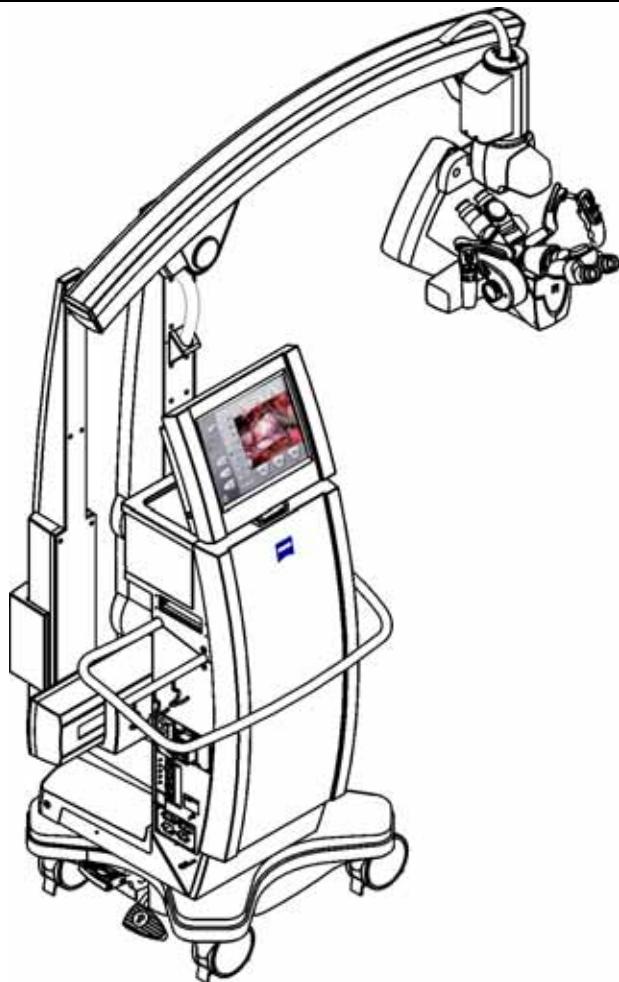


# OPMI® Pentero®

## Software Release 2.20 / 2.21



Instructions for use

G-30-1458-en

Issue 11.1

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## Key to symbols

Different symbols used in this manual draw your attention to safety aspects and useful tips. These symbols are explained in the following.



### **Warning!**

The **warning triangle** indicates potential sources of danger which may constitute a risk of injury for the user or a health hazard.



### **Caution:**

The **square** indicates situations which may lead to malfunction, defects, collision or damage of the system.



### **Note:**

The **hand** indicates hints on the use of the system or other tips for the user.



### **Read the user manual!**

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**AutoDrape™, Superlux, FlexiTrax™, MultiVision™ and FLOW™ 800** are trademarks of Carl Zeiss Surgical GmbH.

## FLOW 800 SW 2.21

FLOW 800 software release 2.21 is not an update, but a software upgrade for the IR800 option of OPMI Pentero for the analysis of infrared video angiography.

Upgrading is only possible for systems with serial number 6631402450 and higher and with software version 2.20.



# Contents

Software Release 2.20 / 2.21	1
– Key to symbols	2
– FLOW 800 SW 2.21	2
<b>Functions at a glance</b>	<b>9</b>
– OPMI Pentero	10
– What to do in an emergency	12
<b>Safety</b>	<b>15</b>
– Protective measures for IT systems and networks	16
– Notes on installation and use	17
– Risk of burn injuries caused by high illumination intensity	23
– Safety devices of the suspension system	26
– Warning labels and notes	28
<b>Description</b>	<b>33</b>
OPMI Pentero	34
– Intended use	34
– Special properties	36
– Surgical microscope and laser micromanipulator	38
– Injecting video images in the surgical microscope	39
– Injecting navigation information in the surgical microscope *)	40
– Overall system configuration	41
– Configuration options	44
Central user interface (touchscreen)	46
– Main menu	50
Controls and connections	52
– Binocular tubes and eyepieces	60
– Handgrips	64
– Superlux 330 illumination system	66
– Operating principle of the additional illumination	68

– Autofocus (focusing aid)	69
– Drape vacuum system	70
– Stand base /FlexiTrack™ system	72
– Connector panel	76
Connecting navigation systems	80
<b>Preparations for use</b>	<b>85</b>
– Relocating the unit	86
Assembling the system	88
– Configurations	88
– Mounting the tube and the eyepieces	90
– Attaching documentation / coobservation equipment	92
– Mounting the mouth switch (option)	94
– Adjusting the position of the handgrips	98
– Attaching sterile drapes	100
– Positioning the system at the operating table	102
– Starting the system	104
– Configuring the handgrips	106
Balancing the system	110
– Adjusting the surgical microscope	115
– USER menu / login	116
– Activating IT system rights and data protection	120
– Configuration menu (CONFIG)	124
<b>Operation</b>	<b>163</b>
Checklist	164
Procedure	167
– Working with the surgical microscope	167
– Comfortable control via the mouth switch (pivoting)	168
– Working with the data injection system	170
Patient Files menu (PAT-FILES)	174
– Managing patient data	174
– Viewing patient data	186
– Viewing patient images	188
– Editing images	192



– Saving	196
– Storing patient data on CD/DVD	198
– Storing patient data on a USB stick	202
What to do in an emergency	208
– Illumination failure - changing the xenon lamp	208
– Failure of the zoom function	210
– Failure of the focusing function	211
– Failure of the magnetic brakes	212
– Touchscreen failure	212
– Failure of the line voltage	212
– Error messages in the data injection system	213
– Failure of all control functions (Emergency mode)	214
– Individual magnetic brakes are blocked (OPMI can not be moved at all or only to a limited extent)	215
<b>Maintenance/Service</b>	<b>217</b>
– Trouble-shooting	218
– Service Contract (Option)	219
– Starting Remote Service	220
– Changing the lamp module	222
– Recommended cleaning method	224
– Sterile drapes	225
– Ordering data	226
– Spare parts	227
– Accessories	228
– Disposal	230
<b>Technical data</b>	<b>231</b>
– OPMI Pentero	232
– 3 CCD PAL video camera, mono and stereo (version 1)	237
– 3 CCD NTSC video camera, mono and stereo (version 1)	238
– 3 CCD PAL video camera, mono and stereo (version 2)	239
– 3 CCD NTSC video camera, mono and stereo (Version 2)	240
– Ambient requirements	241
– Changes to the system	241

<b>Digital video recording (option)</b>	<b>243</b>
Digital video recording (option)	244
– Description	244
– Video clips	248
– Editing video clips	250
– Merging video clips	256
<b>INFRARED 800 fluorescence module (option)</b>	<b>261</b>
Integrated INFRARED 800 (IR 800) fluorescence module	262
– Intended use	262
– Description	266
– Connecting an external monitor (recommended option)	276
– INFRARED 800 settings before every surgical procedure	278
– Checklist for the IR 800 function test	279
Procedure	280
<b>FLOW 800 (option)</b>	<b>287</b>
Normal use	288
Description	292
– General configuration	292
– Configuring INFRARED 800	296
– Activating FLOW 800	298
– Description of INFRARED 800	300
– Description of FLOW 800	306
Preparations for use	318
– Connecting an external monitor (recommended option)	318
– INFRARED 800 settings before every surgical procedure	320
– Checklist for the IR 800 function test	321
Procedure	322
– SETUP phase	322
– RECORD phase	324
– PLAYBACK phase	326
– FLOW 800 processing phase	328



<b>BLUE 400 fluorescence module (option)</b>	<b>339</b>
Integrated BLUE 400 (BL 400) fluorescence module	340
– Intended use	340
– Description	344
BL 400 checklist	348
<b>DICOM (option)</b>	<b>351</b>
DICOM	352
– Intended use	352
– Conformance Statement	352
– Configuring the network connection	356
– Further information on the Ethernet connection	362
– Connection test	364
– Configuring the DICOM connection	366
– Adding, editing and deleting a DICOM server	366
– Configuring the DICOM function	368
– Defining the maximum video export size to network servers	372
– Error messages during system configuration	376
– Importing patient data sets (from RIS systems)	378
– Importing patient data sets (from PACS system)	380
– Loading patient data	382
– Exporting DICOM data to a PACS	390
<b>HDTV camera system (option) (option)</b>	<b>393</b>
	<b>393</b>
HDTV camera system for OPMI Pentero (option)	394
– Intended use	394
– Configuration	395
– Attaching the HDTV components	396
– Connecting the HDTV camera system	398
– Microscope positions with the HDTV camera system	400
Checklist for HDTV camera system for OPMI Pentero	401
Cleaning the HDTV components	403

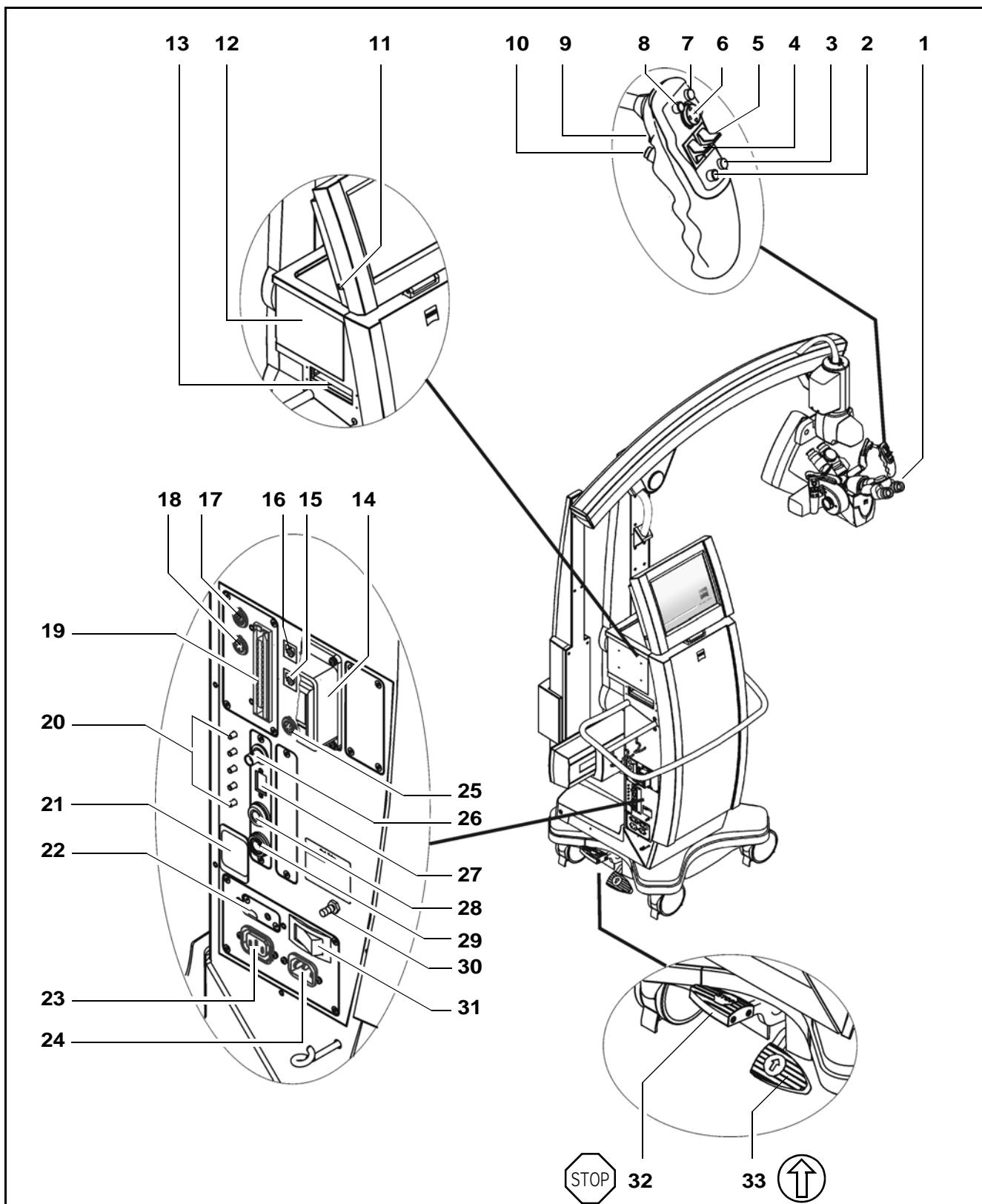


# Functions at a glance

OPMI Pentero	10
What to do in an emergency	12

## OPMI Pentero

1	Adjusting the microscope	page:115, 124ff
2	Programmable button (factory setting: illumination +)	page:108, 136
3	Programmable button (factory setting: illumination -)	page:108, 136
4	Setting focus +/- (configurable: setting zoom +/-)	page:108, 136
5	Setting zoom +/- (configurable: setting focus +/-)	page:108, 136
6	Joystick: moving the OPMI in the XY direction	page:136, 140
7	Programmable button (factory setting: autofocus)	page:108, 142
8	Programmable button (factory setting: trigger photo)	page:106, 136
9	Unlocking/locking magnetic brakes for selected axes (SB)	page:108, 142
10	Unlocking/locking magnetic brakes for all axes (AB)	page:106, 142
11	Connecting USB storage media	page:200ff
12	Changing the xenon lamp / lamp module	page:208, 222
13	CD/DVD drive	page:196
14	Connecting an external navigation system	page:78, 80ff, 154
15	Connecting a LAN cable	page:78
16	Connecting a modem	page:78
17	Connecting a foot rocker switch	page:78
18	AUX port for controlling an external device	page:78, 234
19	Connecting a foot control panel, foot switch or operating chair	page:78
20	Automatic circuit breakers	page:78
21	Emergency switch (remove cover)	page:200
22	Rated voltage indicator	page:76
23	Power outlet	page:76
24	Power inlet (115/230V)	page:76
25	Video input port (e.g. for connecting an endoscope camera)	page:78
26	Video signal output port BNC (VBS)	page:76, 276
27	Video DV output port	page:76
28	Connecting an external monitor (VGA/RGB)	page:76
29	Connecting an external monitor (Y/C)	page:76, 276
30	Connecting the system to potential equalization	page:76
31	Power switch; powering up the system	page:76
32	Locking pedal - press to lock stand in position	page:74, 86
33	Setting straight-ahead travel	page:74 ,86



## What to do in an emergency

- 1 Failure of **illumination** - changing the xenon lamp:
  - Open flap (1)
  - Change the xenon lamp by pulling grip (8) page 208

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- 2 Failure of the **zoom function**:
  - Manually adjust the magnification using zoom knob (2). If the motorized zoom function becomes active of its own accord (e.g. travels to the stop), set emergency switch (7) to the emergency mode (position 2). page 210

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- 3 Failure of the **focusing function**:
  - Manually adjust the working distance using focusing knob (3). If the motorized focusing function becomes active of its own accord (e.g. travels to the stop), set the emergency switch to the emergency mode (position 2) page 211

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- 4 Some of the **magnetic brakes** are blocked:
  - Switch off power switch (4). As soon as the blue screen appears (approx. 10 sec), switch the system back on.  
The OPMI functions (zoom, focus, light and magnetic brakes) are available again after approx. 15 seconds. The computer and touchscreen, however, are disabled.

If the magnetic brakes are still blocked:

  - Hold the microscope on its body (not on the handgrips) and position it manually by overcoming the braking effect. page 215

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- 5 Failure of the **touchscreen**:
  - Do not under any circumstances touch the touchscreen, since this can result in changes to settings and parameters. Zoom, focus, illumination and brakes can still be operated. page 212

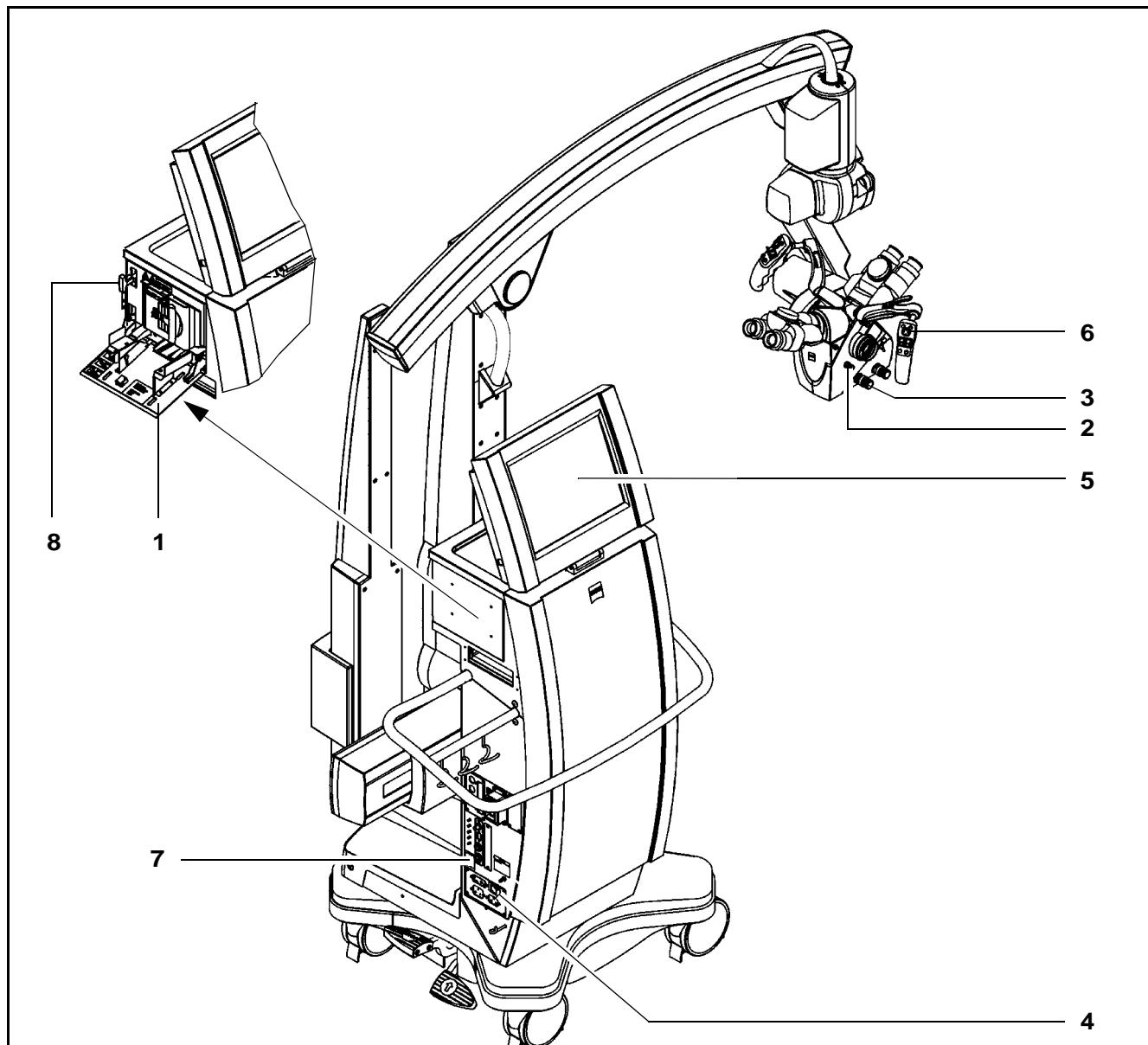
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- 6 Error messages in the **data injection system**:
  - System errors are displayed in the microscope's integrated data injection system. You can delete these messages by acknowledgement using the joystick of the right handgrip (pushbutton) or the touchscreen. page 212

**7 Failure of control functions:**

- Set emergency switch (7) to the emergency mode (position 2). Zoom and focus must then be operated manually (2, 3).
- Hold the microscope on its body (not on the handgrips) and position it manually by overcoming the braking effect.

page 214





# Safety

Protective measures for IT systems and networks	16
Notes on installation and use	17
Risk of burn injuries caused by high illumination intensity	23
Safety devices of the suspension system	26
Warning labels and notes	28

The device described in this manual has been designed and tested in accordance with Carl Zeiss safety standards as well as German and international standards. This guarantees a high degree of instrument safety.

The system described in this user manual has been designed in compliance with the requirements of:

- EN
- IEC
- UL
- CSA

In accordance with Directive 93/42/EEC for medical devices, the complete quality management system of the company Carl Zeiss Surgical GmbH, 73446 Oberkochen, Germany, has been certified by DQS Deutsche Gesellschaft zur Zertifizierung von Managementsystemen GmbH, a notified body, under registration number 250758 MP23.

- In compliance with Directive 93/42 /EEC, the basic configuration of this system is a class I device.  
Equipped with the Integrated Fluorescence Module option, it is a class IIa device.
- For USA: FDA classification: Class I.



We would like to provide you with information about safety aspects which must be observed when handling this device. This chapter contains a summary of the most important information concerning matters relevant to instrument safety.

Important safety information has been incorporated in this manual and is marked with a warning triangle accordingly. Please give this information your special attention.

The correct use of the system is absolutely vital for safe operation. Please make yourself totally familiar with the contents of this manual prior to start-up of the instrument. Please also observe the user manuals of any additional equipment. Further information is available from our service department or from authorized representatives.

- Please observe all applicable accident prevention regulations.
- The instrument must be connected to a special emergency backup line supply in accordance with the regulations or directives which apply in your country.

## Protective measures for IT systems and networks

The user (or IT officer) is responsible for ensuring that no viruses are transferred to the OPMI Pentero system via the network connection.



It is the user's responsibility to ensure that the media used for data communication (CD, DVD, USB stick) are free from viruses.

### **Responsibilities for data protection and information security**

The user (or IT officer) must ensure that the national laws and regulations relating to data protection are complied with.

The operators of IT systems and IT networks are responsible for the definition of the safety standards required, i.e. for the creation of the necessary technical and organizational framework.

#### Definition of terms

Personal data means any information concerning the personal or material circumstances of an identified or identifiable individual. All data directly attributable to a person (employee, customer, supplier), e.g. marital status, type of employment, religion, income, etc., must be protected.

Data processing means the storage (entry, recording or preservation), transfer (transmission to third parties outside the organization), modification (alteration of the substance, including anonymization and aliasing), erasure (deletion) and blocking (labeling so as to restrict further processing or use) of data.

Use means any utilization of data (e.g. in-house transmission).

Recipient means any person or body receiving data. Third party means any person or body other than the controller (legal entity). The transmission of data to third parties is deemed to constitute data transfer.

## **Notes on installation and use**

### **Safe working order**

- Do not operate the equipment contained in the delivery package in
  - explosion-risk areas,
  - the presence of inflammable anesthetics or volatile solvents such as alcohol, benzine or similar chemicals.
- Do not station or use the instrument in damp rooms. Do not expose the instrument to water splashes, dripping water or sprayed water.
- Immediately unplug any equipment that gives off smoke, sparks or strange noises. Do not use the instrument until our service representative has repaired it.

- Do not place any fluid-filled containers on top of the instrument. Make sure that no fluids can seep into the instrument.
- Do not force cable connections. If the male and female parts do not readily connect, make sure that they are appropriate for one another. If any of the connectors are damaged, have our service representative repair them.
- Potential equalization: If requested, the instrument can be incorporated into potential equalization measures.
- Do not use a mobile phone in the vicinity of the equipment because the radio interference can cause the equipment to malfunction. The effects of radio interference on medical equipment depend on a number of various factors and are therefore entirely unforeseeable.



**Warning!**

Do not use the video images for diagnostic purposes, as the video cameras and the monitor have not been calibrated. The visualized images may therefore include deviations in shape, contrast and color.

The company Carl Zeiss shall not be liable for any defective CD/DVD and any resultant loss of images.

- If you have burnt important images on a CD/DVD, we recommend you to create a backup of this CD/DVD using a PC.



**Caution:**

The company Carl Zeiss accepts no liability for any loss of patient, image and video data as well as system or user-specific configuration data. If required, arrange for patient, image and video data as well as all system settings to be backed up by your IT administrator on a regular basis.

In the event of repairs by Carl Zeiss service staff, the recovery of patient, image, video and configuration data is no longer possible.

- Modifications and repairs on these instruments or instruments used with them may only be performed by our service representative or by other authorized persons.
- The manufacturer will not accept any liability for damage caused by unauthorized persons tampering with the instrument; this will also forfeit any rights to claim under warranty.
- Over longer distances (e.g. removal, return for repair, etc), the instrument may only be transported in the original packaging or in special return packaging. Please contact your dealer or the Carl Zeiss service team.
- Use this instrument only for the applications described.

- Only use the instrument with the accessories supplied. Should you wish to use other accessory equipment, make sure that Carl Zeiss or the equipment manufacturer has certified that its use will not impair the safety of instrument.
- Only personnel who have undergone training and instruction are allowed to use this instrument. It is the responsibility of the customer or institution operating the equipment to train and instruct all staff using the equipment.
- Keep the user's manuals where they are easily accessible at all times for the persons operating the instrument.
- Never look at the sun through the binocular tube, the objective lens or an eyepiece.
- Please do not pull at the power cable or any other connecting cables.
- This system is a high-grade technological product. To ensure optimum performance and safe working order, we recommend having the system checked by our service representative on a regular basis. If a failure occurs which you cannot correct with the help of this user manual, attach a sign to the system stating that it is out of order and contact our service representative.



- Observe the labels showing the symbol "Risk of crushing"!

### Notes on EMC (electromagnetic compatibility)

The system meets the EMC requirements of IEC 60601-1-2. During use of the system, the precautionary measures concerning EMC listed below must be observed.

Only use accessories that have been approved by Carl Zeiss for this system.

Do not use any portable or mobile high frequency communication devices in the vicinity of the system, as this may lead to an impairment of its function.

The system complies with the limits for a Class A device concerning radio frequency emission. However, the possibility of interference to high frequency receiving devices (e.g. TV sets or radios) being used in the surroundings cannot be ruled out. If interference of this type occurs, please inform your Carl Zeiss Service.

### Interference radiation

To ensure permissible operation in conjunction with neuromonitoring systems, an optional upgrade kit is available which significantly reduces the system's permissible interference radiation for these sensitive measurements (see Accessories, neuromonitoring upgrade kit, page 229)

### Requirements for operation



#### Note:

- Please also take note of the latest Release Notes about the installed software version. These are part of the delivery package when the system is supplied. After a software update, you will always receive the latest version.

Our service representative or a specialist authorized by us will install the instrument. Please make sure that the following requirements for operation remain fulfilled in the future:

- All mechanical connections (details in the user's manual) which are relevant to safety are properly connected and screw connections tightened.
- All cables and plugs are in good working condition.
- The instrument is plugged into a power outlet which has a properly connected protective ground contact.
- The power cord being used is the one designed for use with this instrument.



#### **Warning!**

For safety reasons, the system must only be used when correctly balanced. Despite the autobalance function, it may happen in exceptional cases that the surgical microscope is not correctly balanced.

With an incorrectly balanced system, brake release may lead to uncontrolled movements of the suspension system. For this reason, the balancing procedure and the subsequent test must not be performed above the patient and only at a safe distance from other persons and instruments.

To check correct balancing of the system, loosen the brakes while holding the microscope tightly at both handgrips. If the system has been correctly balanced, the surgical microscope can be moved almost effortlessly. Repeat the autobalance procedure, if required.

## Connection to data networks

Activities in the data network may interfere with the system. We therefore recommend that you disconnect the system from data networks before surgery.

The network connector must be adequately contact-protected, e.g. made of plastic material.

The cable and connector of the network connection must at least comply with Cat-5e EIA/TIA-568A-5, i.e. the more recent Class D values from ISO/IEC 11801:2002 or EN 50173-1:2002.

### Warning!



Data transmitted by the system into the data network or data available in the data network risk to be corrupted or transmitted incompletely. Therefore, no liability can be accepted for the correctness of the data.

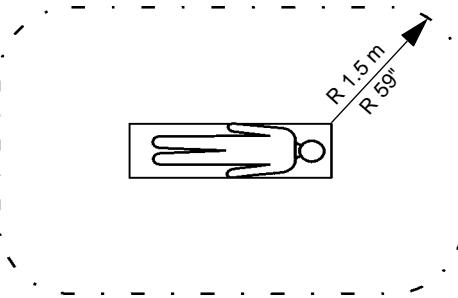
The operator of the data network is responsible for compliance with the legal requirements regarding data security and for the protection of personal rights.

## Connection of equipment from other manufacturers

If you operate this system within the patient area\* in conjunction with devices from other manufacturers which do not comply with the IEC60601-1 standard, you must ensure that either the third-party devices are powered via an isolating transformer, or that each of them is connected with the central ground system via an additional ground terminal (potential equalization).

The leakage current may increase if the system is connected with other devices. The resulting new system must comply with the EN 60601-1-1 standard (Safety Requirements for Medical-Electrical Systems).

\*Fig.: Patient area



**Before every use and after re-equipping the instrument**

- Make sure that all "Requirements for operation" are fulfilled.
- Go through the checklist (see chapter "Operation" or the index).
- Re-attach or close any covers, panels or caps which have been removed or opened.
- Please pay special attention to labels on the unit (warning triangle with an exclamation mark, warning labels and notes).
- Do not cover any ventilation openings.

**For every use of the instrument**

- Using the locking pedal on the base, secure the stand in position. Make sure that the stand is stable and cannot roll away.
- Make sure that nothing obstructs the touch-sensitive area of the touchscreen. Prevent objects from exerting pressure on the touch-sensitive area of the touchscreen.
- Any kind of radiation has a detrimental effect on biological tissue. This also applies to the light illuminating the surgical field. Please therefore reduce the brightness and duration of illumination on the surgical field to the absolute minimum required.
- Never use xenon illumination for ophthalmic procedures.
- Make sure that no xenon light enters the patient's eyes.
- The illumination intensity required depends on the type of application involved. Make sure that no tissue damage is caused by excessive illumination intensity.

**Connection and operation of navigation systems**

Only systems from authorized manufacturers may be connected and used on the navigation interface of OPMI Pentero (see page 80). Authorized manufacturers are companies or institutions with which Carl Zeiss Surgical has concluded an Open Interface Contract and for which the use of the integrated navigation interface with data injection system has been licensed.

Please observe the user manual for the connected system.



## Risk of burn injuries caused by high illumination intensity



### General

The OPMI Pentero is equipped with a powerful xenon illumination system. Excessive illumination intensities may lead to third-degree burns, if used improperly.

The risk of burns is influenced by several different factors:

#### System-related factors:

- The wavelength range is limited by filters to the visible range between 400 nm and 700 nm (between 400 nm and 780 nm in the IR 800 mode only). These filters remain stable over a very long period of time and cannot be exchanged by the user.
- With increasing age of the light source, the actual illumination intensity delivered at the respective setting decreases. When the light source is finally replaced, the illumination intensity increases again to the high, original value.

#### Surgery-related factors:

- The selected intensity of the light source is a major factor for the risk of injury. It should always be set to the minimum required for the surgical procedure to be performed.
- The size of the illuminated field influences the risk of injury in two different ways:
  - If the illuminated area has a large diameter, skin areas are illuminated that are not closely monitored by the surgeon and are not sufficiently irrigated. These areas are particularly prone to injury. Injuries can be prevented by adjusting the diameter of the illuminated field to the smallest size needed for the respective procedure.
  - Reducing the illuminated field increases the intensity because the light becomes more focused. The light intensity should therefore be reduced, if possible, as soon as the diameter of the illuminated area is reduced.
- A long surgical procedure increases the risk of injury, in particular if a standard procedure takes considerably longer than usual.
- Injuries in the peripheral area can be prevented by covering this area with wet, sterile gauze.

- You should also take into account that some areas of the body may be more sensitive than others.
- Certain preparations of the surgical field, local vasoconstrictive medications and incision drapes may also result in a higher risk of injury.

#### Patient-related factors:

- The general condition of a patient's health may contribute to the risk of injury.
- The skin type may also play a major role in this respect.
- Certain medications affect the sensitivity to light.

#### Recommendations

Due to the large number of different factors involved and the lack of scientific publications on this topic, Carl Zeiss cannot provide guidance on acceptable intensities and exposure durations. However, the OPMI Pentero has several features that can help the user to reduce the risk of burns:

- The start value of the light intensity can be set to a low value (page 134).
- The spot function permits you to reduce the size of the illuminated field to the area observed during the procedure (page 66).
- You can then set the light intensity to the value required for the procedure using the buttons on the handgrip or foot control panel. Please note that the use of the spot illumination system increases the intensity as the size of the illuminated field decreases. Therefore adjust the light intensity after changing the diameter of the illuminated field.
- If the system features Automatic Light Field Limitation, this function has been activated at the factory and should not be deactivated.  
In systems without automatic light field limitation, the Light Intensity Control function has been activated at the factory and should not be deactivated.
- The magnification level is usually increased during a procedure, leading to a darker image and thus necessitating an increase in illumination intensity. If zoom-dependent brightness control has been activated, it automatically compensates for this loss in image brightness. (page 134)
- Switch off the light when the microscope is not used, and make sure that it is not pointed at unprotected bare skin.



Please note that most burns affected the skin around the incision. The most important measures to prevent burns are the reduction of the area illuminated by spot illumination and covering the peripheral area with wet sterile gauze. The area of the incision should be constantly irrigated.

**Final remark**

Carl Zeiss recommends:



- Reduce the illumination of the surgical field to the extent required for the patient's safety and for clear microscopic visualization.  
The illumination intensity is preconfigured (factory settings) in such a way that a warning is displayed on the touchscreen and in the data injection system when the threshold value of 25% is exceeded, informing the user of possible tissue damage when the light intensity is too high.
- Please note the warning and safety notes in the "Light" configuration menu (page 134).
- Reduce the exposure time to a minimum.

These measures should help the surgeon to reduce the risk of phototoxic injury of the patient.

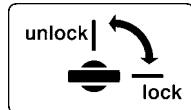
**After every use of the instrument**

- Switch off the system at the power switch after every use.

## Safety devices of the suspension system

### Mechanical end stops

protect cables and the light guide against bending and stretching.



### Transport locks (1)

for locking the axes in position during transportation.

### Safety switch

The brakes will be locked if a spring or cable breaks. You can nevertheless finish surgery, as you can still move the surgical microscope by applying slight force.

### Uninterruptible power supply (UPS)

A UPS is integrated in the system to ensure correct operation in the event of short power failure. It powers the electronic system and the touch-screen, but not the light source.

#### Messages:

- Line power failure: in the event of line power failure, the system is supplied for a short time. If no power is available for a prolonged period, the system is shut down.
- Line power is back: the user is informed when line power is back (Power OK), and all subsystems are re-initialized. This process may take a few seconds.



#### Note:

In general, the system is ready for operation after power-up. A continuous beep indicates extreme discharging of the UPS. In this case, the system should not be powered up for at least five minutes. After this time, you can power up the system again for charging the UPS. For the initial startup or after long rest periods, we recommend the following: leave the powered-up system connected to line power for approx. 12 hours in order to fully charge the UPS.

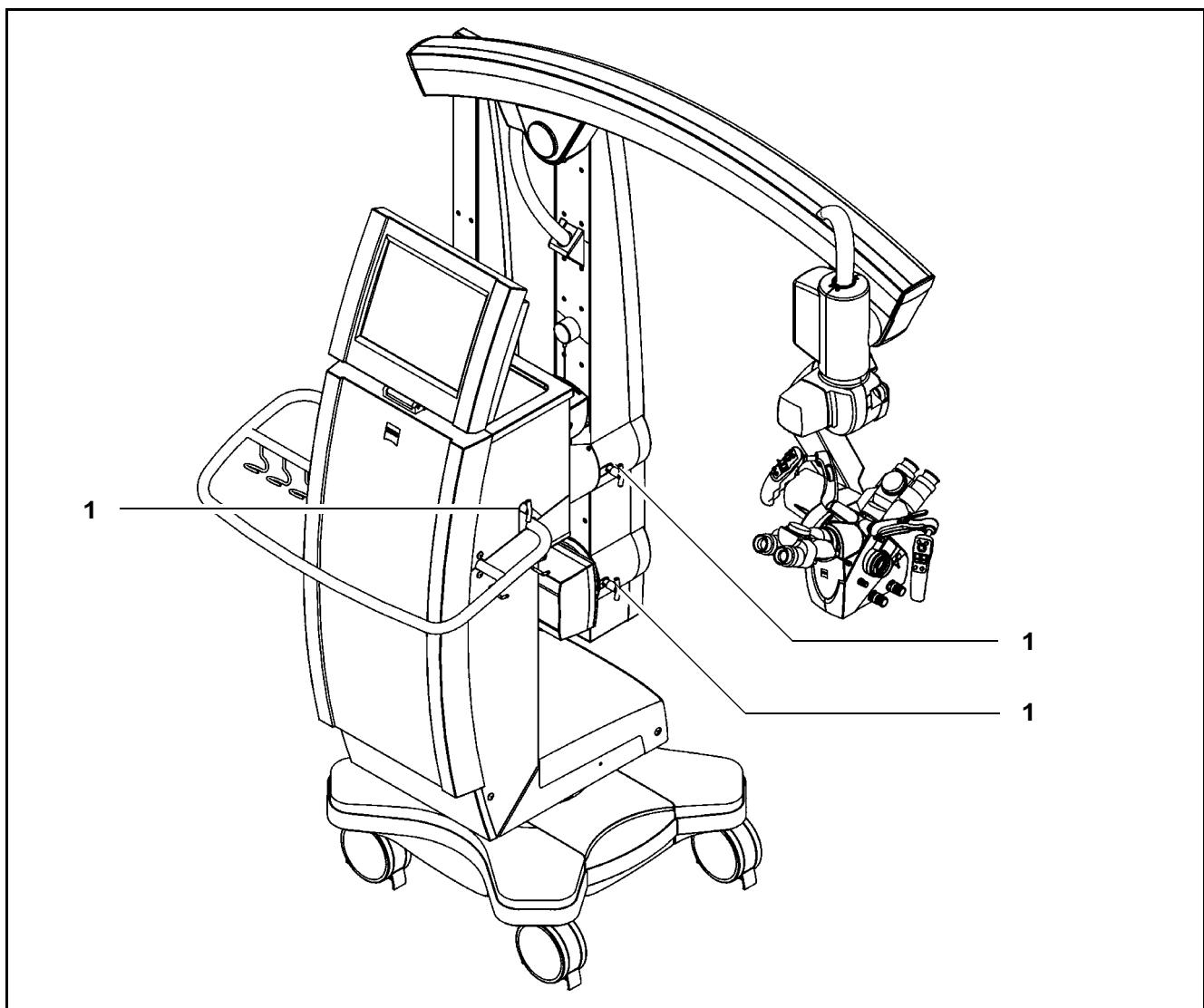
The system automatically tries to remedy problems in the control software. After several unsuccessful attempts, the system executes a PC reset to restart the application. This restart runs automatically in the background and restores the full functionality of the system within approx. 2 minutes. All major basic functions of the OPMI Pentero remain fully available to the user during this time (operation of focus, zoom, light, brakes, motorized XY movement).

### Backup illumination

The lamp module contains two identical lamps. If lamp 1 fails, a quick-action changer ensures that the light guide is supplied by lamp 2. The lamp change does not impair the surgeon in his work.

Heat protection filter

The illumination system is equipped with a heat protection filter.

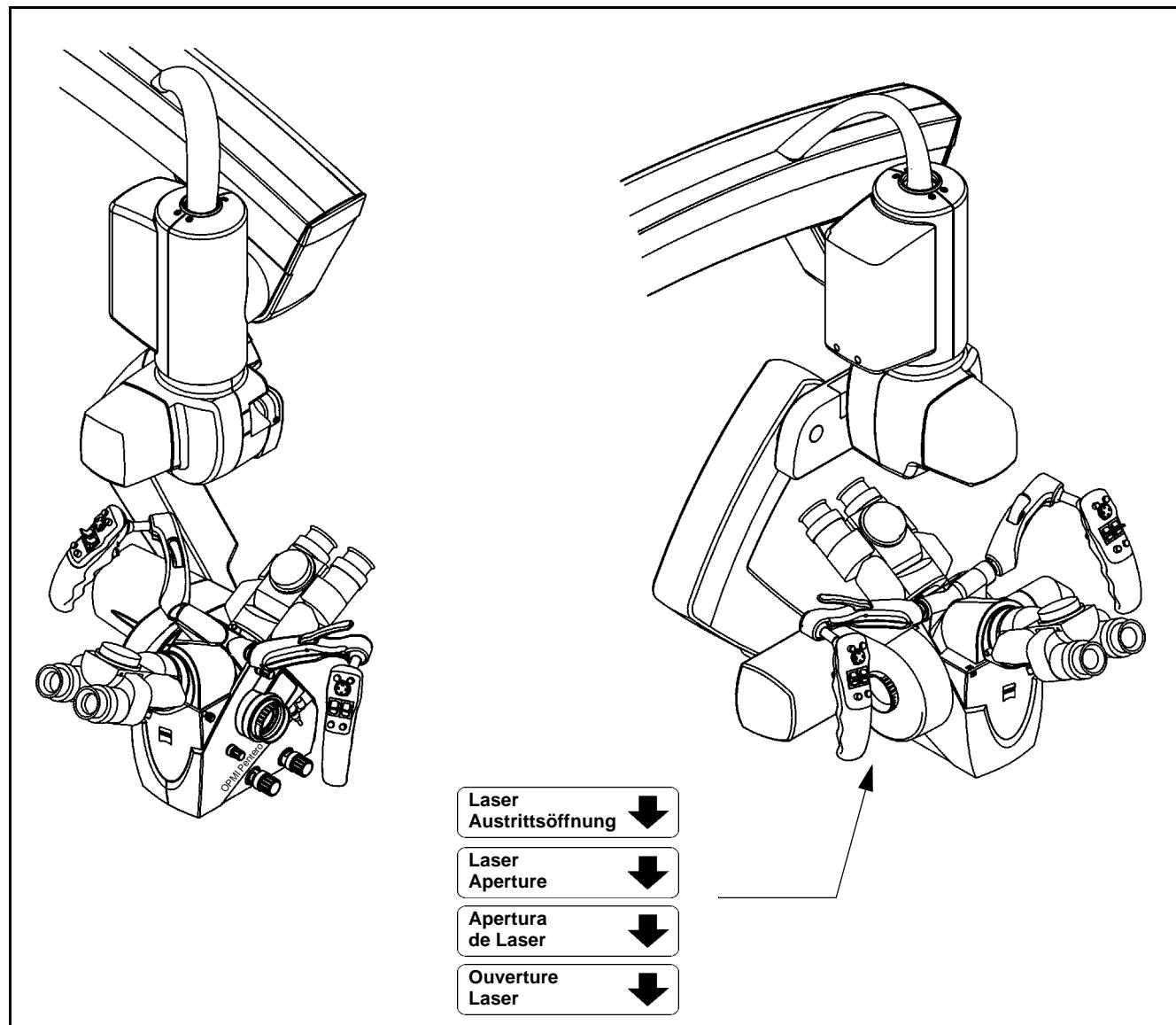


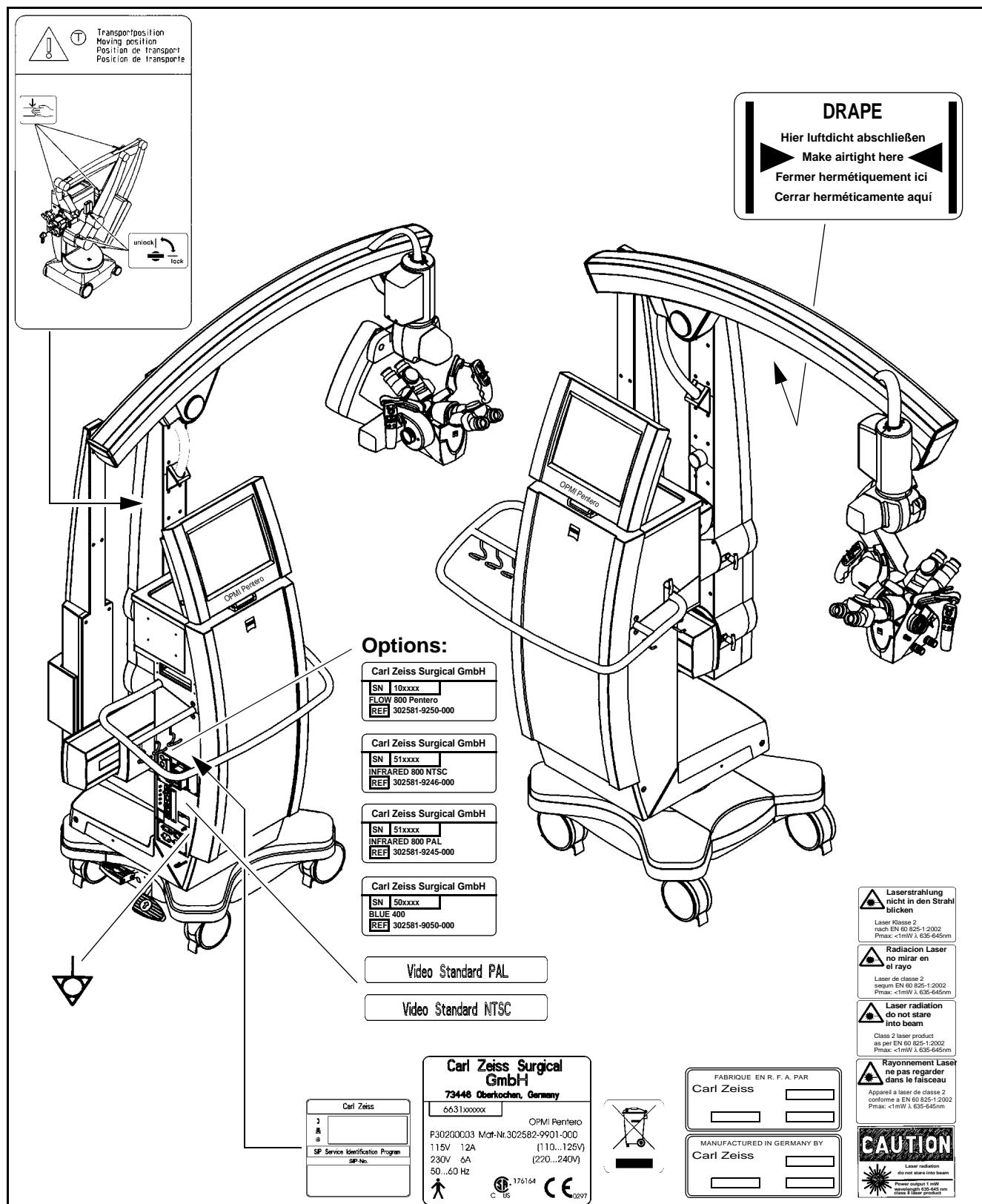
## Warning labels and notes

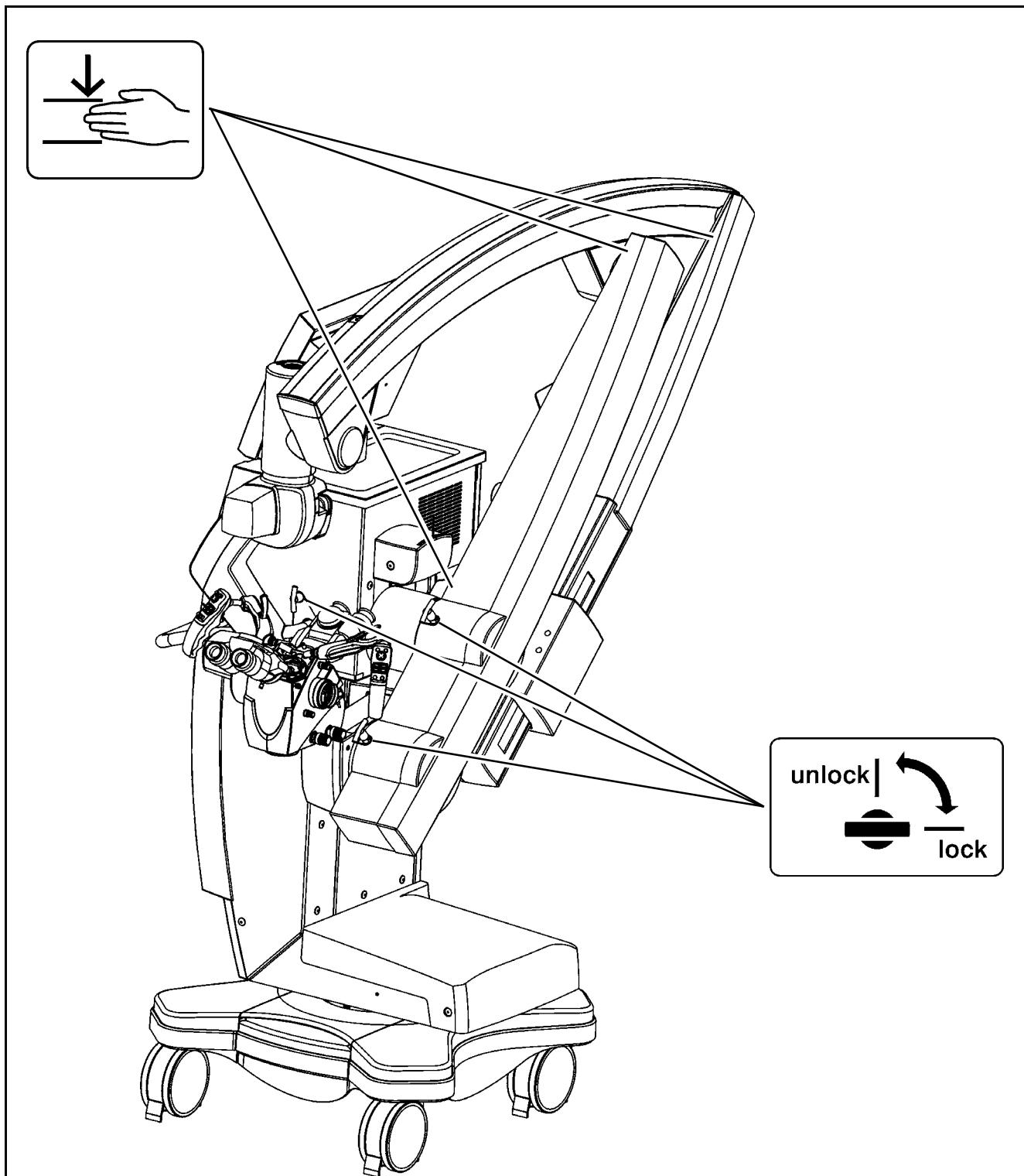
**Caution:**

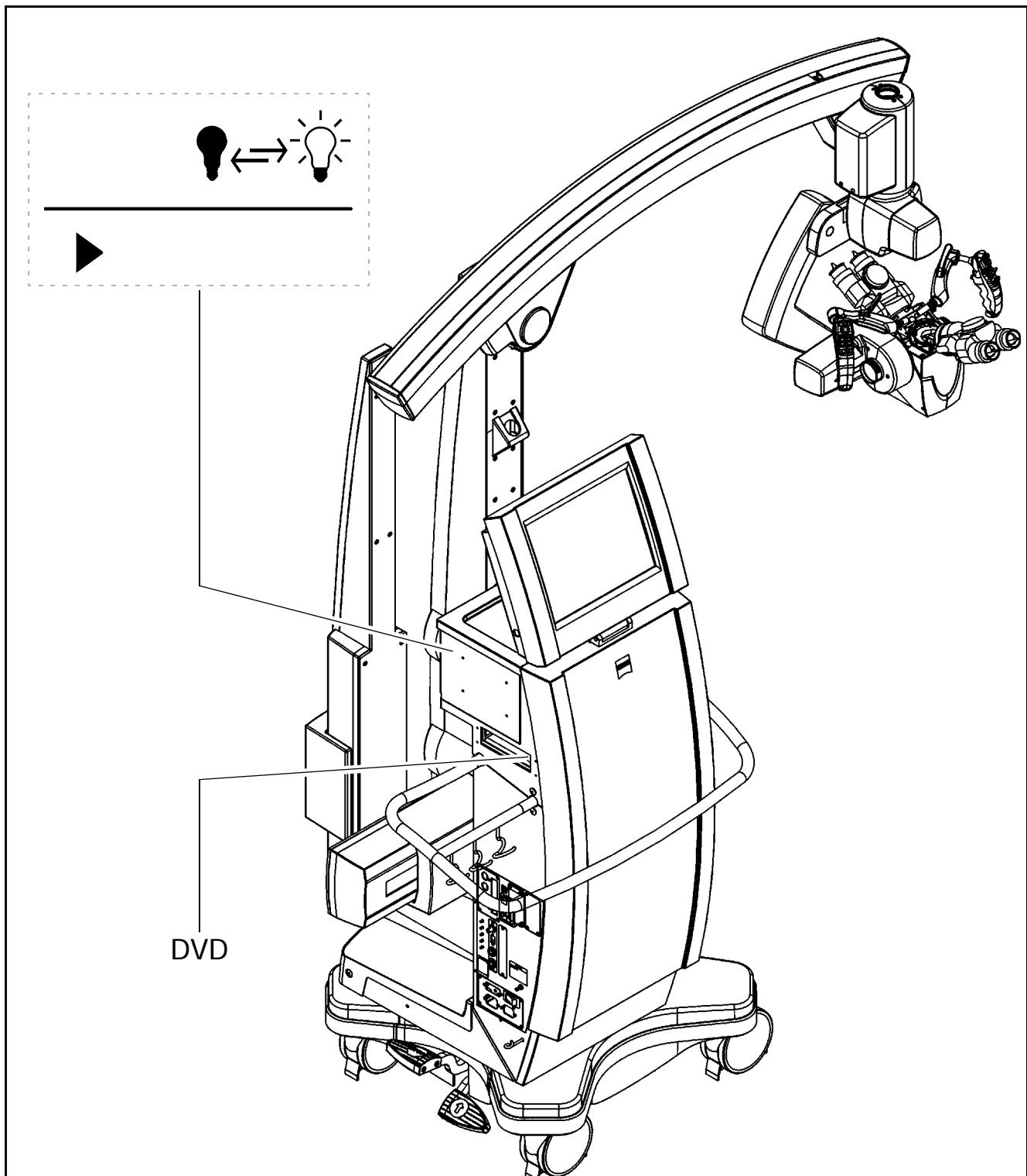
Observe all warning labels and notes!

If any label is missing on your instrument or has become illegible, please contact us or one of our authorized representatives. We will supply the missing labels.





**Labels: transport locks and risk of crushing**

**Labels: lamp change and DVD drive**



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OPMI® Pentero® Software Release 2.20 / 2.21

Issue 11.1  
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# Description

<b>OPMI Pentero</b>	<b>34</b>
Intended use	34
Special properties	36
Surgical microscope and laser micromanipulator	38
Injecting video images in the surgical microscope	39
Injecting navigation information in the surgical microscope *)	40
Overall system configuration	41
Configuration options	44
<b>Central user interface (touchscreen)</b>	<b>46</b>
Main menu	50
<b>Controls and connections</b>	<b>52</b>
Binocular tubes and eyepieces	60
Handgrips	64
Superlux 330 illumination system	66
Operating principle of the additional illumination	68
Autofocus (focusing aid)	69
Drape vacuum system	70
Stand base /FlexiTrack™ system	72
Connector panel	76
<b>Connecting navigation systems</b>	<b>80</b>

# OPMI Pentero

## Intended use

The overall system comprises a surgical microscope and a floor stand containing the electronics and a graphic touchscreen with video display. The OPMI Pentero is ideally suited for cranial and spinal applications in neurosurgery, for ENT applications in the area of the auditory nerve and the base of the skull. Further fields of application include R&P procedures in accident surgery, R&P surgery, and oral and maxillo-facial surgery. The system is also ideally suited for multidisciplinary use in microsurgery. It has also been designed for surgical procedures in which an endoscope and a surgical microscope are used simultaneously. The system is equipped for the connection of navigation systems and for data communication with external network systems.

The system is intended for use in hospitals, clinics or other human medicine institutions.

The functions of the surgical microscope and of the suspension system are controlled by the central control unit in the console. An interactive graphic touchscreen permits you to configure all settings. You can trigger these functions using the buttons on the handgrips or on a foot control panel.

The system must only be operated by physicians, nurses and other medically trained OR staff who have received appropriate briefing and observe the instructions of the user's manual. The installation conditions and the use of the system must meet microsurgical requirements:

- low vibration
- dust-free environment
- level, horizontal positioning
- avoidance of extreme mechanical stress.

### Warning!



- In line with its intended use, the system must only be used on a patient when it has been correctly balanced.  
With an incorrectly balanced system, brake release may lead to uncontrolled movements of the suspension system. For this reason, the balancing procedure and the subsequent test must not be performed above the patient and only at a safe distance from other persons and instruments.

- The system must not be used for ophthalmic procedures.



Note:

- The system is not intended for permanent data archiving. You can use CDs/DVDs, a USB stick or an external hard drive for data backup. All users are responsible for archiving their own data.  
If sufficient storage space is no longer available, the system informs you that files no longer required should be archived or deleted.  
Data can be deleted by every subsequent user!



Note:

- Please also take note of the latest Release Notes about the installed software version. These are part of the delivery package when the system is supplied. After a software update, you will always receive the latest version.



Note on MediLive Video Tools:

The MediLive Video Tools software provides improved compatibility between your PC (Windows™ or MacOS™) and the video DVDs created with OPMI® Pentero®.

Please install MediLive Video Tools on your PC if you notice the following problems:

- The computer cannot read the DVD content or the DVD is not identified because the UDF 2.0 disk format is not recognized.
- The video player or Office™ software is unable to play MPEG2 videos as the MPEG2 decoder is missing.

One MediLive Video Tools CD is supplied as part of the digital video recording option.

The ZEISS cat. no. of this CD is 308203-8040-000.

## Special properties

- The surgical microscope features an integrated beamsplitter system which can be set on the touchscreen (page 130) or on the microscope (manual setting of sliding mirror position; page 54) either as a symmetric optical system for face-to-face use, or for lateral coobservation and documentation.
- An autofocus system can be optionally used to focus the microscope on an object within a working distance of 200 to 500 mm.
- The autofocus system focuses on the object at the press of a button on the handgrip or foot control unit, in combination with the brake buttons. The point of reference is the center of the field of view. If the object is in focus, the focus is visualized by two laser spots which meet in the optical axis at the center of the field of view.
- The magnification ratio of the zoom system is 1:6.
- The system provides an image illuminated with optimum brightness, maximum image contrast and additionally switchable, special illumination for lightening up shadows in narrow channels. An integrated diaphragm permits the depth of field to be set to two levels.
- Filters can be automatically swung into the observation and video beam paths (for special applications such as fluorescence (option)).
- A high-grade 3-chip camera is integrated in the surgical microscope. An additional camera for the stereo mode can be retrofitted at any time by our service representative.
- The surgical microscope is equipped with a fully integrated, digital data injection system for navigation, video, PC, etc. (Multivision system).
- The system is equipped for the connection of a navigation system.
- **Video image injection** combines endoscopy with classical microscope technology.
- **Quick image switchover** between the microscope image and the endoscope image using a handgrip button or foot control unit, making it unnecessary for the surgeon to look up from the surgical field.
- **Video signal output:** what the surgeon currently sees is visualized on an external monitor.
- **Display of operating mode:** every time you press the handgrip button or the foot control unit, the current mode is displayed for 5 seconds in the form of text information superimposed on the current image.



- **Use in a navigation system \*)** possible via the navigation interface.
- **Image superimposition for navigation purposes \*)**: contours are superimposed on the current video image.
- Image injection for navigation purposes \*)
- Control of the graphic user interface, display of the touchscreen, control via the joystick mouse.

**\*) Only possible if a navigation system has been connected.**

- The system can be connected to an existing hospital network for the transfer or exchange of data (images, videos, audio files).
- The video images are visualized on the integrated color display, and are visible in both eyepieces of the surgical microscope. The microscope image is eclipsed by a shutter system for this purpose.
- At the press of a button (using the programmable handgrip button (Multivision function) or the foot switch), the integrated shutter permits rapid switching between the microscope image and the video image. This means that the surgeon can observe the endoscope image in the eyepiece and need not look at an external monitor.
- The coobservation and documentation equipment of the surgical microscope always provides the image seen by the surgeon.
- The touchscreen or an external monitor also displays the image currently seen by the surgeon. This is either the microscope image recorded by the integrated camera of the surgical microscope, or - after switchover - the image provided by a connected endoscope camera.
- An additional tiltable tube (option) can be mounted in a 180° position to the tube for the main surgeon, allowing two surgeons to work face-to-face.
- Important functions such as focusing and zoom have been motorized and can be controlled by the press of a button on the programmable handgrips.



**Warning!**

When connecting instruments from other manufacturers, make sure that safety is guaranteed regarding admissible ground leakage currents. The admissible limit value of the ground leakage current present in the suspension system's power cord is 500 µA in compliance with EN60601-1/IEC 601-1. This value must not be exceeded. CSA NRTL certification in compliance with UL 2601-1 only allows a maximum ground leakage current of 300 µA.

## Surgical microscope and laser micromanipulator

A Zeiss MM6 micromanipulator can be attached to the surgical microscope via the dovetail mount on the bottom of the microscope to permit the use of a laser. Micromanipulators from other manufacturers can be connected, but not electronically controlled.



**Note:**

For the OPMI Pentero, only CZ MM6 micromanipulators carrying the label "Adjusted for OPMI Neuro" may be used.

### Adjusting the surgical microscope and laser micromanipulator to the same focal plane

The OPMI Pentero is equipped with a motorized Varioskop zoom system which is operated via the focus rocker switches of the handgrips (Pos. 4/5, see page 64) or the focus buttons on the foot control panel (Pos. 5/6, see page 138).

The Varioskop is used for the motorized setting of the working distance (coarse focus) and the motorized adjustment of image definition (fine focus). The focus rocker switches allow you to continuously adjust the working distance between 200 mm and 500 mm.

- Set the working distance (coarse focus) to the focus value of the laser micromanipulator. The central user interface (touchscreen) always displays the focus value currently set.
- Use the previously described, recommended procedure to check that the focal planes coincide.
- If necessary, correct the focus by appropriate minor adjustment (fine focus).

The Focus Stop function (Pos. 2 page 124) permits you to deactivate the electrical drive of the focusing system. The focus rocker switches are disabled. This prevents the focal plane setting from being inadvertently changed by motorized movement. If Focus Stop has been activated, no autofocus setting is performed when the brakes are operated, even if the autofocus has been switched on.

## Injecting video images in the surgical microscope

The system described here is also suitable for surgical procedures in which an endoscope and a surgical microscope are used simultaneously.

Endoscopy-supported microsurgery is a frequently used surgery method, permitting minimally invasive procedures in neurosurgery.

- Neuroendoscopy uses special endoscopes and high-resolution video cameras to gain visual access to the skull, brain or spine. "Looking around the corner" is also possible.
- The surgical microscope with its stereoscopic image provides a good overall view of the entire surgical field. It can be securely and reliably positioned and allows convenient operation. Coobservation and documentation equipment can be attached to the surgical microscope.
- The integrated binocular MultiVision system makes the OPMI Pentero the ideal instrument for video image injection.
- The surgeon can perform the entire surgical procedure without taking his eyes from the surgical microscope.
- At the press of a button (using the programmed MultiVision button or programmed button of the foot control unit), the surgeon can rapidly switch between the microscope image and the endoscope image. The microscope image is eclipsed by a mechanical shutter, and the video image provided by the endoscope camera appears in both eyepieces.
- A coobserver on the surgical microscope always sees the same image as the surgeon.
- The touchscreen monitor always displays the image currently seen by the surgeon. This is either the microscope image recorded by the camera in the surgical microscope, or - after switchover - the image provided by the endoscope camera.
- You can record a video and save it on the hard drive for documentation (option). The optionally integrated video recorder records exactly what the surgeon sees, including the chronological sequence of switchover operations.

### Mode display

Every time you press the appropriately programmed MultiVision button of the handgrip or the programmed button of the foot control unit, the current mode is displayed for approx. 10 seconds in the form of text information superimposed on the current image.

When you select an input port without a valid signal, a message is displayed in the selected language for approx. 10 seconds, stating that **no** valid signal is available at this input port (e.g. NO VALID VIDEO SIGNAL), and the shutter is not activated. The shutter is only activated when it makes sense, e.g. only when a video signal is available.

## Injecting navigation information in the surgical microscope \*)

The OPMI Pentero is fully prepared for the connection of navigation systems. The fully integrated, powerful binocular MultiVision system even permits the display of information in color (contours, text, menus) in the superimposition mode. A connected navigation system can also inject various correlated or non-correlated data while the shutter is closed (depending on the connected navigation system).

The navigation interface is set to "active" by default. While the navigation interface is active, the information of the navigation system is injected in the MultiVision display. If you now press the MultiVision button programmed for navigation, the shutter is closed and only the injected navigation image is displayed. A further press of the button opens the shutter again.



**Note:**

- Even with a connected navigation system and the activated navigation interface, the Multivision button can be programmed with a different function available (off, endo, touchscreen).
- For operation with a connected navigation system, please observe the user manual of the navigation system concerned.

\*) Only possible if a navigation system has been connected.

### Connection and operation of navigation systems

Only systems from authorized manufacturers may be connected and used on the navigation interface of OPMI Pentero (see page 80). Authorized manufacturers are companies or institutions with which Carl Zeiss Surgical has concluded an Open Interface Contract and for which the use of the integrated navigation interface with data injection system has been licensed.

Please observe the user manual for the connected system.

## Overall system configuration

The overall system comprises a carrier system and a microscope system. The basic configuration can be upgraded by various options to meet the customer's specific requirements. All options available must be ordered separately.

### **OPMI Pentero basic system**

comprising:

- OPMI Pentero with integrated binocular data injection system and integrated 3CCD MediLive video camera,
- floor stand with touchscreen, integrated xenon illumination system with 2x 300W lamps, autobalance and autodrape systems,
- 180° tiltable binocular tube with 10x push-in widefield eyepieces, spinal adapter for symmetric face-to-face configuration,
- dust cover, 2 video connecting cables, CD-R and USB media for data archiving.

### **Digital video recording \***

Integrated digital video recording system with DVD archiving.  
See page 244.

### **Integrated fluorescence module**

- INFRARED 800 (IR800) \*\*\* see page 261
- FLOW 800 (processing mode for IR 800) \*\*\* see page 287
- BLUE 400 (BL400) \*\*\*see page 339

### **Voice control - dictation - telephony \*\***

Integrated system for voice control, telephony, dictation function

### **DICOM network interface \*\***

This option permits data exchange with an RIS or PACS system (**Radio-logical Information System or Patient Image Archiving System**) via a hospital network system based on the DICOM standard.

**Stereo video system\***

The stereo video option permits 3D viewing or recording of videos using suitable external systems.

**Neuromonitoring kit for OPMI Pentero**

This accessory permits reliable operation in conjunction with neuromonitoring systems (reduced electromagnetic interference radiation).

**HDTV merchandise\***

Visualization of the microscope's field of view in maximum quality on a monitor.

\* Option

\*\* Option, under development (currently not yet available)

\*\*\* The system has been approved in the EU under directive 93/42/EEC. However, according to national regulations, additional authorization may be required in the country in which the system and application will be used.

The fluorescence option is also available in other countries. Please contact your local Carl Zeiss representative for further information.





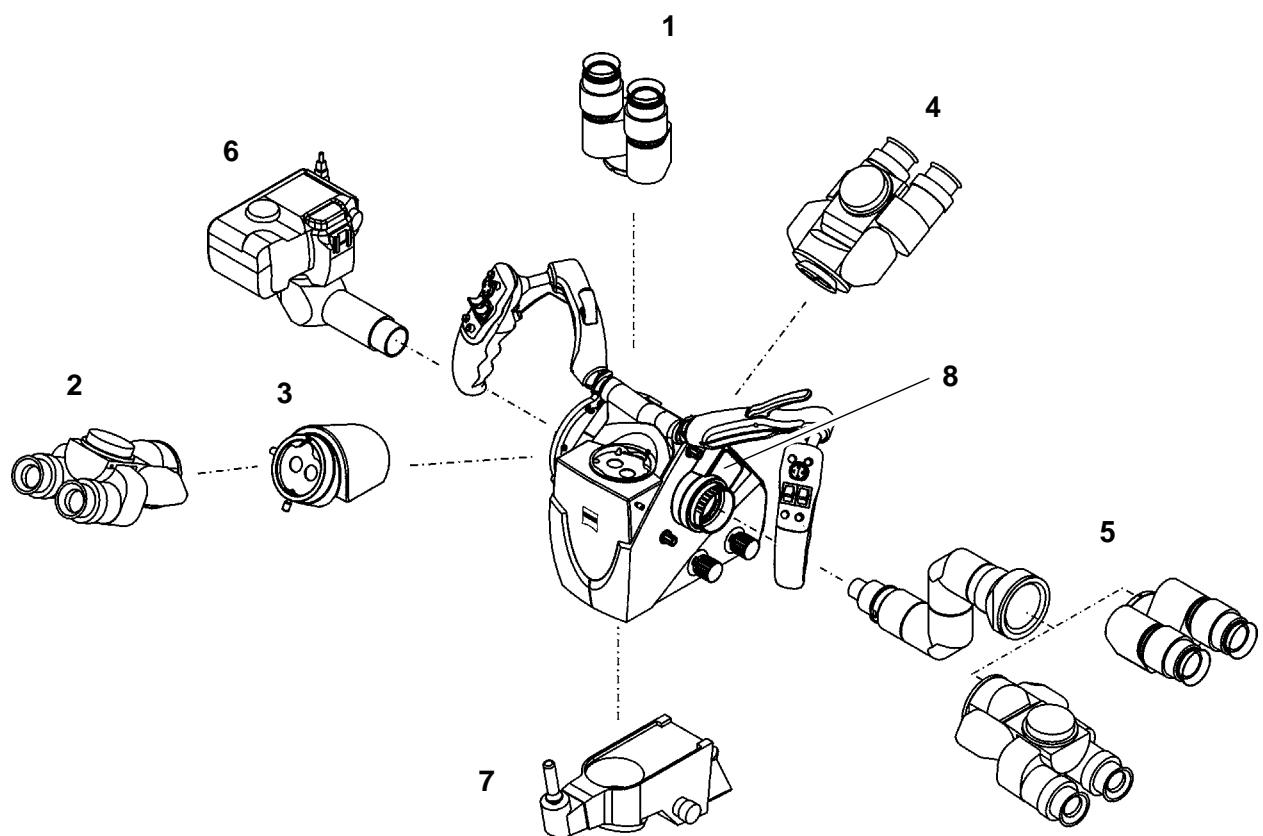
## Configuration options



### Warning!

Please note: The maximum load (accessory equipment) on the microscope body must not exceed 6 kg!

- 1 Surgical microscope with f=170 mm straight tube
- 2 Tilttable binocular tube, f=170 mm
- 3 Spine adapter
- 4 Tilttable binocular tube, f=170 mm, for face-to-face use
- 5 Stereo coobserivation module with straight or tilttable binocular tube
- 6 Digital SLR camera with camera adapter
- 7 Zeiss MM6 micromanipulator  
(or micromanipulators from other manufacturers)
- 8 Antenna (navigation system accessory)  
When a navigation system is connected, the OPMI Pentero has to be additionally equipped with an antenna supplied by the manufacturer of the navigation system, and then calibrated.



## Central user interface (touchscreen)

The video-capable, graphic touchscreen is the user's central communication interface with the system, connected databases and internet connections. In the main menu, it always displays the image of the 3CCD video camera integrated in the microscope body.

The touchscreen gives the user access to the settings of the microscope, suspension system, light source and of the programmable parts of the handgrips and foot control units. It is possible to store settings specific to each user. A sufficient number of memory locations are available for different users.

A full-screen mode permits the touchscreen to be used as a video monitor.



**Note:**

The touchscreen has not been optimized for displaying video images. We recommend a suitable, external video monitor for high-grade visualization of the video images recorded with the integrated 3CCD MediLive camera.

The control panel can be rotated through approx.  $\pm 90^\circ$  and tilted through approx.  $20^\circ$ , permitting easy viewing and operation by the user or other persons.

All functions can be interactively controlled using menus. The display shows the selected functions and settings.

The current date and time are displayed at the top left.

The user interface is largely self-explanatory:

- Press the relevant button to select or activate a function.
- Press and adjust a slider to change a parameter.

Selecting images from a thumbnail preview:

- Press the image required - the selected image will be displayed with a blue frame.
- To select the image for saving, press the Select button. The storage symbol is displayed in the image.  
You can undo the selection by pressing the selected image and the Select button once again. The storage symbol disappears.
- To delete the image, press the Delete button.  
Before the image is deleted, a dialog is displayed, requesting you to confirm the deletion.



**Note:**

Previously saved images are marked by a storage symbol.

- Press these buttons for browsing. The next or previous image will be displayed.

These buttons are only active in selection or configuration menus if several pages exist.

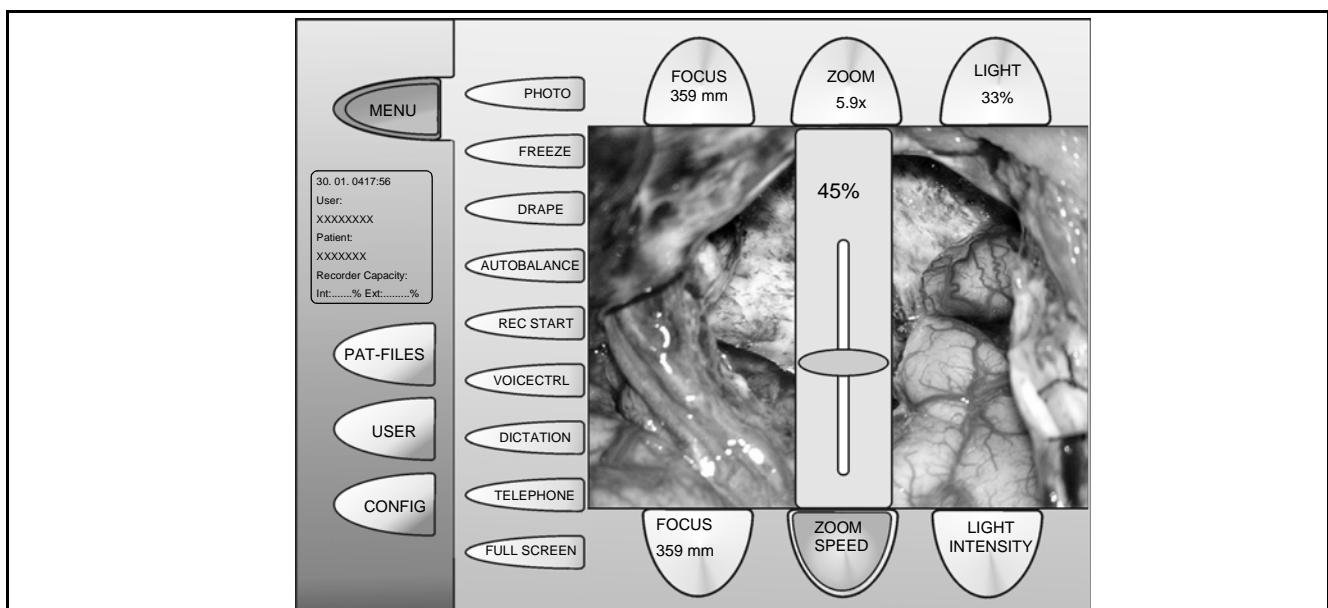
**Note:**

The graphic display is provided with a thin, pressure-sensitive plastic cover. For this reason, tip the display with your finger only and do not use pointed, hard objects which could damage the display.

**Warning!**

Do not use the stored images and videos for diagnostic purposes, as the video cameras and the monitor have not been calibrated. The visualized images may therefore include deviations in scale, color and shape.

The readings displayed are rounded values and are only provided for display and not for measuring purposes.



## Menu overview

The menu is structured as follows:

### MENU

The main menu is constantly displayed after the system has been started. You can use it for triggering a still camera and video recording, for automatic balancing of the system, for activating the drape vacuum system and for switching the illumination on and off. You can also activate the voice control, dictation and telephone functions (option). The full-screen mode permits you to view images or the live video signal in full display size.

### PAT-FILES

Use the Patient Files menu (page 174) to save, edit and manage patient data, videos, images and audio data.

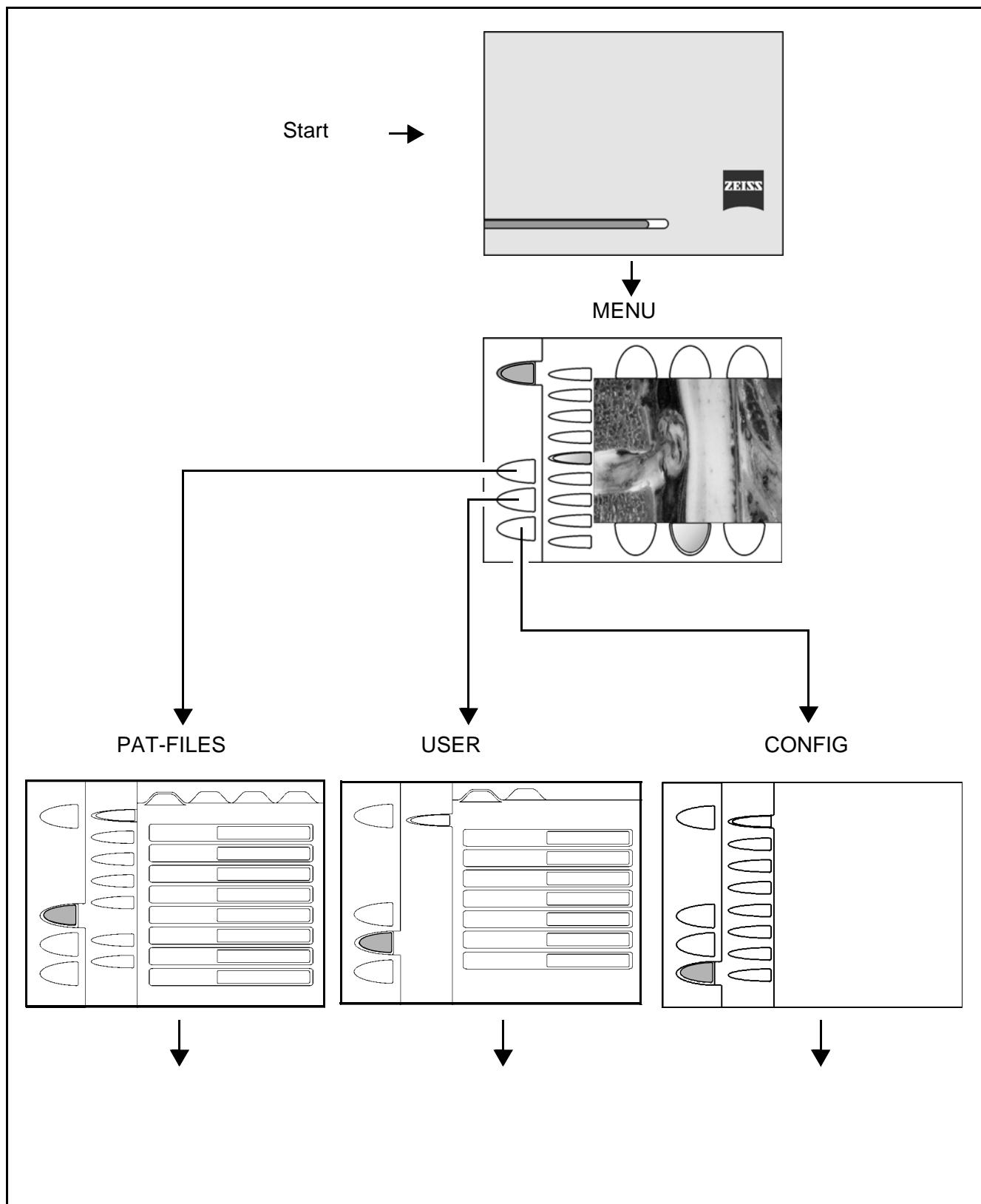
### USER

The USER menu (page 116) permits you to save user-specific settings for several different users. In addition, you can select several different languages for user guidance here.

### CONFIG

The CONFIG menu (page 124) permits you to enter the settings for the microscope and suspension system parameters.





## Main menu

### PHOTO

Press the button to trigger image recording. The captured image is displayed for approx. 5 seconds in the full-screen mode on the touchscreen, and is then automatically saved in the preconfigured image format in the previously selected patient directory.

Press the "CLOSE" button to return to the main menu.

It is not possible to exit the main menu during image recording.

### LIVE / FREEZE

When you press this button, a freeze image is created in the full-screen mode. Press the button again to return to the standard live mode.

### DRAPE

Press the DRAPE button to activate or deactivate the drape vacuum system, see page 70.

### AUTOBALANCE

For automatic balancing of the system. (See "Preparations for use / Balancing the system", page 110).

### REC START / REC STOP (option)

For starting and ending a digital video recording. While video recording is in progress, a "Rec" display with the recording length appears on the monitor and in the data injection system.

### VOICE CTRL (option, currently not yet available)

Various system functions can be activated by voice control.

### DICTIONATION (option, currently not yet available)

This option permits the digital recording of an audio file (e.g. a comment on the video)

### TELEPHONE (option, currently not yet available)

This function permits you to use the system for phoning (integrated microphone and loudspeaker).

### FULL SCREEN

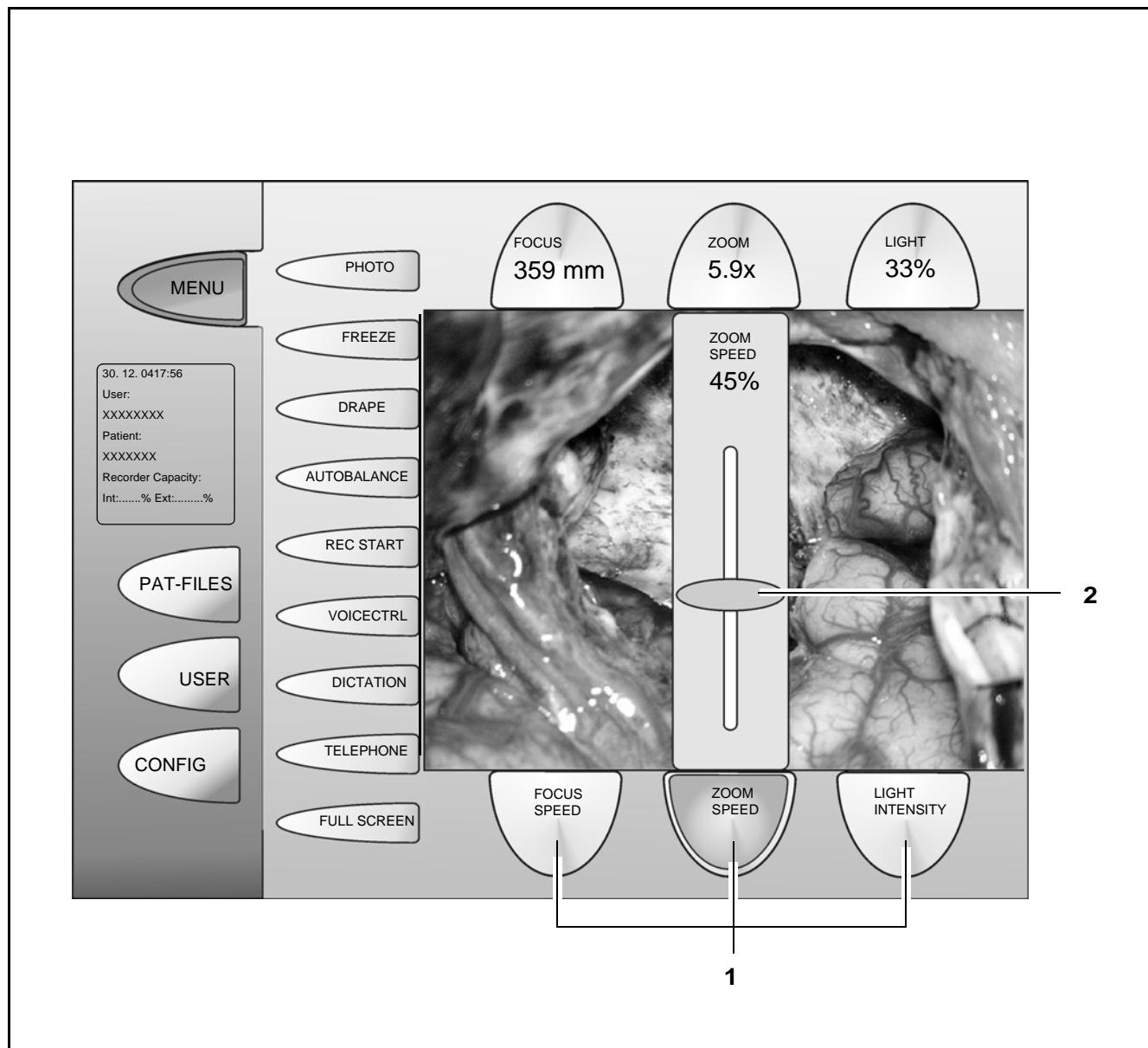
You can switch the video image from the window mode to the full screen mode.



#### Note:

- In the full screen view, in the PAT-FILES menu, two buttons ("Back" and "Next") are displayed, permitting you to browse through several images. Press the "CLOSE" button to return to the main menu.
- The values displayed by the system for zoom, focus and light are rounded values; they are only intended for information, not for measurement purposes.

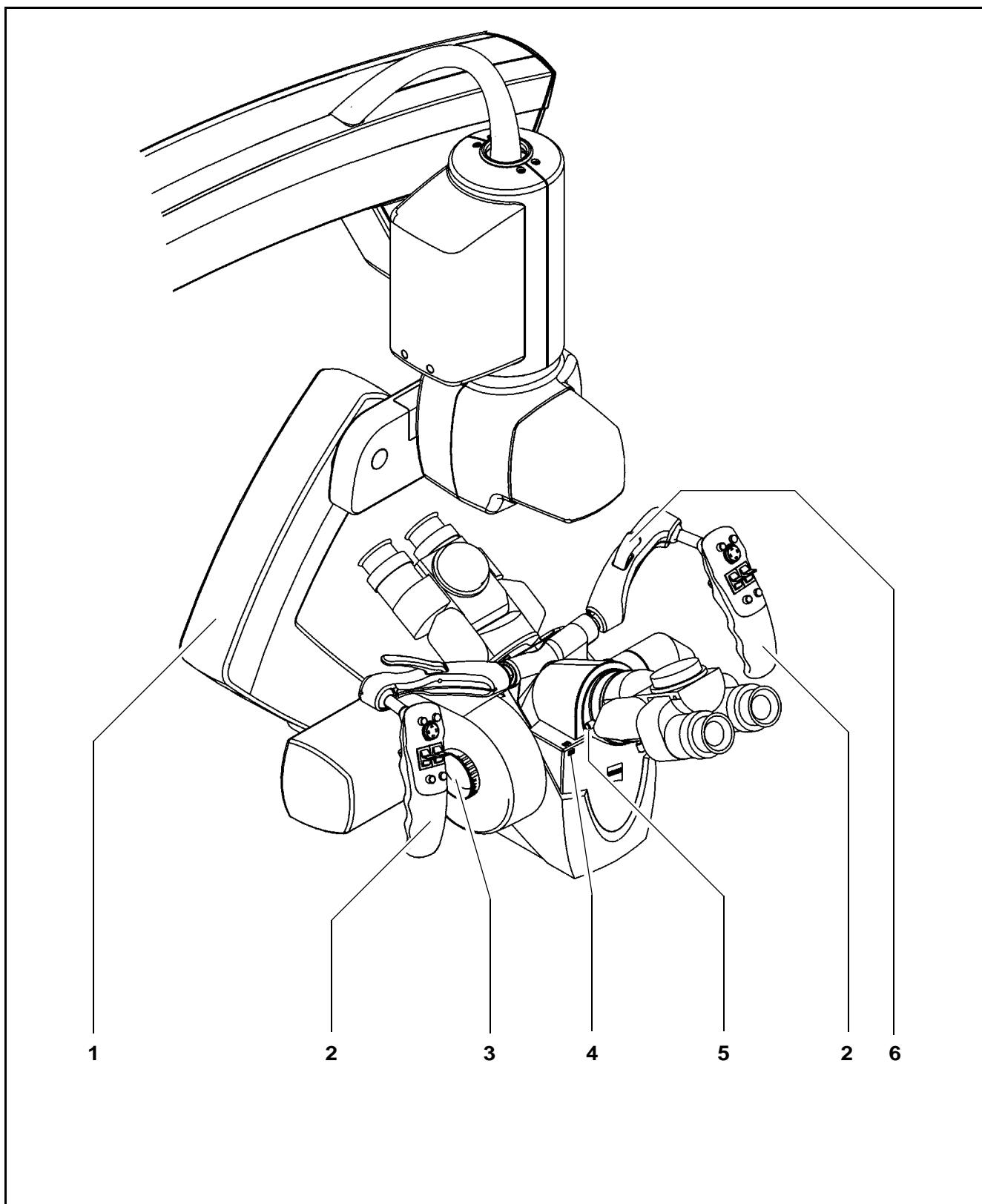
- 1 Activating the setting bar
- 2 Continuous adjustment of settings (e.g. zoom) using the slider.



## Controls and connections

- 1** Microscope mount
- 2** Handgrips with programmable buttons
- 3** Left beamsplitter port  
for documentation and coobservation devices (e.g. still camera or coobservation tube).
- 4** Microphone
- 5** Locking screw for clickstop mechanism  
After opening the locking screw, you can turn the tube (7, next page) to the left or right to three clickstop positions in steps of 5°.
- 6** Handgrip locking mechanism  
After opening the locking levers, you can adjust the ball-jointed handgrips as required.





- 7** 180° tiltable tube  
with f=170 mm focal length and 10x eyepieces
- 8** Spine adapter (removable)  
for improved operating convenience in spinal applications
- 9** Securing screw  
for tube or spine adapter
- 10** Zoom adjusting knob (manual zooming)
- 11** Right beamsplitter port  
for documentation and coobservation devices (e.g. still camera or coobservation tube).
- 12** Adjusting knob for Varioskop (manual focusing)
- 13** Adjusting knob for illuminated field diameter (zoom illumination)

**Warning!**

Adjust the illuminated field diameter and illumination intensity to the values required for the procedure! (See page 23)

- 14** Sliding mirror, manual setting (emergency function)  
The sliding mirror has two positions:

Pos. 1:

The light is directed to the tube mount at the back.

Pos. 2:

The light is directed to the lateral image exit ports. If an external camera is released and the sliding mirror is in Pos. 1, the mirror switches to Pos. 2 during image capture.



Pos. 1



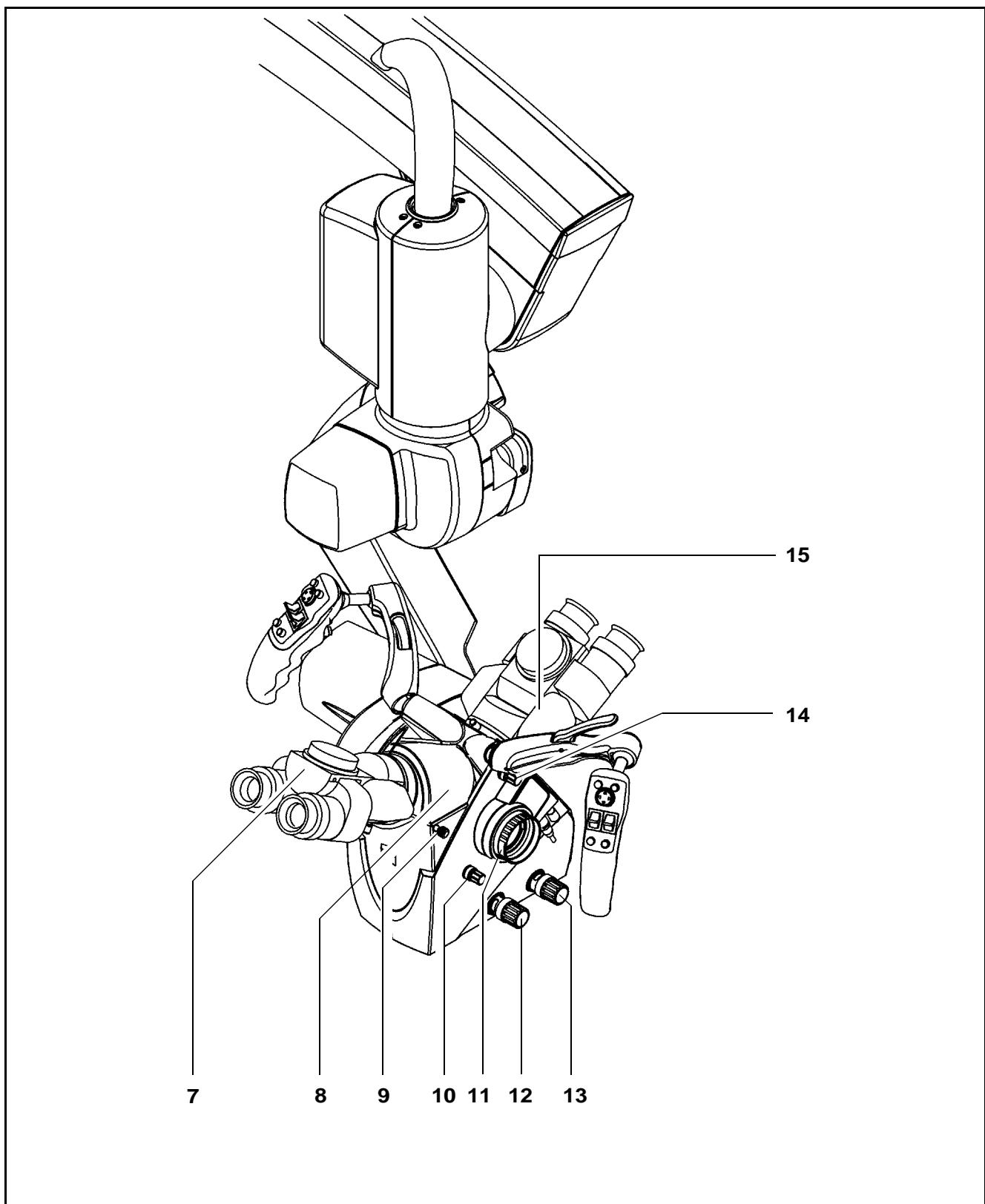
Pos. 2

**Note:**

The type of coobservation (lateral image exit ports: left/right, or opposite image exit ports: face to face) can be configured at the touch-screen, see page 130.

The sliding mirror is electronically positioned accordingly.

- 15** 180° tiltable coobservation tube  
with f=170 mm focal length and 10x eyepieces



**16 Dovetail for connecting a micromanipulator**

A Zeiss MM6 micromanipulator can be attached to the surgical microscope via the dovetail mount on the bottom of the microscope to permit the use of a laser. Micromanipulators from other manufacturers can be connected, but not electronically controlled.

**Note:**

For the OPMI Pentero, only CZ MM6 micromanipulators carrying the label "Adjusted for OPMI Neuro" may be used.

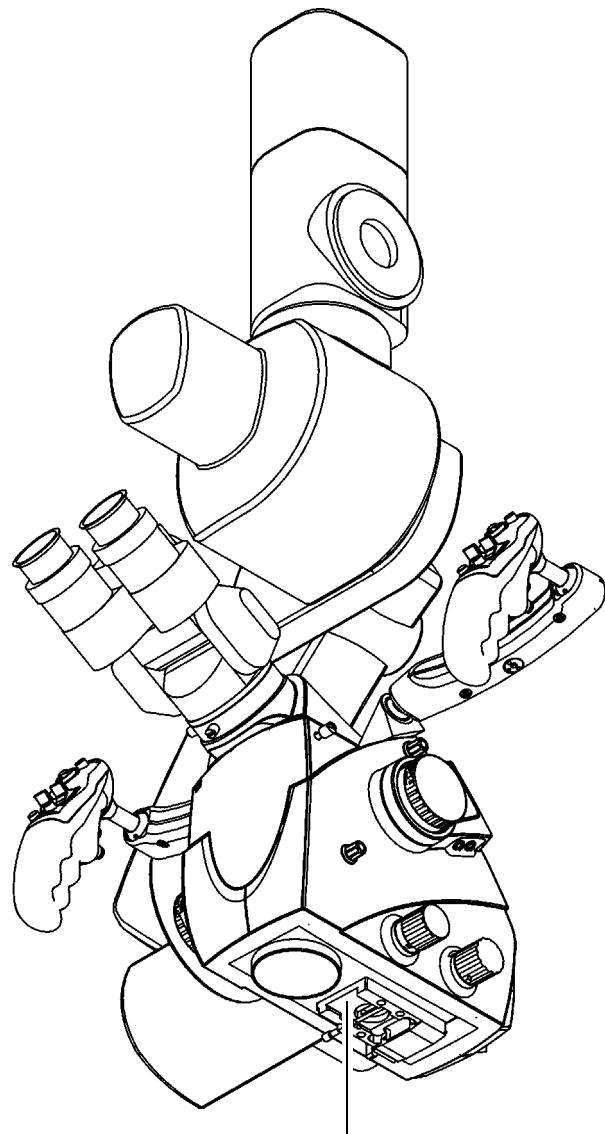
**Adjusting the surgical microscope and laser micromanipulator to the same focal plane**

The OPMI Pentero is equipped with a motorized Varioskop zoom system which is operated via the focus rocker switches of the handgrips (Pos. 4/5, see page 64) or the focus buttons on the foot control panel (Pos. 5/6, see page 138).

