

Technical Manual

TA. 944 100W Linear Amplifier



RACAL
THE ELECTRONICS GROUP

Racal-Mobilcal Limited 464 Basingstoke Road, Reading, Berks. RG2 0RY England
Tel. Reading 84461 or 85571 Telex. 847152 Grams: RACMOBILCAL READING
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Technical manual

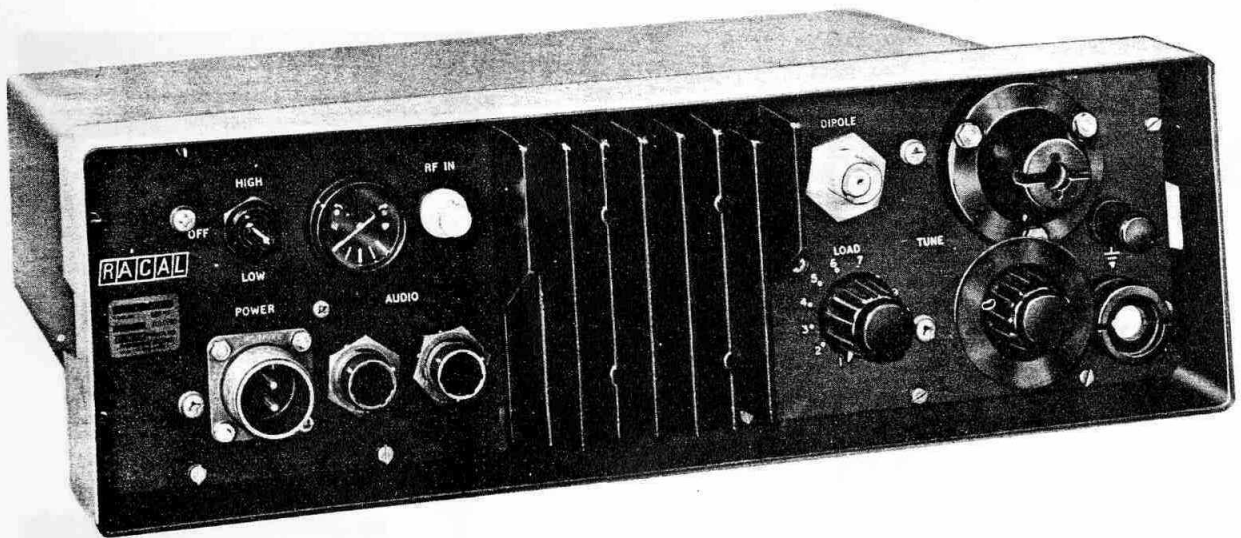
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100Watt Linear Amplifier Type TA.944

DANGER

LETHAL VOLTAGES

*Although every reasonable precaution has been observed
in design to safeguard operating personnel
this warning is . . .*

VITAL !

ADJUSTMENTS

EXERCISE GREAT CARE

DO NOT ADJUST ALONE

If possible, when making adjustments, ensure the presence of another person capable of rendering aid.

SERVICING

SWITCH OFF

**DO NOT TAMPER
WITH INTERLOCKS**

Only authorised personnel should be allowed to remove or neutralise the effect of interlocks. Do not rely on interlock switches for protection.

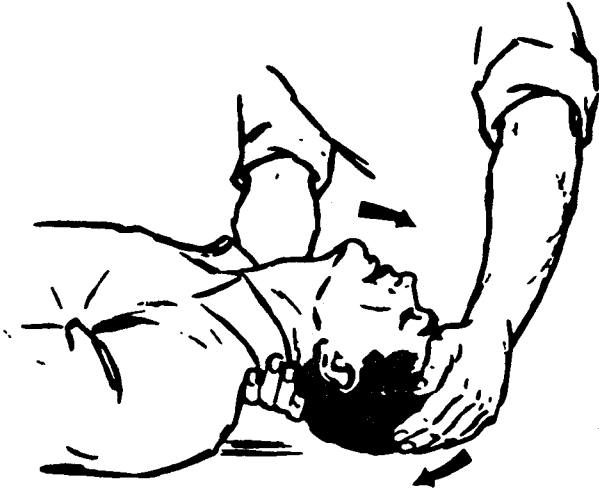
DO NOT SERVICE ALONE

If possible, when servicing, ensure the presence of another person capable of rendering aid.

SEE OVER FOR RESUSCITATION INSTRUCTIONS

FIRST AID

in case of Electric Shock



Have someone else send for a Doctor

Keep patient warm and loosen his clothing

1. Lay victim on his back.
2. Clear victim's mouth and throat.
3. Tilt victim's head back as far as possible and raise his head.
4. Pinch victim's nostrils.
5. Take a deep breath.
6. Cover the victim's mouth with yours and blow, watching his chest rise. Note: Blow forcefully into adults, but gently into children.
7. Move your face away to allow victim to breathe out, watching his chest fall.
8. Repeat first five to ten breaths at a rapid rate; thereafter, take one breath every three to five seconds.
9. Keep victim's head back as far as possible all the time.

**DO NOT Give liquids
until patient is conscious**

THIS HANDBOOK REFERS TO EQUIPMENT
SERIAL NUMBERAND SUBSEQUENT

HANDBOOK AMENDMENTS

See Yellow Amendment Sheet Numbers
which follow this page. The action called for by the amendments
should be carried out by hand as soon as possible.

RACAL MOBILCAL LIMITED, READING

AMENDMENT TO

TA.944 100W LINEAR AMPLIFIER

CHAPTER 8. COMPONENTS LIST

Page 8-2

Amend capacitor 4C25 to read: 4C28, 470 μ F, Electrolytic, Rating 25V
Tol. +50-10% Part No. 921180.

Add capacitor, 4C25 .01 μ F, Fixed, 250V +40% 916187
-20%

Add capacitor, 4C26 .01 μ F, Fixed, 250V +40% 916187
-20%

Add capacitor, 4C27 100 μ F, Electrolytic 63V +50% 921534
-10

Semiconductors

Amend TR1 to read 4TR1 and correct TR1 below this to read 4TR2.

Page 8-3

Amend resistor 1R22 to read 10k Part No. 922267

Page 8-6

Amend resistor 2R3 to read 1k Part No. 922338

Amend capacitor 2C1 to read 100 μ F, 63V +50% Part No. 921534
-10

Amend capacitor 2C5 to read 0.47 μ F, Fixed, 60V, 20% Part No. 916167

Amend capacitor 2C10 to read 47 μ F, Electrolytic, 40V +50% Part No. 921527
-10

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Amend resistor 3R1 Part No. to read 924939

Amend resistor 3R2 Part No. to read 924939

Amend resistor 3R8 to read 22 Ω Part No. 922320

Amend resistor 3R10 to read 22 Ω Part No. 922320

Amend resistor 3R12 to read 22 Ω Part No. 922320

Amend resistor 3R13 to read 22 Ω Part No. 922320

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Delete Resistor 3R72 (4.7k) Not Used.

Amend capacitor 3C14 to read 100p, Ceramic, Part No. 919723

Amend capacitor 3C15 to read 100p, Ceramic, Part No. 919723

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Amend capacitor 3C30 to read 0.01 μ F Disc Ceramic 63v, 20% Part No. 915173
Amend capacitor 3C34 to read 0.22 μ F, 100v, 5% Part No. 920142
Amend capacitor 3C35 to read 0.22 μ F, 100v, 5% Part No. 920142
Amend capacitor 3C36 to read 0.22 μ F, 100v, 5% Part No. 920142
Amend capacitor 3C37 to read 0.22 μ F, 100v, 5% Part No. 920142
Amend capacitor 3C38 to read 0.01 μ F, Disc Ceramic, 63v, 20%, Part No. 915173
Add capacitor 3C39 to read 0.01 μ F, Disc Ceramic, 63v, 20%, Part No. 915173

Page 8-13

Ferrite beads

Add 3FB6 to read FX1242 Part No. 907488
Add 3FB7 to read FX1242 Part No. 907488

Ferrite Cores

Add 4FB6 to read Core, Toroid Part No. 925149
Add 4FB7 to read Core, Toroid Part No. 925149

ILLUSTRATIONS

- Fig. 6. Add choke 2L1 which is located between diodes 2D7 and 2D6 on the board.
Add '+ve' signs to capacitors 2C8 and 2C10 at their junction with 2C6, 2D8, 2D9, 2C7.
- Fig. 7. Delete resistor 3R72.
Add capacitor 3C39 on the track side of PCB between the collector of 3TR19 and earth.
- Fig. 9. Add ferrite core 4FB6 on line, between 4C6(0.5) and junction of 4C2/4C23 negative ends.
Add capacitor 4C27 (100 μ F) between pin D1 (-ve) and pin D2 + 12v.
Amend resistor 1R22 to 10k.
Amend capacitor 2C1 to 100 μ F.
Add ferrite core 4FB7 on +12v line between 4C5(0.5) and connection to choke 4L1 and 4C4.
Amend resistor 2R3 to 1k.
Amend capacitor 2C5 to 0.47 μ F
Amend capacitor 2C10 to 47 μ F
Amend capacitor 4C25 to read 4C28, 470 μ F.

ILLUSTRATIONS (cont.)

Fig. 10. Add capacitor 4C25 (.01 μ F) between SK2 Pin F and earth
Add capacitor 4C26 (.01 μ F) between SK2 Pin E and earth

Amend resistor 3R8 to 22 Ω
Amend resistor 3R10 to 22 Ω
Amend resistor 3R12 to 22 Ω
Amend resistor 3R13 to 22 Ω

Add ferrite bead 3FB6 close to transformer 3T2 and
on line connecting to collector of 3TR4.
Add ferrite bead 3FB7 close to transformer 3T2 and
on line connecting to collector of 3TR5.

Amend transformer 3T3 to read 5 Turns/1 Turn
Amend transformer 3T4 to read 5 Turns/1 Turn

Amend capacitor 3C14 to 100p
Amend capacitor 3C15 to 100p
Amend capacitor 3C30 to read 0.01 μ F

Delete resistor 3R72 (4.7k)

Add capacitor 3C39 (0.01 μ F) between the collector
of transistor 3TR19 and earth.

Amend capacitors 3C36, 3C37, 3C34 and 3C35
to each read 0.22 μ F.

Add capacitor 4C29 (15pF) between the junction
of inductor 4L2/Tag C10/line to SB.1, and earth.

100W LINEAR AMPLIFIER TYPE TA.944

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ILLUSTRATIONS

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TECHNICAL SPECIFICATION

Frequency range	1.6 to 30MHz
Nominal power output into 50 ohms	SSB (A3a, A4j): 100W p.e.p. AM (A2, A3) : 35W carrier with full modulation. The minimum output power over the frequency range 4 to 30MHz is better than 1.5dB below the nominal output.
Harmonic emission	No harmonic will exceed - 40dB relative to full p.e.p. into 50 ohm load.
Intermodulation distortion	-25dB relative to each tone of the standard two tone test at full power into 50 ohms.
Antennas	2.4m (8ft) whip (for operation above 2MHz) End fed . Dipole .
Power supply	<u>Portable operation</u> 24 volt 3.5 Ah nickel cadmium rechargeable battery MA934 <u>Vehicle operation</u> Direct from 12/24 volt vehicle supply
Weight	Basic TA944 unit only 5.9kg (13 lb) Operational amplifier with whip antenna, including cadmium battery MA934 and harness assembly (11.3kg) 25 lbs.
Temperature range	Operating - 10°C to +55°C Storage - 40°C to +70°C
Power consumption	3.5A at 24 volts for SSB average speech
Transmit/Standby Duty Cycle	1:3 at full output C.W. with maximum transmit period of 5 minutes at 40°C ambient temperature.
Front Panel Controls and Facilities	(a) Power switch selecting: LOW POWER OFF HIGH POWER

- (b) Antenna current meter
- (c) Antenna tuning control
- (d) Antenna loading control
- (e) Whip antenna socket
- (f) Dipole antenna socket
- (g) RF input socket
- (h) Socket for PSU
- (i) Two accessory sockets.

CHAPTER 1

GENERAL DESCRIPTION

1. The Linear Amplifier Type TA.944 provides 100 watts p.e.p. output. Although designed primarily for use with any of the Racal Mobilcal HF range of manpacks, it may be operated from any transmitter with an output in the range 1-5 watts. The amplifier has a frequency range of 1.6MHz to 30MHz and its output is fed via an integral antenna tuning network and this will match in to the standard 8ft whip antenna, end fed antenna or dipole.
2. The amplifier incorporates simplified antenna tuning controls with illuminated tuning direction indicators. The amplifier gain is automatically adjusted against overload, VSWR mismatch and excess voltage swing. Protection against an excess heat sink temperature is also incorporated.
3. The TA.944 will operate from battery voltages in the range 12V to 32V d.c. This can be obtained either from an external source, or from a clip-on Nickel-Cadmium battery Type MA.934. A $\pm 18V$ supply is produced by the amplifier unit for use by the manpack when its own battery is disconnected.
4. The internal power supplies are voltage stabilised and overload protected, and a detection circuit prevents operation if the battery voltage is too low. There is also thermal protection for the power switching transistors.
5. The amplifier is suitable for manpack, vehicle or static applications. It is designed to fit a carrying harness identical to the TRA.931 and TRA.932 harness and in this configuration the total weight including battery is 11.3 kg (25 lb).
6. The TA.944 amplifier uses all solid state devices, is fully waterproof and can be totally immersed for an indefinite period. Dehumidifying of the amplifier is achieved by the inclusion of a desiccator unit, which can be replaced or re-conditioned without breaking the main seal on the unit.

CHAPTER 2

INSTALLATION INSTRUCTIONS

PRELIMINARY PROCEDURES

1. Before making any connections to the TA.944 amplifier check that the amplifier, manpack, and power unit are all switched off.
2. When the screw-on battery MA.934 is used, it is normal for the manpack to have a separate battery pack to minimise current drain under long 'listen-out' conditions (amplifier switched off). However, the manpack can be driven from the MA.934 via an inverter in the amplifier unit at lower efficiency.

INSTALLATION PROCEDURES

NOTE: These procedures cover connections to a battery and the manpack using the standard cables.

3. (1) Connect the coaxial cable ST.700664 between the TA.944 RF INPUT socket and the appropriate 50 ohm socket on the manpack, dependent on the operating frequency.
- (2) Connect lead ST.700665, terminated with 6-way Thorn Pygmy plug at each end, into one of the two AUDIO sockets on the manpack and plug the other end into one of the two AUDIO sockets on the TA.944.
- (3) Connect the ST.701865 lead, terminated with a 2-way socket, from a battery to the 2-pin POWER plug on the TA.944. Where the battery is some distance from the amplifier, the lead should be connected to a junction box and the battery connection then continued in heavy duty wire or braid.
Alternatively, the screw-on battery MA.934 may be used.
- (4) Connect all earth terminals to earth. These connections should be as short as possible, be of either stout wire or braid and in vehicle installation must be bonded to the vehicle earth to minimise ignition interference.
- (5) Connect the handset or morse key to the remaining AUDIO socket on the manpack.

NOTE: With the exception of the mic. input, exactly similar connections can be made to the spare AUDIO socket on Amplifier TA.944. For example, where both the handset and key will be required, the key can be connected to the spare AUDIO socket (see Table 1) on the amplifier and the handset to the spare socket on the manpack.

- (6) Connect the antenna to either the whip or to the dipole socket. For recommended antenna details reference should be made to the appropriate section of the operators handbook for the associated manpack. A BNC-C coaxial adapter is supplied for use with the standard dipole antenna. High voltages will be present on the antenna during transmission and if possible it should be erected in a position where it cannot be accidentally touched.

NOTE: When the antenna is connected via the whip socket, the BNC-C adapter should be removed.

CABLE ASSEMBLIES

4. A list of the interconnecting cables available with the amplifier is given below, together with the standard length and the maximum length allowable.

<u>Cable</u>	<u>Quantity</u>	<u>Standard Length</u>	<u>Maximum Length</u>
CA.701865 (2-way)	1	1 metre	1 metre
CA.700664/A (coaxial)	1	1 metre	10 metre
CA.700665/A (6-way)	1	1 metre	1 metre

TABLE 1

Audio Socket Pin Connections

<u>Pin</u>	<u>Function</u>
A	Not used
B	18V, 4A (for manpack, if required)
C	PTT line
D	Earth
E	Keyline
F	A.F.

CHAPTER 3

OPERATING INSTRUCTIONS

INTRODUCTION

1. The manpack and the amplifier must be connected as described in the preceding Chapter.

WARNING: DANGEROUS VOLTAGES ARE PRESENT ON THE ANTENNA DURING TRANSMISSION AND CAUTION MUST BE EXERCISED TO AVOID CONTACT WITH THE ANTENNA AND ITS ACCESSORIES.

TUNING

2. (1) Set the OFF switch on the amplifier to HIGH.
- (2) Check that a meter reading of three-quarters scale is obtained on the amplifier unit. On standby the meter indicates the supply voltage for the manpack.
- (3) Select the required frequency on the manpack and check that the coaxial cable from the amplifier is connected to the correct 50 ohm socket on the manpack for the frequency selected.
- (4) Set the POWER switch on the manpack to LOW.
- (5) Set the Mode switch on the manpack to TUNE.
- (6) Depress either the Press-to-Talk (PTT) switch or the key, and adjust the TUNE control on the manpack for a maximum reading on its meter.

