

---

MODUL SYSTEM  
ELEKTROTOM 400  
Operating Instructions and Technical Data

---

9. The principle of HF-surgery	15
10. Terminology of electrosurgery	16
10.1 Electrotomy - Cutting	16 - 17
10.1.1 Notes on the intensity for cutting	17
10.2 Coagulation	18 - 19
10.2.1 Notes on the intensity for coagulation	20
10.3 Spray-coagulation or fulguration	20
10.4 BI-coagulation	21 - 22
10.5 The MARTIN BI-CO-MATIC device	22
10.5.1 Notes on BI-coagulation technique	23
10.5.1.1 Adhesive effect	23
10.5.1.2 Non-coagulation effect	23
11. Output as function of load resistance	24
11.1 Cutting	24
11.2 Modulation	24
11.3 Spray-coagulation	25
11.4 Contact-coagulation	25
11.5 BI-coagulation	26
12. Output as function of power control	27
12.1 Cutting	27
12.2 Modulation	27
12.3 Spray-coagulation	28
12.4 Contact-coagulation	28
12.5 BI-coagulation	29
13. Technical safety controls	30
14. Guarantee	30
15. The MARTIN ENDOMATIC circuit	31

## 2. TECHNICAL DESCRIPTION

With the MARTIN ELEKTROTOM 400 MODUL SYSTEM, you possess an electrosurgery unit which is constructed according to the latest knowledge of modern electronics according to IEC 601.

Simple operation, clearly arranged controls and the built-in safety circuits according to the new German medical safety law (MedGV) are the highlights of this unit.

The function assemblies are constructed as easy interchangeable modules and allow quick and simple service.

The power supply which produces the DC voltage for the generators is constructed as a high frequency switching power supply. For this reason the unit works with mains voltages which can vary to  $\pm 20\%$ .

The electrosurgical generator MARTIN ELEKTROTOM 400 MODUL SYSTEM has the following features:

- \* compact size and light weight under 10 kg;
- \* a smooth front surface without outstanding knobs and switches allows easiest disinfection. All functions are to switch by soft touch pushbuttons;
- \* no openings or ventilating ducts at the upper surface, no fan, no temperature problems because there are generators with a high efficiency;
- \* simple control with clearly arranged controls with international symbols. Digital indicator shows the chosen output power, which is internal stored even if the unit is switched off;
- \* four different current types for electrosurgical cutting: from smooth cut to heavy scab formation;
- \* two current types for coagulation: high power for contact-coagulation and a high modulated current with a high crest-factor and high peak voltage for spray-coagulation (fulguration);
- \* a separate generator for bipolar coagulation with patented MARTIN-BI-CO-MATIC sensing circuit with starting function and alternative footswitch;
- \* test pushbutton for function test;
- \* combination receptacles for MARTIN coaxial cables and for disposables;
- \* all connections for active electrodes, patient plate and footswitches at the front side;
- \* monitoring circuit for patient plate, to signal defects of patient plate, cable and its connections;
- \* visual and audible monitoring of activated current with coloured indicator lights and different acoustic tones;
- \* infinitely variable output power regulation;

#### 4. IMPORTANT REMARKS

Before using check the unit and the accessories:

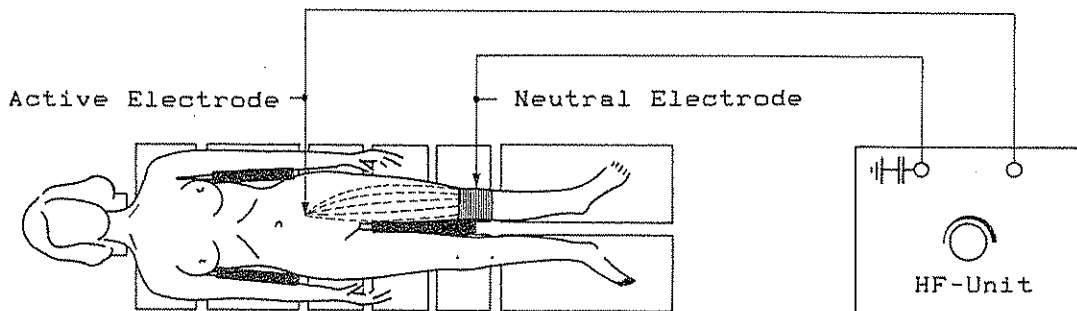
- look for defects at the isolation of cables and plugs;
- do the unit and the accessories belong together?

Furthermore, please check:

- the acoustical warning signal for the connection of the patient plate (disconnect the patient plate);
- endoscopic instruments for use with an electrosurgical generator should be checked for defective insulation. Don't use defective instruments.

Before the patient plate is fixed, please check the patient's position:

- the patient should not come in contact with other grounded metal or conductive parts;
- elastic surfaces on operation tables are a little conductive for downloading statical electricity. The patient is not proper insulated for HF-currents. Place dry and absorbent towels in-between;
- if there is to expect perspiration or moisture, put an insulating foil between the towels to prevent the towels of moisting through;
- to prevent liquid under the patient's body, absorbent towels are to place between the insulating foil and the patient;
- areas of profuse perspiration, at joints of body or limbs, or skin to skin contact areas, should be kept dry by placing towels in-between (arm-body, leg-leg, mamma).