The Varioskop is used for the motorized setting of the working distance (coarse focus) and the motorized adjustment of image definition (fine focus). The focus rocker switches allow you to continuously adjust the working distance between 200 mm and 500 mm.

- Set the working distance (coarse focus) to the focus value of the laser micromanipulator. The central user interface (touchscreen) always displays the focus value currently set.
- Use the previously described, recommended procedure to check that the focal planes coincide.
- If necessary, correct the focus by appropriate minor adjustment (fine focus).

The Focus Stop function (Pos. 2 page 124) permits you to deactivate the electrical drive of the focusing system. The focus rocker switches are disabled. This prevents the focal plane setting from being inadvertently changed by motorized movement. If Focus Stop has been activated, no autofocus setting is performed when the brakes are operated, even if the autofocus has been switched on.



16

**17 Lever for additional illumination**

This lever permits you to switch the additional illumination on and off.  
See "Operating principle of the auxiliary illumination" on page 68.

**Note:**

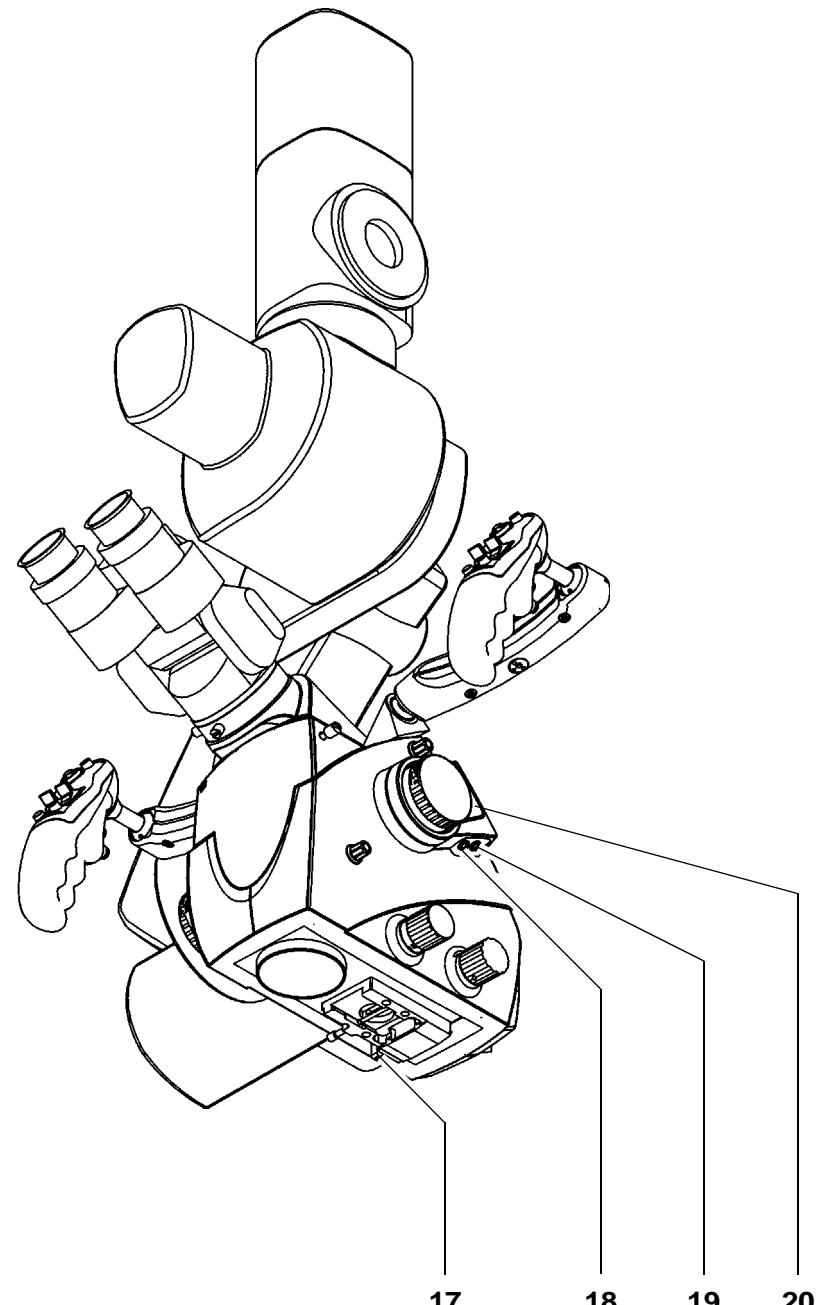
The additional illumination cannot be used when the MM6 micromanipulator has been connected.

**18 Mouth switch socket**

You can use the mouth switch (option) to release or lock the magnetic brakes for the three main axes of the suspension system. The mouth switch has the same function as the SB brake control button on the handgrip.

For mounting the mouth switch, see page 94.

**19 Camera release socket  
for an external still camera****20 Socket  
for connecting an optional antenna module (navigation).**



## Binocular tubes and eyepieces

Depending on the application involved, you can equip the surgical microscope either with one 180° tiltable tube, two 180° tiltable tubes (face-to-face) or with one straight tube only.

### 180° tiltable tube

#### 1 PD adjustment knob

The correct position has been reached when the two eyepiece images merge into one.

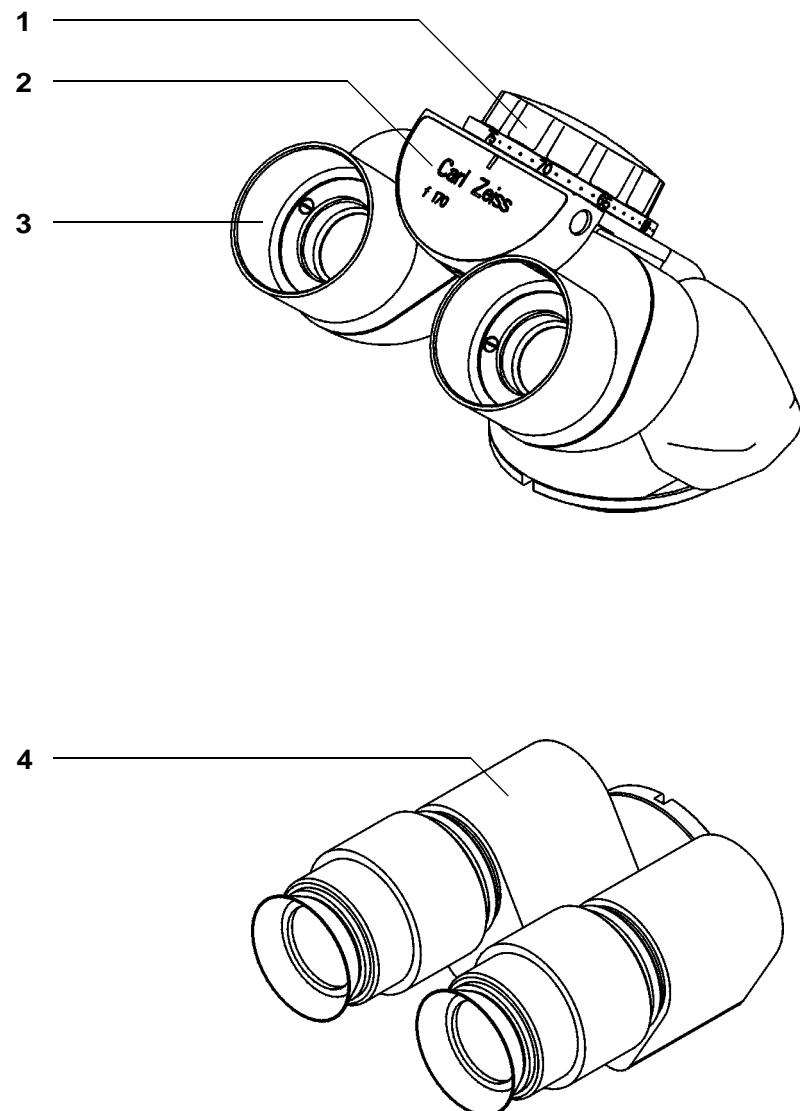
#### 2 180° tiltable binocular tube, $f = 170$ mm

#### 3 Eyepiece mount

### Straight tube

#### 4 Straight tube, $f = 170$ mm





## Widefield eyepieces with magnetic coupling



### Note:

When the eyepiece has been removed from the tube, please remember that it is equipped with a magnetic coupling. Attached eyepieces feature a very minor magnetic field, i.e. the usual regulations for the handling of magnets must only be observed with non-attached eyepieces.

- Do not place the eyepiece near instruments which may be magnetic.
- Do not place the eyepiece on sensitive electronic instruments such as infusion pumps, heart pacemakers, measuring instruments or magnetic data carriers such as disks, audio/video tapes or credit cards.
- Always store the eyepiece in its original packaging, when not using it.

### 1 Eyecup

Always adjust the eyecups in such a way that the entire field of view can be seen.

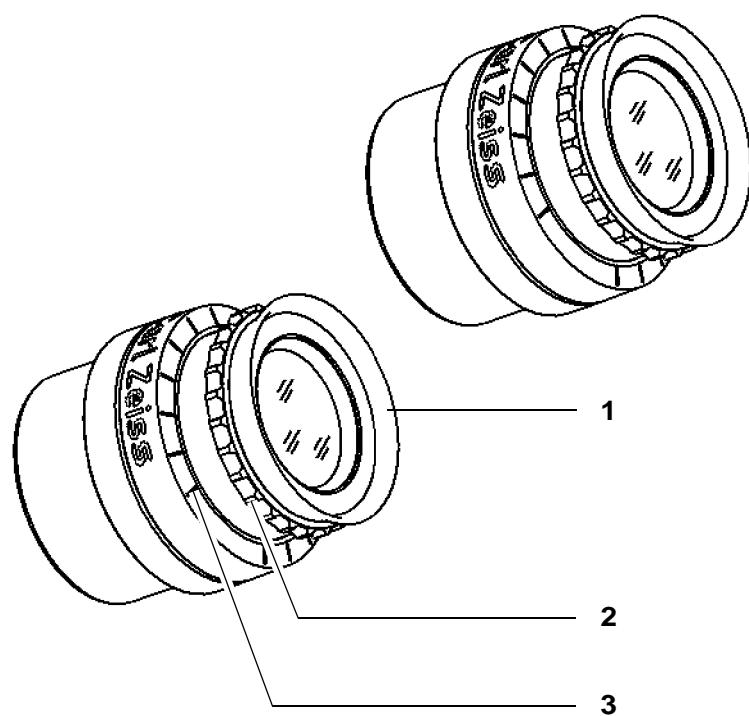
- Viewing with eyeglass- Screw in the eyecups all the way.  
es:
- Viewing without eye- Adapt the eyecups to the viewer's field  
glasses: of view by screwing them outward.  
The three white marking rings facilitate the adjustment.

### 2 Diopter setting ring

The eyepieces enable you to set your prescription between -8 D and +5 D. Eyeglass wearers using their glasses during work should set the diopter setting ring to 0. Turn the ring until the optimum setting has been achieved. An integrated brake holds the setting ring in the position set.

### 3 Diopter scale

For reading off the prescription set.

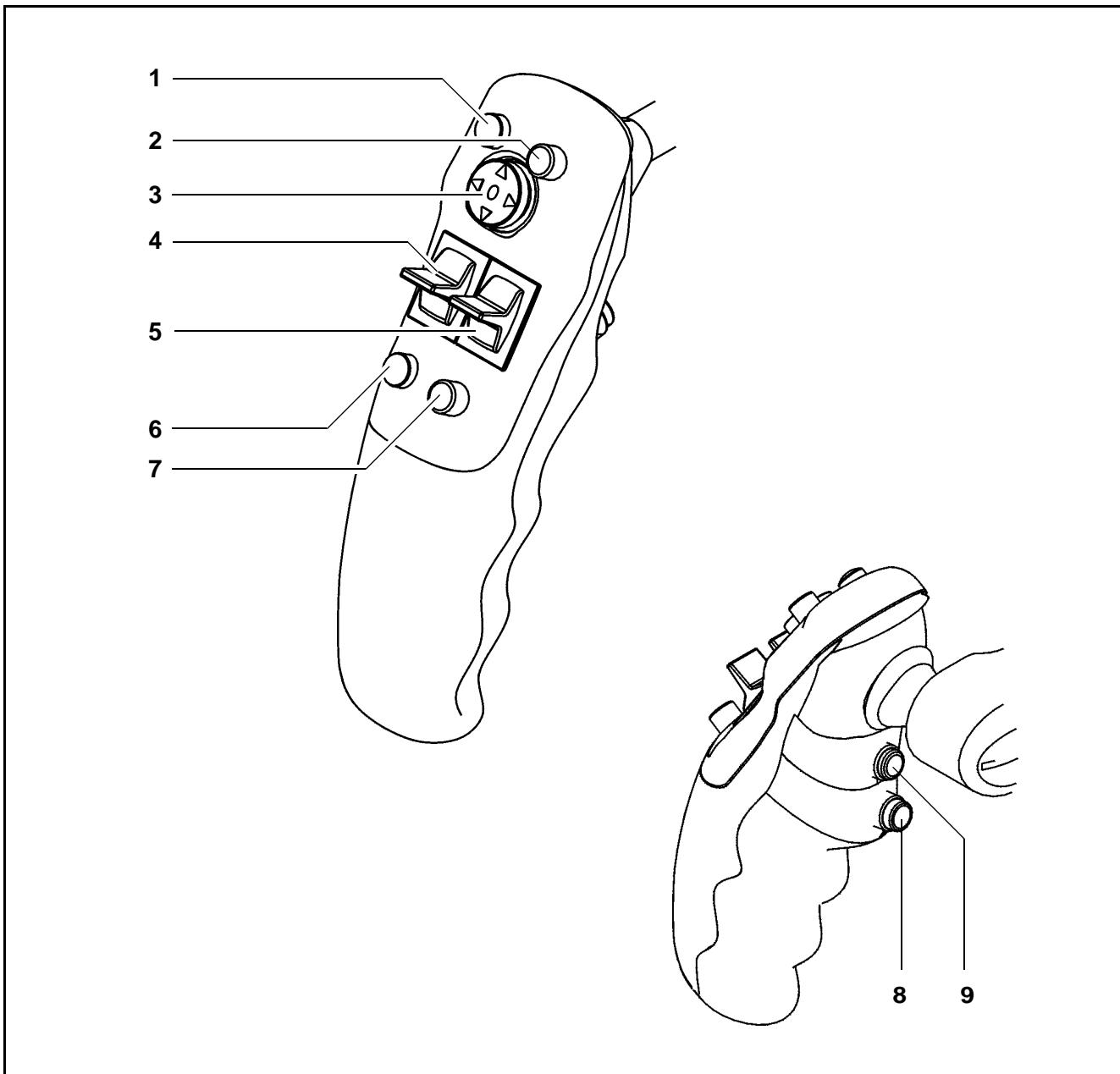


## Handgrips

- 1 Programmable button A**  
(factory setting: trigger photo)
  - 2 Programmable button B**  
(factory setting: autofocus)
  - 3 Joystick**  
In the basic setting, both joysticks can be used for motorized fine movement in the XY directions.  
If the MultiVision function is active, the joystick of the right handgrip is used to control a mouse cursor for the functions of a connected navigation system (depending on the system used) or for menu control of the displayed touchscreen.
-  **Note:**  
Major system errors are displayed in the microscope's integrated data injection system. You can delete these messages by acknowledgement using the joystick of the right handgrip (pushbutton) or the touchscreen.
- 4 Focus + / focus - rocker switch (factory setting)**  
for continuous focusing within the working distance of 200 mm to 500 mm. The current value is displayed on the screen.
  - 5 Zoom + / zoom - rocker switch (factory setting)**  
for magnification setting. The current value is displayed on the screen.
-  **Note:**  
The zoom and focus functions of the two rocker switches (4 and 5) can be interchanged. Call up the CONFIG menu / STAND / HANDGRIPS and briefly press button C. The displays and functions are interchanged
- 6 Programmable button D**  
(factory setting: reduce illumination intensity)
  - 7 Programmable button E**  
(factory setting: increase illumination intensity)
  - 8 Brake release button (AB)**  
Brake release button for all suspension system and microscope axes. For as long as you press this button, all magnetic brakes are released ("All Brakes") and the system can be moved in all directions. When you let go of the button, the magnetic brakes simultaneously lock all axes in position.
  - 9 Brake release button (SB)**

Brake release button for the microscope axes or suspension system axes (factory setting). For as long as you press this button, only the magnetic brakes of the suspension system or microscope axes are released ("Selected Brakes"), and the suspension system or microscope can be moved in all directions. When you let go of the button, the magnetic brakes simultaneously lock these axes in position.

The configuring of the handgrips is described on page 106.



## Superlux 330 illumination system

The illumination system has been completely integrated in the system. The light source generates light whose spectrum resembles that of natural daylight. Regardless of the brightness setting, the color temperature of the light always remains the same.

The illumination system contains two xenon lamps. The second lamp is used as a backup lamp which can be swung into the illumination beam path via a quick-action changer when the first lamp fails. This change takes no longer than a few seconds (lamp change see page 222).

**Warning!**



Never use xenon illumination for ophthalmic procedures.

Make sure that no xenon light enters the patient's eyes.

Make sure that no tissue damage is caused by excessive illumination intensity (see page 20).

**Caution:**



Do not cover the ventilation grid on the stand console. This can lead to overheating of the lamp modules and to lamp failure.

**1 Switching the illumination on and off**

In the main menu on the touchscreen or in the Config menu (Preparations for use / Light, see page 132); (factory setting: light on)

**2 Adjusting the illumination intensity**

Continuously variable from minimum to maximum brightness in a range from 5% to 100%.

You can adjust the illumination intensity using the programmable buttons on the handgrips or foot control panel, or via the main menu on the touchscreen.

**Warning!**



The illumination intensity has been preconfigured in such a way that a warning is displayed on the touchscreen when the threshold value of 25% is exceeded, informing the user of possible tissue damage.

**3 Activating the setting bar**

**4 Adjusting the illuminated field diameter**

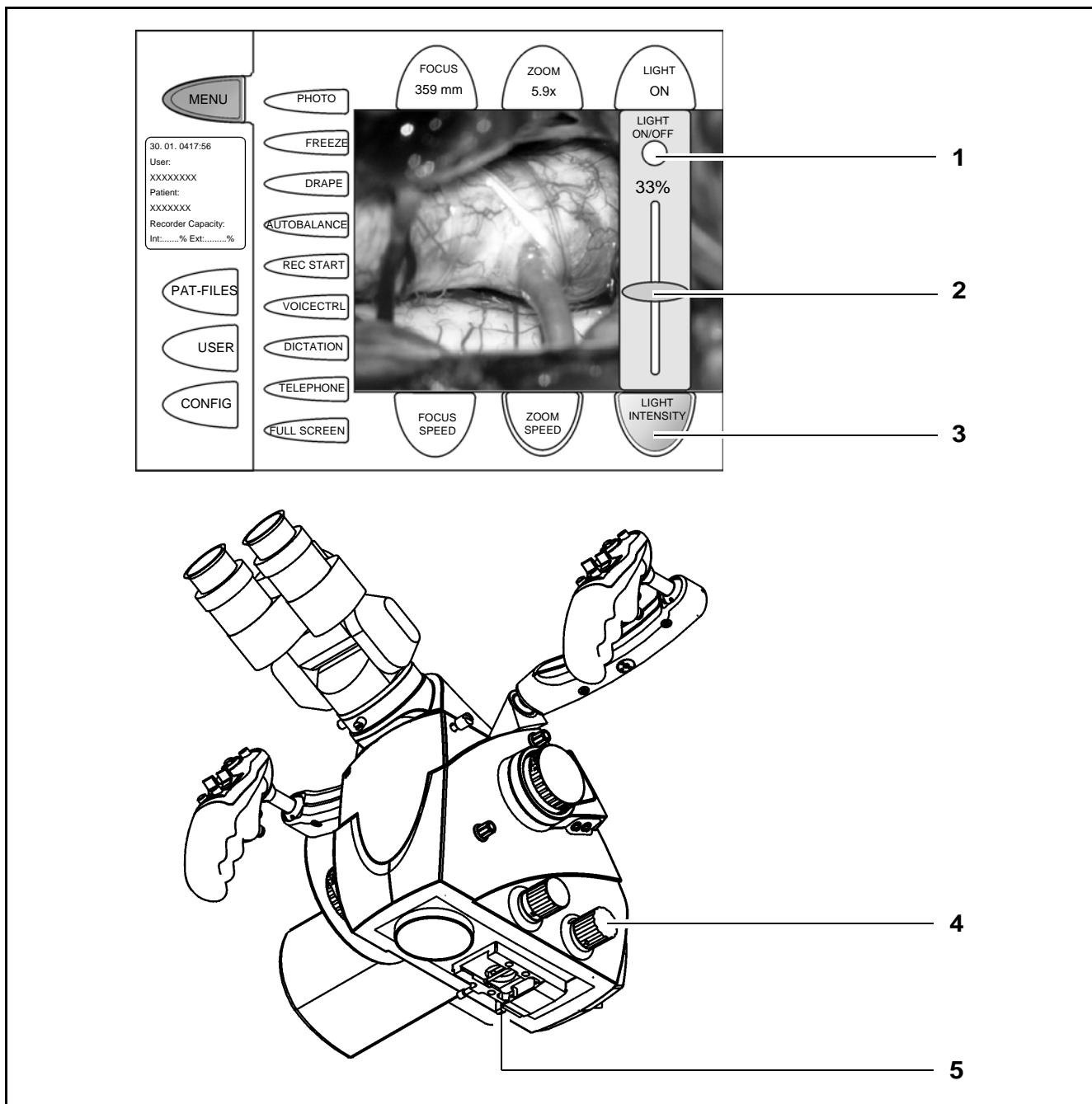
**Warning!**



Adjust the illuminated field diameter and illumination intensity to the values required for the procedure! (See page 23)

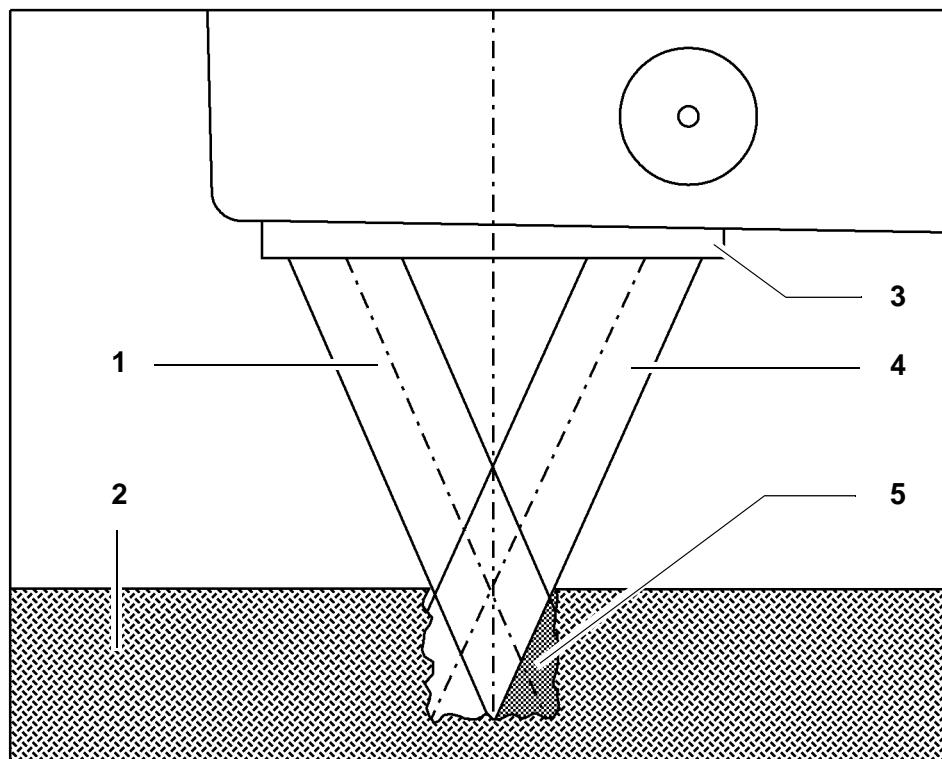
**5 Manually switching the additional illumination on and off**

Configuring the illumination, see page 132.



## Operating principle of the additional illumination

- 1 Additional illumination
- 2 Surgical field
- 3 Objective lens of the surgical microscope
- 4 Main illumination
- 5 Shadow area of main illumination



## Autofocus (focusing aid)

### Operating principle

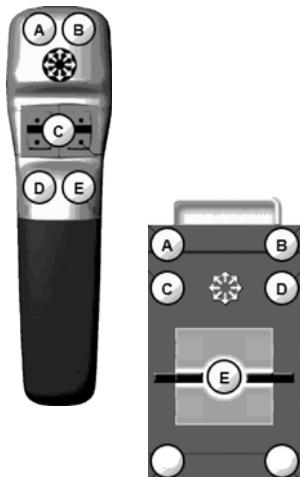
On activation of the function, two parallel, visible laser beams enter the Varioskop and intersect in the focal plane. The Varioskop focusing system is adjusted until the laser beams meet in one point, i.e. until the object plane and the focal plane coincide. The system distinguishes between the right and left laser beams, permitting targeted movement in a defined direction.

When the system is focused in very narrow channels or on glossy, strongly reflecting surfaces, it may happen that one of the two laser beams does not strike the target plane. Laser measurement becomes impossible in this case. The system therefore performs automatic focusing using video contrast measurement.

### Activating the autofocus

You can start the autofocus by:

- pressing an appropriately configured handgrip button (A, B, D, E)
- pressing an appropriately configured foot control button (A, B, C, D)
- linking it with the brake function, i.e. the autofocus is automatically activated after the magnetic brakes are locked.
- optional voice control
- For configuring the autofocus function, see page 108 and page 124.



## Drape vacuum system

To facilitate the draping of the system and intraoperative processes for the OR staff, the system features an integrated drape vacuum system which extracts the air from the drape at the suspension arm and surgical microscope.

- The drape vacuum pump is activated by pressing DRAPE button (1) in the main menu.

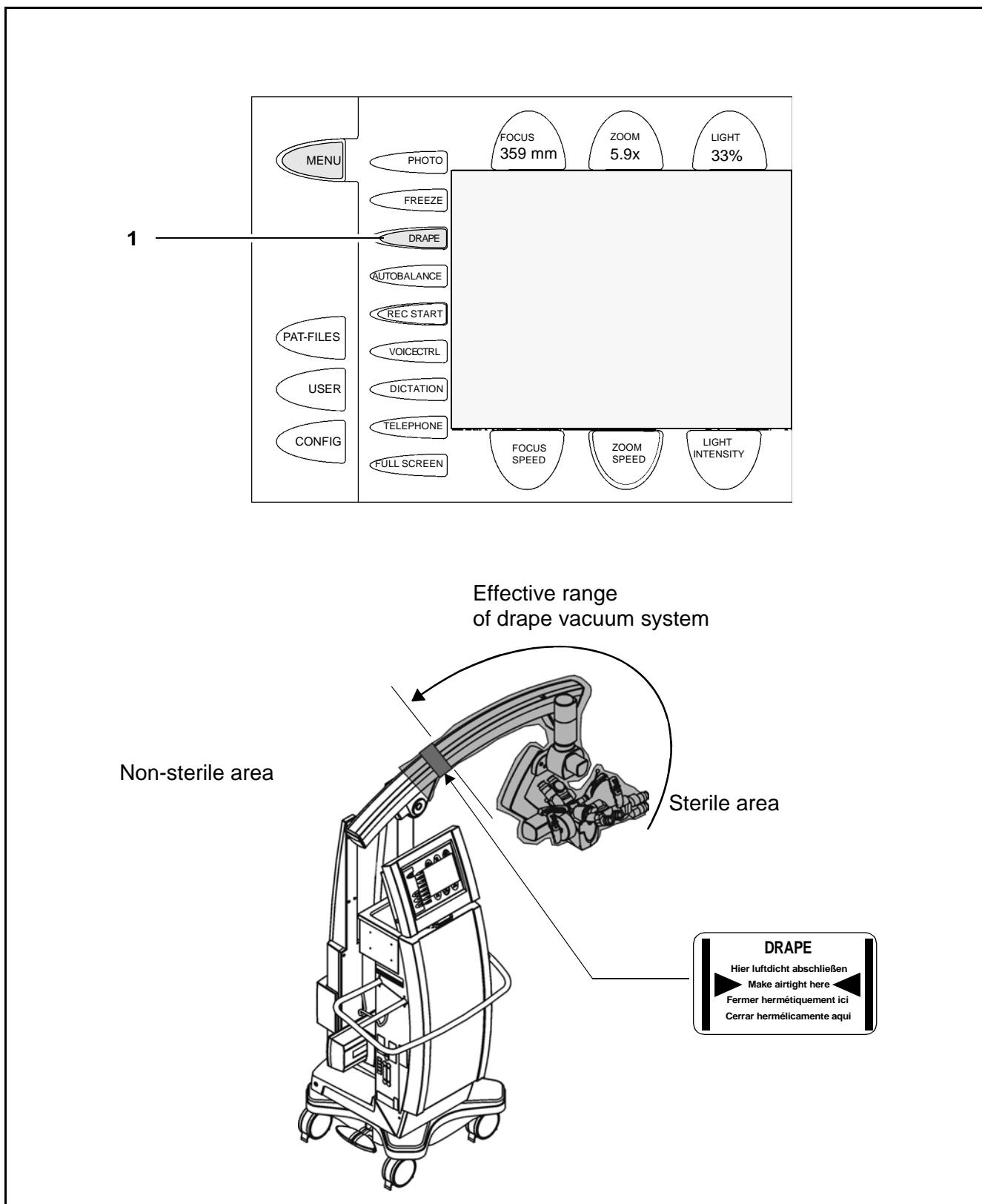


Note:

The vacuum system operates at maximum power during the first 2 minutes approximately. Then it automatically switches to a defined maintaining power to keep up the vacuum.

- The drape vacuum pump is switched off by pressing DRAPE button (1) in the main menu once again.

Attaching sterile drapes, see page 100.



## Stand base /FlexiTrack™ system

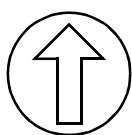
The base of the floor stand permits free positioning and movement of the system in all directions. The FlexiTrack system enables steered straight-ahead movement in corridors and through doorways, and easy, flexible positioning of the system in the OR. It is also easy to drive over thresholds or small obstacles (e.g. elevator doors).

If none of the pedals described below has been pressed, the stand can be moved in any direction. This setting is suited for positioning the floor stand in its location of use. It should, however, not be used to relocate the system over long distances.



### 1 Locks

Press down the pedal all the way to lock the stand in position.  
Press pedal for straight-ahead movement (2) to release the locking pedal. You can now move the stand as required.



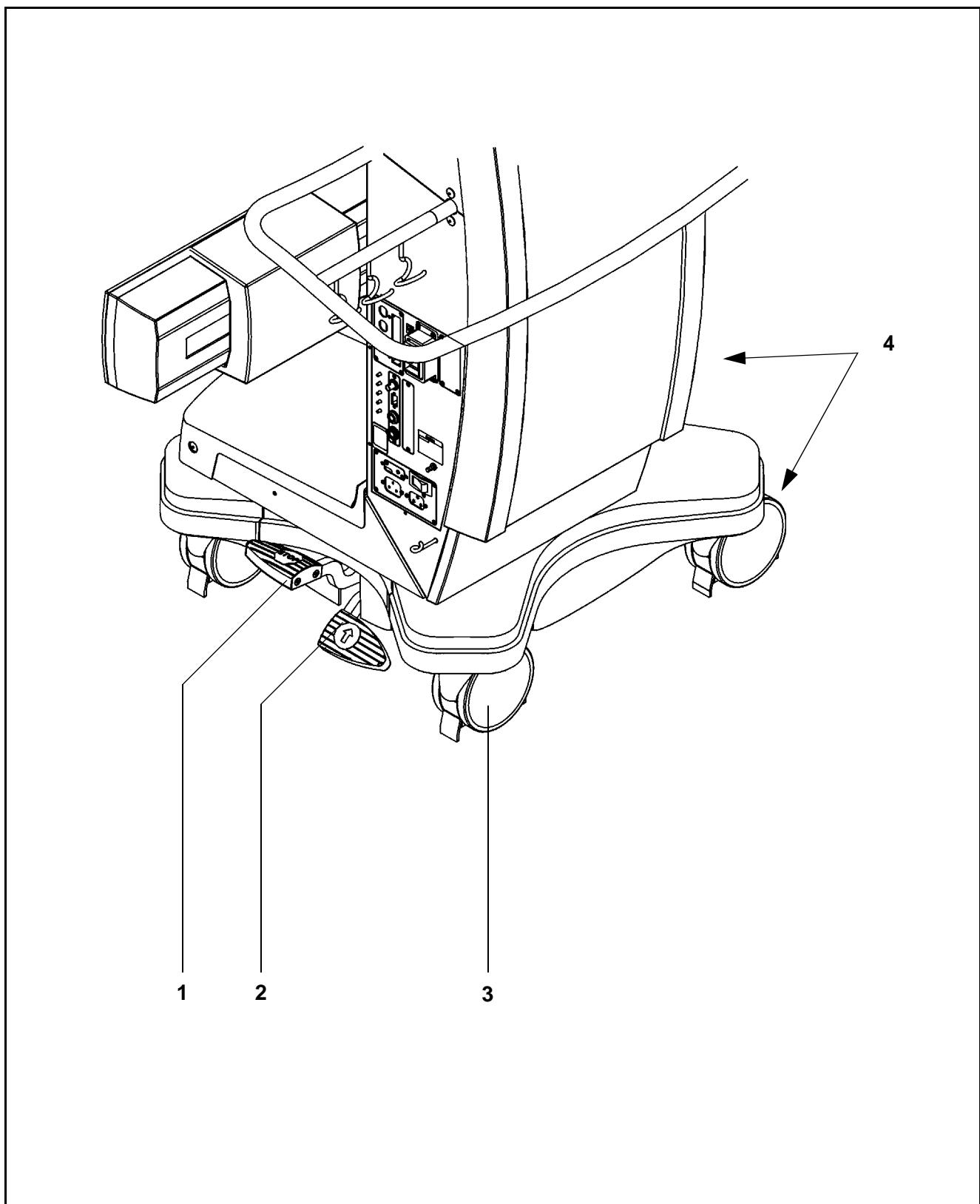
### 2 Pedal for straight-ahead movement

Press this pedal until it snaps in to set the two front casters (4) for straight-ahead travel. Slightly jiggle the suspension system until the two front casters click in straight-ahead travel position. The other casters remain steerable.

Choose this possibility for steering the stand over long distances and for movement in a straight-ahead direction.

When you press pedal (1), all four casters will be steerable again.

### 3 Steerable double caster with cable deflector



### **Relocating the system**

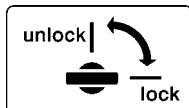
- 1** Maneuvering handle  
for relocating the system.



**Note:**

The maneuvering handle can be folded up to permit the system to be steered through extremely narrow passages. For this, two screws must be loosened on the underside of the handle.

- 2** Transport lock for axis 1  
for locking axis 1 in position during transportation.



- 3** Transport lock for axis 3  
for locking axis 3 in position during transportation.

- 4** Transport lock for axis 2  
for locking axis 2 in position during transportation.

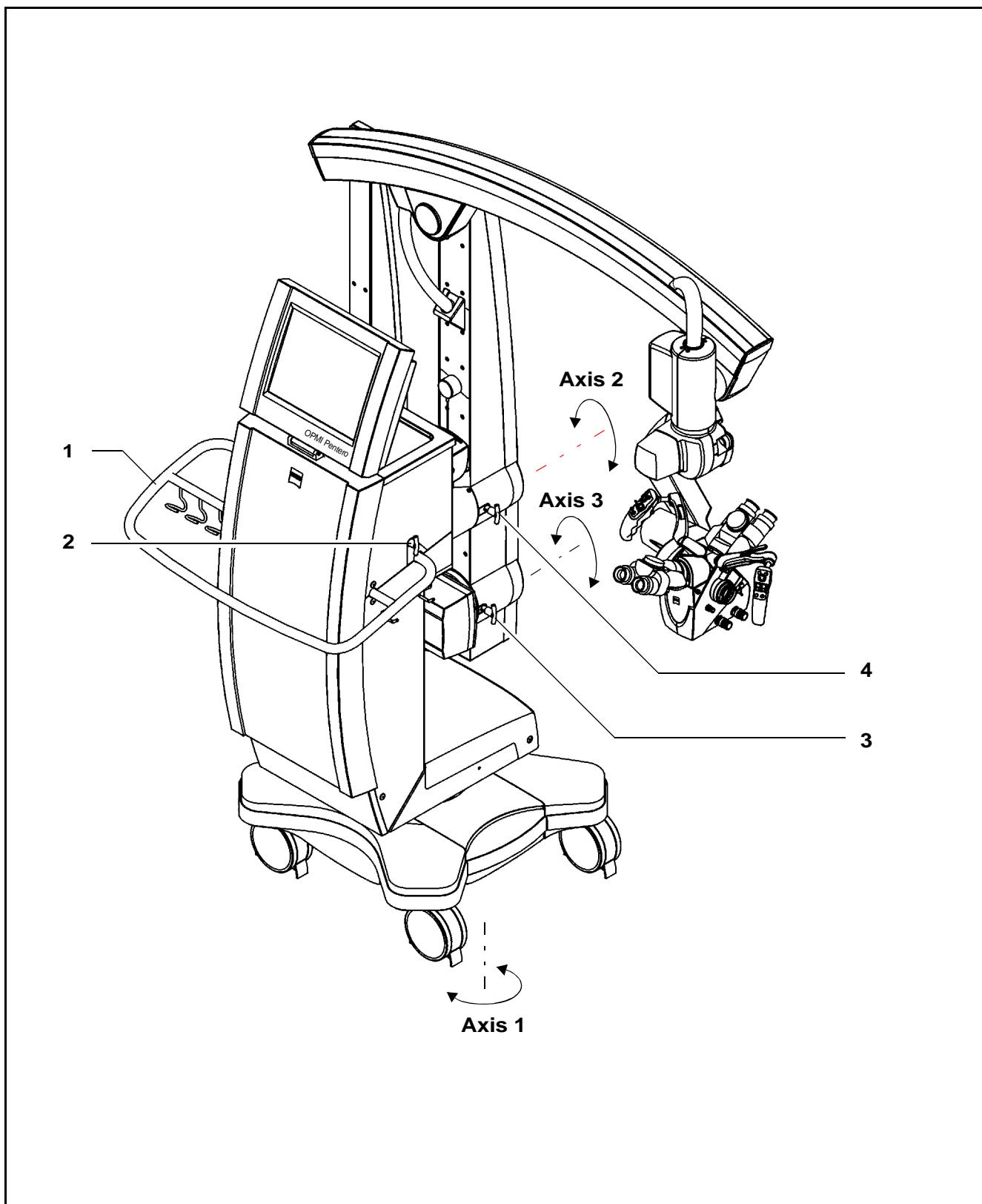


**Note:**

- The grips must be in a horizontal position to permit the transport locks to engage.
- Move the suspension system and the suspension system arms until the transport locks audibly snap in.

### **Releasing the transport locks**

Pull out the transport locks as far as they will go and turn them through 90°.



## Connector panel

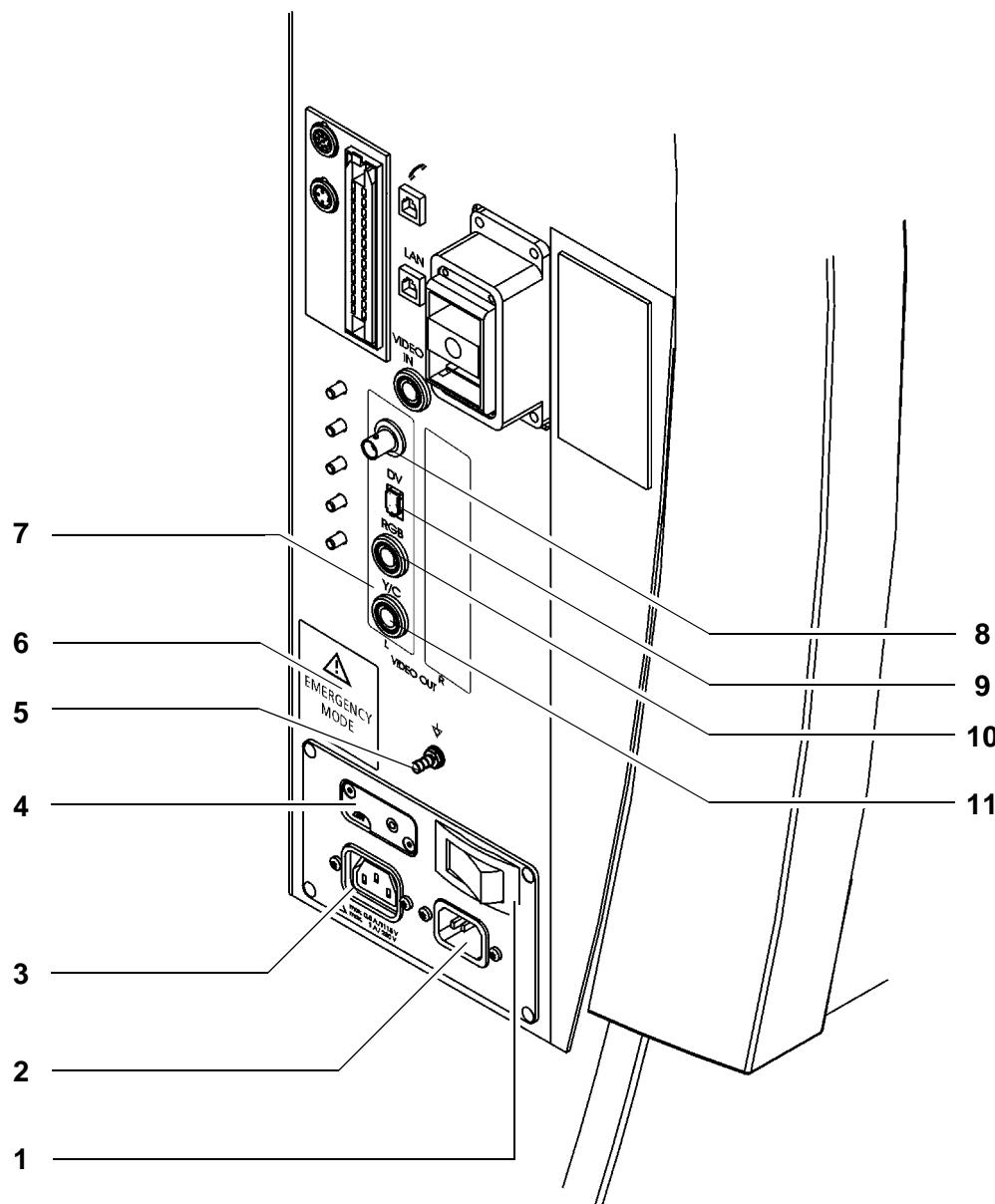
- 1 Power switch**  
When the system is on, the green indicator light in the switch is lit.
- 2 Power inlet, 115/230 V**  
Only connect the system to a wall outlet which is provided with a properly connected protective ground conductor.



### Caution:

Please observe the maximum current consumption of power outlet socket (3). Only connect medical devices approved by us to this outlet (3). When using other instruments, make sure that safety is guaranteed regarding admissible ground leakage currents. The admissible limit value of the ground leakage current present in the suspension system's power cord is 500 µA in compliance with EN60601-1/IEC 601-1. CSA NRTL certification only allows a maximum ground leakage current of 300 µA.

- 3 115/230 V power outlet**  
for medical devices with a current consumption of max. 2A.
- 4 Indicator window for rated voltage**  
The voltage shown here must correspond to the rated voltage provided on the site of installation.
- 5 Potential equalization**  
for connection of the system to the potential equalization system in the OR.
- 6 Cover for standard operation / emergency mode selector switch**  
In the emergency setting, only the illumination system is operational. All other functions are inactive.
- 7 Connector panel with video ports, left (mono):**
- 8 Video signal output port, BNC (VBS)**
- 9 Video-DV out**
- 10 Progressive scan (VGA) or RGB output port**  
(See Video menu/"Selecting the video format for an external video port")
- 11 Video signal output port for an external monitor (Y/C)**



**12 External automatic circuit breakers**

If one of the automatic circuit breakers is activated, try to reactivate the function by pressing the circuit breaker button. Should the automatic circuit breaker be activated again, call our service dept.

**13 Video in Y/C**

e.g. for an endoscope camera

**14 AUX socket**

for controlling an external unit, e.g. a video recorder.

**15 Socket**

for a foot rocker switch (included in delivery package)

**16 Connector for switching component**

Possibility of connecting a foot control panel, footswitch or an operating chair with appropriate footswitch.

**17 Modem connection****18 Ethernet connection (LAN)****19 Connector for cable**

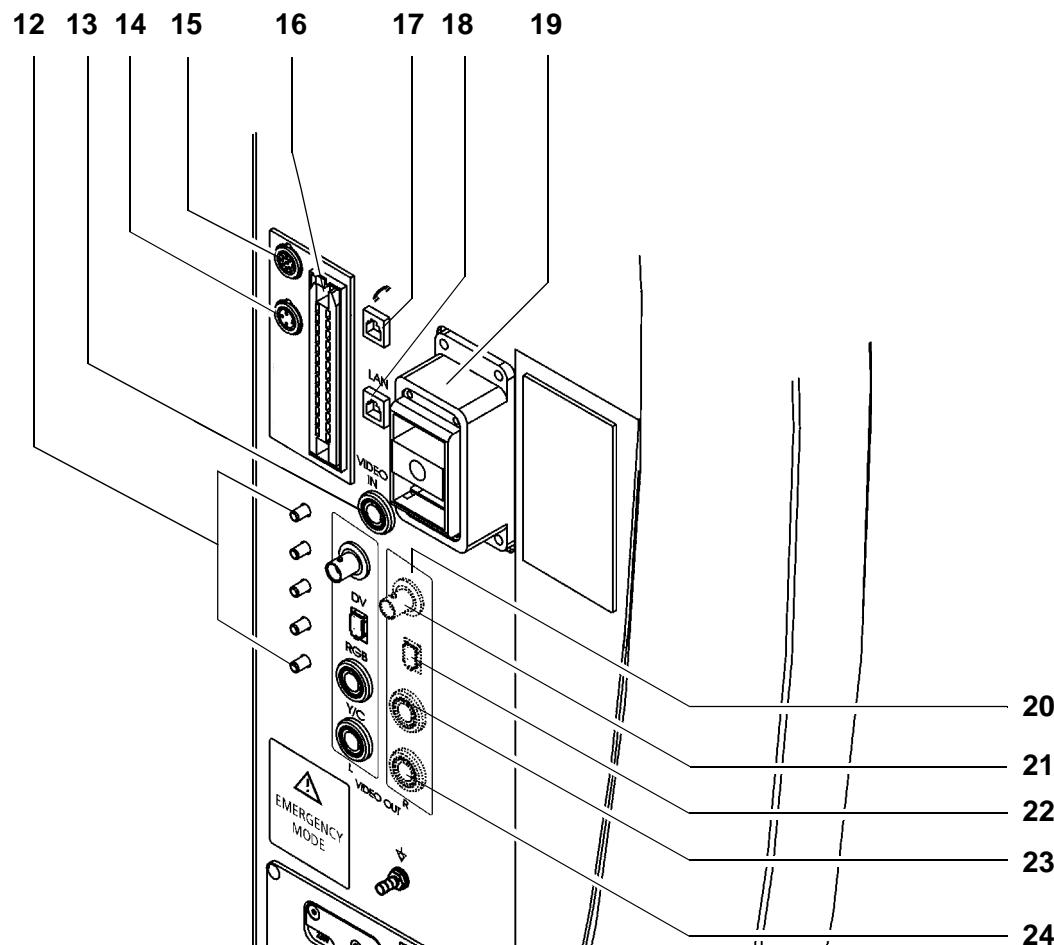
Connecting a microscope navigation system

**20 Connector panel with video ports, right (stereo) (option):****21 Video signal output port, BNC (VBS) (option)****22 Video-DV out (option)****23 Progressive scan (VGA) or RGB output port**

(See Video menu/"Selecting the video format for an external video port")

**24 Video signal output for an external monitor (Y/C) (option)****Note:**

- The stereo video option (items 20-24) enables you to view or record video in 3D using suitable external systems (See page 18).
- In the stereo mode, it is important to connect channels L and R of the 3D system to ports of the same video standard (BNC/VBS or Y/C).



## Connecting navigation systems

The OPMI Pentero is fully prepared for the connection of navigation systems. The link-up using the navigation interface creates a medical system for which the system supplier (manufacturer of the navigation system) must meet the stipulated requirements (approval, qualifications, etc.). All accompanying papers required will be supplied by the manufacturer of the navigation system.

The navigation interface to the OPMI Pentero was developed in cooperation with Carl Zeiss in compliance with the guidelines of the communication protocol for the OPMI Pentero navigation interface.

Additional information is available from our service department or from authorized representatives.

The use of the OPMI Pentero with a connected navigation system requires calibration of the microscope using a technique to be made available by the manufacturer of the connected navigation system. This allows the OPMI Pentero combined with the navigation system to be used like an optical pointer with a variable length (corresponds to the working distance).

- The OPMI Pentero can manage various connected navigation systems and the associated data injection parameters (currently not yet available, systems must be appropriately matched).
- For safety reasons, the OPMI Pentero navigation interface is not enabled unless a connected system authenticates itself.
- Before every surgery using a connected and authenticated navigation system, the function and accuracy of this navigation system must be verified, including visualization in the data injection mode (e.g. focusing on a measuring point or comparison of the focus with the instrument to be navigated). Please also observe the information contained in the respective user's manual for the navigation system used.



### Caution:

For safety and accuracy reasons, the integrated, rotatable tube dovetail mounts must not be used for the operation of OPMI Pentero with a connected navigation system. They must be carefully locked in the central position (tighten the knurled screw to prevent rotation).

- Please follow the instructions given in the user manual for the connected navigation system regarding the configuration of the surgical microscope for use as a navigation tool. This manual is provided by the manufacturer of the navigation system.

**Connection and operation of navigation systems**

Only systems from authorized manufacturers may be connected and used on the navigation interface of OPMI Pentero. Authorized manufacturers are companies or institutions with which Carl Zeiss Surgical has concluded an Open Interface Contract and for which the use of the integrated navigation interface with data injection system has been licensed. Please observe the user manual for the connected system.

## Navigation interfaces

### 1 Joystick

The joystick button on the right handgrip can be used to control software functions of the connected navigation system, if this is supported by the navigation system.

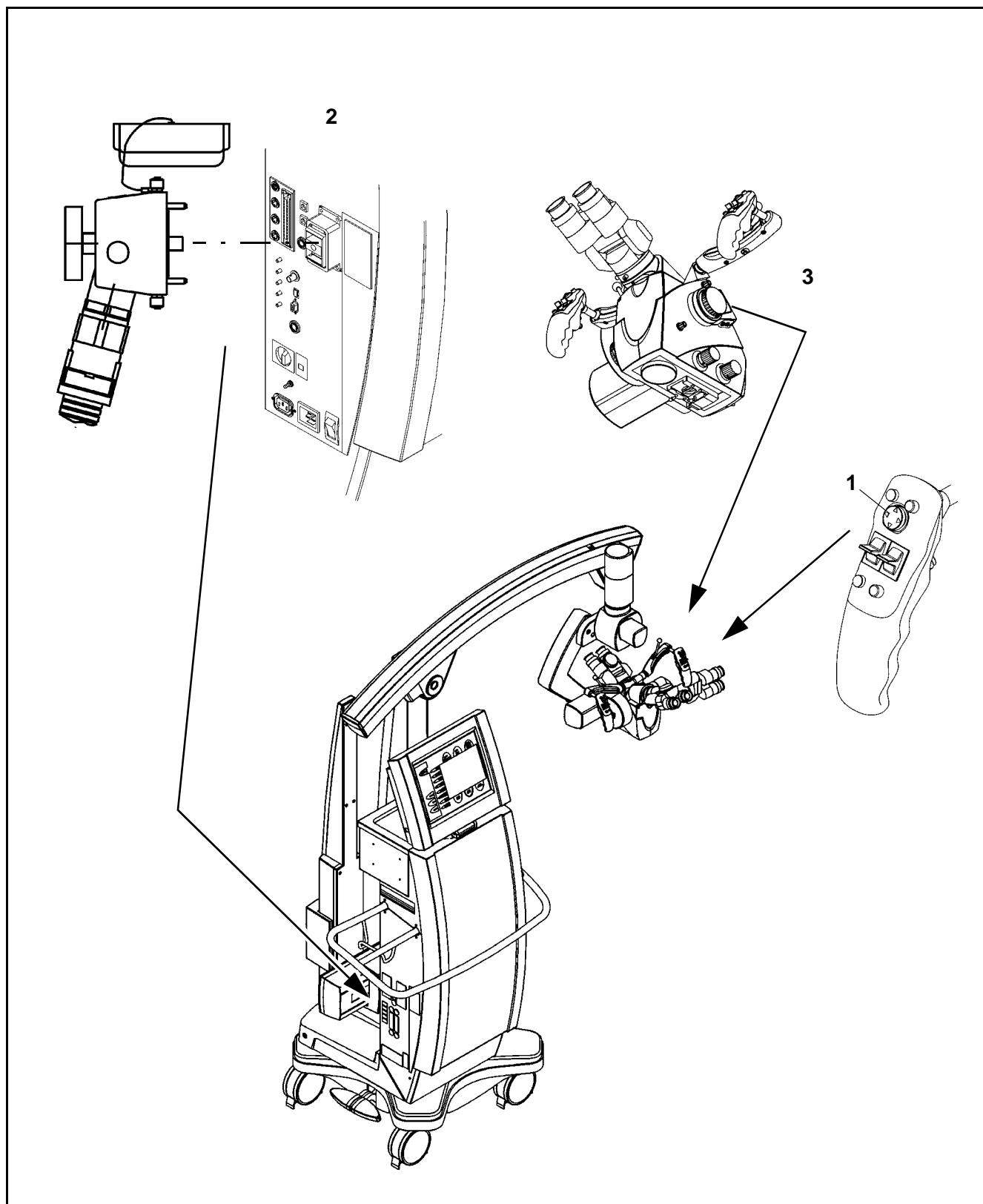
### 2 Connector (example)

for an external microscope navigation system.

### 3 Interface on the surgical microscope

for connecting an optional antenna module.







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# Preparations for use

Relocating the unit	86
<b><u>Assembling the system</u></b>	<b><u>88</u></b>
Configurations	88
Mounting the tube and the eyepieces	90
Attaching documentation / coobservation equipment	92
Mounting the mouth switch (option)	94
Adjusting the position of the handgrips	98
Attaching sterile drapes	100
Positioning the system at the operating table	102
Starting the system	104
Configuring the handgrips	106
<b><u>Balancing the system</u></b>	<b><u>110</u></b>
Adjusting the surgical microscope	115
USER menu / login	116
Activating IT system rights and data protection	120
Configuration menu (CONFIG)	124

## Relocating the unit



Note:

- As the stand can be easily maneuvered, there is a tendency to underestimate its weight. Therefore, move the stand slowly and carefully!



- Pedal for straight-ahead movement (2):  
Press this pedal until it snaps in to set the two front casters (4) for straight-ahead travel. The other casters remain steerable.  
Choose this possibility for steering the stand over long distances and for movement in a straight-ahead direction.

When you slightly press pedal (1), all four casters will be steerable again.

This setting is ideally suited for positioning the stand in its location of use. It is, however, not suited for relocating the stand over long distances.

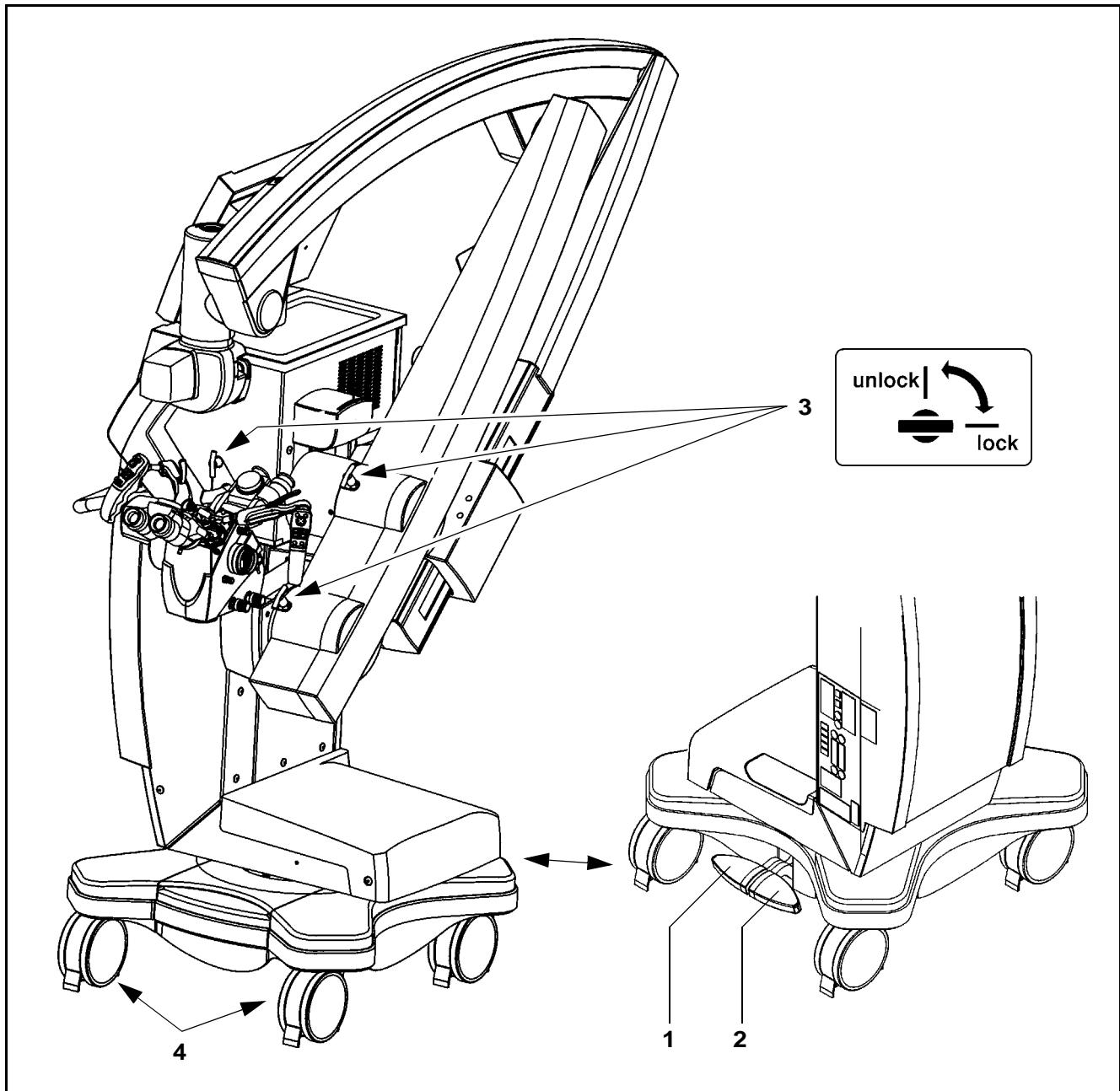
Please observe the following points when relocating the stand:

- Bring the stand into its transport position. (See illustration). Lock the stand in the transport position by allowing transport locks (3) to engage.
- Unplug the power cord from the wall outlet.
- Hang the foot control panel on the hook provided on the handle.
- Hang the power cord on the hooks provided on the handle.
- Release locking tab (1) by pressing pedal (2).
- Be careful of heights when passing through doorways.
- Avoid collisions of any kind.
- Do not go over steps and edges: the column might topple!
- Be extremely careful when moving over slopes.
- Do not park the stand on slopes.
- Step on pedal (1) on the base to secure the stand in position. Make sure that the stand is stable and in a horizontal position, and cannot roll away.



Note:

Over longer distances (e.g. removal, return for repair, etc), the instrument may only be transported in the original packaging or in special return packaging. Please contact your dealer or the Carl Zeiss service team.

**Transport position:**

# Assembling the system

## Configurations

The OPMI Pentero has been designed for different applications in micro-surgery. The stand has been designed for optimum maneuverability. For this reason, a minimum and a maximum configuration are recommended to ensure the safe use of the system.

Minimum configuration (1) comprises e.g. two tiltable tubes with eyepieces or a straight tube with eyepieces and a stereo coobservation module with tube and eyepieces.

The maximum admissible load (configuration options (2)) on the microscope body must not exceed 6 kg! (For weight data, see Accessories page 228). This configuration comprises, for example, a still camera, a face-to-face adapter with a second tiltable tube, a stereo coobservation module with a tiltable tube, a micromanipulator, etc.

Assemble the components you want to use as shown in the illustration on the opposite page and check that they are exactly positioned and firmly mounted (knurled screws have been tightened).



### Caution:

Check that the handgrips and accessories (coobservation or documentation equipment) have been correctly mounted, that they can be moved without restriction across the full swivel range and that they cannot collide with any other units.



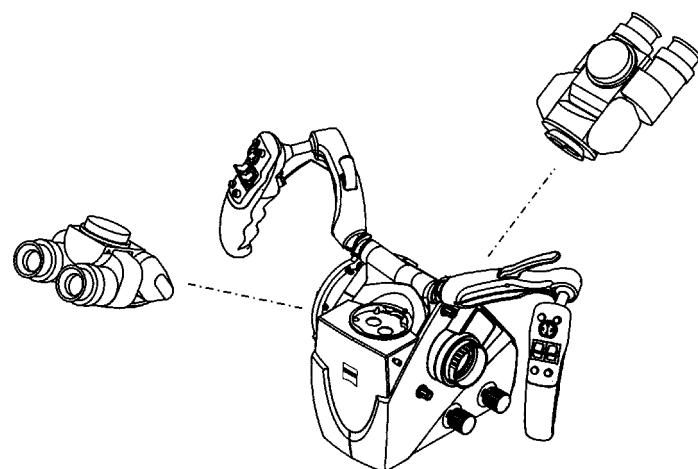
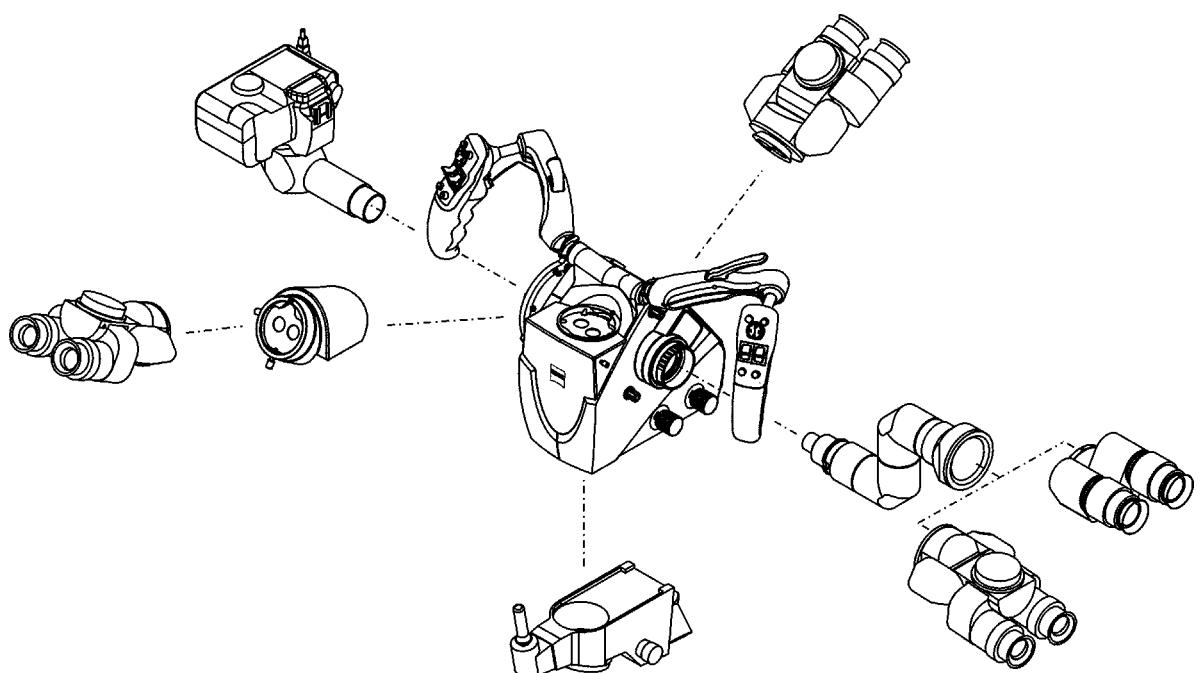
### Warning!

If the weight of the configuration used is higher/lower than that of the recommended configuration, the mobility or balance of the system may be impaired.

**1** Minimum configuration

**2** Configuration options

The maximum load on the microscope must not exceed 6 kg!

**1****2**

## Mounting the tube and the eyepieces



### Warning!

Change the modules and accessories before surgery and without the patient!

### Caution:

- The mounting and removal of modules and accessories leads to a shift in the center of gravity in the microscope and suspension system axes. This could lead to inadvertent tilting of the microscope. To avoid this, balance the system using the autobalance function, see page 110.
- Loosen securing screw (9) by a few turns.
- Remove cover (4) and store it in a safe place.

You have the possibility of mounting tilttable binocular tube (2) or straight tube (5) directly on the microscope body. For spinal applications, we recommend that you first mount spine adapter (3) on the microscope body, followed by binocular tube (2).

- Attach spine adapter (3) to the microscope body and firmly tighten securing screw (9).
- Attach binocular tube (2) to spine adapter (3) and firmly tighten securing screw (8).
- Insert widefield eyepieces (1) as far as they will go in the mounts provided on the binocular tube. The magnetic coupling reliably secures them in position.
- Attach binocular coobservation tube (6) to the microscope body and firmly tighten securing screw (10).
- Insert widefield eyepieces (7) as far as they will go in the mounts provided on the binocular tube. The magnetic coupling reliably secures them in position.



### Note:

If you wish to use documentation equipment, we can supply an eyepiece with a reticle to aid focusing. The retrofitting of a reticle to an eyepiece can only be performed in the factory or by our service staff. Always install the eyepiece with the reticle on the same side of the binocular tube where the documentation equipment is located.

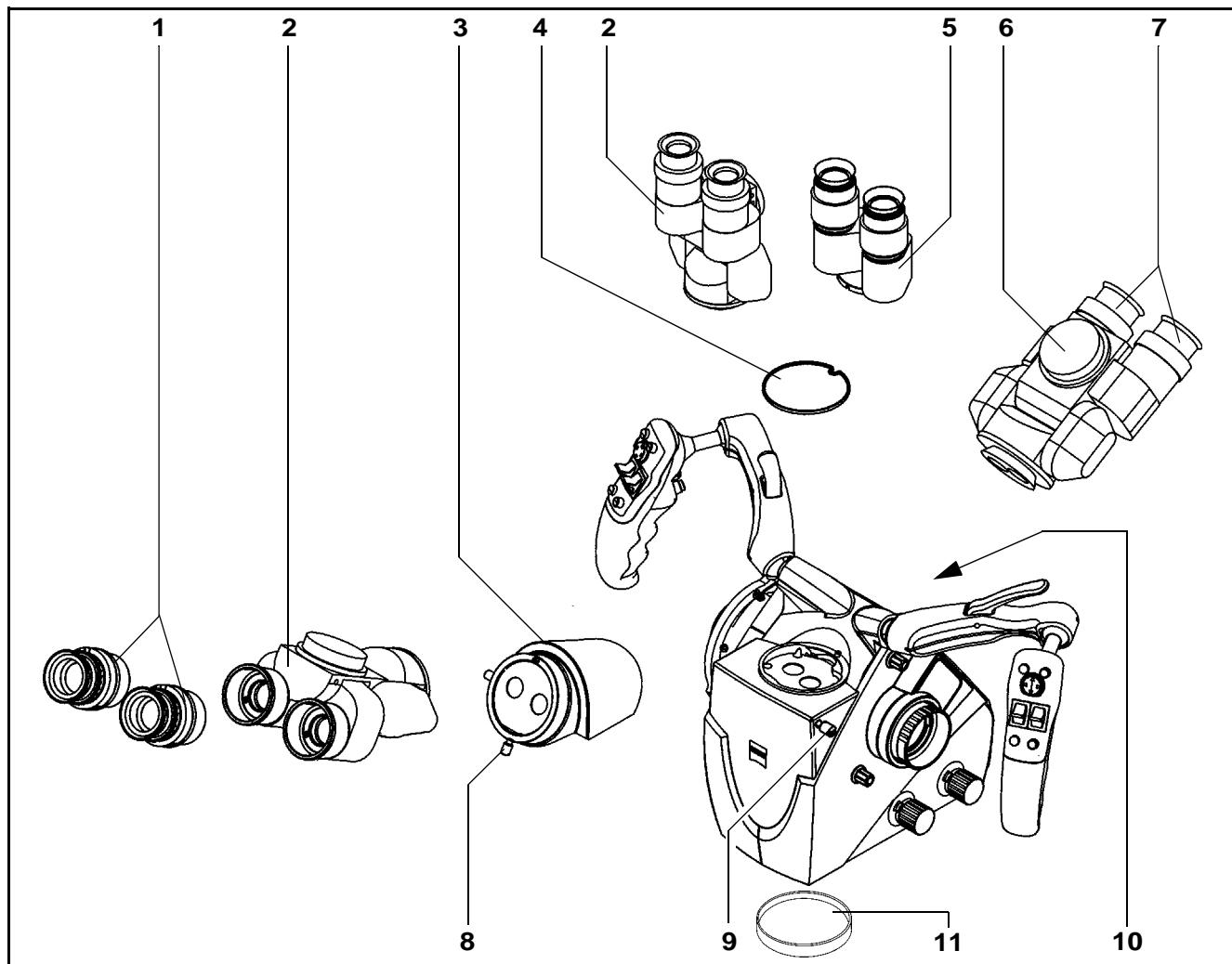
**Caution:**

Before starting up the system, remove protective cover (11) used for transportation from the objective lens.

If the system is operated with protective cover (11) in place, the heat produced by the activated illumination system may cause the cover to melt, leading to irreparable damage to the optical components!

**Warning!**

- Before every use and after re-equipping the instrument, make sure that the modules are securely locked in position.
- Make sure that securing screws (8) and (9) have been firmlly tightened!
- Always re-balance the surgical microscope after re-equipping the system.



## Attaching documentation / coobservation equipment

The camera adapter and coobservation module shown in the illustration are examples of further accessories that can be mounted on the lateral image exit ports. The method described below can also be used for other accessories. The operating principle of the accessories is described in the relevant user manuals.

- Loosen knurled ring (1).



**Note:**

An arrow with the labeling "open" is located on the shaft next to knurled ring (1).

- Remove dust cover (2) and store it in a safe place.
- Insert accessory module (3) in the opening of the image exit port. The opening of the image exit port is fitted with guide projections. The accessory module (3) has the corresponding grooves. Carefully turn the accessory module until the guide projections fit into the grooves, and slide the accessory module in the opening as far as it will go.
- Screw knurled ring (1) onto accessory module (3).
- Firmly tighten knurled ring (1).
- The type of coobservation (lateral image exit ports: left/right, or opposite image exit ports: face to face) can be configured at the touch-screen, see page 130.

The sliding mirror has two positions:

**Left/right:**

The light is directed to the lateral image exit ports. If an external camera is released and the sliding mirror is in the face-to-face position, the mirror switches to the left/right position during image capture.

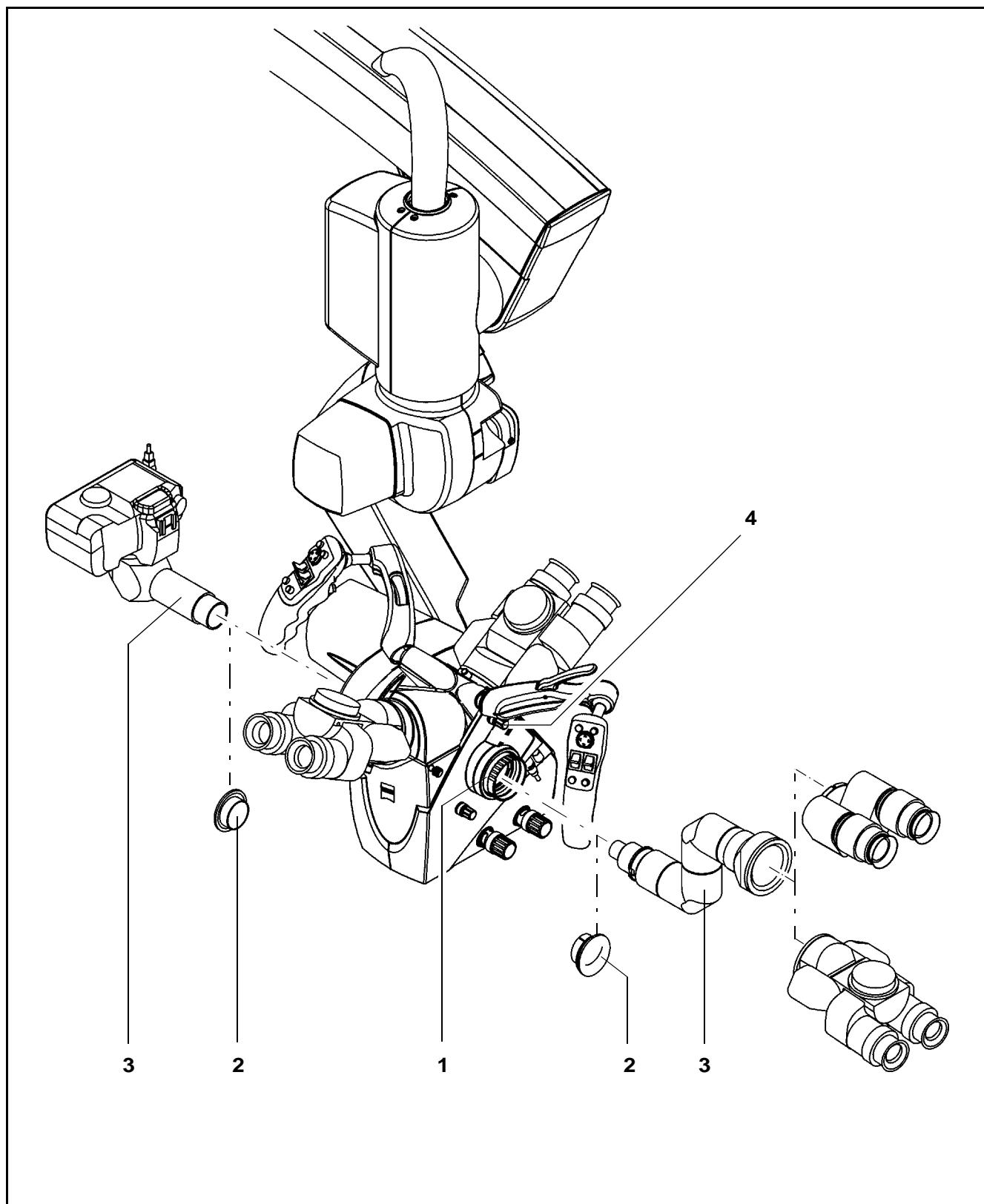
**Face to face:**

The light is directed to the tube mount at the back.



**Note:**

The position of the sliding mirror can also be switched manually using knob (4).



## Mounting the mouth switch (option)



### Note:

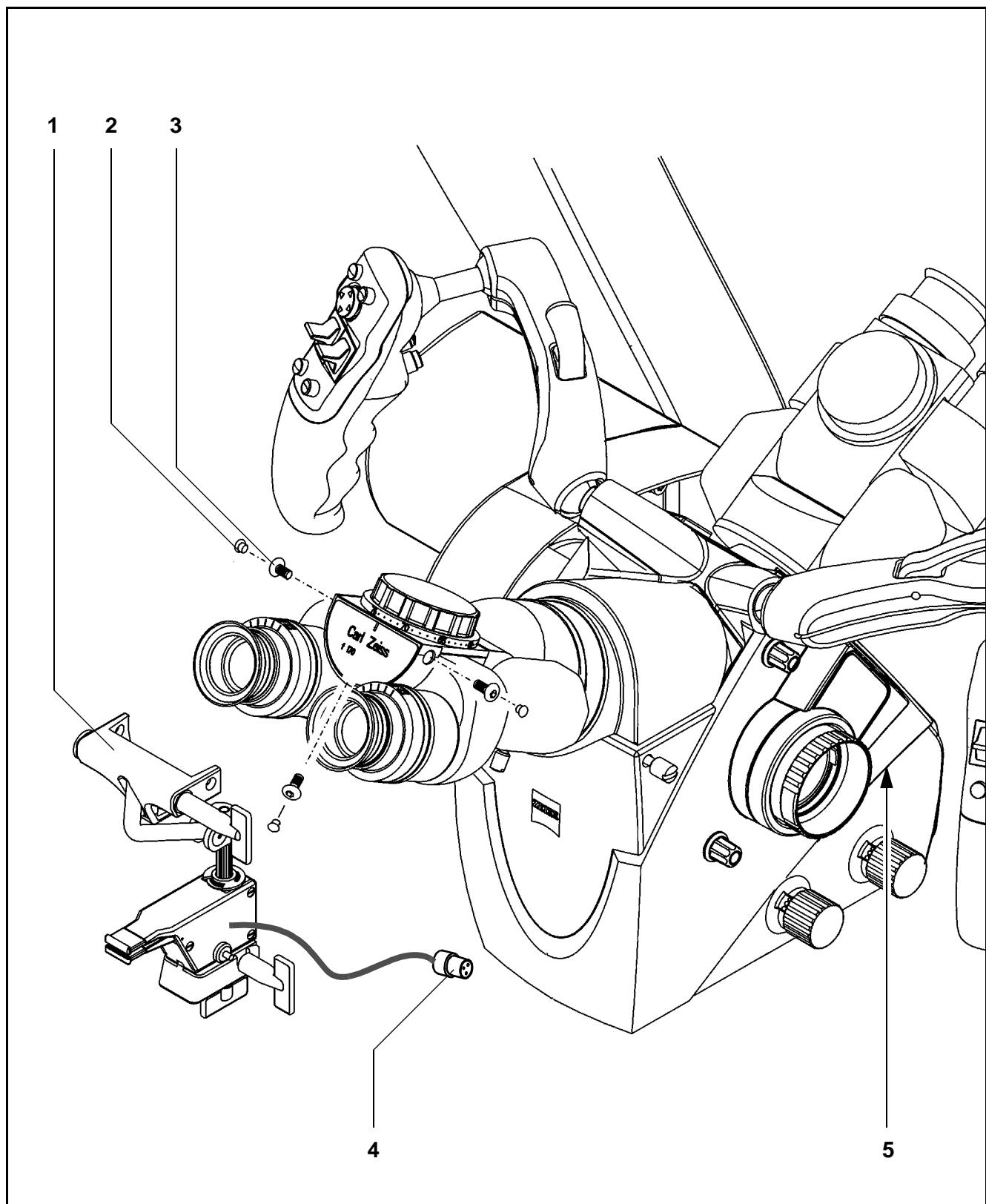
For a detailed description, please see the user manual for the mouth switch.

### Mounting the mouth switch on the 180° tiltable tube

- Remove three protective caps (2).
- Secure mouth switch holder (1) using three screws (3) included in the delivery package.
- Tighten the screws using a 4 mm Allen key.
- Connect contact plug (4) to mouth switch socket (5) on the surgical microscope.
- Set the height, tilt and distance of the mouth switch via the relevant locking screws and properly tighten these screws.
- Make sure that the surgical microscope and suspension system are properly balanced.

Autobalance - Fine adjustment for mouth switch, see page 112.

For operation of the mouth switch, see page 168.



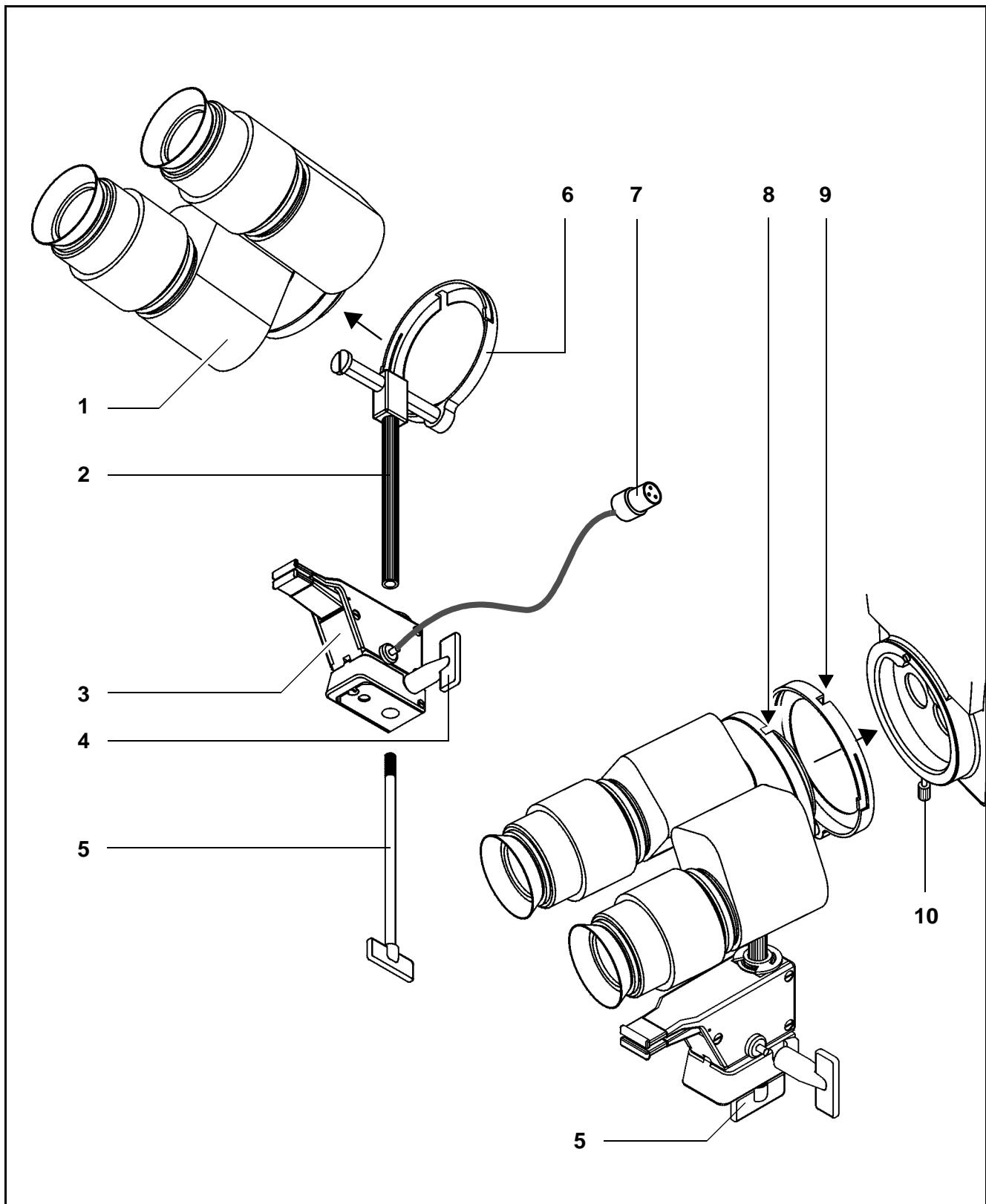
**Mounting the mouth switch on the straight tube**

- Remove locking screw (5) from toothed shaft (2).
- Loosen locking screw (4) by a few turns.
- Remove the mouth switch from the toothed shaft of the tiltable tube mount (delivery status).
- Align mouth switch (3) and push it onto toothed shaft (2).
- Lock mouth switch (3) in position using locking screw (4).
- Reinsert locking screw (5) in toothed shaft (2) and lock it.
- Slide retaining ring (6) onto the front flange of the straight tube.
- Make sure that the two recesses (8 and 9) coincide.
- Attach the straight tube with the complete mouth switch to the microscope body and firmlly tighten securing screw (10).

Autobalance - Fine adjustment for mouth switch, see page 112.

For operation of the mouth switch, see page 168.





## Adjusting the position of the handgrips

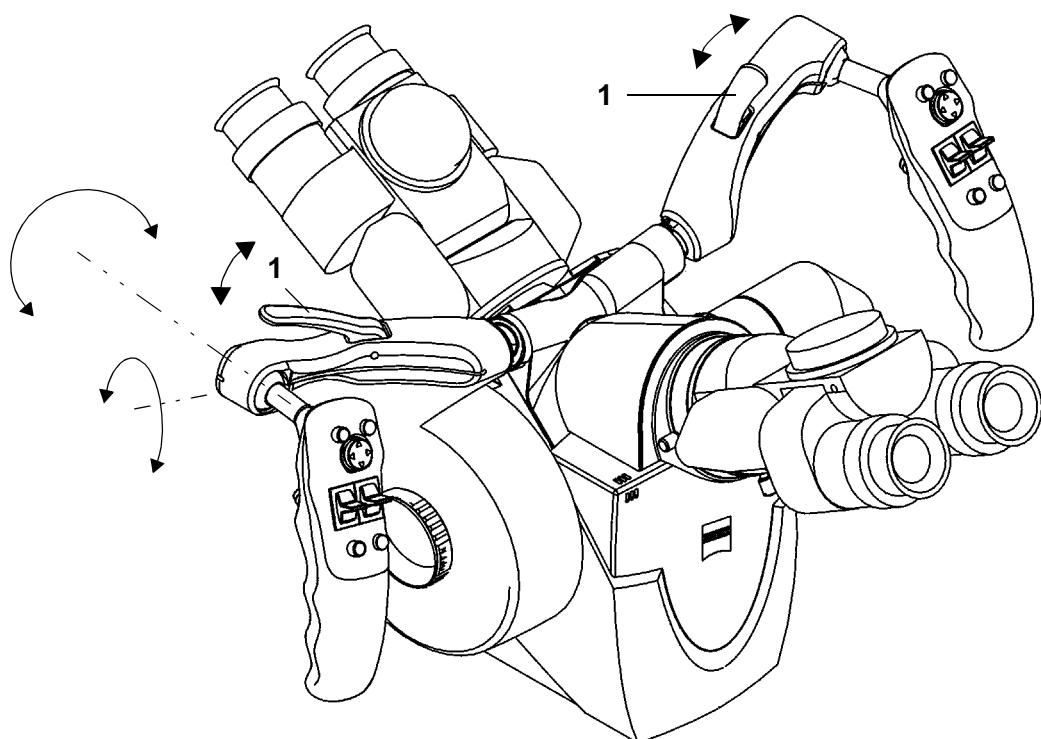
You can adjust the position of the handgrips to meet your specific needs.

- Open locking lever (1) and adjust the mounting bar or the handgrip only to the position required.
- Choose a position of the handgrips which is most convenient for the surgical procedure to be performed. Make sure that there is enough room between the handgrips and the accessories mounted on the microscope.
- Firmly re-tighten locking lever (1).



Note:

The handgrips including the locking levers can be rotated through approx. 180°.





## Attaching sterile drapes

The system features an integrated drape vacuum system which extracts the air from the drape at the suspension arm and surgical microscope.

- Unpack the drape and pull it over the surgical microscope and the suspension arm.
- Pull the drape over marked position (2) of the suspension arm.



**Caution:**

When attaching the drape, please ensure that there is sufficient space for the tilt and rotation movement of the surgical microscope.

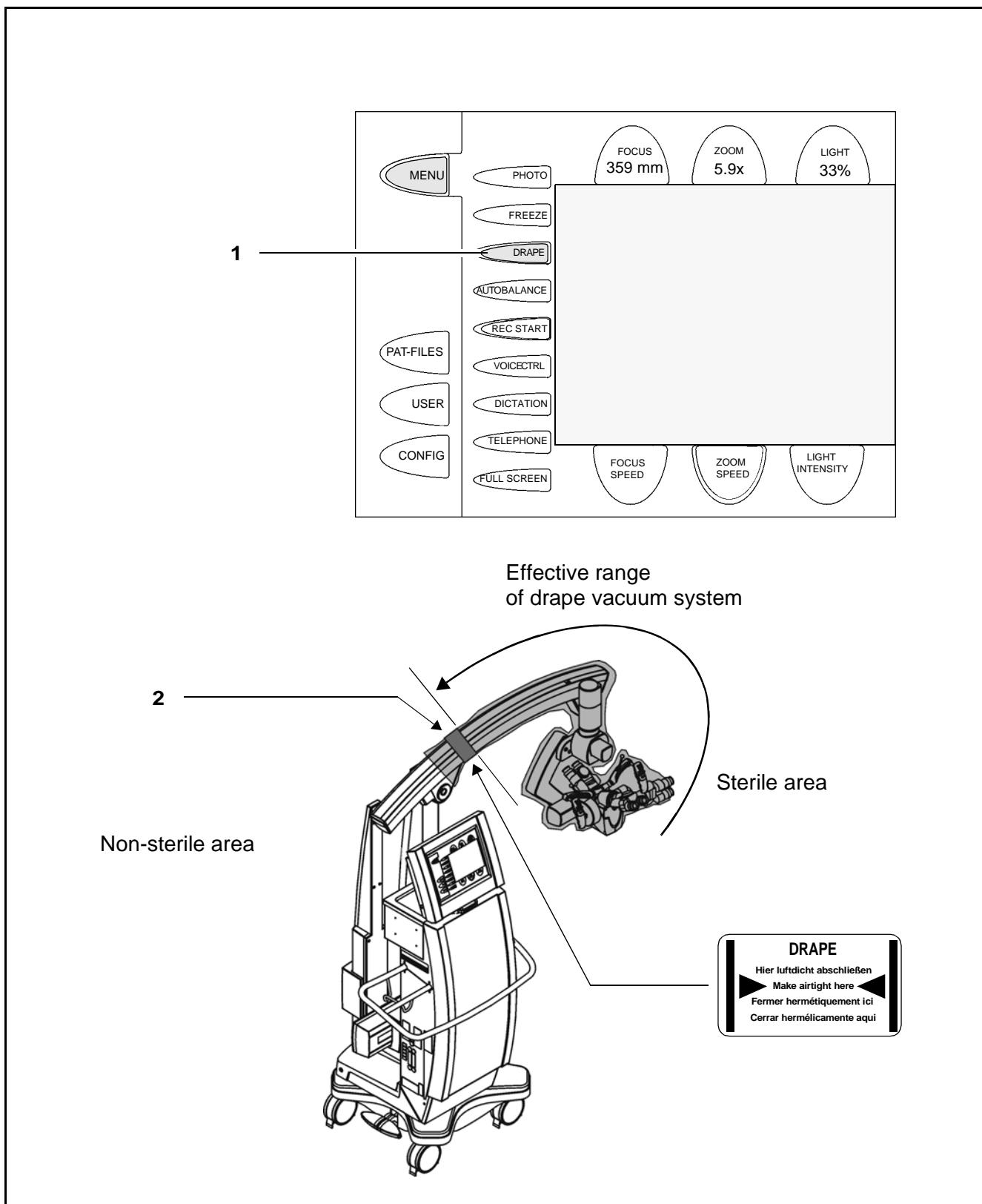
- Make the drape airtight at the marked position (2) using one of the straps.
- The drape vacuum pump is activated by pressing DRAPE button (1) in the main menu.



**Note:**

The vacuum system operates at maximum power during the first 2 minutes approximately. Then it automatically switches to a defined maintaining power to keep up the vacuum.

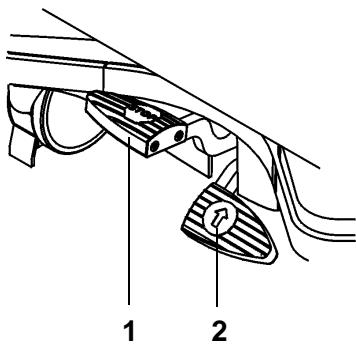
- The drape vacuum pump is switched off by pressing DRAPE button (1) in the main menu once again.



## Positioning the system at the operating table

The stand is provided with a handle which allows the reliable and easy guidance of the system during relocation. Please only use this handle for this purpose.

The stand base is equipped with the new FlexiTrak technology which makes it considerably easier for you to move and position the system in the OR. Two additional pedals on the base allow you to conveniently select the required condition of the stand:



- None of the pedals has been pressed:  
Exact and sensitive positioning in the OR and at the operating table in all directions with a minimum of effort.
- Right-hand pedal (2) is pressed down hard until it snaps in:  
Reliable and precise straight-ahead movement, also over low thresholds (elevator). Press this pedal until it snaps in to set the two front casters for straight-ahead travel. The other casters remain steerable. When you slightly press pedal (1), all four casters will be steerable again.
- Pressing left-hand pedal (1) to the stop will lock the stand base in position, preventing it from inadvertently rolling away. After the system has been finally positioned at the operating table, you should step on this pedal.

**3** Possible positions for cranial procedures

**4** Possible positions for face-to-face procedures (spine)

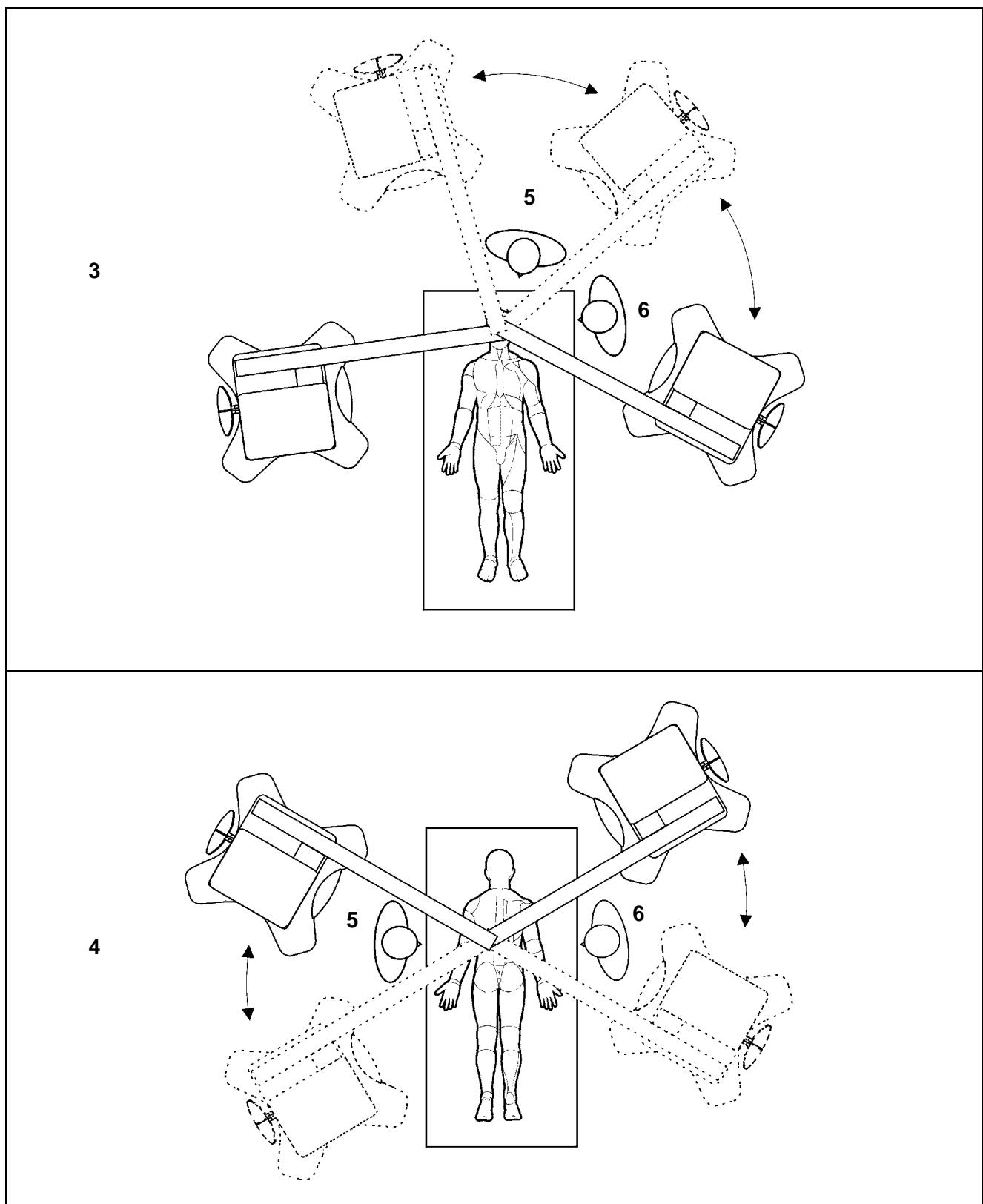
**5** Surgeon

**6** Assistant



**Note:**

The system allows overhead positioning and can therefore be placed in any position behind the surgeon or assistant.



