

THERASONIC 1032

MODEL NO. 50.

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WARRANTY

This Electro-Medical Supplies (Greenham) Ltd,. (hereinafter called the Company) product is warranted against defects in materials and workmanship for a period of one year from the date of shipment. The Company will at its option, repair or replace components which prove to be defective during the Warranty period, provided that the repairs or replacements are carried out by the Company or its approved agents.

The Company will consider itself responsible for the effects on safety, reliability and performance of the product:-

only if assembly operations, re-adjustments, modifications or repairs are carried out by persons authorised by it:

only if the product is used in accordance with the instructions for use:

only if the electrical installation of the relevant room complies with appropriate national requirements.

Should the product be returned to the Company for repair it must be sent carriage paid.

GENERAL INFORMATION

This manual provides the necessary information for the installation, operation and maintenance of the unit.

These instructions must be studied before putting the unit into operation.

The output of this unit could prove to be hazardous to both patient and operator if used contrary to the best physiotherapy practices.

Contra-indications to Ultrasound Therapy

The following list is for guidance only and is by no means exhaustive. If in doubt the patients physician should be consulted.

Ultrasound Therapy should not be given over malignant tumours, over acute infections, over pregnant uterus, over the eyeball, over areas of impaired sensation, over areas of impaired circulation, near areas of thrombosis formation, over sites of radiotherapy.

Extra care should be taken before treating near the eyes, ears or reproductive organs.

Extreme care should be taken treating haemophiliacs.

A patient with an implanted electronic device (e.g. a cardiac pacemaker) should not be treated without the advice and consent of his/her physician.

Standards

The THERASONIC 1032 has been designed to meet the requirements of IEC 601-1:1977 (BS5724:Part 1:1979) "Safety of Medical Electrical Equipment, Part 1:General requirements".

In addition the THERASONIC 1032 has been designed to meet the requirements of I.E.C 601-2-5:1984 (BS5724: Section 2.5:1985) "Specification for safety of ultrasonic therapy equipment".

SPECIFICATION

1032 Ultrasonic Generator - Mains Version

Power input	:	200-240V, 95-120V 50/60Hz.		
Power consumption	:	65W.		
Mains fuses	:	T500mA (5x20 mm)	200-240V	
		T1A (5x20 mm)	95-120V	
Size	:	320x302x125 mm		
Weight	:	2.7 kg.		
Classification	:	Class 1: Type BF. (IEC 601-1:1977)		
Frequency	:	1.1 MHz and 3.3 MHz +/-5%		
Output	:	Both continuous and pulsed output waveforms are available as selected by the front panel. In pulsed mode the output is squarewave modulated.		
Pulse Duration	:	2ms		
Pulse on:off ratio	:	1:2	1:4	1:9
Pulse Repetition Rate	:	166Hz	100Hz	50Hz +/-1%
Temporal Peak/Average intensity ratio	:	3	5	10 +/-20%
Maximum Output Intensity:	:	2.54 Watts per square cm		
Maximum Output Power	:	11.4 W at 1MHz with large applicator		
Timer	:	The digital treatment timer indicates the set time in minutes and seconds prior to the start of treatment and treatment time remaining during treatment. The maximum setting of the timer is 19 minutes.		
Timer accuracy	:	+/- 1 second at all settings		

Contact Monitor : For intensities above 0.1 W/square cm (0.4 W/square cm for the small applicator) the output coupling is monitored. If there is insufficient coupling for more than 2 seconds, the treatment timer is stopped and the treatment light and output display will flash together with an intermittent audible alarm. Treatment is automatically resumed on good contact.

1032B Ultrasonic Generator - Battery Version
Same as above except

Battery : 6V 10 Ampere-hour
Charging input : 8-10V ac or 9-14V dc 2.5 A max
Fuses : Rear panel T3A (5x20mm)
Internal T10A (5x20mm)
Size : 320x300x125 mm
Weight : 4.1 kg.
Battery Indication : When the battery can no longer supply sufficient power to operate the unit at the required output level, the ultrasonic output will be automatically turned off and the timer and output displays will read "Lo bat" indicating that the battery requires a recharge.

Battery Charger

Power Input : 220-240V, 50/60Hz
Power Consumption : 20W.
Mains Fuse : T125mA (5x20mm)
Weight : 1 kg
Output : 9V ac, 2A max
Charging Time : 6 Hours
Classification : Class II: Type B. (IEC 601:1-1977)

Large Applicator

Frequency : 1.1 MHz and 3.3 MHz +/-5%
Effective Radiating Area: 4.4 sq cm at 1.1 MHz
3.9 sq cm at 3.3 MHz
Beam Type : Collimating
Maximum Beam
non-uniformity Ratio : 6.0

Small Applicator

Frequency : 1.1 MHz and 3.3 MHz +/-5%
Effective Radiating Area: 0.7 sq cm at 1.1 MHz
0.6 sq cm at 3.3 MHz
Beam Type : Collimating
Maximum Beam
non-uniformity Ratio : 5.0

Effective Radiating Area is measured in accordance with IEC 150.
Both treatment applicators are suitable for underwater treatment.

General

The unit is fitted with a 4mm socket on the rear panel for connection to an external stimulator for combination therapy. This socket is marked AUX. For this type of treatment the face of the ultrasonic applicator becomes the active electrode for muscle stimulation. A larger dispersive electrode should be properly placed near the treatment site. FOR CONTINUED PROTECTION ANY DEVICE CONNECTED TO THIS SOCKET MUST BE TYPE BF (IEC 601.1).

Each unit is supplied with a detachable mains cable. Both the cable and the socket on the unit meet international safety standards.

All information on fuse ratings and type, supply voltages, model, serial number, and month/year of manufacture is located on the rear panel.

INSTALLATION

Upon receipt of the unit check for any visible or hidden damage which may have occurred in transit. If any signs of damage are found then retain all packing material and inform the carrier and the Company or its agent from whom the unit was purchased.

The THERASONIC 1032 is supplied complete with one or more treatment heads, a mains cable, spare fuses, a bottle of EMS coupling medium and a battery charger for the battery version.

Check that the mains voltage and frequency stamped on the rear panel of the unit or on the battery charger are as required. If the mains supply is not within the range specified on the rear panel DO NOT CONNECT THE UNIT OR THE BATTERY CHARGER TO YOUR MAINS SUPPLY.

If not already fitted, connect a suitable plug to the mains cable. The plug must have provision for an EARTH (GROUND) connection. The mains cable has the following colour code, BROWN is LIVE (LINE), BLUE is NEUTRAL and GREEN/YELLOW is EARTH.

The mains supply must be capable of providing 2A (50/60Hz).

Upon unpacking the applicators remove the protective labels from the treatment face. If these labels are not removed before use damage to the applicators may occur.

Connect the mains cable to the socket on the rear of the unit and connect the mains plug to a suitable socket. The THERASONIC 1032 is now ready for use.

The THERASONIC 1032 Battery Unit is normally supplied with the battery fully charged and is therefore ready for immediate use.

CONTROLS AND MARKINGS

Refer to figure 1 - THERASONIC 1032 Front Panel. The number associated with each control or indicator in this section corresponds to the labelling in figure 1.

- (1) POWER Mains on/off switch. Two position rocker, up for on, down for off.
-For Battery Version:
If the battery is being charged, then this switch will not turn the unit on.
- (2) POWER INDICATOR Green LED to show that the mains is switched on.
- (3) OUTPUT DISPLAY 3 Digit display indicating output power in Watts or output intensity in Watts per square centimetre as shown by the adjacent green indicator LEDs. When the OUTPUT CONTROL is turned to the off position (fully anti-clockwise) this display reads OFF.
- (4) OUTPUT DISPLAY SELECTOR Operating this switch toggles the output display indicator LEDs and changes the output display from Watts to Watts per square centimetre or vice-versa. This is the only switch which operates while the OUTPUT CONTROL is not set to the off position.
- (5) TIMER DISPLAY Indicates the treatment time selected or, with the OUTPUT CONTROL advanced, the treatment time remaining.
- (6) TIMER SELECTOR SWITCHES Used to select the treatment time. Maximum time selectable is 19 minutes.
- (7) FREQUENCY SELECTOR Selects the ultrasound frequency. The frequency selected is indicated by the green LED above each switch.
- (8) OUTPUT MODE SELECTOR Selects the output mode which may be continuous wave or pulsed with one of the on:off ratios shown. The mode selected is indicated by the green LED above each switch.

(9) OUTPUT CONTROL

Determines the output level as indicated by the OUTPUT DISPLAY. When the OUTPUT CONTROL is set to OFF, frequency and output mode and treatment time may be selected. When the control is advanced to the ON position then only the OUTPUT DISPLAY SELECTOR is operable.

(10) TREATMENT LIGHT

Indicates when ultrasonic power is on, as determined by the OUTPUT CONTROL or by activation of the contact control.

Adjacent to the OUTPUT socket are two symbols. The left hand symbol (exclamation mark in triangle) indicates to the operator that these instructions must be read before using the equipment. The right hand symbol (man in square box) indicates that the output of this equipment is isolated from earth and is TYPE BF as defined by IEC601-1:1977 (BS5724:Part 1:1979).

OPERATING INSTRUCTIONS

Numbers in the following operating instructions refer to the front panel drawing, figure 1.

1. Having connected the THERASONIC 1032 to a suitable mains outlet (for the mains version) energise the unit by pressing the Power Switch (1) up. The green Power Indicator LED will light, the buzzer will sound briefly and the Timer Display (5) will show 1032. The microprocessor in the 1032 now completes a short self-test routine.

2. After 4 seconds the Timer Display will change to 00.00 and the 1MHz, CONT. and W/cm² indicator LEDs will light. If the Output Control (9) is in the off position then the Output Display (3) will read OFF. If the Output Control (9) is advanced then the Output Display will show three dashes, ---, and the buzzer will sound. Turn the Output Control (9) fully anti-clockwise until it is felt to "click" off, and the buzzer will stop and display show OFF.

3. Set the required treatment time by pressing the 10 and 1 switches (6). The maximum treatment time allowed is 19 minutes.

4. Select the ultrasonic frequency required using the 1 and 3 switches (7). The green indicator LED above each switch will show which frequency is currently selected. Both frequencies are available with each treatment applicator.
5. Select the output mode using the switches (8) marked CONT, 1:2, 1:4, 1:9. The green indicator LED above each switch shows the current selection.
6. Select the required Output Display indication using the Output Display Selector switch (4). The green LEDs between the switch and the Output Display show the current selection. This is the only selection which may be changed with the Output Control (9) turned on.
7. Select the treatment applicator you require, large or small, if both are available. Place the treatment applicator you have chosen in the holder (between the control panel and the Output Socket). Plug the treatment applicator into the Output Socket on the right hand side of the unit. The THERASONIC 1032 automatically recognises which treatment applicator you have chosen and will now execute a short calibration sequence. During this sequence the Output Display will show "CAL" and a small signal is applied to the applicator. It is important that the applicator is left in the holder during the calibration routine as a small amount of ultrasonic power will be emitted from it as the calibration is performed. Note that if you try to advance the Output Control (9) without an applicator plugged into the Output Socket then the Output Display (3) will show three dashes (---) and the buzzer will sound until the Output Control is returned to the OFF position. If the Output Control is advanced during the calibration sequence then the Output Display will show three dashes (---) and the routine will be suspended until the control is returned to the OFF position.
8. A suitable ultrasonic coupling medium must be applied to the area to be treated. EMS Ultrasonic Coupling Medium is recommended.
9. Turn the Output Control (9) clockwise. It will be felt to "click" on and the treatment light will come on. Advance the control until the desired Intensity or Power is shown on the Output Display (3).
10. If during treatment the applicator face is lifted off the area to be treated, or there is insufficient contact between applicator and patient then after 2 seconds the timer will cease to count down, the buzzer will sound intermittently, the treatment light and Output Display will flash, and the ultrasonic power from the applicator will be greatly reduced. When contact is remade the timer will restart, the buzzer will be silent, the treatment light and Output Display will cease to flash and ultrasonic power will return to the desired level.

11. If at any time during treatment the Output Control is returned to the OFF position, the time will stop and will restart when the Output Control is turned on again.

12. At the end of the treatment time, when the Timer Display (5) reaches 00.00, the buzzer will sound, the ultrasonic power will be turned off and the Output Display (3) will show three dashes (---). When the Output Control (9) is returned to the OFF position the buzzer will cease to sound and the Output Display (3) will show OFF.

13. A socket (4mm) is provided on the rear panel for combination therapy. It is connected electrically to the face of the treatment applicator and may be used as an active electrode for low frequency stimulation or diadynamic currents at the same time as producing ultrasound. For continued safety, equipment connected to this socket must be of type BF ie. with an electrically floating applied part.

14. As the THERASONIC 1032 is microprocessor controlled it continually "self checks". If an error in function of the microprocessor, the ultrasonic generator or the treatment head is detected the ultrasonic power will be immediately turned off and the word FAIL will be displayed on the Timer Display for approximately 2 seconds after which the microprocessor will attempt to restart as if from power up. If the unit repeatedly fails then qualified service personnel must be called in.

15. For operators who require an audible confirmation of the operation of the Timer, Frequency and Mode selector switches, the THERASONIC 1032 has a hidden feature. To operate this feature the Output Display Selector switch (4) must be held depressed when the unit is switched on. Every time the Timer, Frequency, or Output Mode switches are operated and action taken, the buzzer will give a short bleep.

16. On the battery version if the battery is unable to provide sufficient power for the unit to operate correctly, then the ultrasonic output will be switched off and the Timer and Output Displays will show a message "Lo bAt" - indicating that the battery requires recharging.

17. The battery may be recharged either from the mains battery charger or from a cigar lighter socket in an automobile. Connect the appropriate cable from the charger to the socket on the rear panel of the THERASONIC 1032. Switch on the mains charger (or plug the free socket into the cigar lighter). The battery will be fully charged in about 8 hours. Note that the battery will rapidly charge at first, so that it will only take 1 or 2 hours to sufficiently charge the battery for a normal treatment. The charger may be left connected to the unit indefinitely and the battery cannot be overcharged. Do not block the ventilation slots in the 1032 case during charging as heat is generated within the unit.

18. Note that the calibration sequence described in paragraph 7 will be executed whenever a treatment applicator is plugged in or when the ultrasound frequency is changed. THE APPLICATOR MUST BE LEFT IN THE HOLDER AND BE FREE FROM ANY COUPLING MEDIUM DURING THIS SEQUENCE.

17. Units prior to serial number 33780 do not perform the calibration routine as described in paragraphs 7 and 16.

MAINTENANCE

The treatment applicators may be sterilised using a suitable disinfectant after washing off any coupling medium. A 2% solution of glutaraldehyde is known to be an effective disinfectant and will not adversely affect the materials used in the applicator. Immersing the applicator in such a solution for 10 to 20 minutes is recommended after which any remaining solution should be washed off. The applicators are NOT suitable for steam sterilisation.

Inspect the treatment applicators, cables and connectors periodically for signs of damage, especially cable insulation or cracks in the treatment head which could allow ingress of fluids. The treatment applicators must always be treated with care as severe shock, such as dropping the applicator, may adversely affect its characteristics.