NOTE: On the TRA.931 and TRA.932 these lines are enabled on the TUNE position.

- (7) Set the LOAD switch on the amplifier to T. Note which indicator lamp on the meter lights, and rotate the tuning control in the direction indicated until both lamps are extinguished and a meter reading indicating antenna current is obtained. Maximum antenna current is then obtained by selecting the optimum position of the LOAD switch, slightly readjusting the TUNE control as necessary to obtain the optimum reading.

OPERATING

3. (1) Set the POWER switch on the manpack to LOW.

- (2) Set the Mode switch to the desired mode and use the handset or key as required.

CAUTION: The amplifier should not be operated with the manpack on HIGH POWER.

- (3) When the 100 watt output is not required, select LOW on the amplifier; this connects the manpack output directly to the antenna via the integral matching network. The low or high power output of the manpack can then be used in the usual way.
- (4) If the manpack has its own power supply, the amplifier can be set to OFF for listening out purposes; the antenna is still connected through to the manpack.

FREQUENCY CHANGING

4. To change to a new channel frequency, repeat the tuning and operating procedures given in operations 2(3) to 3(2).

CHAPTER 4

CIRCUIT DESCRIPTION

1. The Amplifier TA.944 comprises two functional sections. One is a power supply section and the other is the 100 watt amplifier. The power supply consists of a switching regulator to supply +12V at 30A from supply voltages in the range 12V to 32V, and an inverter supplying +18V at 4A largely for external use.
2. Component references with prefix '4' refer to chassis-mounted components, prefix '1' identifies Power Supply Control board components, prefix '2' identifies Converter board components, and prefix '3' identifies Linear Amplifier board components.

+12V POWER SUPPLY

3. A block diagram of the power supply is shown in Fig.1. To provide a constant +12V from a battery supply covering the range 12V to 32V, a switching system is used where the mark to space ratio of the switching waveform determines the mean voltage transferred from the input to a smoothing circuit. A voltage comparator connected to the output produces an error voltage which is fed via a gate and controls the 'on' time of the waveform from the switching comparator. Thus, if the voltage is too high the 'on' time is made shorter, so reducing the mean voltage fed to the smoothing circuit.
4. The current drawn by the system is also monitored. When the current drain exceeds a preset value, the current comparator produces an error voltage which is fed via two gates to the switching comparator and causes a reduction in the output voltage. The reference input to the current comparator is derived from the output voltage and so both the current and voltage are reduced as the load increases. This produces a re-entrant current characteristic (Fig.4.1).

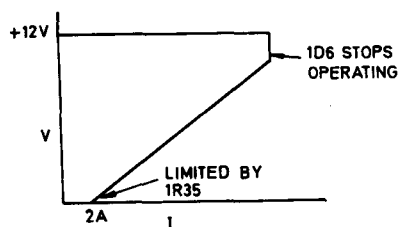


FIG. 4.1 CURRENT RE-ENTRANT CHARACTERISTIC

5. An input of at least 10V must be applied to give correct operation. The AND gate, at switch on, provides an input to the switching comparator which prevents the series switch operating. The input voltage level is monitored by a reference circuit which produces one input to the AND gate. The other input is obtained from a +5V stabiliser circuit which produces the supply voltage for the switching control system. Thus, the AND gate will not operate and release the switching circuits until the input has reached the correct voltage and the control circuits are operative.
6. A thermistor bridge monitors the temperature on the heat sink containing the switching transistors. Under fault conditions, an output from the bridge would be applied via the gate to the switching comparator to make the switch system inoperative.
7. The circuit diagram is shown in Fig.8. The battery is connected in both the HIGH and LOW positions of SA. The series switch consists of the parallel-connected transistors 4TR1, 4TR2 and the smoothing circuit consists of 4L1, 4C4. To limit the switch-on surge as current flows into 4C2, relay 4RLA is initially unenergised and the current has to flow through the limiting resistor 4R1; the diode 4D1 provides reverse polarity protection. Once the switching regulator is operating, 4RLA is energised from the +12V supply, contacts 4RLA/1 close and circuit 4R1, 4D1 is bypassed.
8. 4R2 is a current sensing resistor, 4D2 limits switching spikes and 4D3 limits the negative swing to 0V when the switching transistors go off. 4C1, 4C3, 4C5 and 4C6 are fitted to minimise RFI radiation.
9. The 20kHz oscillator is a conventional multivibrator 1TR3, 1TR4. The square wave output is integrated by 1R11, 1C4 and the triangular waveform produced is fed via the emitter-follower 1TR5 to the switching comparator 1TR6, 1TR7. A d.c. level applied to the other input to the comparator determines how much of the triangular input will appear at the output. In fact, due to the gain of 1TR7, the waveform appears as a pulse rather than the tip of a triangle and it is further 'squared' in the driver stages 1TR8, 1TR9, 1TR10. The driver stages are supplied with at least 15V from a winding on the inverter.

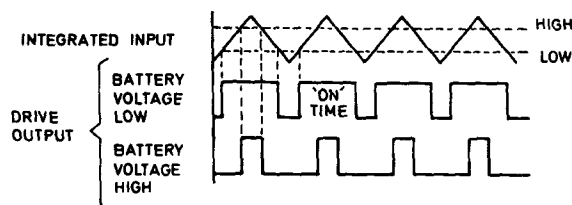


FIG. 4-2 SIMPLIFIED SWITCHING COMPARATOR OPERATION

10. The voltage comparator consists of 1TR19, 1TR20, and its reference is obtained from the zener diode 1D8. The error voltage is fed from 1TR20 collector. The current comparator is 1TR17 circuit. The voltage developed across the current sensing resistor 4R2 is applied between the base and the supply connection to 1TR1 emitter; the latter is fed from

the current source 1TR18. When the voltage drop across the sensing resistor 4R2 exceeds the voltage drop across 1R29, transistor 1TR17 switches on and its output is fed to the switching comparator via the emitter-follower 1TR16. The zener diode 1D7 provides a constant current to 1D5 over the full input voltage range. 1D5 compensates for the voltage drop in 1TR17 and also provides temperature compensation. Zener diode 1D6 holds the base of the current source at 6.2V. However, when the voltage at the junction of 1R37/1R38 falls below 6.2V, the base voltage of 1TR18 also falls, giving the re-entrant characteristic.

11. The AND gate consists of 1TR14, 1TR15. At switch-on, the positive supply voltage is fed via 1D3, 1TR16 and 1D1 to hold the switching system off. When the input exceeds 10V a base drive is applied to 1TR15. The +5V supply for the switch control circuits is obtained from the input via the series control transistor 1TR13. This transistor has zener diode 1D2 as reference. Until 1D2 conducts, and the 5V supply is present, 1TR14 cannot conduct. When 1TR14 conducts, 1TR15 is also able to conduct, the diode 1D3 is reverse biased and the switching comparator is free to operate normally.

12. The thermistor bridge consists of 4TH1/1R1, 1R2, 1R5, 1R6. Bridge unbalance is sensed by 1TR1, 1TR2 such that a high temperature (above approximately 125°C) will cause 1TR11 to clamp the base of 1TR7 to +5V preventing the switch system from operating.

+18V POWER SUPPLY

13. The +18V power supply consists of an inverter operating at 20kHz, with its associated control circuit. The converter consists of the push-pull transistors 2TR4, 2TR5 driving the output transformer 2T2. 2T1 is a saturating drive transformer fed from the output. As the output rises due to one transistor, 2T1 supplies voltage to the base of the conducting transistor. Eventually 2T1 saturates, the base voltages drop to zero, the conducting transistor turns off, the current through 2T2 is reversed, and the other drive transistor turns on.

14. The main secondary output of 2T2 is full wave rectified by 2D8, 2D9, smoothed by 2C8, 2C10 and fed out by the RFI capacitor C7. The voltage from the other secondary is full wave rectified by 2D10, 2D11, and smoothed by 2C9, 2C11. The common point of this secondary is connected to the DC input to give a voltage of at least 15V for the switch drive transistors.

15. At switch on, the voltage across 2C2 is zero and 2TR1, 2TR3 are not conducting. The rising voltage through 2R3, 2R6 causes 2TR1 to switch on first, which in turn switches on 2TR3 to apply base drive to the push-pull transistors. To minimise current drain under receive conditions, 2D6, 2D7 conduct as 2TR4, 2TR5 collectors swing towards 0V, and so reduce the drive to 2TR1 base. This reduces the output bias to a level where approximately 0.5V is maintained across the output transistor which is conducting.

16. If the load is increased until the drop across the current sensing resistors 2R4, 2R5 exceeds that across 2D1, 2R1, transistor 2TR3 will start to turn off and the output transistors will not be fully driven. The voltage across 2C2 will then rise, 2D5 and 2TR2 will conduct and 2TR1 and 2TR3 will be turned off. The only base drive for the output transistors

will then be through 2R7, which allows a short-circuit current of about 2A to flow; this enables the system to revert to normal operation once the overload is removed.

RF INPUT

17. The RF input enters the unit at SK3 and is fed via relay contacts 3RLA/1 (when energised) to an attenuator 3R1, 3R2, 3R3, 3R4. This presents a 50 ohm impedance to the line and also, with 3T1, reduces the input level to about 50mW; this is to avoid overloading the gain controlled input stage.
18. Excluding the automatic level control (ALC) described in para.23, the first stage consists of the common base push-pull amplifier 3TR4, 3TR5, which is transformer coupled to the driver stage.

DRIVER STAGE

19. The driver stage 3TR11, 3TR12, is a push-pull common emitter amplifier with collector to base negative feedback. Its output is transformer coupled via 3T5 to the P.A. stages.

POWER AMPLIFIER STAGES

20. The P.A. stages 3TR14, 3TR15 and 3TR16, 3TR17 are transformer coupled class B amplifiers with negative feedback between collector and base of each stage. The primary of 3T8 is connected across the output of both stages and its secondary feeds the antenna tuning unit. The bias for the P.A. stages is provided by 3D9, which is fed from the current passing through the driver stage.

AMPLIFIER CURRENT DETECTOR

21. The current taken by the amplifier is sensed by resistors 3R64 to 3R71 inclusive and the voltage drop produced is applied to 3TR18 where it is compared with the reference provided by 3R58, 3R62 and applied to 3TR19. The error voltage produced is fed onto the control line to the ALC stage via the emitter-follower 3TR20.

VSWR MISMATCH DETECTION

22. Severe mismatch will cause a reflection through 3T9, which is rectified by 3D12 and fed on to the ALC control line via 3R56. This voltage reduces the drive in to the amplifier when there is a mismatch, to minimise thermal dissipation.

P.A. VOLTAGE DETECTION

23. 3D13 and 3D14 feed a voltage on to the ALC control line when the voltage swing of the P.A. stage exceeds that necessary to maintain operation within the linear region of the stages. The ALC stage then reduces the drive into the P.A. stage to limit the voltage swing.

AUTOMATIC LEVEL CONTROL STAGE

24. The purpose of this stage is to provide an approximately constant output from the P.A. stage by controlling the input to the driver stage. The ALC control line is fed via emitter-follower 3TR2 to the base of the amplifiers 3TR4, 3TR5. The bases of 3TR3, 3TR6 are provided with a fixed voltage from 3R18, 3R19 via emitter-follower 3TR7. The transistors 3TR3, 3TR6 start to conduct when the voltage from 3TR2 emitter falls below that at 3TR7 emitter. This diverts excess input into the loads 3R8, 3R13, and maintains a sensibly constant output from the collectors of 3TR4, 3TR5; under mismatch conditions it would divert more of the input, so reducing the output from 3TR4, 3TR5.
25. Capacitor 3C7 provides a time constant (approx. 1 sec.) to prevent the automatic level control following the variations in the input modulation. Diodes 3D5, 3D6 prevent excessive reverse voltages being applied to 3TR2 to 3TR7 inclusive.

ANTENNA LOADING UNIT

26. Tuning is carried out by adjusting 4L2 and loading is achieved by selecting capacitors, using 11 of the 12 positions on switch SB. The whip antenna being largely capacitive takes its output directly from 4L2, while the dipole requires the additional capacitance 4C19, 4C21 in its feed to minimise harmonics and provide 50 ohm matching.

SEND/RECEIVE SWITCHING

27. With SA in the HIGH position, +18V is applied to 3TR1 circuit. When the PTT line (SK1/C) is energised, 3TR1 is switched on through 3D3. Relays 3RLA and 3RLB are energised and the amplifier is connected in circuit. When the keyline (SK1/E) is earthed, 3TR1 is switched on via 3D4 and 3D2. At the same time, 3C6 charges through 3R11; this provides approximately 0.5 sec. delay after releasing the key before 3TR1 goes off (to prevent continuous on-off relay operation during morse or data transmission).
28. A thermal cut-out is connected in the supply to 3TR1 circuit. It operates if the temperature on the P.A. heat sink exceeds 100°C. In this condition, or with SA set to LOW, the relays are unenergised, the input is fed straight through to the antenna tuning unit and the +12V supply to the RF input and driver stages is disconnected (the P.A. stages remain on but there is no bias).

METER & TUNING INDICATOR

29. In the receive mode, the meter monitors the +18V supply via 3R15, 3R16. In the transmit mode, 3D7 or 3D8 clamps the +18V supply to the meter. A sample of the RF output is coupled via 4C20 to the detector 3D15 and the meter now monitors this voltage.
30. When SB is turned fully clockwise (position T) 3R32 is connected to 0V, which turns on 3TR13; this 'enables' the tuning lamp indicator circuit. The connections to 3D10 and 3D11 are such that a d.c. voltage is produced across 3D10 which is proportional to the r.f. voltage appearing across the antenna (capacitive), and a d.c. voltage is produced across 3D11 which is proportional to the r.f. voltage appearing across 4L2. At resonance these two

voltages are equal. Off resonance, a negative voltage across 3C13 indicates that the voltage across the antenna is greater than across 4L2, and a positive voltage indicates the opposite. A negative voltage causes 3TR10 to conduct, which turns on the L.E.D. indicator in the meter indicating that the tuning control should be turned anti-clockwise. A positive voltage turns on transistors 3TR9, 3TR8 which in turn light the 'clockwise' L.E.D.

CHAPTER 5

DISMANTLING AND RE-ASSEMBLY

REMOVAL OF CASE AND COVERS

1. The case can be removed from the main unit after removal of sixteen screws from around the edge of the front panel. Care must be used during removal to ensure that the internal battery leads, connected between the case and the main unit, are not damaged. Disconnect the leads to allow complete removal of case.
2. The two internal covers are removed by loosening the fixing screws, and sliding the covers to the rear of the unit.

LINEAR AMPLIFIER BOARD REMOVAL

3. (1) The unit should be placed so that the ATU is at the left-hand side of the unit.
(2) Remove the one board retaining screw situated to the rear of the thermal cut-out (Fig.4), taking care not to lose or damage the insulating and metal washers.
(3) Unscrew and remove the six amplifier power transistor securing nuts. (Four transistors are mounted through the cast heat sink and the remaining two are mounted through the chassis to the rear of the heat sink.) Care must be taken not to lose or damage the washers and nuts.
(4) Turn the unit over and remove the eight securing screws from the upper side of the board.
(5) Remove the three crimped leads from the front left side of the board.
(6) The board must now be lifted in an upward direction until the amplifier power transistor studs are clear from the cast heat sink when the board can be 'hinged' on its cable-form to the right of the unit.
(7) The underside of the board is now accessible.

CONVERTER & POWER SUPPLY CONTROL BOARDS REMOVAL

4. The track sides of these two boards are easily made accessible by removing the fixing screws (5 on the converter, 4 on the power supply) and hinging the boards out on their cableforms.

RE-ASSEMBLY

5. The re-assembly procedures are the reverse of the dismantling operations above, but the following points should be noted when replacing the amplifier board.
 - (1) Ensure that all swarf and foreign matter is removed from the mating surfaces and adjacent areas where the power transistors are fixed to the chassis.
 - (2) Lightly smear chassis/transistor mating surfaces with an even film of THERMAFLOW A30/J compound.
 - (3) Ensure that the insulating washer on the retaining screw (para.3(2)) is replaced during re-assembly.

CHAPTER 6

ADJUSTMENTS

INTRODUCTION

1. This chapter details the procedures and tests required to ensure that the TA.944 meets its specification. Access to the circuits is obtained by removing the rear cover (see Chap.5) and the two screening panels from the chassis.

TEST EQUIPMENT

2. The following test equipment is required to carry out the procedures:-
 - (a) Two Tone RF Generator. The associated Racal Mobilcal manpack Type TRA.931 with the CA.531 test set can be used as a two-tone generator.
 - (b) Load Resistors. 2 ohm at 75W, 0.5 ohm at 300W, 100 ohm at 4W, 5 ohm at 80W.
 - (c) 100W, 50 ohm, r.f. power meter, frequency range 1 to 30MHz. The Marconi Type TF 2503 is suitable.
 - (d) Oscilloscope, frequency range 1 to 30MHz, sensitivity 50mV. The Tektronix 453 is suitable.
 - (e) Multimeter, 20 000 ohms per volt. The AVO Model 9 is suitable.
 - (f) Power Supply, 0 to 24V, 0 to 30A. The Farnell Type H60/50 is suitable.

