurs.
2. General Layout

Fig 1

1. Forehead rest
2. Forehead rest locking screw
3. Forehead rest stem
4. Prism holder
5. Doubling prism
6. Illumination LEDs
2. General Layout - continued

Fig 2
7 Viewing lens
8 Milled thumb-wheel
9 Scale
10 Tonogrip (Cone arm securing buttons)
11 Battery Indicator
12 Charging Port
3. Safety and Regulatory Information

3.1 Safety Notices

No user serviceable parts inside.

Do not open the Tonometer case moulding under any circumstances.

Caution: In the event of any malfunction, contact your local distributor or visit our website to contact us directly.

Use only the charger supplied with the device.

The operator should not touch the accessible charger connector and the patient simultaneously.

This product is intended for indoor use only.

This product is not suitable for operation in the presence of a flammable anaesthetic mixture with air or with oxygen or with nitrous oxide.

Not protected against the ingress of water or other fluids.

“Warning: No modification of this equipment is allowed”

The following instructions should be observed to ensure the safety of patients:

Avoid examinations in cases of eye infections or injured corneas

• There is no known contraindication for performing tonometry. Medical assessment is necessary and due care is to be exercised in cases of eye infections and injuries to the cornea.

Only clean and disinfected measuring prisms should be used

• Examinations should be conducted with cleaned and disinfected measuring prisms.
• Tonometer prisms are not dispatched in a disinfected state and should always be disinfected before use.
• The disinfecting of contact glasses e.g. with cotton wool or a damp cloth without putting them into disinfecting fluid is insufficient and should not be allowed.
3. Safety and Regulatory Information - continued

- Incorrect medical disinfecting can cause patients to be infected and can also cause damage to the eyes.
- Residue from the disinfecting may cause a caustic reaction to the patient's eye, therefore rinse throughly.

Applied Parts
Tonosafe Disposable Prism
Goldmann Doubling Prism
Head Rest

No damaged prisms should be used

Before each use the contact surface of all prisms should be checked for contamination or damage (such as scratching, rips or sharp edges). A slit lamp microscope or Loupe is best used for this purpose, at a magnification of 10x to 16x.

- If cracks form, the disinfectant may get into the hollow interior and can enter the patient's eye while tonometry is taking place, leading to irritation of the cornea. Defective measuring prisms should not be used, to avoid any damage to the patient’s cornea.

3. 2 Measuring Prism Replacement

- Due to the number of variables involved - type and concentration of disinfecting material used, number of patients, handling etc. - it is almost impossible to put a figure on the number of times and/or period of time that a measuring prism can safely be used for.

- Our experience, and that of our users, indicates that under ‘normal’ usage (i.e. as per the instructions contained within this instruction manual) a maximum of two years provides an adequate safety factor.

- HAAG-STREIT therefore recommend strongly that no measuring prism is used beyond two years from it’s date of first usage (a measuring prism may be retained as a spare indefinitely - deterioration does not start until it is first used).

- The recommended time is overruled if the prism is in any way damaged within this time period - damaged prisms should be immediately discarded.
3. Safety and Regulatory Information - continued

3. 3 Transportation and Storage

- The Applanation Tonometer conforms to ISO 15004-1:2006 for Storage and Transport Conditions and should always be stored in its carry case when not in use.

**Transport Conditions**
- Temperature: -40°C to +70°C
- Relative Humidity: 10% to 95%
- Atmospheric Pressure: 500hPa to 1060hPa
- Vibration, Sinusoidal: 10Hz to 500Hz: 0.5g
- Shock: 30g, duration 6 ms
- Bump: 10g, duration 6 ms

**Storage Conditions**
- Temperature: -10°C to +55°C
- Relative Humidity: 10% to 95%
- Atmospheric Pressure: 1060hPa

- The Applanation Tonometer should be checked for damage after unpacking.
- Defective equipment should always be returned in appropriate packaging.
- The equipment may only be operated with the listed accessories (see page 33) according to the corresponding operating instructions.
- The battery charger is exempt from the above standard but has been tested for Transport Conditions only within the carry case.

3. 4 Notes on Usage

- Only qualified and trained personnel may operate the equipment.
- The training of the operating personnel is the responsibility of the equipment user.
- This type of sensitive measuring equipment should be checked after exposure to external force (e.g. unintentional shocks or being allowed to fall) and if necessary, should be returned to the manufacturer for repair.
- The manufacturers of the equipment will not be liable for any loss or damage resulting from unauthorized intervention.

