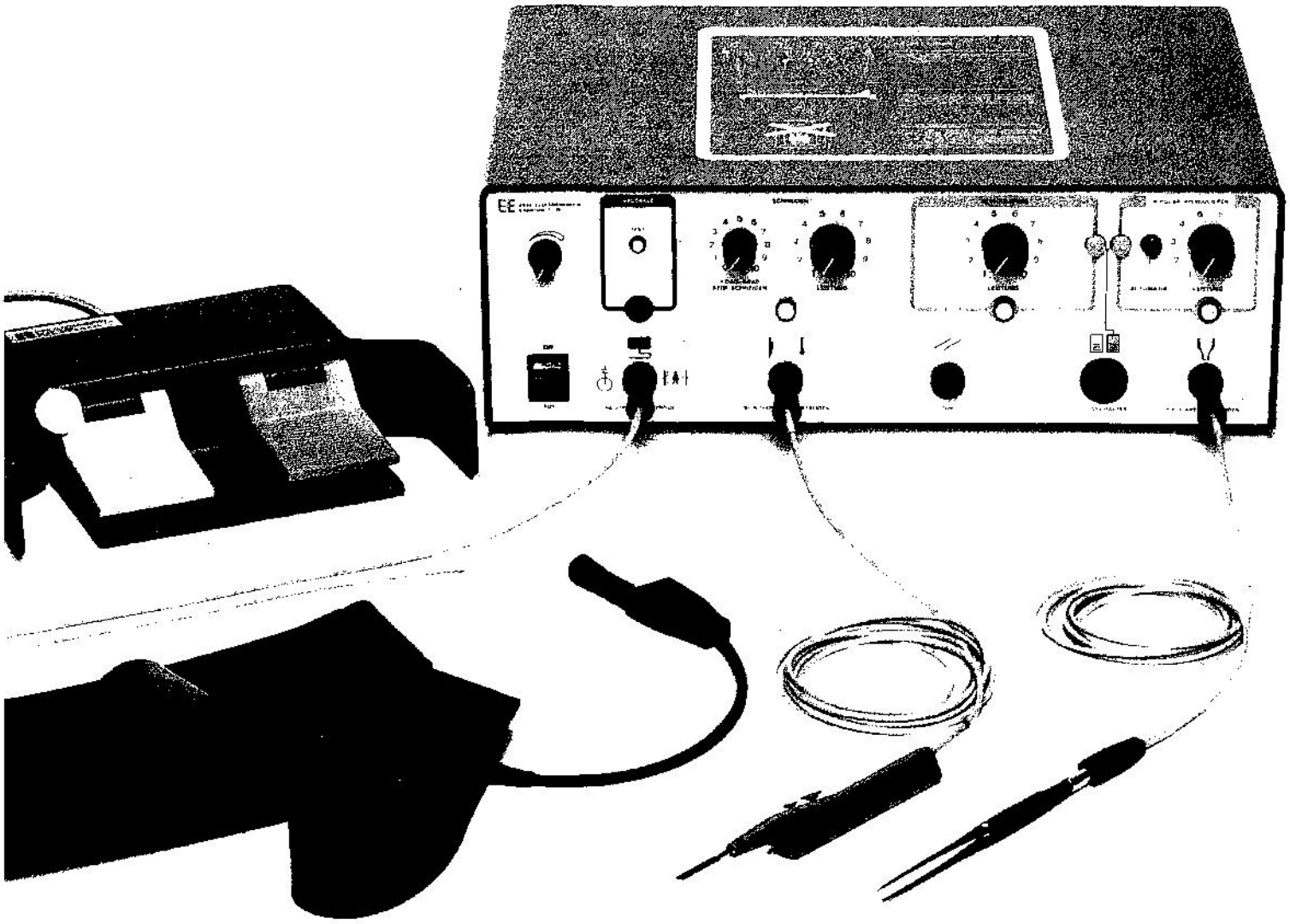
ERBE

ERBOTOM T 400 C

Electrosurgical Unit

Service Documents



MAINTENANCE

CAUTION To prevent danger of severe electrical shock, do not remove the cover of the unit. Refer all servicing problems to qualified service personnel.
The procedures listed below should be carefully followed in order to ensure safe and efficient operation.

PREVENTIVE MAINTENANCE

The following routine inspections shall be carried out on the equipment and accessories in order to keep the equipment within its specification during its lifetime and to warranty safety.

Before every use the following routine inspections shall be carried out:	
Insulation	Checks for any sign of damage to the insulation of the cables, connectors and accessories.
Sentry circuit	The sentry circuit shall be tested for proper function.
Indicators	The audible and visual alarm indicators shall be tested for proper function.

Every three months or after repairs:	
Eearth conductor	An earth continuity test shall be carried out.

Every year or after repairs the following functional checks shall be made:	
Low frequency leakage current tests	Measuring leakage currents (50 or 60 Hz).
Sentry circuit test	Check for proper function.
Audible and visual alarms	Check for proper function.
Output power	Measure max. cut, coag. and bipolar RF output power.
Haemostasis control	Measure max. RF-cutting power in the positions 3 and 9.
Absence of muscular stimulation	Measure the absence of resistance between active and patient plate ($R > 2$ MOhms).
Control the mode of operation	Indication of the earth, earth referenced or floating mode on the frontpanel (6) has to be in accordance with the electrical connection of the patient plate.

The earth referenced or floating mode of operation	Measure the resistance between the patient plate and protective earth ($R > 2$ MOhms).
The earth mode of operation	Measure the resistance between the patient plate and protective earth ($R < 0{,}1$ Ohms).

Corrective Maintenance

Modifications and repairs may only be carried out by ERBE or by service organizations, expressly authorized by ERBE to do so. The latter must provide a certificate on the nature and extent of the repair, and where appropriate, any changes to ratings or working limitations. The certificate must also state the date, the work carried out, and be duly signed.

CIRCUIT DESCRIPTION

Power Supply

The power supply assembly consist of transformer Tr1 and Tr2 (toroidal type) protected against excessive primary current by fuses F1 and F3 as well as excessive coil temperature by two thermal cut off fuses Th2 and Th3 which are embeded in the two 110 V primary windings of transformer Tr2 and a separate thermal sensitive device Th1 placed on the inner circle of the toroidal coil to the transformer Tr2.

Transformer Tr1 produces 18 Vac and 27 Vac.

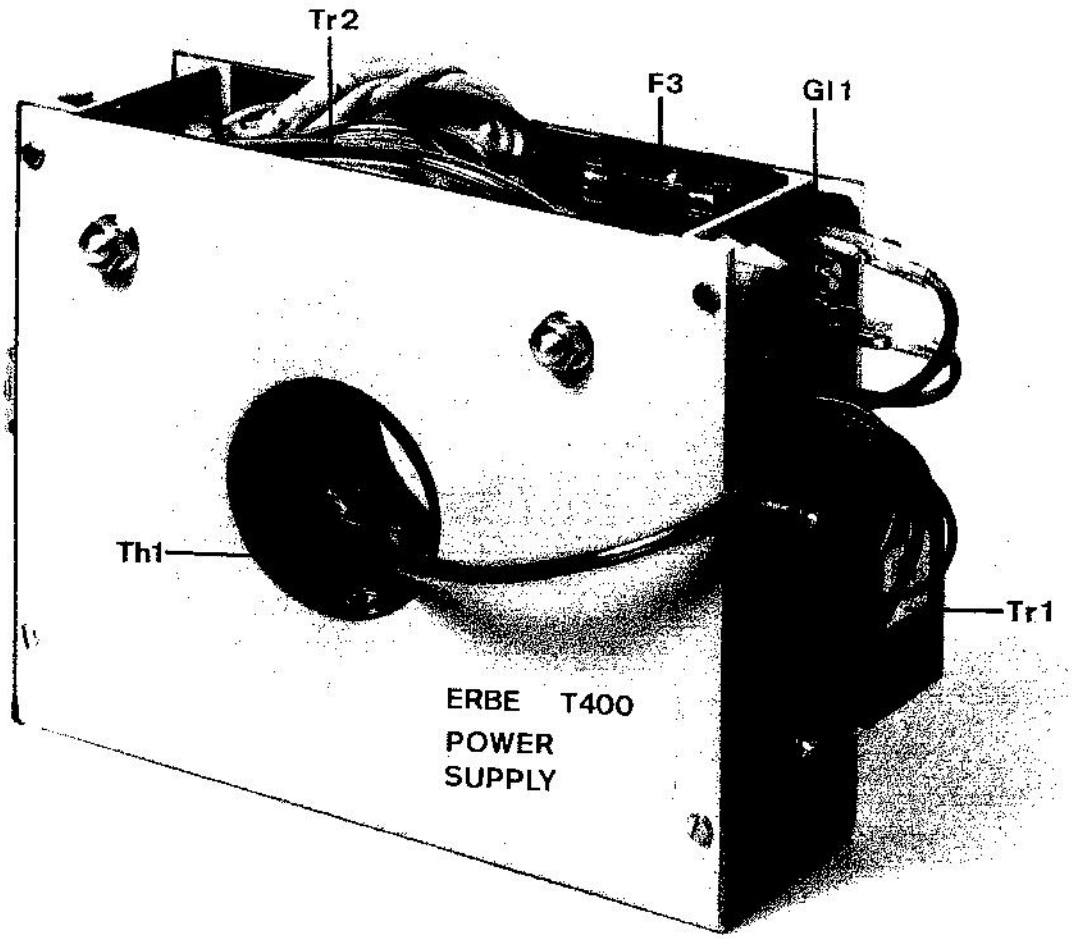
The 27 Vac is rectified by the bridge rectifier Gl1 and stabilized to 24 V by IC1 on PCB 151.2.

