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 this manual in the light of future technical development.

APPROVED for connection to telecommunication systems specified in the instructions for use subject to the conditions set out in them

B.T. APPROVAL No. NS/3333/2/K/453549

Approved for connection to 2 and 4 wire Speechband Private Circuits run by British Telecommunication PLC or Kingston Communications PLC or Mercury Communication Limited.

WARNING

Interconnection directly, or by way of other apparatus, of ports marked:-
"WARNING. CONNECT ONLY APPARATUS COMPLYING WITH BS6301 TO THIS PORT"
with ports not so marked may produce hazardous conditions on the network. Advice should be obtained from a competent engineer before such a connection is made.

WARNING

Certain semi-conductor 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

The power supply module has been designed to meet relevant safety requirements. If it is necessary to replace any safety conscious component only the item quoted in the Parts List MUST be fitted. Ensure that these components are securely fastened and that all insulators and covers are fitted after servicing. Check that all warning labels are in place. If any re-wiring of the mains input supply cables is necessary the specified type MUST be used and alterations to the routeing or connections MUST NOT be made.

VHF BASE STATION
TYPE FR5000

ISSUE 2 FEBRUARY 1990

Printed in England

CONTENTS

RECEIVER MODULE AT04871/-

TRANSMITTER DRIVER MODULE AT04873/-

TRANSMITTER POWER AMPLIFIER MODULE AT04874,9/-

CONTROL MODULE AT04872/-

REMOTE CONTROL OPTION AT14920

CTCSS/VOTING/PIPTONE OPTION AT29061

FORMAT OF THE MANUAL

Division of Information

This service manual is divided into two parts. Part One deals with the general aspects of the overall equipment and is sub-divided into four sections - Product Support Policy, General Information, Commissioning-Installation-Maintenance and Shelf Assembly Mechanical Parts List. Part Two details the modules which make-up the overall equipment with each sub-section dealing with a specific unit, piece part or variant of an assembly.

Some sub-sections or variant information may not be applicable to, or required for, specific equipments supplied to a customer. Sufficient information is, however, given to enable the specific variants to be identified and the relevant information extracted.

Page Numbering

The page numbering in Part One is in the form 2.1, 2.2, 2.3 etc; where the section number precedes the page number. In Part Two the the page numbering system is in the form (AT04870/02,04) 1; where the page number is preceded by the module assembly Part No.

Part Numbering

Each assembly used in this equipment is allocated a discrete Part No. comprising the letters AT followed by five digits (to form the basic number) and, where applicable, a suffix number to indicate a variant of the basic unit (e.g.: AT04871/01 = Receiver, K Band).
A separate Part List for each module is given in the appropriate sub-section of Part Two. A list of mechanical items which comprise the shelf assembly is given in section 3 of Part One.

Note: Unless otherwise stated, all the mechanical items given in the Parts Lists are available as 'spares'. Items NOT listed are NOT available.

Test Equipment

A list of test equipment suitable for carrying out the test and alignment procedures detailed in this service manual is given on pages 3.15 and 3.16 in Part I of this manual. Thereafter the equipments are listed in abbreviated form only
(eg: 12. Marker oscillator) and assume a cross reference to this list.

Amendments

Amendments to this service manual will generally take the form of updated replacement pages; a record of amendments incorporated should be entered on the page provided.

PART I

OVERALL EQUIPMENT DETAILS

SECTION 1
PRODUCT SUPPORT POLICY

EQUIPMENT COVERED

The service policy covers the following ranges of equipment;

(a) FR5000 single channel base station - VHF bands, A,B and K

(b) Base station option cards - CTCSS/Assort and M80RCM.

FR5000 OUTLINE DESCRIPTION

The FR5000 comprises a range of base station equipments. It is of modular construction, each of the functional units being housed in a separate module and plugged into the common shelf from the front to both maximise the flexibility of options and to simplify the service and repair procedure.

The following is a list of the units of which the FR5000 is comprised;

Power supply unit	: AT04870/- used on early versions
Power supply unit	: AT04878/- used on later versions
Control Module	: AT04872/- used on all versions
Receiver Module	: AT04871/- (VHF single channel Xtal)
Transmitter Driver Module	: AT04873/
Power Amplifier	: AT04874/-
Shelf/backplane unit	: AT04875/- used on all versions
M80RCM option	: AT14920
CTCSS/Assort option	: AT29061

For the purposes of this service policy all of the above units, with the sole exception of the backplane PCB (which is totally passive), are repairable and available as Field Exchange Units (FEU's).

SERVICE LEVELS

MINIMUM TRAINING REQUIREMENT

It is essential that this product is only serviced (to any of the following four levels defined) by Philips RCS trained and authorised service workshops personnel.

LEVEL 1 SERVICE/MAINTENANCE

(a) Recommended Field actions

The first level of on-site service and maintenance of the above equipment may involve:-

(i) Routine monitoring of meter points.
(ii) Fault diagnosis by local alarm interpretation.
(iii) Checking of RF, Audio and logic interface connection integrity to the base station.
(iv) Adjustment of the following parameters in accordance with handbook information:-

Tx deviation.
Rx and Tx frequencies.
Rx audio output level and Tx audio sensitivity.
Rx squelch level.

(v) Replacement of the following field exchange parts:-
Unit front panels, fasteners and control knobs.
Externally-accessible fuses.

Details of all the above procedures appear in the FR5000 field service manual.

(b) Test Equipment Requirements

(i) F5000 metering panel.
(ii) AF 600Ω level test set.
(iii) Multimeter.
(iv) Modulation meter.
(v) Field service manual.
(vi) Frequency counter.
(vii) F5000 handset.

Note: Refer to FR5000 Service Manual TP95, Section 3, Table 3.1, for suitable types.

LEVEL 2 SERVICE/MAINTENANCE

(a) Recommended Field and Service Depot actions:-

As for level 1, and additionally:-

(i) Mechanical repairs

(ii) Replacement of following field exchange parts:-
Tx and Rx Unit crystals.
Tx and Rx Crystal oven assembly.

(iii) Replacement of following FEU's:-
Control module audio card.
Control module logic card.
Control module front panel and PCB assembly.
M80RCM Option assembly.
CTCSS/Assort Options card.
Power supply unit.
Receiver unit.
Transmitter driver unit.
Transmitter power amplifier.
Control module.

(iv) Replacement of the following workshop exchange unit:-
Power amplifier control board

(v) Adjustment of replacement modules as in level 1, but in addition;
Setting of RF output power.
Measurement of Rx sensitivity.
Distortion measurement. (Tx & Rx)
Customisation of control module by link selection.
Adjustment of metering controls.
Station checks and air check.
Alignment of replacement RF units on customer frequency.

(b) Test Equipment requirements

Additional to level 1:-

(i) RF power meter and attenuators.
(ii) RF signal generator.
(iii) Distortion analyser.

Note: Refer to FR5000 Service Manual TP95, Section 3, Table 3.1, for suitable types.

LEVEL 3 SERVICE/MAINTENANCE

Level 3 is defined as 'servicing of boards and modules to component level'.

Workshop Facilities Required

Level 3 Service/Maintenance is to be undertaken at well equipped workshops with suitable skill level available and necessary environment and equipment to maintain the original quality standards for the product.

Test Equipment requirements

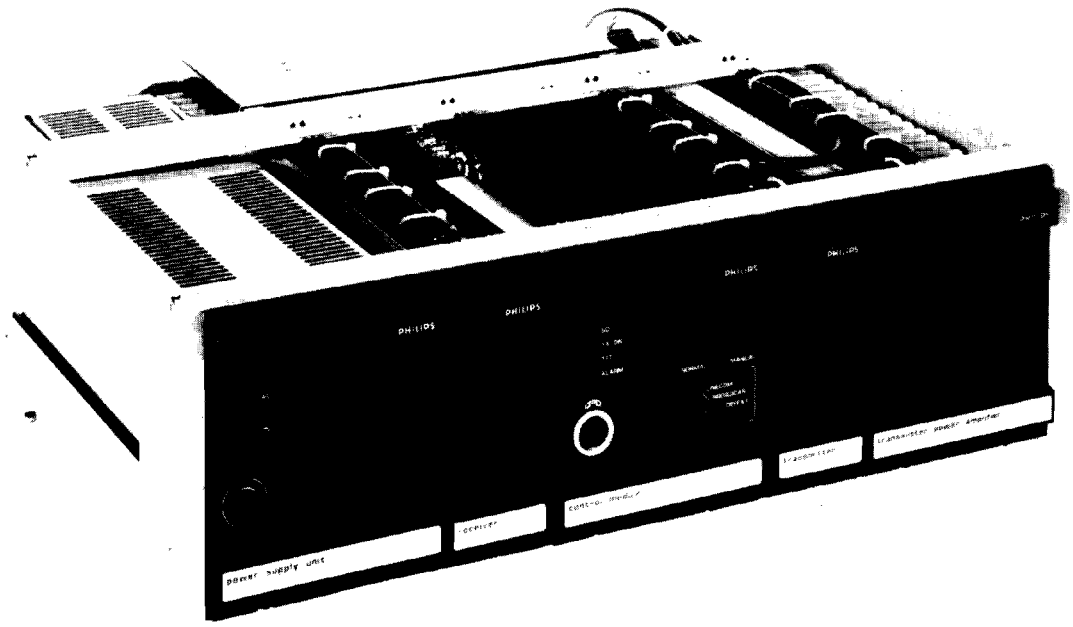
(i) Full Service Manual (TP95)
(ii) Full complement of test equipment as detailed in TP95, Section 3, Table 3.1.

LEVEL 4 SERVICE/MAINTENANCE

This level of repair is carried out at a Central Repair Unit and is intended to cover the complete cosmetic, electrical and mechanical repair of faulty radio units.

The units repaired by the Central Repair Unit are designated as Field Exchange Units (FEU's). All faulty and repaired FEU's shall be routed to and from the Central Repair Unit via Consumer Service. It is essential that faulty and repaired units are packed in a manner that prevents any damage during transit.

SECTION 2
GENERAL INFORMATION



INTRODUCTION

The FR5000 series of frequency modulated base station equipments is designed to meet a wide range of requirements for high quality, versatility and adaptability in the VHF frequency band, including Band III.

A modular approach to the construction of the FR5000 series has been adopted with sub-units sliding into proprietary shelf fittings. Interconnection between units is via flexible ribbons interfaced on a backplane PCB. Flexible coaxial cables allow external receiver and transmitter connections to be made to the fixed shelf bulkhead, and enables all but the power supply module to be withdrawn from the front of the shelf whilst the base station is operational.

Five modules are fitted into FR5000 series shelf:

- Power supply
- Receiver
- Control
- Transmitter driver
- Transmitter power amplifier

The use of individual modules provides for rapid on site repair by module replacement and enables faulty units to be repaired and aligned in a workshop environment.

All 'site' level adjustments are carried out on the control module; all other units are pre-aligned. Faulty units can, therefore, be replaced with the minimum of user disruption.

SUMMARY OF DATA

General

Bands	A9 146-174MHz BO 132-156MHz KO 174-225MHz	
Temperature Range	-30 to +60 °C	
Operational Temperature Range	-30 to +70 °C (Performance to specification not guaranteed)	
Storage Temperature Range	-40 to +80 °C	
Power Supply (AC)	115V or 220-240V ±10% 47-60Hz (Fitted with 24V DC standby)	
Power Supply (DC)	24V -10% +20% +ve or -ve chassis	
Channel Spacing	12,5kHz 20kHz 25kHz	
No. of Channels	Single channel only	
Frequency Stability	±2ppm	
Connectors	Engineers Handset	7 way DIN
	600Ω lines	5 way DIN
	AC Supply input	3 way IEC
	DC Supply input	3 way AMP
	RX RF input	N type
	TX RF output	N type
	Facilities	37 way D
	Metering	15 way D
Indicators	Power supply module:	DC supply on
		AC supply
		DC supply
	Control module:	Squelch
		Tx on
		Talkthrough
		Alarm
		Normal
		Manual

Note: Reference should be made to Part II of this manual for individual detailed module specifications.

CRYSTAL INFORMATION

Note: fc = allocated carrier frequency

The Transmitter frequency is determined by the crystal in the Tx oscillator circuit of the transmitter driver module. The crystal is a type C5691 (Philips specification YE00920) providing 2ppm stability between -30 and +60°C. The crystal is fitted within an oven assembly. The frequency of the crystal is calculated as follows:

Carrier Frequency Band
A9 = 146 to 174MHz
BO = 132 to 156MHz
KO = 174 to 225MHz

Crystal Frequency (fx)
$\frac{fc}{12}$

Crystal Frequency Range
A9 = 12,175 to 14,5MHz
BO = 11 to 13MHz
KO = 14,5 to 18,75MHz

The Receiver frequency is determined by the crystal in the local oscillator circuit of the receiver module. The crystal is a type C5692 (Philips specification YE00921) providing 2ppm stability between -30 and +60 °C. The crystal is fitted within an oven assembly. The frequency of the crystal is calculated as follows:

Band	Carrier Frequency	Crystal Frequency	Crystal Range
A9	146 to 174MHz	$fx = \frac{fc - 21,4}{3}$ MHz	41,533 to 50,867MHz
BO	132 to 156MHz	$fx = \frac{fc - 21,4}{3}$ MHz	36,867 to 44,867MHz
K1	174 to 208,4875MHz	$fx = \frac{fc + 21,4}{4}$ MHz	48,85 to 57,475MHz
K2	208,5 to 225MHz	$fx = \frac{fc - 21,4}{4}$ MHz	46,775 to 50,9MHz

MECHANICAL CONSTRUCTION

The mechanical design of the equipment is based on the use of a standard 483mm (19 inch) rack or a 4, 6 or 12 unit cabinet. All interconnections are made via the backplane so sufficient space should be allowed on installation for the withdrawal of equipment.

The base station comprises five sub-modules - power supply, receiver, control, transmitter driver and transmitter power amplifier. Each module is supported on a runner and is withdrawn from the front of the shelf.

Interconnection between modules is via flexible ribbon cables connected to the backplane. Flexible coaxial cables allow external connections to the receiver and transmitter to be made on the fixed shelf bulkhead. With the exception of the power supply module, checks and adjustments may be made on withdrawn modules whilst the equipment remains operational.

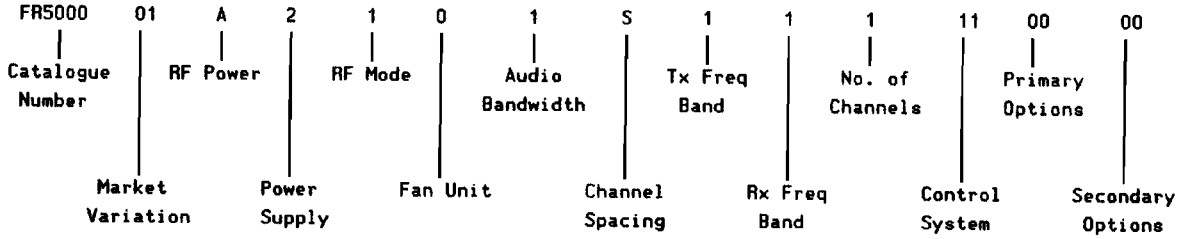
ANCILLARY EQUIPMENT

The following ancillary equipment is available for use with the FR5000 base station. These items are not listed as standard options, are not supplied with the standard equipment and do not form part of the equipment code structure.

Handset Part No. FH00653

EQUIPMENT CODING

The 17-digit code structure comprises a number of options and allows any version of this equipment to be specified. This code is shown on the equipment label, attached to the rear of the unit. A typical code number and its breakdown are given below.



Market Code

01	Standard production
T1	Trunking Applications only

RF Power

A	50 Watts	A9 and B0 Bands only
1	30 Watts	
2	25 Watts	
3	15 Watts	
4	10 Watts	
5	6 Watts	
6	1 Watt	
N	Less Tx Modules, No Tx driver, No Tx PA (Std Var 2 Code N only)	

Power Supply

1	AC mains 220/240V with 24V DC standby +ve or -ve chassis
2	AC mains 110-115V with 24V DC standby +ve or -ve chassis
3	24V DC only +ve or -ve chassis
4	As Code 1 less loudspeaker
5	As Code 2 less loudspeaker
6	As Code 3 less loudspeaker

RF Mode

1	Single antenna working with changeover relay (simplex only)
2	Two antenna
3	Single antenna with isolator and changeover relay (simplex only)
5	Two antenna plus isolator
8	Single antenna with isolator and Duplexer

Note: Duplexer to be ordered separately.

Fan Unit

0	Less Fan Unit	
1	With Fan Unit	Single antenna working with changeover relay (simplex only) Two antenna

Note: Fan assisted cooling is only necessary when greater than 4 x FR5000 (30W) or 2 x FR5000 (50W) equipments are stacked in one cabinet. The ancillary fan shelf must be centrally located within the FR5000 equipments. Spacing between equipments in all cases must be at least 1u and vented. The use of ancillary shelves is permissable if fronted with a 1u vented panel.

Audio Bandwidth

1	300-3000Hz

Channel Spacing

S	12,5kHz
R	20kHz
V	25kHz

TX Frequency Band

N	Less Tx Modules		
1	174 to 225MHz	K0 Band	Not available on 50 Watt versions
2	146 to 174MHz	A9 Band	
3	132 to 156MHz	B0 Band	

RX Frequency Band

N	Less Rx Module	
1	174 to 225MHz	K0 Band
2	146 to 174MHz	A9 Band
3	132 to 156MHz	B0 Band

Number of Channels

0	Single channel, crystal controlled, less crystals
1	Single channel, crystal controlled, with customer crystals

Control System

00	Less control module

Series 10 - Extended Control

11 Standard systems base station or link for control by on-site interconnected equipment (600Ω audio + DC). Maximum distance 100 metres Simplex, duplex or T/T. 4 Wire only.

Note: Less local 2970Hz Keytone detection and generation.

12 As code 11 plus local 2970Hz Keytone detection and generation plus 2-wire line controlled limited facility (Tx/Rx only).

13 As code 11 plus local 2970Hz Keytone detection and generation plus 4-wire line controlled limited facility (Tx/Rx only).

Series 20 Remote Control M80 Signalling 2 Wire

21 Transmit/Receive + Channel change control, 2 wire

22 Transmit/Receive + 3 Facilities (Line intercom + squelch defeat + controlled T/T) + Channel change control, 2 wire

23 Transmit/Receive + 3 Facilities + Simple line fail T/T + Channel change control, 2 wire

24 Transmit/Receive + 3 Facilities + Simple line fail T/T + Supervisories + Channel change control, 2 wire

Series 30 Remote Control M80 Signalling 4 Wire

31 Transmit/Receive + Channel change control, 4 wire

32 Transmit/Receive + 3 Facilities (Line intercom + squelch defeat + controlled T/T) + Channel change control, 4 wire

33 Transmit/Receive + 3 Facilities + Simple line fail T/T + Channel change control, 4 wire

34 Transmit/Receive + 3 Facilities + Simple line fail T/T + Supervisories + Channel change control, 4 wire

Primary Options (Installation)

00 Less installation items

01 Mounting for stack rack, less connectors

04 Mating connectors

05 01 + 04

Secondary Options (selective calling)

00 No selective calling

01 Voting Encoder/CTCSS Encoder/Decoder

02 Voting Encoder

03 CTCSS Encoder/Decoder

04 CTCSS Decoder only

Note: (i) Secondary option 2 codes 1 + 2 not available with 2-wire systems.
(ii) 2970Hz Rx call should not be used with voting.

OUTLINE TECHNICAL DESCRIPTIONS

Power Supply Unit

Three versions of this module provide for operation from an AC supply of either 115V or 240V, or from a nominal 24V DC supply. In each, an unregulated 24V DC output is provided for use on the transmitter power amplifier module and the dual regulators provide two +18V outputs for use on the other modules.

Front panel LEDs indicate the availability of the two types of input and the presence of the DC outputs to the other modules within the equipment. If both AC and DC supplies are present, the relay circuit will select the AC supply. Otherwise it will select the DC supply. However, in the event of an AC over-voltage, the relay circuit will select the DC supply.

This module also houses the AF monitor amplifier and loudspeaker. Provision is made for connection of an external loudspeaker.

Receiver

Received signals from the antenna are routed through the input filter to the RF amplifier and three-stage RF filter.

The injection frequency is provided by a temperature controlled crystal oscillator and two-stage multiplier. The local oscillator signal is mixed with the RF input to produce a 1st IF of 21,4MHz. This is filtered by FL1 and the output matched to the main IF amplifier. The 2nd oscillator, 2nd IF amplifier and discriminator are all housed within IC1, the 2nd IF of 455kHz is filtered in FL2.

Audio from the discriminator is routed as follows:

(i) via a variable gain amplifier to the Rx AF processing circuit on the control module audio board.

(ii) via the noise amplifier and filter to provide an input to the noise operated squelch gate on the logic board of the control module.

A sample of the 1st IF is applied to the metering amplifier and detection circuit producing a DC output which controls the carrier level squelch gate on the logic board of the control module and also provides a carrier level output to the facilities socket for voting use etc.

The injection frequency is also monitored to provide an injection fail indication facility.

Control Module

The local control module comprises an audio board, logic board and front panel assembly. The module houses all the AF processing and switching circuits for both the receiver and transmitter, the squelch control circuits, the logic for the switching circuits and status indicators. The audio inputs may be carried on either 2-wire or 4-wire lines.

Audio routeing for the receiver and transmitter is achieved using a series of gates which are controlled by outputs from the logic board.

Unprocessed audio from the receiver module is filtered, de-emphasised and passed to the squelch gate. This gate is controlled by the carrier and noise squelch circuits on the logic board which are derived from either the filtered noise output or carrier level monitor output on the receiver module. Audio from the squelch gate is applied to the line driver amplifiers and then fed via the line transformers to the 600Ω line. It is also fed to the engineer's handset and monitor amplifier.

Tx audio is derived from either the 600Ω line or the engineer's handset. The latter is applied directly to the pre-emphasis amplifier. The line audio is amplified and then fed, via the sensitivity control, to a high-pass filter and on to the line audio gate. The gated audio is pre-emphasised and passed to the limiting circuit. The output from the limiter is used to control a compressor which in turn adjusts the gain of the pre-emphasis amplifier. Further amplification, controlled by the deviation pot, is followed by a summing network which combines the audio with the CTCSS input.

A low pass filter removes the unwanted harmonics. The output is matched, via a buffer amplifier, to the transmitter driver.

The control module front panel houses the status indicators and provides for the connection of an engineer's handset (EHS). Used in conjunction with the manual/normal switch, the EHS is able to control the operation of the equipment and provide a number of engineering functions.

All front panel indicators are controlled from the logic board, whilst audio routeing for the EHS is carried out on the audio board.

The equipment functions, determined by pre-set links, and all 'site' level adjustments are made at the control module thus restricting any 'on site' adjustments to one module. This allows servicing and maintenance to be performed without disruption to the user.

Transmitter Driver

The transmitter driver converts the audio signal processed by the control module into an phase modulated signal providing a low level RF output to the transmitter power amplifier.

Incoming audio from the control module is fed, via the deviation control, to the pre-emphasis amplifier and to the modulation monitor circuit.

The TX key line controls the bias on two RF amplifier stages and provides the supply to the power control circuit. The line is gated to prevent keying during crystal oven warm-up.

The ovened crystal oscillator produces an output which is phase modulated by the audio; buffer stages isolate the modulator.

The modulator output is multiplied by a single tripler stage and two frequency doublers, and then fed to the driver amplifier and output stage. A filter suppresses harmonics of the output signal, which is fed to the power amplifier module.

Power level control is incorporated which maintains a constant output and compensates for fluctuations in temperature and voltage.

Fault detection circuits provide indication of RF failure, crystal oven warm-up or over-temperature.

Transmitter Power Amplifier

The 50W power amplifier delivers a minimum of 50W into a 50Ω load; on 30 Watt versions the transmitter power amplifier output is greater than 30W into a 50Ω load and may be continuously adjusted down to 6W using the POWER SET control.

In the case of the 30W module, the 24V unregulated DC supply applied to the module is used by the switching regulator to provide the voltage rail for the power amplifier circuit. This arrangement enables the RF output level to be controlled by adjusting the supply rail via the POWER SET feedback loop on the PA control board. An external control line enables the power to be remotely adjusted.

50 Watt modules are slightly different, in that the output stage is fed directly from the 24V unregulated supply, with power control being achieved via the driver transistor only.

A two-tier thermal protection circuit enables the module to register an initial over-temperature condition but continue operating at half power, or shutdown completely if the temperature increase is continued.

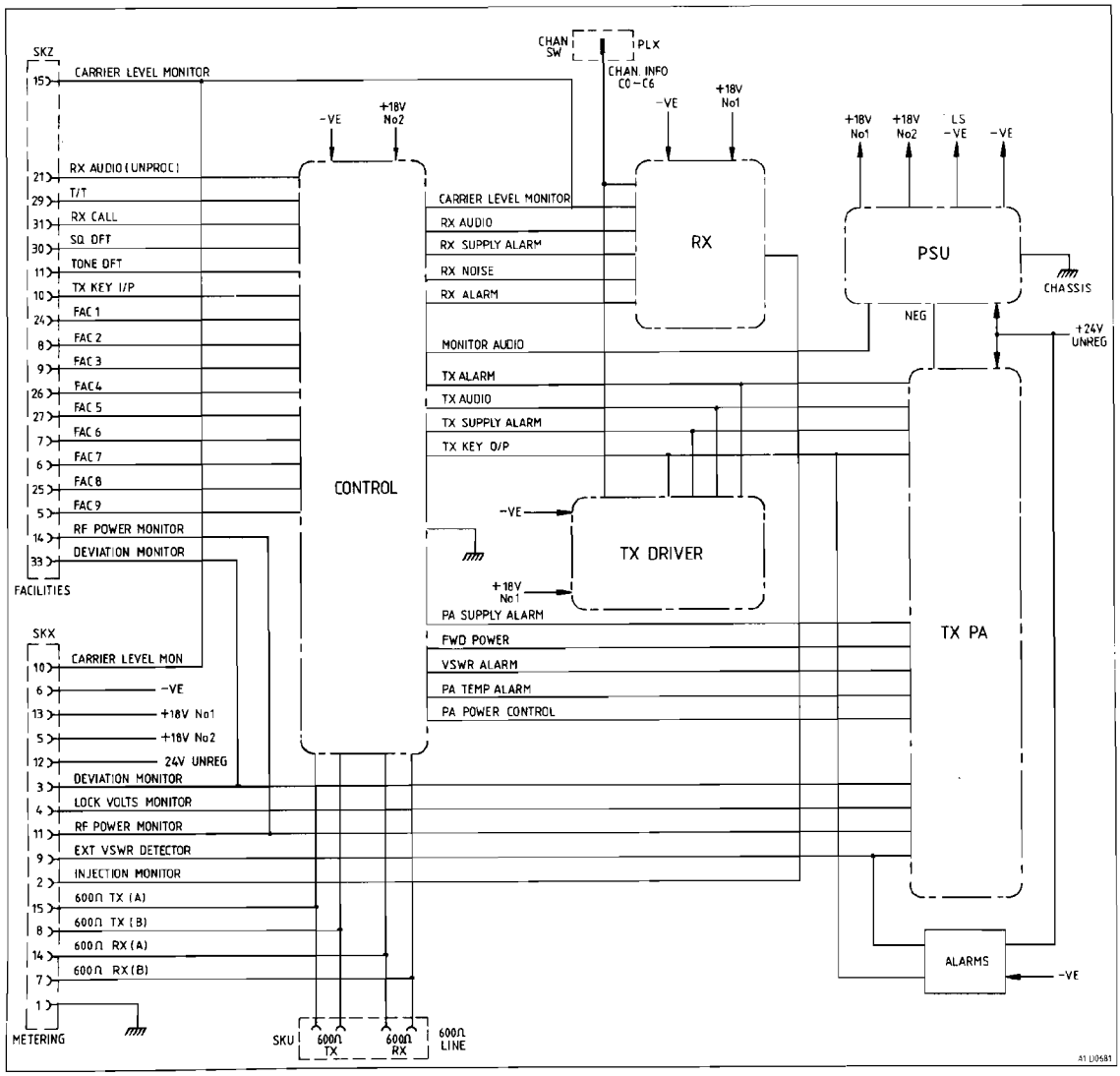


Fig.2.1 Outline Block Diagram - Local Control

LINKING INFORMATION

Links are provided on the backplane PCB assembly, the TX driver and control modules to enable the control functions and characteristics of the equipment to be altered. These are factory set according to the options specified when the equipment is ordered. Further customisation in the field may be carried out.

Backplane Links

LK1 INTERNAL LS

Internal loudspeaker operation.

A-B Internal loudspeaker enabled
B-C Internal loudspeaker disabled

LK2 PA SUPPLY ALARM

Operation of PA supply alarm.

A-B Alarm enabled
B-C Alarm disabled (for when the PA module is not fitted)

LK3 TX ON INDICATION

Connects TX ON indication (and TX power alarm circuit) to either FORWARD POWER (PA fitted) or TX KEY (PA not fitted).

A-B TX KEY (PA not fitted)
B-C FORWARD POWER (PA fitted)

PLV-T-W 600Ω LINKING

Provides 600Ω interface connection at either the Krone block (for direct connection to line) or at the 37-way facilities connector (for connection to local equipment).

PLV-PLT 600Ω in/out on DIN socket
PLV-PLW 600Ω in/out on FACILITY socket (local control)

TX Driver Module Links

LK1 INT/EXT OSC DRIVE

Allows use of external drive source in place of on-board crystal oscillator.

Note: The use of an external drive source also requires the addition of an input socket on the module.

A-B Internal (standard)
B-C External

LK2-3-4 BAND SPLIT LINKS

These are solder bridge type links which should be linked according to the alignment frequency of the module.

Bridged Alignment at or below 208,4875MHz
Open Alignment at or above 208,5MHz

LK5 MOD MONITOR SELECT

Allows the modulation monitor to be configured as either an analogue or logic (open collector) output.

A-B Analogue (standard)
B-C Open collector

LK6 OSCILLATOR KEYING

Allows the internal oscillator either to run continuously or be keyed for single frequency simplex operation.

A-B Keyed
B-C Continuous (standard)

Control Module Links

LK1 REM/LOC FAC SELECTION

Local Control versions do not require any links to be fitted.

Basic M80 remote system only requires two links to be fitted (Squelch Defeat + Talkthrough).

All 15 links factory fitted in remote position.

For each option:

A-B Remote
B-C Local

LK2 DISABLE REMOTE

Used only when an RCM is fitted. Temporarily restores local control for all functions, mainly used as a test facility. Control defaults to local if RCM is not fitted.

A-B Remote enabled (standard)
B-C Remote disabled

LK3 UNDEDICATED FAC LINKING

The facility connections on PLB can be reconfigured, if necessary, to provide alternative functions which are available on pins distributed around (mainly) the logic PCB. The primary functions are linked to these pins by 9 links which would normally all be fitted. Any number of these links may be removed in order to link in the alternative functions required using a Berg-Berg wire link.

LK3 pin 1A to pin 9A FAC1 to FAC9 on facility connector

Primary functions - Normally linked directly to LK3 pins 1A to 9A:

LK3 pin 1B Manual Alarm

Open collector output. Pulls low to indicate MANUAL mode selected from the front panel (ie: external control disabled).

LK3 pin 2B Disable TX

Control input. Prevents the transmitter from being keyed (including remote keying using 2970Hz tone) except for talkthrough operation and keying from the front panel as an engineering function.

LK3 pin 3B Station Alarm

Open collector output. Combined TX/RX alarm. Normally pulled down, releases to indicate an alarm condition in the transmitter driver module, PA module, receiver module or equipment connected to Ext. Alarm input.

LK3 pin 4B Disable ASSORT

Control input. Disable ASSORT encoder.

LK3 pin 5B Disable CTCSS Tone

Control input. Prevents CTCSS tone encoder (internal or external) from modulating transmitter.

LK3 pin 6B Disable Talkthrough

Control input. Prevents talkthrough from being selected (including CTCSS controlled talkthrough) except from the front panel as an engineering function.

LK3 pin 7B Ext. Alarm Input

Control input. To signal alarm from ancillary equipment. Generates station alarm output.

LK3 pin 8B Disable RX

Control input. Disables receiver audio and logic outputs. (Unprocessed RX audio and carrier level monitor remain active).

LK3 pin 9B — Tone Controlled Facility

Open collector output. Pulls low when signal with valid CTCSS tone is received.

Alternative functions - available on individual pins which may be linked to LK3 pins 1A to 9A using a wire link:

Note: With the exception of pins P16, P25 and P26, these pins are located on the control logic PCB.

P1 — -ve

P2 — On Line Data Enable

Control input. Interrupts RX audio to line and enables On Line Data input for sending to line.

P3 — Carrier Cont. Facility

Open collector output. Pulls low when signal received with or without valid CTCSS tone

P4 — Ext. CTCSS Tone

Audio input for CTCSS tone generated internally.

P5 — Carrier SQ DEF

Control input. Defeats carrier squelch but leaves noise squelch operational.

P6 — Carrier SQ Desens

Control input. Desensitises carrier squelch setting by 6db.

P7 — PA Power Control

Control input. Reduces the transmitter output power by 3db (not 1W version).

P8 — PA Power Control

Control input. Reduces the transmitter output power by 6db (not 1W version).

P9 — ASSORT override

P10/11 — TR1 (base/collector)

For buffering logic outputs.

P12/13 — TR16 (base/collector)

For buffering logic outputs.

P14	EHS Enable Control input. Enables engineers handset to function (in broadcast mode) with switch in NORMAL position (ie: external control not interrupted).
P15	EHS MIC. Enabled Open collector output (when linked via TR1 or TR16 on the logic board). Pulls low to indicate that the engineers handset is in use and the microphone is enabled.
P16	Tone Gen O/P - (on Control Audio PCB) Audio output from 2970Hz tone RX CALL generator.
P17	TX Alarm Latch Control input. Enables internal latch in TX alarm circuit for simple main/standby applications.
P18	TX Alarm Output Open collector output (when linked via TR1 or TR16 on the logic board). Normally pulled down, releases to indicate an alarm condition in the TX driver module or PA module.
P19	RX Alarm Output Open collector output (when linked via TR1 or TR16 on the logic board). Normally pulled down, releases to indicate an alarm condition in the receiver module.
P20	EXT RX Alarm I/P Control input. Can be linked to RX squelch logic to generate RX alarm on carrier fail for link applications.
P21	Not TX Logic output. Can be linked to TX alarm latch to give alarm reset when TX unkeyed for simple main/standby applications.
P22 & P23	Spare (to options PCB)
P24	Carrier SQ Open collector output (when linked via TR1 or TR16 on the logic board). Independent output from carrier squelch detector only. Pulls low to indicate carrier squelch threshold exceeded.
P25	-ve - (on Control Audio PCB)

P26 Ext CTCSS Tone - on control audio board.

TP10 2970Hz Detector

Open collector output (when linked via TR1 or TR16 on the logic board). Pulls down when a 2970Hz TX KEY tone has been detected.

LK29(pin A) On-line Data

Audio input. Sends data to line via line level control. Gated by On-line data enable.

LK4 TT HANG TIME

Provides an optional 2 second hang time before carrier drops out.

A-B No hangtime
B-C 2 seconds hangtime (standard)

LK5 SQ OPEN TIME

Selects squelch open and closing time option.

Note: The slow open/fast close setting, whilst reducing squelch tail, may reduce intelligibility on weak signals with flutter.

A-B Slow open/fast close
B-C Fast open/slow close (standard)

LK6 DISCONNECT CARRIER SQ

Disconnects the carrier squelch signal from the internal squelch logic. Used for systems where the carrier squelch detector is used to drive external logic only.

A-B Carrier squelch connected (standard)
B-C Carrier squelch disconnected.

LK7 DISCONNECT RX ALARM

Disconnects RX alarm signal from STATION ALARM output and from front panel alarm indication.

A-B RX alarm connected (standard)
B-C RX alarm disconnected

LK8 SIMPLEX

Mutes the receiver during transmissions for single frequency simplex operation. Also inhibits talkthrough.

Linked by factory for duplex except for single antenna working option or when TX frequency = RX frequency.

A-B Simplex operation
B-C Duplex operation

LK9 DISABLE RX ON RX ALARM

Mutes the receiver when an RX alarm is present (eg: while crystal oven is warming up).

A-B RX disabled on RX alarm
B-C RX not disabled on RX alarm (standard).

LK10 CTCSS CONTROL SELECT

Selects function to be controlled by the CTCSS decoder. Factory linked for squelch except on CTCSS controlled talkthrough option.

1A-1B Squelch
2A-2B Talkthrough
3A-3B RCM facility A
4A-4B RCM facility B

Note: An open collector output is available for CTCSS control of external equipment regardless of link position.

LK11 RX CALL TYPE

Allows SQ DEFEAT to generate an RX CALL signal to provide downward compatibility with 4000 series equipments.

A-B SQ DEF generates RX CALL
B-C SQ DEF does not generate RX CALL (standard)

LK12 PIPTONE ENABLE

Provides transmitter keying whenever squelch opens to enable the transmission of piptone generated on option PCB.

A-B Piptone enabled
B-C Piptone not enabled (standard)

LK13 RX CALL TONE ENABLE

Provides control of 2970Hz generator either from RX CALL (to give 2970Hz RX CALL tone superimposed on RX audio when squelch opens), or from alternative source. (ie: EHS pressel for use as ASSORT override). Output must also be linked for this alternative.

A-B RX CALL tone enabled
B-C RX CALL tone not enabled (standard)

See also LK32.

LK14 INT/EXT CTCSS TONE

Selects either internal or external CTCSS tone.

A-B Internal CTCSS tone (standard)
B-C External CTCSS tone

LK15 TX PRE-EMPHASIS

Allows TX audio response to be set to flat instead of pre-emphasised (for possible link applications).

A-B Pre-emphasised TX audio (standard)
B-C Flat TX audio

LK16 TX NOTCH ALIGN

Normally fitted. Removal disables Notch 2 to facilitate alignment of Notch 2.

LK17 TX NOTCH ALIGN

Normally fitted. Removal disables Notch 1 to facilitate alignment of Notch 2.

LK18 TX NOTCH IN/OUT

Selects 2970Hz notch filter in TX audio path.

A-B Notch filter enabled (standard for remote)
B-C Notch filter disabled (standard for local)

LK19 TX CHAN SPACING

Controls transmitter deviation. Factory linked according to channel spacing.

1A-1B 12,5kHz spacing
2A-2B 20kHz spacing
3A-3B 25kHz spacing

LK20 TX 600Ω INPUT ATTENUATION

Provides 20db gain reduction for high line input levels.

A-B Attenuation out
B-C Attenuation in (standard)

LK21 2-WIRE/4-WIRE OPERATION

Selects 2-wire or 4-wire operation

A-B 4-wire (standard)
B-C 2-wire

LK22 2970HZ DETECTOR NARROW/WIDE

Allows 2970Hz tone detector to detect 2300Hz and 2500Hz FSK tones (as per RCP80).

A-B Narrow (standard)
B-C Wide

LK23 2970HZ DETECTOR ENABLE

Enables 2970Hz TX tone detector. Factory linked to DISABLE for local control options, ENABLE for M80 remote options.

A-B Detector disabled
B-C Detector enabled

LK24 4-WIRE INTERCOM

Provides an intercom path between contollers on a 4-wire M80 system.

1A-1B Intercom path post notch
2A-2B Intercom path pre-notch
3A-3B No intercom path (standard)

LK25 RX AF PATH

RX audio routed either directly or via CTCSS options PCB. Factory linked for 'direct' except when CTCSS option PCB is fitted.

A-B Direct RX audio
B-C RX audio via options PCB

LK26 RX DE-EMPHASIS

Allows RX audio response to be set to flat instead of pre-emphasised (for possible link applications).

A-B De-emphasised RX audio (standard)
B-C Flat RX audio

LK27 RX NOTCH IN/OUT

Selects 2970Hz notch filter in RX audio.

A-B Notch filter disabled (standard for local)
B-C Notch filter enabled (standard for remote)

LK28 RX 600Ω OUTPUT ATTENUATION

Provides 20db or 40db of attenuation of RX 600 Ω output for low output level applications.

1A-1B 40db attenuation
2A-2B 20db attenuation
3A-3B Attenuation out (standard)

LK29 INT/EXT LINE DATA

Allows data to line to be fed from external source (special applications only).

A-B Internal line data (standard)
B-C External line data

LK30 SUPPLY ALARM DEFEAT

Prevents continuous alarms from being generated when the equipment is to be operated with one or more modules missing.

Can also be used as a fault finding aid by short circuiting each pair in turn to determine which module is generating a supply alarm.

Factory set with no links fitted.

1A-1B Defeat PA supply alarm
2A-2B Defeat TX driver supply alarm
3A-3B Defeat RX supply alarm

See also backplane link LK2.

LK31 DISABLE RX CALL OSCILLATOR

Disables 2970Hz RX CALL generator master oscillator to avoid unnecessary spurious radiation when not in use.

A-B Oscillator disabled (standard)
B-C Oscillator enabled

See also LK13.

Table 2.1 - Control Module Standard Linking

LK1	Remote/local facility	-	
LK2	Disable remote	A-B	Enabled
LK3	Undedicated Facilities	-	
LK4	T/T hang time	B-C	Long
LK5	SQ open time	B-C	Fast open/slow close
LK6	Disconnect carrier SQ	A-B	Connected
LK7	Disconnect RX alarm	A-B	RX alarm connected
LK8	Simplex	A-B	Simplex
LK9	Disable RX on RX alarm	B-C	Not disabled
LK10	CTCSS control select	1A-1B	Squelch
LK11	RX call type	B-C	Normal
LK12	Piptone enable	B-C	Not enabled
LK13	RX call tone enable	B-C	Not enabled
LK14	Int/ext CTCSS tone	A-B	Internal
LK15	TX pre-emphasis	A-B	Pre-emphasised
LK16	TX notch align	IN	Non alignment mode
LK17	TX notch align	IN	Non alignment mode
LK18	TX notch in/out	B-C	Local control
LK19	TX channel spacing	1A-1B	12,5kHz
LK20	TX 600 Ω I/P attenuator	B-C	In
LK21	2-wire/4-wire operation	A-B	4-wire
LK22	2970Hz detector narrow/wide	A-B	Narrow
LK23	2970Hz detector enable	A-B	Disabled
LK24	4-wire intercom	3A-3B	No intercom
LK25	RX AF path	A-B	Direct
LK26	RX de-emphasis	A-B	De-emphasised
LK27	RX notch in/out	A-B	Local control
LK28	RX 600 Ω O/P attenuator	3A-3B	Attenuation out
LK29	Int/ext line data	A-B	Internal
LK30	Supply alarm defeat	OUT	No defeat
LK31	Disable RX call oscillator	A-B	Disabled

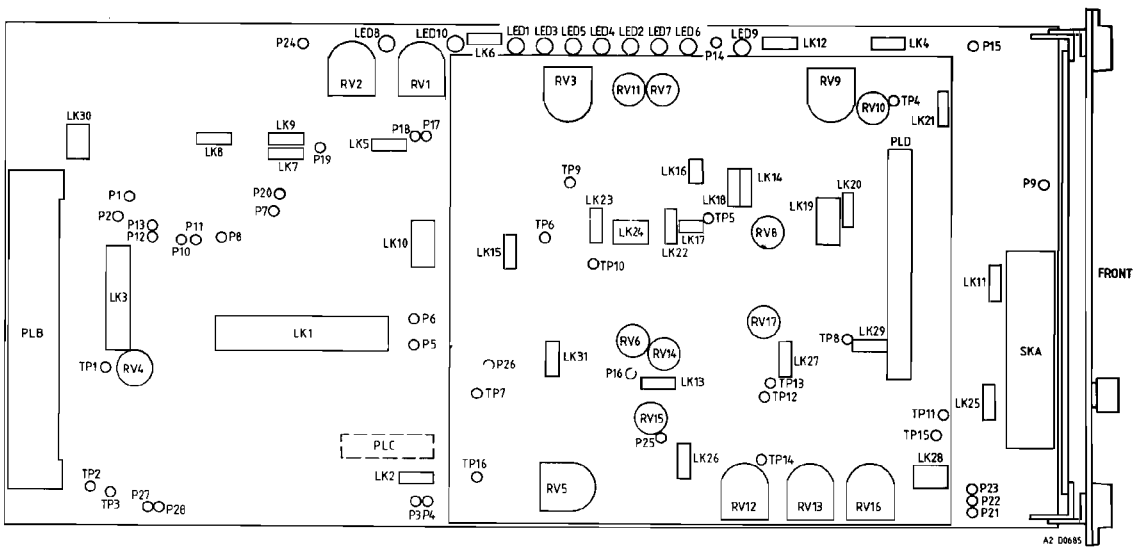


Fig. 2.2 Control Module Links

SECTION 3
INSTALLATION-COMMISSIONING-MAINTENANCE

INSTALLATION

Unpacking & Checking

Equipments are despatched and transported in tailored cardboard packages as detailed in Fig. 3.1.

Note: *It is strongly recommended that the packaging is retained for future transportation of modules.*

The overall packaging caters for a single equipment complete with all acessories and ancillary items (e.g. Handset, Duplexer etc.) in a single package.

The 'heavier' units of the base station (power supply unit and transmitter power amplifier) are removed from the shelf housing and individually packed in tailored cartons, with an additional carton provided for the 'accessories'. The shelf with other units fitted is packed in a separate carton. These inner packages are then fitted into a single outer carton fitted with suitable packing material.

On unpacking, each item should be checked against the contents list and thoroughly inspected for any signs of physical damage.

Note: The Company, or their authorised agents, must be advised by letter, within ten days of equipment receipt, of any damage or shortages found.

Shelf Installation

The base station shelf is supplied for installation into either a standard 483mm (19 inch) rack or a 4, 6 or 12 unit cabinet. All external interconnections are made via the backplane and sufficient space all around the unit should be allowed for access when in the withdrawn position. A depth of approximately 300mm in front of the equipment should be allowed for the withdrawal of the base station.

CAUTION

Do not transport the base station as a complete installation in the shelf housing. Failure to comply with this recommendation may lead to damage to the shelf housing.

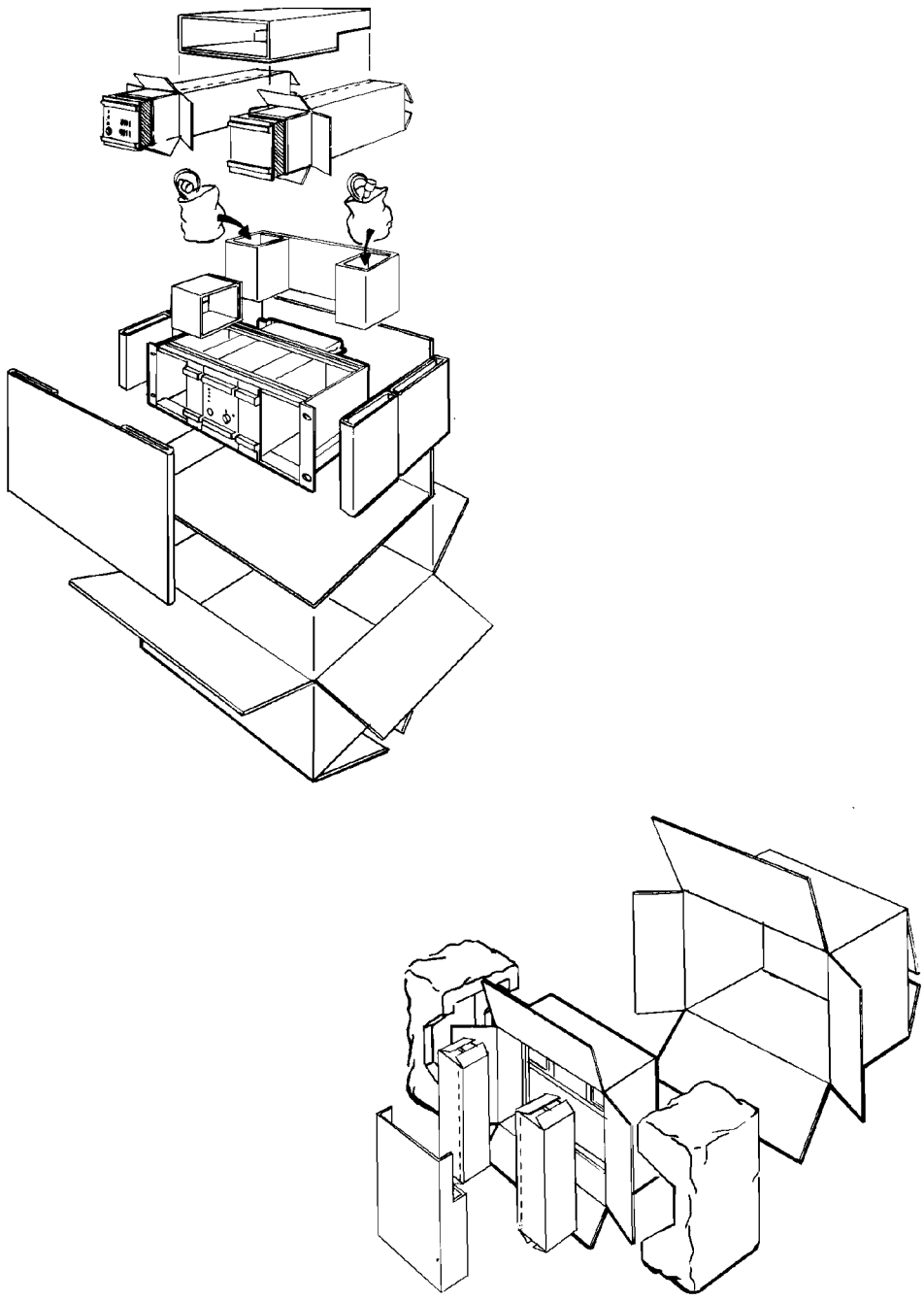


Fig. 3.1. Packaging Arrangements

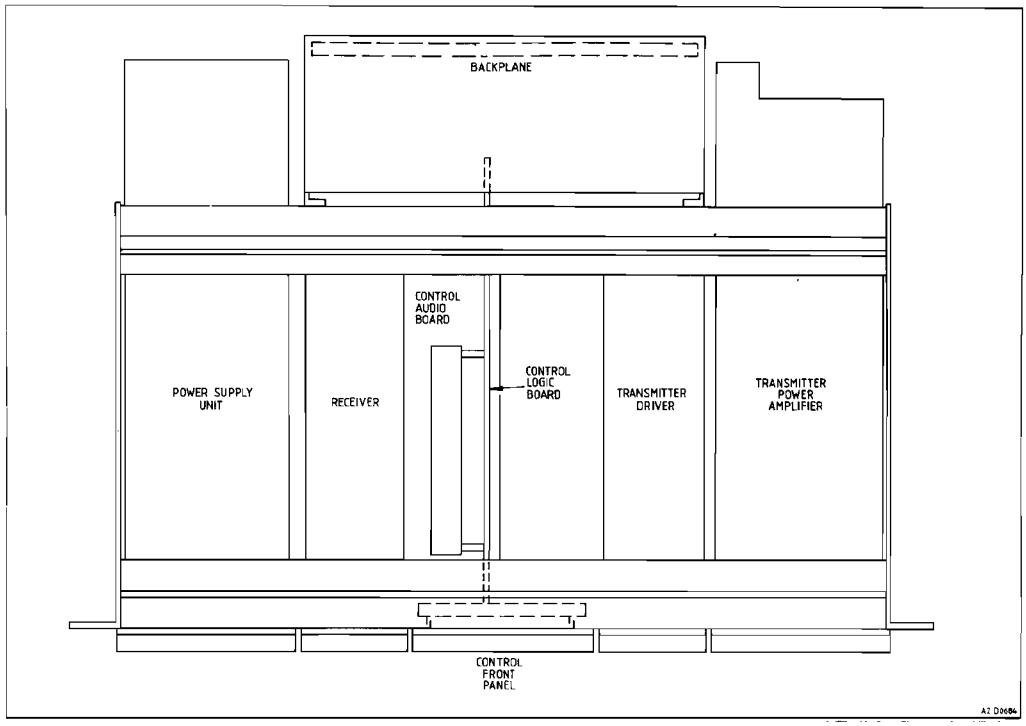


Fig. 3.2 Shelf Layout Diagram

Installation of Units

The power supply and transmitter power amplifier modules are packed separately and require to be installed into the main unit.

1. Power Supply Module

(a) Check that the power supply module is the correct version for the local supply.

(b) AC operated versions

(i) Check that the unit fuse rating is correct.

Supply Voltage	Module Version	Fuse Rating
240V AC	/01	2,5A
115V AC	/02	5A

(ii) If the DC standby supply is not connected ensure that the selector plug is fitted into the DC input connector. This connects the PSU -Ve line to chassis earth.

(iii) If a DC standby supply is connected refer to para.(d).

(c) 24V DC operated versions

(i) Connect the 24V supply to the DC input connector using the socket and lead assembly supplied with the PSU.

(ii) Fit an 'in-line' fuse (supplied with the equipment bagged items) to each (+Ve and -Ve) DC supply line.

(d) DC standby supply

WARNING

Most types of battery contain corrosive liquids and emit explosive gases. Therefore, when installing or charging such types of battery it is essential to follow the battery manufacturers safety recommendations.

(i) This equipment is capable of being supplied from a 24V DC standby source in the event of a mains failure; it is essential that only a professionally designed standby source is used to provide the standby supply to the equipment. Any DC only supply requirement should be met by using the 24V DC only versions of the equipment.

(ii) At regular intervals it is advisable to check that the standby supply is functioning correctly by switching off the AC supply and operating the equipment solely from the standby supply.

(e) Locate and secure the power supply module in position at the left-hand end of the shelf.

(f) Make the appropriate supply connections and check the operation of the power switch and indicators.

(g) With power removed make the connection to the equipment backplane.

2. Transmitter Power Amplifier Module

(a) Locate and secure the module in position at the right-hand end of the shelf.

(b) Make the connections to the transmitter driver, antenna socket and backplane.

Interconnections

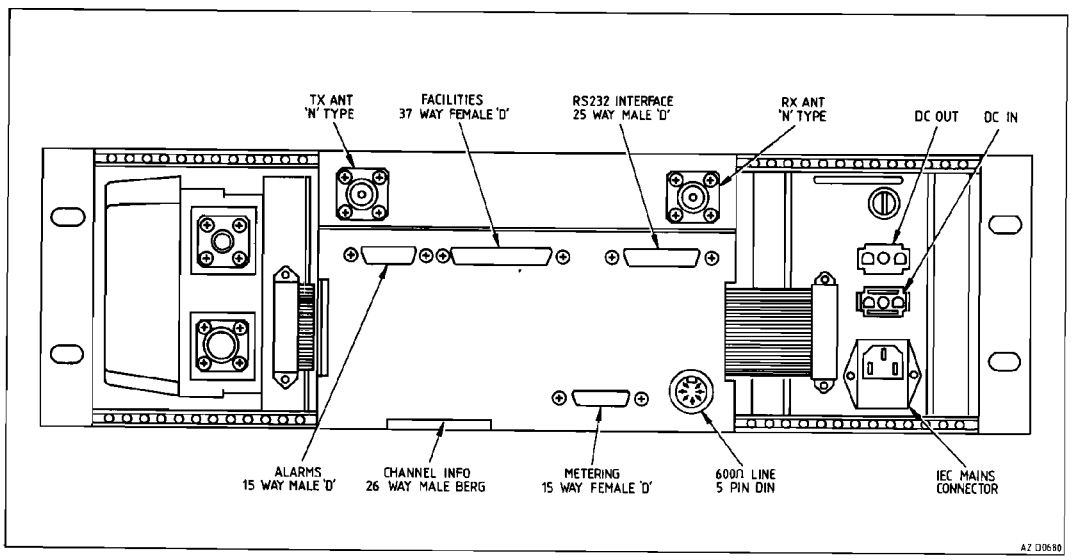


Fig. 3.3 Rear Panel Connections

All external connections to the equipment (including power supply, 600Ω lines, facilities and metering) are made at the rear of the equipment. Separate transmitter and receiver antenna connections are made on the rear of the shelf frame. The rear panel connector layout is shown in Fig.3.3. Fig.3.1 details the interconnections on the backplane assembly.

Linking Checks

Equipment functions are defined by pre-set links located on the backplane and within the transmitter driver and control modules. Although these are set during manufacture it is advisable, before proceeding with the functional tests, to check that the correct links have been selected against the system requirements.

Rack or Cabinet Mounted Installation

The base station may be installed in a 19in rack or in a cabinet. Modules can be withdrawn clear of the rack or cabinet for "in situ" servicing, or removed completely for bench testing or major repairs.

COMMISSIONING

Note: (i) Connection of power supply. This apparatus may be powered from an external 24V DC source. This usage may invalidate any approval given to this apparatus if as a result it ceases to comply with BS6301 : 1982.

(ii) The DC input socket, SKC, is designated:-
"WARNING. CONNECT ONLY APPARATUS COMPLYING WITH BS6301 TO THIS PORT."

(ii) The Engineers Handset Socket, SKE on the Control Module Front Panel, is declared as an accessory port as defined by BS6301

Preliminaries

1. Equipments should have been thoroughly checked for signs of physical damage during transmit as part of the installation procedure.

2. The power supply unit and transmitter power amplifier module should be installed and correctly connected.

3. An electrical check of the power supply unit, under "no-load" conditions should have been carried out (refer to "Installation of Units").

4. Ensure that all equipment links are correctly set against operational requirements.

Test Equipment

Note: Items quoted relate to 'Table 3.1 - List of Recommended Types'

2	AF generator	13	Modulation meter
10	RF signal generator	15	Thruline wattmeter
12	Frequency counter	19	SINAD meter

Functional Checks

Note: (i) To ensure that equipment has reached a stable operating temperature, it must be switched on for at least one hour prior to commencing checks.

(ii) The 600Ω line level used by this equipment is a nominal -14dBm and this is the level used throughout these checks. If the system under test uses a different audio level this may be used as an alternative to the -14dBm.

(iii) msd = maximum system deviation, = 2,5kHz for 12,5kHz channel spacing equipment, 4kHz for 20kHz channel spacing and 5kHz for 25kHz channel spacing.

(iv) All adjustments (RV16,RV1,RV2,RV9,RV3 and RV5 are located within the control module).

1. Receiver Checks

(a) Connect the RF signal generator to the RX antenna socket. Modulate the RF input 1kHz at 60% msd output, 1mV.

(b) Check for audio level of -14dBm across the RX 600Ω line. Adjust RV16 (LINE LEVEL) as necessary.

(c) Reduce the RF input level to 0,3µV PD and check SINAD is better than 12dB.

(d) Reduce the RF input level to give 10dB SINAD.

(e) Set RV1 (CARRIER LEVEL SQUELCH) fully clockwise and adjust RV2 (NOISE SQUELCH) such that the squelch is just open.

(f) Reduce the RF input level by 6dB and check the squelch is closed.

(g) Increase the RF input level to 1mV. Switch off the modulation; check that the fall in the audio level is greater than 50dB.

(h) Disconnect and remove all test equipment.

Note: If a squelch level less sensitive than 0,3µV is required adjust RV1 (CARRIER LEVEL SQUELCH) to the desired level.

2.Transmitter Checks

Note: In order to modulate the carrier signal the manual function switch must be set to TX ON and the PTT switch, on the engineers handset, operated.

(a) Connect the wattmeter and modulation meter to the TX antenna socket and loosely couple the frequency counter.

(b) Connect the AF generator set to 1kHz at -14dBm to the TX 600Ω line.

(c) Connect the engineers handset to the control module front panel and set the manual function switch to TX ON.

(d) Check that the power output is greater than the minimum specified for the unit, and the carrier is within 2ppm of the allocated frequency.

(e) Operate the PTT switch (to modulate the carrier) and check for an output deviation of 60% msd. Adjust RV9 (LINE SENSITIVITY) as necessary.

(f) Increase the AF input by 20dB and sweep the frequency between 300Hz and 8kHz. Check that the deviation (+ve & -ve) does not exceed the msd. Adjust RV3 (DEVIATION) as necessary.
If RV3 requires adjustment repeat step (e).

(g) Disconnect and remove all test equipment.

3. Talkthrough Level

(a) Connect the RF signal generator to the RX antenna socket and the thruline wattmeter and modulation meter to the TX antenna socket.

(b) Modulate the RF input signal 1kHz at 60% msd deviation, output 1mV.

(c) Connect the engineers handset to the control module front panel and set the manual function switch to T/T.

(d) Check for an RF output of greater than 30W with deviation of 60% msd. If necessary, set deviation using RV5 on Control Audio Board AT29024/-.

(e) Disconnect and remove all test equipment.

4. Notch Filter - optional (M80 series signalling)

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

Notch 1 and 2

(a) The RX Call generator is used to provide the 2970Hz tone for this test. Enable the generator by removing link LK13 A-B and connecting LK13A to the -Ve line (P25). Remove link LK21 and connect the generator output (P16) to the TX audio line LK21B. Set link LK18 B-C.

(b) Connect the AC voltmeter to TP6 and check for the presence of a 2970Hz tone. Note this reading.

(c) Set link LK18 A-B.

(d) Link LK16-IN, LK17-OUT. Check TP6 for a level 50dB down on that noted in step(b). Link LK16-OUT, LK17-IN and repeat. Adjust RV7(NOTCH 1) /RV8 (NOTCH 2) as necessary.

2970Hz Detector

(e) Connect the AC voltmeter to TP9 and tune RV11 (2970 DET) for maximum output.

Notch 3

(f) Disconnect the receiver module from the control module. Connect the generator output (P16) to the RX audio line (TP11). Set link LK27 A-B .

(g) Connect the AC voltmeter to TP15 and check for the presence of a 2970Hz tone. Note this reading.

(h) Set link LK27 B-C.

(i) Check TP15 for a level 50dB down on that noted in step (g). Adjust RV17 (NOTCH 3) as necessary.

Conclusion

(j) Disconnect all test equipment and remove the connection between P16/TP11 and P25/LK13. Re-connect the receiver module.

(k) Refit links LK13,LK16-18,LK27 according to operational requirements.

5. Hybrid Balance - optional (2-wire systems)

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

(a) Disconnect the receiver module and remove link LK21.

(b) Apply a 1kHz tone at -14dBm (nominal) across the RX 600Ω line. Note the AC voltmeter reading at LK21C.

(c) Remove the AF generator, re-connect the receiver module and the control equipment. Connect the RF signal generator to the RX antenna socket.

(d) Modulate the RF input signal 1kHz at 60% msd, output 1mV. Check LK21C for minimum level. Adjust RV13 (BALANCE R) as necessary.

(e) Modulate the RF input signal 3kHz at 60% msd, output 1mV. Check LK21C for minimum level. Adjust RV12 (BALANCE X) as necessary.

(e) Modulate the RF input signal with 1kHz, 2kHz, 3kHz in turn. Check LK21C for the "best achievable rejection" across the audio frequency range - better than 20dB down on the level noted in step (b).

(f) Disconnect and remove all test equipment and refit link LK21 according to operational requirements.

MAINTENANCE

Routine Checks

The Performance Checks detailed in the preceding pages should be carried out at regular intervals, as operational requirements permit, to ensure that optimum performance is obtained from the equipment.

A detailed log book should be kept of all data derived from these tests, as this will show any deterioration in performance.

Fault Location

The in-built 'local' supervisory system, contained within the control module, incorporates a number of alarm indicators (LED's), visible when the module is withdrawn fron the equipment. The alarm inputs to these indicators are combined on the logic board to provide a common alarm indication on the front panel of the module. This enables the existence and location of a fault to be quickly identified.

'On-site' Repair & Replacement

Modular construction has been adopted throughout the equipment to simplify maintenance as far as possible. Any suspect module can be easily and quickly removed and replaced with a serviceable spare. The equipment can thus be returned to service with a minimum of delay and a thorough check and repair of the faulty unit or sub-assembly carried out under workshop conditions.

Facilities are available which enable units and sub-assemblies to be tested under operational conditions. Interconnection between modules is via flexible ribbon cables and coaxial cables enabling all but the power supply unit to be withdrawn with the equipment operational.

Note: Care must be taken to avoid damage to interconnecting cables or connectors when withdrawing or replacing modules.

Frequency Label

Each module is fitted with a label on which is inscribed the frequency to which the module has been aligned in the factory. However, should the module be re-aligned in the field the 'old' frequency can be crossed out and the 'new' one added.

Workshop Repair and Alignment

It is recommended that repair and alignment of individual modules is carried out under workshop conditions by fitting the defective units into an otherwise 'known good' base station. Reference should be made to Part II of this manual for details of the appropriate module.

A comprehensive list of test equipment tools is given in this section; 'break-out' connectors which enable test equipment to be connected to the ribbon cable outputs.

Control Module

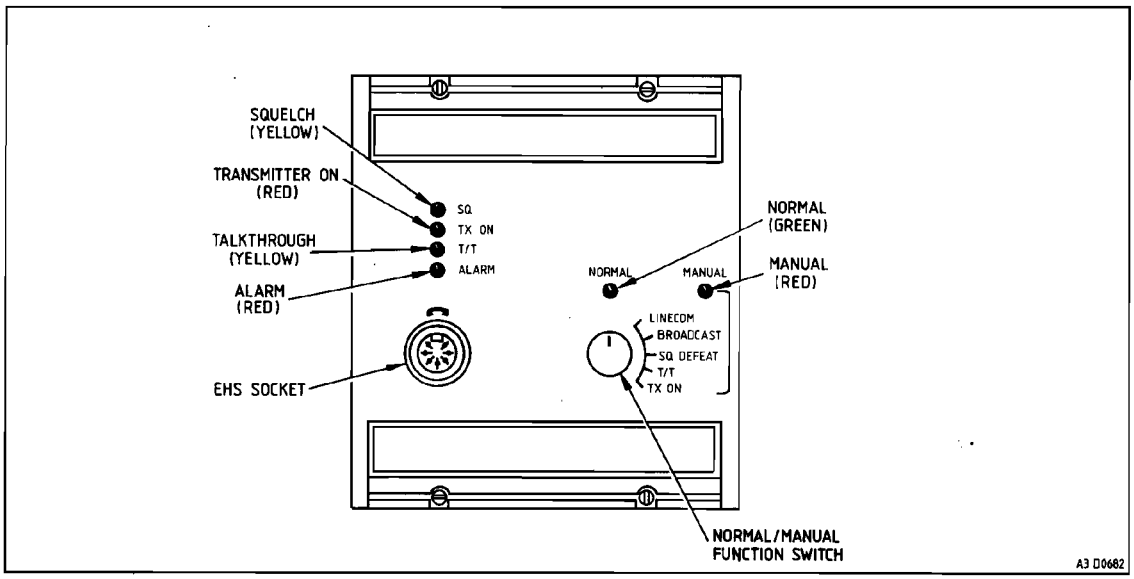


Fig. 3.5 Control Module Front Panel

A 6 position switch is provided on the front panel of the control module which, in conjunction with an engineers handset (EHS), overrides the local on-site control and provides basic control for alignment, testing and communicating 'over-the-air' or via the 600Ω audio interface. When the EHS is connected (via a 7-pin DIN socket on the front panel) the switch provides the following functions:

POSITION	FUNCTION	OPERATION
1	NORMAL	Normal operating position when EHS not in use. EHS pressel is inoperative. See note (iii).
2	LINECOM	Allow communication between EHS and control equipment connected to 600Ω line. Operate pressel to talk 'down-line'.The 600Ω line input is monitored on the loudspeaker and EHS when enabled by the TX KEY signal from the control equipment.
3	BROADCAST	Allows communication over the air between EHS and mobiles/other end of link. Operate pressel to talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.
4	SQUELCH DEFEAT	Opens squelch to check/align receiver. Operate pressel to talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.
5	TALKTHROUGH	Selects talkthrough mode for setting of talkthrough level. Operate pressel to override talkthrough and talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.

6	TX ON	Keys transmitter to give continuous unmodulated carrier for transmitter alignment. Operate pressel to modulate transmitter from 600Ω line input and adjust line sensitivity and CTCSS level. EHS microphone is not enabled.

Note: (i) With the handset connected and the switch in positions 2 to 6 the control module is in 'MANUAL' mode and control from any other source is inhibited. The receiver 600Ω output is also inhibited so as to effectively isolate the base station from the control equipment during engineering functions (i.e. servicing/ alignment).

(ii) When the handset is disconnected, the module defaults to 'NORMAL' mode irrespective of the switch position.

(iii) An engineer may use the EHS to communicate 'over-the-air' overriding any outgoing traffic, by connecting the EHS ENABLE pin on the control logic PCB to -ve. Control equipment inputs are not inhibited.

Also provided on the control module front panel are 7 LED indicators:

FUNCTION (Colour)	OPERATION
TX ON (Red)	Indicates that RF power is being generated by the PA module. See Note.
T/T (Yellow)	Talkthrough mode has been selected.
ALARM (Red)	Flashes to indicate that an alarm condition exists. (See ALARMS section).
NORMAL (Green)	The module is in NORMAL mode.
MANUAL (Red)	Flashes to show that the module is in MANUAL mode.

Note: A link on the backplane enables modification of the TX ON indicator to show TX KEY. This is normally only fitted on low power option equipment (i.e.: when a PA is not fitted, otherwise fault monitoring on the RF PA output is lost).

Alarms

A system of alarms is provided for station monitoring and to assist in fault diagnosis. Various parameters are monitored within the receiver, transmitter driver and PA module with alarm information being fed to the control module. This information is displayed on a row of LEDs inside the control module. The alarm lines are combined to generate a single alarm line to drive the front panel ALARM indicator and also a STATION FAIL output at the facilities socket. Linking is provided to enable additional TX and RX alarm outputs to be accessed, if required.

Local Diagnostics

The front panel alarm indicator will flash when any of the following alarm signals are generated:

* TX supply alarm
TX driver alarm
* PA supply alarm
PA temperature alarm
VSWR alarm
TX alarm latch
* RX supply alarm
RX alarm
External alarm

With the exception of those marked thus * the above alarms are indicated on the row of LEDs within the control module. The source of the alarm condition can therefore be traced by withdrawing the control module and observing which, if any, of the seven internal LEDs are lit. If none are lit then the alarm must be a supply fail on one of the other modules. This can be confirmed by bridging the supply alarm disable link for that module (LK30 on the control module).

Note: (i) A disconnected module will cause a supply fail alarm to be generated.

(ii) At switch on, the ALARM indicator will flash for approximately three minutes while the crystal oven warms up.

Facility Socket Alarm Outputs

The following alarm outputs are available on the facility socket:

(i) STATION ALARM - a summation of:

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm
TX alarm latch
RX supply alarm
RX alarm
External alarm

(ii) DC STANDBY ALARM - Indicates that the DC supply input is being used to power the base station.

(iii) MANUAL ALARM - Indicates that manual mode has been selected.

Additionally, the following subsets of STATION ALARM can be brought out by linking within the control module:

(iv) TX ALARM OUTPUT - a summation of:

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm
TX alarm latch

(v) RX ALARM OUTPUT - a summation of:

RX supply alarm
RX alarm

Alarm Descriptions

PA Supply Alarm	Indicates that the PA regulator voltage is low or that the module has been disconnected.
PA Output Alarm	Indicates that the power control loop in the PA can no longer maintain the correct RF output power. Also indicates the presence of an RF output when the transmitter is not keyed. *Note: For the two stages of temperature shutdown in the PA, complete shutdown will generate a PA O/P alarm, whereas partial shutdown (3dB) will not.*
TX Supply Alarm	Indicates that the Tx driver regulator voltage is low or that the module has been disconnected.
TX Driver Alarm	Indicates an alarm generated by TX driver, caused by: cold oven RF fail high internal temperature
PA Temperature Alarm	Indicates high temperature in the PA module resulting in either 3dB or total shutdown. (PA O/P ALARM will show which).
VSWR Alarm	Indicates that the VSWR at the PA output exceeds approximately 3:1 and proportional shutdown is operative.
TX Alarm Latch	When enabled, indicates that one of the following alarms is active: TX supply alarm TX driver alarm PA supply alarm PA O/P alarm VSWR alarm Can be reset by temporarily disabling. Used only in simple main/standby configurations.

RX Supply Alarm	Indicates that the Rx regulator voltage is low or that the module has been disconnected.
RX Alarm	Indicates alarm (other than supply alarm) generated by RX module, caused by:
	injection fail
External Alarm	Indicates alarm signal present on external alarm input.
DC Standby Alarm	Indicates that the DC supply input is being used to power the base station.
Manual Alarm	Indicates that **MANUAL** mode has been selected from the front panel and therefore the local control inputs have been disabled.

Power Supply Unit

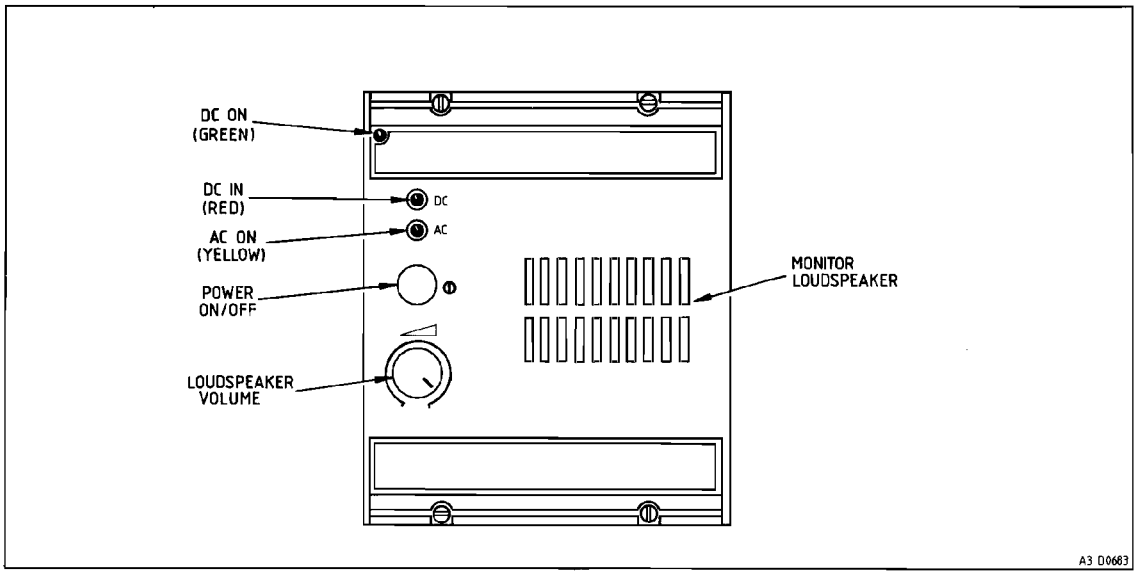


Fig. 3.6 Power Supply Unit Front Panel

The power supply unit houses the power on/off switch and three LEDs which indicate the availability of power supplies. The monitor loudspeaker (optional) and associated volume control are also located within this module.

FUNCTION (Colour)	OPERATION
AC ON (Yellow)	AC supply is present on the module
DC IN (Red)	DC supply is present on the module
DC OUT (Green)	An unregulated 24V DC output is available from the module

TEST EQUIPMENT

Note: The module descriptions given in Part II of this service manual refer only to Item No. and Description of test equipment, therefore, cross reference must be made to this list for full details of suitable types.

The following is a list of test equipment suitable for the maintenance of the FR5000 series of equipments. Equivalent types may be used where those listed are not available, provided that corrections are made for any differences in characteristics.

Table 3.1 - List of Suitable Types of Test Equipment

Item	Description	Outline Parameters	Suitable Type
1	DC power supply	0-40V,1A	
2	AF generator (with output millivoltmeter)		Marconi TF1101
3	Variable DC load	6A at 26V; 1,5A at 18V	Zenith TS (open)
4	Digital Voltmeter	-	Philips 2517X
5	Oscilloscope	General purpose	Hameg 203.5
6	Multimeter	-	AVO 8X
7	Metrohm		Edgecombe Peebles
8	AF power meter	2W @ 8Ω	Marconi TF893B
9	Distortion meter		Lyons Instruments D10
10	RF signal generator	0-250MHz	H-P 8640B
11	Marker oscillator	21,4MHz	Part No. SH10042
12	Frequency counter	10Hz-520MHz	Racal 9916
13	Modulation meter	0-250MHz	Marconi TF2300B
14	AC voltmeter		H-P 400FL
15	Thruline wattmeter	100-250MHz	Bird 4314
16	Spectrum analyser	0-500MHz	Advantest TR4131
17*	Return loss bridge	0-500MHz	Wiltron 60NF50
18	50Ω load(includes sniffer)	3W	Stabilock 4040
19	SINAD Meter		H-P 333A
20	'D' type 'Break-out' connector	9,15, 25 & 37 way	Part No SH10087

21*	Input test lead	-	(local manufacture)
22	Dummy Load	50Ω, 5-150W	Bird Termaline 6154

* required only for optional antenna filter alignment.

