Service Manual

Pye Telecommunications Ltd

UHF Link/Base Station
Type F496

Publication Ref No.TP103

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
UHF LINK/BASE STATION
TYPE F496
SERVICE MANUAL
PROVISIONAL ISSUE

PYE TELECOMMUNICATIONS LIMITED CAMBRIDGE ENGLAND
Printed in England

TP103

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:

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BASE STATION

SECTION 1
GENERAL INFORMATION
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General

Operation	Single or two frequency simplex, duplex or repeater (talkthrough) depending on control option.
Modulation	Phase modulation
Frequency	T1 Band 405–440 MHz U1 Band 440–470 MHz W Band 470–520 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 Range	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 1–6W or 10–25 (with optional 25W PA)
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: ±4 kHz peak (12,5 kHz channel spacing) ±5 kHz peak (20 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	6W Version: Continuous up to +60°C 25W Version: Continuous up to +35°C	
Rise Time	Less than 30mS (Dependant on control module fitted).	

Receiver

Sensitivty	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 75 db	
Intermodulation Attenuation	Better than 75 db	
Audio Output	600 ohm output:	Present adjustable from −15 dbm to 0 dbm with less than 5% distortion (for 60% system deviation at 1 kHz)
	Engineers Handset:	Adjustable, up to 1 mW 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 F496 is a remotely controlled UHF 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 6 watts but, with the addition of an optional power amplifier this output may be increased to 25 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 connect 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:

F496	01	1	2	2	0	0	V	T1	T1	U	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

Power Output

1	25 Watts (Standard setting for all high power equipments, less crystals)
2	15 Watts
3	10 Watts
4	6 Watts (Standard setting for all low power equipments, less crystals)
5	1 Watt

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

T1	405–440
U0	440–470 MHz

Rx Band

T1	405–440 MHz
U0	440–470 MHz

No. of Channels

U	Single Channel	Using Temperature
V	Fitted for six Channels (Systems use only)	Compensated Crystals

Control

Note: In CTCSS control applications tone decoder TED1 must be ordered separately

Special Applications

11	Systems Base Station
12	Link Station Type L496 (RF Power Output 6W max, duplexer working)
13	Systems Base Station with T/T and Danish Extension Control

Remote Control Base Stations Using PC1

21 Tx/Rx–Type 1 Line Switching
22 Tx/Rx + T/T – Type 2B Line Switching
23 Tx/Rx + T/T + SQD – Type 3A Line Switching
27 Tx/Rx + CTCSS Control T/T + SQD – Type 3A Line Switching

Local Control Base Stations Using MC490

41 Tx/Rx
42 Tx/Rx + T/T
47 Tx/Rx + CTCSS Controlled T/T + SQD

Repeater Stations

51 Free Running Repeater Station
57 CTCSS Controlled Repeater Station

Ancillaries

00 Less Options
01 CTCSS (Tone Squelch) encoder and/or decoder function (Encoder TE1 and decoder TED1 must be ordered separately)
10 Mating Connectors
11 10+01
20 Wall Mounting Cradle and Fittings
21 20+01
30 20+10
31 30+01

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 to the F496 base station.

[0] Base station
[1] Regulator board
[2] Receiver board
[3] Transmitter board
[4] 25W P.A. board
[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.

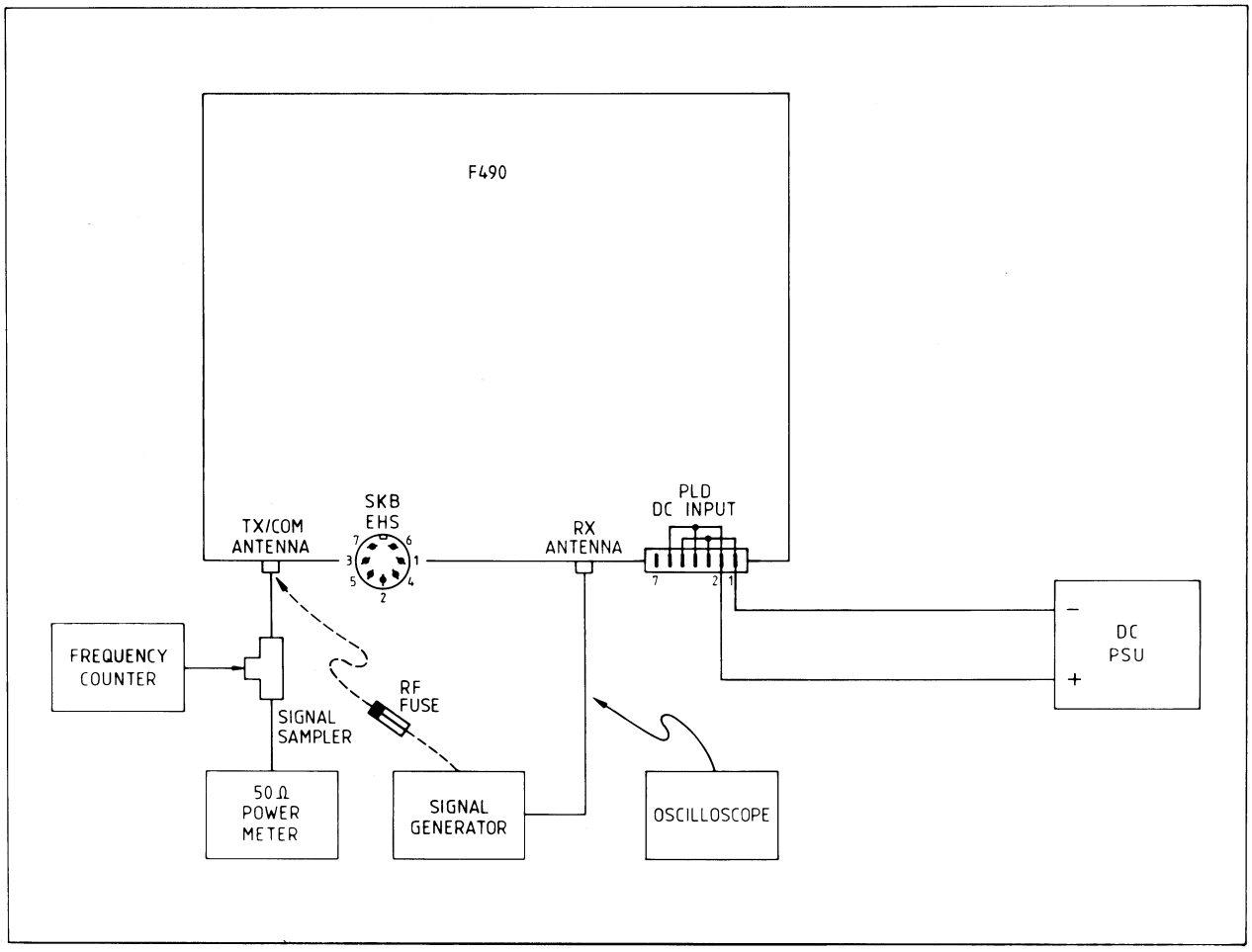


Fig 2.1 Serviceability Test Circuit

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 ptop 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.

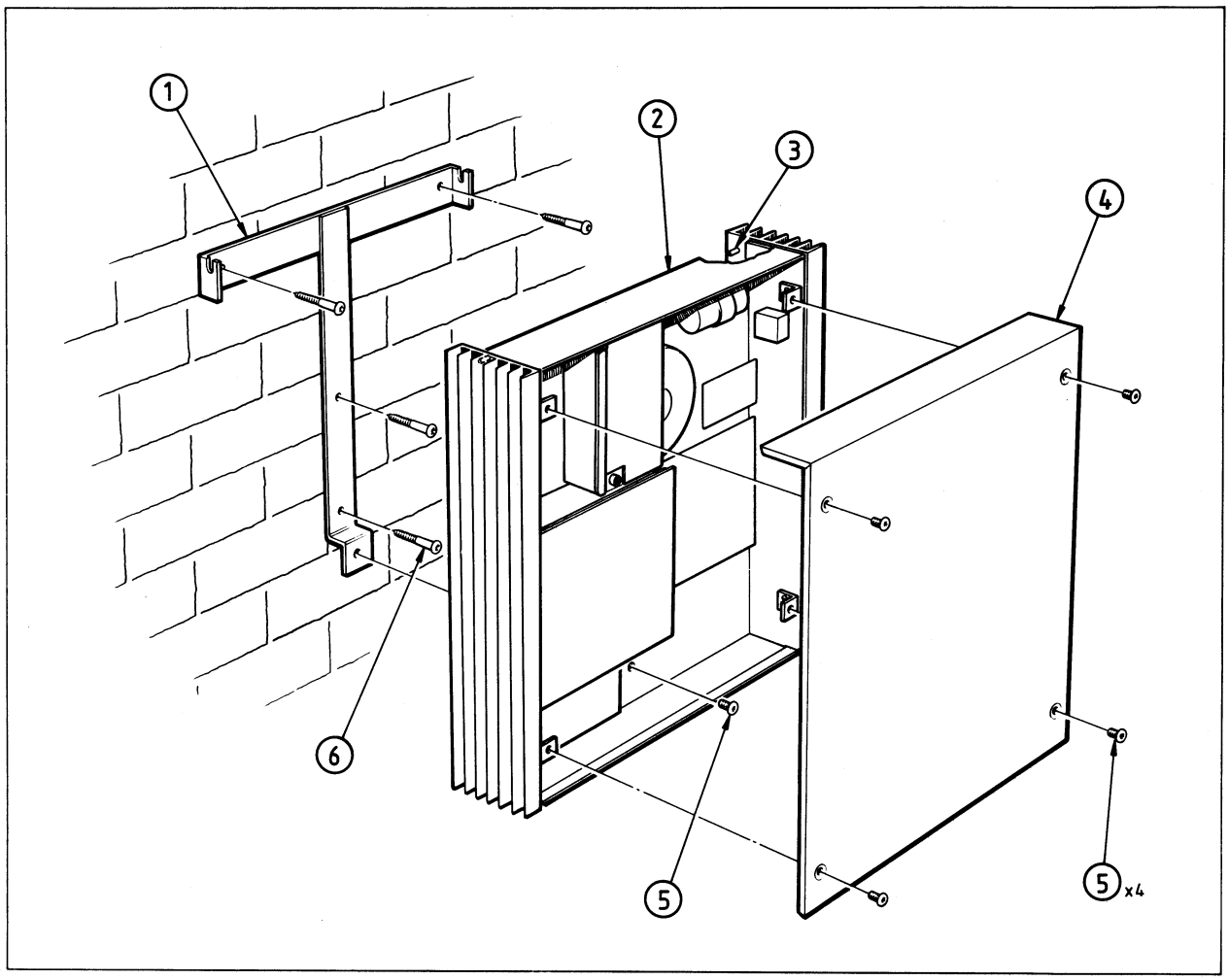


Fig 2.2 Wall Mounted Equipment

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)

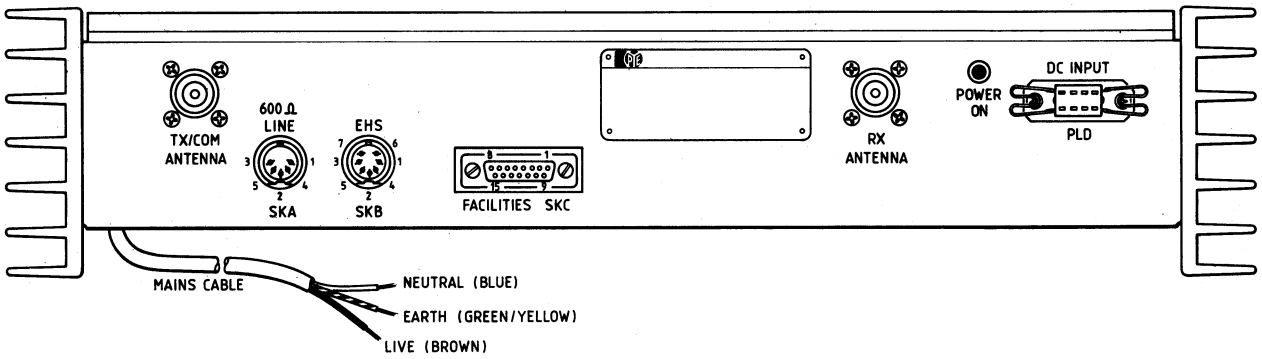


Fig 2.3 Connector Panel

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

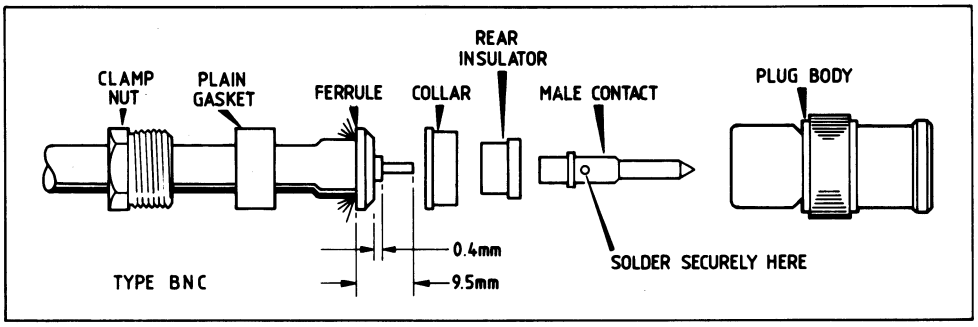


Fig 2.4 Antenna Feeder Plug Assembly

(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 L22–27 (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 (set to the 2nd harmonic) near the IF section.

3. Adjust crystal timmer 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 infringe type approval regulations and/or temperature environmental requirements.

Transmitter

Band	Frequency Range fc(MHz)	Crystal Frequency fx(MHz)	Crystal Range	Crystal Type
T1	405–440	$fx = \frac{fc}{32}$	12,66–13,75	T92DQ
U0	440–470	$fx = \frac{fc}{32}$	13,75–14,69	T92DQ

Receiver

Band	Frequency Rnage (MHz	Crystal Frequency fx(MHz)	Crystal Range	Crystal Type
T1	405–440	$fx = \frac{fc + 21,4}{8}$	53,30–57,66	T84W
U0	440–470	$fx = \frac{fc + 21,4}{8}$	52,33–56,08	T84W

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 receiver front end and mixer, the transmitter PA stages and the control board. It also drives a 10V regulator, situated on the receiver board, which provides power to the remaining circuits.

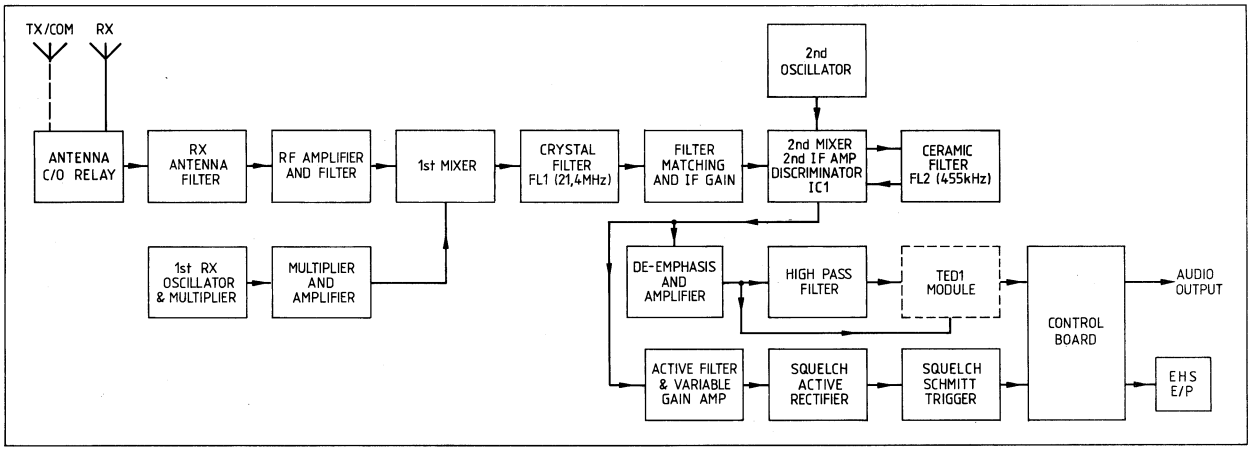


Fig 3.1 Receiver Block Diagram

Receiver

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

The injection frequency from the Rx oscillator is amplified and multiplied then mixed with the RF signal to produce a 1st IF of 21,4 MHz which is filtered by FL1. The output is passed through an emitter follower buffer stage and a common emitter voltage amplifier to IC1.The output from the crystal controlled 2nd oscillator is applied to the 2nd mixer where it is combined with the 1st 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 de-emphasis network and high-pass filter, then, via the TED1 module (if fitted), to the control board.
(ii) To the noise operated squelch detection circuit which provides an output to the squelch gate on the control board

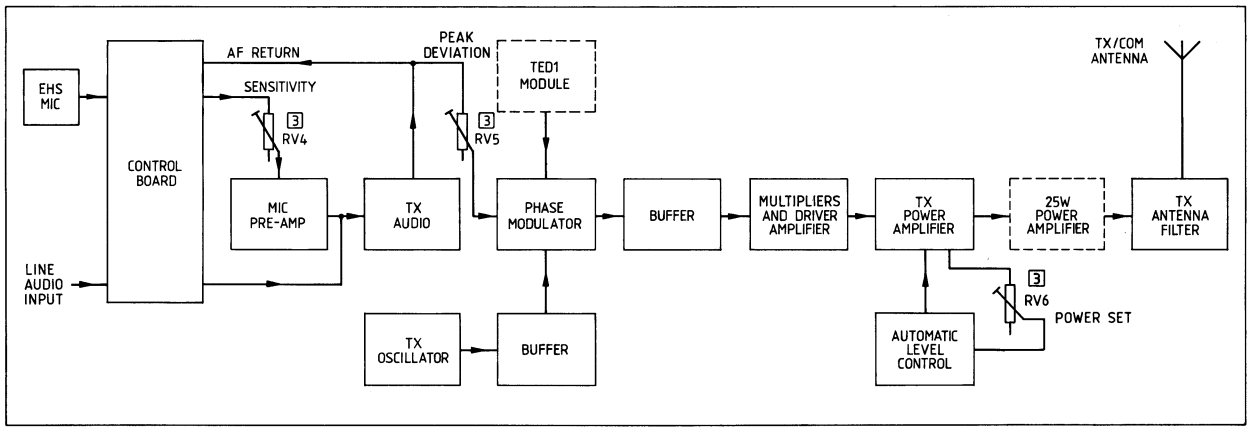


Fig 3.2 Transmitter Block Diagram

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; a buffer stage isolates the phase modulator from the multipliers.

The modulator output is multipled by five doubler stages then passed to the driver amplifier and PA stages. The PA output is applied to the Tx antenna ,via the 25WPA module (if fitted).

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 6W into a 50Ω load which may be continuously adjusted down to 1W The optional power amplifier increases the output to 25W which may be continuously adjusted down to 10W.

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 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 connect 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 L57,C196–199, to an RF filter, L1,2. The output of the common collector amplifier TR1 is applied to a three stage RF filter L3–5 which provides further RF selectivity. The filter output is applied to the 1st mixer TR2.

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 R41–46 known as pozistors, these are positioned adjacent to the crystals and kept in thermal contact with them by means of an insulating sleeve.

The receiver oscillator load L15, C41 is tuned to the 2nd harmonic of the crystal which is doubled byTR12. L17, C48 select the second harmonic, this is doubled in TR13. The output is filtered by L18,L19 and applied to TR14; the amplified signal is filtered by L20, 21 to provide the injection frequency to the 1st mixer a dual gate MOSFET. The filter stages L18,19 and L20,21 provide high selectivity of the injection signal against unwanted harmonics of the crystal.

The 1st mixer TR2 produces an IF of 21,4 MHz, selected by L7,C7. The 8-pole crystal filter FL1 provides the majority of adjacent channel rejection and determines the receiver selectivity.