The unit may be cleaned by wiping over with a clean damp cloth.

On the mains version, the fuses are mounted on the rear panel to the left of the mains inlet. The unit must be disconnected from the mains before any attempt is made to replace these fuses. The fuse holders are of a bayonet type. A suitable screwdriver should be used to lightly press in the fuse holder cap and give it a quarter turn anti-clockwise. Information on fuse type and rating is both on the rear panel and in section 3 of this manual.

The battery charger is protected by an internal mains fuse. To replace this fuse the bottom of the charger unit must be removed. To do this remove the four screws on the bottom cover. The fuse is located on the small printed circuit board attached to the transformer. Replace with the correct rating as indicated in section 3 of this manual.

The charger input is protected by a fuse mounted on the rear panel of the unit. Should the battery fail to charge then this fuse should be inspected.

If any of the fuses continue to blow then qualified service personnel must be called in.

CIRCUIT DESCRIPTIONS

Power Supply (B50-1-14) (Mains Version)

The Therasonic 1032 Power Supply is an off-line switching supply using a half-bridge forward converter configuration. It is capable of providing in excess of 2A at +/-15V and has an auxilliary output of 5V at 1.5 A.

Immediately ahead of the mains inlet (1PL1) is a filter network comprising 1C1-3 and 1L1, which both protects the unit from incoming radio-frequency energy and also prevents high frequency energy generated by the switching action of the supply being injected back into the mains. 1FS1,2 are mains fuses. The mains switch located on the 1032 front panel is connected to the supply by 1SK1.

The mains is rectified by 1BR1 and smoothed by 1C5,6. Note that for 200-240V operation 1BR1 is a full-wave bridge rectifier and that for 95-120V operation 1BR1 acts as a voltage doubler. Negative temperature coefficient thermistor 1RT1 provides in-rush protection and 1C4 additional RFI filtering.

1IC1 (SG3526A) is a PWM controller which regulates the supply. The device has an internal 5V reference, error and current limit amplifiers, soft start facility (set by 1C11), oscillator, pulse control circuitry and output drivers. The main isolating transformer 1T2 is driven in a half bridge configuration by power mosfets 1TR1,2. The lower device is driven directly by the controller (1IC1) and the upper device via 1T1. 1C7 prevents core saturation of 1T2 by removing any DC component from the drive waveform. During start up, power for the control circuitry is provided by linear regulator 1TR1, but when the supply is fully operational bridge rectifier 1D3-6 overrides the transistor. The switching frequency is around 80kHz.

Ultra-fast recovery diodes 1D9-12 rectify the main output from transformer 1T2. 1L3,4 and 1C22,23 filter the +/-15V output. Error amplifier 1IC4 compares the output voltage to the 15V reference supplied by 1IC3. The error signal is fed back to the PWM controller by opto-isolator 1IC5.

An additional secondary winding on 1T2 is rectified by schottky diodes 1D7,8 and filtered by 1L2, 1C27. 1IC2 is a linear 5V regulator providing upto 1.5 A.

1R25 provides a small preload for the main output, ensuring the correct operation of bridge 1D3-6 and the auxilliary 5V output when there is no external load.

Battery Supply (B50-1-64)

The Therasonic 1032 Battery Supply comprises three sections, a charging circuit for the battery, a 5V linear regulator and a switching up convertor to produce the +15V and -15V supplies.

The charging circuit is protected by fuse 6FS1 and is supplied via bridge rectifier 6BR1 so that the circuit will operate from both an AC supply and either polarity of DC source. Relay 6RL1 is enabled when a voltage sufficient to charge the battery is connected to the input of the circuit. This relay disconnects the battery from the rest of the circuitry during charging and so the unit cannot be used during charging. 6IC1 is a voltage regulator supplying 6.9V to the battery for charging. It has an internal current limit of about 1.5 Amps.

6IC2 is a monolithic low drop-out 5V linear regulator providing 5V for the main pcb as well as a reference for the up-convertor circuit. The regulator is fed via a winding on 6L1 and rectifier 6D1 to give the input voltage a slight "boost" when the battery is low.

6IC3 (SG3526) is a PWM controller which regulates the up convertor circuit. The device has error and current limit amplifiers, soft start facility (set by 6C7), oscillator, pulse control circuitry and output drivers. 6TR1 is a high power mosfet which drives the fly-back circuit comprising 6L1, 6D4, 6C13. The 15V output is fed back via 6R3 to the error amplifier of the control device. A negative supply is provided by 6D5,6 and 6C12,14. The mosfet current is limited by 6R14 which together with 6R11 and 12, supply the current limit circuit of 6IC3 with the required voltage.

The supply is capable of delivering in excess of 1.4A at +/-15V and 1A at 5V. 6IC4 is a voltage comparator providing a low battery signal for the microprocessor on the main pcb.

Main Board (B50-1-24) (Up to serial number 37336)

This section should be read in conjunction with block diagram (figure 4) and circuit diagram (figure 6).

2TR1 and associated components form a varactor tuned Hartley oscillator. The oscillator has two frequency ranges. Switching between these ranges is accomplished by 2D1 which is forward biased for the lower 1.1MHz range and reverse biased for the 3.3MHz range. 2D1 is in turn controlled by open collector buffer 2IC4 via 2R1-3.

2TR2-6 form a variable gain amplifier (intermediate amplifier). The input of the amplifier is switched by 1/2 2IC1 which is in a series-shunt configuration. The jfet 2TR2 is used as a voltage controlled resistance which directly adjusts the overall gain of the amplifier. The gain is stabilised by negative feedback via 2R15 and cascode transistor 2TR3. The output of the amplifier is coupled to the power output stage by 2T1.

The power output stage is a mosfet push-pull amplifier. Power mosfets 2TR7,8 are driven in antiphase by 2T1 and in turn drive centre tapped output transformer 2T2. 2RV1,2 set a small quiescent current in each output device. 2T3 and 2C16 provide protection against RFI.

A fraction of the output voltage is fed back via 2T4 to peak detector 2TR11, 2C20. This voltage is compared to that supplied by the output control potentiometer on the front panel by 2IC2b which in turn supplies the control voltage for 2TR2 in the intermediate amplifier. 2R34,2D8 ensure that the amplifier is set to minimum gain when the output control is set to off.

Dual sense amplifier 2IC3 is configured to form a phase detector circuit. The inputs of the sense amplifiers are connected to the input and output of the final output power stage. Since the electrical impedance of the piezo-electric crystal in the treatment applicator is reflected by 2T2 across the output of the amplifier the phase detector can accurately sense when this impedance is real. The output of the phase detector controls the current switches, 1/2 2IC1,2D17,18 which control integrator 2IC2a. This in turn control the varactor diode 2D2 and tunes the oscillator to the parallel resonance point of the piezo-electric crystal.

Transformer 2T5 is driven with a 1MHz square wave from 2TR10. Any impedance connected across the secondary is reflected into the primary circuit and the voltage on the primary is reduced. In this way the presence of and the type of treatment applicator is detected by voltage doubling rectifier circuit 2D4,5,2C18,19.

2IC2d monitors the current taken by the output stage by amplifying the voltage across resistor 2R23.

The output of the current monitor, the voltage from the peak detector, the voltage from the applicator sensing circuit and the voltage from the front panel output control potentiometer are all multiplexed into A to D converter 2IC11 by analogue switch 2IC12 and are therefore monitored by the microprocessor 2IC5.

The 6803 microprocessor 2IC5 has 128 bytes of internal ram and an integral timer. The lower 8 bits of the 16 bit address are latched by 2IC8 from the multiplexed data/address bus. Address decoding is provided by 2IC9 which supplies separate enables for eeprom 2IC7, 64 segment display driver 2IC6, control register 2IC10 and read and write inputs for A to D converter 2IC11.

The control register 2IC10 is an edge triggered octal flip-flop providing signal for frequency selection, A to D multiplexing, output on/off switching, buzzer and output transformer switching relay.

The retriggerable monostable 2IC3 acts as a watchdog for the microprocessor system. If the monostable is not reset regularly then the buzzer will sound, the output will be turned off, and a non-maskable interrupt will be sent to the processor. This will cause an error message to be written to the front panel display and the system will attempt to restart as if from power up.

Main Board (B50-1-74)

Replaces B50-1-24 from serial number 37337

This description should be read in conjunction with block diagram A50-1-02 and circuit diagram B50-1-70.

The microprocessor (7IC1) is a 6803 which has an internal clock, a multiplexed data/address bus, 128 bytes of ram, an integral timer, an 8 bit port and a 5 bit port. The lower 8 bits of the 16 bit address are latched by 7IC7 from the multiplexed data/address bus. Address decoding is provided by 7IC5 which is enabled by the processor clock output E. The device provides separate enables for the eeprom (7IC6), the 64 segment display driver (7IC2), control register (7IC9), frequency control register (7IC12) and read and write inputs for the A to D converter (7IC8).

The eeprom, 7IC6, is a 2732A providing 4 kbytes of memory for the coded program.

The 64 segment display driver, 7IC2, can store 8 bytes of data in its internal memory which it then multiplexes to the front panel displays by its 8 digit and 8 segment drivers at a refresh rate of approximately 250Hz. The microprocessor updates the display 5 times a second.

The control register, 7IC9, is an edge triggered octal flip-flop providing control signals for output on/off switching, A to D converter multiplexing, the buzzer and frequency selection (1 or 3 MHz).

The frequency control register provides an 8 bit control of the digital frequency synthesiser. The frequency generated by the synthesiser will, for the 1MHz range, be $(999+n)$ kHz where n is the control byte supplied by the frequency control register. For the 3MHz range the frequency will be exactly 3 times this value.

The A to D converter, 7IC8, is an 8 bit successive approximation converter. It has an internal 2.55 volt reference (pins 7 and 8) which is used to provide a reference voltage for not only the converter itself, but also the front panel potentiometer and 7RV1. The device uses the processor clock output, E, as its clock. The decoder, 7IC5, provides a write input on pin 4 of the A to D. The device then commences its conversion process and 9us later the 8 bit digital output is available to be read back by the processor using the read input on pin 2.

The retriggerable monostable 7IC4 acts as a watchdog for the microprocessor system. If the monostable is not reset regularly then the buzzer will sound, the output will be turned off, and a non-maskable interrupt will be sent to the processor. This will cause an error message to be written to the front panel display and the system will attempt to restart as if from power up.

The digital frequency synthesiser uses the 1MHz 'E' output from the microprocessor as a reference. This is divided by 1000 by 7IC13 and 7IC14a to provide a 1kHz reference input to the phase-lock loop device 7IC16. The phase-lock loop integrated

circuit (4046), 7IC16 contains an edge triggered phase detector and a voltage-controlled oscillator. The output from the phase detector, pin 13 of 7IC16, is connected to the control input of the voltage-controlled oscillator (vco) via a suitable loop filter comprising 7R6, 7R7, 7C12 and 7C13.

The VCO output on pin 4 of 7IC16 is then applied to the divide-by-3 circuit comprising 7IC17 and 7IC22.

The output of the divide-by-3 circuit is connected to the input of the divide-by-1000 counter comprising 7IC14b and 7IC15. On completion of the 1000th count, the output of the divide-by-1000 on pin 13 of 7IC15, flip-flop 7IC23a will be set and will therefore enable the programmable divide-by- n counter (7IC19 & 20) via the preset value from the frequency control register to zero. The zero count is detected by 7IC21b & c which then issue a pulse to the phase detector, clear the divide-by-1000 and the flip-flop 7IC23a, and load the preset value into the programmable divide-by- n counter starting the process again. The phase detector and loop filter combination will adjust the input to the VCO so that it operates at a frequency and phase such that the positive edges of the 1kHz reference frequency on pin 14 of the phase detector and the pulse on pin 3 coincide. The frequency of the VCO will then be $(1000+n-1) \times 3$ kHz where n is the preset value of the programmable divide-by- n .

The frequency range, 1 or 3 MHz, is selected by 7IC18 and buffered by 7IC3a. Since 7IC3 is an open collector device then 7IC3b & c can turn off the output under control of the microprocessor via control register 7IC9. 7IC3c is the master on/off control and 7IC3b is used to pulse the output in pulsed modes. 7C15, 7D4, 7R12 and 7TR3 level shift the signal to -15V rail. The amplitude of the output at the drain of 7TR3 is controlled by the DC level applied to the base of 7TR2. This signal is buffered by 7TR5 & 6 before being applied to the output power mosfet 7TR7 (mounted on the heatsink). The output transistor drives the output transformer 7T1. The secondary of 7T1 is switched according to the frequency range selected by 7RL1.

A fraction of the output voltage is fed to 7T2, the output of which is rectified by 7TR8 to produce a DC voltage equal to the peak AC voltage across 7C25 and 7R29. This voltage is buffered by 7IC24c and peak detected by 7IC24b (for pulsed operation). The integrator 7IC24a then compares this voltage proportional to the peak AC output voltage to the voltage selected by the front panel potentiometer and adjusts the voltage on the base of 7TR2 to give the correct drive for the output transistor.

7IC3d is used to apply a 500kHz signal to the transformer 7T3. An impedance connected across the secondary of the transformer is reflected into the primary circuit reducing the amplitude of the signal. In this way the presence of a transducer plugged into the output socket is detected. The voltage across the primary is rectified by 7D6 & 7.

The current through the output transistor is measured by monitoring the voltage developed across 7R16 in the source lead of the device. This voltage is level shifted by differential amplifier 7IC24d.

The voltage on the wiper of 7RV1, the output of the head sensing circuit, the voltage from the buffered fed-back output voltage, the voltage from the differential amplifier monitoring the output transistor current and the voltage on the wiper of the front panel potentiometer are multiplexed into the A to D converter by analogue multiplexer 7IC10.

During the calibration sequence the unit checks the ultrasonic transducer by driving it at constant level, enabling analogue switch 7IC18 which turns on 7TR4, and then at differing levels by applying a voltage to the integrator input (7IC24a) overriding the front panel control via 1/4 7IC18.

Front Panel Board (B50-1-34)

The front panel board carries all the front panel display and discrete LEDs and provides the connection between the membrane switch front panel and the main board.

All connections to the main board are made by a 34 way ribbon cable which connects to 3PL1. The seven segment displays (DS1-4) are driven directly from the multiplexed output of the 64 segment display driver on the main board. Data for the discrete LEDs is latched by 3IC1 which drives the LEDs via 3RP1. 3TR1 inverts the signal for the "W" LED to drive the "W/cm2" LED.

The "Power" LED is driven directly from the 5V supply. Potentiometer 3RV1 and switch 3SW1 which together form the Output Control are connected to the board, 3SW1 taking its place in the 3 by 4 switch matrix and 3RV1 being linked to the main board.

Battery Charger

The battery charger comprises mains transformer T1, which is protected by a single mains fuse and a positive temperature coefficient thermistor which acts as a thermal trip. The charger provides approximately 9V rms AC for the charging input of the main unit.

