Assembly Manual for the

H.F. TRANSCEIVER

K-6330

ANOTHER Hi-TECH DICK SMITH KIT

PLEASE READ DISCLAIMER CAREFULLY AS WE CAN ONLY GUARRANTEE PARTS AND NOT THE LABOUR CONTENT YOU PROVIDE

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Here at last is an HF amateur band transceiver that you can build yourself. This up-to-the-minute design can cover any single 500kHz band within 2-30MHz, features CW, LSB and USB transmission modes, and boasts a power output of 30 W PEP (SSB).

This new design is the third in a series of do it yourself amatuer band tranceivers. In September,October and November 1983 'EA' described a 40 channel UHF tranceiver and followed this up with a VHF unit in June and July 1984. Both designs offered good value for money and many hundreds of each have now been built.

We're sure that this new unit will be just as successful. It was developed by Garry Crapp VK2YBX/T and Gill McPherson VK2ZGE, the same team that produced the previous versions.

For the keen amateur, it represents an ideal opportunity to build a really worthwhile piece of gear. Despite the relative circuit complexity, construction is straight forward and alignment is a breeze.

Perhaps the most attractive aspect of the design is the price. The whole kit and caboodle includes a press to talk (PTT) dynamic microphone and all the features pictured! That has to be a really good deal.

Features

As the accompanying specifications panel shows, the new design offers good performance without the fancy "bells and whistles" found on some commercial models. In line with standard practice, it can transmit both LSB (lower sideband) and USB (upper sideband) signals, as well as operating CW. Tuning is by means of a multi-turn pot while a four-digit LED readout indicates the tuned frequency.

To keep costs to a minimum, the transceiver is designed to cover only a single 500kHz band within the range 2-30MHz. This eliminates the need for costly band switching. As a further economy measure, those digits to the left of the decimal point have been omitted from the digital readout (ie. there is an assumed decimal point in front of the first digit of the display).

Thus, if the transceiver is set to 3.568900MHz, the readout will be 5689. This is quite OK in view of the single band operation.

The front panel controls are straightforward. The tuning and volume controls require little comment, as does the signal strength-power meter.

The microphone socket is a standard configuration for PTT operation.

Immediately above the microphone socket are three toggle switches. The first two switches set the transmission mode, either LSB, USB or CW. The third switch, on the extreme right, switches a noise blanker stage in the receiver circuit.

Below the volume control is a control labelled "RIT". This stands for Receiver Incremental Tuning which is just a fancy expression for a clarifier control.

Text and Illustrations courtesy of Electronics Australia

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SPECIFICATIONS

GENERAL

Frequency Range	any 500kHz range within 2-30MHz
Transmission Modes	LSB, USB, CW
Supply Voltage	13.8V DC
Current Drain	4.5A on transmit
Frequency Resolution	100Hz
Stability	100Hz/¼ hour (after warm-up)
Crystal Filter	6 or 8 Pole (10.6935) MHz

TRANSMITTER

Power Output	30W PEP (SSB); 15W (CW)
Occupied Banwidth	±8kHz (−25dB)
Harmonic Suppression	better than 60dB

RECEIVER

Sensitivity	better than 0.5μV (10dB S+N/N)
Selectivity	6dB at 4kHz; 60dB at 7kHz
Intermediate Frequency	10.6935MHz
Image Rejection	better than 50dB
Clarifier Range	±1kHz
Audio Output Power	2W into 8Ω
Noise Blanker	IF impulse type

Dear Customer,

We are pleased that this company is the first International company to release a kit as sophisticated and as functional as the H.F Transceiver kit. It is bound to bring great satisfaction to you in constructing it. We would also like to give a warning. This kit is complex, and so we feel that it should not be undertaken by anyone who does not have considerable experience in constructing RF equipment. Most 'Amateurs' will have the skills necessary to complete this project without great difficulty, but for the inexperienced may we suggest you gain qualified assistance or else return the kit to us in its original packing for a full refund.

Thankyou,
Dick Smith Electronics.

How it works

Let's now go through the block diagram (Fig. 1), before attacking the main circuit diagram. This will give a general idea of the circuit operation and make the subsequent circuit description much easier to follow.

The block diagram shows that the transceiver can be split into two sections — receiver and transmitter — which come together in the antenna filter. Both these sections employ a common voltage tuned oscillator (VTO), frequency counter, heterodyne mixer, and offset (carrier) oscillator.

In the transmit mode, the VTO frequency is mixed with crystal oscillator IC1. The added signal is then mixed in IC2 with a 10.7MHz SSB signal to produce a difference signal and this is fed to an RF linear amplifier (Q1-Q8). From there, the signal passes via the antenna filter circuit (LPF) to the output socket.

The SSB signal is derived using balanced modulator IC5 and the offset oscillator. The offset oscillator produces a nominal 10.7MHz carrier which is modulated by audio from the microphone preamplifier. Because IC5 is a balanced modulator, the carrier is suppressed and a double sideband (DSB) signal appears at the output.

This DSB signal is filtered by a crystal filter which removes one of the sidebands. The output from the crystal filter is then amplified and fed to IC2 where it is mixed with the signal from IC1.

The receiver is a conventional single conversion superheterodyne with an intermediate frequency (IF) of 10.7MHz. The received signal is fed via a variable attenuator network to RF amplifier stage Q21 and thence to mixer stage Q18. Here the signal is mixed with a local oscillator signal from heterodyne mixer IC1 to derive the 10.7MHz IF.

The output from the mixer is fed to a noise blanker stage (Q13 and Q14), thence to the crystal filter, SSB amplifier and IF amplifier stage Q23, Q24. AGC amplifier Q26 samples the output from the IF amplifier and produces a DC voltage which controls the variable attenuator and the gain of Q12.

Finally, the signal from the IF amplifier is fed to SSB detector Q25 and the resulting audio fed to the audio amplifier. The offset oscillator provides carrier re-insertion at the detector.

Circuit details

Now let's take a look at the main circuit diagram. Looks complicated doesn't it? Don't worry — we'll go through it stage by stage and relate each section back to the block diagram. We'll consider the transmitter circuitry first.

The transmitter circuit is activated by the press-to-talk (PTT) switch on the microphone and this controls the various supply rails. We'll come back to that. The signal from the microphone is fed via gain control VR11 to Q32 and Q33 which form a two-stage common emitter amplifier. Feedback resistor R140 provides base bias for Q32.

The amplified signal appears at the collector of Q33 and is fed via C160 to pin 1 of IC5, an AN612 balanced modulator chip. Here the audio signal modulates the carrier signal generated by the offset oscillator (Q34 to Q36) to produce a double sideband (DSB) signal at pin 7 (ie, the carrier is suppressed).

Q34 and crystal X2 form a standard Colpitts oscillator circuit which provides the carrier signal referred to above. It generates one of three different frequencies, depending on the positions of switches SW2 and SW3. SW2 selects either LSB or USB transmission while SW3 selects either SSB or CW mode.

Let's assume initially that the SSB mode is selected. When SW2 is switched to LSB, both Q36 and Q37 are off and Q34 supplies a 10.695MHz carrier (set by VC6) to pin 3 of IC5. When SW2 is switched to USB, Q36 turns on and switches in trimmer capacitor VC7 which pulls down the carrier frequency to 10.692MHz.

The DSB signal from pin 7 of IC5 is fed to 8-pole crystal filter X3 via C167, R152 and switching diode D11. X3 is a bandpass filter with steep skirts. Its job is to remove one of the sidebands and pass the required sideband.

Let's take a closer look at this. When S2 is switched to LSB, the carrier frequency is 10.695MHz and sidebands will be generated either side of this frequency. Since X3 is centred on 10.6935MHz, only the lower sideband will pass through to the output. The upper sideband falls outside the passband and is eliminated.

Similarly, when USB is selected, the carrier frequency is 10.692MHz and the upper sideband passes through to the output. Note that X3 has a passband of about 3kHz.

The resultant SSB signal from X3 passes via C83 and R62 to the base of SSB amplifier stage Q12. The signal is then filtered by IF transformer L15 and fed via C76 and R56 to pin 1 of IC2 where it is mixed with the signal from heterodyne mixer stage IC1.

CW mode

The CW mode functions somewhat differently. When SW3 selects CW, Q35 turns on and trimmer capacitor VC8 sets the carrier frequency to 10.6935MHz. At the same time, +5V is applied to pin 2 of IC5 via D31 and R147 and this switches the carrier signal to the output (pin 7). The unmodulated carrier now passes via X3 and Q12 to IC2 as described above.

Key J2 at the microphone socket is used to key the carrier on and off. It does this by switching the supply rails to the transmitter and receiver circuits. This will be discussed in greater detail later on.

Voltage tuned oscillator

Thus far, we have our SSB (or CW) signal on pin 1 of IC2, ready to be mixed with the heterodyne signal from IC1. This heterodyne signal is derived using mixer IC1 and voltage tuned oscillator (VTO) Q9 to Q11. Let's see how the VTO works.

FET Q9 forms a Colpitts oscillator with output frequency variable over the range 6-6.5MHz by means of varicap diode VC12 in the tuned gate circuit. The tuning voltage on VC12 is set by VR5 and derived from voltage regulator IC3.

The circuit of IC3 is straightforward. Diode D20 provides a 6.2V reference at the non-inverting input of op amp IC3, while R93 and R94 set the gain to give a regulated output voltage of about +7.5V at pin 6.

Q43 and VR6 form the RIT/clarifier circuit. In the receive mode, Q43 turns on and VR6 shunts the feedback network to modify the gain of IC3. This varies the output voltage of IC3 and thus the output frequency of the VTO.

Similarly, during transmit, Q44 turns on and preset trimpot VR7 shunts the feedback network. VR7 thus sets the transmit frequency.

The output of the VTO (Q9) is buffered by Q10 and Q11 which form a two stage amplifier. Q10 is a common emitter amplifier while Q11 is an emitter follower. The output from Q11 is fed via C75 to the frequency counter and via C66 to pin 4 of IC1.

IC1, in association with crystal X1, is a TA7310 oscillator mixer stage. X1 sets the oscillator frequency and is selected according to the band required. The oscillator frequency and the VTO frequency are added together in IC1 and the output appears on pin 6.

From there, the signal is filtered by bandpass filter L3, VC2 and L4, VC3 and fed to several points in the circuit. First, it is fed via C97 to the base of Rx (Receiver) mixer stage Q18 and provides the local oscillator signal during receive. Second, it is fed via C9 and R4 to pin 4 of mixer stage IC2. And third, it is made available at TP2 via D1 for use during the setting up procedure.

IC2, another TA7310 IC, functions as a difference mixer. The higher of the two mixing frequencies is now fed to pin 4 (instead of pin 1 as for IC1). As a result, IC2 subtracts the SSB signal fed via Q12 to its pin 1 input from the signal at its pin 4 input. The difference signal appears at pin 9, passes via C18 to dual gate mosfet Q1, and is filtered by L5, VC4 and L6, VC5.

RF amplifier

Q2 functions as a class A stage with transformer L7 as its collector load. This provides the necessary anti-phase signals to drive the following RF pre-driver stage consisting of Q3 and Q4.

BLOCK DIAGRAM

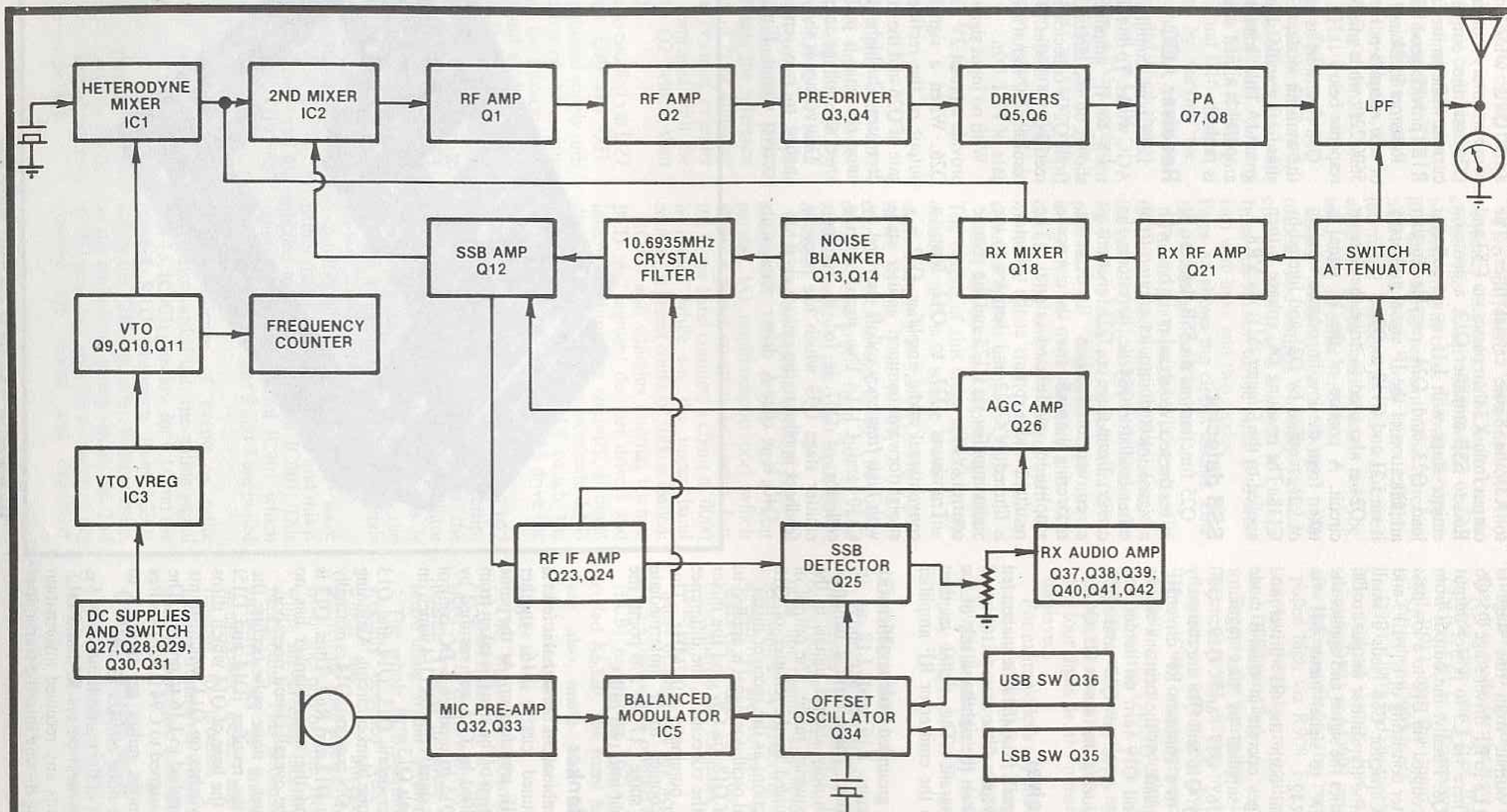


Fig. 1: block diagram of the transceiver. The transistor and IC numbers relate directly to the main circuit diagram.

Q3 and Q4 function as a class-B push-pull stage with bias supplied via R22 and D14. The output from this stage is coupled via L8 to RF driver stage Q5, Q6 and from there via L9 to power output stage Q7, Q8. Finally, the output from Q7, Q8 is coupled via L10 to a low-pass antenna filter consisting of L11-L13 and C51-C57. Capacitor C58 feeds a small portion of the transmitter output to D6 which rectifies the signal and applies the resultant DC to signal meter M1 via VR4 and R42.

Note that both the RF driver and output stages operate in class-B mode with bias supplied by bias regulator stages Q16, Q17 and Q19, Q20 respectively. Q16 and Q19 are thermally connected to a common RF driver/RF output heatsink. As the heatsink warms up, Q16 and Q19 turn on harder and reduce the drive to Q17 and Q20, thereby reducing the bias on Q5, Q6, Q7 and Q8.

The receiver

Input signals from the antenna are fed via the low pass filter network to tuned circuit L20 on the righthand side of the circuit diagram. The signal is then coupled to the emitter or RF amplifier Q21.

Q21 is a grounded base amplifier with tuned circuits L19 and L18 as its collector load. These form a bandpass filter which only accepts signals in the wanted frequency range. The output of L18 is coupled to the emitter of Q18 which functions as the receiver mixer.

The local oscillator signal is applied to the base of Q18 via C97 and the mixer output at the collector is the difference frequency, nominally 10.7MHz. This signal is coupled to IF (intermediate frequency) stage L17. At this point, the signal is split into two paths.

Noise blanker

As shown, most of the signal is fed via C95 to tuned circuit L16, another 10.7MHz IF transformer. At the same time, a portion of the signal is taken from L17, amplified by Q15 and rectified by D14 and D15 to produce a DC control signal. This signal controls Q14 which, in turn, controls Q13.

In greater detail, Q15, Q14 and Q13 form the noise blanker circuit. Assuming S4 is in the ON position, Q14 is normally held off via D13 and R69. Thus, Q13 is also off and the noise blanker has no effect on the overall circuit operation.

If, however, a noise pulse occurs, the output of the rectifier (D14 and D15) pulls down the base of Q14 which turns on. This switches on Q13 which shunts the signal applied to L16 to ground. The low value assigned to C94 (18pF) assures that only noise pulses get through to activate the noise blanker circuit.

Note that in the transmit mode, Q13 is permanently held on via R66 and D12. This prevents any received information from finding its way into the transmitter circuit.

Following L16, the received signal passes via switching diode D10 and R65 to X3, the 8-pole crystal filter. The output from X3 then passes via C83 and R62 to SSB amplifier Q12, a common emitter stage with L15 as its collector load. Q23 and Q24 provide further amplification of the IF signal and apply it via L21 and C119 to Q25.

Q24 is also used to drive the S-meter circuit. A portion of the IF signal is taken from the low impedance winding of L21, rectified by D21 and filtered by C118. The resulting DC voltage is then applied to the S-meter (M1) via VR8.

SSB detector

Q25 functions as an SSB detector. It mixes the received signal on its base with a signal injected into its emitter from offset oscillator Q34 (ie, it restores the carrier). From there on, Q25 functions as a conventional class B detector, recovering the audio from the composite amplitude modulated signal. The resultant audio appears at the collector, is filtered by C122 and then fed to the audio amplifier via C123 and the volume control (VR9).

Transistors Q37 to Q42 form a conventional audio amplifier. Q37 is a straightforward common emitter stage with high frequency rolloff provided by C130 and C131. The signal on the collector of Q37 is fed to common emitter stage Q39 which has negative feedback applied to the emitter via R124.

Q40 is a class-A driver stage with bootstrapping supplied via the output capacitor C140. This stage drives Q41 and Q42 which form a fully complementary output pair. R125 and D24 set the output stage quiescent current while emitter resistors R126 and R127 provide good bias stability.

Resistors R124 and R123 set the gain of the amplifier to around 250 (ie, 5600/22) while C137 rolls off the response below 1kHz.

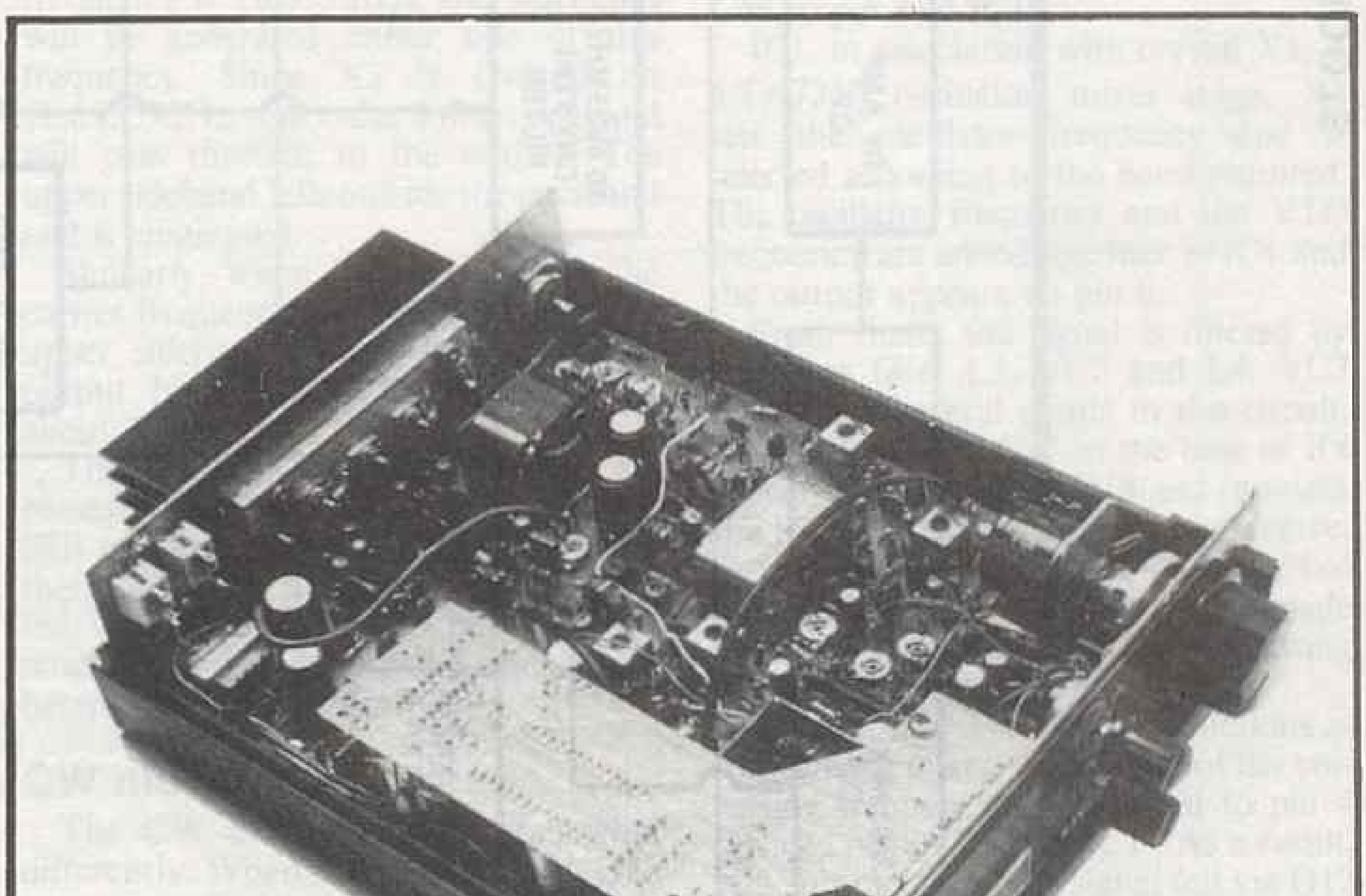
Q38 functions as an audio switch. In the transmit mode, Q38 is biased on and shunts any audio signal across R121 to ground. This means that the audio amplifier is muted when the PTT button is pushed.

Receiver AGC

Let's now examine how the receiver AGC works. To do this, we need to backtrack to IF amplifier stage Q24. As shown on the circuit, part of the signal from Q24's collector is fed to C124 and rectified by diodes D22 and D23. The resulting DC signal is then coupled to the gate of FET Q26.

With no input signal, VR10 and R109 provide a preset 2V bias at the source of Q26. When a signal is received, the output of the rectifier pulls down the gate of Q26 and the voltage across R108 decreases. The higher the signal level, the more the gate is pulled down and the lower the voltage across R108.

This voltage is the AGC signal and is applied to two separate stages in the receiver circuit. First, the AGC signal



The transceiver is housed in a compact plastic case.

controls the gain of SSB amplifier Q12 via R63. The lower the AGC signal, the lower the gain of Q12.

Second, the AGC signal controls the current through Q22 which, in turn, controls PIN diodes D16 and D24. This circuit functions as a variable attenuator for input signals from the antenna, the degree of attenuation being controlled by the AGC voltage.

The circuit works as follows. In the receive mode, Q22 controls D17 and D16 via R86. D17 and D16 are BA244 low impedance switching diodes. As the AGC voltage decreases, Q22's collector voltage rises and D17 and D16 conduct more heavily. Thus, by varying the current through D17 and D16, a variable impedance path is provided which shunts the input signal to ground via C104.

In the transmit mode, +8V is applied permanently to D17 and D16. The diodes now provide a very low impedance path to keep the transmitted signal out of the receiver input (L20).

Power supply

A +10V regulated supply, consisting of Q28, Q29 and D26, supplies power directly to the voltage regulator (IC3), voltage tuned oscillator (Q9 to Q11) and offset oscillator Q34 to Q36. Q28 functions as a conventional series regulator, while D26 sets the reference voltage at the emitter of error amplifier Q29. The voltage on Q29's base, as set by R160 and R132, is compared with the reference voltage on Q2 which then varies the drive to Q1.

The +10V rail is also coupled via D27 to transistor switches Q30 and Q31. These supply +8V regulated supply rails to various other sections of the circuit, depending on whether the transceiver is in the receive or transmit mode.

In the receive mode, the PTT switch is open and D28, D29 and D30 cannot conduct. Therefore Q30 turns on to supply the +8V Rx rail. When the PTT switch is closed for transmit mode, D29 and D30 conduct, Q30 turns off and Q31 turns on to supply the +8V Tx rail. D28 also conducts, turning on Q27 to supply the +12V Tx rail to the transmitter and to 3-terminal regulator IC4.

IC4 provides a regulated +5V rail to the bias regulators (Q16, Q17, Q19 and Q20) in the transmitter circuit.

The final two stages of the RF power amplifier are powered directly from the 13.8V (battery) supply, as is the audio amplifier. This is OK since Q5 to Q8 are normally biased off and can only operate when the preceding transmitter stages are turned on by the PTT switch. Diode D25 and fuse F1 protect against reverse polarity connection to the battery.

Frequency counter

Two different versions of the frequency counter can be built, one to cover the lower (0-0.5MHz) band segment and the other to cover the upper (0.5-0.999MHz) segment. The latter is used exclusively with the 3.5MHz (80-metre) version of the transceiver while the lower band counter must be used with all other versions.

Both versions use a 4-digit LED readout and employ virtually identical circuitry. All that is required to change from one version to the other is to alter two wire links and two diodes.

Page 62 shows the circuit details. Lets take a look at how it works.

The output from the VTO (emitter of Q11) is coupled via a .01μF capacitor to the base of Q901, an MPF102 N-channel FET wired as a source follower. Q901 provides the necessary high input impedance to avoid loading the VTO circuit. The output is taken from the source of Q901 and fed via C902 to common emitter amplifier Q902.

Q902 functions as a clipping amplifier. The output of this stage appears at the collector and is a square wave at the same frequency as the VTO. This signal is fed to pin 1 of IC901, a 74LS90 counter which divides by 10. The output of IC901 is taken from pin 12 and applied directly to the count input (pin 8) of IC903.

IC903 is an Intersil ICM7217A 4-bit counter IC. This device has a 4-bit parallel I/O (input/output) port which allows a preset count to be loaded. For the lower band counter, a count of 0000 is loaded while for the upper band counter, a preset count of 5000 is loaded.

IC903 also contains internal latches, BCD to 7-segment decoder drivers and internal multiplexing circuitry. It direct drives a 4-digit common-cathode LED display (3881). Pins 15-18 switch the display digits while pins 21-28 drive the display segments.

IC902, an Intersil ICM7207 oscillator/frequency divider chip, provides the timebase signals for the counter. Crystal X4 sets the oscillator frequency to 5.24288MHz and this is divided by the chip to produce the STORE and LOAD COUNTER signals on pins 2 and 14 respectively.

Additionally, a 5Hz square wave gating signal appears at pin 13 and this is applied to pins 2 and 3 of IC901. This signal is used to control IC901 which only counts when pins 2 and 3 are pulled low.

The sequence of events is quite straightforward. First, the gating signal (pin 13, IC902) goes low for 0.1s and the divided VTO frequency from IC901 clocks the 7217A counter. Subsequently, at the end of the gating signal, pin 2 of IC902 goes low and the contents of the counter are stored and displayed. Finally, pin 14 of IC902 goes low, Q903 turns on, and the counter is preloaded so that it is ready for the next cycle.

Note that pin 12 of IC903 (LOAD COUNTER) is a Tri-state input. R910 and R911 bias this input to 1/2 Vcc (2.5V) when Q903 is off.

D901, D902 and the two wire links set the preload count. For a 0000-5000 display, D901 and D902 are omitted and the links installed so that pins 5 and 7 are pulled high via R908. For a 5000-9999 display, the links are omitted and D901 and D902 installed.

Because the gating period is 0.1s, and because IC901 divides by 10, the VTO frequency is effectively divided by 100. Thus, IC903 counts between 60,000 and 65,000 pulses, depending upon the setting of the VTO. This means that the counter will overflow several times during the count period so that only the last four digits (ie, the remainder) will be displayed.

For example let's say that the VTO is tuned to 6.3895MHz. This means that the 7217A will count 63,895 pulses (ie, 6.3895MHz divided by 100). Thus, the display will read "3895".

Construction

While the circuit of the new HF transceiver is relatively complex, its construction is reasonably simple and does not require any special assembly techniques. A soldering iron and a screwdriver are virtually all you need. Make sure that the iron has a small chisel-shaped bit, for quick and effective soldering.

Most of the parts are accommodated on a single-sided printed circuit board (PCB) measuring 162 x 199mm and coded K6330. The front & rear panels are also made from PCB copper laminated and are soldered at right angles to the PCB.

The frequency counter circuit is accommodated on a separate double-sided PCB (both versions use the same board). This is mounted on the main board using nylon screws and spacers.

The whole PCB assembly fits into a specially designed ABS plastic case which has two interlocking halves secured by four screws. As can be seen from the photos, the front panel has white silk-screened labelling on a black background. This is combined with an attractive set of knobs, a backlit signal/power meter and the digital readout to produce a professional looking transceiver which is every bit as good as expensive commercial units.

Construction aids

All purchasers of this transceiver kit will receive a detailed assembly manual which describes construction on a step-by-step basis. The parts layout diagram comes complete with a grid pattern and you simply insert each part in turn at the grid location and cross it off the parts list.

In addition, the main PCB will be supplied with a screen-printed overlay to aid the job of parts placement. The copper side of the board will also have a solder mask to reduce the possibility of solder bridges. Provided you take things slowly, it should be almost impossible to make a mistake!

Constructors should also inspect the board very closely to see if the solder mask has encroached on to any of the mounting holes for the components. Check also that all component holes have in fact been drilled and that there is no evidence of bridging in the copper pattern. It's far better to spot and correct any faults at this stage than to try finding them when soldering is complete.

PCB assembly

Now for the PCB assembly. Begin by installing the PC stakes and wire links. Essentially, PC stakes are used at each of the test points (TP1-TP7), as locating points for the front and rear panels, and to support the VTO shield (more on this later).

PC stakes are also used to terminate most of the coil windings (but not L32, L33, L36 and L37) and to terminate the wire links at TP4 and TP5.

The use of PC stakes for the external wiring connections is optional but recommended. PC stakes make it so much easier to disconnect and re-connect wires if that becomes necessary.

With the job of installing all the PC stakes and wire links completed, the next step is to install all the resistors and capacitors. The most important point to remember here is to keep the pigtails as short as possible. Because the circuit is working at high frequencies, any long component pigtails will act as inductors and play merry hell with the performance.

Note that quite a few of the resistors have to be mounted end-on to fit them in. It is a good idea to install these vertical resistors with the colour code running down the body. It is then easier to check the resistor values this way.

Little comment is called for with regard to mounting the capacitors except that you must use the capacitor type designated. There are no exceptions here. Do not interchange greencaps (ie, metallised polyester) for ceramics or tantalums for normal electrolytics, or vice versa.

Semiconductors

The next step is to mount the semiconductors. Do not install the 7805/LM340T regulator or transistors Q5-Q8 at this stage. These components are bolted to the rear heatsink and are installed later.

Mount the diodes first and again make sure that the pigtails are kept as short as possible. Check the polarity of each diode carefully as it is inserted into the PCB. Note that many of the diodes are also mounted end on.

Care is also required when mounting the transistors to ensure correct lead orientation. Double check each transistor against its pinout diagram before soldering it into circuit. The small signal plastic pack transistors (but not Q16 and Q19), plus the metal encapsulated MFE131 (Q1), should be mounted so that the transistor bodies are about 3mm above the surface of the board.

In practice, this simply involves pushing the transistors down onto the board as far as they will go without placing undue strain on the leads. Note that a ferrite bead must be fitted to the base lead of Q21 (C1674).

Transistors Q16 and Q19 at the rear of the PCB should be installed about 6mm proud of the board.

The TO-39 metal package transistors — Q2, Q3 and Q4 — are mounted flat against the PCB. Take care with the orientation of the two BD139 bias regulator transistors (Q17 and Q20) — the metal tabs face towards the two adjacent 1000μF capacitors (C40 and C47). The metal tab of the BD140 faces towards the rear of the PCB.

The integrated circuits should be pushed down onto the PCB as far as they can go before soldering.

Inductors

At this point, you are ready to begin installing the various RF transformers and coils. Nineteen of these have to be wound by you, the constructor. The necessary winding details for the 3.5MHz band are shown Page 19. Be sure to use the correct gauge of wire for each coil and wind the coils exactly to specification.

Install each coil as it is wound and use PC stakes to terminate the windings where appropriate. Note that L11 is supported 6mm above the surface of the board by two PC stakes soldered to the rear of the balun former. If this is not done, there will not be enough room to mount the two adjacent toroid inductors.

Assembly of the main PCB can now be completed by installing the crystal filter, the two crystals and the preset pots.

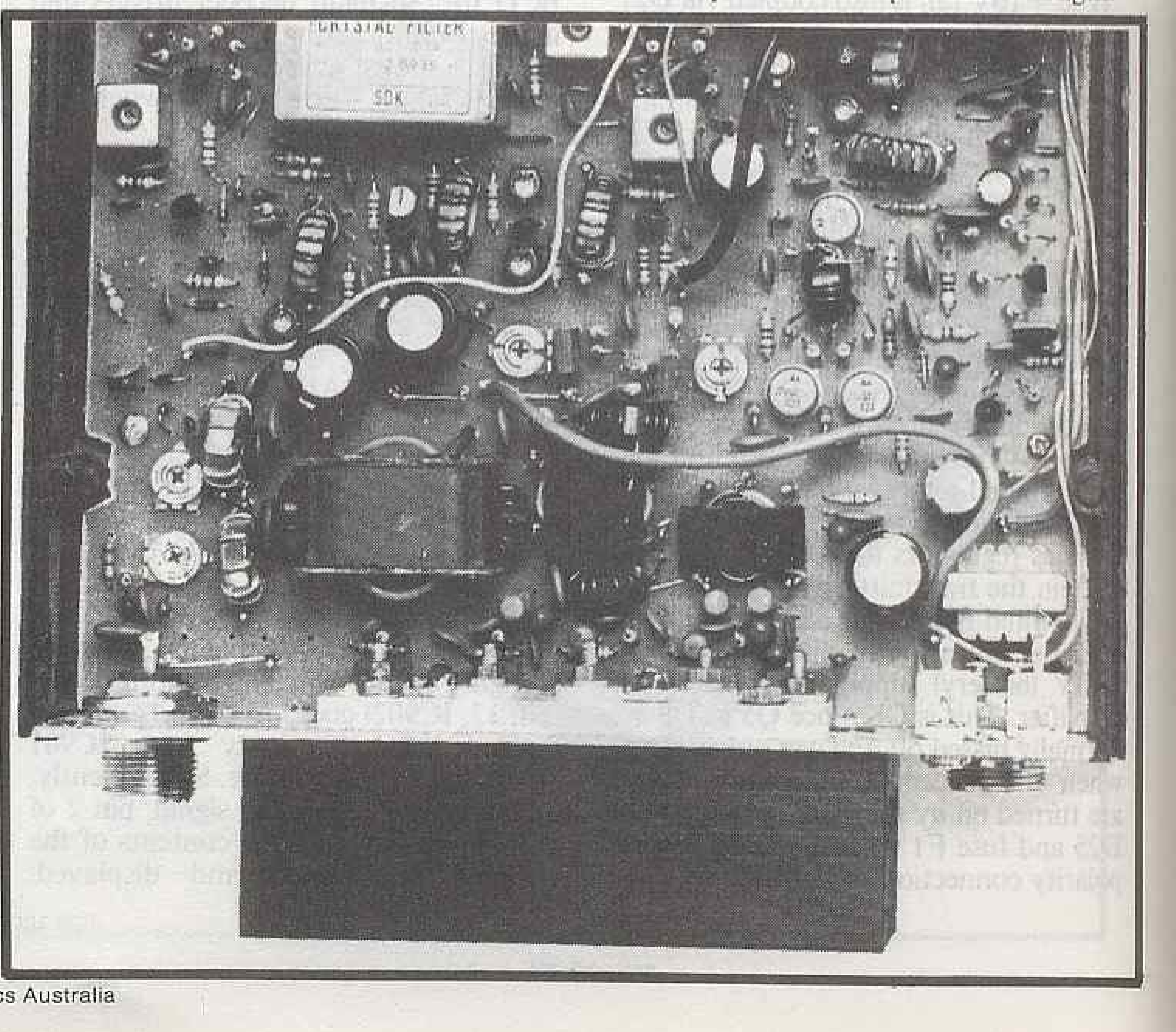
Finally, it is necessary to shield the VTO to prevent spurious radiation into adjacent circuitry. Supplied with the kit is a strip of double-sided PCB laminate which should be cut into two 28mm lengths and two 38mm lengths. The four strips are then soldered to the PC pins at the corners of the VTO circuit.

Final assembly

With assembly of the main PCBs now completed, attention can be turned to the front and rear panels. These are supplied with all the necessary cutouts for the hardware and assembly is quite straightforward. Leave the heatsink assembly to one side for the time being.

With the hardware fitted, slip the front and rear panels into their respective mounting slots in the case and mount the main PCB using the four self-tapping screws provided. The PC stakes at the front and rear of the main PCB are now soldered to the end panels and the case fully assembled to make sure that everything fits.

Adjust the PCB assembly as necessary, then remove it from the case and run a series of solder fillets between the earth pattern on the main PCB and the end panels. This provides strength



and rigidity.

The 10-turn pot (VR5) is mounted on a small piece of PCB laminate soldered at right angles to the main PCB. This laminate is located by three pairs of PC stakes mounted approximately 25mm behind the front panel. The shaft of the pot mates with a 6:1 reduction drive for precise control (see page 64, for details).

Now for the heatsink assembly. The first step is to bolt the 3-terminal regulator and the four RF power transistors, Q5, Q6, Q7 and Q8, to the 80 × 25mm aluminium sub-heatsink.

To do this, install the regulator and transistors on the PCB, then introduce the sub-heatsink through the rear-panel cutout. The regulator and transistors can now be bolted to the sub-heatsink using the countersunk screws supplied. (Refer to page 69).

Note that the transistors must be isolated from the heatsink assembly by means of mica washers and insulating bushes. The 3-terminal regulator is bolted directly to the heatsink. Smear all surfaces with heatsink compound before assembly.

The heatsink assembly can now be completed by bolting the finned extrusion to the sub-heatsink and to the rear panel. Finally, the regulator and transistor leads can be soldered to the PCB.

Note that the bias regulator transistors, Q16 and Q19, should sit firmly against the heatsink when it is all bolted together. Don't forget to smear heatsink compound on the faces of these transistors also.

The internal wiring can now be completed according to the wiring diagrams, on page 71. Medium-duty 10 × 0.2mm hook-up wire should be used for the power supply connections and to switch SW1 (on the back of the volume control), while the remaining front panel connections can be run using light-duty bell wire. Use heavy duty 24 x 0.2mm cable for connection between the power supply and the links at TP4 & TP5.

Note that two connections are run using 50-ohm coaxial cable. (see wiring diagram page 71).

Counter assembly

The counter circuit can now be assembled according to the parts layout diagram. For a 3.5MHz transceiver, build the upper band (5000-9999) version of the counter. For all other frequency bands, build the lower band version.

Assembly of the counter circuit is relatively simple. Bend the leads to the 7805 regulator, the 5.242MHz crystal and the 10μF electrolytic capacitor at right angles before mounting them on the board. Note that the regulator must be mounted proud of the board so that the metal tab does not foul the PC tracks.

The LED display can now be slotted into the front panel and the completed counter PCB mounted on the main PCB using the specified spacers and screws. That done, the terminals on the LED display can be soldered to the matching pads on the counter board.

Finally, remove the counter assembly and connect the three flying leads to the main PCB. That completes the mechanical construction.

Alignment

Most constructors will build the 3.5MHz (80-metre) version of the HF transceiver, so the following alignment notes are for this band only.

The alignment procedure is quite straightforward although you do need access to some test equipment: (1) a digital multimeter; (2) a general coverage shortwave receiver; and (3) a dummy load (eg, Electronics Australia, November 1975, File No. 7/SW/8; or Dick Smith Cat No. D-7010).

A digital frequency meter (DFM) would be useful but is by no means essential since the transceiver's internal frequency counter can be used for alignment. A 15MHz CRO, an RF signal generator and a power meter would also be handy but again are not essential.

Initial checks

(a) Connect the transceiver to a 13.8V supply. The meter lamp should light and the LED readout should display the VTO frequency. This can be checked by adjusting the tuning control — the readout should change.

(b) Turn volume control fully clockwise. Hiss should be heard from the loudspeaker.

(c) If difficulty is experienced, refer to the fault-finding section in the manual.

Frequency counter alignment

(a) Adjust the crystal oscillator in the counter for correct frequency by using an external DFM or calibrated HF receiver.

(b) Disconnect the lead between the VTO and the frequency counter input at the VTO end (ie, leave the other end of the lead connected to the counter input). This lead now becomes a wandering test point to help in alignment.

(c) Connect the test lead to test point TP1 and adjust VC1 for correct crystal frequency. For example, in an 80-metre transceiver the correct adjustment will give a reading of "1920", or 8.1920MHz on an external DFM.

Offset oscillator

(a) Connect the counter to TP8, select USB and adjust VC6 for a reading of "6950" (10.6950MHz on an external DFM).

