LUVIS – A lighting device for contrast sensitivity and acuity charts

Instruction manual

Contents

LUVIS – Illumination Unit

Model STZ-2011A

Operating Instructions

1 Symbols used in this instruction manual

Caution! This symbol indicates a danger for humans or for the device. It is important to pay attention to the information given here.

This symbol indicates useful information. Here, further information about the use of the LUVIS – Lighting Device STZ-2011A can be found.

2 Safety Advice

2.1 General Precautions

- The installation and operating instructions are constituent part of the device. It must be available to the user. Compliance with the installation and operating instructions is a prerequisite for proper use and new employees should be taught the correct operation of the equipment.

- The installation instructions and operating procedures are to be passed on to successors.

- The installation and operating instructions correspond to the model of the device and to the state-of-the-art technology at the time of initial marketing. All rights are reserved for the circuits, processes, names, software programs and devices appearing in this manual.

- The user must be familiar with the correct operation of the device.

- The product is not intended for use in hazardous areas or combustion-promoting environments. Explosion hazard zones may arise through the use of flammable anaesthetic agents, skin cleansers, oxygen and skin disinfectants.

- The unit must be kept away from water. Contact with water, splashes of liquids or wet surfaces can lead to a severe electric shock.

- The unit must be connected to a properly installed socket.

- Before connecting the device, check that the specified voltage and frequency of the device match with the values of the supply network.
- Combined with acuity charts, the product is a medical device and may be operated only by persons who have the proper training or practical experience that ensures proper use of the unit.
- Before operating, the equipment and cables must be inspected for damage. Damaged cables and plugs must be replaced immediately.
- Never touch the patient and open housing or open plug connections at the same time.
- The equipment must not be under voltage when replacing the fuse/ glass tube fuse or the fluorescent tube.
- Fluorescent tubes contain mercury and must be disposed of professionally after replacement.
- Portable multiple sockets must not lie on the ground. Other systems may not be operated on the same multiple socket.
- Reproduction of the installation and operating instructions, even in part, is not permitted without the written permission of STC eyetrial.

	Caution! See accompanying documents
	Manufacturer
	See Instructions for Use
	CE Symbol, a sign of conformity
SN	Serial number
REF	Item number

2.2 Appropriate Use

The device is intended solely for the standard lighting of visual test charts, especially the Pelli-Robson contrast chart

2.3 Improper Use

Any use that is different from the intended use will void the warranty from the producers. Responsibility for damages resulting from improper use rests solely with the user.

3 Product Description

The LUVIS lighting device has been developed to illuminate panels for examining photopic contrast vision in a reproducible and standardized fashion. The requirements for the illumination are oriented on the standard for the testing of visual acuity (DIN EN ISO 8596). On the one hand, the luminance of the panel should be in a certain range, on the other hand, the illumination of the panel surface must be sufficiently uniform. For this purpose LUVIS uses two fluorescent lamps with daylight-like colour and temperature (4000 ° K), which is flicker-free and not visible to the subjects.
The size of the device is based on the Pelli-Robson contrast chart. Other single-sided visual acuity test charts can also be illuminated. The panels use magnetic strips on the back to keep it attached to the back of the unit. The Pelli-Robson tables already come with mounted magnetic strips. Should other tables be used, suitable magnetic strips can be obtained from STC eyetrial.

3.1 List of parts

After opening the box you will find the following items:

1. Housing
2. Tripod base (optional)
3. Tripod rod (optional)
4. Tripod carrier plate (optional)
5. 2 Pelli-Robson charts
6. Mains cable
7. 2 spare fuses
8. 2 star head screws
9. 8 mm Allen key
10. 2 screws for wall mounting (in delivery without tripod)
11. Instruction manual with installation instructions

The lighting unit itself is already assembled and ready for operation.