TEST PROCEDURES AND FAULT FINDING

WARNING : HIGH VOLTAGES ARE PRESENT INSIDE THE UNIT. THE FOLLOWING PRECAUTIONS MUST BE TAKEN WHEN THE TOP COVER OF THE UNIT IS REMOVED.

(1) THE TOP COVER SHOULD ONLY BE REMOVED BY A QUALIFIED SERVICE ENGINEER.

(2) THE UNIT SHOULD BE POWERED FROM AN ISOLATION TRANSFORMER.

(3) NEVER TOUCH ANY COMPONENT ON THE SWITCHED MODE POWER SUPPLY BOARD WHEN THE UNIT IS ON OR THERE IS POWER APPLIED TO THE MAINS INPUT.

Before removing the top cover make sure that the unit is disconnected from the mains supply and that the power switch is in the off position.

To remove the top cover, first turn the unit over so that it is bottom side up. Remove the four M4 x 20mm pan head screws located at each corner of the base moulding complete with their washers. Turn the unit over so that it is the right way up. Now ease the top moulding upward until it is clear of the back panel and then move it slightly to the front to clear the output socket.

Test Procedure - Switched Mode Power Supply(B50-1-14) - Mains Version

Disconnect supply from the main board by removing the 10 way jumper assembly, before performing this test.

EQUIPMENT REQUIRED : Isolation Transformer
DC Power Supply
Variac
Oscilloscope
Load resistors

WARNING: High voltages are present on the mains side of this power supply. Extreme care should be taken during testing.

Figures in square brackets [] refer to 95-120V versions

1. Connect the negative side of the DC power supply to 1TP2 and connect the positive side to 1TP1 via a signal diode (1N4148).

2. Set the supply to 12V DC. Monitor 1TP3 and 1TP4 wth respect to 1TP2 on scope and switch dc supply on. Check 1TP3 and 1TP4 for square waves at approximately 80kHz and that both waveforms are never high at the same time (this means that the two power mosfets 1TR2,3 are never "on" at the same time).

3. Connect variac to isolation transformer and the output from the isolation transformer to the mains input of the power supply. Set the variac to zero. Plug mains switch assembly into 1SK1 and set switch to "on". Connect voltmeter across main +/-15V output from the supply (between pins 5 and 10 of 1PL2).

4. Slowly increase the output from the variac. The reading on the voltmeter should slowly increase and as the reading reaches 30V (corresponding to about 170V [90V] ac in from variac) the squarewaves on 2TP3 and 2TP4 should reduce their "on time" and the supply should stabilise. Check that the output voltage stabilizes at 30V +/- 2V. Check that the output from the 5V regulator is 5V +/- 0.25V

5. Increase output voltage on variac to approximately 240V [115V]. Connect 15 Ohm 100W load to main 30V output. Check that the output voltage is still within 30V +/-2V. Decrease voltage from variac until the output ceases to regulate correctly. Check that voltage from variac is now less than 200V [95V]. Reset output from variac to about 240V [115V].

6. Switch off supply. Disconnect from DC power supply. Leave 15 Ohm load connected to output. Switch on supply and check that the supply starts up successfully into load and that output stabilises at 30V.

7. Check earth leakage current of supply is less than 250uA [90uA]
Switch off the unit.

Reinstall 10 way jumper between power supply and main board.

Test Procedure - Battery Power Supply(B50-1-64)

Disconnect supply from the main board by removing the 10 way jumper assembly, before performing this test.

EQUIPMENT REQUIRED : Digital Multimeter
20 Ohm test load.

1) Check that the battery voltage is between 5.5 and 7V DC and that the 10A fuse 6FS1 is intact.

2) Monitor the outputs with the DVM, they should be +15V, -15V and +5V (+/- 10%).

3) Connect the board to the battery, connect load between +15V and -15V and switch on. Check the rails are +15V and -15V. Connect load between +5V and 0V, check rail is +5V.

4) Short circuit the +15V rail to the 0V rail. The fuse should blow. Switch the unit off, remove the short circuit and replace the fuse. Switch the unit back on and the rails should be back.

- 5) Short circuit the -15V rail to the 0V rail. The rail should shut down but return as soon as the short circuit is removed.
- 6) Short circuit the +5V rail to the 0V rail. The rail should shut down, but return as soon as the short circuit is removed.
- 7) Switch the unit off. Connect the power supply to the charger inputs and set to +12V. The charge relay should now pull in, disabling the output circuit, so there should be no rails even with the supply apparently switched on. Monitor the voltage across the battery. The voltage should read 6.9V +/-5%.
- 8) Disconnect battery and reconnect the power supply in its place, set to 6V. Monitor 6PL3, (this point must be pulled up to +5v with a 10kohm resistor) slowly wind down the voltage, at approximatley 5.5V this output will go low.

Test Procedure - Main Board (B50-1-24)

EQUIPMENT REQUIRED : Oscilloscope
Digital Multimeter
Frequency counter
Frequency lock test lead (See Note)
Test load (See note)

1. Set potentiometers 2RV1 and 2RV2 fully clockwise.
2. Switch on pressing the 1:4 pulse button, this will bring the unit on in a special set up mode. After displaying "1032" in the timer display, the unit will then show 00.00 in the timer and 255 in the Output Display.
3. Using an accurate DVM set to D.C mV, monitor across 2R23 (1ohm) resistor (should be reading near zero). Slowly increase the bias on both pots (2RV1, 2RV2) so that each contributes 20mV i.e a total of 40mV.
4. Set the timer to 10 minutes. Plug test load into the Output socket. Select 3MHz. Monitor TP4 with scope set to DC 5V/division. Connect TP1 to frequency counter. Connect frequency lock test lead to anode of D19 and the other end to TP5 and the scope should show TP4 at approximately +12V. Turn on Output Control and slowly increase to full power. Set frequency on counter to 3.500MHz by adjusting CV2. Move frequency lock test lead from TP5 to TP7 and TP4 should be at -12V. Frequency should now be 3.300 MHz (+/-2%). Return test lead to TP5

Turn Output Control off.

- 5) Switch unit to 1MHz. Plug test load A to Output Socket. Turn Output Control on and to full power. Set frequency on counter to 1.150MHz by adjusting 2CV2. Move Test lead to TP7 and check that the frequency is now 1.065MHz (+/- 2%).

Turn Output Control off. Remove Test Lead. Turn Unit off. Remove the counter from TP1.

- 9) Plug large applicator into Output Socket. Turn unit on. Set Time, Select 1MHz and with the applicator loaded into a suitable test balance, slowly advance the Output Control. The unit will now frequency lock to the applicator and the voltage on TP4 will assume a level somewhere between +12V and -12V dependant on the characteristic frequency of the ultrasonic crystal. Set the Output Control to maximum. Adjust the output power to the correct level (as indicated on the output display) by adjusting 2RV3. If the applicator is unloaded then the contact control should sound an intermittent alarm and treatment light and Output Display will flash.

10) Turn the Output Control to the off position. Select 3MHz. Repeat as in (9) but setting the output power by adjusting 2CV3.

Note

Frequency Lock Test lead comprises a 10 cm lead terminated at each end with a crocodile clip and a 1kOhm resistor in line.

The Test Load is built onto Amphenol connectors type T3424-501 6 way. Connect together pins 2 and 6.

Test Procedure - Main Board (B50-1-74)

EQUIPMENT REQUIRED :	DVM	Front panel
	Frequency counter	Ultrasonic balance
	Oscilloscope	

1) Before switching the unit on, check that there are no loose bits of wire or solder splashes.

2) Check that all rails are free from short circuits. Check:-

- +15v - 0v
- 15v - 0v
- +15v - -15v
- +5v - 0v
- +5v - +15v
- +5v - -15v

3) Connect SMPSU to 7PL2 and front panel to 7PL1.

4) Switch on pressing the 1 and 3 MHz buttons together, this will bring the unit on in the test mode.

5) Turn RV2 fully clockwise.

6) The timer display will show ru 1 (ie RV1). Adjust RV1 until the power display indicates 128. When this is done the display will flash indicating that the preset value is correct. This adjustment sets the sensitivity of the contact control monitor.

7) Issue 3 Main Boards have an extra sequence:

Press the W/Wcm2 button. Timer display will now show ru 5 (ie RV5). Adjust RV5 until display shows 240 (ie 2.4V DC on pin 15 of 7IC10.) This sets the head sense circuit.

8) Press the W/Wcm2 button. Timer display will now show ru 2 (ie RV2). Adjust RV2 until display shows 001. Display flashes when this preset value is correct. This nulls the offset on the current monitor.

9) Press the W/Wcm2 button again. Display now shows 1000 (KHz) and TP9. Connect frequency counter to TP9. Frequency on counter should be +/- 0.004% of that displayed on front panel.

10) Press the W/Wcm2 button again and repeat as in 8. Sequence through the 8 steps: 1000, 1001, 1003, 1007, 1015, 1031, 1063 and 1127 KHz.

11) Switch off. Switch on again pressing the 10, 1 minute and 1:2 buttons together. This sets the board in two different modes:
-frequency mode by pressing the 10 and 1 minute switches. (In this mode the frequency is displayed and can be adjusted. Press 10 for up and 1 for down).
-current mode by pressing the 1:2 button. (The current is displayed on the output display in Amps.)

12) Select 1MHz. Plug test head into output socket. The board will now go through a calibration routine at the end of which, the resonant frequency of the head is displayed on the timer display. Check that frequency displayed agrees with label on the test head, +/-1 KHz.

13) Connect DMM across 7R16 (1R resistor) on DC 2 Volts range. Connect earth clip of scope probe to 7PL5 (floating ground) and probe to end of 7R23 (10K 2W resistor) nearest end to 7R11. Make sure that no other earthed equipment or scope probe is connected to 7TP0.

Place test head on the balance and turn output fully on. Adjust 7RV3 to give 220 Volts peak to peak. Check that current displayed on front panel agrees with DMM, +/-5%. Lift head out of water and check that current cuts back by at least 50%.

14) Turn output power off and wipe head off. Select 3 MHz. Check that frequency displayed corresponds to label on test head after calibration routine. Place head on the balance. Turn output fully on and adjust 7RV4 to give 73 Volts peak to peak. Check current and cutback as in 12.

Switch off.

* A test head consists of a large head with fixed feedback resistors:

- a 220 R 1/3 W 5% resistor between pins 4 and 2 for 1MHz
- a 560 R 1/3 W 5% resistor between pins 5 and 2 for 3 MHz.

Test Procedure - Display Board(B50-1-34)

1. Holding down the 1:9 switch on the front panel, switch on the unit. The timer display should show 1032 for 2 seconds and then a display test sequence will be executed as follows:

(i) The same segment in each of the 7-segment displays is lit in turn.

(ii) Each digit is fully lit in turn.

(iii) All LEDs are lit (except for W/cm2) followed by each LED in turn

3. Following the self test sequence the unit will return to the 1032 display and start up as normal. Check that each pushbutton works and that if the output control is advanced with the timer set to 00.00, the output display reads --- and the buzzer sounds.

4. Switch off.

Treatment Applicators

Both the large and small treatment applicators are calibrated and tested at the factory. It is difficult to service these precision assemblies in the field with the exception of cable replacement. If a treatment applicator fails for any reason other than a cable fault then it should be returned to the factory for exchange/repair.

Diagnosis of cable faults

If a treatment applicator gives a contact alarm at all output intensities AND at both frequencies into a water load, then an open circuit cable is indicated. The screen of the cable may be checked by checking for continuity from pin 2 of the connector to the face of the applicator.

If a treatment applicator causes the timer display to indicate "FAIL" when the OUTPUT CONTROL is advanced at BOTH frequencies, then a short circuit cable is indicated. This can be verified by checking for continuity between pins 1 and 2 of the connector for a large applicator and pins 2 and 3 for a small applicator.

RECOMMENDED SPARE PARTS- MAINS VERSION

Qty	Description	Ref
4	Fuse 20mm 500mA A/S	6-41D
1	Detachable Mains Cable	6-49
1	SMPSU Pcb Assy	B50-1-14
1	Main Pcb Assy	B50-1-24
1	Main Pcb Assy*	B50-1-74
1	Front Panel Pcb Assy	B50-1-34
1	Output Socket 6 Way	16-107
1	Output Plug	16-106
1.4 m	Coaxial Cable	C46A

Note that for units set to 95-125V mains input item 1 in the above list should be replaced by:-

4	Fuse 20mm 1A A/S	6-33B
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RECOMMENDED SPARE PARTS-BATTERY VERSION

Qty	Description	Ref
2	Fuse 20mm 3.15A A/S	6-33A
2	Fuse 20mm 10A A/S	6-79
1	Battery 6V 10Ah	1-72
1	Battery Supply Assy	B50-1-64
1	Main Pcb Assy	B50-1-24
1	Main Pcb Assy*	B50-1-74
1	Front Panel Pcb Assy	B50-1-34
1	Output Socket 6 Way	16-107
1	Output Plug	16-106
1.4 m	Coaxial Cable	C46A

*Note that from serial number 37337 units have been fitted with B50-1-74 Main Boards.