The emitter follower TR3 matches the filter output to the 1st amplifier TR4 whose output is fed to IC1, pin 16.

The crystal controlled 2nd oscillator XL13, TR15 produces an injection frequency which is applied to the 2nd mixer in IC1, on pin 1. The 2nd IF of 455 kHz is filtered in FL2 to reduce noise bandwidth and improve adjacent channel rejection. The 2nd IF is amplified in IC1 and then fed to the discriminator (also in IC1) whose tuned circuit is formed by L8, C20. The discriminator output on pin 9 is routed to the audio and squelch circuits.

The audio signal from the discriminator is de-emphasised by R23, C22, C23 and applied to the variable gain (as determined by RV1) stageTR5,6. The amplified output is fed to TR7 which, together with its associated components from an active high-pass filter to reduce low frequency noise. The output from TR7 is routed to the control board on SKF (Via F1), or via the tone option (if fitted), on G1

Squelch

Under no signal conditions the discriminator output consists substantially of noise which is applied to the active high pass filter TR16 where frequencies above 15 kHz are extracted, the output is applied to amplifierTR17, the gain of which is set by the preset squelch control RV3. D6,7 cause the positive-going half cycles of the signal to be amplified more than those which are negative going thus, IC3 behaves a rectifier with smoothing provided through R95,C75,87. The schmitt trigger TR18,19 provides a switched output which is fed, via SKF, 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 TR43 controlled by TR41 and TR42 with short circuit protection provided by D14.

The regulated output voltage is sampled by TR41 and compared with the 8,2V reference from zener diode D13. Any change in the output voltage develops an error signal between TR42 base and emitter which is applied to the base of TR43 causing the volt-drop to vary in such a manner as to restore the output voltage at the collector of power transistor TR43 to normal (9,8–10,2V depending on the 'select-on-test' value of R186).

R179 ensures that the regulator starts under all normal conditions.

In the event of a short-circuit being present, D14 together with TR42 switch off TR43 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 RV4, to the microphone pre-amplfiier TR20. The two-stage pre-emphasis amplifier TR21,22 has a 6db/octave slope; R111 is selected on test to give optimum symmetry from the diode limiter D9,10; de-emphasis is achieved by R122,C94. A two-stage active low-pass filter TR23,24 removes unwanted high frequency components while the emitter follower TR25 matches the signal, via the peak deviation control RV5, to the phase modulator TR28.

The Tx oscillator TR26 is crystalled controlled (by XL7–12) and operates in the fundamental series resonant mode, the exact frequency of oscillation being set by trimmers L22–27. Crystal stability at low temperatures is acheived by pozistors R131–136.

The output from the oscillator is buffered by TR27 and applied to the phase modulator. The signal at TR28 collector is the phasor sum of the direct component, fed forward via C119, and a component amplified by TR28, the latter being amplitude modulated by the AF signal. The resultant phase modulated output is buffered by TR29 which also 'clips out' the amplitude modulation. TR30 and TR31 are FET frequency doublers, each contributing some gain. A further chain of doublers using bipolar transistors TR32,33,34 bring the RF up to final frequency. total multiplication is being thirty-two.

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 TR40.

R184 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 RV6 (POWER SET). The resultant voltage sum is applied to TR39 base, controlling the degree to which TR39 conducts and consequently the amount of current shunted from TR37 base. Therefore, if the PA current tends to rise, TR37 reduces the supply voltage to TR36 thus and TR38 thus reducing the PA drive.

The power output can be adjusted, by means of RV6, to any level up to 6W (25W PA Module not fitted) or 25W (PA Module fitted).

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 requirmeent 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' in Section 2.

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 accesisble 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).

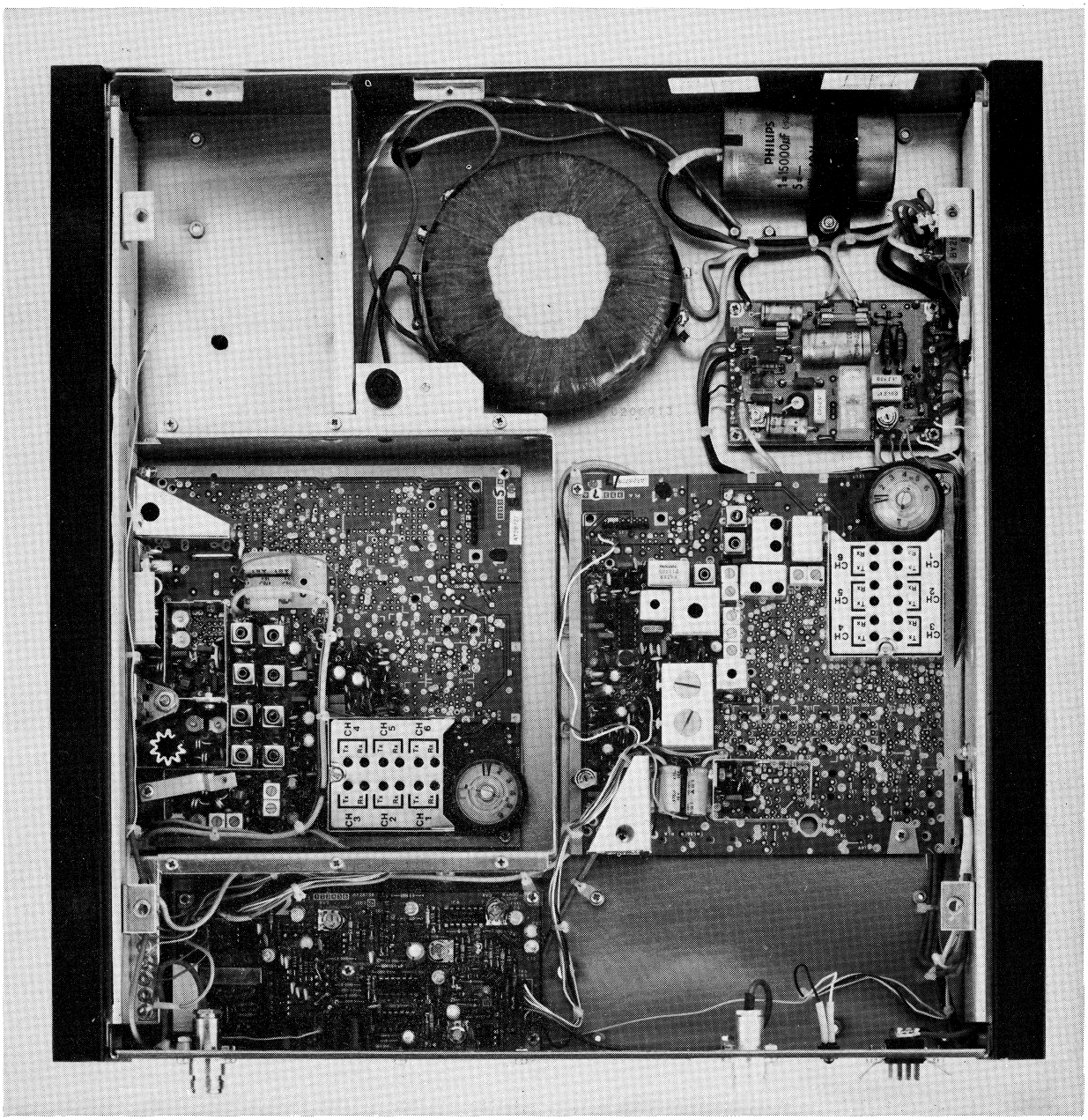


Fig 4.1 Interior View

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 and the 4 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.

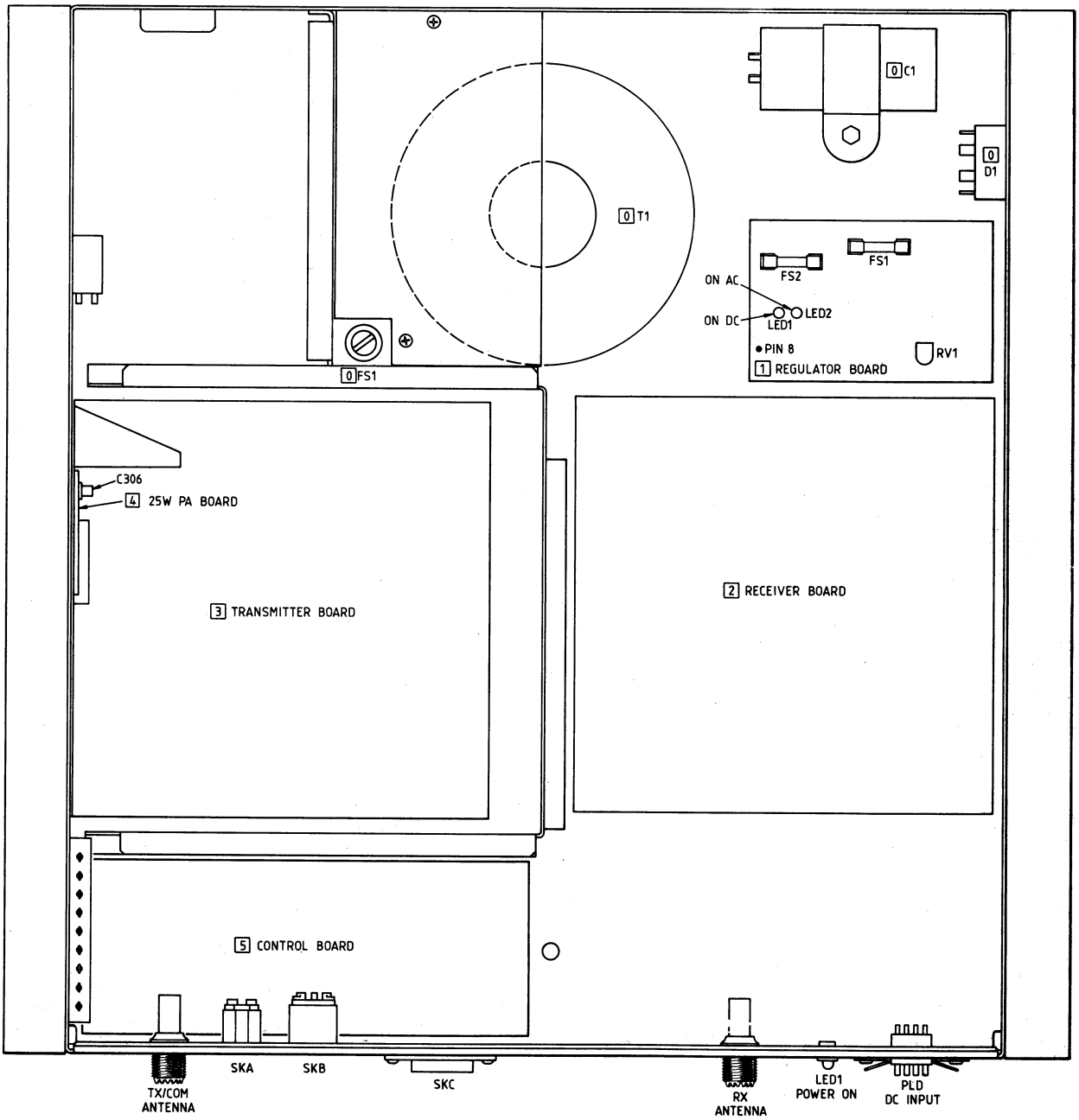


Fig 4.2 Transceiver Layout

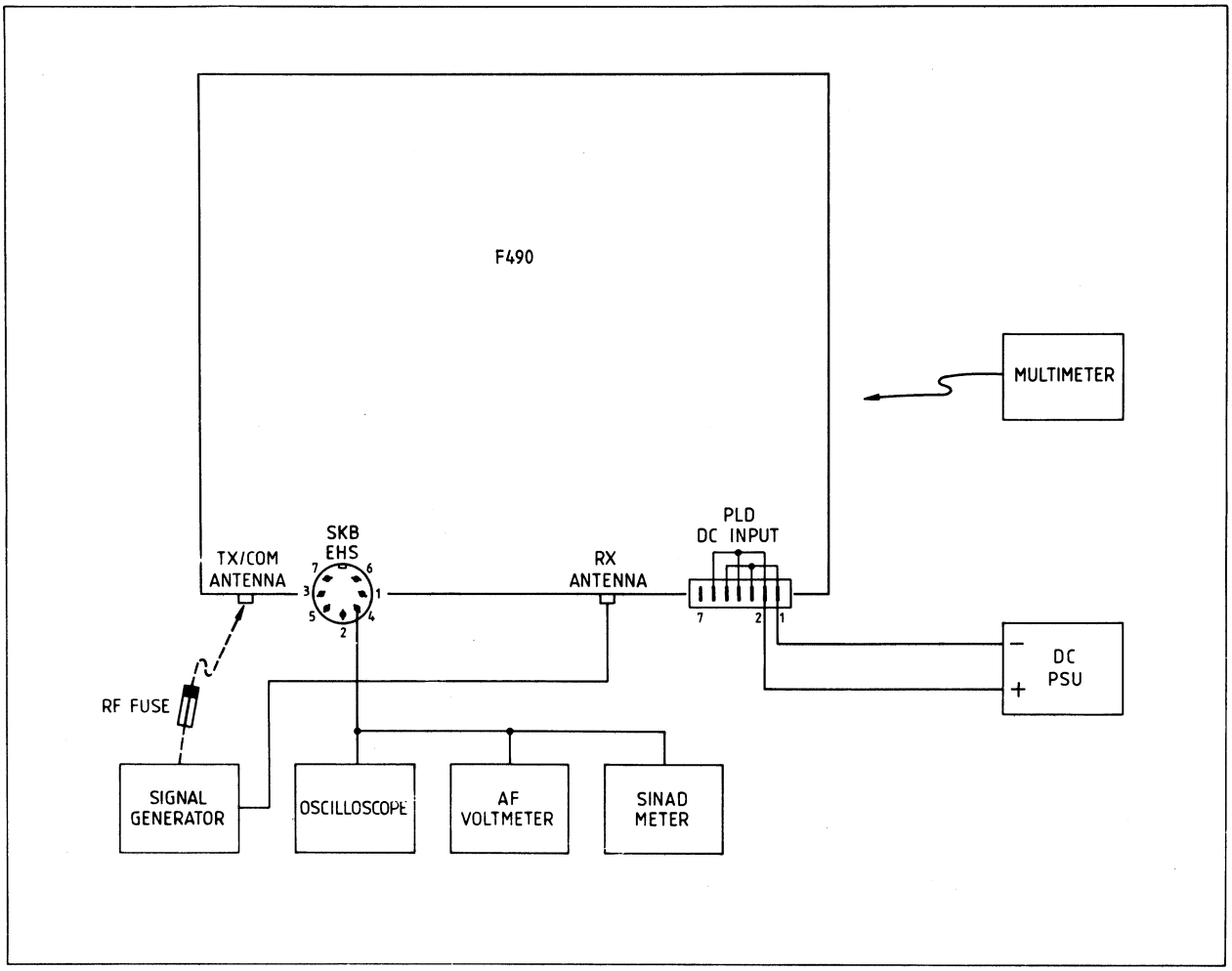


Fig 4.3 Receiver Test Circuit

5. Rx Alignment

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

(b) Select the channel frequency closest to the centre frequency of the band covered. Set the RF signal generator to 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] L15,16 [2] L17	Adjust for maximum Adjust for minimum
B	AV0 (10V DC)	[2] TP2	[2] L18,19	Adjust for minimum
C	AV0 (2,5V DC)	[2] TP3	[2] L20,21	Adjust for absolute maximum
D	AV0 (2,5V DC)	[2] TP3	–	Remove crystal; check voltage is zero
E	Set [2] RV1,3 fully counter-clockwise, and [5] RV1 fully clockwise. Set RF signal generator output to 100mV unmodulated.			
F	SINAD Meter	[0] SKB pin 4	[2] L1–5	Tune in sequence for best quieting, reducing signal generator output, as necessary

G	Marker Oscillator			If necessary, adjust crystal oscillator for zero beat
H	Modulate RF input signal 1kHz at 60% peak deviation, output 1mV			
J	AF Voltmeter	[0] SKB pin 4	[2] L8	Tune for maximum output
K	Oscilloscope	[0] SKB pin 4	[2] L7	Tune for minimum distortion
L	AF Voltmeter	[2] PLA pin E	[2] RV1	Adjust for 100 ±5mV RMS
M	SINAD Meter	[0] SKB pin 4		Set RF input level to 0,35μV modulated as in step H. Check SINAD is greater than 12db.
N	Repeat steps G and M for other channels as applicable			
P	SINAD Meter	[0] SKB pin 4		Reduce RF input level to give 10db SINAD
			[2] RV3	Adjust so that squelch is just open Reduce input level by 6db; check squelch is closed
Q	AF Voltmeter	[0] SKB pin 4		Increase RF input level to 1mV. Switch off modulation; check that fall in AF level is greater than 50db.

Disconnect all test equipment.

