ESCHMANN

TD830

ELECTROSURGICAL UNIT

Service Manual

698260

E-SM44h

Service Manual

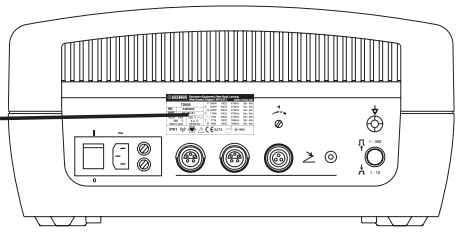
Read these Instructions before use

Keep this 'Service Manual' in a safe convenient place for future reference. Read in conjunction with the relevant Publications detailed in the preliminary information section.

Eschmann After Sales Service Department

The Eschmann After Sales Service Department is staffed and equipped to provide advice and assistance during normal office hours. To avoid delays when making enquiries, please quote the Model and Serial Number of your Electrosurgical Unit which is shown on the Serial Number plate, the location of which is shown below. Please ensure you include all alpha and numeric digits of the Serial Number.

The Serial Number plate is located here, (view from rear of unit).



For further information visit www.eschmann.co.uk

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UK Customers

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Overseas Customers

Contact your local distributor. In case of doubt contact Eschmann Equipment.

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CE 0473 The CE marking affixed to the product certifies that it complies with the European Medical Devices Directive 93/42/EEC and related legislation.

CE 0473

E-SM44h July 2008

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1.0 PRELIMINARY INFORMATION

1.1 This Service Manual should be referred to for details of the TD830 Electrosurgical Unit, REF 83-256-01, 83-257-02, 83-258-03, 83-259-04, 83-260-05, 83-261-06, 83-262-07, 83-263-08, and 83-264-09 (serial number A9B0000 or above).

1.2 Within the text of this manual the term 'coag' is used as a common abbreviation of the term 'coagulation'.

1.3 The TD830 Electrosurgical Unit requires a mains electrical supply corresponding to the voltage shown on the electrical rating plate at the rear of the unit. Only use the mains supply cable supplied. If the plug supplied pre-fitted is not suitable it should be replaced with a suitable plug with protective earthing contact.

1.4 If the plug is a fused type, a 10A fuse must be fitted.

CAUTION

It is most important that fuses of the correct type, size and rating are installed (see Technical Data).

CAUTION

Read this 'Service Manual' carefully and note ALL of the warnings, cautions and safety notes contained within. Keep this 'Service Manual' close-to-hand at all times for reference.

1.5 Ensure that the unit 'mains' switch (42 of Fig. 12) is in the '**O**' position and that the output controls are set to minimum before connecting to, and switching 'on', the mains supply. A complete systems check **must** be carried out before using the Electrosurgery Unit (see the 'Instructions for use').

1.6 Instructions for Use and Service Manuals should be readily accessible for reference prior to and when operating, cleaning and servicing the TD830 Electrosurgical Unit. All manuals are available from Eschmann Equipment, see inside front cover for address details.

Related Technical Publications:-

Instructions for Use - TD830:
Publication number E-IM54, Part No. 698257

Eschmann accessory 'Instructions for use':
Publication number E-IM50, Part No.604802

2. 0 TECHNICAL DATA

GENERAL

The TD830 Electrosurgical Unit (or Surgical Diathermy Unit) is classified as 'HF surgical equipment' [1]

[1] - 'HF surgical equipment' is defined as, "Medical electrical equipment including its associated accessories intended for the performance of surgical operations, such as the 'cutting' [2] or 'coagulation' [3] of biological tissue by means of high frequency (h.f.) currents".

[2] - 'Cutting' is defined as, "Resection or dissection of body tissue caused by the passage of high frequency current of high current density at the active electrode(s)".

[3] - 'Coagulation' is defined as, "Sealing of small blood vessels or of body tissue caused by the passage of high frequency current at the active electrode(s)".

Equipment - High power electrosurgical unit with monopolar and bipolar outputs

Type - Portable

DIMENSIONS

Width . . . . . 39.0 cm

Height . . . . . 19.0 cm

Length . . . . . 42.5 cm

Weight . . . . . 15 kg

ELECTRICAL DATA

(Note: Voltage factory set by transformer tapping, according to model supplied.)

Power Supply . . . . . 230V a.c., 50-60Hz
or, 240V a.c., 50-60Hz
or, 220V a.c., 50-60Hz
or, 110V a.c., 50-60Hz

Current (max.) . . . . . 4.4A (230V) or, 4.2A (240V)
or, 4.6A (220V) or, 8.4A (110V)

Fuse rating (240V, 230V, 220V) 250V, T5A

Fuse rating (110V) . . . . . 125V(min.),T10A

Fuse type . . . . . 20 mm

Bipolar

Carrier frequency - 785kHz nominal, square wave.

Power control - Variable pulse group modu-lation set by front panel control. Amplitude set by micro/macro range buttons.

Load resistance for maximum output power
- 100 ohms (non-inductive) for Macro
- 50 ohms (non-inductive) for Micro

Test load - 100 ohms (non-inductive)

Output (bipolar)

Symbol/Function	Power	Crest factor	Peak Open Circuit Voltage
Coagulation			
Micro range	17W ±20%	Variable	150
Macro range	50W +10% -20%	Variable	230

Power and voltage output data diagrams are shown at the end of section 5.

Monopolar

Carrier frequency - 475kHz nominal, square wave.

Power control - Variable amplitude set by frontp a n e l controls. Preset pulse patterns set by mode switches.

Load resistance for maximum output power is 150 ohms (non-inductive) for cut and pinpoint coag and 200 ohms (non-inductive) for blend, specialist cut and spray coag.

Test load is 200 ohms (non-inductive) for cut and specialist cut and 400 ohms (non-inductive) for blend, spray coag and pinpoint coag.

Output (monopolar)

Output powers are measured to an accuracy of ±20%, with a maximum power of 400 watts.

Symbol/Function	Power	Crest factor	Peak Open Circuit Voltage
Normal cut	345W(-20%)	1.9	1150
Blend	300W(±20%)	3.0	2200
Specialist cut	345W(-20%)	2.1	1500
Pinpoint coag.	170W(±20%)	5.1	2150
Spray coag.	79W(±20%)	8.7	4000

Power and voltage output data diagrams are shown at the end of section 5.

AUDIBLE INDICATORS

*Running tones **

Monopolar

Cut, blend or specialist cut	950Hz
Coagulation, pinpoint or spray	800Hz

Bipolar

Micro or macro	730Hz

(* Approximate values, adjustable volume)

Touch button

A 'bleep' indicates when any function button is pressed, the volume is adjustable with running tones above.

Alarm

All modes - alternating two tone preset to maximum volume (with flashing display).

VISUAL INDICATORS

Green lamp in mains 'on/off' switch to indicate power 'on' from the rear of the electrosurgical unit.

Digital displays and 'function selected' LEDs indicate power 'on' from the front of the electrosurgical unit

Three digital displays indicate *typical power** in cut, coag and bipolar modes. (**Note:** These can be set to display the *typical power** available in watts, or a numerical value up to 10).

(* *typical power* is an indication of the average power delivered over a range of load resistances. It is less than the power delivered to the rated load for maximum power.)

Power output 'activated' LED indicators for:

Cutting modes	Yellow lamp
Coag modes	Blue lamp
Bipolar mode	Blue lamp

Green and bright green function selected LED indicators above (or below) the relevant touch buttons detailed as follows:

Monopolar:

Cut, blend, specialist cut (green)

Pinpoint coag (green)

Spray coag (bright green)

Bipolar:

Micro and macro power range (green)

SAFETY

General

Designed to comply with EN60601-1:1990 Medical electrical equipment - general requirements for safety and IEC60601-2-2: 1998 High-frequency surgical equipment - particular requirements for safety (3rd edition).

General classification, Class 1, Type CF (Defibrillator proof).

Drip-proof (IPX 1)

Patient leakage (risk) current: always less than 100 microamps to earth (ground) from all patient circuits at 230V 50Hz as required by EN60601-1:1990 for the unit in normal condition (typically less than 10 microamps).

Battery

This equipment contains a nickel metal hydride battery. In the event of failure of the display p.c.b. battery, or if the electrosurgical unit is to be disposed of, it is not necessary to remove the battery or to return it to Eschmann Equipment. The battery charge life is six months from a full charge of 48 hours. The battery charges automatically when the unit is 'on'.

Electrode isolation

The plate electrode circuit of this equipment is isolated from earth at both high and low frequency. The bipolar output is also fully isolated at both high and low frequency.

Class

Class 1 denotes that the equipment must be earthed via the protective conductor in the 3-core mains cable connected to a 3-pin plug.

Safety category


This symbol denotes that the equipment is of type CF, i.e. that it complies with type CF leakage current requirements. The symbol also denotes that the equipment will not be damaged by defibrillator discharge and that the plate electrode need not be removed from the patient if a defibrillator is used.

Non-ionizing radiation


This symbol warns the user of the possibility of non-ionizing radiation being emitted by this equipment.

Flammable gases

The TD830 equipment is not suitable for use in the presence of a flammable anaesthetic mixture with air or with Oxygen or Nitrous Oxide.

Protection

IPX 1 This symbol (drip proof) denotes that the equipment meets the requirements of IEC529 for dripping water.

DUTY CYCLE

The duty cycle rating of 10 seconds 'on', 30 seconds 'off', specified on the serial plate as 10s:40s, indicates that the equipment can be used at full output power in any mode for 10 seconds with a 30 seconds rest period. The unit can remain connected to the mains electrical supply with the mains switch in the 'on' position continuously. The 'on' period at lower power levels can be extended.

OTHER SYMBOLS

Note: For numbers in brackets refer to Fig. 1.

 This symbol above item (33) indicates the running tone volume control which has a minimum sound level of 45dBA.

 This symbol above items (1, 14, 21 and 33) indicates increasing power output (1, 14 and 21) and increasing volume (33) for running tone and 'bleep' volume.

 This symbol on the rear panel serial plate (39) and above the mains inlet (40) indicates that the equipment is for use on alternating current only.

 This symbol on the rear panel serial plate indicates that the mains input fuses, rating and type, are as shown below the symbol.

The symbol  on the front panel denotes that the plate electrode is isolated from earth at high frequency. (Note: The plate electrode is also known as the dispersive, neutral, return, indifferent or patient plate electrode and is often simply called the 'pad').

The symbol  on the front panel adjacent to the active outputs (24 to 28) denotes dangerous voltages.

The symbol  on the rear panel serial plate warns the user to read the accompanying documents, the 'Instructions for use'.

The symbol  above sockets (25, 26, 27 and 28) denotes connection socket for a two button electrode handle (fingerswitch type).

The symbol  adjacent to sockets (24, 26 and 31) denotes connection socket for a non-switched active handle actuated by a footswitch.

This symbol  on the monopolar standby selection button (32) (monopolar 'on/off' toggle button) indicates standby mode for part of the equipment only.

The symbols  and  adjacent to the mains 'on/off' switch (42) indicate the ON and OFF positions respectively.

The symbol  adjacent to item (34) indicates the 'equipotentiality' connection point. (Means for connection of a potential equalization conductor).

The symbol  adjacent to button (35) signifies the button in the non-pressed (i.e. normal) state. (Digital display on the front of the electrosurgical unit is a typical power figure, e.g. 0-200watts for monopolar blend).

The symbol  adjacent to button (35) signifies the button in the pressed (i.e. activated) state. (Digital display on the front of the electrosurgical unit shows a numerical value up to 10).

The symbol  adjacent to sockets (36, 37 and 38) indicates the connection point for footswitches.

The symbol **SN** indicates serial number.

The symbol **REF** indicates catalogue number.

The symbol  indicates date of manufacture.

BUTTON SYMBOLS

 Press to select bipolar - micro range

 Press to select bipolar - macro range

 Press to select monopolar - cut

 Press to select monopolar - blend

 Press to select monopolar - specialist cut

 Press to select monopolar - pinpoint coag.

 Press to select monopolar - spray coag.

ALARM SYMBOLS

PCM - Indicates the 'Plate continuity monitor' alarm has been activated.

PAM - Indicates the 'Plate attachment monitor' alarm has been activated.

PEM - Indicates the 'Patient earth monitor' alarm has been activated.

PVM - Indicates the 'Plate voltage monitor' alarm has been activated.

EPM - Indicates the 'Excess power monitor' alarm has been activated.

 - Indicates the 'Multiple activation' alarm has been activated.

! - Indicates an internal fault has been detected (see section 5, Alarm conditions, in the 'Instructions for Use', for details).

ENVIRONMENTAL CONDITIONS FOR TRANSPORT AND STORAGE

Ambient temperature range:
-30°C to +50°C

Relative humidity range:
30-90% RH non-condensing

Atmospheric pressure range:
1060hPa down to 690hPa

3.0 SAFETY NOTES & ALARMS

Attention to the following points is necessary in order to reduce the risk of accidental burns during the use of this electrosurgical unit. Other safety notes and warnings are also given within the text of this manual and these should be noted before using this electrosurgical unit.

DO:

- Use only Eschmann accessories, in particular active and plate electrodes and cables which should preferably be no more than 3 metres in length. All Eschmann accessories are rated above the corresponding maximum peak output voltage of this electrosurgical unit (see graphs in section 5). For reference Eschmann accessories can be used safely at the following h.f. peak voltages:
  Bipolar active - 400 V peak
  Monopolar active - 4000 V peak
  Monopolar plate electrode - 2250 V peak
- Use bipolar techniques in preference to monopolar, whenever possible. For surgical procedures on parts of the body having a relatively small cross-sectional area, the use of bipolar techniques may be desirable to avoid unwanted coagulation.
- Seek approved qualified advice (e.g. cardiology department) before using this electrosurgical unit on patients with implanted pacemakers or other active implants to avoid interference or damage to the implant. Monitor such patients carefully.
- Set power output controls to the minimum setting before use and select the minimum power setting to achieve the desired effect.
- Check all cables and accessories routinely before use. In particular, electrode cables and endoscopically used accessories for possible damage to the insulation.
- Ensure the entire area of the plate electrode is reliably attached to the patient's body and as close to the operating field as possible.
- Store temporarily unused active electrodes such that they are isolated from the patient [e.g. use a quiver (REF 83-186-38) to hold active accessories when not in use].

DO NOT:

- Do not use uninsulated forceps, monopolar or bipolar.
- Do not place monitoring electrodes close to the operating site. When high frequency surgical equipment (i.e. electrosurgical equip-ment) and physiological monitoring equip-ment are used simultaneously on the same patient, any monitoring electrodes should be placed as far as possible from the surgical electrodes. Needle monitoring electrodes are not recommended. In all cases, monitoring systems incorporating high frequency current limiting devices are recommended.
- Do not allow active cables to drape across or contact the patient's body or contact the cables or leads of other equipment.
- Do not use flammable anaesthetics, flammable solvents or oxidizing gases such as nitrous oxide (N_2O) or oxygen if the surgical procedure is carried out in the region of the thorax or head, unless these agents are sucked away.
- Do not allow the patient's body to touch conductive objects. The patient should not come into contact with metal parts which are earthed or which have an appreciable capacitance to earth, e.g. operation table, supports, etc. The use of antistatic sheeting is recommended for this purpose.
- Do not use hook type active cables (with or without adapters designed for use with hook type cables) use 4 mm or 8 mm plug type active cables.
- Do not reuse disposable plate electrodes.
- Do not rely solely on surgical gloves to provide insulation.
- Do not allow 'skin-to-skin' contact (e.g. between the arms and body of the patient), this can be avoided, for example by the insertion of adequate dry gauze.

Attention to the following points will prolong the life and efficiency of your electrosurgical unit and will help to avoid the risk of accidents, or damage:

DO:

- Switch off and disconnect from the mains electrical supply prior to cleaning the equipment and when it is not in use.
- Grasp the connector(s) not the cable when connecting and disconnecting cables and leads from the equipment.
- Contact the hospital electronics engineer or Eschmann After Sales Service Department if the equipment fails to function after checking.
- Ensure the equipment is serviced regularly (at least every six months). Contact Eschmann After Sales Service Department for details.

DO NOT:

- Use a faulty unit as failure could result in an unintended increase of output power.
- Service this equipment unless you are suitably qualified to do so.

Alarm Circuits

3.1 The unit has several alarm circuits as detailed in the following sections.

Plate Continuity Monitor (PCM).

3.2 Ensures that the unit cannot be used in the monopolar mode with an electrically defective plate electrode or cable. It does not monitor the contact between the plate electrode and the patient's body. It is reset automatically when a satisfactory plate electrode and cable are connected to the unit.

Plate Attachment Monitor (PAM).

3.3 Ensures that the unit cannot be used in the monopolar mode if a divided plate electrode is attached to the patient's body incorrectly. Applies only when a divided plate electrode is used and will not operate if monopolar is switched 'off' by the monopolar standby selection button.

Excess Power Monitor (EPM).

3.4 The unit monitors its output power in monopolar and bipolar modes, compares this with the maximum allowed power under single fault conditions and alarms, disabling output, if the delivered power exceeds the allowed value by more than a certain margin.

Patient Earth Monitor (PEM).

3.5 The PEM circuit detects a low impedance path between the patient and earth. It also reduces the chances of secondary contact electrosurgical burns. The circuit detects earth contact paths while the plate electrode is attached to the patient and the unit, when a monopolar fingerswitch or footswitch is pressed, but before the monopolar output is activated. If such an earth path is present, the alarm will operate until the path has been removed and the unit reset by reactivating a pressed monopolar footswitch or fingerswitch.

Plate Voltage Monitor (PVM).

3.6 Is designed to prevent dangerous electrosurgical voltages appearing on the patient's body. Such voltages could occur because of insulation faults in the active circuit or because the active electrode is in contact with an earthed object and could cause burns at points of contact between the patient and conductive objects. This alarm will operate when monopolar output power is 'on' and the fingerswitch or footswitch is operated. This monitor will not detect a poor contact between the plate electrode and the patient. **Note:** Under specific electrical conditions, with the plate electrode completely detached from the patient, the PVM could alarm.

Multiple Activation Alarm.

3.7 Operates if more than one fingerswitch or footswitch is pressed at the same time in a given user section (i.e. monopolar USER 1 or USER 2 or bipolar). It will automatically be reset when ALL activations have been released. This alarm will also operate if a footswitch or fingerswitch is being activated when the unit is switched 'on'. (Note: This could indicate a damaged accessory locked in the 'on' position).

Internal error alarm

3.8 Operates if an internal fault arises such as power being detected when not enabled by a footswitch or fingerswitch.

4.0 INTRODUCTION

GENERAL

Note: For numbers in brackets refer to Fig. 1.

4.1 The TD830 electrosurgical unit provides two outputs both for high power monopolar cut and coag (on a first come first served basis), together with a separate output for bipolar coag. Bipolar coag output is available simultaneously with either monopolar output. The unit incorporates touch button controls, seven segment LED (light emitting diode) displays and LED visual indicators.

4.2 The digital displays can show two scale modes, one shows the *typical* power available in watts the second shows a numerical value up to 10 (the latter is only displayed whilst digital display range selection toggle button (35) is held pressed).

Note: The power delivered depends on the resistance between the active electrode and the plate electrode (or between the tips of bipolar forceps) at the time the power is applied. This resistance can vary widely and many times per second during the application of h.f. output.

4.3 The unit incorporates several alarm code indicators as detailed in the Technical Data section. Innovative safety features include a divided plate electrode monitoring system called the Plate Attachment Monitor (PAM) as well as the standard Eschmann Plate Voltage Monitor (PVM), Patient Earth Monitor (PEM) , and Plate Continuity Monitor (PCM). An Excess Power Monitor (EPM) and a Multiple activation alarm are also included. A high frequency leakage control circuit is included in the monopolar mode.

4.4 Within this manual the terms USER 1 and USER 2 are used to distinguish between the two monopolar outputs. The bipolar output is fully independent of the monopolar output and can be considered as USER 3.