Place dry and absorbent towels in between.

If electrosurgery is used, caution is necessary. The following rules are to observe:

- the current intensity should be set as low as possible for the intended application;

Remark:

Unsatisfactory effects with regular setting could be due to improper placing of the neutral electrode or bad contact of connectors. Broken wires under its insulation or a polluted electrode may be the reason. Before current intensity is increased, these points should be checked.

- if the patient is moved, check patient plate and cables;
- do not touch the active electrode to grounded metal parts or to the patient plate for function proving;
- when operating on parts of the body with small cross section, the bipolar technique can be used to avoid unintentional coagulations to other areas;
- the use of flammable anaesthetic agents, nitrous oxide and oxygen should be avoided when using the electrosurgical unit in the area of the thorax or head. Exception can be taken, if an anaesthetic gas evacuation system or anaesthetic gas concentration monitor are in use. One should allow enough time for flammable substances, such as cleaning and disinfection solutions or adhesive solvents to evaporate after their use. If the evaporation is not sufficient there is a possibility that flammable substances can collect under the patient or in body cavities, such as the navel or vagina. Accumulated substances must be removed before electrosurgery. The possibility of gas explosion or fire should always be kept in mind. Electrosurgical sparks may ignite oxygen enriched textiles or swabs;
- electrosurgical units may cause interferences with improperly shielded electromedical devices.

#### 4.1 CARDIAC PACE-MAKERS

There is a possibility that electrosurgery can interfere or damage pace-makers or pace-maker electrodes. If in doubt, consult the cardiology department or a specialist. Before treating outpatients, ask if the patient is using a pace-maker.

#### 4.2 IMPORTANT MEASURES AT INTRACARDIAL OPERATIONS

- visual check of proper connection of the potential equalization conduction between the device that can change places (safety class I) and the connection to external protective system;
- visual check of correct coupling of several units together;
- visual check of correct patient connections and used sensors to the unit;
- function check of all connected units without patient;

#### 4.4 CARE AND STERILISATION OF ACCESSORIES

Good operation results can only be guaranteed when the active and neutral electrodes are well cleaned and show a clean surface.

Connecting cable and insulation cover must be checked permanently. Do not use parts with defective insulation.

The following sterilisation temperatures are allowed:

	gas sterilisation up to 70° C	steam sterilisation 134° C	hot air sterilisation 200° C
connecting cables for electrode handles	yes	yes	no
electrode handles	yes	yes	no
active electrodes	yes	yes	yes
forceps for bipolar coagulation	yes	yes	no
neutral electrodes	yes	yes	no

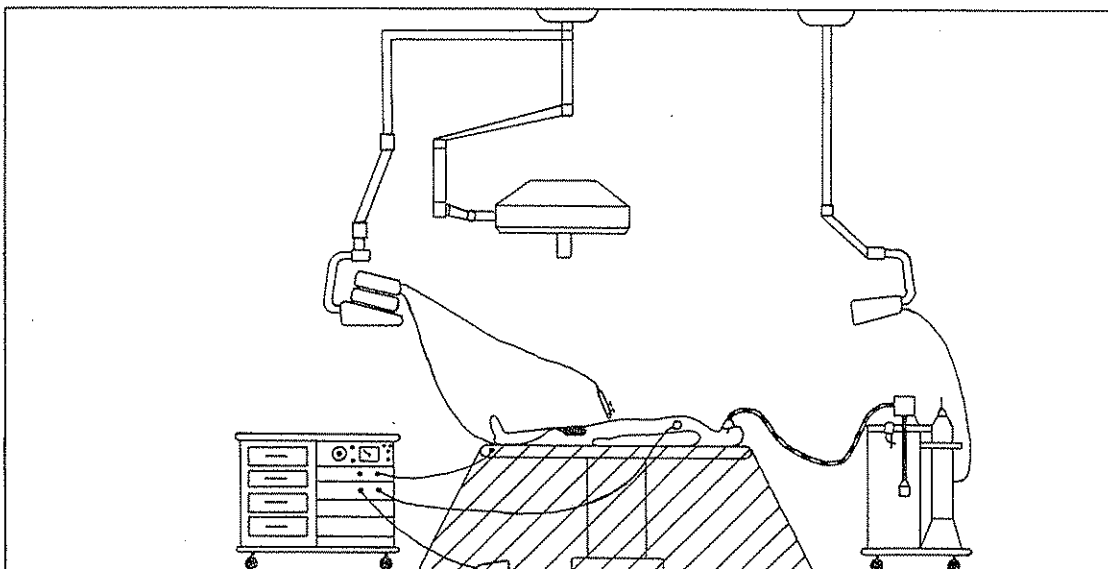
#### 4.5 CLEANING AND DISINFECTION

The unit can be cleaned with the usual, non-alcoholic cleansers on all surfaces including the operation board.

