Service Manual

Pye Telecommunications Ltd

VHF FM Base Station
Type F494

Publication Ref No. TP101

This service manual is for the maintenance of Pye Telecommunications equipment.
The performance figures quoted are typical and are subject to normal manufacturing and service tolerances.

The right is reserved to alter the equipment described in the manual in the light of future technical development

WARNING

Certain semiconductor devices used in this equipment contain Beryllium Oxide. If inhaled, dust from this oxide can be toxic.

No danger can arise from normal handling but no attempt should be made to tamper with these devices.

They should not be discarded with industrial or domestic waste.

WARNING

This equipment has been designed to meet relevant safety requirements.

If it is necessary to replace any safety conscious component (refer to components marked thus (⚠) in Parts List in this manual) the quoted item must be fitted. Ensure that these components are securely fastened and that all insulators or covers are fitted after servicing. Check that all warning labels are in place.

If any rewiring of the mains input supply cables is necessary the specified type must be used and alternations to the routeing or connections must not be made.

PYE
VHF FM BASE STATION
TYPE F494
SERVICE MANUAL
ISSUE 1 JANUARY 1983

PYE TELECOMMUNICATIONS LIMITED CAMBRIDGE ENGLAND
Printed in England

TP101

AMENDMENT LIST

Changes made to the equipment described in this manual are published as amendments which are dated and consecutively numbered.

Reprints of the manual will incorporate all the amendments to date and an entry to this effect will be recorded on the amendment list below. Each page affected by amendment action will bear the amendment number as a suffix to the manual reference number e.g. TP123/4 indicates that the page has been corrected by amendment number 4.

Should it be necessary to raise the issue of a manual the amendment numbering will recommence with No. 1.

Amend't No.	Date	Initials	Remarks

ERRORS & OMISSIONS

The usefulness of this Service Manual depends upon its accuracy. Whilst every endeavour has been made to minimise errors, some may exist. It is therefore requested that any errors or omissions noted be advised as follows:

Please quote:

a) Title of manual
b) TP No. and Issue No.
c) Last amendment No. received
d) Page and/or Fig. No. in error

Please send to:

Pye Telecommunications Ltd.
Publications Dept.
Mariners Way
Cambridge CB4 1BN
England

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BASE STATION

SECTION 1
GENERAL INFORMATION

SUMMARY OF DATA

General

Operation	Single or two frequency simplex, duplex or repeater (talkthrough) depending on control option.
Modulation	Phase modulation
Frequency	A0 Band 148–174 MHz B0 Band 132–156 MHz E0 Band 68– 88 MHz
Channel Spacing	12,5 kHz (S) 20 kHz (R) 25 kHz (V)
No. of Channels	Single or up to 6
Operating Temperature Range	From –30°C to +60°C ambient
Frequency Stability	Better than: ±5ppm between –10°C and +60°C ±5ppm between –30°C and +60°C ±2ppm between –10°C and +60°C using temperature compensated crystal oscillator. (Single channel version only)
Power Supply Requirements	(i) 115,220,240V AC ±10% at 40–60 Hz with +24V DC standby facility, negative ground. (ii) 115,220,240V AC ±10% at 40–60 Hz with +12V DC standby facility, negative ground. (iii) 18–28V DC, negative ground

Power Consumption	Supply	Receive	Transmit
	AC	10VA	160VA (at 25W output)

Dimensions	Width	Height	Depth
	465mm (18,3 in)	410mm (16,1 in)	95mm (3,7 in)

Weight	11 kg (24 lb)
Indicators	POWER ON – Green

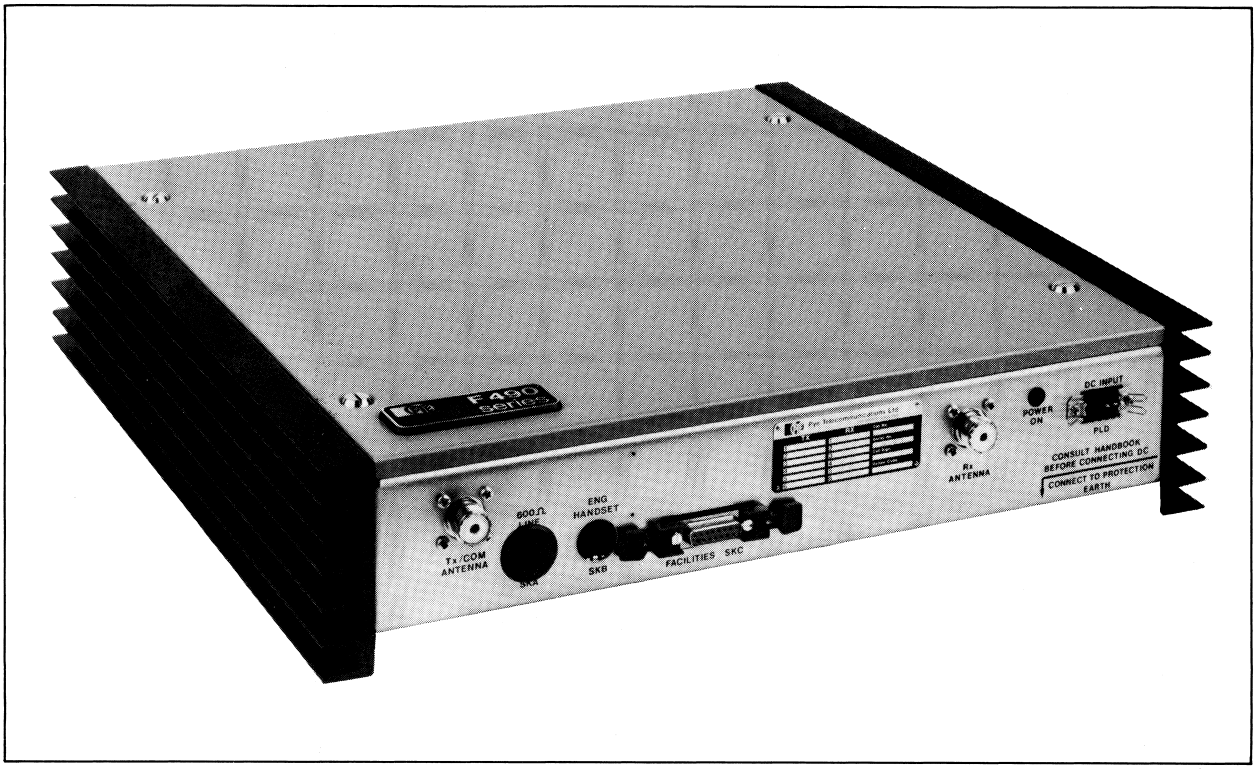
Transmitter

Power Output	Continuously adjustable from 6W to 25W
Output Impedence	50 ohms (nominal)
Spurious Outputs	Less than 0,25μW
Modulation Response	+1 db to –3 db from 300 Hz to 3 kHz, relative to 1 kHz and 6 db/octave pre-emphasis characteristic
Modulation Deviation	Less than: ±2,5 kHz peak (12,5 kHz channel spacing) ±4 kHz peak (20 kHz channel spacing) ±5 kHz peak (25 kHz channel spacing)

Modulation Distortion	Less than 3% (at 60% system deviation with 1 kHz)	
Modulation Sensitivity	600 ohm input:	Preset adjustable from −37 dbm to 0 dbm (for (60% system deviation with 1 kHz)
	Engineers Handset:	Preset adjustable from 2mV to 25mV.
Hum and Noise	Better than −55 db, relative to 3 kHz deviation	
Duty Cycle	Continuous up to +40°C	
Rise Time	Less than 30mS (Dependant on control module fitted).	

Receiver

Sensitivity	12db SINAD for less than 0,35μV (PD) signal input	
Input Impedance	50 ohms (nominal)	
Selectivity	Better than 100 db	
Spurious Response Attenuation	Better than 85 db	
Intermodulation Attenuation	Better than 80 db	
Audio Output	600 Ohm output:	Preset adjustable from −15 dbm to 0 dbm with less than 5% distortion for 60% system deviation at 1 kHz).
	Engineers Handset:	Adjustable, up to 1mW into 300 ohms
Audio Response	+1 db to −3 db from 300 Hz to 3 kHz, relative to 1 kHz and 6 db/octave de-emphasis characteristic	
Squelch Sensitivity	Preset adjustable between 0,3μV and 0,6μV (PD)	
Switching Bandwidth	±0,2% of the mean frequency between the lowest and highest switched channels.	



INTRODUCTION

The F494 is a remotely controlled VHF FM link/base station which may be fitted for single channel or multi-channel (up to 6 channels) operation. The transmitter delivers a nominal power output of 25 watts but, this is continuously adjustable down to 6 watts.

The equipment may be operated from standard AC supplies and has provision for a standby DC supply that is automatically selected in the event of a mains power failure; the standby DC supply may be +12V or +24V. A version of the equipment which operates solely from a +24 DC supply is also available.

The unit is of rugged and modular construction and has been designed to be mounted vertically on a wall using the cradle provided.

Maintenance and servicing are made simply by the liberal provision of test points. For test purposes provision is made for an engineers handset to be connected to the equipment.

A number of control module options are available with this base station enabling it to be used with a variety of Pye Controllers.

OPTIONS

Equipment Label

The sub-assemblies fitted to an equipment will vary according to the role in which it is used. the complement of sub-assemblies for any particular equipment is indicated by a code number shown on the equipment label (together with catalogue and serial numbers) attached to the unit.

A typical equipment number is shown below:

F494	01	1	2	2	0	0	R	A0	A0	6	22	30
Catalogue Number	Market Code	RF Power Output	Power Supply	Antenna	No of Xtalled Chans	Not Used	Channel Spacing	Tx Band	Rx Band	No of Chans	Control	Ancillaries

Frequency Label

The transceiver frequencies, when known, are shown on the frequency label attached to the unit.

Should the equipment be supplied less crystals, reference should be made to CRYSTAL INFORMATION in Section 2.

Market Code

01	Standard Production	02	France	06	Denmark
07	Sweden	25	Austria		

Power Output

1	25 Watts (Standard setting for all high power equipments, less crystals)
2	15 Watts
3	10 Watts
4	6 Watts

Power Supply

1	AC mains with 24V DC Standby, negative ground
2	AC Mains with 12V DC Standby, negative ground
3	24V DC, negative ground

Antenna

1	Two Antennae or Duplexer Working (Duplxer ordered separately)
2	Single Antenna Working with Antenna Changeover Relay (Control options 11,21 & 41 only).

No. of Xtalled Channels

0	Less Crystals
1-6	No. of Crystalled Channels

Channel Spacing

S	12,5 kHz
R	20 kHz
V	25 kHz

Tx Band

A0	148–174 MHz
B0	132–156 MHz
E0	68– 88 MHz

Rx Band

A0	148–174 MHz
B0	132–156 MHz
E0	68– 88 MHz

No. of Channels

1	Single Channel	
6	Fitted for up to Six Channels (Systems Only)	
U	Single Channel	} Using Temperature
V	Fitted for up to Six Channels (Systems Only)	} Compensated Crystals

Control

Special Applications

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21 Tx/Rx–Type 1 Line Switching
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34 Control Unit for M80 series Control Tx/Rx+T/T+SQD–Duplex 4 wire (Systems Only)
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Repeater Stations

51 Free Running Repeater Station
57 CTCSS Controlled Repeater Station

Ancillaries

00 Less Options
01 TE1 (CTCSS Encoder Only Module) fitted
02 TED1 (CTCSS Decoder Only Module) fitted
03 TE1 & TED1 (CTCSS Encoder and Decoder Modules) fitted
10 Mating connectors
11 10 + 01
20 Wall Mounting Cradle and Fittings
21 20 + 01
22 20 + 02
23 20 + 03
30 20 + 10
31 30 + 01
32 30 + 02
33 30 + 03
40 Eurorack Mounting Kit (Non Runner Version)
41 40 + 01
42 40 + 02
43 40 + 03
50 40 + 10
51 50 + 01
52 50 + 02
53 50 + 03

MODULE IDENTIFICATION

For ease of identification each module is allotted a prefix number which is shown on the overall circuit diagram enabling cross references to the text and parts list to be made. It should be noted these prefixes apply only the F494 base station.

[0] Base station chassis
[1] Regulator board
[2] Receiver board
[3] Transmitter board
[4] Not Used
[5] Control board

SECTION 2

INSTALLATION AND OPERATION

UNPACKING

Unpack the container and check that there is no damage or shortage with regard to the items supplied.

Note: Pye Telecommunications Ltd, or our authorised agents, must be advised by letter, of any apparent damage or shortage within 10 days of receipt.

SERVICEABILITY CHECK

Prior to installation it is advisable to bench check the equipment for serviceability in the following manner:

Note: Crystals are normally fitted before shipment and the Frequency Label, on the inside of the transmitter-receiver, itablyt inscribed with details of the channel frequencies. For equipment supplied less crystals reference should be made to CRYSTAL INFORMATION in this section.

Test equipment

The following is a list of recommended test equipment required for the serviceability check:

Description	Type
DC Power Supply, 10-30V, 10A	Farnell H60/25
Signal Generator	Hewlett-packard 8640B
Oscilloscope	Gould Advance 0S1000A
RF Power Meter 50Ω	Bird Termaline 6154
Frequency counter	Racal 9915
Marker Oscillator 10,7 MHz	Pye PT507
Multimeter	Avometer 8
RF Fuse	Marconi TM9884
RF Signal Sampler	Bird 4275
Engineers Handset	Pye FH00653

1. Preliminaries

Remove the cover from the unit as described in EQUIPMENT ACCESS, Section 4.

2. Check that the correct type of control module is fitted and that it is linked correctly for the control method to be used.

3. AC Supply

(a) Check that the correct fuse values are fitted in the equipment

(i)	[0]FS1	Chassis (Mains, Input)	2A (240V); 3,15A (115V) – Time Lag
(ii)	[1]FS1	Regulator Board	10A
(iii)	[1]FS2	Regulator Board	10A

(b) Check that the mains transformer [0]T1 primary windings are correctly wired for the supply voltage used.

(c) Connect the unit to the mains supply and check LED2 (ON AC–Green) on the regulator board and LED1 (POWER ON–Greeen) on the connector panel are lit.

Disconnect the mains supply.

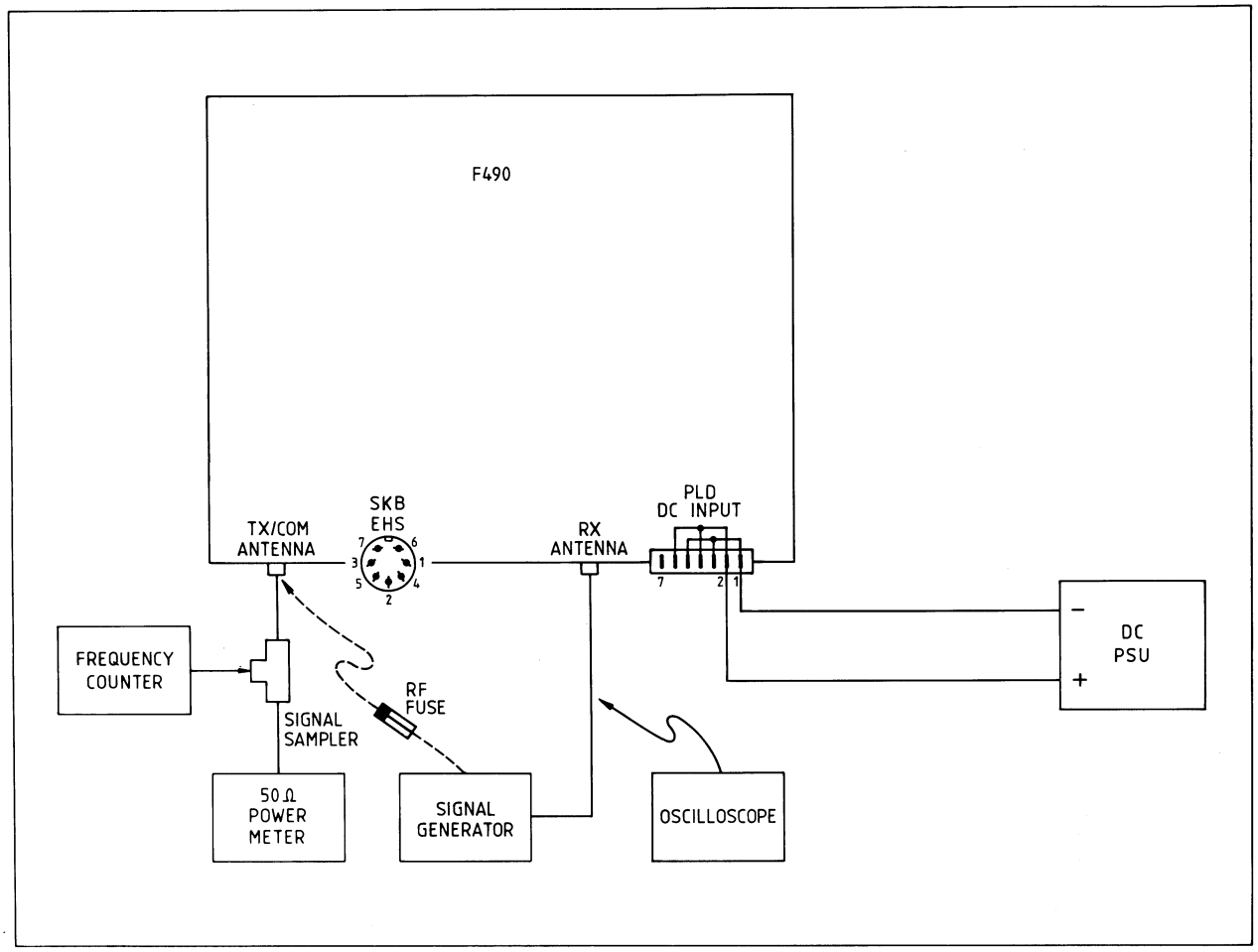


Fig 2.1 Serviceability Test Circuit

4. DC Supply

(a) Set the DC PSU output voltage as follows:

12V DC Unit – 13,8 ±0,2V DC
24V DC Unit – 26,4 ±0,2V DC

With reference to Fig 2.1 connect the PSU to PLD (DC INPUT) on the connector panel

(b) Check that LED 1 (Red) on the regulator board and LED1 (Green) on the connector panel are both lit.

(c) Where applicable, connect the unit to the mains supply and check that LED 1 (Red) on the regulator board goes out and LED 2 (Green) lights. Disconnect the mains supply.

(d) Refit the cover to the unit.

5. Tx Power

(a) Connect the RF power meter to the TX/COM antenna socket

(b) Connect the Engineers Handset (optional item) to SKB (EHS) on the connector panel or (where an EHS is not availabel) short circuit pins 3 and 5 of SKB to key the transmitter

(c) Check that the RF power meter reading is correct for the power output code:

Power Output code	Power Meter Reading
Code 1 (25W)	25–30W
Code 2 (15W)	15–18W
Code 3 (10W)	10–12W
Code 4 (6W)	6–8W
Code 5 (1W)	1–2W

(d) Remove the EHS or short circuit as appropriate and disconnect the RF power meter.

6. AF Output

Note: For single antenna working the TX/COM antenna socket only is used.

(a) Connect the signal generator to the appropriate antenna socket as shown in Fig 2.1; modulate the output at 1kHz to 60% of peak deviation at a level of 1mV.

(b) Connect the Engineers Handset to SKB on the connector panel, close S1 and check that a 1kHz tone can be heard.

Where an EHS is not available this check may be performed as follows:

(i) Connect the oscilloscope across pins 4 and 6 of SKB

(ii) Check that a 1kHz, 1V peak-to-peak sine wave is present

(c) Remove all test equipment

INSTALLATION

The base stations are supplied in one of three power supply codes (AC with 24V DC standby, AC with 12V DC standby or 24V DC only) and care must be taken to ensure the equipment is connected to the correct power supply.

The equipment is designed to be mounted vertically on a wall using the cradle provided (See Fig 2.2).

Note: The location of the unit must allow for:
(i) Adequate air flow around the heatsinks
(ii) Adequate clearances for connectors and securing screws
(iii) Standard lengths of supply and interconnecting cables.
(iv) Suitable location of antennas

1. Check the practicability of the installation by placing the units in position and running the cables.

2. Wall Mounted Equipment

(a) Using the cradle as a template mark the position of the fixing holes.
(b) Drill and plug the wall.
(c) Secure the cralde to the wall using suitable screws.

Note: The cradle must be firmly secured to the wall in order to take the weight of the unit.

(d) Remove the cover from the unit (see EQUIPMENT ACCESS in Section 4).
(e) Locate the transceiver in the cradle and secure it in position using the M5 x 8mm screw provided.
(f) Refit the cover to the unit.

3. Connect the antenna feeder plug provided, to the antenna feeder as shown in Fig 2.4

4. Install the antenna(s) according to the manufacturers instructions.

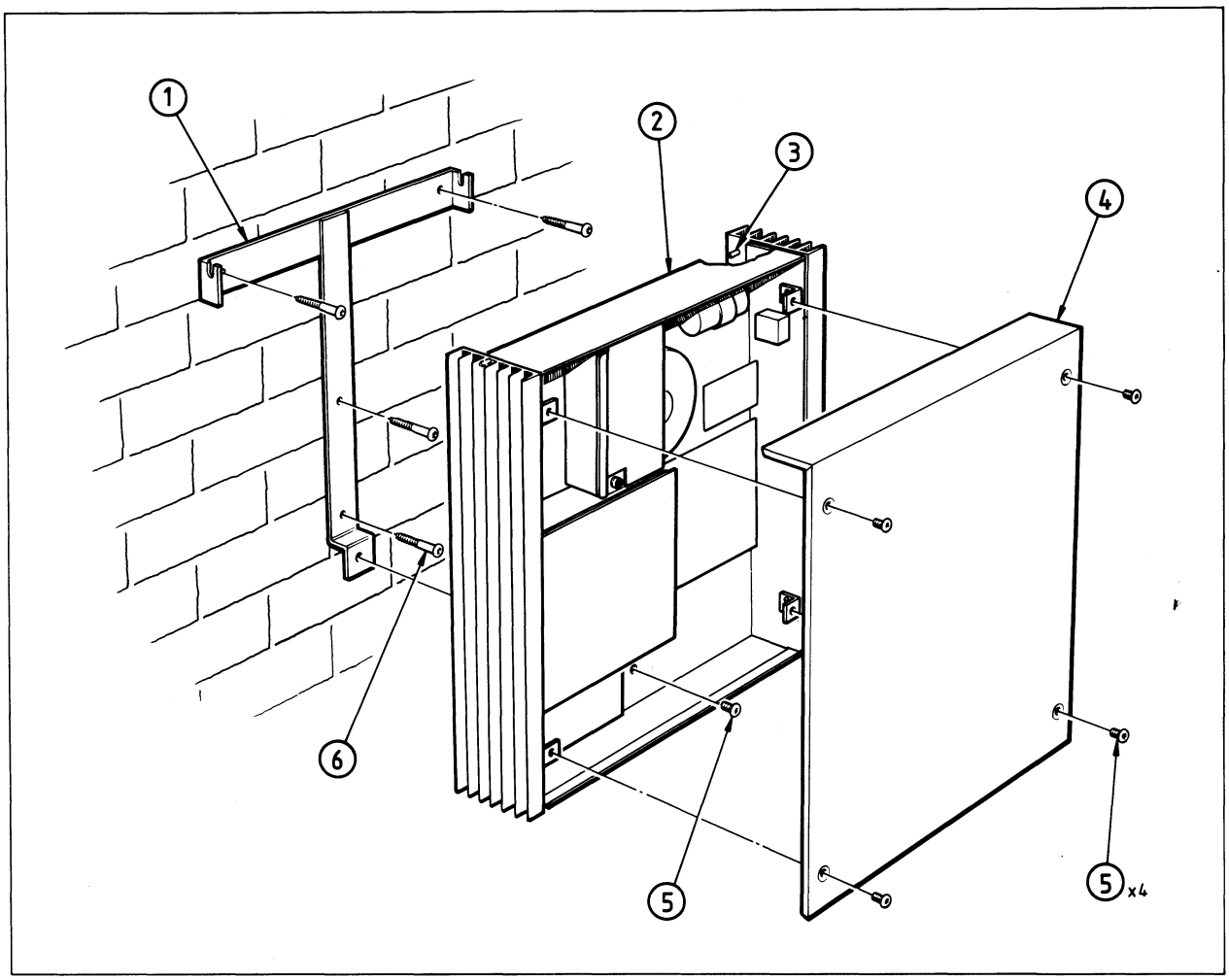


Fig 2.2 Wall Mounted Equipment

1. Cradle
2. F490 equipment
3. Locating pin
4. Equipment cover
5. M5 x 8mm screw (tamperproof – if fitted)
6. Cradle securing screws (not supplied)

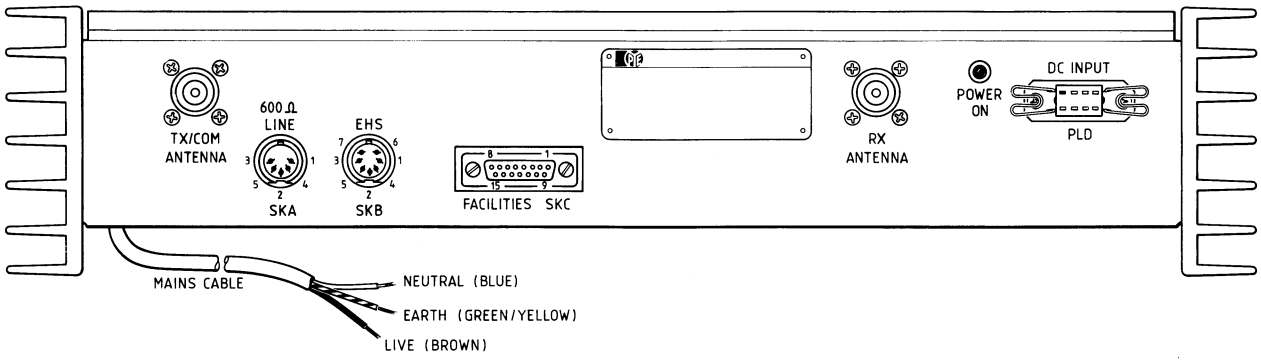


Fig 2.3 Connector Panel

5. With reference to fig 2.3 connect the required power supplies and control cable to the equipment.

6. Count in each channel frequency (see page 2.5). Carry out an air check.

ANTENNA FEEDER PLUG ASSEMBLY

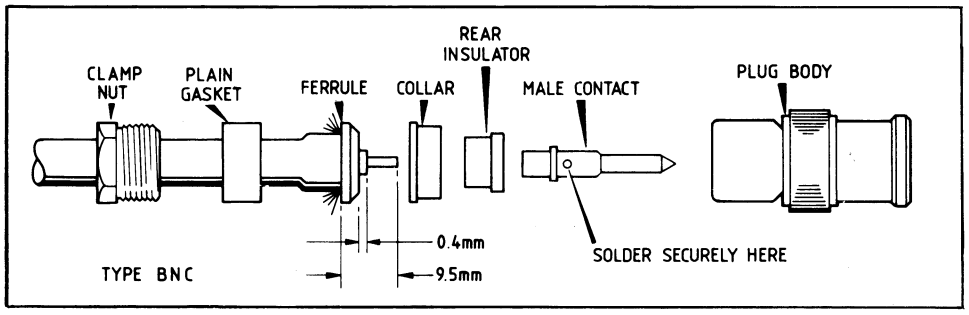


Fig 2.4 Antenna Feeder Plug Assembly

(a) Unscrew and remove the clamp nut and remove the gasket and ferrule from the plug body.

(b) Cut the end of the cable squarely, cut off 12mm (0,5 in) of the cable sheath and slide the clamp nut (head leading) and gasket on the cable.

(c) Cut the braid to 6,5mm (0,25 in) comb out the braid wires and fold them back over the cable sheath.

(d) Slide the ferrule over the exposed dielectric and push home firmly.

(e) Cut off the dielectric 0,4mm (0,02 in) from the face of the ferrule and tin the exposed centre conductor.

(f) Cut off the centre conductor 10mm (0,4 in) from the face of the ferrule. Slide the collar and rear insulator into position.

(g) Locate the male contact over the centre conductor and inside the rear insulator; solder securely in place.

(h) Insert the gasket and clamp nut into the connector body and tighten the clamp nut.

FREQUENCY COUNT

Transmitter

1. Connect the RF power meter to the TX/COM antenna socket and loosely couple the frequency counter to the antenna socket.

2. Connect the equipment to a suitable power supply and observe the frequency counter reading.

3. For each channel check that the output frequency is within 10Hz. Adjust L18–23 (as appropriate) on the transmitter board, if necessary, to achieve this.

Receiver

1. Connect the signal generator to the appropriate antenna socket as shown in Fig 2.1. Set the signal generator output to channel frequency ±10Hz unmodulated at a level of 1mV.

2. Connect the equipment to a suitable supply and hold the marker oscillator near the IF section.

3. Adjust crystal trimmer coils L9–14, as appropriate, for zero audio beat note on each channel.

CRYSTAL INFORMATION

Note: Specifications apply to the UK only, information for other areas being provided on request. Failure to fit the crystals specified for an area may infring type approval regulations and/or temperature environmental requirements.

Band	Frequency Range fc(MHz)	Crystal Frequency fx(MHz)	Crystal Range	Crystal Type
A0	148–174	$fx=\frac{fc-10,7}{3}$	45,76–54,44	T84W
B0	132–156	$fx=\frac{fc+10,7}{3}$	47,56–55,56	T84W
E0	68–88	$fx=\frac{fc+10,7}{2}$	39,35–49,35	T84W

Band	Frequency Range fc (MHz)	Crystal Frequency fx (MHz)	Crystal Range	Crystal Type
A0	148–174	$fx=\frac{fc}{16}$	8,125 – 10,875	T92DQ
B0	132–156	$fx=\frac{fc}{16}$	8,25 – 9,75	T92DQ
E0	68–88	$fx=\frac{fc}{16}$	4,25 – 5,5	T92DQ

SECTION 3

TECHNICAL DESCRIPTION

CIRCUIT SUMMARY

Regulator

The base station is equipped with one of three regulator boards allowing it to be operated from the following supplies.

(i) AC Mains with +24V DC standby
(ii) AC Mains with +12V DC standby
(iii) +24V DC only

In the event of a mains failure, changeover to the standby supply is achieved automatically through RLA.

The regulator provides a +13,5V DC voltage to the transmitter power amplifier stages, and also to the 10V regulator situated on the receiver board.

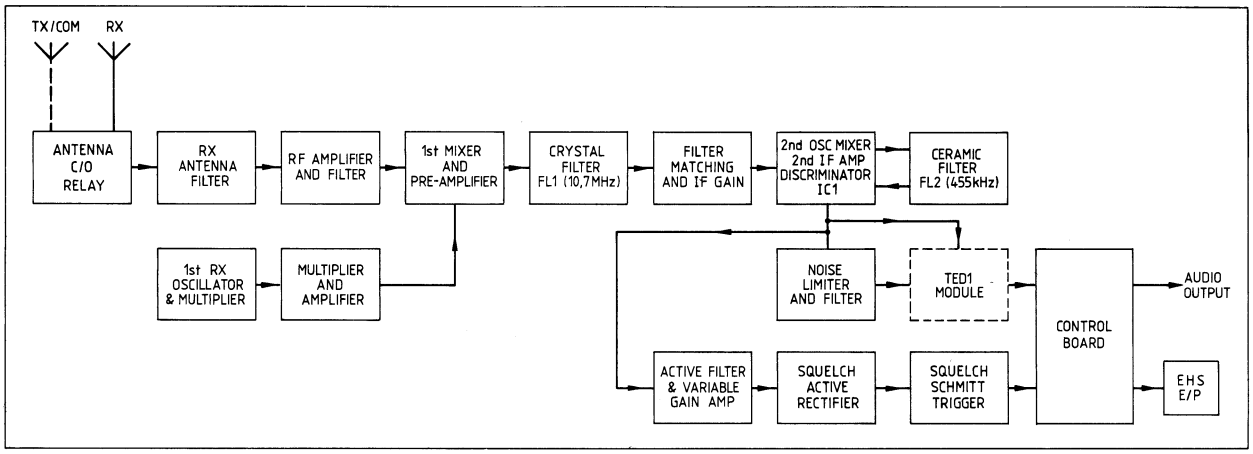


Fig 3.1 Receiver Block Diagram

Receiver

Received signals are routed from the antenna through the Rx antenna filter to the two section RF filter and amplifier; the three section filter provides image channel rejection.

The Rx oscillator output is multipled and amplified then mixed with the RF signal to produce a 1st IF of 10,7 MHz which is filtered by FL1. The filter output is matched by an emitter follower to the IF amp which in turn feeds the signal to IC1. The output from the 2nd oscillator is applied to the 2nd mixer where it is combined with the 1st IF to produce a 2nd IF of 455 kHz; the 2nd IF is passed, via the 2nd IF amplifier and ceramic filter FL2, to the discriminator.

Audio from the discriminator is routed as follows:

(i) To a noise limiter and filter then, via the TED1 module (if fitted), to the control board.
(ii) To the squelch detection circuit which provides an output to the squelch gate on the control board.

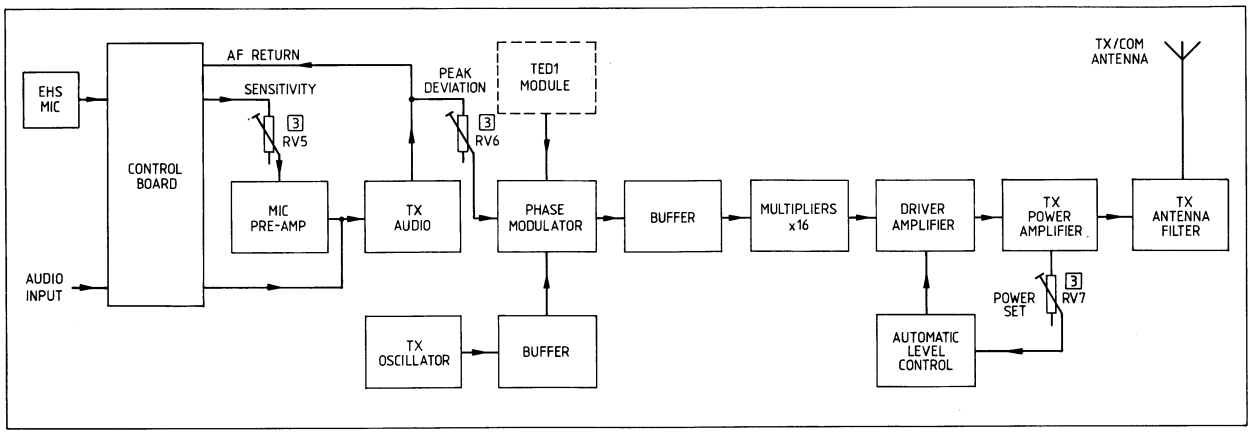


Fig 3.2 Transmitter Block Diagram

Transmitter

The audio input to the control board is fed in as Tx line audio or is derived from the engineers handset. The latter is applied, via the sensitivity control, to the mic pre-amplifier while the line audio is fed directly to the pre-emphasis amplifier in the Tx audio circuits. The AF signal is clipped and de-emphasised then filtered and amplified and passed through the peak deviation control to the phase modulator.

The frequency generated by the Tx oscillator is phase modulated by the audio; buffer stages isolate the phase modulator.

The modulator output is multiplied by four doubler stages then passed to the driver amplifier and PA stages. The PA output is applied to the Tx antenna filter then to the TX/COM antenna.

An automatic level control (ALC) circuit is incorporated which maintains the output at a substantially constant level compensating for fluctuations in voltage and temperature.

The power output is nominally 25W into a 50Ω load which may be continuously adjusted down to 6W using the POWER SET control.

DETAILED CIRCUIT DESCRIPTION

Regulator [1]

Mains with 24V DC standby

The mains input is applied, via [0] FS1, to the step-down transformer [0] T1. The secondary voltage, protected by FS2, is rectified in [0] D1 and smoothed by [0] C1; R9 is the bleed resistor for [0] C1.

Rectification provided by D2,3 is smoothed by C6 to produce a voltage which lights LED2 (ON AC) and energises RLA/1; TR2 conducts to hold off LED1 (ON DC). The contact of RLA connects the voltage from [0] C1 to the regulator [0] IC1.

The low-current regulator provides an output which is set by RV1 (SET VOLTS). The current drawn through [0] IC1 develops a voltage across R1,2, when sufficiently high enough this voltage cuts on the current amplifier [0] TR1,2 enabling up to 7A to be drawn at the output. Current sharing is acheived by R3,4 while C3,4 provide output decoupling.

Thermistor [0] TH1 provides over-temperature protection. At approx 80°C the increased voltage drop across [0] TH1 causes TR1 to conduct pulling pin 2 of the control board low causing thermal shutdown. (i.e. the transmitter disabled).

The DC standby supply is connected to [0] PLD and protected by FS1; D1 protects the circuit from reverse polarity. In the absence of a mains supply RLA is deenergised and TR2 cut off, the DC input is fed through RLA1 to the regulator; LED1 (ON DC) lights; LED2 (ON AC) is extinguished.

Mains with 12V DC standby

This is similar to the 24V DC standby version with the exception of RLA1 being positioned on the output of the low current regulator.

24V DC Only

The DC input of [0] PLD is protected by FS1 and D1, and is indicated by LED1 (ONDC) Operation of the low current regulator and over temperature circuit is similar to that on the 24V standby version.

Receiver [2]

RF signals at the antenna are routed, via the Rx antenna filter L43–46, C187–195 to an RF filter L1,2,C1–3, which reduces intermodulation interference. A variable-gain common-gate RF amplifier follows, whose gain, preset by RV1, can be set for the best sensitivity or the best intermodulation. A further stage of filtering L3–5 provides image channel rejection.

The 1st receiver oscillator, a modified Colpitts type, employs a series resonant third overtone crystal XL1–6 whose exact frequency is set by trimmers L9–14. Crystal stability at low temperatures is acheived by the use of self-regulating resistors R42–47 known as pozistors, these are positioned adjacent to the crystals and kept in thermal contact with them by means of an insulating sleeve.

L15 is tuned to the third harmonic (A and B bands) or second harmonic (E band) of the crystal frequency which is amplified by TR12 and filtered by L16,17 to provide the injection frequency. The signal frequency is added the injection frequency across L17 and applied to the mixer TR7 with L6,7 tuned to the 1st IF at 10,7 MHz. The mixer gain is kept low to obtain a good intermodulation figure. The pre-amplifier TR3, tuned by L7, has its output filtered in FL1, providing adjacent channel rejection.

TR4 is an emitter follower which matches the crystal filter to 1st IF amplifier TR5. The 2nd oscillator, 2nd mixer, 2nd IF amplifier, and discriminator are all incorporated in IC1 whose external circuitry includes the oscillator crystal XL13, a 455 kHz ceramic filter FL2, which reduces noise bandwidth and improves adjacent channel rejection, and the discriminator tuned circuit L8,C36,37.

The audio output from the disciminator is fed to the variable gain stage TR6, whose gain is set byRV2, providing a steady audio output to the tone options and control board. Clipper D3,4 form part of the noise limiter the de-emphasis provided by R27,C42,43; TR7 forms an active high pass filter to reduce low frequency audio noise.

TR7 output is routed to the control board, via the tone option (if fitted).

Squelch

Under no signal conditions the discriminator output consists substantially of noise which is applied to the active filter TR13 where frequencies above 15 kHz are extracted. The filtered noise is applied, via TR13, to an amplifier TR14 the gain of which is set by RV4. D5 causes the positive half cycles of the signal to be amplified more than the negative thus, IC3 behaves as a rectifier with smoothing provided through R80, C79. The schmitt trigger TR15,16 provides a switched output to the squelch gate on the control board.

With a signal present the noise level falls causing IC3 output to fall and the schmitt trigger to change stage.

10V Regulator

This circuit comprises a series limiter TR39 controlled by TR37 and TR38 with short circuit protection provided by D14.

The regulated output voltage is sampled by TR37 and compared with the 8,2V reference from zener diode D13. Any change in the output voltage develops an error signal between TR38 base and emitter which is applied to the base of TR39 causing the volt-drop to vary in such a manner as to restore the output voltage at the collector of power transistor TR39 to normal (9,8–10,2V depending on the 'select-on-test' value of R176).

R179 ensures that the regulator starts under all normal conditions. In the event of a short-circuit being present, 14 together with TR38 switch off TR39 thus protecting the regulator, which resumes normal operation when the short circuit is removed.

Transmitter [3]

Tx line audio from the control board, at SKE, is applied to the pre-emphasis amplifier; audio from the engineers handset is fed, via the sensitivity control RV5, to the microphone pre-amplfiier TR17. The two-stage pre-emphasis amplifier TR18,19 has a 6db/octave slope; R95 is selected on test to give optimum symmetry (at TP9) from the diode limiter D9,10; R105,C96 form the de-emphasis circuit. A two-stage active low-pass filter TR20,21 removes unwanted high frequency components while TR22 provides matching, via the peak deviation control RV6, to the phase modulator TR25.

The Tx oscillator TR23 is crystalled contorlled (by XL7–12) and operates in the fundamental series resonant mode, the exact frequency of oscillation being set by trimmers L18–23. When the 5ppm frequency stability option is exercised, crystal stability is achieved by the use of self regulating resistors, known as pozistors R115–120. These are positioned adjacent to the crystals and kept in thermal contact with them by means of an insulating sleeve.