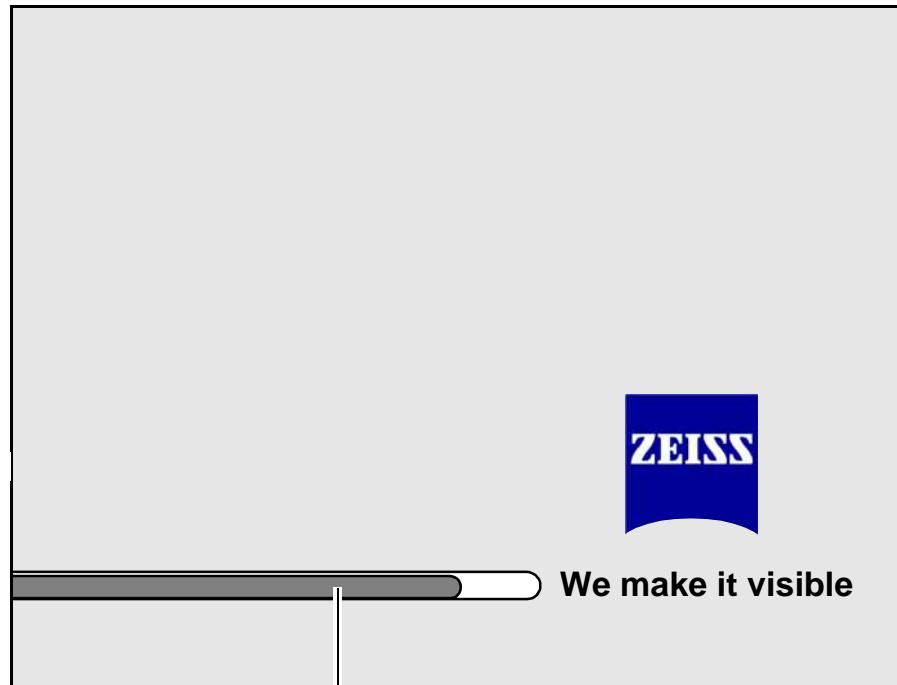
## Starting the system



### Note:

In general, the instrument is ready for operation after startup. A continuous beep indicates extreme discharging of the UPS. In this case, the system should not be powered up for at least five minutes. After this time, you can power up the system again for charging the UPS. For the initial startup or after long rest periods, we recommend the following: leave the powered-up system connected to line power for approx. 12 hours in order to fully charge the UPS.

After power-up of the system, the user interface is initialized. The progress of initialization is indicated by horizontal bar (1). During this process, the system performs a self-test. After the self-test, the system is ready (abbr. 90 sec.) for use and switches to the main menu. In the event of an error, the user is informed both visually on the display and acoustically by a beep. The error messages contain meaningful information with proposals for the user how to solve the problem.



## Configuring the handgrips

Both handgrips are identical. The handgrips are delivered with preconfigured default settings (10) (factory settings).

You can configure both handgrips with the same functions (Config L / R (12)), or you can configure different functions in the right and left handgrip (8, 9).

The CONFIG menu / STAND / HANDGRIPS permits you to select the functions (14) to be assigned to buttons **A**, **B**, **D** or **E**.

- 1** Programmable button **A**  
(factory setting: trigger photo)

- 2** Programmable button **B**  
(factory setting: autofocus)

- 3** Joystick



**Note:** In the basic setting, both joysticks can be used for motorized fine movement in the XY directions.

If the MultiVision function is active, the joystick of the right handgrip is used to control a mouse cursor for the functions of a connected navigation system (depending on the system used) or for menu control of the displayed touchscreen.



**Note:**  
Major system errors are displayed in the microscope's integrated data injection system. You can delete these messages by acknowledgement using the joystick of the right handgrip (pushbutton) or the touchscreen.

- 4** Focus + / focus - rocker switch (factory setting)  
for continuous focusing within the working distance of 200 mm to 500 mm. The current value is displayed on the screen.

- 5** Zoom + / zoom - rocker switch (factory setting)  
for magnification setting. The current value is displayed on the screen.



**Note:**  
The zoom and focus functions of the two rocker switches (4 and 5) can be interchanged. Briefly press button **C** (11). The display and functions are now interchanged.

- 6** Programmable button **D**  
(factory setting: increase illumination intensity (+))

- 7** Programmable button **E**  
(factory setting: reduce illumination intensity (-))

### **12** L/R button

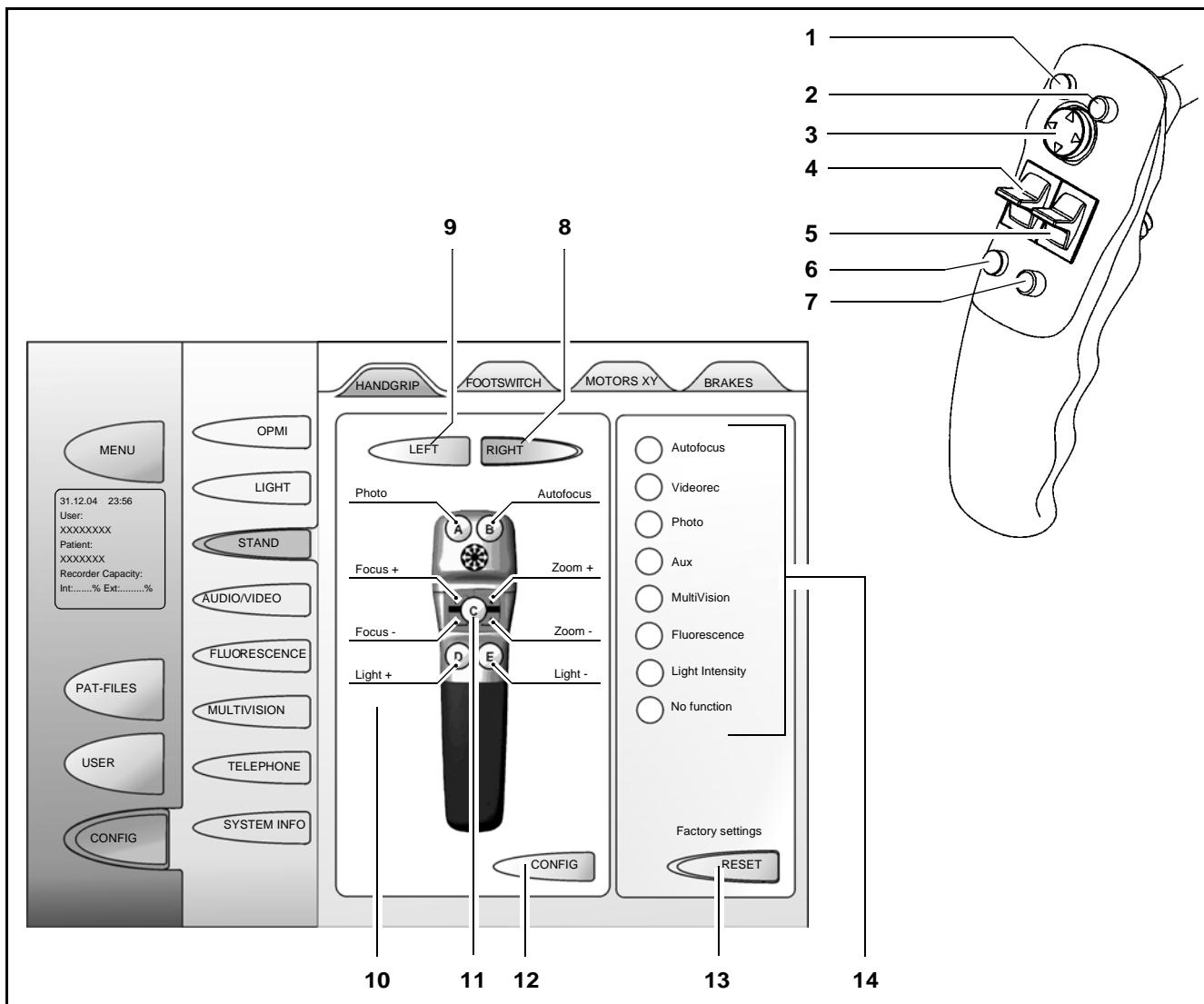
Permits the left and right handgrips to be configured differently using buttons (8 and 9). Buttons (8 and 9) only become visible after button (12) has been pressed.

### **13 Reset button**

When you press the reset button, the default settings (factory settings) will be restored.

### **14 Function selection menu**

Functions available for programming the buttons



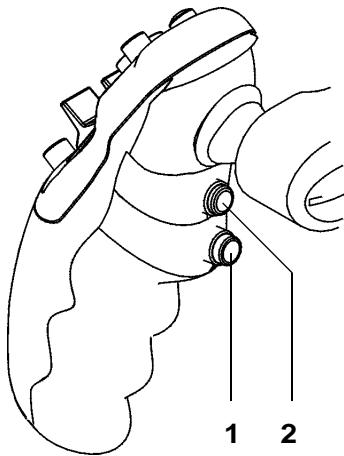
The brake release buttons are located on the back of the handgrips.

### **1 Brake release button (AB)**

Brake release button for all suspension system and microscope axes. For as long as you press this button, all magnetic brakes are released ("All Brakes") and the system can be moved in all directions. When you let go of the button, the magnetic brakes simultaneously lock all axes in position.

### **2 Brake release button (SB)**

Brake release button for the microscope axes or suspension system axes (factory setting). For as long as you press this button, only the magnetic brakes of the suspension system or microscope axes are released ("Selected Brakes"), and the microscope can be moved in all directions. When you let go of the button, the magnetic brakes simultaneously lock these axes in position.



#### **Configuring the SB break release button**

The CONFIG menu / STAND / BRAKES permits you to select whether the SB button should release the microscope or the suspension system axes.

Select the axes which you want to be released when you press SB button (2) on the handgrip. You have the following options:

- |                     |                                   |
|---------------------|-----------------------------------|
| <b>3 Axes 1-2-3</b> | Suspension system axes            |
| <b>4 Axes 4-5-6</b> | Microscope axes (factory setting) |

#### **Configuring the Autofocus (AF) function**

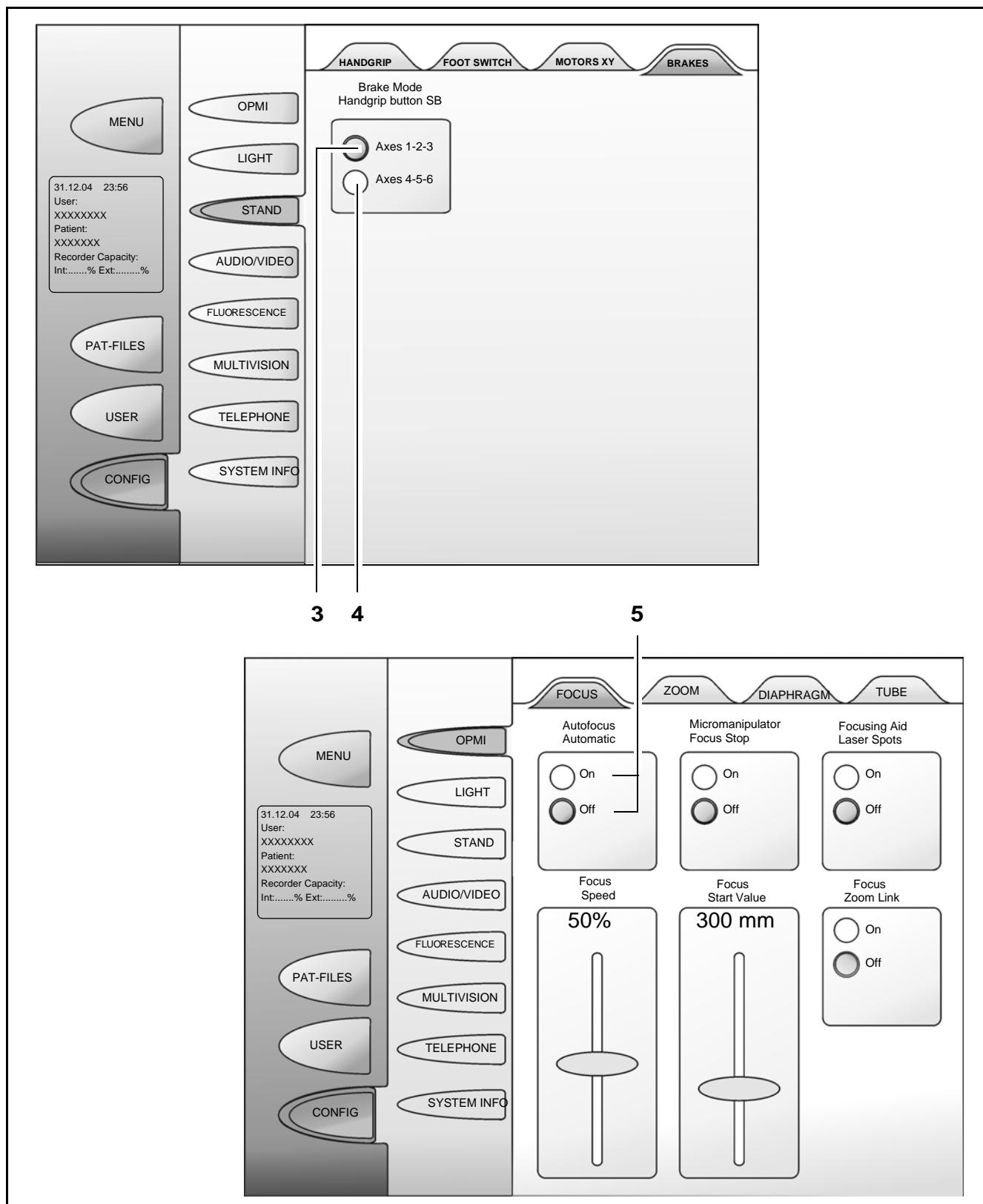
You can configure the AF function in such a way that

- the autofocus is automatically activated after the brakes have been locked,
- the autofocus is not linked with the brake function, and can only be activated using a button on the handgrip.
- Select "On" button (5) in CONFIG menu / OPMI / FOCUS for automatic activation of the autofocus after locking of the brakes. If you select "Off" button (5), the autofocus can only be activated using a button on the handgrip or foot control unit.



#### Note:

When using a micromanipulator from another manufacturer, activate the "Focus Stop" function. This ensures that the selected focus setting is not inadvertently changed by the motorized function (see page 56).



## Balancing the system



### Warning!

For safety reasons, the system must only be used when correctly balanced. Despite the autobalance function, it may happen in exceptional cases that the surgical microscope is not correctly balanced.

With an incorrectly balanced system, brake release may lead to uncontrolled movements of the suspension system. For this reason, the balancing procedure and the subsequent test must not be performed above the patient and only at a safe distance from other persons and instruments.

To check correct balancing of the system, loosen the brakes while holding the microscope tightly at both handgrips. If the system has been correctly balanced, the surgical microscope can be moved almost effortlessly.

Repeat the autobalance procedure, if required.

### Autobalance menu

The system features automatic balancing. The balancing processes can only be triggered by pressing buttons (1 to 3) and ended by pressing button (5). Progress bar (6) keeps the user informed about the activity. The access to other system functions is temporarily blocked during the balancing process



### Caution:

Check before balancing that the handgrips and accessories (coobservation or documentation equipment) have been correctly mounted, that they can be moved without restriction across the full swivel range and that they cannot collide with any other units.

After attaching the drape, check that the microscope's freedom of movement is unobstructed in all directions. In particular, the movement performed by the microscope during the balancing process should be possible without limitations.

Choose from the functions in the Balancing menu:

#### 1 Autobalance complete system (balancing all axes)

If the system has not yet been balanced or if accessories have been mounted on or removed from the microscope, the Autobalance Complete System function allows you to balance the complete system.

Swing out the arm of the suspension system until indicator (4) is centered in the blue area (7). Then you can start the autobalance procedure.

The autobalance function first balances the suspension system axes, then the microscope.



**2 Autobalance microscope (balancing the microscope axes)**

The system has already been balanced, but the microscope configuration has been changed (the total weight remains unchanged, but accessories have been repositioned e.g. from the left to the right, or the tilt of the microscope has been changed). The Autobalance Microscope function permits you to balance microscope axes 4 and 5 only.

**3 Drape Compensation**

This balancing function permits you to compensate for the slight unbalancing caused by the subsequent attachment of a drape.

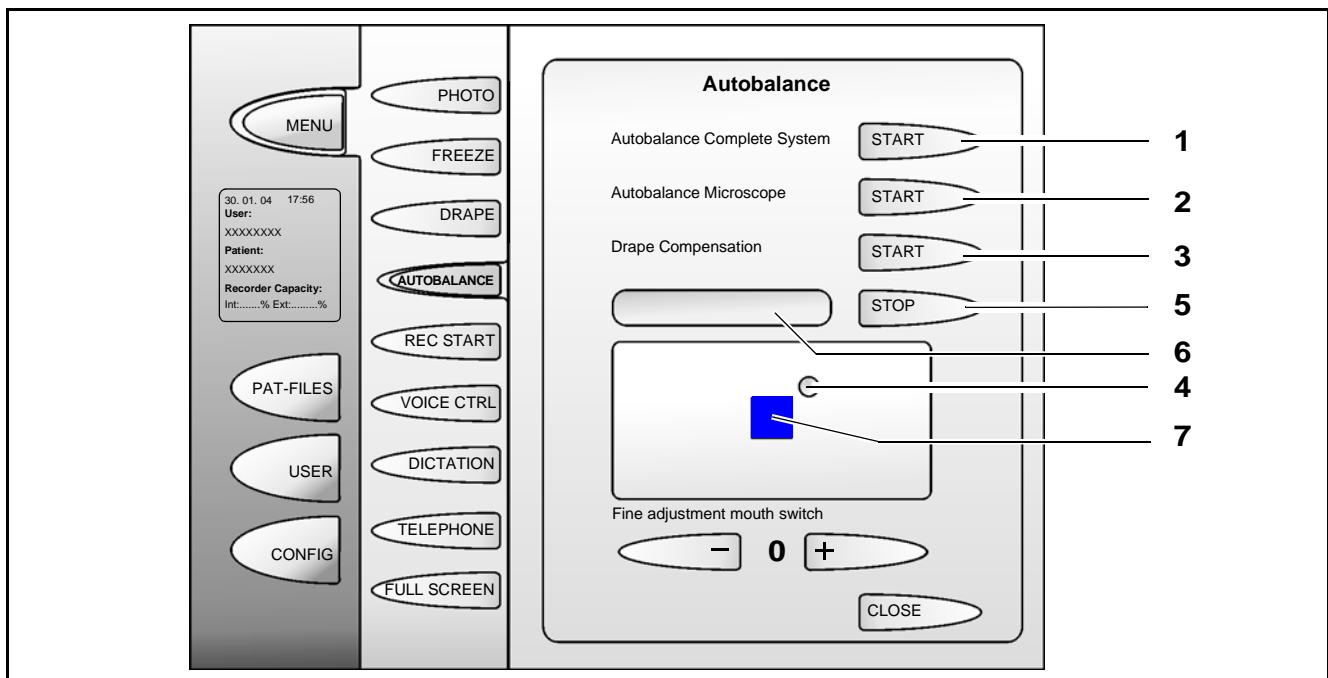
**4 Balance position indicator**

This indicator is used for easy, visual checking as to whether the arm of the suspension system is correctly positioned for autobalancing (1 and 3). Swing out the arm of the suspension system until indicator (4) is located in the blue area. Then you can start the autobalance procedure.



Note:

Autobalancing (1 and 3) is only possible if balance indicator (4) is located in the blue area (7).



### Autobalance - Fine adjustment mouth switch

**Caution:**

The autobalance menu provides two buttons (+/-) for fine adjustment for the mouth switch. They are always available, irrespective of whether a mouth switch has been connected or not.

- Do not press these buttons if you are not using a mouth switch. The system balance is changed by the "Fine adjustment mouth switch" function.
- The additional force effect applied for fine adjustment for the mouth switch can only be reset to zero by a new autobalance procedure.

**Warning!**

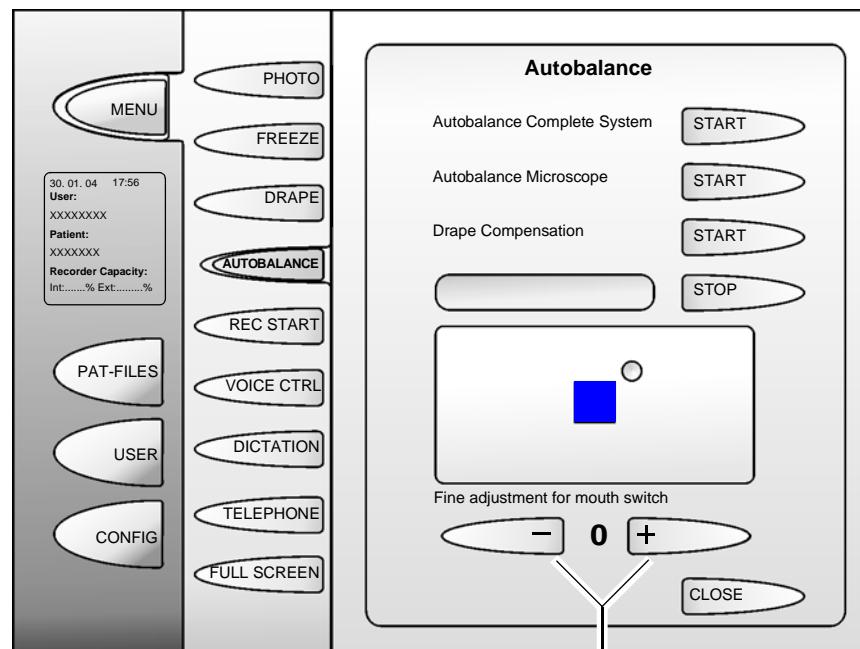
Always perform the autobalance procedure prior to fine adjustment for the mouth switch.

When you press the +/- buttons (1) for fine adjustment for the mouth switch, the weights for the suspension system axes are repositioned depending on the angular position of the suspension system so that a minimal upward/downward force effect occurs.

You can adjust the force action by pressing the buttons several times. The number between the buttons shows how often the buttons have been pressed. After a button has been pressed five times for one direction, the respective button is disabled and no further entry is possible.

**Note:**

The additional force effect applied for fine adjustment for the mouth switch can only be reset to zero by a new autobalance procedure.





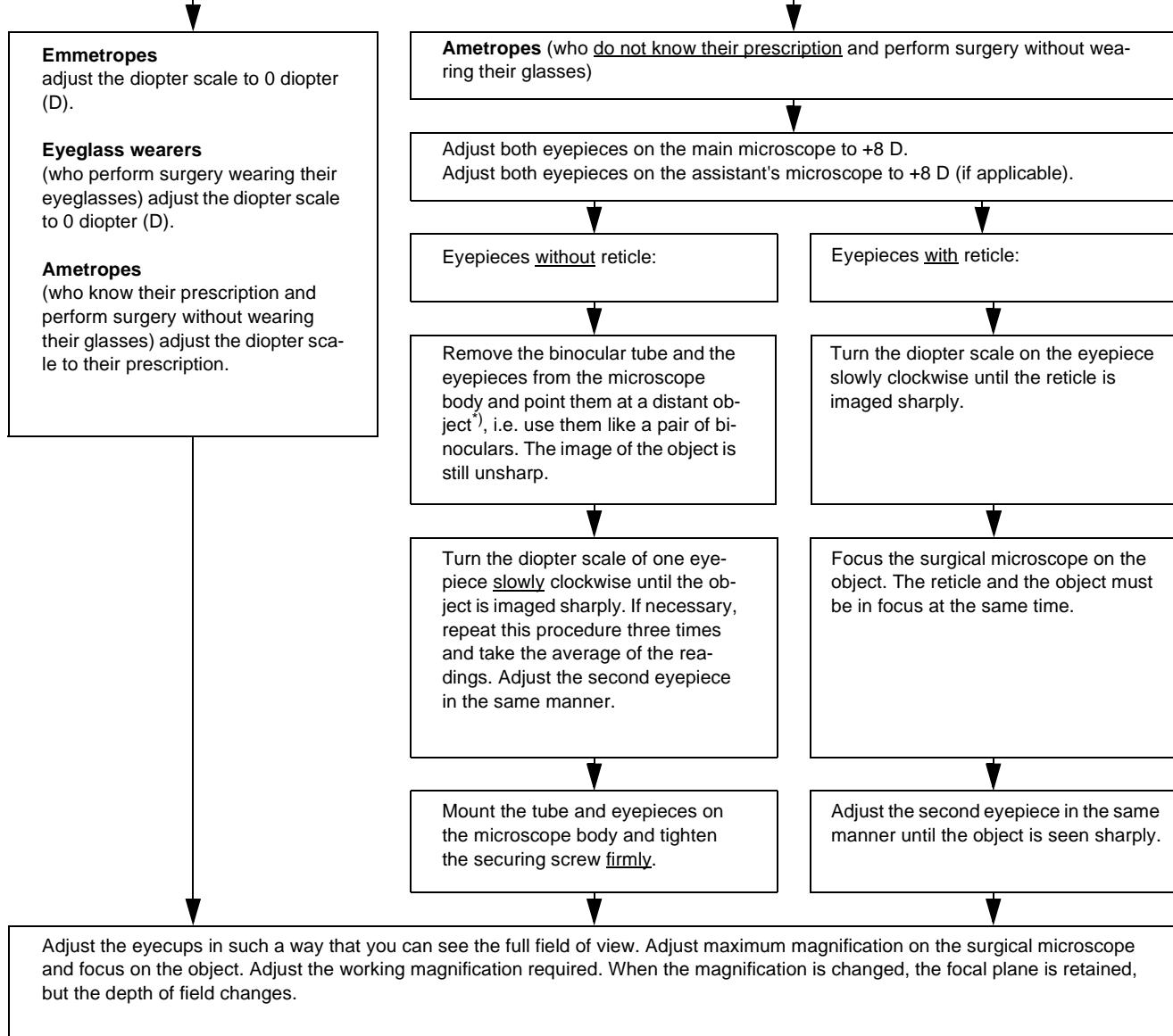
G-30-1458-en

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## Adjusting the surgical microscope

Bring the surgical microscope into its starting position within the focusing range. Adjust the minimum magnification on the surgical microscope. Bring the surgical microscope into the position required. Adjust your interpupillary distance on the binocular tube. Adjust your prescription on the eyepieces. Please note that instrument myopia may occur.



Note: Enter the prescription values in the relevant user profile.



**\*) Warning!** Never use the sun as the distant object!

## USER menu / login

### Default User

On the first login, the system displays a default user and creates a directory for an unknown patient. In the next logins, the system displays the user name last activated.

You can enter your user profile after the first login, and subsequently edit it, if required.



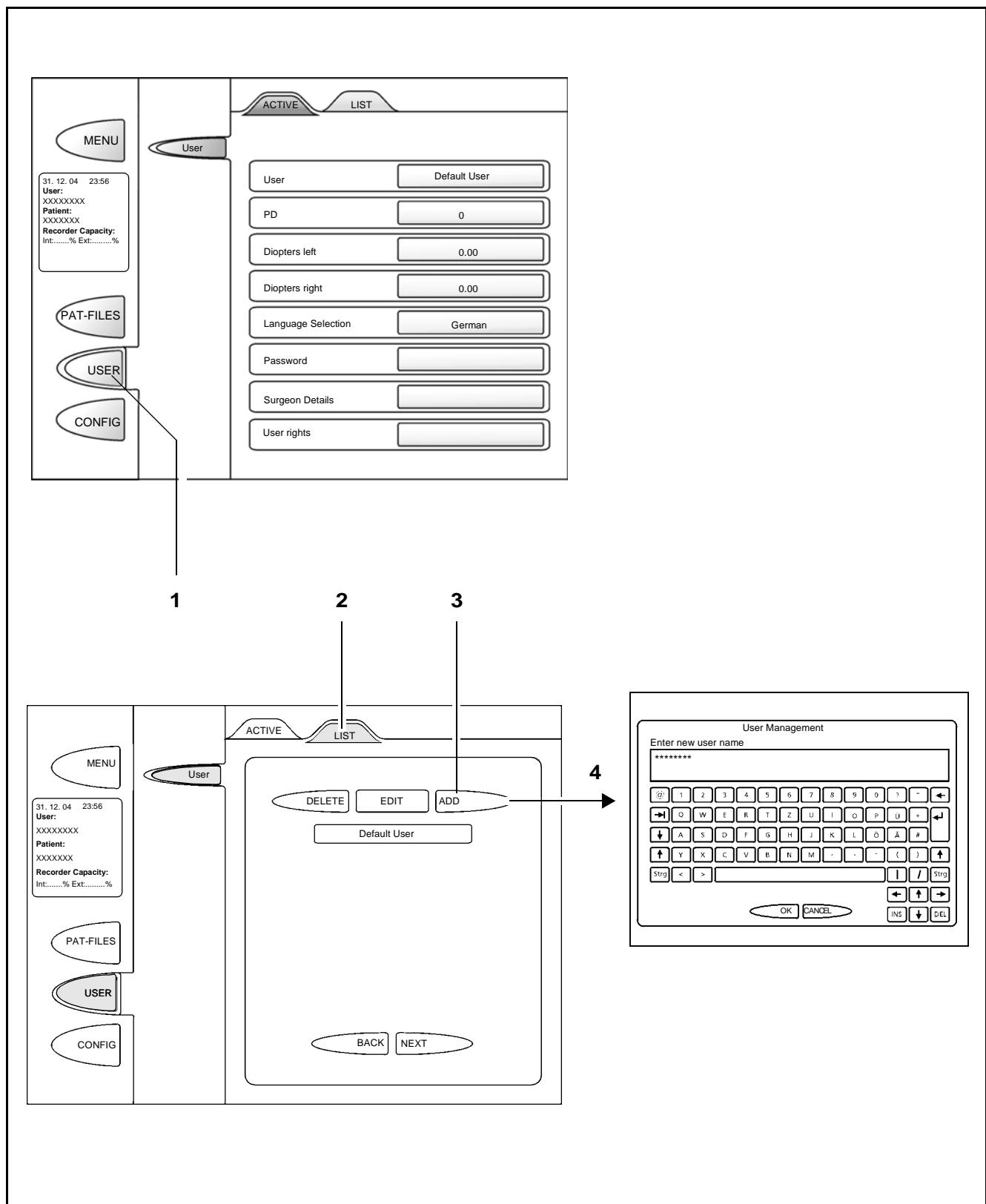
#### Note:

The Default User profile can be neither edited nor changed.

- Press USER button (1).  
The Active tab shows the default user.
- Change to List tab (2) to create your user profile.
- Press ADD button (3) to activate keyboard (4) for the entry.

### Keyboard commands for text entry

- After activation of the keyboard, you can either adopt the default "text or the "old" text (depending on the situation).
- When you press the delete key (|←), the complete text is always deleted.
- Use the cursor keys (←, ↓, →) to position the cursor in the text. The character under which the cursor is currently positioned is highlighted in blue color.
- The functions of the "Insert"(|) and "Del" keys correspond to those of a PC keyboard.



### Creating a new user profile - editing

- Enter your user name (5) and your personal user profile (6). Select the language you wish to use in language selection field (7). Confirm every entry with "OK".
- Enter a password (8) and confirm your entry with "OK".
- Enter the password once again and confirm with "OK".



**Note:**

The system provides password-protected access to protect the patient data contained in it. Password protection is disabled when the system is delivered.

If desired by the user, password protection can be enabled using the master password supplied with the system in a separate, closed envelope (see page 122).



**Caution:**

No password is required for adding a new user name.

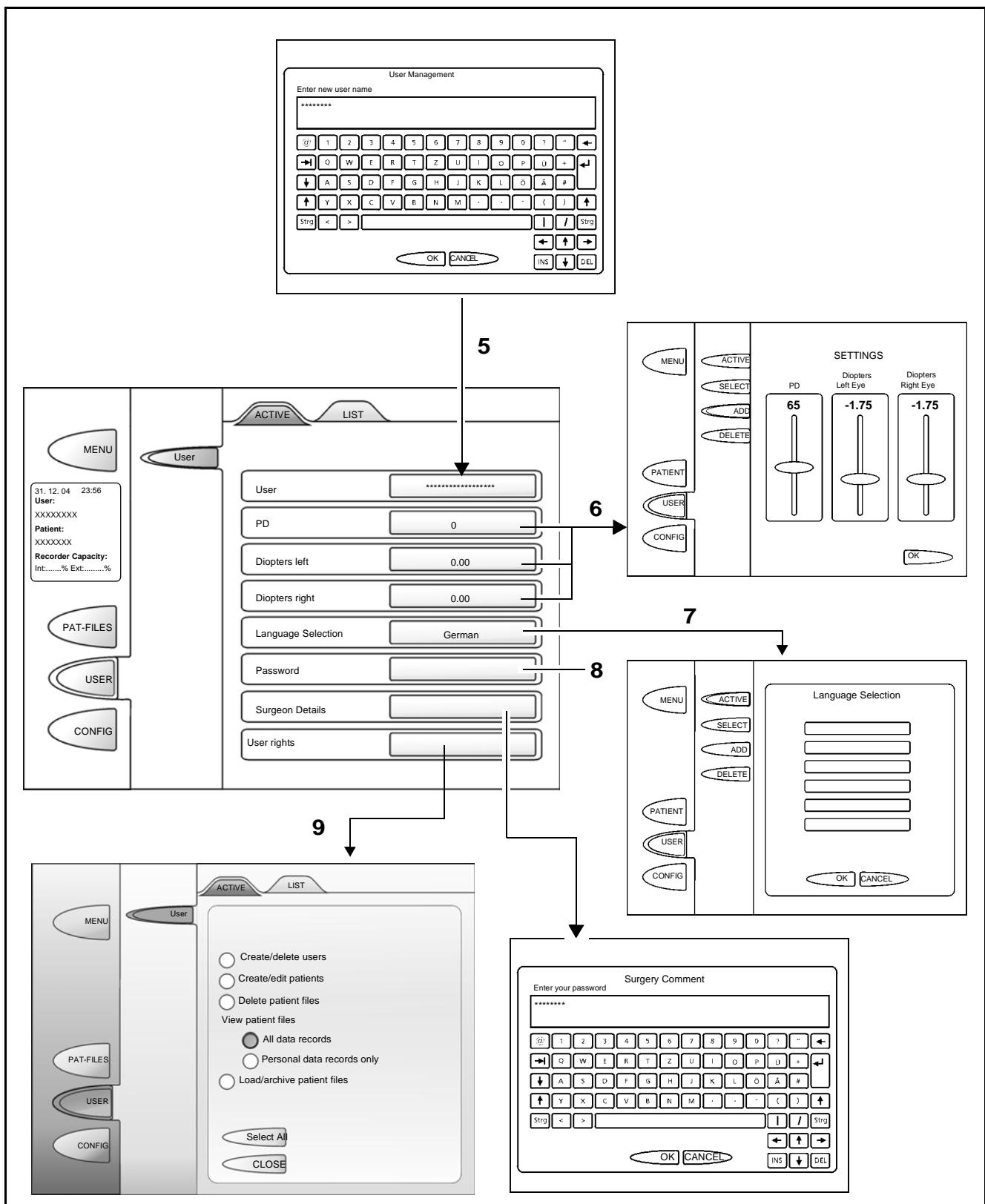
For editing or exporting patient data, you need IT system rights (see page 122) and you have to enter a password. Without IT system rights (9), only the default rights for viewing patient files and data records are enabled. Data storage (archiving) or deletion is not possible without IT system rights.



**Note:**

- During a session, the user has the possibility of entering a new name to include his/her personal profile with the current settings in the selection list.

All entries which you confirm with "OK" are saved in your personal user profile.



## Activating IT system rights and data protection



### Caution:

User password-protected access may be implemented to ensure that only authorized users can view patient-related data.

Always activate the user password in order to prevent unauthorized access.

It is the IT administrator's responsibility to define which rights are assigned to each user.

### IT system rights

You can activate the IT system administrator rights under {CONFIG}[SYSTEM INFO](INFO).

- Factory setting: OFF

On activation of the rights for IT system administration, an input window is opened where the password for the IT system rights must be entered.

### Activating data protection

You can select "Activate data protection" under {CONFIG}[SYSTEM INFO](INFO).

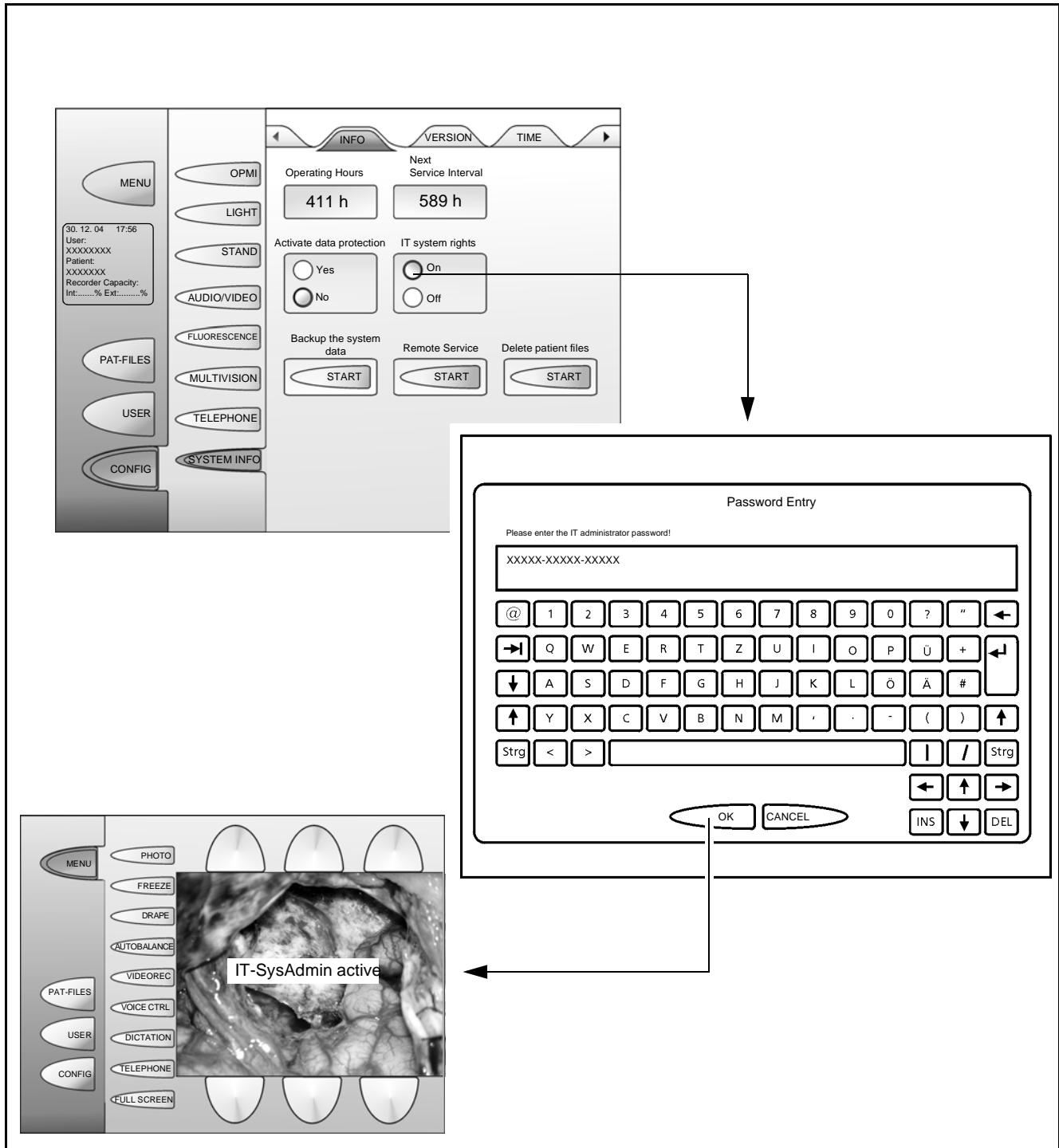
- Yes: The system behaves in accordance with the usual data protection directives. Each user has the system rights assigned by the administrator.
- No: The system ignores any data protection measures and allows straightforward operation. All patient data can be viewed and used by all users. Everyone working with the system can create new users.

Factory setting: No



### Note:

This entry can only be changed with IT system administrator rights.



## **Editing / adding / deleting a USER**

The user LIST menu permits you to perform the following actions:



**Note:**

The user profile includes a comment box where you can enter "surgeon details".

### **EDIT User (1)**

The EDIT menu displays the user profile of the current user.

When you press one of the buttons, an input window is opened.

- Confirm your entries with "OK".

### **ADD User (2)**

The ADD menu permits you to enter a new user.



**Note:**

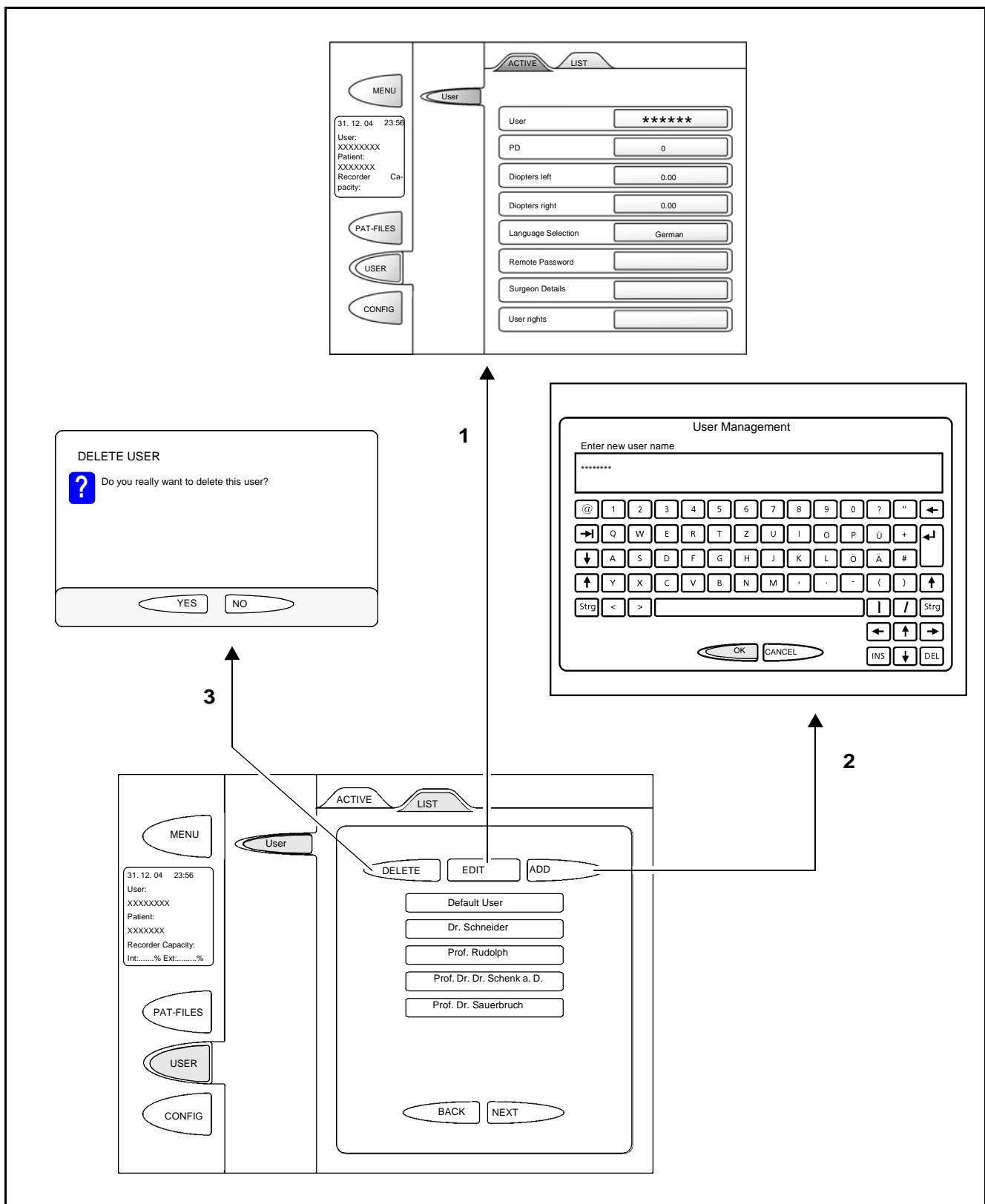
If the user already exists, the message "User already exists" is displayed. The menu returns to the list view.

If the user does not yet exist, the program changes automatically to the "ACTIVE" tab after the entry of the name and confirmation with "OK" to permit the entry of detailed user data.

- Enter the new name in the User Management.
- Enter the user profile and user password (2x) in the menu which then appears.
- Confirm every entry with "OK".

### **DELETE User (3)**

- Press "DELETE".
- Press the user to be deleted.
- Answer the safety inquiry with "Yes" if you really want to delete the selected user.



## Configuration menu (CONFIG)

The CONFIG menu gives you access to all OPMI and stand settings.



### Note:

All settings and changes made to them are automatically saved for the active user upon exiting the menu.

### OPMI

#### FOCUS (Autofocus)

The Focus menu permits you to activate/deactivate or adjust the settings for the following functions:

**1 Automatic AF on/off**

If Automatic AF "on" is selected, the autofocus will be automatically activated every time the brakes are closed.

Autofocus is not possible if:

- the endoscope camera has been selected for visualization
- the shutter in the microscope is closed
- the focus stop button has been activated due to the use of a non-Zeiss micromanipulator.

**2 Micromanipulator focus stop**

When using a micromanipulator from another manufacturer, you must set the focus position corresponding to the manipulator (see page 56). Press the "On" button to save this focus position. Press the "OFF" button to deactivate Focus Stop again.

If Focus Stop has been activated, no autofocus setting is performed when the brakes are operated, even if the autofocus has been switched on. In addition, the focus rocker switches are disabled.

The MM6 micromanipulator is automatically identified by the system. Focusing is limited to max. 400 mm in this case,

**3 Focusing aid laser spots**

Activating or deactivating the autofocus focusing aid (pilot beam for autofocus). If the focusing aid is active, the focusing lasers are switched on when the brakes are released, and motorized fine focusing is activated.

**4 Focus speed**

Setting the focusing speed from minimum to maximum in a range from 5% to 100% in steps of 1%.

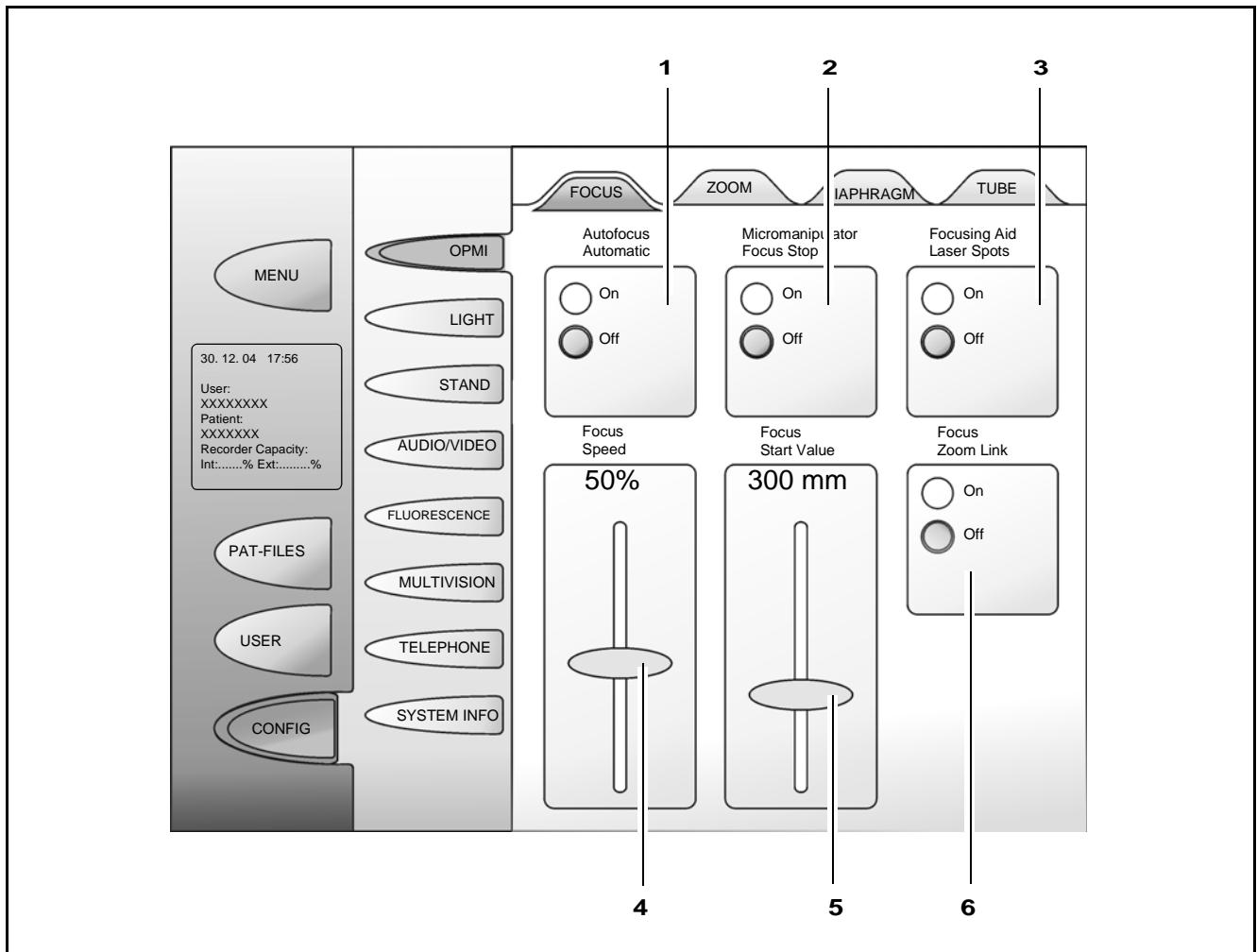
**5 Focus start value**

Enter the working distance at which the focusing system should start to operate after power-up of the system (user-defined setting). The working distance can be set and saved in a range from 200 mm to 500 mm in steps of 5 mm.

## 6 Focus zoom link

This function permits the focusing speed to be coupled with the current zoom value.

The preselected focusing speed is automatically reduced when a higher magnification is used. This facilitates focusing on the object details required.



**ZOOM**

You can activate/deactivate or adjust the settings for the following functions in the Zoom menu:

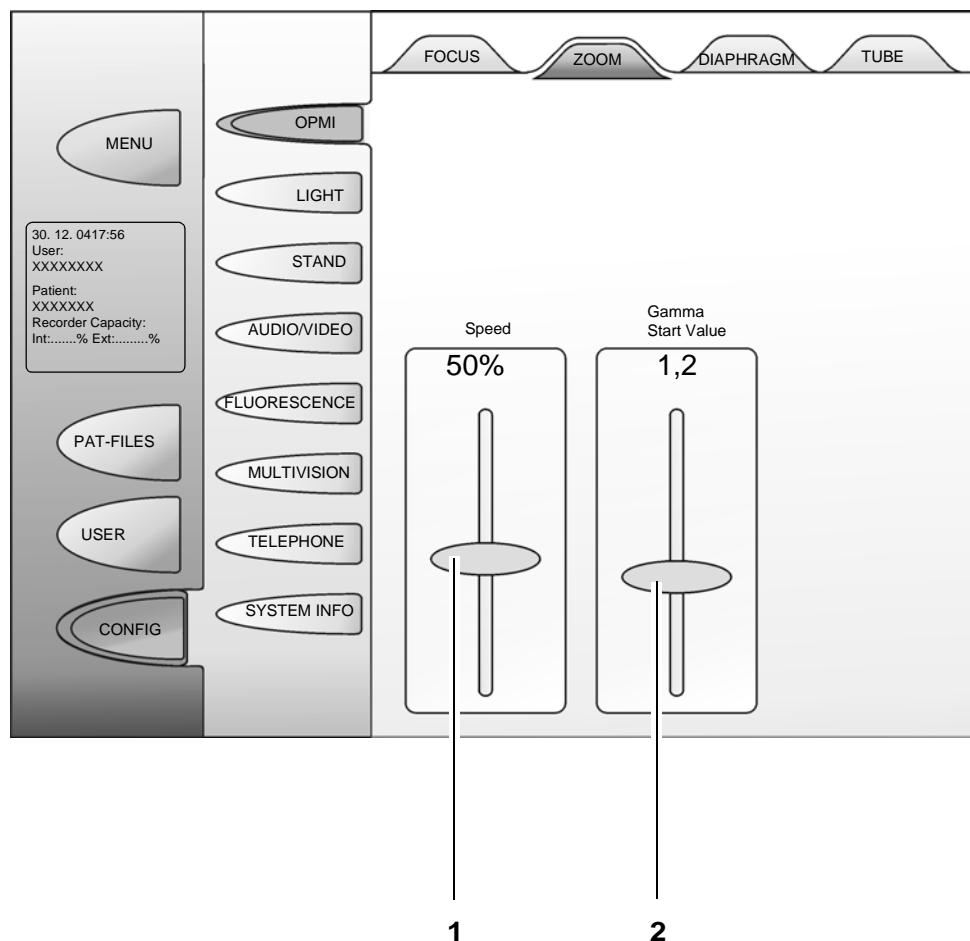
**1 Speed**

Continuous setting of the zoom speed from minimum to maximum in a range from 5% to 100%.

**2 Gamma start value**

Enter the zoom factor (0.4 ... 2.4) at which the magnification system should start to operate after power-up of the system (user-defined setting)





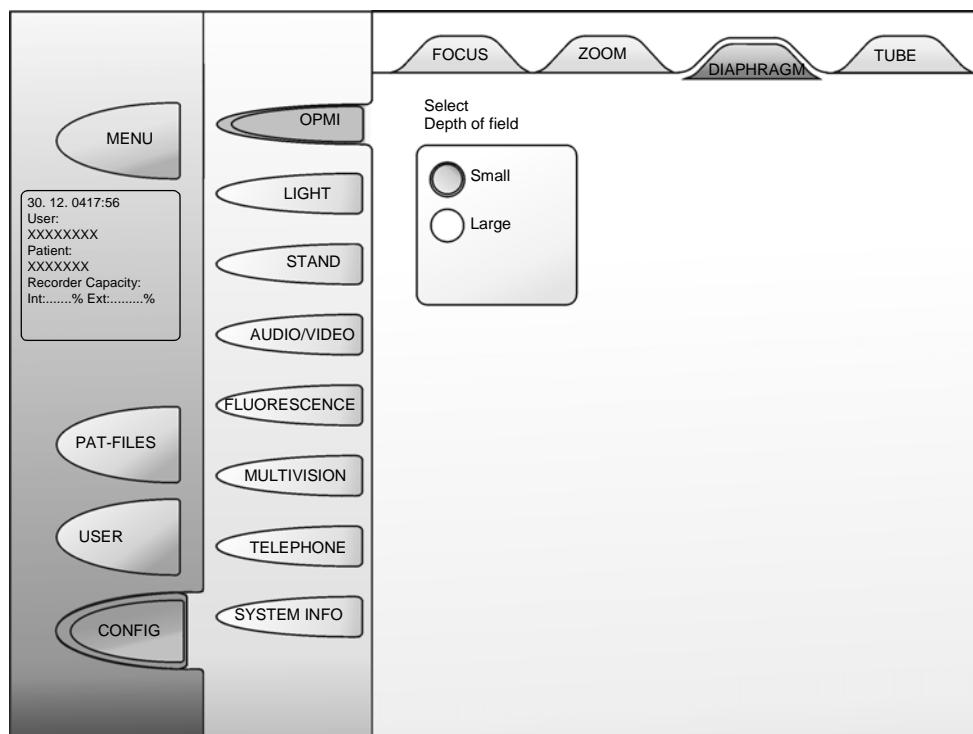
### DIAPHRAGM

You can increase or reduce the depth of field by adjusting the integrated diaphragm.

The following setting options exist:

- Large depth of field → small aperture → less light
- Small depth of field → large aperture → more light





**TUBE**

Select the tubes and eyepieces to be used in the TUBE menu to permit the system to calculate the correct total magnification. The total magnification is displayed in the main menu.

**Options:**

- 1** Eyepiece magnification:  
10x, 12.5x
- 2** Tube focal length:  
125 mm, 170 mm or 200 mm

**Note:**

When you end the menu, a warning message appears, asking whether you have actually mounted the eyepieces and tube as indicated.

You can also select the type of coobservation (position of the sliding mirror).

All settings (1, 2, 3) are saved on a user-specific basis.

**Note:**

Mount a binocular coobservation tube with the appropriate eyepieces (page 90) or a documentation / coobservation module (page 92).

**3 Coobservation**

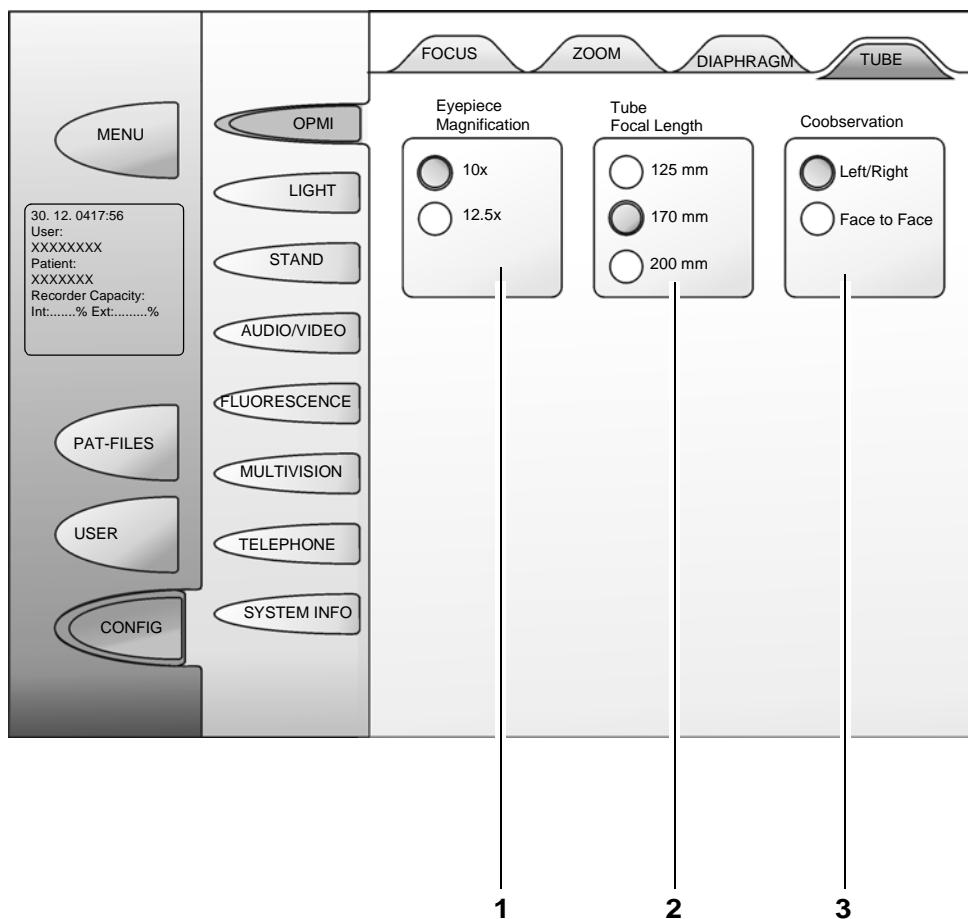
The sliding mirror has two positions:

**Left/right:**

The light is directed to the lateral image exit ports. If an external camera is released and the sliding mirror is in the face-to-face position, the mirror switches to the left/right position during image capture.

**Face to face:**

The light is directed to the tube mount at the back.



## LIGHT

### Illumination intensity

Continuously variable on the touchscreen from minimum to maximum brightness in a range from 5% to 100%.



### **Warning!**

Make sure that no tissue damage is caused by excessive illumination intensity (page 23).

You can activate/deactivate or adjust the settings for the following functions in the Light menu:

- 1 Light on/off
- 2 Speed:  
Setting the speed of the change in intensity.
- 3 Light intensity control or  
Automatic light field limitation



### Note:

The software automatically recognizes which of these functions is installed in your system. The display above field (3) changes accordingly.

### **Light intensity control**

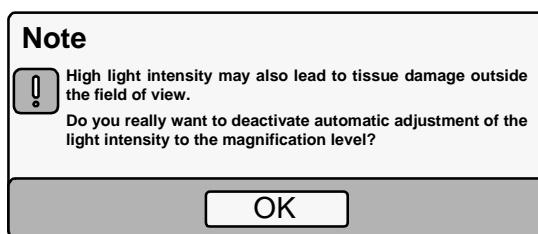
is dependent on the zoom setting and the position of the illuminated field diaphragm. When this function is active, the illumination is automatically adjusted in such a way that the user is provided with a subjectively constant brightness level in the eyepiece, regardless of the zoom factor and light intensity. The on or off mode of light intensity control is stored in the respective user profile.

### **Automatic light field limitation**

The size of the illuminated field is automatically adapted to the field of view (illuminated field = field of view).

This means less exposure of tissue and reduced reflections by too much light in areas outside the field of view, thus providing additional protection against potential tissue damage.

- Automatic light field limitation activated:



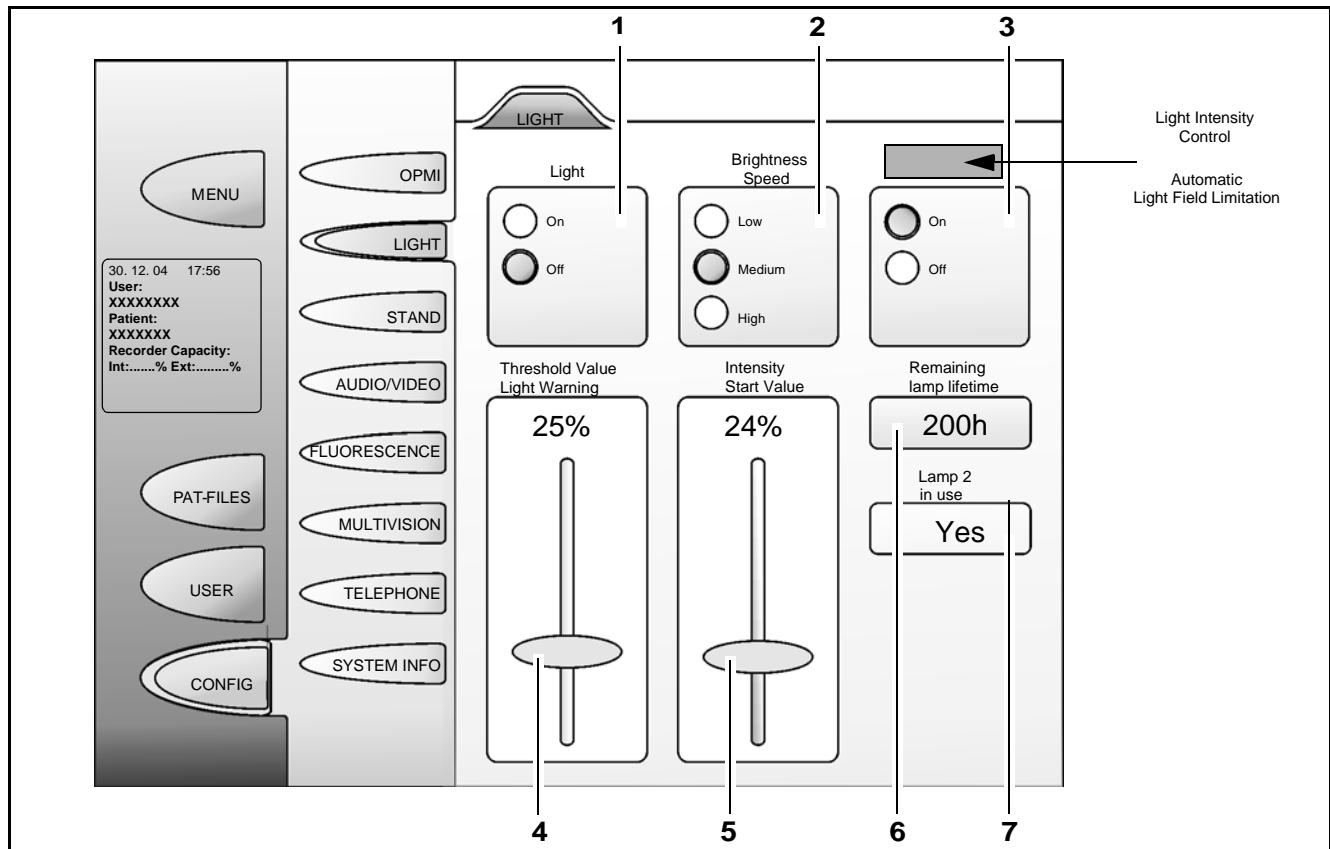
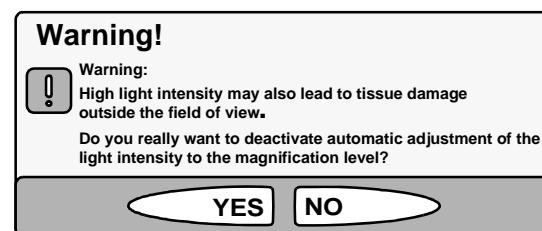
**Note:**

Automatic light field limitation has been activated:

If the magnification is changed in the BL400/IR800 mode (fluorescence option), the light value may significantly increase above the previous level when BL400/IR800 is deactivated.

You can deactivate this function. A warning is displayed which you have to acknowledge. Please note the safety information on page 23.

- Automatic light field limitation deactivated.



**4 Threshold value for light warning**



**Warning!**

Adjust the illuminated field diameter and illumination intensity to the values required for the procedure! (See page 23).

The illumination intensity is preconfigured (factory settings) in such a way that a warning is displayed on the touchscreen when the threshold value of 25% is exceeded, informing the user of possible tissue damage when the light intensity is too high.

The percentage of light intensity is displayed in red typeface on the touchscreen. The light intensity display in the data injection system flashes approx. 5 times when the threshold value has been exceeded. The display is automatically deactivated when the intensity level is back below the threshold (unless "OPMI Data Display" has been activated in the MultiVision menu).

**5 Intensity start value**

Enter the illumination intensity in percent. The xenon lamp will then light at this brightness level after activation (user-defined setting).

The previous brightness-zoom link has been activated at the factory. This means that the displayed intensity start value has been corrected in accordance with the zoom start value and the position of the illuminated field diaphragm and may differ from the selected intensity start value.



**Note:**

The intensity start value can only be adjusted up to a level 1% lower than the setting for the light warning threshold value (4). If the light warning threshold value (4) is adjusted downward, the intensity start value is automatically set to 1% below the light warning threshold value.

**6 Remaining lamp life**

The theoretical, remaining service life of the light source is displayed.

The system automatically monitors the service life of the two lamp modules which is 500h. When this period has been exceeded, the system prompts you after every restart to change the lamp module.

If you continue using the lamp module despite this warning, lamp failure during operation or, in very rare cases, even the explosion of the lamp cannot be ruled out.



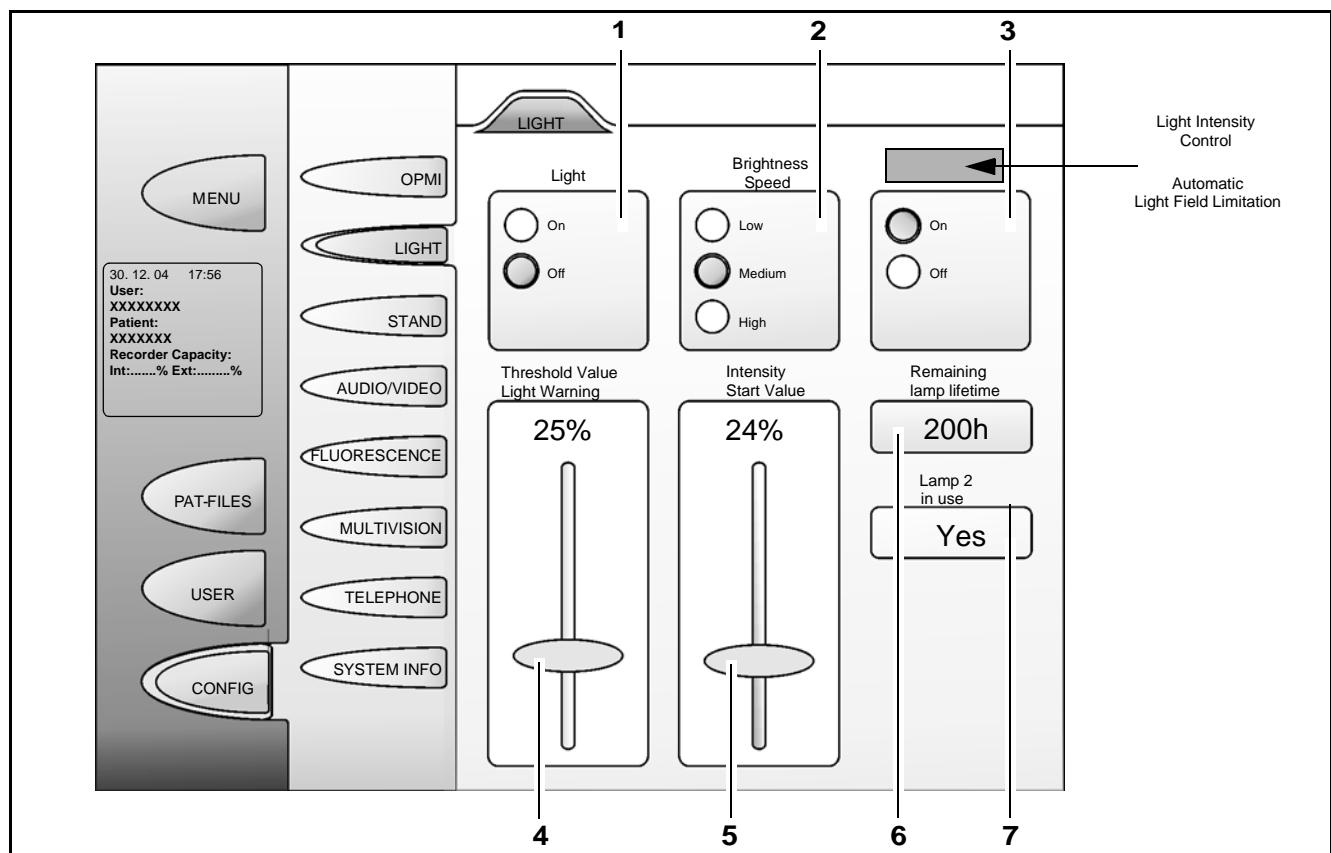
**7 Lamp 2 in use**

If the service life of the main lamp has expired and the backup lamp has been activated, this is indicated by "YES".



**Note:**

In this case, you should replace the used lamp by a new lamp as soon as possible.



## STAND

### HANDGRIPS

#### 1 Joystick

Note: In the basic setting, both joysticks can be used for motorized fine movement in the XY directions.

If the MultiVision function is active, the joystick of the right handgrip is used to control a mouse cursor for the functions of a connected navigation system (depending on the system used) or for menu control of the displayed touchscreen.

#### 2 Zoom / Focus rocker switches +/-

The functions of the rocker switches can be reconfigured by the user.

Note:

The zoom and focus functions of the two rocker switches can be interchanged. Briefly press button (C). The display and functions are now interchanged.

#### 3 Configuring the left handgrip

Press button (6) to select the left handgrip. (Buttons 3 and 4 are only visible if button 6 has been pressed).

#### 4 Configuring the right handgrip

Press button (6) to select the right handgrip. (Buttons 3 and 4 are only visible if button 6 has been pressed).

#### 5 Function selection menu

Functions available for programming the buttons

#### 6 Configuring both handgrips identically

#### 7 Reset button

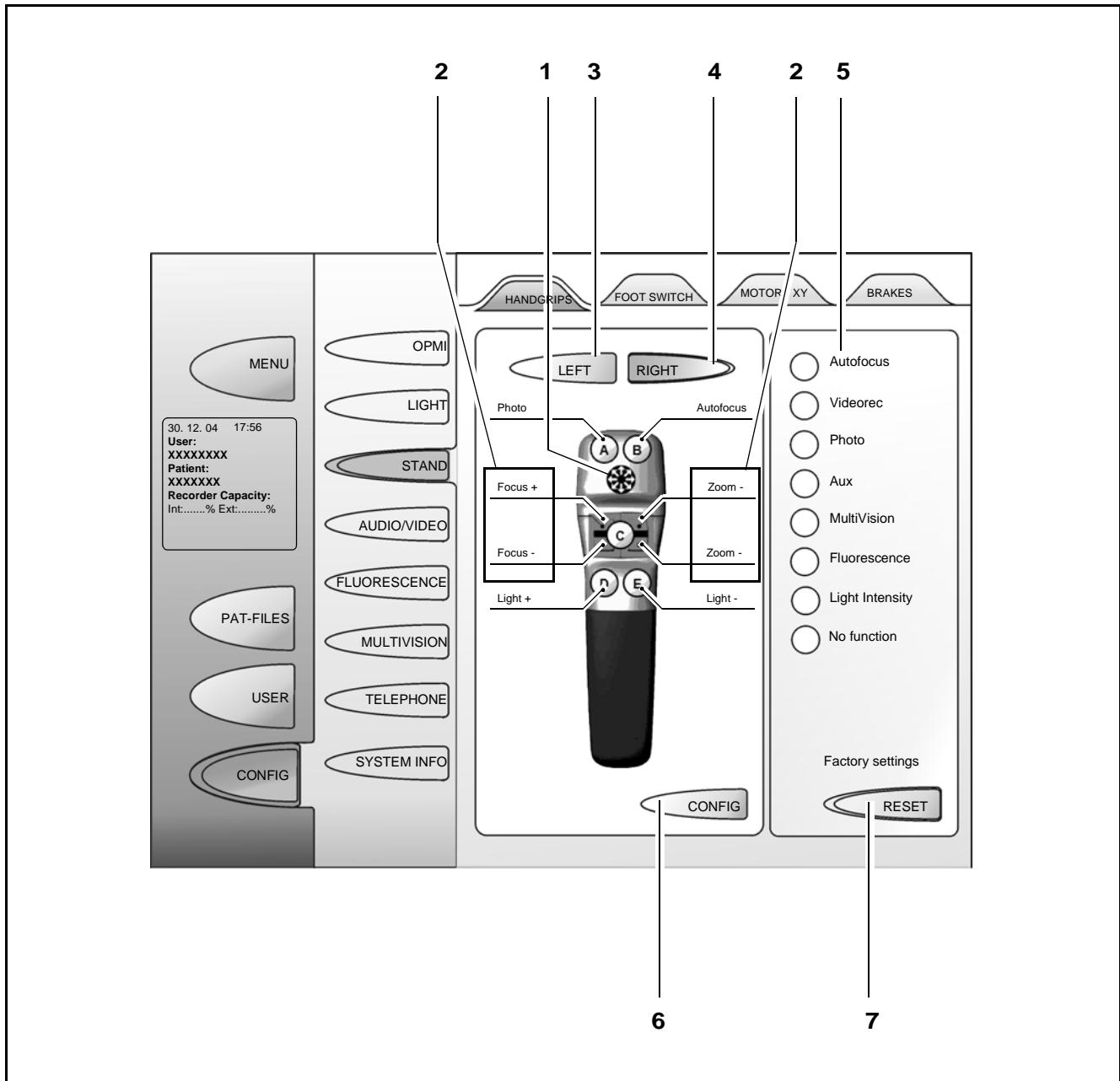
When you press the reset button, the default settings (factory settings, see illustration on the right) will be restored.

### Programmable buttons A, B, D, E



### Configuring the handgrip buttons

- Press (6) to configure both handgrips. For separate programming of the left or right handgrip press (3) or (4) respectively. (Buttons 3 and 4 are only visible if button 6 has been pressed).
- Press the button (A, B, D, E) to which you would like to assign a different function.
- Then press the relevant function in selection menu (5) to assign it to the selected button. The labeling of the button is changed and indicates the new function.



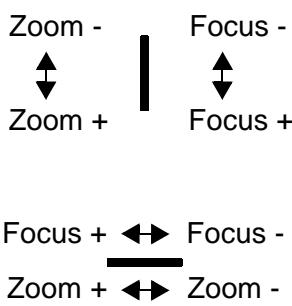
### FOOT SWITCH

Depending on the type of foot control unit used, select for configuration:

- rocker switch menu (1),
- control panel menu (2) or
- footswitch menu (3)

#### **4 Joystick**

The joystick on the foot control panel permits motorized fine movement of the microscope in the XY directions. It can also be used to control a mouse cursor (menu control in data injection) or the functions of a connected navigation system.



#### **5 Focus rocker switch +/-**

The function of the rocker switch is defined, but it can be reconfigured by the user.

#### **6 Zoom rocker switch +/-**

The function of the rocker switch is defined, but it can be reconfigured by the user.

**Note:**

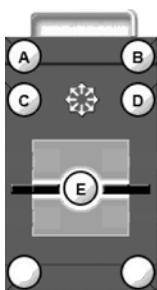
The zoom and focus functions of the two rocker switches can be interchanged. Briefly press button E: the displays and functions are interchanged.

#### **7 Function selection menu**

#### **8 Reset button**

When you press the reset button, the default settings (factory settings) will be restored.

### Programmable buttons A, B, C, D



### Configuring the foot rocker switch, control panel or footswitch

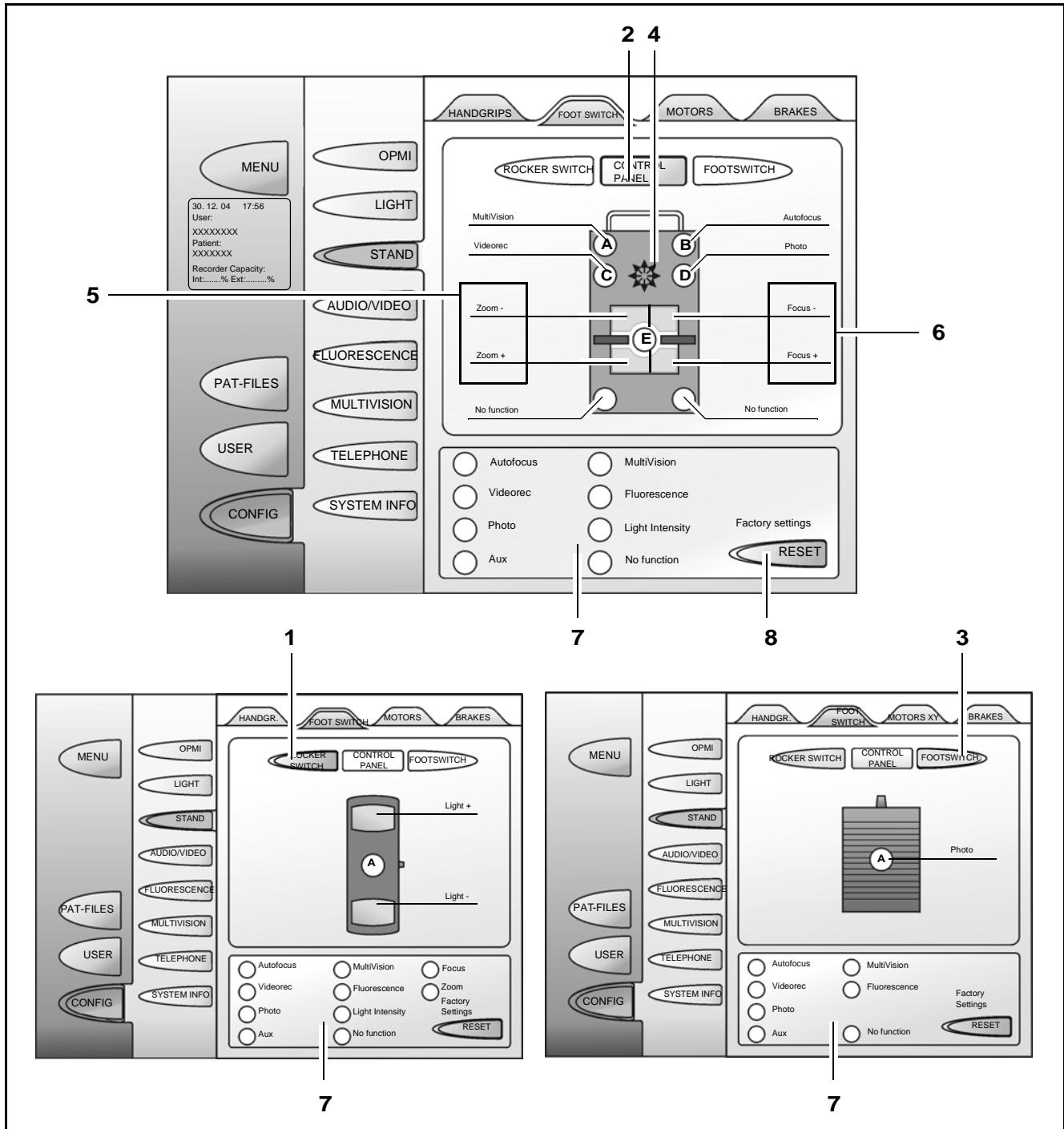
- To configure the foot control unit used, select (1), (2) or (3).
- Press the button (A, B, C, D) to which you would like to assign a different function.

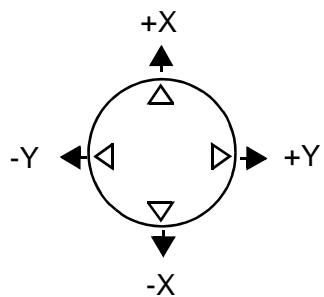
Then press the relevant function in selection menu (7) to assign it to the selected button. The labeling of the button is changed and indicates the new function.



**Note:**

- The foot rocker switch and footswitch can only be assigned one function at a time from selection menu (7) for button A.





### MOTORS XY

As long as the joystick on the handgrip or foot control unit is pressed, the microscope performs a rotary movement or a lateral or front-to-back tilt movement at a constant speed in the direction selected with the joystick.

**1** Zoom link of travel speed XY

Permits a specific focusing speed to be coupled with a zoom value. This means that the speed is automatically reduced when a high magnification is used.

When the function is off, no speed adaptation takes place.



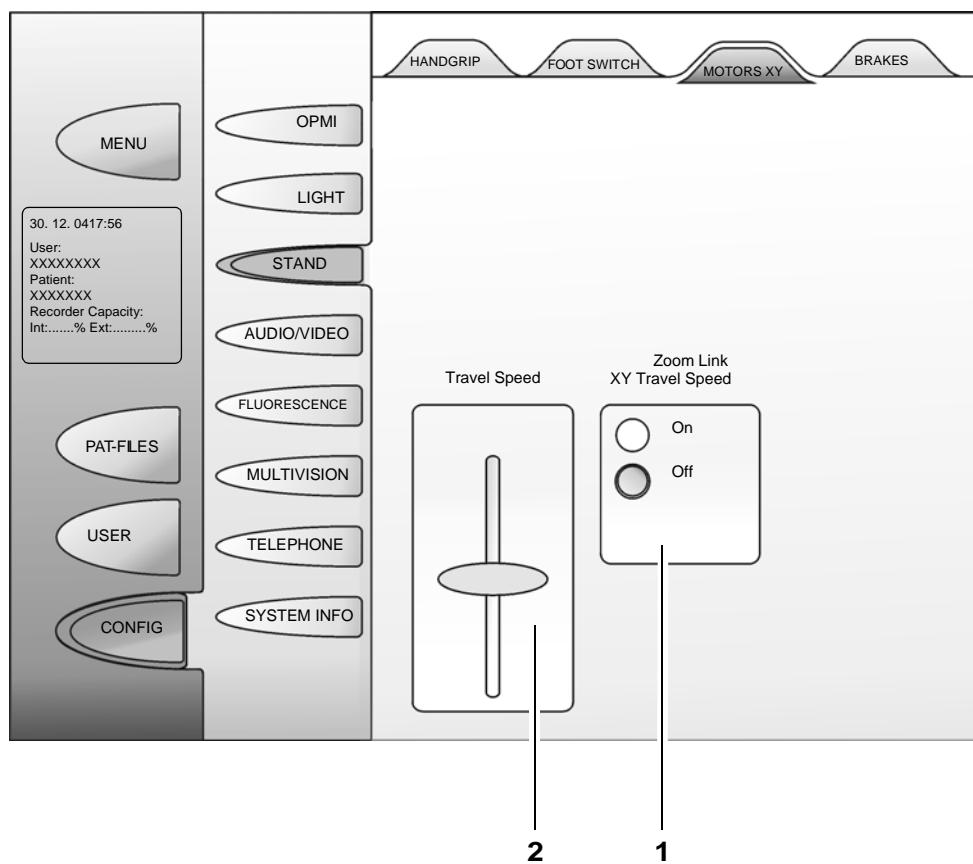
**Note:**

In the Navigation mode, the right-hand joystick can be used to operate major functions of a connected navigation system.

The left-hand joystick continues to be used for controlling the XY movement.

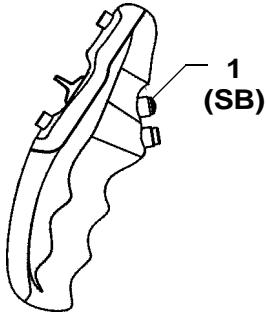
**2** XY travel speed

Is continuously variable in a range from 5% to 100% (user-defined setting).



**BRAKES**

Select the axes which you want to be released when you press SB button (1) on the handgrip. You have the following options:

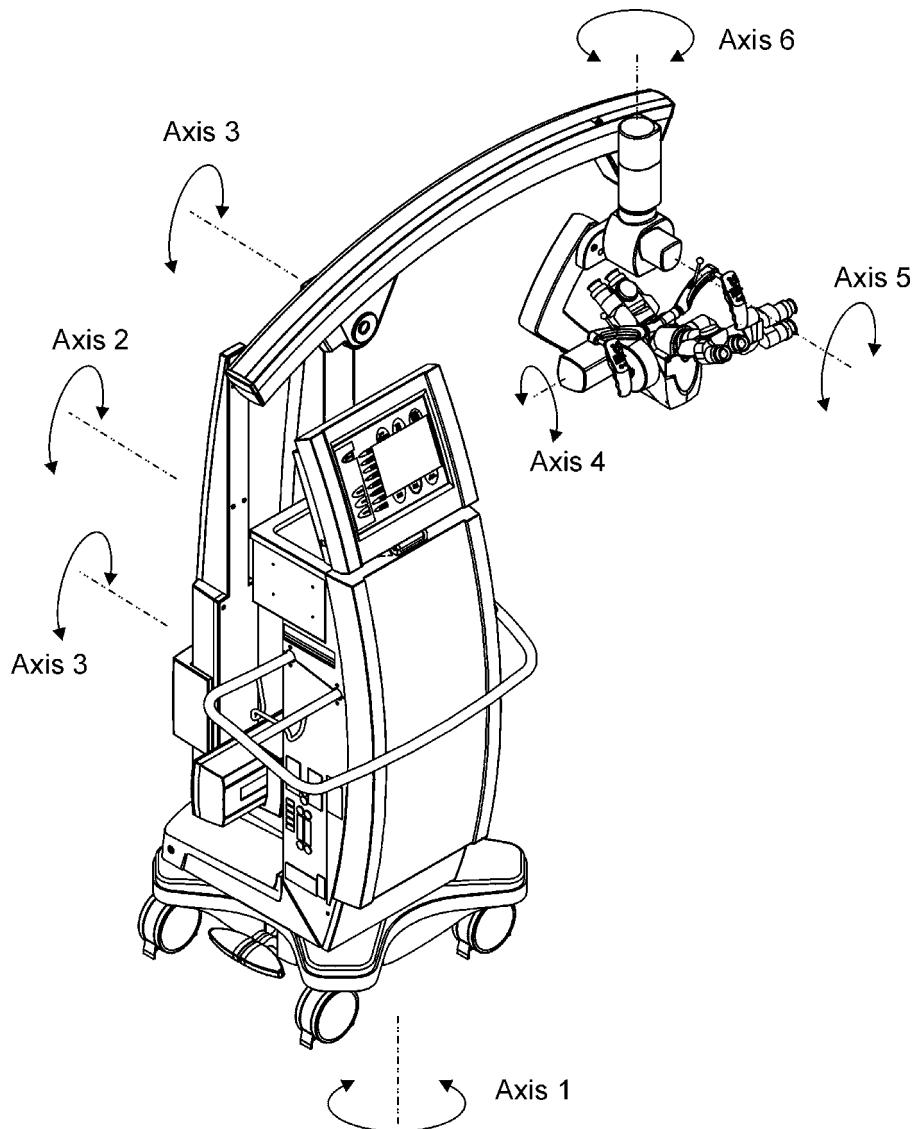


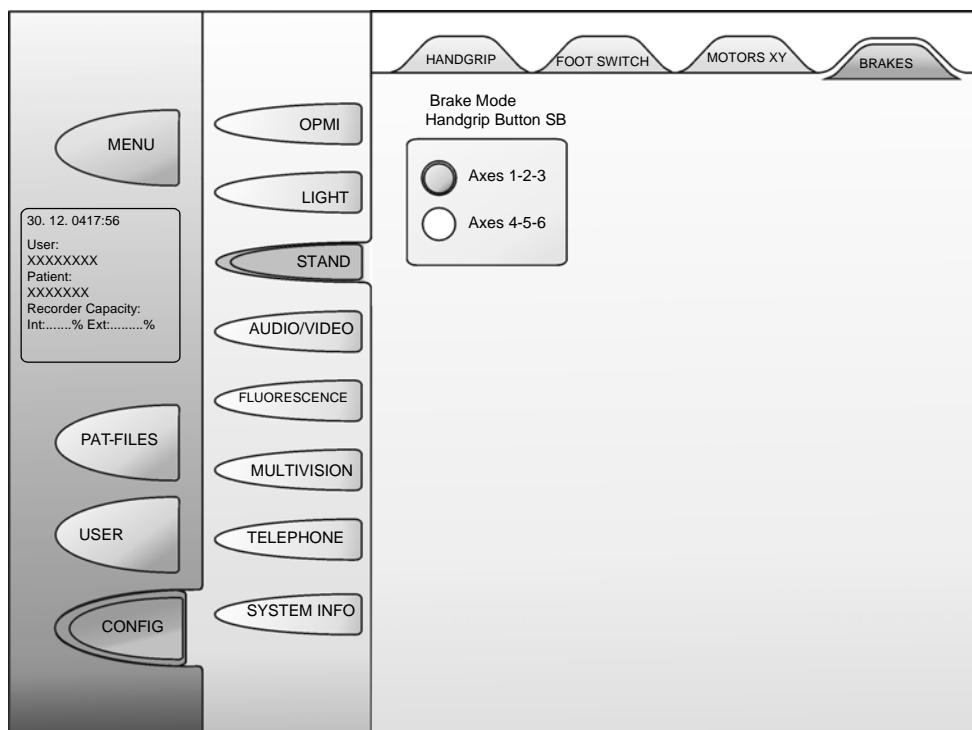
Axes 1-2-3

Suspension system axes

Axes 4-5-6

Microscope axes





## AUDIO/VIDEO

### PHOTO

The Photo function permits you to capture single images. If no external still camera has been connected (see item 3), the system saves a high-resolution freeze image provided by the video signal. The individual image which you capture by pressing the Photo button or a configured button on the handgrip or foot control panel is saved in the patient directory in a previously defined format.

Use the CONFIG menu /STAND/HANDGRIPS or FOOT SWITCH to program a button for this purpose.

#### **1 File format**

You can save your images in three different formats:

JPG	JPEG format
TIFF	TIFF format
BMP	Windows bitmap

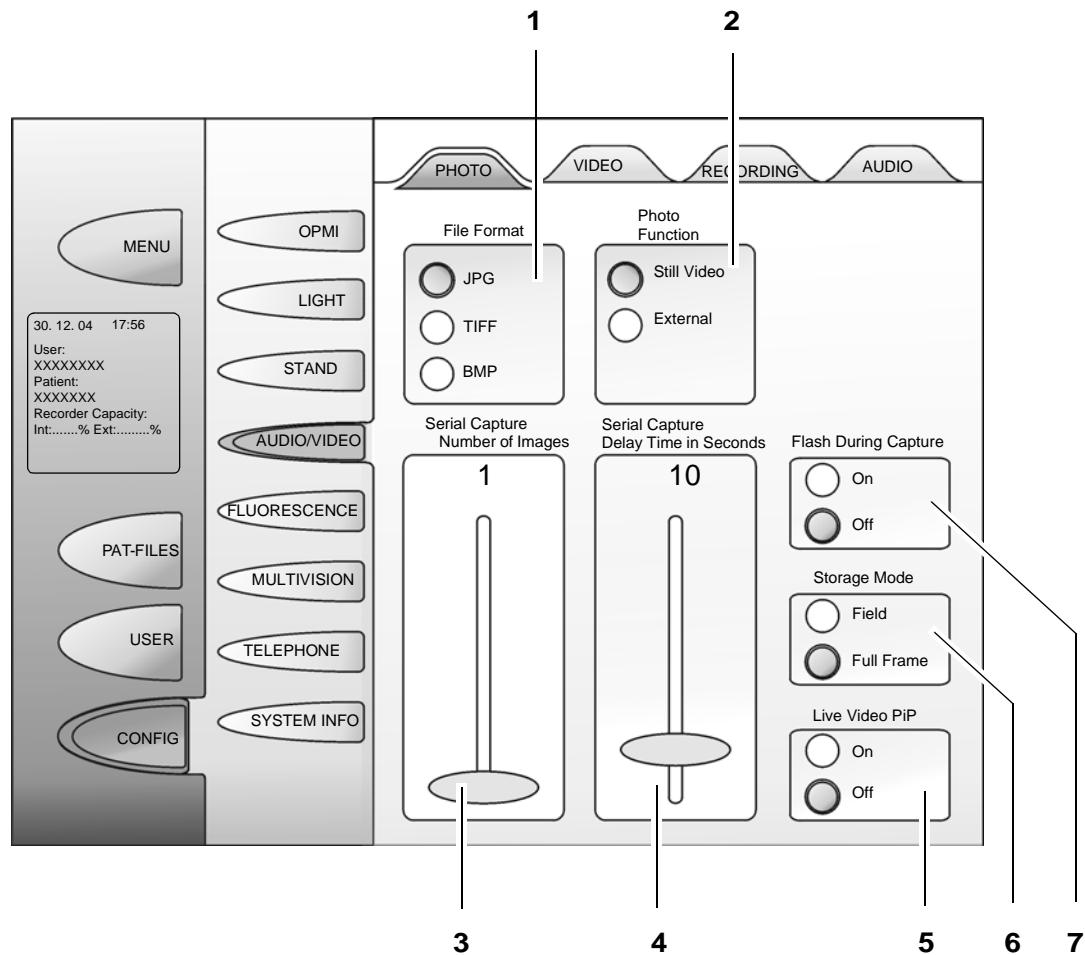
#### **2 Photo Function**

You have the choice between an internal camera (live capture) and an external SLR camera. The internal camera is activated on every system start. If you use an external camera, you must select it using the External button.