DRAWINGS

A50-1-01	BLOCK DIAGRAM MAIN PCB AND FRONT PANEL (Up to serial number 37336)
A50-1-02	BLOCK DIAGRAM MAIN PCB AND FRONT PANEL (From serial number 37337, Digital Version)
B50-1-10	SMPSU CIRCUIT DIAGRAM (Mains Version)
A50-1-60	BATTERY SUPPLY CIRCUIT DIAGRAM
C50-1-20	MAIN PCB CIRCUIT DIAGRAM
C50-1-70	MAIN PCB CIRCUIT DIAGRAM (from serial number 37337, Digital Version)
B50-1-30	DISPLAY BOARD CIRCUIT DIAGRAM
B56-5-01	BATTERY CHARGER COMPLETE
C50-5-11	SMALL TRANSDUCER ASSEMBLY
C50-5-13	LARGE TRANSDUCER ASSEMBLY

B50-1-74

MAIN PCB - DIGITAL

Part Number	Description	Usage	Quantity	Reference
10-115	POT MULTITURN 5K	EACH	5	7RV1-5
10-118	POST HEADER 640456-3	EACH	1	7PL3
10-17	POST HEADER 640456-6	EACH	1	7PL4
12-18	RES 330R 1/3W MF 5%	EACH	2	7R24 & 25
12-22	RES 1k0 1/3W MF 5%	EACH	3	7R5,15,22
12-25	RES 2k2 1/3W MF 5%	EACH	2	7R29,40
12-26	RES 2k7 1/3W MF 5%	EACH	1	7R27
12-27	RES 3k3 1/3W MF 5%	EACH	2	7R11,39
12-29	RES 8k2 1/3W MF 5%	EACH	1	7R19
12-29A	RES 220R 1/3W MF 5%	EACH	2	7R28,41
12-3	RES 390R 1/3W MF 5%	EACH	1	7R3
12-30	RES 10k 1/3W MF 5%	EACH	4	7R8,10,35 &
12-31	RES 15k 1/3W MF 5%	EACH	1	7R9
12-34	RES 33k 1/3W MF 5%	EACH	1	7R7
12-35	RES 47k 1/3W MF 5%	EACH	1	7R33
12-37	RES 100k 1/3W MF 5%	EACH	4	7R1,2,12,30
12-40	RES 220k 1/3W MF 5%	EACH	1	7R36
12-46	RES 1M0 1/3W MF 5%	EACH	2	7R32,34
12-64	RES 39k 1/3W MF 5%	EACH	1	7R6
12-75	RES 1R0 2.5W WW	EACH	1	7R16
12-84	RES 39R 1/3W MF 5%	EACH	1	7R4
12-88	RES 10k 1/4W MF 1%	EACH	3	7R17,18,21
13-18	RES 120R 1/3W MF 5%	EACH	1	7R20
13-67	RES PK 10k x8 9PIN	EACH	1	7RP1
13-8	RES 2M2 1/4W MG 5%	EACH	1	7R31
14-29	RES 10k 2W MF 2%	EACH	1	7R23
14-51	RES 220R 2W MF 5%	EACH	1	7R13
14-70	RES 120R 1W MF 2%	EACH	1	7R14
14-71	RES 220R 7W WW	EACH	1	7R38
14-72	RES MOUNTING BKT.	EACH	1	USE ON 7R38
15-27	RELAY 12V DC DPCO	EACH	1	7RL1
15-80	RELAY SUBMINIATURE	EA	1	7RL2
16-105	SOCKET IC 40PIN	EACH	1	SKT FOR 7IC
16-152	INSULATING PAD T03	EACH	1	
16-153	INSULATING BUSH	EACH	2	
16-22D	SOCKET DIL 24WAY	EACH	1	FOR 7IC6
18-36	TRANSISTOR 2SK175	EACH	1	7TR7
18-70	TRANSISTOR VN10LP	EACH	2	7TR1,3
18-71	TRANSISTOR 2N3906	EACH	2	7TR4,6
18-72	TRANSISTOR 2N3904	EACH	3	7TR2,5,8
19-3	CABLE TIE T18R	EACH	1	
19-3A	CABLE TIE WIT 18V	EACH	1	
2-79	BUZZER 6V PCB MTG	EACH	1	BUZZER
2-80	CONN MOLEX 3192-10	EACH	1	7PL2
2-82	HEADER 34W RT ANGLE	EACH	1	7PL1
28-100	IC 74HC4051	EACH	1	7IC10
28-105	IC 74HCT00	EACH	1	7IC17
28-106	IC 74HCT02	EACH	1	7IC21

B50-1-74

MAIN PCB - DIGITAL

Part Number	Description	Usage	Quantity	Reference
28-108	IC 74HCT193	EACH	2	7IC19,20
28-109	IC 74HCT390	EACH	3	7IC13,14,15
28-111	IC 74HCT4046	EACH	1	7IC16
28-52	IC TL084CN	EACH	1	7IC24
28-63	IC 78L05	EACH	1	7IC11
28-68	IC 74HC74	EACH	2	7IC22,23
28-79	IC 74HCT138	EACH	1	7IC5
28-86	IC 74HCT573	EACH	1	7IC7
28-87	IC 74HCT123	EACH	1	7IC4
28-92	IC 7416	EACH	1	7IC3
28-93	IC 6803P	EACH	1	7IC1
28-94	IC ICM7218AIP1	EACH	1	7IC2
28-96	IC 74HCT574	EACH	2	7IC9,12
28-97	IC ZN449E	EACH	1	7IC8
3-125	CAP 100u 25V EL R	EACH	1	7C2
3-142	CAP 56p 100V CER R	EACH	1	7C53
3-18	CHOKE 2.2UH 2.2A	EACH	1	7L1
3-182	CAP 330pF 100V CER R	EACH	1	7C14
3-183	CAP 220p 350V SM R	EACH	1	7C19
3-184	CAP 5p 350V SM R	EACH	1	7C52
3-188	CAP 0u01 63V PEF R	EACH	1	7C12
3-61	IC 4066B	EACH	1	7IC18
3-78	CAP 10n 63V CER R	EACH	5	7C15,20,25,
3-82	CAP 100n 100V CER R	EACH	1	7C54
3-84	CAP 10u 16V EL R	EACH	4	7C1,6,8,9
33-12	SCREW M3 x 6mm	EACH	4	O/P PANEL &
33-18	SCREW M3 x 10mm	EACH	4	HEATSINK TO
33-20	SCREW M3 x 16mm	EACH	2	7TR7 TO HEA
34-22	WASHER M3 BERYLLIUM	EACH	10	
34-42	NUT M3	EACH	4	
37-27	WASHER FIBRE	EACH	2	
4-26	CAP 22p 100V CER R	EACH	2	7C3,4
4-52	CAP 470p 4kv CER R	EACH	1	7C21
4-73	CAP 330u 25V EL R	EACH	2	7C49,50
4-76	CAP 0u1 63V PEF R	EACH	30	Decoupling
4-84	CAP 470p 100V CER R	EACH	1	7C17
4-88	CAP 4n7 100V PCF R	EACH	1	7C22
4-90	CAP 0u22 63V PEF R	EACH	1	7C13
5-42A	DIODE ZEN BZX85-3V9	EACH	1	7D8
5-43	DIODE SIGNAL 1N4148	EACH	12	7D1-7,9-13
5-81	QUARTZ XTAL 4.00 MHz	EACH	1	7X1
A10-45	FEEDBACK TX 1032	EACH	1	7T2
A10-46	HEAD SENSE TX 1032	EACH	1	7T3
A50-3-20	INSULATOR	EACH	1	
A50-5-17	OUTPUT TRANS LOOM	EACH	1	
A50-6-06	HEATSINK M/C DETAIL	EACH	1	FOR 7TR7
A50-7-01	PROGRAMMED EPROM	EACH	1	7IC6
A58-2-04	MTG. BLOCK HEATSINK	EACH	2	

B50-1-74 MAIN PCB - DIGITAL

Part Number	Description	Usage	Quantity	Reference
B10-48	OUTPUT TX 1032	EACH	1	7T1
B50-1-73	PCB B50-1-73 ISS 6	EACH	1	
B50-5-16	OUTPUT PANEL ASSY	EACH	1	
F6	FASTON RECEP 61134/3	EACH	2	7PL5,6
L57A	LABEL"PER No. BATCH"	EACH	1	
R2	SLEEVE HELSYN	EACH	3	
S58	SILICONE SEALANT	TUBE	1	BUZZER
T37	6BA TINNED BRASS TAG	EACH	2	
T91	PIN TEST POINT	EACH	12	7TP0-10
T96	TAPE PAD D/SIDED	EACH	1	

B50-1-14

SMPSU PCB ASSY

Part Number	Description	Usage	Quantity	Reference
12-17	RES 150R 1/3W MF 5%	EACH	1	1R12
12-18	RES 330R 1/3W MF 5%	EACH	1	1R8
12-19	RES 470R 1/3W MF 5%	EACH	1	1R22
12-22	RES 1k0 1/3W MF 5%	EACH	3	1R13,17,18
12-25	RES 2k2 1/3W MF 5%	EACH	2	1R5,7
12-3	RES 390R 1/3W MF 5%	EACH	1	1R14
12-30	RES 10k 1/3W MF 5%	EACH	1	1R23
12-44A	RES 5k6 1/3W MF 5%	EACH	1	1R24
12-46	RES 1M0 1/3W MF 5%	EACH	1	1R26
12-83	RES 7k5 1/3W MF 5%	EACH	1	1R11
12-87	RES 470R 4W WW	EACH	1	1R25
13-22	RES 820R 1/3W MF 5%	EACH	1	1R6
14-52	RES 22k 2W CF 5%	EACH	2	1R1,2
14-53	RES 82K 2W CF MF 5%	EACH	1	1R3
14-54	RES 270R 1W CF 5%	EACH	1	1R4
14-55	RES 22R 1W CC 5%	EACH	1	1R20
14-56	RES 33R 1W CF 5%	EACH	1	1R21
14-57	RES 0R1 2.5W WW	EACH	1	1R19
14-61	THERMISTOR SG250 NTC	EACH	1	1RT1
15-67	BRIDGE RECT 18DB8A	EACH	1	1BR1
18-87	TRANSISTOR BUX84	EACH	1	1TR1
18-88	TRANSISTOR IRF831	EACH	2	1TR2,3
19-3	CABLE TIE T18R	EACH	3	USE ON 1L2-
2-80	CONN MOLEX 3192-10	EACH	1	1PL2
2-81	CON TRIDENT 4W PCB	EACH	1	1SK1
28-116	IC LM2940CT5	EACH	1	1IC2
28-21	RES 22R 1/3W MF 5%	EACH	4	1R10,15,16,
28-50	IC TL081CP	EACH	1	1IC4
28-88	SG3526N MOTOROLA	EACH	1	1IC1
28-89	IC 78L15A TO-92	EACH	1	1IC3
28-90	OPTO-ISO OPL1264A	EACH	1	1IC5
3-106	CAP 330p 350V SM R	EACH	1	1C8
3-130	CHOKE 2 X 10mH 1A	EACH	1	1L1
3-134	CAP 4p7 100V CER R	EACH	1	1C27
3-79	CAP 1n0 100V CER R	EACH	1	1C14
3-84	CAP 10u 16V EL R	EACH	2	1C11,16
32-50	TRANSFORMER PULSE	EACH	1	1T1
33-12	SCREW M3 x 6mm	EACH	4	
34-22	WASHER M3 BERYLLIUM	EACH	4	
34-42	NUT M3	EACH	4	
4-23	CAP 1000p 500V CER R	EACH	2	1C4,13
4-60	CAP 0u22 250VAC X R	EACH	1	1C1
4-71	CAP 2n5 250VAC Y R	EACH	2	1C2,3
4-72	CAP 220u 250V EL R	EACH	2	1C5,6
4-73	CAP 330u 25V EL R	EACH	1	1C18
4-74	CAP 470u 25V EL R	EACH	2	1C22,23
4-75	CAP 1u0 250V PEF R	EACH	1	1C7
4-76	CAP 0u1 63V PEF R	EACH	9	1C9,10,12,1 19,20,24-26

B50-1-14 SMPSU PCB ASSY (Cont'd)

Part Number	Description	Usage	Quantity	Reference
4-77	CAP 1n0 100V PPF R	EACH	1	1C21
4-78	CAP 4n7 63V PPF R	EACH	1	1C17
5-43	DIODE SIGNAL 1N4148	EACH	5	1D2-6
5-83	DIODE ZENER BZX79C18	EACH	1	1D13
5-84	DIODE SCH'KY 31DQ04	EACH	2	1D7,8
5-85	DIODE BYW29-150	EACH	4	1D9-12
5-92	DIODE ZEN BZX79-C9V1	EACH	1	1D1
6-41D	FUSE 20mm 500mA AS	EACH	2	
6-63	MAINS INLET PCB MTG	EACH	1	1PL1
6-64	FUSEHOLDER PCB MTG	EACH	2	(1FS1,2)
7-82	HEATSINK AAVID	EACH	8	USE ON 1D9- 1TR1-3,1IC2
7-83	HEATSINK DIP1494	EACH	1	USE ON 1IC1 WITH A65 GL
A10-42	CHOKE 100uH 2A dc	EACH	3	1L2-4
A10-43	FERRITE TRANSFORMER	EACH	1	1T2
A65	THERMALLY COND ADHES	EACH	1	AS REQ,D.
B13	CERAMIC BEAD LARGE	EACH	6	USE ON 1R3,
B15	CERAMIC BEADS SMALL	EACH	8	USE ON 1R1,2,4,19
B50-1-13	PCB B50-1-13 ISS 6	EACH	1	
L57A	LABEL"PER No. BATCH"	EACH	1	
T11	HEAT SHRINK.SLEEVING	cm	4	USED ON 1L4
T91	PIN TEST POINT	EACH	6	1TP0-6

EMS (Greenham) Ltd

S T R U C T U R E F I L E P R I N T F R O M : B50-5-14 T O : B50-5-14 20/09/91 PAGE

Type <-- Product --> <--- Description ---> <- Unit -> <- Component -> <--- Description ---> <- Unit -> <- Usage --->

1	B50-5-14	BATTERY 1032 COMPLT.	EACH	33-37A	SCREW M4x20	PAN HD	EACH	4
				34-23	WASHER M4	BERYLLIUM	EACH	4
				6-33A	FUSE 20mm	3A AS	EACH	1
				6-79	Ref : SPARE	- ISSUE TO TEST	EACH	1
				C50-5-03	Ref : SPARE	- ISSUE TO TEST	EACH	1
				C50-5-15	1032 TOP COVER ASSY		EACH	1
					BASE ASSY	BATTERY	EACH	1

Type <-- Product --> <--- Description ---> <- Unit -> <- Component -> <--- Description ---> <- Unit -> <- Usage --->

1	B50-1-24	MAIN PCB ASSY	EACH	B10-48	OUTPUT YX 1032 Ref : 2T2	EACH	1
				B50-1-23	PCB B50-1-23 ISS4	EACH	1
				B50-5-06	OUTPUT PANEL ASSY	EACH	1
				F6	FASTON RECEPT 61134/3 Ref : 2PL4	EACH	1
				L57A	LABEL "PER NO. BATCH	EACH	1
				T76	TAPE 12mm x 66M	CM	5
				T91	PIN TEST POINT Ref : 2TP0-2TP11	EACH	15

Type <-- Product --> <--- Description ---> <- Unit -> <- Component -> <--- Description ---> <- Unit -> <- Usage --->

1	C50-5-15	BASE ASSY BATTERY	1-76	EACH	BATTERY 6V 12AH	EACH	1
					Ref : 6BT1		
			16-21		SOCKET 4mm BLACK	EACH	1
			22-49		FELT BONDED 1/4" THK	SQIN	6
			33-12		SCREW M3X6 PAN HD	EACH	12
			33-14		SCREW M3X8 PAN HD	EACH	1
			33-18		SCREW M3X10 PAN HD	EACH	1
			33-18		SCREW M2X10 PAN HD	EACH	2
			33-37A		SCREW M4X20 PAN HD	EACH	4
			34-20		WASHER M2 BERYLLIUM	EACH	2
			34-22		WASHER M3 BERYLLIUM	EACH	12
			34-23		WASHER M4 BERYLLIUM	EACH	4
			34-42		NUT M3	EACH	2
			35-9A		NUT M2	EACH	2
			6-33A		FUSE 20mm 3A AS	EACH	2
					Ref : 6FS1 10Y TEST SPARE		
			6-37D		FUSEHOLDER PANEL	EACH	1
			6-37F		FUSEHOLDER COVER	EACH	1
			6-79		FUSE 20mm 10A T	EACH	1
					Ref : TEST SPARE		
			7-76		JACK SOCKET 5205	EACH	1
			A50-5-08		CABLE ASSY 10W JMPR	EACH	1
			B50-1-64		BATTERY SUPPLY ASSY	EACH	1
			B50-1-74RC		1032 MAIN PCB RC	EACH	1
			B50-2-08		BATTERY BRACKET	EACH	1
			B60-5-20		REAR PANEL ASSY BATT	EACH	1
			C4		CABLE BLACK 1/0.6	CM	30
			C50-3-02		BASE MULDING	EACH	1
			C65		CABLE BLUE 7/0.2	CM	10
			C72		CABLE RED 7/0.2	CM	30
			C84		CABLE GRN/YEL 24/0.2	CM	35
			F12A		CRIMP TERM. S05360SF	EACH	7
			F3		FASTON TAB XS09770S	EACH	1
			F39		FOOF 3M SJ5012	EACH	4
			L57A		LABEL "PER NO. BATCH	EACH	1
			R2		SLEEVE BLACK HELSYN	EACH	3
			T11A		TERMINAL 42095-1	EACH	2
			T25		TRANS PAD 105-001	EACH	4
			T31A		TAG RED REF XS09778	EACH	3
			F67		BRASS TAB 140613	EACH	1