The output from the oscillator is buffered by TR24 and applied to the phase modulator. The signal at TR25 collector is the phasor sum of the direct componet, fed forward via C119, and a component amplified by TR25, the latter being amplitude modulated by the AF signal. The resultant phase modulated output is buffered by TR26 which also 'clips out' the amplitude modulation. TR27,28 are FET frequency doublers, each contributing some gain. A further pair of doublers using bipolar transistors TR29,30 bring the RF up to final frequency. Total multiplication is 16.

TR31,32,35,36 form an amplifier chain capable of delivering up to 25 watts into a 50Ω load, via the Tx antenna filter L43–46, C187–195.

Automatic level Control

The purpose of this circuit is to maintain the PA output level despite fluctuations in drive level and supply voltage by providing a constant current to TR35,36.

R168 samples the current drawn by the PA to produce a voltage drop which is added to a portion of the voltage across D11,12, determined by the setting of RV7 (POWER SET). The resultant voltage sum is applied to TR34 base, controlling the degree to which TR34 conducts and consequently the amount of current shunted from TR33 base. Therefore, if the PA current tends to rise, TR33 reduces the supply voltage to TR32 thus reducing the PA drive.

SECTION 4

SERVICING

GENERAL

Metal Oxide Silicon Devices

The field effect transistors and C-MOS integrated circuits used in this equipment are metal oxide silicon devices. Because they have an extremely high input impedance, they are susceptible to damage when subjected to high transient voltages or static electrical charges to eliminate the possibility of damage the following precautions must be taken:

(i) Device leads must always be in contact with a conductive material to avoid the build-up of static charges.

(ii) Soldering iron tips, tools and metal parts of test equipment used during servicing must be grounded.

(iii) To avoid transient voltage spikes, devices must not be inserted nor removed with power connected.

(iv) Signals must not be applied to integrated circuits in the absence of power supplies to the devices.

Transmitter Loading

Although the protection circuits ensure that the transceiver operates safely under a wide range of loading conditions, it is not advisable to operate the transmitter without a load connected to the antenna socket. During transmitter servicing, the RF power meter and load provides a suitable termination.

PWB Handling

Take care not to distort the printed wire boards, especially during fitment or removal. Distortion of PWBs can cause hairline cracks in the copper track which are difficult to locate.

'Pozidriv' Screws

Special screwdrivers are required for use with 'Pozidriv' headed fixing screws. 'Pozidriv' screwdriver No 1 is suitable for screws up to metric size M3, screws larger than this require a 'Pozidriv' screwdriver No 2. The use of any other type of screwdriver can result in servere damage to the screwhead.

Heatsink Components

Sufficient heatsink compound (Dow-Corning Type 340) must be applied between the component, insulating washers and heatsink surface to provide a good thermal path.

Connector Pin Cleaning

Under no circumstances should connector pins be cleaned using any abrasive or corrosive agent. Grease or dust should be removed by use of a cleaning fluid such as RS Components Ltd. Catalogue No. 554/175.

Soldering

Soldering operations on PWBs should be kept to a minimum and should preferably be carried out using a low voltage DC soldering iron with an earthed bit. This type of soldering iron MUST be used when replacing FETs or C-MOS integrated circuits. Always ensure that the holes in the printed circuit track are clear of solder before fitting components and check that tracks are clean before applying the soldering iron or solder. The amount of solder and the dwell time of the soldering iron should be kept to a minimum. To reduce the risk of damage to components heatshunts should be used wherever possible. Do not use a permanent magnet soldering iron in the vicinity of coils with ferrite cores.

ROUTINE FREQUENCY ADJUSTMENT

Although the crystal oscillators used in this equipment are extremely accurate and reliable, it must be borne in mind that quartz crystals are subject to 'ageing' and circuits incorporating them therefore require periodic readjustment. This requirement is not affected by the amount of use given to the equipment, 'ageing' occurs even during careful storage. The effects are at a maximum with new crystals, becoming less significant over their life but, to ensure optimum performance the FREQUENCY COUNT in Section 2 must be carried out on installation and thereafter, as a matter of routine, at intervals of six months.

CRYSTAL INFORMATION

For details of crystals see 'CRYSTAL INFORMATION' on page 2.5

CONSTRUCTION

The equipment is housed in a steel case, the vertical sides are each formed by an extruded aluminium heatsink and a steel cover encloses the front.

All connections, except the power supply, are made on the connector panel at the base of the unit, and the mains lead is routed from the rear of the unit to the connector panel enabling all cables to emerge on one side of the equipment.

With the cover removed all boards, except the transmitter, are accessible as is the rear of the connector panel. The transmitter board is housed in its own compartment which is accessed by removal of the transmitter cover.

The equipment is designed to be wall mounted in a steel cradle, two lugs at the top rear of the unit locate in the cradle and the unit is secured by an M5 screw.

Both the cover and the cradle may be secured to the unit, using tamperproof M5 screws, if required. This provides some measure of security; a special tool will be required.

EQUIPMENT ACCESS

WARNING
Before removing the cover or any of the PWBs ensure that the transceiver is disconnected from the power supply.

Tools Required

Flat blade screwdriver, ¼in
'Pozidriv' screwdriver No 1 and No 2
Box spanner, M5
Special screwdriver (for use with tamperproof screws – if fitted).

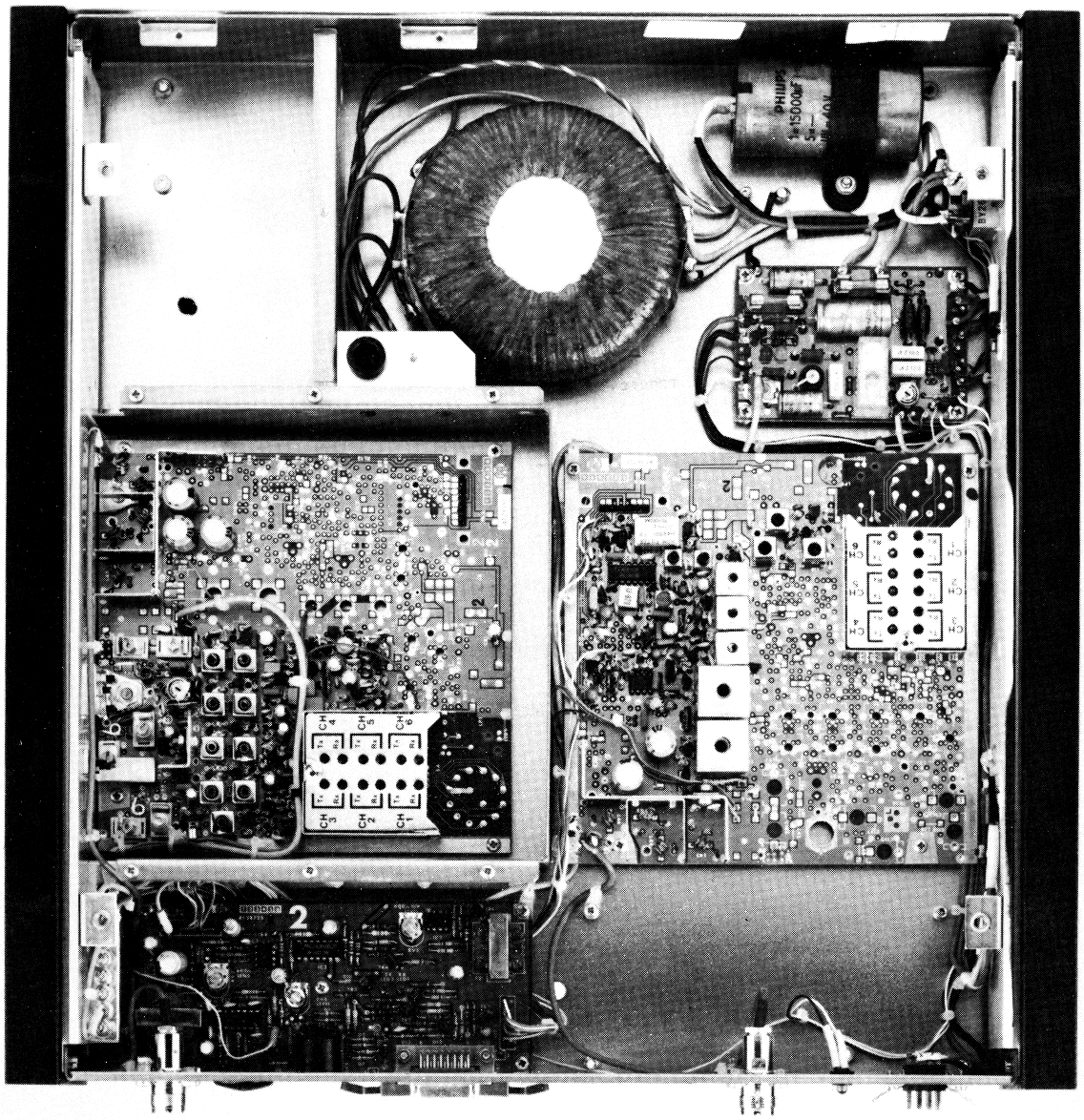


Fig 4.1 Interior View

Front Cover

1. Remove the 4 x M5 screws (4 x tamperproof screws – if fitted) which secure the front cover to the unit.

2. Lift the cover from the unit.

Transformer Cover

1. Remove the mains input fuse [0] FS1 from the transformer cover.

2. Remove the 2 x M3 screws which secure the transformer cover to the chassis.

3. Lift the transformer cover from the unit.

Transmitter Cover

1. Loosen the 6 x M3 screws which secure the transmitter cover to the chassis.

2. Lift the transmitter cover from the chassis

Regulator Board

1. Lift off the regulator output connection (orange lead – pin 8).

2. Unsolder the remaining board connections

3. Remove the 4 x M3 screws which secure the board to the chassis

4. Carefully remove the PWB

Receiver Board

1. Disconnect SKF from the control board and remove the 4 x M3 screws which secure the antenna socket to the connector panel.

2. Remove the 4 x M3 screws which secure the receiver board to the chassis.

3. Carefully remove the PWB.

Transmitter Board

1. Remove the transmitter board cover and the 2 x M3 screws which secure the board to the chassis.

2. Remove the 4 x M3 screws which secure the antenna socket to the connector panel.

3. Remove the 5 x M4 screws which secure the Tx heatsink to the chassis then carefully remove the Tx heatsink (with board attached) from the unit.

Control Board

1. Disconnect the 2 multiway connectors SKE and SKF and the thermal shutdown connection (yellow lead – pin 2) from the board.

2. Remove the 5 x M3 screws which secure the board to the chassis and, if applicable, the two clips which retain SKC (FACILITIES).
3. Carefully remove the PWB.

Feedthrough Capacitors

1. Remove the control board.

2. Remove the 2 x M3 screws which secure the feedthrough assembly to the chassis.

3. Carefully remove the feedthrough assembly.

Replacement Procedure

To refit the boards, feedthrough assembly and cover carry out the removal procedure in reverse, ensuring that wire looms are not fouled, connectors are correctly fitted and securing screws are tight.

TEST EQUIPMENT

The following is a list of test equipment recommended for the alignment, fault location and repair of this equipment. Equivalent types may be used, provided that due corrections are made for any differences in characteristics, particularly input and output impedences.

Description	Type
DC Power Supply Unit 10–30V, 10A	Farnell H60/25
RF Power Meter 50 Ω	Bird Termaline 6154
Multimeter	Avometer 8
Signal Generator	Hewlett-Packard 8640B
Modulation Meter	Radiometer AFM2
Frequency Counter	Racal 9915
AF Generator	Levell TG200FM
AF Voltmeter	Hewlett-Packard 400FL
SINAD Meter	Hewlett-Packard 333A
Oscilloscope	Gould Advance OS1000A
Marker Oscillator 10,7MHz	PYE PT 507
RF Signal Sampler	Bird 4275
RF Fuse	Marconi TM9884

TEST PROCEDURE

1. Preliminaries

   Remove the cover from the unit as described under EQUIPMENT ACCESS, and disconnect the spade connector from pin 8 of the regulator board.

2. AC Supply

   (a) Check that the correct fuse values are fitted in the equipmnet:

[0]FS1	Chassis (Mains Input)	2A(240V);31,5A(115V)-Time Lag
[1]FS1	Regulator Board	10A
[1]FS2	Regulator Board	10A

   (b) Check that the mains transformer [0]T1 primary windings are correctly wired for the supply voltage used.

   (c) Connect the unit to the mains supply and check that LED2 (ON AC–Green) on the regulator board and LED1 (POWER ON-Green) on the connector panel are lit.
   Disconnect the mains supply.

3. DC Supply

   (a) Set the DC PSU output voltage as follows:

   12V DC Units – 138 ±0,2V DC
   24V DC Units – 26,4 ±0,2V DC

   With reference to Fig 4.3 Connect the PSU to PLD (DC INPUT) on the control panel.

   (b) Check that LED1 (ONDC – Red) on the regulator board and LED1 (Green) on the connector panel are both lit.

   (c) Where applicable connect the unit to the mains supply and check that LED1 (Red) on the regulator board goes out and LED2 (Green) lights.

4. Regulator Output

   (a) Check that the voltage reading at pin 8 of the regulator board is as follows

Power Output Code	Regulator Output Voltage
Code 1 (25W)	15 ±0,2V DC
Code 2 (15W)	13,5 ±0,2V DC
Code 3 (10W)	13,5 ±0,2V DC
Code 4 (6W)	13,5 ±0,2V DC
Code 5 (1W)	12,8 ±0,2V DC

   Adjust RV1 (SET VOLTS) on the regulator board, if necessary, to obtain the correct reading.

   (b) Re-connect the spade connector to pin 8 of the regulator board.

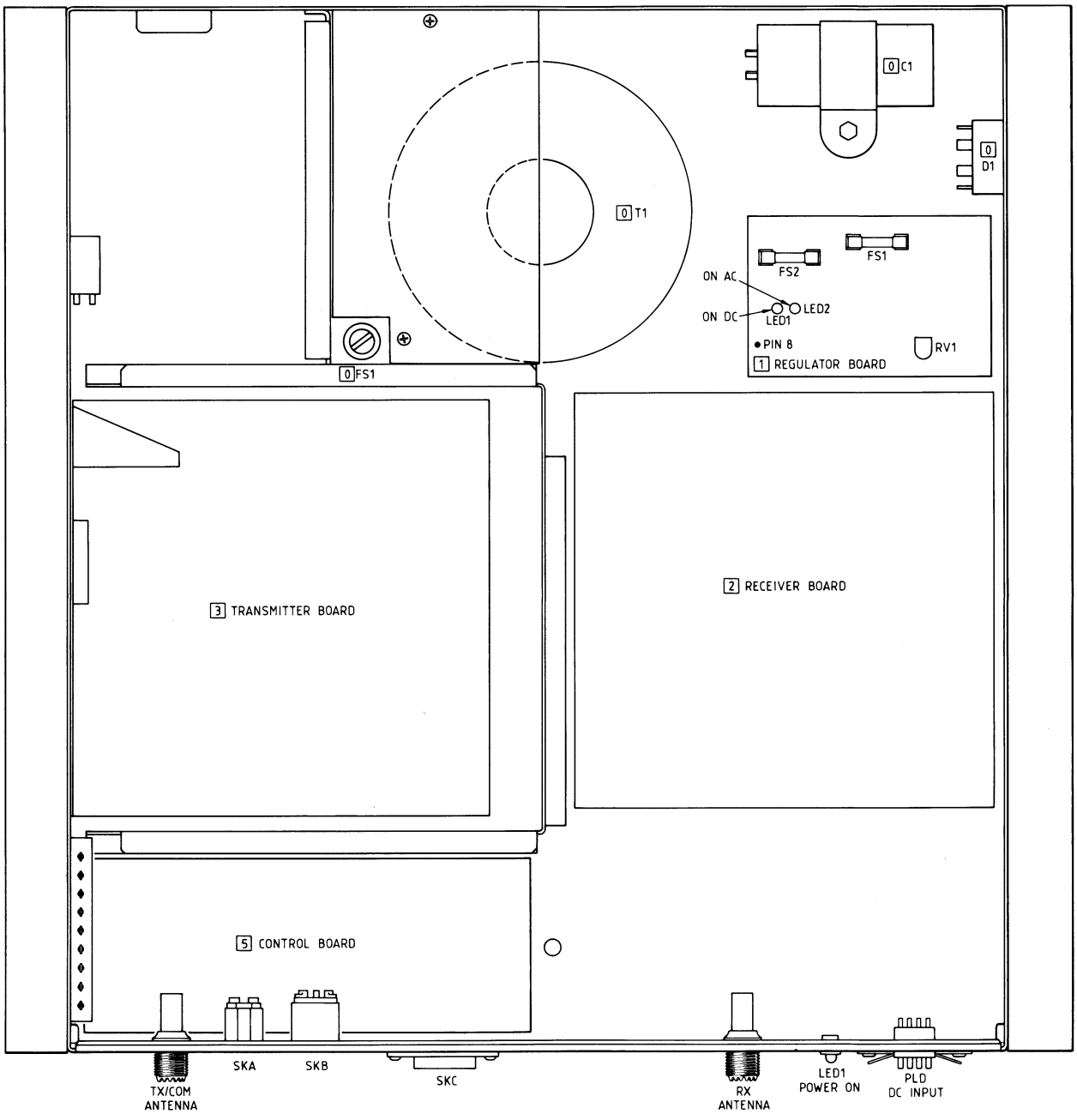


Fig 4.2 Transceiver Layout

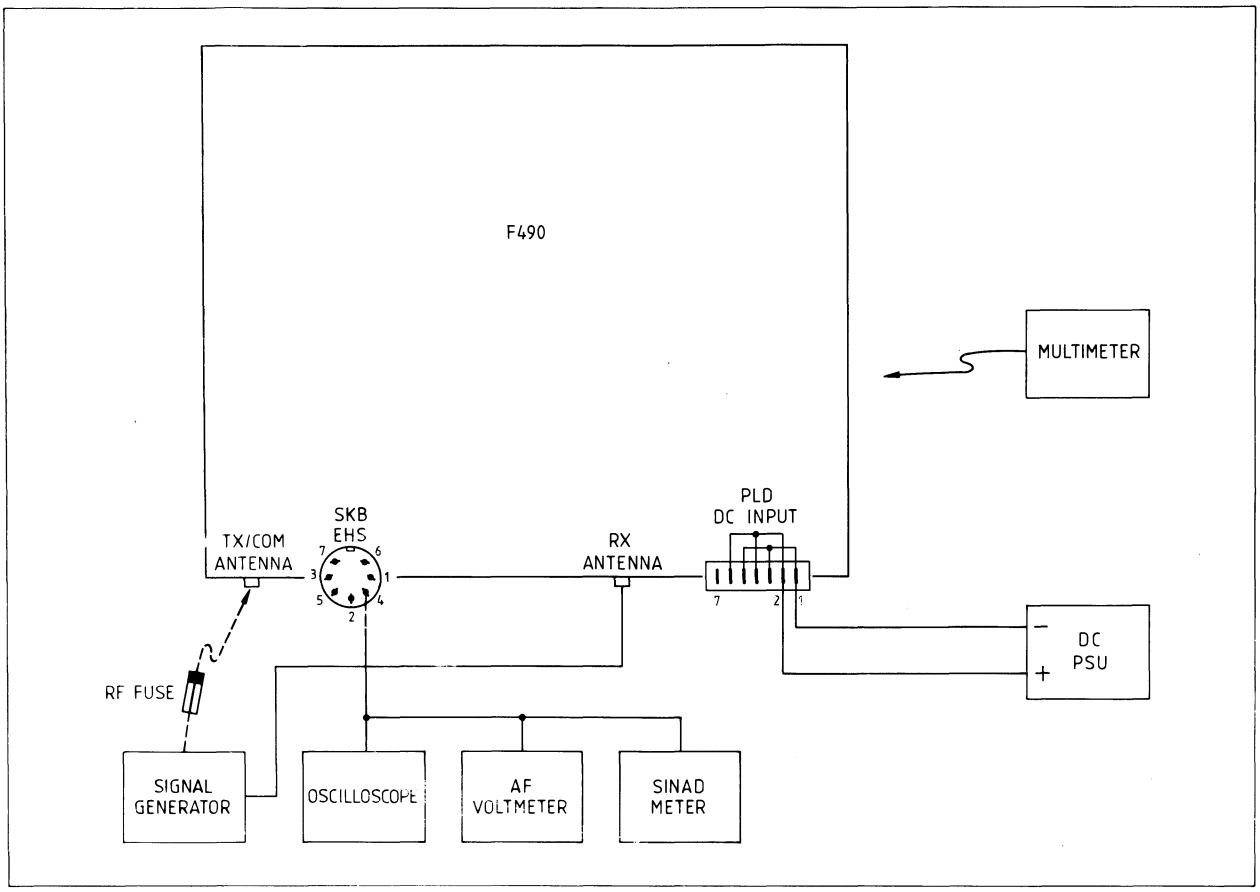


Fig 4.3 Receiver Test Circuit

5. Rx Alignment

(a) Connect test equipment as shown in Fig. 4.3

(b) Select channel frequency closest to the centre frequency of the band covered. Set RF signal generator of this frequency using the frequency counter. Disconnect counter.

(c) Set cores of coils [2] L15, 16,17 flush with the top of their formers.

(d) Carry out the following alignment:

STEP	TEST EQUIPMENT	TEST POINT	TUNE	ADJUSTMENT
A	AV0 (2,5V DC)	[2] TP1	[2] L15 [2] L16	Adjust for maximum Adjust for minimum
B	AV0 (10V DC)	[2] TP7	[2] L16,17 [2] L15,16,17	Adjust for maximum Adjust for maximum
C	Set [2] RV1,2,4 fully counter-clockwise and [5] RV1 fully clockwise. Set RF signal generator output to 100mV unmodulated			
D	SINAD Meter	[0] SKB pin 4	[2] L1-7	Tune in sequence for best quieting, reducing signal generator output, as necessary
E	Marker Oscillator	–	–	If necessary, adjust crystal oscillator for zero beat.
F	Modulate RF input signal 1kHz at 60% peak deviation, output 1mV			
G	AF Voltmeter	[0] SKB pin 4	[2] L8	Tune for maximum

Description	Type
DC Power Supply Unit 10–30V, 10A	Farnell H60/25
RF Power Meter 50 Ω	Bird Termaline 6154
Multimeter	Avometer 8
Signal Generator	Hewlett-Packard 8640B
Modulation Meter	Radiometer AFM2
Frequency Counter	Racal 9915
AF Generator	Levell TG200FM
AF Voltmeter	Hewlett-Packard 400FL
SINAD Meter	Hewlett-Packard 333A
Oscilloscope	Gould Advance OS1000A
Marker Oscillator 10,7MHz	PYE PT 507
RF Signal Sampler	Bird 4275
RF Fuse	Marconi TM9884

TEST PROCEDURE

1. Preliminaries

   Remove the cover from the unit as described under EQUIPMENT ACCESS, and disconnect the spade connector from pin 8 of the regulator board.

2. AC Supply

   (a) Check that the correct fuse values are fitted in the equipmnet:

[0]FS1	Chassis (Mains Input)	2A(240V);31,5A(115V)-Time Lag
[1]FS1	Regulator Board	10A
[1]FS2	Regulator Board	10A

   (b) Check that the mains transformer [0]T1 primary windings are correctly wired for the supply voltage used.

   (c) Connect the unit to the mains supply and check that LED2 (ON AC–Green) on the regulator board and LED1 (POWER ON-Green) on the connector panel are lit.
   Disconnect the mains supply.

3. DC Supply

   (a) Set the DC PSU output voltage as follows:

   12V DC Units – 138 ±0,2V DC
   24V DC Units – 26,4 ±0,2V DC

   With reference to Fig 4.3 Connect the PSU to PLD (DC INPUT) on the control panel.

   (b) Check that LED1 (ONDC – Red) on the regulator board and LED1 (Green) on the connector panel are both lit.

   (c) Where applicable connect the unit to the mains supply and check that LED1 (Red) on the regulator board goes out and LED2 (Green) lights.

4. Regulator Output

   (a) Check that the voltage reading at pin 8 of the regulator board is as follows

Power Output Code	Regulator Output Voltage
Code 1 (25W)	15 ±0,2V DC
Code 2 (15W)	13,5 ±0,2V DC
Code 3 (10W)	13,5 ±0,2V DC
Code 4 (6W)	13,5 ±0,2V DC
Code 5 (1W)	12,8 ±0,2V DC

   Adjust RV1 (SET VOLTS) on the regulator board, if necessary, to obtain the correct reading.

   (b) Re-connect the spade connector to pin 8 of the regulator board.

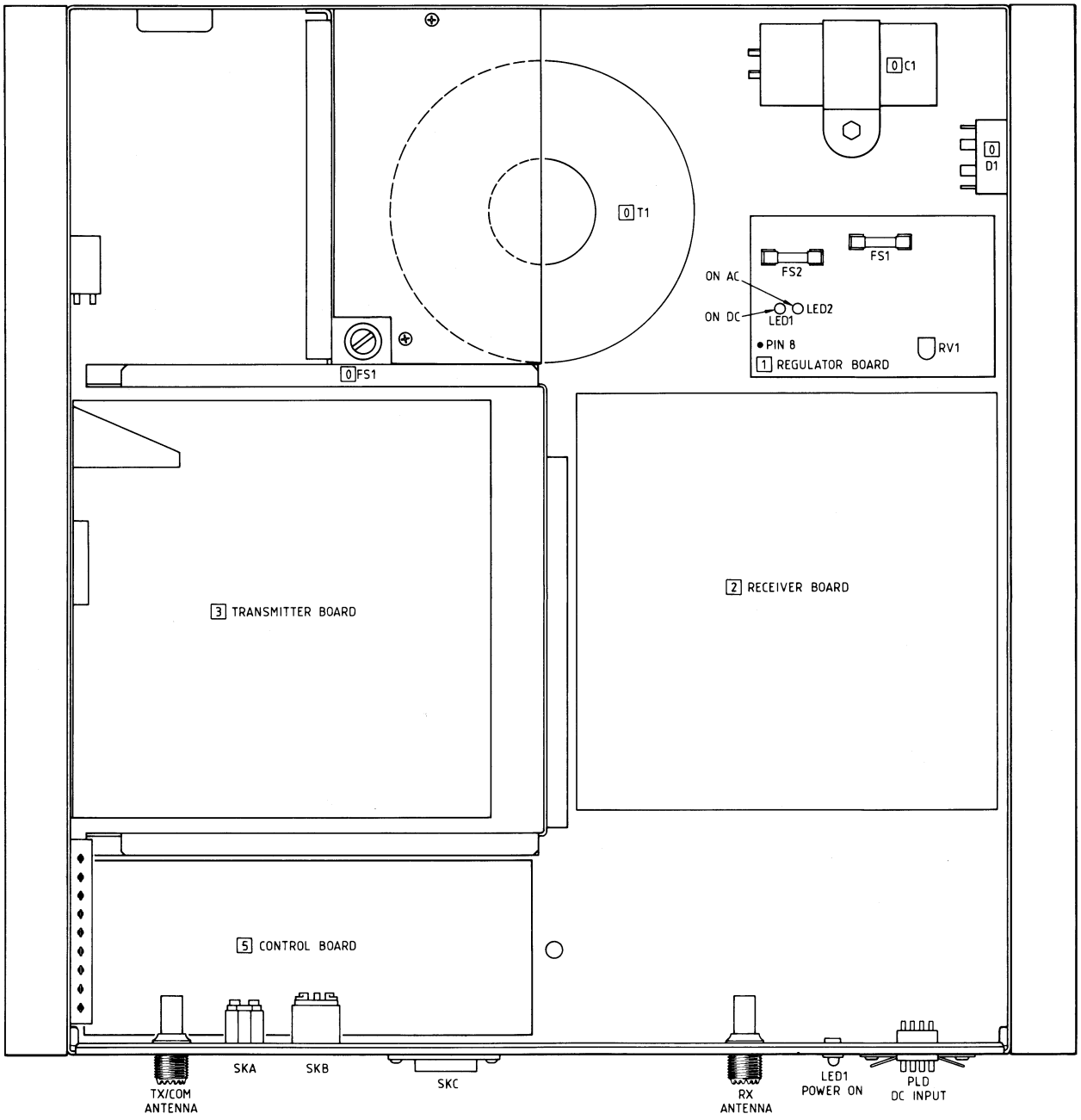


Fig 4.2 Transceiver Layout

H	Oscilloscope	[0] SKB pin 4	[2] L7	Tune for minimum distortion
J	AF Voltmeter	[2] PLA pin E	[2] RV2	Adjust for 100 ±5mV RMS
K	Reduce RF input to 0,3 μV modulated as in step F.			
L	SINAD Meter	[0] SKB pin 4	[2] L2	Adjust for best SINAD
M	AVO (10V DC)	[2] TP7	[2] L17	Adjust for maximum
N	Remove channel crystal and check that TP7 voltage falls by greater than 1V. Refit channel crystal.			
P	SINAD Meter	[0] SKB pin 4	[2] RV1	Adjust for 12db SINAD Adjust [2] L17, if necessary, to achieve this
Q	On multi-channel equipment increase RF input by 2db; for each channel repeat step E, then check SINAD is greater than 12db.			
R	SINAD Meter	[0] SKB pin 4	–	Reduce RF input level to give 10db SINAD
			[2] RV4	Adjust so that squelch is just open
		–		Reduce input level by 6db; check squelch is closed
S	AF Voltmeter	[0] SKB pin 4	–	Increase RF input level to 1mV. Switch off modulation; check fall in AF level is greater than 50db.

Disconnect all test equipment

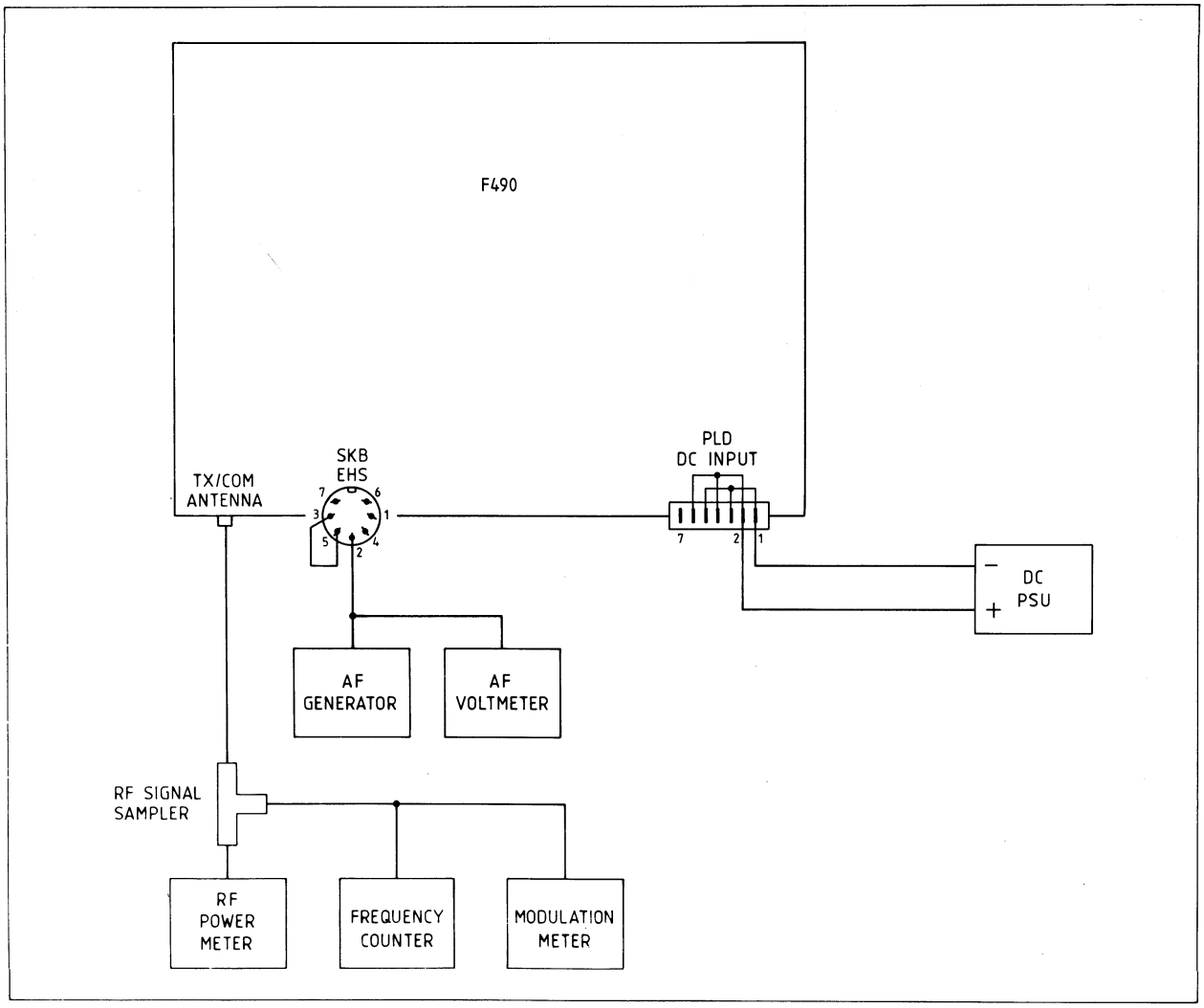


Fig 4.4 Transmitter Test Circuit

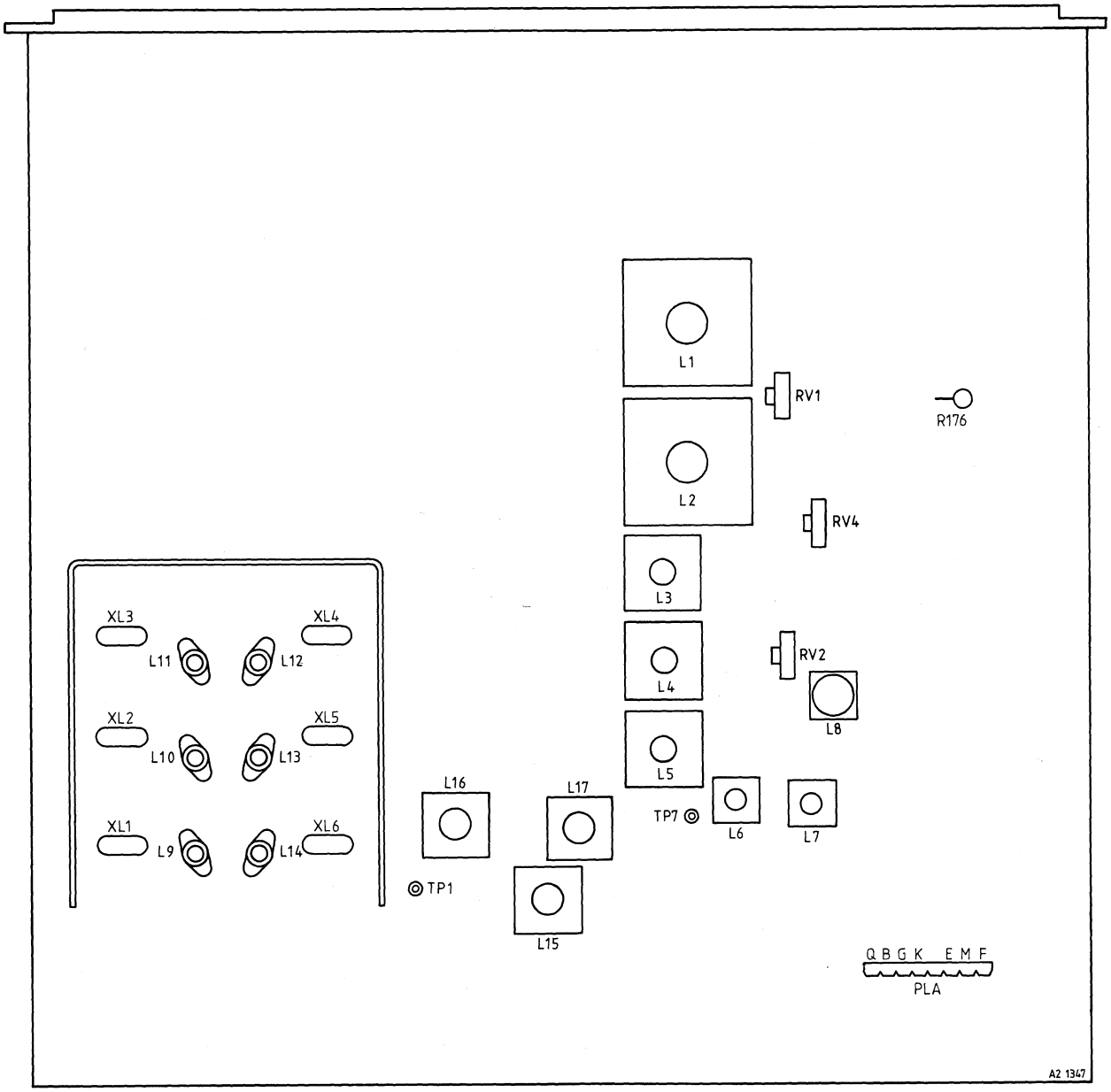


Fig 4.5 Receiver Alignment diagram

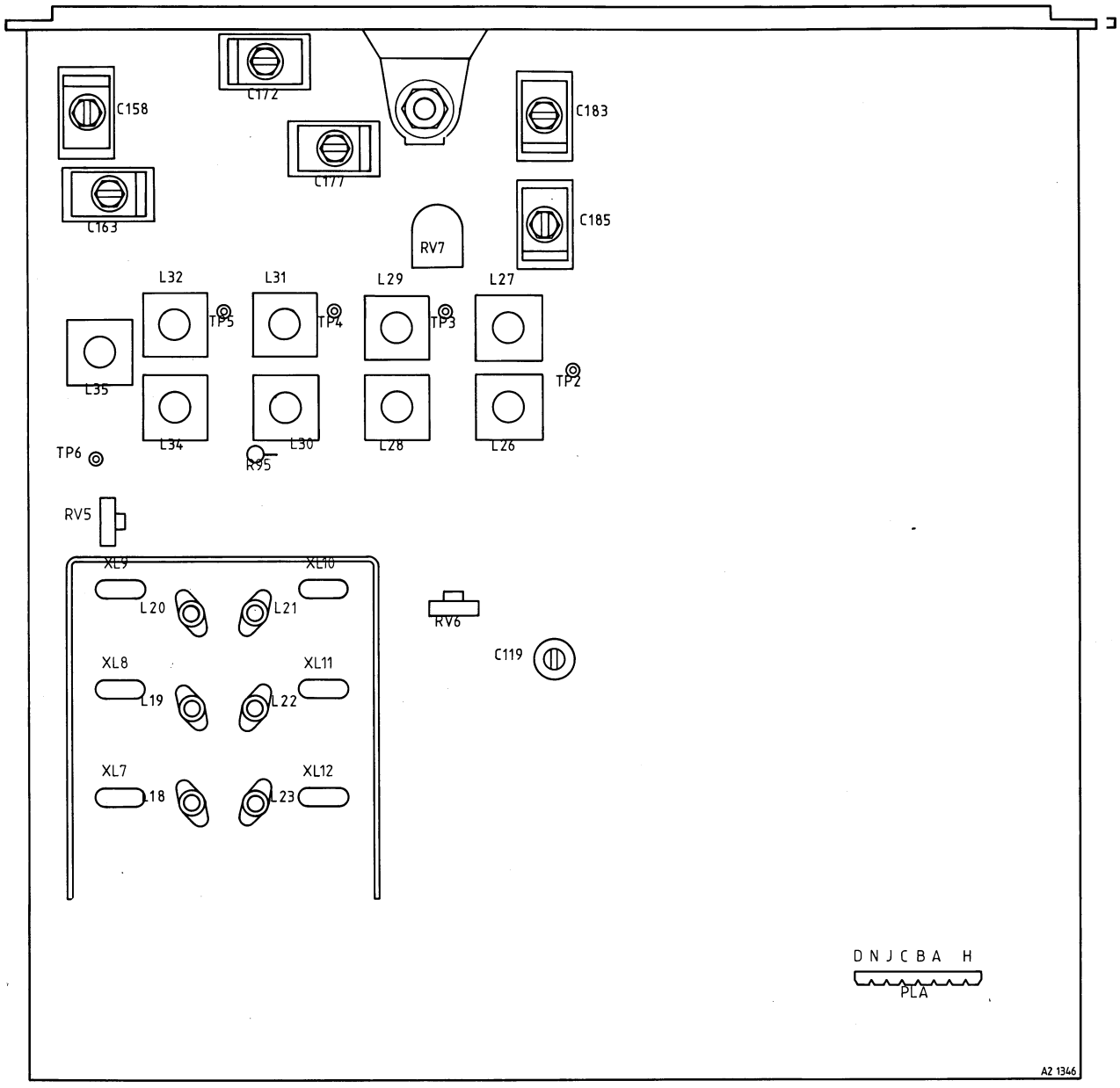


Fig 4.6 Transmitter Alignment diagram

6. Tx Alignment

(a) Connect test equipment as shown in Fig 4.4.

(b) Select channel frequncy closest to the centre frequency of the band covered

(c) Set RV5 to mid position
RV6 to mid position
RV7 fully clockwise

(d) Carry out the following alignment

STEP	TEST EQUIPMENT	TEST POINT	TUNE	ADJUSTMENT
A	AV0 (10V DC)	[3] TP2	[3] C119 [3] L26	Adjust for maximum Adjust for minimum
B	AV0 (10V DC)	[3] TP3	[3] L27 [3] L28	Adjust for maximum Adjust for minimum
C	AV0 (10V DC)	[3] TP4	[2] L29 [3] L30	Adjust for maximum Adjust for minimum
D	AV0 (10V DC)	[3] TP5	[3] L31 [5] L32	Adjust for maximum Adjust for minimum
E	Diode Probe	[3] C163	[3] L34,35,32	Adjust in order for maximum

Note: To prevent the diode probe reading being masked by saturation it may be necessary to turn [3] RV7 fully counter-clockwise whilst adjusting [3] L34,35,32. Turn fully clockwise on completion.