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SECTION 4
SPARES DETAILS

INTRODUCTION

Service support for this equipment is available at two levels - complete module replacement and component level repair. The 'Spares' that are available reflect this policy. However, the exception to this is the control module which has complete PCB assemblies available from Spares Sales.

SPARE MODULES

Individual modules are ordered, via the local Sales outlet, using the module Part Number and appropriate stroke number e.g. if a 24V DC version of the Power Supply Module is required Part Number AT04870/03 should be ordered.

PCBs & COMPONENTS

Component parts and PCB assemblies are available through Spares Sales using the part numbers listed in this service manual.

Part numbers pertaining to individual modules are given in the module descriptions in Part II whilst those parts which form the shelf and backplane assembly are listed in this section.

ORDERING OF 'SPARES'

When ordering spares please quote the Description and Part Number of the item together with the equipment code number.

SURFACE MOUNTED DEVICES (SMDs)

SMDs are supplied in packs, each containing a number of identical components. The quantity of components in each pack will depend on the component type; for transistors and ICs this is usually 5 and for resistors and capacitors the quantity is usually 24.

A pack of SMD components will have its own Part Number which will depend on whether the individual component has an alpha-numeric or 12NC Part Number.

The Part Number for an alpha-numeric SMD component pack comprises the Part Number of the individual component with the prefix AT/.

Eg:	Component Part Number	Pack Part Number
	CL99012	AT/CL99012
	FV99070/SM	AT/FV99070/SM

The Part Number for a 12NC SMD component pack comprises the Part Number of the individual component with the middle group of three digits changed from 999 to 575.

Eg:	Component Part Number	Pack Part Number
	3513 999 55643	3513 575 55643

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

SHELF ASSEMBLY
MISCELLANEOUS PARTS LIST

Cct.Ref	Description	Part No.	Remarks
SUB-ASSEMBLIES			
	Power supply unit	AT04870/-	30W
	Power supply unit	AT04878/-	50W
	Receiver module	AT04871/-	
	Control module	AT04872/-	
	Transmitter driver	AT04873/-	
	Transmitter power amplifier	AT04874/-	30W
	Transmitter power amplifier	AT04879/-	50W
	Shelf/backplane unit	AT04875/01	
	Front panel, blank	AT14907	
	Receptacle PV	FC00787	
	Housing, 2 pos'n	FC00820/02	
	Ty-rap	QA04424	
	Antenna C/O relay assembly comprising:	AT14811	
	Lead assembly co-axial	AT70225	C/O relay - antenna
	Lead assembly co-axial	AT70219	Rx module - C/O relay
	Lead assembly co-axial	AT70220	Tx PA - C/O relay
	Relay 700Ω/18V	FR02092	
LEAD ASSEMBLIES			
	Lead assy coaxial	AT70199	(Rx-backplane)
	Lead assy coaxial	AT70198	(Tx driver-Tx PA)
FIXINGS			
	Cable tie and clamp	QA04427	1/Rx coax - LH support plate
	Scr st pan pozi M3 x 8mm	QJ11902/X	4/coax skt - backplane
	Scr st pan pozi M3 x 10mm	QJ11903/X	1/Rx coax - LH support plate
	Scr st pan pozi M3 x 25mm	QJ11907/X	2/C/O relay
	Nut st hex M3	QA11605/X	4/coax skt - backplane, 1/Rx coax - LH support plate
	Washer st M3	QA15005/X	2/C/O relay
INSTALLATION ITEMS			
	Cover, protective	3513 901 10311	
	Label information	3513 903 71451	600Ω termination
	P clip 3/16"	QA00509	Lead - backplane PCB
	Cable tie	QA04427	BT lines connection
	Shelf support LH	BT26636/01	
	Shelf support RH	BT26636/02	
	Bagged items comprising:	AT36927	
	Rack runner LH	BT24870/01	
	Rack runner RH	BT24870/02	
	Link assy	AT14874	4/control unit
	Fuse 7,5	FF06810	2/DC supply
	Fuseholder	FH02881	2/DC supply
	Scr st pan pozi M5 x 16mm	QJ11934/C)	
	Cage nut	QA16471)-	4/Rack - cabinet
	Fibre washer	CT87184)	
	Scr st tap pozi No6 x 9,5mm	QJ07697/X	4/runners - rack
	PCB assy backplane	AT28996	Not available as spare
	Cable assy 15 & 25-way D type	AT70158	1/PA & Tx driver
	Cable assy 25 & 37-way D type	AT70160	1/control module
	Cable assy 15-way D type skt	AT70161	1/receiver
	Cable assy 25-way D type plug	AT70162	1/PSU
	Clip anti-vibration	FR31604	
	Guide rail	FR31656	
	Nut st hex M3	QA11605/X	2/D type connectors
	Scr st pan pozi M3 x 8mm	QJ11902/X	8/co-ax leads
	Scr st tap pozi No4 x 6,5mm	QJ08227/X	3/rear panel - brackets, 4/protective cover
	Scr st tap pozi No4 x 9,5mm	QJ08243/X	1/rear panel - bracket
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	4/spring PA, 2/spring PSU 2/spring shelf
	Scr st pan pozi M2,5 x 8mm	QJ11946/B	4/rear rails - support brackets

Cct.Ref	Description	Part No.	Remarks
		PCB ASSEMBLY BACKPLANE AT28996	
D1	Diode GP 1N4148	FV05808	
LK1-3	Link connector	FC99060	
T1,2	Transformer 600Ω	FT05324	
PLE	Header str male 2 pos'n	FC00837/02	
PLX	Header 7 pos'n	FC00837/07	
C1,2	Capacitor 22 elec	PS99862	
	Connector strip 2 pair	FC14905	
	Plug PCB 2 x 10	FP99184	
	Lead assy 600Ω	AT70178	
	Spacer tapped	BT27241]_	2/D type connectors
	Screw lock assy	FC15763]	
	Scr st pan 4/40 UNC	QJ08228/X	2/spacer - PCB

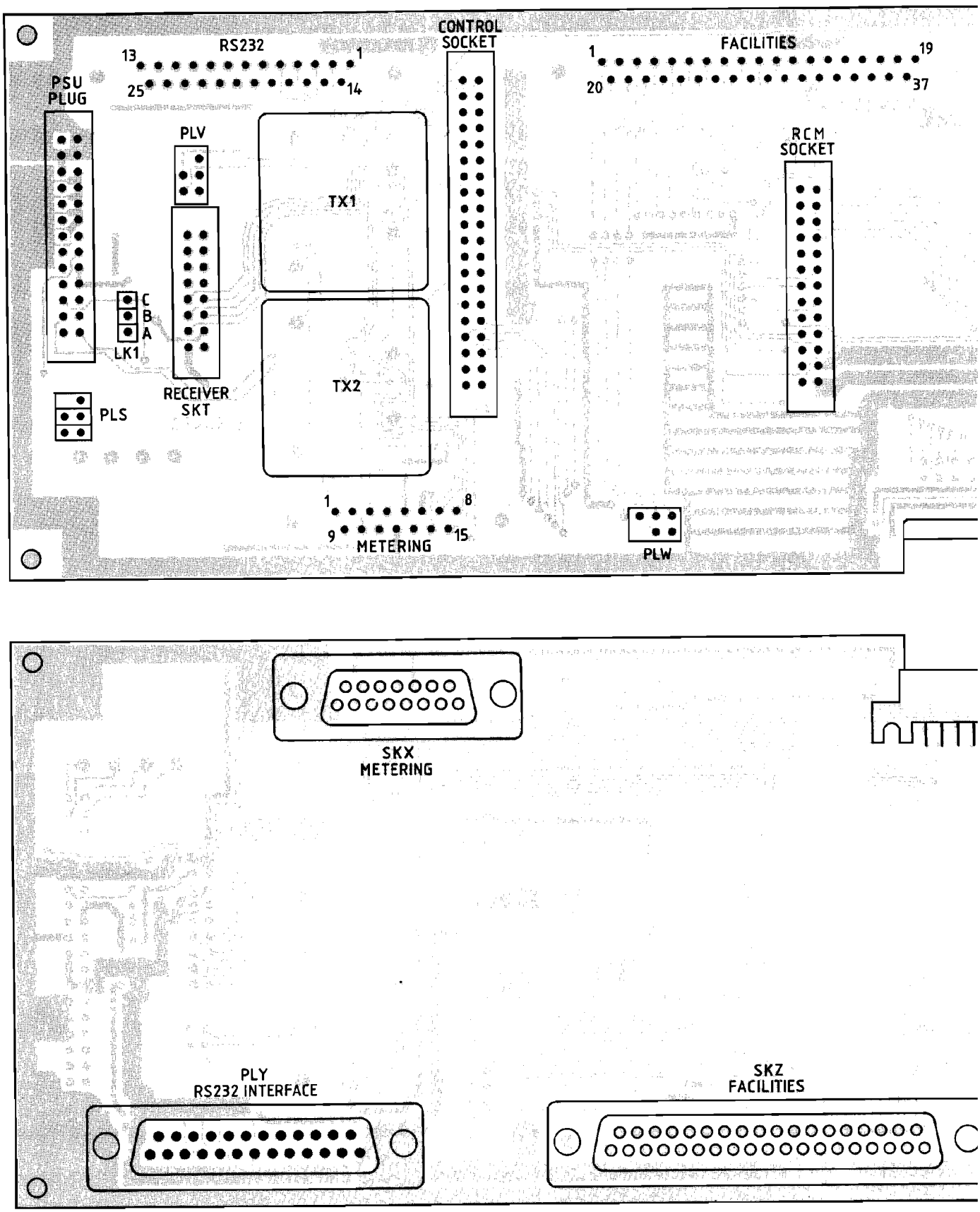


FIG.4.1 BACKPLANE

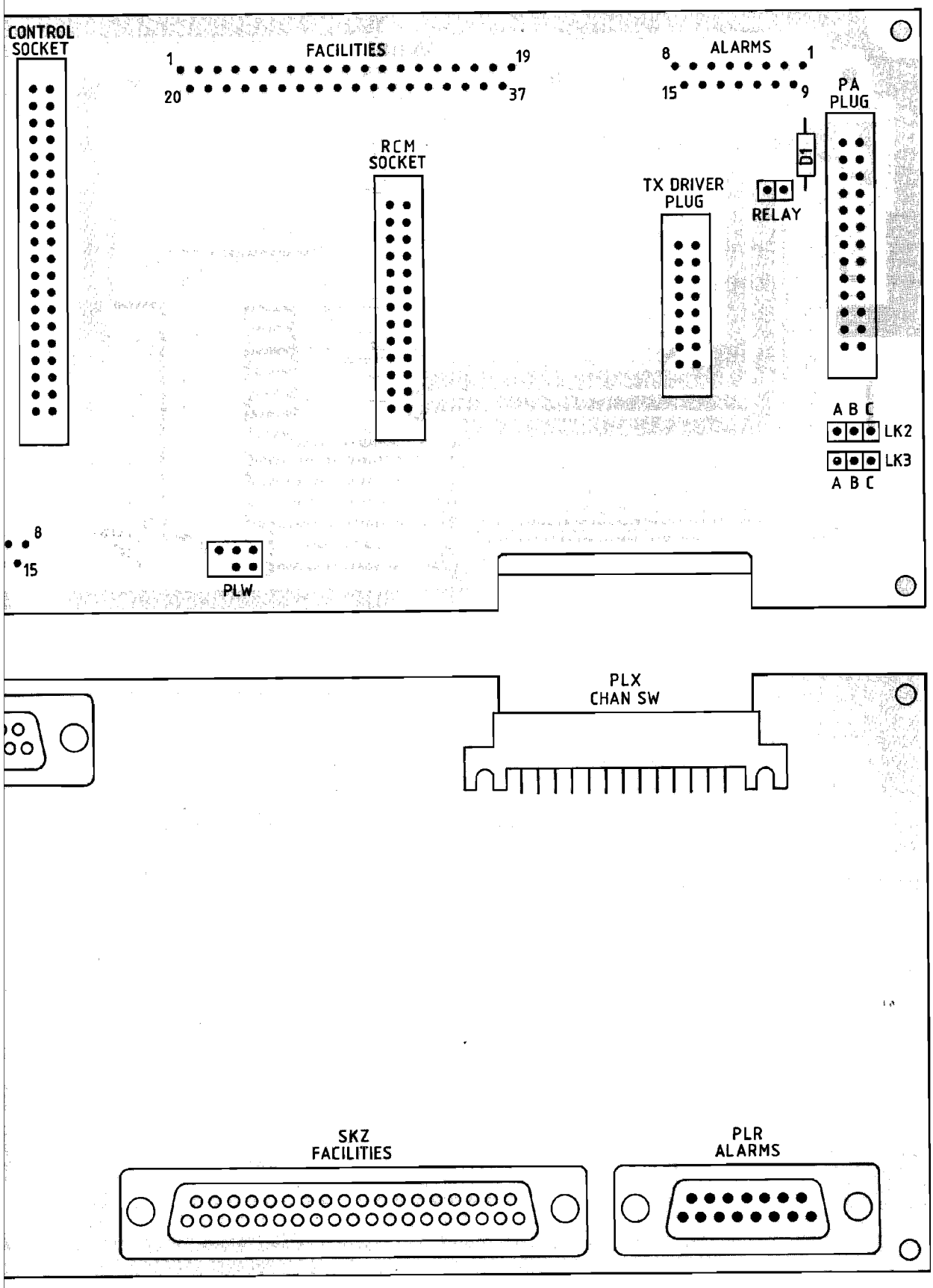
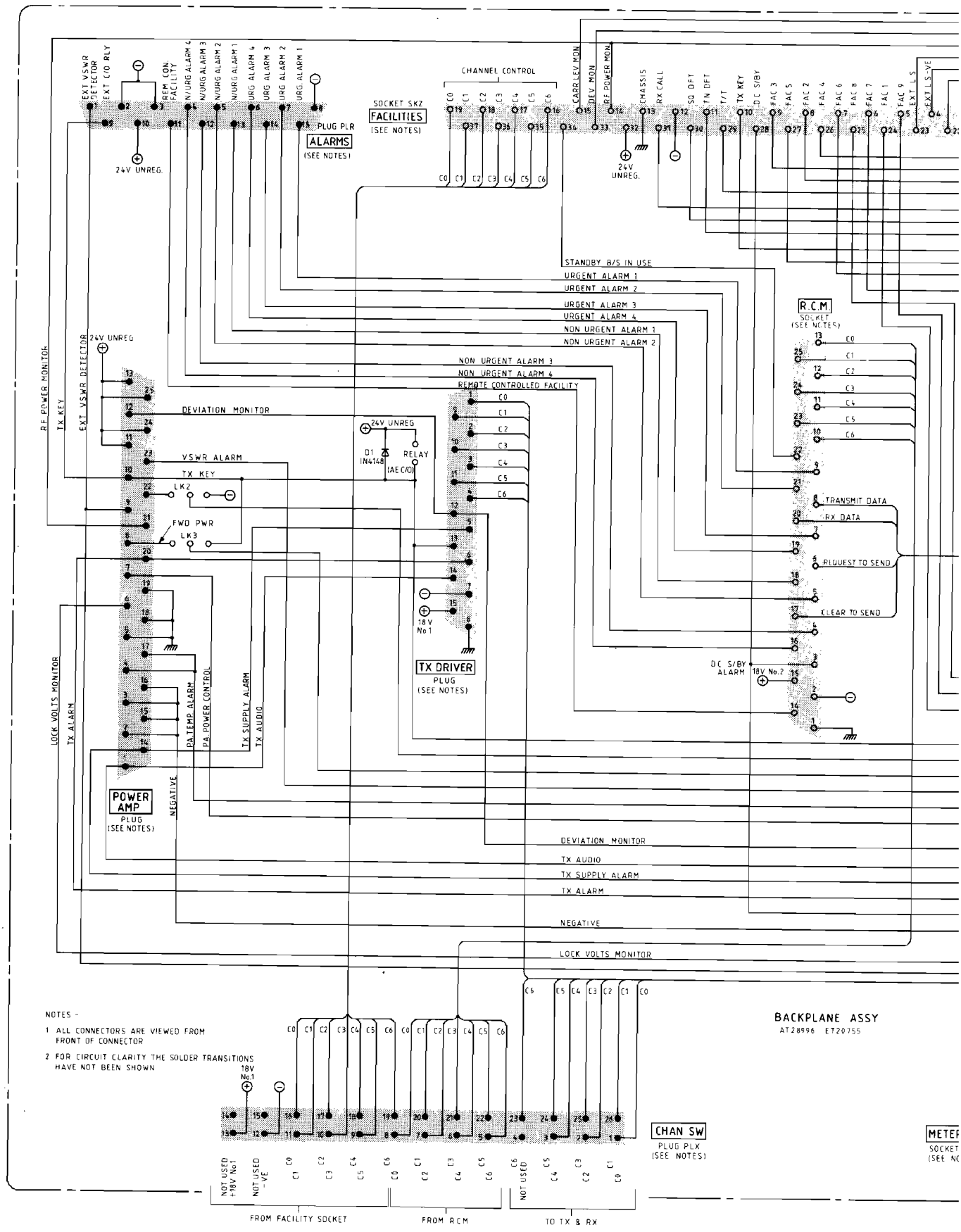


FIG.4.1 BACKPLANE LAYOUT DIAGRAM


EXT VSWR DETECTOR
EXT C/O RLY
REM CON. FACILITY
N/URG ALARM 4
N/URG ALARM 3
N/URG ALARM 2
N/URG ALARM 1
URG ALARM 4
URG ALARM 3
URG ALARM 2
URG ALARM 1
PLUG PLR
ALARMS
(SEE NOTES)
24V UNREG.
SOCKET SK2
FACILITIES
(SEE NOTES)
CHANNEL CONTROL
C0 C1 C2 C3 C4 C5 C6
CARR LEV MON
DEV MON
RF POWER MON
CHASSIS
RX CALL
SQ DFT
TN DFT
T/T
TX KEY
DC S/BY
FAC 3
FAC 5
FAC 2
FAC 4
FAC 6
FAC 8
FAC 7
FAC 1
FAC 9
EXT L.S
EXT L.S -VE
STANDBY B/S IN USE
URGENT ALARM 1
URGENT ALARM 2
URGENT ALARM 3
URGENT ALARM 4
NON URGENT ALARM 1
NON URGENT ALARM 2
NON URGENT ALARM 3
NON URGENT ALARM 4
REMOTE CONTROLLED FACILITY
R.C.M
SOCKET
(SEE NOTES)
TRANSMIT DATA
RX DATA
REQUEST TO SEND
CLEAR TO SEND
RF POWER MONITOR
TX KEY
EXT VSWR DETECTOR
24V UNREG
DEVIATION MONITOR
VSWR ALARM
TX KEY
LK2
FWD PWR
LK3
D1 IN4148
RELAY (AEC/O)
18V No.1
TX DRIVER
PLUG
(SEE NOTES)
DC S/BY ALARM
18V No.2
LOCK VOLTS MONITOR
TX ALARM
PA TEMP ALARM
PA POWER CONTROL
TX SUPPLY ALARM
TX AUDIO
NEGATIVE
POWER AMP
PLUG
(SEE NOTES)
DEVIATION MONITOR
TX AUDIO
TX SUPPLY ALARM
TX ALARM
NEGATIVE
LOCK VOLTS MONITOR
BACKPLANE ASSY
AT28996 ET20755
CHAN SW
PLUG PLX
(SEE NOTES)
METER
SOCKET
(SEE NO
NOT USED +18V No.1
NOT USED -VE
FROM FACILITY SOCKET
FROM RCM
TO TX & RX
NOTES -
1 ALL CONNECTORS ARE VIEWED FROM FRONT OF CONNECTOR
2 FOR CIRCUIT CLARITY THE SOLDER TRANSITIONS HAVE NOT BEEN SHOWN

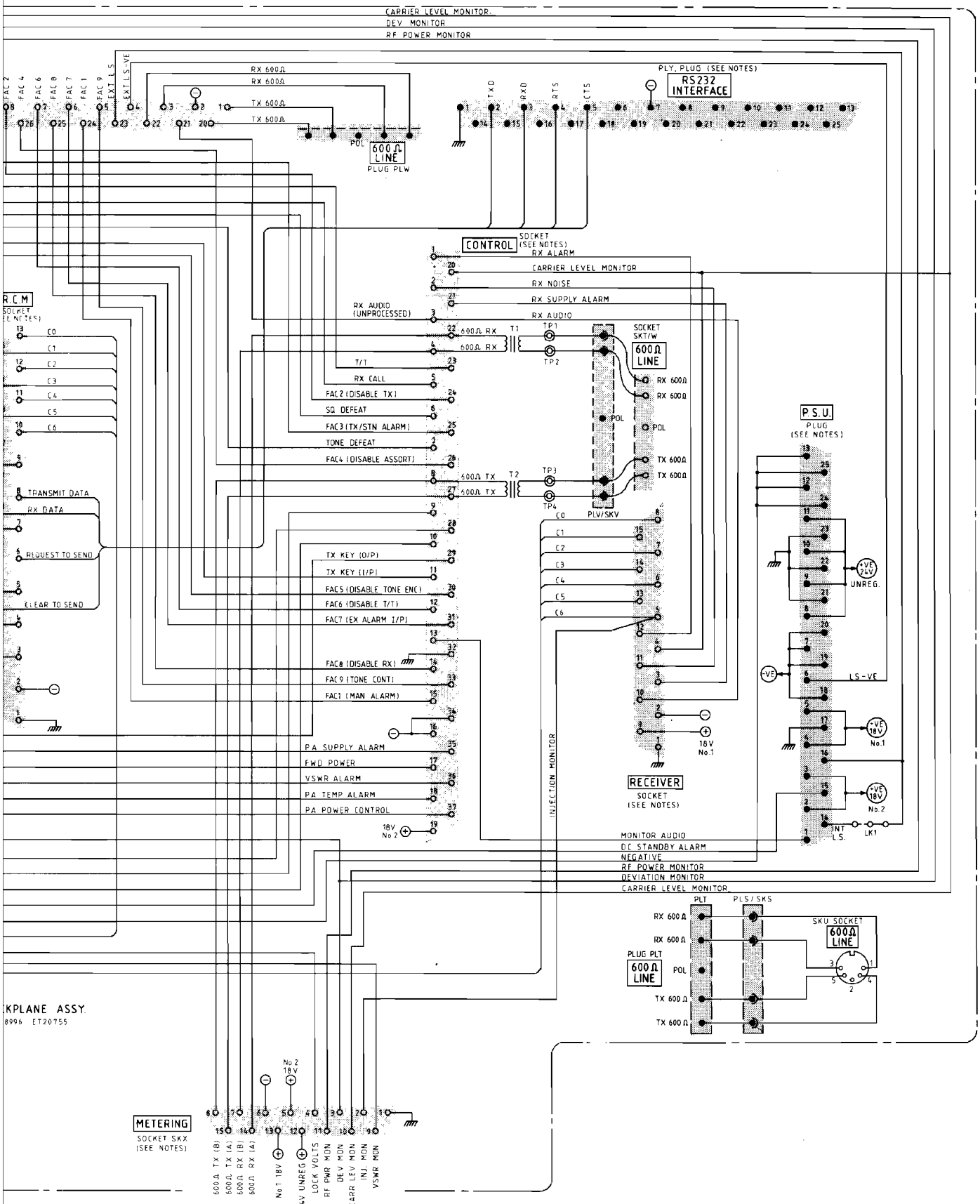


FIG.4.2 BACKPLANE INTERCONNECTIONS

PART II

MODULES

POWER SUPPLY MODULE
AT04870/-

WARNING

This power supply module has been designed to meet relevant safety requirements.
If it is necessary to replace any safety conscious component only the item quoted in the Parts List 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 re-wiring of the mains input supply cables is necessary the specified type MUST be used and alterations to the routeing or connections MUST NOT be made.

INTRODUCTION

Three versions of this module provide for operation from an AC supply of either 115V or 220/240V, or from a 24V nominal DC supply. In each, an unregulated 24V output is provided for use on the transmitter power amplifier whilst the regulator produces a dual output of +18V.

This module also houses the monitor amplifier and loudspeaker (optional).

DETAILED DESCRIPTION

AC Supply

The AC input is applied, via [0]FS1, to the step-down transformer [0]T1. The secondary voltage is rectified in [0]D1 and smoothed by [0]C1; [0]FS2 protects the rectified voltage which is applied to the regulator board across SP6 and SP1.

Rectification provided by [1]D1 and [1]D2 is smoothed by [1]C2 to produce a voltage which lights [0]LED1 (AC ON), energises [1]RLA/1 and causes [1]TR1 to conduct inhibiting the 'DC POWER IN USE' line. The contact of [1]RLA connects the rectified voltage on SP6, via the on/off switch SA, to:

(i) provide an unregulated 24V output across SP3 and SP4

(ii) light [0]LED3 (DC OUT) indicating the presence of an unregulated voltage

(iii) supply an input to the 18V regulators [1]IC1 and [1]IC2

DC Supply

The DC supply is connected to SKC and applied to the regulator board across SP5 and SP2. [0]D3 provides reverse polarity protection and [0]LED2 indicates the presence of a DC input.

The input voltage is routed via the contact of [1]RLA ([1]RLA/1 de-energised) and the on/off switch as described above. The voltage also causes [1]TR2 to conduct to provide an active 'low' on the 'DC POWER IN USE' line.

If the level of the DC supply becomes too high the bias across zener diode [1]D10 will be overcome and [1]RLA/1 will energise. The contact will switch over preventing the high level input from reaching the regulators.

Regulator

The dual regulators [1]IC1 and [1]IC2 are similar in operation, each 18V output is set by a potentiometer, [1]RV2 and [1]RV1 respectively.

Monitor Amp and Loudspeaker

The AF monitor input from the control module is fed, via the front panel volume control [0]RV1, to amplifier [1]IC1. The AF output and LS OV lines are routed to the rear panel connector SKA, enabling either the use of an internal loudspeaker by linking pins 16 and 14 or an external loudspeaker (connected across pins 6 and 16).

SPECIFICATION

AC Input	115, 220, or 240V ±10% 47-60Hz Fuse integral with IEC connector
DC Input	24V -10% +20% +ve or -ve chassis Fuses in line with supply lead
Power consumption	AC Supply 200VA max. DC Supply 160W max.
DC outputs	(i) 25V (nominal) unregulated 4,3A maximum Ripple less than 3V ptp Used for: PA module 4A max C/O relay (35mA) Ext. equip 200mA max (ii) 18V ± 0,5V 1,3A maximum Ripple less than 1mV ptp Used for: TX Driver 0,8A max RX module 0,5A max (iii) 18V ± 0,5V 0,9A maximum Ripple less than 1mV ptp Used for: Local control 0,5A max Remote control 0,3A max Monitor Amp 0,1A max DC fuse on back panel
Monitor Amplifier	Sensitivity 300mV (for 1W into 15Ω) Freq Response 300Hz to 3kHz ±1dB Power Output 2W into 8Ω
Internal Loudspeaker	1W, 16Ω, 2,5 inch
Connectors	Mains input 3 pin IEC male Interface/DC output 25 way D plug DC input * 3 pin AMP female DC output ** 3 pin AMP male * Also used for +ve/-ve chassis linking ** For use as stand-alone PSU

TEST PROCEDURE

Test Equipment required

Note: *Refer to Part I, Table 3.1 for suitable types.*

1. DC Power Supply
2. AF Generator (with output millivoltmeter)
3. Variable DC Load
4. Digital multimeter
5. Oscilloscope.
6. Multimeter
7. Metrohm
8. AF Power Meter
20. 'Break-out' connector 25way

1. Remove the module cover and connect DC supply at 25V to SKC.

2. With front panel switch 'off' check that the green front panel DC ON indicator is not lit.
   With front panel switch 'on', check that both the red DC IN and the green DC ON indicators are lit.

3. Set RV2 to give 18,3V unloaded across SKA pins 2 and 18.
   Connect DC load, set to 1,3A, across SKA pins 2 and 18.
   Check voltage on SKA pin 2 is greater than 17,5V.

4. Set RV1 to give 18,3V unloaded across SKA pins 4 and 18.
   Connect DC load, set to 1,3A, across SKA pins 4 and 18.
   Check voltage on SKA pin 6 is greater than 17,5V.

5. Increase DC supply to 32V and check that the green DC ON indicator is lit.
   Increase supply to 40V and check that green indicator extinguishes.
   Reduce DC supply to 25V.

6. Set front panel volume control fully counter-clockwise.
   Connect AF generator set to 800mV at 1kHz across SKA pins 1 and 17.
   Connect oscilloscope and AF power meter (set to 8Ω) between pins 6 and 16 of SKA.
   Adjust volume control so that AF waveform is just below clipping level.
   Check AF power is greater than 2W.

7. Connect variable load across the un-regulated 24V output PLD.
   Check output is greater than 31V.
   Increase current to 6A; check output is greater than 24V.

8. Set variable load to minimum.
   Remove all connectors and check for isolation between SKC earth terminal and negative terminal.
   Check for continuity between SKC earth terminal and SKA pin 21 and to PLD earth terminal.

9. AC Supply Only

   Re-fit plug into SKC linking negative to earth.

10. Remove all items of test equipment and refit the module cover.

POWER SUPPLY UNIT

AT04870/01 220/240V AC
AT04870/02 115V AC
AT04870/03 24V DC

♁ Denotes safety conscious component.

Cct Ref	Description	Part No.	Remarks
COMMON ITEMS			
	PCB assy regulator	AT28993	Not available as spare
IC1,2	IC volt reg 317	FU99119	
PLD	DC socket & lead assy	AT14751	
SKC	DC socket & lead assy	AT14752	
Volume	Knob printed	BJ30904/03	1/RV1
RV1	Pot 5k 20% log	PL09220	Volume
SA	Switch power c/w bracket	FS50951	On/off
LED2	LED red	FV05858	DC input
LS1	Loudspeaker 15Ω	FS11215	
	Spring retaining LS	BT50521	
	Button black	FR10750	1/SA
	Pillar hexagon	BT04411	
	Scr st tap pozi No6 x 9,5mm	QJ07697/X	3/heatsink - chassis, 2/strap - chassis
	Scr st pan pozi M3 x 8mm	QJ11902/X	1/heatsink - pillar
	Scr st pan pozi M3 x 10mm	QJ11903/X	2/SA, 1/IC1,2
	Nut st hex M2,5	QA11604/B	2/mains plug - chassis
	Nut st hex M3	QA11605/X	1/IC1,2
	Bush LED panel mounting	QA99007	1/LED1,2
	Bush insulating (TO-220)	QA99024	1/IC1,2
	Washer insulating	QA99025	1/IC1,2
	Washer st M3	QA15005/X	1/IC1,2
	FRONT PANEL ASSEMBLY AT14816		
	Panel, front, printed	BJ30973	
LED3	LED green	FV05931	DC power
	Housing, double row, 4 pos'n	FC00821/04	
	Contact, male, crimp	FC00839	
	Fastener	BT17284	4/PSU - shelf
	Handle	BT35950	
	Label Philips	BT38208/01	1/handle
	Label PSU	BT38206/01	1/handle
	Scr st tap pozi No4 x 8mm	QJ08421/X	3/Handle
	AT04870/01 240V AC **AT04870/02 110V AC**		
D1	Rectifier bridge 26MB40A	9337 195 10682	
T1	♁ Transfomer mains	AL21473	
	Plug assy	AT14814	SKC - -Ve
	Lead assy AC	AT70155	LEDs & vol - PCB
	Lead assy	AT70180	AC on/off - mains plug
C1	Cap elect 15000µF -10%,+30%	PS68022	
FS1	Fuse 2,5A, mains, time lag	FF99042	/01 only
FS1	Fuse 5A, mains	FF99038	/02 only
FS2	Fuse 10A	FF99021	
PLB & FS1	♁ Plug mains c/w fuseholder	FP11522	
LED1	LED yellow	FV05930	AC ON
	Protection cap	FC11916	1/C1 terminals
	♁ Strap	BT27069	1/T1
	Label 'MAINS VOLTAGE'	BT37402/01	
	♁ Label 'LIVE TERMINALS ENCLOSED'	BT37403/01	
	♁ Label 'DISCONNECT POWER LEAD'	BT37404/01	
	♁ Cover mains transformer	BT15941	
	Fuse holder panel mounting	FH99100	1/FS2
	Shroud insulating	FH99102	1/FS2 fuseholder
	♁ Boot insulating	FR10953	1/PLB & FS1
	Washer st M6	QA15010/X	1/strap - transformer
	Scr st csk pozi M2,5 x 6mm	QJ11601/B	2/mains plug - chassis
	Scr st hex M6 x 12mm	QJ13328/X	1/strap - transformer 1/transformer - chassis
	Nut st hex M4	QA11607/X	1/D1
	Washer st M4	QA15007	1/D1
	Scr st pan pozi M4 x 20mm	QJ11921/X	1/D1

AT04870/03 24V DC

Cct Ref	Description	Part No.	Remarks
	Lead assy DC	AT70155/01	Vol sw - PCB
	Strap	BT27069	1/baseplate
	Plate blanking	BT20260	For mains connector
	Hole plug black	FG02576	For FS2 fuseholder
	Hole plug black	FG02737	For LED1
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	2/plate blanking
	Scr st pan pozi No6 x 9,5mm	QJ07697/X	2/strap - baseplate

PCB ASSEMBLY REGULATOR AT28993

Semiconductors and IC's

IC1	IC audio amp 2002	FU08027
TR1,2	Transistor BC337 GP	FV05896
D1,2	Diode GP BYW54	FV05892
D3	Diode MR751	FV08961
D4	Diode GP 1N4448	FV05874
D5	Diode GP BYW54	FV05892
D6,7	Diode GP 1N4448	FV05874
D8,9	Diode GP BYW54	FV05892
D10	Diode BZX70-C27	FV05649

Resistors

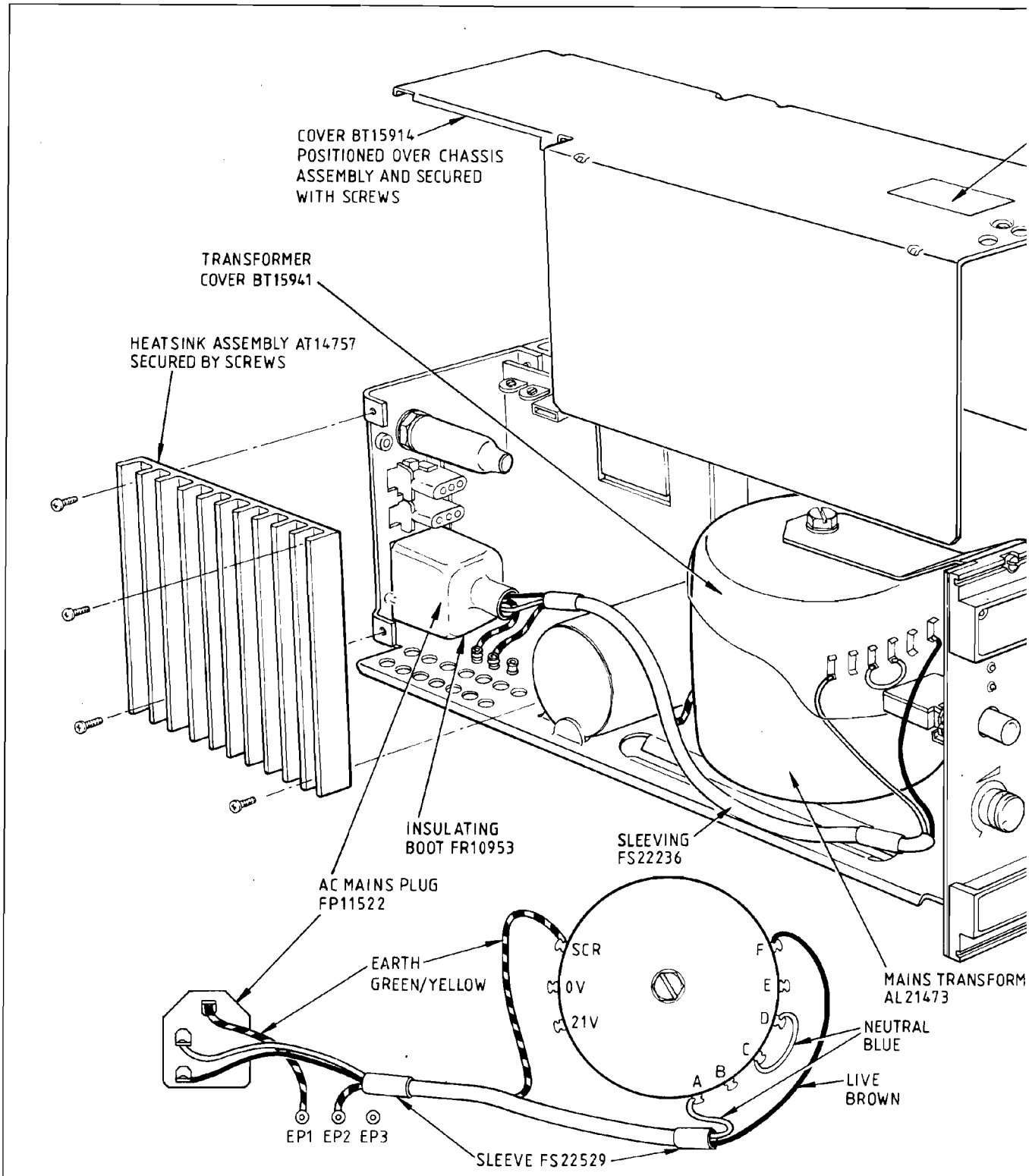
R1-3	1k8	±2%	0,5W	m oxide	PL99308
R4	2k2	±2%	0,5W	m oxide	PL99309
R5	270	±5%	2,5W	ww	PM01129
R6	18k	±2%	0,25W	m film	PM99312
R7	1k	±2%	0,25W	m film	PM99282
R8	4k7	±2%	0,25W	m film	PM99298
R9	2k2	±2%	0,25W	m film	PM99290
R10	1k	±2%	0,25W	m film	PM99282
R11	1	±2%	0,25W	m film	PM99210
R12	220	±2%	0,25W	m film	PM99266
R13	10	±2%	0,25W	m film	PM99234
R14	240	±2%	0,25W	m film	PM99267
R15	2k7	±2%	0,25W	m film	PM99292
R16	240	±2%	0,25W	m film	PM99267
R17	2k7	±2%	0,25W	m film	PM99292
R18	4k7	±2%	0,25W	m film	PM99298
R19	1	±2%	0,25W	m film	PM99210
RV1,2	1k	±20%	Pot skel lin		PL01483

Capacitors

C1	100n	±10%		pes	PQ99511
C2	100	±20%	35V	elec	PS99430
C3	470	±20%	35V	elec	PS99433
C4,5	100n	±10%		pes	PQ99511
C6	470	±20%	16V	elec	PS99416
C7	100n	±10%		pes	PQ99511
C8,9	100	±20%	25V	elec	PS99424
C10	22	±20%	25V	elec	PS99421
C11	470p	±20%		cer	PN99933
C12	2u2	±20%	100V	elec	PS99456
C13	100n	±10%		pes	PQ99511
C14	22	±20%	25V	elec	PS99421
C15	100n	±10%		pes	PQ99511

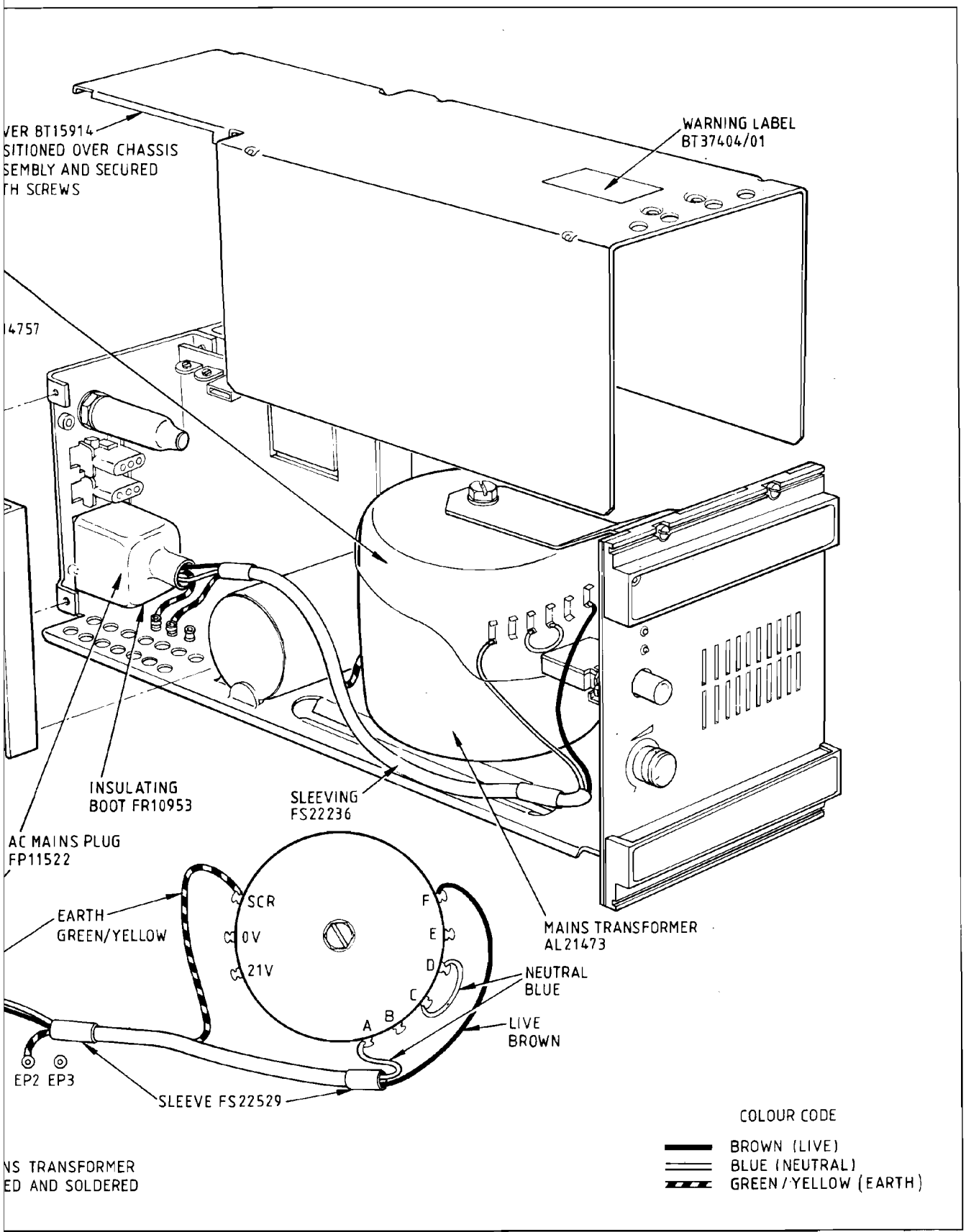
Miscellaneous

RLA	Relay c/o		FR01255	
	Nut st hex M3		QA11605/X	2/SKA,1/IC1
	Scr st pan pozi	M3 x 6mm	QJ11901/X	1/IC1
	Scr st pan pozi	M3 x 10mm	QJ11903/X	2/SKA

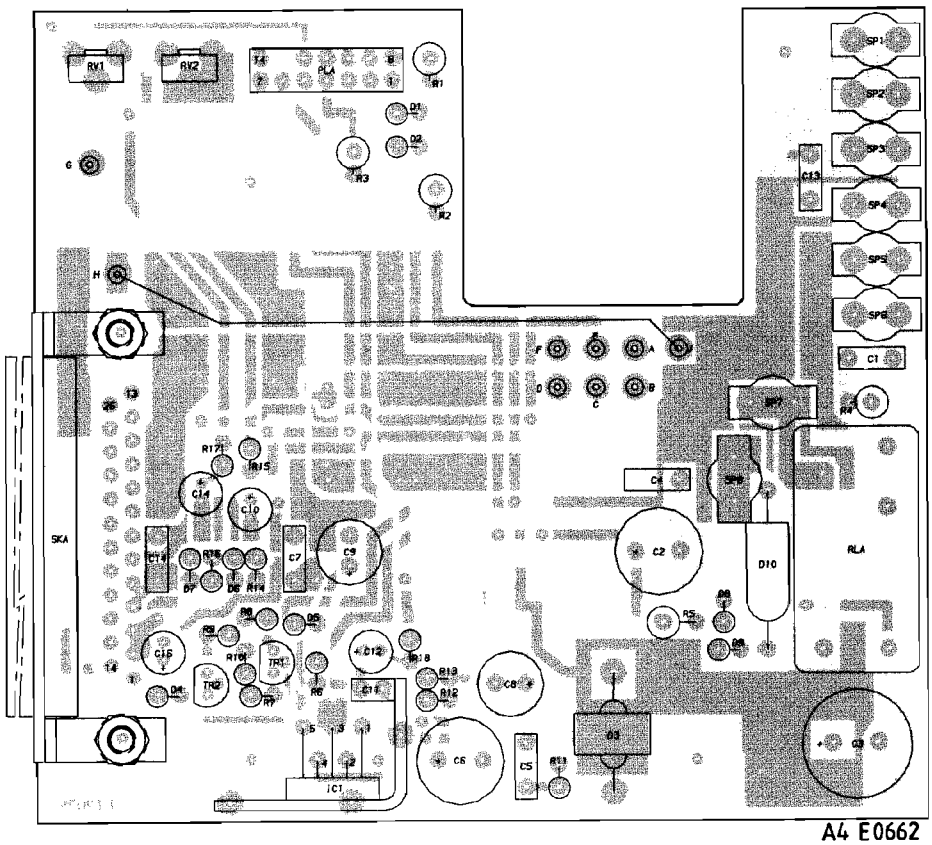


NOTE

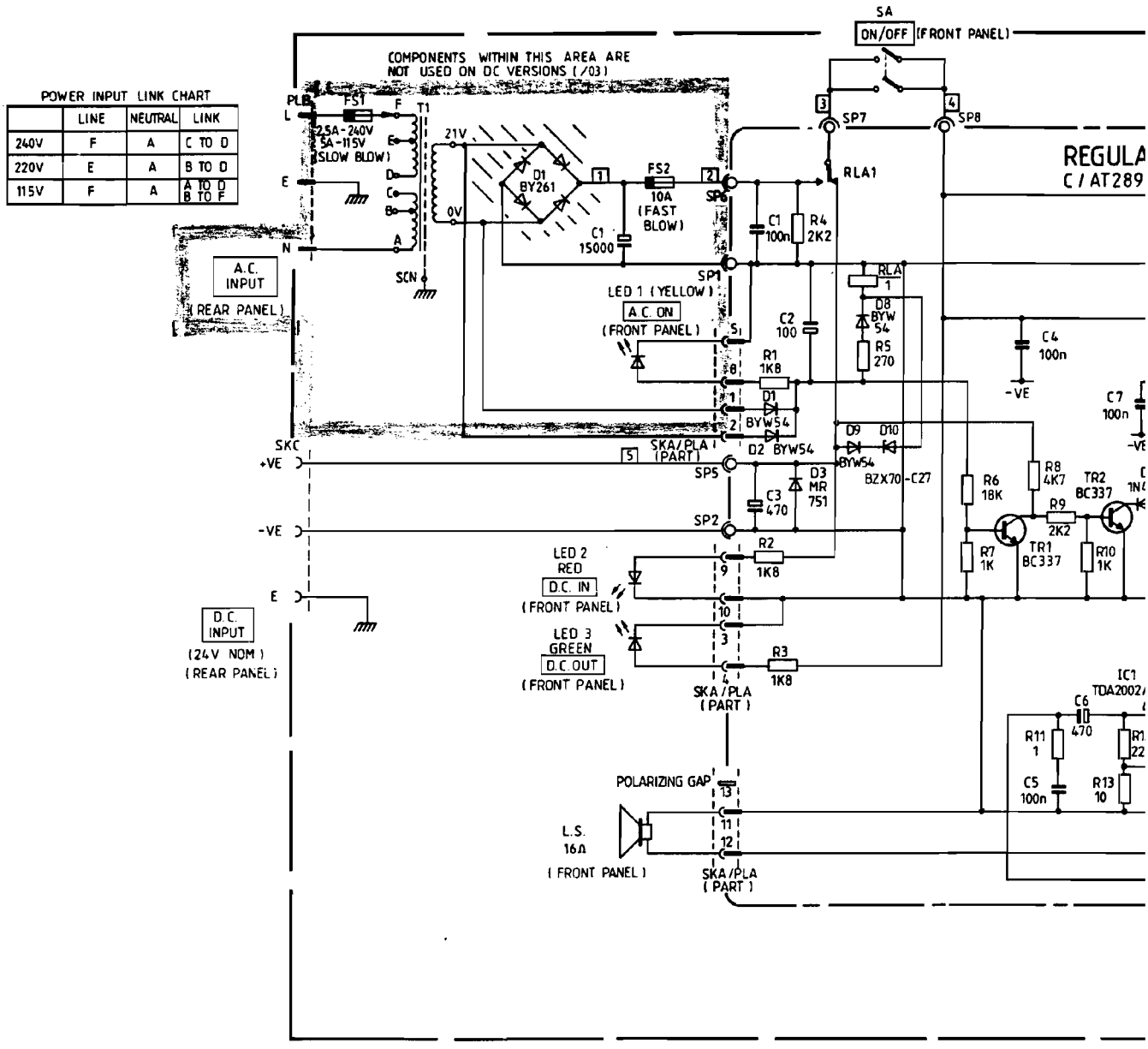
JOINTS ON AC MAINS PLUG, MAINS TRANSFORMER AND EARTH PINS TO BE WRAPPED AND SOLDERED

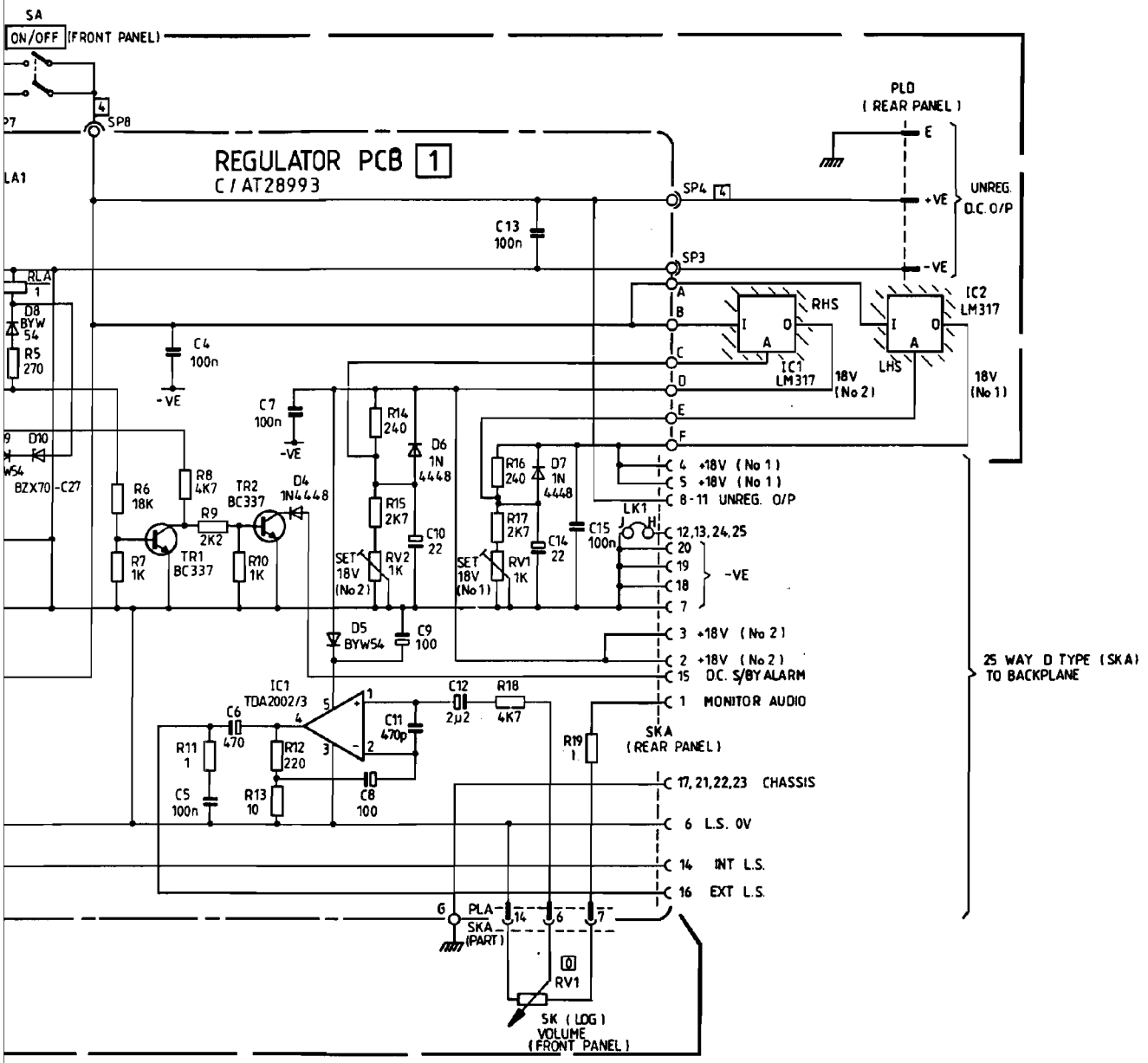


PSU AT04870/-
POWER WIRING DETAILS



REGULATOR AT28993
LAYOUT DIAGRAM


POWER INPUT LINK CHART
LINE
NEUTRAL
LINK
240V
F
A
C TO D
220V
E
A
B TO D
115V
F
A
A TO D
B TO F
COMPONENTS WITHIN THIS AREA ARE NOT USED ON DC VERSIONS (/03)
PL1
FS1
2.5A-240V
5A-115V
(SLOW BLOW)
T1
21V
0V
D1
BY261
FS2
10A
(FAST
BLOW)
C1
15000
C1
100n
R4
2K2
SA
ON/OFF (FRONT PANEL)
SP7
SP8
RLA1
REGULA
C/AT289
A.C.
INPUT
(REAR PANEL)
SCN
SP1
LED 1 (YELLOW)
A.C. ON
(FRONT PANEL)
C2
100
RLA
1
D8
BYW
54
R5
270
C4
100n
-VE
R1
1K8
D1
BYW54
C7
100n
SKC
+VE
SKA/PLA
(PART)
SP5
D2 BYW54
D9
D10
BYW54
BZX70-C27
R6
18K
R8
4K7
TR2
BC337
C3
470
D3
MR
751
SP2
R9
2K2
-VE
R7
1K
TR1
BC337
R10
1K
LED 2
RED
D.C. IN
(FRONT PANEL)
R2
1K8
E
D.C.
INPUT
(24V NOM)
(REAR PANEL)
LED 3
GREEN
D.C.OUT
(FRONT PANEL)
R3
1K8
SKA/PLA
(PART)
IC1
TDA2002
C6
470
R11
1
C5
100n
R13
10
POLARIZING GAP
L.S.
16Ω
(FRONT PANEL)
SKA/PLA
(PART)



PSU AT04870/-
CIRCUIT DIAGRAM

POWER SUPPLY MODULE
AT04878/-

WARNING

This power supply module has been designed to meet relevant safety requirements.
If it is necessary to replace any safety conscious component only the item quoted in the Parts List 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 re-wiring of the mains input supply cables is necessary the specified type MUST be used and alterations to the routeing or connections MUST NOT be made.

INTRODUCTION

Three versions of this module provide for operation from an AC supply of either 115V or 220/240V, or from a 24V nominal DC supply. In each version an unregulated 24V DC output is provided for use on the transmitter power amplifier whilst two regulators each produce an output of +18V DC.

This module also houses the monitor amplifier and loudspeaker (optional).

DETAILED DESCRIPTION

AC Supply

The AC input is applied, via [0]FS1, to the step-down transformer [0]T1. The secondary voltage is rectified in [0]D1 and smoothed by [0]C1; [0]FS2 protects the rectified voltage which is applied to the regulator board across SP6 and SP1.

Rectification provided by [1]D1 and [1]D2 is smoothed by [1]C2 to produce a voltage which lights [0]LED1 (AC ON), causes [1]TR1 to conduct inhibiting the 'DC POWER IN USE' line, provides a supply for [1]RLA via [1]D10 and is fed to [1]IC2 pin6. Contact [1]RLA1 ([1]RLA energised) connects the rectified voltage on SP6, via the on/off switch SA, to:

(i) provide an unregulated 24V output across SP3 and SP4

(ii) light [0]LED3 (DC OUT) indicating the presence of an unregulated voltage

(iii) supply an input to the 18V regulators [0]IC1 and [0]IC2

DC Supply

The DC supply is connected to SKC and applied to the regulator board across SP5 and SP2. [1]D3 provides reverse polarity protection and [0]LED2 indicates the presence of a DC input.

The input voltage is routed via contact [1]RLA1 ([1]RLA de-energised) and the on/off switch as described under 'AC Supply'. The voltage also causes [1]TR2 to conduct to provide an active 'low' on the 'DC POWER IN USE' line.

Supply Monitoring Circuits

The supply monitoring circuits which comprise [1]IC2 and its associated components provide three functions:-

(i) selects the AC supply as a priority

(ii) in the event of an AC over-voltage selects the DC supply

(iii) in the absence of an AC supply holds on the DC supply.

[1]IC2(a) monitors the DC input from SP5 whilst [1]IC2(b) monitors the AC voltage via [1]D1,D2. On the application of AC power [1]IC2(b) senses the voltage at [1]D1,D2, the output from [1]IC2(b) pin7 causes [1]TR3 and hence [1]TR4 to conduct, energising [1]RLA. If an AC over-voltage occurs it is sensed by [1]IC2(b) which causes [1]TR3 and hence [1]TR4 to cut off, de-energising [1]RLA thus disconnecting the rectified AC at SP6 and connecting the external DC input at [0]SKC (unless an over-voltage is also present on the DC input, in which case the output from [1]IC2(a) will maintain [1]TR4 in the conducting state).

With a DC but no AC input connected to the PSU the output of [1]IC2(a) holds [1]TR4 in the cut off state and [1]RLA remains de-energised, should a DC over-voltage occur under these conditions [1]IC2(a) will cause [1]RLA to energise removing the DC supply to the base station.

Regulator

The dual regulators [0]IC1 and [0]IC2 are similar in operation, each 18V output is set by a potentiometer, [1]RV2 and [1]RV1 respectively.

Monitor Amplifier and Loudspeaker

The AF monitor input from the control module is fed, via the front panel volume control [0]RV1, to amplifier [1]IC1. The AF output and LS OV lines are routed to the rear panel connector [0]SKA, enabling either the use of an internal loudspeaker by linking pins 16 and 14 or an external loudspeaker (connected across pins 6 and 16).

SPECIFICATION

AC Input	115, 220, or 240V ±10% 47-60Hz Fuse integral with IEC connector
DC Input	24V -10% +20% +ve or -ve chassis Fuses in line with supply lead
Power consumption	AC Supply 200VA max. DC Supply 160W max.
DC outputs	(i) 25V (nominal) unregulated 5A maximum Ripple less than 3V pk-pk Used for: PA module 4A max C/O relay (35mA) External equip 200mA max (ii) 18V ± 0,5V 1,3A maximum Ripple less than 1mV pk-pk Used for: TX Driver 0,8A max RX module 0,5A max (iii) 18V ± 0,5V 0,9A maximum Ripple less than 1mV ptp Used for: Local control 0,5A max Remote control 0,3A max Monitor Amp 0,1A max DC fuse on back panel
Monitor Amplifier	Sensitivity 300mV (for 1W into 15Ω) Freq Response 300Hz to 3kHz ±1dB Power Output 2W into 8Ω
Internal Loudspeaker	1W, 16Ω, 2,5 inch
Connectors	AC input 3 pin IEC male Interface/DC output 25 way D plug DC input * 3 pin AMP female DC output ** 3 pin AMP male * Also used for +ve/-ve chassis linking ** For use as stand-alone PSU

TEST PROCEDURE

Test Equipment required

Note: Refer to Part I, Table 3.1 for suitable types.

1. DC Power Supply
2. AF Generator (with output millivoltmeter)
3. Variable DC Load
4. Digital multimeter
5. Oscilloscope.
6. Multimeter
7. Metrohm
8. AF Power Meter
20. 'Break-out' connector 25way

1. Remove the module cover and connect DC supply at 25V to SKC.

2. With front panel switch 'off' check that the green front panel DC ON indicator is not lit.
   With front panel switch 'on', check that both the red DC IN and the green DC ON indicators are lit.

3. Set RV2 to give 18,3V unloaded across SKA pins 2 and 18.
   Connect DC load, set to 1,3A, across SKA pins 2 and 18.
   Check voltage on SKA pin 2 is greater than 17,5V.

4. Set RV1 to give 18,3V unloaded across SKA pins 4 and 18.
   Connect DC load, set to 1,3A, across SKA pins 4 and 18.
   Check voltage on SKA pin 6 is greater than 17,5V.

5. Increase DC supply to 32V and check that the green DC ON indicator is lit.
   Increase supply to 40V and check that green indicator extinguishes.
   Reduce DC supply to 25V.

6. Set front panel volume control fully counter-clockwise.
   Connect AF generator set to 800mV at 1kHz across SKA pins 1 and 7.
   Connect oscilloscope and AF power meter (set to 8Ω) between SKA pins 6 and 16.
   Adjust volume control so that AF waveform is just below clipping level.
   Check AF power is greater than 2W.

7. Connect variable load, set to 1A, across the un-regulated 24V output PLD; check output is greater than 31V
   Increase current to 6A; check output is greater than 24V.

8. Set variable load to minimum.
   Remove all connectors and check for isolation between SKC earth terminal and negative terminal.
   Check for continuity between SKC earth terminal and SKA pin 21 and to PLD earth terminal.

9. AC Supply Only

   Re-fit plug into SKC linking negative to earth.

10. Remove all items of test equipment and refit the module cover.

POWER SUPPLY UNIT

AT04878/01 240V AC with Loudspeaker
AT04878/02 110V AC with Loudspeaker
AT04878/03 24V DC with Loudspeaker
AT04878/04 240V AC less Loudspeaker
AT04878/05 110V AC less Loudspeaker
AT04878/06 24V DC less Loudspeaker

♆ Denotes safety conscious component

Cct Ref		Description	Part No	Remarks
COMMON ITEMS				
PLD		DC socket & lead assy	AT14751	
SKC		DC socket & lead assy	AT14752	
		Knob printed	BJ30904/03	1/RV1 (Volume)
RV1		5k ±20% Pot log	PL09220	Volume
SA		Switch power c/w bracket	FS50951	On/off
LED2		LED red	FV05858	DC input
LS1		Loudspeaker 15Ω	FS11215	/01-03
		Spring retaining LS	BT50521	/01-03
		Button black	FR10750	1/SA
		Bush LED panel mounting	QA99007	1/LED2
		Heatsink assembly	AT14757	
		Front panel assembly	AT14816	
		Cover PSU	BT15914	
		Spacer	BT27210	2/SA
		Label, unit	BT38209/01	Unit label
		Nut st hex M2,5	QA11604/B	2/mains plug - chassis (/01,02,04,05), 2/blanking plate (/03,06)
		Scr st tap pozi No6 x 9,5mm	QJ07697/X	3/heatsink - chassis, 3/regulator heatsink - chassis, 4/front panel - chassis, 4/PSU cover - chassis
		Scr st pan pozi M3 x 10mm	QJ11903/X	2/SA
			AT04878/01 240V AC	
			AT04878/02 110V AC	
			AT04878/04 240V AC	
			AT04878/05 110V AC	
		PCB Assy, regulator & h'sink	AT14901/01	
T1	♆	Transfomer mains	AL21473	
		Plug assy	AT14814	SKC - -Ve
		Lead assy AC	AT70234/01	LEDs & vol switch - PCB
		Wire kit	AT70156	
		Lead assy	AT70180	AC on/off - mains plug
LK1		Wire link assembly	AT14923	
C1		15000 -10% +30% Cap elec	PS68022	
FS1	♆	Fuse 2,5A, time lag, mains	FF99042	/01,04 only
FS1	♆	Fuse 5A, mains	FF99038	/02,05 only
FS2		Fuse 10A	FF99021	
PLB/FS1	♆	Plug mains c/w fuseholder	FP11522	
LED1		LED yellow	FV05930	AC ON
		Accessories style CEE22	FS41518	1/AC mains plug retainer
	♆	Strap	BT27069	1/T1
	♆	Label 'LIVE TERMINALS ENCLOSED'	BT37403/01	
	♆	Label 'DISCONNECT POWER LEAD'	BT37404/01	
		Label, Warning	3513 903 40031	
	♆	Cover mains transformer	BT15941	
		Fuse holder panel mounting	FH99100	1/FS2
		Shroud insulating	FH99102	1/FS2 fuseholder
	♆	Boot insulating	FR10953	1/PLB & FS1
	♆	Sleeve pink neoprene	FS22515	3/Mains plug connections
		Cap, protection	FC11916	1/C1 terminals
		Bush LED panel mounting	QA99007	1/LED1
		Washer st M6	QA15010/X	1/strap - transformer
		Scr st tap pozi No6 x 9,5mm	QJ07697/X	2/strap - chassis
		Scr st csk pozi M2,5 x 6mm	QJ11601/B	2/mains plug - chassis
		Scr st hex M6 x 12mm	QJ13328/X	1/strap - transformer, 1/transformer - chassis
			AT04878/03 24V DC ONLY	
		PCB assy regulator & h'sink	AT14901/02	
LK1		Wire link assembly	AT14923	
		Lead assy DC	AT70234/02	Volume switch - PCB

Cct Ref	Description	Part No	Remarks
	Plate blanking	BT20260	For mains connector
	Hole plug black	FG02576	For FS2 fuseholder
	Hole plug black	FG02737	For LED1
	Strap	BT27069	1/Baseplate
	Scr st tap pozi No6 x 9,5mm	QJ07697/X	2/strap - baseplate
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	2/plate blanking

FRONT PANEL ASSEMBLY PSU
AT14816

	Panel, front, printed	BT30973	
	Handle	BT35950	
	Label, PSU	BT38206/01	1/Handle
	Label, Philips	BT38208/01	1/Handle
	Housing, double row, 4 pos'n	FC00821/04	1/LED3
LED3	LED, green	FV05931	DC Power
	Fastener	BT17284	4/PSU-shelf
	Contact, male crimp	FC00839	3/LED wires
	Scr st tap pozi No.4 x 8mm	QJ08241/X	3/Handle-front panel

REGULATOR PCB AND HEATSINK ASSEMBLY

AT14901/01 AC
AT14901/02 DC

	PCB Assembly Regulator	AT29060	
IC1	IC Volt reg 317	FU99119	
D1	Rectifier bridge 26MB40A	9337 195 10682 /01	
	Heatsink	BT45159	
	Pillar hexagon	BT04411	
	Nut st hex M3	QA11605/X	1/IC1
	Nut st hex M4	QA11607/X	1/D1 (/01 only)
	Scr st pan pozi M3 x 5mm	QJ11900/X	4/Regulator PCB - pillars
	Scr st pan pozi M3 x 8mm	QJ11902/X	4/Heatsink - pillars
	Scr st pan pozi M3 x 10mm	QJ11903/X	1/IC1
	Scr st pan pozi M4 x 20mm	QJ11921/X	1/D1 (/01 only)
	Washer st form A M3	QA15005/X	1/IC1
	Washer st form A M4	QA15007/X	1/D1 (/01 only)
	Bush insulating (TO-220)	QA99024	1/IC1
	Washer insulating (TO-220)	QA99025	1/IC1

AT29060
PCB ASSEMBLY REGULATOR

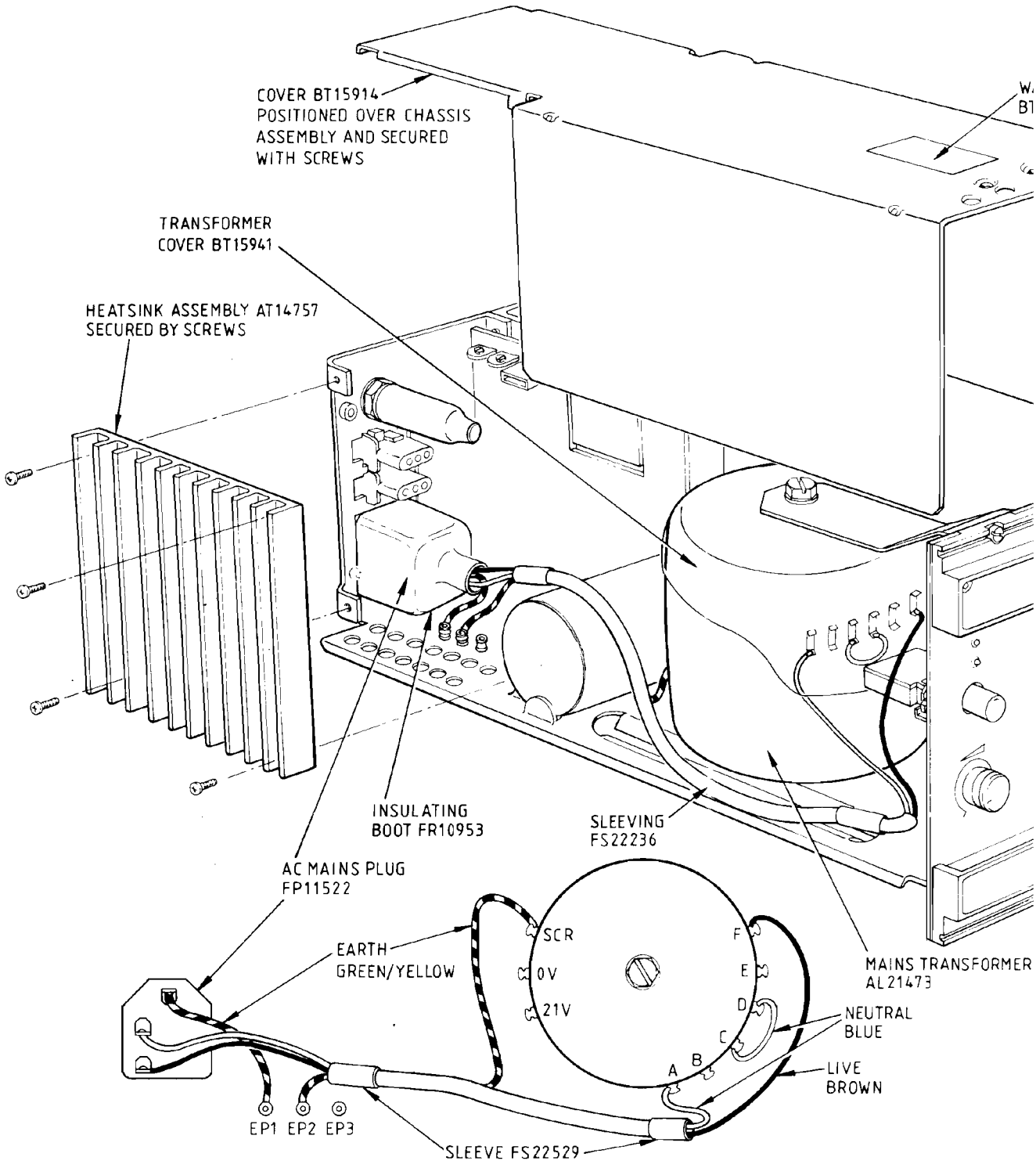
Semiconductors & IC's

IC1	IC Audio amp 2002	FU08027
IC2	IC Dual op amp 1458	FU99092
TR1,2	Transistor BC337 GP	FV05896
TR3	Transistor GP BC547	FV05889
TR4	Transistor BC337 GP	FV05896
D1,2	Diode GP BYW54	FV05892
D3	Diode MR751	FV08961
D4	Diode GP 1N4448	FV05874
D5	Diode GP BYW54	FV05892
D6-8	Diode GP 1N4448	FV05874
D9-11	Diode GP BYW54	FV05892
D12	Diode zener 13V ±5%	FV05871
D13	Diode zener 18V ±5%	FV05873
D14	Diode GP BYW54	FV05892
D15	Diode GP 1N4448	FV05874
D16	Diode GP BYW54	FV05892
D17	Diode GP 1N4448	FV05874

Resistors

R1-3	1k8	0,5W ±2%	m oxide	PL99308
R4	2k2	0,5W ±2%	m oxide	PL99309
R5	3k16	0,25W ±2%	m film	PM99092
R6	18k	0,25W ±2%	m film	PM99312
R7	1k	0,25W ±2%	m film	PM99282
R8	4k7	0,25W ±2%	m film	PM99298
R9	2k2	0,25W ±2%	m film	PM99290
R10	1k	0,25W ±2%	m film	PM99282
R11	1	0,25W ±2%	m film	PM99210
R12	220	0,25W ±2%	m film	PM99266
R13	10	0,25W ±2%	m film	PM99234