  In particular, it is forbidden to loosen any screws; this may reduce the accuracy of the measurement. All ensuing warranty claims will be deemed null and void as a result of unauthorized intervention.
- The Perkins Mk3 should not be used while connected to the battery charger.
3. Safety and Regulatory Information - continued

3. 5 Statutory Requirements

- The Applanation Tonometer is designed as a Class IIa device under the Medical Device Directive 93/42/EEC.

3. 6 Caution

- The safety regulations displayed in the operating instructions are to be observed with special care.

⚠️ Caution
Strictly observe all warning notices!

3. 7 Regulatory Information: CE-Mark

The products fulfil the requirements according to the following standards:

Safety: EN60601-1 Part 1: General Requirements for Safety, Medical Electrical Equipment

Electrical: EN60601-1-2 Part 2: Collateral Standard: Electromagnetic Compatibility

3. Safety and Regulatory Information - continued

3. 7.1 Waste Electrical Electronic Equipment (WEEE)

End of Life and Disposal

The battery may contain toxic or hazardous material and must be disposed of as Waste Electrical Electronic Equipment (WEEE).

For all applicable devices under the WEEE directive, which have reached their end of life, please contact Haag-Streit customer services on 01279 414969, who will instruct you how to return the device for disposal.

3. 8 Environmental Conditions of Use

Temperature: +10°C to +35°C
Relative Humidity: 30% to 90%
Atmospheric Pressure: 800hPa to 1060hPa
Shock (without packing): 10g, duration 6 ms
3.9 EMC (Electro Magnetic Compatibility) Declaration

With the increased number of electronic devices such as PC’s and mobiles, medical devices in use may be susceptible to electromagnetic interference from these devices. Which may result in incorrect operation of the medical device and create a potentially unsafe situation. Medical devices should also not interfere with other devices.

In order to regulate the requirements for EMC with the aim to prevent unsafe product situations, the EN60601-1-2 standard has been implemented. This standard defines the levels of immunity to electromagnetic interferences as well as maximum levels of electromagnetic emissions for medical devices.

Medical devices manufactured by Haag-Streit-UK Ltd conform to this EN60601-1-2 standard for both immunity and emissions.

Nevertheless, special precautions need to be observed:
The use of accessories and cables other than those specified by Haag-Streit-UK Ltd, with the exception of cables sold by Haag-Streit-UK Ltd as replacement parts for internal components, may result in increased emission or decreased immunity of the device.

The medical devices should not be used adjacent to or stacked with other equipment.
If adjacent or stacked use is unavoidable, the medical device should be seen to operate normally as it should in this situation.

Further guidance regarding the EMC environment (in accordance with EN60601-1-2) in which the device should be used is available at: http://www.haagstreituk.com/medicalquality
### 3. Safety and Regulatory Information - continued

#### 3.10 Product Labelling and Safety Symbols

The labels affixed to the equipment are there to remind you of safety precautions. Do not remove these labels.

#### 3.11 Safety Symbols

The Perkins Mk3 Tonometer and its labels include the following markings:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Caution (Consult ‘Instructions for use’)</td>
</tr>
<tr>
<td>CE 0120</td>
<td>This product complies with the essential requirements of the medical devices directive (93/42/EEC). Compliance has been verified by UK notified body per 0120 (SGS United Kingdom Ltd).</td>
</tr>
<tr>
<td>⚠️⚠️⚠️⚠️</td>
<td>Do not dispose of with household refuse. Please contact your local authority for your nearest recycling centre.</td>
</tr>
<tr>
<td>⬛️</td>
<td>Manufacturer</td>
</tr>
<tr>
<td>⬛️</td>
<td>Direct Current (D.C.)</td>
</tr>
<tr>
<td>⬛️</td>
<td>Medical Electrical Equipment Type B</td>
</tr>
<tr>
<td>⬛️</td>
<td>Year of Manufacture</td>
</tr>
<tr>
<td>⬛️</td>
<td>Serial number Perkins Mk3 Tonometer (Example)</td>
</tr>
<tr>
<td>⬛️</td>
<td>Consult ‘Instructions for use’</td>
</tr>
<tr>
<td>⬛️</td>
<td>Storage &amp; Transport</td>
</tr>
<tr>
<td>⬛️</td>
<td>Off Power</td>
</tr>
<tr>
<td>⬛️</td>
<td>On Power</td>
</tr>
</tbody>
</table>
4. Taking a Pressure Measurement

The cornea is applanated with a measuring prism of organic glass that is fitted in a ring shaped holder at the end of the feeler arm. The contact surface of the measuring prism has a diameter of 7.0mm. It is planar with rounded edges to obviate any damage to the cornea.

