



HF1 Surg Bipolar

Universal HF-surgery device
User Manual



HF1 Surg Bipolar

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If errors occur or if contents of this user manual are not clearly formulated, please inform Hager & Werken GmbH & Co KG.

Please read this user manual carefully!

Read this user manual completely and familiarise yourself with the use and functions of the device and all of its accessories, before you start using the device.

Should you fail to follow the instructions, the following problems may occur:

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

Intended purpose

The radio-frequency device HF1 Surg Bipolar is used in dental surgery of the soft tissue and is suitable for the following purposes: oral surgery activities such as cutting, coagulation, removal of soft tissue. No essential performance features according to EN 6061-1 are assigned to the device.

Scope of applications

The HF1 Surg Bipolar device is to be used in dental RF-surgery such as oral surgery, parodontology and bipolar applications. The area of application is professional dentistry facilities.

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 information.

Responsibility of manufacturer

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

- installation and start of operation is done by own personnel or by personnel authorized by the manufacturer
- installation and safety measures comply with national norms and regulations
- the device is used in accordance with the user manual
- no changes are made to the device and its accessories, unless authorized by the manufacturer.

Warranty

The HF1 Surg Bipolar device has a legal warranty of 12 months.



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Explanations to the user manual

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



ATTENTION

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



REMARK

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

Scope of Delivery

HF1 Surg Bipolar - REF 452 459

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
Foot pedal	Steute MKF -MED SK12 IP-Protection X8
User manual	
Medical product journal (Bipolar forceps optional)	

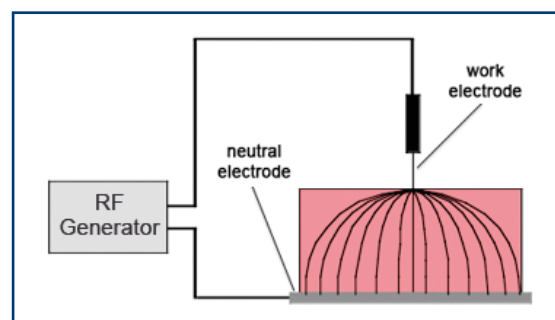
Principle of operation of radio frequency (RF)

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.

THERMAL OPERATION (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.

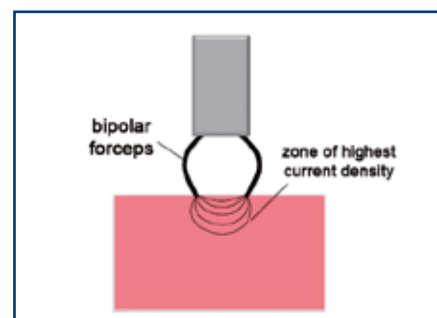
The electric current density leads to a fast and strong heating in tissue, which can be used for cutting and coagulation.



THERMAL OPERATION (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

HF	Frequency + Power:	Monopolar 2.2 MHz max. 50 W load resistance 1000 ohm Bipolar 2.2 MHz max. 46 W load resistance 250 ohm Coagulation 2.2 MHz max. 45 W load resistance 1000 ohm
		permanently /pulsed
Operating temperature		+10 C° - +40 C°
Storage temperature		-20 C° - +60 C°
Humidity		When in operation: <85%, non-condensing When not in operation: <90%, non-condensing
Air pressure		When in operation: 700 hPa - 1080 hPa When not in operation: 500 hPa - 1080 hPa
Power supply		230 V AC, 50/60 Hz Unplug the power plug for an all-pole disconnection of the device.
Power consumption		max. 1.5 A
Power fuse		2 x T1.6 AH
Medical device classification		class IIb
Applicators	Hand piece	autoclavable
Safety		According to DIN EN ISO 6060-1
Electromagnetic compatibility		According to DIN EN ISO 6060-1-2
Safety hf surgery equipment		According to DIN EN ISO 60601-2-2

Cables

HF handpiece cable, yellow	Length 1.50m
HF handpiece cable, blue	Length 1.50m
HF Bipolar cable, optional accessory	Length 1.50m
HF neutral electrode line	Length 1.50m
Foot switch cable	Length 2.50m
Power cable	Length 2.50m

Protection and safety provisions in the dental practice for the use of radio frequency surgery of the HF1 Surg Bipolar device

The HF1 Surg Bipolar device may only be put into operation after the instructions have been given by the operator and in compliance with the prescriptions and safety provisions.



WARNING

The device must only be connected to a power supply with an earth wire in order to avoid the risk of an electric shock.

Check the cables, hand piece and electrodes as well as the foot pedal on visible damage before starting up the HF1 Surg Bipolar device. Instruments with brittle or faulty insulation must not be used as they pose a danger of injury.

When operating the HF1 Surg Bipolar device, unpredictable malfunctions might occur that could cause unwanted output power increase.