Transformer Tr2 produces 100 Vac which is rectified by the bridge rectifier Gl1.

The line power transformer Tr2 (torodial coil transformer) has four primary windings. The line voltage selector diagram is shown inside the cover of the unit. The line voltage selection can be made by changing the bridge wire on multipoint connector terminal St3.

The line transformer Tr1 has only one primary 110 V winding which is parallel to the primary 110 V winding 1–2 of transformer Tr2.

With the front panel power switch Sch1 in the ON position, power is applied to the power supply and to the lamp inside of switch Sch1.



Power Regulator
PCB: EE 156.3

The intensity of the RF output power for cutting, as well as monopolar and bipolar coagulation is regulated by the power regulator on printed circuit board EE 156.3, which is supplied directly from the bridge rectifier GI1. The purpose of the power regulator-board is, to charge the electrolytic capacitor C1 (located to the rear of PCB 156.4 inside the unit)to the voltage that is necessary to produce the required RF-output power for cutting and for monopolar or bipolar coagulation.

The charging voltage of the electrolytic capacitor C1 is controlled by thyristor Ty1 which receives the phase controlled ignition impulses from the unijunction transistor T1.

The unijunction transistor T1 is turned on by the RC network of capacitor C2 and resistor R5. When T1 is on it produces ignition impulses to thyristor Ty1 which controls the charging of the electrolytic capacitor C1. If the cutting channel (A) is activated, the intensity will be controlled by the following components: trimpot TP4 (maximum for channel A), trimpot TP3 (minimum for channel A), potentiometer PA at the frontpanel (intensity control), relay contact rA1, capacitor C1 and zener diode D4. The zener diode D4 limits the voltage of the trigger unit to 15 V.

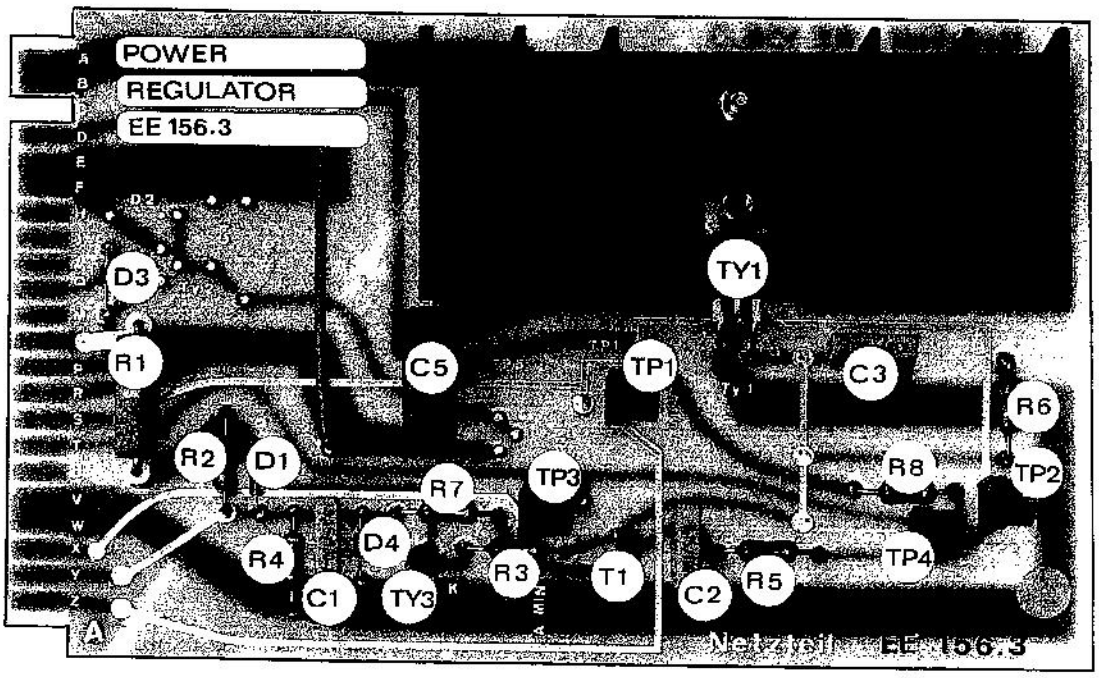
The lower the resistance of potentiometer PA, the sooner capacitor C2 is charged and, the longer the time, current will flow through thyristor Ty1. This results in a greater charge voltage on the electrolytic capacitor C1. To avoid misfiring of Ty1 during the charging time of the electrolytic capacitor C1, transistor T1 is turned off by thyristor Ty2 which is fired simultaneously to Ty1. If the monopolar coagulation channel (B) is activated, capacitor C2 will be charged through resistor R5, trimpot TP2 (maximum for channel B), TP1 (minimum for channel B) and relay contact rB1 from capacitor C1 and zener diode D4.

ATTENTION!

The RF-output power for monopolar coagulation is not adjustable by power amplitude variation through a potentiometer like potentiometer PA for cutting power output adjustment. The output power adjustment for monopolar coagulation is made by adjustment of the pause duration of the pulsmodulated coagulation current through potentiometer PB.

If bipolar coagulation (channel C in the circuit diagram) is activated, the capacitor C2 will be charged through R5, R8, PC, TP2 (C.MIN), TP1 (C.MAX) and over relay contact r1 from capacitor C1 and zener diode D4.

For adjusting the maximum and minimum RF-output power for cutting (A), monopolar coagulation (B) and bipolar coagulation (C) read the section „CALIBRATION AND ADJUSTMENTS".



Monitor for Bipolar Coagulations
PCB EE 151.4

The bipolar generator, PCB EE 150.3, can be switched on by either footswitch or automatic control. When the bipolar generator is switched on by automatic control, a time delay is used for switching on the bipolar coagulation current. This allows the surgeon to use the forceps for tissue preparation prior to the initiation of coagulation. Coagulation begins only when the tissue has been held between the forcep tips for a continuous time interval. This time interval is the delay time which can be pre-set by adjusting trimpot TP3 on PCB 151.4 for a delay of 0 to 5 seconds, thus avoiding unintentional coagulations.

Switching of the bipolar generator by footswitch control.

ATTENTION!
For switching of the bipolar generator by footswitch, depress the grey push button 6 (Sch2 in the circuit diagram) on the front panel.

By pressing the blue pedal of the footswitch, 24V dc is supplied to contact J on PCB 151.4. Relay 1 is activated and the relay contact r1 is closed and the power regulator PCB 156.3 is activated.
The maximum and minimum RF-power can be adjusted by TP1 and TP2 on PCB 151.4. Potentiometer PC on the front panel controls the intensity of the output.

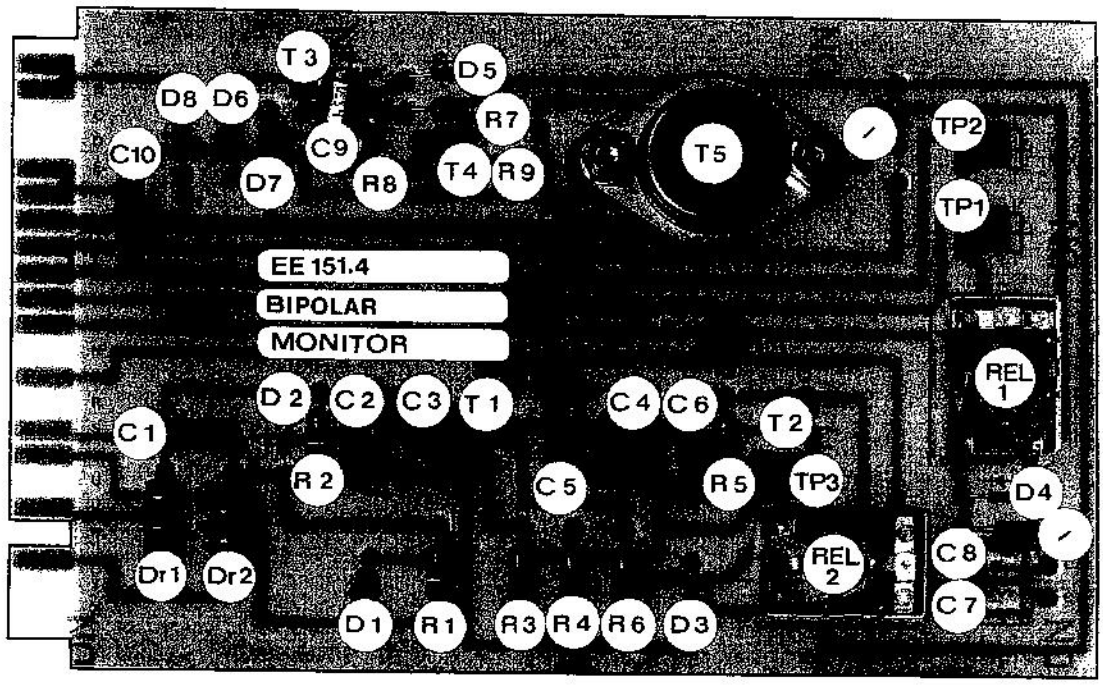
Switching of the bipolar generator by auomatic delay control.