The measuring prism is brought into contact with the eye. The measuring drum is turned to increase pressure on the eye until a continuously regular surface of 3.06 mm $\phi = 7.354$ mm$^2$ has been applanated.

<table>
<thead>
<tr>
<th>Position of the measuring drum</th>
<th>Force</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.81 mN</td>
<td>1.33 kPa</td>
</tr>
<tr>
<td>=10 mm Hg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The relationship between the measuring drum position, force and pressure on the applanation surface

The intraocular pressure in mm Hg is found by multiplying the drum reading by ten.

**SI-Units according to standard ISO 1000**

According to ISO 1000 the derived unit of force is the N (Newton) and its decimal sub-multiple the mN (milli Newton).

The conversion of mm Hg into the SI pressure unit kPa (Kilo Pascal) can be made on the comparison scale in Fig 3.

The measurement of the flattened surface is made directly on the cornea. The built-in duplication system in the measuring prism divides the image and displaces the two semi circular halves from each other by 3.06 mm.

Before measuring, it will be necessary to anaesthetise the cornea locally, to place a strip of fluorescein paper in the conjunctival sac and switch on the blue filter of the tonometer.

The inner border of the ring represents the line of demarcation between the cornea flattened by applanation and the cornea not flattened.
The major advantage of applanation tonometry is the small bulbous deformation that amounts to only 0.56 mm$^3$. The values found by this method of tonometry are only slightly influenced by scleral rigidity and radius of corneal curvature.

Nevertheless, in order to obtain exact results, the method of use indicated must be strictly followed.

The readings obtained are based on the assumption that a cornea with a ‘normal’ thickness is being measured - alteration of the corneal thickness leads to changes in the measured IOP.

A ‘normal’ corneal thickness is considered to be within the area of 530-560 microns. There is no universally agreed formula for the adjustment of the measured tonometry reading against altered corneal thickness.

The users should bear these two facts in mind and keep themselves informed, through the current literature, with regard to the various formulae for adjusting measured tonometry readings in the event of thinned, or thickened, corneas being measured.
5. To Prepare the Prism for Use

5.1 Remove Perkins Mk3 Tonometer from case
Remove the Perkins tonometer from the carrying case by holding the main body. Under no circumstances should it be lifted by the prism holder (Fig 1, 4).

5.2 Doubling Prism
The doubling prism (Fig 1, 5) should be prepared for use by cleaning following the cleaning instructions supplied with the prisms.

5.3 To Insert Prism into Prism Holder

1. Lean the Tonometer back until the prism holder moves forward. (Fig 4a)
2. Gently pinch together the Tonogrip (cone arm securing buttons) (Fig 4a) on either side to hold the prism holder in position.
3. With Tonogrip (cone arm buttons) pressed and the prism holder out (Fig 4b) the prism can be pushed into place.

⚠️ N.B. Failure to follow these instructions could result in severe damage being caused to the instrument.

5.4 Tonosafe Disposable Prism
Alternatively, Tonosafe disposable prisms may be used. These are supplied as sterile single use items to help eliminate the risk of cross infection.

Tonosafe and the prism holder have the same mass as the original doubling prism, so no conversion of results is required. The disposable prism can be inserted in the same manner as above.
6. Operating the Equipment

**Caution**
It is imperative to read chapter 3. Safety and Regulatory Information, and to observe its precautions before operating the equipment.

Sterilized fluorescein paper strips should always be used, as pathogenic exciters thrive well in fluorescein solutions.

Regular calibration of the Tonometer is advised.

Do not use without prism fitted.

It is recommended that only Haag-Streit original Goldmann prisms or Tonosafe are used.

6.1 Preparing the Patient

1. Both eyes must always be anaesthetized (e.g. 2-3 drops each of an anaesthetic within half a minute) to reduce movements of the lids during examination.

2. Place a fluorescein paper strip near the external canthus in the lower conjunctival sac. After a few seconds the lacrimal fluid is sufficiently coloured and the paper can be removed.

   Alternatively combined anaesthetic fluorescein eye drops can be used. When using drops, a solution of sodium fluorescein 0.25% to 0.5% is advisable.

**Caution:** If the prism touches the cornea without any force applied, the pressure arm can vibrate and may disturb the patient. For this reason, the scale is set to read 1 before applying the prism face to the cornea.

