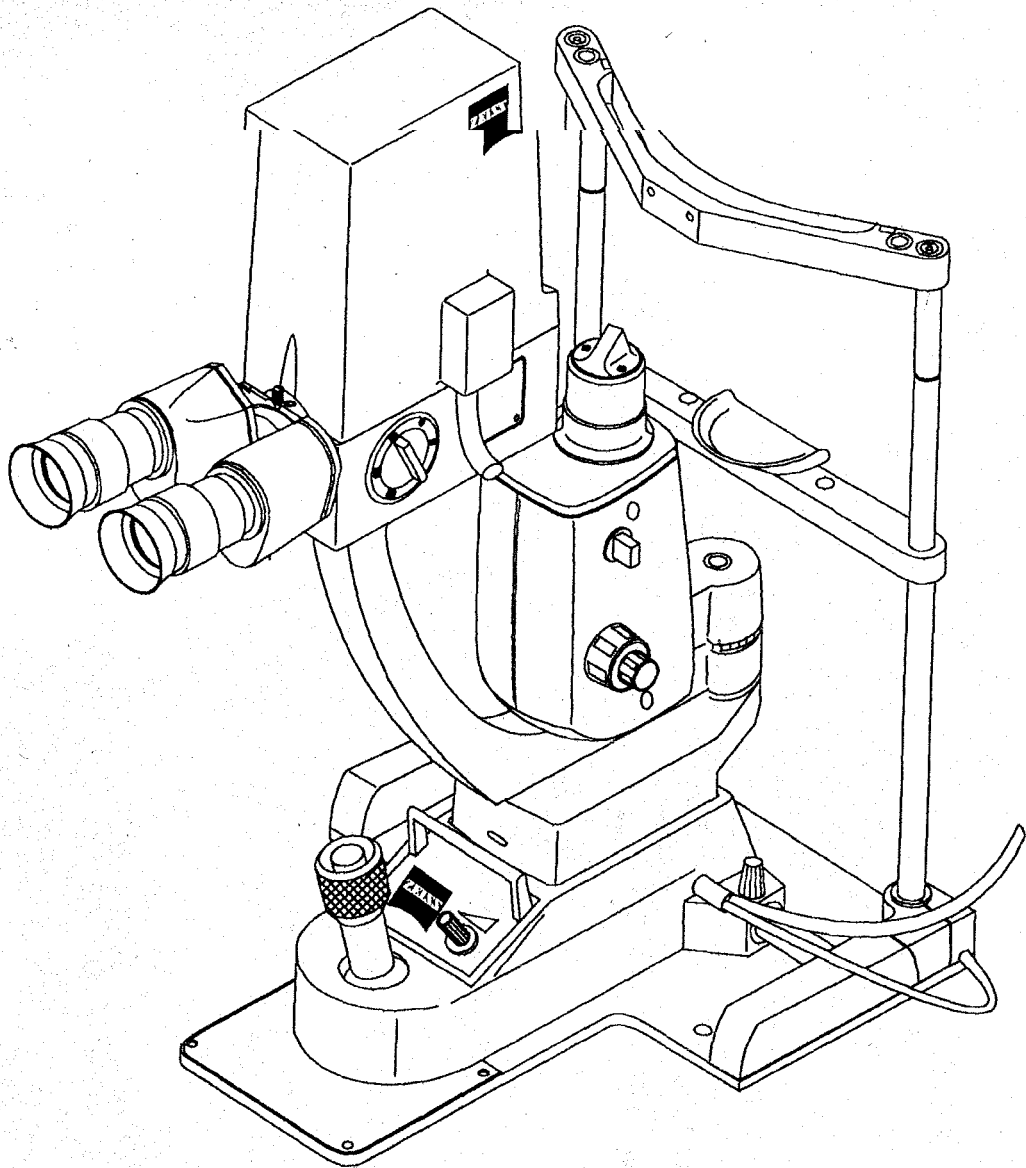


# VISULAS YAG II



User's Manual



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The instrument satisfies the essential safety requirements laid down in EMC regulations 89/336/EEC, 92/31/EEC and 93/68/EEC. It meets the EMC requirements on medical devices compliant to EN 60601-1-2: 1993.



The instrument complies with the Class A limits for radio noise emissions set out in EN 55011: 1991 (clinical environments). Modifications of the instrument not authorised by us will void this declaration.

## Safety precautions

---

This instrument has been developed and tested in accordance with Carl Zeiss safety standards and with national and international regulations. A high degree of instrument safety is thus ensured.

It is recommended in these regulations that the manufacturer explicitly informs the user about the safety aspects of operating the instrument. This chapter contains a summary of the most important precautions to be observed.

Further safety notes are also contained in other parts of this user's manual. These notes are introduced by **Caution** or **Warning** and marked by corresponding pictograms. Please pay special attention to these safety notes.



This symbol means:  
Danger for the instrument.



This symbol means:  
Danger for the user.



### **Caution:**

Correct operation of the instrument is imperative for its safe function. Therefore, please read these operating instructions thoroughly before using the instrument.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Please also observe the instructions given in the user's manuals of the other equipment used with this instrument.

You may obtain further information from our service organisation or authorised representatives.

## Regulations and standards

- This instrument was developed in accordance with the following regulations:

- VDE
- IEC
- UL
- CSA

Manufacture, testing, installation, maintenance and repair of the instrument are subject to relevant German and international regulations (Good Manufacturing Practice).

- The instrument complies with the following standards:  
EN 60601-1 (3/96),  
EN 60601-2-22 (8/93) and  
EN 60825-1 (7/94).
- In accordance with these standards, this instrument is equipped with a beam shutter unit, an energy display, a key switch, an interlock device and all labels and warning signs required.
- Please observe all relevant accident prevention regulations.
- In some countries (e.g. in USA) national regulations specify that this instrument may only be used under supervision of a medical doctor.
- This instrument is classified as a Class 4 laser device. Please observe the safety regulations which apply for this laser classification.

## MedGV regulations

The German medical instrument regulations MedGV require that the customer is supplied with the following information:

- This instrument is a Class 1 medical instrument as defined by MedGV.
- The instrument has been approved in Germany as required by MedGV.
- The type approval number is: 01/M-237/93.
- An instrument log book must be kept.
- Regular safety inspections to ensure proper functioning of this instrument must be performed.

Our service technician or other personnel authorised by us must inspect the instrument once every 12 months and record the results in the instrument log book. See also the chapter *Safety inspections* in this manual.

## Notes on installation and usage

- Do not operate the equipment contained in the delivery package in:
  - explosion-risk areas,
  - the presence of volatile anaesthetics or flammable solvents such as alcohol, benzene or similar chemicals.
- Do not store or use this instrument in damp rooms. Do not expose the instrument to water splashes, dripping water or sprayed water.
- Refer modifications and repairs on this instrument and on instruments used with the VISULAS YAG II only to our service representative or other persons authorised by us.
- The manufacturer is not liable for damage caused by unauthorised persons tampering with the instrument; such tampering will also forfeit any rights to claim under warranty.
- Only use this instrument with peripheral units and accessory equipment delivered by Carl Zeiss.  
Only use other accessory equipment when an official inspection institution has certified that its usage will not impair the safety of the system. The customer or user is responsible for ensuring that this requirement is fulfilled.
- The instrument may be operated only by instructed and trained personnel. It is the responsibility of the owner/user to have operating personnel trained and instructed appropriately.
- At least once a year, all persons who work in the laser hazard area must undergo instruction concerning laser safety regulations and safety measures as well as operation of the equipment. Keep a written record of this instruction and include a list of all the participants.
- Always keep the user's manuals at hand.
- Never look at the sun through the binocular tube or eyepieces.
- Do not pull at any cable connections.

## Requirements for operation of the instrument

Our service representative will install the instrument. Please make sure that the following requirements for operation remain fulfilled in the future.

- All mechanical connections detailed in this user's manual which are relevant to safety are properly connected and screw connections tightened.
- The voltage at the voltage selector on the instrument corresponds with the rated voltage of the line supply on site.
- The instrument is plugged into a power outlet which has a properly connected protective earth connection.
- The power cord being used is the one intended for use with this instrument.
- All cables and plugs are in perfect working condition.

## Important each time before turning on the instrument

- Make sure all operation requirements listed above are fulfilled.
- Pay special attention to warning symbols on the instrument (triangular warning signs with exclamation marks), labels and any parts such as screws or surfaces painted red (—> Fig. 1).
- Do not cover any ventilation grids or slits.
- Make sure the control cable and the power cable are properly plugged in.
- Switch off the aiming beam when the instrument is not in use.

## Important when using the instrument

- Take care to focus the aiming beam on the tissue as exactly as possible.
- Always apply the lowest energy possible to achieve the surgical effect.

### Caution:

Do not use the VISULAS YAG II when a glass intraocular lens has been implanted in the patient's eye. The Nd:YAG laser beam can destroy a glass lens.



## Important when you are finished using the instrument

- Always use the key switch of the instrument to turn it off.
- Be sure to turn off the key switch when the instrument is not in use.

## Moving the unit

- When moving the unit, do not jar or jolt it.



## Notes on laser safety

### Safety precautions for the laser hazard area

The VISULAS YAG II is a class 4 laser device. For this reason, the customer or institution operating this instrument must take precautions to prevent any possible injuries or damage. Please observe applicable national and international regulations.

The following is a list of some of the important points to be observed:

- The laser hazard area is the area in which there is a possibility of exceeding the allowed limits of laser irradiation. This includes the area in which the laser beam might unintentionally be deflected by a reflecting surface.
- Keep the laser hazard area as small as possible. This can be done by using suitable screens and by controlling access. Limit the number of persons in the laser hazard area to as few as possible.
- Post warning signs prominently at the entrance of the laser hazard area.
- Install a warning light to indicate that the laser is in operation.
- Clearly protect and mark the laser hazard area during laser operation. A remote interlock contact enables the laser to be switched off automatically if the laser hazard area is entered during operation. Other safety precautions should be clarified with local authorities or with your laser safety officer.
- All objects within the laser hazard area, including the floor, should have diffusely reflecting surfaces or be covered with diffusely reflecting material.
- Except for the patient, all persons within the laser hazard area must have undergone the appropriate instruction. These persons must wear appropriate laser safety goggles when the laser is in operation.
- The treating physician is protected by a physician's safety filter when working with the slit lamp.

## Safety officer

### Safety officer

The customer or institution operating the instrument and the safety officer are responsible for implementing all safety precautions to protect the patient, the attending physician and any persons present during laser treatment. Observe the relevant national regulations.

The responsibilities of the safety officer, who is appointed in writing by the customer or the institution operating the laser, include:

- realisation of all safety precautions
- instruction of all persons working with the laser in safety precautions and correct operation of the instrument
- marking of the laser hazard area
- checking the warning signs and devices
- correct therapeutic application of the instrument
- safekeeping of the key for the key switch
- safekeeping of the laser instrument
- proper re-connection of the instrument after relocation
- the entries in the instrument log book

## Protective eyewear

- All persons present in the laser hazard area during laser operation must wear protective eyewear.

Exception: The physician performing the therapy is protected by the physician's safety filter incorporated in the optical system of the slit lamp.

