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Please carefully read this user manual!

Read completely this user manual and get familiar with the use and functions of the unit and all accessories, before you start using the device clinically.

Unless you do not follow the directives as instructed, the following problems may occur:

- Serious injuries to the patient
- Serious injuries to the operator or to the service personal
- Damage of malfunction of the unit or of the accessories

Modifications

The manufacturer has the right to modify the appearance and technical data because of new product developments.

The marks: “WARNING”, “ATTENTION” and “REMARK” contain important hints.

Responsibility of manufacturer

Warranty and liability by Hager & Werken GmbH & Co KG is given, if:

- installation and start of operation is done by own personal or by personal authorized by the manufacturer
- installation and safety measures comply with national norms and regulations
- the unit is used in accordance with the user manual
- the unit is used under supervision of a LSO (Laser Safety Officer)
- no manipulations to the unit or to the accessories, if manufacturer does not agree.

Warranty

The LaserHF unit has a legal warranty of 12 months.
Explanations to the user manual

Important directives, especially for technical safety and security, are mentioned:

**WARNING DANGER**

The safety of patients, operator or third persons is in risk. If information is not considered, persons can be in danger.

**ATTENTION**

This information advices to special service procedures or caution measures, which must be considered to avoid damage to the unit.

**REMARK**

This is general and special information to clarify important and helpful instructions.

Scope of Delivery

**LaserHF - REF 452 462**

- LaserHF bare fibre AS 200/240 REF 452 463
- LaserHF bare fibre AS 320/385 REF 452 464
- LaserHF hand piece 6W Laser Red REF 452 465
- LaserHF hand piece PDT Laser Orange REF 452 466
- HF set of instruments, 6 pcs REF 452 440
- HF hand piece Yellow 1,50 m REF 452 423
- HF hand piece Blue 1,50 m REF 452 425
- Neutral electrode REF 452 421
- Laser safety goggle, Lambda One, Filter P1002 REF 355 630
- Laser safety goggle, Skyline Green, Filter P1002 REF 355 631
- Laser safety goggle, Skyline Blue, Filter P0004 REF 355 632
- Laser-Patient safety goggle, Filter PA000 REF 355 633
- Plug door contact/interlock
- Foot pedal
- User manual
- Medical product journal
  (Bipolar forceps optional)
Laser light as well as radio frequency energy can both be used to convert electromagnetic radiation into heat. The basic tissue interaction of laser and radio frequency applications are nearly the same, especially compared in the clinical appearance. Additional to heat effects the laser radiation can be used at low power to perform therapeutic and photoactive applications.

**Interaction of laser light**

**THERMAL INTERACTION**

If laser light is transmitted by thin glass fibres an extreme power density can be created at the fibre output surface. Tissue with mainly water content strongly absorbs the laser radiation and creates heat. The water will be evaporated in shortest time, biological material then will be vaporized – this effect can be used to coagulate and cut tissue as well as to kill pathogen germs. For the most effective way it is necessary to use a wavelength, which is well absorbed in water – the LaserHF unit uses a wavelength of 975 nm, in a maximum of absorption.

**THERAPEUTIC INTERACTION / LLLT**

Laser light does not only perform tissue vaporization or coagulation of blood vessels, more than that it can stimulate cells in a therapeutic sense. In the LLLT (Low Level Laser Therapy) the laser power densities are less than in thermal applications, much smaller than 1 W/cm². Appropriate wavelengths can be found in the red spectral range from 630 – 680 nm, the LaserHF unit uses 660 nm.

LLLT applications are wound healing (stimulation of cell growth), pain treatment (release of nerve irritation) and to treat eczema (stimulation of lymphatic vessels).

**PDT**

As an integral part of the LaserHF device, a second laser source with a red wavelength is added for PDT (Photo Dynamic Therapy).

Using an appropriate substance like Toluidine-Blue the bacteria in tooth pockets, root canals and caries cavities can be stained – the colour molecules will be accumulated in the cell walls of micro organisms, and then afterwards irradiated with red laser light. Due to the laser irradiation oxygen radicals are generated which mortify those cells. The exact treatment can be found in the user manual for PDT.
Interaction of radio frequency (HF)

If radio frequency is guided through very thin metal electrodes, a very large electro-magnetic power density is created in the tissue layer. The water is abruptly heated up in these cells which leads to cooking and rupture, respectively.

**WARNING DANGER**

Laser radiation is very dangerous to the high sensitive, unprotected eye. Therefore the use of appropriate laser protection goggles is mandatory, see PROTECTION GOGGLES.