Type <--- Product --> <--- Description ----> <--- Unit --> <--- Component --> <--- Description ----> <--- Unit --> <--- Usage --->

1	B50-1-64	BATTERY SUPPLY ASSY	EACH	3-79	CAP 10u 100V CER R	EACH	1
					Ref : 6C8		
				3-84	CAP 10u 16V EL R	EACH	3
					Ref : 6C5,7,11		
				33-12	SCREW M3X6 PAN HD	EACH	5
				33-18	SCREW M3X10 PAN HD	EACH	4
				34-22	WASHER M3 BERYLLIUM	EACH	9
				4-74	CAP 470u 25V EL R	EACH	1
					Ref : 6C16		
				4-76	CAP 0u1 63V PEF R	EACH	5
					Ref : 6C2,3,6,10,17		
				5-44	DIODE RECT 1N4004	EACH	2
					Ref : 6D1,2		
				5-84	DIODE SCH-KY 31DQ04	EACH	4
					Ref : 6D3-6		
				6-78	FUSEHOLDER PCB MTG	EACH	1
					Ref : 6FS1		
				6-79	FUSE 20mm 10A T	EACH	1
					Ref : 6FS2		
				A10-53	BATTERY SUPPLY CHOKE	EACH	1
					Ref : 6L1		
				A50-6-05	HEATSINK BATTERY SUP	EACH	1
					Ref : HEATSINK		
				A6-69	MOUNTING BLOCK	EACH	2
					Ref : USE ON HEATSINK		
				B15	CERAMIC BEADS SMALL	EACH	2
				B50-1-63	PCB B50-1-63	EACH	1
				F6	FASTON RECEPT 61134/3	EACH	1
					Ref : 6PL3		

Type <--- Product ---> <--- Description ---> <--- Component ---> <--- Unit ---> <--- Usage --->

1	850-1-64	BATTERY SUPPLY ASSY	EACH	12-16	RES 100R 1/3W MF 5%	EACH	1
					Ref : 6R11		
				12-19	RES 470R 1/3W MF 5%	EACH	1
					Ref : 6R10		
				12-20	RES 500R 1/3W MF 5%	EACH	1
					Ref : 6R2		
				12-27	RES 3k3 1/3W MF 5%	EACH	1
					Ref : 6R7		
				12-28	RES 4k7 1/3W MF 5%	EACH	2
					Ref : 6R3,4		
				12-29A	RES 220R 1/3W MF 5%	EACH	1
					Ref : 6R12		
				12-30	RES 10k 1/3W MF 5%	EACH	2
					Ref : 6K5,16		
				12-31	RES 15k 1/3W MF 5%	EACH	1
					Ref : 6R15		
				12-82	RES 2k0 1/3W MF 5%	EACH	1
					Ref : 6R6		
				12-83	RES 7k5 1/3W MF 5%	EACH	1
					Ref : 6K8		
				13-17	RES 110R 1/3W MF 5%	EACH	1
					Ref : 6R13		
				13-18	RES 120R 1/3W MF 5%	EACH	1
					Ref : 6R1		
				13-89	RES 0R015 4W WW 5%	EACH	1
					Ref : 6R14		
				15-89	BRIDGE RECT KBL08	EACH	1
					Ref : 6BR1		
				15-70	RELAY 6V DC SPC0 16A	EACH	1
					Ref : 6RL2		
				15-71	RELAY 12V DC SPC0	EACH	1
					Ref : 6RL1		
				16-118	HEAT TRANSFER WASHER	EACH	3
				18-70	TRANSISTOR VNI0LP	EACH	1
					Ref : 6TR2		
				18-98	TRANSISTOR 8U211	EACH	1
					Ref : 6TR1		
				19-3	CABLE TIE T18R	EACH	1
					Ref : USE ON 6L1		
				2-80	CUNN MOLEX 3192-10	EACH	1
					Ref : 6PL2		
				28-104	IC LM333N	EACH	1
					Ref : 6IC4		
				28-115	IC LM317T	EACH	1
					Ref : 6IC1		
				28-116	IC LM2910CT6	EACH	1
					Ref : 6IC2		
				28-21	RES 22R 1/3W MF 5%	EACH	1
					Ref : 6R9		
				28-88	SG52BN MOTOROLA	EACH	1
					Ref : 6IC3		
				3-151	CAP 47u 25V EL R	EACH	1
					Ref : 6C4		
				3-186	CAP 4700u 25V EL R	EACH	1
					Ref : 6C1		
				3-173	CUNN PUSH-ON PCB	WAY	6
				3-75	CAP 220u 16V EL R	EACH	4
					Ref : 6C12-15		
				3-78	CAP 10u 50V CER R	EACH	1
					Ref : 6C9		

Type <--- Product --> <--- Description ---> <--- Component --> <--- Description ---> <--- Unit --> <--- Unit --> <--- Usage --->

1	B56-5-01	BATTERY CHARGER 240V	EACH	10-41	PLUG TOP 13 AMP	EACH	1
				14-64	TERMINATOR PTC	EACH	1
				17-64	TERMINAL BLOCK 2 WAY	EACH	1
				19-3	CABLE TIE TIE	EACH	2
				33-19b	SCREW M3X16 C/SUNK	EACH	4
				6-58	FUSE 20mm 100mA AS	EACH	1
				6-78	FUSEHOLDER PCB MTG	EACH	1
				7-15A	INDICATOR SOCKET	EACH	1
				7-75	JACK PLUG 5206	EACH	1
				8-32	LAMP 913-0012 12V	EACH	1
				8-53	LENS GREEN 035-1003	EACH	1
				A10-57	TRANSFORMER 20VA 9V	EACH	1
				A56-1-13	PCB A56-1-13 ISS 1	EACH	1
				A56-4-01	LABEL SER NO	EACH	1
				A56-4-02	LABEL SUPPLY VOLTS	EACH	1
				A56-6-01	ENCLOSURE PLASTIC	EACH	1
				C182	CABLE TWIN CURE	CM	350
				C60	CABLE 2 CORE 1b/0.20	CM	200
				C65	CABLE BLUE 7/0.2	CM	8
				C68	CABLE BROWN 7/0.2	CM	8
				F41	FOOT BLACK	EACH	4
				G13	GROMMET 6.35mm dia	EACH	1
				G7	GROMMET 1/4" 303R	EACH	1
				L57A	LABEL "PER NO. BATCH	EACH	1
				R2	SLEEVE BLACK HELSYN	EACH	4

Type <--- Product ---> <--- Description ---> <- Unit -> <- Component -> <--- Description ---> <- Unit -> <- Usage --->

Type	Product	Description	Unit	Component	Description	Unit	Usage
1	C50-5-13	LRG TRANSDUCER ASSY	EACH	9-104	O RING 200-024-4470	EACH	1
				9-105	O RING 202-528-4470	EACH	1
				9-65	O RING 202-631-4470	EACH	1
				A50-1-53	PCB A50-1-53	EACH	1
				A50-2-05	PLUNGER LARGE	EACH	1
				A50-3-09	INSULATOR LARGE	EACH	1
				A50-3-13	CABLE CLAMP	EACH	1
				A50-5-12	XFAL LARGE HEAD ASSY	EACH	1
				A50-5-23	PLUG ASSY COMP.LARGE	EACH	1
				A7	SILVER LOADED EPOXY	██	1
				B50-3-05	LARGE HANDLE 1032	EACH	1
				L48A	CABLE COAXIAL	□	140
				L18A	LABEL CLING IOP HEAD	EACH	1
				L48A	PLUG LABEL ASSY	EACH	1
				R2	SLEEVE BLACK HELSYN	EACH	2
				S101	SPRING TERRI D11010	EACH	1
				T94	PIN PCB 100	EACH	2

Type <-- Product --> <--- Description ----> <- Unit -> <- Unit -> <- Usage -->

Type	Product	Description	Unit	Unit	Usage
1	C50-5-11	SMLL TRANSDUCER ASSY	EACH		
	9-10b	O RING 202-516-4470	EACH		1
	9-107	O RING 202-514-4470	EACH		1
	9-65	O RING 202-631-4470	EACH		1
	A50-1-43	PCB A50-1-43	EACH		1
	A50-2-07	PLUNGER SMALL	EACH		1
	A50-3-10	INSULATOR SMALL	EACH		1
	A50-3-13	CABLE CLAMP	EACH		1
	A50-5-10	XTAL SMALL HEAD ASSY	EACH		1
	A50-5-22	PLUG ASSY COMP SMALL	EACH		1
	A7	SILVER LOADED EPOXY	KG		1
	B50-3-07	HANDLE SMALL 1032	EACH		1
	C46A	CABLE COAXIAL	C		140
	L89	LABEL TO A41-6-07	EACH		1
	K2	SLEEVE BLACK HELSYN	EACH		2
	S101	SPRING TERRY DI1010	EACH		1
	T94	PIN PCB 1	EACH		2

Type <--- Product ---> <--- Description ---> <--- Unit ---> <--- Component ---> <--- Description ---> <--- Unit ---> <--- Usage --->

1	B50-1-34	DISPLAY PCB ASSY	EACH	10-111A 12-17	POT 10K LIN +SP SW	EACH	1
					RES 150R 1/3W MF 5%	EACH <td>2</td>	2
					Ref : 3R1,4		
				12-22	RES 1K0 1/3W MF 5%	EACH <td>3</td>	3
					Ref : 3R2,3,5		
				13-68	RES PK 150R x8 16PIN	EACH <td>1</td>	1
					Ref : 3RF1		
				16-108	POST HDR RT ANGLE 8W	EACH <td>1</td>	1
					Ref : 3PL2		
				18-72	TRANSISTOR 2N3904	EACH <td>1</td>	1
					Ref : 3TR1		
				28-86	IC 74HCT573	EACH <td>1</td>	1
					Ref : 3IC1		
				3-78	CAP 10u 63V CER R	EACH <td>1</td>	1
					Ref : 3C1		
				3-84	CAP 10u 16V EL R	EACH <td>1</td>	1
					Ref : 3C3		
				4-76	CAP 0u1 63V PEF R	EACH <td>1</td>	1
					Ref : 3C2		
				7-84	LED GREEN	EACH <td>9</td>	9
					Ref : 3D1-9		
				7-85	LED YELLOW	EACH <td>1</td>	1
					Ref : 3D10		
				7-86	DISPLAY 7-SEG 1-DIG	EACH <td>1</td>	1
					Ref : 3DS4		
				7-87	DISPLAY 7-SEG 2-DIG	EACH <td>3</td>	3
					Ref : 3DS1-3		
				A50-5-09	CABLE ASSY	EACH <td>1</td>	1
				B50-1-33	PCB B50-1-33 ISS 6	EACH <td>1</td>	1
				L57A	LABEL PER NO. BATCH	EACH <td>1</td>	1

MASTER AUTHORIZED COPY

Small Transducer Test Procedure

Assembly covered: C50-5-11
Date : 19 October 1992
Issue: 2

Equipment Required: T115 1032 Test Unit
Precision Test Balance
Digital Storage Oscilloscope
DMM

1) Connect DSO to the 1032 Test Unit T115. Set the DSO to store mode 0.1sec/div and 20mV/div with 10:1 probe. Connect DMM on DC 2V range across 7R16 on the main board of the 1032.

2) Connect the transducer under test to the 1032 Test Unit.

3) Select 1MHz to get the unit to calibrate and press the store button on DSO to save the characteristics of the head at the end of the sweep. If the transducer displays two peaks of similar amplitude at 1MHz then reject the head assembly.

4) Mount transducer on the Precision Test Balance and ensure that the head is in water and that there are no air bubbles under the head. Turn output fully on and adjust 9RV1 (preset in connector of transducer furthest the output panel) to give 1.7W on the precision balance. Note the current taken by the transducer when placed on the balance. Lift head out of water and check that the current cuts back by 50%. Check that the cutback works in 3 or 4 places down the scale. Turn Output power off.

5) Lift head out of water and check that it is dry. Select 3MHz and wait for end of calibration sequence. Store the impedance curve on the DSO by pressing the store all button at the end of the calibration routine. Check that the amplitude between the series and parallel resonance exceeds 40mV (with 10:1 probe).

6) Repeat as in 4) but adjust 9RV2 (preset nearest the output panel) to give 1.5W on the Ultrasound Precision Balance and check cutback again as in 4).

Issue	Authority	Remarks	Signed	Date
1	DW	Initial Issue	DW	1.7.87
2	ASA1886B	Presets added; check for double peaks	MJFC	19.10.92

AUTHORISED (Design): *[Signature]* Issue: 2
AGREED (Test) : *[Signature]*
(Q.C) : *[Signature]* 20/10/92

Page 1

MASTER

AUTHORIZED COPY

Large Transducer Test Procedure

Assembly covered: C50-5-13
Date : 20 October 1992
Issue: 2

Equipment Required: T115 1032 Test Unit
Precision Test Balance
Digital Storage Oscilloscope
DMM

- 1) Connect DSO to the 1032 Test Unit T115. Set the DSO to store mode 0.1sec/div and 20mV/div with 10:1 probe. Connect DMM on DC 2V range across 7R16 on the main board of the 1032.
- 2) Connect the transducer under test to the 1032 Test Unit.
- 3) Select 3MHz to get the unit to calibrate and press the store button on DSO to save the characteristics of the head at the end of the sweep. If the transducer displays two peaks of similar amplitude at 3MHz then reject the head assembly.
- 4) Mount transducer on the Precision Test Balance and ensure that the head is in water and that there are no air bubbles under the head. Turn output fully on and adjust 8RV2 (preset in connector of transducer, nearest output panel) to give 9.7W on the precision balance. Note the current taken by the transducer when placed on the balance. Lift head out of water and check that the current cuts back by 50%. Check that the cutback works in 3 or 4 places down the scale. Turn Output power off.
- 5) Lift head out of water and check that it is dry. Select 1MHz and wait for end of calibration sequence.
- 6) Repeat as in 4) but adjust 8RV1 to give 11.3W on the Ultrasound Precision Balance and check cutback again as in 4).