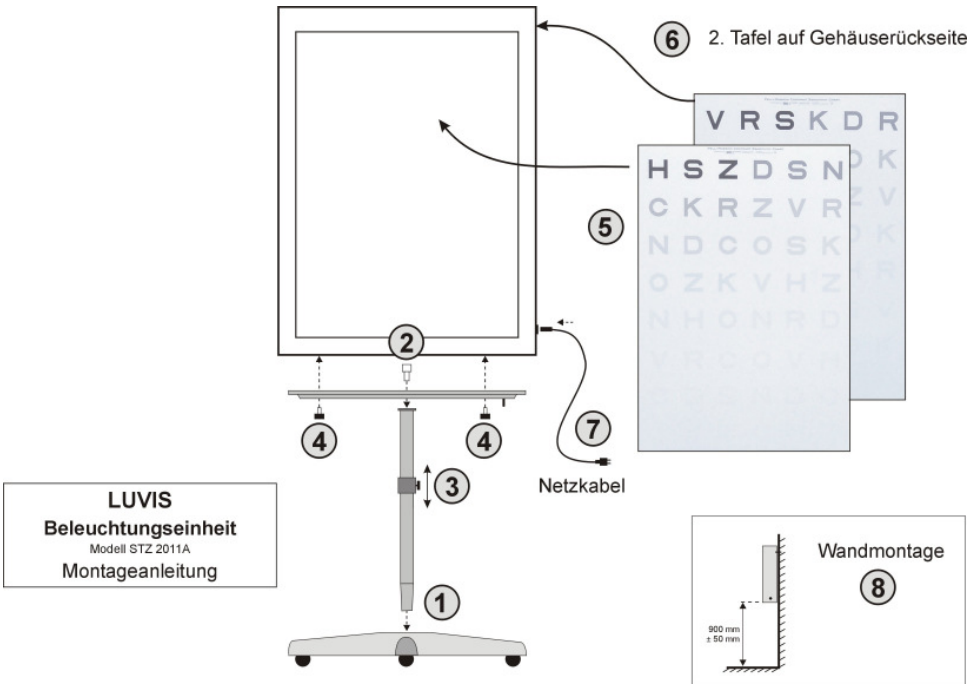
4 ASSEMBLY INSTRUCTIONS

4.1 Installation of castor-mounted tripod

- The assembly is limited to placing the housing on the tripod stand. Please go through the following instructions in order (numbers in parentheses refer to the installation drawing):
- Place the housing with the opening upwards on a flat surface.
- Insert the cone of the tripod rod into the tripod base (1).
- Attach the tripod carrier plate on to the upper edge of the tripod rod using the supplied Allen and L-keys. The screw must be tightened securely (2).
- Loosen the black clampling screw on the tripod rod and pull the inner tube out far enough so that the carrier plate is approximately 12 cm above the clamping screw and tighten it again securely. At this height, the middle of the chart is about 135 cm above the ground after installation of the housing, which corresponds to the average eye level when sitting (3).
- Now hold the tripod base with the carrier plate horizontally at the bottom of the housing and centre the two mounting holes with the corresponding screw threads on the bottom

of the housing. A second person is helpful here. Screw together the housing and the tripod base firmly with the two star head screws. (4) Now place the housing on its rollers.

- Place one of the Pelli-Robson charts symmetrically into the housing at the upper edge. The panel is held magnetically (5).
- The second panel can be mounted on the rear side (6).
- After connecting the power cable, the device is ready. (7)
- To replace the panels remove them as carefully as possible from the sides, touching the edges only.
- To set the device to a different height, one person should hold the housing while a second opens the clamp screw and retightens it at a different level. The inner rod of the tripod has an air brake, so that the housing cannot fall down after opening the clamp.



4.2 Wall installation (8)

If the unit is ordered without a stand, 2 screws are included to mount the device on the wall. Two holes for the screws can be found on the rear panel. The choice of dowel depends on the type of wall (masonry or lightweight construction). The STC eyetrial is pleased to give advice, if required. The carrying capacity must be about 16kg.

The mounting height indicated in the figure leads to a middle panel height of about 135 cm, which corresponds to the average eye level when seated. The height can be adjusted according to the individual conditions (e.g. examination while standing).

4.3 Replacing the lamps

Before replacing the fluorescent lamps, it should be ensured that the device is not under voltage.

