



## Operating instructions

### Operating microscopes

HS Hi-R NEO 900 / HS Hi-R NEO 900A / HS Hi-R NEO 900A NIR

HS ALLEGRA 900 / 590 / 90

### Carrier units

FS 3-45 / FS 2-25 / FS 2-21

FS 2-15 / FS 2-11



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 **HAAG-STREIT  
SURGICAL**

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# 1 Important notes

<b>Proper use</b>	<p>To ensure the safety of patients, users and third parties, the microsurgical operating system may only be operated under observance of the currently valid operating instructions.</p> <p>The microsurgical operating system is exclusively intended for use as described in the currently valid operating instructions.</p> <p>Store the operating instructions for later use in a location that is accessible at all times.</p>
<b>Proper maintenance and repair</b>	<p>To ensure the safety of the user and patient, adhere to all maintenance instructions and recordkeeping procedures as described in this document.</p> <p>The microsurgical operating system may only be repaired or upgraded in accordance with current technical specifications of the manufacturer.</p> <p>A repair or modification of the microsurgical operating system may only be carried out by persons expressly authorized by the manufacturer.</p> <p>In the event of repairs, only original parts of the manufacturer may be used.</p> <p>Following repairs or technical modifications, the equipment is to be recalibrated in accordance with current technical specifications of the manufacturer.</p>
<b>Disclaimer of liability</b>	<p>Improper use, improper repair, and/or improper maintenance shall immediately void any liability on the part of the manufacturer.</p>
<b>Proprietary rights</b>	<p>The contents of these Operating Instructions are copyright-protected. A translation is not permitted without the written authorization of the manufacturer.</p>
<b>Regarding these Operating instructions</b>	<p>The pictures and illustrations shown herein may not be an accurate representation of the device that was delivered, as a result of ongoing research and development.</p>

## 2 The microsurgical operating system

### 2.1 Overview of warning and information signs

In the Operating Instructions	Warnings
	<p><b>Will lead to serious injury or death.</b></p> <ul style="list-style-type: none"> <li>Follow the instructions to avoid a hazard.</li> </ul>
	<p><b>May lead to serious injury or death.</b></p> <ul style="list-style-type: none"> <li>Follow the instructions to avoid a hazard.</li> </ul>
	<p><b>May lead to light to moderately serious injury.</b></p> <ul style="list-style-type: none"> <li>Follow the instructions to avoid a hazard.</li> </ul>
	<p><b>May lead to material damage and / or operating error.</b></p> <ul style="list-style-type: none"> <li>Follow the instructions to avoid a hazard.</li> </ul>
On the microsurgical operating system	Warning and handling instructions
	<p><b>Notice on balancing</b></p> <ul style="list-style-type: none"> <li>Use the microsurgical operating system only when balanced (see page 25).</li> <li>Pay attention to the loading capacity of the carrier unit.</li> </ul>
	<p>Only assemble accessories with a maximum weight of 1 kg between the assistant microscope and the corresponding eyepiece.</p>
	<p><b>Disposal</b></p> <ul style="list-style-type: none"> <li>Pay attention to the disposal information in the instructions.</li> </ul>
	<p><b>Do not push</b></p> <ul style="list-style-type: none"> <li>Do not push the microsurgical operating system on surfaces marked with this symbol.</li> </ul>
	<p><b>Electrostatically endangered components</b></p> <ul style="list-style-type: none"> <li>Apply appropriate protective measures before you touch components or connect cables to components that are marked with the ESD warning label (see page 69).</li> </ul>
	<p><b>Electromagnetic Interference</b></p> <ul style="list-style-type: none"> <li>In the vicinity of equipment marked with this symbol interference are possible (see page 68).</li> </ul>
	<p><b>Risk of tilting</b></p> <ul style="list-style-type: none"> <li>Observe the maximum permissible angle of inclination of the microsurgical operating system in its operating position</li> </ul>
	<p><b>Transport position</b></p> <ul style="list-style-type: none"> <li>Transport the microsurgical operating system exclusively in the transport position.</li> </ul>
	<p><b>Remove mains plug</b></p> <ul style="list-style-type: none"> <li>Remove the mains plug from the socket before dismantling components marked with this symbol.</li> </ul>



**Heat**

- Allow components, that are marked with this symbol, to cool before touching them.



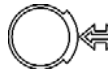
**Do not place liquids**

- Do not place containers with liquids on surfaces marked with this symbol.

**Operating elements**



- Unlock connections such as the light guide connector.



- Mechanical clamping



- Display of the focus shift and the tilt of the microscope



**Homing**

- Restore the basic settings for the XY coupling and the focus module.



- Light source

**L1 / L2**

- Halogen lamp 1 / Halogen lamp 2



- LED 1 / LED 2



- Switch for emergency lighting



- Perform balancing (see page 25).



- Redreflex amplifier

**Connections**



- Connect a potential compensation conductor in accordance with IEC/ EN 60601-1 as necessary.



**Socket to supply auxiliary devices**

- Pay attention to additional information regarding the maximum output power.



- Connect the power supply cable here.

- Note the additional information on the maximum electrical power consumption.



- Connect to the microscope's communication line here.



- Connect an optional foot switch here.



- Socket for RS 232 interface

- The microsurgical operating system -

## 2.2 Intended use

The microsurgical operating system consists of the operating microscope HS Hi-R NEO 900/HS Hi-R NEO 900A/HS Hi-R NEO 900A NIR or HS ALLEGRA 900/590/90, a carrier unit FS 3-45, FS 2-25/FS 2-21 or FS 2-15/FS 2-11 and further accessories as authorised by the manufacturer.

A wide range of surgical interventions are made possible through the modular construction and the diversity of the equipment and accessories.

The operating microscope HS Hi-R NEO 900/HS Hi-R NEO 900A/HS Hi-R NEO 900A NIR and HS ALLEGRA 900/590/90 are designed for use in Ophthalmology and in other disciplines where a vertical line of viewing is required. Due to their high manoeuvrability, the HS ALLEGRA range of operating microscopes are qualified for further applications, in particular ENT- and reconstructive microsurgery are possible, because their line of sight can be tilted or adjusted horizontally. The HS ALLEGRA 590 is particular because of its multidisciplinary application possibilities.

The carrier units FS 3-45, FS 2-25/FS 2-21 and FS 2-15/FS 2-11 have different light sources (LED / halogen) and the operation and the expansion possibilities that correspond to surgical requirements.

The microsurgical operating system is intended

- for use in hospitals, clinics and doctor's surgeries.
- for use within a patient environment.
- to be installed in an environment where operating conditions are appropriate for microsurgical procedures:
  - Little vibration
  - Careful handling
  - Aseptic procedure room/operating room
  - Use with sterilisable operating elements; a sterile cover (drape) may be used in addition.

Only trained personnel familiar with the functions and the controls of this operating microscope are permitted to operate and handle the device. The operator must ensure compliance with the steps required for cleaning, sterilisation, disinfection and changes in the equipment configuration according to instructions.

Portable and mobile high frequency communication devices such as mobile telephones can interfere with the microsurgical operating system.

## 2.3 Typical abuse

Xenon light sources are not authorised for ophthalmology. Serious eye damage is possible.

## 2.4 General warnings



### Explosions danger:

- Use in explosive atmosphere is not permissible!



### Risk of electrical shock:

- To avoid the risk of electrical shock, this equipment must only be connected to a supply mains with a protective earth.
- The microsurgical operation system must only be positioned so that a disconnection from the supply net can be made easily at any time.



### Danger to persons by improper use:

- Follow the operating instructions!
- Avoid an extreme mechanical loading of the microsurgical operation systems!
- Pay attention that the microsurgical operation system is balanced.
- When transporting the microsurgical operating system it must be in its transport position.
- In ophthalmology use exclusively manufacturer approved light sources.
- Never look directly into the light guide.



### Danger to persons by defective equipment:

- Pay attention before use that all mechanical and electrical connections are fitted properly and that they are undamaged.
- Do not begin an operation if a technical defect is present or if a defect is supposed.



### Safety shortfalls through wrong accessories and replacement parts:

The use of other accessories, other transducer and lines than those specified, with the exception of transducers and lines that the manufacturer supplies as spare parts for internal components, can lead to an increased electromagnetic emission or a reduced system interference immunity.

- Use exclusively authorised accessories from the manufacturer!
- The maximum carrier unit load-capacity may not be exceeded!
- The following is valid for all system extensions and changes:
  - Only devices are permissible whose compatibility has been determined.
  - Without additional protective measures, dangerous leakage current or contact current can arise.
  - An additional multiple power socket or an extension cable may not be connected.
  - Changing, the attaching of new elements, the removing, updating or upgrading of equipment that is still connected to a network / data sharing, can lead to new risks.
  - The requirements of EN 60601-1 are to be fulfilled!
  - After the system has been changed, appropriate examinations and tests must be carried out to guarantee safe use.



**! Attention**

**Possible material damage by improper use:**

- Only transport the microsurgical operating system in a balanced condition. Proceed slowly.
- Avoid collision with equipment that is mounted on the ceiling and walls.
- Put the carrier unit down only on an even surface.
- Store the microsurgical operation system only in the transport position and apply firmly two of the brake levers.
- Apply appropriate protective measures before you touch components or connect cables to components that are marked with the ESD warning label (see page 69).

**2.5 Combination possibilities**

	FS 3-45 LED	FS 2-25 LED	FS 2-21 Halogen	FS 2-15 LED	FS 2-11 Halogen
HS Hi-R NEO 900	x	x	x	x	x
HS Hi-R NEO 900A	x	x	x	x	x
HS Hi-R NEO 900A NIR	x	x	-	-	-
HS ALLEGRA 900 / 590	-	x	x	x	x
HS ALLEGRA 90	-	-	-	x	x

**2.6 Microsurgical operating system's equipment**

	HS Hi-R NEO 900	HS Hi-R NEO 900A/ HS Hi-R NEO 900A NIR	HS ALLEGRA 900	HS ALLEGRA 590	HS ALLEGRA 90
<b>Equipment</b>	<b>Magnification</b>				
Motorised zoom	x	x	x	x	-
Manual changer	-	-	-	-	x
	<b>Focusing</b>				
Z-Focusing	x	x	x	x	x
	<b>Other</b>				
XY coupling	x	x	x	x	o
Assistant microscope	-	x	-	-	-
Redreflex module, adjustable	x	x	-	-	-
Redreflex module, fixed	-	-	x	x	x

x = standard, included, o = optional, - = not foreseen, a = on inquiry

- The microsurgical operating system -

	HS Hi-R NEO 900	HS Hi-R NEO 900A/ HS Hi-R NEO 900A NIR	HS ALLEGRA 900	HS ALLEGRA 590	HS ALLEGRA 90
<b>Accessories</b>	<b>Eyepieces</b>				
Eyepiece 200°, 10 x	x	x	-	-	-
Eyepiece 160°, 10 x	o	o	x	x	o
Eyepiece fix, 60°	-	-	o	o	x
Eyepiece 160°, 12,5 x	-	x*	-	-	-
<b>Co-observation</b>					
BS 50:50	o	o	o	-	o
VERTISCOPE T / U	-	-	o	-	o
DIPLOSCOPE T / U	-	-	o	-	o
C.INJECT / C.DUO	o	o	-	-	-
Secondary stereoscopic observers	o	o	o	-	o
M.DIS	o	o	o	o	o
Various camera attachments	o	o	o	-	o
<b>Microscope control</b>					
Foot switch EF 5001	o	o	o	o	o
Foot switch EF 5000	o	o	o	o	o
Foot switch EF 2600	o	o	o	o	o
Foot switch EF 2000	o	o	o	o	o
Foot switch PEDDY	o	o	o	o	o
<b>Other</b>					
EIBOS 2	o	o	o	o	o
TOCULAR	o	o	o	o	o
Motorised slit lamp	o	o	-	-	-
Keratoscope	o	o	o	-	o
Tray	o	o	o	o	o
HS MIOS	o	o	o	o	o
<b>Possible connections of external systems</b>					
iOCT	-	-/o	-	-	-

Due to the wide variety of equipment combinations, deviations from the above are possible. For information about the compatibility of your microsurgical operation system please contact your local sales representative.

\* Assistant microscope

x = standard, included, o = optional, - = not foreseen, a = on inquiry

### 3 Installation, transport and storage

#### ! Attention

#### Possibility of interference caused by electromagnetic incompatibility

Medical Electrical Equipment needs special precautions regarding its electromagnetic compatibility.

- Observe the instructions on the electromagnetic compatibility of the microsurgical operation system (see page 66).

#### 3.1 Installation of the carrier units

The installation of the carrier units should be performed by a manufacturer appointed service technician.

#### ! Attention

#### Possible material damage to electronic components:

- Connect the microsurgical operating system to the power supply only after installing all components.

#### 3.2 Installation of the operating microscope

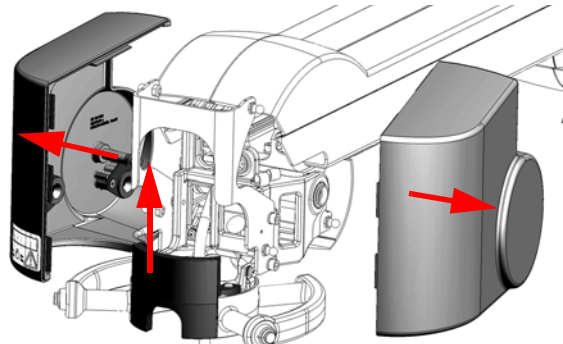
##### 3.2.1 FS 3-45/FS 2-25/FS 2-21

#### ! CAUTION

#### Danger to persons from sudden uplifting of the suspension arm:

- Keep the carrier unit's arm vertical and still when installing.

1.

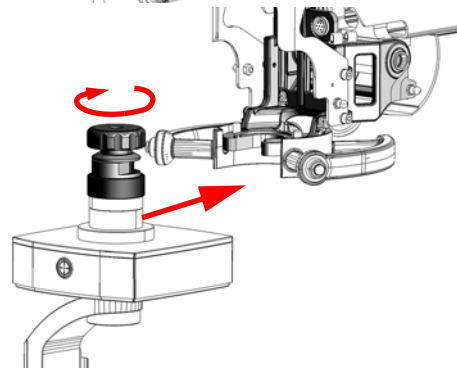


2.

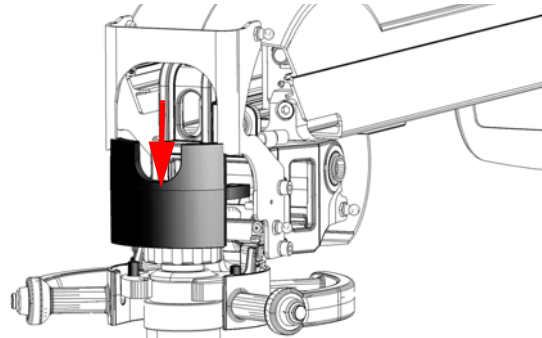
#### ! WARNING

#### Danger to persons from falling components:

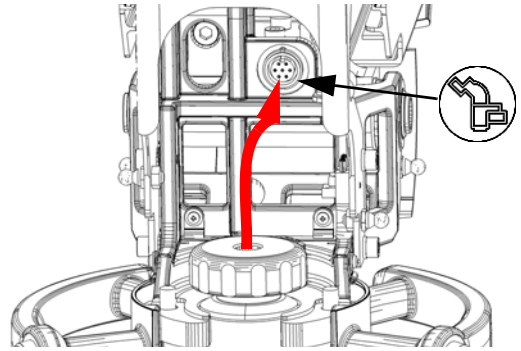
- Ensure that all components are firmly fixed to each other.



3.



4.

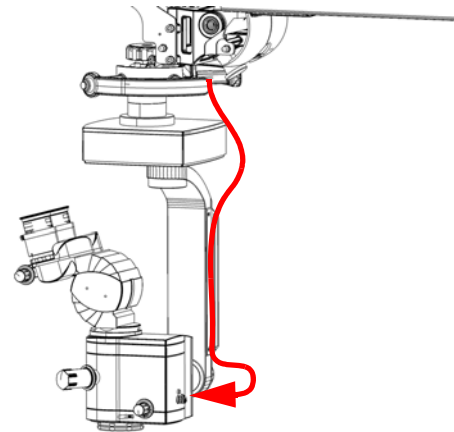


5.

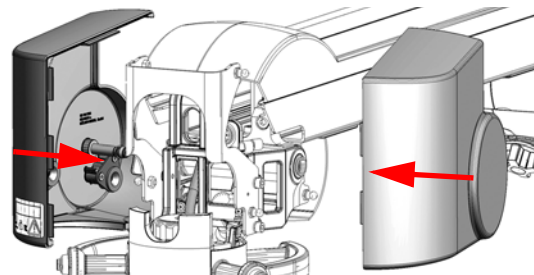
**! Attention**

**Damage to the light guide possible:**

- Make sure that the **light cable** is long enough after installation on the microscope receiver, that the operation microscope is not limited when rotating.



6.



### 3.2.2 FS 2-15 / FS 2-11



#### Danger to persons from sudden uplifting of the suspension arm:

- Keep the carrier unit's arm vertical and still when installing.

1.



#### Danger to persons from falling components:

- Ensure that all components are firmly fixed to each other.

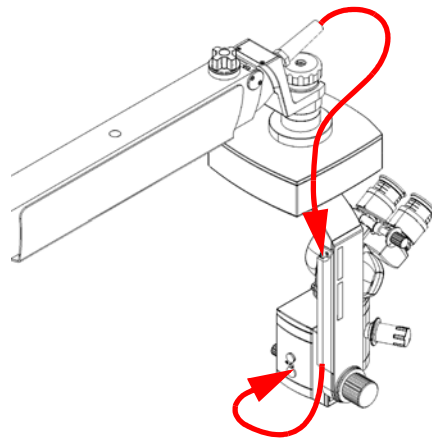
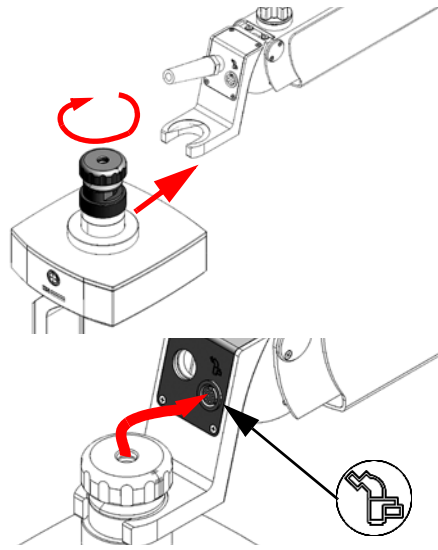
2.

3.



#### Damage to the light guide possible:

- Make sure that the light cable is long enough after installation on the microscope receiver, that the operation microscope is not limited when rotating.

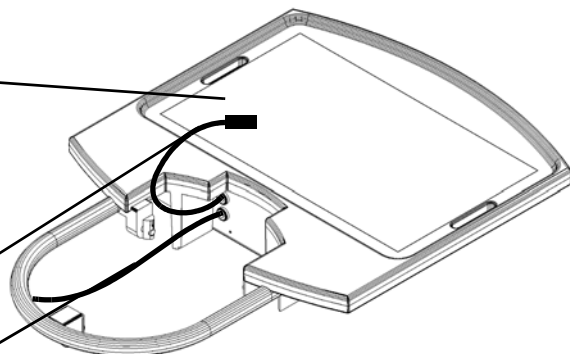


### 3.3 Installation of accessories on the tray

Maximum load bearing capacity 20 kg

Supply lines to accessory articles, maximum output of the isolation transformer: 120 VA

Connection cable to the carrier unit



### 3.4 Deinstallation of the microsurgical operating system

**! Attention**

**Damage to material can possibly occur through improper deinstallation:**

- Before a deinstallation of equipment, make sure that all corresponding electrical and optical connections (connecting cable, light guide) are disconnected.
- Work through the installation instructions backwards.

### 3.5 Transport and storage

#### 3.5.1 FS 3-45/FS 2-25/FS 2-21

**! WARNING**

**Danger to persons by tipping over of the microsurgical operating system:**

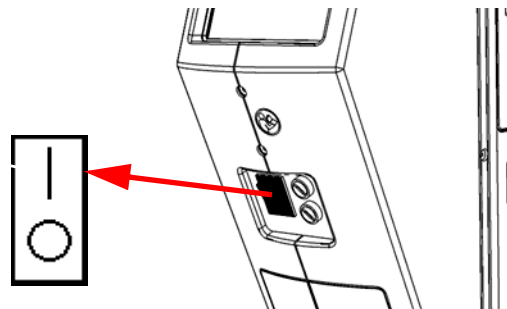
If the working position of the microsurgical operating system is inclined by more than 5° then it can tip over.