Issue	Authority	Remarks	Signed	Date
1	DW	Initial Issue	DW	1.7.87
2	ASA 1886B	Presets added	MJFC	19.10.92

AUTHORISED (Design): *[Signature]* Issue: 2
 AGREED (Test) : *[Signature]*
 (Q.C) : *[Signature]* 20/10/92

11) Switch off. Switch on again pressing the 10, 1 minute and 1:2 buttons together. This sets the board in two different modes:
 -frequency mode by pressing the 10 and 1 minute switches. (In this mode the frequency is displayed and can be adjusted. Press 10 for up and 1 for down).
 -current mode by pressing the 1:2 button. (The current is displayed on the output display in Amps.)


12) Select 1MHz. Plug test head into output socket. The board will now go through a calibration routine at the end of which the resonant frequency of the head is displayed on the timer display. Check that frequency displayed agrees with label on the test head, +/-1 kHz.

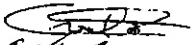

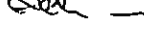
13) Connect DMM across 7R16 (1R resistor) on DC 2 Volts range. Connect earth clip of scope probe to 7PL5 (floating ground) and probe to end of 7R23 (10K 2W resistor) nearest end to 7R11. Make sure that no other earthed equipment or scope probe is connected to 7TP0.
 Place test head on the balance and turn output fully on. Adjust 7RV3 to give 220 Volts peak to peak.
 Check that current displayed on front panel agrees with DMM, +/-5%. Lift head out of water and check that current cuts back by at least 50%.

14) Turn output power off and wipe head off. Select 3 MHz. Check that frequency displayed corresponds to label on test head after calibration routine.
 Place head on the balance. Turn output fully on and adjust 7RV4 to give 73 Volts peak to peak.
 Check current and cutback as in 12.

Switch off.

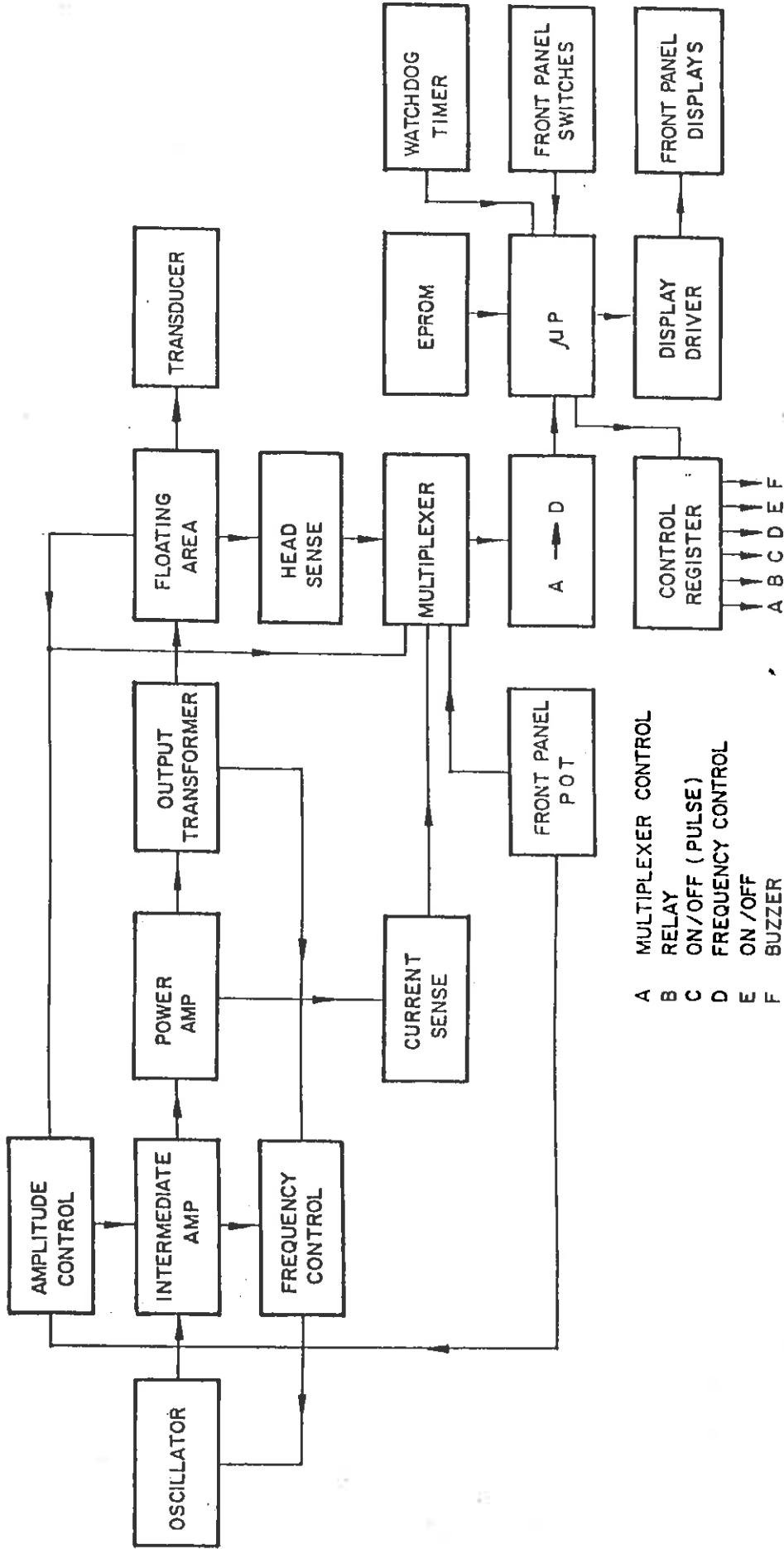
* A test head consists of a large head with fixed feedback resistors:
 - a 220 R 1/3 W 5% resistor between pins 4 and 2 for 1 MHz
 - a 560 R 1/3 W 5% resistor between pins 5 and 2 for 3 MHz.

Issue	Authority	Remarks	Signed	Date
6	ASA 1894D	RV5 Set-up Changed to 190 with head in		9.12.92

 AUTHORISED (Design):  ISSUE:6 PAGE 2 OF 2
 AGREED (Test) : 
 (Q.C.) : 

A.50-1-01

THIRD ANGLE PROJECTION
DO NOT SCALE

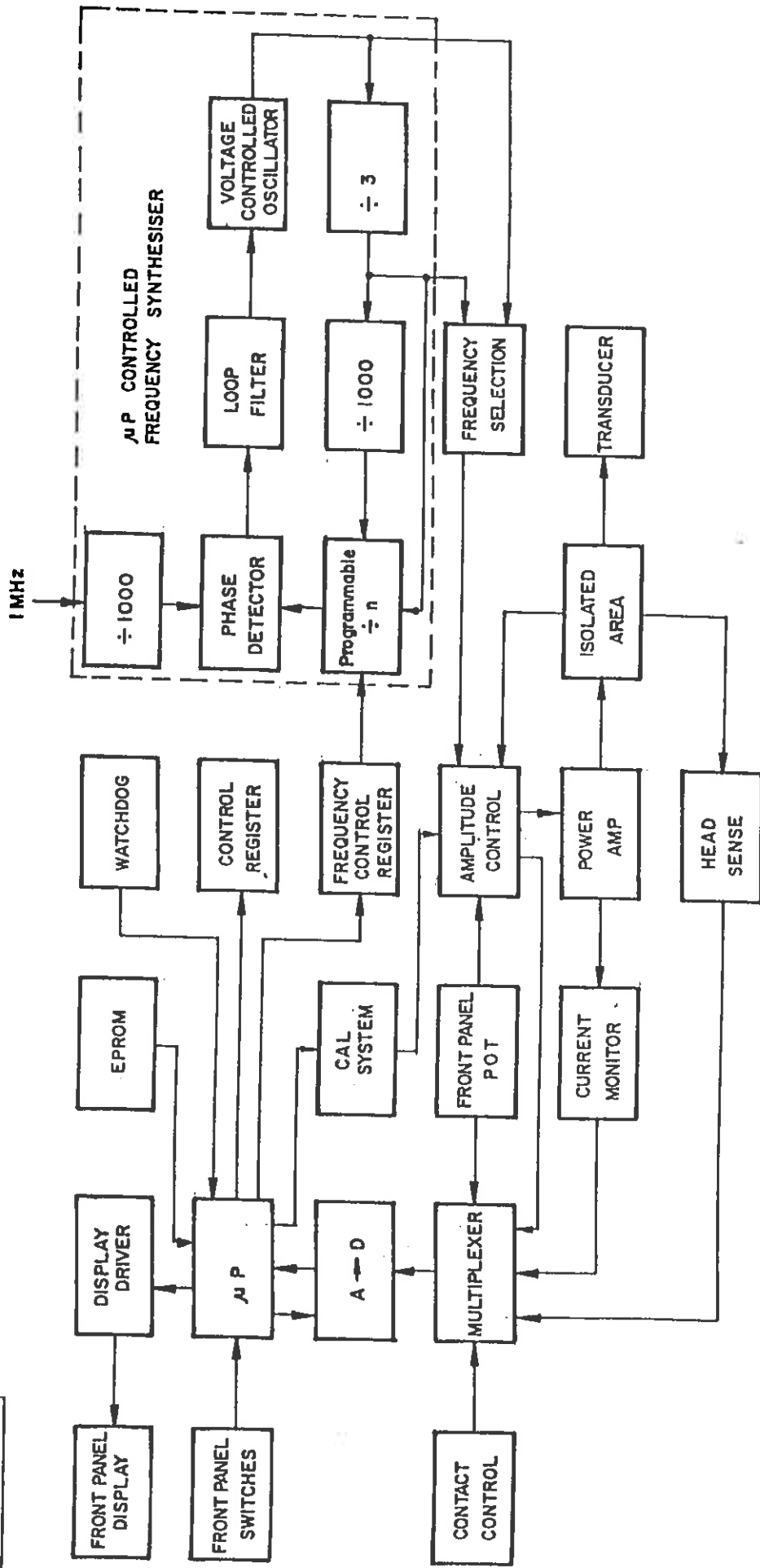


- A MULTIPLEXER CONTROL
- B RELAY ON/OFF (PULSE)
- C FREQUENCY CONTROL
- D ON/OFF BUZZER
- E
- F

ELECTRO-MEDICAL SUPPLIES (Greenham) LTD.			
WANTAGE OXFORDSHIRE		SCALE	TOLERANCE
DRN	CHKD	MATERIAL & FINISH	
J J SHAVE	D L J J		
DESCRIPTION		DRG No.	
1032		A50-1-01	
ISS	AUTHORITY	DATE	SIG
1	DW	25.3.87	JJS
INITIAL ISSUE		DATE	SIG

A50-1-02

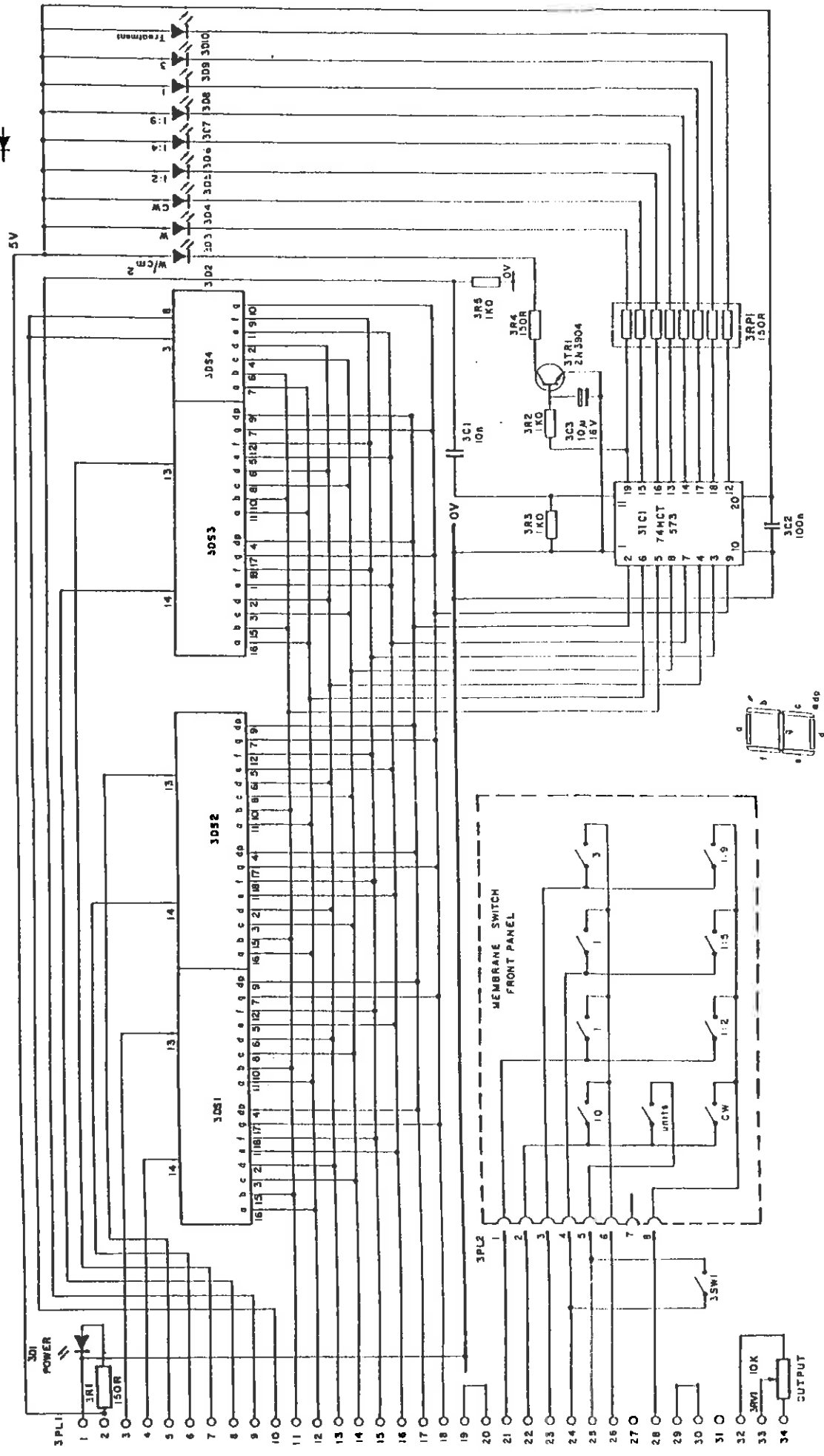
THIRD ANGLE PROJECTION
DO NOT SCALE



ISS AUTHORITY		DATE	SIG	ISS AUTHORITY	DATE	SIG	ISS AUTHORITY	DATE	SIG
				1 DW	INITIAL ISSUE	28/08 JJS			
DESCRIPTION									
1032									
BLOCK DIAGRAM									
DIGITAL VERSION									
DRG No.									
A50-1-02									
ELECTRO-MEDICAL SUPPLIES (Greenham) LTD.									
WANTAGE OXFORDSHIRE									
DRN	CHKD	MATERIAL & FINISH	SCALE	TOLERANCE					
JJS/SHAVE	WJ								