The lamps used are Osram T5 tubes of the type HE 21 W840 with a colour temperature of 4000 ° K, which corresponds to an average daylight. According to the manufacturer they have a service life of 30,000 hours. The loss of brightness during this time is also specified by the manufacturer as only a few percent. Should be a lamp replacement nevertheless be necessary, proceed as follows:
An Allen key, 2 mm in size, is required, which can be obtained if needed from STC eyetrial. First loosen the 4 screws on the front and back of the upper cover plates, as well as the two screws on the front of the lower middle cover plate. Then tilt one sheet of metal gently to the bottom, the other to the top. Remove the upper cover plate; the lower one can only be tilted backwards in the case, as it is connected by a ground wire to the housing.
The light covers on the inside of the device are secured by 3 Allen screws. After loosening these 3 screws (do not remove), the plexiglass cover can be pulled to the side to make the fluorescent tubes accessible. After a quarter turn, they can be removed from the socket. Replacement of the tube takes place in the reverse order.

4.4 Replacing the fuses

Before replacing the fuses, it should be ensured that the device is not under voltage.

The main switch of the device is bipolar and turns off phase and neutral conductor. Two fuses and 2 spare fuses are included. If the equipment fails, first check the fuses. First unplug the mains cable, press the two retaining clips of the adjacent fuse holder with a suitable tool (2 mm screwdriver or similar) and lever the fuse out. Replacement takes place in reverse order. Damage is usually limited to only one fuse. If the fuse blows repeatedly after replacing, there is a fault in the device. In this case contact STC eyetrial. A fuse damage can also occur through the power grid e.g. from lightning. In general, the device will work again after replacing the fuse.

4.5 Cleaning

LUVIS has a powder-coated surface; the paint manufacturer recommends the following for cleaning:

Only pure water, if necessary use with small quantities of neutral detergent (pH 7) - with the help of soft, non-abrasive wipes, cloth or cotton wool. Rubbing is prohibited.

Greasy, oily or sooty substances can be removed with aroma free white spirit, or isopropyl alcohol (IPA). Residues of adhesives, silicone rubber or adhesive tapes, etc. can be also removed in this way.

- Do not use solvents that contain esters, ketones, polyhydric alcohols, aromatics, glycol ethers or halogenated hydrocarbons or the like.
- No scratching or abrasive cleaners.
- No strong acidic or alkaline detergents and wetting agents.
- Do not use detergents of unknown composition.
- The cleaning agent should not exceed 25° C. Never use high-pressure cleaners or steamers. The surface temperature during the cleaning process should also not exceed 25° C. The maximum exposure time of the cleaning agent should not exceed one hour;
- The entire cleaning process can be repeated after at least 24 hours, if necessary.
- Immediately after each cleaning cycle, wipe with pure cold water.

4.6 Spare Parts

The LUVIS lighting device is designed for operating continuously. The life of the fluorescent tubes is specified by the manufacturer as 30,000 hours, which will hardly be achieved with normal use. In principle, every single part of the device can be obtained from STC eyetrial. Repairs that go beyond changing lamps and fuses are strongly discouraged. If a defect occurs that cannot be resolved by changing lamps and fuses, please contact STC eyetrial.

5 EXAMINATION PROCEDURE WITH THE PELLI-ROBSON CHART

For a standardized test of contrast vision, we recommend the use of the examination manual together with the evaluation forms, provided by the panel manufacturer, which are delivered with the chart. The following are excerpts from the original instructions from the company Clement Clarke for the examination with the Pelli-Robson chart. The complete instructions are included with the charts.

5.1 The Pelli-Robson Contrast Sensitivity Chart

(a) *The chart.* This manual is supplied with two charts and two blocks of evaluation forms. The evaluation forms are printed on both sides, each side of the character set corresponds to one of the two Pelli-Robson panels. The two panels have different sequences of letters, but are otherwise identical. The letters are arranged in groups of three, and each row contains two of these three groups. All letters within a group of three have the same contrast. Contrast is reduced from one group of three to the other. The three groups on the evaluation block (but not on the chart itself) are divided by a large gap. (In contrast to a visual acuity chart in which the difficulty increases every line, in the Pelli-Robson chart, the difficulty also increases in the middle of each line.)