MECHANICAL CHECKS

3.
 - (a) Check front panel controls for smooth action, correct orientation and fitting.
 - (b) Ensure that the tuning control moves freely and the end stops function correctly without fouling.

REGULATOR CHECKS

4.
 - (a) Set 1R29 and 1R44 fully clockwise and set POWER switch to LOW. Using the multimeter, verify that the resistance between PL1 pin A and chassis is greater than 1 Mohm. Repeat the test between PL1 pin B and chassis.

- (b) Connect the DC Power Supply, with the output voltage set to zero, to PL1 pins A (positive) and B. Increase the power supply voltage to 12V and visually check that relay 4RLA1 has operated.
- (c) Further increase power supply voltage to 16V and verify that the d.c. input current lies between 0.5A and 1.5A.
- (d) Connect the multimeter, set to the 25V d.c. range, between 4C5 (terminal D2) and 4C6 (terminal D1); 4C5 will be positive. Adjust 1R44 until multimeter reads 13.5V.
- (e) Transfer multimeter to pins A4 (positive) and A3, and verify that a reading of approximately 3V is obtained.
- (f) Connect the multimeter, the 0.5 ohm 300W load, and the 2 ohm 75W load all in parallel between 4C5 and 4C6. Adjust 1R29 until multimeter reads 11.5V.
- (g) Disconnect the 2 ohm load only. Verify that multimeter reading lies between 13V and 13.5V.
- (h) Check that the power supply current drain does not exceed 30A. Increase power supply voltage to 24V and verify that multimeter reading still lies between 13V and 13.5V.
- (i) Check that the power supply current does not exceed 20A. Short-circuit the 0.5 ohm load and verify that the power supply current is now less than 2A. Disconnect short-circuit, load, and multimeter.

CONVERTER CHECKS

- 5. (a) Connect the multimeter between pins D and B (positive) of SK1, and verify that a reading of approximately 20V is obtained.
- (b) Connect the 100 ohm 4W load also between SK1 pins D and B and verify that the multimeter reading is now approximately 19V.
- (c) Connect the 5 ohm 80W load also between pins D and B and verify that the multimeter reading is now approximately 17V.
- (d) Check that the power supply current is approximately 6A. Short-circuit load and verify that power supply current is now less than 1A.
- (e) Disconnect short-circuit, loads, and multimeter. Verify that front panel meter reads between $\frac{1}{2}$ and $\frac{3}{4}$ full scale.

AMPLIFIER CHECKS

6.
 - (a) Connect the power meter and oscilloscope, in parallel, to SK4 (dipole). Set the output of Two Tone RF Generator to SINGLE TONE, with a level of 1W and frequency of 2MHz, and connect it to SK3 (RF IN).
 - (b) Adjust TUNE AND LOAD control on TA.944 to give maximum deflection on oscilloscope. Check that it is greater than 16V peak-to-peak.
 - (c) Set Two Tone RF Generator to 30MHz at a level of 1W, and repeat check (b) above noting that oscilloscope deflection exceeds 18V peak-to-peak.
 - (d) Set Two Tone RF Generator to 12MHz at a level of 1W, and repeat check (b) above noting that oscilloscope deflection exceeds 17V peak-to-peak.
 - (e) Link pins C and D of SK1 and verify that the oscilloscope deflection is unchanged but that the meter reading falls to zero. Remove the link.
 - (f) Link pins E and D of SK1 and repeat test (e) above.
 - (g) Link pins C and D of SK2 and repeat test (e) above.
 - (h) Link pins E and D of SK2 and repeat test (e) above. Leave the link in place.
 - (i) Set 3R55 fully clockwise and set the POWER switch to HIGH. Adjust the TUNE and LOAD controls for maximum reading on the power meter. Continue to adjust POWER control until maximum current is drawn from the power supply (not necessarily at tune). Set 3R55 so that the power supply current is limited to 10A.
 - (j) Readjust the TUNE and LOAD controls for maximum power meter reading; verify that this is at least 80W. Check that the TA.944 meter reads approximately half scale.
 - (k) Set the Two Tone RF Generator to 2MHz and set the LOAD switch to the 'T' position (fully clockwise). Check that the 'anti-clockwise' LED indicator in the meter is illuminated.
 - (l) Repeat test (j) above, checking for a power reading of at least 50W.
 - (m) Set the Two Tone RF Generator to 30MHz, and set LOAD switch to 'T' position. Check that the 'clockwise' LED indicator in the meter is illuminated.

- (n) Repeat test (j) above, checking for a power reading of at least 80W.
- (o) Set the Two Tone RF Generator to '2-tones' and observe oscilloscope waveform for signs of instability or distortion.
- (p) Remove link from SK2 pins E and D and check that power meter reading falls after approximately 0.5 sec.
- (q) Set POWER switch to OFF and disconnect all equipment.

CHAPTER 7

FAULT LOCATION

INTRODUCTION

1. This chapter assumes that all the ancillary equipment, e.g. transmitter-receiver, etc. are operating satisfactorily. For fault location of the ancillary equipment, the relevant handbooks should be consulted.
2. The initial procedure given does not necessitate opening up the amplifier.

INITIAL FAULT LOCATION

3. When the amplifier is on, but without an input signal from the transmitter, the meter indicates a three-quarter scale reading if the +18V transmitter supply is present. During transmission, the meter indicates a full scale reading (Whip) or half scale reading (Dipole) if a signal is being produced at the output of the amplifier.
4. If there is no +18V indication, check the battery supply to the TA.944. If this is present, verify that 18V is present between pins B and D of one of the AUDIO sockets. If 18V is again not present, remove the cover as described in Chapter 5 and check the power supply circuits.
5. If voltages are present, but there is no r.f. output indication, first check that the thermal cut-out has not operated by switching off and allowing the amplifier to cool down for 10 minutes. An excessive rise in the operating temperature of the amplifier could be caused by driving the amplifier for a long period from a transmitter-receiver set to HIGH POWER, lengthy operation in high ambient temperatures, or by restriction of the air flow over the cooling fins.

GENERAL FAULT LOCATION

6. Reference should be made to the circuit diagrams, Figs. 8, 9 and 10, and component layouts Figs. 3 to 7. Typical d.c. voltage levels are given at the end of this chapter.

TABLE 1

D.C. VOLTAGES AT 24V INPUT IN TRANSMIT CONDITION WITH ZERO SIGNAL INPUT

<u>REF.</u>	<u>EMITTER</u>	<u>BASE</u>	<u>COLLECTOR</u>
1TR1	3.6	1.0	5.3
2	3.6	4.2	5.6
3	0	-0.2	2.4
4	0	-0.2	2.4
5	2.0	2.4	5.6
6	2.5	2.0	0
7	2.5	2.3	0.3
8	0	0.3	17.5
9	26.3	25.6	14.8
10	27.0	26.3	14.8
11	5.6	5.3	2.3
12	2.3	2.8	5.6
13	5.6	6.2	22.0
14	0	0.7	0
15	0	0.7	0
16	0	0	5.6
17	21.8	23.3	0
18	5.7	6.3	21.8
19	8.6	7.9	0
20	8.6	7.9	2.8
2TR1	0.5	1.1	12.6
2	0.5	0.5	1.6
3	13.5	13.0	0
4	0	-0.4	13.5
5	0	-0.4	13.5

NOTE: Voltages relative to negative input line except where indicated*
when voltages are relative to chassis.

TABLE 1 (Continued)

<u>REF.</u>	<u>EMITTER</u>	<u>BASE</u>	<u>COLLECTOR</u>
3TR1	1.4	0.7	0
2	3.3	4.0	13.5 *
3	2.6	3.0	13.5
4	2.6	3.3	13.5
5	3.0	3.3	13.5
6	2.6	3.0	13.5
7	2.6	3.5	13.5
8	0	0	19.8 *
9	19.8	19.8	0 *
10	19.8	19.8	0 *
11	2.4	3.3	13.5
12	2.4	3.3	13.5
13	20.0	19.3	19.8 *
14	0	0.7	13.5
15	0	0.7	13.5
16	0	0.7	13.5
17	0	0.7	13.5
18	11.8	11.3	0
19	11.8	11.1	11.1
20	4.0	11.1	0
4TR1	13.8	14.3	24
2	13.8	14.3	24

NOTE: Voltages relative to negative input line except where indicated * when voltages are relative to chassis.

CHAPTER 8
COMPONENTS LISTS
CHASSIS COMPONENTS

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Resistors</u>					
	<u>ohms</u>		<u>W</u>		
4R1	1	Wirewound	12	5	918486
4R2	.01	Wirewound	7	10	922802
4R3	18	Metal Oxide	$\frac{1}{2}$	2	911177
4R4	18	Metal Oxide	$\frac{1}{2}$	2	911177
<u>Capacitors</u>					
	<u>μF</u>		<u>V</u>		
4C1	0.5	Feed Thro	100		922806
4C2	4000	Electrolytic	40	-10+50	923148
4C3	1000p	Ceramic	500	10	918423
4C4	9200	Electrolytic	16	-10+50	923149
4C5	0.5	Feed Thro	100		922806
4C6	0.5	Feed Thro	100		922806
4C7	0.5	Feed Thro	100		922806
4C8	2200p	Mica	350	2	902197
4C9	1500p	Mica	350	2	902189
4C10	1000p	Mica	350	2	913233
4C11	680p	Mica	350	2	902181
4C12	470p	Mica	350	2	902177
4C13	330p	Mica	350	2	902173
4C14	220p	Mica	350	2	902169
4C15	150p	Mica	350	2	902165
4C16	100p	Mica	350	2	902161
4C17	68p	Mica	350	2	902157
4C18	33p	Mica	350	2	902149
4C19	33p	Ceramic	4k	10	915127
4C20	2p	Ceramic	4k	10	920558
4C21	33p	Ceramic	4k	10	915127
4C22	2p	Ceramic	4k	10	920558

Cct. Ref.	Value	Description	Rated	Tol %	Racal Part Number
4C23	1.0	Polyester	100	10	919120
4C24	1.0	Polyester	100	10	919120
4C25	47	Electrolytic	40	+50-10	921527
<u>Semiconductors</u>					
4D1		Diode 1N5401			919948
4D2		Diode 3SF1			921356
4D3		Diode 40956R			923064
TR1		Transistor 2N5039			921339
TR1		Transistor 2N5039			921339
<u>Miscellaneous</u>					
4L1		Inductor			710177
4L2		A.T.U. Assembly			701050
4L3		Inductor			
4TH1		Thermister, 125°C		5	922816
4RLA		Relay	12V		919301
4FS1		Fuse	25A		911143
4FS2		Fuse	25A		911143
SA		Switch, OFF-HIGH-LOW			922819
SB		Switch, LOAD, 12-way			711227
SK1		Socket, 6-pole, fixed			53/909908
SK2		Socket, 6-pole, fixed			53/909908
PL1		Plug, 2-pole, fixed			917789
SK3		Socket, coaxial, BNC			905449
SK4		Socket, Dipole, coaxial			905511
SK5		Socket, Whip (Part of ATU, see 4L2)			
M1		Meter, sealed			711131
		Terminal, Earth			901399
		Desiccator			909909
		Knob, for SB			915126
		Knob, for L2			915125
		Fuseholder			922820
		Thermal Cut-Out			711089
		Thermaflow A30/J Compound			917798

* For ferrite cores and beads refer to Page 8-13.

POWER SUPPLY CONTROL BOARD COMPONENTS

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Resistors</u>					
	<u>ohms</u>		<u>W</u>		
1R1	10	Metal Oxide	$\frac{1}{2}$	2	909145
1R2	1.8k	Metal Oxide	$\frac{1}{2}$	2	907723
1R3	10k	Carbon	$\frac{1}{3}$	5	922267
1R4	4.7k	Carbon	$\frac{1}{3}$	5	922343
1R5	1k	Carbon	$\frac{1}{3}$	5	922338
1R6	3.3k	Metal Oxide	$\frac{1}{2}$	2	918435
1R7	2.2k	Carbon	$\frac{1}{3}$	5	922273
1R8	27k	Carbon	$\frac{1}{3}$	5	919341
1R9	27k	Carbon	$\frac{1}{3}$	5	919341
1R10	2.2k	Carbon	$\frac{1}{3}$	5	922273
1R11	10k	Carbon	$\frac{1}{3}$	5	922267
1R12	4.7k	Carbon	$\frac{1}{3}$	5	922343
1R13	1.8k	Carbon	$\frac{1}{3}$	5	922340
1R14	1k	Carbon	$\frac{1}{3}$	5	922338
1R15	2.2k	Carbon	$\frac{1}{3}$	5	922273
1R16	2.7k	Metal Oxide	$\frac{1}{2}$	2	919322
1R17	47	Carbon	$\frac{1}{3}$	5	922324
1R18	4.7k	Carbon	$\frac{1}{3}$	5	922343
1R19	1	Wirewound	$2\frac{1}{2}$	5	911767
1R20	1	Wirewound	$2\frac{1}{2}$	5	911767
1R21	3.9k	Carbon	$\frac{1}{3}$	5	922342
1R22	1k	Carbon	$\frac{1}{3}$	5	922338
1R23	100	Carbon	$\frac{1}{3}$	5	922328
1R24	10k	Carbon	$\frac{1}{3}$	5	922267
1R25	10k	Carbon	$\frac{1}{3}$	5	922267
1R26	4.7k	Carbon	$\frac{1}{3}$	5	922343
1R27	10k	Carbon	$\frac{1}{3}$	5	922267
1R28	4.7k	Carbon	$\frac{1}{3}$	5	922343
1R29	220	Variable, linear			922190
1R30	100	Metal Oxide	$\frac{1}{2}$	2	913973

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Resistors (Contd.)</u>					
	<u>ohms</u>		<u>W</u>		
1R31	47k	Carbon	$\frac{1}{3}$	5	922349
1R32	1k	Carbon	$\frac{1}{3}$	5	922338
1R33	1.2k	Carbon	$\frac{1}{3}$	5	922339
1R34	2.7k	Carbon	$\frac{1}{3}$	5	922341
1R35	2.7k	Metal Oxide	$\frac{1}{2}$	2	919322
1R36	3.3k	Carbon	$\frac{1}{3}$	5	922363
1R37	4.7k	Carbon	$\frac{1}{3}$	5	922343
1R38	2.7k	Carbon	$\frac{1}{3}$	5	922341
1R39	820	Carbon	$\frac{1}{3}$	5	922274
1R40	2.7k	Carbon	$\frac{1}{3}$	5	922341
1R41	2.2k	Carbon	$\frac{1}{3}$	5	922273
1R42		Not used			
1R43	470	Carbon	$\frac{1}{3}$	5	922272
1R44	470	Variable, linear			922207
1R45	470	Carbon	$\frac{1}{3}$	5	922272
<u>Capacitors</u>					
	<u>μF</u>		<u>V</u>		
1C1	22	Tantalum	16	20	919638
1C2	1500p	Polycarbonate	160	10	922803
1C3	1500p	Polycarbonate	160	10	922803
1C4	4700p	Polycarbonate	160	10	921795
1C5	150p	Disc Ceramic	500	20	919648
1C6	22	Tantalum	16	20	919638
1C7	2200	Tubular Ceramic	350	20	902126
1C8	1	Tantalum	35	20	919635
1C9	0.01	Fixed	250	-20+40	916187
1C10	0.22	Polyester	100	20	909882
1C11	22	Tantalum	16	20	919638
1C12	0.01	Fixed	250	-20 +40	916187
<u>Diodes</u>					
1D1		1N4149			914898
1D2		Zener BZY88 C5V6	5.6		912747
1D3		1N4149			914898
1D4		Zener BZY88 C5V6	5.6		912747
1D5		1N4149			914898

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Diodes (Contd.)</u>			<u>V</u>		
1D6		Zener BZY88 C6V2	6.2		911682
1D7		Zener BZY88 C3V3	3.3		912567
1D8		Zener BZY88 C5V6	5.6		912747
<u>Transistors</u>					
1TR1		ZTX237K			922973
1TR2		ZTX237K			922973
1TR3		ZTX237K			922973
1TR4		ZTX237K			922973
1TR5		ZTX237K			922973
1TR6		ZTX212K			922972
1TR7		ZTX212K			922972
1TR8		ZTX237K			922973
1TR9		2N2904A			919125
1TR10		TIP42B			922810
1TR11		ZTX212K			922972
1TR12		ZTX237K			922973
1TR13		BFY51			908753
1TR14		ZTX237K			922973
1TR15		ZTX237K			922973
1TR16		ZTX237K			922973
1TR17		ZTX212K			922972
1TR18		ZTX237K			922973
1TR19		ZTX212K			922972
1TR20		ZTX212K			922972