ATTENTION!
For switching of the bipolar generator by automatic control, depress the blue push button 6 (Sch2 in the circuit diagram) on the front panel. (The circuit diagram shows Sch2 in automatic mode condition).

Transistor T1 is normally conductive, however when the forcep tips are both in continuous contact with tissue, the base of T1 becomes 0 voltage and T1 is shut off. This allows capacitor C4 to be charged through resistor R4. After the delay time, transistor T2 becomes conductive and activates the relay Rel 2 which closes contact r2 allowing 24V to activate Rel 1 and thus the bipolar generator is activated for use.

Delay time may be adjusted from 0 to 5 seconds with trim potentiometer TP3.

Transistor T5 on PCB 151.4 isolates the bipolar generator from the power supply PCB 156.3 and prevents the bipolar from being supplied power when monopolar generator is activated.

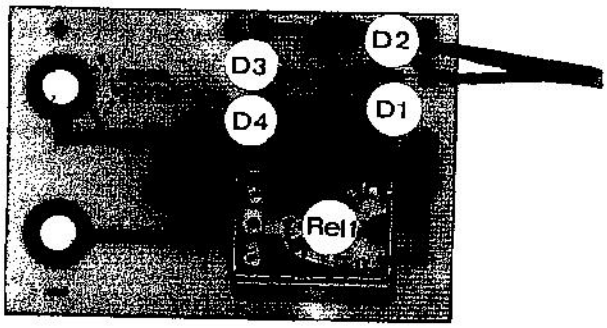


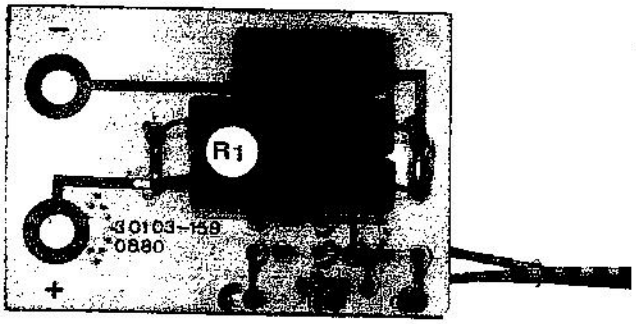
Relay-Board
PCB 30103-159

This PCB is installed on the electrolytic capacitor C1. The resistor R1 on this PCB discharges C1 through contact r1 of relay Rel1 to prevent high peak power during the beginning of cuting when switching over from monopolar coagulation was used before.

Contact r1 is open during either monopolar cutting or coagulation mode so that R1 on PCB 30103-159 is not overloaded.

The relay Rel1 is activated during cutting through diode D3, during monopolar coagulation through diode D2, and during bipolar coagulation through diode D1.





RF + Monitor PC-Board
PCB EE 156.5

PCB EE 156.5 is bearing the following circuit details:

RF-Oscillator
RF-Modulator
RF-Preamplifier
NE-Monitor
AB-Monitor

The RF-Oscillator consists of the transistors T1 and T2 in push-pull arrangement. The oscillator frequency results from the capacitance of C6 and the inductance of the winding 1–4 of the transformer U1. The oscillator is supplied with +24 V through contact 3 of plug St1 from PCB 151.2. The emitter currents of transistors T1 and T2 are fed to transistor T3 in the RF-modulator stage.

The RF-Modulator consists of the timer IC1 which modulates the emitter current of transistors T1 and T2 of the RF-oscillator through transistor T3. The pulse duration is produced by IC1 and is determinated by R2 and C3. The pause, also produced by IC1, can be set for monopolar coagulation by the potentiometer PB and for blended hemostasis by potentiometer PM. The pause duration is also influenced by capacitor C1.
The RF-modulator is supplied through pin 3 of St1 and zener diode D1.

The RF-Preamplifier consists of the transistors T4 and T5 in push-pull arrangement which are supplied through R17 and D7 from electrolytic capacitor C1 from PCB EE 156.3.

The NE-Monitor or Patient Plate Monitor consists of a selfexcitating oscillator T6 which is inductively coupled to the transformer U3. When the patient plate is not connected to the socket S1 the winding 1–4 of U3 is unloaded and the oscillator can oscillate and voltage is induced into winding 7–8. This voltage is fed to the gate of thyristor Ty1 with the result that pin 6 of socket St6 is ground potential. In this condition the red lamp LaNE (patient plate signal) will illuminate and the acoustic signal Su1 on PCB 151.2 will sound when one tries to activate the monopolar cut or coagulation current. In this condition it must be impossible to activate either monopolar output. If no patient plate or a defective patient plate is connected no monopolar output can be activated.

NOTE! The NE-Monitor does not prevent activation of the bipolar output. The surgeon may use the bipolar output without a patient plate being connected and no alarm signals during bipolar operation will be generated.

When the patient plate is properly connected to socked S 1 the winding 1–4 of transformer U3 is loaded and the induced voltage in winding 7–8 of the transformer drops to zero and the result is that thyristor Ty1 insulates pin 6 of socket St6 from ground. Therefore either monopolar output can be activated without visual or audible alarm.

The oscillator frequency is about 20 kHz. The NE-monitor is supplied with +24V through St6 from the voltage regulator on PCB 151.2.

AB-monitor or fingerswitch monitor is made by a self-excitating oscillator T7 which is inductivily coupled through winding 5–8 of the transformer U4. When no fingerswitch of the handcontrol is pressed down, the windings 1–2 or 3–4 are unloaded and the voltage amplitude at the collector of transistor T7 is maximum. Therefore both voltage comparators of IC2 are low and the transistors T8 and T9 insulates pin 1 (channel A) and pin 3 (channel B) of socket St6 from high potential, and the result is that no monopolar output is activated. When the blue fingerswitch is pressed, the winding 1–2 (optional winding 3–4) of transformer U4 is loaded with 22 ohms (this resistor is installed in the handcontrol), so that the voltage at the collector of T7 drops to a lower amplitude which is defined by the output of the voltage comparator B of IC2.

This high potential is switched through transistor T8 to pin 3 (channel B) of socket St6 with the result that the monopolar generator generates modulated RF-current for monopolar coagulation.

When the yellow fingerswitch of the handcontrol is pressed, the winding 1–2 (optional winding 3–4) of the transformer U4 is shorted through R36 so that the collector voltage of T7 drops to such a low amplitude that the output of the voltage comparator A of IC2 becomes also high, and switches high potential through transistor T9 to pin 1 (channel A) of socket St6 with the result that the monopolar generator generates unmodulated RF-curren for cutting.

NOTE! When channel B (coagulation) is activated, **both** output voltages at pins 1 and 3 of St6 are at high potential!

The oscillator frequency of this monitor is about 20 kHz. The AB-monitor is supplied with +24V through St6 from the voltage regulator on PCB 151.2.

The correct AB-monitor status can be adjusted by trimpot TP3.

NOTE! The AB-monitor must be adjusted by TP3 so that definite activation of channel A (cut) or channel B (coag.) is possible.

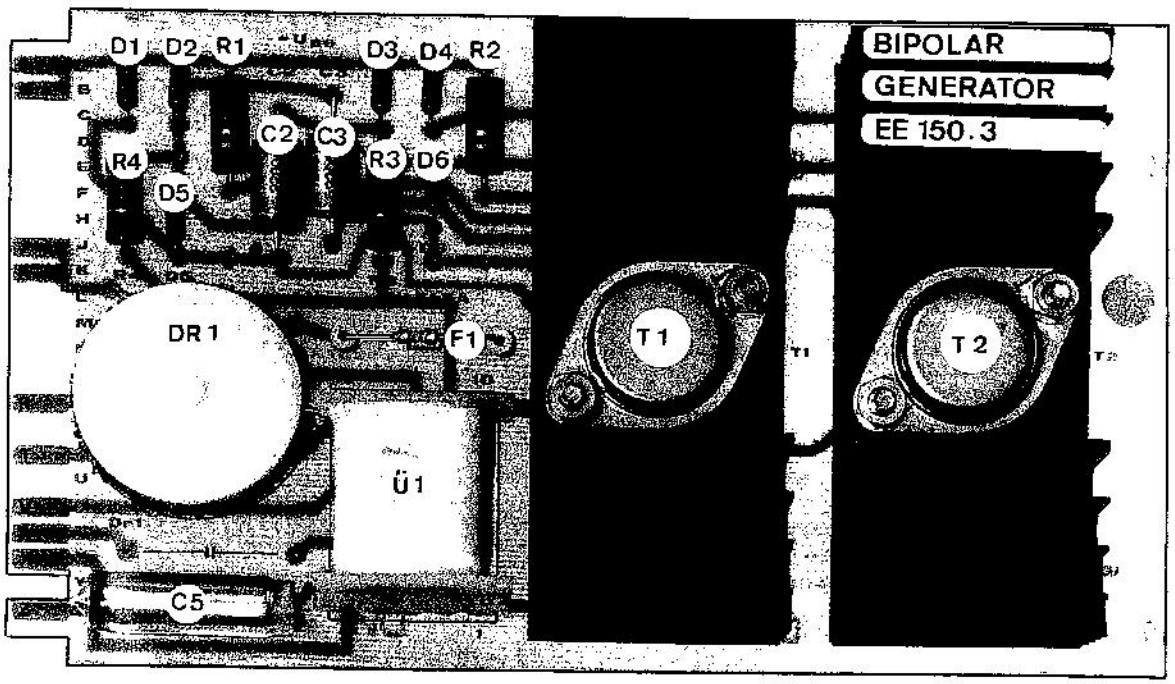
RF-Generator for Bipolar Coagulations PCB EE 150.3

The T 400 ELECTROSURGICAL UNIT is provided with a special RF-generator for bipolar coagulations. It consists of the RF-generator on PCB EE 150.3 and the bipolar monitor for automatic activation of the bipolar RF-generator. The bipolar RF-generator is supplied from the power regulator PCB EE 156.3.

