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REDIFON

Technical Information

INTERIM

MAINTENANCE MANUAL

for

SEALAND 66

MARINE VHF RADIOTELEPHONE

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D.W.S.E.G.
PORTSMOUTH

Redifon Telecommunications Limited, London SW.18., England

PRINTED IN ENGLAND

A Member Company of the Rediffusion Organisation

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SAFETY FIRST

The operation of electronic equipment involves the use of voltages which may be sufficiently high to endanger human life. Although every practicable safety precaution has been incorporated in this equipment the following rules should be observed:—

The power should be removed completely and any high voltage capacitors in power supplies discharged manually with a shorting bar before changing valves or making internal adjustments.

Under no circumstances should any person reach within a unit for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

Under no circumstances should interlock switches be removed, short circuited or tampered with in any way by other than authorised maintenance personnel; nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

WARNING—SEMICONDUCTOR HAZARDS
TOXIC EFFECTS OF BERYLLIUM OXIDE (BERYLLIA)

Electronic components containing Beryllium Oxide are a serious hazard to health unless very carefully handled. The components are:—

Power Transistors, particularly VHF types, e.g. 2N3375, 2N3553, 2N3632, 2N5070, and equivalents.

Power Diodes, Thyristors.

Ceramic material, identified by blue colouration or black lines.

Heat Sink Washers, identified in the finished state by a high polish and dark brass appearance.

Handling Precautions

The components should not be carried loose, which can cause breakages and dust, or broken open for inspection or manipulation. Normal soldering is safe, but excessive heat must be avoided.

Heat sink washers must not be carried loose, abraded by tooling, or heated other than when clamped in a heat sink application. Handle with gloves, cloth or tweezers when removing from equipment.

Cathode Ray Tubes of some makes are coated on the inside with a ceramic Beryllium Oxide mixture. If the glass is broken do not touch with bare fingers or disturb the dust by blowing.

Health Hazards

Beryllium Oxide is highly dangerous in a dust form: if inhaled, poisoning, indicated by respiratory troubles or Cyanosis (grey-blue discolouration of the skin) may develop within a week, or after a latent period extending to several years. Particles penetrating the skin through wounds or abrasions are liable to cause chronic ulcerations.

Disposal Instructions

In view of the health hazard, scrap components must not be thrown out with industrial or domestic waste. Advice should be sought from the local Authority.

Medical Precautions

If Beryllia is believed to be on, or to have entered the skin through cuts or abrasions, the area should be thoroughly washed and treated by normal first – aid methods followed by subsequent medical inspection.

Suspected inhalation should be treated as soon as possible by a Doctor — preferably at a hospital.

C O N T E N T S

1 BRIEF DESCRIPTION AND SPECIFICATION

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1.1 BRIEF DESCRIPTION

The Redifon Sealand 66 VHF Radiotelephone is designed specifically for vessels which require comprehensive extended and remote control facilities for working a full capability ship-to-ship and ship-to-shore communications link. Up to 66 channels may be provided within the International and Private Maritime Bands.

The Sealand 66 system comprises a compact master control unit (MRC66) with up to four additional standard control units (SRC66) and a separate transmitter/receiver unit (MRT66). Further extension units provide operation from bridge wings and cabins, whilst a telephone exchange link unit allows public correspondence operation via the VHF system. Interconnections between the various units are straightforward, thus enabling the Radiotelephone system to be installed to suit the operational requirements of any vessel.

The standard control unit provides facilities for selection of the required channels, transmit/receive operation with high or low transmitter power output, dual watch operation on any two selected channels, or operation via an exchange link unit if fitted. The master control unit provides facilities for selection of standard control units or cabin extensions in addition to the facilities listed above.

The equipment provides full coverage of the International band, comprising channels 01-28 (original channels on the 50kHz plan) and 60-88 (interleaved channels on the 25kHz plan). Selection of the required channel numbers is performed by means of a touch-keyboard, aided by two memory stores. Two channels A and B may be set up in these stores and are then immediately available at a touch of the appropriate key. To change one of these channels, it is only necessary to touch the 'clear' key and enter the new channel.

On the International band the selected channel number is displayed on the illuminated channel readout. In addition to the display readout, calling/ distress channel 16 has an 'In Use' lamp.

Up to 10 channels may be provided in the UK Private band, comprising channels 29-50 (50kHz plan) and interleaved channels 89-109 (25kHz plan). These channels, to customer order, are commissioned by plugging in special integrated circuits (channel IC's). Private channels are selected on the keyboard as P0-P9; the channel readout display also indicates P0-P9 on these channels.

Generation of the required channel frequencies is performed by frequency synthesis, thus obviating the need for channel crystals. The frequency synthesiser system, which incorporates a voltage controlled oscillator (VCO) within a phase-locked loop, gives a high degree of frequency accuracy and stability.