**THERMAL INTERACTION (MONOPOLAR)**

**CUTTING (CUT) / COAGULATION (COAG)**

At monopolar cutting the radio frequency current is led from the device via a work electrode and a large neutral electrode back to the device. The current density at the treatment point is very high, but it is very low at the neutral electrode.

The electric current density leads to a fast and strong heating in tissue, which can be used for cutting and coagulation.

**THERMAL INTERACTION (BIPOLAR)**

At bipolar application the current is going from one side of an instrument (i.e. forceps) to the other side of the device.

The advantage of this technology is to apply the current in an exact defined area, so it can be used for selective coagulation and closing of small vessels.
# Technical Data

<table>
<thead>
<tr>
<th>LASER</th>
<th>wavelength + power diode laser: 975 nm ± 10 nm, 6 Watt, LK 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pulse of duration: mode: cw and pulsed: 5 ms - 50 ms</td>
</tr>
<tr>
<td></td>
<td>wavelength + power PDT/LLLT: 660 nm ± 5 nm, cw, max. 100 mW, LK 3B</td>
</tr>
<tr>
<td></td>
<td>wavelength + power pilot laser: 650 nm, 2 mW, LK1</td>
</tr>
<tr>
<td>HF</td>
<td>frequency + power: 2.2 MHz, max. 50 W</td>
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<tr>
<td></td>
<td>mono- and bipolar</td>
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<tr>
<td></td>
<td>permanently / pulsed</td>
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<tr>
<td>environment temperature</td>
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<tr>
<td>air humidity</td>
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<tr>
<td>power supply</td>
<td>230 V AC, 50/60 Hz</td>
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<tr>
<td>power consumption</td>
<td>max. 1.5 A</td>
</tr>
<tr>
<td>classification medical device</td>
<td>class 2b</td>
</tr>
<tr>
<td>duty cycle</td>
<td>continuous operation 1 min., interval time 4 min.</td>
</tr>
<tr>
<td>applicators</td>
<td>fibre with SMA</td>
</tr>
<tr>
<td></td>
<td>200 µm – endodontics</td>
</tr>
<tr>
<td></td>
<td>320 µm – periodontics, implantology</td>
</tr>
<tr>
<td></td>
<td>320 µm – PDT, LLLT</td>
</tr>
<tr>
<td></td>
<td>Autoclavable</td>
</tr>
<tr>
<td>hand piece</td>
<td>autoclavable</td>
</tr>
</tbody>
</table>
Caution and safety regulations in the dental practice using the LaserHF device

The LaserHF device should only be used after successful introduction to the owner and in accordance to national/international relevant regulations and safety measures.

The area where the LaserHF device should be used, must be in accordance with national accident prevention regulations. Electrical installation must be in accordance with national rules. It is in the responsibility of the owner/user or the (LSO) laser safety officer.

Each application requires its own laser safety goggle. The PDT/LLLT unit (660 nm) and the power laser (975 nm) have different goggles.

- During use the LaserHF should have a minimum distance to walls of about 20 cm. Besides the LaserHF should be used only on an even surface to guarantee a good air circulation.

- Only accessories mentioned by Hager & Werken like glass fibres, hand pieces and electrodes should be used.

- Do not use the LaserHF in a potential explosive atmosphere, regardless from what the explosive situation generates. Especially never use burnable or explosive anesthetics or remove it immediately by effective suction.

- Operator, patient and everybody in the room should wear a laser safety goggle during laser operation. Laser safety goggles will be recommended from Hager & Werken.

- Never look directly or with an optical instrument in the laser beam.

- Surgery with radio frequency should not be used on persons wearing a cardiac pace maker, please consult the cardiac specialist to make sure that the radio frequency does not interfere negatively with the cardiac pace maker.

- None of the cables of LaserHF should be in contact with the patient or in contact with other cables.

- The radio frequency power should be set on lowest level, to prevent from unwanted tissue damage.

- The unit must be free from power supply during cleaning.

- Service and maintenance should be done by authorized personal only.

- If other than the mentioned buttons will be used or if another regulation for the treatment is used, it may lead to serious and dangerous beam emission.

- Any noncompliance with this user manual leads to loss of warranty by manufacturer.
Operator regulation

The LaserHF unit is classified as medical device unit class 2b (Europe). Thus all directions of the European operator regulation apply.

§ 5: Operation and execution
§ 6: Technical controls
§ 7: Medical product documentation

Technical controls:

The user is committed to perform on a regular basis technical controls after the following specifications:
Period: Every 12 months, starting with date of delivery and after each repair.