The bipolar monitor PCB 151.4 is supplied with 18 Vac from the transformer Tr1 of the power supply.

The RF-generator for bipolar coagulations, PCB EE 150.3 consists of the power transistors T1 and T2 which are operating push-pull. The frequency of this selfoscillating generator results from the combination of the capacitance of the cpacitors C2 and C3 as well as the inductance of the primary winding of the RF-transformer U1. Because there is an influence from the secondary loading of the RF-transformer U1 to the inductance of the primary winding, the frequency of this generator varies from approximately 1000 kHz in matched loading to 500 kHz in open circuit condition.

The fuse F1 on PCB 150.3 protects the power supply from excessive current when one of the transistors T1 or T2 or one of the diodes D1 or D4 becomes shorted circuit. Capacitor C5 avoids unwanted neuromuscular stimulations.



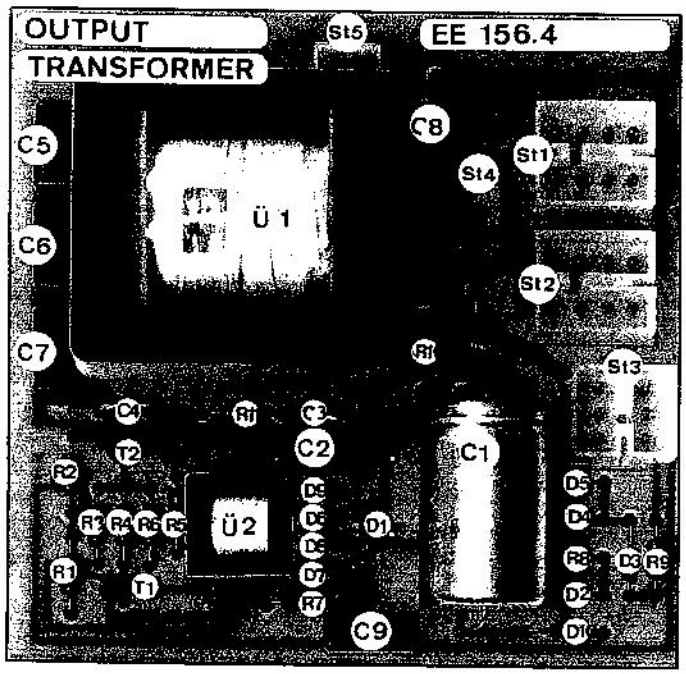
OUTPUT TRANSFORMER AND OPEN CIRCUIT PROTECTION
PCB EE 156.4

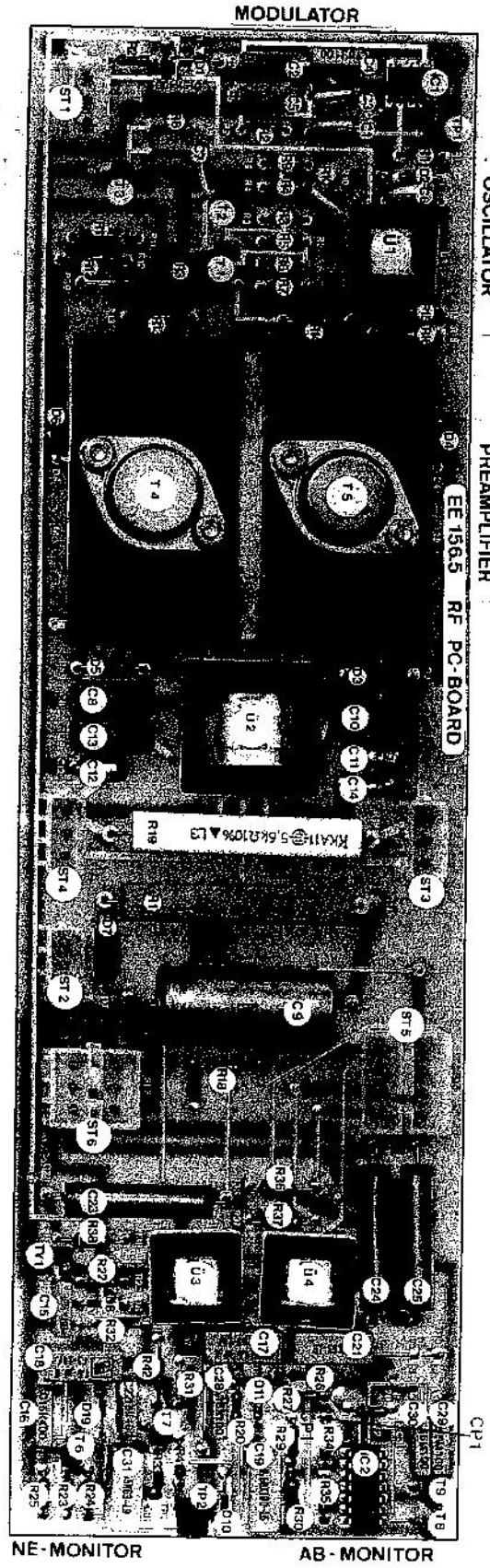
The primary windings of the output transformer U 1 are connected through St4 and St5 to the power amplifier in push-pull arrangement. The secondary windings of U1 are connected through St2 to the output sockets.

NOTE! The capacitor C8 protects the patient against low frequency current which can cause neuro-muscular stimulation. In accordance with the IEC-Standard for high frequency surgical equipment the capacitance of this capacitor should not be less than 2 MOhms.
When changing this capacitor it is very important that it is the same type or a simular type at least.

The output transformer has two different windings which provide two different output impedances. The standard T 400 equipment is adjusted to 200 Ohms output impedance, which is optimal for TUR and surgical procedures where low sparking at the active electrode is desired. For surgical operations where more sparking is desired, the 500 Ohms impedance can be selected by changing the connection on St2.
The circuit diagram shows the 500 Ohms connection which is fed to the three monopolar output sockets S2, S3 and S4 in parallel.
It is also possible to connect S2 to 500 Ohms and S4 and S5 to 200 Ohms, so that the surgeon can use the two different impedances.
The power-amplifier is supplied from the power-regulator through the primary windings of the output-transformer and through the connector St3.
The other electronic components on PCB 156.4 protect the power-amplifier from uncontrolled voltage spikes.

NOTE! It should be noted that the large capacitor C1 on PCB 156.4 is charged to about 300 Volts, and that discharge time is very long. Before servicing this PCB make certain, that C1 is completly discharged.




MODULATOR
OSCILLATOR
PREAMPLIFIER
EE 156.5 RF PC-BOARD
NE-MONITOR
AB-MONITOR
CP1

Logic
PCB EE 151.2

The task of the logic-PCB 151.2 is to coordinate the different functions of the unit:

Cut-Logic
Monopolar Coag.-Logic
Bipolar Coag.-Logic
Priorities
Visual and Audible Signals

Cut-Logic
If activated by footswitch, + 24 V is supplied to contact V on PCB 151.2 and if activated by handcontrol, + 24 V is supplied to the same both contacts V and T. This +24V is fed through diodes D5, D6 to IC2, which turns on transistor T1 and energizes relay Rel A. Transistor T3 does not conduct in this state, because it is shorted by T4 through diode D4. When Rel A is energized, contact rA1 activates the power supply PCB 156.3 and contact rA2 switches on modulation for hemostasis.

Monopolar Coag.-Logic
When channel B is activated by footswitch or handcontrol the +24V is supplied to contact T of PCB 151.2. Therefore transistor T3 is switched on conductive through D6, D7, IC2 and R6. That energizes relay B. It's contact rB1 activates the power supply PCB 156.3 and contact rB2 activates the modulator on PCB 156.5.