- When transporting the microsurgical operating system it must be in its transport position.

**Danger to persons from the sudden uplifting of the suspension arm when the carrier unit is unbalanced:**

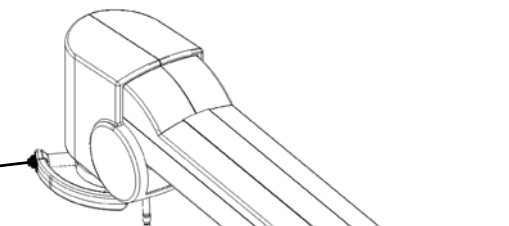
- Transport the carrier unit with the operating microscope attached.

1.



2.

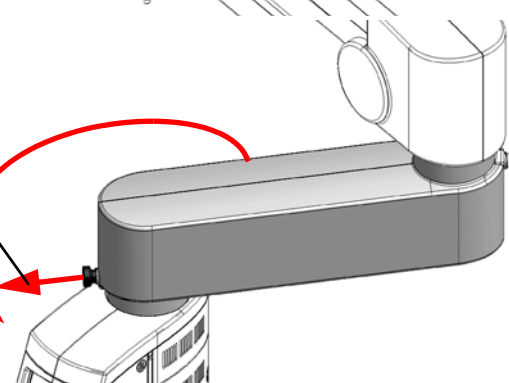
Press and hold the electromagnetic brake button released



3.

Pull lock pin

Turn the carrying arm to the lock in the direction as illustrated

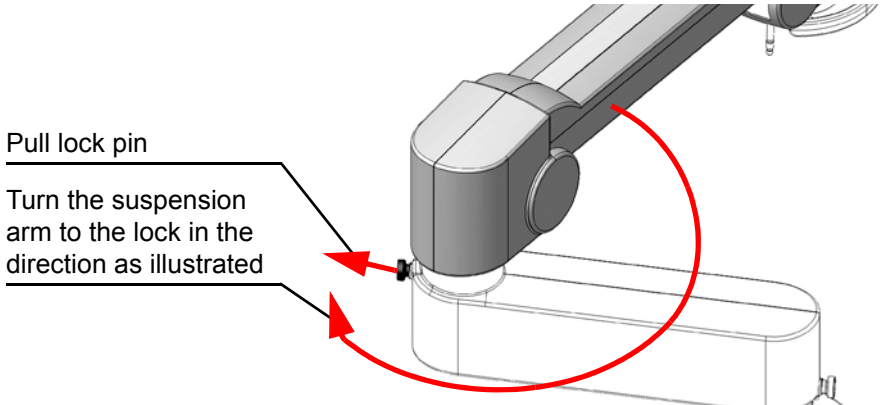


- Installation, transport and storage -

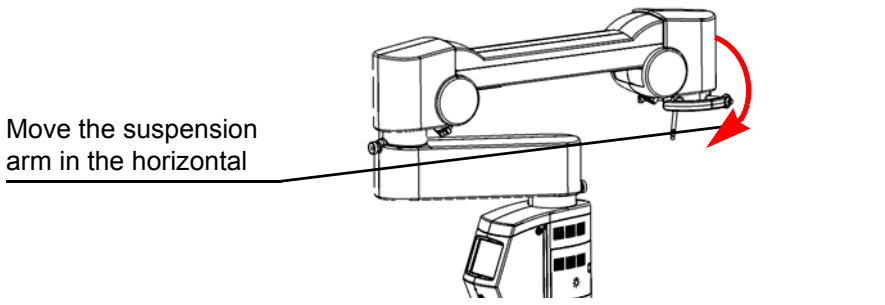
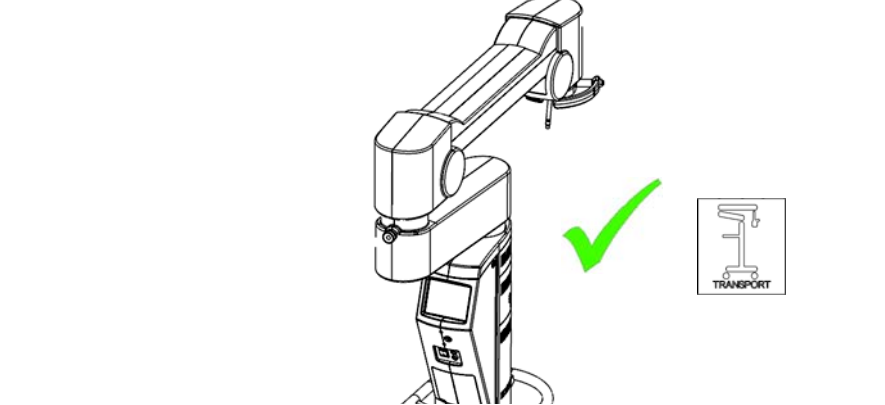
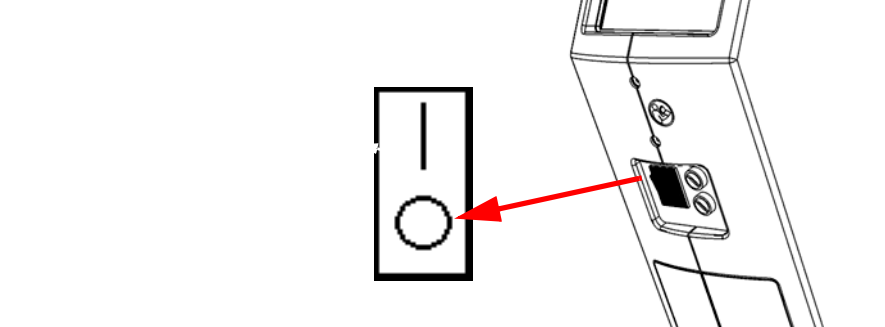

4. 

Pull lock pin

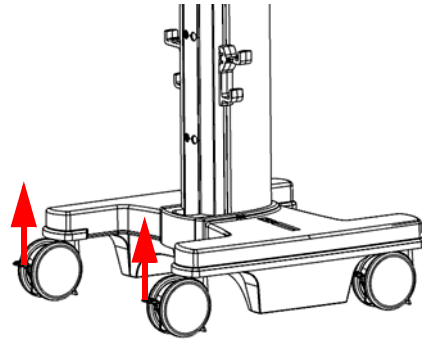
Turn the suspension arm to the lock in the direction as illustrated


5. 

Move the suspension arm in the horizontal


6. 
7. 
8. 

9.



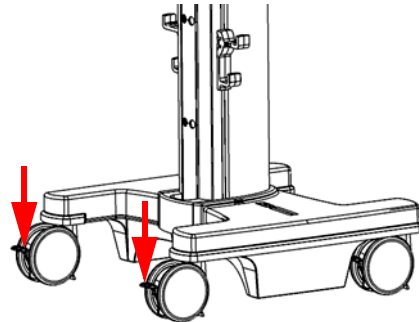
10.

**! Attention**

**Possible material damage through collision and tipping of the microsurgical operating system:**

- Move the carrier unit only by moving the handling frame.
- Do not lean on the carrier unit housing.
- Proceed slowly.
- Place the carrier unit only on a flat and even surface.
- Avoid collisions.

11.



12. • Protect the microsurgical operation system from dust and other contaminants by using the appropriate protective covers.



### 3.5.2 FS 2-15 / FS 2-11



#### **Danger to persons by tipping over of the microsurgical operating system:**

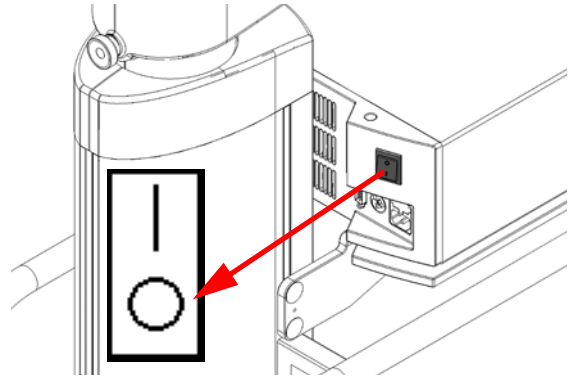
If the working position of the microsurgical operating system is inclined by more than 5° then it can tip over.

- When transporting the microsurgical operating system it must be in its transport position.

#### **Danger to persons from the sudden uplifting of the suspension arm when the carrier unit is unbalanced:**

- Transport the carrier unit with the operating microscope attached.

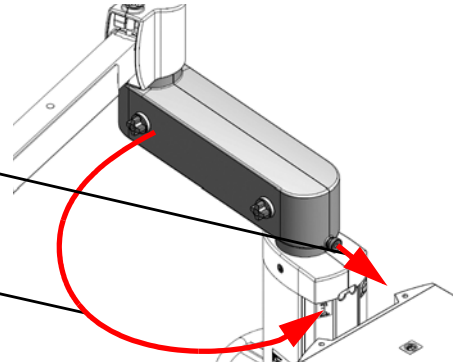
1.



2.

Pull lock pin

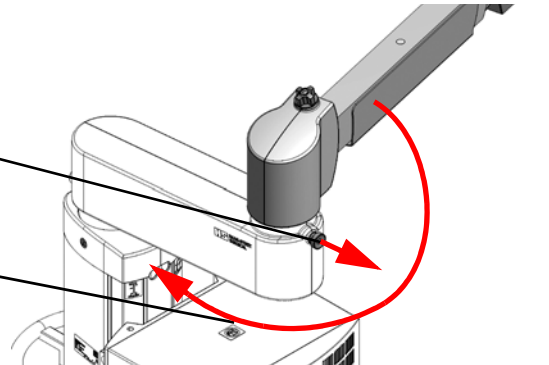
Turn the suspension arm to the lock in the direction as illustrated



3.

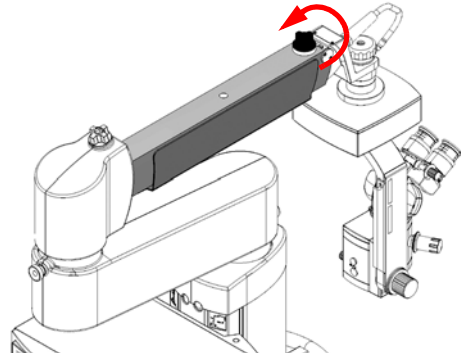
Pull lock pin

Turn the carrying arm to the lock in the direction as illustrated

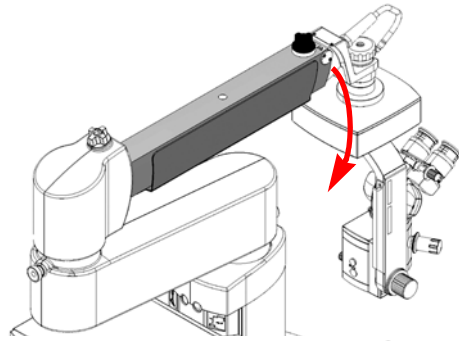


- Installation, transport and storage -

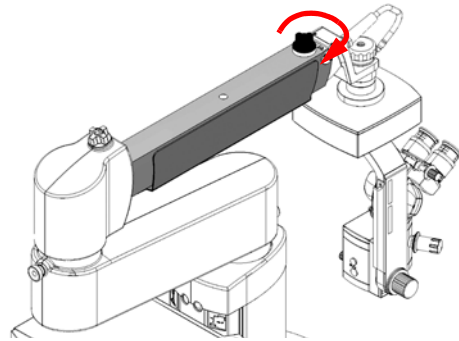
4.



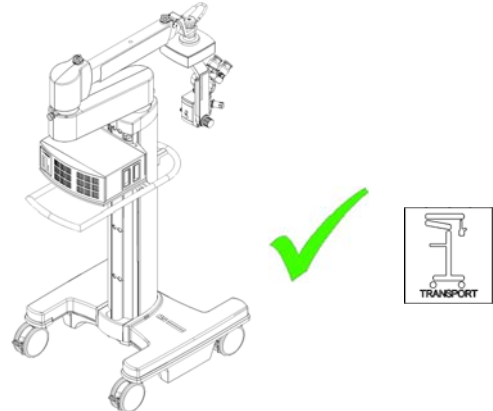
5.



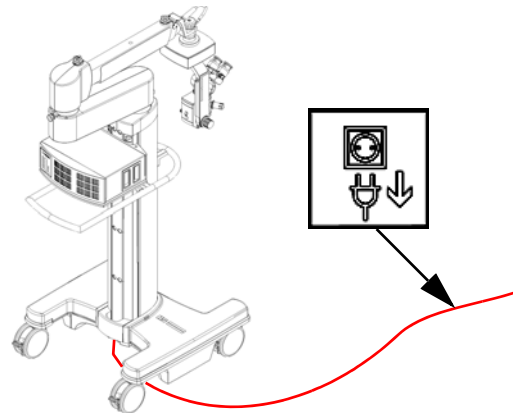
6.



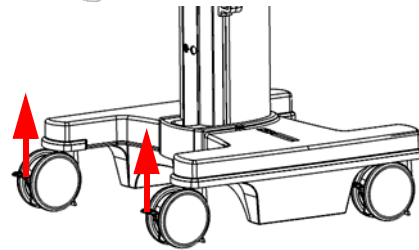
7.



8.



9.



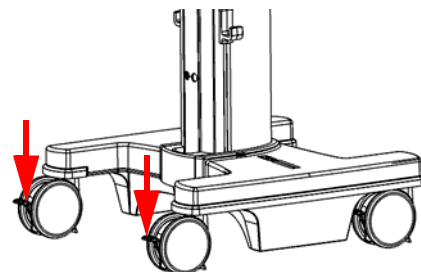
10.

**! Attention**

**Possible material damage through collision and tipping of the microsurgical operating system:**

- Move the carrier unit only by moving the handling frame.
- Do not lean on the carrier unit housing.
- Proceed slowly.
- Place the carrier unit only on a flat and even surface.
- Avoid collisions.

11.



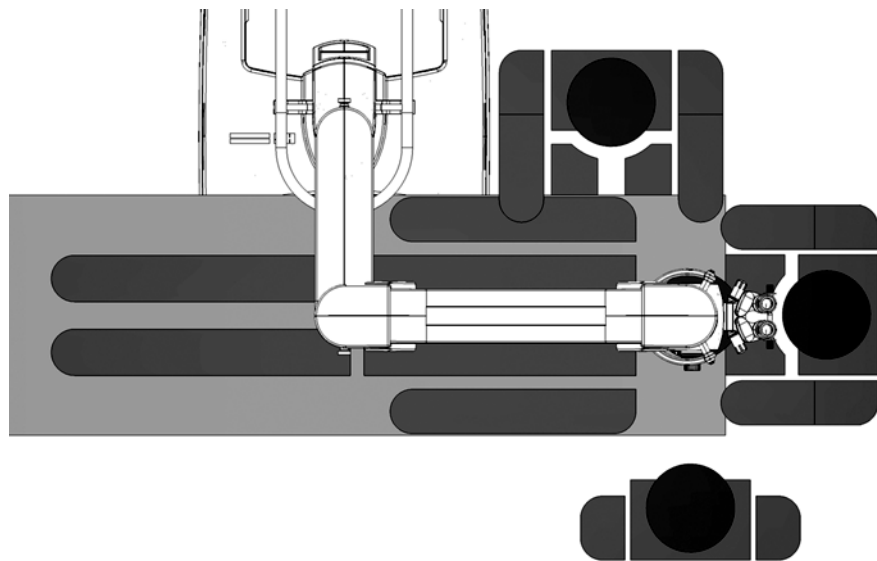
12. • Protect the microsurgical operation system from dust and other contaminants by using the appropriate protective covers.

## 4 Operating the microsurgical operating system

### 4.1 Before each operation

- Make sure that see
1. all mechanical and electrical connections are fitted properly and that they are undamaged.
  2. ensure that the floor stand is connected to a nearby power supply so that it can be easily disconnected.
  3. at least two of the brake levers on the carrier unit are on. page 20,  
page 28
  4. the microsurgical operating system is level.
  5. the microsurgical operating system is balanced. page 25,  
page 30
  6. the microsurgical operating system is in the preferred working position and neither the suspension arm or the carrier arm is in the transport position.
  7. the suspension arm is free to move around the vertical and the horizontal axis when the brake released.
  8. the light source functions perfectly. page 21,  
page 30
  9. the operator settings necessary for the operation are loaded. page 22
  10. the microsurgical operation system is equipped with sterilisable operating elements and is wrapped in a **sterile cover** in accordance with the relevant requirements. page 18
  11. all microsurgical operating systems ventilation slits are open and that, for example, no clothes cover them.

### 4.2 Typical set-up of the microsurgical operating system



### 4.3 Disconnection from the power supply

- Pull the mains cable in order to safely disconnect the microsurgical operating system from the power supply.

### 4.4 Important information regarding sterile use



**Patient will be at risk of infection and / or contamination as a result of non-sterile use:**

- Sterilise the sterilisable operating elements before use (see page 70).
- Before every operation, furnish the microsurgical operation system with the appropriate sterile operating elements (see also Operating Instructions, "Accessories, Spare and Replacement Parts, Disposable Materials").
- The exterior surfaces of sterile operating elements may only come into contact with sterile persons.

Use of sterile covers (drapes):

- Before every operation, furnish the microsurgical operation system with the appropriate sterilisable operating elements. These do not need to be sterilised, they are used to protect the sterile cover.
- Equip the microsurgical operation system with an appropriate sterile cover (see also Operating Instructions, "Accessories, Spare and Replacement Parts, Disposable Materials").

## 4.5 Important information regarding ophthalmology



### Danger to the patient's eyes:

The light emitted from this instrument is potentially hazardous. The longer the duration of exposure, the greater the risk of ocular damage. Exposure to light from this instrument when operated at maximum intensity will exceed the safety guideline according to ISO 15004-2:2007 after 2.2 minutes (with halogen light sources) / after 1.3 minutes (with LED light source). To avoid damage to the eyes the following instructions must be observed.

- In ophthalmology use exclusively manufacturer approved light sources.
- Make sure that safe operation is ensured at every step.
- The carrier units have an integrated UV filter that blocks ultraviolet light under 420 nm and an IR filter that reduces infra red light above 800 nm by 85%.