CONVERTER BOARD COMPONENTS

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Resistors</u>					
	<u>ohms</u>		<u>W</u>		
2R1	22	Carbon	$\frac{1}{3}$	5	922320
2R2	270	Carbon	$\frac{1}{3}$	5	922333
2R3	2.7k	Carbon	$\frac{1}{3}$	5	922341
2R4	0.1	Wirewound	$2\frac{1}{2}$	5	921359
2R5	0.1	Wirewound	$2\frac{1}{2}$	5	921359
2R6	2.7k	Carbon	$\frac{1}{3}$	5	922341
2R7	10k	Carbon	$\frac{1}{3}$	5	922267
2R8	47	Wirewound	6	5	913694
2R9	47	Wirewound	6	5	913694
2R10	10	Wirewound	$2\frac{1}{2}$	5	913571
2R11	47	Wirewound	$2\frac{1}{2}$	5	913588
<u>Capacitors</u>					
	<u>μF</u>		<u>V</u>		
2C1	1	Polyester	100	10	919120
2C2	100	Tantalum	3	20	915170
2C3	1	Polyester	100	10	919120
2C4	.01	Polyester	100	20	918967
2C5	.15	Polyester	100	10	920348
2C6	1000p	Fixed Ceramic	500	10	918423
2C7	1000p	Fixed Ceramic	500	10	918423
2C8	.22	Polyester	100	20	909882
2C9	.22	Polyester	100	20	909882
2C10	1	Polyester	100	10	919120
2C11	100	Tantalum	20	20	913970
2C12	1000p	Fixed Ceramic	500	10	918423
2C13	1000p	Fixed Ceramic	500	10	918423
<u>Transformers</u>					
2T1					710179
2T2					710178

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Diodes</u>					
2D1		1N4002			911460
2D2		1N4002			911460
2D3		1N4002			911460
2D4		1N4002			911460
2D5		1N4002			911460
2D6		1N4002			911460
2D7		1N4002			911460
2D8		3SF1			921356
2D9		3SF1			921356
2D10		3SF1			921356
2D11		3SF1			921356
<u>Transistors</u>					
2TR1		2N3053			906004
2TR2		ZTX237K			922973
2TR3		TIP32A			922809
2TR4		2N5039			921339
2TR5		2N5039			921339
<u>Inductors</u>					
2L1		Choke 4.7 μ H			919468

AMPLIFIER BOARD COMPONENTS

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Resistors</u>					
	<u>ohms</u>		<u>W</u>		
3R1	100	Metal oxide	10	5	922801
3R2	100	Metal oxide	10	5	922801
3R3	220	Carbon	$\frac{1}{3}$	5	922332
3R4	220	Variable preset			922190
3R5	33k	Carbon	$\frac{1}{3}$	5	919340
3R6	1k	Carbon	$\frac{1}{3}$	5	922338
3R7	4.7k	Carbon	$\frac{1}{3}$	5	922343
3R8	47	Carbon	$\frac{1}{3}$	5	922324
3R9	47	Carbon	$\frac{1}{3}$	5	922324
3R10	47	Carbon	$\frac{1}{3}$	5	922324
3R11	1k	Carbon	$\frac{1}{3}$	5	922338
3R12	47	Carbon	$\frac{1}{3}$	5	922324
3R13	47	Carbon	$\frac{1}{3}$	5	922324
3R14	47	Carbon	$\frac{1}{3}$	5	922324
3R15	47k	Carbon	$\frac{1}{3}$	5	922349
3R16	100k	Carbon	$\frac{1}{3}$	5	922270
3R17	1k	Carbon	$\frac{1}{3}$	5	922338
3R18	100	Wirewound	$2\frac{1}{2}$	5	913596
3R19	33	Carbon	$\frac{1}{3}$	5	922322
3R20	470	Carbon	$\frac{1}{3}$	5	922272
3R21	470	Carbon	$\frac{1}{3}$	5	922272
3R22		Not used			
3R23	470	Carbon	$\frac{1}{3}$	5	922272
3R24	47	Carbon	$\frac{1}{3}$	5	922324
3R25	470	Carbon	$\frac{1}{3}$	5	922272
3R26	1	Wirewound	$2\frac{1}{2}$	5	911767
3R27	47	Carbon	$\frac{1}{3}$	5	922324
3R28	47	Carbon	$\frac{1}{3}$	5	922324
3R29	47	Carbon	$\frac{1}{3}$	5	922324
3R30	47	Carbon	$\frac{1}{3}$	5	922324

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Resistors (Contd.)</u>					
	<u>ohms</u>		<u>W</u>		
3R31	47	Carbon	$\frac{1}{3}$	5	922324
3R32	22k	Carbon	$\frac{1}{3}$	5	922347
3R33	22k	Carbon	$\frac{1}{3}$	5	922347
3R34	47	Carbon	$\frac{1}{3}$	5	922324
3R35	47	Carbon	$\frac{1}{3}$	5	922324
3R36	1k	Carbon	$\frac{1}{3}$	5	922338
3R37	22	Carbon	$\frac{1}{3}$	5	922320
3R38	22	Carbon	$\frac{1}{3}$	5	922320
3R39	10	Carbon	$\frac{1}{3}$	5	922316
3R40	22	Carbon	$\frac{1}{3}$	5	922320
3R41	22	Carbon	$\frac{1}{3}$	5	922320
3R42	10	Carbon	$\frac{1}{3}$	5	922316
3R43	1k	Carbon	$\frac{1}{3}$	5	922338
3R44	22	Carbon	$\frac{1}{3}$	5	922320
3R45	22	Carbon	$\frac{1}{3}$	5	922320
3R46	10	Carbon	$\frac{1}{3}$	5	922316
3R47	100	Carbon	$\frac{1}{3}$	5	922328
3R48	100	Carbon	$\frac{1}{3}$	5	922328
3R49	22	Carbon	$\frac{1}{3}$	5	922320
3R50	22	Carbon	$\frac{1}{3}$	5	922320
3R51	10	Carbon	$\frac{1}{3}$	5	922316
3R52		Not used			
3R53	220	Carbon	$\frac{1}{3}$	5	922332
3R54	470	Carbon	$\frac{1}{3}$	5	922272
3R55	1k	Variable, linear			921182
3R56	470k	Carbon	$\frac{1}{3}$	5	922357
3R57	1k	Carbon	$\frac{1}{3}$	5	922338
3R58	1k	Carbon	$\frac{1}{3}$	5	922338
3R59	100	Carbon	$\frac{1}{3}$	5	922328
3R60	470	Carbon	$\frac{1}{3}$	5	922272
3R61	470	Carbon	$\frac{1}{3}$	5	922272
3R62	220	Carbon	$\frac{1}{3}$	5	922332
3R63	100	Carbon	$\frac{1}{3}$	5	922328
3R64	0.1	Wirewound	$2\frac{1}{2}$	5	921359
3R65	0.1	Wirewound	$2\frac{1}{2}$	5	921359

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Resistors (Contd.)</u>					
	<u>ohms</u>		<u>W</u>		
3R66	0.1	Wirewound	2½	5	921359
3R67	0.1	Wirewound	2½	5	921359
3R68	0.1	Wirewound	2½	5	921359
3R69	0.1	Wirewound	2½	5	921359
3R70	0.1	Wirewound	2½	5	921359
3R71	0.1	Wirewound	2½	5	921359
3R72	4.7k	Carbon	⅓	5	922343
<u>Capacitors</u>					
	<u>μF</u>		<u>V</u>		
3C1	.01	Disc Ceramic	63	20	915173
3C2	.01	Disc Ceramic	63	20	915173
3C3	0.1	Polyester	63	10	920566
3C4	0.1	Polyester	63	10	920566
3C5	0.1	Polyester	63	10	920566
3C6	47	Electrolytic	35	20	917478
3C7	100	Electrolytic	20	20	913970
3C8	0.1	Polyester	63	10	920566
3C9	0.1	Polyester	63	10	920566
3C10	0.1	Polyester	63	10	920566
3C11	0.1	Polyester	63	10	920566
3C12	0.1	Polyester	63	10	920566
3C13	.01	Disc Ceramic	63	20	915173
3C14	47p	Disc Ceramic	63	2	919646
3C15	47p	Disc Ceramic	63	2	919646
3C16	47p	Disc Ceramic	63	2	919646
3C17	0.1	Polyester	63	10	920566
3C18	.01	Disc Ceramic	63	20	915173
3C19	47p	Disc Ceramic	63	2	919646
3C20	.01	Disc Ceramic	63	20	915173
3C21	47p	Disc Ceramic	62	2	919646
3C22	0.1	Polyester	63	10	920566
3C23	2.2p	Tubular Ceramic	200	½pF	908829
3C24	0.1	Polyester	63	10	920566
3C25	.01	Disc Ceramic	63	20	915173

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
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Capacitors (Contd.)

	<u>μF</u>		<u>V</u>		
3C26	2.2p	Tubular Ceramic	200	½pF	908829
3C27	47p	Disc Ceramic	63	2	919646
3C28	.01	Disc Ceramic	63	20	915173
3C29	0.1	Polyester	63	10	920566
3C30	0.1	Polyester	63	10	920566
3C31	0.1	Polyester	63	10	920566
3C32	0.1	Polyester	63	10	920566
3C33	0.1	Polyester	63	10	920566
3C34	0.1	Polyester	63	10	920566
3C35	0.1	Polyester	63	10	920566
3C36	0.1	Polyester	63	10	920566
3C37	0.1	Polyester	63	10	920566
3C38	.01	Fixed	250	-20 + 40	916187

Inductors

3L1	1μH				915849
3L2	1μH				915849
3L3	1μH				920572

Transformers

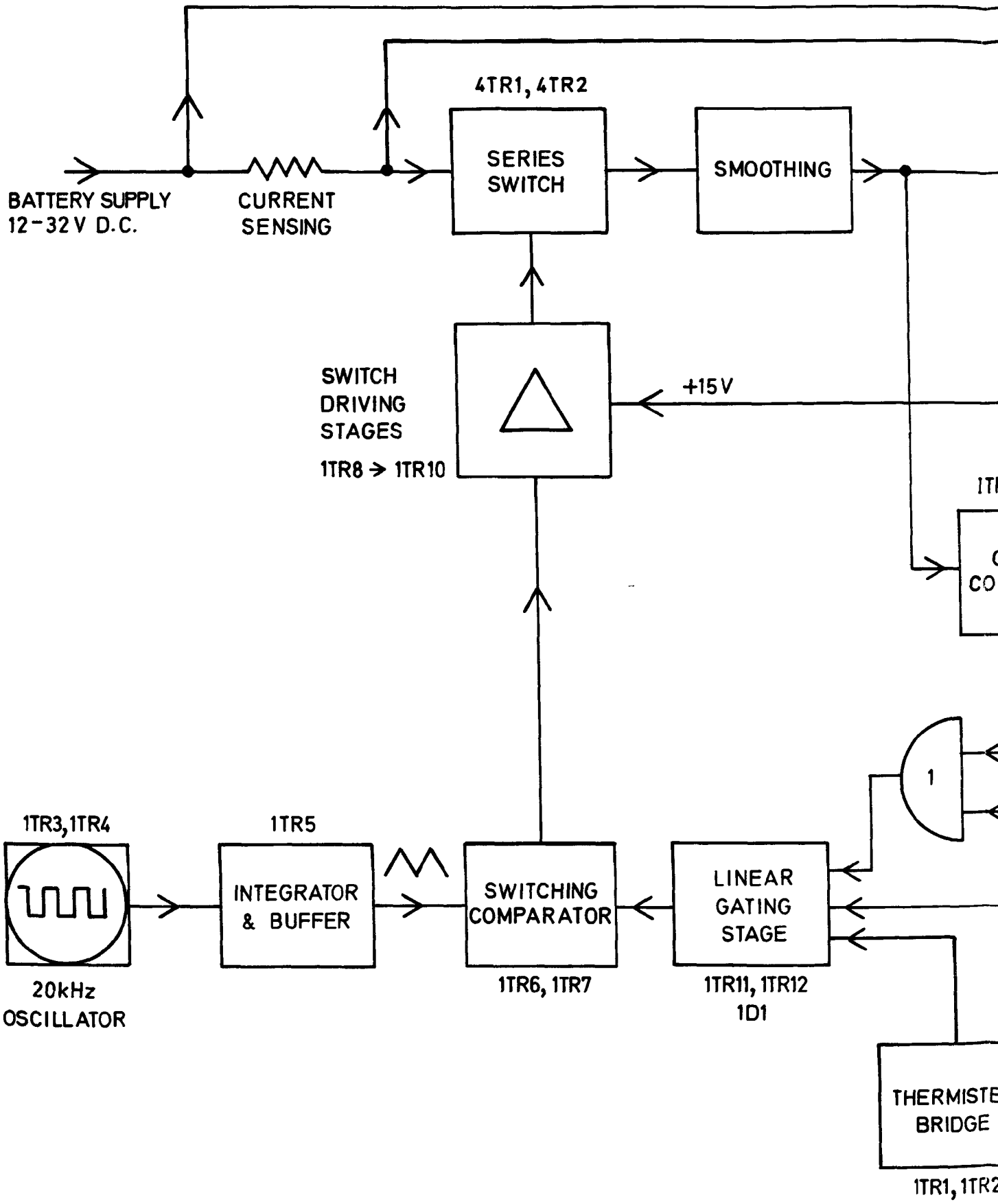
3T1					710180
3T2					710181
3T3					710182
3T4					710182
3T5					710183
3T6					Built on PCB
3T7					710186
3T8					Built on PCB
3T9					Built on PCB
3T10					Built on PCB
3T11					710186

Diodes

3D1		1N4149			914898
3D2		1N4149			914898
3D3		1N4149			914898
3D4		1N4149			914898
3D5		1N4149			914898

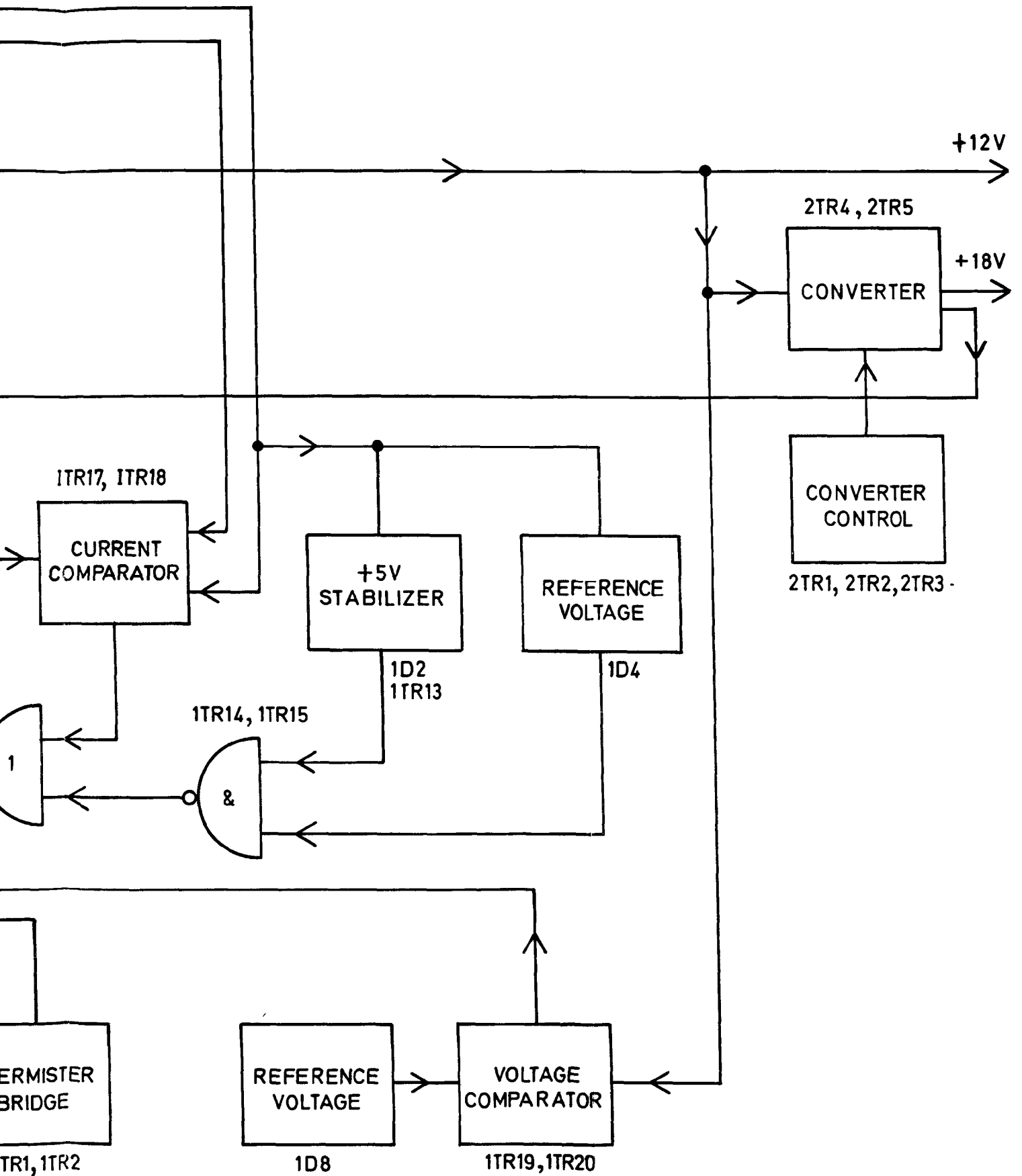
Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Diodes (Contd.)</u>					
3D6		1N4149			914898
3D7		1N4149			914898
3D8		1N4149			914898
3D9		1N4997			917775
3D10		1N4149			914898
3D11		1N4149			914898
3D12		1N4149			914898
3D13		1N4149			914898
3D14		1N4149			914898
3D15		1N4149			914898
<u>Transistors</u>					
3TR1		2N2904			919125
3TR2		2N3053			906004
3TR3		2N3866			917219
3TR4		2N3866			917219
3TR5		2N3866			917219
3TR6		2N3866			917219
3TR7		2N3053			906004
3TR8		ZTX237K			922973
3TR9		ZTX212K			922972
3TR10		ZTX212K			922972
3TR11		PT5740			923056
3TR12		PT5740			923056
3TR13		ZTX212K			922972
3TR14		2N6456			711307
3TR15		2N6456			711307
3TR16		2N6456			711307
3TR17		2N6456			711307
3TR18		2N2904			919125
3TR19		2N2904			919125
3TR20		2N2904			919125
<u>Relays</u>					
3RLA					917779
3RLB					917779