F	Set [3] C185 fully counter-clockwise			
G	Power Supply (current meter)	–	[3] C158,163	Adjust together for maximum supply current
H	RF Power Meter	–	[3]C158,163 [3] C172,177 [3] C183,185	Adjust in pairs for maximum power output

Note: On E band C158, 172, 183 may reach extreme settings near band edge.

K	RF Power Meter	–	[3] RV7	Increase slowly to maximum; check no instability is present
L	Set [3] RV6 for the required output power.			
M	Frequency Counter			Check each channel frequency is within 10Hz.
N	Modulation Meter	–	[3] RV6	with AF input level of 20mV at 1kHz adjust for peak system deviation

Note: Peak system deviation varies with channel spacing:

Channel Spacing (S) 12,5 kHz – Peak Deviation 2,5kHz
Channel Spacing (R) 20kHz – Peak Deviation 4kHz
Channel Spacing (V) 25kHz – Peak Deviation 5kHz

P	Modulation Meter	[3] RV5	Reduce AF input level to 2mV; adjust for 60% peak deviation

Disconnect all test equipment

7. Control

(a) Adjust RV2 to give the required audio sensitivity and, where applicable set RV3 (Rx 600Ω O/P LEVEL) to give the required audio level.

(b) Where applicable, make T/T TEST Link, check that LED1 (T/T) is lit and carry out the following procedure:

(i) Connect the signal generator to the RX ANTENNA socket and loosely couple the modulation meter to the TX/COM ANTENNA socket.

(ii) Set the signal generator output to channel frequency at 1mV modulated by 1 kHz, 40% peak deviation.

(iii) Check that LED2 (TX) is lit and adjust the T/T LEVEL potentiometer to give 60% peak deviation on the modulation meter.

(iv) Disconnect all test equipment and remove the T/T TEST Link.

(c) AC Signalling Control Module (AT28829/–) Only

Note: The notch filters and detector tune filter are aligned in the factory and should not normally require adjustment. If, however, excessive keying tone is present on the transmitter modulation or the transmitter cannot be keyed from the Controller the following alignment may be carried out:

(i) Connect the AF generator set to 2970 Hz ±1 Hz at –20 dbm to SKA as follows:

SKA pins 1 and 3 – 2 wire version
SKA pins 4 and 5 – 4 wire version

Note: An M80 series Controller may be used to generate the 2970 Hz tone.

(ii) Connect the AF Voltmeter to TP3,2 and 4 in turn and adjust RV6,5,7 as follows:

Notch 2	TP3	Adjust RV6 for minimum
Notch 1	TP2	Adjust RV5 for minimum
Detector Tune	TP4	Adjust RV7 for maximum

On completion disconnect all test equipment.

(iii) Connect the signal generator on channel frequency, modulated at 20% by 2970 Hz ± 1 Hz at a level of 1 mV to the receiver input.

(iv) Connect the AF Voltmeter to TP5 and adjust RV6 for a minimum reading.
On completion disconnect all test equipment

(d) AC Signalling Control Module (AT28829/01) Only

Note: The hybrid circuit requires balancing for the particular 600Ω line to be used, therefore, this procedure should be carried out with the base station and M80 Series Controller fully installed.

(i) Make LK3 (SQ DEF) and connect the AF Voltmeter to TP1
(ii) Adjust RV8 and RV9 for a minimum reading
(iii) Disconnect the AF Voltmeter and remove LK3

Alternatively, the hybrid circuit can be balanced using an engineers handset as follows:

(i) Disconect one end of R83
(ii) Make LK2 (EHS INTERCOM) and LK3 (SQ DEF)
(iii) Connect the EHS and operate the PTT switch-Receiver noise should now be audible.
(iv) Adjust RV8 and RV9 for minimum receiver noise.
(v) Disconnect LK2,3 and the EHS and reconnect R83.

SELECT-ON-TEST PROCEDURES

The following 'select-on-test' procedures will only need to be out when certain components (as detailed) are changed. The values of resistance are selected from the ranges given in the Parts List.

Receiver Board [2]

R176 (10V Regulator) – Selected when any of the 10V regulator components are changed.

Commencing with a 120Ω resistor select a value of resistance which gives a voltage reading of 9,8–10,2VDC wrt –ve at PLF pin 7. Increasing the resistance will increase the voltage at PLF pin 7.

Transmitter Board [3]

R95 (Pre-emphasised Amplifier) – Selected when [2] TR21, TR22, D9, D10 are changed.

Connect an AF generator, set to 20mV at 1 kHz to [0] SKB pin 2. Commencing with a 33Ω resistor select a value of resistance which gives symmetrical clipping, measured on oscilloscope, at [3] TP9.

SECTION 5

PARTS LIST

NOTATION

In the following Parts Lists component values are designated as follows:–

Capacitors — Values given in micro Farads unless otherwise stated

22	=	22 microFarad	(F × 10^{-6})
22n	=	22 nanoFarad	(F × 10^{-9})
22p	=	22 picoFarad	(F × 10^{-12})

Fractional values shown thus:

2μ2	=	2,2 microFarad	(2,2 × 10^{-6})F
2n2	=	2,2 nanoFarad	(2,2 × 10^{-9})F
2p2	=	2,2 picoFarad	(2,2 × 10^{-12})F

Resistors — Values given in Ohms unless otherwise stated

22	=	22 ohms	
22k	=	22 kilohms	(Ohms × 10^{3})
22M	=	22 Megohms	(Ohms × 10^{6})

Fractional values are shown thus:

2Ω2	=	2,2 ohms	
2k2	=	2,2 kilohms	(2,2 × 10^{3}) Ohms
2M2	=	2,2 Megohms	(2,2 × 10^{6}) Ohms

ORDERING OF SPARE PARTS

When ordering spares, please quote the description and Part No. of the item and the part number of the sub-assembly on which it is used together with the equipment code number given on the identity plate fixed to the equipment.

The right is reserved to fit alternative types of components with equal or improved performance to those quoted in the Parts List.

ABBREVIATIONS

aluminium	al	electrolytic	elec
cadmium	cad	hexagonal	hex
carbon film	c.film	printed wiring board	PWB
ceramic	cer	polyester	poly
cheesehead	ch	pozidriv	pozi
composition	comp	steel	st
countersunk	csk	tantalum	tant

PARTS LIST
UHF LINK/BASE STATION
TYPE F494
AT00313

	Description	Part No.	Code/Remarks
	SUB ASSEMBLIES		
	PCB assembly, VHF Tx	AT28751/–	Module [3] } See
	PCB assembly, VHF Rx	AT28752/–	Module [2] } headed
	PCB assembly, regulator	AT28724/–	Module [1] } list
	Thermistor and eyelet assembly comprising:	AT13986/01	
	Thermistor, 1k@ 80°C	PL23142	TH1
	Eyelet	QA09726	
	Link/systems control PCB	AT28725/01	
	Link/systems (with T/T) control PCB	AT28817	Module [5]
	DC signalling control PCB	AT28726/01	See Part 2
	MC490 control PCB	AT28824	
	AC signalling control PCB	AT28829	
	Microphone/controller	AT29703	
	Loudspeaker	AT10877/02	See headed list
	MECHANICAL ITEMS		
	Fitting kit, wall mounting comprising:	AT29625	
	Cradle	BT19013	
	Scr resx mshrm st M5 x 8mm	QJ07958/Z	1/Unit–Cradle
	Unit cover	AT14233	
⚠	Mains cover	BT15839	
	Chassis assembly	AT14204	
	Fuse bracket	BT11353	
	Cover fixing bracket	BT11346	2/Regulator heatsink
	Regulator heatsink	BJ37117	
	Blanking plate	BT20183	1/SKC
	Screen lid assembly	AT14315	
	Handle	FP16106	
	ELECTRICAL ITEMS		
	IC7812, regulator	FU99109	IC1
	Transistor BDV92	FV05597	TR1,2
	Bridge rectifier	FV05594	MR1
⚠	Transformer	AL21461	T1
	Diode IN4148	FV05808	LK8
⚠	Fuse 2A, time lag	FF99036	FS1 (For 240V)
⚠	Fuse 3, 15A, time lag	FF99037	FS1 (For 115V)
	Capacitor 15,000μF – 10% +30% elect	PS68022	C1
	Plug 15–way, fixed	FP99013	PLC
	Plug 5–way	FP14431	PLA
	Socket UHF 50Ω	FS16081	1/Rx antenna
	LED, green	FV05882	LED1
	Lead assembly, AC	AT36771	
⚠	Lead assembly, mains	AT36772	
	Lead assembly, regulator	AT36745	
	Lead assembly, COM antenna	AT36770/02	
	Lead assembly, Rx antenna	AT36799	
	Lead assembly	AT36779	1/Rx PCB–RLA
	FIXINGS		
	Screw, special	BT08208	4/Unit cover
	Scr sdriv pan st M2,5 x 6mm	QJ11945/B	2/PLD
	Scr sdriv pan st M2,5 x 8mm	QJ11946/B	1/IC1
	Scr pozi pan st M3 x 6mm	QJ11901/X	2/Mains cover; 3/Rx antenna skt; 3/Tx antenna skt; 4/Regulator 2/Tx PCB; 4/Rx PCB; 6/Tx lid; 1/TH1; 2/Plate

Description					Part No	Code/Remarks
FIXINGS (Contd.)						
Scr	sdriv	pan	st	M3 x 10mm	QJ11903/X	1/Rx antenna skt; 1/Tx antenna skt
Scr	sdriv	pan	st	M3 x 20mm	QJ11906/Z	1/TR1,2
Scr	sdriv	pan	st	M3 x 25mm	QJ11907/X	2/RLA
Scr	sdriv	pan	st	M4 x 12mm	QJ11919/X	1/P Clip; 2/T1
scr	sdriv	pan	st	M4 x 12mm	QJ11919/Z	5/Tx heatsink; 5/Reg heatsink
Scr	sdriv	pan	st	M4 x 30mm	QJ11923/Z	1/D1 – heatsink
Scr	sdriv	pan	st	4-20 x 5/16	QJ08268/X	4/Cover fxg bracket
Nut	hex		st	M2,5	QA11604/B	2/PLD
Nut	hex		st	M3	QA11605/X	4/Rx antenna skt; 4/Tx antenna skt; 1/TR1,2;2/Plate
Nut	hex		st	M4	QA11607/X	1/Clip; 1/D1
Washer			st	M3	QA15005/X	
Washer			st	M4	QA15007/X	
Washer	nylon			M3	QA14905	1/Rx PCB
MISCELLANEOUS						
Hood					FP16108	1/PLC
Fuseholder, panel mounting					FH99100	1/FS1
LED mounting clip and ring					QA99006	1/LED1
Grommet 3/4 in					FG02213	1/600Ω line hole
Strain relief bush					FG02721	1/Chassis – mains cable
Insulating bush					QA05638	1/TR1,2
Mica insulator					QA05639	1/TR1,2
Heatsink compound					HM00404	
Cable clip					QA02218	2/Mains cable
Plug clip					FP16107	2/PLC
Clip 1/8 in					QA00531	2/Antenna cable
Clip 1 1/2 in					QA02571	1/C1
⚠ Label, safety/warning					BT37403/01	1/Transformer cover
⚠ Label, safety/warning					BT37404/01	1/Transformer cover
⚠ Label,safety/warning					BT37405/01	1/Mains cable
⚠ Fuse label					BT38028	1/Transformer cover
Label, information					BT37340	
⚠ Label, warning					BT37434	1/Mains cable
OPTION ITEMS						
Engineers handset					FH00653	Servicing aid
Eurorack Mounting Kit					AT29634	Low cost assembly

PCB ASSEMBLY REGULATOR [1]
AT28724/–

/01 – AC with 24V DC Standby
/02 – AC with 12V DC Standby
/03 – 24V DC only

Description				Part No.	Code/Remarks
SEMICONDUCTORS					
Transitor BC547B				FV05891	TR1;TR2 (AC only)
Diode MR751				FV08961	D1;D2,3 (AC only);
RESISTORS					
0Ω1	±10%	2,5W	WW	PL40113	R3,4
6Ω8	±5%	0,25W	c.film	PM01410	R1,2 (12V standby only)
270	±5%	1,6W	m.film	PL51186	R11 (AC only)
680	±5%	1,6W	m.film	PL51201	R6
1k	±5%	0,25W	c.film	PM01436	R13 (AC only)
1k2	±5%	0,25W	c.film	PM01437	R5
1k2	±5%	1,6W	m.film	PL51202	R10

Description				Part No	Code/Remarks
RESISTORS (Contd.)					
2k2	±5%	1,6W	m.film	PL51203	R8;R9 (AC only)
15k }	±5%	0,25W	c.film	PM01450	R7
18k }				PM10451	R12 (AC only)
Pot skel 470 ±20% lin				PL99006	RV1
CAPACITORS					
100n	±10%	100V	poly	PQ99501	C2,3
220n	±10%	100V	poly	PQ99508	C1
100μ		40V	elect	PS99529	C4;C6 (AC only)
680μ		40V	elect	PS99530	C5(24V versions only)
MISCELLANEOUS					
Fuse 10A				FF99021	FS1;FS2(AC only)
Fuseholder				FH99101	For FS1,2
Relay				FR01255	RLA (AC only)
LED, red				FV05861	LED1
LED, green				FV05933	LED2(AC only)

PCB ASSEMBLY VHF Rx [2]
AT28752/–

/01 Single channel, 25kHz channel spacing	/04 Six channel, 25kHz channel spacing	A band
/02 Single channel, 20kHz channel spacing	/05 Six channel, 20kHz channel spacing	
/03 Single channel, 12,5kHz channel spacing	/06 Six channel, 12,5kHz channel spacing	
/07 single channel, 25kHz channel spacing	/10 Six channel, 25kHz channel spacing	B band
/08 Single channel, 20k channel spacing	/11 Six channel, 20kHz channel spacing	
/09 Single channel, 12,5kHz channel spacing	/12 Six channel, 12,5kHz channel spacing	
/13 Single channel, 25kHz channel spacing	/16 Six channel, 25kHz channel spacing	E band
/14 Single channel, 20kHz channel spacing	/17 Six channel, 20kHz channel spacing	
/15 Single channel, 12,5kHz channel spacing	/18 Six channel, 12,5kHz channel spacing	

Description				Part No.	Code/Remarks
SEMICONDUCTORS					
IC IF amp & discriminator				FU07680	IC1
IC741				FU99073	IC3
Transistor PBC108				FV05800	TR37,38
Transistor PBC108B				FV05802	TR6,14–16
Transistor MPS918–18				FV05893	TR4,5,11,12
Transistor TIS88A				FV08935	TR3
Transistor TIP32				FV08940	TR39
Transistor J309				FV40828	TR1
Transistor WN1003				FV40829	TR2
Zener diode ZF8,2				FV08030	D13
Diode IN4148				FV05808	D1–5,14
RESISTORS					
10				PM01412	R1,59
22				PM01416	R23
100				PM01424	R5,13,71,76,77
150				PM01426	R177,180
470				PM01432	R15,69,179,181
560				PM01433	R57,61
680	±5%	0,25W	c.film	PM01434	R2,14,48;R49–53 (Six channel)
820				PM01435	R4,56
1k				PM01436	R72,73,75,78
1k2				PM01437	R3,20,67
1k8				PM01439	R16,17
2k2				PM01440	R83,182
2k2	±5%	0,125W	c.film	PL99773	R194
2k7				PM01441	R80

Description				Part No	Code/Remarks
RESISTORS (Contd.)					
3k3	±5%	0,25W	c.film	PM01442	R8,21
3k9				PM01443	R10,12
4k7				PM01444	R6,31,34,54,55,64,70,74,82,27
5k6				PM01445	R28,24
6k8				PM01446	R26
8k2				PM01447	R11,63
10k				PM01448	R19,178
15k				PM01450	R25,62
18k				PM01451	R79 (12,5/20kHz channel spacing)
47k				PM01456	R18;R79 (25kHz channel spacing)
82k				PM01459	R29,30
100k				PM01460	R7,9,22,66
Pot skel 470 ±20% lin				PL06730	RV2
Pot skel 4k7 ±20% lin				PL03370	RV1
Pot vert 10k lin				PL62111	RV4
Select-on-Test					
100	±5%	0,25W	c.film	PM01424	R176 SOT
120				PM01425	
150				PM01426	
180				PM01427	
220				PM01428	
270				PM01429	
330				PM01430	
390				PM01431	
470				PM01432	
BAND CONCIOUS RESISTORS					
150	±5%	0,25W	c.film	PM01426	R60 (A,B,E bands)
820				PM01435	R56 (A,B,E bands); R84 (25/20kHz channel spacing)
1k2				PM01437	R81 (25/20kHz channel spacing)
1k5				PM01438	R81,84 (12,5kHz channel spacing)
2k2				PM01440	R65(12,5kHz channel spacing)
2k7				PM01441	R58 (A,B,E bands); R85 (25/20kHz channel spacing only)
3k9				PM01443	R85 (12,5kHz channel spacing)
4k7				PM01444	R65 (25/20kHz channel spacing)
CAPACITORS					
10p	±2%	63V	cer plate	PN99759	C33
47p				PN99767	C28,60
56p				PN99768	C37
82p				PN99770	C17,20
120p				PN99806	C29,36
1n				PN99811	C27,57,64
2n2	±10%	63V	cer plate	PN99812	C59,66
4n7	±10%	63V	cer plate	PN99813	C6,7,15,18,19,21,22,24–26,30,35,39, 56,58,69,70,76,170,186,198
4n7	±10%	100v	cer plate	PN99604	C200
47n				PQ99514	C44,45
100n	±10%	63V	poly	PQ99511	C23,31,32,73,74,197
1μ	±20%	35V	elect	PS99502	C38,41,75
2μ2	±20%	35V	elect	PS99503	C71,72
2μ2		63V	elect	PS99821	C16,46,77,78
6μ8		35V	tant	PS99512	C79
10μ		25V	elect	PS99513	C34, 42
33μ		25V	elect	PS99807	C40
470μ		16V	elect	PS99809	C196,199

Description				Part No	Code/Remarks
BAND CONCIOUS CAPACITORS					
0p56	±10%		cer comp	PN00123	C2(A band);C67(A,B bands)
0p68				PN00124	C2(B band)
0p82				PN00120	C67(E band)
2p2	±0p25	63V	cer plate	PN99751	C187(A band)
2p7				PN99752	C187(B band)
2p7	±5%		cer comp	PN01121	C2(E band)
3p3	±0p25	63V	cer plate	PN99753	C188(A band)
3p9				PN99754	C63,191(A band); C63,188 (B band)
4p7				PN99755	C191(B band)
5p6				PN99756	C188(E band)
6p8				PN99757	C63,187(E band)
8p2				PN99758	C62,189(A band); C62(B band)
10p	±2%	63V	cer plate	PN99759	C189(B band);C191(E band)
12p				PN99760	C68,190(A band);C68(B band)
12p				PN99569	C1,3(A band)
15p				PN99761	C65,192,195(A band);C65,190, 195(B band);C195(E band)
15p				PN99570	C1,3(B band)
18p				PN99762	C194(A band);C192(B band)
22p				PN99797	C194(B band);C62,189(E band)
27p				PN99798	C65,190(E band)
33p				PN99765	C61(A,B bands);C68(E band)
33p				PN99574	C1,3(E band)
39p	±2%	63V	cer plate	PN99766	C192,194(E band)
47p				PN99767	C61(E band)
150p				PN99773	C4(A,B bands)
1n	±10%	63V	cer plate	PN99811	C14(A,B bands)
4n7				PN99813	C4,14(E band)
INDUCTORS					
Coil assembly				FT06446	L8
				AT32122/01	L6;L7(B,E bands)
				AT31224/01	L43–46(E band) } Six channel
				AT31233	L43–46(B band) } Six channel
				AT31233/04	L43–46(A band) } Six channel
				AT32078/03	L17(A,B bands)
				AT32078/04	L16(A,B bands)
				AT32078/05	L15(A,B bands)
				AT32080/03	L15(E band)
				AT32080/05	L17(E band)
				AT32126/06	L1,2(A,B bands)
				AT32126/07	L1,2(E bands)
				AT32172/09	L9–14(A,B bands)
				AT32172/10	L9–14(E band)
				AT32700/01	L4(A band)
				AT32700/09	L3(A band)
				AT32700/10	L5(A band)
				AT32700/11	L3(B band)
				AT32700/12	L4(B band)
				AT32701/11	L5(E band)
				AT32700/13	L5(B band)
				AT32701/09	L3(E band)
				AT32701/10	L4(E band)
Can				BJ34060	For L1,2
Can				FT03516	For L6,7
Can				FT03520	For L3–5
Can				FT03521	For L15–17
MISCELLANEOUS					
Knob, channel				BT37478	
Switch, channel				FS07199	SA } Six channel
Label, channel				BT38029	} Six channel
Compression ring				QA04133	1/SA } Six channel
Header, str,male, 8 way				FC00837/08	
Oscillator cover				BT26305/01	
Regulator screen				BT26304	

Description	Part No	Code/Remarks
MISCELLANEOUS (Contd.)		
Mixer screen	BT26326	
Screen	BT26308	
Crystal, 11,155MHz	FC03174/04	XL13
Crystal filter 25kHz	FC99004	FL1 (20/25kHz channel spacing)
Crystal filter 12,5kHz	FC03293	FL1 (12,5kHz channel spacing)
Ceramic filter 455kHz	FC99020	FL2 (20/25kHz channel spacing)
Ceramic filter 455kHz	FC99022	FL2 (12,5kHz channel spacing)
Lead assembly	AT36746	Rx – Control board
Bead	FC36151	FB1
Scr pozi pan st M3 x 8mm	QJ11902/X	1/TR39
Nut hex st M3	QA11605/X	1/TR39
Washer	BT29237	
Label, ident	BT38030/03	
Heatsink compound	HM00404	

PCB ASSEMBLY VHF Tx [3]
AT28751/–

/01 25W, duplex, single channel	A Band
/02 25W, simplex, single channel	
/03 25W, duplex, six channel	
/04 25W, simplex, six channel	
/05 25W, duplex, single channel	B Band
/06 25W, simplex, single channel	
/07 25W, duplex, six channel	
/08 25W, simplex six channel	
/09 25W, duplex, single channel	E Band
/10 25W, simplex, single channel	
/11 25W, duplex, six channel	
/12 25W, simplex, six channel	

SUB ASSEMBLIES					
Heatsink & feedthru' assembly				AT14231/02	See headed list
SEMICONDUCTORS					
Transistor 2N5447				FV05788	TR34
Transistor PBC108				FV05800	TR17–19,21,22
Transistor PBC108B				FV05802	TR23
Transistor BF244B				FV05827	TR27,28
Transistor				FV05828	TR20
Transistor				FV05830	TR32
Transistor MPS918–18				FV05893	TR24–26,29–31
Transistor TIP32				FV08940	TR33
Transistor RF2123A 'BeO'				FV40830	TR36(B,E bands)
Transistor TP2314 'BeO'				FV41807	TR35
Diode IN4001				FV05840	D11,12
Diode IN4148				FV05808	D8 – Simplex D9,10 – Duplex
Transistor TP2330 'Be0'				FV41841	TR36(A band)
RESISTORS					
1	±10%	0,25W	c.film	PM01400	R163
3Ω3	±10%	0,25W	c.film	PM01406	R171
47	±5%	0,25W	c.film	PM01420	R114,155
56				PM01421	R159
68				PM01422	R186
100				PM01424	R92,99,127,135,151,152
120				PM01425	R90
150				PM01426	R100,142
270				PM01429	R98,147
470				PM01432	R94,130,144
680				PM01434	R89,146,148,R122–126 (Six channel)
820				PM01435	R109,150,154,183
1k2				PM01437	R86,134,158
1k5				PM01438	R110,143

Description				Part No	Code/Remarks
RESISTORS (Contd.)					
2k2	±5%	0,25W	c.film	PM01440	R97,113,121,141
2k7				PM01441	R138
3k3				PM01442	R108,136,157
3k9				PM01443	R139
4k7				PM01444	R103,104,131
5k6				PM01445	R111,137
6k8				PM01446	R101
8k2				PM01447	R102,106,140
10k				PM01448	R88,93,105,145,149,153
12k				PM01449	R96
18k				PM01451	R107,112,133
27k				PM01453	R59
100k				PM01460	R87,91,128,129,132,173
Pot skel 100 ±20% lin				PL03323	RV7
Pot skel 470 ±20% lin				PL06730	RV6
Pot skel 4k7 ±20% lin				PL03370	RV5
Select-on-Test					
33	±5%	0,25W	c.film	PM01418	R95 SOT
39				PM01419	
47				PM01420	
56				PM01421	
68				PM01422	
82				PM01423	
100				PM01424	
120				PM01425	
150				PM01426	
180				PM01427	
220				PM01428	
270				PM01429	
BAND CONCIOUS RESISTORS					
0Ω03	±20%			PL41528	R168(A,B,E bands)
6Ω8	±5%	0,25W	c.film	PM01410	R170(E band)
10	±5%	0,25W	c.film	PM01412	R170(A,B bands); R164(A,E bands)
22				PM01416	R164,169(B band)
39				PM01419	R161(B band); R169(A band)
47				PM01420	R156(A,E bands)
68				PM01442	R169(E band)
100				PM01424	R156(B band); R160(E band)
180				PM01427	R188(E band)
270				PM01429	R161(E band)
330				PM01430	R172(E band)
470				PM01432	R160,172(A,B bands)
820				PM01435	R161(A band);R162,165,166,(A,B,E bands)
1k				PM01436	R167(E band)
2k2				PM01440	R167(A,B bands)
12k	±5%	0,125W	c.film	PL99781	R187(A,B bands)
CAPACITORS					
1n	±10%	63V	cer plate	PN99811	C82,84,87,123,126,131,134, 139,145,150,154,166,173
2n2				PN99812	C92,94,97,103,104,106
2n2	±2,5%	63V	poly	PQ99617	C98,101
4n7	±10%	63V	cer plate	PN99813	C86,100,108,115,120,149,165, 168–170,186
10n	±2,5%	63V	poly	PQ99621	C99,102
100n	±10%	63V	poly	PQ99511	C96,125,129,161,175
0μ1		25V	tant	PS99201	C118
0μ1		50V	elect	PS99863	C109
2μ2	±20%	35V	elect	PS99503	C90
2μ2		63V	elect	PS99821	C83,85,93,95,159,160
33μ		16V	elect	PS99807	C81,88,105,107,124,202
100μ	±20%	3V	elect	PS99510	C91
470μ		16V	elect	PS99809	C174,196,199
Variable	7–35p	160V		PV05118	C119

Description				Part No	Code/Remarks
BAND CONCIOUS CAPACITORS					
0p82				PN00120	C147(E band)
0p56	±10%		cer comp	PN00123	C147(A band)
0p68				PN00124	C147(B band)
1p	±0p25	63V	cer plate	PN99747	C141(A band)
1p2	±10%		cer comp	PN00114	C141(B band)
1p8				PN99750	C130,135(A,E bands); C141(E band)
2p2				PN99751	C187(A band);C130,135(B band)
2p7				PN99752	C187(B band)
3p3				PN99753	C188(A band)
3p9				PN99754	C191(A band);C188(B band)
4p7				PN99755	C191(B band)
5p6	±0p25	63V	cer plate	PN99756	C188(E band)
6p8				PN99757	C187(E band)
8p2				PN99758	C189(A band)
10p				PN99759	C121,122(A band);C184,189(B band) C137,191(E band)
12p				PN99760	C190(A band);C121,122(B band)
15p				PN99761	C195(A,B,E bands); C146,192(A band); C190(B band)
18p				PN99762	C194(A band); C192(B band)
22p				PN99763	C151(A,E bands)
22p				PN99797	C146,194(B band);C189(E band)
27p				PN99798	C146,190,201(E band); C151(B band)
27p				PN99764	C117,140,155(A band); C155,162 (E band)
33p				PN99799	C117,140,155(B band);C122 (E band)
33p				PN99765	C143,176,201(A band); C176(B band); C184(E band)
39p				PN99766	C201(B band); C132,192,194(E band)
39p				PN99800	C143(B band)
47p				PN99767	C133(B band);C128,138,140,157,176 (E band)
56p				PN99802	C133,162(B band)
56p				PN99768	C116,152(A band)
68p				PN99803	C116,152(B band)
68p	±2%	63V	cer plate	PN99769	C143,182(E band)
82p				PN99770	C137(A band); C178,179(B band); C110,133,171(E band)
82p				PN99579	C180,181(B band)
100p				PN99580	C180,181(A band)
100p				PN99805	C137(B band)
100p				PN99771	C112,128,132,138,144,178,179 (A band); C113,116,144,152,167 (E band)
120p				PN99806	C128,132,138,144(B band)
120p				PN99772	C112(B band);C117,180,181(E band)
150p				PN99773	C113(A band); C112(E band)
180p				PN99774	C121(E band)
180p				PN99795	C113(B band)
270p				PN99776	C111(A band)
330p				PN99777	C111(B band)
470p				PN99810	C111(E band)
1n	±10%	63V	cer plate	PN99811	C148,153(A,B bands); C110,114 127,136,142(E band); C80(A,B, E bands – simplex only)
4n7	±10%	63V	cer plate	PN99813	C164(A,B,E bands); C148,153 (E band)
Variable 10–80p				PV01055	C177,185(A,B bands); C158,163 (E bands)
Variable 30–140p				PV01053	C158,163(A,B bands);C177 (E band)
Variable 60–180p				PV01054	C172,183(A,B bands); C185 (E band)
Variable 120–135p				PV09371	C172,183(E band)

Description	Part No	Code/Remarks
INDUCTORS		
Choke 10μH	FT05708	L33
Choke 470μH	FT99007	L47
Choke 15μH	FT99004	L24(A,B bands)
Choke 22μH	FT99011	L25(A,B bands)
Choke 33μH	FT05618	L24(E band)
Choke 47μH	FT99005	L25(E band)
Choke assembly	AT31975/01	FB7,L39(E band)
Coil assembly	AT31185	L37,39(A,B bands)
	AT31186	L42(A,B bands)
	AT31187	L41(A,B bands); L42(E band)
	AT31187/01	L41(E bands)
	AT31188	L38,40(A bands)
	AT31221/04	L38(E band)
	AT31221/05	L40(E band)
	AT31224/01	L43–46(E band)
	AT31233	L43–46(B band)
	AT31233/04	L43–46(A band)
	AT32052/02	L34(A,B bands)
	AT32052/03	L35(A,B bands); L32,35(E band)
	AT32052/04	L32(A,B bands)
	AT32060/01	L31(A,B bands)
	AT32060/02	L30(A,B bands)
	AT32060/03	L32(E bands)
	AT32060/04	L34(E band)
	AT32060/06	L35(E band)
	AT32068/02	L30(E band)
	AT32068/03	L31(E band)
	AT32068/05	L28,29(A,B bands)
	AT32071/04	L26,27(A,B bands)
	AT32071/05	L28(E band)
	AT32103/03	L26,27,29(E band)
	AT32171/23	L18–23(A,B bands)
	AT32188/01	L18–23(E band)
Can	FT03521	For L26–32,34,35
MISCELLANEOUS		
Changeover relay, 9V	FR21703	RLA – simplex
Knob, channel	BT37478	
Switch, channel	FS07199	SA } Six channel
Label, channel	BT38029	
Compression ring	QA04133	1/SA }
Header, str, male, 8 way	FC00837/08	
Oscillator cover	BJ30740	
Regulator screen	BT26304	
Oscillator screen	BT26336	
Screen	BT26308	
Screen, modified	BJ37115	
Heatshunt bracket	BT11351	
Heatsink	QA05849	1/TR34
Heatsink	BT37525	
Heatsink	BT37586	
Heatsink adaptor	QA05776	1/TR35
Ferrox bead	FC36151	2/FB2; 1/FB6
Insulating bead	FJ00007	
Fibre washer 10BA	BT29203	
Support	BT26628	
Shim	BT29967	
Clip	QA04097	
Scr pozi pan st M3 x 10mm	QJ11903/Z	2/Heatsink support
Scr pozi pan st M3 x 6mm	QJ11901/X	2/Support
M3 x 8mm	QJ11902/X	1/TR33
M3 x 20mm	QJ11906/Z	2/Heatshunt–Heatsink
Nut hex st M3	QA11605/X	1/TR33; 2/Heatshunt–Heatsink
Washer	BT29237	
Label,ident	BT38030/04	
Heatsink compound	HM00404	
Lead assembly, Tx antenna	AT36770/03	

LOUDSPEAKER ASSEMBLY
AT10877/02

Description	Part No.	Code/Remarks
Loudspeaker	FS11525	
2-way housing	FT10535	
Tin plated pin	FT10537	
Insulating sleeve	FS22184/04	
Identification sleeve	FS22192/06	
Cover	BT15372/01	
Bracket	BT11251	
Label	BT18990	
Mounting strap	BT27020	
Cloth, rear cover	BT27318	
Speaker grille	BT35823	
Captive nut	QA00114	
Washer, st, 2BA	QA13002/X	2/Strap to cover
Sprint washer 2BA	QA13464/B	2/Strap to cover
Scr, hex, pozi, No. 10B x 20mm	QJ06645/X	
Scr. st. pan, pozi, 4/20 x 5/16 in	QJ08268/A	

PART 2
CONTROL OPTIONS

LINK/SYSTEMS CONTROL MODULE AT28725/01
(FOR USE WITH PRIMARY OPTIONS 11+12 ON EARLY EQUIPMENTS ONLY)

INTRODUCTION

The Link/System control module provides an interface to the F490 series transmitter/receivers when used in link or systems applications. The board provides separate balanced 600Ω input and output connectors, transmit/receive keying, squelch defeat and a squelch logic output facilities. Simplex or duplex operation may be used.

TECHNICAL DESCRIPTION

Tx Audio

Tx audio enters the control board on SKC pins 14 and 15, is fed across T1 and amplified in IC1(b). LK1 is linked in to provide a gain reduction of 20db through R5. RV2 sets the Tx600Ω sensitivity level and the output is fed to the transmitter board.

Rx Audio

Rx audio from PLF is applied, via the squelch gate IC3(b) to the push-pull amplifier IC2. The output is fed across T2 to SKC pins 11 and 12. TR1 switches an impedance of 600Ω across T2 primary in the event of a power failure.

Tx Key

A Tx key 'lo' at SKC pin 6 is applied, via D4,8 to the NAND Schmitt gate IC4(b); the 'hi' at pin 4 produces a 'lo' at pin 10 which switches on TR3 causing LED2 (TX) to light providing TX 10V to PLE and also causes TR4 to conduct applying +15V to the relay line on PLE and SKC; if fitted, the antenna changeover relay operates to select the Tx antenna.

Squelch

A squelch 'lo' from the schmitt trigger on the receiver board switches on TR5 causing:

(i) LED3 (SQ) to light
(ii) The squelch gate IC3(b) to open
(iii) TR7 to conduct providing a squelch output 'lo' through D14 to the SQUELCH LOGIC O/P on SKC pin 3

Squelch Defeat

A squelch defeat 'lo' on SKC pin 4 fed via D12, reverse biases D13; the voltage across zener diode D15 cuts off TR5 to close the squelch gate.

LK3 enables an engineer to defeat the squelch for test purposes.

Rx Inhibit

An Rx inhibit 'lo' at SKC pin 5 produces a 'hi' at IC4 pin 3 to hold off TR2 and inhibit Rx.

Tone Valid

A 'lo' from the tone option module fed in on PLF causes TR6 to conduct preventing TR5 from being turned on by the squelch schmitt trigger. When a valid tone is received the tone module gives a 'hi' output switching off TR6 and allowing TR5 to be switched on.

Engineers Handset

The engineers handset (EHS) is connected to SKB. Immediately the EHS is connected ground is applied to IC4 pin 9 which produces a 'hi' at pin 10 to hold off TR3 and inhibit the Tx condition.

Operation of the PTT switch on the EHS grounds the junction of D4/D8 to apply a 'lo' to IC4 pins 5 and 6; a 'lo' is produced at pin 10 causing TR3 to conduct and the transmit condition assumed. The 'lo' is also applied to D2/D6 producing a 'hi' at IC4 pin 1 to hold off TR2 and inhibit Rx.

Audio from the EHS microphone is fed directly to the transmitter board on PLE (EHS MIC).

Received audio from PLF is routed through R20 and transmit audio through R19 to IC1 pin 2, then through C4 to the EHS earpiece at a level set by RV1.

Intercom

The intercom facility allows an engineer to talk to the Controller using the EHS; LK2 is made.

PARTS LIST
LINK/SYSTEMS CONTROL PCB
AT28725/01

Description				Part No	Code/Remarks
SEMICONDUCTORS & ICS					
IC Dual Op Amp				FU99092	IC1,2
IC4066 MOS				FU99104	IC3
IC4093 MOS				FU99103	IC4
Transistor BC557B				FV05977	TR5,6
Transistor BC337				FV05896	TR7
Transistor BC327				FV05975	TR2–4
Transistor BF245B				FV05900	TR1
Zener Diode 4V7				FV05866	D15
Zener Didoe C5V6				FV05867	D1
Zener Diode 6V8				FV05868	D10
Diode IN4148				FV05808	D2–9,11–14
RESISTORS					
10	±5%	0,25W	c.film	PM01412	R24
270				PM01429	R6
330				PM01430	R7
390				PM01431	R3
680				PM01434	R2
820				PM01435	R11
1K				PM01436	R5,8,35,36,39,45
1k2				PM01437	R14,37,40,44
1k5				PM01438	R12
1k8				PM01439	R25,26,31,32,43
2k7				PM01441	R13
3k3				PM01442	R16,42
4k7				PM01444	R17,20
10k				PM01448	R1,4,9,10,18,21,28,30,33,34, 41,46,51,52
15k				PM01450	R48
18k				PM01451	R15
22k				PM01452	R19,49
47k				PM01456	R22,23,27,29,50
Pot skel 2k2	±20%	lin		PL99001	RV1
Pot skel 47k	±20%	lin		PL01498	RV3
CAPACITORS					
1n	±10%	63V	cer plate	PN99811	C3
4n7	±10%	63V	cer plate	PN99813	C2,9,10–13
4μ7		63V	elect	PS99824	C4–7
10μ		25V	elect	PS99812	C8
33μ		16V	elect	PS99807	C14
470μ		10V	elect	PS99806	C1
MISCELLANEOUS					
Transformer				AL21246	T1,2
Socket, 7 way				FS44448	SKB
Socket, 15 way				FS46114	SKC
LED, red				FV05858	LED1,2
LED, yellow				FV05930	LED3
Scr pozi pan st	M3 x 8mm			QJ11902/X	2/SKC
Nut hex st	M3			QA11605/X	2/SKC

DC SIGNALLING CONTROL MODULE AT28726/01

(FOR USE WITH PRIMARY OPTIONS 21–23,27)

INTRODUCTION

This control board enables the F490 series base stations to be controlled by a Pye PC1 Controller using DC signalling over Post Office lines. Links are provided to enable a number of different switching circuit types to be used.

The Link details for this board are given in Tables 1 and 2.

Link	In/Out	Description
LK1 (–20db gain)	IN	Reduces gain of TX 600Ω line input amp, for line signals greater than –20dbm
LK2 (INTERCOM)	IN	Provides intercom between EHS and Controller. Transmitter cannot be keyed by the handset with LK2 IN
LK3 (SQ DEF)	IN	Enables the Rx squelch to be opened for test purposes
LK4 (TT TEST)	IN	Enables talkthrough to be selected for test purposes
LK5 (TONE SQ/TT)	A TO B IN A TO C IN (VIA DIODE)	Connects tone decoder output to squelch logic circuit Connects tone decoder output to talkthrough logic circuit (See Talkthrough Description)
LK6 (TT DEL OFF)	OUT IN	Talkthrough Mode Only Transmitter remains on for two seconds (approx.) after Rx squelch closes Talkthrough delay removed
LK7 (TD/SD)	OUT IN	'Lo' on SKC pin 4 provides tone defeat 'Lo' on SKC pin 4 provides squelch defeat
LK8,LK9	See Table 2	Controls DC line sensing logic for various switching circuit types.
LK10	IN	Connects POE sensing input to chassis. Used when separate signalling earth wire is not available

Table 1

Switching Circuit Type	Controlled Functions	LK8	LK9
01	Tx/Rx	IN	E–H,I–J
2B	Tx/Rx + T/T	OUT	A–H,F–G,I–J
2J	Tx/Rx + Linefail T/T	OUT	A–H,E–G,I–J
2N	Tx/Rx + Tone Defeat	OUT	A–H,C–J
3A	Tx/Rx + T/T + Tone Defeat	OUT	A–J,B–H,F–G
3B	Tx/Rx + Linefail T/T + Tone Defeat	OUT	A–J,B–H,E–G
4A	Tx/Rx + Linefail T/T	IN	C–H,E–G,I–J

Notes: (i) Types 01 and 4A are 2 wire systems and do not require a signalling earth
(ii) If Squelch Defeat is required instead of Tone Defeat LK7 must be made.

Table 2

TECHNICAL DESCRIPTION

Tx Audio

The audio input is applied on PLA and developed across transformer T1; IC4(a) provides amplificaiton and LK1 may be linked in circuit to provide a 20db attenuation. RV2 sets the TX600Ω sensitivity. The audio is then applied to the Tx gate on IC6 pin 3, further amplified by IC4(b) and fed, via C10, to the transmitter board on PLE.

Rx Audio

The Rx AF output from the receiver board on PLF is applied through C12 to the squelch gate on IC6 pin 11. The audio on IC6 pin 10 is routed in two directions.