The **Perkins** tonometer should be held so that the thumb rests on the milled wheel (Fig 2, 8) controlling the spring. The light is switched on by turning the thumb-wheel until the scale reading (Fig 5) is just above zero.

If the forehead rest (Fig 1, 1) is to be used, the stem (Fig 1, 3), should be extended after loosening the locking screw (Fig 1, 2). When the forehead rest is correctly positioned, tighten the locking screw and the instrument can then be brought towards the patient so that the face of the prism cone comes into contact with the cornea.

It is usually easier to hold the tonometer obliquely with the handle slanted away from the nose (Fig 6). Care should be taken to prevent the prism touching the eyelid margin.
6.1 Preparing the Patient - continued

When seen through the viewing lens (Fig 2, 7) the semicircles of fluorescein should now be clearly visible and appear equal in size, denoting that the contact point is central on the cornea.

The light is switched off by turning the thumb-wheel until the scale reading (Fig 2, 9) is below zero.

⚠️ Note: The lighting is designed to give optimum fluorescence only when the prism cone is at its calibrated position i.e. when the rim of the prism holder is level with, or not more than 1 mm above the case surface.

6.2 Instruction to the Patient

Instruct the patient to look straight ahead or slightly upward and if necessary use a fixation light for this purpose.

It is recommended that patients are repeatedly asked to keep their eyes wide open during the examination. If required, the lids of the examined eye may be held open by the examiner’s fingers provided that no pressure is applied to the eye.
7. Cleaning the Equipment

Cleaning (manual) – non-immersion for Ophthalmic medical devices.

Scope of Action
Non-immersion manual cleaning methods are appropriate for low risk items (those items that come into contact with intact skin or do not contact the patient) where soaking in aqueous solution, e.g. electrical and electronic equipment, will compromise the device.

Alcohol wipes should be used to clean electrical contacts on equipment.

Equipment required:
1. A warm water/detergent solution at correct/recommended dilution.
2. A clean, disposable, absorbent, non-shedding cloth for application of detergent solution.
3. A clean, disposable, absorbent, non-shedding cloth for drying equipment.
4. An appropriate chemical neutraliser, first aid kit and eyewash, in case of splashing with detergent.

Procedure:
Ensure that it is disconnected from the charger and the unit is switched off (pointer reaches just below zero) before commencing the cleaning procedure.

Wearing protective clothing, immerse the cleaning cloth in the detergent solution and wring thoroughly.

Commencing with the upper surface of the item, wipe thoroughly ensuring that detergent solution does not enter the electrical components.

Periodically rinse the cloth in clean water and repeat the above steps.

Surfaces should be carefully hand-dried using a fresh dry cloth.
Note: Non-immersion, manual cleaning is not a disinfection process, but where an alcohol wipe is used to dry surfaces, this may have a disinfecting effect.

Safely dispose of cleaning materials and alcohol wipes, if used.

The above was written with reference to: Sterilization Disinfection and cleaning of Medical Devices & Equipment: Guidance on Decontamination from the Microbiology Advisory Committee to the Department of Health Medical Devices Agency (MAC manual section 2 page 20 updated April 2005)
8. General Notes

⚠️ Note
Only the shortest possible measuring time periods should be carried out on each eye. Should drying of the cornea epithelium be observed, then vision and field of sight should be checked in advance.

The measuring procedure can be repeated several times. Excited or anxious patients often display a higher ocular pressure during the first measurement.

For this reason, a reduction of tension is experienced during the first few minutes, as patients notice that tonometric examinations cause no unpleasant effects. A test measuring procedure should therefore be first made on each eye. These results can be disregarded. Thereafter, three measuring procedures are to be carried out on each eye. The readings will be correct when the pressure has been stabilised.

When the measuring procedure lasts too long on one eye, drying will occur on the cornea epithelium of both eyes. A ring of fluorescein-positive deposits around the contact positions of the cornea and the measuring element will occur on the eye under examination.

On the other eye, map-like fluorescein-positive dried places will occur, which will not allow a reliable measuring procedure.

Extensive drying phenomena disappear after a short time without treatment becoming necessary. Focused vision will be affected by such fine epithelium defects.

8. 1 Astigmatism

If the cornea is spherical, measurements can be made on any meridian, but it is most convenient to do it on the 0° meridian.

This is not so when eyes with higher corneal astigmatism that 3 dioptres are examined, as the flattened areas are not circular but elliptic.