Covering:
Visual check of the unit and accessories
Check according to IEC 62353 (VDE 0751)
- Protective earth resistance
- Alternate leakage current
- Alternate patient leakage current

Function check
- Main switch
- Touch display
- Tubular switches
- Emergency switch

Measurement of radio frequency (HF) output power at a load of 1 kΩ:
- Output CUT (50W)
- Output COAG (45W)
- Output (45W)

Measurement of laser output power
- Output PDT (10mW and 100mW)
- Output Laser (100mW and 6W)

All results of measurements must be documented according to IEC 62353 (VDE 0751) concerning the first measured values. If defects occur during the controls, the user is responsible to initiate repair.
**Preparation to start the device**

- Before the LaserHF unit will be started, make sure, that the unit is at room temperature for at least 30 minutes to avoid condensed water.

- It is important that the ventilation slots are not covered and the unit has a minimum distance to walls and other units of 20 cm.

**Start up**

- All national safety aspects must be fulfilled.
- Connect interlock output with door contact or use a short cut plug.
- Connect foot switch with unit.
- Connect power supply cable first to the unit, then to house power output.
- Connect laser fibres to the hand pieces: open fixture, carefully feed in the fibre from the rear side through the hand piece and fixture, close fixture.
- Open the fixture at radio frequency (HF) hand pieces and insert appropriate electrodes. Close fixture.
- Put the hand pieces in the tubular switches and connect laser light fibres and radio frequency (HF) cable with the unit.
- Connect the neutral electrode.
- Power switch turn on (back side).
- The unit will IMMEDIATELY start with a self test.

**Label**

At the front side of the unit:

![Label Image](image)

At the back side of the unit:

![Label Image](image)
**Unit Front**

1. Tubular switch radio frequency (HF)
2. Display (touch screen)
3. **EMERGENCY**-switch (on top of unit)
4. Tubular switch LASER
5. Neutral electrode
6. Output HF CUT
7. Output HF COAG
8. Output HF BIPOL
9. Output laser 660 nm
10. Output laser 975 nm

**Unit Back**

1. Power supply with fuses
2. Interlock
3. Foot switch
4. Potential balance
5. Type label
6. Laser warning
7. Ventilation

**Dual User Conception:**

It is possible to choose every single application (mode) by using the touch screen as well as by using the tubular switches (except BIPOLAR). Because of safety reasons the simultaneous selection of a mode via touch screen or via tubular switch is intended in the following way:

- Always – if a button of mode is coloured – the mode can be started or finished using the touch screen or the tubular switches.
- Once a mode has been selected, it cannot be interrupted with another mode button or another tubular switch.
- The BIPOLAR MODE can be selected only by touch screen.
- It is possible to pre-select a mode by activating the mode button, even without taking the hand piece from the tubular switch.
- Except at BIPOLAR, to activate always the hand piece must be taken out of tubular switch.
Start
Start the unit by using the power switch at the back side of the unit.

Immediately with the start of the unit the display will ask for input of an user code. (Default is: 9999. Please change the code during the first use of the device for your own safety, p. 15/17).

If the user code matches the correct 4 digit code, the main menu immediately appears.

If the code input is false, input of the code is requested again.

With acceptance of the user code the main menu will appear:
- CUT
- COAG
- BIPOL
- PDT
- LASER
- Information
- Software Version / Warning Signals

Following possibilities are available:
- Go to information menu by pressing the button in the right upper corner
- Mode selection by buttons – pressing of one of the coloured buttons directly lead to a mode. If a mode selection button is GREY, it is not possible because another mode is active.
- Mode selection by tubular switch – by taking the hand piece from the tubular switch the appropriate mode will be selected, if no other mode is active.

Information

- Loudness warning sound
- Return to factory settings
- Adjustment of display
- Brightness of display
- User code setting
- Language
Touch one of the symbol buttons – with exception of FACT SET, SIGNAL ON/OFF, JUSTAGE DISPLAY, CODE SET – and a green window appears and settings can be changed by using the ▲ und ▼ buttons and accept by ← button.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Sound Icon" /></td>
<td>Adjustment of loudness for warning sound (window)</td>
</tr>
<tr>
<td><img src="image2.png" alt="Volume Icon" /></td>
<td>On/Off for sound of button</td>
</tr>
<tr>
<td><img src="image3.png" alt="FACT SET Icon" /></td>
<td>Reset to factory setting</td>
</tr>
<tr>
<td><img src="image4.png" alt="Screen Icon" /></td>
<td>Adjustment of display (special display)</td>
</tr>
<tr>
<td><img src="image5.png" alt="Brightness Icon" /></td>
<td>Adjustment of brightness display (window)</td>
</tr>
<tr>
<td><img src="image6.png" alt="Laser Icon" /></td>
<td>Brightness of pilot laser (window)</td>
</tr>
<tr>
<td><img src="image7.png" alt="Code Set Icon" /></td>
<td>User code setting</td>
</tr>
<tr>
<td><img src="image8.png" alt="Language Icon" /></td>
<td>Language: Deutsch, English (window)</td>
</tr>
</tbody>
</table>
**Settings:**

**Sound for buttons**

The sound for button confirmation can be set ON/OFF.