- Protective eyewear is absolutely necessary when the VISULAS YAG II is in use.

The protective eyewear we offer have been adapted to the special requirements of the VISULAS YAG II.

We recommend the following protective goggles:

Safety eyeglasses with side protection    30 68 81-9010

Safety goggles    30 68 81-9020

Protective eyewear with diopter correction are available from opticians. The safety goggles can be worn over normal corrective spectacles.

## Safety precautions

---

### Explosion and fire hazards

- Do not use the laser together with flammable anaesthetics.
- Keep materials which might explode away from the laser hazard area. Easily flammable materials can start fires.
- An Nd:YAG laser beam can set fire to many non-metallic materials such as explosive or flammable gases or liquids, including some of the solutions used in preparation for surgical procedures.
- Flammable drapes, surgical gowns, gauze and other ignitable materials must be kept out of the beam path. We recommend using non-flammable materials and instruments and wearing gowns and clothing which do not easily catch fire. A fire extinguisher should be kept in the vicinity of the laser instrument.

### Dangers caused by direct irradiation and reflection

- The instrument emits invisible laser radiation which is dangerous for the human eye and skin.
- Strictly avoid irradiation of the eye or skin by direct or scattered radiation. Metal and other surfaces reflect laser rays!
- All persons present in the laser hazard area must therefore wear protective goggles as a precaution against unintentional direct or reflected radiation!
- Remove or cover any shiny, reflecting objects within the laser hazard area.
- Take safety precautions if noxious gases, dust and vapours, secondary radiation or explosive gas mixtures may result from laser irradiation on any materials within the laser hazard area.
- In the optical path of the laser beam, only use instruments which have a shape or a type of surface which will prevent dangerous reflections.

### System malfunction

- If troubles occur during testing or operation of the laser system that cannot be remedied following the instructions given in section *Maintenance, miscellaneous*, shut down the instrument and attach a sign which clearly states the instrument is out of order.

## Safety devices of the instrument

Safety device	Effect
Key switch	Unauthorised persons must be prevented from turning on the laser of the VISULAS YAG II. Because of this, the instrument is equipped with a key switch. The key must be removed when the instrument is not in use.
Remote interlock	The possibility of triggering the laser can be made dependent on whether an external contact is open or closed, e.g. on a door. Our service representative will be of assistance if you wish connect the laser to a remote interlock. If the laser is not connected to a remote interlock, a shorting plug which bridges the pins must be inserted in the interlock socket. The instrument is delivered with the shorting plug inserted.
Energy monitor of surgical beam	Laser triggering is automatically blocked when the metered energy is out of a pre-defined range.
Safety monitor in control unit	The electronics of the control unit monitor various functions and values. If a certain value is outside its allowed range, the system blocks laser triggering.
LASER STOP button	The LASER STOP button is used in the event of unforeseeable dangerous situations. When pressed, the system goes into STANDBY and all of the functions on the control unit are rendered inoperable. Press the LASER STOP button again to continue.
Laser warning lamp	This lamp lights in READY mode and in STANDBY mode, when the aiming beam is on.
Test shots system	When the unit is turned on, in addition to the safety test of the system, a series of internal test shots is made for calibrating the energy display. Test shots are also made automatically when the system is switched to READY mode if it has been in STANDBY for one hour or longer. The user can also start a series of test shots by pressing the TEST SHOTS key. We recommend doing this regularly, e.g. when no shots have been released for a longer period of time (30 minutes or longer).

## Warning labels and notes



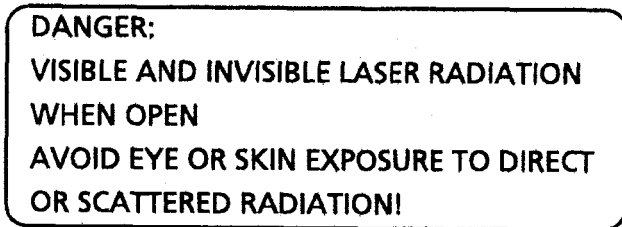
### Caution:

Observe all warning labels and notes!

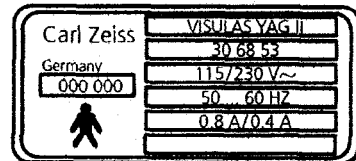
Fig. 1 shows the labels used.

Fig. 2 shows where the labels are located on the instrument.

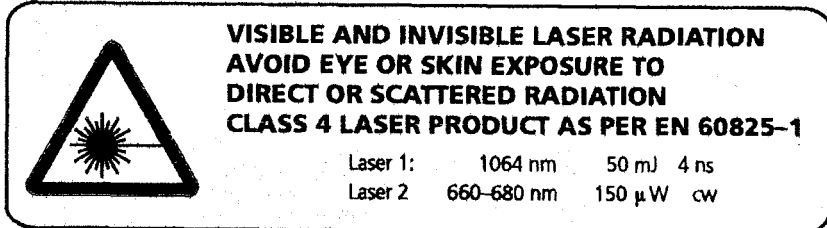
Position 1



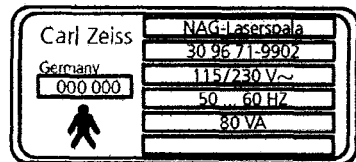
Position 2



Position 3



Position 4



Position 5



Fig. 1 Warning labels and notes

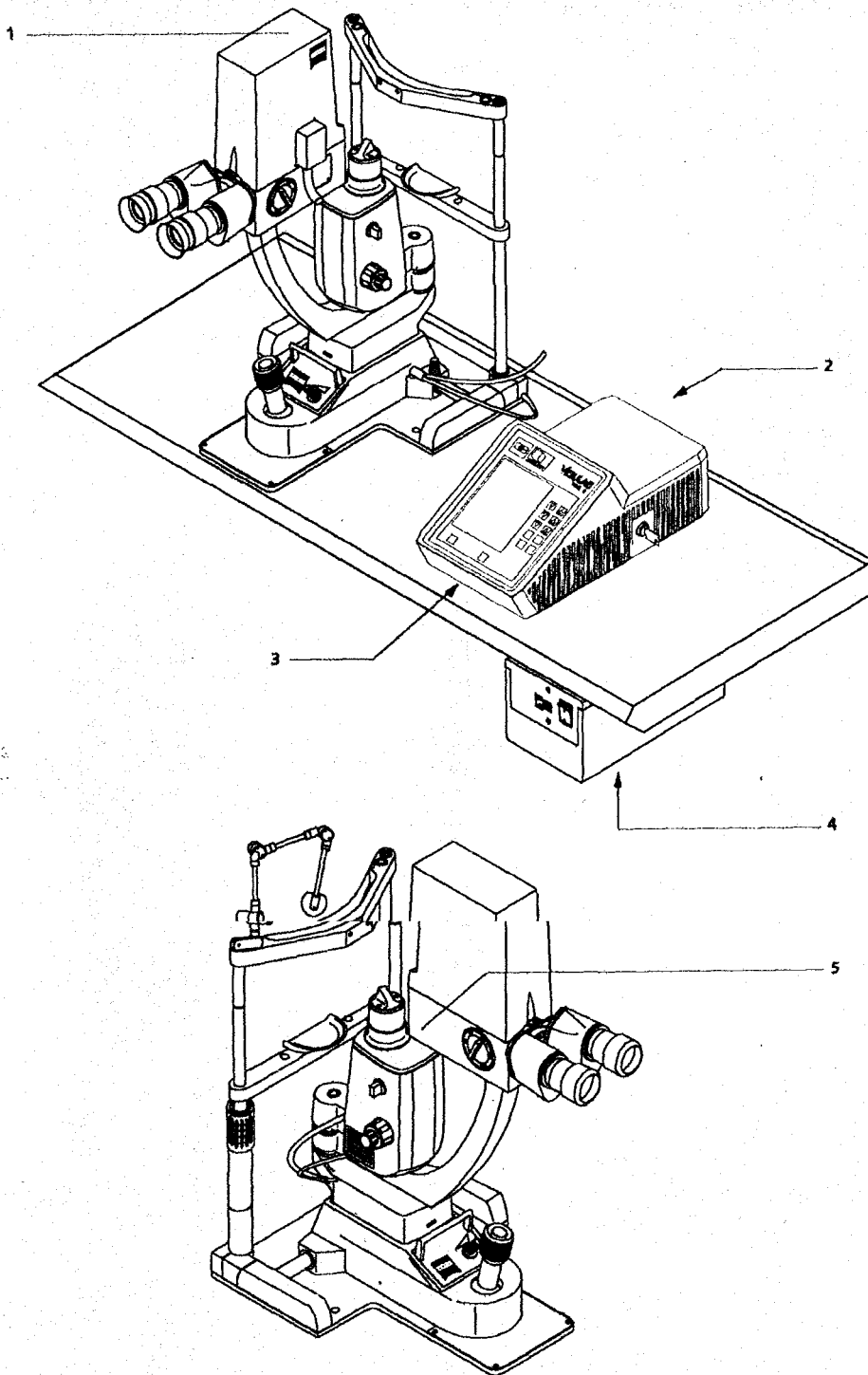


Fig. 2. Position of warning labels on the instrument

## General

### Application

The VISULAS YAG II is an ophthalmic therapy unit based on photodisruption. Applications for this instrument include posterior capsulotomies and pupillary membranectomies. Physicians should review available literature for use of an Nd:YAG laser in these and any additional procedures.



### Caution:

The VISULAS YAG II should be operated only by physicians who have adequate knowledge in the medical application of this device, including knowledge of treatment parameters, tissue effects, potential side effects, etc.

### Contraindications

Do not use the VISULAS YAG II when a glass intraocular lens has been implanted in the patient's eye. The Nd:YAG laser beam can destroy a glass lens.

