Martin

Martin MD 70
Electrosurgical Unit

Service-manual

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12. Trouble Shooting

13. Alignment, Settings

1. NOTES ON PRODUCT LIABILITY

Martin only accepts responsibility for the safety, reliability and performance of the units when:

1) Expansion of the installation, adjustments, modifications or repairs are carried out by a person authorised by Martin

2) The electrical installations in the room comply with IEC regulations

3) The unit is operated according to the instructions given

2. TECHNICAL DATA

Unit type	
Power requirement (volts) Alternating current ± 20%	220 - 240 V ~
Current consumption (max VA)	125
Mains frequency	50 - 60 Hz
Classification	I
Type	BF
HF nominal frequency kHz	500
Inpulse frequency of modulation kHz	33
DAB	10/30 sec. (*)

(*) DAB is the ratio of loading time to dead time

2.1 Crest Factor (**):

CURRENT TYPE	MD 70
SPRAY COAGULATION	1,5
CUT I	2,2
CUT II	4,8

**) The crest factor is the ratio of peak power to r.m.s. power

2.2 HF Output: Macro

CURRENT TYPE	WATTS	IN OHMS
SPRAY COAGULATION	30	1000
CUT I	50	1000
CUT II	50	1000

2.3 HF Output: Micro

can be selected by pressing the "micro" touch-button

CURRENT TYPE	WATTS	IN OHMS
SPRAY COAGULATION	15	1000
CUT I	15	1000
CUT II	15	1000

Weight kg		4,75
Dimensions	height mm	97 mm
	width mm	256 mm
	depth mm	320 mm

Construction: The functional assemblies are easily interchangeable. Entire construction according to VDE 0750 Part 1/05.82 (= IEC 601-1/1977) and VDE 0750 Part 202/09.84 (= IEC 601-2-2)

2.4

Certificates:	MD 70
FTZ serial test number	applied for
Construction type approval	01/M-135/90

3. TECHNICAL DESCRIPTION

The Martin MD 70 electrosurgical unit is constructed using the most modern components of power electronics and the latest safety technology according to VDE 0750 and DIN IEC 601.

The MARTIN MD 70 electrosurgical unit displays the following features:

1. High output power to carry out all electrosurgical proceedings in dentistry.

2. Monoterminal technique possible in all indications due to special power characteristics.

3. To meet the special requirements for working in the dental, oral and mandibular areas, the high frequency current can be activated by one of two handles for cutting and / or coagulation.

4. A handle without finger switch may be connected to the footswitch.

5. The micro function enables power to be reduced for tricky applications.

6. Infinitely variable output power.

7. Acoustic warning feature in high frequency activation > 10 sec. (switch-on time).

ENTRY INSPECTION

DAMAGES CAUSED DURING TRANSPORT

Kindly check units and accessories for damages caused during transport or shortcomings.

DAMAGE CLAIMS

Damage claims may only be considered if the seller or carrier is immediately advised. After this, a report on the damage must be compiled. This report must be sent to the nearest MARTIN representative or to MARTIN headquarters so that the insurance company can be advised.

RETURNING GOODS

If a unit has to be sent back to MARTIN or to a MARTIN service point, it should be in the original box if possible. The following details must be enclosed:

Name and address of proprietor, type and serial number of the unit, description of defect.

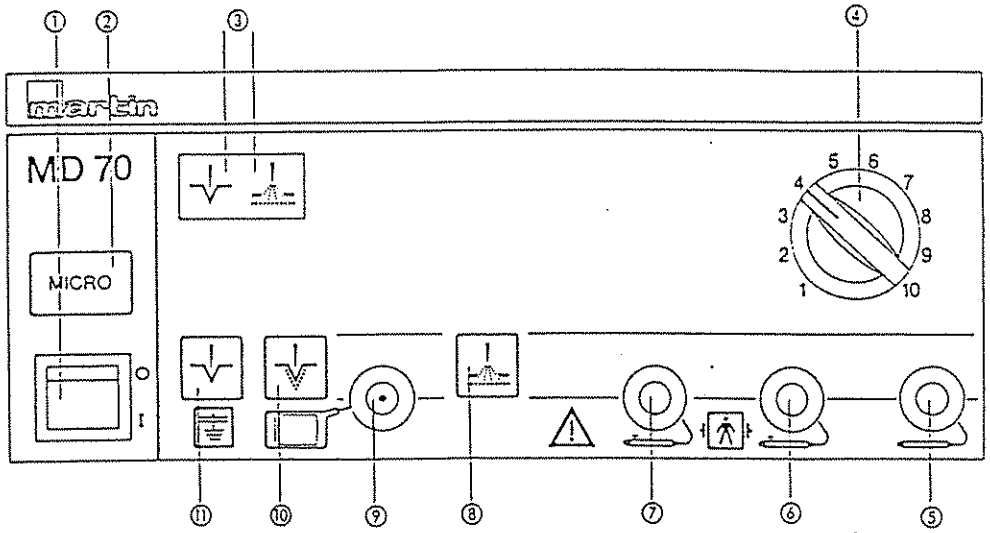
IMPORTANT NOTES

Improper use and non-observance of safety regulations may lead to serious accidents when using electrosurgical units.

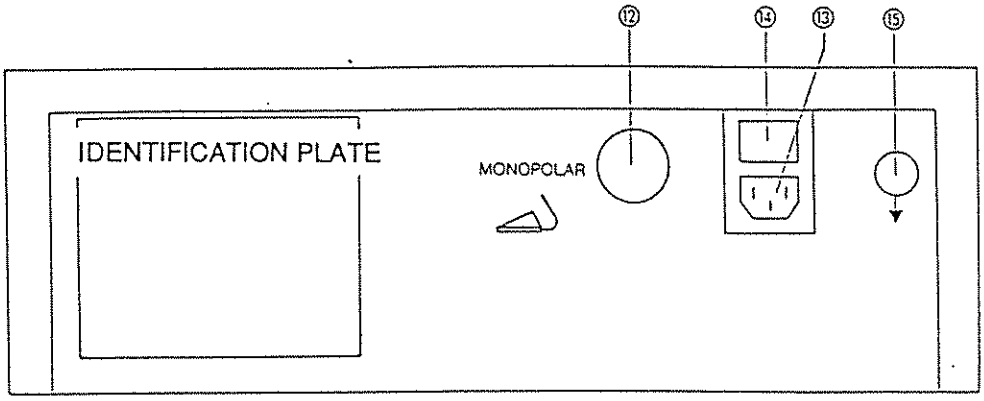
Therefore please read these operating instructions to find out how your new unit works and about the basic laws of physics concerning the electrosurgical technique.

This unit may only be used in rooms used for medical purposes which have been installed according to VDE 0107.

4.0 FUNCTION OF OPERATING ELEMENTS AND INDICATOR LIGHTS



4.1



1 Mains switch "ON / OFF"

2 Touch-button for change to Micro

3 Indicator light for CUTTING and FULGURATION

4 Control knob

5 Socket for single-pole handle without switch (can only be activated by the footswitch)

6 + 7 Socket for handle with fingerswitch

8 Touch-button for FULGURATION

9 Socket for neutral electrode

10 Touch-button for CUT II

11 Touch-button for CUT I

12 Socket for footswitch

13 Socket for mains cable

14 Fuses

15 Equipotential connection

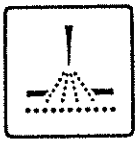
Cut I

Unmodulated HF current with high effective power at a relatively low voltage.

This current type produces a sharp cut without or with very little sparking and therefore without additional scab formation at the cut surfaces.

Cut II

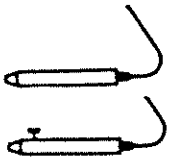
Weakly-modulated HF current to cut with little scab formation at the cut surfaces.



Spray coagulation

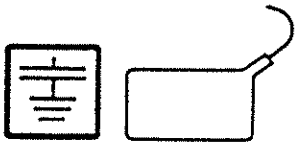
Very strong modulated HF current with very high voltage for spray coagulation or fulguration.

Touch-button for reduced output / micro-function



Sockets for electrode handles

Symbol for classification of unit in class BF (the unit is defibrillator proof).

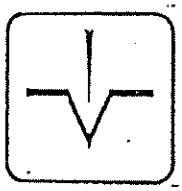


Socket for neutral electrode. Neutral electrode earth-insulated at high frequency.

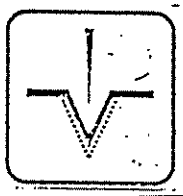
means CAUTION! READ INSTRUCTIONS

4.3 MARTIN MD 70 ELECTROSURGICAL UNIT

In the top-class MARTIN MD 70 electrosurgical unit, the current form can be set between completely unmodulated HF current and strongly modulated HF current for fulguration.

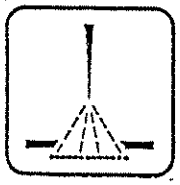


Unmodulated HF current allows optimal cutting. By filtering (lack of any modulation of HF current oscillations), sparking at the cutting electrodes and thus the danger of burns at the surface cuts are reduced to an absolute minimum.



Weakly modulated HF current very clearly displays one of the main advantages of electrical cutting: a clear operating area with minimal or no bleeding.

This current form also enables the experienced surgeon to cut without causing burns when a good operating technique is used.



Strongly modulated HF current with high voltage peaks make fulguration possible. Sparking over the air space between the electrode and the tissue produced intentionally when using this current type causes limited scab formation on the tissue surface and tissue destruction.

STARTING THE UNIT

The unit is ready for use when it has been connected to the mains (see section 7), the electrode handle with the active electrode has been connected, and the switch 1 has been pressed.

5.0 FUNCTION TEST

Before using the unit, the following test must be carried out:

Switch on the HF current using the footswitch or the button on the electrode handle. The indicator light 3 should light up and the acoustic switch-on signal should sound.

CAUTION

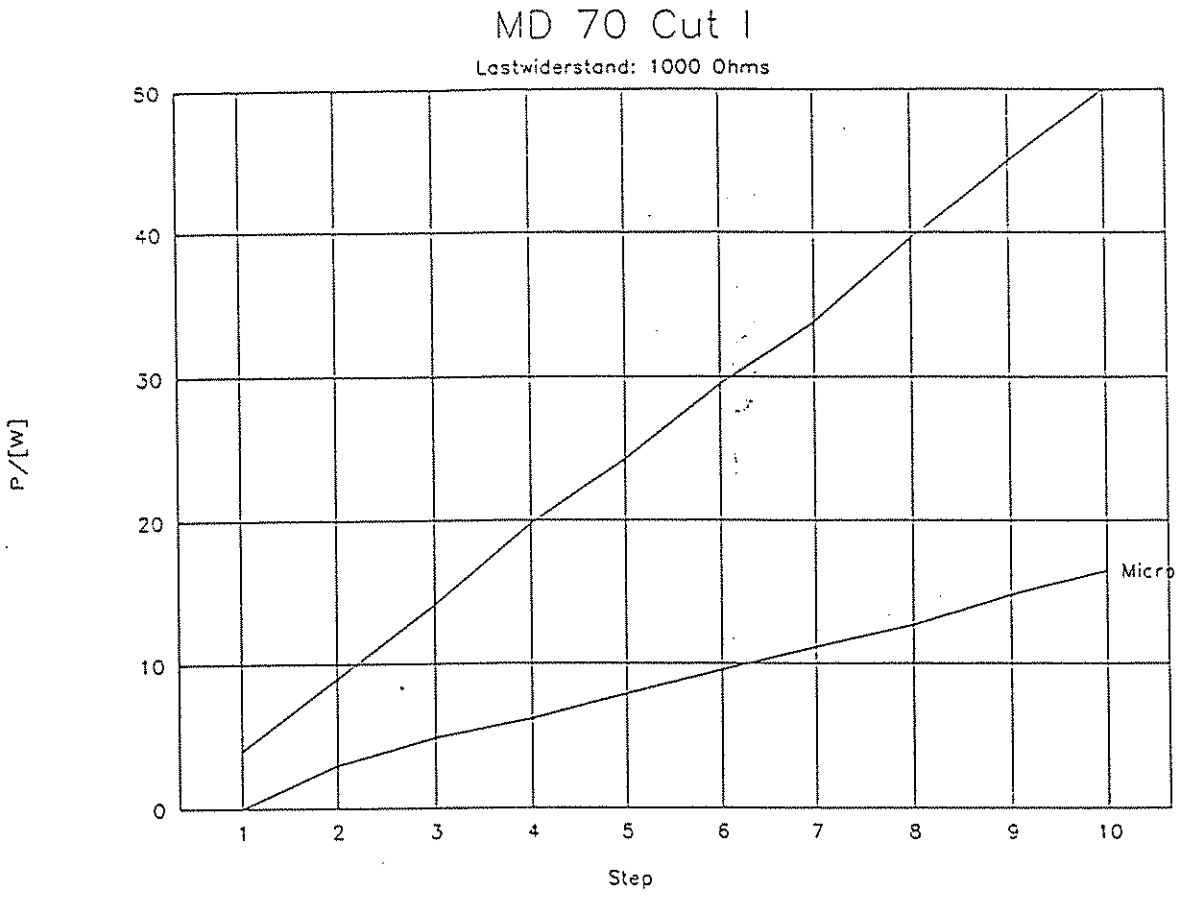
When there is an optical or acoustic signal when the footswitch or electrode handle are not connected, the unit is faulty and must be checked. If the defect is observed after the footswitch or the electrode handle have been connected, either the footswitch, the electrode handle or the connecting cable of the electrode handle is faulty. Check these parts immediately and replace if necessary.

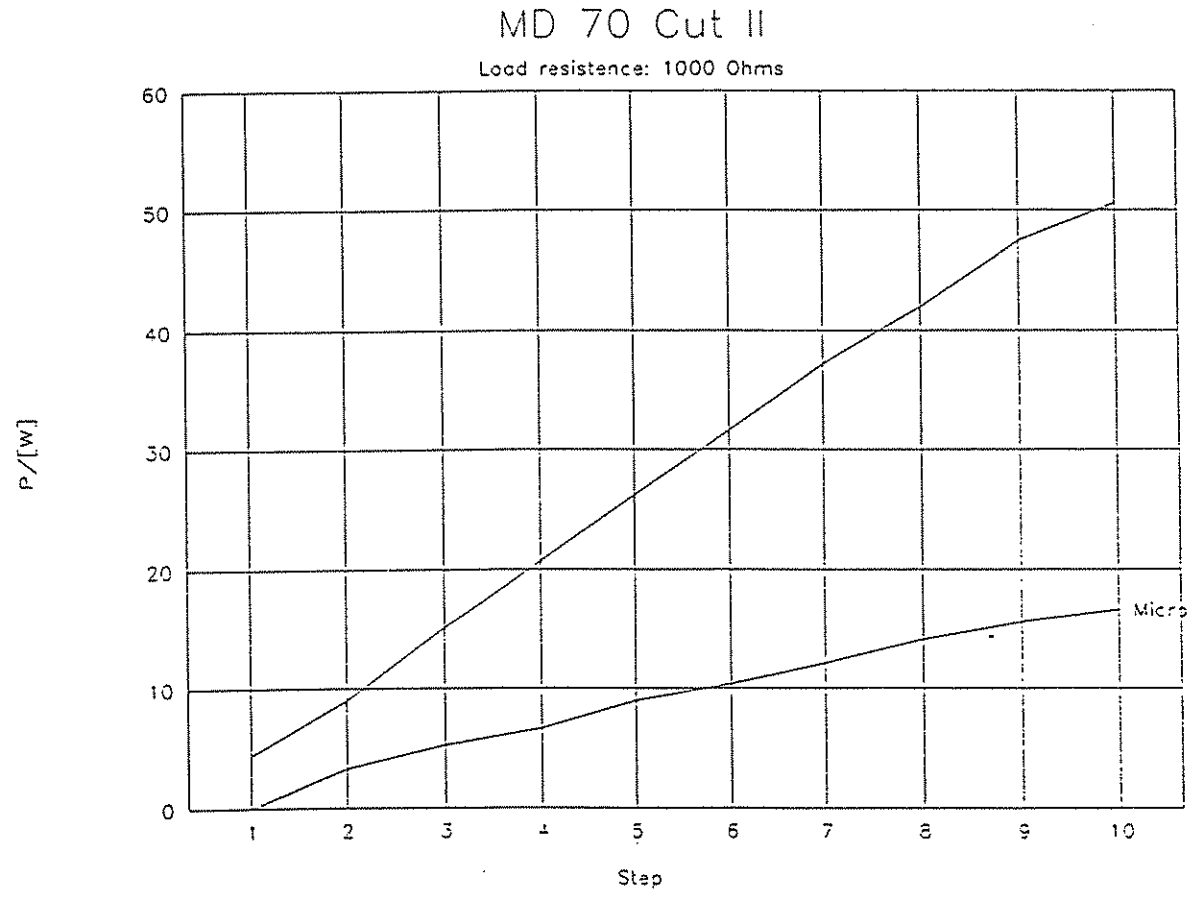
When switching on HF current using the footswitch, connect handle without fingerswitch to socket 5. When connecting the footswitch (socket 12), please ensure that the plug is correctly introduced into the socket. The lug inside the plug must be pushed into the notch on the socket.