(b) *Mounting the chart .* The chart should be suspended so that its centre point is located approximately at the height of the eyes of the patient.

(c) *Illuminating the chart.* The chart should be illuminated as evenly as possible, so that the luminance (brightness) of the white areas amounts to about 85 cd/m2 (the valid range is 60-120 cd/m2, corresponding to an exposure of 1/15 and 1/30 second at f / 5.6 at an ASA value of 100). Avoid glare. The patient should not see the lamps themselves or their mirror-like reflection on the chart surface.

Contrast sensitivity test

1. *Testing a patient.* Test the eyes of the patient before his pupils are dilated, or other medication is administered to his eyes. The patient should sit or stand directly in front of the chart so that the distance from the eye to the board is about 1 meter (the allowable range is between 85 and 115 cm.) Patients should use their best vision correction lenses, if necessary with an additional +0.75 dioptres to correct for the distance of 1 meter to the chart. (The sensitivity of the patient is not reduced by small refractive errors, because the letters are so large.)

2. *Measuring the performance of the patient.* Enter the name of the patient, the date and the name of the examiner in the evaluation form. The patient should try once to read every letter on the chart, starting with the dark letters in the upper left corner and then continuing horizontally to the end of the line. Underline or circle each correctly read letter on the evaluation form and stroke through each incorrect letter read.

3. *Don't let the patient give up too soon.* Let the patient guess the letter, if he thinks the letters are invisible. You should wait several seconds for the weakest letters, but don't let the patient give up until he has got 2 of the 3 letters in a group of three wrong. The reliability of the results depends on this.

4. *Evaluation of the test.* The sensitivity of the patient is determined by the group of three letters with the lowest contrast, in which 2 of the 3 letters are named correctly. The logarithm of contrast sensitivity for the group is indicated by the number displayed on the block next to each group of three. The number is located to the right or left of the group of three; you should take the number that is closest to the group of three. Enter this number as the log contrast sensitivity.

5. *Testing the fellow eye.* The patient should be tested three times, once for each eye and once for both eyes. When testing one eye, cover the other eye. The three measurements should not take more than 8 minutes. The binocular logarithm of contrast sensitivity is generally 0.15 higher than the monocular.

Notes

(a) Service life and care of the chart. The support material of plastic and the special colour of the panel were chosen because of their good stability or contrast clarity. The panel may not be used if it has visible marks, such as fingerprints. Where necessary, the board can be gently wiped with a soft cloth and a highly diluted soap or detergent solution. Rinse with clean water. Prevent exposure to direct sunlight or a UV light source. To prolong the life of the panel, it is recommended to turn the table towards the wall, when not in use. An expiration date is printed on each unit during production but this can be prolonged by proper handling and use. If the background contrast recognizably deteriorates, it is recommended to replace the chart.

(b) Explaining the test. This test will be unknown to most of your patients, and they are more likely to exert themselves, if they understand why the test is performed. One possible explanation would be: "In daily life we don't look at small black objects. It is therefore more realistic to measure the contrast sensitivity of how well we see large, dimly visible objects around us. This panel is a little different from a normal chart-doubt. Here the letters are all the same size and are less and less distinct towards the bottom. In the top row the letters are in black and white and have a high contrast. Below them they are gray and less easy to see, like looking through dirty or fogged glasses. You should read as many letters as you can. The letters at the bottom of the chart are difficult for everybody to read, so do not be discouraged." If the patient then has problems with a letter, you can give him suggestions, to help him see it. "Try to read only one letter at a time. Blink once, or try to see the letter from another angle, by turning your head sideways." Show the patient (without touching the chart) the letter he should focus on. "Try this one. Do you see anything against the white background? Do you see a spot? Is it round or square? Can you see corners or lines? Try again. Perhaps the letter will suddenly be visible. Guess again. "

(c) Logarithm of the contrast sensitivity. With a panel of this kind, contrast is best defined as the difference in luminance between the letter and background, divided by the luminance of the background. This is referred to as the Weber contrast and should not be confused with the Michelson contrast, a different luminance ratio, which is normally used for grating stimuli. The lowest visible contrast is called the contrast threshold. As a rule, the reciprocal of the contrast threshold is used to describe the contrast sensitivity. This has the advantage that the better the patient, the higher the sensitivity value is. If the logarithm with base 10 (common logarithm) is used, there is the additional advantage that same sized steps reflect the same effect. When looking through a steamed window (or cataract), which reduces the contrast by a factor of 2, the logarithm of contrast sensitivity would reduce by 0.3, regardless of the observers initial contrast sensitivity. The contrast threshold c of the logarithm of contrast sensitivity s can be calculated by the formula c = / 10s.