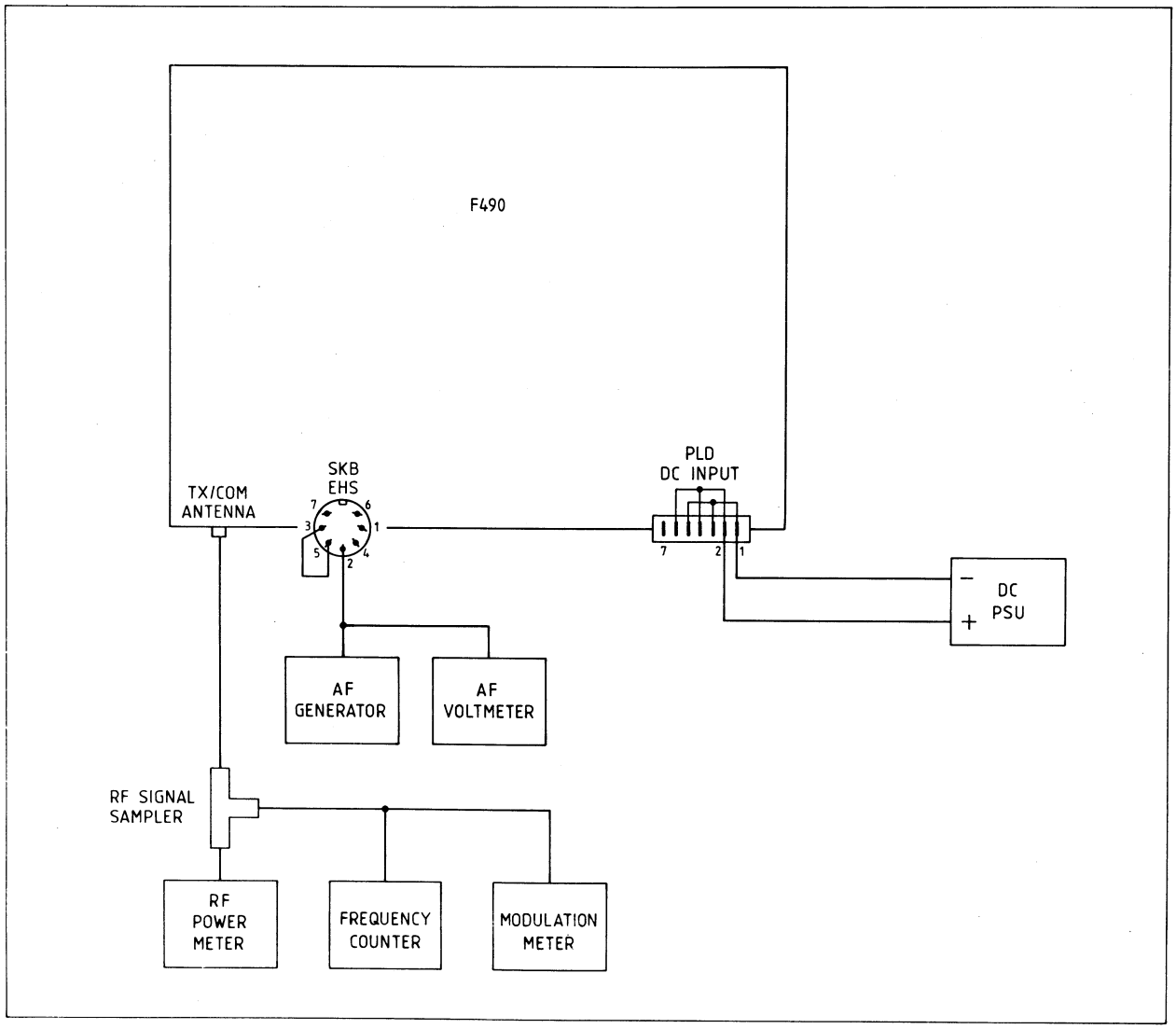


Fig 4.4 Transmitter Test Circuit

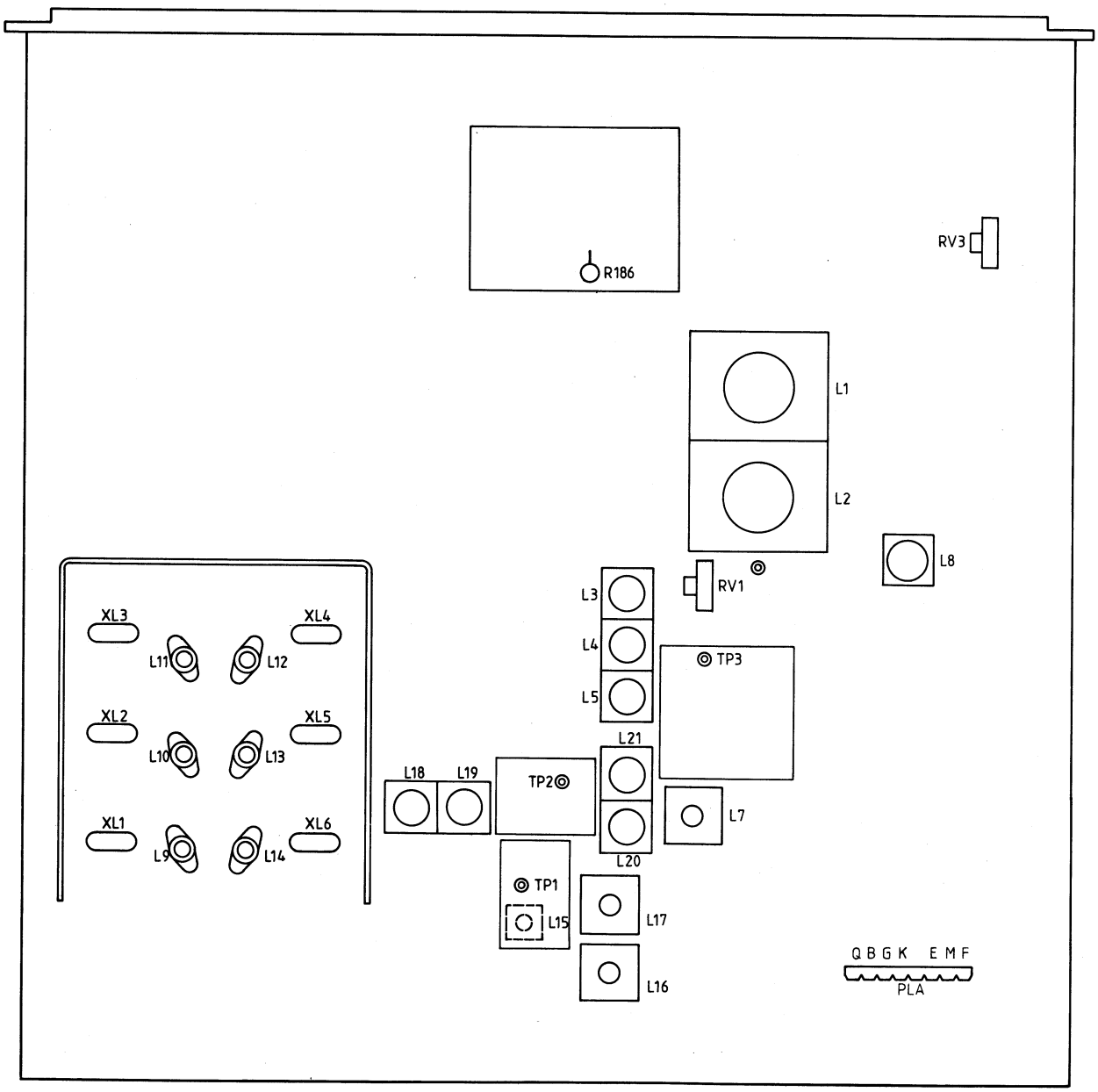


Fig 4.5 Receiver Alignment diagram

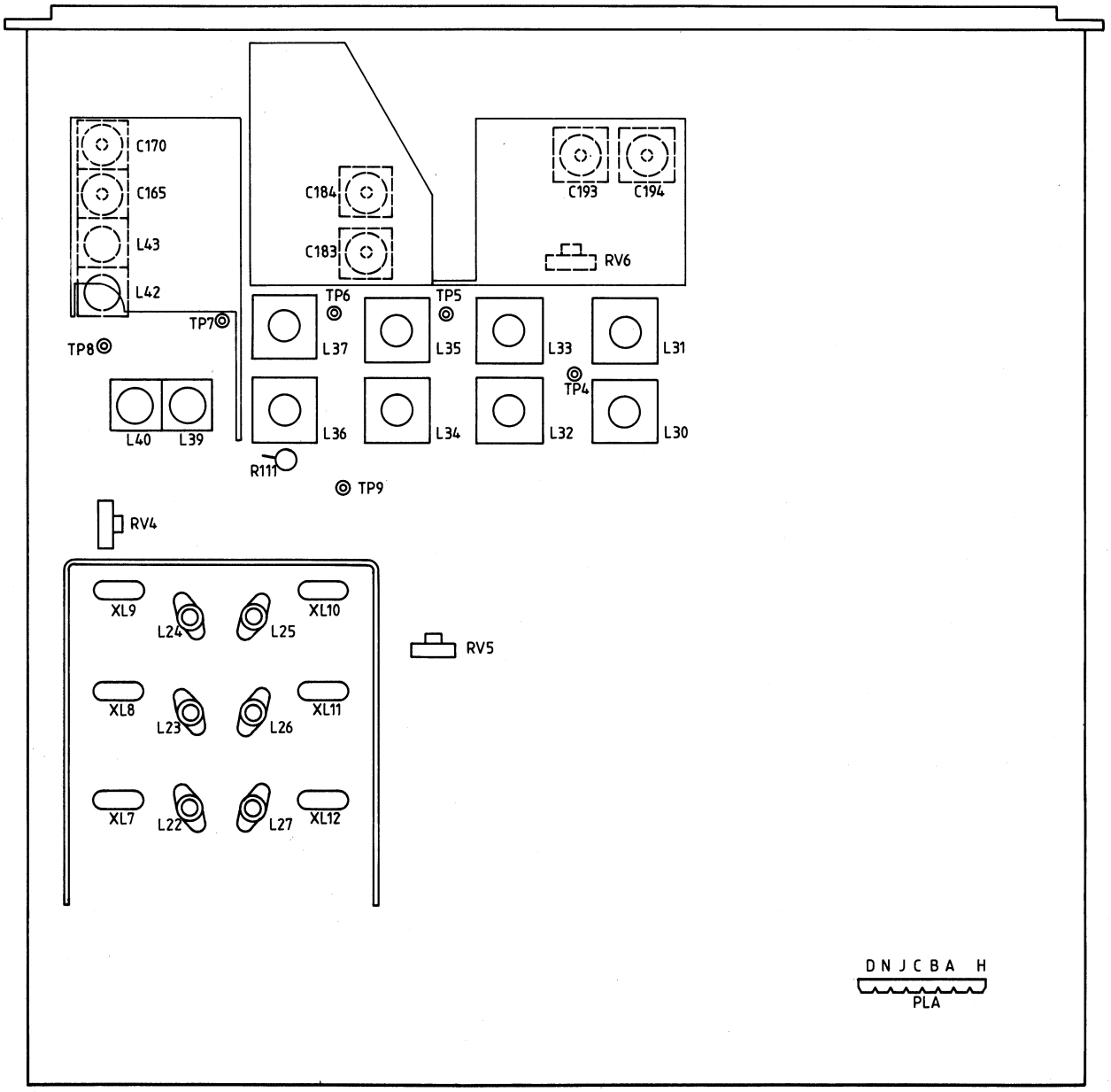


Fig 4.6 Transmitter Alignment diagram

6. Tx Alignment

(a) Connect test equipment as shown in Fig 4.4

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

(c) Set cores of coils [3] L30–37 flush with the top of their formers. Set C183, 193 to half-mesh

(d) Set RV4 to mid position
RV5 to mid positon
RV6 fully counter-clockwise

(e) Carry out the following alignment:

STEP	TEST EQUIPMENT	TEST POINT	TUNE	ADJUSTMENT
A	AV0(10V DC)	[3] TP4	[3] L30,31	Adjust for maximum
B	AV0 (2,5V DC)	[3] TP5	[3] L32,33	Adjust for maximum
			[3] L34	Adjust for minimum
C	AV0 (2,5V DC)	[3]TP6	[3]L35	Adjust for maximum
			[3] L36	Adjust for minimum
D	AV0 (2,5V DC)	[3] TP7	[3] L37	Adjust for maximum
			[3] L39	Adjust for minimum
E	AV0 (10V DC)	[3] TP8	[3] L39,40	Adjust for maximum
			[3] L42	Adjust for minimum
F	RF Power Meter		[3] L43 [3] C165	Initially adjust for maximum supply current. When power meter registers output power tune for maximum output power
G	RF Power Meter		[3] C165,170	Tune in pairs indicated for absolute maximum output power
			[3] C183,184 [3] C193,194	
H (25W Units only)	RF Power Meter		[4] C306 [3] C193,194	Tune for maximum power output Tune for power output greater than 25W
J	RF Power Meter		[3] RV6	Increase slowly to maximum; check no instability is present
K	Set [3] RV6 for the required output power			
L	Frequency Counter			Check each channel frequency is within 10Hz
M	Modulation Meter		[3] RV5	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

N	Modulation Meter		[3] RV4	Reduce AF input level to 2mV; adjust for 60% peak system 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 1 mV 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.

SELECT-ON-TEST PROCEDURES

The following 'select-on-test' procedures will only need to be carried 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]

R186 (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 9,8–10,2 DC wrt –ve at PLF pin 7.

Increasing the resistance will increase the voltage at PLF pin 7.

Transmitter Board [3]

R111 (Pre-emphasised Amplifier) – Selected when [2] TR21, TR22, D9, D10 are changed.

Connect an AF generator, set to 20mV at 1kHz [0]SKB pin 2. Commencing with a 22Ω resistor select a value of resistance which gives symmetrical clipping, measured on an 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	($F \times 10^{-6}$)
22n	=	22 nanoFarad	($F \times 10^{-9}$)
22p	=	22 picoFarad	($F \times 10^{-12}$)

Fractional values shown thus:

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

Resistors — Values given in Ohms unless otherwise stated

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

Fractional values are shown thus:

2Ω2	=	2,2 ohms	
2k2	=	2,2 kilohms	($2,2 \times 10^{3}$) Ohms
2M2	=	2,2 Megohms	($2,2 \times 10^{6}$) 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 F496
AT00312

	Description	Part No.	Code/Remarks
	SUB ASSEMBLIES		
	PCB assembly, UHF Tx	AT28727/–	Module [3] See
	PCB assembly, UHF Rx	AT28728/–	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	Module [5]
	Link/Systems (with T/T) control PCB	AT28817	Primary Option
	DC Signalling control PCB	AT28726/01	See headed
	MC490 control PCB including:	AT28824	lists
	Microphone/controller	AT29703	
	Loudspeaker	AT10877/02	
	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	BT37117	
	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 7-way	FS46814	SKD
	LED, green	FV05882	LED 1
	Lead assembly, AC	AT36771	
⚠	Lead assembly, Mains	AT36772	
	Lead assembly, Regulator	AT36745	
	Lead assembly, Rx antenna	AT36781	
	FIXINGS		
	Screw, special	BT08209	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; 1TH1 2/Plate
	Scr sdriv pan st M3 x 10mm	QJ11903/X	1/Rx antenna skt; 1/Tx antenna skt; 3/Tyraps
	Scr sdriv pan st M3 x 20mm	QJ11906/Z	1/TR1,2
	Scr pozi pan st M4 x 8mm	QJ11917/X	1/T1

Description					Part No	Code/Remarks
FIXINGS (Contd.)						
Scr	sdriv	pan	st	M4 x 12mm	QJ11919/X	1/P Clip
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	hmr	dr		No00 x 1/8	QJ06603/B	4/Unit label
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	
MISCELLANEOUS						
Hood					FP16018	1/PLC
Fuseholder, panel mounting					FH99100	1/FS1
LED mounting clip and ring					QA99006	1/LED1
Grommet 3/4in					FG02213	1/600Ω line holde
Strain relief bush					FG02721	1/Chassis – mains cable
Insulating bush					QA05638	1/TR1,2
Mica insulator					QA05639	1/TR1,2
Cable clip					QA02218	2/Mains cable
Plug clip					FP16107	2/PLC
Clip 1/8					QA00531	2/Antenna cable
Clip 1 1/2in					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					BT18922	
⚠ Label, warning					BT37434	1/Mains cable
OPTIONAL ITEMS						
Engineers handset					FH00653	Servicing aid

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					
Transistor BC547B				FV05891	TR1;TR2(AC only)
Diode MR751				FV08961	D1;D2,3(AC only) D4(12V standby 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)
56	±5%	6W	WW	PM01221	R14(12V standby 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
2k2	±5%	1,6W	m.film	PL51203	R8;R9(AC only)
15k	±5%	0,25W	c.film	PM01450	R7
18k	±5%	0,25W	c.film	PM001451	R12(AC only)
Pot skel 470 ±20% lin				PL99006	RV1

Description				Part No	Code/Remarks
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 UHF Rx [2]
AT28728/–

/01	Single channel, 25kHz channel spacing	U0 Band
/02	Single channel, 20kHz channel spacing	U0 Band
/04	Single channel, 25kHz channel spacing	T1 Band
/05	Single channel, 20kHz channel spacing	T1 Band
/07	Six channel, 25kHz channel spacing	U0 Band
/08	six channel, 20kHz channel spacing	U0 Band
/10	Six channel, 25kHz channel spacing	T1 Band
/11	six channel, 20kHz channel spacing	T1 Band

Description				Part No.	Code/Remarks
SEMICONDUCTORS & ICS					
IC IF amp & discriminator				FU07680	IC1
IC741				FU99073	IC3
Transistor BC547				FV05889	TR5,6,41,42
Transistor BC547B				FV05891	TR15,17–19
Transistor BFR99				FV07515	TR14
Transistor BFT95				FV07539	TR1
Transistor MPS–A13				FV08935	TR7,16
Transistor TIP32				FV08940	TR43
Transistor V850B				FV39006	TR2
Transistor MPS918–18				FV05895	TR3,4,11–13
Zener diode ZF8,2				FV08030	D13
Diode IN4148				FV05808	D1,2,5–7
Diode IN4001				FV05840	D14
RESISTORS					
1	±10%	0,25W	c.film	PM01400	R65,83A
56				PM01421	R66
100				PM01424	R4,6,13,56,59,60,64,86,91,92,186
150				PM01426	R70,187,190
220				PM01428	R63,69; R3(U0 band)
390				PM01431	R3(T1 band)
470				PM01432	R17,84,152,189,191
560				PM01433	R76
560	±5%	0,25W	c.film	PL99766	R1
680				PM01434	R16,47,55 R48–52(Six channel)
820				PM01435	R58,97
1k				PM01436	R87,89,90,93
1k2				PM01437	R22,27,31,81,98
1k5				PM01438	R2,8,10
1k8				PM01439	R18,19,75
2k2				PM01440	R72,96,100,192
3k9				PM01443	R12,15,95
4k7				PM01444	R79,80,85,99
5k6				PM01445	R57,62,67
8k2				PM01447	R14,78
10k				PM01448	R21,34A,73,74,188

Description				Part No	Code/Remarks
RESISTORS (Contd.)					
15k	±5%	0,25W	c.film	PM01450	R61,68,77
18k				PM01451	R94
39k				PM01455	R54
47k				PM01456	R20,28,71
56k				PM01457	R53
100k				PM01460	R7,9,11,23,82,88
120k				PM01461	R5,25
560k				PM01469	R24
680k				PM01470	R29,30
Posistor 6k ±2%				PL23136	R41;R42–46(Six channel)
Thermistor				PL23088	TH83
Pot skel 10k ±20% lin				PL03647	RV1
Pot skel 10k ±20% lin				PL03627	RV3
Select-on-Test					
120	±5%	0,25W	c.film	PM01425	R186 SOT
150				PM01426	
180				PM01427	
220				PM01428	
270				PM01429	
330				PM01430	
390				PM01431	
470				PM01432	
CAPACITORS					
0p56	±10%		cer comp	PN00123	C42
2p7	±0p25	63V	cer plate	PN99752	C65
3p3				PN99753	C48,54
3p9				PN99754	C49
5p6	±0p25		cer tub	PN04142	C2,196–199
10p	±2%	63V	cer plate	PN99754	C18
22p				PN99763	C44
27p				PN99764	C41
33p				PN99765	C45
33p				PN99574	C210
33p				PN99799	C40
39p				PN99766	C7
47p				PN99801	C39
56p				PN99768	C61
68p				PN99769	C64
100p				PN99771	C62
180p				PN99774	C20
470p	±10%	100V	cer plate	PN99599	C206,207
1n				PN99600	C1A,208,211
1n	±10%	63V	cer plate	PN99811	C1,3,4,8,14,28A,38A,46, 47,50,51,53,55,55A,57
4n7				PN99813	C5,9,11–13,15,21–23,26, 27,38,42,52,56,58–60, 66,67,71,73,202
100n	±10%	63V	poly	PQ99511	C6,10,16,17,24,70,201
1	±20%	35V	elect	PS99502	C63,72,75
1		63V	elect	PS99820	C25
2μ2	±20%	25V	elect	PS99821	C87
4μ7		63V	elect	PS99504	C28,68,69,74
10	±20%	15/16V	elect	PS99505	C19
470	–10%+50%	16V	elect	PS45808	C200,204
INDUCTORS					
Coil assembly				AL03156	L8
				AT30082	L1 (U0 band)
				AT30082/01	L1 (T1 band)
				AT30082/02	L2 (U0 band)
				AT30082/03	L2 (T1 band)
				AT30083	L57

Description					Part No.	Code/Remarks
INDUCTORS (Contd.)						
					AT32052/02	L17
					AT32060/01	L16
					AT32078/05	L15
					AT32156/01	L21 (T1 band)
					AT32156/03	L3,5 (U0 band) L20 (T1 band)
					AT32156/04	L18,19 L21 (U0 band)
					AT32156/10	L4 (T1 band)
					AT32156/11	L20 (T1 band)
					AT32156/13	L4 (U0 band)
					AT32156/14	L3,5 (T1 band)
					AT32171/17	L7
					AT32172/09	L9;L10–14 (Six channel)
					AT32323	L6
Can					AT12487	For L18,19
Can					AT12487/04	For L20,21
Can					AT12487/23	For L3,5 (U0 band)
Can					AT12487/25	For L3,5 (T1 band)
Can					FT03521	For L7,16,17
MISCELLANEOUS						
Knob, channel					BT37478	
Switch, channel					FS07199	SA } Six channel only
Label, channel					BT38029	}
Compression ring					QA04133	1/SA }
Header, str, male, 8 way					FC00837/08	
Oscillator cover					BJ30740	
Oscillator screen					BT26305/01	
Antenna filter screen					BJ37114	
Mixer screen					BT15812	
Oscillator/multiplier can					BT15805	
Rx oscillator can					FC00126	
Screen					BT26316	
Screen					BT26320	1/TR43
Can					FT03520	1/2nd Osc; 1/RF front end
Crystal 20,945 MHz					FC03174/05	XL13
Crystal filter 25kHz					FC03528	FL1 (25kHz channel spacing)
Crystal filter 20kHz					FC99040	FL1 (20kHz channel spacing)
Ceramic filter 455kHz					FC99020	FL2
Cable assembly					AT36613	WLK6
Lead assembly					AT36746	Rx – Control board
Machined cavity					BT36892	
Cavity screw					BT08621	
Pad					BT24685	
Clip					QA04097	2/Mixer screen
Stand off insulator					FJ00183	1/RF Input
Scr	sdriv	pan	st	M2,5 x 6mm	QJ11945/B	6/Cavity
Scr	nylon	pan		M2,5 x 6mm	QJ10700	2/Cavity
Scr	pozi	pan	st	M3 x 8mm	QJ11902/X	1/TR43
Scr	nylon	ch		6BA x ¼in	QJ05001	2/Cavity
Scr	sdriv	pan	st	No.4 x ¼in	QJ08275/X	1/Oscillator cover
Nut	hex	st		M3	QA11605/X	1/TR43
Washer					BT29237	2/Oscillator cover
Label, ident					BT38030/01	
Heatsink compound					HM00404	

