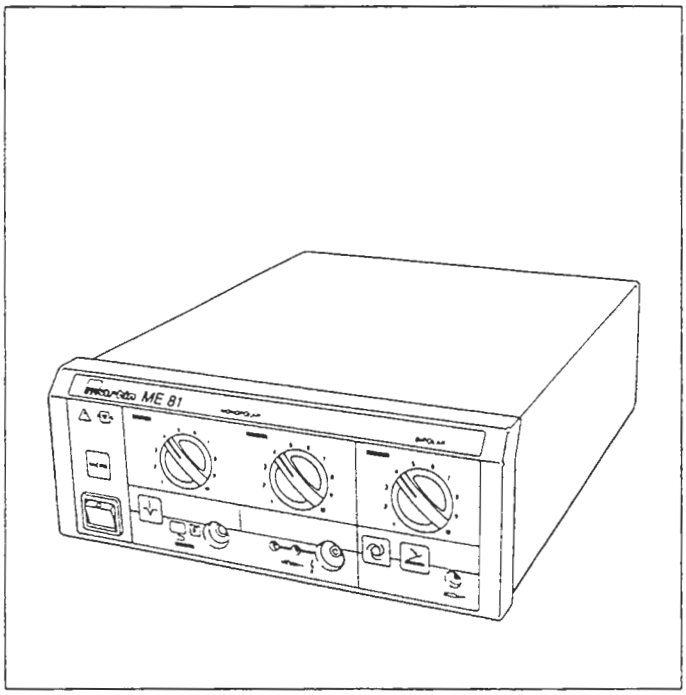


Martin ME 81
Service Manual

Service Manual ME 81

1. Technical Description of the ME 81

2. Disassembling and Reassembling of Subassemblies

SERVICE MANUAL ME 81

This documentation is made to give to the service people all information to enable them to detect and remove disturbances and defects at the electrosurgery unit ME 81 and to verify the operating data and the functional safety.

Herein included is a technical description of the unit, an assembling instruction for the exchange of modules, an instruction for finding out certain faults by a formal procedure, alignment instructions and presentation of the design revisions established in the course of time. The knowledge of the user's instruction manual will be presupposed.

In the foot line of this document is indicated:

- Author Martin Medizintechnik, responsible for contence
- Editor
- Validity for electrosurgical unit ME 81
- State of revision
- Page number

The state of revision is indicated in the form X.Y. In case of editorial corrections or supplements, the digit Y will be advanced for 1. In the case of general alterations or novelties with this unit, the digit X will be advanced for 1 and the digit Y will be reset to zero. Thus the former release of the service manual looses validity for all new releases of the unit.

1. Technical Description of the ME 81

1.1 General

The MARTIN ME 81 is an universal electrosurgery unit intended for the requirements of general practitioners which may also be used in the hospital area. It is a technical improvement of its predecessor ME 80 and offers the features as follows:

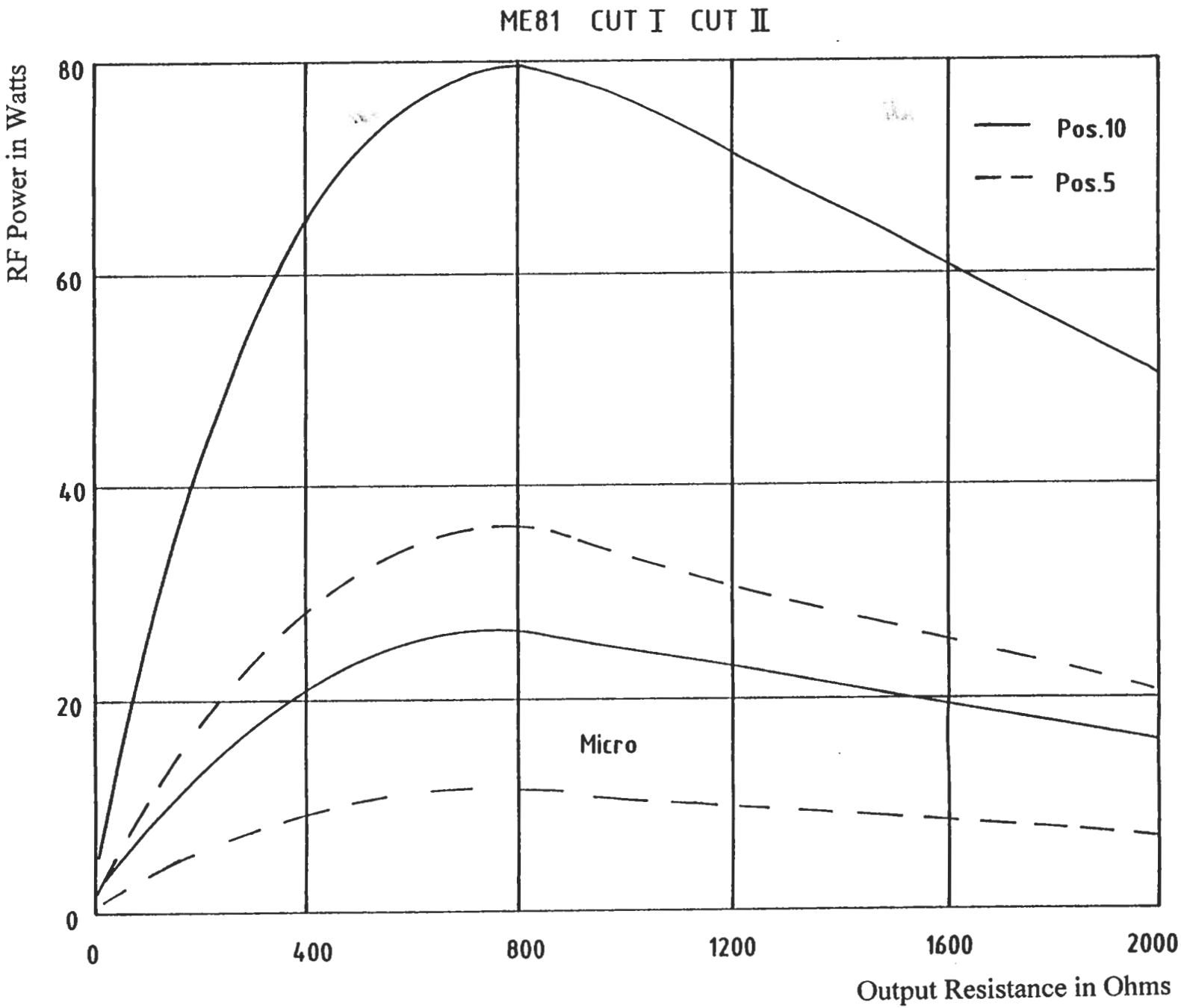
- New ergonomic improved self-explaining layout of the front panel
- Two improved monopolar cutting current modes with a power of 80 Watts
- Improved spray coagulation with a power of 30 Watts
- Bipolar coagulation with a power of 70 Watts
- Separate settable output power for all of the three operation modes by rotary knobs
- MICRO function for more precise power setting in the lower power range
- Optical and acoustic activation indication according to IEC 601
- Optional connection of monopolar MARTIN handpiece or of single use accessories
- Activation of monopolar operation modes optional by handpiece or by foot switch
- Activation of bipolar coagulation optional by foot switch or automatically
- Optional connection of a non-sectioned or a sectioned neutral electrode.
- All over closed case without venting slots

1.2 Technical Data

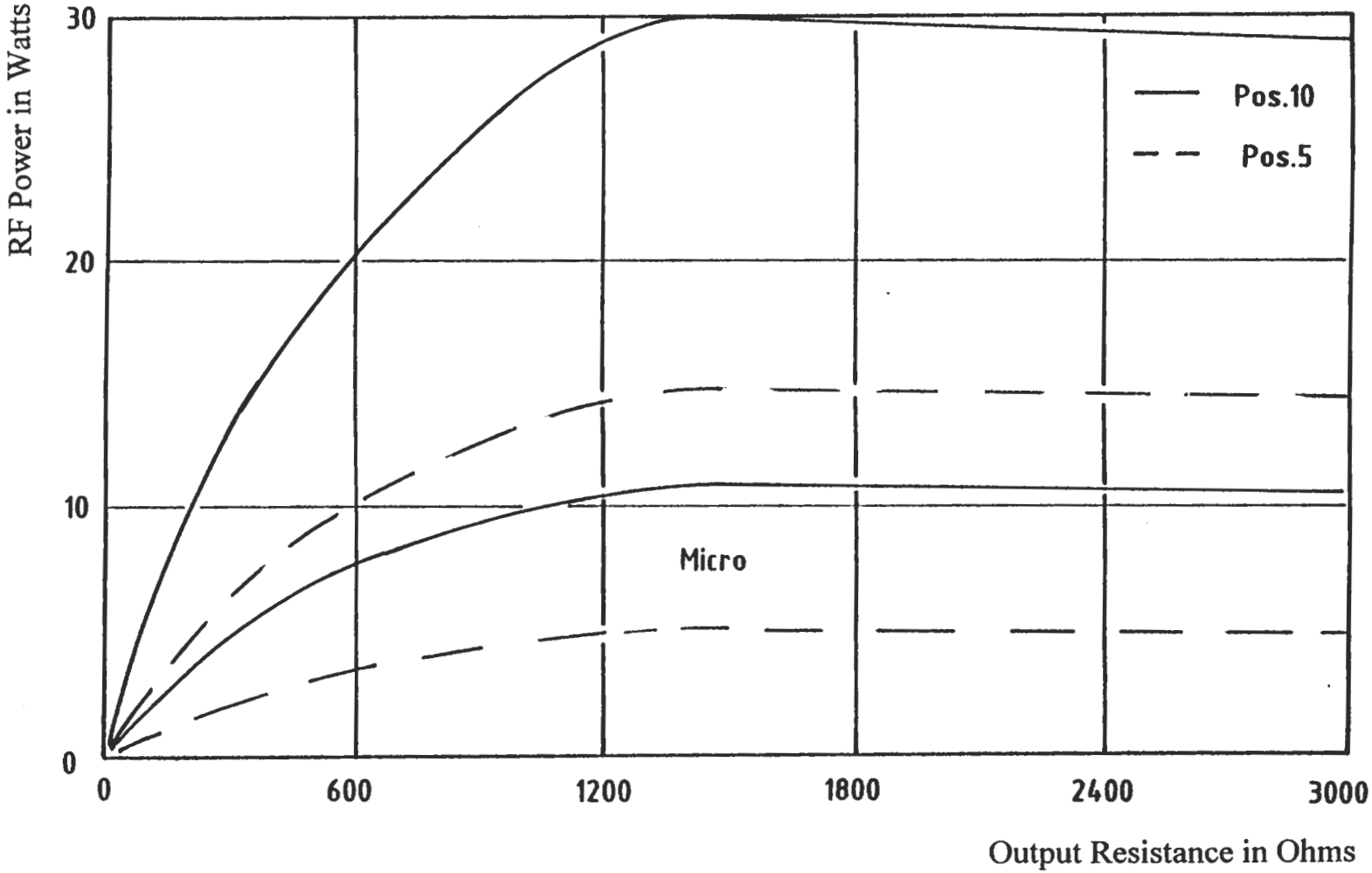
Mains Voltage:	110V to 120V/220V to 240V 50Hz to 60Hz, changeable
Mains Fuses:	110V to 120V: 1.6A slow blow (2 pcs. 5X20mm) 220V to 240V: 0.8A slow blow (2 pcs. 5X20mm)
Power Consumption:	approx. 190VA at maximum output power
Output Power:	Cut I: max. 80 Watts at 750 Ohms Cut II: max. 80 Watts at 750 Ohms Coagulation: max. 30 Watts at 1500 Ohms Bipolar Coag.: max. 70 Watts at 150 Ohms
Output Voltage:	Cut I: max. 850VPP, open circuit Cut II: max. 1200VPP, open circuit Coagulation: max. 3200VPP, open circuit Bipolar Coag.: max. 350VPP, open circuit
Protection class:	I
Nominal frequency:	500kHz
Applied Part:	CF defibrillation proof, monopolar and bipolar
Operation Mode:	Intermitting operation INT 10s/30s
Dimensions:	256mm X 97mm X 320mm
Weight:	4.6kg

CE 0123

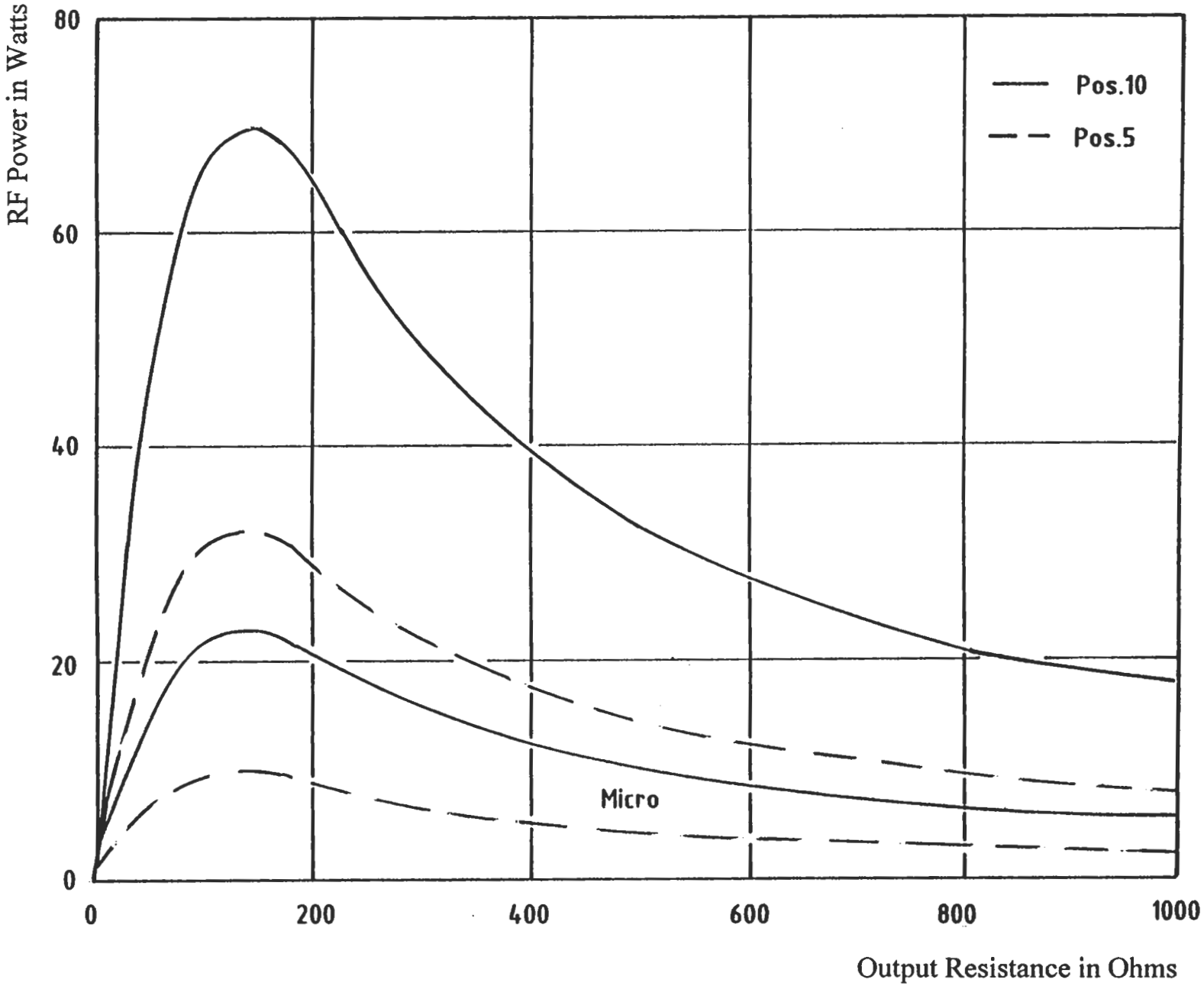
The unit has the CE-marking acc. to the Council Directive 93/42/EEC of 14 June 1993 concerning medical devices.