1. A minimum distance of approx. 20 cm from any wall has to be kept at all times during operation.
2. **The NEUTRAL ELECTRODE should be in close contact with to a correspondingly prepared suitable area of the PATIENT'S body with its entire surface, as defined by the PRODUCER.**
3. The PATIENT should not get in touch with any metal parts that are grounded or have a significant earth capacitance (e.g. operating table supports etc.).
4. Skin-to-skin contacts (e.g. between the arms and the body of the PATIENT) should be avoided, e.g. by inserting dry gauze. The cable leading to the HF1 Surg Bipolar device should neither touch the patient nor any other wiring. Instruments which are temporarily not in use during the treatment have to be kept away from the patient, e.g. on the instrument table.
5. The output power should be set as low as possible for the corresponding purpose.
6. **An obviously low output value or functional failure of the HF1 Surg Bipolar device in usual operation can be caused by insufficient contact of the NEUTRAL ELECTRODE or insufficient contact in its connections. In such case, the contact of the NEUTRAL ELECTRODE and its connections should be checked before setting a higher output power.**
7. The use of ignitable anaesthetics or combustible gases like nitrous oxide (N₂O) and oxygen should be avoided if a surgical intervention is executed in the head area, unless these substances are aspirated. If possible, non-ignitable ingredients should be used for cleaning and disinfection. Ignitable ingredients used as cleaning and disinfection agents or as solvents for adhesives should have evaporated before the use of the RF-surgery.
8. For patients with pacemakers or other active implants, there is a potential DANGER of disturbance of the pacemaker function or damage to the pacemaker. In case of doubt, consult an expert.
9. The accessories must have a minimum accessory reference voltage of 500 V. Only use the original accessories contained in the scope of delivery and offered by the manufacturer to achieve maximum safety for the patient and the dentist. The characteristics of the applied parts and wires are adapted to the output power and output voltage of the device, so that a safe operation is ensured for all operation modes and settings.
10. The device must be disconnected from the power supply during cleaning.
11. Service and maintenance tasks may only be executed by authorized specialized personnel.
12. The radiation emitted by the HF1 Surg Bipolar device during operation can interfere with the functionality of other electric devices. Computers, laptops and mobile phones should be kept away from the HF1 Surg Bipolar device. Data on computers and laptops should be saved beforehand.
13. If any safety provisions and operating instructions contained in this manual are violated, each warranty and liability of the manufacturer is cancelled.
14. In operating rooms, the device must only be used with pedal switches with AP labeling.

Operator regulation

According to Council Directive 93/42/EEC, the device is classified as medical device unit class IIb. Thus all directions of the European operator regulation apply.

Technical controls:

The user is committed to perform technical controls on a regular basis conforming to the following specifications:

Period: Every 24 months, starting with the 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
- Receptacles switch

Measurement of radio frequency (RF) output power at a load of 1 k Ω :

- Output CUT (50W)
- Output COAG (45W)
- Output (45W)

All results of measurements must be documented according to DIN EN ISO 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

- In order to avoid condensed water, make sure the device has been at room temperature for at least 30 minutes before you use it.

Start up

- Connect foot switch with device.
- First of all connect the power supply cable to the device, then connect it to the house power output.
- Equip the RF-handpieces with the appropriate electrode, by slightly loosening the handle tip.
- Put the hand pieces in the receptacles and connect the radio frequency (RF) cable to the device.
Please pay attention to the marks (coloured).
- Connect the neutral electrode.
- Press the on/off power switch (back of device).
- The device will IMMEDIATELY start with a self test.

Taking out of operation after use

1. Put the hand piece into the receptacle
2. Remove the electrode and reprocess it accordingly
3. Put the main switch 3 (back of the device) into zero position

Label At the back of the device:

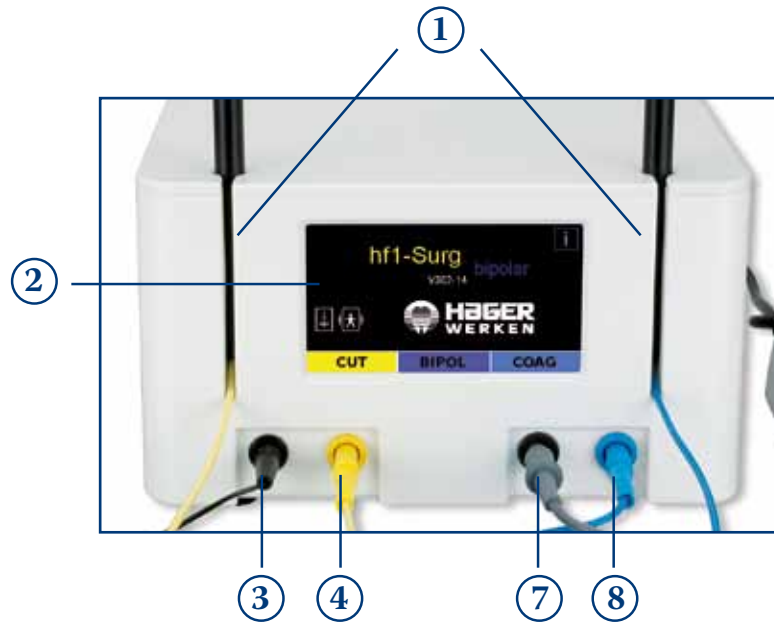


Legend

- ① Manufacturer
- ② On / off
- ③ Power fuse
- ④ Alternating current
- ⑤ CE-mark
- ⑥ Foot switch
- ⑦ Adhere to user manual
- ⑧ Disposal
- ⑨ Non-ionising radiation
- ⑩ Defibrillation-protected part
- ⑪ Date of construction