The transmitter provides power outputs of up to 25W (high) or approximately 1W (low) selected by a front panel switch. A level and mismatch detector circuit protects the transmitter against damage due to short circuit, open circuit or mismatched aerials and/or feeders.

The receiver comprises two separate RF/IF strips for single frequency and double frequency channels, followed by a common audio amplifier. The audio output stages provide 1mW for the handset earpieces, and up to 2W for the internal 10Ω loudspeaker (SRC66); an external loudspeaker is used with the MRC66. An optional loudhailer amplifier is available, which provides up to 5W output for bridge wing loudspeakers.

A dual watch facility is incorporated in the equipment. Operation of the Dual Watch key on the keyboard causes the receiver to scan the two channels set up in the A and B memory stores, at approximately 0·2 second intervals. The dual watch channels may be any two of the available channels, International or Private. When a signal is received on either channel the receiver pauses for up to 8 seconds, the channel readout indicating the received channel number.

Operation of the Radiotelephone may be either simplex or duplex on the appropriate channels. In normal installations two aerials are required. One is connected via a built-in aerial changeover relay to either the transmitter output or the single frequency receiver input. The second aerial is connected to the double frequency receiver input.

On the International band, single aerial working (including duplex) is possible using Duplexer type DXU66. If simplex operation only is acceptable then single aerial working can be achieved by means of an internal diode switching circuit, which is linked in as required. On early equipments (up to serial no. 149) this modification has to be fitted at the factory or by the local depot/agent when required.

The MRT66 transmitter/receiver unit is contained in a rugged waterproof case of diecast aluminium construction. The top and bottom covers of the case can be removed to gain access to all internal components without removing the unit from its mounting frame. The MRC66 and SRC66 control units are also of fully waterproof diecast construction, with recessed front panels to protect the controls. The control units can be withdrawn from their housings for access to internal components.

All units are of modular construction, and all printed circuit boards are of high grade glass-fibre material. Reliability is assured by the use of silicon transistors and integrated circuits throughout the equipment.

The transmitter/receiver unit is supplied with a bulkhead mounting frame, and control units are provided with a multi-position mounting cradle permitting installation on a bulkhead, deckhead or bench top. A separate mounting kit is available for mounting control units in a console or a standard 19 inch rack. Special bulkhead mounting versions of the control units are available to special order, for locations where the projection from the bulkhead must be kept to a minimum.

The units are installed separately in the required positions, interconnections being made by means of multicore cables which enter each unit via watertight glands. Maximum recommended cable length from the transmitter/receiver unit to any control unit is 206m (670ft).

The performance of the equipment is in accordance with ITU regulations. It is designed to meet UK specification MPT1251, issued by the Home Office, and complies with the relevant European specifications.

The Sealand 66 system operates from the ships AC mains supply, with automatic changeover to a secondary 24V DC supply should the mains supply fail. Voltage variations within ±10% will not affect the equipment specification, but safe operation is obtained with DC inputs between 18 - 34V. An optional battery reversion unit is available for installations which require operation from a 48V DC supply.

The standard Sealand 66 system is not suitable for base station use, but a special version modified to SK10263/S can be supplied for this purpose (for further details refer to Redifon Marine Division).

1.2 ANCILLARY UNITS

In any system using more than one control unit, the Master Control function is performed by an MRC66. Up to four standard control units type SRC66 may be used and these are selected by a front panel switch on the master control unit. A typical installation may, for example, utilise a master control unit on the bridge, with standard control units in the captain's cabin, radio room and ship's office. This system allows the Radiotelephone to be operated from any of the four positions, but with priority of operation from the bridge whenever necessary.

Extension units which can be selected from a master control unit MRC66 are listed below:-

Cabin extension:	ECU61
Cabin extension with loudspeaker and calling facility:	ECU60
Bridge wing extension handset (plug-in type):	ECU63
Bridge wing extension handset in waterproof box:	ECU62
Bridge wing loudspeakers (weatherproof):	15Ω, 8W e.g. Rola Celestion FG/C or Redifon A4559 Edn. A
Bridge wing loudhailer amplifier (5W) for use with the above loudspeakers:	11201A

An external loudspeaker 11207A must be used with the MRC66 since this unit does not include an internal loudspeaker.

An exchange link unit ELU66 allows duplex public correspondence calls via the ship's private 2-wire telephone exchange. The exchange link unit may be selected from either a master or a standard control unit (only one control unit in any system may be allowed to select public correspondence operation). For full details of this unit see separate ELU66 handbook, no. 1007-1.

Where operation of the Sealand 66 is required from a 48V DC supply, a battery reversion unit 11202A is available (to special order only).

1.3 SPECIFICATION

1.3.1 General

Frequency coverage

Transmitter 156·025 - 158·500MHz

Receiver 156·300 - 158·500MHz single frequency channels

160·625 - 163·000MHz double frequency channels

Frequency stability

± 10 parts in 10^6

Channel separation

25kHz

Number of channels

Maximum of 66

International channels 01-28 and 60-88 (excluding guard channels 75 and 76) may be selected directly at the keyboard. Any 10 Private channels from the range 29-50 and 89-109 may be preset, and are selected as P0-P9. (International channels may also be preset if required).