OPERATING MODES / DISPLAY OPTION

Monopolar mode

4.5 The monopolar operating mode offers a choice of fingerswitch or footswitch control of 'cut' or 'coagulation' outputs for USER 1. Fingerswitch operation utilises the Eschmann two-button fingerswitch whilst footswitch control requires the use of an active electrode handle in conjunction with one of a range of electrical footswitches.

Bipolar mode

4.6 Bipolar coag is an efficient method of effecting haemostasis, and closure of vessels such as Fallopian tubes. It is extremely safe to use, as the main current path is between the tips of the bipolar forceps and the tissue held between them is directly in view of the surgeon at all times.

4.7 A plate electrode is not required and safety is increased even further as two power range outputs are available allowing precise setting of the power output.

4.8 The bipolar mode of operation offers a choice of footswitch, electrical or pneumatic.

Monopolar standby mode

4.9 The unit can be switched into monopolar standby mode, in which only bipolar power is available, using monopolar standby selection button (32). This button is a toggle switch, each press of the button will turn monopolar mode 'on' (if 'off') or 'off' (if 'on'). This button (32) can be considered as an 'on/off' switch for monopolar, the advantage being that if only bipolar outputs are required and monopolar standby mode is selected, no plate electrode needs to be connected to the unit. (If monopolar standby mode is not selected for 'bipolar use only' and a patient plate electrode is not connected to the unit the PAM alarm or PCM alarm will activate). The unit is in monopolar standby mode when only the digital display for bipolar can be seen illuminated.

Digital display options

4.10 The digital displays normally show the *typical power** available in watts. The digital displays can also show a numerical value up to 10 (maximum). To display the power setting as a numerical value up to 10 press and hold the digital display range selection button (35). The display will revert to the normal setting (and display the *typical power** available in watts) when the button is released.
(* *typical power* is an indication of the average power delivered over a range of load resistances. It is less than the power delivered to the rated load for maximum power.)

ACCESSORIES

4.11 The equipment is designed to be used with the Eschmann range of active, plate and bipolar cables. The front panel is colour coded, PALE BLUE for bipolar, YELLOW for monopolar cut, blend and specialist cut, and BLUE for monopolar coag. For a list of all accessories see the 'Instructions for use'.

ASSOCIATED PUBLICATIONS

4.12 This manual contains service and maintenance instructions for user servicable parts (PCBs are deemed to be none user serviceable) and an illustrated parts list. For detailed user instructions refer to the TD830 Instructions for Use, E-IM44 (part number 698257).

EQUIPMENT CERTIFICATION

4.13 The electrosurgical unit fully complies with the major international safety standards (see Technical Data). (Note: Tested at 230V).

CAUTION

This electrosurgical unit is to be operated by medically qualified personnel only.

SERVICING

4.14 It is recommended that electrosurgical safety checks and routine servicing are carried out at regular intervals (every six months) and only by Eschmann trained personnel or Eschmann trained hospital engineers, otherwise the warranty could be infringed.

4.15 Read the information given in this manual carefully before using, cleaning, sterilizing, or servicing the electrosurgical unit.

1 Power output control, BIPOLAR
2 MICRO BIPOLAR selected, indicator (green LED)
3 Touch button, MICRO BIPOLAR
4 MACRO BIPOLAR selected, indicator (green LED)
5 Touch button, MACRO BIPOLAR
6 BIPOLAR digital power display (green seven segment LEDs)
7 BIPOLAR, power activated indicator (blue LED)
8 MONOPOLAR CUT digital power display (green seven segment LEDs)
9 MONOPOLAR CUT, power activated indicator (yellow LED)
10 MONOPOLAR (normal cut) selected, indicator (green LED)
11 Touch button MONOPOLAR (normal cut)
12 MONOPOLAR (blend) selected, indicator (green LED)
13 Touch button MONOPOLAR (blend)
14 Power output control, MONOPOLAR (cut)
15 Touch button MONOPOLAR (specialist cut)
16 MONOPOLAR (specialist cut) selected, indicator (green LED)
17 MONOPOLAR COAGULATION (pinpoint) selected, indicator (green LED)
18 MONOPOLAR COAGULATION (spray) selected, indicator (bright green LED)
19 Touch button MONOPOLAR COAGULATION (pinpoint)
20 Touch button MONOPOLAR COAGULATION (spray)
21 Power output control MONOPOLAR COAGULATION
22 MONOPOLAR COAGULATION, power activated indicator (blue LED)
23 MONOPOLAR COAGULATION digital power display (green seven segment LEDs)
24 8mm active electrode socket USER 1 only (footswitch activation only) - red
25 Fingerswitch sockets (for use with active electrode socket 26) - black
26 4mm active electrode socket USER 1 (footswitch or fingerswitch activation) - red
27 Fingerswitch sockets (for use with active electrode socket 28) - black
28 4mm active electrode socket USER 2 (fingerswitch activation only) - red
29 'S' (scope) connector socket (for use with flexible endoscopes)
30 Plate electrode connector socket - black
31 Bipolar output socket - white
32 Monopolar standby selection button (monopolar 'on/off' toggle button)
33 Running tone volume control
34 Potential equalization point (see Technical Data section)
35 Digital display range selection button (display in watts if not held pressed)
36 Bipolar pneumatic (white) footswitch socket
37 Bipolar electric (white) footswitch socket
38 Sockets for monopolar footswitches (blue, yellow or combination blue and yellow)
39 Serial number plate
40 Mains cable connection socket
41 Mains fuses (see technical data)
42 Mains power on/off control (with internal green lamp)

A1 - PCM alarm activated LED
A2 - PAM alarm activated LED
A3 - PEM alarm activated LED
A4 - PVM alarm activated LED
A5 - EPM alarm activated LED
A6 - MULTIPLE ACTIVATION alarm LED
A7 - Internal error alarm activated LED

All alarms are accompanied by an audible two tone warning and the activated digital displays will flash (i.e. if in monopolar standby mode, only the bipolar digital display will flash).

Key to Figure 1

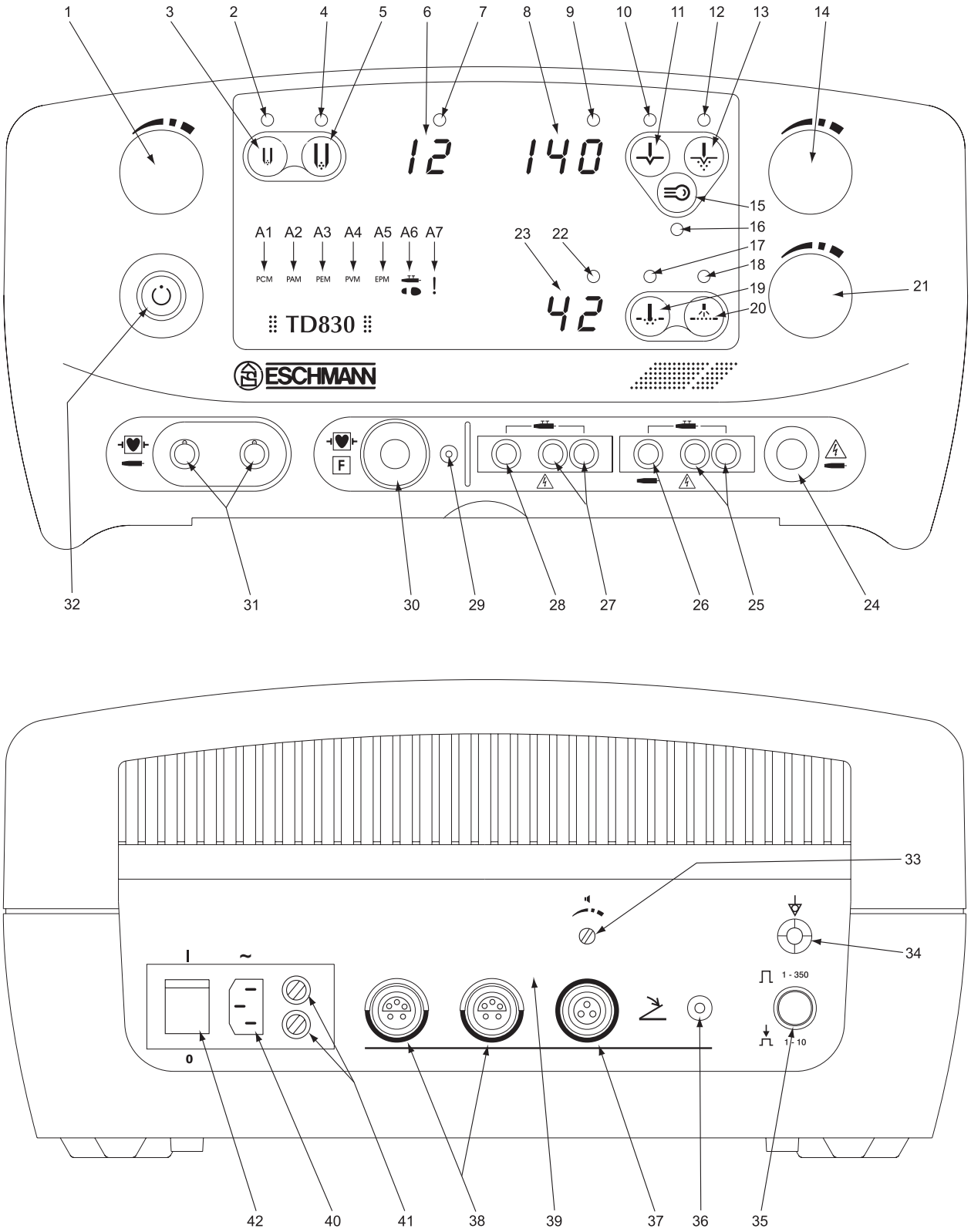


Figure 1 - Part identification

5.0 DESCRIPTION

CONSTRUCTION (See Fig. 6)

5.1 The TD830 Electrosurgical unit is made of four principle electronic sub assemblies as listed below :

- Front panel
- Rear panel
- Mains transformer and rectification assembly
- Main printed circuit board assembly

5.2 The front panel includes the display and control board, operator controls, finger switch inputs and the RF outputs.

5.3 The rear panel includes the foot switch interface, mains input switch and lamp, display control switch and the tone volume control.

5.4 The mains transformer and rectification assembly, fitted inside on the right hand side (when viewed from the front) on a metal base plate, provides mains isolation and voltage conversion, protection and a 180V d.c. rectified power feed to the RF power section.

5.5 The main printed circuit board assembly, positioned within the unit on the left hand side (when viewed from the front) fitted on a metal base plate, controls and supplies all the RF outputs.

SUB ASSEMBLY DESCRIPTIONS

(see Fig.6)

Front panel

5.6 The front panel assembly comprises a main display and control board (see 5.7) with its buttons, LEDs and three 7 segment displays (Bipolar, Monopolar Cut and Monopolar Coag). There are three Potentiometer controls for setting RF power levels (Bipolar, Monopolar Cut and Monopolar Coag), a Bovie sensing microswitch and pivot assembly. The panel also includes the connectors and cabling for the four RF outputs (Plate, Bipolar, Mono1, Mono 2 and Bovie). There are two current sense toroids, the larger for leakage sensing and the smaller for output current sensing.

5.7 The main display and control board performs the following functions:-

i Uses the front panel control knobs to set the maximum allowable power for each mode.

ii Allows mode selection (IC4) and display (IC8) through 8 front panel buttons and associated LEDs (Bipolar Macro or Micro; Specialist Cut, Normal Cut or Blend; Pinpoint Coag. or Spray Coag. and Standby).

iii Provides the controls for all RF outputs through a 64-way ribbon cable (J6).

iv Provides alarm control and logic (IC6) and illuminates an LED to indicate the type of Alarm.

v Provides three digital 7 segment displays (IC13, IC1, IC5) for power levels of Bipolar, Cut and Coag.

vi Provides all logic for foot and finger switch controls (IC12, IC11).

vii Provides Battery back up of the last mode selection before switching off (BATT1, IC2,IC4).

viii Uses the Bovie sense microswitch to enable the RF routing to the Bovi RF output for Mono user 1.

ix Provides CMOS (IC9, IC10) and open collector drives (IC7) for the main printed circuit board assembly.

x Provides control signals as follows:

SPEC	BLEND
CUT	SPRAY
CUTMODE	COAGMODE
MONENABLE	BIPENABLE
BIP_LOW	MONORELAY1_SEL
PEM_RELAY	MONORELAY2_SEL
MONORELAYBOVI_SEL	

xi Provides Tone Generator controls as follows:

BLEEP_TONE	CUT_TONE
COAG_TONE	BIPOLAR_TONE
ALARM_TONE	

xii Receives Foot and Finger switch signals as follows:

FINGERCUT_1	FINGERCOAG_1
FINGERCUT_2	FINGERCOAG_2
FOOTCUT_1	FOOTCOAG_1
FOOTAIR_BIP	FOOTELEC_BIP

xiii Receives alarm signals as follows:

PVM	PAM
PCM	PEM
MONOPWRDET	BIP_EXCESS
MONO_EXCESS	

ALARM SQUARE (from Tone generator).

5.8 The one set up potentiometer (VR1) is factory set at manufacture and does not need resetting during the life of the product.

Rear panel (see Fig. 6)

5.9 The rear panel provides connection to the mains a.c. supply via an IEC inlet (which includes fuses, switch and integral green lamp), also fitted to the rear panel are:

i A volume control potentiometer.

ii A range switch.

iii Two Monopolar footswitch circular multi-pin connectors

iv An electrical Bipolar footswitch connector.

v A pneumatic Bipolar footswitch connector.

vi The Rating and Serial Number plate.

vii A 15 way interconnect cable (from the footswitches, range switch, volume control and the Mother board of the main PCB Assembly).
viii Mains interconnect to the Mains Transformer Assembly.
ix Safety earth strap for the rear panel.

5.10 The two Monopolar footswitch circular multi-pin connectors are wired together so that either of two footswitches can enable RF power.

5.11 The range switch selects either normal power levels or a 0–10 range when pressed (see the 'Instructions for Use' supplied with the unit).

Mains transformer & rectification assembly (see Fig.6)

5.12 The mains transformer and rectification assembly comprises a 50/60Hz mains transformer with several secondaries providing the following:

i 50 V a.c. (Bipolar low/Micro) and 75V a.c. (Bipolar high/Macro) for the Bipolar Output.
ii 15 V a.c. (rms) for the +15V output supply from the PSU board.
iii 15V a.c. (rms) for the -15V output supply from the PSU board.
iv 5V a.c. (rms) for the +5V output supply from the PSU board.

5.13 The above a.c. supplies are connected to the motherboard at SK12 through a 9-way cable and connector from the Transformer PCB. They are short circuit protected by thermistors, which recover when an overload is removed.

5.14 Another secondary provides the feed for a rectifier whose output from the PCB is through a 2-wire (P1) connection to a large reservoir capacitor fitted near the transformer. This provides a 180V d.c. power feed to the Monopolar outputs which are supplied from the capacitor to the mother board at SK13. This secondary is protected by an internal over temperature sensor. Fitted to the discharge resistor is a capacitor so that energy is drained away to make the capacitor safe when the mains power is switched off.

5.15 The mains input voltage is factory selected by links on the input connector P10.

Main printed circuit board assembly (see Fig. 6)

5.16 The main printed circuit board assembly comprises a motherboard assembly (Part No 715205) which supports the other boards that make up the main printed circuit board assembly. The motherboard provides the inter-board connections and power feeds to the other boards of this assembly and is positioned horizontally under them. The other boards are listed below and are detailed in their own sections:

- Patient Interface (Active) PCB
- Patient Interface (Plate) PCB
- Tone Generator PCB
- PSU PCB
- Bipolar PCB
- Crowbar PCB
- PCM DC regulator PCB
- Monopolar Power Amplifier PCB comprising the:
  - Spray and Monopolar PCB which includes the:
    - Relay PCB
    - Logic and pulse PCB

5.17 The motherboard receives power from the mains transformer (SK12), 180V d.c. power (SK13), control from the front panel (SK2) and the rear panel (SK14) and current (SK3) and leakage sensor (SK4) feedback. The rear panel footswitch circuitry has an isolated supply (IC3) and interface (IC's 1 and 2) providing 250V AC isolation.

5.18 Capacitors are fitted to the motherboard (C1-2, C4-7, C10, C13-14, C15 A-I) to protect against RF interference.

Patient Interface (Active) PCB (Part No 715201)

5.19 This board is fitted in the front slot nearest the display board (SK3 of the Mother board). It receives a single Monopolar Active RF power feed on PL4-2.

5.20 It also receives control signals (MONORELAY_1, MONORELAY_2, MONORELAY_BOVI) and returns finger switch signals (FINGERCOAG_1, FINGERCUT_1, FINGERCOAG_2 and FINGERCUT_2) to the display board through the motherboard and the 64-way ribbon connector.

5.21 The Monopolar RF feed is routed by HV RF relays to one of three outputs: Mono1 (connector PL1 through Relay RL3), Mono2 (PL2, RL1) or Bovi (PL3, RL2). This is done under control from the display board (signal names MONORELAY_1, MONORELAY_2, MONORELAY_BOVI).

5.22 In addition to the RF power output feed to Monopolar 1 there are two finger switch control lines which allow activation of Cut or Coag RF power (PL1-2, PL1-1). These lines are supplied with a sensing drive signal (IC1, TR1, L1) through a transformer (TX10) and return to two opto-isolators (O11, O12). When a fingerswitch is pressed that line causes current to flow through the opto-isolator and activate the control signal from the PIA active board to the display board (signal names FINGERCOAG_1, FINGERCUT_1).

5.23 The same applies to Monopolar 2 (PL2-3, 4). (Opto-isolators O13, O14, signal names FINGERCOAG_2 and FINGERCUT_2).

5.24 Fingerswitch signals (FINGERCUT/COAG_1,_2) are returned to the Display board through the motherboard and the 64-way ribbon connector.

Patient Interface (Plate) PCB (Part No 715203)

5.25 This board is fitted in the second slot from the front (SK4 of the Mother board). It receives a single Monopolar Plate RF power feed on PL2-4. This is then fed into two plate outputs via HV RF capacitors C1 and C6 (PL2 -2,3). These go to the front panel Plate RF output along with a third plate wire (PL2 -1) which becomes shorted to PL2-2 when a plate connector is fitted.

5.26 It also receives a control signal (PEM_RELAY) and returns alarm signals (PEM, PCM, PAM, PVM) to the display board through the motherboard and the 64-way interconnecting ribbon cable.

5.27 When a plate connector is fitted terminals PL2-1 and PL2-2 are shorted together. This turns on an Oscillator (TR1, TR2, TX3) which is detected by IC4B and RV5 and supplies a PCM 'OK' signal (low) to the display board. Conversely if the plate connector is not fitted a PCM alarm (high) is sent to the Display board. If the plate is not fitted correctly to the patient PL2-3 is isolated from PL2-2 at the oscillator frequency. This is sensed (IC4A, RV4) and sends a PAM (plate attached alarm) to the display board which gives the alarm.

5.28 The plate voltage is monitored through PL2-1, C10, C13, R 10-14. This voltage is then sensed (IC3, RV2, D15, C44) and, if high, sends a PVM (high) signal to the display board.

5.29 A sample of the impedance between the plate and earth (at the units mains inlet) is carried out during a 20-40msec sample just before supplying any RF output power. This is achieved using relay RL1, Oscillator IC1F, TR6, L2, C16 and TX2. If the PEM impedance is below 200W as sensed by IC2, RV3, D14 and R32 an alarm is sent to the Display board (signal name PEM). Oscillator TR5, TX4, C18 provides the means to supply an isolated DC rail on the secondary of TX4 ,D3, D4.

Tone Generator PCB (Part No 715273)

5.30 This board is fitted in the third slot from the front (SK5 of the Mother board). It receives control signals (CUTTONE, COAGTONE, BIPTONE, BLEEP, ALARM) from and returns ALARM SQUARE to the display board through the motherboard and 64-way connector.