PCB ASSEMBLY UHF TX[3]
AT28727/–

/01	25W, duplex, single channel	U0 Band	/03	25W, duplex, single channel	T1 Band
/02	6W, duplex, single channel		/04	6W, duplex, single channel	
/05	25W, duplex, six channel		/07	25W, duplex, six channel	
/06	6W duplex, six channel		/08	6W, duplex, six channel	
/09	25W, simplex, single channel		/11	25W, simplex, single channel	
/10	6W, simplex, single channel		/12	6W, simplex,single channel	
/13	25W, simplex, six channel		/15	25W, simplex, six channel	
/14	6W, simplex, six channel		/16	6W, simplex, six channel	

Description	Part No.	Code/Remarks
SUB ASSEMBLIES		
25W PA assembly	AT28585	Module [4] See headed list
Heatsink & feedthru' assembly	AT14231/01	
		4/96
SEMICONDUCTORS		
Transistor 2N5447	FV05879	TR39
Transistor 576BLY 'Be0' MRF604	FV05504	TR36 5322-130-62204 102,-
Transistor BC547	FV05889	TR20–25
Transistor BC547B	FV05891	TR28
Transistor BFR91	FV05544	TR34,35
Transistor BF245B	FV05900	TR30,31
Transistor MPS918–18	FV05893	TR26,27,29,32,33
Transistor MRF629 'Be0'	FV37843	TR38 5322-130-62012 79,50
Transistor SD1136 'Be0' 2N5946	FV40833	TR40 5322-130-61818 315,-
Transistor TIP115	FV05791	TR37
Diode IN4148	FV05808	D9,10
Diode IN4001	FV05840	D11,12,16
RESISTORS		
0Ω1 ±10% 2,5W WW	PL40113	R184
10	PM01412	R148,150,176,178,179,182
47	PM01420	R177
68	PM01422	R104
100	PM01424	R108,115,129,130,137,145,158,160, 164,165,168,169,172,173
120	PM01425	R106
150	PM01426	R116,152
220	PM01428	R110
390	PM01431	R114
470	PM01432	R105,140,156,171,181
680	PM01434	R159,161
820	PM01435	R163,167,175
1k	PM01436	R141
1k2	PM01437	R101,144,155,174
2k2	PM01440	R113,128,151,154
2k7	PM01441	R125
3k3 ±5% 0,25W c.film	PM01442	R147
5k6	PM01445	R119,146,162,166
6k8	PM01446	R121
8k2	PM01447	R117,127,153
10k	PM01448	R103,109,112,120,157,170
12k	PM01449	R118,123,124,180
15k	Pm01450	R126
18k	PM01451	R122,143
33k	PM01454	R61
100k	PM01460	R102,107,138,139,142
Pozistor 6k ±20%	PL23136	R131 R132–136(Six channel only)
Pot skel 100 ±20% lin	PL99009	RV6
Pot skel 470 ±20% lin	PL06730	RV5
Pot skel 4k7 ±20% lin	PL03370	RV4

Description				Part No	Code/Remarks
RESISTORS (Contd.)					
Select-on-Test					
22				PM01416	
27				PM01417	
33				PM01418	
39				PM01419	
47	±5%	0,25W	c.film	PM01420	R111 SOT
56				PM01421	
68				PM01422	
82				PM01423	
100				PM01424	
CAPACITORS					
0p33	±10%		cer comp	PN00115	C150
0p68	±10%		cer comp	PN00124	C144
1p8				PN99750	C137,163
2p2	±0p25	63V	cer plate	PN99751	C130
3p3				PN99562	C209
5p6	±0p25		cer tub	PN04142	C173,196–199
6p8	±0p25	63V	cer plate	PN99757	C149
8p2				PN99758	C167
10p	±5%		cer tub	PN09047	C178,188,190
10p				PN99759	C121,122,142
15p				PN99761	C154,155
22p				PN99763	C147,148
47p				PN99767	C115,134
68p				PN99769	C119
82p				PN99770	C140,141 (except /07,/08)
100p	±2%	63V	cer plate	PN99771	C129,135 C140,141 (/07,/08 only)
150p				PN99773	C112
220p				PN99775	C116
220p				PN99584	C109A
270p				PN99776	C109,110
1n	±10%	63v	cer plate	PN99811	C78,80,85,105–107,111, 113,118,125–127,131–133,136,138, 139,143,145,146,151–153,156–161, 166,168,175–177,180,186,187,189,
2n2	±10%	63V	cer plate	PN99812	C89,91,93,100,101,103
2n2	±2,5%	100v	poly	PQ99617	C95,98
4n7	±10%	100V	cer plate	PN41315	C212
4n7	±10%	63V	cer palte	PN99813	C83,86,97,114,120, 162,164,171,172,182,185
10n	±2,5%	100V	poly	PQ99621	C96,99
100n	±10%	63V	poly	PQ99511	C124,128,169,174,179, 181,191,192
0μ1		50V	elect	PS99863	C108
0μ1		25V	tant	PS99201	C117
4μ7	±20%	25V	elect	PS99504	C87
2μ2		63V	elect	PS99821	C79,82,90,92
33		16V	elect	PS99807	C77,81,84,102,104,123
100	±20%	3V	elect	PS99510	C88
470	±50%–10%	16V	elect	PS45808	C200,204
Variable 2–18p 250V				PV07670	C165,170,183,184,193,194
INDUCTORS					
Coil assembly				AT30080	L44,46–48,50,51,54
				AT30083/01	L57
				AT32052/02	L36,37
				AT32060/01	L32–35
				AT32068/05	L30,31
				AT32156/03	L39,40,42,43(U0 band)
				AT32156/07	L39,40,42,43(T1 band)
				AT32171/10	L22;23–27 (Six channel)
Choke assembly				AT31961/05	L49,53
Choke assembly				AT31961/06	L45

Description	Part No.	Code/Remarks
INDUCTORS (Contd.)		
Choke assembly	AT32323	L38,41
Choke 22μH	FT99011	L29
Choke 470μH	FT99007	L28
Loop	AT32932	L52,55,56
Loop	AT32904	
Can	AT12487/04	For L39,40,42,43
Can	FT03521	For L30–37
MISCELLANEOUS		
Lead assembly	AT36770/01	Tx antenna (Duplex)
Knob, channel	BT37478	
Switch, channel	FS07199	SA } Six channel
Label, channel	BT38029	
Compression ring	QA04133	1/SA }
Header, str, male, 8 way	FC00837/08	
Heatsink	QA05842	1/TR38
Heatsink	QA05786	1/TR36
Heatsink support	BT26628	
Heatsink bracket	BT11350	1/TR36
Oscillator cover	BJ30740	
25W PA screen	BT26312	1/Module [4]
Relay screen	BT26313	1/RLA
PA Screen 1 (underside)	BT26314	
PA Screen 2 (underside)	BT26315/01	
PA Screen 1 (upperside)	BT26318	1/PA 1st stage
PA Screen 2 (upperside)	BT26319	1/PA 2nd stage
PA Screen 3 (upperside)	BT26320	1/PA 3rd stage
Antenna filter screen	BT37114	
Oscillator screen	BT26305/01	
Bead	FC36151	FB1,2
Transipad	QA05821	1/TR36
Grommet	FG02252	
Pad	BT24685	1/C200,204
Standoff insulator	FJ00183	1/RF Output
Pillar, hexagon	BT04465	
Scr pozi pan st M2,5 x 5mm	QJ11944/B	1/Ant filter screen – heatsink
Scr sdriv pan st M2,5 x 10mm	QJ11947/B	2/TR300
Scr pozi pan st M3 x 6mm	QJ11901/X	1/Heatsink; 1/PCB
Scr pozi pan st M3 x 8mm	QJ11902/X	1/TR37
Scr sdriv pan st M3 x 10mm	QJ11903/Z	2/Heatsink support
Scr sdriv pan st No.4 x ¼in	QJ08275/X	1/Oscillator cover
Nut st M3	QA11605/X	1/TR37
Washer	BT29237	2/Oscilaltor cover
Label, ident	BT38030/01	
Heatsink compound	HM00404	

25W PA ASSEMBLY [4]
AT28585

SEMICONDUCTORS						
Transistor CD4442 'Be0'	UHOB 30			FV33815	TR300	5322-130-62008
RESISTORS						
10	±5%	0,125W	c.film	PL99750	R300	
CAPACITORS						
2p2	±5%		cer tub	PN01074	C307	
10p	±5%		cer tub	PN09047	C302,303,308,309	
1n	±10%	100V	cer plate	PN99600	C304	
4n7	±10%	100V	cer plate	PN99604	C300,301	
100n	±10%	63V	poly	PQ99511	C305	
Variable	2–15p			PV07270	C306	

Description	Part No	Code/Remarks
INDUCTORS		
Coil assembly	AT30080	L301
Choke assembly	AT31961/07	L300
Loop	AT32933	L302
Loop	AT32936	L303
MISCELLANEOUS		
Solder tag 6BA	FT00049	

HEATSINK AND FEEDTHRU' ASSEMBLY AT14231/01

MISCELLANEOUS						
Bracket assembly					AT14232	See headed list
Cover bracket					BT11346	2/Bracket assembly
Transmitter heatsink					BJ37118	
Transistor heatsink					BT37594	
Pillar, hexagon					BT04413	2/Bracket assembly – heatsink
Lead assembly					AT36767	1/Feedthru' assembly – Regulator PCB
Lead assembly					AT36768	1/Feedthru' assembly – Control PCB
Lead assembly					AT36769/01	1/Feedthru' assembly – Tx PCB
Ferrox cube core					FC02103	
Ferrite bead					FC34450	
Grommet 3/8					FG02268	1/Bracket assembly
Pin 1/16 in x 5/8					QA08331	
Scr	pozi	pan	st	M3 x 6mm	QJ11901/X	2/Bracket assmebly – Pillars
Scr	sdriv	pan	st	M3 x 16mm	QJ11905/Z	2/Bracket assembly – heatsink
Scr	sdriv	pan	st	M3 x 20mm	QJ11906/Z	3/Device – heatsink
Scr	sdriv	pan	st	4–20 x 5/16	QJ08268/X	4/Cover bracket – heatsink
Nut	hex		st	M3	QA11605/X	3/Device – heatsink

BRACKET ASSEMBLY AT14232

Feedthru' bracket	BT11352	
Capacitor 1000p ±100% – 0% feedthru'	PN99200	[0] C1–8

PART 2
CONTROL OPTIONS

LINK/SYSTEMS CONTROL MODULE AT28725/01
(FOR USE WITH PRIMARY OPTIONS 11–13,51,57,58)

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' form 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 SQULECH 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				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	±5%	0,25W	c.film	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.

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 for two seconds (approx.) after Rx squelch closes Talkthrough delay removed
LK7 (TD/SQ)	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 simulated by switching on TR2 for engineers test purposes only. 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.

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 and closes and the trnamsitter 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

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 transmit.

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 simulated 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

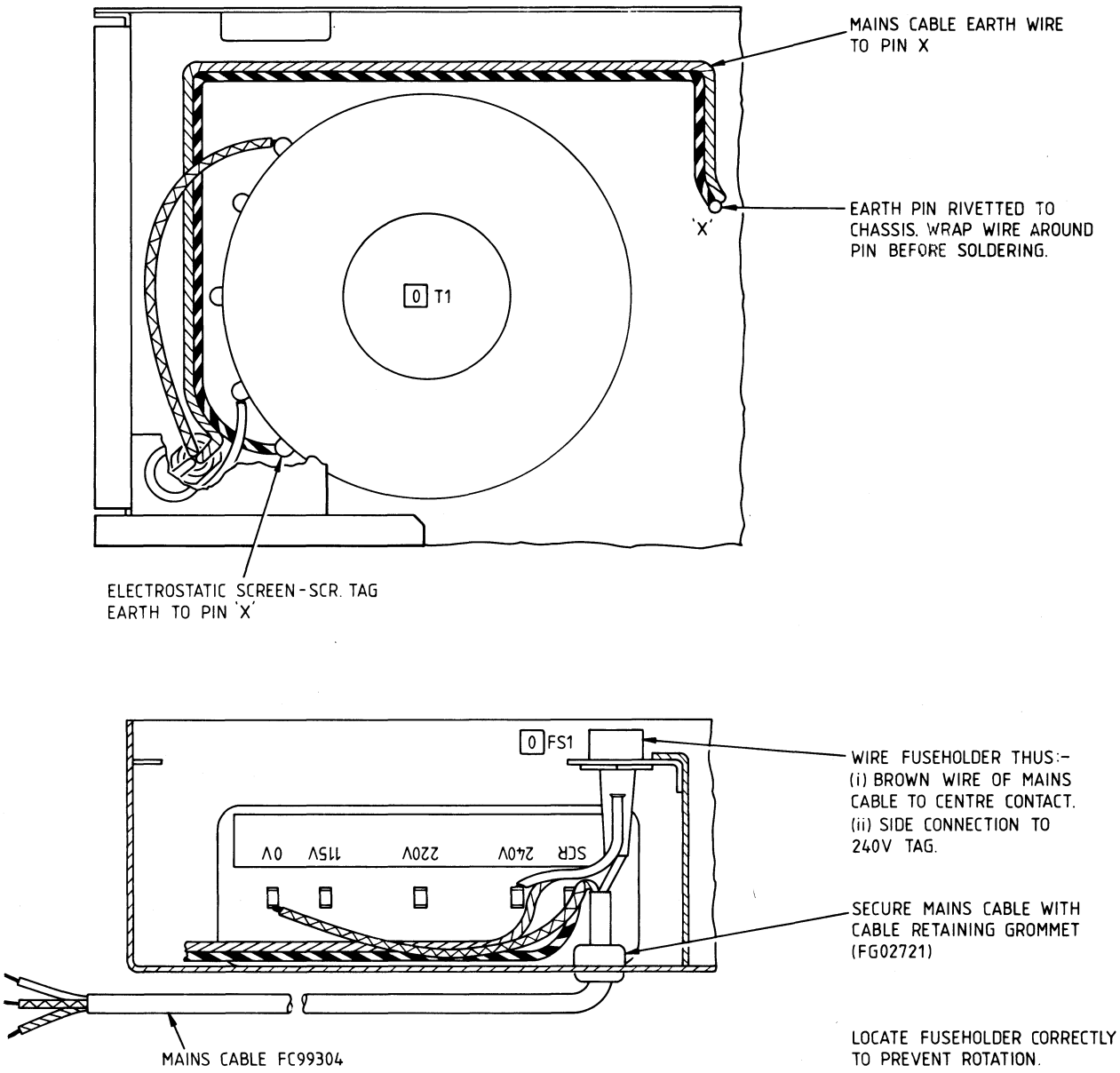
Description				Part No	Code/Remarks
SEMICONDUCTORS & ICS					
IC Dual Op-Amp				FU99092	IC1–3
IC Audio Amp				FU08027	IC7
IC				FU07686	IC8
IC4066 MOS				FU99104	IC4
IC4093 MOS				FU99103	IC5
IC40106 MOS				FU99126	IC6
Transistor BC547B				FV05891	TR4,5,13,14
Transistor BF245B				FV05900	TR3
Transistor 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 150p 270p 330p	±2%	63V	cer plate	PN99771 PN99773 PN99776 PN99777	C11 C9 C14 C4,5
470p 1n 4n7	±10%	63V	cer plate	PN99810 PN99811 PN99813	C6 C36 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
10		25V	elect	PS99812	C8,18,21,25,39
22		25V	elect	PS99813	C31
47		25V	elect	PS99814	C15,38
470		25V	elect	PS99816	C28,33