ME81 CUT I CUT II
RF Power in Watts
80
60
40
20
0
0
400
800
1200
1600
2000
Output Resistance in Ohms
Pos.10
Pos.5
Micro

ME81 Coagulation



ME81 Bipolar Coagulation



1.3 Features and Operation

The front panel of the ME 81 is sectioned in three blocks: General front panel, monopolar front panel and bipolar front panel.

In the general front panel section, the mains switch and the key for the MICRO function which acts on all current modes simultaneously are placed. On pushing the MICRO key this function will be enabled by which the key will light. On pushing anew, this function will be disabled again by which the key becomes dark again (toggle mode switching). At the MICRO setting, the output power will be reduced to a third. This function is useful if preparations with coagulation with precise power setting shall be performed.

In the monopolar front panel section, the handles for monopolar and bipolar power settings, the RF indication lamps, the sockets for handpiece and neutral electrode, the lamp for neutral electrode alarm and the toggle mode key for cutting current mode selection are placed. The field for power setting for cutting is marked yellow, that for coagulation blue. The key in the yellow field changes in toggle mode between "Cut I" (dark key) and "Cut II" (lighted key).

The ME 81 offers a combination socket which enables the connection of a sterilizable MARTIN handpiece as well as a single use handpiece with three-pin connector. This handpieces have two finger switches for activation of cutting current (yellow) and coagulation current (blue). Furthermore, any electrosurgical instrument with a connection cable with 4 Millimeter plug can be connected. In this case, activation will be performed by foot switch.

Two types or neutral electrodes can be connected to the ME 81 and be monitored. The most common electrode is a reusable non-sectioned rubber electrode with a connection cable with two lines which are in contact at the electrode side. By this current loop the ME 81 monitors the electrode for connection and the cable for interruption. Additional, the electrodes with two sections can be used which are often common in hospitals and which incorporate the patient into the monitoring current loop and so enable a monitoring for right application of the electrode. On not connected or interrupted cable, in case of sectioned electrodes also on missing or faulty contact to the patient, the lamp near the neutral electrode socket will blink. Additional, on attempt of activating a monopolar current mode, an intermitting alarm sound is audible.

The ME 81 offers a "CF"-type applied part, i. e. the neutral electrode is not related to ground potential which enables the unit to be used more universal. As a consequence, the unit cannot be operated without a neutral electrode like units with a "BF"-type applied part.

In the bipolar front panel section, the handles for setting and the activation indication for bipolar coagulation, the socket for the forceps connection cable and two keys which select the mode of activation are placed. On operating the right key which will lihgt then, activation of bipolar coagulation by foot switch will be enabled. If the left key will be operated, bipolar coagulation will be activated on contact of the tissue with the forceps and will be deactivated on release of the tissue or if the coagulation has desiccated the tissue to a degree that the coagulation process has come to an end.

The settings remain stored in the power-off state of the unit even on disconnection of the unit from mains.

In all of the three operation modes activation will be indicated by a continuous sound which has a different frequency for each operation mode. After approx. 15 Seconds the level of this signal increases. This shall draw the user's attention to the fact that activation of the unit is still valid, because in general an uninterrupted activation of such a long period is unusual. If current shall be activated beyond this time period by intention of the user, a short interruption of activation will reset the timer prior to increase of loudness.

Mains terminal block, foot switch sockets and the feature of connecting an equipotential line are placed at the rear of the unit. The mains terminal block includes the external accessible mains fuses.

The RF generator used in the ME 81 operates with a high degree of effectivity under all matching conditions which makes venting slots in the case of the unit obsolete which enables an easy wipe-off disinfection and impedes the settling of germs inside the unit. The outputs are short-proof. An overload in surgical practice is almost impossible.

1.4 Mechanical Design

The service concept of the ME 81 provides that in case of repair faulty modules will be replaced at the actual site. Thus the fault diagnosis is reduced to the determination of the faulty module which can be replaced rapidly which compensates the higher requirement of material by time saving and simpler mamagement of material.

According to this, the ME 81 is assembled from components which are exclusively mounted by screws and plug-in connection. The bottom part of the case picks up all components. The electronic circuits are placed at four printed circuit boards (PCBs). For service purposes the unit can be dismantled to the components as follows:

- Case base with holders, stands and type label
- case top
- Mains terminal block with mains fuses
- Equipotential connection pin

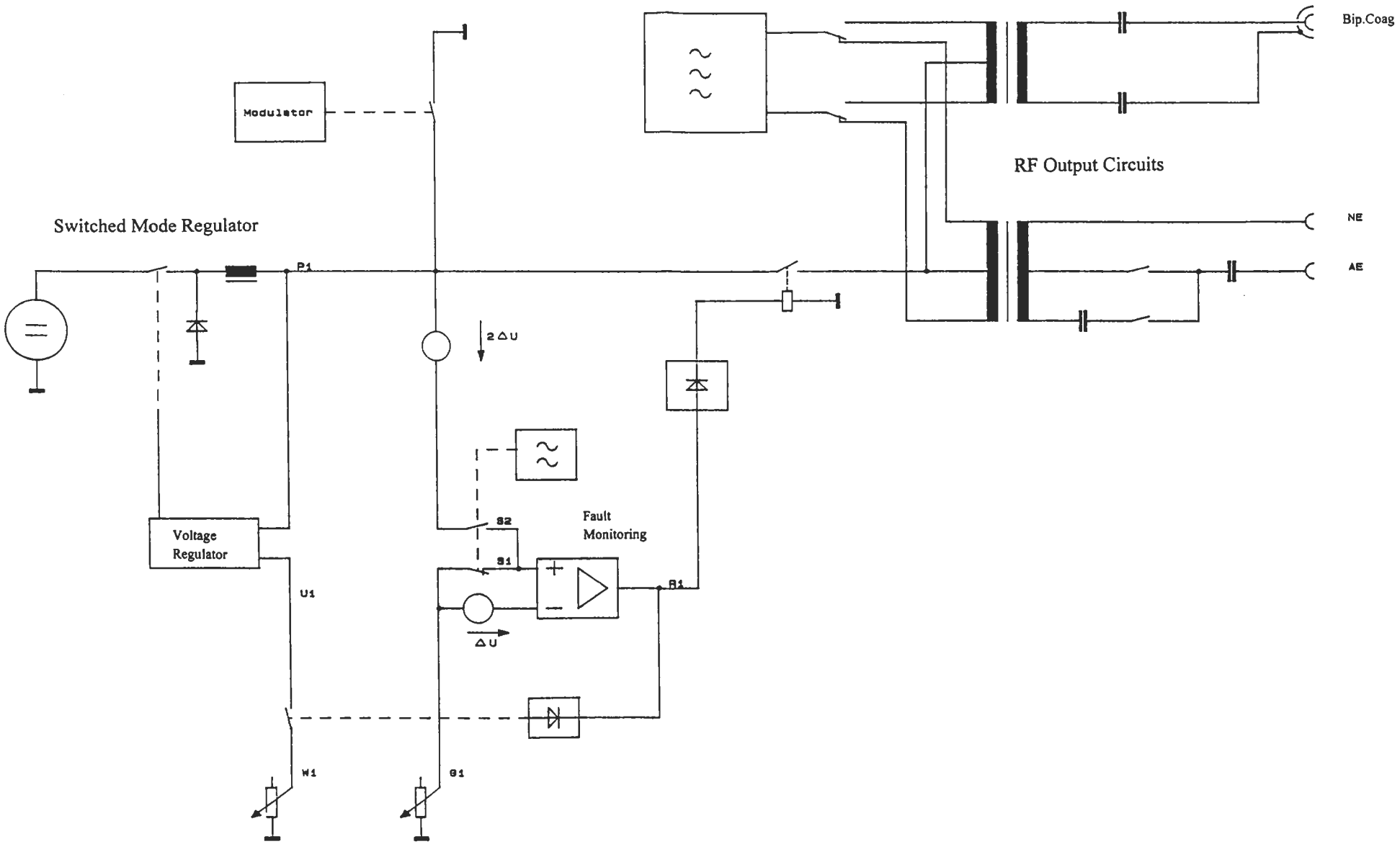
- Foot switch sockets
- Mains transformer with cable tree
- Switched mode power supply PCB
- RF generator and control PCB
- RF output PCB
- Safety covers
- Front panel, consisting of the following components:
  - Plastic front part with front layouts
  - Mains switch
  - Three setpoint potentiometers with rotary knobs
  - Front PCB with keys, indication lamps and the following sockets:
    - Neutral electrode socket
    - Active electrode socket
    - Bipolar socket

1.5 Principle of Operation

1.5.1 RF Generator and Output Circuit

The RF generator is a harmonic power oscillator equipped with power MOSFET transistors. The operation frequency is determined by a tank circuit by which the reactive output circuit is part of this tank circuit and thus frequency influencing. The highest frequency occurs under open circuit condition, the lowest under short circuit condition. Due to this self-matching, the generator is resistent against shorting and change of load and does not suffer from the matching problems associated with generators operating at a fixed frequency.

The output power will be set by the level of the voltage P1 present at the center tap of the output transformer, matching to a nominal output resistance is performed by a capacitor connected in serial to the output. By relays one of two nominal resistances are selectable.


Modulator
Switched Mode Regulator
RF Output Circuits
Bip.Coag
NE
AE
P1
2ΔU
Voltage Regulator
U1
S2
S1
Fault Monitoring
R1
ΔU
W1
B1
Power Setting

1.5.2 Power Controller and Modulator

The generator input voltage P1 is used to set the output power and is generated from an unregulated DC voltage by a switched mode power regulator according to the stepdown regulator principle. Thus this switched mode regulator serves as a power controller.

The voltage P1 is no even DC voltage but represents the rectified tank circuit voltage with half the amplitude. The mean value of this course of voltage represents the DC voltage P1 which will be regulated by the voltage regulator.

The modulator periodically shorts this voltage P1. Thus the voltage P1 gets a square-wave shaped envelope. This makes the voltage regulator increasing the square-wave amplitude for keeping the mean value of P1 constant.

1.5.3 Fault Monitoring and Setpoint Generation

In order to prevent an overdose due to a fault of the unit, the supply voltage P1 of the generator will be switched off on fault occurence. This is controlled by a monitoring circuit which compares the value of P1 with a setpoint value. This compare setpoint value G1 is to be generated separate from the setpoint value W1 for the generation of P1 else a fault in the setpoint value generation itself cannot be recognized. From this reason, the setpoint generator up to the setting potentiometer is double.

The monitoring circuit is performed in a manner that its failure results in a switch-off of P1 else its failure cannot be recognized by the user. For this purpose, a dynamic monitoring principle is used. The switches S1 and S2 form a commutator which changes the input of the comparator between the compare setpoint value G1 and the voltage P1, diminished by a small voltage "2·ΔU", with a frequency of some Kilohertz.

The compare input of the comparator is fed with the compare setpoint value G1, diminished by a small voltage "ΔU".

If S1 is closed, the voltage at the comparator input is higher than that at the compare input and thus the output is high. On closing S2, it is just vice versa. If P1 is as high as G1, the comparator output turns to low. So, a square wave voltage is established at the comparator output. Via a rectifier which only reacts upon the AC component of this voltage, this energizes the relay in the path of P1. If P1 becomes higher than G1 for more than "ΔU", the comparator input becomes no more negative with regard to its compare input and the output remains static on high level. The rectifier will generate no more current and the relay will be released.

1.6 Circuit Description

1.6.1 Block Diagram

The block diagram shows the individual functional sections and their interconnections. In detail, they have the following functions:

Power supply and power controller:

Two separate circuits are placed common at the power supply PCB A1. There is a switched mode regulator according to the stepdown regulator principle which generates the 15V supply for the signal and control circuits and is protected from the input side by the fuse F2 (1A medium blow).

The power controller is a similar circuit according to the stepdown regulator principle, its output voltage P1 represents the energy source for the RF generator and will be controlled by the analogue signal U1. P1 has twice the voltage value of U1. The power controller is protected from the input side by the fuse F1 (4A medium blow).

Voltage supply and power controller are fed from separate secondary windings of the mains transformer T1.

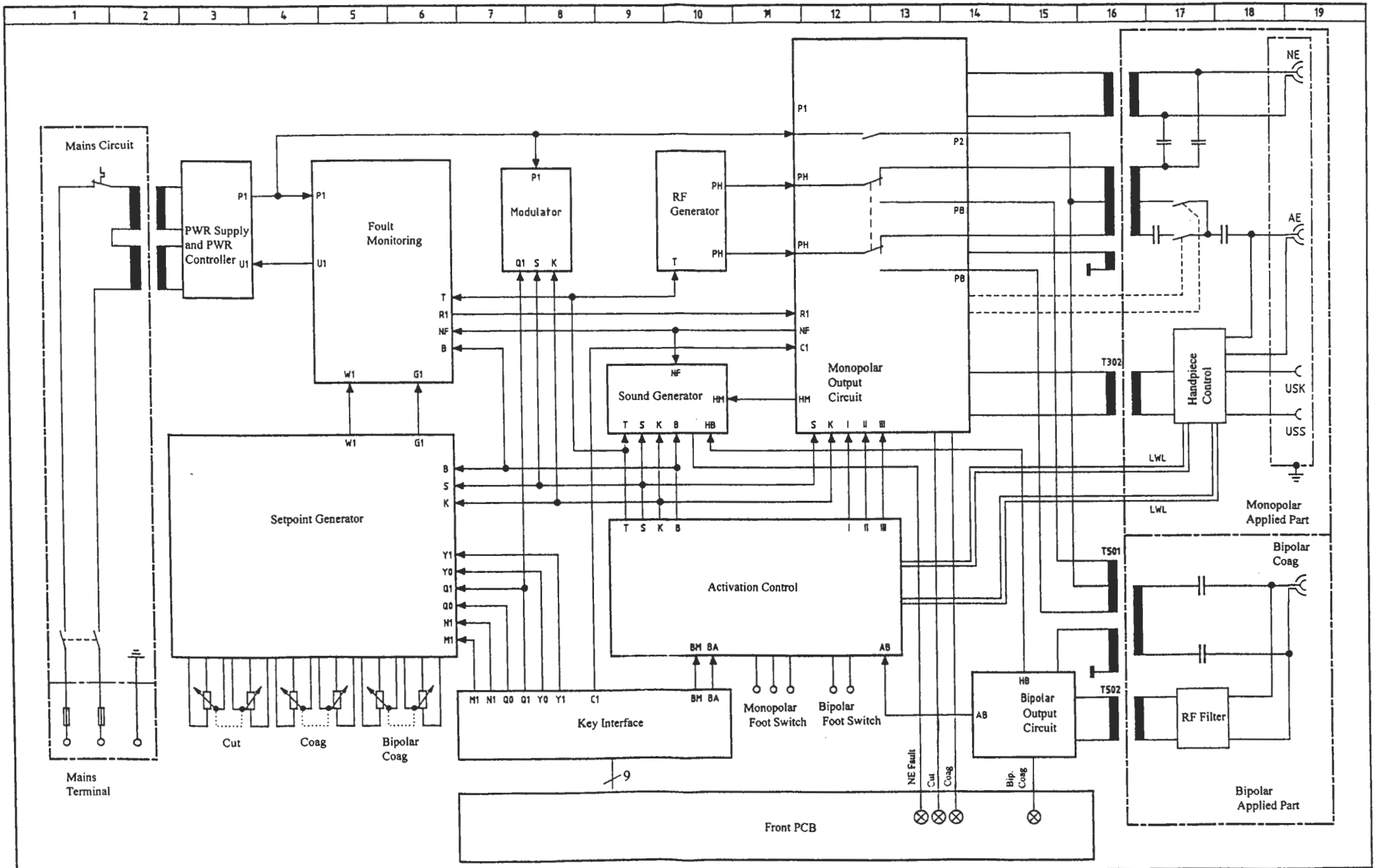
RF generator and modulator:

They are placed in the middle in the right third of the RF generator PCB and form together the RF generator. The generator will be activated by the signal T. Activation and setting of the modulator are performed by the signals Q1, S and K. It acts on the RF generator supply voltage P1. The symmetric outputs PH are fed to the corresponding output transformer, via the center tap of which the voltage P1 is fed to the generator.