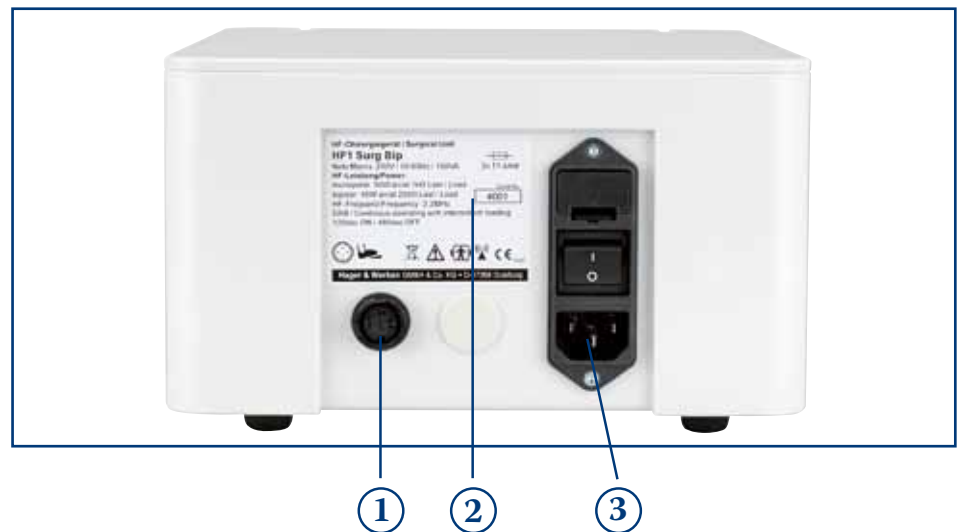
Front

1. Receptacles radio frequency (RF)
2. Display (touch screen)
3. Neutral electrode
4. Output HF CUT
7. Output HF BIPOL
8. Output HF COAG



Back

1. Foot switch
2. Type label
3. 230 V Power supply and main switch



Dual User Conception:

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

- Whenever a mode operation button is coloured, the mode can be selected and finished using either the touch screen or the receptacles.
- Once a mode has been selected, it cannot be interrupted with another mode button or removal of another receptacles.
- The BIPOLAR MODE can be selected by touch screen only.
- It is possible to pre-select a mode by activating the mode button, even without taking the hand piece from the receptacles.
- Except for BIPOLAR, a handpiece must be taken out of the respectacle for an activation.

RF



Standard hand piece



HF-electrode CUT



HF-electrode COAG



Neutral electrode

Start

Start the device by using the power switch at the back of the device.



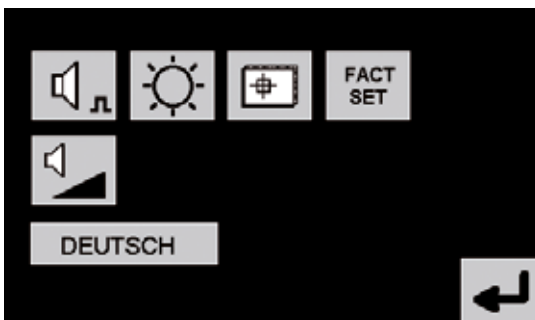
With acceptance of the user code the main menu will appear:

- CUT
- BIPOL
- COAG
- ⓘ Information
- Software Version

The following options are available:

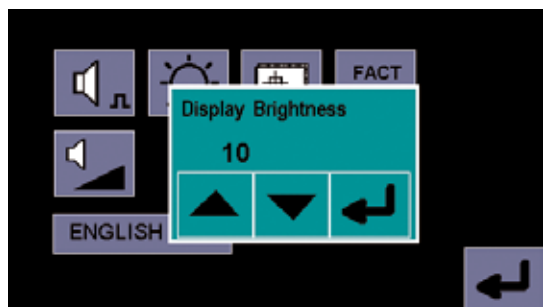
- Go to information menu by pressing the button ⓘ in the right upper corner
- Mode selection by buttons – pressing one of the coloured buttons directly leads to a mode. If a mode selection button is GREY, this is not possible as another mode is active.
- Mode selection by receptacle – by taking the hand piece out of the receptacle the according mode will be selected, if no other mode is active.

Information



ⓘ = Information

- Loudness acousting warning signals
- Return to factory settings
- Adjustment of display
- Brightness of display
- Language

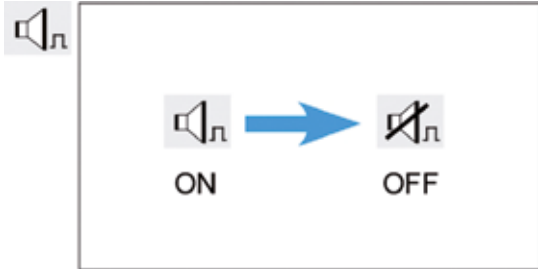


Touch one of the symbol buttons – with exception of FACT SET, SIGNAL ON/OFF, JUSTAGE DISPLAY, CODE SET – and a green window appears and settings can be changed by using the ▲ and ▼ buttons and accept by ← button.