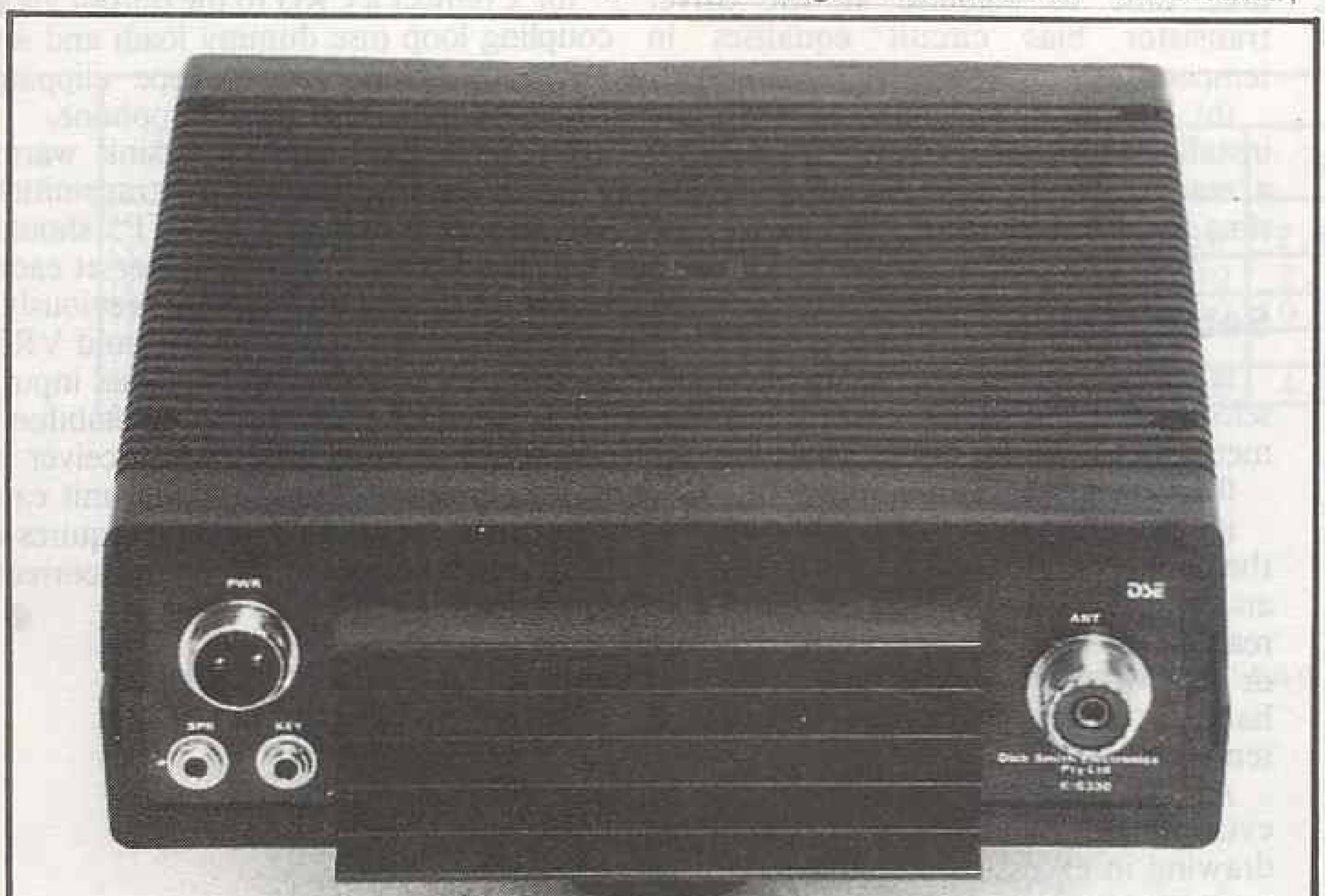
(b) Select LSB and adjust VC8 for a reading of "6920" (10.6920MHz).

(c) Select CW and adjust VC7 for a reading of "6935" (10.6935MHz).

(d) Reconnect test lead to VTO output. Display should now read VTO frequency.

VTO alignment

The VTO should theoretically cover 6-6.5MHz when the main tuning control is rotated from one extreme to the other. In practice, the VTO should be adjusted for a 100kHz overrange at either end (ie, the VTO should cover 5.9MHz to 6.6MHz).



The rear pannel carries various sockets for power, speaker, key and antenna connections.

(a) Set the RIT (clarifier) switch to the centre-off position.

(b) Set the tuning control fully anti-clockwise and note the reading on the display. This should be around 4000 (ie, 100kHz below 500kHz).

(c) Adjust the tuning control fully clockwise. The display should now read around 1000 (ie, 100kHz above 999.9kHz).

(d) If this tuning range cannot be achieved, adjustment of the turns on L14 will be required.

L14 is adjusted by spreading out or bunching the turns over approximately one-third of the winding. Several adjustments may be required to give a VTO range of 6-6.5MHz with equal 100kHz overrange at either end. An overlap of around 100kHz is desirable, but 50kHz is acceptable.

When the tuning range is correct, L14 should be glued in position using epoxy adhesive. Exercise care with this adjustment, as the performance of the transceiver is dependent on the VTO. (Ref to page 60 for final positioning of L14).

Note: if the lower band version of the counter is used, L14 should be adjusted so that the display reads between 9000 and 6000 (ie, 100kHz below 0kHz and 100kHz above 500kHz).

Heterodyne mixer

(a) Connect a 100μA DC meter (use your multimeter) to TP2 and set VTO to centre range (ie, for a display reading of 2500 or 7500).

(b) Adjust VC2 and VC3 for maximum reading (about 30μA).

(c) If an external DFM is available, check the frequency at the output of L4. This should be the crystal oscillator frequency plus the VTO frequency. For example, if the crystal oscillator frequency is 8.192MHz and the VTO is set to 6.25MHz, the DFM should read 14.442MHz.

This can also be checked by placing the antenna to a shortwave receiver close to L4.

Receiver alignment

(a) Advance volume control fully and adjust L21, L15, L16 and L17 in order for maximum noise from the loudspeaker.

(b) If a calibrated signal generator is available, adjust the output of the generator to 10.6935MHz and select CW mode on the transceiver.

(c) Peak L21, L15, L16 and L17 for maximum reading with considerable input into the emitter of mixer transistor Q18 via a 100pF coupling capacitor. Approximately 10μV from the signal generator will produce a meter deflection. Note that VR8 (meter adjust) should be set approximately three-quarters clockwise.

(d) Connect a 3.5MHz 50-ohm antenna to the transceiver and check for receiver noise. Tune to the centre of the band.

(e) With no received signal, peak VC9, VC10 and VC11 in order for maximum receiver noise. This can also be observed as a small deflection on the S-meter.

(f) If a calibrated signal generator is available, connect it to the antenna input and adjust it for a half-scale reading on the S-meter. Reduce the signal generator level as VC9, VC10 and VC11 are tuned for maximum reading.

Note: most operators will use only a small portion of the tuning range, eg 3.5MHz to 3.7MHz. In this case, VC9, VC10 and VC11 should be adjusted to obtain equal sensitivity at the top and bottom of the range after first aligning at the centre frequency (3.6MHz).

AGC and S-meter

(a) Connect a DC voltmeter to TP7 and adjust VR10 for 2V DC with no signal input.

(b) If a calibrated signal generator is available, adjust VR8 (S-meter adjust) for an S9 reading with 100μV input.

Transmitter alignment

(a) Set VR1, VR2, VR4, VR12 and VR13 to mid-position.

(b) Set VR3 and VR11 fully anti-clockwise.

(c) Note reading on counter and tune for convenient readout; eg, 2000.

(d) Connect the microphone, operate the PTT switch and set VR7 for the same reading. Release the PTT switch and check that the reading stays the same.

(e) Connect a 50-ohm dummy load to the transceiver output and select either USB or LSB.

(f) Remove link from TP4 and insert a 100mA meter with polarity as shown on PC overlay.

(g) Press PTT switch and adjust VR1 for 50mA idling current with no microphone input. Note: this reading will take time to stabilise as the driver transistor bias circuit equalises in temperature.

(h) Re-install the link at TP4 and install the meter at TP5. Adjust VR2 for a reading of 100mA. As before, allow time for the reading to stabilise.

Second mixer

(a) Set VC4 and VC5 to mid-position, select CW mode and connect a DC amp meter (0-5A) in the power lead.

(b) Connect a 100mA meter to TP3.

(c) Set the transceiver to the centre of the band, operate the PTT button or key, and adjust VC4 and VC5 for maximum reading at TP3. Note: operate the PTT or key for short periods only. Use your hand to check for excessive heatsink temperature.

At this stage, RF output should be evident and the transceiver should be drawing in excess of 3A. If an external power meter is available, check that the transmitter delivers around 15W CW.

Balanced modulator

(a) Select the USB mode and connect a dummy load to the output.

(b) Couple the load to a shortwave receiver or CRO via a coupling loop (a few turns will do) and set VR11 fully anticlockwise.

(c) Adjust VR12 and VR13 for minimum RF output with no input to the microphone. If using a shortwave receiver, set VR12 and VR13 for minimum S-meter reading.

(d) Switch to LSB mode and repeat step (c). If using a CRO, switch between USB and LSB and adjust VR12 and VR13 for equal minimum readings.

ALC adjustment

(a) Set VR11 three-quarters clockwise and select either USB or LSB mode. Set VR3 (ALC adjustment) fully anti-clockwise.

(b) Operate PTT while whistling into the microphone. The current drawn by the transceiver should increase towards 5A peak during short whistle bursts.

(c) Rotate VR3 clockwise until RF output just decreases as short whistles are fed to the microphone. This can be monitored using a CRO or shortwave receiver as above and can also be seen on the RF output meter on the front panel.

(d) If the transceiver is to be used to drive a linear amplifier, and the full 30W PEP is not required, the ALC control can be used to reduce the RF output to the required level.

Final adjustments

(a) Connect a calibrated RF power meter and adjust VR4 to obtain a similar reading on the front panel meter. If no external power meter is available, operate PTT switch, whistle into microphone and set VR4 so that the front panel meter reads in red on signal peaks.

(b) Connect a CRO to the output via a coupling loop (use dummy load) and set VR3 for minimum envelope clipping when speaking into the microphone.

(c) With the output heatsink warm (from use), a final check of transmitter bias at test points TP4 and TP5 should be made. Insert a current meter at each test point in turn as described previously. Adjust VR1 for 50mA at TP4 and VR2 for 100mA at TP5 with no signal input. Allow time for the readings to stabilise.

Construction of the HF transceiver is now completed. Note that the unit can draw up to 5A on transmit and requires a good regulated power supply for correct operation. ●

TRANSISTOR AND IC VOLTAGES.

DEVICE		EMITTER/SOURCE VOLTAGE	BASE/GATE 1 VOLTAGE	COLLECTOR/DRAIN VOLTAGE	GATE 2 VOLTAGE	MODE
Q1	MFE131	0.50 (S)	-	9.30 (D)	3.00 (G2)	Tx
Q2	2N4427	0.60	1.30	13.50	-	Tx
Q3	2N4427	0.20	0.95	12.00	-	Tx
Q4	2N4427	0.20	0.95	12.00	-	Tx
Q5	2SC2166	-	0.68	13.80	-	Tx
Q6	2SC2166	-	0.68	13.80	-	Tx
Q7	2SC2312	-	0.71	13.80	-	Tx
Q8	2SC2312	-	0.71	13.80	-	Tx
Q9	MPF102	0.55 (S)	-	5.80 (D)	-	
Q10	2SC710	-	0.69	4.60	-	
Q11	BC547	4.00	4.60	6.20	-	
Q12	2SC710	1.20	1.80	10.00	-	
Q13	2SC710	-	0.60	-	-	
Q14	2SA733	9.00	8.45	1.70	-	
Q15	2SC710	-	0.70	5.00	-	
Q16	BC547	-	0.60	1.45	-	Tx
Q17	BD139	0.72	1.40	3.90	-	
Q18	2SC1674	0.10	0.80	9.00	-	
Q19	BC547	-	0.65	1.50	-	
Q20	BD139	0.77	1.50	3.80	-	
Q21	2SC1674	1.40	2.20	9.00	-	
Q22	BC547	1.40	2.00	4.50	-	
Q23	2SC710	-	0.72	2.60	-	
Q24	2SC710	1.90	2.60	7.50	-	
Q25	2SC710	0.30	0.70	3.00	-	
Q26	BF245	2.00 (S)	2.00 (G1)	7.80 (D)	-	
Q27	BC327/8	13.80	12.80	13.60	-	Tx
Q28	BD140	13.80	13.00	10.00	-	
Q29	BC547	4.70	5.30	12.70	-	
Q30	BC337/8	8.00	8.50	8.50	-	
Q31	BC577	9.00	9.00	8.60	-	Tx
Q32	BC548	5.00	1.10	1.90	-	Tx
Q33	BC548	1.25	1.90	4.60	-	Tx
Q34	BC547	2.50	3.00	8.75	-	
Q35	BC547		DEPENDS UPON MODE			Tx
Q36	BC547		DEPENDS UPON MODE			Tx
Q37	BC548	1.00	1.60	6.50	-	
Q38	BC547		0.70	-	-	Tx
Q39	BC548	7.60	8.00	13.20	-	
Q40	BC557	13.80	13.20	8.10	-	
Q41	BC337/8	7.50	8.10	13.80	-	
Q42	BC327/8	7.50	6.90	-	-	
Q43	BC547	-	0.70	-	-	
Q44	BC547	-	0.70	-	-	Tx

DEVICE		PIN NUMBER 1	2	3	4	5	6	7	8	9	MODE
IC1	7310	2.60	2.00	1.60	2.50	-	9.80	2.00	8.60	1.30	
IC2	7310	2.80	2.00	1.40	2.70	-	7.30	2.30	9.60	8.00	Tx
IC3	LM301	1.30	6.00	6.00	-	-	7.30	10.00	7.00	-	
IC4	7805	13.50	GND	5.00	-	-	-	-	-	-	Tx
IC5	AN612	3.00	3.40	3.40	-	6.00	8.30	4.80	-	-	Tx

NOTES: Variations typical volts ± 25%. If greater than this, check for fault (reason)

MAIN SUPPLY.

10volts supply nominal	9.50 - 10.50V
+8V RX	8.00 - 9.00V
+8V TX	8.00 - 9.00V
+12V TX	12.00 - 13.50V

PARTS LIST

Please check all the parts in this kit against the parts list. In the unlikely event of a part being missing or incorrectly supplied, you MUST use the Quality Control Card included in your kit. You can send the card directly to the Kit Department at the Head Office or drop it in at your nearest Dick Smith Store.

RESISTORS

Resistor	2.2	ohm	1/4W	x 2
Resistor	10	ohm	1/4W	x 7
Resistor	18	ohm	1/4W	x 2
Resistor	22	ohm	1/4W	x 5
Resistor	47	ohm	1/4W	x 5
Resistor	68	ohm	1/4W	x 1
Resistor	100	ohm	1/4W	x16
Resistor	180	ohm	1/4W	x 1
Resistor	220	ohm	1/4W	x 7
Resistor	330	ohm	1/4W	x 7
Resistor	390	ohm	1/4W	x 2
Resistor	470	ohm	1/4W	x 5
Resistor	560	ohm	1/4W	x 3
Resistor	680	ohm	1/4W	x 5
Resistor	1K	ohm	1/4W	x14
Resistor	1.5K	ohm	1/4W	x 3
Resistor	1.8K	ohm	1/4W	x 1
Resistor	2.2K	ohm	1/4W	x 5
Resistor	2.7K	ohm	1/4W	x 1
Resistor	3.3K	ohm	1/4W	x12
Resistor	3.9K	ohm	1/4W	x 3
Resistor	4.7K	ohm	1/4W	x 8
Resistor	5.6K	ohm	1/4W	x 1
Resistor	8.2K	ohm	1/4W	x 1
Resistor	10K	ohm	1/4W	x19
Resistor	15K	ohm	1/4W	x 5
Resistor	22K	ohm	1/4W	x 4
Resistor	33K	ohm	1/4W	x 5
Resistor	47K	ohm	1/4W	x 8
Resistor	100K	ohm	1/4W	x 9
Resistor	120K	ohm	1/4W	x 1
Resistor	180K	ohm	1/4W	x 1
Resistor	220K	ohm	1/4W	x 1
Resistor	560K	ohm	1/4W	x 2
Resistor	820K	ohm	1/4W	x 1

CAPACITORS

Ceramic	2.2pf		x 2
Ceramic	4.7pf		x 2
Ceramic	10pf		x 1
Ceramic	15pf		x 3
Ceramic	18pf		x 1
Ceramic	22pf		x 1
Ceramic	33pf		x 6
Ceramic	39pf		x 2
Ceramic	47pf		x 6
Ceramic	82pf		x 1
Ceramic	100pf		x 2
Ceramic	220pf		x 4
Ceramic	330pF		x 1
Ceramic	390pF		x 1
Ceramic	470pf		x 1
Ceramic	680pF		x 1
Ceramic	.001uf/ 1000pf		x 6
Ceramic	.0022uf/ 2200pf		x 1
Ceramic	.0047uf /4700pf		x 3
Ceramic	.01uf		x55
Ceramic	.047uf		x15
Ceramic	.1uf		x12
Ceramic	2.2pf	NPO	x 1
Ceramic	10pf	NPO	x 1
Ceramic	15pf	NPO	x 1
Ceramic	18pF	NPO	x 1
Ceramic	22pf	NPO	x 1
Ceramic	47pF	NPO	x 1
Ceramic	100pf	NPO	x 1

Greencap	.01uf		x 1
Greencap	.022uf		x 1
Greencap	.039uf		x 3
Electro	10uf	16V	x 1
Electro	47uf	16V	x 4
Electro	100uf	25V	x 2
Electro	220uf	16V	x 1
Electro	470uf	16V	x 1
Electro	1000uf	16V	x 3
Tantalum	.1uf	25V	x 1
Tantalum	.22uf	25V	x 3
Tantalum	.33uf	25V	x 1
Tantalum	1uf	25V	x 7
Tantalum	2.2uf	25V	x 1
Tantalum	3.3uf	25V	x 1
Tantalum	4.7uf	16V	x 1
Tantalum	10uf	16V	x11
Tantalum	22uf	6V	x 1
Tantalum	100uf	3V	x 2
Silver Mica	68pf		x 1
Silver Mica	150pf		x 1
Silver Mica	220pf		x 1
Silver Mica	330pf		x 2
Silver Mica	470pf		x 2
Silver Mica	1000pf		x 2
Polystyrene	56pf		x 1
Polystyrene	470pf		x 1

All NPO capacitors are identified either by the markings "NPO" or a coloured dot on the top edge of the capacitor. (current stock has black or green dots).

DIODES

Diode	IN60/OA95	x 8
Diode	IN914/1N4148	x 17
Diode	1N4002	x 2
Diode	BA244	x 2
Diode Zener	5.6V 400mV (IN752)	x 2
Diode Zener	6.2V 400mV (IN753)	x 2
Diode Varicap	MV104	x 1

TRANSISTORS

Transistor	BC547/DS547/BC107	x12
Transistor	BC548/DS548/BC108	x 4
Transistor	BC557/DS557/	x 3
Transistor	BC327/BC328	x 2
Transistor	BC337/BC338	x 2
Transistor	BD139	x 2
Transistor	BD140	x 1
Transistor	MFE131	x 1
Transistor	2N4427	x 3
Transistor	2SC2166	x 2
Transistor	2SC2312 / 2SC1969	x 2
Transistor	MPF102/BF245	x 2
Transistor	2SC710	x 7
Transistor	2SA733	x 1
Transistor	2SC1674	x 2
Transistor	BF245	x 1

INTERGRATED CIRCIUTS

IC	74LS90	x 1
IC	7217A	x 1
IC	7207	x 1
IC	C3001/TA7310P	x 2
IC	LM301/748	x 1
IC	AN612	x 1
IC	7805 (Volt Reg.)	x 2

CRYSTALS

Xtal	10.692MHz	x 1
Xtal	10.6935MHz.(filter)	x 1
Xtal	5.242MHz	x 1
Xtal	8.192MHz	x 1

COMPONENTS

Trimcap	2-20pf	4
Trimcap	5-60pf	7
Trimcap	5-70pf	1
Trimpot	100R	2
Trimpot	1K	1
Trimpot	5K	3
Trimpot	10K	3
Trimpot	50K	1
RF Choke	1.8uH	2
RF Choke	4.7uH	1
RF Choke	100uH	6
RF Choke	150uH	3
DC Smoothing Choke		1
Toroid Ring	(Yellow)	2
Toroid Ring	(Red/Brown)	9
Toroid Ring	(Blk Ferrite sml)	15
Toroid Ring	(Blk Ferrite lge)	4
Can	10MA015S	4
Ferrite Bead	(Blk)	2

HARDWARE

Pot Mini 5K/10K	1
Pot Mini 5K/10K (Switched)	1
Pot Ten Turn 100K	1
Knob (Small)	2
Knob (Tuning)	1
Socket 'P' Type	1
DC Socket 2 Pin	1
Mic Socket 4 Pin	1
Switch SPDT	3
Socket DC 3.5mm	2
Verner Drive	1
Fuse Holder 3AG (Inline)	1
Fuse 7.5A 3AG	1
'S' Meter (200uA)	1
Display Module (NSB3881)	1
Tuning Pot PCB Bracket	1
Solder	1
Tinned Copper Wire	1
H/U Wire	1
SCl Shielded Wire	1
Coax Braid	1
EN/Copper Wire	1
Case Bracket Support	2
Wing Nuts	2
Silicon Grease	1
Screws,Nuts & Washers	1
Spacers	5
PCB Pins	110
Mica Washer (TO220)	4
Nylon Bush	4
PCB (Counter Board)	1
PCB (Main Board)	1
Front Panel	1
Back Panel	1
Heatsink	1
Heatsink Plate	1
Plastic Case	1
Case Bracket	1
Speaker	1
Microphone	1
VCO Shield	1
Instructions	1
Circuit Diagram	1

COMPONENT LOCATIONS

All components in this parts list are listed as follows: component number, location on PCB, value and colour code or type, respectively. Please note that all resistors are 1/4w unless specified otherwise.

RESISTORS

R1	---	Not Allocated		☐
R2	C16	100R	(brn-blk-brn)	☐
R3	D15	220R	(red-red-brn)	☐
R4	E13	220R	(red-red-brn)	☐
R5	H13	3.3K	(org-org-red)	☐
R6	G13	330R	(org-org-brn)	☐
R7	E12	10K	(brn-blk-org)	☐
R8	F10	1K	(brn-blk-red)	☐
R9	E10	560R	(grn-blu-brn)	☐
R10	E12	22K	(red-red-org)	☐
R11	C12	100R	(brn-blk-brn)	☐
R12	D9	100R	(brn-blk-brn)	☐
R13	B8	470R	(yel-vio-brn)	☐
R14	C9	220R	(red-red-brn)	☐
R15	E8	390R	(org-wht-brn)	☐
R16	D8	47R	(yel-vio-blk)	☐
R17	C8	3.9K	(org-wht-red)	☐
R18	C7	10R	(brn-blk-blk)	☐
R19	C5	2.2K	(red-red-red)	☐
R20	D6	22R	(red-red-blk)	☐
R21	E6	22R	(red-red-blk)	☐
R22	C7	47R	(yel-vio-blk)	☐
R23	E5	680R	(blu-gry-brn)	☐
R24	D7	10R	(brn-blk-blk)	☐
R25	F7	10R	(brn-blk-blk)	☐
R26	F5	680R	(blu-gry-brn)	☐
R27	D4	47R	(yel-vio-blk)	☐
R28	F2	100R	(brn-blk-brn)	☐
R29	F1	22R	(red-red-blk)	☐
R30	H1	22R	(red-red-blk)	☐

COMPONENT LOCATIONS

R31	H2	100R	(brn-blk-brn)	□
R32	J1	10R	(brn-blk-blk)	□
R33	L1	10R	(brn-blk-blk)	□
R34	J2	100R	(brn-blk-brn)	□
R35	K2	100R	(brn-blk-brn)	□
R36	H6	2.7K	(red-vio-red)	□
R37	H6	18R	(brn-gry-blk)	□
R38	G7	330R	(org-org-brn)	□
R39	H7	1.5K	(brn-grn-red)	□
R40	H6	10R	(brn-blk-blk)	□
R41	J7	220R	(red-red-brn)	□
R42	P7	47K	(yel-vio-org)	□
R43	P3	680R	(blu-gry-brn)	□
R44	F15	10K	(brn-blk-org)	□
R45	F16	100K	(brn-blk-yel)	□
R46	E16	470R	(yel-vio-brn)	□
R47	O18	10K	(brn-blk-org)	□
R48	E16	4.7K	(yel-vio-red)	□
R49	E15	100R	(brn-blk-brn)	□
R50	E17	3.3K	(org-org-red)	□
R51	D17	15K	(brn-grn-org)	□
R52	D16	1K	(brn-blk-red)	□
R53	D16	10R	(brn-blk-blk)	□
R54	D15	100R	(brn-blk-brn)	□
R55	D16	330R	(org-org-brn)	□
R56	P13	330R	(org-org-brn)	□
R57	P9	47R	(yel-vio-blk)	□
R58	O10	560R	(grn-blu-brn)	□
R59	O12	10K	(brn-blk-org)	□
R60	O11	15k	(brn-grn-org)	□
R61	N11	10K	(brn-blk-org)	□
R62	N12	330R	(org-org-brn)	□
R63	N11	10K	(brn-blk-org)	□
R64	J11	2.2K	(red-red-red)	□
R65	I12	100R	(brn-blk-brn)	□
R66	H13	47K	(yel-vio-org)	□
R67	G13	22K	(red-red-org)	□
R68	G11	100K	(brn-blk-yel)	□
R69	G11	820K	(gry-red-yel)	□
R70	G12	4.7K	(yel-vio-red)	□
R71	H12	560K	(grn-blu-yel)	□
R72	G11	1k	(brn-blk-red)	□
R73	G11	100K	(brn-blk-yel)	□
R74	H9	100R	(brn-blk-brn)	□
R75	H9	180K	(brn-gry-yel)	□
R76	G7	10K	(brn-blk-org)	□
R77	H8	100R	(brn-blk-brn)	□
R78	I8	4.7K	(yel-vio-red)	□
R79	J9	4.7K	(yel-vio-red)	□
R80	L9	100R	(brn-blk-brn)	□
R81	L7	680R	(blu-gry-brn)	□
R82	L9	2.2K	(red-red-red)	□
R83	L8	68R	(blu-gry-blk)	□
R84	L7	1K	(brn-blk-red)	□
R85	M9	4.7K	(yel-vio-red)	□
R86	N7	1.8K	(brn-gry-red)	□
R87	N10	1K	(brn-blk-red)	□
R88	N9	3.9K	(org-wht-red)	□
R89	M10	22K	(red-red-org)	□
R90	D19	3.3K	(org-org-red)	□
R91	M18	3.3K	(org-org-red)	□
R92	P18	33K	(org-org-org)	□
R93	P16	1.5K	(brn-grn-red)	□
R94	O15	8.2K	(gry-red-red)	□
R95	O17	220R	(red-red-brn)	□
R96	O13	33K	(org-org-org)	□
R97	N13	1.5K	(brn-grn-red)	□
R98	P13	470R	(yel-vio-brn)	□
R99	N12	47R	(yel-vio-blk)	□
R100	I13	100R	(brn-blk-brn)	□
R101	M13	33K	(org-org-org)	□
R102	M14	3.3K	(org-org-red)	□
R103	M15	1K	(brn-blk-red)	□
R104	L14	10K	(brn-blk-org)	□
R105	K14	3.9K	(org-wht-red)	□
R106	K13	100K	(brn-blk-yel)	□
R107	K12	10K	(brn-blk-org)	□
R108	M13	680R	(blu-gry-brn)	□
R109	J13	4.7K	(yel-vio-red)	□
R110	K18	3.3K	(org-org-red)	□
R111	J18	100K	(brn-blk-yel)	□
R112	J18	15K	(brn-grn-org)	□
R113	K19	390R	(org-wht-brn)	□
R114	J19	2.2K	(red-red-red)	□
R115	J19	4.7K	(yel-vio-red)	□
R116	J18	120K	(brn-red-yel)	□
R117	J17	2.2K	(red-red-red)	□
R118	I17	47K	(yel-vio-org)	□
R119	J18	10K	(brn-blk-org)	□
R120	K20	4.7K	(yel-vio-red)	□
R121	I19	560K	(grn-blu-yel)	□
R122	I18	220K	(red-red-yel)	□
R123	I19	22R	(red-red-blk)	□
R124	I18	5.6K	(grn-blu-red)	□
R125	H18	18R	(brn-gry-blk)	□
R126	H18	2.2R	(red-red-gld)	□
R127	H18	2.2R	(red-red-gld)	□
R128	H18	220R	(red-red-brn)	□
R129	A7	1K	(brn-blk-red)	□
R130	B7	470R	(yel-vio-brn)	□
R131	B9	1K	(brn-blk-red)	□
R132	C8	10K	(brn-blk-org)	□
R133	A6	1K	(brn-blk-red)	□
R134	B6	33K	(org-org-org)	□
R135	B9	1K	(brn-blk-red)	□
R136	B12	3.3K	(org-org-red)	□
R137	B11	33K	(org-org-org)	□
R138	K16	1K	(brn-blk-red)	□
R139	K17	10K	(brn-blk-org)	□
R140	I17	100K	(brn-blk-yel)	□
R141	K16	1K	(brn-blk-red)	□
R142	I17	1K	(brn-blk-red)	□
R143	L17	15K	(brn-grn-org)	□
R144	J17	3.3K	(org-org-red)	□
R145	L17	560R	(grn-blu-brn)	□
R146	J16	100K	(brn-blk-yel)	□
R147	H16	10K	(brn-blk-org)	□
R148	I15	47K	(yel-vio-org)	□
R149	I14	330R	(org-org-brn)	□
R150	J14	3.3K	(org-org-red)	□
R151	I13	100R	(brn-blk-brn)	□
R152	I14	470R	(yel-vio-brn)	□
R153	N15	220R	(red-red-brn)	□
R154	L16	1K	(brn-blk-red)	□
R155	N16	10K	(brn-blk-org)	□
R156	M15	22K	(red-red-org)	□
R157	L19	3.3K	(org-org-red)	□
R158	K19	3.3K	(org-org-red)	□
R159	K19	15K	(brn-grn-org)	□
R160	B8	10K	(brn-blk-org)	□
R161	M9	3.3K	(org-org-red)	□
R162	I11	100R	(brn-blk-brn)	□

CAPACITORS

C1	B17	330pF	(Ceramic)	□
C2	C18	390pF	(Ceramic)	□
C3	---	Not Allocated		□
C4	C17	15pF	(Ceramic)	□

C5	B16	1uF	(Tantalum)
C6	D17	22pF	(Ceramic)
C7	C14	0.01uF	(Ceramic)
C8	B15	33pF	(Ceramic)
C9	D13	1000pF	(Ceramic)
C10	D13	33pF	(Ceramic)
C11	D13	47pF	(Ceramic)
C12	F14	100pF	(Ceramic)
C13	F14	680pF	(Ceramic)
C14	G14	0.01uF	(Ceramic)
C15	H14	0.22uF	(Tantalum)
C16	G14	0.01uF	(Ceramic)
C17	G14	10uF/16V	(Tantalum)
C18	F12	0.01uF	(Ceramic)
C19	E11	Not Allocated	
C20	F10	Not Allocated	
C21	C12	0.01uF	(Ceramic)
C22	E11	15pF	(Ceramic)
C23	E9	0.01uF	(Ceramic)
C24	C9	0.047uF	(Ceramic)
C25	D8	0.1uF	(Ceramic)
C26	F8	0.01uF	(Ceramic)
C27	C8	0.01uF	(Ceramic)
C28	E5	0.1uF	(Ceramic)
C29	C6	10uF/16V	(Tantalum)
C30	C7	0.1uF	(Ceramic)
C31	E5	0.1uF	(Ceramic)
C32	D4	0.1uF	(Ceramic)
C33	D4	10uF/16V	(Tantalum)
C34	E2	100uF/3V	(Tantalum)
C35	F2	0.047uF	(Ceramic)
C36	F2	0.01uF	(Ceramic)
C37	H2	0.01uF	(Ceramic)
C38	I3	0.1uF	(Ceramic)
C39	I6	0.1uF	(Ceramic)
C40	K7	1000uF/16V	(Electro)
C41	G4	68pF	(Silver Mica)
C42	I2	100uF/3V	(Tantalum)
C43	I1	0.047uF	(Ceramic)
C44	J2	0.01uF	(Ceramic)
C45	L2	0.01uF	(Ceramic)
C46	J5	0.1uF	(Ceramic)
C47	L6	1000uF/16V	(Electro)
C48	M5	0.1uF	(Ceramic)
C49	K3	220pF	(Silver Mica)
C50	N5	2.2pF	(Ceramic) NPO
C51	M5	470pF	(Silver Mica)
C52	N5	150pF	(Silver Mica)
C53	M4	1000pF	(Silver Mica)
C54	---	Not Allocated	
C55	M1	1000pF	(Silver Mica)
C56	N2	330pF	(Silver Mica)
C57	P2	470pF	(Silver Mica)
C58	P2	18pF	(Ceramic) NPO
C59	P2	0.01uF	(Ceramic)
C60	O2	1uf/16V	(Tantalum)
C61	P6	0.22uF/16V	(Tantalum)
C62	P6	0.01uF	(Ceramic)
C63	P8	0.01uF	(Ceramic)
C64	H7	.047uF	(Ceramic)
C65	G2	0.01uF	(Ceramic)
C66	K2	0.01uF	(Ceramic)
C67	---	Not Allocated	
C68	F16	56pf	(Polystyrene)
C69	E15	470pF	(Polystyrene)
C70	F17	0.047uF	(Ceramic)
C71	E16	100pF	(Ceramic) NPO
C72	F17	0.047uF	(Ceramic)
C73	D15	1uF	(Tantalum)
C74	D16	0.047uF	(Ceramic)
C75	D17	0.01uF	(Ceramic)
C76	P12	0.01uF	(Ceramic)
C77	P9	100pF	(Ceramic)
C78	P9	0.01uF	(Ceramic)
C79	O10	10uf/16V	(Tantalum)
C80	O10	0.047uF	(Ceramic)
C81	P11	0.1uF	(Ceramic)
C82	N12	0.047uF	(Ceramic)
C83	N12	0.01uF	(Ceramic)
C84	N11	10pF	(Ceramic) NPO
C85	J11	15pF	(Ceramic) NPO
C86	J12	0.01uF	(Ceramic)
C87	I10	0.01uF	(Ceramic)
C88	H13	82pF	(Ceramic)
C89	G12	4.7uf/16V	(Tantalum)
C90	H12	0.01uF	(Ceramic)
C91	H11	220pF	(Ceramic)
C92	H11	4700pF	(Ceramic)
C93	G11	220pF	(Ceramic)
C94	G10	18pF	(Ceramic)
C95	I11	2.2pF	(Ceramic)
C96	G9	0.01uF	(Ceramic)
C97	G8	1000pF	(Ceramic)
C98	---	Not Allocated	
C99	J8	15pF	(Ceramic)
C100	K8	0.01uF	(Ceramic)
C101	K8	.01uF	(Ceramic)
C102	L7	0.01uF	(Ceramic)
C103	N6	47pF NPO	(Ceramic)
C104	N7	0.01uF	(Ceramic)
C105	N9	1uF/16V	(Tantalum)
C106	N8	0.01uF	(Ceramic)
C107	O7	0.01uF	(Ceramic)
C108	O11	0.01uF	(Ceramic)
C109	O8	1uF/16V	(Tantalum)
C110	D19	0.01uF	(Ceramic)
C111	N19	0.01uF	(Ceramic)
C112	N15	0.047uF	(Ceramic)
C113	N17	33pF	(Ceramic)
C114	P17	1uF	(Tantalum)
C115	O13	0.047uF	(Ceramic)
C116	O13	0.01uF	(Ceramic)
C117	K14	47uF/10V	(Electro)
C118	O15	0.01uF	(Ceramic)
C119	N13	4.7pF	(Ceramic)
C120	M14	39pF	(Ceramic)
C121	L15	1000pF	(Ceramic)
C122	N15	1000pF	(Ceramic)
C123	L14	0.039uF	(Greencap)
C124	N13	10pF	(Ceramic)
C125	L13	3.3uF	(Tantalum)
C126	L13	10uF	(Tantalum)
C127	M13	2200pF	(Ceramic)
C128	K14	0.047uF	(Ceramic)
C129	K18	0.039uF	(Greencap)
C130	K18	1000pF	(Ceramic)
C131	K19	4700pF	(Ceramic)
C132	J19	10uF/16V	(Tantalum)
C133	J19	0.022uF	(Greencap)
C134	K17	100uF/16V	(Electro)
C135	J18	0.1uF	(Tantalum)
C136	J19	0.01uF	(Ceramic)
C137	I19	10uF/16V	(Tantalum)
C138	J18	0.1uF	(Ceramic)
C139	I18	0.01uF	(Greencap)
C140	H17	220uF/16V	(Electro) RB
C141	F9	100uF/16V	(Electro) RB
C142	C1	0.047uF	(Ceramic)
C143	D3	1000uF/16V	(Electro)
C144	C4	470uF/16V	(Electro)
C145	B7	0.1uF	(Ceramic)
C146	C12	10uF/16V	(Tantalum)

COMPONENT LOCATIONS

C147	B9 ,	47uF/16V	(Electro)........	☐
C148	C5 ,	0.01uF	(Ceramic)........	☐
C149	D2 ,	1uF	(Tantalum)......	☐
C150	B10,	10uf/16V	(Tantalum)......	☐
C151	B11,	0.01uF	(Ceramic)........	☐
C152	B9 ,	0.01uF	(Ceramic)........	☐
C153	C12,	10uF/16V	(Tantalum)......	☐
C154	C12,	0.01uF	(Ceramic)........	☐
C155	E2 ,	10uF/16V	(Tantalum)......	☐
C156	K16,	0.039uF	(Greencap)......	☐
C157	J16,	4700pF	(Ceramic)........	☐
C158	K18,	47uf/16V	(Electro)........	☐
C159	I17,	22uF/6.3V	(Tantalum)......	☐
C160	J16,	2.2uF/16V	(Tantalum)......	☐
C161	I16,	0.01uF	(Ceramic)........	☐
C162	I15,	0.01uF	(Ceramic)........	☐
C163	H15,	0.01uF	(Ceramic)........	☐
C164	H15,	0.22uF	(Tantalum)......	☐
C165	I14,	0.047uF	(Ceramic)........	☐
C166	I13,	47uF/16V	(Electro)........	☐
C167	I14,	0.01uF	(Ceramic)........	☐
C168	K14,	0.01uF	(Ceramic)........	☐
C169	J15,	47pF	(Ceramic)........	☐
C170	J16,	4.7pF	(Ceramic)........	☐
C171	M16,	220pF	(Ceramic)........	☐
C172	L16,	470pf	(Ceramic)........	☐
C173	M15,	0.047uF	(Ceramic)........	☐
C174	L19,	0.01uF	(Ceramic)........	☐
C175	M19,	0.01uF	(Ceramic)........	☐
C176	A6 ,	0.01uF	(Ceramic)........	☐
C177	I4 ,	330pF	(Silver Mica)....	☐
C178	A17,	22pF	(Ceramic) NPO....	☐
C179	L9 ,	1000pF	(Ceramic)........	☐
C180	L9 ,	.01uF	(Ceramic)........	☐
C181	I11,	.01uF	(Ceramic)........	☐
C182	E13,	220pF	(Ceramic)........	☐
C183	---,	33pF	(Ceramic)........	☐
C184	---,	33pF	(Ceramic)........	☐
C185	---,	47pF	(Ceramic)........	☐
C186	---,	47pF	(Ceramic)........	☐
C187	---,	47pF	(Ceramic)........	☐
C188	---,	47pF	(Ceramic)........	☐

DIODES

D1	D13,	IN60/OA95	(Diode)........	☐
D2	E10,	IN60/OA95	(Diode)........	☐
D3	C6 ,	IN914/IN4148	(Diode)........	☐
D4	P7 ,	5.6V 400mV	(Zener)........	☐
D5	O5 ,	IN914/IN4148	(Diode)........	☐
D6	P3 ,	IN60/OA95	(Diode)........	☐
D7	---,	Not Allocated.....	....	☐
D8	E15,	6.2V 400mV	(Zener)........	☐
D9	O12,	IN914/IN4148	(Diode)........	☐
D10	I12,	IN914/IN4148	(Diode)........	☐
D11	I13,	IN914/in4148	(Diode)........	☐
D12	H13,	IN914/IN4148	(Diode)........	☐
D13	F11,	IN914/IN4148	(Diode)........	☐
D14	H11,	IN60/OA95	(Diode)........	☐
D15	G10,	IN60/OA95	(Diode)........	☐
D16	M8 ,	BA244	(Diode)........	☐
D17	N7 ,	BA244	(Diode)........	☐
D18	N9 ,	IN914/IN4148	(Diode)........	☐
D19	N10,	IN914/IN4148	(Diode)........	☐
D20	O16,	6.2V 400mV	(Zener)........	☐
D21	N15,	IN60/OA95	(Diode)........	☐
D22	L13,	IN60/OA95	(Diode)........	☐
D23	L13,	IN60/OA95	(Diode)........	☐
D24	I18,	IN914/IN4148	(Diode)........	☐
D25	A1 ,	IN4001/IN4002	(Diode)........	☐
D26	A9 ,	5.6V 400mV	(Zener)........	☐
D27	A11,	IN4001/IN4002	(Diode)........	☐
D28	A6 ,	IN914/IN4148	(Diode)........	☐
D29	A10,	IN914/IN4148	(Diode)........	☐
D30	A12,	IN914/IN4148	(Diode)........	☐
D31	H16,	IN914/IN4148	(Diode)........	☐
D32	O9 ,	IN914/IN4148	(Diode)........	☐

TRANSISTORS

Q1	E11,	MFE131	(Transistor)....	☐
Q2	D8 ,	2N4427/2N3948	(Transistor)..	☐
Q3	D6 ,	2N4427/2N3948	(Transistor)..	☐
Q4	E6 ,	2N4427/2N3948	(Transistor)..	☐
Q5	F1 ,	2SC2166	(Transistor)....	☐
Q6	H1 ,	2SC2166	(Transistor)....	☐
Q7	J1 ,	2SC2312 2SC1969	(Transistor).	☐
Q8	L1 ,	2SC2312 2SC1969	(Transistor).	☐
Q9	F16,	MPF102	(Transistor)....	☐
Q10	D17,	2SC710	(Transistor)....	☐
Q11	D16,	BC107/BC547	(Transistor)....	☐
Q12	O11,	2SC710	(Transistor)....	☐
Q13	H12,	2SC710	(Transistor)....	☐
Q14	G11,	2SA733	(Transistor)....	☐
Q15	G10,	2SC710	(Transistor)....	☐
Q16	G1 ,	BC107/BC547	(Transistor)....	☐
Q17	G6 ,	BD139	(Transistor)....	☐
Q18	H8 ,	2SC1674	(Transistor)....	☐
Q19	K1 ,	BC107/BC547	(Transistor)....	☐
Q20	H6 ,	BD139	(Transistor)....	☐
Q21	K8 ,	2SC1674	(Transistor)....	☐
Q22	O8 ,	BC107/BC547	(Transistor)....	☐
Q23	P12,	2SC710	(Transistor)....	☐
Q24	O13,	2SC710	(Transistor)....	☐
Q25	M15,	2SC710	(Transistor)....	☐
Q26	M13,	BF245	(Transistor)....	☐
Q27	B5 ,	BC327/BC328	(Transistor)....	☐
Q28	A7 ,	BD140	(Transistor)....	☐
Q29	A8 ,	BC107/BC547	(Transistor)....	☐
Q30	A10,	BC337	(Transistor)....	☐
Q31	B11,	BC557	(Transistor)....	☐
Q32	K16,	BC108/BC548	(Transistor)....	☐
Q33	J17,	BC108/BC548	(Transistor)....	☐
Q34	M15,	BC107/BC547	(Transistor)....	☐
Q35	L19,	BC107/BC547	(Transistor)....	☐
Q36	M19,	BC107/BC547	(Transistor)....	☐
Q37	K19,	BC108/BC548	(Transistor)....	☐
Q38	J20,	BC107/BC547	(Transistor)....	☐
Q39	J19,	BC108/BC548	(Transistor)....	☐
Q40	I18,	BC557	(Transistor)....	☐
Q41	I17,	BC337/338	(Transistor)....	☐
Q42	H19,	BC327/328	(Transistor)....	☐
Q43	C19,	BC107/BC547	(Transistor)....	☐
Q44	N19,	BC107/BC547	(Transistor)....	☐

CRYSTALS

X1	B18,	Xtal 8.192MHz..............	☐
X2	M17,	Xtal 10.692MHz.............	☐
X3	K11,	Xtal 10.6935MHz.(filter)...	☐

INTERGRATED CIRCIUTS

IC1	C18,	3001/TA7310P	(IC)............	☐
IC2	F13,	3001/TA7310P	(IC)............	☐
IC3	N16,	LM301	(IC)............	☐
IC4	E1 ,	7805	(Volt Reg)......	☐
IC5	I15,	AN612	(IC)............	☐

COMPONENT LOCATIONS

TRIMPOTS

```
VR1   F6  , 1ØØR          (Trimpot)........☐
VR2   J6  , 1ØØR          (Trimpot)........☐
VR3   O4  , 5K            (Trimpot)........☐
VR4   O3  , 5ØK           (Trimpot)........☐
VR5   ---, 1ØØK   Tuning Pot (1ØT).....☐
VR6   ---, 1ØK   Clarifier Pot.........☐
VR7   O19, 1Øk            (Trimpot)........☐
VR8   P15, 5k             (Trimpot)........☐
VR9   ---, 1ØK   SW/Volume Pot.........☐
VR1Ø  K13, 5K             (Trimpot)........☐
VR11  L15, 1ØK            (Trimpot)........☐
VR12  H15, 1K             (Trimpot)........☐
VR13  K16, 1ØK            (Trimpot)........☐
```

TRIMCAPS

```
VC1   A17, 2ØpF           (Trimcap)........☐
VC2   A15, 6ØpF           (Trimcap)........☐
VC3   B14, 6ØpF           (Trimcap)........☐
VC4   D11, 6ØpF           (Trimcap)........☐
VC5   D1Ø, 6ØpF           (Trimcap)........☐
VC6   M18, 2ØpF           (Trimcap)........☐
VC7   L18, 2ØpF           (Trimcap)........☐
VC8   M18, 2ØpF           (Trimcap)........☐
VC9   I8 , 6ØpF           (Trimcap)........☐
VC1Ø  J9 , 6ØpF           (Trimcap)........☐
VC11  N7 , 6ØpF           (Trimcap)........☐
VC12  F15, MV1Ø4          (Varicap)........☐
```

COILS & CHOKES

```
L1   ---, Not Allocated...............☐
L2   ---, Not Allocated...............☐
L3   B15, Toriod (yellow).............☐
L4   C13, Toriod (yellow).............☐
L5   D11, Toriod (Red/Brown)..........
L6   D1Ø, Toriod (Red/Brown)..........
L7   E7 , Ferrite Bead................
L8   F4 , Ferrite Bead (Four used)....
L9   H4 , Ferrite Bead (Six used).....
L1Ø  K4 , Ferrite Bead (Four used)....
L11  N5 , Toriod (Red/Brown)..........
L12  N3 , Toriod (Red/Brown)..........
L13  N1 , Toriod (Red/Brown)..........
L14  G16, Toriod (Red/Brown)..........
L15  P1Ø, Can 1ØMAØ15S (1Ø.7MHz)......
L16  I12, Can 1ØMAØ15S (1Ø.7MHz)......
L17  G1Ø, Can 1ØMAØ15S (1Ø.7MHz)......
L18  I9 , Toriod (Red/Brown)..........
L19  K9 , Toriod (Red/Brown)..........
L2Ø  M8 , Toriod (Red/Brown)..........
L21  N14, Can 1ØMAØ15S (1Ø.7MHz)......
L22  L18, RF Choke 4.7uH..............
L23  J14, RF Choke 15ØuH..............
L24  B3 , DC Smoothing Choke..........
L25  F17, RF Choke 15ØuH..............
L26  F12, RF Choke 1ØØuH..............
L27  F13, RF Choke 1ØØuH..............
L28  G2 , RF Choke 1.8uH..............
L29  H2 , RF Choke 1.8uH..............
L3Ø  F2 , RF Choke 1ØØuH..............
L31  F2 , RF Choke 1ØØuH..............
L32  H3 , RF Choke 22ØuH(Ferrite RING )
L33  H5 , RF Choke 22ØuH(Ferrite RING )
L34  I2 , RF Choke 1ØØuH..............
L35  I5 , RF Choke 1ØØuH..............
L36  J4 , RF Choke 22ØuH(Ferrite RING )
L37  M4 , RF Choke 22ØuH(Ferrite RING )
L38  N15, RF Choke 15ØuH..............
```

COIL	TYPE	PRIMARY TURNS	PRIMARY WIRE	SECONDARY TURNS	SECONDARY WIRE
L3	Yellow Toriod	16	26B&S	--	--
L4	Yellow Toriod	16	26B&S	3	Bell Wire
L5	Brown Toriod	59	3ØB&S	--	--
L6	Brown Toriod	59	3ØB&S	12	3ØB&S
L7	Ferrite Ring	6	26B&S	6	26B&S
L8	4 Ferrite Rings	6	24B&S	2	24/Ø.2
L9	6 Ferrite Rings	2	24/Ø.2	1	Braid
L1Ø	4 Ferrite Rings	1	Braid	2	32/Ø.2
L11	Brown Toriod	15	2ØB&S	--	--
L12	Brown Toriod	15	2ØB&S	--	--
L13	Brown Toriod	15	2ØB&S	--	--
L14	Brown Toriod	35	3ØB&S	--	--
L18	Brown Toriod	59	3ØB&S	--	--
L19	Brown Toriod	59	3ØB&S	--	--
L2Ø	Brown Toriod	59	3ØB&S	12	3ØB&S
L32	Ferrite Ring	1Ø	22B&S	--	--
L33	Ferrite Ring	1Ø	22B&S	--	--
L36	Ferrite Ring	1Ø	22B&S	--	--
L37	Ferrite Ring	1Ø	22B&S	--	--

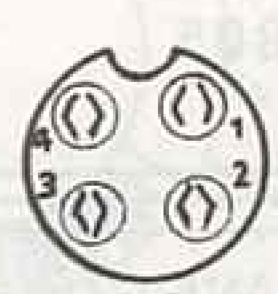
Notes :

All toriod primaries have a space between the winding ends to provide correct lead spacing for PCB mounting. Toriod secondaries are wound over one end of their respective primaries.