Monopolar output circuit:

It forms the interface to the monopolar applied part and includes the fault protection relay K304 in the path of P1 and the monopolar/bipolar switchover relay K303 which are driven by the signal R1, the neutral electrode monitoring, the auxiliar supply for handpiece control, the drivers for the monopolar RF indication lamps, the relays K301 and K302 in the RF output and a load circuit for the generator. All components of the monopolar output circuit as well as the transformers to the applied part are placed backwards on the right of the RF generator PCB A2 under the monopolar output PCB A3.

The neutral electrode monitor operates with a harmonic oscillator which tank circuit voltage is fed via the transformer T300 to both of the terminals of the NE socket. On connection of a neutral electrode with twin-line cord with the conductors shorted at the electrode side (single-sectored electrode) or on correct application of a two-sectored electrode, the oscillator will be damped by this shunt. On missing electrode, rupture of cable or faulty application, this damping will be lower. This will be used for generation of a fault signal NF.



Block Diagram
Electrosurgery Unit ME81

The auxiliar supply of the handpiece control consists of an oscillator which voltage will be transferred to the applied part by the transformer T302.

The driver circuit for the RF indication lamps will be controlled by an auxiliar winding of the monopolar output transformer. The signals S and K select that lamp of both which has to light. Additional, a signal HM is generated which indicates the presence of monopolar RF voltage.

The RF generator shows the peculiarity to start oscillation just when its auxiliar voltage is present though it is not able to produce power. But because of feedback from the tank circuit in case of low loading (open output) and low setting (MICRO), the voltage P1 may increase to higher values than determined by setting which would activate the fault monitor. From this reason, at low settings a minimum load will be connected to the generator by the signal C1.

Monopolar applied part:

It is the monopolar patient interface and is placed at the monopolar RF output PCB A3. The transformers which form the interface to the monopolar output circuit are placed at the RF generator PCB A2, the output sockets are placed at the front PCB A4.

The handpiece control decodes the signals of the finger switches of the active electrode handpiece and transfers them to the monopolar activation control via optocoupler. These optocouplers consist of separate transmitters and receivers which are linked by a light-guiding plastic fibre. The receivers are placed at the center front of the RF generator PCB A2. The active electrode sockets are designed in a manner which enables the connection of a MARTIN coax plug as well as that of a three-pin flat connector as is common in the north american market. The handpiece control will be supplied from the monopolar output circuit via transformer T302.

Bipolar output circuit:

It represents the interface to the bipolar applied part, includes the automatic bipolar activation circuit and a driver for the bipolar RF indication and is placed right at the front of the RF generator PCB A2.

The automatic bipolar activation enables automatic activation of bipolar RF current on application of the bipolar forceps. It operates according to the principle of the damped harmonic oscillator (see NE monitoring circuit of monopolar output circuit). Via transformer T502, its tank circuit voltage will be applied to the branches of the connected bipolar forceps. The shunt formed by the tissue between the branches dampes the oscillator which will be used to generate the signal AB.

The driver of the bipolar RF indication lamp will be controlled by an auxiliar winding of the bipolar RF output transformer T501 and generates a signal HB which indicates the presence of bipolar RF voltage.

Bipolar applied part:

This represents the bipolar patient interface and is placed with the bipolar output RF transformer T501 right at the front of the RF generator PCB A2.

Activation control:

This associates the signals of the finger switches and the foot switches with the corresponding selection of operation mode, with the associated energization of relays and selection of the path of the setpoint value. It is placed backwards at the left and at the center front (optocoupler receivers) of the RF generator PCB A2.

The signals BM and BA select the bipolar output to be activated by the bipolar foot switch (BM) or automatically on application of the bipolar forceps (BA) by the signal AB.

The selection of the operation mode "Cutting" will be indicated by the signal S, that of the operation mode "Coagulation" by the signal K, that of the operation mode "Bipolar Coagulation" by the signal B. The activation signal T is a OR connection of the signals S, K and B.

The relays of the monopolar output circuit are driven by the signals I, II and III.

Setpoint generator:

This is placed left hand at the front of the RF generator PCB and consists of two separate circuits for the generation of the setpoint value W1 and the compare setpoint value G1.

The signals S, K and B select one of the three potentiometers at the front panel as a signal source for generating the values of W1 and G1. The signal M1 switches the setpoint value W1, the signal N1 the compare setpoint value G1 to the MICRO mode.

The signals Q0 and Y0 or Q1 and Y1 select the matching of the setpoint values between "Cut I" and "Cut II".

Fault monitoring:

This is placed backwards on the left of the RF generator PCB A2. The principle is explained in 1.5.3. In addition to the signals shown in the figure at page 9, the signals T, NF and B are of account. The signal T activates the circuit; the signal U1 will just become the signal W1 if the signal T is active. The signal R1 as a fault-free, i. e. square wave signal occurs just on occurence of T.

The neutral electrode fault signal NF blocks the signal R1 except B is active, because a neutral electrode fault does not matter bipolar coagulation.

Sound generator:

This is placed on the left of the RF generator PCB A2 and consists of a voltage controlled oscillator which frequency of sound is controlled by the signals S, K and B as well as HM and HB, a blinker and a timer. The blinker will be controlled by the neutral electrode fault signal NF, it drives the NE fault indication lamp at the front panel and influences the sound signal in case of NE fault. The timer makes the sound level increase after approx. 15 seconds of activation time and will be started by the signal T.

Key interface:

This is placed on the left of the RF generator PCB A2 and has the function of storage of the transient key operation and to acknowledge this by lighting the key. This is performed by means of bistable relays.

The MICRO key controls the signals M1, N1 and C1. The signals BM and BA are generated by the keys with the "automatic" and "foot switch" logos in the section on the right of the front panel.

The key with the "blend cut" logo controls the change between "Cut I" and "Cut II" by the signals Q0 and Y0 or Q1 and Y1.

1.6.2 Signals and Their Functions

S: (active high)

The "Cutting" control signal will be generated by the activation control by operation of the yellow key at the handpiece or the yellow pedal of the foot switch. It effects the selection of the setting for cutting at the setpoint generator, the activation of the acoustic signal for cutting at the sound generator and the selection of the indication lamp for cutting activation at the monopolar output circuit. Additional, in combination with the signal Q1 it effects the activation of the modulator.

K: (active high)

The "Coagulation" control signal will be generated by the activation control by operation of the blue key at the handpiece or the blue pedal of the foot switch. It effects the selection of the setting for coagulation at the setpoint generator, the activation of the acoustic signal for coagulation at the sound generator, the selection of the indication lamp for coagulation activation at the monopolar output circuit and the activation of the modulator.

B: (active high)

The "Bipolar Coagulation" control signal will be generated by the activation control by operation of the bipolar foot switch or on application of the bipolar forceps. It effects the selection of the setting for bipolar coagulation at the setpoint generator, the activation of the acoustic signal for bipolar coagulation and the ignoring of the neutral electrode fault signal at the fault monitoring circuit.

T: (active high)

The "Activation" control signal will be generated by the activation control and is an OR connection of the signals S, K and B. It effects the activation of the RF generator and the signals U1 and R1 at the fault monitoring circuit and starts the 15 Seconds-timer at the sound generator.

M1: (active low)

The "Micro" control signal will be generated by the key interface and controls the change of the setpoint value W1 to the MICRO mode at the setpoint generator.

N1: (active low)

The "Parralel Micro" control signal will be generated by the key interface and controls the change of the compare setpoint value G1 to the MICRO mode at the setpoint generator (parallel to M1).

Q0: (active high)

The "Cut I" control signal will be generated by the key interface and controls the selection of "Cut I" for the setpoint value W1 on activation of S at the setpoint generator. It is mutual latched to Q1.

Y0: (active high)

The "Parallel Cut I" control signal will be generated by the key interface and controls the selection of "Cut I" for the compare setpoint value G1 on activation of S at the setpoint generator (parallel to Q0).

Q1: (active high)

The "Cut II" control signal will be generated by the key interface and controls the selection of "Cut II" for the setpoint value W1 on activation of S at the setpoint generator. It is mutual latched to Q0.

Y1: (active high)

The "Parallel Cut II" control signal will be generated by the key interface and controls the selection of "Cut II" for the compare setpoint value G1 on activation of S at the setpoint generator (parallel to Q1).

C1: (active high)

The "Load" control signal will be generated by the key interface and connects a basic load to the RF generator. Complementary to M1 and N1.

BM: (active high)

The "Manual Bipolar" control signal will be generated by the key interface and selects the bipolar foot switch to be the source of control for activation of the bipolar output at the activation control circuit. Complementary to BA.

BA: (active high)

The "Bipolar Automatic" control signal will be generated by the key interface and selects the signal BA to be the source of control for automatically activation of the bipolar output at the activation control circuit. Complementary to BM.

AB: (active high)

The "Automatic Bipolar" control signal will be generated by the bipolar output circuit and indicates the application of a bipolar forceps for automatically activation of the bipolar output to the activation control circuit.

HM: (active high)

The "RF Monopolar" control signal will be generated by the monopolar output circuit and indicates the presence of monopolar RF voltage. At the sound generator, it participates in the generation of the acoustic signals for monopolar operation modes.

HB: (active high)

The "RF Bipolar" control signal will be generated by the bipolar output circuit and indicates the presence of bipolar RF voltage. At the sound generator, it participates in the generation of the acoustic signal for bipolar operation mode.

NF: (active high)

The "NE Fault" control signal will be generated by the monopolar output circuit and indicates a neutral electrode to be missing, faulty or applied incorrect. It effects a message to the fault monitoring circuit and the activation of the blinking of the NE fault lamp as well as an alarm sound on attempt of monopolar activation.

W1:

The "Setpoint Value" analogue signal will be generated by the setpoint generator and represents the controlling value U1 of the power controller after passing the fault monitoring circuit. Range: 0 to 12 Volts.

G1:

The "Compare Setpoint Value" analogue signal will be generated by the setpoint generator and represents the compare value for fault detection at the fault monitoring circuit. It is the same value as W1. Range: 0 to 12 Volts.

U1:

The "Controlling Value" analogue signal will be generated by the fault monitoring circuit and represents the input value of the power controller. On activation it corresponds to the value W1. Range: 0 to 12 Volts.

P1:

The "DC Input" voltage will be generated by the power controller and represents the energy source of the RF generator and the actual value for fault monitoring. Modulation is performed by influencing this voltage. Range of mean value: 0 to 24 Volts.

PH:

The "RF Voltage" is the voltage present at the generator output (tank circuit). Maximum peak value: 200 Volts.

R1:

The "Auxiliar Relay Voltage" will be generated by the fault monitoring circuit and forms in the fault-free condition the auxiliar energy in the monopolar output circuit to energize the relays on activation. On activation in fault-free condition, it is a square wave signal with a mean value of 6 to 9 Volts.

I: (active low, depending on R1)

The "Cutting Relay" control signal will be generated by the activation control and energizes the relay K301 at the monopolar output circuit for the cutting operation mode.

II: (active low, depending on R1)

The "Coagulation Relay" control signal will be generated by the activation control and energizes the relay K302 at the monopolar output circuit for the coagulation operation mode.

III: (active low, depending on R1)

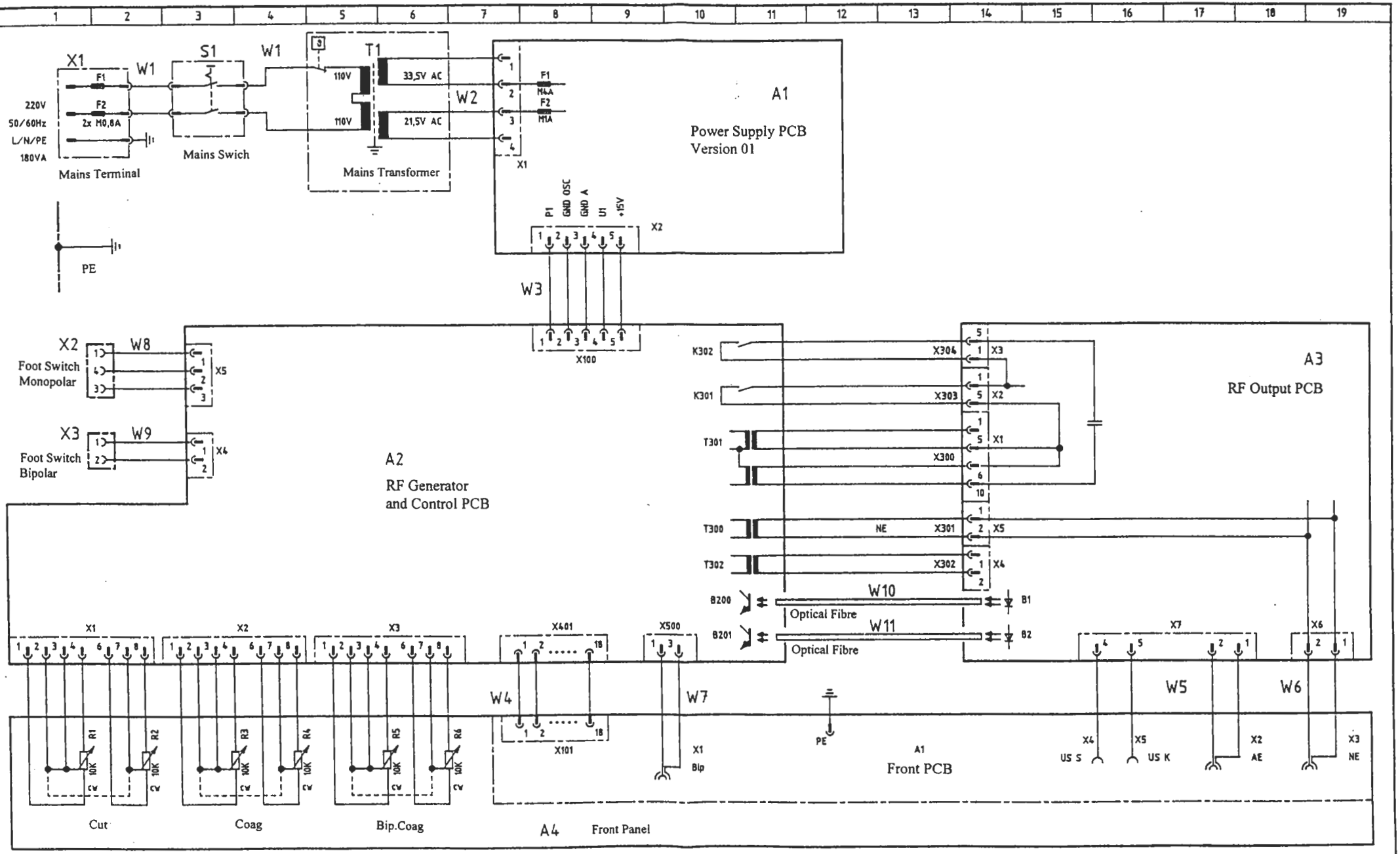
The "Bipolar Coagulation Relay" control signal will be genrated by the activation control and energizes the relay K303 which switches the RF generator to the bipolar output.