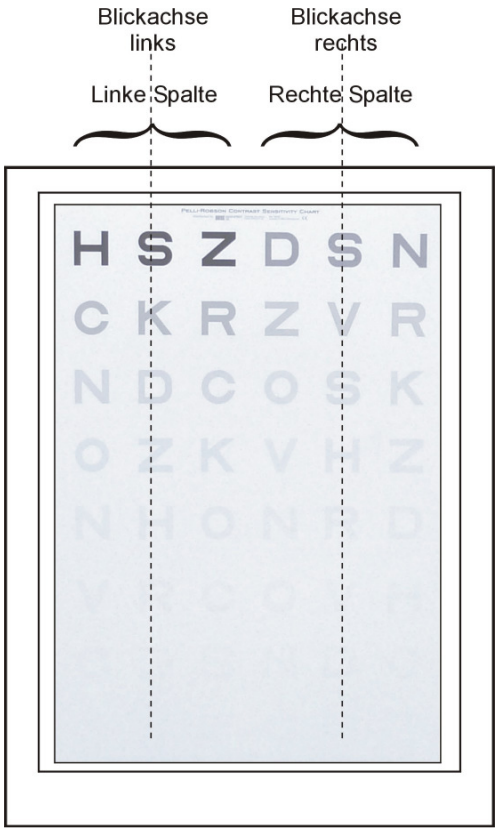
(d) Standardization. This manual and the accompanying tables are designed to ensure maximum comparability of results obtained from different users. The luminance, font and letter spacing of the chart is therefore based on the recommendations of the Committee on Vision of the National Academy of Sciences and National Research Council (Adv. Ophthal. 41, 103-148.1980). This comparison can only be attained if the user adheres strictly to these instructions.

(e) Accuracy. The accuracy of one measurement of the logarithm of contrast sensitivity of a patient depends primarily on two factors: The accuracy of the contrast calibration of the chart (guaranteed maximum of ± 0.075) and the intrinsic variability due to the probabilistic nature of the responses of the patient, which because of the carefully balanced design results in a standard deviation of only 0.11 (see Pelli et al., 1988).

References. Pelli, D.G. Robson, J.G., and Wilkins, A.J (1988) Designing a new letter chart for measuring contrast sensitivity. *Clinical Vision Sciences 2:187-199.* (Note: This article describes an earlier protoype of the chart, which used a different viewing distance.) Other interesting articles can be found in *Clinical Vision Sciences*.

5.2 Supplement to performing the test from STC eyetrial

The above procedure described under (b) for carrying out the contrast test refers to the freely hanging Pelli-Robson chart. When using the chart in the LUVIS lighting device it should be ensured that there are no reflections on the letters to be read. If one looks centrally at the unit, small reflections may occur because of the dull surface of the Pelli-Robson chart. The following procedure is therefore recommended:



The Pelli-Robson letter chart consists of 2 groups of 3 characters per line, each of the same contrast.

This arrangement can be divided accordingly into two parts: a left and right column of threes.

To distinguish reflexes, it is recommended that when reading the group on the left the axis of sight in moved to the middle of the left column. Similarly for reading the right column. The necessary shift is only about 13 cm to the right and left of centre.

6 Technical Specifications

Power Consumption	45 W (max.)
Rated voltage	220 – 240 V / 50 – 60 Hz
Fuses	2 x T 1A 250 V
Material Pelli-Robson chart	Carton
Mounting	Magnetic
Material housing	Aluminium and Steel
Dimensions	Width 700 mm, Height 950 mm, Depth 180 mm
Weight with chart and tripod	Ca. 20.7 kg
Weight with chart without tripod	Ca. 15.5 kg
Protection class	I

CE Specifications subject to change.