5.31 The Tone Generator has a speaker (LS1) which gives the following tones when activated:

- 950Hz for Monopolar Cut.
- 800Hz for Monopolar Coag
- 730Hz for Bipolar

Note: If both Bipolar and Monopolar modes are active it is the first tone which is retained until it is released.

5.32 When a button is pressed a 'bleep' is given and when an alarm is given a loud two-tone sound is provided. Cut, Coag and Bipolar Tones are provided by IC1 and fed through IC2 and speaker driver IC4. Alarm and two tone control is provided by IC3 and IC6.

5.33 The volume of Cut, Coag, and Bipolar tones and the 'bleep' are controllable by the potentiometer on the rear panel. This is fed through the motherboard to the Tone Generator.

PSU PCB (Part No 732061)

5.34 This board is fitted in the fourth slot from the front (SK6 of the Mother board). It receives AC power from the Mains transformer through SK12 and SK6 on the motherboard and provides +15V (SK6 A-C2), +5V (SK6 A-C4) and –15V (SK6 A-C6) for all the other boards in the unit. These rails are fed through the Mother board.

Note: The +15V regulator on this board does get hot.

Bipolar PCB (Part No 715222)

5.35 This board is fitted in the fifth slot from the front (SK7 of the Mother board). It receives AC power from the mains transformer through SK12 and SK7 on the motherboard and provides a Bipolar RF output on PL1 which is connected to the front panel through a 2 wire RF cable.

5.36 It receives control signals (BIP_EN, BIP_LOW) from the display board through the motherboard and the 64-way ribbon cable. It also receives a power level control (BIPC-, BIPC+) and excess power threshold (BIP_LEVEL) from the front panel Bipolar control knob.

5.37 The Bipolar control knob is composed of two ganged potentiometers one of which (BIPC 100KΩ) provides power control and is routed through the display board 64-way ribbon cable and motherboard to the bipolar board. The other (BIP_LEVEL) is buffered on the display board and fed to the Bipolar through the 64-way ribbon cable and motherboard.

5.38 The Bipolar board has a Push Pull RF output driver (IC6, TR7, TR8) which feeds RF power through a transformer (TR6). The transformer provides isolation and voltage step up. Control of power is achieved by controlling the output duty cycle (IC5, IC8).

5.39 IC10 provides the fundamental oscillator, which also limits the on time of each FET driver and through IC9, forces the drive for FET's TR7 and TR8 to be asynchronous.

5.40 The Transformer primary voltage (IC3C, VOLTAGE_A/B) is combined with the output current (TR5, CURRENT+/-) to provide the output power level (IC1, R3, C10). This is then compared (IC2B) with the front panel displayed power level (BIP_LEVEL , IC3A,B) and if the output power exceeds a tolerance from the displayed power level (VR3,4) an alarm signal (IC7, PL3-24, BIP_EXCESS) is sent to the display board and the RF power is immediately removed (IC8B, IC8A).

5.41 Current limit is provided by IC3D, TR2 and set by VR2.

Crowbar PCB (Part No 732059)

5.42 This board is fitted in SK8 between the Bipolar board in SK7 and the PCM board in SK9. It is a small board

secured near the Mother board. It provides over voltage protection for the Monopolar inverter d.c. power feed.

5.43 In normal operation the 180V d.c. is supplied by the transformer assembly and reservoir capacitor and fed through SK13 on the Mother board and on to SK8-1,2 on the Crowbar at which point it is passed through a safety fuse (5A FF) and on to the PCM board back through SK8-4,5.

5.44 If the PCM board fails such that it places too many volts (140V) into the inverter, the Crowbar circuit detects this and turns on a high power transistor to load the 180V power feed to the PCM. This diverts current away from the failed PCM board until the fuse on the Crowbar board blows and isolates the 180V source.

5.45 The 5A fuse also protects against FET failures within the output inverter or any other form of short circuit within the PCM, which loads the High Voltage power rail.

PCM (Power control Mono) DC regulator PCB (Part No 715272).

5.46 This board is fitted in the second slot from the back (SK9 of the motherboard). It provides a regulated d.c. supply to the Monopolar RF inverter.

5.47 180V d.c. power is provided from the Crowbar protection circuit through the motherboard.

5.48 Control signals (MON_ENABLE, CUT_MODE, COAG_MODE, SPRAY, CUT, BLEND, SPEC_CUT) are received from the display board along with the power level (0-15V control from the front panel Cut or Coag control knobs).

5.49 A Mono-power-detect signal is returned to the display board (D5, R10, R11) through the motherboard (SK9 A22) and the 64-way ribbon cable. This is a Logic level, which is high when the output of the regulator is above 5V (i.e. on). If this signal is high when power was not requested the display board and tone generator give an internal fault (**!**) alarm.

5.50 This board uses a step down, pulse width modulated voltage regulator to provide a variable output voltage of 5–120V from the 180V supply. Switching FET's (TR3, TR4) are driven by IC1 from IC8 and controlled by IC7 to force the output voltage (A30, C30) to be proportional (R9, R16, R30) to the dc control level on IC7 pin 2. Output power is proportional to the square of the output RF voltage and so it is important to provide a regulated output proportional to the square root of the front panel setting to have a linear relationship between control setting and final output power.

5.51 The control level on IC7 pin 2 is derived from the front panel Coag or Cut control knob. This is sent by the display board according to whether a Cut or Coag switch has been activated and passed to the PCM board through the 64-way ribbon cable connector and motherboard.

5.52 This control/power level is received by the PCM board (A12), scaled (R18, R19), buffered and square rooted (IC4A), and further scaled (R21, R24-R28, IC2, IC3) according to the mode of operation of the unit (Spray/Blend/Cut etc.). When using Specialist cut mode an initial power boost (10%) (R22, IC3, IC6B) is provided for a period of about 300msec (C17 ,VR1).

5.53 The input current to the PCM board is monitored (R1A-E) and sensed (TR1) to limit (IC2A, IC3A) the input current drawn by the PCM card to less than 8Amps in case of a fault on the regulator or on the subsequent RF inverter.

5.54 An output fuse (5A FF) is also used to protect the output stage of the PCM card.

Monopolar Power Amplifier PCB (Part No 715275)

5.56 This assembly is made up of three boards and fitted into the slot nearest the rear panel (motherboard SK11) the three boards are:

Spray and Monopolar PCB

Relay PCB

Logic and Pulse PCB

These boards detailed in the following sections are not available as separate, individual boards.

Spray and Monopolar PCB

5.57 The Spray and Monopolar board is a large board and carries two other circuit boards, the relay PCB and the Logic and Pulse PCB. Its function is to take the regulated 5–120V d.c. supply (PL2) and turn this into a high frequency high voltage RF source.

5.58 The pulsed RF output for Cut, Blend, Pinpoint and Specialist Cut is provided by switching (TR14, 16, 18, 19) the supply, alternately through an RF output transformer (T1).

5.59 The high voltage low duty cycle Spray output is provided by releasing (TR4-11) energy, stored in an inductor (L1) through the output transformer (T1) and resonating capacitors (C8A-E).

5.60 The regulated d.c. is fed to this board from the PCM regulator board through the motherboard (SK9, SK10) and a 2 wire interconnecting cable to PL2.

5.61 The controls are received through SK11 and passed to the Logic and Pulse board (SK3). Drive waveforms for the switching FET's (TR14 etc.) are provided by the Logic and pulse board, buffered and amplified (IC9, 10, 15, 16 and IC14 for Spray) on the spray and monopolar board.

5.62 The RF Output current is sensed by a toroid (MTG 24-27) and fed back to the logic and pulse board for current limiting and control (SK6).

Relay PCB

5.63 The Relay board is a small board holding 3 relays (RLA-C) mounted on the Spray and Monopolar board.

5.64 Relay 'A' passes the energy pulse from the Spray circuit to the output transformer in Spray mode only. In all other modes this relay is off and isolated.

5.65 Relays 'B' and 'C' pass the push pull power drive from the switching FET's to the output transformer in all modes accept Spray.

5.66 These relays are special high voltage devices.

Logic and Pulse PCB

5.67 The Logic and pulse board assembly is fitted with surface mounted components and is mounted on the spray and monopolar board assembly. This board provides all the control and interfacing for the Monopolar output. It has the RF oscillators (IC8, IC9) for Cut modes and Pinpoint and the RF oscillator (IC11) for Spray.

5.68 It receives control signals (CUT, SPEC, BLEND, CUTMODE, COAGMODE, MONENABLE) from the Display board and sends an excess power alarm signal back to the display (via the Monopolar Power Amplifier Assembly and Motherboard and 64-way ribbon cable). All inverter pulse drive waveforms (PL4 -15, 16, 19, 20) for the Spray and Monopolar board are supplied by this board.

5.69 It receives Voltage feedback (IC24B, TP33) from the Primary of the Monopolar output transformer and current feedback (IC 24A, TP25) from the Current Sense coil which is fitted near the front panel. These two feedbacks are used to measure the output power of the unit (IC18) which is compared (IC5B) with the front panel setting (PL4-21, IC12B, TP19).

5.70 If the output power exceeds the set power level by an excessive margin an alarm is given (PL4-22, IC12C) and RF power is removed (IC22A, IC21B, C) by stopping the RF inverter clocks.

5.71 This board also receives (PL4-10, 11, IC23, IC13B, IC14A) the leakage current feedback from the Leakage sensor near the front panel. This leakage current is compared (IC14D) with a 75mA target level set up by VR20. If the leakage current exceeds the 75mA threshold, the output power will be reduced (IC19A, IC16A, IC15B, IC19D, IC22A) to limit it to 75mA.

5.72 This board also delays the control of leakage current to allow full power at the beginning of a cut. Leakage control is disabled when the Monopolar output is loaded by less than a set point, see table 2.

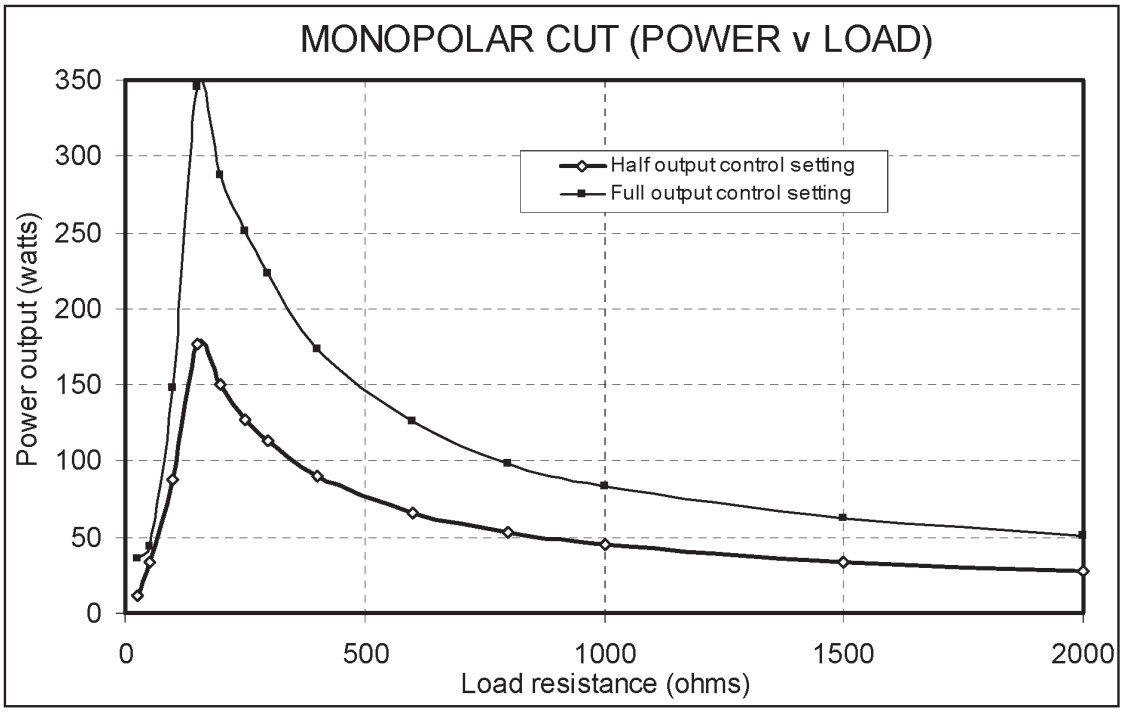
5.73 The load is measured (VR21, IC24C, IC14C, IC15A, IC2, IC16B) for Spray Coag by monitoring the decay rate of the output power after an energy pulse (IC17A). The load measurement for all other modes is achieved by comparing (IC14B) the output voltage (TP33) and the output current (R112, VR22) to see if their ratio is above or below the set point. If above, then leakage control is in operation. If not, then leakage control is disabled.

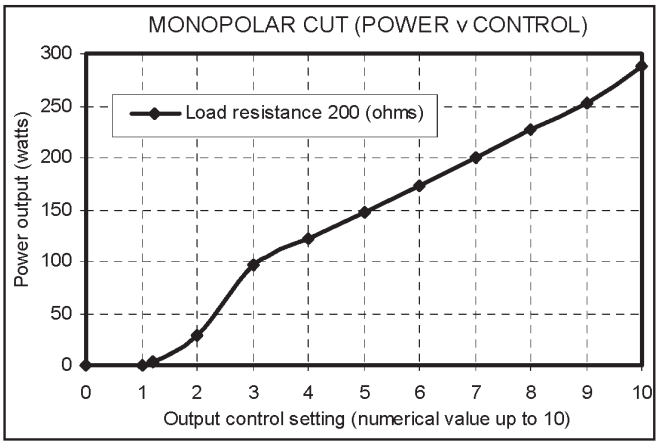
5.74 The Relay board controls are also supplied by the logic and pulse board (TR1, TR2, PL4, 17-18).

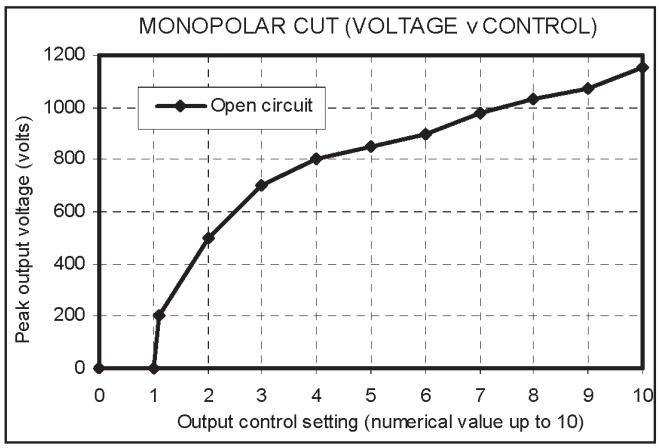
POWER OUTPUT GRAPHS

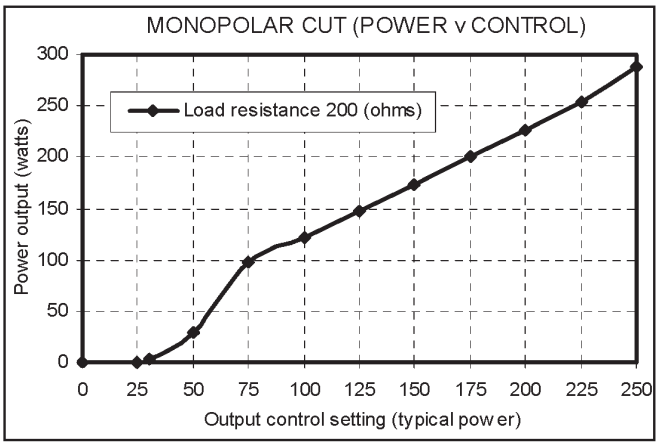
5.75 The power output graphs (shown on the following pages) have been optimized to provide effective cutting and coagulation over the wide range of tissue impedances that may be encountered. The low impedance region of the profiles, below the normal operating range, is controlled by a current limiting circuit designed to protect the equipment and accessories connected to it. All measurements are made at 20°C (68°F).