2. Disassembling and Reassembling of Subassemblies

2.1 Subassemblies and Mechanical Components

Item	Designation	Ordering No.
1	Case Base	08-012-00-15
2	Case Top	08-012-00-02
3	Front Panel	08-010-00-01
4	Front Layout ME 81	08-010-00-22
5	Rotary knob	08-006-00-01
10	Mains Terminal Block	08-024-00-01
11	Mains Fuse Holder	08-034-00-01
12	Mains Transformer	08-024-00-02
13	Equipotential Connection Pin	08-027-00-01
14	Mains Switch	08-024-00-03
20	Setpoint Potentiometer, cpl.	08-034-00-02
21	Socket for Neutral Electrode, cpl.	08-024-00-04
24	Socket for Active Electrode, cpl.	08-001-00-01
25	Socket Bipolar, cpl.	08-003-00-01
26	Socket for Monopolar Foot Switch, cpl.	08-022-00-01
27	Soccket for Bipolar foot Switch, cpl.	08-003-00-02
30	Front PCB A4	08-010-00-21
31	RF Generator and Control PCB A2	08-012-00-16
32	RF Output PCB A3	08-022-00-11
33	Switched Mode Power Supply PCB A1	08-032-00-01
40	Cable Connector 5 Lines SMPS/RF Generator	08-041-00-01
41	Cable set of PE lines	08-027-00-02
42	Optical Plastic Fibre	08-020-00-01
50	Safety Cover, Top Side	08-034-00-03
51	Safety Cover, RF Output PCB	08-034-00-04
52	Safety Cover, Front Side	08-034-00-05
53	Locking Clip for 18 Pin DIL Connector	08-041-00-02

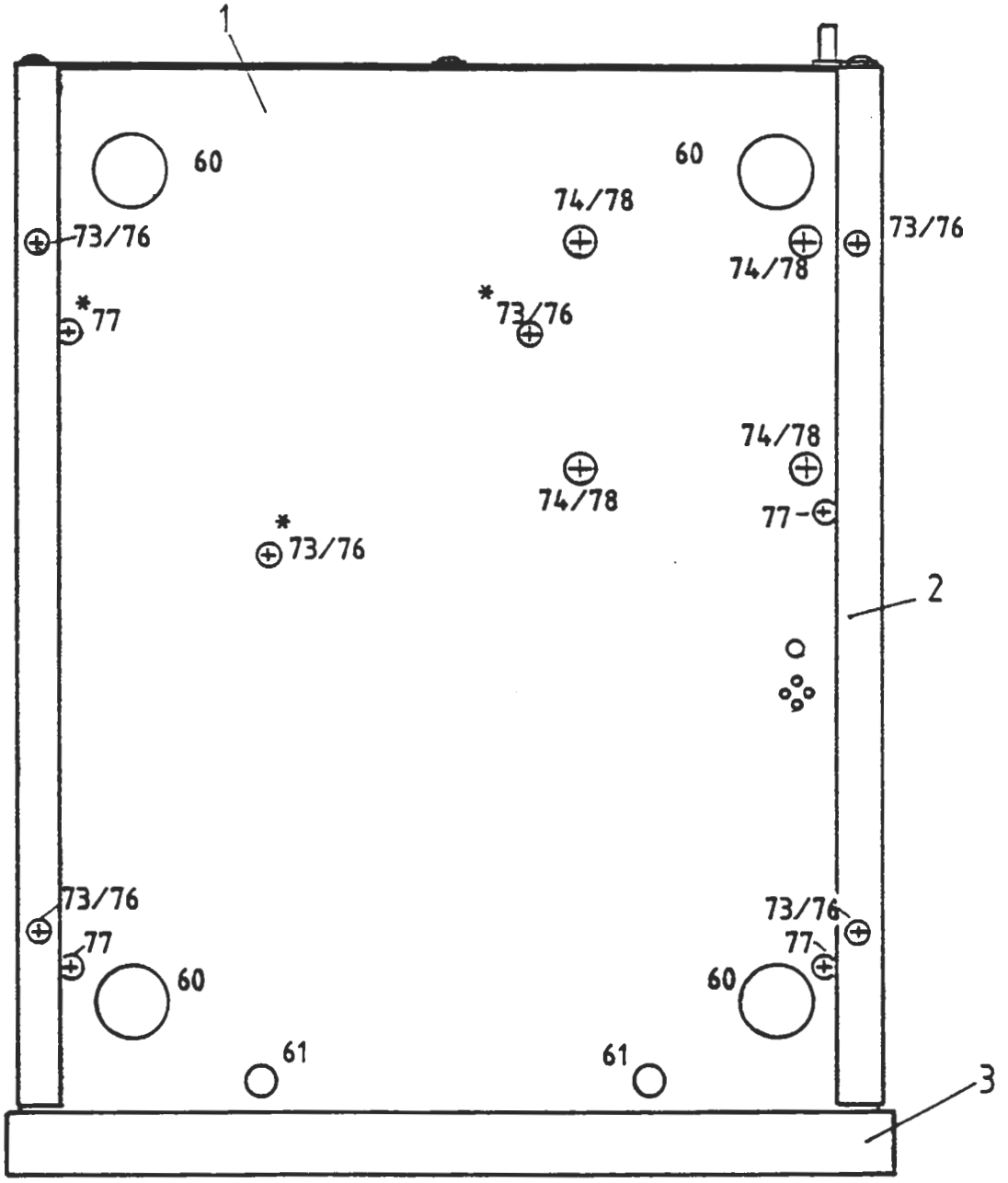
Item	Designation	Ordering No.
*	Set of Small Mechanical Parts	08-018-00-01
60	Case Stand	*
61	Blind Plug 6 Millimeters	*
62	Circlip ring 12 X 1.0	*
63	Circlip ring 18 X 1.2	*
64	Plastic spacer Bolt M3 X 6 I/O	*
65	Plastic Spacer Bolt M3 X 10 I/O	*
66	Plastic Spacer Bolt M3 X 10 I/I	*
67	Plastic Spacer bolt M3 X 35 I/I	*
68	Spacer 6/3.4 X 10	*
69	Adhesive Board Fixing Bar	*
70	Nut M3	*
71	Nut M4	*
72	Plain Nut M6	*
73	Lock Washer S3	*
74	Lock Washer S4	*
75	Lock washer S6	*
76	Phillips Tallow-Drop Screw M3 X 6	*
77	Phillips Countersunk screw M3 X 6	*
78	Phillips Tallow-Drop screw M4 X 8	*
79	Tallow-Drop Self-Tapping Screw 2.9 X 6.5	*
	Set of Adhesive Labels for ME Units	08-018-00-02
	Kit for Change of Mains Voltage	08-024-00-05
	Incandescant Bulb for Front PCB	08-012-00-03
	Fuse 1.6A Slow Blow ME 81/110V to 120V	08-034-00-08
	Fuse 0.8A Slow Blow ME 81/220V to 240V	08-034-00-09
	Fuse 1A Medium Blow for Supply	08-034-00-10
	Fuse 4A Medium blow for Power Controller	08-034-00-11

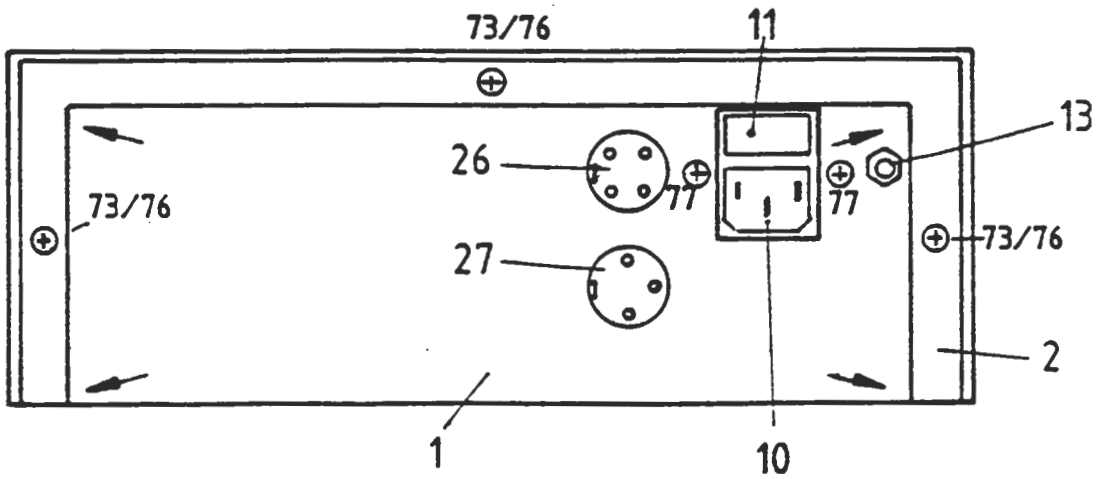


Wiring Diagram Electrosurgery Unit ME81		Page 21

2.2 Opening and Closing of Case

1. Disconnect mains cord.
2. Unscrew the 7 Phillips screws (76) from the rim of the case top at the rear and the bottom.
3. Release case top (2) from the groove in the front panel. For this purpose, carefully pull off the case top against the rear side with a lever at the positions marked with arrows.
4. Slide case top backwards. Remove it backwards.
5. For reassembling place case top from the backside and slide it to the front.
6. Take care for correct insertion into the groove in the front panel especially at the lower edges and the upper angles. Push case top into the groove until the rim attches the rear. Do not pull with screws to the front else the rim at the rear may be bended.
7. Place again the 7 Phillips screws (76) with lock washers (73). Do not tighten yet. First tighten the screws at the rear side, then those at the bottom side.
8. Check for the standing of the unit on a smooth surface without mechanical distortion. Else loosen screws, remove distortions and retighten screws again.
9. After any manipulation inside the unit the safety checks according to 4.7 are to be performed.


1
60
60
74/78
73/76
74/78
73/76
*77
*73/76
74/78
74/78
77
*73/76
2
73/76
77
73/76
77
60
60
61
61
3


73/76
11
13
26
77
77
73/76
73/76
27
2
1
10

2.3 Front Panel, Front PCB, Sockets

The front panel (3) is a plastic mould which picks up the potentiometers for settings (20) and the front PCB A4 (30) and is covered with a layout.

The front PCB includes keys, indication lamps and sockets.

2.3.1 Exchange of Potentiometer (20)

1. Open case according to 2.2.
2. Pull off rotary knob (5) in axial direction. Use pliers with cloth.
3. Disconnect cable connection at the RF generator PCB A2 (31).
4. Unscrew potentiometer nut with socket wrench or pliers, remove potentiometer from the backside.
5. Place the spare part with the cable terminals to the right. On tightening the nut keep the potentiometer held counterwise with the hand else the settings may be shifted clockwise.
6. Place rotary knob, note the flatting at the axle. If mounted correct, the rim of the rotary knob is in level with the front surface.
7. Reconnect cable connector.
8. Close case according to 2.2.
9. Check functions and perform safety check according to 4.7.

2.3.2 Exchange of Front Layout (4)

1. Peel off old front layout.
2. Place new front layout at the upper edge, take care of exact fitting at the edges of the rotary knobs. Press on all over the surface. Eventually exercise placing with old layout.

3. Disassembling and Reassembling of Front Panel (3)

1. Open Case according to 2.2.

2. Release connection X6 of the neutral electrode socket and connection X7 of the active electrode socket from the RF output PCB A3.

3. Release connections X1, X2 and X3 of the potentiometers and connection X500 of the bipolar output socket from the RF generator PCB A2. Release locking clip (53) from the DIL connector X401 at the RF generator PCB A2 and unplug DIL connector.

4. Loosen the four M4 screws (78) at the left and the right of the inside of the front panel. Lift front panel and pull frontwards while the heads of the lower screws (78) have to pass through the upside expansions of the keyhole shaped holes.

5. If necessary, release the four mains switch connections.

6. If necessary, release the protective earth connector. Remove front panel.

7. For reassembling, first reconnect protective earth connector.

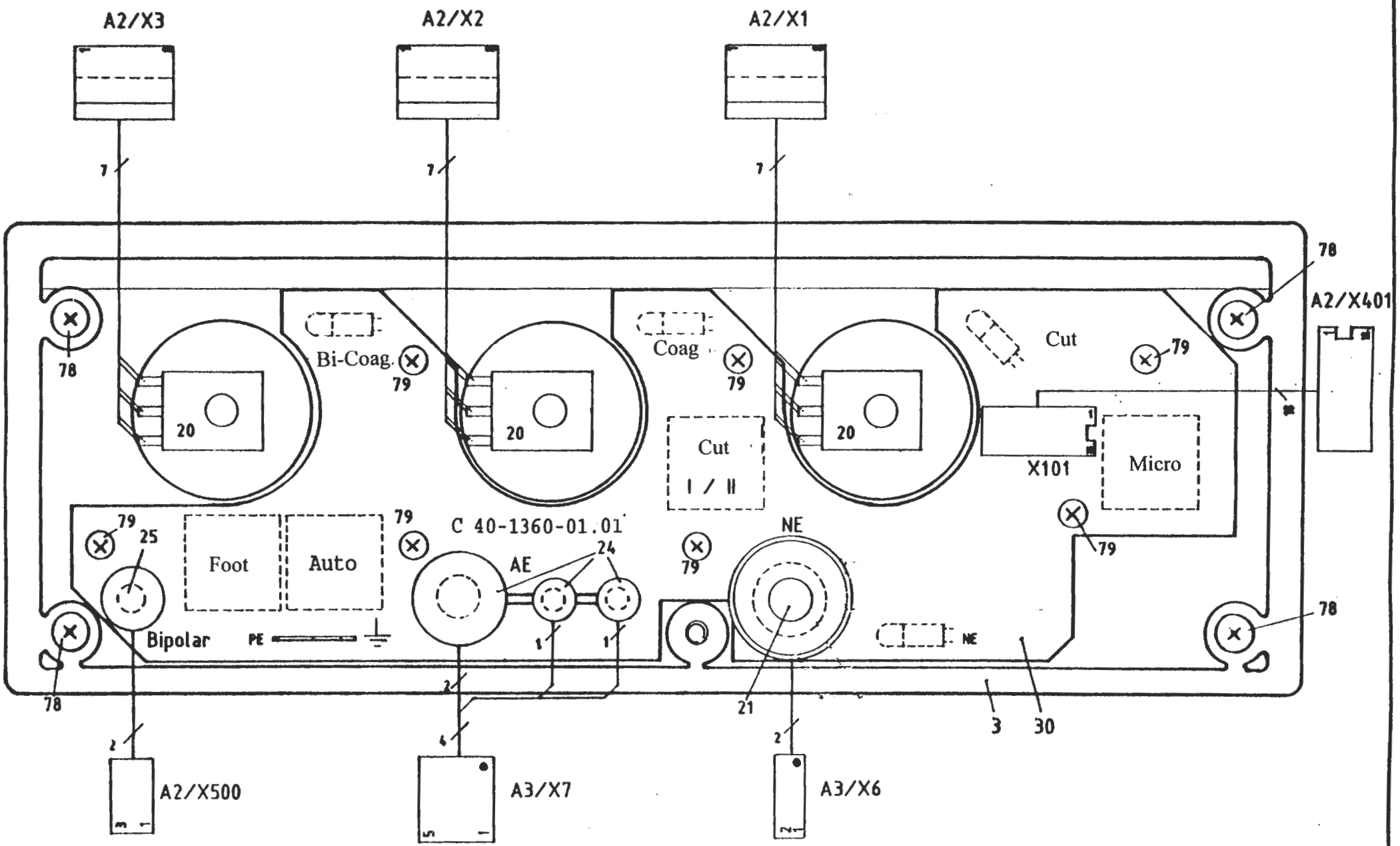
8. If necessary, reconnect the four mains switch connectors according to the wiring diagram, in the course of which the brown cables are to be connected to the one side, the black ones to the other side.

9. Place back front panel from the upper side. By this, guide the upper screws (78) into the slots in the case base (1) and the lower screws (78) into the upper expansion of the keyhole shaped holes. Shift front panel (78) downwards and tighten screws (78).

10. Reconnect bipolar socket connection X500 as well as the potentiometer connections X1, X2 and X3 to the RF generator PCB A2. Reconnect DIL connector X401 and lock with clip (53).

11. Close case according to 2.2.

12. Perform functional and safety check according to 4.7.


A2/X3
A2/X2
A2/X1
7
7
7
78
78
A2/X401
Bi-Coag.
79
Coag
79
Cut
79
20
20
20
Cut
I / II
X101
Micro
79
79
79
79
25
Foot
Auto
C 40-1360-01.01
AE
24
NE
Bipolar
PE
NE
78
78
1
1
2
21
3
30
2
4
2
A2/X500
A3/X7
A3/X6

2.3.4 Disassembling and Reassembling of Front PCB A4

1. Open case according to 2.2 and remove front panel according to 2.3.3, the cable connections of the mains switch don't need to be disconnected.