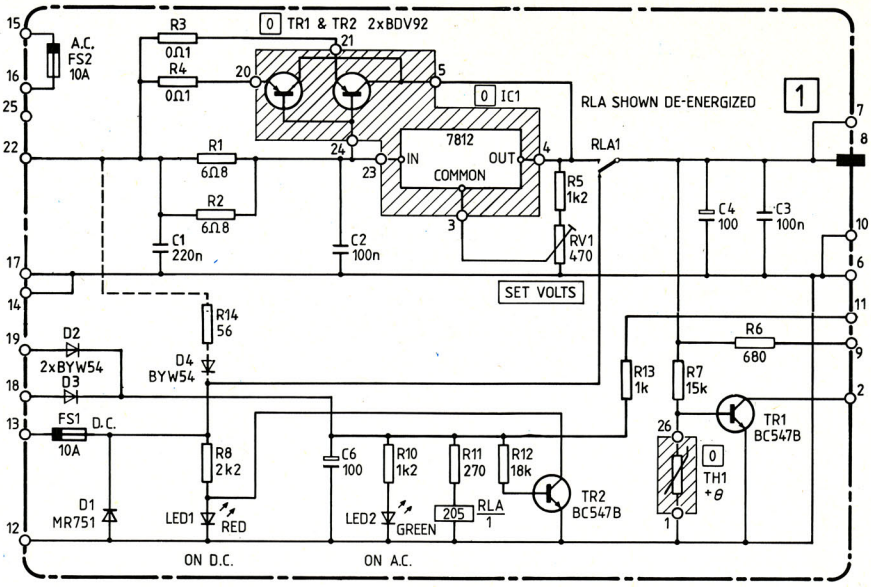
MISCELLANEOUS

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

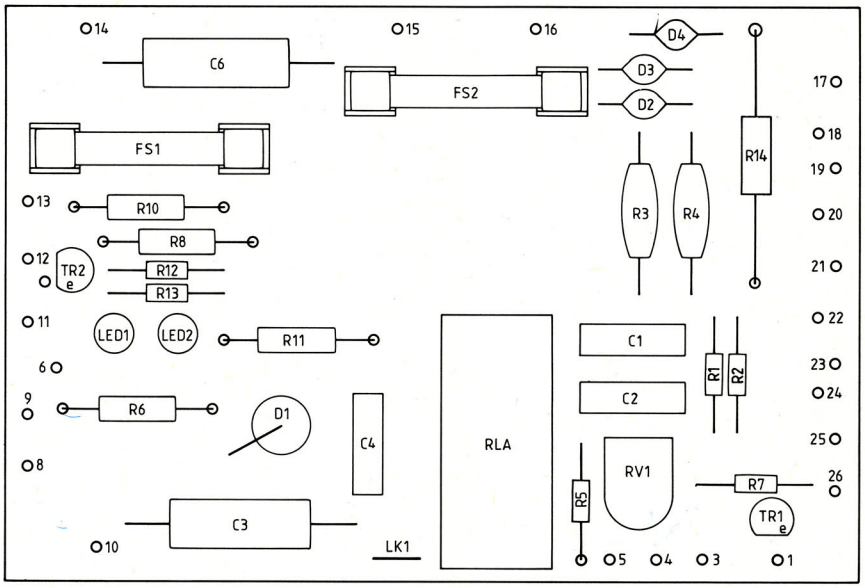


TP101

FIG 6.1 F490 TRANSCEIVER POWER WIRING DETAILS



AT28724/02



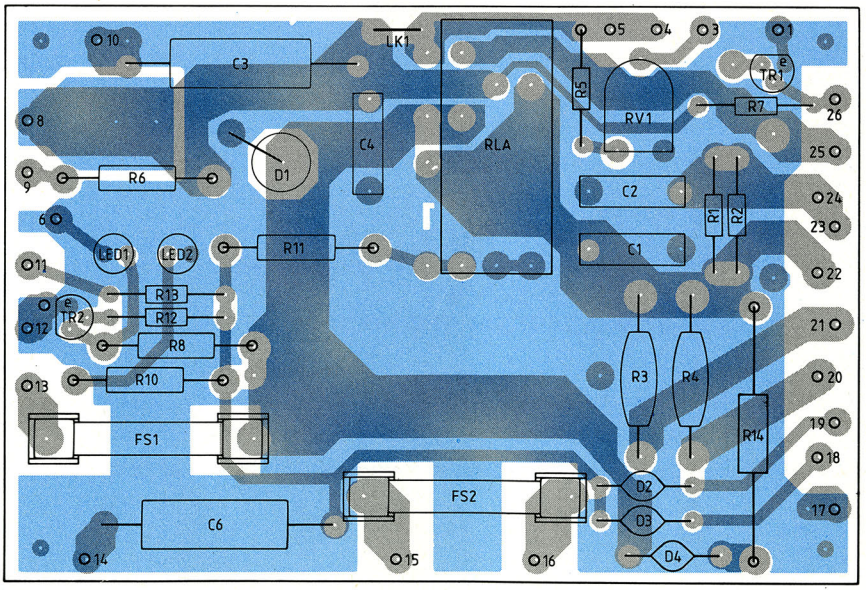
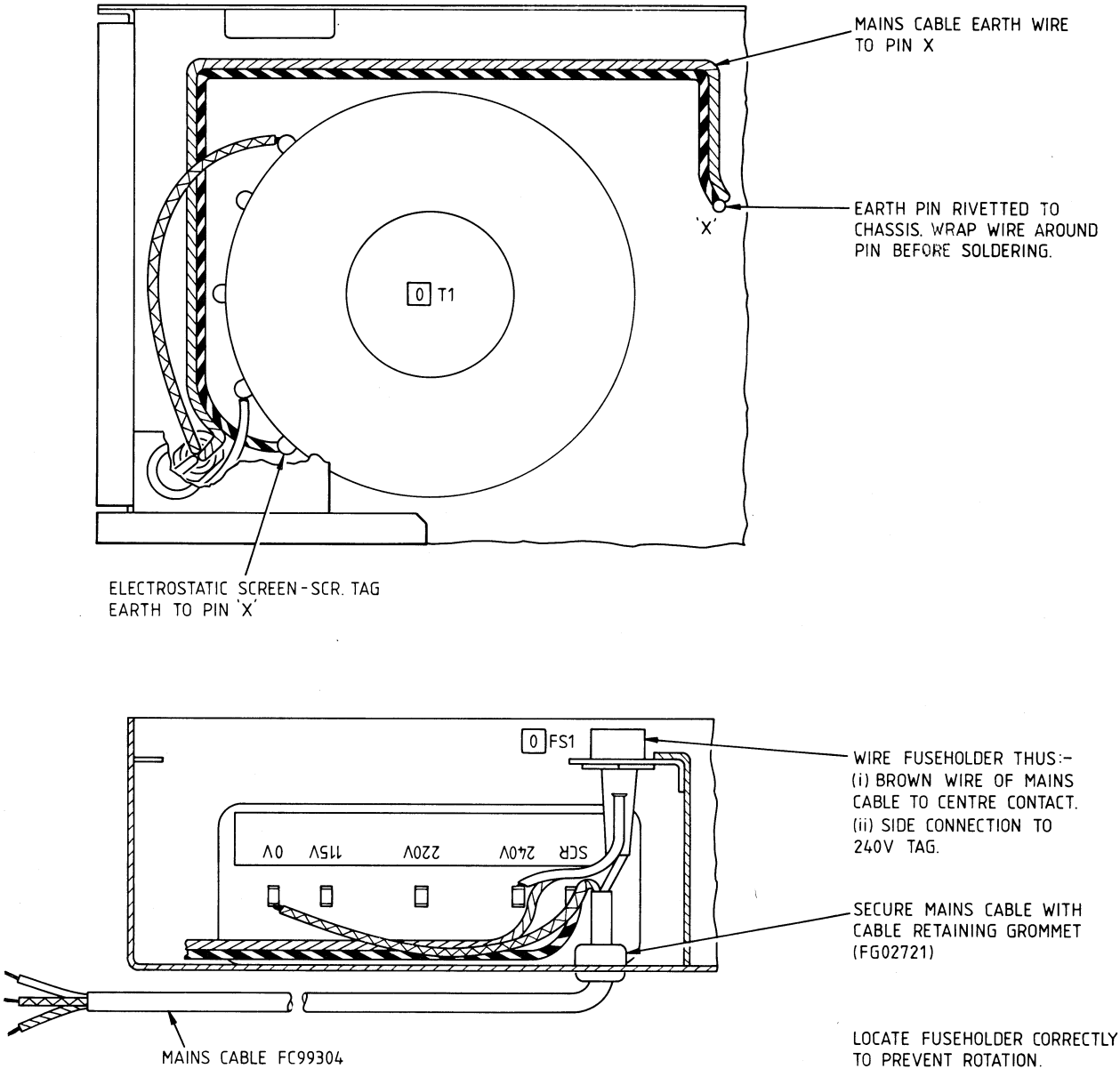
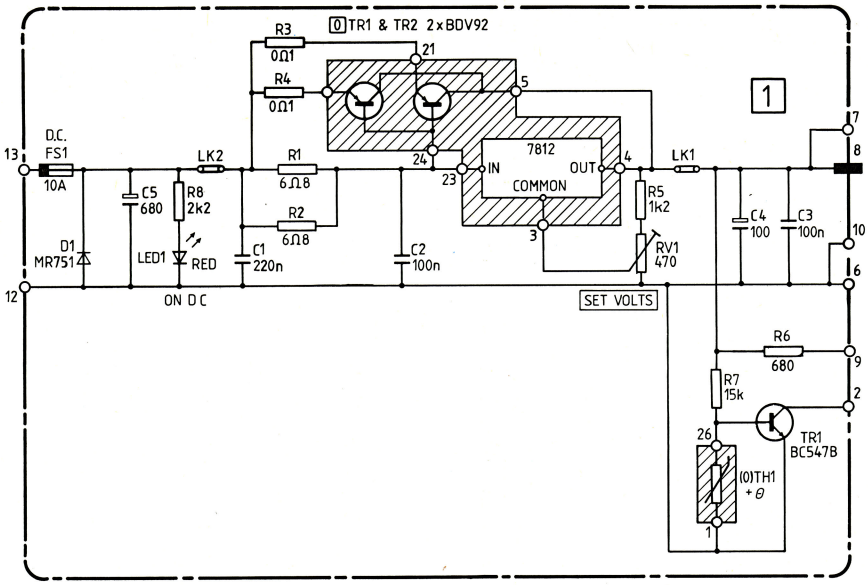


FIG 6.2 AC/12V DC REGULATOR
AT28724/02
CIRCUIT AND LAYOUT DIAGRAMS

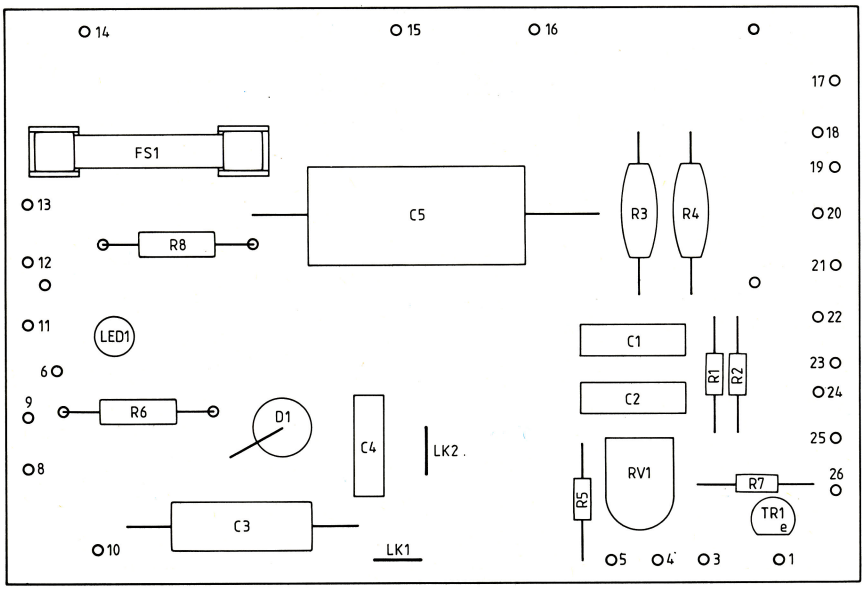


TP101

FIG 6.1 F490 TRANSCEIVER
POWER WIRING DETAILS



AT28724/03



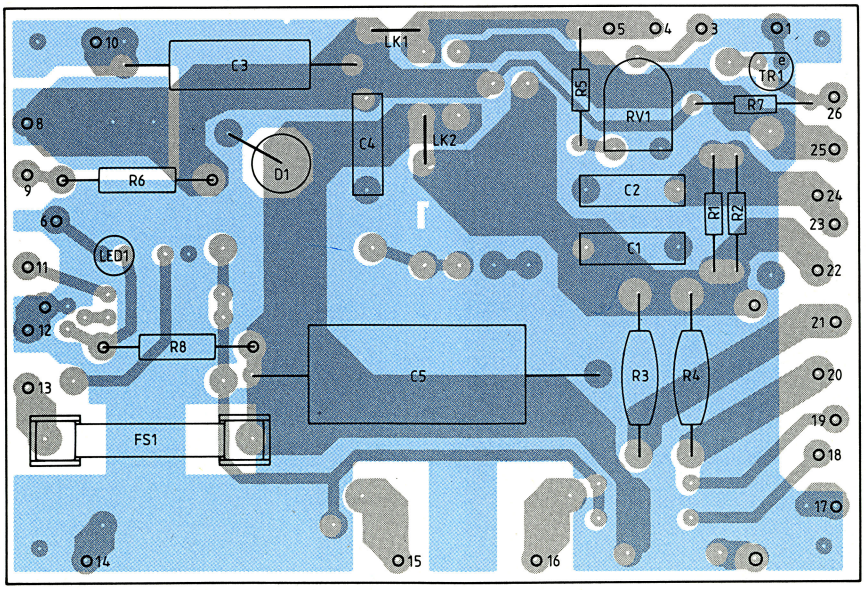
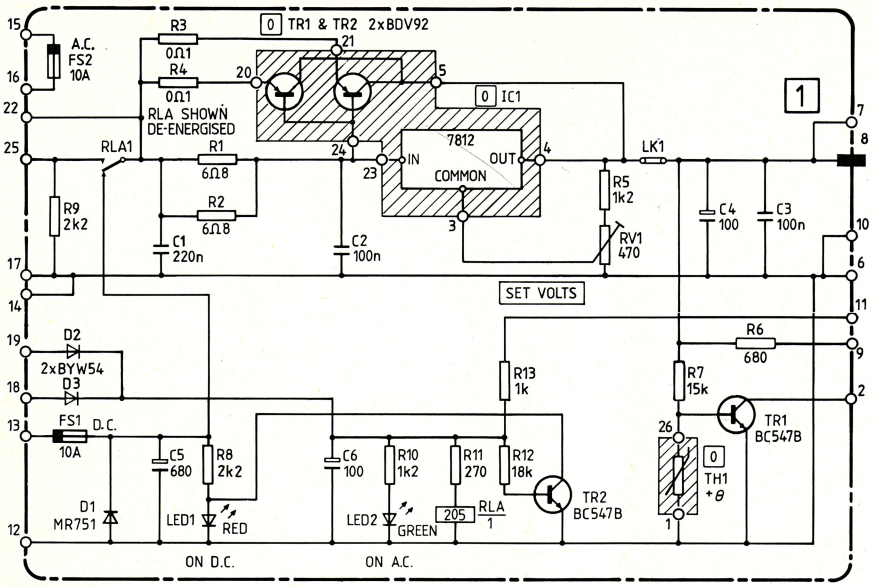
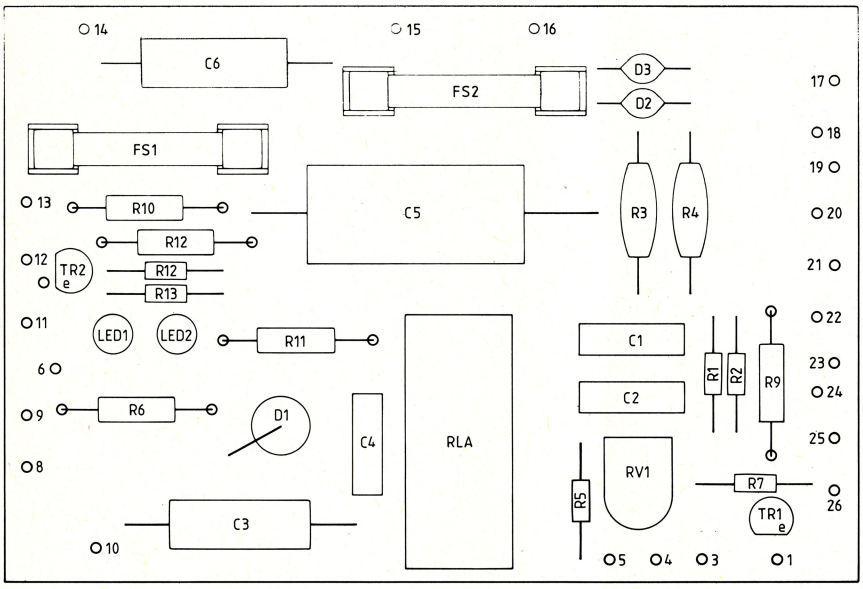


FIG 6.3 24V DC (ONLY) REGULATOR
AT28724/03
CIRCUIT AND LAYOUT DIAGRAMS



AT26724/01



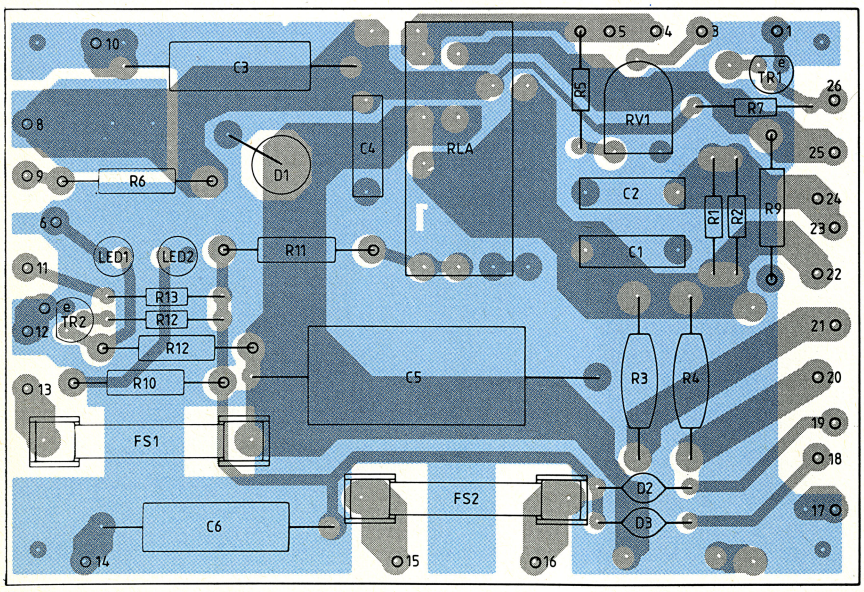
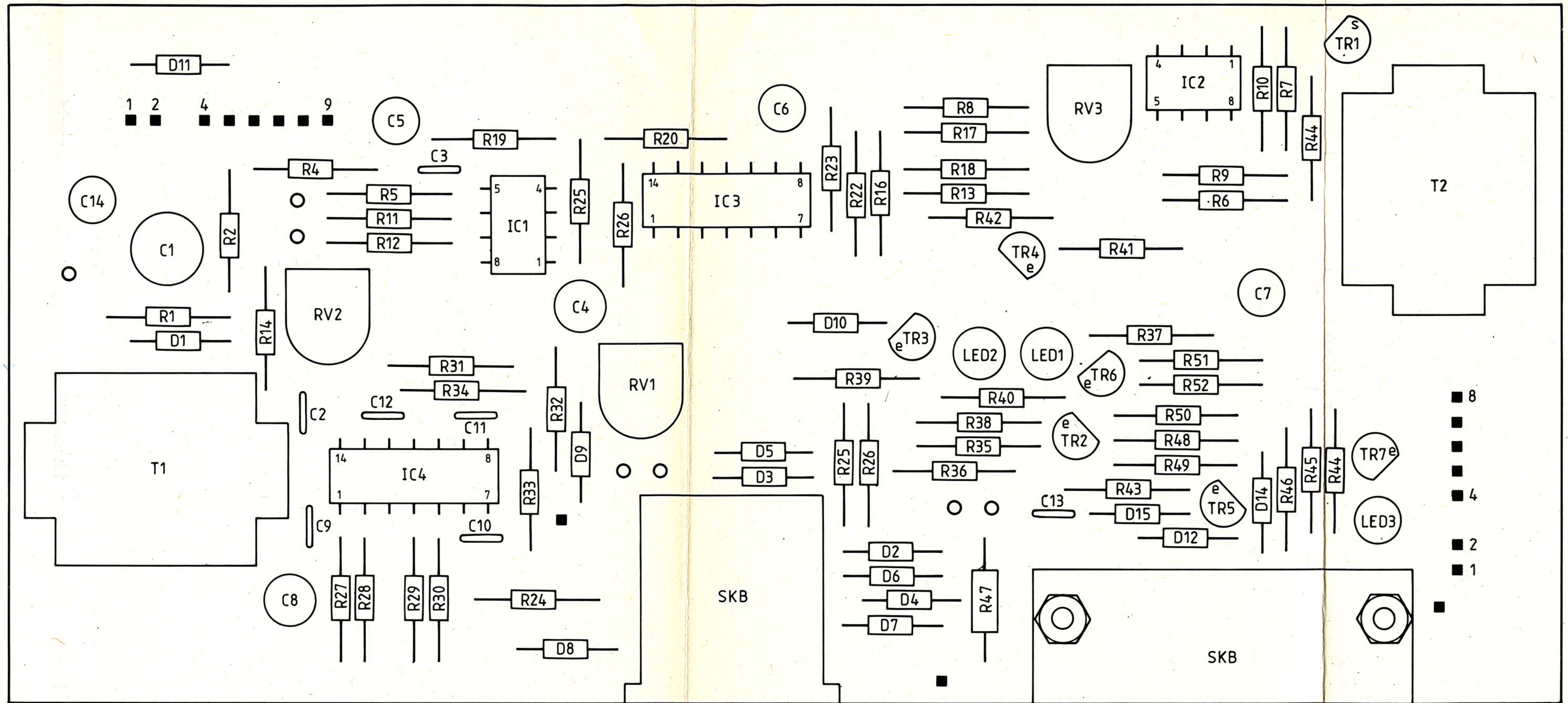
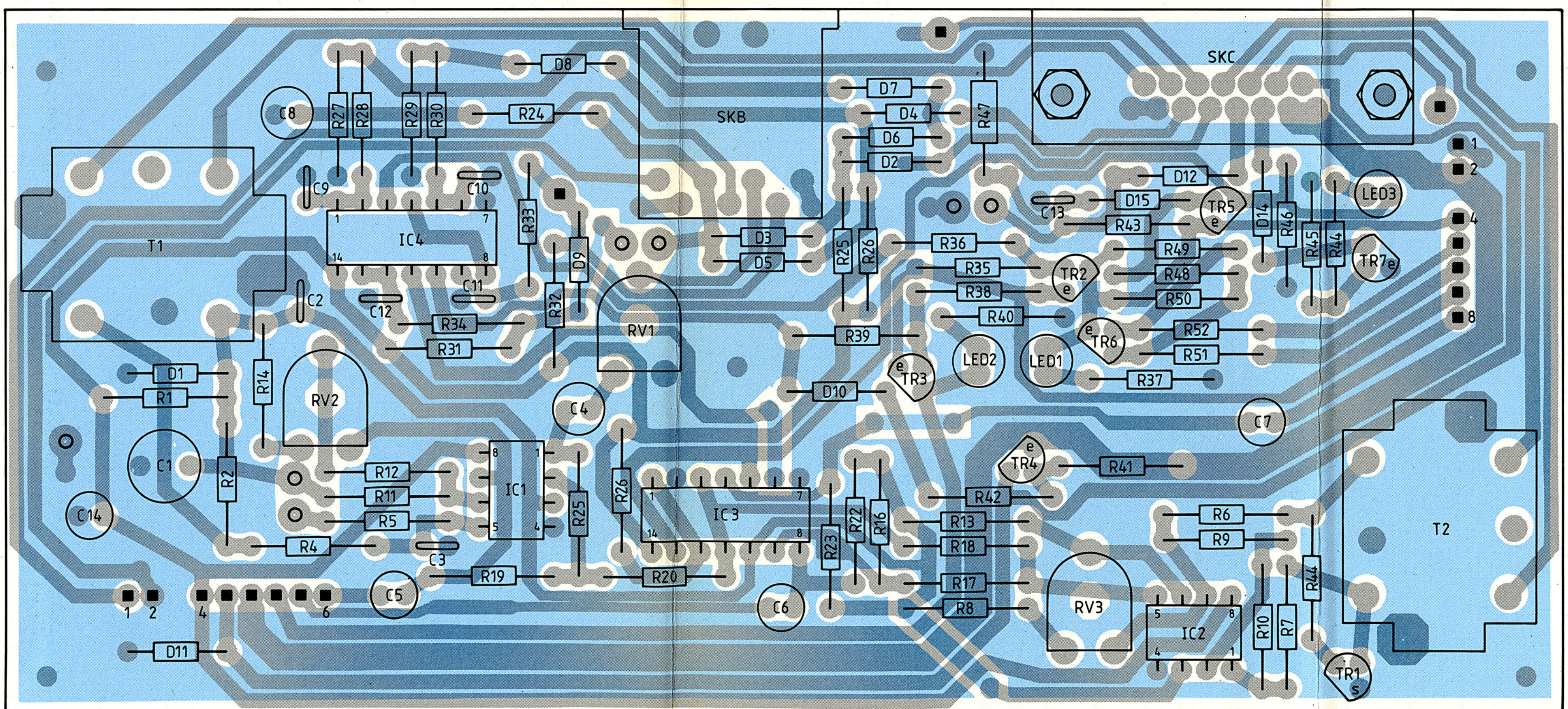