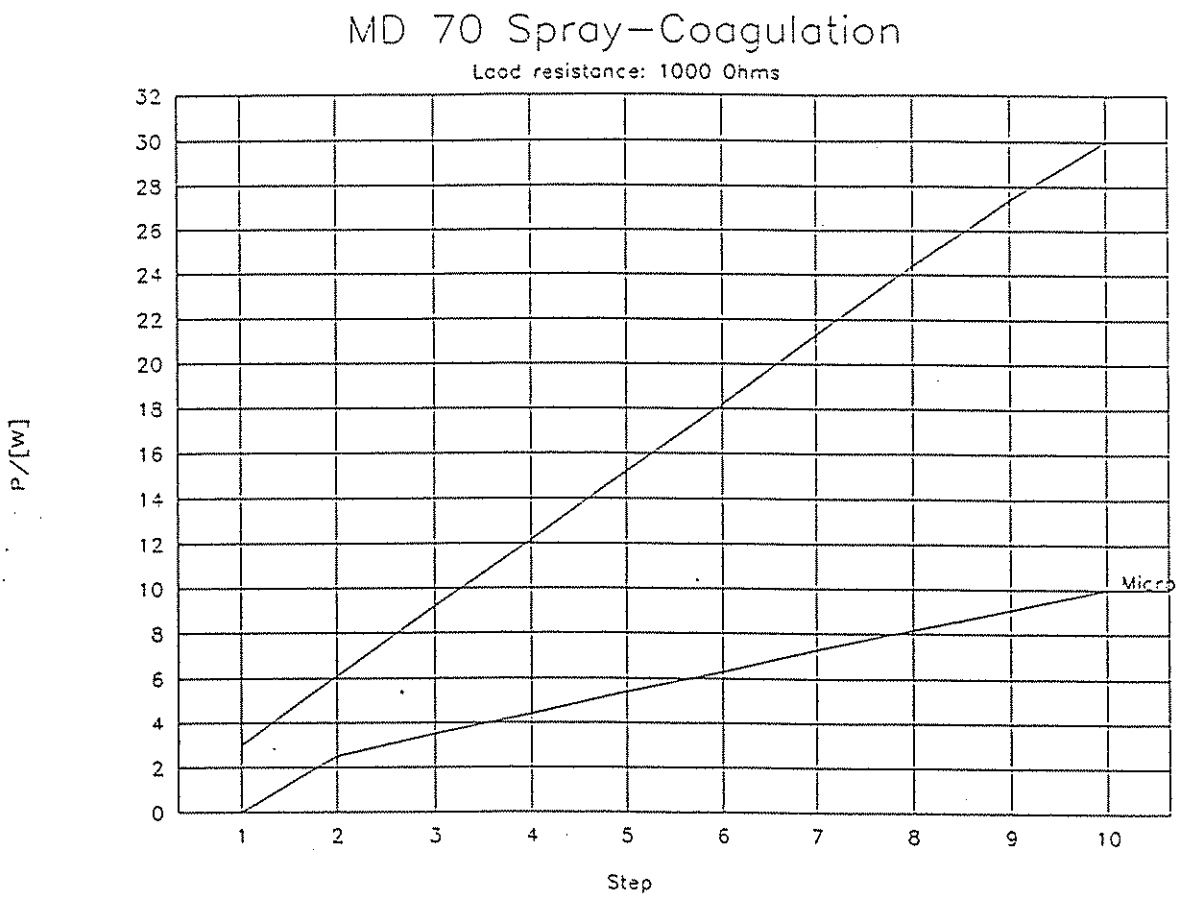
The active electrodes are introduced into the electrode handle from the front and fixed into position by turning the screw-cap clockwise.

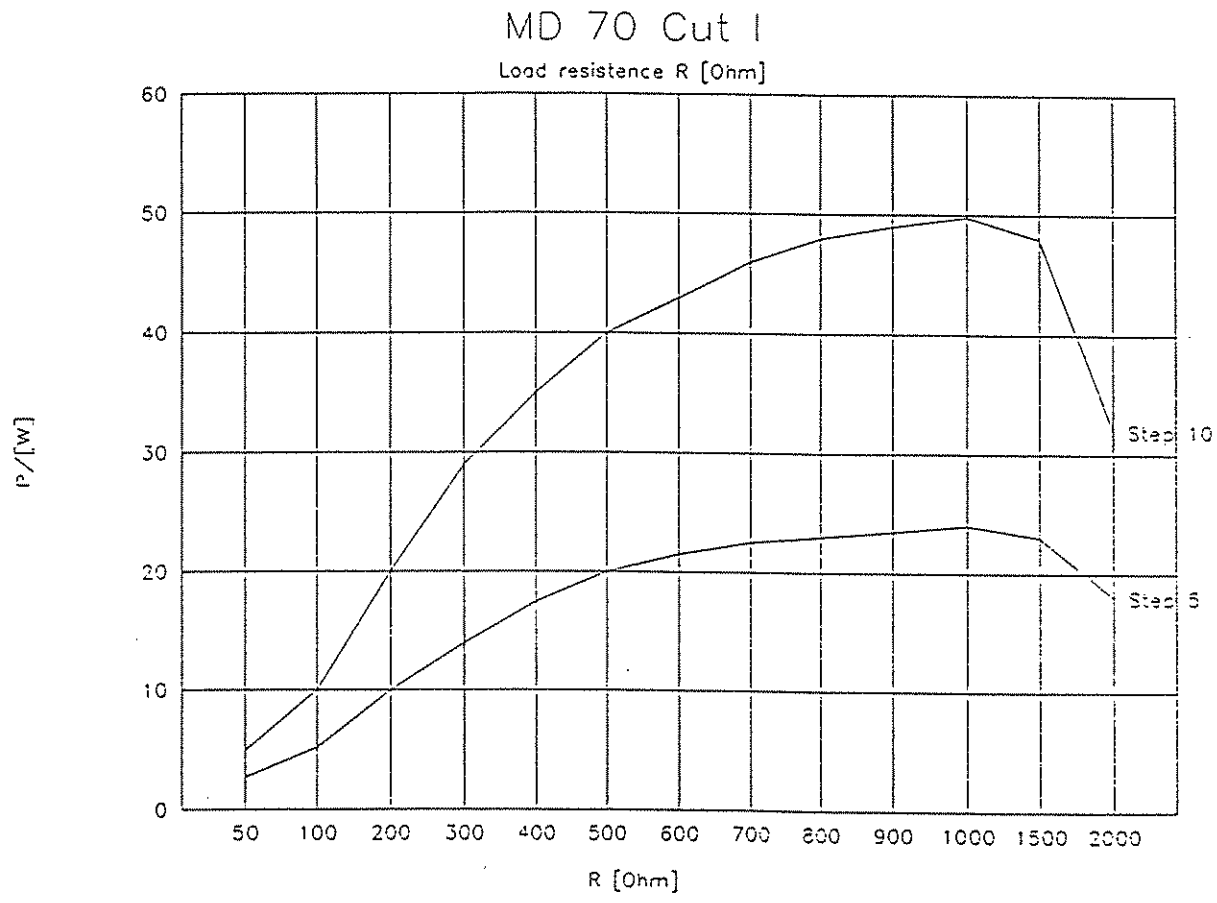
Using the manual remote control integrated in the unit, the cutting or coagulation current may also be switched on by a fingerswitch located on the electrode handle. For this purpose, MARTIN has developed a fingerswitch especially suited to conditions when operating in the mouth. By pressing slightly on the rubber collar on the electrode handle, manual remote control is triggered. The entire collar reacts, it is not necessary to hold the electrode in a certain way. This makes handling considerably easier when using angled electrodes or when operating in areas difficult to access.

6.0 Diagram MD 70

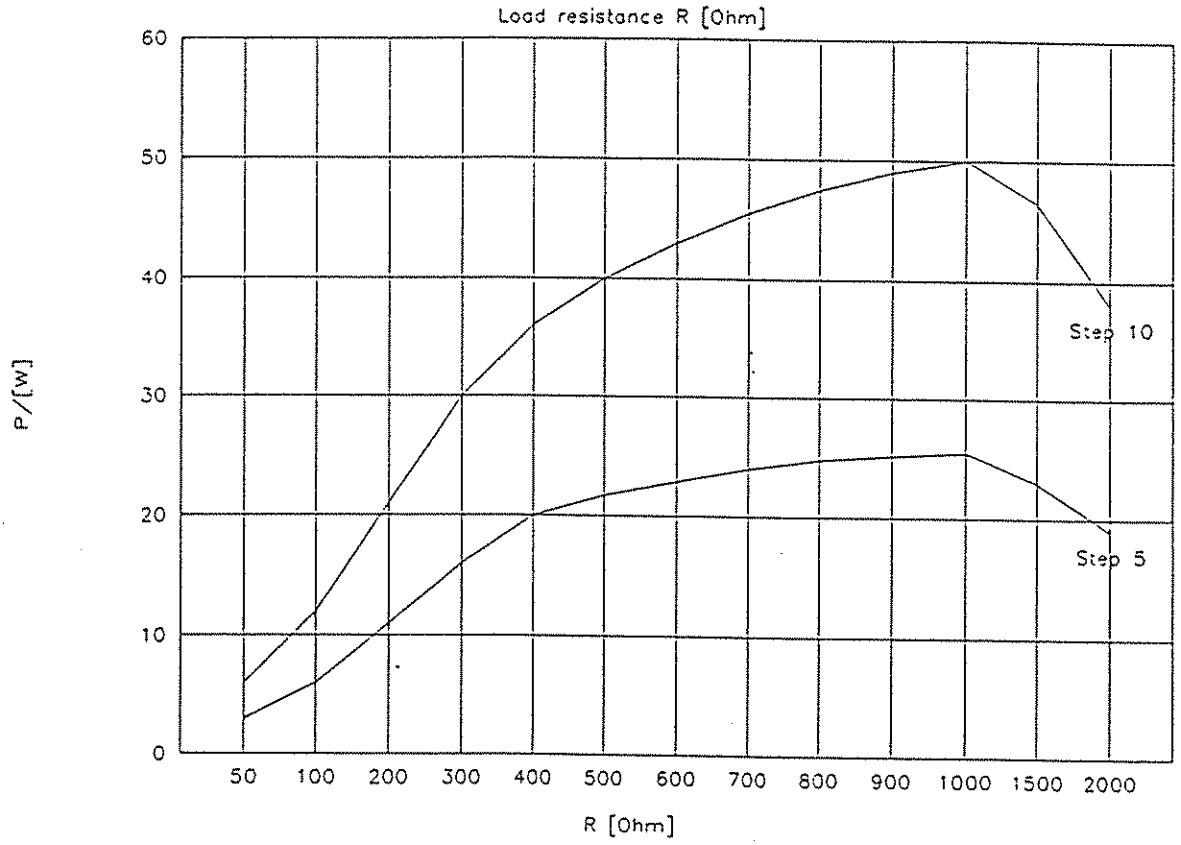




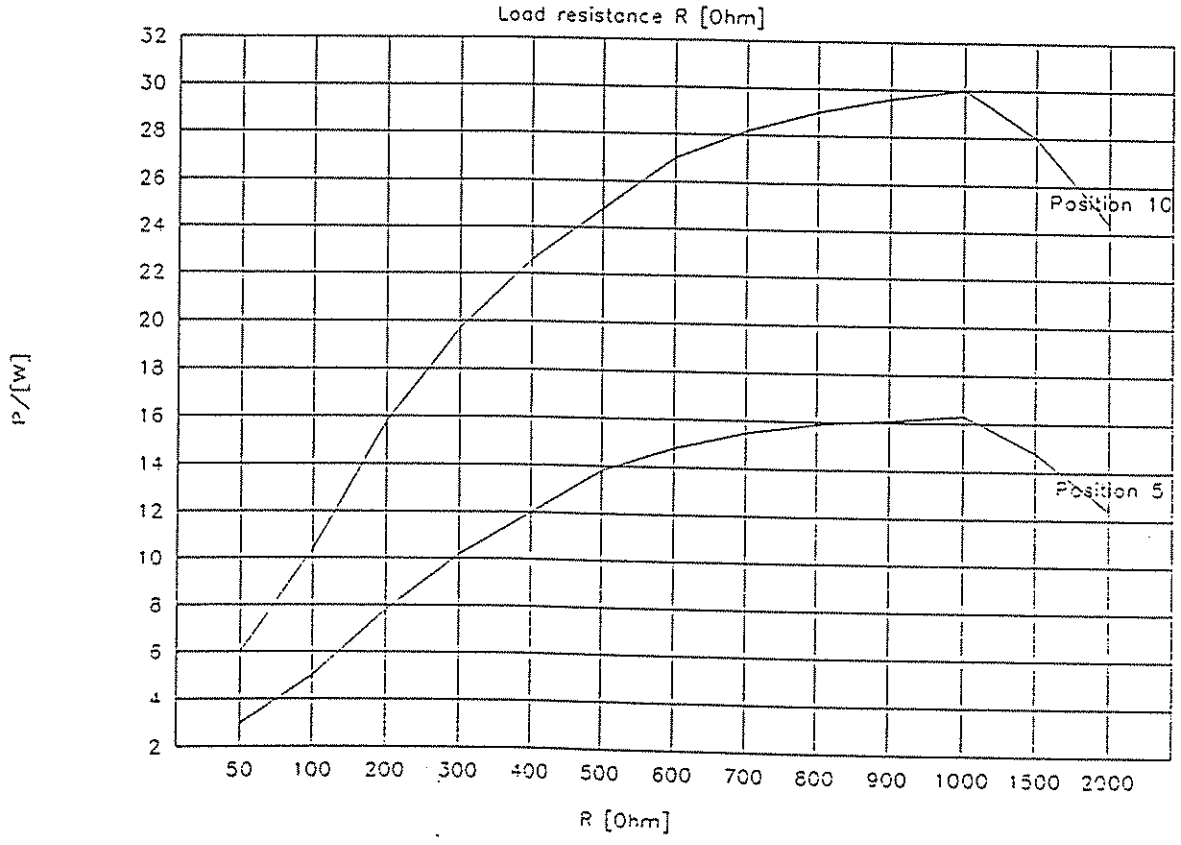

MD 70 Spray–Coagulation
Load resistance: 1000 Ohms
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
Step
Micro


MD 70 Cut I
Load resistence R [Ohm]
60
50
40
30
20
10
0
50
100
200
300
400
500
600
700
800
900
1000
1500
2000
R [Ohm]
Step 10
Step 5