**Brightness of display**

Brightness of the display can be set in steps 1 – 10, confirm with button.

**Brightness of pilot laser**

Brightness of the pilot laser can be set in steps 1 – 10, confirm with button.

**Loudness of warning sound**

Loudness of the warning sound (ATTENTION: radio frequency and laser have different sounds) - can be set in steps 1 – 10, confirm with button.
Adjustment of display

The display can be adjusted horizontally and vertically. For this use a sharp instrument (i.e. pencil, ballpoint) and touch SLIGHTLY the main lines, until a long sound occurs. Short sound signals the ongoing adjustment.
Confirm with pressure on middle button, until sound occurs.

User code setting

The user of the LaserHF device can change the 4 digit code and store with the return button ↓.

Reset to factory settings by long pressing of the button – until sound occurs. All storable parameters – except CODE – will be resetted to factory settings.

In case the USER CODE has been lost, please contact HAGER & WERKEN by email: info@hagerwerken.de and mention your unit number to get a new user code.
Precision of power setting radio frequency (HF)

The power of the radio frequency generator depends on the tissue specific resistance and can vary within limits. The specified 50 W are in accordance with a specific resistance of 1 kΩ. The settings of the radiofrequency will be displayed without the measuring unit [W] and will be scaled in accordance with the graph.

Precision of power settings LASER

The laser power will be permanently measured in the device and compared with a stored characteristic line of the laser module. A deviation of ± 20 % leads to switch-off the device.
Selection of the correct radio frequency (HF) mode

**ATTENTION**
All surgical applications with radio frequency need local or block anaesthesia.

**Cutting - CUT MODE**
This mode – with a permanent power flow – is best rated for clean cuts in tissue without coagulation. In this mode cutting is with marginal heat and little hemostasis and can be used near to bones or to the periost tissue to avoid shrinking processes of the tissue.
Histological examinations can be done in this mode as well.

**Hint:** Activate the electrode by pressing the foot switch before touching the tissue. Then a regular cut will be produced from the beginning.

**Cutting / Coagulation - CUT / COAG MODE**
This mode allows the precise cutting and simultaneous coagulation of the cut surface. Clinically the coagulation zone is marginal, but allows an effective hemostasis, does not disturb the primarily wound healing and disappears spontaneous after the wound is healed. These cuts do not need suturing, thus this mode is very effective in cosmetic surgery.

**Hint:** Activate the electrode by pressing the foot switch before touching the tissue. Then a regular cut will be produced from the beginning.

**Coagulation permanently and pulsed - COAG MODE**
This mode is for an immediate hemostasis – a coagulation electrode (i.e. a ball or a thick needle) should gently touch the area for coagulation, then the foot switch is activated. Bleedings from small vessels can be stopped using pulsed coagulation.

**Hint:** The electrode will be placed – gently touching – to the area. No pressure! Then the electrode will be activated.

**Hint:** Do not coagulate in a “blood lake”, instead remove most of the blood in advance of coagulation.

**Coagulation - BIPOLAR MODE**
This mode is for immediate coagulation of smaller vessels with diameters up to max. 2.0 mm. In this case the pulsed coagulation is recommended.

**Hint:** First take the vessel with a bipolar forceps, then activate the radio frequency.
Correct power setting

The success of all radio frequency measures is strongly dependent on the right choice of electrodes, the mode and the correct power setting.

**Correct:** The electrode is sliding easily through the tissue without resistance and without spark formation.

**Wrong: too low power setting!**
The electrode must be dragged through the tissue and spark formation is found. Tissue residuals remain at the electrode.

**Wrong: too high power setting!**
The electrode is sliding easily through the tissue, but with strong spark formation and discolouration of the tissue.

Setting of level of coagulation (C)

Coagulation with radio frequency is done with high power, usually this is performed not permanently but in a pulsed way. It means that the power applied to the tissue is not permanent, but in quick cycles with periodical pauses. An average lower power results. The power is getting lower the longer pauses are in relation to the periods of power output. A pulse always is 10 ms long, power emission and pauses can be adjusted in 8 steps as level of coagulation (C) – see table.