(i) Through RV4 (Talkthrough Level) to IC4 pin 2 when talkthrough is selected
(ii) Via R26, to IC5(a) which amplifies the signal and feeds it, via RV3 (Rx600Ω O/P Level), through the gate to the push-pull amplifier IC3 and across T1 to Lines 1 and 2.

TR1 across the output of the push-pull amplifier proves an effective open-circuit during normal operation but provides an impedence of 600Ω across T1 secondary in the event of a power failure.

DC Signalling

The DC signalling voltages on lines 1 and 2 are fed through the resistor networks R1,2,3 and R4,5,6 to the input side of the opto-couples IC1 and IC2; zener diodes D1,2 andD3,4 protect the circuit from transient voltages.

The input from the Post Office line may be any combination of+50V, –50V or 0V depending on the switching circuit type employed.

The voltages will determine which of the opto-couplers give an output to LK9 as follows:

Line 1 +50V	Pin D 'Lo'
Line 1 –50V	Pin C 'Lo'
Line 2 +50V	Pin B 'Lo'
Line 2 –50V	Pin A 'Lo'

Due to the action of the opto-couplers a signalling voltage on lines 1 or 2 will produce a 'lo' on IC1 or IC2 at pin 6 or 7.

IC7 is a NAND SCHMITT TRIGGER and, therefore, a 'lo' on pin 8 or 9 will give a 'hi' at pin 10 and hence a 'hi' at Pin F; a line fail situation will give a 'hi' at pins 8 and 9 and, therefore, a 'lo' at pin 10 which inverted by IC8 will provide a 'hi' at pin E.

The 'lo's' from IC1 and IC2 are also fed directly to the matrix providing a 'lo' at pin A (IC2 pin 7), pin B (IC2 pin 6) pin C (IC1 pin 7) and pin D (IC1 pin 6).

The output of the matrix pins G–J are designated as follows:

G – Talkthrough ('hi' active)
H – Tx ('lo' active)
I – 10V (permanent 'hi')
J – Squelch/Tone Defeat ('lo' active)

The matrix is linked as required according to the type of switching circuit used.

Note: If permanent Talkthrough is required link I–G. On no account should LK4 be used as is will inhibit the function of temperature shutdown.

Receive

In the quiescent state the control board is in the receive condition. The 'lo' at IC8 pin 9 is inverted and the resultant 'lo' at pin 12 causes TR5 to conduct providing 10V Rx to the receiver board [2] on PLF.

Tx Key

A Tx 'lo' at H is fed to IC7 pin 6, the resulting 'hi' is inverted by IC8(d) and causes TR3 to conduct providing Tx10V to the transmitter module. Further inversion by IC8(F) produces a 'hi' which applied, via R57, to hold off TR5 and thus prevent:

(i) Rx10V being fed to the receiver module.
(ii) TR6 conducting and hence keeping the squelch gate closed in the transmit condition.

Squelch

A squelch 'lo' from the schmitt trigger on the receiver module switches on TR6 (providing TR5 is conducting) causing:

(i) LED3 (Squelch) to light
(ii) The squelch gate to open
(iii) D14 to conduct

Tone Defeat

A 'lo' at matrix pin J gives a 'hi' at IC7 pin 11, this is fed via D15, to cut off TR7 (ie A Tone Valid input is simultated).

This enables a squelch input from the receiver to switch on TR6.

Squelch Defeat

The 'hi' on IC7 pin 11 appears as a 'lo' on IC8 pin 4 which with LK7 (TD/SD) made switches on TR6 and hence opens the squelch gate.

LK3 enables an engineer to defeat the squelch for test purposes.

Engineers Handset

The enginers handset (EHS) is connected to SKB. Immediately the EHS is connected ground is applied to D9, 10 to inhibit Talkthrough and Transmit.

Operation of the PTT switch on the EHS grounds pin 5 of IC7 to produce a 'hi' at pin 4 and therefore establish the Tx condition.

Audio from the EHS microphone is fed directly to the transmitter board on PLE (EHS MIC).

Audio from the receiver board through R21, and on transmit through R20 is fed, via the EHS amplifier, to the earpiece at a level set by RV1.

Intercom

The intercom facility allows an engineer to talk to the Controller using the EHS; LK2 is made.

When a 50V Tx key signal is received from the Controller the Tx audio gate is opened and audio from the line on RV2 is applied to IC5 pin 6 then fed, via C1, toi the EHS earpiece at a level set by RV1.

Operation of the PTT switch grounds SKB pin 5 which reverse biases D11 preventing talkthrough (via D9) and transmit (via D10).

The 'hi' on IC8 pin 2 opens the intercom gate.

Audio from the EHS microphone is fed to PLE (EHS MIC) is amplified, and reappears on PLE (AF RETURN), it then passes through the intercom gate and is applied to the line.

Temperature Shutdown

The temperature shutdown input appears as a 'lo' generated by the regulator board. D9 and D10 are made to conduct thus inhibiting talkthrough and transmit.

Talkthrough

A talkthrough 'hi' at matrix pin G is fed through R42 and inverted by IC8(e) the 'lo' at pin 10 switches on TR2 lighting LED1 (TT).

When the squelch opens a 'lo' from the receiver board switches on TR6 causing D14 to conduct feeding a 'hi' to IC7 pin 1. The resultant 'lo' at pin 3 switches on TR3 providing 10V Tx to the transmitter board.

The 'hi' at IC7 pin 1 is 'held' by C21 so that when the squelch closes there is a delay before the 10V Tx is removed; the delay is determined by the time constant R59/C21. With LK6 made R60 is brought into circuit effectively removing the delay.

LK4 (T/T TEST) enables talkthrough to be selected for test purposes by switching on TR2. LK4 MUST NOT be used to provide permanent talkthrough.

Talkthrough may also be initiated by the tone option module (if fitted) by connecting a diode across pins A and C of LK5. The way in which the diode is connected and the state of the T/T switch at the PC1 Controller determines the mode of talkthrough selected.

LK5	T/T Switch	Talkthrough Mode
A —▷|— C	OFF	No Talkthrough
	ON	Talkthrough (Tone Mobiles Only)
A —|◁— C	OFF	Talkthrough (Tone Mobiles Only)
	ON	Talkthrough (All Mobiles)

A TONE VALID 'hi' from the tone option board is applied, via LK5, and inverted by IC8(e) the 'lo' at pin 10 switches on TR2 to produce talkthrough as before.

PARTS LIST

DC SIGNALLING CONTROL PCB

AT28726/01

Description				Part No	Remarks
SEMICONDUCTORS & ICS					
IC Dual Opto-Isolator				FU99350	IC1,2
IC Dual Op-Amp				FU99092	IC3–5
IC4066 MOS				FU99104	IC6
IC4093 MOS				FU99103	IC7
IC40106 MOs				FU99126	IC8
Transistor BF245B				FV05900	TR1
Transistor BC547B				FV05891	TR8
Transistor BC557B				FV05977	TR2,6,7
Transistor BC327				FV05975	TR3–5
Zener Diode 15V				FV05872	D1–4
Zener Diode C5V6				FV05867	D5
Zener Diode 6V8				FV05868	D12
Diode IN4148				FV05808	D6–11,13–15
RESISTORS					
270				PM01429	R3,4
390				PM01431	R9
470				PM01432	R37
560				PM01433	R45A
680				PM01434	R2,5,10
1k	±5%	0,25W	c.film	PM01436	R41,50,52,57,58
1k2				PM01437	R49,55,61
1k8				PM01439	R39
2k2				PM01440	R46,46A,51,56
3k3				PM01442	R54,60
2k2	±5%	1,6W	m.film	PL51203	R1,6
3k9				PM01443	R15
4k7				PM01444	R8,13,14,25,42,47,63,72
8k2				PM01447	R11
10k				PM01448	R17,18,22,26,30,31,36,38 40,43–45,48,53,64,65,
22k	±5%	0,25W	c.film		67,69–71
22k				PM01452	R7,23,24,66
33k				PM01454	R32–35
47k				PM01456	R28,29,62
68k				PM01458	R16
82k				PM01459	R12
100k				PM01460	R19,21,27
150k				PM01462	R59
Pot skel 2k2				PL99001	RV1
Pot skel 10k	±20% lin			PL01478	RV4
Pot skel 47k				PL01498	RV2,3
CAPACITORS					
180p				PN99774	C5
270p	±2%	63V	cer plate	PN99776	C23
330p				PN99777	C8
4n7	±10%	63V	cer plate	PN99813	C3,7,13–18
2μ2	±10%	250V	poly	PQ38181	C2
4μ7		63V	elect	PS99824	C1,4,9–12,19,20
10		63V	elect	PS99822	C21
33		16V	elect	PS99807	C6,22
MISCELLANEOUS					
Transformer				AL21246	T1
Socket 7 way				FS41448	SKB
Socket 5 way				FS44449	SKA
LED, red				FV05858	LED1,2
LED, yellow				FV05930	LED3

LINK/SYSTEMS (WITH TALKTHROUGH) CONTROL MODULE AT28817
(FOR USE WITH PRIMARY OPTIONS 11–13,51,57,58)

The Link/Systems (with Talkthrough) control module provides an interface to the F490 series transmitter/receivers when used in link or systems applications.

The board provides separate balanced 600Ω input and output connections, talkthrough, transmit/receive keying, squelch defeat, and squelch logic output facilities. Simplex or duplex operation may be used.

The link details for this board are given in Table 1.

Link	In/Out	Description
LK1 (–20db GAIN)	IN	Reduces gain of Tx600Ω line input amp, for line signals greater than –20dbm.
LK3 (SQ DEF)	IN	Enables Rx squelch to be opened for test purposes
LK4 (TT TEST)	IN	Enables Talkthough to be selected for test purposes
LK5 (TONE SQ/TT)	ATO B IN	Connects tone decoder output to squelch logic circuit
	ATO C IN (VIA DIODE)	Connects tone decoder output to talkthrough logic circuit
LK6 (TT DEL OFF)		Talkthrough Mode Only
	OUT	Transmitter remains on for two seconds (approx.) after Rx squelch drops out
	IN	Talkthrough delay removed
LK7 (TD/SD)	OUT	'Lo' on SKC pin 4 provides tone defeat
	IN	'Lo' on SKC pin 4 provides squelch defeat
LK8 (BUSY/TONE)		Tone Options Only
	OUT	The presence of a carrier without a valid tone provides a logic 'hi' at SKC pin 13 to drive a BUSY lamp
	IN	The presence of a carrier with a valid tone provides a logic 'lo' to SKC pin 13 to switch external equipment.
LK9 (T/T SENSE)	ATO B IN	'Lo' on SKC pin 2 (T/T) selects talkthrough
	A TO C IN	'Lo' on SKC pin 2 (T/T) inhibits continuous talkthrough
LK10 (T/T LATCH)		3/5 Tone Selected T/T Systems Only Latches equipment in talkthrough until the Rx squelch closes and the transmitter is turned off.

Table 1

TECHNICAL DESCRIPTION

Tx Audio

Tx audio enters the control board on SKC pins 14 and 15 is fed across T1 and amplified in IC1(a); the output is fed, via the Tx gate IC4(a) and amplifier IC3(a) to the transmitter board. LK1 enables the gain of IC1(a) to be reduced by 20db through R3,4 and RV2 sets the Tx600Ω sensitivity level.

Rx Audio

Rx audio from the receiver board is fed, via the squelch gate IC4(c) to the amplifier IC3(b); the amplifier output is routed in two directions:

(i) Via RV3 (Rx 600Ω O/P LEVEL), to the Rx 600Ω output amp. IC2.
(ii) Through RV4 (T/T LEVEL) to the talkthrough gate

IC2 amplifies the Rx audio and feeds it across T2 to SKC pins 11 and 12. TR1 provides an effective open circuit during normal operation but provides an impedance of 600Ω across T2 in the event of a power failure.

Tx Key

A Tx Key 'Lo' on SKC is inverted by the NAND schmitt gate IC6(d), the 'hi' at pin 8 opens the Tx gate and provides a 'lo' at pin 10 to switch on TR3 and TR10; LED2 lights and Tx10V is supplied to the transmitter board and 13,5V is applied to the relay line to operate the antenna changeover relay. D5 inhibits talkthrough in the transmit condition.

Squelch

A squelch 'lo' from the receiver board switches on TR8 applying a 'hi' to TR9 providing a 'lo' at SKC pin 13 to drive a BUSY lamp, and to the NAND schmitt gate IC5(b), to switch on TR6, when a 'hi' is present at IC5 pin 5.

The conduction of TR6 causes:

(i) LED4 (SQ) to light
(ii) The squelch gate IC4(b & c) to operate
(iii) TR5 to conduct providing a squelch logic output 'lo' to SKC

Tone Defeat

A 'lo' on SKC pin 4 is fed to TR7, via D11, to provide a hi to IC5 pin 5 enabling a carrier 'hi' on pin 6 to open the squelch.

Squelch Defeat

The 'lo' on SKC pin 4 is applied to TR6, via LK7 (IN), switching it on thus opening the squelch.

LK3 enables an engineer to defeat the squelch for test purposes.

Engineers Handset

The engineers handset (EHS) is connected to SKB. Immediately the EHS is connected ground is applied to D6,7 to inhibit talkthrough and transmit.

Operation of the PTT switch on the EHS grounds IC6 pin 9 produces a 'hi' at pin 8 which opens the Tx gate and turns on TR3, via IC6(e), to establish the transmit condition.

The 'lo' from SKB pin 5 also inhibits the receiver by applying a 'hi' to TR4 base.

Audio from the EHS microphone is fed directly to the transmitter board.

Received audio on PLF is routed, via the squelch gate and R8, and transmit audio, via the Tx gate and R6, to the EHS amp. IC1(b) then trhough C20 to the EHS earpiece at a level set by RV1.

Talkthrough

A 'lo' at SKC pin 2 selects talkthrough according to the position of LK9 (See Table 1).

With LK9 linked A to B the 'lo' at SKC produces a 'hi' at IC6 pin 4 which is fed through IC6(c) to turn on TR2.

When TR2 conducts LED1 (T/T) lights and a 'hi' is applied to IC5 pin 2. A squlech 'lo' causes TR6 to conduct and the 'hi' applied to IC5 pin 1 will result in a 'lo' at pin 11 switching on TR3; LED2 (Tx) lights and the transmit condition is assumed.

The 'hi' input to IC5(d) is stored in C9 so when the squelch closes there is a delay (determined by the time constant R30/C9) before the transmitter is unkeyed. When LK6 is made R29 is brought into circuit effectively removing the delay.

With LK9 linked A to C the 10V line provides the 'hi', via R55, which gives talkthrough; the presence of a 'lo' at SKC pin 2 pulls down the 10V and so inhibits talkthrough.

LK4 (T/T TEST) enables talkthrough to be selected for test purposes by switching on TR2. LK4 MUST NOT be used to provide permanent talkthrough.

Talkthrough may also be initiated by the tone option module (if fitted) by connecting a diode across pins A and C of LK5. The way in which the diode is connected and the state of the T/T switching input at SKC pin 2 determines the mode of talkthrough selected.

LK5	SKC pin 2	Talkthrough Mode
A —▶|— C	Hi	Tone Mobiles Only
	Lo	All Mobiles
A —|◀— C	Hi	No Talkthrough
	Lo	Tone Mobiles Only

LK5 A–B: A TONE VALID 'hi' is applied to IC5 enabling TR6 to conduct and open the squelch.

LK5 A —▶\|— C: A TONE VALID 'hi' is fed to R62/R63 to initiate talkthrough for tone mobiles only when the talkthrough switch is off.

LK5 A —\|◀— C: The presence of an invalid tone will apply a 'lo' to R62/R63 thus inhibiting talkthrough. A TONE VALID 'hi' will effectively remove the 'lo' from R62/R63 allowing talkthrough to occur.

When made, LK10 (T/T LATCH) feeds the Tx 10V line to IC6(c) keeping the equipment in talkthrough until the squelch closes and TR3 cuts off. LK10 is only used with 5 tone controlled talkthrough system.

With LK8 (BUSY/TONE) made a 'lo' from the TONE VALID output holds off TR9. A TONE VALID 'hi' allows R9 to conduct providing a 'lo' to SKC pin 13 for switching an external unit.

PARTS LIST

LINK/SYSTEMS (WITH TALKTHROUGH) CONTROL PCB

AT28817

Description				Part No	Code/Remarks
SEMICONDUCTORS & ICS					
IC Dual Op. Amp				FU99092	IC1–3
IC4066 MOS				FU99104	IC4
IC4093 MOS				FU99103	IC5
IC40106 MOS				FU99126	IC6
Transistor BC337				FV05896	TR5–9
Transistor BF245B				FV05900	TR1
Transistor BC327				FV05975	TR3,4,10
Transistor BC557B				FV05977	TR2,6–8
Zener Diode C5V6				FV05867	D1
Zener Didoe 6V8				FV05868	D8
Diode IN4148				FV05808	D2–7,9–14
RESISTORS					
10				PM01412	R70
270				PM01429	R11
330				PM01430	R12
390				PM01431	R10
680				PM01434	R1
820				PM01435	R5
1k				PM01436	R24,28,34,37–39
1k8				PM01439	R54–57
2k2				PM01440	R40,44,71
3k3				PM01442	R7,29
4k7				PM01444	R16,20,31–33,35,36,67,68
8k2		±5%	0,25W	c.film PM01447	R4
10k				PM01448	R13,14,21–23,25,41–43,45–50,53, 59–66,69
22k				PM01452	R2,9
47k				PM01456	R17,19,52,58
56k				PM01457	R8
68k				PM01458	R15
82k				PM01459	R3
100k				PM01460	R6
150k				PM01462	R30
220k				PM01464	R18,51
Pot skel 2k2			±20%	lin	PL99001 RV1,4
Pot skel 10k			±20%	lin	PL01478 RV2,3
CAPACITORS					
100p				PN99792	C19
180p		±2%	63V	cer plate	PN99774 C2
330p				PN99777	C5
4n7		±10%	63V	cer plate	PN99813 C1,6,11–14,16–18,21
10n		±10%	63V	poly	PQ99511 C3
4μ7			63V	elect	PS99824 C4,7,20
10			63V	elect	PS99822 C9,15
33			16V	elect	PS99807 C10
470			10V	elect	PS99806 C8
MISCELLANEOUS					
Transformer				AL21246	T1,2
Socket, 7 way				FS44448	SKB
Socket, 15 way				FS46114	SKC
LED, red				FV05858	LED1–3
LED, yellow				FV05930	LED4
Scr, pozi, pan, st	M3 x 8mm			QJ11902/X	2/SKC
Nut, hex, st	M3			QA11605/X	2/SKC

MC490 CONTROL MODULE AT28824

(FOR USE WITH PRIMARY OPTIONS 41,42,47)

INTRODUCTION

The MC490 control module enables the F490 series equipment to be used with the Microphone/ Controller and a loudspeaker.

The board provides separate input and output lines, a 3ΩAF amplifier (with DC controlled volume) talkthrough transmit/receive keying, and squelch defeat facilities. Simplex or duplex operation may be used.

The link details for this board are given in Table 1.

Link	In/Out	Description
LK1 (TX AF)	A TO C IN B TO D IN E TO G IN	For use with the mic,/controller LK1 is permanently linked A–C,E–G and B–D, to bypass T1 and feed the line audio input to IC1(a)
	A TO B IN C TO D IN E TO F IN	Enables a 600Ω audio input to be applied to the board
LK2 (TX AF GAIN)	IN	Increases gain of TX AF amp by 20db (approx.)
LK3 (T/T TEST)	IN	Enables Talkthrough to be selected for test purposes
LK4 (TT DEL OFF)		Talkthrough Mode Only
	OUT	Transmitter remains on for two seconds (approx.) after Rx squelch closes
	IN	Talkthrough delay removed
LK5 (T/T LATCH)		3/5 Tone Selected T/T Systems Only
	IN	Latches equipment in talkthrough until the Rx squelch closes and the transmitter is turned off
LK6 (SQ DEF)	IN	Enables Rx squelch to be opened for test purposes
LK7 (TD/SD)	OUT	'Lo' on SKC pin 4 provides tone defeat
	IN	'Lo' on SKC pin 4 provides squelch defeat
LK8 (TONE SQ/TT)	A TO B IN (VIA DIODE)	Connects tone decoder output to talkthrough logic circuit
	A TO C IN	Connects tone decoder output to squelch logic circuit
	C TO D IN	Provides an external access to the squelch through SKC pin 10
LK9 (DUPLEX)	OUT	Simplex operation selected
	IN	Duplex operation selected

Table 1

Note: Wire links WL1, 2 and 3 may be removed to allow SKC pins 13, 10 and 9 to be used for non standard modifications (ie: Driving an auxilliary lamp circuit).

Tx Audio

Audio from the Microphone/Controller, enters the board on SKC pins 14 and 15 and is fed, via C1,7 and R3 to the Tx AF amp IC1(a). The output is applied, via RV2 (TX AF GAIN), to the Tx AF gate IC4(a). LK2 enables the gain of IC1(a) to be increased by 20db.

When the Tx gate is opened audio is fed to a second amplifier IC3(a) whose output is applied through C16 to TR5 and through C17 to the transmitter board.

As the output from IC3(a) increases above 1V (approx.), TR5 conducts which in turn reduces the impedance of R3 thus reducing the input to IC1(a).

Rx Audio

Rx audio from the receiver board is fed, via the squelch gate IC4(b) and buffer IC3(b) to the EHS amp and the voltage controlled attenuator IC8. The volume control on the microphone, type controller varies the amount of attenuation in IC8 and therefore the audio level applied to amplifier IC7 and hence the loudspeaker. Increasing the volume control resistance increases the attenuation in IC8.

Tx Key

A Tx Key 'lo' at SKC is inverted by IC6(e) providing a 'hi' to open the Tx gate and enable IC5(e) to produce a 'lo' at pin 10.

The 'lo' switches on TR6 applying 15V to the relay line causing the antenna changeover relay to operate and TR9 to conduct which lights LED2 (TX) and supplies TX10V to the transmitter board.

IC6(d) inverts the 'lo' cutting off TR10 to inhibit the receiver

Squelch

A squelch 'lo' from the receiver board turns on TR12 applying a 'hi' to TR13 (providing a 'lo' to the BUSY line on SKC) and IC5 pin 13 when a 'hi' is present at pin 12 the resultant 'lo' on pin 11 turns on TR11 causing:

(i) LED 4 (SQ) to light
(ii) The squelch gate IC4 (b&c) to operate
(iii) A 'hi' to be applied to IC5 pin 2

Tone Defeat

A 'lo' on SKC pin 4 is inverted by IC6(c), and fed, via D8, to IC5 pin 12. The presence of a TONE VALID 'hi' on pin 13 produces a 'lo' output which switches on TR11 causing the squelch to open.

Squelch Defeat

The 'lo' at SKC pin 4 produces a 'lo' on IC6 pin 13 which is fed, via LK9, D9, to TR11 causing it to conduct and open the squelch.

Engineers Handset

The engineers handset (EHS) is connected to SKB. Immediately the EHS is connected IC5 pin 8 is grounded preventing talkthrough and transmissions from the microphone/controller.

Operation of the PTT switch grounds IC6 pin 10 producing a 'hi' at pin 11 to open the Tx gate and turn on TR9 establishing the transmit condition. The receiver is inhibited through IC6(d) and TR10.

Rx audio from PLF is routed, via the squelch gate and R18, to the EHS amp IC2(b) while Tx audio from IC1(a) is passed, via the Tx gate and R17. The audio output at pin 7 is fed to the earpiece at a level set by RV1 (EHS LEVEL).

Talkthrough

Operation of the TT switch on the Microphone/Controller, applies a 'lo' to SKC pin 2, TR2 turns on and the output is fed as follows:

(i) Through D7 to hold of TR9 and inhibit the transmit condition.
(ii) Through D7, IC6(d) to turn on TR10, assuming the receive condition.
(iii) Via IC5(b) to turn on TR7 assuming the talkthrough mode as indicated by LED1 (T/T).

A squelch 'lo' from the receiver board produces at 'hi' at IC5 pin 2 (see squelch description) resulting in a 'lo' at pin 3 which turns on TR8. A 'hi' is applied to IC6(b) which is inverted and causes TR9 to conduct and the transmit condition to be assumed; the receiver is inhibited.

The 'hi' on the collector of TR8 is stored in C39 so when the squelch closes there is a delay before the transmitter unkeyed. The delay is determined by the time constant R58/C39 and may be removed by making LK4 which brings R59 into circuit.

LK3 (T/TEST) enables talkthrough to be selected for test purposes by switching on TR2. LK3 MUST NOT be used to provide permanent talkthrough.

Talkthrough may also be initiated by the tone option module – a diode is connected across LK8 pins A and B. The way in which the diode is connected and the position of the TT switch on the microphone determines the mode of talkthrough selected.

LK5	TT Switch	Talkthrough Mode
A —▶|— B	OFF	No Talkthrough
	ON	Tone Mobiles Only
A —|◀— B	OFF	Tone Mobiles Only
	ON	All Mobiles

LK8 A —▶\|— B:– A TONE VALID 'hi' is fed, via R72,73, to IC5 pin 6 initiating talkthrough for tone mobiles only when the TT switch is off.

LK8 A —\|◀— B:– The presence of an invalid tone will apply a 'lo' to IC5(b) thus inhibiting, talkthrough even with the TT switch on. A TONE VALID 'hi' will remove the 'lo' allowing talkthrough to take place provided the TT switch is on.

LK5 (T/T LATCH) is normally used for 3/5 tone systems and when made the TX10V line is connected through D5 to IC5 pin 6 locking the equipment in talkthrough until the squelch closes and TR9 is cut off.

PARTS LIST

MC490 CONTROL PCB
AT28824

Description				Part No	Code/Remarks
SEMICONDUCTORS & ICS					
IC Dual Op-Amp				FU99092	IC1–3
IC Audio Amp				FU08027	IC7
IC				FU07686	IC8
IC4066 MOS				FU99104	IC4
IC4093 MOS				FU99103	IC5
IC40106 MOS				FU99126	IC6
Transistor BC547B				FV05891	TR4,5,13,14
Transistor BF245B				FV05900	TR3
Transistor BC327				FV05975	TR6–10
Transistor BC557B				FV05977	TR1,2,7,8,11,12
Zener Diode C5V6				FV05867	D2
Zener Diode 6V8				FV05868	D3
Diode IN4148				FV05808	D1,4–10
RESISTORS					
2Ω2				PM01404	R42
10				PM01412	R44,46,47
150				PM01426	R31
220				PM01428	R43,45
470				PM01432	R39,69
680				PM01434	R1
820				PM01435	R34
1k				PM01436	R26,38,40,53,57,63,66,68,81,85
1k2				PM01437	R5
1k8				PM01439	R74,76,79
2k2				PM01440	R19,27,48–50
3k3				PM01442	R12,20,59
3k9	±5%	0,25W	c.film	PM01443	R47
4k7				PM01444	R2,4,35,36,55,60–62,64,65,70,83,84
10k				PM01448	R9,11,23,51,52,54,56,71–73,75,77,78, 80,82,86–88
18k				PM01451	R41,90
22k				PM01452	R3,25,89
27k				PM01453	R28
33k				PM01454	R8,10,13,30
47k				PM01456	R7,15,21,24,32,33
56k				PM01457	R18
68k				PM01458	R22
100k				PM01460	R14,17,37
150k				PM01462	R58
220k				PM01464	R16
390k				PM01467	R29
Potskel 2k2 ±20%		lin		PL99001	RV1,3
Potskel 10k ±20%		lin		PL01478	RV2
Select-on-Test					
1k				PM01436	
1k2				PM01437	
1k5				PM01438	
1k8				PM01439	
2k2	±5%	0,25w	c.film	PM01440	
2k7				PM01441	R6 SOT
3k3				PM01442	
3k9				PM01443	
4k7				PM01444	
5k6				PM01445	

CAPACITORS

100p	±2%	63V	cer plate	PN99771	C11
150p	±2%	63V	cer plate	PN99773	C9
270p	±2%	63V	cer plate	PN99776	C14
330p	±2%	63V	cer plate	PN99777	C4,5
470p	±10%	63V	cer plate	PN99810	C6
1n	±10%	63V	cer plate	PN99811	C36
4n7	±10%	63V	cer plate	PN99813	C19,23,24,26,27,34,40–45
100n	±10%	63V	poly	PQ99511	C13,29,30,32
1n		63V	elect	PS99820	C1,7,20,35,37
4μ7		63V	elect	PS99824	C2,3,10,12,16,17,22,38
10		25V	elect	PS99812	C8,18,21,25,39
22		25V	elect	PS99813	C31
47		25V	elect	PS99814	C15
470		25V	elect	PS99816	C28,33

MISCELLANEOUS

Transformer		AL21246	T1
Socket, 7 way		FS44448	SKB
Socket, 15 way		FS46114	SKC
LED, red		FV05858	LED1–3
LED, yellow		FV05930	LED4
Heatsink		BT37525	1/IC7
Scr, pozi, pan, st	M3 x 6mm	QJ11901/X	1/IC7–Heatsink
Scr, pozi, pan, st	M3 x 8mm	QJ11902/X	2/SKC
Nut, hex, st	M3	QA11605/X	1/IC7–Heatsink;2/SKC
Washer	M3	QA13624	1/IC7–Heatsink

MICROPHONE/CONTROLLER

Microphone/Controller (less connectors)	AT29704
Microphone/Controller (with connectors)	AT29703
Spares Kit	AT29705

Includes: Transmit switch
Slide switch & volume control (complete with knob)

AC SIGNALLING CONTROL AND FACILITY MODULES

INTRODUCTION

These modules enable the F490 series base stations to be controlled by a Pye M80 series Controller, using AC signalling over a 2/4 wire 600Ω line.

The AC signalling system uses a 2970Hz continuous tone to key the transmitter and a 125ms (approx.) burst of FSK data to provide additional facilities. (ie: Squelch Defeat, Talkthrough etc.). The FSK data is decoded by the facility module.

The control module will provide only the transmit/receive function, where the additional facilities are required both modules must be fitted.

AC SIGNALLING CONTROL MODULE AT28829/– (FOR USE WITH PRIMARY OPTIONS 31–34,37)

LINK DETAILS

The Link details for this board are given in Table 1.

Link	In/Out	Description
LK1 (–20db gain)	IN	Reduces gain of TX600Ω line input amp for line signals greater than –20dbm
LK2(EHS INTERCOM)	IN	Provides intercom between EHS and Controller. Transmitter cannot be keyed by handset when LK2 is IN
LK3(SQDEF)	IN	Enables Rx squelch to be opened for test purposes
LK4 (TT TEST)	IN	Enables talkthrough to be selected for test purposes
LK5 (TONE SQ/TT)	A TO B IN A TO C IN (VIA DIODE)	Connects tone decoder output to squelch logic circuit Connects tone decoder output to talkthrough logic circuit (See Talkthrough Description)
LK6 (DEL OFF)	 OUT IN	Talkthrough Mode Only Transmitter remains on for two seconds (approx.) after Rx squelch closes Talkthrough delay removed
LK7 (TD/SD)	OUT IN	'Lo' on PLG pin 4 provides tone defeat 'Lo' on PLG pin 4 provides squelch defeat
LK8 (PRE-EMP)	IN	Provides 10 db of high frequency lift to compensate for lines which have a poor frequency response; this is especially important as the 2970 Hz key tone is at the top end of the audio range.
LK9 (DUPLEX)	OUT IN	Rx keyed off when TX selected Rx on continuously
LK10 (TT LATCH)	 IN	3/5 Tone Selected TT Systems Only Latches equipment in talkthrough until the Rx squelch closes and the transmitter is turned off

Table 1

TECHNICAL DESCRIPTION

Tx Audio

The audio input is fed in on PLA, across pins 1 and 3 (2 wire) or pins 4 and 5 (4 wire); T1,2 provide matching to the amplifier IC1(a). LK1 is linked in when 20db attenuation is required. R44,46,47 and C22 form an electronic hybrid which is balanced by RV8,9 to cancel the Rx audio signal from IC6(b) preventing it from being fed to the Tx audio line; the Tx audio sensitivity is set by RV2.

The gyrator notch filter IC2 removes the 2970Hz tone from the audio signal and feeds it to the tone detector, via amplifier IC4(a).

IC1(b) amplies the Tx audio and feeds it in two directions:

(i) To the facility module (if fitted), via PLG pin 7.
(ii) To the TX/TT gate IC9(a)

Gyrator notch filter IC3 provides further rejection of the 2970Hz tone; IC4(b) amplifies the audio and applies it to the transmitter board on PLE.

Rx Audio

The Rx audio output from the receiver board on PLF is applied, via C27 to the squelch gate IC9(c) and then amplified in IC8(b).

The amplifier output is routed in two directions:

(i) To the notch filter IC7
(ii) Via RV4 (T/T LEVEL) to the TX/TT gate

NOTCH 3 removes the 2970Hz component from the Rx audio signal as an additional precaution against breakthrough to the Tx audio line.

RV3 (Rx 600Ω O/P LEVEL) sets the audio input level to the push pull amplifier IC6 whose output is fed across 1 to the 600Ω line on PLA pins 1 and 3.

Tx Key

The 2970Hz tone filtered from the Tx audio signal by IC2 is amplified by IC4(a), filtered again by gyrator, notch IC5 and detected by D4 and D5. TR9 is made to conduct feeding a 'lo' to IC11(b) (a NAND SCHMITT gate). The resultant 'hi' opens the TX/TT gate and is inverted by IC10(d) producing a 'lo' which is routed as follows:

(i) To IC11 pin 2 to inhibit talkthrough
(ii) To turn on TR8 which lights LED2 (TX) and supplies the TX+10V line, thus establishing the transmit condition.
(iii) Inverted by IC10(e) to turn off TR4 thus inhibiting the receiver.
(iv) To turn on TR1 which supplies +13,5V to the antenna changeover relay.

Squelch

A squelch 'lo' from the receiver board switches on TR5 which lights LED3(SQ), opens the squelch gate IC9(c) and enables IC11 pin 12 (See Talkthrough)

Engineers Handset

The engineers handset (EHS) is connected to SKB. Immediately the EHS is connected the to the junction D10/D11 is grounded thus inhibiting talkthrough and the transmit function. Operation of the PTT switch grounds IC11 pin 5 producing a 'hi' at pin 4 which opens the TX/TT gate and is inverted by IC10(d) producing a 'lo' which is routed as previously described under Tx Key.

Audio from the EHS microphone is fed direct to the transmitter board on PLE.

Rx audio (via R83) and Tx audio (via R82) is fed through the EHS amp IC8(a) to the EHS earpiece at a level set by RV1.

Intercom

With LK2 IN the intercom facility allows an engineer to talk to the Controller using the EHS. When a 2970 Hz key signal is received from the Controller the TX/TT gate feeds audio from the line, via R82, to the EHS amp then to the earpiece at a level set by RV1. Operation of the PTT switch applies a 'lo', via LK2, to open the intercom gate TR2. Audio from the EHS microphone is applied directly to the transmitter board, the audio reappears on the AF RETURN line and is fed, via the intercom gate, to the Rx audio path on the input of IC8(b) and hence to the 600Ω line. D12 prevents the transmitter from being keyed by the PTT switch when intercom is selected.

Note: The following facilities can only be selected from the Controller when the facility module is fitted; the interconnection made on PLG.

Tone Defeat

A 'lo' on PLG pin 4 is inverted by IC10(a) producing a hi which turns off TR6 alllowing a squelch input from the receiver board to switch on TR5. (ie: A Tone Valid input is simultated).

Squelch Defeat

A 'lo' on PLG pin 4 is fed, via LK7, causing TR5 to conduct thus opening the squelch. LK3 enables the squelch to be opened for test purposes.

Talkthrough

A T/T 'lo' on PLG pin 5 is inverted by IC10(f) and fed to IC11 pin 1; IC11 pin 1; when IC11 pin 2 is 'hi' (ie: No keying tone is present) the output on pin 3 is 'lo'. TR7 is switched on causing LED1 (T/T) to light and a 'hi' to be fed to IC11 pin 13.

With IC11 pin 12 enabled by the squelch a 'lo' is produced at pin 11 which is double inverted by IC10(b) and IC10(c) causing TR8 to conduct, so keying the transmitter and providing talkthrough.

LK4 (TT TEST) enables talkthrough to be selected for test purposes; LK4 MUST NOT be used to provide permanent talkthrough. Continuous talkthrough may be selected by linking PLG pins 5 and 8.

Talkthrough may also be initiated by the tone option module (if fitted) by connecting a diode across pins A and C of LK5. The way in which the diode is connected and the state of the T/T switching input at PLG pin 5 determines the mode of talkthrough selected.

LK5	PLG pin 5	Talkthrough Mode
A —▷|— C	Hi	Tone Mobiles Only
	Lo	All Mobiles
A —|◁— C	Hi	No Talkthrough
	Lo	Tone Mobiles Only

LK5 A–B: A TONE VALID 'Hi' is applied to TR5 causing it to conduct and open the squelch.

LK5A —▷\|— C: A TONE VALID 'hi' is fed to R92/R93 to initiate talkthrough for tone mobilesonly when the talkthrough switch is off.

LK5A —\|◁— C: The presence of an invalid tone will apply a 'lo' to R92/R93 thus inhibiting talkthrough. A TONE VALID 'hi' will effectively remove the 'lo' from R92/R93 allowing talkthrough to occur.

When made, LK10 (T/T LATCH) feeds the Tx 10V line to IC11(a) keeping the equipment in talkthrough until the squelch closes and TR8 cuts off. LK10 is only used with 3/5 tone controlled talkthrough systems.

AC SIGNALLING FACILITY MODULE AT28830/–
(FOR USE WITH PRIMARY OPTIONS 33,37)

To be issued later.