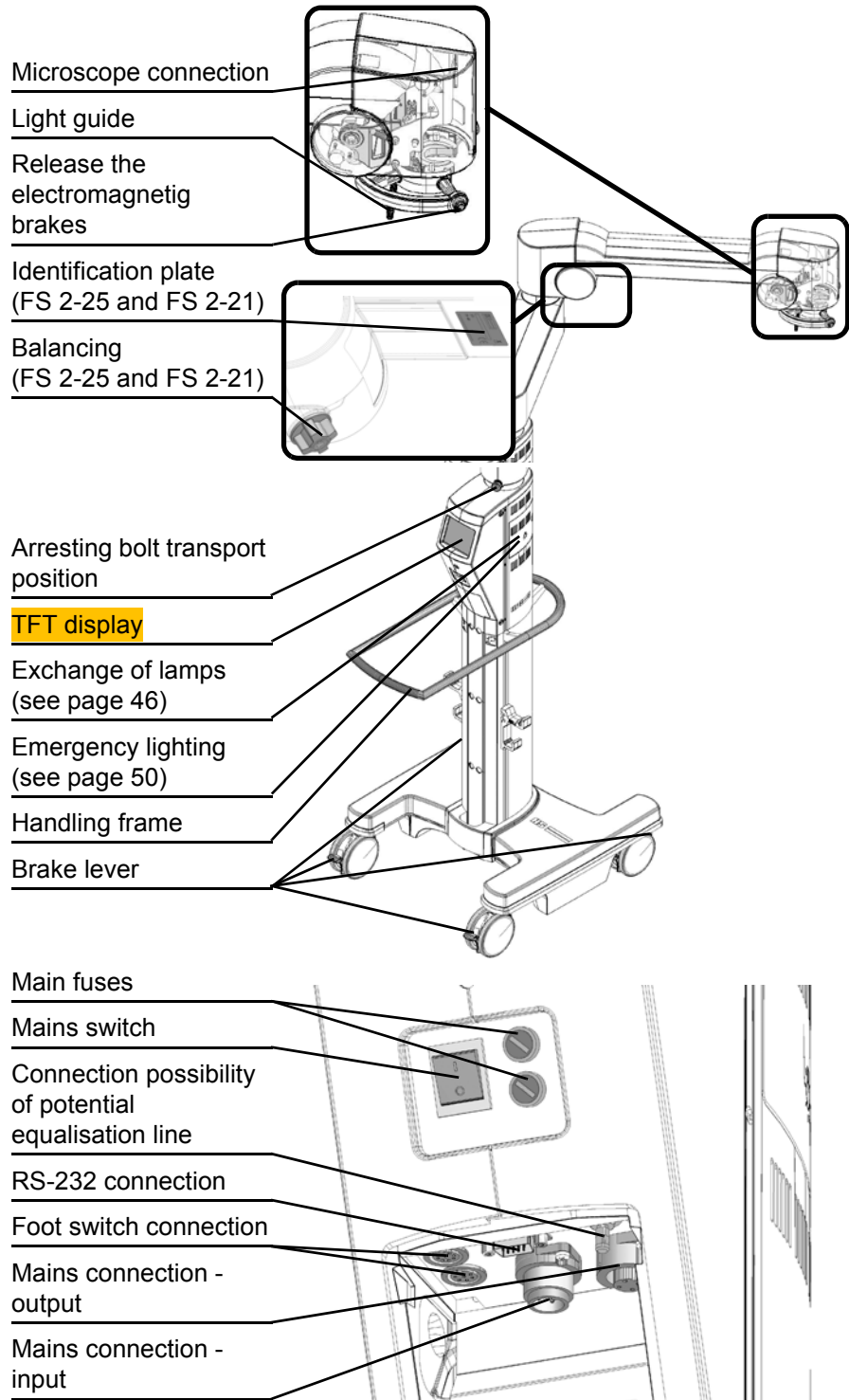
It is recommended to consult specialist literature for an optimal protection of the patient's eyes. The risk of ocular damage can be minimised as follows:

- Reduce the level of the illumination intensity:
  - If the illumination intensity is halved, the time doubles before exceeding the safety limits according to ISO 15004-2:2007.
  - Expanding the illumination field does not reduce the danger of photochemical damage.
- Reducing the pupil's exposure time:
  - Cover the pupils during pauses in the operation.
  - Switch off the illumination.
- Reduce the short-wave spectral part of the microscope illumination using a protective filter (see page 32, page 36, page 40, page 44, page 42).
- Tilt the microscope axis away from the patient's line of sight.
- Further individual factors influence the risk of photochemical damage:
  - Enlargement of the patient's pupils
  - Age of the patient
  - Sensitising because of medicines
  - Ametropia of the patients eyes, condition of the eye lens
  - Individual working style of the operating doctor.

## 4.6 Carrier units

### 4.6.1 FS 3-45/FS 2-25/FS 2-21

#### 4.6.1.1 Overview of the operating elements



### 4.6.1.2 Setting up the microsurgical operating system

**Main menu**

Dialogue Illumination

Dialogue Microscope

Dialogue User

Dialogue Settings

Dialogue Discipline

Dialogue Balance

Contrast adjustment

brightness

microscope

Dr. Lindberg

settings

discipline

balance

display

3.9x 300 mm

**Important operating keys**

Save and exit the dialogue

OK

Exit the dialogue without saving

Cancel

**Illumination**

Halogen light source

Brightness adjustment

Light source on / off

Elapsed operation time

Active lamp

Reset elapsed operation time

Reserve lamp

1.1 ISO

L1 Operation time: 5 h

L2 Operation time: 0 h

OK

OK

**Attention**

**Unexpected defective illumination is possible:**

- Reset the elapsed operation time only when a halogen lamp is replaced.

**LED light source**

Brightness adjustment

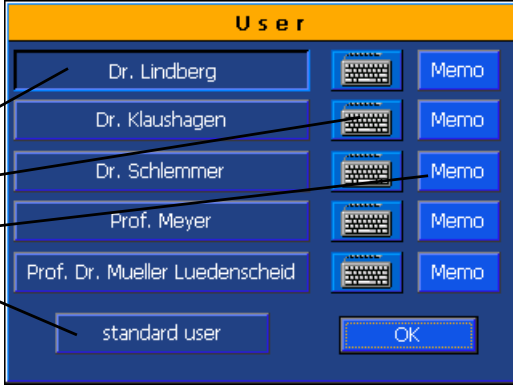
Light source on / off

0.35

OK



User



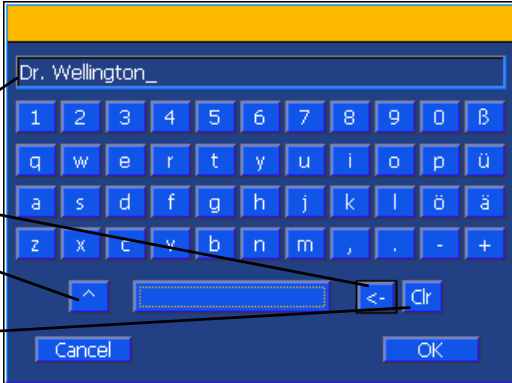
Load user settings

Edit user name

Adjust user settings

Load standard settings

Edit user name



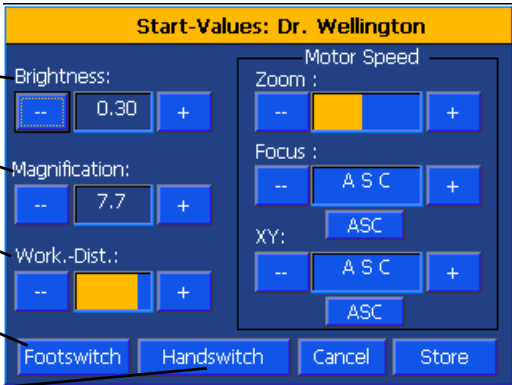
Preview

Delete single characters

Capital letters

Delete the complete user name

User settings



Brightness adjustment

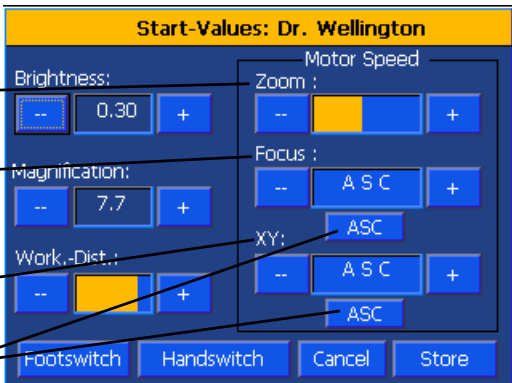
Magnification adjustment

Working distance adjustment

Foot switch configuration

Hand switch configuration

Zoom speed adjustment



Focus speed manual adjustment

Speed of the XY coupling manual adjustment

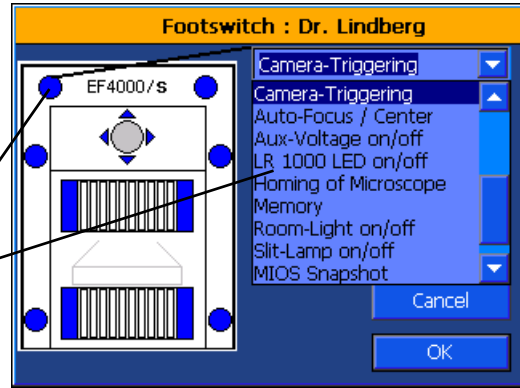
Automatic Speed Control on / off

**Automatic Speed Control**

- The function Automatic Speed Control adjusts the motor speed to match the actual magnification. To switch off the function adjust the motor speed manually.

Foot switch configuration

Select the switch  
Available functions



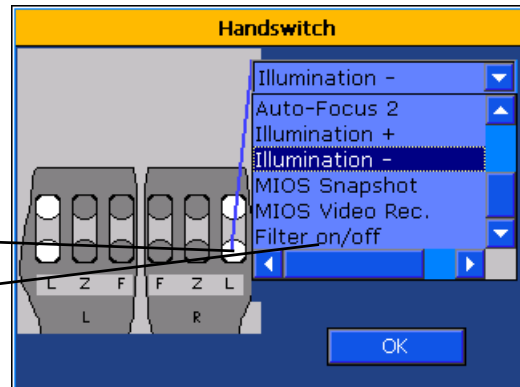
**! Attention**

**Operating error through wrongly labelled operating panel:**

- Change the labelling of the foot switch to reflect an changed foot switch configuration.

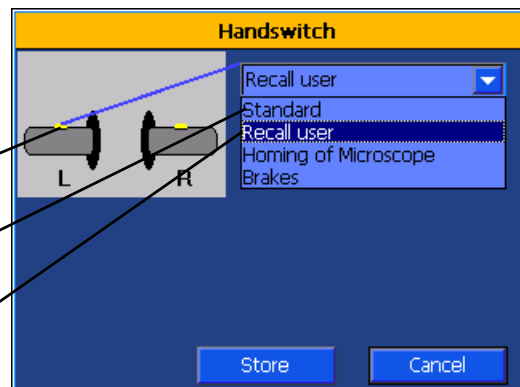
Hand switch configuration - ALLEGRA 590

Select the switch  
Available functions

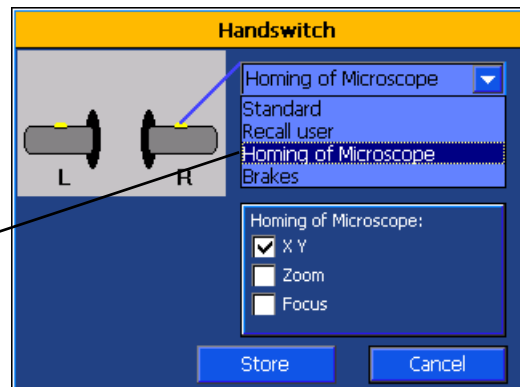


Hand switch configuration - Other

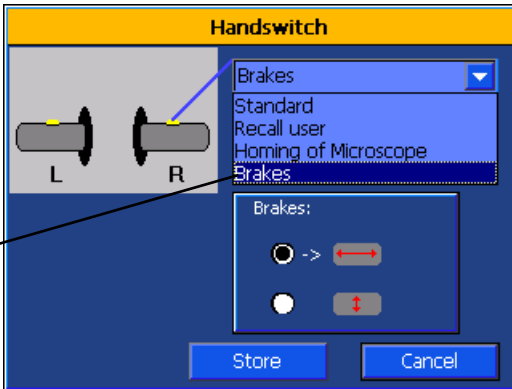
Select the switch  
Release all electromagnetic brakes  
Call up all settings for the last selected user



Call up the basic settings for all selected microscope functions



- Operating the microsurgical operating system -



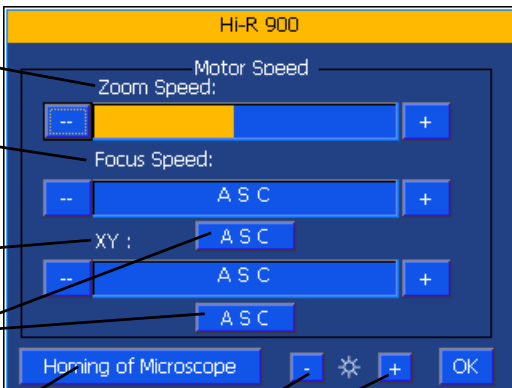
The 'Handswitch' dialog box shows two handswitches labeled 'L' and 'R'. A dropdown menu for 'Brakes' is open, showing options: 'Standard', 'Recall user', 'Homing of Microscope', and 'Brakes'. Below the dropdown, there are two radio buttons for 'Brakes:'. The first radio button is selected and is accompanied by a horizontal double-headed arrow. The second radio button is unselected and is accompanied by a vertical double-headed arrow. At the bottom are 'Store' and 'Cancel' buttons.

Release electromagnetic brakes in a horizontal or vertical direction

 Discipline

- Proceed analogue to dialogue „User“.

 Microscope



The 'Hi-R 900' dialog box is titled 'Motor Speed'. It contains several sliders and buttons: 'Zoom Speed' with a slider and '+' '-' buttons; 'Focus Speed' with a slider and '+' '-' buttons; 'XY' with a slider and '+' '-' buttons; and another slider with '+' '-' buttons. At the bottom, there are buttons for 'Homing of Microscope', a sun icon, a '+' button, and an 'OK' button.

Zoom speed adjustment

Fosus speed manual adjustment

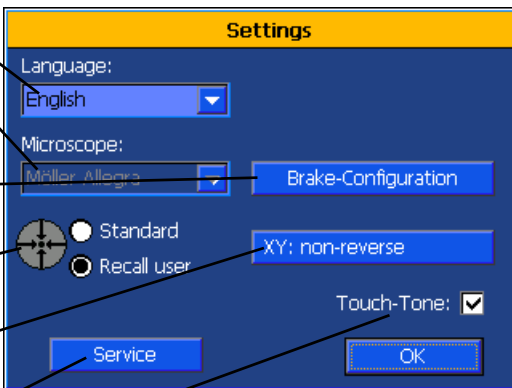
Speed of the XY coupling manual adjustment

Automatic Speed Control on / off

Call up the basic settings for the microscope

HS Hi-R NEO 900/  
HS Hi-R NEO 900A:  
Contrast adjustment of the microscope display

 Settings



The 'Settings' dialog box includes: 'Language:' dropdown set to 'English'; 'Microscope:' dropdown set to 'Miller Allegro' with a 'Brake-Configuration' button; a joystick icon with radio buttons for 'Standard' and 'Recall user'; a 'XY: non-reverse' button; a 'Touch-Tone:' checkbox which is checked; and 'Service' and 'OK' buttons at the bottom.

Available languages

Operating microscope

Configuration of the carrier unit's brake button

Homing button configuration

inverse activation of the XY couplin on / off

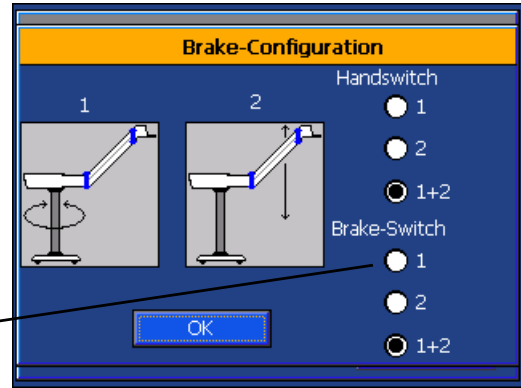
Service settings, password protected

Key-sound on / off

- Standard:
- Call up the basic settings for the XY coupling and the focusing.
- Recall user:
- Call up all settings for the last selected user.

Configuration of the carrier unit's brake buttone

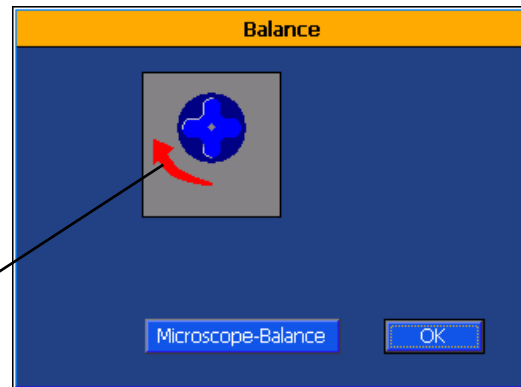
Brake functions:  
 1:  
 Horizontal movement  
 2:  
 Vertical movement



 Balance

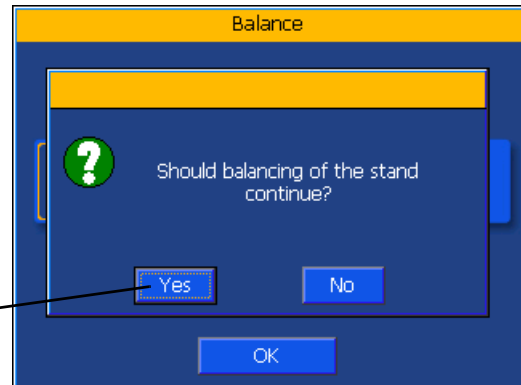
FS 2-25/FS 2-21

To adjust the weight compensation turn the knob on the floor stand in the indicated direction.

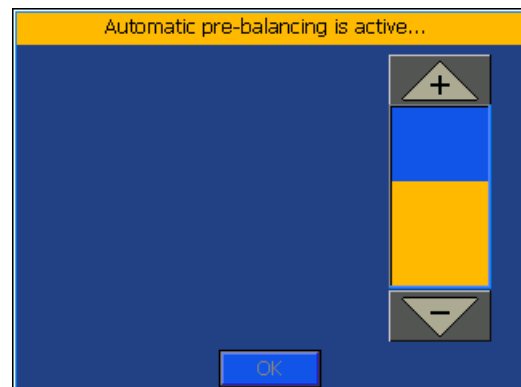


FS 3-45

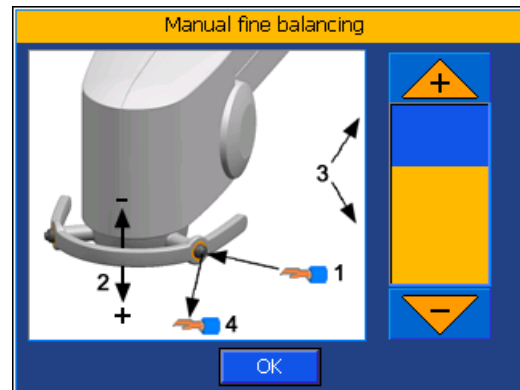
Confirm to balance the floor stand.  
 This process will take approximately 2 minutes and cannot be stopped.



The floor stand carries out automatic pre-balancing.  
 In the following manual fine balancing, the weight compensation can be adapted to the individual preferences.

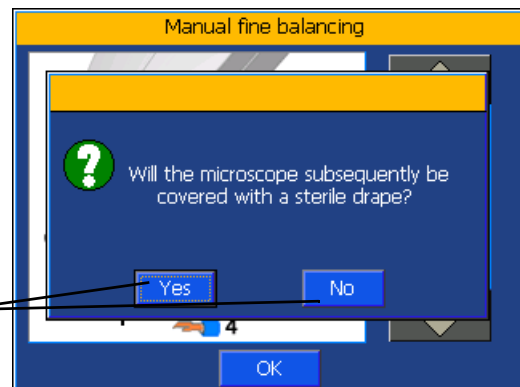


- Operating the microsurgical operating system -



1. Release and hold released the electromagnetic brakes (1).  
You may use the brake buttons on the floor stand's head or the brake buttons on the hand switch of the microscope.
2. Move the suspension arm up and down and feel if it needs further balancing (2).
3. Balance the suspension arm by choosing „+“ or „-“ until it is fine balanced (3).
4. De-release the brakes (3) and confirm with „OK“.

Select if the microscope will subsequently be draped. If yes, the additional weight will be included in the balancing.



### 4.6.1.3 Configurable functions for hand and foot switches

Function name	Description
„no Function“	The key has no function.
„Illumination + (SL r)“/ „Illumination - (SL l)“	<ul style="list-style-type: none"> <li>• Increase (+)/decrease (-) the microscope illumination.</li> </ul> If slit lamp is activated: <ul style="list-style-type: none"> <li>• Move the slit lamp to the right (SL r) or to the left (SL l).</li> </ul>
„Illumination on/off“	<ul style="list-style-type: none"> <li>• Switch the microscope illumination on/off.</li> </ul>
„Zoom +“/„Zoom -“	<ul style="list-style-type: none"> <li>• Increase (+)/decrease (-) the magnification of the operating microscope.</li> </ul>
„Focus +“/„Focus -“	<ul style="list-style-type: none"> <li>• Move the microscope upwards (+)/downwards (-), to re-adjust the focusing.</li> </ul>
„XY reverse/ non reverse“	<ul style="list-style-type: none"> <li>• Control an attached XY coupling via the foot switch - reverse/ non reverse.</li> </ul>
„Homing of Microscope“	<ul style="list-style-type: none"> <li>• Recall the following default values of the XY coupling and/or magnification and/or focus:                             <ul style="list-style-type: none"> <li>• XY coupling: middle position</li> <li>• Magnification: 4x</li> <li>• Focus: Default position</li> </ul> </li> </ul>
„Recall user“	<ul style="list-style-type: none"> <li>• Recall the following default values of the last selected user:                             <ul style="list-style-type: none"> <li>• Magnification</li> <li>• Working distance</li> <li>• Light intensity</li> <li>• Focus speed</li> <li>• Zoom speed</li> <li>• Speed of the XY coupling</li> </ul> </li> </ul>
„C.INJECT Overlay on/ off“ 2)	<ul style="list-style-type: none"> <li>• Overlaying an image from an external data source over the microscope live image.</li> </ul>
„C.INJECT full image on/off“ 2)	<ul style="list-style-type: none"> <li>• Dim the live image of the microscope and show only the picture from an external data source.</li> </ul>
„HS MIOS photo“ 1)	<ul style="list-style-type: none"> <li>• Create a snapshot of the camera image in HS MIOS or operate the automatic editing function of HS MIOS (see user instructions of HS MIOS).</li> </ul>
„HS MIOS video“ 1)	<ul style="list-style-type: none"> <li>• Start/Stop a HS MIOS video recording.</li> </ul>
„Microphone on/off“ 1)	<ul style="list-style-type: none"> <li>• Switch the audio function of the video recording of HS MIOS on/off.</li> </ul>
„OCT“ 3)	<ul style="list-style-type: none"> <li>• Configure the selected keys via the iOCT.</li> </ul>
„Slitlamp on/off“ 4)	<ul style="list-style-type: none"> <li>• Switch the audio function of the video recording of HS MIOS on/off.</li> </ul>
„Release brakes“	<ul style="list-style-type: none"> <li>• Release the selected axis (horizontal and/or vertical) of the microsurgical operating system.</li> </ul>

1) This function requires HS MIOS and possibly further optional modules of HS MIOS.