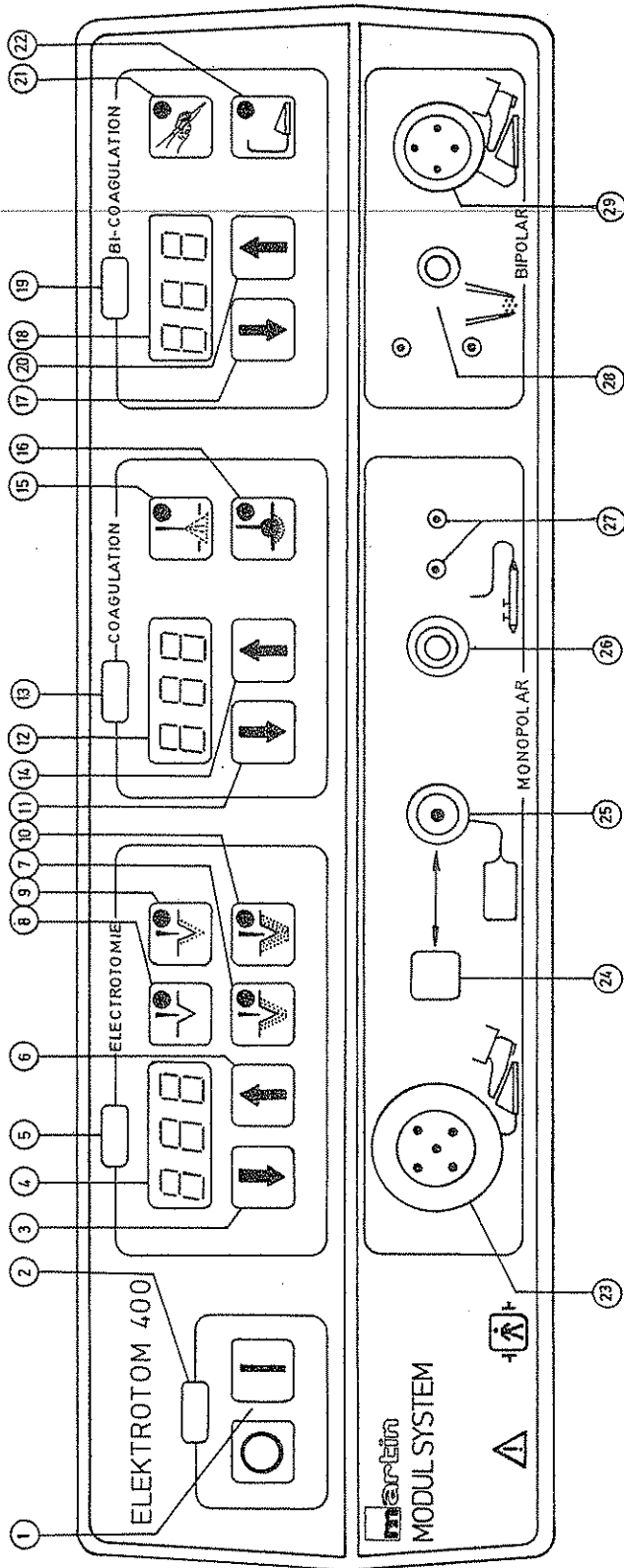
Unit and accessories can be disinfected with the usual disinfectants used in the operation room.

#### 4.6 ATTENTION WHEN USING FOOTSWITCHES

In the area described as "medical zone" only footswitches which are proved and described as "OP-safe" may be used. Please see drawing below.



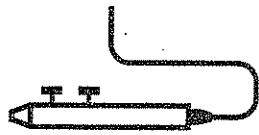
6. FUNCTION OF OPERATING ELEMENTS AND SIGNAL LAMPS:



- 1 Mains switch ON/OFF
- 2 Mains signal lamp, green
- 3 Switch HF-power CUT LOWER
- 4 LED display monitor for CUTTING
- 5 Signal lamp CUT HIGHER
- 6 Switch HF-power CUT HIGHER
- 7 Button BLEND II
- 8 Button PURE CUT
- 9 Button BLEND I
- 10 Button BLEND III
- 11 Switch HF-power COAGULATION LOWER
- 12 LED display monitor for COAGULATION
- 13 Signal lamp COAGULATION
- 14 Switch HF-power COAGULATION HIGHER
- 15 Button FULGURATION

- 16 Button CONTACT-COAGULATION
- 17 Switch for HF-power BI-COAGULATION LOWER
- 18 LED display monitor for BI-COAGULATION
- 19 Signal lamp BI-COAGULATION
- 20 Switch HF-power for BI-COAGULATION HIGHER
- 21 Switch MARTIN-BI-CO-MATIC
- 22 Footswitch ON/OFF
- 23 Connection socket for double-pedal footswitch
- 24 Test switch for safety circuit
- 25 Connection socket for neutral electrode
- 26 Connection socket for active electrode
- 27 Additional socket for disposable handle
- 28 Connection socket for instruments for BI-Coagulation
- 29 Connection socket for single-pedal footswitch (BI-Coagulation)

6.2 EXPLANATION OF THE SYMBOLS PRINTED ON THE OPERATION BOARD



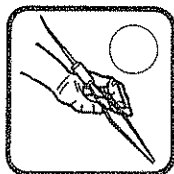
Connection for electrode handle with double fingerswitch for cutting or coagulation.