L7 consists of 6 turns of 4 strands 26B&S twisted together. Primary is between strand 1 start and strand 2 finish. Strand 2 start is join to strand 1 finish. Strand 4 start is join to strand 3 finish and becomes the secondary centre tap. The secondary is between strand 3 start and strand 4 finish.

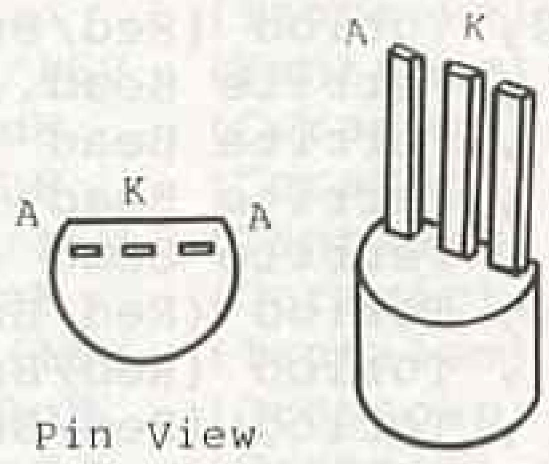
The turns on L14 should be bunched or spread as required to obtain correct VTO tuning range.

MICROPHONE WIRING DETAILS
(Front View of Microphone Plug)

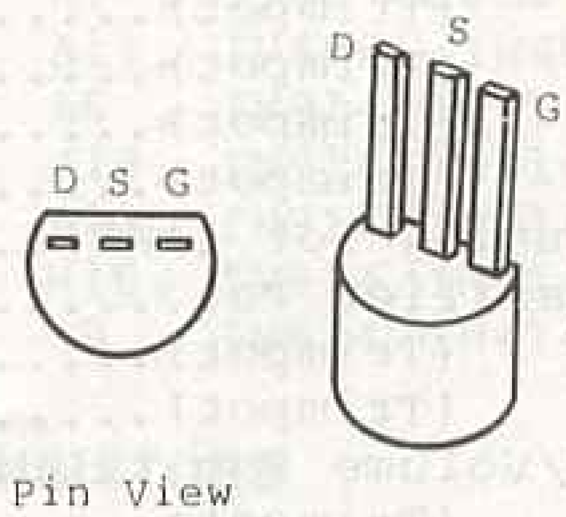


1.......yellow
2.......black and braid (earth)
3.......not used
4.......red

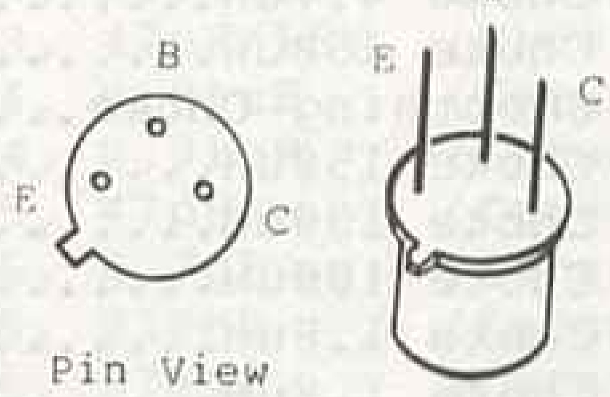
COMPONENT PINOUTS



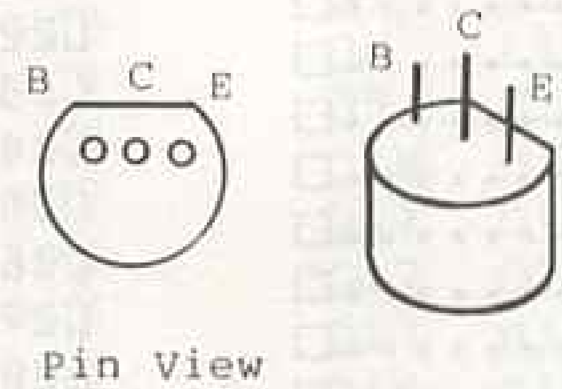
MV104



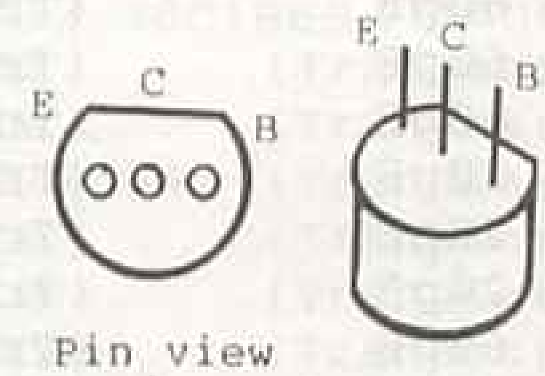
MPF102



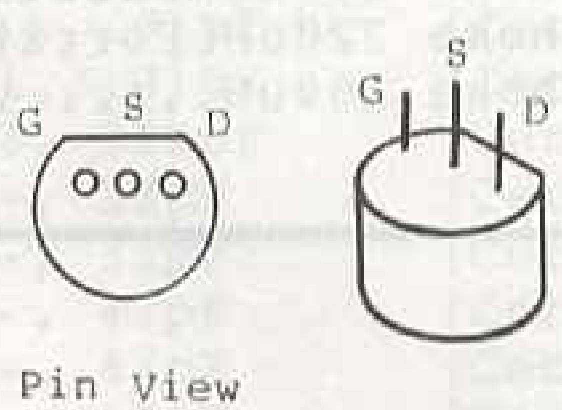
2N3948/2N4427



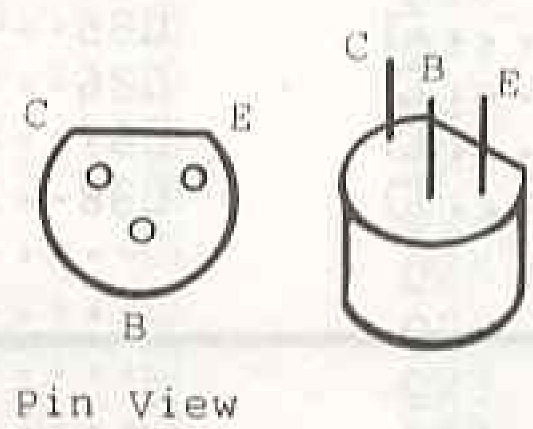
2SC710/2SA733



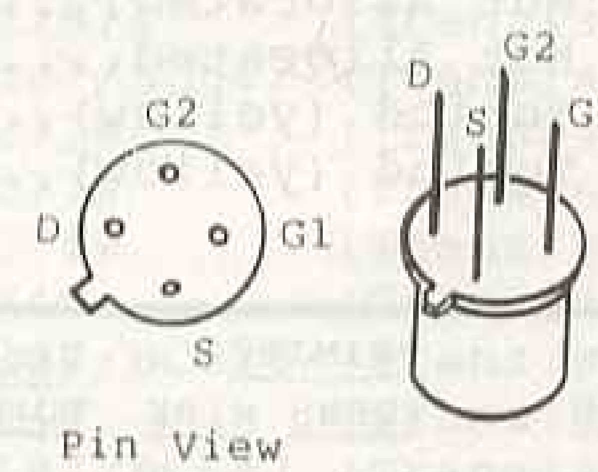
2SC1674



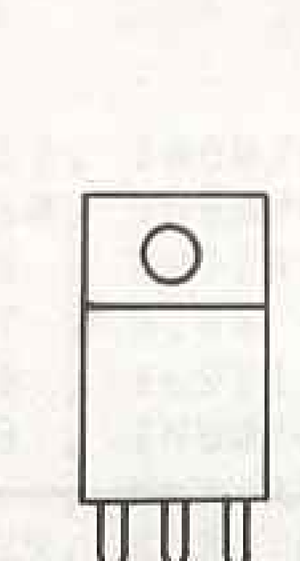
BF245



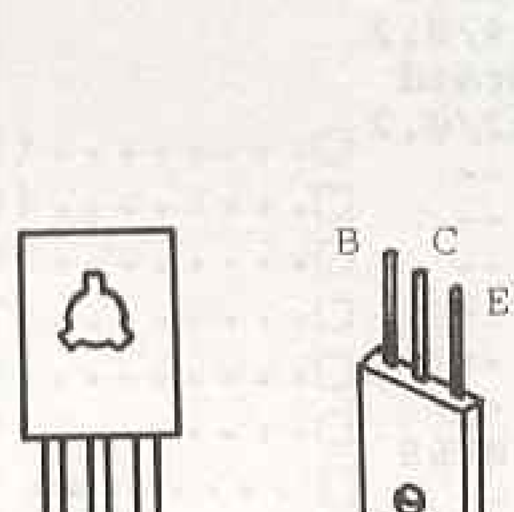
BC547/548/557
327/328/337/338



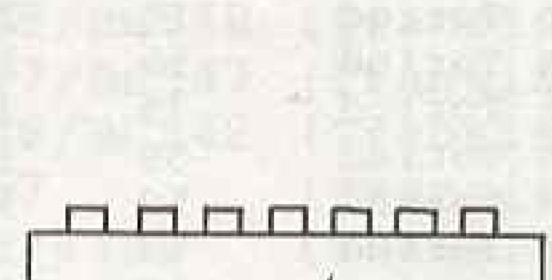
MFE131/3SK40

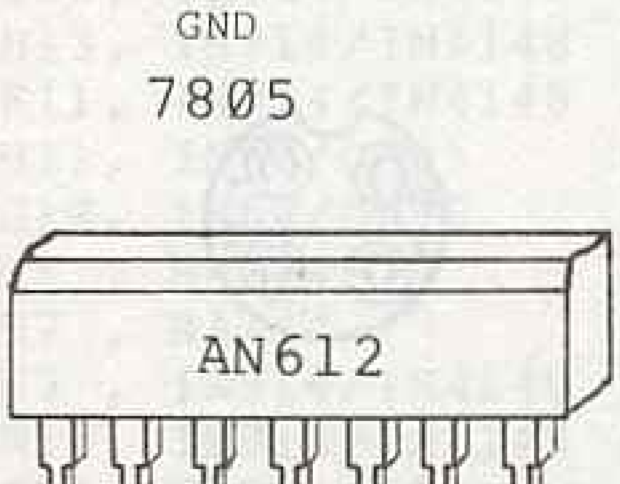


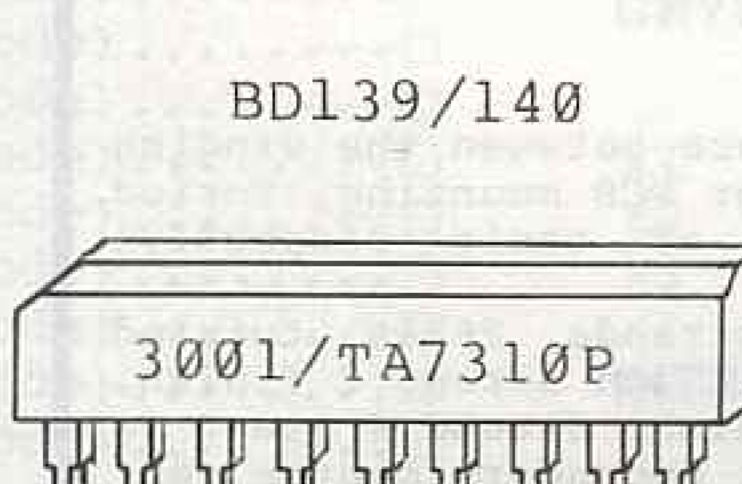
7805

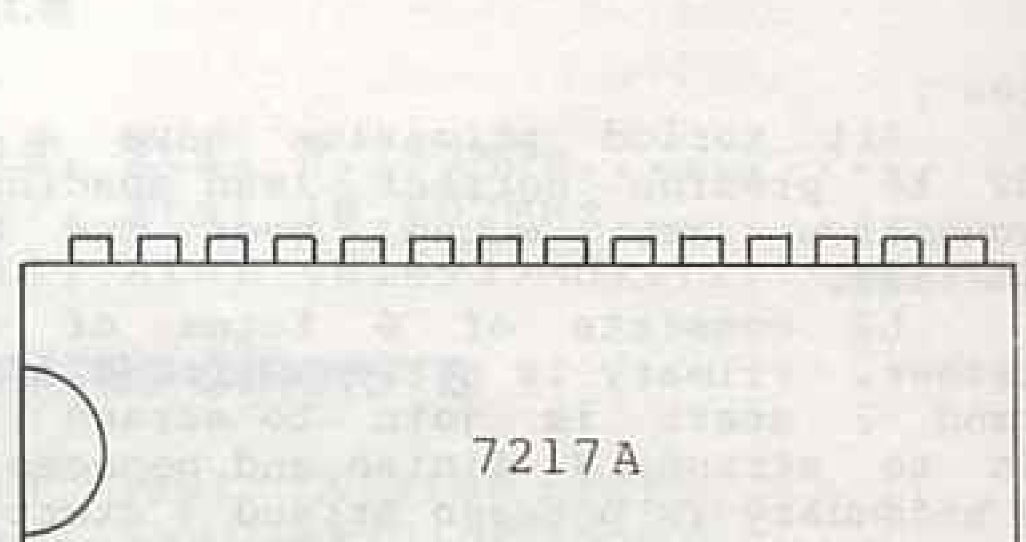


BD139/140

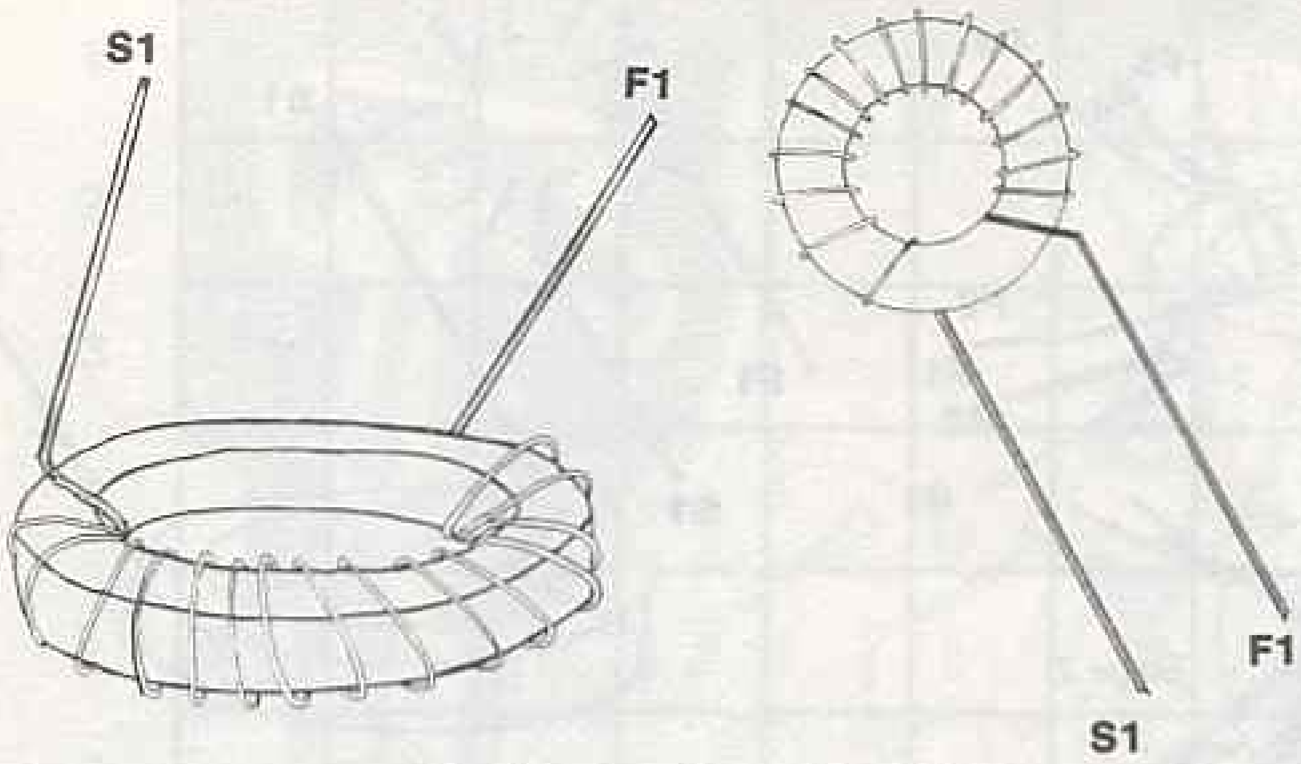




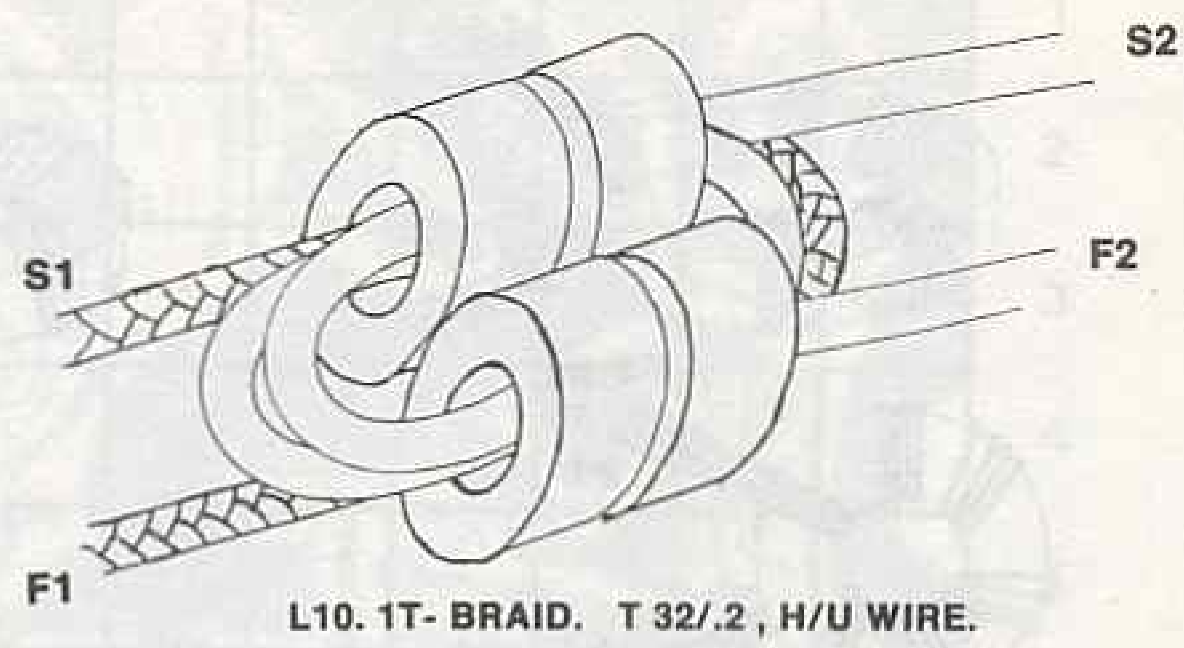




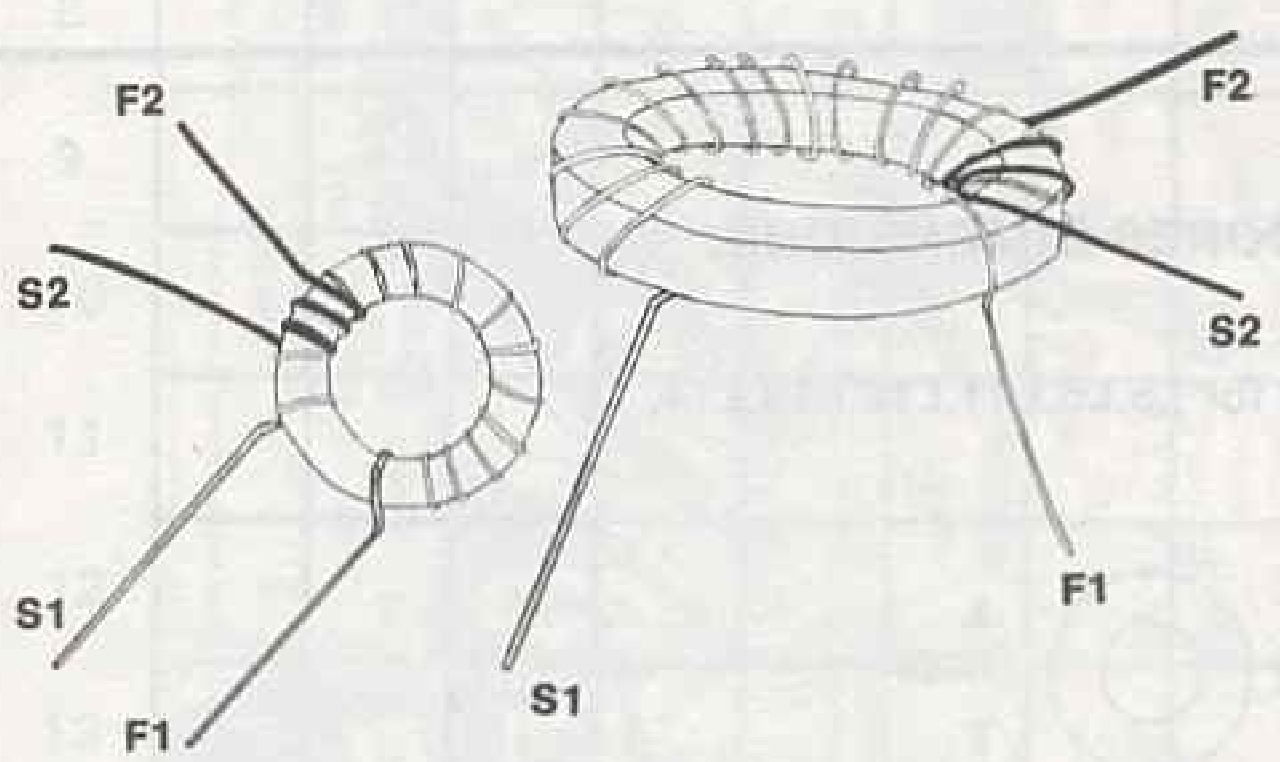
COIL WINDING DETAILS



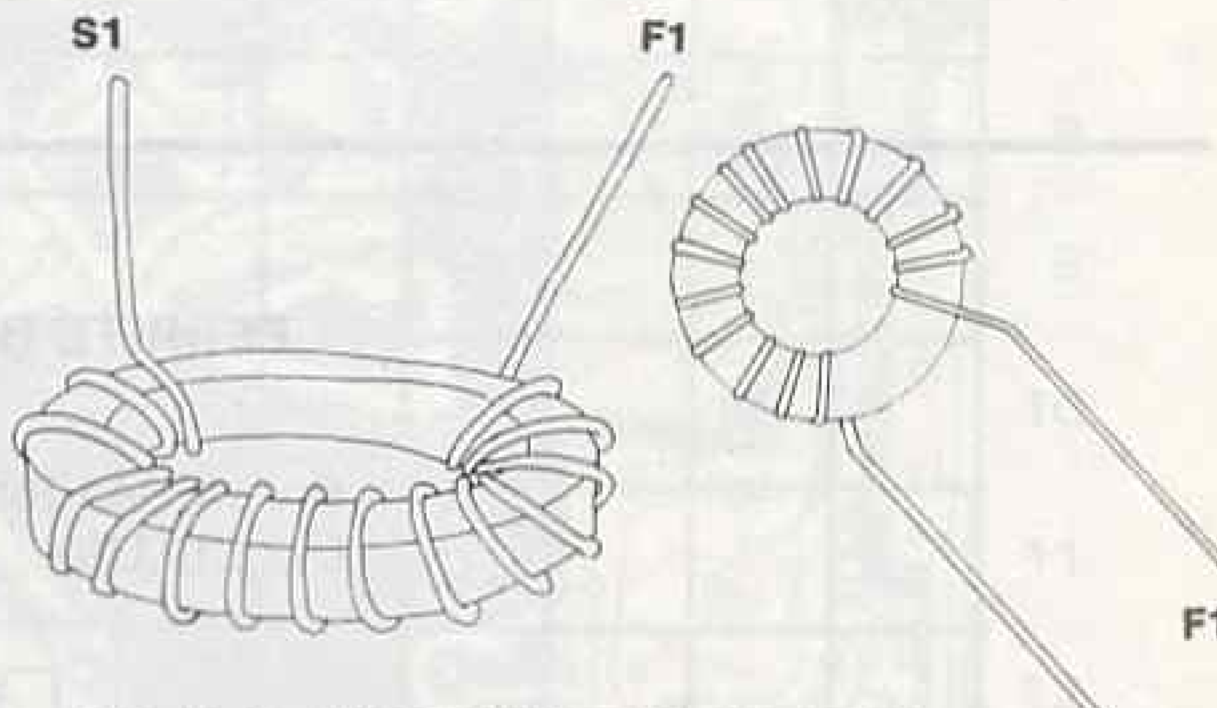
L3 . YELLOW CORE 16T 26 B&S.



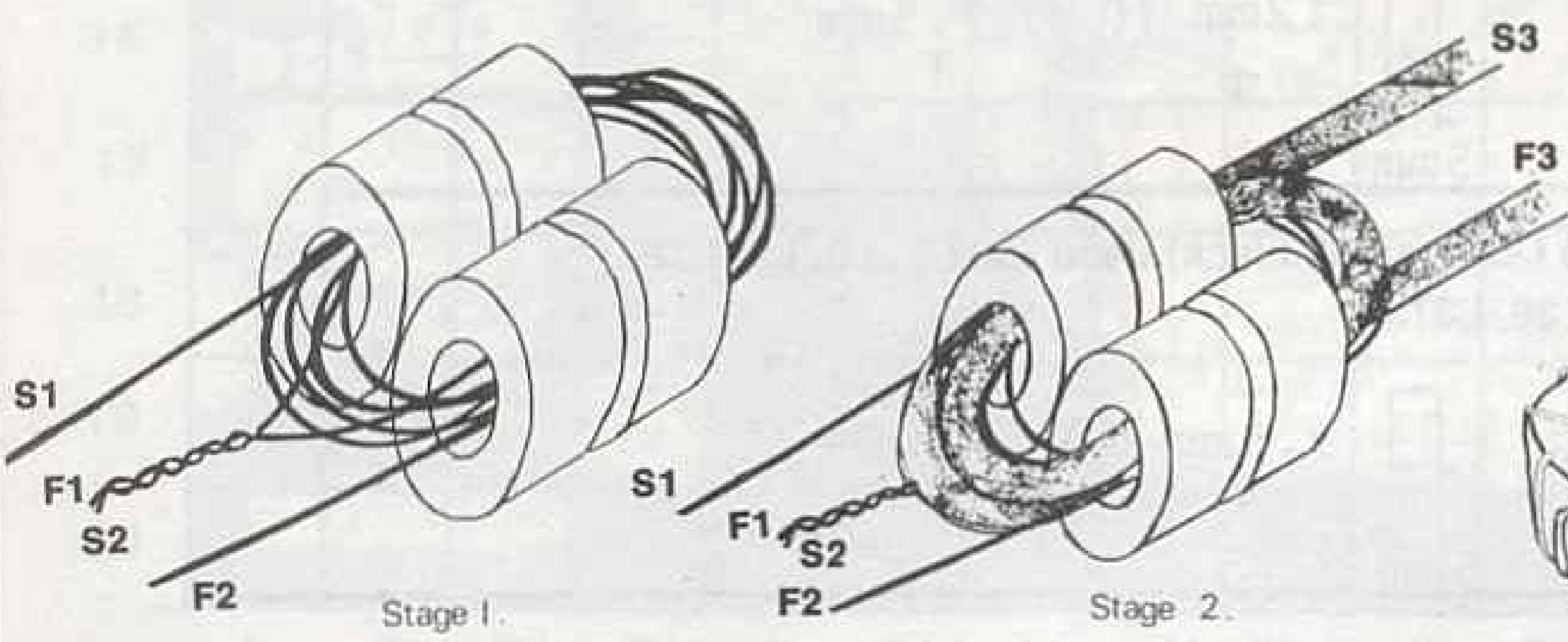
L10. 1T- BRAID. T 32/.2 , H/U WIRE.



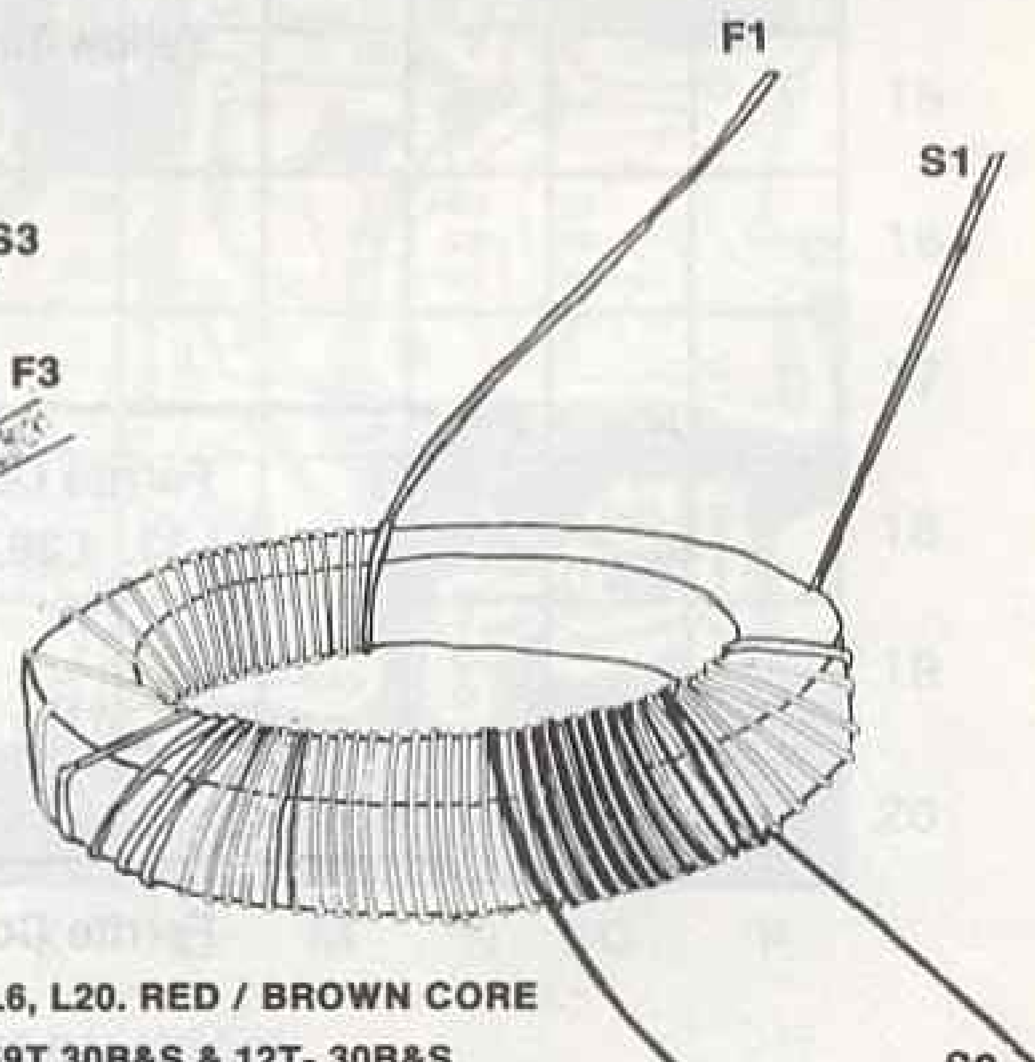
L4. YELLOW CORE. 16T- 26B&S. 3T- BELL WIRE.



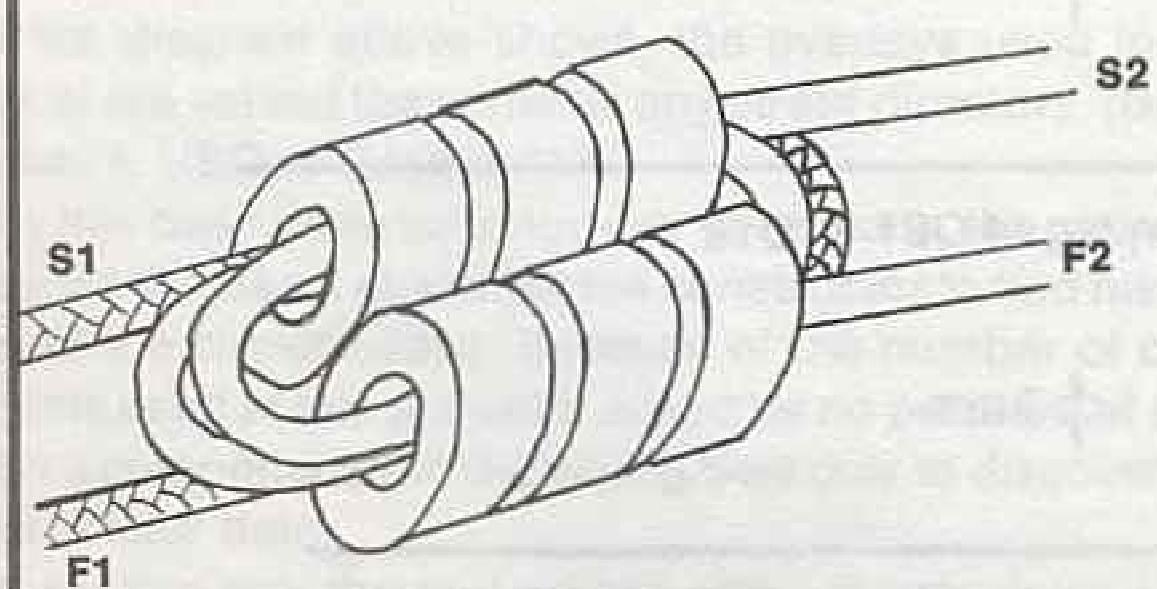
L11, 12, 13, RED/BROWN CORE, 15T- 20 B&S.



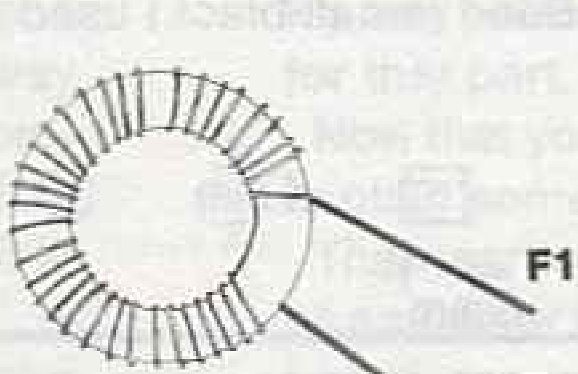
L8. 3T- BIFILER 24B&S, 2T H/U WIRE 24/.2



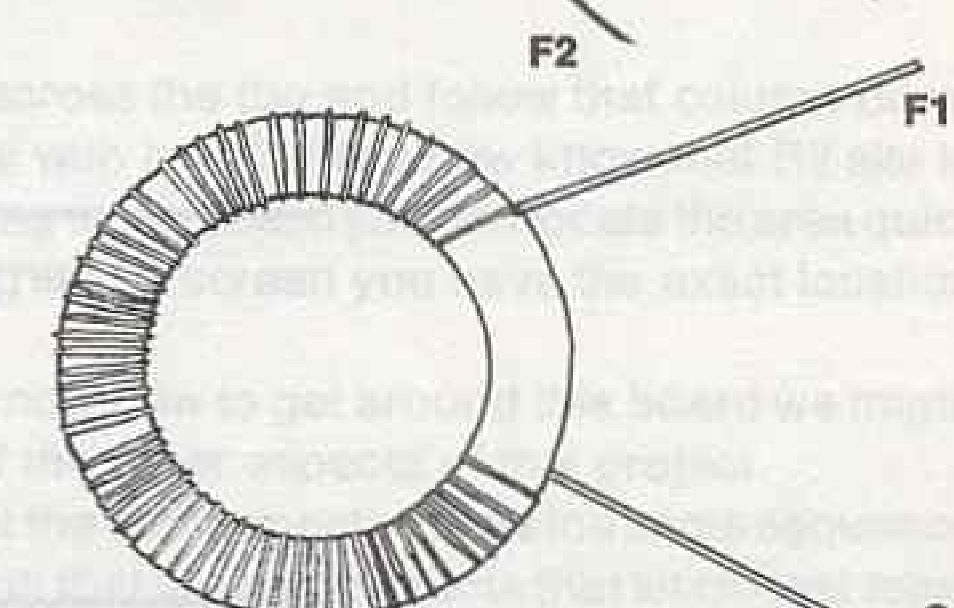
L6, L20. RED / BROWN CORE
59T 30B&S & 12T- 30B&S



L9. 2T- 24/.2 ,H/U WIRE. 1T- BRAID.

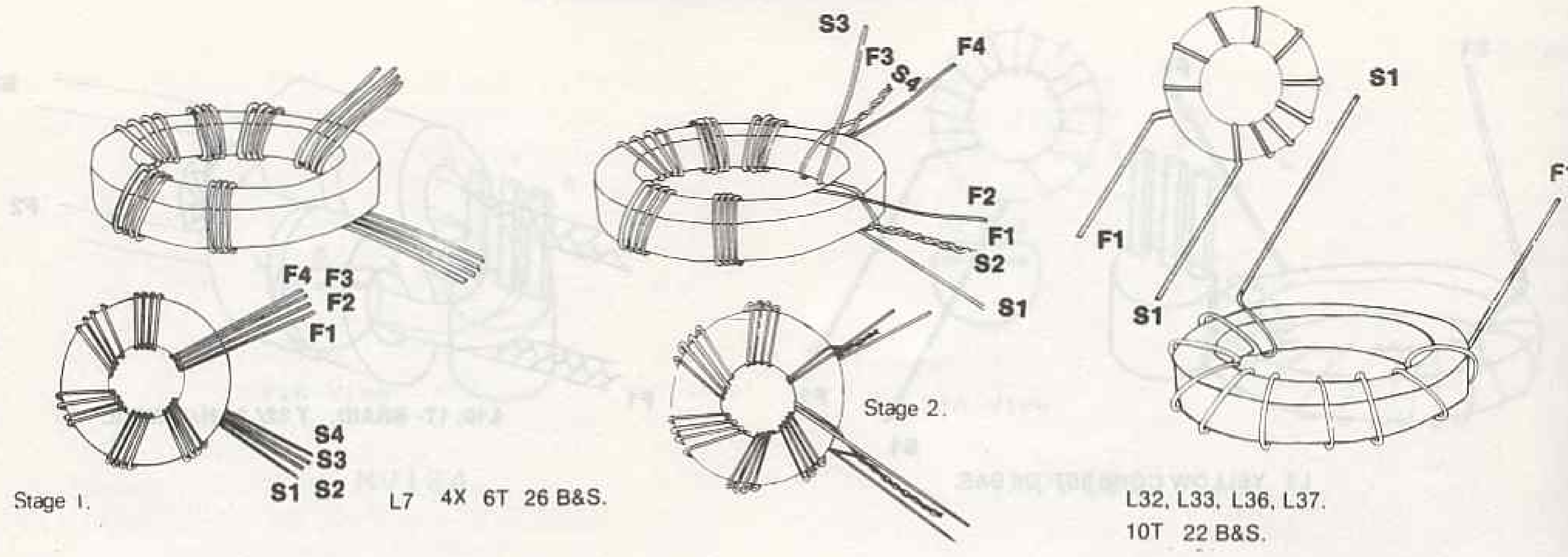


L14. RED/BROWN CORE. 35T- 30B&S.