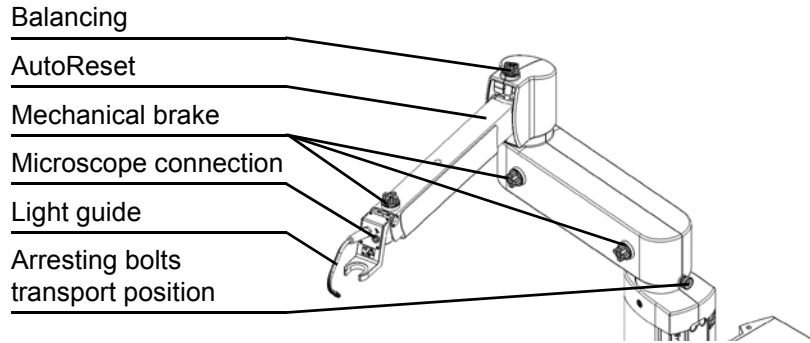
2) This function requires C.INJECT.

3) This function requires iOCT.

4) This function requires a slitlamp.

## 4.6.2 FS 2-15 / FS 2-11

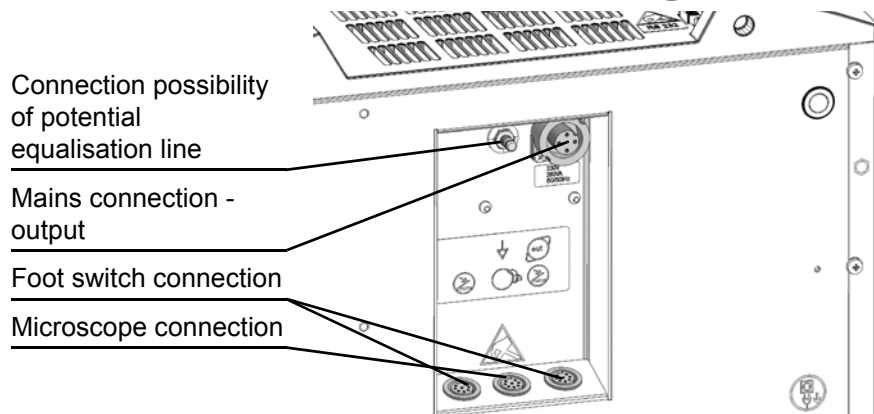
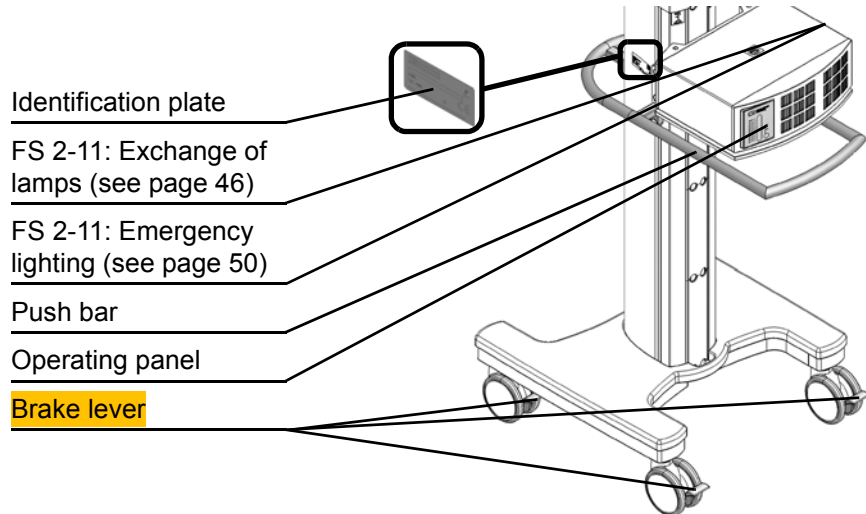
### 4.6.2.1 Overview of the operating elements



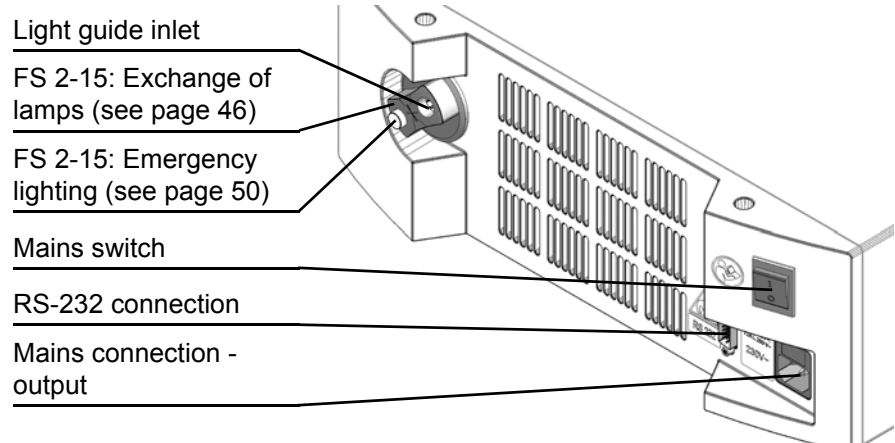
#### AutoReset

- If the suspension arm is moved to its upper stop,
  - the microscope light can be automatically switched off and/or
  - the homing of the operating microscope can be performed automatically.

To configure this function, please contact your local sales representative.

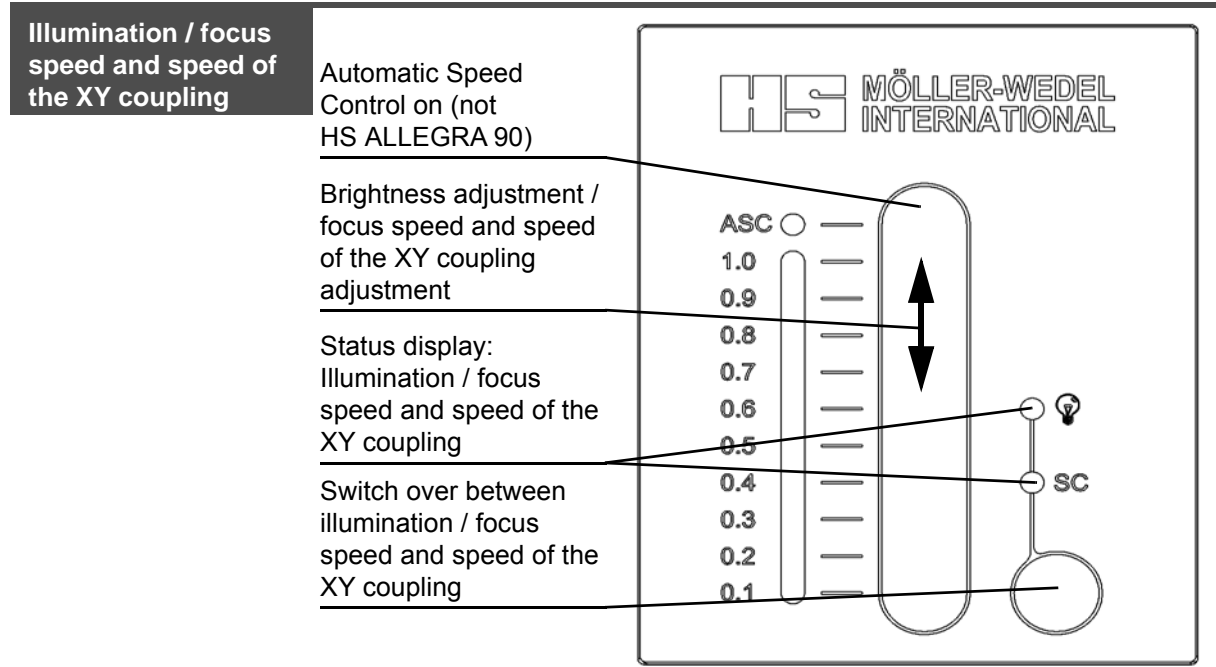


- Operating the microsurgical operating system -



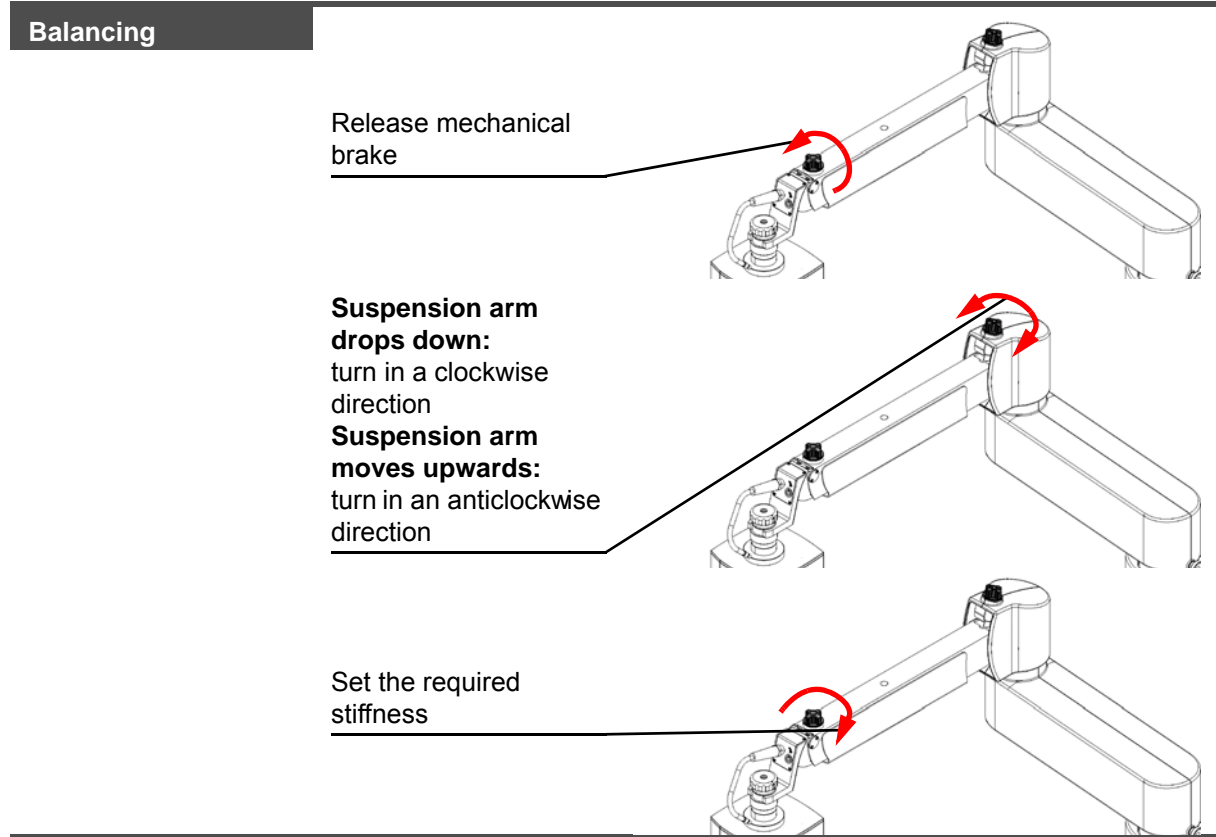


### 4.6.2.2 Setting up the microsurgical operating system



#### Automatic Speed Control

- The function Automatic Speed Control adjusts the motor speed to match the actual magnification. To switch off the function adjust the motor speed manually.



Certain hand- and foot-switch functions as well as the homing key for an XY coupling and the „AutoReset“ function may be configured using the RS-232 interface, depending upon the microsurgical operating system. Please consult your local sales representative.

## 4.7 Operating microscopes

### 4.7.1 HS Hi-R NEO 900A/HS Hi-R NEO 900A NIR

#### Positioning

Homing: Call up the basic settings for the XY coupling and the focusing / configurable

Release the electromagnetic brakes / configurable!

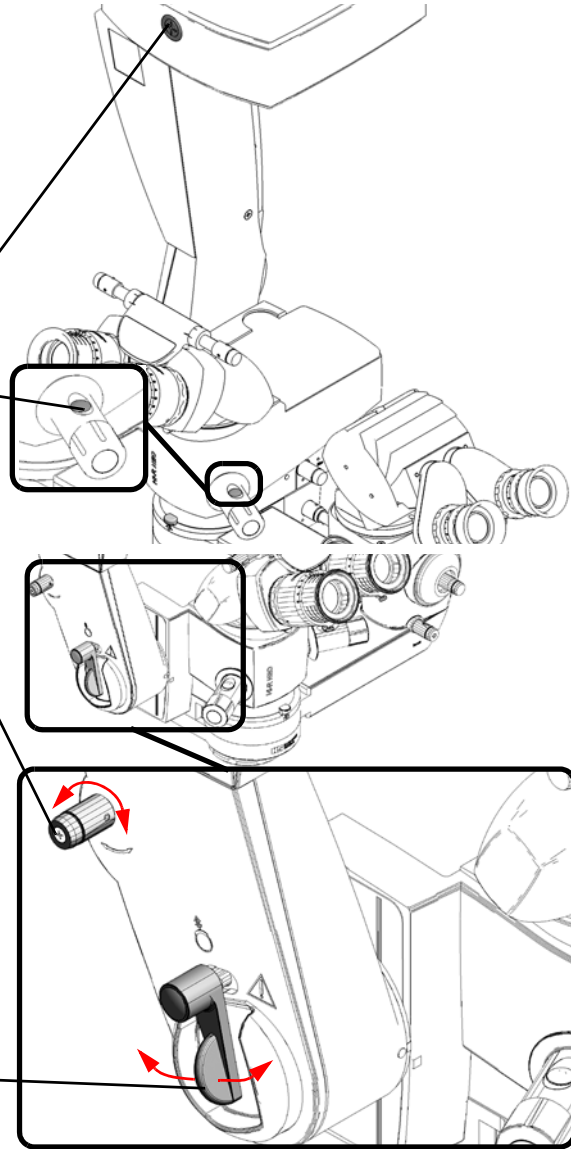
Fine adjustment of the microscope tilt:  $\pm 10^\circ$

#### ! Attention

To ensure full operability the lever should be in middle position.

- Reset the fine adjustment before pre-adjusting the microscope tilt.

Pre-adjustment of the microscope tilt:  $-70^\circ \dots +90^\circ$



#### ! CAUTION

#### Danger to patient through pre-adjustment during surgery:

The operating microscope may tilt during the setting of the microscope tilt.

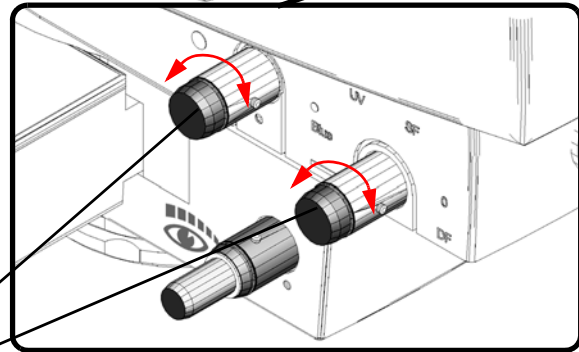
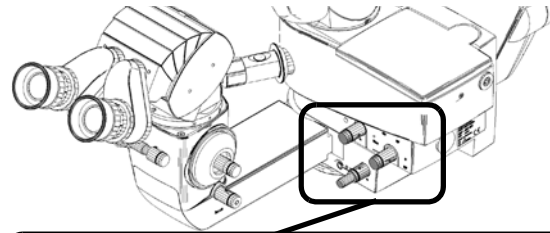
- Pre-adjust the microscope tilt before surgery.
- Always hold the operating microscope while pre-adjusting the tilt.

#### Focusing

- Position the operating microscope over the operation field.
- Adjust for minimum magnification.
- Focus the operating microscope manually.
- Adjust for maximum magnification.
- Focus the operating microscope using the foot switch.
- Adjust for the required magnification.

! Before use, supply with sterilisable operating element.


**Illumination field and filters**



Adjust illumination field diameter<sup>1</sup>

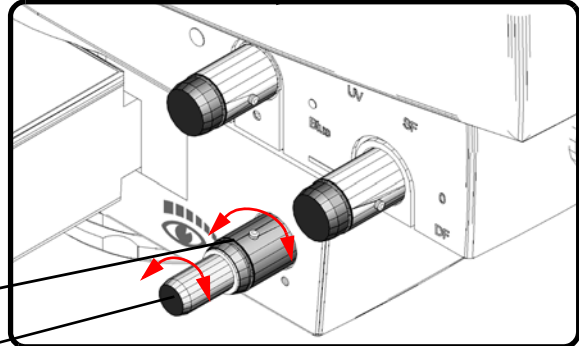
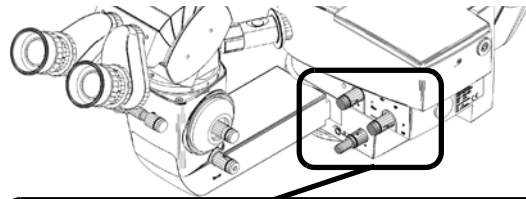
Select filter by rotating:<sup>1</sup>

Recommended operating period for ophthalmology according to ISO 15004 in minutes with light source and brightness:

		FS 2-21, FS 2-11	FS 3-45, FS 2-25, FS 2-15
0	no filter		
	• optimum color fidelity		
	Slit 3 mm		
	• optimum color fidelity		
UV	UV filter		
	• Yellow light color		
	Ophthalmology:		
	• recommended for LED and halogen illumination		
SF	Softfilter		
	• Alignment of the LED light to the halogen light		
	Ophthalmology:		
	• recommended for LED illumination		
DL	Daylight filter		
	• Alignment of the halogen light to the daylight		
Blue	Blue filter		
	• Excitation of fluorescence		
	• short-term use with application of fluorescein		

<sup>1</sup> Before use, supply with sterilisable operating element.

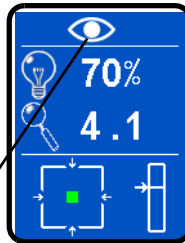
Redreflex



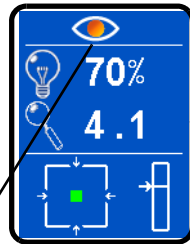
Adjust illumination angle for optimal Redreflex!<sup>1</sup>

Adjust Redreflex:<sup>1</sup>

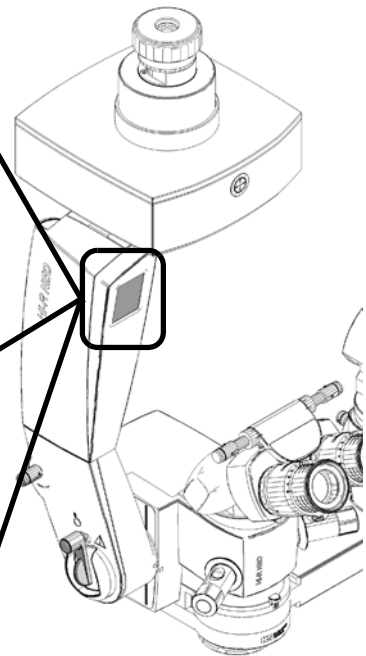
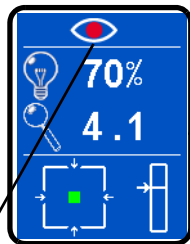
The redreflex is turned off.  
In the assistant microscope the Redreflex is visible in one eyepiece.