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number
<u>Ferrite Beads</u>					
3FB1		FX1242			907488
3FB2		FX1242			907488
3FB3		FX1242			907488
3FB4		FX1242			907488
3FB5		FX1115			900461
4FB2		FX 2049 (2 off)			914353
<u>Ferrite Cores</u>					
4FB1		Core, Toroid			917102
4FB3		Core, Toroid			917102
4FB4		Core, Toroid			917102
4FB5		Core, Toroid			917102



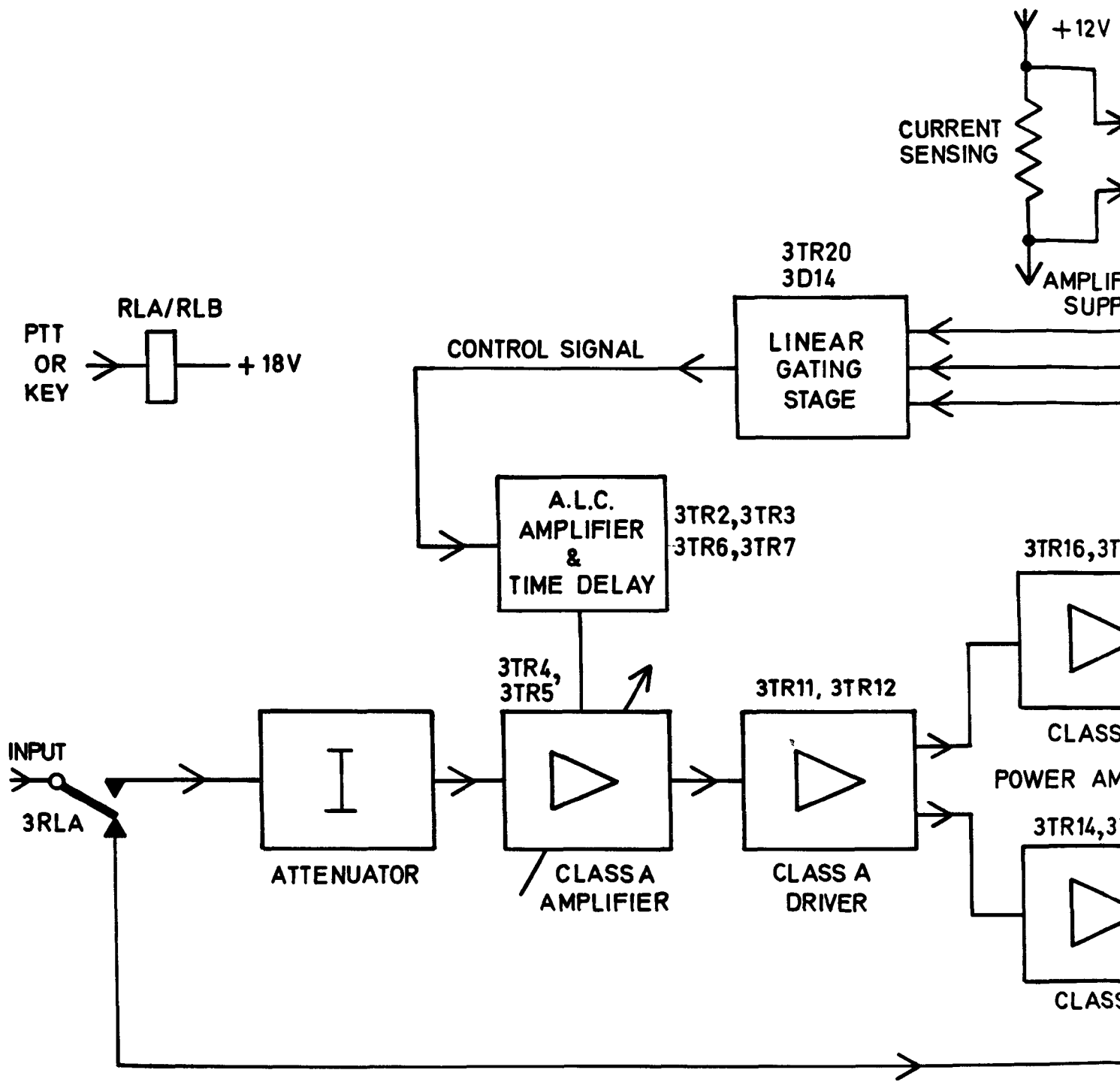
WOH 4029

Block Diagram: Power