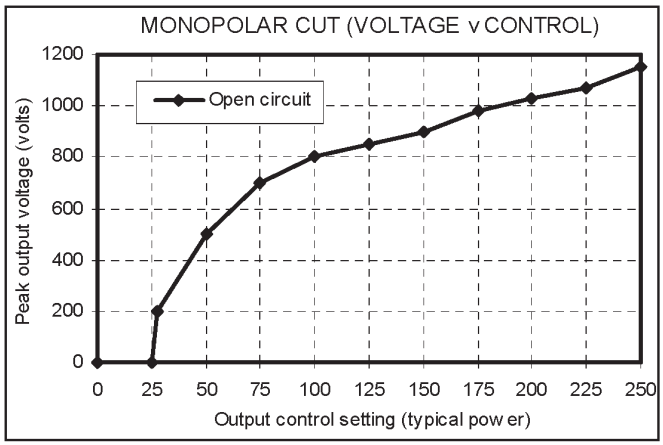
MONOPOLAR CUT DIAGRAMS



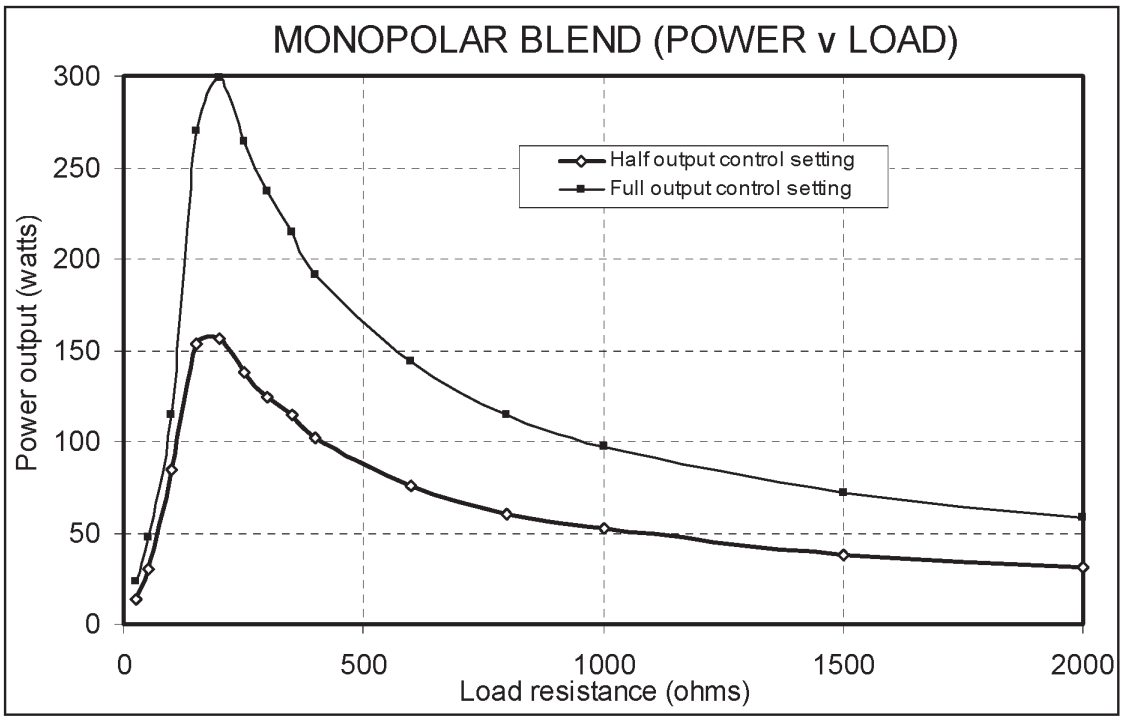


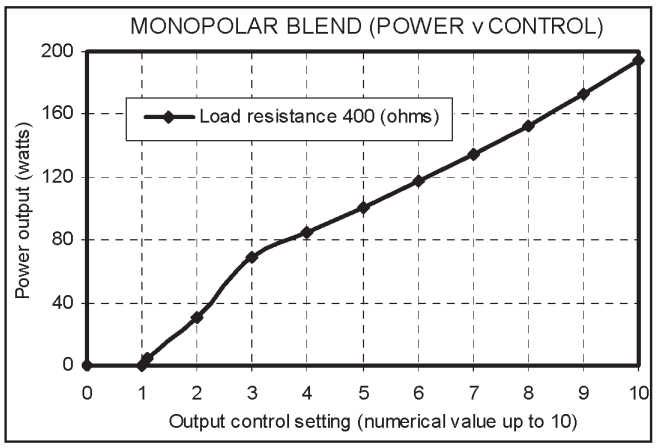


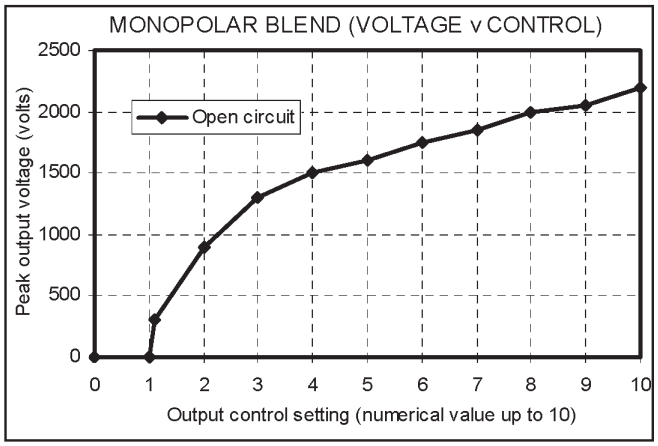


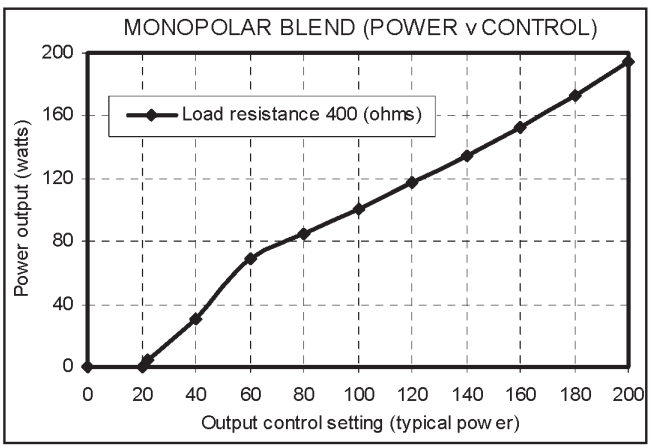


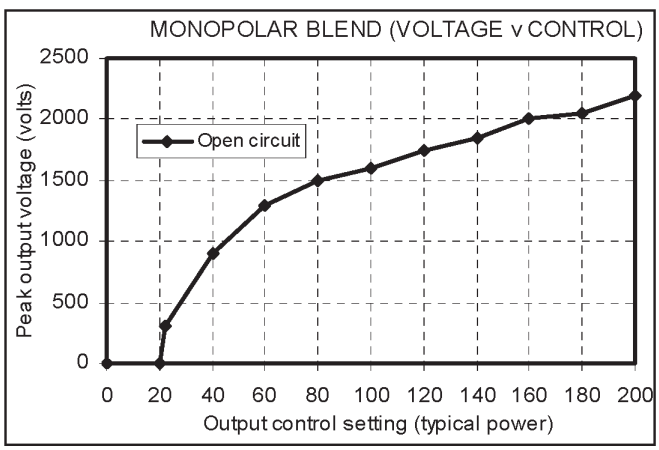
MONOPOLAR BLEND DIAGRAMS



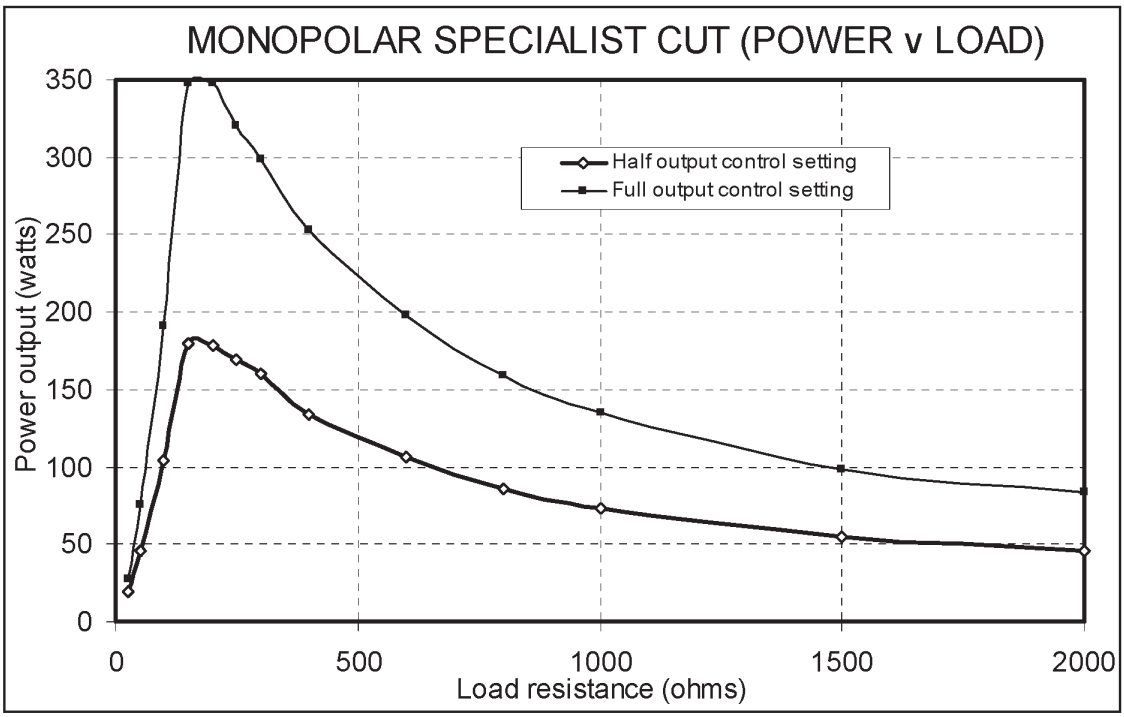


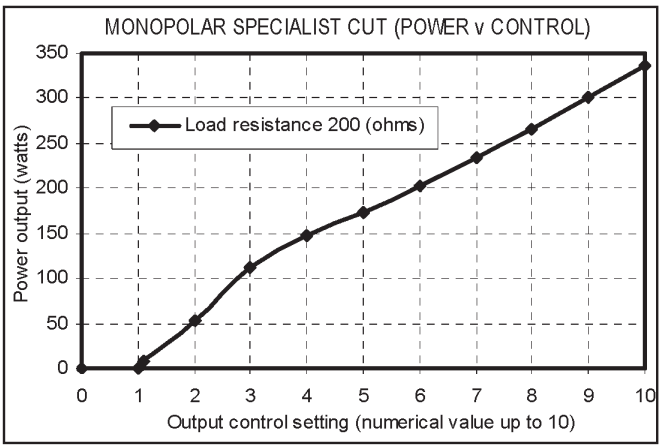


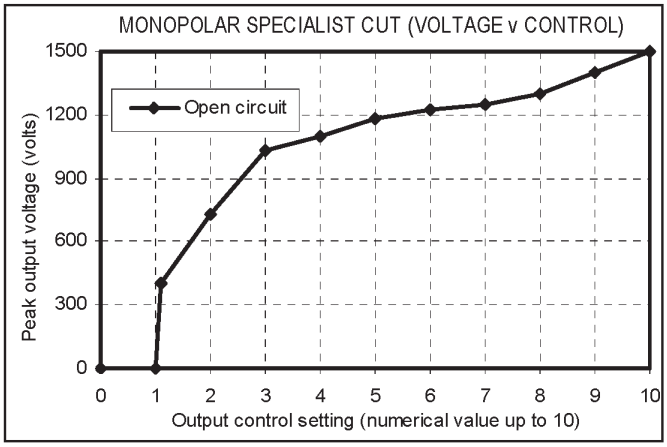


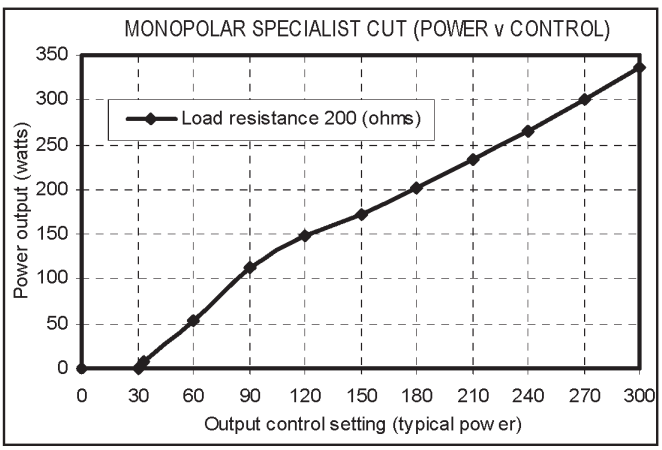


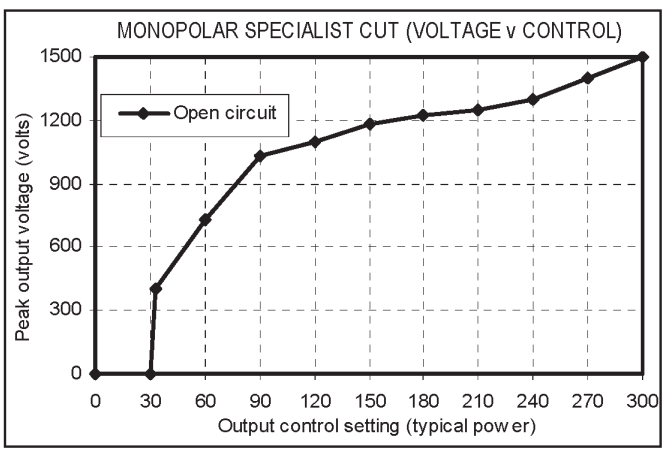
MONOPOLAR SPECIALIST CUT DIAGRAMS



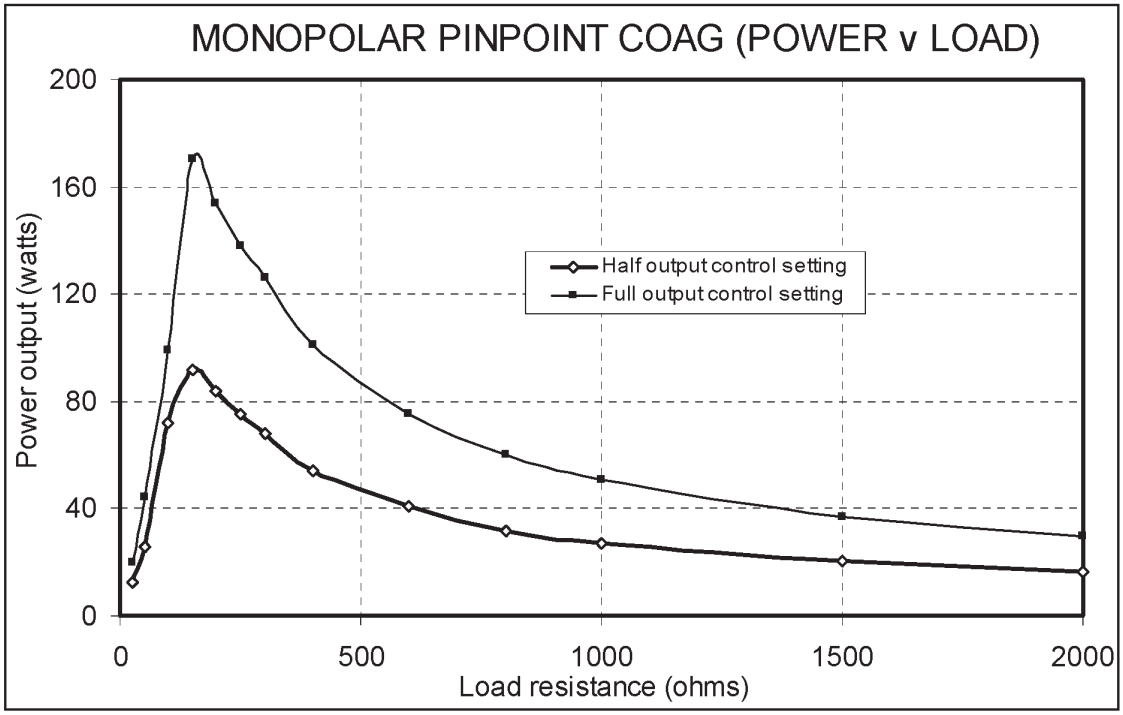


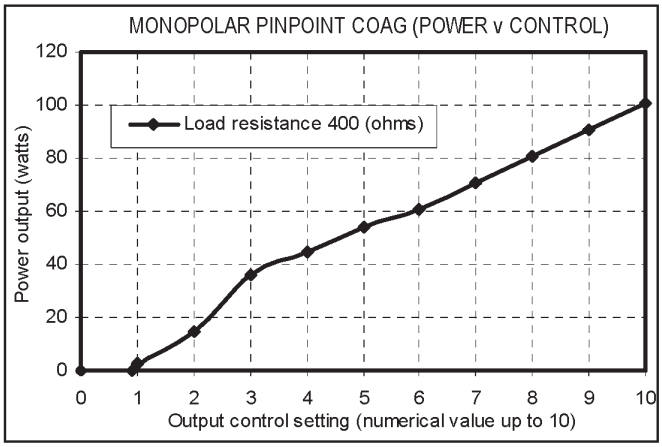


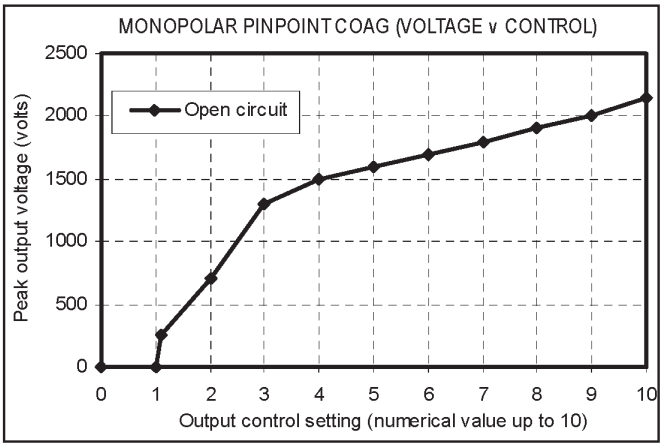


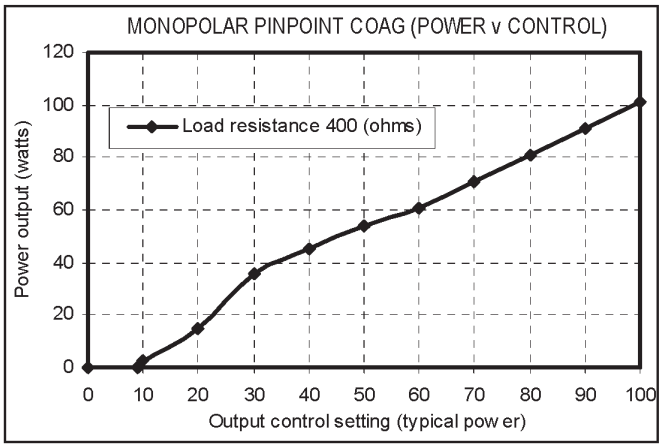


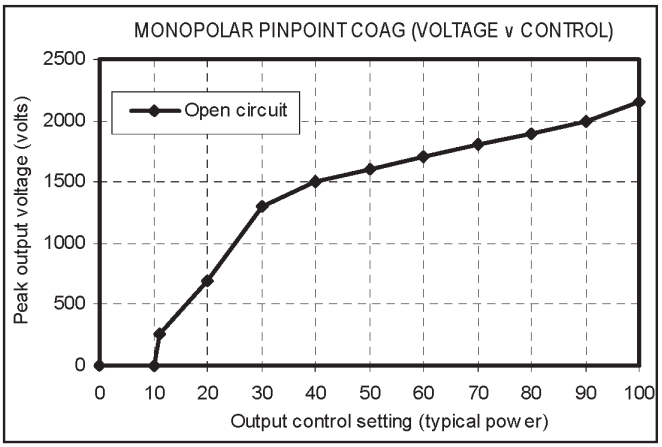
MONOPOLAR PINPOINT COAG DIAGRAMS



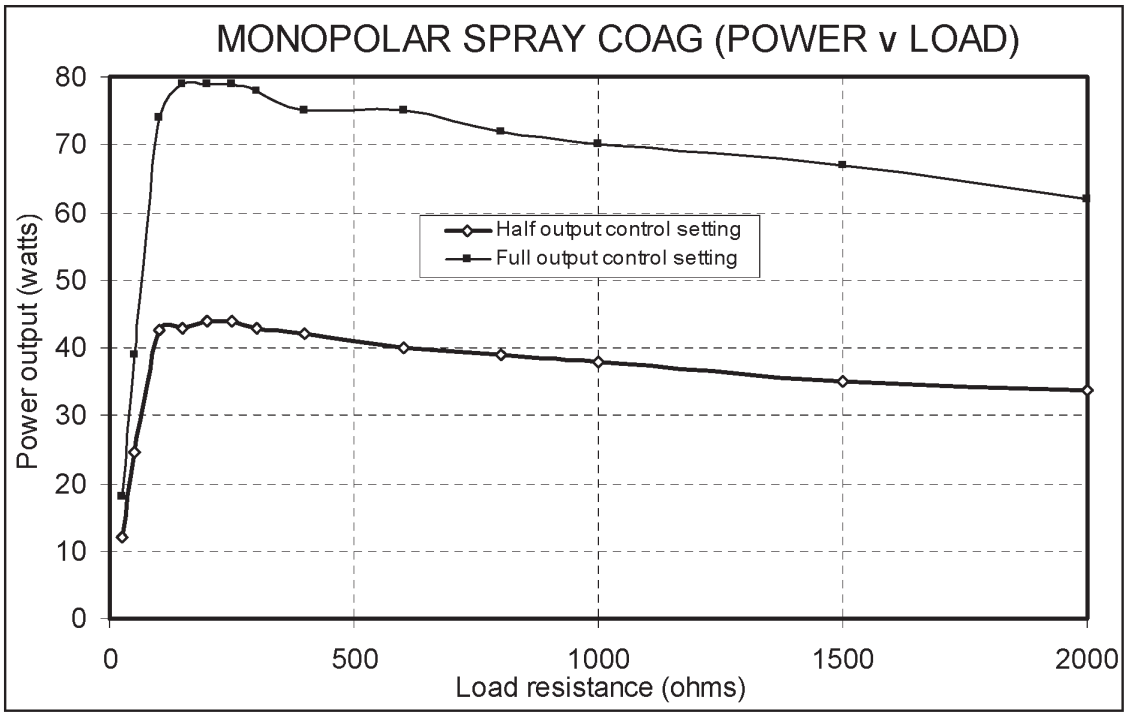


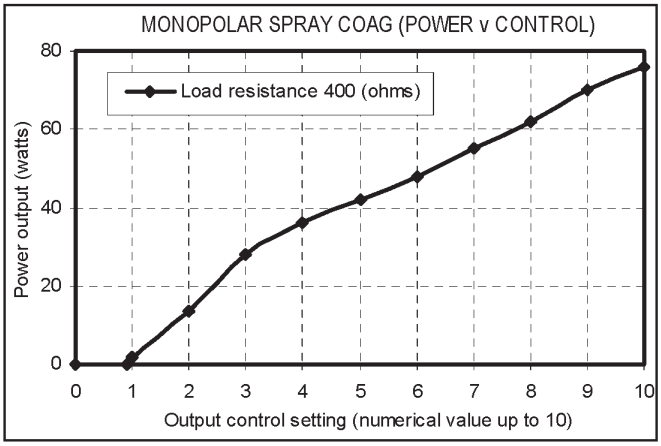


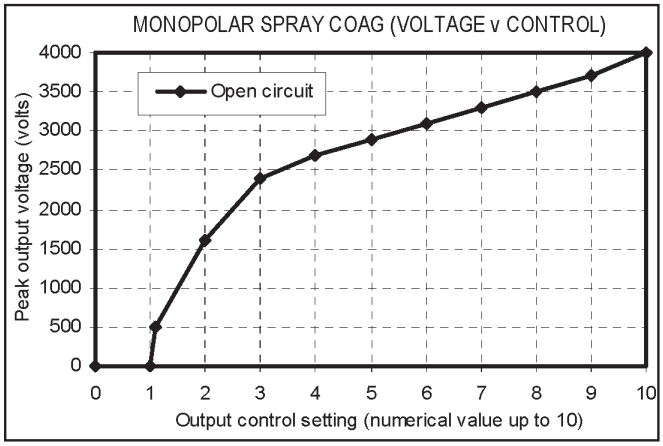


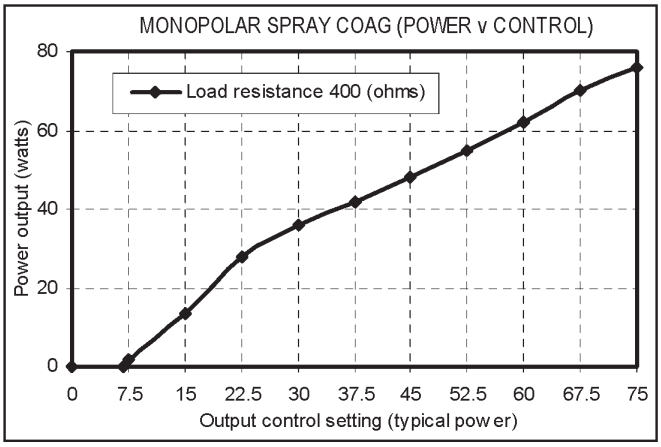


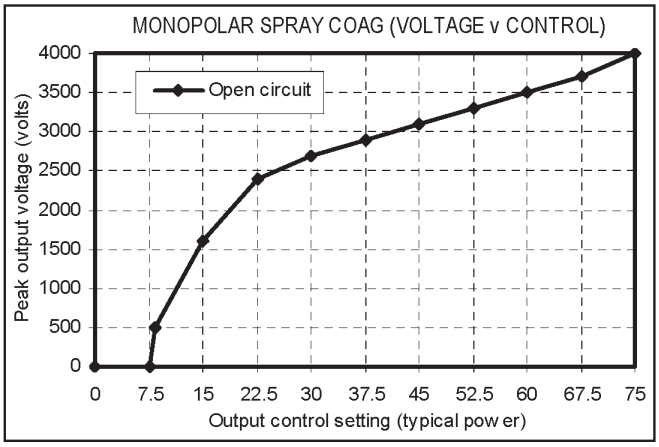
MONOPOLAR SPRAY COAG DIAGRAMS



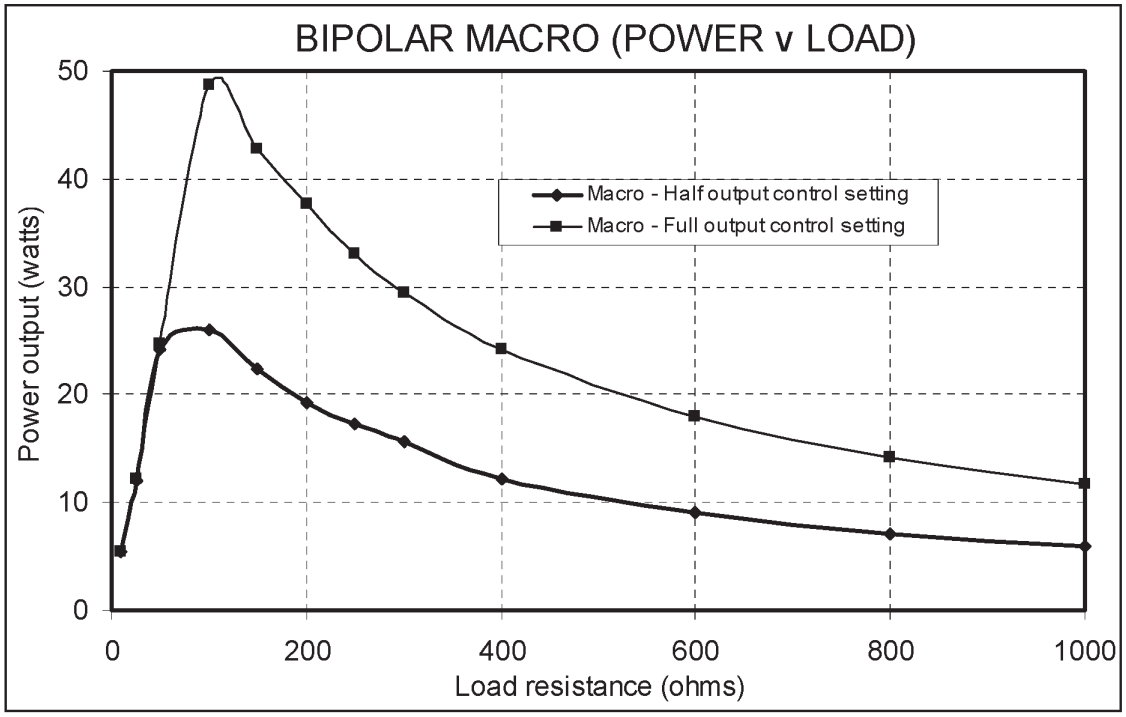


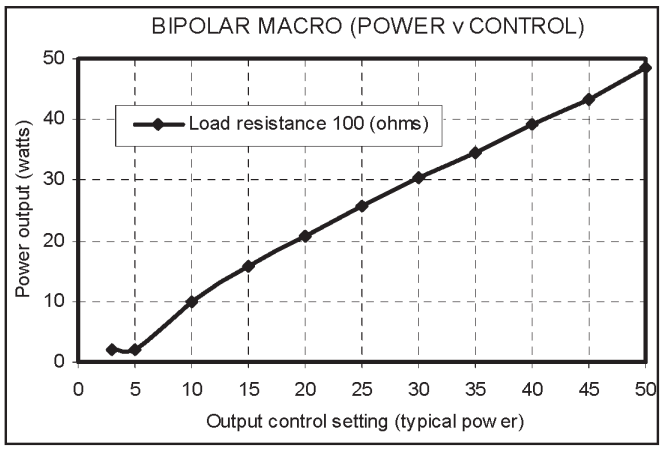


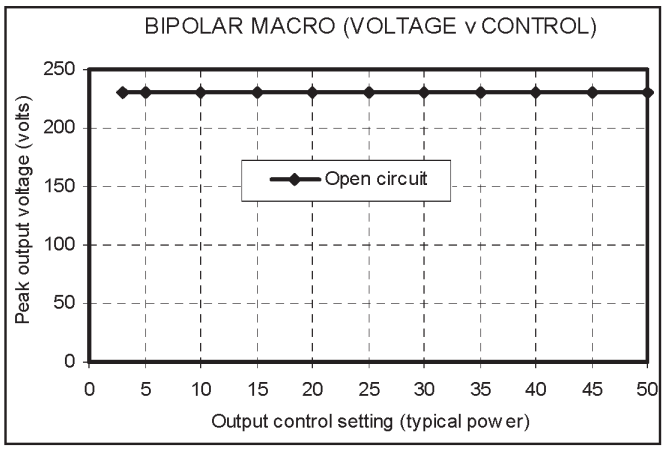


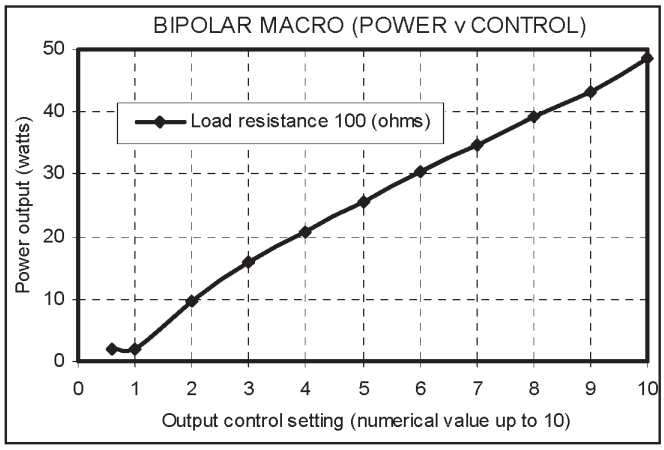


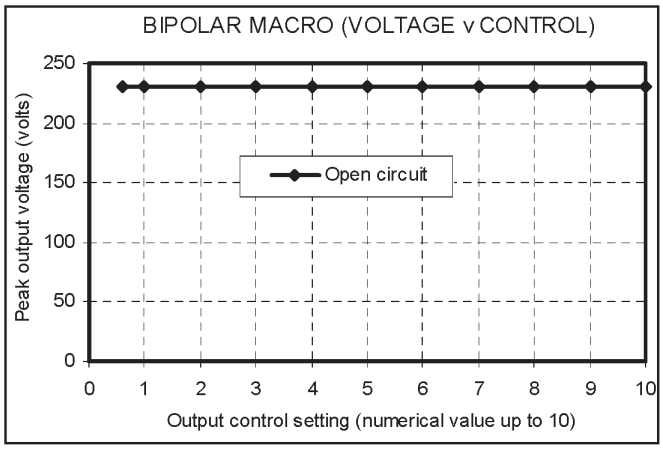
BIPOLAR MACRO DIAGRAMS



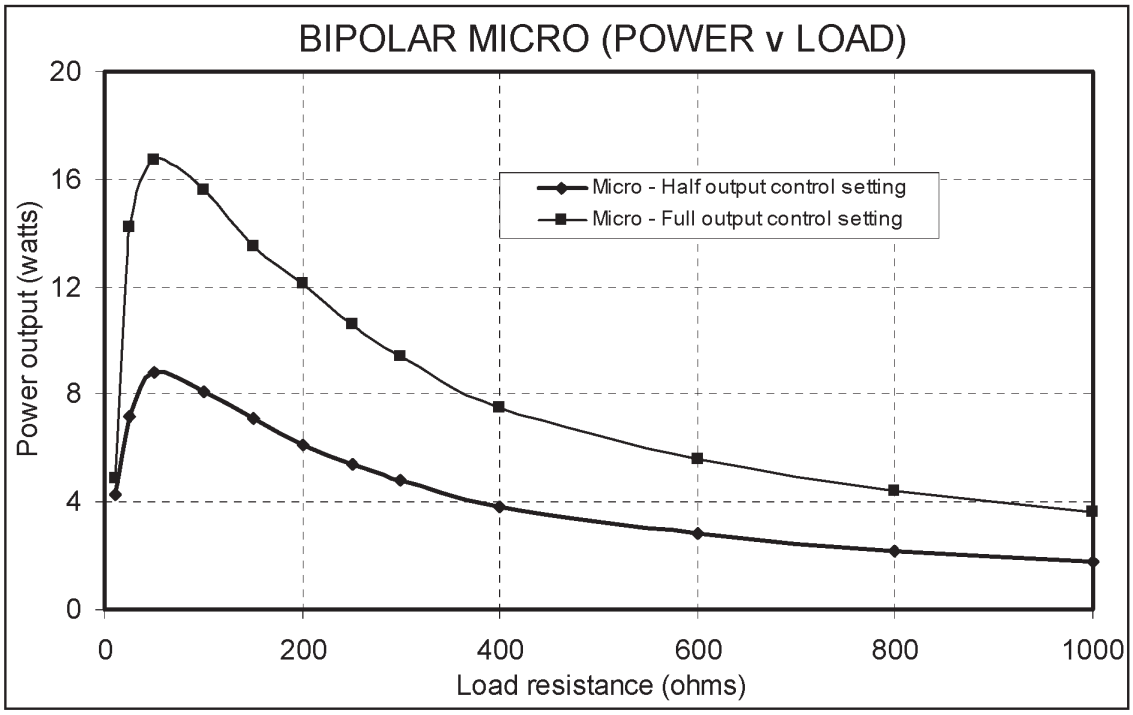


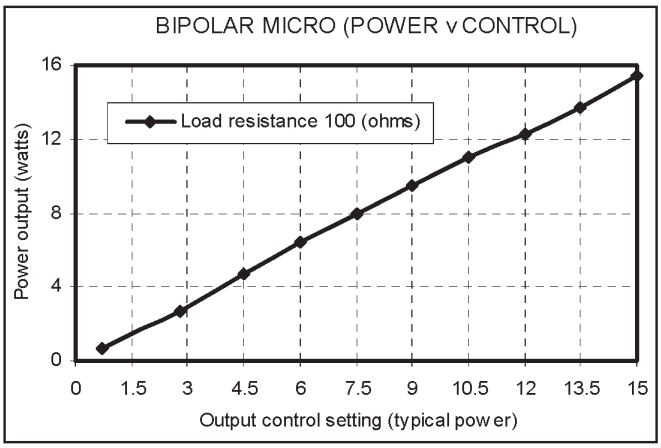


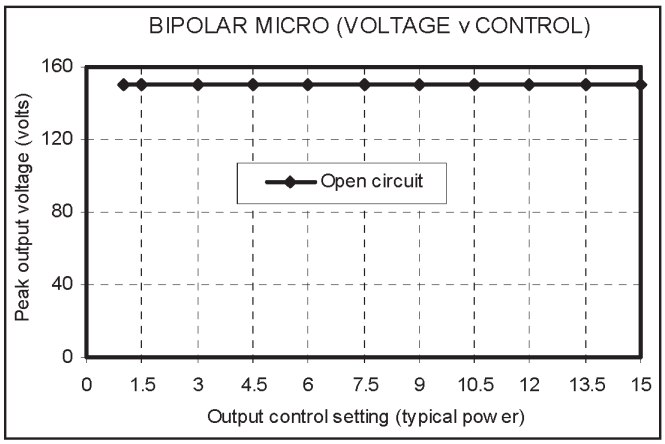


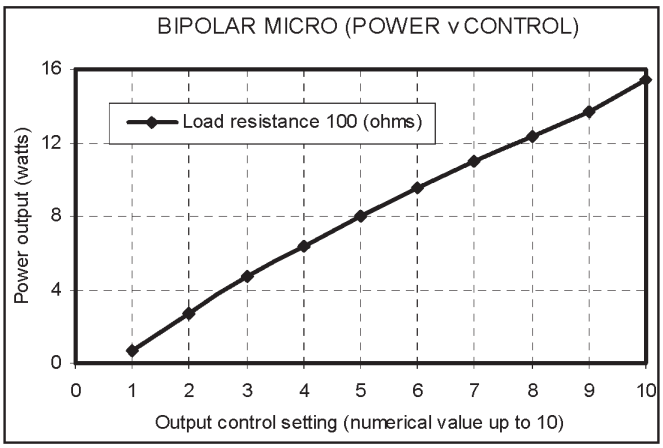


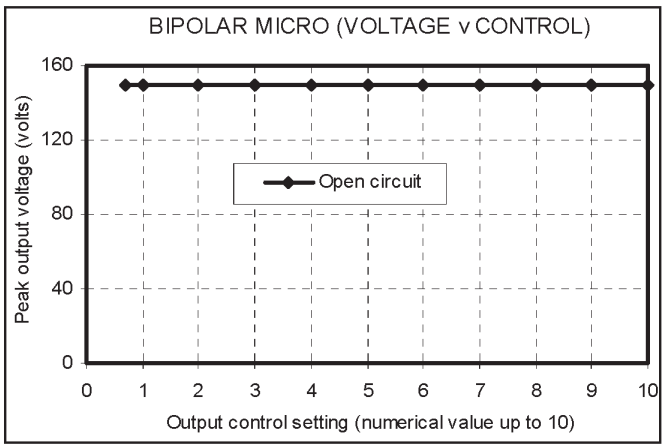
BIPOLAR MICRO DIAGRAMS











6.0 MAINTENANCE

ROUTINE CHECK

6.1 Routine checking should be limited to external checks of the unit, and must include all accessories and cables. Routine checks detailed in the 'Instructions for use' (see Section 1, Related Technical Publications') must be carried out each time the unit is used.

SYSTEMS CHECK

6.2 The systems check detailed in the 'Instructions for use' should be carried out before the unit is used for the first time and after every service or maintenance procedure. In addition the systems check should involve verification of the performance of the unit relative to the information under Performance Checks (sections 6.27 through to 6.34). This should be done at least every six months. Also see the section 'Short circuit test'.

CLEANING DISINFECTION AND CARE

6.3 Consult the 'Instructions for use' for cleaning disinfection and care instructions.

ACCESS FOR MAINTENANCE

WARNING

When the equipment cover is removed potentially dangerous voltages are exposed.

CAUTION

Before removing a board, disconnect plug from socket P1 on mains transformer board (see 22, parts list 1) and wait for five minutes to allow mains storage capacitor (12, parts list 1) to discharge.