	Adjustment of loudness for warning sound (window)
	On/Off for sound of button
FACT SET	Reset to factory setting
	Adjustment of display (special display)
	Adjustment of brightness display (window)
DEUTSCH	Language: Deutsch, English (window)

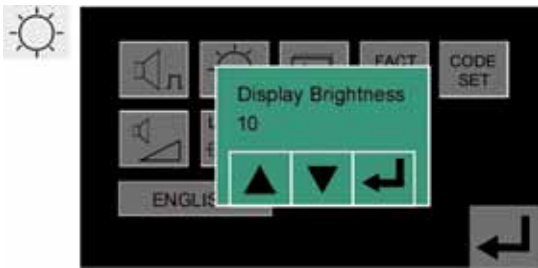
Settings:

Sound for buttons



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

Brightness of display



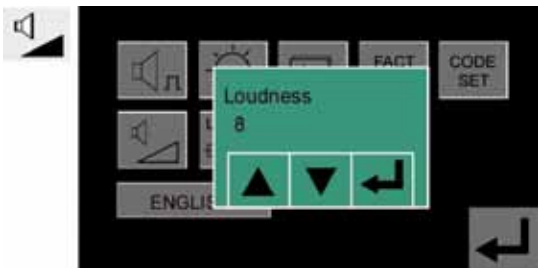
Brightness of the display can be set in steps 1 – 10, confirm with ↵ button.

Adjustment of display



The display can be adjusted horizontally and vertically. To do so, use a sharp instrument (i.e. pencil, ballpoint) and GENTLY touch the main lines, until a long acoustic signal occurs. Short acoustic signals the ongoing adjustment. To confirm, press the centre button with pressure until you hear a beep.

Loudness of warning sound



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

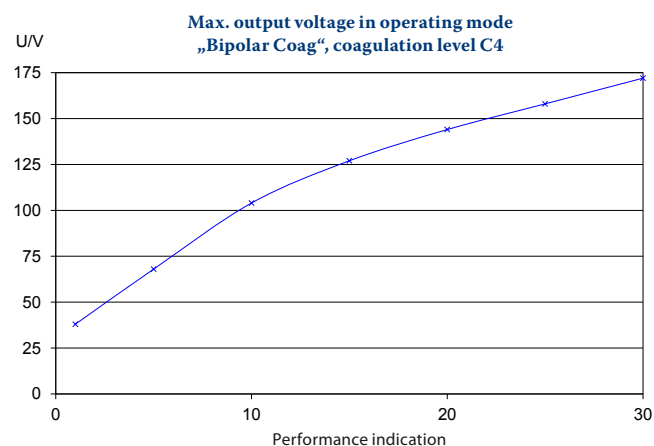
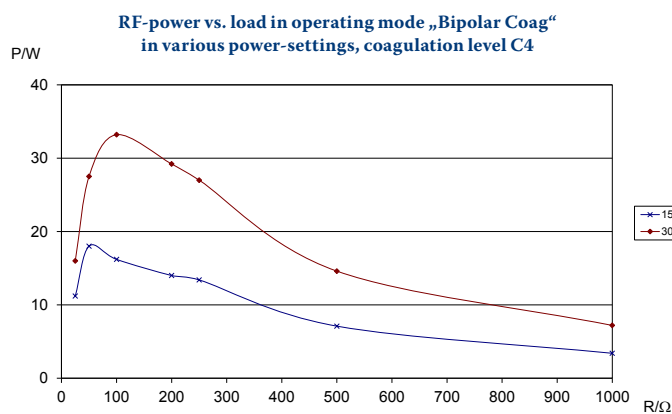
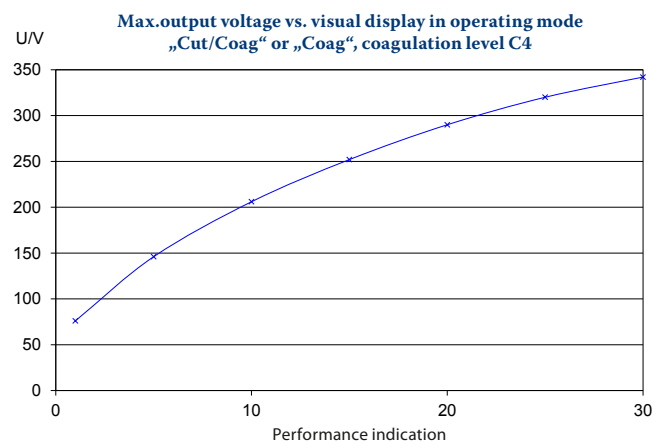
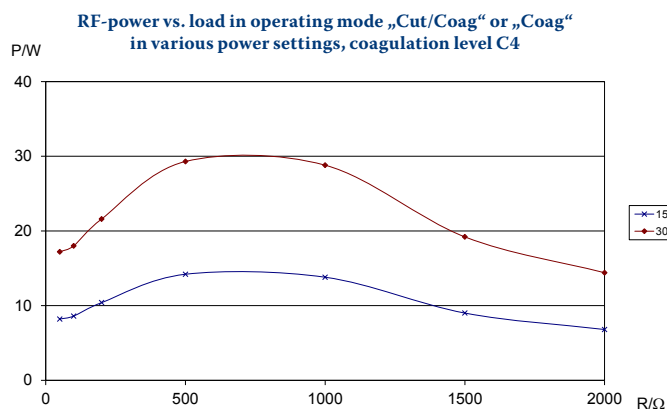
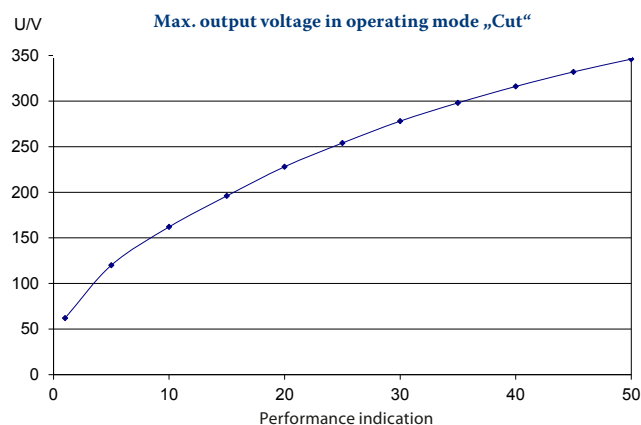
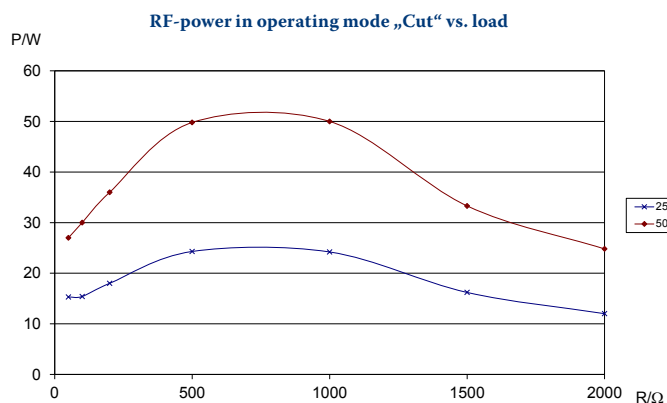
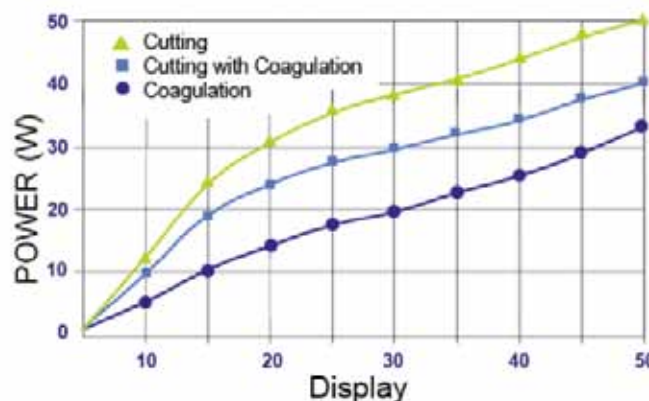