### Potential complications

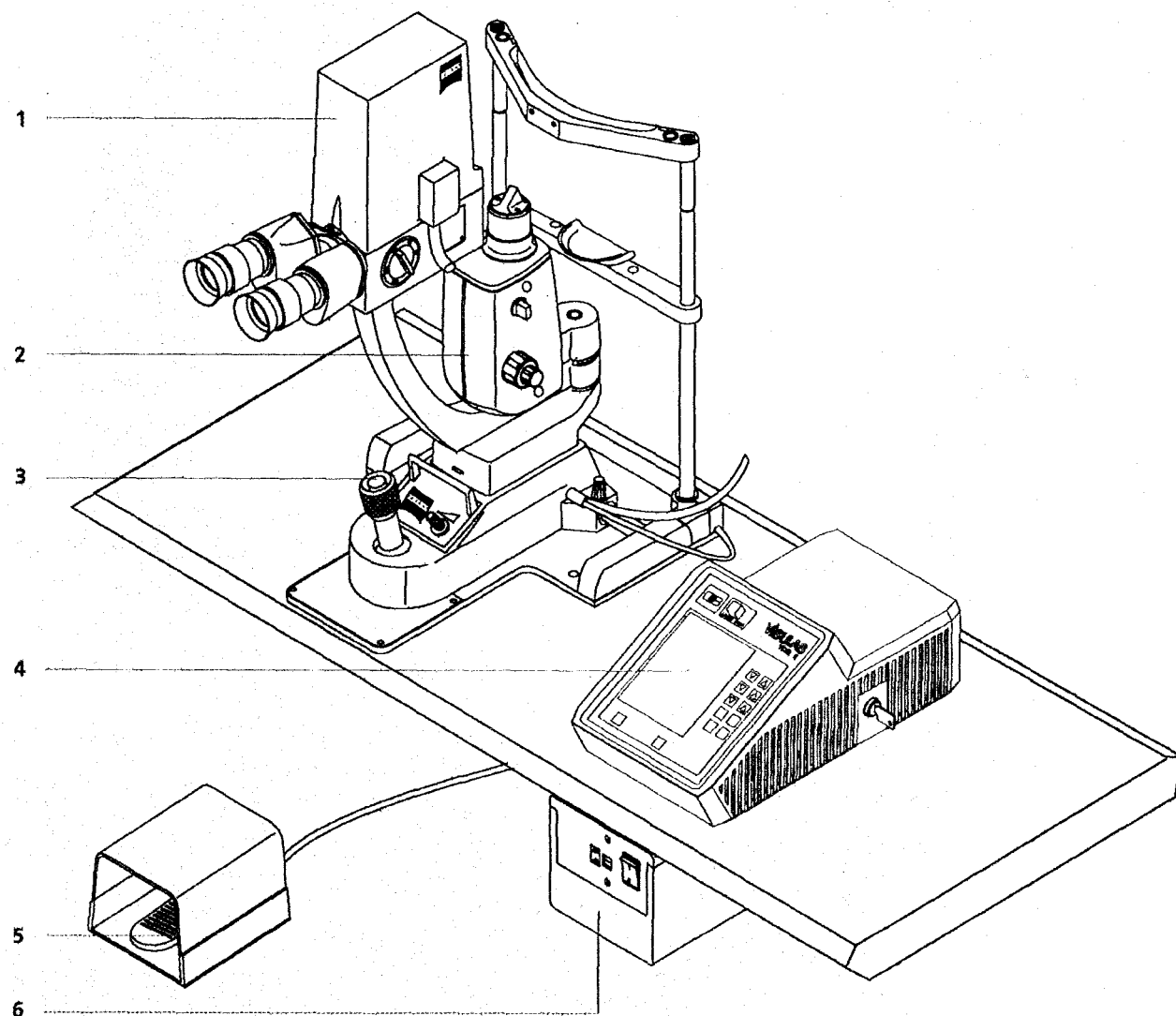
Cystoid macular edema and retinal detachment have been reported following Nd:YAG laser capsulotomy. The incidence is not known, but is estimated to be less than 1% each.

## Instrument components

The components of the VISULAS YAG II are shown in Fig. 3. The detailed description of these components begins on page 18.

The slit lamp and the control unit may be placed on any table of suitable height having a level table top. The slit lamp must always be mounted to the table top through mounting holes (7, Fig. 12, p. 27). The power supply for the slit lamp should also be mounted to this table.

The laser may either be triggered through foot switch (5) or hand release button (3). The power supply unit for the laser slit lamp contains a selector switch (→ Fig. 13, page 28).

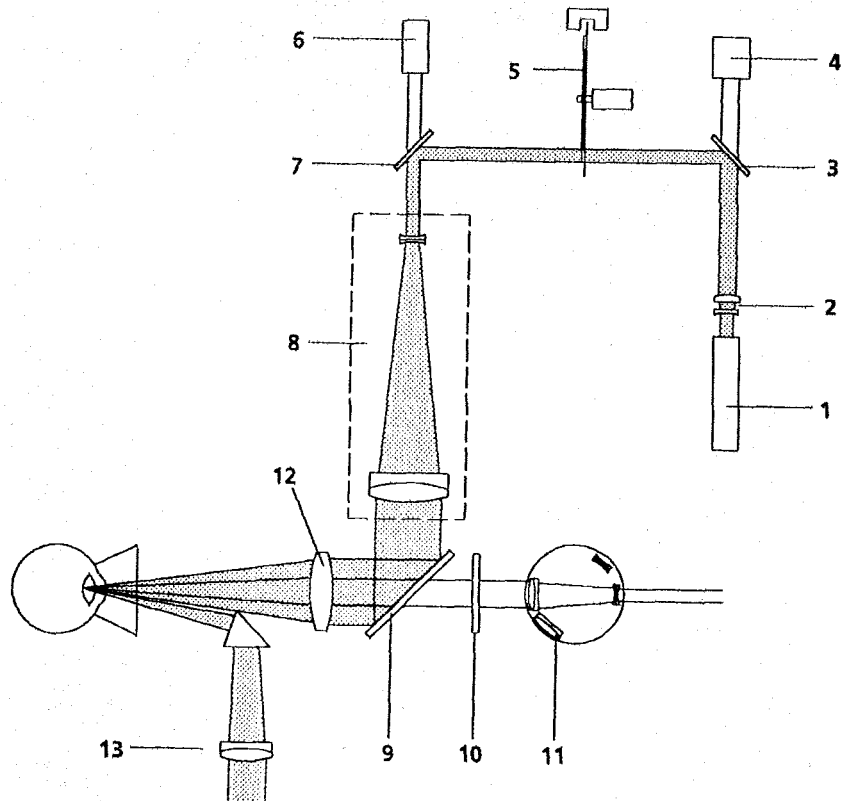


- |                                     |   |
|-------------------------------------|---|
| 1 VISULAS YAG II laser head         | 4 Control unit                          |
| 2 Laser slit lamp                   | 5 Foot switch                           |
| 3 Joystick with hand release button | 6 Power supply unit for laser slit lamp |

Fig. 3 Instrument components



## Optical system



- 1 Nd:YAG laser
- 2 Focus shift optics (→ Fig. 5, page 17)
- 3 Partially transmitting mirror for energy meter
- 4 Power meter and pulse counter
- 5 Attenuation filter wheel and position encoder
- 6 4-point aiming beam diode laser
- 7 Coupling mirror for aiming beam
- 8 Beam expanding system
- 9 Coupling mirror for coupling the laser beam into the observation path
- 10 Physician's safety filter
- 11 Galilean magnification changer
- 12 Slit lamp objective
- 13 Slit illuminator

Fig. 4 Optical diagram

### Principle of Nd:YAG laser treatment

A Q-switched Nd:YAG laser generates an extremely strong and very short light pulse causing ionisation of the material in the focus of the laser beam. This results in a plasma, i.e. a gaseous mixture of neutral atoms, positive ions, electrons and photons. A small flash is visible. This phenomenon is referred to as "optical breakdown". The plasma expands at a great speed in the direction of the laser source, forming a so-called "cavitation bubble" in the aqueous humour. Subsequently, the cavitation bubble implodes creating shock waves great enough to destroy tissue. A cracking sound can be heard.

Because the plasma and the cavitation bubble expand in the direction of the laser source, the VISULAS YAG II is equipped with special optics which shift the focus of the surgical beam approx. 150  $\mu\text{m}$  towards the fundus of the patient's eye. This ensures that in treating secondary cataracts the intraocular lens is not directly affected by the plasma.

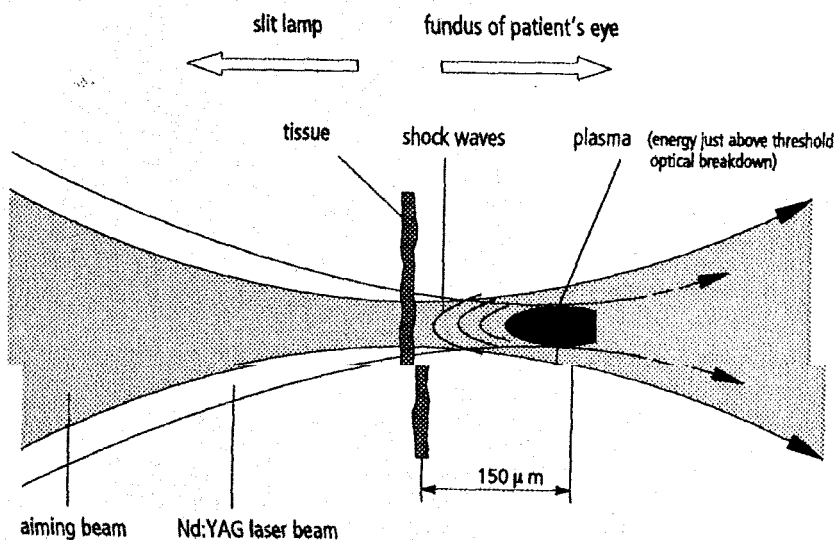
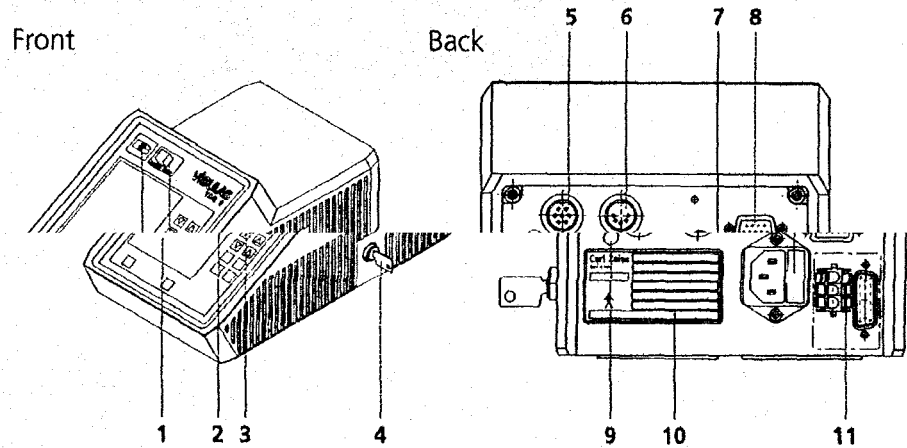


Fig. 5 Principle of photodisruption with the Nd:YAG laser

## Controls, displays, connections

## Control unit



- 1 Display field and keys (—> Fig. 7, page 19)
- 2 Laser warning lamp  
This lamp lights in READY mode and in STANDBY mode, when the aiming beam is on.
- 3 LASER STOP button  
When pressed, the system goes into STANDBY and all of the functions on the control unit are locked. Press the LASER STOP button again to continue.
- 4 Key switch
- 5 Connector for cable from power supply unit for the laser slit lamp.
- 6 Connector for remote interlock  
If the laser is not connected to a remote interlock, a shorting plug which bridges the pins must be inserted in the interlock connector. The instrument is delivered with the shorting plug inserted.
- 7 Socket for power cord with integrated fuses
- 8 Serial port for service purposes.
- 9 Line voltage indication window  
The displayed voltage must correspond to the voltage rating of the line supply.
- 10 Instrument rating plate showing the electrical line supply requirements.
- 11 Socket for control cable from laser head