2. Remove the 7 Phillips self-tapping screws (79) and remove the front PCB from the front panel.

3. On change of the front PCB move all of the sockets from the old to the new part according to 2.3.5 to 2.3.7.

4. For reassembling, place front PCB even at the front panel.

5. When the front PCB attaches all of the fastening points, place again all of the 7 self-tapping screws. Do not tighten too strong.

6. Reassemble front panel according to 2.3.3 and close case according to 2.2.

7. Perform functional and safety check according to 4.7.

2.3.5 Exchange of Active Electrode Combination Socket (24)

1. Open case according to 2.2 and remove front panel according to 2.3.3.

2. Disassemble front PCB according to 2.3.4.

3. Remove circlip ring (63) with circlip pliers from the coax socket. By this guide the cable out of the ring gap.

4. Push coax socket and both of the 4 Millimeters sockets frontwards out of the board. Guide the cables of the 4 Millimeters sockets through the gap in the board towards the bigger boring of the coax socket. Remove cable tree through this boring.

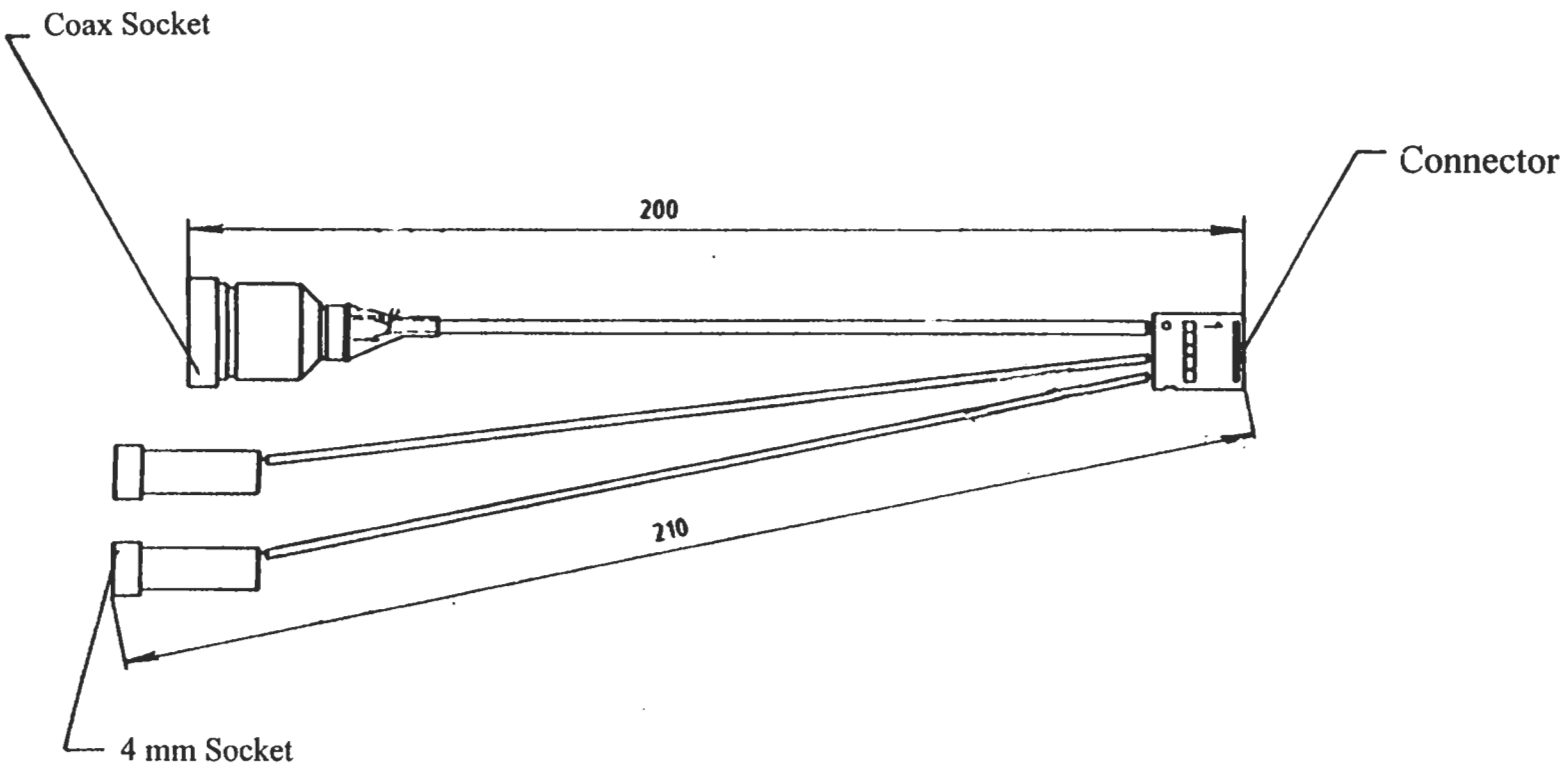
5. To place the spare part, guide the connector through the bigger boring from the component side of the board. Guide connections of the 4 Millimeter sockets through the gap in the board to the borings for the 4 Millimeter sockets. **Hazard of confusion!** Place the 4 Millimeter socket with the red cable connection in the outer, that with the white cable connection in the center position!

6. Guide circlip ring (63) over the cable of the coax socket and place it at the coax socket

7. Reassemble front PCB according to 2.3.4.

8. Reassemble front panel according to 2.3.3 and close case according to 2.2.

9. Perform functional and safety check according to 4.7.

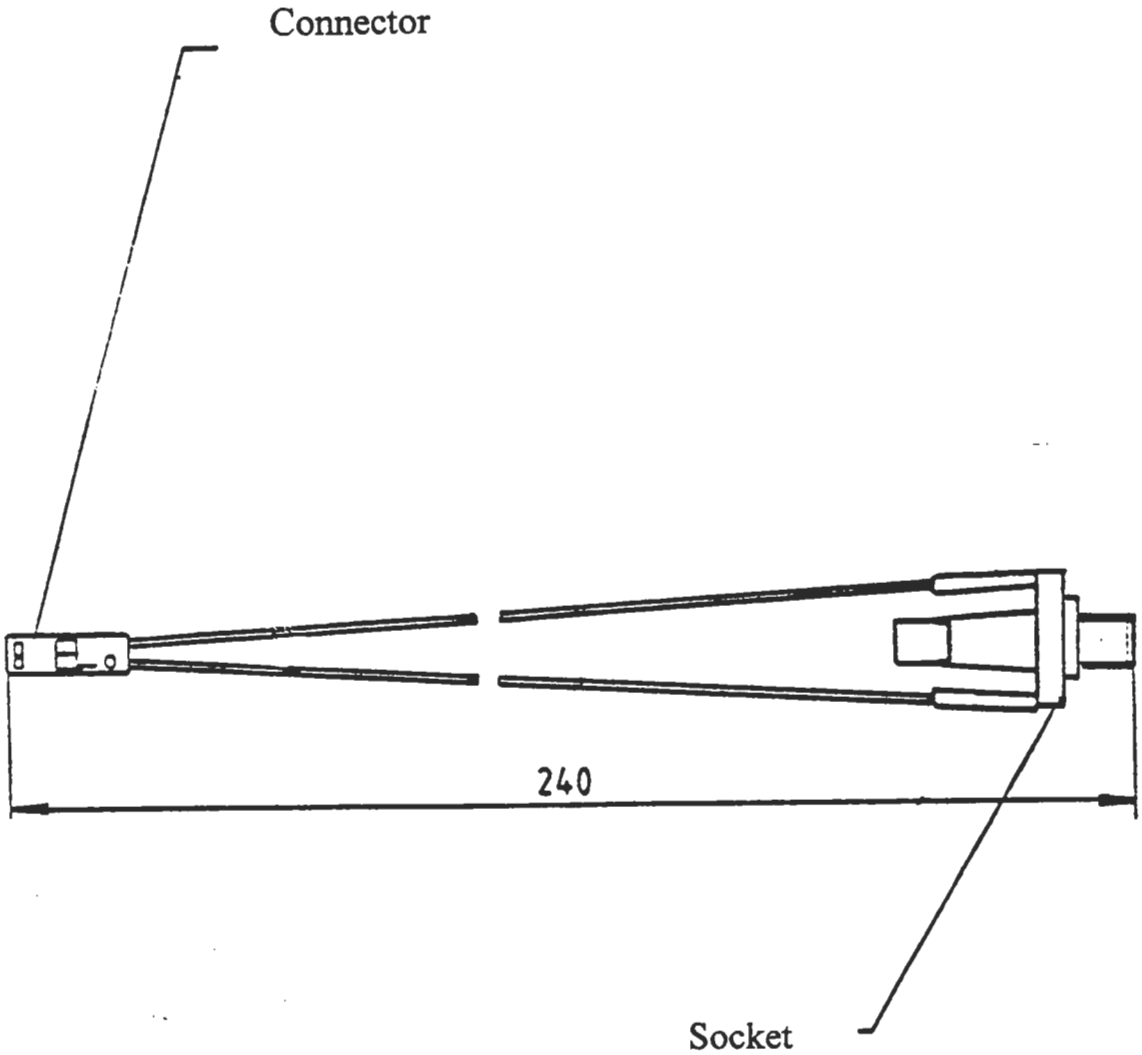

Coax Socket
Connector
200
210
4 mm Socket

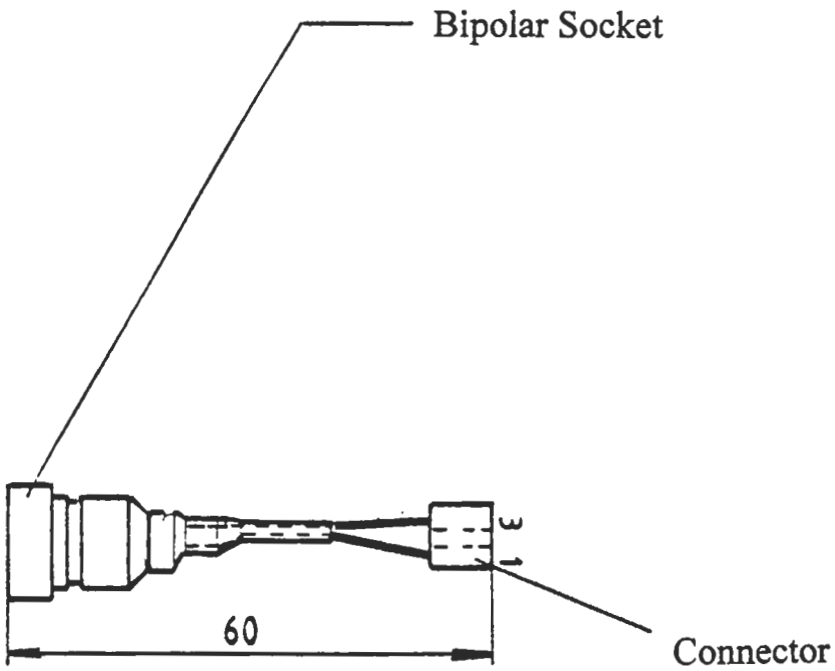
2.3.6 Exchange of Neutral Electrode Socket

1. Open case according to 2.2 and remove front panel according to 2.3.3.
2. Unscrew NE socket from the insulation cup. The insulation cup is fixed at the front PCB. In case of its damage, the front PCB has to be exchanged.
3. Screw new socket in the insulation cup. Take care of correct positioning at the beginning for not damaging the fine-pitched thread in the plastic of the insulation cup. On tightening take care of not bending the contact tongue of the socket. Check correct position of the contact tongue with NE plug and adjust if necessary.
4. Reassemble front panel according to 2.3.3 and close case according to 2.2.
5. Perform functional and safety check according to 4.7.

2.3.7 Exchange of Bipolar Socket (25)

1. Open case according to 2.2 and remove front panel according to 2.3.3.
2. Disassemble front PCB according to 2.3.4.
3. Remove circlip ring (62) with circlip pliers from bipolar socket and connection cable.
4. Remove socket with connection cable frontwards.
5. Guide the connector of the new part through the hole from the front side and place socket.
6. Guide circlip ring over the connection cable and place circlip ring at the socket.
7. Reassemble front PCB according to 2.3.4.
8. Reassemble front panel according to 2.3.3 and close case according to 2.2.
9. Perform functional and safety check according to 4.7.


Connector
240
Socket

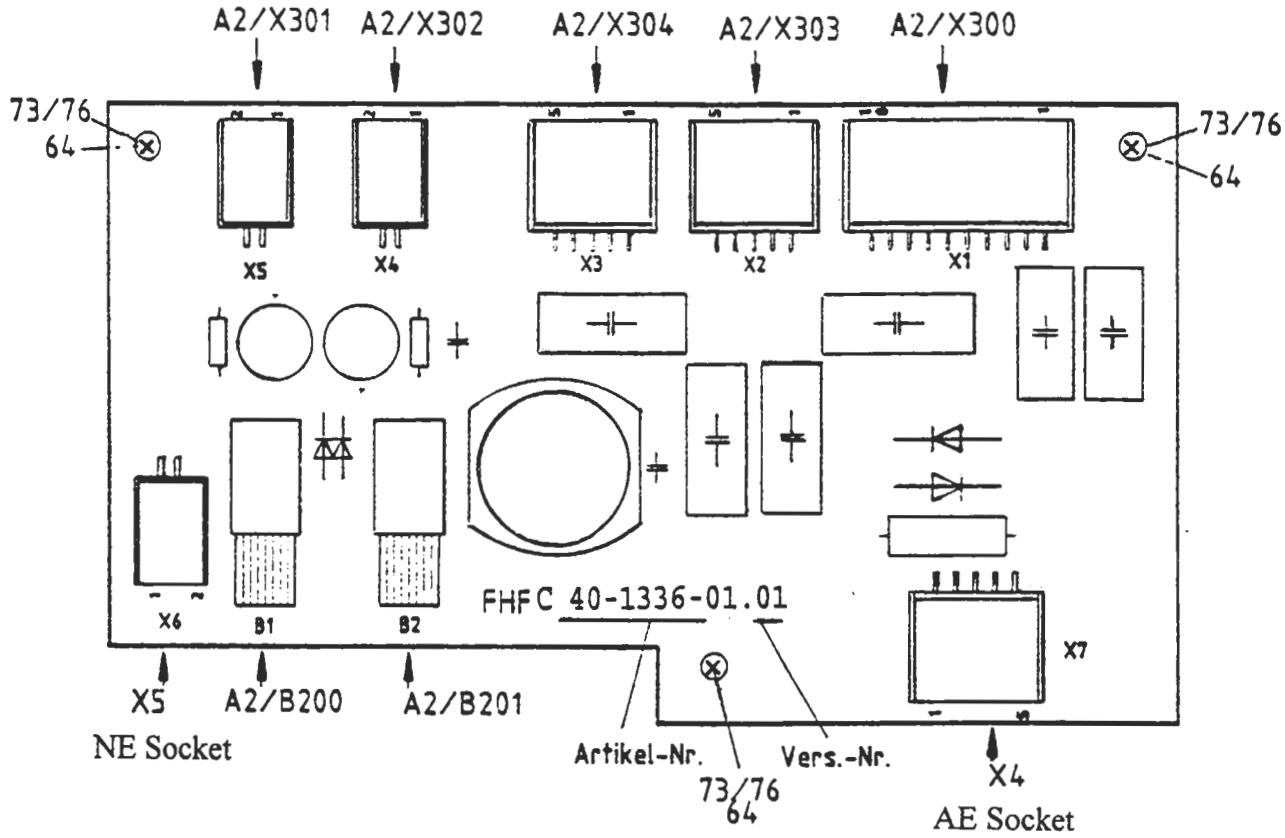

Bipolar Socket
3
1
60
Connector

2.3.8 Exchange of Mains Switch S1 (14)

1. Open case according to 2.2.
2. Remove both of the plastic bolts (66) at the left of the RF generator board. Lift board slightly and remove cable tree to the mains switch from the space between board and case base.
3. Release connection X500 of the bipolar socket at the RF generator PCB. Loosen the four screws (78) and remove front panel.
4. Disconnect cables from the mains switch (14).
5. Push out mains switch to the front side by alternating pressing at the left and the right tongues at the upper side of the switch body.
6. Press new part from the front side into the front panel. Take care for having the "0" symbol at the one edge of the rocker upside.
7. Connect cable tree to mains switch according to wiring diagram. The contact groups of the mains switch are separated vertically. Connect brown cables to the outer side, the black cables to the inner side. Connect the cables from the mains terminal block to the lower side, those leading to the transformer at the upper side (in case of doubt check with wiring continuity checker).
8. Reassemble front panel according to 2.3.3 and reconnect connection X500 of the bipolar socket at the RF generator PCB.
9. Close case according to 2.2.
10. Perform functional and safety check according to 4.7.