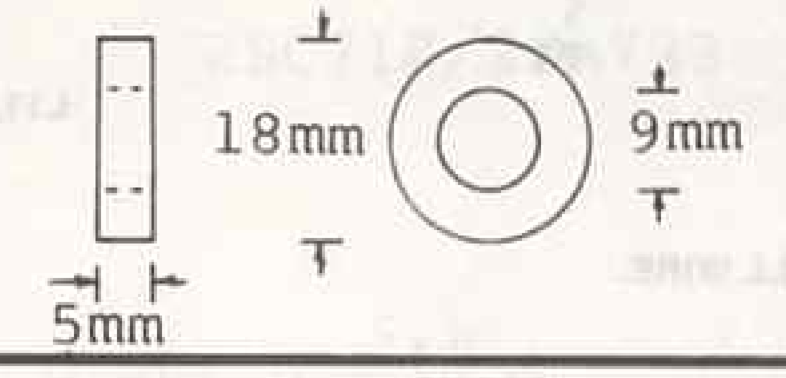
L5,L18,L19. RED/BROWN CORE. 59T- 30B&S.

COIL WINDING DETAILS

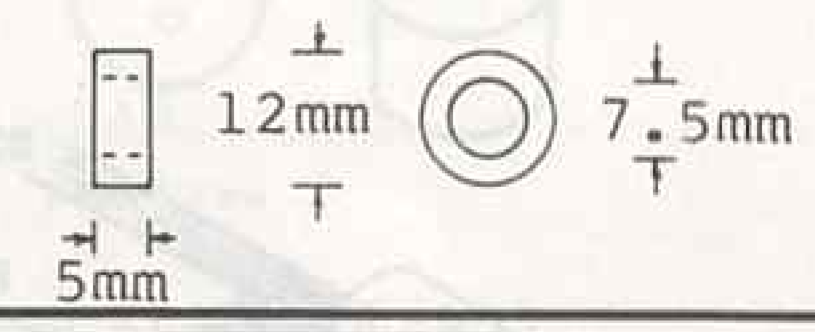


FERRITE BEAD / CORES DIMENSIONS.

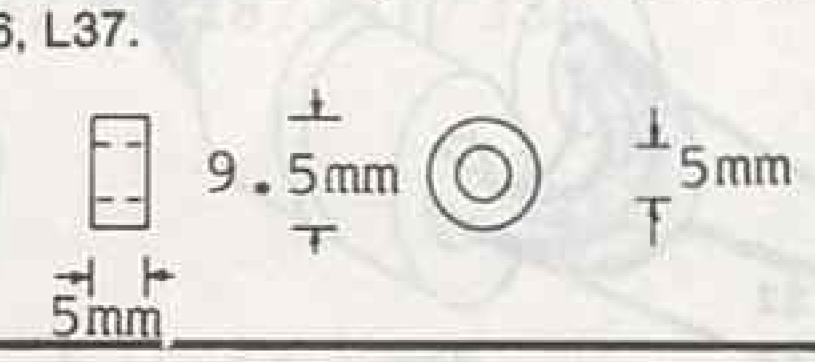
Brown/Red Toriod used for L5,L6,L11,L12,L13,L14, L18,L19,L20.



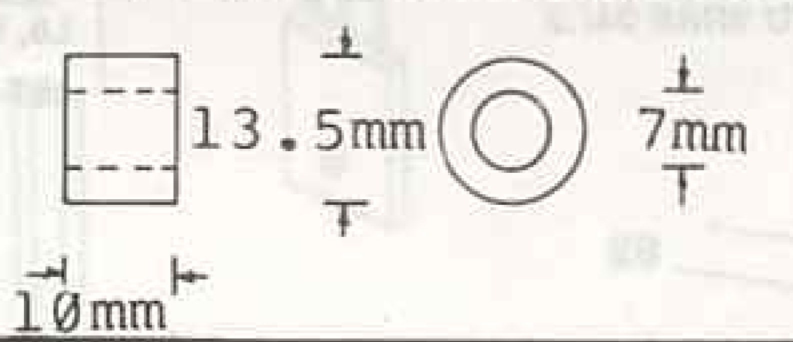
Yellow Toriod used for L3 & L4



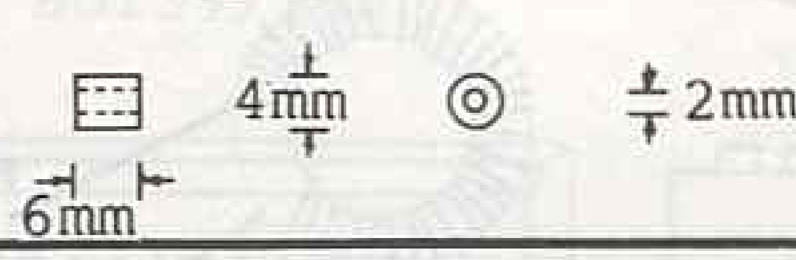
Ferrite Core (small black) used for L7, L8, L9, L32, L33, L36, L37.

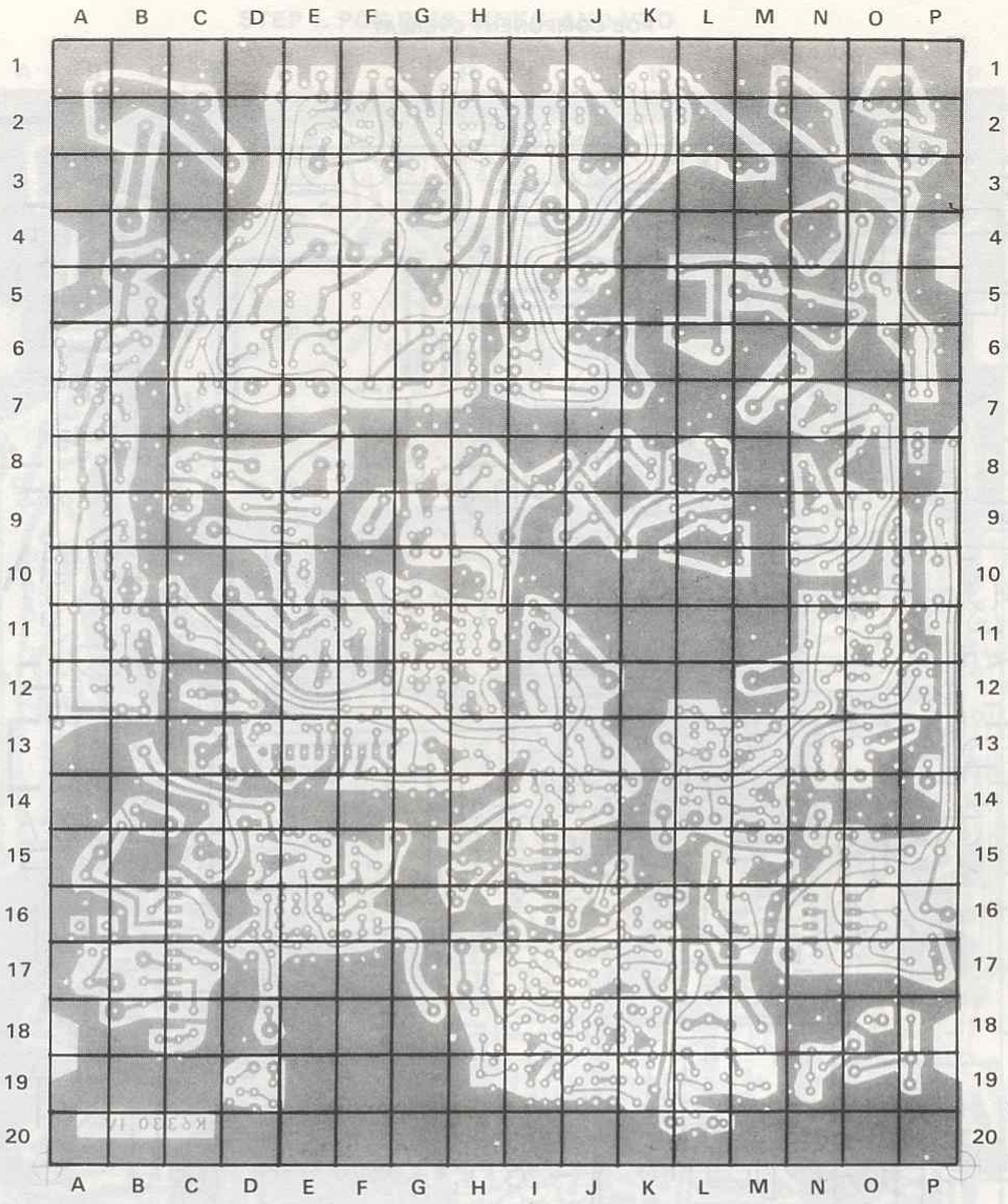


Ferrite Core (Large black) used for L10.



Ferrite Bead (small black) used on leg of Q21 & Q18





GENERAL INTRODUCTORY INFORMATION

As the diagram above shows, the overlays used in this manual are set out the same as any street directory. (Be it a Melway's, UBD or Gregory's.)

This has been done for a number of reasons, the main one being it will make it easier for the constructor to find his way around the circiut board. Because of the number of components used in this project it would be no problem at all to insert a component into the wrong hole only to discover it at a much later date.

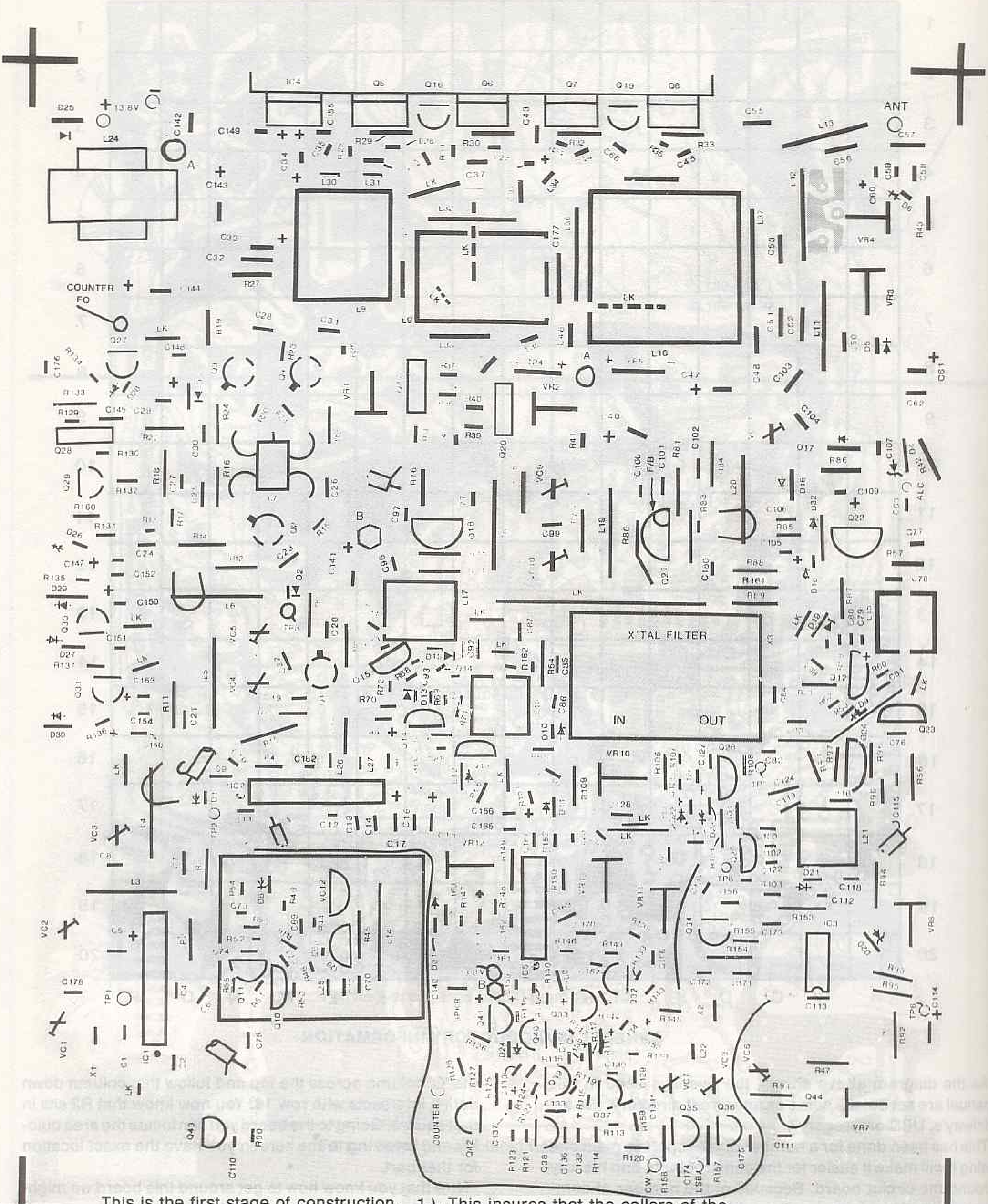
As you can see, the grid we are using is very much like a street directory, with the alphabetic co-ordinates along the horizontal and the numeric co-ordinates along the vertical axis. All references to a location are in the form of alphabet followed by a numeral. If you care to look back at the parts list, you will see the component number followed by the location and value, e.g. R2, C16,100R (brn, blk, brn).

To locate this particular component location you first locate the 'C' column across the top and follow that column down until it intersects with row 16. You now know that R2 sits in that square. Going to the board you can locate the area quickly and referring to the screen you have the exact location for that part.

Now that you know how to get around this board we might explain some of the other aspects of this project.

The insertion of the components follow the same sequence as any other kit, in that the components that sit closest tothe board are inserted first. We insert resistors, capacitors, diodes, transistors, trimcaps, IC's, crystals, trimpots, chokes & coils. The overlays on the following pages show various stages of construction, broken up to provide easy to handle sections along with a checklist to make sure all parts are inserted as needed. This should prove invaluable to all constructors.

PCB COMPONENT OVERLAY



This is the first stage of construction, and as you can see, it involves only PCB pins, links, (note position of insulated link) and VTO shield.

1. First of all, we will start by mounting the VTO shield. The four PCB pins used in holding the shield together should be inserted into PCB holes from the copper side of the board. The long side of the pins should be inserted first (refer to Fig 1.). This insures that the collars of the pins do not splay the sides of the shield.

2. Supplied in your kit is a small piece of thin PCB material. This should then be cut to suitable lengths and soldered to the above pins, forming a shield for the VTO (refer to Fig 2).

3. Insert and solder all PCB pins and links as shown on layout. Use 25B&S Tin/Cu wire supplied for all links except

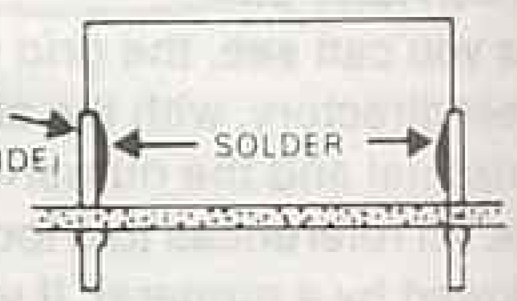
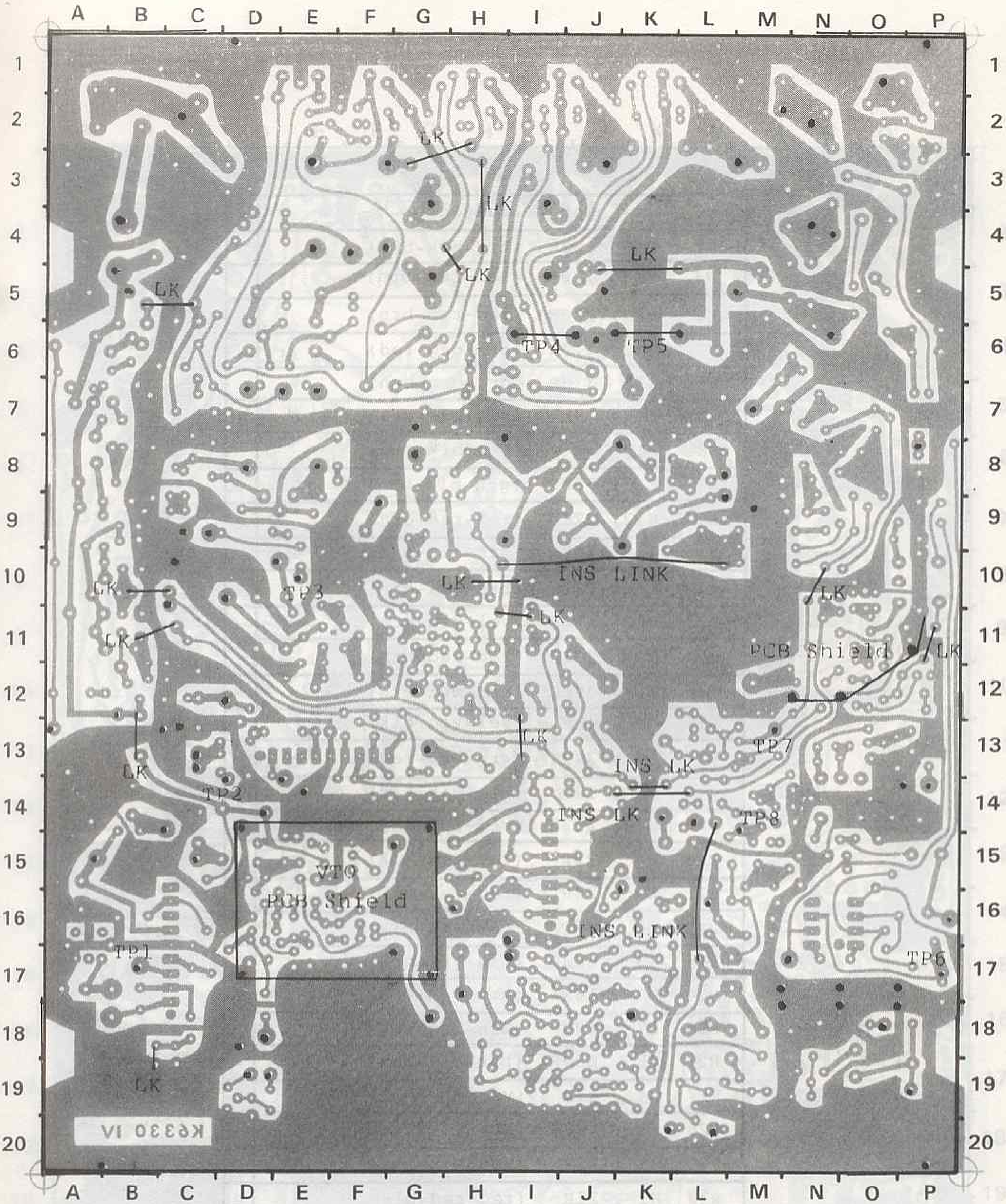


FIG.1

STEP 1. PCB PINS, LINKS, AND VTO



those shown as insulated links (use telephone wire).

4. PCB Pins used to secure the PCB shield at location O12, are inserted in the same manner as described in step 1.(Mounting of VTO shield).

5. Links shown for TP4 & TP5 are soldered to two PCB pins temorarily. Use two lengths of 25B&S tinned copper wire, twisted together for each link.(Ref to Fig 3).

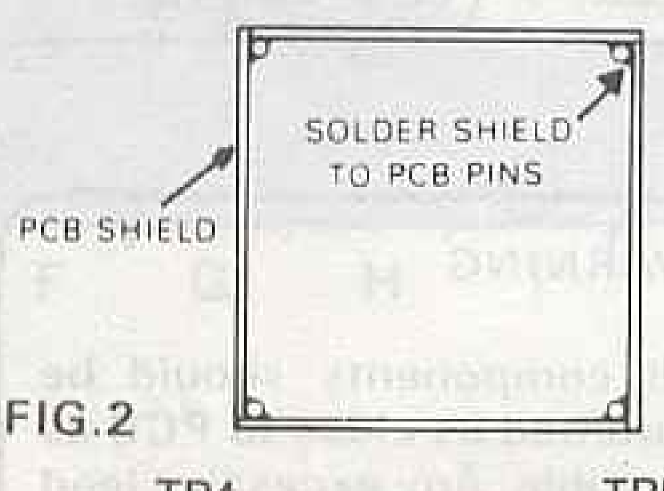


FIG.2

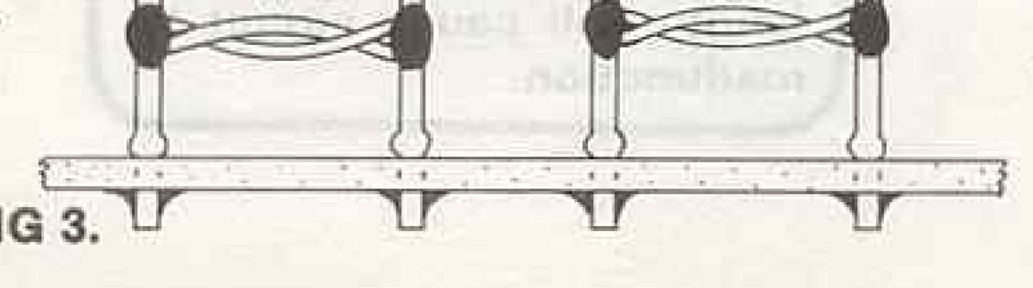


FIG 3.

Note: A number of PCB holes shown on the overlay, have not been drilled to accomodate the PCB Pins. This is only in cases where single core bell wire is used. Constructors may either solder the bell wire directly into the board or enlarge to holes a whisker to accomodate the pins.

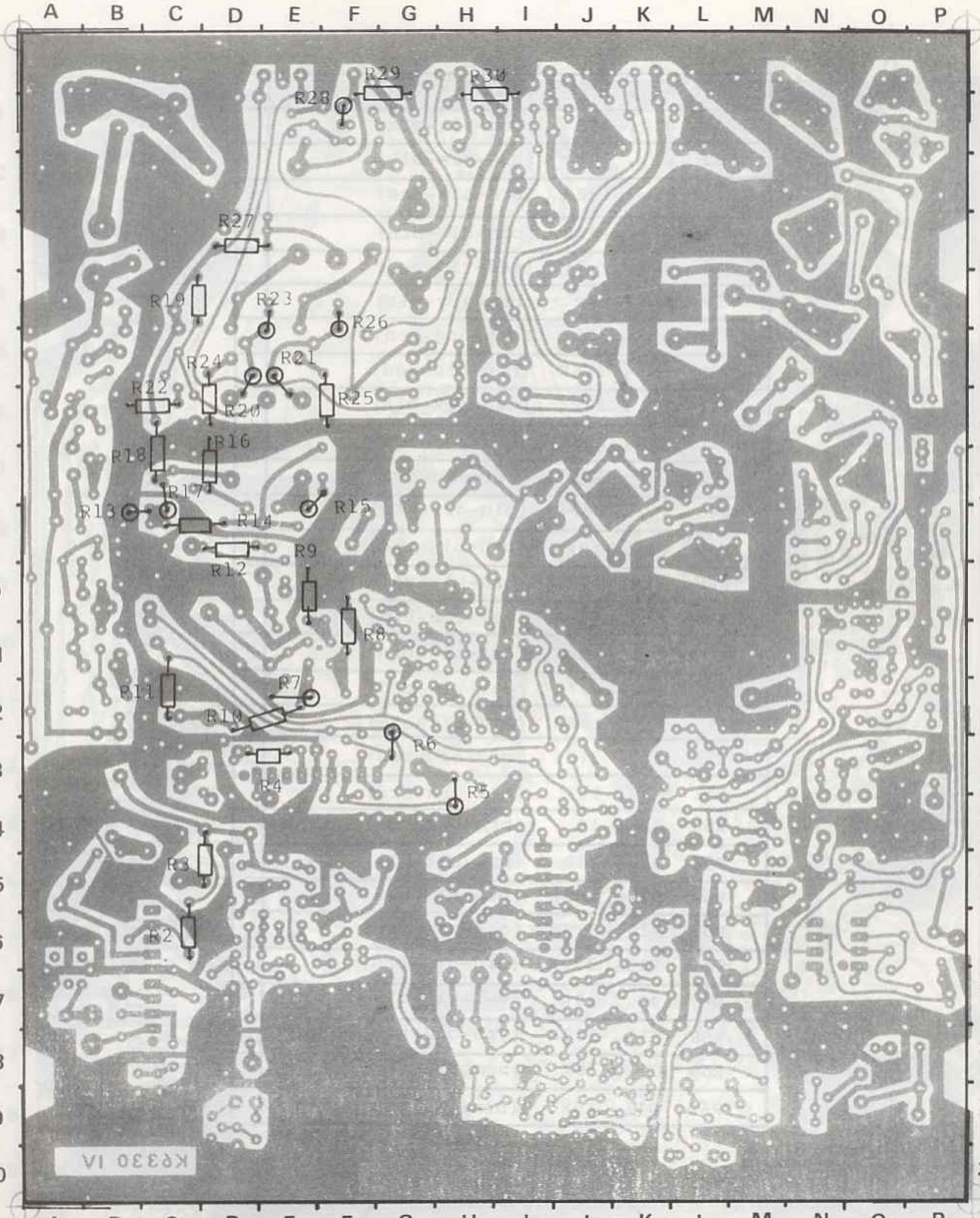
STEP 2. RESISTORS R1-R30

R1	---	Not Allocated	
R2	C16, 100R	(brn-blk-brn)	
R3	D15, 220R	(red-red-brn)	
R4	E13, 220R	(red-red-brn)	
R5	H13, 3.3K	(org-org-red)	
R6	G13 330R	(org-org-brn)	
R7	E12, 10K	(brn-blk-org)	
R8	F10, 1K	(brn-blk-red)	
R9	E10, 560R	(grn-blu-brn)	
R10	E12, 22K	(red-red-org)	
R11	C12, 100R	(brn-blk-brn)	
R12	D9 , 100R	(brn-blk-brn)	
R13	B8 , 470R	(yel-vio-brn)	
R14	C9 , 220R	(red-red-brn)	
R15	E8 , 390R	(org-wht-brn)	
R16	D8 , 47R	(yel-vio-blk)	
R17	C8 , 3.9K	(org-wht-red)	
R18	C7 , 10R	(brn-blk-blk)	
R19	C5 , 2.2K	(red-red-red)	
R20	D6 , 22R	(red-red-blk)	
R21	E6 , 22R	(red-red-blk)	
R22	C7 , 47R	(yel-vio-blk)	
R23	E5 , 680R	(blu-gry-brn)	
R24	D7 , 10R	(brn-blk-blk)	
R25	F7 , 10R	(brn-blk-blk)	
R26	F5 , 680R	(blu-gry-brn)	
R27	D4 , 47R	(yel-vio-blk)	
R28	F2 , 100R	(brn-blk-brn)	
R29	F1 , 22R	(red-red-blk)	
R30	H1 , 22R	(red-red-blk)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 2. RESISTORS R1-R30



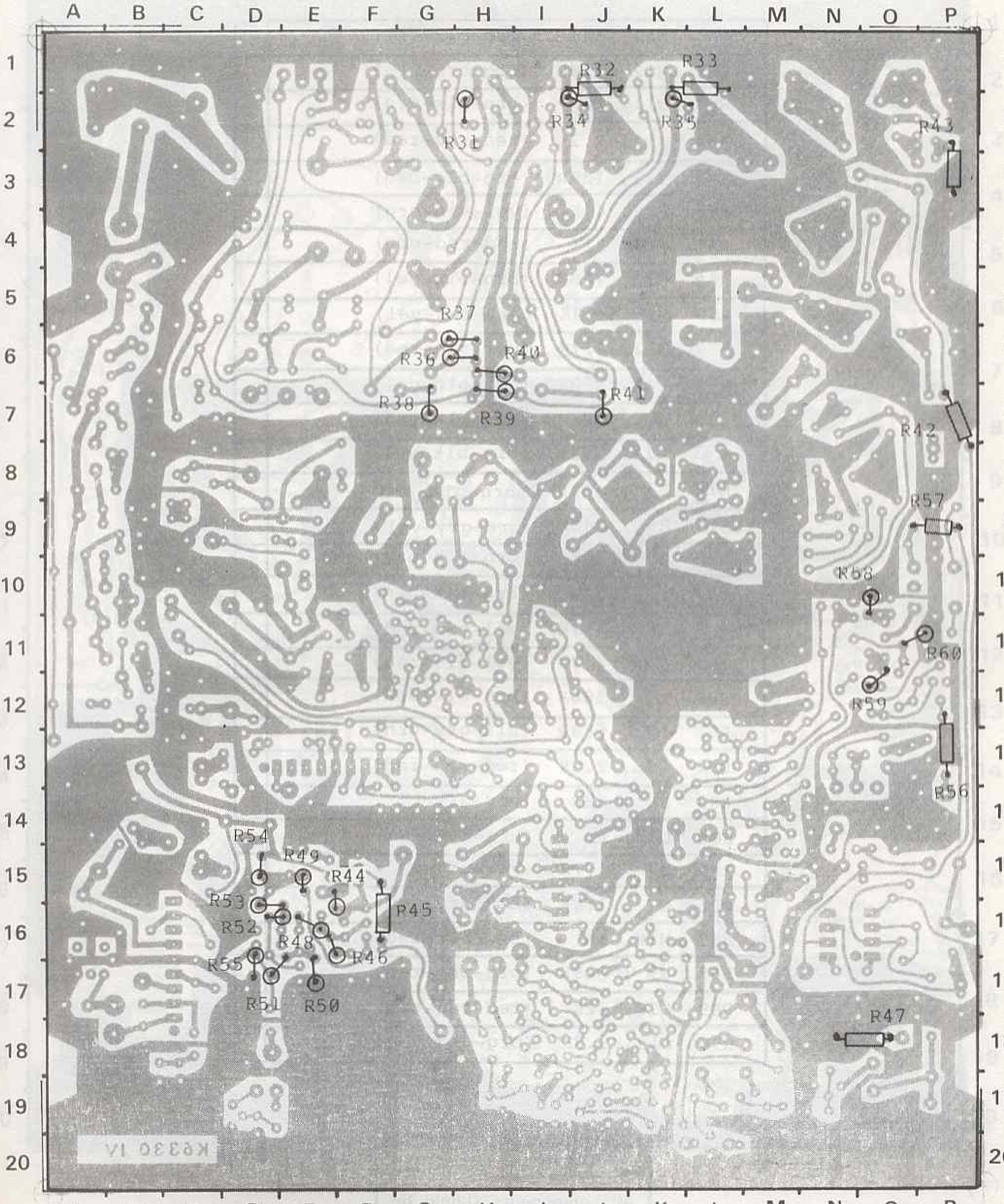
STEP 3. RESISTORS R31-R60

R31	H2	1ØØR	(brn-blk-brn)	
R32	J1	1ØR	(brn-blk-blk)	
R33	L1	1ØR	(brn-blk-blk)	
R34	J2	1ØØR	(brn-blk-brn)	
R35	K2	1ØØR	(brn-blk-brn)	
R36	H6	2.7K	(red-vio-red)	
R37	H6	18R	(brn-gry-blk)	
R38	G7	33ØR	(org-org-brn)	
R39	H7	1.5K	(brn-grn-red)	
R4Ø	H6	1ØR	(brn-blk-blk)	
R41	J7	22ØR	(red-red-brn)	
R42	P7	47K	(yel-vio-org)	
R43	P3	68ØR	(blu-gry-brn)	
R44	F15	1ØK	(brn-blk-org)	
R45	F16	1ØØK	(brn-blk-yel)	
R46	E16	47ØR	(yel-vio-brn)	
R47	O18	1ØK	(brn-blk-org)	
R48	E16	4.7K	(yel-vio-red)	
R49	E15	1ØØR	(brn-blk-brn)	
R5Ø	E17	3.3K	(org-org-red)	
R51	D17	15K	(brn-grn-org)	
R52	D16	1K	(brn-blk-red)	
R53	D16	1ØR	(brn-blk-blk)	
R54	D15	1ØØR	(brn-blk-brn)	
R55	D16	33ØR	(org-org-brn)	
R56	P13	33ØR	(org-org-brn)	
R57	P9	47R	(yel-vio-blk)	
R58	O11	56ØR	(grn-blu-brn)	
R59	O12	1ØK	(brn blk-org)	
R6Ø	O11	15k	(brn-grn-org)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 3. RESISTORS R31-R60



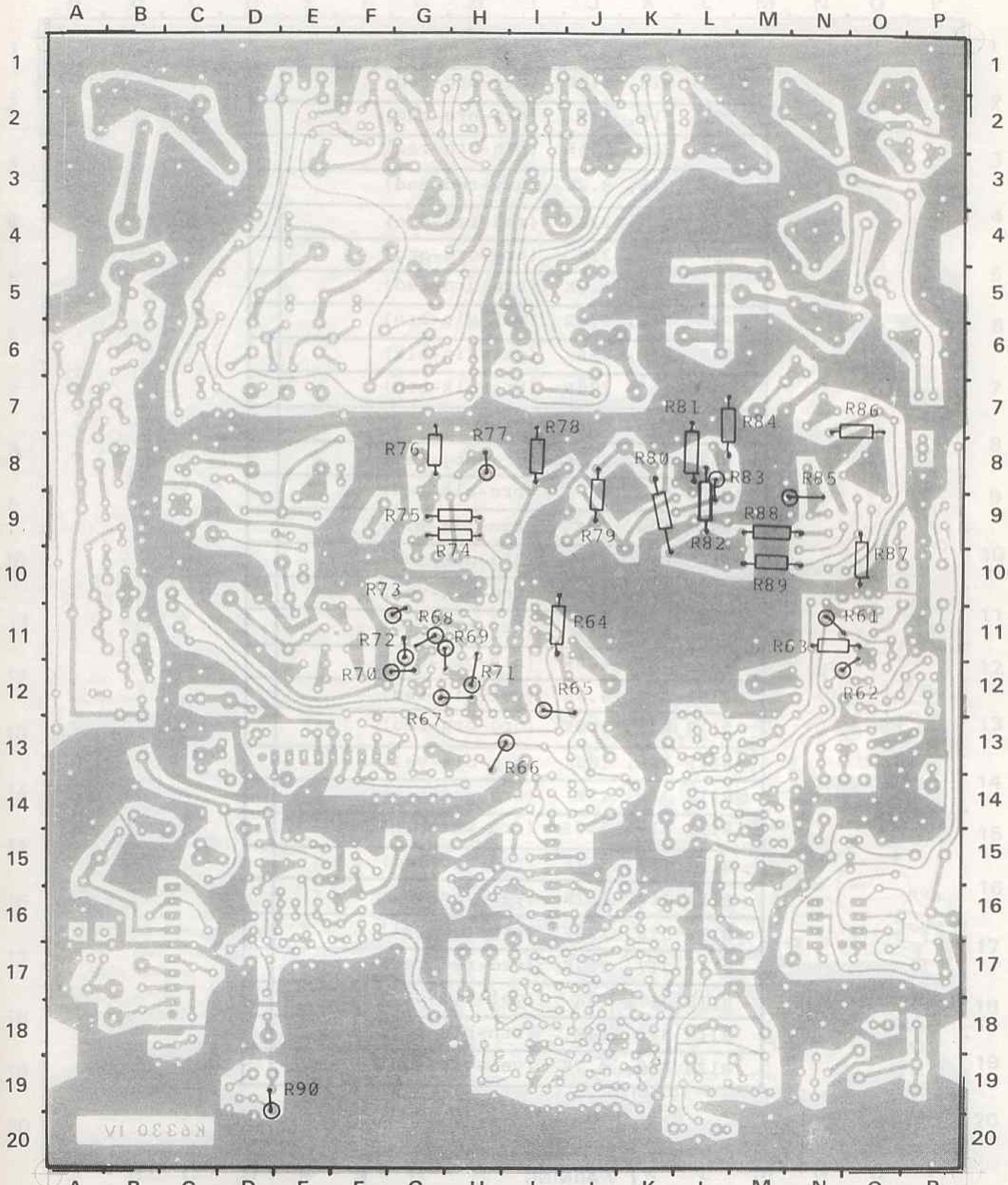
STEP 4. RESISTORS R61-R90

R61	N11,	10K	(brn-blk-org)	
R62	N12,	330R	(org-org-brn)	
R63	N11,	10K	(brn-blk-org)	
R64	J11,	2.2K	(red-red-red)	
R65	I12,	100R	(brn-blk-brn)	
R66	H13,	47K	(yel-vio-org)	
R67	G13,	22K	(red-red-org)	
R68	G11,	100K	(brn-blk-yel)	
R69	G11,	820K	(gry-red-yel)	
R70	G12,	4.7K	(yel-vio-red)	
R71	H12,	560K	(grn-blu-yel)	
R72	G11,	1k	(brn-blk-red)	
R73	G11,	100K	(brn-blk-yel)	
R74	H9 ,	100R	(brn-blk-brn)	
R75	H9 ,	180k	(brn-gry-yel)	
R76	G7 ,	10K	(brn-blk-org)	
R77	H8 ,	100R	(brn-blk-brn)	
R78	I8 ,	4.7K	(yel-vio-red)	
R79	J9 ,	4.7K	(yel-vio-red)	
R80	L9 ,	100R	(brn-blk-brn)	
R81	L7 ,	680R	(blu-gry-brn)	
R82	L9 ,	2.2K	(red-red-red)	
R83	L8 ,	68R	(blu-gry-blk)	
R84	L7 ,	1K	(brn-blk-red)	
R85	M9 ,	4.7K	(yel-vio-red)	
R86	N7 ,	1.8K	(brn-gry-red)	
R87	N10,	1K	(brn-blk-red)	
R88	N9 ,	3.9K	(org-wht-red)	
R89	M10,	22K	(red-red-org)	
R90	D19,	3.3K	(org-org-red)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 4. RESISTORS R61-R90



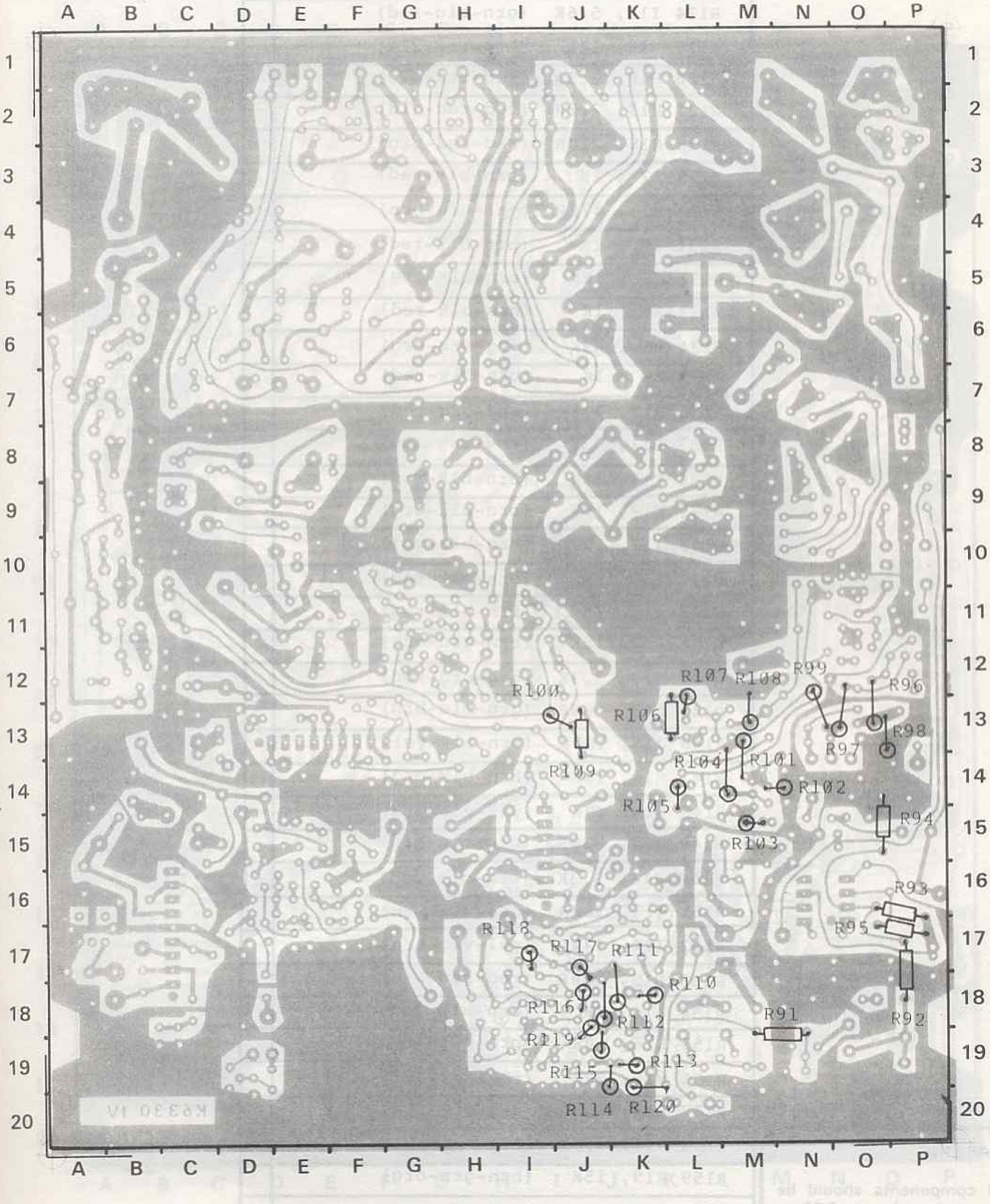
STEP 5. RESISTORS R91-R120

R91	M18,	3.3K	(org-org-red)	
R92	P18,	33K	(org-org-org)	
R93	P16,	1.5K	(brn-grn-red)	
R94	O15,	8.2K	(gry-red-red)	
R95	O17,	22ØR	(red-red-brn)	
R96	O13,	33K	(org-org-org)	
R97	N13,	1.5K	(brn-grn-red)	
R98	P13,	47ØR	(yel-vio-brn)	
R99	N12,	47R	(yel-vio-blk)	
R1ØØ	I13,	1ØØR	(brn-blk-brn)	
R1Ø1	M13,	33K	(org-org-org)	
R1Ø2	M14,	3.3K	(org-org-red)	
R1Ø3	M15,	1K	(brn-blk-red)	
R1Ø4	L14,	1ØK	(brn-blk-org)	
R1Ø5	K14,	3.9K	(org-wht-red)	
R1Ø6	K13,	1ØØK	(brn-blk-yel)	
R1Ø7	K12,	1ØK	(brn-blk-org)	
R1Ø8	M13,	68ØR	(blu-gry-brn)	
R1Ø9	J13,	4.7K	(yel-vio-red)	
R11Ø	K18,	3.3K	(org-org-red)	
R111	J18,	1ØØK	(brn-blk-yel)	
R112	J18,	15K	(brn-grn-org)	
R113	K19,	39ØR	(org-wht-brn)	
R114	J19,	2.2K	(red-red-red)	
R115	J19,	4.7K	(yel-vio-red)	
R116	J18,	12ØK	(brn-red-yel)	
R117	J17,	2.2K	(red-red-red)	
R118	I17,	47K	(yel-vio-org)	
R119	J18.	1ØK	(brn-blk-org)	
R12Ø	K2Ø,	4.7K	(yel-vio-red)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 5. RESISTORS R91-R120