PARTS LIST
AC SIGNALLING CONTROL PCB
AT28829/–

/01 2 Wire simplex
/02 4 Wire Duplex

Description				part No	Code/Remarks
SEMICONDUCTORS & ICS					
IC Dual Op Amp				FU99092	IC1–8
IC4053				FU99142	IC9
IC4093 MOS				FU99103	IC11
IC40106				FU99126	IC10
Transistor BF245B				FV05900	TR3
Transistor BC327				FV05975	TR1,4,8
Transistor BC547B				FV05891	TR9
Transistor, BC557B				FV05977	TR2,5–7
Zener Diode C5V6				FV05867	D1
Zener Diode 6V8				FV05868	D6
Diode IN4148				FV05808	D2–5,7–14
RESISTORS					
100	±5%	0,25W	c.film	PM01424	R85
300	±5%	0,25W	c.film	PM01430	R80
390	±5%	0,25W	c.film	PM01431	R43
562	±1%	0,25W	m.film	PL99083	R45; R1–/02 only
1k	±5%	0,25W	c.film	PM01436	R15,38,69,103,108,112
1k5	±5%	0,25W	c.film	PM01438	R13
1k8	±5%	0,25W	c.film	PM01439	R6
2k2	±5%	0,25W	c.film	PM01440	R5
3k3	±5%	0,25W	c.film	PM01442	R7,106
4k7	±5%	0,25W	c.film	PM01444	R37,39,40,63,67,109,111
5k6	±5%	0,25W	c.film	PM01445	R30,33
6k8	±5%	0,25W	c.film	PM01446	R5
8k2	±5%	0,25W	c.film	PM01447	R14,34
10k	±5%	0,25W	c.film	PM01448	R11,23,36,41,49,51–53,55 61,64,68,72–74,76,77,79,84 86,87,89,91–99,101,102,104; R44–/01 only; R2–/02 only
10k	±1%	0,25W	m.film	PL99098	R8–10,16–18,26,27,54,56,57
10k5	±1%	0,25W	m.film	PL45281	R28
12k	±5%	0,25W	c.film	PM01449	R3
13k	±1%	0,25W	m.film	PL45289	R12,19,29,58
15k	±5%	0,25W	c.film	PM01450	R47–/01 only
22k	±5%	0,25W	c.film	PM01452	R42,78
27k	±5%	0,25W	c.film	PM01453	R83
33k	±5%	0,25W	c.film	PM01454	R46–/01 only
39k	±5%	0,25W	c.film	PM01455	R31,32
47k	±5%	0,25W	c.film	PM01456	R62,66,71
68k	±5%	0,25W	c.film	PM01458	R48
100k	±5%	0,25W	c.film	PM01460	R4,22,81
150k	±5%	0,25W	c.film	PM01462	R107
330k	±5%	0,25W	c.film	PM01466	R82
CAPACITORS					
47p	±5%	63V	cer plate	PN99767	C1
100p	±5%	63V	cer plate	PN99792	C2
270p	±5%	63V	cer plate	PN99776	C33
330p	±5%	63V	cer plate	PN99777	C23
4n7	±5%	25V	cer plate	PN99731	C5–9,11,24,26;C22–/01 only
4n7	±10%	63V	cer plate	PN99813	C28,29,31
22n	±10%	63V	cer plate	PN99515	C3,21; C20–/02 only
100n	±10%	63V	cer plate	PN99511	C4,10
2μ2	±20%	100v	elect	PS99456	C12,13,16,17,27
4μ7	±20%	63V	elect	PS99444	C14,18,32
10μ	±20%	50V	elect	PS99436	C30,34,36
470μ	±20%	10V	elect	PS99405	C19

Description	Part No.	Code/Remarks
MISCELLANEOUS		
Transformer	FT05323	T1;T2–/02 only
Socket 7 way	FS44448	SKB
Socket, 5 way	FS44449	SKA
LED, red	FV05858	LED1,2
LED, yellow	FV05930	LED3
Pot skel 1k ±20%	PL99678	RV5–7,10
Pot skel 2k2 ±20%	PL99001	RV1
Pot skel 4k7 ±20%	PL01486	RV8–/01 only
Pot skel 10k ±20%	PL01478	RV2–4;RV9–/01 only

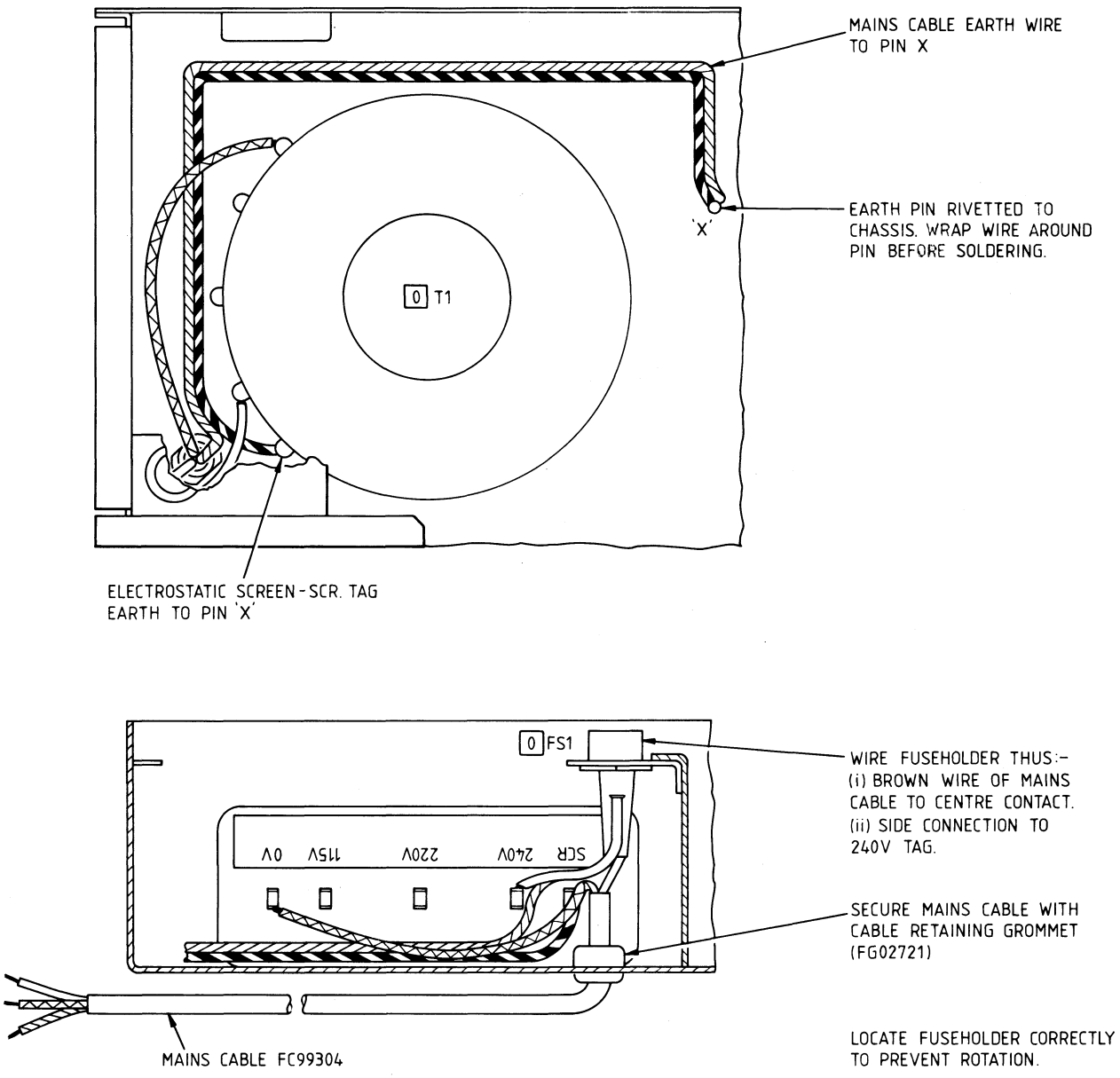
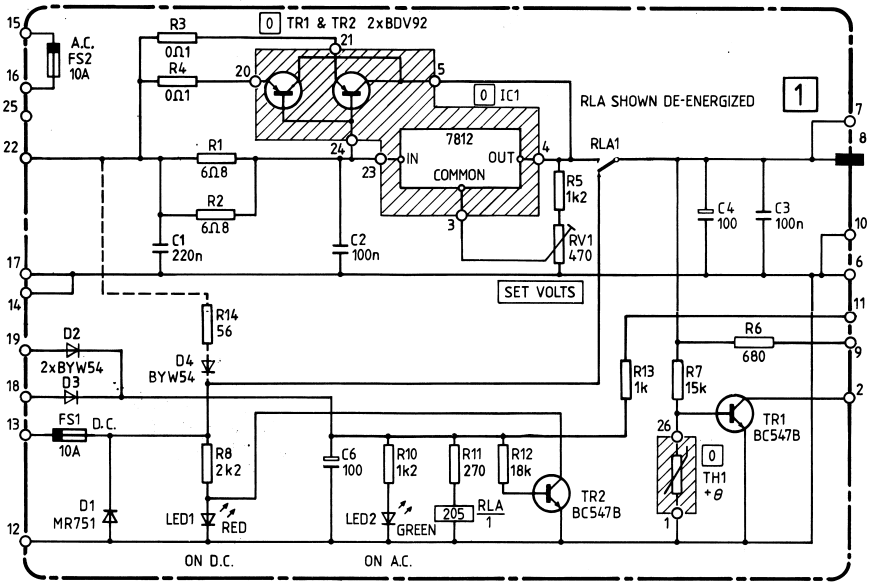
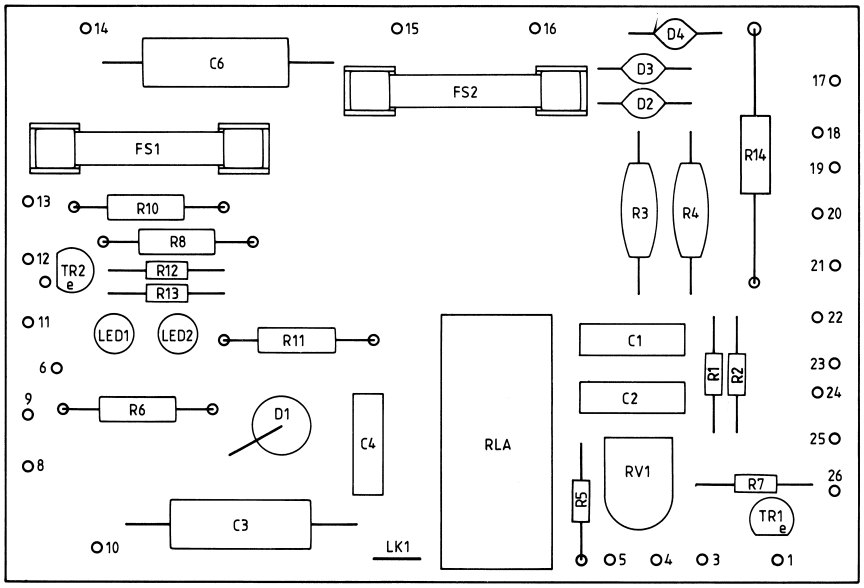


FIG 6.1 F490 TRANSCEIVER
POWER WIRING DETAILS



AT28724/02



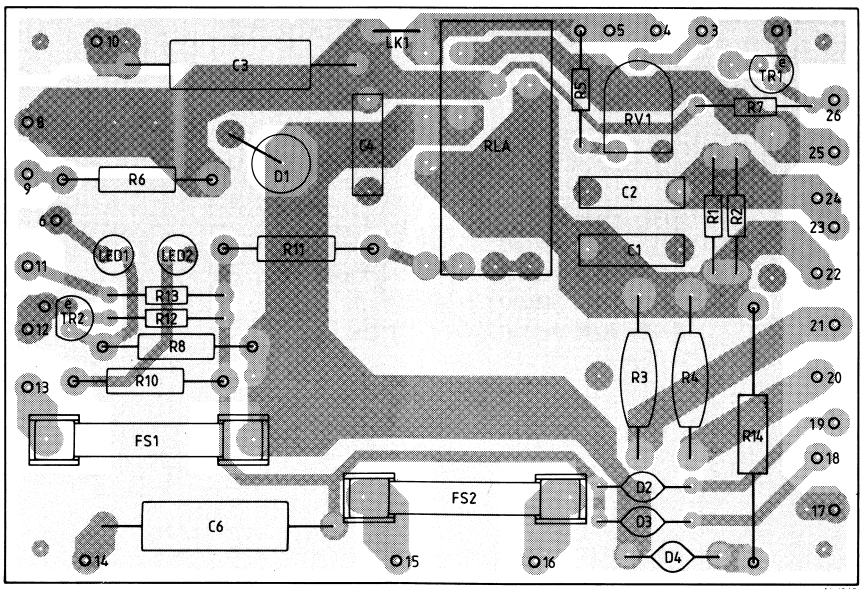


FIG 6.2 AC/12V DC REGULATOR
AT28724/02
CIRCUIT AND LAYOUT DIAGRAMS

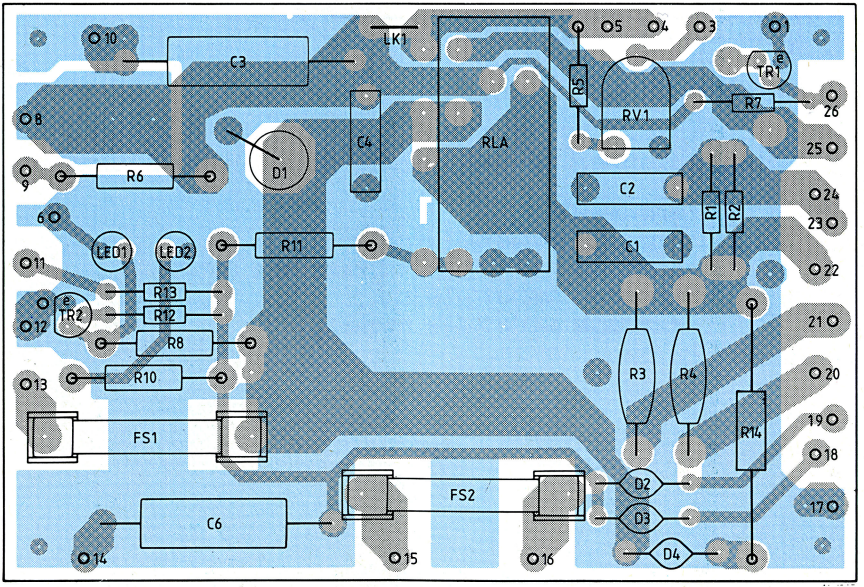


FIG 6.2 AC/12V DC REGULATOR
AT28724/02
CIRCUIT AND LAYOUT DIAGRAMS

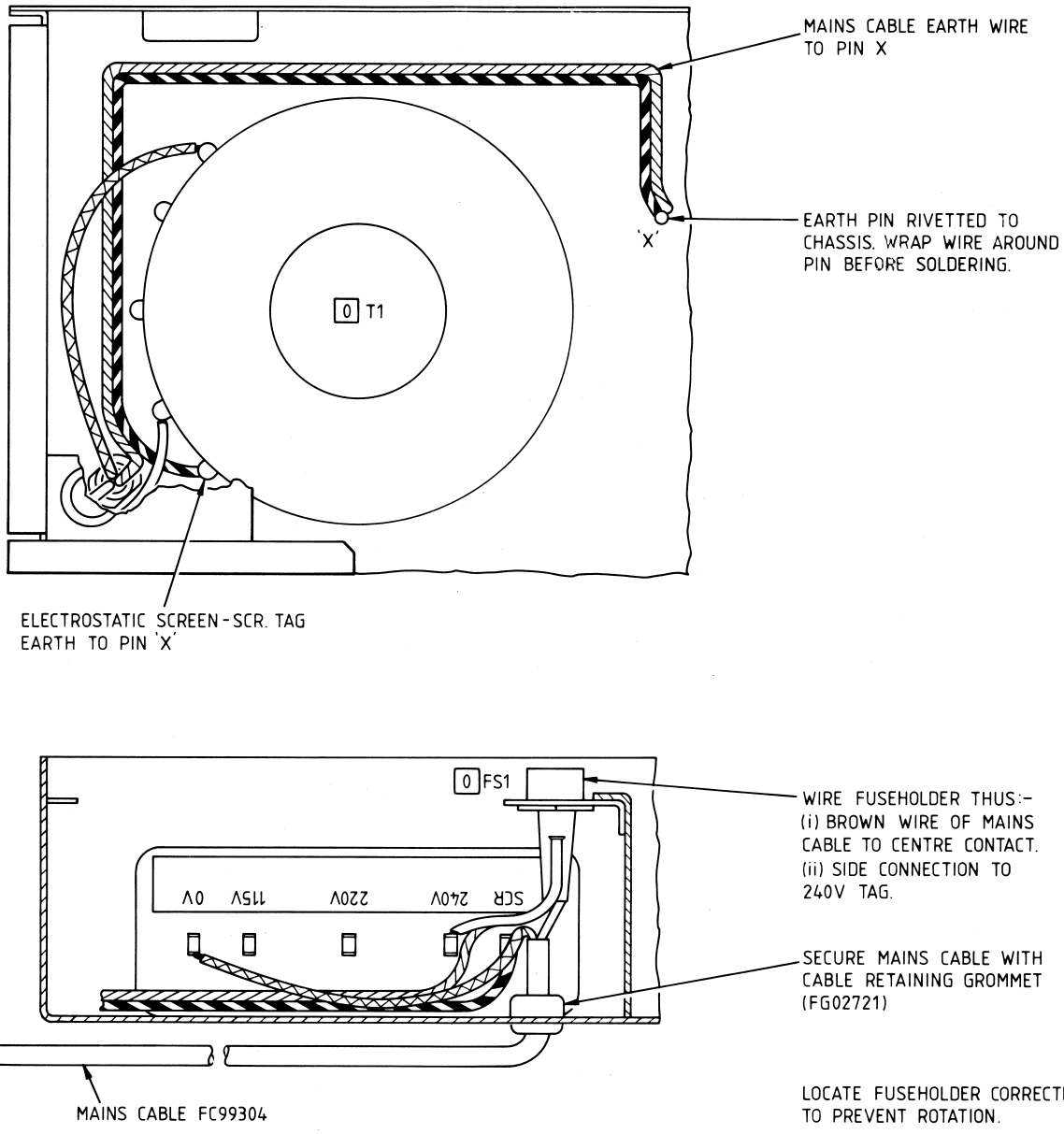
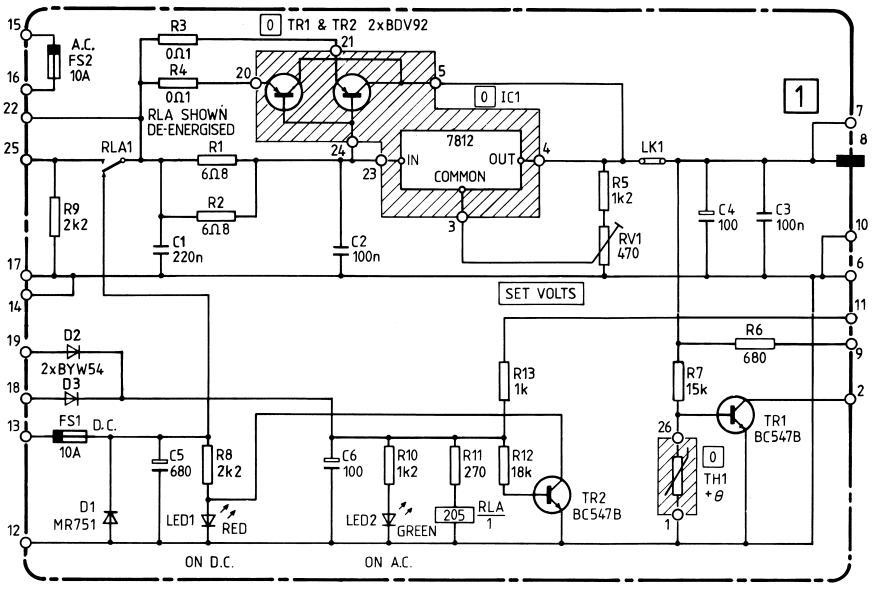
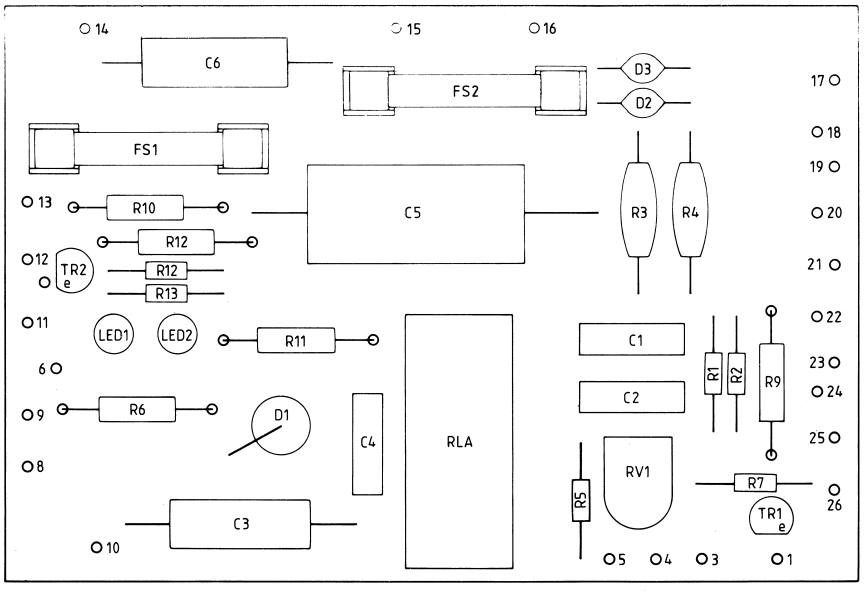


FIG 6.1 F490 TRANSCEIVER
POWER WIRING DETAILS



AT26724/01



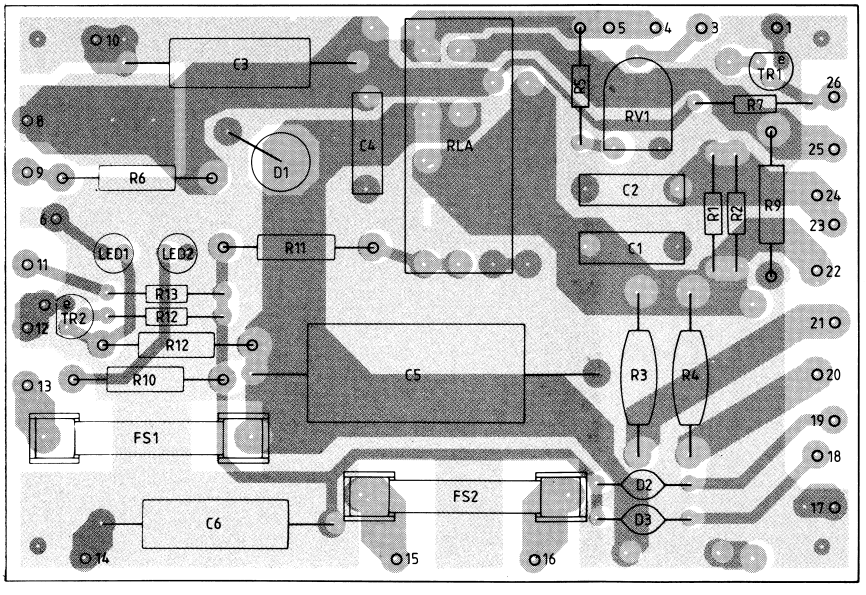


FIG 6.4 AC/24V DC REGULATOR
AT28724/01
CIRCUIT AND LAYOUT DIAGRAMS

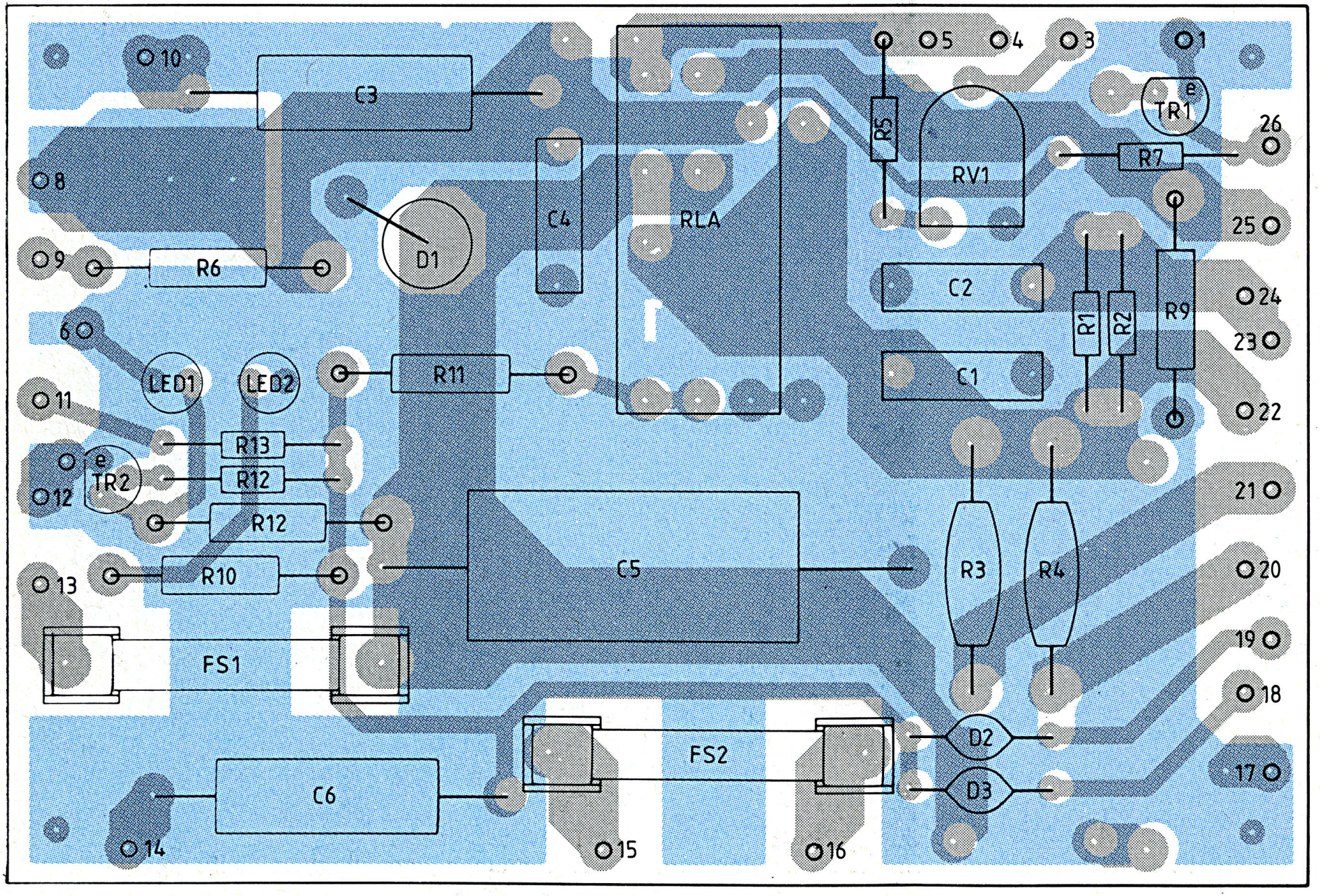
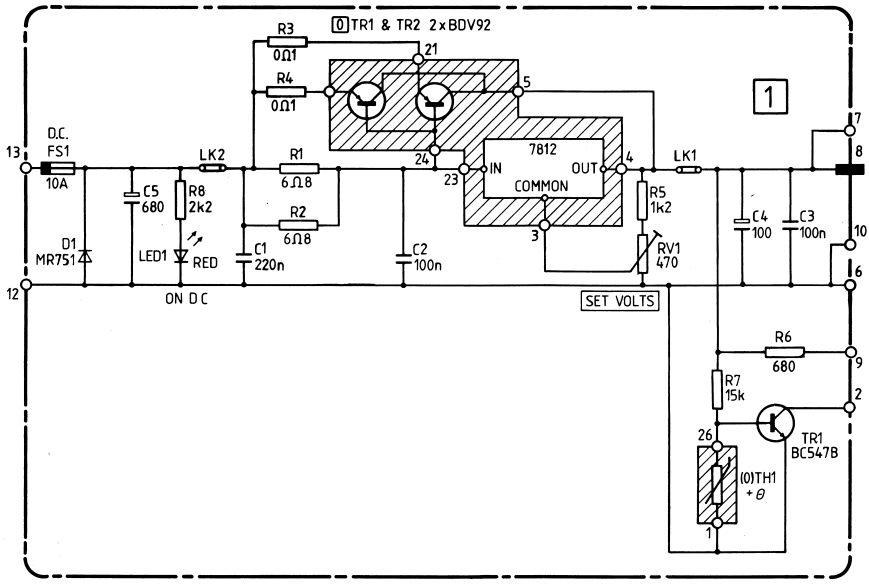
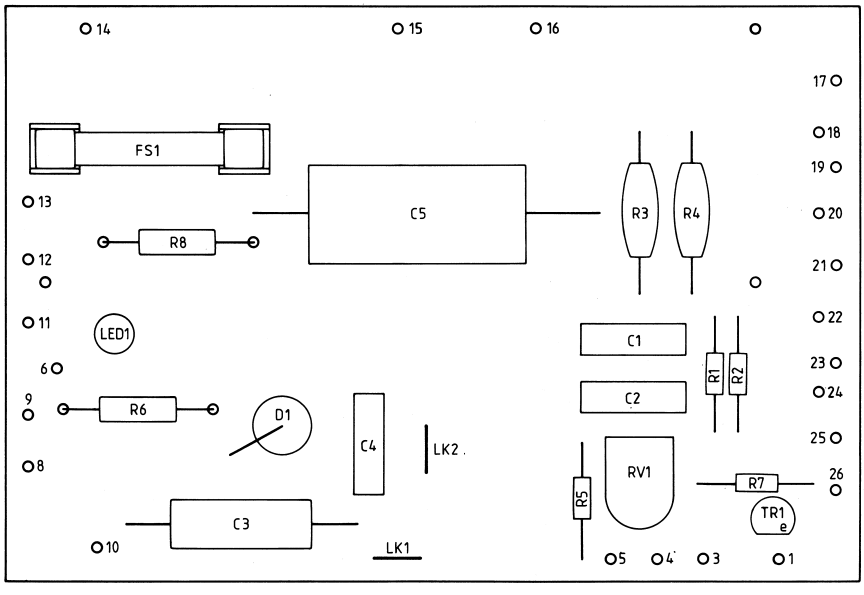


FIG 6.4 AC/24V DC REGULATOR
AT28724/01
CIRCUIT AND LAYOUT DIAGRAMS



AT28724/03



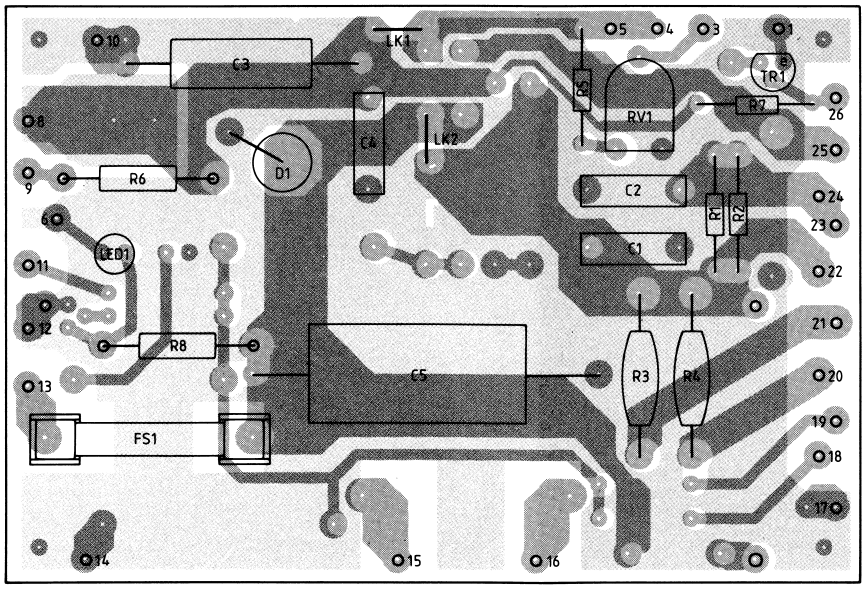


FIG 6.3 24V DC (ONLY) REGULATOR
AT28724/03
CIRCUIT AND LAYOUT DIAGRAMS

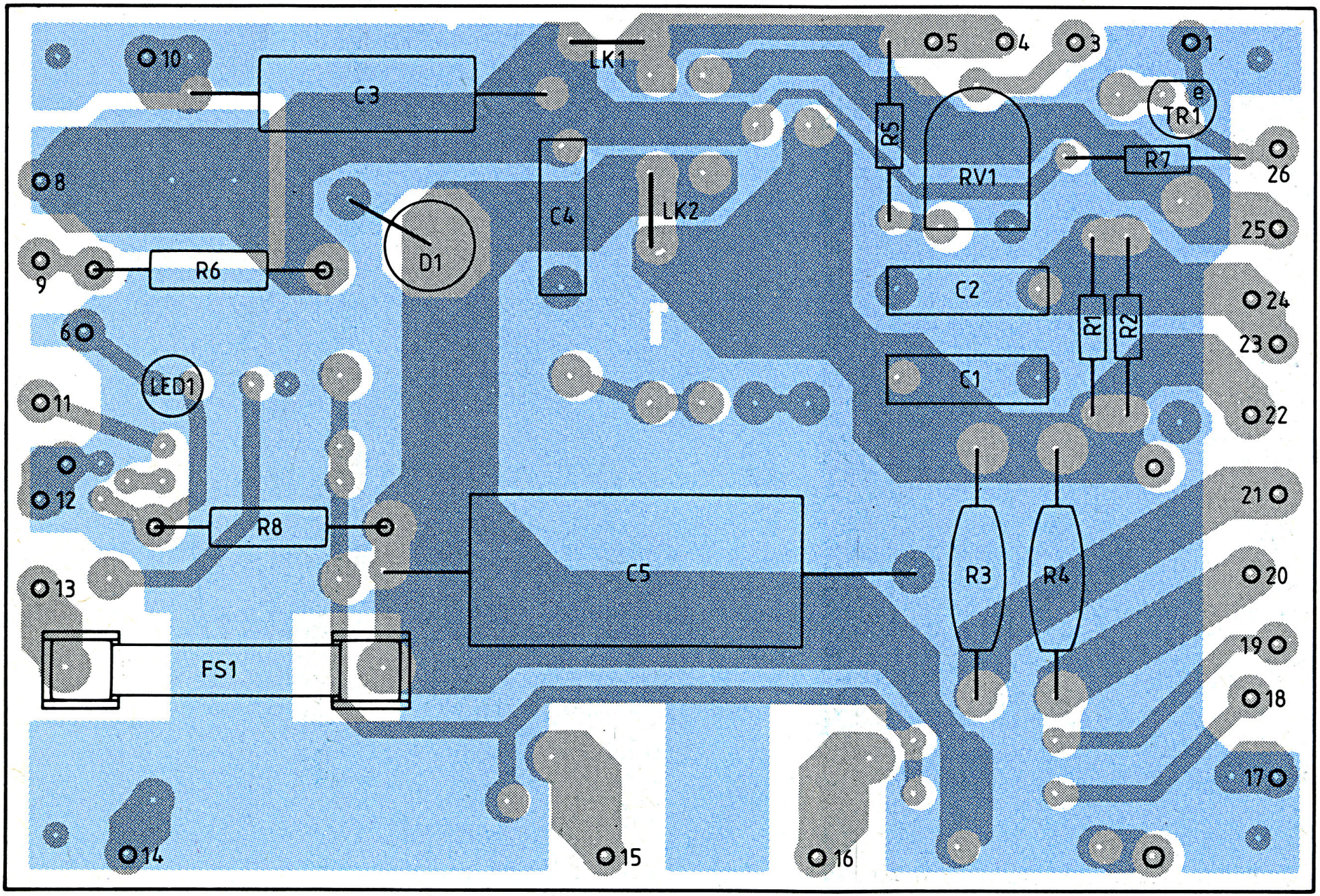
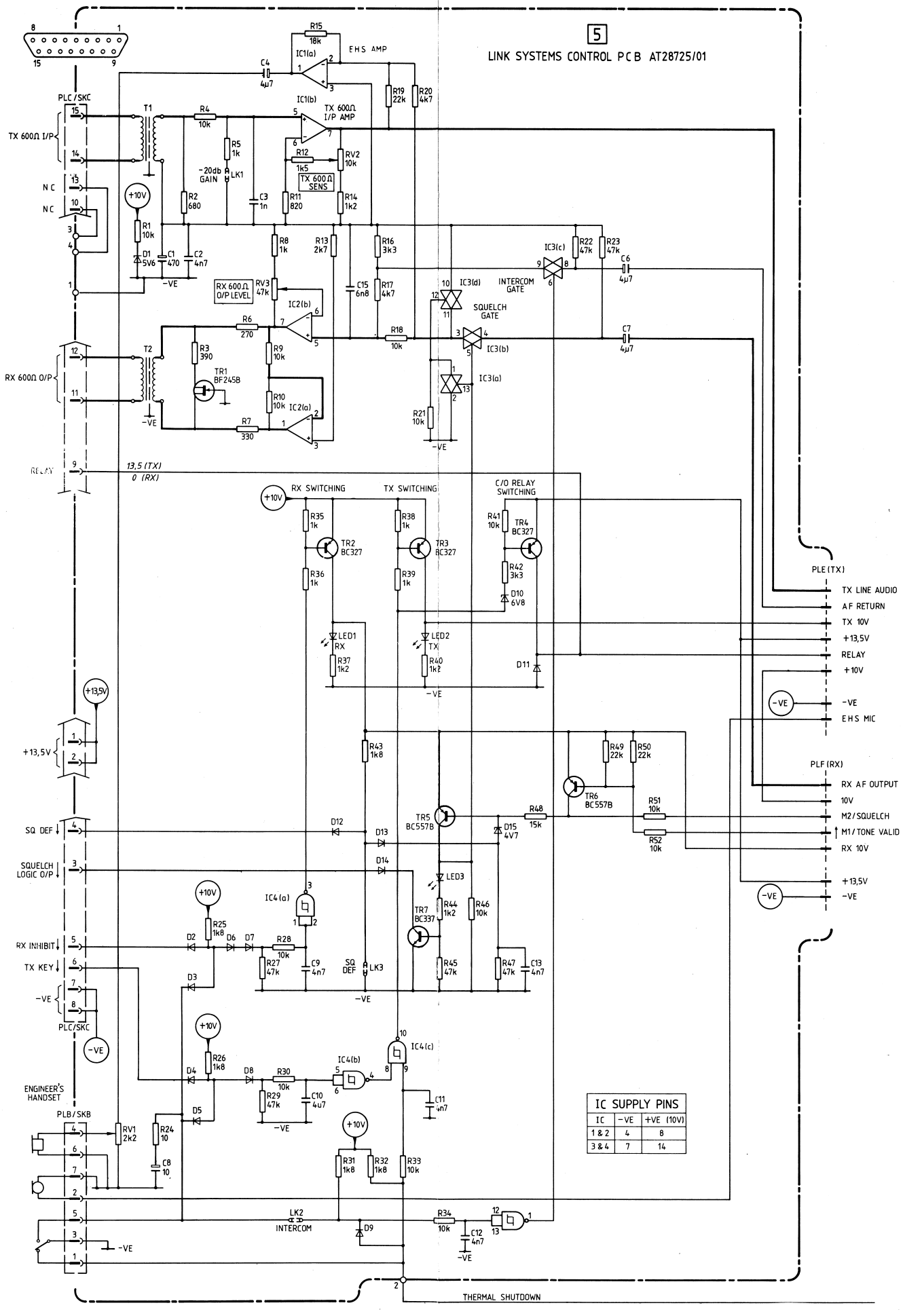
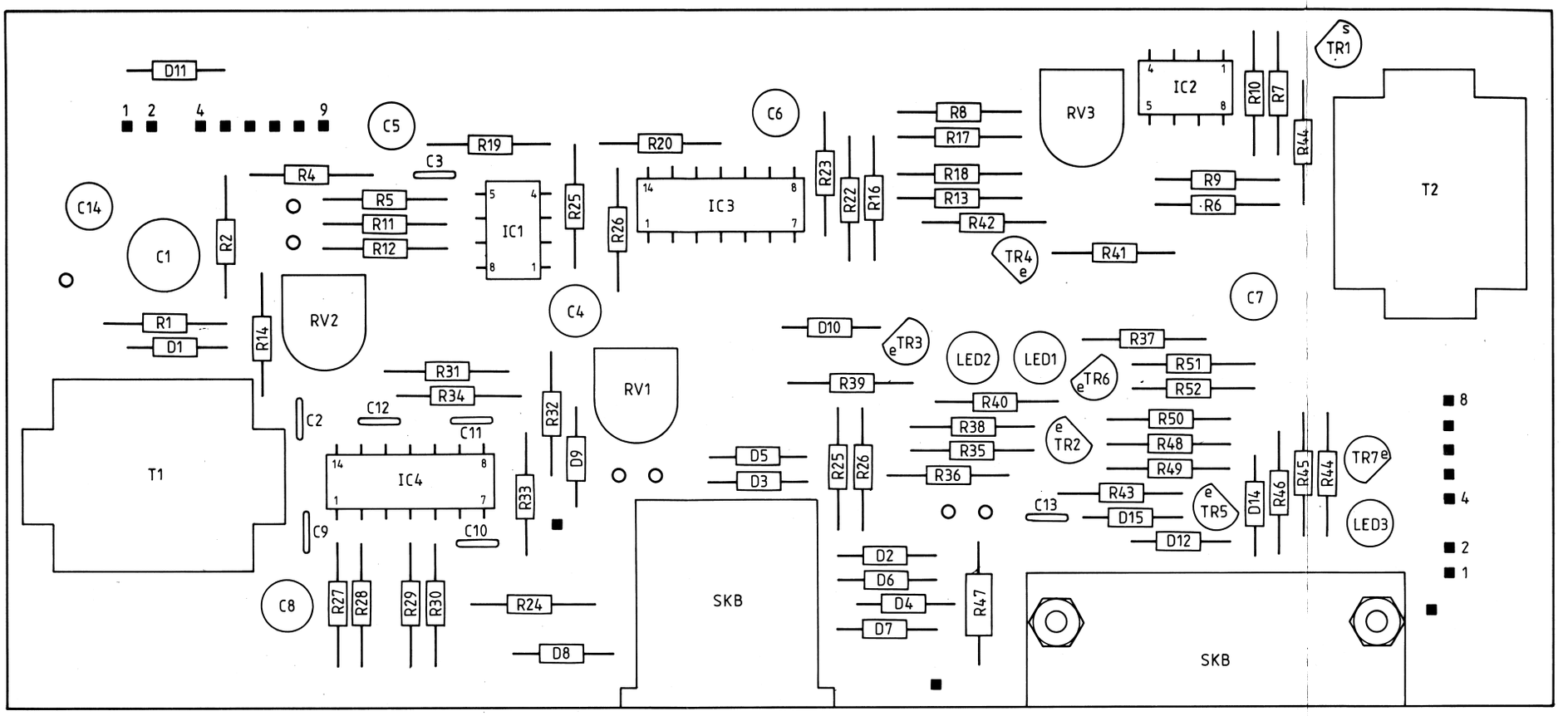