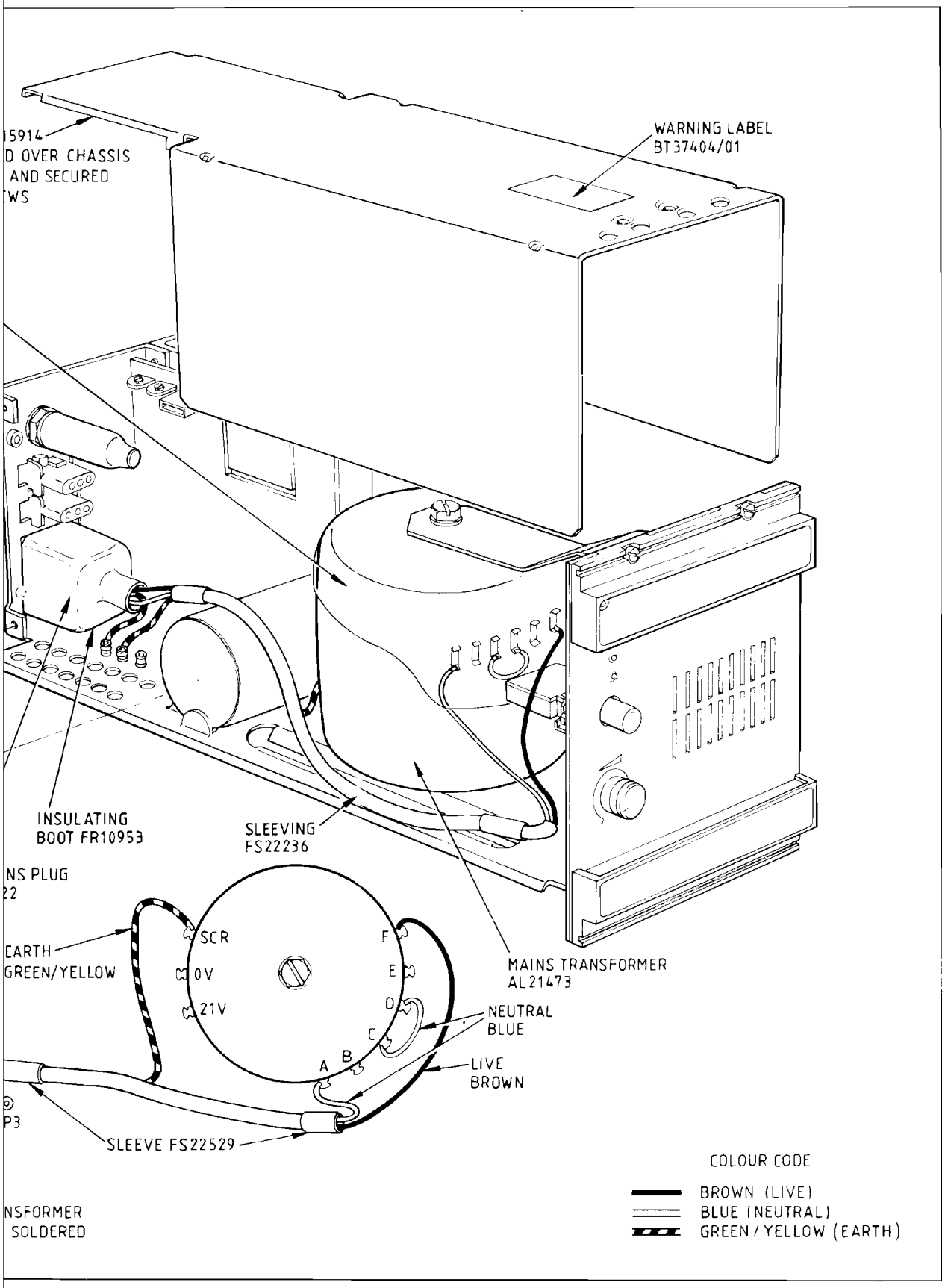
Cct Ref	Description	Part No.	Remarks
Resistors (Cont'd)			
R14	240 0,25W ±2% m film	PM99267	
R15	2k7 0,25W ±2% m film	PM99292	
R16	240 0,25W ±2% m film	PM99267	
R17	2k7 0,25W ±2% m film	PM99292	
R18	4k7 0,25W ±2% m film	PM99298	
R19	1 0,25W ±2% m film	PM99210	
R20	180 0,25W ±2% m film	PM99264	
R21	18k 0,25W ±2% m film	PM99312	
R22	12k 0,25W ±2% m film	PM99308	
R23	18k 0,25W ±2% m film	PM99312	
R24	12k 0,25W ±2% m film	PM99308	
R25	1k 0,25W ±2% m film	PM99282	
R26	33k 0,25W ±2% m film	PM99318	
R27	18k 0,25W ±2% m film	PM99312	
R28	1k3 0,25W ±2% m film	PM99285	
R29	150k 0,25W ±2% m film	PM99334	
R30	18k 0,25W ±2% m film	PM99312	
R31	6k8 0,25W ±2% m film	PM99302	
R32	560 0,25W ±2% m film	PM99276	
R33	180 0,25W ±2% m film	PM99264	
RV1/2	1k ±20% Pot skel lin	PL01483	
Capacitors			
C1	100n ±10% 63V pes	PQ99511	
C2	100 ±20% 50V elec	PS99440	
C3	470 ±20% 35V elec	PS99433	
C4,5	100n ±10% 63V pes	PQ99511	
C6	470 ±20% 16V elec	PS99416	
C7	100n ±10% 63V pes	PQ99511	
C8,9	100 ±20% 25V elec	PS99424	
C10	22 ±20% 25V elec	PS99421	
C11	470p ±20% cer	PN99933	
C12	2µ2 ±20% 100V elec	PS99456	
C13	100n ±10% 63V pes	PQ99511	
C14	22 ±20% 25V elec	PS99421	
C15	100n ±10% 63V pes	PQ99511	
C16	47 ±20% 50V elec	PS99439	
Miscellaneous			
PLA	Plug PCB mtd straight 2 x 7	FP99290	
RLA	Relay 2 pole changeover	FR21714	
SKA	Socket 25-way D type angle	FS99082	
	Heatsink	BT37523	1/IC1
	Insulating bead	FJ00007	1/R5
	Nut st hex M3	QA11605/X	2/SKA, 1/IC1
	Scr st pan pozi M3 x 6mm	QJ11901/X	1/IC1
	Scr st pan pozi M3 x 10mm	QJ11903/X	2/SKA



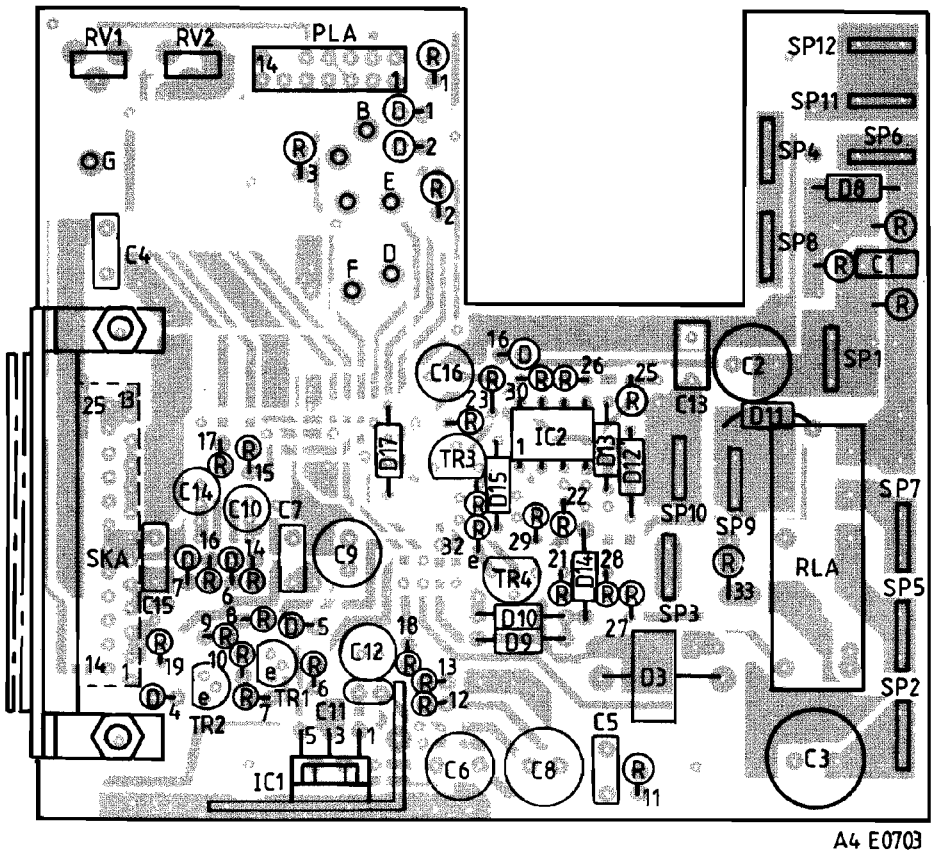
NOTE

JOINTS ON AC MAINS PLUG, MAINS TRANSFORMER AND EARTH PINS TO BE WRAPPED AND SOLDERED

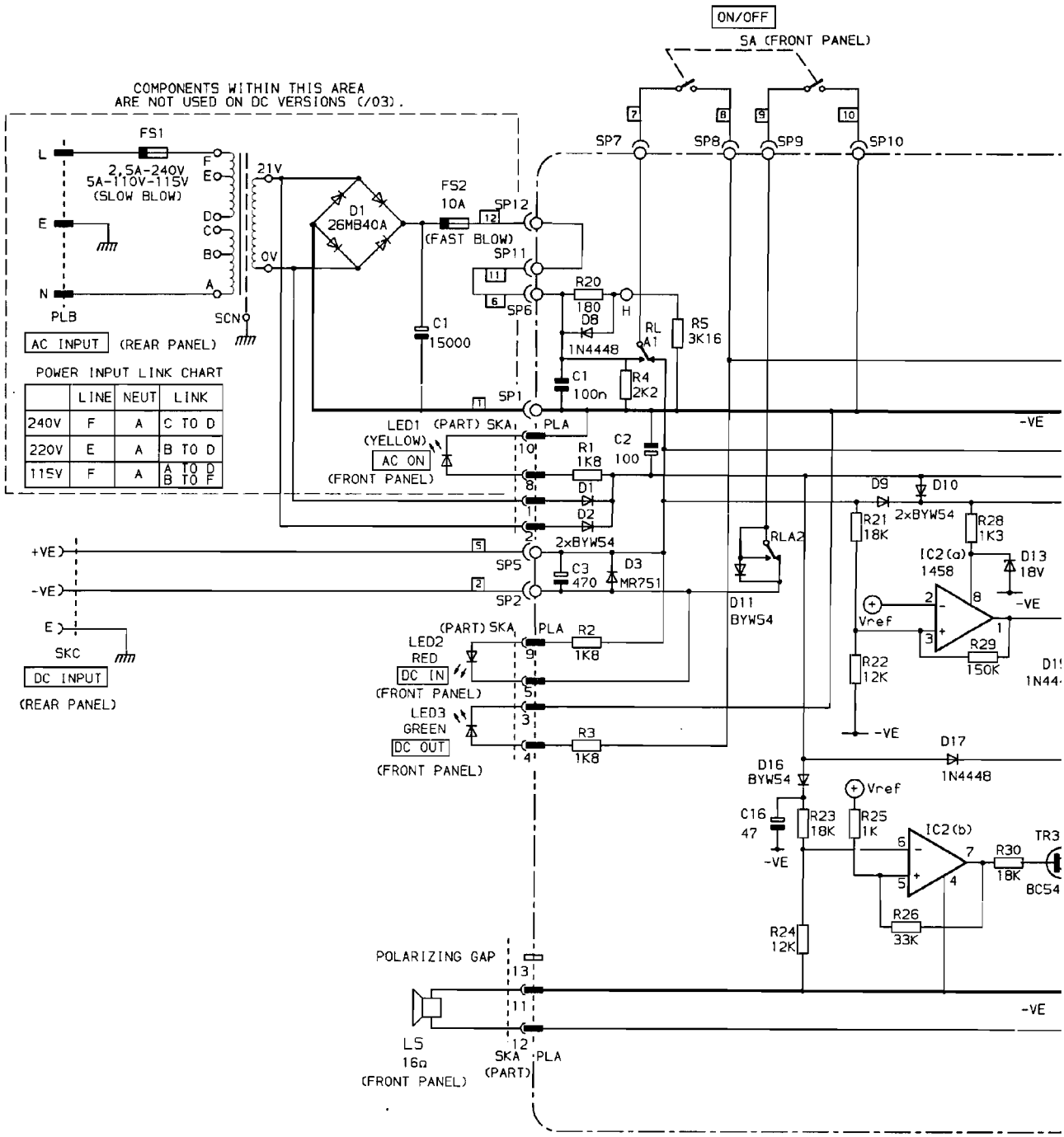
PSU ATO4878/
POWER WIRING



PSU ATO4878/-
POWER WIRING DETAILS

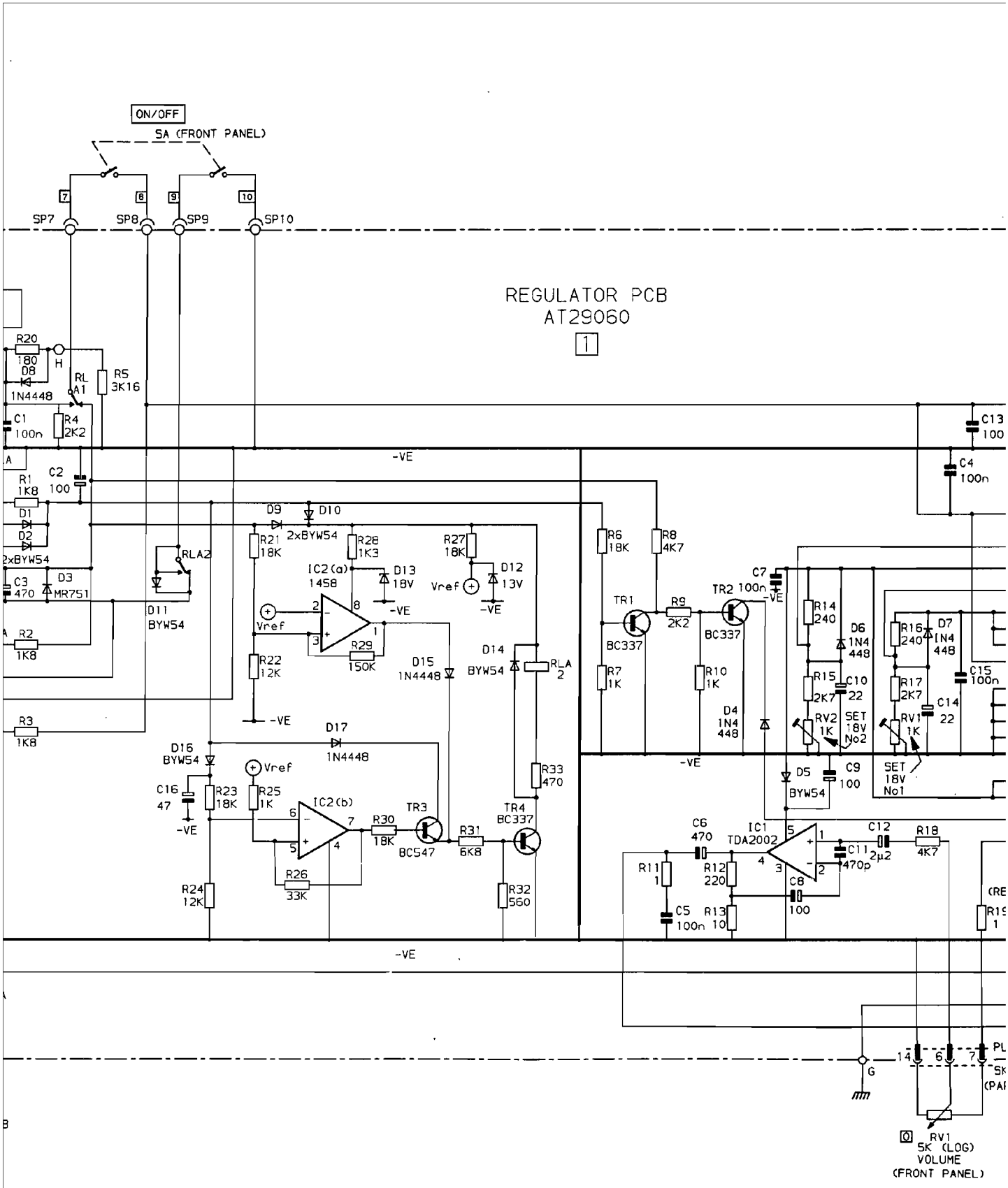


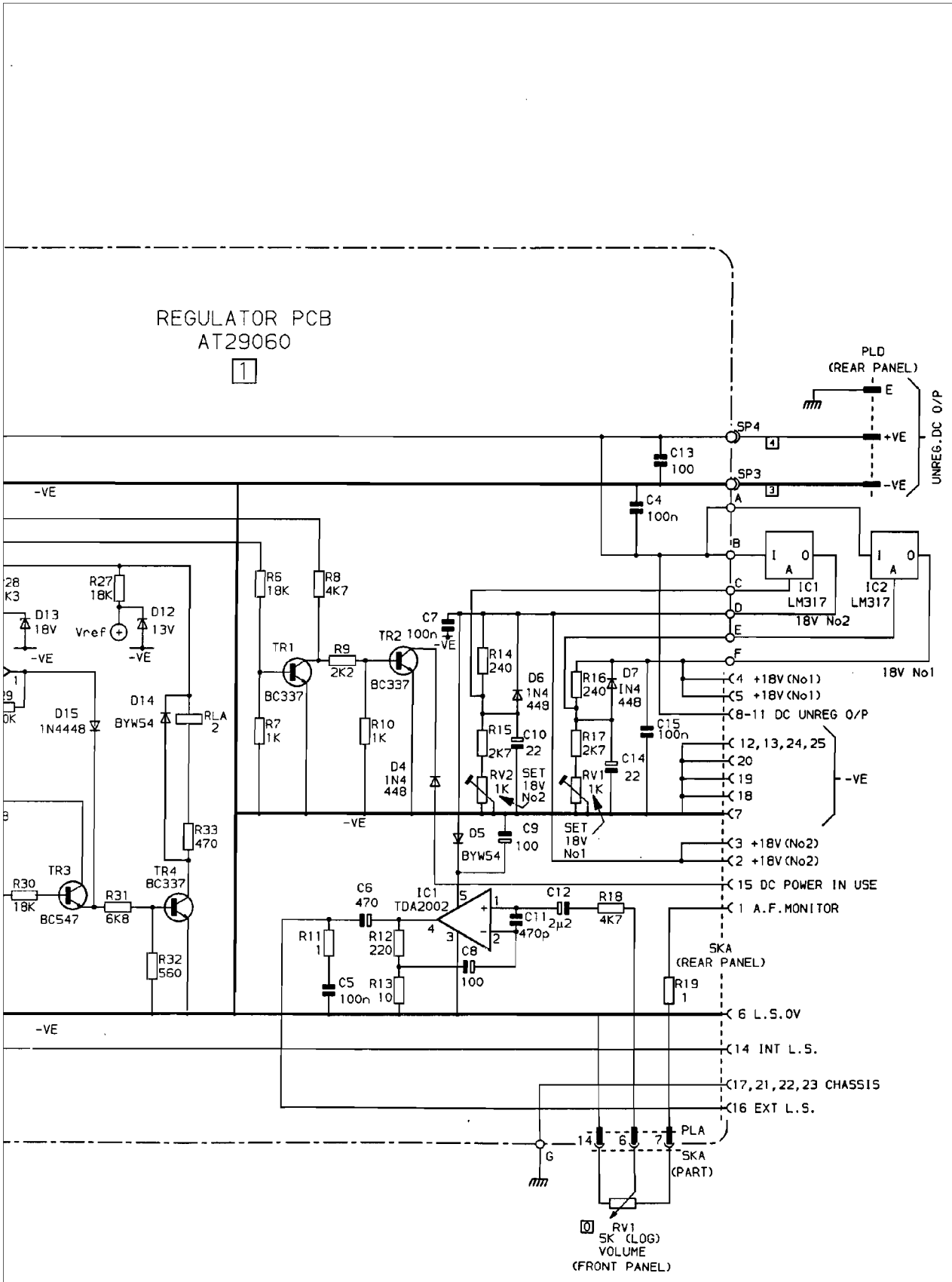
REGULATOR AT29060
LAYOUT DIAGRAM



NOTES

1. WHEN REFERENCE IS MADE TO COMPONENTS ON THE REGULATOR PCB
   PREFIX [1] SHOULD BE USED, ANY COMPONENT NOT ON THE PCB
   PREFIX [0] SHOULD BE USED.


ON/OFF
SA (FRONT PANEL)
SP7
SP8
SP9
SP10
REGULATOR PCB
AT29060
1
R20
180
D8
1N4448
H
RL
A1
R5
3K16
C1
100n
R4
2K2
C2
100
R1
1K8
D1
D2
2xBYW54
C3
470
D3
MR751
R2
1K8
R3
1K8
RLA2
D11
BYW54
-VE
D9
D10
2xBYW54
R21
18K
R28
1K3
R27
18K
IC2(a)
1458
D13
18V
Vref
D12
13V
R29
150K
R22
12K
D15
1N4448
D14
BYW54
RLA
2
D17
1N4448
D16
BYW54
C16
47
R23
18K
R25
1K
IC2(b)
R30
18K
TR3
BC547
R31
6K8
TR4
BC337
R33
470
R24
12K
R26
33K
R32
560
R6
18K
R8
4K7
TR1
BC337
R9
2K2
TR2
BC337
C7
100n
R7
1K
R10
1K
D4
1N4
448
R14
240
D6
1N4
448
R16
240
D7
1N4
448
R15
2K7
C10
22
R17
2K7
C14
22
C15
100n
RV2
1K
SET
18V
No2
RV1
1K
SET
18V
No1
D5
BYW54
C9
100
C6
470
IC1
TDA2002
C12
2µ2
R18
4K7
C11
470p
R11
1
R12
220
C8
100
C5
100n
R13
10
C13
100
C4
100n
G
14
6
7
RV1
5K (LOG)
VOLUME
(FRONT PANEL)



PSU AT04878/-
CIRCUIT DIAGRAM

RECEIVER MODULE
AT04871/-

INTRODUCTION

The receiver module converts the RF signals at the antenna into audio which is processed in the control module. Carrier level squelch and noise squelch outputs are also provided to the control module.

The injection frequency is derived from an oven controlled crystal oscillator.

DETAILED DESCRIPTION

RF Head

RF signals at the antenna are routed to a two stage RF filter comprising L1, C3, C4 inductively coupled to L2, C7, C8. Capacitive tuning of each stage is used. RF amplification is provided by TR1, a dual gate FET, the output of which is fed to a further three stage RF filter L3, C14; L4, C18; L5, C20; likewise capacitive tuning of each stage is used. These three stages together with the initial two, provide image channel rejection and protection from blocking. The amplified and filtered RF signal is applied via C52 to gate g1 of the 1st mixer stage TR7.

Local Oscillator

The injection frequency is provided by a crystal controlled oscillator XL1, TR2 operating on the crystal third overtone. Temperature stabilisation is provided by a crystal oven assembly and accurate frequency adjustment is achieved by L6. The oscillator output is fed via buffer TR3 through multiplication stages (2 x 2 on K Band; 1 x 3 on A and B Bands) to the injection amplifier TR6. The output from TR6 is fed to a top coupled bandpass filter L10, C44, C45 and C47, C48, L11. The injection frequency is passed to gate g2 of the 1st mixer and to detector circuit D6, C60 which feeds the injection fail detector, TR16, TR19.

Mixer

The mixer output on the drain of TR7 contains a component which is the required 21,4MHz difference frequency and this is recovered across inductor L12,R57 for connection to the crystal filter FL1, which provides the majority of adjacent channel rejection.

IF Stages

TR9 is used to match the filter output to the main IF gain stage TR10. The 2nd oscillator, 2nd IF amplifier and discriminator are all incorporated in IC1, the external circuitry of which includes the 2nd oscillator crystal XL2, a 455kHz ceramic filter FL2 which reduces noise bandwidth and improves adjacent channel rejection, and the discriminator quadrature tuned circuit L15, C76, C77 tuned to the 2nd IF of 455kHz.

AF Stages.

The audio output from the discriminator is amplified by the variable gain stage IC7(a), controlled by RV3, to provide a specific audio level to AF processing circuits on the control board. The discriminator output is also applied to the noise circuit.

Noise Circuit

The noise signal level is set, via RV4, by variable gain amplifier 1C8(a) and then fed to the two-stage high-pass filter 1C8(b), 1C9(a) which removes all signals below 3kHz (i.e. modulation) to ensure that only 'noise' is passed, via buffer amp 1C9(b) to the noise squelch control circuit on the control module logic board.

Metering Circuit

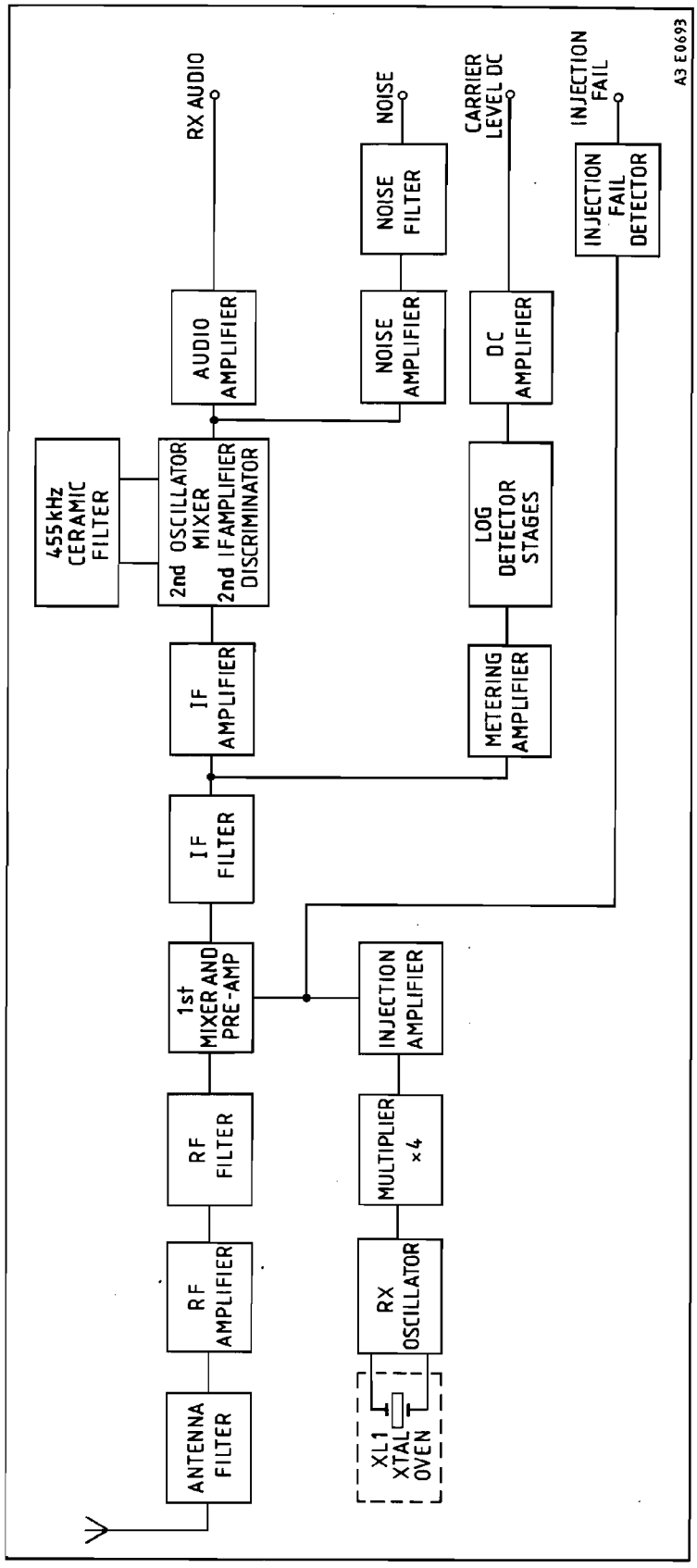
A sample of IF from the drain of TR9 is amplified in three stages TR11, TR12, TR13 and level set by RV1 to give a sufficient signal to operate the limiting detectors IC2-IC5. Ceramic filter FL3 selects the 21,4MHz frequency component from the wideband noise and TR14 matches the filter output to 1C2. The collector load of TR11 is temperature controlled by TR8 and its associated circuit using a -ve temperature coefficient thermistor TH1, to provide overall temperature compensation.

The limiting detector circuit comprises successive detection log IF strips utilising integrated circuits. The four stages are connected in cascade with the detected output from each stage being parallel with all other previous stages. An overall range of 40dB is achieved within this circuit with RV2 setting the final DC level to buffer amplifier IC6(a). The DC output signal is fed to the carrier level squelch circuit on the control module logic board and to the metering output pin of the facilities socket.

CRYSTAL INFORMATION

Crystal Type: C5692, ±2ppm oven controlled

Band	Carrier Frequency	Crystal Frequency	Crystal Range
A9	146 to 174MHz	$fx = \frac{fc - 21,4}{3}$ MHz	41,533 to 50,867MHz
B0	132 to 156MHz	$fx = \frac{fc - 21,4}{3}$ MHz	36,867 to 44,867MHz
K1	174 to 208,4875MHz	$fx = \frac{fc + 21,4}{4}$ MHz	48,85 to 57,475MHz
K2	208,5 to 225MHz	$fx = \frac{fc - 21,4}{4}$ MHz	46,775 to 50,9MHz



RECEIVER 04871/-
BLOCK DIAGRAM

SPECIFICATION

Bands	A9 146-174MHz BO 132-156MHz KO 174-225MHz
Channel Spacing	12,5kHz, 20kHz, 25kHz
Input Impedance	50Ω nominal
Max. RF input level	2V from 50Ω source
Number of Channels	Single channel only
Audio Response *	300 Hz to 3kHz +1 -3dB rel to level at 1kHz and 6dB/oct de-emphasis
Distortion	Less than 2,5% (60% deviation at 1kHz)
Signal/Noise ratio	Greater than 46dB at 1mV RF input (measured flat)
Line O/P impedance *	600Ω balanced
Supply Input	18V ±0,5V at 0,5A max.
Line O/P level *	4-Wire -37 to +47dBm (for 60% deviation at 1kHz) adjustable 2-Wire (remote) -16 to 0dBm (for 60% deviation at 1kHz) adjustable *Note: On 2-Wire system, O/P level should be within 6dB of TX input level*
Unprocessed RX Audio O/P level	300mV into 10k (for 60% deviation at 1kHz) not de-emphasised

* measured via control unit

INTERNAL MODULE INDICATIONS

Injection fail	Indicates that the local oscillator injection level at the mixer is low.

TEST PROCEDURE

Test Equipment required

Note: Refer to Part I, Table 3.1 for suitable types.

4. Digital Voltmeter
5. Oscilloscope
9. Distortion Meter
10. RF signal generator
11. Marker Oscillator
19. SINAD Meter
20. 'Break-out' connector 15 way

Preliminaries

1. Slacken the retaining screws and remove the screened cover from the module.

2. Set all potentiometers to mid-position and remove the crystal oven assembly and channel crystal.

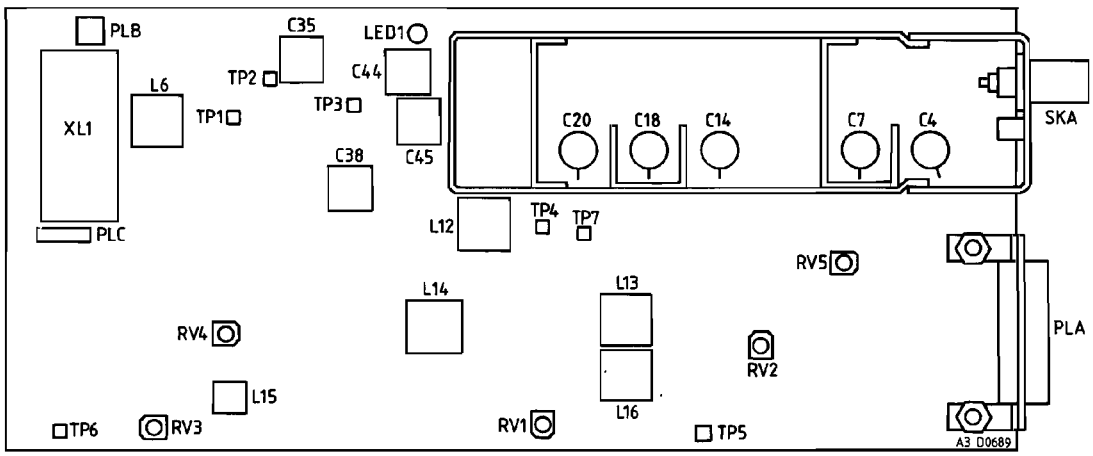


Fig. 1 Receiver Alignment Diagram

3. Connect the receiver module to the backplane, via the 'break-out' connector.
   Check PLA pin 9 for a DC input of +18V. Check power supply unit if this is incorrect.

4. Check TP6 on the receiver board for +14V DC. Adjust RV5 (SET 14V) as necessary.

5. Check that the following indicator is lit:

   control logic board [3C] LED4 RX ALARM (Red)

Receiver Alignment

6. Connect the voltmeter probe to TP1. Insert the channel crystal into socket 'XL1'. As this is done, the voltmeter reading should increase.

7. Adjust trimmer C35 for minimum voltmeter reading.

8. Move probe to TP2 and adjust C38 for minimum reading.

9. Move probe to TP3 and re-adjust C35 and C38 for maximum reading.

10. Adjust C44 for minimum reading, then C45 for maximum reading.

11. Move probe to TP4 and re-adjust C44 and C45 for maximum reading. Disconnect the voltmeter.

12. Connect the oscilloscope across the RX 600Ω audio line and the signal generator to the RF input SKA.

13. Modulate the RF input signal 1kHz at 60% maximum system deviation (msd), output 1mV. Sweep the generator plus and minus 30kHz of the anticipated channel frequency until the oscillope shows that the signal has been found. Adjust, in order, C20, C18, C14, C7 and C4 for maximum SINAD, decreasing the signal generator output level as necessary. Adjust L15 for maximum output.

14. Fit crystal oven assembly to XL1; connect flying lead to PLC on the PCB. Allow at least two minutes warm up time for the oven. Check supply current.
Reset the signal generator to channel frequency, and switch off the modulation.
Adjust L6 to zero beat the receiver onto frequency using the marker oscillator.
Reduce the signal generator level as necessary to observe the beat note on the oscilloscope.

15. Set the signal generator output to 1mV, with modulation applied and adjust L12 and L14 for SINAD of better than 30dB.

16. Reset the signal generator output level to 0,3µV and check for SINAD of 12dB.

17. Connect the voltmeter to PLA pin 4 (carrier level DC) and with thermistor TH1 temporarily short circuited adjust L13 and L16 for maximum reading.

18. Reset the signal generator output level to 1mV and check for a voltmeter reading of 10V. Adjust RV2 as necessary

19. Reset the signal generator output level to 0,3µV and check for a voltmeter reading of 4V. Adjust RV1 as necessary

20. Reset the signal generator output level to 10µV and check for a voltmeter reading of 8,8V.

21. Reset the signal generator output level to zero and check for a voltmeter reading of 3,3V.

Noise Detector

Note: Before proceeding with this check set the noise squelch control [3C]RV2 on the control logic board fully counter clockwise.

22. Reset the signal generator output level to produce a receiver SINAD of 12dB. Disconnect the oscilloscope.

23. Connect the voltmeter across the 600Ω Rx audio line on the rear panel and check for -20dBm. Adjust RV4 (SET NOISE) on the receiver module as necessary.

Distortion

24. Connect the distortion meter to PLA pin 10 (Rx audio) and set the signal generator output to 1mV.
Check PLA pin 10 for a reading of 300mV. Adjust RV3 as necessary.

Conclusion

25. Disconnect and remove all items of test equipment and refit the module cover.

RECEIVER MODULE

AT04871/01	K0 BAND, 12,5KHZ CHANNEL SPACING
AT04871/02	A9 BAND, 12,5KHZ CHANNEL SPACING
AT04871/03	B0 BAND, 12,5KHZ CHANNEL SPACING
AT04871/12	A9 BAND, 20/25KHZ CHANNEL SPACING
AT04871/13	B0 BAND, 20/25KHZ CHANNEL SPACING

Cct. Ref	Description	Part No.	Remarks
	PCB assembly Rx	AT28989/-	Not available as spare
	Front Panel Assembly, Rx	AT14817	
	Lid sealed box	BT13800	
	Cover plate rear	BT15913	
	Seal RF	BT29999	
	Label frequency align.	BT38238	
	Label, unit	BT38209/01	
	Box, RF, sealed	BT36216	
	Nut, st, hex, M2,5	QA11604/X	2/PLA
	Scr, st, pan, pozi, M2,5x8	QJ11946/X	2/PLA
	Scr st tap pan M3 x 6mm	QJ11550/X1	1/Antenna bracket - rear cover plate
	Scr st tap pan M3 x 6mm	QJ11551/X1	2/front panel - box, 14/cover - box, 4/PCB - box
	Scr st tap pozi No4 x 4,5mm	QJ08219/X	4/rear cover plate - box

FRONT PANEL ASSEMBLY
AT14817

Panel, front	BT23740	
Label, Philips	BT38216/01	
Fastener	BT17284	2/Rx - shelf
Handle	BT35949	
Scr st tap pozi No4 x 8mm	QJ08421/X	2/Handle

PCB ASSEMBLY RX

AT28989/01	K0 BAND, 12,5KHZ CHANNEL SPACING
/02	A9 BAND, 12,5KHZ CHANNEL SPACING
/03	B0 BAND, 12,5KHZ CHANNEL SPACING
/12	A9 BAND, 20/25KHZ CHANNEL SPACING
/13	B0 BAND, 20/25KHZ CHANNEL SPACING

PCB assy crystal oven	AT28910/04	Not available as spare

Semi-conductors and IC's

IC1	IC amp & discriminator 3357	FU07680
IC2-5	IC limiting RF amp 1613	FU08859
IC6-9	IC dual op amp MC1458D	3513 999 45004
IC10	IC 7806	FU99702
IC11	IC volt reg 317	FU99119
TR1	Transistor BF981	FV05895
TR2	Transistor MMBT918	FV99122/SM
TR3	Transistor MMBFU310/TI	3513 999 05009
TR4-6	Transistor MMBT918	FV99122/SM
TR7	Transistor BF981	FV05895
TR8	Transistor MMBT918	FV99122/SM
TR9	Transistor ON977/TI	3513 999 05007
TR10-13	Transistor MMBT918	FV99122/SM
TR14	Transistor MMBFU310/TI	3513 999 05009
TR15-17	Transistor BCX19	FV99102/SM
D1	Diode BZX84C6V8	3513 999 20011
D2	Diode Hyb.Cct BAV99	3513 999 15002
D3	Diode BZX84C6V8	3513 999 20011
D6	Diode BAT17	FV99070/SM

Inductors

L1	Coil	AT30626	A & B Bands
L1	Coil	AT30606	K Band
L2	Coil assy	AT30626/03	A & B Bands
L2	Coil air spaced 6mm	AT30606/02	K Band
L3	Coil assy	AT30626/01	A & B Bands
L3	Coil air spaced 6mm	AT30606/01	K Band
L4	Coil	AT30626	A & B Bands
L4	Coil	AT30606	K Band
L5	Coil assy	AT30626/02	A & B Bands
L5	Coil air spaced 6mm	AT30606/01	K Band

Cct. Ref	Description	Part No.	Remarks
Inductors Cont'd			
L6	Coil assy	AT32171/25	A & K Bands
L6	Coil assy	AT32171/26	B Band
	core	FC99105/01	
L7	Choke 1000µ ±10%	FT99008	
L8	Coil assy	AT32078/10	A & B Bands
L8	Coil assy	AT32079/03	K Band
L9-11	Coil assy	AT32080/10	A & B Bands
L9-11	Coil assy	AT32077/03	K Band
L12	Coil assy	AT32171/27	
	core	FC99105/01	
L13	Coil assy	AT32171/28	
	core	FC99105/01	
L14	Coil assy	AT32171/19	
	core	FC36120/01	
L15	Coil 455kHz	FT06616	
L16	Coil assy	AT32171/28	
	core	FC99105/01	
L17-19	Inductor 0µ15 ±20%	FT99290/SM	
L20,21	Choke assy	AT31684	
L22,23	Inductor 0µ15 ±20%	FT99290/SM	
L24	Inductor 1µ ±10%	FT99300/SM	
L25	Coil assy	AT30625	
Resistors			
R1	18k ±5% 0,125W SMD	3513 999 80051	
R2	68k ±5% 0,125W SMD	3513 999 80058	
R3	39k ±5% 0,125W SMD	3513 999 80055	
R4	68k ±5% 0,125W SMD	3513 999 80058	
R5	150 ±5% 0,125W SMD	3513 999 80026	
R6	4k7 ±5% 0,125W SMD	3513 999 80044	
R7	47 ±5% 0,125W SMD	3513 999 80020	
R8			Not Used
R9	100 ±5% 0,125W SMD	3513 999 80024	
R10	4k7 ±5% 0,125W SMD	3513 999 80044	
R11	680 ±5% 0,125W SMD	3513 999 80034	
R12	3k3 ±5% 0,125W SMD	3513 999 80042	
R13	3k9 ±5% 0,125W SMD	3513 999 80043	
R14	560 ±5% 0,125W SMD	3513 999 80033	
R15	1k ±5% 0,125W SMD	3513 999 80036	
R16	10k ±5% 0,125W SMD	3513 999 80048	
R17	470 ±5% 0,125W SMD	3513 999 80032	
R18	47k ±5% 0,125W SMD	3513 999 80056	
R19	4k7 ±5% 0,125W SMD	3513 999 80044	
R20	10 ±5% 0,125W SMD	3513 999 80012	
R21	560 ±5% 0,125W SMD	3513 999 80033	
R22	27 ±5% 0,125W SMD	3513 999 80017	
R23	10k ±5% 0,125W SMD	3513 999 80048	
R24	10 ±5% 0,125W SMD	3513 999 80012	
R25	47k ±5% 0,125W SMD	3513 999 80056	
R26	4k7 ±5% 0,125W SMD	3513 999 80044	
R27	560 ±5% 0,125W SMD	3513 999 80033	
R28	27 ±5% 0,125W SMD	3513 999 80017	
R29	10k ±5% 0,125W SMD	3513 999 80048	
R30	10 ±5% 0,125W SMD	3513 999 80012	
R31	8k2 ±5% 0,125W SMD	3513 999 80047	
R32	1k5 ±5% 0,125W SMD	3513 999 80038	
R33	27 ±5% 0,125W SMD	3513 999 80017	
R34	150 ±5% 0,125W SMD	3513 999 80026	
R35	10k ±5% 0,125W SMD	3513 999 80048	
R36	100 ±5% 0,125W SMD	3513 999 80024	
R37,38	4k7 ±5% 0,125W SMD	3513 999 80044	
R39,40	47k ±5% 0,125W SMD	3513 999 80056	
R41	150 ±5% 0,125W SMD	3513 999 80026	
R42	10k ±5% 0,125W SMD	3513 999 80048	
R43	18k ±5% 0,125W SMD	3513 999 80051	
R44	15k ±5% 0,125W SMD	3513 999 80050	
R45	470 ±5% 0,125W SMD	3513 999 80032	
R46	10k ±5% 0,125W SMD	3513 999 80048	
R47	220 ±5% 0,125W SMD	3513 999 80028	
R48	15k ±5% 0,125W SMD	3513 999 80050	
R49	3k9 ±5% 0,125W SMD	3513 999 80043	
R50	680 ±5% 0,125W SMD	3513 999 80034	
R51	100 ±5% 0,125W SMD	3513 999 80024	
R52	10 ±5% 0,125W SMD	3513 999 80012	

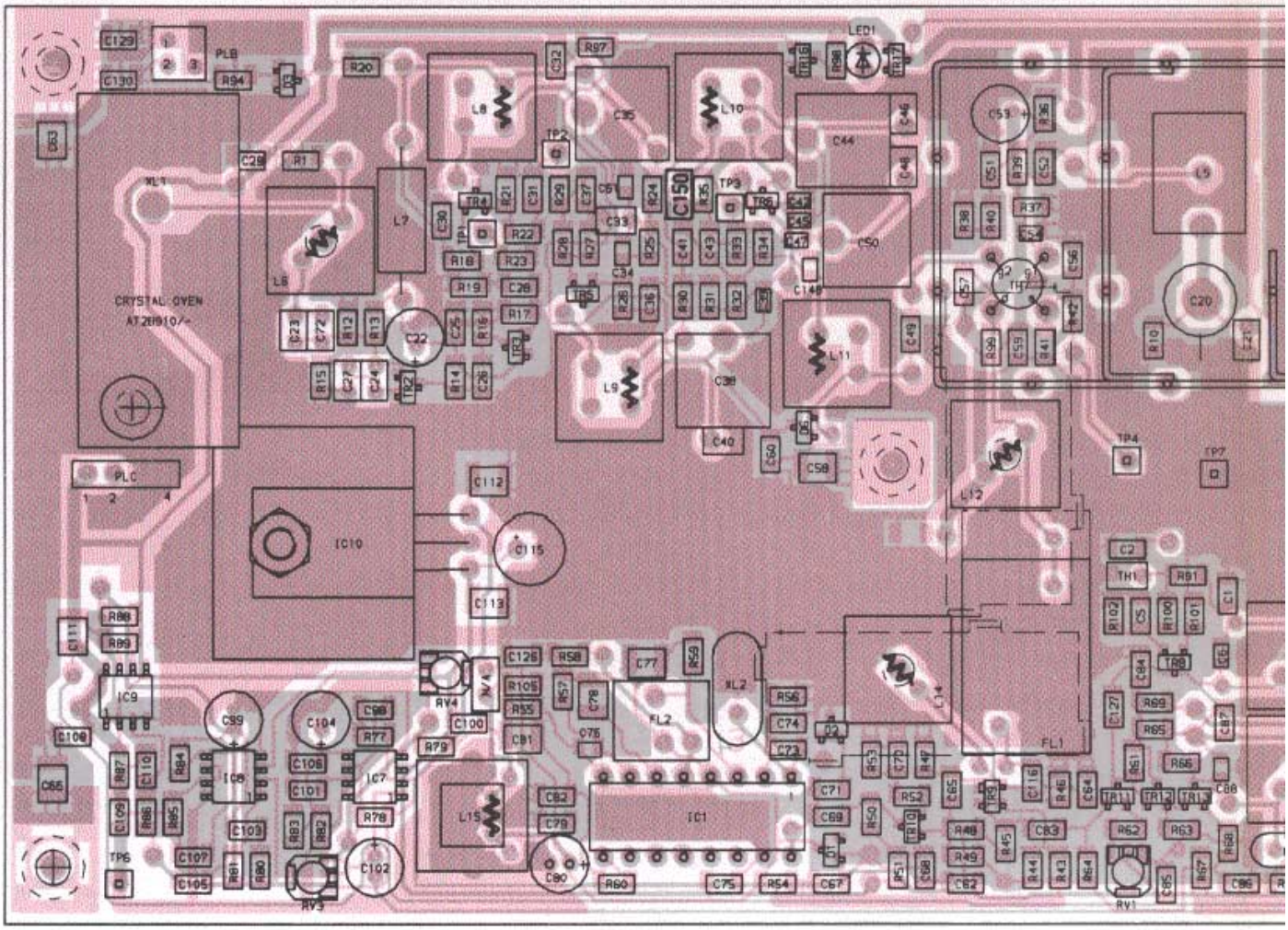
Cct. Ref	Description				Part No.	Remarks
Resistors (Cont'd)						
R53	470	±5%	0,125W	SMD	3513 999 80032	
R54	680	±5%	0,125W	SMD	3513 999 80034	
R55	10k	±5%	0,125W	SMD	3513 999 80048	
R56	150k	±5%	0,125W	SMD	3513 999 80062	
R57	47k	±5%	0,125W	SMD	3513 999 80056	
R58,59	1k8	±5%	0,125W	SMD	3513 999 80039	
R60	1k	±5%	0,125W	SMD	3513 999 80036	
R61	2k2	±5%	0,125W	SMD	3513 999 80040	
R62	33	±5%	0,125W	SMD	3513 999 80018	
R63	1k8	±5%	0,125W	SMD	3513 999 80039	
R64	1k	±5%	0,125W	SMD	3513 999 80036	
R65	220	±5%	0,125W	SMD	3513 999 80028	
R66	1k8	±5%	0,125W	SMD	3513 999 80039	
R67	330	±5%	0,125W	SMD	3513 999 80030	
R68,69	47	±5%	0,125W	SMD	3513 999 80020	
R70	1k5	±5%	0,125W	SMD	3513 999 80038	
R71	47	±5%	0,125W	SMD	3513 999 80020	
R72	470	±5%	0,125W	SMD	3513 999 80032	
R73	2k2	±5%	0,125W	SMD	3513 999 80040	
R74	10k	±5%	0,125W	SMD	3513 999 80048	
R75	1k5	±5%	0,125W	SMD	3513 999 80038	
R76	10k	±5%	0,125W	SMD	3513 999 80048	
R77	22k	±5%	0,125W	SMD	3513 999 80052	
R78	10k	±5%	0,125W	SMD	3513 999 80048	
R79	150k	±5%	0,125W	SMD	3513 999 80062	
R80	2k2	±5%	0,125W	SMD	3513 999 80040	
R81	47k	±5%	0,125W	SMD	3513 999 80056	
R82,83	4k7	±5%	0,125W	SMD	3513 999 80044	
R84	15k	±5%	0,125W	SMD	3513 999 80050	
R85	6k8	±5%	0,125W	SMD	3513 999 80046	
R86	15k	±5%	0,125W	SMD	3513 999 80050	
R87	6k8	±5%	0,125W	SMD	3513 999 80046	
R88,89	4k7	±5%	0,125W	SMD	3513 999 80044	
R90	100	±5%	0,125W	SMD	3513 999 80024	
R91	2k2	±5%	0,125W	SMD	3513 999 80040	
R92	220	±5%	0,125W	SMD	3513 999 80028	
R93	1k8	±5%	0,125W	SMD	3513 999 80039	
R94	330	±5%	0,125W	SMD	3513 999 80030	
R95	1k5	±5%	0,125W	SMD	3513 999 80038	
R96	220	±5%	0,125W	SMD	3513 999 80028	
R97,98	1k	±5%	0,125W	SMD	3513 999 80036	
R99	1k8	±5%	0,125W	SMD	3513 999 80039	
R100,101	1k	±5%	0,125W	SMD	3513 999 80036	
R102	2k2	±5%	0,125W	SMD	3513 999 80040	
R103	330	±5%	0,125W	SMD	3513 999 80030	
R104						Not Used
R105	10	±5%	0,125W	SMD	3513 999 80012	
RV1	100	±25%	pot cermet		PL99550/SM	
RV2	1k	±25%	pot cermet		3513 999 95003	
RV3,4	50k	±25%	pot cermet		PL99566/SM	
RV5	1k	±25%	pot cermet		3513 999 95003	
Capacitors						
C1,2	4n7	±10%	50V	SMD	3513 999 55484	
C3	2p7	±0p25		cer	PN99589	A & B Bands
C3						Not Used on K Band
C4	2p-14p var				PV99012	
C5	4n7	±10%	50V	SMD	3513 999 55484	
C6	27p	±5%	50V	SMD	3513 999 55318	
C7	2p-14p var				PV99012	
C8	2p7	±0p25		cer	PN99589	A & B Bands
C8						Not Used on K Band
C9	33	±20%	16V elec		PS99409	
C10	1n	±5%	50V	SMD	3513 999 55418	
C22	33	±20%	16V	elec	PS99409	
C11,12	4n7	±10%	50V	SMD	3513 999 55484	
C13	100n	±10%	50V	SMD	3513 999 55017	
C14	2p-14p var				PV99012	
C15	4n7	±10%	50V	SMD	3513 999 55484	
C16	2p7	±0p25		cer	PN99589	A & B Bands
C16						Not Used on K Band
C17	4n7	±10%	50V	SMD	3513 999 55484	
C18	2p-14p var				PV99012	
C19	2p7	±0p25		cer	PN99589	A & B Bands

Cct. Ref	Description				Part No.	Remarks
Capacitors (Cont'd)						
C19						Not Used on K Band
C20	2p-14p var				PV99012	
C21	2p7	±0p25		cer	PN99589	A & B Bands
C21						Not Used on K Band
C23	39p	±5%		cer	PN99946	A & B Bands
C23	22p	±5%		cer	PN99943	K Band
C24	100p	±5%		cer	PN99878	
C25	4n7	±10%	50V	SMD	3513 999 55484	
C26	1n	±5%	50V	SMD	3513 999 55418	
C27	47p	±5%		cer	PN99874	A & B Bands
C27	33p	±5%		cer	PN99872	K Band
C28-32	4n7	±10%	50V	SMD	3513 999 55484	
C33						Not Used
C34	2p2	±0p25	50V	SMD	3513 999 55305	
C35	2p-18p var		pcb mtg		PV99006	
C36,37	4n7	±10%	50V	SMD	3513 999 55484	
C38	2p-18p var		pcb mtg		PV99006	
C39	2p2	0p25	50V	SMD	3513 999 55305	
C40						Not Used
C41	4n7	±10%	50V	SMD	3513 999 55484	
C42	1p8	0p25	50V	SMD	3513 999 55304	
C43	4n7	±10%	50V	SMD	3513 999 55484	
C44	2p-18p var		pcb mtg		PV99006	
C45	1p	0p25	50V	SMD	3513 999 55301	
C46						Not Used
C47	1p	0p25	50V	SMD	3513 999 55301	
C48						Not Used
C49	4n7	±10%	50V	SMD	3513 999 55484	
C50	2p-18p var		pcb mtg		PV99006	
C51,52	4n7	±10%	50V	SMD	3513 999 55484	
C53	33	±20%	16V	elec	PS99409	
C54	1p8	0p25	50V	SMD	3513 999 55304	
C55						Not Used
C56	4n7	±10%	50V	SMD	3513 999 55484	
C57	39p	±5%	50V	SMD	CN99038	
C58	100n	±10%	50V	SMD	3513 999 55017	
C59,60	4n7	±10%	50V	SMD	3513 999 55484	
C61	12p	±5%	50V	SMD	3513 999 55314	
C62	4n7	±10%	50V	SMD	3513 999 55484	
C63	100n	±10%	50V	SMD	3513 999 55017	
C64	39p	±5%	50V	SMD	CN99038	
C65	4n7	±10%	50V	SMD	3513 999 55484	
C66	100n	±10%	50V	SMD	3513 999 55017	
C67-71	4n7	±10%	50V	SMD	3513 999 55484	
C72	4p7	±0p25		cer	PN99862	
C73	39p	±5%	50V	SMD	CN99038	
C74	82p	±5%	50V	SMD	CN99042	
C75	4n7	±10%	50V	SMD	3513 999 55484	
C76	10p	±5%	50V	SMD	3513 999 55313	
C77,78	100n	±10%	50V	SMD	3513 999 55017	
C79	4n7	±10%	50V	SMD	3513 999 55484	
C80	33	±20%	16V	elec	PS99409	
C81	100n	±10%	50V	SMD	3513 999 55017	
C82	4n7	±10%	50V	SMD	3513 999 55484	
C83-87	10n	±10%	50V	SMD	3513 999 55492	
C88	27p	±5%	50V	SMD	3513 999 55318	
C89	10n	±10%	50V	SMD	3513 999 55492	
C90	1p	0p25	50V	SMD	3513 999 55301	
C91,92	10n	±10%	50V	SMD	3513 999 55492	
C93,94						Not Used
C95	10n	±10%	50V	SMD	3513 999 55492	
C96	4n7	±10%	50V	SMD	3513 999 55484	
C97	10n	±10%	50V	SMD	3513 999 55492	
C98	1n5	±5%	50V	SMD	3513 999 55420	
C99	33	±20%	16V	elec	PS99409	
C100,101	10n	±10%	50V	SMD	3513 999 55492	
C102	33	±20%	16V	elec	PS99409	
C103	10n	±10%	50V	SMD	3513 999 55492	
C104	33	±20%	16V	elec	PS99409	
C105	1n	±5%	50V	SMD	3513 999 55418	
C106	10n	±10%	50V	SMD	3513 999 55492	
C107	1n	±5%	50V	SMD	3513 999 55418	
C108	4n7	±10%	50V	SMD	3513 999 55484	
C109,110	1n	±5%	50V	SMD	3513 999 55418	
C111-113	100n	±10%	50V	SMD	3513 999 55017	

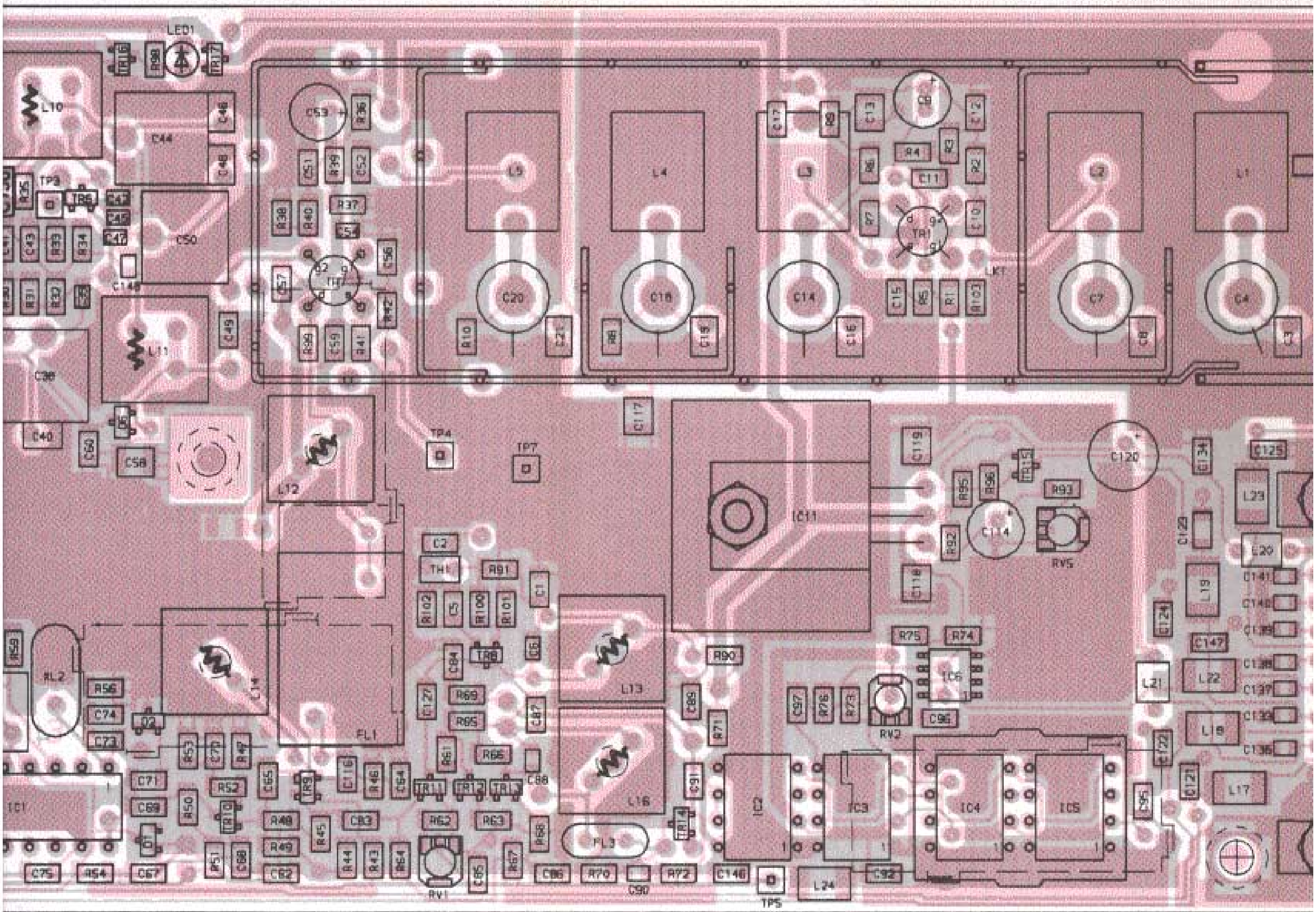
Cct. Ref	Description				Part No.	Remarks
Capacitors (Cont'd)						
C114	33	±20%	16V	elec	PS99409	
C115	47	20%	25V	elec	PS99423	
C116	39p	±5%	50V	SMD	CN99038	
C117-119	100n	±10%	50V	SMD	3513 999 55017	
C120	47	±10%	25V	elec	PS99423	
C121-125	1n	±5%	50V	SMD	3513 999 55418	
C126,127	4n7	±10%	50V	SMD	3513 999 55484	
C129,130	1n	±5%	50V	SMD	3513 999 55418	
C130-132						Not Used
C133	1n	±10%	50V	SMD	3513 999 55459	
C134	1n	±5%	50V	SMD	3513 999 55418	
C135						Not Used
C136-141	1n	±10%	50V	SMD	3513 999 55459	
C142-145						Not Used
C146	10n	±10%	50V	SMD	3513 999 55492	
C147	1n	±5%	50V	SMD	3513 999 55418	
C148,149	2p2	0p25	50V	Hyb.Cct	3513 999 55305	
C150	1n	±5%		cer	PN99900	A & B Bands
Miscellaneous						
PLA	Plug 15-way rt angle D				FP12115	
PLB	Header PCB mtd str 2 x 2-way				FP99172	
PLC	Header str male 4 posn				FC00837/04	
LK2	Header 2 posn				FC00837/02	
SKA	Socket BNC				FS43779	Antenna
XL2	Crystal 20,945MHz				FC03174/05	
FL1	Crystal filter				FC03564	12,5kHz Channel spacing
FL1	Crystal filter 25kHz				FC03528	20/25kHz Channel spacing
FL2	Cer filter 455kHz Nom/12,5kHz				FC99022	12,5kHz Channel spacing
FL2	Cer filter 455kHz Nom/25kHz				FC99020	20/25kHz Channel spacing
FL3	Crystal filter 25kHz				FC03574	
TH1	Thermistor 1k5				PL23089	
LED2	LED red				FV05860	
TP1-7	Header str male 1 posn				3513 504 00121	
	Pillar hexagon				BT04132	1/crystal oven assy
	Lid RF front end				BT13801	
	Can screening				FC00126	1/IC4 & 5
	Core cup				FC02121	1/L15
	Sleeving heatshrink 6mm				FS23168	1/L15
	Can				FT03521	1/L6,8-14,16
	Heatsink twisted vane				QA05850	1/IC10,11
	Screen assy, RF front end				AT14868	
	Bracket, antenna, Rx				BT11427	
	Screen, mixer, underside				BT26374	1/metering, 1/pre-filter, 1/post filter
	Socket, crystal				FS42611	2/XL1
	Nut st hex M3				QA11605/X	2/PLA - Rx PCB, 1/IC10,11
	Washer st M3				QA15005/X	2/PLA - Rx PCB
	Bush LED panel mounting				QA99007	1/Lid RF front end
	Bush insulating (TO-220)				QA99024	1/IC11 - heatsink
	Washer thermal (TO-220)				QA99111	1/IC11 - heatsink
	Scr st tap pozi No4 x 4,5mm				QJ08219/X	4/Lid - RF front end
	Scr st pan pozi M3 x 8mm				QJ11902/X	2/Crystal oven pillar 1/IC10,11 - heatsink 2/PLA - Rx PCB
	Washer M2,6				QA15004/X	4/lid - screen

PCB ASSEMBLY CRYSTAL OVEN
AT28910/04

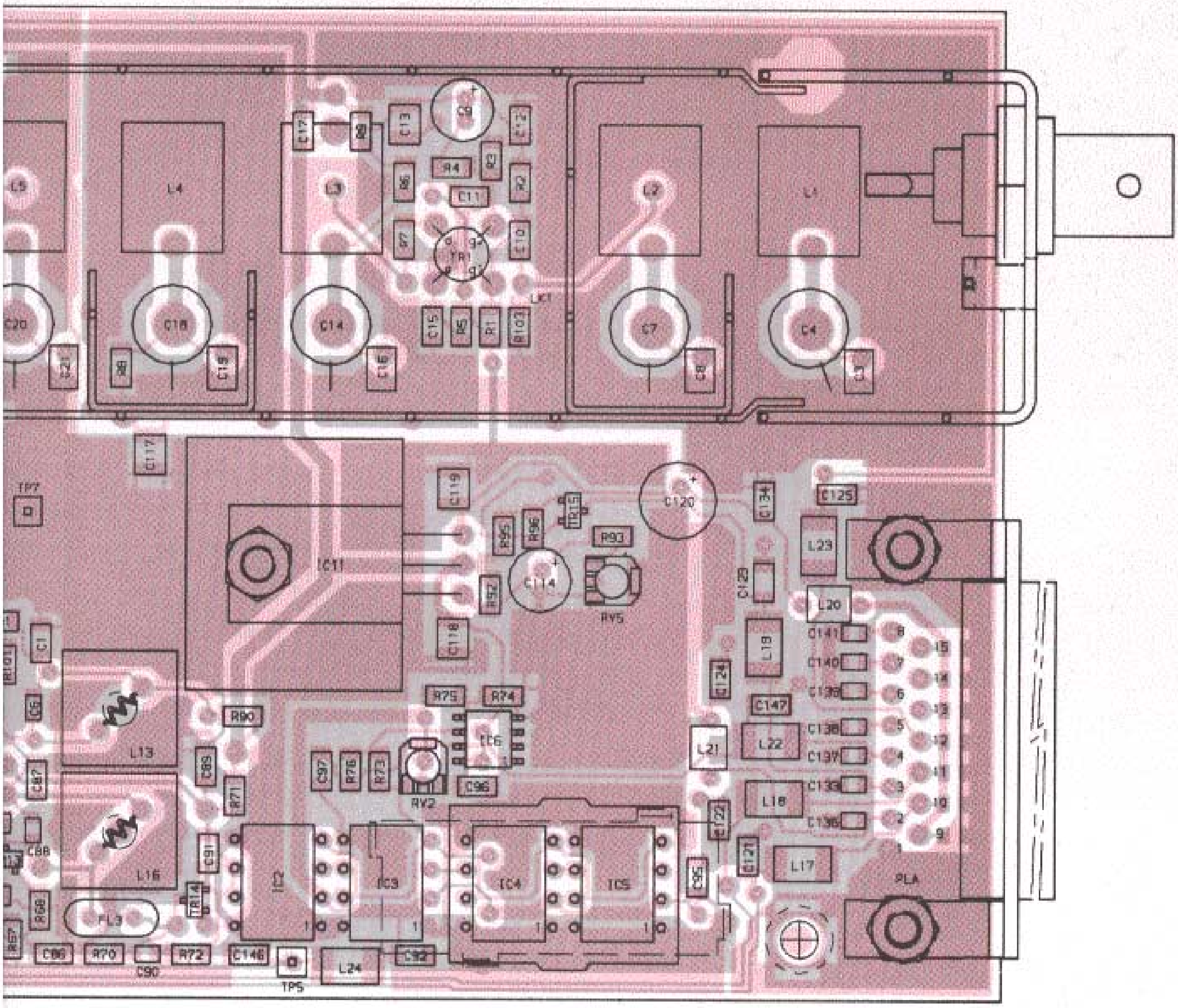
TR1	Transistor power GP BD436				FV05886	
TR2	Transistor small signal BC327				FV05975	
R1	82	±5%	0,25W c film		PM01423	
R2	1Ω8	±5%	0,25W c film		PM01403	
C1	4n7	±20%	cer		PN99919	
TH1	Thermistor PTC 70°				PL23137	
	Mica insulator				BT36934/01	1/TR1 - heatsink
	Holder crystal (oven)				BT45138	
	Retainer				BT48021	
	Scr st pan pozi M2,5 x 5mm				QJ11944/B	
	Scr st pan pozi M2,5 x 6mm				QJ11945/B	



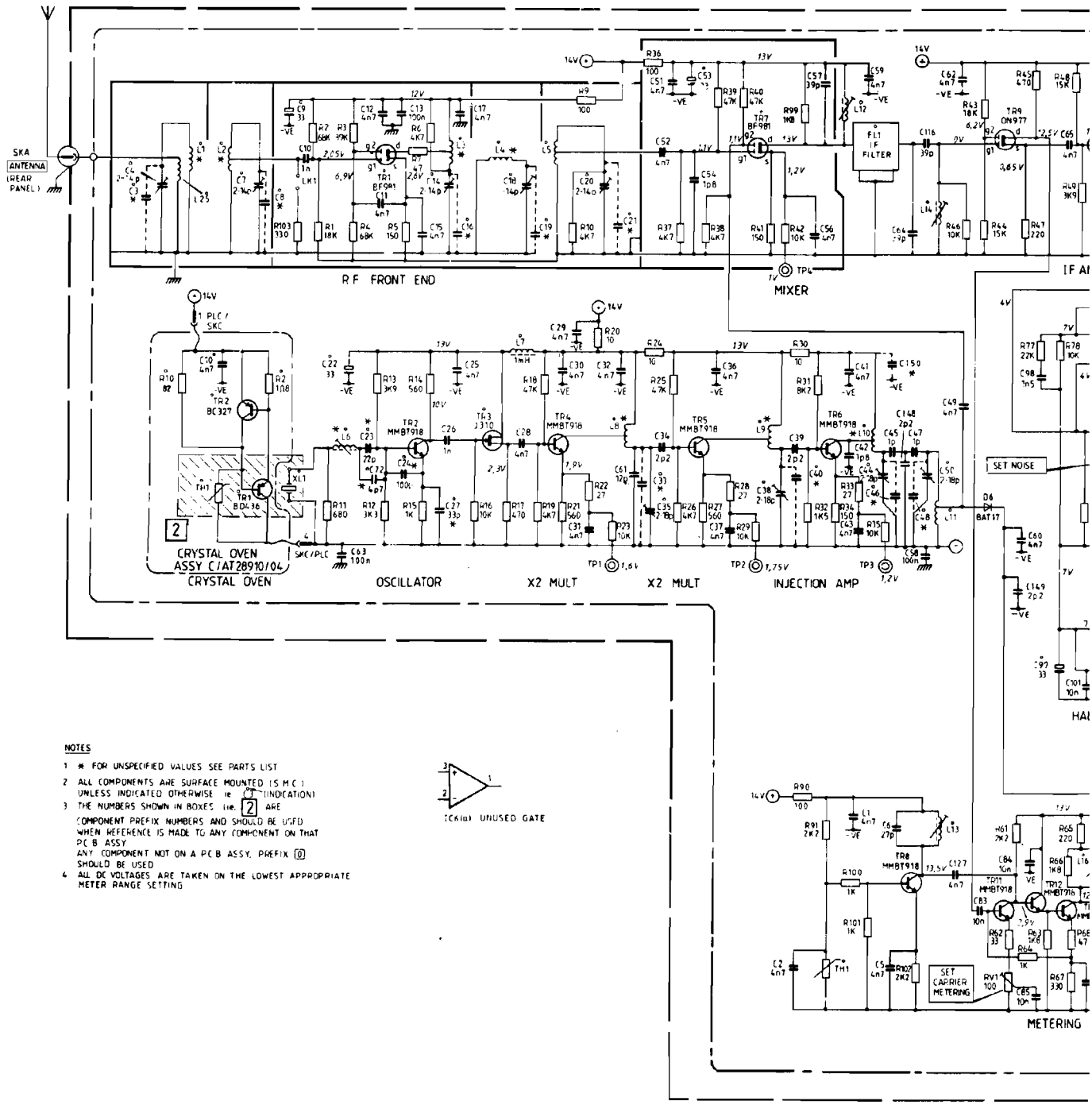
RECEIVER ATO4871/-
LAYOUT DIAGRAM



LED1
L10
C44
C50
L11
C38
C40
C58
C53
R36
R37
R38
R40
C54
C56
C57
TR7
R42
C59
R41
L5
C20
R10
L4
C18
R8
C19
L3
C14
C16
TR1
C15
R5
R1
R103
LK1
L2
C7
L1
C4
TP4
TP7
L12
C117
IC11
C119
R95
R96
R93
C120
C114
RVS
C118
C125
L23
L20
L19
C147
L22
L18
L17
L21
C2
TH1
R91
C1
R102
R100
R101
L13
L16
R90
C84
TR8
R69
R65
R66
C88
C87
C127
R61
R62
R63
TR11
TR12
TR13
R75
R74
IC6
R73
R76
C97
RV2
C96
IC2
IC3
IC4
IC5
RL2
R56
C74
C73
L14
FL1
R59
IC1
C71
C69
R52
R50
R53
R47
C65
R48
R49
R45
R46
R44
R43
R64
C83
C94
C116
RV1
FL3
C85
R67
R68
C86
R70
C90
R72
C146
TP5
L24
C92
C75
R54
C67
R51
C68
C62
C91
R71
C89
R14
C95
C121
C122
C124
C136
C137
C138
C139
C140
C141
C123
C134

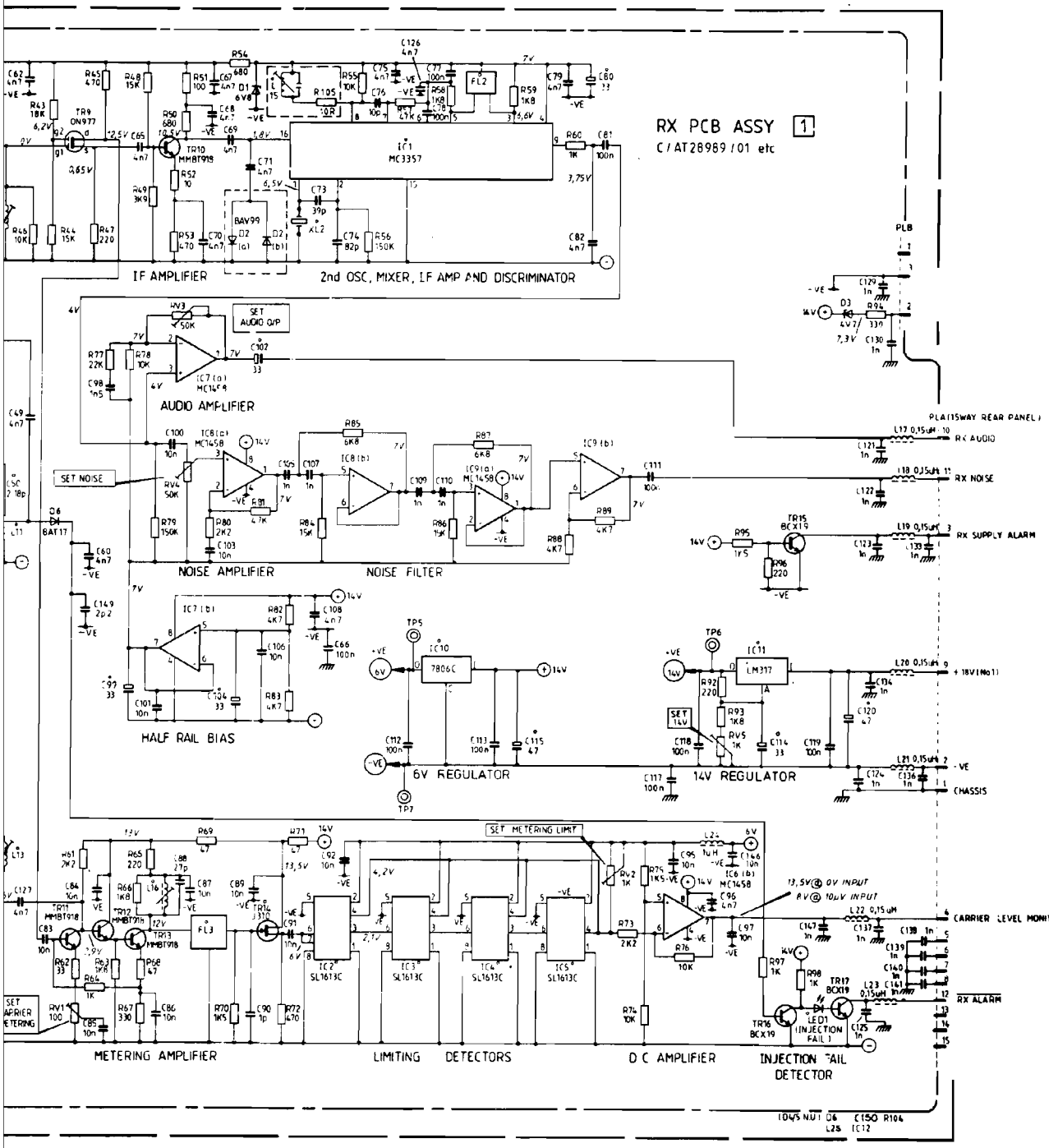


L5
L4
L3
L2
L1
C20
C18
C14
C7
C4
C17
C13
C9
R4
R6
R3
R2
C11
R7
TR1
C10
LK1
C15
R5
R1
R103
C16
C19
C8
C3
C117
TP7
IC11
C119
R95
R96
R15
R93
C120
C134
C125
L23
C114
R92
RV5
C129
L20
C118
L19
C141
C140
C139
C138
C137
C133
C136
C124
C147
L22
L21
L18
R75
R74
IC6
R90
L13
C89
R71
C97
R76
R73
RV2
C96
C122
C121
L17
C91
L16
C88
IC2
IC3
IC4
IC5
C95
PLA
TR14
FL3
R68
R67
C86
R70
C90
R72
C146
TP5
L24
C92



NOTES

1. * FOR UNSPECIFIED VALUES SEE PARTS LIST
2. ALL COMPONENTS ARE SURFACE MOUNTED (S.M.C.) UNLESS INDICATED OTHERWISE ie (C) (INDICATION)
3. THE NUMBERS SHOWN IN BOXES (ie. [2]) ARE COMPONENT PREFIX NUMBERS AND SHOULD BE USED WHEN REFERENCE IS MADE TO ANY COMPONENT ON THAT P.C.B. ASSY. ANY COMPONENT NOT ON A P.C.B. ASSY. PREFIX [0] SHOULD BE USED
4. ALL DC VOLTAGES ARE TAKEN ON THE LOWEST APPROPRIATE METER RANGE SETTING



RECEIVER ATO4871/-
CIRCUIT DIAGRAM

TRANSMITTER DRIVER MODULE
AT04873/-

INTRODUCTION

The transmitter driver module converts the processed audio from the control unit into an FM modulation signal to provide a nominal 1W RF output to the transmitter power amplifier. The module provides RF power monitoring and control circuits modulation monitoring and RF fail detection. The oscillator crystal is temperature controlled using an oven assembly.