B 50-1-30

THIRD ANGLE PROJECTION
DO NOT SCALE

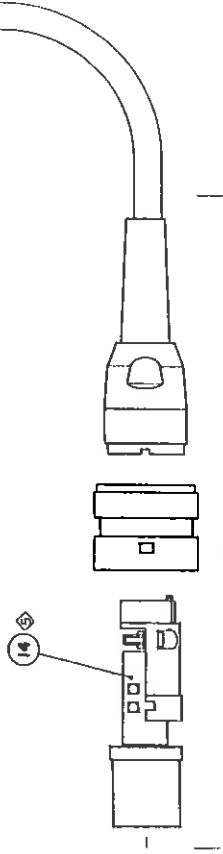
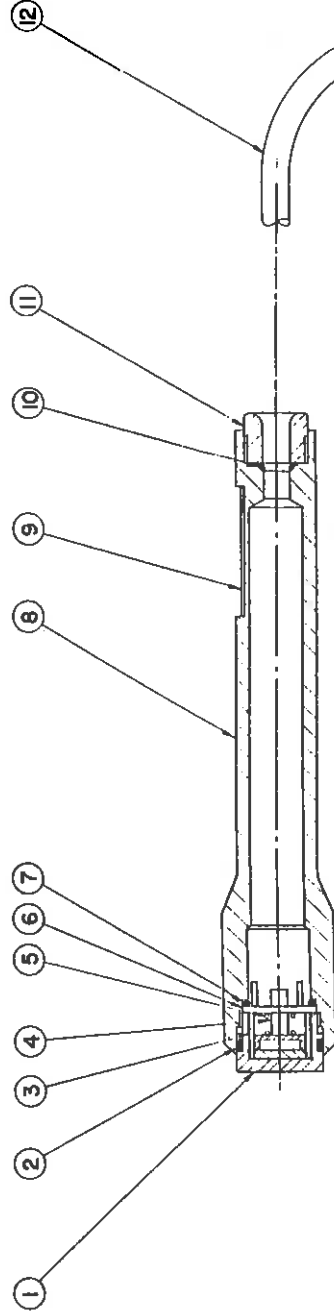
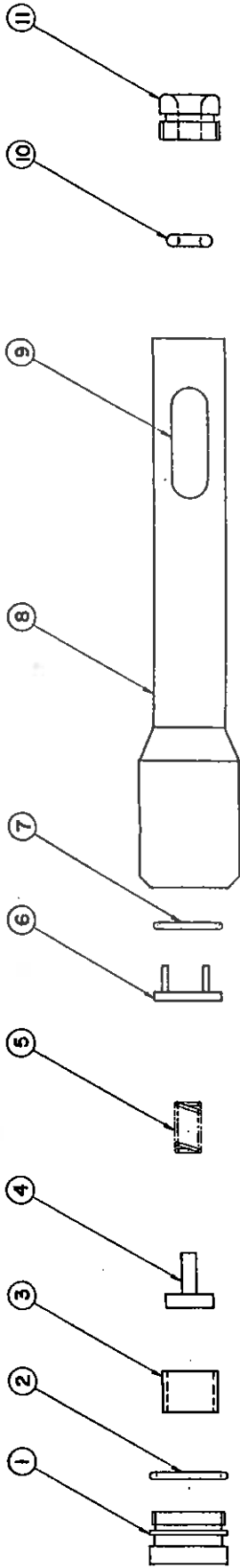


- NOTE -
- 3DS1-3 ARE COMMON ANODE 7 SEGMENT R.H. DECIMAL POINT DOUBLE DIGIT LED DISPLAYS.
 - 3DS4 IS A COMMON ANODE 7 SEGMENT R.H. DECIMAL POINT SINGLE DIGIT LED DISPLAY.
 - 3D1-9 ARE GREEN LEDS 3D10 IS AN ORANGE LED.

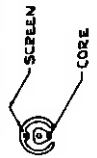
ELECTRO-MEDICAL SUPPLIES (Greenham) LTD.				
DRN	CHKD	MATERIAL & FINISH	SCALE	TOLERANCE
J J SHAVE	JWS			
COMPONENTS		ADDED	2	DW
INITIAL ISSUE		1	DW	
DESCRIPTION		1032		
DRG No		1032		

CIRCUIT DIAGRAM

170



NOTES!
TRANSducer HEAD CONNECTIONS.



TRANSducer PLUG CONNECTIONS.

- PIN NO 1 NO CONNECTION.
- PIN NO 2 SCREEN.
- PIN NO 3 CENTRE CORE
- PIN NO 4 TO PLUG, P.C.B
- PIN NO 5 TO PLUG, P.C.B
- PIN NO 6 LINE TO PIN NO 2

TEST COMPLETE HEAD FOR LEAKS BY IMMERSING
IN WATER AND APPLY A VACUUM 5" Hg (0=at)

REF	QTY/REP	DESCRIPTION	REMARKS
14	ASD-1-94	PLUG, PC B	
13	6-106	PLUG ASSY	AMPHENOL
12	CAS-A	CABLE ASSY (2' LONG)	1.5M
11	ASD-3-13	CABLE CLAMP	
10	9-65	O-RING 201-031	
9	AMG-07	SERIAL NO LABEL	
8	BS3-07	HANDLE 201-514	
7	107	SCREWS 201-514	
6	300-44	SCREWS	
5	5100-07	SPRING TERRY DIODIO	SLEEP PLATE
4	ASD-3-10	LINE WIRE	
3	9-106	O-RING .001-516	
2	ASD-3-10	HEAD ASSY	
1			REMARKS

DATE	BY	REVISION	DESCRIPTION
5/20/02	PLUG, PC B ADDED	39384	
4/11/00	SPRING DIODIO-HEAD ADDED	33187	
3/11/00	CABLE LDRW MODIFIED	28345	
2/03	LINE WIRE '21R'	49345	
1/01	NEW ASSY ADDED	7761	

DESIGNER	J. SHAW	SCALE	2:1
DRAWN	A. MAJFORD	SEE DETAILS	
CHECKED			
DATE			

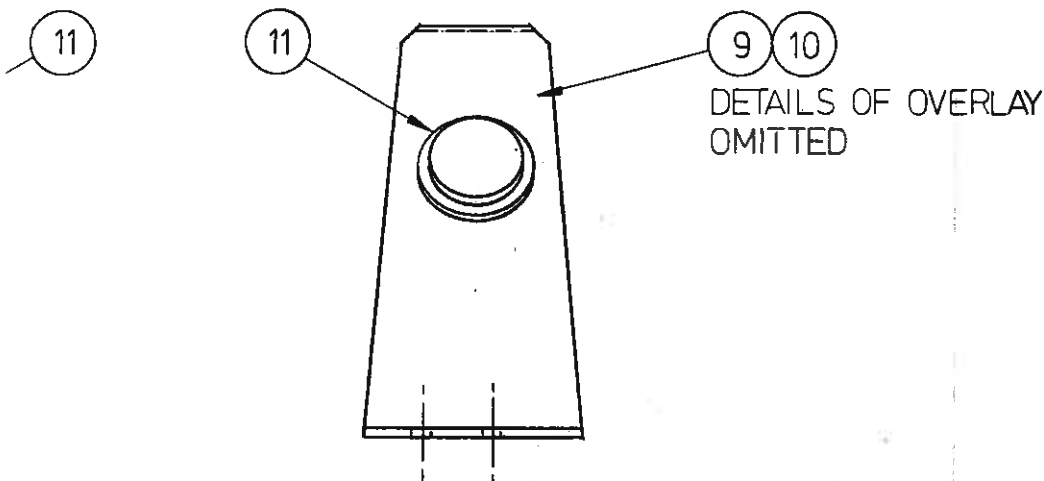
DESCRIPTION: SMALL TRANSDUCER ASSY

DATE: 11/01/02

BY: [Signature]

ELECTRO-MEDICAL SUPPLIES (Greenham) LTD.
WANTAGE OXFORDSHIRE

DRAWN TO BS 308



DETAILS OF OVERLAY
OMITTED

UNCONTROLLED COPY
ISSUED FOR INFORMATION
ONLY WILL NOT BE
UPDATED.

NOTE :- PINS 1 AND 3 ON SOCKET 11 ARE LINKED
VIA BROWN CABLE 70 LONG
PIN 1 ON SOCKET 11 GOES TO PIN 1 ON SOCKET 1

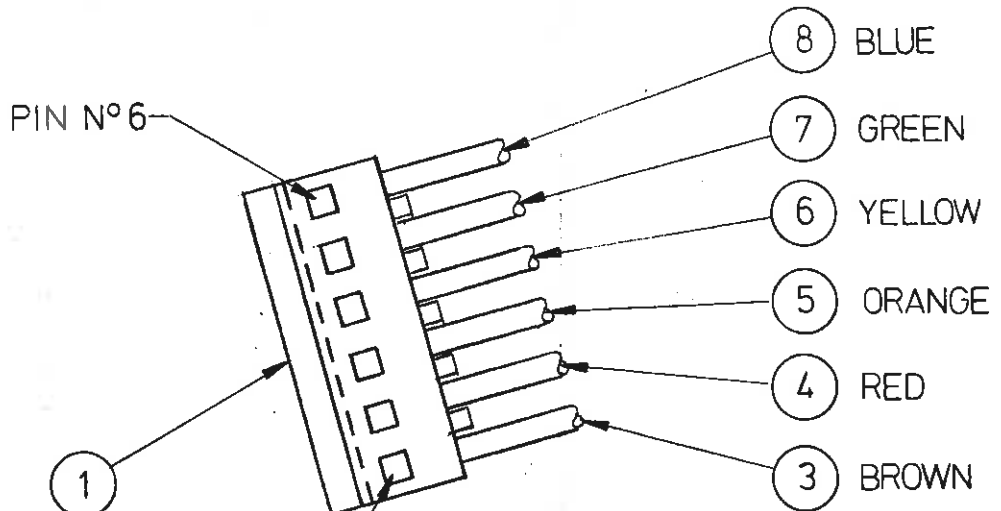
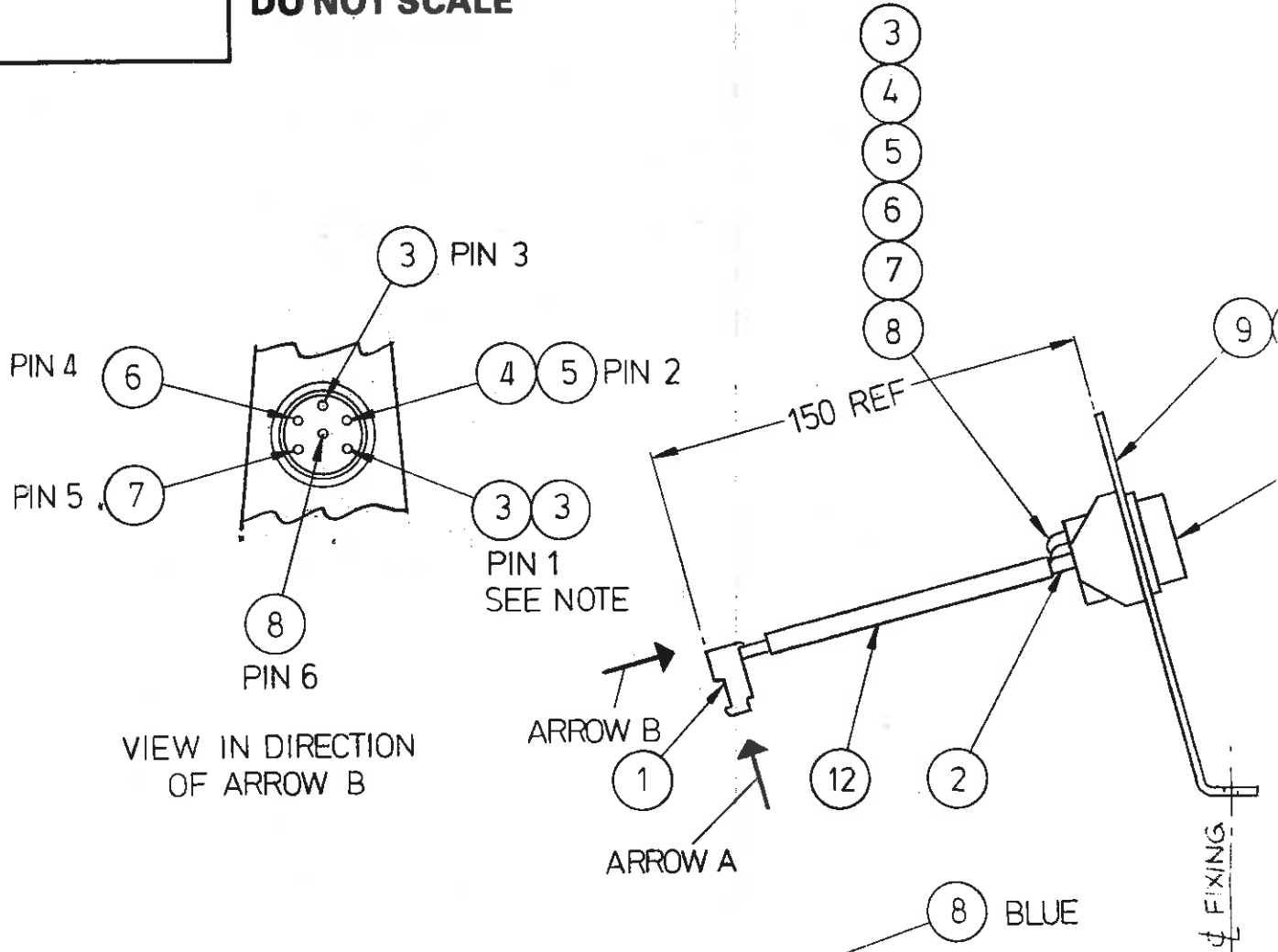
13	L57A	LABEL 'PER' NO BATCH	1	NOT SHOWN
12	2-23	SPYRAP	1	100mm LG
11	16-107	SOCKET 6W AMPHENOL	1	
10	A50-2-02	OUTPUT PANEL	1	
9	A50-3-12	OUTPUT PANEL OVERLAY	1	
8	C 65	CABLE BLUE 7/02	1	150mm LG
7	C 66	CABLE GREEN 7/02	1	"
6	C 63	CABLE YELLOW 7/02	1	"
5	C 73	CABLE ORANGE 7/02	1	"
4	C 72	CABLE RED 7/02	1	"
3	C 68	CABLE BROWN 7/02	1	220mm LG
2	R2	SLEEVE BLACK HELSYN	6	
1	16-02	SOCKET AMP MTA 6 WAY	1	
REF	DRG NO/SR	DESCRIPTION	QTY	REMARKS

IN CONTACT WITH THE
RES
LARGE WIRES AS FAR AWAY
THE GREEN AND YELLOW WIRES

ELECTRO-MEDICAL SUPPLIES (Greenham) LTD.
WANTAGE OXFORDSHIRE

DRN JJ SHAVE	CHKD 	MATERIAL & FINISH SEE DETAILS	SCALE 1:1 UON	TOLERANCE ~
7	ASA 1960 D	WORK INSTRUCTION NOTE ADDED	9.7.93	JJS
6	ASA 1883 B	DELETE 19-3.T2 : ADD 2-23	26.11.92	mpfc
ISS	AUTHORITY	DATE	SIG	
DESCRIPTION DIGITAL 1032 OUTPUT PANEL ASSY			DRG No. B 50-5-16	

**THIRD ANGLE PROJECTION
DO NOT SCALE**



ISS	AUTHORITY		DATE

TEST PROCEDURE
1032 DIGITAL MAIN BOARD.