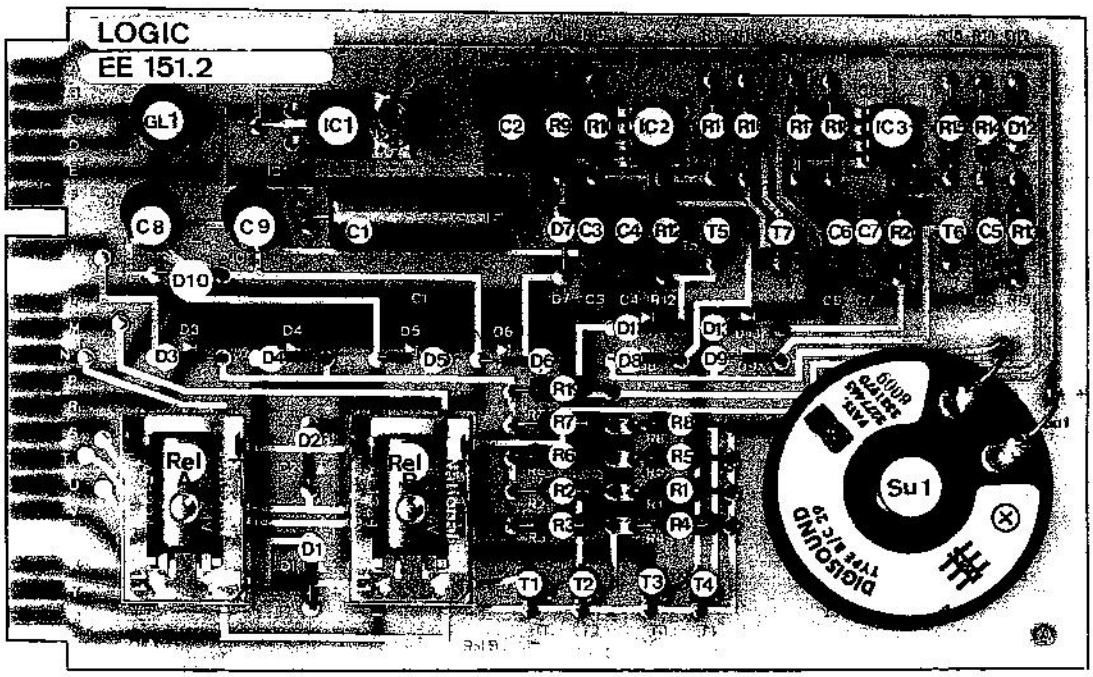
Bipolar Coag.-Logic
When the bipolar generator is activated, it must be shure that the monopolar generator can not be activated simultaneously. If the bipolar generator is activated either by footswitch or by automatically the +24V is fed to contact J on PCB 151.2 and 151.4 with the result that realy Rel1 on PCB 151.4 activates the power supply over it's contact r1. To ensure, that bipolar coagulation current has priority relay A and relay B are blocked through R3, T2 and D3, R7, T4 on PCB 151.2.

Priorities
To prevent multi-activation of the different functions the logic on PCB 151.2 has to coordinate priorities.
First priority is patient plate alarm.
Second priority is bipolar coagulation.
Third priority is cut.
Fourth priority is monopolar coag.

Visual and Audible Signals
Patient plate fault conditions are indicated at the same time by acoustic and optically signals.
The audible signal is generated by IC2, which delivers an output signal from output 3 over R11 to T5 which activates Su1 giving an interrupted audible signal. IC2 is activated by Ty1 on PCB 156.5 through D3 on PCB 156.3. The voltage at contact P on PCB 151.2 is at ground so that IC2 is started and activation of the monopolar generator is prevented, because the bases of T1 and T3 are also at ground. Because lamp LaNE is also connected to Ty1 on PCB 156.5 it illuminates in a patient plate fault condition.

ATTENTION!
When there is a fault associated with the patient plate, audible and visual alarm signals are only given when an attempt is made to operate the monopolar generator.

The lamps LaA and LaB are in parallel with relays Rel A and Rel B and illuminate when the corresponding relay is activated. The lamp LaC, which indicates bipolar current, is directly activated from the footswitch socket through contact J on PCB 151.2.
The audible signal for cut is activated through T6 which is activated through D4, R19 and R14. This audible signal is a continuous tone.
The audible signal for monopolar coagulation is a modulated tone. It is activated through D10, T7, IC3, R15, D12 and T6 which is modulated by IC3.
The audible signal for bipolar coagulation is identical the audible cut signal. It is activated through D13, R20 and T6.



Power-Amplifier PCB EE 156.6

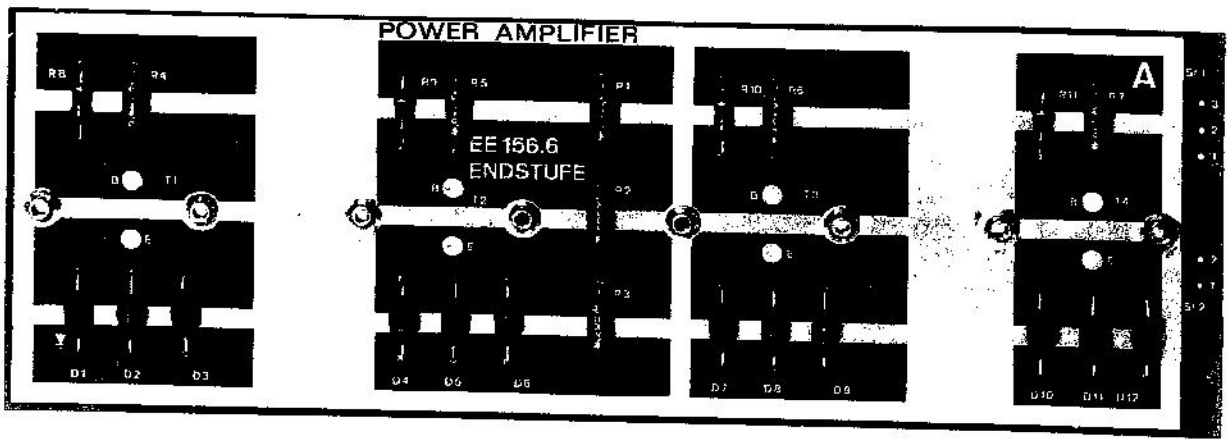
The power-amplifier consists of two times 4 transisors T1 to T4 in push-pull condition located on the heat sink which is mounted at the rear of the unit.

The collectors of these 8 transistors, which are electrically simular with the transistor case, are directly mounted on the heat sink without electric insulation but in good thermal contact to the heat sink and the chassis of the equipment. Electrical connection to the base and emitter pins is made by small sockets on the printed circuit boards behind the heat sink.

NOTE! The transistors T1 to T4 are installed on the heat sink by 4 mm srews and electrical connection to the base and emitter pins is made by small sockets behind the heat sink without soldering. Before installing transistors make shure, that the base and emitter pins are in correct position so that they fit into the small sockets.

The preamplified RF-power from the RF-oscillator is fed through connectors St3 and St4 on PCB 156.5 to the bases of the transistors T1 to T4, which are in parallel service. The emitters of the transistors T1 to T4 are connected to the output-transformer through the sockets St4 and St5 on PCB 156.4.

To protect the transistors T1 to T4 against uncontrolled voltage impulses they are provided with a voltage clipper circuit on PCB 156.4.



CALIBRATIONS AND ADJUSTMENTS

This section provides the procedure for calibrations and adjustments to bring the model T 400 electrosurgical unit within the specifications. Physical location of the adjustments is shown in the photographs in section 11 CIRCUIT DESCRIPTIONS and the recommended test equipments are listed below.

Recommended Test Equipments

1 digital voltmeter, with more than 1 MOhms input impedance
1 rf-power-meter, model 1200, Dempsey, or ERBE electrosurgical power meter

The following adjustments can be done

AB Monitor function
Bipolar output power
Bipolar automatic delay time
Monopolar cut output power
Monopolar coag. output power

AB-Monitor Adjustment (PCB 156.5)

- Connect a handcontrol with two pushbuttons to socket 4a or 4b (S4 or S3 in the circuit diagram).
- Disconnect patient plate during AB-monitor adjustment to avoid RF-power interference which can disturb the digital voltmeter. Take no notice of the patient plate audible alarm during depressing the pushbuttons of the handcontrol.
- Connect a digital voltmeter to check point CP1 on PCB 156.5 and ground. Set the digital voltmeter to dc voltage.
- Depress the blue pushbutton (coag.) on the handcontrol and adjust 6±0,2 Vdc with trimpot TP3 on PCB 156.3.
- Connect the paient plate to socket 2 (S1 in the circuit diagram).
- Check if cut is activated when the yellow pushbutton on the handcontrol is depressed.
- If cut and coag. are activated confusedly and relay RelA and relay RelB rattle, adjust TP3, so that activation of cut and coag. is definite.

Bipolar Output Power (PCB 151.4)

- Connect bipolar forceps to socket 7a or 7b (S6 or S7 in the circuit diagram).
- Connect the RF-power meter to the two tips of the forceps.
- Depress the blue pushbutton 6 on the T 400 front panel.
- Set the RF-power meter to 125 Ohms load resistance (heavy load) and low power range (high sense).
- Set the bipolar intensity control to step 10.
- Adjust the bipolar RF-output power to 50±2 Watts by trimming potentiometer TP1 ($C_{max.}$) on PCB 151.4.
- Set the bipolar intensity control to step 1.
- Adjust the bipolar RF-output power to 2,5±1 watts by trimming potentiometer TP2 ($C_{min.}$) on PCB 151.4.
- Check if the bipolar RF output power increases with bipolar intensity control setting.