DETAILED DESCRIPTION

Regulator

The on-board regulator IC5 provides a +14V DC supply from the +18V line input; RV1 sets the output voltage level. The front panel indicator [O] LED1 (green) is lit when the +18V input is present. The +14V output line is monitored by TR18, via zener diode D14. Should the output voltage drop below +13V the base potential of TR17 and TR18 is low enough to switch off both transistors. The current limit resistor R108 causes the front panel indicator to dim and TR18 indicates a fault by sending the VOLTS OK line on SKA pin 5 'high'.

Tx Audio and Monitor

Incoming audio from the control module on SKA pin 14 is applied, via the deviation control RV3, to amplifier IC1(a) and to the monitor amplifier IC2(b). The output from IC1(a) is 'integrated' in IC1(b) to provide a pre-emphasised audio signal to the phase modulator, via R16, R17 and R19. This gives an overall FM characteristic to the module.

IC2(a) and its associated circuit act as a peak rectifier producing a DC signal which is buffered by IC2(d) then amplified in IC2(c) and fed, via LK5, to the monitor line on SKA pin 12; The output is a nominal 1V/1kHz (deviation). At approximately 1,5V (i.e. 1,5kHz deviation) TR10 and TR11 conduct; TR10 causes LED (MOD) to light and TR11 provides an open collector output which is selected via LK5 as an alternative means of monitoring and modulation.

Tx Key

The Tx key line is active 'low'. IC3(d) inverts the input and the resultant 'high' is passed to gate IC3(c) which is controlled by the oven circuit in order to prevent Tx keying should the oven circuit fail.

Under 'normal' conditions a 'low' is applied to the base of TR16 sending the collector towards +14V, providing the bias voltage on the G2 inputs of TR2 and TR3 enabling them to conduct. This potential also supplies the power control RV2 and is used to enable the fault gate IC3(a). Interruption of the keying circuit will therefore prevent TR2 and TR3 conducting, disable the power control circuit (shutting down TR8) and provide a fault indication.

Setting LK6 a-b will enable the Tx key line to control the Tx oscillator, via TR16 base.

Tx Oscillator

The Tx oscillator TR1 is crystal controlled by XL1 and operates in the fundamental parallel resonant mode, the exact frequency of oscillation being set by trimmer C1. Crystal stability is achieved using a crystal oven assembly.

Crystal oven temperature stabilisation is provided by thermistor TH1 and TR1. As the temperature rises to approximately 80°C the resistance of TH1 produces a fall in the voltage dropped across R1 hence reducing the conduction rate of TR1 to a steady value sufficient to maintain the oven at this temperature. TR2 provides current limiting to prevent TR1 being over-driven at power-up.

The oven current is sensed by TR14, using the voltage across R94 and R96. At power-up the current is high causing TR14 to conduct, LED2 (OVEN COLD) is lit and TR15 collector is 'low'. This 'low' inhibits the Tx keying line via gate IC3(c) and provides a fault indication via IC3(a). When the correct oven temperature stabilises the current falls and TR14 is switched off, LED2 is extinguished and TR15 collector goes 'high' allowing 'normal' operation.

If the oven temperature increases the resistance of TH1 will increase causing TR15 to conduct sending the collector 'low'. This inhibits the Tx keying line and indicates a fault via IC3(a). LED2 remains off due to D12.

Phase Modulator and Multipliers

The oscillator output is matched by buffer amplifier TR2 to the three-stage phase modulator L1-L3 and varicap diodes D1-D6. Solder links LK2-LK4 provide additional capacitors for coverage at the bottom end of the band.

The resultant phase modulated output is amplified by TR3; TR4 provides matching to the multiplier stages.

The first multiplier TR5 is a tripler circuit with D9 providing RF detection for monitoring purposes on TP2. The second stage TR6 is a frequency doubler as is the final stage TR7.

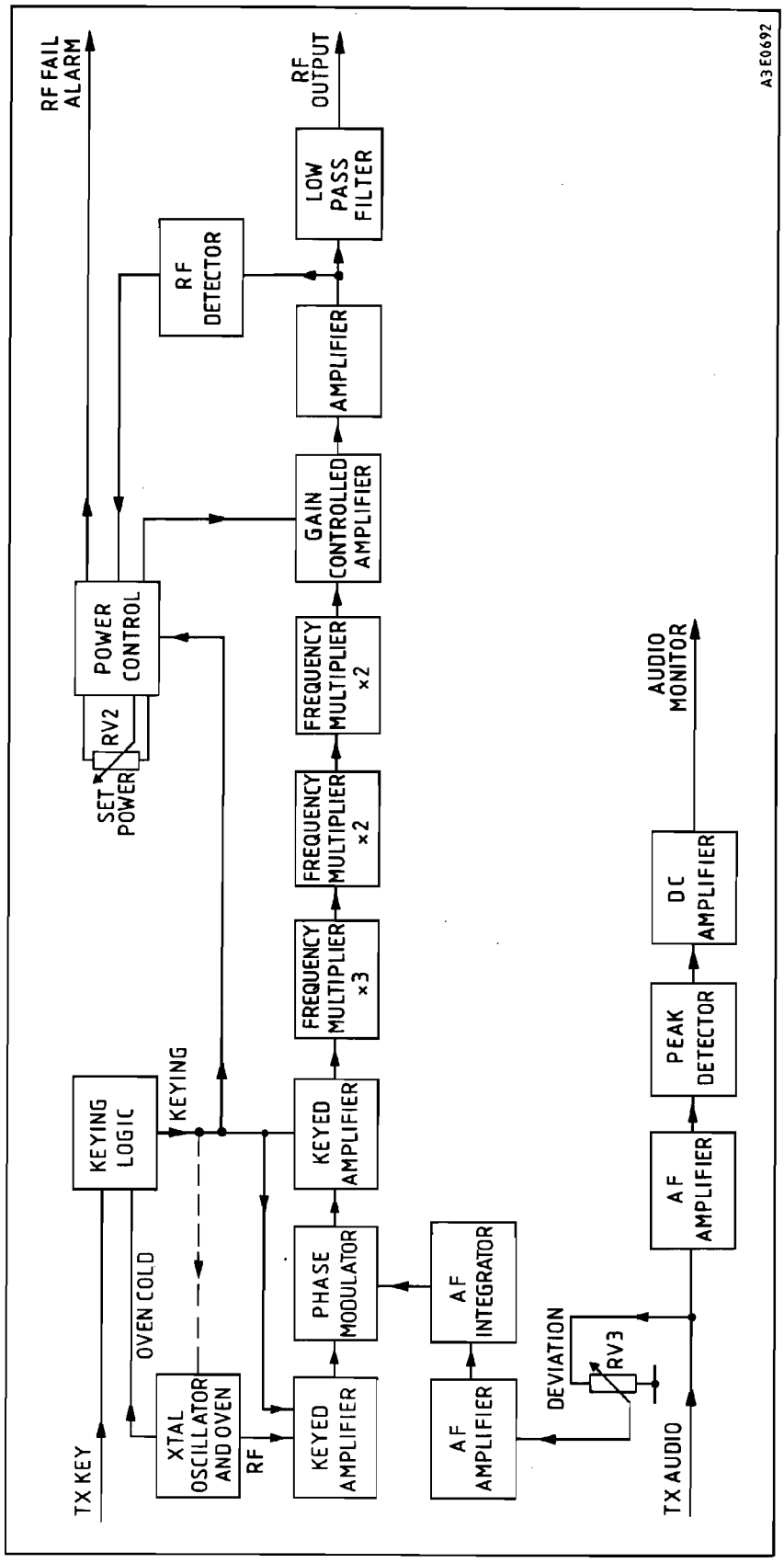
Power Amplifier and Control

RF amplification is provided by TR8 which is coupled to output transistor TR9 by matching bandpass filter L14 and L15. TR8 operates from a variable supply voltage enabling the power output level to be set by RV2. TR9 output is matched to 50Ω by 'T' filter L17, L19 and C10 with L19-L21 and associated capacitors forming an output filter for matching into the transmitter power amplifier.

The power control circuit operates in a feedback loop. D10 detects the output from TR9 which is fed via IC4(a) to the differential amplifier. RV2 provides the reference voltage. The output from IC4(b), controlled by the feedBack level, provides the supply voltage to TR8 and hence determines the RF output level.

RF Fail

IC4(d) is a comparator with inputs from the power level control RV2 and the RF detector. If the detected voltage falls below the threshold voltage, set by R83 and R84, the comparator output goes 'high' producing a fault alarm and causing LED3 (RF FAIL) to light.



TX DRIVER AT04873/-
BLOCK DIAGRAM

CRYSTAL INFORMATION

Crystal Type:	C5691, ±2ppm oven controlled
Carrier Frequency:	A9 = 146 to 174MHz BO = 132 to 156MHz KO = 174 to 225MHz
Crystal Frequency:	$fx = \frac{fc}{12}$ MHz
Crystal Range:	A9 = 12,175 to 14,5MHz BO = 11 to 13MHz KO = 14,5 to 18,75MHz

SPECIFICATION

Bands	A9 = 146 - 174MHz BO = 132 - 156MHz KO = 174 - 225MHz
Channel Spacing	12,5kHz, 20kHz, 25kHz
Output Power	1,25W (adjustable)
Output Impedance	50Ω nominal
Duty Cycle	100%
Frequency Stability	±2ppm between -30°C and +60°C
Number of Channels	Single channel only
Audio Response	300 Hz to 9kHz ±0,5dB relative to 1kHz at 1kHz deviation (FM characteristic)
Distortion	Less than 0,5% at 3kHz deviation. Measured at 1kHz with 750µS de-emphasis.
Hum and Noise	Better than -46dB (relative to 1,5kHz deviation). Measured with 750µS de-emphasis
Supply Input	18V ±0,5V at 0,8A max.
Line I/P impedance *	600Ω balanced
Line I/P sensitivity *	4-Wire: -37 to 0dBm (for 60% deviation at 1kHz) adjustable 2-Wire (remote): -16 to 0dBm (for 60% deviation at 1kHz) adjustable

* measured via Control Module

INTERNAL MODULE INDICATIONS

Oven cold	Indicates that crystal oven is below temperature.
Mod	Lights when deviation exceeds approximately 1kHz.
RF fail	Indicates that the RF output from the TX driver is low.

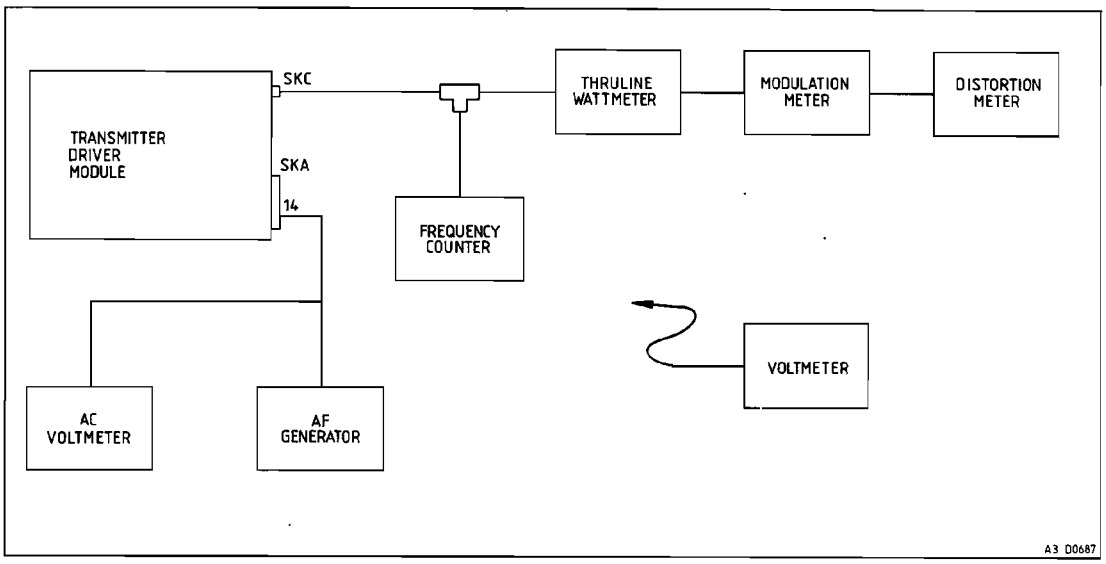


Fig. 1 Transmitter Driver Test Circuit

TEST PROCEDURE

Note: *Unless otherwise stated all test points are measured with respect to -ve (ie:TP9).*

Test Equipment required

Note: *Refer to Part I, Table 3.1 for suitable types.*

2	AF Generator	13	Modulation Meter
4	Digital Multimeter	14	AC Voltmeter
9	Distortion Meter	15	Thruline Wattmeter
12	Frequency Counter	20	'Break-out' connector 25 way

Preliminaries

1. Remove the screened cover from the transmitter driver module.

2. Link: LK1 a-b, LK5 b-c, LK6 a-b.
   If the carrier frequency is greater than 208,5MHz check solder links LK2, LK3 and LK4.
   Remove the crystal oven assembly and channel crystal.

3. Connect the transmitter driver to the backplane SKA via the 'break-out' connector.
   Check PLA pin 15 for a +18V DC input. Check power supply unit if this is incorrect.

4. Set RV1 (SET 14V) fully counter-clockwise. Check TP8 for less than +13V DC. Check that the green front panel DC POWER indicator is dimly lit.

5. Adjust RV1 for +14V on TP8.

6. Remove the DC power supply and refit the channel crystal and crystal assembly.

7. Connect the test equipment to the module as shown in Fig. 1.

Indicators and Oven Check

8. Reconnect the DC power supply.
Check that the following indicators are lit:

transmitter front panel	[4]LED1 DC POWER (Green)
transmitter driver board	[4]LED2 OVEN COLD (Red)
control logic board	[3C]LED5 TX ALARM (Red)

9. Set the AF generator output to 600mV at 1kHz. Check LK5 pin'a' for a voltmeter reading of 3V ± 0,2V. Switch off the AF input and check the reading is less than 100mV.

10. Set the AF input level to 260mV and check that the MOD indicator LED1 (green) is not lit.

Increase the input level to 340mV and check that the MOD indicator lights. Switch off the AF input.

11. With the crystal oven operating at 'normal' temperature check that both the OVEN COLD indicator on the transmitter driver and the TX ALARM indicator on the control logic board are not lit.

RF Alignment

12. Set RV2 (SET POWER) fully clockwise (maximum power). Connect the EHS to the control module front panel and set the function switch to manual - TX ON.

13. Key the transmitter using the EHS. Monitor each test point in turn and tune the module as follows:

TEST POINT	TUNE	TYPICAL READING (V) KEYED	UNKEYED
TP1	L1,L2,L3 peak	1,0	0,5
TP2	C2 peak, C3 dip	14,3	13,5
TP3	C3 peak, C4 shallow dip	1,5	0,44
TP4	C5 peak, C4 peak, C6 dip	0,75	0
TP5	C7 dip	5,5	0,02
TP7	C8 peak	6,0	0
RF Power Meter	C9, C10 maximum power	-	-

Check that the RF FAIL indicator LED3 is lit.

14. Check output power is greater than 1,5W. Re-tune C2-C10 as necessary for maximum power.
Adjust RV2 (SET POWER) for a power output of 1,25W. Check that the RF FAIL indicator is extinguished.
Tune C2-C9 for minimum voltage reading on TP7.
Tune C10 for minimum reading on TP7, adjust RV2 as necessary to obtain 1,25W and check that the corresponding reading on TP7 is less than 8V.

15. Tune C1 to give the correct carrier frequency.

Modulator Alignment

16. Set RV3 (DEV) to mid-position. Set AF generator output to 600mV at 1kHz. Tune L1, L2, L3 for maximum deviation. Set RV3 for 3kHz deviation.

17. Set AF generator output to 10kHz deviation at 1kHz. Set de-emphasis on modulation meter to 750µS. Check distortion is less than 1% .

18. Switch off de-emphasis. Set the modulation to 1kHz, 1kHz deviation. Use distortion meter as AC voltmeter to note the recovered audio level. Check frequency response is as follows:

FREQUENCY	MAX.	MIN.
1kHz	0dB	0dB (reference)
60Hz	0dB	-1dB
300Hz	+0,2dB	-0,2dB
3kHz	+0,2dB	-0,2dB

Conclusion

19. Disconnect and remove all items of test equipment.

20. Set Links LK1, LK5 and LK6 as required and refit the module cover.

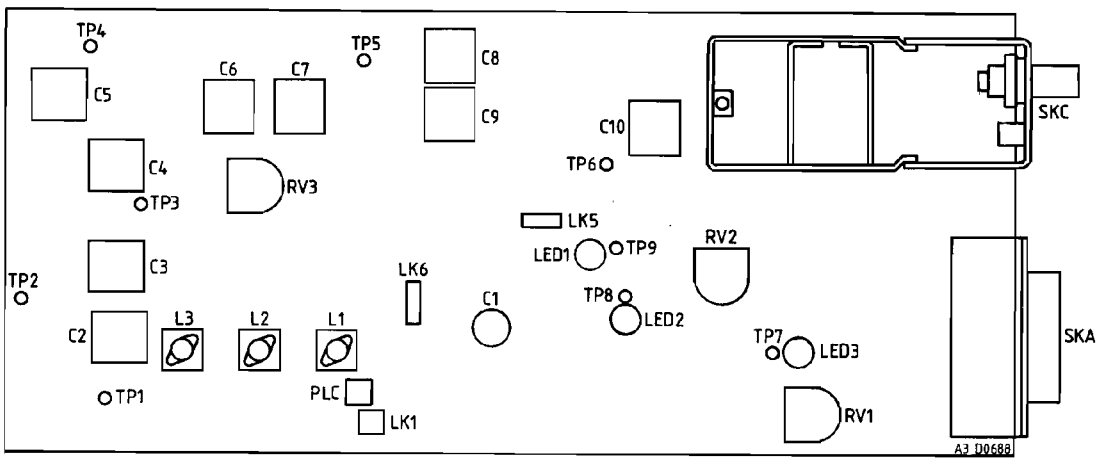


Fig. 2 Transmitter Driver Alignment Diagram

TX DRIVER MODULE

AT04873/01 K0 BAND
AT04873/02 A9 BAND
AT04873/03 B0 BAND

Cct. Ref	Description	Part No.	Remarks
	PCB assy Tx driver	AT28990/-	Not available as spare
	Box, RF sealed	BT36216	
	Lid sealed box	BT13800	
	Cover plate rear	BT15913	
	Seal RF	BT29999	
	Label frequency align.	BT38238	
	Label, unit	BT38209/01	Unit label
	Scr st tap pozi No4 x 4,5mm	QJ08219/X	4/rear cover - box
	Scr st tap pan M3 x 6mm	QJ11550/X1	1/antenna bracket - rear cover plate
	Scr st tap pan M3 x 8mm	QJ11551/X1	2/front panel - box, 14/cover - box, 4/PCB - box
	Scr st pan pozi M2,5 x 8mm	QJ11946/X	2/SKA
	Nut st hex M2,5	QA11604/X	2/SKA

FRONT PANEL ASSEMBLY TX
AT14819

	Panel, front	BT23740	
	Fastener	BT17284	2/Tx - shelf
	Handle	BT35949	
	Label, Tx	BT38205/02	1/handle
	Label, Philips	BT38216/01	1/handle
	Scr st tap pozi No4 x 8mm	QJ08421/X	2/handle

PCB ASSEMBLY TX DRIVER
AT28990/01 K0 BAND
AT28990/02 A9 BAND
AT28990/03 B0 BAND

	PCB assy crystal oven	AT28910/04	Not available as spare

Semi-conductors and IC's

IC1	IC dual op amp MC1458D	3513 999 45004	
IC2	IC op amp LM324	3513 999 45005	
IC3	IC 4093BT	FU99466/SM	
IC4	IC op amp LM324	3513 999 45005	
IC5	IC volt reg 317	FU99119	
TR1	Transistor MMBT918	FV99122/SM	
TR2,3	Transistor BF989	FV99157/SM	
TR4	Transistor MMBFU310/TI	3513 999 05009	
TR5,6	Transistor MMBT918	FV99122/SM	
TR7	Transistor BFQ18	3513 999 00023	
TR8	Transistor BFQ17	FV99108/SM	Spares pack Part No. 3513 575 00022
TR9	Transistor TP2314 "Be O"	FV41807	
TR10-12	Transistor BCX19	FV99102/SM	
TR13	Transistor BCX54	3513 999 00018	
TR14,15	Transistor BCX19	FV99102/SM	
TR16	Transistor BCX17	3513 999 00004	
TR17,18	Transistor BCX19	FV99102/SM	
D1-6	Diode BBY40	3513 999 25001	
D7,8			Not Used
D9,10	Diode BAS16 SMD	3513 999 15003	
D11	Diode BAV99 SMD	3513 999 15002	
D12,13	Diode BAS16 SMD	3513 999 15003	
D14	Diode BZX84C12	FV99017/SM	

Inductors

L1-3	Coil assy	AT32171/27	A & B Bands
L1-3	Coil assy	AT32171/25	K Band
L4-7	Choke 4µ7 ±10% RF min	FT99105	
L8	Coil assy	AT32071/06	A & B Bands
L8	Coil assy	AT32069/01	K Band
L9	Coil assy	AT32071/07	A & B Bands
L9	Coil assy	AT32069	K Band
L10	Coil assy	AT32068/06	A & B Bands
L10	Coil assy	AT32061/03	K Band
L11	Coil assy	AT32068/07	A & B Bands

Cct. Ref	Description	Part No.	Remarks
Inductors (Cont'd)			
L11	Coil assy	AT32061	K Band
L12	Coil assy	AT32054/04	A & B Bands
L12	Coil assy	AT32077/04	K Band
L13	Coil assy	AT32054/03	
L14,15	Coil air spaced 6mm	AT30623	
L16	Coil air spaced 3mm	AT31011/03	
L17	Coil air spaced 3mm	AT31011/03	A & K Bands
L17	Coil air spaced 3mm	AT31011/04	B Band
L18	Coil air spaced 3mm	AT31011/03	A & K Bands
L18	Coil air spaced 3mm	AT31011/02	B Band
L19,20	Coil air spaced 3mm	AT31011/02	A & B Bands
L19,20	Coil air spaced 3mm	AT31011/01	K Band
L21	Coil air spaced 3mm	AT31011/04	A & B Bands
L21	Coil air spaced 3mm	AT31011/02	K Band
L22-27	Inductor 0µ15 ±20%	FT99290/SM	
FB1,2	Choke assy	AT31684	
Resistors			
R1,2	47k ±5% 0,125W SMD	3513 999 80056	
R3	3k3 ±2% 0,25W m film	PM99294	
R4	150 ±5% 0,125W SMD	3513 999 80026	
R5	68k ±5% 0,125W SMD	3513 999 80058	
R6	56 ±5% 0,125W SMD	3513 999 80021	
R7	15k ±5% 0,125W SMD	3513 999 80050	
R8	3k3 ±5% 0,125W SMD	3513 999 80042	
R9	39k ±5% 0,125W SMD	3513 999 80055	
R10	100 ±5% 0,125W SMD	3513 999 80024	
R11	68k ±5% 0,125W SMD	3513 999 80058	
R12	100 ±2% 0,25W m film	PM99258	A & B Bands
R12	82 ±2% 0,25W m film	PM99256	K Band
R13	10 ±5% 0,125W SMD	3513 999 80012	
R14			Not Used
R15	270 ±5% 0,125W SMD	3513 999 80029	
R16,17	15k ±5% 0,125W SMD	3513 999 80050	
R18	100 ±2% 0,25W m film	PM99258	A & B Bands
R18	82 ±2% 0,25W m film	PM99256	K Band
R19	15k ±5% 0,125W SMD	3513 999 80050	
R20	100 ±2% 0,25W m film	PM99258	A & B Bands
R20	82 ±2% 0,25W m film	PM99256	K Band
R21	15k ±5% 0,125W SMD	3513 999 80050	
R22	68k ±5% 0,125W SMD	3513 999 80058	
R23			Not Used
R24	68k ±5% 0,125W SMD	3513 999 80058	
R25	39k ±5% 0,125W SMD	3513 999 80055	
R26	270 ±5% 0,125W SMD	3513 999 80029	
R27	10 ±5% 0,125W SMD	3513 999 80012	
R28	47 ±2% 0,25W m film	PM99250	
R29	10 ±5% 0,125W SMD	3513 999 80012	
R30	1k8 ±5% 0,125W SMD	3513 999 80039	
R31	470 ±5% 0,125W SMD	3513 999 80032	
R32	47k ±5% 0,125W SMD	3513 999 80056	
R33	4k7 ±5% 0,125W SMD	3513 999 80044	
R34	220 ±5% 0,125W SMD	3513 999 80028	
R35	10 ±5% 0,125W SMD	3513 999 80012	
R36	10 ±2% 0,25W m film	PM99234	
R37	1k5 ±5% 0,125W SMD	3513 999 80038	
R38	47k ±5% 0,125W SMD	3513 999 80056	
R39	4k7 ±5% 0,125W SMD	3513 999 80044	
R40	100 ±5% 0,125W SMD	3513 999 80024	
R41	10 ±5% 0,125W SMD	3513 999 80012	
R42	1 ±2% 0,25W m film	PM99210	
R43	47k ±5% 0,125W SMD	3513 999 80056	
R44	2k2 ±5% 0,125W SMD	3513 999 80040	
R45	27 ±2% 0,25W m film	PM99244	
R46	10 ±5% 0,125W SMD	3513 999 80012	
R47	100 ±2% 0,25W m film	PM99258	
R48	10 ±5% 0,125W SMD	3513 999 80012	
R49	15k ±5% 0,125W SMD	3513 999 80050	
R50	470 ±5% 0,125W SMD	3513 999 80032	
R51	1k5 ±2% 0,25W m film	PM99286	
R52	47 ±2% 0,25W m film	PM99250	
R53	2Ω7 ±2% 0,25W m film	PM99220	
R54	10k ±5% 0,125W SMD	3513 999 80048	
R55	220 ±5% 0,125W SMD	3513 999 80028	

Cct. Ref	Description				Part No.	Remarks
Resistors (Cont'd)						
R56	100k	±5%	0,125W	SMD	3513 999 80060	
R57	47k	±2%	0,25W	m film	PM99322	
R58	2k2	±5%	0,125W	SMD	3513 999 80040	
R59	68k	±5%	0,125W	SMD	3513 999 80058	
R60	47k	±5%	0,125W	SMD	3513 999 80056	
R61	33k	±5%	0,125W	SMD	3513 999 80054	
R62	36k	±2%	0,25W	m film	PM99319	A & B Bands
R62	47k	±2%	0,25W	m film	PM99322	K Band
R63	68k	±5%	0,125W	SMD	3513 999 80058	
R64,65	100k	±1%	0,25W	m film	PM99110	
R66	2M2	±5%	0,125W	SMD	CL99076	
R67	26k1	±1%	0,25W	m film	PL99103	
R68	4k7	±5%	0,125W	SMD	3513 999 80044	
R69	4k64	±1%	0,25W	m film	PL99094	
R70,71	46k4	±1%	0,25W	m film	PL99106	
R72	10k	±1%	0,25W	m film	PL99098	
R73	100k	±1%	0,25W	m film	PM99110	
R74	220	±5%	0,125W	SMD	3513 999 80028	
R75	2k2	±5%	0,125W	SMD	3513 999 80040	
R76	1k5	±5%	0,125W	SMD	3513 999 80038	
R77	2k2	±5%	0,125W	SMD	3513 999 80040	
R78	1k5	±5%	0,125W	SMD	3513 999 80038	
R79,80	2k2	±5%	0,125W	SMD	3513 999 80040	
R81	10k	±5%	0,125W	SMD	3513 999 80048	
R82,83	100k	±5%	0,125W	SMD	3513 999 80060	
R84	10k	±5%	0,125W	SMD	3513 999 80048	
R85	10k	±2%	0,25W	m film	PM99306	
R86	6k8	±5%	0,125W	SMD	3513 999 80046	
R87	2k2	±5%	0,125W	SMD	3513 999 80040	
R88,89	1k5	±5%	0,125W	SMD	3513 999 80038	
R90	100k	±5%	0,125W	SMD	3513 999 80060	
R91	2k2	±5%	0,125W	SMD	3513 999 80040	
R92,93	10k	±5%	0,125W	SMD	3513 999 80048	
R94	5Ω1	±2%	0,25W	m film	PM99227	
R95	470	±5%	0,125W	SMD	3513 999 80032	
R96	5Ω1	±2%	0,25W	m film	PM99227	
R97,98	1k5	±5%	0,125W	SMD	3513 999 80038	
R99	1k8	±5%	0,125W	SMD	3513 999 80039	
R100	10k	±5%	0,125W	SMD	3513 999 80048	
R101	10	±5%	0,125W	SMD	3513 999 80012	
R102-104	10k	±5%	0,125W	SMD	3513 999 80048	
R105-107	2k7	±5%	0,125W	SMD	3513 999 80041	
R108	3k3	±5%	0,125W	SMD	3513 999 80042	
R109	6k8	±5%	0,125W	SMD	3513 999 80046	
R110,111	33k	±5%	0,125W	SMD	3513 999 80054	
R112	6k8	±5%	0,125W	SMD	3513 999 80046	
R113	220	±5%	0,125W	SMD	3513 999 80028	
R114	1k8	±5%	0,125W	SMD	3513 999 80039	
RV1	1k	±20%	Pot skel lin		PL01490	
RV2,3	10k	±20%	Pot skel lin		PL01478	
Capacitors						
C1	2p-14p		variable		PV99012	
C2	4p-40p		variable		PV07682	
C3	5p5-50p		variable	PCB mtg	PV99007	
C4-7	2p-18p		variable	PCB mtg	PV99006	
C8	4p-40p		variable		PV07682	A & B Bands
C8	2p-18p		variable	PCB mtg	PV99006	K Band
C9,10	5p5-50p		variable	PCB mtg	PV99007	A & B Bands
C9,10	2p-18p		variable	PCB mtg	PV99006	K Band
C11						Not Used
C12	15p	±5%		cer	PN99941	
C13	22p	±5%	50V	SMD	3513 999 55317	
C14	8p2	±0p25	50V	SMD	3513 999 55312	
C15	150p	±5%	50V	SMD	CN99045	
C16	10n	±10%	50V	SMD	3513 999 55492	
C17	47p	±5%	50V	SMD	CN99039	
C18	33	±20%	35V	elec	PS99429	
C19	10n	±10%	50V	SMD	3513 999 55492	
C20	1n	±5%	50V	SMD	3513 999 55418	
C21	10n	±10%	50V	SMD	3513 999 55492	
C22	2µ2	±20%	100V	elec	PS99456	
C23	10n	±10	50V	SMD	3513 999 55492	
C24	100n	±10%	50V	SMD	3513 999 55017	

Cct. Ref	Description				Part No.	Remarks
Capacitors (Cont'd)						
C25	220p	±5%	50V	SMD	CN99047	
C26	10n	±10%	50V	SMD	3513 999 55492	
C27	82p	±5%		cer	PN99877	A Band
C27	120p	±5%		cer	PN99879	B Band
C27	56p	±5%		cer	PN99875	K Band
C28						Not Used on A & B Bands
C28	33p	±5%		cer	PN99872	K Band
C29	3p3	±0p25		cer	PN99860	
C30	220p	±5%	50V	SMD	CN99047	
C31	82p	±5%		cer	PN99877	A Band
C31	120p	±5%		cer	PN99879	B Band
C31	56p	±5%		cer	PN99875	K Band
C32						Not Used on A & B Bands
C32	33p	±5%		cer	PN99872	K Band
C33	3p3	±0p25		cer	PN99860	
C34	220p	±5%	50V	SMD	CN99047	
C35	82p	±5%		cer	PN99877	A Band
C35	120p	±5%		cer	PN99879	B Band
C35	56p	±5%		cer	PN99875	K Band
C36						Not Used on A & B Bands
C36	33p	±5%		cer	PN99872	K Band
C37	1n	±5%	50V	SMD	3513 999 55418	
C38						Not Used
C39	10n	±10%	50V	SMD	3513 999 55492	
C40	1n	±5%	50V	SMD	3513 999 55418	
C41,42	10n	±10%	50V	SMD	3513 999 55492	
C43	10	±20%	63V	elec	PS99445	
C44,45	10n	±10%	50V	SMD	3513 999 55492	
C46	1n	±5%	50V	SMD	3513 999 55418	
C47,48	10n	±10%	50V	SMD	3513 999 55492	
C49	1p	±0p25		cer	PN99854	
C50	10n	±10%	50V	SMD	3513 999 55492	
C51	12p	±5%		cer	PN99867	
C52	1p	±0p25		cer	PN99854	
C53						Not Used
C54	10n	±10%	50V	SMD	3513 999 55492	
C55	18p	±5%		cer	PN99869	
C56	27p	±5%		cer	PN99871	
C57,58	10n	±10%	50V	SMD	3513 999 55492	
C59	1p	±0p25		cer	PN99854	
C60	10n	±10%	50V	SMD	3513 999 55492	
C61	4p7	±0p25		cer	PN99862	
C62	1p	±0p25		cer	PN99854	
C63						Not Used
C64	10n	±10%	50V	SMD	3513 999 55492	
C65	10p	±5%		cer	PN99866	
C66						Not Used on A & B Bands
C66	22p	±5%		cer	PN99870	K Band
C67	4n7	±20%		cer	PN99919	
C68,69	10n	±10%	50V	SMD	3513 999 55492	
C70	1p	±0p25		cer	PN99854	
C71	10n	±10%	50V	SMD	3513 999 55492	
C72	1p	±0p25		cer	PN99854	
C73,74						Not Used
C75	10n	±10%	50V	SMD	3513 999 55492	
C76	4p7	±0p25		cer	PN99862	
C77						Not Used
C78						Not Used on A & B Bands
C78	10n	±10%	50V	SMD	3513 999 55492	K Band
C79	1p	±0p25		cer	PN99854	
C80	6p8	±0p5	50V	SMD	3513 999 55311	
C81	100n	±10%	50V	SMD	3513 999 55017	
C82						Not Used
C83	2p2	±0p25		cer	PN99858	A & B Bands
C83	1p	±0p25		cer	PN99854	K Band
C84						Not Used
C85	10	±20%	63V	elec	PS99445	
C86	56p	±5%	50V	SMD	CN99040	A & B Bands
C86						Not Used on K Band
C87	10n	±10%	50V	SMD	3513 999 55492	
C88	10	±20%	63V	elec	PS99445	
C90,91	10n	±10%	50V	SMD	3513 999 55492	
C92,93	100n	±10%	50V	SMD	3513 999 55017	
C94,95	10n	±10%	50V	SMD	3513 999 55492	
C96	47p	±5%	50V	SMD	CN99039	

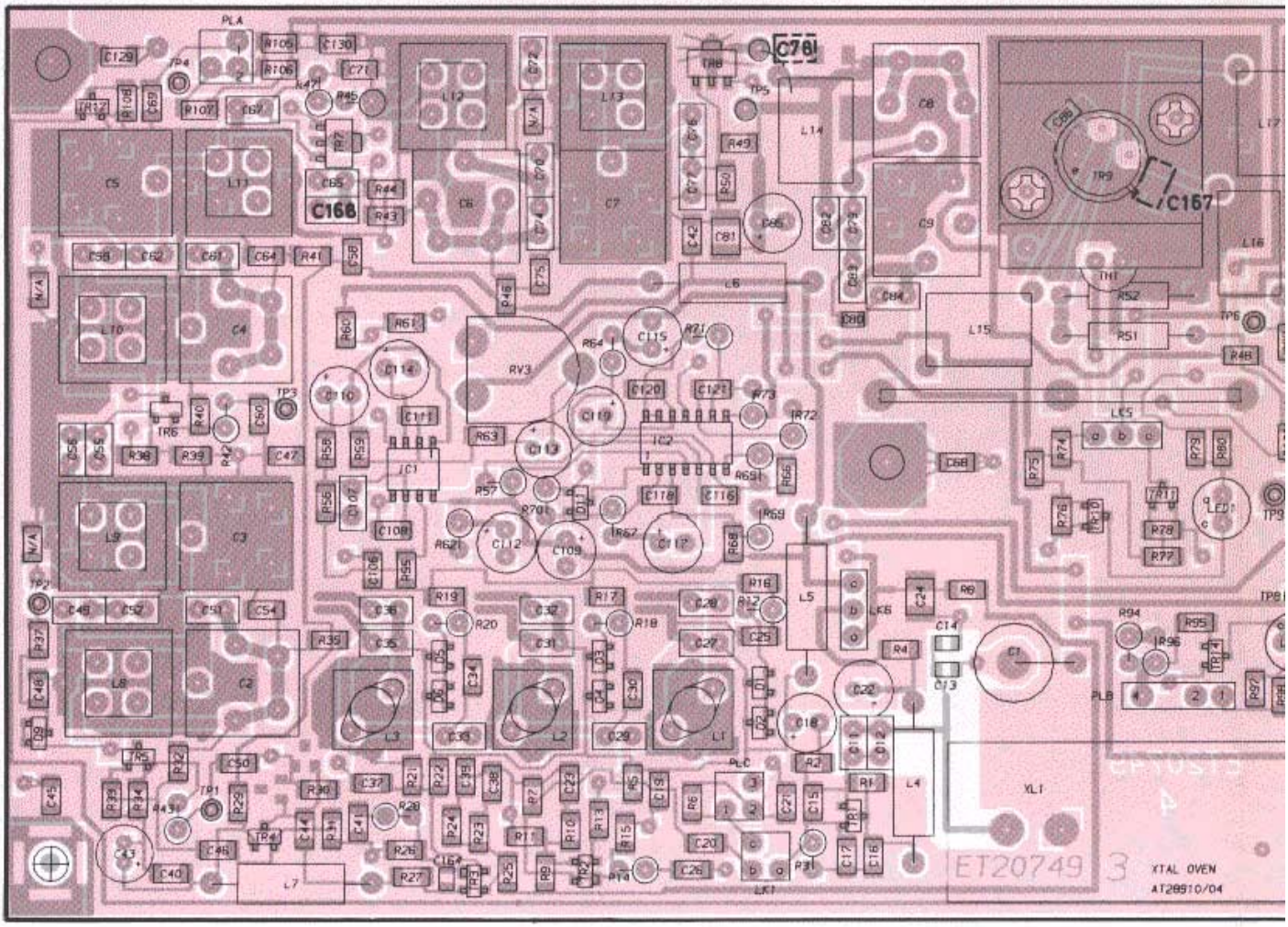
Cct. Ref	Description				Part No.	Remarks
Capacitors (Cont'd)						
C97	1n	±5%	50V	SMD	3513 999 55418	
C98	4p2	±0p25		cer	PN99862	A & B Bands
C98	8p2	±0p25		cer	PN99865	K Band
C99	8p2	±0p25		cer	PN99865	
C100	15p	±5%		cer	PN99868	A & B Bands
C100	22p	±5%		cer	PN99870	K Band
C101	10p	±0p25		cer	PN99866	A & B Bands
C101	6p8	±0p25		cer	PN99864	K Band
C102	27p	±5%		cer	PN99871	
C103						Not Used
C104	22p	±5%		cer	PN99870	A & B Bands
C104	18p	±5%		cer	PN99869	K Band
C105,106	10n	±10%	50V	SMD	3513 999 55492	
C107	100n	±20%	50V	submin pes	PQ99556	
C108	47p	±5%	50V	SMD	CN99039	
C109,110	10	±20%	63V	elec	PS99445	
C111	47p	±5%	50V	SMD	CN99039	
C112	10	±20%	63V	elec	PS99445	
C113	2µ2	±20%	100V	elec	PS99456	
C114,115	10	±20%	63V	elec	PS99445	
C116	47p	±5%	50V	SMD	CN99039	
C117	10	±20%	63V	elec	PS99445	
C118	47p	±5%	50V	SMD	CN99039	
C119	2µ2	±20%	100V	elec	PS99456	
C120,121	47p	±5%	50V	SMD	CN99039	
C122	100n	±10%	50V	SMD	3513 999 55017	
C123-125	47p	±5%	50V	SMD	CN99039	
C126	4n7	±10%	50V	SMD	3513 999 55484	
C127	270n	±10%	50V	SMD	3513 999 55022	
C128	47p	±5%	50V	SMD	CN99039	
C129,130	10n	±10%	50V	SMD	3513 999 55492	
C131	100n	±10%	50V	SMD	3513 999 55017	
C132	10	±20%	63V	elec	PS99445	
C133	33	±20%	35V	elec	PS99429	
C134	10	±20%	63V	elec	PS99445	
C135-148						Not Used
C149	1n	±10%	50V	SMD	3513 999 55459	
C150	1n	±5%	50V	SMD	3513 999 55418	
C151-157	1n	±10%	50V	SMD	3513 999 55459	
C158	1n	±5%	50V	SMD	3513 999 55418	
C159						Not Used
C160	68p	±5%	500V	SMD	3513 999 55659	
C161	470p	±5%	200V	SMD	CN99590	
C162	68p	±5%	500V	SMD	3513 999 55659	
C163	470p	±5%	200V	SMD	CN99590	
C164	4p7	±0p25	50V	SMD	3513 999 55309	
C165	27p	±5%		cer	PN99871	
C166	1n	±10%	50V	SMD	3513 999 55459	
C167	22p	±5%	50V	SMD	3513 999 55317	A Band
C167	33p	±5%	50V	SMD	CN99037	B Band
C168	1n	±10%	50V	SMD	3513 999 55459	
C169	2p2	±0p25	50V	SMD	3513 999 55305	A & B Bands
C170	470p	±5%	200V	SMD	CN99590	A & B Bands

Miscellaneous			
LK1,5,6	Link connector	FC99060	
SKA	Socket rt angle D 15-way	FS42136	
SKC	Socket BNC type	FS43779	Antenna
LED1	LED green	FV05931	
LED2,3	LED red	FV05860	
TH1	Thermistor	PL23147	
TP1-9	Header str male 1 posn	FC00837/01	
LK5,6	Header str male 3 posn	FC00837/03	
PLB	Header str male 4 posn	FC00837/04	
LK1,PLA,C	Plug PCB mtd 2 x 2-way	FP99172	
	Socket, Xtal	FS42611	2/X11
	Pillar hexagon	BT04132	1/crystal oven assy
	Can	BT15879/01	1/L1-3
	Can	FT03521	1/L8-15
	Link connector	FC99060	1/LK1,5,6
	Screen assy, output filter	AT14869	
	Comprising:		
	Screen output filter	BT26400	
	Finger, contact	BT17286	

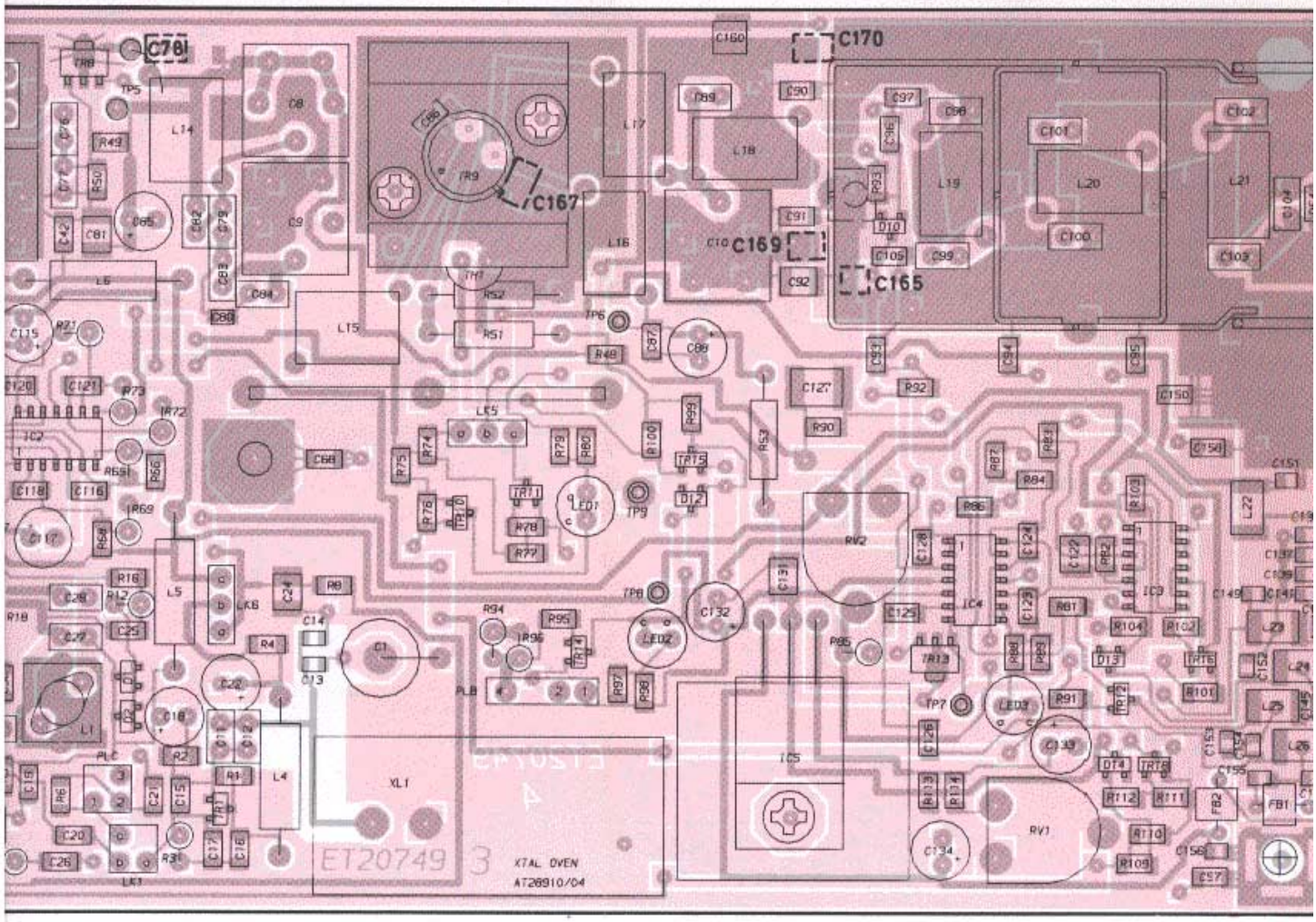
Cct. Ref	Description	Part No.	Remarks
Miscellaneous (Cont'd)			
	Screen trans/Xtal	BT26406	
	Heatsink twisted vane	QA05850	1/IC5
	Heatsink	QA05861	1/TR9
	Bracket, antenna Tx driver	BT11439	
	Spacer, LED 3,5mm x 4,76mm	QA05856	1/LED1
	Nut st hex M2,5	QA11604/B	2/TR9
	Nut st hex M3	QA11605/X	1/heatsink, 2/15-way socket
	Washer st M2,5	QA15004/B	2/TR9
	Washer st M3	QA15005/X	1/heatsink, 2/15-way socket
	Washer thermal (TO-220)	QA99111	1/IC5
	Washer, fibre	BT29806/02	2/fixing screws - TR9 heatsink
	Scr st pan pozi M3 x 8mm	QJ11902/X	1/Tx PCB - pillar, 1/Xtal oven - pillar, 2/15-way socket
	Scr st pan pozi M2,5 x 8mm	QJ11946/B	2/TR9
	Scr st pan pozi M3 x 10mm	QJ11903/X	1/heatsink - IC5

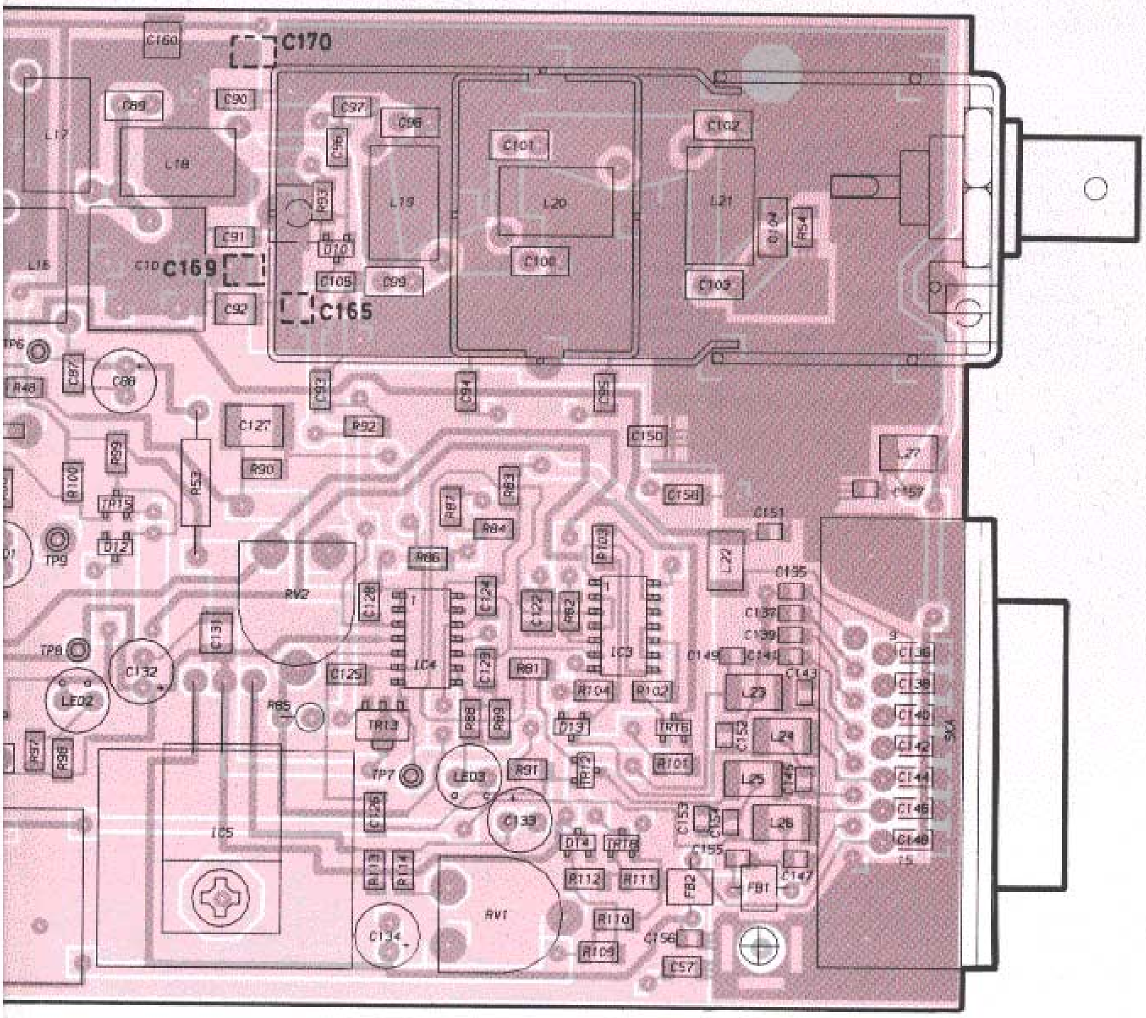
PCB ASSEMBLY CRSTAL OVEN
AT28910/04

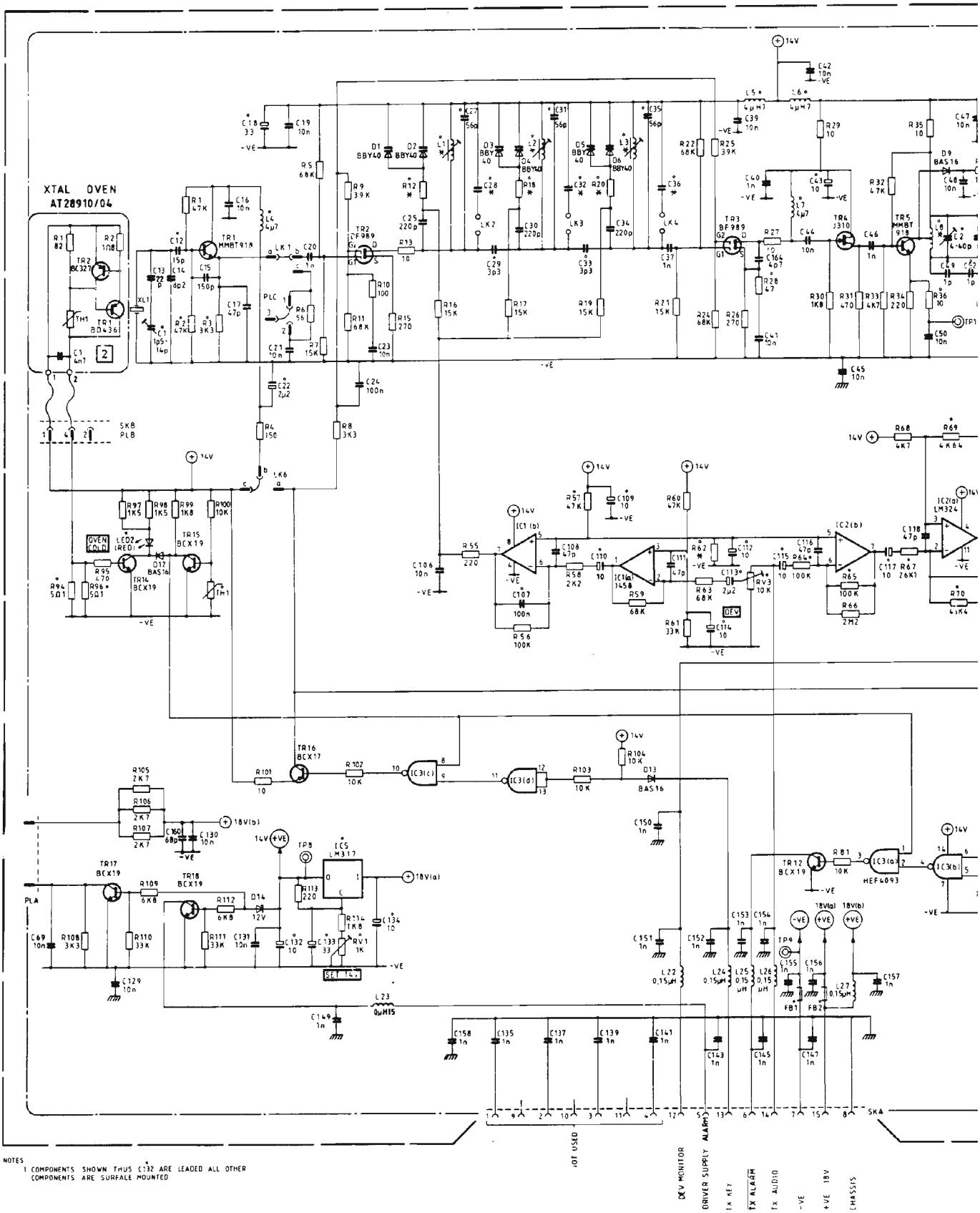
TR1	Transistor power GP BD436	FV05886	
TR2	Transistor small signal BC327	FV05975	
R1	82 ±5% 0,25W c film	PM01423	
R2	1Ω8 ±5% 0,25W c film	PM01403	
C1	4n7 ±20% cer	PN99919	
TH1	Thermistor PTC 70°C	PL23137	
	Mica insulator	BT36934/01	For TR1 & heatsink
	Holder crystal (oven)	BT45138	
	Retainer	BT48021	
	Scr st pan pozi M2,5 x 5mm	QJ11944/B	
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	



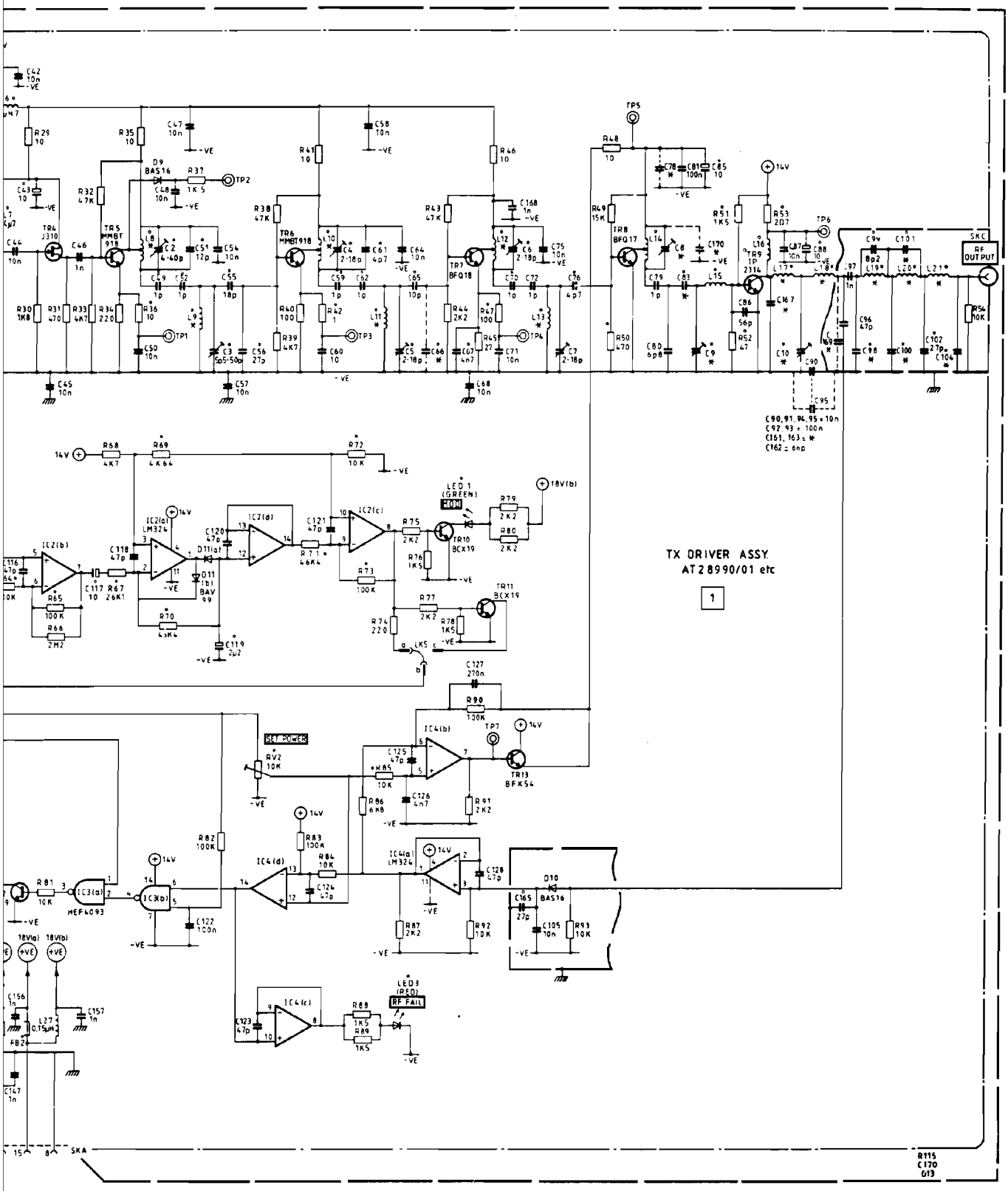
TX DRIVER ATO4873/-
LAYOUT DIAGRAM


C170
C167
C169
C165
XTAL OVEN
AT26910/04
ET20749


C170
C160
C169
C165
C89
C90
C97
C98
C96
C101
C102
L17
L18
L19
L20
L21
R53
D10
C91
C105
C99
C100
C103
R54
L16
C92
TP6
C87
C88
R48
C93
C94
C95
C127
R92
C150
L27
R90
R100
R87
R83
C158
C157
C151
TR15
R84
R103
L22
TP9
D12
R86
RV2
C128
C124
C122
R82
IC3
C135
C137
C139
C141
C149
C143
C136
C138
C140
C142
C144
C146
C148
TP8
C131
C132
C125
IC4
C123
R81
R104
R102
L23
L24
L25
L26
LED2
R85
TR13
R88
R89
D13
TR16
R97
R98
TP7
LED3
R91
TR17
R101
C153
C152
C155
IC5
C126
C133
D14
TR18
C147
R113
R114
R112
R111
FB2
FB1
RV1
R110
C134
C156
R109
C57
SK4



NOTES
1 COMPONENTS SHOWN THUS C132 ARE LEADED ALL OTHER COMPONENTS ARE SURFACE MOUNTED



TX DRIVER ATO4873/-
CIRCUIT DIAGRAM

TRANSMITTER POWER AMPLIFIER MODULE
AT04874/- 30W VERSIONS
AT04879/- 50W VERSIONS

INTRODUCTION

The transmitter power amplifier comprises two boards - an RF power amplifier and a PA control board.

The power amplifier accepts the nominal 1,25W input from the transmitter driver and provides a 30W (AT04874/-) or 50W (AT04879/-) output to the antenna. The control board provides power output regulation and also VSWR and thermal monitoring.

RF POWER AMPLIFIER AT28992/- (30W) AT29059/- (50W)

The low power RF input from the transmitter driver module is applied to a two-stage power amplifier TR1 and TR2, each transistor operating in class C . Automatic level control is provided by the switching regulator controlling the voltage supply line to:-

(i) TR1 and TR2 on AT28992/- versions.
(ii) TR1 on AT29059/- versions.

TR2 on AT29059/- versions is supplied with unregulated +24V from the PA Control PCB.

The RF power output from TR2 is fed via a harmonic filter to the antenna. LK1 may be removed from circuit to allow assessment of the antenna filter under workshop conditions. Stripline inductor L17 and power coupler D1, D2 provide forward and reverse power monitoring to the control board.

PA CONTROL BOARD AT28991/01

Power Level Control

The switching regulator circuit IC1, TR3, D6, uses the unregulated +24V DC input to provide a suitable supply voltage to power amplifier [0]TR1 and, on AT04874/- versions, [0]TR2 at a level determined by the forward power feedBack circuit. On AT04879/- versions an unregulated +24V supply is provided for [0]TR2. L3 acts as a flywheel coil to store energy which is drawn off by the power amplifier.

The Tx key input is used as the enable input to IC1 thus ensuring that the PA is shut down in the non-transmit condition.

At power-up the switching regulator is set to produce a nominal +15V supply to the PA. R37 provides current limiting to protect the regulator from short circuits.

A power coupler on L17 in the PA taps off the forward and reverse power to provide regulation of the RF output level and give VSWR indication and protection.

The forward power is detected by D1 and applied to the variable gain amplifier IC3(c). Gain is set by RV1 (POWER SET). The DC output from IC3(c) is compared to +5V in IC3(d) producing a DC level which is applied to IC1 pin 1. The switching regulator compares the level on pin 1 with the +2,5V reference on pin 2 and adjusts the supply voltage to the PA accordingly. The DC output from IC3(d) is also used to provide an open collector monitor of forward power through TR7.

Reverse power detected by D2 is applied to IC3(b) to produce a DC output which is compared to +5V in IC3(a). The resulting output is passed to comparator IC3(d) to control the voltage supply line and hence RF power output as previously described. The output from IC3(a) is also used to provide an open collector output for VSWR alarm, via TR8.

An external VSWR detector may be connected directly to the reverse power line on SKC pin 9 whilst the output on pin 21 provides a metering point for forward power.

External control of comparator IC3(d) enables remote adjustment of the power output; a value of resistance, selected in the control module, connected between PLC pin7 and OV reducing the transmitter power output.

Over-temperature Protection

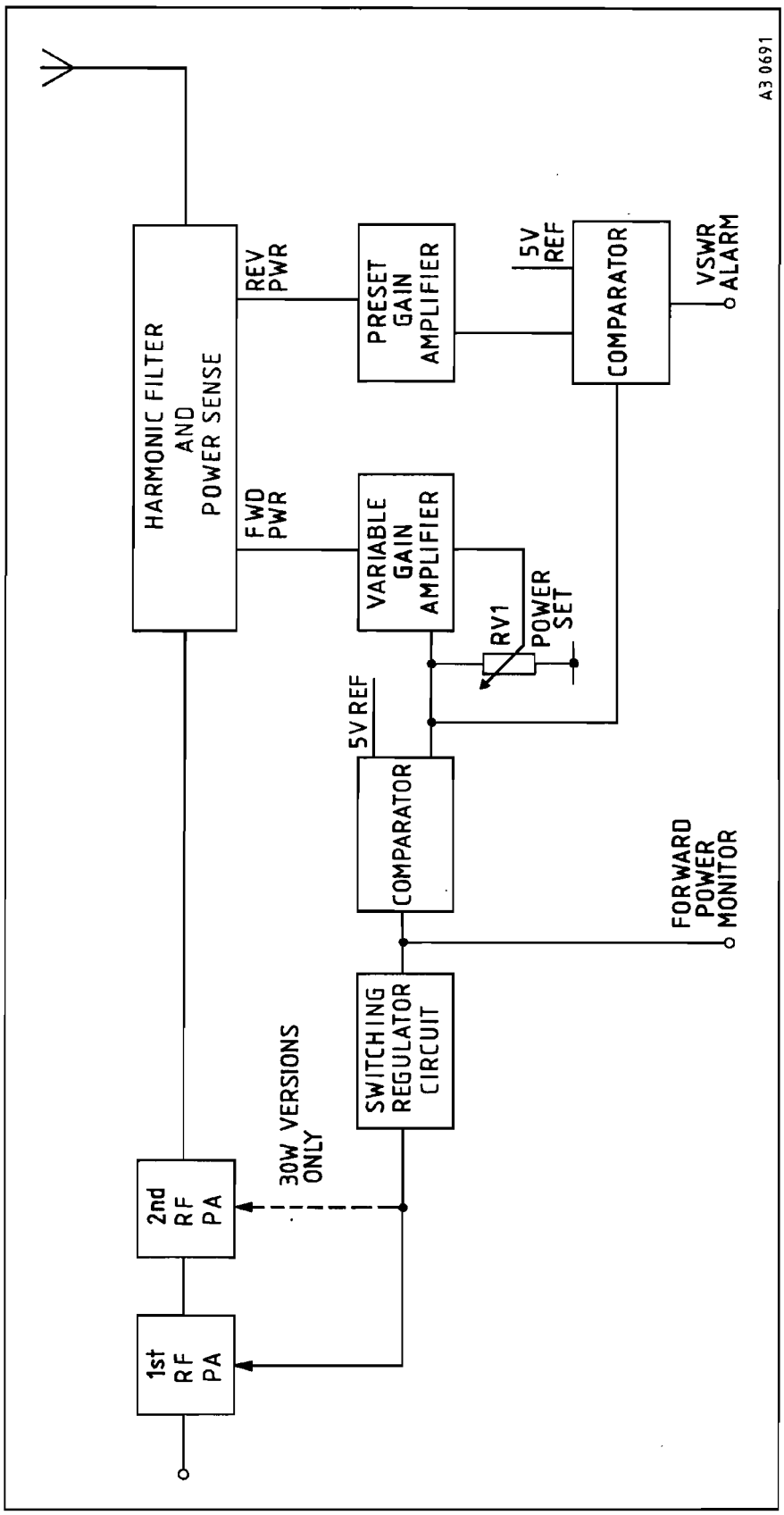
Over-temperature protection within the module is provided by thermistor TH1 and dual comparator IC2(a) and IC2(b). At 'normal' operating temperatures the potential from TH1 on IC2 pin 2 is greater than the bias on pins 3 and 5. The output from both comparators is 'low' and the module functions as normal.

Should the temperature rise slightly above the nominal 80°C the potential from TH1 will fall as its resistance rises. The biasing arrangement is such that this potential will now be less than that on IC2 pin 3 but still greater than that at IC2 pin 5. The output from IC2(b) will remain 'low' but the output from IC2(a) will go 'high' causing TR5 and TR6 to conduct. TR5 provides an over-temperature alarm on SKC pin 17 and TR6 reduces the reference input on IC3(d) to a level such that the RF power output is reduced by 3dB (half-power), thus reducing the module dissipation.

A larger rise in heatsink temperature further decreases the potential from TH1, the bias level on IC2 pin 5 is now greater than the level on pin 6 and the output from IC2(b) goes 'high'. The enable line on IC1 pin 10 goes 'high', inhibitting the switching regulator so providing total shutdown; TR4 conducts providing a temperature shutdown alarm on SKC pin 4.

SPECIFICATION

Band	A9 146-174MHz B0 132-156MHz K0 174-225MHz	 AT04874/- versions only
Output Impedance	50Ω nominal	
Output Power	30W, adjustable down to 6W 50W	AT04874/- versions AT04879/- versions
Output Power Stability	Less than ±1dB variation over full range of voltage, temperature, .switching bandwidth, and input power	
Duty Cycle	100%	
Input Impedance	50Ω nominal, VSWR less than 2:1	
Input Power	1,25W ±1dB 2W maximum without damage	
Temperature Protection	3dB power reduction if heatsink temp exceeds 85°C total shutdown above 87°C	



TX POWER AMPLIFIER ATO4874/- AND ATO4879/-
BLOCK DIAGRAM

Supply Input	24V +20% -10% at 3A maximum
Alarm Outputs (Open collector)	1) Supply Alarm (normally pulled low)
	2) VSWR Alarm (pull low on alarm) Indicates proportional shutdown operative
	3) Temp Alarm 1 (pull low on alarm) Indicates 3dB power reduction operative
	4) Temp Alarm 2 (pull low on alarm) Indicates complete shut-off

TEST PROCEDURE

Test Equipment required

Note: Refer to Part I, Table 3.1 for list of suitable types.

2 AF Generator
10* RF Signal Generator
15 Thruline Wattmeter
16 Spectrum Analyser
17* Return Loss Bridge
18 50Ω Load (includes sniffer)
20 'Break-out' connector 25 way
21* Input Test Lead (local manufacture)

* Required only for optional Antenna Filter Alignment check

Preliminaries

1. Remove the cover plate from the power amplifier module. Disconnect the ribbon cable from the control board and remove the cover plate from the power amplifier board.

2. Ensure that LK1 and LK2 (where fitted) on AT28991/01 are as follows:- LK1 Open Circuit, LK2 Short Circuit.

Antenna Filter Alignment

Note: This check ensures that the input match of the antenna filter is maintained over the entire bandwidth of the equipment. It is factory set and should not normally require adjustment but may be carried out if any of the filter coils have been replaced or adjusted.

3. With the test equipment connected as shown in Fig.1 measure the 'return loss' of the 50Ω termaline load. This should be greater than 25dB.

4. Remove link LK1 from the power amplifier board and connect the input test lead and plug from the return loss bridge. Ensure that the clip on the test lead is connected to the filter screen. Connect the 50Ω load to the antenna socket SKB.

5. Sweep the RF signal generator output over the range of the filter (132-174MHz for A and B bands), (174-226MHz for K band) and check the return loss is greater than 20dB. If part of the sweep between these limits show a return loss of less than 20dB slight adjustment to the filter coils L14, L15 and L16 is required. DO NOT adjust L18.

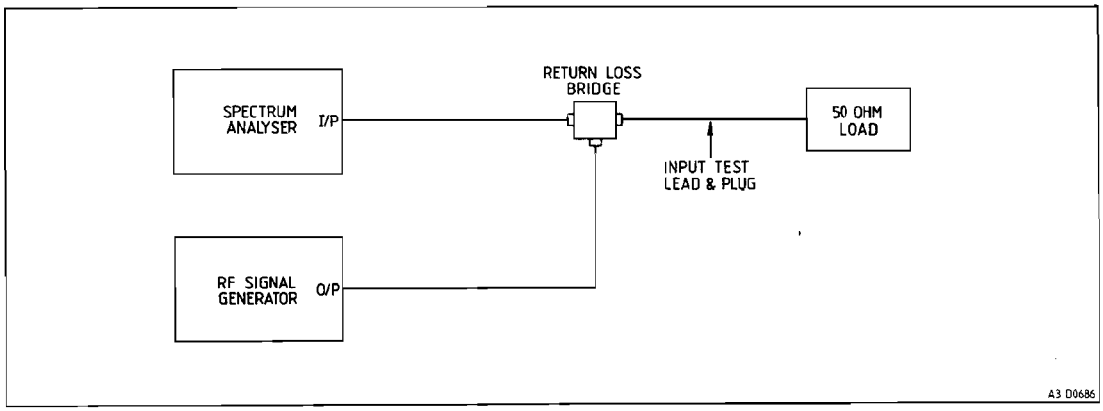


Fig.1 'Return Loss' Measurement

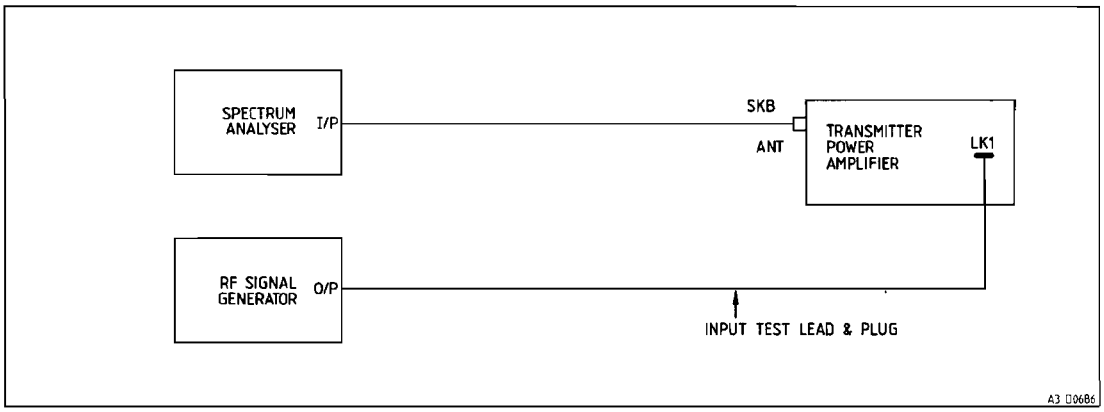


Fig.2 Antenna Filter Test Circuit - Direct Sweep

Note: (i) Tuning is effected by either squeezing (to increase inductance) or parting (to reduce inductance) the turns of the coil. To assist coil tuning the use of a piece of ferrite or brass held near the coil will indicate whether more or less inductance, respectively, is required.

(ii) It is normal for the return loss to deteriorate rapidly above 175MHz (A and B bands), 226MHz (K band).

6. Connect the test equipment as shown in Fig.2 and sweep the filter directly. The attenuation at 264MHz (A and B bands), 350MHz (K band) should be greater than 55dB.

7. Remove the test equipment and refit LK1.

Amplifier Alignment

8. Connect the thruline wattmeter to the antenna socket SKB and the spectrum analyser to the sniffer port (monitor output).

9. Reconnect the ribbon cable to the control board (SKA/PLA) and connect the ribbon cable from the backplane to the module (SKC), via the 'break-out' connector. Check that the green front panel DC POWER indicator is lit.

10. Check the following voltages on the control board:

+24V	on PLC pin 2	25V ±0,5V
+14V	on PLD pin 6	14V ±0,5V
+5V	on PLD pin 4	5V ±0,25V

11. Connect the AF generator set to 1kHz at -14dBm to the Tx 600Ω line. Connect the engineers handset to the control module front panel and set the manual function switch to TX ON.

12. Operate the EHS PTT switch, to key the transmitter.

13. Set the wattmeter to 'reverse' and adjust C7 on the PA board, for minimum reverse power.

14. Tune C14, C24 on the PA board for maximum power output.

15. Repeat steps 13 and 14. Check output power is greater than 35W (AT28992/-), 60W (AT29059/-).

16. Set RV1 (POWER SET) on the control board for an output of 30W (AT28992/-), 50W (AT29059/-).

17. Set RV1 fully clockwise. Check for a power output of greater than 35W (AT28992/-), 60W (AT29059/-). Re-adjust C24 if necessary. Reset RV1 for an output of 30W (AT28992/-), 50W (AT29059/-).

18. Temporarily short circuit SKC pins 2 and 7 and check for a power output fall to 12-18W (AT28992/-), 20-30W (AT29059/-) (ie: 3dB down, half-power).

19. Disconnect the RF input from the driver module to the PA board on SKA. Check the VSWR ALARM indicator LED3 on the Control Logic PCB is lit.