The Redreflex is in its center position.  
In the main eyepiece-head the Redreflex is slightly distinct.  
In the assistant microscope the Redreflex is visible in both eyepieces.

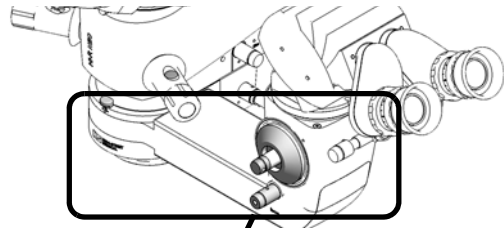


The Redreflex is in its final position.  
In the main eyepiece-head the Redreflex is maximally distinct.  
In the assistant microscope Redreflex is visible in only one eyepiece.



<sup>1</sup> Before use, supply with sterilisable operating element.

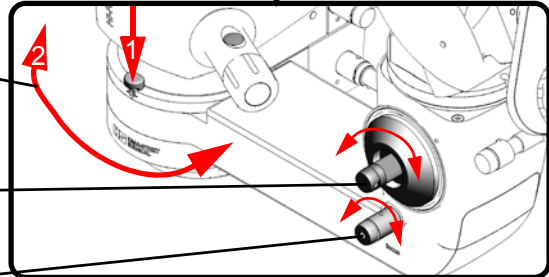
**Assistant microscope**



Panning the assistant microscope

Select magnification of the assistant microscope by rotating!

Focus the assistant microscope by rotating!



**! Attention**

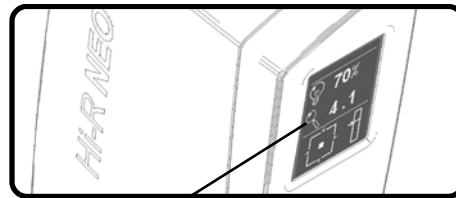
**Loss of function due to heavy accessories**

- Only assemble accessories with a maximum weight of 1 kg between the assistant microscope and the corresponding eyepiece.

**Other**

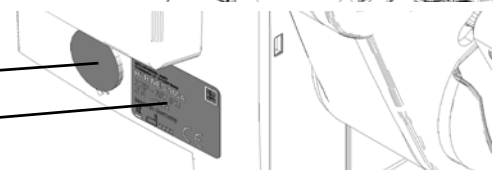
Display:

- Redreflex
- current brightness
- current magnification
- current position of the XY coupling
- current position of the Z focus

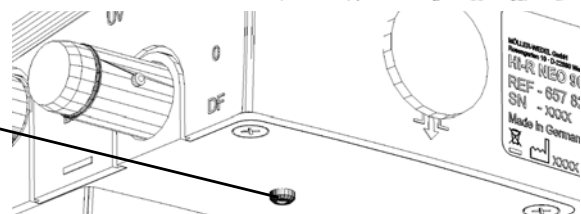


Light guide inlet

Identification plate



Release the light guide



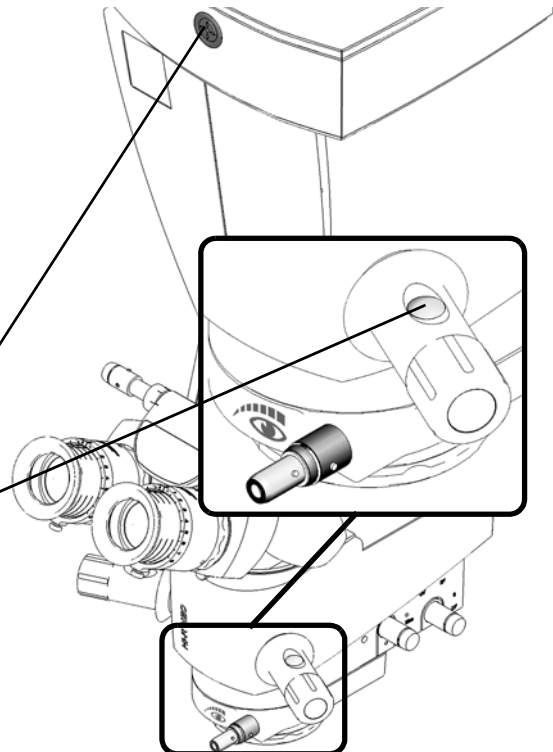
! Before use, supply with sterilisable operating element.

## 4.7.2 HS Hi-R NEO 900

### Positioning

Homing: Call up the basic settings for the XY coupling and the focusing / configurable

Release the electromagnetic brakes / configurable!



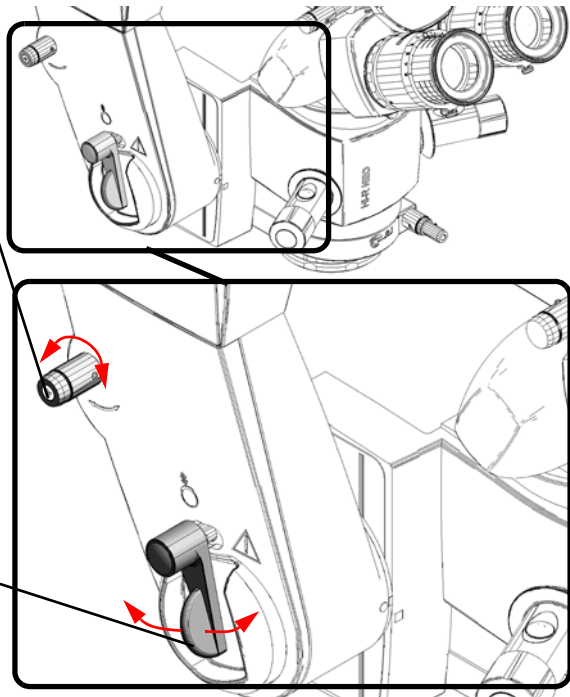
Fine adjustment of the microscope tilt:  $\pm 10^\circ$

### ! Attention

To ensure full operability the lever should be in middle position.

- Reset the fine adjustment before pre-adjusting the microscope tilt.

Pre-adjustment of the microscope tilt:  $-70^\circ \dots +90^\circ$



### ! CAUTION

#### Danger to patient through pre-adjustment during surgery:

The operating microscope may tilt during the setting of the microscope tilt.

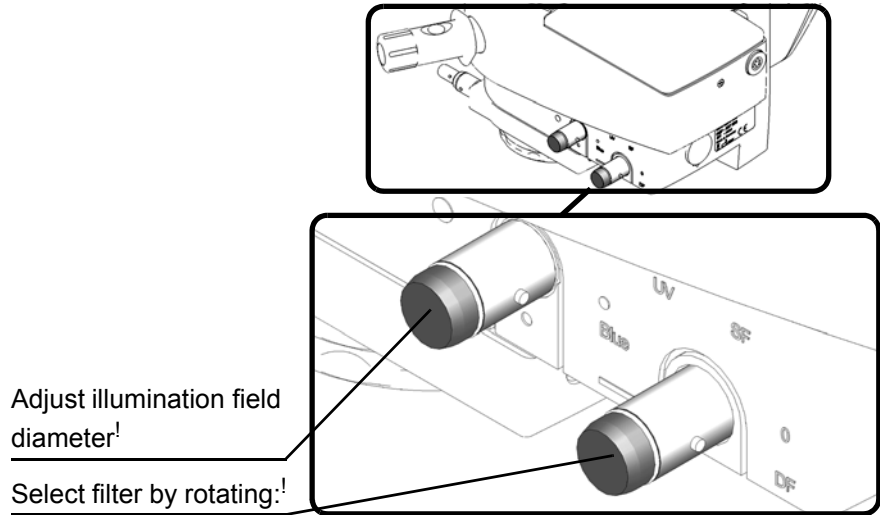
- Pre-adjust the microscope tilt before surgery.
- Always hold the operating microscope while pre-adjusting the tilt.

! Before use, supply with sterilisable operating element.

**Focusing**

- Position the operating microscope over the operation field.
- Adjust for minimum magnification.
- Focus the operating microscope manually.
- Adjust for maximum magnification.
- Focus the operating microscope using the foot switch.
- Adjust for the required magnification.

**Illumination field and filters**



Recommended operating period for ophthalmology according to ISO 15004 in minutes with light source and brightness:

		FS 2-21, FS 2-11	FS 3-45, FS 2-25, FS 2-15
		Halogen, 100%	LED, 100%
		Halogen, 50%	LED, 50%
0	no filter • optimum color fidelity	2.2	2.2
☐	Slit 3 mm • optimum color fidelity	2.2	2.6
UV	UV filter • Yellow light color Ophthalmology: • recommended for LED and halogen illumination	36	68.4
SF	Softfilter • Alignment of the LED light to the halogen light Ophthalmology: • recommended for LED illumination	2.2	12.0
DL	Daylight filter • Alignment of the halogen light to the daylight	2.2	2.6

! Before use, supply with sterilisable operating element.

Redreflex

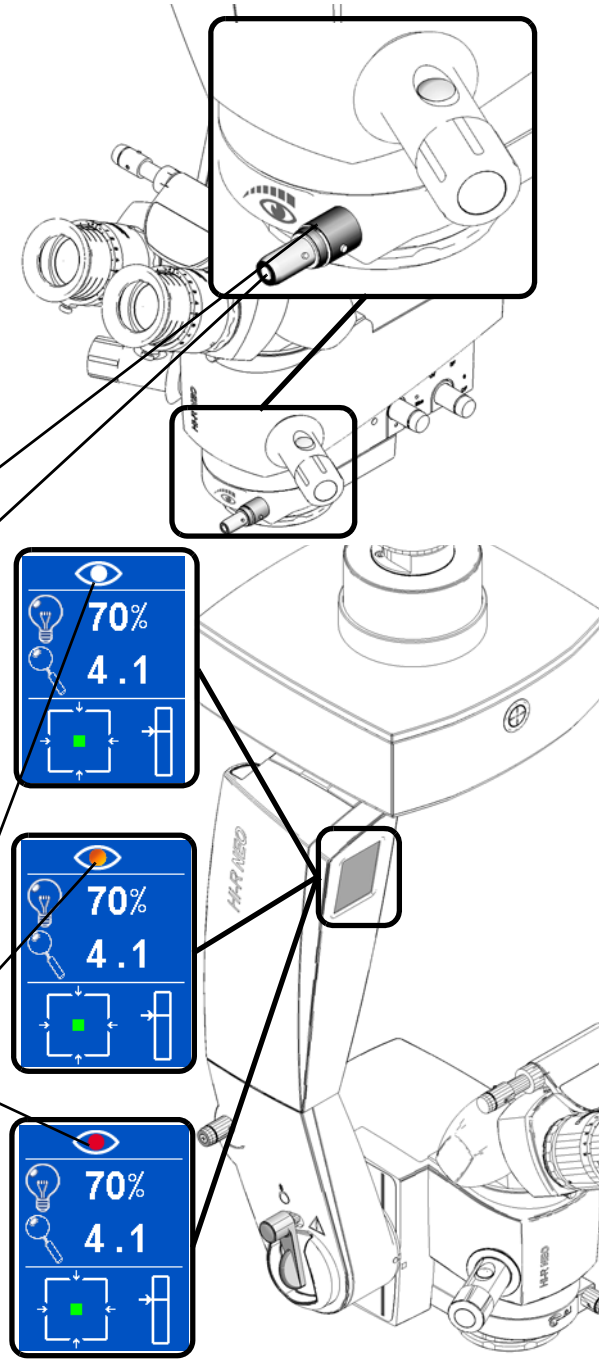
Adjust illumination angle for optimal Redreflex!

Adjust Redreflex:!

The redreflex is turned off.

The Redreflex is in its center position. It is slightly distinct.

The Redreflex is in its final position. It is maximally distinct.



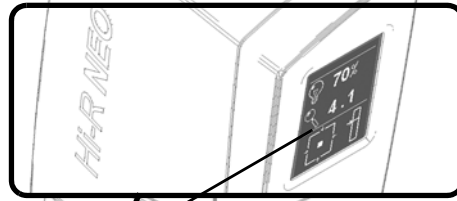
! Before use, supply with sterilisable operating element.



Other

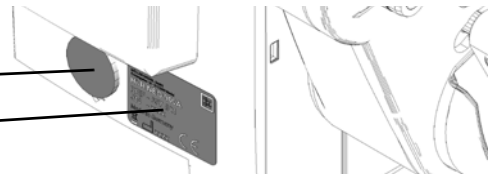
Display:

- Redreflex
- current brightness
- current magnification
- current position of the XY coupling
- current position of the Z focus

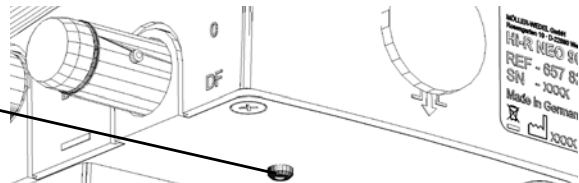


Light guide inlet

Identification plate



Release the light guide



! Before use, supply with sterilisable operating element.

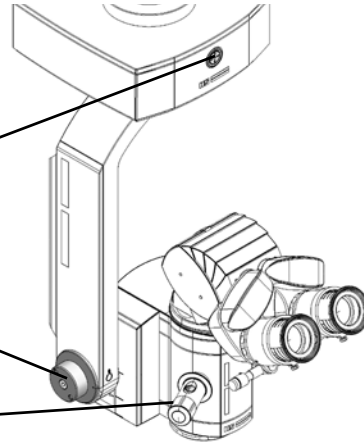
### 4.7.3 HS ALLEGRA 900

#### Positioning

Homing: Call up the basic settings for the XY coupling and the focusing / configurable

Release and applying of the brake to tilt the microscope!

Release the electromagnetic brakes / configurable!

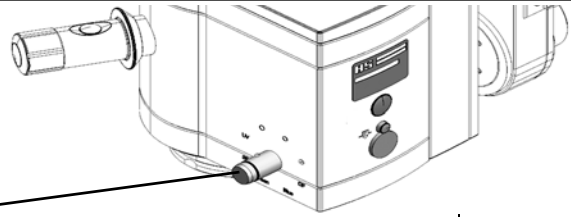


#### Focusing

- Position the operating microscope over the operation field.
- Adjust for minimum magnification.
- Focus the operating microscope manually.
- Adjust for maximum magnification.
- Focus the operating microscope using the foot switch.
- Adjust for the required magnification.




! Before use, supply with sterilisable operating element.

**Illumination field and filters**



Select filter by rotating:!

Recommended operating period for ophthalmology according to ISO 15004 in minutes with light source and brightness:

		FS 2-21, FS 2-11	FS 2-25, FS 2-15
		Halogen, 100%	LED, 100%
		Halogen, 50%	LED, 50%
	Mini Spot 0,25 mm • optimum color fidelity	2.2	1.3
	Spot 2,65 mm • optimum color fidelity	2.2	1.3
	size aperture 5 mm • optimum color fidelity	2.2	1.3
UV	UV filter • Yellow light color  Ophthalmology: • recommended for LED and halogen illumination	36	34.2
SF	Soffilter • Alignment of the LED light to the halogen light  Ophthalmology: • recommended for LED illumination	2.2	6.0
DL	Daylight filter • Alignment of the halogen light to the daylight	2.2	1.3
Blue	Blue filter • Excitation of fluorescence • short-term use with application of fluorescein	2.2	1.3
Green	Green filter • Improvement of contrast in operations on blood vessels	2.2	1.3

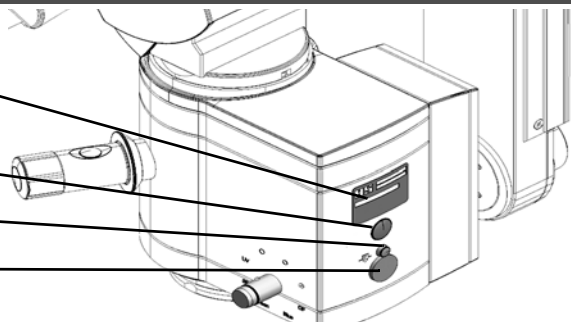
**Other**

Identification plate

Camera connection (optional)

Release the light guide

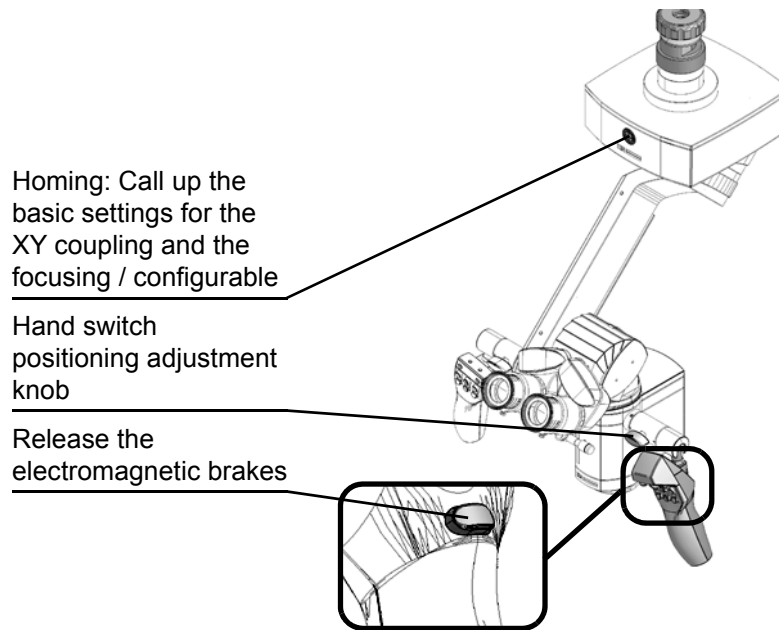
Light guide inlet



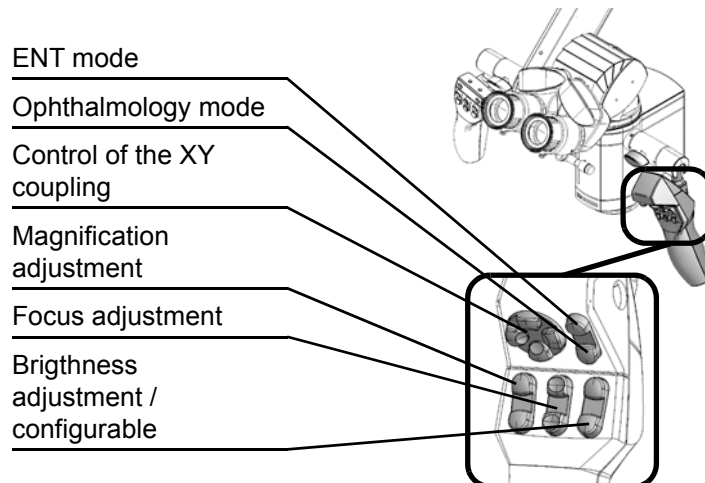
! Before use, supply with sterilisable operating element.

## 4.7.4 HS ALLEGRA 590

### Positioning



### Hand switch



#### ENT mode:

- The electromagnetic brakes of the operating microscope can be released.
- The focus range changes to  $\pm 10$  mm.

#### Ophthalmology mode:

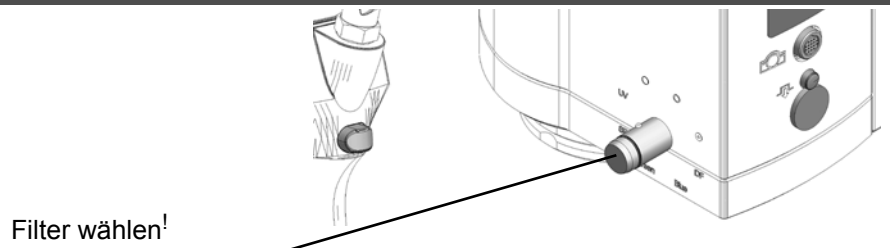
- The electromagnetic brakes of the operating microscope cannot be released.
- The focus range changes to + 20 mm ... - 30 mm.

### Focusing

- Position the operating microscope over the operation field.
- Adjust for minimum magnification.
- Focus the operating microscope manually.
- Adjust for maximum magnification.
- Focus the operating microscope using the foot switch.
- Adjust for the required magnification.




! Vor der Bedienung mit sterilisierbarem Bedienelement ausstatten.