Bipolar Automatic Delay Time (PCB 151.4)

- Depress the blue pushbutton 6 (Sch2 at the circuit diagram) on the T 400 front panel.
- Connect a bipolar forceps to socket 7a or 7b (S6 or S7 at the circuit diagram).
- Make a short circuit between the two tips of the bipolar forceps (if no bipolar forceps is available make a short circuit between the two poles of socket 7b).
- Adjust the desired delay time by TP3 on PCB 151.4 in the range from 1 to 5 sec. The standard delay time is 2 sec. If no delay time is desired, remove the capacitor C4 on PCB 151.4.

Monopolar Cut Output Power (PCB 156.3)

- Connect the patient plate to socket 2 (S1 at the circuit diagram) on the T 400 front panel to the patient plate input socket of the RF-power meter.
- Connect a handcontrol with two pushbuttons to socket 4a or 4b (S4 or S3 at the circuit diagram) and connect the active input socket of the RF-power meter with the active electrode which is in the handcontrol.
- Set the RF-power meter to 125 ohms load resistance („heavy load") and high power range („normal sense"). When the ERBE RF-power meter is used set it to 600 watts power range.
- Set hemostasis control 13 on the T 400 front panel to zero.
- Set cut intensity control 12 on the T 400 front panel to 10.
- Depress the yellow pushbutton on the handcontrol or the yellow pedal of the footswitch to activate cut power (channel A).
- Adjust the maximum cut power by trimming potentiometer TP4 ($A_{max.}$) on PCB 156.3, which shall be 400 ±20 watts, which is done correctly when the Dempsey analyzer showes 360 watts.

ATTENTION!
The RF-output power is a function of the T 400 output impedance and the load resistance. The maximum output power is available only when the load resistance is equal to the output impedance of the electrosurgical unit. If the load resistance is not equal to the output impedance of the electrosurgical unit, the output power is lower. See output power versus load resistance graphs section 9.

Example: The measuring is made with the Dempsey model 1200 surgical analyzer, „heavy load" (125 ohms), „normal sense". If this power meter shows 360 watts than the real maximum output power of the T 400 is 400 watts at 200 ohms matched load resistance.

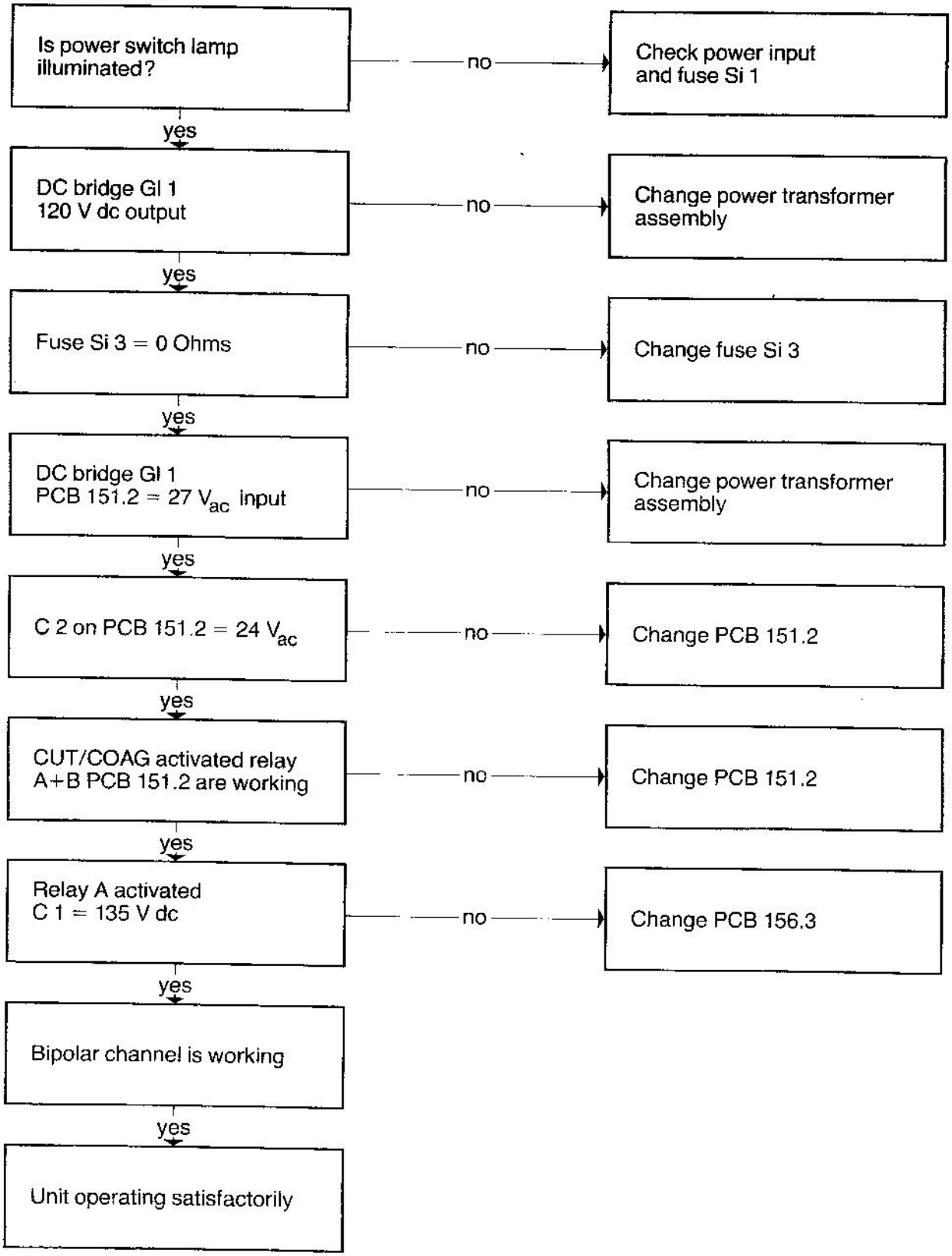
- Set cut intensity control to step 1.
- Set RF-power meter to high sense (ERBE power meter 60 watts).
- Adjust the minimum cut output power to 2,5 +3/−1 watts by trimming potentiometer TP3 ($A_{min.}$) on PCB 156.3.
- Check if cut output power increases with cut intensity setting.

Monopolar Coag. Output Power (PCB 156.3 and 156.5)

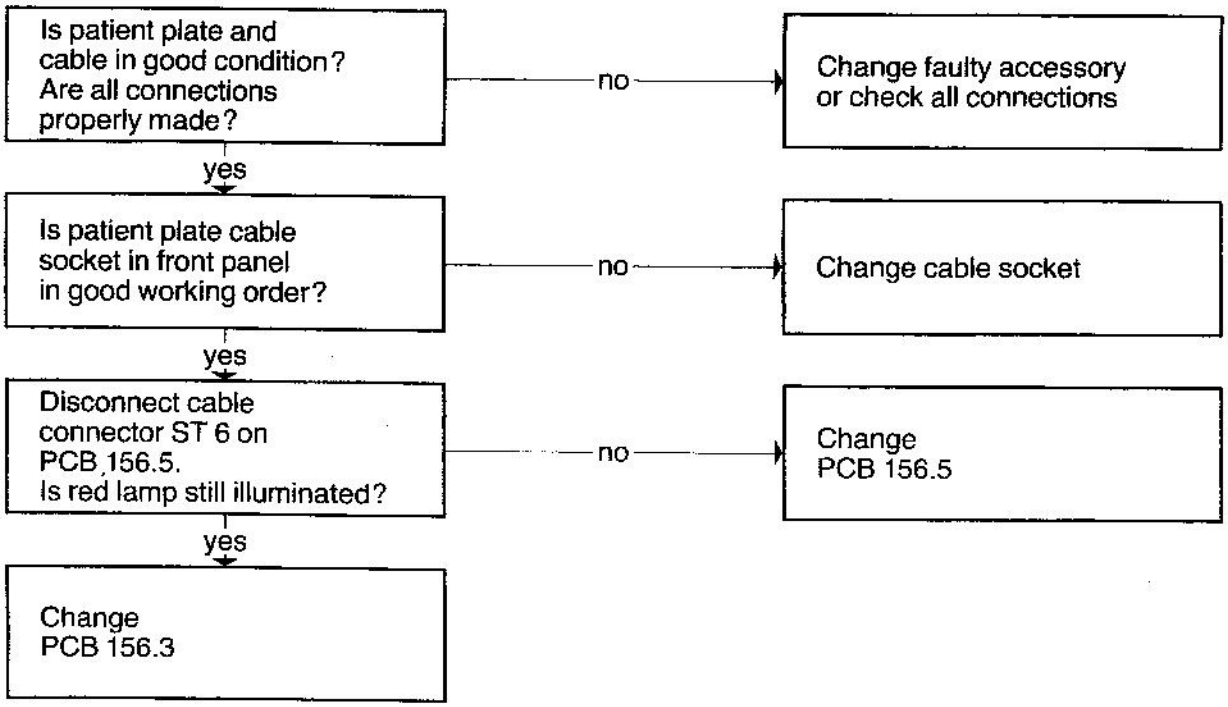
- Connect patient plate to socket 2 (S1 at the circuit diagram) and the patient plate input socket of the RF-power meter.
- Connect a handcontrol with two pushbuttons to socket 4a or 4b (S3 or S4 at the circuit diagram) and to the active input socket of the RF-power meter with the active electrode, which is in the handcontrol.
- Set the RF-power meter to „heavy load" and „normal sense". The ERBE RF-power meter has to be set to „600 watts".
- Set coag. intensity control on the T 400 front panel to step 10.
- Set the trimming potentiometer TP1 on PCB 156.5 clockwise until stop.
- Connect a voltmeter to the electrolytic capacitor C1 which is located behind the PCB 156.4 and set it to dc voltage.
- Depress the blue pusbutton on the handcontrol or the blue pedal on the footswitch to activate the monopolar coag. power (channel B).
- Adjust the voltage at C1 by trimming potentiometer TP2 ($B_{max.}$) on PCB 156.3 to 105 V.
- Adjust the maximum coag. output power to 300 ± 20 watts by trimming potentiometer TP1 on PCB 156.3.
- Set coag. intensity control to step 1.
- Adjust the trimming potentiometer TP1 on top of the potentiometer PB (coag. intensity control) which is located behind the T 400 front panel, so that the monopolar coag. power is less than 25 watts.
- Check if the monopolar coag. power increases with monopolar coag. intensity setting.
- If there is a rattle sound at any monopolar coag. intensity setting in the toroidal transformer Tr2, the voltage at C1 must be adjusted less than 105 V by TP2 on PCB 156.3, and than the maximum monopolar coag. power must be calibrated by TP1 on PCB 156.3 to 300 ± 20 watts.