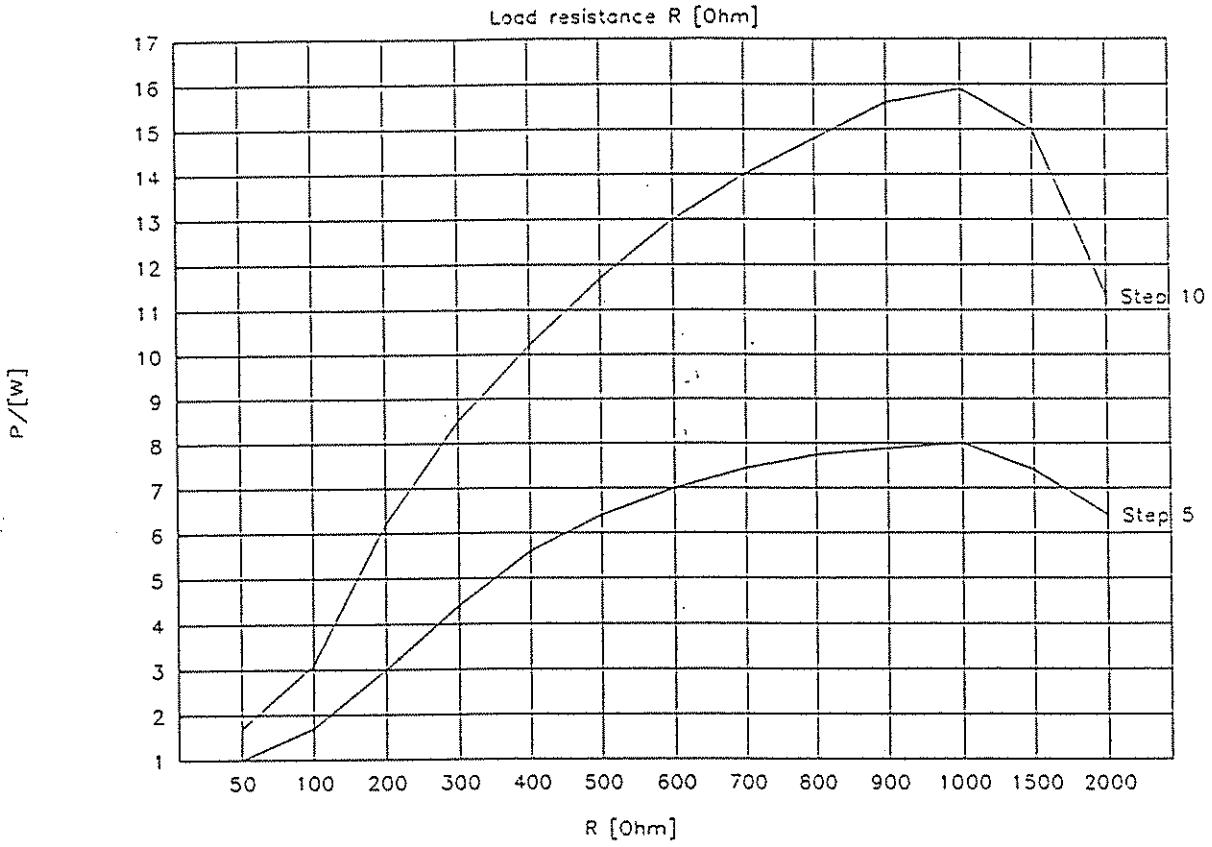
MD 70 Cut II



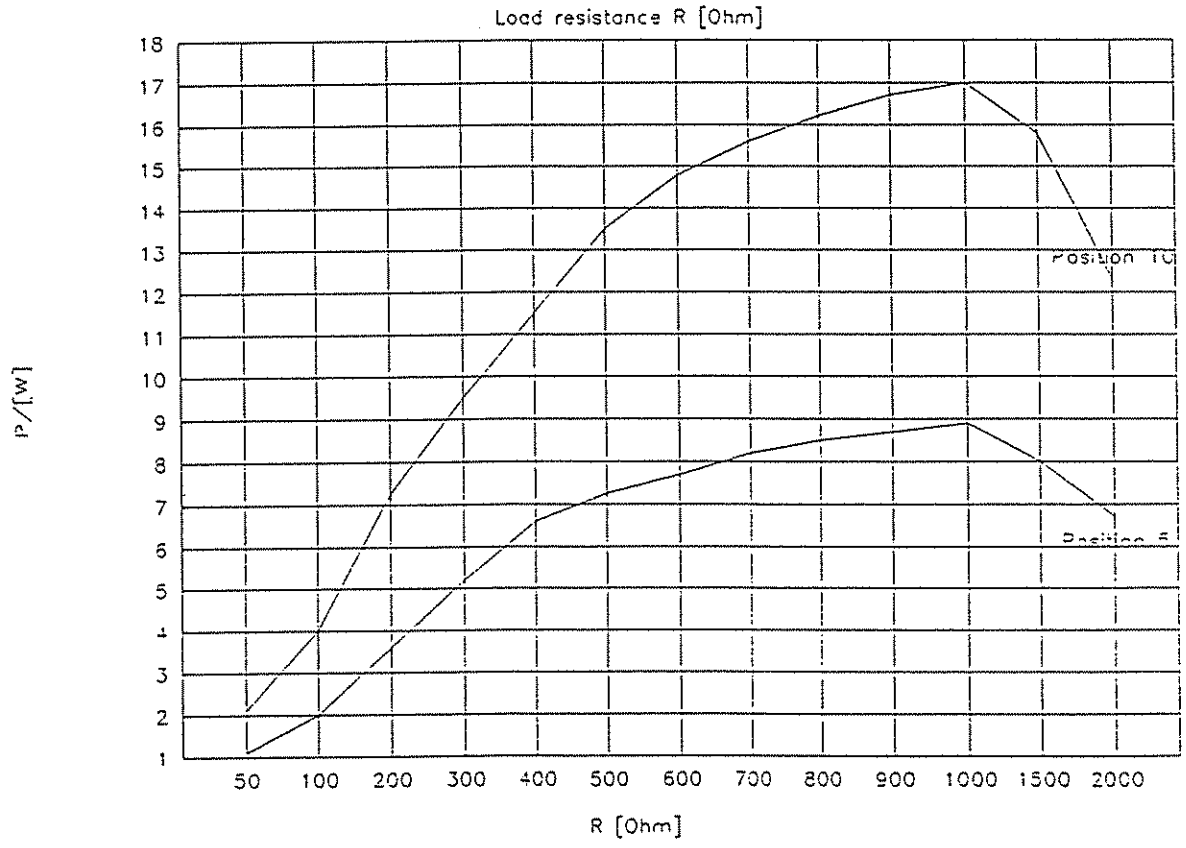
MD 70 Spray–Coagulation



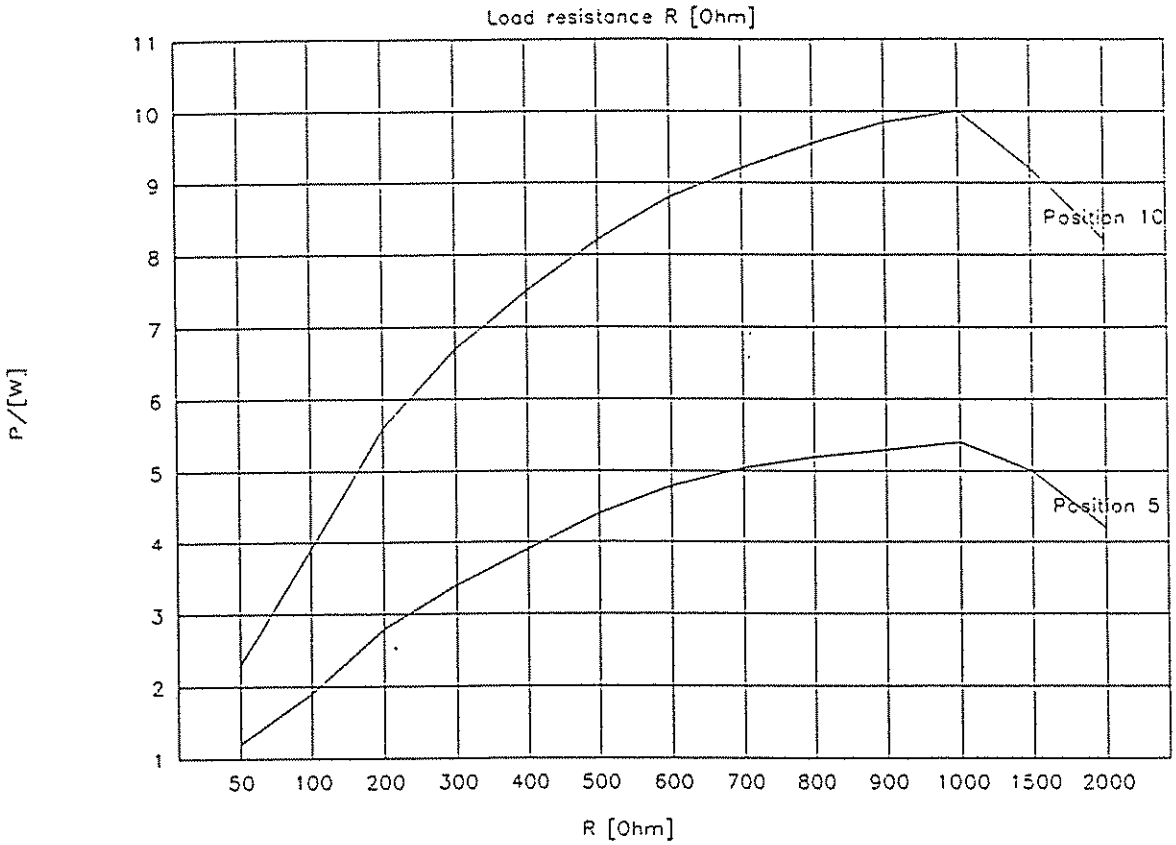
MD 70 Cut I Micro



MD 70 Cut II Micro



MD 70 Sray–Coagulation Micro



7.0 REPEATED TECHNICAL SAFETY CHECKS ACCORDING TO PARAGRAPH 11 OF THE MEDGV (GERMAN REGULATION ON MEDICAL EQUIPMENT) FOR HIGH-FREQUENCY SURGICAL UNITS

The following checks must be carried out at least every 12 months by competent, trained and experienced people who can carry them out independently:

Check unit and accessories for mechanical damage which could influence their operation.
Check to see if the labels relating to safety measures are legible.

Check fuse links on the miniature fuses for nominal current and fusing characteristics.

Check functioning of the unit according to the operating instructions.

Check increase in power output corresponding to phase sequence of the intensity adjustor.
Compare nominal / actual values of the maximum power given at all the outlets in the different modes of operation at the rated load resistances given in section 2.

Compare nominal / actual values of the maximum power given in the Cut I (macro) mode with 100 Ohms.
Nominal value = 10 watts 20%

Check acoustic and / or optical signals during power output.

Measure protective conductor resistance according to VDE 0751 Part 1:
Limit: 0.2 Ohms

Measure leakage current of the standby unit according to VDE 0751 Part 1:
Limit: 500 mA

Measure patient standby leakage current according to VDE 0751 Part 1:
Limit: 10 mA

The standby leakage current may not be more than 1.5 times greater than the values first measured and at the same time must not be greater than the limit mentioned above.

The first values measured are to be taken from the enclosed test reports which were compiled

when the unit was first installed.

According to MedGV, the technical safety check is to be recorded in the booklet which comes with the unit. The results of the test must be documented.

If the unit is not functioning properly, either send it to be repaired or inform the operator of the unit of the associated danger.

CAUTION

Disconnect the plug before opening the unit.

Checks on the unit must only be carried out by qualified MARTIN servicemen or by agents expressly authorised to carry them out.

9. PRINCIPLE OF MARTIN - Electrosurgical Units

9.1 General

The basic method of radio frequency generation and protection against overdosage is common to all MARTIN radio frequency electrosurgical units. The RF generator is a freely oscillating power oscillator in push-pull to which a switched-mode regulator acting as a power controller is connected. Its output is capacitively matched to the load resistance.

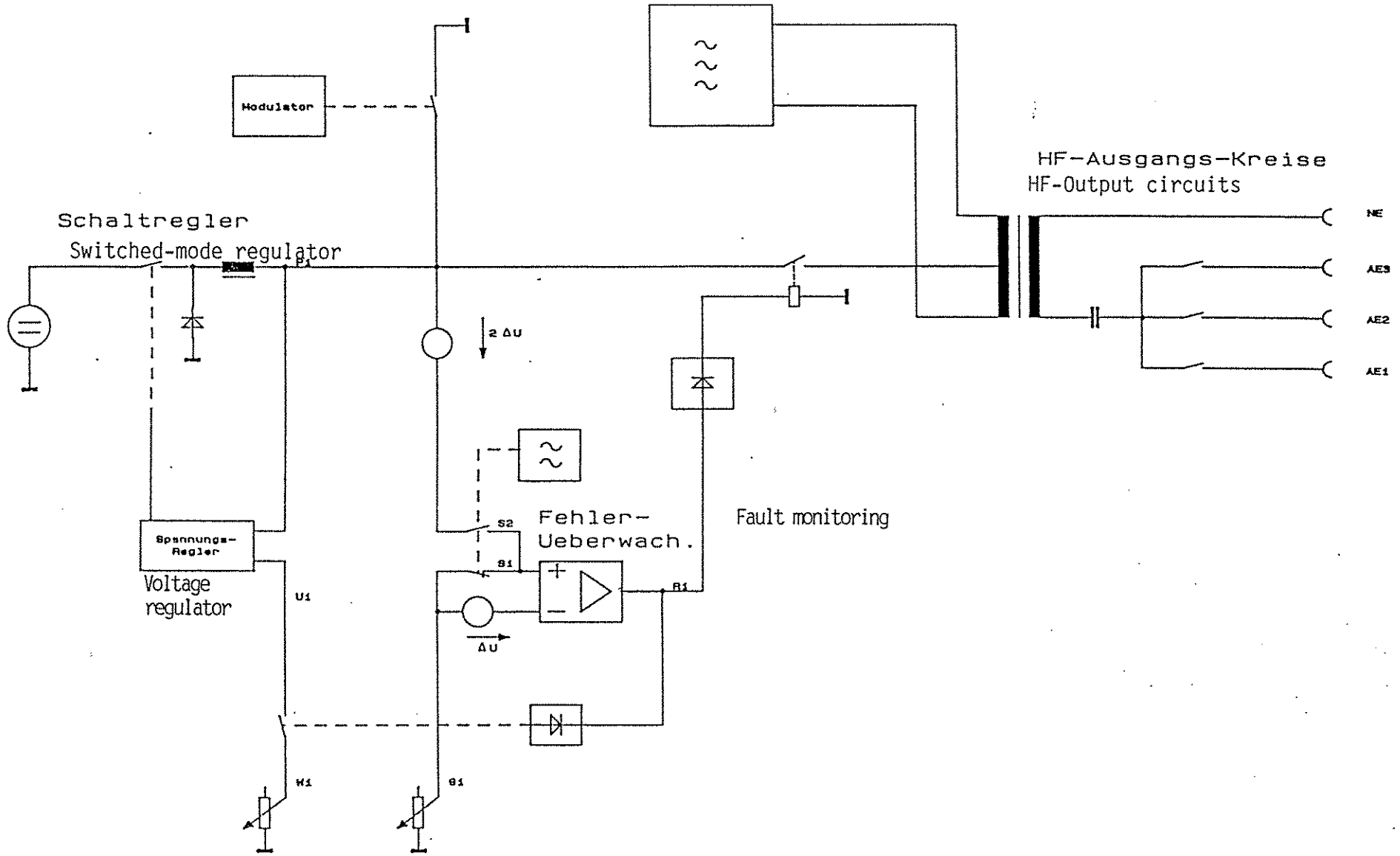
The modulated current types (mixed current types) are generated by periodic short-circuiting of the generator operating voltage P1.

To protect against too high output power resulting from a fault, the generator operating voltage P1 is compared with a reference set point G1 which has the same value as the set point W1, but is separately generated. If P1 becomes unacceptably high compared with G1, the watchdog circuit cuts off the generator operating voltage.

9.2 RF generator and output circuit

The RF generator is a harmonic power oscillator designed with MOSFET power transistors. The operating frequency is determined by a resonant circuit. The capacitive output circuit is part of the resonant circuit capacitance and is thus frequency determining. The highest frequency occurs under no-load conditions and the lowest with short-circuit. This self-adaptation makes the generator proof against short-circuit and load variation, and eliminates the adaptation problems of fixed-frequency generators.

The output power is set via the level of voltage P1 at the centre point of the output transformer; matching to a nominal terminating resistor is carried out by a capacitor in series with the output. One of three outputs can be selected by relays.



Prinzip der HF-Erzeugung und Fehlerschutz-Schaltung	Principle of HF-generation and fault-protection circuit	martin	MD 70	5.6.91 Datum	9.1.G1 Seite

9.3 Power controller and modulator

The generator input voltage P1 is used to set the output power and is obtained by means of a switched-mode regulator from an unstabilized d.c. voltage according to the low-setting adjuster principle. This switched-mode regulator thus acts as the power controller.

The voltage P1 is not a pure d.c. voltage but represents the rectified resonant circuit voltage with half the amplitude. The average value of this voltage characteristic represents the d.c. voltage P1 to which the voltage regulator regulates.

The modulator periodically short-circuits the voltage P1. This gives the voltage P1 a square-shaped envelope curve. The voltage regulator then reacts with an increase in the square-wave amplitude, thereby maintaining the average value of P1.

9.4 Fault monitoring and set-point generator

In order to prevent an overdose due to an equipment fault, the generator power supply P1 is switched off in the event of a fault. This is controlled by a watchdog circuit which compares the value of P1 with a set value. This set reference point G1 must be generated separately from the set point W1 responsible for P1, otherwise a fault in the set-point generator itself cannot be detected. For this reason, the set-point generator for all units right up to the adjustment potentiometer is provided in duplicate.

The watchdog circuit is designed in such a manner that its failure causes the interruption of P1, otherwise its failure might not be recognized by the user. For this purpose, a dynamic monitoring principle is employed. Switches S1 and S2 represent a changeover switch which switches the input of a comparator to and fro at a frequency of a few kHz between the reference set point G1 and the voltage P1 reduced by a small voltage "2*delta U".

The reference set point G1 reduced by a small voltage "delta U" is fed to the reference input of the comparator.

When switch S1 is closed, the voltage at the comparator input is higher than at the reference input and its output is thus positive. When S2 closes, the situation is exactly reversed; when P1 is exactly the same value as G1, the comparator output becomes zero. There is thus a square-wave voltage at the output of the comparator, which goes via a rectifier which responds only to the a.c. voltage component and causes the relay in the circuit of P1 to energize. If P1 becomes higher than G1 by more than "delta U", the comparator input will no longer be negative with respect to the reference input and the output remains static on positive. The rectifier then no longer delivers current and the relay comes off.

10. CIRCUIT DESCRIPTION MD 70

10.1 Block diagram

The block diagram shows the individual functional groups as well as their interconnections. The individual groups have the following functions:

Power pack and power controller:

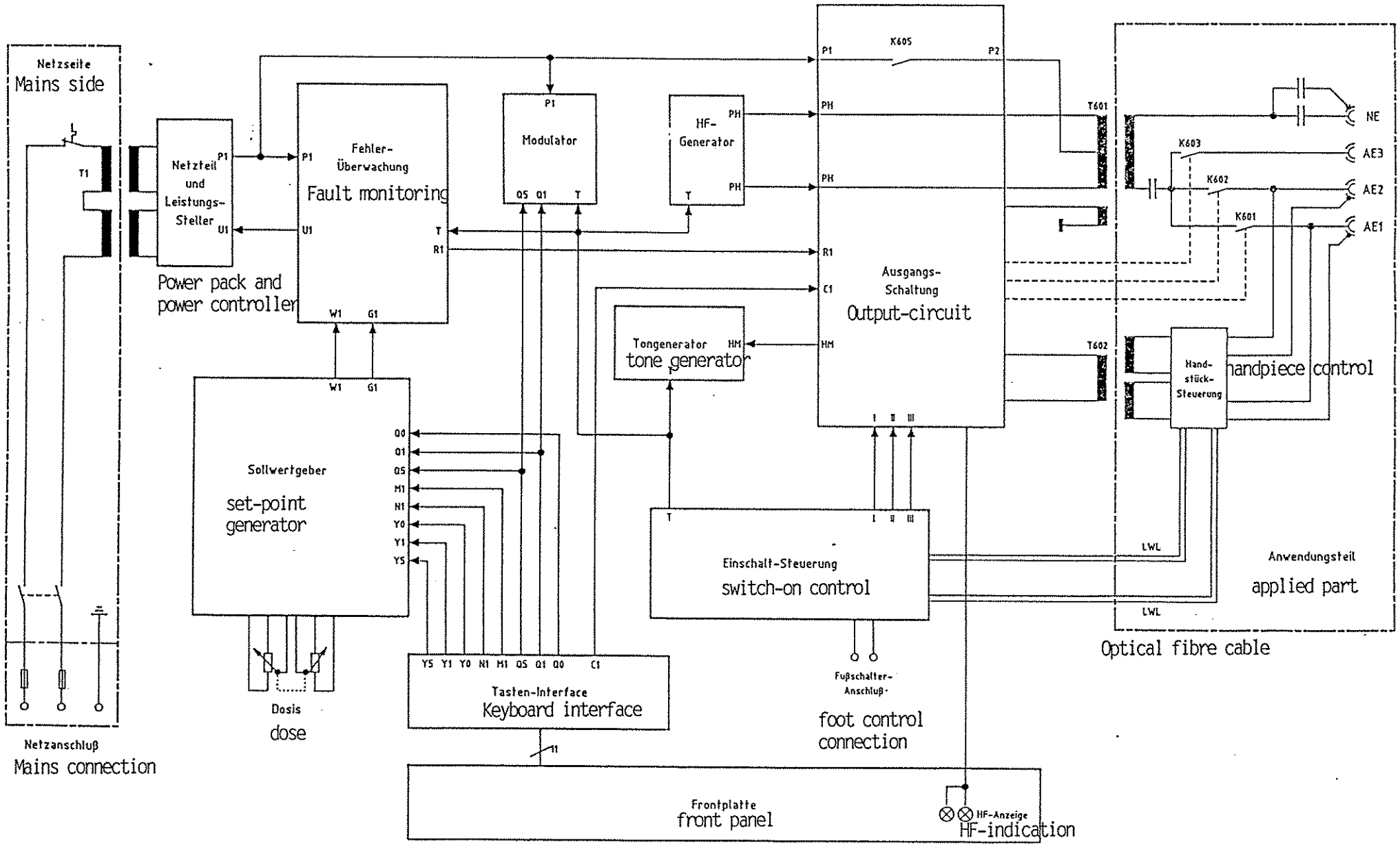
Two separate switching circuits are located together on the power pack card A1. The power pack is a switched-mode regulator according to the principle of the low-setting adjuster, which produces the 15 V supply for the signalling and control electronics and on the input side is protected by the fuse F2 (1 A medium-blow).
The power controller is a similar circuit according to the low-setting adjuster principle; its output voltage P1 is the power source for the RF generator and is controlled by the analog signal U1. P1 has twice the voltage value of U1. The power controller is protected on the input side with the fuse F1 (4 A medium-blow).
The power pack and power controller are supplied by two separate secondary windings of mains transformer T1.

RF generator and modulator:

These are located in the middle in the right-hand third of the RF generator card and together form the RF generator. The generator is activated by the signal T. The modulator is activated and adjusted by the signals Q1, S and K; it acts on the RF generator supply voltage P1. The balanced outputs PH are fed to the output transformer through whose centre tapping point the voltage P1 is fed to the RF generator.

Output circuit:

This forms the interface to the applied part and contains the fault protection relay K605 in the circuit of P1, which is energized by the signal R1, the auxiliary supply for the handpiece control, the driver circuit for the RF indicator lamps, relays K601, K602 and K603 in the RF output and a load circuit for the generator. All parts of the output circuit as well as the transformers for the applied part are located at rear right on the RF generator card A2 under the output card A3.



Änderung	Datum	Name	Norm	Datum 7. Dezember 1990	Bearb. Baumgarten	Gepr.	Ersatz durch:	Ersatz für:	Ursprung:

martin

BLOCKSCHALT-PLAN
CHIRURGIE-GERÄT MD 70
MD 70

5.6.91

10.1.G1

Block diagram Electrosurgical unit

The auxiliary supply of the handpiece control consists of an oscillator whose voltage is fed by transformer T602 to the applied part.

The driver circuit for the RF indicator lamps is controlled by an auxiliary winding of the monopolar RF output transformer T601. In addition, a signal HM is produced which indicates the presence of monopolar RF voltage.

The RF generator has the property of responding to its auxiliary supply voltage, but it cannot then feed out power. If damping is too low (no-load) with a low setting (Micro), the voltage P1 could increase to higher values than allowed by the set point through the effect of the resonant circuit, which would cause the fault detection circuit to trip. Therefore, with a low setting, the signal C1 applies a basic load to the generator.