**Illumination field and filters**

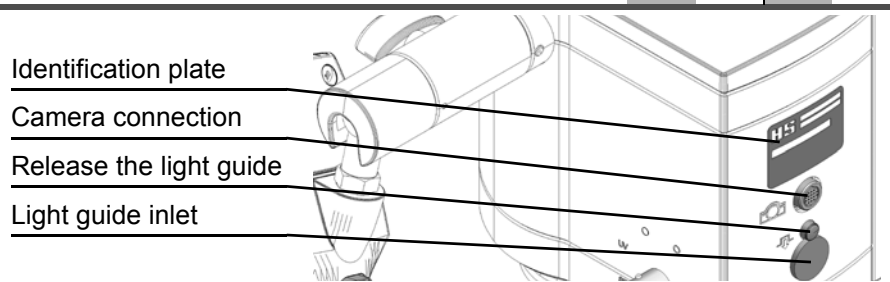


Filter wählen!

Recommended operating period for ophthalmology according to ISO 15004 in minutes with light source and brightness:

		FS 2-21, FS 2-11		FS 2-25, FS 2-15	
		Halogen, 100%	Halogen, 50%	LED, 100%	LED, 50%
 Mini Spot 0,25 mm • optimum color fidelity		2.2	4.4	1.3	2.6
 Spot 2,65 mm • optimum color fidelity		2.2	4.4	1.3	2.6
 size aperture 5 mm • optimum color fidelity		2.2	4.4	1.3	2.6
UV UV filter • Yellow light color Ophthalmology: • recommended for LED and halogen illumination		36	72	34.2	68.4
SF Softfilter • Alignment of the LED light to the halogen light Ophthalmology: • recommended for LED illumination		2.2	4.4	6.0	12.0
DL Daylight filter • Alignment of the halogen light to the daylight		2.2	4.4	1.3	2.6
Blue Blue filter • Excitation of fluorescence • short-term use with application of fluorescein		2.2	4.4	1.3	2.6
Green Green filter • Improvement of contrast in operations on blood vessels		2.2	4.4	1.3	2.6

**Other**



! Vor der Bedienung mit sterilisierbarem Bedienelement ausstatten.

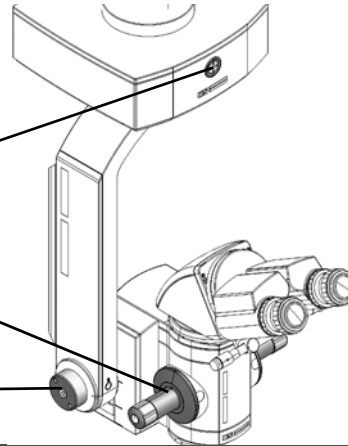
## 4.7.5 HS ALLEGRA 90

### Positioning

Homing: Call up the basic settings for the XY coupling and the focusing / configurable

Select magnification by rotating!

Release and applying of the brake to tilt the microscope!

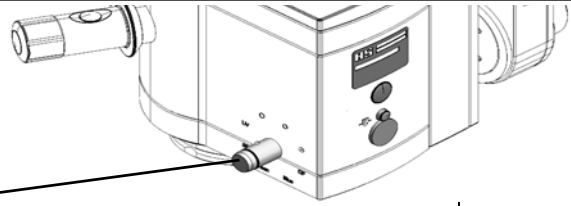


### Focusing

- Position the operating microscope over the operation field.
- Adjust for minimum magnification.
- Focus the operating microscope manually.
- Adjust for maximum magnification.
- Focus the operating microscope using the foot switch.
- Adjust for the required magnification.




! Vor der Bedienung mit sterilisierbarem Bedienelement ausstatten.

**Illumination field and filters**



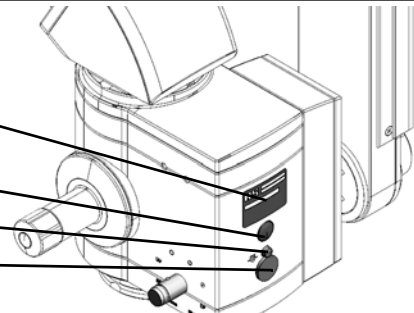
Select filter by rotating:!

Recommended operating period for ophthalmology according to ISO 15004 in minutes with light source and brightness:

		FS 2-21, FS 2-11	FS 2-25, FS 2-15
		Halogen, 100%	LED, 100%
		Halogen, 50%	LED, 50%
	Mini Spot 0,25 mm • optimum color fidelity	2.2	2.2
	Spot 2,65 mm • optimum color fidelity	2.2	2.2
	size aperture 5 mm • optimum color fidelity	2.2	2.2
UV	UV filter • Yellow light color  Ophthalmology: • recommended for LED and halogen illumination	36	72
SF	Soffilter • Alignment of the LED light to the halogen light  Ophthalmology: • recommended for LED illumination	2.2	2.2
DL	Daylight filter • Alignment of the halogen light to the daylight	2.2	2.2
Blue	Blue filter • Excitation of fluorescence • short-term use with application of fluorescein	2.2	2.2
Green	Green filter • Improvement of contrast in operations on blood vessels	2.2	2.2

**Other**

- Identification plate
- Camera connection (optional)
- Release the light guide
- Light guide inlet



! Vor der Bedienung mit sterilisierbarem Bedienelement ausstatten.

## 5 Disposable materials and spare parts

<b>HS Hi-R NEO 900 / HS Hi-R NEO 900A</b>	• <b>Cover set, sterilisable 6</b>	REF 628 510
	• Optic cleaning set	REF 690 160
<b>HS ALLEGRA 900 / 90</b>	• Cover set, sterilisable 1	REF 628 506
	• Optic cleaning set	REF 690 160
<b>HS ALLEGRA 590</b>	• Sterile cover hand switch	REF 190 301
	• Sterile cover	REF 190 303
	• Cover set, sterilisable 3	REF 628 507
	• Optic cleaning set	REF 690 160
<b>FS 3-45 / FS 2-25 / FS 2-21</b>	• Mains cable (EU), 8 m	REF 614 221
	• Mains cable (US), 8 m	REF 614 222
	• Mains cable (CN), 8 m	REF 614 223
	• Mains cable (CH), 8 m	REF 614 224
	• Mains cable (BR), 8 m	REF 614 226
	• Mains cable (UK), 8 m	REF 614 229
	• Halogen lamp 15V / 150W HLX 64 634 (only FS 2-21)	REF 123 112 61
	• Tool kit (incl. fuse set)	REF 615 575
<b>FS 2-15 / FS 2-11</b>	• Mains cable (EU), 8 m	REF 614 231
	• Mains cable (US), 8 m	REF 614 232
	• Mains cable (CN), 8 m	REF 614 233
	• Mains cable (BR), 8 m	REF 614 236
	• Mains cable (UK), 8 m	REF 614 239
	• Halogen lamp 15V / 150W HLX 64 634 (only FS 2-11)	REF 123 112 61
	• Back-up cabel, 4,5 m	REF 615 754
<b>EF 5001</b>		



## 6 Maintenance and service

### 6.1 Cleaning, Disinfection and Sterilisation

- Perform the processing of the microsurgical operating system and of the sterilizable operating elements according to the processing instructions in the annex (see page 70).

### 6.2 Maintenance

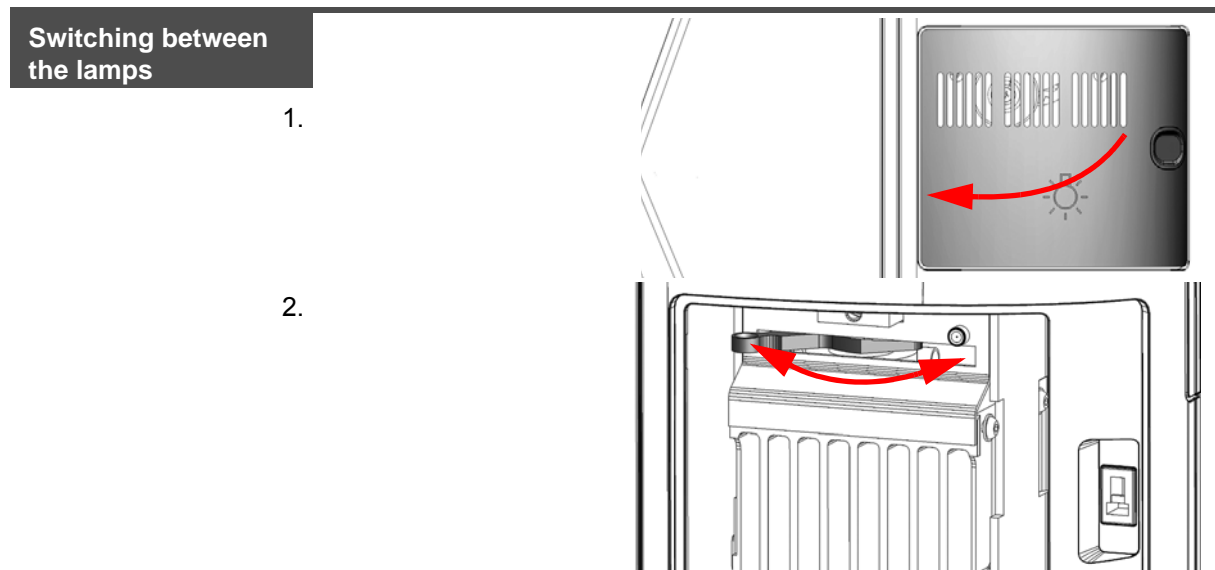
The microsurgical operating systems mechanic and optic are wear free. Certain electrical components have a life expectancy of between ten and twenty years, thereafter there is a probability of electronic failure once the life of the system exceeds years.

Components with a limited life, in particular lamps, should according to the user instruction be regularly exchanged. Other components e.g. light conductor, cable, plastic covers, lens etc., can be damaged through rough handling or careless cleaning, these should be regularly examined and exchanged as necessary.

Although the microsurgical operating system basically requires no regular maintenance, an annual inspection by authorized personnel is recommended, within the scope of a service contract, for example. Authorized personnel are entitled to request additional technical documentation from the manufacturer. In the event of service or repairs, contact your local sales representative.

### 6.3 Exchange of lamps

#### 6.3.1 FS 3-45/FS 2-25



### 6.3.2 FS 2-21

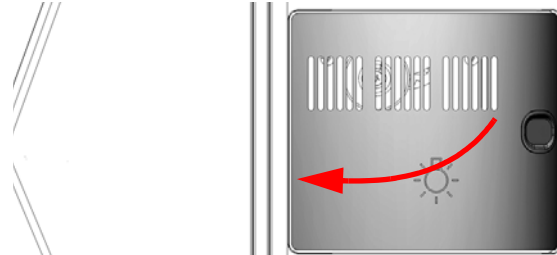
#### Switching between the lamps

**CAUTION**

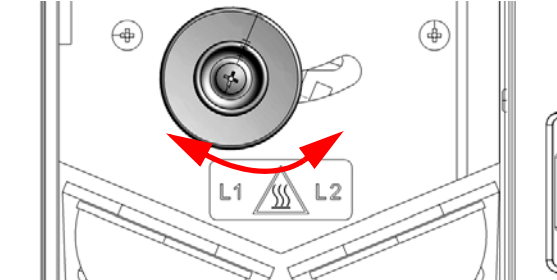
#### Danger of burning by hot halogen lamps:

- Avoid contact.

1.



2.



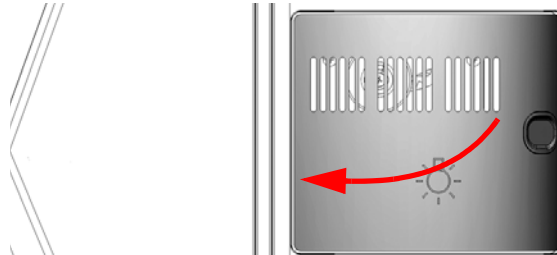
#### Exchange of lamps

**CAUTION**

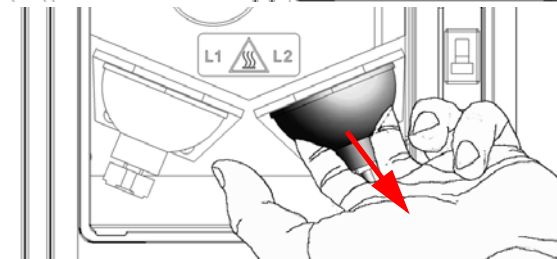
#### Danger of burning by hot halogen lamps:

- Allow halogen lamps to cool before exchanging them.

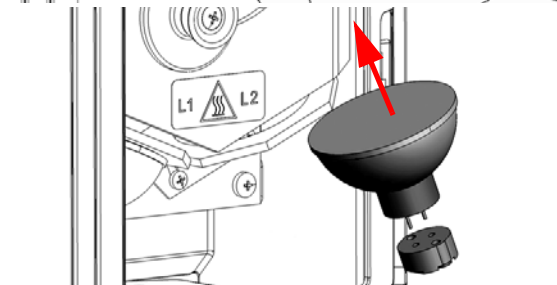
1.

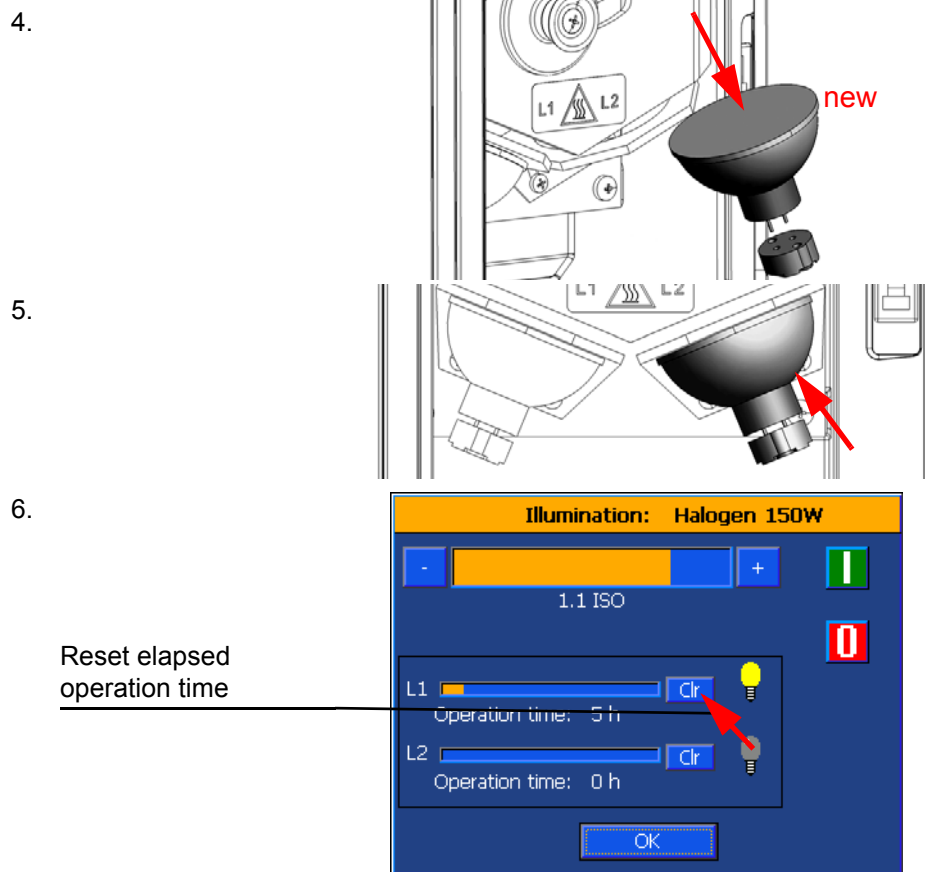


2.



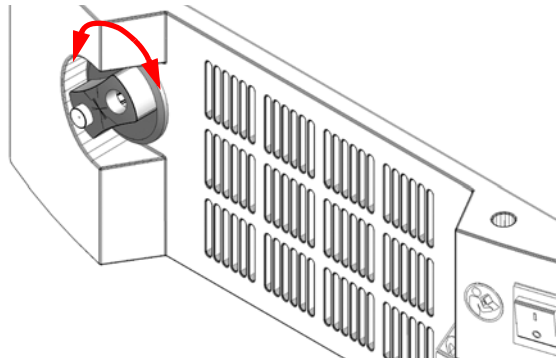
3.





### 6.3.3 FS 2-15

Switching between the lamps



### 6.3.4 FS 2-11

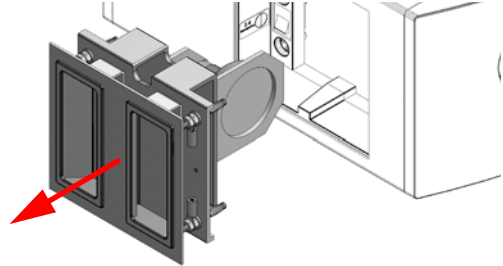
#### Switching between the lamps



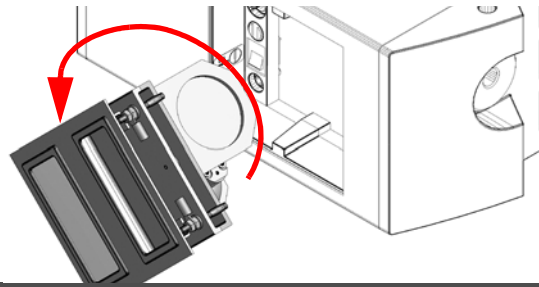
#### Danger of burning by hot halogen lamps:

- Avoid contact.

1.



2.



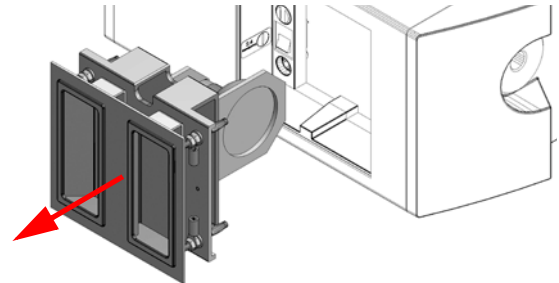
#### Exchange of lamps



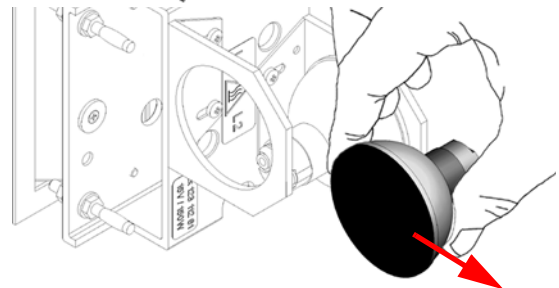
#### Danger of burning by hot halogen lamps:

- Allow halogen lamps to cool before exchanging them.

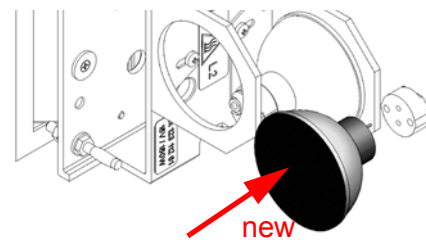
1.



2.



3.



## 6.4 Emergency lighting

If the lighting fails due to an internal malfunction, the microsurgical operation system can be operated using emergency lighting.

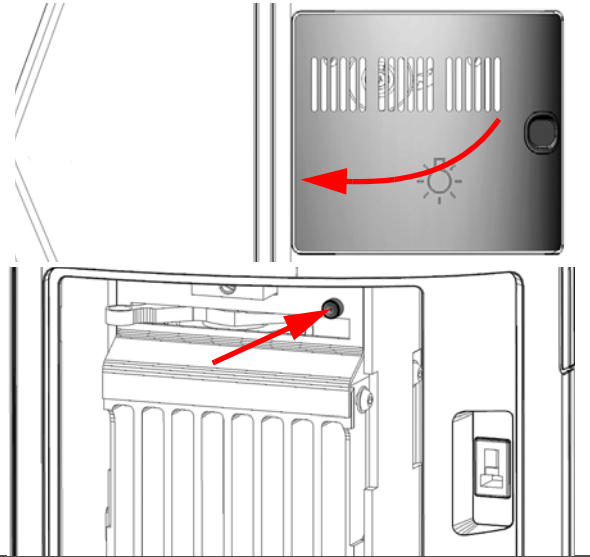
- The brightness will be preset to 70% of the maximum brightness.

FS 3-45/FS 2-25

1.



2.