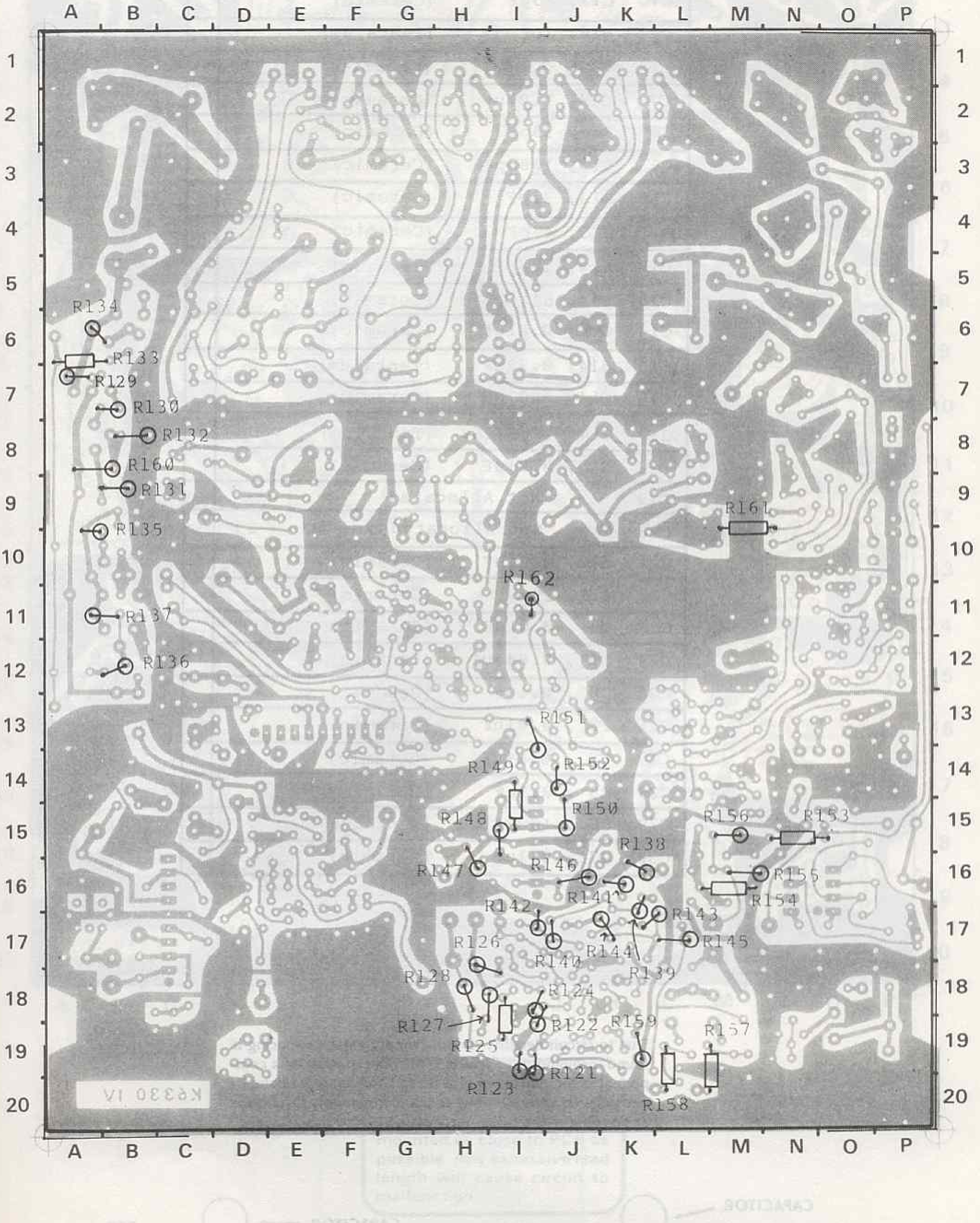
STEP 6. RESISTORS R121-R162

R121	I19,	560K	(grn-blu-yel)	
R122	I18,	220K	(red-red-yel)	
R123	I19,	22R	(red-red-blk)	
R124	I18,	5.6K	(grn-blu-red)	
R125	H18,	18R	(brn-gry-blk)	
R126	H18,	2.2R	(red-red-gld)	
R127	H18,	2.2R	(red-red-gld)	
R128	H18,	220R	(red-red-brn)	
R129	A7 ,	1K	(brn-blk-red)	
R130	B7 ,	470R	(yel-vio-brn)	
R131	B9 ,	1K	(brn-blk-red)	
R132	C8 ,	10K	(brn-blk-org)	
R133	A6 ,	1K	(brn-blk-red)	
R134	B6 ,	33K	(org-org-org)	
R135	B9 ,	1K	(brn-blk-red)	
R136	B12,	3.3K	(org-org-red)	
R137	B11,	33K	(org-org-org)	
R138	K16,	1K	(brn-blk-red)	
R139	K17,	10K	(brn-blk-org)	
R140	I17,	100K	(brn-blk-yel)	
R141	K16,	1K	(brn-blk-red)	
R142	I17,	1K	(brn-blk-red)	
R143	L17,	15K	(brn-grn-org)	
R144	J17,	3.3K	(org-org-red)	
R145	L17,	560R	(grn-blu-brn)	
R146	J16,	100K	(brn-blk-yel)	
R147	H16,	10K	(brn-blk-org)	
R148	I15,	47K	(yel-vio-org)	
R149	I14,	330R	(org-org-brn)	
R150	J14,	3.3K	(org-org-red)	
R151	I13,	100R	(brn-blk-brn)	
R152	I14,	470R	(yel-vio-brn)	
R153	N15,	220R	(red-red-brn)	
R154	L16,	1K	(brn-blk-red)	
R155	N16,	10K	(brn-blk-org)	
R156	M15,	22K	(red-red-org)	
R157	L19,	3.3K	(org-org-red)	
R158	K19,	3.3K	(org-org-red)	
R159	K19,	15K	(brn-grn-org)	
R160	B8 ,	10K	(brn-blk-org)	
R161	M9 ,	3.3K	(org-org-red)	
R162	I11,	100R	(brn-blk-brn)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

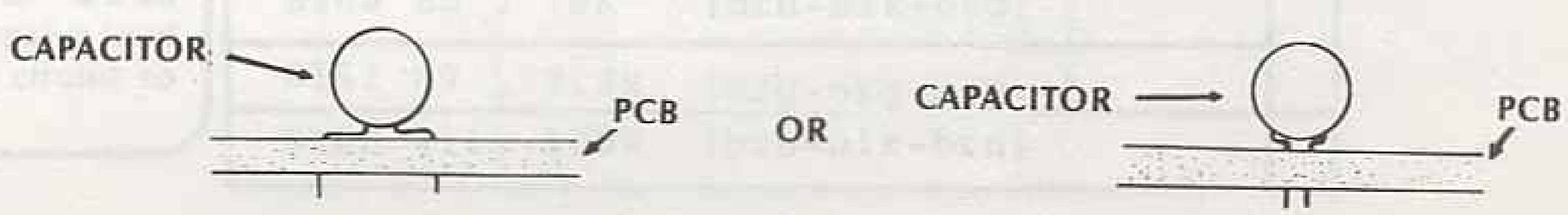
STEP 6. RESISTORS R121-R162



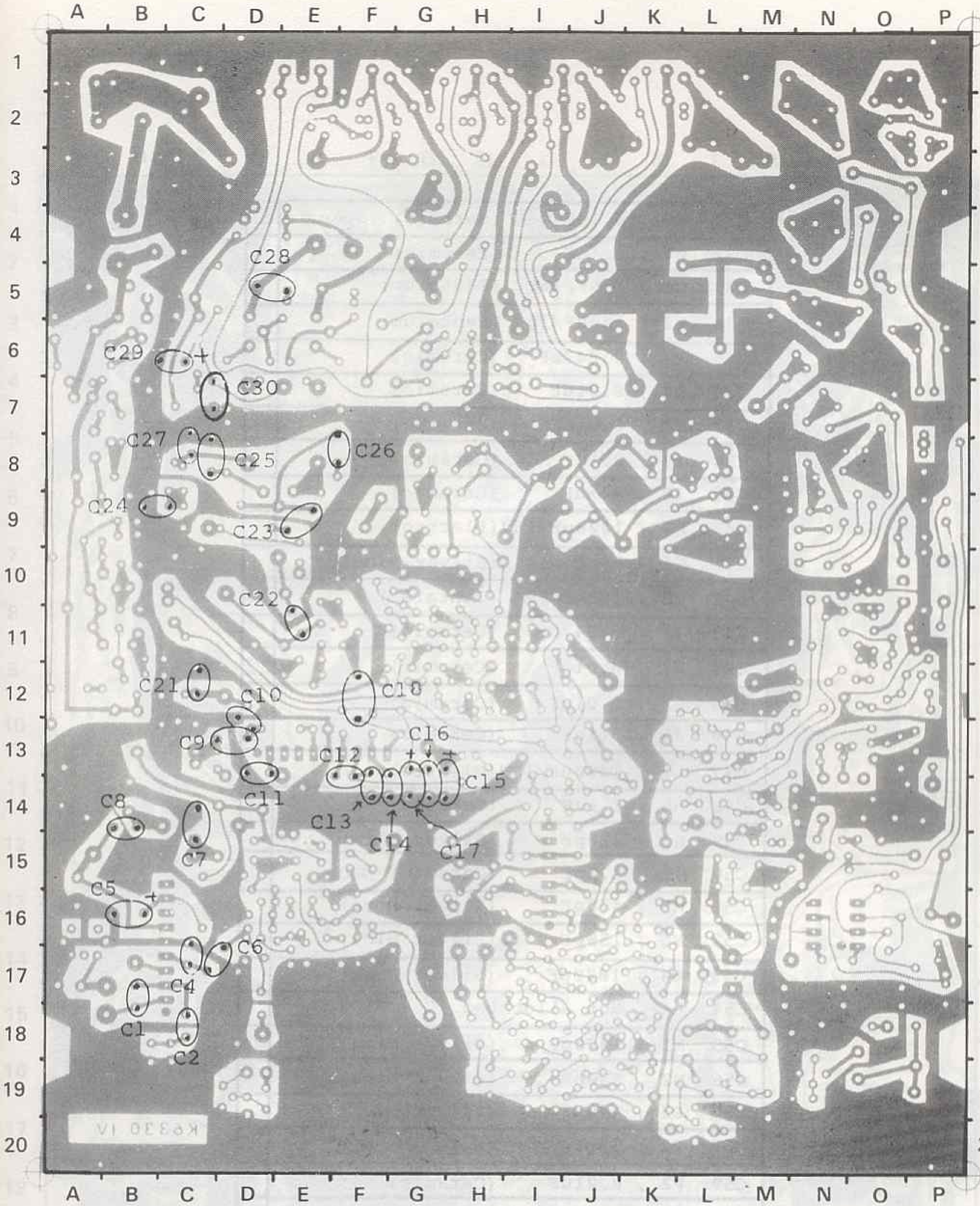
STEP 7. CAPACITORS C1-C30

C1	B17, 330pF (Ceramic)	
C2	C18, 390pF (Ceramic)	
C3	---, Not Allocated	
C4	C17, 15pF (Ceramic)	
C5	B16, 1uF (Tantalum)	
C6	D17, 22pF (Ceramic)	
C7	C14, 0.01uF (Ceramic)	
C8	B15, 33pF (Ceramic)	
C9	D13, 1000pF (Ceramic)	
C10	D13, 33pF (Ceramic)	
C11	D13, 47pF (Ceramic)	
C12	F14, 100pF (Ceramic)	
C13	F14, 680 pF (Ceramic)	
C14	G14, 0.01uF (Ceramic)	
C15	H14, 0.22uF (Tantalum)	
C16	G14, 0.01uF (Ceramic)	
C17	G14, 10uF/16V (Tantalum)	
C18	F12, 0.01uF (Ceramic)	
C19	, Not Allocated	
C20	, Not Allocated	
C21	C12, 0.01uF (Ceramic)	
C22	E11, 15pF (Ceramic)	
C23	E9 , 0.01uF (Ceramic)	
C24	C9 , 0.047uF (Ceramic)	
C25	D8 , 0.1uF (Ceramic)	
C26	F8 , 0.01uF (Ceramic)	
C27	C8 , 0.01uF (Ceramic)	
C28	E5 , 0.1uF (Ceramic)	
C29	C6 , 10uF/16V (Tantalum)	
C30	C7 , 0.1uF (Ceramic)	

Due to circuit density, various component hole spacing is found throughout the board. If the hole spacing for a component is too narrow or visa-versa, then bend the component legs (as shown below) so that components sit as close as possible to the PCB.



STEP 7. CAPACITORS C1-C30



> WARNING
>
> All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 8. CAPACITORS C31-C60

C31	E5	0.1uF	(Ceramic)	
C32	D4	0.1uF	(Ceramic)	
C33	D4	10uF/16V	(Tantalum)	
C34	E2	100uF/3V	(Tantalum)	
C35	F2	0.047uF	(Ceramic)	
C36	F2	0.01uF	(Ceramic)	
C37	H2	0.01uF	(Ceramic)	
C38	I3	0.1uF	(Ceramic)	
C39	I6	0.1uF	(Ceramic)	
C40	K7	1000uF/16V	(Electro)	
C41	G4	68pF	(Silver Mica)	
C42	I2	100uF/3V	(Tantalum)	
C43	I1	0.047uF	(Ceramic)	
C44	J2	0.01uF	(Ceramic)	
C45	L2	0.01uF	(Ceramic)	
C46	J5	0.1uF	(Ceramic)	
C47	L6	1000uF/16V	(Electro)	
C48	M5	0.1uF	(Ceramic)	
C49	K3	220pF	(Silver Mica)	
C50	N5	2.2pF	(Ceramic) NPO	
C51	M5	470pF	(Silver Mica)	
C52	N5	150pF	(Silver Mica)	
C53	M4	1000pF	(Silver Mica)	
C54	---	Not Allocated		
C55	M1	1000pF	(Silver Mica)	
C56	N2	330pF	(Silver Mica)	
C57	P2	470pF	(Silver Mica)	
C58	P2	18pF	(Ceramic) NPO	
C59	P2	0.01uF	(Ceramic)	
C60	O2	1uf/16V	(Tantalum)	

WARNING

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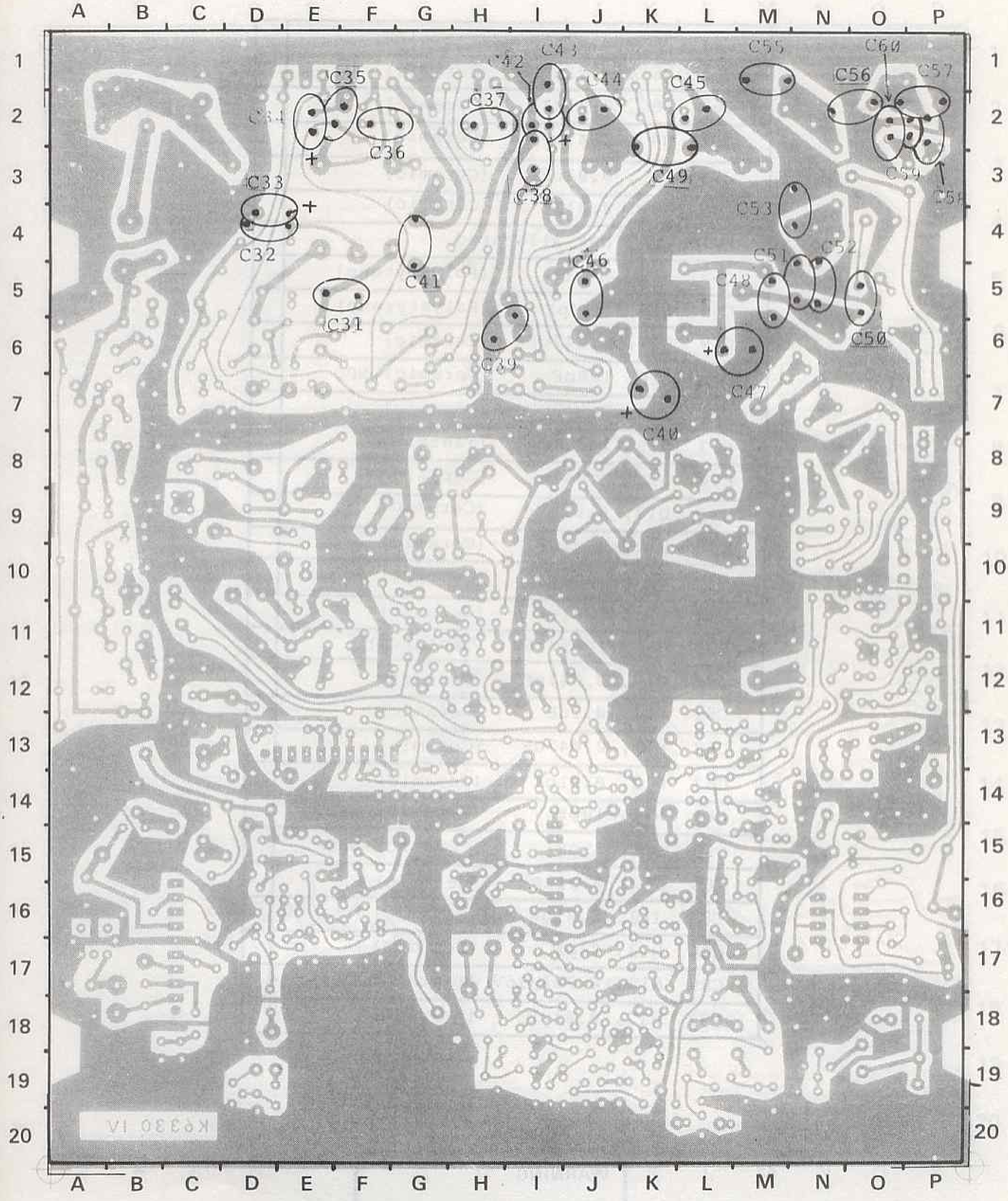
STEP 8. CAPACITORS C31-C60



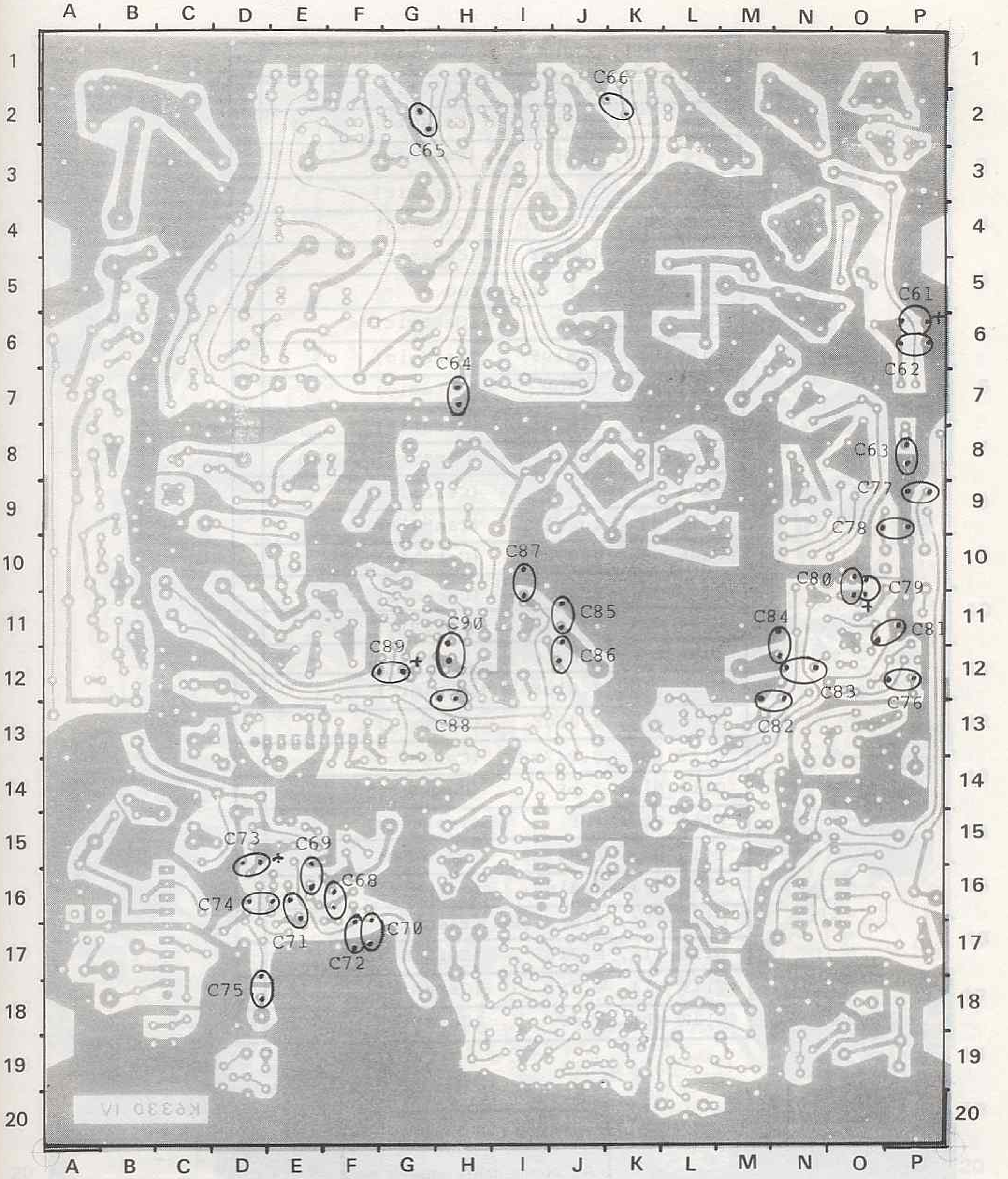
STEP 9. CAPACITORS C61-C90

C61	P6 ,	0.22uF/16V	(Tantalum)	
C62	P6 ,	0.01uF	(Ceramic)	
C63	P8 ,	0.01uF	(Ceramic)	
C64	H7 ,	.047uF	(Ceramic)	
C65	G2 ,	0.01uF	(Ceramic)	
C66	K2 ,	0.01uF	(Ceramic)	
C67	---,	Not Allocated		
C68	F16,	56pf	(Polystyrene)	
C69	E15,	470pF	(Polystyrene)	
C70	F17,	0.047uF	(Ceramic)	
C71	E16,	100pF	(Ceramic) NPO	
C72	F17,	0.047uF	(Ceramic)	
C73	D15,	1uF	(Tantalum)	
C74	D16,	0.047uF	(Ceramic)	
C75	D17,	0.01uF	(Ceramic)	
C76	P12,	0.01uF	(Ceramic)	
C77	P9 ,	100pF	(Ceramic)	
C78	P9 ,	0.01uF	(Ceramic)	
C79	O10,	10uf/16V	(Tantalum)	
C80	O10,	0.047uF	(Ceramic)	
C81	P11,	0.1uF	(Ceramic)	
C82	N12,	0.047uF	(Ceramic)	
C83	N12,	0.01uF	(Ceramic)	
C84	N11,	10pF	(Ceramic) NPO	
C85	J11,	15pF	(Ceramic) NPO	
C86	J12,	0.01uF	(Ceramic)	
C87	I10,	0.01uF	(Ceramic)	
C88	H13,	82pF	(Ceramic)	
C89	G12,	4.7uf/16V	(Tantalum)	
C90	H12,	0.01uF	(Ceramic)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 9. CAPACITORS C61-C90



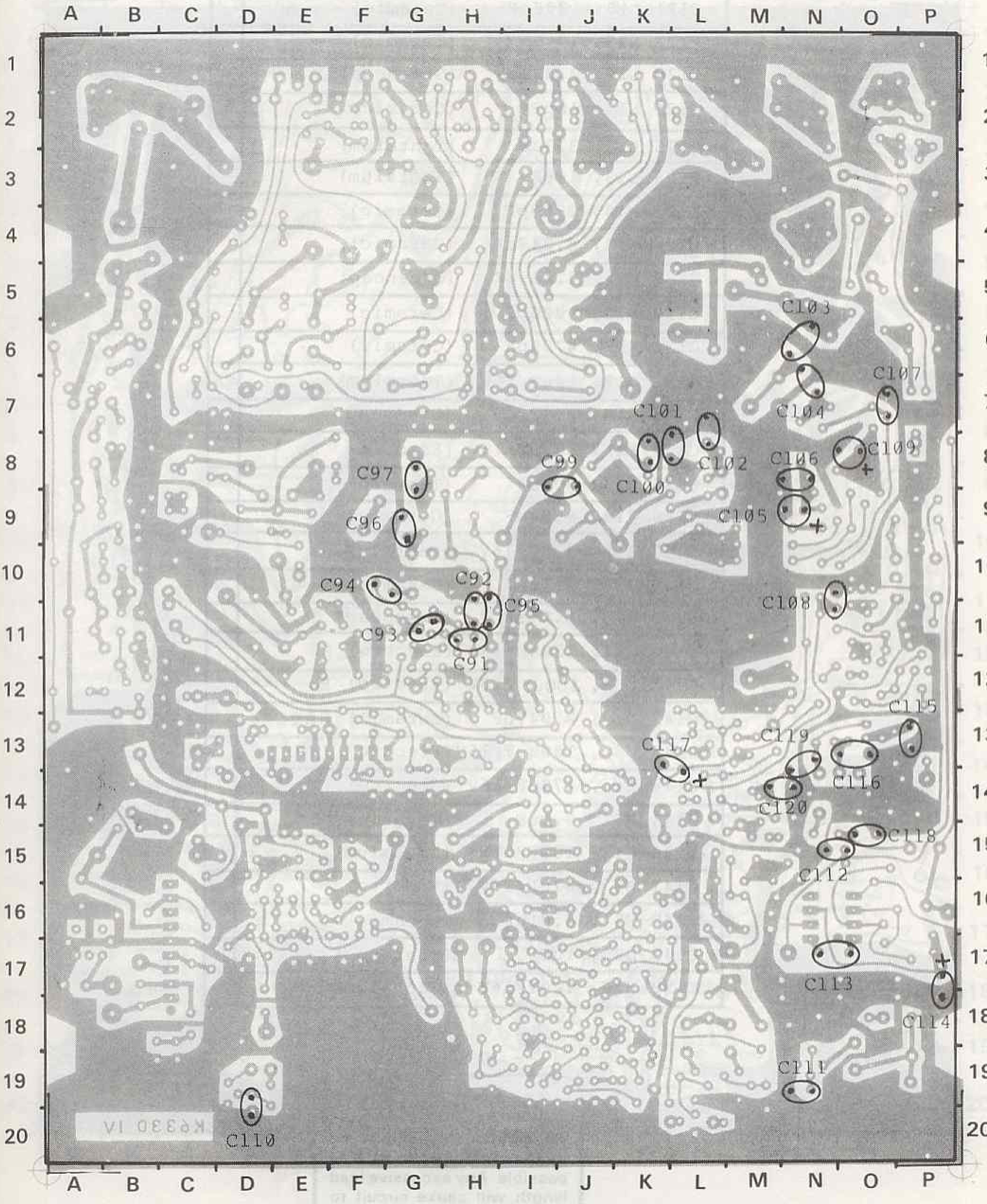
STEP 10. CAPACITORS C91-C120

C91	H11,	220pF	(Ceramic)		
C92	H11,	4700pF	(Ceramic)		
C93	G11,	220pF	(Ceramic)		
C94	G10,	18pF	(Ceramic)		
C95	I11,	2.2pF	(Ceramic)		
C96	G9 ,	0.01uF	(Ceramic)		
C97	G8 ,	1000pF	(Ceramic)		
C98	---,	Not Allocated			
C99	J8 ,	15pF	(Ceramic)		
C100	K8 ,	0.01uF	(Ceramic)		
C101	K8 ,	.01uF	(Ceramic)		
C102	L7 ,	0.01uF	(Ceramic)		
C103	N6 ,	47pF	(Ceramic)	NPO	
C104	N7 ,	0.01uF	(Ceramic)		
C105	N9 ,	1uF/16V	(Tantalum)		
C106	N8 ,	0.01uF	(Ceramic)		
C107	O7 ,	0.01uF	(Ceramic)		
C108	O11,	0.01uF	(Ceramic)		
C109	O8 ,	1uF/16V	(Tantalum)		
C110	D19,	0.01uF	(Ceramic)		
C111	N19,	0.01uF	(Ceramic)		
C112	N15,	0.047uF	(Ceramic)		
C113	N17,	33pF	(Ceramic)		
C114	P17,	1uF	(Tantalum)		
C115	O13,	0.047uF	(Ceramic)		
C116	O13,	0.01uF	(Ceramic)		
C117	K14,	47uF/10V	(Electro)		
C118	O15,	0.01uF	(Ceramic)		
C119	N13,	4.7pF	(Ceramic)		
C120	M14,	39pF	(Ceramic)		

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 10. CAPACITORS C91-C120



STEP 11. CAPACITORS C121-C150

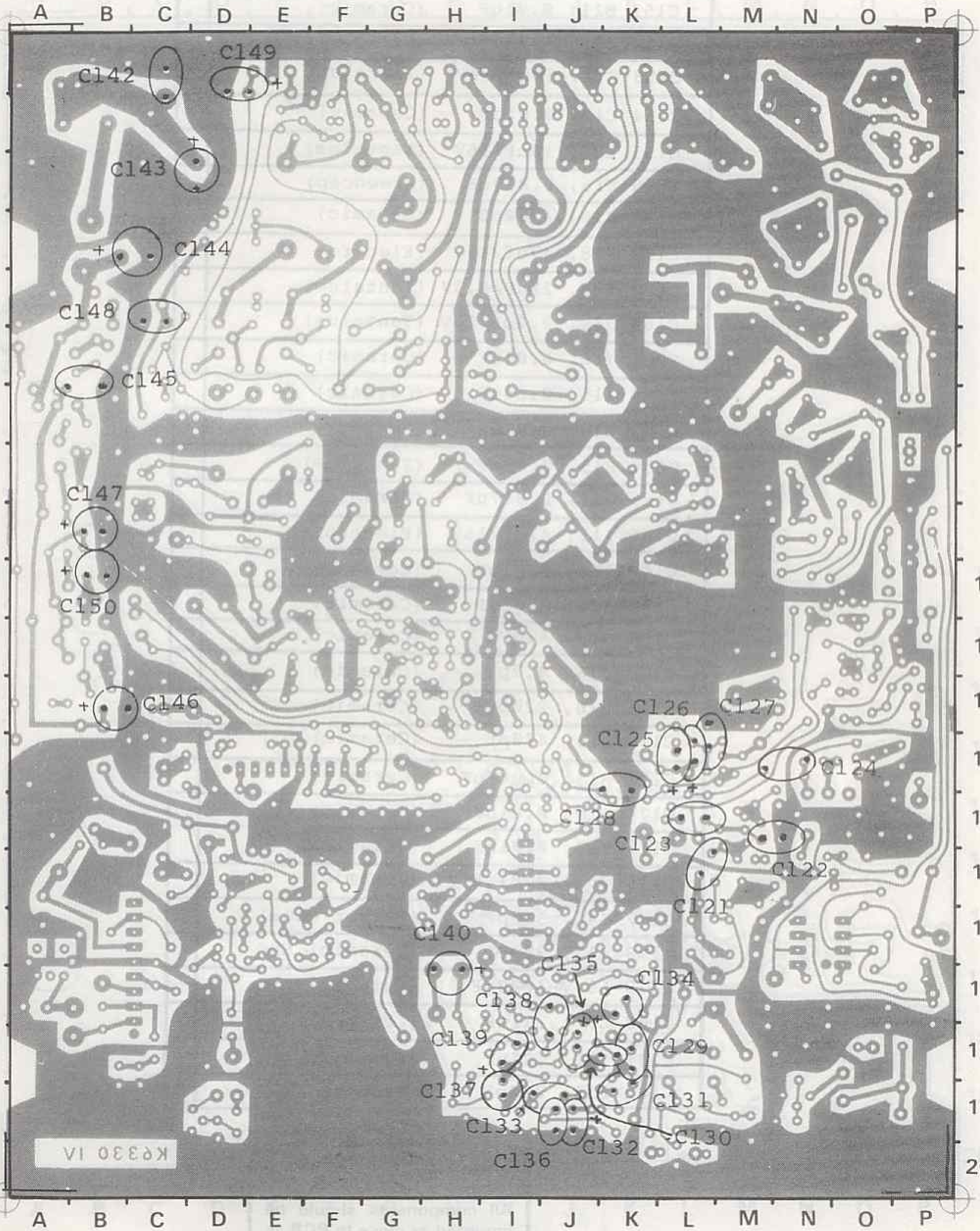
* C141 - is located on the front panel (Ref to Pg 67).

C121	L15,	1000pF	(Ceramic)		
C122	N15,	1000pF	(Ceramic)		
C123	L14,	0.039uF	(Greencap)		
C124	N13,	10pF	(Ceramic)		
C125	L13,	3.3uF	(Tantalum)		
C126	L13,	10uF	(Tantalum)		
C127	M13,	2200pF	(Ceramic)		
C128	K14,	0.047uF	(Ceramic)		
C129	K18,	0.039uF	(Greencap)		
C130	K18,	1000pF	(Ceramic)		
C131	K19,	4700pF	(Ceramic)		
C132	J19,	10uF/16V	(Tantalum)		
C133	J19,	0.022uF	(Greencap)		
C134	K17 ,	100uF/16V	(Electro)		
C135	J18,	0.1uF	(Tantalum)		
C136	J19,	0.01uF	(Ceramic)		
C137	I19,	10uF/16V	(Tantalum)		
C138	J18,	0.1uF	(Ceramic)		
C139	I18,	0.01uF	(Greencap)		
C140	H17,	220uF/16V	(Electro)	RB	
* C141	,	100uF /16V	(Electro)	RB	
C142	C1 ,	0.047uF	(Ceramic)		
C143	D3 ,	1000uF/16V	(Electro)		
C144	C4 ,	470uF/16V	(Electro)		
C145	B7 ,	0.1uF	(Ceramic)		
C146	C12,	10uF/16V	(Tantalum)		
C147	B9 ,	47uF/16V	(Electro)		
C148	C5 ,	0.01uF	(Ceramic)		
C149	D2 ,	1uF	(Tantalum)		
C150	B10,	10uf/16V	(Tantalum)		

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 11. CAPACITORS C121-C150



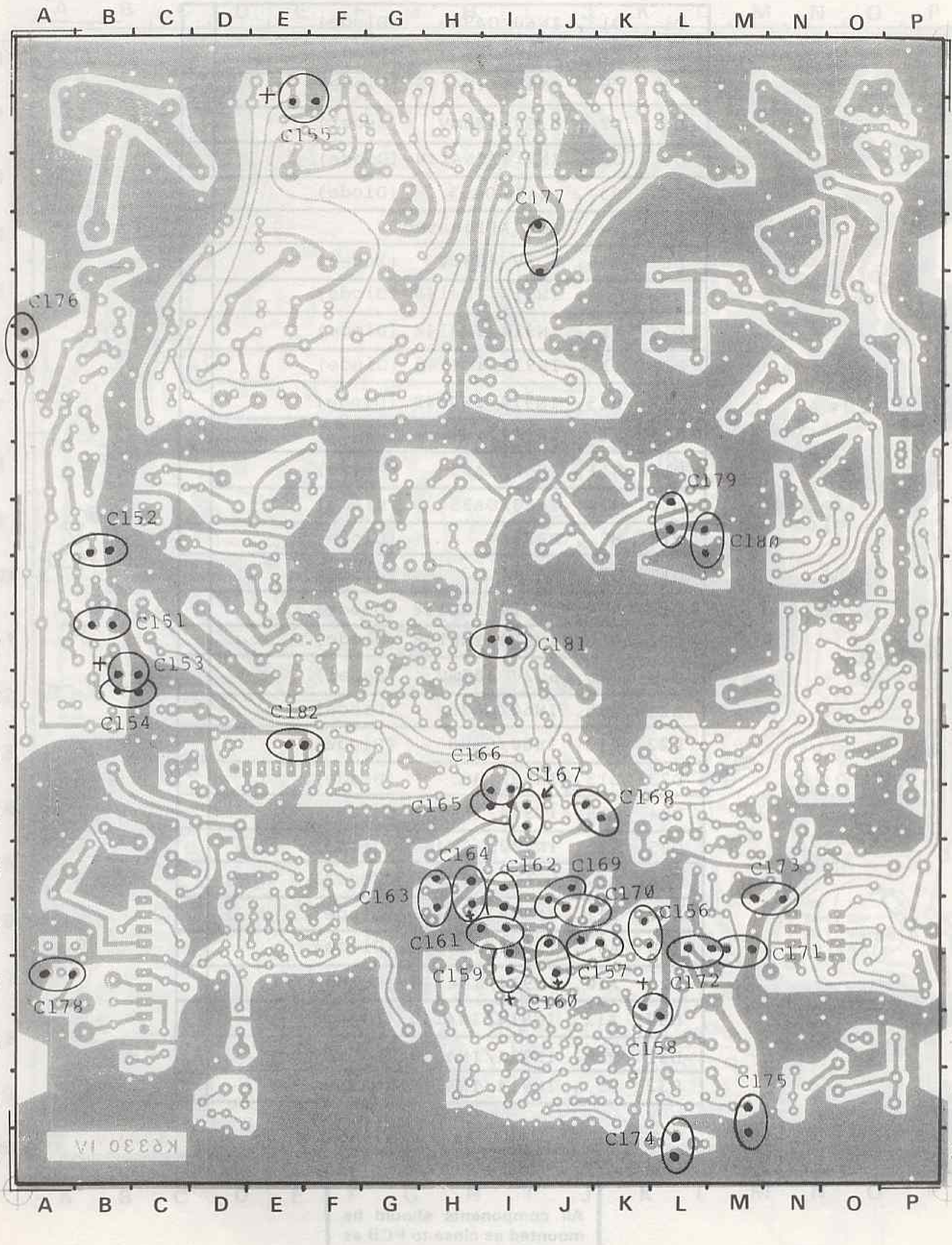
STEP 12. CAPACITORS C151-C182

C151	B11,	0.01uF	(Ceramic)	
C152	B9 ,	0.01uF	(Ceramic)	
C153	C12,	10uF/16V	(Tantalum)	
C154	C12,	0.01uF	(Ceramic)	
C155	E2 ,	10uF/16V	(Tantalum)	
C156	K16,	0.039uF	(Greencap)	
C157	J16,	4700pF	(Ceramic)	
C158	K18,	47uf/16V	(Electro)	
C159	I17,	22uF/6.3V	(Tantalum)	
C160	J16,	2.2uF/16V	(Tantalum)	
C161	I16,	0.01uF	(Ceramic)	
C162	I15,	0.01uF	(Ceramic)	
C163	H15,	0.01uF	(Ceramic)	
C164	H15,	0.22uF	(Tantalum)	
C165	I14,	0.047uF	(Ceramic)	
C166	I13,	47uF/16V	(Electro)	
C167	I14,	0.01uF	(Ceramic)	
C168	K14,	0.01uF	(Ceramic)	
C169	J15,	47pF	(Ceramic)	
C170	J16,	4.7pF	(Ceramic)	
C171	M16,	220pF	(Ceramic)	
C172	L16,	470pf	(Ceramic)	
C173	M15,	0.047uF	(Ceramic)	
C174	L19,	0.01uF	(Ceramic)	
C175	M19,	0.01uF	(Ceramic)	
C176	A6 ,	0.01uF	(Ceramic)	
C177	I4 ,	330pF	(Silver Mica)	
C178	A17,	22pF	(Ceramic) NPO	
C179	L9 ,	1000pF	(Ceramic)	
C180	L9 ,	.01uF	(Ceramic)	
C181	I11,	.01uF	(Ceramic)	
C182	E13,	220pF	(Ceramic)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 12. CAPACITORS C151-C182



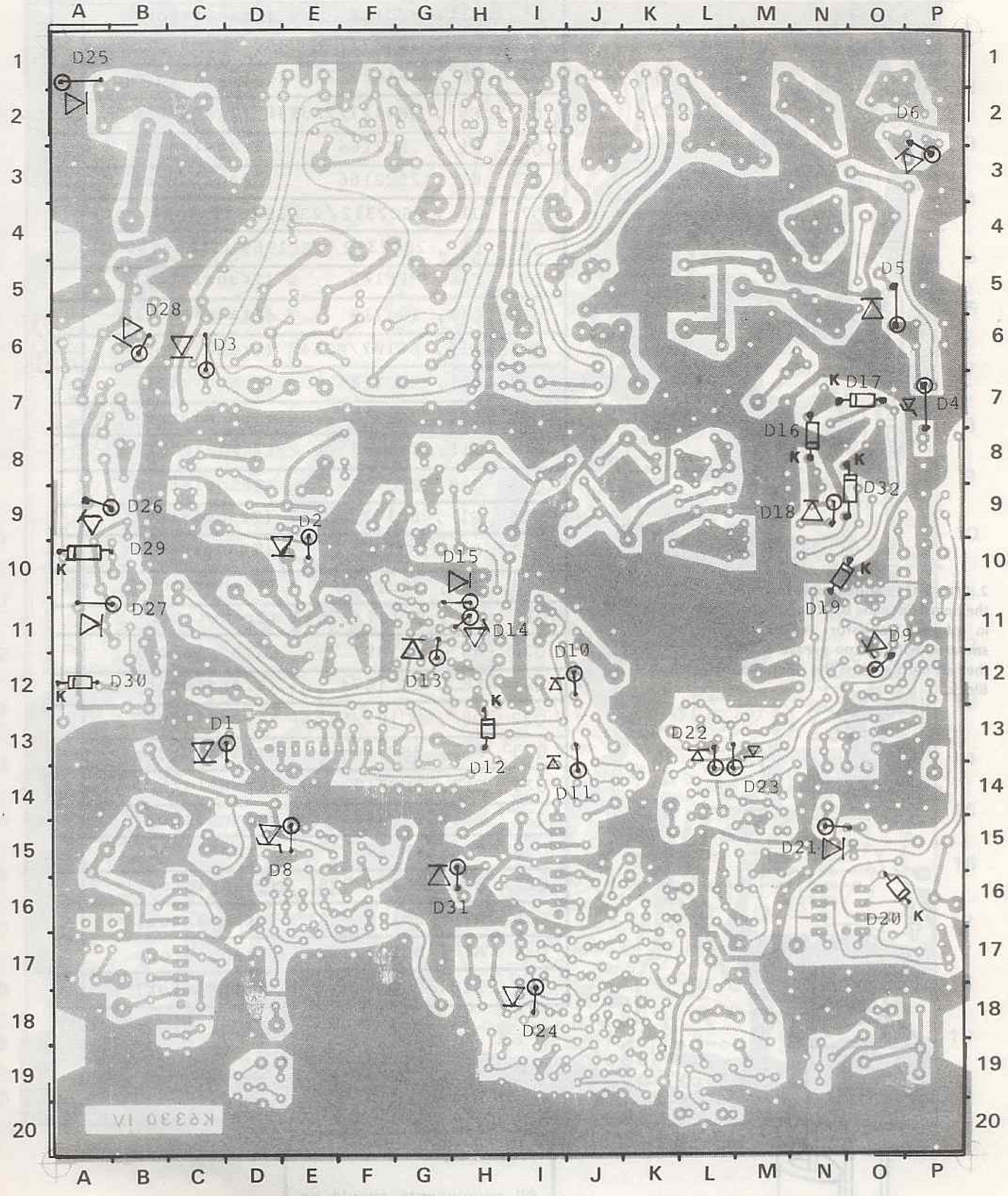
STEP 13. DIODES D1-D32

D1	D13,	IN6Ø/OA95	(Diode)	
D2	E1Ø,	IN6Ø/OA95	(Diode)	
D3	C6 ,	IN914/IN4148	(Diode)	
D4	P7 ,	5.6V 4ØØmV	(Zener)	
D5	O5 ,	IN914/IN4148	(Diode)	
D6	P3 ,	IN6Ø/OA95	(Diode)	
D7	---	Not Allocated		
D8	E15,	6.2V 4ØØmV	(Zener)	
D9	O12,	IN914/IN4148	(Diode)	
D1Ø	I12,	IN914/IN4148	(Diode)	
D11	I13,	IN914/in4148	(Diode)	
D12	H13,	IN914/IN4148	(Diode)	
D13	F11,	IN914/IN4148	(Diode)	
D14	H11,	IN6Ø/OA95	(Diode)	
D15	G1Ø,	IN6Ø/OA95	(Diode)	
D16	M8 ,	BA244	(Diode)	
D17	N7 ,	BA244	(Diode)	
D18	N9 ,	IN914/IN4148	(Diode)	
D19	N1Ø,	IN914/IN4148	(Diode)	
D2Ø	O16,	6.2V 4ØØmV	(Zener)	
D21	N15,	IN6Ø/OA95	(Diode)	
D22	L13,	IN6Ø/OA95	(Diode)	
D23	L13,	IN6Ø/OA95	(Diode)	
D24	I18,	IN914/IN4148	(Diode)	
D25	A1 ,	IN4ØØ1/IN4ØØ2	(Diode)	
D26	A9 ,	5.6V 4ØØmV	(Zener)	
D27	A11,	IN4ØØ1/IN4ØØ2	(Diode)	
D28	A6 ,	IN914/IN4148	(Diode)	
D29	A1Ø,	IN914/IN4148	(Diode)	
D3Ø	A12,	IN914/IN4148	(Diode)	
D31	H16,	IN914/IN4148	(Diode)	
D32	O9 ,	IN914/IN4148	(Diode)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 13. DIODES D1-D32

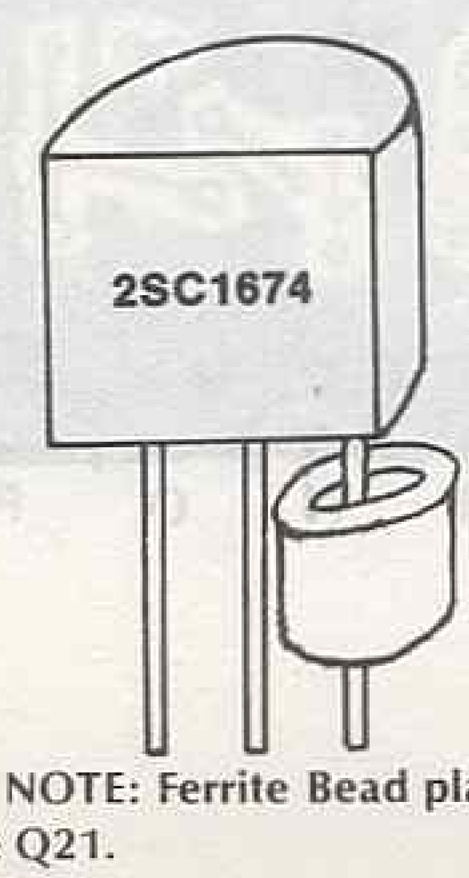


STEP 14. TRANSISTORS Q1-Q30

1. Before soldering transistors Q5-Q8 into main PCB these should be secured to Back panel & Aluminium heatsink bracket. Heatsink compound should be used.