<table>
<thead>
<tr>
<th>Value of coagulation</th>
<th>Time of pause (ms)</th>
<th>Time of pulse (ms)</th>
<th>Maximal possible average power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 1</td>
<td>1</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>C 2</td>
<td>2</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>C 3</td>
<td>3</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>C 4</td>
<td>4</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>C 5</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>C 6</td>
<td>6</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>C 7</td>
<td>7</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>C 8</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

Example: C5 (1:1, 5 ms Pulse, 5 ms Pause)

In principle: The bigger the coagulation area at the tissue, the more power is needed and the level of coagulation C is lower.

Big areas: C1 - C3, small areas: C4 - C6, very small areas and special applications: C7 - C8, the fine control by power adjustment.

If high voltage is needed due to physiological conditions at the tissue, the level of coagulation should be at that maximum value that the application is still possible.
Description of the modes

HF-CUT MODE

Symbols

- Permanent cutting (CUT PERM)
- Cutting with coagulation (CUT COAG)

In CUT MODE – yellow display – the parameter for monopolar radio frequency can be selected.

Power: from 10 – 100 % of nominal power, selectable with ▲ and ▼

Permanent cutting (CUT PERM) or cutting with coagulation (CUT COAG)

Level of coagulation C1 – C8

P1 – P5 = storage places

If the button for level of coagulation is touched, a green window opens and the level of coagulation can be adjusted from C1 – C8 with ▲ and ▼

Confirm with ◀.

5 storage places are available in CUT MODE.

The actual selected parameters will be stored by touching one of the areas 1 – 5 for longer than 2 sec.

Recall of stored values by simple touching of the area number.

Back to CUT MODE with ◀.
**HF-COAG MODE**

**Symbols**

- **Permanent coagulation** (COAG PERM)
- **Pulsed coagulation** (COAG PULSE)
- **Pulse duration**
- **Level of coagulation**

In COAG MODE – blue display – the parameters for monopolar coagulation can be selected.

**Power**: from 10 – 100 % of nominal power, by selection with ▲ and ▼.

- Permanent or pulsed coagulation
- Level of coagulation C1 – C8.
- P1 – P5 = memory places

In pulsed mode the pulse duration can be selected from 50 ms – 1 s with the ▲ and ▼ buttons.

Confirm with ◄.

If the button for level of coagulation is touched, a green window opens and the level of coagulation can be adjusted from C1 – C8 with ▲ and ▼.

Confirm with ◄.
5 memory places are available.
Pressing the area 1 – 5 for more than 2 sec the actual parameter will be stored.
Recall of stored parameter simply press the area number.
Back to COAG MODE with ←.

**HF-BIPOLAR MODE**

Symbols

Permanent coagulation  
(COAG PERM)

Pulsed coagulation  
(COAG PULSE)

Pulse duration

Level of coagulation

In COAG MODE – blue-violet display – the parameters for bipolar coagulation can be selected.
Power: from 10 – 100% of nominal power, by selection with ▲ and ▼
Permanent or pulsed coagulation .
Level of coagulation C1 – C8
P1 – P5 = memory places

In pulsed mode the pulse duration can be selected from 50 ms – 1 s with the ▲ and ▼ buttons.
Confirm with ←.
5 memory places are available. Pressing the area 1 – 5 for more than 2 sec the actual parameter will be stored. Recall of stored parameter simply press the area number. Back to BIPOLAR MODE with ↓.
IMPORTANT REMARK:

For optimal guiding of the laser fibre we recommend to use a Miraject PL Super cannula (REF 254 214). Please consider that sufficient fibre length should be positioned, in case the cannula should be bended.

**LASER MODE**

Symbos

- Permanent LASER (LASER cw)
- Pulsed LASER (LASER pulse)
- PPR: Pulse-Pause-Ratio

In LASER MODE – RED display – parameters of the power laser 975 nm can be adjusted.

Power: 0.1–6 W, adjust with ▲ and ▼

Mode: cw (continuous wave)/pulsed, activation by pressing button cw

Pressing START activates the unit.

P1 – P10 = preset programs

P4: Program is limited to 2 Watt

In pulse mode the pulse duration (Ton) and the Pulse-Pause Ratio (PPR) relation can be set.

Ton: is the pulse time laser ON

PPR (Pulse-Pause Ratio): can be set from 1:1 up to 1:20

Pressing START activates the unit.
Ton: adjustable with ▲ and ▼

Confirm Ton with ←

PPR: activation by pressing the button PPR adjustable with ▲ and ▼

Confirm with ←

Once the laser is activated, the status bar shows !LASER ! and a symbol for safety goggles.

Pressing STOP switches the unit into standby

10 memory places (2 pages)

Pressing area 1 – 5 recalls a preset program

Changes to the program with pressing for more than 2 sec.