Connection for footswitch (double-pedal footswitch / single-pedal footswitch).



Connection for the neutral electrode.



Switching-on button for MARTIN BI-COMATIC circuit. When button lights, the HF-power for BI-Coagulation is automatically switched on after the forceps' tip has touched the tissue.



Connection for bipolar coagulation.



Symbol for classification of the unit in class BF. The output of the unit is DEFI-BRILLATOR PROOF.



Symbol for classification of the unit in class CF.



Attention! Read instructions!

## 7. SETTING\_UP

Connect the unit to the mains, connect the neutral electrode and the electrode handle with active electrode. Then, after pressing button I (at the mains on/off switch) and one of the current selection buttons (button 7, 8, 9, 10, 15 or 16), the unit is ready for use. The green signal lamp 2 must light.

For current selection, please see page 13.

The cutting or coagulation current is switched on by pressing the yellow push-button (CUT) or the blue push-button (COAG) at the double electrode handle; at the double-pedal footswitch with the yellow (CUT) or blue (COAG) pedal.

## 8. FUNCTION\_CHECK

Before using the unit, all functions have to be checked.

Please make the following function test:

1. Pull out of socket 25 the connecting cable for the neutral electrode. The monitoring circuit for the neutral electrode sounds and the red warning light 24 flashes.
2. Reconnect the connecting cable for the neutral electrode into socket 25. The warning signal should disappear and the red warning light should not flash anymore.
3. Connect connecting cable for electrode handle to socket 26.

With fingerswitch or footswitch switch on the different currents. The signal lamps 5 and 13 have to light and the acoustic signal has to sound.

4. Connect connecting cable for bipolar forceps to socket 28.

Switch on the current by means of forceps or footswitch. The signal lamp 19 has to light and the acoustic signal has to sound.

### ATTENTION!

The unit is faulty and must be checked when the HF-switching-on-signal flashes without the footswitch or electrode handle being connected. If the fault is indicated after connecting the footswitch or electrode handle, one of these accessories is defect. Check these parts immediately and replace them if necessary.

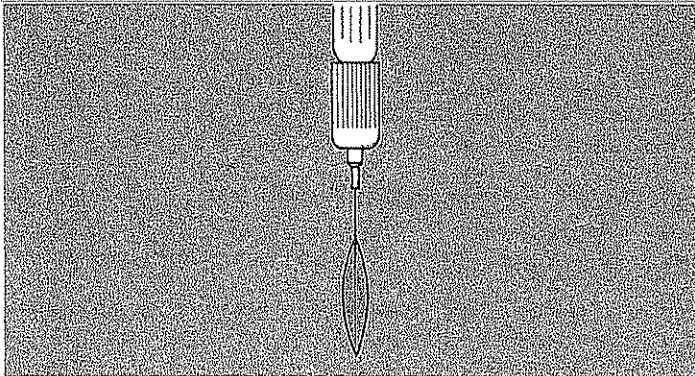
The connecting cable or the neutral electrode is defect when despite connected neutral electrode the red field 24 flashes and the warning signal is audible when the HF-power is switched on. In this case replace the parts as otherwise the unit cannot be used.

10. TERMINOLOGY OF ELECTROSURGERY

10.1. ELECTROTOMY - CUTTING

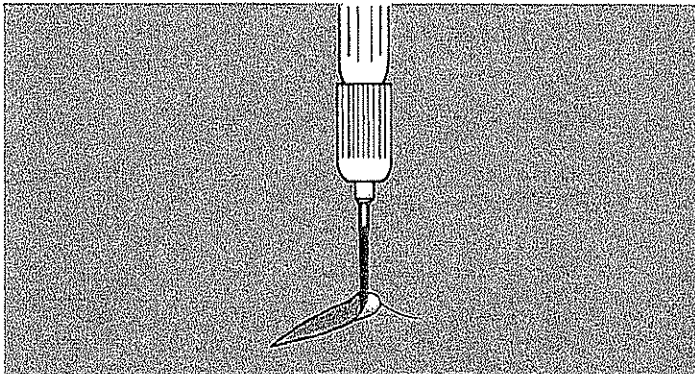
Active electrodes with a relatively thin cross-section such as needle, knife, lancet, wire loop or band loop electrodes are used for cutting.

The choice of the different electrode forms depends on the intended cutting effect.