It has been calculated that, in cases of larger corneal astigmatisms, a surface of 7.354 mm² (ø 3.06 mm) is to be planalated, when the measuring prism is at an angle of 43° to the meridian of the greatest radius.
8. 1 Astigmatism - continued

For example

If the corneal astigmatism amounts to

\[
\begin{align*}
6.5 \text{ mm/ } 30^\circ &= 52.0 \text{ D/30}^\circ \text{ and} \\
8.5 \text{ mm/ } 120^\circ &= 40.0 \text{ D/120}^\circ
\end{align*}
\]

the graduation value 120° of the prism is set at the 43° mark of the prism holder.

If there is a corneal astigmatism of

\[
\begin{align*}
8.5 \text{ mm/ } 30^\circ &= 40.0 \text{ D/30}^\circ \text{ and} \\
6.5 \text{ mm/ } 120^\circ &= 52.0 \text{ D/120}^\circ
\end{align*}
\]

the graduation value 30° is set at the 43° mark.

In other words, set the axial position of the greatest radius, that is the axis of a minus cylinder, on the prism graduation at the red mark on the prism holder.

8. 2 To use the instrument on animals

Unfortunately, most animal eyes have a cornea that behaves differently from the human cornea and the Fick-Maklakov law does not apply for the standard diameter of applanation. It is necessary to remove the patient's forehead rest and calibrate the tonometer for each species used. This can be done quite simply by connecting the anterior chamber to a reservoir and taking tonometer readings at different pressure levels. In most cases, it will be found that the tonometric reading is lower than that obtained for the human eye. The eyes of rhesus and cynomolgus monkeys behave very similarly to the human eye, but those of the rabbit and cat give lower readings.

Note: If the instrument is used on animals then this device falls outside of the CE0120 approval as a medical device.

8. 3 Special Precautions

The Perkins hand-held tonometer is a delicate precision instrument, carefully inspected and certified. Each instrument has been tested at 0 - 5 gram positions on the scale (1 gram increments) and found to be correct within the limits specified on the certificate accompanying each tonometer. It is desirable to clean the calibrating weights, as well as the prism, in an antiseptic solution, before checking the instrument, to minimize the risks of cross-infection (see cleaning instructions accompanying the prisms for decontamination instructions).
9. Measurement

Measurement of the force necessary to flatten a corneal surface of constant (ø 3.06mm) size.

<table>
<thead>
<tr>
<th>Dial indicator</th>
<th>Force</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.81 mN</td>
<td>1.33 kPa = 10mm Hg</td>
</tr>
</tbody>
</table>

Adjust the force by turning the thumb-wheel (Fig 2, 8) until the inner margins of the semicircles coincide (Fig 7).

The tonometer is removed from the eye and the reading noted. The large divisions of the scale represent grams and the small divisions 0.2 gram.

The reading is multiplied by ten to give the tension in millimetres of mercury (mm Hg). Readings should be repeated until a steady value is obtained; this will usually be slightly lower than the initial reading.

If the semicircles appear large and are not reduced by diminishing the force of the spring, the tonometer has been pushed too close to the eye and withdrawing it slightly will bring the prism within the range of free movement.

If it is desired to use the Perkins tonometer without any forehead rest, the instrument can be steadied by resting the fingers against the patient’s malar region while the prism is in contact with the cornea.
9. Measurement - continued

1. Immediately before taking the measurements, the patient should be made to close the eyes briefly so that the cornea becomes sufficiently moistened with the lacrimal fluid and fluorescein.

2. By moving the tonometer forward, the measuring prism is brought into contact with the centre of the cornea over the area above the pupils. The limbus of the cornea will be illuminated with a bluish hue. This illumination is best observed by direct sight from the opposite side of the illumination unit by the examiner.

As soon as the limbus of the cornea illuminates, cease any further forward movement of the tonometer immediately.

3. After obtaining contact, commence observing the cornea. A regular pulsation of the two semi circular fluorescein rings, which can be of varying size dependent on the ocular pressure, when the measuring drum is at setting 1, will show that the tonometer is in the correct measuring position.

4. The pressure on the eye is increased by turning the milled thumb wheel on the tonometer, until the edges of both fluorescein rings just meet (Fig. 9). The edges cross over each other with the pulsation of the eye. The width of the fluorescein ring around the contact position of the measuring prism should be 1/10 approx. of the diameter of the applanation surface (0.3 mm).

5. Reading the scale:
   - The reading
   - multiplied by 10
   - gives the ocular pressure in mm Hg

Note
The following are schematically simplified illustrations!