CAUTION

This equipment contains 'static sensitive devices', during maintenance appropriate handling precautions should be followed at all times.

6.4 Before gaining access inside the unit switch off the mains supply and remove the mains lead.

Top cover

6.5 To remove the top cover turn the unit over and remove the two cover retaining screws located in the base recesses near the two rear feet. Carefully turn the unit back onto its feet and lift the rear of the top cover up and then backwards releasing it from the front panel. To replace the cover reverse this procedure.

Front panel

6.6 To release the front panel first remove the top cover (see 6.5) and then the two screws at the bottom rear edge of the front panel moulding (see 18 parts list 4) and finally remove the two screws from inside the unit (see 15 parts list 4) that hold the front cover to the base moulding. To finally release the front panel unplug all cables from the internal electronics noting their locations.

Rear panel

6.7 To remove the rear panel in the easiest manner use the sequence that follows:-

i Release the two brackets (5, parts list 1) holding the power amplifier board (1, parts list 4) in place.
ii Release the two leads plugged into the top of the power amplifier board and carefully remove the power amplifier board from the unit by releasing it from its mother board connection.
iii Unplug the lead from the back panel where it plugs into the transformer socket and release the earth connection from the back panel to the chassis plate.
iii Release the rear panel connection to the mother board and then lift the rear panel up and out of its location in the base moulding.

To replace the rear panel reverse the above sequence and check all leads have been connected.

REMOVAL AND INSTALLATION

Circuit board removal (except crowbar)

6.8 To remove any circuit board remove the top cover as detailed in section 6.5. The large power amplifier board is removed as detailed in 6.7 parts i and ii, all other boards (except the crowbar board, see section 6.9) can be removed from the mother board after removing both PCB clamps (4, parts list 1) fitted to the top of the PCB card guides (1, parts list 3).

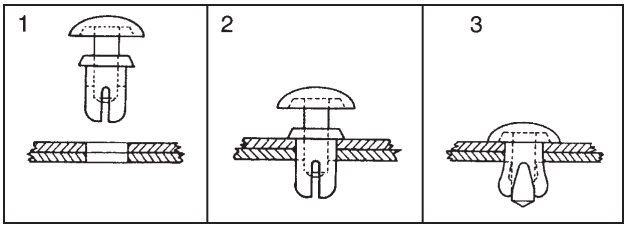
Crowbar board removal

6.9 The crowbar board, situated between the Power control (monopolar) board and the Bipolar board, can only be removed after first removing both of these boards from the unit. Once access has been made to the crowbar board the retaining rivet through the bracket and crowbar board should be removed (not the rivet through the bracket and the mother board) see the 'Rivet removal/replacement' section that follows. Finally remove the crowbar board from the mother board.