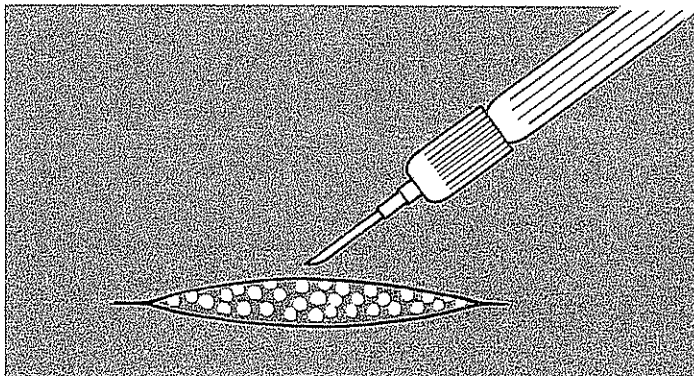


Needle or lancet electrodes with a cross-section which is as thin as possible are best suited for smooth cuts without scab formation (surface coagulation).

Smooth cutting makes it easier to prevent the formation of scab on the surfaces of the cut.



Electrodes with a large cross-section make it difficult to obtain a smooth cut, causing simultaneous scab formation at the surfaces of the cut.



Lancet or knife electrodes are best suited for cutting in fatty tissue.

Because of the increased electrical resistance, the intensity may have to be selected 1-2 scale graduations higher.

## 10.2 COAGULATION

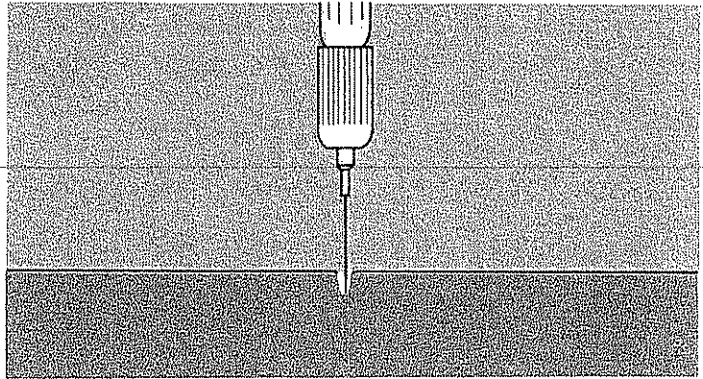
There is a wide range of indications for coagulation in general surgery and many different types of active electrodes and even instruments are used.

Coagulation with the smallest possible extension of the coagulation area is carried out with fine needle electrodes.

### Examples:

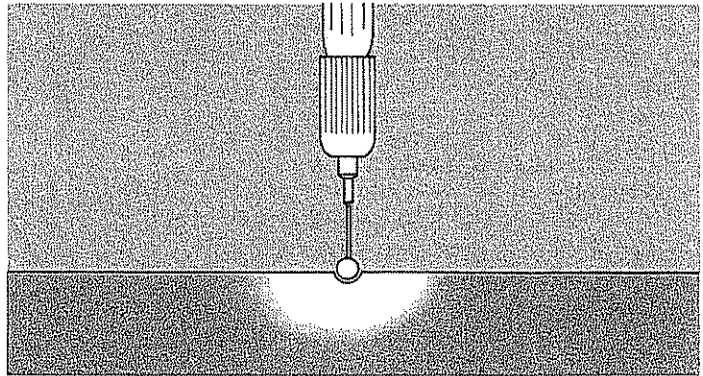
Cyclo-diathermy on detachment of the retina, epilation.

To avoid a cutting effect, current quality II is preferable.

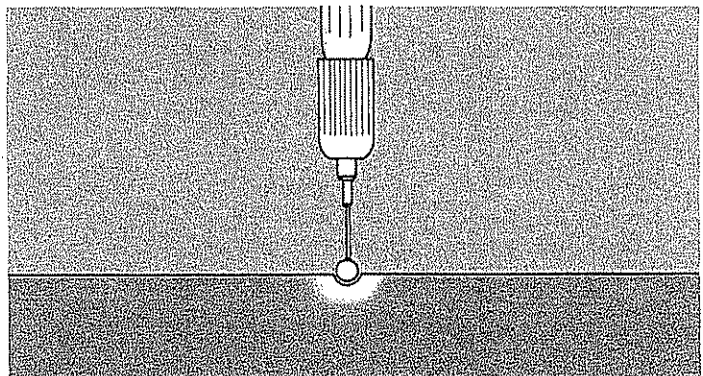


The extension of the coagulation area can be controlled by varying the intensity in addition to the choice of electrodes.

With low intensity settings, coagulation takes place slowly and extends over a relatively large area.



With high intensity settings, rapid and limited coagulation. The tissue dries out in the immediate area of the coagulation electrodes and the current flow declines because of the increased resistance.