FIG 6.3 24V DC (ONLY) REGULATOR
AT28724/03
CIRCUIT AND LAYOUT DIAGRAMS

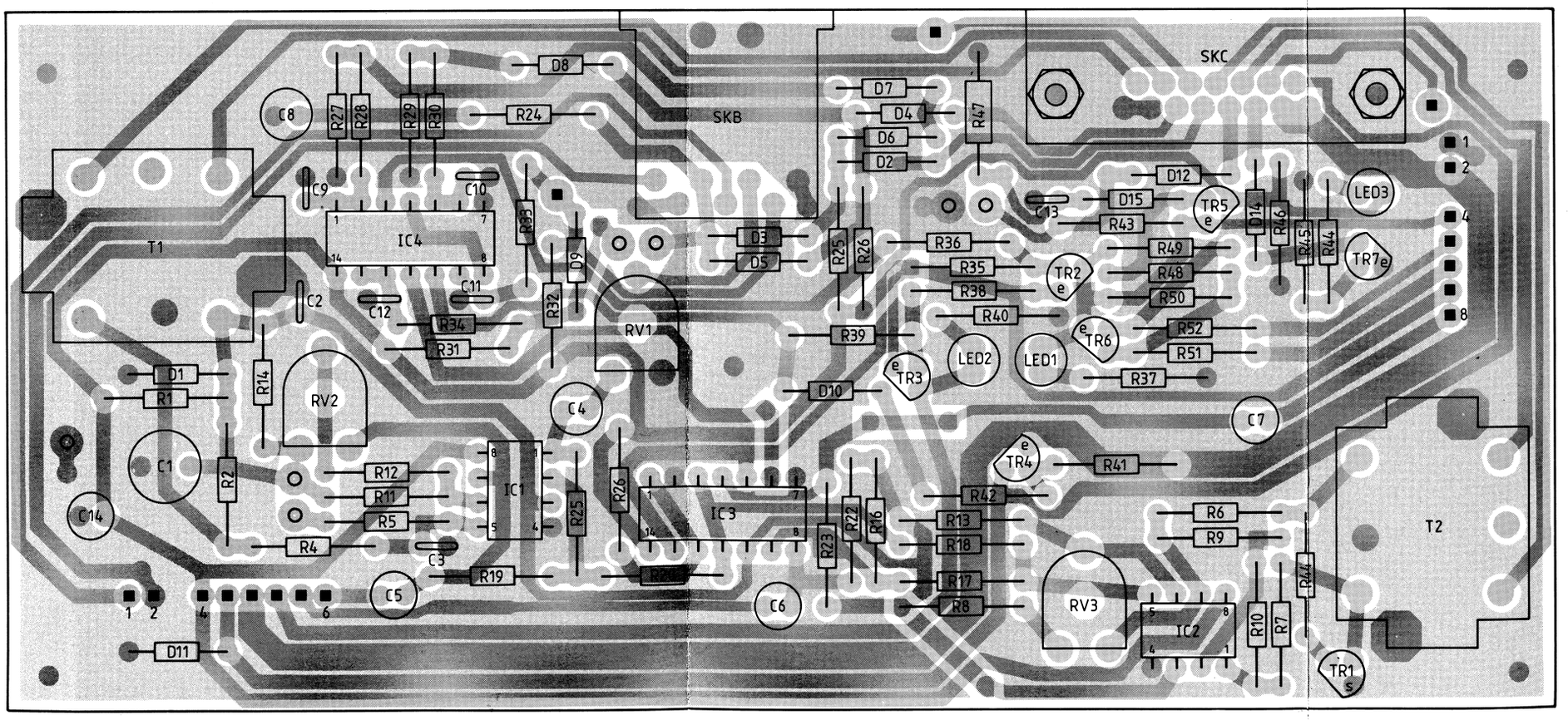


IC SUPPLY PINS		
IC	-VE	+VE (10V)
1 & 2	4	8
3 & 4	7	14

FIG 6.5 LINK/SYSTEMS CONTROL MODULE AT28725/01 CIRCUIT AND LAYOUT DIAGRAMS


D11
1 2 4 9
C5
R19
C3
R4
R5
R11
R12
C14
C1
R2
IC1
R25
R26
C6
IC3
R20
R23
R22
R16
R8
R17
R18
R13
R42
RV3
IC2
R10
R7
R44
TR1
T2
R9
R6
TR4
R41
C7
C4
R1
D1
R14
RV2
D10
TR3
LED2
LED1
R37
R51
R52
TR6
R39
R40
R38
R35
R36
TR2
R50
R48
R49
R43
D15
D12
C13
TR5
D14
R46
R45
R44
TR7
LED3
8
4
2
1
T1
R31
R34
C12
C11
C2
IC4
R32
D9
R33
C9
C10
D5
D3
R25
R26
SKB
C8
R27
R28
R29
R30
R24
D8
D2
D6
D4
D7
R47
SKB

AT28725/01


D8
C8
R27
R28
R29
R30
R24
SKB
D7
D4
D6
D2
R47
SKC
1
2
4
8
D12
D15
R43
C13
TR5
D14
R46
R45
R44
LED3
TR7
T1
C9
C10
IC4
R33
D9
D3
D5
R25
R26
R36
R35
R38
R40
TR2
R50
R48
R49
C2
C12
C11
R34
R31
R32
RV1
R39
LED2
LED1
TR6
R52
R51
R37
D1
R1
R14
RV2
D10
TR3
C4
C7
C1
R2
R12
R11
R5
R4
IC1
R25
R26
IC3
R23
R22
R16
R42
R13
R18
R17
R8
TR4
R41
R6
R9
T2
C14
C3
R19
C5
C6
RV3
IC2
R10
R7
R44
TR1
1 2 4 6
D11

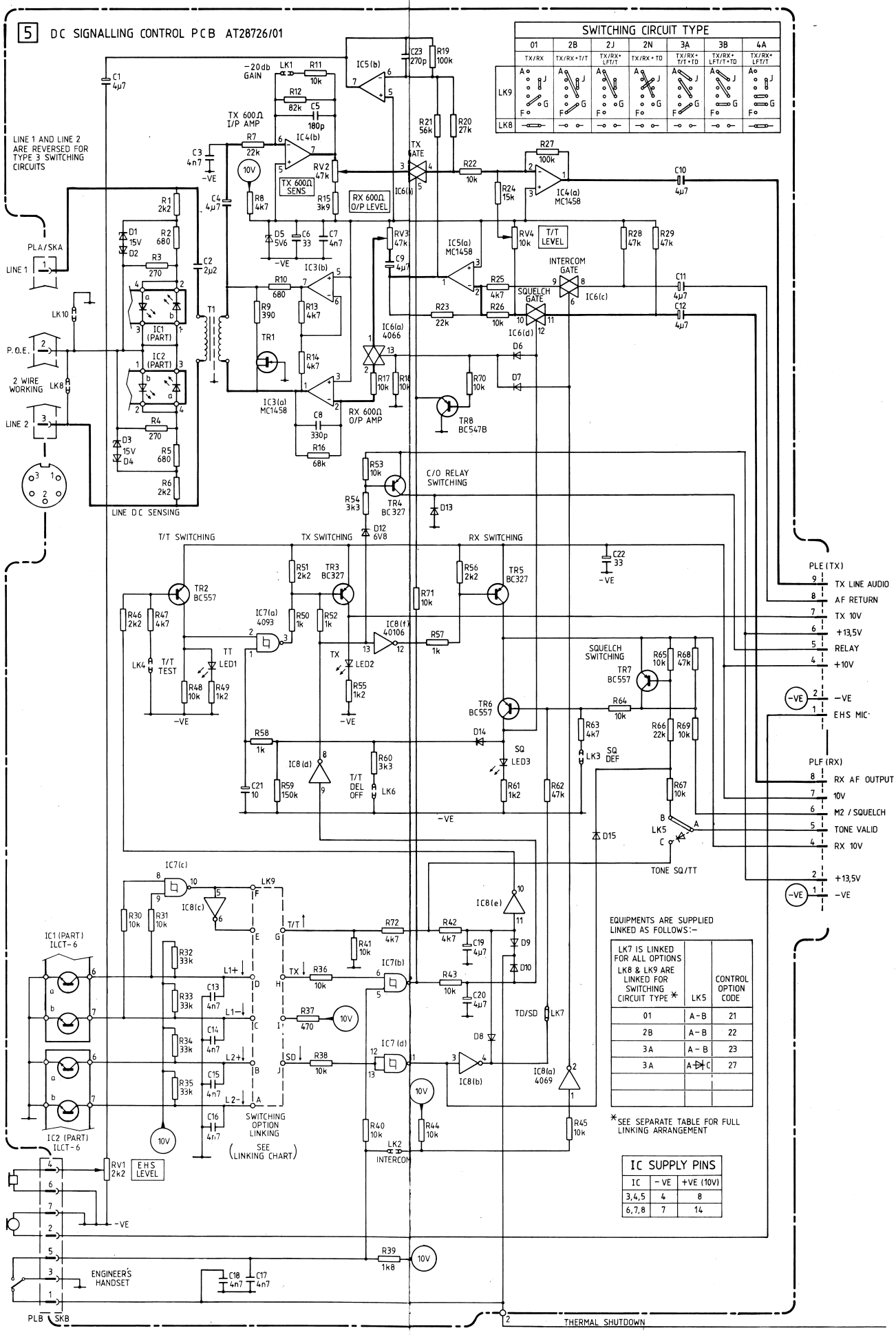
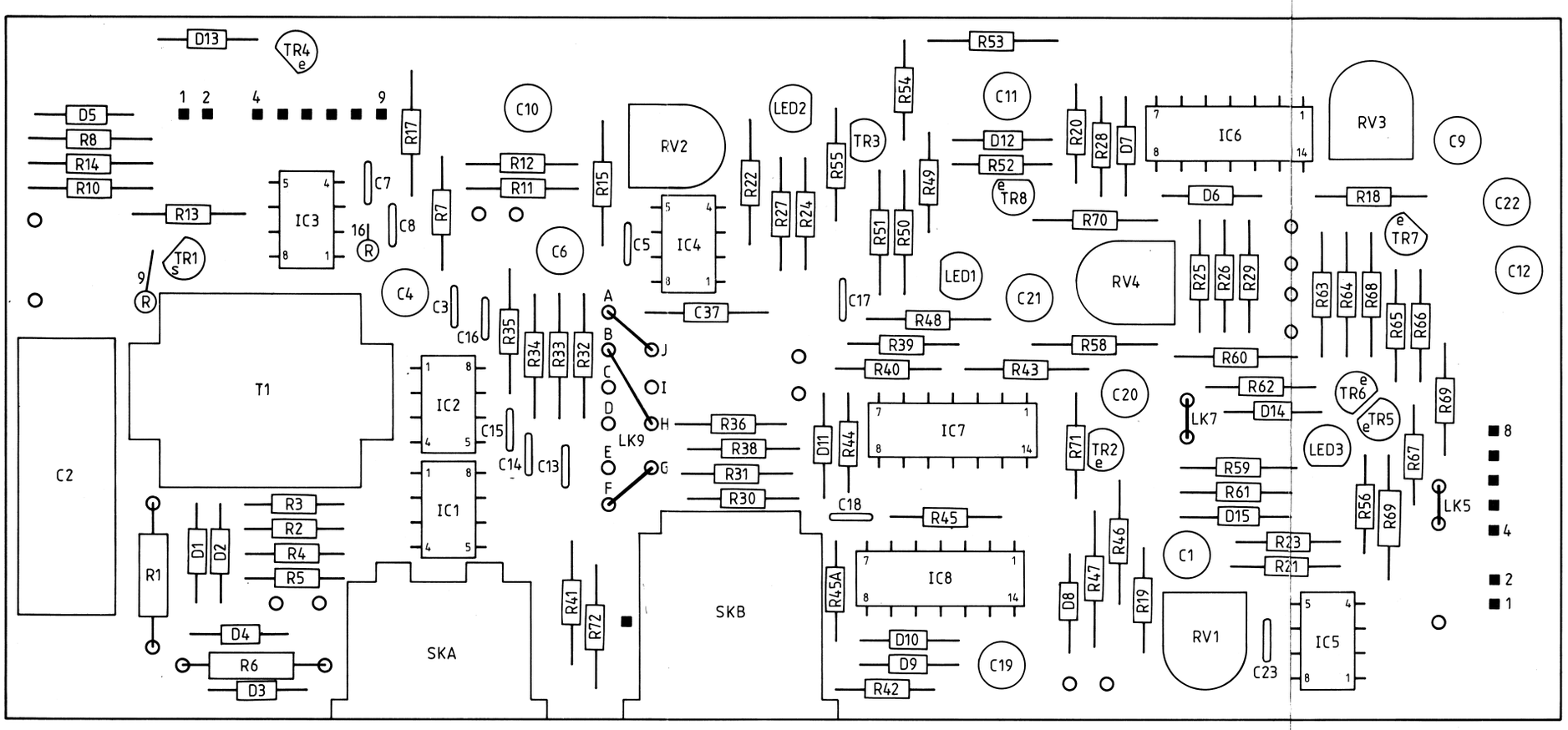
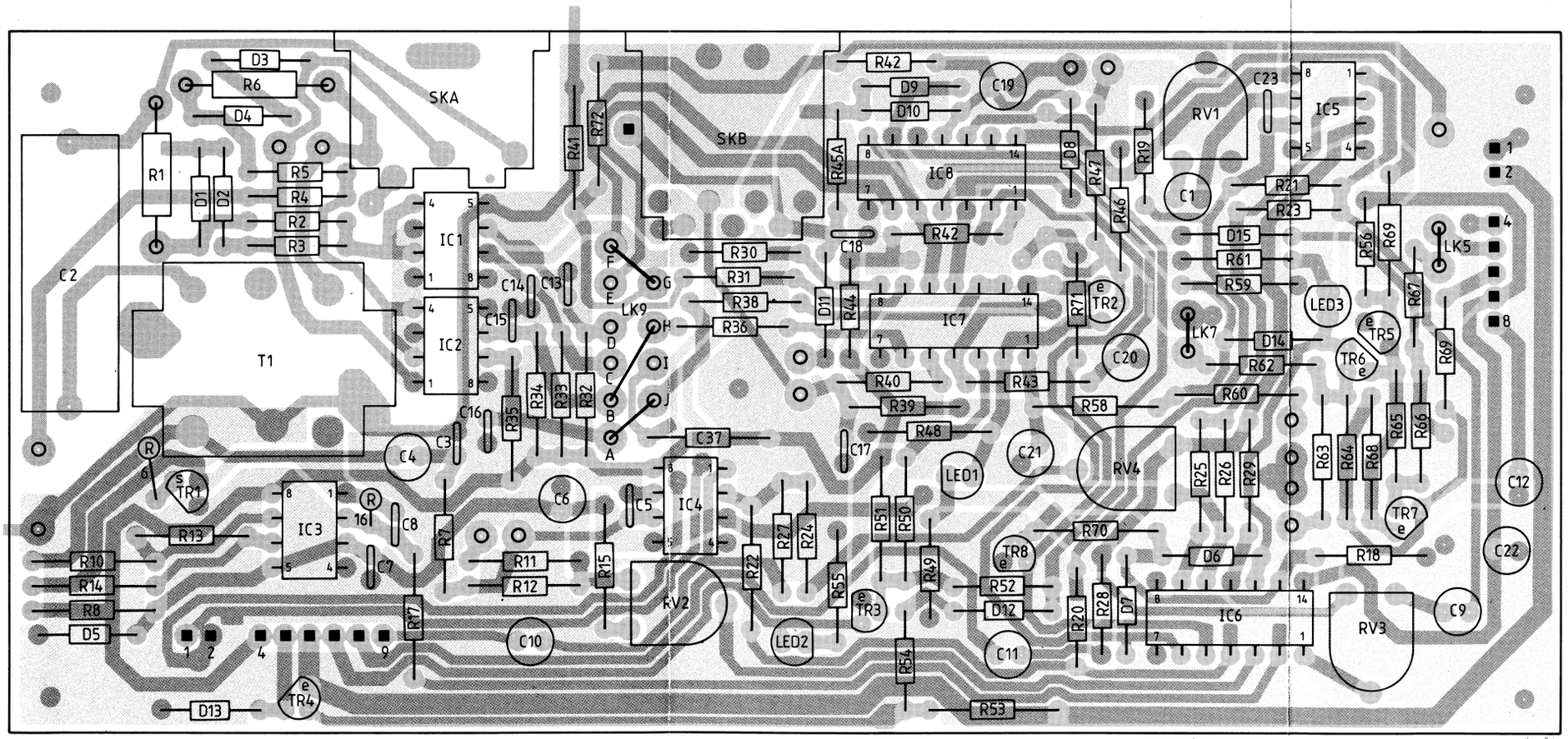
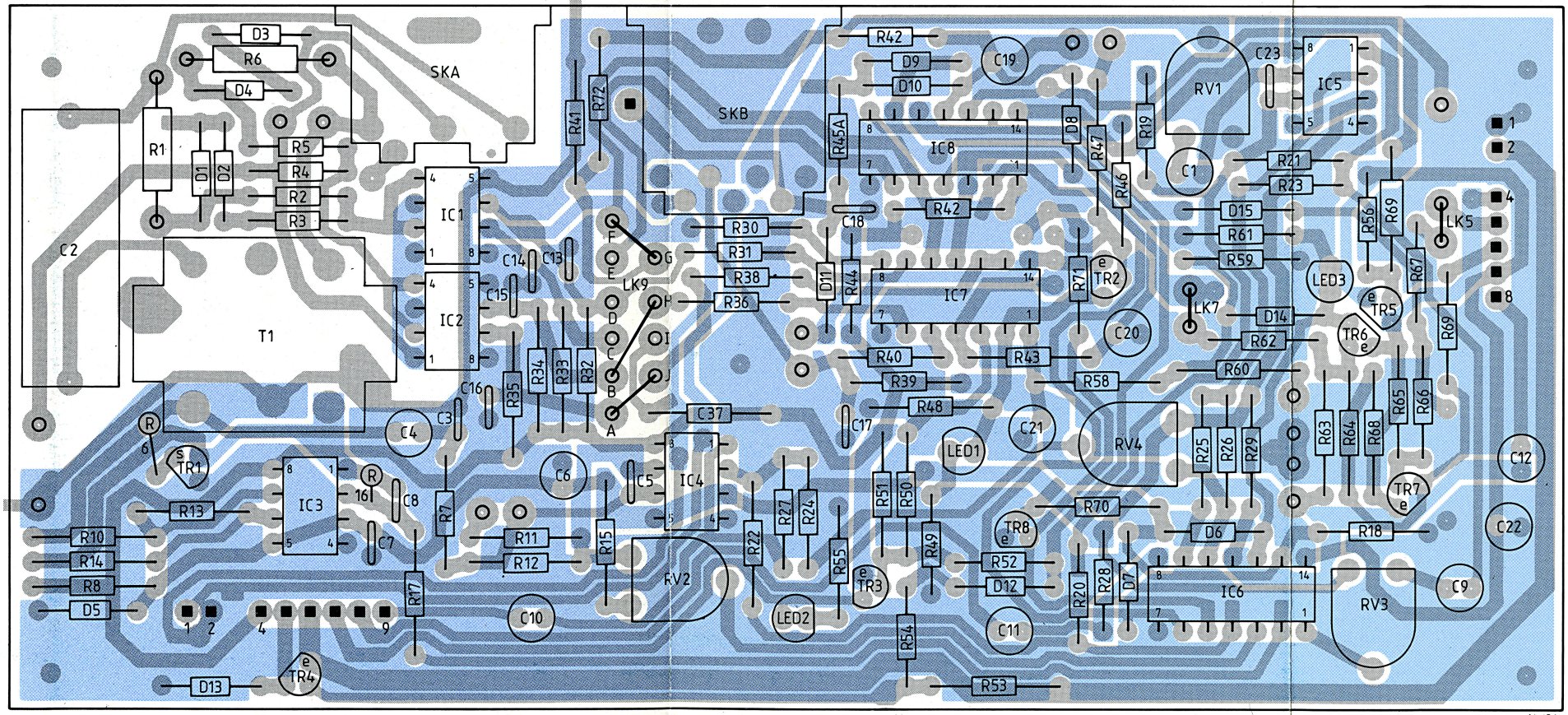


FIG 6.6 DC SIGNALLING CONTROL MODULE AT28726/01 CIRCUIT AND LAYOUT DIAGRAMS


D13
TR4
e
D5
R8
R14
R10
R13
TR1
s
R17
C10
R12
R11
R15
RV2
LED2
R53
R54
C11
R20
R28
D7
IC6
RV3
C9
C22
C12
R18
TR7
e
D6
R70
TR8
e
D12
R52
R55
TR3
R49
R51
R50
R22
R27
R24
C7
C8
R7
C6
C5
IC4
IC3
C4
C3
C16
C37
C17
LED1
C21
RV4
R25
R26
R29
R63
R64
R68
R65
R66
R48
R39
R40
R43
R58
R60
R62
D14
TR6
e
TR5
e
R69
LK7
LED3
R59
R61
D15
R56
R69
R67
LK5
R23
R21
C1
C20
R71
TR2
e
D11
R44
IC7
R36
R38
R31
R30
C18
R45
R45A
IC8
D8
R47
R46
R19
RV1
C23
IC5
T1
C2
R1
D1
D2
R3
R2
R4
R5
IC1
IC2
C15
C14
C13
LK9
A
B
C
D
E
F
G
H
I
J
R35
R34
R33
R32
R41
R72
SKA
SKB
D4
R6
D3
8
4
2
1

AT28726/01


D3
R6
D4
SKA
SKB
R42
D9
D10
C19
R41
R72
R45A
IC8
D8
R47
R19
RV1
C23
IC5
R1
D1
D2
R5
R4
R2
R3
IC1
IC2
C15
C14
C13
LK9
R30
R31
R38
R36
C18
R42
D11
R44
IC7
R71
TR2
e
C1
R21
R23
D15
R61
R59
R56
R69
R67
LK5
LED3
LK7
D14
R62
TR6
e
TR5
e
R69
C20
R40
R43
R39
R58
R60
R48
C37
C17
LED1
C21
RV4
R25
R26
R29
R63
R64
R68
R65
R66
C12
TR7
e
R70
TR8
e
D6
R18
C22
R52
D12
R55
TR3
e
R49
R51
R50
R22
R27
R24
C7
C8
R7
C6
C5
IC4
IC3
C4
C3
C16
R35
R34
R33
R32
T1
C2
TR1
s
R13
R10
R14
R8
D5
R17
C10
R12
R11
R15
RV2
LED2
R53
R54
C11
R20
R28
D7
IC6
RV3
C9
TR4
e
D13
A
B
C
D
E
F
G
H
I
J
1
2
4
8


SKA
SKB
D3
R6
D4
R1
D1
D2
R5
R4
R2
R3
C2
T1
IC1
IC2
C14
C13
C15
C16
C3
C4
R35
R34
R33
R32
R72
R41
F
E
D
C
B
A
G
H
I
J
LK9
R
S
TR1
IC3
C8
C7
R13
R10
R14
R8
D5
R7
R17
R11
R12
C6
C10
R15
C5
IC4
C37
R30
R31
R38
R36
R42
D9
D10
C19
IC8
R45A
C18
D11
R44
R42
R71
TR2
C20
R40
R39
R48
R43
R58
C17
LED1
C21
RV4
R70
TR8
R52
D12
C11
R51
R50
R49
R54
R53
RV2
R22
R27
R24
R55
TR3
LED2
D13
TR4
D8
R47
R46
R19
RV1
C1
C23
IC5
R21
R23
D15
R61
R59
LK7
D14
R62
R60
R25
R26
R29
D6
IC6
R20
R28
D7
RV3
R63
R64
R68
R65
R66
R18
R56
R69
LED3
TR5
TR6
TR7
R67
LK5
C12
C22
C9
1
2
4
8
9

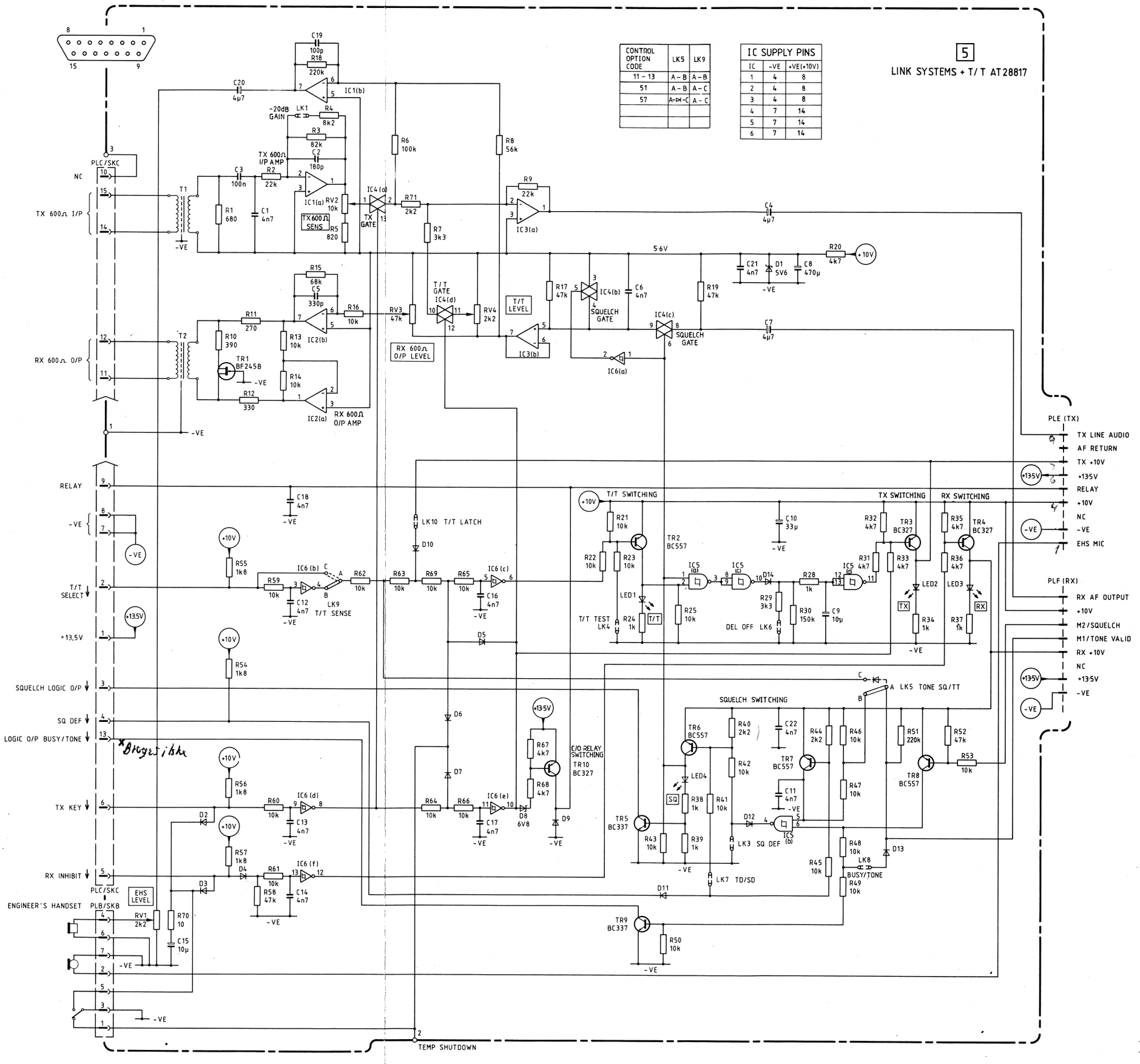
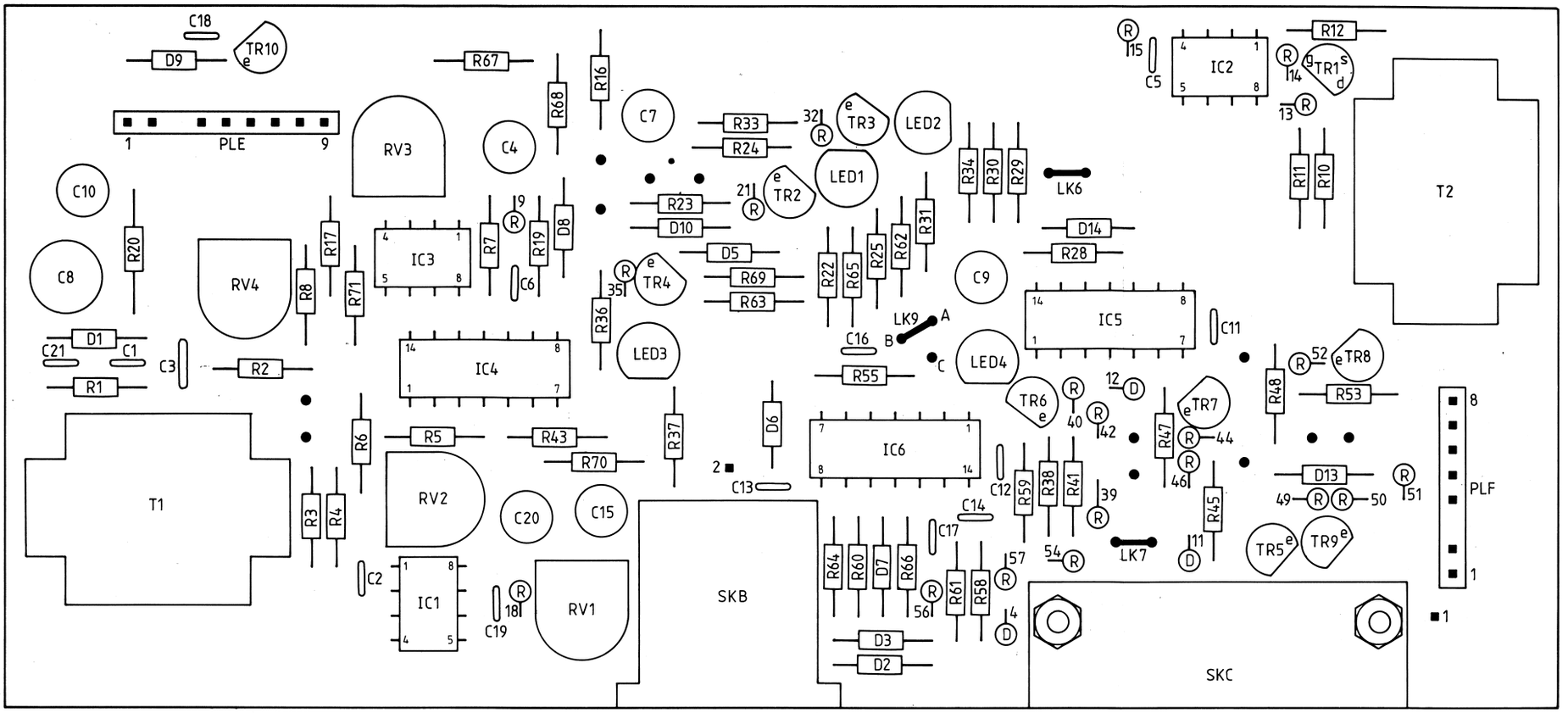
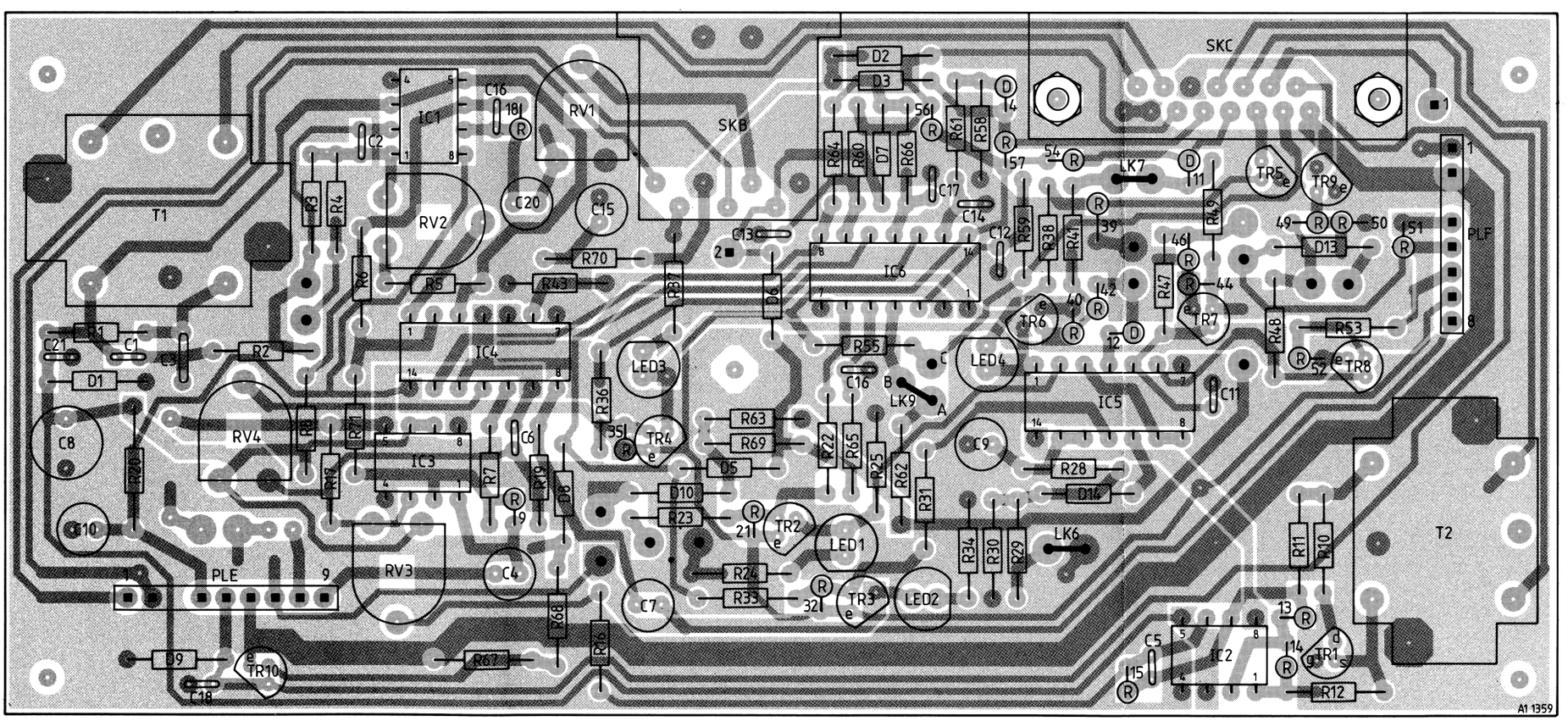
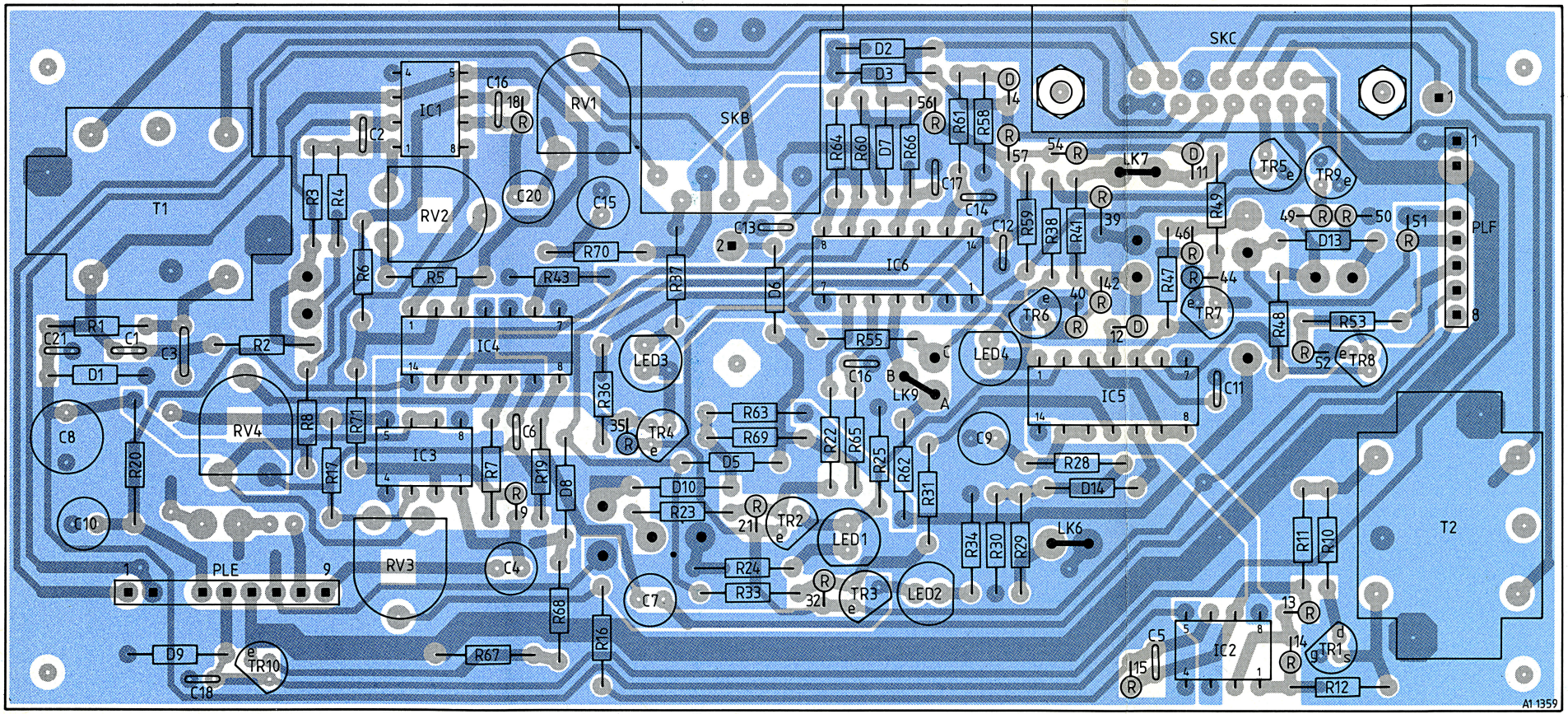


FIG 6.7 LINK/SYSTEMS (WITH TALKTHROUGH) CONTROL MODULE AT28817
CIRCUIT AND LAYOUT DIAGRAMS


C18
D9
TR10
R67
R16
R68
C7
R33
R24
TR3
LED2
R12
R15
C5
IC2
R14
TR1
R13
PLE
RV3
C4
R23
D10
TR2
LED1
R34
R30
R29
LK6
R11
R10
T2
C10
R20
R17
IC3
R7
R19
D8
C6
R31
D14
R28
C8
RV4
R8
R71
R25
R62
R22
R65
R69
R63
TR4
C9
R36
LED3
LK9
C16
IC5
C11
D1
C21
C1
C3
R2
IC4
R55
LED4
TR6
TR7
R48
R53
TR8
R1
R6
R5
R43
R70
R37
D6
IC6
R47
PLF
T1
RV2
C20
C15
C13
C12
R59
R38
R41
R45
D13
R51
R3
R4
C2
IC1
C19
RV1
SKB
R64
R60
D7
R66
R61
R58
C17
C14
LK7
TR5
TR9
SKC
D3
D2

AT28817


SKC
SKB
RV1
IC1
T1
RV2
IC6
IC4
IC5
RV4
IC3
RV3
PLE
T2
PLF
LED1
LED2
LED3
LED4
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
LK6
LK7
LK9
A1 1359


SKC
SKB
T1
T2
RV1
RV2
RV3
RV4
IC1
IC2
IC3
IC4
IC5
IC6
LED1
LED2
LED3
LED4
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
LK6
LK7
LK9
PLE
PLF
A1 1359