Rivet removal/replacement (crowbar board)

6.10 To remove the rivet pull up the plunger head (see 2 below) taking care not to damage rivet head, pull rivet out from bracket (see 1 below). To replace the rivet align the holes in board and bracket (see 1 below), place rivet into

hole so that the shoulder of the rivet shaft is flush with the outer cover face (see 2 below), press rivet plunger head until flush with cover surface (see 3 below).



Circuit board replacement

6.11 All boards incorporate anti-confusion plug and socket connections, otherwise replacing boards is self-evident, but ensure that any disconnected cables are correctly connected. When replacing the crowbar board ensure the rivet is replaced as detailed in section 6.10. Ensure all PCB clips and clamps are replaced after installation

SUPPLY FAULTS

6.12 When the unit is switched 'on', the green 'mains' pilot lamp in the switch should come 'on'. If no pilot lamps come 'on' check the mains fuses on the rear panel (Fig. 1 item 41). If fuses are satisfactory, check fuse in mains supply plug and if this is satisfactory, check that electrical supply is available.

Fuse Renewal (Fig. 1 item 41)

6.13 To fit a new fuse:

i Ensure unit is disconnected from mains electrical supply.
ii Remove fuse retainer and fuse.
iii Fit new fuse of correct type and rating (see unit back panel).

If the fuse repeatedly fails, either when the unit is switched 'on' or during use, call Eschmann Equipment After Sales Service Department (see inside front cover) or the hospital engineer.

FAULT FINDING

6.14 If the equipment malfunctions, first check accessories and cables by substitution before doing further checks.

Alarms

6.15 All alarm conditions are indicated by an audible two-tone alarm and an error indication on the front panel. The alarm symbols are detailed in the Technical data section with additional information in the 'Safety notes and alarms' section of the 'Instructions for use'. The 'Instructions for use' also provide details of alarm conditions, identification and remedies but for ease of reference the remedies are repeated below:

Alarm remedies

6.16 If the PCM circuit has been activated:

(i) Check plate electrode is connected to unit.
(ii) Check plate electrode and cable for condition, if faulty, substitute new plate electrode and/or cable. This procedure should normally be carried out before plate electrode is attached to patient.

6.17 If the PAM circuit has been activated:

(i) If a divided plate cable and divided plate electrode are being used check that the divided plate electrode is making good contact with the patient's body.
(ii) Check plate electrode and cable for condition, if faulty, substitute new plate electrode and/or cable. This procedure should normally be carried out before plate electrode is attached to patient.

6.18 If the PEM circuit has been activated:

(i) Check for accidental direct contact between patient and an earthed object, (drip stand or conductive part of operation table).
(ii) If applicable disconnect suspect ECG electrodes. **Note:** An activated PEM alarm will be reset by removing the earth path and reactivating a monopolar footswitch or fingerswitch.

6.19 If the  circuit has been activated:

(i) The alarm will operate if the bipolar pneumatic footswitch and the bipolar electrical footswitch are pressed simultaneously. The alarm will also sound if both the cut and coag footswitches, or if one of the two footswitches and a fingerswitch button are pressed simultaneously for USER 1, or if both fingerswitch buttons are pressed for USER 1 or USER 2. The circuit will automatically reset when ALL activations stop from ALL switches. This is an important safety feature and applies to any combination of footswitch and fingerswitch.

6.20 If the EPM circuit has been activated:

(i) Because the EPM alarm cannot be reset by the User, if unit EPM alarm activates as soon as output is activated, Eschmann Equipment should be contacted.

6.21 If the PVM circuit has been activated:

(i) If unit PVM alarm activates check for accidental direct contact between the active electrode and an earthed object.
(ii) Check that the plate electrode is correctly attached to the patient's body.

Note: An activated PVM alarm will automatically be reset by releasing a depressed footswitch or fingerswitch.

If none of the above remedies stop the alarm activated, or the (**!**) alarm is activated contact Eschmann Equipment and do not use the unit.

EXTENDER BOARD (Fig. 2)

WARNING

When the extender board is used in the monopolar power control position, high voltages are exposed and extreme care must be taken.

6.22 To facilitate testing and servicing of boards on the mother board, Eschmann have produced a special-to-type extender board (Part No. 711367). The board has separate pins located below the 96-way socket, allowing easy connection of measuring equipment.

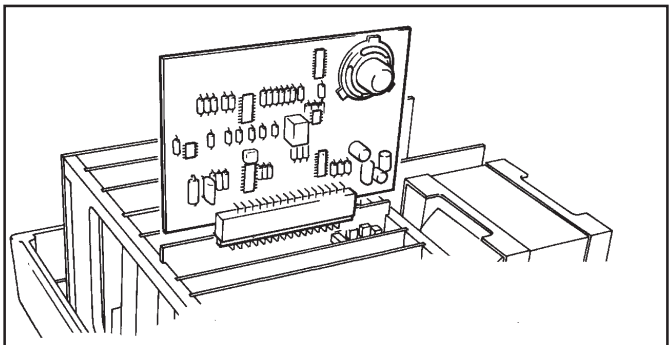


Fig. 2 Using the extender board

6.23 Three LEDs on the board indicate healthy logic supply rails. The left hand LED indicates -15Vd.c. and just comes 'on' at -14Vd.c. The centre LED indicates +15Vd.c. and just comes 'on' at +14Vd.c., while the right hand LED indicates +5Vd.c., and just comes 'on' at +4Vd.c.

6.24 When it is necessary to test a board, disconnect plug from socket P1 on mains transformer board (see 22, parts list 1) and wait for five minutes to allow capacitor (12, parts list 1) to discharge. Disconnect/remove the board from the mother board and replace it with the extender board. Plug the removed board into the top of the extender board as shown in Fig. 2. Where applicable, any disconnected cables should be reconnected to the board being serviced.

Note: If testing PCM pcb (item 2, parts list 4), the plug must be reconnected to socket P1 on the mains transformer board. (Running tones and lamps will not be enabled with P1 disconnected).

FREQUENCY OF CALIBRATION

6.25 Calibration need only involve verification of the performance of the unit relative to the information under Performance Checks (sections 6.25 through 6.33). This should be carried out at least every six months.

PERFORMANCE CHECKS

General

6.26 Unless otherwise stated, errors found in the output waveforms and the current readings measured will indicate a fault in the unit and will probably need the attendance of a service engineer.

Output Waveform Timings

6.27 The following equipment will be needed:

- Oscilloscope with timebase resolution to at least 10 nanoseconds.
- Current probe or inductive pick-up loop attached to the oscilloscope.
- Eschmann ETS3 test set.

Note: The Eschmann ETS3 test set should be used for routine power output checking. When set for monopolar power output, the test load is 200 or 400 ohms and the power output can be read directly from the outer scale of the appropriate meter. This value can be compared with the value derived from the relevant monopolar power graph and should be within the limits required by EN60601-1:1990 and IEC60601-2-2:1998. For bipolar power measurement the test load is 100 ohms.

Instructions for use, and connections are given in the test set lid.

Do not use test sets ETS1 or ETS2 as they are not designed for use on the TD830 Electrosurgical unit.

Preparation

6.28 Prepare the equipment as follows:

i Connect ETS3 test set to the unit with appropriate load and meter as required by each waveform diagram (Figs. 3, 4 and 5).

ii Connect probe, or inductive pick-up loop to the plate connecting wire.

iii Adjust oscilloscope to give, as near as possible, the waveforms shown in each diagram with the power at setting 5 on the power control. Do not exceed duty cycle of the unit or the test set.

Timing Measurements

6.29 Follow the instructions on the ETS3 test set, and check the timing measurements given on Figs. 3 and 4 (monopolar) and Fig. 5 (bipolar) against the information given in Table 1.

Monopolar Output Current

6.30 The maximum currents into 200 ohms for the monopolar outputs should be checked using the ETS3 test set. The instructions for connection to the test set are on the inside of the test set lid.

Mode	Limits
Normal cut	1.06 to 1.22 A
Blend	1.10 to 1.34 A
Specialist cut	1.18 to 1.32 A
Pinpoint coag	0.77 to 0.95 A
Spray coag	0.57 to 0.69 A

If the readings for these currents are out of specification, contact the Eschmann Equipment After Sales Service Department.

Specialist Cut Boost Check

6.31 Set the oscilloscope timebase to 100ms per division. Connect the oscilloscope and current probe to the plate connecting wire on the ETS3 test set, and set the test box for a 200 ohm load and 1.5A meter. Set the output mode on the unit to specialist cut, and the output level to 5. Enable the output and observe that the amplitude of the pulses is initially increased for about 300 milliseconds before settling to a continuous lower 'normal' level.

Monopolar Current Limit Check

6.32 Connect the ETS3 test set the unit to as follows:

ETS3 Socket	Connect to
1	Earth (footswitch plug)
2	Plate and socket 4 on ETS3
3	Not connected
4	Socket 2 on ETS3
5	Not connected
6	Not connected
7	Active from TD830

These connections connect a 100Ω load, and a 1.5A meter across the output.

6.33 Ensure that the unit is at normal operating temperatures and check that the currents are:

Mode	Limits
Normal cut	1.11 to 1.36A
Blend	0.97 to 1.18A
Specialist cut	1.27 to 1.56A
Pinpoint coag	0.89 to 1.10A
Spray coag	0.77 to 0.94A

Bipolar Output Current

6.34 The bipolar output currents should be checked using an ETS3 test set connected as instructed for bipolar measurements.

Mode and Power Level	Limits
50W setting 10	0.63 to 0.77A
50W setting 5.5	0.46 to 0.57A
15W setting 10	0.36 to 0.44A

If any of the above readings do not come within the limits contact Eschmann Equipment After Sales Service Department.

ACTIVE RELAY FUNCTION TEST

6.35 It is important to carry out a check for a possible short circuit of the relays on the active monopolar patient interface board every six months. This test is performed as detailed in the following sections.

6.36 Fit a 200ohm resistor and a 250mA ammeter in series between the plate socket and the monopolar 1 active 4mm output socket. Energise in turn the other two monopolar outputs (monopolar 2 active 4mm socket and Bovie type active 8mm socket) in open circuit at maximum power display level in spray coag, normal cut and specialist cut.

6.37 Confirm that the current does not exceed 150mA in any of these conditions. Repeat this test with the ammeter connected to the monopolar 2 active 4mm socket and the to the Bovie type active socket. Do not use the unit if it fails this test.

NOTE: In order to energise the Bovie type active 8mm socket it is necessary to insert an 8mm plug. In order to energise the adjacent monopolar 1 active 4mm output socket it is necessary to ensure that there is not an 8mm plug inserted into the Bovie type active 8mm socket.

SET UP OVERVIEW

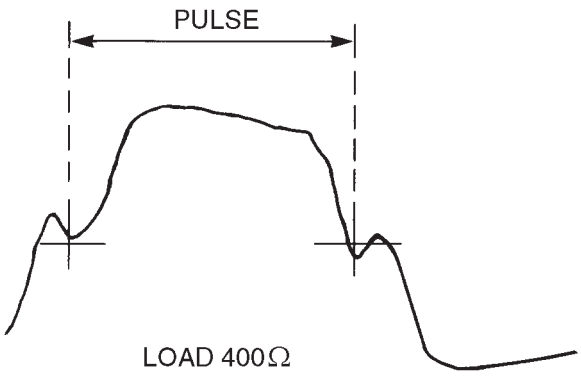
6.38 The information given in Table 2 gives an easy guide for set up of the TD830 Electrosurgical unit by an Eschmann trained engineer and cannot be used without the test criteria or properly calibrated test equipment.

SYSTEM DIAGRAM

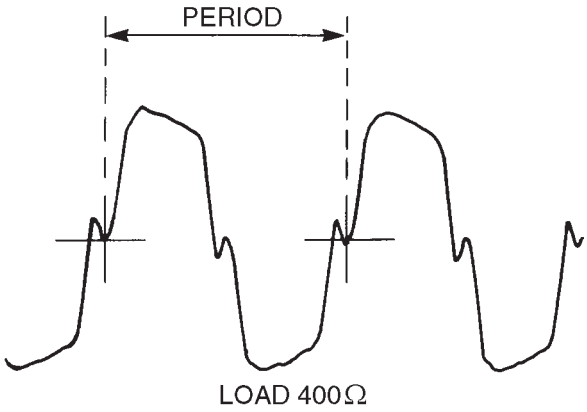
6.39 The system diagram is shown in Fig. 6.

Table 1 Monopolar And Bipolar Timing Measurements

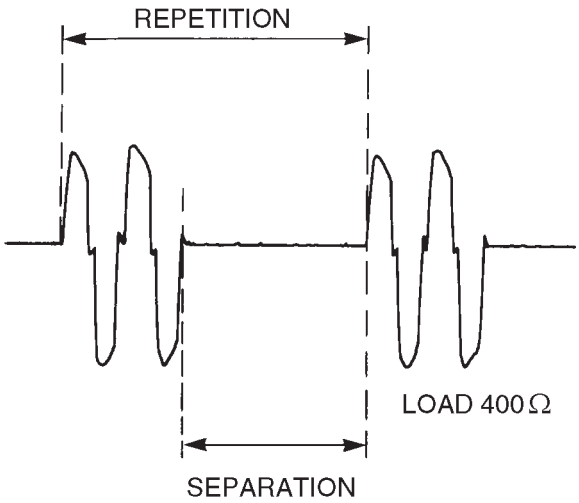
Monopolar Measurement		Function	Figure	Timing
1	Pulse width	Normal cut, blend, pinpoint coag	3A	0.90 to 0.98 µsec
2	Carrier frequency period	Normal cut, blend, pinpoint coag	3B	2.05 to 2.25 µsec
3	Pulse group separation	Blend	3C	6.1 to 6.5 µsec
4	Pulse group repetition	Blend	3C	10.0 to 10.8 µsec
5	Pulse group separation	Pinpoint coag	3D	13.0 to 14.2 µsec
6	Identical pulse group repetition	Pinpoint coag	3D	33.0 to 35.0 µsec
7	Pulse width	Specialist cut	4E	0.56 to 0.64 µsec
8	Carrier frequency period	Specialist cut	4F	2.05 to 2.25 µsec
9	Pulse width	Spray coag	4G	1.13 to 1.43 µsec
10	Pulse repetition	Spray coag	4H	32.0 to 34.0 µsec
Bipolar Measurement		**Function**	**Figure**	**Timing**
1	Pulse width	Macro / Micro power	5A	0.61 to 0.65 µsec
2	Carrier frequency period	Macro / Micro power	5B	1.2 to 1.43 µsec
3	Pulse group repetition	Macro / Micro power	5C	39.0 to 43.0 µsec
4	Minimum pulse group length	Macro / Micro power	5D	1.2 to 1.43 µsec
5	Maximum pulse group length	Macro / Micro power	5E	34.0 to 37.0 µsec
6	Half power pulse group length	Macro / Micro power	5F	9.0 to 15.0 µsec



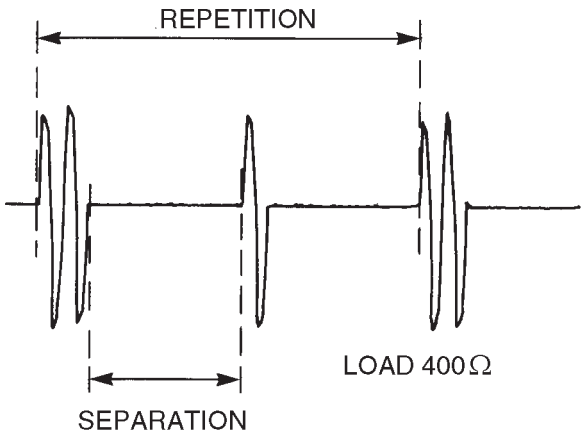
A. Pulse Width for Normal Cut, Blend and Pinpoint Coag



B. Carrier Frequency Period for Normal Cut, Blend and Pinpoint Coag

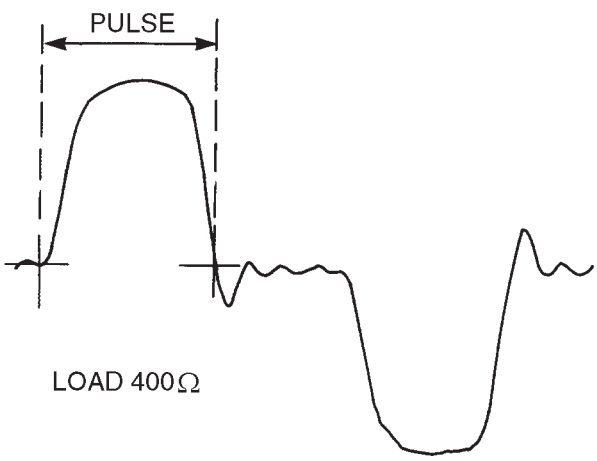


C. Pulse Group Separation and Repetition for Blend

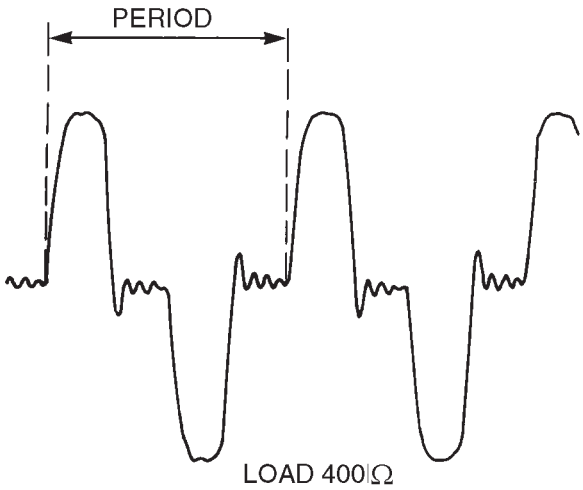


D. Pulse Group Separation and Repetition for Pinpoint Coag

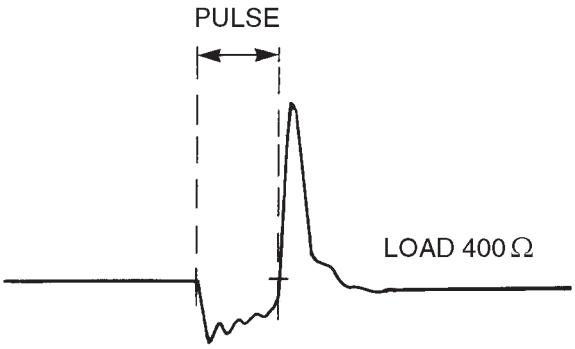
Fig. 3 Waveforms for Monopolar Mode (part 1)