10.2.1 NOTES ON THE INTENSITY FOR COAGULATION

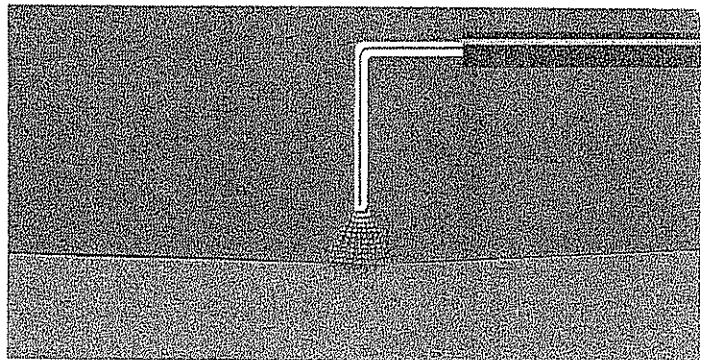
Indication	Dosage regulator setting	
	Contact-Coagulation	Spray-Coagulation
Coagulations with ball or plate electrodes	3 - 5	-
Coagulations with hemostatic forceps held on the tissue	3 - 5	-
Coagulations with knife electrodes, needle electrodes, cutting snares during TUR	-	4 - 6

These values are empirical values. They can shift upwards with unfavourable electrical relations.

10.3. SPRAY-COAGULATION OR FULGURATION

This type of coagulation is carried out with HF-current of very high voltage and strong modulation (high Crest-factor). For this purpose sparks are made to jump from a suitable electrode across an air gap onto the tissue. The heat produced thereby effects a coagulation restricted to the tissue surface.

For spray-coagulation press button 15.



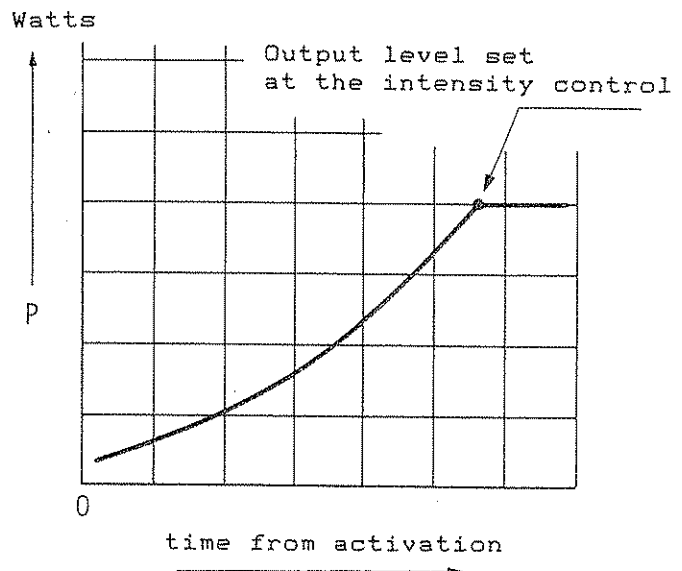
Both "shanks" of the forceps used are mutually insulated and are connected to be bipolar cable. One "shank" is for current inlet, the other "shank" for current outlet. If a vessel or a piece of tissue is gripped with these special forceps and high frequency current is applied, then according to the intensity, heat is generated in the tissue squeezed between the two metal points, and the intended coagulation effect is achieved.

The high frequency current for BI-coagulation must be absolutely earth-free, so that the current can only flow between the tips of the forceps and cannot be transferred to the patient. The necessary high frequency voltage for this process is so low, that the special forceps do not have to be insulated. The surgeon can hold them in his hand without any fear of burning himself.

### 10.5 THE MARTIN BI-CO-MATIC DEVICE

Because of its special advantages, BI-coagulation is frequently preferred in micro-surgical operations and wherever extra care of tissues should be taken during hemostasis. Here, it is often cumbersome and difficult to use a footswitch for controlling the BI-coagulation.

With the MARTIN BI-CO-MATIC feature, which was developed by us and is incorporated in all Elektrotom units, the high frequency current can be switched on when the two tips of the coagulation instrument make contact with tissue and slowly accelerates it in a pre-determined, adjustable curve. The delayed increase in current compensates for the decrease in tissue resistance during the early phase of a coagulation and prevents an unintentionally high flow of current. The BI-CO-MATIC can be switched on or off by the push button.



When the BI-CO-MATIC feature is off, the current must be activated by footswitch.

### ATTENTION AT ENDOSCOPIC OPERATIONS

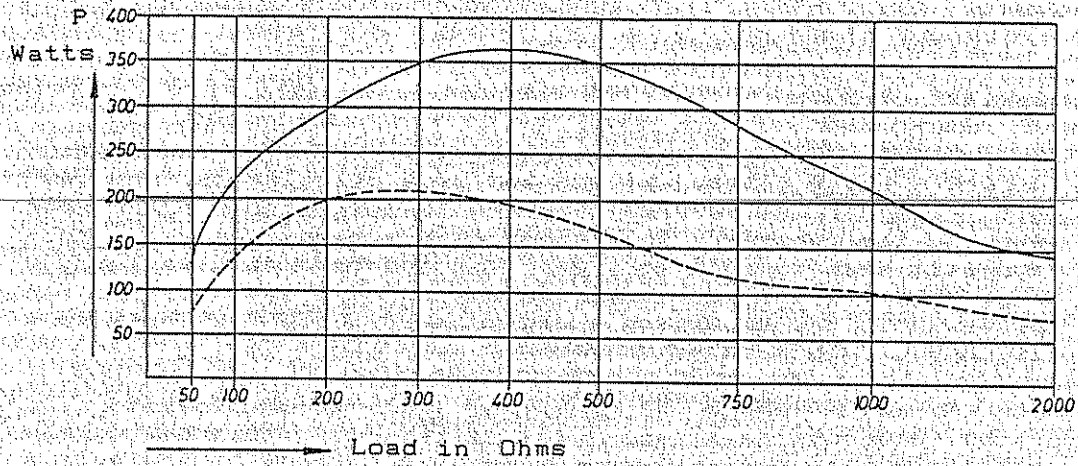
At endoscopic operations the MARTIN BI-CO-MATIC device is to turn off. When pushing button 22 (for operating with foot-pedal) the MARTIN BI-CO-MATIC device is turned off. The button lights up.