Fig. 6 Control unit

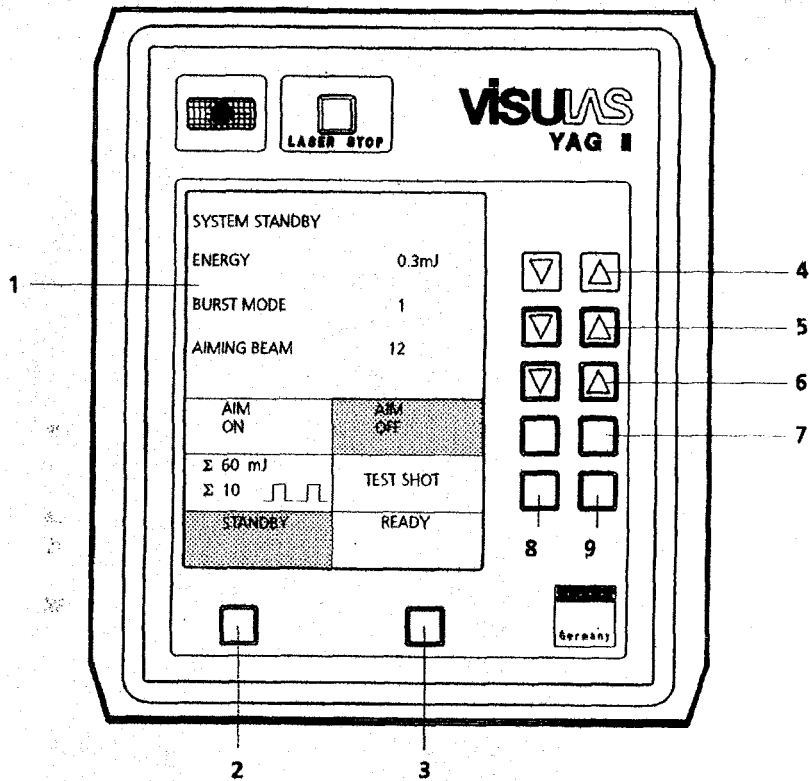
## Display field and keys

(Fig. 7)

This panel contains an illuminated LCD screen and keys for controlling the instrument functions.

If a technical error occurs, a corresponding error message will be displayed.

(→ Troubleshooting tables, p. 36).



- |                   |  |
|-------------------|--|
| 1 Display         | 6 AIMING BEAM keys                                   |
| 2 STANDBY key     | 7 AIM ON/OFF   |
| 3 READY key       | 8 Reset key for accumulated energy and pulse counter |
| 4 ENERGY keys     | 9 TEST SHOTS key                                     |
| 5 BURST MODE keys |  |

Fig. 7 Display field with control keys

## Operating modes

### Power-up mode

- This mode is started with the key switch.
- The system test and internal test shots for calibrating the energy display run automatically.
- If no error is detected, the system will go into STANDBY after approx. 10 s.

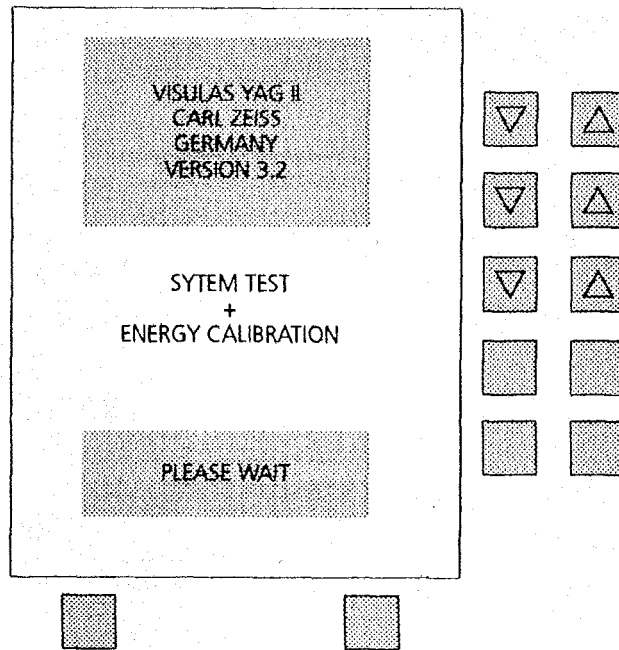


Fig. 8 Power-up mode

## STANDBY mode

- The system automatically goes into STANDBY after the system test. The STANDBY field in the display has a dark background.
- The therapy laser cannot be triggered.
- The aiming beam can be turned on or off using keys (7). The laser warning lamp lights when the aiming beam is turned on.
- All of the keys are active and the parameters of the laser system can be changed.
- The READY mode can be activated using key (3).

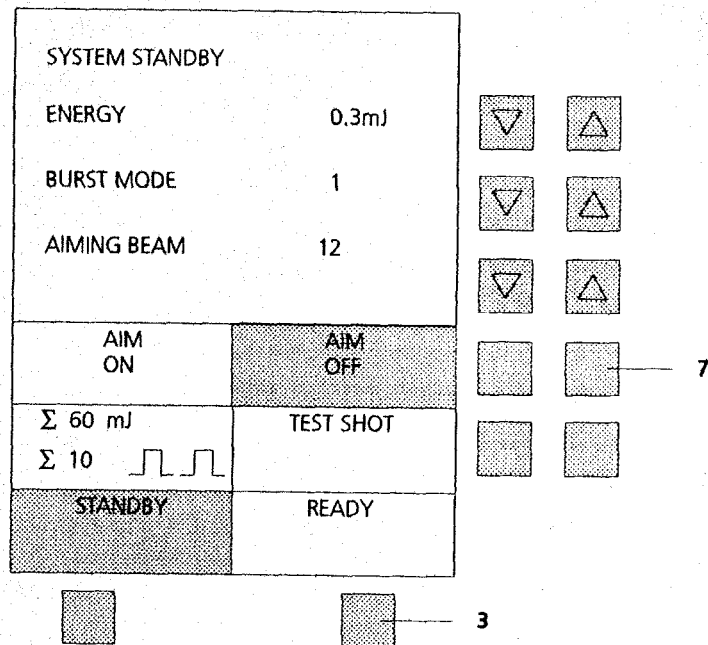


Fig. 9 STANDBY mode

## Description of instrument

### READY mode

- To activate the READY mode, press key (3) in STANDBY.
- The laser warning lamp lights.



### Warning:

After 2 seconds the therapy laser is active. Pressing the foot switch or the hand release button will trigger a laser pulse.

- The aiming beam is automatically on.
- To return to STANDBY mode, press key (2).
- The system automatically switches back to STANDBY after five minutes if no shots are released.

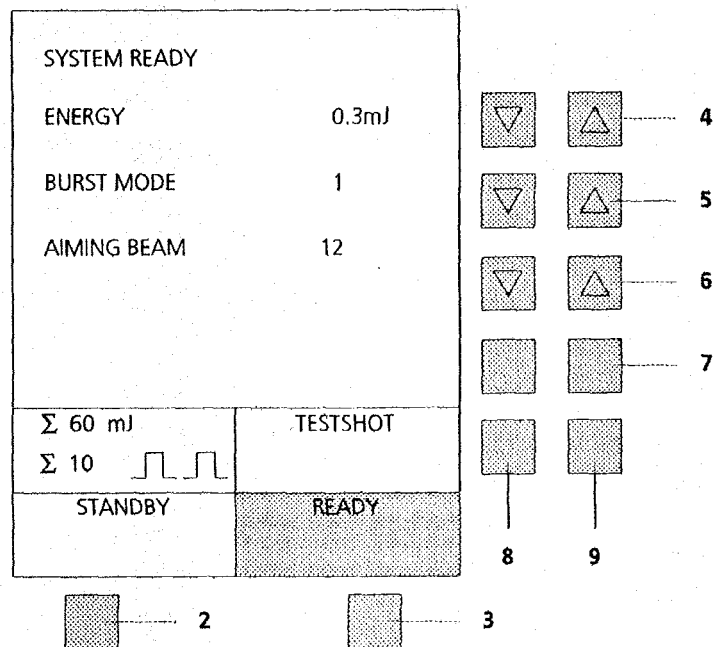


Fig. 10 READY mode

## Key functions in STANDBY and READY modes

(Fig. 7, Fig. 9, Fig. 10)

### 2 STANDBY key

### 3 READY key

#### Warning:

In READY mode the therapy laser is active. Operating the foot switch or the hand release button will trigger a laser pulse.



### 4 ENERGY keys

These two keys increase ( $\Delta$ ) or decrease ( $\nabla$ ) the energy level. You can choose among 9 energy levels. The lowest level corresponds to approx. 0.3 mJ and the highest to approx. 10 mJ.

The energy reading is the average of the last five shots calculated for the current energy level. The output energy of the Nd:YAG laser tube may drift to a small degree. Therefore, check the energy reading regularly.

### 5 BURST MODE keys

The burst mode is selected by pressing the  $\Delta$  or  $\nabla$  key. You can choose among three burst modes:

- 1 single shot
- 2 double shot
- 3 triple shot

Burst modes 2 and 3 should only be used in exceptional cases.

### 6 AIMING BEAM keys

These two keys increase ( $\Delta$ ) or decrease ( $\nabla$ ) the brightness setting of the aiming beam. You can choose among 20 brightness levels.

### 7 AIM ON/OFF keys

These keys turn the aiming beam on or off. They are not active in READY mode.

### 8 Reset key for accumulated energy and pulse counter

( $\Sigma$  mJ) and the pulse counter.

### 9 TEST SHOT key

Pressing this key starts a series of internal test shots to refresh the energy reading. A few safety checks are also made. Test shots should also be made when the laser has been in STANDBY and no shots have been made for a longer period of time.



**Laser slit lamp**

(Fig. 11)

**1 Prism head****2 Filter selector**

*White index line pointing upward:* Full aperture combined with heat absorbing filter.

*White index line facing patient:* Blue filter for tonometry and fluorescence observation.

*White index line facing physician:* Red-free filter for contrast enhancement in fundus observation.

**3 Height control for chin rest****4 Slit width control****5 Slit length control**

Variable in steps: 1, 3, 5, 9, 14 mm

Special slit: 5.0 x 1.0 mm,  $\pm 45^\circ$ ,  $90^\circ$

**6 Cover of halogen lamp**

(For exchanging the lamp, see page 40.)

**7 Pupillary distance scale****8 Binocular tube****9 Rubber eyecups****10 Magnification changer** (The diameter of the field of view depends on magnification)

Magnification	Field of view
5x	42 mm
8x	26 mm
12x	16 mm
20x	10 mm
30x	6 mm

**11 Fastening screw**

This screw fastens the binocular tube or another component to the microscope body.