Back to LASER MODE with ←. 
Pressing an area 6 – 10 recalls a preset program.

Changes to the program with pressing for more than 2 sec.

Back to LASER MODE with ↓.
IMPORTANT REMARK:

For optimal guiding of the laser fibre we recommend to use a Miraject PL Super cannula (REF 254 214). Please consider that sufficient fibre length should be positioned, in case the cannula should be bended.

**PDT/LLLT MODE**

In PDT/LLLT MODE – ORANGE display – the following parameter for PDT/LLLT-laser (660 nm) can be adjusted.

- **Power**: 10 – 100 mW cw
- **Time of Irradiation**: 1 – 300 s
- **PRG** = preset programs
- **MEM** = memory

Pressing button **START** activates the unit.

Set timer with ▲ and ▼

Confirm with ●.

5 memory places

Pressing an area 1 – 5 recalls a preset program.

Changes to the program with pressing for more than 2 sec.

Back to PDT MODE with ●.
Once the laser is activated, the status bar shows !LASER! and a symbol for safety goggle.

Pressing STOP switches the unit into standby.

General advice

- Only use cleaning and disinfection materials, which are checked and permitted by local advisory boards.
- Do not clean the laser hand pieces with bleaching agents, chloric cleaning substances, liquid or chemical disinfection solutions or other products based on sodium hydrate (i.e. bull cleaner) – the anodized aluminum surface can be damaged.

For cleaning and disinfection please follow this direction:

- Open the fixture (clamp bolt).
- Remove light fibre from the clamp bolt.
- Remove canula from the clamp bolt.
- Rinse handle, clamp bolt and canula using a pH-neutral cleanser. Remove all blood and tissue residuals.
- Use disinfection spray for handle, clamp bolt and canula.
- Clean handle, clamp bolt and canula with ultrasound before autoclave.

Sterilization (cleaning as above) of radio frequency (HF) hand pieces

- Remove electrode from hand piece.
- The radio frequency (HF) hand piece can be sterilized including the cable (i.e. steriCLIN-bag).
- The hand piece should be sterilized in an autoclave using 134 °C at 5 minutes exposure time at 2 bar overpressure.

Sterilization of the laser hand piece

- Hand piece and clamp bolt can be autoclaved in a bag (i.e. steriCLIN-bag).
- The hand piece should be sterilized in an autoclave using 134 °C at 5 minutes exposure time at 2 bar overpressure.
- Only autoclaves should be used which comply with EN 13060 or which at least work with fractioned streaming processes and are adequate for sterilization of hand pieces.
- Sterilization of laser fibres – separate directive.

IMPORTANT ADVICE:

NEVER autoclave hand piece and clamp bolt WITH interposed laser fibre.
**ERROR management**

Every ERROR will be displayed in a picture-in-picture function in the display.

Then a purple sub-window appears with ERROR status and ERROR number. The ERRORS are arranged by priorities, always only the most serious ERROR will be displayed.

**ERROR Groups:**

**INFORMATION** – can be acknowledged with the return button
- If the laser or PDT fibre is not recognized at the laser outputs
- If the interlock connection is open
- If – after START of LASER / PDT – the foot switch is not used for 2 minutes
- If a hand piece is in the tubular switch and should be activated

**DATA ERRORS** – can be acknowledged with the return button
- All relevant data will be always checked on plausibility and double stored
- AN ERROR will be displayed, if
  > an ERROR is detected during reading/storing
  > parameter will show wrong values

**ERRORS, which stop the initiation**
- ERROR in hardware
- ERROR in monitoring
- ERROR in communication
- ERROR in ROM
- Power down / Emergency