Applied part:

This forms the monopolar patient interface and is located on the RF output card A3. The transformers, which form the interface to the monopolar output circuit, are located on the RF generator card A2; the output sockets are on the front card A4.

The handpiece control decodes the signals of the finger switches on the electrode handles, and sends them by optocouplers to the switch-on control. These optocouplers consist of separate transmitters and receivers connected by plastic optical fibre cable. The receivers are located on the left-hand side of the RF generator card A2. The handpiece control is supplied via transformer T602 from the monopolar output circuit. It consists of two separate circuits supplied separately.

Switch-on control:

This converts the signals of the finger switches and the foot controls into a corresponding selection of the appropriate relay energization. It is located on the left (optical fibre receiver) and in the middle on the RF generator card A2.

The relays in the monopolar output circuit are energized by the switching signals I, II and III. Switching signal I energizes relay K601 of the output AE1 and is activated by the handpiece connected. The same applies to signal II which energizes relay K602 of the output AE2. Switching signal III is activated by the foot control and energizes K603 of output AE3. The activation signal T appears on actuation of one of the three switching signals.

Set-point generator:

This is located at front right on the RF generator card and consists of two separate circuits for the generation of set point W1 and the reference set point G1.

The signals Q0, Q1 and Q5 select the set-point adjustment for current types Cutting I, Cutting II and Spray Coagulation for the set point W1; signals Y0, Y1 and Y5 do the same for the reference set point G1.

Fault monitoring:

This is located at rear left on the RF generator card A2. The principle is explained in 9.4. In addition to the signals indicated in 9.4, the signal T also plays a part. Signal T activates the circuit; signal W1 is only fed to U1 when signal T is active. Signal R1 as fault-free signal, i.e. square-wave signal, only appears with T.

Tone generator:

This is located on the left in the centre of the RF generator card A2 and consists of a voltage-controlled oscillator, whose audio amplitude is controlled by the signals T and HM.

Keyboard interface:

This is located at front left on the RF generator card A2 and has the function of storing the brief actuation of the keys and of acknowledging this actuation by key illumination. This is done by means of bistable relays.

The "Micro" button operates the signals M1, N1 and C1.

Selection of the current type is controlled with the selection keys for Cutting I (signals Q0 and Y0), Cutting II (signals Q1 and Y1) and Spray Coagulation (signals Q5 and Y5). The selection keys cancel each other out.

10.2 Signals and their functions shown in the block diagram

T: (active high)
"Keying" control signal. This is supplied by the switch-on control and appears on activation. It actuates the RF generator and modulator, enables the signals U1 and R1 in the fault monitoring and actuates the tone generator.

M1: (Active low)
The "Micro" control signal is generated by the keyboard interface and switches the set point W1 to "Micro" mode in the set-point generator.

N1: (Active low)
The "parallel signal Micro" control signal is generated by the keyboard interface, and in the set-point generator it controls switching of the reference set point G1 to "Micro" mode (in parallel with M1).

Q0 (Active high)
The control signal "Cutting I" is generated by the keyboard interface and, in the set-point generator, controls selection for Cutting I for set point W1. It is interlocked against Q1 and Q5.

Y0: (Active high)
"Parallel signal cutting I" control signal. This is generated by the keyboard interface and, in the set-point generator, controls selection for cutting I for the reference set point G1. It is in parallel with Q0.

Q1 (Active high)
The "Cutting II" control signal is generated by the keyboard interface and, in the set-point generator controls selection for cutting II for the set point W1. It actuates the modulator and is interlocked against Q0 and Q5.

Y1: (Active high)
"Parallel signal cutting II" control signal. This is generated by the keyboard interface and, in the set-point generator, controls selection for cutting II for the reference set point G1. It is in parallel with Q1.

Q5: (Active high)
"Spray coagulation" control signal. This is generated by the keyboard interface and, in the set-point generator, controls selection of spray coagulation for the set point W1. It actuates the modulator and is interlocked against Q0 and Q1.

Y5: (Active high)
"Parallel signal spray coagulation" control signal. This is generated by the keyboard interface and, in the set-point generator, controls selection of spray coagulation for the reference set point G1. It is in parallel with Q5.

C1: (Active high)
The "Load" control signal is generated by the keyboard interface and in "Micro" mode applies a basic load to the RF generator. Complementary to M1 and N1.

HM: (Active high)
The "Radio frequency monopolar" control signal is generated by the output circuit and indicates the presence of RF voltage. It participates in the tone generator in the production of audible signals.

W1:
The "Set point" analog signal is generated by the set-point generator and, after passing through the fault monitoring, forms the manipulated variable U1 for the power controller.
Range: 0 - 10 V

G1:
The "Reference set point" analog signal is generated by the set-point generator and, in the monitoring circuit, provides the reference value for fault detection. It has the same value as W1.
Range: 0 - 10 V

U1:
The "Manipulated variable" analog signal is generated by the fault monitoring and forms the control voltage for the power controller. It corresponds to W1 on actuation.
Range: 0 - 10 V

P1:
The "D.c. input voltage" is generated by the monopolar power controller and forms the power source for the RF generator as well as the actual value for fault monitoring. Modulation is achieved by influencing this voltage.
Average value range: 0 - 20 V

PH:
The "RF voltage" is the RF voltage at the output (resonant circuit) of the generator.
Peak value max. 250 V.

R1:
The "Relay auxiliary voltage" is generated by the fault monitoring and, in the absence of a fault, forms the auxiliary power for energizing the relays on activation in the output circuit. In the absence of a fault on activation, it is a square-wave voltage.
Average value: 6 V - 9 V.

I: (Active low, dependent on R1)
"Relay I" switching signal is generated by the switch-on control and, in the output circuit, energizes relay K601 for output AE 1.

II: (Active low, dependent on R1)
"Relay II" switching signal is generated by the switch-on control and, in the output circuit, energizes relay K602 for output AE 2.

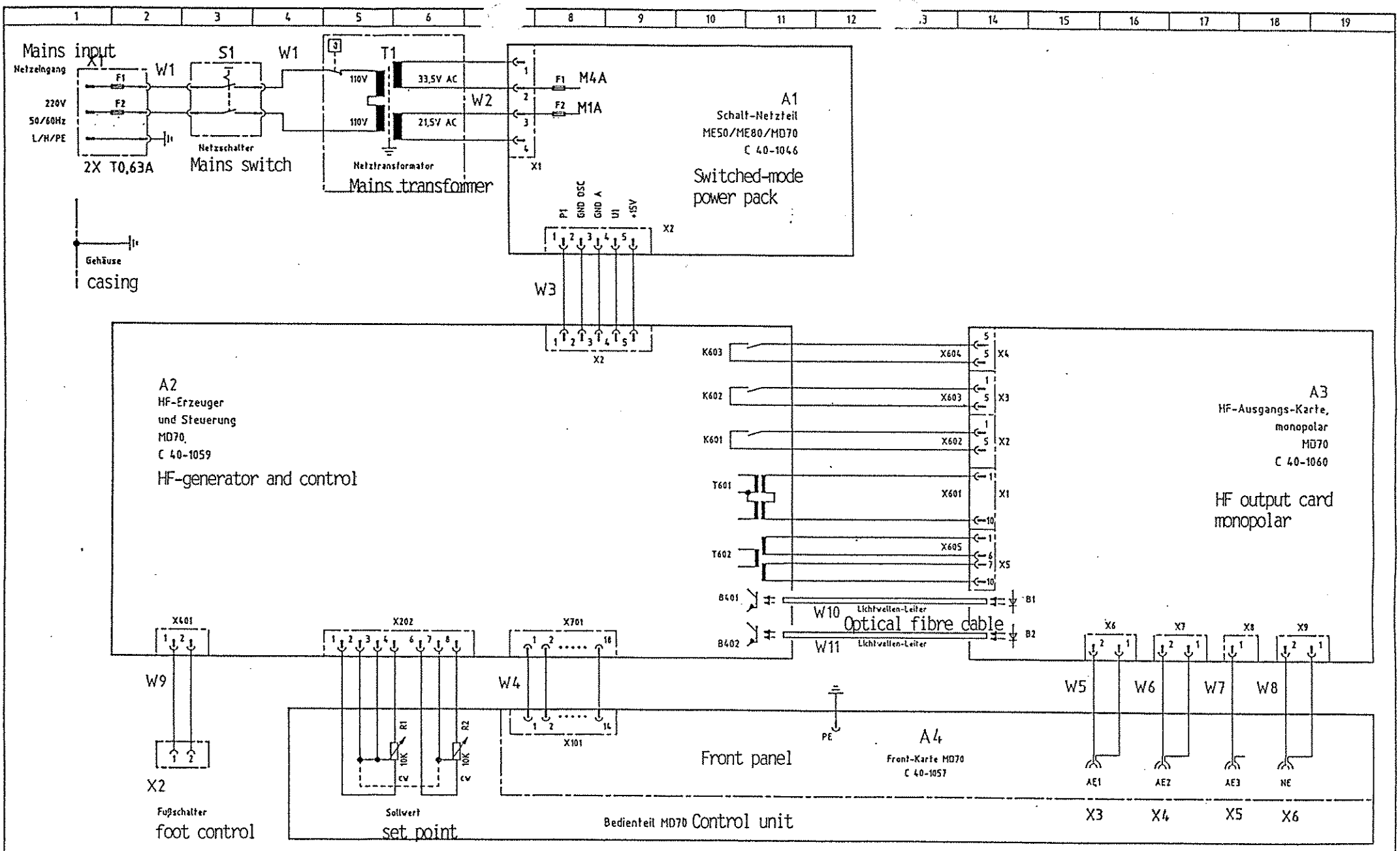
III: (Active low, dependent on R1)
"Relay III" switching signal is generated by the switch-on control and, in the output circuit, energizes relay K603 for output AE 3.

11. MECHANICAL CONSTRUCTION, REPLACING SUB-ASSEMBLIES

11.1 Sub-assemblies and mechanical components

Item	Designation	Order No.
1	Casing, base	08-012-00-01
2	Casing, top	08-012-00-02
3	Front panel MD 70	08-010-00-06
4	Front membrane panel MD 70	08-010-00-07
5	Rotary knob D30	08-006-00-01
10	Mains connection combination	08-024-00-01
11	Mains fuse holder	08-034-00-01
12	Mains transformer	08-024-00-02
13	Connection for equipotential bonding	08-027-00-01
14	Mains switch	08-024-00-03
20	Set-point control with cable	08-034-00-02
21	Patient-plate connection socket with cable	08-024-00-04
22	Insulating cup for patient-plate socket	08-016-00-01
23	Insulated nut for patient-plate socket	08-016-00-02
24	Active-electrode connection socket I with cable	08-001-00-02
25	Active-electrode connection socket II with cable	08-001-00-03
26	Active-electrode connection socket III with cable	08-001-00-04
27	Foot control socket with cable	08-003-00-02
30	Front card MD 70 with cable	08-010-00-08
31	RF generator and control MD 70	08-014-00-04
32	RF output card MD 70	08-014-00-05
33	Switched-mode power pack	08-032-00-01
40	Connector 5-pole, power pack/RF generator	08-041-00-03
41	Set of PE connecting cables MD 70	08-027-00-02
42	Plastic optical fibre cables	08-020-00-01
50	Safety cover, top section	08-034-00-03
51	Safety cover, output card	08-034-00-04
52	Safety cover, front panel	08-034-00-05
53	Locking clip for DIL-connector, 14-pole	08-041-00-04
54	Cover	08-041-00-05

Item	Designation	Order No.
*	Set of small mechanical parts ME 50/80/ MD 70	08-018-00-01
60	Casing base	*
61	Filler plug 6 mm	*
62	Circlip 12x1.0 mm	*
63	Circlip 18x1.2 mm	*
64	Plastic spacer pin M3x6 I/A	*
65	Plastic spacer pin M3x10 I/A	*
66	Plastic spacer pin M3x10 I/I	*
67	Plastic spacer pin M3x40 I/I	*
68	Spacer bush 6/3, 4x10	*
69	Support rail for power pack	*
70	Nut M3	*
71	Nut M4	*
72	Plain nut M6	*
73	Lock washer S3	*
74	Lock washer S4	*
75	Lock washer S5	*
76	Phillips tallow-drop screw M3x6	*
77	Phillips countersunk screw M3x6	*
78	Phillips tallow-drop screw M4x8	*
79	Tallow-drop self-tapping screw 2.9x6.5	*
80	Phillips tallow-drop screw M3x8	*
	Set of adhesive labels ME units	08-018-00-02
	Conversion kit for mains voltage adjustment	08-024-00-05
	Filament lamp	08-012-00-03
	Fuse 1.25 A slow-blow (115 V)	08-034-00-06
	Fuse 0.63 A slow-blow (230 V)	08-034-00-07
	Fuse 1 A medium-blow (aux. supply)	08-034-00-10
	Fuse 4 A medium-blow (power controller)	08-034-00-11



Wiring diagram Electrosurgical Unit

c				Datum	12. Oktober 1990		martin	VERBINDUNGS-PLAN CHIRURGIE-GERÄT MD 70	5.6.91	11.2.G1
b				Bearb.	Baumgarten					
a	ÜBERARBEITET	26.11.1990	Ba	Gepr.						
	Änderung	Datum	Name	Norm		Ersatz durch:	Ersatz für:	Ursprung:		

11.3 Opening and closing the casing

1. Unscrew the 7 Phillips screws (76) from the edge of the top part of the casing at the rear and at the base.

2. Detach the top part of the casing (2) from the groove in the front panel by carefully levering off, with a lever, towards the rear those parts of the top section marked with arrows.

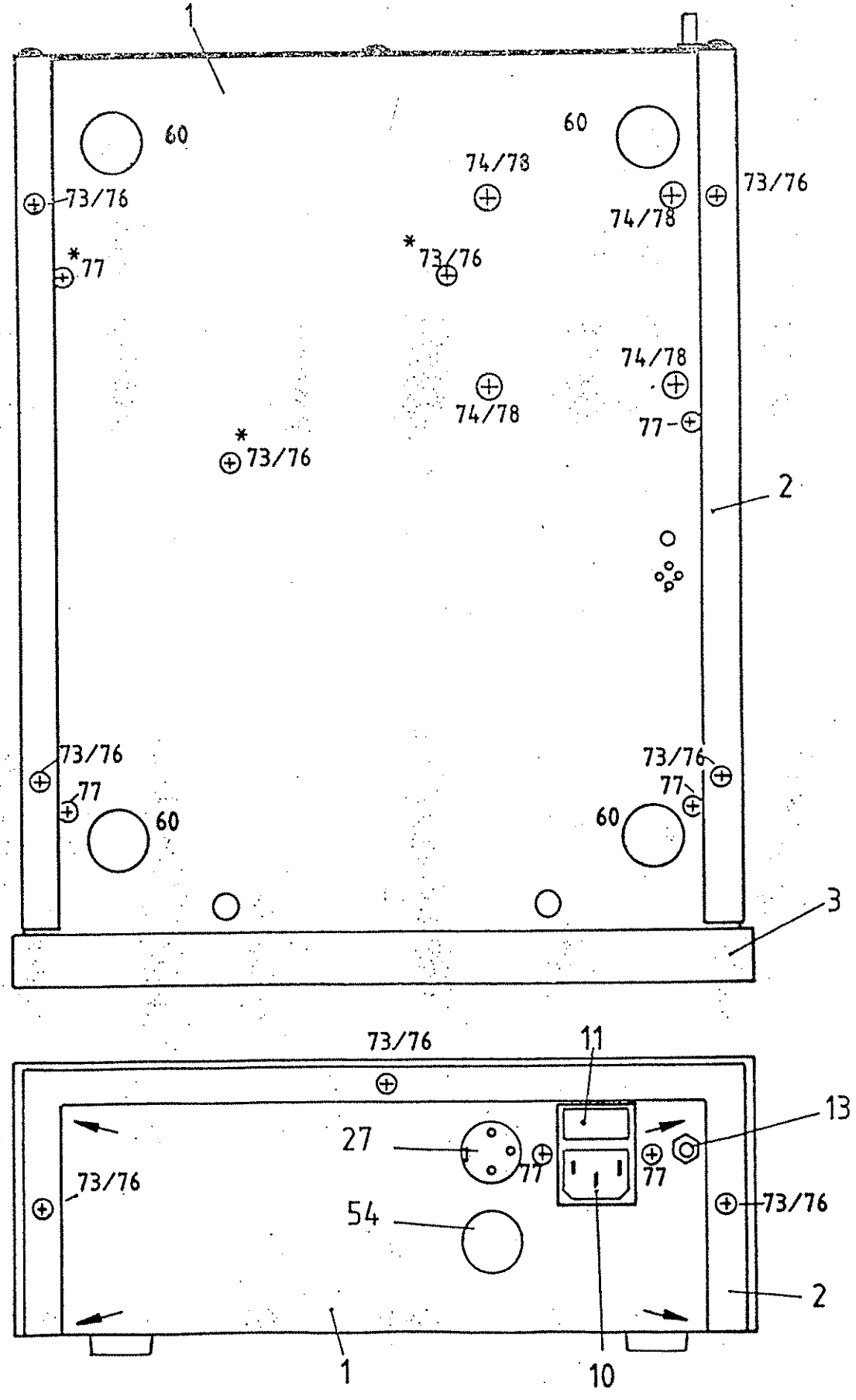
3. Slide the top part to the rear. For units of the first series, the cover is provided with a PE conductor terminal. Disconnect the PE conductor at top left on the inside. It need not be reconnected on re-assembly; the cable must then be removed. Remove the cover towards the rear.

4. For assembly, refit the top part from the rear and slide it forward.

5. Ensure correct entry into the groove in the front panel, particularly at the bottom edges and the top corners. Slide in the top part until the rear edge is against the rear side. Do not draw forward with the screws, since this can bend the rear edge.

6. Screw in the 7 Phillips screws (76) with lock washers (73) again, but do not yet tighten them. First tighten the screws at the rear and then those on the underside. In the case of units of the first series, the top part may possibly be fastened with slotted screws. These should be replaced with Phillips screws M3x6.

7. Check that the unit stands on a smooth surface without deformation on all four feet. Otherwise, slacken the fastening screws again, rectify the deformation and retighten the screws.



View from underneath
View from the rear

Casing Gehäuse MD 70	Ansicht von unten	martin	5.6.91	11.3.G1

11.4 Front panel, front card, sockets

The front panel (3) is a plastic moulding containing the potentiometer for the set-point adjustment (20) and the front card A4 (30) and is covered at the front with a membrane. The front card contains the keys, indicator lamps and RF connection sockets.