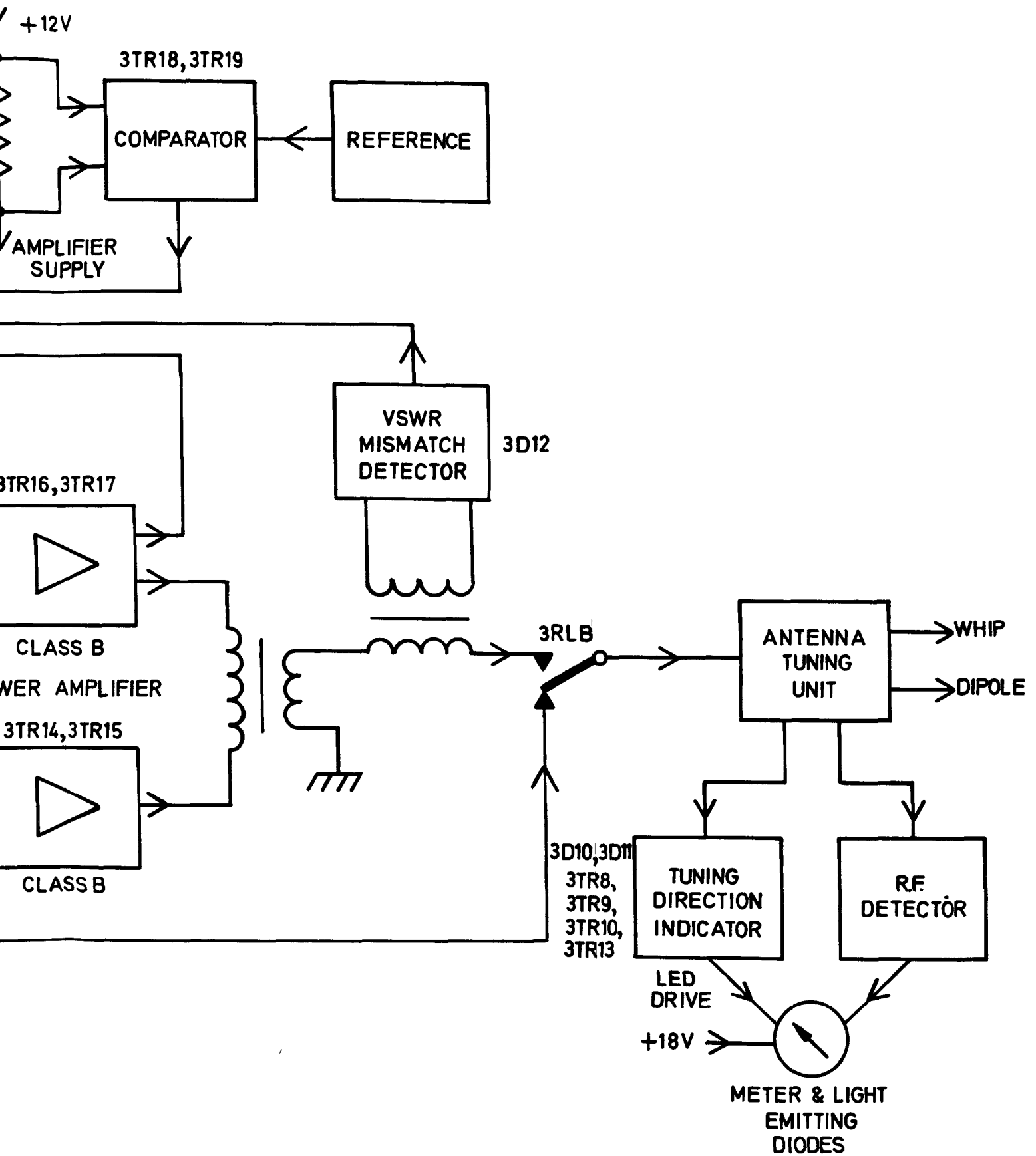
Power Supply TA.944

Fig.1



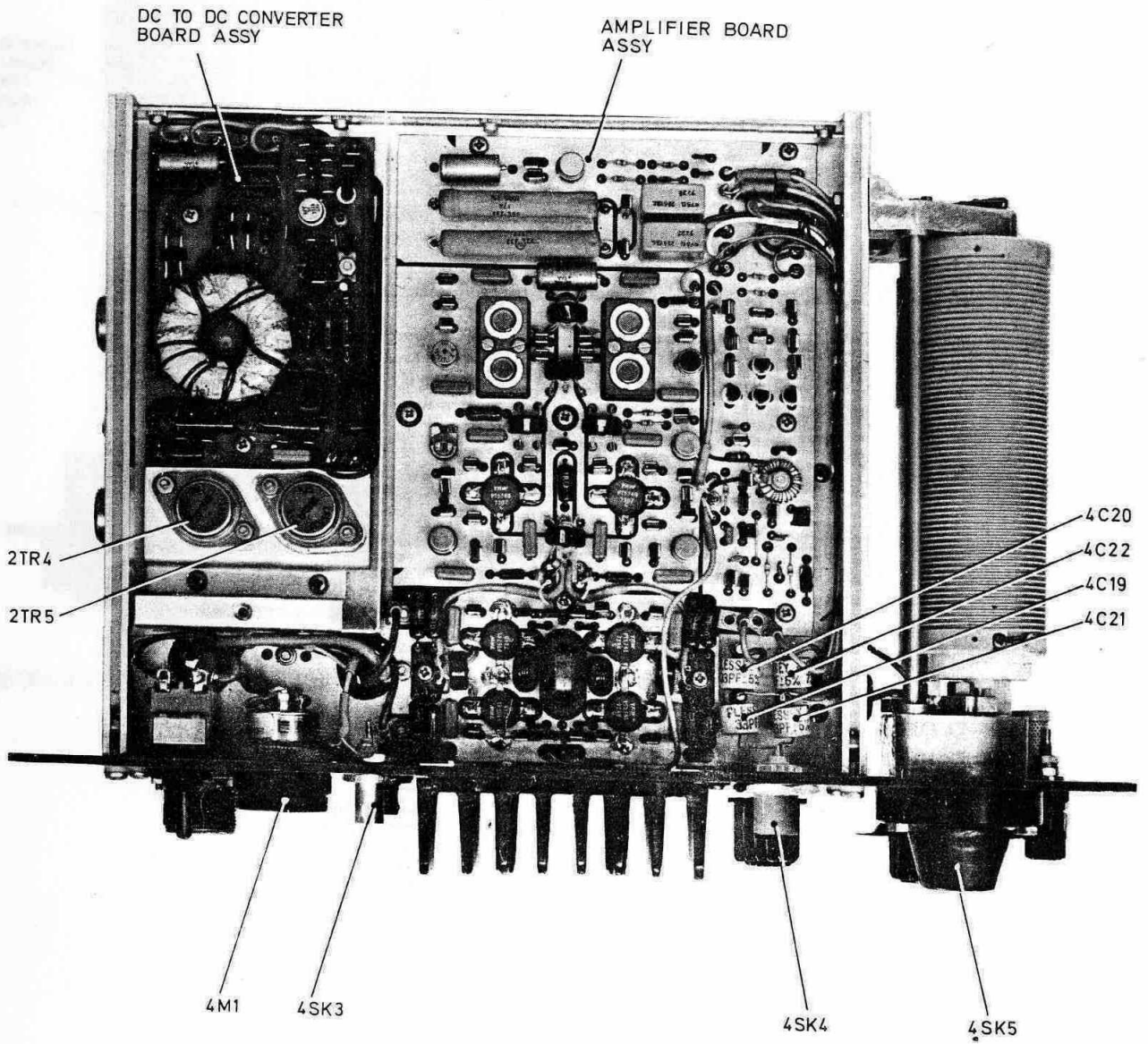
WOH 4029

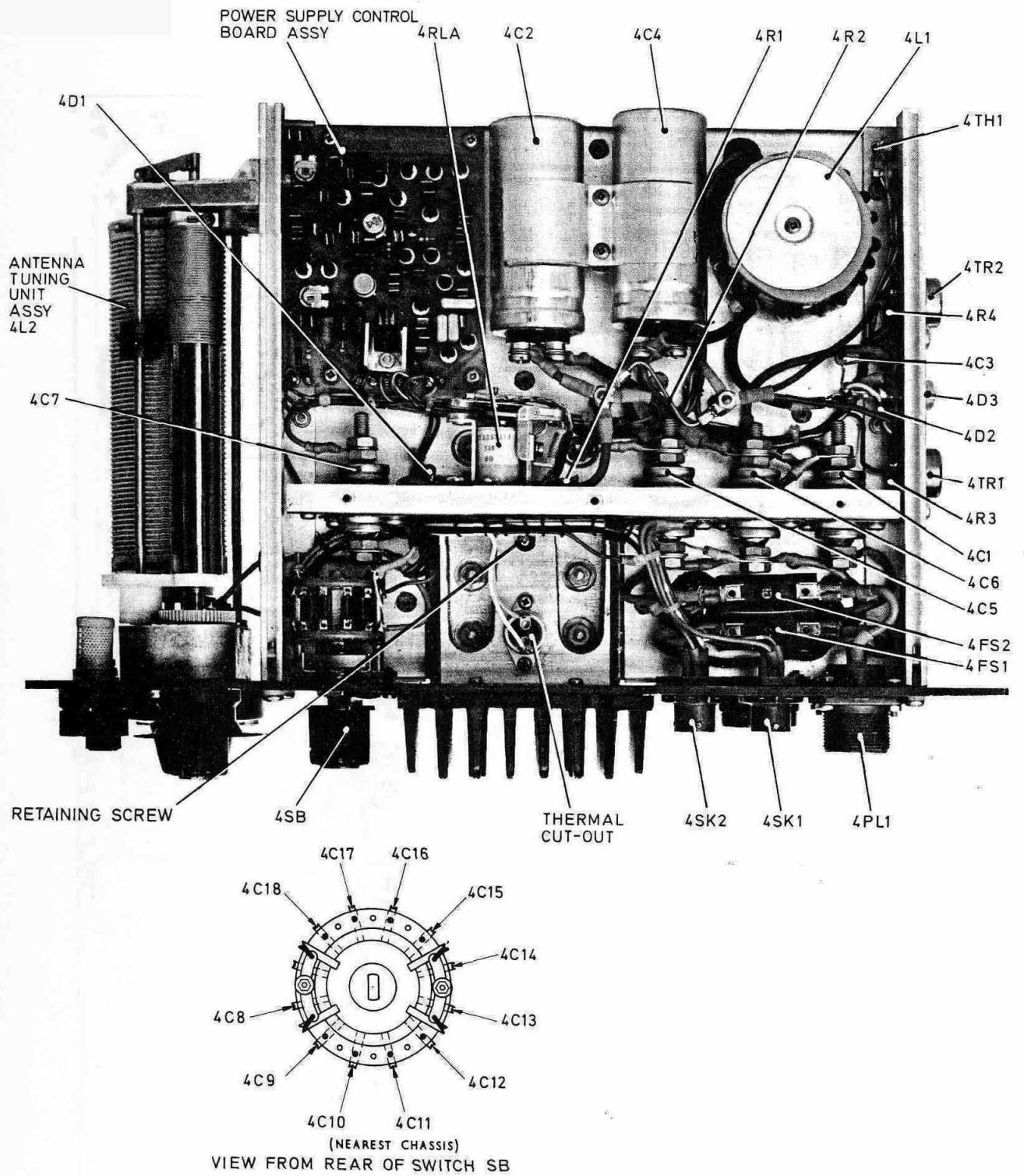
Block Diagram: Linear

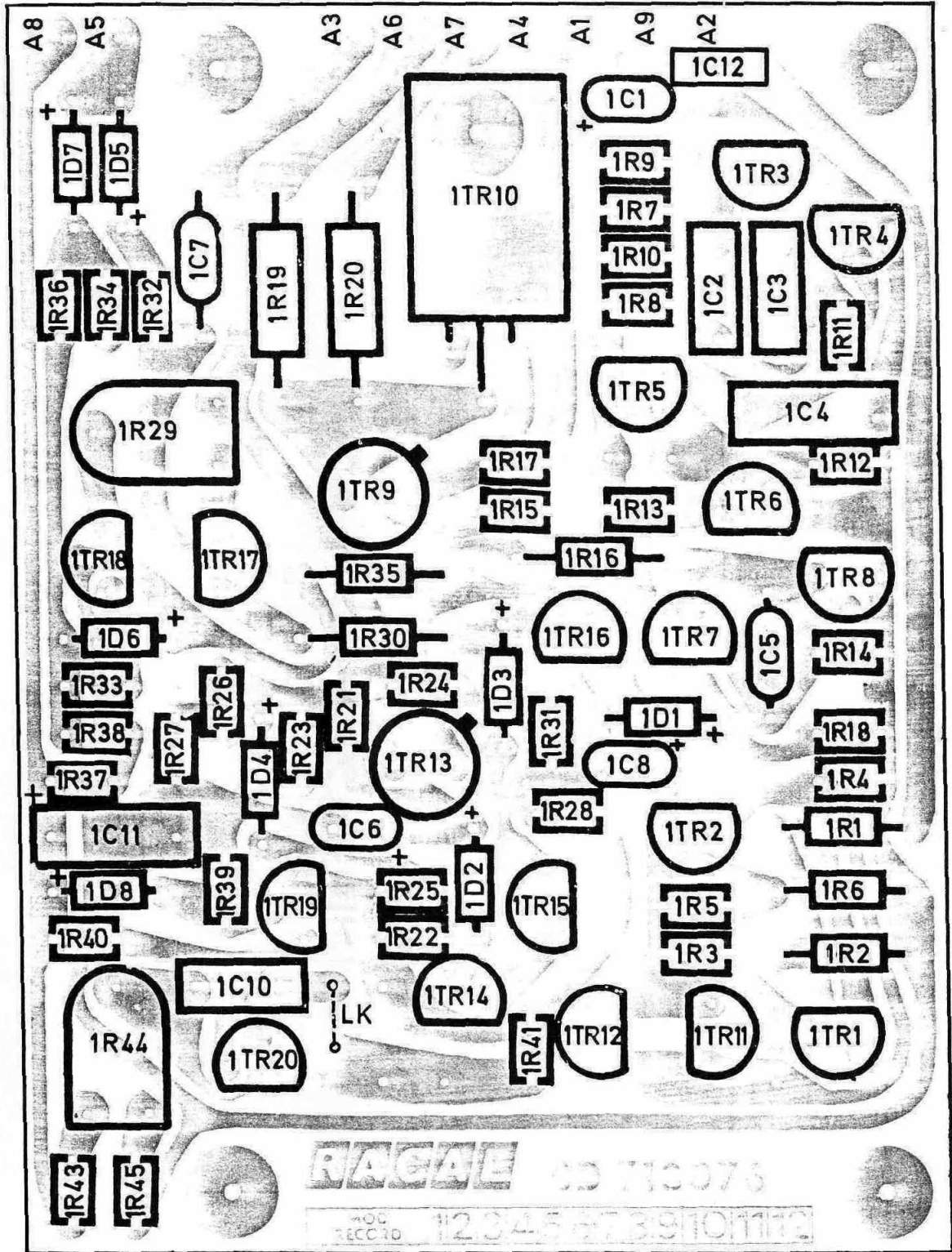


Linear Amplifier TA.944

Fig. 2

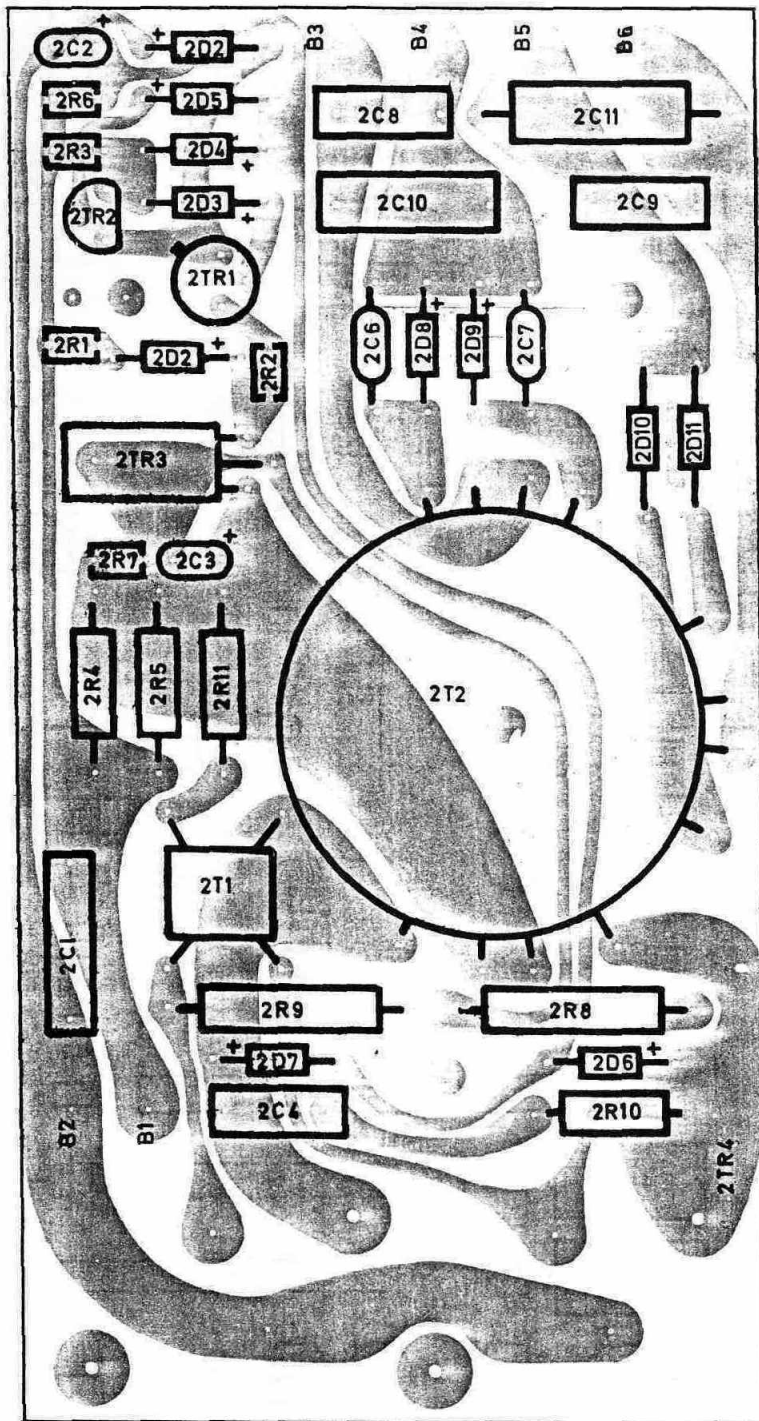






Layout : Power Supply Control
P.C. Board TA.944

Fig. 5

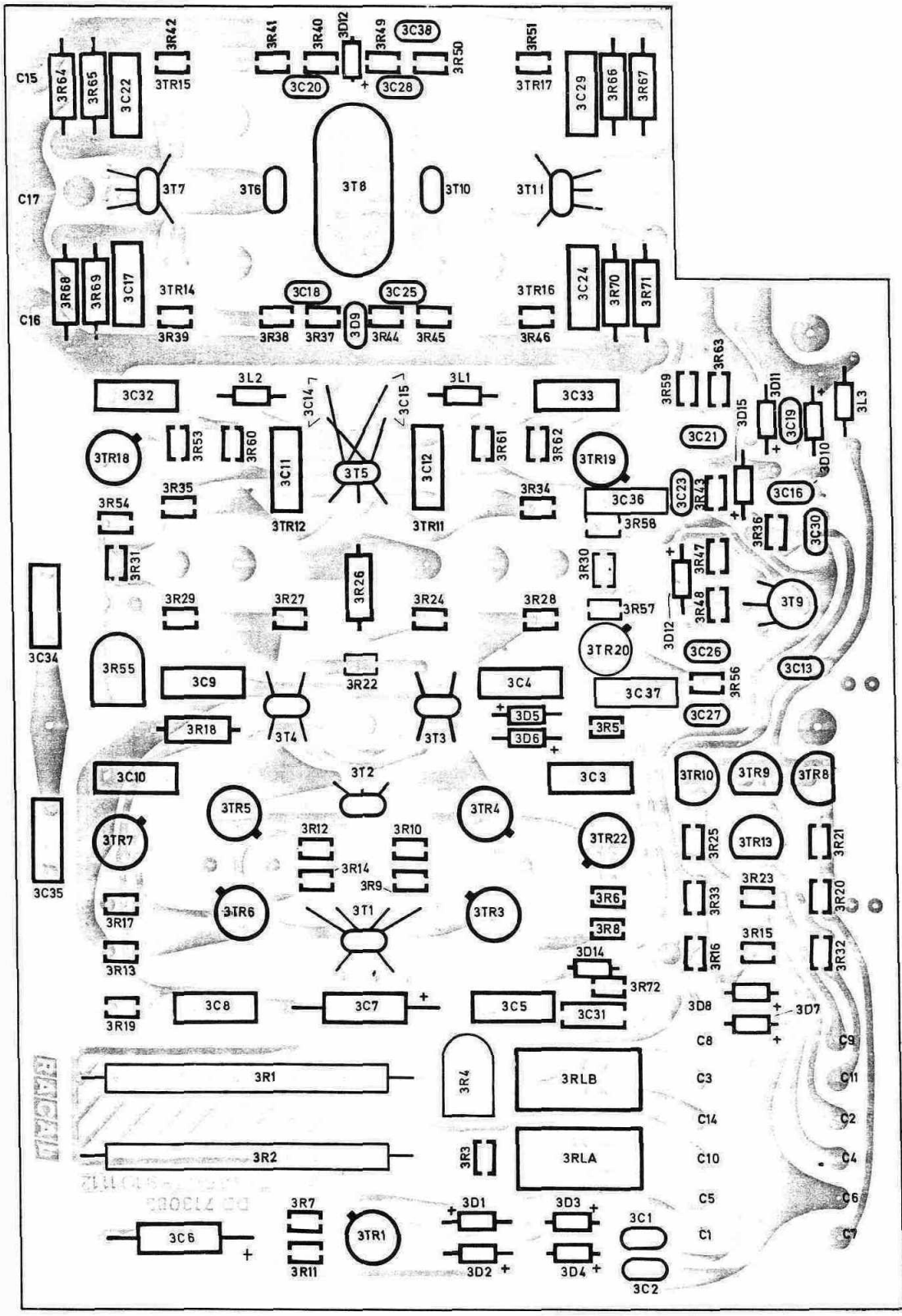


WOH4029 | CD713080 SHT.2

WOH4029 | CD713080 SHT.3