Troubleshooting

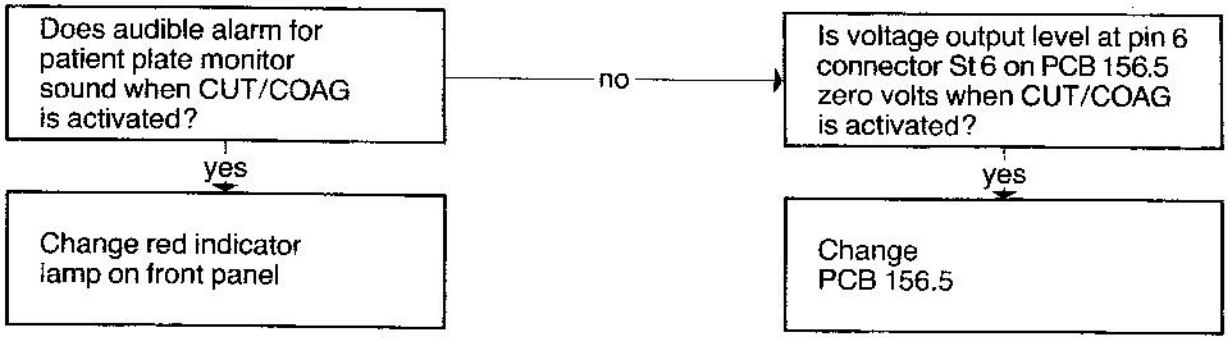
General Failure



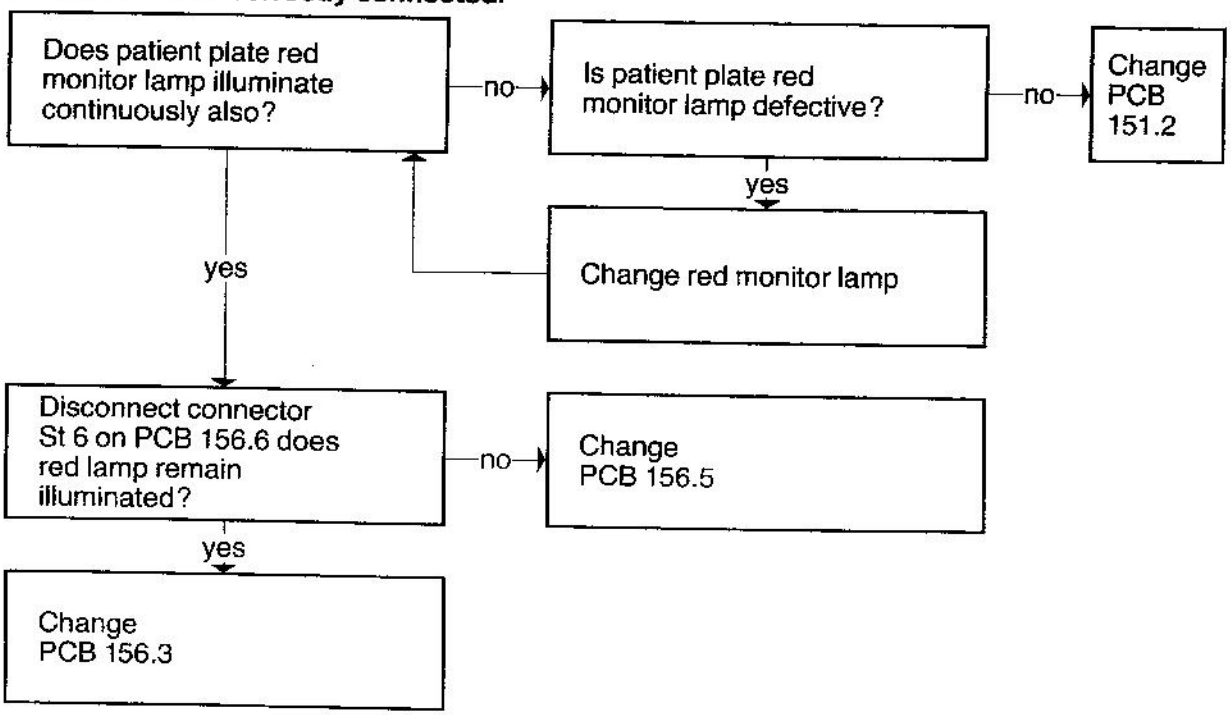
Failure - patient plate monitoring lamp illuminates constantly even when patient plate is correctly connected.



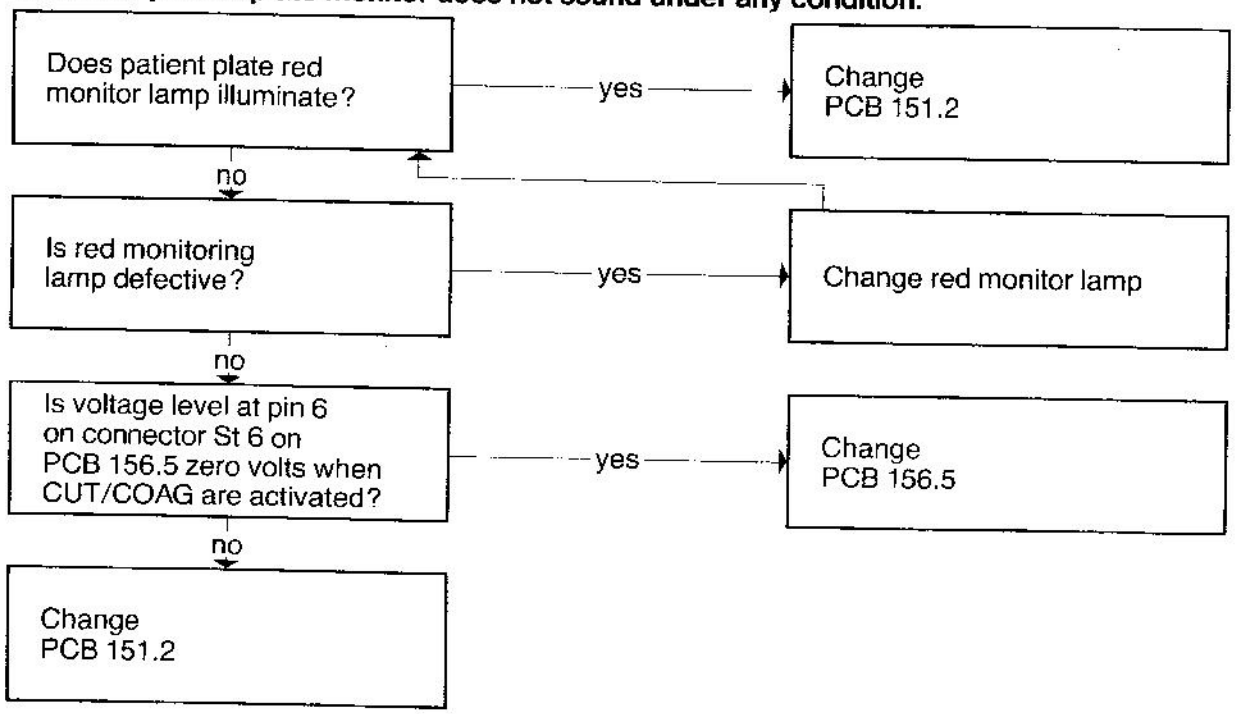
Failure - patient plate monitoring lamp doos not illuminate when patient plate cable is not connected.

