Self-tonometer OCUTON S

In Germany roughly 1,2 million people suffer from the eye disease glaucoma. This disease, which the patient is often unaware of, may lead to loss of sight if not treated in time. Glaucoma is one of the most common reasons for losing one's sight in the industrialised countries.

Intraocular pressure - which can be determined by means of a so-called tonometer - is an important parameter in recognition and treatment of this disease. Until now a measurement of the intraocular pressure has only been possible by an ophthalmologist. The measurement of this parameter is quite expensive and consequently large sections of the population can hardly be examined regularly.

The intraocular pressure may vary significantly over a short time scale, which may cause considerable damage to the eye. Thus, tight control of this parameter is a precondition for an optimum treatment. For the first time the OCUTON S self-tonometer allows the patient to measure the intraocular pressure of his eyes by himself to provide important data for diagnosis and therapy to his ophtalmologist. Of course the measurement has to be carried out under the ophthalmologist´s guidance and control.

For measuring the intraocular pressure the automatic self-tonometer OCUTON S operates as follows: a defined force moves a body with an even surface perpendicular to the spherical cornea and flattens it (applanation) in order to generate a counter pressure equivalent to the intraocular pressure.

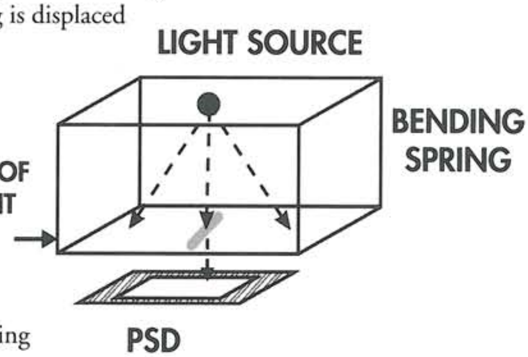
The pressure is determined as Pi = F/Ap by measuring the applanation surface (Ap) and the exerted force (F). The force necessary for applanation is controlled by a d.c.-drive which operates a movable carrier. The body to be moved against the eye - a prism - is connected to the carrier via a bending spring so that the rising counter-force leads to an elastic deformation of the spring.

As a result the spring displacement is indirectly proportional to the drive direction:

F = D x s, where
F = back driving force (mW),
s = spring displacement (mm) and
D = spring constant (mN/mm).

In this way the measurement of the force may be reduced to a measurement of the displacement, which is accomplished by means of a SiTek linear Position Sensing Detector (PSD); namely 1L5SP.

In detail, a parallel spring guide is used which is connected to a slit with the dimensions 2,0 x 0,4 mm. An IR-source (LED) is situated at a defined distance from the slit. In this way the light spot moves along the PSD element as the spring is displaced by the counter-force.



In processing the PSD signals the partial currents Y1 and Y2 are converted to proportional voltages U1 and U2. Afterwards the voltages are used for determining the position of the light spot.
The following two quantities are therefore calculated

sum voltage Us = U1 + U2 and
differential voltage Ud = U1 - U2.

The differential signal Ud, which is the real position-sensitive value, is supplied to an AC/DC-converter which uses the sum signal Us as a reference voltage. Both signal levels are matched to each other so that the differential voltage is equal to, or lower than, the sum voltage.