Fig. 8
Semi circular images in the centre of the field of sight

Fig. 9
Correct final position
9.1 Sources of Error

4.5.1 Fluorescein ring / Distance to the patient

<table>
<thead>
<tr>
<th>Result</th>
<th>Image in ocular</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>The fluorescein ring is too wide</td>
<td></td>
<td>The measuring prism was not dried after cleaning, or the eyelids came into contact with the measuring prism whilst measuring.</td>
<td>The tonometer should be withdrawn and the measuring prism dried with a cotton wool swab.</td>
</tr>
<tr>
<td>The fluorescein ring is too narrow</td>
<td></td>
<td>The lacrimal fluid has dried.</td>
<td>Let the patient close the eyes once or twice. Then repeat the measuring procedure.</td>
</tr>
<tr>
<td>No semi circular rings appear, only the centre line</td>
<td></td>
<td>The measuring prism is not touching the cornea. Should the patient withdraw their head slightly, the irregular pulsations will occur and the prism will only contact the eye intermittently. Should the patient withdraw the head further, then the fluorescein rings will disappear altogether.</td>
<td>Steady patient’s head.</td>
</tr>
<tr>
<td>Both of the too large semi circular rings appear partly</td>
<td></td>
<td>Should the tonometer be moved forward towards the patient, or should the patient move towards the tonometer whilst the measurement is being taken, then the feeler arm will come into contact with a sprung stop piece. The applanation surface is then too large.</td>
<td>The image will not change when turning the milled thumb wheel. Withdraw the tonometer until the regular pulsations of a corresponding smaller applanation surface indicate the correct measuring position and pressure changes lead to immediate applanation surface changes.</td>
</tr>
</tbody>
</table>

Fig 10
### 9.2 Inaccurate Horizontal Centering

<table>
<thead>
<tr>
<th>Result</th>
<th>Image in ocular</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>The upper semi circular ring appears partly</td>
<td><img src="image1" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is too far on the right.</td>
<td>Move the tonometer to the right.</td>
</tr>
<tr>
<td>The upper semi circular ring appears completely - the lower ring partly</td>
<td><img src="image2" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is still too far on the right.</td>
<td>Move the tonometer to the right.</td>
</tr>
<tr>
<td>Correct position: The edges of both semi circular rings meet exactly in the centre of the ocular</td>
<td><img src="image3" alt="Image" /></td>
<td>The measuring prism is focused precisely on the eye.</td>
<td>Move the tonometer to the left.</td>
</tr>
<tr>
<td>The lower semi circular ring appears completely - the upper ring partly</td>
<td><img src="image4" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is still too far on the left.</td>
<td>Move the tonometer to the left.</td>
</tr>
<tr>
<td>The lower semi circular ring appears partly</td>
<td><img src="image5" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is too far on the left.</td>
<td>Move the tonometer to the left.</td>
</tr>
</tbody>
</table>

Fig 11
## 9. 3 Inaccurate Vertical Centering

<table>
<thead>
<tr>
<th>Result</th>
<th>Image in ocular</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A semi circular ring appears partly in the upper half</td>
<td><img src="image1.png" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is too far up.</td>
<td>Move the tonometer upwards.</td>
</tr>
<tr>
<td>The ring appears completely in the upper half</td>
<td><img src="image2.png" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is still too far up.</td>
<td>Move the tonometer upwards.</td>
</tr>
<tr>
<td>The ring appears almost completely in the upper half, and partly cut in the lower half</td>
<td><img src="image3.png" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is still too far up.</td>
<td>Move the tonometer upwards.</td>
</tr>
<tr>
<td>Two partly cut rings appear, the larger one in the upper half</td>
<td><img src="image4.png" alt="Image" /></td>
<td>The measuring prism is not focused on the eye. The eye is still too far up.</td>
<td>Move the tonometer upwards.</td>
</tr>
<tr>
<td>Correct position: The edges of both semi circular rings meet exactly in the centre of the ocular</td>
<td><img src="image5.png" alt="Image" /></td>
<td>The measuring prism is focused precisely on the eye.</td>
<td></td>
</tr>
</tbody>
</table>

Fig 12
### 9. 4 Inaccurate Pressure

<table>
<thead>
<tr>
<th>Result</th>
<th>Image in ocular</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>The outer edges of the fluorescein rings touch each other</td>
<td><img src="image1.png" alt="Image" /></td>
<td>Pressure is too strongly reduced</td>
<td>Increase the pressure by turning the milled thumb wheel.</td>
</tr>
<tr>
<td>The fluorescein rings coincide and form a line</td>
<td><img src="image2.png" alt="Image" /></td>
<td>The pressure is reduced</td>
<td>Increase the pressure by turning the milled thumb wheel.</td>
</tr>
<tr>
<td>The fluorescein rings do not touch each other</td>
<td><img src="image3.png" alt="Image" /></td>
<td>The pressure is too strongly increased</td>
<td>Reduce the pressure by turning the milled thumb wheel.</td>
</tr>
</tbody>
</table>