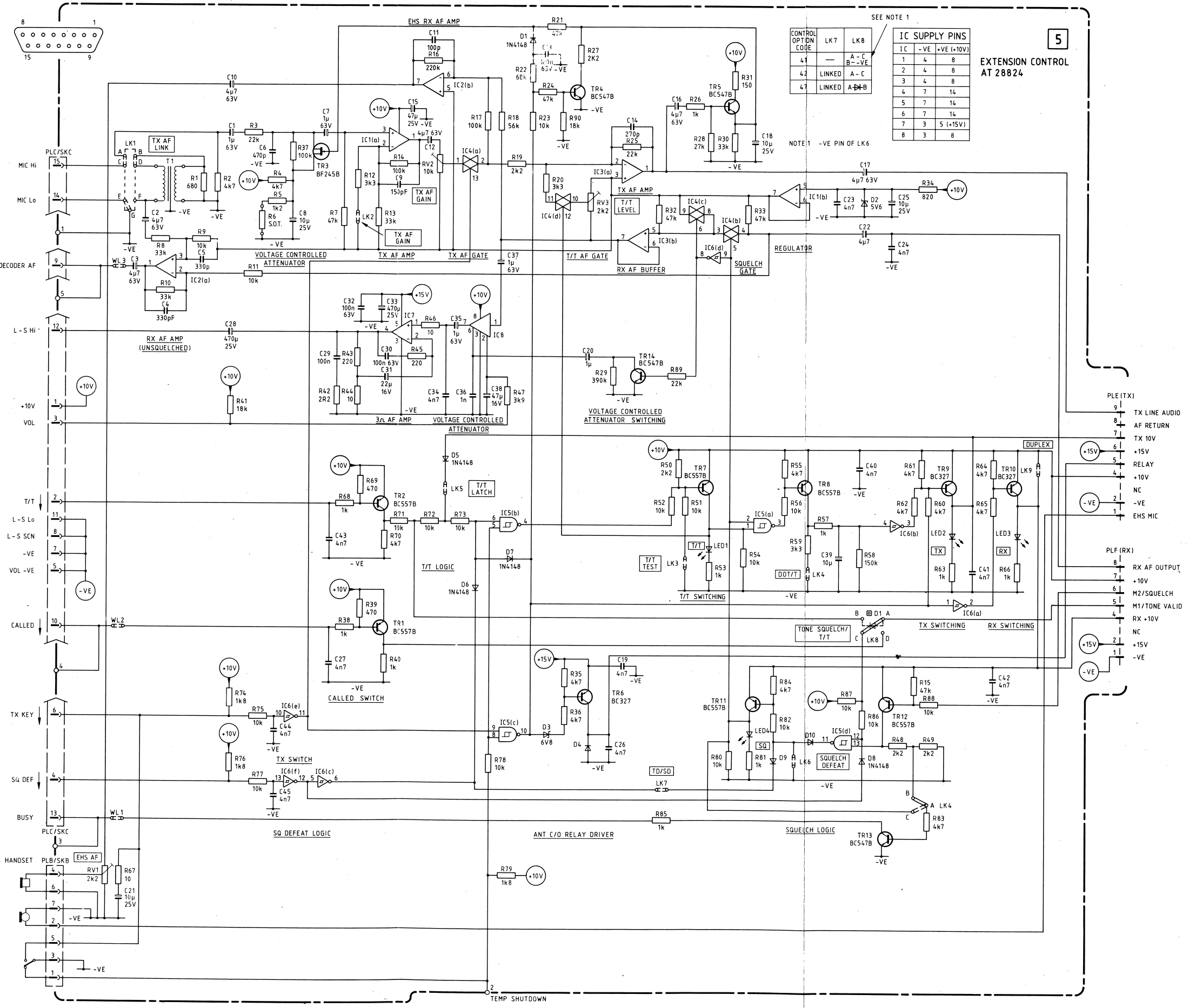
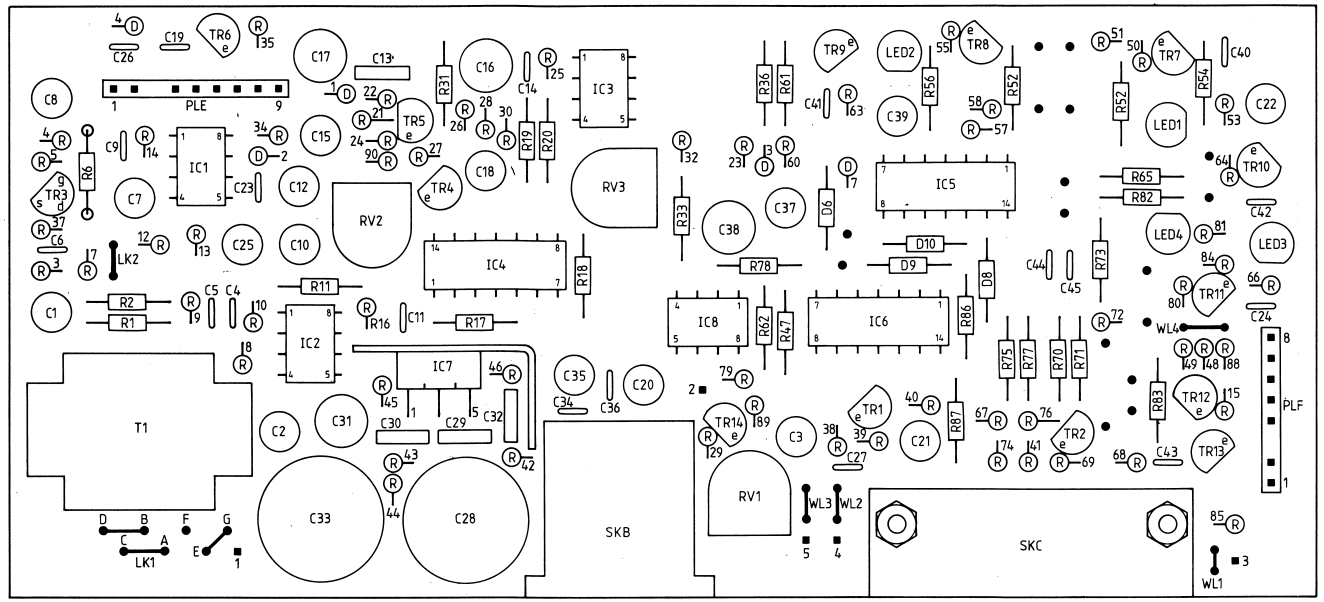
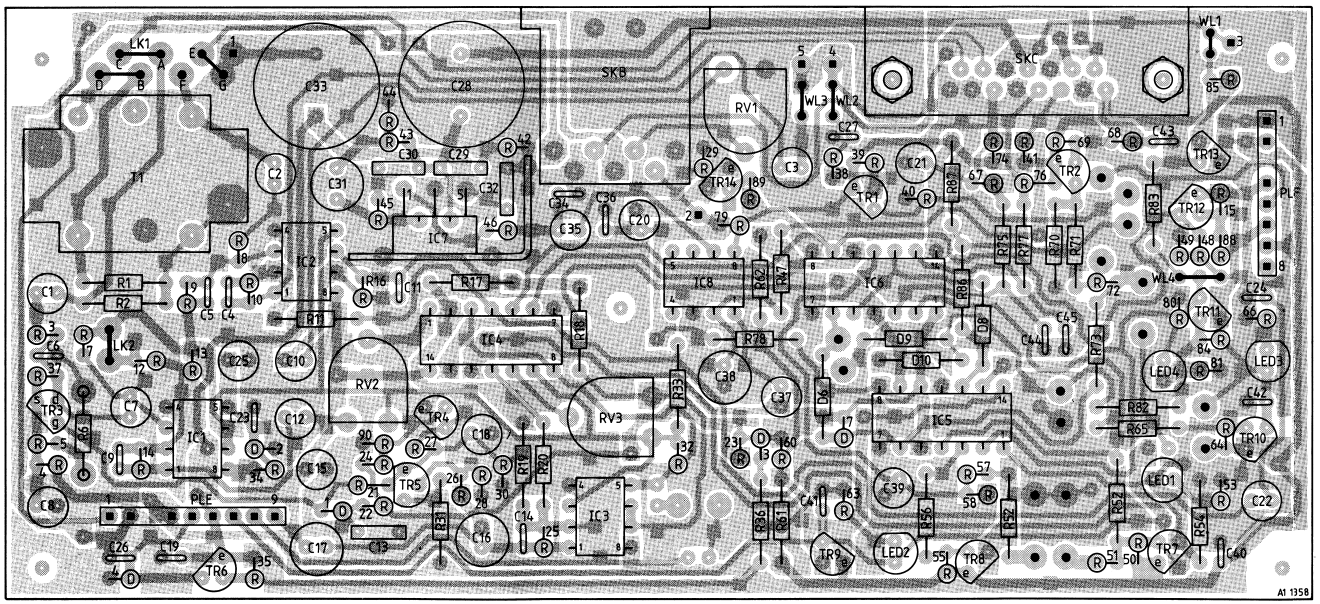
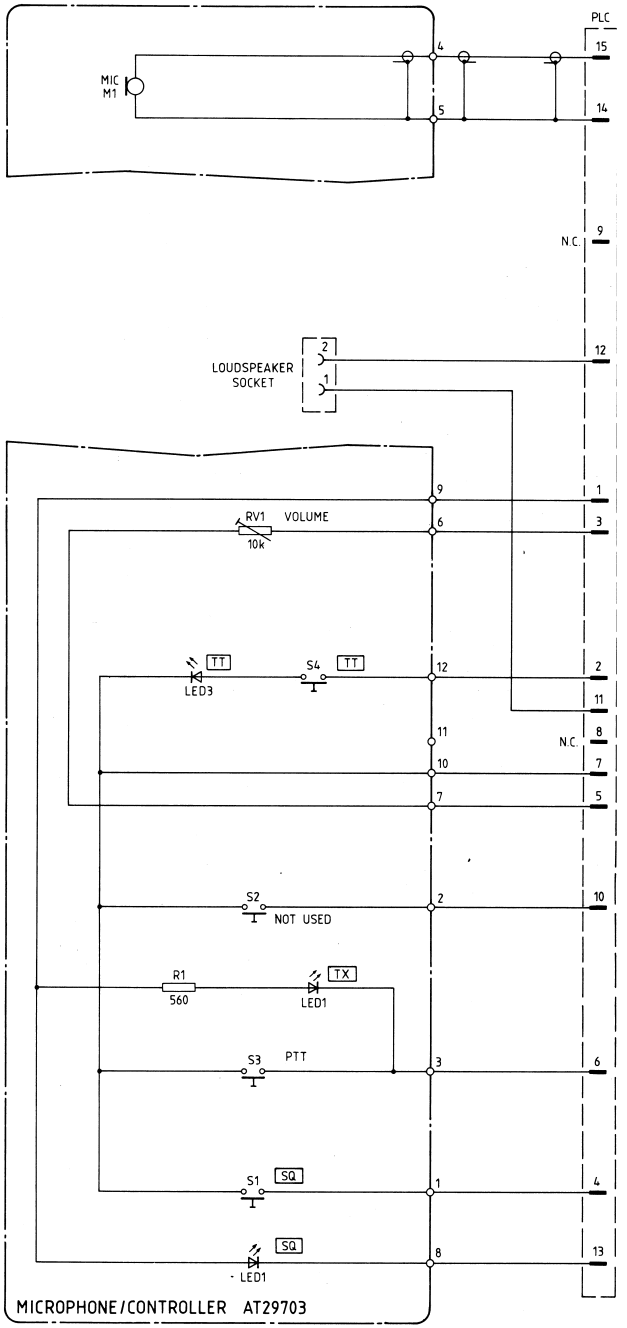


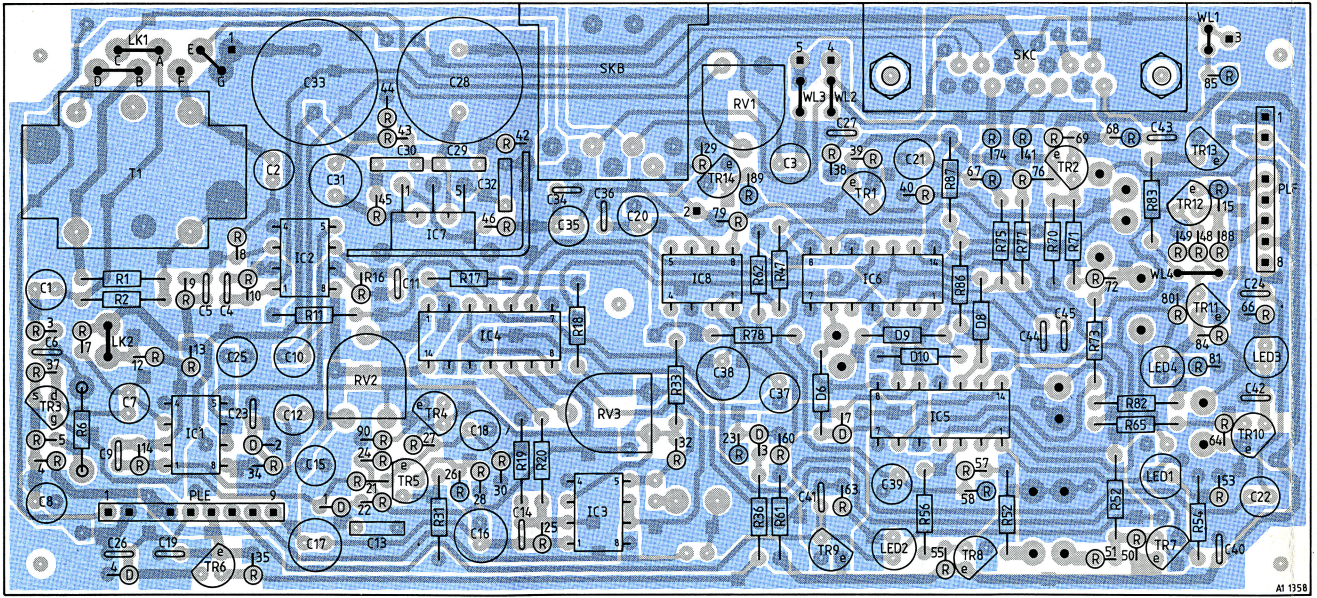
FIG 6.8 MC490 CONTROL MODULE AT28824 CIRCUIT AND LAYOUT DIAGRAMS

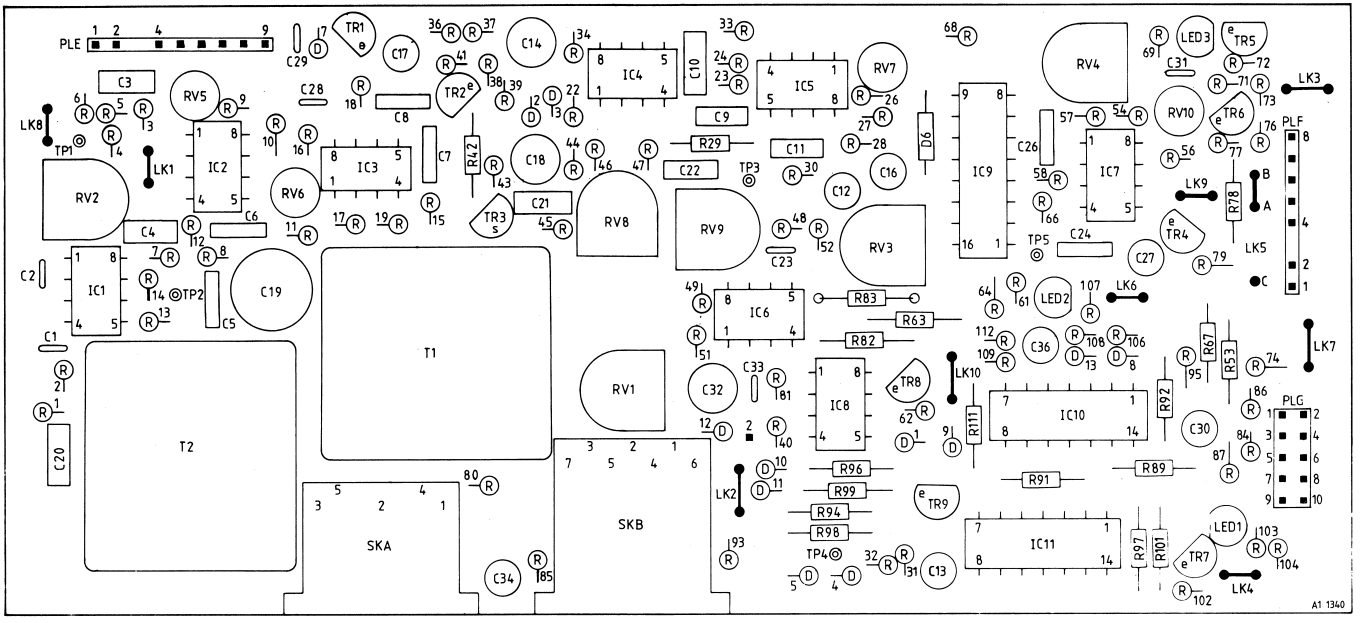

PLE
PLF
SKB
SKC
RV1
RV2
RV3
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
TR12
TR13
TR14
LED1
LED2
LED3
LED4
LK1
LK2
T1
WL1
WL2
WL3
WL4

AT28824

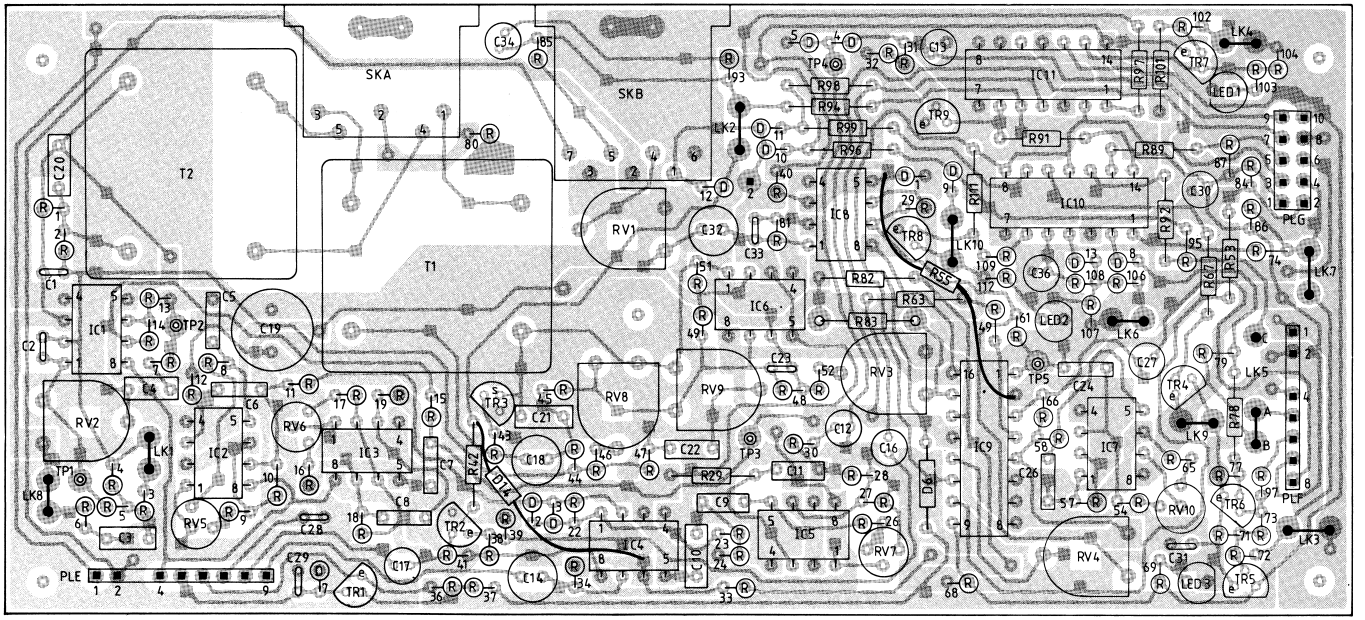

A1 1358

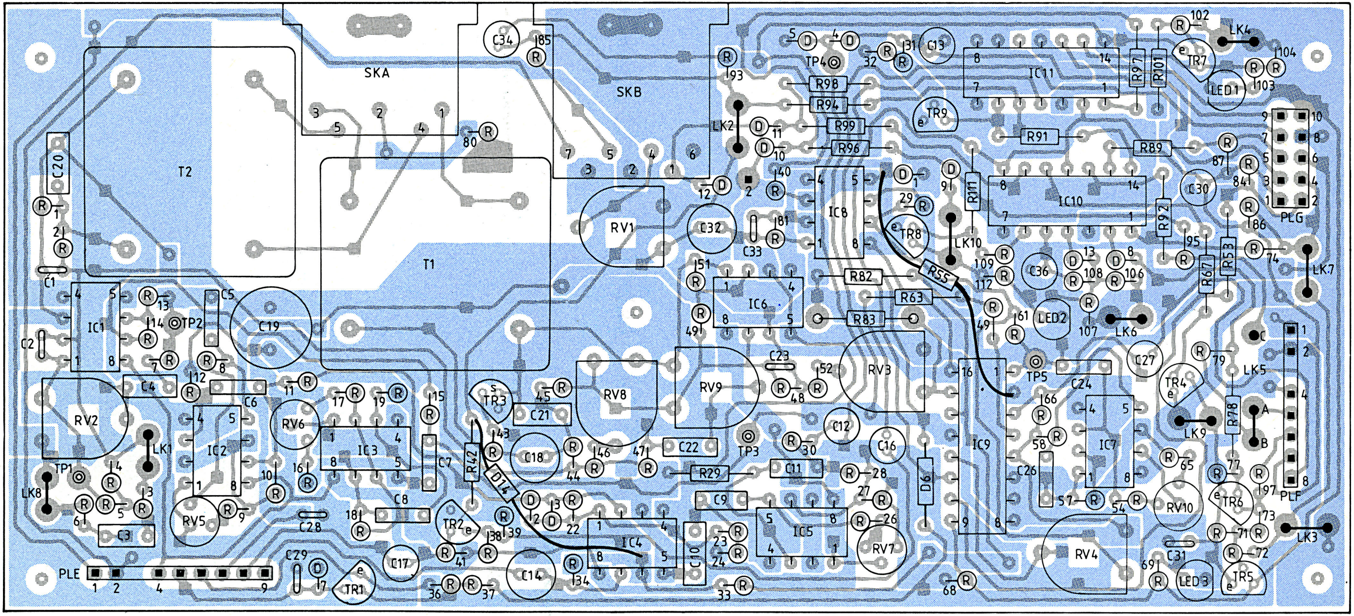

MIC
M1
PLC
N.C.
LOUDSPEAKER
SOCKET
RV1
VOLUME
10k
LED3
S4
TT
S2
NOT USED
R1
560
TX
LED1
S3
PTT
S1
SQ
MICROPHONE/CONTROLLER AT29703

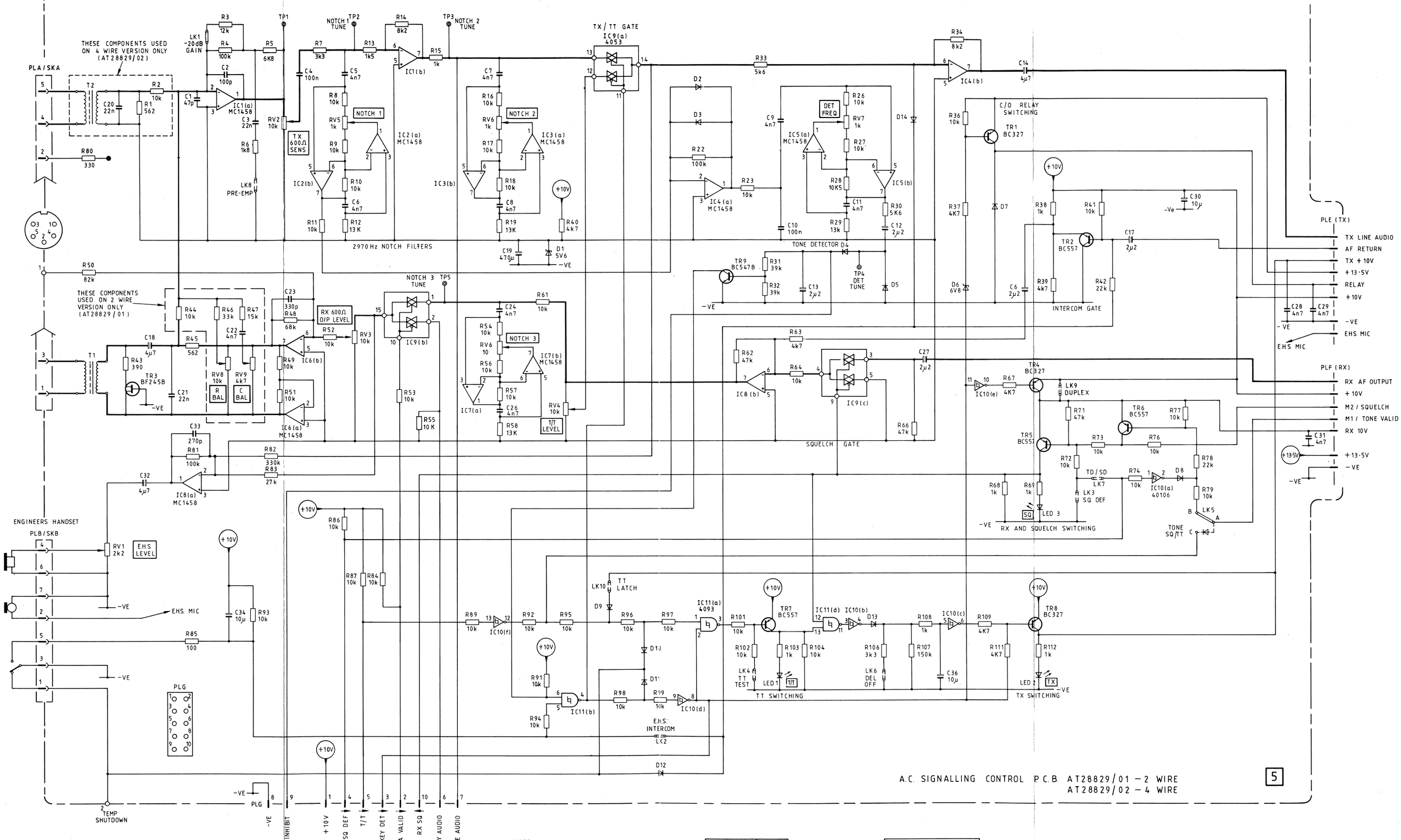

LK1
SKB
SKC
WL1
WL2
WL3
WL4
RV1
RV2
RV3
T1
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
PLE
PLF
LED1
LED2
LED3
LED4
LK2
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
TR12
TR13
TR14
A1 1358


PLE
SKA
SKB
T1
T2
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
RV1
RV2
RV3
RV4
RV5
RV6
RV7
RV8
RV9
RV10
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
LED1
LED2
LED3
LK1
LK2
LK3
LK4
LK5
LK6
LK7
LK8
LK9
LK10
PLF
PLG
A1 1340

AT28829


PLE
SKA
SKB
T1
T2
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
RV1
RV2
RV3
RV4
RV5
RV6
RV7
RV8
RV9
RV10
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
LED1
LED2
LED3
LK1
LK2
LK3
LK4
LK5
LK6
LK7
LK8
LK9
LK10
PLF
PLG


SKA
SKB
T1
T2
C20
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C16
C17
C18
C19
C21
C22
C23
C24
C26
C27
C28
C29
C30
C31
C32
C33
C34
C36
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
RV1
RV2
RV3
RV4
RV5
RV6
RV7
RV8
RV9
RV10
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TP1
TP2
TP3
TP4
TP5
LK1
LK2
LK3
LK4
LK5
LK6
LK7
LK8
LK9
LK10
LED1
LED2
LED3
R29
R42
R53
R55
R63
R67
R78
R82
R83
R89
R91
R92
R94
R96
R97
R98
R99
R101
R111
D6
D14
PLE
PLF
PLG



NOTE
LK9 IS FITTED ON 4 WIRE VERSION.

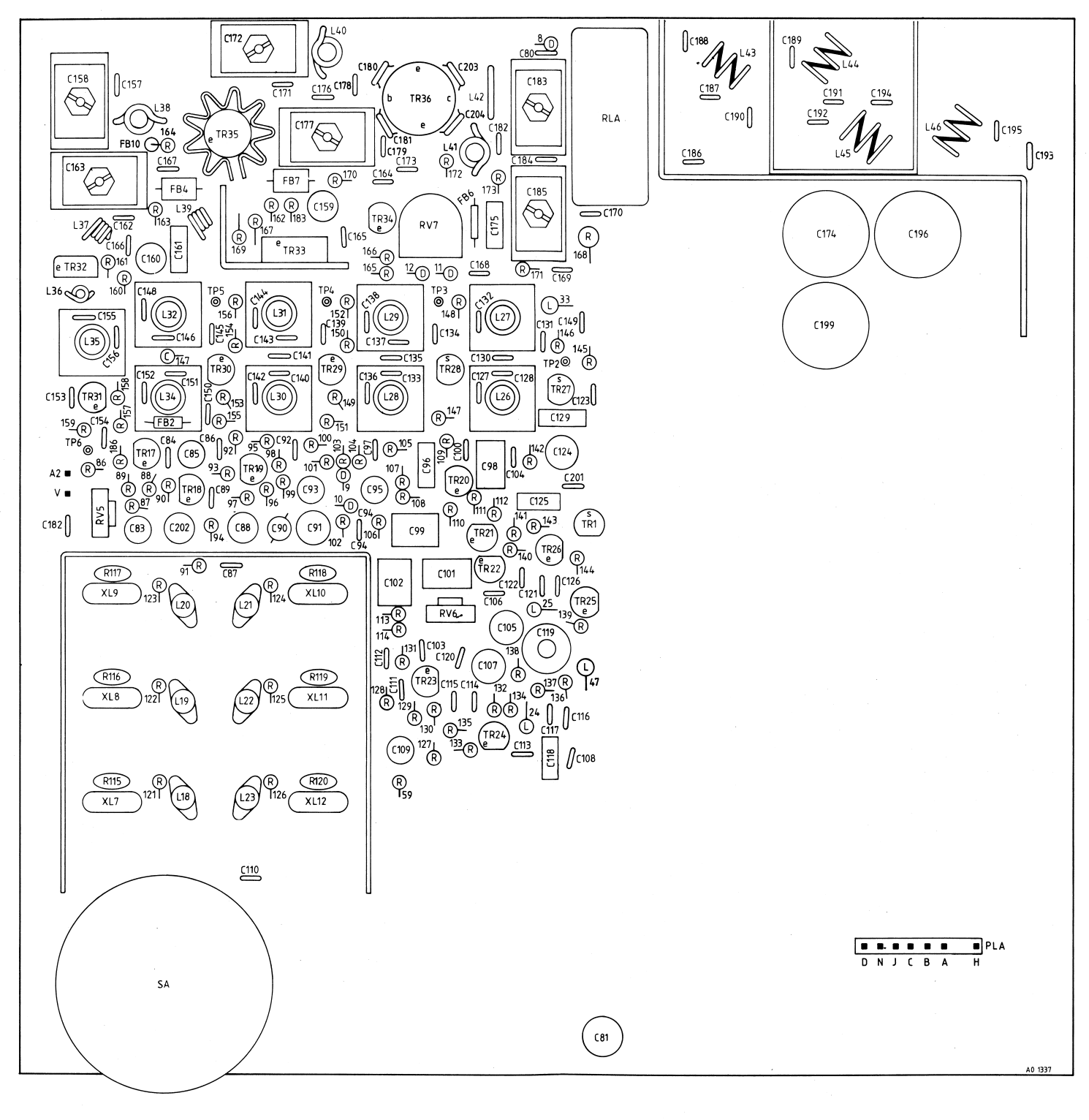
CONTROL OPTION CODE	LK5
31 — 34	A — B
35 — 38	A ⊣▷ C

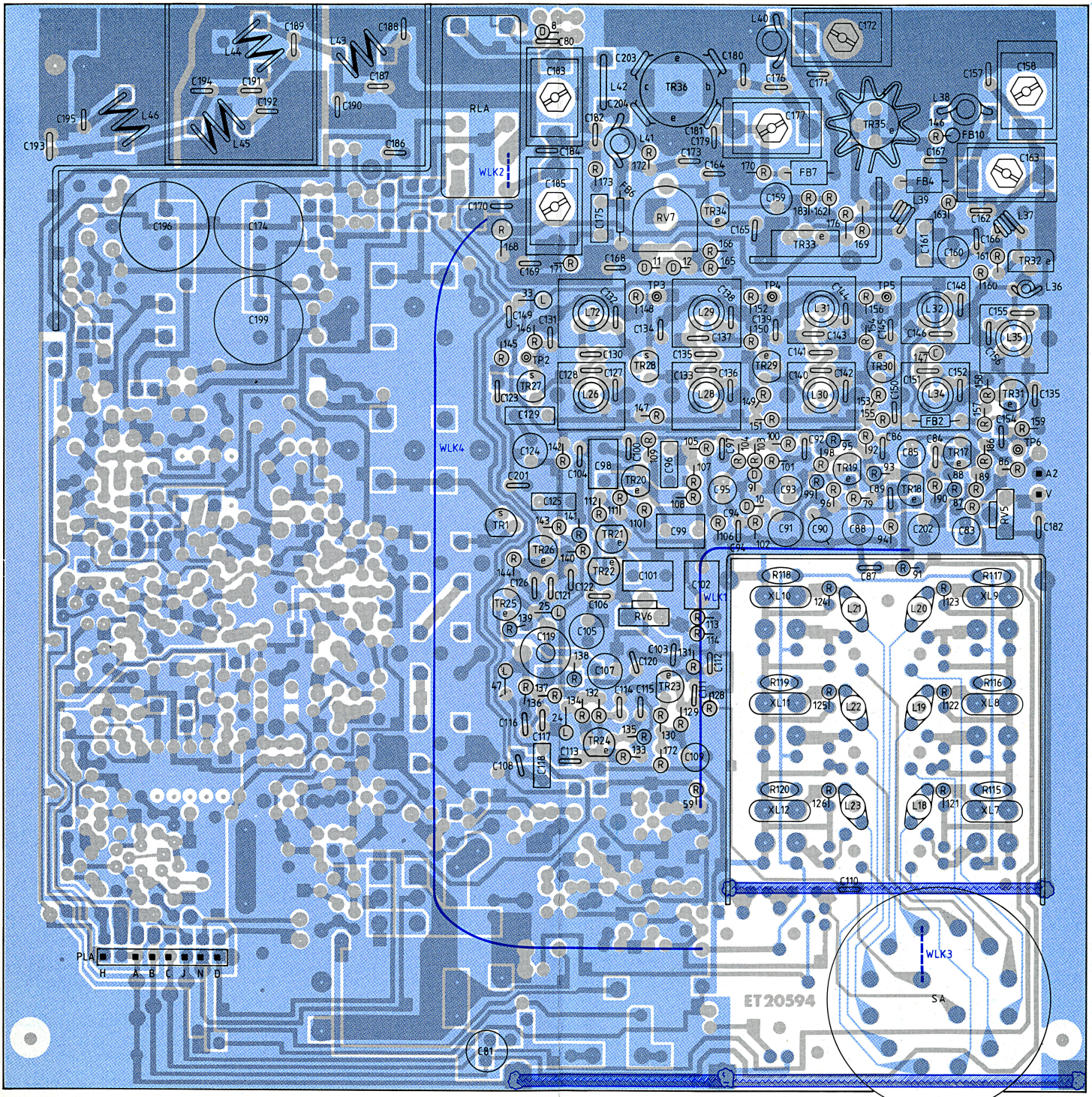
I C SUPPLY PINS		
I C	-VE	+VE (10V)
1 – 8	4	8
9	8	16
10, 11	7	14

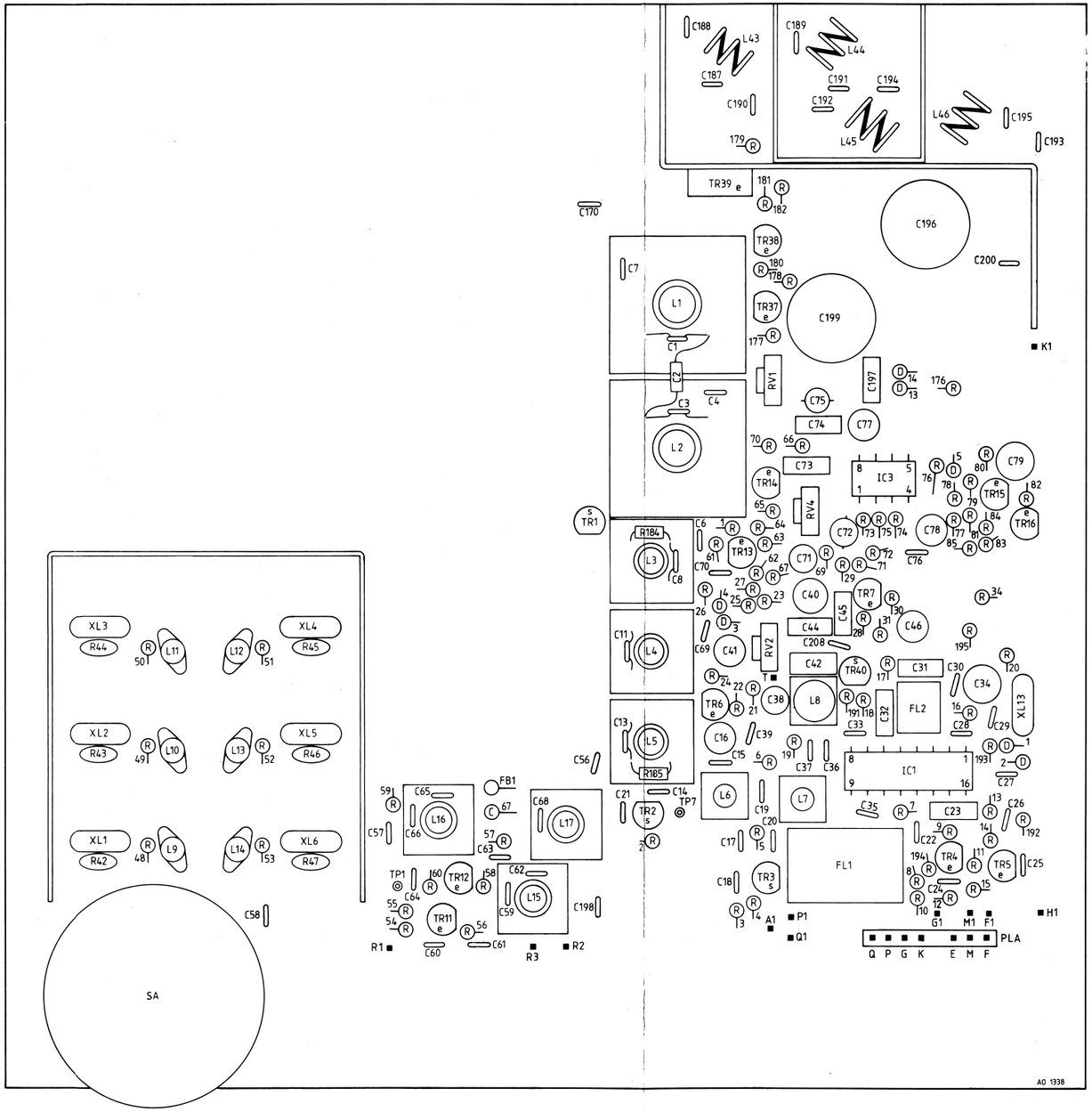
A.C. SIGNALLING CONTROL P.C.B. AT28829/01 – 2 WIRE
AT28829/02 – 4 WIRE

5

FIG 6.9 AC SIGNALLING CONTROL MODULE AT28829
CIRCUIT AND LAYOUT DIAGRAMS


C172
L40
C171
C176
C178
C180
C203
TR36
C181
C179
C173
L42
C204
C182
L41
172
C164
170
FB7
C159
162
183
167
169
TR33
C165
TR34
RV7
FB6
C175
173
C184
C185
C183
8
C80
RLA
C170
168
171
C169
166
165
12
11
C168
C158
C157
L38
164
FB10
TR35
C163
C167
FB4
163
L39
C162
L37
C166
C160
C161
e TR32
161
160
L36
C148
L32
C146
TP5
156
C144
L31
C143
TP4
152
C139
150
C138
L29
C137
TP3
148
C132
L27
33
C131
C149
146
145
C134
C130
TP2
C155
L35
C156
C147
C141
C135
TR30
TR29
TR28
TR27
C123
C129
C153
TR31
158
157
C154
159
C152
C151
L34
FB2
C150
153
155
C142
C140
L30
149
151
C136
C133
L28
147
C127
C128
L26
C125
TP6
186
C84
C86
92
95
98
100
103
104
C91
105
C96
109
C100
C98
C104
142
C124
A2
86
89
88
90
93
TR19
101
107
C201
V
87
C89
97
99
196
C93
C95
TR20
108
111
112
C110
RV5
C182
C83
C202
94
C88
C90
C91
102
106
C99
TR21
110
141
143
TR1
140
TR26
144
C102
C101
TR22
C122
C106
C121
C126
TR25
139
RV6
113
114
C105
C119
25
138
C112
131
C103
C120
C107
47
128
C111
C115
C114
132
134
137
136
129
130
135
24
C116
C117
C109
127
133
TR24
C113
C118
C108
59
R117
XL9
123
L20
91
C87
L21
124
R118
XL10
R116
XL8
122
L19
L22
125
R119
XL11
R115
XL7
121
L18
L23
126
R120
XL12
C110
SA
C81
C188
L43
C187
C190
C189
L44
C191
C194
C192
L45
L46
C195
C193
C186
C174
C196
C199
PLA
D N J C B A H
A0 1337


WLK1
WLK2
WLK3
WLK4
RLA
PLA
H A B C J N D
ET 20594
SA
TR36
TR35
TR34
TR33
TR32
TR31
TR30
TR29
TR28
TR27
TR26
TR25
TR24
TR23
TR22
TR21
TR20
TR19
TR18
TR17
TR1
RV7
RV6
RV5
FB10
FB7
FB6
FB4
FB2
TP2
TP3
TP4
TP5
TP6
A2
V