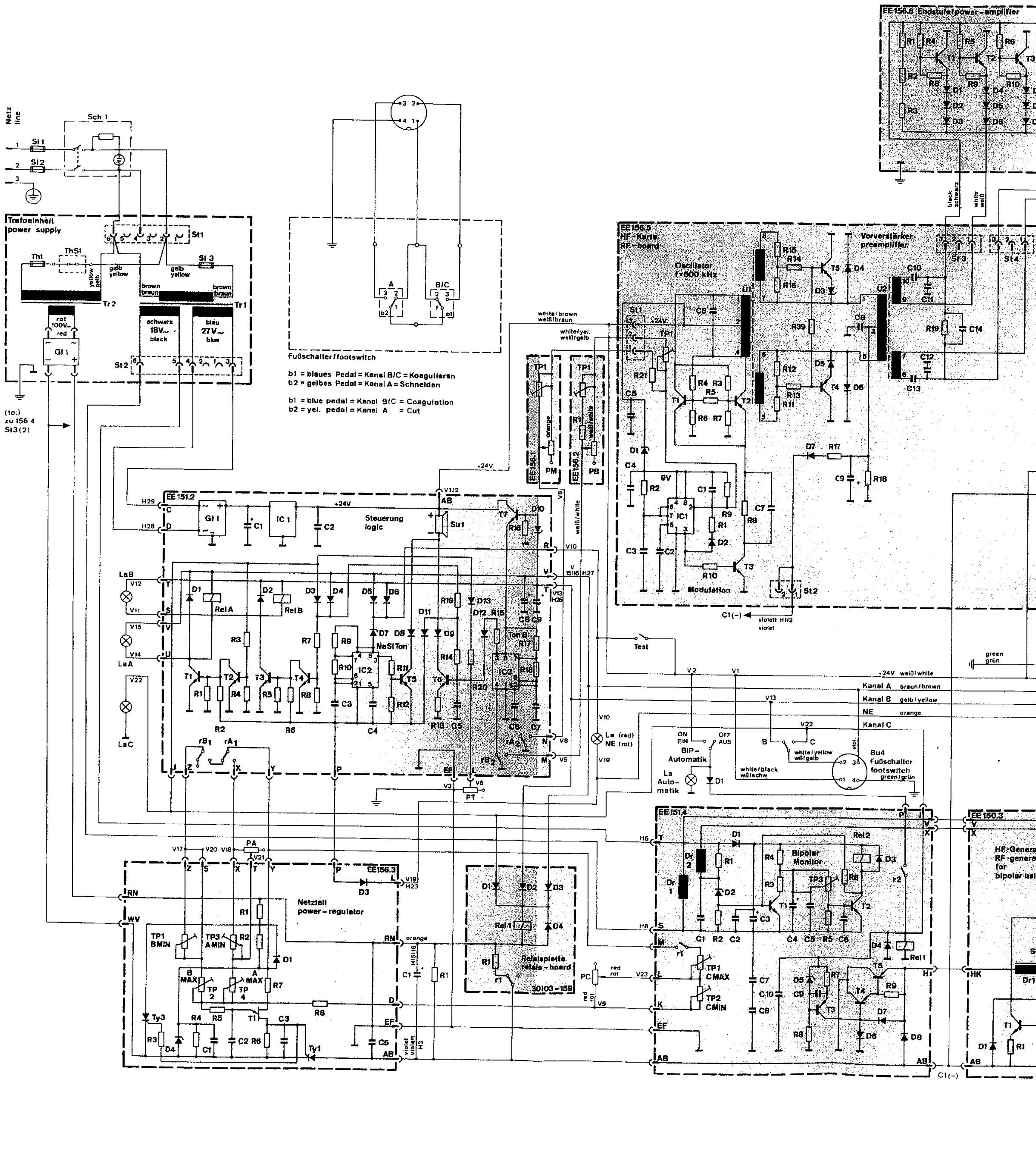


Failure – alarm for patient plate monitor sounds continuously when patient plate accessories are correctly connected.

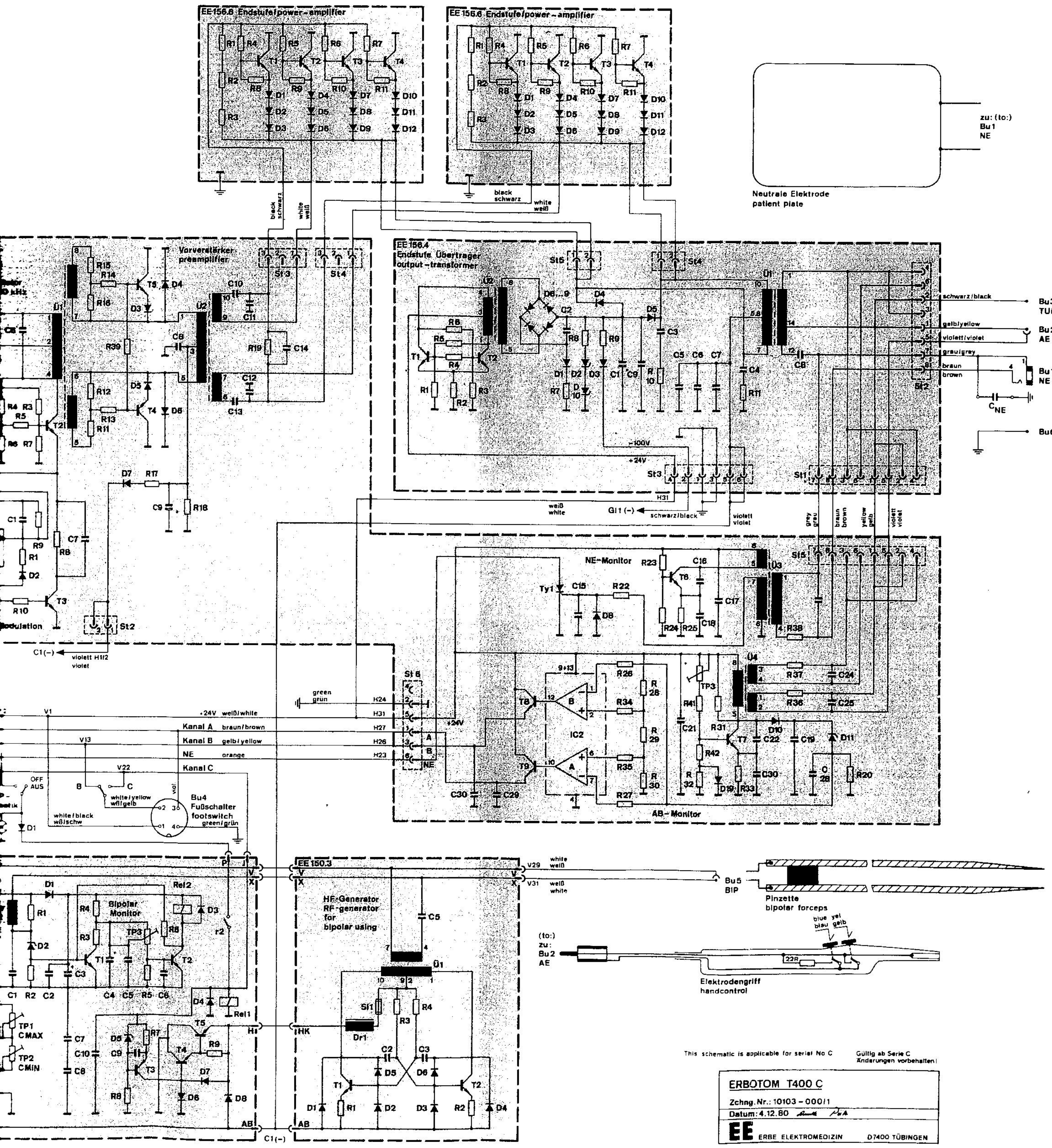


Alarm for patient plate monitor does not sound under any condition.





Netz line
Trafoeinheit power supply
Fußschalter/footswitch
b1 = blaues Pedal = Kanal B/C = Koagulieren
b2 = gelbes Pedal = Kanal A = Schneiden
b1 = blue pedal = Kanal B/C = Coagulation
b2 = yel. pedal = Kanal A = Cut
EE 151.2 Steuerung logic
EE 156.6 Endstufe/power-amplifier
EE 156.5 HF-Karte RF-board
Oscillator f≈500 kHz
Vorverstärker preamplifier
Modulation
Netzteil power-regulator
Relaisplatte relais-board
EE 151.4 Bipolar Monitor
BIP-Automatik
Bu4 Fußschalter footswitch
EE 150.3 HF-Generator RF-generator for bipolar use



This schematic is applicable for serial No C

Gültig ab Serie C
Änderungen vorbehalten!

ERBOTOM T400 C

Zchng.Nr.: 10103 - 000/1

Datum: 4.12.80

EE ERBE ELEKTROMEDIZIN D7400 TÜBINGEN