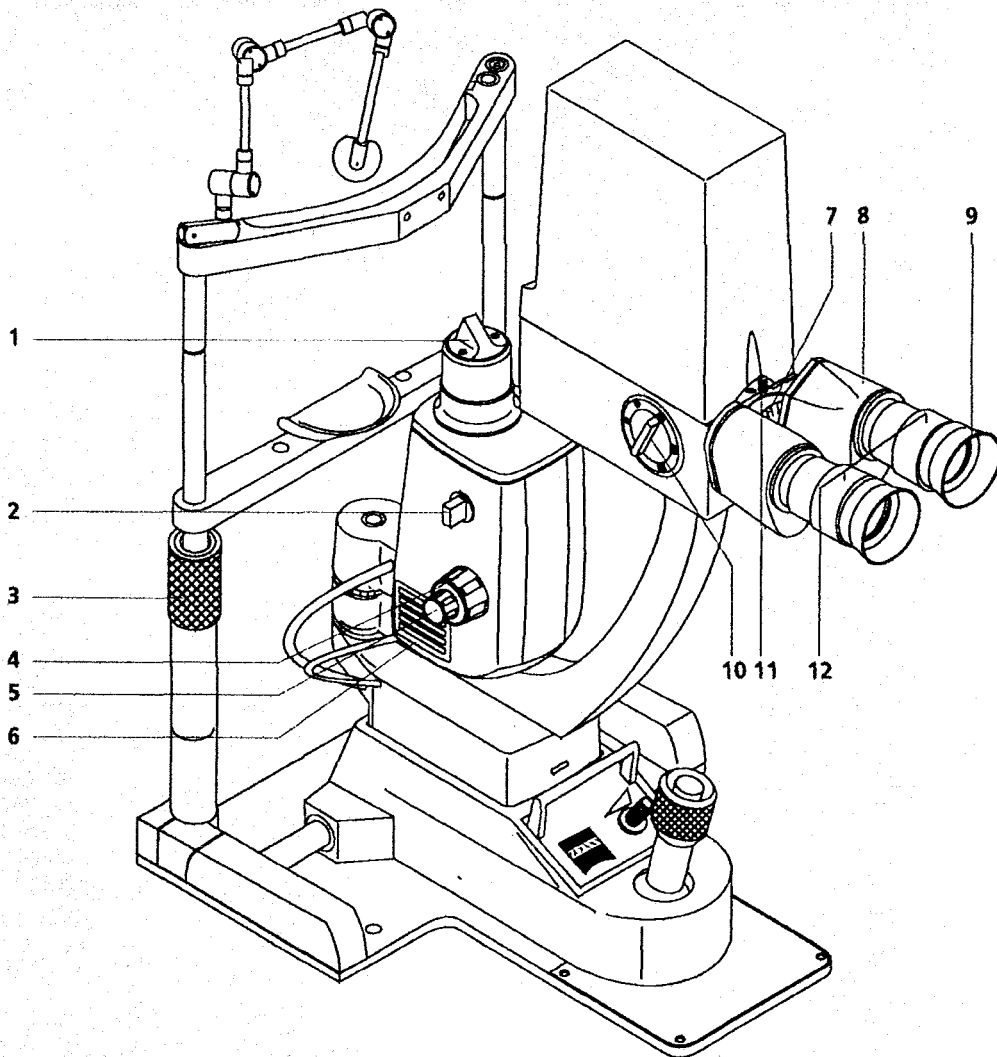
**Caution:**

Screw (11) must be tightened firmly. Always check it before using the instrument.

**12 Eyepieces**

Standard equipment includes 12.5x eyepieces. For measurement and as focusing aid, you may insert one eyepiece with a reticle.

## Laser slit lamp



- 1 Prism head
- 2 Filter selector
- 3 Height control for chin rest
- 4 Slit width control
- 5 Slit length control
- 6 Cover for halogen lamp

- 7 Pupillary distance scale
- 8 Binocular tube
- 9 Rubber eyecups
- 10 Magnification changer
- 11 Fastening screw for binocular tube
- 12 Eyepieces

Fig. 11 Slit lamp

**Head rest**

(Fig. 12)

**1 Socket connection for fixation lamp**

The forehead rest contains two sockets, one on the right and one on the left, for mounting a fixation lamp.

**Caution:**

Only use a red LED (catalogue no.30 13 50-9052) in the fixation lamp (optional) of the laser slit lamp. If a normal incandescent bulb is used, the fixation lamp can overheat and be destroyed.

**2 Patient's forehead band****3 Index line for medium eye level**

Adjust the height of chin rest (4) using control so that the patient's eye is level with the index line.

**4 Patient's chin rest****Instrument base**

(Fig. 12)

**5 Tension control for instrument base****6 Connection cable for laser slit lamp**

The connector of this cable is plugged into socket (7, Fig. 13) of the slit lamp power supply.

**7 Mounting holes**

Provided for screwing the instrument base to the support by means of the corresponding screws.

**8 Base lock**

Handle pulled forward:	base locked
Handle pushed back:	base unlocked

**9 Brightness control of slit illuminator****10 Joystick****11 Hand release button**

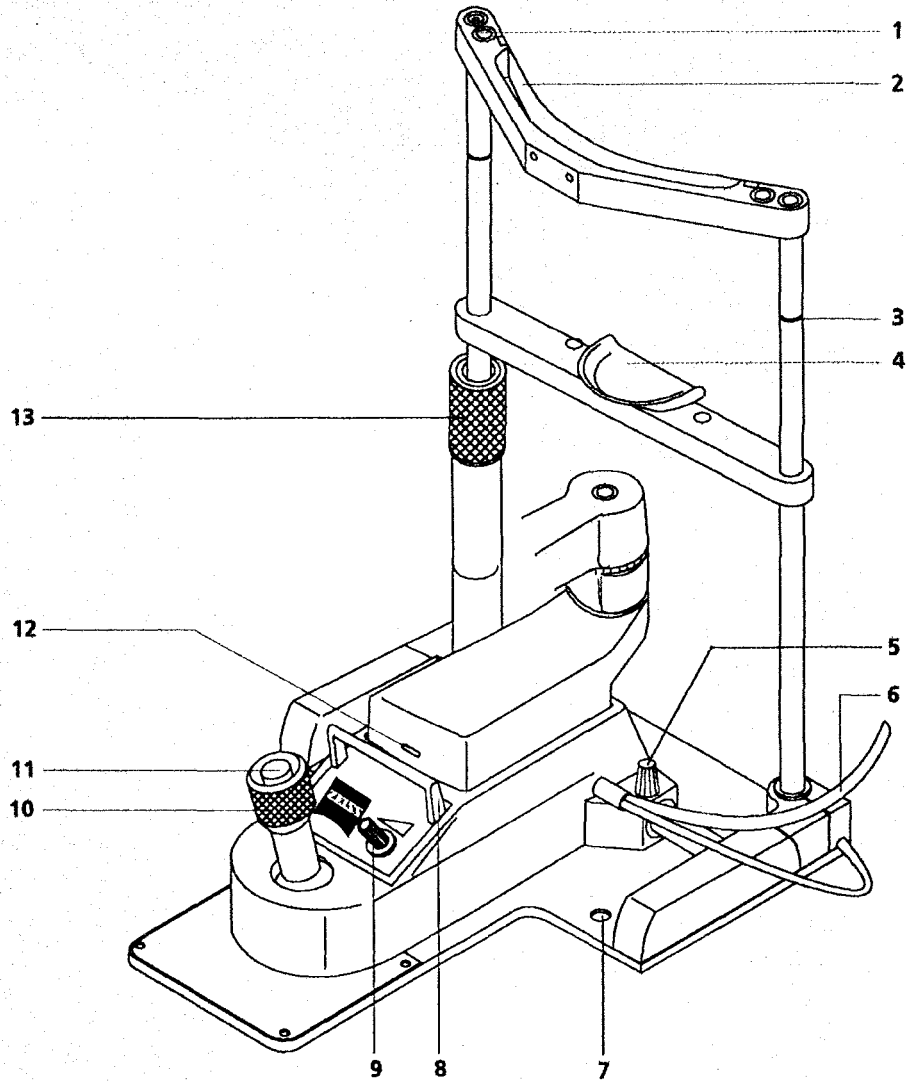
You can trigger the laser either with the foot switch or the hand release button. The selector for release by hand or foot switch is located on the power supply unit for the laser slit lamp. (→ p. 28).

**12 Index mark for mid-position**

This index mark indicates the mid-position of the vertical motion range.

Turn the joystick handle for vertical adjustment.

**13 Height control for chin rest**



- |                                       |  |
|---------------------------------------|--|
| 1 Socket connection for fixation lamp | 8 Fast-action base lock                  |
| 2 Patient's forehead band             | 9 Brightness control of slit illuminator |
| 3 Index line for medium eye level     | 10 Joystick                              |
| 4 Patient's chin rest                 | 11 Hand release button                   |
| 5 Tension control for instrument base | 12 Index mark for mid-position           |
| 6 Connecting cable for slit lamp      | 13 Height control for chin rest          |
| 7 Mounting holes                      |  |

Fig. 12 Instrument base with head rest

### Power supply for laser slit lamp

You can mount the power supply unit by means of two support rails upside down underneath the table top of the asymmetric instrument table.

#### 1 Hand/foot switch release selector

You can trigger the laser either with the foot switch or the hand release button.

#### 2 Power switch

The switch lights when the unit is turned on.

#### 3 Line voltage selector

The voltage selected must correspond to the rating of the local mains.

#### 4 Connector for foot switch

#### 5 Socket for power cord with integrated fuses

Use only the power cord intended for use with the instrument.

The fuse ratings depend on the local line voltage.

(—> *Specifications, p. 45*).

Exchanging the fuses is described on page 39.

#### 6 Connection socket for cable to control unit.

#### 7 Connector for laser slit lamp

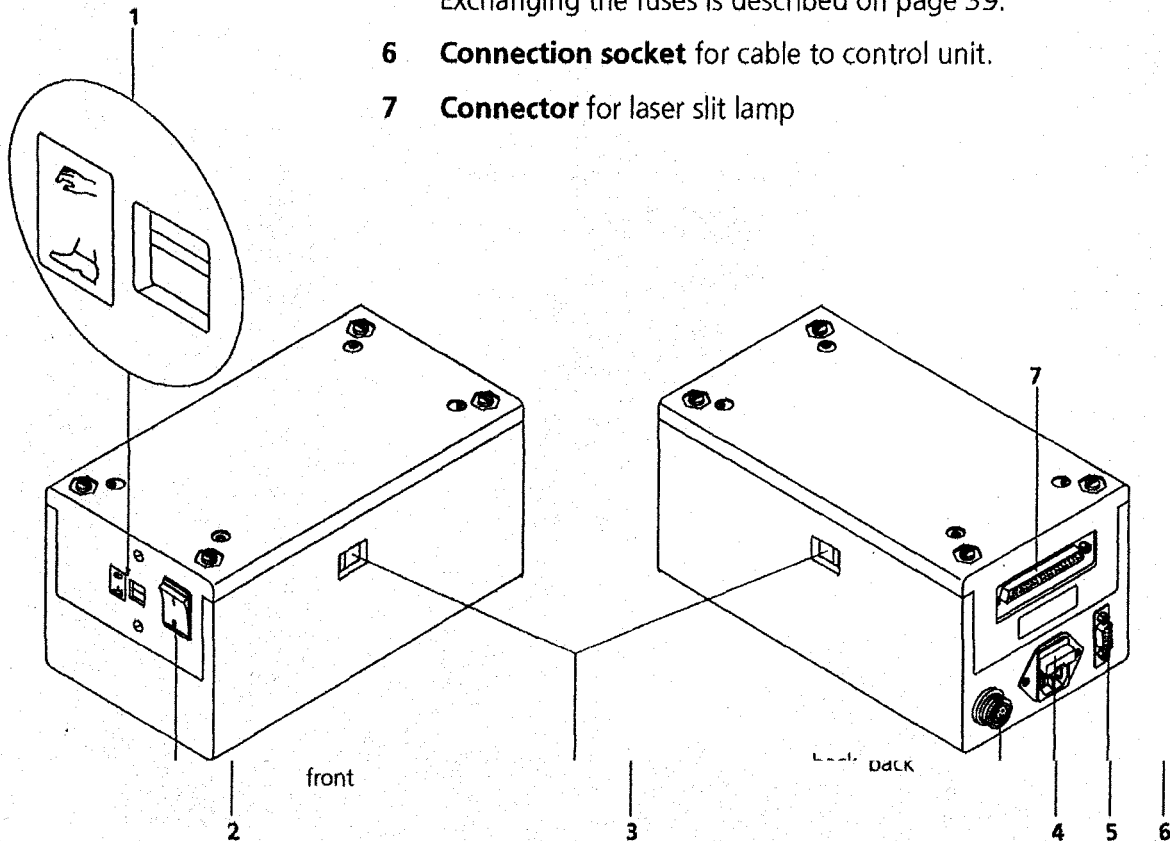


Fig. 13 Power supply unit for laser slit lamp

## Installation of the instrument

The instrument will be installed by a service technician employed with or authorised by us. On this occasion, the technician will instruct the operator in the use of the instrument. The following instructions only cover operations the user can perform after installation.