20. Disconnect and remove all items of test equipment and refit the covers to the module.

TX POWER AMPLIFIER

AT04874/01 K0 BAND 30W
AT04874/02 A9 BAND 30W
AT04874/03 B0 BAND 30W
AT04879/02 A9 BAND 50W
AT04879/03 B0 BAND 50W

Cct. Ref	Description	Part No.	Remarks
	Feedthrough plate assembly	AT14803	
	PCB assy TX PA control	AT28991/01	
	PCB assy TX PA	AT28992/-	30W
	PCB assy TX PA	AT29059/-	50W
	Housing & heatsink TX PA	BT45146	30W
	Housing & heatsink TX PA	BT45169	50W
	Lid assy TX PA	AT29404	
SKA	Socket BNC str 50Ω	FS43808	RF I/P
SKB	Socket 50Ω N type	FS16081	RF O/P
TR1	Transistor BLY87C "Be O"	FV05647	(Tx PA PCB)
TR2	Transistor SD1274-3	FV42221	30W (Tx PA PCB)
TR2	Transistor SD1468-6 "Be O"	FV42231	50W (Tx PA PCB)
C10	Capacitor, 47p, ±5%, 500V SMD	3513 999 55655	50W B Band (Tx PA PCB)
C19,20	Capacitor, 220p, ±5%, 200V SMD	3513 999 55671	30W (Tx PA PCB)
C19,20	Capacitor, 220p, ±5%, 200V SMD	3513 999 55671	50W A Band (Tx PA PCB)
C19,20	Capacitor, 470p, ±5%, 200V SMD	3513 999 55679	50W B Band (Tx PA PCB)
C53	Capacitor, 47p, ±5%, 500V SMD	3513 999 55655	50W (Tx PA PCB)
	Lid unit	BT13802	
	Bushing shorty	FG02736	3/Tx PA lid
	Strap, earth	3513 904 40011	50W 1/TR2
	Label frequency align.	BT38238	
	Label, Beryllium oxide	CM01125	
	Label, unit	BT38209/01	Casting
	Nut st hex M3	QA11605/X	1/TR1,TR3,D6(PA control) 1/SKB, 2/f'thru assy - housing & heatsink
	Washer st M3	QA15005/X	1/TR1,TR3,D6(PA control), 1/SKB, 2/f'thru assy - housing & heatsink
	Bush insulating (TO-220)	QA99024	1/TR1,TR3,D6(PA control)
	Washer thermal	QA99111	50W 1/TR1,TR3,D6(PA control)
	Scr st tap pan M3 x 6mm	QJ11550/X1	2/front panel - housing & heatsink, 11/PA lid, 7/TX PA PCB - housing & heatsink, 4/TX PA Control PCB - housing & heatsink, 11/unit lid, 7/RF connectors
	Scr st tap pan M3 x 10mm	QJ11552/X1	1/Tx PA PCB - housing & heatsink
	Scr st tap pan M2,5 x 8mm	QJ11581/X1	50W 2/TR2
	Scr st pan pozi M3 x 16mm	QJ11905/X	1/TR1,TR3,D6(PA control), 1/SKB
	Scr st hex M3 x 12mm	QJ13255/X	2/f'thru assy - housing & heatsink

LID ASSEMBLY, TX PA AT29404

Cable assy ribbon 26-way	AT70154	DC interconnecting
Lid Tx PA	BT13808	
Scr st pan pozi M2,5 x 8mm	QJ11946/B	2/SKC
Nut st M2,5	QA11604/B	2/SKC

FRONT PANEL ASSEMBLY AT14820

Panel, front	BT23741	
Label, TX PA	BT38206/03	1/handle
Label, Philips	BT38217/01	1/handle
Fastener	BT17284	4/PA - shelf
Handle	BT35950	
Scr st tap pozi No4 x 8mm	QJ08241/X	3/handle

PCB ASSEMBLY TX PA CONTROL
AT28991/01

Cct Ref	Description	Part No.	Remarks
Semiconductors & IC's			
IC1	IC SG3524N	FU09729	
IC2	IC Dual op amp 1458	FU99092	
IC3	IC LM324	FU99115	
TR1	Transistor BD947	FV99042	
TR2	Transistor BSS64	FV99119/SM	
TR3	Transistor RFP10N12	FV08879	
TR4-9	Transistor BCW71	FV99100/SM	
D1	Diode BAS16	3513 999 15003	
D2	Diode BZX84C15	FV99018/SM	
D3	Diode BZX84C8V2	FV99013/SM	
D4,5	Diode BAS16	3513 999 15003	
D6	Diode GP BYW29-150	FV99171	
D7	Diode BAS16	3513 999 15003	
Resistors			
R1	39k ±5% 0,125W SMD	3513 999 80055	
R2	1k8 ±5% 0,125W SMD	3513 999 80039	
R3	680 ±5% 0,125W SMD	3513 999 80034	
R4	390 ±5% 0,125W SMD	3513 999 80031	
R5	1k5 ±5% 0,125W SMD	3513 999 80038	
R6	100 ±2% 0,5W m oxide	PL99293	
R7	10k ±5% 0,125W SMD	3513 999 80048	
R8-10	100k ±5% 0,125W SMD	3513 999 80060	
R11	220 ±5% 0,125W SMD	3513 999 80028	
R12	4k7 ±5% 0,125W SMD	3513 999 80044	
R13	22k ±5% 0,125W SMD	3513 999 80052	
R14	4k7 ±5% 0,125W SMD	3513 999 80044	
R15	1k8 ±5% 0,125W SMD	3513 999 80039	
R16	100k ±5% 0,125W SMD	3513 999 80060	
R17	18k ±5% 0,125W SMD	3513 999 80051	
R18	22k ±5% 0,125W SMD	3513 999 80052	
R19-21	4k7 ±5% 0,125W SMD	3513 999 80044	
R22	3k9 ±5% 0,125W SMD	3513 999 80043	
R23	680 ±5% 0,125W SMD	3513 999 80034	
R24	1k8 ±5% 0,125W SMD	3513 999 80039	
R25	10k ±5% 0,125W SMD	3513 999 80048	
R26	150 ±5% 0,125W SMD	3513 999 80026	
R27	1k ±5% 0,125W SMD	3513 999 80036	
R28,29	27k ±5% 0,125W SMD	3513 999 80053	
R30	47k ±5% 0,125W SMD	3513 999 80056	
R31	4k7 ±5% 0,125W SMD	3513 999 80044	
R32	10 ±5% 0,125W SMD	3513 999 80012	
R33,34	18k ±5% 0,125W SMD	3513 999 80051	
R35	22k ±5% 0,125W SMD	3513 999 80052	
R36	27k ±5% 0,125W SMD	3513 999 80053	
R37	30milli-ohm ±20%	PL41528	
R38,39	27k ±5% 0,125W SMD	3513 999 80053	
R40,41	1k ±5% 0,125W SMD	3513 999 80036	
R42	10k ±5% 0,125W SMD	3513 999 80048	
R43,44	18k ±5% 0,125W SMD	3513 999 80051	
R45,46	4k7 ±5% 0,125W SMD	3513 999 80044	
R47	27k ±5% 0,125W SMD	3513 999 80053	
R48	10k ±5% 0,125W SMD	3513 999 80048	
R49	1k ±5% 0,125W SMD	3513 999 80036	
R50	100k ±5% 0,125W SMD	3513 999 80060	
R51,52	10k ±5% 0,125W SMD	3513 999 80048	
R53	100k ±5% 0,125W SMD	3513 999 80060	
R54	10k ±5% 0,125W SMD	3513 999 80048	
R55	47k ±5% 0,125W SMD	3513 999 80056	
R56	4k7 ±5% 0,125W SMD	3513 999 80044	
R57	150 ±5% 0,125W SMD	3513 999 80026	
R58	220 ±5% 0,125W SMD	3513 999 80028	
RV1	10k ±20% Pot,skel,lin	PL01478	

Cct Ref	Description				Part No	Remarks
Capacitors						
C1	100n	±10%	50V	SMD	3513 999 55017	
C2-8	1n	±5%	50V	SMD	3513 999 55418	
C9	470	±20%	40V	elec	PS45812	
C10	1n	±5%	50V	SMD	3513 999 55418	
C11	100n	±10%	50V	SMD	3513 999 55017	
C12	470n	±5%		submin pes	PQ99538	
C13	1n	±5%	50V	SMD	3513 999 55418	
C14	100n	±10%	50V	SMD	3513 999 55017	
C15	100	±20%	63V	elec	PS38287	
C16	1n	±5%	50V	SMD	3513 999 55418	
C17	10n	±10%	50V	SMD	3513 999 55492	
C18						Not Used
C19	15n	±10%	50V	SMD	CN99116	
C20,21	1n	±5%	50V	SMD	3513 999 55418	
C22	100n	±10%	50V	SMD	3513 999 55017	
C23,24	1n	±5%	50V	SMD	3513 999 55418	
C25	10n	±10%	50V	SMD	3513 999 55492	
C26	100	±20%	63V	elec	PS38287	
C27	1n	±5%	50V	SMD	3513 999 55418	
C28	470	±20%	40V	elec	PS45812	
C29	100n	±10%	50V	SMD	3513 999 55017	
C30,31	1n	±5%	50V	SMD	3513 999 55418	
C32	270n	±10%	50V	SMD	3513 999 55022	
C33,34	100n	±10%	50V	SMD	3513 999 55017	
C35,36	470n	±5%		submin pes	PQ99538	
C37	470	±20%	40V	elect	PS45812	
C38	10n	±5%		submin pes	PQ99532	
C39	100n	±10%	50V	SMD	3513 999 55017	
C40	1n	±5%	50V	SMD	3513 999 55418	
C41	470n	±5%		submin pes	PQ99538	
C42	470	±20%	40V	elect	PS45812	
C43	1n	±5%	50V	SMD	3513 999 55418	
C44,45	100n	±10%	50V	SMD	3513 999 55017	
C46	10n	±10%	50V	SMD	3513 999 55492	
C47	470n	±5%		submin pes	PQ99538	
C48	1n	±5%	50V	SMD	3513 999 55418	
C49	100n	±10%	50V	SMD	3513 999 55017	
C50	10n	±10%	50V	SMD	3513 999 55492	
C51	1n	±5%	50V	SMD	3513 999 55418	
C52	15n	±10%	50V	SMD	CN99116	
C53-61	1n	±5%	50V	SMD	3513 999 55418	
C62	270n	±10%	50V	SMD	3513 999 55022	
Inductors						
L1	Choke				AL21474	
L2	Choke assy				AT30092	
L3,4	Choke				AL21474	
Miscellaneous						
FS1	Fuse 5A quick acting				FF99018	
TH1	Thermistor PTC 70°C				PL23137	
	Fuseholder PCB mtg				FH99101	1/FS1
	Header, str, male 1 pos'n				3513 504 00121	1/TP -ve
PLB,C	Plug, PCB mtg, str 2 x 2				FP99172	
PLD	Plug, PCB mtg, str 2 x 3				FP99174	
PLA	Plug, PCB mtg, str 2 x 13				FP99186	

PCB ASSEMBLY TX PA
AT28992/01 K BAND 30W
AT28992/02 A BAND 30W
AT28992/03 B BAND 30W

Semiconductors						
TR1,2						Part of module assy
D1,2	Diode schottky				FV09000	
Resistors						
R1	10	±5%	0,5W	carb	PM00001	
R2	100	±5%	0,5W	carb	PM00024	
R3	10	±5%	0,5W	carb	PM00001	A & K Bands

Cct Ref	Description			Part No	Remarks
Resistors Cont'd					
R3	3Ω3 ±5%	0,25W	c film	PM01406	B Band
R4	150 ±5%	2,5W	m film	PL51219	
R5	68 ±5%	0,25W	c film	PM01422	
R6	47k ±5%	0,25W	c film	PM01456	
Capacitors					
C1,2	1n ±5%		cer	PN99900	
C3	100n ±20%		cer	PN99927	
C4	18p ±5%	500V	NPO	PN10377	
C5	56p ±5%	500V	c disc	PN14335	A & B Bands
C5	39p ±5%	500V	cer	PN14335	K Band
C6	100p ±5%	500V	SMD	3513 999 55663	A & B Bands
C6	Not Used				K Band
C7	16-90p		trimmer	PV06601	
C8	100 ±20%	63V	elec	PS38287	
C9	100n ±5%		submin pes	PQ99535	
C10	56p ±5%	500V	c disc	PN14335	A Band
C10	38p ±5%	500V	c disc	PN12307	B Band
C10	18p ±5%	500V	c disc	PN10377	K Band
C11,12	1n ±5%		cer	PN99900	
C13	100n ±20%		cer	PN99927	
C14	16-90p		trimmer	PV06601	
C15	220p ±5%	200V	SMD	3513 999 55671	
C15	Not Used				K Band
C16	100 ±20%	63V	elec	PS38287	
C17	10n ±5%		cer	PN99906	
C18	100n ±5%		submin pes	PQ99535	
C19,20					Part of module assy
C21	1n ±5%		cer	PN99900	
C22	100p ±5%	500V	SMD	3513 999 96053	
C22	Not Used				K Band
C23	1n ±5%		cer	PN99900	
C24	16-90p		trimmer	PV06601	
C25	1n ±5%		cer	PN99900	
C26	100n ±20%		cer	PN99927	
C27-30	1n ±5%		cer	PN99900	
C31	12p ±5%	500V	cer	PN09382	A & B Bands
C31	10p 0p5	500V	NPO	PN09344	K Band
C32	4p ±0p25	500V	NPO	PN02410	A & B Bands
C32	3p ±0p25	500V	NPO	PN02338	K Band
C33	470n ±5%		submin pes	PQ99538	
C34	10p ±0p5	500V	NPO	PN09344	
C35	12p ±5%	500V	cer	PN09382	A & B Bands
C35	7p ±0p5	500V	cer	PN06303	K Band
C36	5p ±0p25	500V	c disc	PN04306	A & B Bands
C36	4p ±0p25	500V	NPO	PN02410	K Band
C37	12p ±5%	500V	cer	PN09382	A & B Bands
C37	10p ±0p5	500V	NPO	PN09344	K Band
C38,39	15p ±5%	500V	c disc	PN10376	A & B Bands
C38,39	12p ±5%	500V	cer	PN09382	K Band
C40-44	1n ±5%		cer	PN99900	
C45	12p ±5%	500V	cer	PN09382	A & B Bands
C45	10p ±0p5	500V	NPO	PN09344	K Band
C46	1n ±5%		cer	PN99900	
C47	15p ±5%	500V	c disc	PN10376	A & B Bands
C47	12p ±5%	500V	NPO	PN10376	K Band
C48	5p ±0p25	500V	c disc	PN04306	A & B Bands
C48	4p ±0p25	500V	NPO	PN02410	K Band
C49	100n ±5%		submin pes	PQ99535	
C50	39p ±5%	500V	cer	PN14335	K Band
C50	Not Used				A & B Bands
C51	470p ±5%	200V	SMD	3513 999 55679	A & B Bands
C51	150p ±5%	50V	SMD	3513 999 55667	K Band
Inductors					
L1	Coil			AT30624/02	A & B Bands
L1	Coil			AT31342/01	K Band
L2	Loop(8mm)			AT31511/02	A & B Bands
L2	Loop(11mm)			AT31511/01	K Band
L3					Not Used
L4	Coil			AT30624/01	
L5	Coil			AT30624/02	
L6	Choke assy			AT30092	

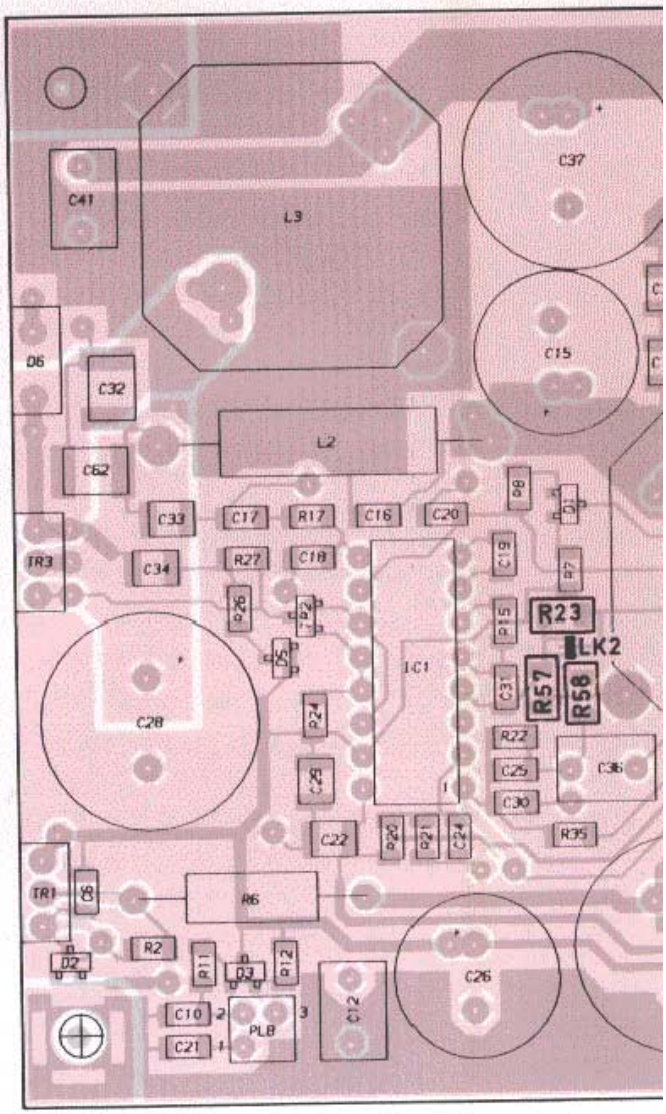
Cct Ref	Description	Part No	Remarks
Inductors (Cont'd)			
L7	Inductor	BT37703	
L8	Choke assy	AT31975/01	
L9			Not Used
L10	Coil	AT30624/01	
L11	Choke assy	AT30092	
L12			Not Used
L13	Loop(11mm)	AT31511/01	A & B Bands
L13	Loop(8mm)	AT31511/02	K Band
L14	Coil	AT30624/02	A & B Bands
L14	Coil	AT31342/01	K Band
L15	Coil	AT31342/02	A & B Bands
L15	Coil	AT30624/02	K Band
L16	Coil	AT30624/03	A & B Bands
L16	Coil	AT31434/01	K Band
L17			Not Used
L18	Coil	AT30624/02	A & B Bands
L18	Coil	AT31434/02	K Band
Miscellaneous			
	Link connector	FC99060	
	Screen, TX PA filter	BT26410	
	Header, str, male, 4 pos'n	FC00837/04	

PCB ASSEMBLY PA

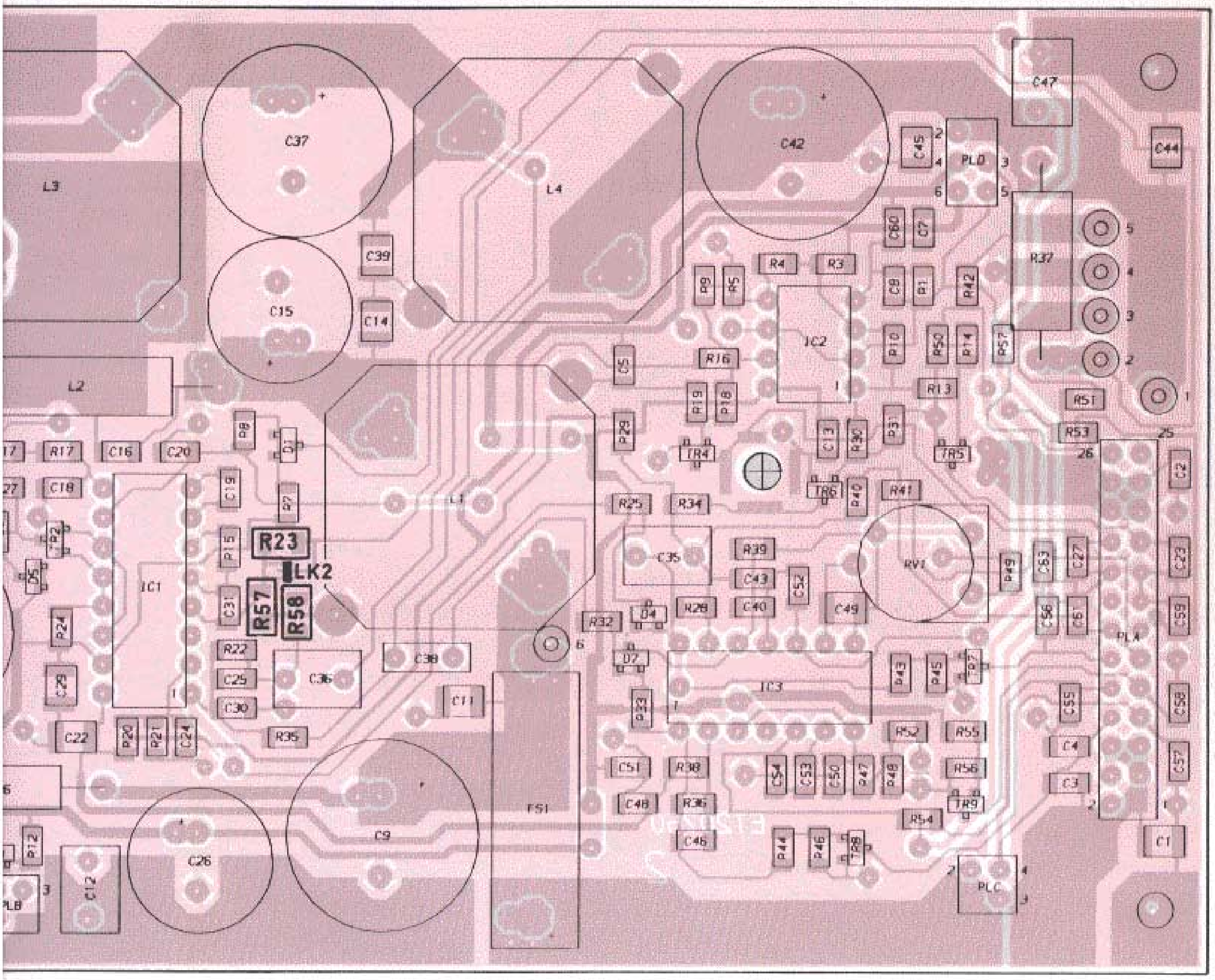
AT29059/02 A9 BAND 50W
AT29059/03 B0 BAND 50W

Cct Ref	Description	Part No	Remarks
Semiconductors & IC's			
D1,2	Diode Schottky	FV09000	
Resistors			
R1	10 ±5% 0,5W Carb.	PM00001	
R2	100 ±5% 0,5W Carb.	PM00024	
R3	10 ±5% 0,5W Carb.	PM00001	
R5	68 ±5% 0,25W c film	PM01422	
R6	47k ±5% 0,25W c film	PM01456	
Capacitors			
C1,2	1n ±5% cer	PN99900	
C3	100n ±20% cer	PN99927	
C4	18p ±5% 500V C disc	PN10377	
C5	56p ±5% 500V C disc	PN14335	
C6	150p ±5% 300V SMD	3513 999 55667	
C7	16-90p variable	PV06601	
C8	100 20% 63V elec	PS38287	
C9	100n ±5% pes	PQ99535	
C10	56p ±5% 500V C disc	PN14335	A Band
C11,12	1n ±5% cer	PN99900	
C13	100n ±20% cer	PN99927	
C14	16-90p variable	PV06601	
C15	220p ±5% 200V SMD	3513 999 55671	
C16	100 20% 63V elec	PS38287	
C18	100n ±5% pes	PQ99535	
C21	1n ±5% cer	PN99900	
C22	100p ±5% 500V SMD	3513 999 96053	
C23	1n ±5% cer	PN99900	
C24	16-90p variable	PV06601	
C25	1n ±5% cer	PN99900	
C26	100n ±20% cer	PN99927	
C27-30	1n ±5% cer	PN99900	
C31	12p ±0p5 500V cer	PN09382	
C32	4p ±0p25 500V	PN02410	
C33	470n ±5% pes	PQ99538	
C34	10p ±0p5 500V cer	PN09344	
C35	12p ±0p5 500V cer	PN09382	
C36	5p ±0p25 500V C disc	PN04306	
C37	12p ±0p5 500V cer	PN09382	
C38,39	15p ±5% 500V C disc	PN10376	
C40-44	1n ±5% cer	PN99900	

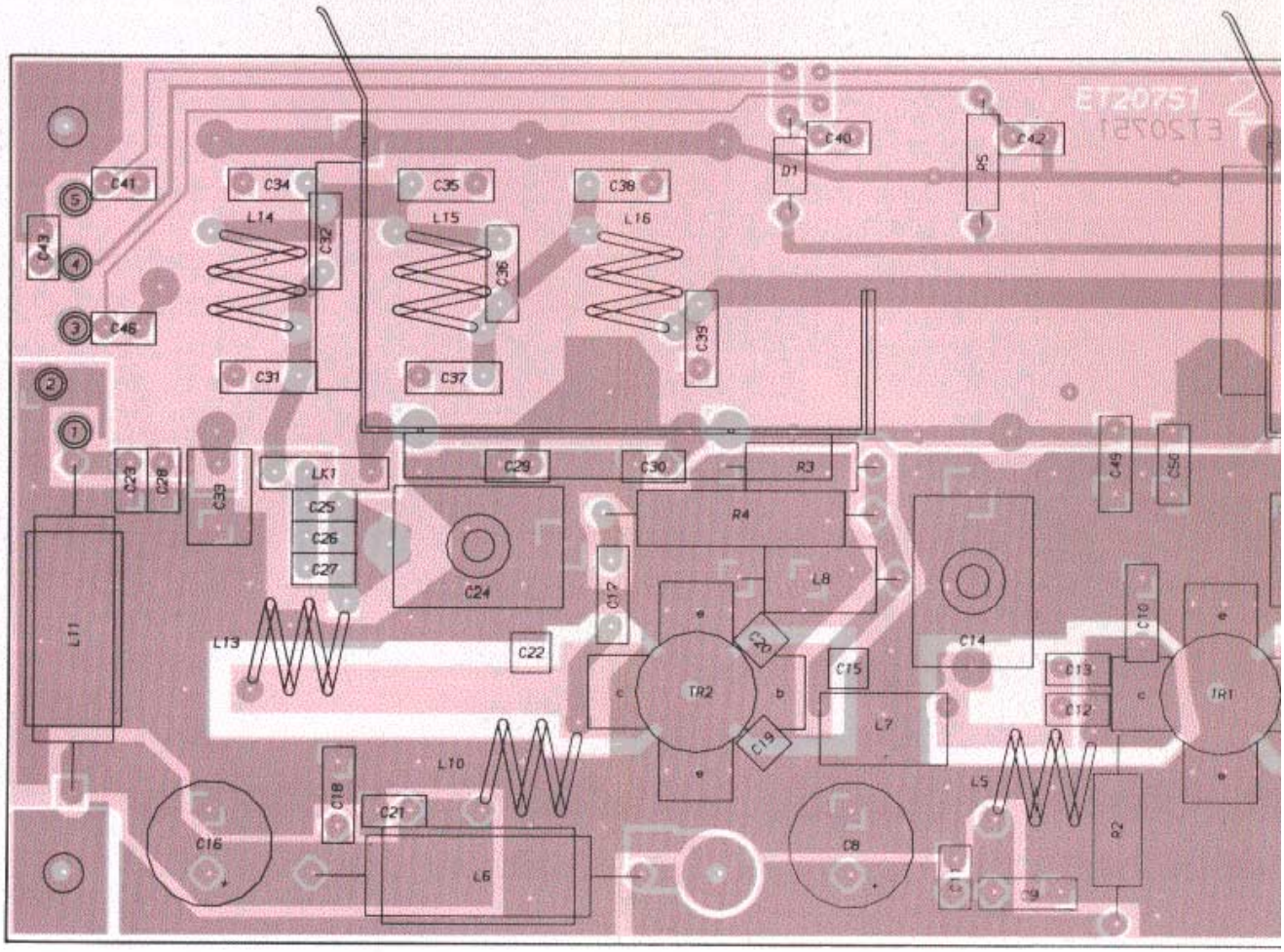
Cct Ref	Description				Part No	Remarks
Capacitors Cont'd						
C45	12p	±0p5	500V	cer	PN09382	
C46	1n	±5%		cer	PN99900	
C47	15p	±5%	500V	C disc	PN10376	
C48	5p	±0p25	500V	C disc	PN04306	
C49	100n	±5%		pes	PQ99535	
C50-52	470p	±5%	200V	SMD	3513 999 55679	
C54	100p	±5%	500V	SMD	3513 999 96053	B Band
Inductors						
L1	Coil				AT30624/02	
L2	Loop (8mm high)				AT31511/02	
L4	Coil				AT30624/01	
L5	Coil				AT30624/02	
L6	Choke Assy				AT30092	
L7	Inductor				BT37703	
L8	Choke Assy				AT31975/01	
L10	Coil				AT30624/02	
L11	Choke Assy				AT30092	
L13	Loop (11mm high)				AT31511/01	
L14	Coil				AT30624/02	
L15	Coil				AT31342/02	
L16	Coil				AT30624/03	
L18	Coil				AT30624/02	
Miscellaneous						
	Screen Tx PA Filter				BT26410	
	Hder str male 4 pos'n				FC00837/04	
LK1	Link Connector				FC99060	



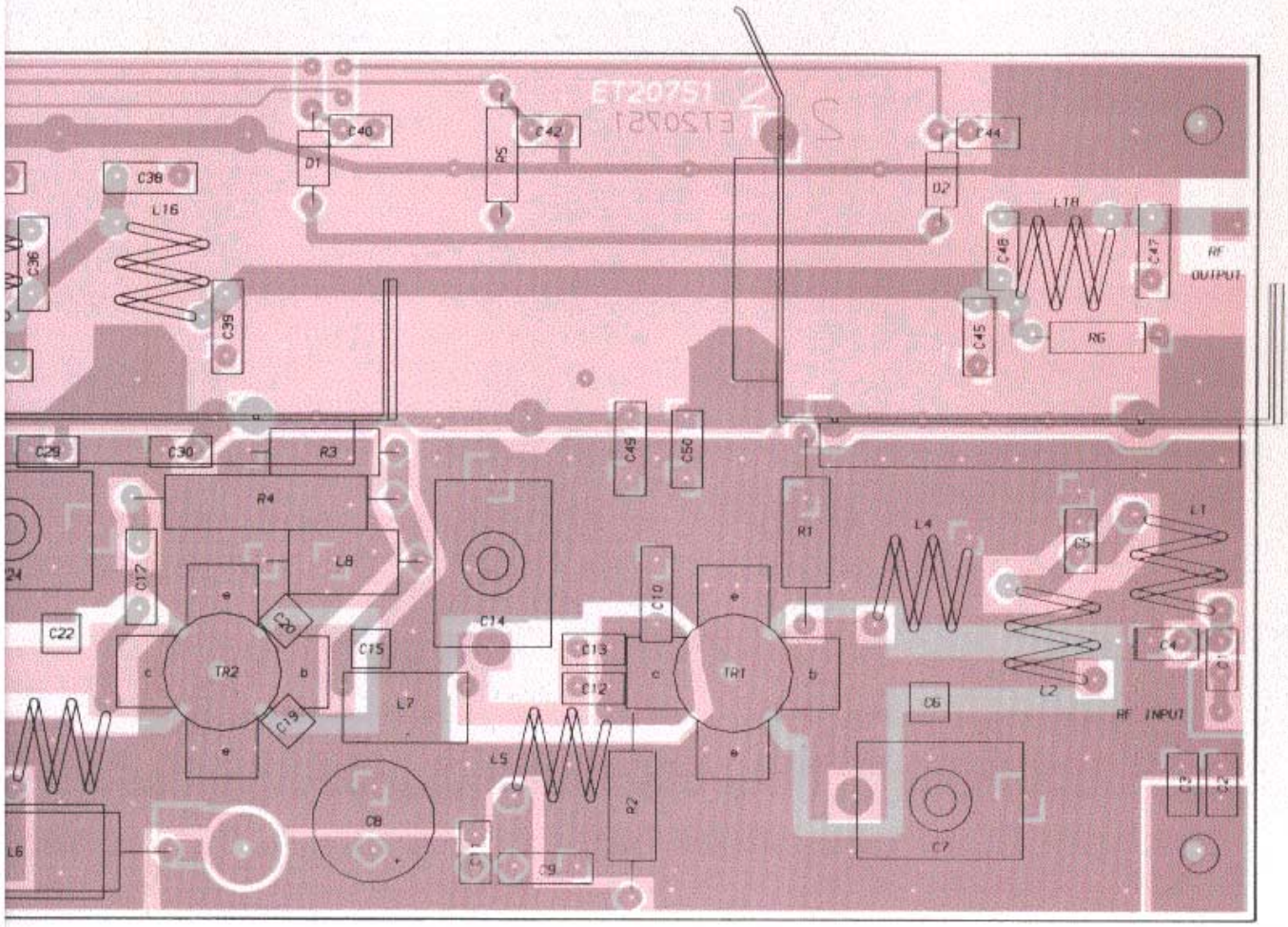
TX PA CONTROL AT28991/01
LAYOUT DIAGRAM



C37
C42
C47
C44
C45
PLD
L3
L4
C39
C15
C14
L2
R37
C60
C7
R4
R3
R9
R5
C8
R1
R42
IC2
R16
R10
R50
R14
R57
R13
R51
R53
R19
R18
R29
C13
R30
R31
TR4
TR5
TR6
R40
R41
R17
C16
C20
R8
D1
C19
C18
R7
L1
R25
R34
R23
LK2
R15
R57
R58
IC1
C31
C35
R39
C43
C52
C49
RV1
R49
C63
C27
C23
C2
PLA
C56
C6
C59
D5
R24
R32
D4
R28
C40
C22
C25
C30
C36
C38
D2
C11
R33
IC3
R43
R45
TR7
C55
C58
C4
C3
C57
C1
C29
R20
R21
C24
R35
R52
R55
C51
R38
C54
C53
C50
R47
R48
R56
C48
R36
TR9
C46
R44
R46
TR8
R54
PLC
FS1
C9
C26
C12
PLB
R12



TX PA AT28992/-
LAYOUT DIAGRAM



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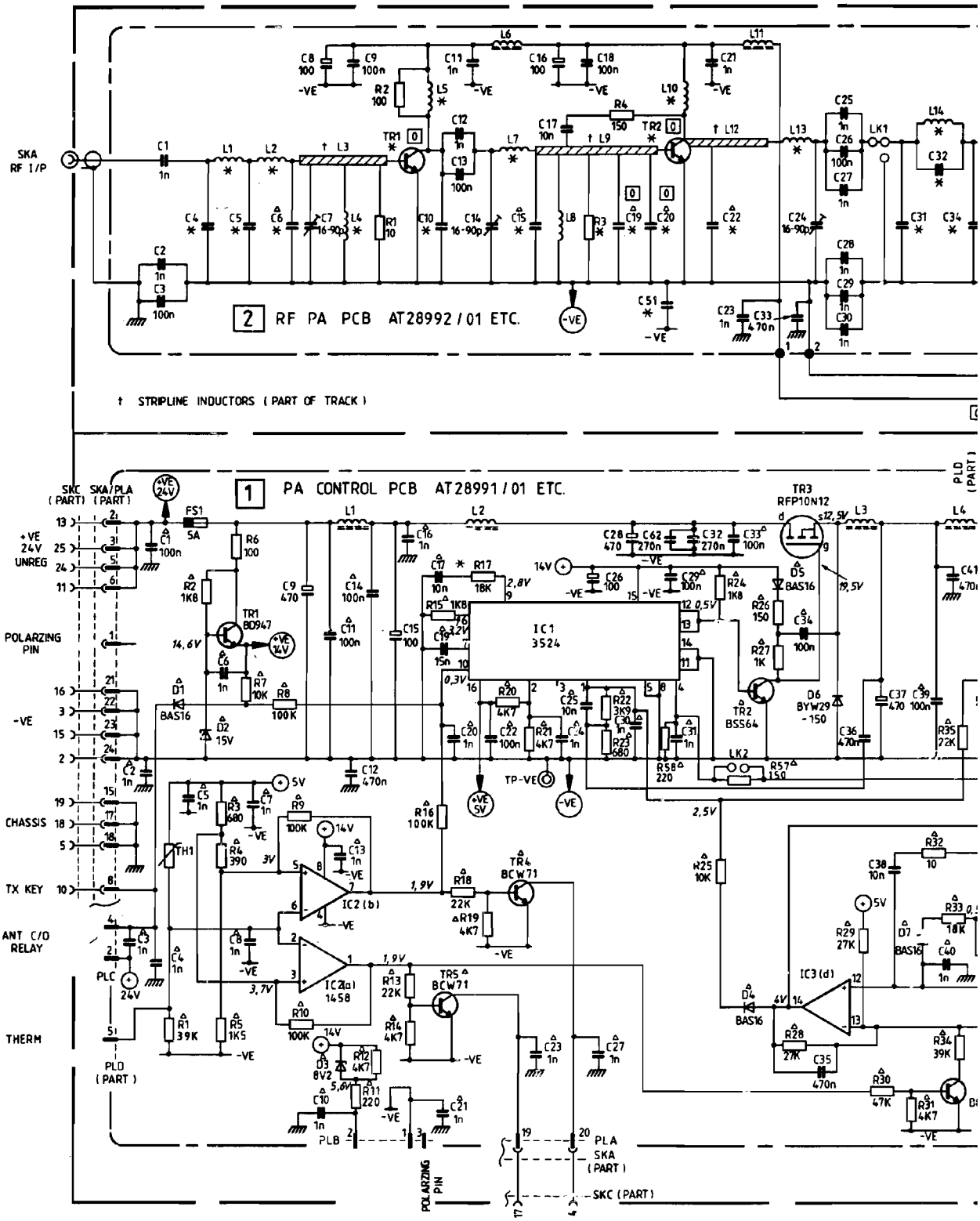
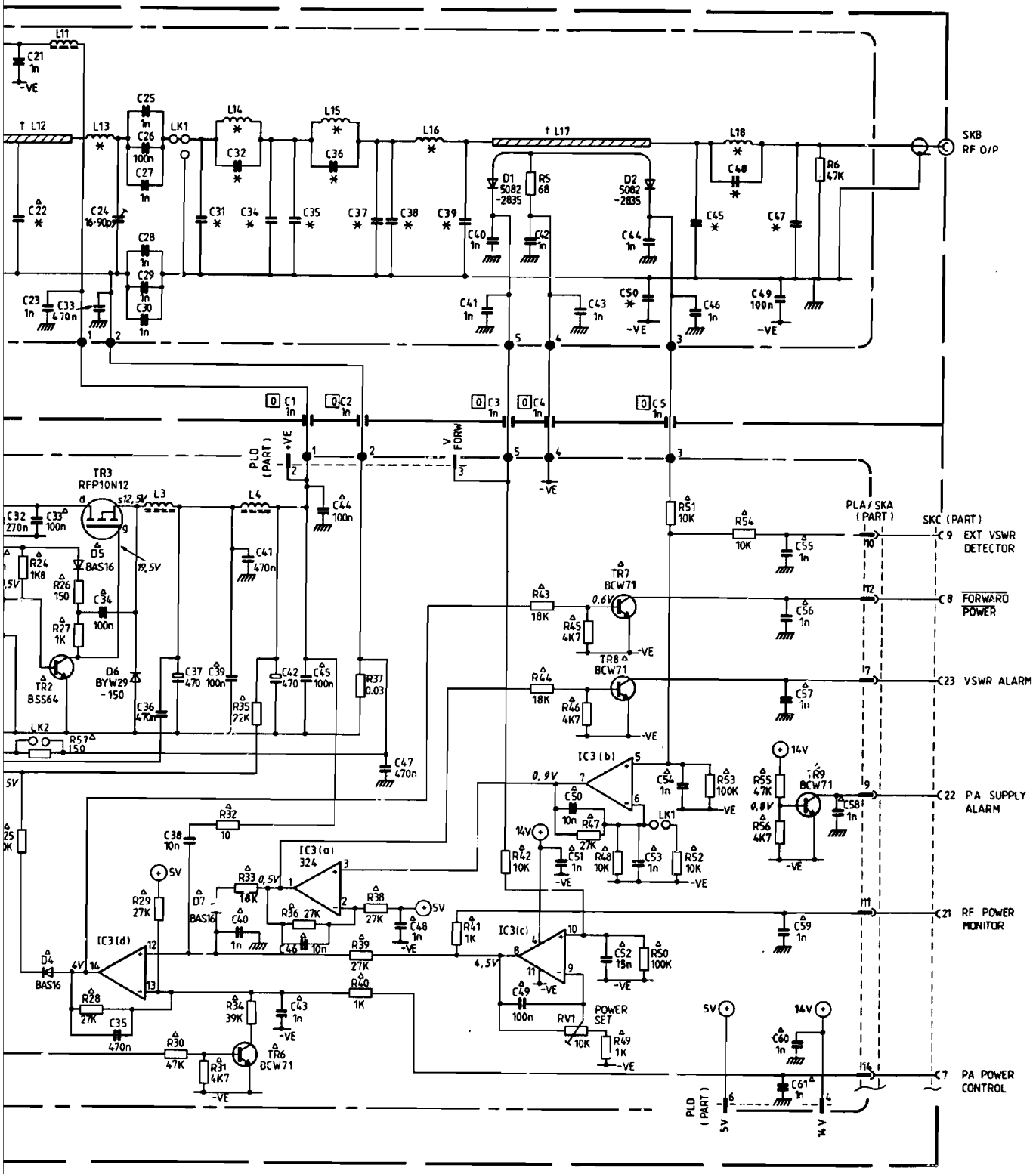
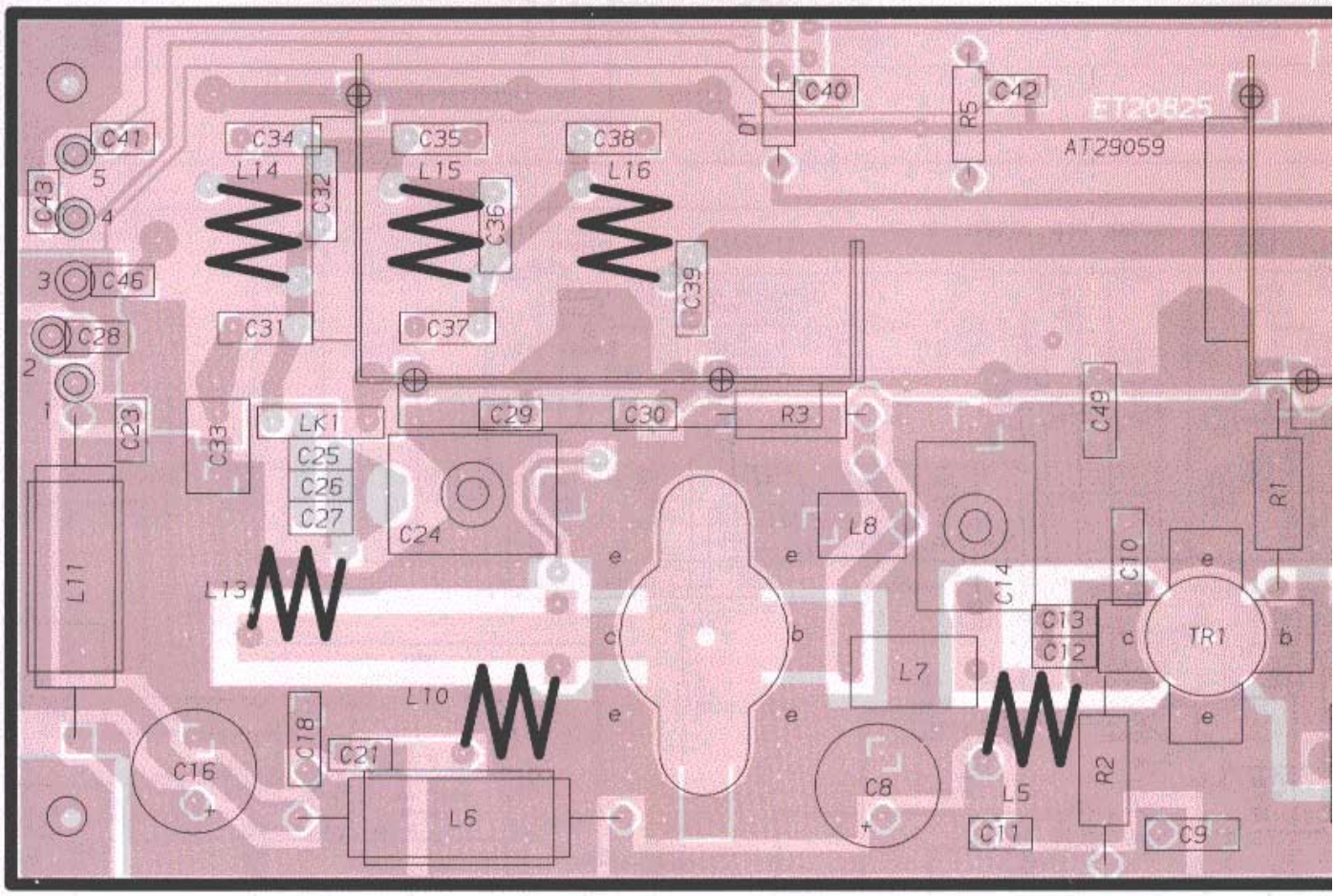


NOTES

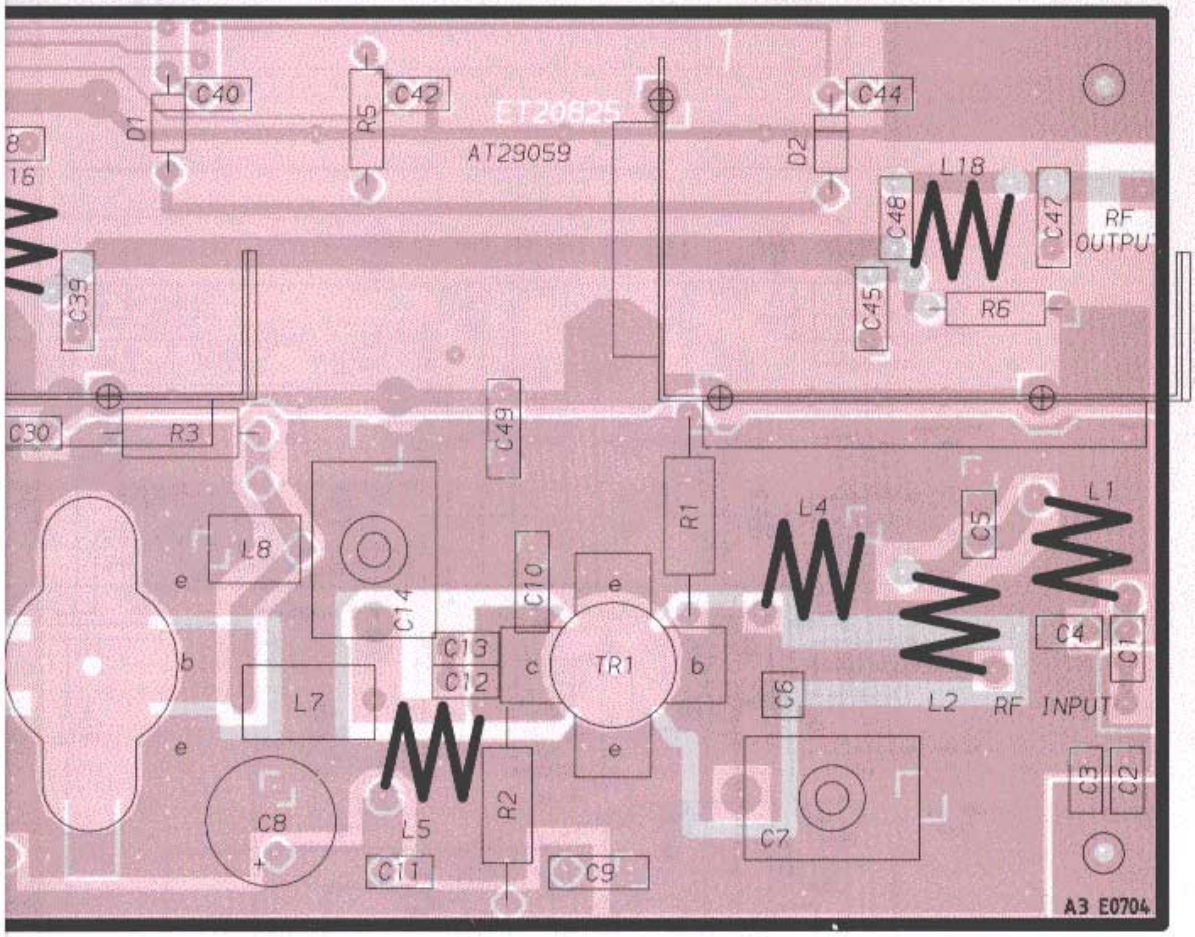
1. * FOR UNSPECIFIED VALUES OR TYPES SEE PARTS LIST
2. THE NUMBERS SHOWN IN BOXES (ie. [2]) ARE COMPONENT PREFIX NUMBERS AND SHOULD BE USED WHEN REFERENCE IS MADE TO ANY COMPONENT ON THAT PC.B. ASSY. ANY COMPONENT NOT ON A PC.B. ASSY. PREFIX [0] SHOULD BE USED
3. COMPONENTS SHOWN THUS C3 ARE SURFACE MOUNTED ALL OTHERS ARE LEADED.



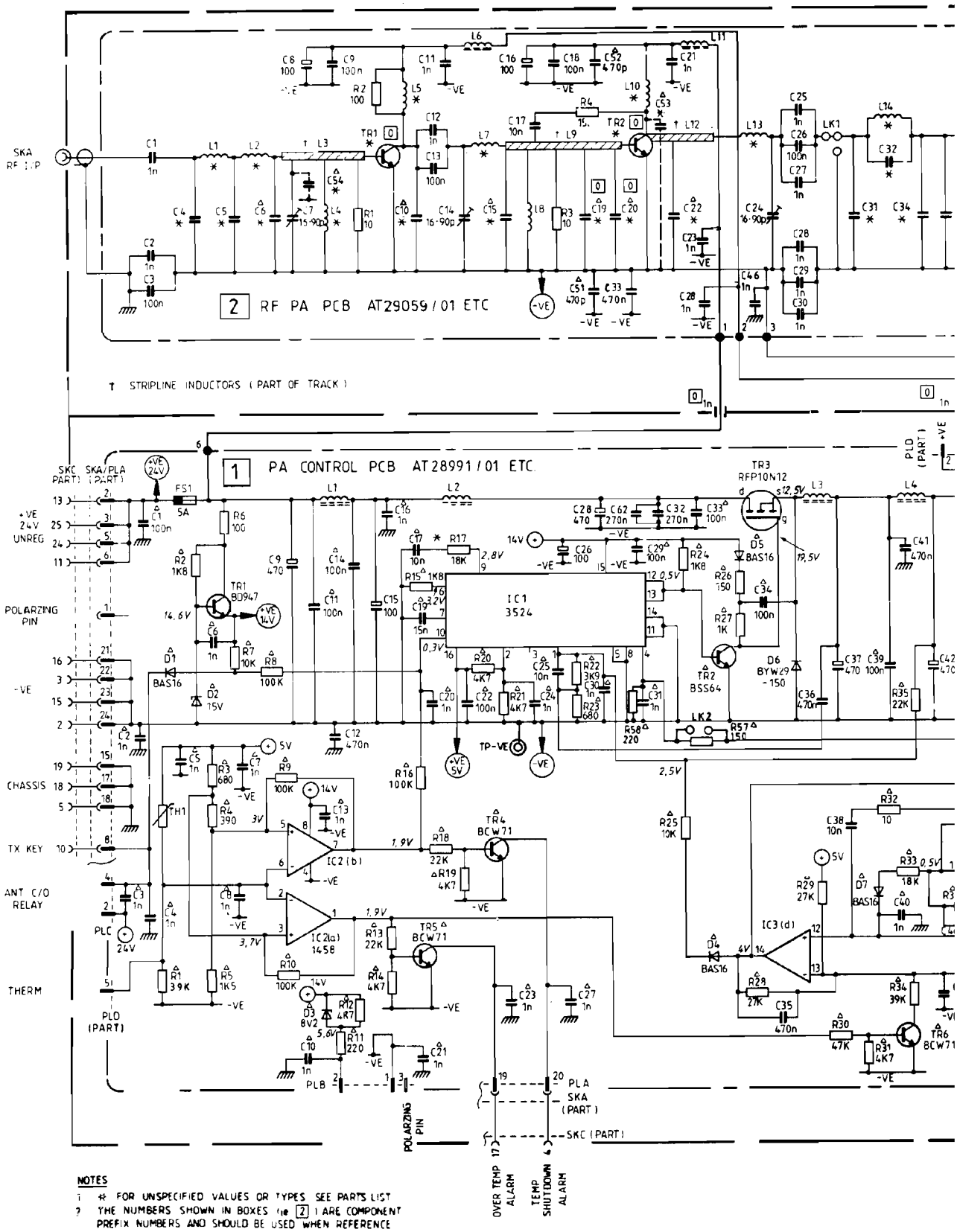
TX POWER AMPLIFIER ATO4874/-
CIRCUIT DIAGRAM



TX PA AT29059/-
LAYOUT DIAGRAM



TX PA AT29059/-
LAYOUT DIAGRAM



NOTES

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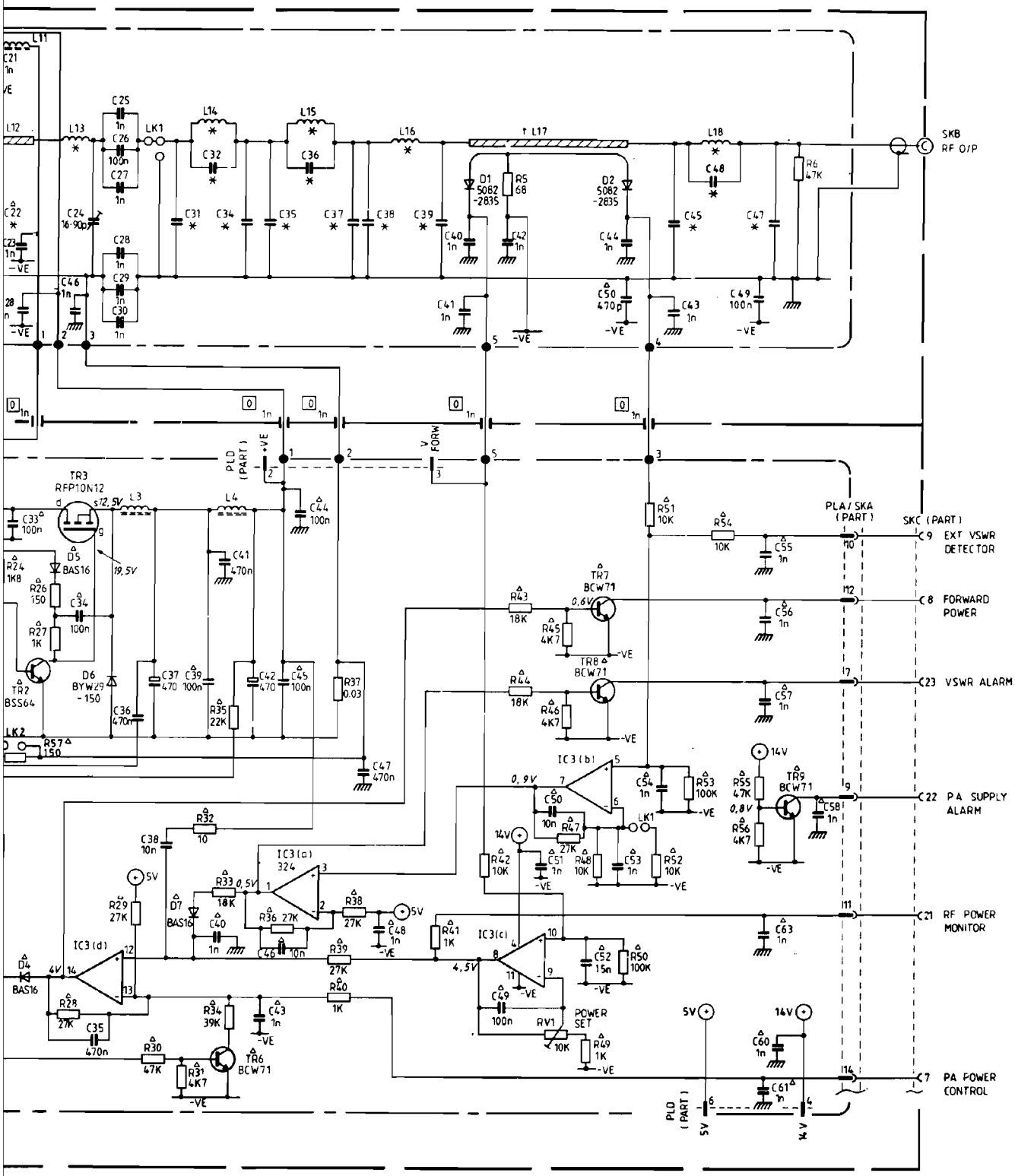
2 THE NUMBERS SHOWN IN BOXES (ie 2) ARE COMPONENT PREFIX NUMBERS AND SHOULD BE USED WHEN REFERENCE IS MADE TO ANY COMPONENT ON THAT PCB ASSY ANY COMPONENT NOT ON A PCB ASSY PREFIX 0 SHOULD BE USED

3 COMPONENTS SHOWN THUS (△) ARE SURFACE MOUNTED ALL OTHERS ARE LEADED



TX POWER AMPLIFIER AT04879/-
CIRCUIT DIAGRAM

CONTROL MODULE
AT04872/-

INTRODUCTION

The basic control module provides an interface for local on-site control together with all the transmitter and receiver audio clipping, filtering and switching circuits. Both carrier and noise squelch detection circuits are included and also the audio filters and 2970 detectors necessary for simple (TX/RX only) 2 or 4 wire M80 series remote control.

In this form the module comprises three PCB assemblies:

(i) audio board

(ii) logic board

(iii) front panel

DETAILED DESCRIPTION

CONTROL AUDIO BOARD

The functions of the control audio board are divided as follows:

(i) Rx Audio - AF processing, squelch switching, Rx call generator data combining network and line amplifiers.

(ii) Tx Audio - AF processing, notch filter and tone detector, audio switching and line amplifier.

(iii) EHS Interface - Audio switching and mute control; monitor amp.

Rx Audio

Unprocessed audio from the receiver module is fed, via the backplane to the control logic board and then to the audio board on PLD pin 36. The signal is fed to an active high-pass filter IC47(a+b) and is then de-emphasised in IC39(b) and passed to the delay equaliser IC39(a). LK26 sets the de-emphasis response (A-B flat; B-C de-emphasised) and IC39(a) provides 'good' group delay equalisation.

The output from IC39(a) is fed two ways:

(i) To the T/T audio gate IC43(d) at a level set by RV5.

(ii) To the squelch controlled audio gate IC46(a). The squelch gate is enabled by a SQUELCH OPEN 'high' from the logic board on PLD pin 27, audio passes to IC39(c+d) an active low-pass filter. When the squelch control line is 'low' the gate is disabled and DC inhibits the audio line. The output from the filter is fed to the EHS audio line PLD pin 33 and the monitor amp IC35(d) and to the audio routeing gates IC44(b+c). The action of these two gates is controlled by inputs from the logic board:

a. In the 'normal' mode of operation the MANUAL input, PLD pin 22, is 'high', this enables gate IC44(c) allowing audio to pass via the notch filter to the line drivers.

b. In the receiver mute condition the MUTE GATE input, PLD pin 21, is 'high', this enables gate IC44(b) and a DC level is applied to the audio line, thus inhibiting the AF path.

The notch filter IC34 is linked into circuit via LK27 and is used to remove any 2970Hz keytone frequency component present in the audio signal. The balanced line driver amplifiers IC38(a,b,c+d) provide an audio output to the 600Ω line at a level set by RV16. LK28 sets the output attention.

Rx Call

The Rx call generator IC29 produces a 2970Hz Rx call tone when commanded to do so by the logic switching input on PLD pin 35. The oscillator circuit XL1, IC27(d,e+f) produces a frequency of 29,7kHz which is applied to the CLK input of the generator. When the RX CALL line is 'high' the generator is enabled, IC29 divides the oscillator output by 10 and produces four outputs on Q1-Q4 which are summed across R184-R187 to produce a 2970Hz sine wave. RV15 sets the Rx call tone level and IC37(d) matches the generator output to the bandpass filter IC37(b) which 'cleans up' the sine wave output. Two other inputs are also applied to the matching stage - Tx audio from the 600Ω line, via LK24, when 4 wire intercom is used and data from the RCM at a level set by RV14.

The output from the filter IC37(b) is combined with the Rx audio and fed to the line drivers at a level set by RV16, then passed to the RX 600Ω line.

Tx Audio

The transmitter audio input to the control module may be carried on either a 2-wire or 4-wire line. On 4-wire schemes the audio inputs are on two separate pairs of wires, but for 2-wire applications both the Tx audio and Rx audio inputs are applied across the 'Rx 600Ω O/P' (PLB pins 4 and 22) and fed to the Tx 600Ω amplifier via the hybrid circuit IC37(c).

Tx audio routed via LK21 and LK20 is amplified by IC31(b) then fed, via the sensitivity control RV9, to the high-pass filter IC31(c). A two-stage notch filter IC33(a+b) removes the 2970Hz keytone component and IC35(c) provides group delay equalisation. Audio from the high-pass filter IC31(c) and the output from the 2nd stage notch filter is also routed to LK24, for use in 4-wire intercom applications. The 2970Hz tone extracted by the 1st stage of notch filtering is detected in IC36(c), passed through band-stop notch filter IC36(a+d) and fed via buffer IC36(b) to the 2970 DET line PLD pin 31.

Audio from IC35(c) is routed to the line audio gate IC43(b) which is enabled when the LINE input on PLD pin 13 is 'high'. IC35(b) is a variable gain amplifier controlled by compressor TR14 using the output from limiter IC41(a). Pre-emphasis is provided by IC35(a) whose response is set using LK15. TR8-TR9 prevent the limiter reaching the positive and negative rails and in addition the signal on TR8 collector is 'fed back' to operate the compressor TR14. Thus, the compressor only controls the variable gain amplifier once limiting is reached and is switched off 'out-of-limiting'.

During RCM operation TR15 is made to conduct by the DATA ENABLE input on PLD pin 17 going 'high' effectively grounding the feedBack path to the compressor.

The Tx audio path is inhibited when data from the RCM is present.

Audio from the limiting circuit is amplified by 1C41(b) with RV3 setting the peak deviation. IC32(a) combines the Tx audio signal with the CTCSS tone (via LK14) which may be either generated externally or on the logic board. The combined signal is applied to the low-pass filter which removes unwanted harmonics then fed, via LK19 to the high-pass filter IC32(c). LK19 is set according to the required channel spacing to select the appropriate value of resistor that will give the correct frequency response. LK19 linked 1A-1B gives high frequency roll-off for 12,5kHz spacing. The output on PLB pin 28 is applied, via the backplane, to the Tx driver module.

EHS Interface

Provision has been made for an engineer's handset (EHS) to be connected to the control module front panel. The control audio board houses the interface between the EHS and the Tx audio and Rx audio circuits.

Microphone audio across PLD pins 2 and 1 is amplified in IC31(d) with RV10 setting the sensitivity, then routed to the mic. audio gate IC44(a). A MIC ENABLE 'high' on PLD pin 12 enables the gate and mic. audio passes to the variable gain amplifier and pre-emphasis circuits.

Receiver audio from the output of the low-pass filter, IC39(d), is routed to the monitor amplifier IC35(d) and to the EHS earpiece, via PLD pin 33. The output from the monitor amplifier is applied, via the backplane to the monitor loudspeaker located on the PSU module. Audio to the EHS earpiece is routed via the control front panel.

In the transmit mode the Rx audio route to the EHS is inhibited through TR18 unless 'linecom' is selected on the front panel then the audio is routed through TR10 to the EHS.

CONTROL FRONT PANEL

The front panel of the control module houses the EHS socket, control switch and function indicators.

Engineers Handset

The engineers handset (EHS) is connected to the 7-pin DIN socket [0] SKE on the front panel and is used in conjunction with the function switch SA to provide various engineering facilities.

Connection of the handset is sensed by diodes D1 and D2. The MAKE or BREAK line is connected to COM (-ve) according to operation of the pressel.

Switch SA selects either the NORMAL mode or one of five facilities in the MANUAL mode.

NORMAL (SA position 1)

The EHS is non-functional irrespective of the operation of the pressel. The +14V line is connected via SA2 to the NOR gate IC1(a) and to IC1(b) pin 6. LED6 is held off via TR6 and the 'high' on the output of IC1(d) switches on TR5 to light LED7 (NORMAL). The MANUAL line PLA pin 20 is 'high' which provides a 'high' to the MANUAL and MIC ENABLE lines on the audio board, via the logic board.

MANUAL (SA positions 2-6)

Either the MAKE or BREAK line on PLC is connected to -ve as determined by the operation of the pressel. This -ve ('low') is detected by either D1 or D2 and applied to the NOR gate IC1(a) which produces a 'high' output fed via SA1 to the function control lines. IC1(d) provides an output 'low' which holds off LED7 (NORMAL) and inhibits the receiver path on the audio board. The detected 'low' also enables gate IC1(b) allowing the output from oscillator IC2(a) to switch TR6, thus causing LED6 (MANUAL) to flash.

MON. AUDIO on PLA pin 19 is applied to the buffer amplifier IC2(b) then fed to the EHS earpiece.

(i) LINECOM (SA position 2)
The 'high' on the LINECOM control line PLA pin 30 is routed via the logic board to produce a 'low' at the audio board PLD pin 20 which holds off TR10 thus preventing receive audio reaching the EHS earpiece.

(ii) BROADCAST (SA position 3)
The BROADCAST control line PLA pin 26 is connected directly to the +14V line. All audio paths are enabled as for 'normal' operation; use of the EHS enables communication 'over-the-air'.

(iii) SQ DEFEAT (SA position 4)
The 'high' on the SQ DEFEAT control line PLA pin 28 produces a 'high' from the logic board on PLA pin 23 which lights LED2 (SQUELCH), via TR1, and provides a 'high' to the audio board on PLD pin 27 to enable the squelch audio gate IC46(a).

This facility is used for receiver alignment; use of the EHS enables communication 'over-the-air'.

(iv) T/T (SA position 5)
The 'high' on the T/T control line PLA pin 29 produces a 'high' from the logic board on PLA pin 25 which lights LED4 (T/T), via TR3, and provides a 'high' to the audio board on PLD pin 18 to enable the T/T gate IC43(d). This facility is used for setting the talkthrough level; use of the EHS enables communication 'over-the-air'.

(v) TX ON (SA position 6)
The 'high' on the TX ON control line PLA pin 24 is applied to the logic board which produces the following outputs:

a. A 'high' on PLA pin 21 which lights LED3 (TX ON), via TR2.

b. A 'high' to the audio board on PLD pin 13 to enable the line gate IC43(b).

c. A 'low' to the audio board on PLD pin 29 to inhibit the mic enable gate IC44(a) thus preventing EHS mic audio reaching the transmitter.

This facility provides a continuous unmodulated carrier for transmitter alignment, operation of the pressel will provide modulation from the 600Ω line input enabling adjustment of the line sensitivity and CTCSS level.

Alarm Indication

In the alarm condition a 'low' is present on PLA pin 13 which enables gate IC1(c). TR4 is switched at a rate determined by oscillator circuit IC2(a) causing LED5 (ALARM) to flash.

CONTROL LOGIC BOARD

This board provides all the logic switching for the control module which determines the audio routeing, tone routeing, alarm switching and facility controls. Circuits are provided for carrier level and noise squelch control and a linkable interface enables connection of a remote control module.

Squelch Control

Noise Squelch - Rx noise from the receiver module on PLB pin 2 is applied to amplifier IC42(a) at a level set by RV2 (NOISE SQUELCH). The output is detected by IC40(a), D2(a), D2(b) and fed to low pass filter IC42(b) (which has a low roll-off characteristic) producing a DC level which is applied to schmitt trigger IC30(a). The schmitt trigger output is fed to NAND gate IC20(b) and is used to light LED8 (NOISE SQUELCH) via TR21.

Carrier Level Squelch - The carrier level input on PLB pin 20 is combined with the offset voltage from RV1 in DC amplifier IC30(b). Low pass filter IC30(c) and schmitt trigger IC30(d) operate in a similar manner to the noise squelch circuit to produce an output which is fed via LK6 to NAND gate IC20(b). LED10 indicates CARRIER SQUELCH. LK6 (NOISE SQ. ONLY) is normally linked A-B but may be left open circuit to allow operation from noise squelch only and enable the carrier squelch output to be linked via P24 to an open collector output for use as an external facility.

The third input to NAND gate IC20(b) is derived from the RX INHIBIT input (FAC8) and provided all three inputs are 'high' the resultant output from NAND gate IC16(a) is also 'high'. LK5 (SQUELCH RESPONSE) and D3, R65, C12 provide a time constant circuit which prevents 'chatter'.

The AND gate IC9(d) combines the carrier present 'high' from IC16(a) with a tone valid input from IC6(a) to produce a tone + carrier output which is routed through LK10 and available as an open collector output on TR4.

LK10 routes the 'tone + carrier' signal according to the squelch control function required.

(i)	Position 1 (SQ)	direct feed to AND gate (IC9(c)
(ii)	Position 2 (TT)	direct feed to RCM interface IC3 and via inverter IC25(d) to talkthrough enable gate IC8(d)
(iii)	Position 3	spare
(iv)	Position 4 (EXT, FAC)	external facility via RCM interface IC3

A 'high' on IC9(c) pin 8 enables the AND gate IC9(c) allowing the carrier present signal from IC16(a) to be fed to the squelch control gate. The carrier present input is also fed to the RCM interface and is available as an open collector output on TR3.

The squelch control gate IC21(a) also accepts three other inputs derived from the squelch defeat line, via IC12(a), and from the manual squelch defeat control on the front panel. When any of the inputs are 'high' the OR gate produces a logic 1, which is fed via IC11(a), to the SQUELCH OPEN line. The output from IC11(a) is controlled from IC15(d) whose inputs are derived from the RX INHIBIT line and the ON LINE DATA ENABLE line. A 'high' from IC15(d) enables gate IC11(a) producing a SQUELCH OPEN 'high' causing the squelch gate on the control audio board to open and the front panel squelch indicator to light

Rx Call

The Rx Call type is set by LK11 which may be linked to allow SQ DEFEAT to control RX CALL for compatibility with the 4000 series of equipments, or (as standard) RX CALL not controlled by SQ DEFEAT.

The AND gate IC10(d) is controlled by the output from IC15(d) (derived from the RX INHIBIT line) producing an Rx Call input to the audio board, via OR gate IC6(b). This signal also provides an Rx Call indication on the front panel, is fed to the RCM interface and is provided as an open collector output from TR5.

Manual Control

When the equipment is in the manual mode of operation a 'low' is applied to the MANUAL input on SKA pin 20 which is routed as follows.

Directly to:

(i) IC19(a) for MIC GATE control on PLD pin 12

(ii) the audio board on PLD pin 22 to disable IC44(c)*

and via R241 to:

(i) IC49(b) for MUTE GATE control on PLD pin 21

(ii) piptone gate IC22(b)

(iii) the DISABLE ASSORT gate IC5(a), the LINE DATA ENABLE gate IC5(b) and MAN ALARM generator TR2, via inverter IC26(c)

(iv) RCM interface, IC4

**Note: Resistor R309 on the audio board may be removed if the Rx audio line is required to be inhibited in the manual mode.*

Tx Key

The Tx Key input from the control equipment is applied on PLB pin 11. It is fed to the RCM interface link LK1 and combined with the 2970Hz detector input (from the audio board) in IC8(c). The output from this AND gate is passed to the audio board on PLD pin 30 (TX) and fed, via the inhibit gate IC14(c), to the Tx control gate IC21(b). The presence of a TX INHIBIT input, fed through IC14(a) and IC26(b), will pull this input low, via D11(b), and is also applied to the talkthrough gate IC19(b), via D11(a).

In addition to the Tx Key line the OR gate IC21(b) inputs are derived from the ALARM AIR DATA ENABLE line, via IC13(a), the manual TX ON input from the front panel and EHS control gate IC19(a). When any of these inputs are 'high' a logic output results, this is used to inhibit the receiver, via IC8(a), when LK8 is set for simplex operation and to provide a Tx Key input to the transmitter driver, power amplifier module and RCM. If LINECOM is selected the Tx Key line is inhibited in IC22(a).

Talkthrough (T/T)

Talkthrough may be initiated either by a backplane (active low) input on PLB pin 23 or by a tone input on SKA pin 3. The backplane input is fed directly to IC8(d) and tapped off to the RCM interface link LK1. The tone input is combined with the carrier in IC9(d) and routed, via LK10:2A-2B and inverter IC25(d), to IC8(d). If either input on IC8(d) is 'low' the output is also 'low' and providing the gate IC14(d) is enabled (i.e.: manual mode not selected) the output from IC8(d) is inverted and fed as a 'high' to IC6(c). If the manual mode is selected the talkthrough input is inhibited by IC14(d) and the input to IC6(c) is derived from the front panel switch (MAN T/T) input. For either condition a 'high' is fed to IC11(b). This AND gate is controlled by the output from IC23(a) such that if any input on pins 2-5 is 'high' a 'low' is produced which inhibits the talkthrough line. The output from IC11(b) provides the front panel T/T ON indication and is fed to AND gate IC10(c) which is in turn controlled by the carrier present output from IC9(d). IC19(b) produces a 'low' for the T/T hangtime circuit which 'holds' talkthrough during any fluctuations in audio level. A 'high' from IC16(c) is routed via IC6(d) and IC22(a) to providing Tx Key to the driver and power amplifier modules as previously described.

Alarms

The alarm inputs are applied via the backplane, the supply alarms are active 'high' all others being active 'low'. The TX, RX, VSWR and PA Temp alarm inputs have a direct feed to an alarm indicator. LK30 provides a means of overriding the supply alarm input to prevent an alarm condition each time a module is disconnected. All alarm inputs are 'paralleled' to the RCM interface.

Rx Alarm - The RX ALARM and RX SUPPLY ALARM (inverted in IC26(f)) are combined in IC24(c). Provision is made for an additional input on P20. The combined alarm output is routed via LK7 to AND gate IC24(b) and following inversion by IC26(a) may be used to disable the receiver, via LK9. With LK7 open circuit P19 may be linked to an open collector output to provide a separate external Rx alarm indication.

Power Alarm - NOR gate IC15(a) and AND gate IC8(b) each compare the forward power input from the TX PA with the Tx Key sense line. If only one input is present each gate produces an output 'high' which results in a 'low' from inverter IC25(b) causing LED6 (PA O/P ALARM) to light.

Tx Alarm - IC28(a) combines and inverts the PA SUPPLY ALARM, TX SUPPLY ALARM and an input from the power alarm circuit to produce a 'low' which is combined, in IC24(a), with the TX ALARM and VSWR ALARM (via D13) providing an output 'low' which is inverted by IC26(d) and applied to the latching circuit IC28(b+c).

The latching circuit provides for simple mains/standby configurations using an input on P17, with the output taken off P18 and indicated by LED2 (LATCH).