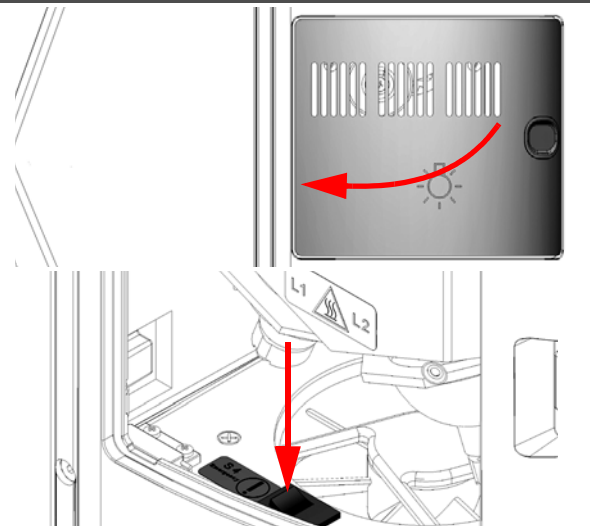


FS 2-21

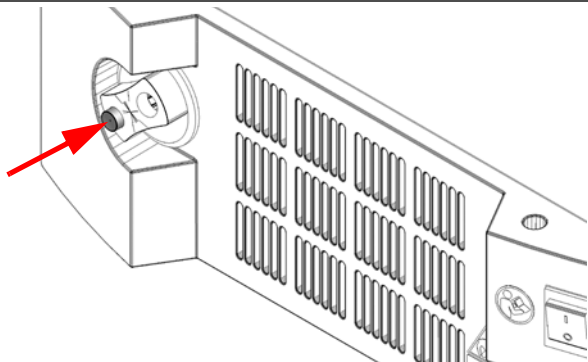
1.



2.

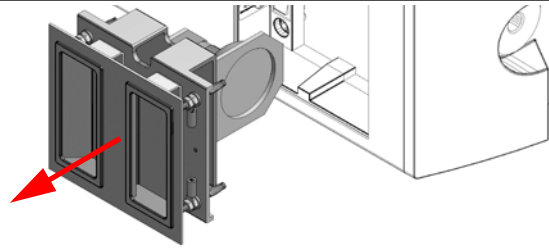


FS 2-15

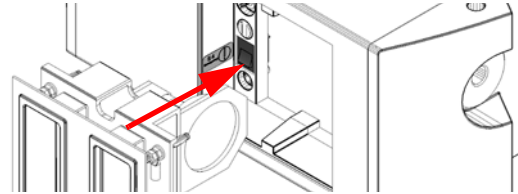


FS 2-11

1.



2.



## 6.5 Resolving defects



**WARNING**

**Danger to patients caused by defective microsurgical operating system:**

- Do not begin an operation if a technical defect is present or if a defect is suspected.
- Should the defect not be resolved through the described measures then contact your local sales representative.

### 6.5.1 FS 3-45/FS 2-25/FS 2-21

Defect	Cause	Remedial action
Movement of operating microscope in its mounting	Microscope mounting knob is loose	<ul style="list-style-type: none"> <li>• Tighten microscope mounting (see page 8)</li> </ul>
TFT display not functioning	Backlighting at minimum	<ul style="list-style-type: none"> <li>• Press the TFT display</li> <li>• Adjust contrast (see page 21)</li> </ul>
	Internal defect	<ul style="list-style-type: none"> <li>• Switch the microsurgical operating system off and on again</li> </ul>
No power supply light	Defect in the power supply	<ul style="list-style-type: none"> <li>• Check electrical supply</li> <li>• Check fuses and exchange them if necessary</li> </ul>
No lighting on switching on	No power supply to the light source	<ul style="list-style-type: none"> <li>• Check if the mains switch lights</li> <li>• Close the flap in front of the lamp module</li> </ul>
	Wrong lamp settings	<ul style="list-style-type: none"> <li>• Check the lamp settings (see page 21)</li> <li>• Check the filter position (see page 32, page 36, page 40, page 44, page 42)</li> </ul>
	Light beam interrupted	<ul style="list-style-type: none"> <li>• Check the light guide connection (see page 8)</li> <li>• Remove dust cap</li> </ul>
	Defective light source	<ul style="list-style-type: none"> <li>• Switch between the lamps (see page 46, page 47)</li> <li>• FS 2-21: Replace the defective lamps (see page 47)</li> <li>• Switch on emergency lighting (see page 50, page 50)</li> </ul>

Brightness adjustment not possible	Wrong lamp settings	<ul style="list-style-type: none"> <li>• Check the lamp settings (see page 21)</li> </ul>
	Emergency lighting switched on	<ul style="list-style-type: none"> <li>• FS 3-45/FS 2-25: Switch the microsurgical operating system off and on again</li> <li>• FS 2-21: Switch off the emergency lighting (see page 50)</li> </ul>
Foot switch reacts not as expected	Pedal function wrongly allocated	<ul style="list-style-type: none"> <li>• Check the configuration of the foot switch (see page 23)</li> </ul>
	Communication error between the carrier unit and the foot switch	<ul style="list-style-type: none"> <li>• Check foot switch connection</li> </ul>
Suspension arm moves upwards or downwards	System not balanced	<ul style="list-style-type: none"> <li>• Carry out balancing (see page 25)</li> </ul>
Electromagnetic brakes cannot be released	Brake key is not aligned to the electromagnetic brake	<ul style="list-style-type: none"> <li>• Check the brake configuration (see page 25, page 23)</li> </ul>
	System not balanced	<ul style="list-style-type: none"> <li>• Carry out balancing (see page 25)</li> </ul>
<b>Error report</b>	<b>Cause</b>	<b>Remedial action</b>
Firmware-Version not up to date!! Please update it, otherwise the Device may not work properly!	Internal incompatibility between software versions	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>
Error Floorstand: Comm. Error Microscope!	Communication error between the carrier unit and the operating microscope	<ul style="list-style-type: none"> <li>• Check the microscope connection (see page 8)</li> </ul>
Error Floorstand: Error Supply 30V	Internal defect	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>
Error Floorstand: Error Footswitch	Key jammed	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>
Error Floorstand: Error Brake-, Mouth- or P-Switch	Key jammed	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>
Error Floorstand: Floorstand not balanced !	System not balanced	<ul style="list-style-type: none"> <li>• Carry out balancing (see page 25)</li> </ul>
Microscope-Error : Handswitch	Key jammed	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>
Microscope-Error : Power Failure	Internal defect	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>
Microscope-Error : No Microscope	Communication error between the carrier unit and the operating microscope	<ul style="list-style-type: none"> <li>• Check the microscope connection (see page 8)</li> </ul>
Microscope-Error : Motor Error	Internal defect	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>

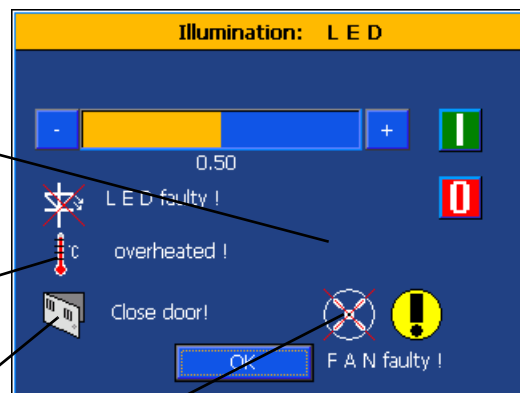
Microscope-Error : EEPROM- or Transmit-Error	Internal Defect	<ul style="list-style-type: none"> <li>Please contact your local sales representative.</li> </ul>
<b>FS 3-45/FS 2-25</b>		
F A N faulty !	The fan is defective.	<ul style="list-style-type: none"> <li>Please contact your local sales representative.</li> </ul>
L E D faulty !	LED is defective	<ul style="list-style-type: none"> <li>Switch between the lamps (see page 46)</li> <li>Notbeleuchtung einschalten (see page 50)</li> </ul>
overheated !	The LED light source is overheated.	<ul style="list-style-type: none"> <li>Remove all objects that cover the ventilation slits.</li> </ul>

Emergency lighting is switched on.  
Adjustment of the brightness is not possible. Switch the microsurgical operating system off and on again.

The LED light source is overheated. Remove all objects that cover the ventilation slits.

The flap in front of the light source is open. Close the flap.

The fan is defective. Contact your local sales representative.

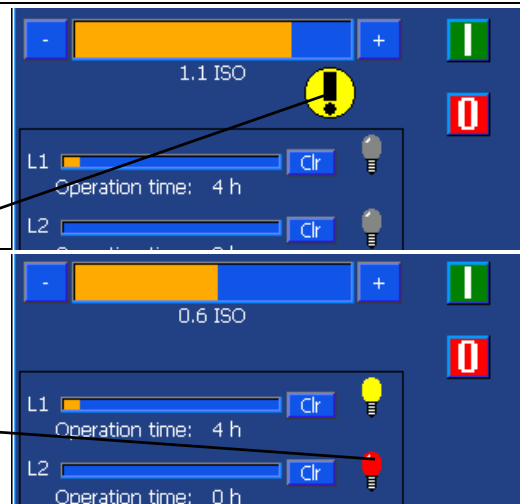


**FS 2-21**

Lamp 1 expired !	The life expectancy of the halogen lamp is reached	<ul style="list-style-type: none"> <li>Replace the halogen lamp (see page 47)</li> </ul>
Lamp 2 expired !		
Spare-Lamp faulty !	Reserve lamp is defective	<ul style="list-style-type: none"> <li>Replace the halogen lamp (see page 47)</li> </ul>

Emergency lighting is switched on. Adjustment of the brightness is not possible. Switch of emergency lighting.

Reserve lamp is defective. Replace the halogen lamp.





### 6.5.2 FS 2-15 / FS 2-11

Defect	Cause	Remedial action
Movement of operating microscope in its mounting	Microscope mounting knob is loose	<ul style="list-style-type: none"> <li>• Tighten microscope mounting (see page 10)</li> </ul>
No power supply light	Defect in the power supply	<ul style="list-style-type: none"> <li>• Check electrical supply</li> <li>• Check fuses and exchange them if necessary</li> </ul>
No lighting on switching on	No power supply to the light source	<ul style="list-style-type: none"> <li>• Check if the mains switch lights</li> </ul>
	Wrong lamp settings	<ul style="list-style-type: none"> <li>• Check the lamp settings (see page 30)</li> <li>• Check the filter position (see page 32, page 36, page 40, page 44, page 42)</li> </ul>
	Light beam interrupted	<ul style="list-style-type: none"> <li>• Check the light guide connection (see page 10)</li> <li>• Remove dust cap</li> </ul>
	Defective light source	<ul style="list-style-type: none"> <li>• Switch between the lamps (see page 48, page 49)</li> <li>• FS 2-11: Replace the defective lamps (see page 49)</li> <li>• Switch on emergency lighting (see page 50, page 51)</li> </ul>
Brightness adjustment not possible	Emergency lighting switched on	<ul style="list-style-type: none"> <li>• FS 2-15: Switch the microsurgical operating system off and on again</li> <li>• FS 2-11: Switch off the emergency lighting (see page 51)</li> </ul>
Foot switch reacts not as expected	Communication error between the carrier unit and the foot switch	<ul style="list-style-type: none"> <li>• Check foot switch connection</li> </ul>
Suspension arm moves upwards or downwards	System not balanced	<ul style="list-style-type: none"> <li>• Carry out balancing (see page 30)</li> </ul>
Suspension arm cannot be moved vertically	Mechanical brake is in action	<ul style="list-style-type: none"> <li>• Set the required friction (see page 30)</li> </ul>
Suspension arm and the carrier arm are too difficult / too easy to move	Pre-adjustment of the brakes is too strong / too weak	<ul style="list-style-type: none"> <li>• Please contact your local sales representative.</li> </ul>

Error report

FS 2-15

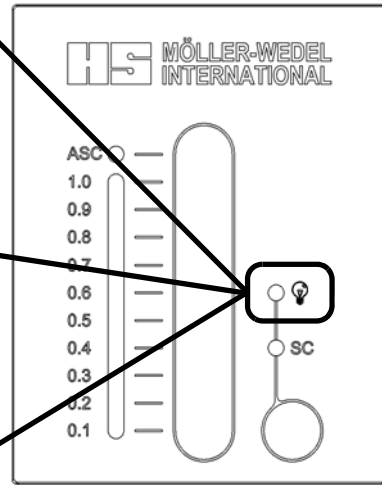
The fan or one of the LEDs is defective.  
Contact your local sales representative.



Emergency lighting is switched on.  
Adjustment of the brightness is not possible. Switch the microsurgical operating system off and on again.



The LED light source is overheated. Remove all objects that cover the ventilation slits.

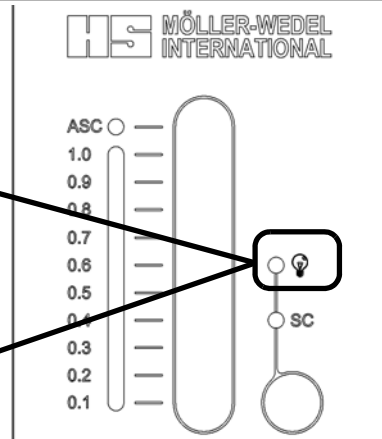


FS 2-11

Emergency lighting is switched on.  
Adjustment of the brightness is not possible. Switch of emergency lighting.



Reserve lamp is defective. Replace the halogen lamp.



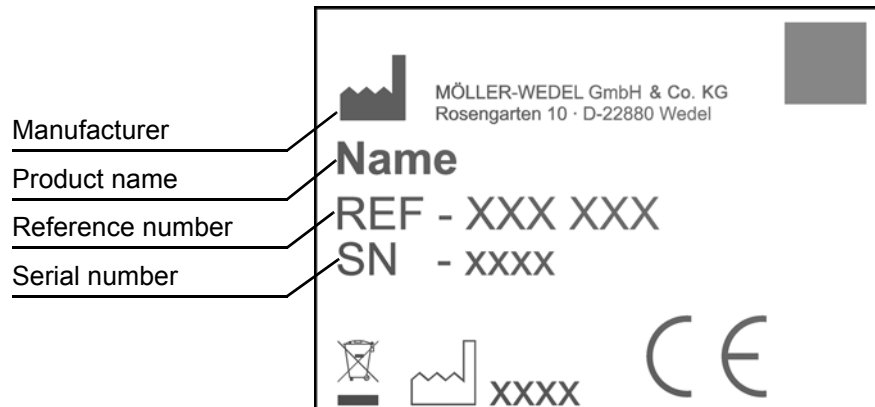
## 7 Manufacturer's details and contact information

Manufacturer of microsurgical operating system is, as described in this manual,

MÖLLER-WEDEL GmbH & Co. KG  
Rosengarten 10  
D-22880 Wedel  
Deutschland.

The microsurgical operating system is marketed worldwide by the  
HAAG-STREIT SURGICAL GmbH  
Rosengarten 10  
D-22880 Wedel  
Deutschland.

If you have any questions, please provide your country representative the reference and serial numbers for the relevant components. You can obtain these from the respective components' type plates. A list of country representatives worldwide can be found on the HAAG-STREIT SURGICAL GmbH website ([www.haag-streit.com](http://www.haag-streit.com)).




## 8 Disposal

Within the European Union, microsurgical operating systems and their components are governed by Directive 2012/19/EU on electrical and electronic equipment, and may not be disposed of together with waste from private households.

The manufacturer accepts returned microsurgical operating systems and components for recycling and disposal. Please contact your local sales representative.

## 9 Technical Data

### 9.1 Microsurgical operating system

<b>Ambient conditions</b>	Operating temperature [°C]	+ 10 ... + 40
	Storage and transport temperature [°C]	- 20 ... + 70
	Relative humidity [%]	10 ... 90
	Air pressure [hPa]	795 ... 1060
<b>Conformity</b>	Classification	 93/42/EEC Class I
	Safety	EN 60 601-1 protection class I
	EMC	EN 60 601-1-2
	UMDNS	12-539

## 9.2 Carrier units

		FS 3-45	FS 2-25	FS 2-21
<b>Identification</b>	Reference number REF	615 705	615 550	615 510
<b>Mechanical specifications</b>	Dimensions in transport position (H x W x D) [mm]	1970 x 1320 x 795	1936 x 1040 x 727	1936 x 1040 x 727
	Weight [kg]	345	240	240
	Load bearing carrier arm [kg]	10 ... 22	5.5 ... 17	5.5 ... 17
<b>Working area</b>	Maximal length of the arm [mm]	1600	1320	1320
	Suspension arm deviation [mm]	895	720	720
	Carrier arm swivel area [°]	270	270	270
	Suspension arm swivel area [°]	270	270	270
<b>Light source</b>	Illumination	LED, 50 W	LED, 50 W	Halogen, 15 V/ 150 W
	UV filter, permanent	< 400 nm	< 400 nm	< 400 nm
	IR filter, permanent	> 800 nm	> 800 nm	> 800 nm
<b>Electrical specifications</b>	Possible operating voltages [V~]*	100/115/230	100/115/230	100/115/230
	Operating voltage tolerance [%]	± 10	± 10	± 10
	Maximal power consumption [VA]	1200	1000	1200
	Protection type through housing	IP 20	IP 20	IP 20

\* The microsurgical operating system is set for one of the specified operating voltages. The set operating voltage is indicated on the nameplate of your system.  
Changes to the preset operating voltage may only be performed by an authorized service technician.

- Technical Data -

		FS 2-15	FS 2-11
<b>Identification</b>	Reference number	615 515	615 511
	REF		
<b>Mechanical specifications</b>	Dimensions in transport position (H x W x D) [mm]	1777 x 900 x 650	1777 x 900 x 650
	Weight [kg]	198	198
	Load bearing carrier arm [kg]	4 ... 15	4 ... 15
<b>Working area</b>	Maximal length of the arm [mm]	1223	1223
	Suspension arm deviation [mm]	680	680
	Carrier arm swivel area [°]	300	300
	Suspension arm swivel area [°]	300	300
<b>Light source</b>	Illumination	LED, 50 W	Halogen, 15 V / 150 W
	UV filter, permanent	< 400 nm	< 400 nm
	IR filter, permanent	> 800 nm	> 800 nm
<b>Electrical specifications</b>	Possible operating voltages [V~]*	100/115/230	100/115/230
	Operating voltage tolerance [%]	± 10	± 10
	Maximal power consumption [VA]	450	600
	Protection type through housing	IP 20	IP 20

\* The microsurgical operating system is set for one of the specified operating voltages. The set operating voltage is indicated on the nameplate of your system.

Changes to the preset operating voltage may only be performed by an authorized service technician.