11.4.1 Replacement of potentiometer (20)

1. Withdraw rotary knob (5) with pliers in the axial direction using a cloth in between as protection.

2. Detach cable connection on RF generator and control card A2 (31).

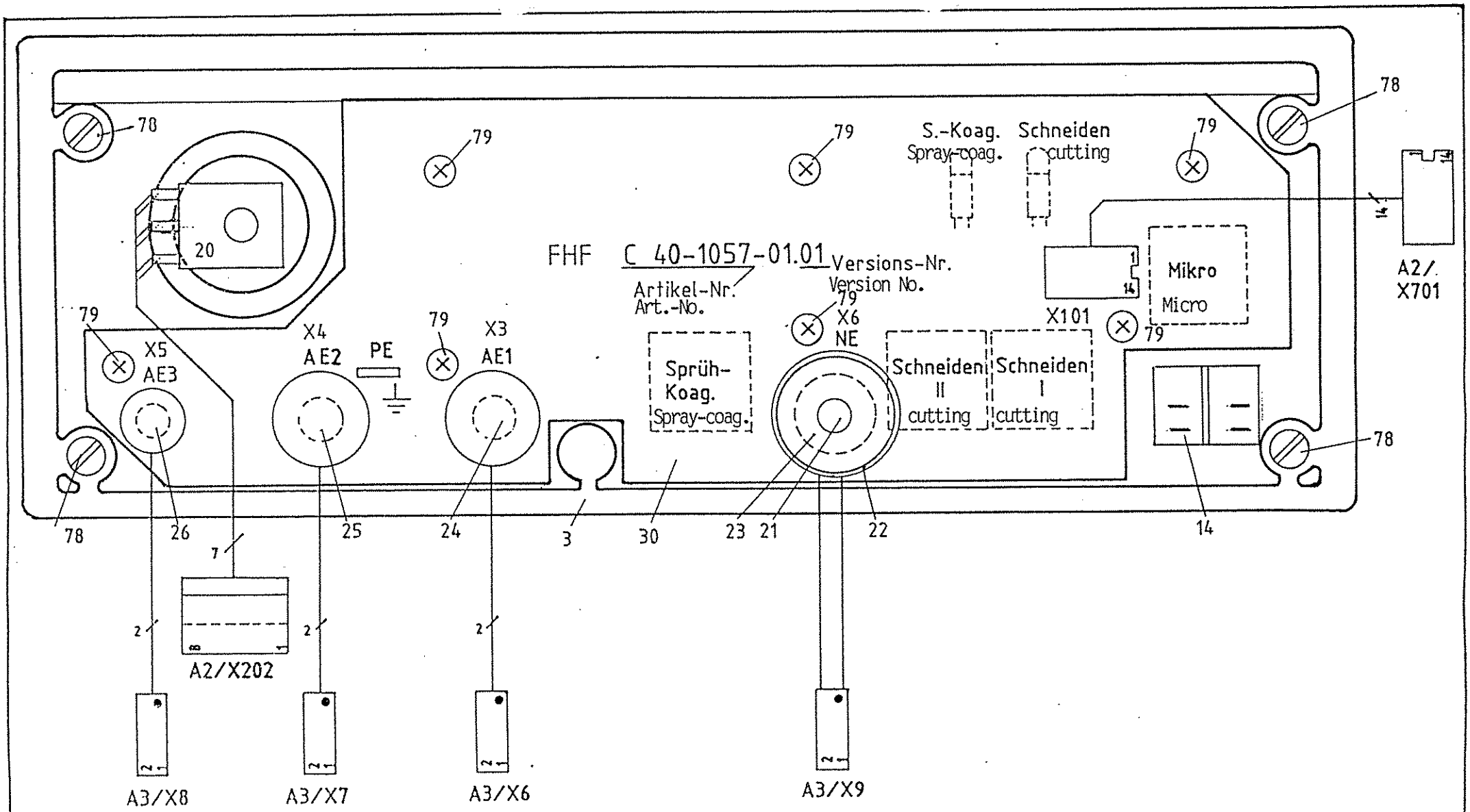
3. Unscrew potentiometer nut with socket wrench or pliers; remove the potentiometer towards the rear.

4. Insert the replacement with terminals on the right. When tightening the nut, firmly hold the potentiometer at the back by hand, otherwise it will be twisted clockwise.

5. There is an old version of the potentiometer (20) recognizable by the spacer bush on the potentiometer spindle for length compensation, and a new version without length compensation. Only the new version is supplied as replacement, which means that the spacer bush is no longer needed.

6. Fit rotary knob paying attention to the flat side of the spindle. When correctly fitted, the surface of the knob must be level with the front surface of the panel.

7. Connect the cable.



Location drawing, front panel
Wiring and component diagram front panel A 4

Lageplan Frontteil Anschluß- und Befestigungsplan Frontkarte A4	martin	MD 70	5.6.91 Datum	11.4.G1 Seite

11.4.2 Replacement of front membrane (4)

1. Remove old front membrane.

2. Apply new front membrane to the top edge while ensuring accurate fitting to the edges of the rotary knobs. Press on firmly over the whole area. If necessary, practice application with old membrane.

11.4.3 Removal and fitting of front panel (3)

1. Unplug plug-in connector X9 for the patient plate connection and plug-in connectors X6, X7 and X8 for active electrode connection as well as PE connection X10 from output card A3.

2. Disconnect potentiometer terminal X202 from RF generator card A2. Detach the locking clip (53) on DIL connector X 701 on RF generator and control card A2 and withdraw the connector.

3. Loosen the four M4 screws (78) on the left and right on the inside of the front panel. Lift up the front panel and withdraw it forwards so that the heads of the lower screws (78) pass through the top wider part of the elongated holes ("key holes").

4. If necessary, disconnect the four mains switch terminals.

5. If necessary, detach the PE conductor connection. Take off the front panel.

6. During assembly, connect the earth wire first of all.

7. If necessary, connect up the mains switch terminals according to the wiring diagram, with the brown cables connected to one side and the black cables to the other side. For the old version having only black cables, use a continuity tester or mark the cable before disconnection!

8. Fit the front panel from the top while ensuring that the top screws (78) enter the slots in the casing base (1) and the lower screws (78) enter the top wide part of the elongated holes in the casing. Lock the front panel in position at the bottom and tighten screws (78).

9. Connect potentiometer terminal X202 to RF generator and control card A2. Plug in the DIL connector X401 and lock in position with the clip (53).

10. Connect the PE connection X10, plug-in connector X9 for the patient plate connection and plug-in connectors X6, X7 and X8 for active electrode connection into output card A3.

11.4.4 Removal and fitting of front card A4 (30)

1. Remove front panel (see 11.4.3). The connecting cables must not be disconnected from the mains switch.

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

3. When exchanging the front card, fit all sockets from the old part onto the new part (see 11.4.5 - 11.4.7).

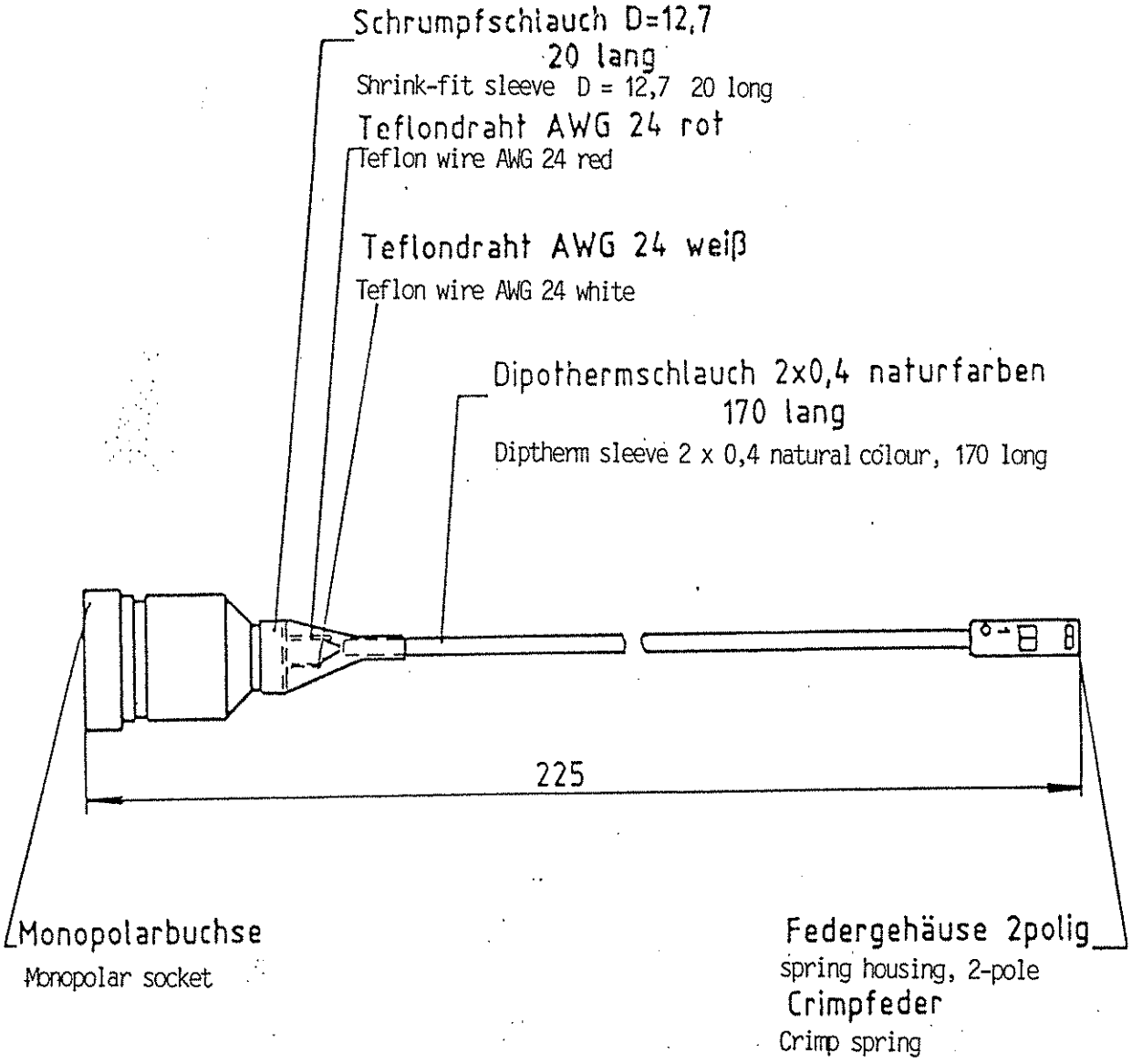
4. Ensure that the front card is straight when fitting it into the front panel.

5. When the card is making contact with all fastening points, screw in the 7 self-tapping screws. Do not over-tighten!

6. Fit the front panel (see 11.4.3.).

11.4.5 Replacement of active electrode sockets X3 (24) and X4 (25)

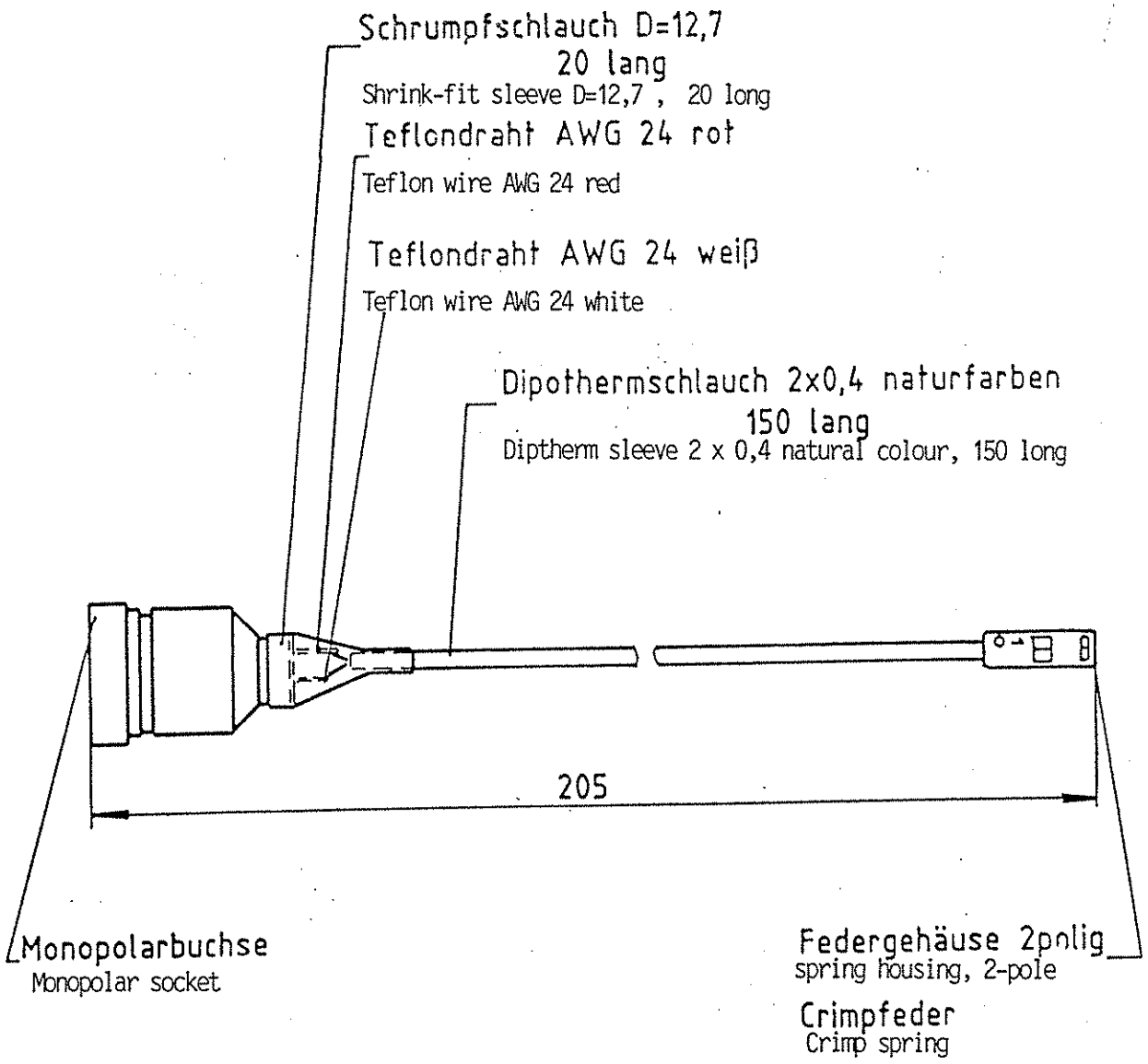
1. Remove front panel (see 11.4.3)
2. Remove front card (see 11.4.4)
3. Remove circlip (63) from the coaxial socket with circlip pliers, at the same time also pulling the cable out of the ring aperture.
4. Press out the coaxial socket towards the front. Withdraw the bunch of cables through this hole.
5. To fit the new part, feed the connection plug coming from the component side through the hole.
6. Slide the circlip (63) over the cable connection of the coaxial socket and fit onto the coaxial socket.
7. Fit front card (see 11.4.4)
8. Fit front panel (see 11.4.3).



Wire Draht	colour Farbe	length Länge	Anschluß connection spring housing Federgehäuse	monopolar socket Monopolarbuchse
Teflondraht AWG 24	rot	red 180	1	außen outer
" Teflon wire AWG 24	weiß	white 180	2	innen inner

Item 24 Active electrode connection socket.

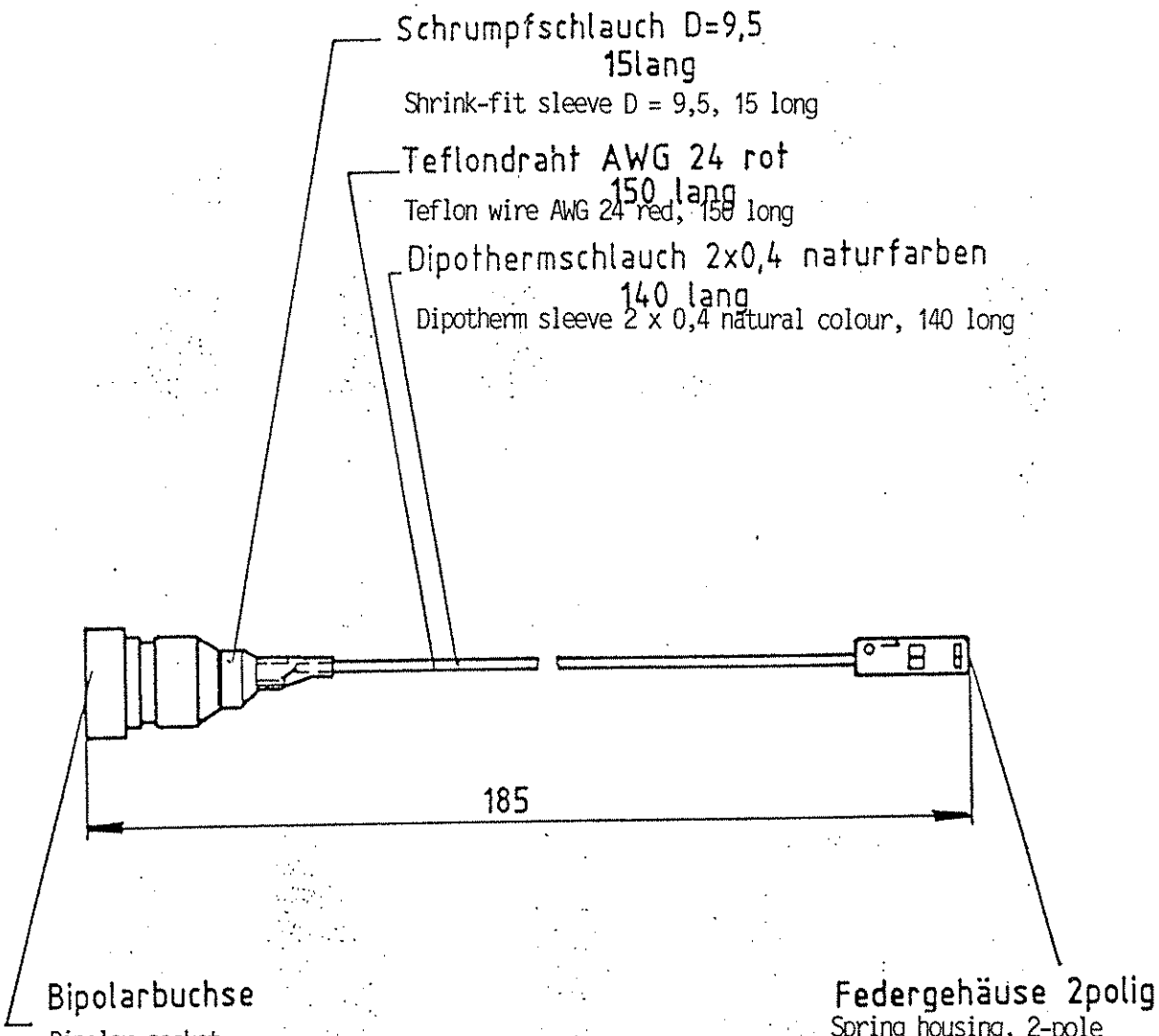
Pos.24	Aktivelektroden-Anschlußbuchse AE1 (X3)	MD 70	martin	5.6.91 Datum	11.4.G2 Seite



Wire Draht	Colour Farbe	Length Länge	Anschluß connection spring housing Federgehäuse	 monopolar socket Monopolarbuchse
Teflondraht AWG 24 " Teflon wire AWG 24	rot weiß	red 160 white 160	1 2	außen outer innen inner

Item 25 Active electrode connection socket

Pos.25	Aktivelektroden-Anschlußbuchse AE2 (X4)	MD 70	martin	5.6.91 Datum	11.4.G3 Seite



Anschluß: Federgehäuse 1 - Buchse-innen
Connection: Spring housing 1 - socket inner

Item 26 Active electrode connection socket

Pos.26	Aktivelektroden-Anschlußbuchse AE3 (X5)	MD 70	martin	5.6.91 Datum	11.4.G4 Seite

11.4.6 Replacement of active electrode socket X5 (26)

1. Remove front panel (see 11.4.3)
2. Remove front card (see 11.4.4)
3. Remove circlip (62) from the coaxial socket with circlip pliers and remove the connecting cable.
4. Remove socket with connecting cable towards the front.
5. Feed the connection plug of the new part from the front through the hole and insert the socket.
6. Slide the circlip over the connecting cable and fit it onto the socket.
7. Fit front card (see 11.4.4)
8. Fit front panel (see 11.4.3).