**Correct position:** The inner edges of the fluorescein rings touch each other

**Accurate pressure - precise focusing of the measuring prism**

---

**Fig 13**
10. Case Contents

1  Perkins Tonometer Mk3
2  Forehead Rest
3  Doubling Prism/Black Tonosafe Holder
4  Two-gram weight
5  Five-gram weight
6  Battery Charger
7  Adaptor (UK, US, EU)
8  Setting Block

Fig 14
11. Calibration Check

Regular calibration of the Tonometer is advised.

⚠️ Please see 7.3 Special Precautions

**Proceed as follows:-**

1. Insert the doubling prism (Fig 1, 5) into the prism holder (Fig 1, 4).

**Check for zero position**

2. Adjust the milled thumb-wheel (Fig 2, 8) so that the scale reading is below zero by the full thickness of one scale line. Whatever the angle of the instrument in the hand the prism should tend towards its backward position.

3. Set the scale reading above zero by the full thickness of one scale line. The prism should tend towards its forward position regardless of the angle of the tonometer.

**Check at the 2 g position**

4. To make a rough check adjust the milled thumb-wheel (Fig 2, 8) so that the scale reading is below the 2 mark by the full thickness of one scale line. Place the instrument on a flat horizontal surface with the setting block under the body and the prism cone upwards as shown in Fig 15. Place the 2 g weight, recess downward, centrally on the prism cone and check that it carries the prism positively down to its lowest position.

5. Also, as a rough check, set the scale reading above the 2 mark by the full thickness of the scale line and place the instrument on the setting block as before. Place the 2 g weight on the prism and check that it remains in its highest position.

*(If the prism is accidentally pushed down to its lowest position with the weight on the prism, it should rise again to its highest position and freely remain there).*

If desired, the Actual point of balance can be established by adjusting the milled thumb-wheel (Fig 2, 8) until the prism floats at the calibration-position (rim of prism holder level with, or not more than 1 mm above the case surface).
11. Calibration Check - continued

Check at the 5 g position
6. Repeat the process as described in 4. and 5. above, but using the 5 mark on the scale and a setting one-and-a-half lines width above and then below the 5 mark and with the 5 g weight on the prism cone. The actual point of balance can again be found if required.

⚠️ Note: The tolerances in the zero, 2 g and 5 g tests above represent ±0.05, ±0.05 and ±0.075g respectively. If the tonometer is found to be outside the stated limits it should be returned to your supplier for attention.

12. Storage of Prism and Tonometer
The doubling prism must always be removed from the tonometer, cleaned following the cleaning instructions supplied with the prisms and inserted, cone downward, into the hole in the foam interior of the carrying case (Fig 14, 3). The tonometer should then be returned to the carrying case.

Do not pack the Perkins tonometer with the prism still in the instrument.

Never store the instrument with the spring under load - i.e. return the milled thumb-wheel to below zero.

⚠️ The suppliers cannot accept responsibility for the performance, reliability or safety of this equipment if it is used, serviced or modified by unauthorized persons.

Exterior cleaning of the tonometer body should be carried out using an antiseptic wipe, a cloth moistened in a mild soap solution or with 70% isopropyl alcohol.

Solutions containing alcohol, benzene etc., should not be used.

Note
Repairs
In the event of damage do not attempt local repairs but return the tonometer in its case, carefully packed, to your manufacturer for attention.

⚠️ Warranty
Unauthorized attempts at repair will immediately nullify the warranty.
13. Charging the Battery

Blue Illumination LEDs
The LEDs, two in number, are filament replacement LEDs (Fig 1, 6). The LEDs are fixed in position to create maximum fluorescent effect during measurement. When the LEDs go dim, the battery indicator will be red in colour, indicating that the battery needs to be charged, using the charger supplied, type 2116 manufactured by Mascot AS in Norway.

14. Battery Pack

The Perkins Mk3 Tonometer is powered by a 3.6V Ni MH chargeable battery pack that will last for approx. 25 hours. The battery indicator LED (Fig 2, 11) indicates:

- green  
  - Fully charged
- orange  
  - Several hours of use left, approx.
- red  
  - Battery needs to be charged

⚠️ Warning
The battery pack requires no maintenance and should give substantial use before replacement is required. The replacement of the battery pack should only be carried out by the manufacturer. The battery pack should only be recharged using the charger supplied with the unit.
15. Charger Unit

The charger unit has a 3 coloured LED (yellow, orange and green) that flashes 6 different modes (see printing on charger).