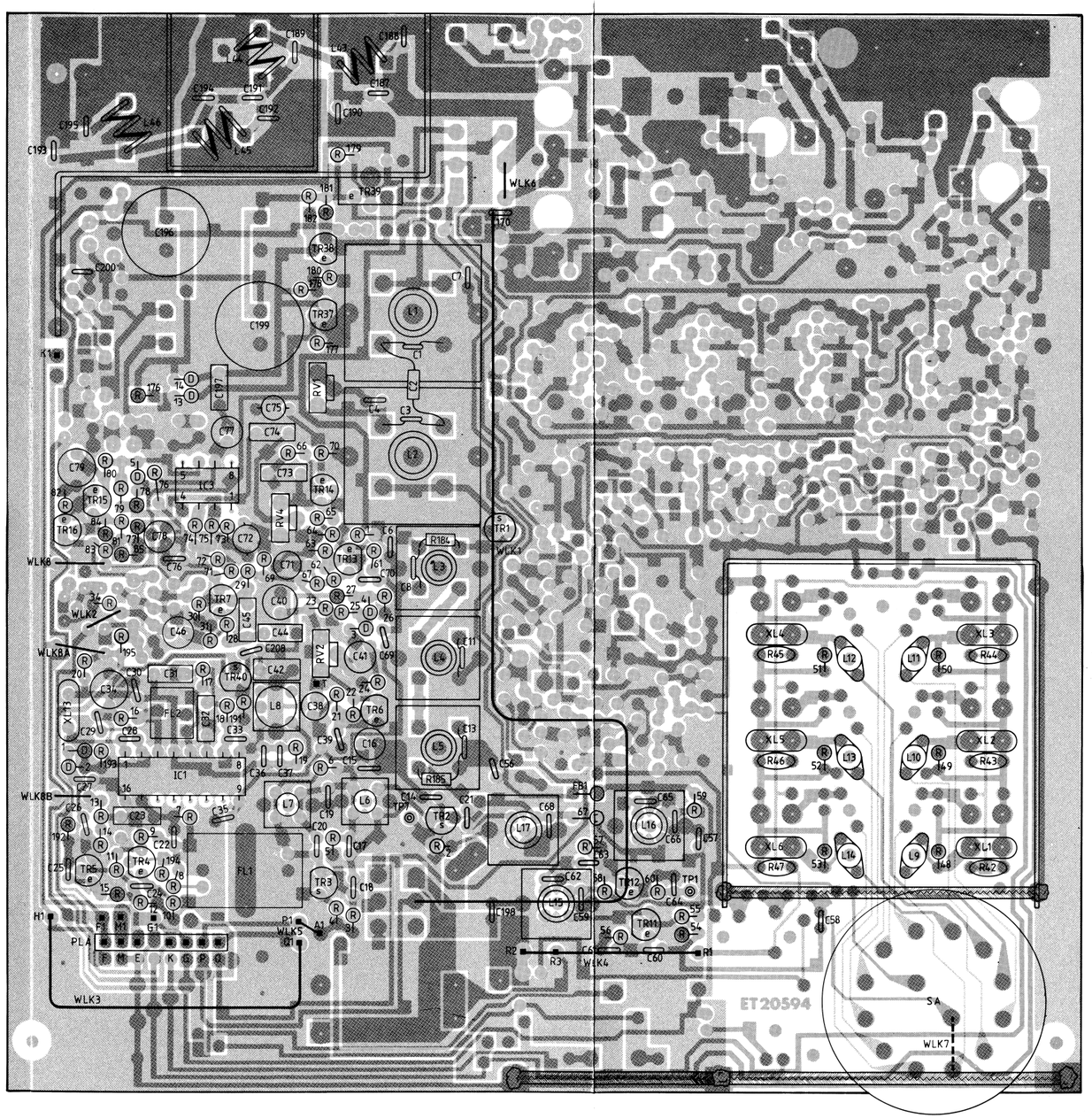
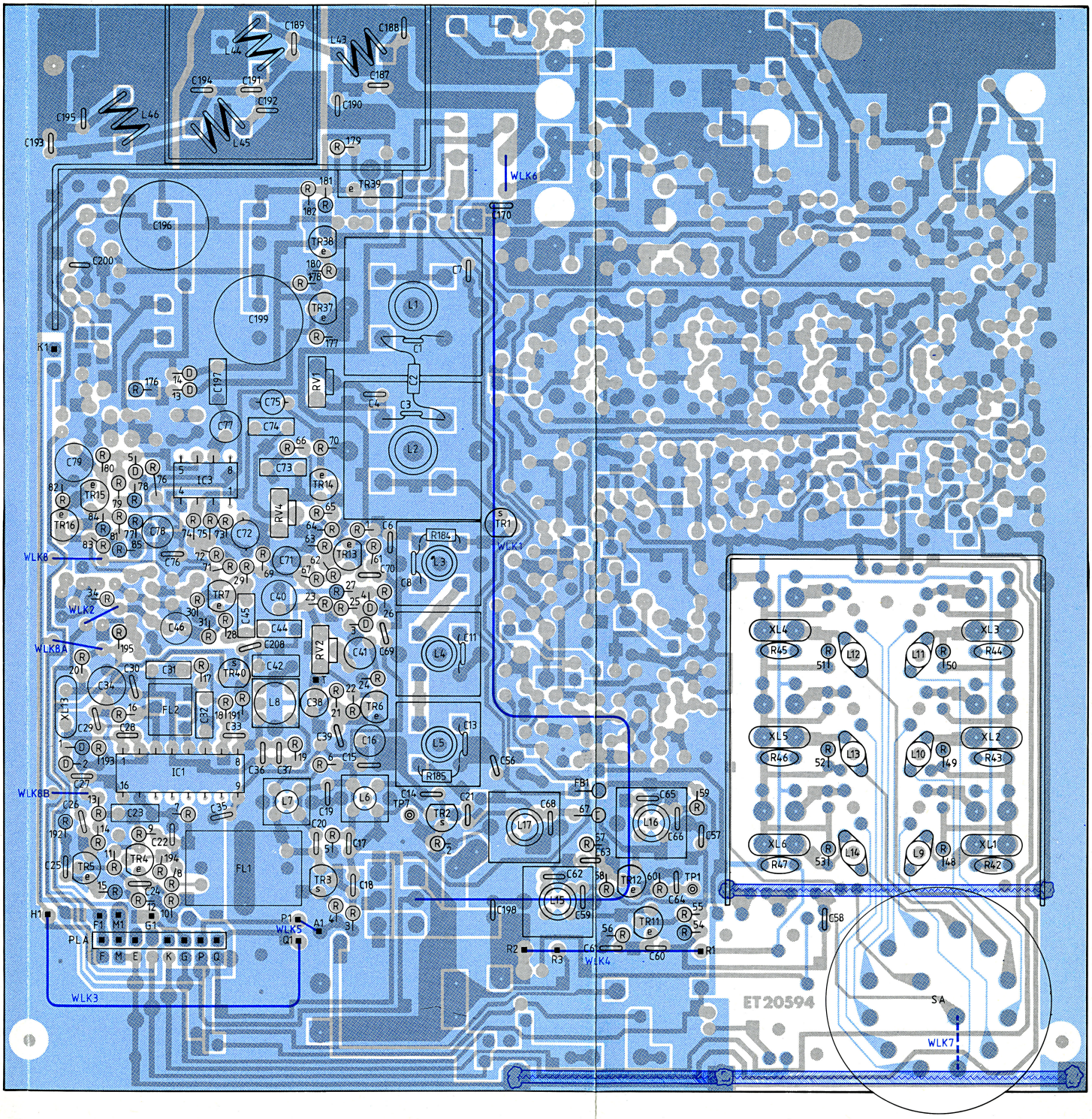


FIG 6.11 RECEIVER BOARD
AT28752/– ISSUE 3
LAYOUT DIAGRAM


ET20594
WLK1
WLK2
WLK3
WLK4
WLK5
WLK6
WLK7
WLK8
WLK8A
WLK8B
IC1
IC3
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR10
TR11
TR12
TR13
TR14
TR15
TR16
TR37
TR38
TR39
TR40
L1
L2
L3
L4
L5
L6
L7
L8
L10
L11
L12
L13
L14
L15
L16
L17
L43
L44
L45
L46
RV1
RV2
RV4
FL1
FL2
SA

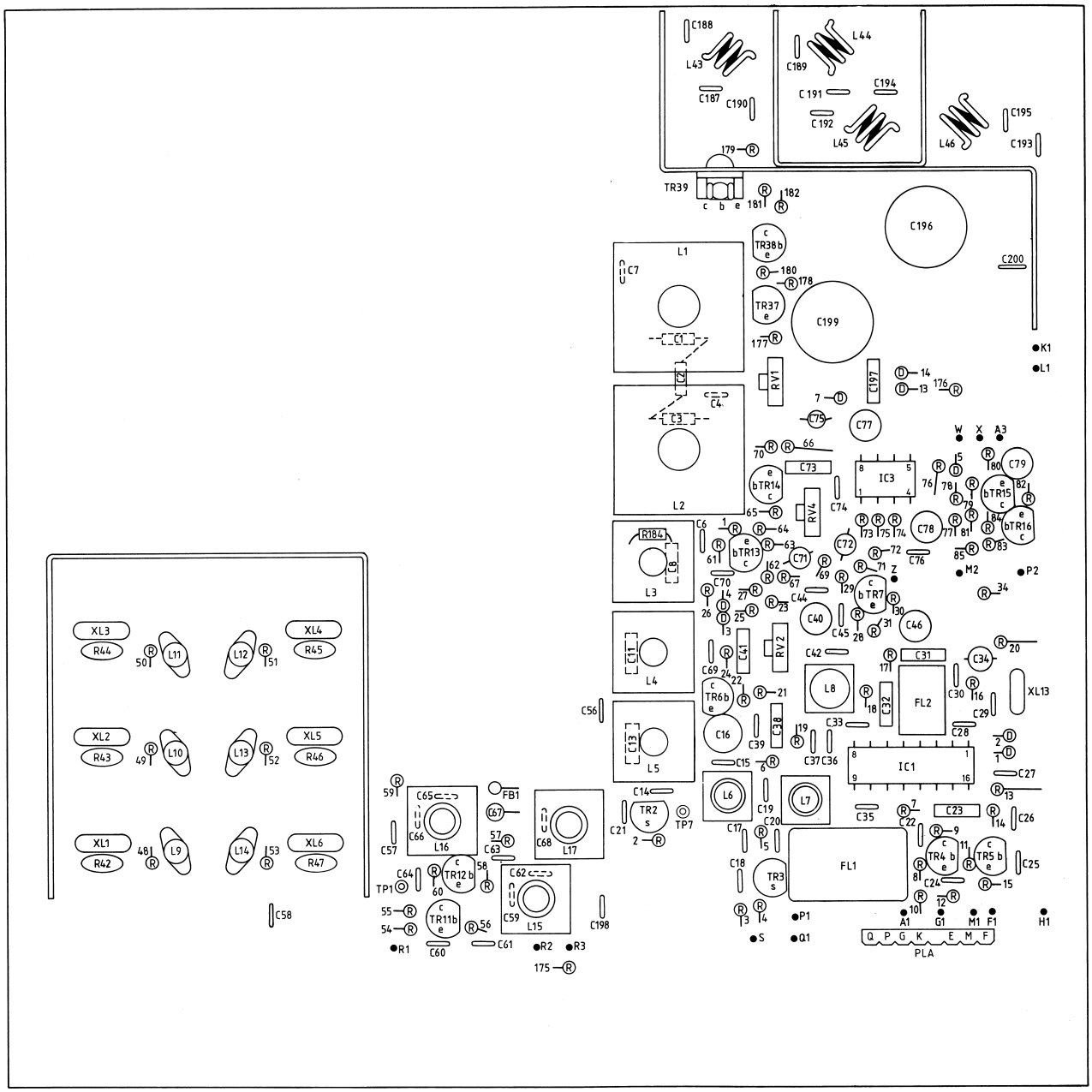
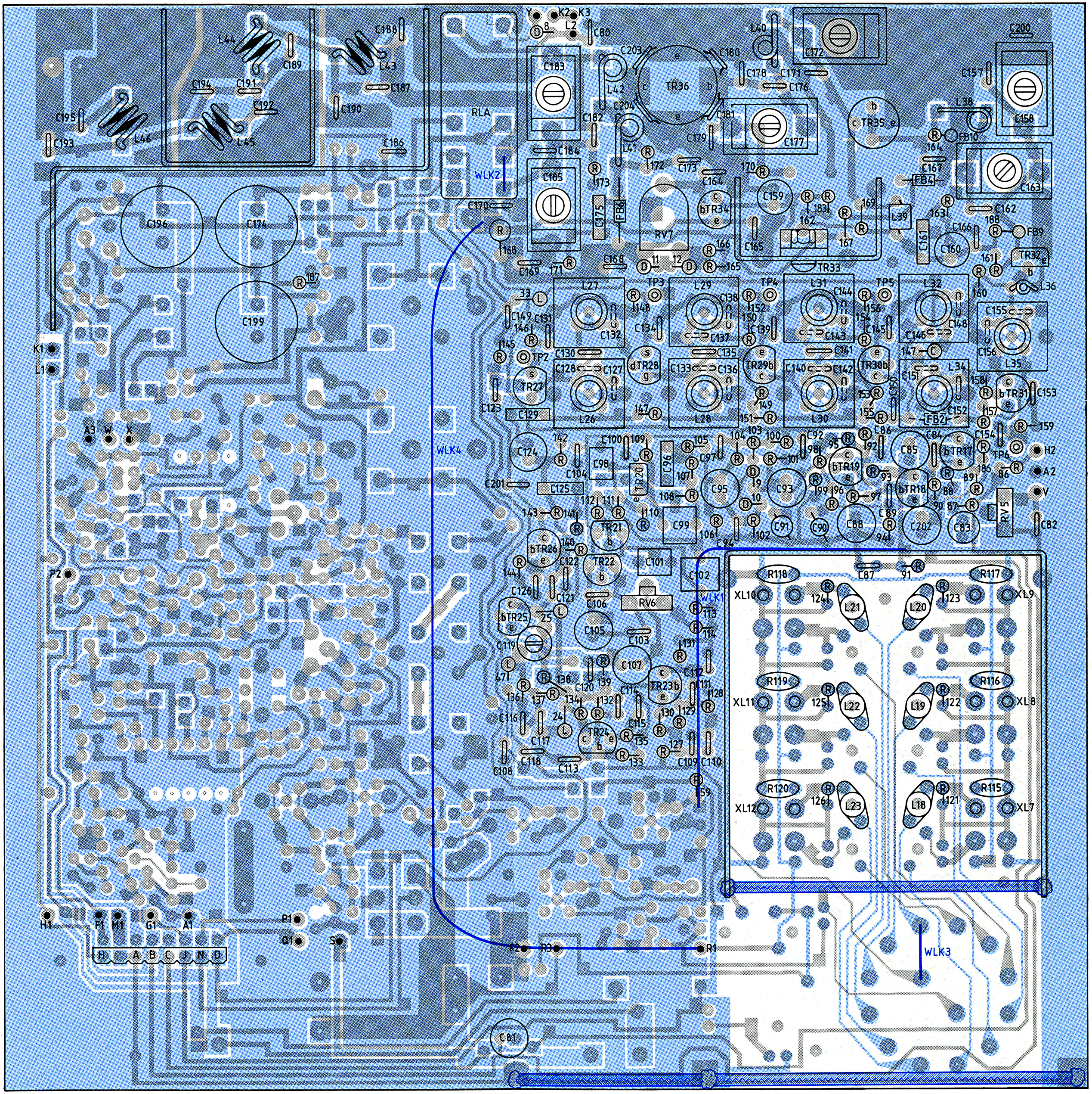
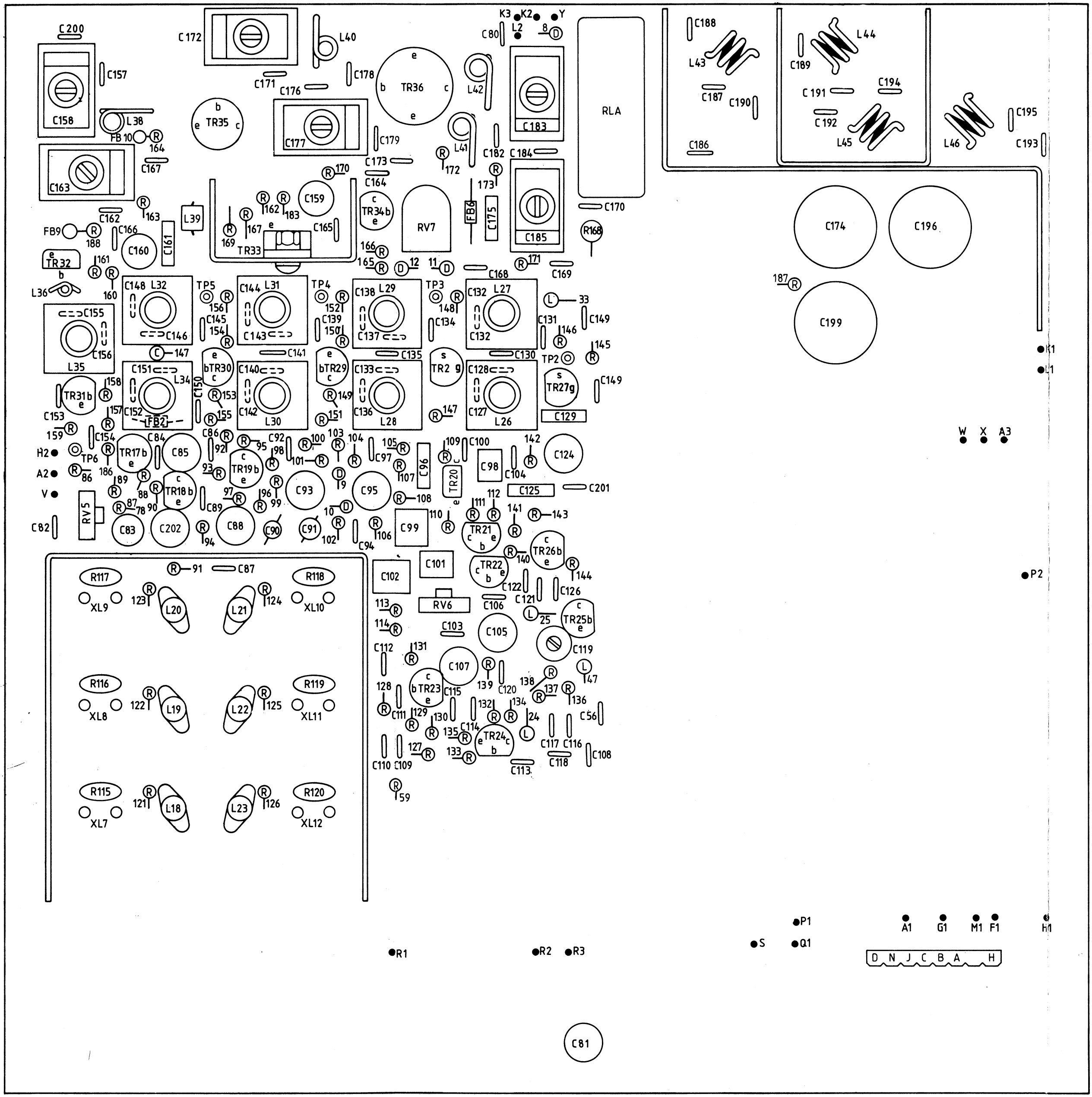


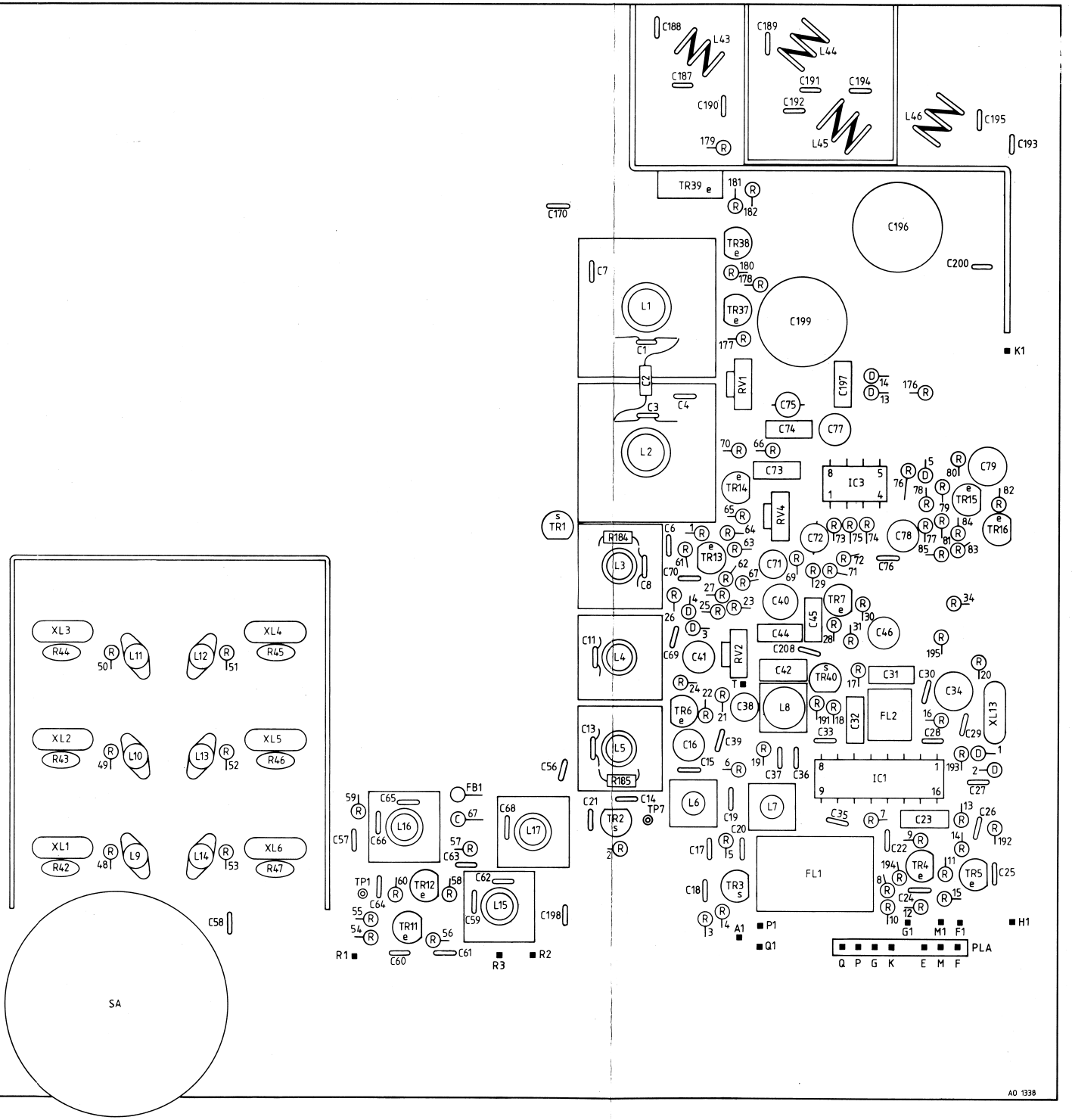
FIG 6.12 TRANSMITTER AND RECEIVER BOARDS
AT28751/– AND AT28752/– ISSUE 2
LAYOUT DIAGRAMS



RLA
WLK1
WLK2
WLK3
WLK4
TR36
TR35
TR33
TR32
TR27
TR28
TR29
TR30
TR31
TR21
TR22
TR25
TR26
TR24
TR23
TR20
TR19
TR18
TR17
TR34
RV5
RV6
RV7
L44
L43
L45
L46
L42
L41
L40
L38
L39
L36
L35
L34
L32
L31
L30
L29
L28
L27
L26
L23
L22
L21
L20
L19
L18
C196
C174
C199
C183
C185
C177
C172
C158
C163
C124
C202
C83
C88
C81
R118
R117
R119
R116
R120
R115
XL10
XL9
XL11
XL8
XL12
XL7
FB2
FB4
FB6
FB9
FB10
TP2
TP3
TP4
TP5
TP6
K1
L1
A3
W
X
P2
H1
F1
M1
G1
A1
P1
Q1
S
H2
A2
V
R1
R2
R3
Y
K2
K3
H
A
B
C
J
N
D



C200
C172
L40
K3 K2 Y
L2 8
C80
C157
C158
C178
TR36
C171
C176
L42
C183
RLA
C188
L43
L44
C189
C187
C190
C191
C194
C192
L45
L46
C195
C193
C186
TR35
C177
C179
L41
L38
FB 10
164
C167
C163
C173
172
182
C184
170
C164
173
C159
TR34
FB6
C175
C185
C170
C162
163
162
183
L39
C165
RV7
R168
FB9
188
C166
C160
C161
169
167
TR33
166
165
12
11
171
C169
C168
C174
C196
TR32
161
160
187
L36
C148
L32
TP5
C144
L31
TP4
C138
L29
TP3
C132
L27
33
C155
C145
156
152
148
C149
C146
C143
C139
C137
C134
C131
146
C156
L35
154
150
145
147
C141
C135
C130
TP2
C199
TR30
TR29
TR2
TR27
C151
L34
C140
C133
C128
C149
C150
153
149
TR31
158
157
C152
FB2
C142
L30
C136
L28
C127
L26
C129
C153
155
151
147
159
C154
C84
C86
92
95
C92
100
103
104
105
109
C100
142
C124
W X A3
H2
TP6
TR17
C85
TR19
98
101
C97
C96
C98
C104
A2
186
93
107
TR20
86
89
88
TR18
97
96
99
C93
9
C95
C125
C201
V
87
78
90
C89
10
108
111
112
141
143
C82
RV5
C83
C202
C88
C90
C91
102
C94
106
C99
110
TR21
TR26
C87
91
C101
140
R117
R118
C102
TR22
144
P2
XL9
123
L20
L21
124
XL10
C122
C121
C126
113
RV6
C106
25
TR25
114
C103
C105
C119
C112
131
C107
R116
R119
139
C120
138
47
TR23
137
136
XL8
122
L19
L22
125
XL11
128
C115
132
134
C111
129
130
24
C56
C114
135
TR24
C117
C116
127
133
C118
C108
C110
C109
C113
R115
R120
59
121
L18
L23
126
XL7
XL12
P1
A1 G1 M1 F1 H1
S
Q1
R1
R2 R3
D N J C B A H
C81
K1
L1


C188
L43
C187
C190
179
C189
L44
C191
C194
C192
L45
L46
C195
C193
TR39
181
182
C170
C196
C200
TR38
180
178
C7
L1
C1
C199
TR37
177
K1
C2
RV1
C197
D14
D13
176
C3
C4
C75
C74
C77
L2
70
66
C73
IC3
C79
TR14
TR15
TR16
S
TR1
65
RV4
C72
C78
C6
R184
L3
C8
TR13
C70
C71
C76
C40
TR7
C45
C44
C208
C46
34
C11
L4
C41
RV2
C42
TR40
C31
C30
C34
XL13
C13
L5
R185
TR6
C38
L8
C32
FL2
C33
C28
C29
C56
C16
C39
C15
C37
C36
IC1
C27
C21
C14
TP7
TR2
L6
L7
C19
C20
C35
C23
C26
C17
C22
TR4
TR5
C25
FL1
C18
TR3
C24
C12
G1
M1
F1
H1
A1
P1
Q1
PLA
Q P G K E M F
XL3
R44
L11
XL4
R45
L12
XL2
R43
L10
XL5
R46
L13
XL1
R42
L9
XL6
R47
L14
C58
SA
C65
C66
L16
FB1
C67
C68
L17
C57
C63
TP1
C64
TR12
C62
L15
C59
C198
TR11
C60
C61
R1
R3
R2
AO 1338

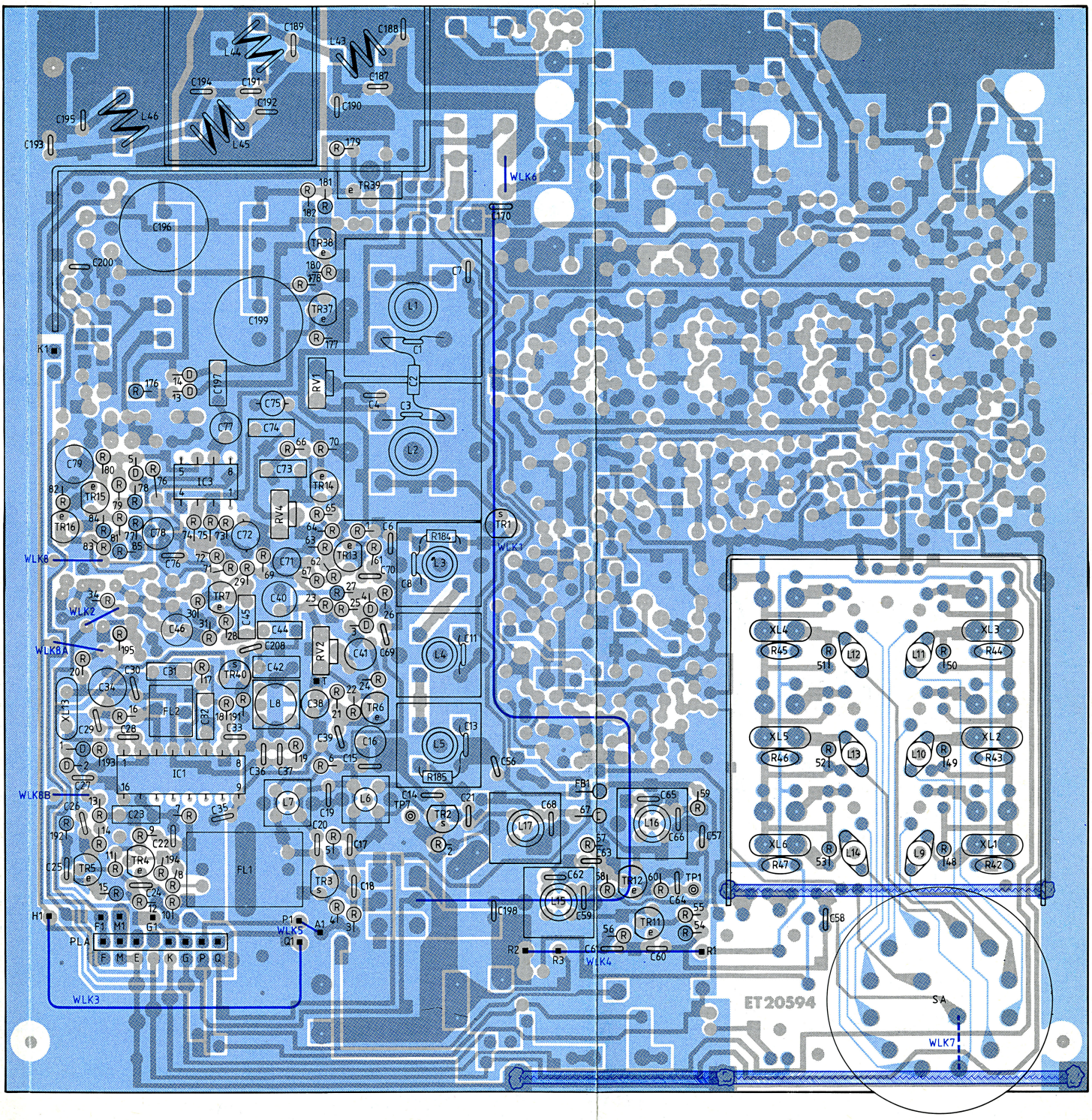


FIG 6.11 RECEIVER BOARD
AT28752/– ISSUE 3
LAYOUT DIAGRAM

3 VHF TRANSMITTER ASSEMBLY AT28751

TX OSCILLATOR

PHASE MODULATOR

TX MULTIPLIERS AND AMPLIFIERS

TX AUTOMATIC LEVEL CONTROL

RV7 POWER SET

NOTE
WHEN RLA IS NOT FITTED
TX 10V IS SUPPLIED DIRECTLY
FROM SKE PIN 7 VIA (3) C6

TX RF POWER AMPLIFIERS

ANTENNA FILTER

TX/COM ANTENNA

RX ANTENNA

TO RX INPUT

†WHEN RLA NOT FITTED

TO RX INPUT

PLA
+10V
-VE
EHS MUTE
TX IN BAND TX ENCODE
TX 10V
SPARE
SUB AUDIO TX ENCODE

MP1 (a) = 2mV r.m.s. (b) = 20mV r.m.s. 1kHz

SEE NOTE

MIC PRE-AMP

PRE-EMPHASISED AMP

LIMITER

DE-EMPHASIS

LOW PASS FILTER

LOW PASS FILTER

AMP

RV6 PEAK DEV SET

MP3 (a) 3.9V (b) 2.8V

HEATSINK PART OF TX ASSEMBLY

MP2 LINE I/P ONLY 700mV p. to p. FOR ± 3kHz DEV

MP4 LEVEL FOR 25kHz CHANNEL SPACING (a) 160mV (b) 90mV

REGULATOR AT28724/01

MAINS INPUT

DC INPUT 24V NOMINAL

SET VOLTS

ON D.C

ON A.C.

0 ON THERMAL SHUTDOWN

PLE/SKE
9 TX LINE AUDIO
8 AF RETURN
7 TX 10V
6 +13,5V
5
4 +10V
2 -VE
1 EHS AUDIO

PLF/SKF
8 RX AF OUTPUT
7 10V
6 M2/SQUELCH
5 TONE VALID
4 RX 10V
2 +13,5V
1 -VE

MP5 290mV 100mV r.m.s.

PLA
RX AUDIO
TONE VALID
RX AUDIO FOR DECODERS
RX AUDIO RETURN
GROUND
10V

MP6 290mV

SEE NOTE 4

2 VHF RECEIVER AT28752

FROM RLA2 OR RX ANTENNA

ANTENNA FILTER

RX RF AMPLIFIER

1st MIXER AND PRE-AMP

2ND OSC MIXER

IF AMP

DISCRIMINATOR

MP7 LEVEL FOR 25kHz CHANNEL SPACING 250mV

RX NOISE LIMITER AND FILTER

MP8 2V

RX OSCILLATOR MULTIPLIER AND AMPLIFIER

SQUELCH FILTER AMPLIFIER AND ACTIVE RECTIFIER

SQUELCH SCHMITT TRIGGER

10V REGULATOR

TO PIN 2 CONTROL PCB

THERMAL SHUTDOWN

NOTES

1 CHASSIS COMPONENTS ARE PREFIXED (0)

2 * FOR UNSPECIFIED COMPONENTS SEE PARTS LIST.

3 FOR SOT COMPONENTS SEE PARTS LIST FOR VALUES

4 AUDIO FEED VIA F1 EXCEPT WHEN TONE DECODER IS FITTED, THEN VIA G1

VOLTAGE ANALYSIS FOR A BAND F494

UNLESS MARKED OTHERWISE ALL VOLTAGES SHOWN ARE MEASURED WITH BOTH TRANSMITTER AND RECEIVER ENERGISED, BUT UNCRYSTALLED

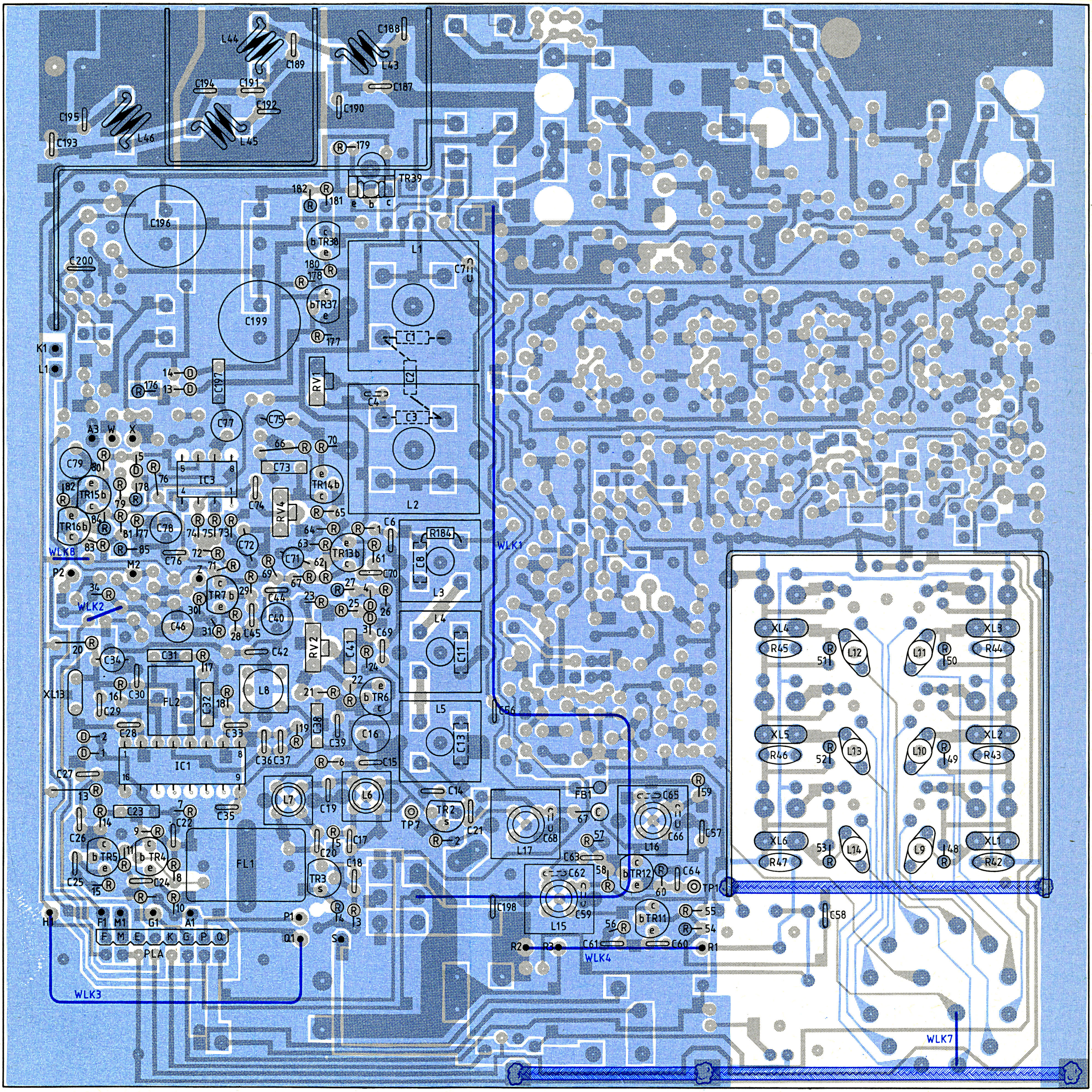
VOLTAGES SHOWN THUS:— ⬭ REPRESENT TYPICAL VALUES WHEN FITTED WITH A CHANNEL CRYSTAL, TUNED ACCORDING TO THE HANDBOOK

ALL MEASUREMENTS MADE WITH A 20kΩ/VOLT METER ON EITHER THE 2,5V OR 10V OR 25V SCALE

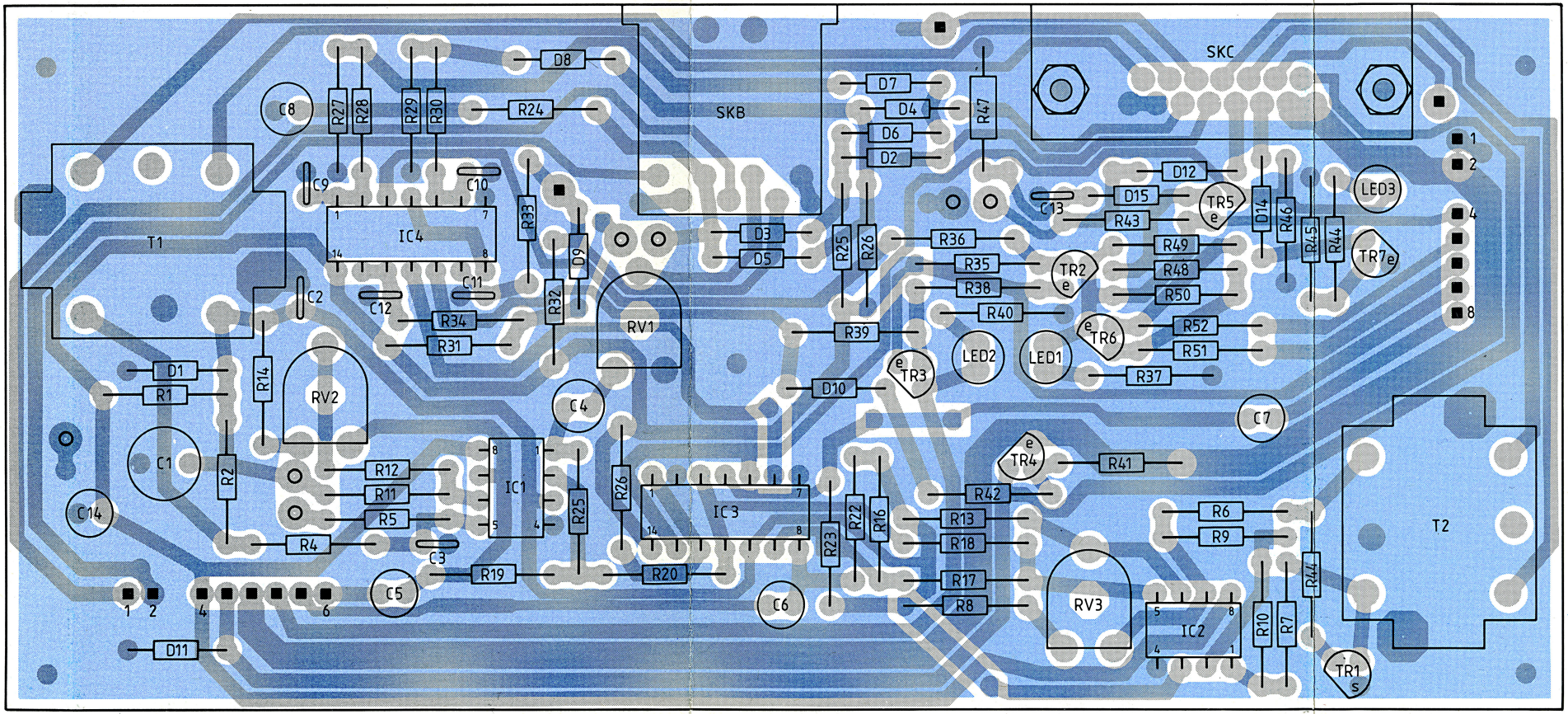
TRANSMITTER AUDIO MEASUREMENTS ARE SHOWN AT TWO LEVELS
(a) REPRESENTS THE CLIPPED LEVEL SET FOR PEAK DEVIATION
(b) REPRESENTS THE UNCLIPPED LEVEL SET 60% PEAK DEVIATION AT 1kHz MODULATION FREQUENCY

RECEIVER AUDIO MEASUREMENTS ARE SHOWN FOR 1mV p.d. RF SIGNAL LEVEL AT THE ANT SKT WITH 60% PEAK DEVIATION 1kHz MODULATION FREQUENCY

FIG 6.13 F494 TRANSCEIVER CIRCUIT DIAGRAM


L44
C188
C189
L43
C187
C194
C191
C192
C190
C195
L46
L45
C193
TR39
C196
C200
C199
RV1
TR38
TR37
L1
C71
C1
C2
C3
C4
L2
K1
L1
C77
C75
C79
TR15b
TR16b
IC3
C73
C74
RV4
TR14b
C78
C76
C72
C71
TR13b
C70
R184
C8
L3
L4
C11
L5
C13
WLK1
WLK6
WLK2
P2
M2
TR7b
C44
C40
C46
C45
C42
C34
C31
RV2
C41
C69
TR6
FL2
C32
L8
C30
C29
XL13
C38
C39
C16
C28
C33
C36
C37
C15
C27
IC1
L7
L6
C14
C23
C35
C19
TR2
TP7
C21
FB1
C65
C68
L17
C66
C57
C26
TR5
TR4
C22
FL1
C17
C20
C18
C25
C24
TR3
C63
C62
L16
C64
TR12
TP1
C198
L15
C59
TR11
C58
P1
PLA
WLK3
C61
C60
WLK4
R1
R2
R3
XL4
XL3
R45
R44
L12
L11
XL5
XL2
R46
R43
L13
L10
XL6
XL1
R47
R42
L14
L9
WLK7
WLK5

TP101


SKB
SKC
T1
T2
IC1
IC2
IC3
IC4
RV1
RV2
RV3
LED1
LED2
LED3
TR1 s
TR2 e
TR3 e
TR4 e
TR5 e
TR6 e
TR7 e
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D14
D15
R1
R2
R4
R5
R6
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R14
R16
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R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
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R47
R48
R49
R50
R51
R52

Pye Telecom

Pye Telecommunications Ltd
St Andrews Road Cambridge
England CB4 1DW
Tel: Cambridge (0223) 61222
Telex: 81166 (PYETEL G)

Printed in England