2. Q16 & Q19 should only be soldered into the board once the back panel & heatsink are in place. Transistor cases should be smeared with silicon grease & soldered so they sit hard against the Aluminium H/Sink Block.

Q1	E11,	MFE131	(Transistor)	
Q2	D8 ,	2N4427/2N3948	(Transistor)	
Q3	D6 ,	2N4427/2N3948	(Transistor)	
Q4	E6 ,	2N4427/2N3948	(Transistor)	
Q5	F1 ,	2SC2166	(Transistor)	
Q6	H1 ,	2SC2166	(Transistor)	
Q7	J1 ,	2SC2312/2SC1969	(Transistor)	
Q8	L1 ,	2SC2312/2SC1969	(Transistor)	
Q9	F16,	MPF102	(Transistor)	
Q10	D17,	2SC710	(Transistor)	
Q11	D16,	BC107/BC547	(Transistor)	
Q12	O11,	2SC710	(Transistor)	
Q13	H12,	2SC710	(Transistor)	
Q14	G11,	2SA733	(Transistor)	
Q15	G10,	2SC710	(Transistor)	
Q16	G1 ,	BC107/BC547	(Transistor)	
Q17	G6 ,	BD139	(Transistor)	
Q18	H8 ,	2SC1674	(Transistor)	
Q19	K1 ,	BC107/BC547	(Transistor)	
Q20	H6 ,	BD139	(Transistor)	
* Q21	K8 ,	2SC1674	(Transistor)	
Q22	O8 ,	BC107/BC547	(Transistor)	
Q23	P12,	2SC710	(Transistor)	
Q24	O13,	2SC710	(Transistor)	
Q25	M15,	2SC710	(Transistor)	
Q26	M13,	BF245	(Transistor)	
Q27	B5 ,	BC327/328	(Transistor)	
Q28	A7 ,	BD140	(Transistor)	
Q29	A8 ,	BC107/BC547	(Transistor)	
Q30	A10,	BC337	(Transistor)	

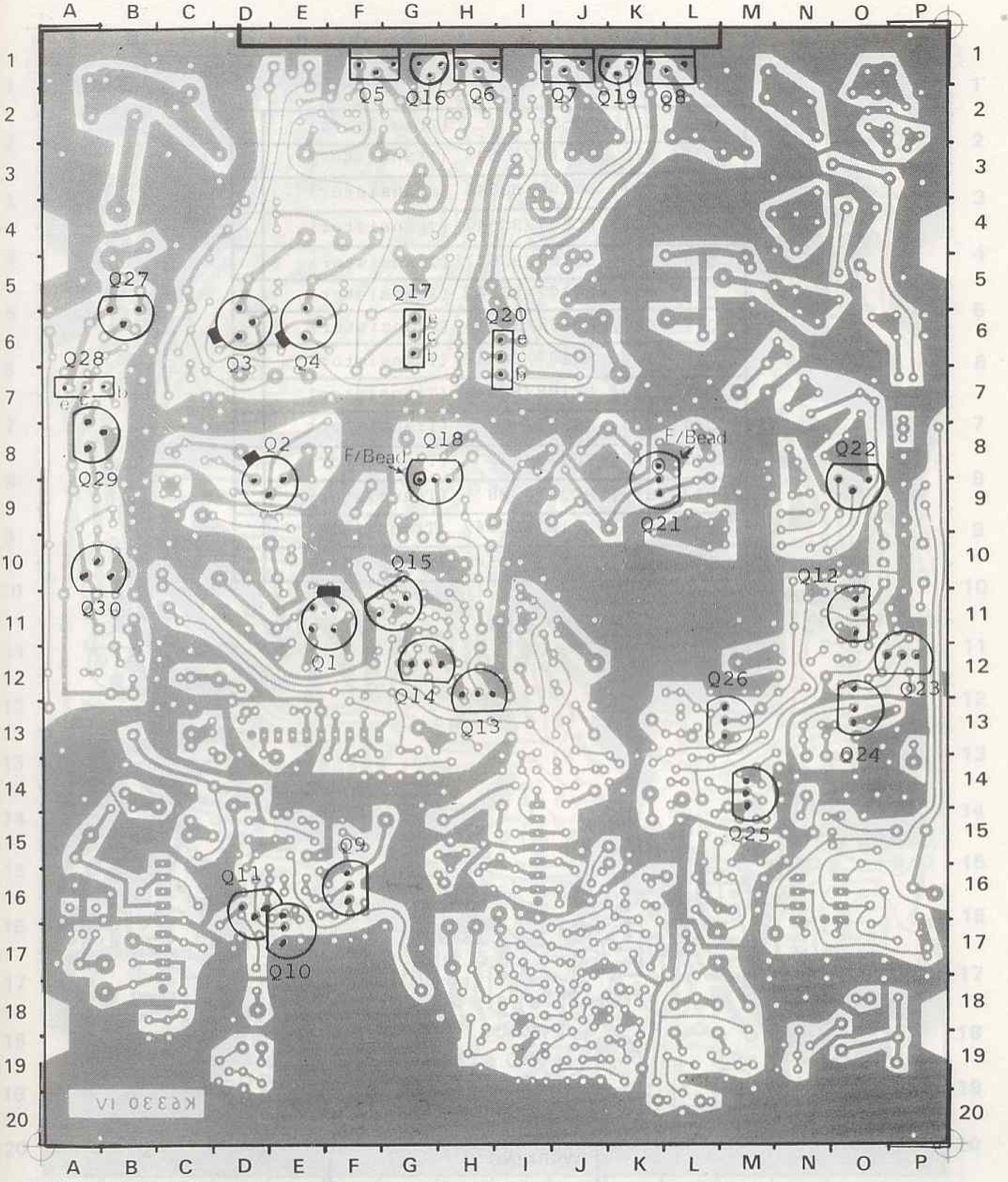


* NOTE: Ferrite Bead placed on leg of Q18 & Q21.

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 14. TRANSISTORS Q1-Q30



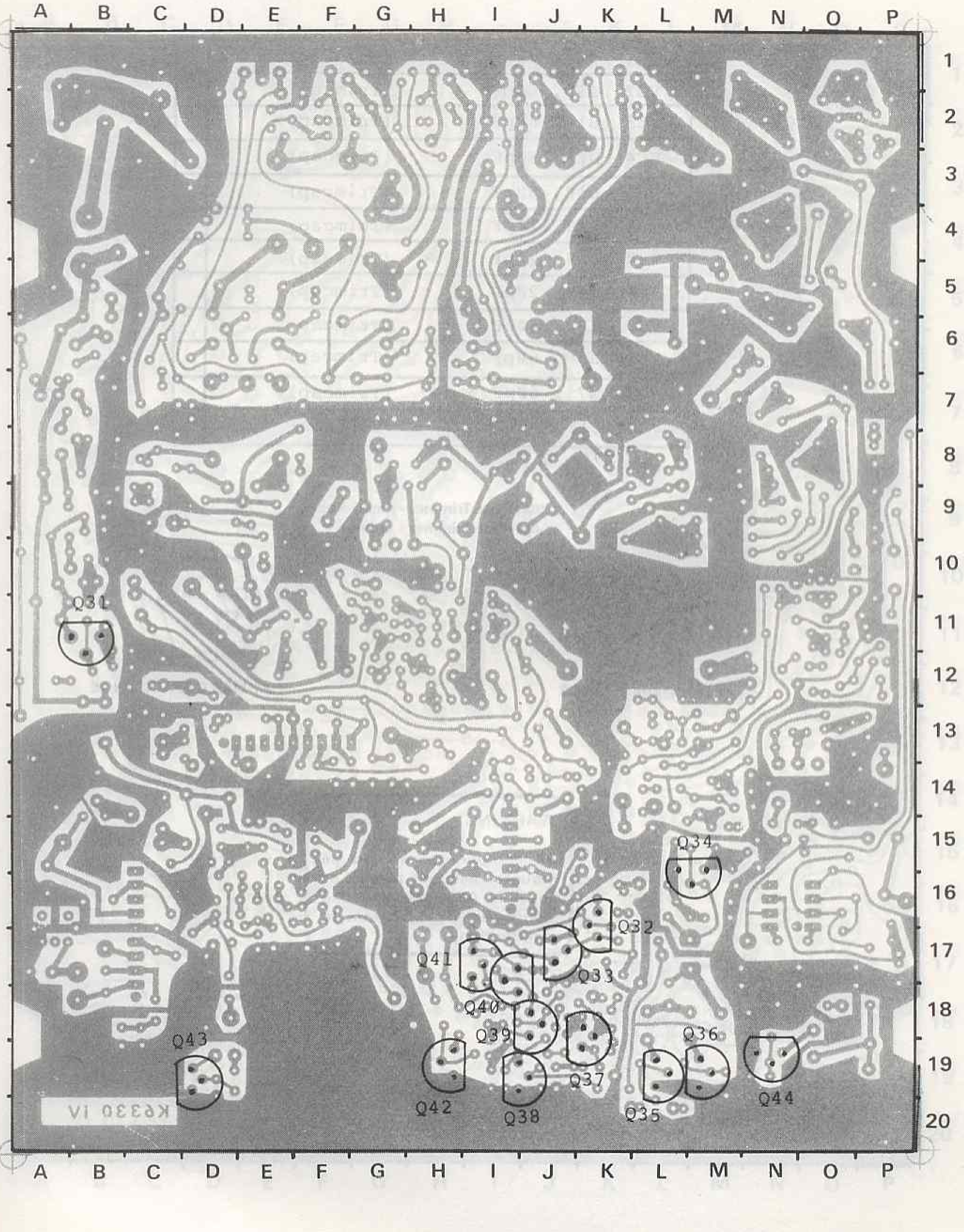
STEP 15. TRANSISTORS Q31-Q44

Q31	B11,	BC557	(Transistor)	
Q32	K16,	BC108/BC548	(Transistor)	
Q33	J17,	BC108/BC548	(Transistor)	
Q34	M15,	BC107/BC547	(Transistor)	
Q35	L19,	BC107/BC547	(Transistor)	
Q36	M19,	BC107/BC547	(Transistor)	
Q37	K19,	BC108/BC548	(Transistor)	
Q38	J20,	BC107/BC547	(Transistor)	
Q39	J19,	BC108/BC548	(Transistor)	
Q40	I18,	BC557	(Transistor)	
Q41	I17,	BC337/338	(Transistor)	
Q42	H19,	BC327/328	(Transistor)	
Q43	C19,	BC107/BC547	(Transistor)	
Q44	N19,	BC107/BC547	(Transistor)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

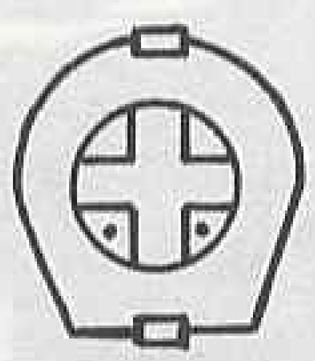
STEP 15. TRANSISTORS Q31-Q44



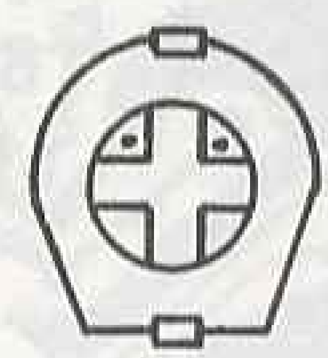
STEP 16. TRIMCAPS VC1-VC12

VC1	A17,	20pF	(Trimcap)	
VC2	A15,	60pF	(Trimcap)	
VC3	B14,	60pF	(Trimcap)	
VC4	D11,	60pF	(Trimcap)	
VC5	D10,	60pF	(Trimcap)	
VC6	M18,	20pF	(Trimcap)	
VC7	L18,	20pF	(Trimcap)	
VC8	M18,	20pF	(Trimcap)	
VC9	I8 ,	60pF	(Trimcap)	
VC10	J9 ,	60pF	(Trimcap)	
VC11	N7 ,	60pF	(Trimcap)	
VC12	F15,	MV104	(Varicap)	

20pF Type Trimmer - Pink / Red.
60pF Type Trimmer - Brown.



AT MIN CAPACITANCE

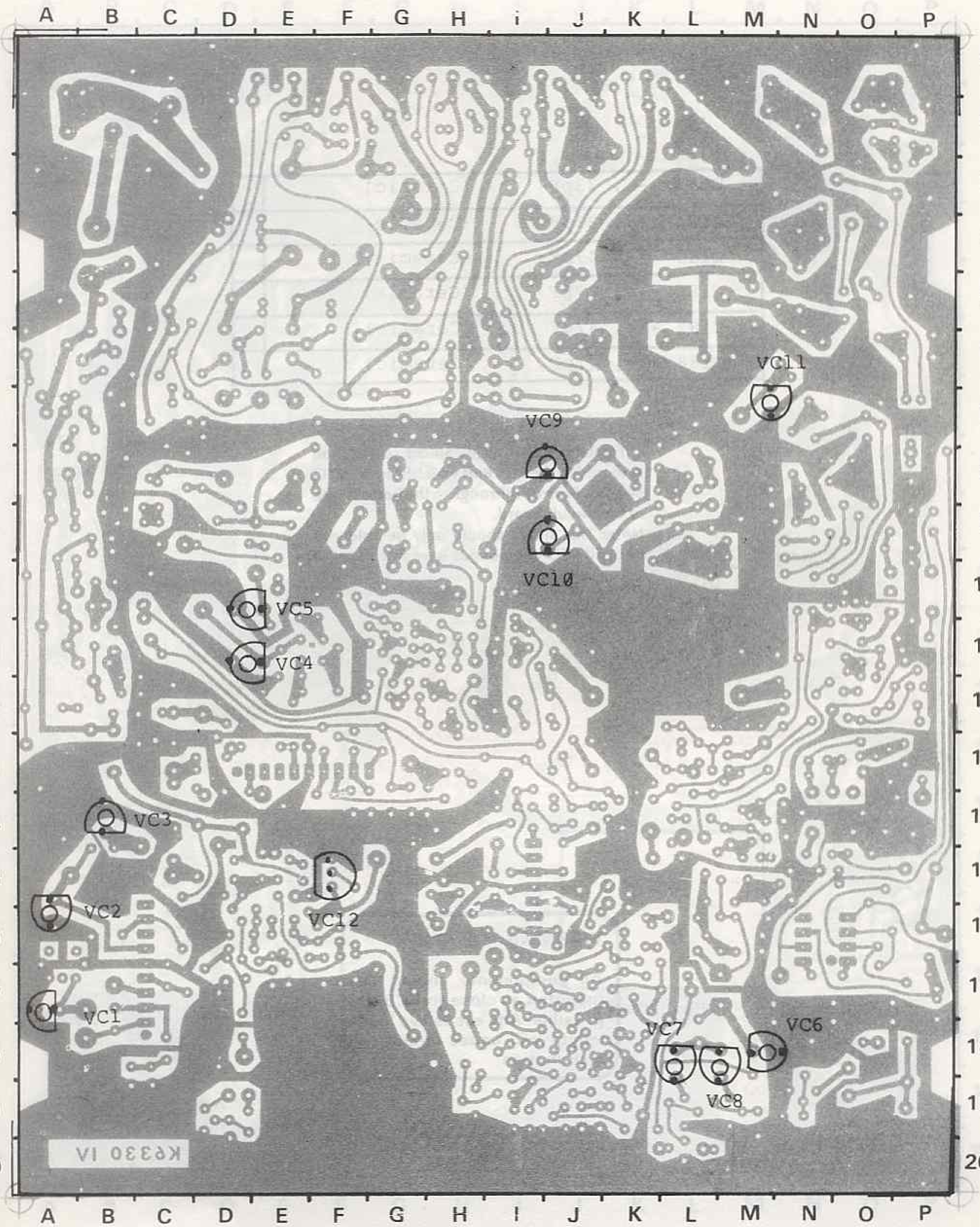


AT MAX CAPACITANCE

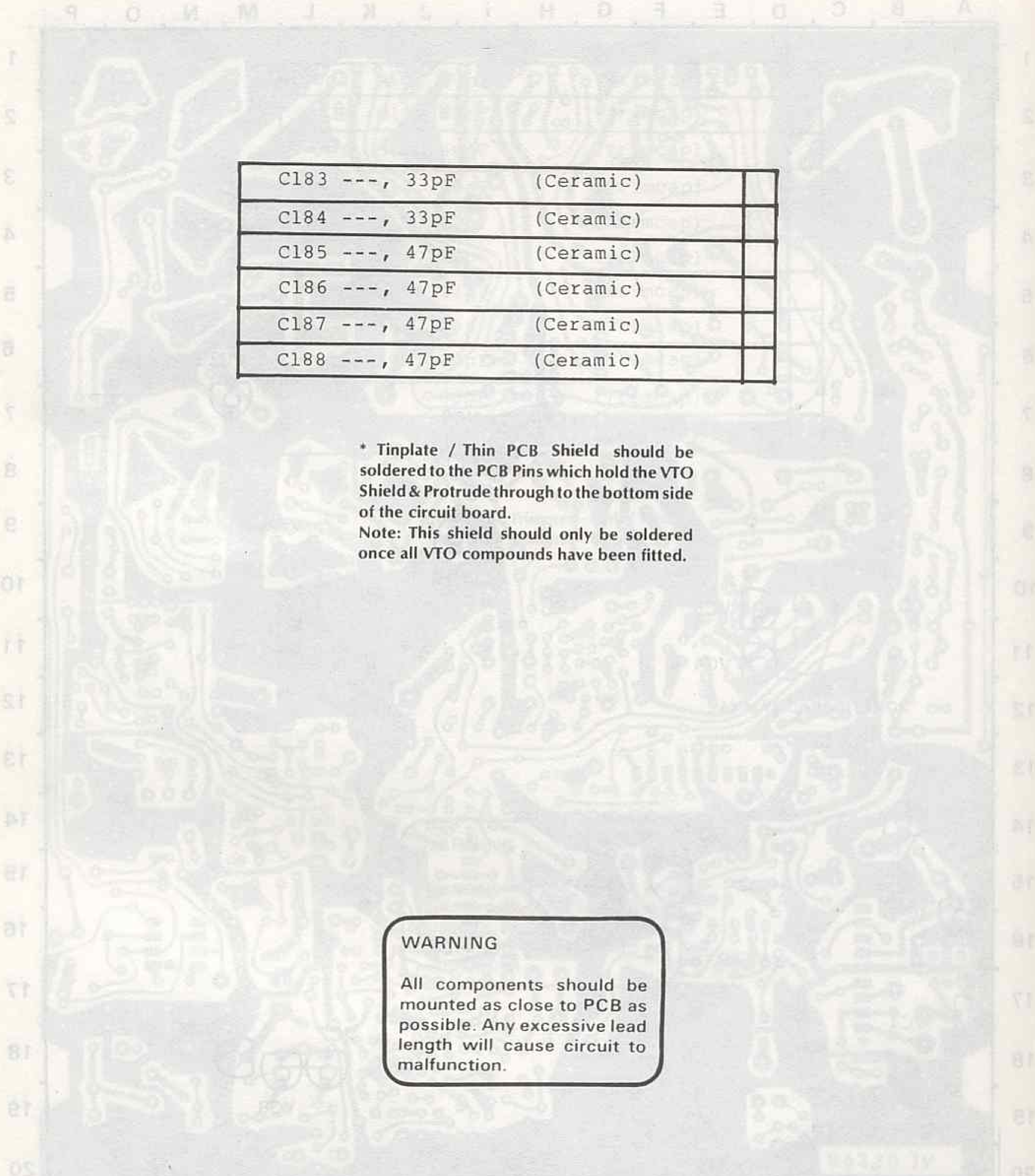
WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 16. TRIMCAPS VC1-VC12



STEP 17. CAPACITORS C183 -C188



C183 ---, 33pF	(Ceramic)	
C184 ---, 33pF	(Ceramic)	
C185 ---, 47pF	(Ceramic)	
C186 ---, 47pF	(Ceramic)	
C187 ---, 47pF	(Ceramic)	
C188 ---, 47pF	(Ceramic)	

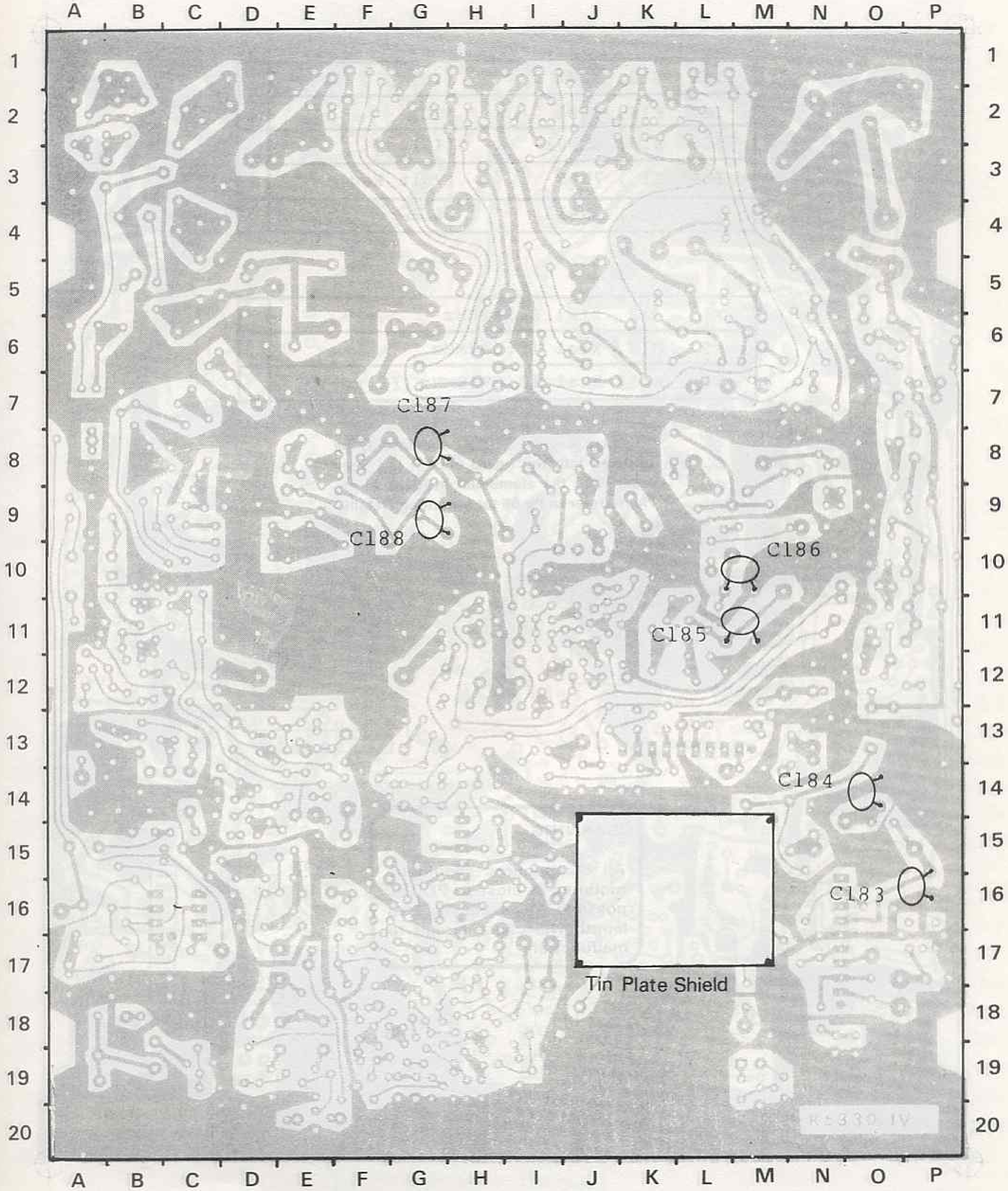
* Tinplate / Thin PCB Shield should be soldered to the PCB Pins which hold the VTO Shield & Protrude through to the bottom side of the circuit board.
Note: This shield should only be soldered once all VTO compounds have been fitted.

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 17. UNDERBOARD COMPONENTS

CAPACITORS C183 -C188



STEP 18. IC'S 1C1-IC5 – CRYSTALS X1-X3

	IC1	B18, 3001	(IC)		
	IC2	F13, 3001	(IC)		
	IC3	N16, LM301	(IC)		
*	IC4	E1 , 7805	(Volt Reg)		
	IC5	I15, AN612	(IC)		

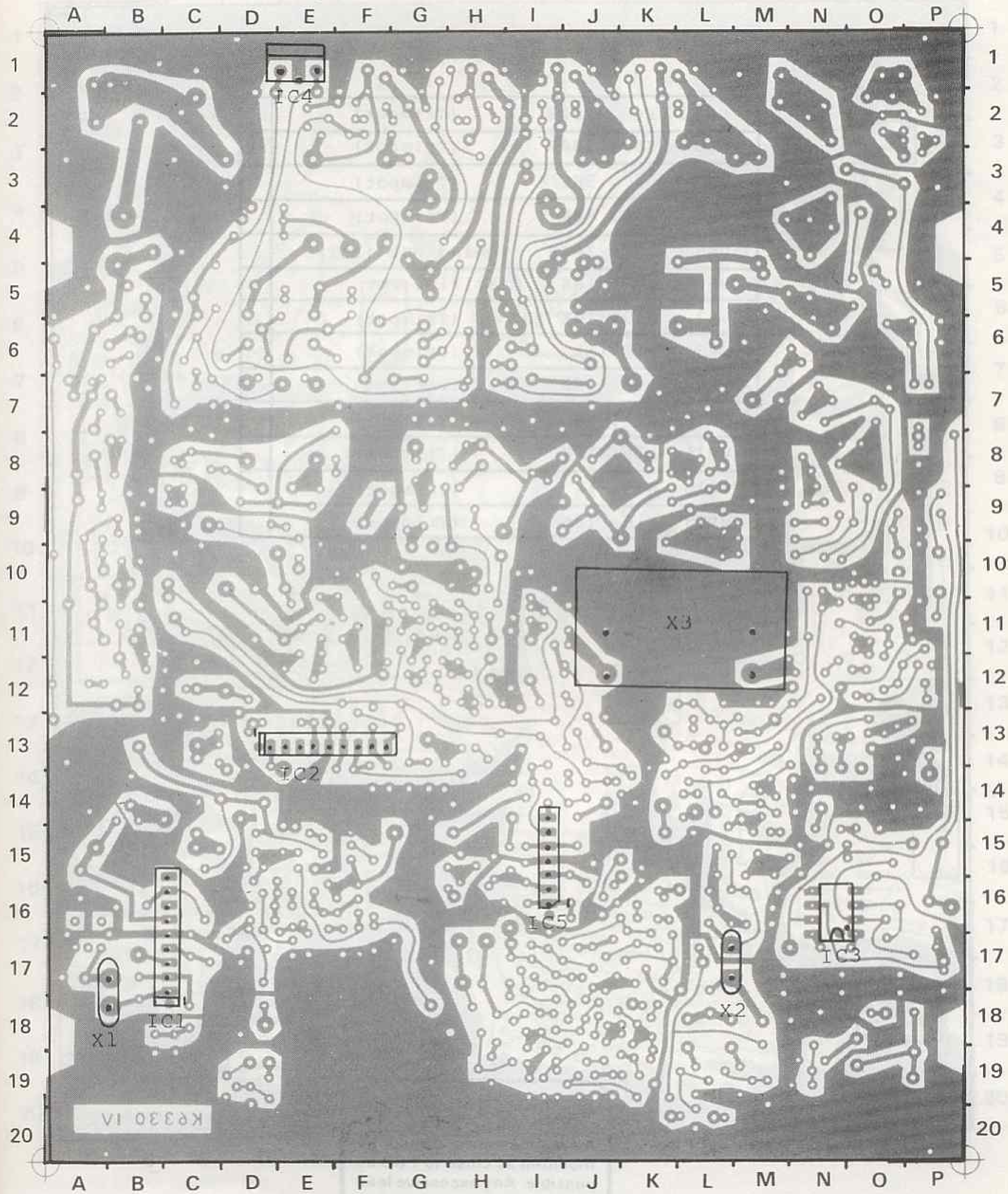
X1	A18, Xtal 8.192MHz		
X2	M17, Xtal 10.692MHz		
X3	K11, Xtal 10.6935MHz (filter)		

* Voltage Regulator (IC4) should only be soldered into the board once it has been secured to the aluminium heatsink block. Please refer to Pg 68 for Mounting Details.

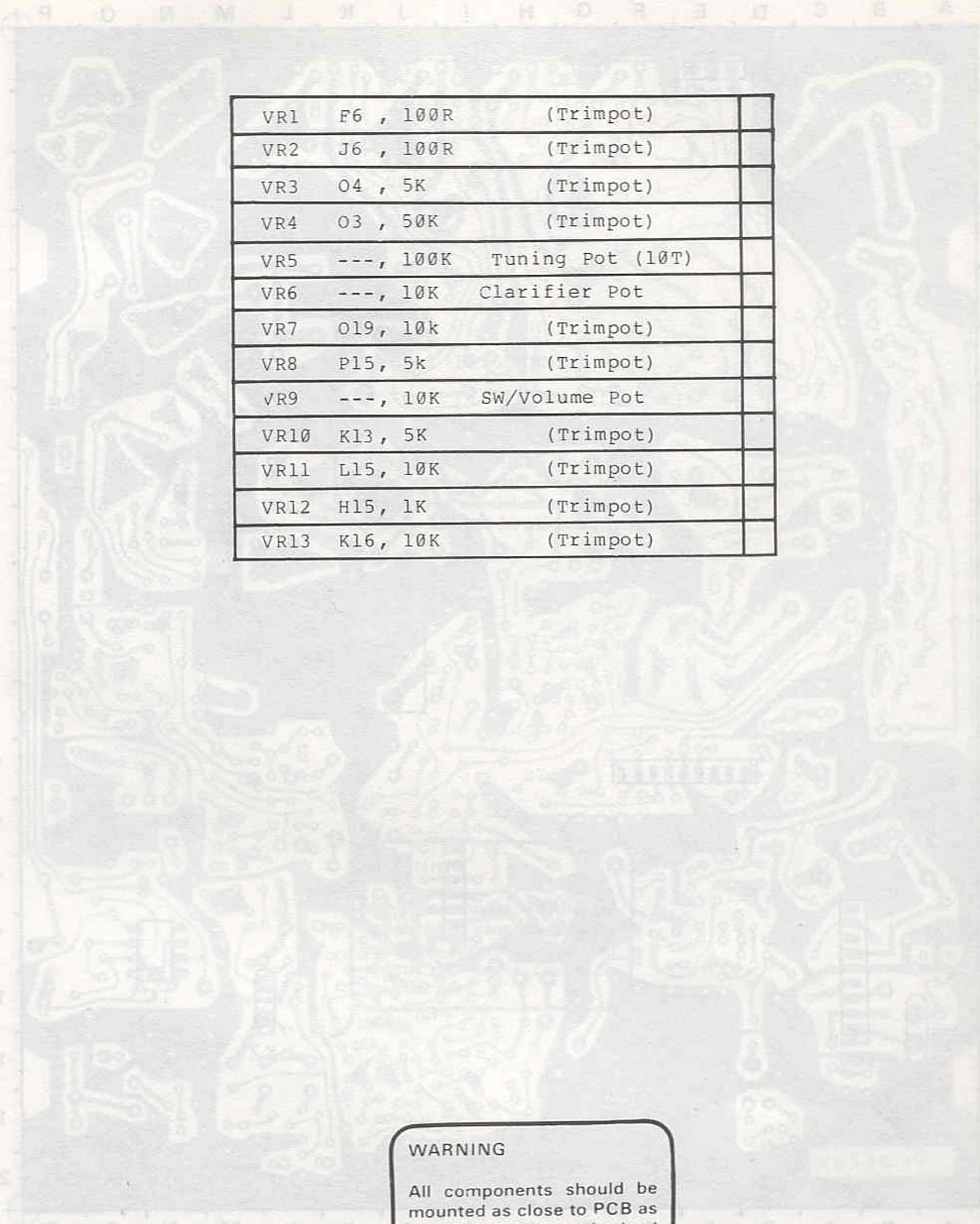
WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 18. IC'S ICI-IC5 CRYSTALS X1-X3



STEP 19. TRIMPOTS VR1-VR13

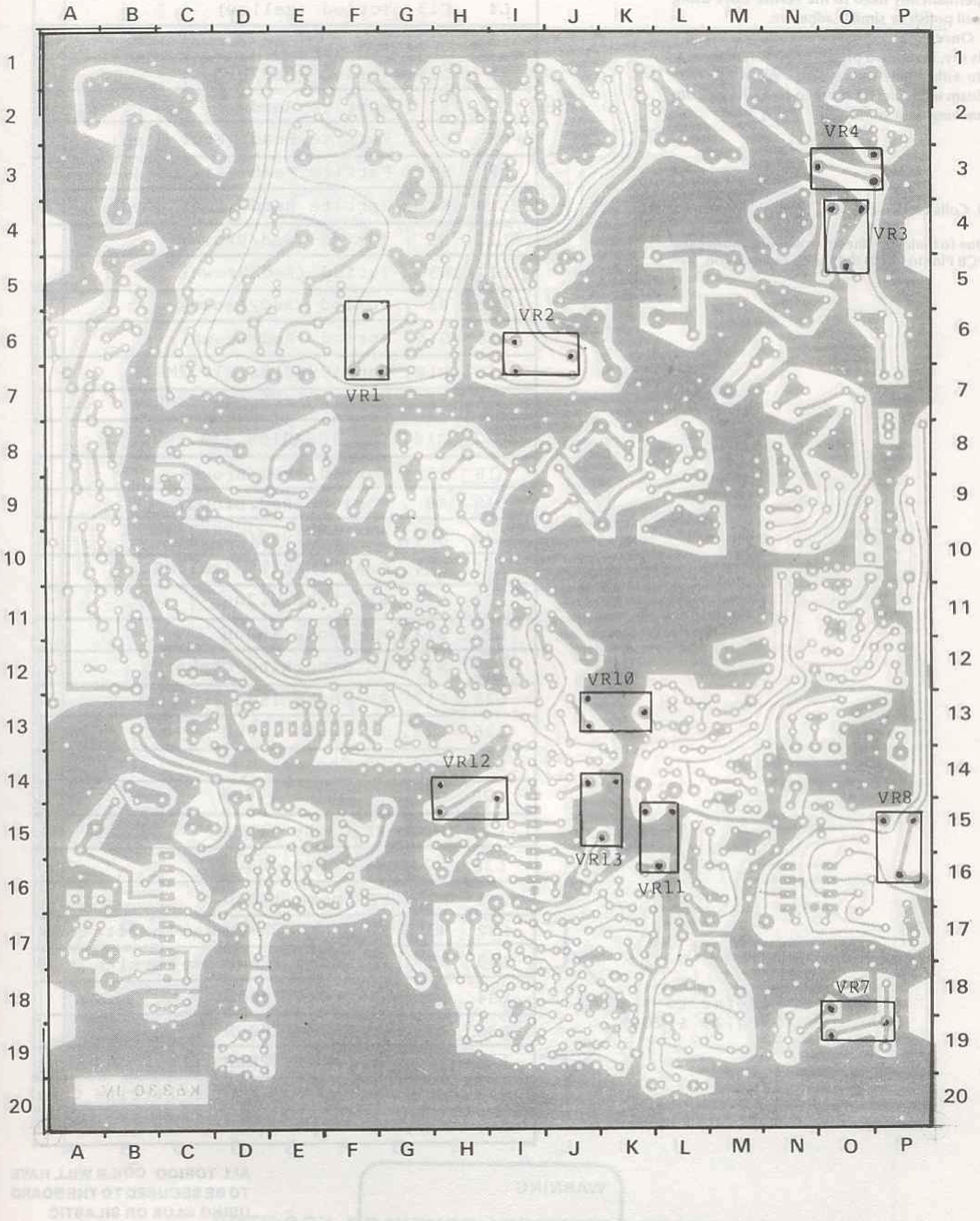


VR1	F6 ,	100R	(Trimpot)	
VR2	J6 ,	100R	(Trimpot)	
VR3	O4 ,	5K	(Trimpot)	
VR4	O3 ,	50K	(Trimpot)	
VR5	---,	100K	Tuning Pot (10T)	
VR6	---,	10K	Clarifier Pot	
VR7	O19,	10k	(Trimpot)	
VR8	P15,	5k	(Trimpot)	
VR9	---,	10K	SW/Volume Pot	
VR10	K13,	5K	(Trimpot)	
VR11	L15,	10K	(Trimpot)	
VR12	H15,	1K	(Trimpot)	
VR13	K16,	10K	(Trimpot)	

WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

STEP 19. TRIMPOTS VR1-VR13



STEP 20. COILS & CHOKES L1-L38

1. Final Adjustments of L14 (VTO Coil)

Once the VTO has been aligned to its correct tuning range, the coil windings need to be permanently fixed to the Ferrite Core using nail polish or similar adhesive.

Once the above has been completed & glue is dry, insert two pieces of polystyrene form to either side of L14. Now fill in between foam with silicon rubber to prevent coil from moving with vibration.

2. Coils L8,L9 & L10.

Due to their size, these coils will sit above the PCB Pins to which they are soldered too.

L1	---,	Not Allocated	
L2	---,	Not Allocated	
L3	B15,	Toriod (yellow)	
L4	C13,	Toriod (yellow)	
L5	D11,	Toriod (Red/Brown)	
L6	D10,	Toriod (Red/Brown)	
L7	E7 ,	Ferrite Bead	
L8	F4 ,	Ferrite Bead (Four used)	
L9	H4 ,	Ferrite Bead (Six used)	
L10	K4 ,	Ferrite Bead (Four used)	
L11	N5 ,	Toriod (Red/Brown)	
L12	N3 ,	Toriod (Red/Brown)	
L13	N1 ,	Toriod (Red/Brown)	
L14	G16,	Toriod (Red/Brown)	
L15	P10,	Can 10MA015S (10.7MHz)	
L16	I12,	Can 10MA015S (10.7MHz)	
L17	G10,	Can 10MA015S (10.7MHz)	
L18	I9 ,	Toriod (Red/Brown)	
L19	K9 ,	Toriod (Red/Brown)	
L20	M8 ,	Toriod (Red/Brown)	
L21	N14,	Can 10MA015S (10.7MHz)	
L22	L18,	RF Choke 4.7uH	
L23	J14,	RF Choke 150uH	
L24	B3 ,	DC Smoothing Choke	
L25	F17,	RF Choke 150uH	
L26	F12,	RF Choke 100uH	
L27	F13,	RF Choke 100uH	
L28	G2 ,	RF Choke 1.8uH	
L29	H2 ,	RF Choke 1.8uH	
L30	F2 ,	RF Choke 100uH	
L31	F2 ,	RF Choke 100uH	
L32	H3 ,	RF Choke 220uH use Ferrite Core	
L33	H5 ,	RF Choke 220uH use Ferrite Core	
L34	I2 ,	RF Choke 100uH	
L35	I5 ,	RF Choke 100uH	
L36	J4 ,	RF Choke 220uH use Ferrite Core	
L37	M4 ,	RF Choke 220uH use Ferrite Core	
L38	N15,	RF Choke 150uH	

Refer to Pg.19 & 20.