When the Tonometer is first plugged into the battery charger, the battery charger LED will show orange for several seconds while it gives a short charge to the Tonometer battery.

The battery charger will then switch to yellow for several seconds while it carries out initialization analysis of the Tonometer battery. If the Tonometer battery condition is ok the battery charger LED will switch to orange again for the “fast” charge and stay orange until Tonometer battery is almost fully charged (up to 3 hours).

When the battery charger detects the Tonometer battery is almost fully charged the battery charger LED switches to green with short flashes of yellow (up to 1 hour) to complete the charge.

When the top-off charge is complete, the battery charger LED will switch to solid green (trickle charge) indicating the Tonometer battery is fully charged.

⚠️ Please Note:
If after the analysis mode the LED alternately flashes between orange and green, this indicates a battery fault. In this case return the Tonometer and battery charger to the manufacturer.

Charger Specification

NiMH Charger with exchangable wall AC plug
input 100-240 Vac, 50-60 Hz
0.3 A. Output 3.6Vdc
Cells 140mA

16. Technical Specifications

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0 - 50 mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement uncertainty of the force impingement on the measuring prism over a measuring range from 0 - 49.03mN</td>
<td>Standard divergence: 0.49mN ≤ 3s ≤ 1.5% of rated value</td>
</tr>
<tr>
<td>Net Weight, packed</td>
<td>1.0kg</td>
</tr>
</tbody>
</table>
References

Perkins ES: Hand-held applanation tonometer.  

Perkins ES: Tonometry in experimental animals.  

Heid S and Flament J: Aplanotonométrie à main.  

Flament J: Aplanotonométrie à main chez le sujet couché.  

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Dunn JS and Brubaker RF: Perkins applanation tonometer, clinical and laboratory evaluation.  
Arch of Ophthalmol 1973 89 149-151.

Radtke ND and Cohan BE: Intraocular pressure measurement in the newborn.  

Al-Abrak MH and Samuel JR: Effects of general anaesthesia on the intraocular pressure in man.  

Fujikawa LS, Salahuddin SZ, Palestine AG, Masur H, Nussenblatt RB and Gallo RC: Isolation of human T-lymphotropic virus type III from the tears of a patient with the acquired immunodeficiency syndrome.  
Lancet 1985 2 529-530.

Recommendations for preventing possible transmission of human T-lymphotropic virus type III/lymphadenopathy-associated virus from tears.  
### Catalogue Description

**Catalogue Number** 5806000

Standard device, comprising - The Perkins hand-held tonometer, doubling prism, patient’s forehead rest, instruction manual and Certificate of Accuracy. The setting block and weights (5g and 2g) are also carried in the case provided.

### Accessories

<table>
<thead>
<tr>
<th>Catalogue Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5806030</td>
<td>Carrying case</td>
</tr>
<tr>
<td>5801004</td>
<td>Five-gram weight</td>
</tr>
<tr>
<td>5801005</td>
<td>Two-gram weight</td>
</tr>
<tr>
<td>5806012</td>
<td>Setting block</td>
</tr>
<tr>
<td>5806038</td>
<td>Patient’s forehead rest</td>
</tr>
<tr>
<td>1902516</td>
<td>User’s Instruction Manual</td>
</tr>
<tr>
<td>5801068</td>
<td>Doubling prism</td>
</tr>
<tr>
<td>5806028</td>
<td>Battery charging unit</td>
</tr>
<tr>
<td>5805100</td>
<td>1 box of 100 prisms and 5 prism holders (EU)</td>
</tr>
<tr>
<td>5805080</td>
<td>1 box of 100 prisms and 5 prism holders. <em>(USA only)</em></td>
</tr>
<tr>
<td>5805091</td>
<td>1 box of 20 Tonosafe prisms + 1 Holder</td>
</tr>
<tr>
<td>5806046</td>
<td>Adaptor (UK)</td>
</tr>
<tr>
<td>5806047</td>
<td>Adaptor (EU)</td>
</tr>
<tr>
<td>5806048</td>
<td>Adaptor (US)</td>
</tr>
</tbody>
</table>

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For the full IFU (Instructions for use) see Haag-Streit UK website
www.haagstreituk.com/ifu

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