#### **3 Serial image capture, number of images**

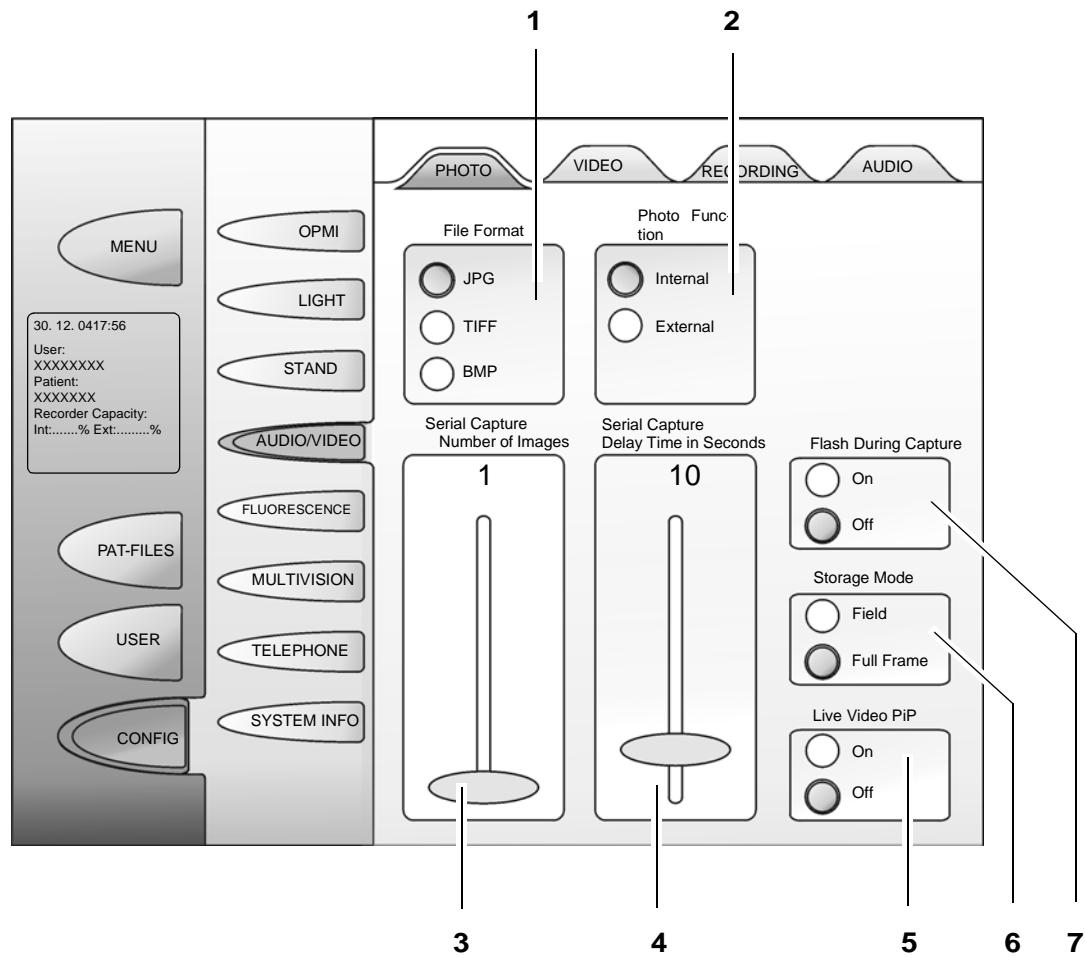
Select here whether you wish to capture single images or serial images (number of images is displayed next to the Rec. display).





- 4 Serial capture, delay time in seconds (for serial images only)  
Set the delay time between two images (maximum delay time: 60 seconds). Start serial image capture by pressing the Photo button in the menu on the touchscreen. The program identifies the serial capture function if the number of images in (4) is higher than 1.  
After the start, the number of serial images appears at the bottom left of the touchscreen and is incremented. When you press the Photo button again, serial image capture is stopped.  
However, you can create single photos at any time by pressing the appropriate handgrip button (configuration: Photo, see page 136).
- 5 Live Video PiP  
You can use a picture-in-picture display for single images. While the freeze image is displayed, the live image continues to be visible in the upper right corner of the display. If you save the single image, the display returns to the live image mode. The saved image is displayed for approx. two seconds in the upper right corner. The live image is not visible in the saved image.
- 6 Storage mode
  - Field:  
In this mode, only one field of the video signal is saved. The second field is computed by doubling the lines, thus replacing the missing field. This mode provides maximum resolution for moving objects, as it compensates for the blur caused by movement.
  - Full frame:  
This mode saves both fields of the video signal. It provides maximum resolution for unmoving objects.
- 7 Flash during capture
  - On: pulsed mode of the light source (flash function, factory setting)
  - Off: illumination intensity of the light source remains as set.





## VIDEO

Use this menu to configure the functions of the integrated 3CCD video camera.

### Setting the brightness

#### Automatic brightness control "Auto" (1) and (4)

The brightness can be set by adjusting slider (4). The video system tries to maintain the selected brightness at a constant level by independent control of the exposure time.

#### Manual brightness control using "shutter" (2) and (5)

The exposure time of the camera can be varied in discrete steps by pressing the appropriate button. (The camera does not control image brightness).

The default setting corresponds approx. to 1/50 or 1/100 in PAL systems and to approx. 1/60 or 1/120 in NTSC systems.

### Selecting the brightness range (2)

You can select between two light metering patterns:

#### Spot

The exposure is measured in a very small field in the image center. This metering pattern is suitable for work in narrow channels with a small illuminated field diameter. It is unsuitable, however, if the image area of interest is not located at the image center. Select the "Full" mode in this case.

#### Full

Light metering is performed across the full video image. This metering pattern is recommended if the surgical field is fully and evenly illuminated, if pronounced reflections are present, or if your working area is not located at the image center.

### Selecting the video format for an external video port (VGA)(3)

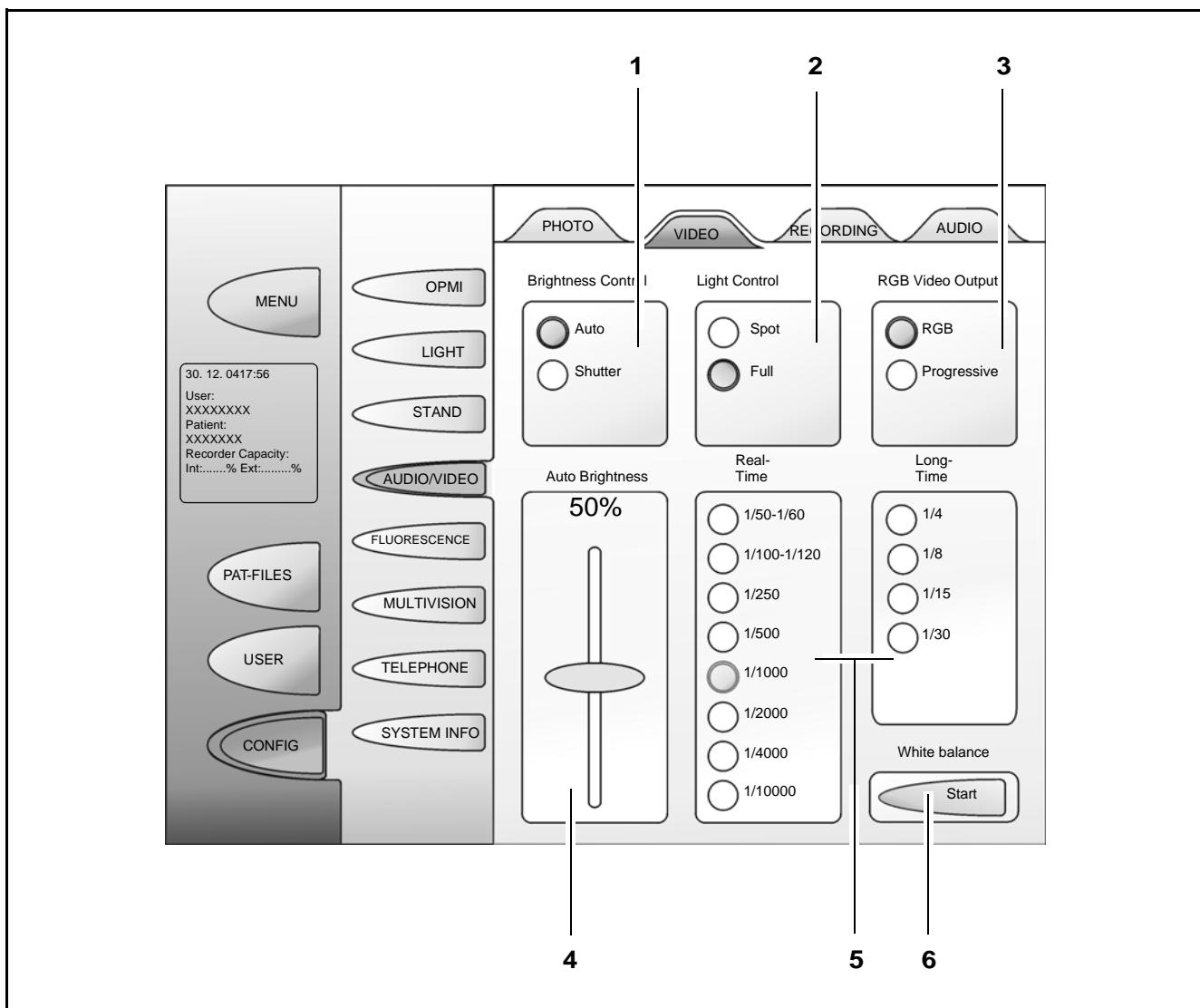
- RGB: Interlaced format (analog video)
- Progressive: Non-interlaced format (digital video, progressive scan)



### Autom. white balance (6)

Press the White Balance start button (6) to perform the white balance procedure for the video image. The system adjusts the video signal in such a way that white areas in the surgical field are also white in the video image.

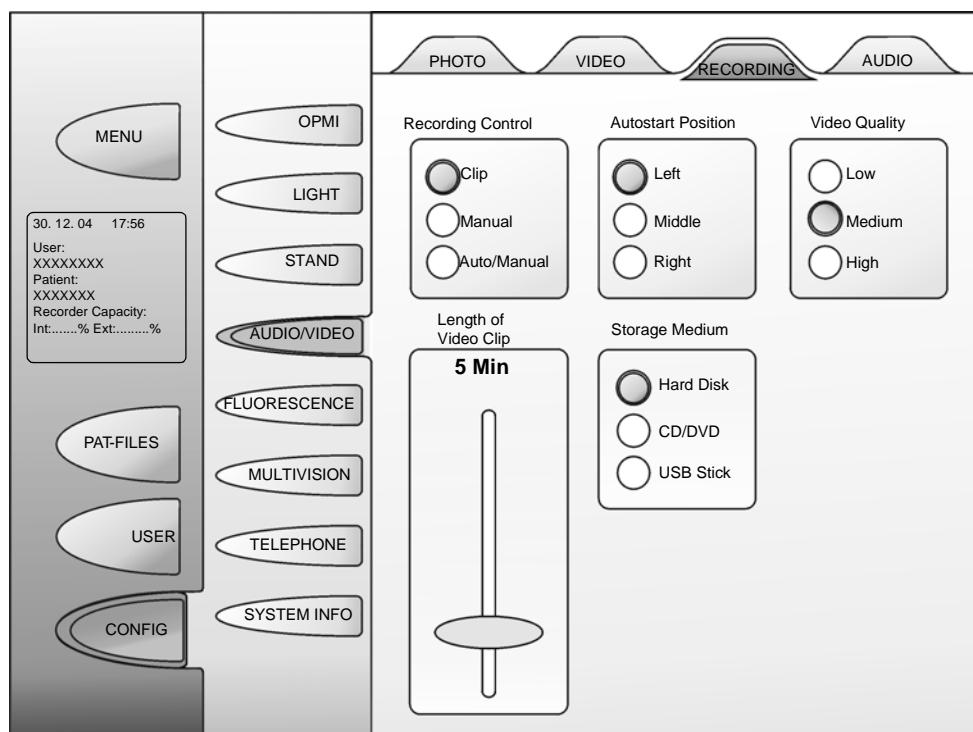
To achieve this, place a suitable white object (e.g. a piece of white paper with a matte surface, or white gauze bandage) under the microscope and focus the microscope on it, using a medium brightness level.



**Digital video recording (option), see page 244****Description**

The video recorded with the integrated video camera is saved as a digital MPG2 file in the relevant patient directory. The recorded video clips can be played back using the integrated video player. You can also export these files to a CD/DVD or USB stick.





## AUDIO

Setting the microphone sensitivity and playback volume.

Audio recording during surgery takes place via the microphone integrated in the OPMI Pentero microscope and is stored as an MPEG file.

The audio signal is automatically output when the MPEG video is played back via a player.



**Note:**

The Audio tab is only active if the video recording license has been activated.

**1** Audio playback

- On: the MPEG video is automatically played with sound.
- Off: the MPEG video is played without sound.



**Note:**

When playing the video, you can subsequently activate or deactivate the sound. A loudspeaker button is provided in the lower task bar of the player or editor. When you press the loudspeaker button, a menu (5) is opened that permits you to adjust the volume and to activate or deactivate the sound.

**2** Volume

Use the slider to adjust the playback volume.

**3** Microphone recording

- On: the MPEG video is recorded with sound.
- Off: the MPEG video is recorded without sound.

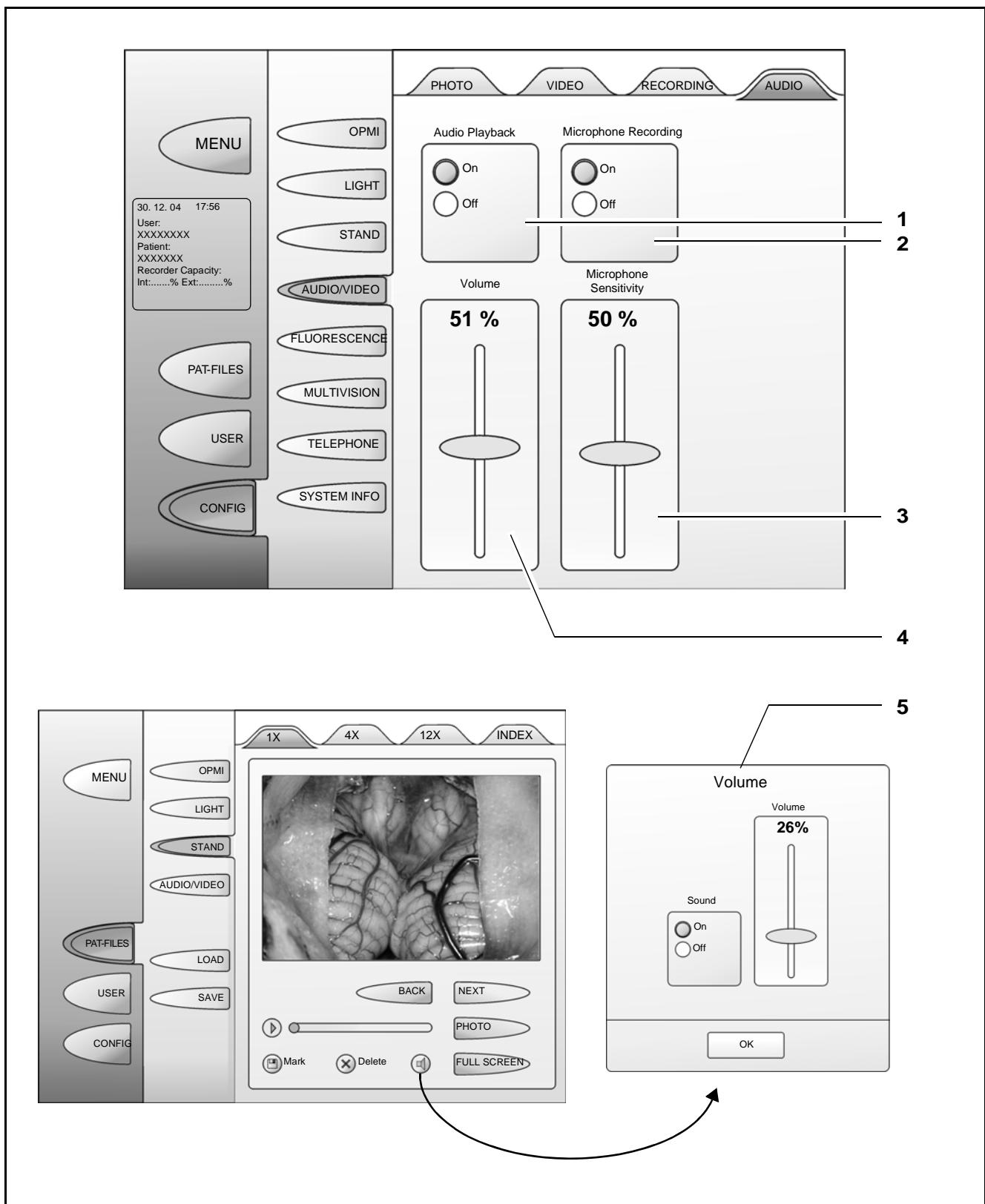
**4** Microphone sensitivity

Use the slider to adjust the sensitivity of the microphone.



**Note:**

If audio playback and/or microphone recording have been deactivated, the relevant sliders are disabled.



## MULTIVISION



Note: In the basic setting, both joysticks can be used for motorized fine movement in the XY directions.

If the MultiVision function is active, the joystick of the right handgrip is used to control a mouse cursor for the functions of a connected navigation system (depending on the system used) or for menu control of the displayed touchscreen.

### 1 OPMI Data Display

This function permits you to configure which information should be displayed in the MultiVision display in the OPMI. These values are then constantly displayed at the lower edge of the current image. The following displays are possible (individually or in combination):

- Current zoom value
- Current focus position
- Current brightness intensity

### 2 Navigation interface on/off

Activating a connected navigation system (RS 232 interface).



Note: Activating the navigation interface also enables the "Navigation" button function of MultiVision.

### 3 Focus crosshairs on/off

Use this function to select whether crosshairs should be displayed or not. The crosshairs mark the optical axis.



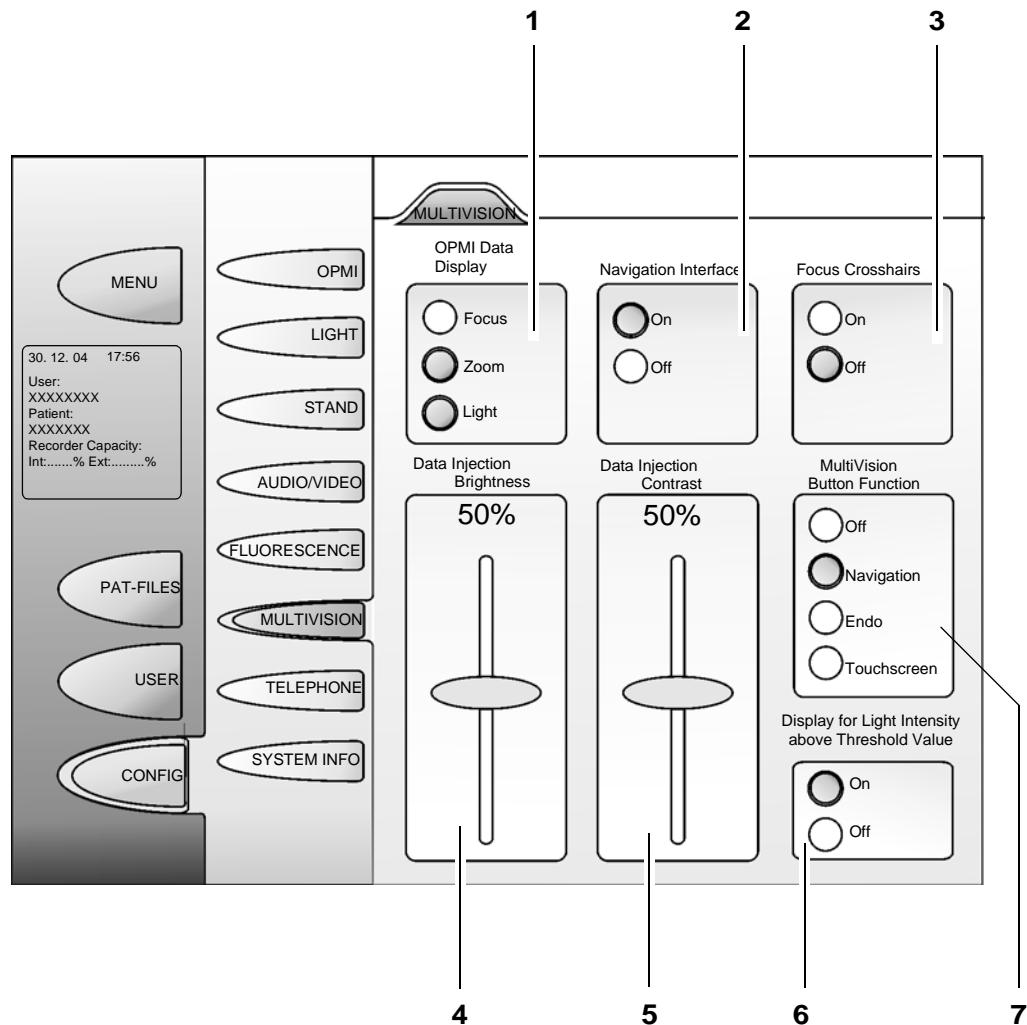
Note:  
Is deactivated when a navigation system has been connected.

### 4 Data injection brightness

Used to set the brightness of data injection, variable from 0% to 100%.  
The settings always apply to the current display.

### 5 Data injection contrast

Used to set the contrast of data injection, variable from 0% to 100%.  
The settings always apply to the current display.



- 6 Display for light intensity above threshold value: light warning**  
For activating and deactivating the warning display of the data injection system (DIS) in the eyepiece.

The illumination intensity is preconfigured (factory settings) in such a way that a warning is displayed on the touchscreen when the threshold value of 25% is exceeded, informing the user of possible tissue damage when the light intensity is too high (see page 23). The percentage of light intensity is displayed in red typeface on the touchscreen.

The light intensity display in the data injection system flashes approx. 5 times when the threshold value has been exceeded. The display is automatically deactivated when the intensity level is back below the threshold (unless "OPMI Data Display" has been activated in the MultiVision menu).

**On:** If the light intensity exceeds the light warning threshold, the respective light intensity value is displayed in the DIS for approx 5 sec.

**Off:** No display in the DIS if the light intensity exceeds the light warning threshold. After activation, the following warning is displayed once: "Warning High light intensity may lead to tissue damage! Please consider using the lowest possible light intensity for your application."

Factory setting: On

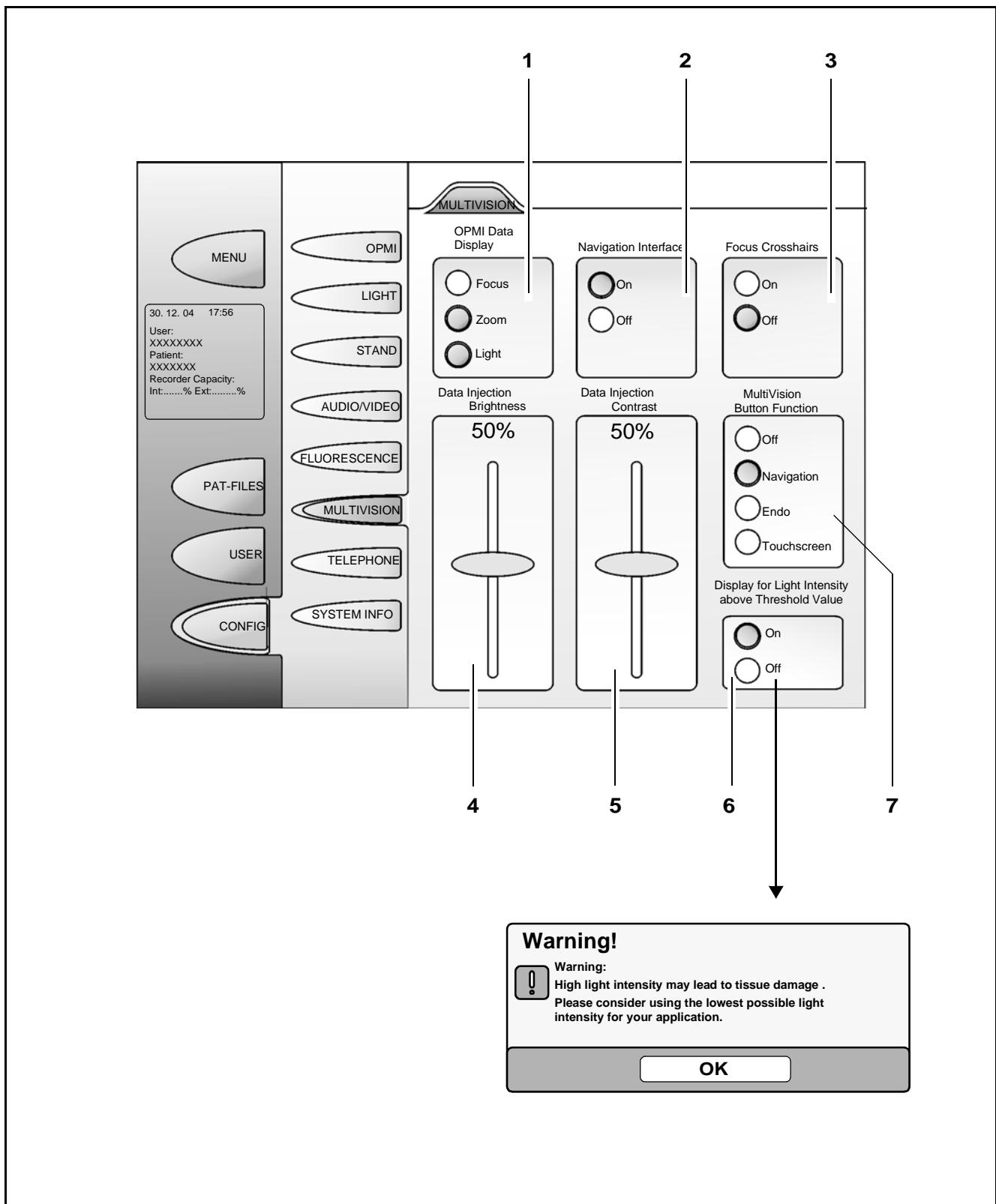
**7 MultiVision button control**

Permits selection of the type of data to be superimposed in the display.

—

- |              |   |
|--------------|---|
| Navigation:  | shutter closes the microscope image - only navigation is displayed,     |
| Endo:        | shutter closes the microscope image - the endoscope image is displayed, |
| Touchscreen: | shutter closes the microscope image - the touchscreen is displayed.     |





## System information - SYSTEM INFO

### INFO

#### 1 Operating hours display

Indicates the operating time since the installation of the system. Due to tests and inspections, operating hours may already appear in the display.

#### 2 Service interval display

Indicates the operating hours after which the next service call has been scheduled.

#### 3 Exporting logfiles to CZ

When you press this button, the logfiles are saved in encrypted form to USB or CD/DVD. You can then send this data to the Zeiss service department.

#### 4 Activating data protection

Yes: The system behaves in accordance with the usual data protection directives. Each user has the system rights assigned by the administrator.

No: The system ignores any data protection measures and allows straightforward operation. All patient data can be viewed and used by all users. Everyone working with the system can create new users.

Factory setting: No

#### 5 Remote Service

See page 220.

#### 6 IT system rights

This function permits you to activate the IT system administrator rights to protect the access to patient files with a password.

Factory setting: OFF

The password protection can be activated and deactivated using a master password.

You receive the master password in a closed envelope.

The system is delivered with deactivated password protection.

Before you activate password protection, every user of the system must define a personal password (at least 3 characters).

For editing saved patient files, you need IT system rights and you have to enter a password. Without IT system rights, only the default rights for viewing patient files and data records are enabled. Data storage (archiving) or deletion is not possible without IT system rights.



**Caution:**

After password protection has been activated, all users who have not yet defined their own passwords are no longer able to access the system.

**Note:**

You can also obtain the valid IT Sysadmin password from your local Carl Zeiss representative.

**7 Deleting patient files**

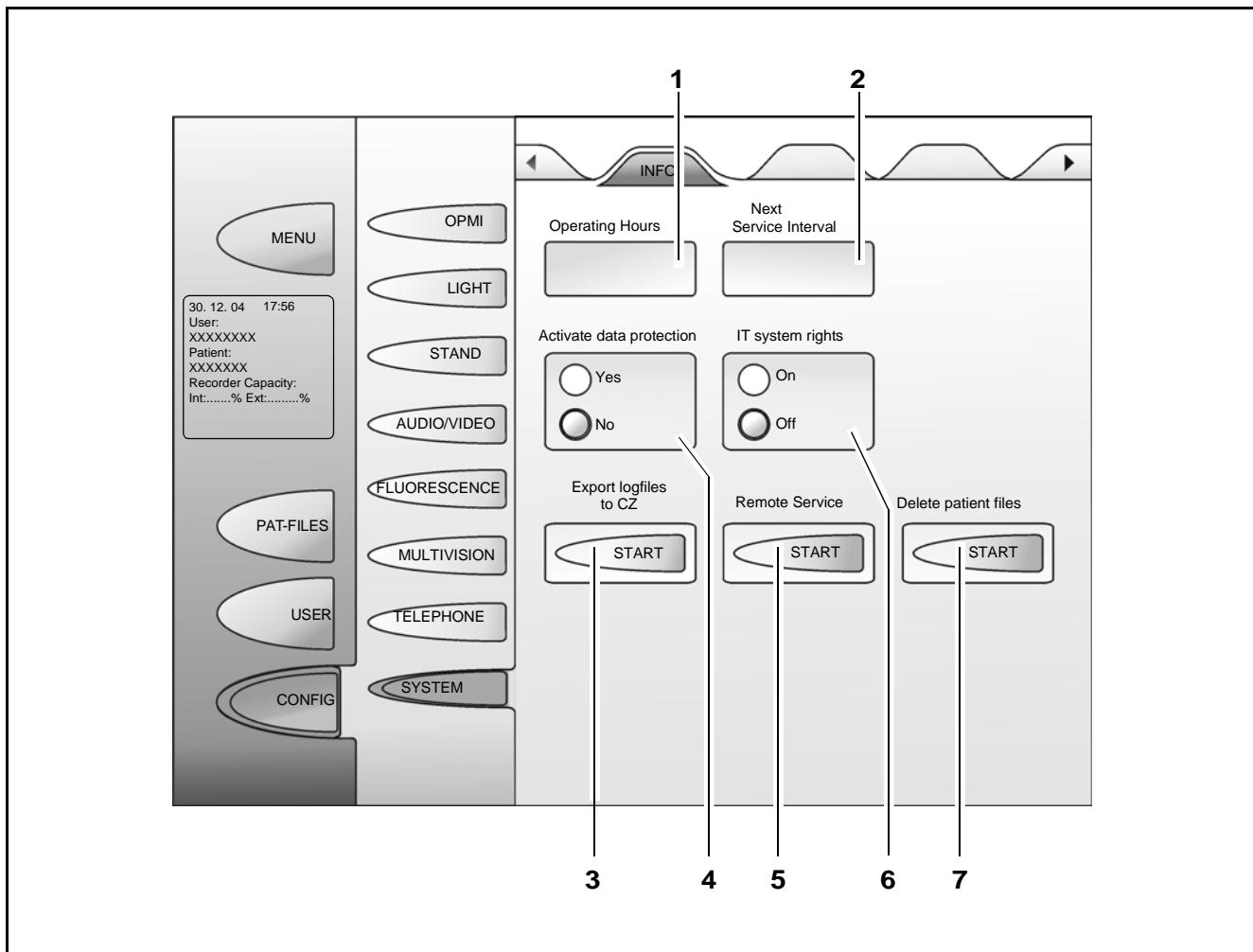
All patient data are completely deleted.

The deleted data can no longer be restored.

The deletion process may take a while (approx. 1 to 2 hours).



- The system cannot be operated during this time.
- Do not power down the system during this time.



## System information - SYSTEM INFO

### VERSION

**1 Version**

Version number of the software

**2 Note**

Additional information on the specified version is displayed here.  
For example: Not for medical use, just for demonstration issues!

### TIME/DATE

The time/date setting function is only accessible via the password for IT system rights (see page 158). After entry of the password, the time/date setting function is enabled.

**3 System-date**

Enter or edit the date in the format: day.month.year.  
The maximum date is the year 2025.

**4 System-Time**

Enter or edit the time in the format: hh-mm

**5 Date format**

Conversion of the date display from European to US format.

**6 Summer time**

On: The system clock is put forward one hour.

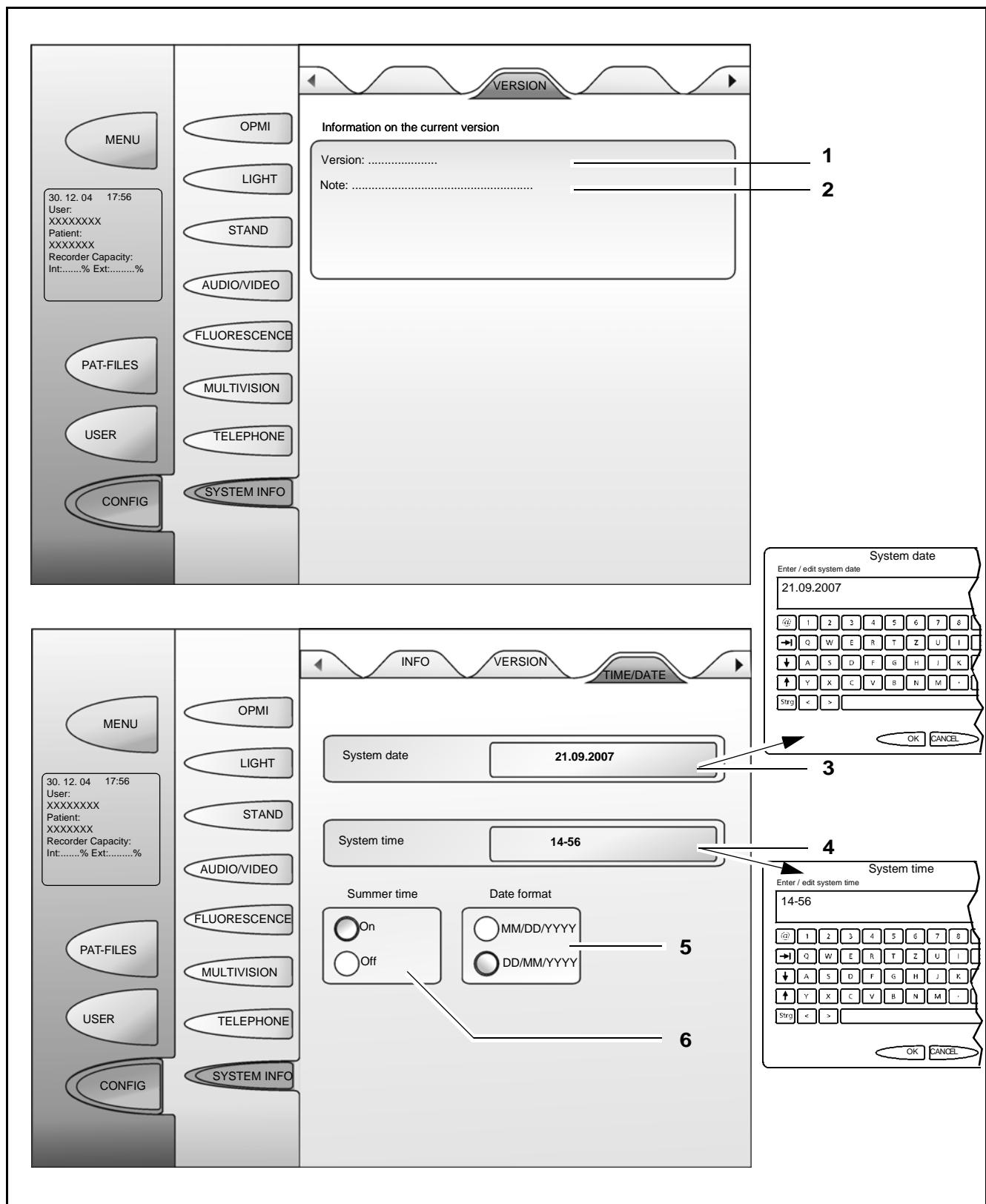
Off: The system clock is put backward one hour.

Factory setting: Off

### Network and DICOM

The NETWORK and DICOM tabs are only active after the DICOM option has been enabled (see page 358 and page 351).







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# Operation

<b>Checklist</b>	<b>164</b>
<hr/>	
<b>Procedure</b>	<b>167</b>
Working with the surgical microscope	167
Comfortable control via the mouth switch (pivoting)	168
Working with the data injection system	170
<hr/>	
<b>Patient Files menu (PAT-FILES)</b>	<b>174</b>
Managing patient data	174
Viewing patient data	186
Viewing patient images	188
Editing images	192
Saving	196
Storing patient data on CD/DVD	198
Storing patient data on a USB stick	202
<hr/>	
<b>What to do in an emergency</b>	<b>208</b>
Illumination failure - changing the xenon lamp	208
Failure of the zoom function	210
Failure of the focusing function	211
Failure of the magnetic brakes	212
Touchscreen failure	212
Failure of the line voltage	212
Error messages in the data injection system	213
Failure of all control functions (Emergency mode)	214
Individual magnetic brakes are blocked (OPMI can not be moved at all or only to a limited extent)	215

## Checklist

Always check the following points before surgery (without the patient!):



### **Caution:**

- Before starting the system, remove the protective cover used for transportation from the objective lens.
- Check the safe position of the handgrips.
- Make sure that there is enough room between the instrument and the accessories installed.
- Turn on the system at its power switch.

### System test

- After power-up of the system, the user interface is initialized. The progress of initialization is indicated by a horizontal bar. During this process, the system performs a self-test. After the self-test, the system is ready for use and switches to the main menu. In the event of an error, the user is informed both visually on the display and acoustically by a beep. The error messages contain meaningful information with proposals for the user how to solve the problem.

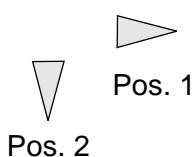
### Eyepieces / binocular tube

- Check that the binocular tube has been securely mounted.
- Check that the securing screw has been firmly tightened.
- Check that the surgical microscope and the tube are in a position convenient for you.
- Check that the correct interpupillary distance has been set.
- Check that the eyecups have been adjusted in such a way that you can see the full field of view.
- Check that the correct prescription has been set on the diopter scale.

### Sliding mirror

Set the adjusting knob for the sliding mirror to Pos. 1 if a second binocular tube has been mounted on the 180° tube port. (When a camera is released, the sliding mirror briefly adopts position 2 automatically.)

Set the adjusting knob for the sliding mirror to Pos. 2 if a coobservation tube or camera adapter has been mounted on one of the lateral ports.



### Note:

The type of coobservation (lateral image exit ports: left/right, or opposite image exit ports: face to face) can be configured at the touchscreen, see page 130.

Video / Photo:

Check that the handgrip buttons for triggering video or photographic documentation are functioning correctly.

Suspension system

- Check that the transport locks are open.

Balance:

- Check before balancing that the handgrips and accessories (observation or documentation equipment) have been correctly mounted, that they can be moved without restriction across the full swivel range and that they cannot collide with any other units.
- Check that the suspension system and the overall system have been balanced.

**Warning!**

For safety reasons, the system must only be used when correctly balanced. Despite the autobalance function, it may happen in exceptional cases that the surgical microscope is not correctly balanced.

With an incorrectly balanced system, brake release may lead to uncontrolled movements of the suspension system. For this reason, the balancing procedure and the subsequent test must not be performed above the patient and only at a safe distance from other persons and instruments.

To check correct balancing of the system, unlock the brakes while holding the microscope tightly at both handgrips. When the system has been correctly balanced, the surgical microscope can be moved almost effortlessly.

Stand base

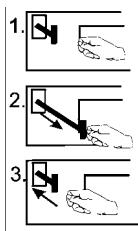
- Check that the locking pedal has been pressed and the stand is stable.

Touchscreen

- Check that the main menu is displayed on the touchscreen.

Drape vacuum system

- Check that the drape vacuum system is operative.

Illumination

- Make sure that the light source always contains two operational lamps when you start surgery. Check both lamps for correct function by operating the lamp changing lever.
- Check that the xenon illumination has been switched on via the touchscreen and the surgical field is evenly illuminated.

**Warning!**

Adjust the illuminated field diameter and illumination intensity to the values required for the procedure! (See page 23).

**Note:**

The illumination intensity is preconfigured (factory settings) in such a way that a warning is displayed on the touchscreen when the threshold value of 25% is exceeded, informing the user of possible tissue damage when the light intensity is too high.

If OK is pressed after this warning, the percentage of the light intensity value is displayed on the touchscreen and the data injection system in red typeface.

**Accessories**

- Check that the accessories are functioning correctly.
- Using the relevant user manuals, check that the other equipment (illumination system, video system, etc.) is working properly.
- Check that the micromanipulator is functioning correctly (see page 38).

**Warning!**

If a function fails, you must not use this instrument for safety reasons. Correct the fault (see the "Troubleshooting table") or contact our service dept.

## Procedure

### Working with the surgical microscope

- All preparations for surgery have been completed.
- Switch on the system.
- The system has been checked using the checklist.
- Set the brightness level of the surgical field illumination as required.
- Press the release button for the magnetic brakes and move the suspension system and the microscope over the surgical field.
- Bring the suspension system and the surgical microscope into an ergonomic position within the working distance.
- Press the AF button.
- Select the magnification required (zoom). Look through the eyepieces of the binocular tube. Adjust the eyepieces in such a way that you can see both the edge of the field of view and the microscope image sharply.
- Switch off the units when you are not using them.

## Comfortable control via the mouth switch (pivoting)

### Requirements

- The foot control panel has been connected.
- The mouth switch has been mounted and connected, see page 94.
- The complete system has been correctly balanced, see page 110.



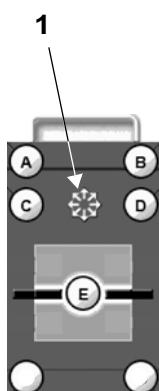
### Warning!

- To check correct balancing of the system, unlock the brakes while holding the microscope tightly at both handgrips.  
When the system has been correctly balanced, the surgical microscope can be moved almost effortlessly.
- Position the microscope above the required object point in the surgical field.
- Select the working distance and magnification required.
- Unlock the magnetic brakes by pressing the mouth switch.



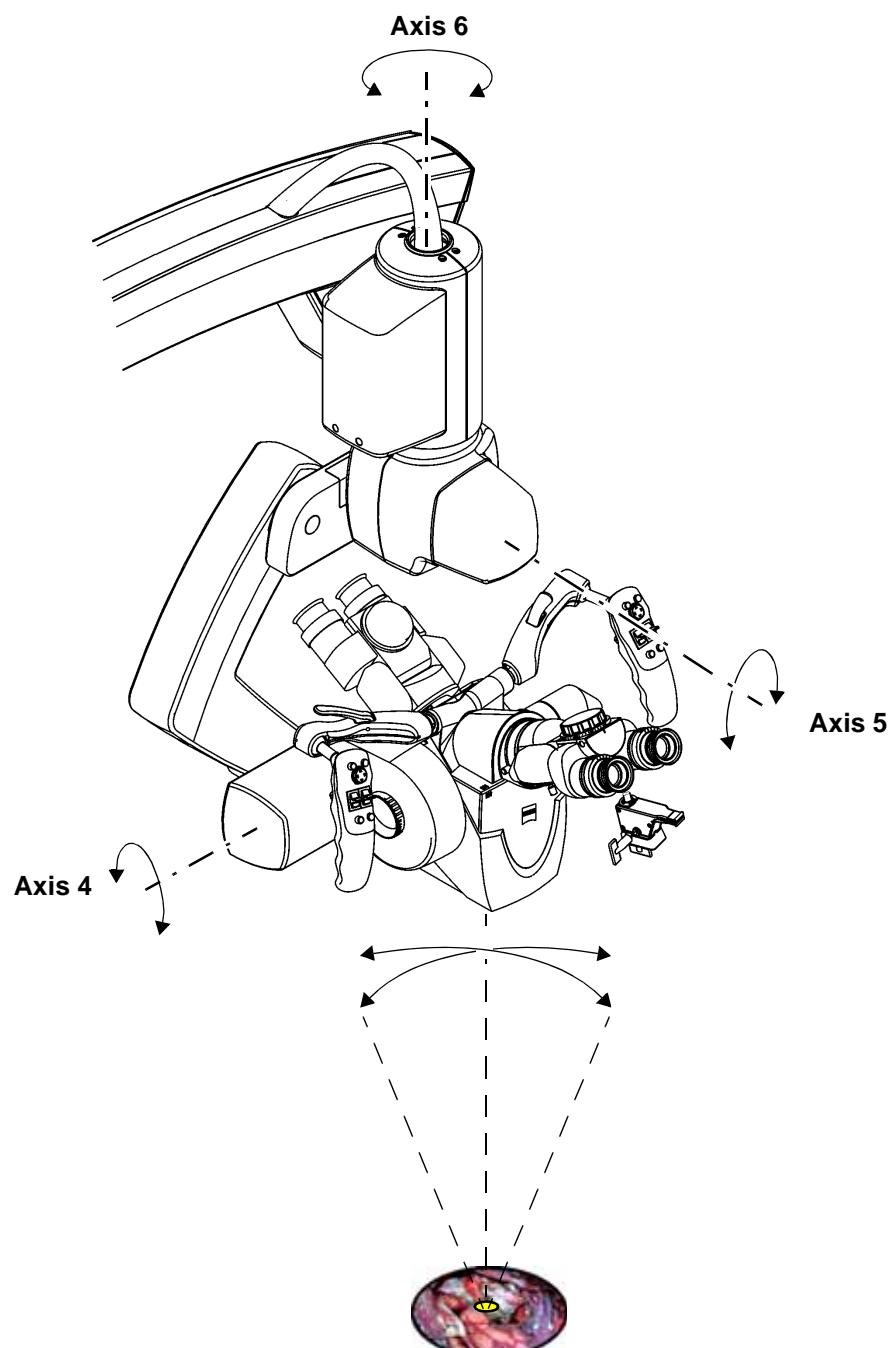
### Note:

Mouth switch fine balancing can be adjusted to the user's specific requirements, see page 112.



- Joystick (1) on the foot control panel permits you to move the microscope in the X and Y directions on a circular arc at the working distance above the object point.
- In this process, you use the mouth switch to keep the microscope focused on the object point in the surgical field.

Comfortable control via the mouth switch works irrespectively of the selected front-to-back or lateral tilt of the microscope's optical axis in the entire adjustment range of axes 4, 5 and 6.



## Working with the data injection system

### Video image injection

- Check the system setup using the checklist.
- Switch on all units of the system.
- Make sure that an external video signal is present (see page 78).
- Trigger image switchover by pressing the programmed 'MultiVision' button of the handgrip or the foot control unit:  
The microscope image is eclipsed, and the external video image becomes visible instead. If no external video signal is present, the message "No Video Signal" is briefly displayed.
- Deactivate the video image display again by briefly (< 2 s) pressing the programmed 'Display' button of the handgrip or the foot control unit:  
The video image disappears. The microscope image is visible again in both eyepieces. Text information on the current mode is superimposed for 15 seconds on the current image.



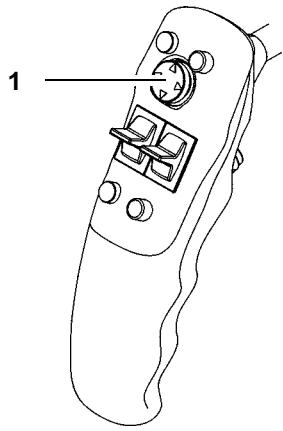


### Displaying the touchscreen

The OPMI Pentero has been switched on and the main menu is displayed.

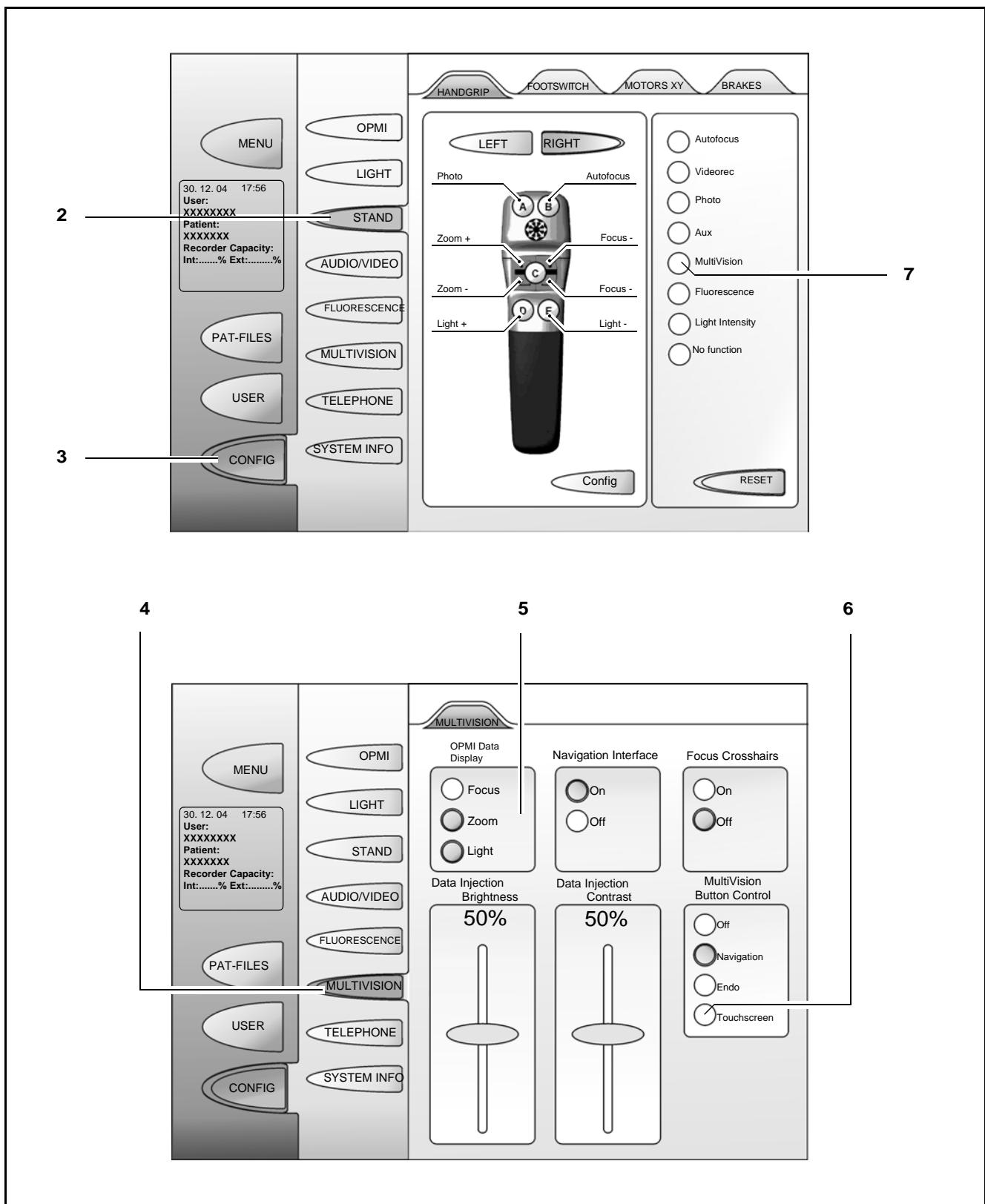
- Press CONFIG button (3), then STAND button (2).
- Select one of the programmable buttons on the handgrip or foot switch and assign the MultiVision function (7) to it.
- Select MultiVision button (4) in the CONFIG menu, see also page 154.
- Press touchscreen button (6) in the MultiVision field.
- Use data display field (5) to select the information (zoom, focus, light) you want to have displayed in the microscope.

To display the touchscreen, press the programmed MultiVision button on the handgrip or foot control unit. The microscope image is eclipsed and the touchscreen image is displayed.



A mouse cursor appears on the touchscreen and in the microscope image; you can navigate with this cursor using joystick (1) of the right handgrip.

- To activate a function, place the mouse cursor on the relevant button and press the joystick center.
  - To adjust a slider, place the mouse cursor on the slider grip and shift it upward or downward by pressing the joystick.
- Alternatively, place the mouse cursor on the required position of the slider grip and press the joystick center to shift the slider to this position.



## Patient Files menu (PAT-FILES)

### Managing patient data

The PAT-FILES menu permits you to store patient data (images, videos, etc.). You can use the dialog windows for filing, copying, renaming or shifting files. The data to be stored is saved in a special directory on the hard drive. If the computer has been connected to a network, patient data can be transmitted to or received from further network drives. You can also send data by email to selected addresses or copy data to connected network drives.



**Note:**

For safety reasons, data import from and data export to network drives (e.g. DICOM) are not possible during surgery (main menu).

- Change from the main menu to PAT-FILES menu (1).
- If password protection has been enabled, enter your user password (2).

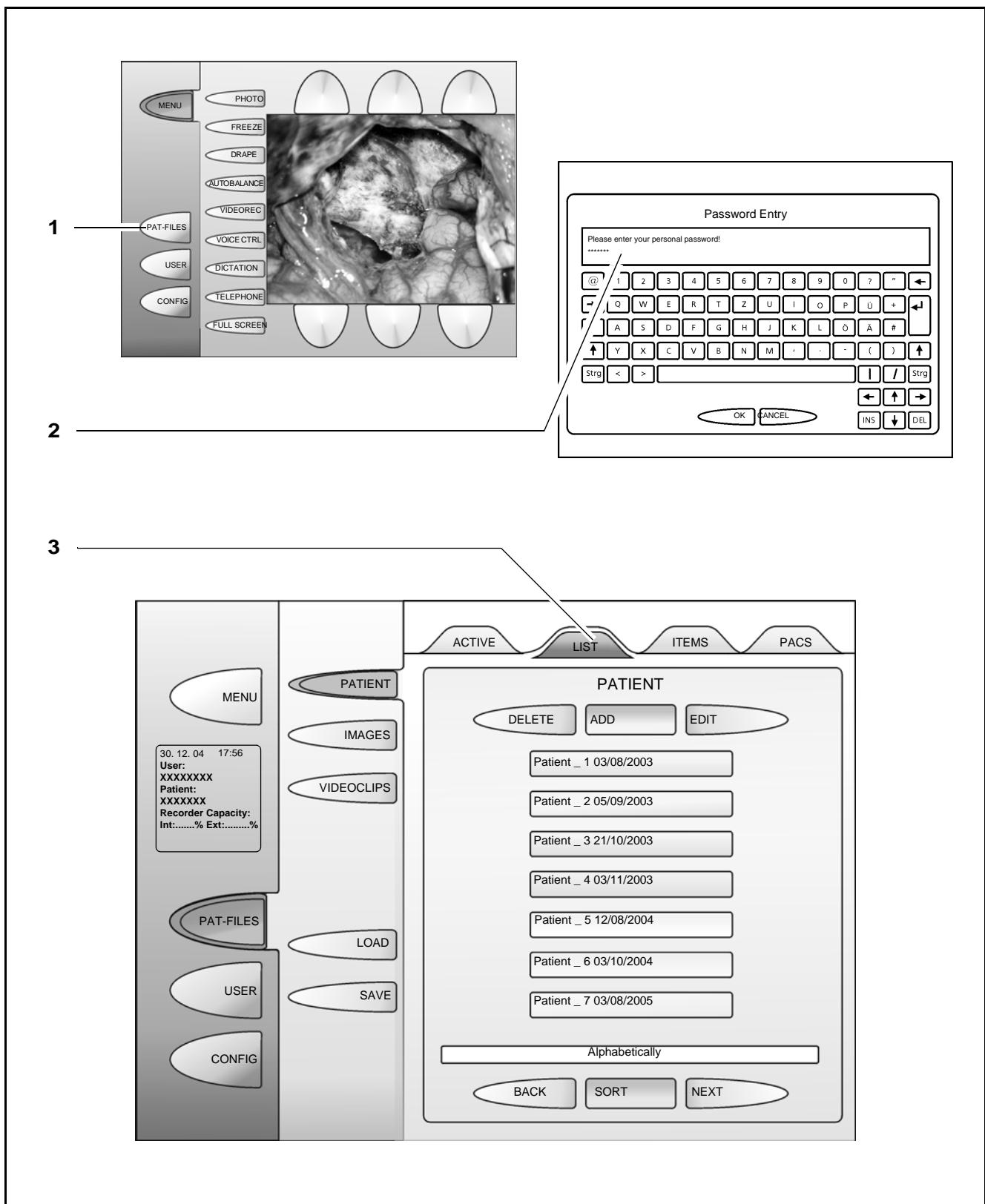
#### 3 List of patient files

All patient files are listed here according to the selected sorting and filter criteria. The patient name last selected is always highlighted, irrespective of its position in the list.

**Note:**

- Press these buttons for browsing.  
These buttons are only active in selection menus if several pages exist.





### Patient list

#### 1 DELETE

The selected patient data record is deleted.

#### 2 ADD

A new patient name with a consecutive number is created. The program changes automatically to the Active mode.

#### 3 EDIT

The selected patient data record can be edited. The program changes automatically to the Active mode. Details of the patient data record are displayed and can be edited.

#### 4 SORT

You can select the sorting and filter criteria for the patient list. Press the SORT button to view the details.

See next page.

#### BACK, NEXT

For browsing in the patient list.



### Active patient

#### 5 Editing the patient data record.

The selected patient data record can be edited here.

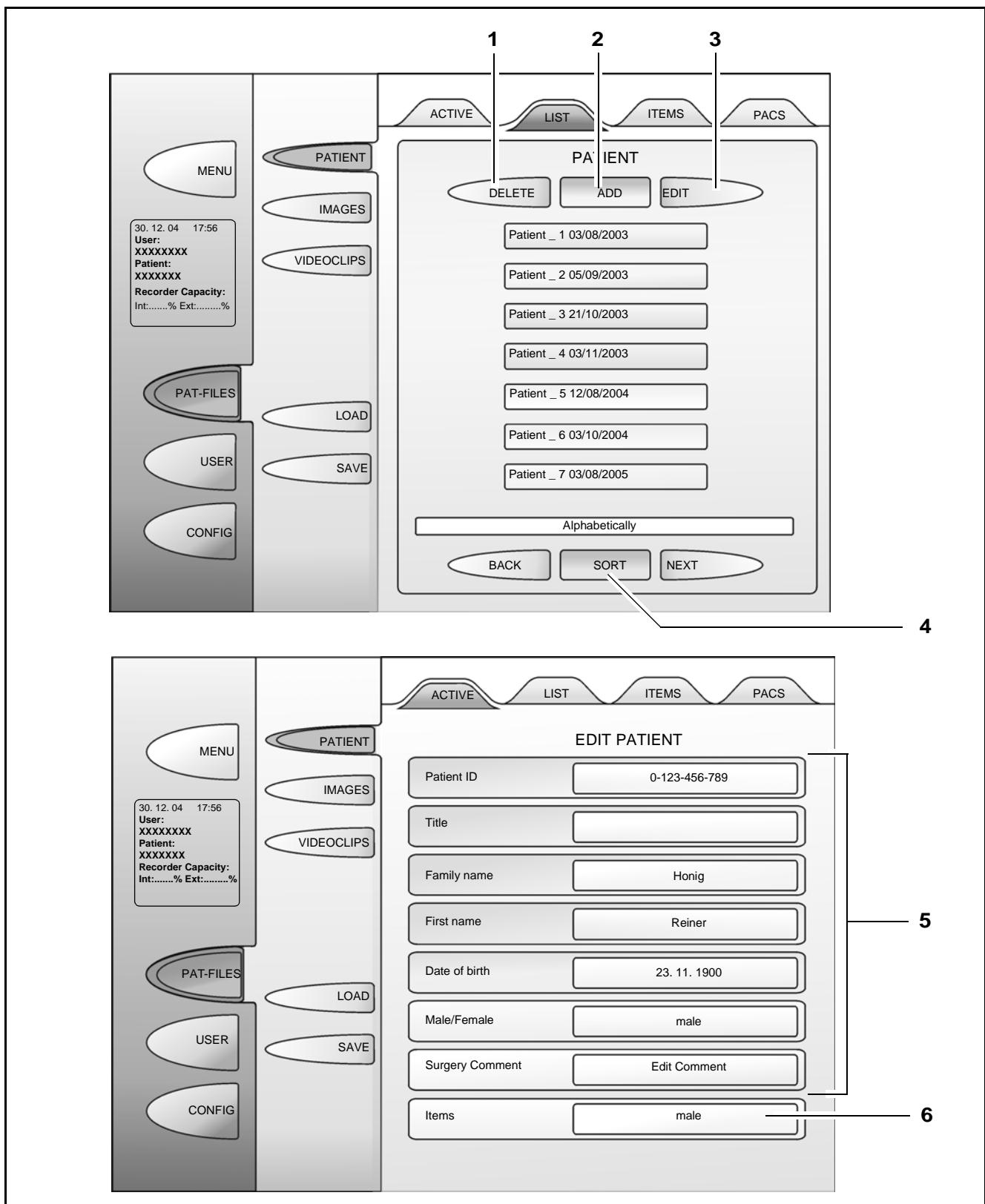
#### 6 Items

This button opens the dialog for viewing, adding or deleting items to be used as filter criteria in patient searches. The items are visualized as text in the button.



#### Note:

If more items have been selected than can be displayed on the button, this is indicated to the user by ... .



## Sorting the patient list

When you press the "SORT" button of the LIST tab, the sorting menu is opened. It permits you to select surgeons' names and/or items as filter criteria and search criteria for the patient list.

### 4 SORT

Select the sorting and filter criteria for the patient list here.

### 7 Filter criteria display

The current settings of the sorting and filter criteria are displayed above the "SORT" button. Only one line is displayed. If the output is longer, it is cut off automatically and the remainder is symbolized by an asterisk ("\*").

### 8 Filter criteria

Example:

Sort: alphabetically, filter: surgeon = Prof. Dr. Harry Hirsch or

Sort: chronologically, filter: glioblastoma

If "data size" has been selected as sorting criterion, the data volume required (in MB) is displayed on the right of the patient name.

### 9 Close

When you press the Close button, the patient list is rearranged in accordance with the selected criteria.

If no items have been defined, the "Select an item" button is disabled and displayed in gray color.

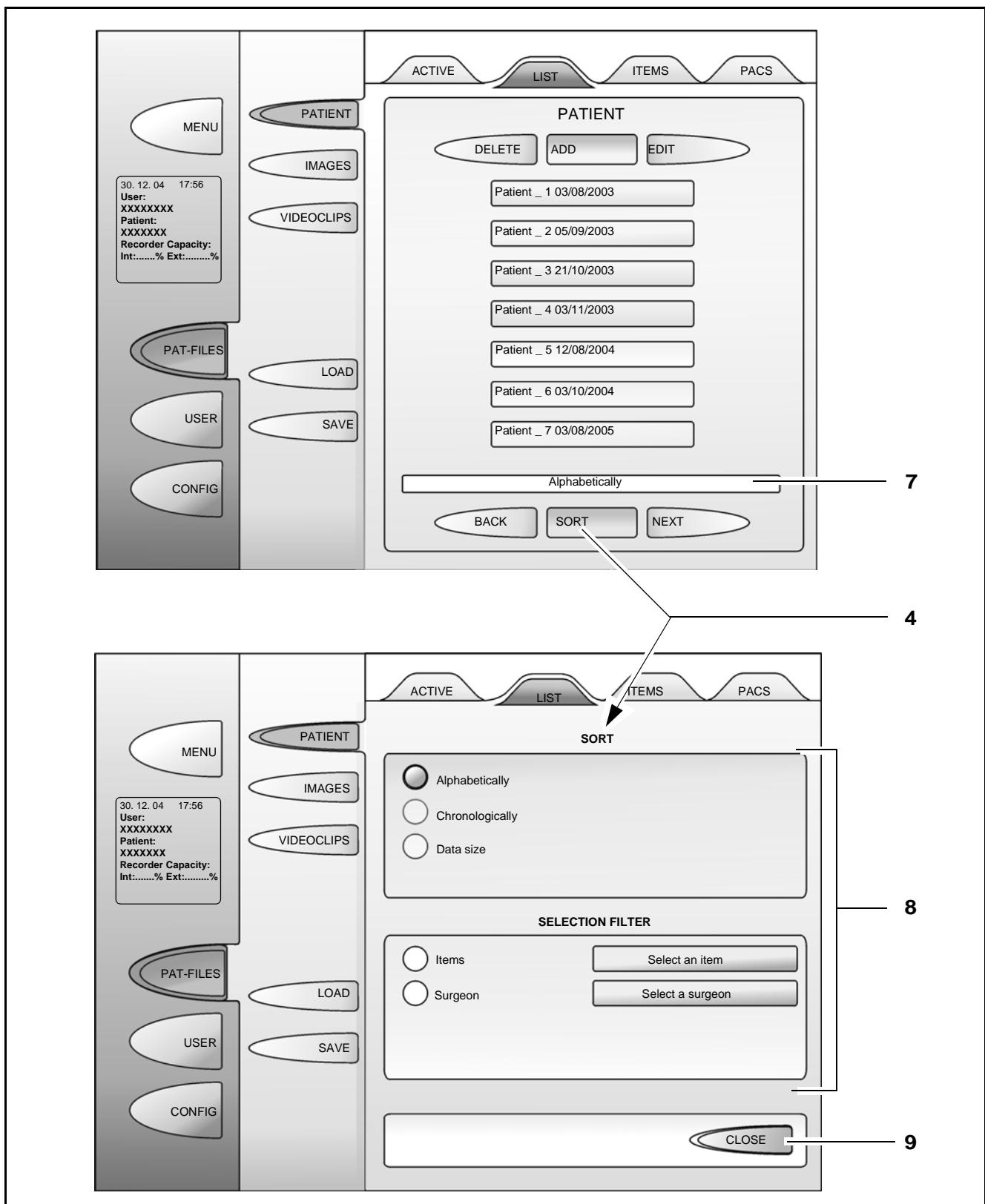
Factory setting for the creation of a new user:

- Alphabetical sorting selected
- No selection filter selected.



### Note:

The filter criteria are linked by AND functions. As a result, it may happen that no search results are displayed if several criteria have been selected



### Patient menu search items

#### 10 Selected items menu

When you press the "Select an item" button, menu (1) is opened. It permits you to select one or several previously defined items and to add them to the filter criteria for the patient search.

#### 11 "Selected items" text box

Selected items (buttons) are highlighted in blue color to indicate that they are enabled, and are also displayed in text form in the "Selected items" text box. Deselection of a button automatically removes the item from the text box.

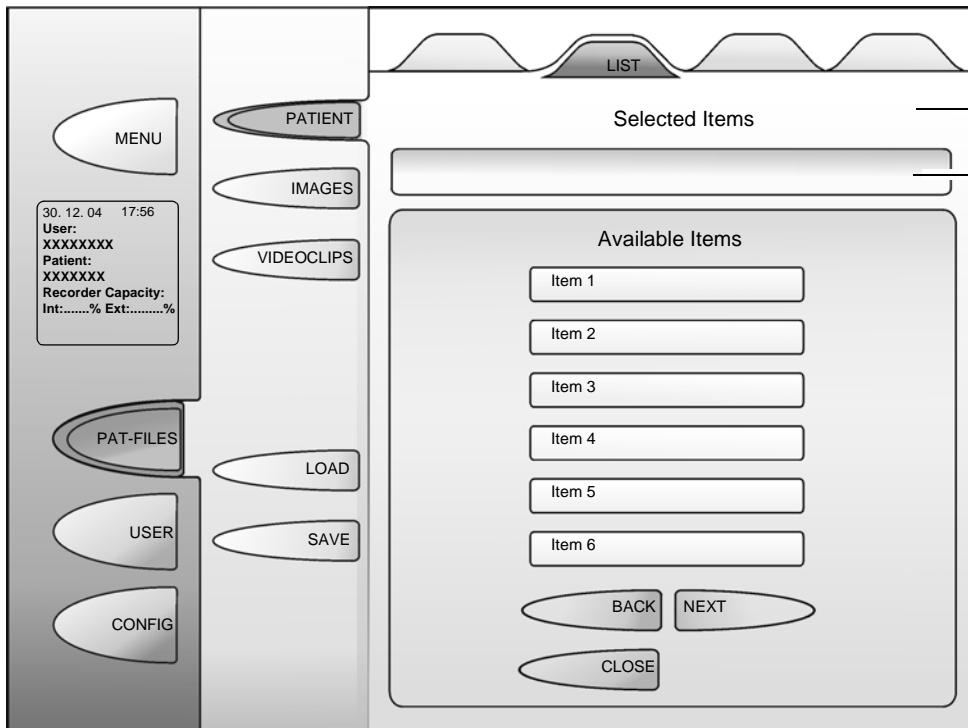
A maximum of two lines are displayed in the text box. Any additional items included in the text box are indicated by ....

This dialog box only displays items previously defined in the ITEMS tab (see Pos. 12).

#### 12 ITEMS tab

This tab permits you to delete old items, add new items or edit existing items. The entries of this list are available in the SORT dialog "Items" for selection.





Selected Items

10

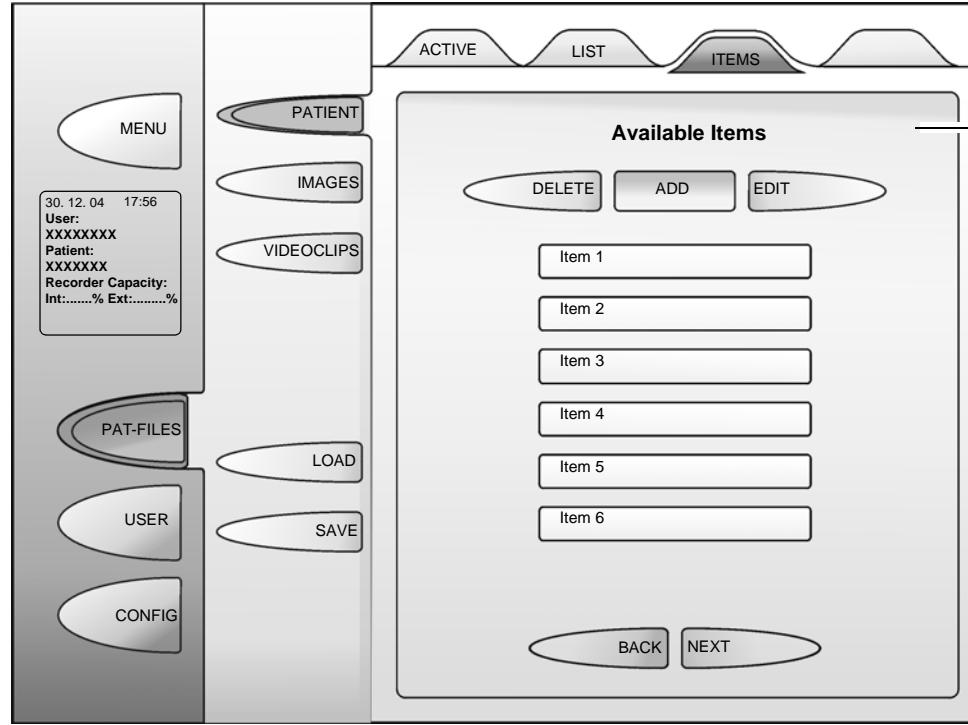
11

## Available Items

- Item 1
- Item 2
- Item 3
- Item 4
- Item 5
- Item 6

BACK    NEXT

CLOSE



Available Items

12

- DELETE    ADD    EDIT
- Item 1
- Item 2
- Item 3
- Item 4
- Item 5
- Item 6

BACK    NEXT

## Patient Groups

This menu provides an overview of patients and a fast, easy way of deleting or storing several patient files in one go.



### Note:

- The Groups tab displays all patients contained in the local database (in accordance with the selected user rights).
- You can select several patient files at a time.

### Deleting several patients

The data records highlighted in blue color (4) can be deleted.

You will be asked to confirm the deletion before the deletion process is started.

The currently active patient cannot be deleted. If selected for deletion, he must be excluded from the deletion process.

An hourglass is displayed while deletion is in progress.



Please note that deleted data can no longer be restored.

### SORT

You can select the sorting and filter criteria (4) for the patient list here. See page 178.

ACTIVE	LIST	ITEMS	PACS	GROUPS
Patient _ 1 03/08/2003	Patient _ 10 03/08/2005	Patient _ 20 03/04/2005		
Patient _ 2 05/09/2003	Patient _ 11 05/09/2004	Patient _ 21 05/01/2004		
Patient _ 3 21/10/2003	Patient _ 13 21/10/2004			
Patient _ 4 03/11/2003	Patient _ 14 03/11/2003			
Patient _ 5 12/08/2004	Patient _ 15 12/08/2004			
Patient _ 6 03/10/2004	Patient _ 16 09/10/2004			
Patient _ 7 03/08/2005	Patient _ 17 03/08/2002			
Patient _ 8 03/10/2004	Patient _ 18 03/6/2001			
Patient _ 9 03/08/2005	Patient _ 19 03/07/2005			

Sort: Alphabetically

Mark      Delete      BACK      SORT      NEXT

4            1            2            3

### Storing several patients

Proceed as follows to save the patient files of several local patients to CD/DVD or to a USB stick:

Press "Mark" button (1) to confirm your selection of patients/patient files (2) (highlighted in blue color).

- Open "LIST" tab (3).
- Press "SAVE" button (4).
- Select the "CD/DVD" or "USB Stick" tab (5) in the SAVE menu.



#### Note:

The display shows the number of images or video clips selected for export.

- Check whether a new, blank data carrier is contained in the CD/DVD drive or whether a USB stick has been inserted (6).

### Export in the DICOM format (7)

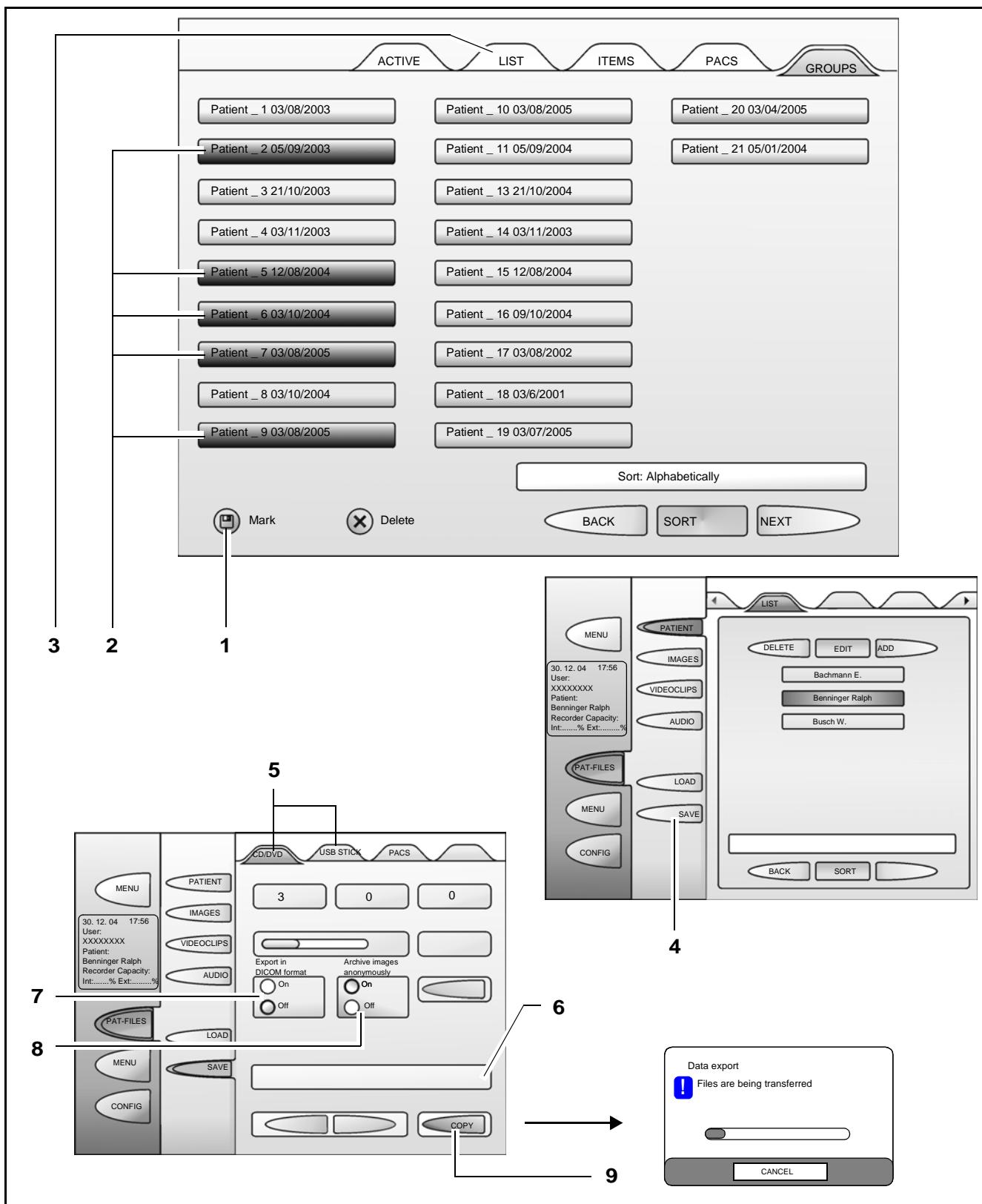
On: Selected images are saved in a DICOM structure on the CD/DVD medium.

Off: Image data is saved in the native format (TIFF, BMP, JPG) in the predefined patient data structure.

### Save images anonymously (8)

Enables anonymous saving of the selected images.

- On: All image information in the EXIF format without surgeon's and patient's names.
  - Off: All image information in the EXIF format with surgeon's and patient's names.
- 
- Press "COPY" (9) to export the images.  
The data export process is indicated by a progress bar.



## Viewing patient data

### Overview

Patient images or patient videos	– Loading – Saving – Viewing	page 204 page 196 f. page 244 f.
Patient images	– Editing	page 192
Patient videos	– Editing  Only possible with the option: Digital video recording  <u>Note:</u> The Editor is only active if the video recording license has been activated.	page 244 f.

#### 1 Images

The integrated viewer permits you to view patient images. The viewer is only available in the patient mode.

#### 2 Video clips

The integrated player permits you to view patient video clips. The player is only available in the patient mode. If an audio signal has been recorded or is available, this signal is automatically output when the video clip is played back with the player. The sound volume is adjustable in the player during playback.



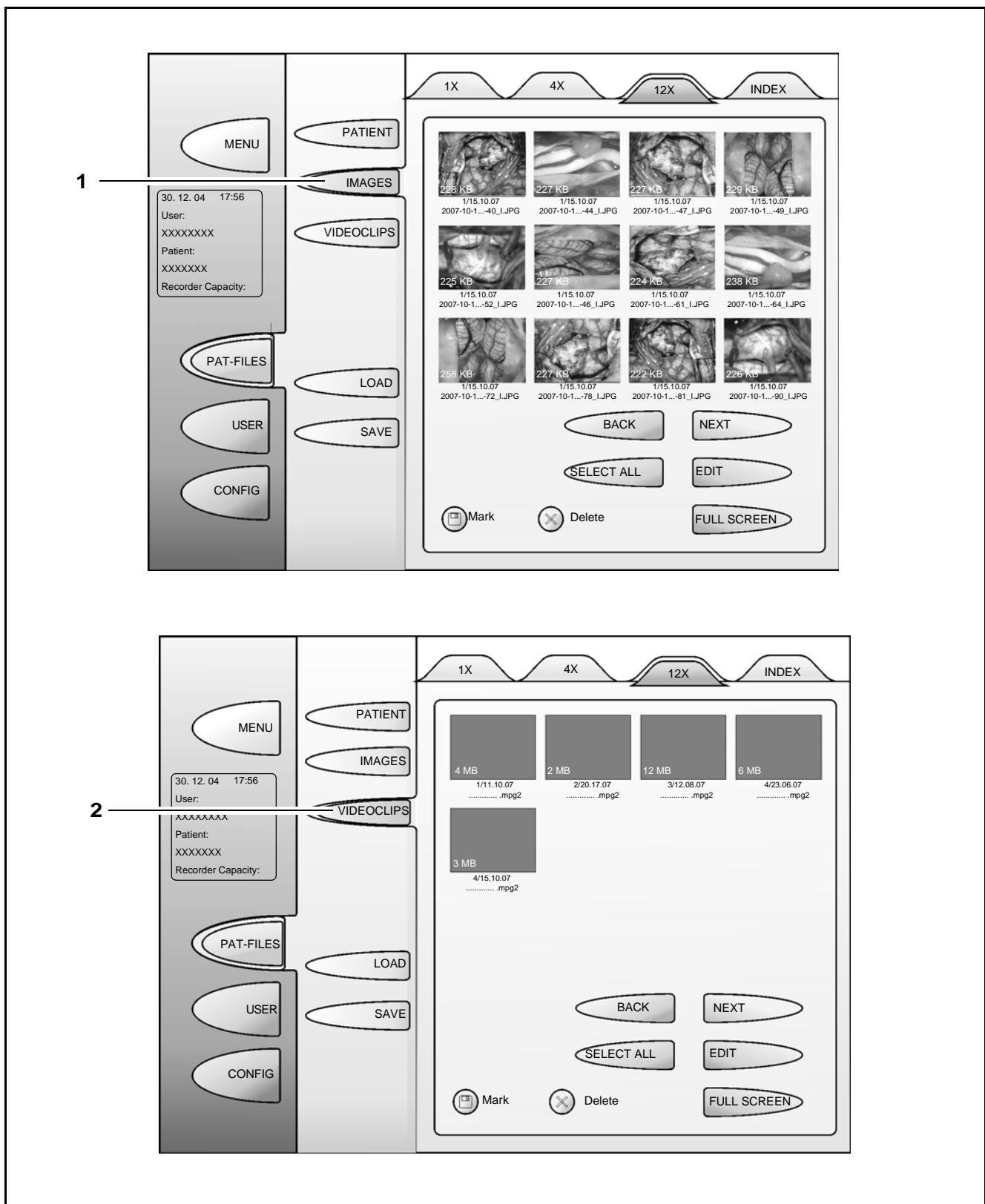
#### Note:

The loudspeaker in OPMI Pentero has not been designed for optimum audio rendition.



#### Note:

The file size is indicated at the bottom left in the preview of videos and images.



## Viewing patient images

- Select the patient required.
- Press the active IMAGES button (2).  
If this button is not active, the local database does not contain any images for the patient concerned. To load images from the network, from a CD/DVD or from a USB stick to the current patient directory, press LOAD button (7).

### Image preview

- Single image (3) in a large window.
- Preview with 4 thumbnails (4).
- Preview with 12 thumbnails (5).
- Full screen image (9) on the touchscreen.



### Note:

- Use the browse function ("Back" and "Next") (11) if more than 1 image or more than 4 or 12 thumbnails are available.
- In the full screen view, two buttons ("Back" and "Next") are displayed, permitting you to browse through several images. Press "Close" to return to the main menu.

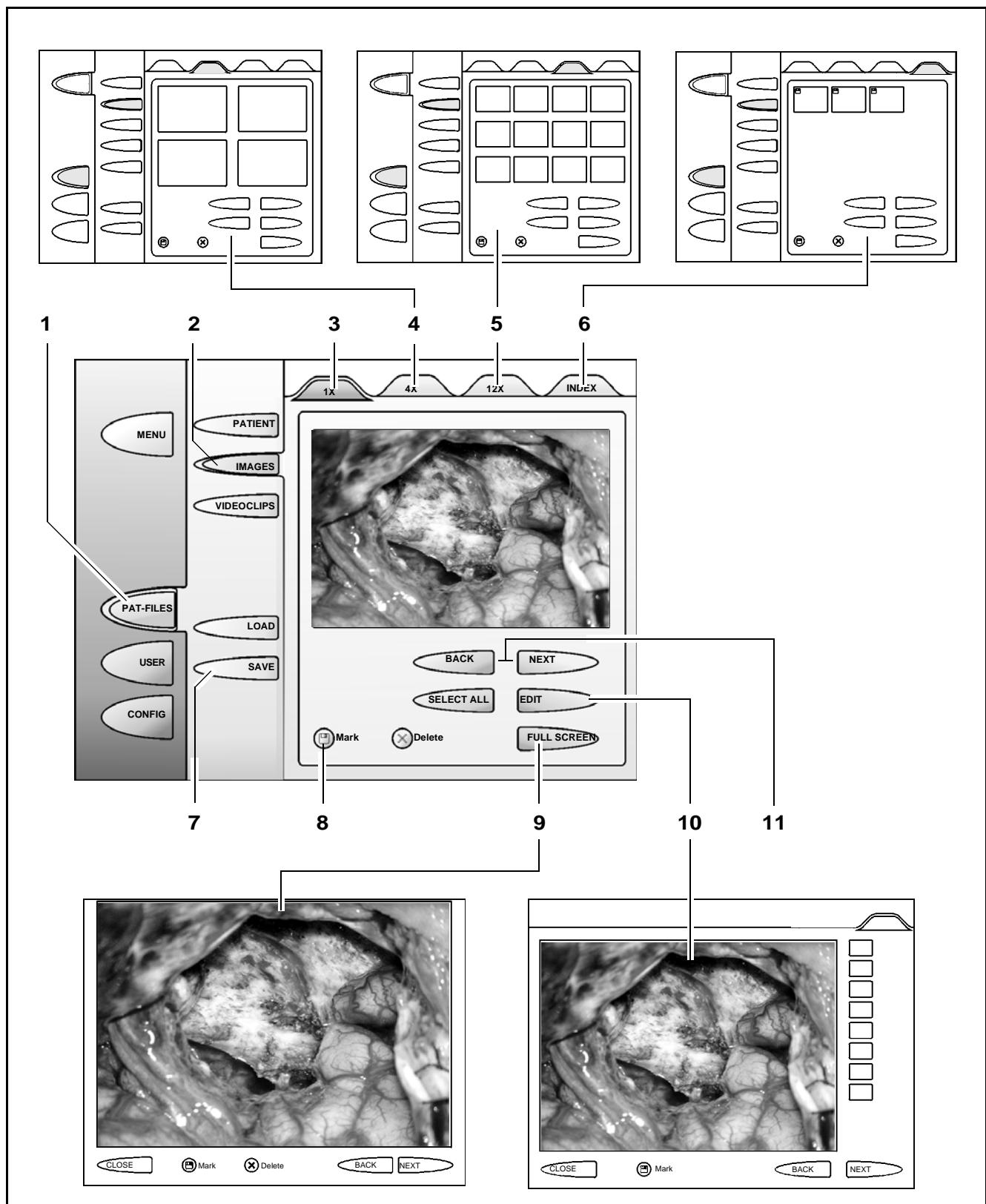
### Index (6)

- Select index view (6) if you wish to see an overview of the images you have selected in a thumbnail display using the Mark button (8).

### Editing images (10)

You can edit recorded images, if necessary, e.g. by adding text and markings.

- Select the image to be edited and press EDIT button (10). Details of this function are described on the next pages.



**12 Loading images (import)**

To load images from the network, from a CD/DVD or a USB stick, press LOAD button (1).

**13 Storing images (export)**

To save images to a network or to a CD/DVD or USB stick, press SAVE button (2).

**Note:**

Please note that any patient files stored on or loaded from USB or CD/DVD will automatically be assigned the current date and the currently selected patient name.

Selecting images from a thumbnail preview:

- Press the image required - the selected image will be displayed with a blue frame.

**14 Selecting images (for storing)**

To select the image, press MARK button (14). The selection symbol is displayed in the image.

You can undo the selection by pressing the selected image and the Mark button once again. The selection symbol disappears.

**15 Deleting images**

To delete the image, press the Delete button.

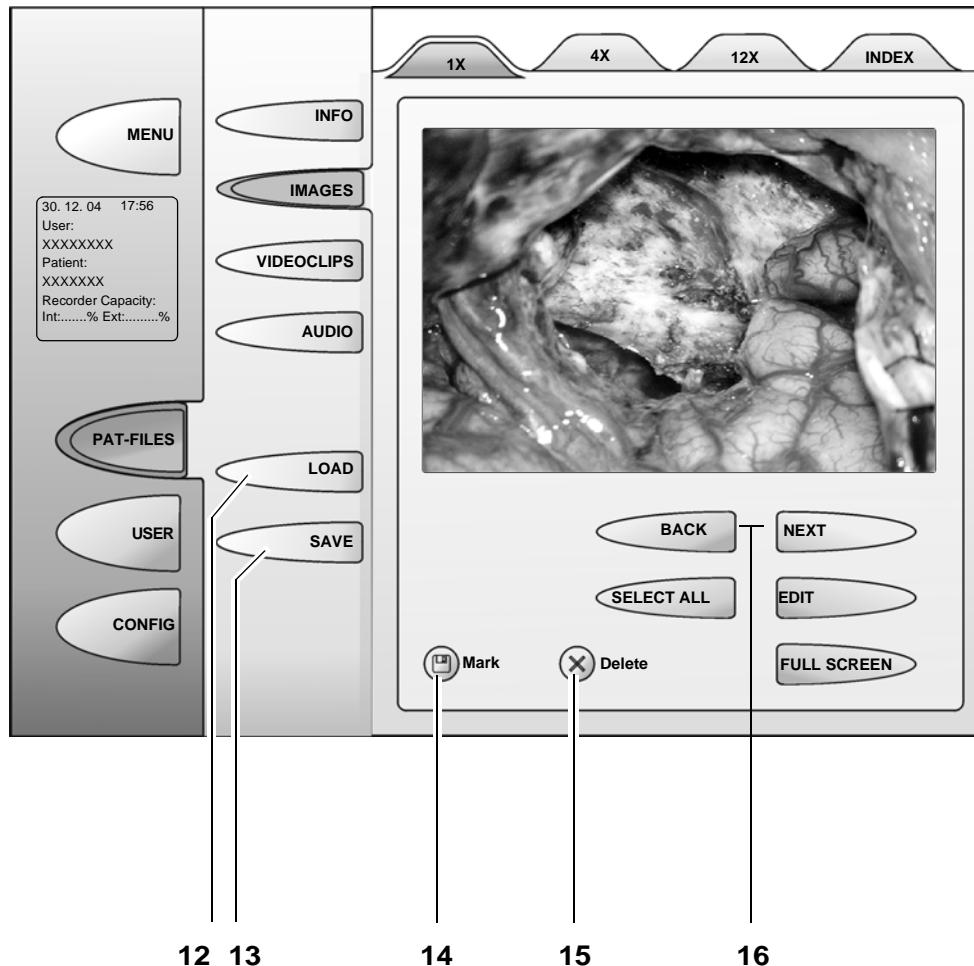
Before the image is deleted, a dialog is displayed, requesting you to confirm the deletion.

**16 Browsing**

Press these buttons for browsing. The next or previous image will be displayed. These buttons are only active if more than 1 image or more than 4 or 12 thumbnails are available.



In the full screen view, two buttons ("Back" and "Next") are displayed, permitting you to browse through several images.



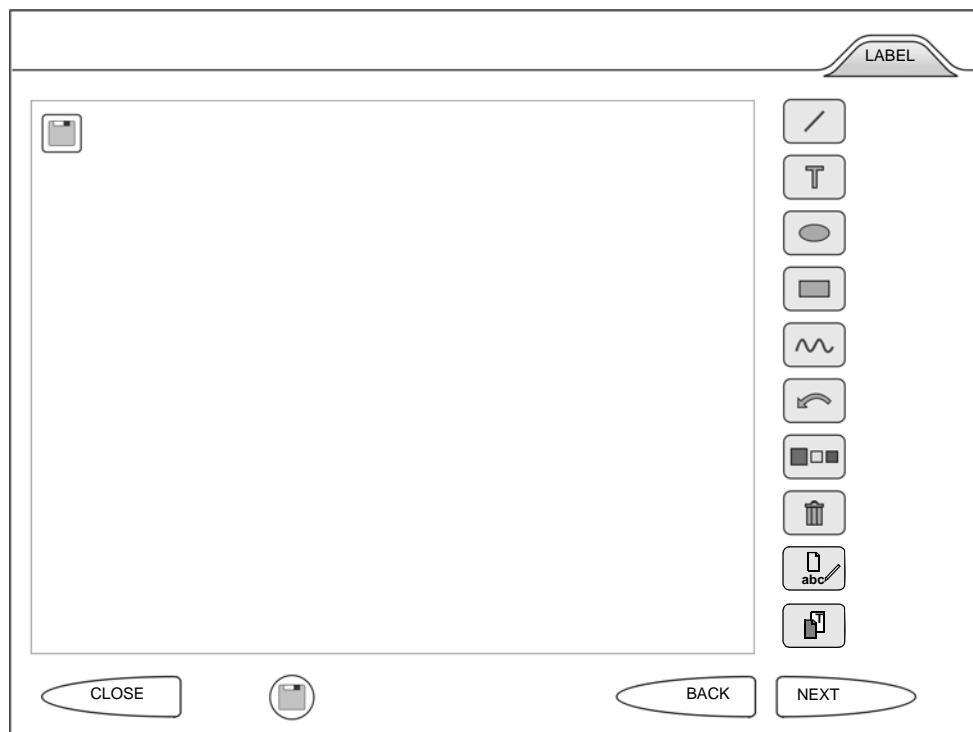
## Editing images

If you press the "Edit" button under the menu item "Images", the editor for editing images is opened.

- Proceed as follows to enter markings in the image:
  - When using a touchscreen, put your finger in the relevant position on the screen, and move your finger to a new position while keeping it on the screen.
  - When using the touchpad or a mouse, set the cursor to the relevant position in the image, hold down the left mouse button or the touchpad button while moving the cursor to the new position.

For the description of the individual functions, no distinction between these two methods is made in this user manual. The procedure is generally referred to as "clicking in the image".

You can enter as many markings in the image as required. The following functions are available for this purpose:



**Inserting a line**

After pressing the button, you can insert a line in the image. Click in the image at the desired starting point of the line and draw the line to the desired end point.

**Inserting a text field**

After pressing the button, you can insert a text field in the image. First enter your text via the virtual keypad, then click in the image at the position where the text field is to be inserted.

**Inserting an ellipse**

After pressing the button, you can insert an ellipse in the image. Click in the image at the relevant position and drag the ellipse open until it has the desired shape and size.

**Inserting a rectangle**

After pressing the button, you can insert a rectangle in the image. Click in the image at the relevant position and drag the rectangle open until it has the desired shape and size.

**Inserting a free-hand line**

After pressing the button, you can insert a free-hand line in the image. Click in the image at the desired starting point of the free-hand line and draw the line to the desired end point. Changes in direction and intersections are permissible.

**Undo**

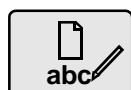
Press this button to delete the last marking you entered.

**Colors**

Press this button to change the color in which the lines, ellipses, rectangles or polygons to be entered should be displayed.

**Trash**

Press this button to delete all markings entered in the image.



### **Renaming files**

This function permits you to assign specific names to the images to meet your requirements.



### **Adding / editing an image comment**

This function is used to open the "Image Information" dialog for an image (EXIF\* data) which allows you to add comments or edit existing comments.

\*EXIF stands for "Exchangeable Image File" and describes a manufacturer- and system-independent standard file format for the exchange of image files. The file consists of the actual image information and the metadata file affix. The digital camera uses this affix to store setting data for the exposure, including the camera type, date and time, lens type, focal length, aperture, ISO value, etc.

### **Close**

Press the button to close the editor for editing images and to return to the Patient Files menu. The markings you have entered are deleted, unless you have previously saved the edited image.

### **Saving**

Press the button to save the edited image. The copy with the entered markings is saved. The original is retained.

### **Back**

Press the button to switch to the previous image. If you switch to the previous image without saving, the entered markings will be lost.

### **Next**

Press the button to switch to the next image. If you switch to the next image without saving, the entered markings will be lost.



## Saving



### Note:

The system is not intended for permanent data archiving. You can use CDs/DVDs, a USB stick, an external hard drive or a hospital server (DICOM option, see page 351) for data backup. All users are responsible for archiving their own data.

If sufficient storage space is no longer available, the system informs you that files no longer required should be archived or deleted.

Data can be deleted by every subsequent user!