11.4.7. Replacement of patient plate socket X6 (21)

1. Remove front panel (see 11.4.3)

2. Remove front card (see 11.4.4)

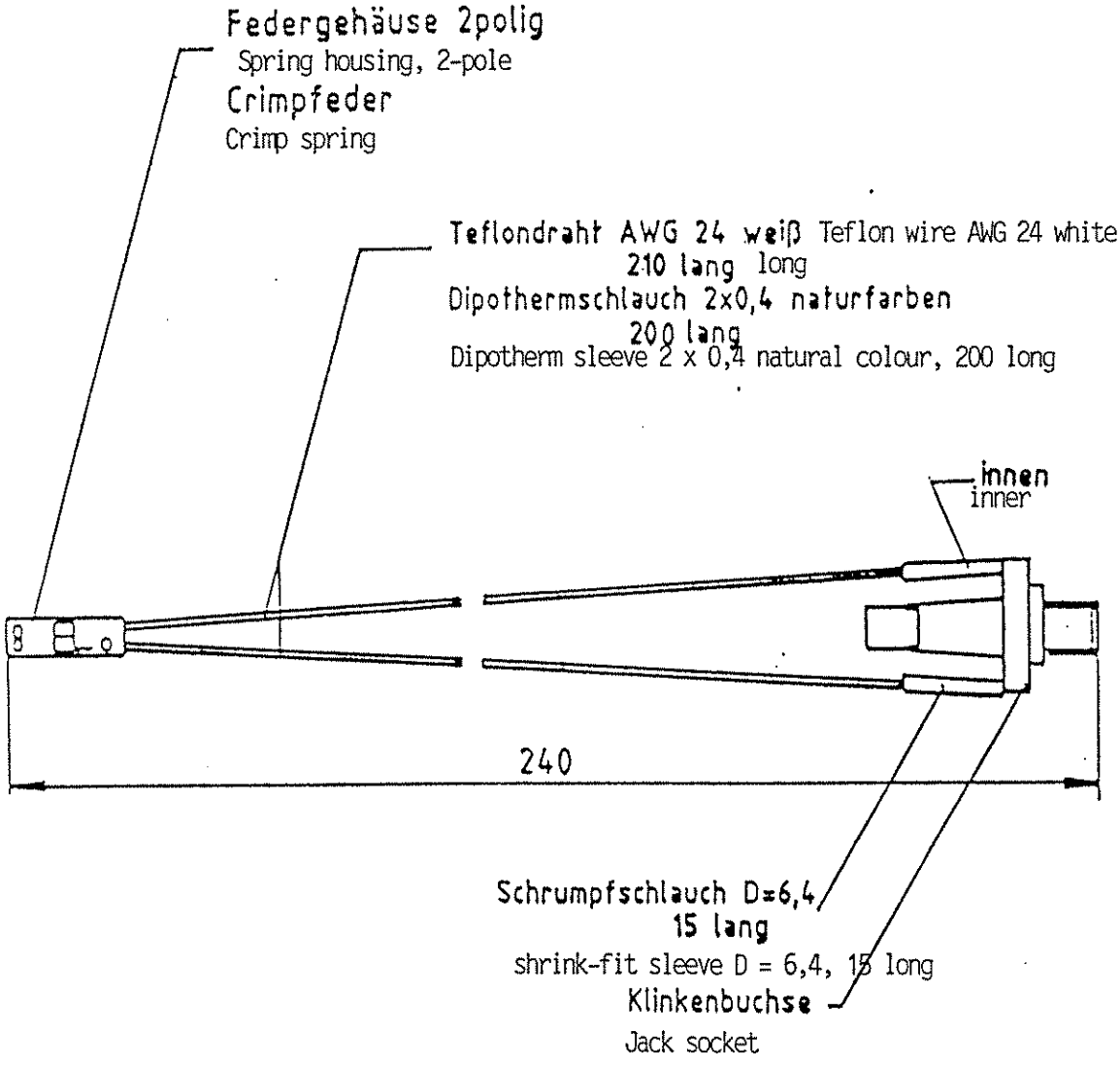
3. Unscrew the plastic nut (23) on the front of the front card with pliers. Because this nut is stuck with adhesive to the front card and possibly also to the socket thread, it will be difficult to remove it without damaging it. It must therefore be replaced.

4. Press out the socket to the front.

5. Insert the new part into the insulating cup from the rear with the contact latch facing upwards. If the insulating cup has become detached from the p.c. board or has to be renewed, it must be stuck to the board making complete flush contact. Screw on the plastic nut from the front and tighten. The nut must also be stuck flush against the p.c. board. The adhesive is not for fastening purposes, but to provide insulation! A suitable adhesive is cyanoacrylate adhesive.

6. Fit front card (see 11.4.4)

7. Fit front panel (see 11.4.3).



Item 21 Patient plate, connection socket

Pos.21	Neutralelektroden-Anschlußbuchse X6	MD 70	martin	6.6.91 Datum	11.4.G5 Seite

11.4.8 Replacement of mains switch S1 (14)

1. Remove the two plastic nuts (66) on the left-hand side of the RF generator card. Lift the card slightly and take the cables to the mains switch out of the space between card and casing base.

2. Loosen the four screws (78) and take off the front panel.

3. Remove the cable from the mains switch (14). On units of the first series manufactured, all four cables are black. Because of the risk of confusion, the cables should be marked, otherwise identification afterwards will require the use of a continuity tester.

4. Press out the mains switch towards the front by pressing with a screwdriver or similar from the rear alternately on the left and right on the fastening tabs at the top of the switch housing.

5. Press the new component from the front into the front panel, making sure that the "0" is at the top on the front side of the rocker switch.

6. Connect the cables to the mains switch according to the wiring diagram. The switch wafers of the mains switch are separated perpendicularly from one another. Connect the brown cables to one side and the black ones to the other side. It does not matter which colour is on the left or right side. Cables of the same colour can be interchanged. In the case of older, uniformly black cables, connect these according to previous marking or after identification with a continuity tester.

7. Refit the front panel (see 11.4.3)

11.5 Removal and fitting of output card A3 (32)

1. Detach plug-in connector X9 of the patient plate connection and X6, X7 and X8 of the active electrode connection. Detach PE conductor terminal X10.

2. Disconnect optical fibre conductor from opto-transmitters B1 (V5) and B2 (V10) by loosening the knurled nuts of the clamping connections at the opto-transmitters and withdraw the optical fibre conductors.

3. Disconnect the plug-in connector of the RF output transformer at X1, relay connectors in the output circuit at X2, X3 and X4 as well as the auxiliary transformer at X5.

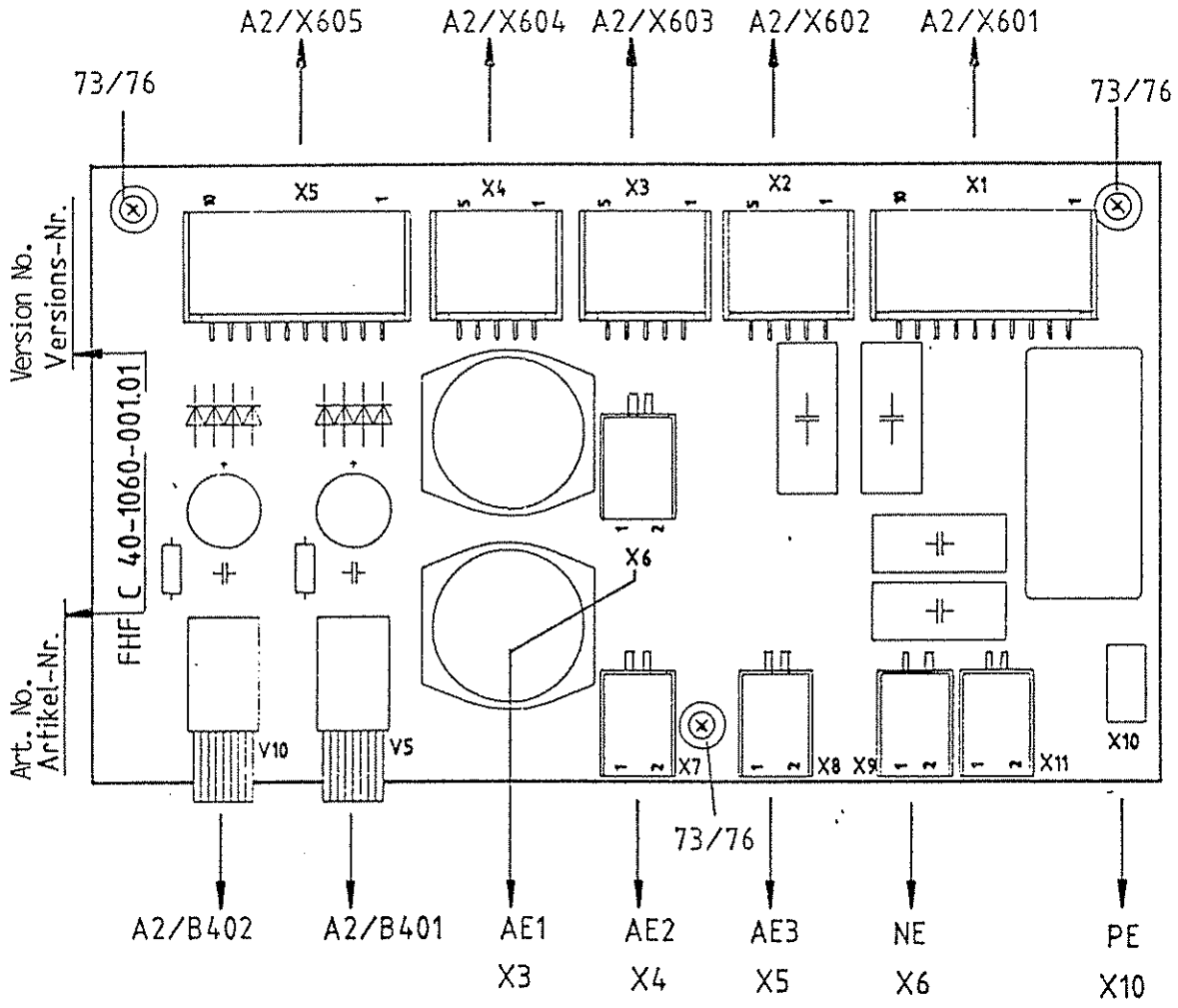
4. Unscrew Phillips screws (76) and take out the card.

5. When fitting the card, first check the tightness of the plastic spacer bolts (64); they may have loosened on removal of the card. Then fit the card and fasten it with screws (76) and lock washers (73).

6. Plug in the connector of the RF output transformer to X1 at rear right. Plug the relay connectors into X2, X3 and X4. Please note to avoid the risk of confusion: connect right-hand relay to right-hand connector X2; left-hand relay to left-hand connector X4! Plug in auxiliary transformer connector at X5.

7. Connect optical fibre conductor. Risk of confusion: conductors must be crossed; the right-hand transmitter should go to the rear receiver! Insert the optical fibre conductors as far as they will go up to the limit stop (approx. 17 mm) into the opto-transmitter housing and tighten the knurled nut.

8. Connect PE conductor connection X10. Plug patient plate connecting plug into X9 and active electrode connecting plug into X6, X7 and X8. The connecting cables of the active electrode sockets are designed so that confusion is excluded due to the cable lengths.



Wiring and component diagram / HF output card A3

Anschluß- und Befestigungsplan HF-Ausgangskarte A3	MD 70	martin	10.6.91 Datum	11.5.G1 Seite

11.6 Removal and fitting of RF generator card A2 (31)

1. Disconnect patient plate and active electrode connections as well as PE-conductor from the RF output card.

2. Disconnect potentiometer connections from plug-in connector on the RF generator card. Disconnect front card connection X701 on the RF generator card by detaching the locking clip.

3. Disconnect foot control connection X401 at the rear of the RF generator card.

4. Disconnect plug connection X2 on the switched-mode power unit card.

5. Unscrew the three plastic nuts (66) used as spacers from the top of the p.c. board.

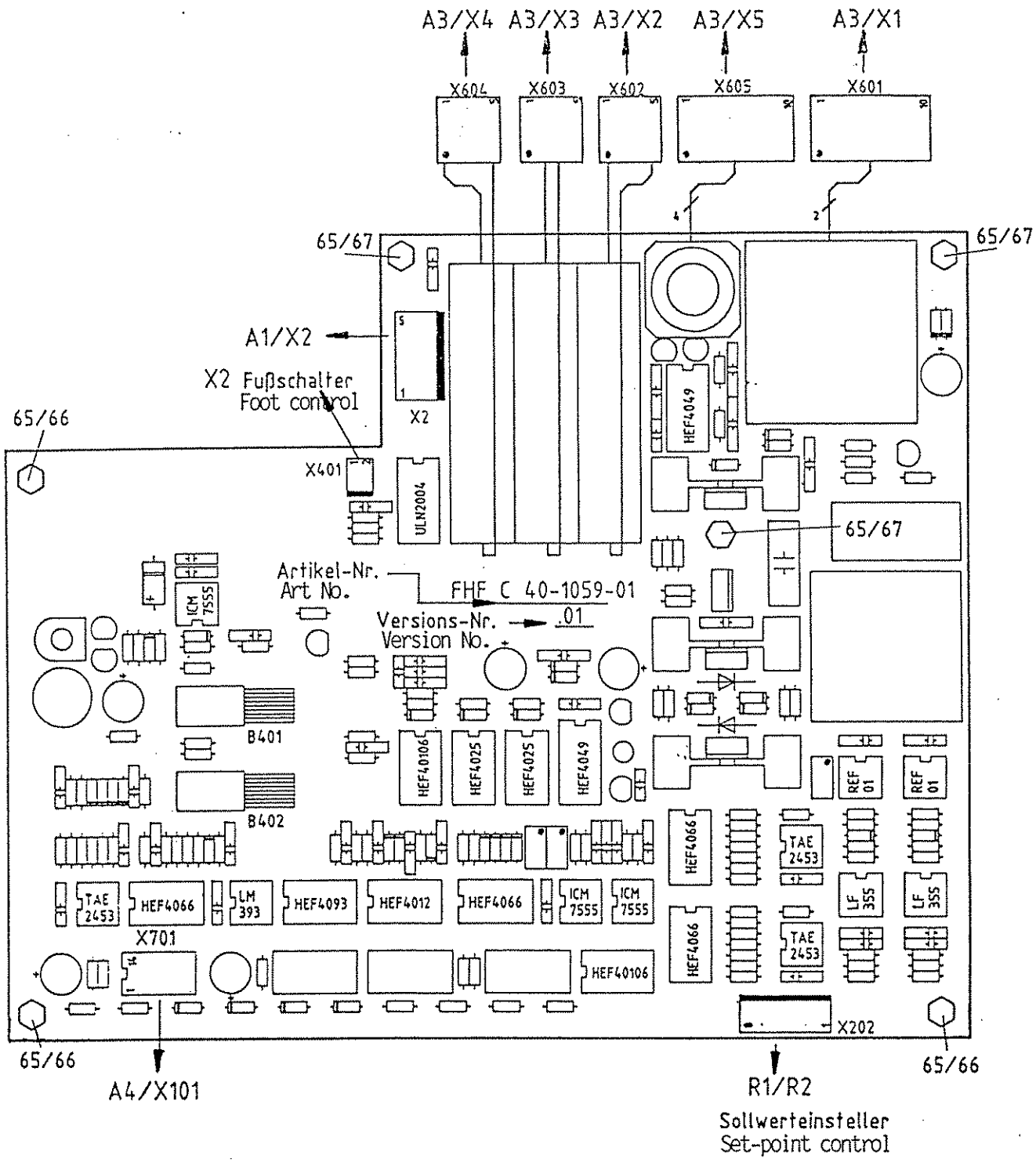
6. Remove the countersunk screw (77) marked with * as well as the two Phillips screws (76) marked with * from the base. Take out the RF generator card along with the output card (32).

7. When exchanging the RF generator card, the RF output card (see 11.5) including spacer bolts (64, 65, 66), the safety cover (51) and the optical fibre conductor (42) as well as the 5-pole connector (40) at X2 must be removed from the old card and fitted on the new one. Replace any spacer bolts with damaged threads. On some units of the first series, the outer 10 mm spacer bolts between card and casing base are secured to the base with M4 countersunk screws. When replacing these bolts, attention must be given to correct thread size. (Specially marked 10 mm spacer bolts with M4 blind hole as well as M4 countersunk screws are enclosed with the assembly kit U39-0002).

8. Insert the module making sure that the connecting cables for the foot control sockets do not get drawn under the RF generator card. Screw countersunk screw (77) as well as the two Phillips screws (76) with lock washers (73) into the base and tighten. Screw on nuts (66) from the top and tighten.

9. Connect 5-pole connector to X2 of the switched-mode power unit card. Make connection from the foot control sockets to X401 of the RF generator card. Plug the DIL connector of the front card connection into X701 on the RF generator card and secure with the clip (53). Plug potentiometer connection into X202.

10. Connect the PE conductor to X10, the patient plate socket to X9 and the active electrode socket connections to X6, X7 and X8 of the RF output card.