Reset to factory settings by pressing the button for a longer time - until you hear a beep. All storable parameters – except CODE – will be reset to factory settings.



Precision of power setting radio frequency (RF)

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 radio frequency will be displayed without the measuring unit [W] and will be scaled in accordance with the graph.



Selection of the correct radio frequency (RF) 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 haemostasis and can be used near to bones or to the periosteal tissue to avoid shrinking processes of the tissue.

This mode is also perfectly suited for histological examinations.

Tip: 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 haemostasis, does not disturb the primary wound healing, and disappears spontaneously after the wound is healed. These cuts do not need suturing, thus this mode is very effective in cosmetic surgery.

Tip: 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 haemostasis – a coagulation electrode (i.e. a ball or a thick needle) should gently touch the area for coagulation, only then the foot switch is activated. Bleedings from small vessels can be stopped using pulsed coagulation.

Tip: Gently place the electrode to the area (do not use any pressure!). Then the electrode will be activated.

Tip: Do not coagulate in a “blood lake“, instead press, spray or aspirate the blood off prior to 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.

Tip: First take the vessel with bipolar forceps, then activate the radio frequency.

Correct power setting

The success of all radio frequency measures strongly depends 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.

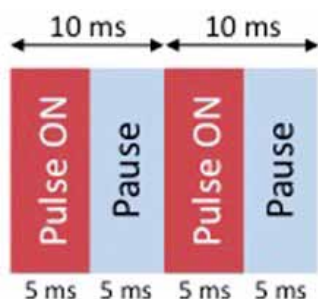
Wrong: too high power setting!

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 longer the pauses are in relation to the periods of power output, the lower the power gets. A pulse always is 10 ms long, power emission and pauses can be adjusted in 8 steps as level of coagulation (C) – see table.

Value of coagulation	Time of pause (ms)	Time of pulse (ms)	Maximal possible average power (W)
C 1	1	9	45
C 2	2	8	40
C 3	3	7	35
C 4	4	6	30
C 5	5	5	25
C 6	6	4	20
C 7	7	3	15
C 8	8	2	10



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 lower is the level of coagulation C that has to be set.