### Backing up patient data on CD/DVD

All data available in the system can be archived on CD/DVD. The data is filed in a UDF format (Version 2) in the same structure as used in the system.

Despite careful selection of the multiformat burner, reliable writing to and reading from all commercial media cannot be guaranteed.



### Note:

- For data recording and archiving, please use only new, high-grade, undamaged and practice-proven media (without scratches!).
- Although the system features an integrated multiformat burner, we recommend the use of DVD+R or DVD-R media (faster loading and finalization cycles and better playback compatibility of the burnt media, compared with DVD+/-RW media). Double-layer DVDs are currently not yet supported.
- The use of commercial 16x DVD-R blanks may lead to problems. The integrated burner with the existing firmware status has only been specified for 8x blanks and is therefore unable to write to all types of 16x DVD-R disks. This is indicated by a write error message at the beginning of video recording or by a transmission error message at the beginning of data export.  
Therefore use only the ZEISS 16x DVD-R disks available under cat. no. 308203-8080-000.
- The use of CD-RW media is not recommended.
- We recommend using a new medium for every procedure, as the multiple use of a medium to completely fill it will lead to significantly longer access, read and burn times (multisession).

- We recommend not to play back the recorded video clip while recording is in progress, as no data can be written to the medium during playback. After the end of this time shift function, recording is continued which, in exceptional cases, may lead to extremely long finalization times or to problems during finalization or reading of the media.
- We recommend to archive the data only after surgery has been completed.



#### Note on MediLive Video Tools:

The MediLive Video Tools software provides improved compatibility between your PC (Windows™ or MacOS™) and the video DVDs created with OPMI® Pentero®.

Please install MediLive Video Tools on your PC if you notice the following problems:

- The computer cannot read the DVD content or the DVD is not identified because the UDF 2.0 disk format is not recognized.
- The video player or Office™ software is unable to play MPEG2 videos as the MPEG2 decoder is missing.

One MediLive Video Tools CD is supplied as part of the digital video recording option.

The ZEISS cat. no. of this CD is 308203-8040-000.

## Storing patient data on CD/DVD

Proceed as follows to store local patient data on a CD or DVD:

- Open PAT-FILES menu (1).
- Open "LIST" tab (2).
- Activate the required patient in list (3).
- Open the image folder of the patient (4).
- Click on the images you want to export and mark them by pressing Mark button (5).
- Press "SAVE" button (6).
- Select "CD/DVD" tab (7) in the SAVE menu.



Note:

The display shows the number of images selected for export.

- Check whether a new, blank data carrier is contained in the CD/DVD drive (8).

9 Export in the DICOM format

On: Selected images are saved in a DICOM structure on the CD/DVD medium.

Off: Image data is saved in the native format (TIFF, BMP, JPG) in the predefined patient data structure.

10 Save images anonymously

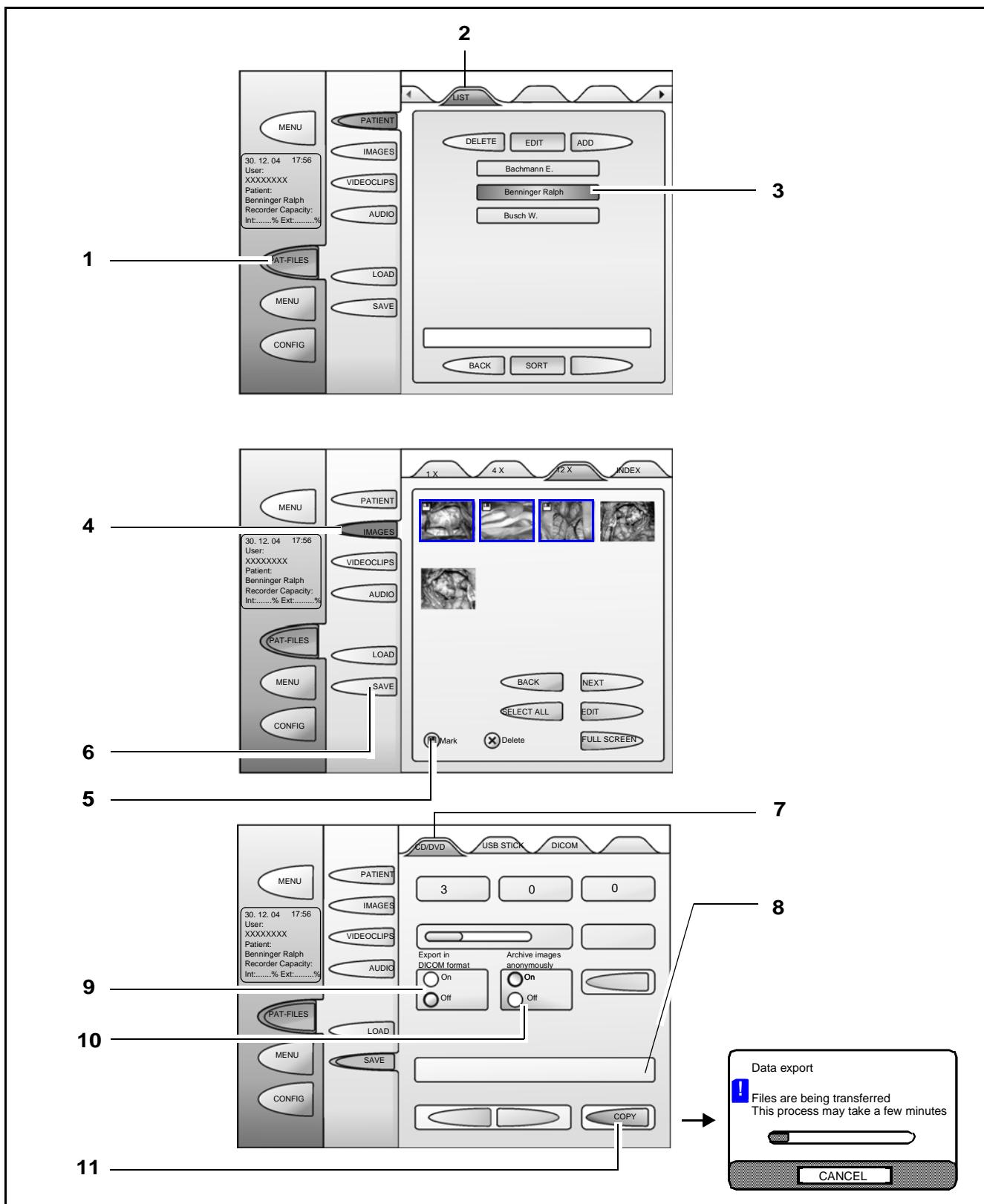
Enables anonymous saving of the selected images.

- On: All image information in the EXIF format without surgeon's and patient's names.
- Off: All image information in the EXIF format with surgeon's and patient's names.

- Press "COPY" (11) to export the images.

The data export process is indicated by a progress bar.

In the local image folder, exported images are marked by the storage symbol



### USB data port

A USB port is provided on the left-hand side of the monitor. It is used for fast, easy storage of image and video data on the USB storage media included in the delivery package (memory stick and USB mini hard drive).

- Insert USB memory stick (1), for example, in USB socket (2).
- Check whether the storage space available is sufficient for the data to be stored. The system displays the memory capacity required.
- Press Copy button (3) to copy data to the USB stick.



**Caution:**

- It is the user's responsibility to ensure that the media used for data communication (CD, DVD, USB stick) are free from viruses.
- External hard drives with an external power supply must not be connected.



**Note:**

- Due to the wide variety of different types available, we cannot guarantee the function of every USB memory stick. Only use USB memory sticks of the type contained in the delivery package or available from Carl Zeiss.
- Due to the wide variety of different types available, we cannot guarantee the function of every external hard drive. Only use the external USB mini hard drive included in the delivery package or available from Carl Zeiss.
- For hardware connected to the USB port for the first time, it may take the system a few minutes to find and install the drivers.
- Place the external USB mini hard drive securely on the surface behind the touchscreen. Before transportation of the system, remove the external USB mini hard drive and keep it in a safe place.



**Note on MediLive Video Tools:**

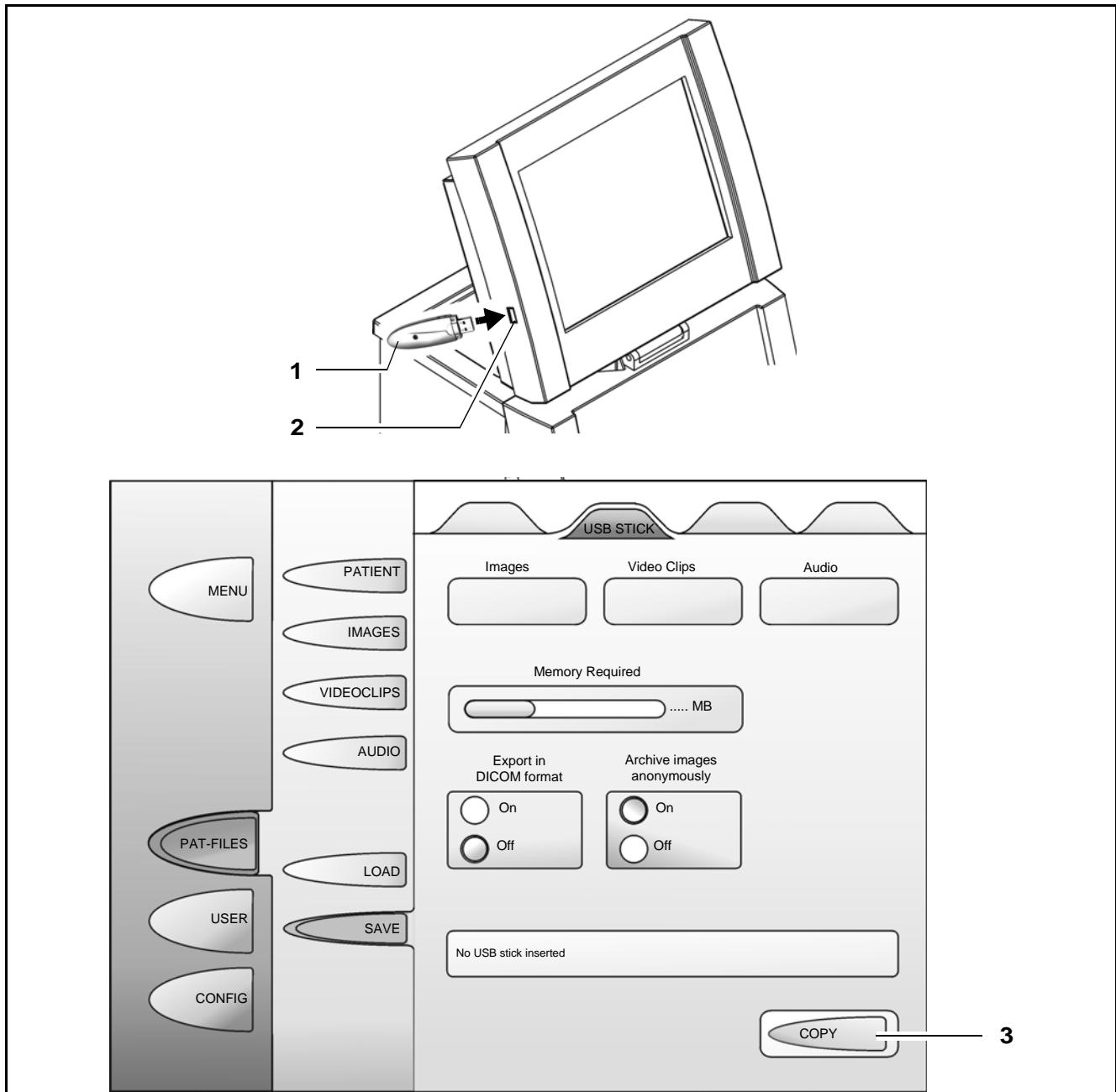
The MediLive Video Tools software provides improved compatibility between your PC (Windows™ or MacOS™) and the video DVDs created with OPMI® Pentero®.

Please install MediLive Video Tools on your PC if you notice the following problems:

- The computer cannot read the DVD content or the DVD is not identified because the UDF 2.0 disk format is not recognized.
- The video player or Office™ software is unable to play MPEG2 videos as the MPEG2 decoder is missing.

One MediLive Video Tools CD is supplied as part of the digital video recording option.

The ZEISS cat. no. of this CD is 308203-8040-000.



## Storing patient data on a USB stick

Proceed as follows to save local patient data to a USB stick:

- Open PAT-FILES menu (1).
- Open "LIST" tab (2).
- Activate the required patient in list (3).
- Open the image folder of the patient (4).
- Click on the images you want to export and mark them by pressing Mark button (5).
- Press "SAVE" button (6).
- Select "USB STICK" tab (7) in the SAVE menu.



Note:

The display shows the number of images selected for export.

- Check whether a USB stick is inserted in the USB socket on the touch-screen.
- Press "COPY" (9) to export the images.  
The data export process is indicated by a progress bar.

In the local image folder, exported images are marked by the storage symbol .

10 Export in the DICOM format

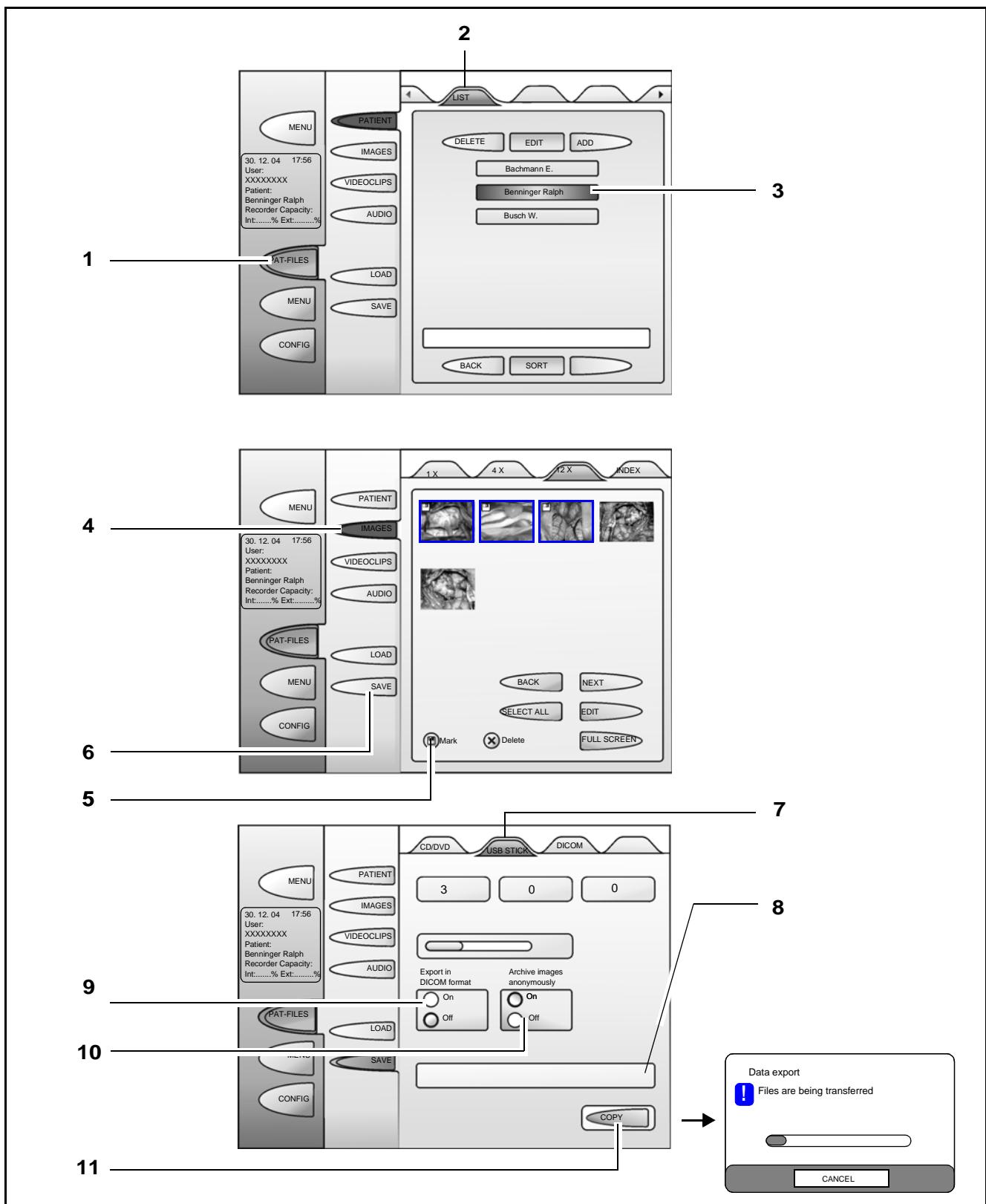
On: Selected images are archived in a DICOM structure on the USB stick.

Off: Image data is saved in the native format (TIFF, BMP, JPG) in the predefined patient data structure.

11 Save images anonymously

Enables anonymous saving of the selected images.

- On: All image information in the EXIF format without surgeon's and patient's names.
- Off: All image information in the EXIF format with surgeon's and patient's names.



## Loading patient data



### Note:

- When data is imported, the system checks whether the medium contains the PatientInfo\_FamilyName\_FirstName\_DateofBirth.xml file for the active patient.
- When the "Load" tab is activated for data import, the last tab selected by the user is always opened. On first access, the DVD tab is opened and afterwards always the last tab used.

### If the XML file is recognized:

A check is made whether the patient data record corresponds to the entries for the patient currently selected. If the patient assignment is not correct, the user is informed that the data does not correspond to the current patient. The following dialog box appears: "Patient data to be imported do not refer to the current patient! Do you want the data to be assigned to the current patient?" Yes / No

- Yes: data is imported to the current patient.
- No: an additional message appears after the data has been copied: "The data has been allocated to newly created patient XYZ". (XYZ = generated patient name)

### If the XML file is not available:

The following dialog box appears: "Do you want the data to be assigned to the current patient?" Yes / No

- Yes: data is imported to the current patient.
- No: an additional message appears after the data has been copied: "The data has been allocated to newly created patient XYZ". (XYZ = generated patient name)



### Note:

XML (Extensible Markup Language) is a standard for creating machine-readable and human-readable documents in the form of a tree structure. XML defines the rules for the structure of such documents. The details of the relevant documents must be specified for the concrete application involved ("XML application"). This refers in particular to the definition of the structural elements and their arrangement within the document tree.

**1 Explorer**

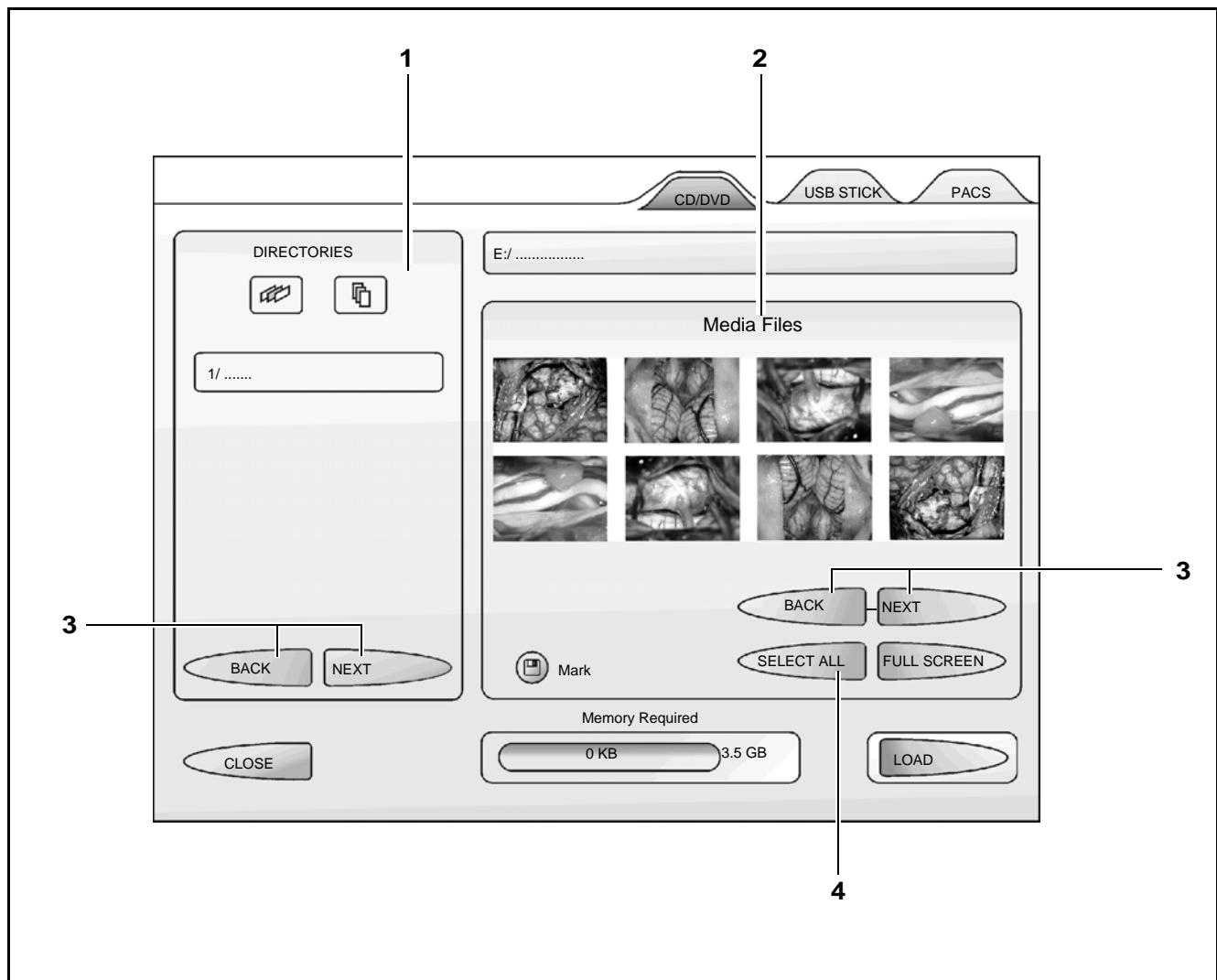
**2 Media viewer**

**3 Browse buttons**

These buttons are only active if more than the displayed directories or media are available.

**4 Select All**

Press this button to select all files in media viewer (2).



**5 Loading images (import)**

To load images from a CD/DVD, USB stick or hospital server (DICOM), press the LOAD button.

**6 Media Files display**

The Media Files display shows 8 thumbnails per page.

After data selection, the following note is displayed:

"You have made the following selection:

- Selected files : n (n=number of files)  
Memory required: 347.23 MB"

**7 FULL SCREEN button**

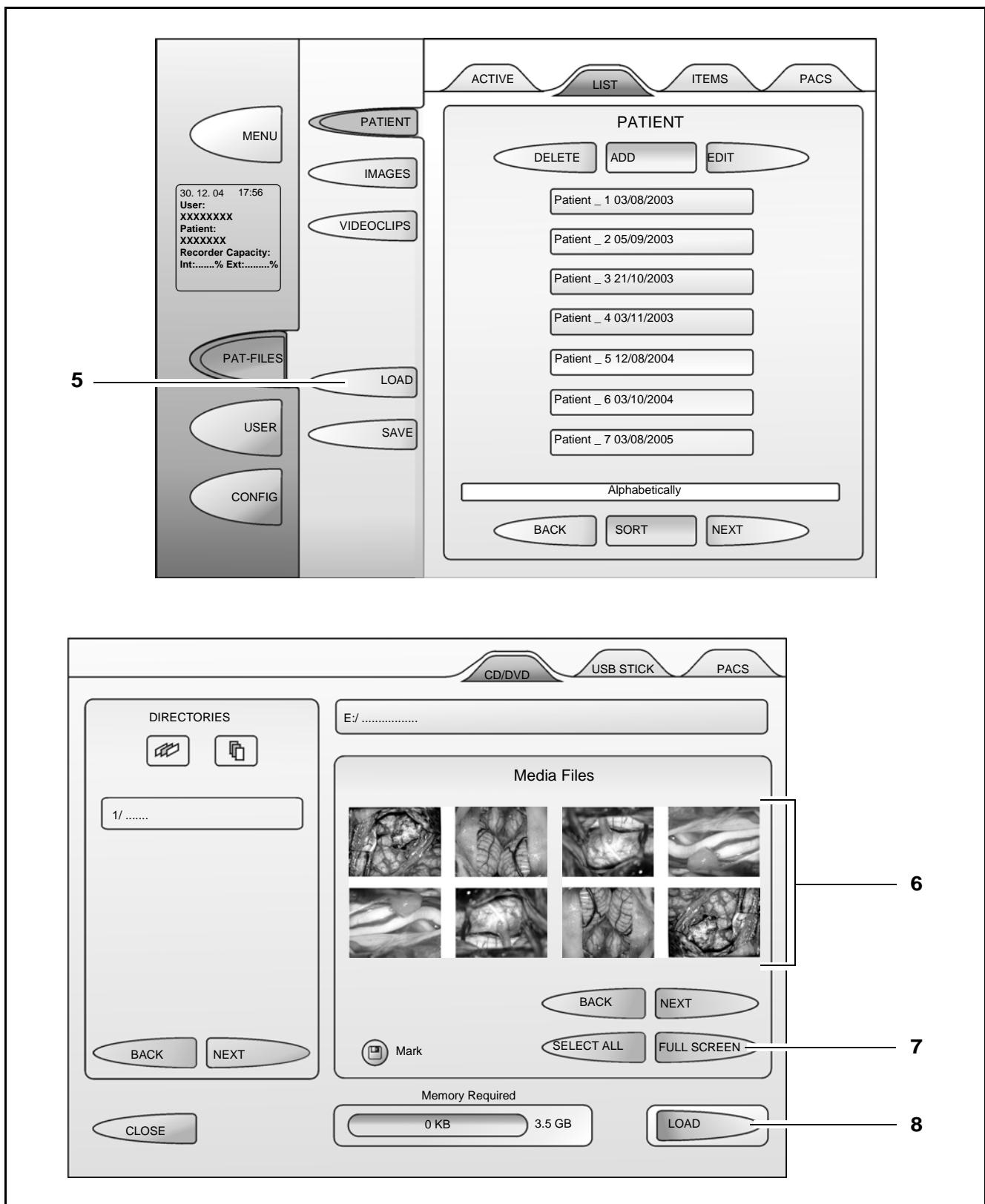
When you press this button, the system automatically starts the full-screen image viewer or full-screen video viewer for the media type concerned. The BACK and NEXT buttons of the image or video viewer permit you to automatically switch to the next or previous media file. When you press the CLOSE button, the program automatically returns to the LOAD menu.

**8 LOAD button**

Press the LOAD button to start the loading process.

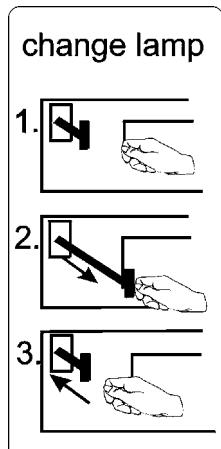
**Pop-up message:**

- If there is no CD/DVD medium in the drive, the following note is displayed: "No formatted medium in the drive".
- If no USB stick has been inserted, the following note is displayed: "No USB stick inserted".



## What to do in an emergency

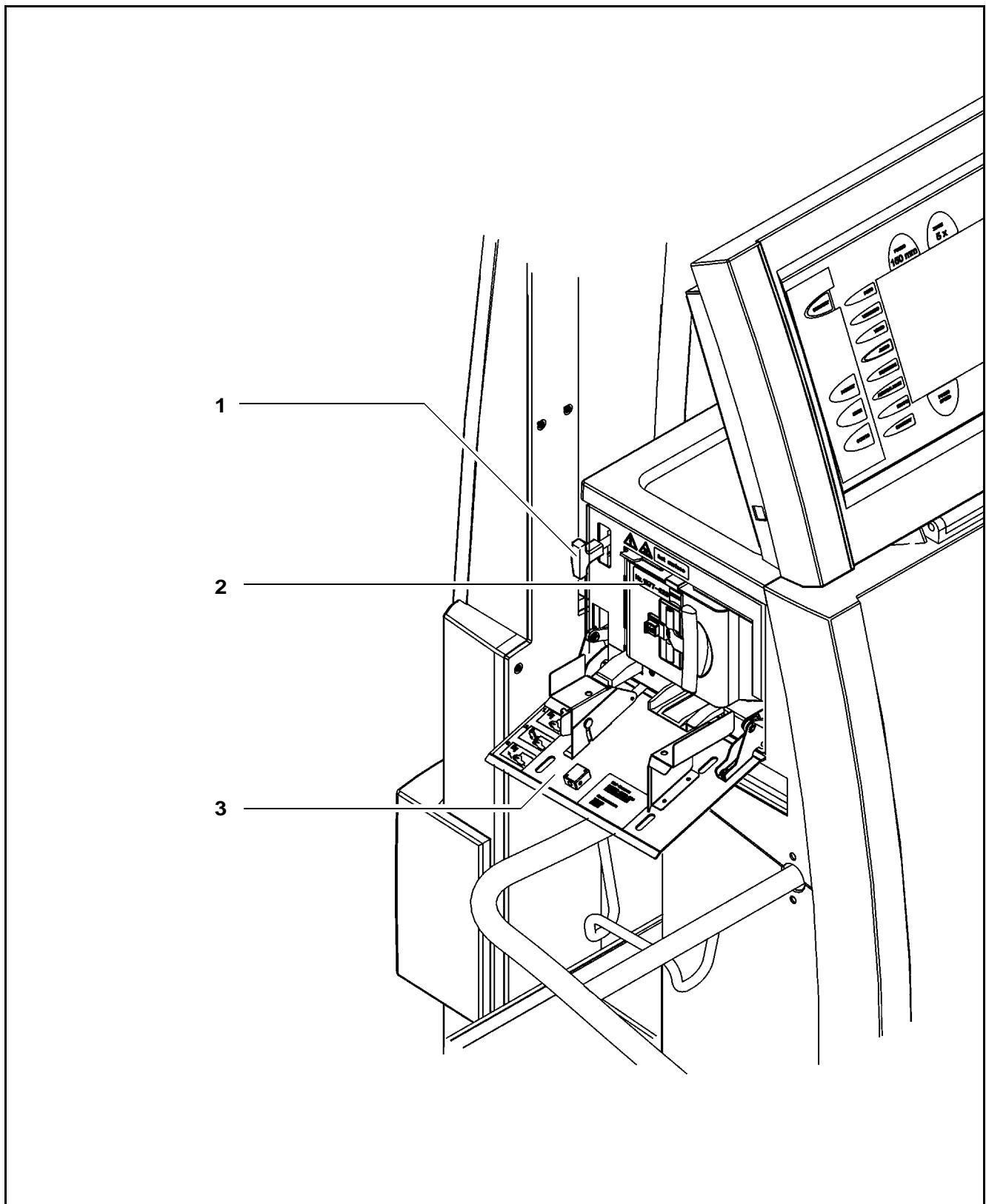
### Illumination failure - changing the xenon lamp



- Open flap (3) as far as it will go.  
Lever (1) for changing the lamp moves out.
- Pull out lever (1) as far as it will go, without using too much force.  
If you do not properly pull the lever, the lamp is not changed. Pull the lever again to make the lamp snap in.
- Close the flap again.
- Order a new xenon lamp. Cat. No. (2) is shown on the lamp module.

Note:

- Only change the used lamp if replacement is available on site (for the lamp change, see page 222).  
Always operate the illumination system with both xenon lamps. If one of the lamp fails, switch to the second lamp. Leave the failed lamp in the lamp housing until it is replaced by a new lamp.
- Every time you switch on the system, it indicates that you are using the backup lamp, until the used lamp is replaced.



## Failure of the zoom function

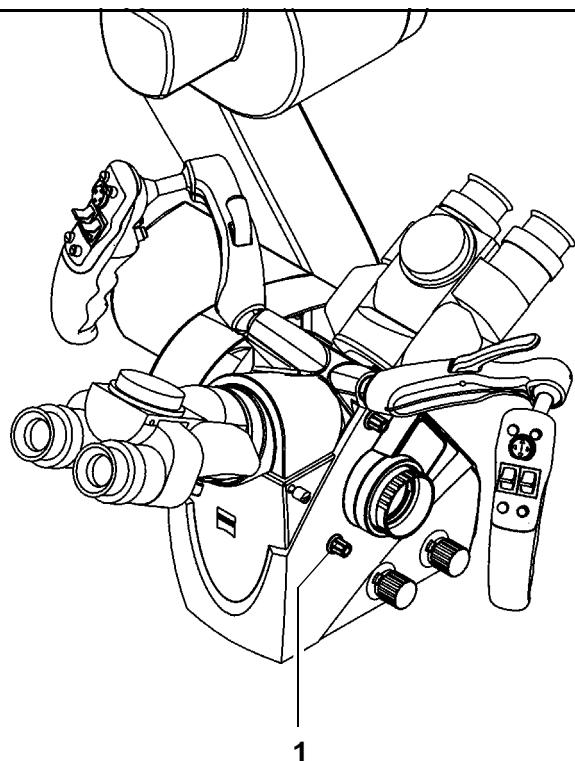
### Failure of the zoom function while all other functions of the suspension system work correctly

- Adjust the magnification manually using zoom knob (1).

### Failure of the zoom drive

In the event of a failure of the zoom drive (e.g. zoom drive moves constantly into an end position):

- Set the mode selector switch on the connection panel to emergency operation. This ensures that the light source continues to be operative without any restrictions.
- Adjust the magnification manually using zoom knob (1).
- Continue surgery by manually operating the suspension system and the surgical microscope by overcoming the locking effect of the brakes.



## Failure of the focusing function

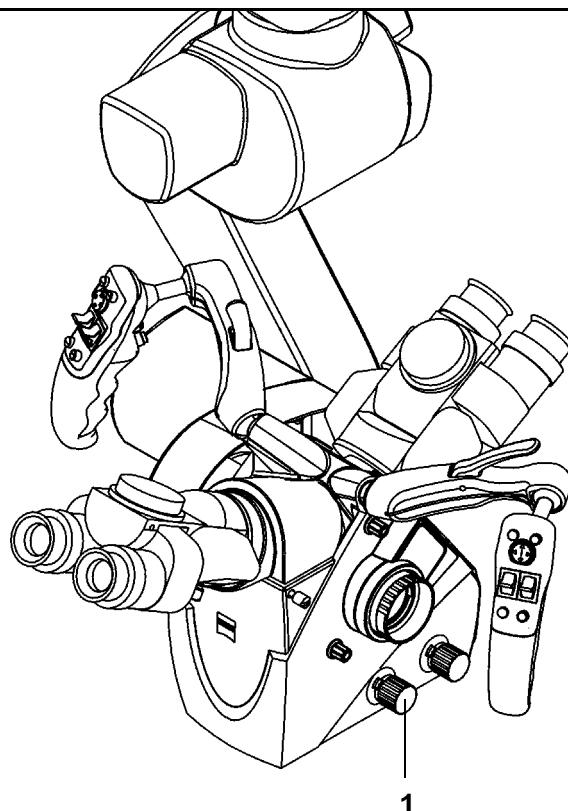
### Failure of the focusing function while all other functions of the suspension system work correctly

- Adjust the working distance manually using focusing knob (1).

### Failure of the focusing drive

In the event of a malfunction of the focusing drive (e.g. focusing drive moves constantly into an end position):

- Set the mode selector switch on the connection panel to emergency operation. This ensures that the light source continues to be operative without any restrictions.
- Adjust the working distance manually using focusing knob (1).
- Continue surgery by manually operating the suspension system and the surgical microscope by overcoming the locking effect of the brakes.



## Failure of the magnetic brakes

If the magnetic brakes fail (magnetic brakes are locked), you can manually move the axes of the stand by overcoming the locking effect of the brakes.

## Touchscreen failure



### Warning!

Do not under any circumstances touch the touchscreen. There is a possibility that only the illumination of the display has failed. In this case, you would inadvertently call menus or change settings when touching the screen.



### Note:

If the touchscreen no longer responds to your entries, you can still continue to operate the OPMI Pentero with the current settings.

To restore the touchscreen function, proceed as follows:

- Switch the suspension system off and back on again after a short time (approx. 2 minutes).

After power-up, the system automatically goes into the standard operating mode after it has completed a self-test (approx. 30 seconds).

- Check all functions of the surgical microscope and suspension system.

You can continue surgery in the standard operating mode.

## Failure of the line voltage

In the event of power failure, the uninterruptible power supply (UPS) automatically starts to operate. It ensures for a short period of time that no data will be lost.



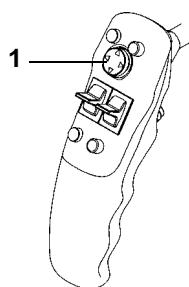
### Note:

The UPS does not power the light source and microscope functions.

If no power is available over a prolonged period of time, the system is shut down. As soon as line power is back, the user is informed accordingly (Power OK) and all subsystems are re-initialized.

In the event of power failure (magnetic brakes are locked), you can manually position the arm of the suspension system with the microscope by overcoming the locking effect of the brakes.

## Error messages in the data injection system

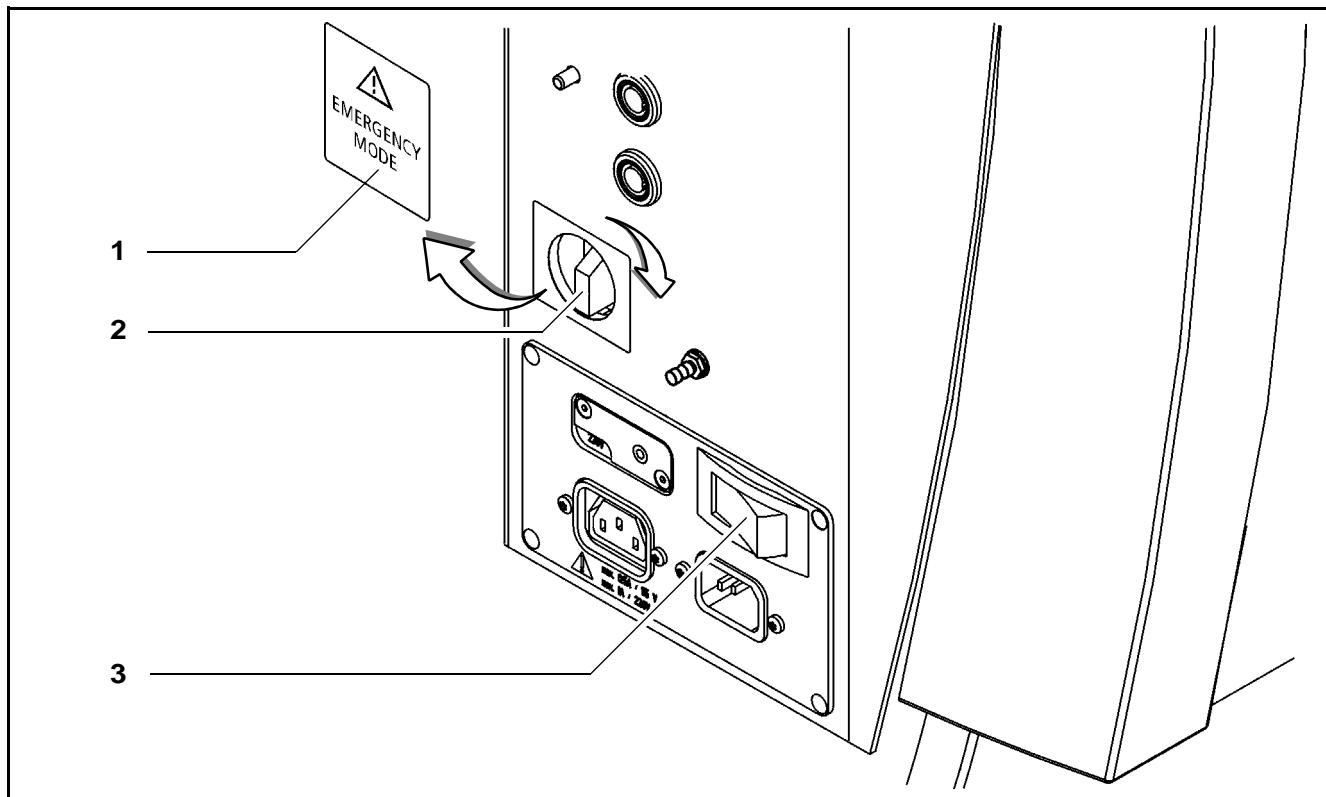


Major system errors are displayed in the microscope's integrated data injection system. You can delete these messages by acknowledgement using joystick (1) of the right handgrip (pushbutton) or the touchscreen.

## Failure of all control functions (Emergency mode)

- Check whether power switch (3) has been switched on.
- Remove magnetic plate (1) which covers emergency mode switch (2).
- Set switch (2) from position 1 to position 2 (emergency mode).

The microscope and suspension system functions have now been completely deactivated. The emergency mode ensures that the illumination continues to function with constant and sufficient intensity.



## Individual magnetic brakes are blocked (OPMI can not be moved at all or only to a limited extent)

It is possible that the integrated safety switches are activated and block some magnetic brakes. This can considerably restrict maneuverability of the microscope.

Proceed as follows to reset the microscope functions and to allow surgery to be finished:

- Turn off the system at the power switch. It can be switched on again as soon as the blue screen appears (approx. 10 seconds).
  - The system is operative again after approx. 15 seconds.
  - Computer and touchscreen are inoperative.

The following microscope functions are still available:

- Motorized focusing via handgrip or foot control panel
- Motorized magnification setting via handgrip or foot control panel
- Focus and zoom speeds correspond to the speeds set before the malfunction
- Brake functions AB (All Brakes) and SB (Selected Brakes) on the handgrip
- Brightness setting of xenon illumination via handgrip or foot control panel.  
Perhaps only a constant illumination value of approx. 70% (depending on the respective cause of the defect).
- Video image on an external monitor (external video cable of microscope camera).
- System balancing is retained with the same setting as before the malfunction. Unfortunately, new autobalance is not possible. Therefore, please do not change the OPMI configuration.
- After completion of surgery, we recommend you to contact the responsible Carl Zeiss service team to ensure that no hardware defect is present.



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OPMI® Pentero® Software Release 2.20 / 2.21

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# Maintenance/Service

Trouble-shooting	218
Service Contract (Option)	219
Starting Remote Service	220
Changing the lamp module	222
Recommended cleaning method	224
Sterile drapes	225
Ordering data	226
Spare parts	227
Accessories	228
Disposal	230

## Trouble-shooting

This system is a high-grade technological product. To ensure optimum performance and safe working order, we recommend having the system checked by our service representative on a regular basis. If a failure occurs which you cannot correct using the information displayed on the touchscreen, attach a sign to the system stating that it is out of order and contract our service representative.



## Service Contract (Option)



A service contract concluded with Carl Zeiss supports the high reliability of your OPMI Pentero in everyday use:

- 24 hour availability to the user in our support center on all issues concerning application and technology,
- use of remote service and remote diagnosis,
- short response times if a service call is required,
- service specialists on customer's site usually within 24 hours,
- repair within 2 working days after error diagnosis,
- maintenance work can be planned due to annual preventive maintenance of your system,
- update of your software applications.

Further information is available from our service department or from authorized representatives.

### Update management

All software updates from version 2.0 require a license number specifically assigned for the serial number of the system and the software version to be installed; this is referred to as update license in the following. A software update cannot be performed without this update license.

Customers who have concluded a Service Contract will receive the update license free of charge together with the update medium.

Customers who do not have a Service Contract but wish to install the latest software on their system must purchase an update license from CZ.

## Starting Remote Service

To permit Remote Service to be started online, the following requirements must be met:

- The OPMI Pentero must be connected to an analog telephone extension (modem is integrated in OPMI Pentero).
- The OPMI Pentero must be connected to a wall outlet provided with a properly connected protective ground conductor.
- The OPMI Pentero has been switched on and the main menu is displayed.
- You must have a phone link with the Zeiss Service Dept.
- Press CONFIG button (1), then SYSTEM INFO button (2) to access the overview.
- Press the Remote Service start button (3).

After a certain dial-in time of the Zeiss Service Dept., a window for access confirmation is displayed.

- Confirm the start of Remote Service (4).

The service client has been activated when Remote Service start button (3) is displayed in blue color. The message "Remote Service Active" (5) is displayed in the main menu.



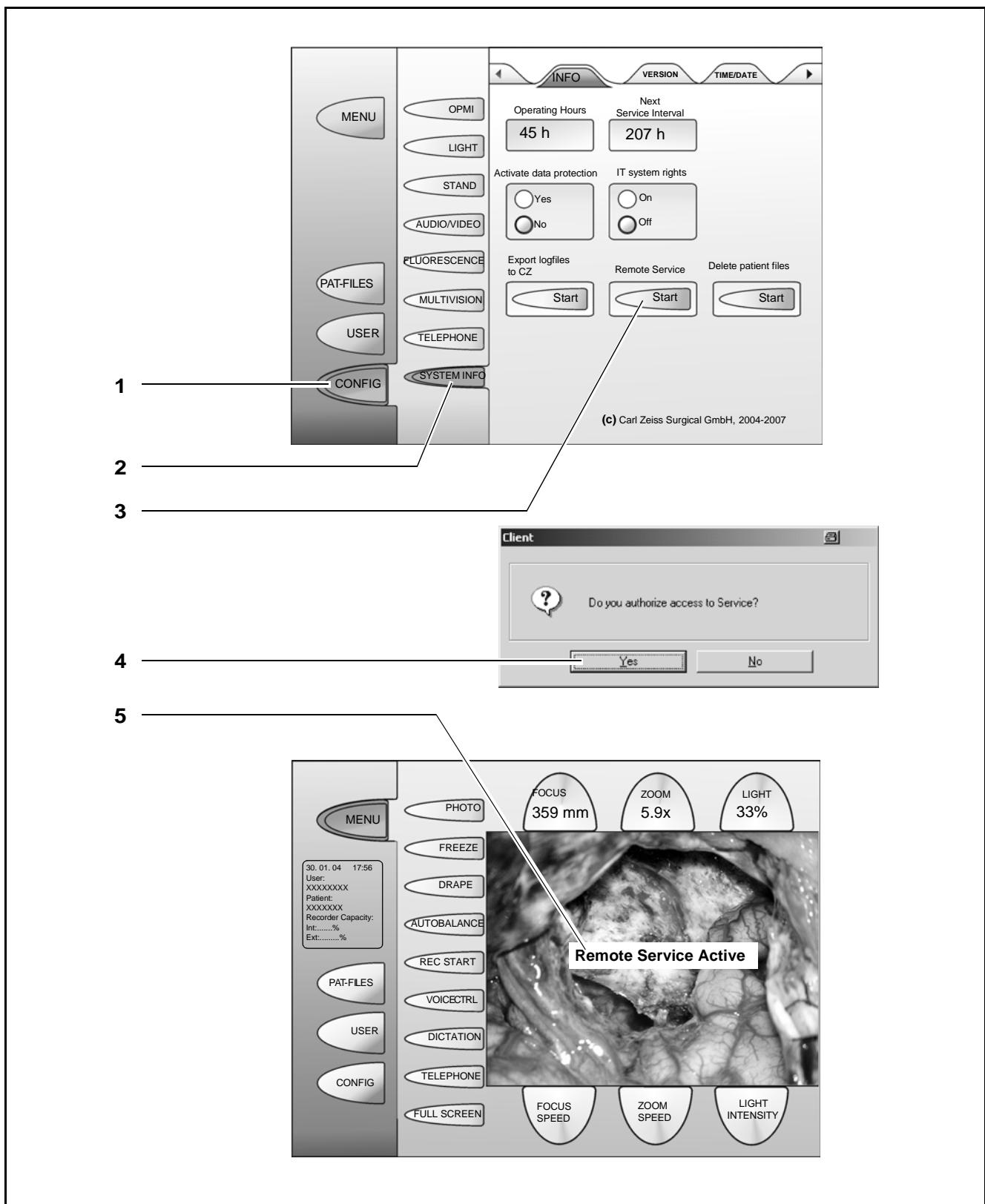
### Note:

For operations to be performed directly on the system during the Remote Service call, it is vital that you remain in constant dialog with the service engineer and follow his instructions.



### Warning!

Please note that uncontrolled movements of the system may occur during the Remote Service call.



## Changing the lamp module



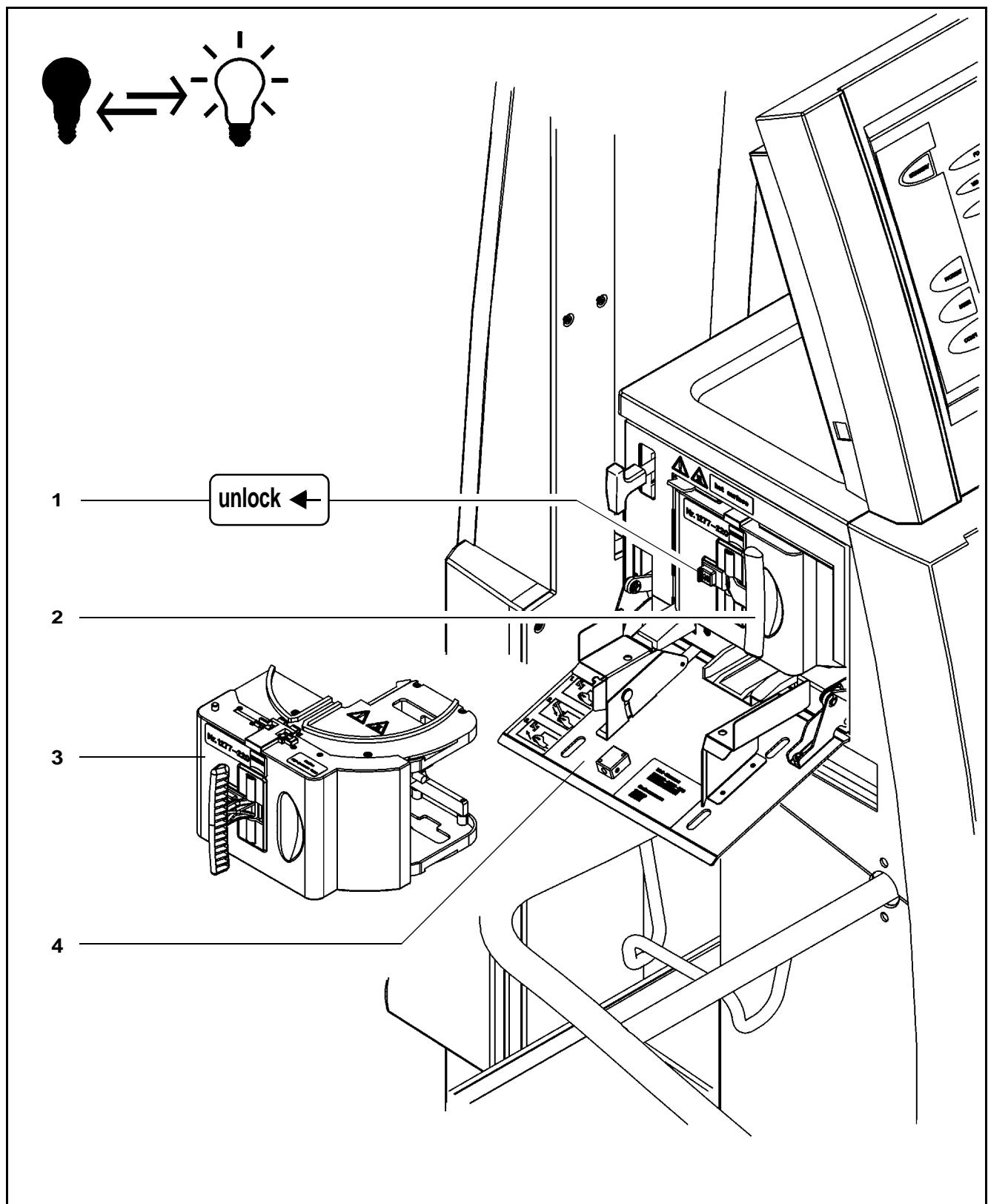
### Warning!

- Only change the used lamp module (3) if replacement (Cat. No. 1277-220) is available on site.
- Only change the lamp module after it has cooled down (this takes approx. 10 min)! In the event of a malfunction, there is a risk of explosion due to the high pressure inside the lamp. The hot surface of the xenon lamp may also cause burns.
- Make sure to store the used lamp module in the protective case (1279-403) provided for this purpose.
- Never push the red button (1) to the left in the direction of the arrow ("unlock") while the lamp module is outside the lamp housing. The high-pressure lamp would be unprotected in this case.

**unlock** ←

- First turn off the system at the power switch.
  - Remove the protective case from the new lamp module.
  - Open flap (4) as far as it will go.
  - Pull grip (2) on the lamp module to the left.
  - Carefully remove the lamp module from the lamp housing.
  - Put the used lamp module in the protective case (1279-403) provided for this purpose.
  - Carefully slide the new lamp module into the lamp housing.
  - Push red button (1) to the left in the direction of the arrow ("unlock") until grip (2) swings back.
  - Close flap (4) by slightly pressing it against the housing until you feel the lock engage.
- 
- Pack the used lamp module in the original protective packaging and ship it to the nearest Carl Zeiss service representative.

**unlock** ←



## Recommended cleaning method



### Warning!

If possible, the devices and accessories should be cleaned immediately after use. Contaminations should not be allowed to dry on the objects, as this would make cleaning and disinfecting more difficult.

### Cleaning optical surfaces

The multi-layer T\* coating of the optical components (e.g. eyepieces, objective lenses) ensures optimum image quality.

Image quality is impaired by even slight contamination. To protect the internal optics from dust, the system should never be left without the objective lens, binocular tube and eyepieces. After use, cover the system to protect it from dust. Always store optical components and accessories in dust-free cases when they are not being used.

Clean the external surfaces of optical components as required:



### Caution:

Do not use any chemical detergents or aggressive substances. These may damage the optical surfaces.

- Remove coarse dirt (splashes of blood etc.) using distilled water to which a dash of household dish-washing liquid has been added. Wipe the surfaces only with a damp, under no circumstances with a wet cloth.  
Any remaining marks can be easily removed using the following aids.
- For thorough cleaning of optical surfaces, use the optics cleaning set (Cat. No. 1216-071) or damp optics cleaning wipes (available from specialized dealers).
- Remove minor contaminations such as dust, streaks, etc. using a clean microfiber cleaning cloth (available from specialized dealers or under Cat.No. 1254-655).

### Fogging of optical surfaces

To protect the eyepiece optics from fogging, we recommend using an anti-fogging agent.



### Note:

Anti-fogging agents provided by eyecare professionals for use with eye-glass lenses are also suitable for Zeiss eyepieces.

- Please observe the instructions for use supplied with each anti-fogging agent.

Anti-fogging agents do not only ensure fog-free optics. They also clean the eyepiece optics and protect them against dirt, grease, dust, fluff and fingerprints.

### Cleaning the touchscreen

Clean the touchscreen with alcohol-free glass cleaner.

- Apply the cleaning agent on a soft, clean cloth (do not spray or pour it directly on the touchscreen!) and wipe the touchscreen with the moist cloth.
- Do not let any cleaning agent seep into the device.



### Cleaning mechanical surfaces

All mechanical surfaces of the equipment can be cleaned by wiping them with a damp cloth. Do not use any aggressive or abrasive cleaning agents.

Clean off any residue using a mixture of 50% ethyl alcohol and 50% distilled water plus a dash of household dish-washing liquid.

## Sterile drapes

Sterile single-use drapes are available for covering the system.

We recommend Carl Zeiss drapes, cat. no.: 306026-0000-000



#### Note:

When draping the system, make sure there is enough slack in the drapes to allow for movement of the microscope carrier and surgical microscope. It is especially important that the drapes are completely loose around the handgrips. The surgeon must be able to operate the buttons through the drape.

Use the drape vacuum system to attach the drapes (page 100).

## Ordering data

### OPMI Pentero system

Description	Cat. No.
<b>Basic configuration</b> comprising OPMI Pentero with binocular MultiVision system, touchscreen, autobalance and autodrape systems, Superlux 330 light source with 2x 300W xenon lamp, MediLive video system, one 180° tilttable binocular tube with 10x push-in widefield eyepieces, spinal adapter for symmetric face-to-face configuration, dust cover, 2 video connection cables, CD-R and USB media for data archiving	302582-9901-000
<b>Option: digital video recording</b> Integrated digital video recording system with DVD archiving	302581-9790-000
<b>Option: integrated fluorescence module</b> Integrated INFRARED 800 fluorescence module (PAL) Integrated INFRARED 800 fluorescence module (NTSC) (including IR 800 fluorescence target)	302581-9245-000 302581-9246-000 302581-9247-000
<b>Option: integrated fluorescence module</b> Integrated FLOW 800 fluorescence processing module for OPMI Pentero	302581-9250-000
<b>Option: integrated fluorescence module</b> Integrated BLUE 400 fluorescence module (including BLUE 400 fluorescence target)	302581-9050-000 302581-9052-000
<b>Option: stereo video</b> MediLive PAL stereo camera (version 1) MediLive NTSC stereo camera (version 1) MediLive PAL stereo camera (version 2) MediLive NTSC stereo camera (version 2)	302581-9713-000 302581-9753-000 302581-9716-000 302581-9756-000



<b>Option: DICOM network</b>	
DICOM network interface for data communication with a hospital network	302581-9270-000
<b>Option: HDTV camera system for OPMI Pentero</b>	308203-2010-000
Ikegami HDL-20 DI HDTV camera incl. attachment components	

## Spare parts

Description	Cat. no.
New Superlux 330 lamp module	000000-1277-220
Superlux 330 exchange lamp module	000000-1294-658

## Accessories

Please observe the following:

Only operate the instrument with the accessories included in the delivery package. If you want to use other accessories, make sure that Carl Zeiss or the manufacturer of the accessories has proved and confirmed that these accessories meet the respective technical safety standards and can be used without risk.

Description	Cat. No.	Weight
Stereo coobservation module	1063-869	1.0 kg
180° tiltable tube	303791-0000-000	1.1 kg
Widefield optics with rotatable dovetail (spinal adapter)	302581-9200-000	0.52 kg
Camera adapter f=340 mm T2	1022-973	0.42 kg
MM6 CO <sub>2</sub> micromanipulator	306953-0000-000	1.14 kg
Mouth switch for 180° tiltable tube	1177-805	0.47 kg
Mouth switch holder for straight tube	1116-378	0.4 kg
10x/18B eyepieces (2 units)	305542-0000-000	0.26 kg
12.5x/21B eyepieces (2 units)	305543-9901-000	0.26 kg
Waterproof foot control panel 2 with 14 functions, 6.0 m cable	304979-9050-000	-
USB memory stick	458-366	-
External USB mini hard drive	486-937	-
Cable for RGB video monitor (D-Sub 15-pin HD)	458-903	-
Cable for RGB PC monitor (5x BNC connector)	458-905	-
BLUE 400 fluorescence target	302581-9052-000	-
Superlux 330 lamp module, 300 W	1277-220	-
Video trolley with isolating transformer 920VA+115/230V	301687-9043-000	-



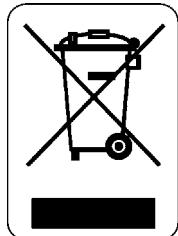
VisionGuard replacement lenses (sterile, box of 20)	306001-0000-000	-
Zeiss sterile drapes, type 26, pack of 5	306026-0000-000	-
CD: MediLive Video Tools	308203-8040-000	-
Neuromonitoring upgrade kit	305989-9100-000	-

### Video / audio cables

Description	Cat. No.
S-VHS connecting cable, 2x4 pins Mini DIN, 2m	301687-9102-000
Video connecting cable Y/C in, 10m	418-953
Video connecting cable Y/C out, 10m	457-982
Video connecting cable RGB/VGA out, 10m	458-903
Video connecting cable RGB/5x BNC out, 10m	458-905
BNC-BNC cable, 1m	301687-9100-000
BNC-BNC cable, 10m	301687-9101-000
Audio cable (2 channels) CINCH-CINCH, 1.5m	301687-9103-000
BNC cable set, 2m	301687-9109-000

## Disposal

### **User information on the disposal of electrical and electronic devices**



This symbol means that the product must not be disposed of as normal domestic waste.

The correct disposal of electrical or electronic devices helps to protect the environment and to prevent potential hazards to the environment and/or human health which may occur as a result of improper handling of the devices concerned.

For detailed information on the disposal of the product, please contact your local dealer or the device manufacturer or its legal successor. Please also note the manufacturer's topical information on the internet. In the event of resale of the product or its components, the seller is required to inform the buyer that the product must be disposed of in accordance with the applicable national regulations currently in force.

#### **For end customers in the European Union**

Please contact your dealer or supplier if you wish to dispose of electrical or electronic devices.

#### **Information on disposal in countries outside the European Union**

This symbol is only applicable in the European Union. For the disposal of electrical and electronic devices, please observe the relevant national legislation and other regulations applicable in your country.

# Technical data

OPMI Pentero	232
3 CCD PAL video camera, mono and stereo (version 1)	237
3 CCD NTSC video camera, mono and stereo (version 1)	238
3 CCD PAL video camera, mono and stereo (version 2)	239
3 CCD NTSC video camera, mono and stereo (Version 2)	240
Ambient requirements	241
Changes to the system	241

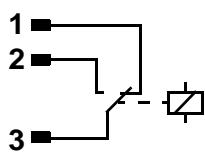
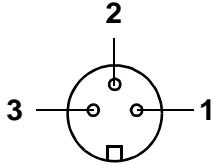
**OPMI Pentero**

Tube / Eyepieces	Removable tiltable tube Tilt range 180° Focal length $f = 170$ mm for main observer and coobserver (option) 10x/21B (12.5x/18B) magnetic widefield eyepieces with integrated eyecups.
Varioskop objective lens	Working distance: $\geq 200 \dots \leq 500$ mm Motorized, adjustable speed. Manual adjustment possible (emergency mode). Autofocus functions. Sensor for working distance for neuronavigation.
Magnification	Zoom system with 1:6 ratio, magnification factor $\gamma = 0.4x - 2.4x$ . Motorized magnification change on microscope. Manual adjustment possible (emergency mode). Sensor for zoom system for neuronavigation.
Autofocus (AF) / Focusing aid	When AF is triggered, two laser beams intersecting in the focal plane are visible (wavelength 635 nm, laser class II). <ul style="list-style-type: none"> <li>– Autofocus, activated manually, via handgrip or footswitch or voice control (voice control currently not yet available)</li> <li>– Autofocus, activated automatically, in combination with the SB/AB brake buttons.</li> </ul>
Laser class	Aiming beams: 2 complying with EN 60825-1:2002 $P_{max} < 1\text{mW}$ $\lambda$ 635-645 nm
Total magnification with tube $f=170$ mm and eyepiece 10x	2.2 -13.0 at working distance of 200 mm 1.6 - 9.7 at working distance of 300 mm 1.4 - 8.6 at working distance of 350 mm 1.3 - 7.8 at working distance of 400 mm 1.1 - 6.5 at working distance of 500 mm
Total magnification with tube $f=170$ mm and eyepiece 12.5x	2.7 -16.2 at working distance of 200 mm 2.0 -12.1 at working distance of 300 mm 1.8 -10.8 at working distance of 350 mm 1.6 - 9.7 at working distance of 400 mm 1.4 - 8.2 at working distance of 500 mm



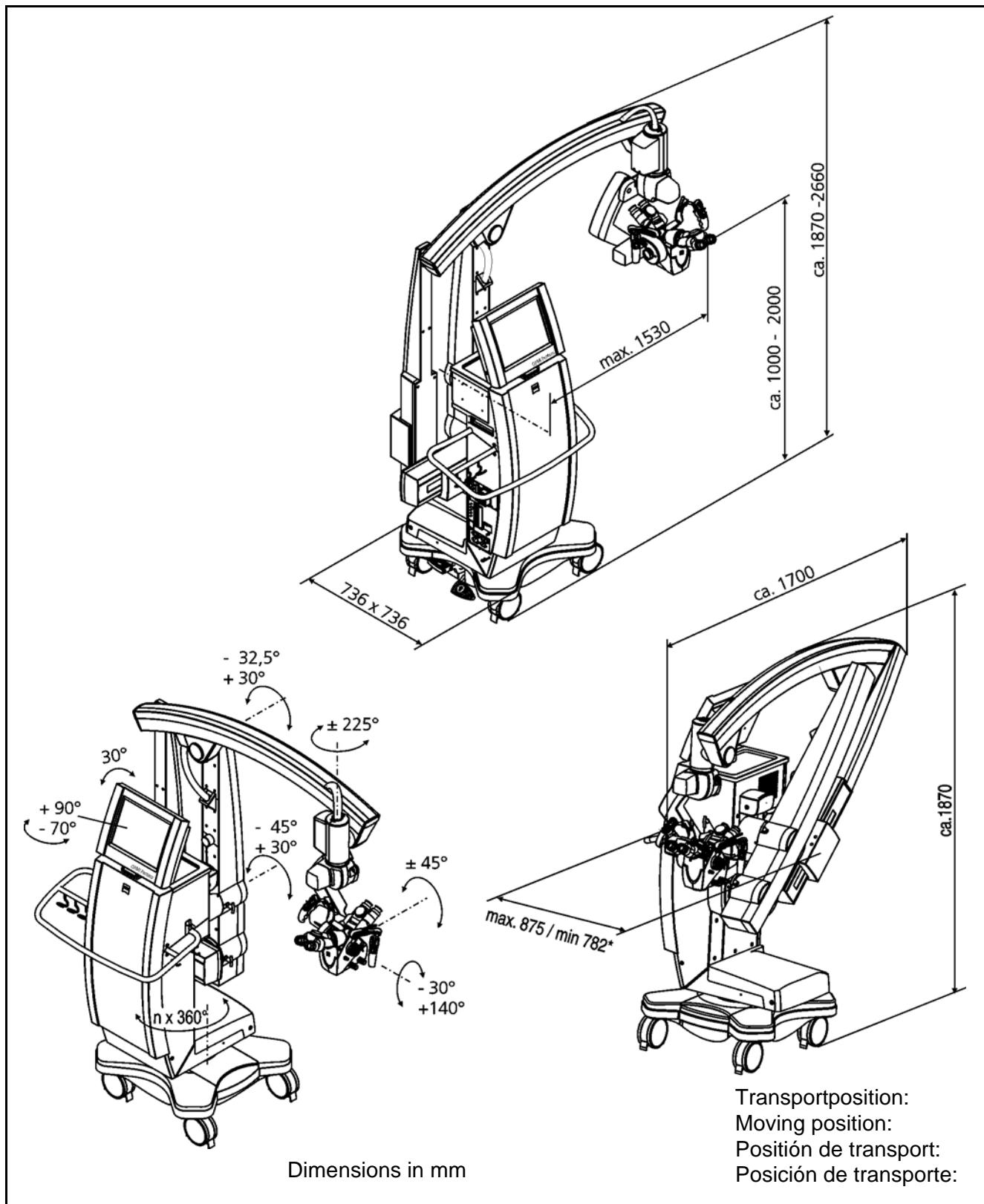
	Illumination	Fully integrated, coaxial fiber optic illumination with an S light guide. Manually adjustable illuminated field (dia. 91 mm) to "spot" illumination (dia. 16 mm). These specifications relate to an $f = 200$ mm objective lens. Increased illumination intensity in a small illuminated field. Additionally switchable auxiliary illumination for lightening up shadows. This illumination comes from a different direction and at a smaller angle of incidence than the main illumination.
Video Standard PAL or Video Standard NTSC	Motorized XY movement	Motorized XY movement over the entire front-to-back and lateral tilt ranges of the microscope, variable speed.
	Depth of field	Swing-in double iris diaphragm, switchable to two levels. The brightness of data injection remains unaffected.
	Coobservation port	The OPMI is equipped with an integrated 180° coobservation port (standard tube port). Simultaneous photography and video recording (2D and 3D) are possible.
	Video system	Integrated 3-chip 1/2" progressive scan video camera, mono (option: stereo) for PAL / NTSC
	Max. additional load on the microscope	The maximum admissible load (accessory equipment) on the microscope <u>must not exceed 6 kg!</u>

AUX port  
View of connector side



Line connection	Only connect the suspension system to power outlets which are provided with a properly connected protective ground conductor.
Rated voltage	115 VAC (100...125 VAC ± 10%) 230 VAC (220...240 VAC ± 10%)
Current consumption	115 VAC max. 12 A 230 VAC max. 6 A
Rated frequency	50...60 Hz
Fuses	Automatic circuit breaker
Electrical outlets	<ul style="list-style-type: none"> <li>– Power outlet 115/230 V, max. 2 A</li> <li>– AUX port for an external signal of a maximum of 24 V / 0.5 A.</li> </ul>
Electrical standard	<p>Complying with IEC 60601-1 / EN 60601-1; UL 60601-1; CAN/CSA-C22.2 No. 601.1-M90</p> <p>Protection class I, degree of protection IPX0</p> <p>Type B equipment </p>
Product classification	<ul style="list-style-type: none"> <li>– As per Directive 93/42/EEC, Annex IX: Class I I</li> <li>– With intraoperative fluorescence: Class IIa</li> </ul>
DICOM (option):	IT network connector, class A, as per EN 60601-1
Approval	
EMC requirements	<p>The system meets the EMC requirements of IEC 60601-1-2.</p> <p>The system meets the RFI requirements of Class A (hospital grade).</p>
CE labeling	<p>The system meets the essential requirements stipulated in Annex I to the 93/42/EEC directive governing medical devices.</p> <p>The system is labeled with:</p>

Max. dimensions in transport position	W x H x D: 875/782* x 1880 x 1700 mm *) After loosening two screws on the underside of the handle and folding up the handle.
Weight of system incl. transport container	approx. 600 kg
Weight of system	approx. 325 kg



**Note:**

For reasons of production and material requirement planning, different versions are used for the integrated video camera. This does not lead to any differences in quality or application for the user.

### 3 CCD PAL video camera, mono and stereo (version 1)

**Video Standard PAL**

Image sensor	Three 1/2" interline transfer progressive scan CCD image sensors
Horizontal resolution	800 lines
Vertical resolution	PAL output: 500 lines Progressive Scan output: 582 lines
Signal-to-noise ratio	62 dB
Scan system	Progressive scan, 625 lines, 50 full frames/second
Interlace:	50 fields / second
Video output ports analog:	VBS: 1.0 V <sub>p-p</sub> /75 Ω PAL composite  Y/C: 1.0 V <sub>p-p</sub> /75 Ω luminance, 0.3 V <sub>p-p</sub> /75 Ω chroma  RGB: 0.7 V <sub>p-p</sub> /75 Ω for R, G, B; 4.0 V <sub>p-p</sub> /75 Ω synchronization (synchronization for green and composite)  Progressive Scan: VGA, 75 Hz vertical frequency; resolution 800 (H) x 600 (V) 0.7 V <sub>p-p</sub> /75 Ω for R, G, B; 4.0 V <sub>p-p</sub> /75 Ω synchronization (H and V synchronization)
Video output ports digital:	DV (Firewire/IEEE 1394a unlocked audio): compressed digital video signal

### 3 CCD NTSC video camera, mono and stereo (version 1)

**Video Standard NTSC**

Image sensor	Three 1/2" interline transfer progressive scan CCD image sensors
Horizontal resolution	800 lines
Vertical resolution	NTSC output: 400 lines Progressive Scan output: 494 lines
Signal-to-noise ratio	62 dB
Scan system	Progressive scan, 525 lines, 60 full frames/second
Interlace:	60 fields / second
Video output ports analog:	VBS: 1.0 V <sub>p-p</sub> /75 Ω PAL composite  Y/C: 1.0 V <sub>p-p</sub> /75 Ω luminance, 0.286 V <sub>p-p</sub> /75 Ω chroma  RGB: 0.7 V <sub>p-p</sub> /75 Ω for R, G, B; 4.0 V <sub>p-p</sub> /75 Ω synchronization (synchronization for green and composite)  Progressive Scan: VGA, 60 Hz vertical frequency; resolution 640 (H) x 480 (V) 0.7 V <sub>p-p</sub> /75 Ω for R, G, B; 4.0 V <sub>p-p</sub> /75 Ω synchronization (H and V synchronization)
Video output ports digital:	DV (Firewire/IEEE 1394a unlocked audio): compressed digital video signal



### 3 CCD PAL video camera, mono and stereo (version 2)

**Video Standard PAL**

Image sensor	Three 1/2 in. interline transfer CCD image sensors
Horizontal resolution	850 lines
Vertical resolution	PAL output: 440 lines
Signal-to-noise ratio	63 dB
Scan system	625 lines, 50 fields/second
Video output ports	<p><b>Analog:</b></p> <p>VBS: 1.0 V<sub>p-p</sub>/75 Ω PAL composite</p> <p>Y/C: 1.0 V<sub>p-p</sub>/75 Ω luminance, 0.3 V<sub>p-p</sub>/75 Ω chroma</p> <p>RGB: 0.7 V<sub>p-p</sub>/75 Ω for R, G, B; 0.3 V<sub>p-p</sub>/75 Ω synchronization (synchronization for green and composite)</p> <p>Progressive Scan: resolution 1024 (H) x 768 (V) (interpolated); 60 Hz vertical frequency; 0.7 V<sub>p-p</sub>/75 Ω for R, G, B; 4.0 V<sub>p-p</sub>/75 Ω synchronization (H and V synchronization)</p> <p><b>Digital:</b></p> <p>DV (Firewire/IEEE 1394a): compressed digital video signal, YUV 4:2:0</p> <p>DVI: For LC monitor, 1024 (H) x 768 (V) (interpolated), 60 Hz vertical frequency</p>

### 3 CCD NTSC video camera, mono and stereo (Version 2)

**Video Standard NTSC**

Image sensor	Three 1/2 in. interline transfer CCD image sensors
Horizontal resolution	850 lines
Vertical resolution	NTSC output: 400 lines
Signal-to-noise ratio	63 dB
Scan system	525 lines, 60 fields/second
Video output ports	<p><b>Analog:</b></p> <p>VBS: 1.0 V<sub>p-p</sub>/75 Ω PAL composite</p> <p>Y/C: 1.0 V<sub>p-p</sub>/75 Ω luminance, 0.286 V<sub>p-p</sub>/75 Ω chroma</p> <p>Progressive Scan: resolution 1024 (H) x 768 (V) (interpolated); 60 Hz vertical frequency 0.7 V<sub>p-p</sub>/75 Ω for R, G, B; 4.0 V<sub>p-p</sub>/75 Ω synchronization (H and V synchronization)</p> <p><b>Digital:</b></p> <p>DV (Firewire/IEEE 1394a): YUV 4:1:1</p> <p><b>DVI:</b> For LC monitor, 1024 (H) x 768 (V) (interpolated), 60 Hz vertical frequency</p>



## Ambient requirements

For operation	Temperature Relative humidity Air pressure	+ 10 °C...+ 35 °C 30 %...75 % 700 hPa...1060 hPa
For transportation and storage	Temperature Relative humidity (without condensation) Air pressure	- 20 °C...+ 60 °C 10 %...92 % 500 hPa...1060 hPa
Magnetic resonance (MR)	For operation in an MR environment, OPMI Pentero must be positioned in such a way that all system components (suspension system, microscope) remain outside the <b>5 gauss line</b> . OPMI Pentero must be powered down during MR image capture. Only use OPMI Pentero when no MR image capture is in progress.	

## Changes to the system

Subject to changes in design and scope of delivery as a result of ongoing technical development.



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OPMI® Pentero® Software Release 2.20 / 2.21

Issue 11.1  
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# Digital video recording (option)

<b>Digital video recording (option)</b>	<b>244</b>
Description	244
Video clips	248
Editing video clips	250
Merging video clips	256

# Digital video recording (option)

## Description

The video recorded with the integrated video camera is saved as a digital MPG2 file in the relevant patient directory. The recorded video clips can be played back using the integrated video player. You can also export these files to a CD/DVD or USB stick.

During surgery, you can save the data on the internal hard drive or record it simultaneously on DVD, CD or USB.

You start and end a video recording by pressing the REC START / REC STOP button in the main menu, by using voice control (option) or by pressing a previously configured button on the handgrip or foot control panel.

A "Rec" display appears on the touchscreen while video recording is in progress.

Before starting a video recording, the system checks whether sufficient storage space is available, and informs the user that old files should be deleted.

If the storage space available is not sufficient for video recording, the system stops the recording after displaying an appropriate message.

If video recording is stopped, the file will be closed. A restart of recording leads to a new file being created whose name contains the start date and time. The file is stored in the patient directory currently selected.

If you press the photo button on the OPMI handgrip while video recording is in progress, a single image is created from the video data stream and a marker is inserted in the video.

You can select these markers at the press of a button during video editing on the OPMI. The corresponding position in the video is then displayed.

### 1 Recording control

Clip: recording video clips with a pre-defined time span. Press the Rec Start button to start recording. Recording is stopped automatically after the preselected time (4) has elapsed.



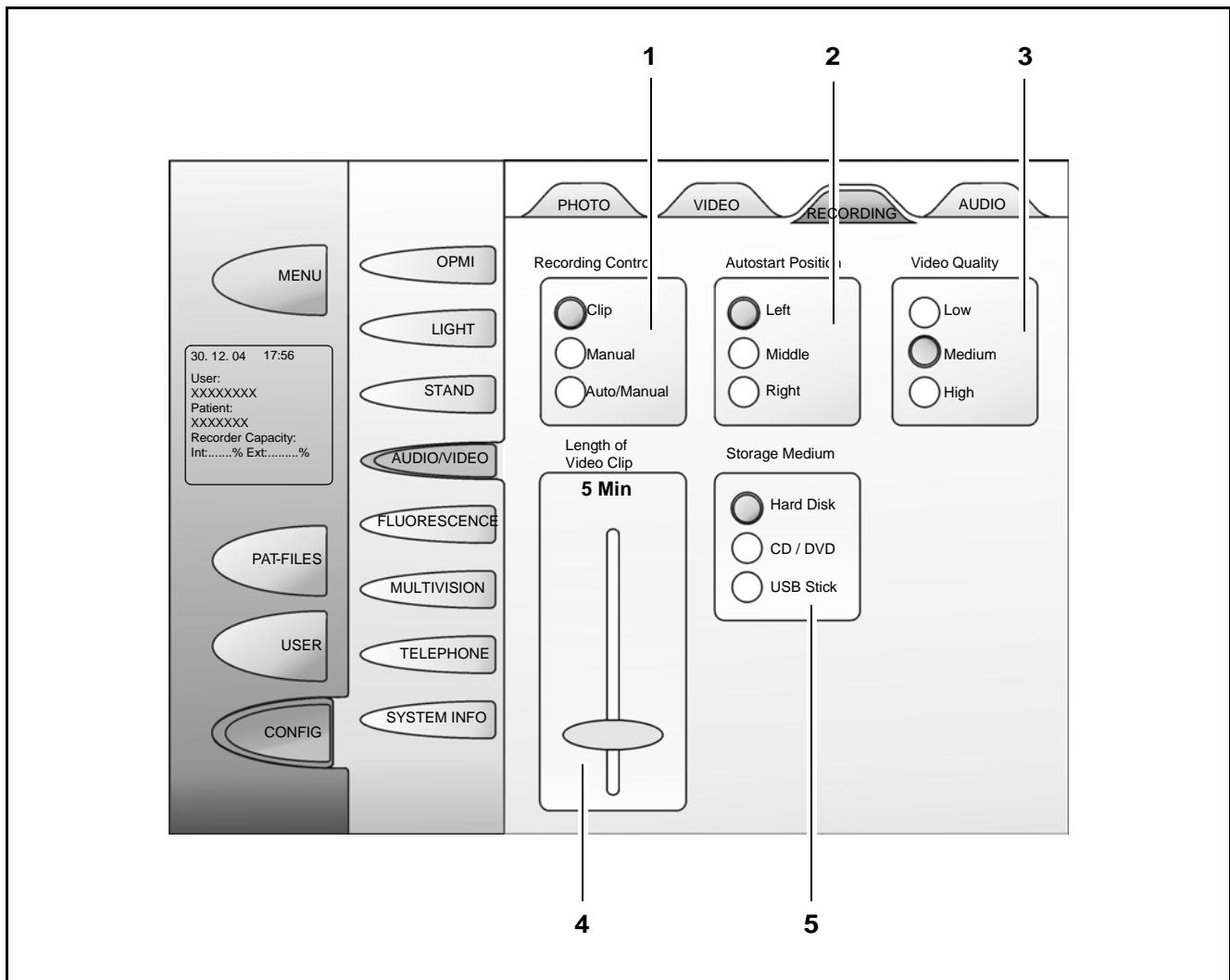
#### Note:

The system informs you one minute before the end of the runtime, permitting you to extend the recording time by the preselected period.

Manual: video recording of a non-predefined length. You can control the recording as required by pressing the Rec Start and Rec Stop buttons.

Auto/Manual: video recording of a non-defined length and creation of video clips with a predefined length.

You can control the recording as required by pressing the Rec Start and Rec Stop buttons. When you press the photo button, a video clip of a predefined length (4) is created.



**2 Autostart position**

If you have selected "Auto/Manual" in the menu item Recording Control, this function permits you to select the autostart position within the sequence to be recorded.

Left: the autostart position defines the beginning of the sequence to be recorded.

Middle: the autostart position is exactly in the middle of the sequence to be recorded.

Right: the autostart position defines the end of the sequence to be recorded.

**3 Video quality**

This function permits you to select the recording quality and the storage space needed.

Selection of the highest video quality means that the maximum video length is at its shortest.

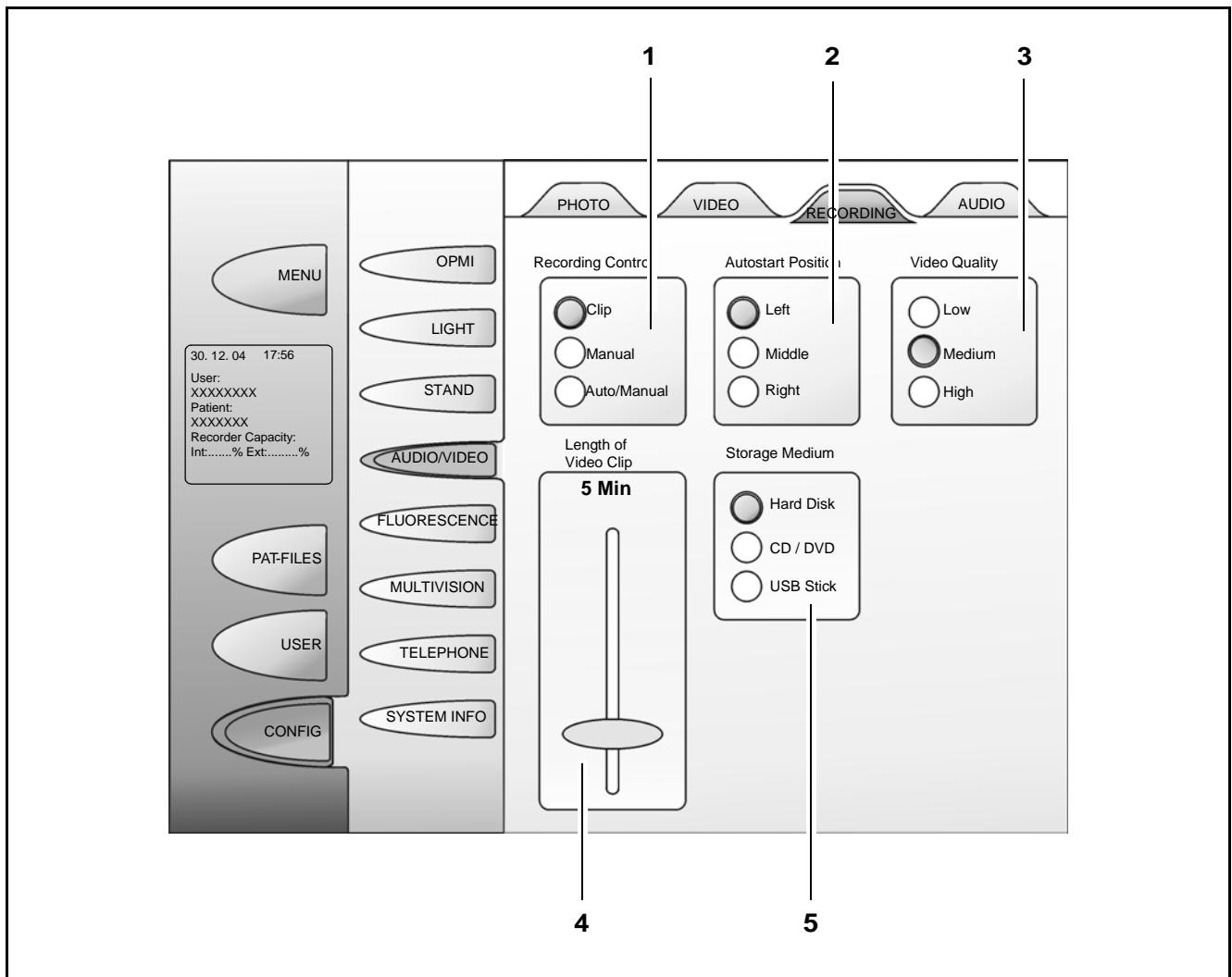
**4 Length of the video clip**

This slider permits you to set a time period in the range from 1 minute to 10 minutes:

**5 Storage Medium**

Select the storage medium to be used for saving the video recording. The video is always saved on the hard drive. In addition, you can optionally save the video on CD/DVD or USB stick by pressing the appropriate button.





## Video clips



### Recorded videos

#### Note:

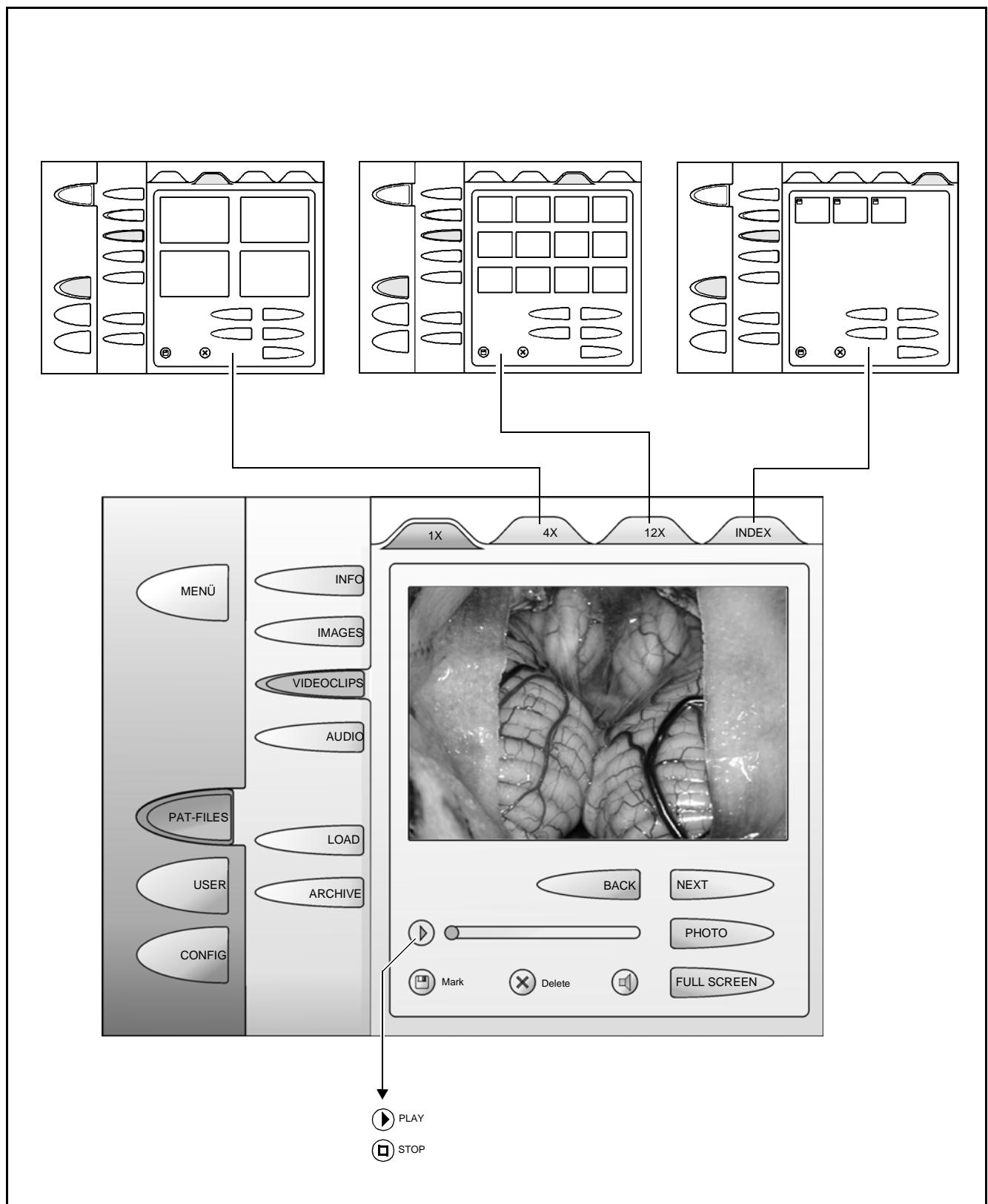
The integrated player which is only available in the Patient mode permits you to view video recordings.

- Select the patient required from the patient list.
- Press the active VIDEOCLIPS button.  
If this button is not active, the database does not contain any videos for the patient concerned.
- Select the video clip required by clicking on it in the 4 or 12 thumbnail preview. The selected video is marked by a blue frame.  
Use the browse function (back and next) if more than 4 or 12 video clips are available.
- Press the playback button (▶) to play the selected video clip in the player. Press the stop button (■) to stop the video.
- When playing the video, you can subsequently activate or deactivate the sound. A loudspeaker button (Speaker icon) is provided in the lower task bar of the player or editor. When you press the loudspeaker button, a menu is opened that permits you to adjust the volume and to activate or deactivate the sound.

### File name

The file name of a newly created video file (resulting from recording, merging, clip compilation or parallel streaming on USB/DVD) is generated in the following format:

Video file:	dd-mm-yy hh-mm-ss <b>V</b> .mpg
Clip file:	dd-mm-yy hh-mm-ss <b>C</b> .mpg
Merged file:	dd-mm-yy hh-mm-ss <b>M</b> .mpg
Image file:	dd-mm-yy hh-mm-ss <b>I</b> .jpg



## Editing video clips

**Caution:**

Do not edit video clips while recording is in progress. First end the recording.

If you press the "Edit" button under the menu item "Videoclips", the editor for editing the video sequences is opened.

**Note:**

The term video sequence refers to the complete recorded sequence, whereas the section to be cut out is called the video clip.

The display shows you a progress bar, buttons for playback of the video sequence and buttons for editing the sequence.

### Progress bar

The progress bar provides the following information:

- the current playback position

You can change the current position by adjusting the slider to a new position.

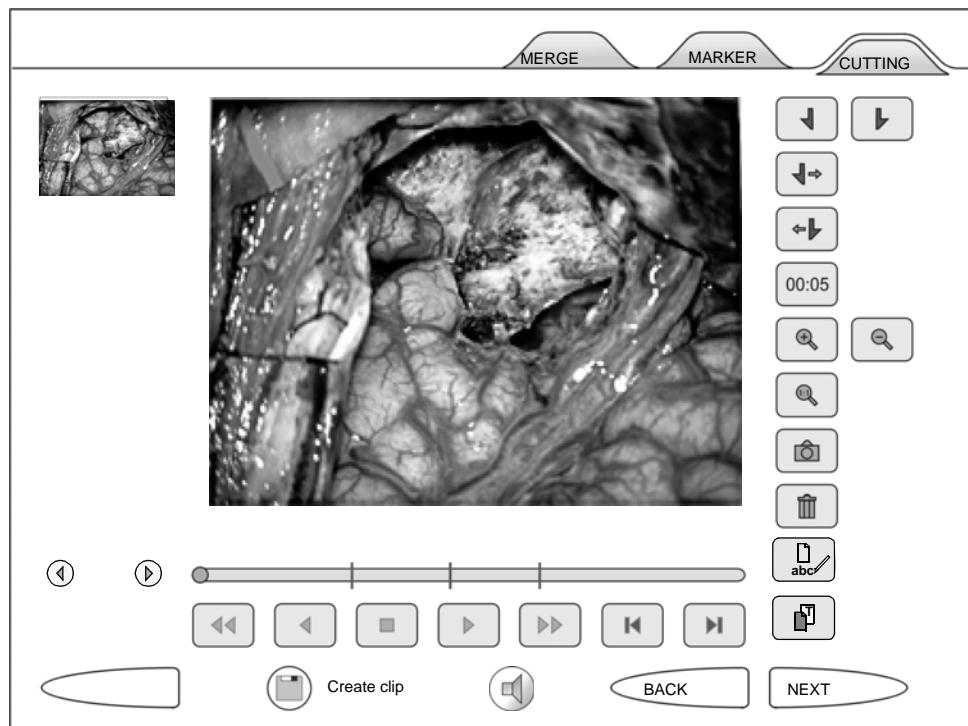
- the current cutting markers which you use to define the video clip to be cut out
- the markers used to display single images that were stored from the current sequence

On the right of the progress bar, the system displays the following information:

- total length of the video sequence
- current playback position of the displayed video image
- clip (time scale magnification on the progress bar, depending on the zoom factor)

### Playing back the video sequence

The following buttons are available for playing back the video sequence:



## Play



Press this button to play back a video sequence in forward direction at single speed.

# Rewind



Press this button to play back a video sequence in reverse direction at single speed.

## Pause



Press this button to interrupt the playback of a video sequence. The last image played in the sequence is displayed as a freeze image.

## Fast forward



You can use the fast forward function to search a video sequence for scenes which are of particular importance or interest to you. The sequence is played at double speed.

### Fast rewind



You can use the fast rewind function to search a video sequence for scenes which are of particular importance or interest to you. The sequence is played in reverse direction at double speed.

### Jumping to the previous/next marker



If single images were recorded within a video sequence, these were stored as markers in the sequence. Since single images often show important scenes within a sequence, MediLive MindStream permits you to jump between the scenes marked by single images in the sequence.

### Editing the video sequence

The following buttons are available for editing the video sequence:

#### Setting the start marker



You use the start marker to mark the beginning of the video clip which you want to cut from the video sequence. After activating the button, you can set a start marker on the progress bar. If you set a start marker, you also have to set a corresponding end marker. You can also remove a marker you have set by pressing the "trash" button.

#### Setting the end marker



You use the end marker to mark the end of the video clip which you want to cut from the video sequence. After activating the button, you can set an end marker on the progress bar. If you set an end marker, you also have to set a corresponding start marker. You can also remove a marker you have set by pressing the "trash" button.

#### Clip from start marker



You can also define a video clip to be cut out, without setting an end marker. Clip from start marker defines the beginning of the video clip, but does not require an end marker as its counterpart. After activating the button, you can set a clip from start marker on the progress bar. The end of the video clip is defined by the selected length of the video clip. Select the length of the clip in the Configuration menu or using "Enter length of the video clip". You can also remove a marker you have set by pressing the "trash" button.

### Clip from end marker



You can also define a video clip to be cut out, without defining a start marker. Clip from end marker defines the end of the video clip, but does not require a start marker as its counterpart. After activating the button, you can set a clip from end marker on the progress bar. The start of the video clip is defined by the selected length of the video clip. Select the length of the clip in the Configuration menu or using "Enter length of the video clip". You can also remove a marker you have set by pressing the "trash" button.

### Entering the length of the video clip



You can define the length of the video clip to be cut from the sequence. After you have activated the button, the virtual keypad is opened. The length of the video clip must be between 0.1 and 30 minutes.

### Zoom +



You can magnify the time scale in the progress bar by factor 2 by the press of a button for more detailed viewing of a section of the video sequence which is of particular importance or interest to you. The runtime is updated in accordance with the zoom factor. You can press this button several times successively.

### Zoom -



You can demagnify the time scale in the progress bar by factor 2 by the press of a button, after you have viewed an important section in more detail. The runtime is updated in accordance with the zoom factor. You can press this button several times successively.

### Zoom 1:1



You can reset the time scale to 1:1 in the progress bar. In this mode, no section of the video sequence is shown separately, but the complete video sequence is displayed in the same mode.

### Photo



Press this button to capture and save a single image from the sequence. A marker is set at the same time.

### Caution:

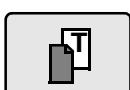
Always use this button to capture a single image from a recorded video sequence. Do not use the configured handgrip or foot control buttons for this purpose!