FIG 6.4 AC/24V DC REGULATOR
AT28724/01
CIRCUIT AND LAYOUT DIAGRAMS


D11
1 2 4 9
C5
C6
R19
R20
R8
R17
R18
R13
R42
RV3
IC2
R10
R7
R44
TR1
T2
C14
C1
R2
R4
C3
R5
R11
R12
IC1
R25
R26
IC3
R23
R22
R16
R9
R6
TR4
R41
C7
RV2
R1
D1
R14
C4
D10
TR3
LED2
LED1
R37
R51
R52
TR6
R31
R34
R39
R40
R50
R48
R49
T1
C2
C12
C11
RV1
R32
D9
IC4
R33
D5
D3
R38
R35
R36
TR2
R43
D15
D12
C13
TR5
D14
R46
R45
TR7
LED3
8 4 2 1
C9
C10
C8
R27
R28
R29
R30
R24
D8
SKB
D2
D6
D4
D7
R47

AT28725/01


D8
SKC
SKB
C8
R27
R28
R29
R30
R24
D7
D4
D6
D2
R47
T1
C9
C10
IC4
R33
D9
D3
D5
R25
R26
R36
R35
R38
R40
D12
D15
C13
R43
TR5
D14
R46
R45
R44
LED3
TR7
TR2
R49
R48
R50
TR6
R52
R51
R37
C2
C12
C11
R34
R31
R32
RV1
R39
LED2
LED1
D10
TR3
D1
R1
R14
RV2
C4
C7
C1
R2
R12
R11
R5
R4
C3
IC1
R26
IC3
R23
R22
R16
TR4
R41
R42
R13
R18
R17
R8
R6
R9
T2
C14
R19
R20
C5
C6
RV3
IC2
R10
R7
TR1
1 2 4 6
D11
1 2 4 8

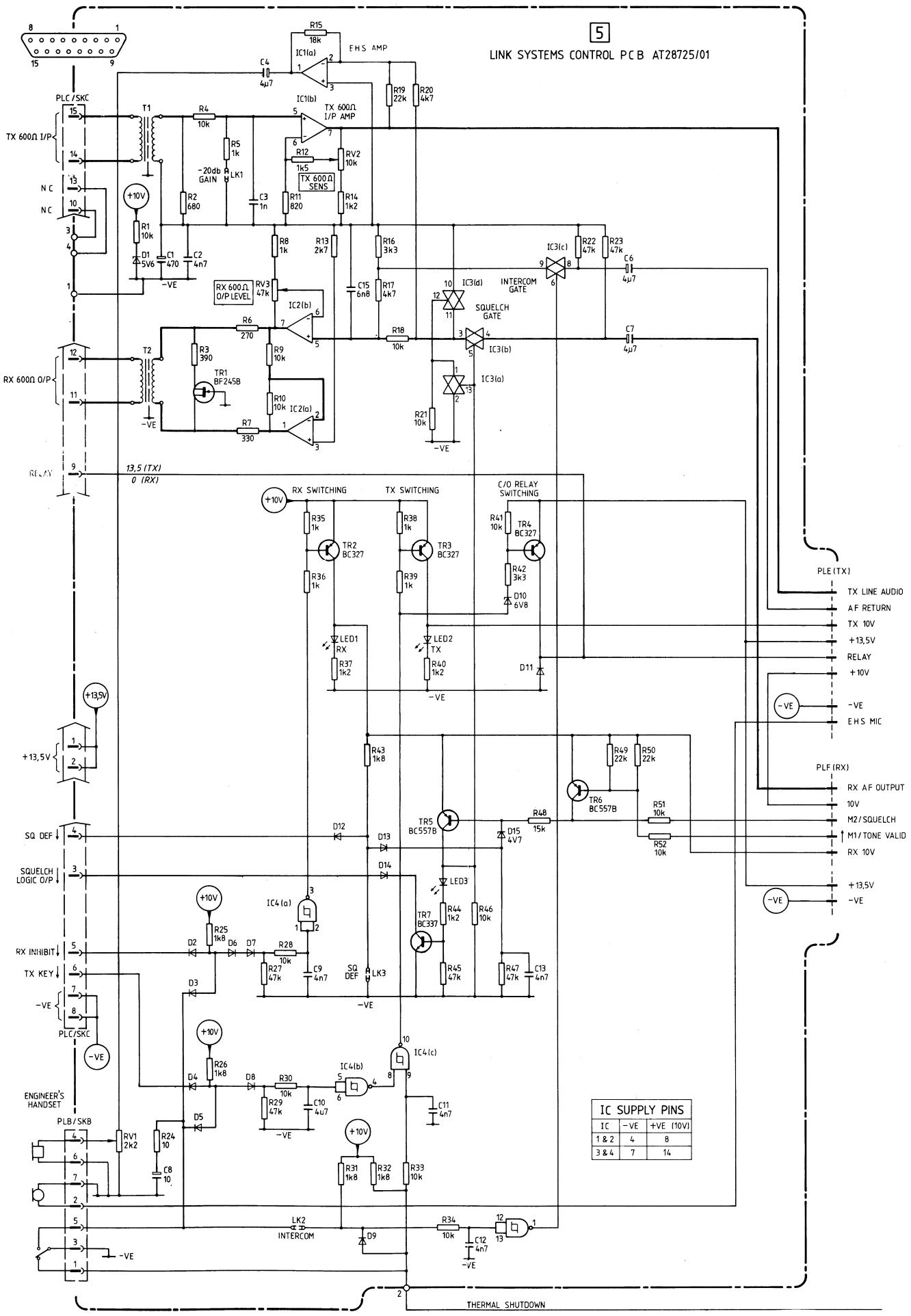


FIG 6.5 LINK/SYSTEMS CONTROL MODULE AT28725/01 CIRCUIT AND LAYOUT DIAGRAMS

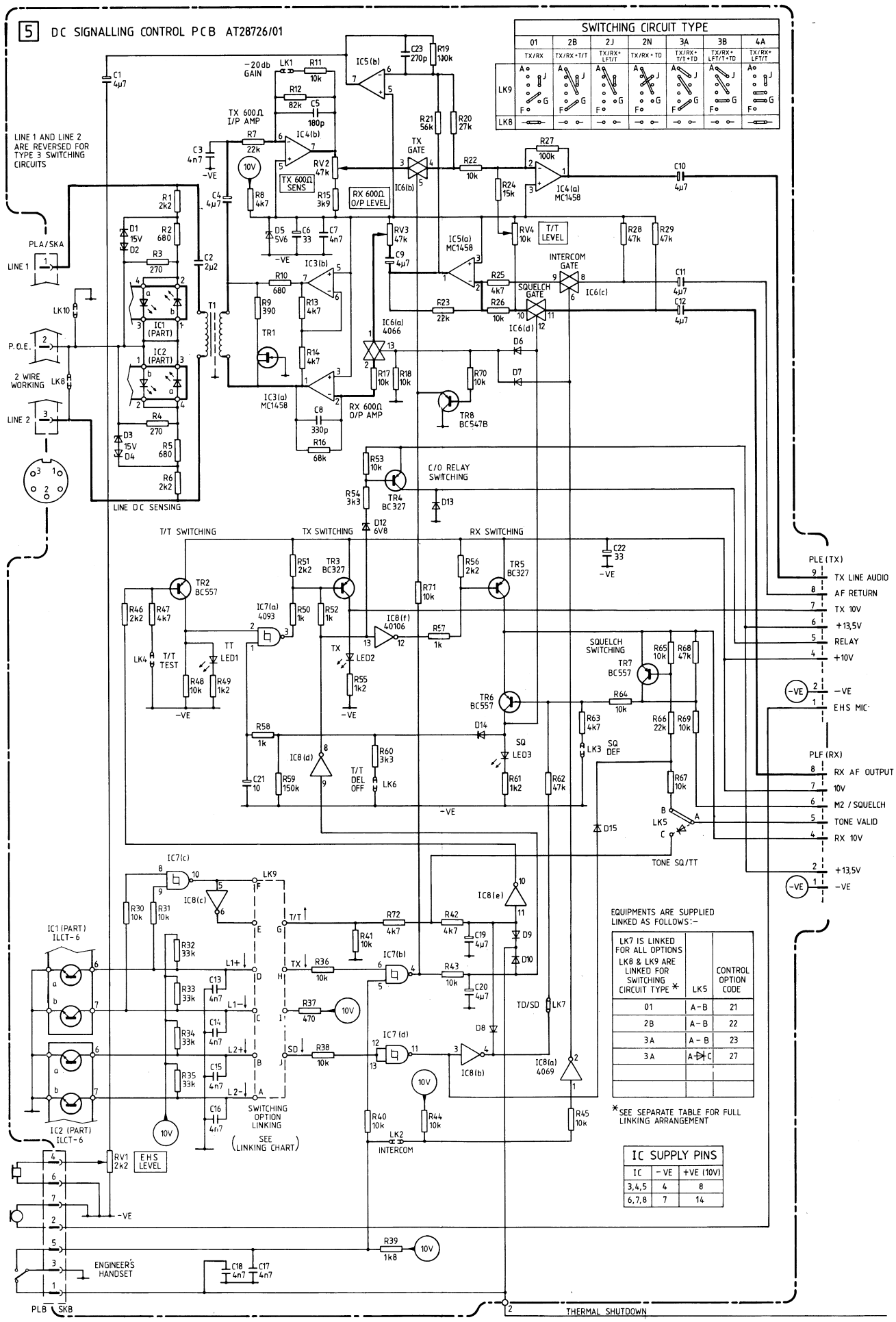
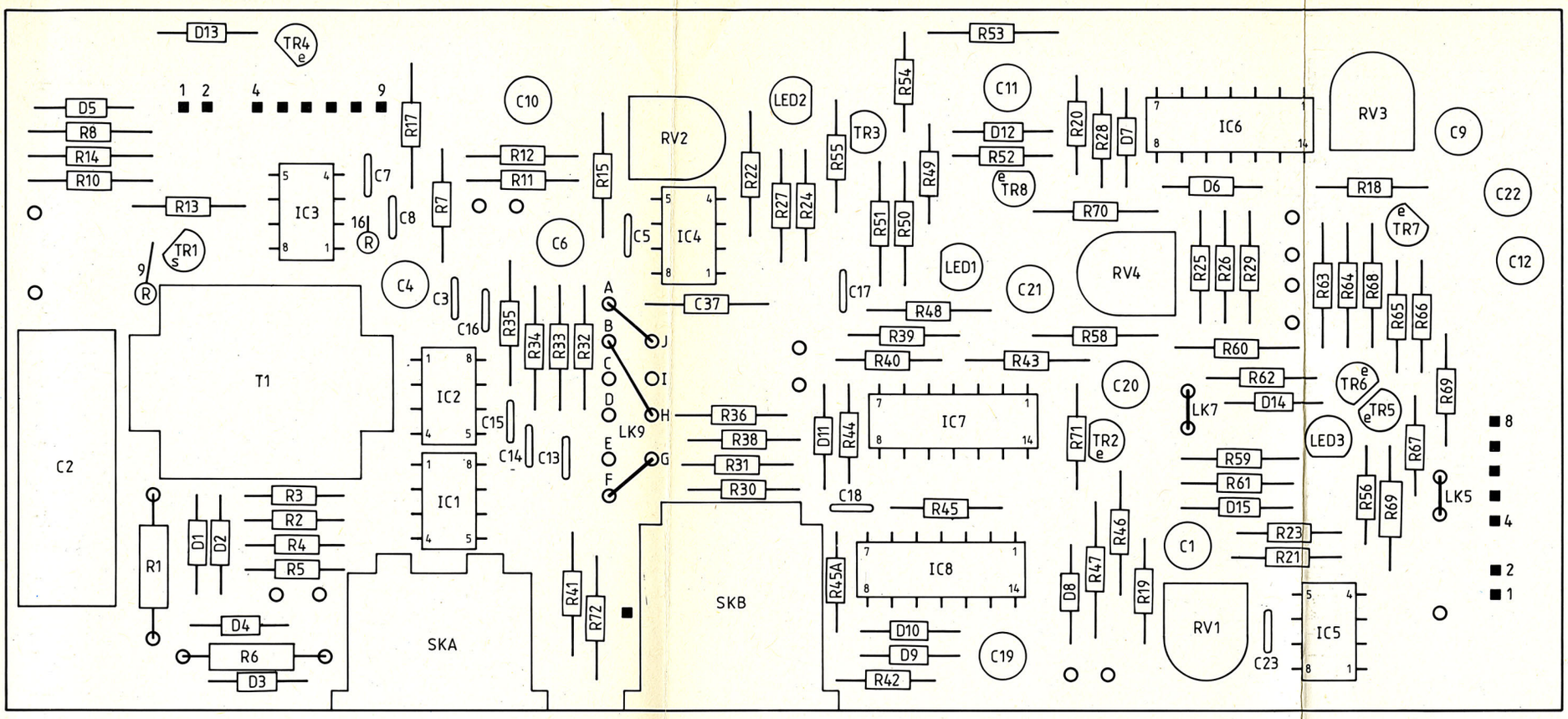
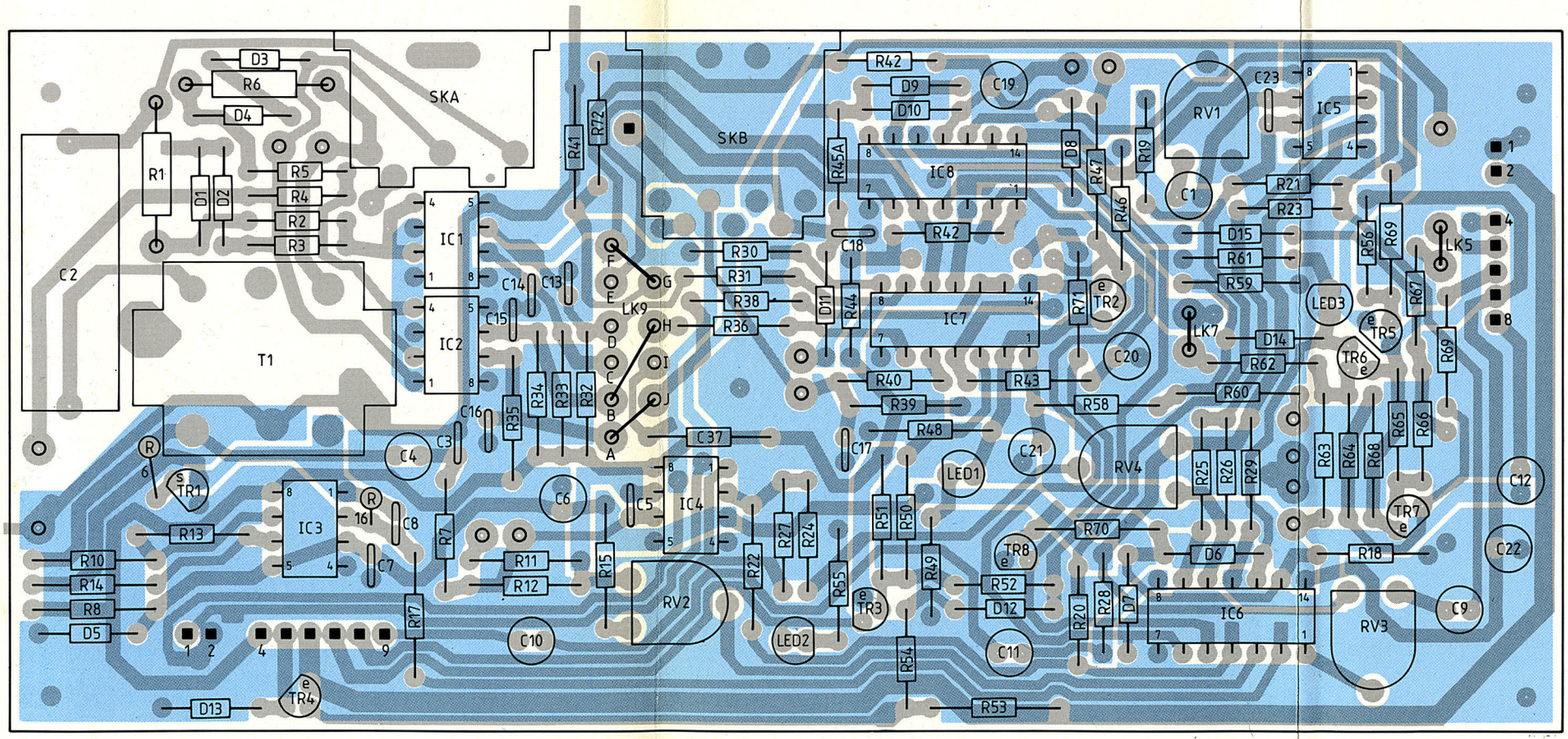