2.4 Disassembling and Reassembling of Monopolar Output PCB A3 (32)

1. Open case according to 2.2.
2. Release connection X6 of the NE socket and X7 of the AE socket.
3. Release optical fibres from the optocoupler transmitters B1 and B2. For this purpose, loosen the knurled lock screws at the optocoupler transmitters and pull off fibres.
4. Release connection X1 of the RF output transformer, connections X2 and X3 of the output circuit relays and connections X4 and X5 of the auxiliar transformers.
5. Remove Phillips screws (76), remove board.
6. For reassembling of the board, check first the plastic bolts (64) for correct tightening, because they may be loosend by disassembling of the board. Then place board and assemble with screws (76) and lock washers (73).
7. Reconnect connection X1 of the RF output transformer at the right behind. Reconnect connections X2 and X3 of the relays. Hazard of confusion, place the connector of the right relay at the right socket, that of the left relay at the left socket! Reconnect connections X4 and X5 of the auxiliar transformers, from the right transformer to X4, from the left transformer to X5.
8. Reconnect optical fibres. Hazard of confusion, guide the fibres in parallel, right transmitter to right receiver! Push fibres into the transmitter's body up to the end (approx. 17 Millimeters) and tighten knurled lock nuts.
9. Reconnect connections X6 of NE socket and X7 of AE socket.
10. Close case according to 2.2.
11. Perform functional and safety check according to 4.7.


A2/X301
A2/X302
A2/X304
A2/X303
A2/X300
73/76
64
73/76
64
X5
X4
X3
X2
X1
X6
B1
B2
X7
FHFC 40-1336-01.01
X5
NE Socket
A2/B200
A2/B201
Artikel-Nr.
Vers.-Nr.
73/76
64
X4
AE Socket

2.5 Disassembling and Reassembling of RF Generator PCB A2 (31)

1. Open case according to 2.2.

2. Release connections of AE socket and NE socket from RF output PCB.

3. Release potentiometer connections X1, X2 and X3 at the RF generator PCB. Release connection X500 of the bipolar socket. Release front PCB connection X401 at the RF generator PCB, for that purpose release locking clip (53).

4. Release foot switch connections X4 and X5 at the RF generator PCB.

5. Release connection X2 at the power supply PCB (33).

6. Unscrew the three plastic bolts (66) from the top side of the board.

7. From the bottom side, remove the countersunk screw (77) signed with * and both of the Phillips screws (76) signed with *. Remove RF generator PCB together with RF output PCB (32).

8. On exchange of the RF generator PCB, the RF output PCB A3 (see 2.4) has to be moved from the old to the new part including the spacing bolts (64, 65, 66), the safety cover (51) and the optical plastic fibres (42) as well as the spacing bolt at the center of the front edge of the board and the five-lined connection cable (40) at X100. Replace spacing bolts with damaged thread.

9. Place back subassembly. Take care of the connection cables of the foot switch sockets not to come under the board. Place countersunk screw (77) as well as both of the Phillips screws (76) with lock washers (73) from the bottom side and tighten. Place and tighten plastic bolts (66) at the upper side.

10. Reconnect connection X2 at the power supply PCB. Reconnect the connections X4 and X5 of the foot switch sockets at the RF generator PCB. Reconnect DIL connector X401 of the front PCB at the RF generator PCB and lock with clip (53). Reconnect connections X1, X2, and X3 of the potentiometers. Take care of parallel guiding of the connections, hazared of confusion! Reconnect connection X550 of the bipolar socket.

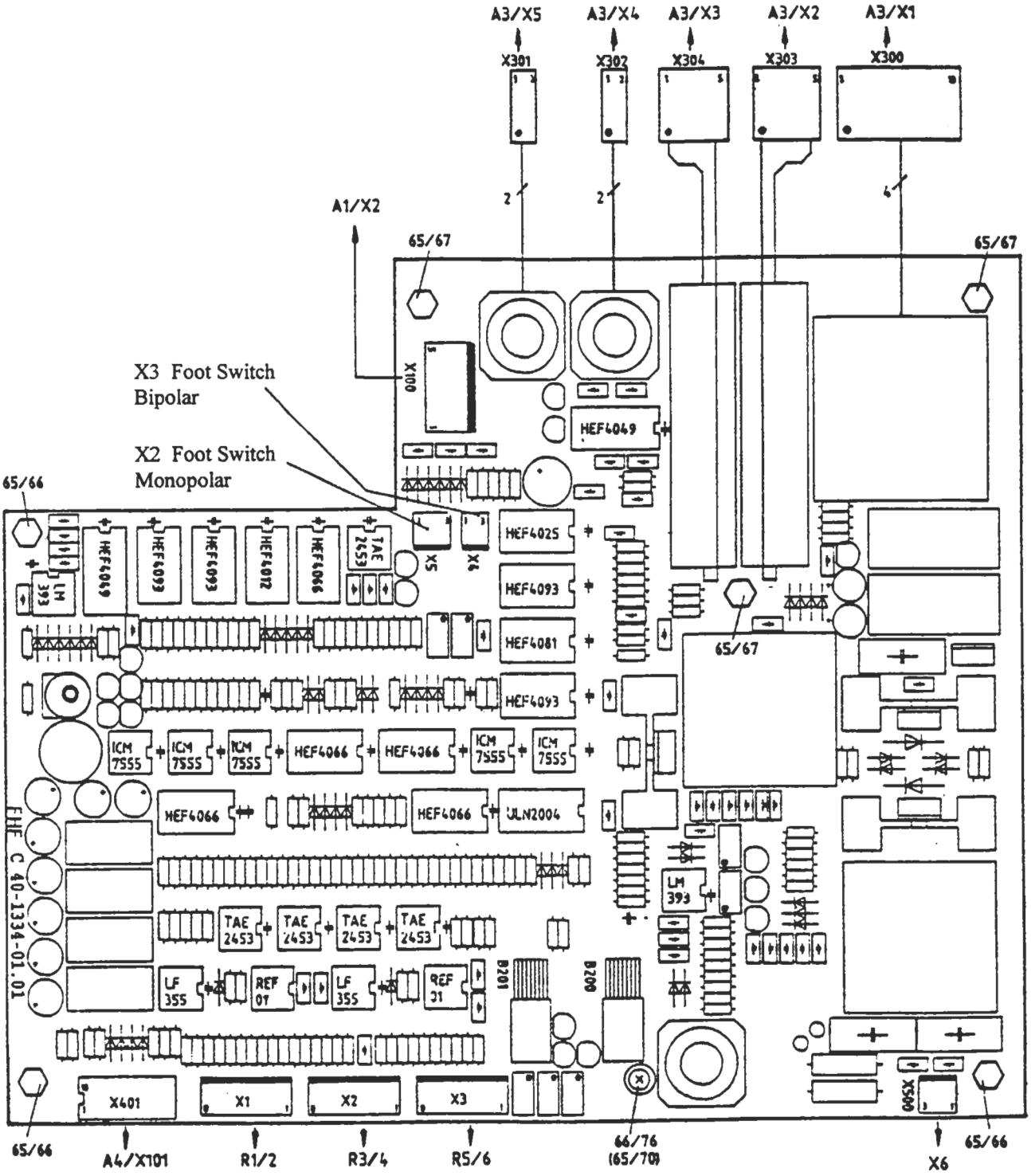
11. Reconnect connections X6 of the NE socket and X7 of the AE socket at the RF output PCB.

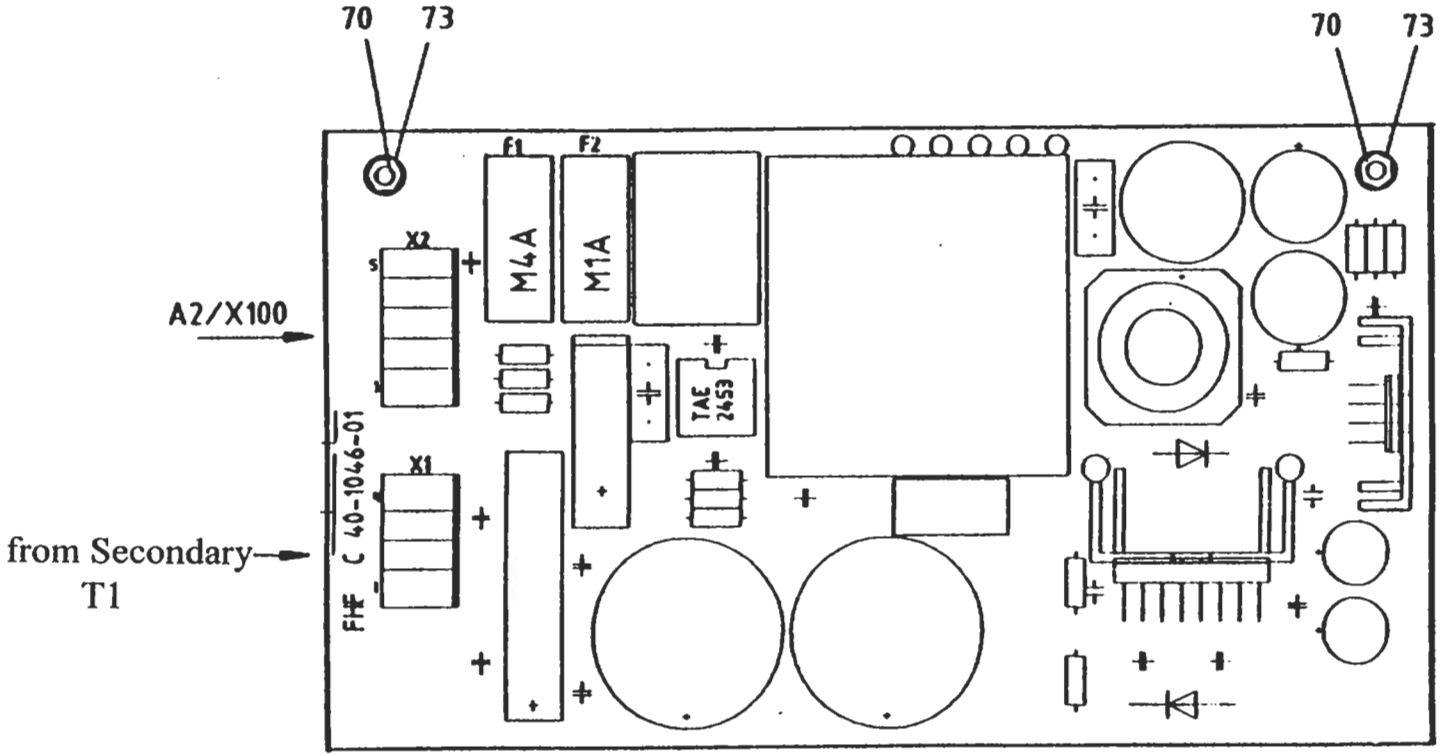
12. Alignment of the operation point of the neutral electrode monitoring circuit according to 4.4 and of the bipolar activation circuit according to 4.5.

13. Alignment of the output power at "Cut II" and "Coagulation" according to 4.3.

14. Close case according to 2.2.

15. Perform functional and safety check according to 4.7.


A3/X5
A3/X4
A3/X3
A3/X2
A3/X1
X301
X302
X304
X303
X300
A1/X2
65/67
65/67
X3 Foot Switch
Bipolar
X2 Foot Switch
Monopolar
65/66
X100
HEF4049
HEF4025
HEF4093
HEF4081
HEF4093
ICM 7555
HEF4066
ULN2004
TAE 2453
LF 355
REF 01
LM 393
X5
X4
X401
X1
X2
X3
X500
FHF C 40-1334-01.01
65/66
A4/X101
R1/2
R3/4
R5/6
66/76
(65/70)
X6
65/66

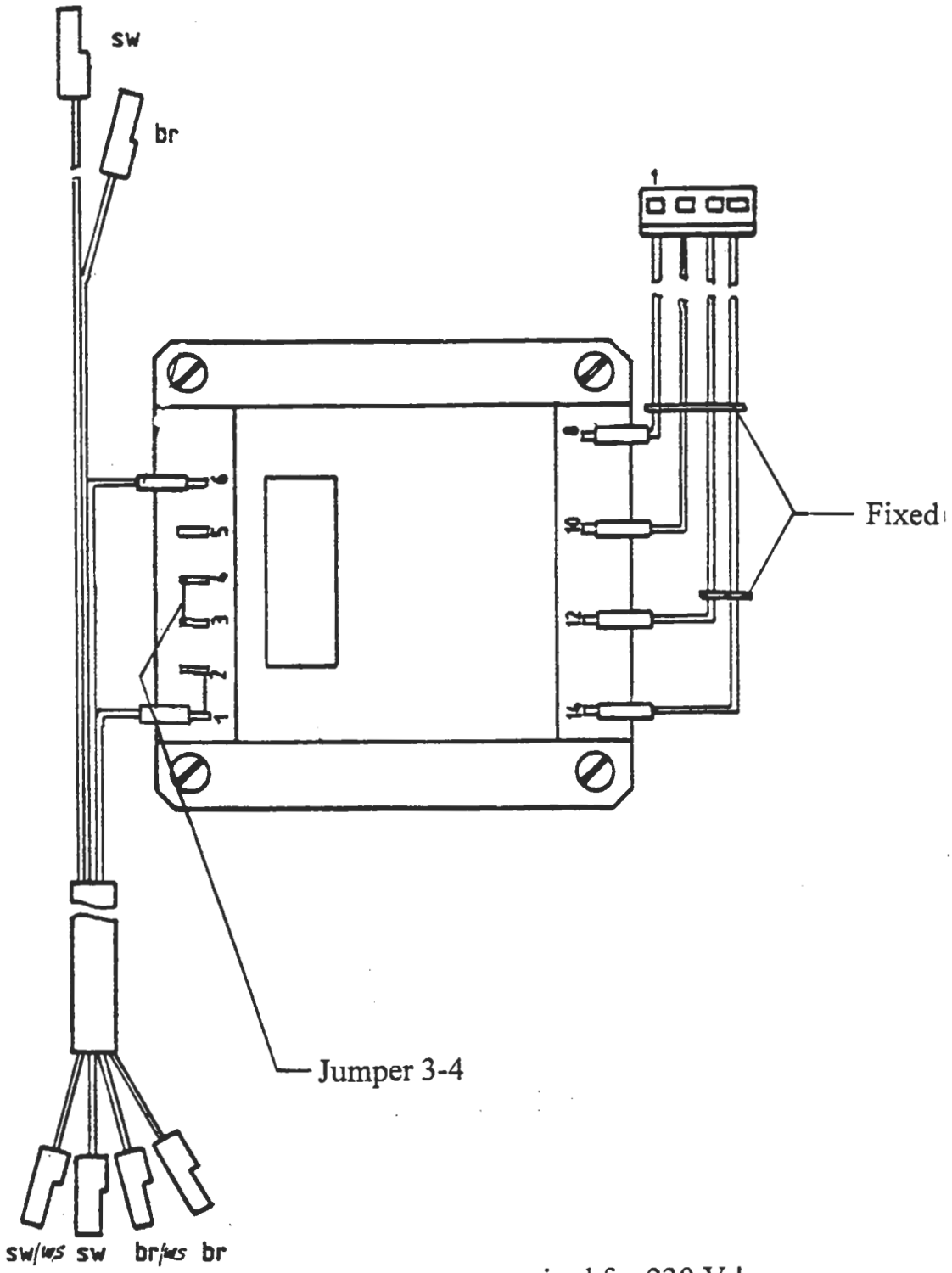

70
73
70
73
F1
F2
M4A
M1A
X2
X1
A2/X100
from Secondary
T1
FHF C 40-1046-01
TAE
2453

2.6 Disassembling and Reassembling of Power Supply PCB A1 (33)

1. Open case according to 2.2 and release connections X2 and X1.
2. Remove nuts (70) and lock washers (73). Bend board frontwards away from the stud bolts, release it from the fixing bar (69) and remove it.
3. Place new board into the fixing bar (69) at the bottom and push it at the stud bolts at the top with spacers (68). Place lock washers (73) and nuts (70) and tighten. The ME 81 is only to be equipped with a power supply board with a version number greater or equal to 01.
4. Reconnect secondary connector of the transformer to X1 and five-lined connection cable (40) to X2 and close case according to 2.2.
5. Perform functional and safety check according to 4.7.