**Trash**

Press this button to delete all markers entered in a video sequence.

**Renaming files**

This function permits you to assign specific names to the images to meet your requirements.

**Adding / editing a comment**

This function is used to open the "Information" dialog for a video which allows you to add your own comments or edit existing comments.

**Close**

Press this button to close the editor for editing video sequences and to return to the Patient Files menu. The markers entered for cutting are deleted, unless you have previously saved the edited sequence.

**Create clip**

Press this button to save the edited sequence. The video clip defined by the set markers is saved under a separate name. The original is retained.

**Back**

Press this button to switch to the previous video sequence. If you switch to the previous sequence without saving, the markers entered for cutting will be lost.

**Next**

Press this button to switch to the next video sequence. If you switch to the next sequence without saving, the markers entered for cutting will be lost.

**Total length**

Indicates the length of the video sequence.

**Position**

Indicates the played video time.

### Clip length

Indicates the length of the marked video clip.

### Clip

The blue bar below the video normally represents the video length. If you press one of the zoom buttons (   ) once or multiple times, the section of the blue bar changes in accordance with the time scale.

### Marker

This tab contains all photos created from the selected video. Markers in the video are assigned to the photos. If you select a photo, the program branches automatically to the corresponding marker in the CUTTING tab. The corresponding position of the video is displayed.

## Merging video clips

The "MERGE" function permits you to select video clips from the list of existing video clips of a patient, and to merge them into a new video clip.

Path: PAT-FILES / VIDEOCLIPS / EDIT / MERGE

MERGE tab

### Videos box

The Videos box gives an overview of all video clips available of the patient concerned.

### New Clip box

The New Clip box permits you to combine individual video clips available in the Videos box to create a new video clip and to save it in the Videos box.

**Video file:** dd-mm-yy hh-mm-ss **V.mpg**

**Clip file:** dd-mm-yy hh-mm-ss **C.mpg**

**Merged file:** dd-mm-yy hh-mm-ss **M.mpg**

### **Compiling a new video clip**

Select the video clips required by clicking on them in the Videos box and transfer them to the New Clip box by pressing the <INSERT> or <APPEND> button.

### **Editing the new video clip**

#### Extending the new video clip:

Select the video clip required in the Videos box and click on the video clip in the New Clip box before or after which the selected video clip is to be inserted.

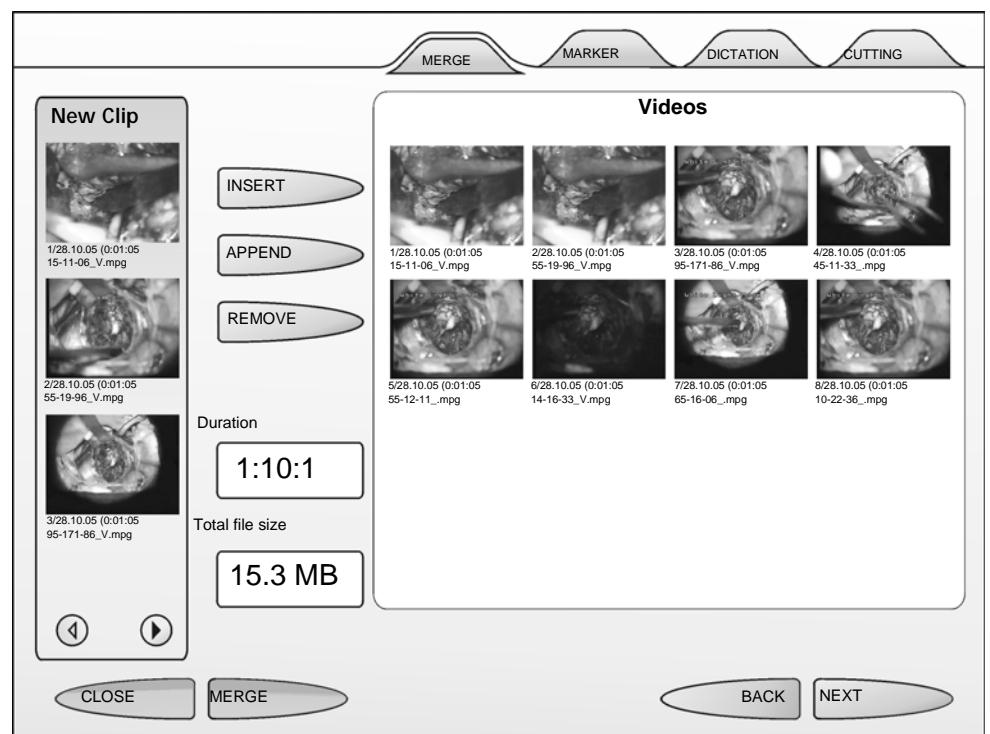
Use <INSERT> to place the selected video clip before the relevant video clip in the New Clip box.

Use <APPEND> to place the selected video clip after the relevant video clip in the New Clip box.

#### Removing a video clip from the New Clip box:

Click on the relevant video clip in the New Clip box and press the <REMOVE> button.





### **Creating a new video clip**

Use <MERGE> to combine all selected video clips in the New Clip box into a new video clip. The new video clip is then included in the Videos box.

The virtual keypad is automatically displayed to enable you to enter a name for the new video clip.

The new clip has the extension "M" for Merge.

### **Display: Duration and file size**

After you have inserted or appended a video clip in the "New Clip" box, the total duration of the video to be created and its total file size are computed and displayed.



**Note:**

The new video file resulting from the merging process must not exceed a segment size of 1 GB. If a larger amount of data is merged, the target file is treated like a single video, but it actually consists of several video fragments. Only one file is visible for the user. A thumbnail is generated for each newly created video. The date and time stamp of the newly created video shows the current date and time:

dd-mm-yy hh-mm-ss M.mpg

### **Re-editing the new video clip**

The new video clip in the Videos box can be transferred back to the New Clip box using <INSERT> or <APPEND> and can be re-edited. Press the <MERGE> button to transfer the re-edited video clip as a second version of the new video clip to the Videos box.

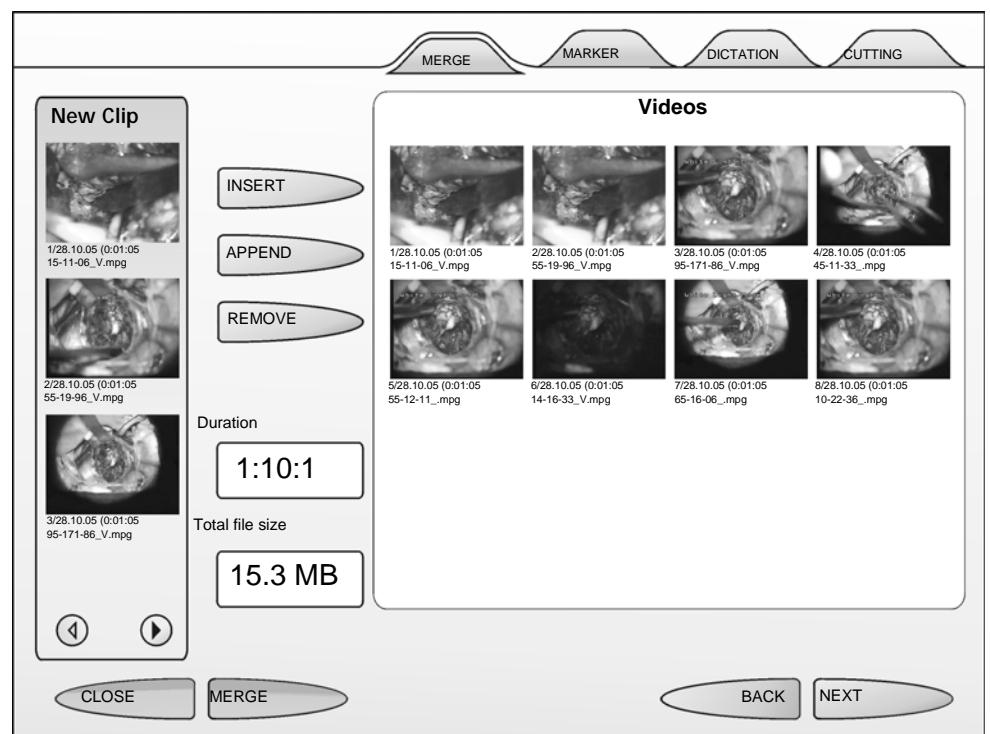


**Note:**

You can avoid long creation times (waiting times) if

- the individual video clips you are merging do not exceed a length of 5 minutes
- the total length of the new video clip does not exceed 60 minutes.

A new video clip of approx. 60 minutes can be burnt on a DVD without any problems.



## MediLive Video Tools



### Note on MediLive Video Tools:

The MediLive Video Tools software provides improved compatibility between your PC (Windows™ or MacOS™) and the video DVDs created with OPMI® Pentero®.

Please install MediLive Video Tools on your PC if you notice the following problems:

- The computer cannot read the DVD content or the DVD is not identified because the UDF 2.0 disk format is not recognized.
- The video player or Office™ software is unable to play MPEG2 videos as the MPEG2 decoder is missing.

One MediLive Video Tools CD is supplied as part of the digital video recording option.

The ZEISS cat. no. of this CD is 308203-8040-000.



# INFRARED 800 fluorescence module (option)



## Note:

The system including the IR 800 option has been approved for use in the EU, USA and Japan in accordance with the respective national regulations. The fluorescence option is also available in other countries. However, according to national regulations, additional authorization may be required in the country in which the instrument and application will be used. Please contact your local Carl Zeiss representative for further information.

<b>Integrated INFRARED 800 (IR 800) fluorescence module</b>	<b>262</b>
Intended use	262
Description	266
Connecting an external monitor (recommended option)	276
INFRARED 800 settings before every surgical procedure	278
Checklist for the IR 800 function test	279
<b>Procedure</b>	<b>280</b>

# Integrated INFRARED 800 (IR 800) fluorescence module

## Intended use

Carl Zeiss Surgical GmbH
SN 51xxxx
INFRARED 800 PAL
REF 302581-9245-000

Carl Zeiss Surgical GmbH
SN 51xxxx
INFRARED 800 NTSC
REF 302581-9246-000



The integrated INFRARED 800 (IR 800) fluorescence module of OPMI Pentero is used to visualize fluorescent areas in the surgical field and permits recording a video of the emitted fluorescent light.

The IR 800 fluorescence module has been designed for excitation in the wavelength range from 700 to 780 nm and for fluorescence visualization in the wavelength range from 820 to 900 nm.

Note:

The fluorescence application generates an image signal in the near infrared. This image cannot be observed through the surgical microscope, but it is recorded using a special camera and visualized on the touch-screen and/or on an optionally connected monitor.



**Warning!**

- Only use fluorescence media approved for the planned application.

Contraindications

The medical contraindications applicable to the use of OPMI Pentero in combination with a fluorescence medium are those to be taken into account when using suitable brand substances and state-of-the-art examination techniques.

- Check whether the fluorescence medium can be excited in the wavelength range from 700 to 780 nm and whether it emits fluorescent light of sufficient intensity in the wavelength range from 820 to 900 nm.
- As in almost all diagnostic procedures, false-positive and false-negative results can also occur in PDD-based recognition (PDD: photodynamic diagnosis). Evaluation using other methods is necessary.



**Warning!**

Do not use the video images for diagnostic purposes, as the video cameras and the monitor have not been calibrated. The visualized images may therefore include deviations in shape, contrast and color.



Note:

- Autofocus is disabled in the fluorescence mode.

- Optimum illumination in the fluorescence mode is achieved if the illuminated field diameter on the OPMI is set to the middle position and the wide OPMI diaphragm is selected, i.e. a small depth of field is set. Both adjustments are made automatically when the IR 800 mode is started.
- The illumination intensity is automatically adjusted to 50% when IR 800 is started. For an optimum video signal, the illumination intensity may range between 80% and 100%.
- The illumination intensity is influenced by the following factors:
  - the selected brightness of the light source
  - the working distance (see SETUP menu, page 268)
  - the zoom link function (which is automatically deactivated when the IR 800 mode is started).  
The zoom link function changes the illumination intensity when the zoom value is changed.
- With increasing operating time of the light source, the illumination intensity and, as a result, the brightness of fluorescence decrease. When a specified, guaranteed lamp service life is exceeded, the user will be warned in a message on the touchscreen that the brightness of the light source is no longer sufficient for correct fluorescence application. At the same time, the user is prompted on the touchscreen that a new lamp for fluorescence application needs to be installed. This message appears on power-up of the system, and will only disappear after acknowledgement by the user.

**Warning!**

- Make sure that no tissue damage is caused by excessive illumination intensity (see ).
- Always perform a function test before using this module (see checklist page 279).
- The system must not be used for ophthalmic procedures.

**Warning!**

Reliable visualization of fluorescent areas with IR 800 is not or no longer possible in the following situations:

- Insufficient brightness in deep channels
- Working distance too large (focus threshold)  
(recommended working distance: less than approx. 300 mm)

- Zoom setting too high  
(recommended zoom setting: factor equal to/smaller than 5.0x)
- Selected illuminated field diameter too large  
Optimum illumination in the fluorescence mode is achieved if the illuminated field diameter on the OPMI is set to the middle position and the wide OPMI diaphragm is selected, i.e. a small depth of field is set. Both adjustments are made automatically when the IR 800 mode is started.

**Caution:**

Infrared light sources (e.g. navigation systems) may cause disturbances during the INFRARED 800 application.

We recommend the following measures to avoid this effect:

- Perform a function test prior to application in order to check whether any reflections are caused by a source of disturbance, and reposition the source of disturbance if necessary.
- If any reflections occur, prevent the incidence of light by tilting or covering the eyepieces.
- Make sure that no navigation systems are directed at the surgical field during the INFRARED 800 application.



## Description

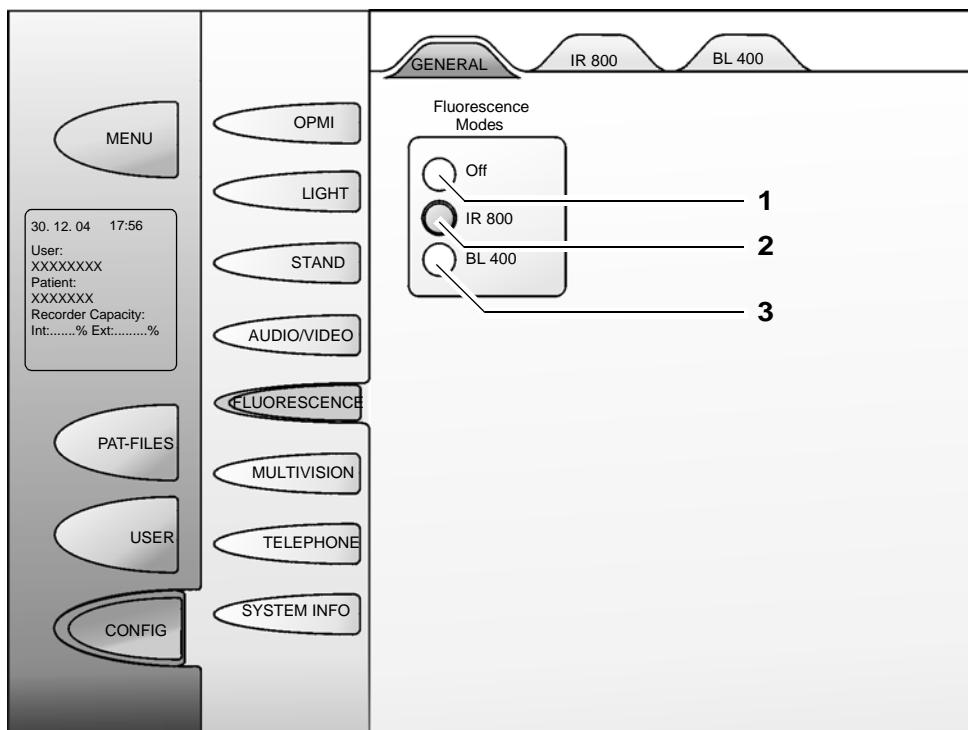
### FLUORESCENCE

- 1** Deactivating fluorescence applications
- 2** Activating the integrated INFRARED 800 (IR 800) fluorescence module  
The IR 800 fluorescence application comprises three different phases: the preparatory phase (SETUP, see page 268), the recording phase (RECORD, see page 270) and the playback phase (PLAYBACK, see page 272). The configuration menu permits you to adjust each setting parameter of the individual phases which are then saved for the relevant user.
- 3** Activating the integrated BLUE 400 (BL 400) fluorescence module Option, see page 339.



Note:

A button either on the handgrip of the surgical microscope or on the foot control unit can be programmed for the fluorescence application. This configured fluorescence button can then be used to start one of the two optional fluorescence applications, depending on which program (IR 800 or BL 400) has been selected.  
You can only use BL 400 or IR 800 alternatively.



**Note:**

The IR 800 fluorescence application has been optimally configured through the preconfigured factory setting in the IR 800 mode. Manual settings or adjustments are possible, but should be checked before application using the fluorescence target.

The changed settings are saved in your user profile.

### **IR 800 Setup menu**

The Setup menu is used to configure the setup procedure in order to achieve optimum quality of the video image. Any deviation from the pre-configured parameters (items 2, 3 and 4) may lead to a loss in video image quality.

#### **1 Auto Zoom**

- On: the total magnification is changed automatically to the preconfigured value (2) without pop-up message.
- Off: a setting dialog is displayed for changing the total magnification beyond the preconfigured range (2).

Factory setting: Off

#### **2 MultiVision**

- On: The content of the touchscreen monitor is also displayed in the data injection system during the PLAYBACK mode. Please switch to the full screen mode for better visualization.
- Off: No display in the data injection system.

Factory setting: Off

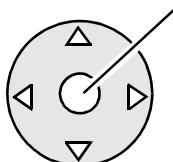
#### **3 Total magnification**

If the current total magnification is within the configurable limit value (blue range is our recommendation), the zoom is not changed during the setup phase.

If the magnification value is outside the preset limit, the following happens:

- With Auto Zoom on: the zoom factor setting is automatically changed to the preconfigured value (2).
- With Auto Zoom off: a pop-up box with a setting bar appears. The setting bar automatically disappears after correction of the value within the setting range.  
To retain the current settings, press "Ignore" on the touchscreen or the center button of the joystick on the right handgrip.

Center button



Adjustment range: 2x - 13x

Factory setting: 5x

**Note:**

Make sure that the correct settings for the eyepieces and the tube have been selected in the tube menu (Config/OPMI/Tube) to permit the system to calculate the correct total magnification. The total magnification is displayed in the main menu.

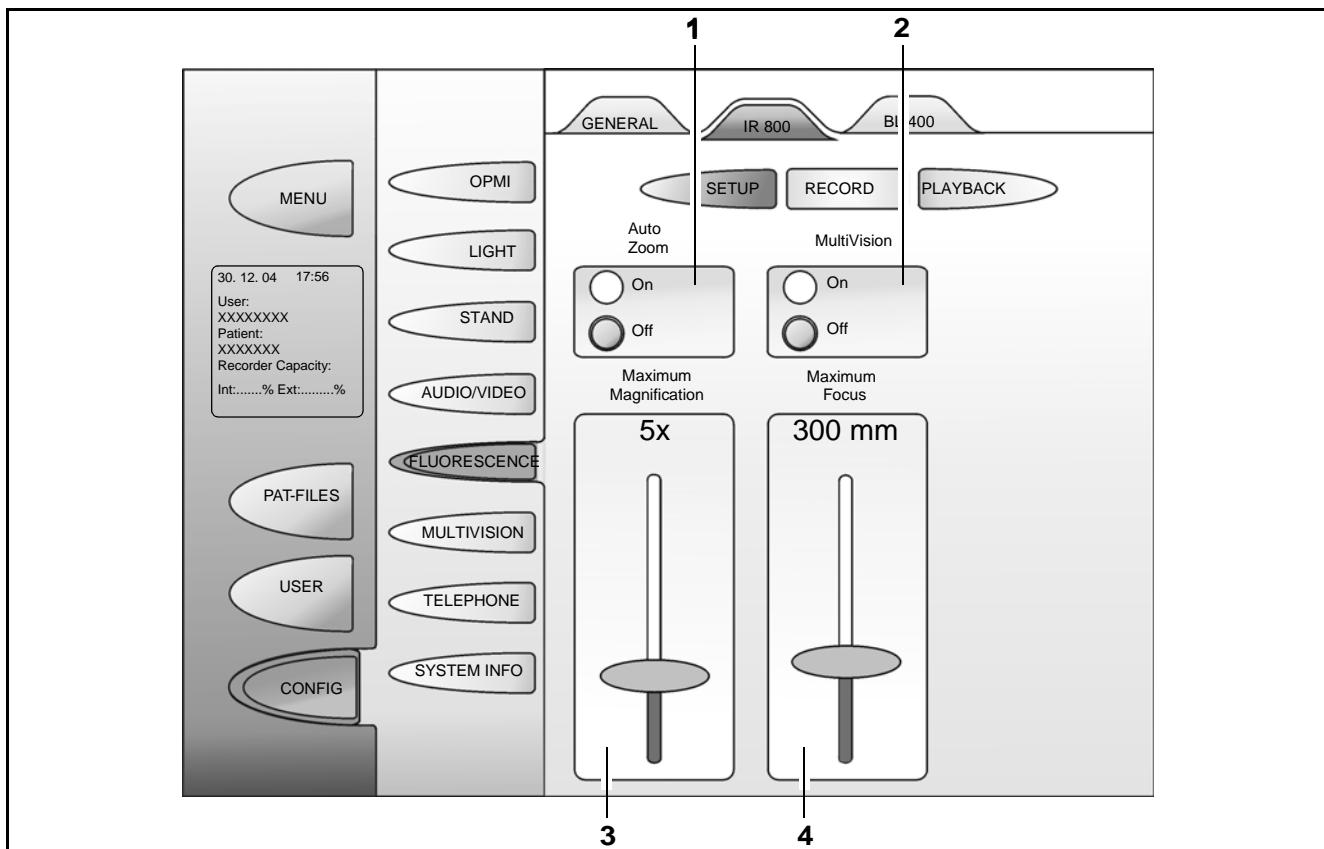
**4 Focus threshold (working distance)**

If the current focus value lies within the limit configured here, no message is displayed to the user during the setup phase. If the focus value exceeds the set limit, the user is prompted in a pop-up window to reduce the focus value accordingly (see Auto Zoom: Off).

Adjustment range: 200 mm-500 mm Factory setting: 300 mm

**Caution:**

After adjustment of the focus, make sure to refocus the object by moving the microscope upwards or downwards after unlocking the brakes.



## IR 800 -Record menu

This menu permits you to make the following settings for the recording phase:

### 1 External monitor

- Standard: output of the white light camera signal on the external monitor.
- IR800: output of the IR 800 camera signal on the external monitor. No text displays or time data are displayed on the external monitor.

Factory setting: IR800

### 2 IR camera gain

- Auto: the camera gain is automatically adjusted to the current conditions. "Manual Gain Setting" slider (3) is disabled.
- Manual: you can set the camera gain to a fixed value. Use "Manual Gain Setting" slider (3) to select this value.

Factory setting: Auto

### 3 Manual gain setting

Slider for manual adjustment of the camera gain.  
(See Pos. 2 Camera Gain)

Adjustment range: 1% - 100%

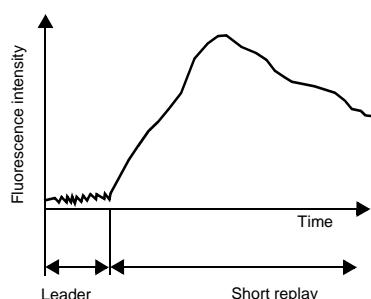
Factory setting: 70%



#### Note:

When Auto Camera Gain is deactivated (end Auto Gain or select manual setting), you can manually adjust the gain value on the touch-screen or using the yellow light button on the right handgrip.

In both cases, Gain button (5) is displayed on the bottom right of the video image for activation of slider (6).



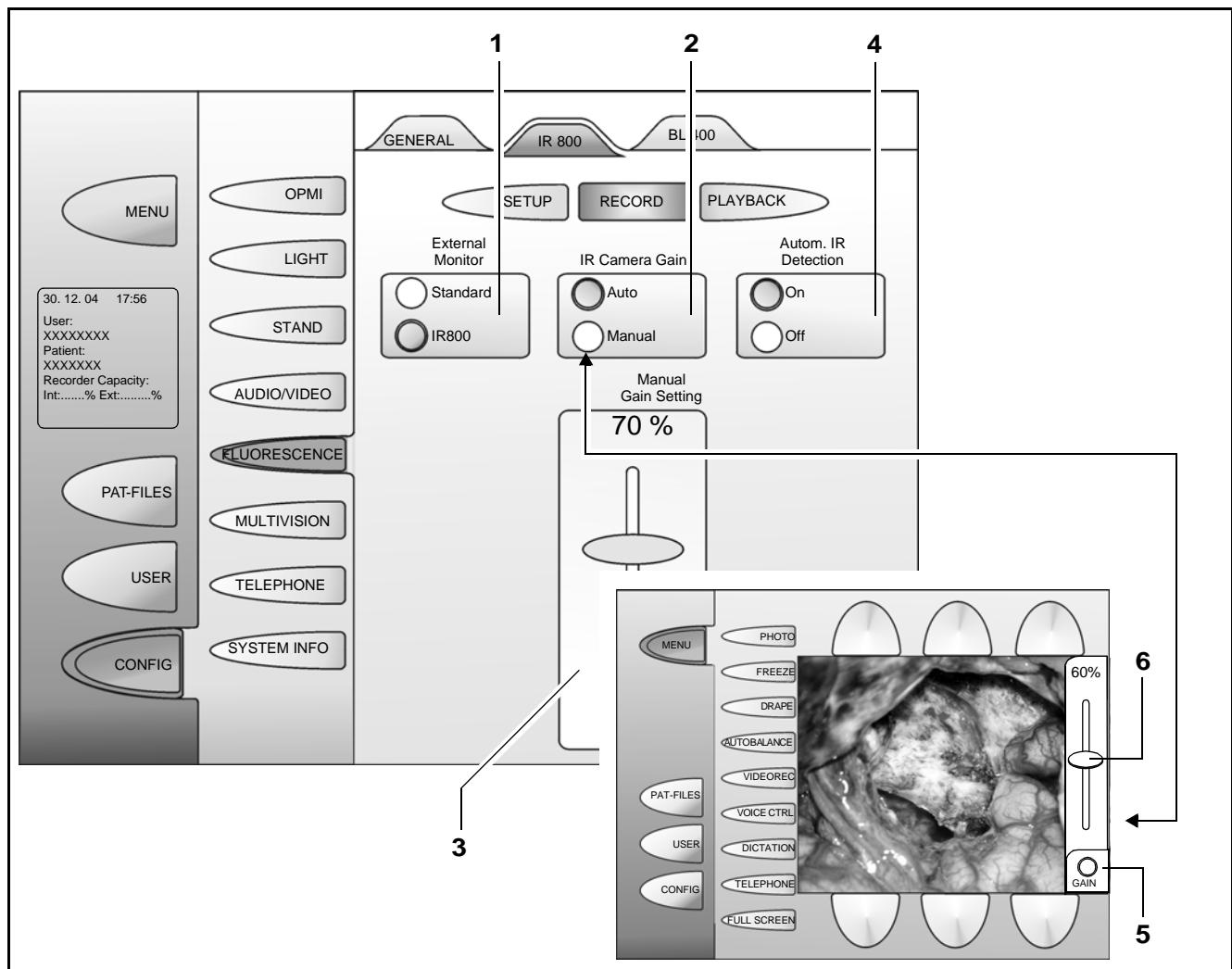
#### 4 Autom. IR detection

- On: The video signal is analyzed for fluorescence flow in the RECORD mode.  
If fluorescence flow is detected, the black leader is not displayed in the playback mode.
- Off: No automatic FL detection, the complete recorded video is played in the playback mode.

Factory setting: On

Note:

The played video includes the black leader whether automatic FL detection has been activated or deactivated.



## IR 800 Playback menu

The Playback menu is used to configure video playback.

### 1 External monitor

- Standard: The white light camera signal is output on the external monitor during the PLAYBACK mode instead of the white light video recorded synchronously with the IR 800 video.
- IR 800: The IR 800 video is output on the external monitor during the PLAYBACK mode.

Factory setting: IR 800

### 2 MultiVision

- On: The content of the touchscreen monitor is also displayed in the data injection system during the PLAYBACK mode. Please switch to the full screen mode for better visualization.
- Off: No display in the data injection system.

Factory setting: Off

### 3 PiP in Replay (playback mode only)

- On: When PiP (Picture in Picture) has been activated, the simultaneously recorded white light video is displayed in a small window at the top right of the touchscreen.
- Off: No PiP display.

Factory setting: On

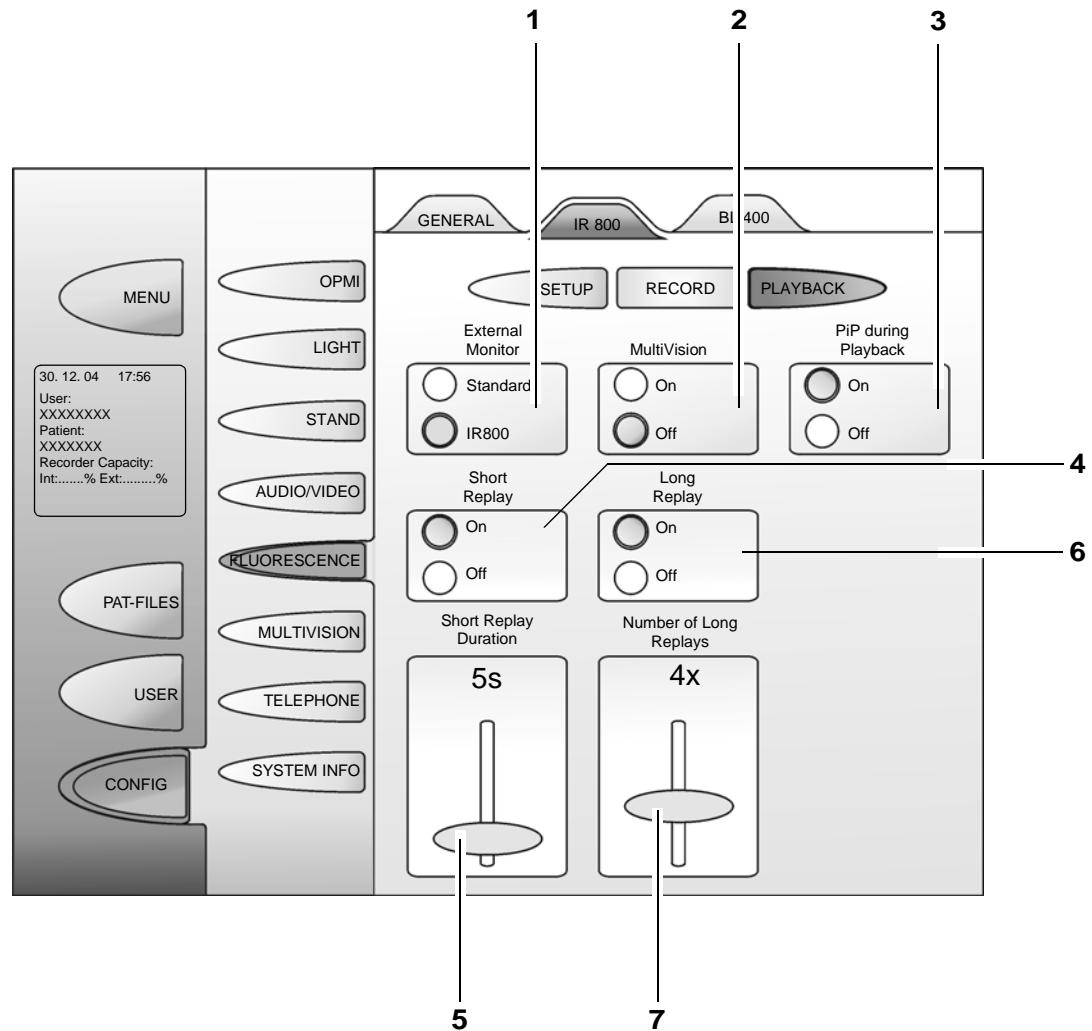


#### Note:

A video clip is recorded and saved in the white light mode at the same time as the fluorescence video clip.

Videos started with REC START are recorded irrespective of this process. If IR 800 is selected for the external monitor (1), this video is briefly interrupted by the displayed replay screens \*)

\*) Digital video recording option is required.



#### 4 Short replay

- On: Only the initial phase of the recorded IR 800 video is displayed at the beginning of the PLAYBACK mode. You can adjust the length of the sequence using the "Short Replay Duration" slider. The replays can only be stopped by pressing the FL button. They will be stopped automatically after 25 replays.  
If fluorescence detection has been activated, the video starts after detection of the fluorescence flow. The preceding black leader will not be displayed.
- Off: No replay function available. The "Short Replay Duration" slider is disabled.

Factory setting: On

#### 5 Short replay duration

This slider permits you to select the length of the video clip to be played when Short Replay has been activated:

Adjustment range: 3s - 30s

Factory setting: 5s

#### 6 Long replay

- On: The complete recorded fluorescence video is played repeatedly. You can select the number of playbacks using the "Number of Long Replays" slider.  
If fluorescence detection has been activated, the video sequence starts after detection of the fluorescence flow. The preceding black leader will not be displayed.
- Off: No long replay function available. The "Number of Replays" slider is disabled.

Factory setting: On

#### 7 Number of replays

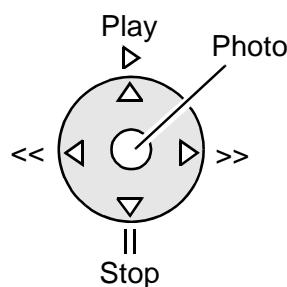
After the end of recording, the complete recorded fluorescence video clip can be automatically replayed up to 10 times (as an endless loop). The process can be stopped any time by pressing the fluorescence button on the handgrip or foot control unit.

Adjustment range: 1-10

Factory setting: 5

During the PLAYBACK phase (short and long replays), you can use the joystick of the right handgrip to control the playback process (play, stop, fast forward, fast rewind, photo).



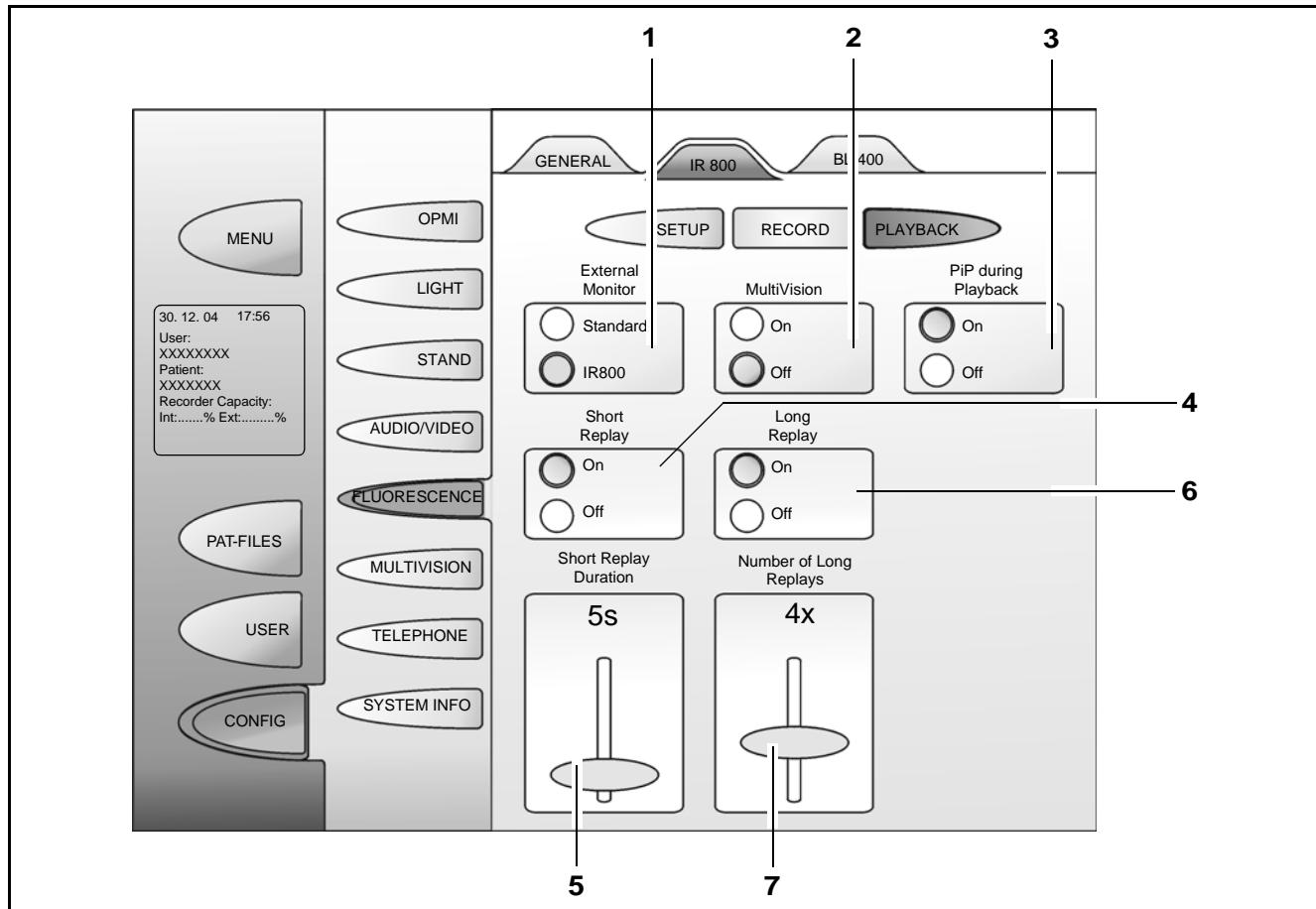


- Briefly press **[Stop] + << or >>** Video moves backward or forward in steps  
- stops when buttons are released
- Hold down **[Stop] + << or >>** Video clip is slowly played forward or backward  
- stops when buttons are released
- Hold down **[Play] + << or >>** Fast forward or fast rewind of video clip  
- stops when buttons are released

Note:

Tip for IR800 Replay:

If an external monitor is connected, you can switch to the full-screen mode on the touchscreen.



## Connecting an external monitor (recommended option)



### Note:

When using the IR 800 application, we recommend that you **always** connect an external monitor for viewing the IR 800 sequences.



### Caution:

Only connect the monitor to a wall outlet which is provided with a properly connected protective ground conductor.

Please observe the maximum current consumption of the power outlet socket of OPMI Pentero. Only connect medical devices approved by us to this outlet. When using other devices, make sure that safety is guaranteed regarding admissible ground leakage currents. The admissible limit value of the ground leakage current present in the suspension system's power cord is 500 µA in compliance with EN60601-1/IEC 601-1. CSA NRTL certification only allows a maximum ground leakage current of 300 µA.

- 1 Video signal output port BNC (VBS) for connecting an external monitor.

Suitable for devices capable of processing VBS signals, or if video signals have to be transmitted over relatively long distances (e.g. BNC lines already installed on site). The two ports are independent of each other and can be used as required.

- 2 Video signal output port for an external monitor (Y/C) for connecting a further external monitor.

We recommend using devices suitable for Y/C signals, if possible. This standard provides higher video image quality than VBS. The two ports are independent of each other and can be used as required.

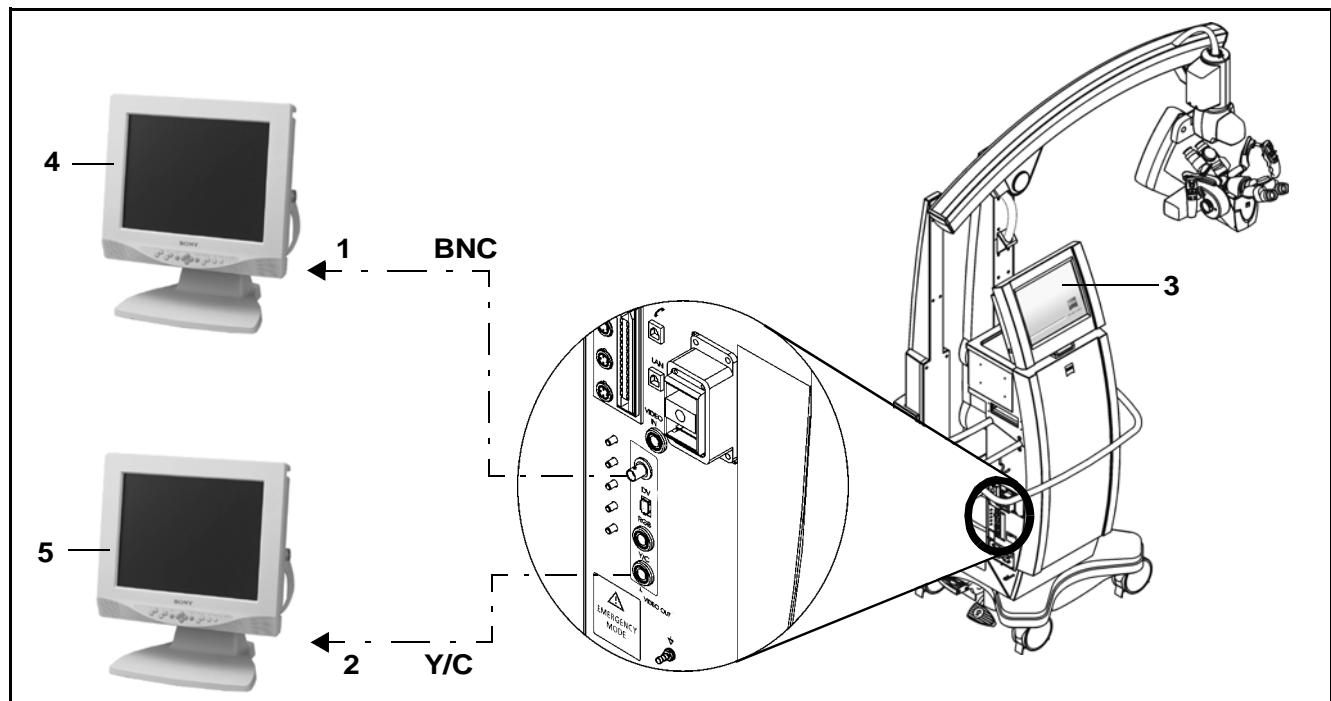


### Note:

#### Tip for IR800 Replay

If an external monitor is connected, you can switch to the full-screen mode on the touchscreen.

Pos.	Display	IR 800 mode		White light mode
		Recording mode	Playback mode	
3	Touchscreen	Live image of IR 800 camera with text display	Replays IR 800 image	White light image
4	OR monitor on video-out port: BNC (recommended option)	Depending on configuration used: <ul style="list-style-type: none"><li>– White light image</li><li>– Live image of IR 800 camera without text display</li></ul>	Depending on configuration used: <ul style="list-style-type: none"><li>– White light image</li><li>– Replays IR 800 image</li></ul>	White light image
5	OR monitor on video-out port: Y/C (recommended option)	Depending on configuration used: <ul style="list-style-type: none"><li>– White light image</li><li>– Live image of IR 800 camera without text display</li></ul>	Depending on configuration used: <ul style="list-style-type: none"><li>– White light image</li><li>– Replays IR 800 image</li></ul>	White light image



## INFRARED 800 settings before every surgical procedure

- The button configuration on the handgrip or foot control panel and the menu settings have been performed and checked (see page 292).
- The function test with the INFRARED 800 fluorescence module has been performed in accordance with the checklist (page 279) and OPMI Pentero is ready for surgery.
- The INFRARED 800 fluorescence module can be used when the target anatomy has been exposed during surgery and can be observed through the microscope without visual obstruction.



## Checklist for the IR 800 function test



### Warning!

The IR 800 fluorescence target and the touchscreen are not sterile. Therefore perform the function test before surgery (without patient!).

Always check the following points before the use of the integrated fluorescence module (without patient!):

- Place the IR 800 fluorescence target on a level surface.
- Set the focus to **300 mm** and the zoom to **3.5x** on the handgrip (**the 3.5x zoom value is only used for the function test**). Refocus the image by moving the microscope upwards or downwards after unlocking the brakes.
- Check the function of the external monitor (option).
- Activate the fluorescence function by pressing the configured button of the handgrip or foot control unit.

### Comparison:

The function test is successful if the images on the touchscreen and on the external monitor correspond to the supplied test pattern of the fluorescence target. Minor differences in brightness and inhomogeneities are permissible.



### Caution:

Infrared light sources (e.g. navigation systems) may cause disturbances during the INFRARED 800 application.

We recommend the following measures to avoid this effect:

- Perform a function test prior to application in order to check whether any reflections are caused by a source of disturbance, and reposition the source of disturbance if necessary.
- If any reflections occur, prevent the incidence of light by tilting or covering the eyepieces.
- Make sure that no navigation systems are directed at the surgical field during the INFRARED 800 application.

# Procedure

## SETUP phase



### Note:

You can stop the Infrared 800 application in any phase by pressing the fluorescence button for 2 seconds.

Press the fluorescence button to start the SETUP phase and set up your system to provide optimum quality of the video image.

A pop-up message "Start IR 800 - SETUP" appears for approx. 3s to indicate that setup has been started.

- The following settings are checked:

### 1 Focusing

The system checks whether the focus is outside a preconfigured tolerance range. If this is the case, you are prompted to position the focus in the pre-defined range. After setting the focus, you have to refocus the object by moving the microscope upward or downward.

### 2 Total magnification

The system checks whether the total magnification of the system is outside a preconfigured tolerance range. If this is the case and "Auto Zoom" has been activated, the zoom value of the OPMI is automatically set to the preconfigured value. If "Auto Zoom" has been deactivated, you are prompted to manually set the zoom value.



### Note:

- To retain the current settings, press "Ignore" on the touchscreen or the center button of the joystick on the right handgrip.
- After completion of the setup phase, the pop-up message "Live image (OPMI)- Ready for IR 800" is displayed for 5 minutes in the white light live image.
- To start the subsequent recording phase, press the FL button on the handgrip or foot control unit once again.
- If more than 5 minutes elapse between the end of the SETUP phase and the start of the RECORD phase, the above setup process is repeated.



### Note:

- The fluorescence medium approved for the application must not be administered to the patient **until after the start** of the RECORD phase (system takes about 3 seconds).

**Note:**

Automatic light field limitation has been activated:

If the magnification or light intensity is changed in the IR800 mode (fluorescence option), the light value may significantly increase above the previous level when IR800 is deactivated.

## RECORD phase

The RECORD phase is activated when the fluorescence button is pressed for the second time.



**Note:**

The light intensity start value on activation of the recording mode is always 50%.

The RECORD phase takes no longer than 5 minutes. Then the program changes automatically to the PLAYBACK mode.

**1 Light intensity**

The light intensity can be changed during the RECORD mode via the main menu or the buttons of the left handgrip.

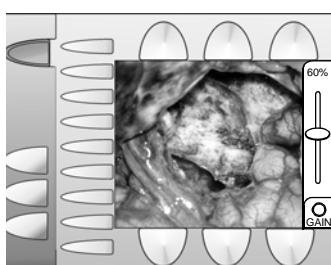
**2 Automatic camera gain control (AGC)**

Depending on whether or not you configured automatic camera gain control and automatic fluorescence detection in the IR 800 Record menu, the following options are available:

- AGC activated: In the automatic mode, camera gain is controlled in such a way that no major overshooting of the video signal occurs.
- AGC deactivated: Camera gain is constantly adjusted to the value manually preset by the user.

**Note:**

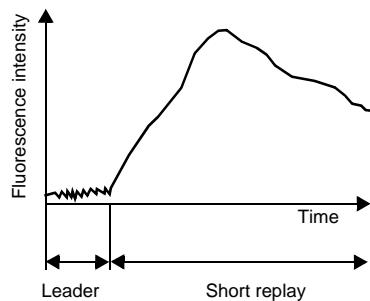
When Auto Camera Gain is deactivated (end Auto Gain or select manual setting), you can manually adjust the gain value on the touchscreen or using the yellow light button on the right handgrip.



In both cases, the Gain button is displayed on the bottom right of the touchscreen for activation of a slider.

The slider can be displayed or hidden by pressing the Gain button on the touchscreen.

### Automatic Fluorescence Detection (AFD)



- AFD activated: Video recording is started immediately when you have switched to the Record mode. The video signal is constantly analyzed for fluorescence flow. If fluorescence detection has been activated, the PLAYBACK sequence starts after detection of the fluorescence flow. The preceding black phase (leader, see diagram) is not displayed during playback of the short and long replays. The complete video sequence (including the black leader) is saved in the patient file.
- AFD deactivated: The short and long replays are played completely, including any existing black phase.

The Record mode is stopped either by the user by means of the FL button or after the maximum time span of 5 minutes has elapsed.

After the end of the RECORD phase, the system changes to the PLAYBACK phase.

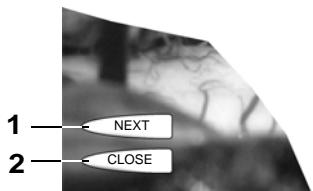


**Note:**

After the RECORD phase, press the fluorescence button for at least 2 seconds to end IR 800.

PiP visualization of the current OPMI white light video is not possible during the RECORD phase.

### Function of NEXT button



If you activate the full screen mode during the RECORD phase by pressing the full screen button, NEXT button (1) appears above CLOSE button (2).

- Press NEXT button (1) to activate the PLAYBACK phase (first short, then long replays).

- If you press the NEXT button again, you will return to the standard mode.

Press "CLOSE" button (2) to return from the full screen mode to the main menu.



**Note:**

A video clip is recorded and saved in the white light mode at the same time as the fluorescence video clip.

Videos started with RECSTART are recorded irrespective of this process. If IR 800 is selected for the external monitor, this video is briefly interrupted by the displayed replay screens.\*)

\*) Digital video recording option is required.

## PLAYBACK phase

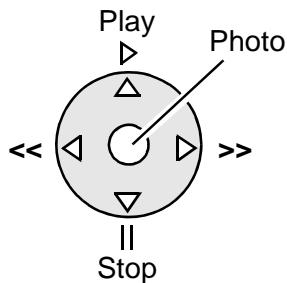
The PLAYBACK phase is activated on the third press of the fluorescence button. This phase comprises two successive visualization modes:

### 1 Short replay

If short replays have been configured, only the initial phase of the recorded video is replayed during the predefined time until you press the FL button or the maximum number of loops has been reached. They will be followed by long replays, if appropriately configured.

### 2 Long replay

- In the long replay mode, the recorded video is replayed several times in its full length. The number of replays can be selected. If you press the FL button during the PLAYBACK phase, this visualization mode is stopped immediately and the white light mode is reactivated.
- If AFD has been activated and fluorescence has been detected, the recorded video is played back from the point of FL detection. Any black phase is therefore not displayed.
- During the PLAYBACK phase (short and long replays), you can use the joystick of the right handgrip to control the playback process (play, stop, fast forward, fast rewind, photo).



Briefly press **[Stop]** + **<<** or **>>** Video moves backward or forward in steps  
 - stops when buttons are released

Hold down **[Stop]** + **<<** or **>>** Video clip is slowly played forward or backward  
 - stops when buttons are released

Hold down **[Play]** + **<<** or **>>** Fast forward or fast rewind of video clip  
 - stops when buttons are released

### 3 PiP in Replay (playback mode only)

- On: When PiP (Picture in Picture) has been activated, the simultaneously recorded white light video is displayed in a small window at the top right of the touchscreen.
- Off: No PiP display.

**Note:**

- You can end recording and playback by pressing the fluorescence button once again.
- After the end of the PLAYBACK phase, the system returns to the white light mode with the same settings that existed before the start of IR 800.
- During recording and playback of the fluorescence video, no other system action can be executed, except brightness, zoom and focus adjustment.



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# FLOW 800 (option)

**Note:**

FLOW 800 software release 2.21 is not an update, but a software upgrade for the INFRARED 800 option of OPMI Pentero for the analysis of infrared video angiography. Only systems with software version 2.20 can be upgraded.

**Note:**

The system including the FLOW 800 option has been approved for use in the EU and Japan in accordance with the respective national regulations and has been provided with the CE mark. The fluorescence option is also available in other countries. However, according to national regulations, additional authorization may be required in the country in which the system and application will be used. Please contact your local Carl Zeiss representative for further information.

**Normal use**

288

<b>Description</b>	<b>292</b>
General configuration	292
Configuring INFRARED 800	296
Activating FLOW 800	298
Description of INFRARED 800	300
Description of FLOW 800	306
<b>Preparations for use</b>	<b>318</b>
Connecting an external monitor (recommended option)	318
INFRARED 800 settings before every surgical procedure	320
Checklist for the IR 800 function test	321
<b>Procedure</b>	<b>322</b>
SETUP phase	322
RECORD phase	324
PLAYBACK phase	326
FLOW 800 processing phase	328

## Normal use

Carl Zeiss Surgical GmbH	
SN	10xxxx
FLOW 800 Pentero	
REF	302581-9250-000

The FLOW 800 processing mode provides a convenient user interface for the handling and visualization of the fluorescence videodata recorded via the INFRARED 800 fluorescence option.

Only one INFRARED 800 patient video at a time can be analyzed using FLOW 800. For this purpose, images are stored in addition to the video in the relevant patient file. The INFRARED 800 fluorescence module has been designed for excitation in the wavelength range from 700 to 780 nm and for fluorescence visualization in the wavelength range from 820 to 900 nm.



**Note:**

The fluorescence application generates an image signal in the near infrared. This image cannot be observed through the surgical microscope, but it is recorded using a special camera and visualized on the touch-screen and/or on an optionally connected monitor.

The FLOW 800 processing mode can be used to compare and detail intraoperative observations based on INFRARED 800, or to study more complex interactions postoperatively and subject them to more detailed analysis. The generated data can be exported for use in publications.



**Warning!**

The system must **not** be used for ophthalmic procedures.



**Warning!**

Only use fluorescent agents approved for the planned application.

**Contraindications**

The medical contraindications applicable to the use of OPMI Pentero in combination with a fluorescent agent are those to be taken into account when using suitable brand substances and state-of-the-art examination techniques.

- Check whether the fluorescent agent can be excited in the wavelength range from 700 to 780 nm and whether it emits fluorescent light of sufficient intensity in the wavelength range from 820 to 900 nm.

A fluorescence signal with an appropriate level is required for AFD (Automatic Fluorescence Detection, see page 324) and FLOW 800 visualization. An inadequate fluorescence signal may lead to inaccurate AFD computation and FLOW 800 visualization.

As in almost all procedures, false-positive and false-negative results may occur. Evaluation using other methods is necessary.

**Warning!**

- Do not use video images for diagnostic purposes, as the video cameras and the monitor have not been calibrated. The visualized images may therefore include deviations in shape, contrast and color.
- In the event of failure of the FLOW 800 processing application, the INFRARED 800 replay videos are still available to the user.
- When saving data to external data media (in particular USB storage media not approved by ZEISS):  
check that the data export was successful!
- The export of videos with the associated FLOW 800 processing data is only possible via USB and DVD. If DICOM is used for export, videos can only be exported without FLOW 800 processing data.
- The readings displayed in the processing mode (SI units) are rounded values. They are only provided for clearer indication, not for measuring purposes.

**Note:**

Like any device used in the OR, this system may fail. We would therefore recommend to have a suitable surgical microscope at hand as a replacement during surgery.

**Note:**

- Autofocus is disabled in the fluorescence mode.
- Optimum illumination in the fluorescence mode is achieved if the illuminated field diameter on the OPMI is set to the mid-position and the large OPMI aperture is selected, i.e. a small depth of field is set. Both adjustments are made automatically when the INFRARED 800 mode is started.
- The illumination intensity is automatically adjusted to 50% when INFRARED 800 is started. For an optimum video signal, the illumination intensity may range between 80% and 100%.
- The illumination intensity is influenced by the following factors:
  - the selected brightness of the light source
  - the working distance (see SETUP menu, page 296)
  - the zoom link function (which is automatically deactivated when the INFRARED 800 mode is started).  
The zoom link function changes the illumination intensity when the zoom value is changed.
  - With increasing operating time of the light source, the illumination intensity and, as a result, the brightness of fluorescence decrease. When a specified, guaranteed lamp service life is exceeded, the user will be warned in a message on the touchscreen that the brightness of the light source is no longer sufficient for correct fluorescence application. At the same time, the user is prompted on the touchscreen that a new lamp for fluorescence application needs to be installed. This message appears on power-up of the system, and will only disappear after acknowledgement by the user.

**Warning!**

- The touchscreen surface is non-sterile!  
The touchscreen must only be operated by non-sterile personnel. Sterile persons must always use sterile medical applicators to operate the touchscreen. Use standard sterile medical applicators for this purpose.
- Make sure that no tissue damage is caused by excessive illumination intensity (see page 23).
- Always perform a function test before using this module (see checklist page 321).

**Warning!**

Reliable visualization of fluorescent areas with IR 800 is not or no longer possible in the following situations:

- Insufficient brightness in deep channels
- Working distance too large (focus threshold)  
(recommended working distance: less than approx. 300 mm)
- Zoom setting too high  
(recommended zoom setting: factor equal to/smaller than 5.0x)
- Selected illuminated field diameter too large  
Optimum illumination in the fluorescence mode is achieved if the illuminated field diameter on the OPMI is set to the middle position and the wide OPMI diaphragm is selected, i.e. a small depth of field is set. Both adjustments are made automatically when the IR 800 mode is started.

**Caution:**

Infrared light sources (e.g. navigation systems) may cause disturbances during the INFRARED 800/FLOW 800 application.

We recommend the following measures to avoid this effect:

- Perform a function test prior to application in order to check whether any reflections are caused by a source of disturbance, and reposition the source of disturbance if necessary.
- If any reflections occur, prevent the incidence of light by tilting or covering the eyepieces.
- Make sure that no navigation systems are directed at the surgical field during the INFRARED 800/FLOW 800 application.

## Description

### General configuration

#### Touchscreen

- In the Config menu, select Stand - **Handgrip or Foot control panel**.
- Assign the **Fluorescence** function to one of the configurable buttons (A,B,C,D)(see page 106).
- In the Config menu, select Fluorescence - General - **IR 800**.
- Select the required settings for the Setup, Record and Playback phases in the IR 800 menu.



Note:

FLOW 800 can be activated in the IR 800 menu (see page 298).

Your settings are saved for the current user.



Note:

The preconfigured automatic functions ensure that the INFRARED 800 fluorescence application has been optimally configured. Manual settings or adjustments are possible, but do not always lead to an optimum result. Check the settings before application using the fluorescence target. The changed settings are saved in your user profile.

## Selecting the file format

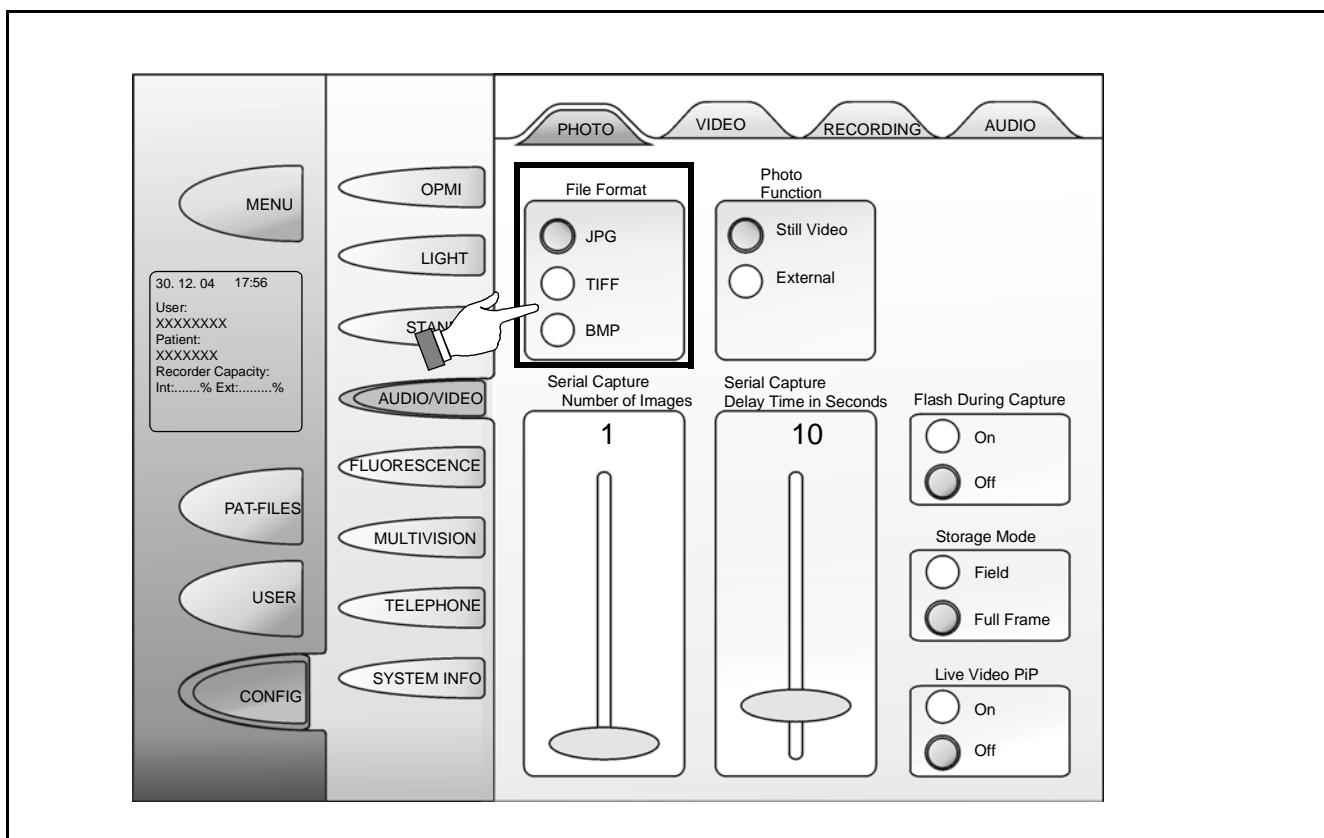


### Note:

In the Config menu, the Photo tab under AUDIO/VIDEO offers the possibility of choosing between three different file formats (JPG, TIFF, BMP). The factory setting is the JPG format.

JPG is a graphic format involving compression prone to loss. The higher the compression, the more artifacts and digital noise will appear in the compressed image. When a JPG image is decompressed, the compression losses will remain and cannot be reversed. If you subject a JPG image to several decompression and compression steps and various image processing procedures, image quality will deteriorate from one step to the next.

We recommend using the TIFF or BMP file format for the IR800 processing application.



## INFRARED 800 FLUORESCENCE

- 1 Deactivating the fluorescence applications
- 2 Activating the integrated INFRARED 800 (IR 800) fluorescence module  
The INFRARED 800 fluorescence application comprises four different phases: the preparatory phase (SETUP, see page 296), the recording phase (RECORD, see page 300), the playback phase (PLAYBACK, see page 302) and the FLOW 800 processing phase (see page 308). The configuration menu permits you to adjust all setting parameters of the individual phases (the "Processing" phase does not have any specific setting parameters), which are then saved for the relevant user.
- 3 Activating the integrated BLUE 400 (BL 400) fluorescence module

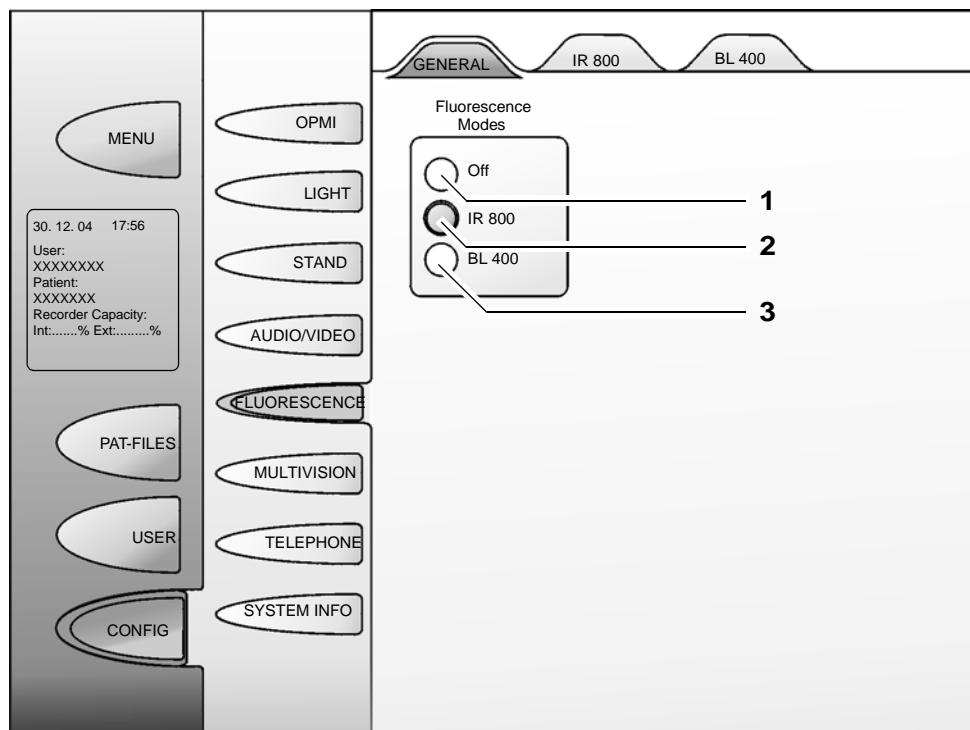


Note:

A button either on the handgrip of the surgical microscope or on the foot control panel can be programmed for the fluorescence application.

This configured fluorescence button can then be used to start one of the two optional fluorescence applications, depending on which option (IR 800 or BL 400) has been selected.

You can only use BL 400 or IR 800 alternatively.



## Configuring INFRARED 800

### INFRARED 800 Setup menu



**Note:**

The INFRARED 800 fluorescence application has been optimally configured through the preconfigured factory setting in the INFRARED 800 mode. Manual settings or adjustments are possible, but should be checked before application using the fluorescence target.

The changed settings are saved in your user profile.

The Setup menu is used to configure the setup procedure in order to achieve optimum quality of the video image. Any deviation from the pre-configured parameters (items 2, 3 and 4) may lead to a loss in video image quality.

#### 1 Auto Zoom

- On: the total magnification is changed automatically to the preconfigured value (3) without pop-up message.
- Off: a setting dialog is displayed for changing the total magnification beyond the preconfigured range (3).

Factory setting: Off

#### 2 MultiVision

- On: if MultiVision is activated during setup, setting aids in the form of bars for zoom, focus and light intensity will be displayed in the data injection system.
- Off: No display in the data injection system.

Factory setting: Off

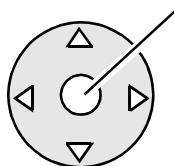
#### 3 Maximum magnification

If the current maximum magnification is within the configurable limit value (blue range is our recommendation), the zoom is not changed during the setup phase.

If the magnification value is outside the preset limit, the following happens:

- With Auto Zoom on: the zoom factor setting is automatically changed to the preconfigured value (3).
- With Auto Zoom off: a pop-up box with a setting bar appears. The setting bar automatically disappears after correction of the value within the setting range  
To retain the current settings, press "Ignore" on the touchscreen or the center button of the joystick on the right handgrip.

Center button

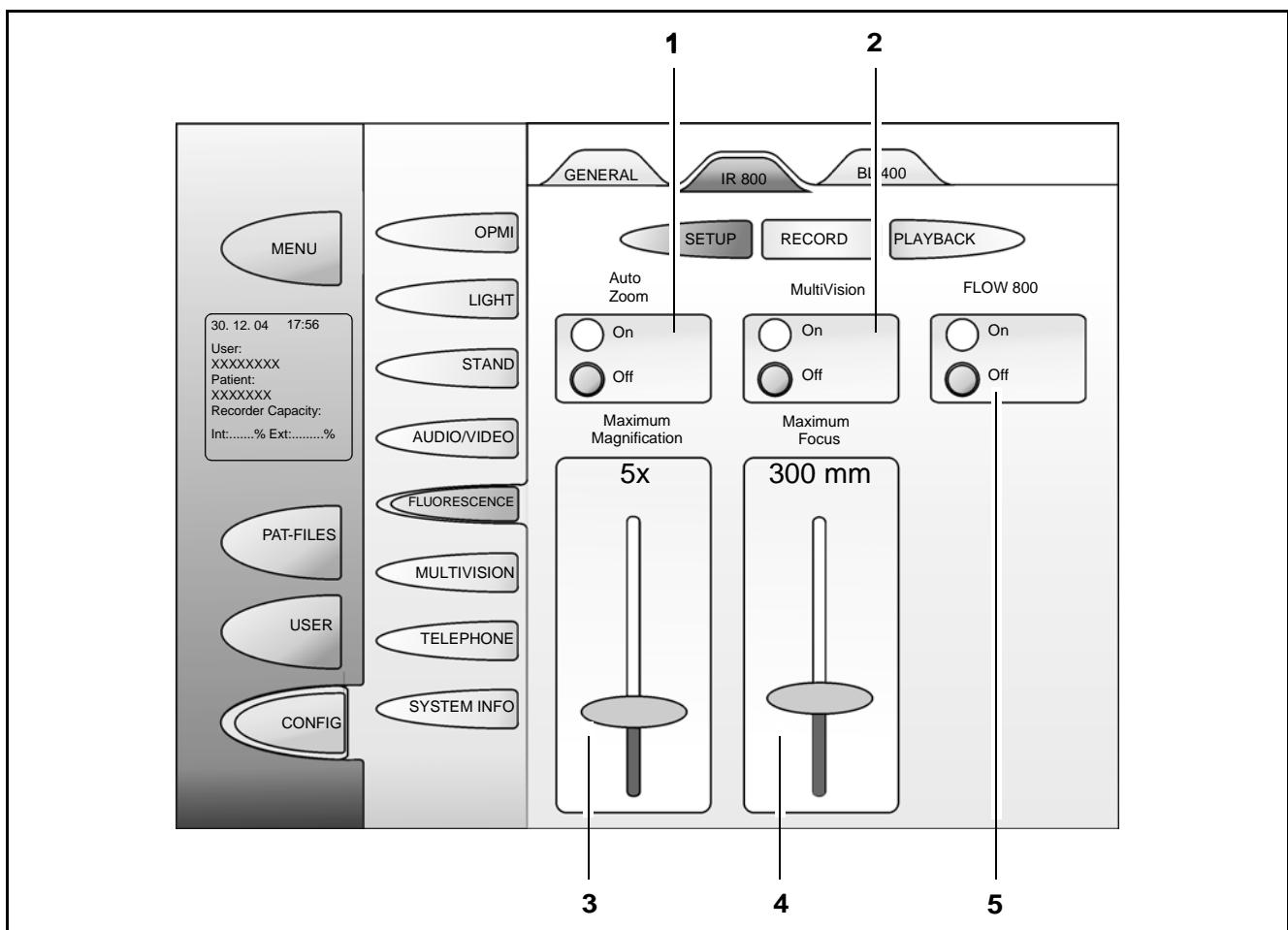


Adjustment range: 2x - 13x

Factory setting: 5x

**Note:**

Make sure that the correct settings for the eyepieces and the tube have been selected in the tube menu (Config/OPMI/Tube) to permit the system to calculate the correct total magnification. The total magnification is displayed in the main menu.



#### 4 Maximum focus (working distance)

If the current focus value lies within the limit configured here, no message is displayed to the user during the setup phase. If the focus value exceeds the set limit, the user is prompted in a pop-up window to reduce the focus value accordingly (see Auto Zoom: Off).

Adjustment range: 200 mm-500 mm   Factory setting: 300 mm



#### **Caution:**

After setting of the focus, ensure that the object is in focus again. The autofocus can still be used at this stage (IR800 setup). Unlock the brakes, move the microscope to a suitable distance and activate the autofocus for focusing.

The pop-up window disappears when the autofocus has been activated.

## Activating FLOW 800

#### 5 FLOW 800 mode

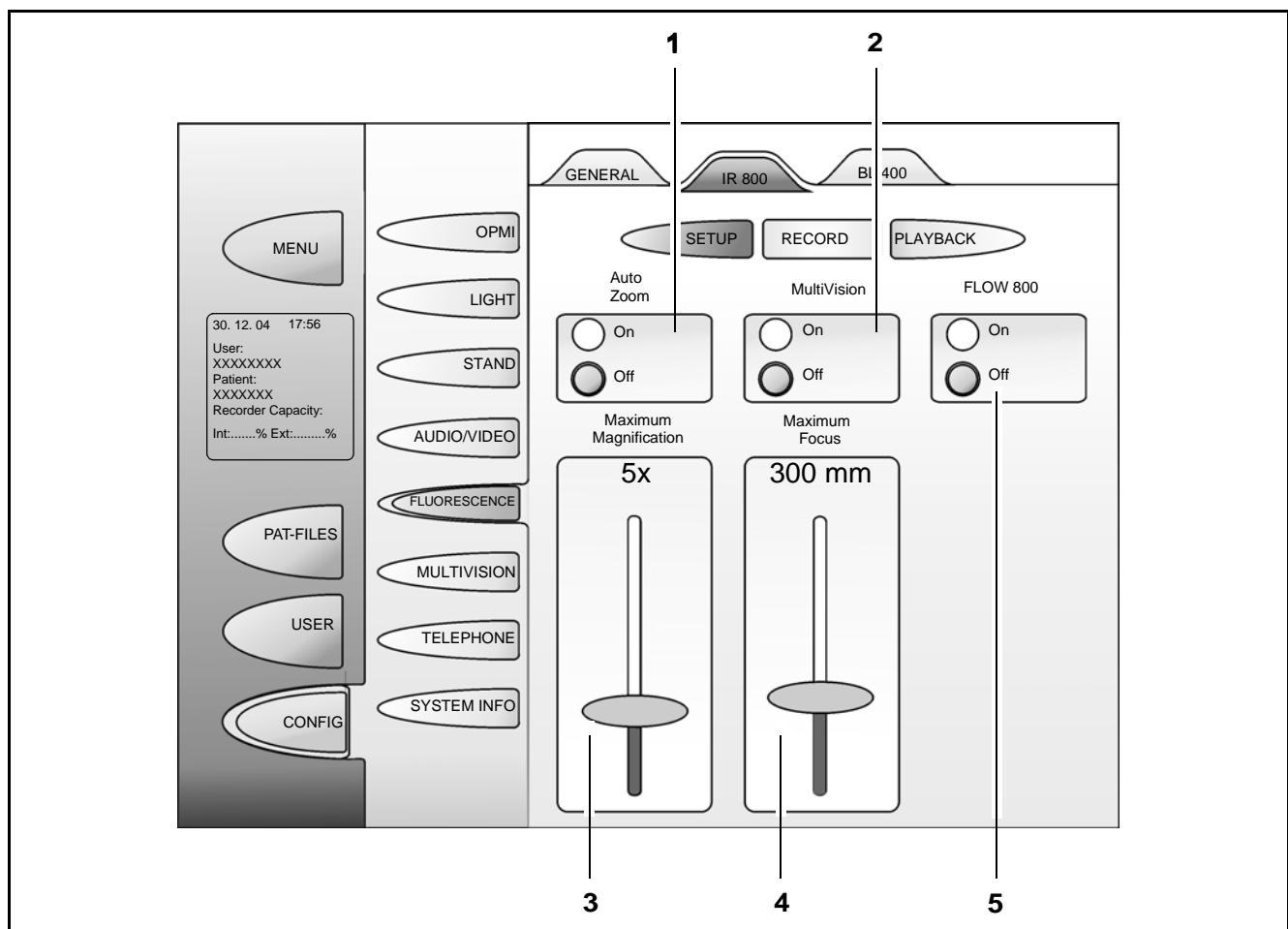
Comfortable handling and visualization of the fluorescence video data recorded with the INFRARED 800 fluorescence option. After activation of the mode, FLOW 800 data is additionally recorded during IR800 video recording. If FLOW 800 is deactivated during IR800 recording, FLOW 800 processing of this IR 800 video will not be possible.

- On: FLOW 800 data is additionally recorded during INFRARED 800 video recording. You can start FLOW 800 at the end of the replay phase by pressing the fluorescence button.
- Off: no FLOW 800 data is recorded during INFRARED 800 video recording. FLOW 800 processing is not possible for the recorded INFRARED 800 video (not even subsequently). At the end of the replay phase, the INFRARED 800 cycle is ended without FLOW 800 by pressing the fluorescence button.



#### Note:

- For a newly created user, the default setting for "FLOW 800" is "Off".
- You can also activate FLOW 800 processing from the Patient File menu for previously recorded INFRARED 800 data, provided that this data is processable, i.e. that it is marked with "A" (see page 306).



## Description of INFRARED 800

### INFRARED 800 Record menu

This menu permits you to make the following settings for the recording phase:

#### 1 External monitor

- Standard: output of the white light camera signal on the external monitor.
- IR800: output of the INFRARED 800 camera signal on the external monitor.  
No text displays or time data are displayed on the external monitor.

Factory setting: IR800

#### 2 IR camera gain

- Auto: the camera gain is automatically adjusted to the current conditions. "Manual gain setting" slider (3) is disabled.
- Manual: you can set the camera gain to a fixed value. Use "Manual gain setting" slider (3) to select this value.

Factory setting: Auto

#### 3 Manual gain setting

Slider for manual adjustment of the camera gain.  
(See Pos. 2 Camera gain)

Adjustment range: 4% - 100%

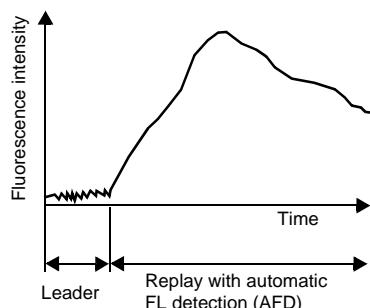
Factory setting: 20%



#### Note:

When Auto Camera Gain is deactivated (end Auto Gain or select manual setting), you can manually adjust the gain value on the touch-screen or using the yellow light button on the right handgrip.

In both cases, Gain button (5) is displayed on the bottom right of the video image for activation of slider (6).



#### 4 Autom. IR detection

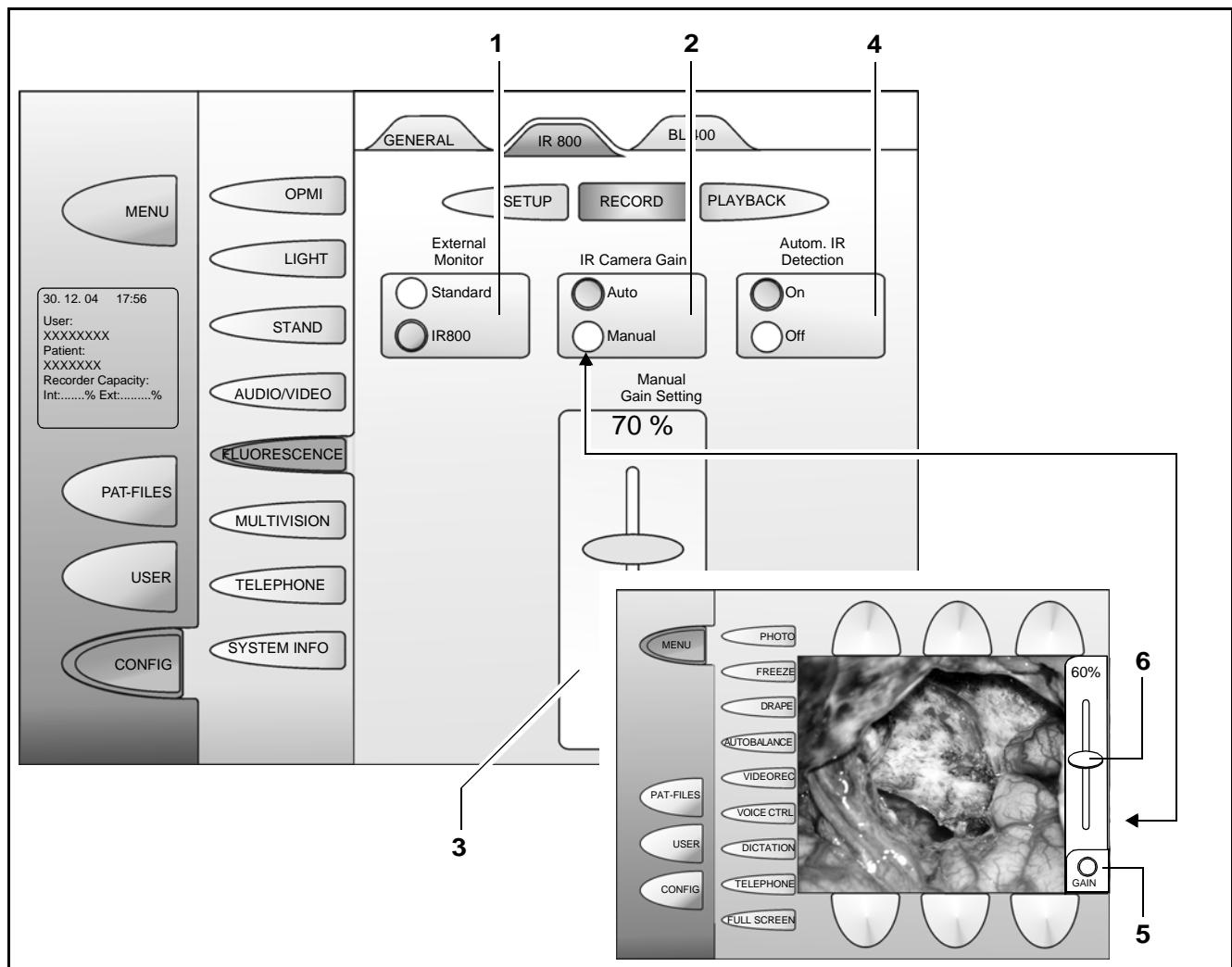
(Automatic fluorescence detection AFD see page 324)

- **On:** The video signal is analyzed for fluorescence flows in the RECORD mode.  
If fluorescence flow is detected, the black leader is not displayed in the playback mode.
- **Off:** no automatic FL detection, the complete recorded video is played in the playback mode.

Factory setting: On

**Note:**

The stored video always contains the complete data record including the black leader, irrespective of whether automatic FL detection has been activated or deactivated.



## INFRARED 800 Playback menu

The Playback menu is used to configure video playback.

### 1 External monitor

- Standard: The white light camera signal is output on the external monitor during the PLAYBACK mode instead of the white light video recorded synchronously with the INFRARED 800 video.
- IR 800: The INFRARED 800 video is output on the external monitor during the PLAYBACK mode.

Factory setting: IR 800

### 2 MultiVision

- On: The content of the touchscreen monitor is also displayed in the data injection system during the PLAYBACK mode. Please switch to the full screen mode for better visualization.
- Off: No display in the data injection system.

Factory setting: Off

### 3 PiP in Replay (playback mode only)

- On: When PiP (Picture in Picture) has been activated, the simultaneously recorded white light video is displayed in a small window at the top right of the touchscreen.
- Off: No PiP display.

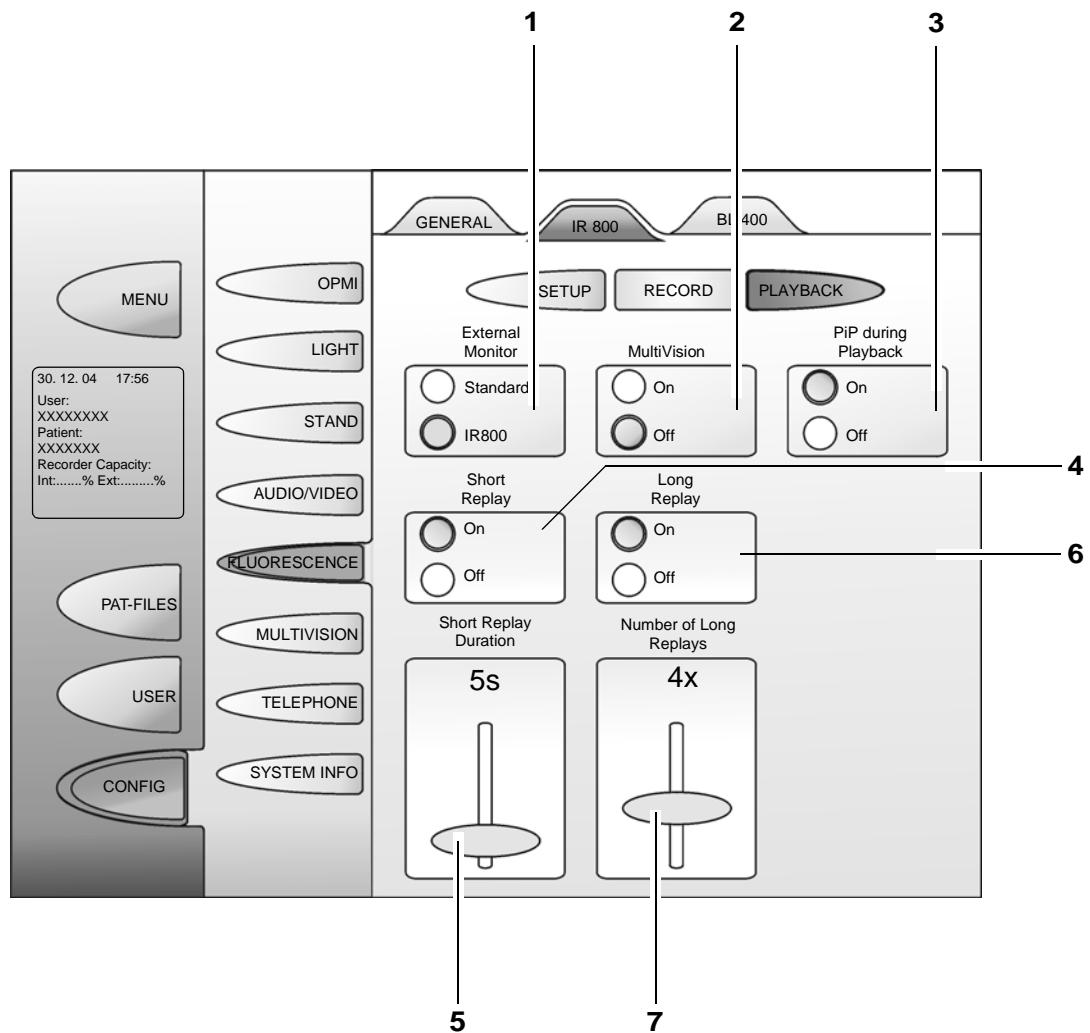
Factory setting: On

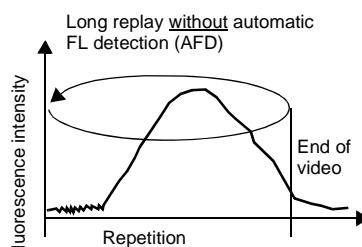
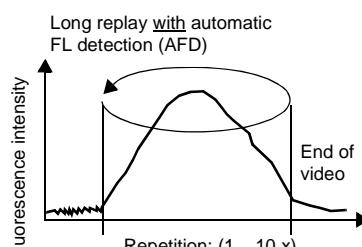
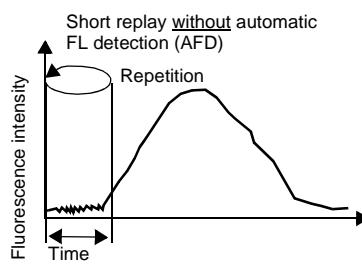
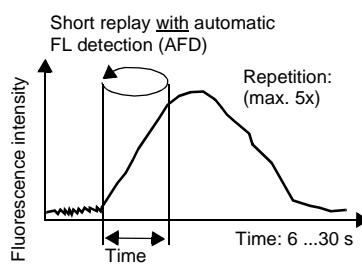


#### Note:

A video clip is recorded and saved in the white light mode at the same time as the fluorescence video clip (prerequisite: the Digital Video Recording option).

Videos started with REC START are recorded irrespective of this process. If IR 800 is selected for the external monitor (1), this video is briefly interrupted by the displayed replay screens





#### 4 Short replay

- **On:** A brief sequence of the recorded INFRARED 800 video is displayed at the beginning of the PLAYBACK mode. You can adjust the length of the sequence using the "Short Replay Duration" slider. The replays can only be stopped by pressing the FL button. They will be stopped automatically after 5 replays.  
If fluorescence detection has been activated, the video starts after detection of the fluorescence flow. The preceding black leader will not be displayed.
- **Off:** No replay function available. The "Short Replay Duration" slider is disabled.

Factory setting: On

#### 5 Short replay duration

This slider permits you to select the length of the video clip to be played when Short Replay has been activated:

Adjustment range: 6s - 30s

Factory setting: 8s

#### 6 Long replay

- **On:** The recorded fluorescence video is played repeatedly without limitation of the playback duration. You can select the number of playbacks using the "Number of Long Replays" slider.  
If fluorescence detection has been activated, the video sequence starts after detection of the fluorescence flow. The preceding black leader will not be displayed.
- **Off:** No long replays available. The "Number of Replays" slider is disabled.

Factory setting: On

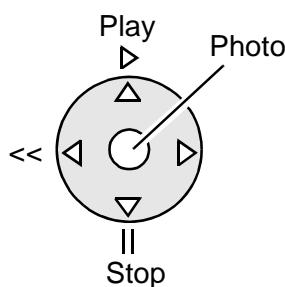
#### 7 Number of replays

After the end of recording, the complete recorded fluorescence video clip can be automatically replayed up to 10 times (as an endless loop). The process can be stopped any time by pressing the fluorescence button on the handgrip or foot control unit.

Adjustment range: 1 - 10

Factory setting: 5

During the PLAYBACK phase (short and long replays), you can use the joystick of the right handgrip to control the playback process (play, stop, fast forward, fast rewind, photo).

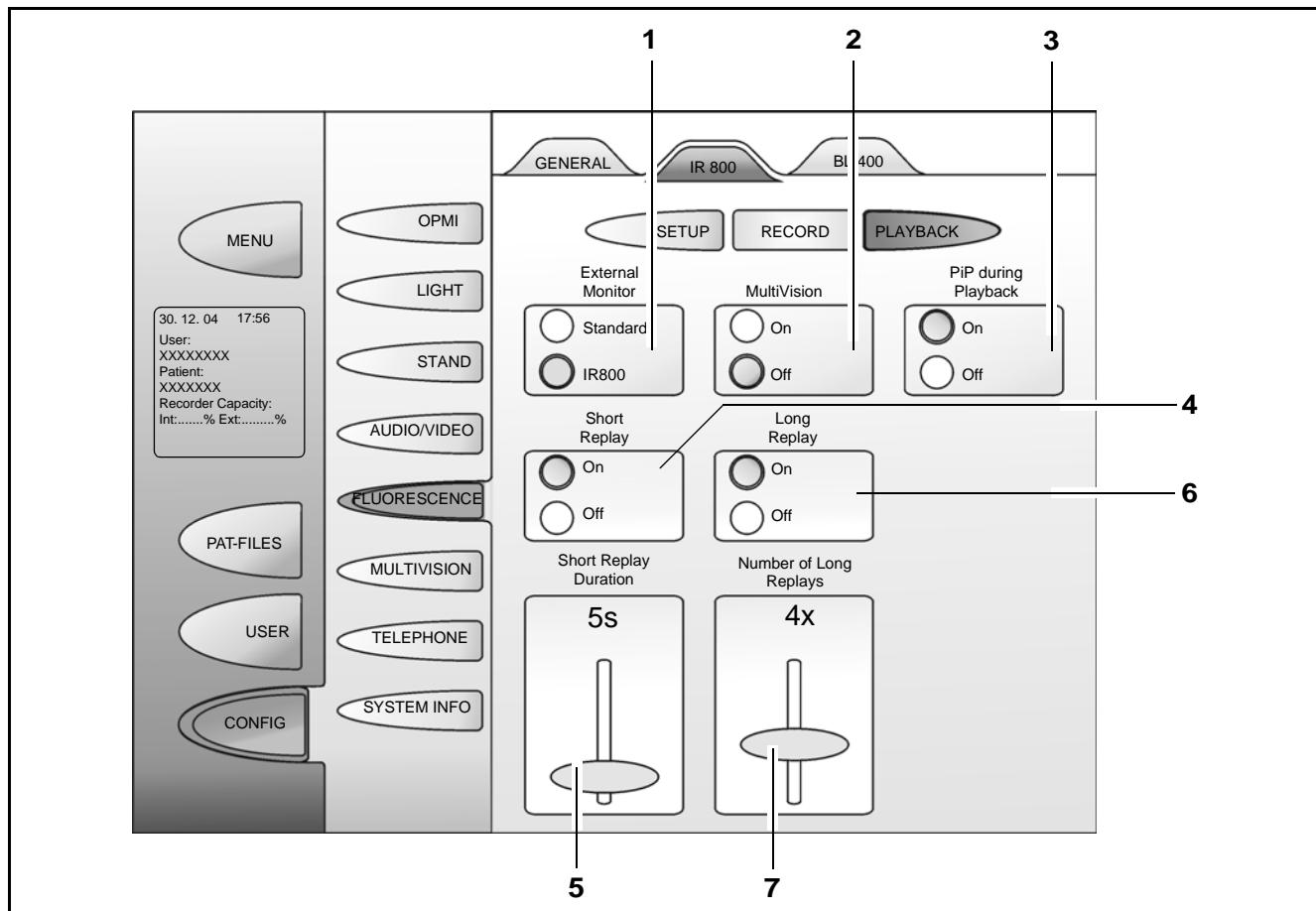


- Briefly press **Stop + << or >>** Video moves backward or forward in steps  
- stops when buttons are released
- Hold down **Stop + << or >>** Video clip is slowly played forward or backward  
- stops when buttons are released
- Hold down **Play + << or >>** Fast forward or fast rewind of video clip  
- stops when buttons are released

Note:

A tip for INFRARED 800 replay:

If an external monitor is connected, you can switch to the full-screen mode on the touchscreen.



## Description of FLOW 800

### Starting the FLOW 800 processing mode



**Caution:**

To obtain optimum FLOW 800 data, avoid changing the following parameters during data recording:

- Zoom factor
- Working distance/focus
- Light intensity
- Position of the OPMI stand, i.e. unlocking of brakes or joystick-controlled movement
- Position of the light field aperture

The following influences are corrected automatically:

- Camera gain adjustment (via AGC or manually)
- Slight wobbling of the microscope  
(e.g. during operation of the handgrip buttons)

**1 In the INFRARED 800 Setup menu:**

The INFRARED 800 Setup menu includes the "FLOW 800" processing mode which permits activation and deactivation of FLOW 800 processing. This requires a specific license. If this license is not available, "FLOW 800" is disabled.

The FLOW 800 processing phase can be started at the end of the Replay phase by pressing the fluorescence button if the FLOW 800 processing mode has been activated in the INFRARED 800 SETUP menu.

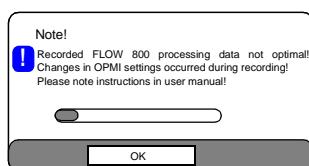
**2 In the Patient File menu:**

You can also activate FLOW 800 processing from the Patient File menu for previously recorded IR800 data, provided that this data is processable, i.e. that it is marked with "A".