Please verify the correct connection.

11. Output as function of load resistance  
(Power characteristic)

11.1 Current type: Cutting

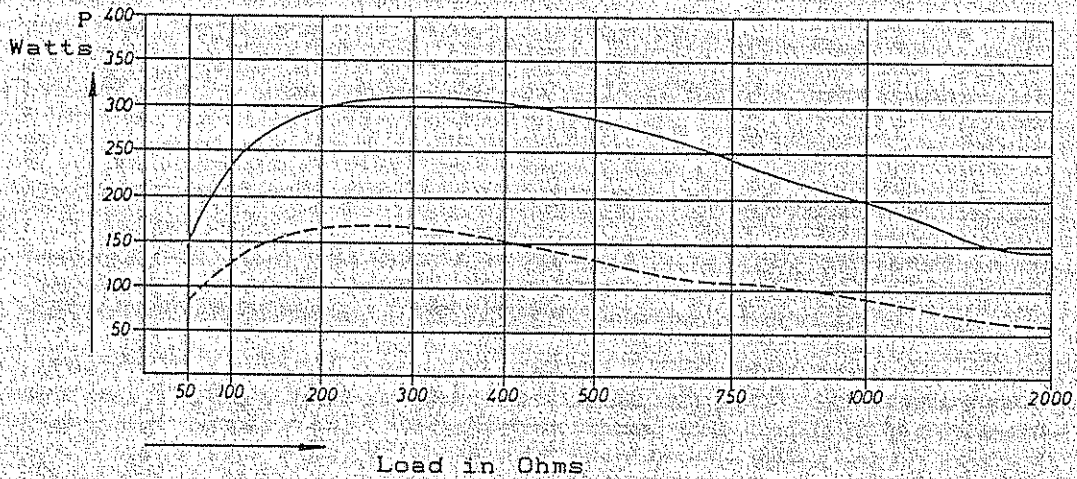
— full power (step 10)  
- - - half power (step 5)



Output as function of load resistance  
(Power characteristic)

11.2 Current type: Modulation

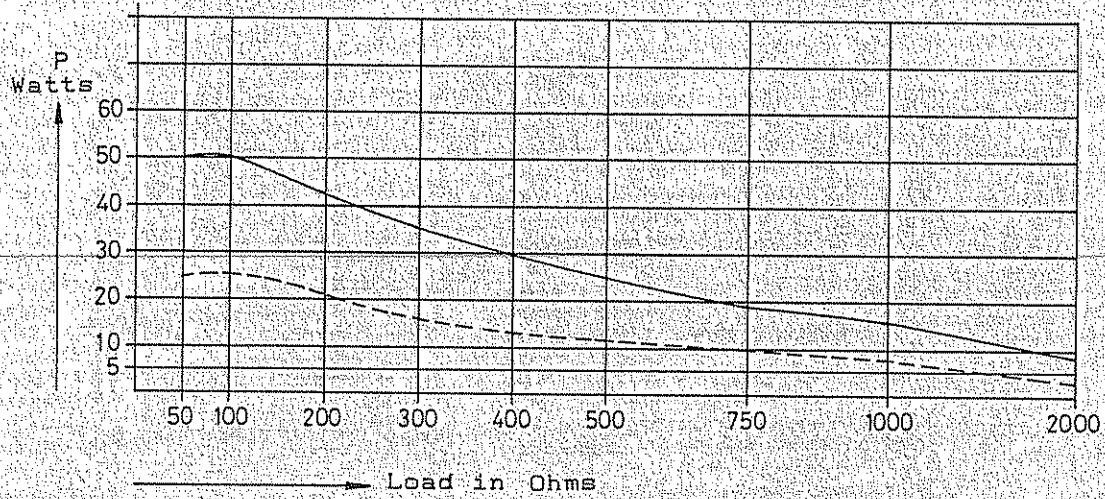
— full power (step 10)  
- - - half power (step 5)



Output as function of load resistance  
(Power characteristic)