2.7 Exchange of Mains Transformer T1 (12)

1. Open case according to 2.2. Loosen both of the plastic bolts (66) at the left side of the RF generator PCB and pull the cable tree out of the space between case base and RF generator PCB.
2. Release cable tree from mains switch (14) and from mains terminal block (10). If necessary, release cable connection X401 at the RF generator PCB for better accessibility.
3. Release secondary connection X1 of the transformer at the power supply PCB.
4. Unscrew the four screws from the bottom side and remove transformer.
5. For transformer assembling, place transformer with the secondary connector to the right and tighten with screws (78) and lock washers (74).
6. Reconnect connection X1 of the transformer to the power supply PCB.
7. Connect primary cable tree to mains terminal block and mains switch according to wiring diagram. Hazard of confusion with the connection of the mains switch! The contact groups of the mains switch are separated vertically. The brown cables are to be connected to the outer side, the black ones to the inner side.The cables from the mains treminal block are to be connected to the lower side, those from the transformer at the upper side (if necessary check with a wiring continuity checker).
8. Lift RF generator board slightly at the left side and place cable tree into the space be-tween case bottom, left side rim and board. Replace and tighten plastic bolts (66). Reconnect DIL connection X401 at the RF generator PCB and lock with clip (53). Close case according to 2.2.
9. Perform functional and safety check according to 4.7.



wired for 230 V !

2.8 Exchange of Mains Terminal Block X1 (10)

1. Check first that the fault is not with the mains fuses or the fuse holder (11).
2. Open case according to 2.2 and disconnect flat cable connectors of the primary cable tree.
3. Remove countersunk screws (77) (nuts at the inner side).
4. Remove part from the inner side and disconnect protective earth terminal.
5. On assembling of a new part, first reconnect the protective earth terminal.
6. Place new part from the inside in the orifice in the rear of the case and assemble from the outside with Phillips countersunk screws (77) and from the inside with lock washers (73) and M3 nuts (70).
7. Reconnect cable tree connectors and move fuse holder with fuses from the old to the new part.
8. Close case according to 2.2.
9. Perform functional and safety check according to 4.7.

2.9 Exchange of Foot Switch Sockets X2 (26) and X3 (27)

1. Open case according to 2.2.
2. Release the connection X4 or X5 of the socket of concern at the RF generator PCB behind.
3. Remove ring nut at the inside of the rear case with special wrench or screwdriver. If necessary, remove power supply PCB according to 2.6. Remove socket with cable backwards.
4. Place new part from the rear and push ring nut over the cable. Take care on setting the nut at the body of the socket. On placing, the ring nut may wedge at the fine-pitch plastic thread and so damage the thread. In case of difficulty, check the fitting of both parts in the disassembled state.
5. Reconnect connection X4 or X5 of concerning socket at the RF generator PCB. If necessary, reassemble power supply PCB according to 2.6.
6. Close case according to 2.2.
7. Perform functional and safety check according to 4.7.

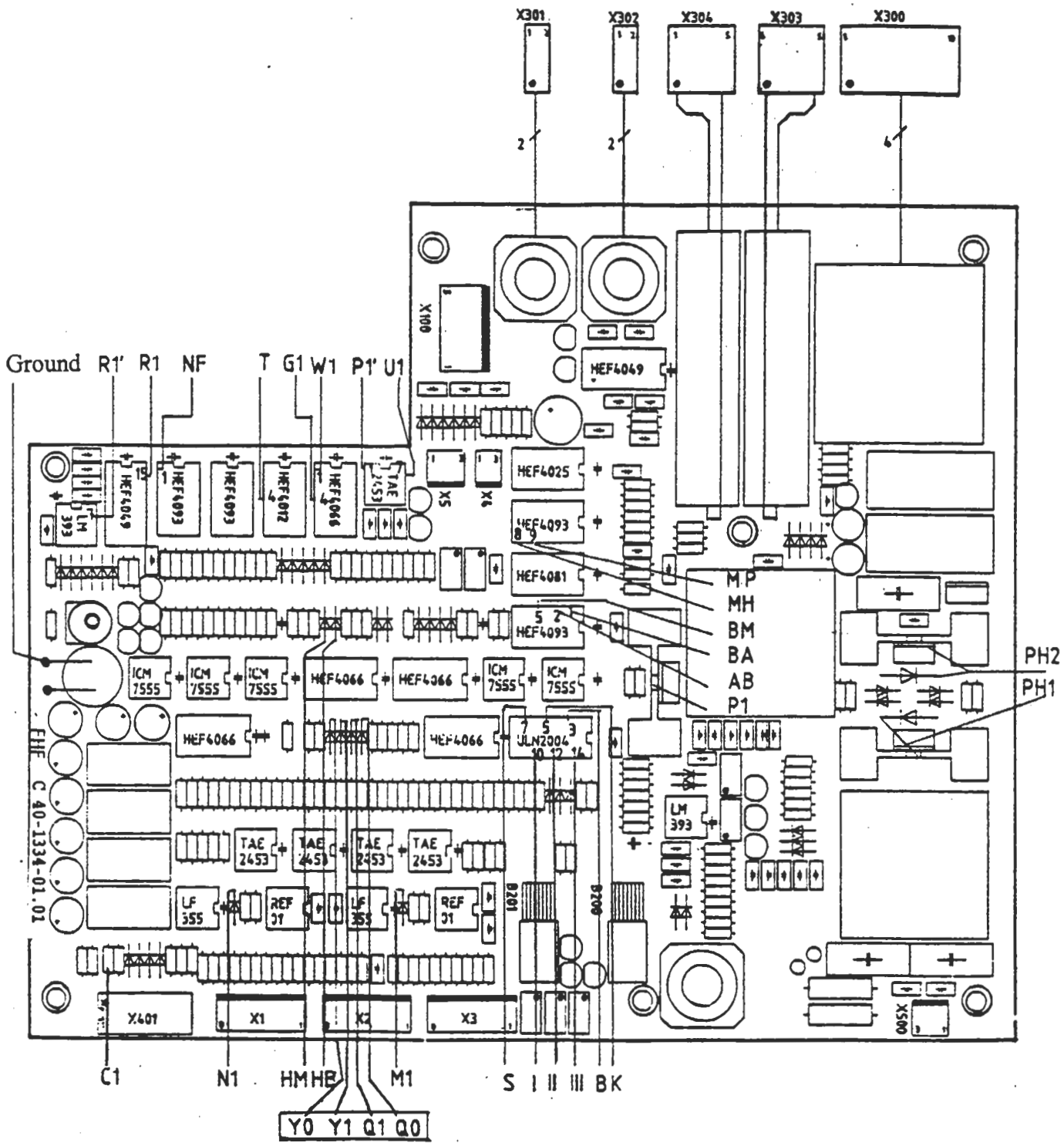
3. Fault Detection

3.1 Test Points and Procedure

Aim of the fault detection shall be to find out a faulty subassembly inside the unit for exchange without trial and error.

For repairs, no soldering is required. All components are connected with plugs. For fault detection in the electronic circuits, a simple multimeter with the functions AC and DC voltage meter and wiring continuity check is sufficient.

With the signals shown in the block diagram in 1.6.1 it should be possible to find out the faulty functional section and so the faulty subassembly. In the following this procedure will be shown at several fault examples. This catalogue does not demand for completeness.



RF Generator PCB Position of Test Points	ME 81	martin		Page 42

3.2 Fault Detection in Case of Total Failure

Fault appearence: No function, the front panel remains dark as if the unit could not be switched on.

Probably cause: a) interruption in the path of the 15V supply
b) Shorting of the 15V supply

Fault detection:

1. Connect voltmeter to the terminals at the mains terminal block. Mains voltage present?

   NO: Check mains cord and mains fuses. Fuse blown?

   YES: Exchange. Will blow again immediately?

   NO: End
   YES: Short circuit at or around the mains transformer. End.

2. Connect voltmeter to the terminals 2 and 6 of the mains transformer. Mains voltage present?

   NO: Faulty mains switch or cable connections. End.

3. Connect voltmeter to the terminals 2 and 5 of the mains transformer. Mains voltage present?

   NO: Faulty temperature switch in the mains transformer. End.

4. Connect voltmeter to the secondary terminals 12 and 14. Voltage of approx. 21V present?

   NO Interruption inside the transformer. End.

5. Check fuse F2 at the power supply PCB. Fuse blown?

   YES: Faulty power supply PCB. End.

6. Check heatsink at the right side of the power supply PCB for heat development. Will heatsink be hot?

   Yes:Short circuit at the RF generator PCB. End.
   NO: Fault at the power supply PCB. End.

7. Fault of the Keys and the Lamps at the Front PCB

Fault appearence: One ore more single keys do not operate or keying will not be acknow ledged. Lamps do not operate.

Probably cause: a) Interruption at the front PCB or the connection cable
b) Fault of the key interface

Fault detection:

1. Release cable connection X401 at the RF generator PCB and provisional connect spare part PCB instead. Is fault no more visible?

   Yes: Fault of the front PCB. In case of incandescent lamp likely blow-out. End.

   NO: Fault of the key interface. Exchange RF generator PCB. End.

3.4 Failure of Monopolar RF Generator

Fault appearence: On activation, there still is an acoustic signal but there is no RF power available at any output in any operation mode.

Probably cause:
a) Oscillator fault
b) Modulator fault
c) Power controller fault

Fault detection:

1. Try activation of "Cut I". Is the yellow RF indication lamp lighting?

   NO: Fault of the RF generator PCB A2. End.

2. Set left rotary knob to "1" and check signal U1. Vary rotary knob setting in small range. Is U1 also varying?

   NO: Fault of the signal electronic circuits of the RF generator PCB A2. End.

3. Check voltage P1 and vary rotary knob in small range around setting "1". is P1 also varying?

   NO: Check voltage at the secondary terminals 8 and 10 of the mains transformer. Are there approx. 33V present?

   NO: Interruption in the transformer. End.
   YES: Check fuse F1 at the power supply PCB. Fuse blown?

   NO: Fault of power supply PCB. End.
   Yes: Exchange. Fuse will blow again immediately?

   YES: Fault of power supply PCB. End.
   NO: Fault canceled?

   YES: End.
   NO: Go to 2.

   YES: Fault of the relay driver of the RF generator PCB A2. End.

4. Alignment, Changes, Check

4.1 Position of Alignment Points

All alignment positions are placed at the RF generator PCB (31). These are:

- S2: Setting of the output power of the current mode "Cut II"
- SK: Setting of the output power of the operation mode "Coagulation"
- NE: Setting of the operation point of the neutral electrode monitoring circuit
- BI: Setting of the operation point of the automatical bipolar activation circuit

The exact position of the alignment points is shown in the figure next page.

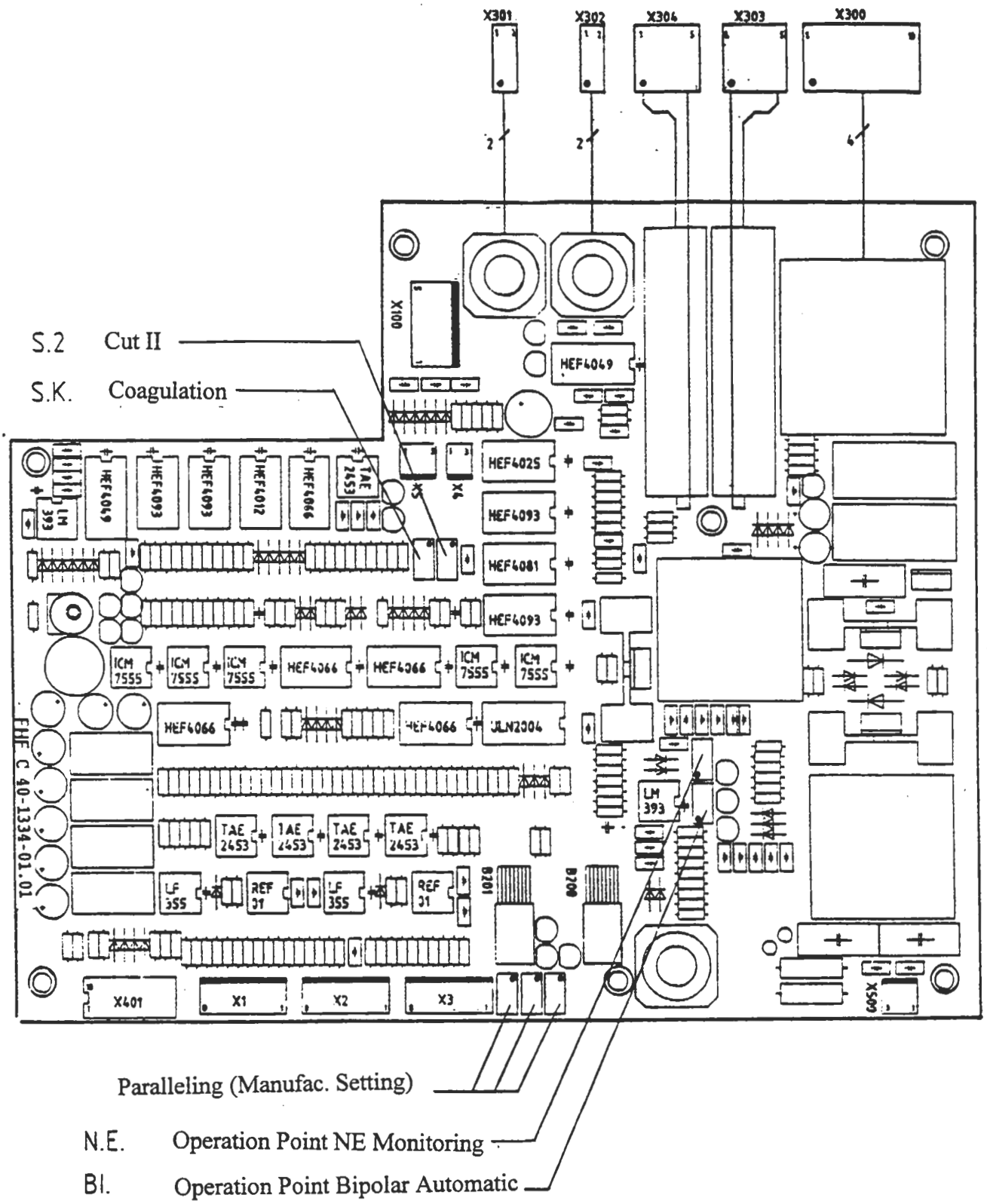
4.2 General Statements on RF Output Power Measurement

In contrast to other electrical values, the measurement of electric radio frequency power is associated with high tolerances. The reasons for this are especially:

1. Generally, power measurement is based on a RMS current measurement by which the current accounts in the second power. Thus an error of 5 Percents with the current makes an error of 10 Percents with the power.

2. The matching resistor represented by a RF power meter is in no case a pure ohmic resistor but is associated with a reactive component which changes the result of a measurement depending on the spectral composition of the RF current.

3. At the service, the output power generally will be measured with short lines between electrosurgery unit and power meter. According to IEC 601, the output power will be measured in a defined arrangement with completely unrolled connection cables of the original accessories. All ratings concerning the RF output power are referred to this arrangement. In contrast to the measurement with short lines, this arrangement shows higher power at monopolar operation. Explanation: The incuctance of the loop formed by the AE and NE connection cables particular compensates the capacity of the matching capacitor and thus diminishes its impedance. In the case of bipolar operation, a lower output power will be gained. Explanation: The capacity of the coaxial bipolar connection cable represents a not negligible shunt to the power meter.