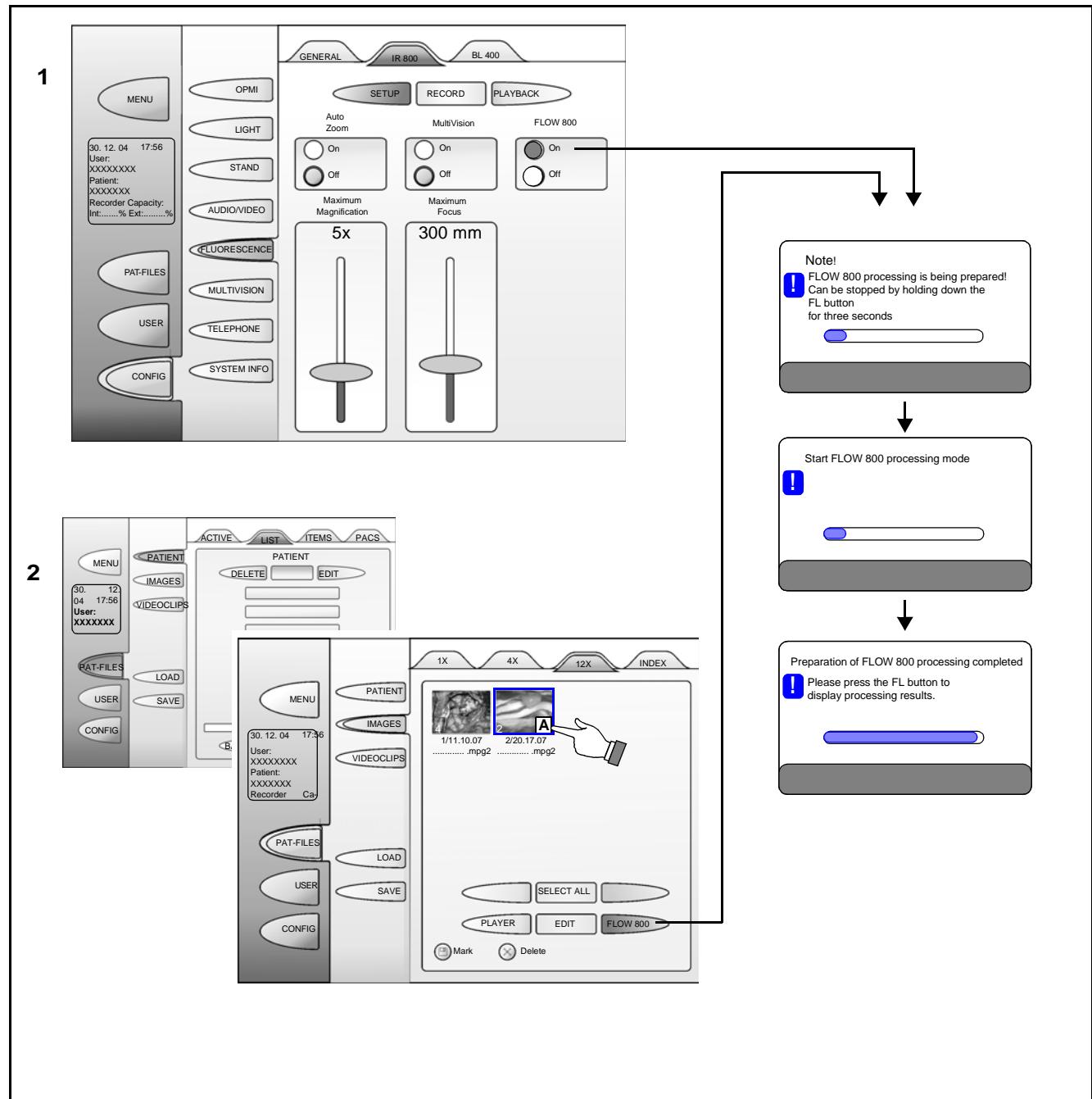
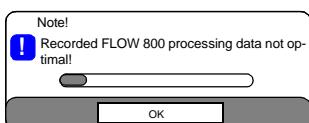
In the VIDEO CLIPS tab, select a video from the list of all videos of a patient. The thumbnail of the video must be marked with "A" (recorded with analysis data) on the bottom right. The FLOW 800 button on this page is enabled, and the processing mode can be started by pressing this button.

The data is checked before the INFRARED 800 video is displayed in the processing mode.

- The data is not optimal if OPMI settings were changed (e.g. change of focus) during recording of the INFRARED 800 data. In this case, a message box with a note to this effect appears before the data is displayed.



- The data is not optimal if single images could not be recorded. In this case, a message box with a note to this effect appears before the data is displayed.



## FLOW 800 MAP

The MAP submenu summarizes specific features of the fluorescence procedure in a single image.

### 1 Delay

When you press the "Delay" button, the time delay is displayed as a false-color image.

The time when fluorescence started can thus be recorded for each image point and visualized in a false-color map. This provides an overview using different colors for differentiation. An intuitive color scale marks early starts of fluorescence in red and late starts in blue.

### 2 Maximum intensity

When you press the "Maximum Intensity" button, the maximum intensity is visualized as a gray level image.

The maximum of fluorescence attained at each image point is displayed in the form of gray levels. The map display gives a summary overview - irrespective of the moment in time - of the maximum fluorescence level achieved during the observation period (video recording). This provides a clear, static means for checking whether the fluorescence distribution in the observed areas meets the expectations.



#### Note:

In the FLOW 800 process, you can toggle between the two map types using the right and left ( $\blacktriangleleft$   $\triangleright$ ) joystick buttons (the visualization changes at each press of a button).

### 3 Automatic

For automatic image correction (e.g. AFD, movement correction).

Factory setting: On

When the function is off, no automatic image correction is performed. Deactivation only makes sense if the automatic function does not provide a usable result.

You can toggle between the two statuses for comparison.

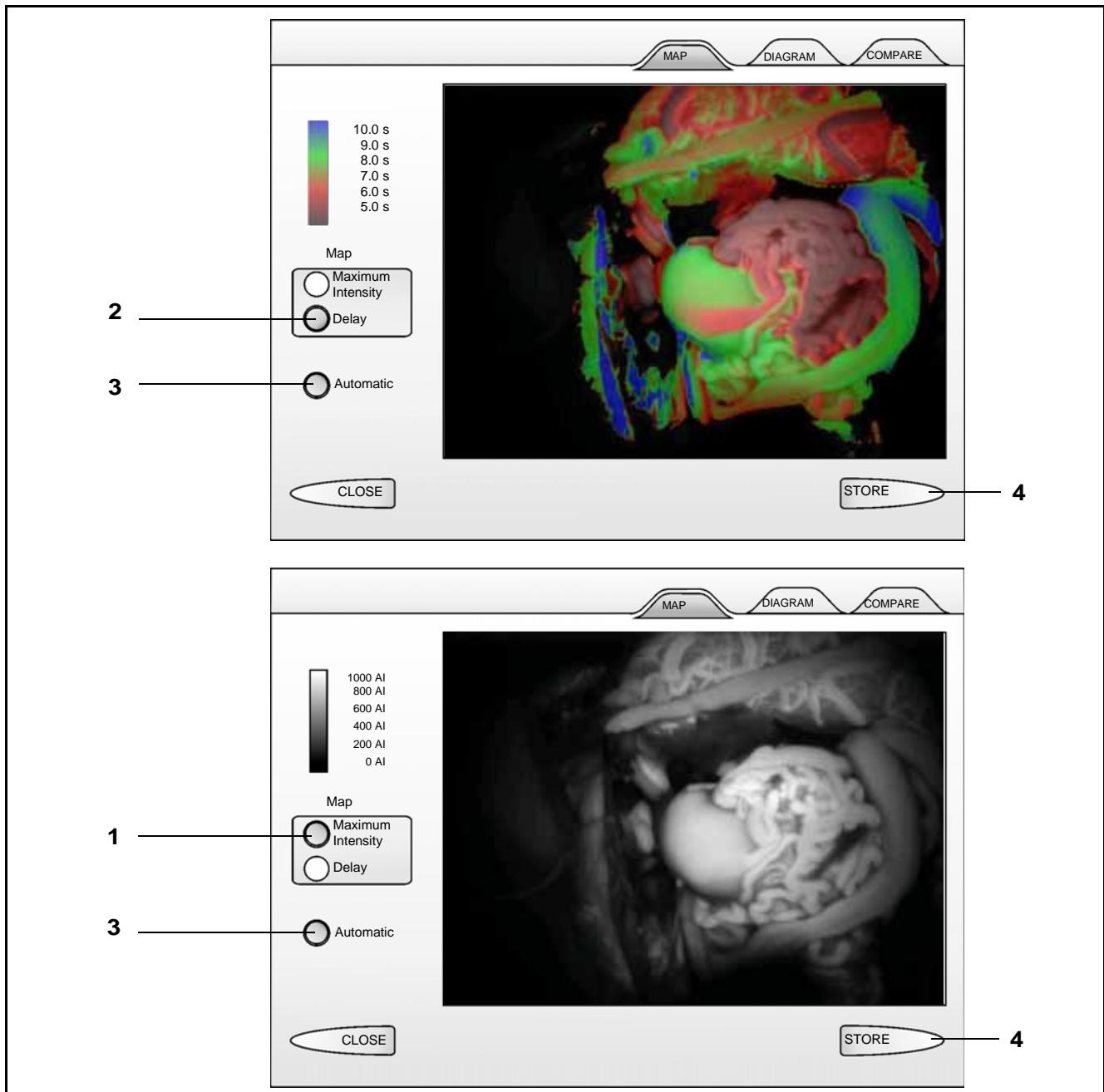
### 4 Store

The Store function permits you to save the images for documentation purposes in the image directory of the relevant patient.



#### Note:

During the INFRARED 800 process, the Store function can also be operated via one of the configurable buttons (Photo  $\cong$  Save) on the handgrip or foot control panel. (Only if FLOW 800 was activated in INFRARED 800. If it was activated via Patient Files, the Photo button on the handgrip does not have this function.)



## FLOW 800 DIAGRAM

The DIAGRAM submenu permits you to perform a targeted analysis of partial areas by defining ROIs (regions of interest).

The ROIs are defined on the touchscreen. Two ROI types are available: rectangular and adaptive. The adaptive ROIs follow the structures in the image.

**1 Result window**

The result window displays fluorescence over time as a curve.

**2 Video window**

Window with video player functionality. You can use this window to navigate to a point in the video where the ROIs are clearly visible. If you press the "Set ROI" button, the display in the video window automatically changes to "Maximum Intensity". When the ROI is set, a magnified display appears automatically to facilitate fine positioning of the ROI.

**3 ROI size**

for setting the ROI size

**4 ROI type**

Two ROI types are available: rectangular and adaptive.

Adaptive ROIs may lead to jagged curves in low-contrast tissue structures.

We recommend using rectangular ROIs in this case.

**5 CALCULATE**

After setting (at least) one ROI, you can start the calculation by pressing the CALCULATE button.

Note:

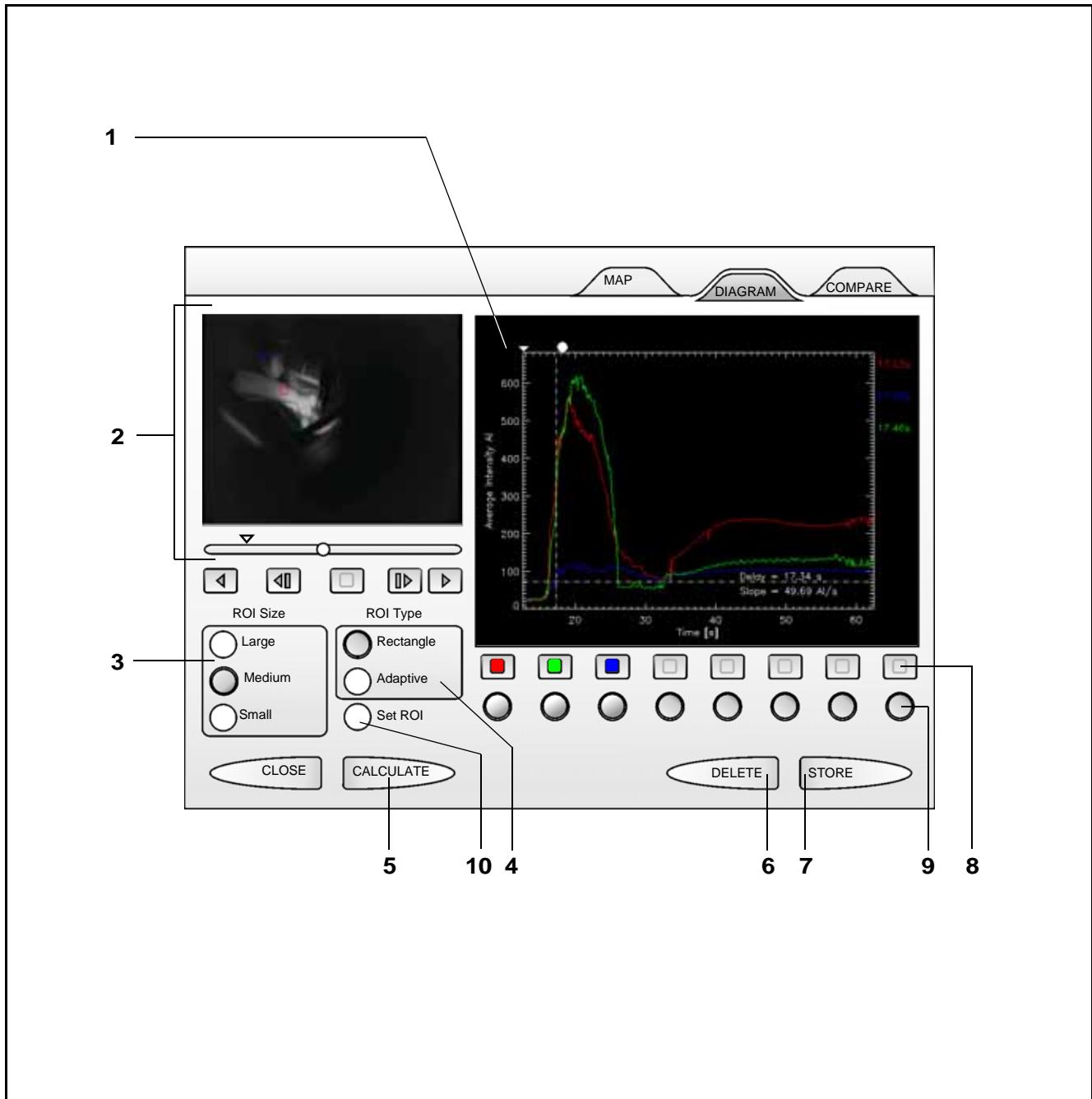
A maximum of eight ROIs can be set and calculated.



**6 DELETE**

for deleting the ROI and its calculation.

First press the relevant rectangular result button (8). Then press DELETE button (6).



**7 STORE**

The STORE button permits you to save the diagram to the analysis directory of the corresponding patient.

**Tip:**

By exporting the patient files (saving to CD/DVD or a USB medium), a Diagram.csv file is created in Patient Files/Analysis. The csv file contains the diagram values which can be exported to spreadsheet programs.

**8 Result buttons**

for selecting the active ROI.

**9 Display buttons**

for switching the ROI display on and off.

**10 Set ROI**

A ROI can only be set after pressing the "Set ROI" button.

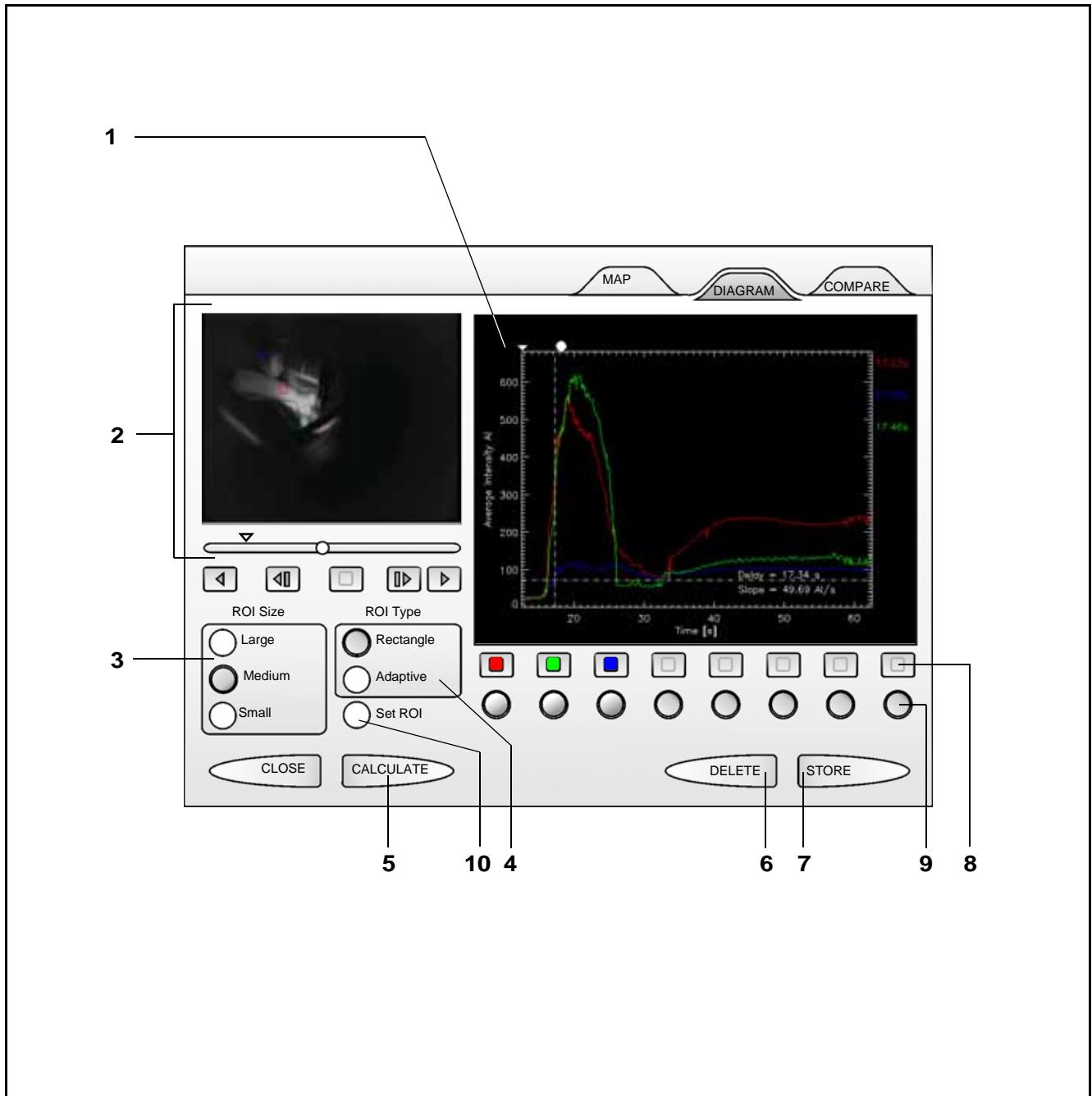
When the "Set ROI" button has been pressed, video window (2) displays the "Maximum Intensity" view. You can now set a ROI.



**Tip:** You can also use the "Set ROI" button to display the ROIs already defined in the intensity map in the player. When you press the button again, the display returns to the video image, without the need to set a ROI.

**Note:**

The seconds displayed in the processing mode (SI units) are rounded values. They are only provided for clearer indication, not for measuring purposes.



## Time marks in the FLOW 800 DIAGRAM

### 1 Video player time marks

A time mark (○) which marks the current position of the video in the diagram is displayed at the upper edge of the Diagram window and in the time bar of the video player.

The position of the mark is updated when the single step ▶ and stop ■ buttons of the player are pressed, and when you touch the video player time bar. The mark is not visible during the play function.

### 2 AFD time mark (Automatic Fluorescence Detection)

An ADF time mark (▽) which marks the calculated moment of fluorescence flow is displayed at the upper edge of the Diagram window and in the time bar of the video player.

If the automatic function (4) (MAP submenu) has been activated, the AFD time mark is positioned above the Y axis at the beginning of the diagram.

## Delay value display (3)

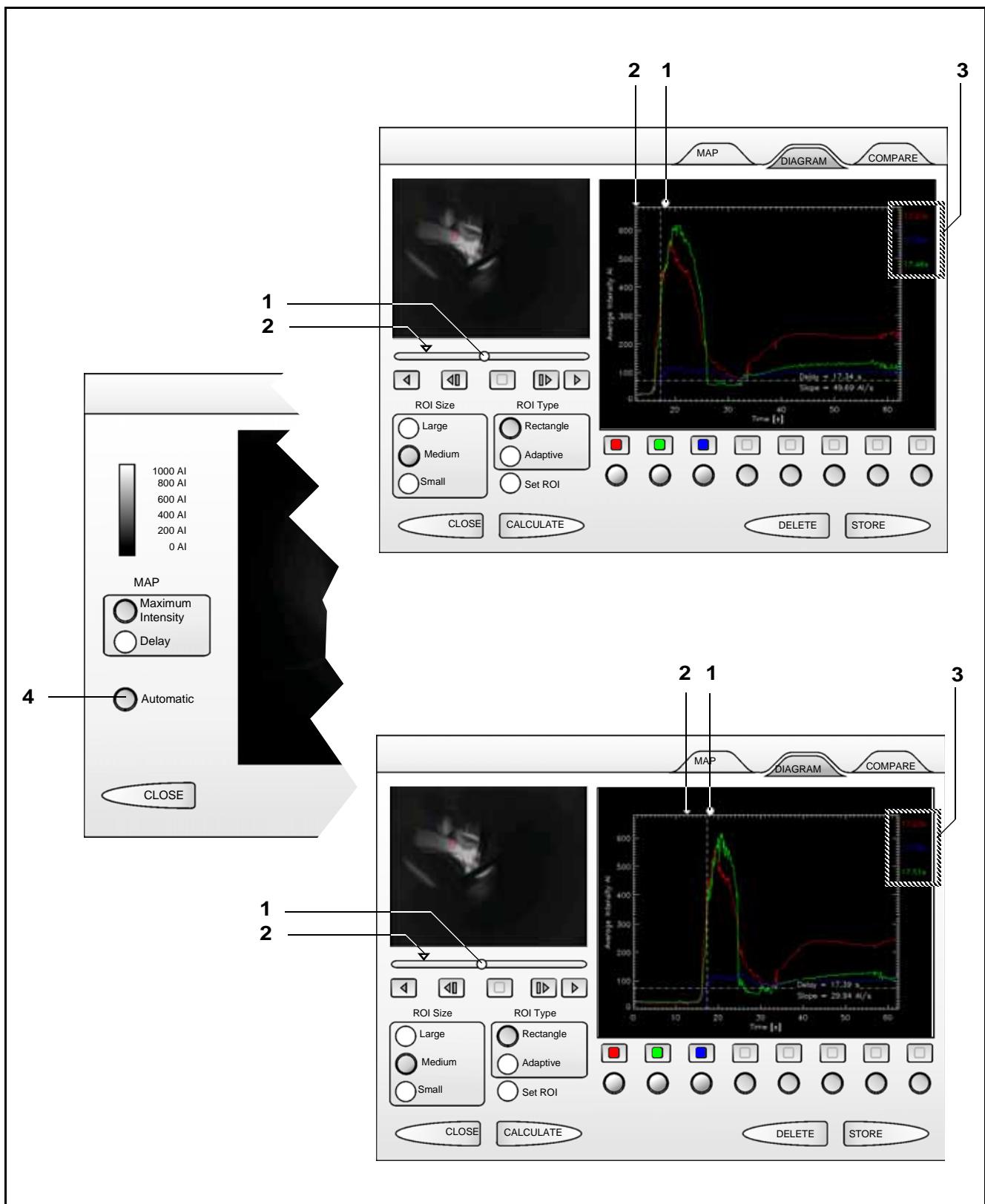
To enable faster comparison of the delay values of the marked ROIs, the values of all ROIs shown in the diagram are displayed at the top right, next to diagram (3).

- The values are shown in the color of the associated ROI/diagram curve.
- The list is sorted according to the amounts of the delay values. The lowest delay value appears in the first position.



### Warning!

The readings displayed in the processing mode (SI units) are rounded values. They are only provided for clearer indication, not for measuring purposes.



## FLOW 800 COMPARE

The "COMPARE" menu is used to compare maps or diagrams with each other. The maps of the current video (4) can be compared with those of earlier videos (5) of the same patient. The current diagram (6) can also be compared with diagrams of earlier videos (7). The diagrams must be saved for this purpose (see notes).

### 1 Search window for comparison video

For searching the INFRARED 800 video to be compared, scroll through the list of INFRARED 800 videos available for comparison using the "BACK" and "NEXT" buttons. The video to be used for comparison is selected by clicking on one of the thumbnails displayed above the "BACK" and "NEXT" buttons.

The videos are displayed in the sequence in which they were recorded.

### 2 Mode

Select the visualization mode to be used for the comparison of the images:

Maximum Intensity, Delay or Diagram



#### Notes on the Diagram mode:

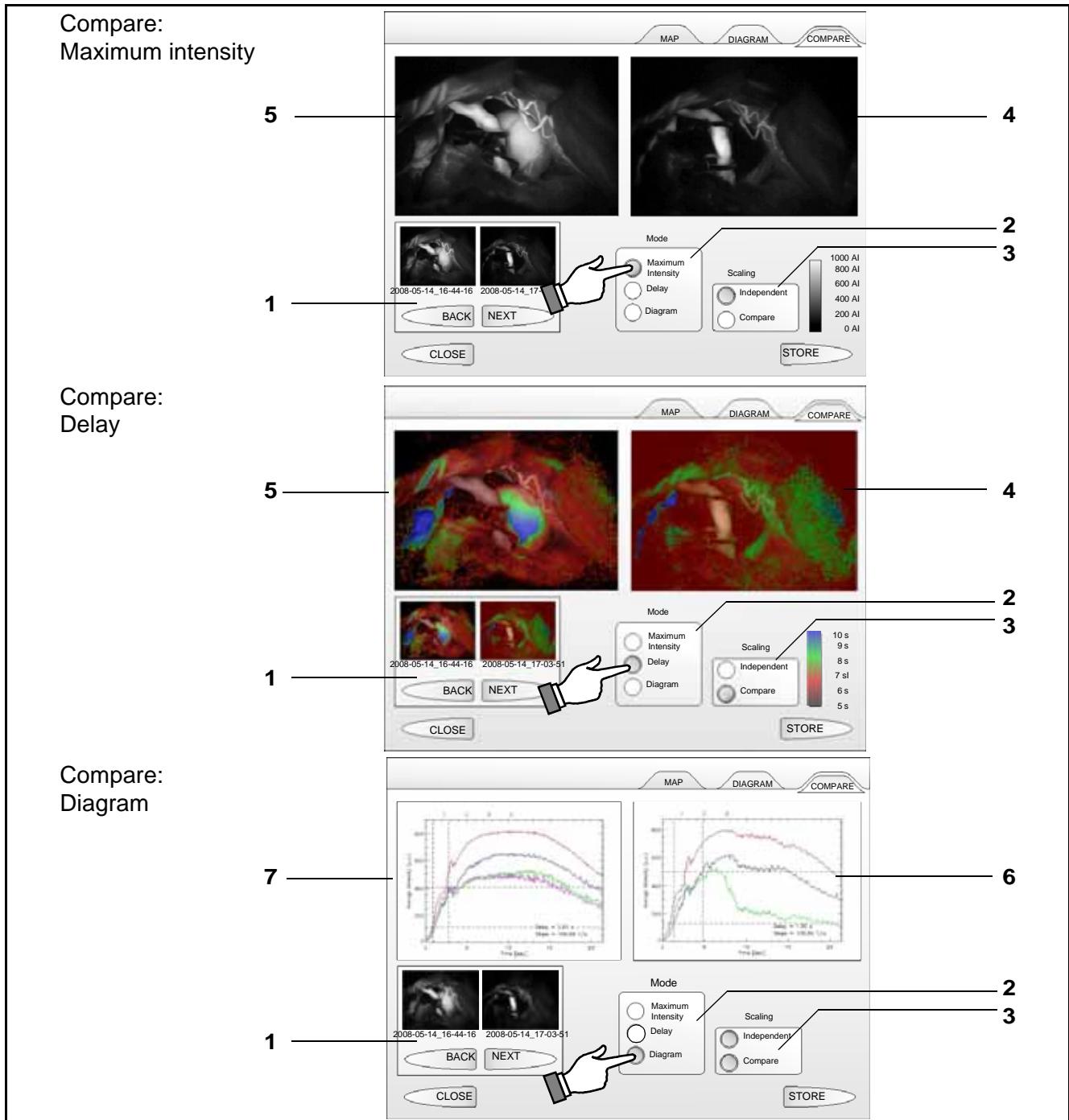
- If no diagram has been saved for the displayed processing data, the Diagram button is grayed out.
- Only diagrams previously created with STORE on the Diagram page are offered for comparison. However, diagrams are offered for all videos of the patient.
- The STORE function files the diagrams and ROI images also under PAT-FILES / IMAGES. If the images have been deleted or renamed there, they are not offered for comparison here.
- This also applies after the import of processing data. For this reason, the diagram images and ROI images also have to be imported in order to display diagrams for comparison.
- In the Diagram mode, the search window displays the ROI images associated with the diagrams.

### 3 Scaling

- Independent: common scaling is canceled.
- Compare: display at a common scale.
- Scaling is disabled in the Diagram mode.

Note:

A comparison of delays only makes sense if AFD was activated when the video was recorded. The times then refer to the moment when fluorescence started to flow as determined by AFD.



## Preparations for use

### Connecting an external monitor (recommended option)



#### Note:

When using the IR 800 application, we recommend that you **always** connect an external monitor for viewing the IR 800 sequences.



#### Caution:

Only connect the monitor to a wall outlet which is provided with a properly connected protective ground conductor.

Please observe the maximum current consumption of the power outlet socket of OPMI Pentero. Only connect medical devices approved by us to this outlet. When using other devices, make sure that safety is guaranteed regarding admissible ground leakage currents. The admissible limit value of the ground leakage current present in the suspension system's power cord is 500 µA in compliance with EN60601-1/IEC 601-1. CSA NRTL certification only allows a maximum ground leakage current of 300 µA.

- 1 Video signal output port BNC (VBS) for connecting an external monitor.

Suitable for devices capable of processing VBS signals, or if video signals have to be transmitted over relatively long distances (e.g. BNC lines already installed on site). The two ports are independent of each other and can be used as required.

- 2 Video signal output port for an external monitor (Y/C) for connecting a further external monitor.

We recommend using devices suitable for Y/C signals, if possible. This standard provides higher video image quality than VBS. The two ports are independent of each other and can be used as required.

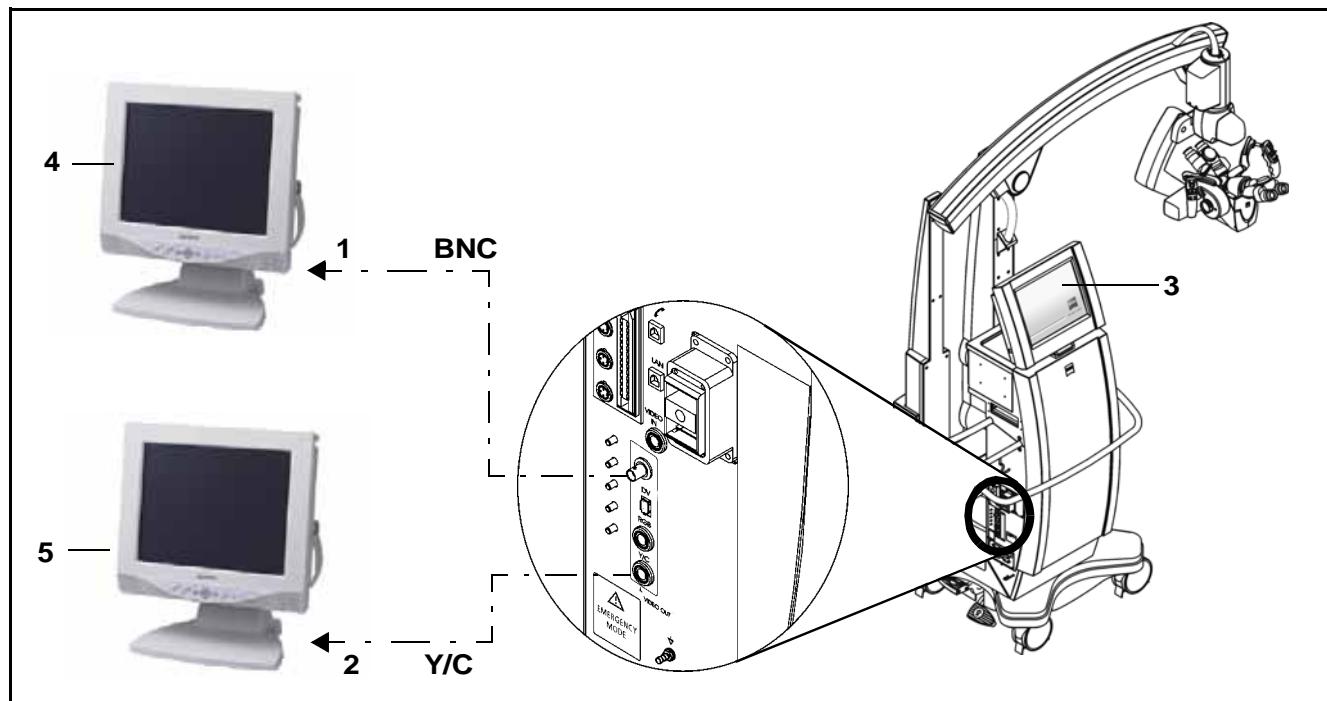


#### Note:

Tip for IR800 Replay

If an external monitor is connected, you can switch to the full-screen mode on the touchscreen.

Pos.	Display	IR 800 mode		White light mode
		Recording mode	Playback mode	
3	Touchscreen	Live image of IR 800 camera with text display	Replays IR 800 image	White light image
4	OR monitor on video-out port:  BNC (recommended option for video signal over large distances)	Depending on configuration used:  – White light image – Live image of IR 800 camera without text display	Depending on configuration used:  – White light image – Replays IR 800 image	White light image
5	OR monitor on video-out port:  Y/C (recommended option for enhanced video quality)	Depending on configuration used:  – White light image – Live image of IR 800 camera without text display	Depending on configuration used:  – White light image – Replays IR 800 image	White light image



## INFRARED 800 settings before every surgical procedure

- The button configuration on the handgrip or foot control panel and the menu settings have been performed and checked (see page 292).
- The function test with the INFRARED 800 fluorescence module has been performed in accordance with the checklist (page 321) and OPMI Pentero is ready for surgery.
- The INFRARED 800 fluorescence module can be used when the target anatomy has been exposed during surgery and can be observed through the microscope without visual obstruction.



## Checklist for the IR 800 function test



### Warning!

The IR 800 fluorescence target and the touchscreen are not sterile. Therefore perform the function test before surgery (without patient!).

Always check the following points before the use of the integrated fluorescence module (without patient!):

- Place the IR 800 fluorescence target on a level surface.
- Set the focus to **300 mm** and the zoom to **3.5x** on the handgrip (**the 3.5x zoom value is only used for the function test**). Refocus the image by moving the microscope upwards or downwards after unlocking the brakes.
- Check the function of the external monitor (option).
- Activate the fluorescence function by pressing the configured button of the handgrip or foot control unit.

### Comparison:

The function test is successful if the images on the touchscreen and on the external monitor correspond to the supplied test pattern of the fluorescence target. Minor differences in brightness and inhomogeneities are permissible.



### Caution:

Infrared light sources (e.g. navigation systems) may cause disturbances during the INFRARED 800 application.

We recommend the following measures to avoid this effect:

- Perform a function test prior to application in order to check whether any reflections are caused by a source of disturbance, and reposition the source of disturbance if necessary.
- If any reflections occur, prevent the incidence of light by tilting or covering the eyepieces.
- Make sure that no navigation systems are directed at the surgical field during the INFRARED 800 application.

## Procedure



### Warning!

The touchscreen surface is non-sterile!

The touchscreen must only be operated by non-sterile personnel.

Sterile persons must always use sterile medical applicators to operate the touchscreen. Use standard sterile medical applicators for this purpose.

### Operation of the IR procedure using the handgrip buttons

The entire INFRARED 800 procedure (incl. the display of maps in the processing menu) can be operated via the handgrip.

The joystick permits you to toggle between map displays and to trigger the camera (if a button has been appropriately configured).

Detailed analyses (diagram, comparison), however, can only be performed on the touchscreen.

Information on the current status is provided through:

- a pop-up window at the beginning of every new phase,
- a blue text line displayed at the top left of the video window.

## SETUP phase



### Note:

You can stop the Infrared 800 application in any phase by pressing the fluorescence button longer than 3 seconds.

Press the fluorescence button to start the SETUP phase and set up your system to provide optimum quality of the video image.

A pop-up message "Start IR 800 - SETUP" appears for approx. 3s to indicate that setup has been started.

- The following settings are checked:

#### 1 Focusing

The system checks whether the focus is outside a preconfigured tolerance range. If this is the case, you are prompted to position the focus in the pre-defined range. After setting the focus, you have to re-focus the object by moving the microscope upward or downward.

#### 2 Total magnification

The system checks whether the total magnification of the system is outside a preconfigured tolerance range. If this is the case and "Auto Zoom" has been activated, the zoom value of the OPMI is automatically set to the preconfigured value. If "Auto Zoom" has been deactivated, you are prompted to manually set the zoom value.



Note:

- To retain the current settings, press "Ignore" on the touchscreen or the center button of the joystick on the right handgrip.
- After completion of the setup phase, the pop-up message "Live image (OPMI)- Ready for IR 800" is displayed for 5 minutes in the white light live image.
- To start the subsequent recording phase, press the FL button on the handgrip or foot control unit once again.
- If more than 5 minutes elapse between the end of the SETUP phase and the start of the RECORD phase, the above setup process is repeated.



Note:

- The fluorescent agent approved for the application must not be administered to the patient **until after the start** of the RECORD phase (system takes about 3 seconds).



Note:

Automatic light field limitation has been activated:

If the magnification or light intensity is changed in the IR800 mode (fluorescence option), the light value may significantly increase above the previous level when INFRARED 800 is deactivated. Reset the light value to the previous level after deactivating INFRARED 800.

## RECORD phase

The RECORD phase is activated when the fluorescence button is pressed for the second time.



**Note:**

The light intensity start value on activation of the recording mode is always 50%.

The RECORD phase takes no longer than 5 minutes. Then the program changes automatically to the PLAYBACK mode.

**1 Light intensity**

The light intensity can be changed during the RECORD mode via the main menu or the buttons of the left handgrip.

**2 IR Camera Gain**

- Auto: the camera gain is automatically adjusted to the current conditions. "Manual gain setting" slider (3) is disabled.
- Manual: you can set the camera gain to a fixed value. Use "Manual gain setting slider (3) to select this value.

Factory setting: Auto

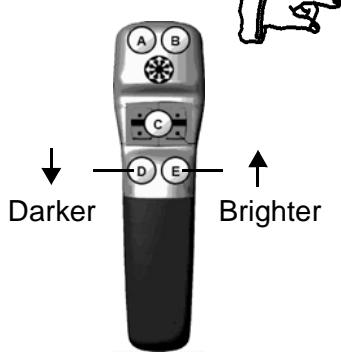
Manual gain setting

Slider for manual adjustment of the camera gain.

(See Pos. 2 Camera Gain)

Adjustment range: 4% - 100%

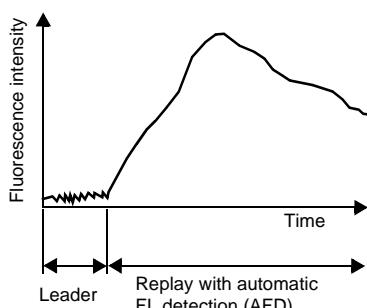
Factory setting: 20%



**Note:**

When Auto Camera Gain is deactivated (end Auto Gain or select manual setting), you can manually adjust the gain value on the touch-screen or using the yellow light button on the right handgrip.

In both cases, the Gain button is displayed on the bottom right of the video image for activation of a slider.



### Automatic Fluorescence Detection (AFD)

AFD activated: Video recording is started immediately when you have switched to the Record mode (prerequisite: the Digital Video Recording option). The video signal is constantly analyzed for fluorescence flow. If fluorescence detection has been activated, the PLAY-

BACK sequence starts after detection of the fluorescence flow. The preceding black phase (leader, see diagram) is not displayed during playback of the short and long replays.

AFD also has an effect on the display of the processing data in the diagram: if AFD is active, processing occurs without the leader.

- The stored video always includes the black leader, irrespective of whether automatic FL detection has been activated or deactivated.
- AFD deactivated: The short and long replays are played completely, including any existing black phase.

The Record mode is stopped either by the user by means of the FL button or after the maximum time span of 5 minutes has elapsed.

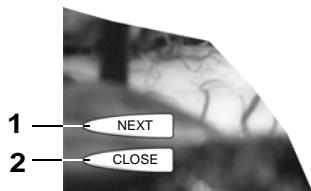
After the end of the RECORD phase, the system changes to the PLAYBACK phase.



Note:

After the RECORD phase, press the fluorescence button for at least 3 seconds to end INFRARED 800.

PiP visualization of the current OPMI white light video is not possible during the RECORD phase.



**NEXT button**

If you activate the full screen mode during the RECORD phase by pressing the full screen button, NEXT button (1) appears above CLOSE button (2).

- Press NEXT button (1) to activate the PLAYBACK phase (first short, then long replays). If the processing mode has been activated, the processing data will now be prepared.
- If you press the NEXT button again, you will return to the standard mode.

Press "CLOSE" button (2) to return from the full screen mode to the main menu.



Note:

A video clip is recorded and saved in the white light mode at the same time as the fluorescence video clip (prerequisite: the Digital Video Recording option).

Videos started with REC START are recorded irrespective of this process. If INFRARED 800 is selected for the external monitor, this video is briefly interrupted by the displayed replay screens.

## PLAYBACK phase

The PLAYBACK phase is activated on the third press of the fluorescence button. This phase comprises two successive visualization modes:

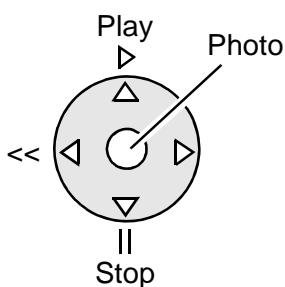
### 1 Short replay

If short replays have been configured, a short sequence of the recorded INFRARED 800 video is replayed during the predefined time until you press the FL button or the maximum number of loops has been reached. They will be followed by long replays, if appropriately configured.

### 2 Long replay

- In the long replay mode, the recorded video is replayed several times without limitation of the playback duration. The number of replays can be selected. If you press the FL button during the PLAYBACK phase, this visualization mode is stopped immediately and the system returns to the white light mode if the processing mode has not been configured.
- If AFD has been activated and fluorescence has been detected, the recorded video is played back from the point of FL detection. Any black phase is therefore not displayed.
- During the PLAYBACK phase (short and long replays), you can use the joystick of the right handgrip to control the playback process (play, stop, fast forward, fast rewind, photo).

:



Briefly press **Stop** + **<<** or **>>** Video moves backward or forward in steps

- stops when buttons are released

Hold down **Stop** + **<<** or **>>** Video clip is slowly played forward or backward

- stops when buttons are released

Hold down **Play** + **<<** or **>>** Fast forward or fast rewind of video clip

- stops when buttons are released

### 3 PiP in Replay (playback mode only)

- On: When PiP (Picture in Picture) has been activated, the simultaneously recorded white light video is displayed in a small window at the top right of the touchscreen.
- Off: No PiP display.



Note:

- You can end recording and playback by pressing the fluorescence button once again.
- If "FLOW 800" has not been configured, the system returns to the white light mode after the PLAYBACK phase, with the same settings that existed before the start of INFRARED 800.

## FLOW 800 processing phase



**Note:**

You can stop FLOW 800 processing by pressing the fluorescence button longer than 3 seconds.

- Press the fluorescence button to start the FLOW 800 processing phase.
- A pop-up message "**Start FLOW 800 processing mode**" appears for approx. 3s to indicate that the processing phase has started.
- In the live image, the preparation of the processing data is indicated in blue typeface "**FLOW 800 Processing**" with the **progress displayed in percent (%)**

When the preparation has been completed, a pop-up message appears:

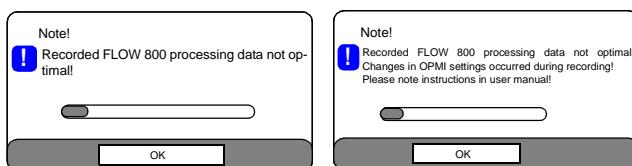
- "**Preparation of FLOW 800 processing completed**  
**Please press the FL button to display processing results.**
- The message "**Ready for FLOW 800 processing**" appears in blue typeface in the live image.
- Press the fluorescence button.

After the fluorescence button has been pressed, the FLOW 800 processing mode is opened with the MAP submenu and the Delay setting.



**Note:**

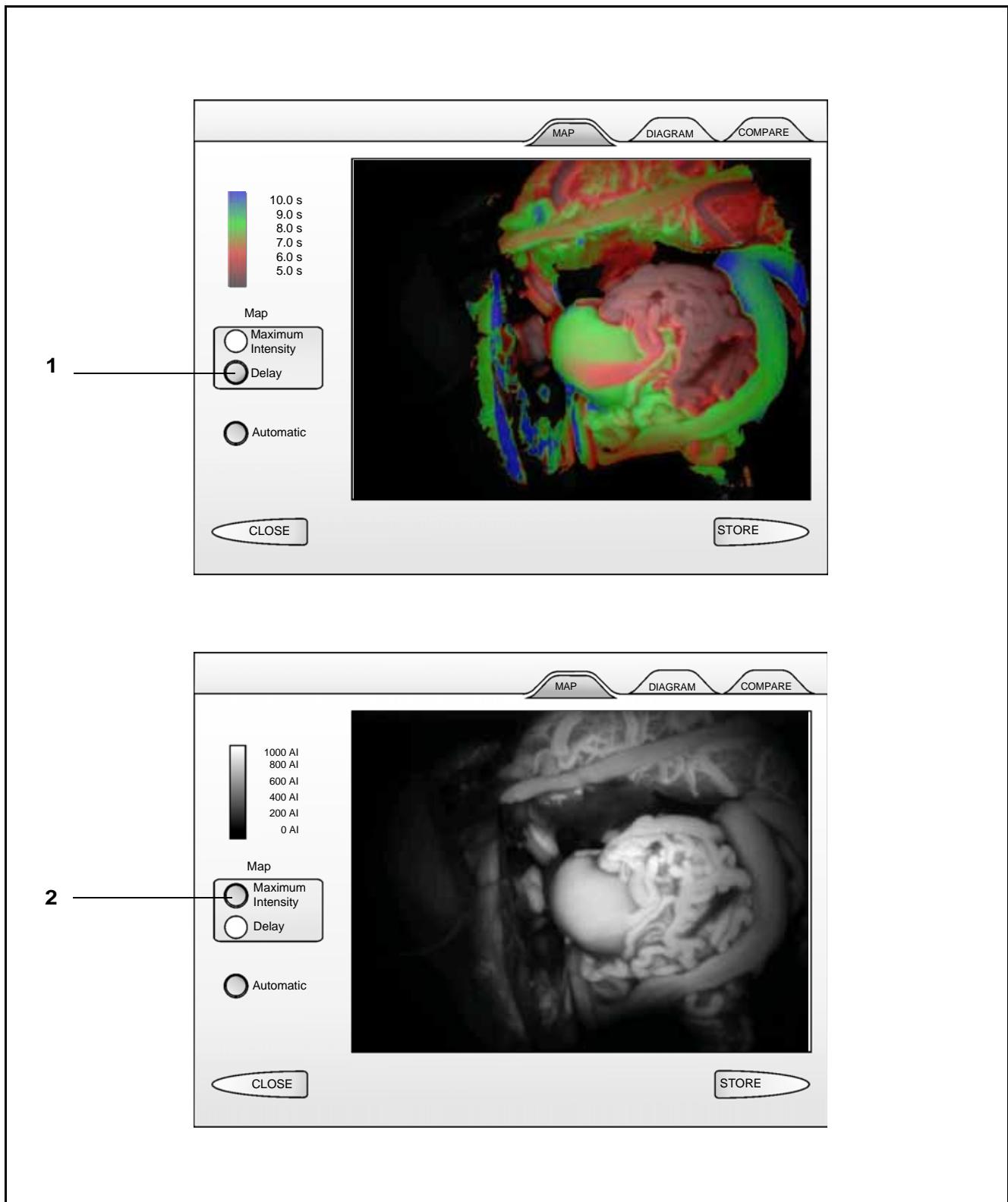
The following messages appear only if the data is 'not optimal', i.e. in the event of missing images or operating errors.



### FLOW 800 MAP

Choose between the two views:

- 1 "Delay"  
Display as a false-color image visualizing the time differences in the fluorescence flow.
- 2 "Maximum intensity"  
Display as a gray level image visualizing maximum intensity at each point during the video.



## DIAGRAM

Setting ROI (ROI = region of interest)

The selected regions are set in several steps:

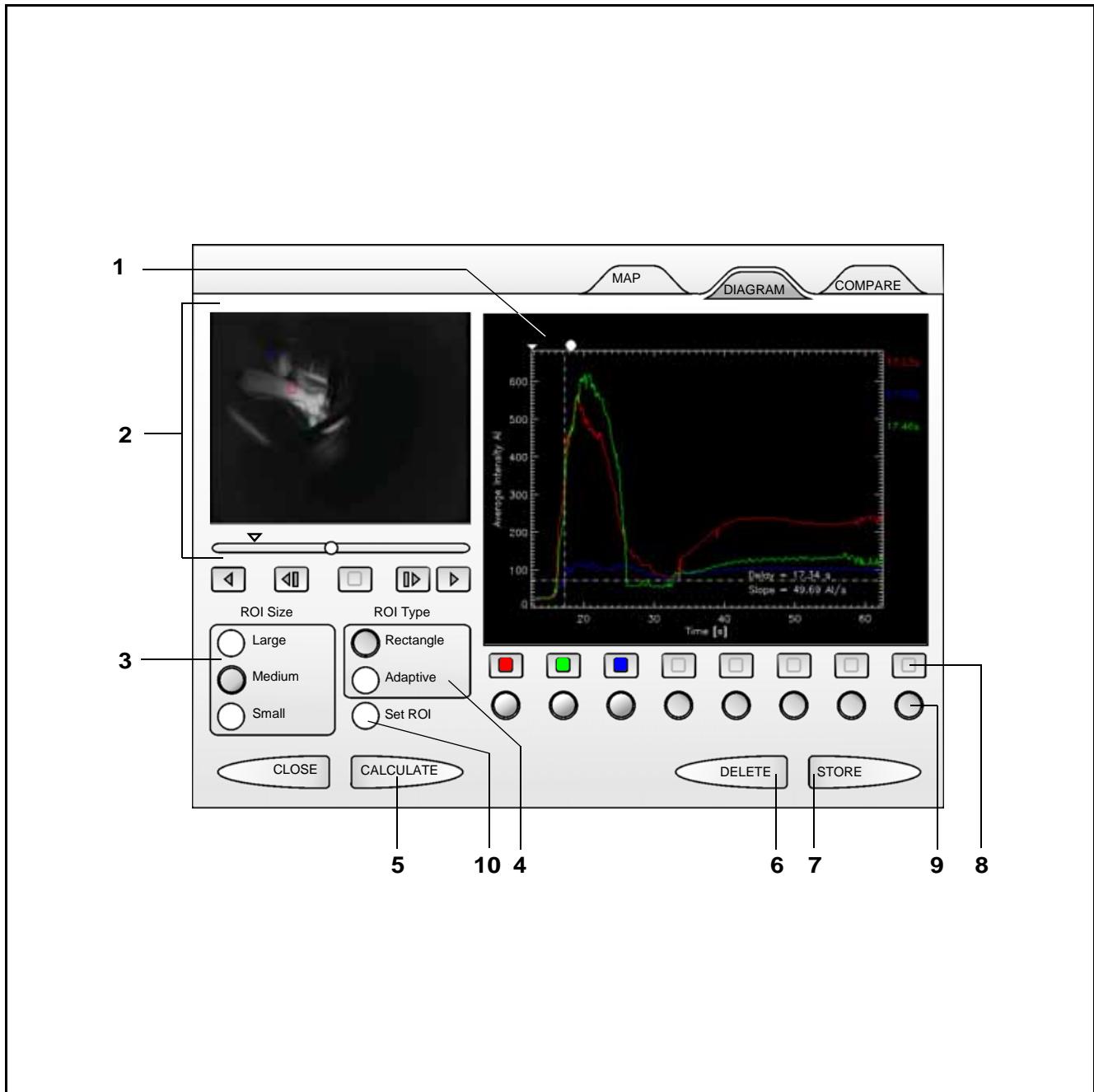
- Step A** The DIAGRAM menu offers a window with video player functionality (2).  
Navigate to the point in the video that contains the most interesting regions for processing.
- Step B** Press the "Set ROI" button (10).
- Step C** Roughly click on the target region in the displayed video image. A magnified image of the selected region is displayed.
- Step D** The magnified display permits you to  
a) perform fine positioning  
b) change the size of the ROI (3) (small, medium, large)  
c) toggle between the ROI types (4) of rectangle and adaptive
- Step E** Press the CALCULATE button (5) to generate the diagram and to have the line for the new ROI calculated and displayed.

Steps **A - E** can be repeated for additional ROIs.



Tips:

- Instead of starting the calculation every time you have set a ROI, you can also set all selection points (steps **A-D**) and finally perform the calculation in step **E**.
- A maximum of eight ROIs can be marked.
- The result is displayed as a curve in the result window (1). The STORE function permits you to save the diagram for documentation purpose. It is automatically filed in the analysis directory of the relevant patient.
- Adaptive ROIs may lead to jagged curves in low-contrast tissue structures.  
We recommend using rectangular ROIs in this case.



**Result buttons (8)**

for selecting the active ROI.

In the upper row (square buttons) only one button is active at a time. When this result button is pressed, the display of the associated diagram curve includes an auxiliary line at 50% of the maximum intensity and the AFD as a time axis.

An active diagram curve can be deleted by pressing DELETE button (6).

**Display buttons (9)**

for switching the ROI display on and off. The lower row (round buttons) is used to display/hide the associated curve.

Hidden curves and their values are not taken into account in the calculation and are not saved. After calculation of at least one measuring position, the display looks as follows: in the result window, the result is shown both as a curve and in the form of text, and one result button is highlighted in color. The button below the result button is blue to indicate that the results are actually displayed. The "CALCULATE" button (5) is disabled as no further ROIs have been selected. You can generate results for further ROIs by pressing the "Set ROI" button and clicking in the video window.

**STORE (7)**

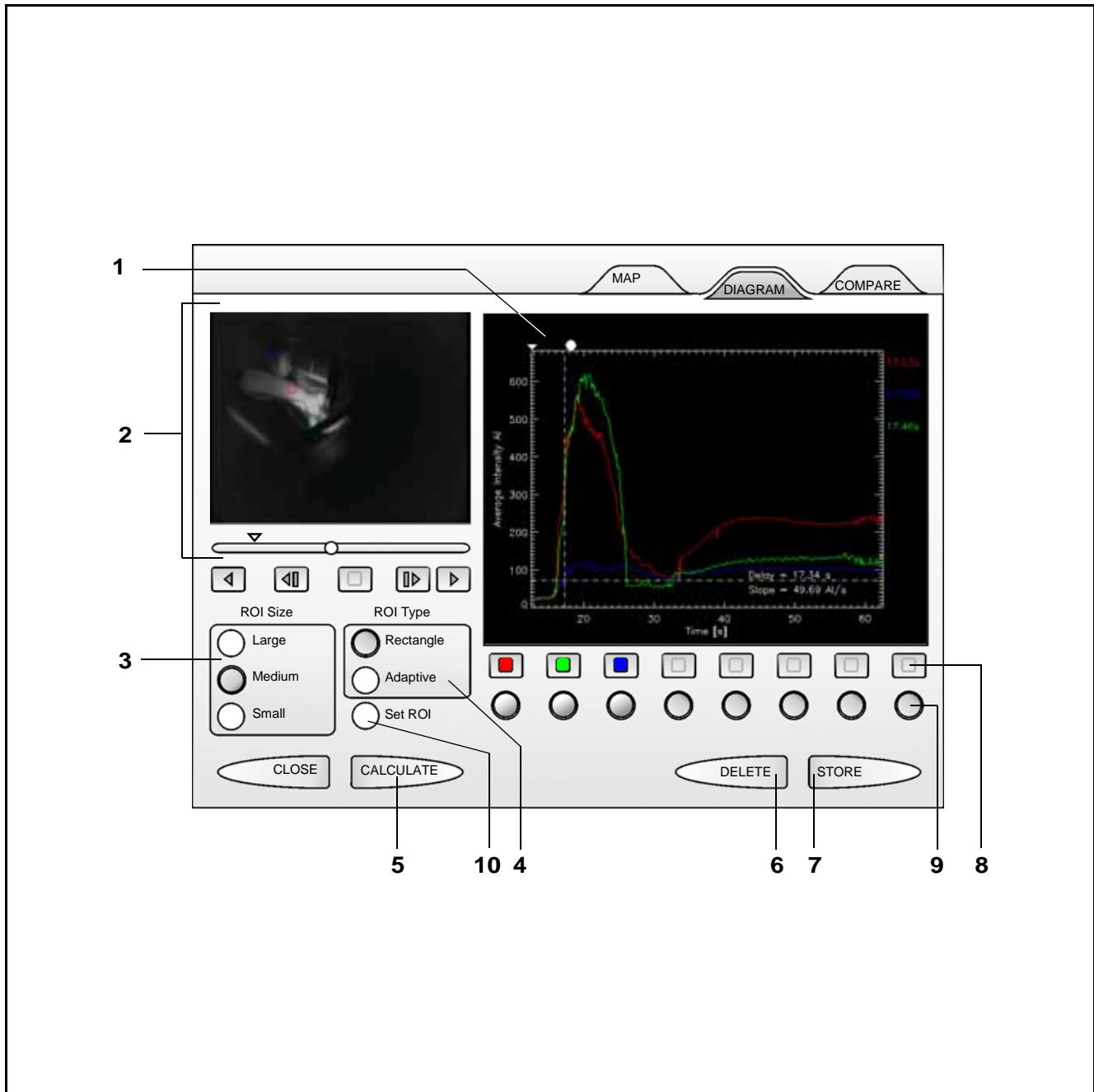
The STORE button permits you to save the diagram to the image directory of the corresponding patient.

- Only diagrams previously created with STORE on the Diagram page are offered for comparison.
- Only the visible curves and their values are saved, hidden curves are not saved.
- The STORE function files the diagrams and ROI images also under PAT-FILES / IMAGES. If the images have been deleted or renamed there, they are not offered for comparison.
- The diagrams and ROI images are saved in pairs. If one image of an image pair has been deleted or renamed, they are not offered for comparison.

**Tip:**

By exporting the patient files (saving to CD/DVD or a USB medium), a Diagram.csv file is created in Patient Files/Analysis. The csv file contains the diagram values which can be exported to spreadsheet programs.





## FLOW 800 COMPARE

The "COMPARE" menu is used to compare images or diagrams of a patient video. The maps of the current video (on the right) can be compared with those of earlier videos (on the left) of the same patient. The current diagram (on the right) can also be compared with diagrams of earlier videos (on the left). The diagrams must be saved in the FLOW 800 diagram mode for this purpose.

The image/diagram last saved is displayed on the right-hand side. For searching the images and diagrams to be compared, scroll through the list in the search window using the "BACK" and "NEXT" buttons. Select the images required by clicking on the thumbnails. The images are displayed in the sequence in which they were recorded. The time stamp of the video file is displayed below the images in the search window to facilitate orientation.



### Note:

If a video has been renamed:

If the name of the video no longer includes the time stamp format, the beginning of the new file name is displayed according to the space available (max. 19 characters). Longer names are shortened accordingly, and three dots are added.

The following characters are not allowed in the rename dialog: dot, apostrophe and question mark.

Select the visualization mode to be used for the comparison of the images:

- Maximum Intensity: display as gray level image.
- Delay: display as false color image over time.



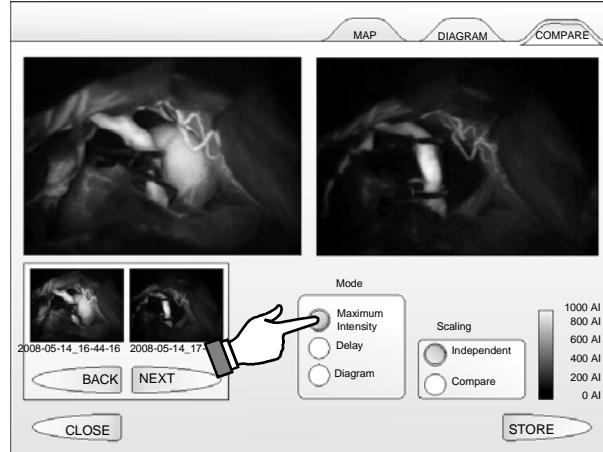
### Note:

– By default, the results are visualized with identical scaling. You can cancel identical scaling in the "Maximum Intensity" and "Delay" modes by pressing the "Independent" button. The images can then be compared at independent scales.

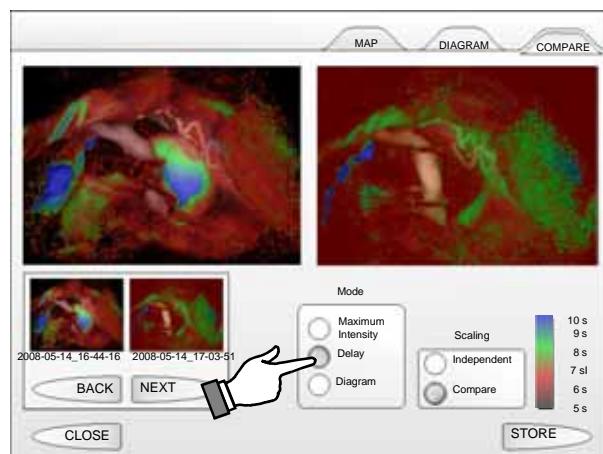
– A comparison of delays only makes sense if AFD was activated when the video was recorded.

- Diagram: comparison of diagrams
- Scaling is disabled in the Diagram mode.
- If no diagram has been saved for the displayed processing data, the Diagram button is disabled.

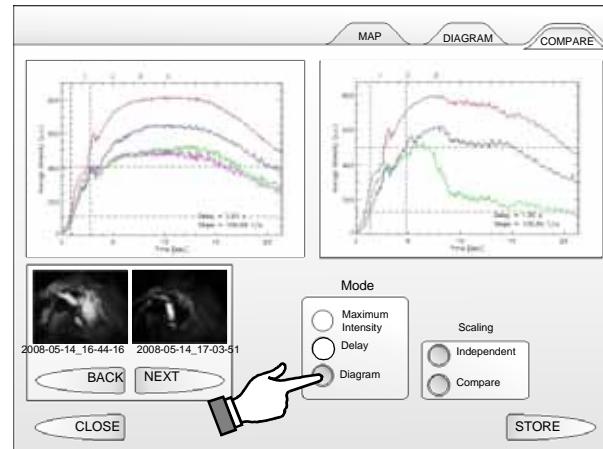
Compare:  
Maximum intensity



Compare:  
Delay



Compare:  
Diagram



## Saving comparisons

The "COMPARE" menu permits you to save the comparisons of images or diagrams.



### Note:

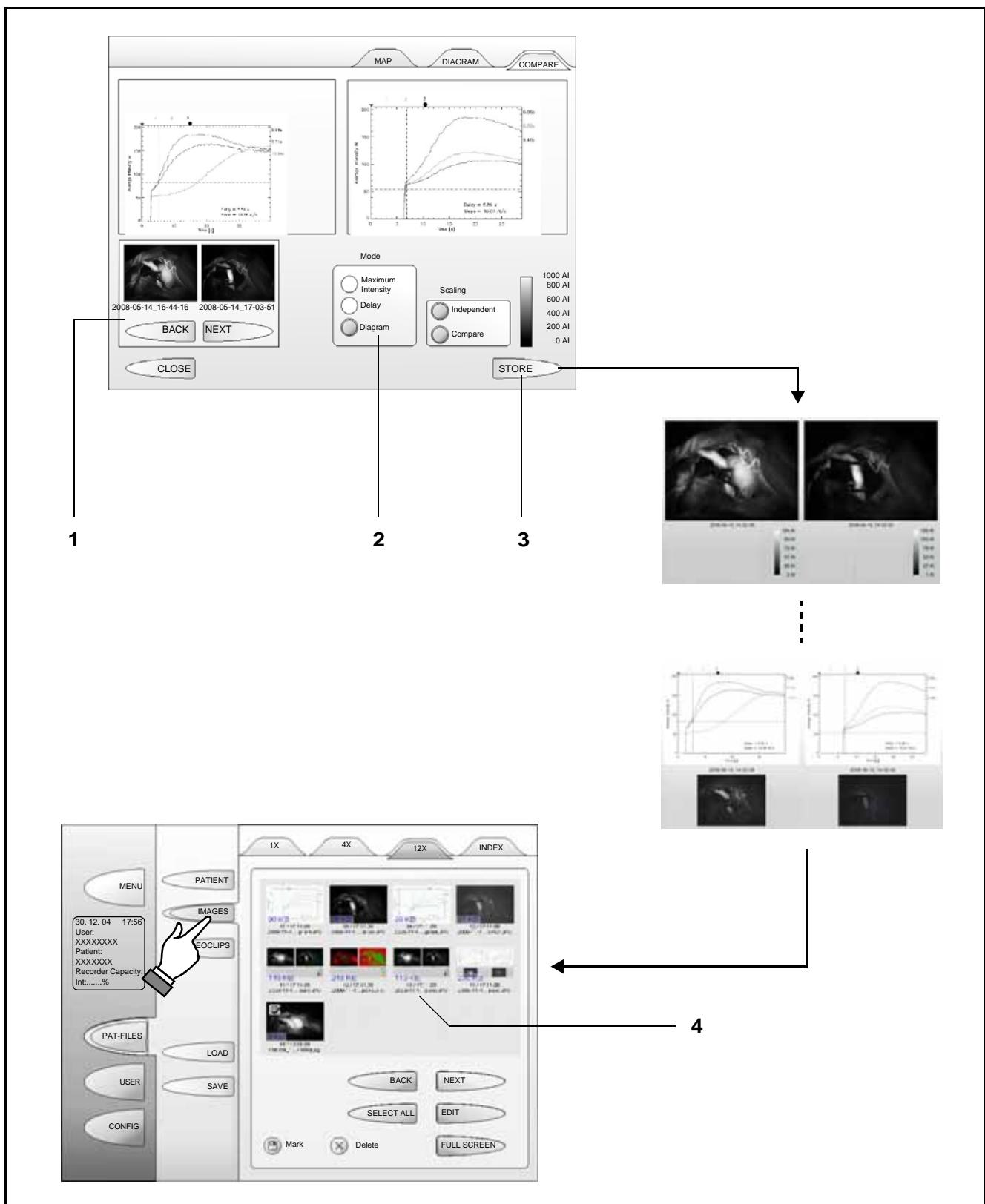
Only images and diagrams previously created with STORE are offered for comparison.

- Under Mode (2), select the visualization mode to be used for saving the comparison of the images.
  - Maximum Intensity: comparison of gray level images
  - Delay: comparison of false color images
  - Diagram: comparison of diagrams
- Use the "BACK" and "NEXT" buttons in search window (1) to select the image to be displayed for comparison with the current image. Select the images required by clicking on the thumbnails. The images are displayed in the sequence in which they were recorded.
- STORE button (3) permits you to save the comparison image to the image directory of the corresponding patient.
- The patient's image directory (4) permits you to view, edit or save the images (see Seite 1).



### Note:

When saving data to external data media (in particular USB storage media not approved by ZEISS):  
check that the data export was successful!





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# BLUE 400 fluorescence module (option)



## Note:

The system has been approved in the EU under directive 93/42/EEC. However, according to national regulations, additional authorization may be required in the country in which the system and application will be used.  
The fluorescence option is also available in other countries. Please contact your local Carl Zeiss representative for further information.

<b>Integrated BLUE 400 (BL 400) fluorescence module</b>	<b>340</b>
Intended use	340
Description	344
<b>BL 400 checklist</b>	<b>348</b>

# Integrated BLUE 400 (BL 400) fluorescence module

## Intended use

Carl Zeiss Surgical GmbH	
SN	50xxxx
BLUE 400	
REF	302581-9050-000

The integrated BLUE 400 fluorescence module is used to visualize fluorescent areas. The module has been designed for excitation in the wavelength range from 400 to 410 nm and for observation in the wavelength range from 620 to 710 nm. By pressing a button, the surgeon can switch between white light and the blue-violet excitation light for fluorescence.

### Intended use under standard conditions

The BLUE 400 fluorescence option permits the user to visualize and digitally record fluorescence light and auto-fluorescence light emitted by tissue. \*) The OPMI Pentero user manual only specifies the wavelength region of the light source used for the selection of suitable fluorescence media. The filters have been selected and specified on the basis of the technical data of typical fluorescence media. The exact specification of the fluorescence medium has not been included, however, since further influencing factors existing in addition to technical parameters need to be assessed by the user.

The visualization of the fluorescence signal is influenced by several different factors:

- the fluorescence medium and its concentration in the tissue
- the illumination intensity of the light source in the defined wavelength range
- the transmission of the optical system
- the total magnification and the aperture setting
- the working distance and the illuminated field diameter

\*) Digital video recording option is required.



**Note:**

The illumination intensity is influenced by the following factors:

- the selected brightness of the light source
- the illuminated field diameter
- the working distance
- the zoom link function

**Caution:**

The zoom link function increases the illumination intensity when a higher zoom value is set!

**Warning!**

Make sure that no tissue damage is caused by excessive illumination intensity (see ).

**Warning!**

- Only use fluorescence media approved for the planned application.
- Check whether the fluorescence medium can be excited in the wavelength range from 400 to 410 nm and whether it emits fluorescent light of sufficient intensity in the wavelength range from 620 to 710 nm.
- As in almost all diagnostic procedures, false-positive and false-negative results can also occur in the fluorescence-based method. Evaluation by the user based on other methods is necessary.

**Contraindications**

The medical contraindications applicable to the use of OPMI Pentero in combination with a fluorescence medium are those to be taken into account when using suitable brand substances.

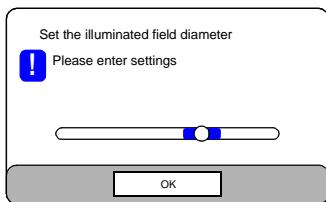
The surgeon can choose whether the surgical field should be illuminated with blue violet excitation light for fluorescence or with light for normal observation. For this, the surgeon switches to the type of illumination required using a preconfigured button either on the microscope handgrip or foot control unit.

This button on the handgrip or foot control unit permits the surgeon to toggle between the standard white light mode and the fluorescence mode during surgery. This mode permits visual observation of the fluorescence through the eyepieces. Press the fluorescence button again to switch back to the white light mode.



**Note:**

- To obtain optimum illumination in the fluorescence mode, set the adjusting knob for the illuminated field diameter on the OPMI to the center position.



If the software detects that the OPMI supports a motorized illuminated field diaphragm, the illuminated field diameter settings are performed automatically and no dialog is displayed.

If no motorized illuminated field diaphragm is detected, the dialog shown on the left is displayed.

- Change the illuminated field diameter until the red button is located within the blue area.
- The room lighting impairs the visualization of fluorescence both on the monitor and when seen through the eyepieces. For surgery using the BLUE 400 option, you should therefore make sure that the room is darkened, if possible.



**Warning!**

Perform a function test before using this module (see page 348). Focus the microscope on the BLUE 400 fluorescence target supplied, and switch to the fluorescence mode. The function test is successful if the image on the touchscreen corresponds to the enclosed photo. Slight deviations in color and brightness are permissible.



## Description

### FLUORESCENCE

- 1 Deactivating the fluorescence applications
- 2 Activating the integrated INFRARED 800 (IR 800) fluorescence module  
Option, see page 261.
- 3 Activating the integrated BLUE 400 fluorescence module (BL 400)  
The OPMI Pentero with BL 400 fluorescence module can be used in two different modes. In the white light mode, the object is illuminated with visible light, as usual. To switch to the fluorescence mode, use the handgrip or foot control panel (configurable buttons, see page 136 and page 138).

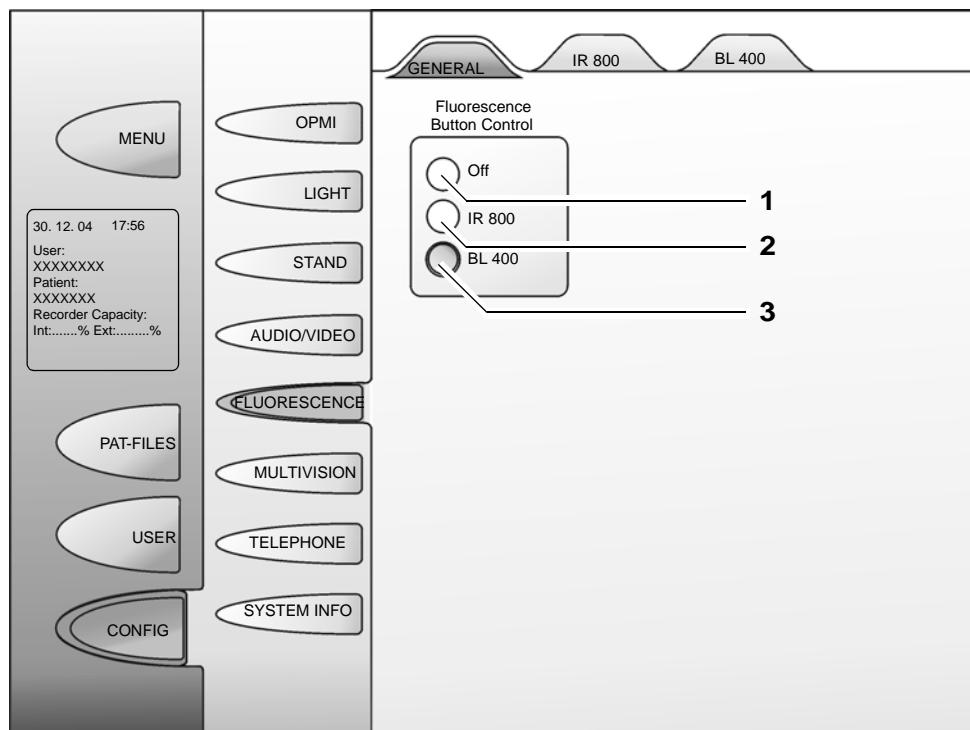


Note:

A button either on the handgrip of the surgical microscope or on the foot control unit can be programmed for the fluorescence application.

This configured fluorescence button can then be used to start one of the two optional fluorescence applications, depending on which option (IR 800 or BL 400) has been selected.

You can only use BL 400 or IR 800 alternatively.



## Integrated BLUE 400 (BL 400) fluorescence module



### Warning!

Perform a function test before using this module (see page 348). Focus the microscope on the fluorescence target supplied, and switch to the fluorescence mode. The function test is successful if the image on the touch-screen corresponds to the enclosed photo. Slight deviations in color and brightness are permissible.

#### Brightness control

##### 1 Auto

The video system tries to maintain the selected brightness at a constant level by automatic control of the exposure time.

##### 2 Shutter

The exposure time of the camera can be varied by pressing the appropriate button (4). (The camera does not control image brightness).

The default setting corresponds approx. to 1/50 or 1/100 in PAL systems and approx. 1/60 or 1/120 in NTSC systems.



#### Note:

- If fluorescence intensity is low, the quality of the display on the monitor can be improved by selecting longer shutter times.
- To obtain optimum illumination in the fluorescence mode, set the adjusting knob for the illuminated field diameter on the OPMI roughly to the center position.  
Your system performs this setting automatically or displays a dialog with a setting bar (see Checklist/Microscope page 349).

##### 3 Light intensity initial value

Enter the illumination intensity in percent. The xenon lamp will light at this brightness level when you switch to the fluorescence mode.

When you switch back to the white light mode, the light intensity previously used in this mode will automatically be set again.

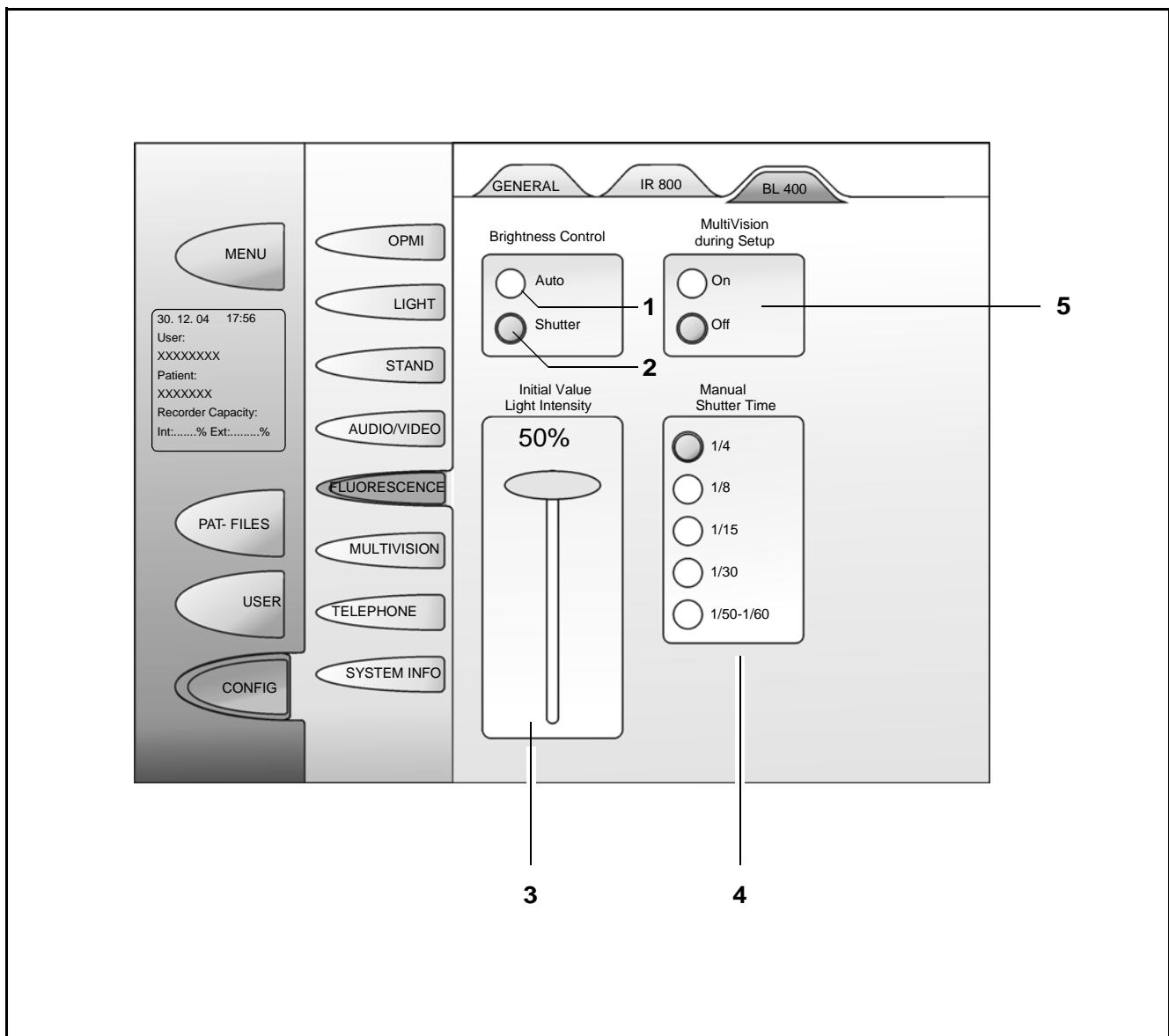
##### 4 Manual shutter time

The exposure time of the camera can be varied by pressing the appropriate button.

## 5 MultiVision during setup

During the setup phase (focus, zoom, light, illuminated field diaphragm, etc. are set to defined values), message boxes can be displayed on the touchscreen.

If "Multivision during Setup" has been set to ON, these messages are also displayed in the microscope's data injection system (DIS); if the function is OFF, the messages are not displayed in the DIS.



## BL 400 checklist



### Warning!

- The BLUE 400 fluorescence target is not sterile. Therefore perform the function test before surgery (without patient!).
- With increasing operating time of the light source, the illumination intensity and, as a result, the brightness of fluorescence decrease. When a specified, guaranteed lamp service life is exceeded, the user will be warned in a message on the touchscreen that the brightness of the light source is no longer sufficient for correct fluorescence application. At the same time, the user is prompted on the touchscreen that a new lamp for fluorescence application needs to be installed. This message appears on power-up of the system, and will only disappear after acknowledgement by the user.

Always check the following points before the use of the integrated fluorescence module (without patient!):

(Also note the brief operating instructions enclosed with the BLUE 400 fluorescence target).

- Place the BLUE 400 fluorescence target on a level surface.

#### Touchscreen:

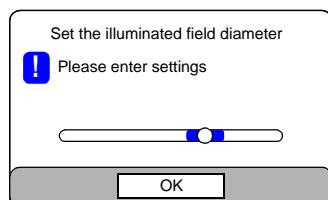
- In the **Config menu**, select FLUORESCENCE - GENERAL - BLUE 400.
- In the **BL 400 menu**, set brightness control to AUTO.
- In the **BL 400 menu**, set the light intensity start value to 100%.
- In the **Config menu** OPMI-DIAPHRAGM, set the function Preselection Depth of Field to Small.
- In the **Config menu**: OPMI-FOCUS, set the function Focusing Aid Laser Spots to On.

#### Handgrip:

- On the focus rocker switch of the **handgrip**, set the working distance to 250 mm (display on the touchscreen: FOCUS 250 mm).
- On the zoom rocker switch of the **handgrip**, set the magnification to factor 3 (display on the touchscreen: ZOOM 3x).

#### Microscope:

- On the **microscope**, set the adjustment knob for the illuminated field diameter to a medium diameter.



If the software detects that the OPMI supports a motorized illuminated field diaphragm, the illuminated field diameter settings are performed automatically and no dialog is displayed.

If no motorized illuminated field diaphragm is detected, the dialog shown on the left is displayed.

- Change the illuminated field diameter until the red button is located within the blue area.
- Using the focusing aid, adjust the microscope in such a way that the image on the touchscreen corresponds to the enclosed photo.

#### **Comparison:**

The function test is successful if the image on the touchscreen corresponds to the enclosed photo.

Slight deviations in color and brightness are permissible.



#### **Note:**

The room lighting impairs the visualization of fluorescence both on the monitor and when seen through the eyepieces. For surgery using the BLUE 400 option, you should therefore make sure that the room is darkened, if possible.



#### **Note:**

Automatic light field limitation has been activated:

If the magnification or light intensity is changed in the FL400 mode (fluorescence option), the light value may significantly increase above the previous level when BL400 is deactivated.



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# DICOM (option)

<b>DICOM</b>	<b>352</b>
Intended use	352
Conformance Statement	352
Configuring the network connection	356
Further information on the Ethernet connection	362
Connection test	364
Configuring the DICOM connection	366
Adding, editing and deleting a DICOM server	366
Configuring the DICOM function	368
Defining the maximum video export size to network servers	372
Error messages during system configuration	376
Importing patient data sets (from RIS systems)	378
Importing patient data sets (from PACS system)	380
Loading patient data	382
Exporting DICOM data to a PACS	390

# DICOM

## Intended use

DICOM is the abbreviation for **Digital Imaging and Communications in Medicine**, a recommended standard for the exchange of images and videos in medicine. In addition to image and video data, the DICOM data set also contains meta information such as patient name, recording date and system parameters.

In Conformance Statements, manufacturers and implementers describe which DICOM functions are supported by their systems, permitting users familiar with DICOM to determine whether the required functions can be implemented with the systems to be purchased.

## Conformance Statement



### Caution:

- DICOM stipulates that a Conformance Statement must be created for each device or program that conforms to the standard. The format and content of the statement must comply with the DICOM standard. The Conformance Statement specifies which DICOM services and options are supported, which features and upgrades have been implemented by the manufacturer and how the device communicates with other systems. Theoretically, the comparison of two Conformance Statements enables you to find out whether two DICOM-compatible devices can communicate with each other.  
Use the Conformance Statement to check that the connection parameters have been correctly defined. Carl Zeiss does not assume any responsibility for interferences in this respect with other devices.

## Activation

The password is a kind of license key assigned by Zeiss. This password and the default passwords are activated by our service staff.

Network and DICOM addresses must be defined by the IT administrator responsible. All IT and DICOM parameters (PACS/RIS name, AE title, IP address, port number) must be known to the Zeiss service staff prior to installation. Caution: Please note that the AE titles are case-sensitive!



**Warning!**

Do not use imported images and videos for diagnostic purposes!

Perform diagnosis only at approved diagnostic workstations.

If possible, do not enter patient master data locally in order to avoid confusion. Load the patient master data from a PACS/RIS system.

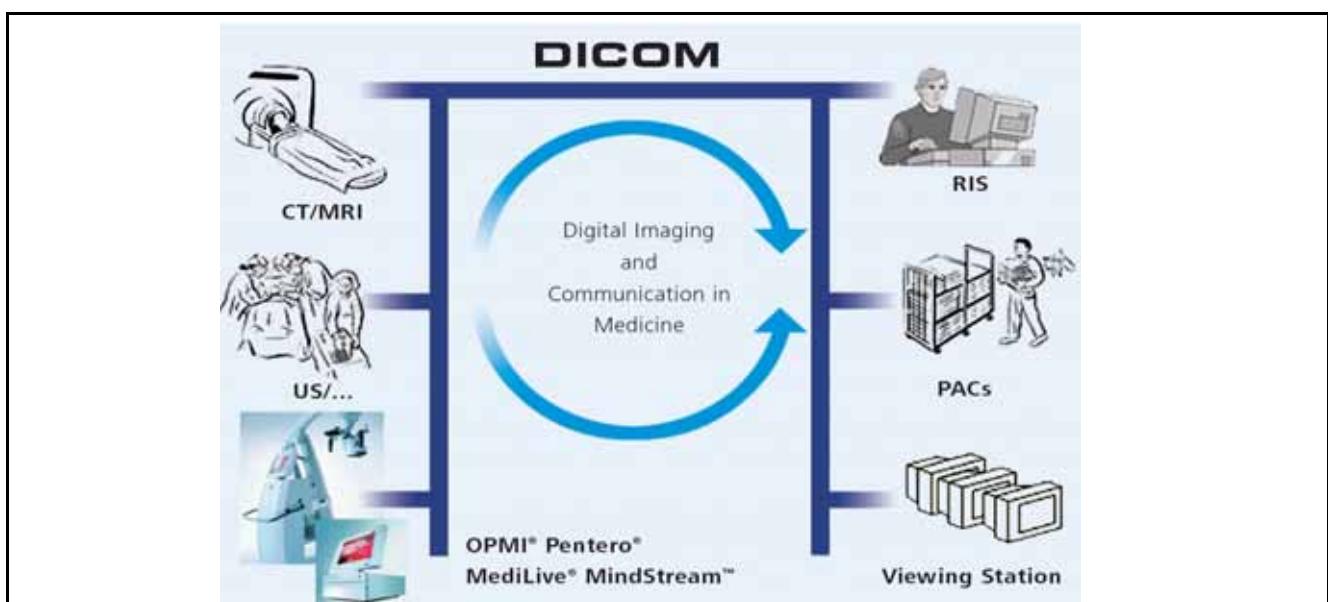
The abbreviation RIS stands for **RadiologyInformation System**.

PACS stands for **Picture Archiving and Communication System**.

**Note:**

The system is not intended for permanent data archiving. You can use CDs/DVDs, a USB stick, an external hard drive or a hospital server (DICOM option, see page 351) for data backup. All users are responsible for archiving their own data.

Data can be deleted by every subsequent user!



**Caution:**

- It is the user's responsibility to ensure that the system environment is free from viruses.
- The network connector must be adequately contact-protected, e.g. made of plastic material.
- The cable and connector of the network connection must at least comply with Cat-5e EIA/TIA-568A-5, i.e. the more recent Class D values from ISO/IEC 11801:2002 or EN 50173-1:2002.
- Do not use loaded images and videos for diagnostic purposes.
- Always enter the patient ID to ensure that data to be stored in a DICOM archive are not assigned inadvertently to the wrong patient.  
If you change a patient ID imported via DICOM, it cannot be guaranteed that the data is assigned to the correct patient when it is stored in the archive.
- Select the correct PACS.
- Check the connection configuration with the PACS; otherwise there is the risk of data being lost.
- Correctly implement the TCP/IP configuration.
- Perform a connection test.
- Use the DICOM standard.
- Export to CD/DVD or USB stick is only enabled after authentication by the user and password entry.
- In addition, there is the possibility of anonymizing DICOM data.

**Warning!**

Data transmitted by the system into the data network or data available in the data network risk to be corrupted or transmitted incompletely. Therefore, no liability can be accepted for the correctness of the data.

The operator of the data network is responsible for compliance with the legal requirements regarding data security and for the protection of personal rights.



## Configuring the network connection

### Activation

The password is a license key assigned by Zeiss. This password and the default passwords are activated by our service staff. The passwords are given to you in a separate envelope.

Network and DICOM addresses must be defined by the IT administrator responsible.



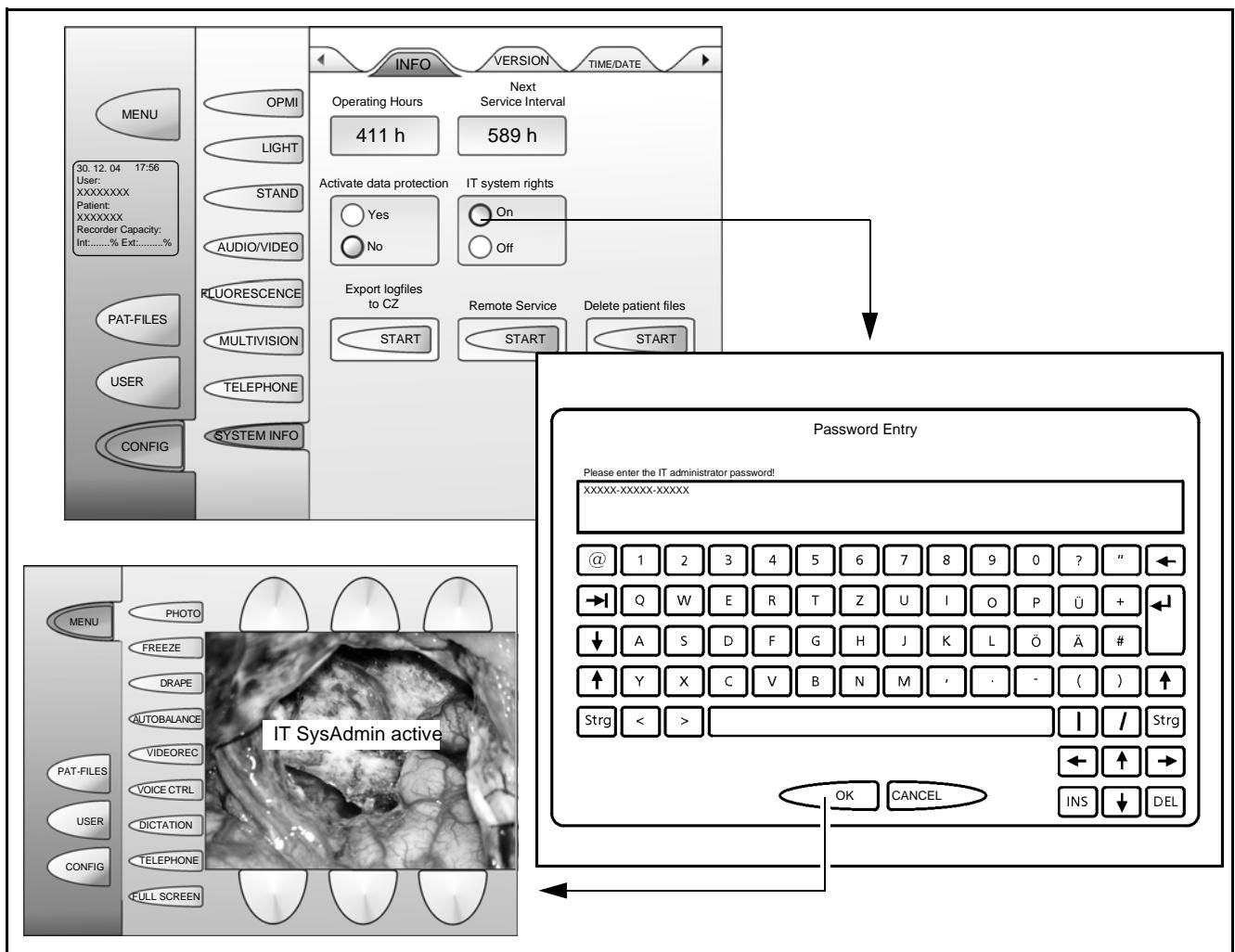
**Note:**

When the IT system rights have been activated, the following note is displayed in the main menu: "IT SysAdmin active".



**Caution:**

After entry of the license, the system must be switched off and on again.



**Note:**

The NETWORK and DICOM tabs become accessible only after entry of the DICOM license and when the system has been switched off and on again. The tabs can only be accessed by the IT administrator.

You can make the local network settings in the {CONFIG}[SYSTEM-INFO](NETWORK) tab.

The IT administrator defines the IP address management selection:

**1 Dynamic IP address (DHCP)**

Factory setting: Dynamic IP address active

Assignment of a dynamic IP address: a dynamic IP address is an IP address which is only valid for the duration of one Internet or network session. Dynamic means that the network user receives a new public IP address every time he logs onto the network.

**2 Static IP address**

Assignment of a fixed IP address: fixed IP addresses are addresses constantly assigned to a system.

**Caution:**

Names and addresses must not be assigned several times! They must occur only once in the network (host-to-host connection).

### Activating a dynamic IP address

**3 Host:**

The host name is made available by the IT administrator.

On pressing the button, the keyboard dialog opens and enables you to enter the host name. Only alphanumeric characters are permitted. Factory setting: "---

**Note:**

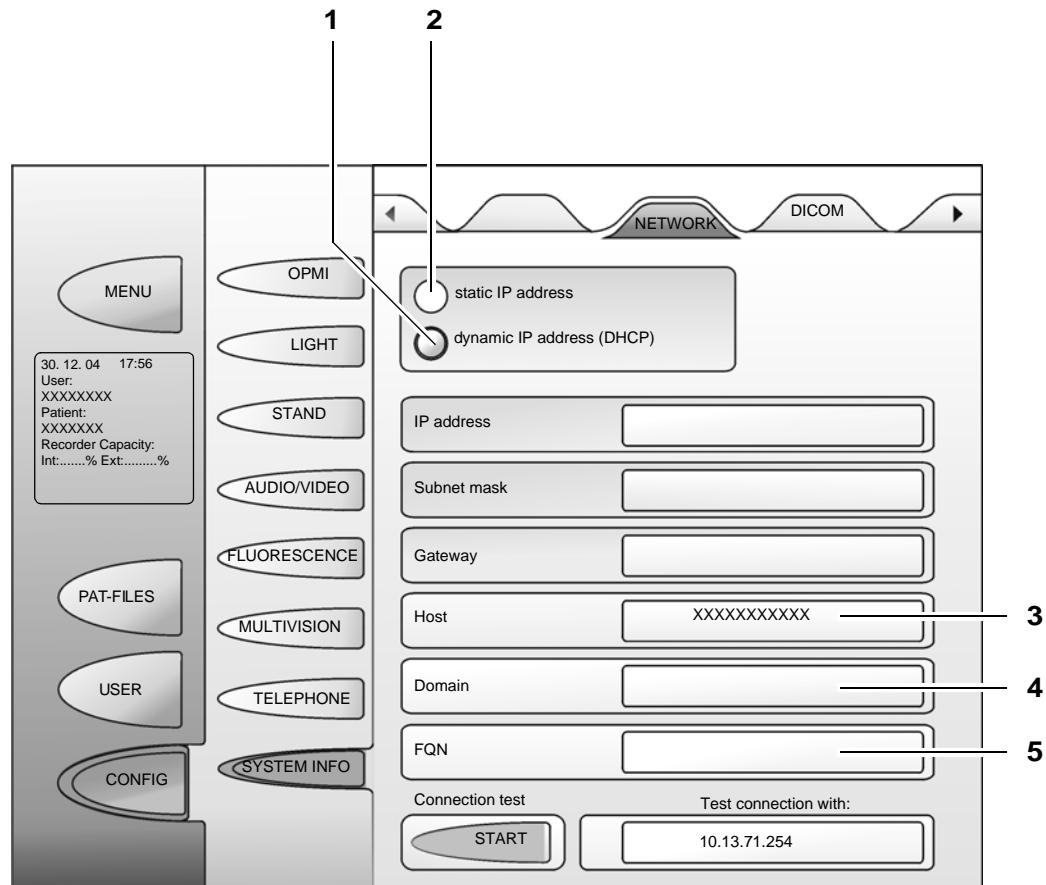
It may take some time until a connection is found.

**4 Domain**

The domain name specifies an authorization area describing the areas with which network communication is possible. It cannot be changed by the user.