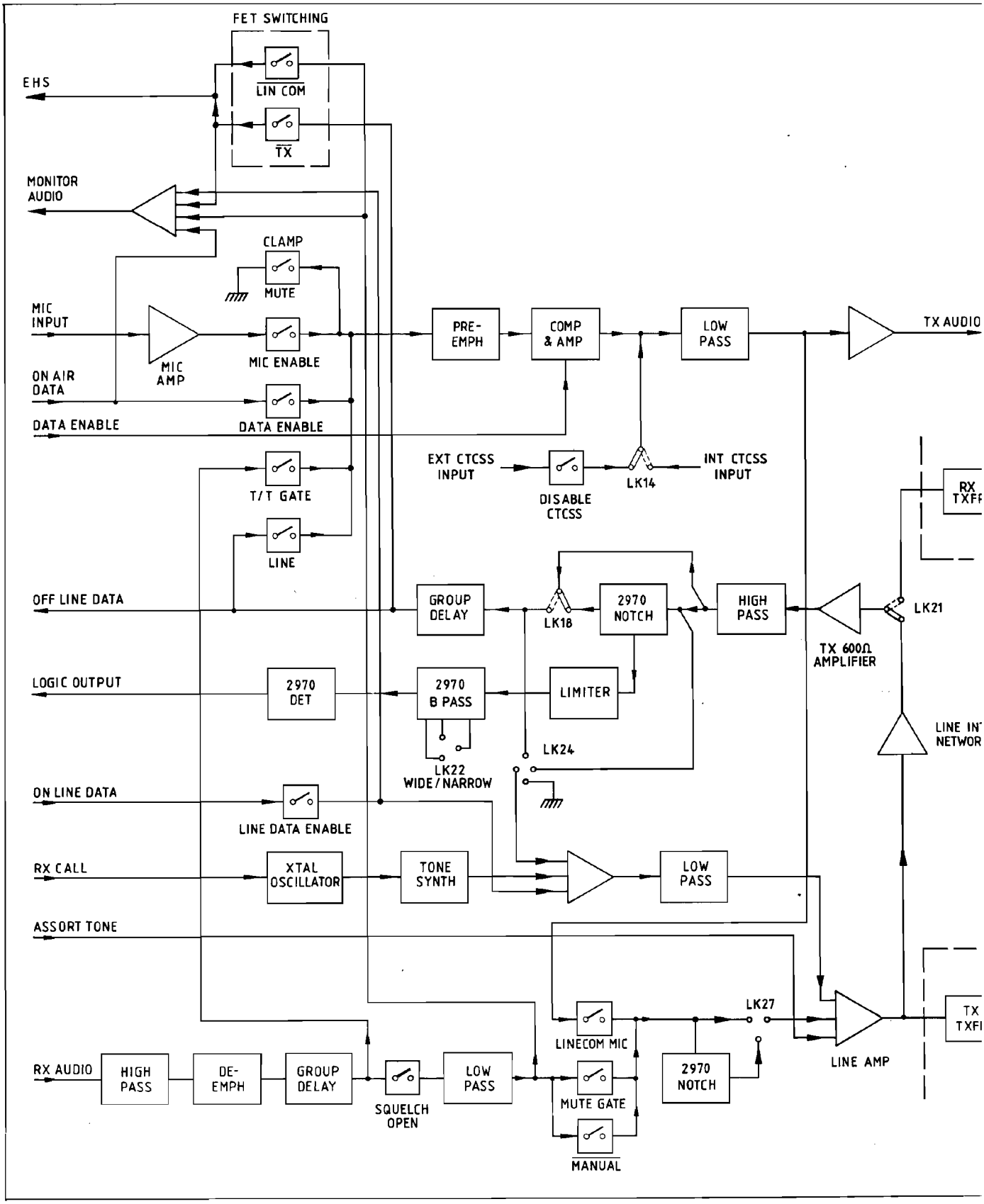
The output from the latching circuit is combined, in IC24(b), with the Rx alarm from IC24(c) and an external alarm input (indicated by LED7). The output from IC24(c) is in turn combined with the VSWR ALARM and PA TEMP ALARM in IC20(a) to provide a single alarm indication to the front panel, via IC16(d). The output from IC24(b) is also available from the open collector of TR6.

RCM Interface

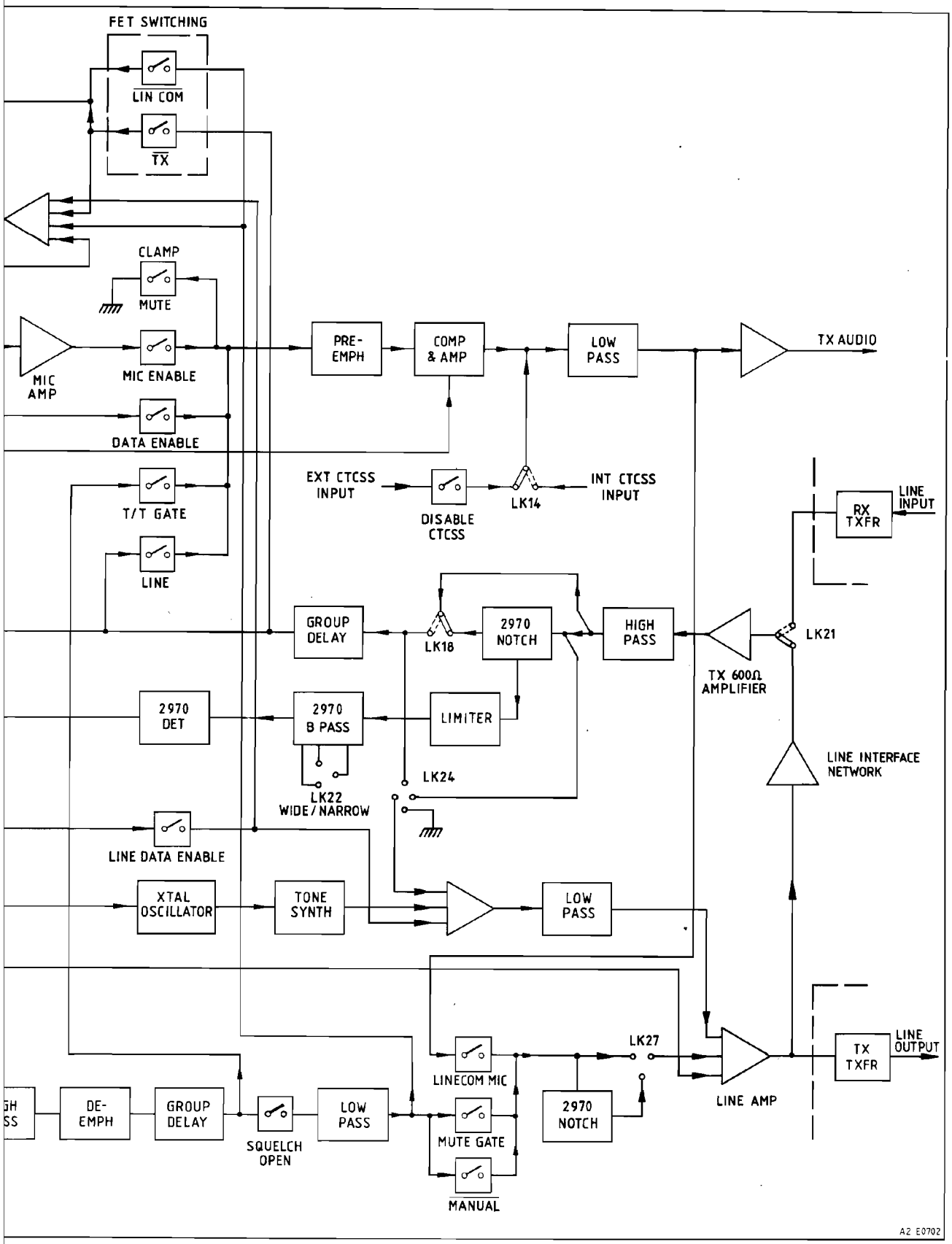
The RCM interface circuit provides for the connection of a basic (TX/RX only) M80 type control unit. LK1 provides linkable facilities with IC1-4 performing a serial-to-parallel data conversion.

IC7 (a+b) enables the carrier squelch to be adjusted (using RV1) or defeated from an RCM or (by linking P6/P5 and disconnecting D7) provide 3 set levels of squelch de-sensitisation.

Similarly, IC13 (c+d) provide control of the PA (from inputs on P7, P8) using gates IC45 (a, c + d). Three set levels of 3dB, 6dB and 10dB are available.



CONTROL MODULE A
BLOCK DIAGRAM



CONTROL MODULE AT04872/-
BLOCK DIAGRAM

SPECIFICATION

General

Supply input	18V ±0,5V at 0,5A maximum (without RCM but including options PCB)	
Connectors	Interface to Backplane	37 way D plug
	Interface to RCM	16 way BERG header
	Interface to Option PCB	18 way BERG header
	Engineers Handset	7 way DIN socket
Indicators	Front Panel:	Squelch
		TX ON
		Talkthrough
		Alarm
		Normal
		Manual
	Internal:	TX Alarm
		RX Alarm
		PA Temp Alarm
		PA O/P Alarm
		VSWR Alarm
		Latched TX Alarm
		External Alarm
		2970 Detector
		Noise Squelch
		Carrier Squelch

TX Audio Path

Audio Response	Base Station (12,5kHz) Rel 6dB/oct 300 - 3000 Hz +0,5 -2,8 dB
	Base Station (20/25kHz) Rel 6dB/oct 300 - 3000 Hz +0,5 -1,5 dB
Line I/P impedance	600Ω balanced
Line I/P sensitivity	4-wire -37 to 0dBm (for 60% deviation at 1kHz) adjustable
	2-wire (remote) -16 to 0dBm (for 60% deviation at 1kHz) adjustable
EHS Mic I/P	600Ω approx
EHS Mic sensitivity	2mV (for 60% deviation at 1kHz)
TX Audio O/P impedance	100Ω approx
TX Audio O/P level	300mV/60% (12,5kHz) 480mV/60% (20kHz) 600mV/60% (25kHz)
S/N Ratio	Greater than 50dB rel to 60% deviation level
Distortion	Less than 0,5% (measured at 1kHz/60%)

RX Audio Path

Audio Response	Base Station (12,5/20/25kHz) Rel 6dB/oct 300 - 3000 Hz +0,5 -1,0 dB
Line O/P impedance	600Ω balanced, via external transformer
Line O/P level	4-wire -37 to +4dBm (for 60% deviation at 1kHz) adjustable 2-wire (remote) -16 to OdBm (for 60% deviation at 1kHz) adjustable Note on 2-wire system, O/P level should be within 6dB of TX input level
RX Audio I/P impedance	3kΩ approx
RX Audio I/P level	300mV (for 60% deviation)
S/N Ratio	Greater than 50dB rel to 60% deviation level
Distortion	Less than 0,5% (measured at 1kHz/60% at +4dBm 600Ω O/P level)
Noise Squelch range	8 to 18dB SINAD adjustable (Normally preset to 10dB SINAD)
Carrier Squelch range	0,3 to 10μV adjustable

EXTERNAL CONTROL INTERFACE

The following control functions, with the exception of the 600Ω interface, are available at the facilities connector (37 way D type):

*Note: (i) Facilities marked * are secondary functions which require linking on the control module to bring them to the facility connector.*

(ii) The 600Ω interface can be brought to the facility connector by changing a link on the backplane PCB. For direct connection to British Telecom lines the Krone socket must be used.

Control Inputs (pull 'low' to enable function):

(TX Facilities) -	TX Key Talkthrough Disable TT Disable CTCSS Tone PA Power Reduction (3dB) * PA Power Reduction (6dB) *
(RX Facilities) -	Squelch Defeat Tone Defeat (CTCSS) Disable RX Disable ASSORT ASSORT Override Carrier Squelch Defeat * (i.e. Noise Squelch only) Carrier Squelch Desensitisation * (6dB)

(General Facilities) External Alarm input (to generate station alarm from ancillary Equipment)
EHS Enable * (enables EHS in NORMAL mode)
On Line Date Enable *
Channel Control (7 lines common RX/TX - Synthesised only)

Logic Outputs (Open Collector pulling to -ve):

(TX Facilities) - TX Alarm * (Normally combined with RX Alarm to give Station Alarm).
Ext C/O relay (For driving relay connected to +24V only)
Mod Monitor (Linkable alternative to analogue mod monitor)

(RX Facilities) - RX Call
Tone Controlled Facility
Carrier Controlled Facility *
RX Alarm *

(General Facilities) - DC Standby Alarm
Station Alarm (Combined RX/TX Alarm)
Manual Alarm (Indicates use of EHS manual control)
EHS Mic enabled *

Audio Inputs:

TX 600Ω input (balanced)
Ext CTCSS input * (unbalanced)

Audio Outputs:

RX 600Ω output (balanced)
RX unprocessed audio (unbalanced)
External loudspeaker

Analogue Outputs:

RX carrier level monitor
TX mod monitor
RF power monitor

INTERNAL MODULE INDICATIONS

Noise Squelch — Indicates that the noise squelch threshold has been exceeded.

Carrier Squelch — Indicates that the carrier squelch threshold has been exceeded.

2970 Detect — Indicates that a 2970Hz keytone has been detected.

PA Output Alarm — Indicates that the power control loop in the PA can no longer maintain the correct RF output power. Also indicates the presence of an RF output when the transmitter is not keyed.

Note: For the two stages of temperature shutdown in the PA, complete shutdown will generate a PA O/P alarm, whereas partial shutdown (3dB) will not.

TX Driver Alarm	Indicates an alarm generated by TX driver, caused by: cold oven RF fail high internal temperature out-of-lock (synthesised only)
PA Temperature Alarm	Indicates high temperature in the PA module resulting in either 3dB or total shutdown. (PA O/P ALARM will show which.
VSWR Alarm	Indicates that the VSWR at the PA output exceeds approximately 3:1 and proportional shutdown is operative.
TX Alarm Latch	When enabled, indicates that one of the following alarms is active: TX supply alarm TX driver alarm PA supply alarm PA O/P alarm VSWR alarm Can be reset by temporarily disabling. Used only in simple main/standby configurations.
RX Alarm	Indicates alarm (other than supply alarm) generated by RX module, caused by: injection fail out-of-lock (synthesised)
External Alarm input.	Indicates alarm signal present on external alarm
Manual Alarm	Indicates that MANUAL mode has been selected from the front panel and therefore the local control inputs have been disabled.

CONTROL MODULE

AT04872/01	Control System Code 12,13	Secondary Option 00
AT04872/05	Control System Code 12	Secondary Option 03,04
	Control System Code 13	Secondary Option 01-04
AT04872/06	Control System Code 21-24	Secondary Option 00
	Control System Code 31-34	Secondary Option 00
AT04872/07	Control System Code 21-24	Secondary Option 03,04
	Control System Code 31-34	Secondary Option 01-04
AT04872/08	Control System Code 11	Secondary Option 00
AT04872/09	Control System Code 11	Secondary Option 03,04

Cct. Ref	Description	Part No.	Remarks
	PCB assembly control logic	AT29023	
	PCB assembly control audio	AT29024/01	/01,05-07
	PCB assembly control audio	AT29024/05	/08,09
	PCB assembly front panel	AT28997/01	
	PCB assembly Voting/CTCSS	AT29061	/05,07,09
	M80 Signalling assembly	AT14920	/06,07
	Socket assembly 7-way DIN	AT14815	Engineers handset
	Knob printed	BJ30904/04	1/S1
	Spindle	BT07168	1/control knob-S1
	Circlip	QA01107	1/control knob
	Spire clip	QA04145	1/control knob
	Pillar hexagon	BT04463	4/audio screen-audio PCB
	Pillar 35mm long	BT04075	/05,07,09
	Pillar 7,1mm long	BT04074	/05,07,09
	Bushing shorty	FG02736	6/audio screen
	Scr st tap pozi No.6 x 6,4mm	QJ07703/B	4/plate assy mtg-bracket
	Scr st pan pozi M3 x 6mm	QJ11901/X	4/control PCB 4/logic PCB
	Scr st tap pozi No 4 x 8mm	QJ08241/X	/06,07
	Nut st M3	QA11605/X	4/audio screen-audio PCB

FRONT PANEL ASSEMBLY
AT14818

Panel, front, printed	BJ30975	
Fastener	BT17284	4/control module-shelf
Handle	BT35950	
Label Philips	BT38217/01	1/handle
Label RCM	BT38206/02	1/handle
Scr st tap pozi No.4 x 8mm	QJ08241/X	3/handle

PCB ASSEMBLY CONTROL LOGIC
AT29023

Semiconductors and IC's

IC1-4			Not Used
IC5-7	IC 4071B	FU99408/SM	
IC8-11	IC 4081B	FU99413/SM	
IC12-15	IC 4001B	FU99400/SM	
IC16	IC 4011B	3513 999 35002	
IC17	IC 4075B	FU99411/SM	
IC18,19	IC 4025B	FU99405/SM	
IC20	IC 4023B	FU99404/SM	
IC21	IC 4072B	FU99409/SM	
IC22	IC 4073B	FU99410/SM	
IC23	IC 4002B	FU99401/SM	
IC24	IC 4073B	FU99410/SM	
IC25	IC 4049B	FU99471/SM	
IC26	IC 4069UB	FU99472/SM	
IC27			Not Used
IC28	IC 4025B	FU99405/SM	
IC29			Not Used
IC30	IC Quad op amp LM348	3513 999 45003	
IC31-39			Not Used
IC40	IC Dual op amp 4558	FU99806/SM	
IC41			Not Used
IC42	IC Dual op amp 4558	FU99806/SM	
IC43,44			Not Used
IC45	IC 4066B	3513 999 35019	
IC46,47			Not Used
IC48	IC volt reg 317	FU99119	
IC49	IC 4001B	FU99400/SM	
TR1-6	Transistor BCX19	FV99102/SM	
TR7	Transistor BC337 GP	FV05896	
TR8-11			Not Used

Cct. Ref	Description	Part No.	Remarks
Semiconductors and IC's Cont'd			
TR12,13	Transistor BCX19	FV99102/SM	
TR14,15			Not Used
TR16	Transistor BCX19	FV99102/SM	
TR17,18			Not Used
TR19	Transistor BCX17	3513 999 00004	
TR20-22	Transistor BCX19	FV99102/SM	
D1	Diode GP 1N4148	FV05808	
D2,3	Diode BAV99 SMD	3513 999 15002	
D4-6			Not Used
D7	Diode GP 1N4148	FV05808	
D8	Diode BAV99 SMD	3513 999 15002	
D9,10			Not Used
D11	Diode BAV70 SMD	3513 999 15000	
D12			Not Used
D13	Diode GP 1N4148	FV05808	
D14			Not Used
D15	Diode BAV99	3513 999 15002	
Resistors			
R1	10k ±5% 0,125W SMD	3513 999 80048	
R2,3			Not Used
R4-10	10k ±5% 0,125W SMD	3513 999 80048	
R11	2k2 ±5% 0,125W SMD	3513 999 80040	
R12-27	10k ±5% 0,125W SMD	3513 999 80048	
R28			Not Used
R29	1k ±5% 0,25W c film	PM01436	
R30	150k ±5% 0,25W c film	PM01462	
R31	10k ±2% 0,25W m film	PM99306	
R32	100k ±5% 0,125W SMD	3513 999 80060	
R33	100 ±5% 0,125W SMD	3513 999 80024	
R34-36			Not Used
R37	10k ±5% 0,125W SMD	3513 999 80048	
R38	75k ±2% 0,25W m film	PM99327	
R39	150k ±2% 0,25W m film	PM99334	
R40			Not Used
R41	10k ±2% 0,25W m film	PM99306	
R42	15k ±2% 0,25W m film	PM99310	
R43,44	10k ±5% 0,125W SMD	3513 999 80048	
R45	10k ±2% 0,25W m film	PM99306	
R46	33k ±2% 0,25W m film	PM99318	
R47	33k ±2% 0,25W m film	PM99318	
R48	10k ±2% 0,25W m film	PM99306	
R49	16k ±2% 0,25W m film	PM99311	
R50	100k ±2% 0,25W m film	PM99330	
R51,52	10k ±5% 0,125W SMD	3513 999 80048	
R53	3k9 ±2% 0,25W m film	PM99296	
R54	39k ±2% 0,25W m film	PM99320	
R55	2k2 ±2% 0,25W m film	PM99290	
R56	82k ±2% 0,25W m film	PM99328	
R57	22k ±2% 0,25W m film	PM99314	
R58	47k ±2% 0,25W m film	PM99322	
R59-61	33k ±2% 0,25W m film	PM99318	
R62	27k ±2% 0,25W m film	PM99316	
R63	12k ±2% 0,25W m film	PM99308	
R64	2k2 ±5% 0,125W SMD	3513 999 80040	
R65	100k ±2% 0,25W m film	PM99330	
R66	1k ±5% 0,125W SMD	3513 999 80036	
R67,68			Not Used
R69	10k ±2% 0,25W m film	PM99306	
R70	10k ±5% 0,125W SMD	3513 999 80048	
R71			Not Used
R72	10k ±5% 0,125W SMD	3513 999 80048	
R73	18k ±2% 0,25W m film	PM99312	
R74	4k7 ±2% 0,25W m film	PM99298	
R75	8k2 ±2% 0,25W m film	PM99304	
R76-83	10k ±5% 0,125W SMD	3513 999 80048	
R84-86			Not Used
R87	6k8 ±5% 0,125W SMD	3513 999 80046	
R88-99			Not Used
R100	220 ±5% 0,125W SMD	3513 999 80028	
R101	1k8 ±5% 0,125W SMD	3513 999 80039	
R102-232			Not Used
R233,234	10k ±5% 0,125W SMD	3513 999 80048	
R235	100k ±5% 0,125W SMD	3513 999 80060	

Cct. Ref	Description				Part No.	Remarks
Resistors Cont'd						
R236	10k	±5%	0,125W	SMD	3513 999 80048	
R237-240						Not Used
R241-244	10k	±5%	0,125W	SMD	3513 999 80048	
R245-248						Not Used
R249	10k	±5%	0,125W	SMD	3513 999 80048	
R250-271						Not Used
R272-274	10k	±5%	0,125W	SMD	3513 999 80048	
R275,276						Not Used
R277	10k	±5%	0,125W	SMD	3513 999 80048	
R278	2k2	±5%	0,125W	SMD	3513 999 80040	
R279	10k	±5%	0,125W	SMD	3513 999 80048	
R280-283						Not Used
R284	2k2	±5%	0,125W	SMD	3513 999 80040	
R285	10k	±5%	0,125W	SMD	3513 999 80048	
R286	100k	±5%	0,125W	SMD	3513 999 80060	
R287	10k	±5%	0,125W	SMD	3513 999 80048	
R288	100k	±5%	0,125W	SMD	3513 999 80060	
R289-293						Not Used
R294-297	10k	±5%	0,125W	SMD	3513 999 80048	
R298,299	100k	±5%	0,125W	SMD	3513 999 80060	
R300-314						Not Used
R315	100k	±5%	0,125W	SMD	3513 999 80060	
R316	10k	±5%	0,125W	SMD	3513 999 80048	
R317	100k	±5%	0,125W	SMD	3513 999 80060	
R318						Not Used
R319-324	10k	±5%	0,125W	SMD	3513 999 80048	
R325-332						Not Used
R333	100k	±5%	0,125W	SMD	3513 999 80060	
R334	2k2	±5%	0,125W	SMD	3513 999 80040	
R335-337						Not Used
R338	10k	±5%	0,125W	SMD	3513 999 80048	
RN1	10k	±5%	9-pin SIL		RN99528	
RN2	2k2	±5%	9-pin SIL		RN99526	
RN3-6	10k	±5%	6-pin SIL		RN99368	
RV1	100k	±20%	Pot skel lin		PL99016	
RV2	10k	±20%	Pot skel lin		PL01478	
RV3						Not Used
RV4	1k	±20%	Pot cermet lin		PL99016	
Capacitors						
C1-4						Not Used
C5	56n	±10%	50V	SMD	3513 999 55014	
C6	12n	±10%	50V	SMD	CN99115	
C7	10	±20%	50V	elec	PS99436	
C8,9	56n	±10%	50V	SMD	3513 999 55014	
C10	12n	±10%	50V	SMD	CN99115	
C11	56n	±10%	50V	SMD	3513 999 55014	
C12	0µ22		50V	elec	PS99865	
C13,14	10	±20%	50V	elec	PS99436	
C15-20						Not Used
C21	100	±20%	25V	elec	PS99424	
C22,23	100n	±10%	50V	SMD	3513 999 55017	
C24-80						Not Used
C81	10n	±10%	50V	SMD	3513 999 55471	
C82-84	1n	±10%	50V	SMD	3513 999 55459	
C85-87	10n	±10%	50V	SMD	3513 999 55471	
C88	1n	±10%	50V	SMD	3513 999 55459	
C89-92	10n	±10%	50V	SMD	3513 999 55471	
C93	1n	±10%	50V	SMD	3513 999 55459	
C94,95	10n	±10%	50V	SMD	3513 999 55471	
C96						Not Used
C97-101	10n	±10%	50V	SMD	3513 999 55471	
C102	1n	±10%	50V	SMD	3513 999 55459	
C103-107	10n	±10%	50V	SMD	3513 999 55471	
C108	1n	±10%	50V	SMD	3513 999 55459	
C109-117	10n	±10%	50V	SMD	3513 999 55471	
C118						Not Used
C119-121	56n	±10%	50V	SMD	3513 999 55014	
C122-127						Not Used
C128	1	±20%	100V	elec	PS99455	
C129-133						Not Used
C134	100n	±10%	50V	SMD	3513 999 55017	
C135-136						Not Used
C137	10	±20%	50V	elec	PS99436	

Cct. Ref	Description				Part No.	Remarks
Capacitors Cont'd						
C138						Not Used
C139-141	56n	±10%	50V	SMD	3513 999 55014	
C142						Not Used
C143-150	33p	±5%	50V	SMD	3513 999 55319	
C151-204						Not Used
C205-207	56n	±10%	50V	SMD	3513 999 55014	
C208-210						Not Used
C211	1n	±10%	50V	SMD	3513 999 55459	
C212						Not Used
C213	1n	±10%	50V	SMD	3513 999 55459	
C214-218						Not Used
C219	1n	±10%	50V	SMD	3513 999 55459	
C220-223						Not Used
C224-226	1n	±10%	50V	SMD	3513 999 55459	

Miscellaneous

LED1-10	LED red	FV05860	
TP1-3	Header str male 1 pos'n	3513 504 00121	1/P1,2,5-11,14,15,19,20
	Header str male 2 pos'n	FC00837/02	1/P3&4,12&13,17&18,27&28
	Header str male 3 pos'n	FC00837/03	1/LK2,4-9,11,12,25,P21&22&23
	Header str male 15 pos'n	FC00837/15	LK1
	Plug, PCB mounted str 2 x 3	FP99174	LK30
	Plug, PCB mounted str 2 x 9	FP99176	LK3
	Plug, PCB mounted str 2 x 4	FP99196	LK10
	Plug, PCB mounted str 2 x 15	FP99296	LK1
PLB	Plug D type 37-way	FP99028	
PLC	Header less ears 16 pos'n	FP99221	
SKA	Conn. double row 2 x 17 pos,n	FC03608/17	Mates with PLA on front panel
SKD	Conn. female socket 40 pos'n	FS99191	
	Cable, 40-way ribbon IDC	FC99205	
	Connector PCB solder 40 pos'n	FP99155	
	Link connector	FC99060	
	Heatsink twisted vane	QA05850	1/IC48
	Nut st hex M3	QA11605/X	1/IC48 - heatsink, 2/PLB
	Washer st M3	QA15005/X	2/PLB
	Bush insulating (TO-220)	QA99024	2/IC48
	Washer thermal (TO-220)	QA99111	1/IC48
	Scr st pan pozi M3 x 8mm	QJ11902/X	2/PLB
	Scr st pan pozi M3 x 10mm	QJ11903/X	1/IC48 - heatsink

PCB ASSEMBLY CONTROL AUDIO AT29024/01,05

Semiconductors and IC's

IC1-27			Not Used
IC27	IC 4069UB	FU99472/SM	
IC28			Not Used
IC29	IC 4018B	FU99442/SM	
IC30			Not Used
IC31-39	IC quad op amp LM348	3513 999 45003	
IC40			Not Used
IC41	IC dual op amp MC1458D	3513 999 45004	
IC42			Not Used
IC43,44	IC 4066B	3513 999 35019	
IC45			Not Used
IC46	IC 4053B	FU99483/SM	
IC47	IC dual op amp MC1458D	3513 999 45004	
TR1-7			Not Used
TR8	Transistor BCX17	3513 999 00004	
TR9	Transistor BCX19	FV99102/SM	
TR10	Transistor BSR58	FV99156/SM	
TR11	Transistor BCX19	FV99102/SM	
TR12,13			Not Used
TR14,15	Transistor BCX19	FV99102/SM	
TR16,17			Not Used
TR18	Transistor BCX19	FV99156/SM	
D1-3			Not Used
D4	Diode BAW56	FV99061/SM	
D5,6	Diode BAV99	3513 999 15002	
D7,8			Not Used
D9,10	Diode BAV99	3513 999 15002	

Cct. Ref	Description				Part No.	Remarks
Resistors						
R1-27						Not Used
R28	100k	±5%	0,125W	SMD	3513 999 80060	
R29-83						Not Used
R84	1M	±5%	0,125W	SMD	3513 999 80072	
R85,86	470k	±5%	0,125W	SMD	CL99068	
R87						Not Used
R88	22k	±2%	0,25W	m film	PM99314	
R89	100k	±2%	0,25W	m film	PM99330	
R90	100k	±5%	0,125W	SMD	3513 999 80060	
R91	100k	±2%	0,25W	m film	PM99330	
R92	47k	±5%	0,125W	SMD	3513 999 80056	
R93,94	22k	±5%	0,125W	SMD	3513 999 80052	
R95-97	100k	±5%	0,125W	SMD	3513 999 80060	
R98	22	±5%	0,125W	SMD	3513 999 80016	
R99	47	±5%	0,125W	SMD	3513 999 80020	
R100,101						Not Used
R102	2k2	±2%	0,25W	m film	PM99290	
R103	100k	±5%	0,125W	SMD	3513 999 80060	
R104	68k	±2%	0,25W	m film	PM99326	
R105	2k2	±2%	0,25W	m film	PM99290	
R106	56k	±2%	0,25W	m film	PM99324	
R107	100k	±5%	0,125W	SMD	3513 999 80060	
R108	4k7	±5%	0,125W	SMD	3513 999 80044	
R109	100k	±5%	0,125W	SMD	3513 999 80060	
R110	15k	±2%	0,25W	m film	PM99310	
R111	2k2	±5%	0,125W	SMD	3513 999 80040	
R112	100k	±5%	0,125W	SMD	3513 999 80060	
R113	22k	±5%	0,125W	SMD	3513 999 80052	
R114	8k2	±5%	0,125W	SMD	3513 999 80047	
R115,116	2k7	±5%	0,125W	SMD	3513 999 80041	
R117	8k2	±5%	0,125W	SMD	3513 999 80047	
R118	3k6	±2%	0,25W	m film	PM99295	
R119	12k	±2%	0,25W	m film	PM99308	
R120	4k7	±2%	0,25W	m film	PM99298	
R121	56k	±5%	0,125W	SMD	3513 999 80057	
R122	27k	±5%	0,125W	SMD	3513 999 80053	
R123	33k	±5%	0,125W	SMD	3513 999 80054	
R124	30k	±2%	0,25W	m film	PM99317	
R125	33k	±2%	0,25W	m film	PM99318	
R126	10k	±2%	0,25W	m film	PM99306	
R127	39k	±2%	0,25W	m film	PM99320	
R128	11k	±2%	0,25W	m film	PM99307	
R129	22k	±2%	0,25W	m film	PM99314	
R130	15k	±2%	0,25W	m film	PM99310	
R131	12k	±2%	0,25W	m film	PM99308	
R132						Not Used
R133	12k	±2%	0,25W	m film	PM99308	
R134	100k	±5%	0,125W	SMD	3513 999 80060	
R135,136						Not Used
R137	1k	±2%	0,25W	m film	PM99282	
R138,139						Not Used
R140	1k	±2%	0,25W	m film	PM99282	
R141,142						Not Used
R143,144	12k1	±1%	0,25W	m film	PL99099	/01
R145	10k	±1%	0,25W	m film	PL99098	/01
R146	8k66	±1%	0,25W	m film	PL45273	/01
R147	2k2	±2%	0,25W	m film	PM99290	/01
R148	2k2	±2%	0,25W	m film	PM99290	
R149						Not Used
R150,151	12k1	±1%	0,25W	m film	PL99099	/01
R152	10k	±1%	0,25W	m film	PL99098	/01
R153	8k66	±1%	0,25W	m film	PL45273	/01
R154	47k	±2%	0,25W	m film	PM99322	
R155	120k	±2%	0,25W	m film	PM99332	
R156	220	±5%	0,125W	SMD	3513 999 80028	
R157	6k8	±5%	0,125W	SMD	3513 999 80046	
R158	100k	±5%	0,125W	SMD	3513 999 80060	
R159	10k	±5%	0,125W	SMD	3513 999 80048	
R160	620	±2%	0,25W	m film	PM99277	
R161	560	±5%	0,125W	SMD	3513 999 80033	
R162-164	47k	±5%	0,125W	SMD	3513 999 80056	
R165	1k	±5%	0,125W	SMD	3513 999 80036	
R166	15k	±5%	0,125W	SMD	3513 999 80050	
R167	2k2	±5%	0,125W	SMD	3513 999 80040	
R168	470k	±5%	0,125W	SMD	CL99068	

Cct. Ref	Description				Part No.	Remarks
Resistors (Cont'd)						
R169,170	12k1	±1%	0,25W	m film	PL99099	/01
R171	10k	±1%	0,25W	m film	PL99098	/01
R172	8k66	±1%	0,25W	m film	PL45273	/01
R173	180	±5%	0,125W	SMD	3513 999 80027	
R174	2k7	±5%	0,125W	SMD	3513 999 80041	
R175	100	±5%	0,125W	SMD	3513 999 80024	
R176	27k	±5%	0,125W	SMD	3513 999 80053	
R177	18k	±2%	0,25W	m film	PM99312	/01
R178						Not Used
R179	47k	±5%	0,125W	SMD	3513 999 80056	
R180	8k2	±5%	0,125W	SMD	3513 999 80047	
R181	2k2	±5%	0,125W	SMD	3513 999 80040	
R182,183	22k	±5%	0,125W	SMD	3513 999 80052	
R184	127k	±1%	0,25W	m film	PL51200	/01
R185,186	90k9	±1%	0,25W	m film	PL45368	/01
R187	127k	±1%	0,25W	m film	PL51200	/01
R188	8k2	±5%	0,125W	SMD	3513 999 80047	
R189	120k	±5%	0,125W	SMD	3513 999 80061	
R190	10k	±5%	0,125W	SMD	3513 999 80048	
R191,192	27k	±5%	0,125W	SMD	3513 999 80053	
R193	10k	±5%	0,125W	SMD	3513 999 80048	
R194	33k	±5%	0,125W	SMD	3513 999 80054	
R195	39k	±5%	0,125W	SMD	3513 999 80055	
R196,197						Not Used
R198	18k	±5%	0,125W	SMD	3513 999 80051	
R199	10k	±5%	0,125W	SMD	3513 999 80048	
R200-203	10	±5%	0,125W	SMD	3513 999 80012	
R204	18k	±5%	0,125W	SMD	3513 999 80051	
R205	10k	±5%	0,125W	SMD	3513 999 80048	
R206	100	±5%	0,125W	SMD	3513 999 80024	
R207	27	±2%	0,25W	m film	PM99244	
R208	110	±2%	0,25W	m film	PM99259	
R209	470	±2%	0,25W	m film	PM99274	
R210	18k	±5%	0,125W	SMD	3513 999 80051	
R211	24k	±2%	0,25W	m film	PM99315	
R212						Not Used
R213	1k	±2%	0,25W	m film	PM99282	
R214	1k	±2%	0,25W	m film	PM99282	
R215	1k	±2%	0,25W	m film	PM99282	
R216						Not Used
R217	1	±5%	0,25W	c film	PM01400	
R218	1k5	±2%	0,25W	m film	PM99286	
R219	47k	±2%	0,25W	m film	PM99322	
R220	120k	±2%	0,25W	m film	PM99332	
R221	27k	±2%	0,25W	m film	PM99316	
R222	13k	±2%	0,25W	m film	PM99309	
R223	39k	±2%	0,25W	m film	PM99320	
R224	16k	±2%	0,25W	m film	PM99311	
R225	47k	±5%	0,125W	SMD	3513 999 80056	
R226	120k	±5%	0,125W	SMD	3513 999 80061	
R227,228	12k1	±1%	0,25W	m film	PL99099	/01
R229	10k	±1%	0,25W	m film	PL99098	/01
R230	8k66	±1%	0,25W	m film	PL45273	/01
R231	6k8	±5%	0,125W	SMD	3513 999 80046	
R232	1k5	±5%	0,125W	SMD	3513 999 80038	
R233-236						Not Used
R237	47k	±5%	0,125W	SMD	3513 999 80056	
R238-244						Not Used
R245	100	±5%	0,125W	SMD	3513 999 80024	
R246	10k	±5%	0,125W	SMD	3513 999 80048	
R247-254						Not Used
R255	10k	±5%	0,125W	SMD	3513 999 80048	
R256	100k	±5%	0,125W	SMD	3513 999 80060	
R257	2k2	±5%	0,125W	SMD	3513 999 80040	
R258						Not Used
R259	100	±5%	0,125W	SMD	3513 999 80024	
R607-264						Not Used
R265	15k	±2%	0,25W	m film	PM99310	
R267,268	10k	±5%	0,125W	SMD	3513 999 80048	
R269	47k	±5%	0,125W	SMD	3513 999 80056	
R270	100	±5%	0,125W	SMD	3513 999 80024	
R271	22k	±2%	0,25W	m film	PM99314	
R272-279						Not Used
R280	100k	±5%	0,125W	SMD	3513 999 80060	
R281	2k2	±5%	0,125W	SMD	3513 999 80040	

Cct. Ref	Description					Part No.	Remarks
Resistors Cont'd							
R282	100k	±5%	0,125W	SMD		3513 999 80060	
R283	1k	±5%	0,125W	SMD		3513 999 80036	
R283-300							Not Used
R301	47k	±5%	0,125W	SMD		3513 999 80056	
R302-308	10k	±5%	0,125W	SMD		3513 999 80048	
R309	1	±5%	0,25W	c film		PM01400	
R310	4k7	±5%	0,125W	SMD		3513 999 80044	
R311,312	10k	±5%	0,125W	SMD		3513 999 80048	
R313	47k	±5%	0,125W	SMD		3513 999 80056	
R314	10k	±5%	0,125W	SMD		3513 999 80048	
R315-324							Not Used
R325-327	10k	±5%	0,125W	SMD		3513 999 80048	
R328-331	100k	±5%	0,125W	SMD		3513 999 80060	
R332	10k	±5%	0,125W	SMD		3513 999 80048	
R333,334							Not Used
R335	91k	±2%	0,25W	m film		PM99329	
R336,337	2k2	±5%	0,125W	SMD		3513 999 80040	
RV1,2							Not Used
RV3	100k	±20%	Pot skel lin			PL99016	
RV5	4k7	±20%	Pot skel lin			PL01486	
RV6	50k	±20%	Pot cermet lin			PL99584	
RV7,8	2k	±20%	Pot encl lin			PL65802	/01
RV9	4k7	±20%	Pot skel lin			PL01486	
RV10	50k	±20%	Pot cermet lin			PL99584	
RV11	2k	±20%	Pot encl lin			PL65802	/01
RV12,13	10k	±20%	Pot skel lin			PL01478	
RV14	50k	±20%	Pot cermet lin			PL99584	
RV15	10k	±20%	Pot encl lin			PL99697	/01
RV16	100k	±20%	Pot skel lin			PL99016	
RV17	2k	±20%	Pot encl lin			PL65802	/01
RN8	100k	±5%	9-pin SIL			RN99531	
Capacitors							
C1-14							Not Used
C15-17	10	±20%	50V	elec		PS99436	
C18	1	±20%	100V	elec		PS99455	
C19,20	100	±20%	25V	elec		PS99424	
C21-23							Not Used
C24	2n2	±2,5%	100V	pp		PQ99617	
C25							Not Used
C26-29	10	±20%	50V	elec		PS99436	
C30	10n	±2,5%	63V	pp		PQ99621	
C31	680p	±2,5%	100V	pp		PQ99614	
C32	3n3	±2,5%	63V	pp		PQ99618	
C33	1n5	±2,5%	100V	pp		PQ99616	
C34	3n3	±10%	50V	SMD		CN99108	
C35	10	±20%	50V	elec		PS99436	
C36,37	1	±20%	100V	elec		PS99455	
C38,39							Not Used
C40	2n2	±5%		cer		PN99902	/01
C41	15n	±5%		cer		PN99907	
C42	2n2	±5%		cer		PN99902	/01
C43	15n	±5%		cer		PN99907	/01
C44,45	10n	±10%	50V	SMD		3513 999 55492	
C46,47							Not Used
C48	10n	±10%	50V	SMD		3513 999 55492	
C49	1	±20%	100V	elec		PS99455	
C50-53	10	±20%	50V	elec		PS99436	
C54	1	±20%	100V	elec		PS99455	
C55	15n	±5%		cer		PN99907	/01
C56	2n2	±5%		cer		PN99902	/01
C57	10	±20%	50V	elec		PS99436	/01
C58	10n	±5%		submin pes		PQ99532	
C59	22n	±10%	50V	SMD		3513 999 55496	
C60	56n	±10%	50V	SMD		3513 999 55014	
C61	2n2	±5%	50V	SMD		3513 999 55003	
C62	1n	±5%	50V	SMD		3513 999 55418	
163	56n	±10%	50V	SMD		3513 999 55014	
C64							Not Used
C65	10	±20%	50V	elec		PS99436	
C66	10n	±10%	50V	SMD		3513 999 55492	
C67	1	±20%	100V	elec		PS99455	
C68							Not Used

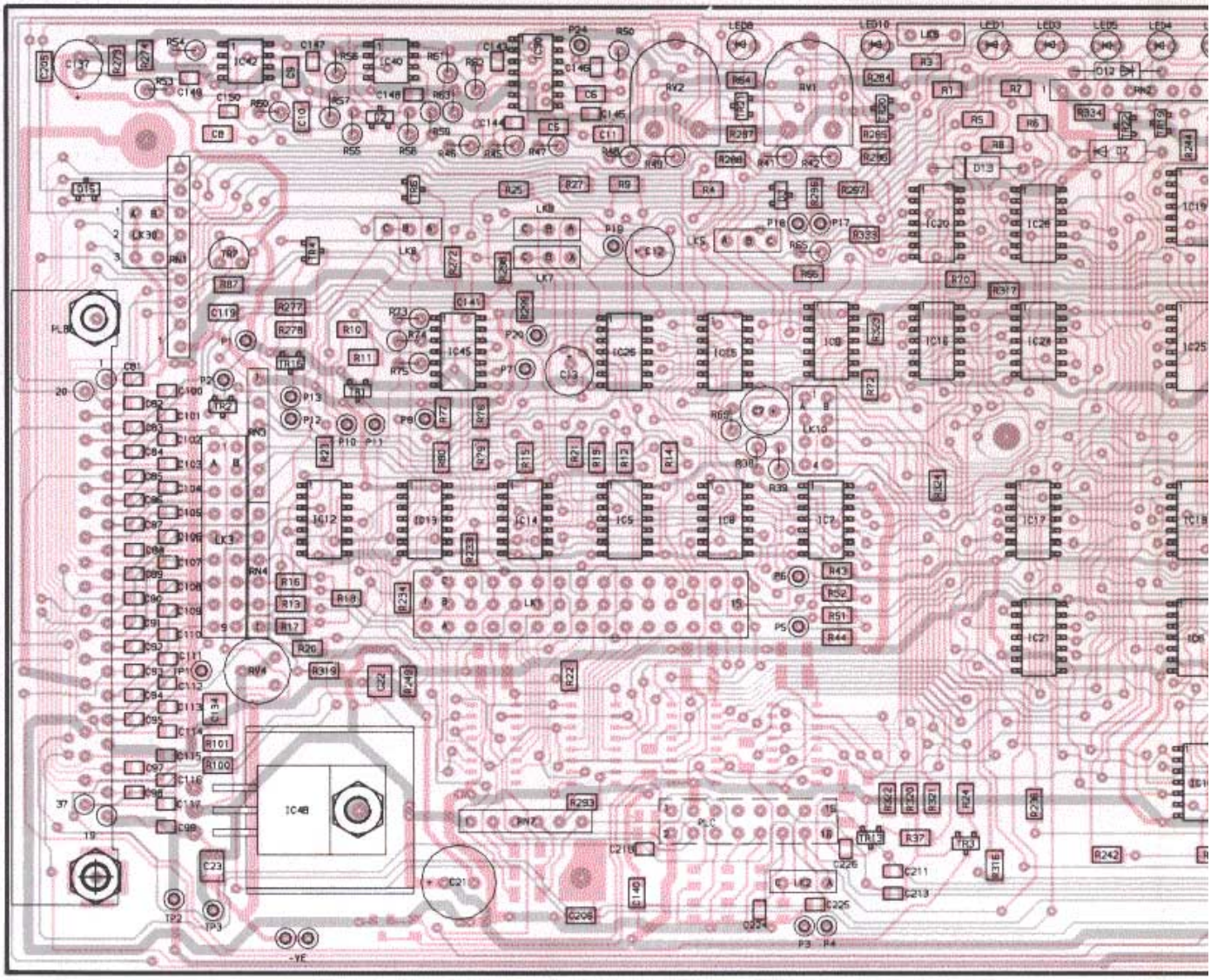
Cct. Ref	Description				Part No.	Remarks
Capacitors (Cont'd)						
C69	100n	±5%		submin pes	PQ99535	
C70,71	10n	±10%	50V	SMD	3513 999 55492	
C72	10n	±2,5%	63V	pp	PQ99621	
C73	470p	±5%	50V	SMD	3513 999 55414	
C74	3n3	±5%	50V	SMD	CN99154	
C75	1n8	±5%	50V	SMD	CN99058	
C76	100n	±10%	50V	SMD	3513 999 55017	
C77	15n	±5%		cer	PN99907	
C78	2n2	±5%		cer	PN99902	/01
C79	330p	±5%		cer	PN99884	/01
C80	100n	±10%	50V	SMD	3513 999 55017	
C81-117						Not Used
C118	47p	±5%	50V	SMD	CN99039	
C119-121						Not Used
C122	56n	±10%	50V	SMD	3513 999 55014	
C123	3n3	±20%		cer	PN99918	
C124	4µ7	±20%	63V	elec	PS99444	
C125	1n	±5%	50V	SMD	3513 999 55418	
C126	4µ7	±20%	63V	elec	PS99444	
C127	100n	±10%	50V	SMD	3513 999 55017	
C128						Not Used
C129	1	±20%	100V	elec	PS99455	
C130	680p	±5%		cer	PN99888	/01
C131,132						Not Used
C133	1n5	±2,5%	100V	pp	PQ99616	
C134-137						Not Used
C138	1	±20%	100V	elec	PS99455	
C139-150						Not Used
C151-153	33p	±5%	50V	SMD	3513 999 55319	
C154						Not Used
C155	1n	±10%	50V	SMD	3513 999 55459	
C156-159	33p	±5%	50V	SMD	3513 999 55319	
C160-163						Not Used
C164-171	33p	±5%	50V	SMD	3513 999 55319	
C172						Not Used
C173-176	33p	±5%	50V	SMD	3513 999 55319	
C177	1n	±10%	50V	SMD	3513 999 55459	
C178-185	33p	±5%	50V	SMD	3513 999 55319	
C186	1n	±10%	50V	SMD	3513 999 55459	
C187-194	33p	±5%	50V	SMD	3513 999 55319	
C195,196	1n	±10%	50V	SMD	3513 999 55459	
C197,198	33p	±5%	50V	SMD	3513 999 55319	
C199,200						Not Used
C201,202	33p	±5%	50V	SMD	3513 999 55319	
C203	1n	±10%	50V	SMD	3513 999 55459	
C227-229	56n	±10%	50V	SMD	3513 999 55014	
C230,231	33p	±5%	50V	SMD	3513 999 55319	
C232	470n	±10%	35V	tant SMD	CS99388	
Miscellaneous						
XL1	Crystal 29700Hz				FC06154	/01
	Link connector				FC99060	

FRONT PANEL PCB ASSEMBLY
AT28997/01

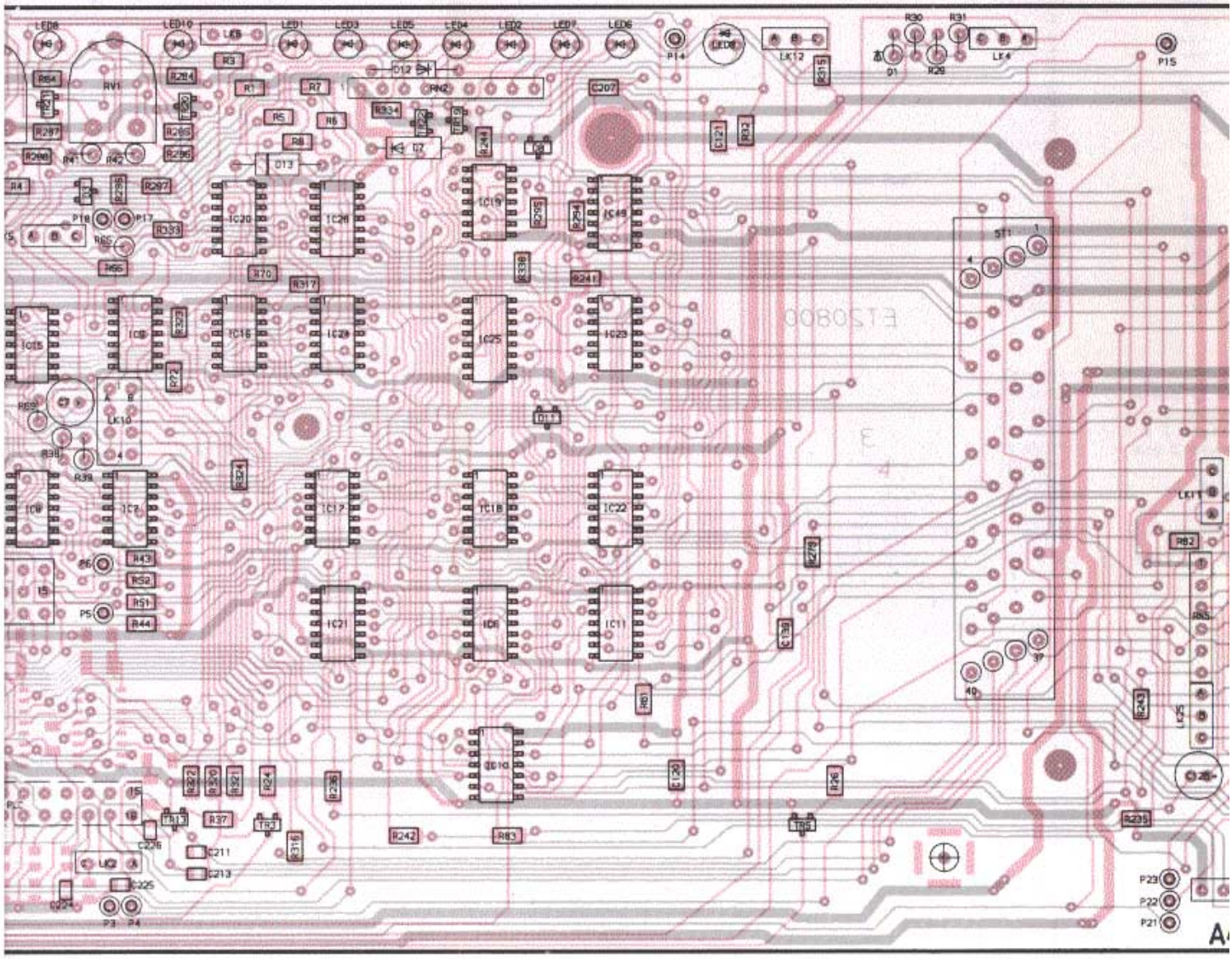
Semiconductors & IC's		
IC1	IC4001	FU99060
IC2	IC Dual op amp 1458	FU99092
TR1-6	Transistor BC547B	FV05891
D1-4	Diode 1N4148	FV05808
D5	Diode 8V2 ±5%	FV05970

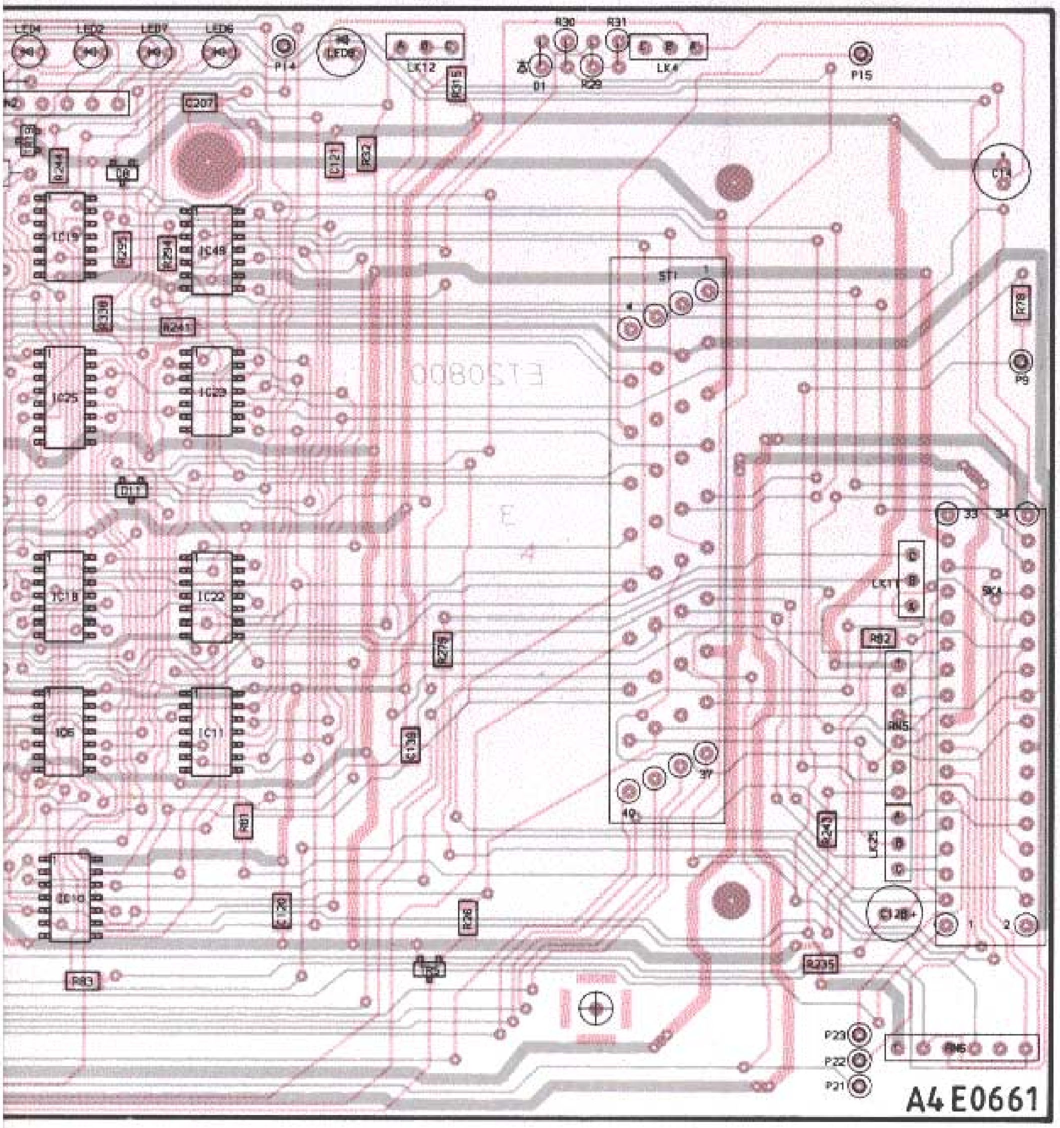
Resistors					
R1-3	100k	±5%	0,25W	c film	PM01460
R4	10k	±5%	0,25W	c film	PM01448
R5,6	100k	±5%	0,25W	c film	PM01460
R7-15	10k	±5%	0,25W	c film	PM01448
R16	220	±5%	0,25W	c film	PM01428
R17-22	1k	±5%	0,25W	c film	PM01436
R23,24	100k	±5%	0,25W	c film	PM01460

Cct Ref	Description	Part No	Remarks
Resistors (Cont'd)			
R25	47k ±5% 0,25W c film	PM01456	
R26	100k ±5% 0,25W c film	PM01460	
R27	330 ±5% 0,25W c film	PM01430	
R28	100k ±5% 0,25W c film	PM01460	
R29	4k7 ±5% 0,25W c film	PM01444	
Capacitors			
C1-3	4µ7 ±20% 63V elec	PS99444	
C4-7	100n ±20% cer	PN99927	
C8,9	4µ7 ±20% 63V elec	PS99444	
C10	100n ±20% cer	PN99927	
C11	4µ7 ±20% 63V elec	PS99444	
C12,13	33p ±5% cer	PN99872	
C14-21			Not Used
C22	10n ±20% cer	PN99921	
C23	1n ±20% cer	PN99915	
C24	10n ±20% cer	PN99921	
C25	1n ±20% cer	PN99915	
C26,27	10n ±20% cer	PN99921	
C28			Not Used
C29-37	10n ±20% cer	PN99921	
C38	1n ±20% cer	PN99915	
C39,40	10n ±20% cer	PN99921	
C41	1n ±20% cer	PN99915	
C42-48	10n ±20% cer	PN99921	
C49-52	1n ±20% cer	PN99915	
C53-59	10n ±20% cer	PN99921	
Miscellaneous			
PLA	Plug PCB mtd Straight 2 x 17	FP99188	
PLB	Header, less ears 20 pos'n	FP99222	
PLC	Plug PCB mtd Straight 2 x 4	FP99196	
PLD	Plug PCB mtd Straight 2 x 2	FP99172	
LK1	Header straight male 3 pos'n	FC00837	
	Link connector	FC99060	1/LK1
SA	Switch 6 way 2 pole	FS07159/01	
LED2,4	LED Yellow	FV05930	1/Squelch, 1/T/T
LED3,5,6	LED Red	FV05858	1/Tx on, 1/Alarm, 1/Manual
LED7	LED Green	FV05931	1/Normal
	Spacer, LED 3,5mm x 4,76mm	QA05856	1/LED2-7

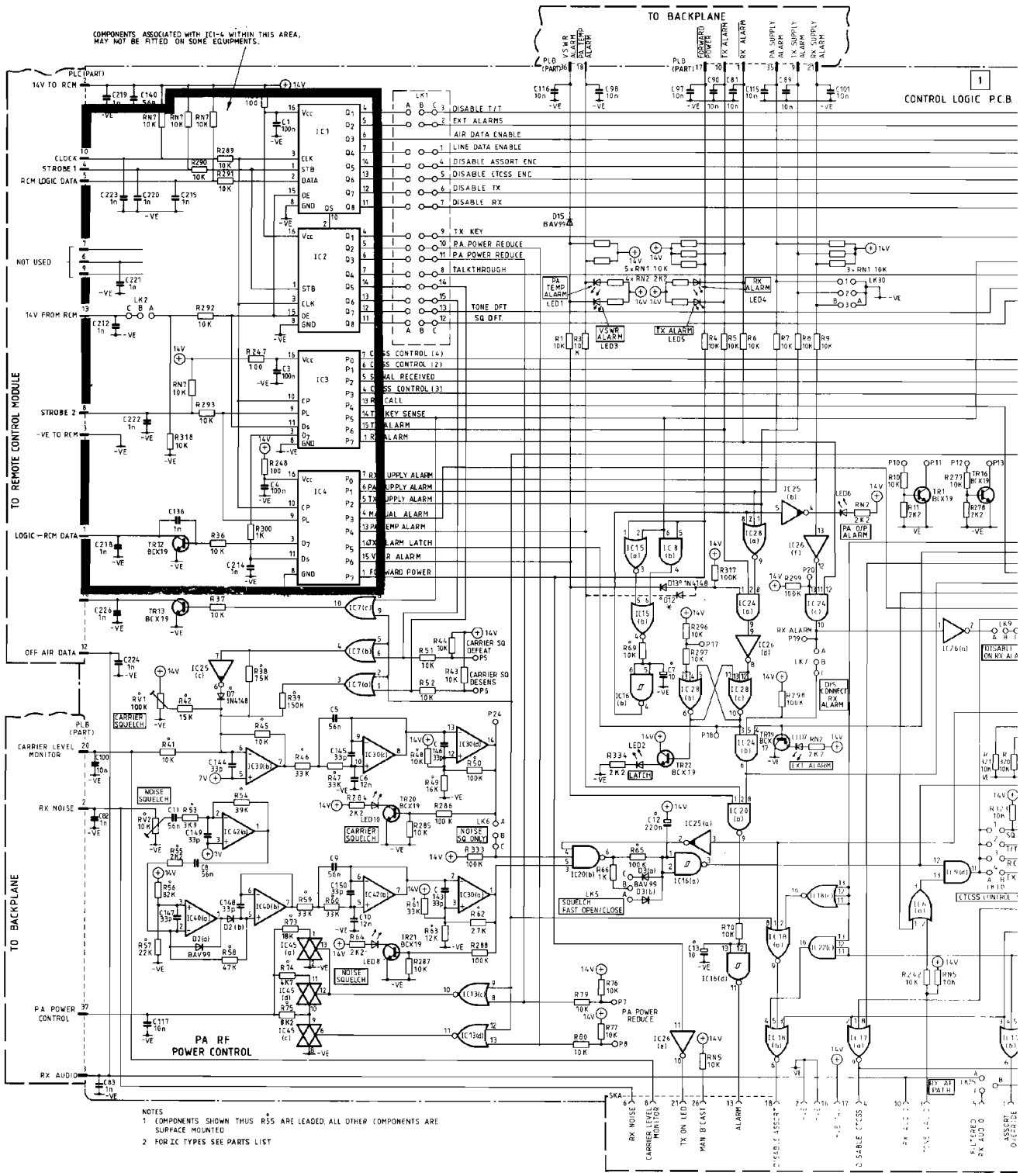


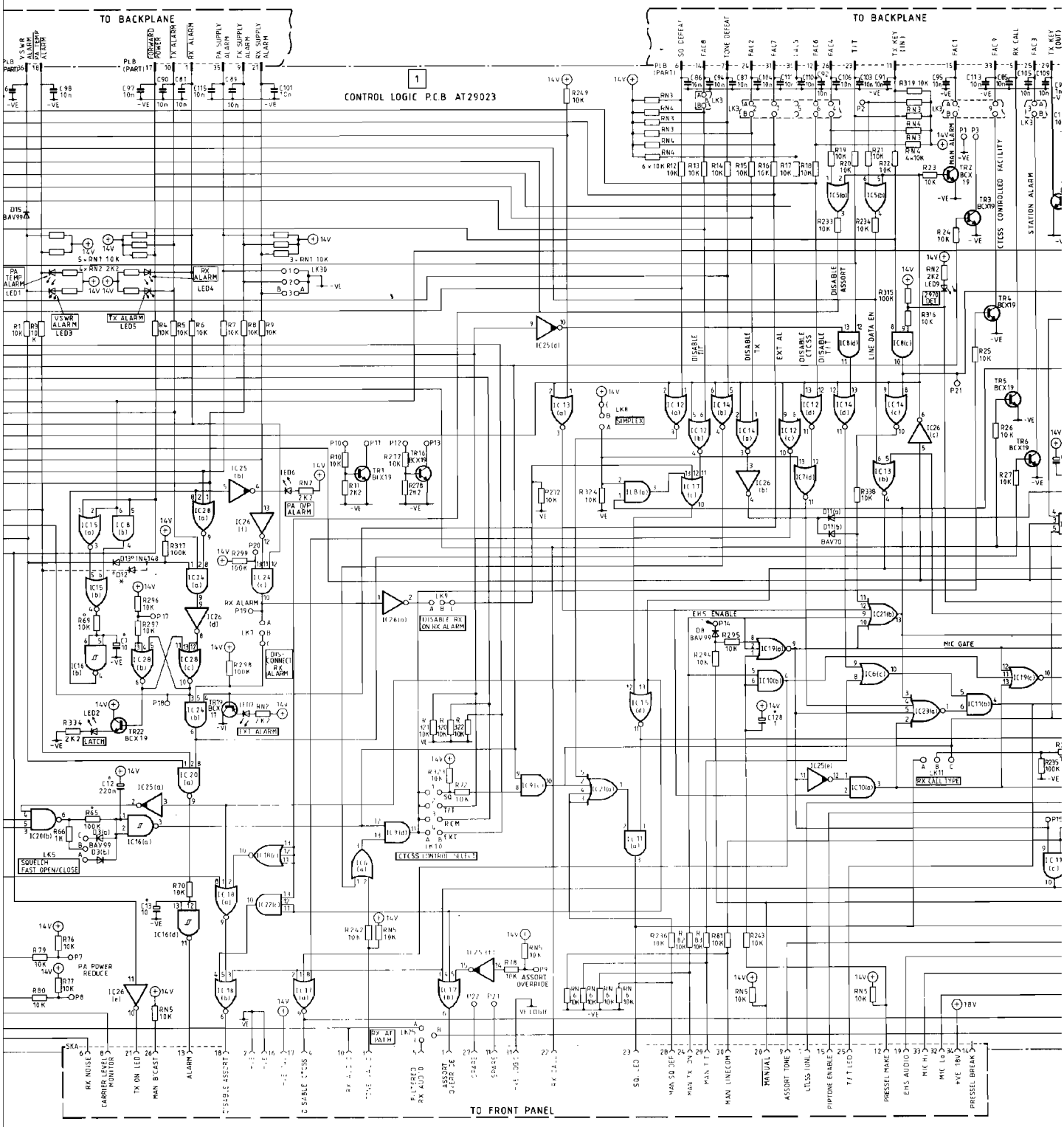
CONTROL LOGIC AT29023
LAYOUT DIAGRAM

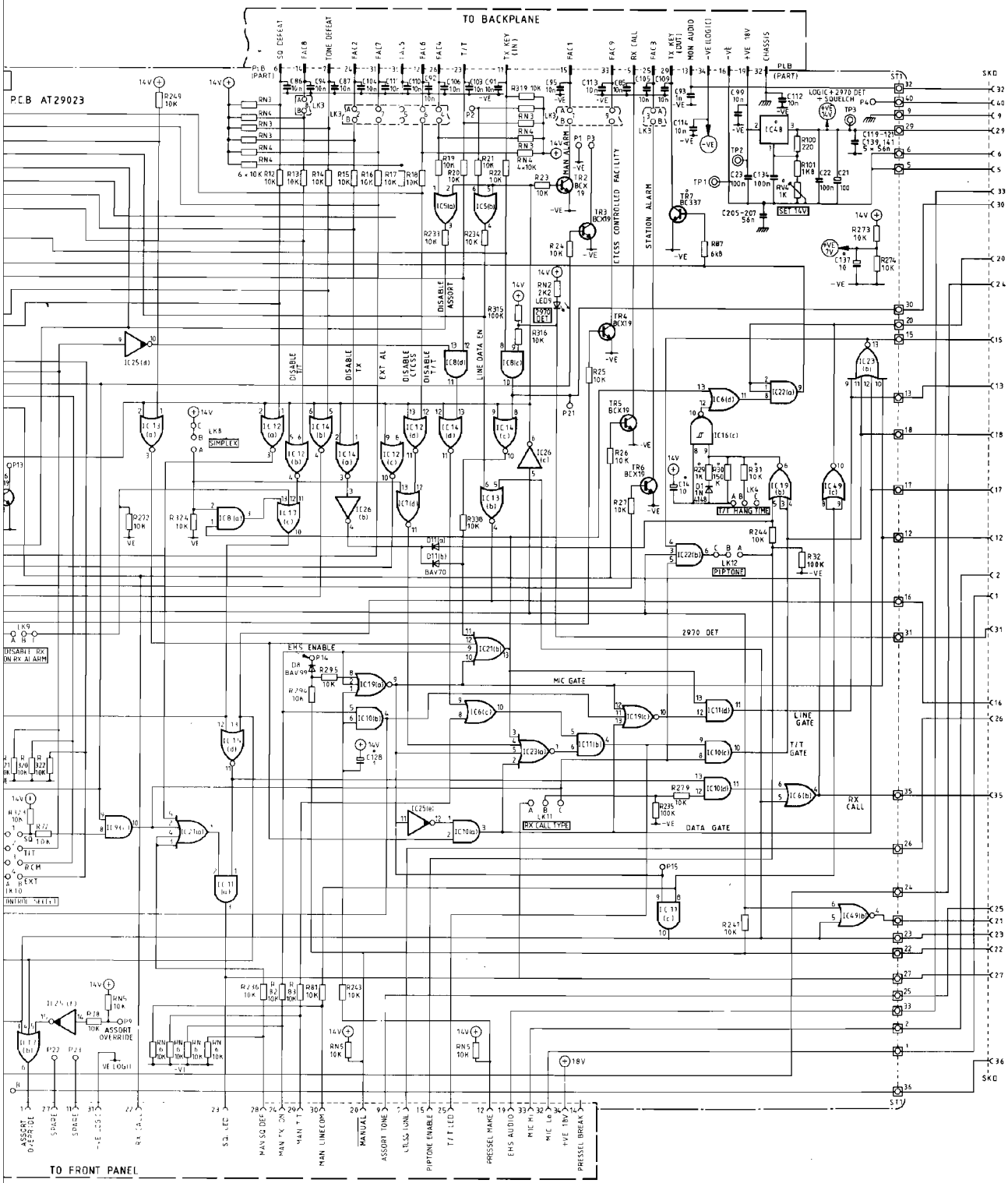




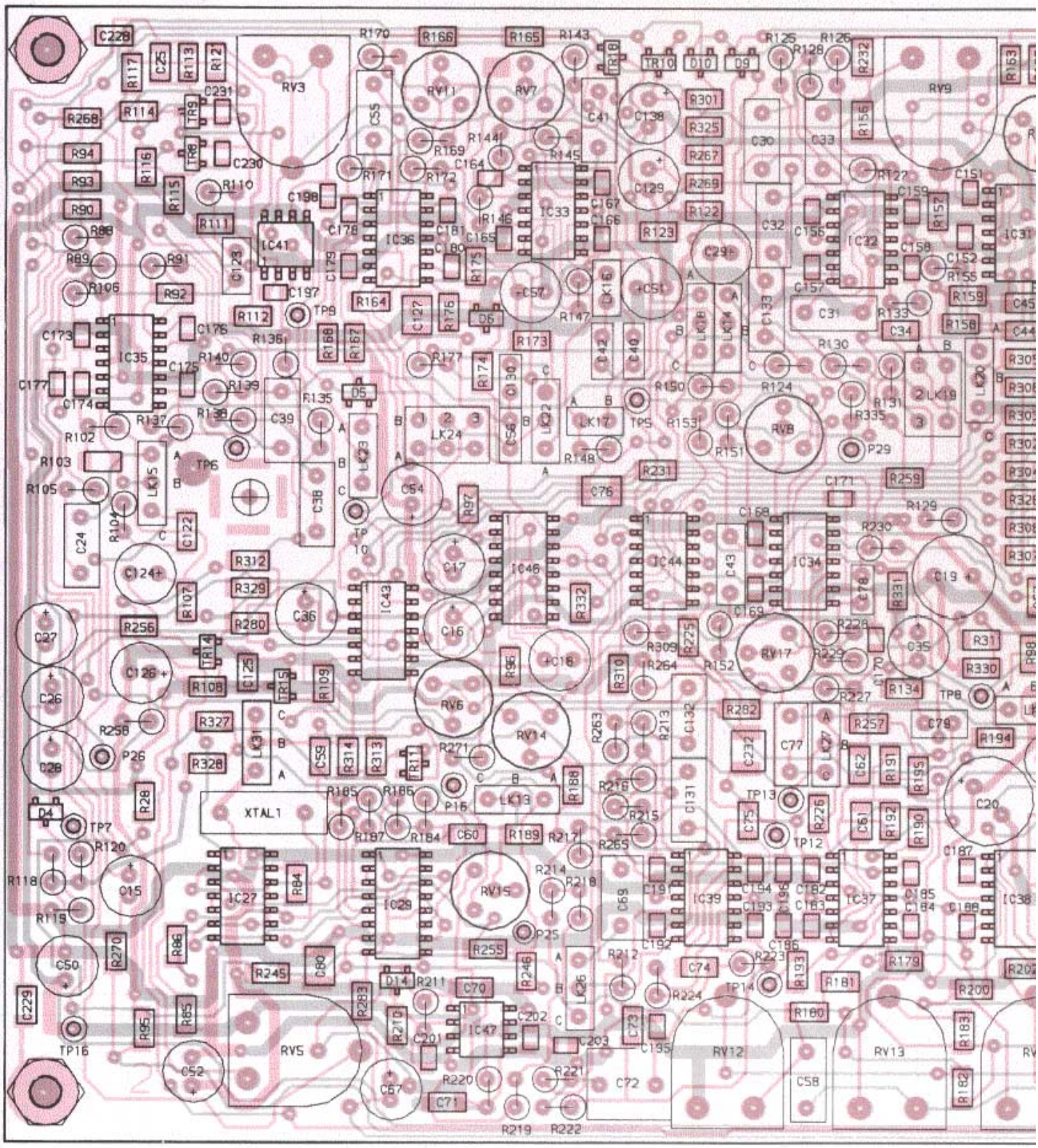
LED4
LED2
LED7
LED6
P14
LED8
LK12
R30
R31
LK4
D1
R29
R315
P15
C207
C121
R32
C14
R244
D8
IC19
R295
R294
IC48
ST1
R78
R338
R241
P9
IC25
IC23
D11
LK11
SK4
IC18
IC22
R82
R278
RN5
IC6
IC11
C130
R81
R243
LK25
IC10
C128
C120
R26
R83
R235
P23
P22
P21
RN6
A4 E0661


TO BACKPLANE
CONTROL LOGIC P.C.B.
COMPONENTS ASSOCIATED WITH IC1-4 WITHIN THIS AREA, MAY NOT BE FITTED ON SOME EQUIPMENTS.
TO REMOTE CONTROL MODULE
TO BACKPLANE
PA RF POWER CONTROL
DISABLE T/T
EXT ALARMS
AIR DATA ENABLE
LINE DATA ENABLE
DISABLE ASSORT ENC
DISABLE CTCSS ENC
DISABLE TX
DISABLE RX
TX KEY
PA POWER REDUCE
PA POWER REDUCE
TALKTHROUGH
TONE DET
SQ DET
CLOCK
STROBE 1
RCM LOGIC DATA
STROBE 2
LOGIC – RCM DATA
OFF AIR DATA
CARRIER LEVEL MONITOR
RX NOISE
PA POWER CONTROL
RX AUDIO
14V TO RCM
14V FROM RCM
-VE TO RCM
NOT USED
CARRIER SQUELCH
NOISE SQUELCH
NOISE SQ ONLY
SQUELCH FAST OPEN/CLOSE
PA TEMP ALARM
VSWR ALARM
TX ALARM
RX ALARM
PA SUPPLY ALARM
TX SUPPLY ALARM
RX SUPPLY ALARM
FORWARD POWER
PA O/P ALARM
EXT ALARM
DISCONNECT RX ALARM
CARRIER SQ DEFEAT
CARRIER SQ DESENS
NOTES
1 COMPONENTS SHOWN THUS R55 ARE LEADED, ALL OTHER COMPONENTS ARE SURFACE MOUNTED
2 FOR IC TYPES SEE PARTS LIST