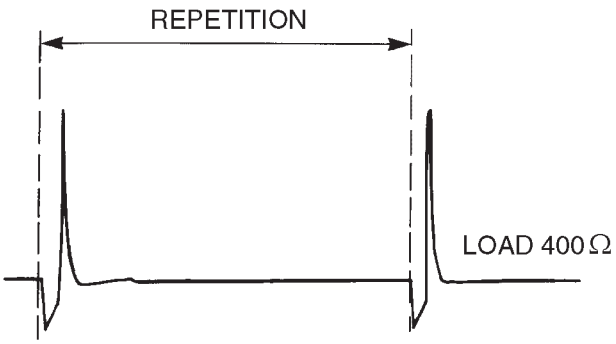
E. Pulse Width for Specialist Cut



F. Carrier Frequency Period for Specialist Cut

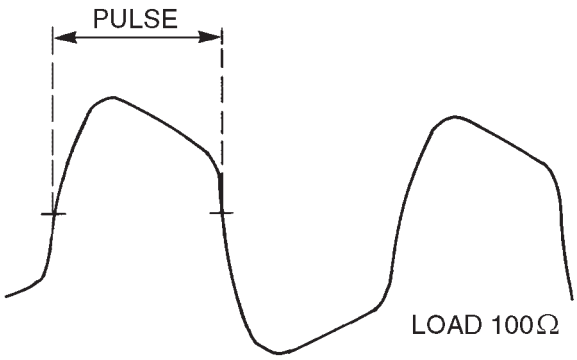


G. Pulse Width for Spray Coag

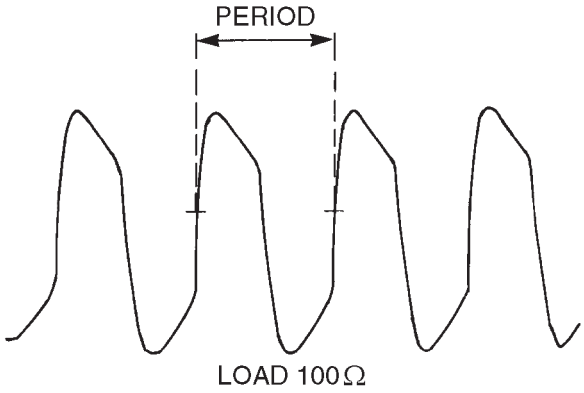


H. Pulse Repetition for Spray Coag

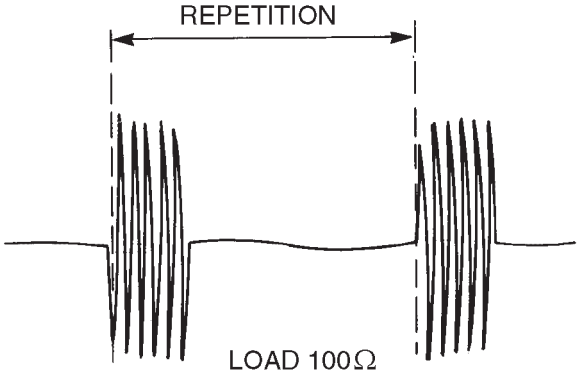
Fig. 4 Wave forms for Monopolar Mode(part 2)



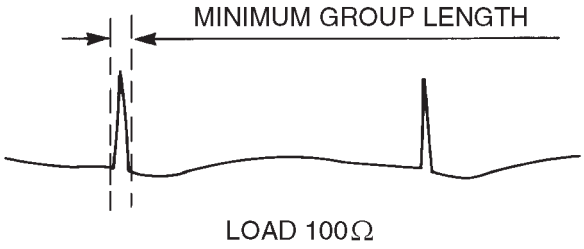
A. Bipolar Pulse Width



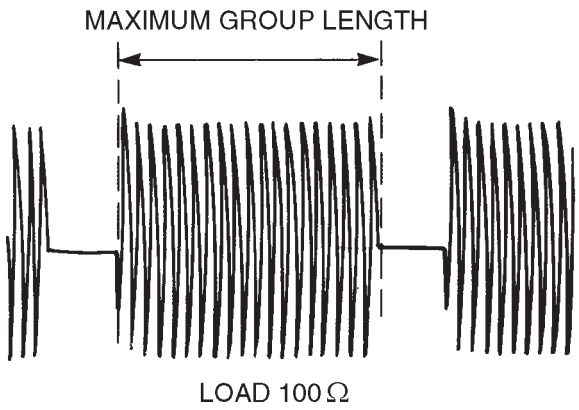
B. Bipolar Carrier Frequency Period



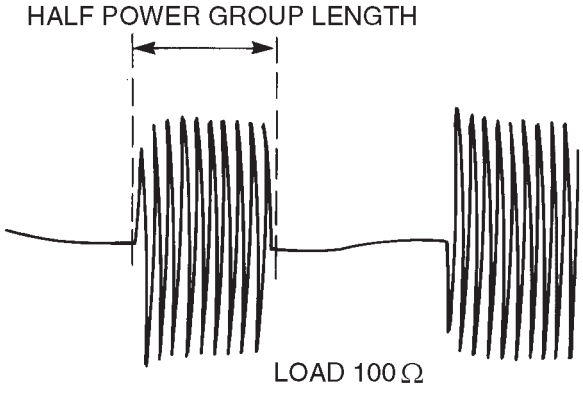
C. Bipolar Group Repetition



D. Bipolar Minimum Group Length



E. Bipolar Maximum Pulse Length



F. Bipolar Half Power Group Length

Fig. 5 Waveforms for Bipolar Mode

TABLE 2 - TD830 SET UP OVERVIEW

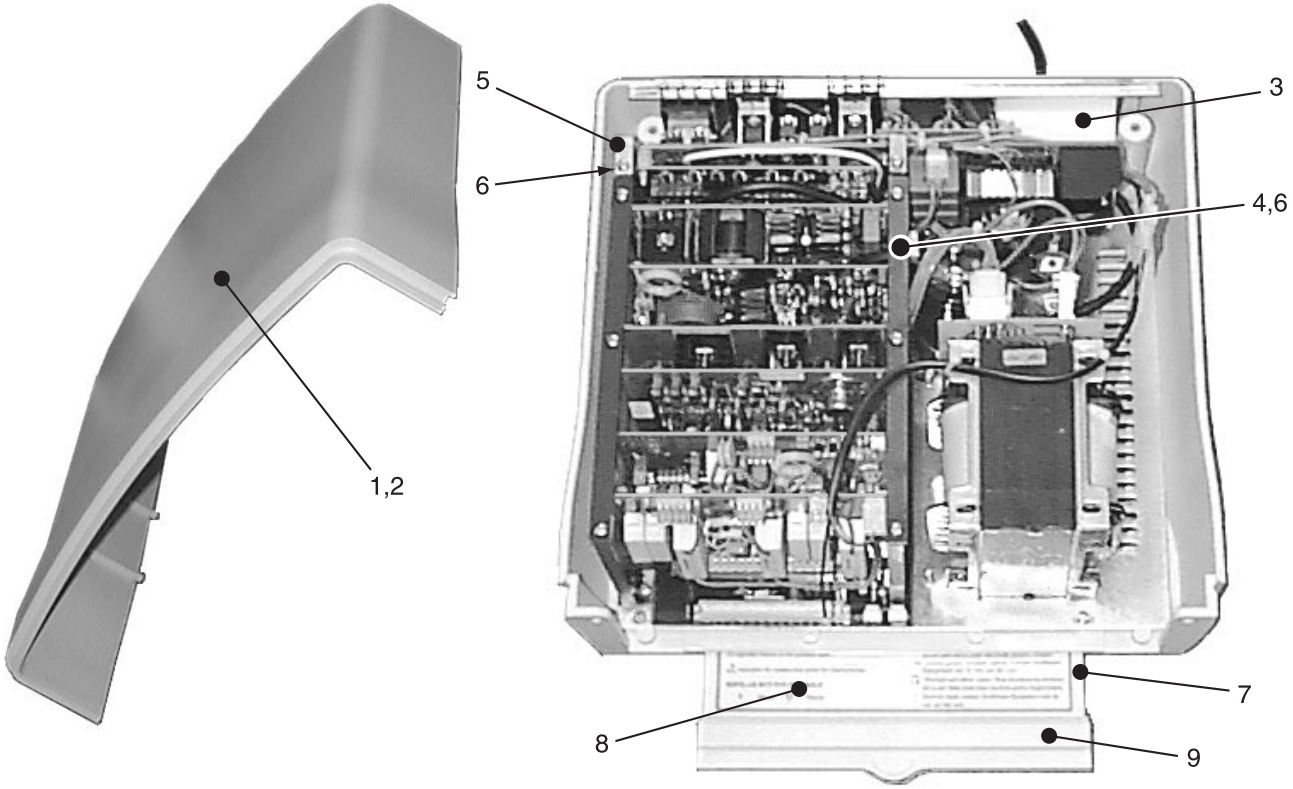
FUNCTION	CONDITIONS OF SET UP	TEST TARGET	POT / BOARD
CUT POWER	400Ω load	173 watt (0.66Amp)	VR2 / PCM
SPEC POWER	400Ω load	253 watt (0.79Amp)	VR4 / PCM
BLEND POWER	400Ω load	191 watt (0.69Amp)	VR3 / PCM
PINPOINT POWER	400Ω load	101 watt (0.50Amp)	VR5 / PCM
SPRAY POWER	400Ω load	75 watt (0.43Amp)	VR6 / PCM
CUT CURRENT LIMIT	100Ω load	1.22 Amp	VR11 / LAP
SPEC CURRENT LIMIT	100Ω load	1.38 Amp	VR9 / LAP
BLEND CURRENT LIMIT	100Ω load	1.07 Amp	VR12 / LAP
PINPOINT CURRENT LIMIT	100Ω load	0.99 Amp	VR13 / LAP
SPRAY CURRENT LIMIT	100Ω load	0.86 Amp	VR10 / LAP
BIPOLAR CURRENT LIMIT	100Ω load Full power	0.71 Amp	VR2 / BIP
MULTIPLIER DC OFFSET	No power	<20mV	VR1 / BIP
MACRO EXCESS THRESHOLD	50watt 100Ω load		VR3 / BIP
MICRO EXCESS THRESHOLD	20watt 100Ω load		VR4 / BIP
PVM THRESHOLD	400Ω, Full power spec cut, short active.	0.32Amp	RV2 / PIA Plate.
PEM THRESHOLD	220Ω load to ground on. 270Ω off		RV3 / PIA Plate.
PAM THRESHOLD	120Ω Alarm off. 130Ω Alarm on		RV4 / PIA Plate.
PCM THRESHOLD	900Ω Alarm on	200mV	RV5 / PIA Plate.
FINGER SWITCH OSCILLATOR	TP9	40-50KHz	RV1 / PIA Active.

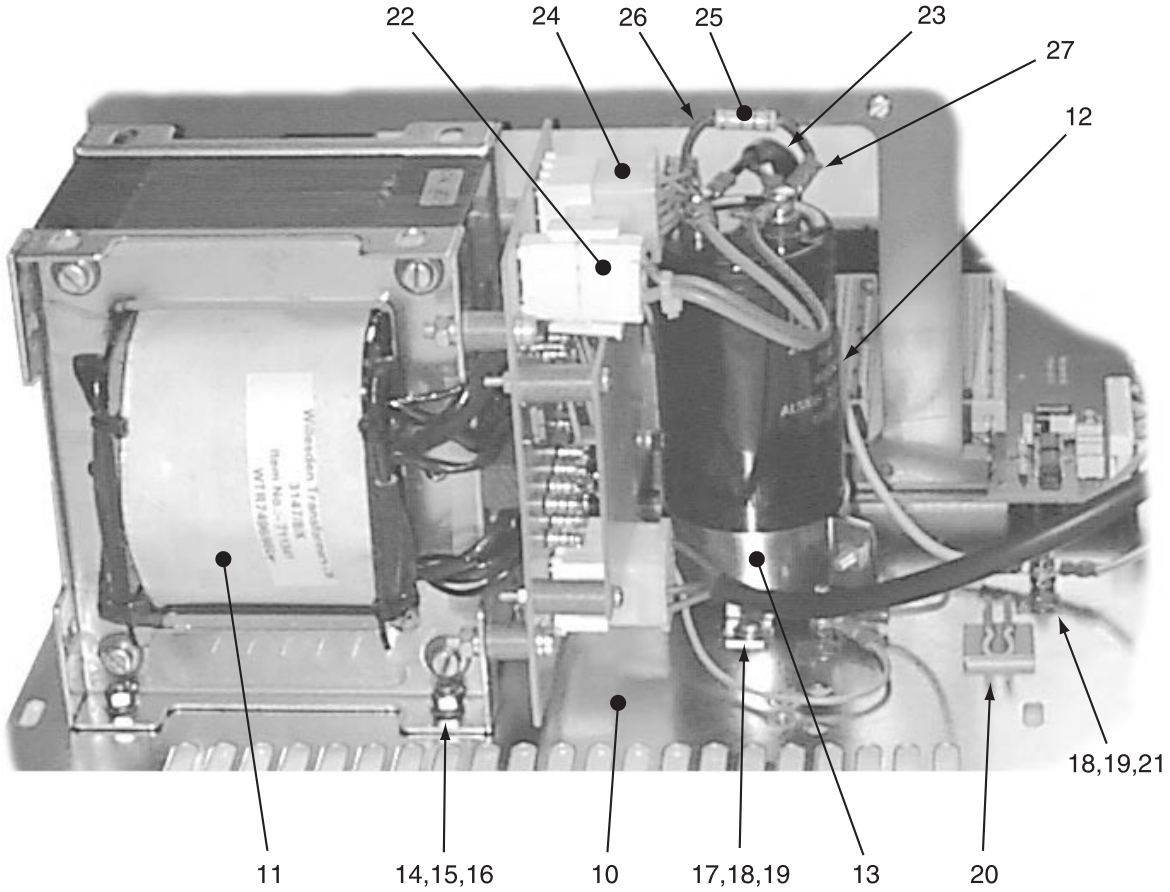
TABLE 2 (CONTINUED) - TD830 SET UP OVERVIEW

MONO MULTIPLIER DC OFFSET	No power	<20mV	VR15 / LAP
SPRAY EXCESS THRESHOLD			VR17 / LAP
PINPOINT EXCESS THRESHOLD			VR14 / LAP
BLEND EXCESS THRESHOLD			VR18 / LAP
SPEC CUT EXCESS THRESHOLD			VR16 / LAP
CUT EXCESS THRESHOLD			VR19 / LAP
SPRAY THRESHOLD	2KΩ load off, 2K7Ω load on		VR21 / LAP
CUT THRESHOLD	9KΩ load off, 11KΩ load on		VR22 / LAP
LEAKAGE LEVEL.	Leakage to ground.	75mA (<100mA).	VR20 / LAP
DISPLAY 0-15V CONTROL		0.1 below maximum	VR1 / DISPLAY
GROUP SEPARATION FOR PINPOINT COAG			VR1 / LAP
GROUP SEPARATION FOR BLEND			VR2 / LAP
PULSE WIDTH FOR CUT			VR3 / LAP
PULSE WIDTH FOR SPECIALIST CUT			VR4 / LAP
OFF TIME FOR CUT, BLEND & PINPOINT			VR5 / LAP
OFF TIME FOR SPECIALIST CUT			VR6 / LAP
PULSE SEPARATION FOR SPRAY			VR7 / LAP
PULSE WIDTH FOR SPRAY COAG			VR8 / LAP
TONE BALANCE	No tones on	TP1 at 12V	RV1 / TONE
CUT TONE		950Hz	RV3 / TONE
COAG TONE		800Hz	RV4 / TONE
BIPOLAR TONE		730Hz	RV5 / TONE

7. ILLUSTRATED PARTS LISTS

Illustrated parts list 1

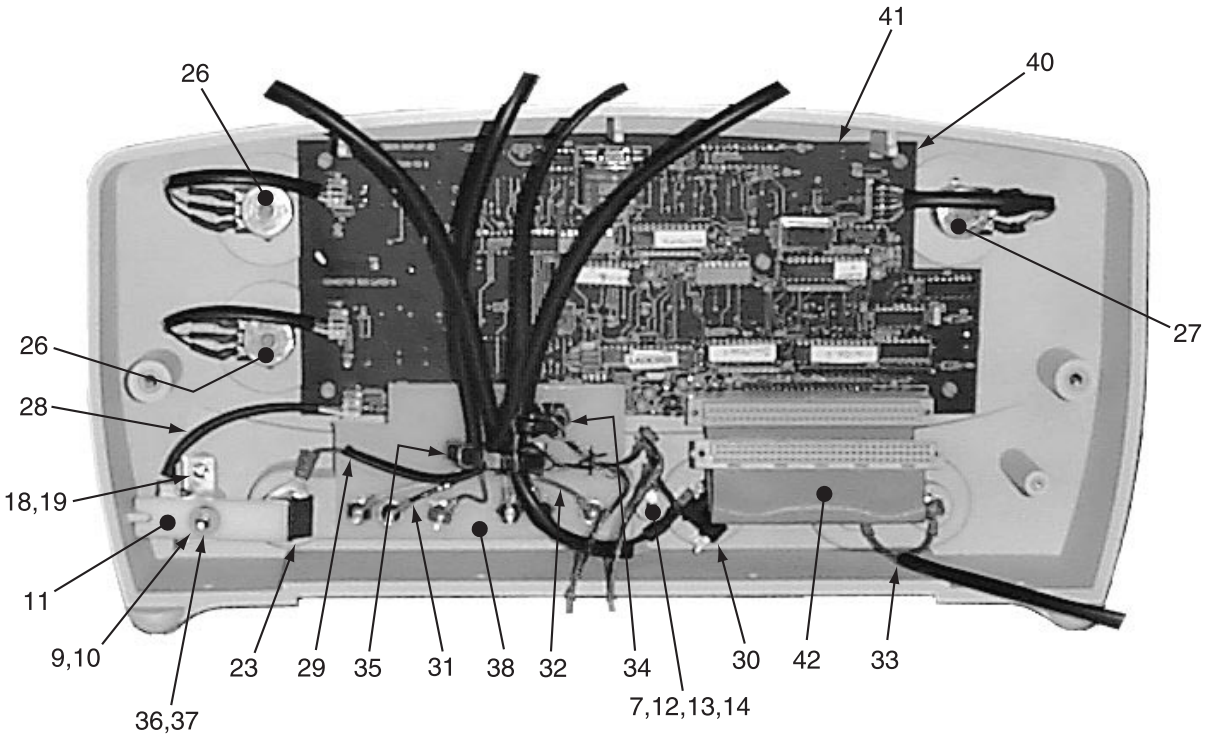


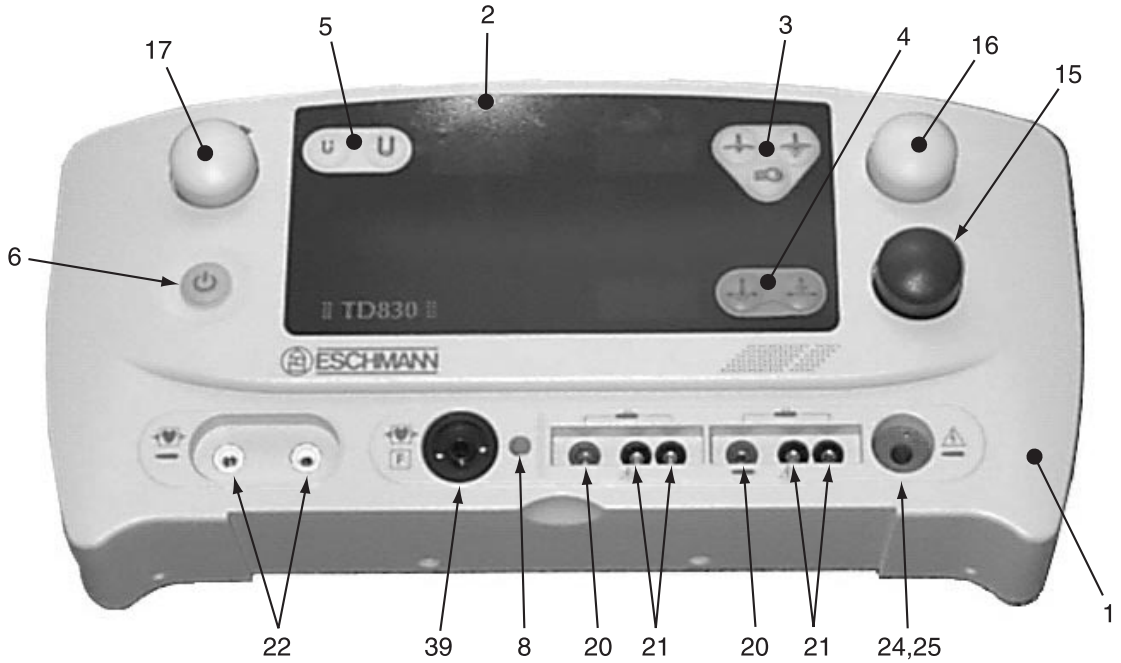


Item No.	Description	Part No.	Qty.	Spares Qty. #
1	Top moulding	715101	1	–
2	M6 x 50mm, socket head screw	710159	2	–
3	Cover insulation mains inlet	715257	1	–
4	PCB clamp	715322	2	–
5	Securing bracket	745340	2	–
6	No. 8 x 3/8" self tapping screw	707402	8	–
7	Support card for basic user guide	715108	1	–
8	Basic user guide, language dependent as below:			
	English	715264	1	–
	or French	715265	1	–
	or Spanish	715268	1	–
	or Italian	715266	1	–
	or Greek	715269	1	–
	or Portuguese	715267	1	–
9	Handle	715109	1	–
*	Chassis sub assembly	715301	1	–
10	• Chassis plate	715103	1	–
11	• Transformer	711341	1	–
12	• Capacitor 2200µF	745331	1	–
13	• Capacitor clamp	697605	1	–
14	• M5 x 10mm socket cap head screw	710270	4	–
15	• M5 chimney nut (Note: M5 nut illustrated)	715271	4	–
16	• M5 shakeproof washer	710733	4	–
17	• M4 x 8mm socket cap head screw	710215	3	–
18	• M4 washer	710700	3	–
19	• M4 shakeproof washer	710732	5	–
*	• Earth symbol label	604994	3	–
20	• Clip board guide KKU-4	745338	1	–
21	• M4 nut	710821	6	–
*	• Chassis lead kit	715330	1	–
22	• • Capacitor to transformer Lead S/A	711346	1	–
23	• • Capacitor to mother board Lead S/A	715215	1	–
24	• • Transformer to mother board Lead S/A	715214	1	–
*	• • Resistor sub-assembly	715362	1	–
25	• • • Resistor 10Kohm	715363	1	–
26	• • • Sleeve	696541	2	–
27	• • • M4 ring crimp	697300	2	–