## Operation

### Binocular tube and eyepieces

- Insert the binocular tube (2) into the tube mount of the microscope body and tighten clamp screw (1).

 **Note:**

You may mount another component such as a beam splitter between the microscope body and the binocular tube. Secure this component in the same way using clamp screw (1).

- Push eyepieces (4) into the binocular tube and turn them until the index mark on the diopter scale is visible. Tighten knurled rings (3). The eyepiece with the reticle (optional) is to be used on the side of the leading eye of the operator.

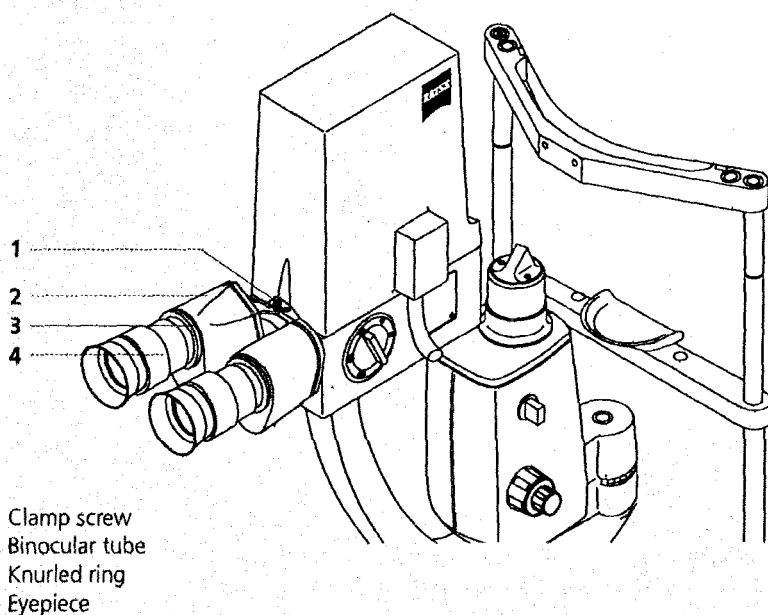


Fig. 14 Binocular tube and eyepieces

### Adjusting the slit lamp

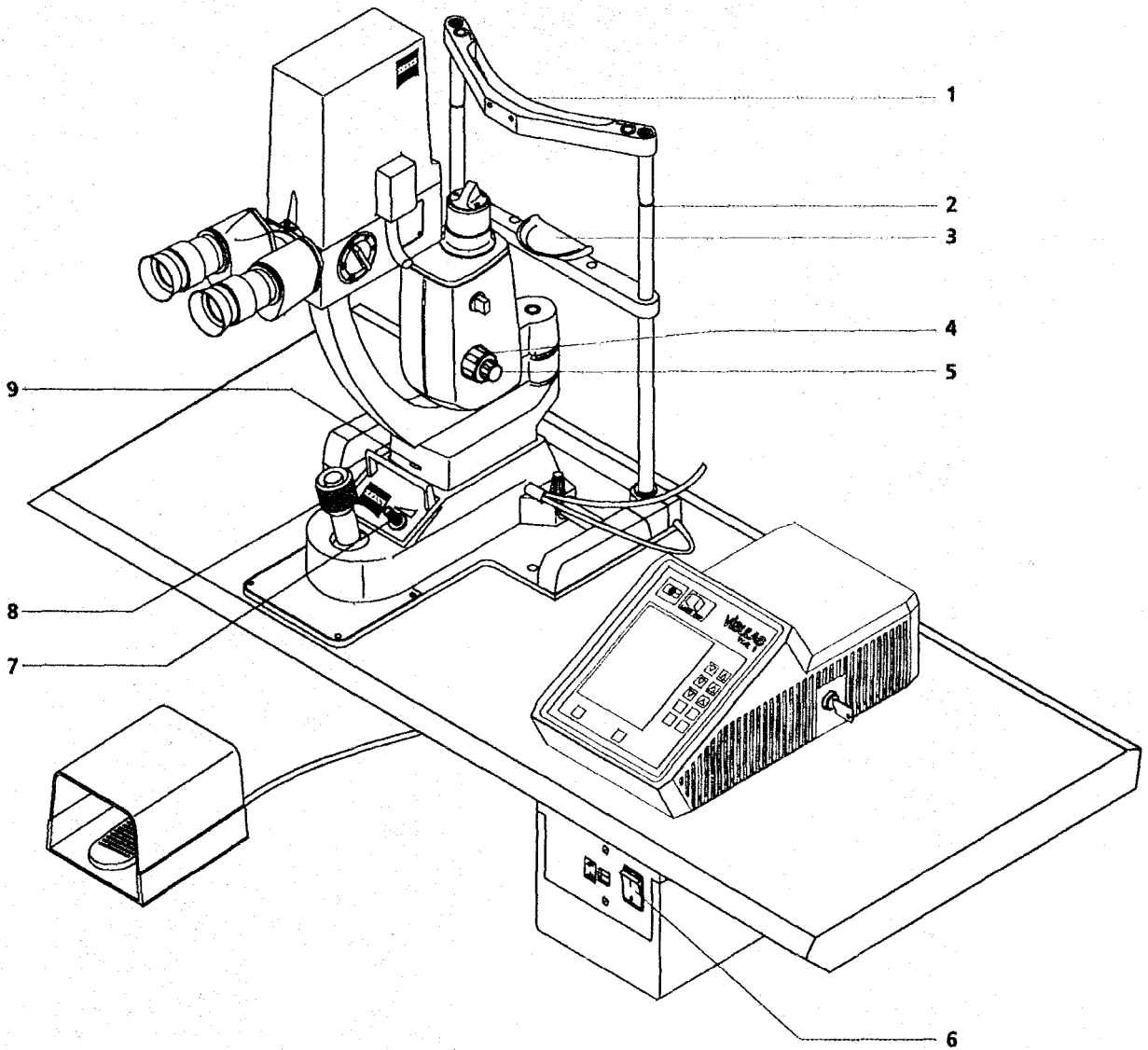


#### Caution:

If you use the VISULAS YAG II in combination with the Comb Slit Lamp 306771-9901, make sure to connect the foot switch to the power supply unit for the slit lamp. If you connect it directly to the control unit, the position monitor of the slit lamp is not operative.

Before treating a patient with the Nd:YAG laser, the physician should be fully familiar with the use of the slit lamp. The procedures listed in the following table refer to Fig. 15.

Adjustment	Procedure
Turning on the slit lamp	Actuate power switch (6).
Moving slit lamp to mid-position	Turn joystick until the red index mark (9) is level with the instrument base.
Adjusting brightness of slit image	Turn brightness control (7).
Adjusting the pupillary distance	Push eyepiece tubes together or pull them apart.
Adjusting the eyepieces	—> table on page 32.
Positioning the patient	Set patient's chair to optimum height and distance to the head rest.
	Position the patient's head so that his chin is in the chin rest (3) and his forehead presses against the forehead rest band (1).
	Set height of chin rest (3) so that the patient's eye is level with index line (2).
Positioning the slit lamp	Align the slit to the patient's eye by moving the slit lamp base and operating the joystick.
Adjusting the slit size	Use controls (4) and (5) to adjust length and width of the slit.





- |                       |                               |
|-----------------------|-------------------------------|
| 1 Forehead rest band  | 6 Power switch                |
| 2 Index line          | 7 Brightness control          |
| 3 Chin rest           | 8 Joystick                    |
| 4 Slit width control  | 9 Index mark for mid-position |
| 5 Slit length control |                               |

Fig. 15 Adjusting the slit lamp



## Adjusting the eyepieces

Operator		Required operations	
Basic adjustments for all operators		Adjust pupillary distance on binocular tube.	
		 Note: Please note that instrument myopia may occur (also with emmetropes). In this case, adjust the eyepieces as described under "Ametropes working without spectacles".	
Emmetropes		Set diopter setting ring to 0 D.	
Ametropes working with spectacles		Set diopter setting ring to 0 D.	
		Fold down the rubber eyecups.	
Ametropes working without spectacles			
	With known refractive power	Set diopter setting ring to the refractive power.	
	With unknown refractive power	Set both eyepieces to + 8 D.	
		Set 5x magnification.	
		Eye-piece without reticle	Eye-piece with reticle
		Remove binocular tube with eyepieces from microscope tube and using them like a pair of binoculars point them at a distant object*) 	Turn diopter setting ring slowly clockwise until the reticles appear sharply focused.
		Turn diopter setting ring slowly clockwise until the object appears sharply focused. If necessary, repeat this procedure three times and take the average of found readings. Adjust the second eyepiece in the same way.	Focus the corneal microscope on the object. Now, reticle and object should appear sharply focused at the same time.
		Mount tube with eyepieces to microscope body and tighten clamp screw firmly.	Adjust the second eyepiece until the object appears sharply focused. (Normally, only one eyepiece with reticle is used.)
		Set the desired working magnification.	

**Warning:**

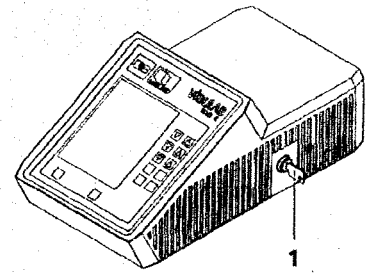
\*) Never point it at the sun!

**Note:**

If several physicians use the instrument, it is advisable to draw up a table with the individual refractive powers and keep it in a handy location near the instrument.