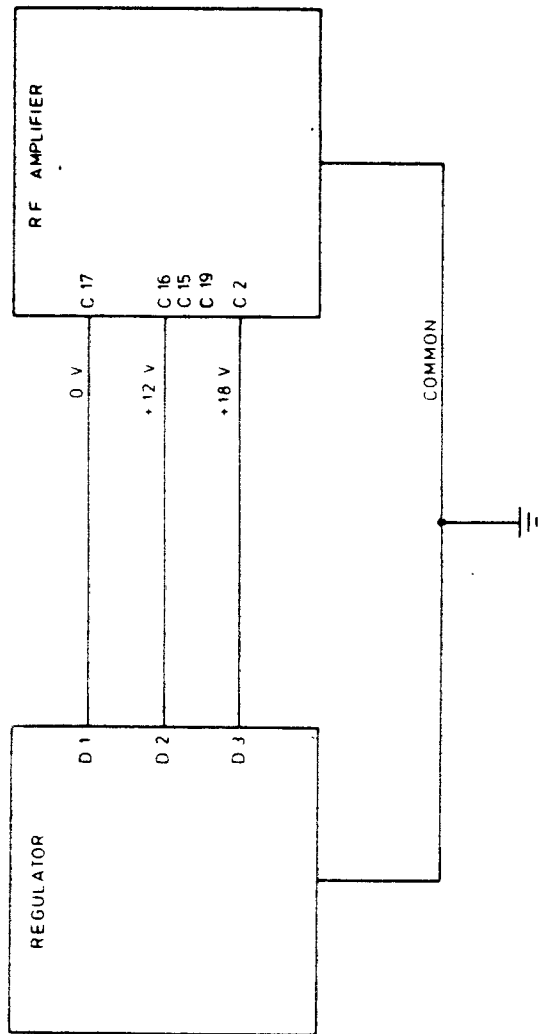
Layout : Converter P.C. Board TA.944

Fig. 6



Layout : Linear Amplifier P.C. Board TA.944

Fig.7

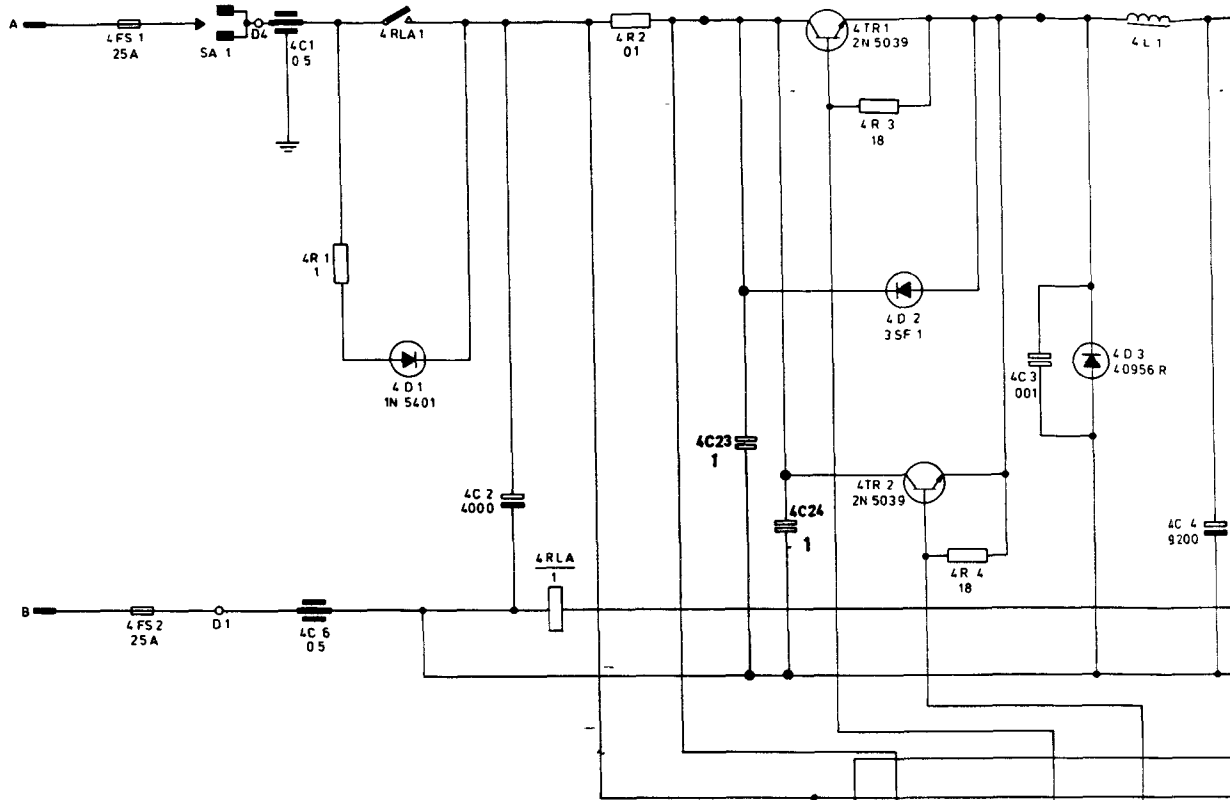


BATTERY
SUPPLY

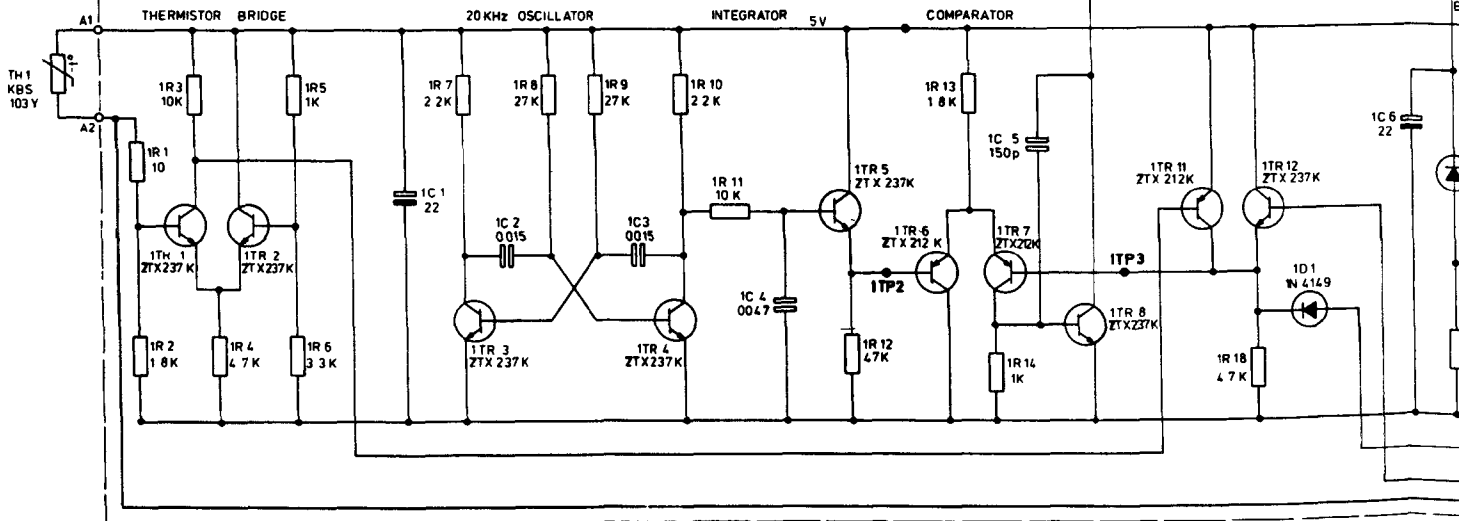
WOH 4029	BC701949
1	

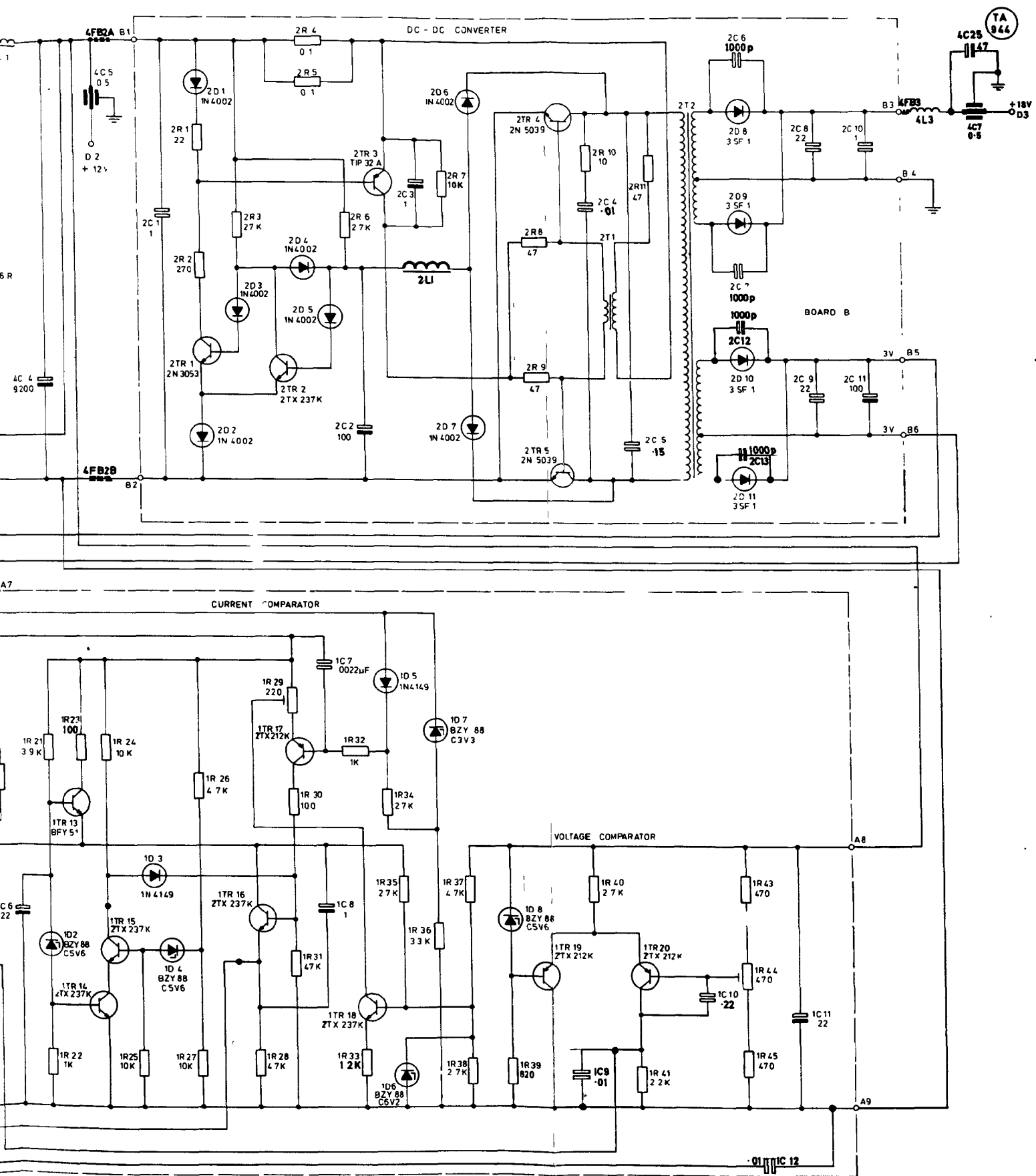
Circuit: Board Interconnections TA.944 Fig. 8

PL 1
BATTERY
SUPPLY
12-32 V DC



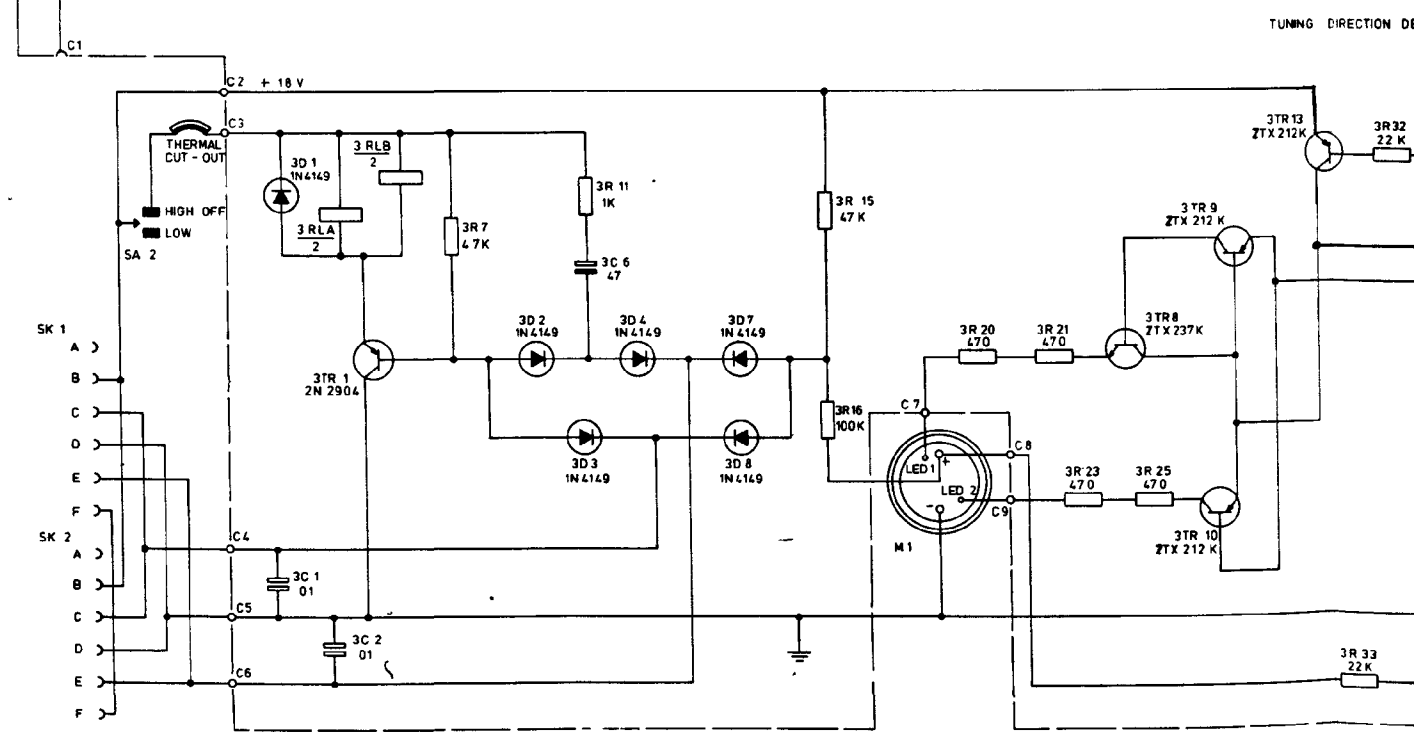
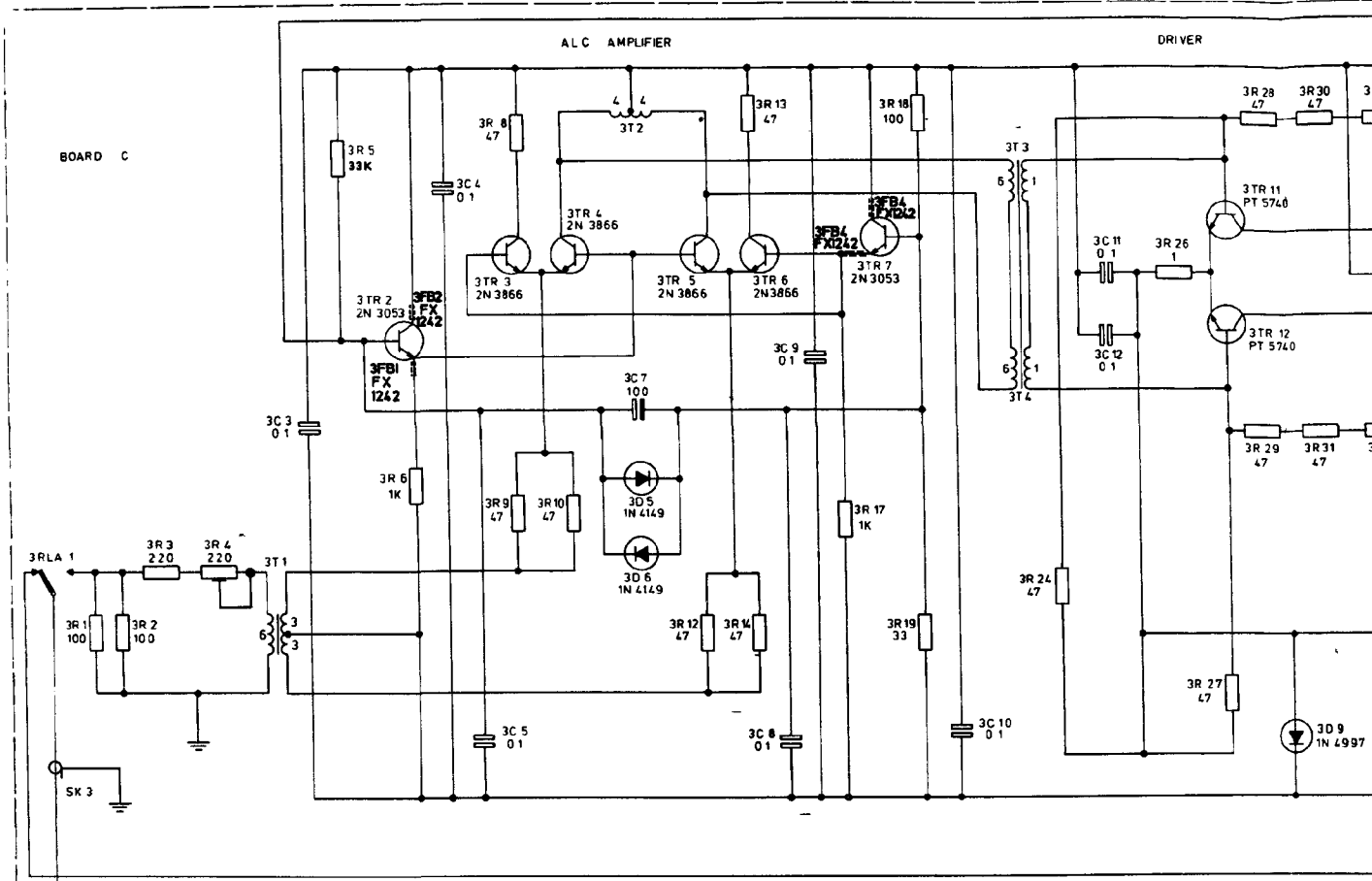
BOARD A