### 9.3 Operating microscopes

		HS Hi-R NEO 900									
<b>Identification</b>	Reference number	657 820									
	REF										
	chosen eyepiece	200°, 10 x - REF 656 935					160°, 10 x - REF 656 672				
<b>Mechanical specifications</b>	Dimensions (H x W x D) [mm]	534 x 223 x 312					534 x 223 x 333				
	Weight [kg]	9.2					8.8				
<b>Working area</b>	Rotation [°]										
	Inclination [°]	- 70 ... + 90 / ± 10					- 70 ... + 90 / ± 10				
	Lateral tilt [°]	-					-				
	30° axis [°]	-					-				
	XY area [mm]	± 30					± 30				
<b>Filter</b>	UV filter	< 515 nm					< 515 nm				
	Soft light filter	x					x				
	Daylight filter	x					x				
	Blue filter	x					x				
<b>Optical specifications</b>	Stereo basis [mm]	25					25				
	Illumination angle	6° / -2° ... -1° / +2°					6° / -2° ... -1° / +2°				
	Focusing mode	Z-Focusing					Z-Focusing				
	Focusing area [mm]	+ 17 ... - 33					+ 17 ... - 33				
	Magnification mode	Zoom, motorised, 6 x					Zoom, motorised, 6 x				
	Focal distance of the front lense f [mm]	175	200	225	250	400	175	200	225	250	400
	Working distance [mm]	165	190	215	240	390	165	190	215	240	390
	Magnification range	4.4 x ... 26.6 x	3.9 x ... 23.2 x	3.5 x ... 20.7 x	3.1 x ... 18.6 x	1.9 x ... 11.6 x	4.9 x ... 29.3 x	4.3 x ... 25.7 x	3.8 x ... 22.8 x	3.4 x ... 20.5 x	2.1 x ... 12.8 x
	Ø Visual field [mm]	7.9 ... 47.4	9.0 ... 54.2	10.2 ... 61.0	11.3 ... 67.7	18.1 ... 108.3	7.2 ... 42.9	8.2 ... 49.0	9.2 ... 55.2	10.2 ... 61.3	16.4 ... 98.0
	Ø Illuminated field [mm]	27 ... 51	31 ... 59	35 ... 61	38 ... 68	62 ... 108	27 ... 51	31 ... 59	35 ... 61	38 ... 68	62 ... 108

- Technical Data -

		HS Hi-R NEO 900A											
<b>Identification</b>	Reference number	657 821											
	REF												
	chosen eyepiece	200°, 10 x - REF 656 935					160°, 10 x - REF 656 672						
<b>Mechanical specifications</b>	Dimensions (H x W x D) [mm]	562 x 460 x 312					562 x 460 x 333						
	Weight [kg]	11.5					11.1						
<b>Working area</b>	Rotation [°]												
	Inclination [°]	- 70 ... + 90 / ± 10					- 70 ... + 90 / ± 10						
	Lateral tilt [°]	-					-						
	30° axis [°]	-					-						
	XY area [mm]	± 30					± 30						
<b>Filter</b>	UV filter	< 515 nm					< 515 nm						
	Soft light filter	x					x						
	Daylight filter	x					x						
	Blue filter	x					x						
<b>Optical specifications</b>	Stereo basis [mm]	25					25						
	Illumination angle	6° / -2° ... -1° / +2°					6° / -2° ... -1° / +2°						
	Focusing mode	Z-Focusing					Z-Focusing						
	Focusing area [mm]	+ 17 ... - 33					+ 17 ... - 33						
	Magnification mode	Zoom, motorised, 6 x					Zoom, motorised, 6 x						
	Focal distance of the front lense f [mm]	175	200	225	250	400	175	200	225	250	400		
	Working distance [mm]	165	190	215	240	390	165	190	215	240	390		
	Magnification range	4.4 x	26.6 x	3.9 x	23.2 x	3.5 x	20.7 x	3.1 x	18.6 x	1.9 x	11.6 x	4.9 x	29.3 x
		7.9 ... 47.4	9.0 ... 54.2	10.2 ... 61.0	11.3 ... 67.7	18.1 ... 108.3	7.2 ... 42.9	8.2 ... 49.0	9.2 ... 55.2	10.2 ... 61.3	16.4 ... 98.0	4.3 x	25.7 x
	Ø Visual field [mm]	27 ... 51	31 ... 59	35 ... 61	38 ... 68	62 ... 108	27 ... 51	31 ... 59	35 ... 61	38 ... 68	62 ... 108	4.3 x	25.7 x
	Ø Illuminated field [mm]	27 ... 51	31 ... 59	35 ... 61	38 ... 68	62 ... 108	27 ... 51	31 ... 59	35 ... 61	38 ... 68	62 ... 108	3.8 x	22.8 x
											3.4 x	20.5 x	
											2.1 x	12.8 x	



- Technical Data -

		HS Hi-R <b>NEO</b> 900A NIR			
<b>Identification</b>	Reference number	657 822			
	REF				
	chosen eyepiece	200°, 10 x - REF 656 935		160°, 10 x - REF 656 672	
<b>Mechanical specifications</b>	Dimensions (H x W x D) [mm]	562 x 460 x 312		562 x 460 x 333	
	Weight [kg]	11.5		11.1	
<b>Working area</b>	Rotation [°]				
	Inclination [°]	± 15		± 15	
	Lateral tilt [°]	-		-	
	30° axis [°]	-		-	
	XY area [mm]	± 30		± 30	
<b>Filter</b>	UV filter	< 515 nm		< 515 nm	
	Soft light filter	x		x	
	Daylight filter	x		x	
	Blue filter	x		x	
<b>Optical specifications</b>	Stereo basis [mm]	25		25	
	Illumination angle	6° / -2° ... -1° / +2°		6° / -2° ... -1° / +2°	
	Focusing mode	Z-Fokus		Z-Fokus	
	Focusing area [mm]	+ 17 ... - 33		+ 17 ... - 33	
	Magnification mode	Zoom, motorisch, 6 x		Zoom, motorisch, 6 x	
	Focal distance of the front lense f [mm]	175	200	175	200
	Working distance [mm]	165	190	165	190
	Magnification range	4.4 x ... 26.6 x	3.9 x ... 23.2 x	4.9 x ... 29.3 x	4.3 x ... 25.7 x
	Ø Visual field [mm]	7.9 ... 47.4	9.0 ... 54.2	7.2 ... 42.9	8.2 ... 49.0
	Ø Illuminated field [mm]	27 ... 51	31 ... 59	27 ... 51	31 ... 59

- Technical Data -

		HS ALLEGRA 900							
<b>Identification</b>	Reference number	657H591							
	REF								
	chosen eyepiece	160°, 10 x - REF 656 672				fix 60°, 12,5 x - REF 655 500 / REF 657 017			
<b>Mechanical specifications</b>	Dimensions (H x W x D) [mm]	519 x 227 x 344				519 x 227 x 344			
	Weight [kg]	7.4				7.5			
<b>Working area</b>	Rotation [°]	± 169				± 169			
	Inclination [°]	- 8 ... 100				- 8 ... 100			
	Lateral tilt [°]	-				-			
	30° axis [°]	-				-			
	XY area [mm]	± 30				± 30			
<b>Filter</b>	UV filter	< 515 nm				< 515 nm			
	Soft light filter	x				x			
	Daylight filter	x				x			
	Blue filter	x				x			
	Green filter	x				x			
<b>Optical specifications</b>	Stereo basis [mm]	25				25			
	Illumination angle	6 / - 1				6 / - 1			
	Focusing mode	Z-Focusing				Z-Focusing			
	Focusing area [mm]	+ 20 ... - 30				+ 20 ... - 30			
	Magnification mode	Zoom, motorised, 6 x				Zoom, motorised, 6 x			
	Focal distance of the front lense f [mm]	175	200	225	250	175	200	225	250
	Working distance [mm]	165	190	215	240	165	190	215	240
	Magnification range	4.9 x ... 29.3 x	4.3 x ... 25.7 x	3.8 x ... 22.8 x	3.4 x ... 20.5 x	4.7 x ... 28.1 x	4.1 x ... 24.6 x	3.7 x ... 21.9 x	3.3 x ... 19.7 x
	Ø Visual field [mm]	7.2 ... 42.9	8.2 ... 49.0	9.2 ... 55.2	10.2 ... 61.2	7.6 ... 45.3	8.6 ... 51.7	9.7 ... 58.2	10.8 ... 64.7
	Ø Illuminated field [mm]	3 ... 53	3 ... 60	3 ... 68	4 ... 75	3 ... 53	3 ... 60	3 ... 68	4 ... 75

- Technical Data -

		HS ALLEGRA 590			
<b>Identification</b>	Reference number REF	657H582			
	chosen eyepiece	160°, 10 x - REF 656 672			
<b>Mechanical specifications</b>	Dimensions (H x W x D) [mm]	533 x 410 x 439			
	Weight [kg]	9.5			
<b>Working area</b>	Rotation [°]	± 169			
	Inclination [°]	- 30 ... 120			
	Lateral tilt [°]	± 45			
	30° axis [°]	- 70 ... 266			
	XY area [mm]	± 30			
<b>Filter</b>	UV filter	< 515 nm			
	Soft light filter	x			
	Daylight filter	x			
	Blue filter	x			
	Green filter	x			
<b>Optical specifications</b>	Stereo basis [mm]	25			
	Illumination angle	6 / - 1			
	Focusing mode	Z-Focusing			
	Focusing area [mm]	+ 20 ... - 30			
	Magnification mode	Zoom, motorised, 6 x			
	Focal distance of the front lense f [mm]	175	200	225	250
	Working distance [mm]	165	190	215	240
	Magnification range	4.9 x ... 29.3 x	4.3 x ... 25.7 x	3.8 x ... 22.8 x	3.4 x ... 20.5 x
	Ø Visual field [mm]	7.2 ... 42.9	8.2 ... 49.0	9.2 ... 55.2	10.2 ... 61.2
	Ø Illuminated field [mm]	3 ... 53	3 ... 60	3 ... 68	4 ... 75

- Technical Data -

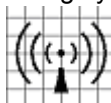
		HS ALLEGRA 90							
<b>Identification</b>	Reference number	657H580							
	REF								
	chosen eyepiece	160°, 10 x - REF 656 672				fix 60°, 12,5 x - REF 655 500 / REF 657 017			
	XY coupling	- x				- x			
<b>Mechanical specifications</b>	Dimensions (H x W x D) [mm]	422 x 234 x 285	519 x 234 x 285	422 x 234 x 285	519 x 234 x 285	422 x 234 x 285	519 x 234 x 285	422 x 234 x 285	519 x 234 x 285
	Weight [kg]	4.9	7.5	5.0	7.6	4.9	7.5	5.0	7.6
<b>Working area</b>	Rotation [°]	± 169				± 169			
	Inclination [°]	- 8 ... 100				- 8 ... 100			
	Lateral tilt [°]	-				-			
	30° axis [°]	-				-			
	XY area [mm]	- ± 30				- ± 30			
<b>Filter</b>	UV filter	< 515 nm				< 515 nm			
	Soft light filter	x				x			
	Daylight filter	x				x			
	Blue filter	x				x			
	Green filter	x				x			
<b>Optical specifications</b>	Stereo basis [mm]	25				25			
	Illumination angle	6 / - 1				6 / - 1			
	Focusing mode	Z-Focusing				Z-Focusing			
	Focusing area [mm]	+ 20 ... - 30				+ 20 ... - 30			
	Magnification mode	Changer, manual, 5 x				Changer, manual, 5 x			
	Focal distance of the front lense f [mm]	175	200	225	250	175	200	225	250
	Working distance [mm]	165	190	215	240	165	190	215	240
	Magnification range	4.0 x ... 36.1 x	3.5 x ... 31.6 x	3.1 x ... 28.1 x	2.8 x ... 25.3 x	3.8 x ... 34.6 x	3.3 x ... 30.3 x	3.0 x ... 27.0	2.7 x ... 24.3 x
	Ø Visual field [mm]	5.8 ... 53.0	6.6 ... 60.6	7.5 ... 68.2	8.3 ... 75.8	6.1 ... 56.0	7.0 ... 64.0	7.9 ... 72.0	8.8 ... 80.0
	Ø Illuminated field [mm]	3 ... 53	3 ... 60	3 ... 68	4 ... 75	3 ... 53	3 ... 60	3 ... 68	4 ... 75

## 10 Appendix

### 10.1 Guiding principles and manufacturers declaration

<b>Electromagnetic emission</b>		
The microsurgical operating system as specified in the intended use is intended for use within the electromagnetic environment specified below. The customer or the user of the microsurgical operating system should ensure that it is used in such an environment.		
<b>Interference emission - measurements</b>	<b>Compliance</b>	<b>Electromagnetic environment – guidance</b>
RF emissions CISPR 11	Group 1	The microsurgical operating system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The microsurgical operating system is suitable for use in facilities other than the residential ones, which are directly connected to the public supply network that supplies buildings used for residential purposes, provided that the following warning will be considered: <b>Warning:</b> The microsurgical operating system is only intended for use by medical professionals. This is a Class A device according to CISPR 11 In the living area this product may cause radio interference in which case it may be necessary in this case to take appropriate remedial action, such as new direction, new arrangement or shielding of the microsurgical system or filtering the connection to the site.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC61000-3-3	complies	

<b>Electromagnetic immunity</b>			
The microsurgical operating system as specified in the intended use is intended for use in the electromagnetic environment specified below. The customer or the user of the microsurgical operating system should assure that it is used in such an environment.			
<b>Immunity Test</b>	<b>IEC 60601 test level</b>	<b>Compliance level</b>	<b>Electromagnetic environment - guidance</b>
Electrostatic discharge IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, then the relative humidity should be at least 30 %.
Electrical fast transient / burst IEC61000-4-4	± 2 kV for power supply lines ± 1 kV for input / output lines	± 2 kV for power supply lines ± 1 kV for input / output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV voltage phase-to-phase ± 2 kV voltage phase to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC61000-4-11	< 5% $U_T$ (95% dip in $U_T$ ) for 25 cycles  40% $U_T$ (60% dip in $U_T$ ) for 5 cycles  70% $U_T$ (30% dip in $U_T$ ) for 25 cycles  < 5% $U_T$ (>95% dip in $U_T$ ) for 5 s	< 5% $U_T$ (>95% dip in $U_T$ ) for ½ cycle  40% $U_T$ (60% dip in $U_T$ ) for 5 cycles  70% $U_T$ (30% dip in $U_T$ ) for 25 cycles  < 5% $U_T$ (>95% dip in $U_T$ ) for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the use of the microsurgical operating system requires continued operation during power mains interrupts, it is recommended that the microsurgical operating system be powered from an uninterruptible power supply UPS or a battery.
Power frequency (50 Hz / 60 Hz) magnetic field IEC 61000-4-8	3 A/m	not applicable	
Note: $U_T$ is the a.c. mains voltage prior to application of the test level.			

<b>Electromagnetic immunity</b>			
The microsurgical operating system as specified in the intended use is intended for use in the electromagnetic environment specified below. The customer or the user of the microsurgical operating system should assure that it is used in such an environment.			
<b>Immunity Test</b>	<b>IEC 60601 test level</b>	<b>Compliance level</b>	<b>Electromagnetic environment - guidance</b>
Transient HF emission according to IEC 61000-4-6	3 V <sub>eff</sub> . 150 kHz to 80 MHz	3 V	Portable and mobile RF communications equipment should be used no closer to any part of this device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. <b>Recommended separation distance:</b> $d = 1,2 \times \sqrt{P}$ 150 kHz to 80 MHz $d = 1,2 \times \sqrt{P}$ 80 MHz to 800 MHz $d = 2,3 \times \sqrt{P}$ 800 MHz to 2.5 GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey <sup>a</sup> , should be less than the compliance level in each frequency range <sup>b</sup> . Interference may occur in the vicinity of equipment marked with the following symbol: 
Transitive HF emissions to IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	
Note 1: At 80 MHz and 800 MHz, the higher frequency range applies. Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

- a. Field strengths from fixed transmitters, such as base stations for radio (cellular /cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which this device is used exceeds the applicable RF compliance level above, this device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocation of the device.
- b. Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

<b>Recommended separation distances between portable and mobile RF communications equipment and the microsurgical operating system</b>			
The microsurgical operating system as specified in the intended use is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of this device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the microsurgical operating system as recommended below, according to the maximum output power of the communications equipment..			
Rated maximum output power of transmitter in Watt W	Separation distance according to frequency of transmitter in meters m		
	150 kHz to 80 MHz $d = 1,2 \times \sqrt{P}$	80 MHz to 800 MHz $d = 1,2 \times \sqrt{P}$	800 MHz to 2.5 GHz $d = 2,3 \times \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.20	1.20	2.30
10	3.80	3.80	7.30
100	12.00	12.00	23.00
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters [m] can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts [W] according to the transmitter manufacturer. Note 1: At 80 MHz and 800 MHz, the higher frequency range applies. Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

## 10.2 ESD protective measures

The operator should ensure that all persons who put the microsurgical operating system into operation, perform maintenance, or perform any work on the microsurgical operating system that includes connecting or disconnecting cables to or from the system, are informed about the ESD warning label and receive training on appropriate ESD precautions. The training should at least include the following contents:

Non-conductive materials such as glass and plastic get charged electrostatically, when being rubbed with certain materials. Typical examples for the generation of electrostatic charges are:

- Walking on a PVC flooring
- Dooning of plastic-containing garments

By a sudden discharge, for example, when touching electrical contacts, electronic components can be damaged or destroyed.

The following is recommended as most important protective measure:

- Grasp a grounded object, such as an equipotential connector, before touching electrostatic endangered components or their contacts.



## 10.3 Cleaning, disinfection and sterilization

- Perform the processing before each use.

The operator must ensure that processing is carried out within an appropriate validated method in accordance with the appropriate local regulations.

For processing, take into account at least the following requirements:

- Detergents and disinfectants must be approved for the treatment of medical products.
- Steam sterilization in accordance with the standards ISO 17665 and EN 285
- Washer-disinfectors according to ISO 15883

### 10.3.1 Checking and testing

- Check all items for mechanical damages before and after processing. Replace damaged items.
- Make sure that no visible residual impurities remain on the articles.
- Ensure that glass surfaces are clean and free of streaks.

### 10.3.2 Microsurgical operating system

#### Manual cleaning

#### ! Attention

#### Intruding liquids damage the microsurgical operating system:

- Make sure that no fluids seep into the microsurgical operating system.
- Do not use any scouring agents or abrasive materials.

#### Oculars

##### Materials required

- Dry microfibre cloth
- If necessary: damp cloth

##### Process

- Remove minor contamination such as fingerprints with the microfibre cloth.
- If necessary, clean the glass surfaces from dirt such as dried blood or residues of saline solution with a damp cloth. Dry the surface with the microfibre cloth.

#### Front lense

##### Materials required

- Damp cloths
- pH-neutral cleaning agent (pH < 8)
- Dry cotton or microfibre cloth

##### Process

- Apply the cleaning agent with a damp cloth. Clean the glass surfaces thoroughly.
- Remove all visible residues of the cleaning agent with a second damp cloth.
- Dry the surfaces with the dry cloth.

<b>Monitors</b>	<p>Materials required</p> <ul style="list-style-type: none"><li>• Damp cloth</li><li>• Dry microfibre cloth</li></ul> <p>Process</p> <ul style="list-style-type: none"><li>• Clean the surfaces with the damp cloth. Dry the surfaces with the microfibre cloth.</li></ul>
<b>Surfaces</b>	<p>Materials required</p> <ul style="list-style-type: none"><li>• Cotton or microfibre cloth</li><li>• pH-neutral cleaning agent (pH &lt; 8), that is suitable for aluminium and plastic surfaces.</li></ul> <p>Process</p> <ul style="list-style-type: none"><li>• Apply the cleaning agent with the cloth.</li><li>• Wipe the surfaces.</li><li>• Make sure that the cleaning agent does not get onto glass surfaces and not into the housing interior.</li></ul>
<b>Floor stand castors</b>	<p>Materials required</p> <ul style="list-style-type: none"><li>• Cotton or microfibre cloth</li><li>• pH-neutral cleaning agent (pH &lt; 8)</li></ul> <p>Process</p> <ul style="list-style-type: none"><li>• Soak the cloth with the cleaning agent.</li><li>• Roll the floor stand over the soaked cloth.</li></ul>
<b>Disinfection</b>	<p>Materials required</p> <ul style="list-style-type: none"><li>• Cotton or microfibre cloth</li><li>• Surface disinfectant based on alcohol</li></ul> <p>Process</p> <ul style="list-style-type: none"><li>• Soak the cloth with the disinfectant.</li><li>• Apply the disinfectant.</li><li>• Avoid direct spraying of disinfectants.</li><li>• Make sure that the disinfectant does not get inside the housing interior.</li></ul>
<b>Sterilization</b>	<p>Sterilization is not possible. In use the microsurgical operating system is provided with a sterile drape/sterilizable operating elements.</p>

### 10.3.3 Sterilizable operating elements

<b>Manual cleaning and disinfection</b>	<p>Materials required</p> <ul style="list-style-type: none"><li>• Tools for cleaning of cavities, crevices, etc.</li><li>• Cleaning agent (pH &lt; 11,5)</li><li>• Glutaraldehyde-based or alcohol-based disinfectant</li></ul> <p>Process</p> <ul style="list-style-type: none"><li>• Clean the items thoroughly, especially in confined spaces.</li><li>• Rinse the items with demineralized water.</li><li>• Disinfect the items.</li><li>• Rinse the items with demineralized water.</li><li>• Dry the items.</li></ul>
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**Automated cleaning  
and disinfection**

Materials required

- Cleaning agent (pH < 11,5)

Process

- Position the articles so that fluid can flow out of crevices without obstruction.
- Choose a cleaning / disinfection program with the following parameters:
  - Pre-cleaning at < 20°C
  - Cleaning at 40°C to 45°C for 5 minutes
  - Final rinse with demineralized water
  - Thermal disinfection at 93°C for 10 minutes

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**Sterilization**

- Pack the items in the manner common for packing sterile medical devices in hospitals.
- Sterilize the items by steam sterilization with fractionated initial vacuum at 134° C for at least 5 minutes.  
Steam sterilization at up to 139° C for up to 18 minutes is possible.
- Store the items in the manner common for storing sterile medical devices in hospitals.

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