6.1 Delivery contents

Basic equipment
- Housing, ready for use
- Mains cable
- Instructions

Optional
- Height-adjustable tripod
- Set of Pelli-Robson charts

6.2 Spare parts

Fluorescent tubes:	OSRAM HE 21W840
Fuses:	230V 1A slow
Power cable:	3 m white
Magnet strips:	self-adhesive, to attach additional sheets

6.3 Contact

STC *eyetrial*
Dipl. Ing. Wilhelm Durst
Schleichstraße 12-16
72076 Tübingen
Fax: 07071-295021
Mail: wilhelm.durst@stz-eyetrial.de

7 NOTE ON ELECTROMAGNETIC COMPATIBILITY

Guidance and manufacturer's declaration-electromagnetic emissions		
The LUVIS lighting device is intended for use in the electromagnetic environment specified below. The customer or user of the device should ensure that they are used in such surroundings.		
Emission measurements	**Compliance Level**	**Electromagnetic environment guidance**
RF emissions CISPR 11	Group 1	LUVIS uses only RF energy for its internal function. Therefore, its RF emissions are very low and are unlikely to cause disturbance to any device.
RF emissions CISPR 11	Class B	LUVIS is for use in all facilities, including living areas and those that are directly connected to a public supply network that supplies buildings used for residential purposes.
Harmonics IEC 61000-3-2	Class A	
Voltage fluctuations / flicker according to IEC 61000-3-3	Conditions met	

Guidance and manufacturer's declaration-electromagnetic immunity			
LUVIS is intended for use in the electromagnetic environment specified below. The customer or user of LUVIS should ensure that they are used in such surroundings.			
Immunity Test	**IEC 60601-Test Level**	**Compliance Level**	**Electromagnetic environment guidance**
Static discharge (ESD) according to IEC 61000-4-2	+ 6 kV contact discharge (indirect) + 8 kV Air discharge	± 6 kV contact discharge ± 8 kV Air discharge	Floors should be made of wood, concrete or ceramic tiles. If the floor is covered with synthetic material, the relative humidity should be less than 30%.
Electrical fast transient / burst according to IEC 61000-4-4	± 2 kV for power lines ± 1 kV for input and output cables **=> not applicable**	± 2 kV for power lines ± 1 kV for input and output cables **=> not applicable**	The quality of the voltage supply should be that of a typical commercial or hospital environment.
Surges according to IEC 61000-4-5	± 1 kV Differential mode (symmetrical)	± 1 kV Differential mode (symmetrical)	The quality of the supply voltage should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations according to IEC 61000-4-11	< 5% U_T or ½ cycle (> 95 % dip) 40% U_T for 5 periods (60 % dip) 70% U_T or 25 periods (30 % dip) < 5% U_T for 5 s (> 95 % dip)	< 5% U_T or ½ cycle (> 95 % dip) 40% U_T for 5 periods (60 % dip) 70% U_T for 25 periods (30 % dip) < 5% U_T for 5 s (> 95 % dip)	The quality of the supply voltage should be that of a typical commercial or hospital environment. Should the use of LUVIS be affected by power mains interruptions, it is recommended to use an uninterruptible power supply or a battery.
Magnetic field at supply frequency (50/60 Hz) according to IEC 61000-4-8	3 A/m	3 A/m	Magnetic fields at mains frequency should comply to the typical values found in commercial and hospital environments
NOTE: U_T is the ac mains voltage prior to application of the test			