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

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

Description of the modes

HF-CUT MODE

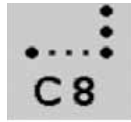
Symbols



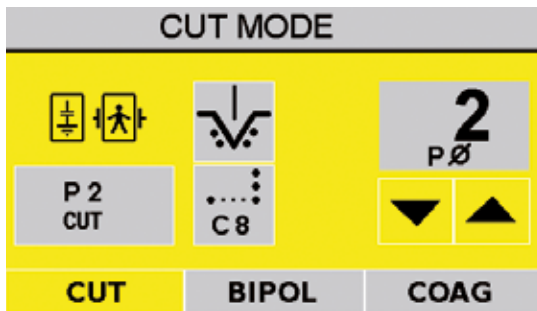
Permanent cutting
(CUT PERM)



Cutting with coagulation
(CUT COAG)



Level of coagulation



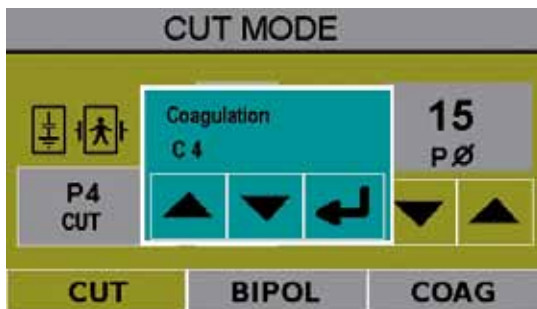
In CUT MODE – yellow display – the parameter for monopolar radio frequency can be selected.

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 ↵.

P1 CUT	35 P Ø
P2 CUT COAG	26 P Ø C 2
P3 CUT	28 P Ø
P4 CUT COAG	15 P Ø C 5
P5 CUT COAG	18 P Ø C 6

5 storage places are available in CUT MODE.

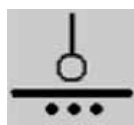
The actual selected parameters will be stored by touching one of the areas 1 – 5 for longer than 2 sec.

Recall stored values by simply touching the area number.

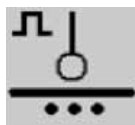
Back to CUT MODE with ↵.

HF-COAG MODE

Symbols



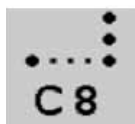
Permanent coagulation
(COAG PERM)



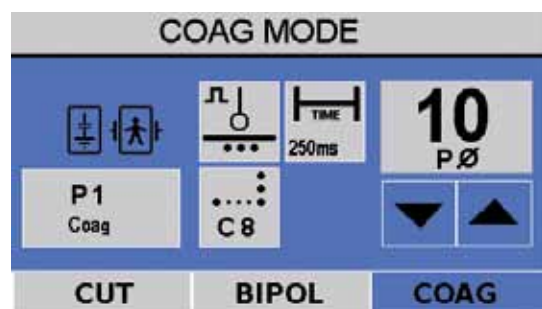
Pulsed coagulation
(COAGPULS)



Pulse duration



Level of coagulation



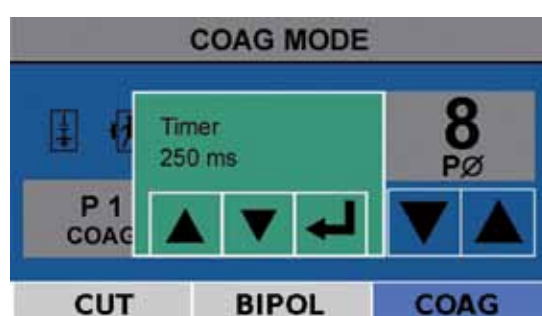
In COAG MODE – blue display – the parameters for monopolar coagulation can be selected.

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

Permanent or pulsed coagulation

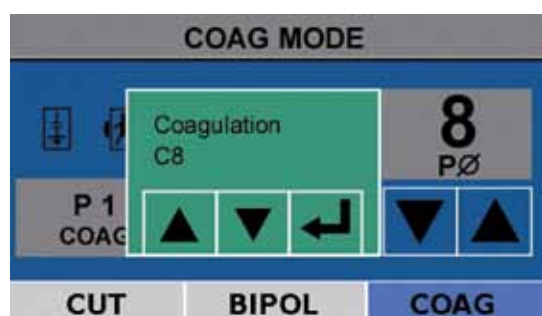
Level of coagulation C1 – C8. Activate by touching the button, adjust with ▲ and ▼ buttons.

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 ↵.

P1 COAG PULS	7 P.Ø	C8	250 ms
P2 COAG PULS	17 P.Ø	C3	350 ms
P3 COAG PERM	17 P.Ø	C1	
P4 COAG PULS	18 P.Ø	C3	200 ms
P5 COAG PERM	19 P.Ø	C3	

5 memory places are available.

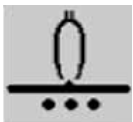
By pressing the area 1 – 5 for more than 2 sec, you store the current parameter..

Recall stored parameters by simply pressing the area number.

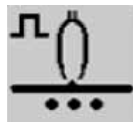
Back to COAG MODE with ↩.

HF-BIPOLAR MODE

Symbols



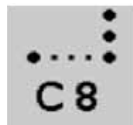
Permanent coagulation
(COAG PERM)



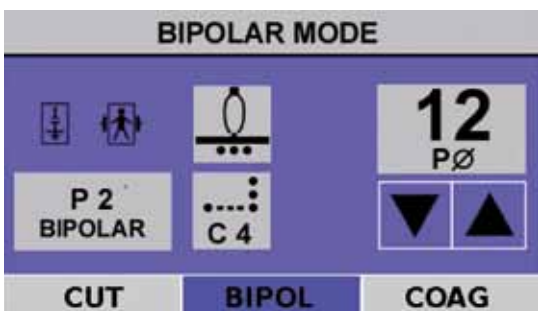
Pulsed coagulation
(COAGPULS)



Pulse duration



Level of coagulation



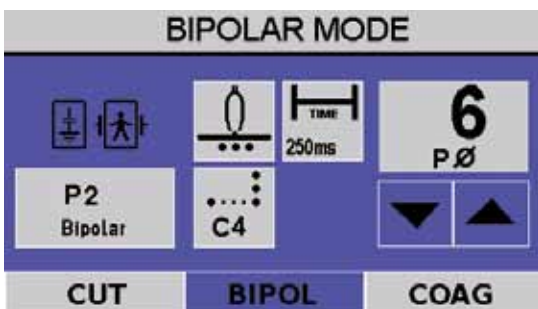
In COAG MODE – violet-blue display – the parameters for bipolar coagulation can be selected.