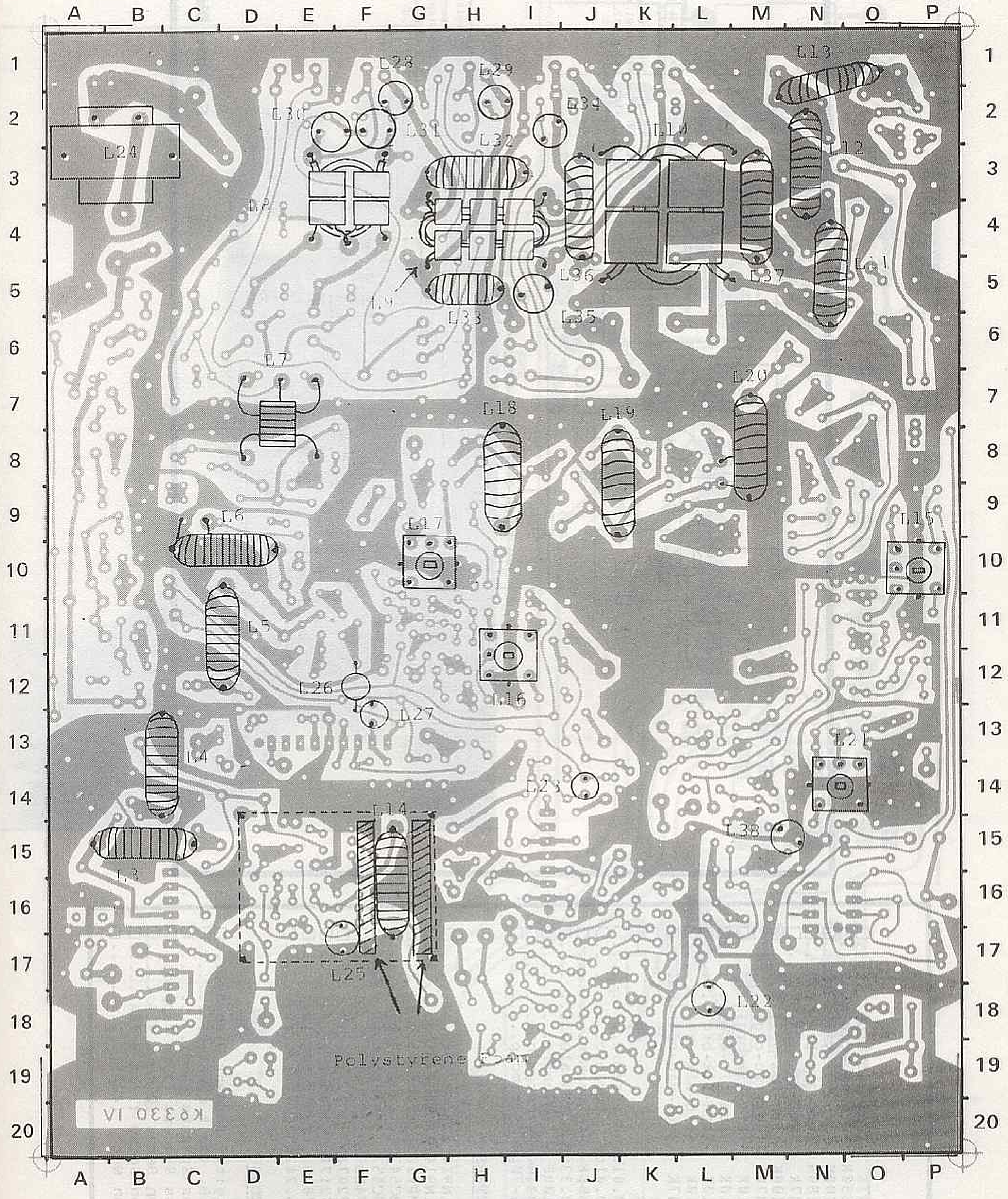
WARNING

All components should be mounted as close to PCB as possible. Any excessive lead length will cause circuit to malfunction.

ALL TORIOD COILS WILL HAVE TO BE SECURED TO THE BOARD USING GLUE OR SILASTIC COMPOUND.

NOTE: THIS SHOULD ONLY BE DONE ONCE UNIT IS FULLY OPERATIONAL

STEP 20. COILS & CHOKES L1-L38



NOTE:COIL DRAWINGS ARE NOT TO SCALE

RESISTORS

R901	47k	(yel-vio-org)	☐
R902	330R	(org-org-brn)	☐
R903	100K	(brn-blk-yel)	☐
R904	180R	(brn-gry-brn)	☐
R905	47k	(yel-vio-org)	☐
R906	100K	(brn-blk-yel)	☐
R907	47K	(yel-vio-org)	☐
R908	10K	(brn-blk-org)	☐
R909	10K	(brn-blk-org)	☐
R910	10K	(brn-blk-org)	☐
R911	10k	(brn-blk-org)	☐
R912	47K	(yel-vio-org)	☐

CAPACITORS

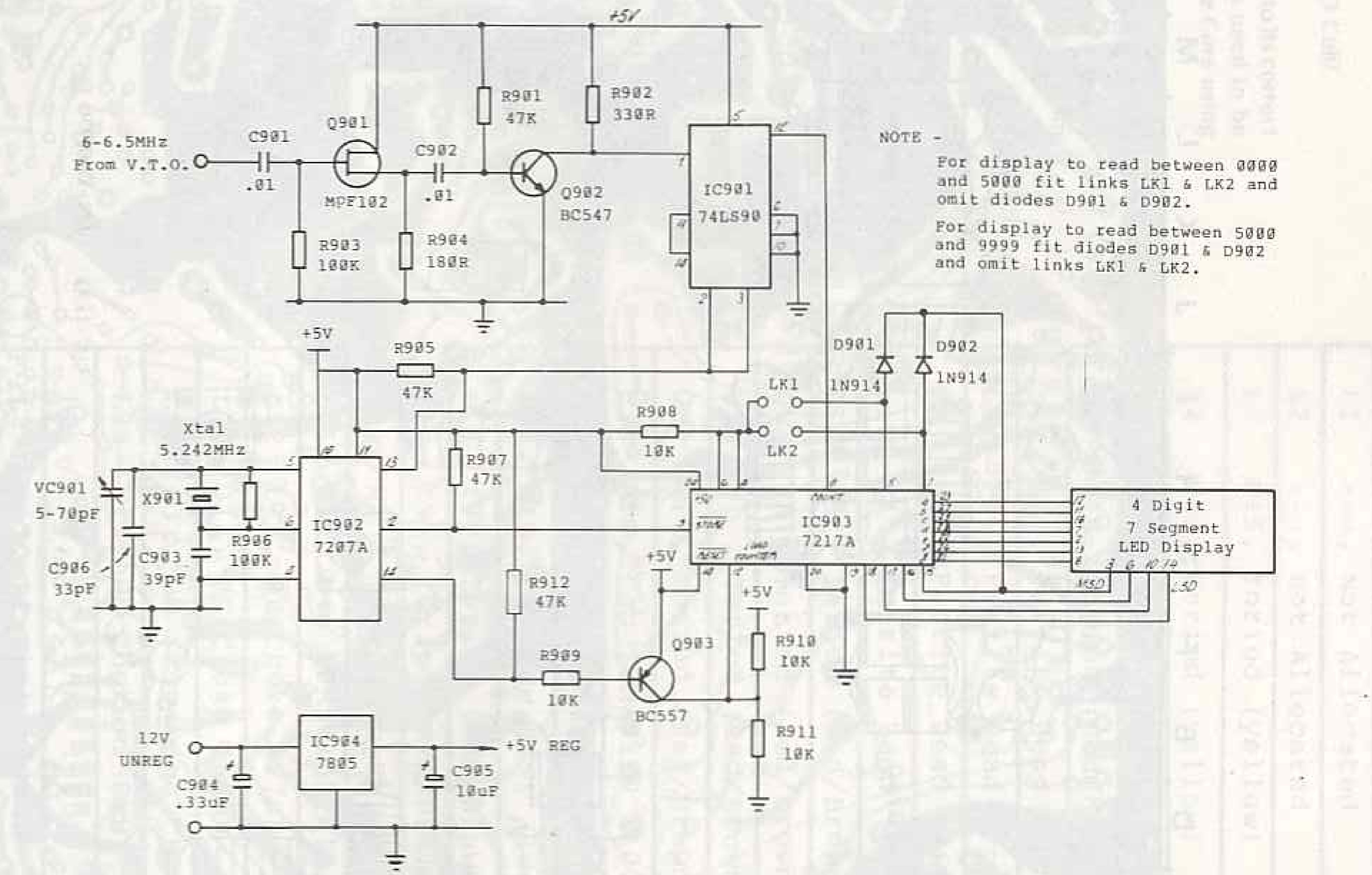
C901	0.01uF	Ceramic	☐
C902	0.01uF	Ceramic	☐
C903	39pF	Ceramic	☐
C904	0.33uF	Tantalum	☐
C905	10uF	Electro	☐
C906	33 pF	Ceramic	☐
VC901	5-70pF	Trimcap	☐

SEMICONDUCTORS

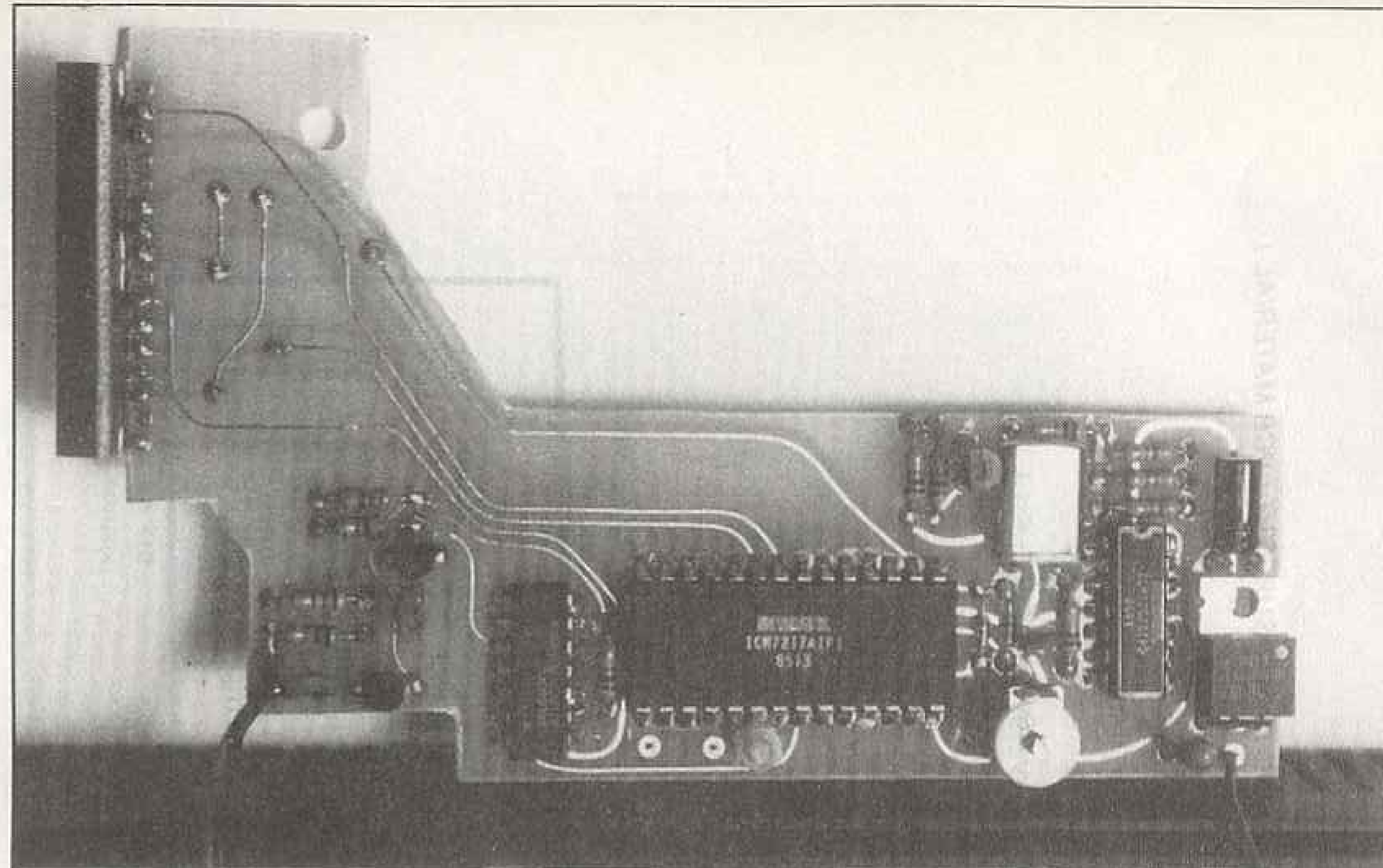
D901	1N914/1N4148	(diode)	☐
D902	1N914/1N4148	(diode)	☐
Q901	MPF102	(transistor)	☐
Q902	BC547	(transistor)	☐
Q903	BC557	(transistor)	☐
IC901	74LS90	(IC)	☐
IC902	7207A	(IC)	☐
IC903	7217A	(IC)	☐
IC904	7805	(volt reg.)	☐
X901	5.242MHz	(xtal)	☐

MISCELLANEOUS

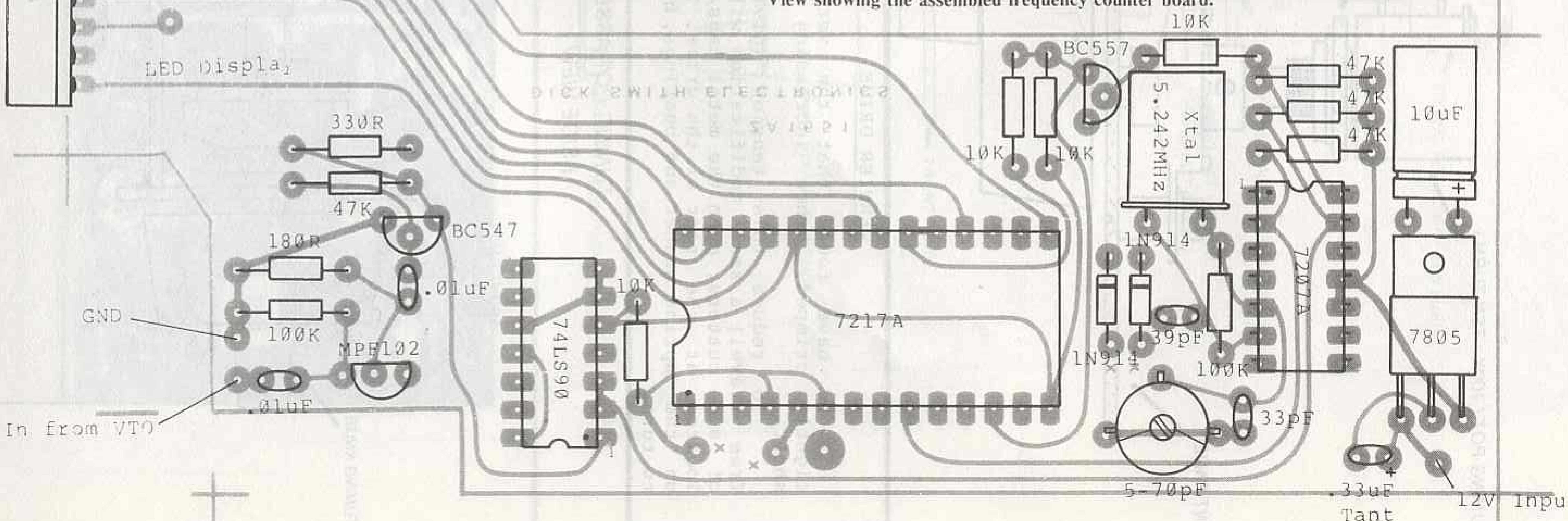
1 x 4 Digit 7 Segment Display....	☐
1 x P.C.B. (suit counter)........	☐
2 x Brass Spacers (6mm)..........	☐
2 x Brass Spacers (25mm tapped)..	☐
2 x Nylon Screw (25mm x 4BA).....	☐
2 x Nylon Screw (12mm x 4BA).....	☐
2 x Nylon Nut (4BA)..............	☐



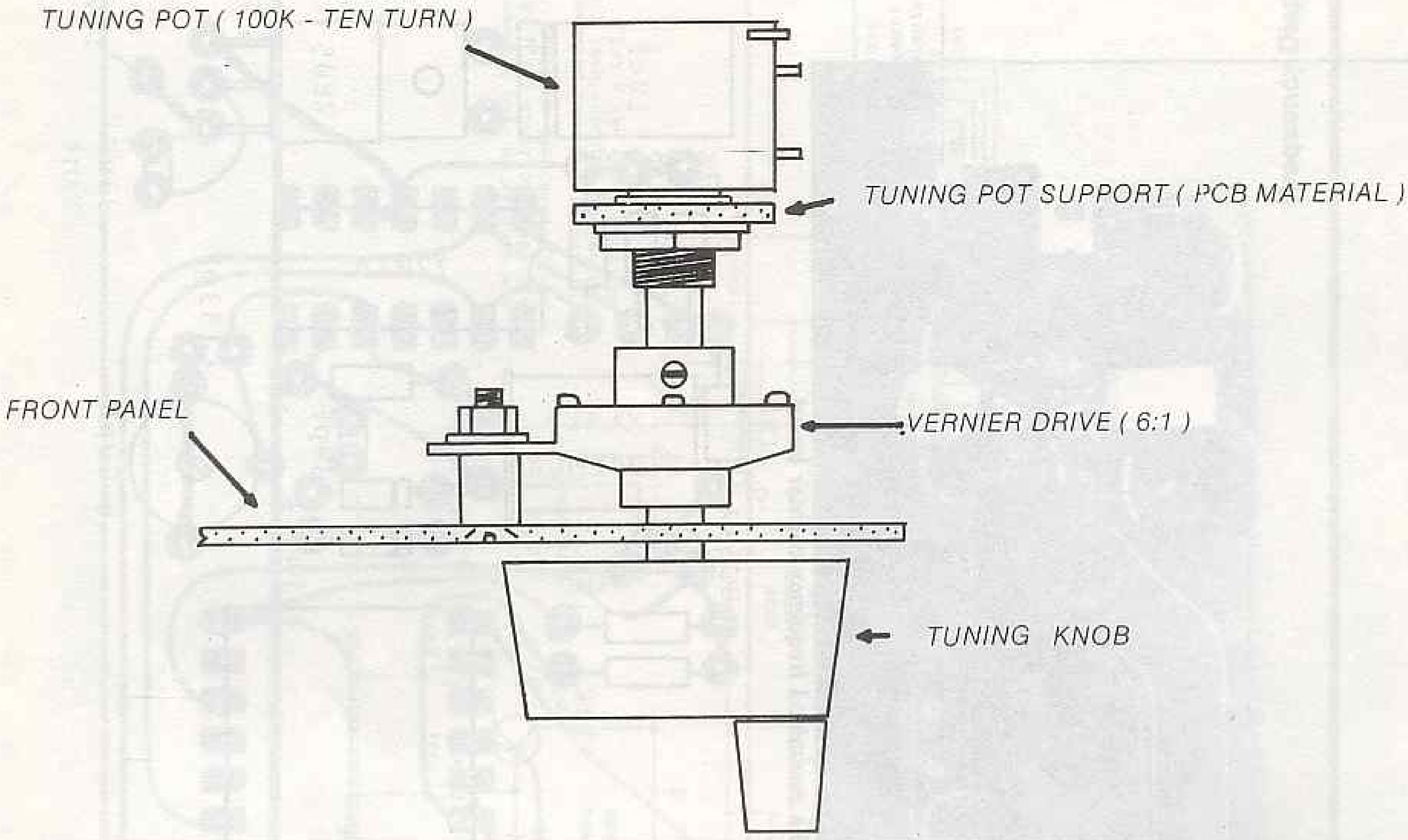
Frequency Display Circuit



View showing the assembled frequency counter board.



TUNING POT ASSEMBLY
(TOP VIEW)

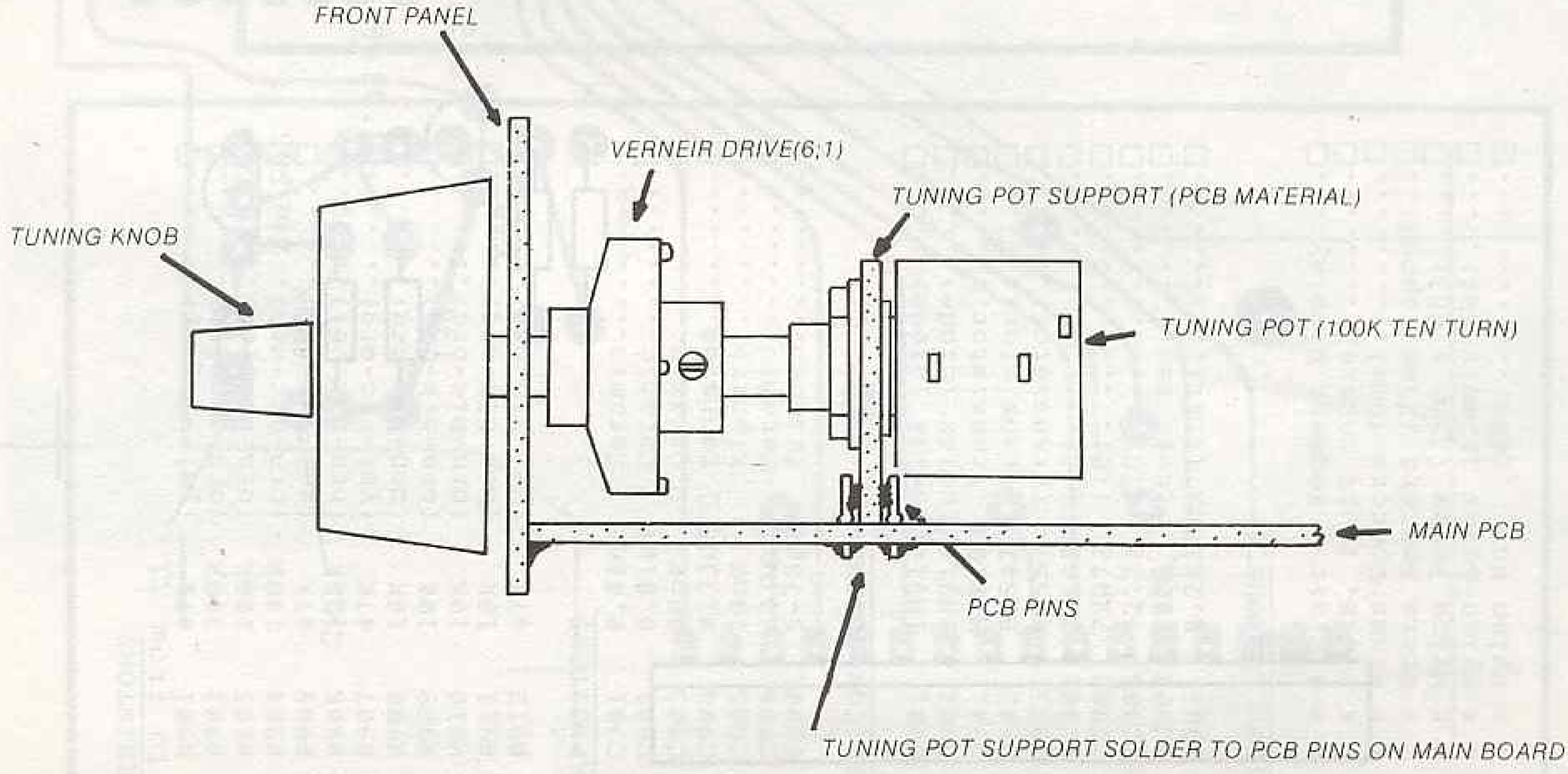


VERNIER DRIVE

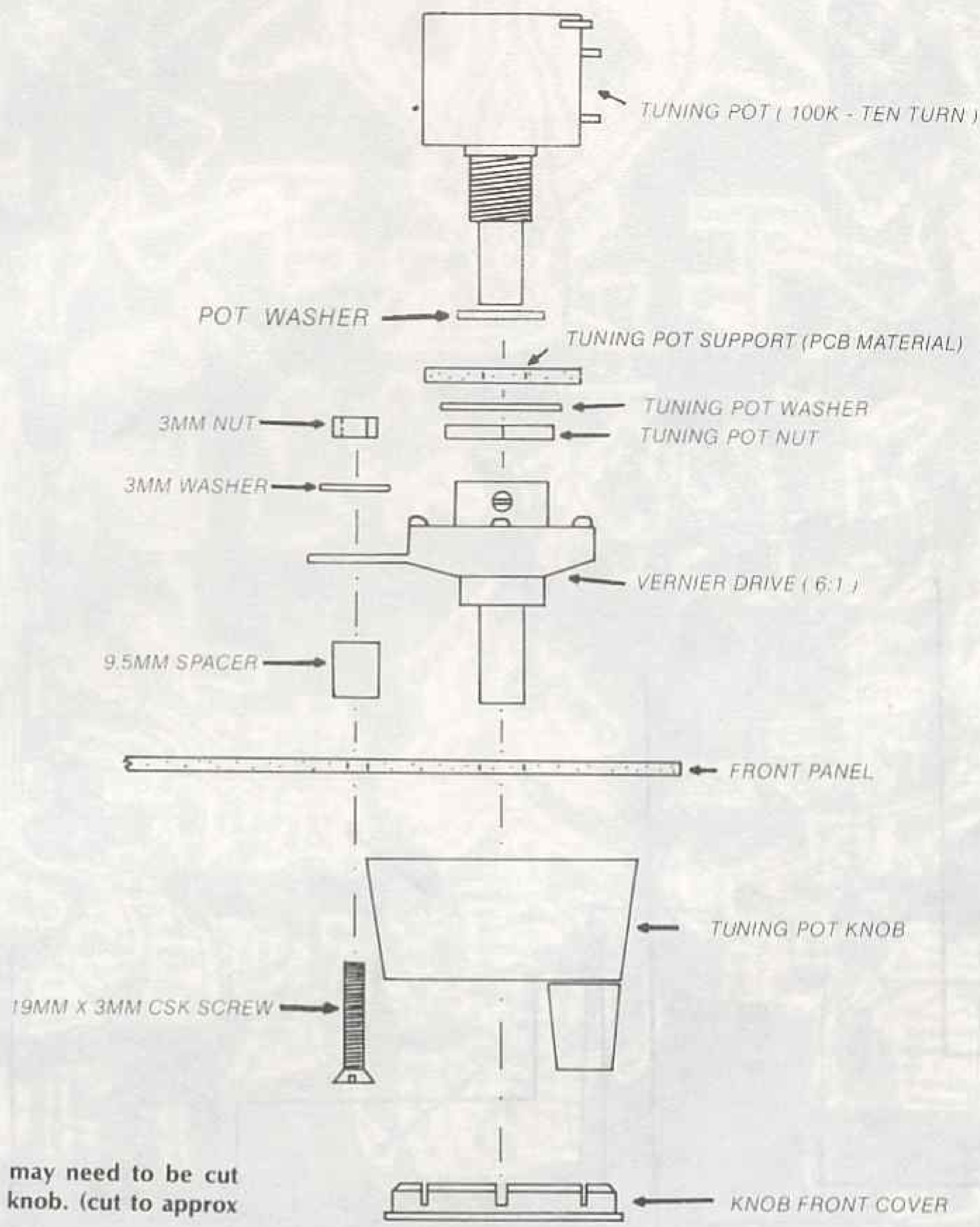
We have found that the vernier drive cases have been tightly crimped, hence increasing the movement tension of the shaft.

To reduce this tension (giving the shaft a little more free travel) a small modification will be required. Using a pair of side cutters, open the metal tabs/claws (a little) which are located at the rear of the drive. This will reduce the tension on the spring washer and bearings, hence making the shaft easier to turn.

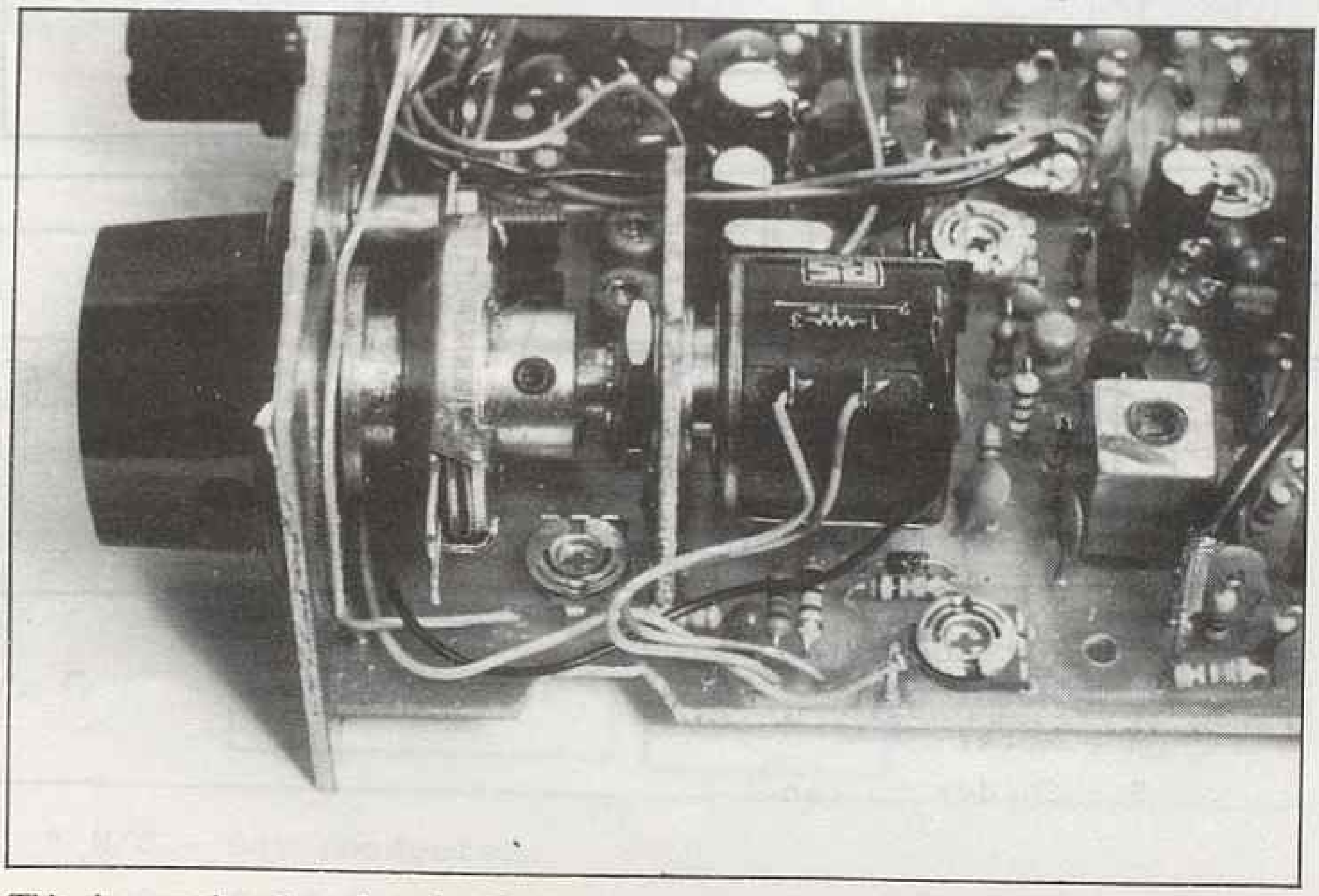
TUNING POT ASSEMBLY
(SIDE VIEW)



TUNING POT ASSEMBLY
(EXPLODED VIEW)

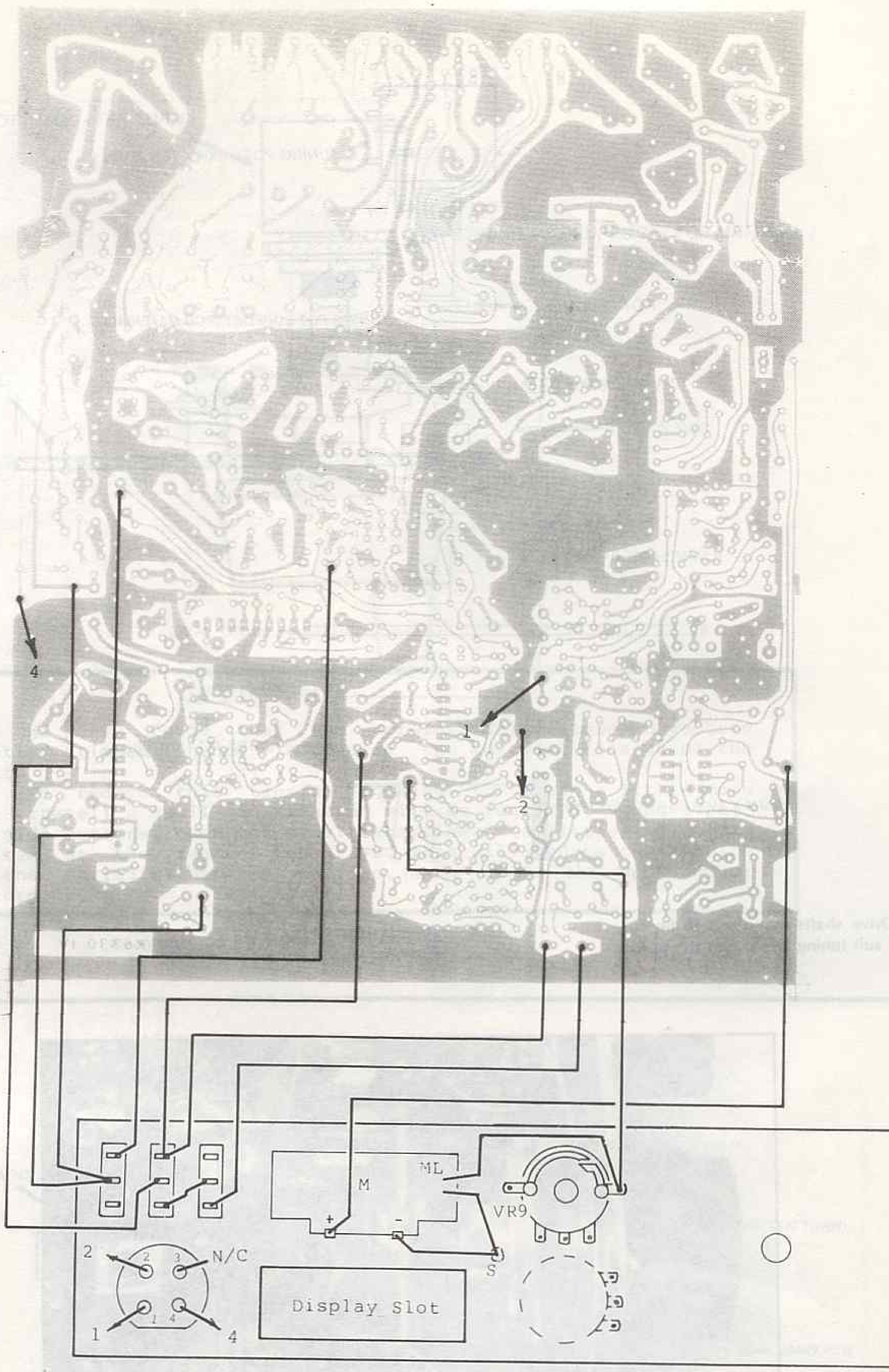


* Vernier Drive shafts may need to be cut shorter to suit tuning knob. (cut to approx 14mm)



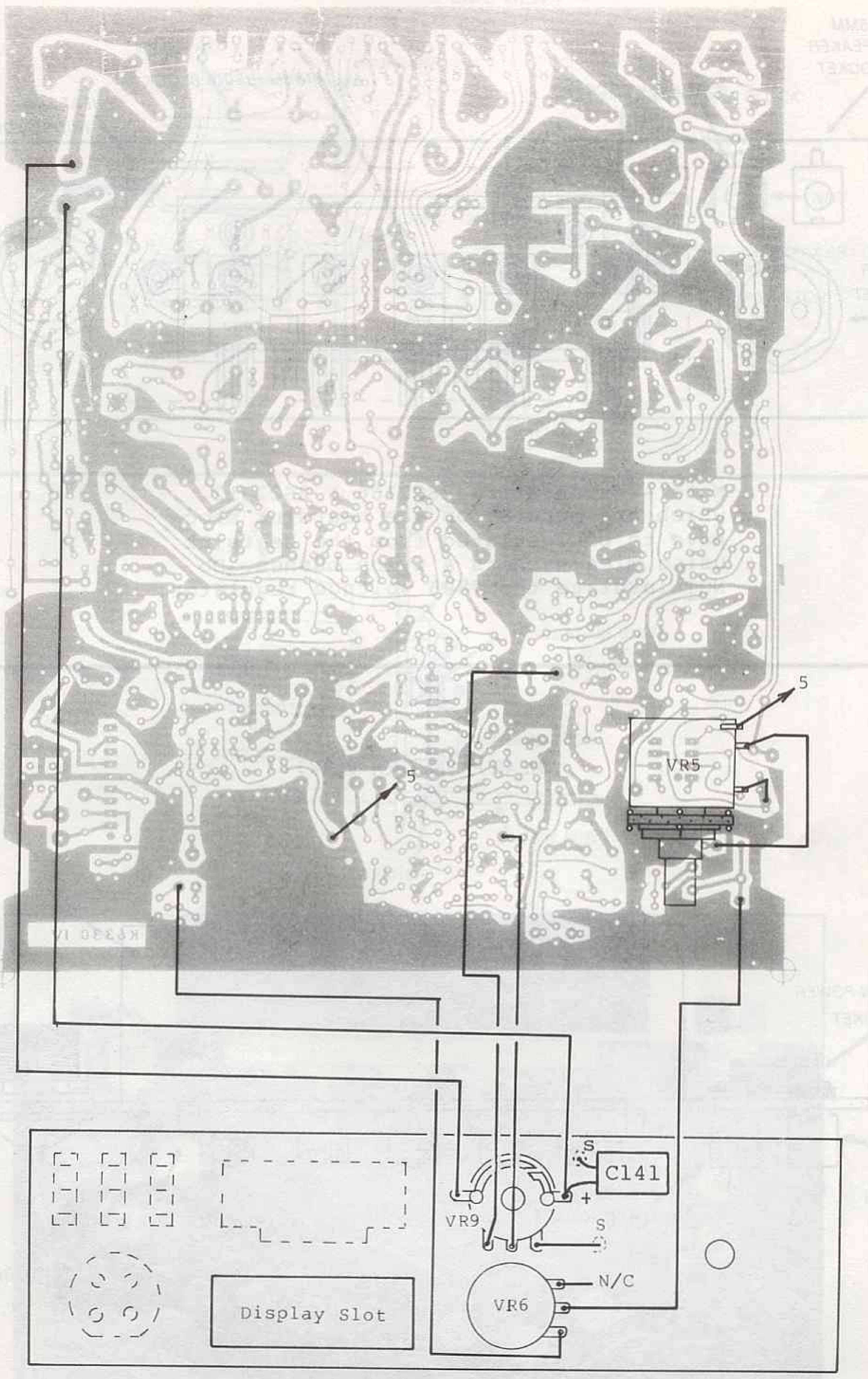
This close-up view shows how the 10-turn tuning pot is mounted.

FRONT PANEL WIRING LAYOUT PART A.



* N/C - Not connected.
ML - Meter Lamp
M - Meter
S - Solder to panel

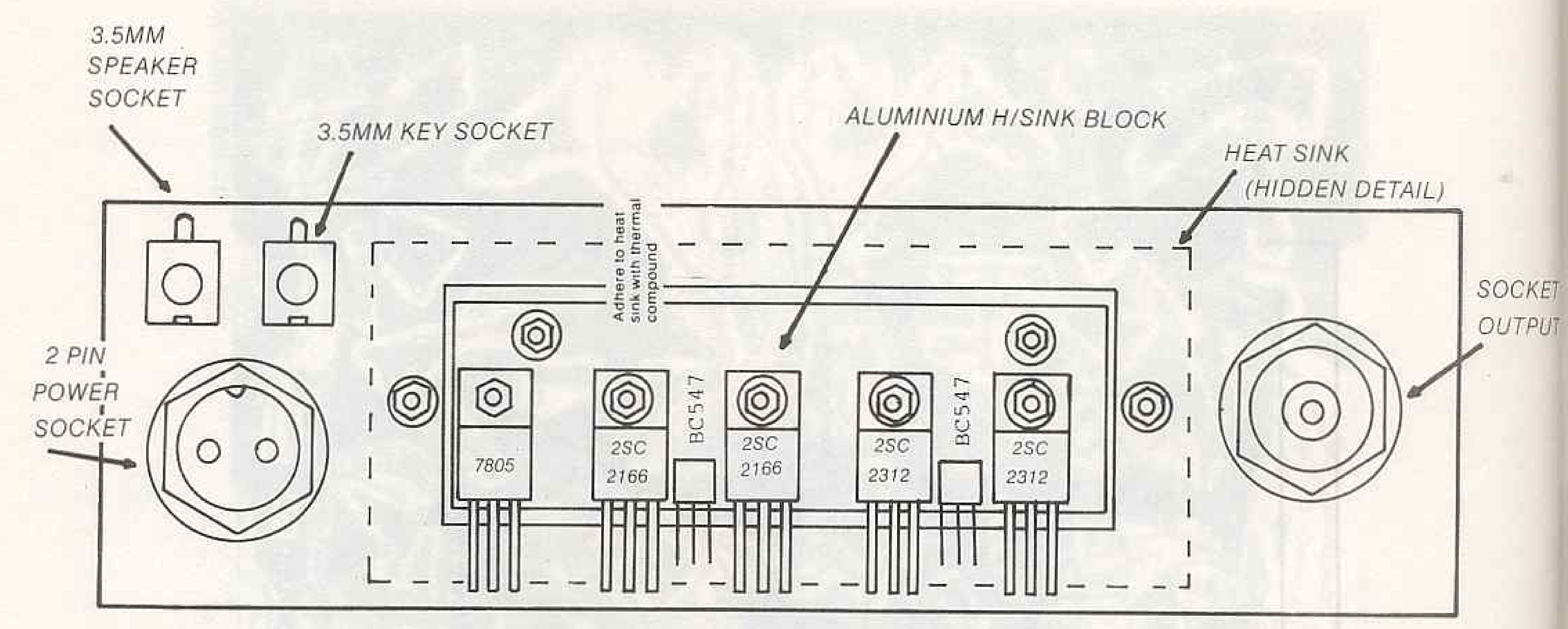
FRONT PANEL WIRING LAYOUT PART B.



* N/C - Not connected.