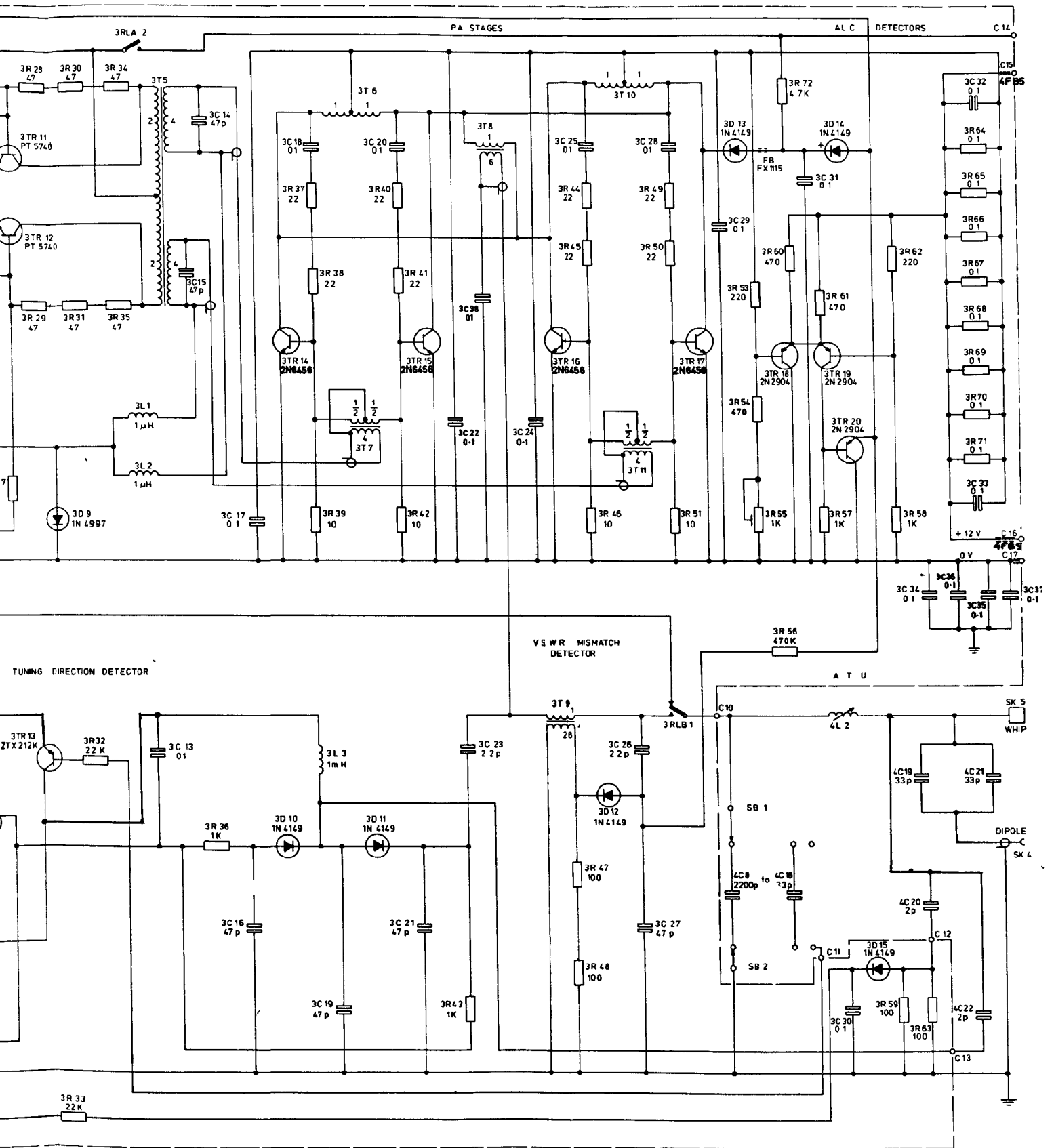




Power Supply TA.944

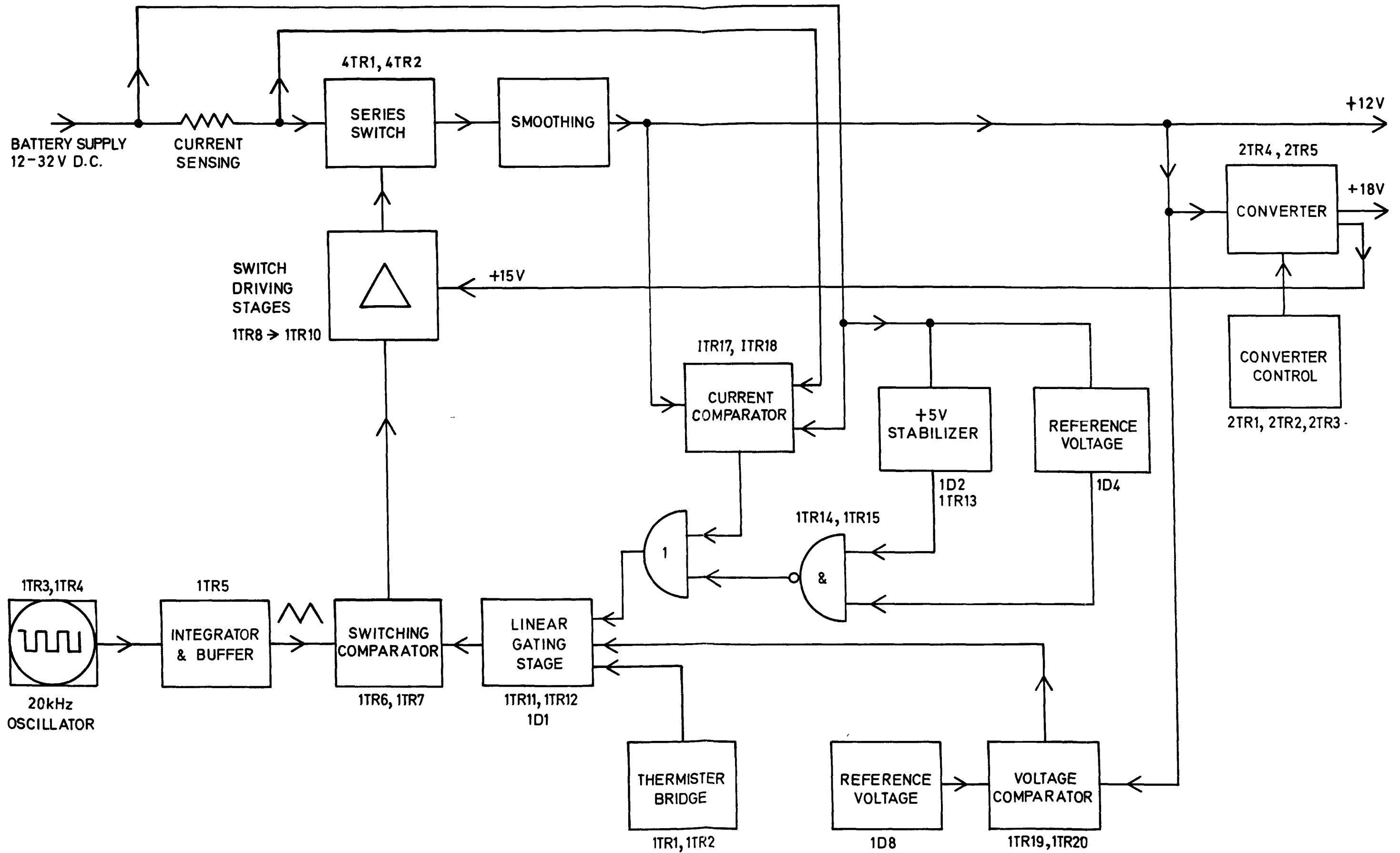
Fig. 9

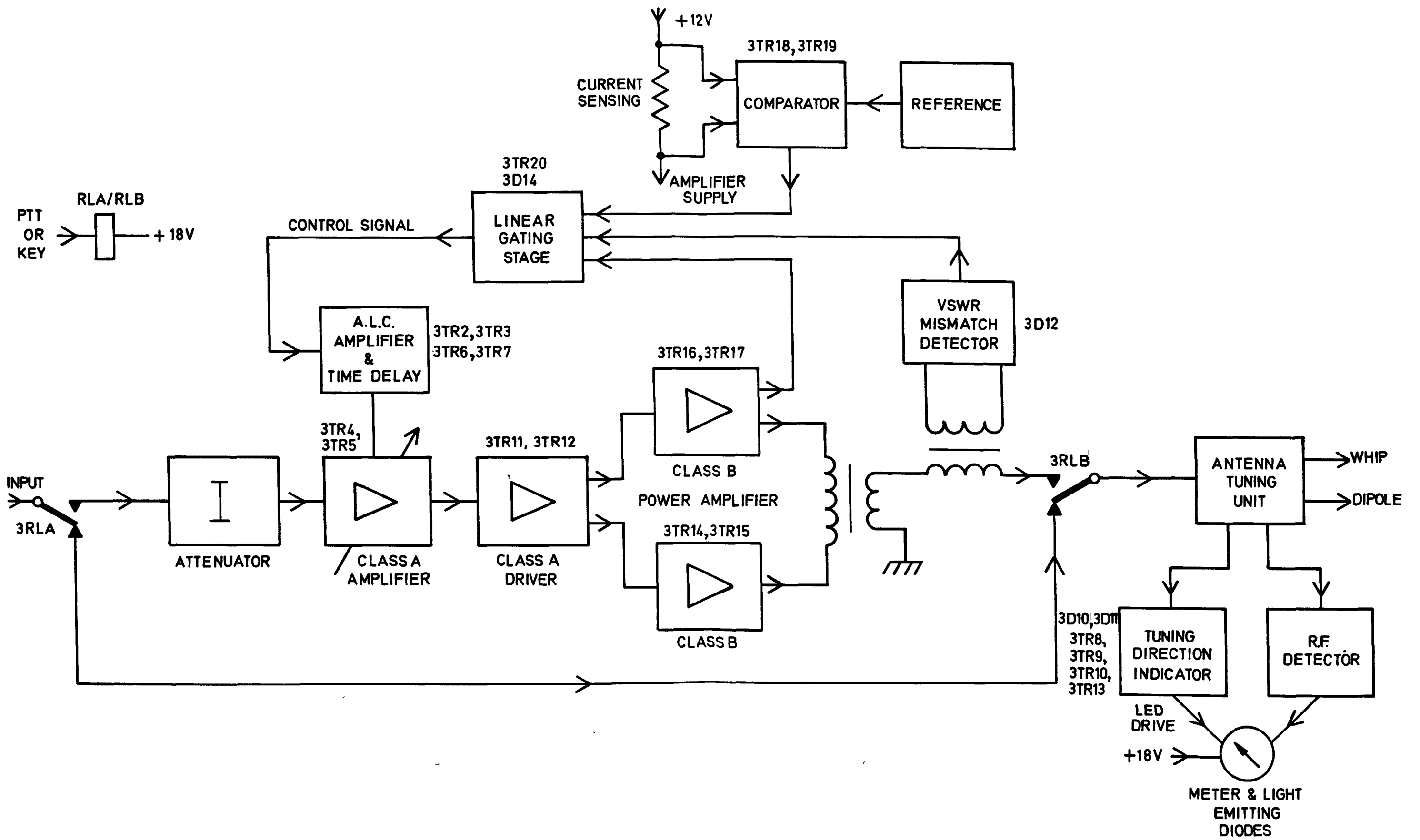




Circuit: Amplifier Stages TA.944

Fig.10

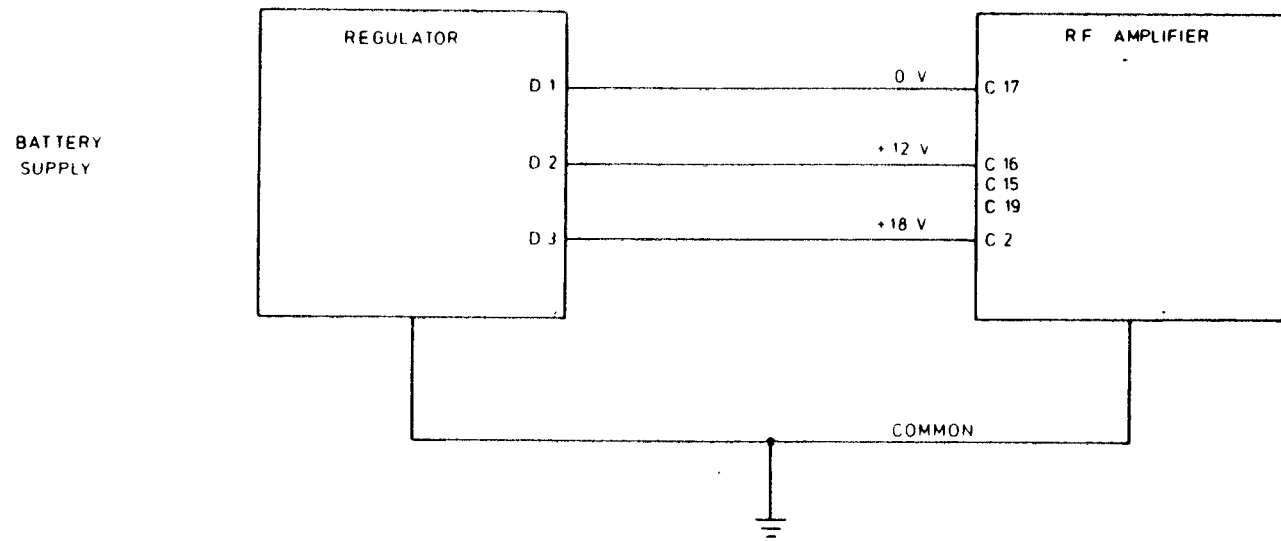




WOH 4029

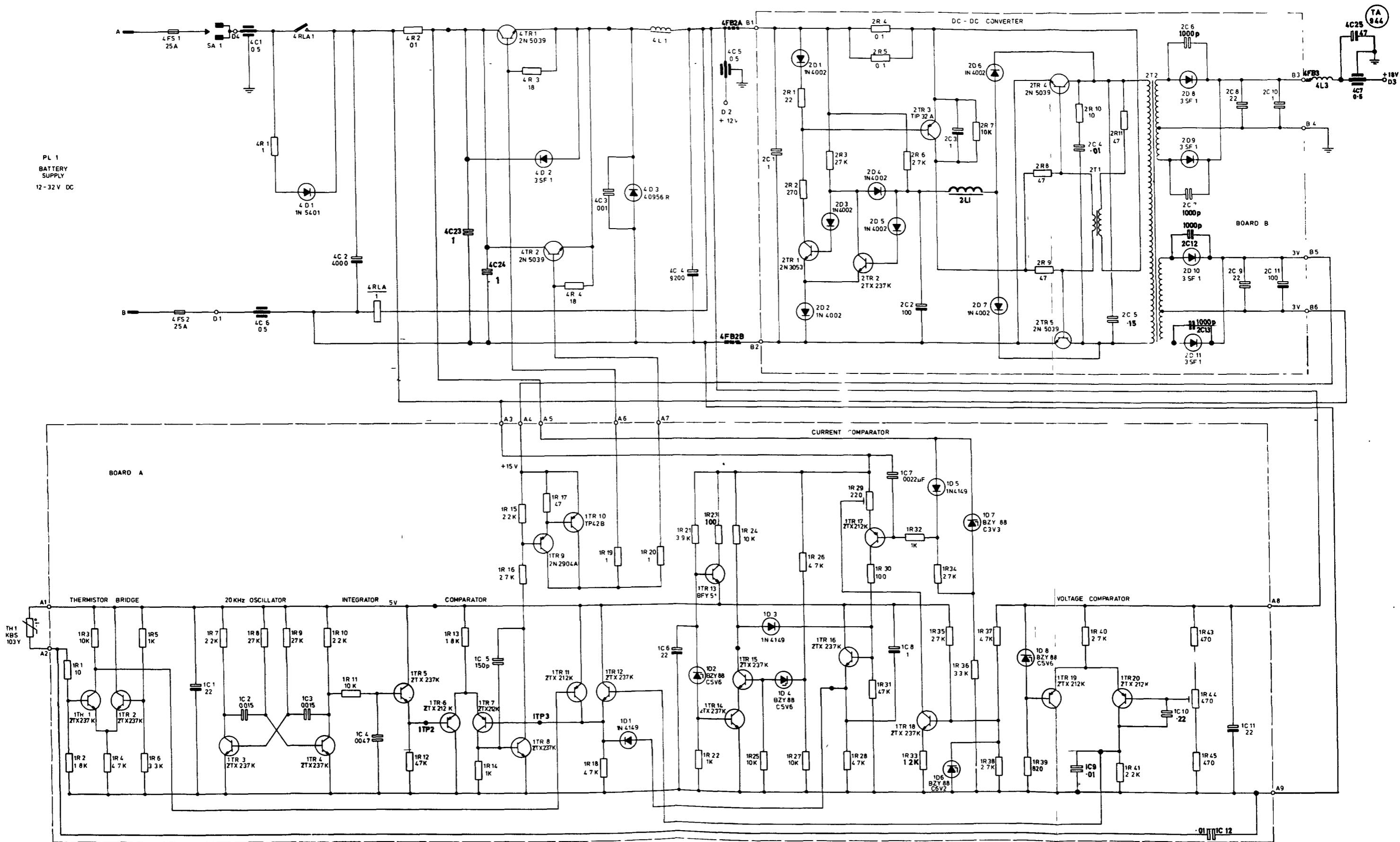
Block Diagram: Linear Amplifier TA.944

Fig. 2



WOH 4029	BC 701949
1	

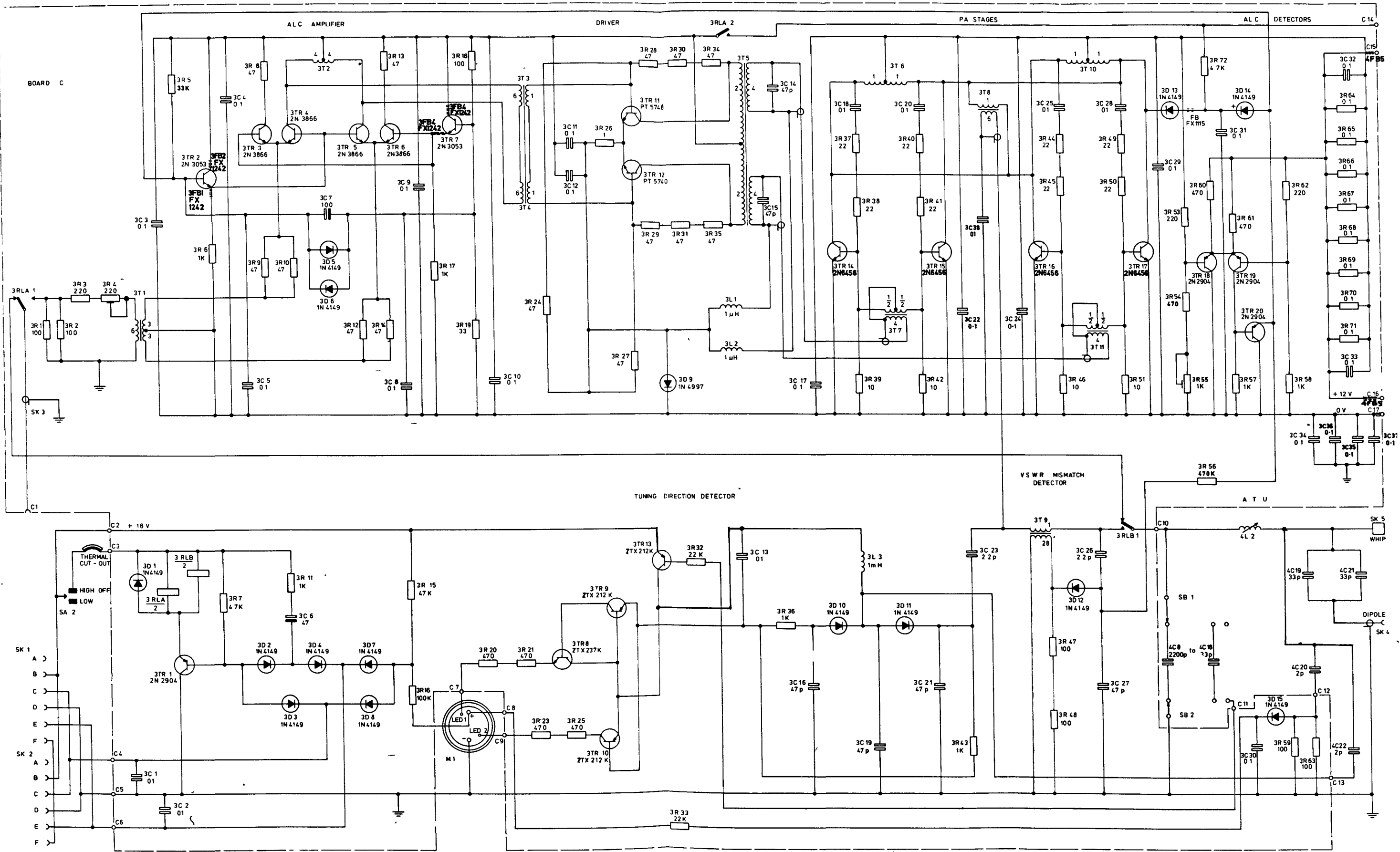
Circuit: Board Interconnections TA.944 Fig. 8



WOH 4029 DC701197
1 2 3

Circuit: Power Supply TA.944

Fig. 9



Circuit: Amplifier Stages TA.944