Power: from 10 – 100% of nominal power

Permanent or pulsed coagulation.

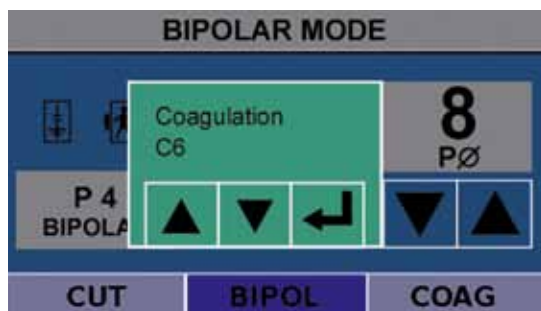
Level of coagulation C1 – C8, by selection with ▲ and ▼

P1 – P5 = memory places



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

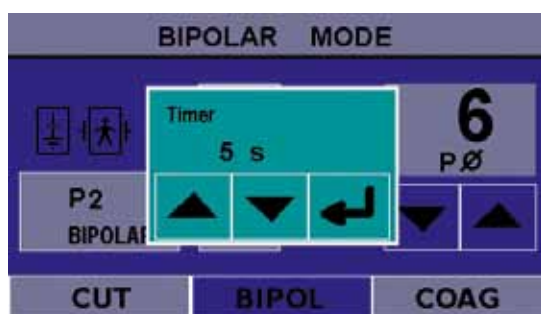
Confirm with ↩.



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 ↵.



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

Confirm with ↵.

P1 BIPOLAR PULS	10 P.Ø	C6	5 s
P2 BIPOLAR PERM	6 P.Ø	C4	
P3 BIPOLAR PERM	11 P.Ø	C3	
P4 BIPOLAR PERM	10 P.Ø	C7	
P5 BIPOLAR PULS	25 P.Ø	C5	350 ms

5 memory places are available.

By pressing the area 1 – 5 for more than 2 sec, you store the current parameters.

Recall stored parameters by simply pressing the area number.

Back to BIPOLAR MODE with ↵.

Cleaning and disinfecting the HF1 Surg Bipolar housing

- Only use cleaning and disinfection wipes approved by the manufacturer to be used for plastic housings.

Conditioning advice for hand pieces of HF1 Surg Bipolar (DIN ISO 17664:2004)

General information:

- Only use cleaning and disinfection agents that have been tested and approved by the relevant national bodies.
- The hand piece and its cable can be sterilised together in the autoclave, using a foil sterilisation bag (e.g. steriCLIN-heat sealing bag).

Limitation of reprocessing:

Frequent reprocessing has only got a small impact on this instrument. The instrument's shelf life is mainly determined by wear and damage by use.

Place of handling:	Clean surface with a disposable cloth or paper.
Storage and transport:	No special requirements.
Preparations for cleaning:	Disassemble product into its components (For electrode: see separate instructions).
Cleaning:	Use cleaning wipes and suitable cleaning agents to clean the product. No mechanical cleaning. Keep away from running water.
Disinfection:	Use disinfectant wipes and/or a disinfectant spray to disinfect the product. No mechanical disinfection. Keep away from running water.
Maintenance:	No special requirements.
Packaging:	Standardised packaging material may and should be used for sterilisation processes.
Sterilisation:	Vapour sterilisation at 134 °C for 5 minutes and 2 bar excess pressure.
Control/Functional check:	Sight check on damages, wear, deformation.
Storage:	No special requirements.

The a.m. instructions have been validated as SUITABLE for preparation of a medical device and its re-use by the medical device manufacturer. It is the reprocessor's responsibility that the actual reprocessing achieves the required results with the equipment and materials applied and personnel involved in the reprocessing site. Normally, validation and routine control are necessary. Furthermore, the reprocessor should evaluate any deviation from the provided instructions regarding efficiency and possible adverse consequences.

ERROR management

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

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

ERROR Groups:

INFORMATION – can be confirmed with the return button

- If a hand piece is in the respectacle and should be activated

DATA ERRORS – can be confirmed with the return button

- All relevant data will always be checked on plausibility and double stored
- AN ERROR will be displayed, if
 - > an ERROR is detected during reading/storing
 - > a parameter shows wrong values

ERRORS, which stop the initiation

- ERROR in hardware
- ERROR in monitoring
- ERROR in communication
- ERROR in ROM

If any errors occur, please contact the HAGER & WERKEN Service.

Environmental Policy

The EU-guideline 2012/19/EU on the disposal of electronic and electrical equipment says that:

This equipment must not be disposed of with domestic waste.

The user is legally obliged to dispose of this equipment at public collection points set up for this purpose or to return it to the point of sale at the end of its service life.