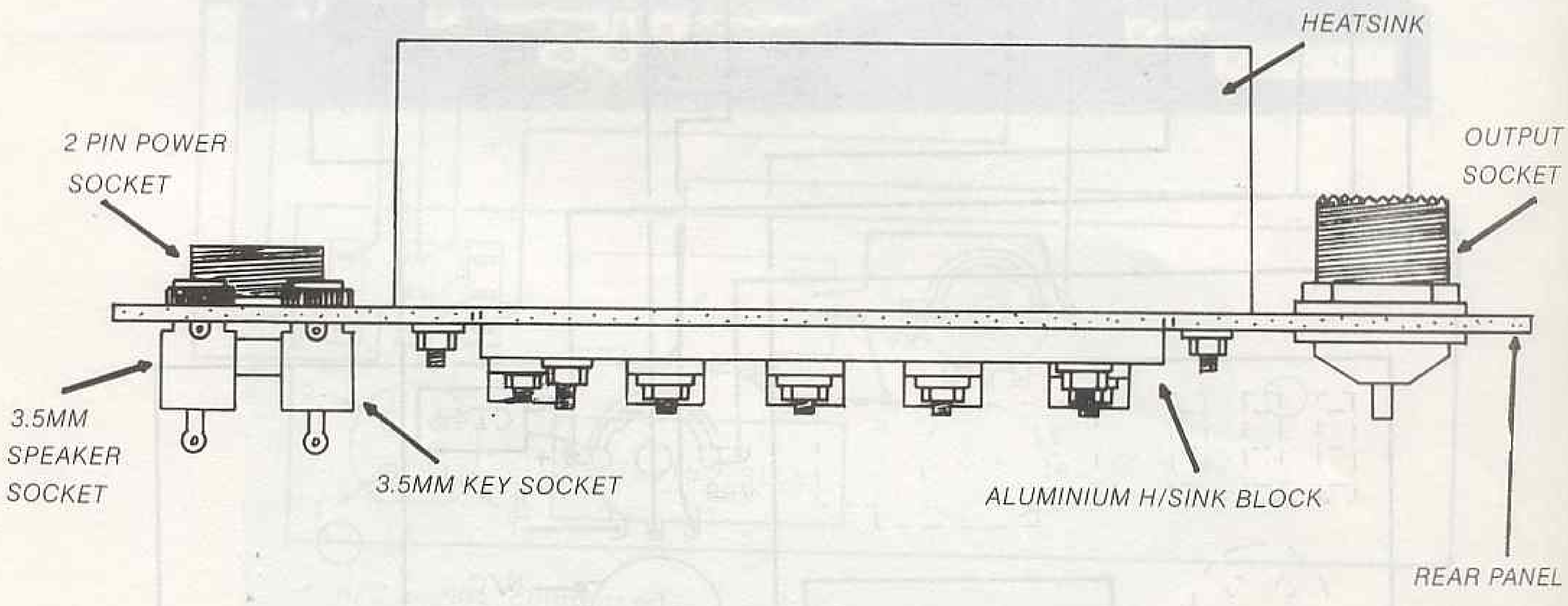
S - Solder to panel

REAR PANEL (INSIDE VIEW)

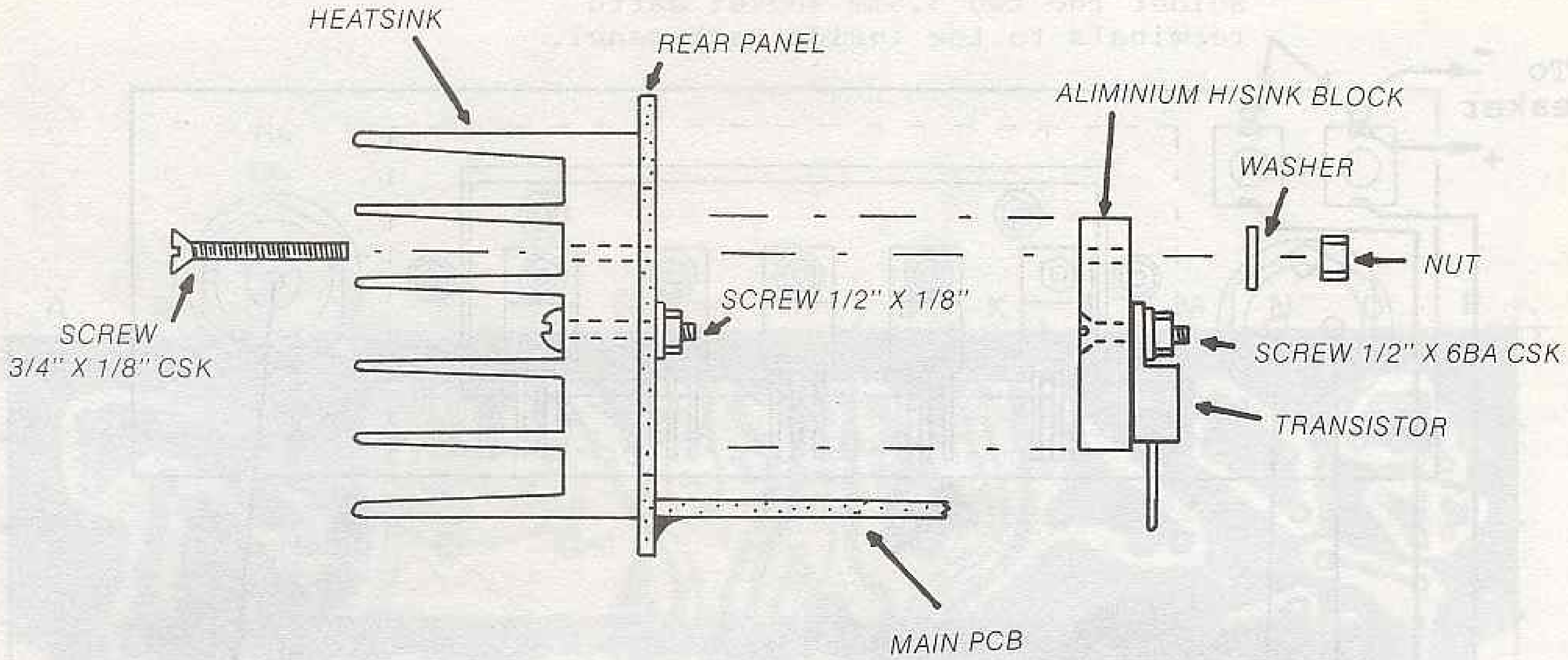


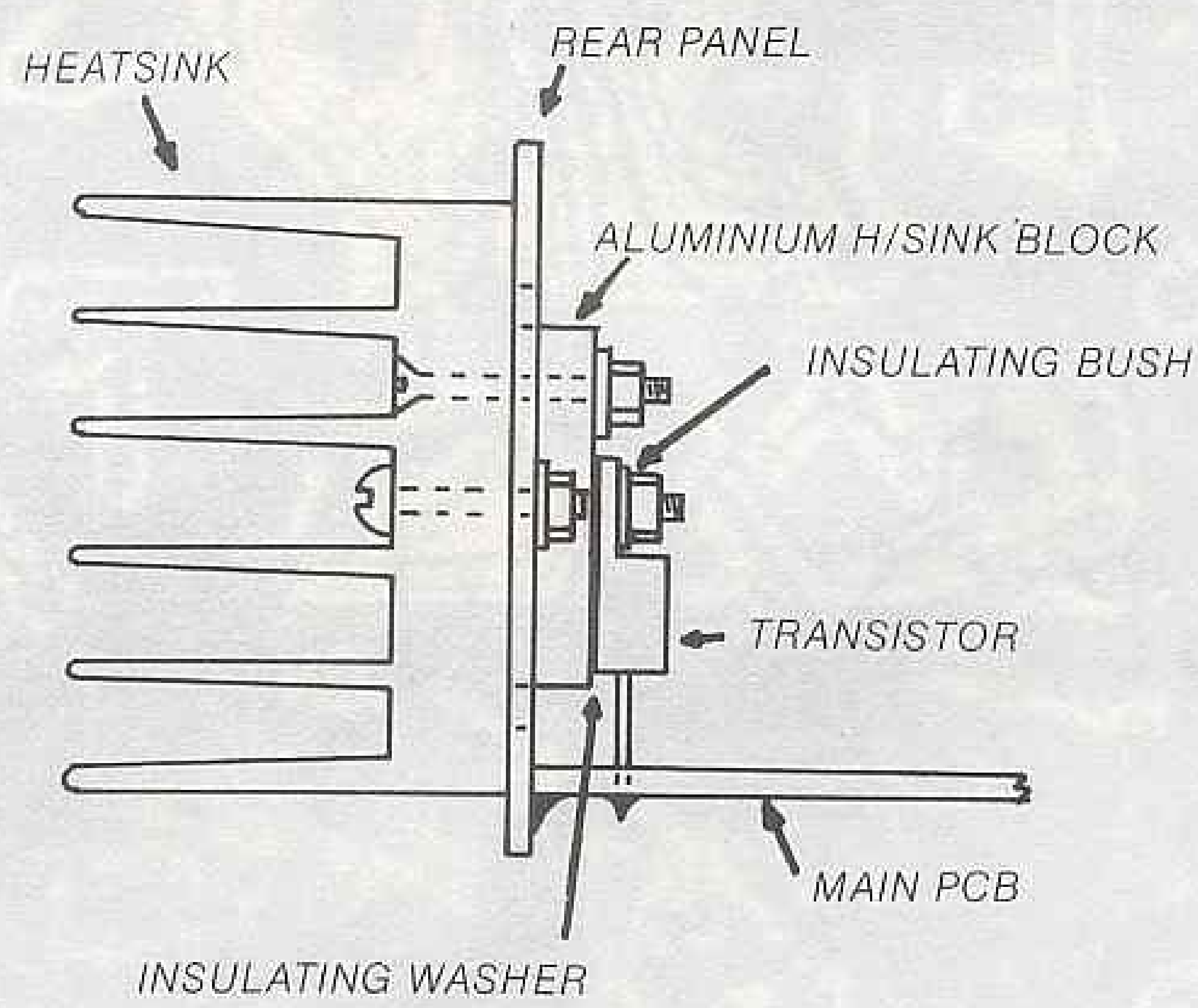
Note - Transistors 2SC2166 & 2SC2312 which are mounted on the heatsink block have to be insulated from the heatsink using mica washers & nylon bushes. Do <u>NOT</u> insulate the 7805 voltage regulator.

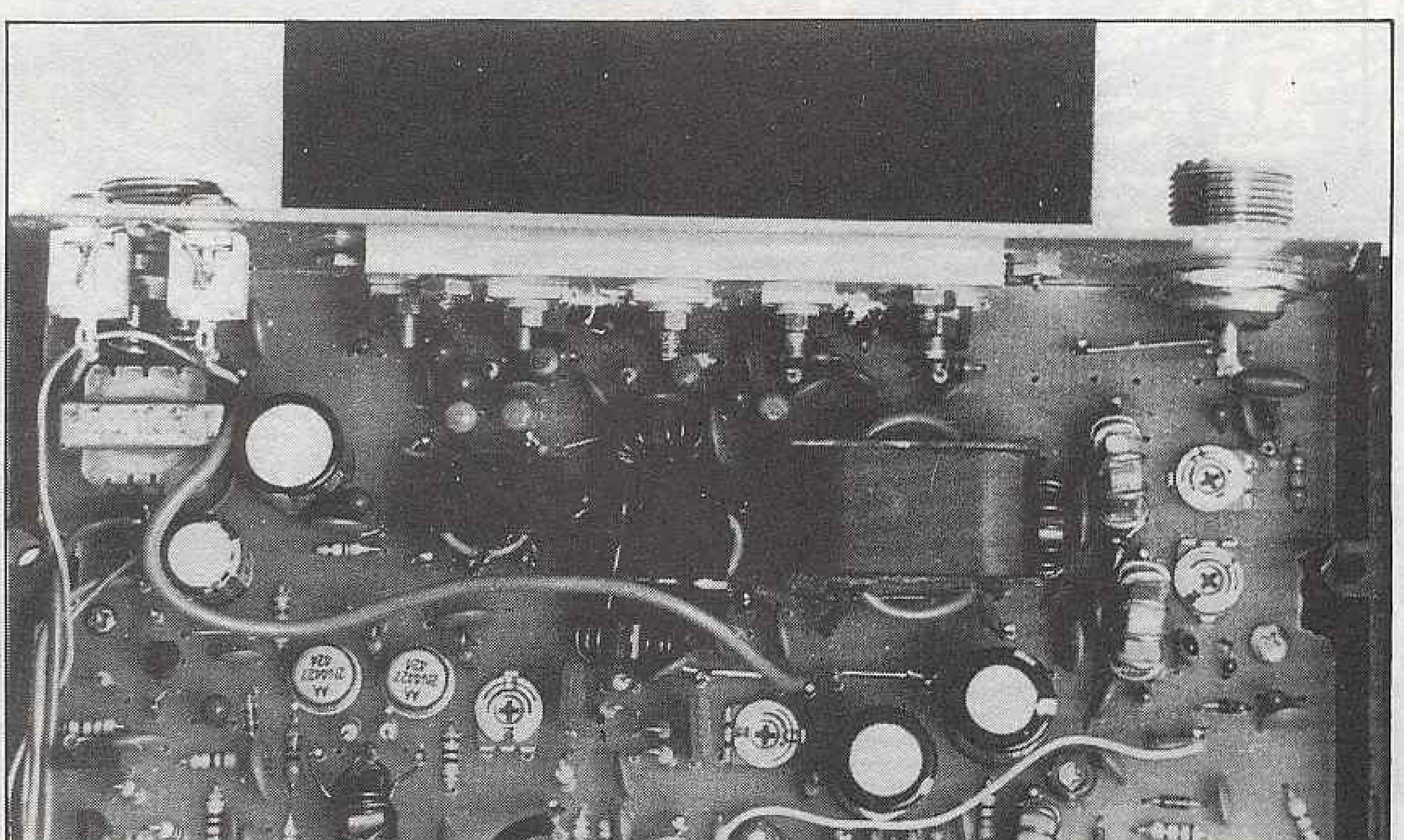
REAR PANEL (TOP VIEW)



TRANSISTOR MOUNTING ON BACK PANEL
(SIDE VIEW)

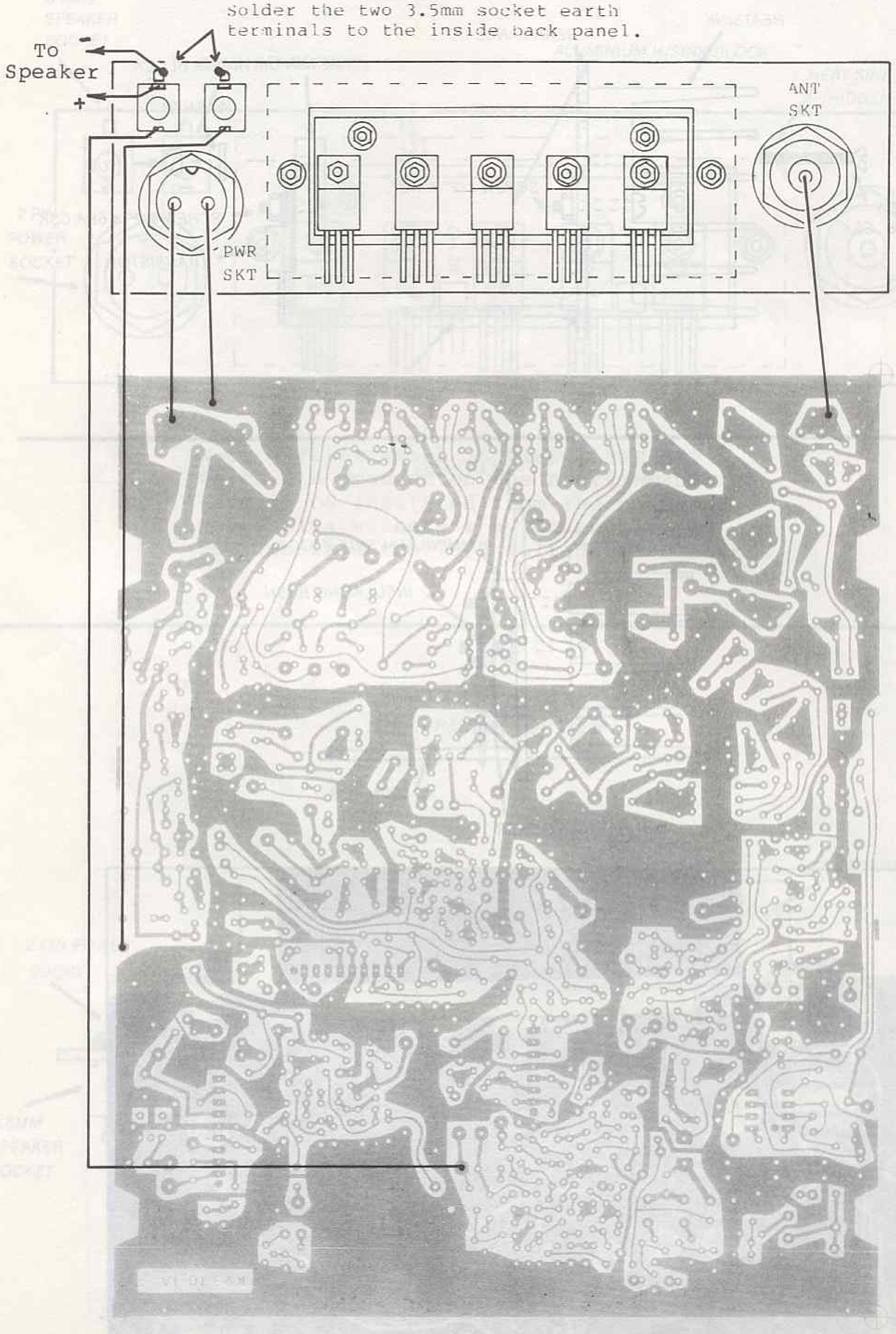






This photo shows the RF output and low pass filter stages.

BACK PANEL WIRING



Note : Speaker is glued to the bottom half of the case.

STEP 21.INSULTATED FLYING LEADS

MOUNTING OF COUNTER BOARD / MODULE.

Below is a diagram showing how the counter printed circuit board is secured to the main transceiver board.

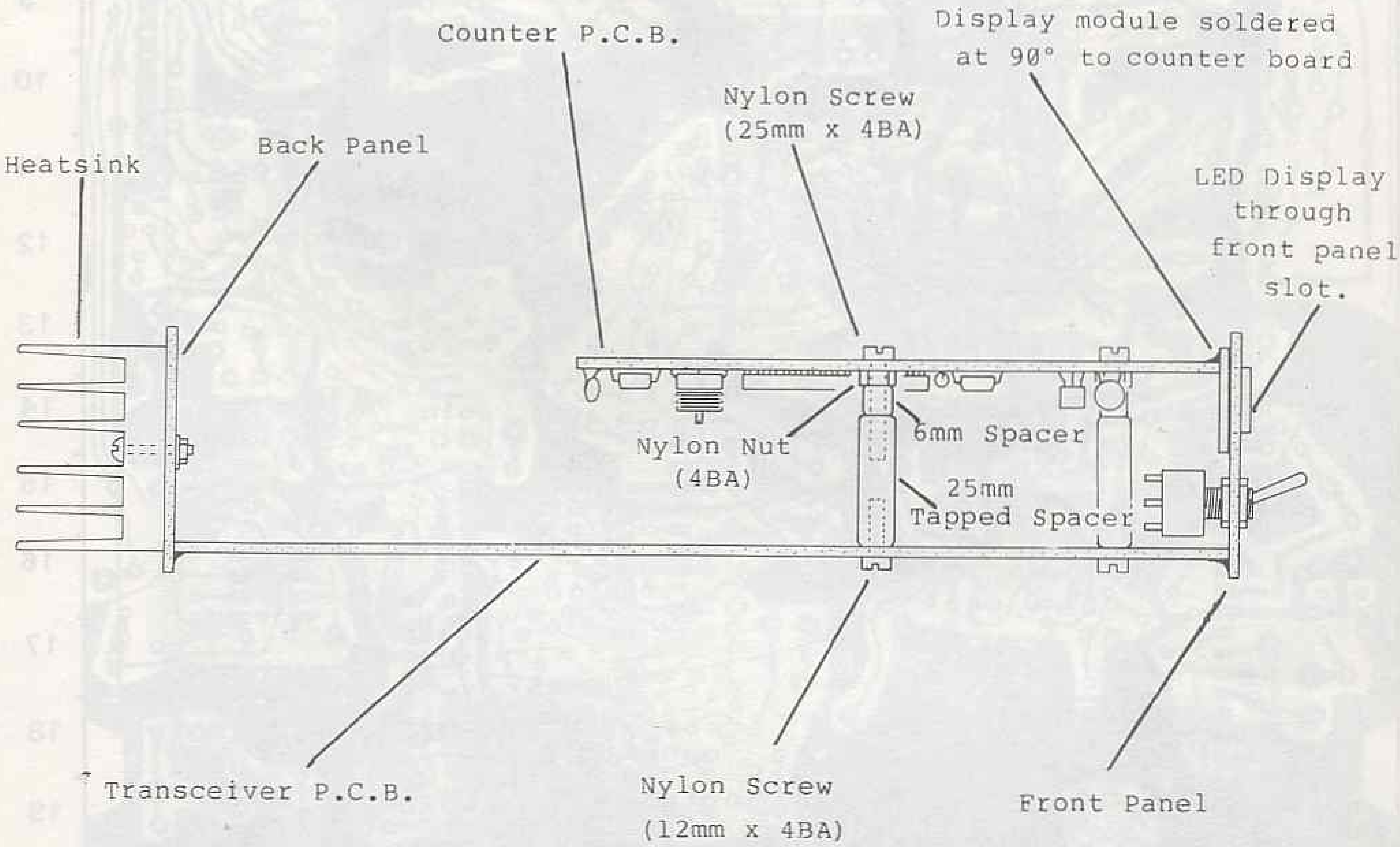
Please note the different length spacers used and their mounting positions between the two boards. Since the mounting holes have been located close to the copper tracking, nylon screws and nuts have been used to insulate the metal spacers from the board.

The display module is soldered at 90 deg. to the counter board so that the LED displays sit vertically and can be slotted through the front panel cut-away.

If the counter printed circuit board is supplied with plated-through holes, please disregard the following two paragraphs as they are not applicable. Note, if the counter printed circuit board is double sided and does not have plated-through holes, it is very important that all components are soldered to both top and bottom sides of the board. At solder pads where components are not located, tinned copper wire can be used to join the two corresponding pads.(ie - feed the tin/cu. wire through the hole and then solder both top and bottom pads.)

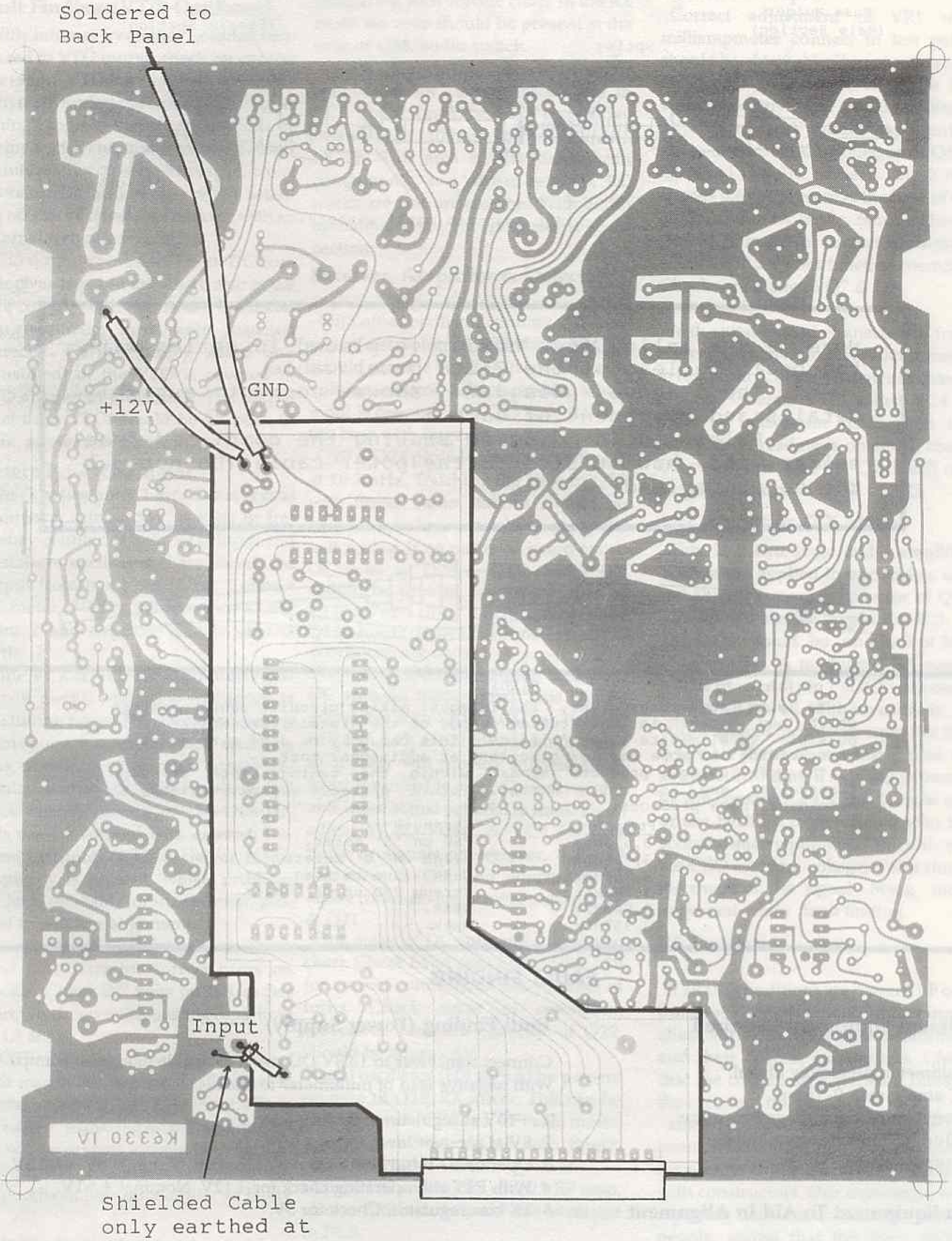
Latter does not apply to the two solder pads located opposite to pin 1 and 4 of IC903 (7217A), as these are only used if you require the display to count from 0000 to 5000.

ie for 7MHz, 14MHz, 28MHz amateur operation etc where the band edge starts at an even megahertz.



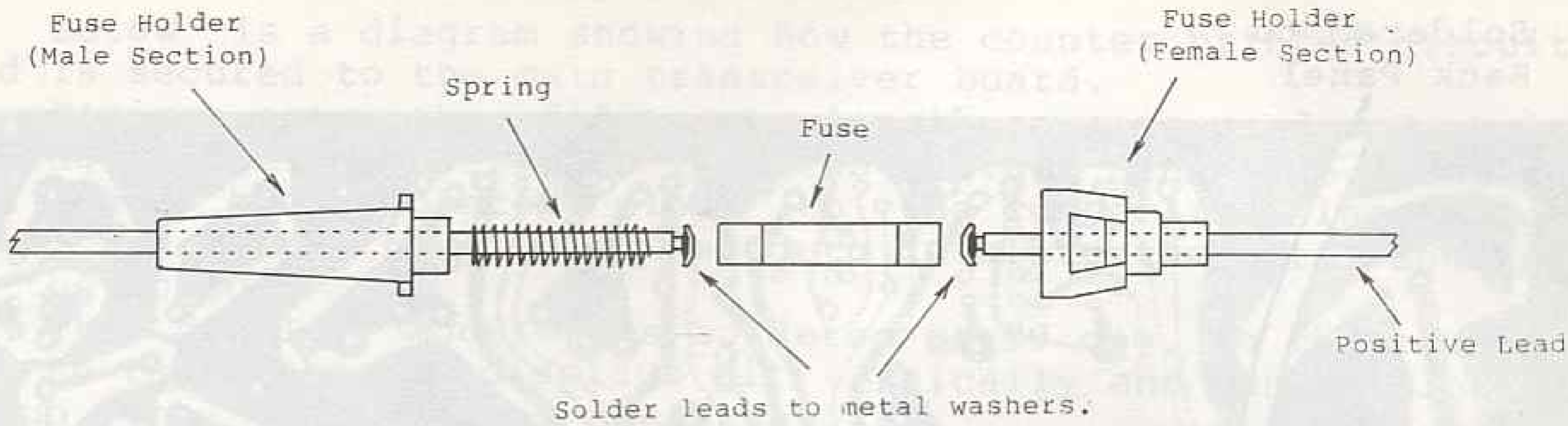
NOTE: You may find that the 25mm nylon screw is a little to long for the tapped spacer. With a pair of side cutters cut the screw shorter (ie. to approx 20mm).

WIRING OF COUNTER BOARD TO THE MAIN PCB.

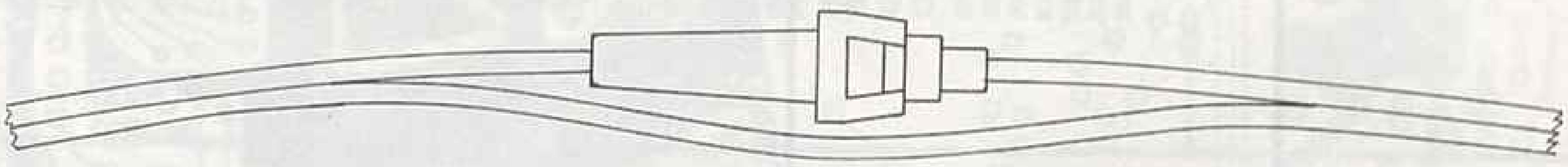


NOTE: Counter PCB super imposed on the main board has been offset to one side only to show wiring connections.

FUSE HOLDER ASSEMBLY



> Note : The inline fuse holder is placed in series with the positive lead of the FIG.8 power cable.
>
> The above diagram shows correct assembly details and placement of each item.
>
> Below is a diagram showing the completed fuse holder and how it sits on the power cable.(Do not cut the negative lead).



BIRDIES

As with any transceiver, the integral mixing circuits cause products which may appear in the tuning range of the transceiver. Whilst it is possible to eliminate these 'birdies', this can only be done with addition of shielding and more complex circuitry at additional cost.

The following products appear within the tuning range of your transceiver and are quite normal. Future upgrades may be available to eliminate these products.

Frequency	Strength
3.553Mhz	FSD on 'S' meter.
3.709Mhz	+10dB on 'S' meter.
3.754Mhz	Weak - due to freq. ctr.
3.795Mhz	Strong FSD on 'S' meter.
3.909Mhz	Weak.
3.957Mhz	Weak.

FAULT FINDING

Minimum Equipment Required

1. Multimeter, preferably digital.
2. DC amp meter, 0-5 amp.
3. Shortwave receiver, general coverage.
4. 100uA DC meter, or multimeter with similar range.

Extra Equipment To Aid In Alignment

1. CRO, bandwith to 15mHz.
2. Frequency counter, up to 50mHz.
3. HF power meter, 2-30mHz, 50w.

Other Equipment, If Available

1. Signal generator.

Fault Finding (Power Supply)

Connect tranceiver to 13.8V DC supply, capable of at least 5 amps. With negative lead of multimeter to chassis, check for:

1. +10V at regulator, tolerance 0.5V +/-
2. 8V at receiver level, 8V +/- 0.5V.
3. Operate PTT and check for +8V transmit. Nominal 8V +/-0.5V.
4. With PTT still operating check for +12V. Nominal +/-1V.
5. TX bias regulator. Check for 5V.

If all these voltages are correct, proceed to next section.

Fault Finding (VTO Regulator)

Note, the 10V regulator must be working in the transceiver for the following checks to be made. Check for DC volts at test point 6, output of IC3 (LM301). This should be nominally 7.3V to 7.5V. Also check volts on cathode of D20, a 6.2V Zener.

This should be nominally 6.2V

Fault Finding (VTO Oscillator)

With internal frequency counter connected to VTO output,check for correct operation. VTO should tune 6-6.5mHz with main tuning pot from one end of its tuning range to the other. This can be verified with communications receiver or internal frequency display. Correct operation can also be checked by listening on a sw receiver, or checking with an external frequency counter.

If no output is present, check DC conditions as listed in DC chart, also make sure correct components are fitted and semiconductors have been installed correctly. Correct tuning range and adjustment of the VTO is covered in VTO alignment previously. The output level from VTO should be 1V peak to peak, as measured on CRO.

Heterodyne Oscillator

Check at test point 1 for correct crystal frequency, using a SW receiver or frequency counter. If both VTO input and crystal are oscillating there should be output from band pass filter. Connect DC meter, 100uA positive lead to test point 2 and negative lead to chassis earth.

Tune VC2 & VC3 for maximum reading on meter, with VTO frequency at half tuning range. The output frequency at this point measured at local oscillator coax, should be VTO plus crystal frequency, nominally 6.25mHz plus 8.192 gives final frequency of 14.4420mHz. This can be verified with external frequency counter or HF recieiver. If this frequency is present, which provides the local oscillator for the receiver, proceed to receiver alignment.

If no output is available then check band pass filter for correct turns on toroids. Check DC volts on IC1 as per chart, check correct resonating capacitors on L3 & L4.

NOTE: No output will occur unless both inputs are present. i.e. 8.192mHz crystal oscillator and VTO input. IC1 is wired as a "summing mixer" and no output will be present without both inputs.

If both VTO and crystal are oscillating, suspect band pass filter tuning or faulty IC.

Fault Finding (Receiver)

Audio:

With volume control fully clockwise, (VR9), touching either end of R105 (3.9K) buzzing should be heard in speaker. If not, check DC voltage at positive end of C140 (220mfd). This should be approximately half supply. Nominally 7V DC with no signal.

Check DC volts on Q40, Q39, Q37, comparing with voltage chart. In the RX mode no volts should be present at the base of Q38, audio switch.

Check component values and semi] conductors for correct installation in PCB. There should be +12V on positive end of C134 (100mfd 16V).

NOTE: This area is very dense with components, and shorts between PC tracks are not uncommon. With audio operating correctly, proceed to next section.

Receiver, Amplifier & Detector

With offset oscillator running, (RF output at test point 8), SSB detector Q25 should provide buzzing in speaker with volume control half clockwise, when input is connected to Q25 base (touching base with finger etc.).

Q23 & Q24 provide most of the IF gain at 10.7mHz. Touching the base of Q23 with finger, radio stations should be heard in speaker with volume at approx half setting. If no output is heard check DC volts on Q23 & Q24. +7.5V DC should be present on positive end of C117 (47mfd 10V). Touching the base of Q12 should deflect the S-meter if all DC conditions are correct.

Test point 7 (AGC) should be 2 volts DC with no input signal. This will be adjustable with VR10 AGC set. Peaking L17, L16, L15, & L21 for maximum noise in speaker will provide suitable alignment for initial testing. Connect a suitable input signal or aerial to transceiver, adjust VC11, VC10, & VC9 for max noise or signals on reciever. If the IF alignment is OK, and adjustment of above trimmers has no effect, check Q18 & Q21.

First measure DC volts and compare to chart. Check band pass filter L18 & L19 for correct connections and number of turns. Check value of resonating capacitors. Measure collector of Q22, should be approx 4V.

Local oscillator (L0) should be present on base of Q18, RX mixer. This can be checked with CRO or RF volt meter. Touching emitter of Q18 with finger, noise should be heard in speaker.

Check DC conditions of Q21 RF amp, also correct installation of this transistor in PCB.

NOTE: Ferrite bead is fitted to the base lead.

HF Alignment- Transmitter Section

For TX to operate it will be assumed that the RX sections are OK, as some of these are common to the transmitter circuits.

Transmitter Adjustment-RF Driver & Output

Correct adjustment of VR1 with milliampmeter connect to test point, should be obtainable. If no current reading occurs on transmit, check for DC volts at positive end of C34 (100mfd 3V). Approx 0.6V should be present.

Also check that the collector of Q5 & Q6 has 13.8V DC present. Check that approx 0.6V is present at the base of Q5 & Q6 in the TX mode. Similar checks should be made for correct adjustment of VR2 if it does not function correctly. Checks are made to Q7 & Q8 respectively.

With suitable load connected to tranceiver select CW. Connect 100uA meter to test point 3, negative meter to chassis ground. Operate PTT, adjust VC4 & VC5, for maximum reading on the meter. If no reading is obtained, check DC conditions of FET Q1. If still no output, check conditions on IC2.

Mic Amplifier (TX Mode)

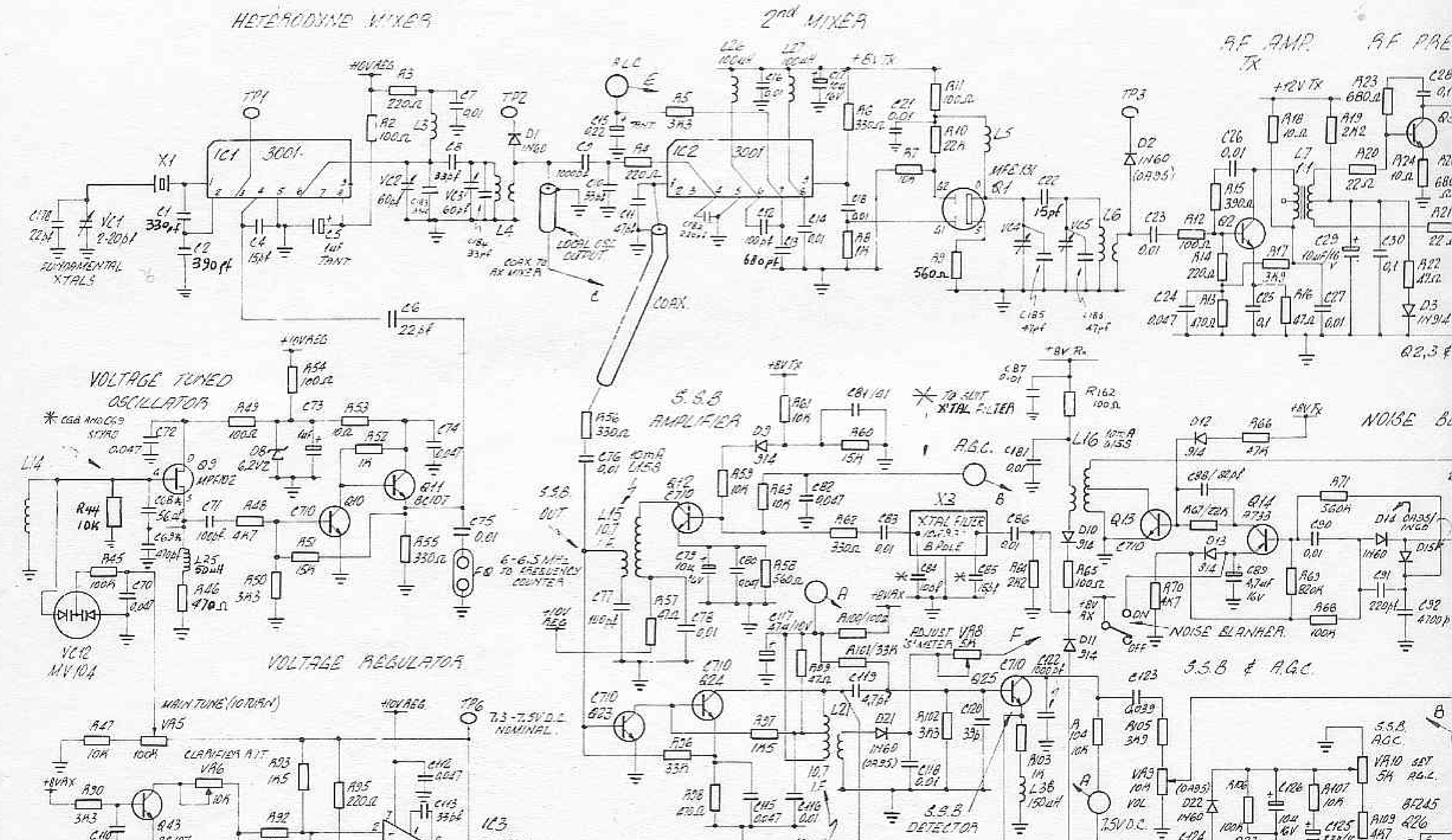
This is a two stage audio amplifier. With audio applied to mic socket, output should appear at collector of Q33. This should also be on pin 1 of IC5.

RF level should be on pin 3 of IC5, (10.693mHz). A modulated RF output will be present at pin 7 of IC5 with audio input if all is well. With no audio in, no output should be present at pin 7 of IC5. A CRO is the best test instrument for above fault finding, if no CRO is owned by the constructor try to borrow one or use facilities from a friend who has access to such equipment. Not only can the CRO measure voltage, it also shows the shape of the signal being more important when fault finding.

RF Output

If all DC conditions are correct, RF output should be present. With no output, check wiring of interstage transformers and their correct connections. Check that the correct capacitors are fitted to the coils and filters.

Make sure that the enamel wire has been cleaned thoroughly on the transformers, as this is a very common fault with constructors. Our experience with repairing kits contructed by various people, shows that the most simple faults stops them from working. Most common faults are solder bridges or tracks across IC's or transistors. Incorrect insertion of components into PCB. Very rarely are the components at fault, it is most likely that there has been a mistake in the construction of a particular area.


HETERODYNE MIXER
2nd MIXER
R.F. AMP. TX
VOLTAGE TUNED OSCILLATOR
S.S.B. AMPLIFIER
A.G.C.
XTAL FILTER
NOISE BLANKER
S.S.B. & A.G.C.
S.S.B. DETECTOR
VOLTAGE REGULATOR
LM301
POWER SUPPLY
DC INPUT SK2
MIC. AMP.
BALANCED MODULATOR
CARRIER BALANCE
MIC SOCKET SK3
KEY J2
MAIN TUNE (10 TURN)
CLARIFIER R.I.T.
SET TX FR
6-6.5 MHz TO FREQUENCY COUNTER
COAX TO RX MIXER
LOCAL OSC OUTPUT
FUNDAMENTAL XTALS
SW1 ON VA9 ON VOLUME CONTROL
7.3-7.5V D.C. NOMINAL
+5V BIAS REG. TX.

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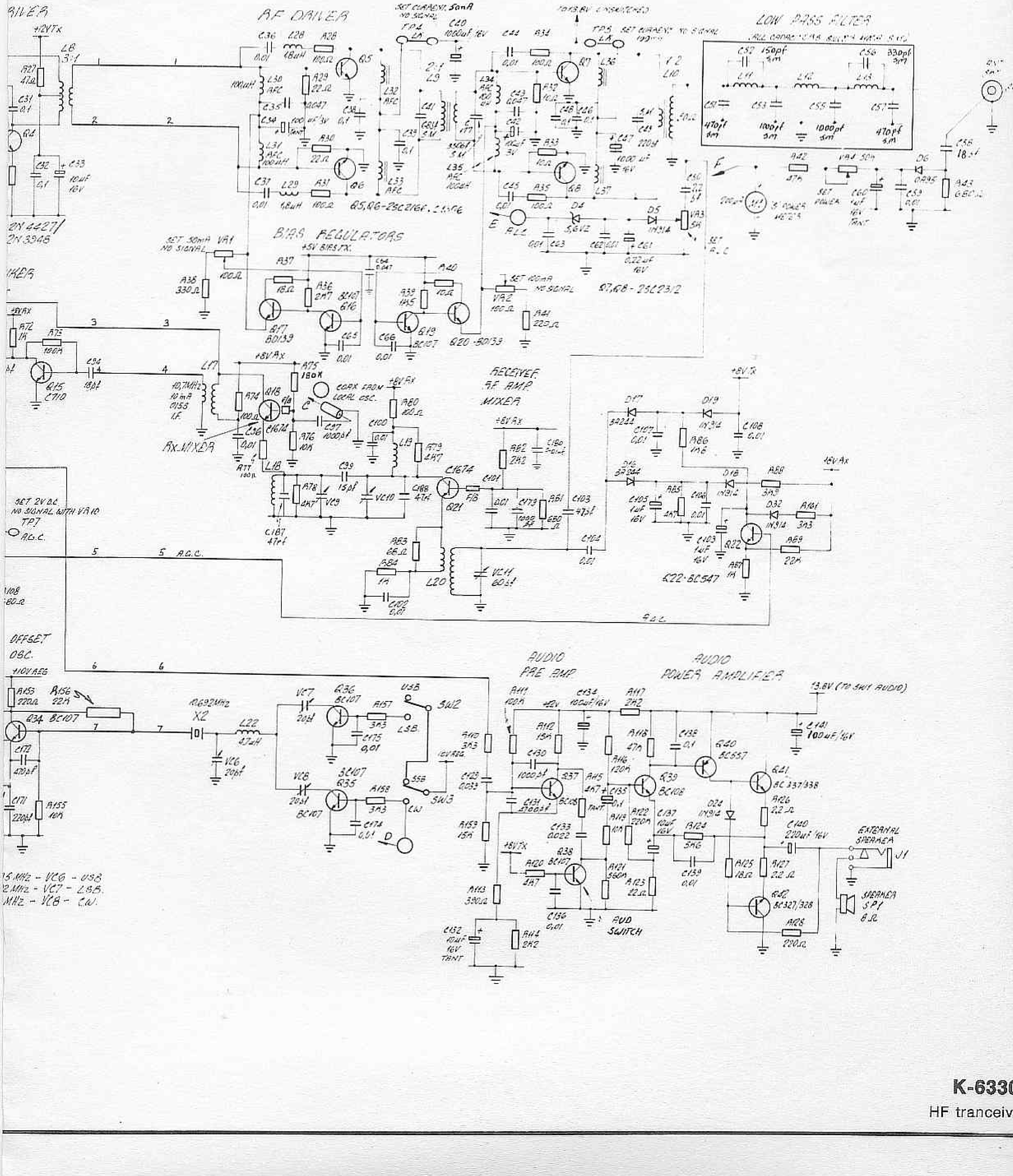

K-6330

HF tranceiver