If any errors occur, please contact the HAGER & WERKEN Service.
## List error messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Error no.</th>
<th>Description</th>
</tr>
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<td>0001</td>
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</tr>
<tr>
<td>Check PDT-Fibre</td>
<td>0002</td>
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<tr>
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<td>0003</td>
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<tr>
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<tr>
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<td>0006</td>
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<tr>
<td>Backup-Data</td>
<td>0016</td>
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<tr>
<td>Backup-Data</td>
<td>0001</td>
<td>Backup of working parameter</td>
</tr>
<tr>
<td>Backup-Data</td>
<td>0256</td>
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<tr>
<td>Standard-Data</td>
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<td>Standard-Data</td>
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<td>Standard-Data</td>
<td>0512</td>
<td>Default value mode parameter</td>
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<tr>
<td>Data-Error</td>
<td>0064</td>
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<tr>
<td>Data-Error</td>
<td>0004</td>
<td>Correction Work parameter</td>
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<tr>
<td>Data-Error</td>
<td>1024</td>
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<tr>
<td>Hardware-Error</td>
<td>0001</td>
<td>ERROR_VOLTAGE_NOT_LOW</td>
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<td>Hardware-Error</td>
<td>0002</td>
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<td>Hardware-Error</td>
<td>0003</td>
<td>ERROR_DRVBACKLAS_NOT_HIGH</td>
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<tr>
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<td>ERROR_DRVBACKPDT_NOT_HIGH</td>
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<td>0005</td>
<td>ERROR_HFBACKM1_NOT_HIGH</td>
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<td>Hardware-Error</td>
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<tr>
<td>Hardware-Error</td>
<td>0007</td>
<td>ERROR_HFBACKB_NOT_HIGH</td>
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<tr>
<td>Hardware-Error</td>
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</tr>
<tr>
<td>Hardware-Error</td>
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<td>ERROR_FIN1_NOT_HIGH</td>
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<td>Hardware-Error</td>
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<td>0014</td>
<td>ERROR_DRVBACKLAS_NOT_LOW</td>
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<td>ERROR_DRVBACKPDT_NOT_LOW</td>
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<td>0016</td>
<td>ERROR_HFDRVMON_NOT_HIGH</td>
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<td>Hardware-Error</td>
<td>0017</td>
<td>ERROR_VOLTAGE_OUT_OF_RANGE_HF1</td>
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<tr>
<td>Hardware-Error</td>
<td>0018</td>
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<tr>
<td>Hardware-Error</td>
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<tr>
<td>Hardware-Error</td>
<td>0020</td>
<td>ERROR_CURRENT_OUT_OF_RANGE_PDT</td>
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<tr>
<td>Category</td>
<td>Code</td>
<td>Description</td>
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<tr>
<td>Hardware-Error</td>
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<td>ERROR_CURRENT_OUT_OF_RANGE_LAS</td>
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<td>ERROR_HFBACKM1_NOT_LOW</td>
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<td>0023</td>
<td>ERROR_HFBACKM2_NOT_LOW</td>
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<td>0024</td>
<td>ERROR_HFBACKB_NOT_LOW</td>
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<tr>
<td>Hardware-Error</td>
<td>0025</td>
<td>ERROR_VLASER_NOT_LOW</td>
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<tr>
<td>Hardware-Error</td>
<td>0026</td>
<td>ERROR_FOOT_NOT_LOW</td>
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<td>Hardware-Error</td>
<td>0027</td>
<td>ERROR_UNKNOWN_OPMODE</td>
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<td>Hardware-Error</td>
<td>0028</td>
<td>ERROR_ROM_CHECK</td>
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<td>Hardware-Error</td>
<td>0029</td>
<td>ERROR_RAM_CHECK</td>
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<td>Hardware-Error</td>
<td>0030</td>
<td>ERROR_EE_CHECKSUM</td>
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<td>Hardware-Error</td>
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<td>ERROR_VLASER_TOO_LOW</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0257</td>
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<td>Diagnosis-Error</td>
<td>0258</td>
<td>HF-Power too low</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0259</td>
<td>HF analog voltage too high</td>
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<td>Diagnosis-Error</td>
<td>0260</td>
<td>Laser-Power too high</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0261</td>
<td>Laser-Power too low</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0262</td>
<td>Laser analog current too high</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0263</td>
<td>PDT-Power too high</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0264</td>
<td>PDT-Power too low</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0265</td>
<td>PDT analog current too high</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0266</td>
<td>Idle analog voltage too high</td>
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<tr>
<td>Diagnosis-Error</td>
<td>0267</td>
<td>Idle analog current too high</td>
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<td>Diagnosis-Error</td>
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<td>Failed check of program storage</td>
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<td>--</td>
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## Applications Laser