Wiring and component diagram / HF generator and control card A2

Anschluß- und Befestigungsplan HF-Erzeuger- und Steuerkarte A2	MD 70	martin	10.6.91 Datum	11.6.G1 Seite

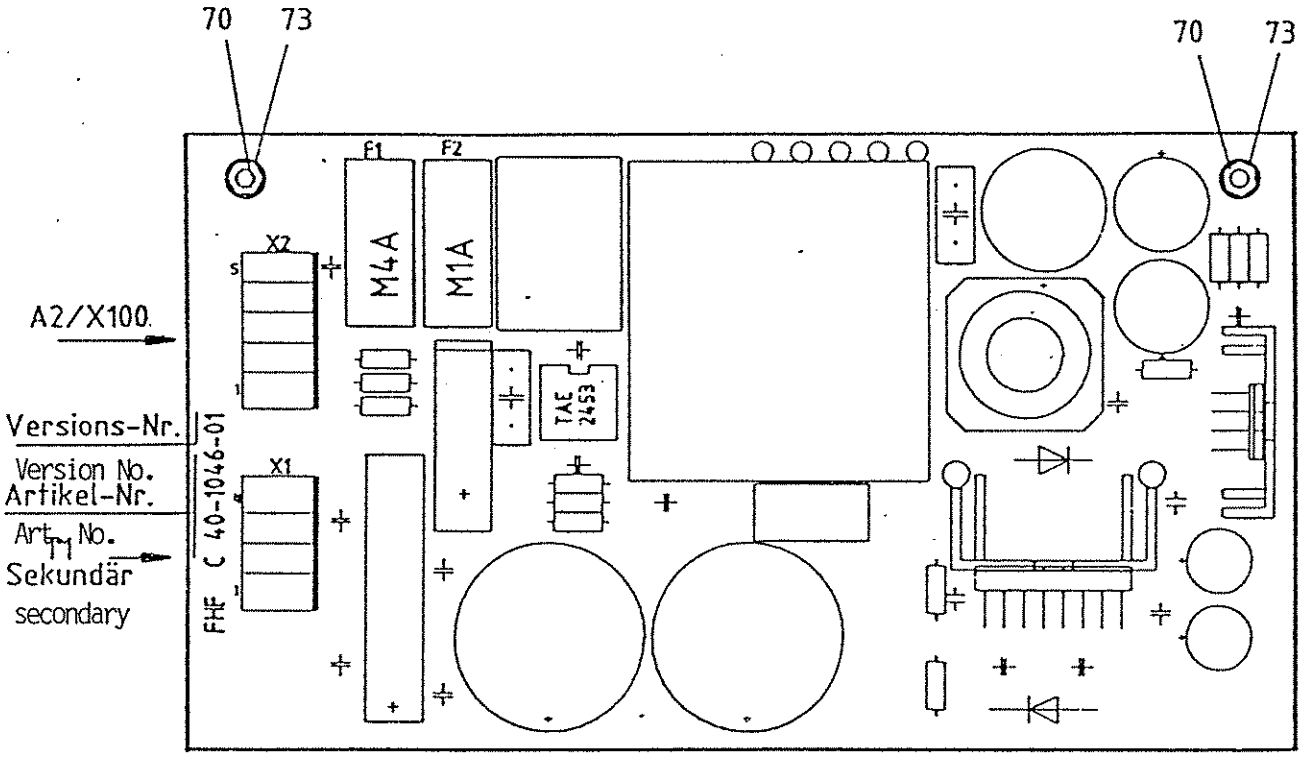
11.7 Removal and fitting of the switched-mode power supply A1 (33)

1. Disconnect plug connectors X2 and X1.

2. Remove nuts (70) and lock washers (73). Tilt the card forwards and withdraw it from the stud bolts, detach it at the bottom from the support rails (69) and remove it.

3. Insert the new component in the rails (69) at bottom left and right and at the top on stud bolts with spacer bushes (68). Fit lock washers (73) and nuts (70) and tighten.

4. Connect the secondary connection of the transformer to X1 and the 5-pole connector (40) to the RF generator card at X2.



Wiring and component diagram
Switched-mode power pack card A1

Anschluß- und Befestigungsplan Schaltnetzteilkarte A1	martin	MD 70	6.6.91 Datum	11.7.G1 Seite

11.8 Exchanging mains transformer T1 (12)

1. Unscrew the two plastic nuts (66) on the left side of the RF generator card and withdraw the cable from the space between the casing base and the RF generator card.

2. Disconnect the cable leads from the mains switch (14) and from the mains terminal (10). Do this if necessary by disconnecting plug connection X701 on the RF generator to give better access.

3. Disconnect the secondary connection of the transformer at plug connection X1 of the switched-mode power unit.

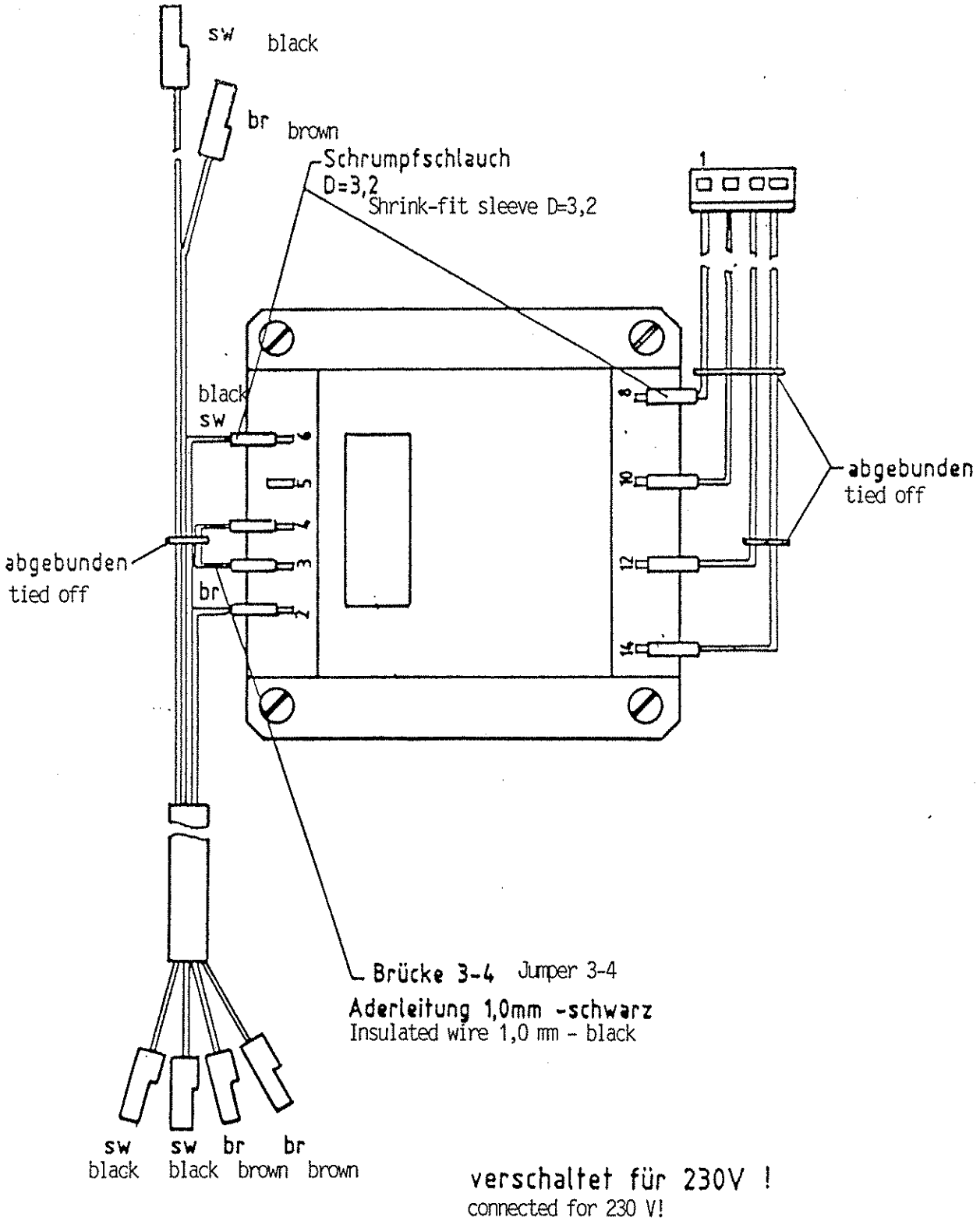
4. Unscrew the four screws (78) in the base and remove the transformer.

5. To install a transformer, insert it with its secondary terminals towards the right and secure it with screws (78) and lock washers (74).

6. Connect the secondary connection of the transformer to plug-in connector X1 on the switch-mode power unit.

7. Connect the primary-side cable leads to the mains terminal and mains switch in accordance with the wiring diagram. Risk of confusion when connecting the mains switch! The two wafers of the mains switch are at right angles to one another. Connect the brown cables to one wafer and the black ones to the other. In the first series of the unit, all cables of the cable harness are black. In this case, a continuity tester must be used or the cable marked before the transformer is exchanged.

8. Lift the left side of the RF generator card slightly and lay the cables in the free space between casing base, left outer side and p.c. board. Screw in the plastic nuts (66) and tighten them. Reconnect the DIL plug-in connector X701 on the RF generator card and secure with the clip.



Item 12 Mains transformer

Pos.12	Netztransformator	MD 70	martin	6.6.91 Datum	11.8.G1 Seite

11.9 Replacement of mains terminal bank X1 (10)

1. First check whether the fault is in the fuse or the fuse holder (11).
2. Disconnect the flat connector of the primary-side cables.
3. Unscrew countersunk screws (77) (nuts on the inside).
4. Remove the terminal bank inwards and disconnect the PE conductor.
5. When fitting the new component, first fit the PE conductor.
6. Insert the new component from inside into the space in the rear panel of the casing, and secure from the outside with Phillips countersunk screws (77), and on the inside with lock washers (73) and nuts M3 (70). (On units of the first series manufactured, tallow-drop screws may have been used instead of countersunk screws. These must then be re-used).
7. Fit the connecting cable and fit the fuse holder from the old terminal bank to the new one.

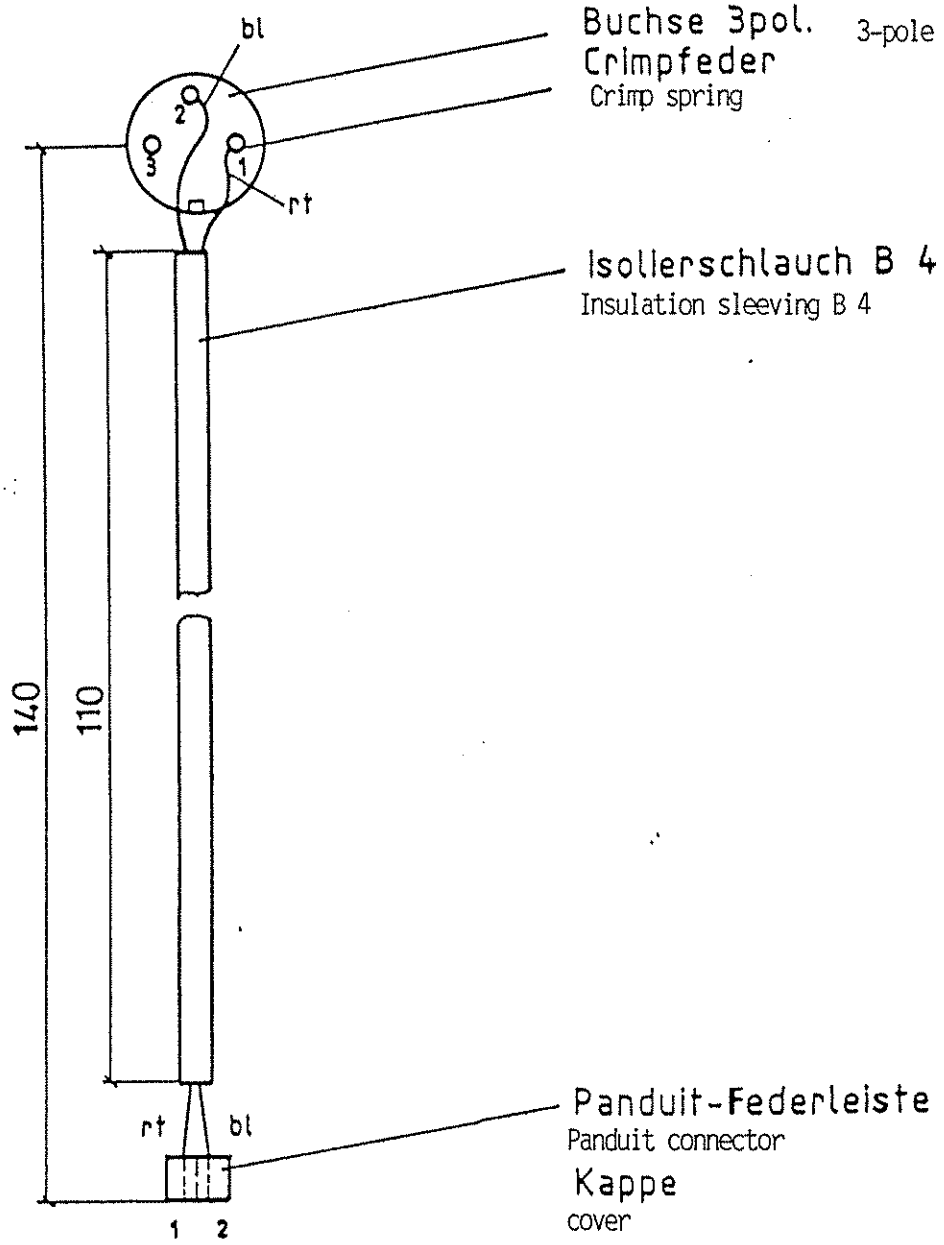
11.10 Replacement of foot control socket X2 (27)

1. Disconnect the connection of the socket at plug-in connector X401 on the RF generator card at the rear.

2. Unscrew the ring nut on the inside of the casing rear panel with special spanner or screwdriver. If necessary, remove the switched-mode power pack (see 11.7). Take out the socket with cable towards the rear.

3. Insert the new socket from the rear and slide the ring nut along the cable. Take care when screwing the nut onto the socket. The threaded ring can tilt very slightly when it is screwed onto the fine thread in the plastic, thereby damaging the thread. In the event of difficulties in fitting these two parts, dismantle and check them.

4. Connect the socket connection to the plug-in connector X401 on the RF generator card. Refit the switched-mode power unit (see 11.7).



Aderleitung AWG 22 rot -140 lang
Aderleitung AWG 22 blau-140 lang

Insulated wire AWG 22 red - 140 long
Insulated wire. AWG 22 blue - 140 long

Item 27 Bipolar foot control socket

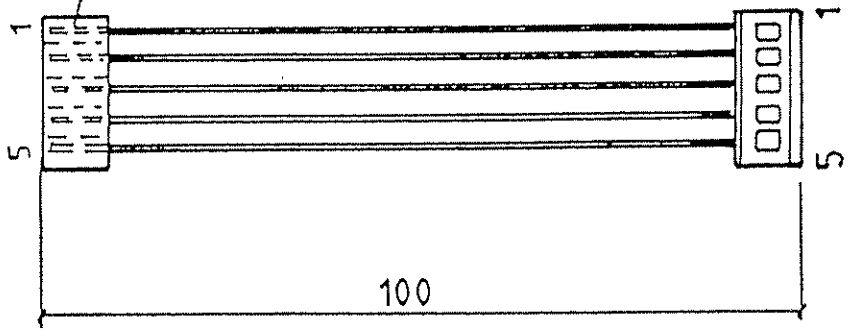
Pos.27	Bipolare Fußschalterbuchse X2	MD 70	martin	6.6.91	11.10.G1

Pandult-Federleiste 5polig

Panduit connector, 5-pole

Kappe

cover



Aderleitung AWG 18 blau

Insulated wire AWG 18 blue

5 Leitungen 100mm lang

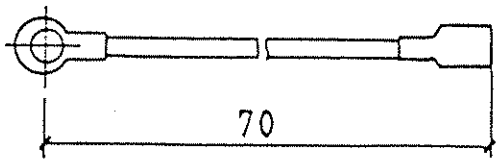
5 wires 100 mm long

Item 40 5-pole plug-in connector

Pos.40	Verbinder 5polig A1/X2 - A2/X2	MD 70	martin	6.6.91 Datum	11.11.G1 Seite

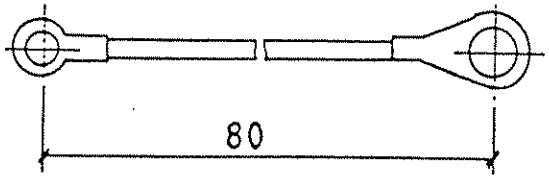
Kabelschuh M4
Cable lug M 4

1.



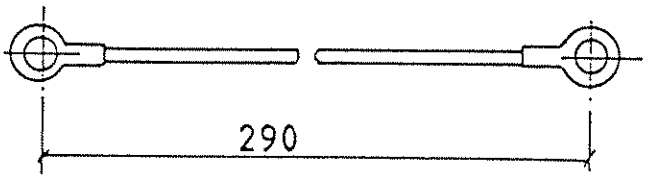
Flachsteckhülse 4,8
Tab receptacle 4,8

2.



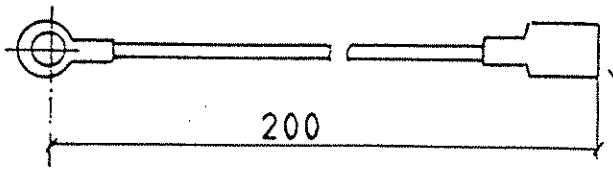
Kabelschuh M6
Cable lug M 6

3.



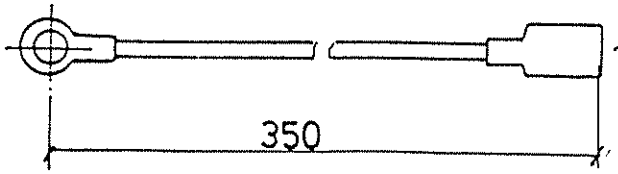
Kabelschuh M4
Cable Lug M 4

4.



Flachsteckhülse 6,3
Tab receptacle 6,3

5.