## Adjusting the laser (Fig. 16 and 17)

Operation	Execution
Turning on the laser system	Actuate key switch (1, Fig. 16) on control unit. The system test runs automatically for about 10 s. If the message "SYSTEM IS ACTIVE" appears on the display, the instrument is in STANDBY mode.
Selecting the parameters (Fig. 17).	
Turning on the aiming beam.	Press keys (7).
Setting aiming beam brightness	Use keys (6).
Setting pulse energy	Use keys (4). Always use the lowest possible energy to achieve the desired effect. If it should be necessary to increase the energy to more than 2.0 mJ without any obvious reasons, check if you hold the contact lens properly and the laser is focused correctly. (—> <i>Positioning the contact lens, Focusing</i> ).
Burst mode	Burst mode 1: Single pulse mode To be used for all applications unless there are special indications.  Burst mode 2 or 3: Multiple pulse mode To be used only in exceptional cases requiring extremely high energy.



1 Key switch

Fig. 16 Control unit

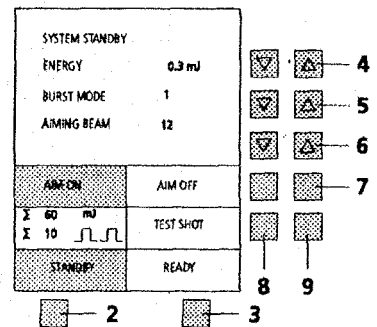


Fig. 17 STANDBY mode

## Positioning the contact lens

It is important that you only use contact lenses designed for use with an Nd:YAG laser. (—> *Accessories and spare parts, page 43*).



### Caution:

Always hold the contact lens perpendicularly to the laser beam the front surface of the contact lens. Holding the lens improperly will cause distortions in the laser focus, which may result in unwanted side effects.

## Focusing

Exact positioning of the laser focus is essential for successful treatment with an Nd:YAG laser. The more exactly the laser is focused, the less energy is required to achieve the desired effect thus considerably reducing the risk of unwanted side effects.

The optical system is designed so that the focus of the 4-point aiming beam coincides with the main photodisruptive effect of the optical breakdown (—> *Fig. 5, page 17*). For this reason it is essential that you focus the aiming beam exactly on the tissue to be treated.

- Using the joystick of the slit lamp, carefully focus the aiming beam so that the four spots merge to form one spot on the tissue to be treated. Find the point where the spot has the smallest possible diameter.

This principle is illustrated in Fig. 18.

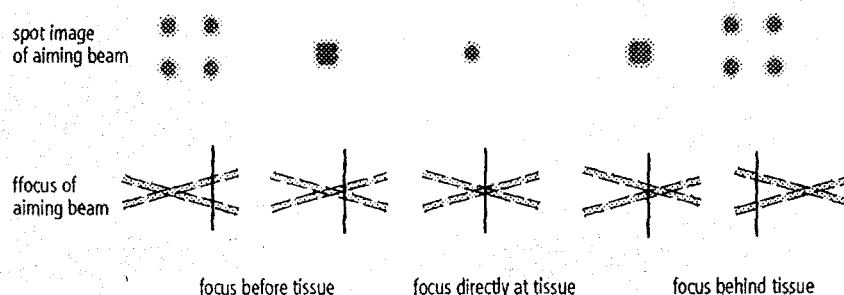


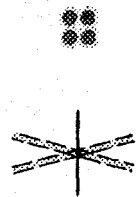
Fig. 18 Focusing the aiming beam



**Note:**

In some cases, the laser beam is distorted in the patient's eye, e.g. in the periphery or by astigmatism. In such cases it will be impossible to unite the four points in a single, clearly defined spot. This is not caused by a technical fault. The distortion is made visible by the four-point aiming beam system, which provides additional safety in assessing the required energy.

- Focus the aiming beam so that the four points are as close as possible (—> e.g. Fig. 19).  
In such a case, you may need to select a higher energy to achieve the desired effect as the surgical beam of the Nd:YAG laser will be distorted just as the aiming beam.
- If, before the next shot, you can see a clearly defined point again instead of the distorted image, you should reduce the energy again.



focus directly at tissue

Fig. 19 Distorted aiming beam

## Laser treatment

- Press key (3) to activate the READY mode. The foot switch or the hand release button is now operative.

**Caution:**

Only press the foot switch or the hand release button when the area of treatment is distinctly localised and Nd:YAG laser irradiation is desired!

- Re-check the operating parameters of the laser system. If necessary, correct the settings using keys (4), (5) and (6).
- Locate the area of treatment and focus carefully (—> *Focusing, page 34*).
- Actuate the foot switch or the hand release button to trigger a laser pulse.



**Note:**

Always switch to STANDBY using key (2) when not performing laser treatment.  
After treatment, always turn the instrument off using the key switch.

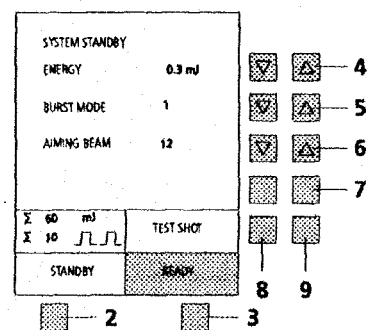


Fig. 20 Checking operating parameters

**Troubleshooting tables**

If a malfunction occurs when using the instrument, you can use the troubleshooting tables to help identify the cause of the problem. The failure can often be corrected by persons trained in using the instrument, except in those cases where "contact service technician" is expressly said.

If a failure occurs which cannot be corrected using the following troubleshooting tables, please contact our service representative. Attach a sign to the instrument which clearly states that it is out of order.

If there is a malfunction, a system message will appear on the display of the control unit. The system will also generate a beep.

## Error messages

Error code/message	Possible cause	Remedy
RELEASE ACTUATOR	– Foot switch or hand release button being pressed.	– Release foot switch or hand release button.
DOOR INTERLOCK ! CLOSE THE DOOR !	– Door to laser hazard area is open (interlock). – Shorting plug not plugged in connector (5, Fig. 6, p. 18).	– Close the door. – Plug in shorting plug.
TEMP. TOO HIGH PLEASE WAIT !	– Temperature in control unit too high. – Ventilation slots (vents on unit) are covered. – Ambient temperature is >35 °C.	– Wait for unit to cool down. The unit will beep when it is operative again. – Vents must not be covered. – Take care that ambient temperature drops below 35 °C.
HEAD TOO WARM PLEASE WAIT	– Laser head too warm.  – Ambient temperature is >35 °C.	– Wait for unit to cool down. The unit will beep when it is operative again. – Take care that ambient temperature drops below 35 °C.
F4_0 SERVICE ACTUATOR	– Foot switch or hand release button jammed or pressed during power up.	– Switch off the unit, release foot switch or hand release button or press several times. Then switch it on again.
F4_1 SERVICE ACTUATOR	– Foot switch or hand release button defective.	– Switch off the unit, release foot switch or hand release button or press several times. Then switch it on again.
F4_3 SERVICE ACTUATOR	– Foot switch not connected. – Foot switch or hand release button defective.	– Connect foot switch. – Switch off the unit, release foot switch or hand release button or press several times. Then switch it on again.
F4_4 SERVICE KEYPAD	– A key is jammed.	– Press all keys. Switch unit off and back on.

## Laser slit lamp

Error code/message	Possible cause	Remedy
No function at all	<ul style="list-style-type: none"> <li>– Power cord of control unit not connected.</li> <li>– Power supply unit not switched on.</li> <li>– Plug of connecting cable not properly connected to power supply unit.</li> </ul>	<ul style="list-style-type: none"> <li>– Connect power cord.</li> <li>– Switch on power supply unit (2, Fig. 13).</li> <li>– Plug the plug properly into connector (7, Fig. 13).</li> </ul>
No slit illumination available	<ul style="list-style-type: none"> <li>– Slit fully closed.</li> <li>– Halogen lamp defective</li> </ul>	<ul style="list-style-type: none"> <li>– Use control (4, Fig. 11) to adjust slit width.</li> <li>– Exchange halogen lamp. (—&gt; page 40).</li> </ul>
Poor slit illumination	<ul style="list-style-type: none"> <li>– Selected lamp voltage too low.</li> <li>– Halogen lamp not inserted properly.</li> <li>– Slit length not adjusted properly.</li> <li>– Slit width not adjusted properly.</li> <li>– Filter selector control not set correctly.</li> </ul>	<ul style="list-style-type: none"> <li>– Turn control (9, Fig. 12) to adjust the brightness as desired.</li> <li>– Insert halogen lamp properly. (—&gt; page 40).</li> <li>– Use control (5 Fig. 11) to adjust slit length.</li> <li>– Use control (4, Fig. 11) to adjust slit width.</li> <li>– Check position of filter selector control (white line should point upward).</li> </ul>
Difficulties when viewing through corneal microscope	<ul style="list-style-type: none"> <li>– Magnification of corneal microscope not adjusted properly.</li> <li>– Pupillary distance of binocular tube not adjusted properly.</li> <li>– Eyepieces not adjusted properly.</li> </ul>	<ul style="list-style-type: none"> <li>– Turn control of magnification changer (10, Fig. 11) to the desired magnification.</li> <li>– Adjust pupillary distance of binocular tube.</li> <li>– Adjust eyepieces (—&gt; page 32).</li> </ul>
Movement of instrument base too stiff	<ul style="list-style-type: none"> <li>– Instrument base locked with fast-action base lock.</li> <li>– Instrument base clamped with tension screw.</li> </ul>	<ul style="list-style-type: none"> <li>– Unlock base lock (8, Fig. 12).</li> <li>– Loosen tension screw (5, Fig. 12).</li> </ul>

## Changing fuses

### Power supply for slit lamp

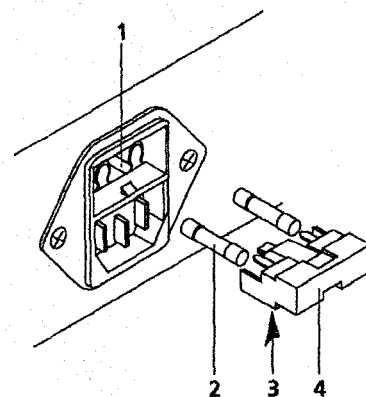
The fuses in the power supply are integrated in the power connector. This connector is located on the back of the unit (→ Fig. 13, page 28).

- Actuate power switch to switch off the unit.
- Disconnect the power cord.
- Unlock fuse holder (4) by compressing spring clip (3) and remove it from fuse drawer (1).
- Take out blown fuses (2). Replace them with new ones.
- Push fuse holder back into fuse drawer until spring clip snaps in.



**Note:**

Make sure the fuse ratings are correct for the local line voltage. (→ Specifications, pages 45 ff.).



- 1 Fuse drawer
- 2 Fuse
- 3 Spring clip
- 4 Fuse holder

Fig. 21 Power connector with fuse drawer (power supply)

### Control unit

The fuses in the control unit are integrated in the power connector. This connector is located on the back of the unit (→ Fig. 6, page 18).

- Actuate power switch to switch off the unit.
- Disconnect the power cord.
- Pry open the cover with a pointed tool.
- Take out blown fuses. Replace them with new ones.



**Note:**

Make sure the fuse ratings are correct for the local line voltage. (→ Specifications, pages 45ff.).