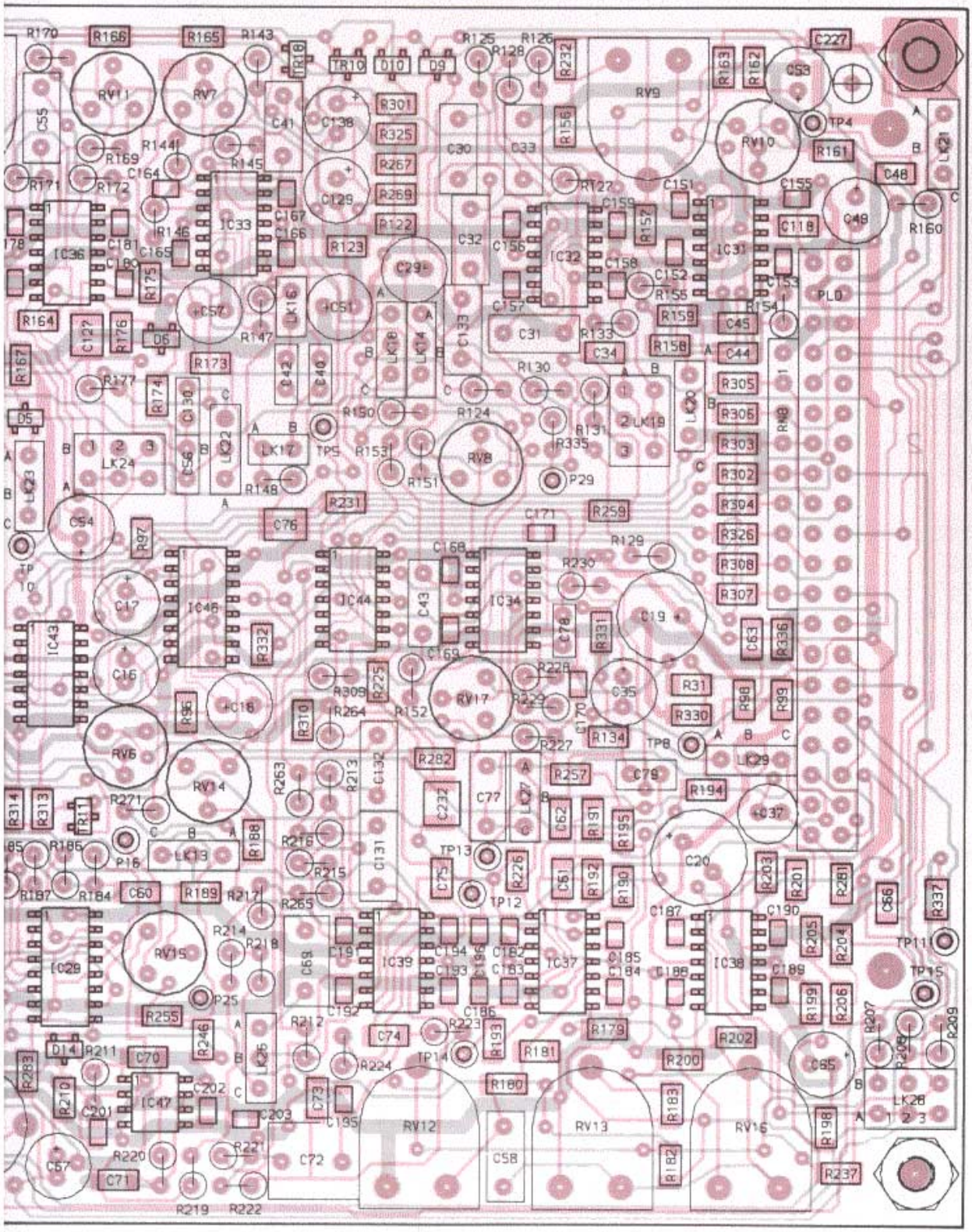

TO BACKPLANE
CONTROL LOGIC P.C.B AT29023
TO BACKPLANE
TO FRONT PANEL



CONTROL LOGIC AT29023
CIRCUIT DIAGRAM

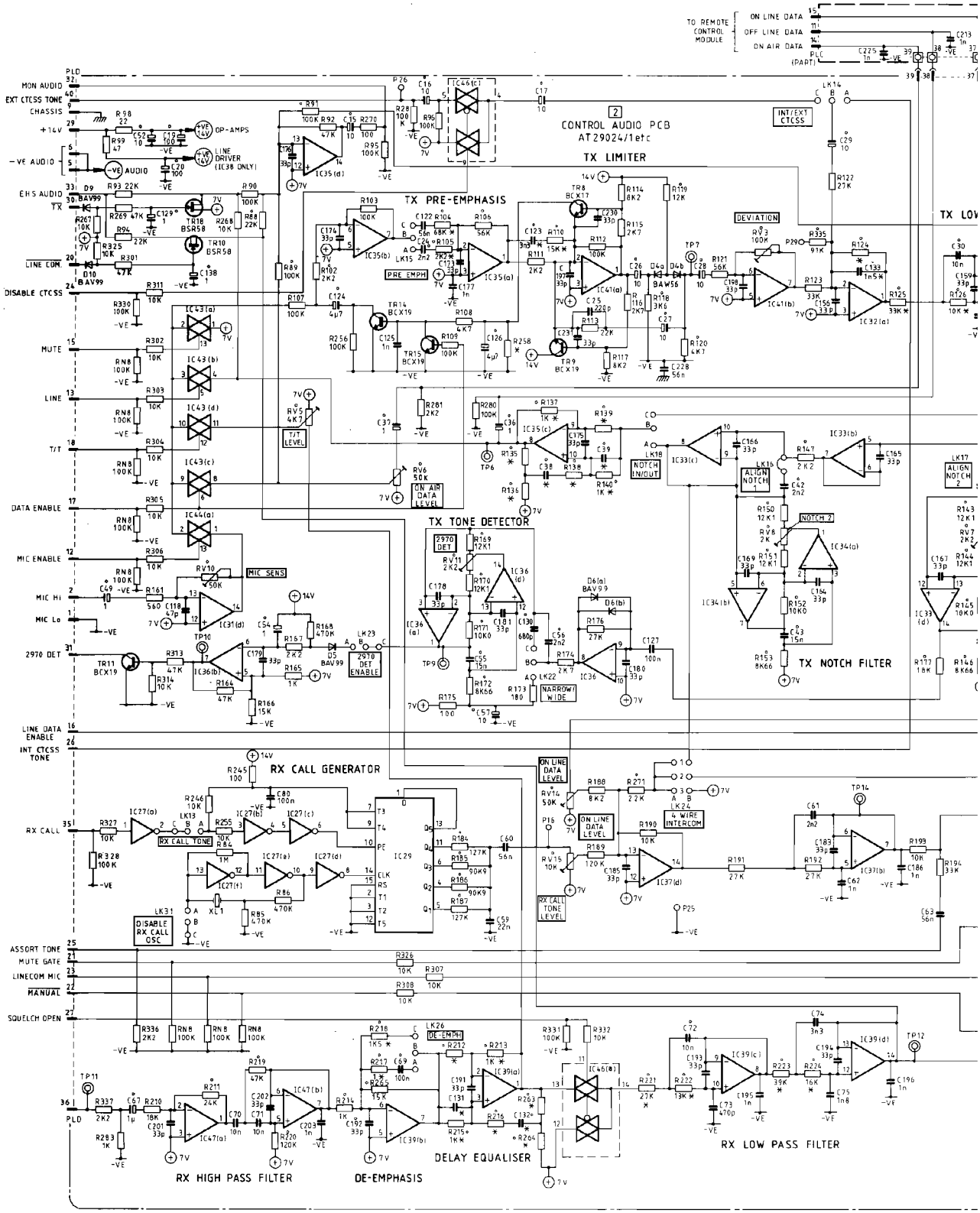


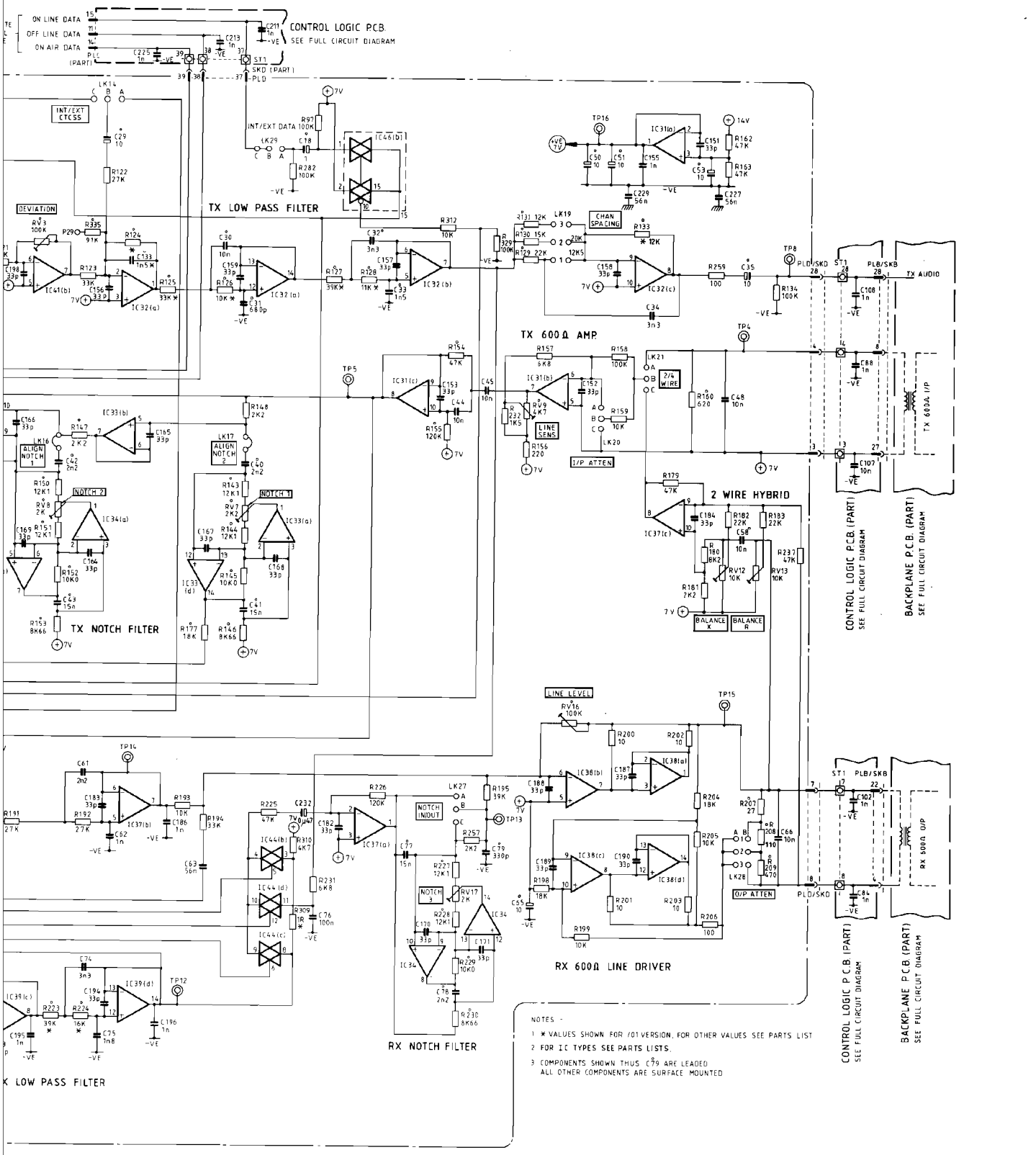
CONTROL AUDIO AT29024/01
LAYOUT DIAGRAM



A4 E0663

CONTROL AUDIO AT29024/01
LAYOUT DIAGRAM


CONTROL AUDIO PCB
AT29024/1etc
TX LIMITER
TX PRE-EMPHASIS
TX TONE DETECTOR
TX NOTCH FILTER
RX CALL GENERATOR
RX HIGH PASS FILTER
DE-EMPHASIS
DELAY EQUALISER
RX LOW PASS FILTER
TO REMOTE CONTROL MODULE
ON LINE DATA
OFF LINE DATA
ON AIR DATA
PLC (PART)
MON AUDIO
EXT CTCSS TONE
CHASSIS
+14V
-VE AUDIO
EHS AUDIO TX
LINE CON
DISABLE CTCSS
MUTE
LINE
T/T
DATA ENABLE
MIC ENABLE
MIC HI
MIC Lo
2970 DET
LINE DATA ENABLE
INT CTCSS TONE
RX CALL
ASSORT TONE
MUTE GATE
LINECOM MIC
MANUAL
SQUELCH OPEN
OP-AMPS
LINE DRIVER (IC38 ONLY)
AUDIO
INT/EXT CTCSS
DEVIATION
ON AIR DATA LEVEL
T/T LEVEL
MIC SENS
NOTCH IN/OUT
ALIGN NOTCH 1
ALIGN NOTCH 2
NOTCH 2
2970 DET ENABLE
NARROW/WIDE
ON LINE DATA LEVEL
RX CALL TONE LEVEL
4 WIRE INTERCOM
RX CALL TONE
DISABLE RX CALL OSC
DE-EMPH
PRE EMPH



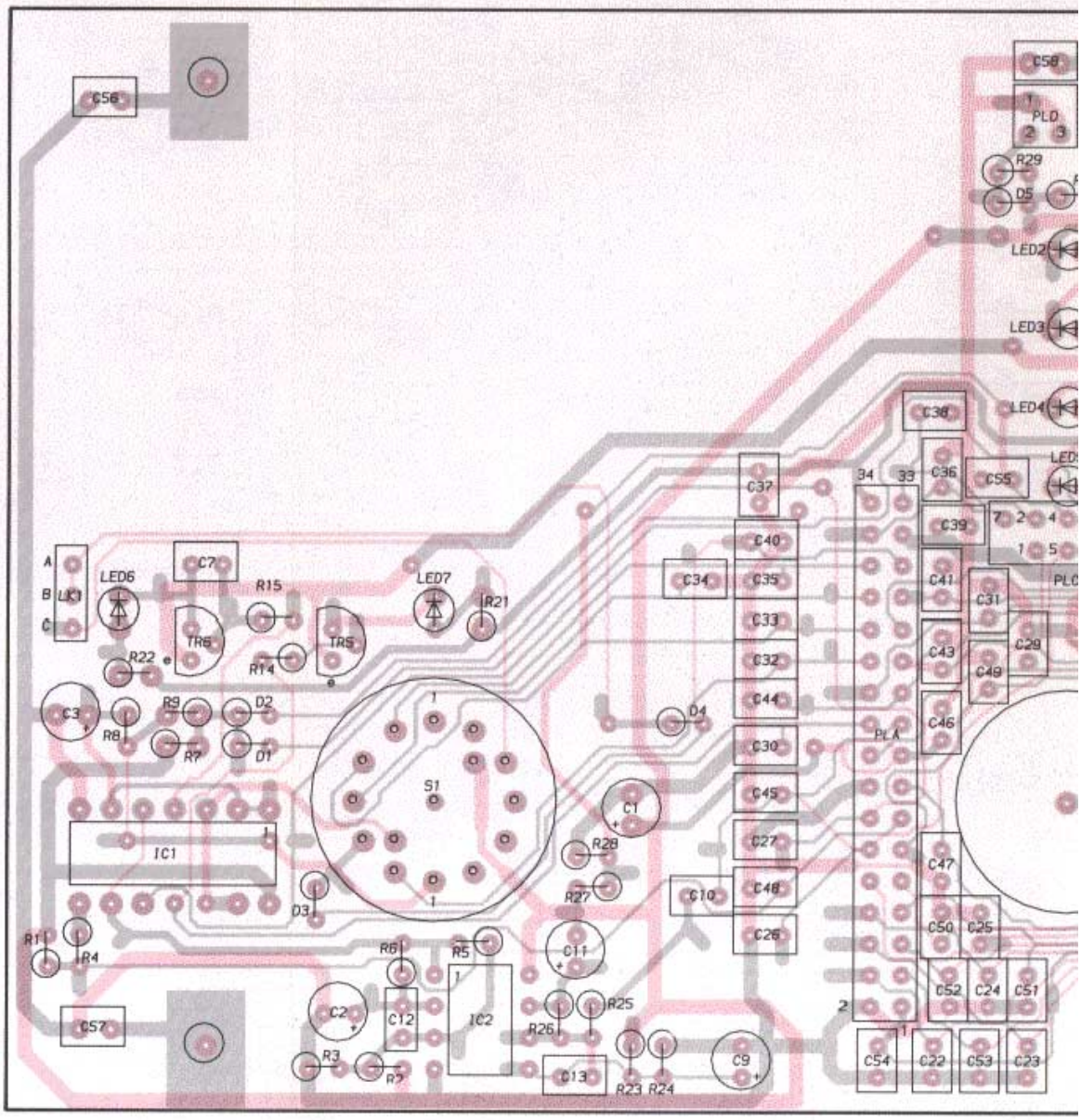
NOTES -

1 * VALUES SHOWN FOR /01 VERSION, FOR OTHER VALUES SEE PARTS LIST

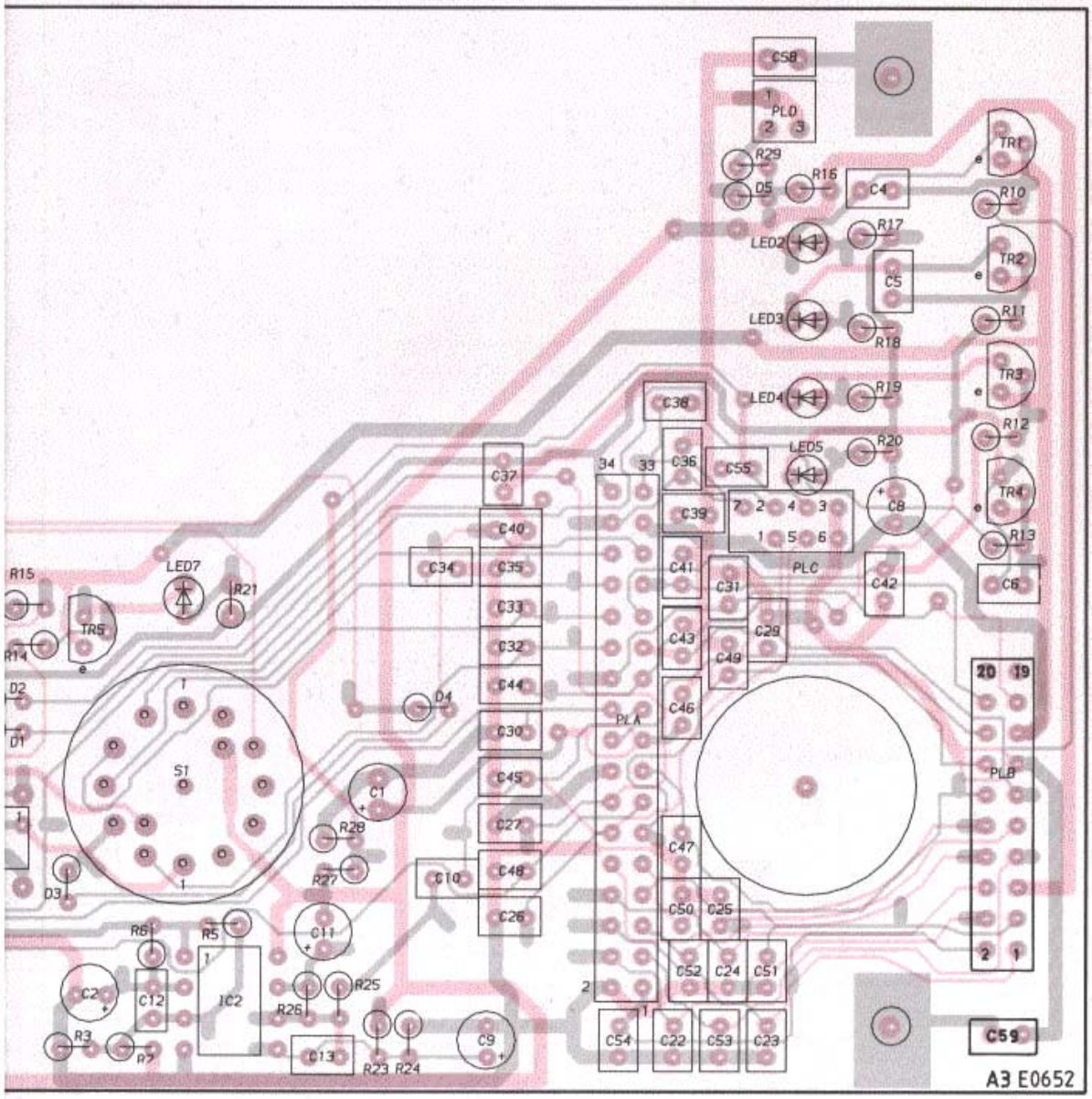
2 FOR IC TYPES SEE PARTS LISTS.

3 COMPONENTS SHOWN THUS (C79 ARE LEADED
ALL OTHER COMPONENTS ARE SURFACE MOUNTED

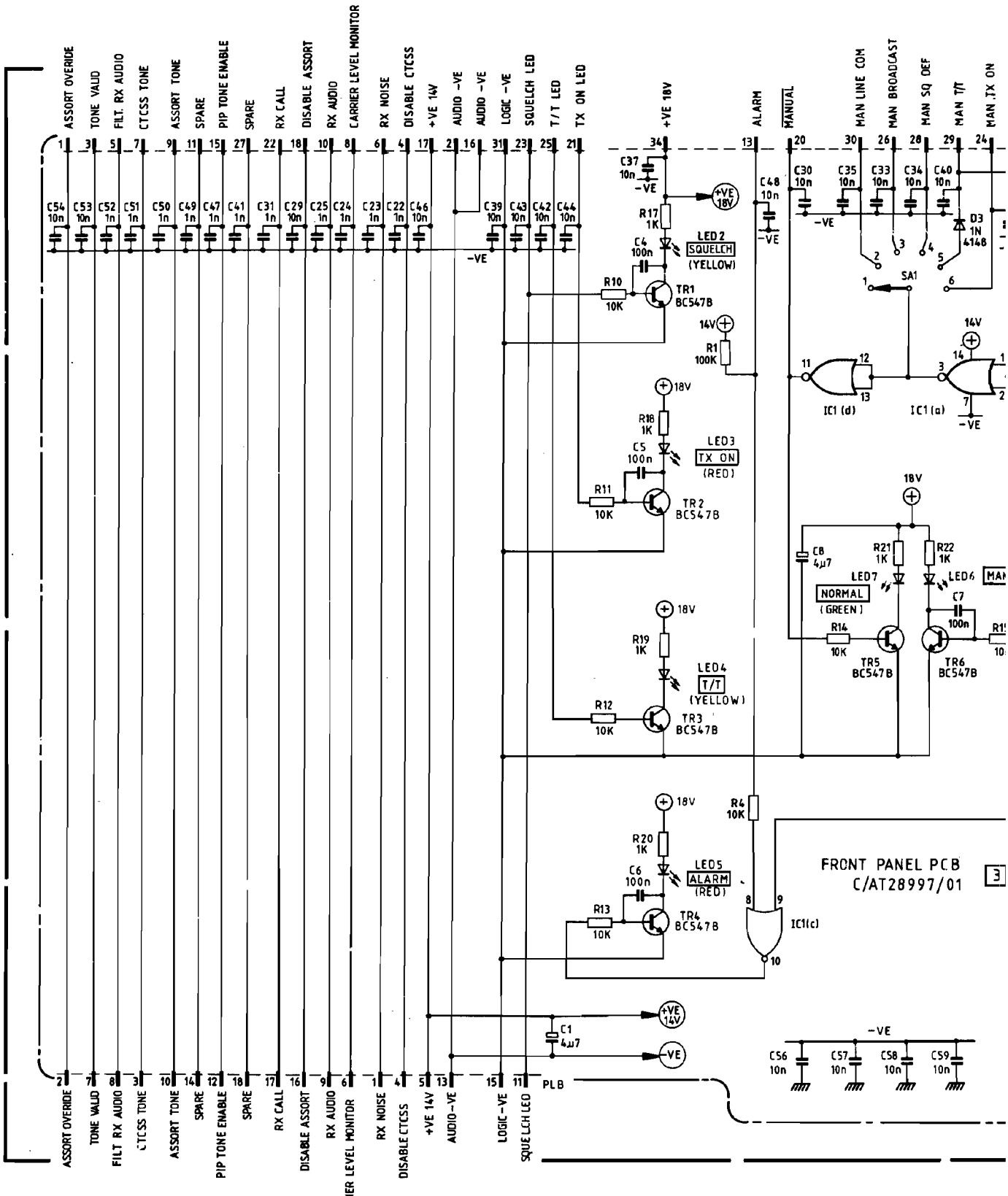
CONTROL AUDIO AT29024/01
CIRCUIT DIAGRAM

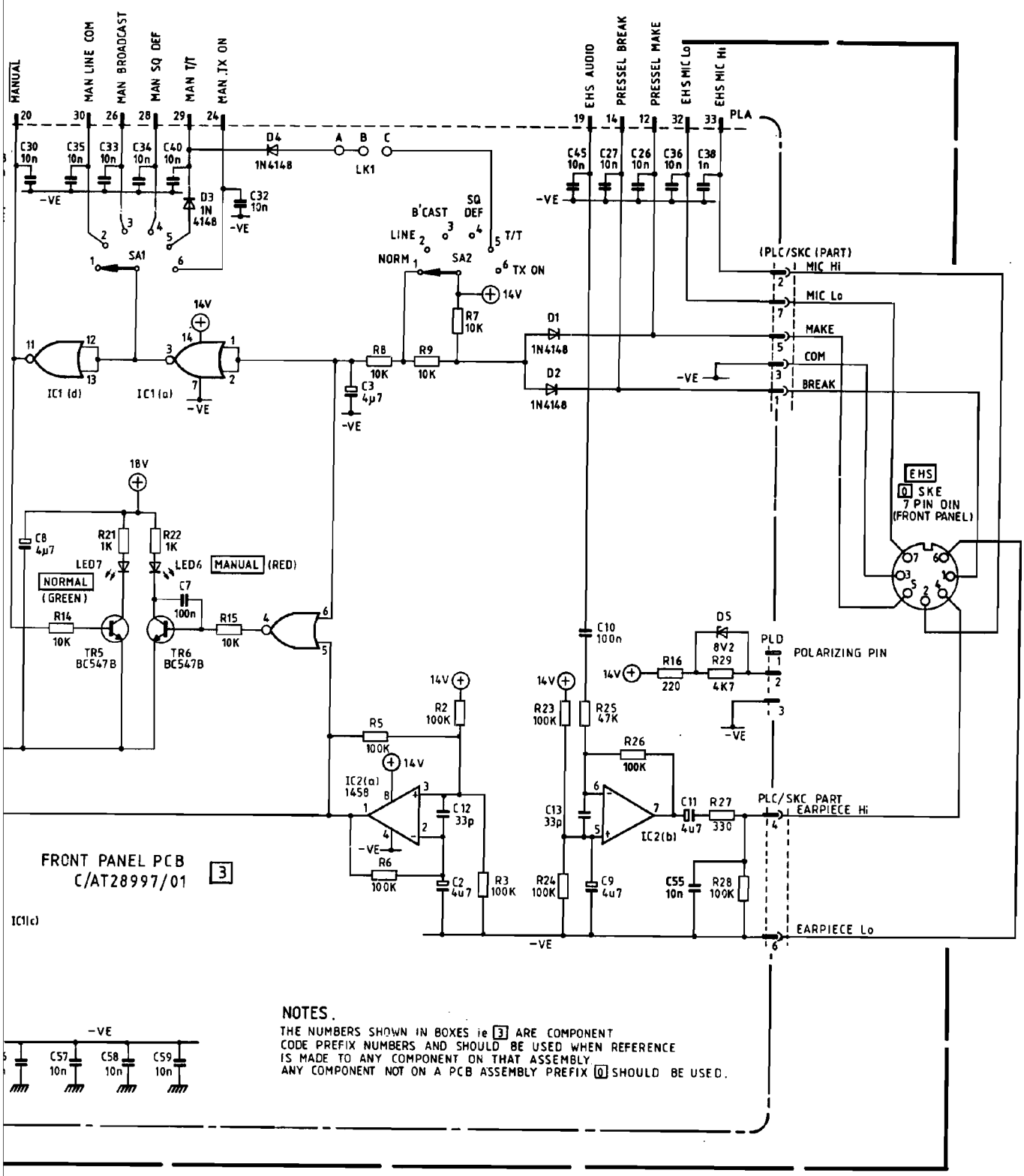


CONTROL FRONT PANEL AT28997/01
LAYOUT DIAGRAM



CONTROL FRONT PANEL AT28997/01
LAYOUT DIAGRAM


ASSORT OVERIDE
TONE VALID
FILT. RX AUDIO
CTCSS TONE
ASSORT TONE
SPARE
PIP TONE ENABLE
SPARE
RX CALL
DISABLE ASSORT
RX AUDIO
CARRIER LEVEL MONITOR
RX NOISE
DISABLE CTCSS
+VE 14V
AUDIO -VE
AUDIO -VE
LOGIC -VE
SQUELCH LED
T/T LED
TX ON LED
+VE 18V
ALARM
MANUAL
MAN LINE COM
MAN BROADCAST
MAN SQ DEF
MAN T/T
MAN TX ON
-VE
LED2 SQUELCH (YELLOW)
LED3 TX ON (RED)
LED4 T/T (YELLOW)
LED5 ALARM (RED)
LED6
LED7 NORMAL (GREEN)
TR1 BC547B
TR2 BC547B
TR3 BC547B
TR4 BC547B
TR5 BC547B
TR6 BC547B
SA1
D3 1N 4148
IC1 (d)
IC1 (a)
IC1(c)
FRONT PANEL PCB
C/AT28997/01
3
PLB



NOTES.

THE NUMBERS SHOWN IN BOXES ie [3] ARE COMPONENT CODE PREFIX NUMBERS AND SHOULD BE USED WHEN REFERENCE IS MADE TO ANY COMPONENT ON THAT ASSEMBLY.
ANY COMPONENT NOT ON A PCB ASSEMBLY PREFIX [0] SHOULD BE USED.

CONTROL FRONT PANEL AT28997/01
CIRCUIT DIAGRAM

REMOTE CONTROL OPTION
AT14920

INTRODUCTION

The Remote Control Assembly may be fitted as an optional extra to the FR5000 series Base Stations. It enables the Base Station to be controlled by a M80 series Controller using AC signalling over a 2/4 wire 600Ω line.
The Remote Control Assembly is located in the Control Module where it is mounted on a PCB carrier plate, the assembly comprises a motherboard, which provides an interface with the Base Station, and a Facilities PCB. The AC signalling system uses a 2970Hz continuous tone to key the transmitter and a 112ms burst of FSK data which contains commands for activating the squelch defeat, line intercom and talkthrough facilities.

SUMMARY OF DATA

Line Connections

Type	2 or 4 wire
Line Specification	minimum specification to British Telecom schedule A line or equivalent.

Line audio

Audio Level	2 wire -18dBm 4 wire -14dBm
Frequency Response	300Hz to 3,4kHz±3dB relative to level at 1kHz, or as limited by British Telecom line.
Control Frequencies	2970Hz ±5Hz (key tone) 2295Hz ±5Hz (FSK low tone) 2505Hz ±5Hz (FSK high tone)
Key Tone Level	at least 18dB below peak speech line audio level and greater than -42dBm.
FSK Level	at least 8dB below peak speech line audio level and greater than -40dBm.

Control Functions

Transmission rate	300 baud
Preamble tone length	125ms±25ms
Start bit	logic 0
Stop bit	logic 1
Parity	odd
Bit time	36,6ms±3%
Inter word time	less than 15ms

INSTALLATION

Installation Items

Description	Part No	Remarks
Scr st tap pozi No4 x 8mm	QJ08241/X	2/M80 signalling assembly - Control Module

Note: Refer to Fig.1 throughout this installation procedure.

(1) Release the securing fasteners and withdraw the Control Module on its runners to gain access to the Control Logic PCB.

(2) Connect the lead assembly AT70246 to PLC on the Interface PCB and, routeing the leads around the back of the PCB carrier, pass the free end of the lead assembly through the top rearmost hole in the Control Plate.

(3) Taking care not to trap the lead assembly, hook the M80 signalling assembly mounting plate round the rear end of the control plate and secure the upper and lower lugs to the Control Unit front panel with the two screws provided.

CAUTION
Before the following connections are made it is important to ensure LK2 of AT04872/- is set B-C, this is to prevent contention between the outputs of IC1, IC2 of AT04872/- and the RCM control outputs.

(4) Referring to the STANDARD LINKING FUNCTIONS connect the free end of lead assembly AT70246 to P21 and the appropriate pins of LK1 on the Control Logic PCB to provide the functions required.

(5) Connect cable assembly AT70245 from PLB on the Interface assembly to PLC on the Control Logic PCB.

(6) Connect the 25-way ribbon cable from the backplane to the Interface assembly.

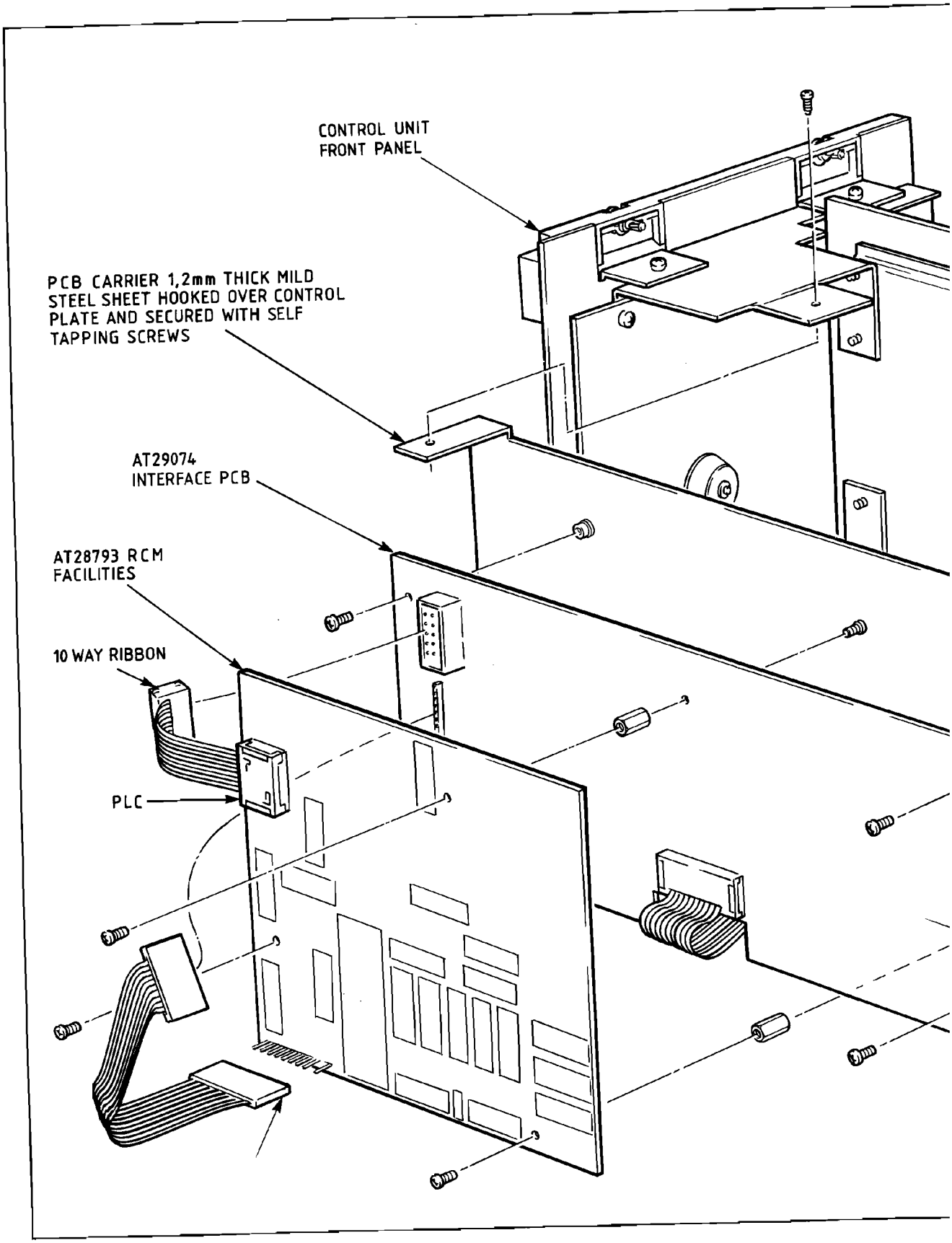
(7) Push the Control Module into the shelf assembly and tighten the securing fasteners.

STANDARD LINKING FUNCTIONS

Note: (i) The following table defines the interconnection between the Interface PCB and the Base Station Control Module Logic PCB necessary to achieve a number of standard functions. Due to the flexible design of the Base Station it is impractical to produce a definitive list of all the potentially useful linking combinations that could be made.

(ii) Leads not used should be parked on the appropriate 'a' position of LK1 on Control Logic PCB AT29023.

(iii) The interconnecting leads are colour coded, using the resistor convention, with respect to the pin numbers on AT29074.


CONTROL UNIT
FRONT PANEL
PCB CARRIER 1,2mm THICK MILD
STEEL SHEET HOOKED OVER CONTROL
PLATE AND SECURED WITH SELF
TAPPING SCREWS
AT29074
INTERFACE PCB
AT28793 RCM
FACILITIES
10 WAY RIBBON
PLC

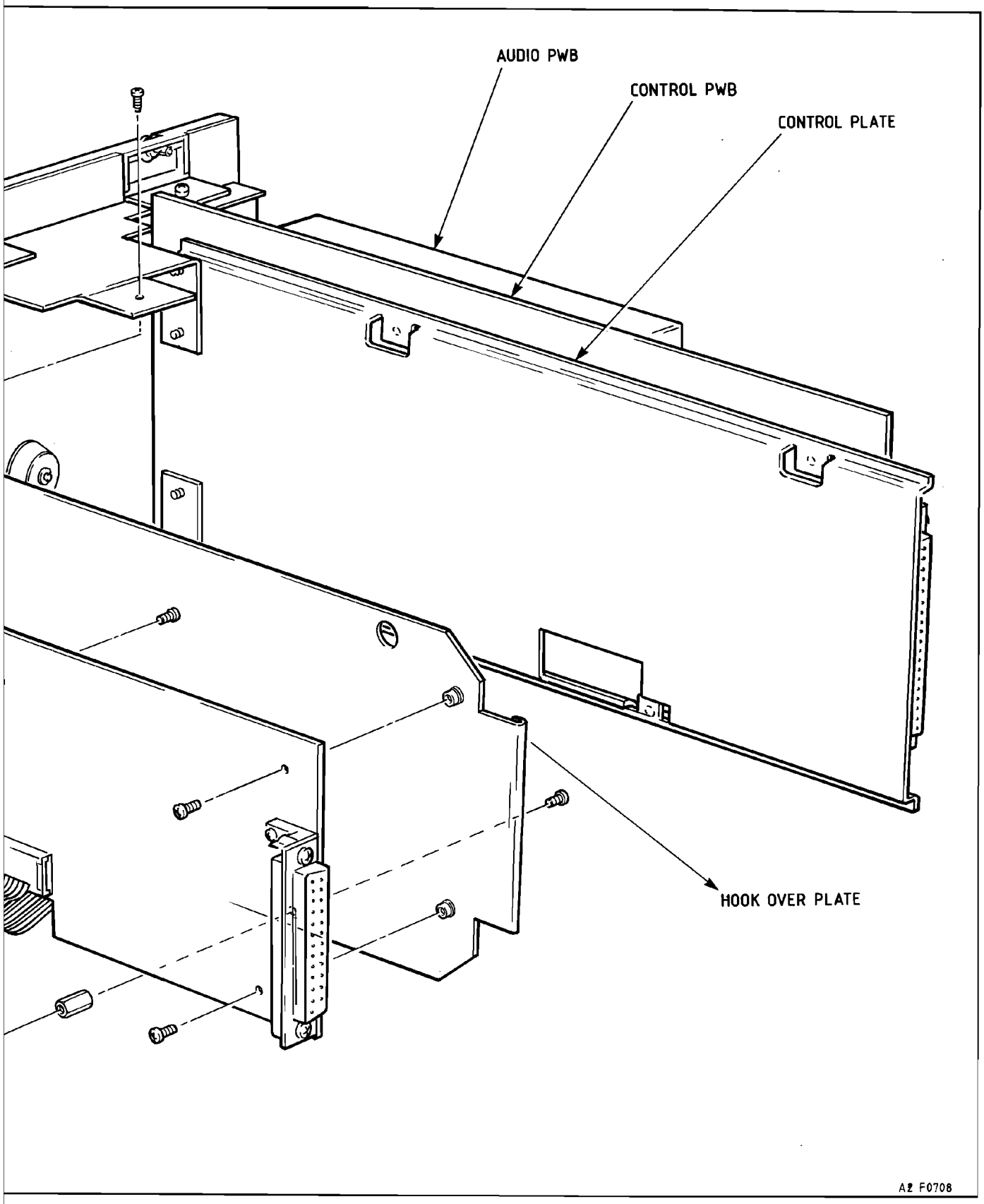


FIG. 1 INSTALLATION

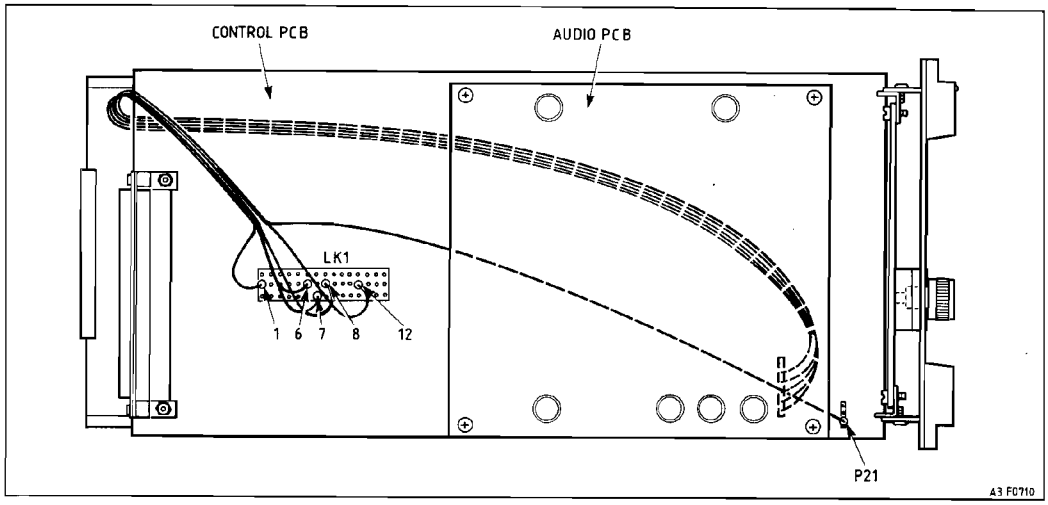


Fig. 2 Connections

Function	Interconnection		Remarks
	Interface PCB AT29074	Logic PCB AT29023	
Key Tone I/P to RCM	PLC pin 1 (Brown lead)	P21	Required when T/T function enabled and is fitted as standard. Used to prevent Line Fail T/T timeout when Tx is keyed.
Intercom enable Intercom disable	PLC pin 2 PLC pin 2 (Red lead)	LK1 pin 6b LK1 pin 6a	
Line data enable Supervisory tone signal enable Supervisory tone signal disable	PLC pin 3 PLC pin 3 (Orange lead)	LK1 pin 1b LK1 pin 1a	Enables supervisory tone to line, when deselected RV4 of AT28793 should be adjusted to set minimum audio from FSK tone generator.
Talkthrough enable Talkthrough disable	PLC pin 4 PLC pin 4 (Yellow lead)	LK1 pin 8b LK1 pin 8a	
Squelch defeat enable Squelch defeat disable	PLC pin 5 PLC pin 5 (Green lead)	LK1 pin 12b LK1 pin 12a	
Base Station Select required Base Station Select not required	PLC pin 6 PLC pin 6 (Blue lead)	LK1 pin 6c LK1 pin 7a	This function is exclusive with the channel change option. PLC pin 6 may also be used to connect M80 special function output to any control function on LK1 of AT04872/- e.g. disable CTCSS encode.

DETAILED DESCRIPTION

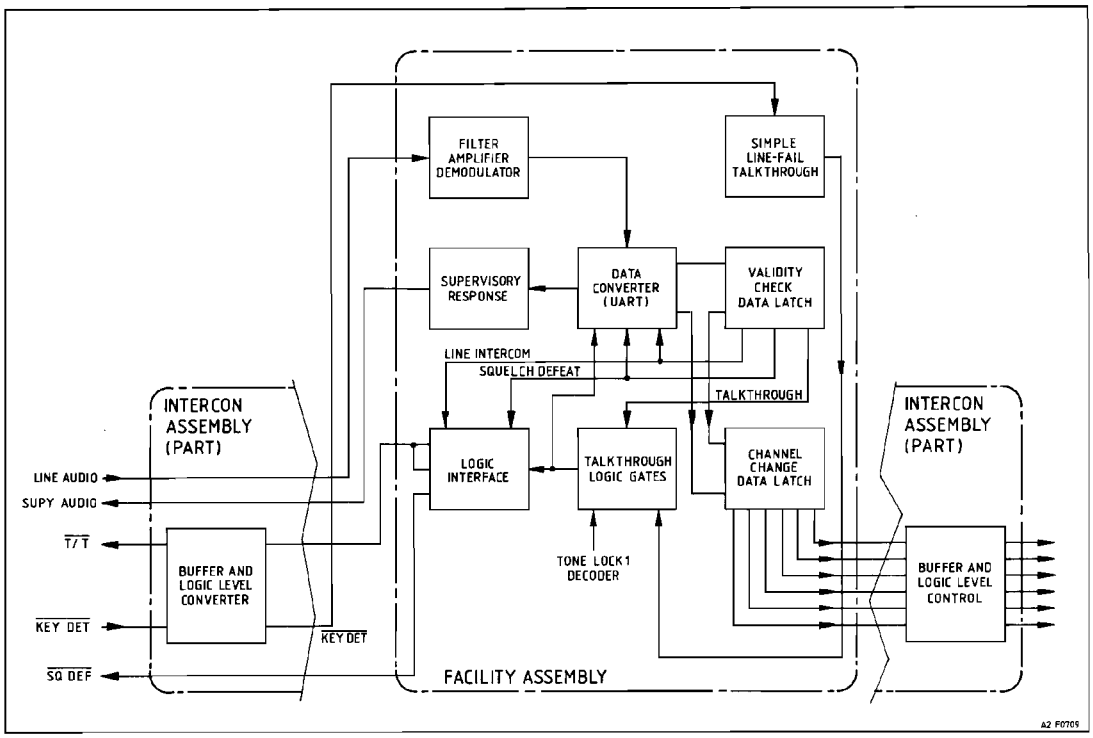


Fig. 3 Block Diagram

Summary

Interface PCB AT29074

The Interface PCB provides matching between the Facility PCB, Base Station and M80 Control Unit, also the 10V DC supply for the Facility PCB. An 18V DC input from the Base Station PSU is fed via PLA pin 15 to voltage regulator IC1, the output of which is the 10V DC supply for the Interface and Facility PCB's.

IC2, a Quad Comparator, acts as a buffer and logic level converter for the FSK DATA VALID, T/T, LINE I/C and KEY DETECT facilities. IC3, IC4 and IC5 control the Channel Change and Logic Function outputs as set by LK1, LK2 and LK3.

Links LK1 and LK2 control the logic inversion function of quad exclusive OR gates IC3 and IC4. LK1 enables the logic output of IC5 channel lines C1 to C6 to be inverted thereby allowing the channel change output to be linked via LK3 to provide base station site selection when channel change is not required. LK2 enables the logic output of IC5 'special function 4' and 'free function pin' lines to be inverted. Link LK3 provides access to the eight output signals from IC5 (six channel change, 'special function 4' and 'free function pin') via a current limiting resistor, R15, to a common connection at PLC pin 6 which may be used to drive a Base Station control module, this allows special functions e.g. 'RF power control' to be selected on the basis of channel selected.

Facilities PCB AT28793/04

The purpose of the Facilities PCB is to decode commands originating from the M80 series Controller. These commands are in the form of FSK bursts and the assembly converts them into logic outputs corresponding to the base station facility requested by each command.

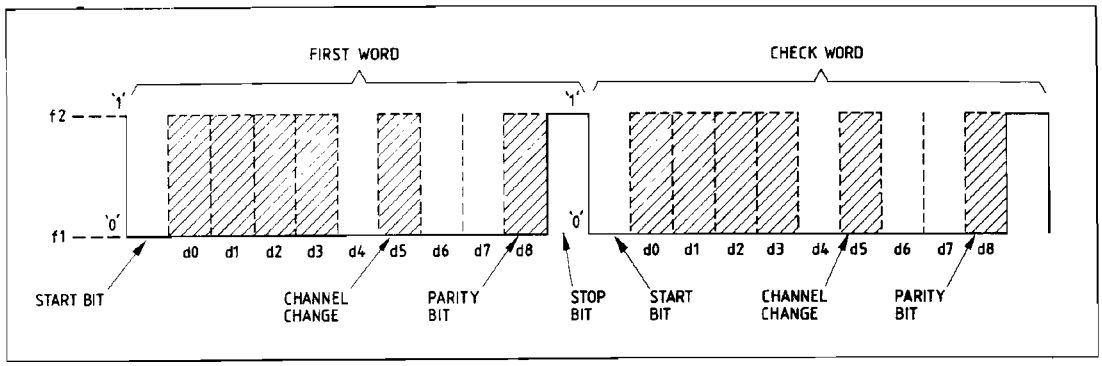


Fig. 4 M80 Signalling Format

Fig. 4 shows the format of an M80 FSK signalling burst. It consists of two eleven bit words, the second being a repeat of the first to provide extra security against noise and speech being decoded as FSK commands. Each word begins with a start bit, followed by the eight data bits, then a parity bit and finally a stop bit. The first four bits provide individual control for the base station facilities, provided the four most significant bits are 'low'. The sixth bit is used as a flag to indicate that the first four bits are to be interpreted as a channel change information, bits 4,5 and 7 being low.

Demodulation and Data Conversion

Line audio comes into the Facilities PCB on SKG pin 7 and is fed through a bandpass filter (IC1, IC2) and unity gain buffer amplifier IC3(b). After attenuation of the audio signal by R12 and R13, the FSK information present in the audio is fed into the demodulator IC4 and the demodulated output appears as a digital pulse train at pin 7. This output is gated with the lock output from IC4 pin 6 to provide a valid demodulated signal. NAND gate IC20(c) will then allow the data through to IC14, the Universal Asynchronous Receiver/Transmitter (UART), via IC8(c). Movement of data from IC20(c) is prevented by the OR gate IC8(c) while supervisory information is being sent.

The data is fed into IC14 on the 'Serial Data In' terminal, pin 20. IC14 converts this serial form data into parallel form by loading it into it's receiver holding register and then presenting the data outputs simultaneously on the receiver bus IC14 pins 5-12. When this has occurred, a logic 'high' appears on the Data Available Terminal pin 19 to flag the arrival of each word. Half a UART clock period later, IC15(b) applies a 'low' to IC14 pin 18 (Data Available Reset) resetting pin 19 to a 'low'. This enables IC14 to receive the next data pulse train from IC4.

Word Validation

IC15(a), IC16, IC18 and IC21 serve to check the validity of FSK information received by the Remote Control Module. A correct FSK signal burst should consist of two identical eight bit words. Each word is checked individually and then the lower nibble of the two are compared before their information is accepted. Referring to the receiver bus terminals of IC14, the frame error (FE) and parity error (PE) outputs indicate when the received word is the wrong length or when an odd number of bits have been corrupted in transmission.

For a correct data word, IC14 pins 5,6,8,13 and 14 of will be 'low'. When these outputs are accompanied by the data reset from IC15(b), there will be a pulsed 'high' output from the NOR gate IC21. This will be inverted to 'low' at the output of IC19(a). The result of this arrangement is that on arrival of the first data word, the output from IC15(a) pin 1 is switched to a 'low'. This 'low' together with the pulsed 'low' output from IC19(a) enables IC16(a) to latch the first four bits of the data word coming in from the D0-D3 terminals of IC14. On the arrival of the second data word, the pulsed 'high' output from IC21 will result in a reversal of the outputs from IC15(a) pins 1 and 2. In this state the latch IC16 will be disabled.

IC18 will then have the first data word from latch IC16 presented to it on pins 1,9,11 and 14 and the second data word, from IC14, presented on pins 2,7,10 and 15. Comparison of both words by IC18 will be enabled while there is a pulsed 'high' from IC21. If both words are the same, the outputs from IC18 pins 12 and 13 will be low and storing of the new information in the output latch IC17 will be enabled.

Facility Outputs

The valid data necessary for providing facility control in the base station appears as a 'high' on IC17 pins 4,5 and 6. Output pin 3 is a spare. Each output is then fed to the Interface PCB via a logic interface circuit comprising IC20(a),IC23 and TR1.

These outputs are routed as follows:-

(i) The talkthrough output from IC17 pin 6 is fed through OR gates IC7(a) and IC8(a), a 5V to 10V logic level converter IC23(d) and the NAND gate IC20(a). Gates IC8(a) and IC10(a) are to ensure that the mobile controlled talkthrough facility is only enabled when the Tone Lock Decoder is in receipt of the appropriate lock tone, i.e. when the receiver squelch is lifted. The talkthrough output is gated at IC7(a) with an output from the line-fail counter IC6. This allows IC6 to switch talkthrough on in the event of a line condition i.e. when the key tone is absent at SKG pin 9 of the Facilities PCB.

(ii) Squelch defeat output from pin 5 switches on TR1 and the collector current of this then operates the squelch defeat logic in the receiver. The squelch defeat control is also fed through logic level converter IC23(c) and gated with the talkthrough control at IC20(a). This ensures that the squelch defeat overrides the talkthrough.

(iii) The line intercom output from IC17 pin 4 is fed to IC23(b) which acts as a non-inverting buffer and logic level converter. This output is used in the Audio Assembly to inhibit keying of the transmitter.

Supervisory Function

IC9, IC12(a), IC13 and the associated logic gates provide a superivsory function by enabling a serial form data output from IC14, and from this producing a supervisory FSK tone burst.

To initiate this fuction, the current score of facility outputs from IC17 is transferred to the transmit bus, IC14 pins 26-29, via the select gate IC22. However, when the channel change facility occurs, IC22 will be switched to its opposite state, causing DO-D3 (pins 9-12) of the receive bus to be connected directly to DO-D3 of the transmit bus in IC14. D4, D6 and D7 of the transmit bus are strapped to logic 'low' and thus represent the check bits of the originally received word. D5 represents channel change and is also 'low', except when channel change is indicated in which case it will be 'high'.

When IC14 pin 23 is pulsed 'low', the data available on the transmit bus appears in serial form on the serial data output terminal, pin 25. This output is fed into IC9 on pin 9 where it is converted to FSK modulated data and is then routed to the Audio Assembly via SKG pin 6. The frequency of the FSK output is determined by externally connected timing resistors. Trimming potentiometers RV2 and RV3 provide a high and low frequency to the FSK output while RV4 sets the amplitude.

IC13 is a decade counter and controls the timing of FSK sends from IC9. On arrival of the first valid data word, the output of IC12(a) pin 2 will be clocked to a logic 'low' causing a reset to be applied to counter IC13 on pin 15. On arrival of the second valid word, the clocked output of IC12(a) changes its state to a logic high, and the reset is removed from IC13 allowing it to begin its count of 0-8. When IC13 reaches the count of 3 it will, by means of NAND gate IC10(a), cause a double negative-going pulse to be applied to IC14 pin 23. This results in a double send of the data word from IC14 pin 25, which is a facsimile of the originally received FSK signalling burst. The counter IC13 stops at 8 because of a reset 'high' from pin 8 to pin 13.

Channel Change

Referring to Fig.3 the binary coded channel change information is contained in the DO-D2 bits of the FSK data word. This is distinguished from facility information by the D5 bit which produces a logic 'high' on IC14 pin 7. Additionally, bits D4, D6 and D7 will produce a 'low' on pins 5,6 and 8 of IC14 and when these outputs are fed to IC25, they will be treated as valid channel change information. When this condition exists, and the output from IC18 pin 3 pulses 'high' then the output on IC25 pin 3 will also pulse 'high'. This enables the eight bit addressable latch IC24 to latch in the channel change information from IC14.

When a valid channel change word is received, the output at IC12(b) pin 13 will clock 'high'. Since this output is fed onto the transmit bus, IC14 pin 31, it will result in the supervisory signal correctly representing receipt of channel change information.

Line-Fail

The function of this is to provide an automatic switch to talkthrough if the line connection between the Remote Control Module and the M80 series Controller is broken. The counter of IC6 is reset whenever a valid data word is received and whenever keytone is detected. If neither of these events occur in a time period of 54 seconds, the counter will stop and IC6 pin 15 will go 'high'. Provided the link LK2 is in position B-D, this 'high' will be used to switch the Base Station to talkthrough.

Two alternative link positions are provided, these are:-

(i) A-D to provided continuous talkthrough

(ii) C-D to inhibit line-Fail talkthrough

Data Codes

The following is a list of the remotely controlled facilities and the data codes used for selecting them.

D7	D6	D5	D4	---------	D3	D2	D1	D0	Normal Use	
0	0	0	0		*	*	*	*		
Indicates bit per function								Function 1	Talkthrough	on = 1 off = 0
								Function 2	Squelch Defeat	on = 1 off = 0
								Function 3	Line Intercom	on = 1 off = 0
								Function 4	Special Function Reserved	
0	0	1	0		0	*	*	*		
Channel change					Binary coded channel number Null channel = 0000 i.e. no channel selected					
					0	0	0	1	Channel 1 selected	
					0	0	1	0	Channel 2 selected	
					0	0	1	1	Channel 3 selected	
					0	1	0	0	Channel 4 selected	
					0	1	0	1	Channel 5 selected	
					0	1	1	0	Channel 6 selected	

SETTING UP AND ALIGNMENT PROCEDURE

Note: (i) Before carrying out the following procedure ensure that the base station transmitter and receiver are correctly aligned.
(ii) For the purpose of this procedure no links need be fitted to the Interface PCB AT29074

TEST EQUIPMENT

Note: Refer to Part I, Table 3.1 for suitable types.

10 RF Signal Generator
2 AF Generator
19 SINAD Meter
22 50W, 50Ω Dummy Load
4 Digital Voltmeter
5 Oscilloscope
12 Frequency counter
- M80 Series Control Unit (wired for 2 or 4 wire line as required with facilities and channel change

TEST PROCEDURES

Linking Information

FACILITY ASSEMBLY AT28793/04

Link	Position	Function
LK1	A-B B-C	Engineering Tone On Supervisory On
LK2	B-D A-D C-D	Line Fail Talkthrough Permanent Talkthrough Inhibited Talkthrough

INTERFACE BOARD AT29074

Link	Position	Function
LK1	B-C A-B	Channel Change Logic Output Active Low Channel Change Logic Output Active High
LK2	B-C A-B	Logic Function Output Active Low Logic Function Output Active High
LK3	A B C D E F G H	Channel 1 Channel 2 Channel 3 Channel 4 Channel 5 Channel 6 Special Function Unused Open Collector Buffer

Note: (i) Set LK1 active low to select a channel, active high to select a base station.
(ii) Standard position for LK1, LK2 is B-C
(iii) Default standard for LK1, LK2 is low.

DC Supply Check

1. Switch off the base station and disconnect PLG/SKG interconnecting the RCM Facility PCB AT28793/04 and the Interface PCB AT29074.

2. Switch on the base station and check that the voltage between pin 2 of regulator IC1 and the negative plain of the Interconnecting PCB AT29074 is between 9,3 and 10,5V DC.

3. Switch off the base station and reconnect PLG/SKG.

FSK Output Level

1. Link RCM Facility PCB AT28793/04 as follows:-

   LK1 A-B Engineering Tone On
   LK2 C-D Inhibit Talkthrough

2. Ensure interconnections between Interface PCB AT29074 and Logic PCB AT29023 are as follows:-

   PLC pin 1 - P21 connected

   All other connections in the park position (pin 'a')

3. On the Logic PCB AT29023 connect a temporary shorting link between LK1 pin 1B and TP1 (ground), this opens the audio data path between the RCM Facility PCB AT28793/04 and line.

4. Connect the Audio Level Meter to SKU pins 1 and 3 (600Ω Rx) at the rear of the base station.

5. Switch on the base station.

6. Adjust RV4 on RCM Facility PCB AT28973/04 and RV14 on Control Audio PCB AT29024/01 for maximum output.

7. Adjust RV14 on Control Audio PCB AT29024/01 for an output to line of -10dBm.

8. Adjust RV4 on RCM Facility PCB AT28973/04 for an output to line of -14dBm (4 wire), -18dBm (2 wire).

9. Disconnect the Audio Level Meter from SKU pins 1 and 3, connect the Audio Frequency Counter to SKU pins 1 and 3.

Note: The controls detailed in the following procedures are factory preset; adjustments are normally only required if associated components are replaced.

10. Check tone output frequency is 2295Hz±5Hz, if necessary adjust RV3 on the RCM Facility PCB AT28793/04 to obtain this frequency.

11. Remove LK1 on the RCM Facility PCB AT28793/04.

12. Check tone output frequency is now 2505Hz±5Hz, if necessary adjust RV2 on the RCM Facility PCB AT28793/04 to obtain this frequency.

13. Refit LK1 on the RCM Facility PCB AT28793/04 in the B-C position.

14. Remove the temporary shorting link between LK1 pin 1b and TP1 on the Logic PCB AT29023, fitted at step 3.

15. Check that the FSK tone to line is muted.

16. If the Line Fail Talkthrough option is required fit LK2 B-D on the RCM Facility PCB AT28793/04.

FSK Receiver

1. Set the AF Signal Generator to -14dBm at 2,4kHz and connect to SKU pins 4 and 5 (Tx) on the rear of the base station.

2. Using the oscilloscope check that the peak voltage on TP1 of the RCM Facility PCB AT28793/04 is greater than 60mV.

3. Switch off the base station.

Functional Checks

1. Connect the M80 Series Control Unit to the 600Ω line socket SKU at the rear of the base station.

2. Connect the Thruline Wattmeter to the base station Tx Output.

3. Set the RF Signal Generator to 1mV at the frequency in use and connect to the base station Rx input.

4. Select the required Functions by removing the appropriate interconnecting leads between the Interface PCB AT29074 and the Logic PCB AT29023 from the 'park' position and connecting them to the enable position. Switch on the base station.

5. Carry out the applicable Functional Checks dependent on the linking and Options for which the base station is set up.

6. If any of the Functional checks fail, set up the FSK demodulator as follows:-
   (i) Using the oscilloscope, monitor IC20 pin 10 on the RCM Facility PCB AT28793/04
   (ii) Continually send Data Code 0000 0001 from the M80 Control Unit and adjust RV1 on the RCM Facility PCB AT28793/04 for a 1 to 1 mark space ratio for start bit and first data bit.

7. If Line Fail Talkthrough is enabled, disconnect the M80 Control Unit from the base station and check that the base station detects Line Fail within one minute and switches to Talkthrough.

Conclusion

1. Switch off base station and remove all test equipment.

2. Set links as required and reconnect all leads disconnected for the Test Procedure.

PARTS LIST

REMOTE CONTROL ASSEMBLY
AT14920

Cct Ref	Description	Part No.	Remarks
	PCB Assy RCM Facility	AT28793/04	
	PCB Assy Interface	AT29074	
	Cable assy ribbon	AT70246	To LK1, P21 Control PCB
	Cable assy ribbon	AT70247	To PLB Channel 1-6 Facilities
	Carrier Assy	AT14919	
	Pillar hexagon	BT04402	2/Carrier-Facilities PCB
	Pillar hexagon	BT04404	1/Carrier-Facilities PCB
	Scr st csk pozi M2,5 x 6mm	QJ11601/B	1/Post-carrier
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	3/Facilities PCB-posts, 2/Posts-carrier
	Scr st pan pozi M3 x 6mm	QJ11901/X	4/Interface PCB-carrier

FACILITY PCB
AT28793/04

Semiconductors & IC's

IC1-3	IC Dual Op Amp 1458	FU99092
IC4	IC FSK Demod/tone decoder	FU03751
IC5	IC 4060mos	FU99121
IC6	IC 4020mos	FU99067
IC7,8	IC 4071mos	FU99093
IC9	IC Mono function gen	FU03750
IC10	IC 4011mos	FU99062
IC11	IC 4081mos	FU99097
IC12	IC 4013mos	FU99064
IC13	IC 4017mos	FU99101
IC14	IC Uart	FU09159
IC15	IC 4027mos	FU99071
IC16,17	IC 4076mos	FU99140
IC18	IC Cos/mos Mag Comparator	FU09166
IC19	IC 4093mos	FU99103
IC20	IC 4023mos	FU99069
IC21	IC 4078mos	FU99130
IC22	IC 4019mos	FU99066
IC23	IC Quad comparator	FU99120
IC24	IC 4099	FU99136
IC25	IC 4585	FU99144
TR1,2	Transistor BC547b	FV05891

Resistors

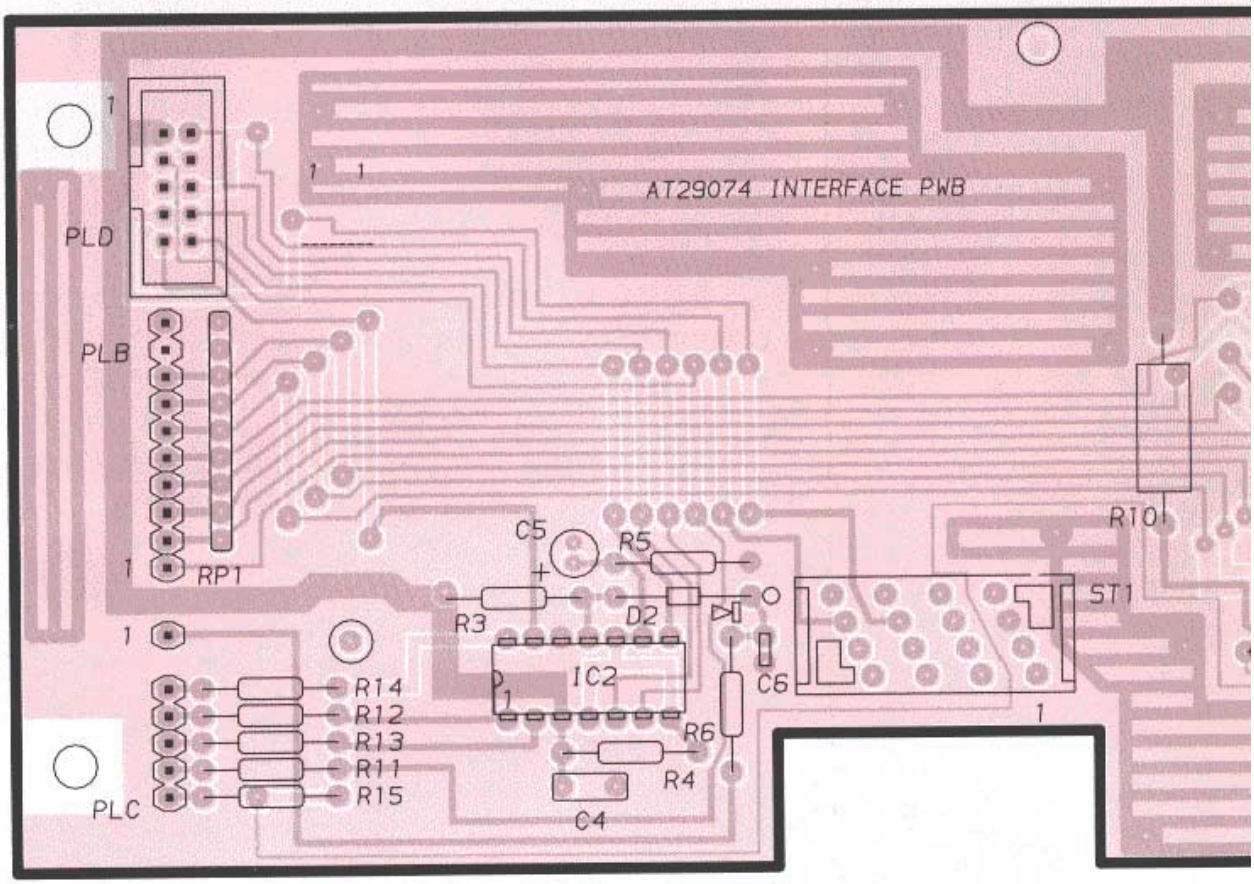
R1	4k64	±1%	0,25W	m film	PL99094
R2-4	8k25	±1%	0,25W	m film	PL99097
R5	6k81	±1%	0,25W	m film	PL99096
R6	21k5	±1%	0,25W	m film	PL99102
R7-9	8k25	±1%	0,25W	m film	PL99097
R10	6k81	±1%	0,25W	m film	PL99096
R11	38k3	±1%	0,25W	m film	PL99105
R12	3k3	±5%	0,25W	c film	PM01442
R13	2k2	±5%	0,25W	c film	PM01440
R14	150k	±5%	0,25W	c film	PM01462
R15	82k5	±1%	0,25W	m film	PL99109
R16	1m	±1%	0,25W	m film	PL51210
R17,18	100k	±1%	0,25W	m film	PL99110
R19	560k	±5%	0,25W	c film	PM01469
R20-22	22k	±5%	0,25W	c film	PM01452
R23	100k	±5%	0,25W	c film	PM01460
R24-27	56k	±5%	0,25W	c film	PM01457
R28	100k	±5%	0,25W	c film	PM01460
R29	1m	±1%	0,25w	m film	PL51210
R30	10k	±5%	0,25W	c film	PM01448
R31	100k	±5%	0,25W	c film	PM01460
R32	52k3	±1%	0,25W	m film	PL45345
R33	59k	±1%	0,25W	m film	PL45350
R34	220	±5%	0,25W	c film	PM01428
R35,36	10k	±5%	0,25W	c film	PM01448
R37	39k	±5%	0,25W	c film	PM01455
R38-40	10k	±5%	0,25W	c film	PM01448
R41	100k	±5%	0,25W	c film	PM01460
R42	100	±5%	0,25W	c film	PM01424

Cct Ref	Description	Part No.	Remarks
Resistors (Cont'd)			
R43,44	10k ±5% 0,25W c film	PM01448	
R45	100k ±5% 0,25W c film	PM01460	
R46	10k ±5% 0,25W c film	PM01448	
R47	39k ±5% 0,25W c film	PM01455	
R48,49	Not Used		
R50	10k ±5% 0,25W c film	PM01448	
R51-54	100k ±5% 0,25W c film	PM01460	
RV1	47k ±20% Pot skel lin	PL01498	
RV2/3	10k ±20% Pot skel lin	PL01478	
RV4	47k ±20% Pot skel lin	PL01498	
Capacitors			
C1	10 ±20% 63V elec	PS99445	
C2	10n ±5% pes	PQ99532	
C3,4	10n ±2,5% 63V pp	PQ99621	
C5	10n ±5% pes	PQ99532	
C6	100n ±10% 63V pes	PQ99511	
C7	4n7 ±5% 25V cerm	PN99731	
C8-10	100n ±10% 63V pes	PQ99511	
C11,12	10n ±10% 63V pes	PQ99510	
C13	470p ±5% cer	PN99886	
C14	220p ±5% cer	PN99882	
C15	33 ±20% 16V elec	PS99409	
C16	6n8 ±5% 25V cer	PN99732	
C17	1 ±20% 50V elec	PS99869	
C18	10 ±20% 63V elec	PS99445	
C19	470n ±20% 50V elec	PS99867	
C20,21	33 ±20% 16V elec	PS99409	
Miscellaneous			
	Cable ribbon 10 x 28awg	FC99200	
	Con fem skt 10 pos'n	FS99185	
PLA	Con PCB solder 10 pos'n	FP99150	
	Link connector	FC99060	
XL1	Xtal, cer resonator 307khz	FC03199	

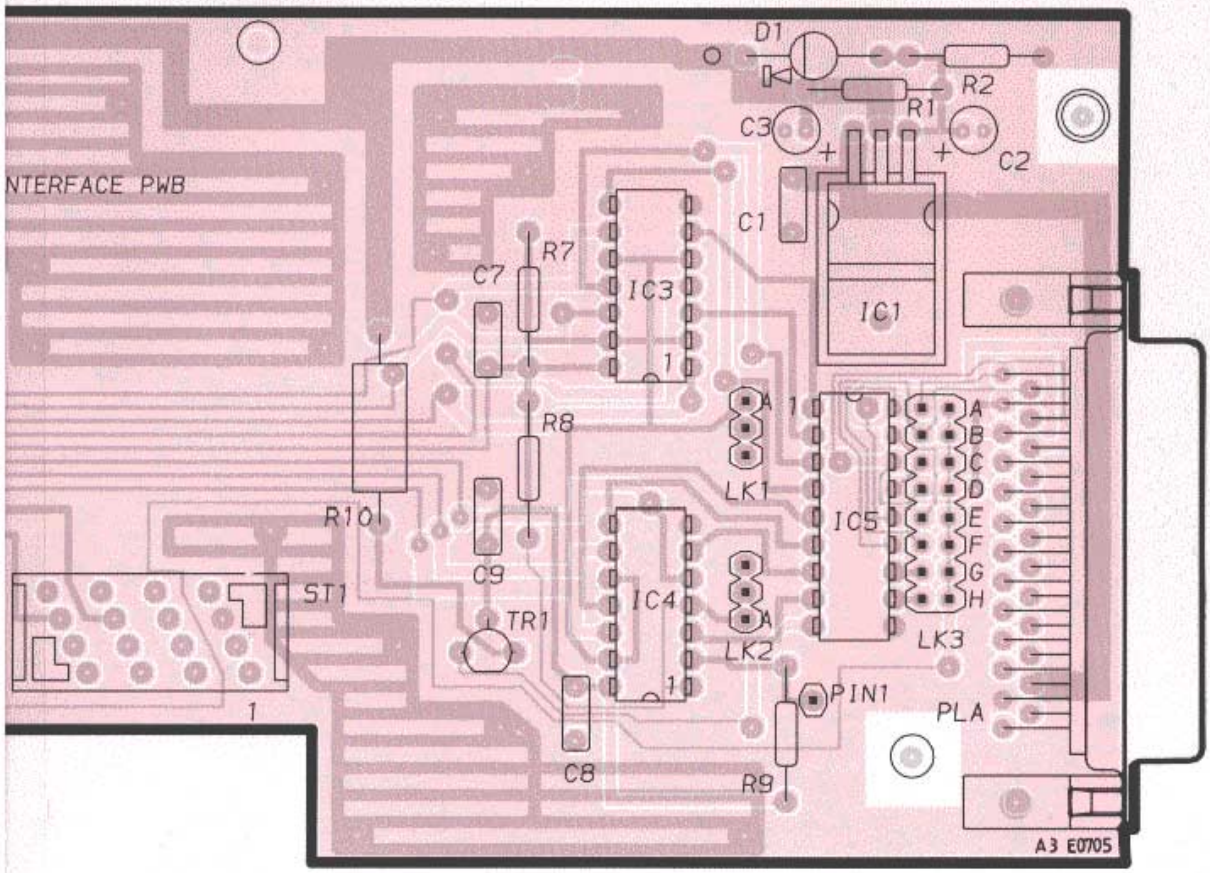
INTERFACE PCB
AT29074

Semiconductors & IC's			
IC1	IC Volt reg 317	FU99119	
IC2	IC Quad comparator	FU99120	
IC3,4	IC 74HC86	3513 993 32027	
IC5	IC UDN2595A	FU99708	
TR1	Transistor BC337	FV05896	
D1	Diode GP BYW54	FV05892	
D2	Diode GP 1N4148	FV05808	
D3			Not Used
D4-7	Diode GP 1N4148	FV05808	
Resistors			
R1	215 ±1% 0,25W m film	PL99078	
R2	1k47 ±1% 0,25W m film	PL99088	
R3	100k ±2% 0,25W m film	PM99330	
R4,5	10k ±2% 0,25W m film	PM99306	
R6	1k ±2% 0,25W m film	PM99282	
R7-9	10k ±2% 0,25W m film	PM99306	
R10	100 ±5% 2,5W ww	PM01124	
R11-15	820 ±2% 0,25W m film	PM99280	
RN1	100k ±5% 9-pin sil	RN99531	
Capacitors			
C1	100n ±10% 63V pes	PQ99511	
C2,3	1 ±20% 50V elec	PS99869	
C4	100n ±10% 63V pes	PQ99511	
C5	10 ±20% 35V elec	PS99861	
C6	1n ±20% cer	PN99915	
C7-9	100n ±10% 63V pes	PQ99511	