FIG 6.6 DC SIGNALLING CONTROL MODULE AT28726/01
CIRCUIT AND LAYOUT DIAGRAMS


D13
TR4
1 2 4 9
D5
R8
R14
R10
R13
TR1
IC3
C7
C8
R17
R7
C10
R12
R11
R15
C6
RV2
C5
IC4
R22
R27
R24
LED2
R55
TR3
R54
R53
C11
D12
R52
TR8
R49
R51
R50
C17
C37
R48
R39
R40
R43
R58
R60
C20
C21
LED1
RV4
IC6
R20
R28
D7
D6
R70
RV3
C9
R18
C22
TR7
C12
R25
R26
R29
R63
R64
R68
R65
R66
R69
TR6
TR5
LK7
D14
R62
LED3
R67
LK5
R59
R61
D15
R23
R21
C1
RV1
IC5
C23
R56
C4
C3
C16
R35
R34
R33
R32
T1
C2
IC2
IC1
C15
C14
C13
A
B
C
D
E
F
J
I
H
G
LK9
R36
R38
R31
R30
C18
R45
R45A
IC8
D11
R44
IC7
R71
TR2
D8
R47
R46
R19
R41
R72
SKA
SKB
R1
D1
D2
R3
R2
R4
R5
D4
R6
D3
8
4
2
1

AT28726/01


D3
R6
D4
SKA
R1
D1
D2
R5
R4
R2
R3
C2
T1
IC1
IC2
R41
R72
SKB
R42
D9
D10
C19
R45A
IC8
D8
R47
R19
RV1
C23
IC5
C1
R21
R23
R46
C18
R30
R31
R38
R36
D11
R44
IC7
R71
TR2
R42
D15
R61
R59
R56
R69
LK5
LED3
R67
TR5
TR6
LK7
D14
R62
C20
R40
R43
R39
R58
R60
R48
C17
C37
LED1
C21
RV4
R25
R26
R29
R63
R64
R68
R65
R66
R69
C12
TR7
R70
D6
R18
C22
TR8
R52
D12
R51
R50
R49
TR3
R55
R54
R53
C11
IC6
R20
R28
D7
RV3
C9
C4
C3
C16
R35
R34
R33
R32
C15
C14
C13
LK9
C5
IC4
R22
R27
R24
LED2
C6
RV2
R15
R11
R12
C10
R17
R7
C8
C7
IC3
R13
TR1
R10
R14
R8
D5
TR4
D13
1 2 4 9
6
16
8
4
2
1

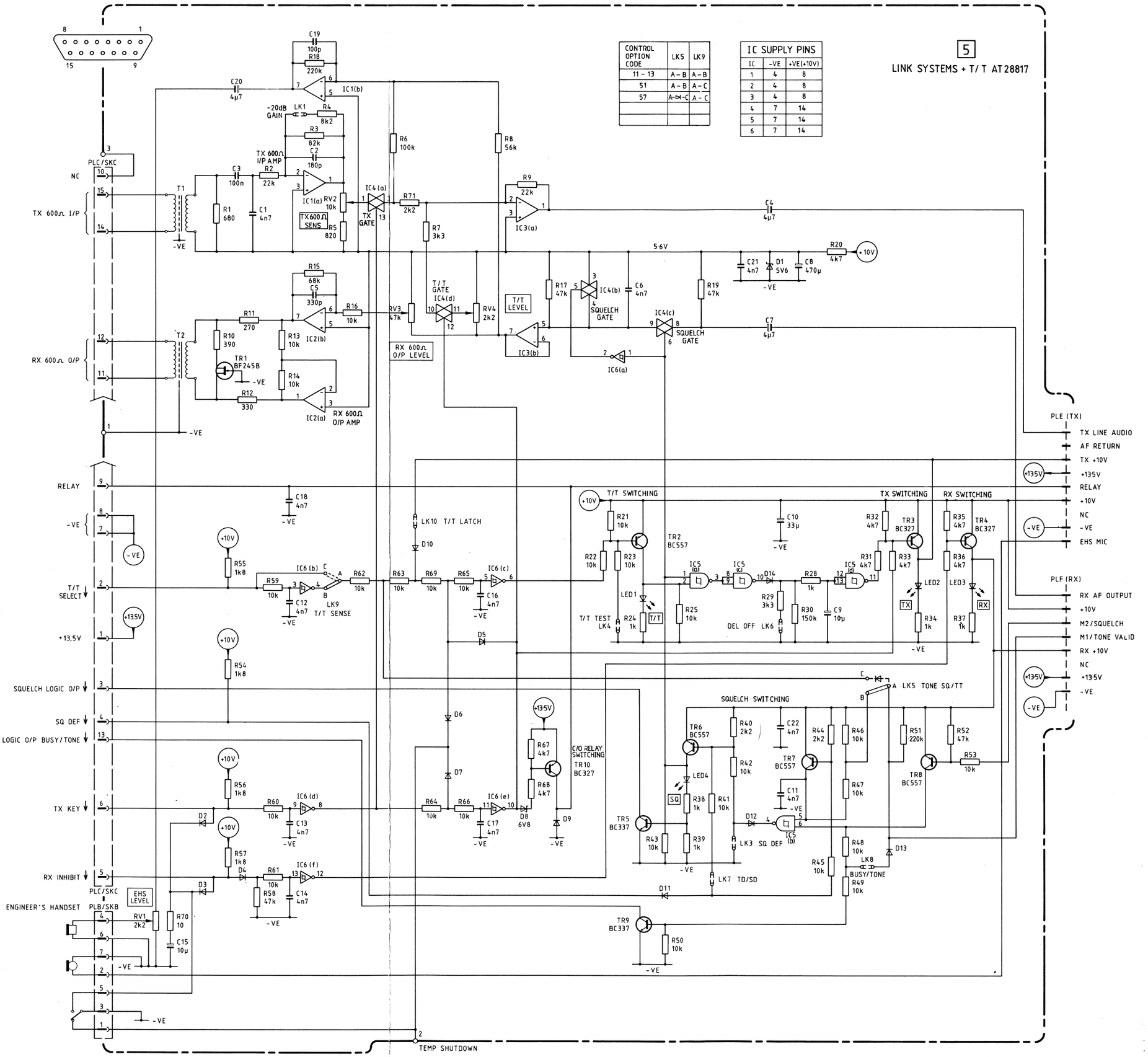
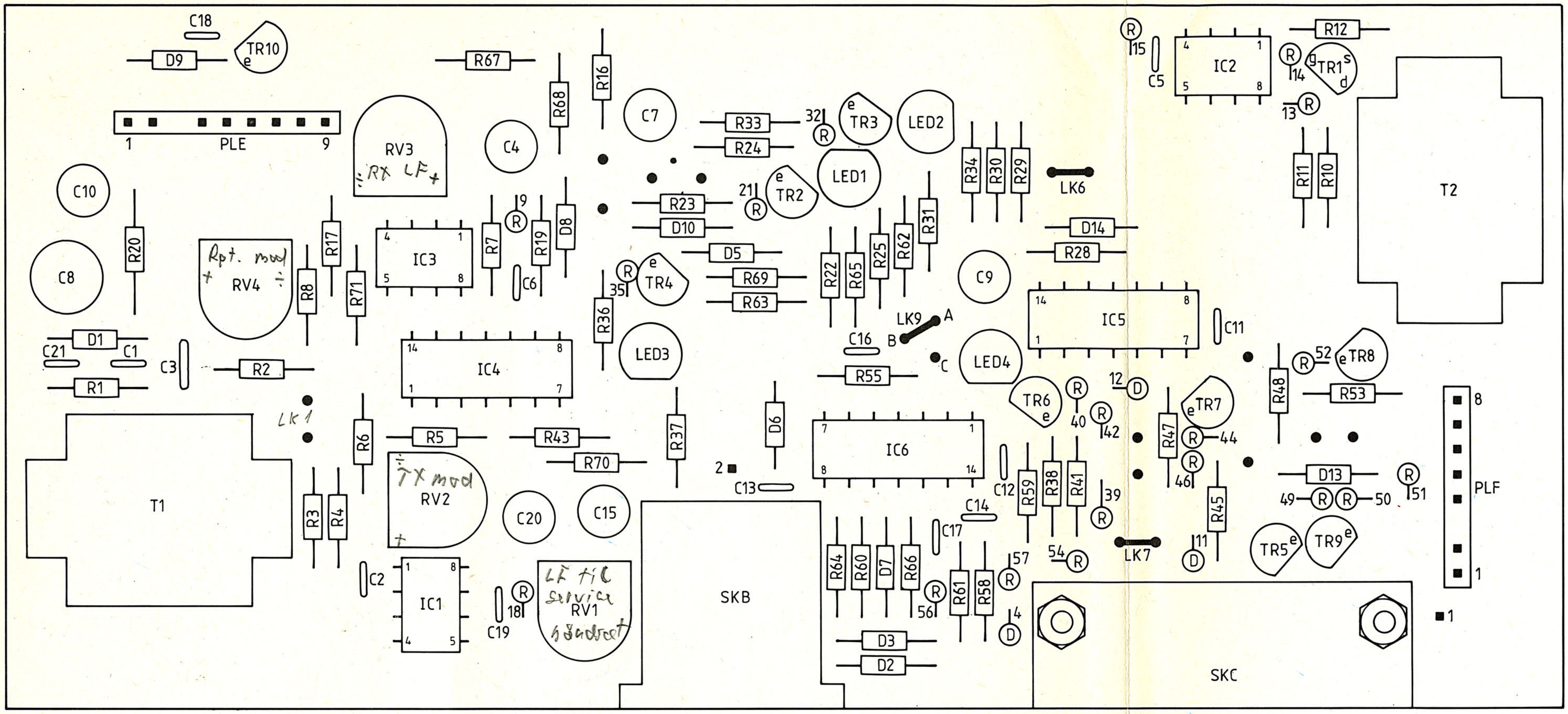
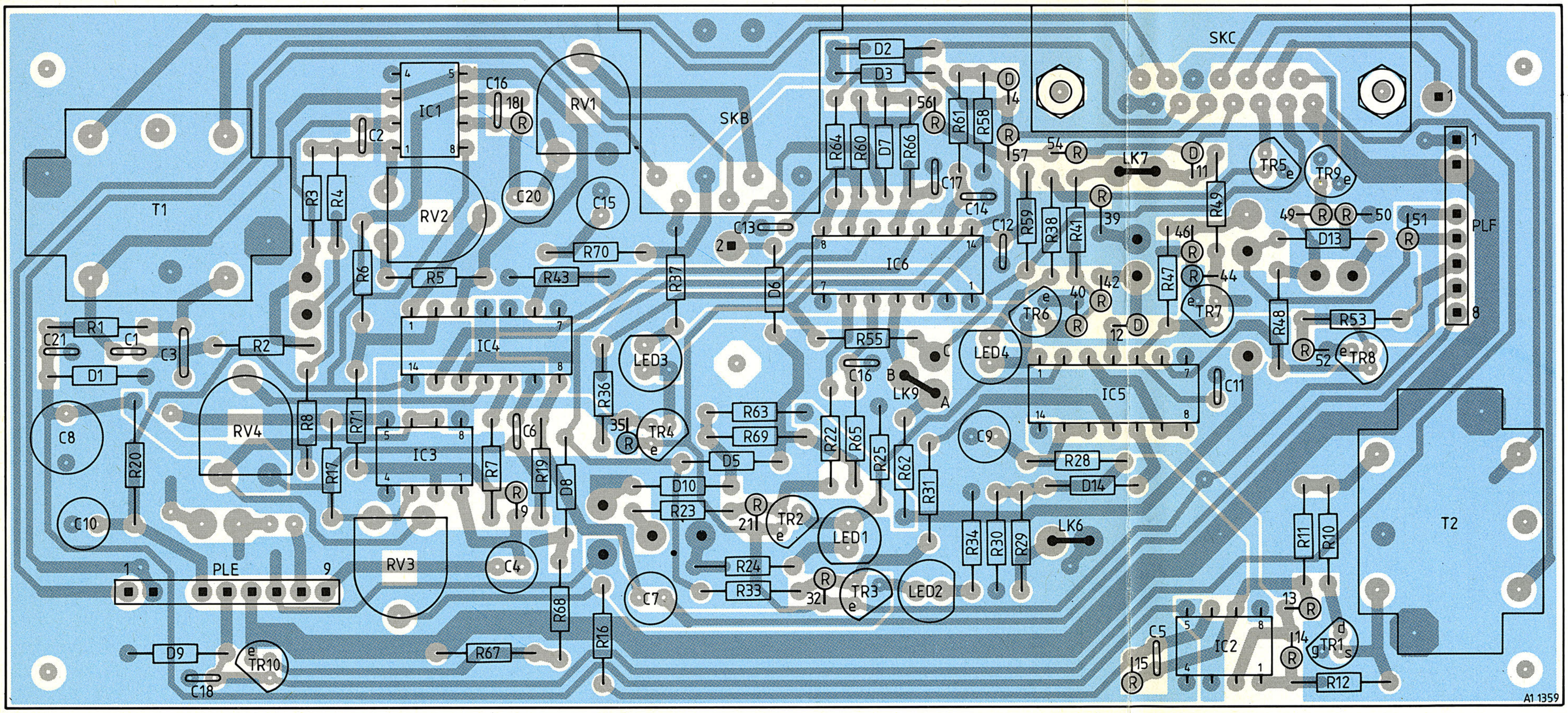


FIG 6.7 LINK/SYSTEMS (WITH TALKTHROUGH) CONTROL MODULE AT28817
CIRCUIT AND LAYOUT DIAGRAMS


PLE
1
9
RV3
RV4
RV2
RV1
T1
T2
SKB
SKC
PLF
IC1
IC2
IC3
IC4
IC5
IC6
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
LED1
LED2
LED3
LED4
LK1
LK6
LK7
LK9
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
D1
D2
D3
D5
D6
D7
D8
D9
D10
D13
D14
R1
R2
R3
R4
R5
R6
R7
R8
R10
R11
R12
R16
R17
R19
R20
R22
R23
R24
R25
R28
R29
R30
R31
R33
R34
R36
R37
R38
R41
R43
R45
R47
R48
R53
R55
R58
R59
R60
R61
R62
R63
R64
R65
R66
R67
R68
R69
R70
R71
TX mod

AT28817


PLE
1
9
RV1
RV2
RV3
RV4
T1
T2
SKB
SKC
PLF
IC1
IC2
IC3
IC4
IC5
IC6
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
LED1
LED2
LED3
LED4
LK6
LK7
LK9
A1 1359

5

EXTENSION CONTROL
AT 28824

CONTROL OPTION CODE	LK7	LK8
41	—	A - C B - -VE
42	LINKED	A - C
47	LINKED	A ⊣ B

SEE NOTE 1

IC SUPPLY PINS		
IC	-VE	+VE (+10V)
1	4	8
2	4	8
3	4	8
4	7	14
5	7	14
6	7	14
7	3	5 (+15V)
8	3	8

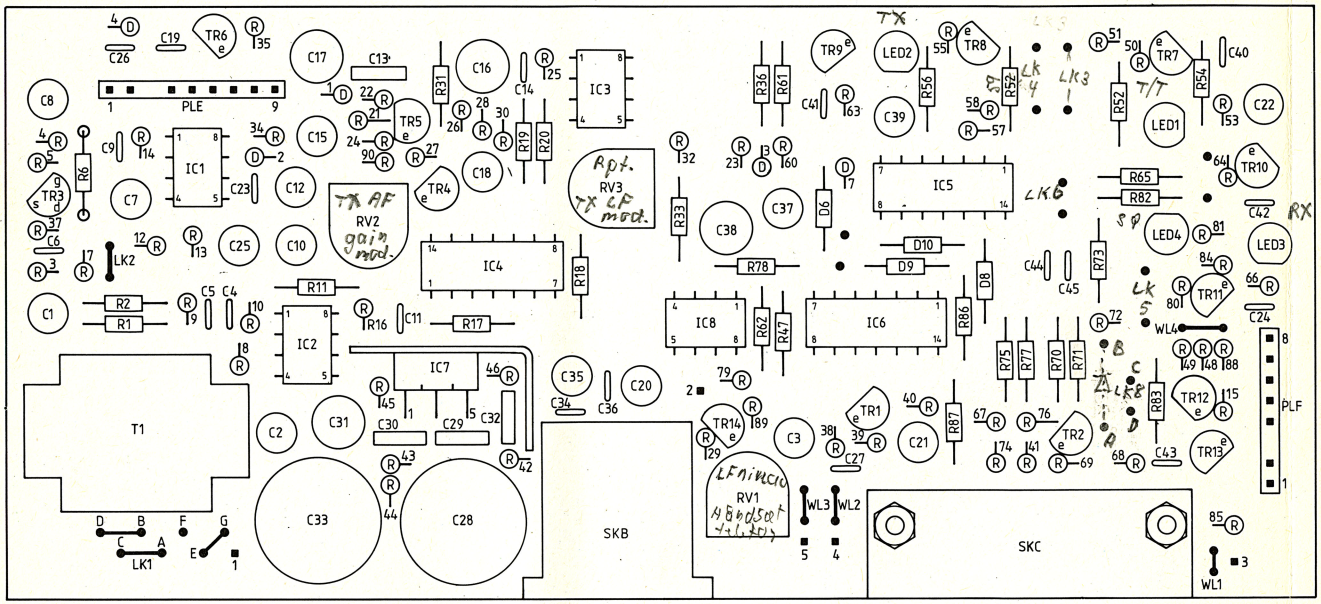
NOTE 1 -VE PIN OF LK6

PLC/SKC
MIC Hi
MIC Lo
DECODER AF
L-S Hi
+10V
VOL
T/T
L-S Lo
L-S SCN
-VE
VOL -VE
CALLED
TX KEY
SQ DEF
BUSY
PLC/SKC
HEERS HANDSET
PLB/SKB
EHS AF
TX AF LINK
EHS RX AF AMP
VOLTAGE CONTROLLED ATTENUATOR
TX AF AMP
TX AF GATE
TX AF GAIN
T/T AF GATE
T/T LEVEL
RX AF BUFFER
REGULATOR
SQUELCH GATE
RX AF AMP (UNSQUELCHED)
3Ω AF AMP
VOLTAGE CONTROLLED ATTENUATOR
VOLTAGE CONTROLLED ATTENUATOR SWITCHING
T/T LATCH
T/T LOGIC
T/T TEST
T/T SWITCHING
DUPLEX
DOT/T
TONE SQUELCH/ T/T
TX SWITCHING
RX SWITCHING
CALLED SWITCH
SQ DEFEAT LOGIC
ANT C/O RELAY DRIVER
SQUELCH LOGIC
SQUELCH DEFEAT
TX SWITCH
TEMP SHUTDOWN

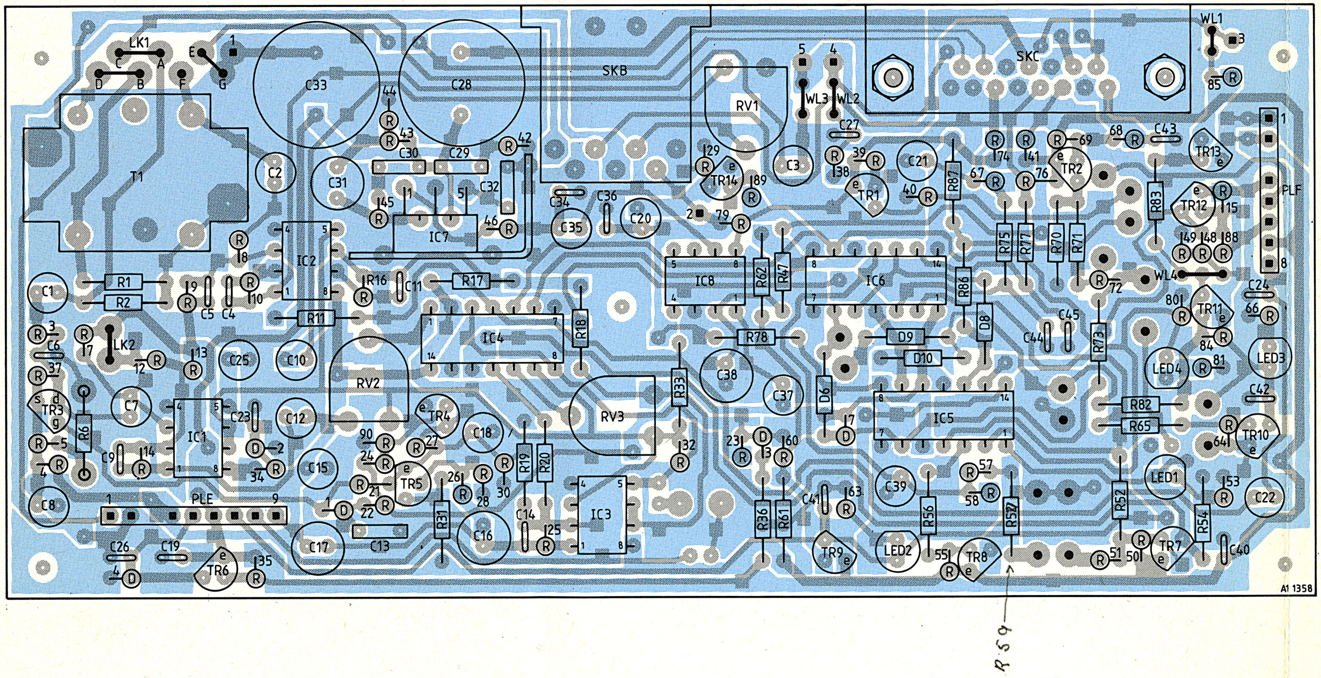
PLE (TX)
9 TX LINE AUDIO
8 AF RETURN
7 TX 10V
6 +15V
5 RELAY
4 +10V
3 NC
2 -VE
1 EHS MIC