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<tr>
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<th>$T_{off}$</th>
<th>Remarks</th>
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<tr>
<td>Laser PRG 1 – 5</td>
<td>1.5 W</td>
<td>cw</td>
<td>50 ms</td>
<td>Use 320 µm fiber</td>
</tr>
<tr>
<td>PER – Coagulation</td>
<td>1.0 W</td>
<td>cw</td>
<td></td>
<td>Use 320 µm fiber</td>
</tr>
<tr>
<td>PER – Bacteria reduction</td>
<td>2.0 W</td>
<td>20 ms</td>
<td>25 ms</td>
<td>(LIMIT 2 W) Use 320 µm fiber</td>
</tr>
<tr>
<td>ENDO – Canal decontamination</td>
<td>2.0 W</td>
<td>5 ms</td>
<td></td>
<td>First insert the fiber into the root canal, then activate the laser. Remove the activated fiber - slowly and with rotating movement – within 10 – 30 s. Repeat this procedure 2 – 4 times. (LIMIT 0,5 W) Use 320 µm fiber Time per tooth is about 30 – 120 s. Keep the laser fiber at least 1 cm in distance to the irradiated area. Do not remain at one place, keep the fiber in movement.</td>
</tr>
<tr>
<td>DES – Desensibilization</td>
<td>0.1 W</td>
<td>cw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser PRG 6 – 10</td>
<td>3 W</td>
<td>10 ms</td>
<td>20 ms</td>
<td>(LIMIT 4 W) Use 320 µm fiber</td>
</tr>
<tr>
<td>SURG – Crown lengthening</td>
<td>5 W</td>
<td>cw</td>
<td></td>
<td>Use 320 µm fiber</td>
</tr>
<tr>
<td>SURG – Fibroma removal / Cutting</td>
<td>3 W</td>
<td>10 ms</td>
<td></td>
<td>Use 320 µm fiber</td>
</tr>
<tr>
<td>SURG – Gingivectomy</td>
<td>4 W</td>
<td>cw</td>
<td></td>
<td>Use 320 µm fiber</td>
</tr>
<tr>
<td>IMPL – Implant recovery</td>
<td>2 W</td>
<td>cw</td>
<td></td>
<td>Use 320 µm fiber</td>
</tr>
<tr>
<td>BLEA – Bleaching</td>
<td></td>
<td></td>
<td></td>
<td>First apply the bleaching material, than irradiate each tooth with the laser from a distance of 3 – 5 cm (focus diameter should be about 0,7 – 1,0 cm). Stop, if bubbles occur. After laser activation continue the bleaching procedure without laser.</td>
</tr>
<tr>
<td>PDT PRG 1 – 5</td>
<td>10 – 100 mW</td>
<td>10 – 300 s</td>
<td></td>
<td>Apply the color dye for about 30 – 60 s, irradiate with the laser for about 30 – 60 s Use 320 µm fiber Use 320 µm fiber, about 120 – 300 s Use 320 µm fiber, about 120 – 300 s Use 320 µm fiber, about 120 – 300 s Use 320 µm fiber, about 120 – 300 s</td>
</tr>
<tr>
<td>PDT Photodynamic therapy</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Acupuncture, pain treatment</td>
<td></td>
<td></td>
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<tr>
<td>Herpes</td>
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<tr>
<td>Aphthae</td>
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<tr>
<td>Pressure points</td>
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## Applications HF

<table>
<thead>
<tr>
<th>Program</th>
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<th>Value of Coagulation</th>
<th>time</th>
</tr>
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<tbody>
<tr>
<td>CUT PRG 1 – 5</td>
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<td></td>
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</tr>
<tr>
<td>1 – CUT</td>
<td>35</td>
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<tr>
<td>2 – CUT COAG</td>
<td>26</td>
<td>C2</td>
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<tr>
<td>3 – CUT</td>
<td>28</td>
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<tr>
<td>4 – CUT COAG</td>
<td>15</td>
<td>C5</td>
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<tr>
<td>5 – CUT COAG</td>
<td>18</td>
<td>C6</td>
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<tr>
<td>COAG PRG 1 – 5</td>
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</tr>
<tr>
<td>1 – COAG PERM</td>
<td>25</td>
<td>C3</td>
<td></td>
</tr>
<tr>
<td>2 – COAG PERM</td>
<td>30</td>
<td>C1</td>
<td></td>
</tr>
<tr>
<td>3 – COAG PERM</td>
<td>7</td>
<td>C3</td>
<td></td>
</tr>
<tr>
<td>4 – COAG PULSE</td>
<td>35</td>
<td>C3</td>
<td>200 ms</td>
</tr>
<tr>
<td>5 – COAG PULSE</td>
<td>30</td>
<td>C1</td>
<td>200 ms</td>
</tr>
<tr>
<td>BIPOL PRG 1 – 5</td>
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<tr>
<td>1 – BIPOLAR PERM</td>
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<td>C3</td>
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</tr>
<tr>
<td>2 – BIPOLAR PERM</td>
<td>30</td>
<td>C1</td>
<td></td>
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<tr>
<td>3 – BIPOLAR PERM</td>
<td>7</td>
<td>C3</td>
<td></td>
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<tr>
<td>4 – BIPOLAR PULSE</td>
<td>35</td>
<td>C3</td>
<td>200 ms</td>
</tr>
<tr>
<td>5 – BIPOLAR PULSE</td>
<td>30</td>
<td>C1</td>
<td>200 ms</td>
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