**5 FQN (Full Qualified Name)**

This is the device address assigned by the DHCP server. It cannot be changed by the user.



## Activating a static IP address

The following information is made available by the IT administrator:

**1** IP address:

Opens the keyboard dialog for the entry of the local IP address.

Only numeric entries with the following syntax are possible:  
<No>.<No>.<No>.<No> (No. ranging between 0 and 255)

Factory setting: 127.0.0.1

**2** Subnet mask:

Opens the keyboard dialog for the entry of the local subnet mask.

Only numeric entries with the following syntax are possible:  
<No>.<No>.<No>.<No> (No. ranging between 0 and 255)

Factory setting: 255.255.0.0

**3** Gateway:

Opens the keyboard dialog for the entry of the local gateway.

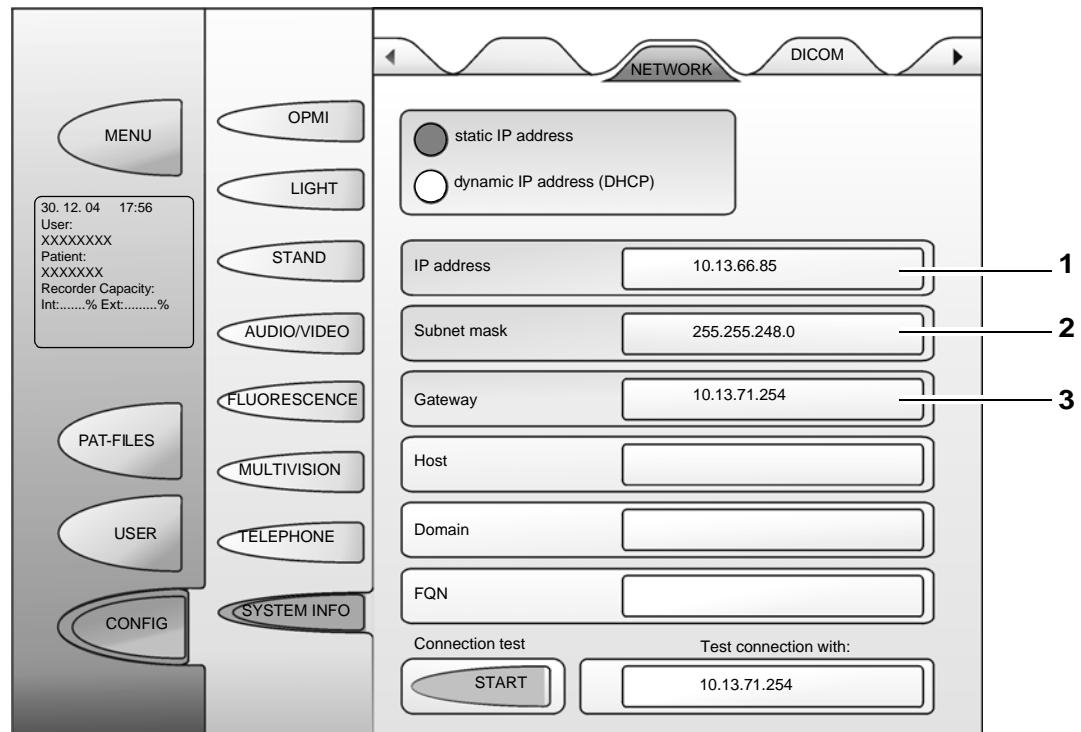
Only numeric entries with the following syntax are possible:  
<No>.<No>.<No>.<No> (No. ranging between 0 and 255)

Factory setting: 127.0.0.1



Note:

If no gateway is required or available, open the keyboard dialog for entry and delete (←) the existing entry.



## Further information on the Ethernet connection

You can make the local network settings in the {CONFIG}[SYSTEM-INFO](NETWORK) tab.

Your local network administrator will tell you how to configure the Ethernet connection to ensure that it matches the network configuration at the site of installation:

"Static IP address" or "Dynamic IP address (DHCP)".

Depending on whether you selected "Static IP address" or "Dynamic IP address (DHCP)", different input fields will be displayed:

Static IP address	Dynamic IP address (DHCP)
<b>IP address</b> 127.0.0.1	<b>IP address</b> <blank>
<b>Subnet mask</b> 255.255.0.0	<b>Subnet mask</b> <blank>
<b>Gateway</b> 127.0.0.1	<b>Gateway</b> <blank>
<b>Host name</b> <blank>	<b>Host name</b> <XXXXXXXX>
<b>Domain</b> <blank>	<b>Domain</b> <blank>
<b>FQN</b> <blank>	<b>FQN</b> <blank>

For the static IP address, entry of the gateway is optional.

### Configuration of the static IP address

#### IP address

127.0.0.1 is the default value. All systems are delivered with the same IP address.

The IP address is divided into numeric blocks:

XXX . XXX . XXX . XXX

#### Subnet mask

255.255.0.0 is the default value. All systems are delivered with the same subnet mask.



**Gateway**

The default gateway address setting on delivery is 127.0.0.1.

**Configuration of the dynamic IP address**

XXX . XXX . XXX . XXX

**Automatic log-in**

The dynamic configuration is performed automatically by the DHCP client integrated in the system.

The DHCP client of your system receives the following information from the server of the local data network (DHCP server):

**IP address**

**Subnet mask**

**Gateway** (optional).

- Connect your system to the data network, i.e. make the Ethernet connection between your system and the local data network.

Plug and Play:

As soon as your system has been connected to the local data network, it contacts the DHCP server of the data network by transmitting its preset host name (XXXXXX) to the DHCP server.

The DHCP server of the data network replies by returning the host name (XXXXXX) of your system together with its own address, i.e. its domain name (e.g.: uni\_klinik.de), to your system.

Your system has now been properly logged in to the local data network.

This address composed of the host and domain names is the "full qualified name" (FQN). You need the full qualified name to log in to your system from the internet using for example:

[http://imagebox.uni\\_klinik.de](http://imagebox.uni_klinik.de)

**Note:**

If other systems are already operated within the local data network, different host names must be used. In this case, you need to change the host name of the system to be newly installed.

**Manual log-in**

For manual configuration of the dynamic IP address, you need to enter the host name.

## Connection test



### Note:

The valid IP address with subnet mask, gateway and open ports is tested.

The connection test can be exited using the "Close" button. The user returns to the {CONFIG}[SYSTEMINFO](NETWORK) tab.

The "Repeat" button permits you to repeat the connection test with the existing network configuration. The results of the previous test are then deleted from the list.

The "Details" button permits you to have the test results displayed in a non-editable text field.

Use the two navigation buttons  $\downarrow$ ,  $\uparrow$  to navigate in the text field (jump to the next line in the text with one click).

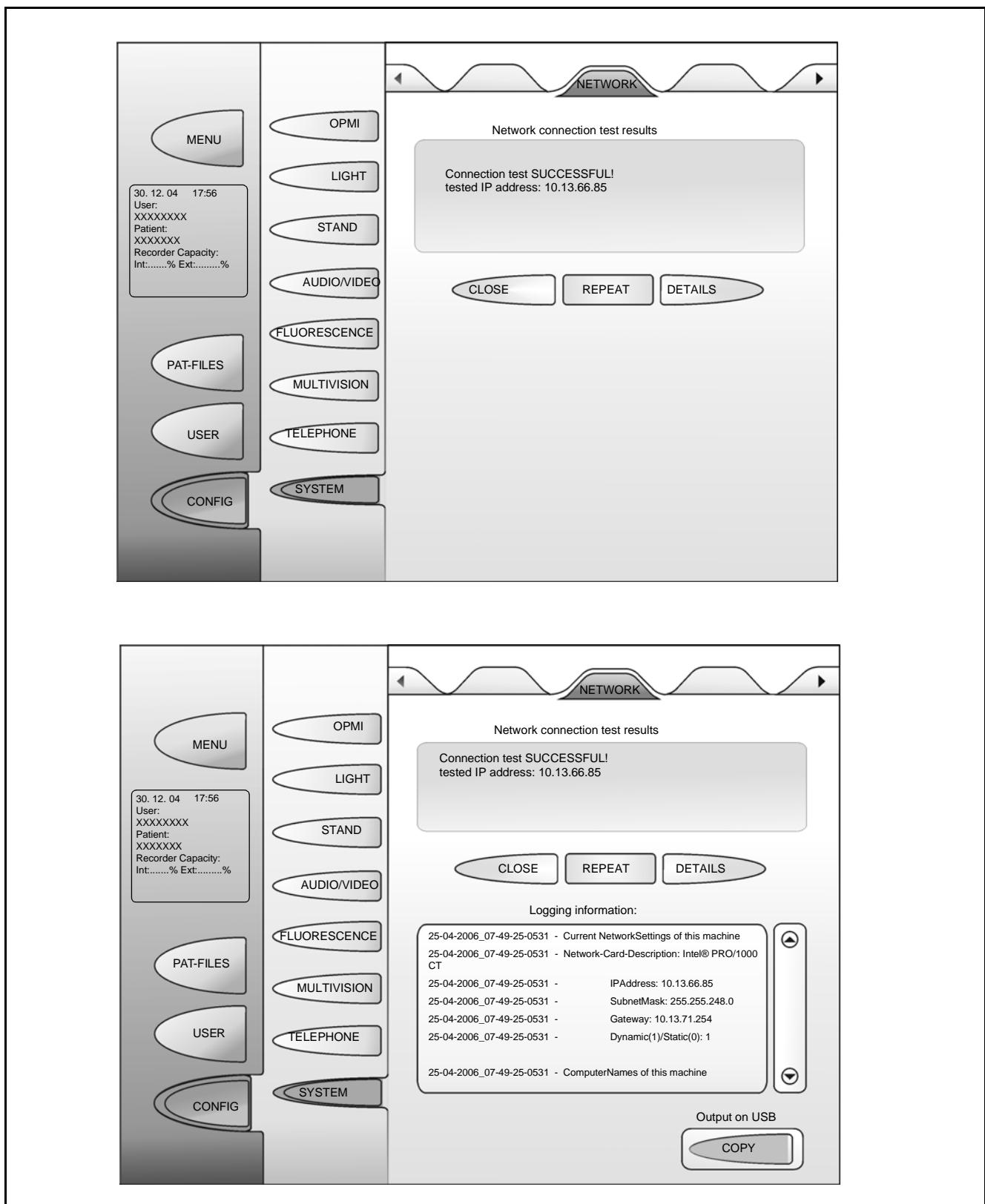
### Testing the connection

- Enter a known IP-address (e.g. the address of a PACS installed in the network).
- Press the START button.  
Display: Connection Test SUCCESSFUL  
If Connection Test FAILED is displayed:
- Press the DETAILS key.
- The "Copy" button permits you to copy the file to a connected USB stick.  
Forward this "Logging Information" to your IT administrator or to the Carl Zeiss service staff to clarify any problems.

### Copying the Logging Information to the USB stick.

The valid IP address with subnet mask, gateway and open ports is tested.  
The result is output in a dialog as non-editable text.

The dialog shows the test results for the network settings. The "Copy" button permits you to copy the file to a connected USB stick.



## Configuring the DICOM connection

The following information is made available by the IT administrator:

- AE title
- Port number
- Name of institute

## Adding, editing and deleting a DICOM server

### ADD

A new DICOM server connection is configured. The program changes automatically to the entry mode.

The control elements for the entry of attribute values are displayed on two pages. You can navigate between the two pages using the "NEXT" and "BACK" buttons. "BACK" is active when the second page is displayed, "NEXT" is active when the first page of the dialog is displayed.

### EDIT

Press the "EDIT" button to configure the selected DICOM server.

### DELETE

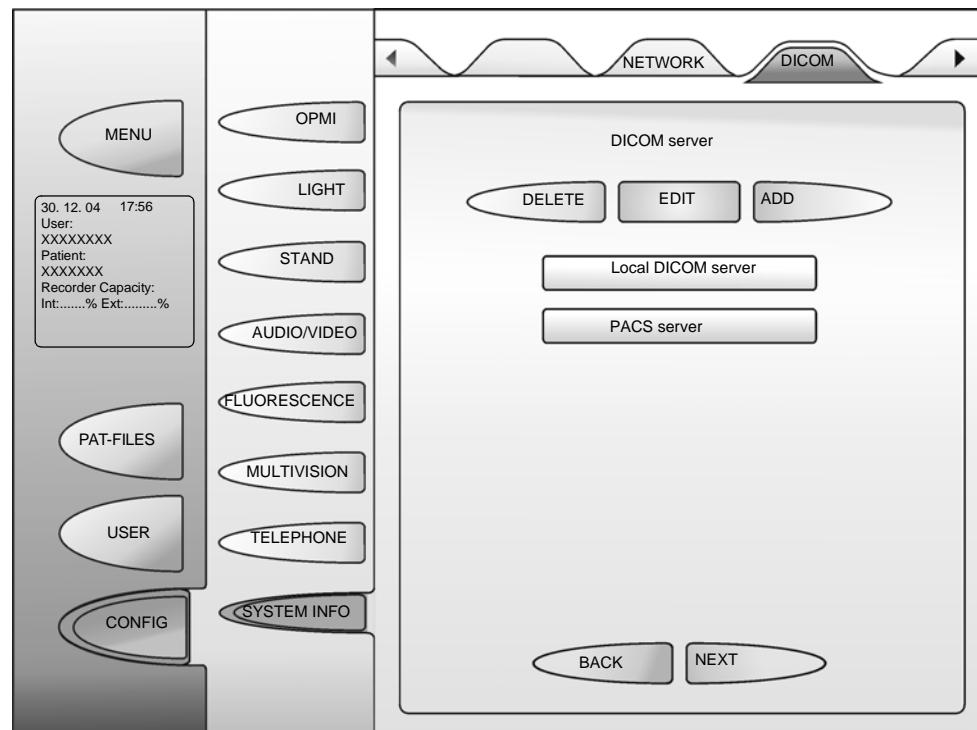
The selected DICOM server is deleted.



### Note:

The company Carl Zeiss accepts no liability for any loss of patient, image and video data as well as system or user-specific configuration data. If required, arrange for patient, image and video data as well as all system settings to be backed up by your IT administrator on a regular basis.

In the event of repairs by Carl Zeiss service staff, the recovery of patient, image, video and configuration data is no longer possible.



## Configuring the DICOM function

Press the "EDIT" button to configure the settings for a new or existing DICOM server.



**Caution:**

- IT Admin rights are required for all DICOM settings.
- Names and addresses must not be assigned several times! They must occur only once in the network.  
To enable communication with a PACS or RIS, the PACS or RIS attributes (AE title, port number, IP address) must be entered.



Note:

The control elements for the entry of attribute values are listed on two pages. You can navigate between the two pages using the "NEXT" and "BACK" buttons. "BACK" is active when the second page is displayed, "NEXT" is active when the first page of the dialog is displayed.

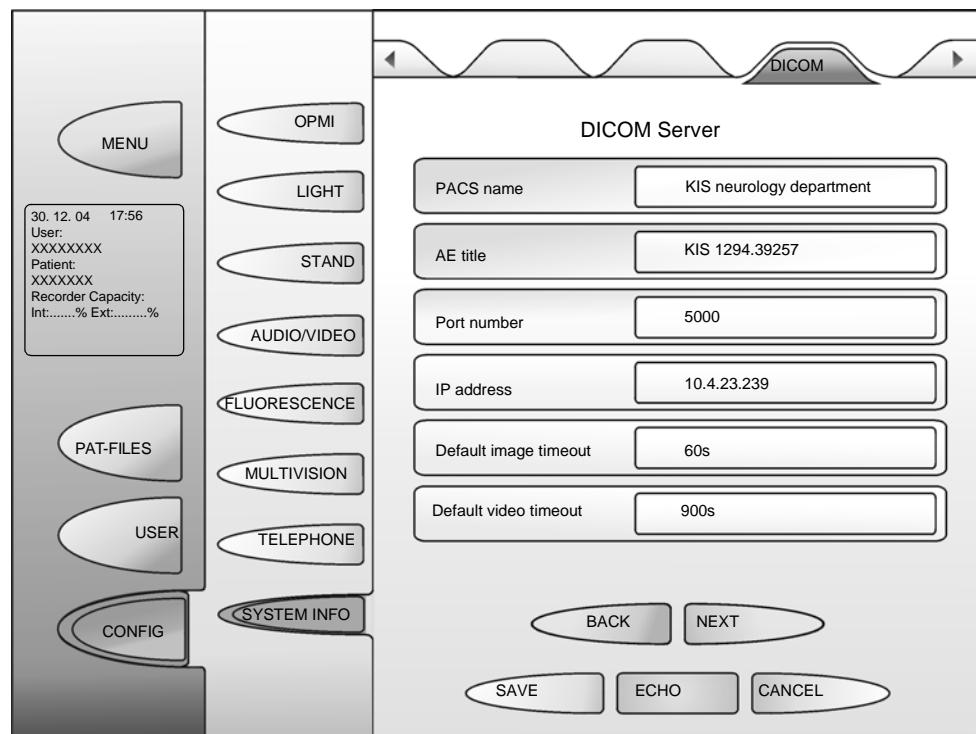
When you press the "EDIT" button, the first page appears where you can enter the following DICOM attribute values:

- PACS name: DICOM server name, freely selectable
- AE title: is made available by the IT administrator.
- Port number: is made available by the IT administrator.
- IP address: is made available by the IT administrator.
- Default image timeout  
Valid range: 10 - 600 seconds, factory setting: 10 seconds.  
The factory setting for default image timeout is 60s.
- Default video timeout  
Valid range: 60 - 900 seconds, factory setting: 10 seconds.  
A maximum total length can be set for all files to be exported. If this field is left blank during the entry, this means (almost) unlimited time-out.



Note:

In programming and network technology, timeout describes the time that a procedure is allowed to take before being aborted with an error message.



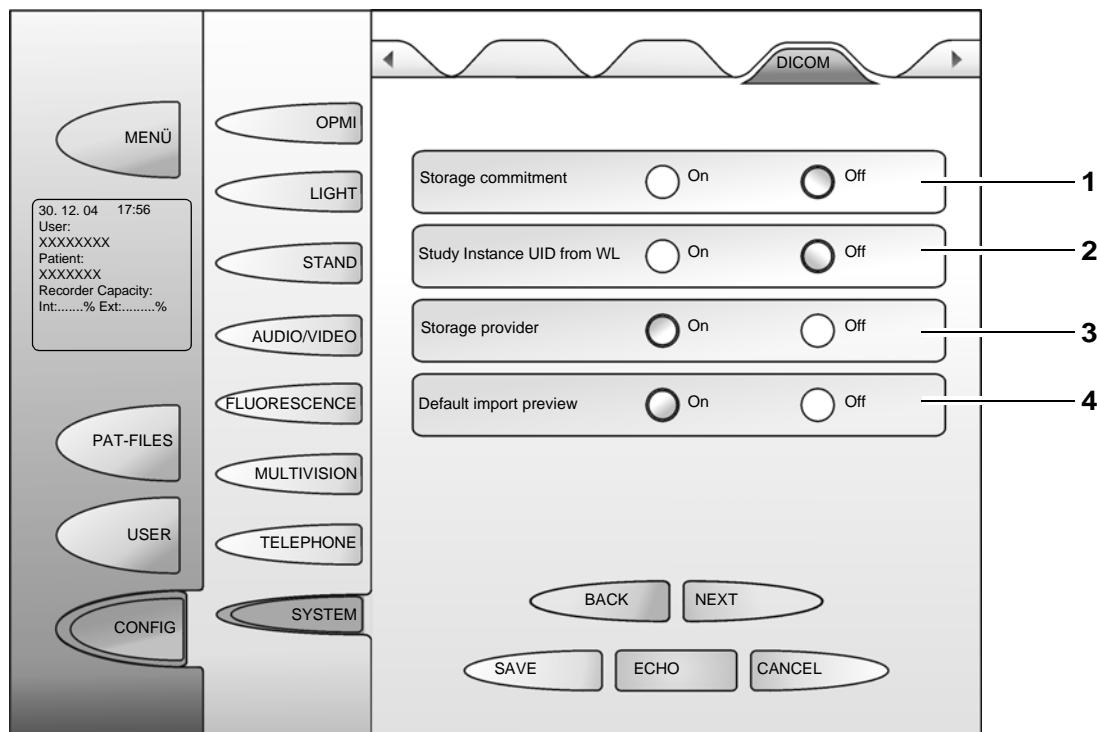
When you press the "NEXT" button, the second page appears where you can enter the following settings:

- 1 Storage commitment**  
If the "Storage commitment" function is active, successful saving of patient data is confirmed by the PACS system.  
Possible settings: On/Off, factory setting: Off
- 2 Study Instance UID from WL (Work List)**  
Numeric work list from the RIS system to be copied or not?  
Possible settings: On/Off, factory setting: Off
- 3 Storage provider**  
The list of possible DICOM servers displayed for LOAD and SAVE will only include the servers for which "Storage provider ON" was selected.  
Possible settings: On/Off, factory setting: On
- 4 Default import preview**  
A preview (thumbnail) will always be displayed if the selected file is an image.  
No preview will be displayed if the selected file is a video.  
Possible settings: On/Off, factory setting: On  
  
If the SOPClassID (SOP=Service Objekt Pair) is unknown, a preview will only be displayed if the new selection box "Default import preview ON/OFF" on the second page of the DICOM node settings has been set to ON. This may take very long, as the display of the preview requires loading of the complete file. The default setting of the new parameter is ON; otherwise it would be likely that previous users no longer receive a preview display.

Press the SAVE button to enter the settings made.

It is not possible to enter PACS names twice. This is checked when the name is entered. If double entry was made, a warning message is displayed when the menu is exited (via "Save"), requesting the user to change the name accordingly.





## Defining the maximum video export size to network servers



### Note:

The maximum video size and the maximum total export size can be set by users with IT administrator rights under "Local DICOM Server". If this field is left blank during the entry, this means (almost) unlimited export size.

- 1 Maximum video size for export in MB of the video file to be exported
- 2 Maximum total size for export in MB of the files to be exported (total size of the study)

File size (3) of the files to be exported is graphically displayed.



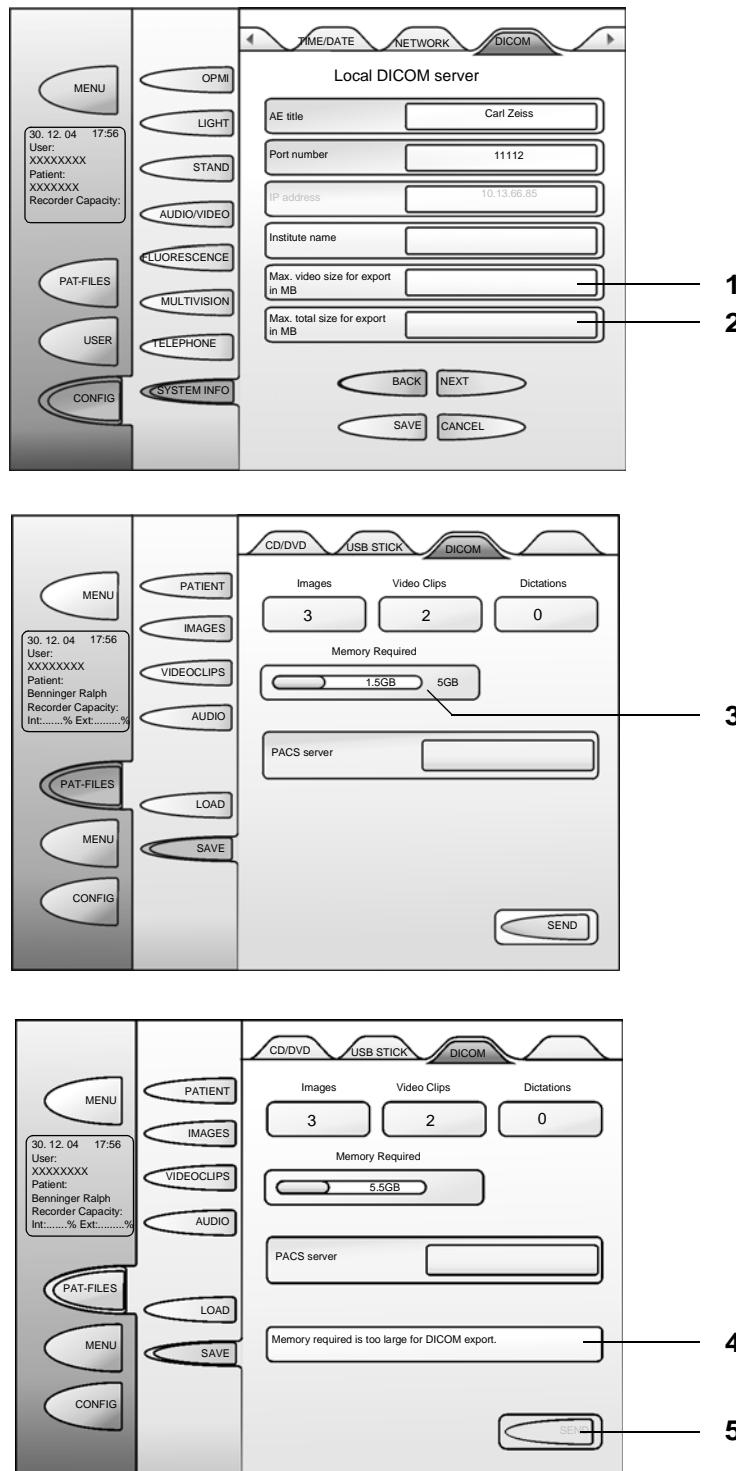
### Caution:

If one of the video files to be exported exceeds the maximum video size, SEND button (5) remains disabled. The message "At least one video file is too large for DICOM export" (4) is displayed.

It is the user's responsibility to split the relevant video files.

If the total size for files to be exported is exceeded, SEND button (5) remains disabled. The message "Memory required is too large for DICOM export" (4) is displayed.

It is the user's responsibility to deselect some of the files until the volume remains below the limit for total export size.



**DICOM server echo**

- Configure the host (DICOM server) and save the data by pressing the Save button.
- Press ECHO button (1).  
SUCCESSFUL is displayed.  
If FAILED is displayed:
- Press DETAILS button (2).
- The "Copy" button permits you to copy the file to a connected USB stick.  
Forward this "Logging Information" to your IT administrator or to the Carl Zeiss service staff to clarify any problems.

The "CANCEL" button permits the edit procedure for this PACS configuration to be cancelled. An existing PACS configuration remains unchanged. A new PACS configuration is not created when "CANCEL" has been pressed.

If changes were made, but not saved in the dialog, a message to this effect is displayed when you exit the dialog (text: "You made changes. Do you want to save the changes (Y/N)?")

You can exit the test result dialog by pressing the "CLOSE" button.

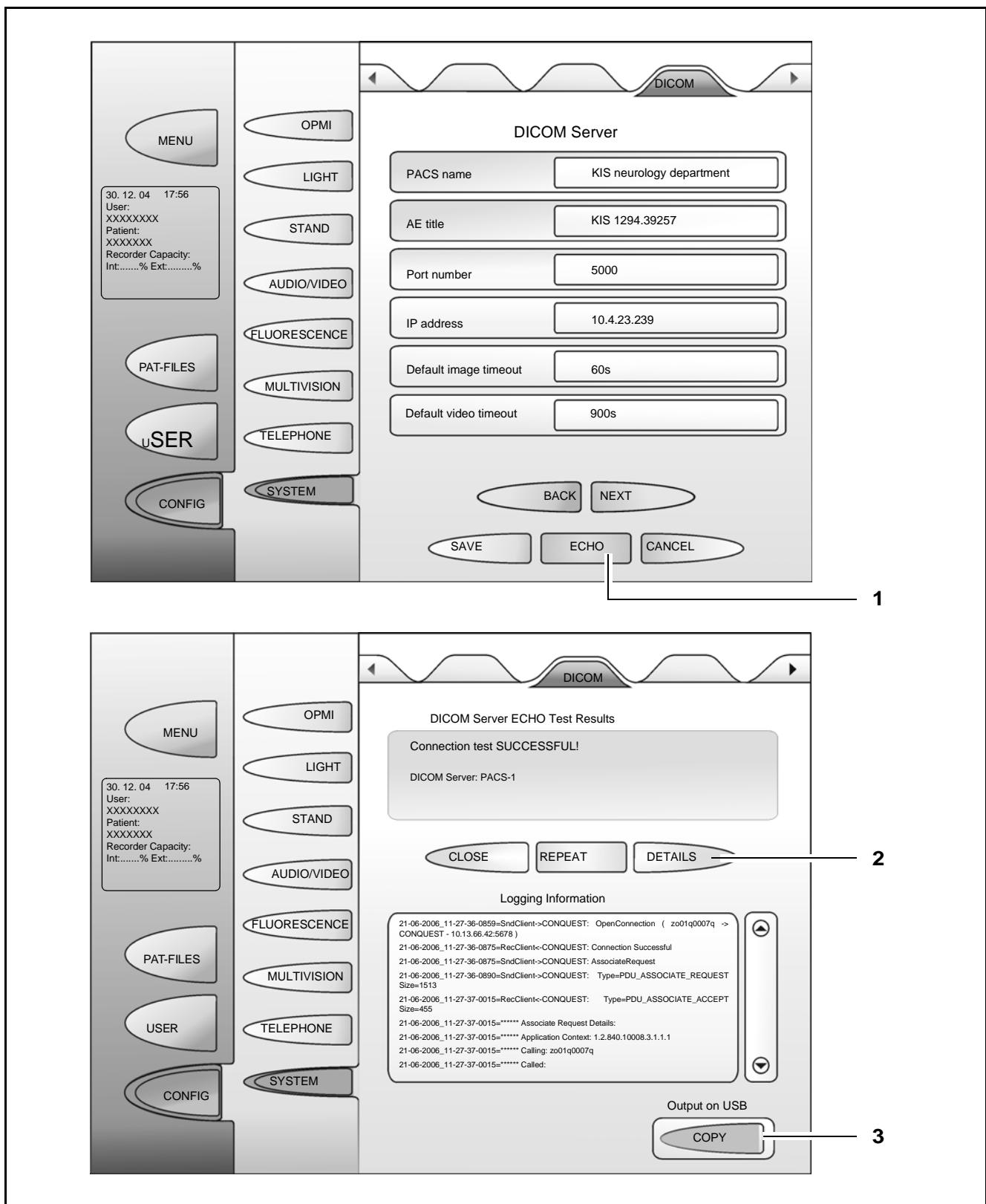
The "Repeat" button permits you to repeat the connection test in the test results dialog using the configured DICOM server. The results of the previous test are then deleted from the list.

The "DETAILS" button permits you to have the test results displayed in a non-editable text field.

Use the two navigation buttons to navigate in the text field (one click = jump to the next line in the text).

The "COPY" button (3) permits you to copy the test results file to USB.





## Error messages during system configuration

Touchscreen text	No.	DICOM Reply Text (number is included in logfile)	Comment	Action
Selected server does not support this inquiry	209	Abstract syntax not supported by the server	Remote system is unable to handle our image types (visible light)	Enable the remote system to receive visible light images.
Internal error of DICOM component	234	Procesing failure	Remote system has a processing problem	Search logfile of remote system for further information
Internal error of DICOM component	235	Resource limitation	Remote system has a processing problem	Search logfile of remote system for further information
Server was unable to correctly process the inquiry	243	Server Error (Reserved)	Remote system has a processing problem	Search logfile of remote system for further information
Timeout ...	246	Server did not answer request. Timeout.	System does not respond within configured timeout interval	Check IP address, extend timeout if necessary
Server connection failed	247	The attempt to connect was forcefully rejected	Computer can be reached at IP address, but no DICOM service is executed on the port	Wrong IP address or port, or server application of remote system is not running
Server was unable to process inquiry	257	Out of Resources - unable to calculate number of matches	Remote system has a processing problem	Search logfile of remote system for further information
Server was unable to process inquiry	258	Out of Resources - Unable to perform sub-operations	Remote system has a processing problem	Search logfile of remote system for further information
This modality is unknown to the server	259	Move Destination Unknown	Pentero / Mindstream not known to remote system	Configure AE title, IP address port etc. in remote system



## Importing patient data sets (from RIS systems)

The abbreviation RIS stands for **Radiology Information System** and designates IT systems for the documentation and management of medical and administrative data in radiology. Proceed as follows to download a patient data set from an RIS server:

- Open the PAT-FILES menu.
- Open the "DICOM" tab (1)



Note:

The DICOM tab is only active if the DICOM license has been activated.

- Select the server (2) from which you want to import the data (RIS).
- In the RIS system, the search criteria are defined in work list (3). Press START button (4) to activate the search criteria.
- Fill in at least one field of the offered search criteria (5). The search criteria are interpreted as "AND conjunction". Empty search windows are interpreted as "wild card".



Note:

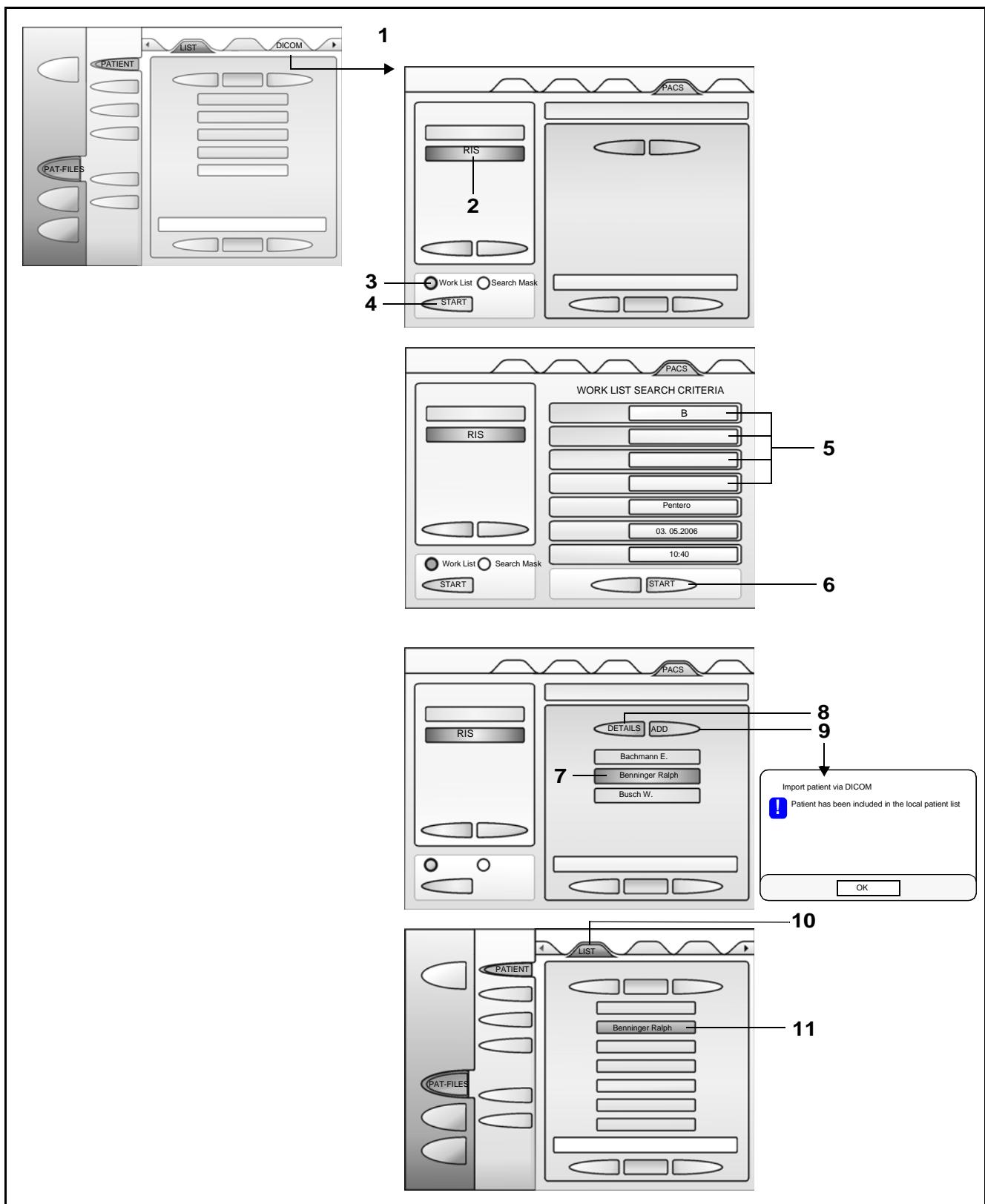
To limit the search, you can enter the first letter of the patient name, for example, provided that the RIS system supports this function.

- Press DETAILS button (8) to view the relevant patient data.
- Transfer patient data set (7) to the patient list by pressing ADD button (9). Acknowledge the message "Patient has been included in the local patient list" by pressing OK.
- Return to the "LIST" tab (10). The empty imported patient data set (11) has been added to the list.



Note:

The imported patient data set (11) does not yet include any images or videos. They must be downloaded to this folder from the relevant server via the "LOAD" function.



## Importing patient data sets (from PACS system)

The abbreviation PACS stands for **P**icture **A**rchiving and **C**ommunication **S**ystem, a system based on digital computers and networks which is used for image archiving and communication in medicine. Proceed as follows to download a patient data set from an PACS server:

- Open the PAT-FILES menu.
- Open the "DICOM" tab (1)



Note:

The DICOM tab is only active if the DICOM license has been activated.

- Select the server (2) from which you want to import the data (PACS).
- In the PACS system, the search criteria are defined in a search mask (3).  
Press START button (4) to activate the search criteria.
- Fill in at least one field of the offered search criteria (5). The search criteria are interpreted as "AND conjunction". Empty search windows are interpreted as "wild card".



Note:

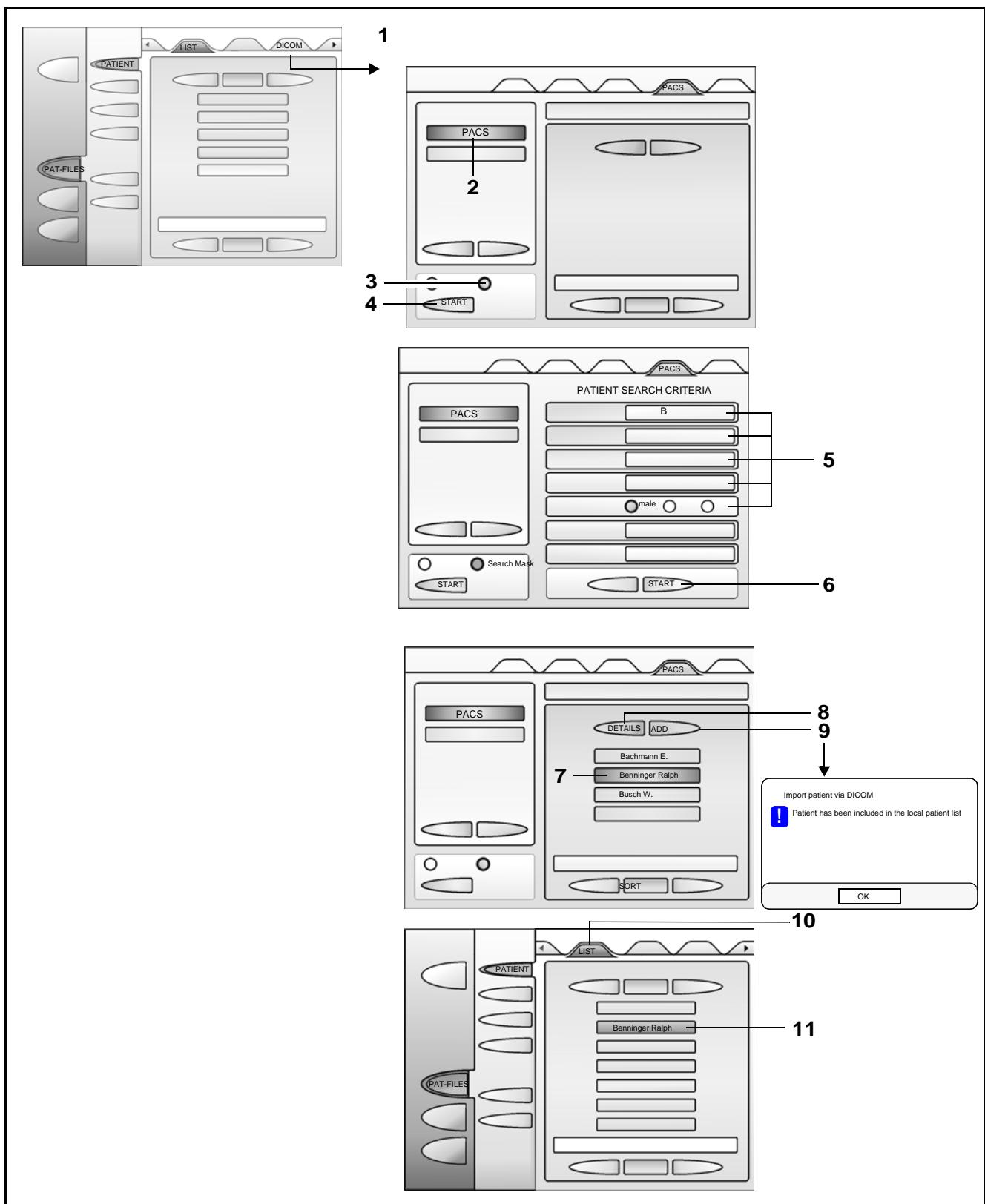
To limit the search, you can enter the first letter of the patient name, for example, provided that the system supports this function. When you press the SORT button, the sorting criteria "Alphabetically" or "Date of Birth" are offered. The relevant data is displayed in the next pop-up window.

- Press DETAILS button (8) to view the relevant patient data.
- Transfer patient data set (7) to the patient list by pressing ADD button (9).  
Acknowledge the message "Patient has been included in the local patient list" by pressing OK.
- Return to the "LIST" tab (10).  
The empty imported patient data set (11) has been added to the list.



Note:

The imported patient data set (11) does not yet include any images or videos. They must be downloaded to this folder from the relevant server via the "LOAD" function.



## Loading patient data

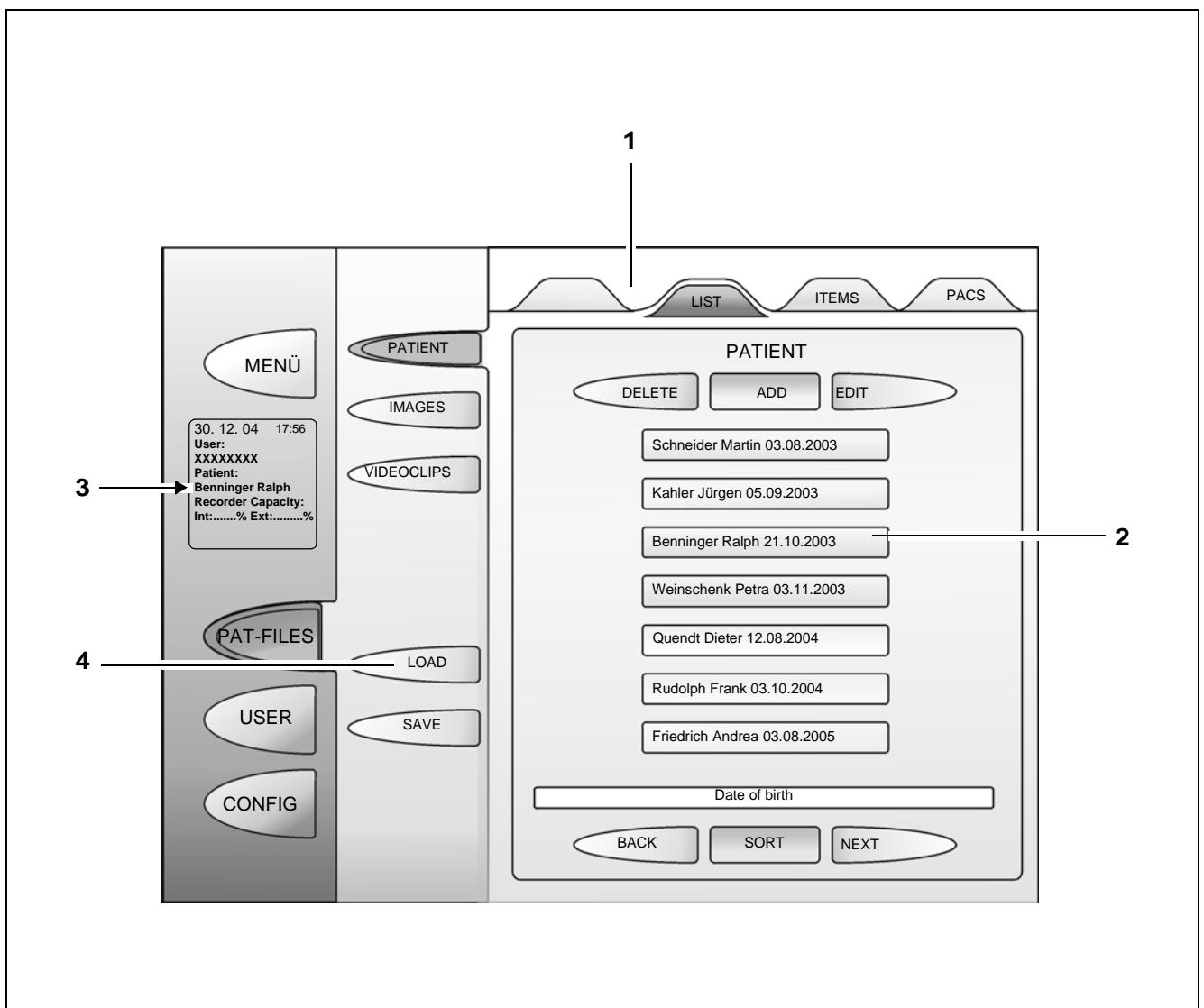


### Warning!

Do not use imported images and videos for diagnostic purposes!  
Perform diagnosis only at approved diagnostic workstations.  
If possible, do not enter patient master data locally in order to avoid confusion. Load the patient master data from a PACS/RIS system.

### Select patient

- Open the PAT DATA menu.
- Open the "LIST" tab (1)
- Select the patient folder (2) to which the patient data is to be copied.
- Click on the patient folder (2) and check in display (3) whether the patient has really been activated.
- Press LOAD button (4).

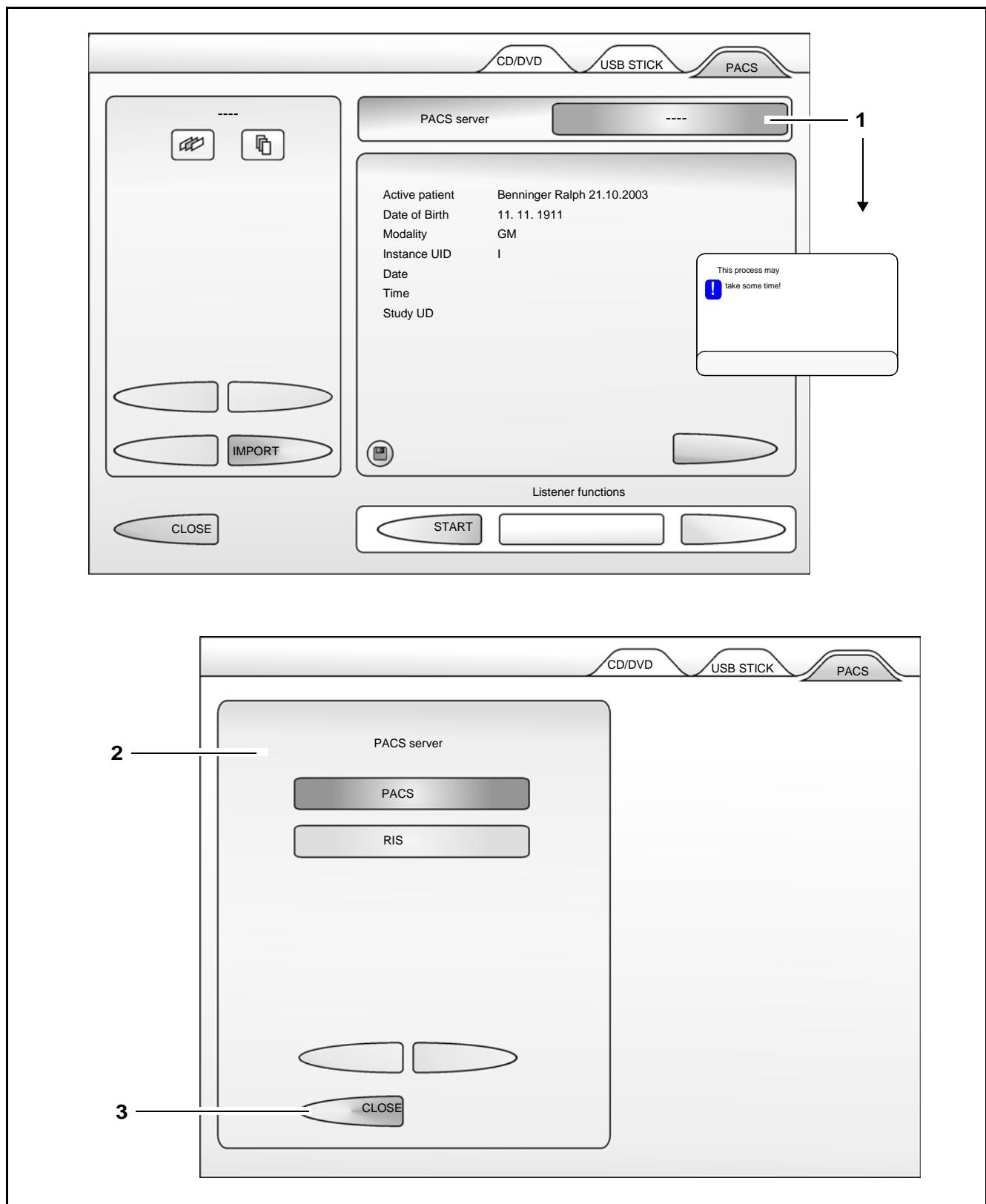


**Selecting the data source (server)**

- Open the server selection window (2) by pressing button (1).
- Select the relevant server from the server selection window.
- Activate the selected server by pressing button (3).

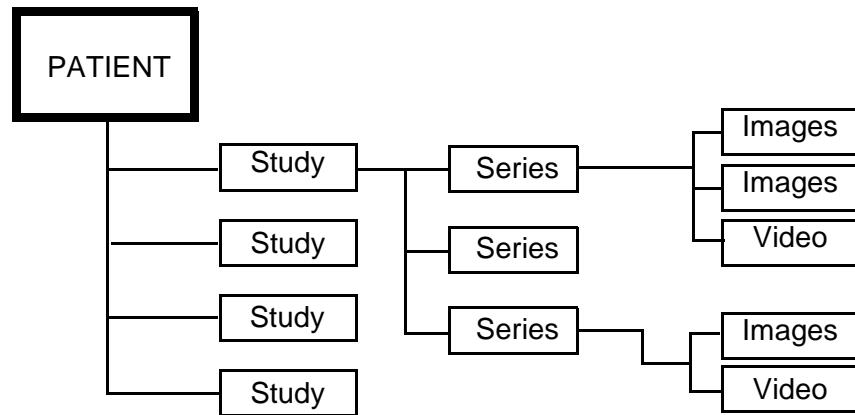
**Note:**

If connection to the selected server is not possible, check the network connection and the DICOM configuration.



## Importing DICOM data

### Overview of the patient data structure



Patient archives are hierarchically structured in study-series-images-videos. Proceed as follows to save patient images locally:

Existing studies on the selected patient are shown at the top level.

- Activate the required study (3) and press the Import button (4).

All series in this study are shown at the second level.

- Activate the required series (5) and press the Import button (6).

All images and videos of the selected series are shown at the third level.

#### 1 Explorer

Displays the folders of studies, series, images or videos:

Two navigation buttons in the Explorer enable you to change to the next level.

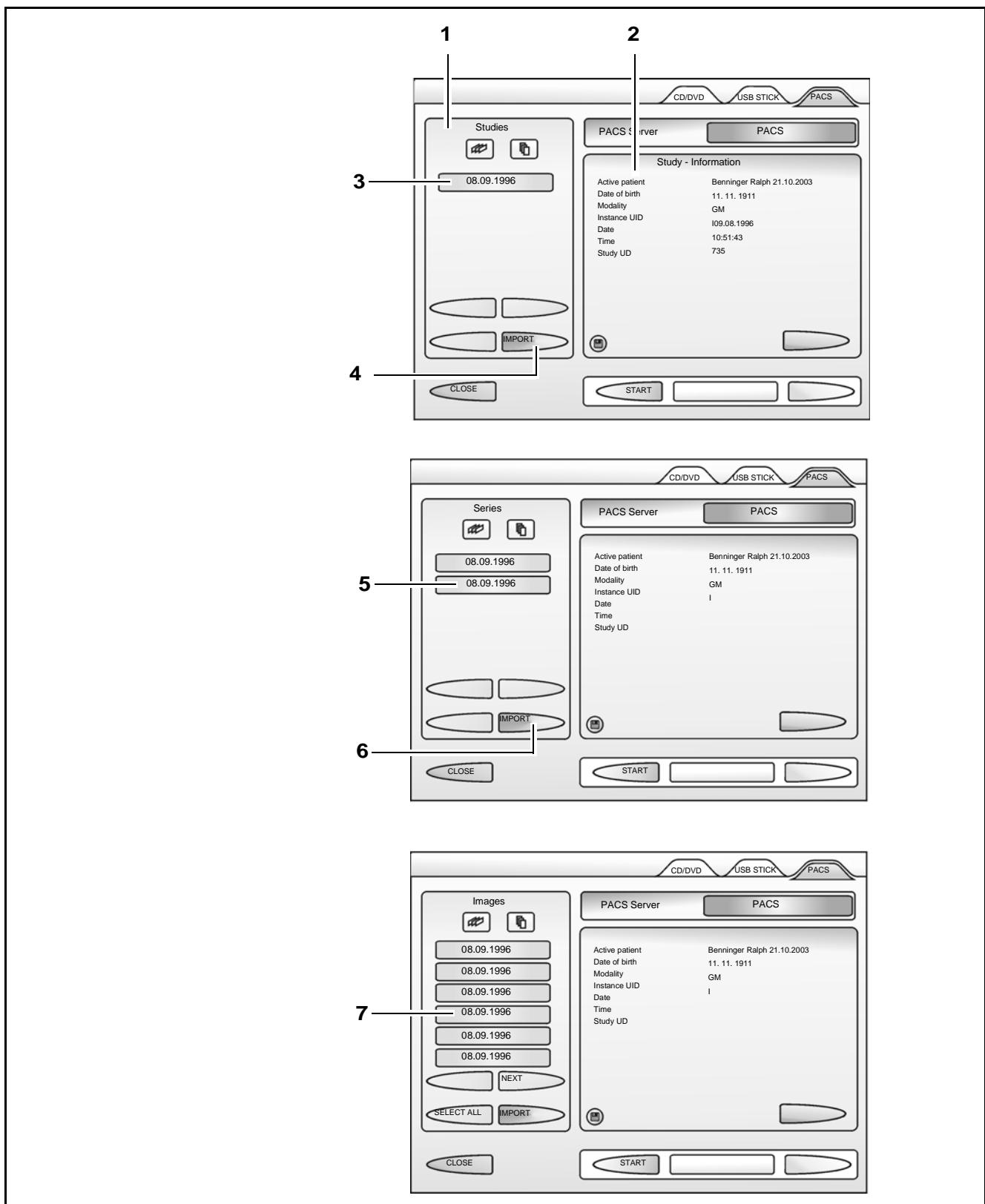
#### 2 Object viewer

For the visualization of the object selected in the Explorer.



Note: Modality :

- GM Images or videos recorded with the microscope camera of OPMI Pentero.
- OT External images or videos

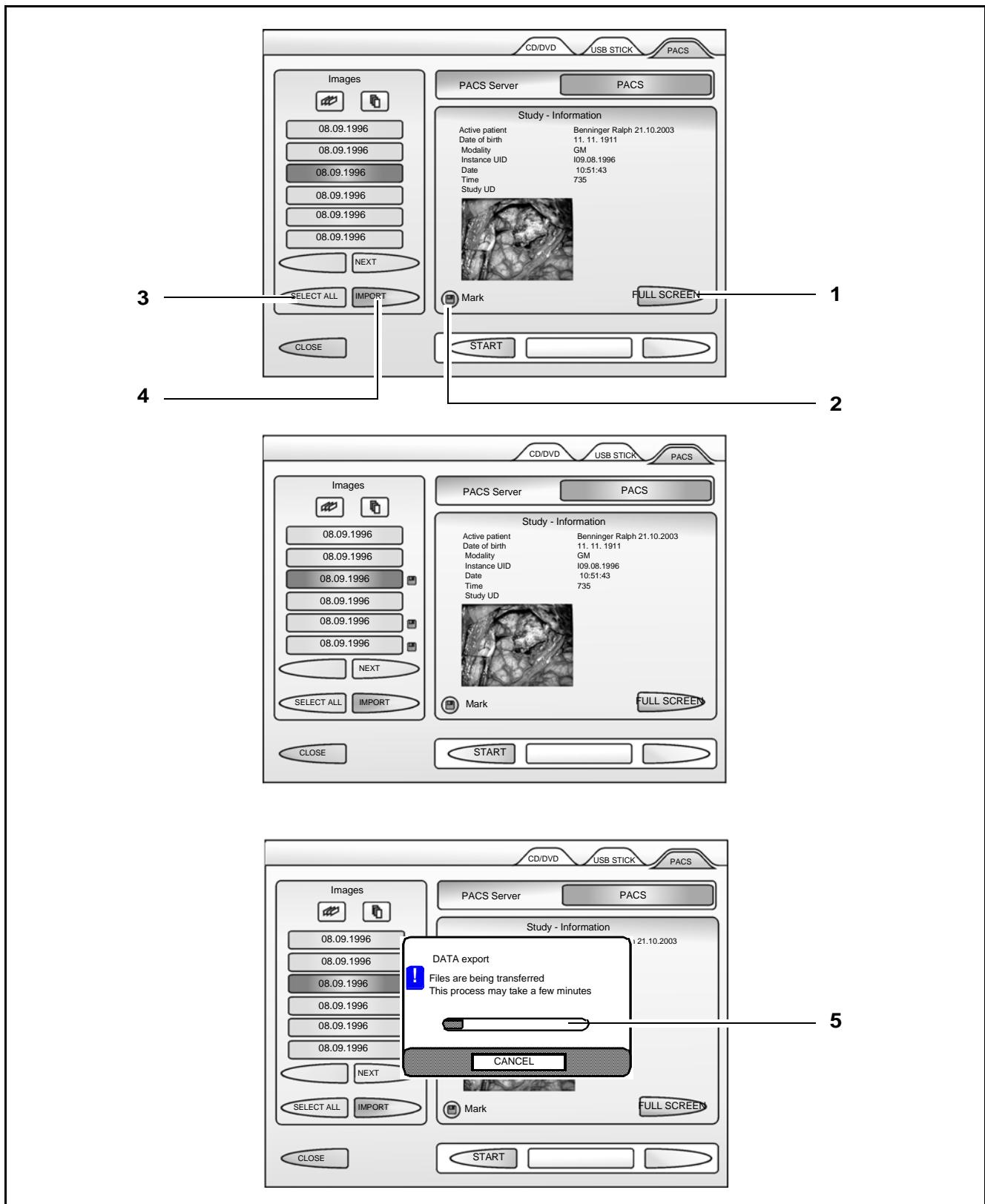


- Select the required image in the explorer; the image information and a thumbnail of the image will be displayed in the viewer.  
No preview will be displayed if the selected file is a video.
- 1 FULL SCREEN button**  
Press the FULL SCREEN button to view the selected image in full size.
- 2 Mark button**  
Press the Mark button to mark the selected image or video for subsequent import. In the explorer, the selected image can be identified by the Selected icon. 
- 3 SELECT ALL button**  
The SELECT ALL button permits you to select all images or videos of a series in one go. In the explorer, all selected images can be identified by the Selected icon .
- 4 IMPORT button**  
Press the IMPORT button to import all images or all selected images to the patient folder.  
The data import process is indicated by progress bar (5).



Note:

Images and videos imported from DICOM and stored locally are marked with "D" at the bottom right.



## Exporting DICOM data to a PACS

Proceed as follows to copy local patient data to a PACS server:

- Open PAT-FILES menu (1).
- Open "LIST" tab (2).
- Activate the required patient in list (3).
- Open the image folder of the patient (4).
- Click on the images or videos you want to export and mark them by pressing Mark button (5).
- Press "SAVE" button (6).
- Select the "DICOM" tab (7) in the SAVE menu.



Note:

The display shows the number of images selected for export.

- Select the DICOM server (8) to which you want to export the data.
- Press "COPY" (9) to export the files.  
The data export process is indicated by a progress bar.
- In the local image folder, exported images and videos are marked by the storage symbol .

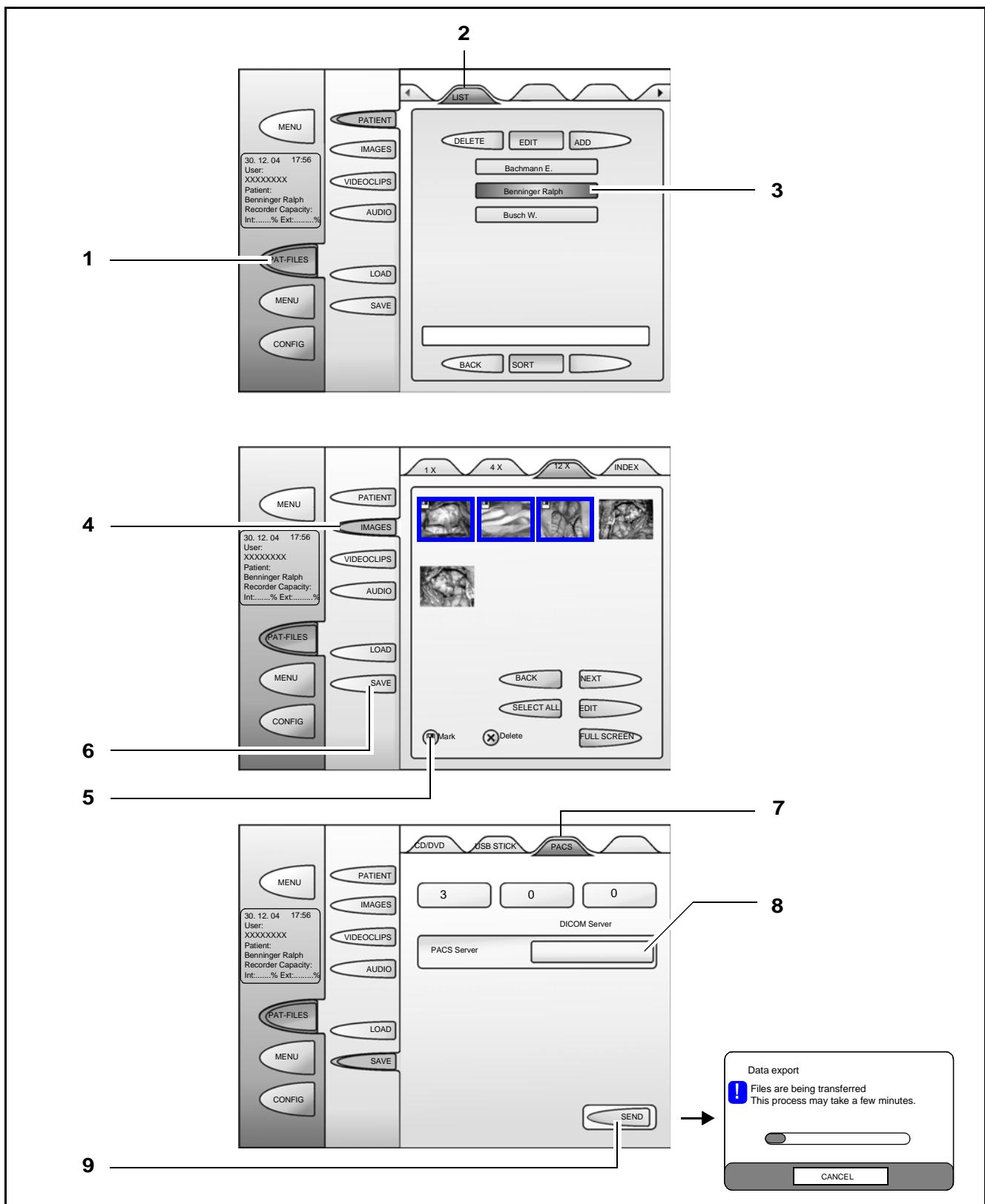


**Caution:**

Always enter the patient ID to ensure that data to be stored in a DICOM archive are not assigned inadvertently to the wrong patient.

If you change a patient ID imported via DICOM, it cannot be guaranteed that the image data is assigned to the correct patient when it is stored in the archive.

Before deleting the local data, check whether this data has been correctly saved to the PACS.





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# HDTV camera system (option) (option)



## Note:

The system including the HDTV camera system option has been approved for use in the USA in accordance with the respective national regulations. However, according to national regulations, additional authorization may be required in the country in which the instrument and application will be used.

Please contact your local Carl Zeiss representative for further information.

<b>HDTV camera system for OPMI Pentero (option)</b>	<b>394</b>
Intended use	394
Configuration	395
Attaching the HDTV components	396
Connecting the HDTV camera system	398
Microscope positions with the HDTV camera system	400
<b>Checklist for HDTV camera system for OPMI Pentero</b>	<b>401</b>
<b>Cleaning the HDTV components</b>	<b>403</b>

# HDTV camera system for OPMI Pentero (option)

## Intended use

The HDTV camera system serves for the recording of live images of the field of view of the microscope. The images can be recorded for documentation and presentation purposes using an HD recorder. Furthermore, it is possible to display the microscope field on a monitor with optimum quality.



### Warning!

- The records must not be used for diagnostic purposes as the video camera and the monitor are not specifically calibrated for this application. The visualized images may therefore include deviations in shape, contrast and color.
- Use only the following HDTV components!
  - In particular, only angled optics with beam splitter 20, CZ No. 1499-862, may be used!

### The HDTV option comprises the following components:

Description	Cat. No.:
Adapters	303032-0000-000
Angled optics with beam splitter 20	1499-862
Video objective lens f = 85 mm	301677-9085-000
HD camera with C-mount thread	
CCU cable	

## Configuration



**Caution:**

The maximum admissible load on the microscope must not exceed 6 kg!  
Remove any unneeded accessories when using the HDTV option!



**Warning!**

If the weight of the configuration used is higher than that of the recommended configuration, the mobility or balance of the system may be impaired.

Microscope accessories	Cat. No.	Weight
Stereo coobservation module	1063-869	1.0 kg
180° tilttable tube	303791-0000-000	1.1 kg
Widefield optics with rotatable dovetail (spine adapter)	302581-9200-000	0.52 kg
Camera adapter f=340 mm T2	1022-973	0.42 kg
MM6 CO <sub>2</sub> micromanipulator	306953-0000-000	1.14 kg
Mouth switch for 180° tilttable tube	1177-805	0.47 kg
Mouth switch holder for straight tube	1116-378	0.4 kg
10x/18B eyepieces (2 units)	305542-0000-000	0.26 kg
12.5x/21B eyepieces (2 units)	305543-9901-000	0.26 kg

### HDTV components

HDTV camera incl. angled connector and cable	---	0.31 kg
Video objective lens f = 85 mm	301677-9085-000	0.39 kg
Angled optics with beam splitter 20	1499-862	0.52 kg
Adapter, 25 mm	303032-0000-000	0.15 kg

## Attaching the HDTV components



### Warning!

Change the modules and accessories before surgery and without the patient!

- Loosen securing screw (10) by a few turns.
- Remove binocular tube (4) and widefield eyepieces (5).
- Loosen mounting screw (12) by a few turns and remove spine adapter (11).
- Place adapter (8) on the microscope body and **firmly** tighten securing screw (12).
- Place angled optics (6) on adapter (8) and **firmly** tighten securing screw (9).
- Attach binocular tube (4) with widefield eyepieces (5) on angled optics (6) and **firmly** tighten securing screw (7).
- Remove dust cover (14) and store it in a safe place.
- Insert video objective lens (3) into the opening of the left image exit port. The opening of the image exit port is fitted with guide projections. Video objective lens (3) has the corresponding grooves. Carefully turn the accessory module until the guide projections fit into the grooves, and slide video objective lens (3) in the opening as far as it will go.
- Screw knurled ring (13) onto the video objective lens and **firmly** tighten knurled ring (13).
- Carefully screw camera (2) into the C-mount adapter of video objective lens (3); for the camera positions, please see page 400.
- Insert coded coupling (1) of the system cable into camera (2) (connector snaps in).

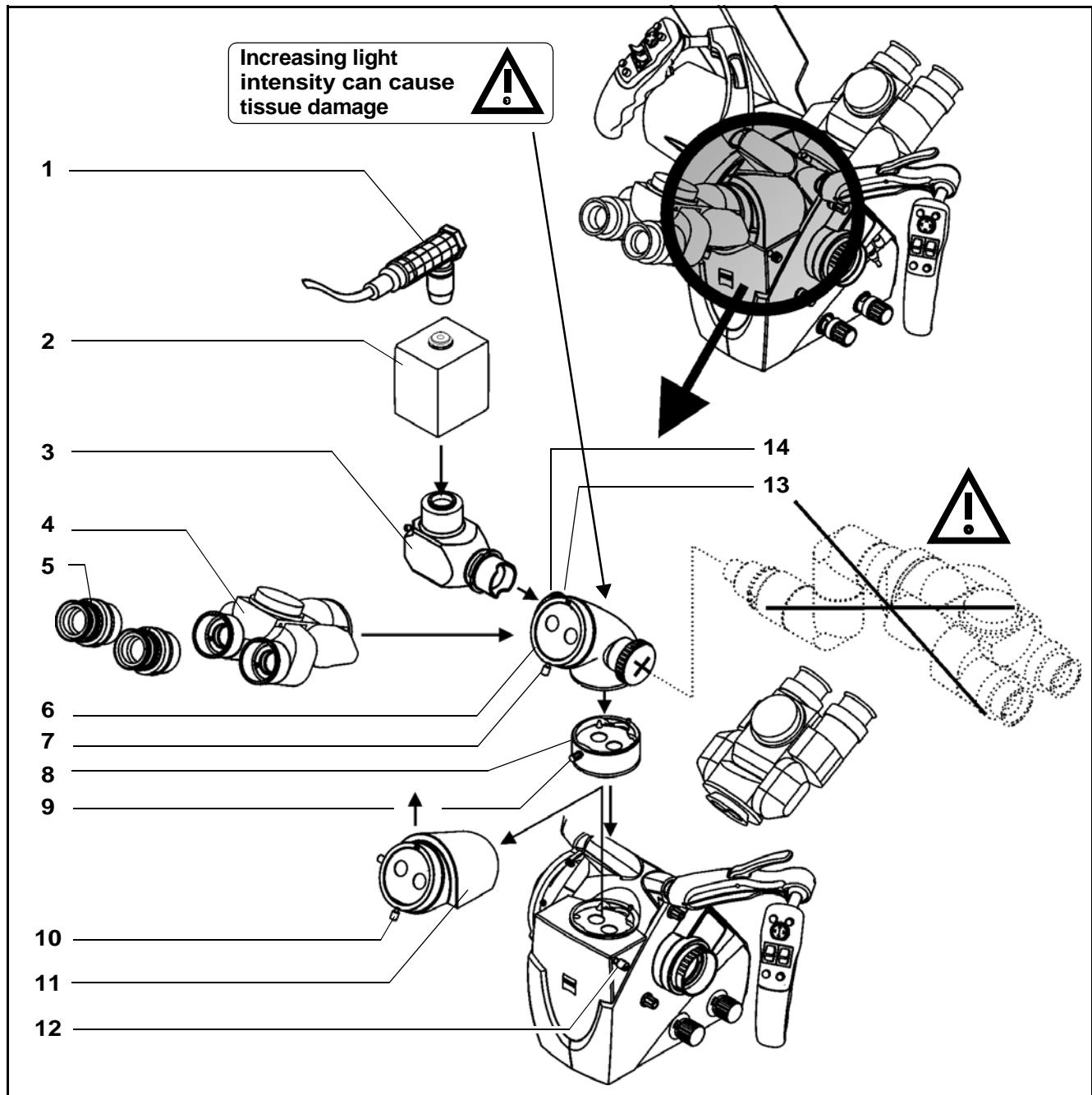


### Caution:

Check that the mounted accessories can be moved without restriction across the full swivel range and that they cannot collide with any other units. With the video objective lens being attached, the handgrip on the left cannot be moved as required. Move the handgrip in a position where no mechanical force is exerted on the video objective lens. Before every use and after re-equipping the system, make sure that the modules are securely locked in position and that all fastening screws are **firmly** tightened!

Always re-balance the surgical microscope after re-equipping the system.

Do not attach any accessories to the right-hand image port of the angled optics (6)



## Connecting the HDTV camera system

**Caution:**

- Only connect the monitor to wall outlets which are provided with a properly connected protective ground conductor.
- When compiling your system, please make sure to comply with the requirements of EN 60601-1-1.

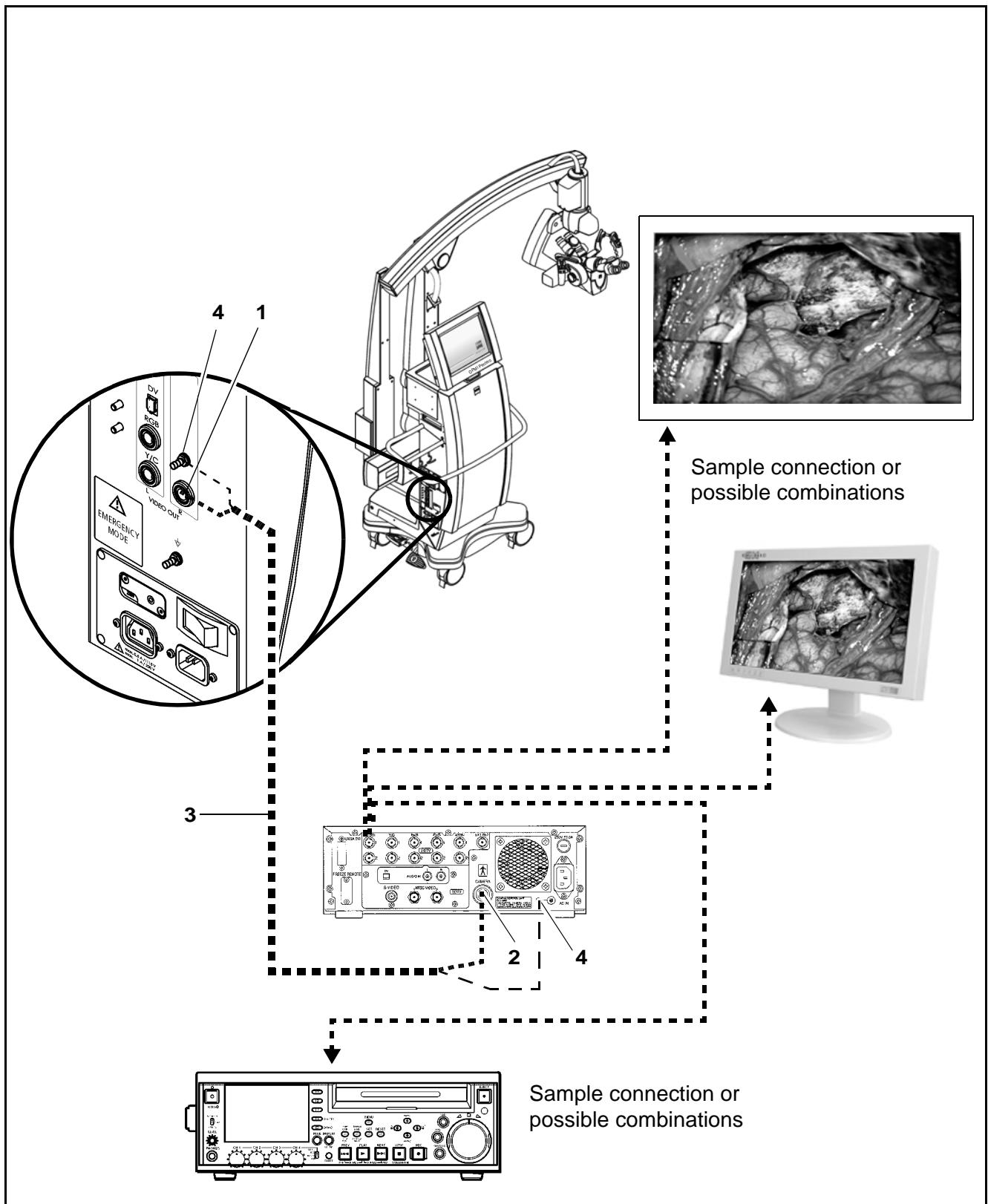
- Connect the camera output port (1) on the OPMI Pentero with the camera input port of the CCU (2) using supplied system cable (3).
- Connect ground connection cable (4) to ensure an interference-free image.

**Note:**

- All external components (recorders, monitors) are preferably connected via "HD-SDI".
- Alternatively, analog RGB / YPbPR ports can be used.
- Both output ports are available in duplicate.

**Caution:**

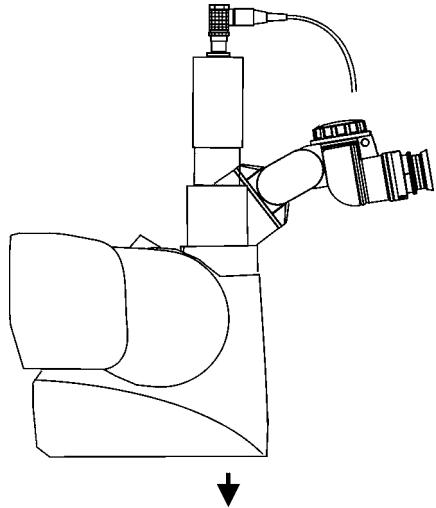
Correct operation of the external components (cameras, recorders, monitors) is vital for safe operation. Please make yourself totally familiar with the contents of this manual prior to start-up of the device.



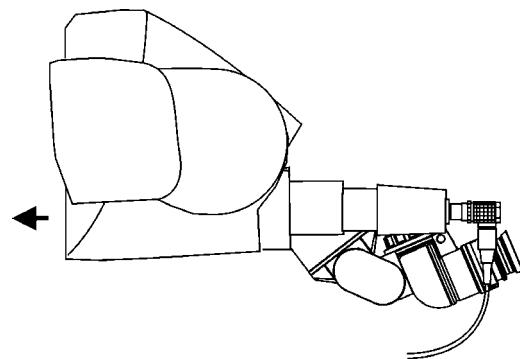
## Microscope positions with the HDTV camera system

### Positions for typical applications:

Position when optical axis is mostly perpendicular  
(e.g. spinal and most cranial procedures)



Position when optical axis is mostly horizontal  
(e.g. posterior fossa procedures)



# Checklist for HDTV camera system for OPMI Pentero

Always check the following points before surgery (without the patient!):



**Caution:**

- Before starting the system, remove the protective cover used for transportation from the objective lens.



**Note:**

Make sure that the general functions of the OPMI Pentero have been checked using the checklist, page 164!



**HDTV components**

**Caution:**

- Only use the HDTV components, see page 394  
!In particular, only angled optics with beam splitter 20, CZ No. 1499-862, may be used!
- Check that the HDTV components are properly installed and all fastening screws are firmly tightened.
- Check that the maximum permissible load of 6 kg has not been exceeded and superfluous accessories have been removed.



**Caution:**

- With the video objective lens being attached, the handgrip on the left cannot be moved as required. Move the handgrip in a position where no mechanical force is exerted on the video objective lens.
- Check before balancing that the handgrips and accessories have been correctly mounted, that they can be moved without restriction across the full swivel range and that they cannot collide with any other units.
- Check that the suspension system and the overall system have been balanced.
- Proper functioning of the HDTV components (camera, video recorder(s), monitor(s)) has been checked using the relevant user manuals.
- Check whether the brightness of the camera image on the HDTV monitor corresponds to the brightness of the microscope image. Correct any wrong camera settings using the relevant user manuals.

Increasing light intensity can cause tissue damage



**Warning!**

- When the HDTV components are used, there is minimum loss of light.

- Check and correct the illumination of the surgical field to the extent required for the patient's safety and for clear microscopic visualization (see page 23).
- Adjust the illuminated field diameter and illumination intensity to the values required for the procedure.
- Correct the brightness of the camera image through the settings on the control unit of the HDTV camera and not by increasing the light intensity of the microscope illuminator.



**Note:**

The illumination intensity is preconfigured (factory settings) in such a way that a warning is displayed on the touchscreen when the threshold value of 25% is exceeded, informing the user of possible tissue damage when the light intensity is too high.

This warning can only be acknowledged with OK. The percentage of light intensity is then displayed in red typeface on the touchscreen and as a blinking warning light in the data injection system when the threshold value is exceeded.

## Cleaning the HDTV components



### Warning!

If possible, the accessories should be cleaned immediately after use. Contaminations should not be allowed to dry on the objects, as this would make cleaning more difficult.



### Note:

Clean the HDTV components with alcohol-free glass cleaner.

- Apply the cleaning agent on a soft, clean cloth (do not spray or pour it directly on the HDTV components!) and wipe the components with the moist cloth.
- Do not let any cleaning agent seep into these components: adapter, angled optics, video objective lens, HD camera with C-mount thread and CCU cable.



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OPMI® Pentero® Software Release 2.20 / 2.21

Issue 11.1  
Printed on 18. 02. 2009

# Index

## Numerics

- 180° tilttable tube 88
  - 3 CCD NTSC video camera, mono and stereo 238
  - 3 CCD NTSC video camera, mono and stereo (Version 2) 240
  - 3 CCD PAL video camera, mono and stereo 237
  - 3 CCD PAL video camera, mono and stereo (version 2) 239
- ## A
- Accessories 228
  - Accident prevention regulations 16
  - Adding 366
    - Additional illumination 68
    - Additional illumination, operating principle 68
    - Additional illumination, switching on and off 66
  - Adjusted for OPMI Neuro 38, 56
  - Adjusting knob for illuminated field diameter 54
  - Adjusting knob for Varioskop (manual focusing) 54
  - Adjusting the surgical microscope 115
  - AFD 283, 324
  - AFD time mark 314
  - AGC 282
  - Ambient requirements 241
  - Antenna module socket 58
  - Anti-fogging agent 224
  - Approval 234
  - Archiving, not for permanent 35
  - Archiving, not permanent 196, 353
  - Assembling, system 88
  - Attaching the HDTV components 396
  - Autobalance 110
    - Autobalance - Fine adjustment mouth switch 112
    - Autobalance Complete System 110
    - Autobalance Microscope 111
  - Autofocus operating principle 69
  - Autom. IR detection 301
  - Autom. white balance 149
  - Automatic AF on/off 124
  - Automatic brightness control "Auto" 148
  - Automatic camera gain control (AGC) 282
  - Automatic fluorescence detection (AFD) 283, 324
  - Automatic IR detection (IR800) 271, 301
  - Automatic light field limitation 132, 133, 349

AUX port 234  
AUX socket 78  
Axes, balancing 110

**B**

Backing up patient data on CD/DVD 196  
Backup illumination 26  
Balance position 111  
Balancing 110  
Balancing the microscope axes 111  
Balancing, automatic 110  
Beep, continuous 26  
BL 400 266, 344  
BL 400 checklist 348  
BLUE 400 fluorescence module (option) 339  
BRAKES for axes 1-2-3 142  
BRAKES for axes 4-5-6 142  
Brightness range, selection of (video) 148  
Brightness, setting of (video) 148  
Browsing 190  
Burn injuries caused by high illumination intensity 23

**C**

Camera release socket 58  
Central user interface 46  
Changes to the system 241  
Changing the xenon lamp 208  
Checklist 164  
checklist 348  
Checklist for HDTV camera system 401  
Checklist for the IR 800 function test 279, 321  
Cleaning agents 225  
Cleaning mechanical surfaces 225  
Cleaning method, recommended 224  
Cleaning optical surfaces 224  
Cleaning the HDTV components 403  
Cleaning the touchscreen 225  
Cleaning, immediately after use 224  
Comment box - Surgeon Details 122  
COMPARE 316  
Computer and touchscreen are inoperative. 215  
Configuration, general 292  
Configurations 88  
Configuring the Autofocus (AF) function 108  
Configuring the DICOM function 368  
Connecting the HDTV camera system 398  
Connecting the stand 102  
Connector for cable to navigation computer 78



- Connector for switching component 78
  - Connector panel 76
  - continuous beep 104
  - Control functions, failure of 214
  - Controls, displays, connections 52
  - Creating a new video clip 256
- D**
- Data injection brightness 154
  - Data injection contrast 154
  - Data injection system 170
  - Data loss 35, 196, 353
  - Data protection responsibilities 17
  - Data protection, activation 158
  - Data size as sorting criterion 178
  - Data storage on CD/DVD 198
  - Data storage on USB stick 202
  - Date 160
  - Date format 160
  - Default settings 107, 136, 138
  - Default User 116
  - Delete key 116
  - Deleting images 190
  - Depth of field 128
  - Description 33, 292
  - Description of FLOW 800 306
  - Description of INFRARED 800 300
  - Device class 16
  - Diagnostic purposes, do not use video images 18, 262, 394
  - DICOM 351
  - DICOM connection, configuration 366
  - DICOM server echo 374
  - DICOM server, adding, editing and deleting 366
  - Digital video recording (option) 243
  - Diopter scale 62
  - Diopter setting ring 62
  - Disinfecting and cleaning, by machine 224
  - Display
    - duration and file size 258
  - Display buttons 332
  - Disposal 230
  - Domain name 363
  - Dovetail for connecting a micromanipulator 56
  - Drape Compensation 111
  - Drape vacuum system 70
  - Drapes 225
  - Drapes, attaching 100

- Dynamic IP address (DHCP) 358  
Dynamic IP address, activation 358
- E**
- Editing images 188, 192
  - Editing video clips 250
  - Electrical standard 234
  - Electromagnetic compatibility 19
  - Emergency backup line supply 16
  - Emergency mode 214
  - Emergency mode selector 76
  - Emergency, what to do 12
  - Ending operation of the unit 25
  - Error messages in the data injection system 213
  - Exporting DICOM data to a PACS 390
  - External camera 144
  - External hard drive, connection 200
  - External monitor connection (option) 276, 318
  - Eyecup 62
  - Eyepiece mount 60
  - Eyepiece optics, fog-free 224
  - Eyepieces, mounting 90
- F**
- Factory settings 107
  - Failure of a function 166
  - Failure of all control functions 214
  - Failure of magnetic brakes 212
  - Failure of the focusing function 211
  - Failure of the graphic touchscreen 212
  - Failure of xenon lamp 208
  - FDA classification 16
  - Field 146
  - File format 144
  - File format selection 293
  - File name 248
  - Filter criteria 178
  - Filter criteria display 178
  - Fine adjustment for mouth switch 112
  - Flash during capture 146
  - FLOW 306
  - FLOW 800 (option) 287
  - FLOW 800 activation 298
  - FLOW 800 COMPARE 316
  - FLOW 800 description 306
  - FLOW 800 DIAGRAM 310
  - FLUORESCENCE 266, 344
  - Fluorescence applications, deactivating 266, 344

- Fluorescence applications, deactivation 294  
Fluorescence module BLUE 400 266, 340, 344  
Fluorescence module IR 800 (option) 262  
Focus Crosshairs 154  
Focus rocker switch 138  
Focus speed 124  
Focus start value 124  
Focus stop 124  
Focus zoom link 125  
Focusing 69  
Focusing aid 69  
Focusing aid (Autofocus) 69  
Focusing aid, laser spots 124  
Focusing beam 69  
Focusing function, failure 211  
Fogging of optical surfaces 224  
Foot control panel menu 138  
Foot rocker switch menu 138  
Foot rocker switch, control panel or footswitch, configuration 138  
Footswitch menu 138  
Full 148  
Full frame 146  
FULL SCREEN button 388  
Full screen view 188  
Function of NEXT button 283
- G**
- Gamma start value 126  
Ground leakage currents 37
- H**
- Handgrips on surgical microscope 64  
Handgrips, adjustment 98  
HDTV camera system 393  
HDTV camera system for OPMI Pentero 394  
Heat protection filter 27  
Horizontal resolution 237, 238, 239, 240  
Host 358  
Host name 363
- I**
- Illuminated field diameter, adjustment 66  
Illumination intensity 132  
Illumination intensity, adjustment 66  
Illumination, switching on and off 66  
Image preview 188  
Image sensor 237, 238, 239, 240  
Images, stored 18, 262, 394

IMPORT button 388  
Importing DICOM data 386  
Importing patient data sets (from PACS system) 380  
Importing patient data sets (from RIS systems) 378  
Index 188  
Indicator window for rated voltage 76  
Individual magnetic brakes are locked 215  
INFRARED 800 (IR 800), activation 294  
INFRARED 800 description 300  
INFRARED 800 Playback menu 302  
INFRARED 800 Record menu 300  
INFRARED 800 Setup menu 296  
Initial start-up 26, 104  
Installation, notes 17  
Integrated BLUE 400 fluorescence module 266, 344  
Integrated BLUE 400 fluorescence module (option) 340  
Integrated INFRARED 800 fluorescence module 262  
Interface on microscope mount 82  
Interpupillary distance 60  
IR 800 Playback menu 272  
IR 800 Record menu 270  
IR camera gain (IR800) 270, 300, 324  
IR800 configuration 296  
IR800 fluorescence module (option) 261  
IR800 Setup menu 268  
IT system administrator and data protection activation 120  
IT system rights 158

**J**  
Joystick 106  
Joystick with MultiVision function 106, 154

**K**  
Key to symbols 2  
Keyboard commands 116

**L**  
Lamp change 208  
Lamp life 134  
Lamp module, changing of 222  
Language selection 118  
Laser class 232  
Laser spots 124  
Left beamsplitter port 52  
Lever for additional illumination 58  
Light intensity 324  
Light intensity control 132  
Light on/off 132



- Line power failure 26
  - List of patient files 174
  - Live Video PiP 146
  - LOAD button 188
  - Loading images (import) 190, 206
  - Locks 72
  - LogFile export to CZ 158
  - Logging information, copying to USB stick 364, 374
  - Long replay (IR 800) 274
- M**
- Magnetic brakes, failure 212
  - Maintenance/Service 217
  - Make 132
  - Maneuvering handle 74
  - Manual brightness control, "shutter 148
  - Manual gain setting (IR800) 270, 300
  - Manual log-in 363
  - Mark button 388
  - Marker 255
  - Maximum configuration 44, 88
  - Mechanical surfaces, cleaning 225
  - MediLive Video Tools 260
  - Merging video clips 256, 258
  - Micromanipulator connection 56
  - Micromanipulator focus stop 124
  - Micromanipulator MM6 38
  - Microscope positions with the HDTV camera system 400
  - Minimum configuration 88
  - MM6 micromanipulator 38, 56
  - Mobile phones 18
  - Mode selector for standard operation / emergency operation 76
  - Mounting the mouth switch on the 180° tiltable tube 94
  - Mouth switch socket 58
  - Mouth switch, mounting on straight tube 96
  - MPG2 file 150, 244
  - MULTIVISION 154
  - MultiVision button control 156
- N**
- NAV connector 82
  - Navigation information injection 40
  - Navigation Interface 154
  - Navigation interfaces 82
  - Navigation system, activation 154
  - Navigation systems, connection of 80
  - Network connection, configuration 356
  - New video clip 258

- NEXT 325  
NEXT button 283, 325  
Non-Zeiss equipment, connecting 21  
Non-Zeiss units, connecting 37  
Normal use 288  
Notes on EMC 19  
Notes on use 17  
Number of replays (IR 800) 274
- O**
- Operating hours display 158  
Operation 163  
Operation, requirements 20  
OPMI and micromanipulator, adjustment to the same focal plane 38, 56  
OPMI Data Display 154  
Optical surfaces, cleaning 224  
Optical surfaces, fogging 224  
Ordering data 226  
Overall system configuration 41
- P**
- PAL video output ports 237, 238, 239, 240  
Password 118  
Password for patient data protection 118  
Password protection, enabling 118  
PAT-FILES 174  
Patient data, loading of 204, 382  
Patient data, managing 174  
Patient Files menu 174  
Patient Groups 182, 184  
Patient images, viewing 188  
Patient list 176  
Patient list sorting 178  
PD adjustment 60  
Pedal for straight-ahead movement 72  
Photo menu 144  
PiP in Replay (IR800) 272, 284, 302, 326  
Playback menu 272, 302  
PLAYBACK phase 326  
Porphyrin, note 262, 341  
Positioning at operating table, system 102  
Potential equalization 18, 76  
Power failure, short-term 26  
Power outlet, 115/230V 76  
Power switch 76  
Preparations for use 85, 318  
Procedure 167, 280, 322  
Progressive scan (VGA) or RGB output port 76



Protective ground contact 20  
Protective measures for IT systems and networks 16

**R**

Rated voltage, indicator window 76  
RECORD phase 324  
Re-equipping the instrument 22  
Release Notes 20, 35  
Relocating the system 74  
Relocating the unit 86  
Remote Service 158, 219  
Remote Service, starting 220  
Requirements for operation 20  
Reset button 107  
Result buttons 332  
Right beamsplitter port 54  
ROI, setting of 330

**S**

Safety 15  
Safety information 16  
Safety standards 16  
Saline solution, physiological 224  
Save 196  
Scan system 237, 238, 239, 240  
Securing screw 88  
SELECT ALL button 388  
Selecting images 190  
Serial capture, delay time 146  
Serial image capture, number of images 144  
Serial images 144  
Service contract 219  
Service interval display 158  
SETUP phase 322  
Short replay (IR 800) 274  
Short replay duration (IR 800) 274  
Signal-to-noise ratio 237, 238, 239, 240  
Single images 144  
Sliding mirror, manual setting 54  
Socket for foot rocker switch 78  
Software update 219  
Sorting the patient list 178  
Spare parts 227  
Special properties 36  
Spot 148  
Stand base 72  
Static IP address 358  
Static IP address, activation 360



Steerable caster with cable deflector 72  
Steerable double casters 72  
Sterile drapes 225  
Storage Medium 246  
Storage mode 146  
Storage space, no longer sufficient 35, 196, 353  
Storing images (export) 190  
Storing patient data on a USB stick 202  
Storing patient data on CD/DVD 198  
Summer time 160  
Surgical microscope, working with 167  
System date 160  
SYSTEM INFO 158, 160  
System information 158, 160  
System time 160  
System, assembling 88  
System, positioning at operating table 102

**T**

Technical data 231  
Text entry 116  
Time 160  
Time marks in the FLOW 800 DIAGRAM 314  
Time/date setting 160  
Tissue damage caused by high illumination intensity 132  
Total magnification, calculation 130, 269  
Touchscreen 46  
Touchscreen, display of 172  
Transport locks 74  
Travel speed XY 140  
Trouble-shooting table 218  
Tube and eyepieces for main microscope 60  
TUBE menu 130  
Tube, mounting 90

**U**

Uninterruptible power supply 26, 212  
Update license 219  
Update management 219  
UPS 26  
USB data port 200  
USB memory stick 200  
USB port 200  
USB socket 200  
Use of the instrument, before 22  
Use of the instrument, for every 22  
Use, notes 17  
User name, entry 116



User profile, creating new 118  
User profile, editing 118

**V**

Version number 160  
Vertical resolution 237, 238, 239, 240  
Video / audio cables 229  
Video clip length 246  
Video clips 248  
Video format for external video port (VGA) 148  
Video image injection 170  
Video image injection in the surgical microscope 39  
Video images not for diagnostic purposes 18, 262, 394  
Video images, stored 18, 262, 394  
Video menu 148  
Video player time marks 314  
Video quality 246  
Video recording (option) 243  
Video signal output port for an external monitor (Y/C) 76, 276, 318  
Video signal output port, BNC (VBS) 76  
Video-DV out 76

**W**

Weight of the HDTV components 395  
What to do in an emergency 208  
White balance 149  
Widefield eyepieces with magnetic coupling 62  
Working with the surgical microscope 167

**X**

Xenon lamp, failure 208

**Z**

Zoom adjusting knob (emergency operation) 54  
Zoom factor, setting of (gamma start value) 126  
Zoom function, failure 210  
Zoom link of travel speed XY 140  
Zoom menu 126  
Zoom rocker switch 138  
Zoom speed 126



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