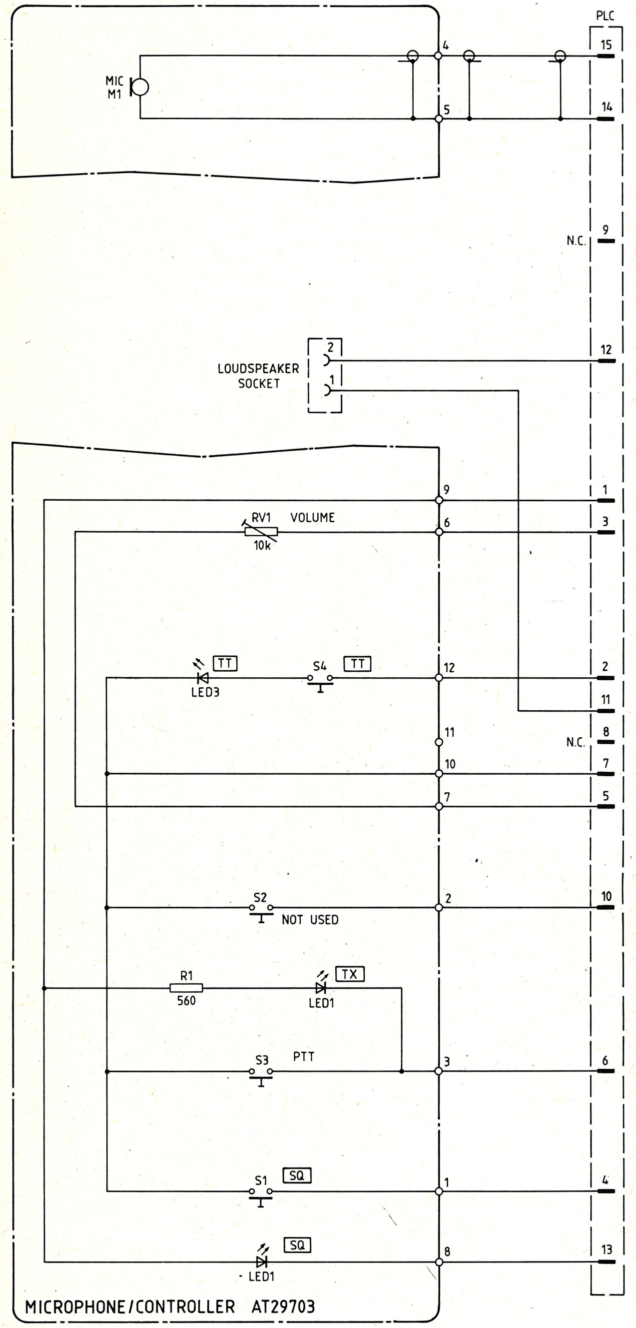
PLF (RX)
8 RX AF OUTPUT
7 +10V
6 M2/SQUELCH
5 M1/TONE VALID
4 RX +10V
3 NC
2 +15V
1 -VE

FIG 6.8 MC490 CONTROL MODULE AT28824 CIRCUIT AND LAYOUT DIAGRAMS


TX AF
RV2
gain mod.
Rpt.
RV3
TX LF mod.
LF Ainvio
RV1
Handset
PLE
PLF
SKB
SKC
T1
LK1
LK2
WL1
WL2
WL3
WL4
RX
TX

AT28824


SKB
SKC
T1
PLE
PLF
RV1
RV2
RV3
A1 1358
R59


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

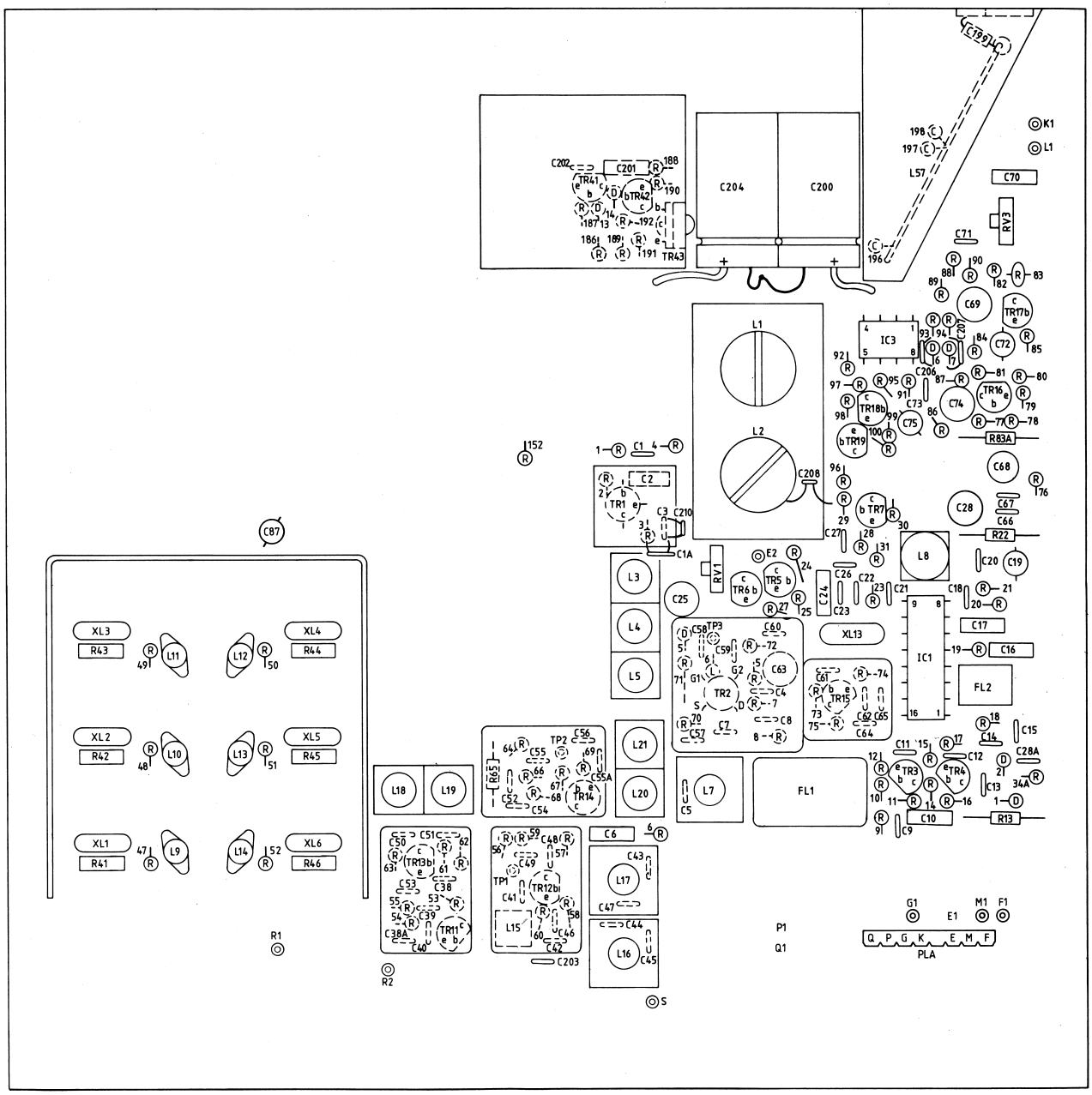
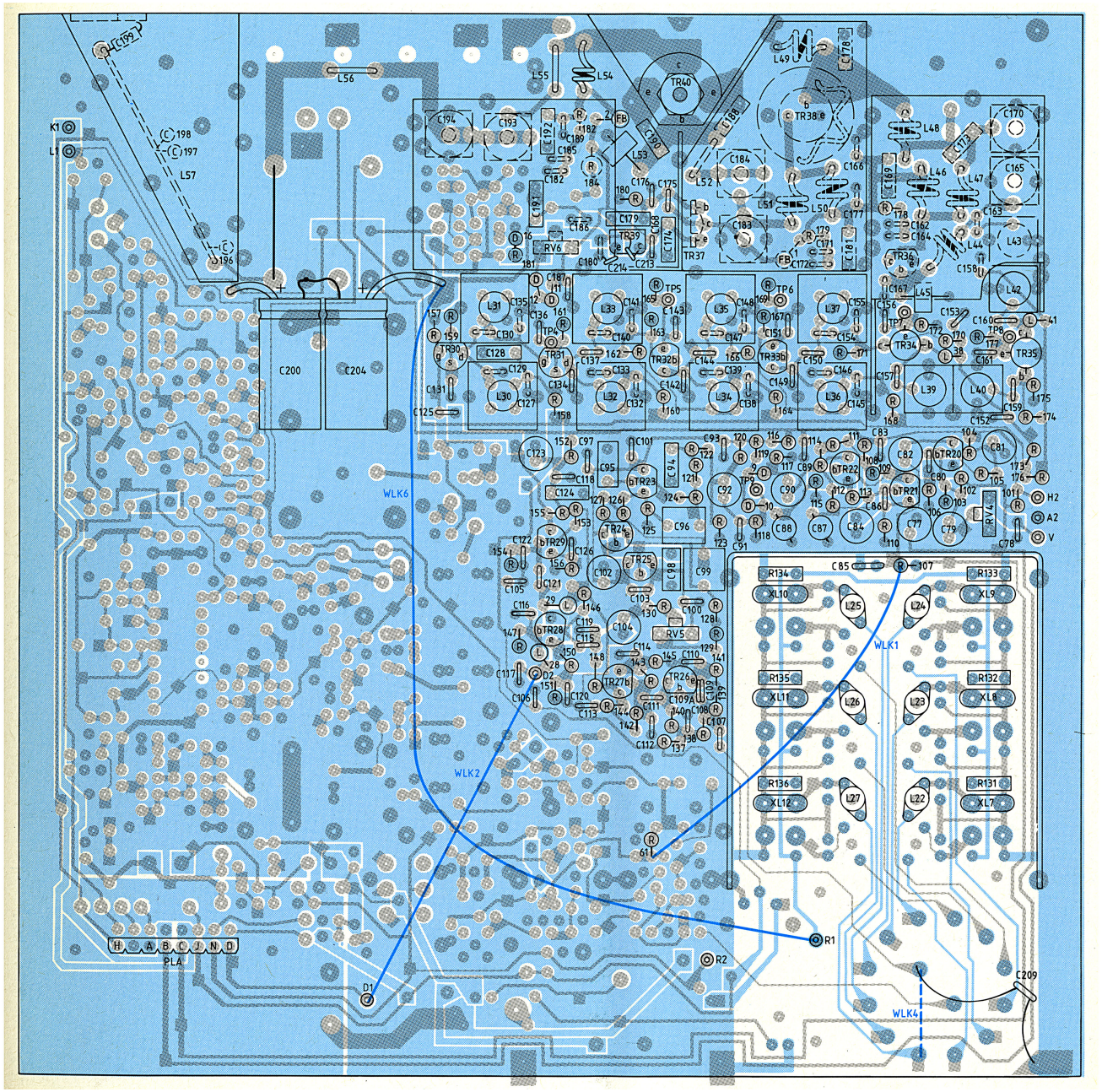


FIG 6.9 TRANSMITTER AND RECEIVER BOARDS AT28727/– AND AT28728/– LAYOUT DIAGRAMS


WLK6
WLK2
WLK1
WLK4
PLA
H A B C J N D
K1
L1
D1
R1
R2
C200
C204
C209
L56
L55
L54
L49
L57
L53
L52
L51
L50
L48
L47
L46
L45
L44
L43
L42
L41
L39
L40
TR40
TR38
TR37
TR36
TR34
TR35
TR30
TR31
TR32b
TR33b
TR39
TR23
TR22
TR20
TR21
TR24
TR25
TR26
TR27b
TR28
TR29
RV6
RV5
RV4
C85
C307
R134
R133
R135
R132
R136
R131
XL10
XL9
XL11
XL8
XL12
XL7
L25
L24
L26
L23
L27
L22


C204
C200
K1
L1
D1
R1
R2
H2
A2
V
D N J C B A H
PLA

NOTES

1. CHASSIS COMPONENTS ARE PREFIXED (0)
2. ✳ FOR UNSPECIFIED COMPONENTS SEE PARTS LIST
3. FOR S.O.T. COMPONENTS SEE PARTS LIST FOR VALUES
4. AUDIO FEED VIA F1 EXCEPT WHEN TONE DECODER IS FITTED, THEN VIA G1

MEASUREMENTS FOR 6W EQUIPMENT
SUPPLY VOLTS INCREASED TO 15V FOR 25W EQUIPMENT

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

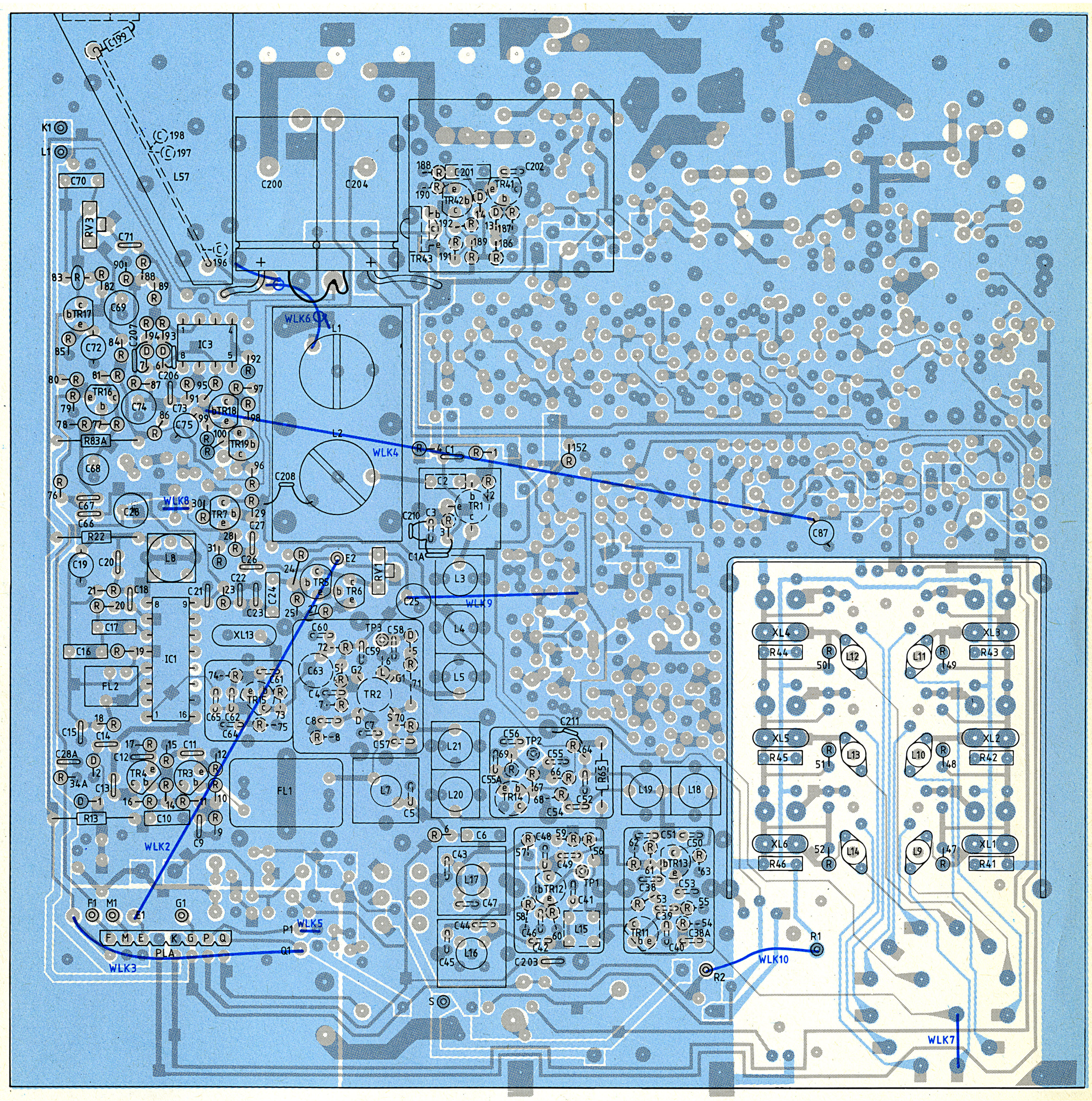
ALL MEASUREMENTS MADE WITH A 20kΩ/VOLT METER ON EITHER THE 2,5V OR 10V FSD RANGE AS APPROPRIATE

TRANSMITTER AUDIO MEASUREMENTS ARE SHOWN AT TWO LEVELS.
(a) REPRESENTS THE CLIPPED LEVEL SET FOR ± 5kHz DEVIATION
(b) REPRESENTS THE UNCLIPPED LEVEL SET FOR ± 3kHz DEVIATION

RECEIVER AUDIO MEASUREMENTS ARE SHOWN FOR 1mV RF SIGNAL LEVEL AT THE ANT SKT (3kHz DEVIATION)

TRANSMITTER AND RECEIVER AUDIO MEASUREMENTS AT 1kHz

FIG 6.10 F496 TRANSCEIVER CIRCUIT DIAGRAM



C199
K1
L1
C198
C197
L57
C70
RV3
C71
196
C200
C204
188
C201
C202
190
TR42
TR41
192
TR43
189
187
186
191
WLK6
L1
IC3
C69
C72
C207
TR17
C206
TR16
C74
TR18
C73
C75
TR19
R83A
C68
L2
WLK4
C1
152
C208
C2
TR1
C67
C66
C26
WLK8
TR7
C27
C210
C3
C87
R22
C19
C20
L8
C26
E2
RV1
TR5
TR6
L3
C18
C21
C22
C24
C23
C25
WLK9
C17
C16
IC1
XL13
C60
TP3
C58
C59
C63
TR2
FL2
TR15
C65
C62
C64
L4
L5
C8
C7
C57
C15
C14
C28A
C12
C11
TR4
TR3
C13
C10
R13
WLK2
FL1
L7
C5
L21
L20
C56
TP2
C211
C55
C55A
TR14
C54
C52
R65
L19
L18
C6
C43
L17
C47
C48
C49
TR12
TP1
C41
C51
C50
TR13
C53
C36
C39
TR11
C38A
C40
C44
L16
C45
C42
C203
L15
F1
M1
E1
G1
PLA
WLK3
P1
WLK5
Q1
S
R1
R2
WLK10
WLK7
XL4
XL3
R44
R43
L12
L11
XL5
XL2
R45
R42
L13
L10
XL6
XL1
R46
R41
L14
L9

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