Aderleitung 1,0mm² grün/gelb
Insulated wire green/yellow

Item 41 Set of PE leads

Pos.41	Satz PE-Leitungen	MD 70	martin	5.6.91 Datum	11.11.G2 Seite

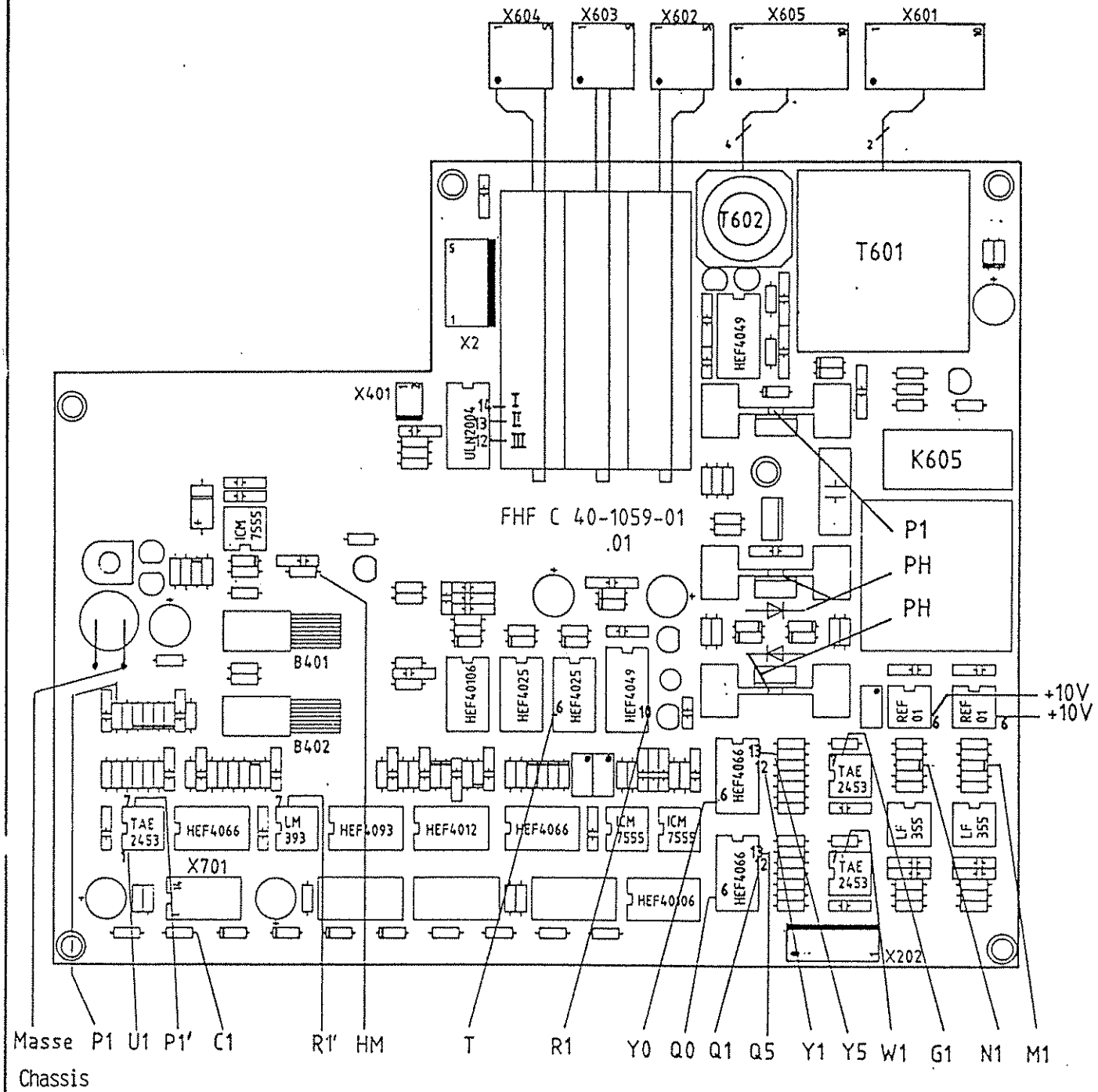
12. TROUBLE-SHOOTING

12.1 Measuring points and procedures

The aim of trouble-shooting should be to localize a defective sub-assembly within the unit, so that it can be exchanged.

No soldering work is required for repairs; all sub-assemblies are connected with plug-in connectors. A simple multimeter providing d.c. voltage measurement, a.c. voltage measurement and continuity testing is sufficient for trouble-shooting in the electronic circuitry.

It should be possible to determine the defective functional group by means of the signals shown in the block diagram in 10.1, so that the defective sub-assembly will also be localized. This procedure is illustrated in the following by the use of a few examples of faults. This list of examples makes no claim to be comprehensive.



HF-generator card A 2 / Location drawing of the measuring point

HF-Erzeugerkarte A2 Lageplan der Meßpunkte	MD 70	martin	10.6.91 Datum	12.1.G1 Seite

12.2 Trouble-shooting on total breakdown

Symptom: No sign of any function. The front panel remains unlit as if the unit had not been switched on.

Possible causes:
a) Break in the 15 V supply circuit
b) Short-circuit in the 15 V supply

Trouble-shooting:

1. Apply voltmeter to the terminals at the rear of the mains terminal bank. Is mains voltage present?
   No: Check mains connecting cable and mains fuses.
   Fuse blown?
   Yes: Replace. Does it blow again immediately?
   No: End
   Yes: Short-circuit in or on the mains transformer. End

2. Apply voltmeter to terminals 2 and 6 of the mains transformer. Is mains voltage present?
   No: Mains switch or connecting plug faulty. End

3. Apply voltmeter to terminals 2 and 5 of the mains transformer. Mains voltage present?
   No: Thermostat in mains transformer faulty. End

4. Apply voltmeter to the secondary side terminals 12 and 14. Is there approximately 21 V present?
   No: Open-circuit in the transformer. End

5. Check fuse F2 in switched-mode power unit.
   Fuse blown?
   Yes: Switched-mode power unit faulty. End

6. Check heat sink temperature on the right on the outside of the switched-mode power unit. Is the heat sink warm?
   Yes: Short-circuit on the RF generator card. End
   No: Fault in the switched-mode power unit. End

12.3 Malfunctions of keys and lamps on the front card

Symptom: One or more keys not operating or their operation not acknowledged; lamps not operating.

Possible cause:
a) Open-circuit on the front panel or the feeder
b) Fault in a keyboard interface.

Trouble-shooting:

1. Disconnect connector X701 on the RF generator card and temporarily connect replacement front card.
   Does this rectify the malfunction?
   Yes: Fault in the front card.
   With filament lamps, very probably burnt out. End.
   No: Fault in keyboard interface. Replace RF generator card A2.

12.4 Failure of the monopolar RF generator

Symptom: Activation still produces an audible signal, but RF power is not produced at any output in any operating mode.

Possible cause:
a) Oscillator faulty
b) Modulator faulty
c) Power controller faulty

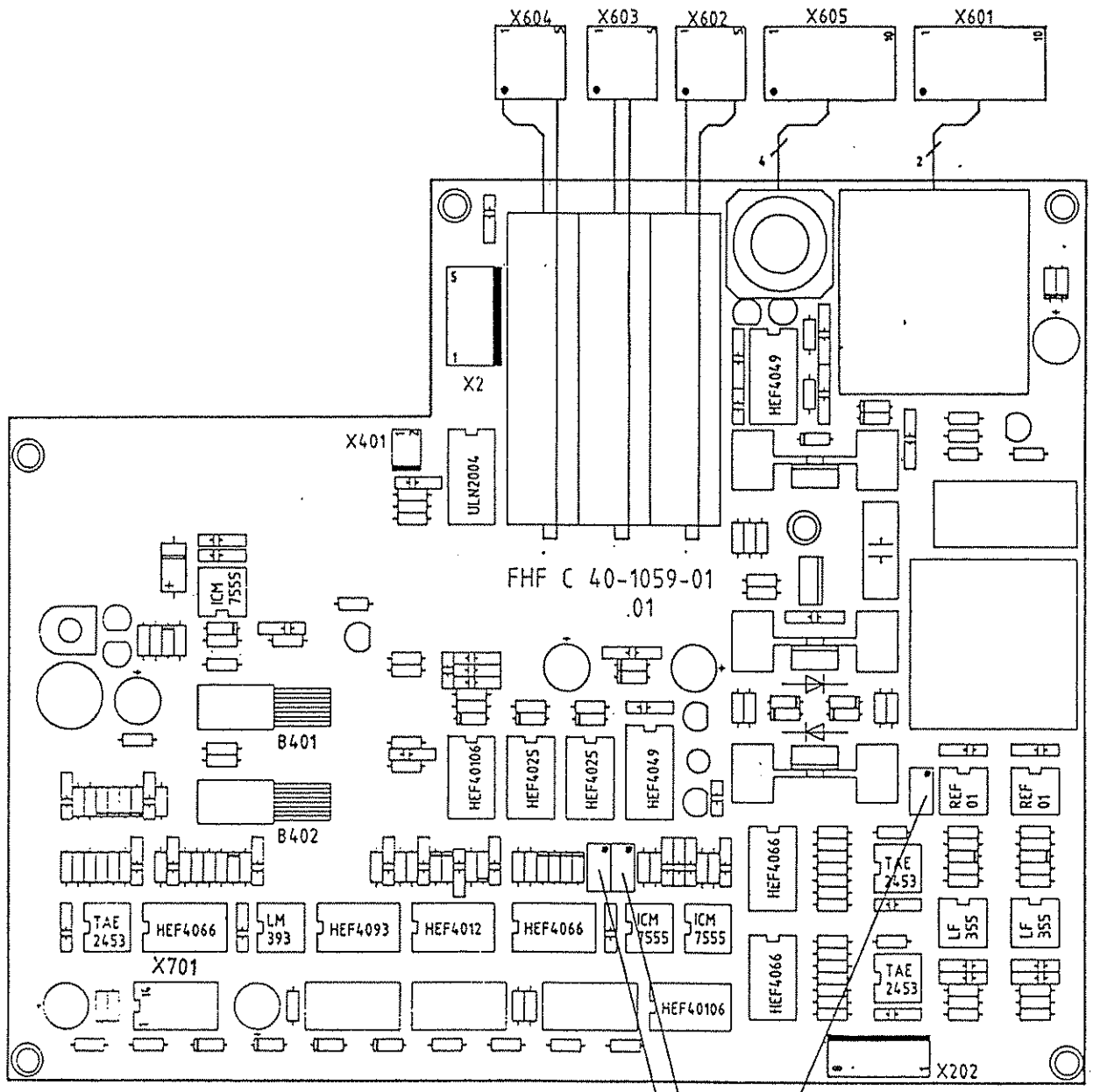
Trouble-shooting:

1. Activation test with Cutting I. Does the yellow RF indicator lamp light?
   No: Fault on RF generator card A2. End

2. Set left-hand power controller to 1 and measure signal U1. Vary the power controller over a small range. Does U1 also vary?
   No: Fault in the signal electronics on the RF generator card. End

3. Measure voltage P1 and vary the power controller over a small range either side of setting 1. Does P1 vary with it?
   No: Measure voltage at the transformer secondary terminals 8 and 10. Is there approximately 33 V present?
   No: Transformer open-circuit. End
   Yes: Check fuse F1 in the switched-mode power unit.
   Fuse blown?
   No: Switched-mode power unit faulty. End
   Yes: Exchange.
   Fuse blows again immediately:
   Yes: Switched-mode power unit faulty. End
   No: Fault remedied?
   Yes: End
   No: continue at 2.
   Yes: Fault in the relay control on the RF generator card A2. End

13. ALIGNMENT, SETTINGS



S.2 Alignment, Cutting II
S.2 Abgleich Schneiden II
S.K.Abgleich Sprühkoagulation
S.K. Alignment, Spray coagulation

Gleichlauf
(Werkseinstellung)
Synchronous operation (factory setting)

Location drawing of the alignment points

Lageplan der Abgleichpunkte	MD 70	martin	10.6.91	13.1.G1

13.2 Basic information on RF output power measurement

Measurement of the electrical radio frequency output power differs from measurement of other electrical quantities in that it involves wide tolerances. The main reasons for this are:

1. Power measurement is normally based on measurement of the r.m.s. value of the current, in which the current is entered quadratically. A 5 % error in measurement of the current thus results in a 10 % measuring error for the power.

2. The terminating resistor, which represents an RF power meter, is never a pure resistance but includes reactive components, which alter the measuring result according to the spectral composition of the RF current.

3. During servicing, the output power is normally obtained with short leads between the electrosurgical unit and the meter. But according to IEC 601, the output power should be measured with cables from the original accessories fully laid out according to a specific arrangement. The data for the output power of the ME series of equipment is based on this type of measurement. Compared with the measurement with short leads, this results in a higher output power.
   Reason: The inductance of the fixed loops of active electrode and patient plate cables or earthing cables partly compensates for the capacitance of the matching capacitor and thus reduces the impedance.

The regulations themselves therefore allow measured values to be accepted as correct which deviate by up to $\pm$ 20 % from the rated value. The following measuring tolerances are regarded as permissible for the unit:

MD 70:

Cutting I	50 W at 1000 ohm	-20/+20 % (40-60 W)
Cutting II	50 W at 1000 ohm	-20/+20 % (40-60 W)
Spray coagulation	30 W at 1000 ohm	-20/+20 % (24-36 W)

The units are set in the factory with the MARTIN portable measuring set Feucht FM2097.

13.3 Alignment of RF output power

MD 70 units are not provided with any adjustment facility for the "Cutting I" operating mode. The output power of operating modes "Cutting II" and "Spray Coagulation" is aligned by adjusting the depth of modulation.

For setting "Cutting II", proceed as follows:

1. Connect power meter to AE1 or AE2 with accessory cable and set to 1000 ohm.

2. Select "Cutting II" mode, switch off "Micro" mode, set power controller to 10.

3. Activate with finger switch and set 50 W output power at setting point "S.2" at front centre on the RF generator card A2 by gradual adjustment. More power: anti-clockwise; less power: clockwise.

For setting "Spray Coagulation", proceed as follows:

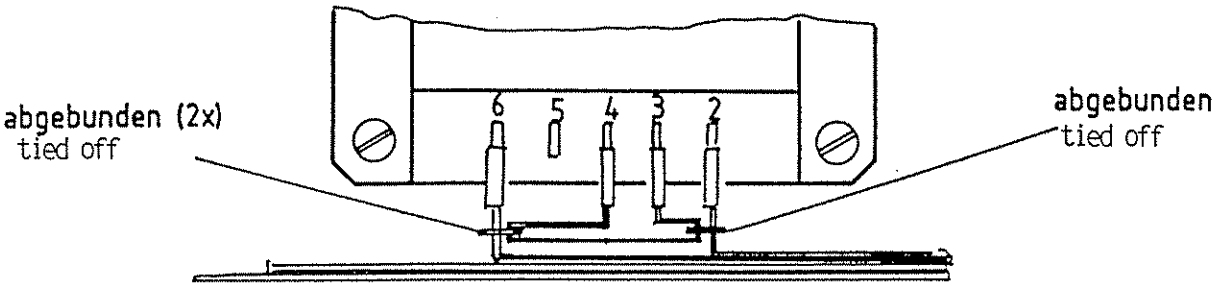
1. Connect power meter to AE1 or AE2 with accessory cable and set to 1000 ohm.

2. Select "Spray coagulation" current type, switch off "Micro" mode and set centre power controller to 10.

3. Activate with finger switch and set 30 W output power at setting point "S.K." at front centre of the RF generator card A2 by gradual adjustment. More power: anti-clockwise; less power: clockwise.

The adjuster for the depth of modulation, particularly the "S.K." adjuster for spray coagulation should be moved only very gradually from its original position, otherwise there is the danger that the depth of modulation will be set too high, causing damage to the switched-mode power unit or the RF generator. When using the MARTIN measuring instrument (Feucht FM2097), observe the calibration pauses.

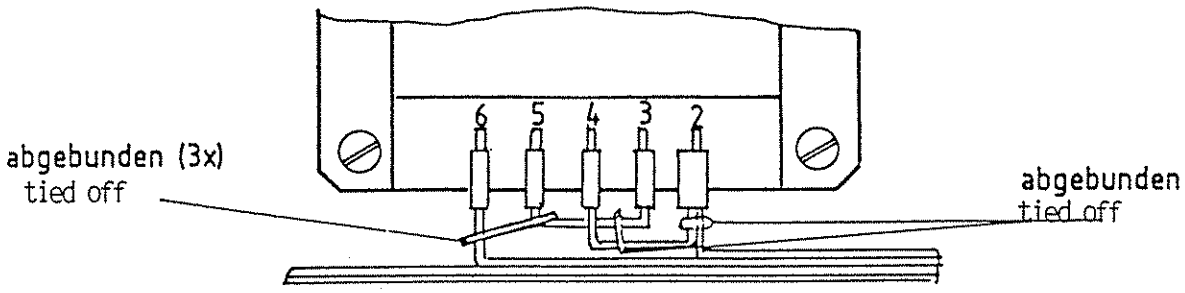
230 V



Netzanschluß: Klemme 2 und 6
Brücke von 3 nach 4

Mains connection: terminals 2 and 6
jumper from 3 to 4

115 V



Netzanschluß: Klemme 2 und 6
Brücke von 2 nach 4 und von 3 nach 5

Mains connection: terminals 2 and 6
jumper from 2 to 4 and from 3 to 5

Selection of mains voltage at mains transformer

Umstellung der Netzspannung am Netztransformator	MD 70	martin	10.6.91 Datum	13.4.G1 Seite

13.4 Selection of mains voltage

The MD 70 units are adjusted in the factory to the mains voltage for the market for which they are intended. If it becomes necessary to change to a different mains voltage, the soldered terminals on the primary side of the mains transformer must be changed over and the mains fuses changed. A conversion kit is supplied for this.

To change from 230 V to 115 V, proceed as follows:

1. Unplug the mains cable and open the casing (see 11.3).
2. Remove the cable ties which secure the cables to the transformer terminals 2 and 3.
3. Unsolder the cables from transformer terminals 2 and 3 by firstly cutting up the shrink-fit sleeving, unsoldering the cables and then removing the remains of the sleeving.
4. Insert the unsoldered cable ends together through a piece of shrink-fit sleeving from the conversion kit (large diameter) and solder both together to transformer terminal 2 in accordance with the transformer wiring diagram. Then shrink-fit the sleeving.
5. Fit shrink-fit sleeving (small diameter) to both ends of the cable jumper from the conversion kit and solder across transformer terminals 3 and 5 according to the transformer wiring diagram. Then shrink on the sleeving.
6. Remove mains fuses and insert two 1.25 A slow-blow fuses.
7. Replace the adhesive label "Voltage and fuse selection" or stick a new label over the old one and enter the new voltage.
8. Close the casing (see 11.3).

To change from 115 V to 230 V, proceed as follows:

1. Unplug the mains cable and open the casing (see 11.3).
2. Unsolder the cables from transformer terminals 2, 3 and 5 by firstly cutting up the shrink-fit sleeving, unsoldering the cables and then removing the remains of the sleeving.
3. Fit 4 pieces of shrink-fit sleeving (small diameter) from the conversion kit to the end of the cable jumper from the transformer terminal. Solder the cable jumper to transformer terminal 3 according to the transformer wiring diagram and then shrink on the sleeving.
4. Fit shrink-fit sleeving (small diameter) onto the end of the still unconnected cable from the cableform and solder to transformer terminal 2 according to the transformer wiring diagram. Then shrink on.

5. Tie the cables at transformer terminals 2 and 3 together according to the transformer wiring diagram, using cable ties from the conversion kit.

6. Remove mains fuses and insert two 0.36 A slow-blow fuses.

7. Replace the adhesive label "Voltage and fuse selection" or stick a new label over the old one and enter the new voltage.

8. Close the casing (see 11.3).