S/A = Sub-assembly
* = not identified on illustrations (sub-assembly or self evident)

Illustrated parts list 2





Item No.	Description	Part No.	Qty.	Spares Qty. #
*	Front panel sub-assembly	715302	1	–
1	• Front moulding	715102	1	–
2	• Window	715113	1	–
*	• Rubber buttons - set of 4	715114	1	–
3	• • Rubber button Cut	715115	1	–
4	• • Rubber button Coag	715116	1	–
5	• • Rubber button Micro/Macro	715123	1	–
6	• • Rubber button standby On/Off	714124	1	–

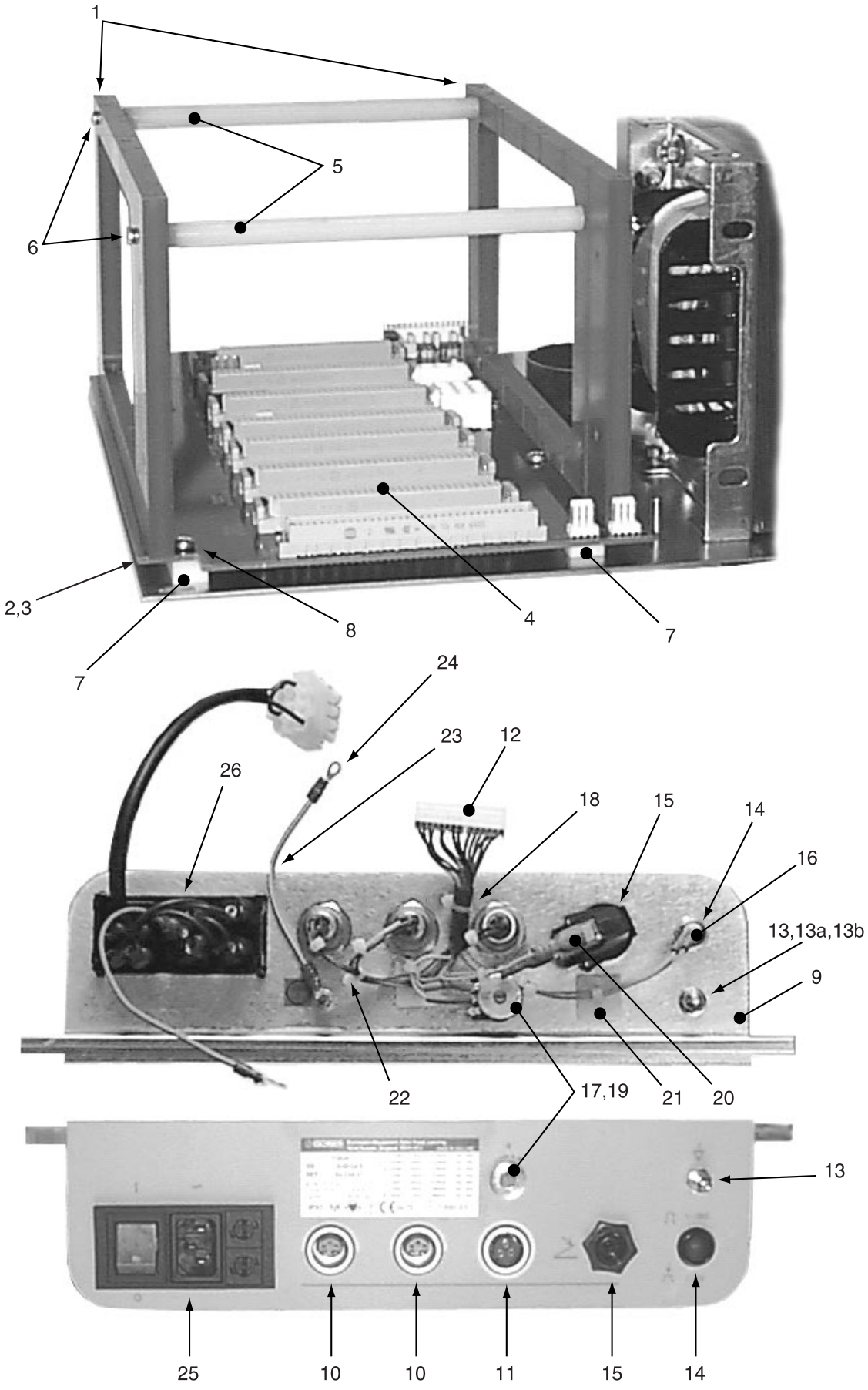
Item No.	Description	Part No.	Qty.	Spares Qty. #
7	• S Lead plug	715091	1	–
8	• S Lead cover button	715118	1	–
9	• Skiffy washer	715252	1	–
10	• Spring	715107	1	–
11	• Lever 715106	1	–	
12	• M2 plain washer	709864	2	–
13	• M2 shakeproof washer	710735	2	–
14	• M2 nut	710838	2	–
15	• Knob - Blue	715110	1	–
16	• Knob - Yellow	715111	1	–
17	• Knob - Ice Blue	715112	1	–
18	• M3 x 6mm socket button head screw	710590	2	–
19	• M3 shakeproof washer	710734	2	–
20	• 4mm Socket - Red	715359**	2	–
21	• 4mm Socket - Black	715360**	4	–
22	• 4mm Socket - White	715361**	2	–
23	• Bovie spring contact	713900	1	–
24	• Bovie socket sleeve	713898	1	1
25	• Bovie socket nut	713901	2	–
*	• Lead/Control kit	715276	1	–
26	• • Single gang potentiometer S/A	715245	2	–
27	• • Dual gang potentiometer S/A	715246	1	–
28	• • Bovie switch S/A	715217	1	–
29	• • Bovie active lead S/A	715236	1	–
*	• • Output lead S/A (also see parts list 4)	715258	1	–
30	• • Plate lead S/A	715240	1	1
31	• • Fingerswitch lead S/A	715238	1	–
32	• • Fingerswitch & active lead S/A	715237	1	–
33	• • Bipolar output lead S/A	715239	1	–
34	• • Current sense transformer S/A	715248	1	–
35	• • Leakage sense transformer S/A	715260	1	–
36	• M3 nyloc nut	710390	1	–
37	• M3 x 35mm stud	715256	1	–
38	• Support plate	715242	1	–
*	• Cable ties	695776	3	–
39	• Plate socket nut	711917	1	1
40	• Screw thumb slotted M3	715263	6	–
41	• Front panel PCB S/A	715207	1	–
42	• 64-Way ribbon cable	715235	1	–

S/A = Sub-assembly

* = not identified on illustrations (sub-assembly or self evident)

** These original sockets are no longer available and have been replaced by the following, 715359 now 715391, 715360 now 715392 and 715361 now 715393. The new sockets require soldering to the looms. If the existing loom has ferrules fitted these should be removed to allow soldering, alternatively new looms without ferrules should be used. Ensure on assembly that the looms are replaced within items 34 and 35 above as found.

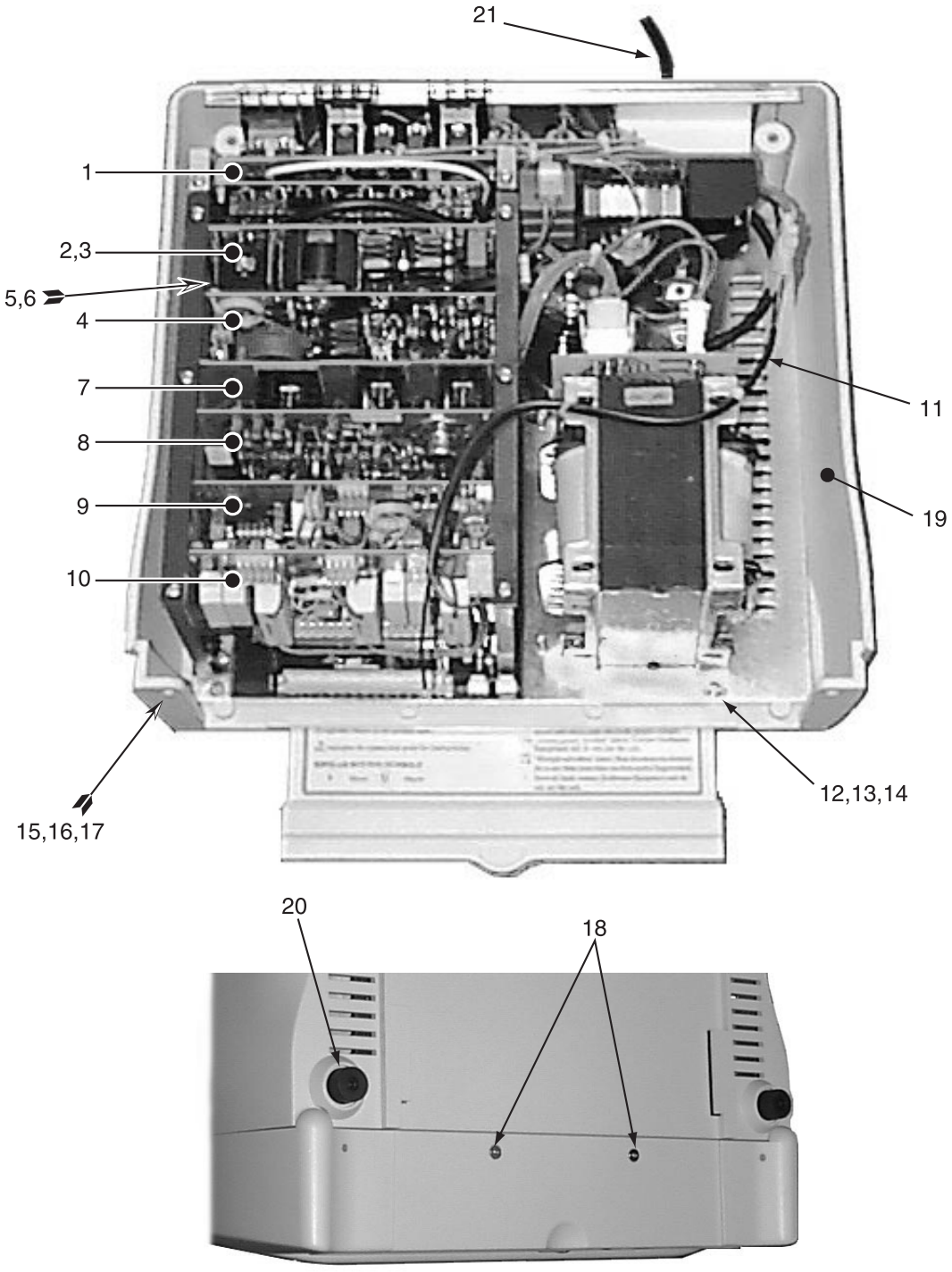
Illustrated parts list 3



Item No.	Description	Part No.	Qty.	Spares Qty. #
*	Cardframe sub-assembly	715255	1	–
1	• Card guide	715213	2	–
2	• No. 8 x 3/8" self tapping screw	707402	6	–
3	• M4 nylon washer	307231	6	–
4	• Mother board sub assembly	715205	1	–
5	• Cardframe spacer	715321	2	–
6	• No. 6 x 3/4" pan head screw	706993	4	–
7	• Mother board spacing strips	711348	2	–
8	• M4 x 16 socket cap head screw	710219	8	–
*	Rear panel sub-assembly	715304	1	–
9	• Rear panel (including graphics overlay)	715104	1	–
10	• 5 Pin Lemo socket	696685	2	1
11	• 3 Pin Lemo socket	696720	1	1
12	• Connector 15-way MTA	715223	1	–
13	• Potential equalization stud	718668	1	–
13a	• M6 nut	710372	1	–
13b	• M6 shakeproof washer	713963	1	–
14	• Range switch	714349	1	–
15	• Air switch panel mount	715270	1	1
16	• Sleeve (small)	715364	12	–
17	• Potentiometer 100ohm	696896	1	–
18	• Sleeve (large)	697395	1	–
19	• Potentiometer mounting kit	697475	1	–
20	• Crimp 0.25" F/M receptacle	695837	2	–
*	• Cable 7/0.2 Orange	695889	A/R	–
*	• Cable 7/0.2 Red	695890	A/R	–
*	• Cable 7/0.2 Mauve	695891	A/R	–
*	• Cable 7/0.2 White	695892	A/R	–
*	• Cable 7/0.2 Yellow	695893	A/R	–
*	• Cable 7/0.2 Grey	695906	A/R	–
*	• Cable 7/0.2 Pink	695907	A/R	–
*	• Cable 7/0.2 Red/White	695908	A/R	–
*	• Cable 7/0.2 Red/Yellow	696000	A/R	–
*	• Cable 7/0.2 Red/Blue	696001	A/R	–
21	• Cable tie base	695437	3	–
22	• Cable tie	695776	12	–
23	• Cable 24/0.2	696113	A/R	–
24	• M4 ring terminal	697300	2	–
25	Mains inlet sub-assembly (voltage dependent, see parts list 4 for fuse details)			
	110V (with 2 x T10A fuse)	715325	1	–
	or 220V (with 2 x T5A fuse)	715326	1	–
	or 230V (with 2 x T5A fuse), CE version	715306	1	–
	or 240V (with 2 x T5A fuse)	715327	1	–

* not identified on illustrations (sub-assembly or self evident)

Illustrated parts list 4



Item No.	Description	Part No.	Qty.	Spares Qty. #
*	Printed circuit board kit	715249	1	–
1	• Power amplifier board	715275	1	–
2	• Power control (monopolar) board (PCM)	715272	1	1
3	• • PCM board fuse, FF5A	713056	1	2
4	• Bipolar board	715222	1	–
5	• Crowbar board		732059	1
–				
6	• • Crowbar board fuse, FF5A	713056	1	2
7	• Power supply board	732061	1	1
8	• Tone generator board	715273	1	–
9	• Bipolar and plate patient interface board	715201	1	–
10	• Monopolar patient interface board	715203	1	–
11	Mother board to amplifier board lead	715216	1	–
12	M4 x 10mm soc. hd. screw	710211	4	–
13	M4 shakeproof washer	710731	4	–
14	M4 plain washer	709861	4	–
15	M6 x 16mm soc. hd. screw	709840	2	–
16	M6 plain washer	709863	2	–
17	M6 shakeproof washer	710736	2	–
18	M4 x 10mm countersunk socket head screw	710221	2	–
19	Base moulding	715100	1	–
20	Base feet	715307	4	–
21	Mains lead , type dependent			
	English	714188	1	–
*	Mains fuse, voltage dependent			
	110V, T10A 696776	2	4	
	or 220V/230V/240V, T5A	696775	2	4

* not identified on illustrations (kit or self evident)

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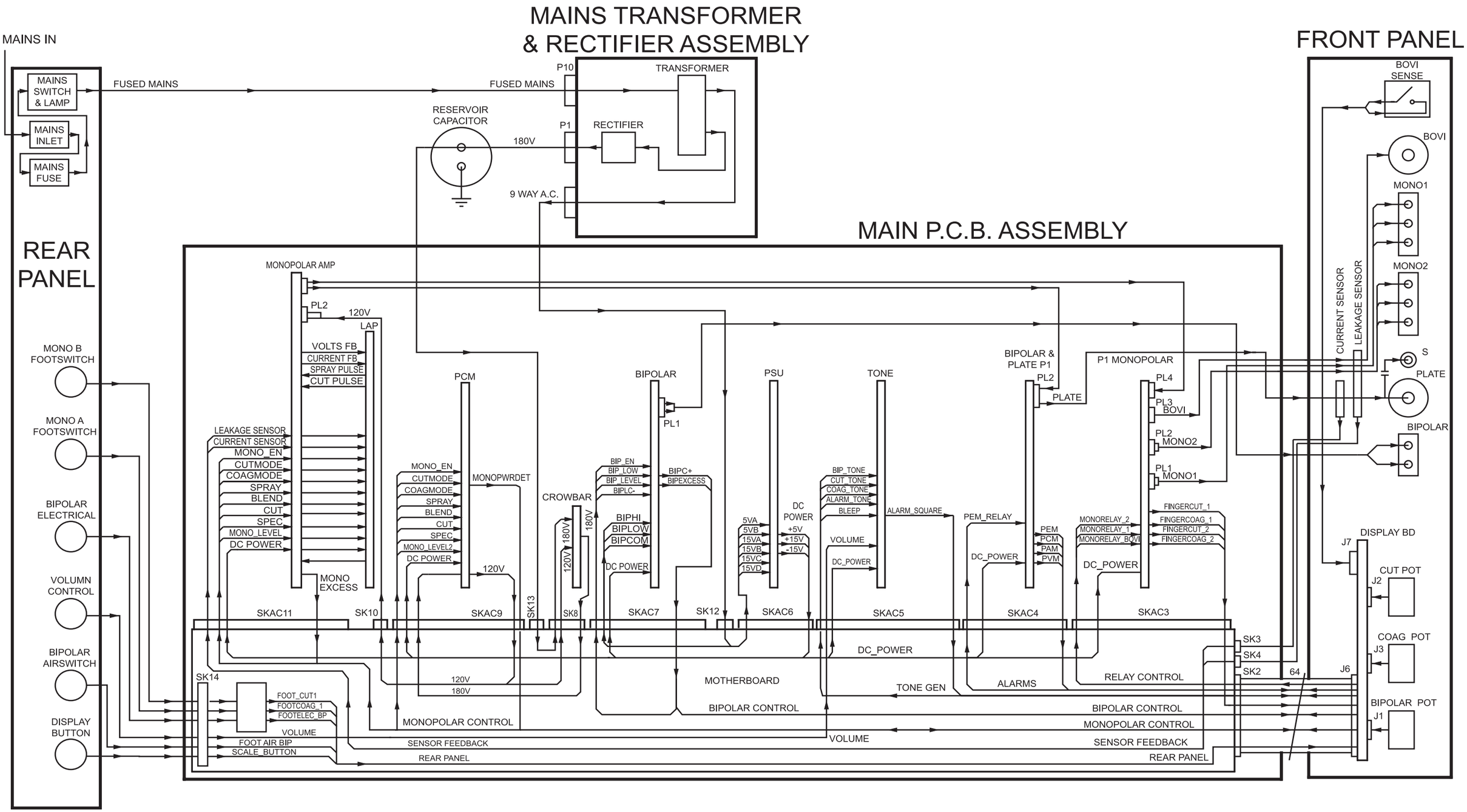

FIG.6 TD830 ELECTROSURGICAL UNIT - SYSTEM DIAGRAM