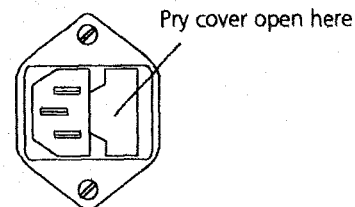


Fig. 22 Power connector with fuse drawer (control unit)

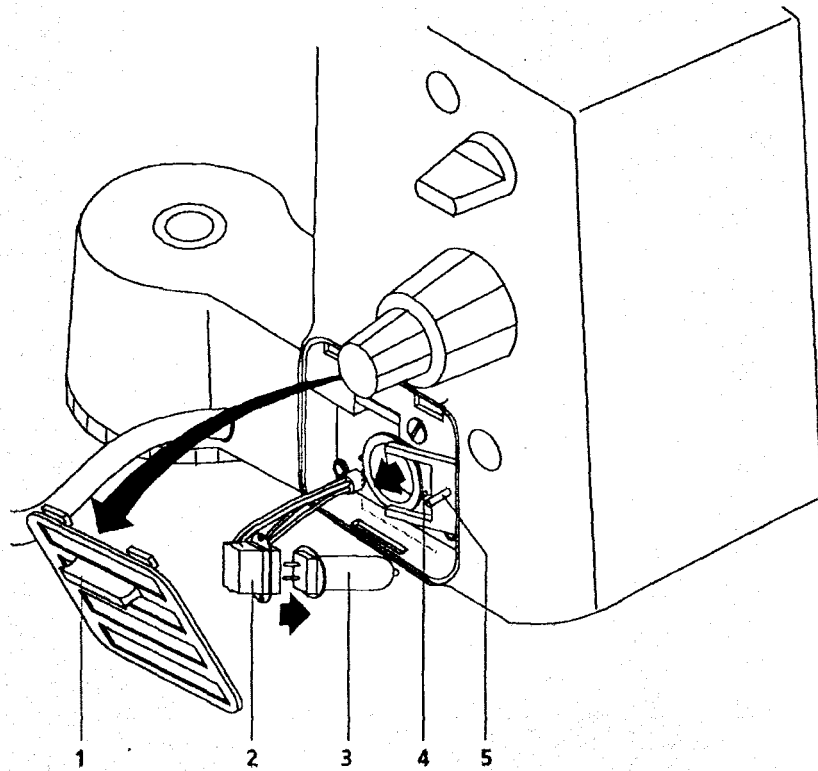


### Exchanging the halogen bulb in the slit lamp

**Warning:**

Before exchanging the bulb, switch off the power switch and disconnect the power cord. Let the bulb cool down or wear heat-insulating gloves.

- Exchange the halogen bulb (3) as illustrated in Fig. 23.
- To unlock the lamp holder, swing lever (5) aside.
- Do not touch the glass bulb with bare fingers.
- When inserting the lamp, make sure lamp holder (2) is oriented properly to locating pins (4).



- 1 Cover of halogen lamp
- 2 Lamp holder
- 3 Halogen bulb
- 4 Locating pins
- 5 Lever

Fig. 23 Exchanging the halogen bulb

## Care of the instrument

### Cleaning optical components

The multilayer T\* (T-star) antireflection coating of our optical components (e.g. eyepieces and objectives) results in excellent image quality. Even slight contamination of the optics or a fingerprint will impair the quality. In order to protect the internal optics from dust, it should never be left without objective, binocular tube and eyepieces installed. After use, cover the instrument to protect it from dust. Always store objectives, eyepieces and accessories which are not being used in dust-free cases.

The external surfaces of the optical components (eyepieces, objectives) may be cleaned, if necessary:

- Remove dust on the optical surfaces using a squeeze blower or a grease-free brush.
- Thorough cleaning is easily and quickly performed with our moist, anti-static cleaning cloths.

Please follow the instructions on the packing of the cleaning cloths.

In this manner you will maintain the high image quality.

Pack of 100 cleaning cloths:

Catalogue no. 30 61 18-0000

**Safety inspections**

In order to ensure proper functioning of this instrument, it must be subjected to safety inspection in compliance with relevant national regulations (in Germany MedGV §11). The inspection is to be performed annually by service technicians employed with or authorised by Carl Zeiss and the results recorded in the instrument log book. This inspection must also be done when the unit has not been used for one year or longer. The inspection must cover the following items and operations:

**Electrical safety**

- Ground wire resistance to power cable:  $R_{PE} \leq 0.2 \text{ Ohm}$ .  
The test points are all conductive parts which might carry dangerous voltage if there is a malfunction.
- Ground leakage current: The ground leakage current is to be metered using a special adapter cable only when the instrument is on (observe metering notes!).
- Visual inspection of components according to "Inspection of medical equipment" (Safety folder).

**Functional safety inspection**

- Foot switch, hand release button
- Energy monitoring system and system shut-off
- Interlock
- Threshold values for burst modes 1, 2 and 3
- Optical breakdown in air
- All functions

**Drawing up an inspection report**

- Inspection of the alignment of the therapy laser to the slit lamp.
- Inspection of alignment of the aiming beam to the therapy laser beam.
- Inspection of internal energy meter

**Cleaning of slit lamp optics****Preparation of the unit for usage and presentation to the user**

## Ordering data, accessories and spare parts

### 1. YAG II surgical slit lamp with VISULAS YAG II

#### Overview of components:

	Catalogue number
VISULAS YAG II with control unit and laser head	30 68 53-9901
Power supply unit for laser slit lamp	30 96 71-9200 or 30 96 71-9902
YAG II surgical slit Lamp	31 93 40-9201
125 mm straight tube	30 37 60-0000
12.5x eyepieces	30 55 17-9901

#### Contact lenses

Contact lens: Abraham YAG laser lens for capsulotomy	30 68 77-9001
Contact lens: Peyman 12.5 mm, wide-angle (YAG) for the anterior vitreous body and anterior chamber	30 68 77-9002
Contact lens: Peyman 18.0 mm, wide-angle (YAG) for the intermediate vitreous body	30 68 77-9003
Contact lens: Peyman 25.0 mm, wide-angle (YAG) for the posterior vitreous body	30 68 77-9004
Contact lens: OAIY Abraham iridectomy (YAG)	30 68 77-9011

#### Protective eyewear

Safety eyeglasses (with side pieces) as per DIN 58215 for Nd:YAG lasers	30 68 81-9010
Safety goggles as per DIN 58215 for Nd:YAG lasers for spectacle wearers	30 68 81-9020

#### Practice eye

Practice eye for VISULAS YAG	30 68 51-9051
Replacement foils for practice eyes (48 pcs)	30 68 51-9053
5 replacement lenses for practice eye	30 68 51-9054

#### Fixation lamp + blinking diode

Fixation lamp with plug contact	30 07 15-9901
Blinking diode, red, for fixation lamp	30 13 50-9052
Occluding disk for fixation lamp	30 07 14-0000

**Fuses**

		Catalogue number
Fuses for power supply unit (two required)		
115 V	1.6 A, slow-blow, 5 x 20 mm	0127.023
220 V	0.8 A, slow-blow, 5 x 20mm	0127.019
Fuse for laser control unit (two required)		
115 V	3.15 A, slow-blow, 5 x 20mm	0127.026
220 V	3.15 A, slow-blow, 5 x 20mm	0127.026


**Miscellaneous**

Halogen bulb, 12V 30W, for slit lamp	38 01 20-7040
100 cleaning cloths	30 61 18-0000
Anti-fogging agent	30 55 50-9910

Our sales representative will readily give you information about other accessory equipment:

- Photography
- Video documentation
- Coobservation, etc.

## Slit lamp

Travel of instrument base	Lateral: 110 mm Depth: 90 mm Height: 30 mm
Slit lamp	12V 30W halogen lamp, adjustable brightness Slit length adjustable in steps: 1, 3, 5, 9, 14 mm; $\pm 45^\circ$ , $90^\circ$ Slit width continuously adjustable: 0 ... 14 mm 
Corneal microscope	Magnifications with magnification changer: 5x, 8x, 12x, 20x, 30x with 12.5x eyepieces and $f = 125$ mm tube. $f = 125$ mm straight tube with 50 ... 75 mm PD adjustment range Option: inclined tube. Eyepieces: 12.5x high-eyepoint with $\pm 8$ D compensation of ametropia. Options: 10x, 16x, 20x eyepieces Reticles may be mounted in all types of eyepieces.
Power supply	Power is supplied from separate power supply unit.
Dimensions (incl. laser head)	H x W x D = 610 mm x 300 mm x 400 mm
Weight (incl. laser head, tube and eyepieces)	12 kg

## Power supply unit for slit lamp

Line voltage	115 V (90 V ... 138 V) 230 V (198 V ... 265 V) adjustable at external voltage selector.
Line frequency	50 ... 60 Hz
Max. power consumption	80 VA
Main fuses	115 V: 2x 1.6 A, slow-blow, 5 x 20 mm, Cat. No. 0127.023 230 V: 2x 0.8 A, slow-blow, 5 x 20 mm, Cat. No. 0127.019
Protective earthing connection	Only use power outlets with proper protective earth connection.
Dimensions	H x W x D = 100 mm x 110 mm x 200 mm
Weight	3.5 kg

## VISULAS YAG II laser system

Laser class	IV (CDRH) 4 (EN 60825-1)
Wavelength of surgical laser	1064 nm
Mode	Super Gaussian
Pulse duration	< 4 ns (typically 2 ... 3 ns)

Burst mode	Energy (typical)	Max. shot repetition rate	Burst frequency
1 (single pulse)	10 mJ	2 Hz (2 shots/s)	—
2 (double pulse)	23 mJ	0.5 Hz (1 shot/2 s)	50 kHz
3 (triple pulse)	37 mJ	0.25 Hz (1 shot/4 s)	50 kHz

Energy attenuation	9 levels: 3, 5, 8, 12, 16, 20, 30, 50 and 100% transmission		
Beam diameter at focal point	10 $\mu\text{m}$ in air ( $1/e^2$ )		
Aperture angle	18° (full angle)		
Aiming beam	Wavelength: 660 ... 680 nm Power: 5 $\mu\text{W}$ ... 150 $\mu\text{W}$ 4-point focusing system, focus diameter < 20 $\mu\text{m}$ in air ( $1/e^2$ )		
Ambient conditions	Admissible temperature:	: 10 ... 35 °C (50 ... 95 °F)	
	Admissible humidity:	: 0 ... 95% (no condensation)	
Electrical standards complied with	EN 60601-1, EN 60601-2-22; EN 60825-1		
Line voltage	115 V (90 V ... 138 V) 230 V (198 V ... 265 V)		
Line frequency	50 ... 60 Hz		
Nominal current	0.8 A (115 V)/0.4 A (230 V)		
Main fuses	115 V: 2x 3.15 A, slow-blow, 5 x 20 mm, Cat. No. 0127.023 230 V: 2x 3.15 A, slow-blow, 5 x 20 mm, Cat. No. 0127.019		
Protective earthing connection	Only use power outlets with proper protective earth connection.		
Dimensions	H x W x D = 128 mm x 165 mm x 315 mm		
Weight	4.5 kg		

Technical details and scope of delivery are subject to change.



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