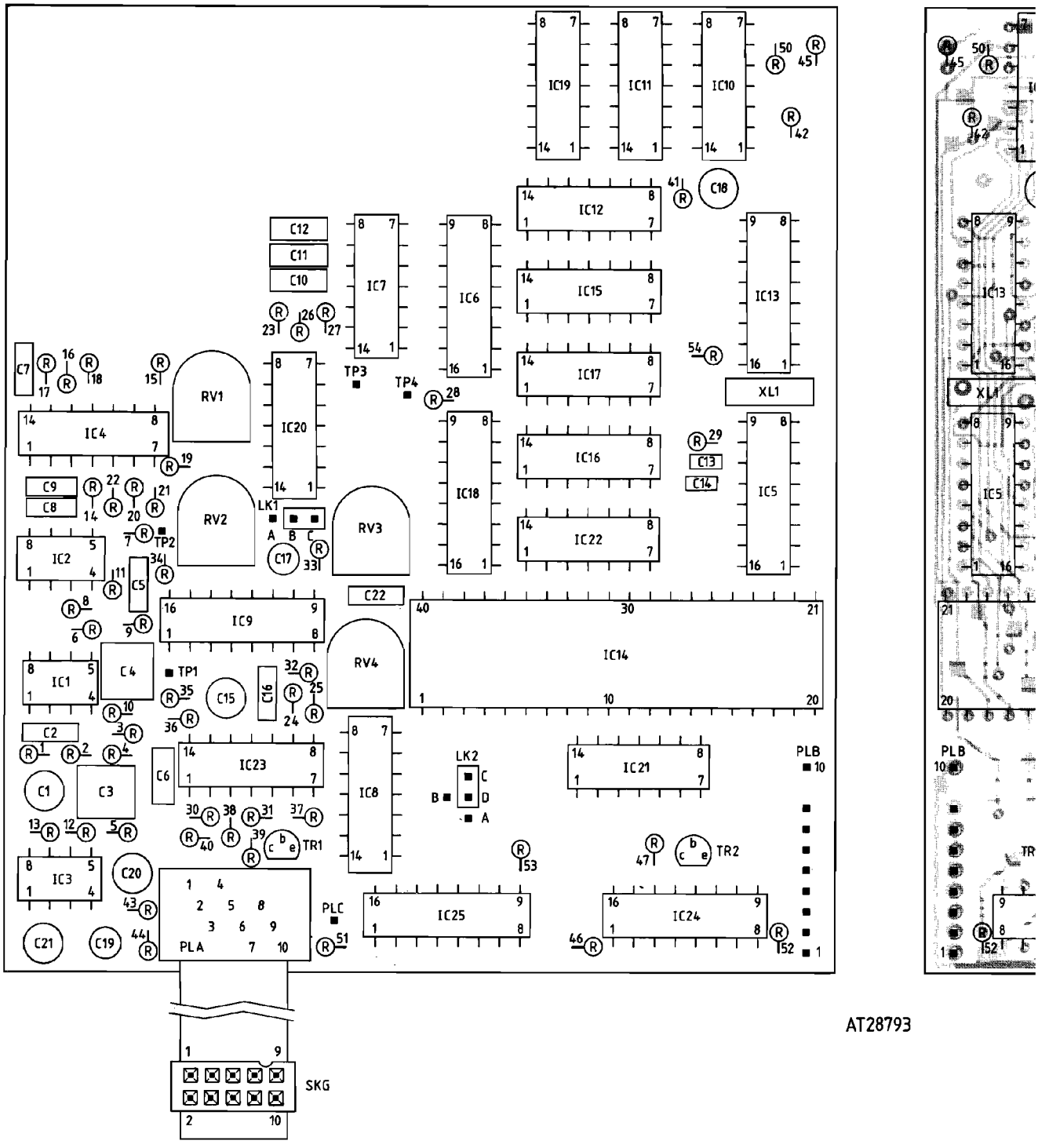
Cct Ref	Description	Part No.	Remarks
Miscellaneous			
	Cable assy ribbon	AT70245	To PLC on Control PCB
	Connector PCB solder 16 pos'n	FP99151	
Pin 1	Header 1 pos'n	3513 504 00121	
	Header less ears 10 pos'n	FP99220	
LK1,2	Header str male 3 pos'n	FC00837/03	
PLC	Header str male 7 pos'n	FC00837/07	
	Header str male 10 pos'n	FC00837/10	
	Link connector	FC99060	
	Plug 25-way D-type angle	FP99027	
LK3	Plug PCB mtd 2 X 8	FP99182	
	Nut st hex M2,5	QA11604/B	2/25-way plug
	Nut st hex M3	QA11605/X	1/IC1
	Bush insulating (TO-220)	QA99024	1/IC1
	Washer thermal (TO-220)	QA99111	1/IC1
	Scr st pan pozi M3 x 6mm	QJ11901/X	1/IC1
	Scr st pan pozi M2,5 x 10mm	QJ11947/B	2/25-way plug



INTERFACE PCB AT29074
LAYOUT DIAGRAM

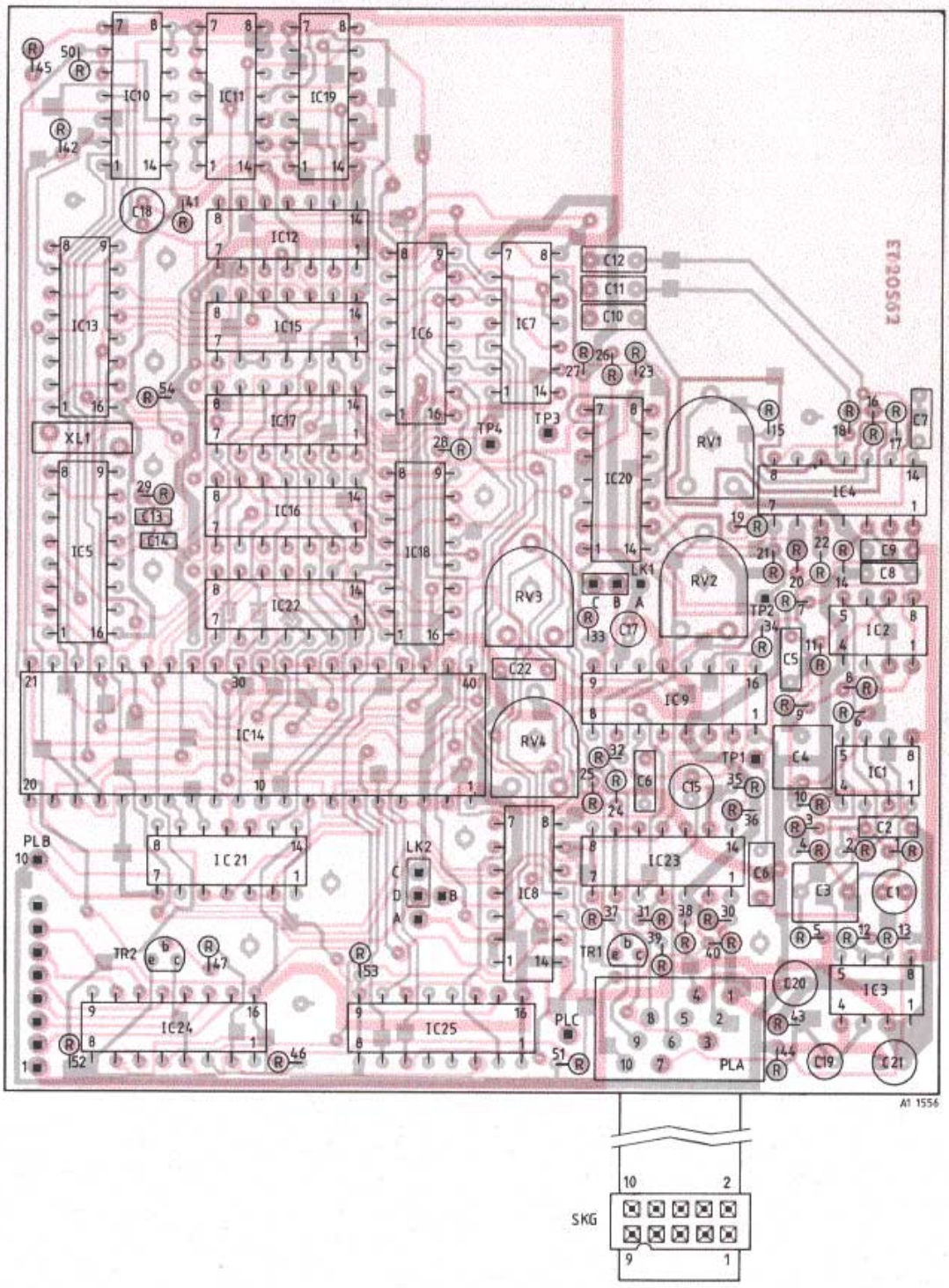


INTERFACE PCB AT29074
LAYOUT DIAGRAM



AT28793

FACILITY PCB
LAYOUT DIAGRA



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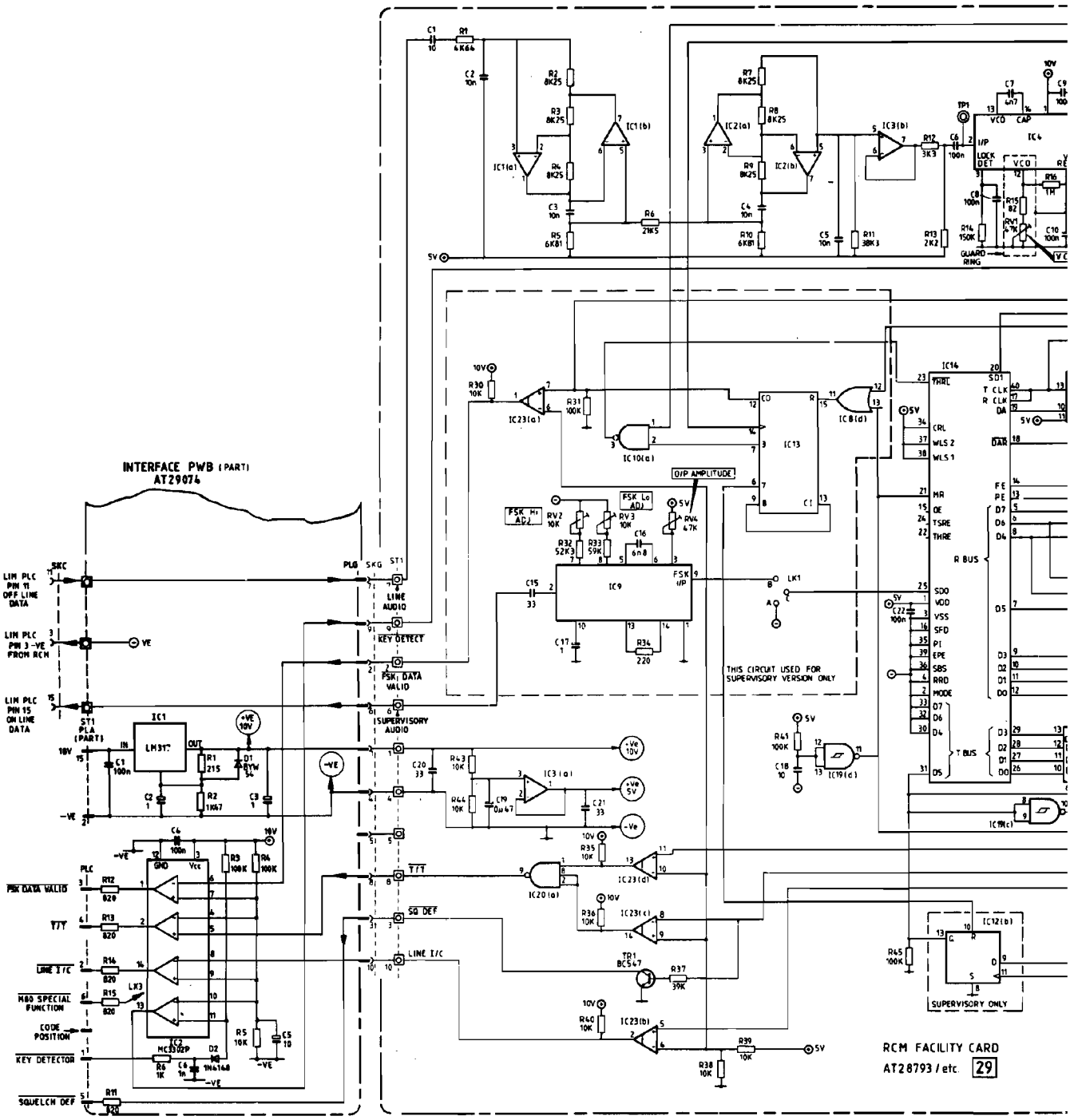
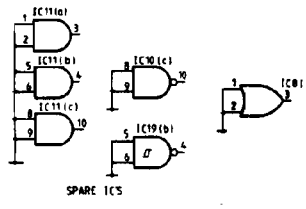
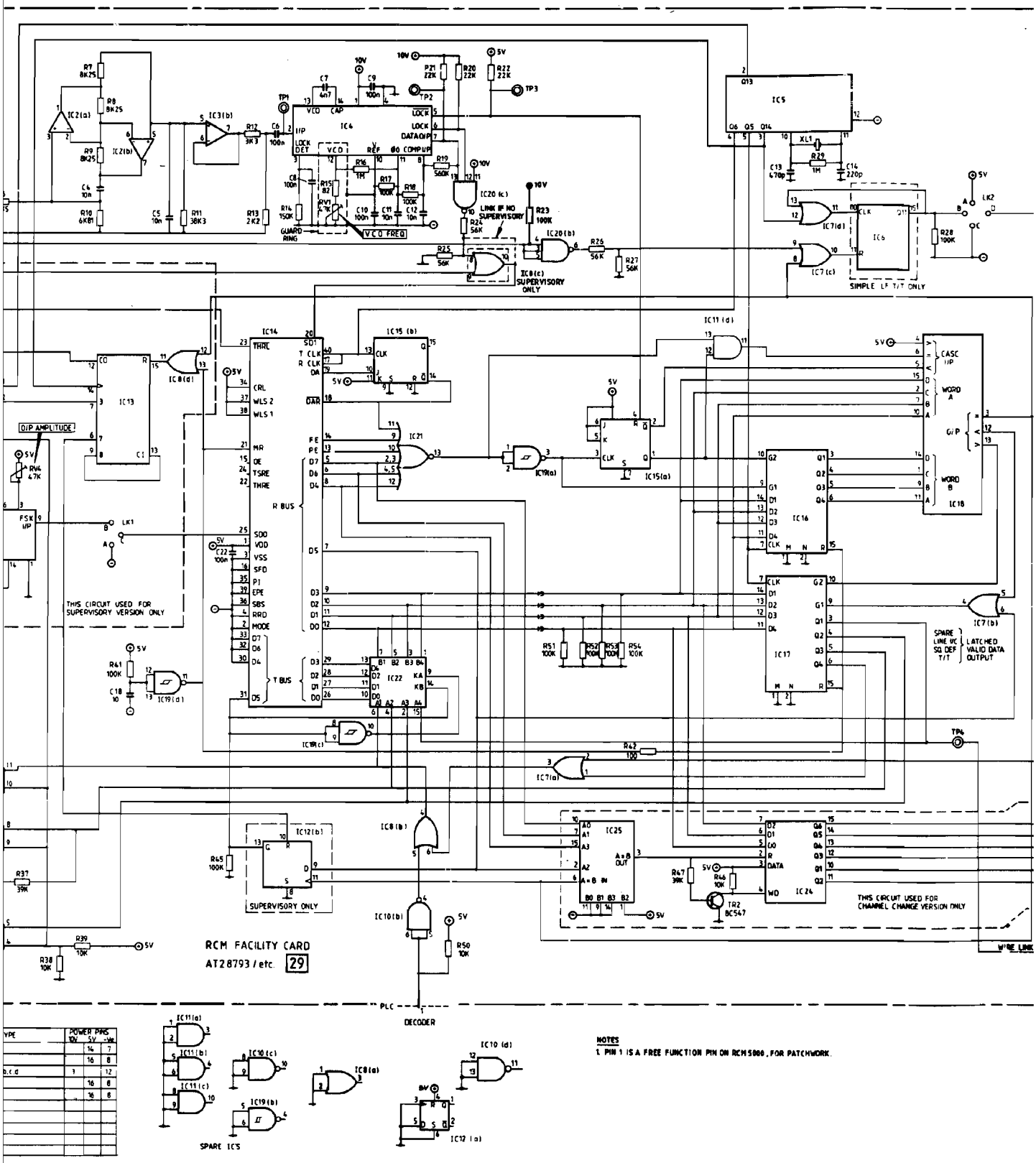
FACILITY PCB AT28793/04
LAYOUT DIAGRAM

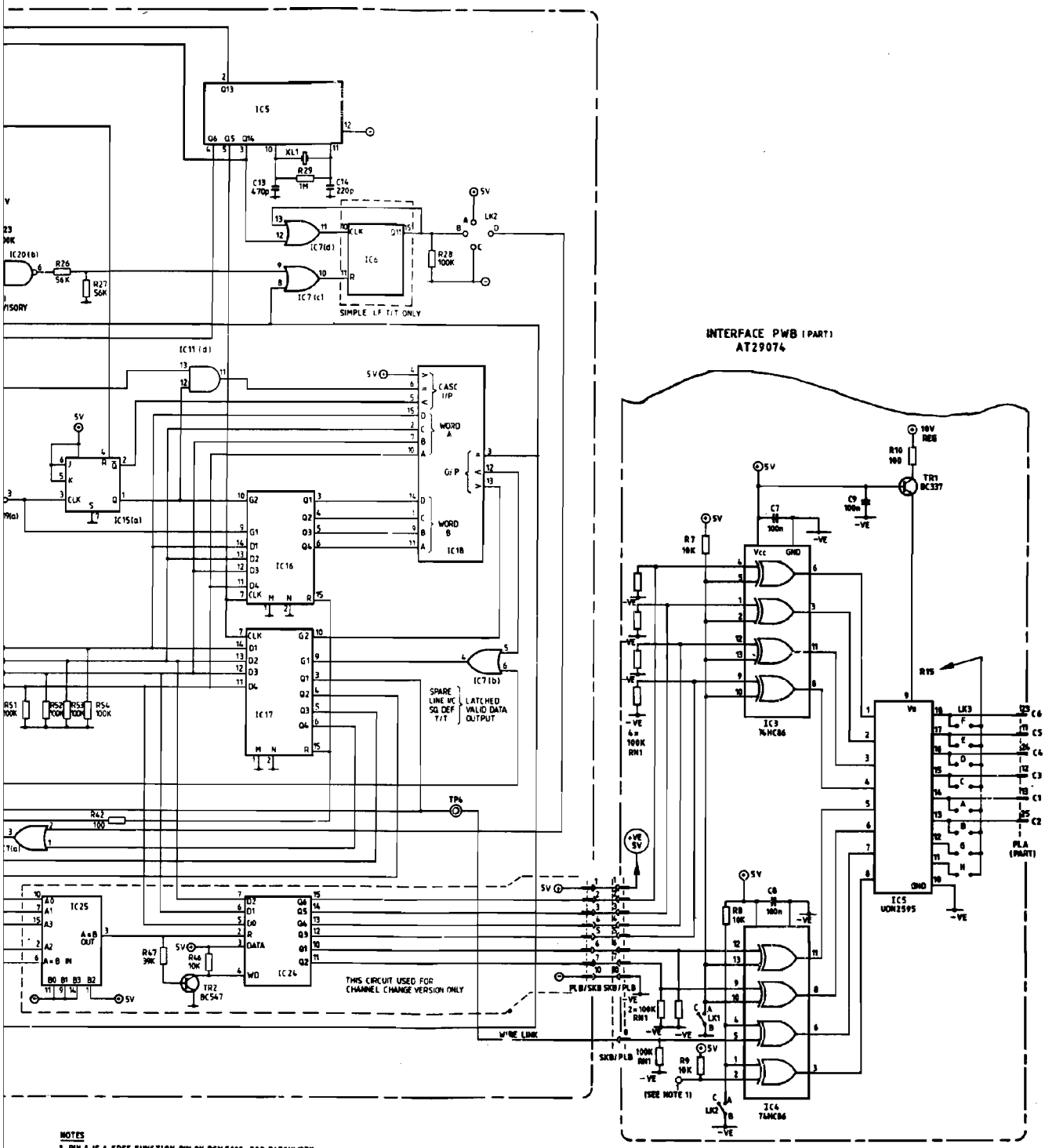


IC INFORMATION FOR RCM FACILITY CARD ONLY

IC No	TYPE	POWER PINS 10V	5V	-Ve
1	1458 a b	8		4
2	1458 a b	8		4
3	1458 a b	8		4
4	XR2211	1		4
5	4060		16	8
6	4020		16	8
7	4071 a b c d		14	7
8	4071 c d a (b SPARE)		14	7
9	XR2206	4		12
10	4011 a b d (c SPARE)		14	7
11	4081 a (b.b.c SPARE)		14	7
12	4013 a b		14	7
13	4017		16	8
14	COP1054		1	3
15	4027 a b		16	8
16	4076		16	8
17	4076		16	8
18	4585		16	8
19	4098 a c d (b SPARE)		14	7
20	4023 a b c	14		7
21	4078		14	7
22	4019		16	8
23	3302 a b c d	1		12
24	4099		16	8
25	4585		16	8




RCM FACILITY CARD
AT28793 / etc.
29
THIS CIRCUIT USED FOR SUPERVISORY VERSION ONLY
SUPERVISORY ONLY
THIS CIRCUIT USED FOR CHANNEL CHANGE VERSION ONLY
SIMPLE LF T/T ONLY
SPARE IC'S
DECODER
WIRE LINK
NOTES
1. PIN 1 IS A FREE FUNCTION PIN ON RCM5000, FOR PATCHWORK.



NOTES

1 PIN 1 IS A FREE FUNCTION PIN ON RCM5000, FOR PATCHWORK.

REMOTE CONTROL AT14920
CIRCUIT DIAGRAM

5000 SERIES CTCSS/VOTING/PIPTONE OPTIONS PCB

INTRODUCTION

The CTCSS/Voting/Piptone PCB is an option which may be fitted to the FR5000 series base stations. When fitted, it is located in the Control Module where it is mounted on the Control Logic PCB and electrically connected to the Front Panel PCB.

CTCSS

The CTCSS circuits provide sub-audio signalling facilities for FR5000 series base stations when used in CTCSS (Continuous Tone Controlled Squelch System) applications. In the receive mode, the decode facility is used to inhibit the audio path to the loudspeaker pending receipt of the correct tone. In the encode mode, activated by the press-to-transmit switch, the sub-audio tone is used to modulate the outgoing carrier.

Voting

The Voting circuits facilitate the automatic selection of the 'best' of a number of base station sites within range of a calling mobile. The Voting requirement is for the equipment to ensure that only intelligible signals are considered for selection purposes, and to automatically select the strongest signal. The basis for assessing the signal strength is receiver noise and carrier level as measured at the base station.

Piptone

Where a requirement exists to indicate that a channel is 'busy' provision is made to key the transmitter when the squelch opens to enable the transmission of a piptone. The piptone generator, when activated by a piptone enable input from the Control Logic PCB, provides a tone which is combined with the CTCSS tone and fed to the transmitter audio circuitry.

SUMMARY OF DATA

CTCSS

Signalling Format	Continuous sub-audio tone. Standard EIA CTCSS tones

CTCSS Encoder

Maximum No. of Tones	38
Tone Frequency Range	67,0Hz - 250,3Hz (Refer to Table 1 for specific frequencies)
Frequency Accuracy	Better than ±5% relative to nominal EIA frequency over the operating temperature range
Amplitude Stability	Less than ±1dB variation with frequency and temperature
Harmonic Distortion	Less than 5%
Risetime	Less than 50ms to 90% output level after removing inhibit

Reference Oscillator Frequency	1MHz	
Encode Level	15% Deviation	Nominal, adjustable between 8 and 16%

CTCSS Decoder

Frequency Accuracy	Better than 0,5%	
Selectivity	±0,5% minimum, ±3% maximum with a typical value of 1,7%	
Response Time	Less than 250ms	
Decode Sensitivity	0,2µV	

CTCSS Filter

Passband Gain	0dB ±0,5dB at 1kHz	
Passband Ripple	Less than ±0,5dB over the range 300Hz to 3kHz, relative to 1kHz	
Stopband Attenuation	Greater than 40dB over the range 67Hz to 250Hz	

Voting

Voting Frequencies (Hz)	2707 or No Tone - Squelch closed 2730 - Squelch open, no threshold exceeded 2791 - Threshold 1 exceeded 2852 - Threshold 2 exceeded 2913 - Threshold 3 exceeded 2972 - Threshold 4 exceeded	
Voting Frequency Tolerance	±1Hz	
Voting Level	-24dBm	
Voting Threshold Levels	0,6µV 1,0µV 2,0µV 5,0µV	Nominal, adjustable to suit customer requirements

Voting Filter

Passband gain	0dB ± 0,5dB at 1kHz	
Passband ripple	Less than ±0,5dB over the range 300 - 2500Hz, relative to 1kHz	
Standard attenuation	Greater than 30dB over the range 2,7kHz to 3kHz	

Piptone

Piptone Frequency		950 - 1100Hz
Piptone Level		60% Deviation Nominal, adjustable to suit customer requirements
Piptone Repitition Rate	2 Seconds (approx.)	

INSTALLATION

Note: (i) Refer to Fig.1 throughout this installation procedure.
(ii) Before installation ensure that all Links and Switches are set for the functions and frequencies required.

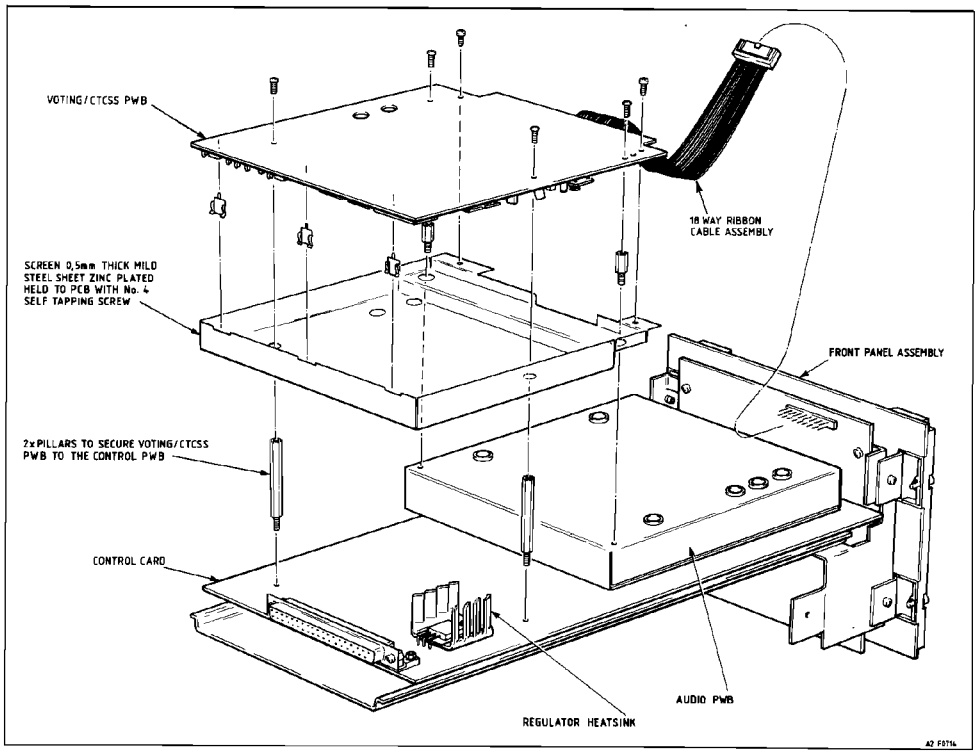


Fig.1 Installation

Installation Items

Description	Part No	Remarks
Pillar 7,1mm long	BT04074	2 off
Pillar 35mm long	BT04075	2 off

(1) Release the securing fasteners and withdraw the Control Module on its runners to gain access to the Control Logic PCB.

(2) Remove and retain the two M3 screws securing the Control Logic PCB to the plate assembly, fit the two 35mm hexagonal pillars provided in their place.

(3) Remove and retain the two rearmost M3 screws securing the screen assembly to the Control Audio PCB, fit the two 7,1mm hexagonal pillars provided in their place.

(4) Using the four screws retained at steps (2) and (3) secure the CTCSS/Voting/Piptone PCB to the four pillars.

(5) Connect the 20-way ribbon cable to PLB on the Control Module Front Panel PCB.

(6) Ensure all Links on the Control Logic and Options PCB's are correctly set for the options required.

(7) Relocate the Control Module in the shelf and lock the securing fasteners.

DETAILED DESCRIPTION

CTCSS

A separate IC, type FX365, is used for both the decode and encode functions. This permits duplex operation, with different decode and encode frequencies if necessary. The required 5 volt supply is provided by IC7(c).
A 1MHz clock frequency, generated by the oscillator in the decoder, IC15, and crystal XL1, is used to clock IC15 and, via pin 2, encoder IC16. Incoming Rx audio is applied to IC7(b), a low-pass filter with gain, which attenuates noise and speech signals above the tone signalling frequency range.
The signal level at the decoder input is preset at the factory and should not normally require adjustment, if however it becomes necessary to increase the decoder sensitivity or reduce 'falsing' RV3 may be adjusted. To increase decoder sensitivity turn RV3 clockwise (with PCB viewed from the non-component side), to reduce decoder 'falsing' turn RV3 anti-clockwise. When a tone is detected a 'low' output from IC15 pin 13 is fed to TR1, cutting it off, which produces a 'high' output to PLA pin 7. The 'low' output from IC15 pin 13 is also fed to TR2, cutting it off, which illuminates LED2, the Tone Valid indicator. The decode frequencies are set by DIL switch SA. The decoder can be overridden by linking LK10(b) D-E.

The CTCSS encoder is activated by the removal of the Disable CTCSS input at PLA pin 4 which connects to IC16 pin 17. The encoder output from IC16 pin 16 is fed via C33 to:-

(i) RV2, the set CTCSS LEVEL potentiometer, where it is combined with the output from the piptone generator and fed via summing amplifier IC7(d) to PLA pin 3

(ii) IC7(a) and its associated circuitry, illuminating LED3, the CTCSS TONE GENERATED indicator.

The encode frequencies are set by DIL switch SB.

Voting (ASSORT)

The output of Voting Encoder, IC14, is a sinewave, the frequency of which varies in steps between 2707Hz and 2972Hz according to the state of the squelch and the received signal strength.
With LK6 linked B-C no tone is produced when the squelch is closed, with LK6 linked A-B the lowest tone is produced when the squelch is closed. The next higher frequency corresponds to the squelch being open but no RF threshold level being exceeded.
Receiver noise at PLA pin 1 is fed via C27 and R43 to active rectifier, IC2(b) and associated components, which produces a DC level which corresponds to the receiver noise level. This DC is fed via IC8(a) to position C of links LK1-4.
A Carrier Level input at PLA pin 6 is fed via IC8(b) and associated circuitry to position A of links LK1-4.
The +14V DC at PLA pin 5 is applied across potential divider network R36,44, the input to IC2(a) being taken from their junction. IC2(a) output, a +7V DC reference is fed via R48 to potentiometers RV4-7 which set the four signal level thresholds. The comparators, IC9(a-d), can operate on either receiver noise DC or carrier level DC ,depending on the settings of LK1-4. Normally the lower two levels operate on receiver noise (links set B-C), and the two higher levels operate on carrier level (links set A-B).

The output from the comparators is fed to a series of OR gates IC12(b-d) which prevent invalid frequencies being generated if the thresholds are incorrectly set. Thus if any comparator operates before other comparators with a lower threshold level then the transmission gates associated with the lower levels are also opened.

Transmission gates IC13(a-d) are used to switch resistors R62-67 into the oscillator timing circuit as the thresholds are exceeded, thus increasing the tone frequency. The sinewave output from IC14 pin 2 is fed via R76, C40, R84 and TR4 to amplifier IC3(b) the gain of which is controlled by RV10, ASSORT LEVEL. IC3(b) output from pin 7 is fed via C42 to PLA pin 10 as ASSORT Tone. If the 'Disable ASSORT' input, PLA pin 16, is 'high' TR3 conducts, cutting off TR4 so that there is no voting tone output.
The voting encoder can be disabled by setting LK9 to B-C.

Piptone

A 'high' input on PLA pin 12 causes relaxation oscillator IC1(a) to apply a positive pulse to Wien Bridge oscillator IC1(b) approximately every 2 seconds producing a piptone. The output of IC1(a) is also fed via D1, R9 to LED1, PIPTONE indicator, causing it to flash at approximately 2 second intervals. The piptone, at a level set by RV1, PIPTONE LEVEL, is combined with the generated CTCSS tone in summing amplifier IC7(d) and then routed to the transmitter audio circuitry.
To enable the piptone level to be set, LK10(a) is linked A-B, causing the tone to be generated continuously.

Audio Filters

The receiver audio on PLA pin 9 is fed directly to a low-pass filter and, via Link 7 a high-pass filter. The low-pass filter comprising IC3(a), IC4(a,b), IC8(d), IC10(a-d) and their associated circuitry is used to remove speech frequencies within the frequency range of the voting tones, the notch frequencies being set by RV11-13. The high-pass filter comprising IC5(a,b), IC6(a,b), IC11(a-d) and their associated circuitry is used to remove CTCSS tones from the incoming Rx audio, and pass speech frequencies above 300Hz, the notch frequencies being set by RV14-16. Both filters are active seventh-order elliptic function filters and have a nominal unity gain in their respective passband. The low-pass filter is by-passed when LK7 is in the B-C position, the high-pass filter is by-passed when LK8 is in the B-C position. With both LK7 and LK8 in the A-B position both filters are in circuit. If filtered audio is required, LK25 on the Control Logic PCB must be linked B-C.

CTCSS Frequency Setting Up Procedure

Switch SA sets CTCSS encode frequency, switch SB sets CTCSS decode frequency. For Voting/Piptone Option both switches should be set to the 'No tone' position.

Nominal Frequency (Hz)	Switch Positions					
	1	2	3	4	5	6
67,0	0	0	0	0	0	0
71,9	0	0	0	0	0	1
74,4	1	0	0	0	0	0
77,0	0	0	0	0	1	1
79,7	0	1	0	0	0	0
82,5	1	0	0	0	0	1
85,4	1	1	0	0	0	0
88,5	1	0	0	0	1	1
91,5	0	0	1	0	0	0
94,8	0	1	0	0	0	1
97,4	1	0	1	0	0	0
100,0	0	1	0	0	1	1
103,5	1	1	0	0	0	1
107,2	1	1	0	0	1	1
110,9	0	0	1	0	0	1
114,8	0	0	1	0	1	1
118,8	1	0	1	0	0	1
123,0	1	0	1	0	1	1
127,3	0	1	1	0	0	1
131,8	0	1	1	0	1	1
136,5	1	1	1	0	0	1
141,3	1	1	1	0	1	1
146,2	0	0	0	1	0	1
151,4	0	0	0	1	1	1
156,7	1	0	0	1	0	1
162,2	1	0	0	1	1	1
167,9	0	1	0	1	0	1
173,8	0	1	0	1	1	1
179,9	1	1	0	1	0	1
186,2	1	1	0	1	1	1
192,8	0	0	1	1	0	1
203,5	0	0	1	1	1	1
210,7	1	0	1	1	0	1
218,1	1	0	1	1	1	1
225,7	0	1	1	1	0	1
233,6	0	1	1	1	1	1
241,8	1	1	1	1	0	1
250,3	1	1	1	1	1	1
No tone	1	1	1	1	0	0

0 = open, 1 = closed.

Table 1

TEST PROCEDURE

Test Equipment Required

Note: Refer to Part I, Table 3.1 for suitable types

10	RF Signal Generator	13	Modulation Meter
2	AF Generator	12	Frequency Counter
15	Thruline Wattmeter	4	Digital Voltmeter
19	SINAD Meter		

Note: (i) Before carrying out the following procedure ensure that the base station transmitter and receiver are correctly aligned.
(ii) For the CTCSS modulating frequency use the customer's frequency if known, or, if not known, 100.0Hz

Linking Information

Functions

LK1-4 A-B Carrier Level
B-C Noise Level

LK5 A-B Squelch. (Always set A-B)
B-C Rx Call

LK6 A-B Voting tone when squelch closed
B-C No voting tone when squelch closed

LK7 A-B Low pass filter in circuit
B-C Low pass filter out of circuit

LK8 A-B High pass filter in circuit
B-C High pass filter out of circuit

LK9 A-B Assort voting tone on
B-C Assort voting tone off

LK10a A-B Pip tone on at all times (Engineering mode)
B-C Pip tone keyed (active high)

LK10b D-E CTCSS tone lock off
E-F CTCSS tone lock enabled

Option	Option Board Links										
	LK1	LK2	LK3	LK4	LK5	LK6	LK7	LK8	LK9	LK10a	LK10b
CTCSS/Voting/Pip	B-C	B-C	A-B	A-B	A-B	A-B	A-B	A-B	A-B	B-C	E-F
Voting/Pip	B-C	B-C	A-B	A-B	A-B	A-B	A-B	B-C	A-B	B-C	E-D
CTCSS/Pip	B-C	B-C	A-B	A-B	A-B	A-B	B-C	A-B	B-C	B-C	E-F
CTCSS Decode/Pip	B-C	B-C	A-B	A-B	A-B	A-B	B-C	A-B	B-C	B-C	E-F

Ensure LK25 on the Control Logic PCB is linked B-C.

CTCSS Decode

(1) Set Links 1-10 on the options PCB for the CTCSS Decode/Pip option

(2) Set the signal generator frequency to the channel in use, output level 1mV with no CTCSS modulation and connect to the receiver antenna. Check that the Squelch Indicator on the Control Module front panel is extinguished.

(3) Link LK10b E-D, check that the Squelch Indicator on the Control Module front panel is lit. Reset LK10b E-F.

(4) Modulate the signal generator with the CTCSS frequency in use at 15% deviation, check that LED2, TONE VALID, on the options PCB and the Squelch Indicator on the Control Module front panel are lit.

(5) Reduce the signal generator output level to 0,2µV, check that LED2, TONE VALID, on the options PCB remains lit. Reduce the signal generator output to 0µV, check that LED2, TONE VALID, on the options PCB is extinguished.

CTCSS Encode

(1) Set Links 1-10 on the Options PCB for the CTCSS/Pip option

(2) Connect the modulation meter, via the thruline wattmeter, to the transmitter antenna socket, key the transmitter with no external modulation applied and adjust RV2, CTCSS LEVEL on the options PCB to give 15% deviation.

(3) Set the AF generator to 600mV at 1kHz and connect to SKA pin 14 on the transmitter driver module, adjust RV3, DEVIATION, on the Control Audio PCB to give 100% deviation.

(4) Set the AF generator to each of the following modulating frequencies in turn, 300Hz, 700Hz, 1kHz, 2kHz and 3kHz and check that the Peak System Deviation (+ve and -ve) at each frequency does not exceed:-
±5kHz for 25kHz Channel Spacing Equipments.
±4kHz for 20kHz Channel Spacing Equipments.
±2,5kHz for 12,5kHz Channel Spacing Equipments.

Voting

(1) Set Links 1-10 on the Options PCB for the Voting/Pip option

(2) With no RF input to the receiver and the squelch closed check that the Voting tone frequency is 2707Hz ±1Hz, if necessary adjust RV9 on the options PCB to achieve this frequency.

(3) Using the voltmeter check that the line level at PLA pin 10 is -24dBm (49mV), if necessary adjust RV10 on the options PCB, ASSORT LEVEL, to achieve this figure.

(4) Set the RF signal generator frequency to that of the channel in use, modulated with 1kHz at 60% deviation and connect to the receiver antenna socket. With the RF signal generator output at 0µV check that the four threshold level LED's, LED4-7, on the options PCB are extinguished.

(5) Set RV4-7 on the options PCB fully counter-clockwise.

(6) Set the signal generator output level to 0,6µV, turn the RF off then on and slowly rotate RV4 until LED7, LEVEL 1, JUST illuminates; check that the frequency is 2971Hz ±7Hz.

(7) Set the signal generator output level to 1,0µV, turn the RF off then on and slowly rotate RV5 until LED6, LEVEL 2, JUST illuminates; check that the frequency is 2852Hz ±5Hz.

(8) Set the signal generator output level to 2,0µV, turn the RF off then on and slowly rotate RV6 until LED5, LEVEL 3, JUST illuminates; check that the frequency is 2913Hz ±2Hz.

(9) Set the signal generator output level to 5,0µV, turn the RF off then on and slowly rotate RV7 until LED4, LEVEL 4, JUST illuminates; check that the frequency is 2972Hz ±1Hz. If necessary adjust RV8 on the Options PCB to achieve this frequency.

(10) Disable voting by fitting a temporary link between LK3 pin 4B and -ve on the Control Logic PCB, set the signal generator output to 1mV, unmodulated, check that the rejection is greater than 40dB down. Remove the temporary link.

Receiver Audio Response

(1) Defeat CTCSS encoder by linking LK10(b) D-E; defeat Voting by linking LK9 B-C.

(2) Set the signal generator output to 1mV with 60% deviation and check the frequency response at the line output at the frequencies tabulated below:-

Option	250Hz		300Hz		1kHz	3kHz	
	Min(dB)	Max(dB)	Min(dB)	Max(dB)	0dB ref	Min(dB)	Max(dB)
CTCSS Decode	-60	-30	+7,5	+11,4	0dB ref	-12,5	-8,6
Voting	-	-	+7,5	+11,4	0dB ref	-80	-40
CTCSS Decode + Voting	-60	-30	+7,0	+11,9	0dB ref	-80	-40

Piptone

(1) Set links 1-10 on the Options Board for CTCSS/Voting/Pip. Link LK12 A-B on the Control Logic PCB. Link LK10a on the Options Board A-B.

(2) Defeat CTCSS Tone by fitting a temporary link between LK3 pin 5B and -ve on the Control Logic PCB; key transmitter with no external modulation applied and adjust RV1, PIPTONE LEVEL, for 60% deviation.

(3) Using the frequency counter, check that the Piptone frequency is between 950 - 1100Hz.

WARNING
During the following check the Transmitter will key when the squelch opens

(4) Link LK10a B-C. Set the signal generator to the frequency of the channel in use at an output of 1mV, check that the PIPTONE indicator, LED1 on the Options Board flashes

(5) Remove the temporary link between LK3 pin 5B and -ve on the Control Logic PCB, fitted at step (2)

CAUTION
The surface mount potentiometers RV11-16 are difficult to adjust due to the shallow slot for the adjusting tool, extra care is therefore needed.

Note: RV11-16 are preset at the factory and should only be adjusted if a filter has been repaired or the filter response does not meet specification, do not attempt adjustment before checking the filter response.

CTCSS Filter

(1) Ensure that RV14,15,16 are set to their mid position. Link LK7 B-C, LK8 A-B.

(2) Connect the AF generator to the Options PCB PLA pin 9 and the distortion analyser to the Options PCB PLA pin 8.

(3) Set the AF generator to 142,0Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV14 to obtain the greatest rejection (measured in dB).

(4) Set the AF generator to 252,4Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV15 to obtain the greatest rejection (measured in dB).

(5) Set the AF generator to 222,9Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV16 to obtain the greatest rejection (measured in dB).

(6) Set the AF generator to 1000Hz at 300mV, check that the distortion analyser, set to 'voltmeter', reads 300mV ±18mV. Using the distortion analyser set level function adjust the sensitivity vernier for a reading of 0dB.

(7) Set the AF generator in turn to the frequencies listed below and check that the reading on the distortion analyser is within the given limits.

Frequency (Hz)	Output Level (dB relative to 1000Hz)	
	Minimum	Maximum
67	-	-40
250	-	-40
300	-0,5	+0,5
1000	0	0
2000	-0,5	+0,5
3000	-0,5	+0,5

Voting Filter

(1) Ensure that RV11,12,13 are set to their mid position. Link LK7 A-B, LK8 B-C.

(2) Connect the AF generator to the Options PCB PLA pin 9 and the distortion analyser to the Options PCB PLA pin 8.

(3) Set the AF generator to 2851Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV11 to obtain the greatest rejection (measured in dB).

(4) Set the AF generator to 2698Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV12 to obtain the greatest rejection (measured in dB).

(5) Set the AF generator to 4150Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV13 to obtain the greatest rejection (measured in dB).

(6) Set the AF generator to 1000Hz at 300mV, check that the distortion analyser, set to 'voltmeter', reads 300mV ±18mV. Using the distortion analyser set level function adjust the sensitivity vernier for a reading of 0dB.

(7) Set the AF generator in turn to the frequencies listed below and check that the reading on the distortion analyser is within the given limits.

Frequency (Hz)	Output Level (dB relative to 1000Hz)	
	Minimum	Maximum
300	-0,5	+0,5
1000	0	0
2000	-0,5	+0,5
2500	-0,5	+0,5
2700	-	-30
3000	-	-30

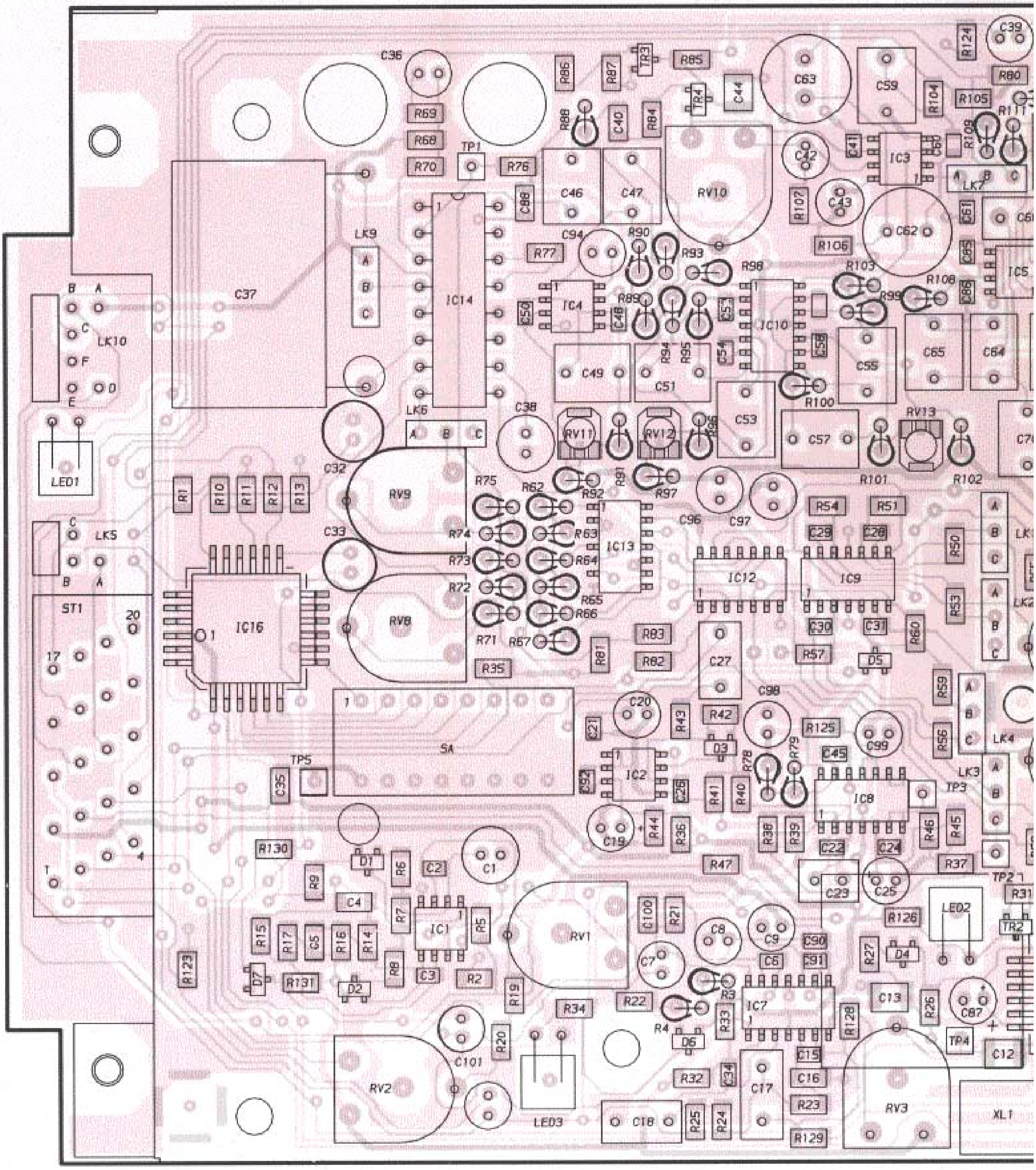
VOTING/CTCSS PCB ASSEMBLY
AT29061

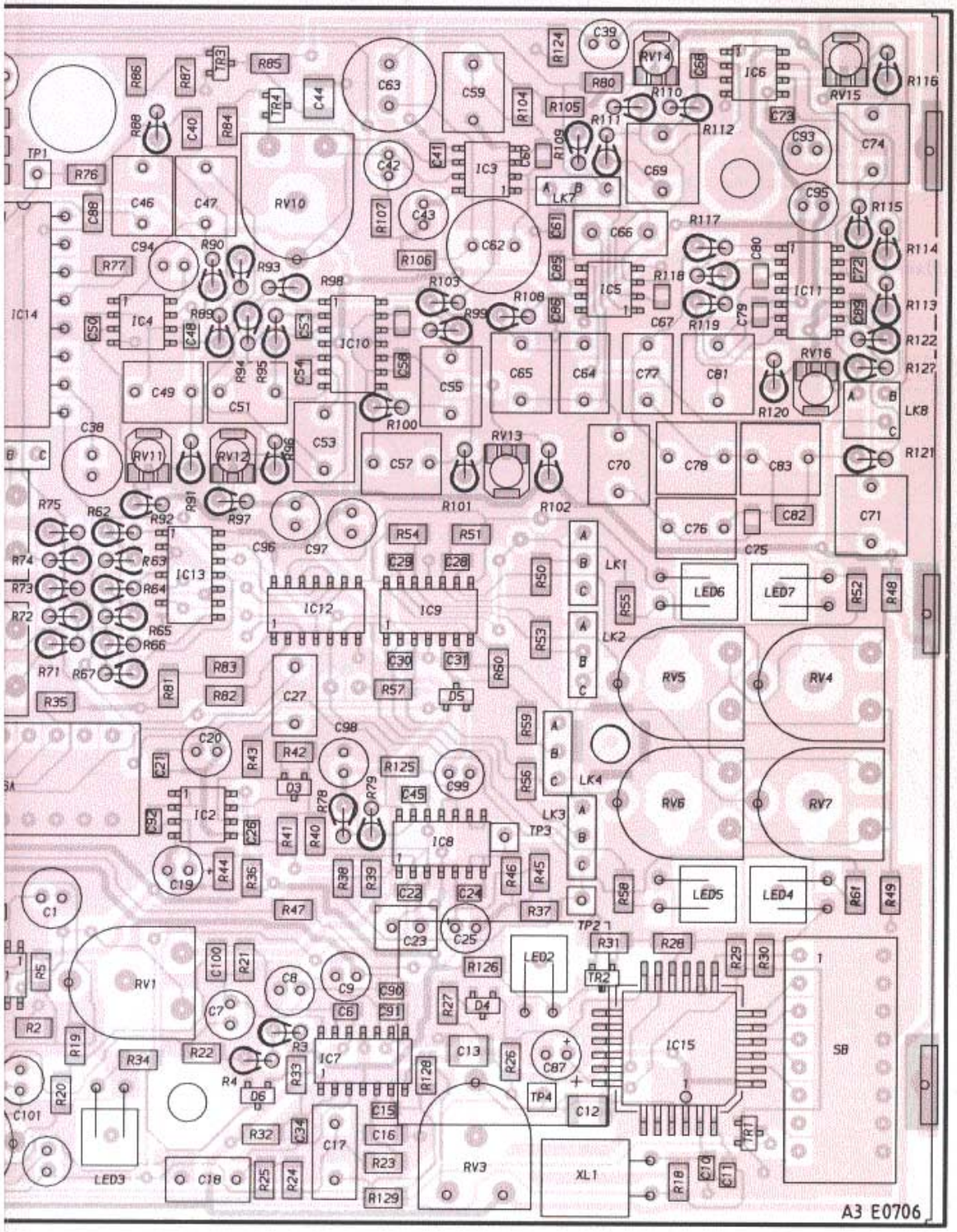
Cct Ref	Description	Part No	Remarks
Semiconductors & IC's			
IC1	IC Dual op amp MC1458D	3513 999 45004	
IC2	IC Dual op amp 4558	FU99806/SM	
IC3-6	IC Dual op amp MC1458D	3513 999 45004	
IC7	IC SMD LM348D	3513 999 45003	
IC8/9	IC SMD LM324 op amp	3513 999 45005	
IC10,11	IC SMD LM348D	3513 999 45003	
IC12	IC 4071B	FU99408/SM	
IC13	IC 4066B	3513 999 35019	
IC14	IC mono function gen	FU03750	
IC15,16	IC CTCSS encode/decode	FU99815/SM	
TR1-3	Transistor BCX19	FV99102/SM	
TR4	Transistor SMD BSR58	FV99156/SM	
D1	Diode Hyb Cct BAW56	3513 999 15001	
D2	Diode Hyb Cct BAV70	3513 999 15000	
D3	Diode Hyb Cct BAV99	3513 999 15002	
D4-7	Diode Hyb Cct BAS16	3513 999 15003	
Resistors			
R1,2	47k ±5% 0,125W SMD	3513 999 80056	
R3	36k ±2% 0,25W m film	PM99319	
R4	20k ±2% 0,25W m film	PM99313	
R5	47k ±5% 0,125W SMD	3513 999 80056	
R6	10k ±5% 0,125W SMD	3513 999 80048	
R7	100k ±5% 0,125W SMD	3513 999 80060	
R8	1k ±5% 0,125W SMD	3513 999 80036	
R9	1k5 ±5% 0,125W SMD	3513 999 80038	
R10	10k ±5% 0,125W SMD	3513 999 80048	
R11	3k3 ±5% 0,125W SMD	3513 999 80042	
R12	10k ±5% 0,125W SMD	3513 999 80048	
R13	3k3 ±5% 0,125W SMD	3513 999 80042	
R14	47k ±5% 0,125W SMD	3513 999 80056	
R15	22k ±5% 0,125W SMD	3513 999 80052	
R16	47k ±5% 0,125W SMD	3513 999 80056	
R17	10k ±5% 0,125W SMD	3513 999 80048	
R18	1M ±5% 0,125W SMD	3513 999 80072	
R19	56k ±5% 0,125W SMD	3513 999 80057	
R20	47k ±5% 0,125W SMD	3513 999 80056	
R21	22k ±5% 0,125W SMD	3513 999 80052	
R22-25	100k ±5% 0,125W SMD	3513 999 80060	
R26	820k ±5% 0,125W SMD	3513 999 80071	
R27	330k ±5% 0,125W SMD	3513 999 80066	
R28-31	4k7 ±5% 0,125W SMD	3513 999 80044	
R32	1k ±5% 0,125W SMD	3513 999 80036	
R33	47k ±5% 0,125W SMD	3513 999 80056	
R34	1k5 ±5% 0,125W SMD	3513 999 80038	
R35,36	10k ±5% 0,125W SMD	3513 999 80048	
R37	3k3 ±5% 0,125W SMD	3513 999 80042	
R38	68k ±5% 0,125W SMD	3513 999 80058	
R39	6k8 ±5% 0,125W SMD	3513 999 80046	
R40	47k ±5% 0,125W SMD	3513 999 80056	
R41	4k7 ±5% 0,125W SMD	3513 999 80044	
R42	68k ±5% 0,125W SMD	3513 999 80058	
R43	4k7 ±5% 0,125W SMD	3513 999 80044	
R44	10k ±5% 0,125W SMD	3513 999 80048	
R45	18k ±5% 0,125W SMD	3513 999 80051	
R46	10k ±5% 0,125W SMD	3513 999 80048	
R47	15k ±5% 0,125W SMD	3513 999 80050	
R48,49	1k5 ±5% 0,125W SMD	3513 999 80038	
R50	33k ±5% 0,125W SMD	3513 999 80054	
R51	180k ±5% 0,125W SMD	3513 999 80063	
R52	1k5 ±5% 0,125W SMD	3513 999 80038	
R53	15k ±5% 0,125W SMD	3513 999 80050	
R54	180k ±5% 0,125W SMD	3513 999 80063	
R55	1k5 ±5% 0,125W SMD	3513 999 80038	
R56	4k7 ±5% 0,125W SMD	3513 999 80044	
R57	180k ±5% 0,125W SMD	3513 999 80063	
R58	1k5 ±5% 0,125W SMD	3513 999 80038	
R59	4k7 ±5% 0,125W SMD	3513 999 80044	
R60	180k ±5% 0,125W SMD	3513 999 80063	
R61	1k5 ±5% 0,125W SMD	3513 999 80038	
R62	56k2 ±1% 0,25W m film	PM99107	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R63	2k15	±1%	0,25W	m film	PM99090	
R64	46k4	±1%	0,25W	m film	PM99106	
R65	2k15	±1%	0,25W	m film	PM99090	
R66	38k3	±1%	0,25W	m film	PM99105	
R67	31k6	±1%	0,25W	m film	PM99104	
R68,69	4k7	±5%	0,125W	SMD	3513 999 80044	
R70	22k	±5%	0,125W	SMD	3513 999 80052	
R71	27k	±2%	0,25W	m film	PM99316	
R72	6k81	±1%	0,25W	m film	PM99096	
R73	464	±1%	0,25W	m film	PM99082	
R74	26k1	±1%	0,25W	m film	PM99103	
R75	8k25	±1%	0,25W	m film	PM99097	
R76	4k7	±5%	0,125W	SMD	3513 999 80044	
R77	220	±5%	0,125W	SMD	3513 999 80028	
R78,79	10k	±1%	0,25W	m film	PM99098	
R80	47k	±5%	0,125W	SMD	3513 999 80056	
R81-83	10k	±5%	0,125W	SMD	3513 999 80048	
R84,85	22k	±5%	0,125W	SMD	3513 999 80052	
R86	10k	±5%	0,125W	SMD	3513 999 80048	
R87	1k5	±5%	0,125W	SMD	3513 999 80038	
R88	8k25	±1%	0,25W	m film	PM99097	
R89	12k1	±1%	0,25W	m film	PM99099	
R90	10k	±1%	0,25W	m film	PM99098	
R91	8k2	±2%	0,25W	m film	PM99304	
R92	20k	±2%	0,25W	m film	PM99313	
R93	10k	±1%	0,25W	m film	PM99098	
R94	17k8	±1%	0,25W	m film	PM99101	
R95	10k	±1%	0,25W	m film	PM99098	
R96	8k2	±2%	0,25W	m film	PM99304	
R97	24k	±2%	0,25W	m film	PM99315	
R98	10k	±1%	0,25W	m film	PM99098	
R99	3k16	±1%	0,25W	m film	PM99092	
R100	10k	±1%	0,25W	m film	PM99098	
R101	8k2	±2%	0,25W	m film	PM99304	
R102	10k	±1%	0,25W	m film	PM99098	
R103	4k64	±1%	0,25W	m film	PM99094	
R104	22k	±5%	0,125W	SMD	3513 999 80052	
R105	10k	±5%	0,125W	SMD	3513 999 80048	
R106,107	100k	±5%	0,125W	SMD	3513 999 80060	
R108	56k	±2%	0,25W	m film	PM99324	
R109	10k	±1%	0,25W	m film	PM99098	
R110	1k	±1%	0,25W	m film	PM99086	
R111	10k	±1%	0,25W	m film	PM99098	
R112	22k	±2%	0,25W	m film	PM99314	
R113	10k	±1%	0,25W	m film	PM99098	
R114	1k	±1%	0,25W	m film	PM99086	
R115	10k	±1%	0,25W	m film	PM99098	
R116	36k	±2%	0,25W	m film	PM99319	
R117	10k	±1%	0,25W	m film	PM99098	
R118	1k	±1%	0,25W	m film	PM99086	
R119	10k	±1%	0,25W	m film	PM99098	
R120	33k	±2%	0,25W	m film	PM99318	
R121	56k	±2%	0,25W	m film	PM99324	
R122	110k	±2%	0,25W	m film	PM99331	
R123,124	100k	±5%	0,125W	SMD	3513 999 80060	
R125	3k3	±5%	0,125W	SMD	3513 999 80042	
R126	1k5	±5%	0,125W	SMD	3513 999 80038	
R127	5k1	±2%	0,25W	m film	PM99299	
R128,129	1k	±5%	0,125W	SMD	3513 999 80036	
R130	10k	±5%	0,125W	SMD	3513 999 80048	
R131	100k	±5%	0,125W	SMD	3513 999 80060	
RV1,2	10k	±20%	Pot skel lin		PL01478	
RV3	2k2	±20%	Pot skel lin		PL99001	
RV4-7	47k	±20%	Pot skel lin		PL01498	
RV8,9	4k7	±20%	Pot skel lin		PL01486	
RV10	10k	±20%	Pot skel lin		PL01478	
RV11-13	5k	±25%	Pot lin		PL99560/SM	
RV14-16	10k	±25%	Pot		3513 999 95007	
Capacitors						
C1	22	±20%	25V	elec	PS99421	
C2,3	47p	±5%	50V	SMD	3513 999 55321	
C4,5	3n3	±5%	200V	SMD	CN99154	
C6	47p	±5%	50V	SMD	3513 999 55321	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C7-9	10	±20%	16V	elec	PS99855	
C10	68p	±5%	50V	SMD	3513 999 55323	
C11	33p	±5%	50V	SMD	3513 999 55319	
C12,13	100n	±10%	200V	SMD	3513 999 55017	
C14						Not Used
C15	47p	±5%	50V	SMD	3513 999 55321	
C16	680p	±5%	50V	SMD	CN99053	
C17	33n	±5%		pes	PQ99539	
C18	10n	±5%		cer	PN99906	
C19,20	10	±20%	16V	elec	PS99855	
C21,22	47p	±5%	50V	SMD	3513 999 55321	
C23	100n	±20%	50V	pes	PQ99556	
C24	47p	±5%	50V	SMD	3513 999 55321	
C25	470n	±20%	50V	elec	PS99867	
C26	47p	±5%	50V	SMD	3513 999 55321	
C27	10n	±5%		cer	PN99906	
C28-31	47p	±5%	50V	SMD	3513 999 55321	
C32	1	±20%	100V	elec	PS99455	
C33	10	±20%	16V	elec	PS99855	
C34	47p	±5%	50V	SMD	3513 999 55321	
C35	10n	±10%	200V	SMD	3513 999 55492	
C36	10	±20%	16V	elec	PS99855	
C37	10n	±2%	200V	mica	PP25012	
C38	1	±20%	100V	elec	PS99455	
C39	10	±20%	16V	elec	PS99855	
C40	10n	±10%	200V	SMD	3513 999 55492	
C41	47p	±5%	50V	SMD	3513 999 55321	
C42,43	10	±20%	16V	elec	PS99855	
C44	100n	±10%	200V	SMD	3513 999 55017	
C45	47p	±5%	50V	SMD	3513 999 55321	
C46,47	6n8	±5%		cer	PN99905	
C48	47p	±5%	50V	SMD	3513 999 55321	
C49	6n8	±5%		cer	PN99905	
C50	47p	±5%	50V	SMD	3513 999 55321	
C51	6n8	±5%		cer	PN99905	
C52	47p	±5%	50V	SMD	3513 999 55321	
C53	6n8	±5%		cer	PN99905	
C54	47p	±5%	50V	SMD	3513 999 55321	
C55	6n8	±5%		cer	PN99905	
C56	47p	±5%	50V	SMD	3513 999 55321	
C57	6n8	±5%		cer	PN99905	
C58	47p	±5%	50V	SMD	3513 999 55321	
C59	6n8	±5%		cer	PN99905	
C60,61	47p	±5%	50V	SMD	3513 999 55321	
C62,63	100	±20%	25V	elec	PS99424	
C64	3n3	±2,5%	63V	pp	PQ99618	
C65	4n7	±2,5%	63V	pp	PQ99619	
C66	47n	±5%		pes	PQ99534	
C67,68	47p	±5%	50V	SMD	3513 999 55321	
C69	10n	±2,5%	63V	pp	PQ99621	
C70	6n8	±2,5%	63V	pp	PQ99620	
C71	10n	±2,5%	63V	pp	PQ99621	
C72,73	47p	±5%	50V	SMD	3513 999 55321	
C74	10n	±2,5%	63V	pp	PQ99621	
C75	560p	±5%	50V	SMD	CN99033	
C76	6n8	±2,5%	63V	pp	PQ99620	
C77	3n3	±2,5%	63V	pp	PQ99618	
C78	10n	±2,5%	63V	pp	PQ99621	
C79,80	47p	±5%	50V	SMD	3513 999 55321	
C81	10n	±2,5%	63V	pp	PQ99621	
C82	1n5	±5%	50V	SMD	3513 999 55420	
C83	10n	±2,5%	63V	pp	PQ99621	
C84	10	±20%	16V	elec	PS99855	
C85,86	47p	±5%	50V	SMD	3513 999 55321	
C87	1	±20%	100V	elec	PS99455	
C88	10n	±10%	200V	SMD	3513 999 55492	
C89-92	47p	±5%	50V	SMD	3513 999 55321	
C93-99	10	±20%	16V	elec	PS99855	
C100	3n3	±5%	200V	SMD	CN99154	
C101	2µ2	±20%	50V	elec	PS99871	

Cct Ref	Description	Part No	Remarks
Miscellaneous			
	Clip	QA04097	3/Screen
	Header straight male 1 pos'n	3513 504 00121	
	Header straight male 3 pos'n	FC00837/03	
	Holder LED	QA05846	1/LED1-7
	Lead Assembly	AT70237	
LED1-7	LED red	FV05860	
	Link connector	FC99060	
	Mount foam 25 x 12 x 1,5mm	FR05020	1/C37
	Plug PCB mtd rt angle 2 x 2	FP99173	
	Plug PCB mtd rt angle 2 x 4	FP99197	
	Plug PCB mtd straight 2 x 2	FP99172	
	Screen CTCSS/ASSORT	BT26415	
	Scr st tap pozi No4 x 6,5mm	QJ08227/X	2/Screen-PCB
	Switch min dil 8-way	FS99031	
	Tab mtg ½" x ½" x 1,5mm	FR05017	1/XL1
XL1	Xtal 1MHz holder QC45	FC06165	
Installation Items			
	Pillar 7,5mm long	BT04074	
	Pillar 35mm long	BT04075	
	Scr st pan pozi M3 x 6mm	QJ11901/X	2/Control audio PCB, 2/Control logic PCB, 4/Voting CTCSS PCB-pillars


C36
R69
R68
R70
TP1
R76
R86
R87
TR3
R85
TR4
C44
C63
C59
R124
C39
R80
R104
R105
R88
C40
R84
C41
IC3
C60
R109
R111
C37
C46
C47
RV10
C42
C43
R107
C61
LK7
C88
IC14
LK9
A
B
C
R77
C94
R90
R93
R98
R106
C62
R103
R108
R99
C65
IC5
C86
IC4
C50
C48
R89
R94
R95
C52
C54
IC10
C58
C55
C65
C64
LK10
F
D
E
C49
C51
R100
LED1
LK6
C38
RV11
RV12
R96
C53
C57
RV13
R101
R102
C32
RV9
R75
R62
R91
R92
R97
C96
C97
R54
R51
R1
R10
R11
R12
R13
LK5
R74
R63
IC13
C29
C28
R50
C33
R73
R64
IC12
IC9
ST1
20
17
IC16
RV8
R72
R65
R66
R71
R67
R83
R82
R81
R35
C27
C30
C31
R57
D5
R53
R60
LK2
R59
5A
C20
R42
R43
C21
C98
R125
C99
R56
LK4
LK3
TP5
C35
C92
IC2
D3
C26
R41
R40
R78
R79
C45
IC8
TP3
R44
C19
R36
R38
R39
R46
R45
R130
D1
R6
C2
C1
C22
C24
R47
R37
TP2
R9
C4
R31
R7
IC1
R5
RV1
C100
R21
C23
C25
LED2
TR2
R15
R17
C5
R16
R14
C8
C9
C90
R126
R27
D4
R123
D7
R131
D2
R8
C3
R2
R19
C7
C6
C91
R3
R34
R22
IC7
C13
R26
C87
R4
D6
R33
R128
TP4
C12
C101
R20
C15
RV2
LED3
R32
C34
C17
C16
RV3
XL1
C18
R25
R24
R23
R129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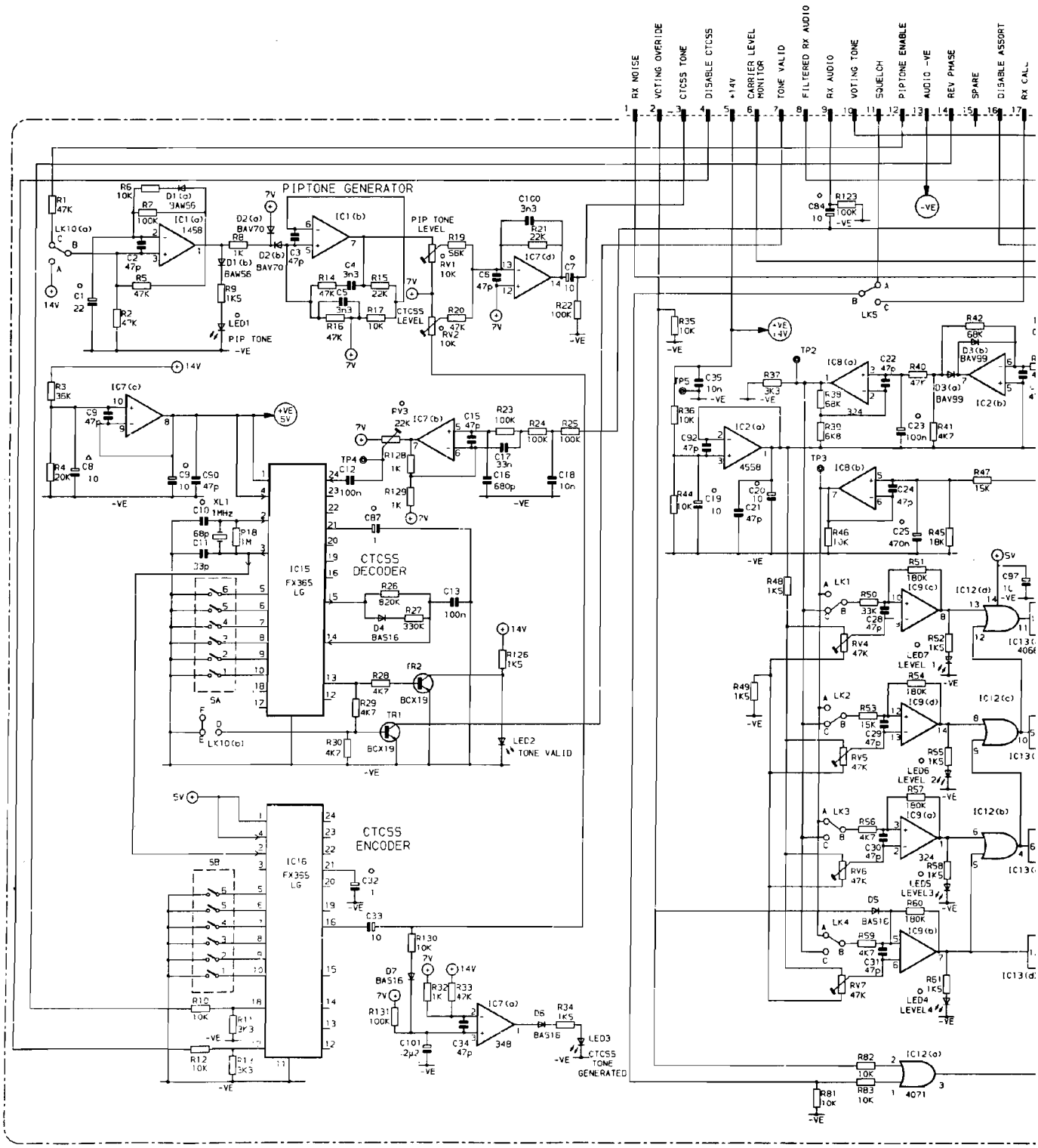
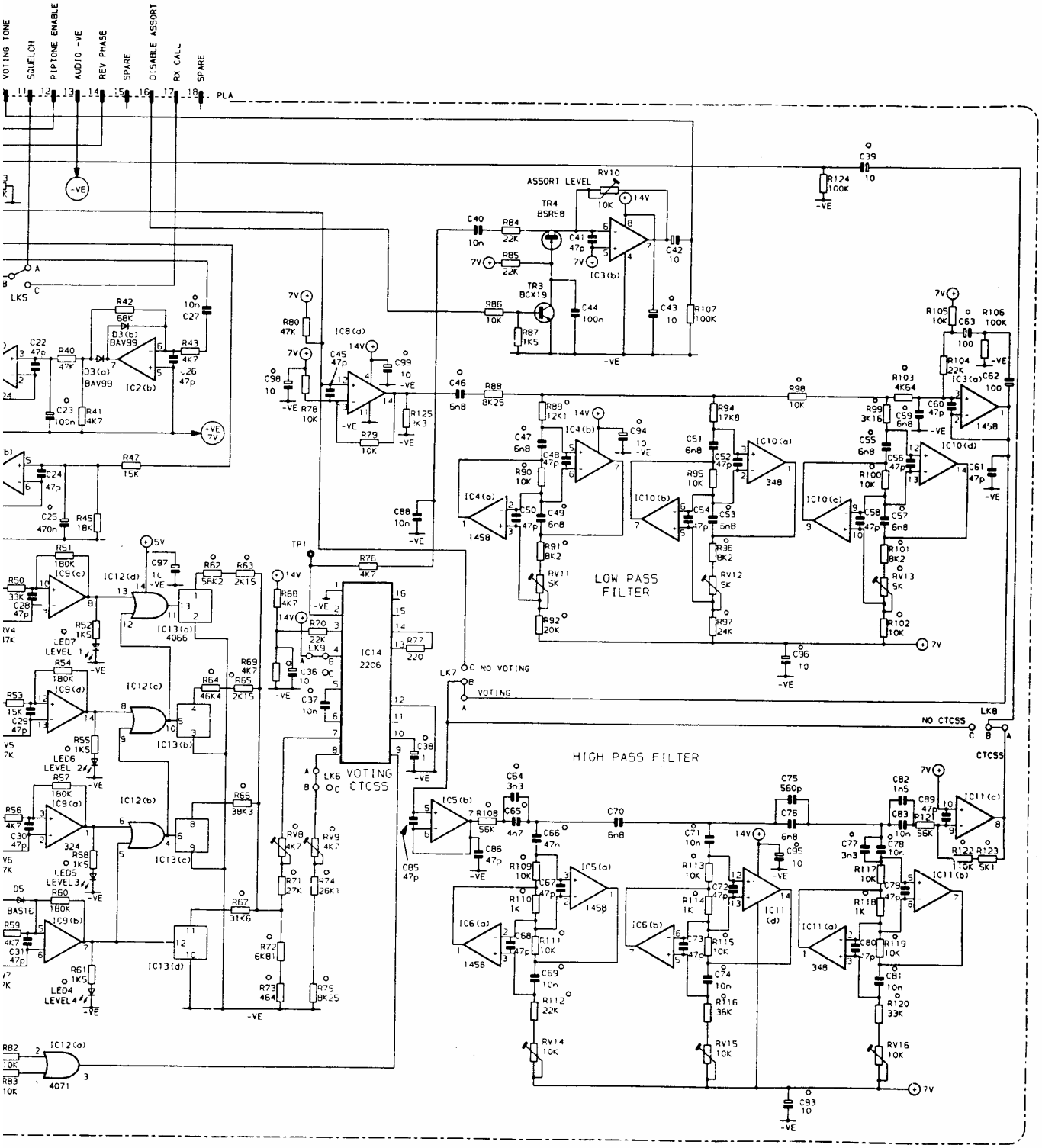


IC No	TYPE	SUPPLY PIN No 14V	5V	-VE
1	1458a-b	8		4
2	4558a-b	8		4
3	1458a-b	8		4
4	1458a-b	8		4
5	1458a-b	8		4
6	1458a-b	8		4
7	348a-b	4		11
8	324a-d(c-spare)	4		11
9	324a-d	4		11
10	348a-b	4		11
11	348a-d	4		11
12	4071a-d	14		7

IC No	TYPE	SUPPLY PIN No 14V	5V	-VE
13	4066a-d	14		7
14	XR2206	14		12
15	FX365LG		1	11
16	FX365LG		1	11

1. ALL COMPONENTS SHOWN THUS C9° ARE LEADED.
THOSE NOT MARKED ARE SURFACE MOUNTED (S.M.C.)



VOTING/CTCSS PCB AT29061
CIRCUIT DIAGRAM