X301
X302
X304
X303
X300
S.2 Cut II
S.K. Coagulation
FHF C 40-1334-01.01
Paralleling (Manufac. Setting)
N.E. Operation Point NE Monitoring
BI. Operation Point Bipolar Automatic

Thus the standards permit measured values to be correct which deviate up to +/- 20 Percents from the nominal value. For the ME 81, the following tolerances of measurement are permissible:

Cut I:	80W at 750 Ohms -20/+20% (64W to 96W)
Cut II:	80W at 750 Ohms -20/+20% (64W to 96W)
Coagulation:	30W at 1500 Ohms -20/+20% (24W to 36W)
Bip. Coag.:	70W at 150 Ohms -20/+20% (56W to 84W)

At the manufacturer's site, the units are adjusted using a MARTIN RF power meter EPM 2 or FM 2097.

4.3 Alignment of RF Output Power

The unit ME 81 offers no possibility of adjustment for the current modes "Cut I" and "Bipolar Coagulation". The output powers of the modes "Cut II" and "Coagulation" are to adjust by alignment of the degree of modulation.

1. The adjustment of "Cut II" will be performed as follows:

2. Connect power meter and set it to 750 Ohms.

3. Select "Cut II" with the MICRO mode disabled, set left rotary knob to "10".

Activate cutting and adjust output power to 80 Watts at the trimmer "S.2" behind of the RF generator PCB A2 by carefully turning. More power: turn counterclockwise; less power: turn clockwise.

The "Coagulation" adjustment is to perform as follows:

1. Connect power meter and set it to 1500 Ohms.

2. Disable MICRO mode and set center rotary knob to "10".

3. Activate coagulation and adjust output power to 30 Watts at the trimmer "S.K." behind of the RF generator PCB A2 by carefully turning. More power: turn counterclockwise; less power: turn clockwise.

The adjustment of the degree of modulation, especially that of the coagulation should only slowly be moved from its former position else there is the hazard of setting the degree of modulation too high which may damage the power controller or the RF generator. Note calibration breaks at the MARTIN power meter.

4.4 Adjustment of NE Monitoring Circuit

1. Connect 235 Ohms resistor to the terminals of the NE socket (useful: place a 235 Ohms resistor in a common available 1/4" coax plug).
2. Turn trimmer "NE" at the right side of the RF generator PCB clockwise until the NE fault lamp starts blinking.
3. Turn trimmer "NE" slowly counterclockwise until blinking stops.
4. Check function by disconnecting and reconnecting of the plug.

4.5 Adjustment of Activation Threshold of Bipolar Automatic

1. Set right rotary knob to "1", set MICRO mode and bipolar automatic mode.
2. Connect resistor of 2000 Ohms to terminals of bipolar output socket (wrap wires of resistor around the tips of a bipolar forceps). For this purpose, take care that the bipolar output power is set to minimum else there is the hazard of burnings!
3. Turn trimmer "BI."at the right side of the RF generator PCB A2 clockwise until activation is disabled. Then turn slowly counterclockwise until activation is enabled again.
4. Check function by disconnecting and reconnecting of bipolar plug.

4.6 Change of Mains Voltage

The ME 81 is set to the mains voltage of the destination market at the manufacturer's site. If a change to an other mains voltage is desired, the interconnections at the primary of the mains transformer have to be changed by soldering and the mains fuses have to be changed. For this purpose, a changing kit will be offered.

Changing from **230V to 115V** is to be performed as follows:

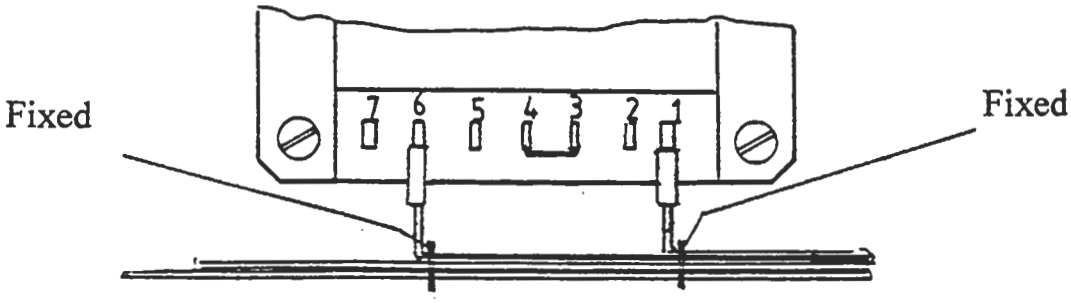
1. Disconnect mains cord and open case according to 2.2.
2. Remove cable connection or jumper between transformer terminals 3 and 4 by soldering. Eventually remove cable band which fixes cable connection and replace bands after removing of cable connection.
3. Connect transformer terminals 2 and 3 as well as 4 and 5 with soldered jumpers according to the figure next page.
4. Replace mains fuses by two fuses with 1.6A slow blow.
5. Replace label "Voltage and Fuses" at the rear, sign new voltage.
6. Close case according to 2.2 and perform safety checks according to 4.7.

Changing from **115V to 230V** is to be performed as follows:

1. Disconnect mains cord and open case according to 2.2.
2. Remove cable connections or jumpers between transformer terminals 2 and 3 as well as 4 and 5 by soldering. Eventually remove cable band which fixes cable connection and replace bands after remove of cable connection.
3. Connect transformer terminals 3 and 4 with soldered jumper according to the figure next page.
4. Replace mains fuses by two fuses with 0.8A slow blow.
5. Replace label "Voltage and Fuses" at the rear, sign new voltage.
6. Close case according to 2.2 and perform safety checks according to 4.7.

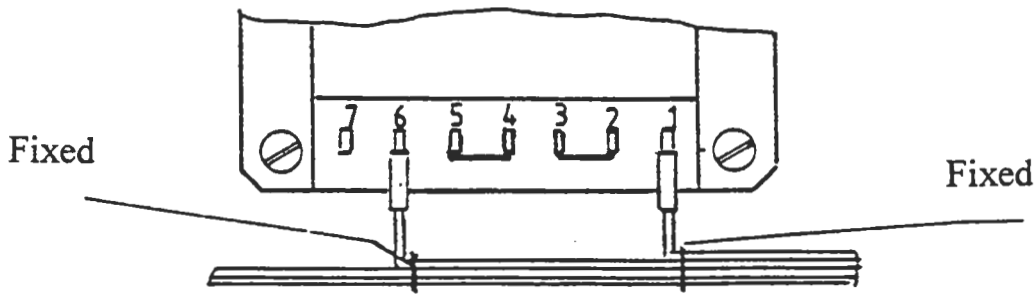
For the extraordinary voltages 100V (Japan) and 127V (Mexico), special mains transformers are available on request.

230 V



Mains Connection: Terminals 1 and 6
Jumper from 3 to 4

115 V



Mains Connection: Terminals 1 and 6
Jumpers from 2 to 3 and 4 to 5

4.7 Repetitive Safety Checks

At this unit, the following checks are to be performed at least each twelfe months by persons who are in the position to perform such safety checks in an ordinary manner because of their training, their knowledge and their experience gained by practice and who are not subject to orders concerning this checking activities.

- Check visual unit and accessories for function impairing mechanical damages.
- Check safety relevant labels for readability.
- Check fuse cartridges for nominal current value and blow characteristic.
- Perform functional check according to the user's instruction manual.
- Check for continuous change of output power corresponding to the sense of turn of the power setting potentiometers.
- Check for acoustic and optical alarms and cutoff of RF power activation on interruption of the neutral electrode.
- Compare setpoint and actual values of maximum output power fed to the nominal resistors according to item 4.2 at all of the four operation modes.
- Compare setpoint and actual values of maximum output power of the monopolar output at current mode "Cut I" fed to a 400 Ohms load. The fed power has lo be lower than that fed to a 750 Ohms resistor
- Compare setpoint and actual values of maximum output power of the bipolar output at current mode "Bipolar Coagulation" fed to a 50 Ohms load. The fed power has lo be lower than that fed to a 150 Ohms resistor
- Check acoustic and optical signals at power activation.
- Measure resistance of PE circuit according to IEC 601-1. Maximum value: 0.2 Ω.
- Measure leakage current of the unit according to IEC 601-1. Maximum value: 500 µA.
- Measure patient leakage current according to IEC 601-1. Maximum value: 10 µA.

The leakage currents may override the first measured values for 50 Percent and additionally shall not override the maximum values mentioned above.

The first measured values can be seen from the attached test reports at the first setup of the unit. The safety check is to enter in the unit's accompanying booklet and test results are to be recorded.

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Test Report	ID No.: .....
Tester:	Serial No.: ME 81.....
Owner:	Manufacturer: **Martin Medizin-Technik**
.....	Kind of Unit: **Electrosurgery Unit**
.....	Type: **ME 81**
	Year of Production: .....

Test Standard: **IEC 601** ❑ ..... ❑

Test Result:

❑ 1. Measurements see Reverse of this Test Report.

❑ 2. Points of no Compliance:.....
.....
.....
.....
.....
.....
.....

❑ 3. No Faults or Faults which do not concern Safety. The unit may be operated for further Use.

❑ 4. The Unit may be operated for further Use if the Faults mentioned above are removed.

❑ 5. Errors which require Maintenence or repair of the Unit before next Operation else Patients, Users or Third Persons may be Object of Hazard.

Date: Signature: Next Date of Check:

Test Report Sheet for Repetitive Safety Checks, Front Face

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Tester:	Current No.:

Test Report: **Type: ME 81** **Serial No.:**

	i. O.	n. i. O.	entfällt	Bem.
1. Type label				
2. User's Instruction Manual				
3. Labeling				
4. Operation Elements				
5. Equipotential Connector				
6. Genuine Accessories? (Else Designation of Manufacturer)				
7. Visual Check of RF Connection Cords				
8. Foot Switch at OP Waterproof and AP Proof				
9. No Output Power on Missing Neutral Electrode				
10. Monitoring Circuit of Neutral Electrode (Acoustic Signal				
11. Check for Operation of Hand and Foot Switch Control				
12. Check for Optical and Acoustig Signal on RF Activation				

13 RF Power Measurement (Maximum at Nominal Resistance)

Cutting 1 at 750 Ohms: ..... Watts
Cutting 2 at 750 Ohms: ..... Watts
Coagulation at 1500 Ohms: .....Watts
Bipolar Coagulation at 150 Ohms: ..... Watts

Comments:.....
.....
.....
.....

Electrical Measurements According to IEC 601

14. Insulation Resistance Mains versus Case: ..... MΩ
15. Insulation Resistance Applied Part: ..... MΩ
16. Measurement of Protective Earth Conductor Resistance ..... Ω
17. Low Frrequency Leakage Current, Normal Condition ..... µA
18. Low Frequency Leakage Current, Single Fault Condition ..... µA
19. Enclosure Leakage Current, Normal Condition ..... µA
20. Enclosure Leakage Current, Single Fault Condition PE Conductor ..... µA
21. Enclosure Leakage Current, Single Fault Condition Mains ..... µA
22. Patient Leakage Current, Normal Condition ..... µA
23. Patient Leakage Current, Single Fault Condition PE Conductor ..... µA
24. Patient Leakage Current, Single Fault Condition Mains ..... µA
25. Patient Auxiliary Current, Normal Condition: ..... µA
26. Patient Auxiliary Current, Single Fault Condition PE Conductor ..... µA
27. Patient Auxiliary Current, Single Fault Condition Mains: ..... µA
28. Patient Leakage Current with Voltage in Parallel to Applied Part: ..... µA
29. dto., Interchanged Phases: ..... µA

Unit Checked at: ..... **From:** .....

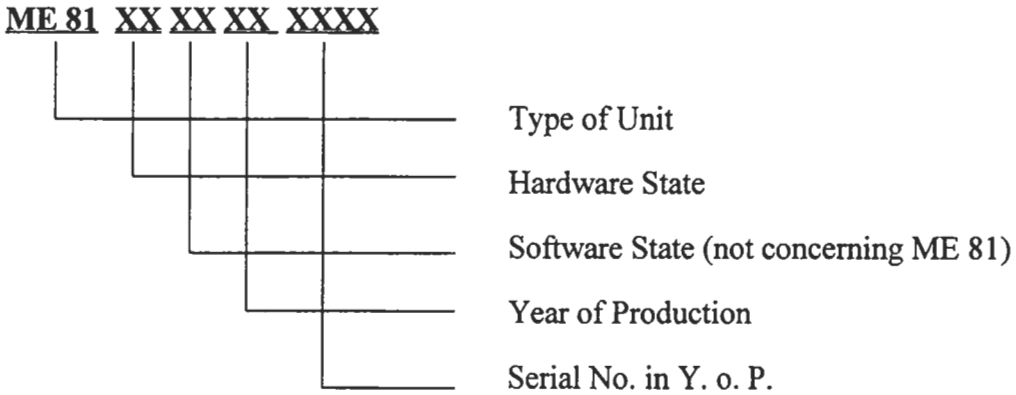
Test Report Sheet for Repetitive Safety Checks, Reverse

5. Alterations

5.1 Procedure

As experience shows, during their sales lifetime technical products undergo repeated technical alterations due to steady product improvements. To the service, this imposes the problem of having several versions of the same type of unit and prior to each repair it must be clarified which version is present.

In the past this was indicated by an additional hardware index label. At the ME 81 this is now indicated in the serial number:



The hardware state is defined by:

- Revision state of boards
- Revision state of mechanical construction
- Revision state of alignment

The boards are equipped with two labels. One of the labels contains the manufacturer's identity number C 40-XXXX and a continuing testing number with sign or identity number of the tester. The second label indicates the state of revision. If such a revision is present in the market, it will be concern of the following items.

If such a board will be repaired at the manufacturer's site, it will get a third "repair" label. If possible, such boards will be updated to the actual state of revision and, after complete test procedure, will be used for repairs as exchange boards.

If it has the same MARTIN ordering number as the old part according to 2.1 (not to be confused with the manufacturer's identity code), a board with a higher state of revision may replace a board of lower state of revision (stepdown compatibility). **Vice versa, this is generally not valid!**

What makes the difference of new revisions with respect to their predecessors and which compatibilities are valid will be explained in the items corresponding to the different configurations. On release of a new revision a description of the new configuration will be created and distributed by the Martin Service Center by the same way as this service documentation.

5. Configurations

5.2.1 Hardware Configuration "00"

The configuration "00" is the first configuration of the ME 81 manufactured and consists of the board versions as follows:

- Power supply PCB A1: 01
- RF generator PCB A2: 01
- RF output PCB A3: 00
- Front PCB A4: 00

Take care that the power supply PCB ia version "01" which is able to deliver a higher current at low output voltage with respect to the version "00". This is required because of the improved coagulation performance with respect to the predecessor ME 80.

Emphased care must be taken for not confusing this boards with those boards of the units ME 80 and ME 50 which are identical in the connection layout.

Concerning the mechanical design, the difference between ME 81 in the configuration "00" and the units ME 80 and ME 50 is only in the mains switch with an illuminated rocker.

Configuration 0100

This configuration is a design review for the PCS – Monitoring function to adapt the TWIN – PAD.

Power supply PCB A1 # 08-032-00-01:	Version 01
RF – Generator PCB A2 # 08-012-00-16:	Version 02
RF – output PCB A3 # 08-022-00-11:	Version 00
Front PCB A4 # 08-010-00-21	Version 00

Configuration 0200

This configuration is a design review for the Neutral – Electrode Socket (# 08-024-00-04).

Configuration 0300

This configuration is a design review for the RF – Generator PCB (Connector for the Potentiometer / HF – Power).

Power supply PCB A1 # 08-032-00-01:	Version 01
RF – Generator PCB A2 # 08-012-00-16	Version 03
RF – Output PCB A3 # 08-022-00-11	Version 00
Front PCB A4 # 08-010-00-21	Version 00

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