Catalogue of error messages

Message	Error no.	Description
Backup-Data	0016	Backup of configuration parameter
Backup-Data	0001	Backup of working parameter
Backup-Data	0256	Backup of mode parameter
Standard-Data	0032	Default value configuration parameter loaded
Standard-Data	0002	Default value work parameter loaded
Standard-Data	0512	Default value mode parameter loaded
Data-Error	0064	Correction configuration parameter
Data-Error	0004	Correction work parameter
Data-Error	1024	Correction mode parameter
Hardware-Error	0001	ERROR_VOLTAGE_NOT_LOW
Hardware-Error	0002	ERROR_CURRENT_NOT_LOW
Hardware-Error	0003	ERROR_DRVBACKLAS_NOT_HIGH
Hardware-Error	0004	ERROR_DRVBACKPDT_NOT_HIGH
Hardware-Error	0005	ERROR_HFBACKM1_NOT_HIGH
Hardware-Error	0006	ERROR_HFBACKM2_NOT_HIGH
Hardware-Error	0007	ERROR_HFBACKB_NOT_HIGH
Hardware-Error	0008	ERROR_HFDRVMON_NOT_LOW
Hardware-Error	0009	ERROR_FIN1_NOT_HIGH
Hardware-Error	0010	ERROR_FIN2_NOT_HIGH
Hardware-Error	0011	ERROR_FOOT_NOT_HIGH
Hardware-Error	0012	ERROR_VOLTAGE_OUT_OF_RANGE
Hardware-Error	0013	ERROR_CURRENT_OUT_OF_RANGE
Hardware-Error	0014	ERROR_DRVBACKLAS_NOT_LOW
Hardware-Error	0015	ERROR_DRVBACKPDT_NOT_LOW
Hardware-Error	0016	ERROR_HFDRVMON_NOT_HIGH
Hardware-Error	0017	ERROR_VOLTAGE_OUT_OF_RANGE_HF1
Hardware-Error	0018	ERROR_VOLTAGE_OUT_OF_RANGE_HF3
Hardware-Error	0019	ERROR_CURRENT_OUT_OF_RANGE_HF3
Hardware-Error	0020	ERROR_CURRENT_OUT_OF_RANGE_PDT
Hardware-Error	0022	ERROR_HFBACKM1_NOT_LOW
Hardware-Error	0023	ERROR_HFBACKM2_NOT_LOW
Hardware-Error	0024	ERROR_HFBACKB_NOT_LOW
Hardware-Error	0026	ERROR_FOOT_NOT_LOW
Hardware-Error	0027	ERROR_UNKNOWN_OPMODE
Hardware-Error	0028	ERROR_ROM_CHECK
Hardware-Error	0029	ERROR_RAM_CHECK
Hardware-Error	0030	ERROR_EE_CHECKSUM
Diagnosis-Error	0257	RF-power too high
Diagnosis-Error	0258	RF-power too low
Diagnosis-Error	0259	RF analogue voltage too high
Diagnosis-Error	0266	Idle analogue voltage too high
Diagnosis-Error	0267	Idle analogue current too high
Diagnosis-Error	0511	RF-power out of range
Communication-Error	0513	No connection to power supply electronics
ROM-Error	Checksum	Failed check of programme storage
Power-Off	--	Device switched off

Application examples: RF

RF CUT & CUT COAG				
PRG No.	programme	power (Watt)	coagulation grade	Indications & remarks
1	CUT	35		(filtered wave) - sulcus dilatation - gingivectomy - internal gingivectomy
3	CUT	28		- open curetage - tumor resection - flap preparation - vestibulum plastic - excision
2	CUT COAG	26	C2	(slightly modulated or non filtered wave) - gingivoplastic - exposure of teeth, stubs, approximal steps or crown edges
4	CUT COAG	15	C5	- removal of hyperplasia for ablation of tissue if simultaneous coagulation is requested with the cut
5	CUT COAG	18	C6	(Attention: 10% loss of tissue about 24 h post operatively due to extended lateral heat) Use only if distance to bone or periost is sufficient!

RF COAG PERM & COAG PULSE					
PRG No.	programme	power (Watt)	coagulation grade	time (ms)	Indications & remarks
1	COAG PERM	25	C3		(strong modulated wave = half wave modulated) - only for coagulation
2	COAG PERM	30	C1		- little use in the oral cavity! - a continuous coagulation should be considered merely in patients, which are therapeuted by blood thinning medication
3	COAG PERM	7	C3		Attention: plane and deep areas!
4	COAG PULSE	35	C3	200	pulse coagulation (patented in HF-Surg and LaserHF units) - punctual with a thick needle electrode, optimal for COAG
5	COAG PULSE	30	C1	200	- denaturation of top cell layer, hemostasis

RF BIPOLAR PERM & BIPOLAR PULSE					
PRG No.	programme	power (Watt)	coagulation grade	time (ms)	Indications & remarks
1	BIPOLAR PERM	25	C3		(strong modulated wave = half wave modulated)
2	BIPOLAR PERM	30	C1		- plane and deep areas - very intensive
3	BIPOLAR PERM	7	C3		- better use the pulse coagulation
4	BIPOLAR PULSE	35	C3	200	- coagulation of larger vessels in the oral cavity
5	BIPOLAR PULSE	30	C1	200	- the use of bipolar forceps may replace suturation or fibrin glue.



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