UNITS COVERED : 1032 Digital Main Board (Model 50) B50-1-74
DATE : 9.12.1992
ISSUE : 6
No. of Pages : 2

EQUIPMENT REQUIRED : Test head * SMPSU
DVM Front panel
Frequency counter Ultrasonic balance
Oscilloscope

1) Before switching the unit on check that there are no loose bits of wire or solder splashes.

2) Check that all rails are free from short circuits. Check:-

+15v - 0v
-15v - 0v
+15v - -15v
+5v - 0v
+5v - +15v
+5v - -15v

3) Connect SMPSU to 7PL2 and front panel to 7PL1.

4) Switch on pressing the 1 and 3 MHz buttons together, this will bring the unit on in the test mode.

5) Turn RV2 fully clockwise.

6) The timer display will show ru 1 (ie RV1). Adjust RV1 until the power display indicates 128. When this is done the display will flash indicating that the preset value is correct. This adjustment sets the sensitivity of the contact control monitor.

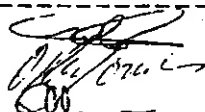
7) Press the W/Wcm2 button. Timer display will now show ru 2 (ie RV2). Adjust RV2 until display shows 001. Display flashes when this preset value is correct. This nulls the offset on the current monitor.

8) Press the W/Wcm2 button. Timer display will now show ru 5 (ie RV5). Connect a large head to the output socket and Adjust 7RV5 until display shows 190 (ie 1.9 V DC on pin 15 of 7IC10.) This sets the head sense circuit.

9) Press the W/Wcm2 button again. Display now shows 1000 (KHz) and TP9. Connect frequency counter to TP9. Frequency on counter should be +/- 0.004% of that displayed on front panel.

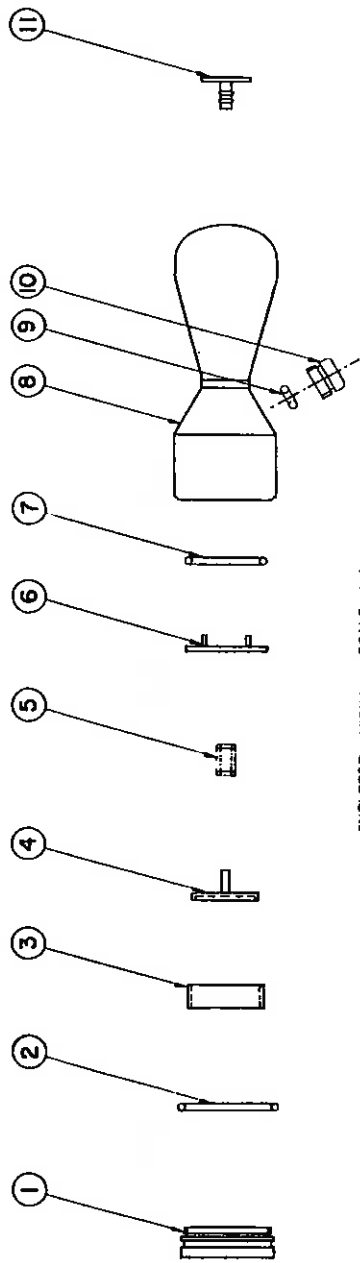
10) Press the W/Wcm2 button again and repeat as in 9. Sequence through the 8 steps: 1000, 1001, 1003, 1007, 1015, 1031, 1063 and 1127 KHz.

AUTHORISED (Design):
AGREED (Test) :
(Q.C.) :

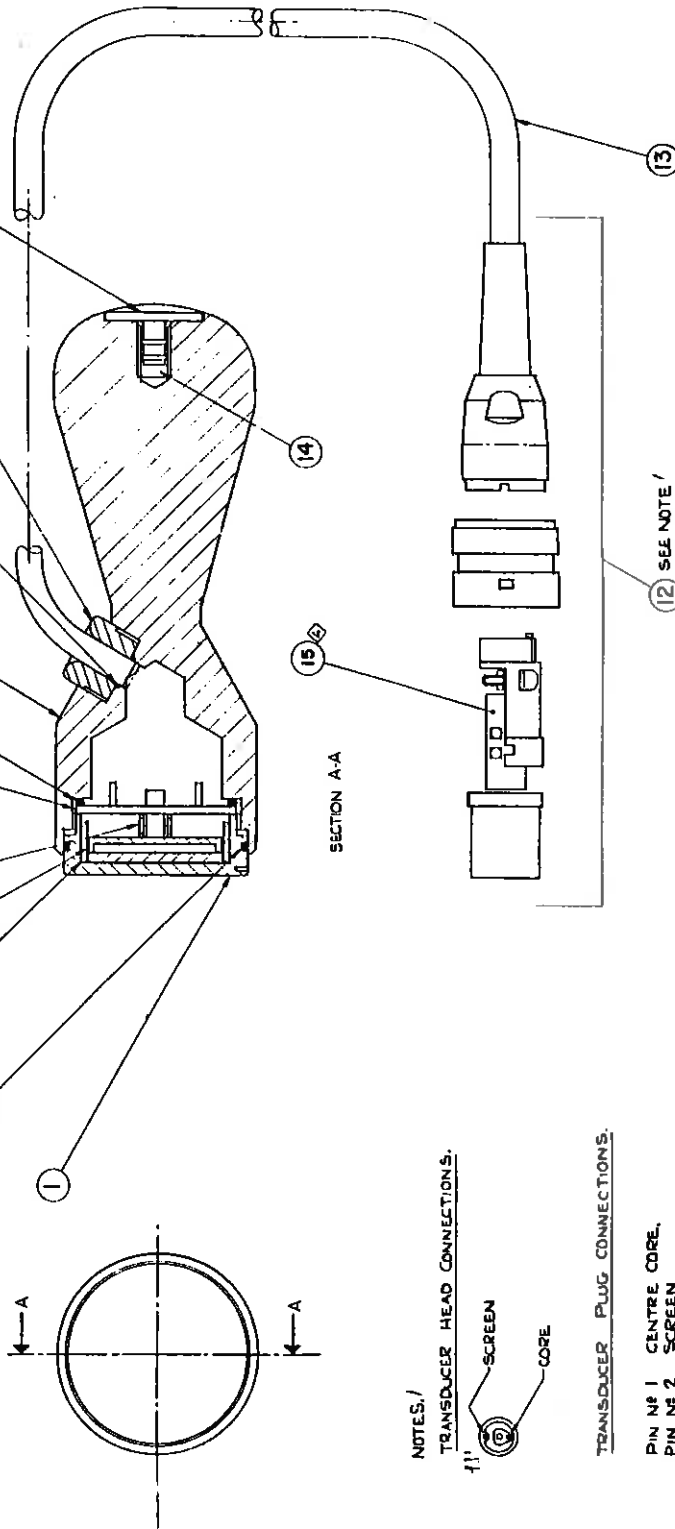


ISSUE:6

PAGE 1 OF 2

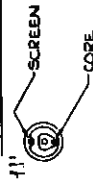


EXPLODED VIEW SCALE 1:1



NOTES /

TRANS-DUCER HEAD CONNECTIONS.



TRANS-DUCER PLUG CONNECTIONS.

- PIN № 1 CENTRE CORE.
- PIN № 2 SCREEN
- PIN № 3 NO CONNECTION
- PIN № 4 TO PLUG, P.C.B
- PIN № 5 TO PLUG, P.C.B
- PIN № 6 TO...2TR RESISTOR ON P.C.B.

TEST COMPLETE HEAD FOR LEAKS BY IMMERSING
IN WATER AND APPLY A VACUUM 5"Hg (0.2 ac)

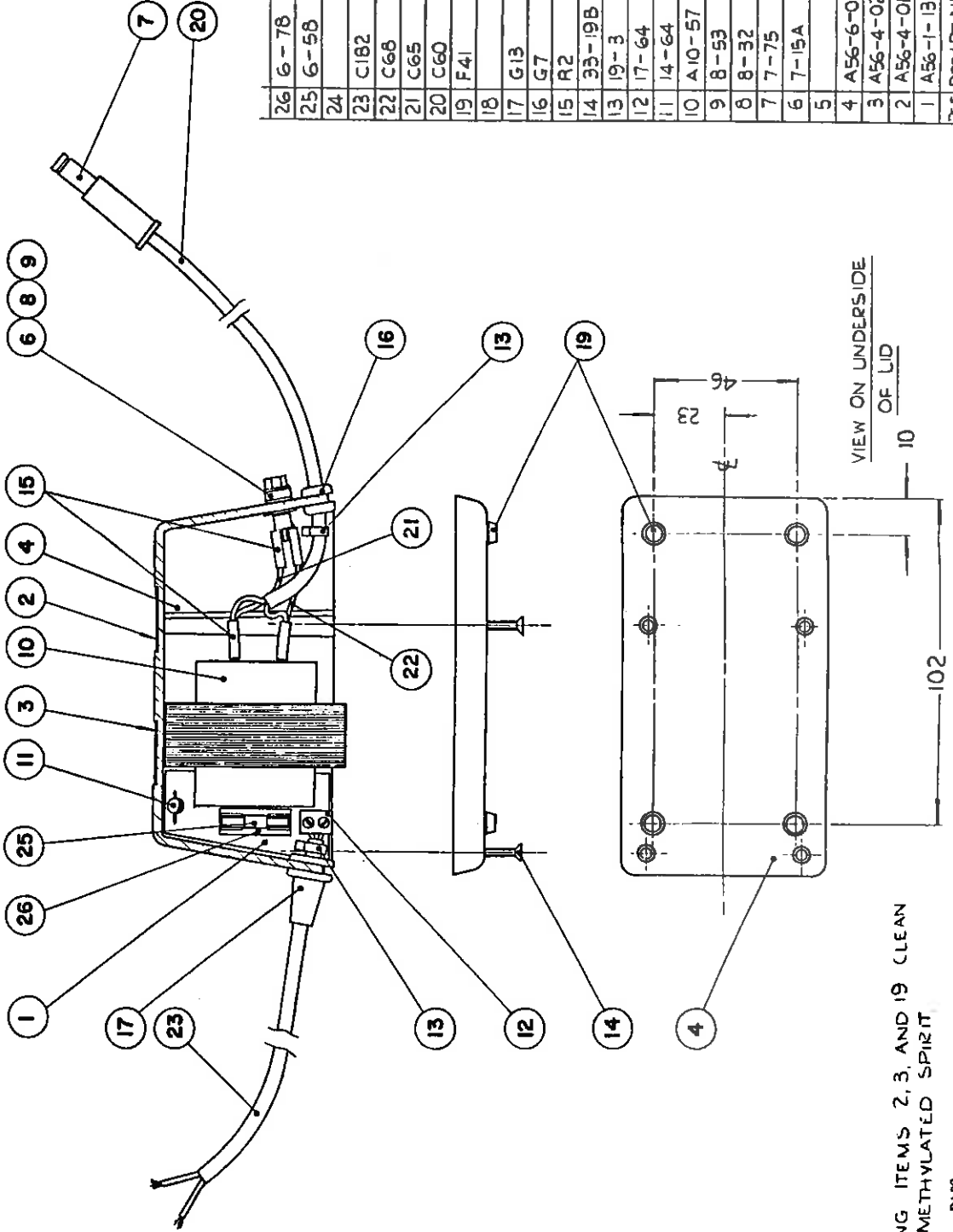
QTY	REF	DRG/REV	DESCRIPTION	REMARKS
1	5	ASO-1-B	PLUG P.C.B	
1	14	558	SILICONE RUBBER COMP	A/R
1	13	C46A	CABLE	(S LONG) 1.2M
1	12	16-105	PLUG ASSY	
1	11	ASO-2-30	LABEL	
1	10	ASO-3-13	CABLE CLAWS	
1	9	2-24	O RING	303 631
1	8	850-3-05	HANDLE	
1	7	9-104	O RING	200-024
1	6	ASO-1-54	PLUG ASSY	
1	5	5101	SPRING TERRY D.O.D	SILVER PLATE
1	4	ASO-3-05	PLUNGER	
1	3	ASO-3-09	INSULATOR	
1	2	9-105	O RING	303-525
1	1	150-5-12	HEAD ASSY	
1	REF	DRG/REV	DESCRIPTION	REMARKS

ELECTRO-MEDICAL SUPPLIES (Greenham) LTD.			
QTY	REF	DRG/REV	DESCRIPTION
1	5	ASO-1-B	PLUG P.C.B
1	4	292 D	PLUG P.C.B
1	3	1166 D	SPRING TERRY D.O.D
1	2	1165 B	Cable length reduced
1	1	DW	NEW ASSY



DRAWN TO BS 308

THIRD ANGLE PROJECTION
DO NOT SCALE



REF	DRG/PT N ^o	DESCRIPTION	REMARKS	QTY
26	6-76	FUSE HOLDER		1
25	6-58	FUSE, 20mm 100mA		1
24				
23	C182	CABLE TWIN CORE	300 cm	-
22	C68	CABLE BROWN 7/0.2	8 cm	-
21	C65	CABLE BLUE 7/0.2	8 cm	-
20	C60	CABLE TWIN CORE	150 cm	-
19	F41	FOOT, SELF ADHESIVE	BLACK	4
18				
17	G13	GROMMET Ø 6,35		1
16	G7	GROMMET Ø 6,35		1
15	R2	SLEEVE, HELSYN	BLACK	4
14	33-19B	M3 X 16 C/SUNK SCREW		4
13	19-3	CABLE TIE		2
12	17-64	TERMINAL BLOCK 2-WAY		1
11	14-64	THERMISTOR P.T.C		1
10	A10-57	TRANSFORMER 20VA 9V		1
9	B-53	LENS GREEN		1
8	B-32	LAMP 913-0012 12V		1
7	7-75	JACK PLUG 906		1
6	7-15A	INDICATOR SOCKET		1
5				
4	A56-6-01	ENCLOSURE PLASTIC		1
3	A56-4-02	LABEL SUPPLY VOLTS		1
2	A56-4-01	LABEL SERIAL NO		1
1	A56-1-13	P.C.B		1

ELECTRO-MEDICAL SUPPLIES (Greenham) LTD.			
DRN	CHKD	MATERIAL & FINISH	TOLERANCE
A. MURDRE	J. SHAW	SEE PARTS LIST	±0.2

DESCRIPTION		DRG NO.
240 VOLT CHARGER ASSEMBLY.		B 56-5-01

ISS AUTHORITY	DATE	S/G	ISS AUTHORITY	DATE	S/G

NOTE: - BEFORE FITTING ITEMS 2, 3, AND 19 CLEAN ALL DIMS IN DIM. ALL JOINTS SOLDERED.