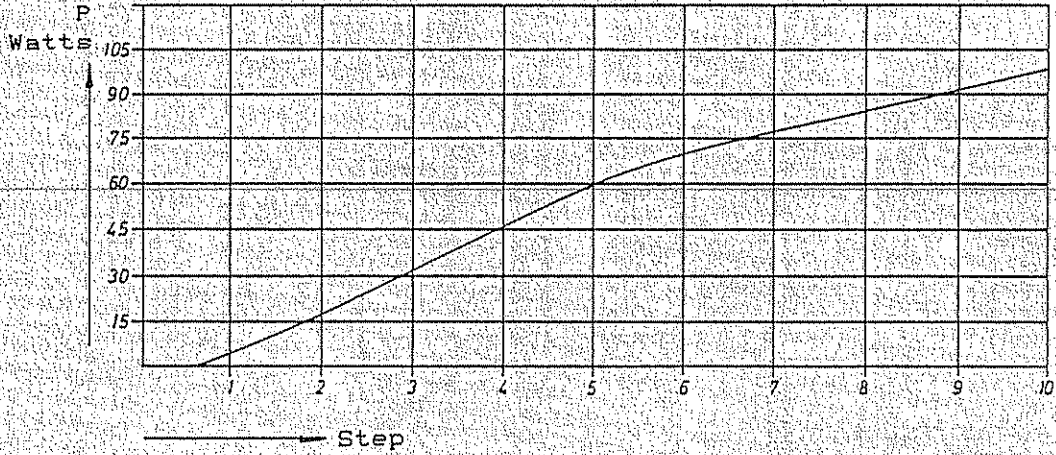
11.5 Current type: BI-Coagulation

— full power (step 10)  
- - - half power (step 5)



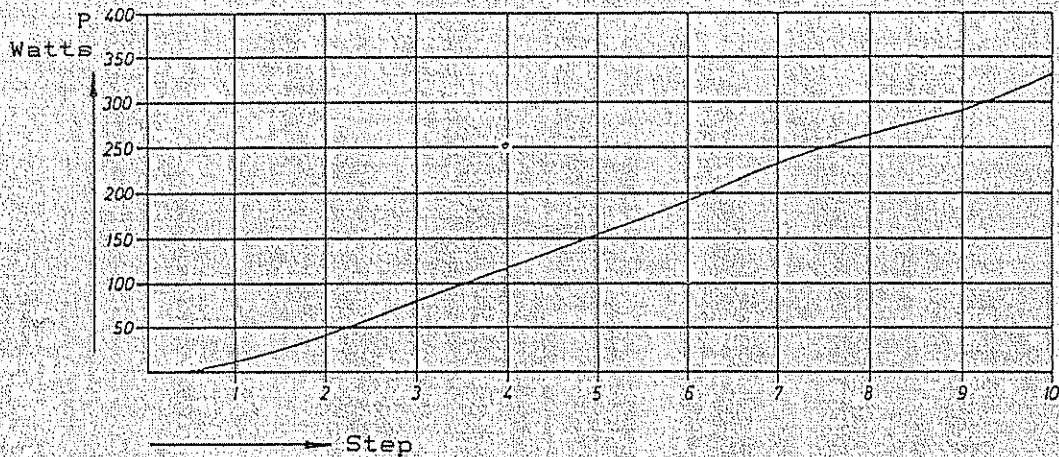
Output as function of power control

12.3 Current type: Spray-Coagulation  
Load resistance: 500 Ohms



Output as function of power control

12.4 Current type: Contact-Coagulation  
Load resistance: 300 Ohms



### 13. TECHNICAL SAFETY CONTROLS

These controls have to be performed once a year according to the list below.

1. Visual check up for proper condition of a) unit  
b) accessories
  2. Equipment earth examination
  3. Leakage testing
  4. Isolation testing
  5. Testing of the unit functions
- 
6. Testing of the monitoring circuit for the neutral electrode

The test results have to be documented in the booklet which belongs to the unit.

### 14. GUARANTEE

This unit is guaranteed for 12 months, starting from the date of delivery to the end user.

Within this period of guarantee all defects which can be proven to be manufacturing or material faults, are repaired, free of charge, by our appointed service-agents, or directly in our factory.

Please keep the guarantee card and also note its wording.

#### IMPORTANT REMARK!

Repair of the unit only by us or a duly authorized repairman.

If repair is done by an authorized repairman, the owner/user of the unit is requested to obtain a certificate describing kind and extent of repair. This certificate has to show the date of repair as well as company name and signature. If the modification or repair has not been done by the manufacturer of the unit, modified or repaired units have to bear the mark of the repairer.

## Our Manufacturing Programme:

CHROMOPHARE® Operating Lamps

CHROMOPHARE® Examination Lamps

Portable Table Top Units, for HF-Surgery, for hospital and consulting rooms

HF-Surgery Units, installed in the operating theatre

---

Martin Teletom System



Martin Medizin-Technik · Ludwigstaler Straße 132  
Postfach 60 · D-7200 Tuttlingen · Germany (Fed. Rep.)  
Telefon (074 61) 706-0 · Telex 762 696 gema d  
Telegramme · Gema Tuttlingen  
Telefax (074 61) 706 193  
Teletex 74 61 406

589 GA E 100 e Printed in Germany (Fed. Rep.)

Copyright by Martin Medizin-Technik.  
Nachdruck, auch auszugsweise, verboten.