Guidance and manufacturer's declaration-electromagnetic immunity			
LUVIS is intended for use in the electromagnetic environment specified below. The customer or user of LUVIS should ensure that they are used in such surroundings.			
Immunity Test	**IEC 60601-Test Level**	**Compliance Level**	**Electromagnetic environment guidance**
Conducted RF according to IEC 61000-4-6 Radiated RF according to IEC 61000-4-3	3 Ed. 150 kHz to 80 MHz 3 V/m 80 MHz to 2.5 GHz	3 Ed 10V/m	Portable and mobile RF communications equipment should not be used closer to LUVIS (including the cable) than the recommended safe distance calculated according to the appropriate equation. **Recommended separation distance:** $d =$ $[3.5/3]\sqrt{P} = 1.,2\sqrt{P}$ $d =$ $[3.5/10]\sqrt{P} = 0.35\sqrt{P}$ for 80 MHz to 800 MHz $d =$ $[7.0/10]\sqrt{P} = 0.7\sqrt{P}$ for 800 MHz to 2.5 GHz where P is the maximum output power in watts (W) according to data provided by the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters should be less than the compliance level for all frequencies according to an electromagnetic site survey. Interference is possible In the vicinity of equipment marked with the following symbol. 
NOTE 1:The higher frequency range is applicable at 80 MHz and 800 MHz. NOTE 2:These guidelines may not be applicable in all cases. The spread of electromagnetic variables is affected by absorption and reflection from structures, objects and people.			

a) Field strengths from fixed transmitters, such as base stations for mobile telephones and land mobile radios, amateur radio station, AM and FM radio and TV broadcast can be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed transmitters, a study of the site should be carried out. If the measured field strength at the location where the equipment is to be used exceeds the agreed levels above, the device should be observed, to verify that it is functioning correctly. If abnormal performance is observed, additional measures may be necessary, such as changing or relocating the device.

b) Field strengths should be less than [V1] V / m over the frequency range 150 kHz to 80 MHz.

Recommended separation distances between portable and mobile devices
RF communications equipment and LUVIS

LUVIS is intended for use in the electromagnetic environment specified below. The customer or user of LUVIS can help to prevent electromagnetic interference by maintaining the minimum distance between portable and mobile RF communications equipment (transmitters) and LUVIS - depending on the output cables of the communication device, as specified below.

Maximum output power of the transmitter W	**Separation distance dependent on the frequency m**		
	150 kHz to 80 MHz **$d = 1.2 \sqrt{P}$**	80 MHz to 800 MHz **$d = 0.35 \sqrt{P}$**	800 MHz to 2.5 GHz **$d = 0.7 \sqrt{P}$**
0.01	0.12	0.04	0.07
0.1	0.38	0.11	0.22
1	1.20	0.35	0.70
10	3.79	1.11	2.21
100	12.00	3.50	7.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d can be estimated using the equation applicable to the frequency of the transmitter in the relevant column, where P is the maximum output power of the transmitter in watts (W) according to the manufacturer.

NOTE 1:
To calculate the recommended safe distance for transmitters in the frequency range from 80MHz to 2.5 GHz, an additional factor of 10/3 is used to decrease the likelihood that mobile / portable communications equipment could cause interference if inadvertently brought into patient areas.
NOTE 2:
These guidelines may not apply in all situations. The spread of electromagnetic variables is affected by absorption and reflection from structures, objects and people.

December 2011

EG - KONFORMITÄTSERKLÄRUNG
EC - DECLARATION OF CONFORMITY

Für das nachstehend bezeichnete Produkt / For the following named product

Produktname / Name of product:	**Beleuchtungseinrichtung für Kontrast- und Visustafeln/ A lighting devicefor contrast sensitivity and acuity charts**
Modell/Typ / Model/Type:	Modell STZ-2011A/Model STZ-2011A
Hersteller / Manufacturer:	STZ eyetrial/STC eyetrial
Anschrift / Address:	Schleichstraße 12 72076 Tübingen

erklären wir, dass es den Anforderungen der Richtlinien EMV - Richtlinie 2004/108/EG und der Niederspannungsrichtlinie 2006/95/EG entspricht.

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we declare that the requirements of the EMC directives - corresponding to Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC are met.

Hinsichtlich der Konformität zur Niederspannungsrichtlinie wurden folgende Normen herangezogen:

The product conforms to the European standards:

Niederspannungsrichtlinie/ Low Voltage Directive:
DIN EN 60598-1:2008+A11:2008-10

TÜBINGEN, 20.12.2011

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Prof. Dr. med. Barbara Wilhelm, Manager