If an unused or unauthorised channel is selected, indication is given by a flashing warning display of the channel number; the transmitter and receiver are inhibited.

Modulation

Phase modulation; maximum deviation ±5kHz

Aerial impedance

50Ω unbalanced

Duty cycle

Continuous

Temperature range

$-10^{\circ}C$ to $+50^{\circ}C$

Storage temperature

$-20^{\circ}C$ to $+65^{\circ}C$

Power supplies

The equipment operates from two independent supplies; primary supply is ships AC mains, secondary supply DC batteries.

Automatic changeover to secondary supply if primary supply fails.

Primary supply

110-120V or 220-240V, 45-60Hz

Transformer tappings in steps of 5V

Specification unaffected by ±10% variation in supply voltage

Secondary supply

26·4V DC (nominal 24V battery)

Specification unaffected by ±10% variation in supply voltage

Minimum voltage 19V

Maximum voltage 32V

Both poles of this supply are isolated from the equipment earth. The equipment may therefore be connected to a positive earth, negative earth or floating secondary supply.

Operation from nominal 48V DC supply is possible using optional battery reversion unit 11202A (to special order only).

Consumption

Receiving: approximately 45VA

Transmitting (high power output): approximately 150VA.

System configurations

Any system from basic transmitter/receiver unit MRT66 with one standard control unit (SRC66) to full system capability comprising the following: Transmitter/receiver unit with a master control unit (MRC66) and up to four standard control units, together with cabin and bridge wing extensions and telephone exchange connection.

NOTES

1. There are no user controls on the MRT66 which therefore always requires at least one control unit (master or standard).

2. Maximum recommended cable length from the transmitter/receiver unit to any control unit is 206m (670ft).

Mountings

Bulkhead mounting frame supplied with transmitter/receiver unit MRT66

Multi-position mounting cradle supplied with control units SRC66 and MRC66, permitting installation on bulkhead, deckhead or bench top.

Rack/console mounting kit type 11219A is available for use with control units (this kit must be fitted at the factory or by the local depot/agent).

Special bulkhead mounting control units can be supplied to special order (refer to Redifon Marine Division for details).

Dimensions and weights (including mounting frame/cradle)	Width	Height	Depth	Weight
Transmitter/receiver unit MRT66	337mm (13-1/4in)	483mm (19in)	127mm (5in)	16.3kg (36lb)
Standard control unit SRC66	470mm (18½in)	165mm (6½in)	178mm (7in)	8.3kg (18lb)
Master control unit MRC66	470mm (18½in)	165mm (6½in)	178mm (7in)	8.3kg (18lb)
Bulkhead mounting SRC66 (no mtg. frame required)	Type 11217A	refer to Redifon Marine Division		
Bulkhead mounting MRC66 (no mtg. frame required)	Type 11217B			

Compass safe distances .... see page 1-5(a)

1.3.2 Transmitter

Power output

High power 20-25W

Low power **less than 1W**

AF input impedance

Approximately 1kΩ (microphone impedance 300Ω)

Modulation sensitivity

6mV emf from 300Ω source for ±3kHz deviation at 1kHz

Modulation response

Within +1dB -3dB of a 6dB/octave pre-emphasis characteristic from 300Hz to 3kHz

Compass safe distances

	Grade of compass		
	I (1/4°)	II & III (1°)	IV (2°)
Transmitter/receiver MRT66	920mm (3ft)	610mm (2ft)	460mm (1½ft)
Duplexer DXU66	920mm (3ft)	610mm (2ft)	460mm (1½ft)
Distribution box 11128A	920mm (3ft)	610mm (2ft)	305mm (1ft)
Control unit MRC66 or SRC66	1070mm (3½ft)	610mm (2ft)	460mm (1½ft)
Control unit handset	610mm (2ft)	305mm (1ft)	155mm (6in)
Loudspeaker 11207A	1830mm (6ft)	1070mm (3½ft)	765mm (2½ft)

Modulation distortion

Less than 10% for ±3kHz deviation at 1kHz

Noise level

At least 40dB down relative to ±3kHz deviation at 1kHz

Spurious radiation

Less than 2µW into 50Ω

Output protection

The transmitter can be operated for at least 10 minutes with the aerial open circuit or short circuit

1.3.3 Receiver

Sensitivity

A signal of 1µV emf with ±3kHz deviation at 1kHz will give a signal/noise ratio better than 20dB, or a SND/ND (SINAD) ratio better than 20dB using suitable weighting filter.

Intermediate frequency

10·7MHz on single frequency channels

15·3MHz on double frequency channels

IF bandwidth

±7·5kHz

Modulation response

Within +1dB -3dB of a 6dB/octave de-emphasis characteristic from 300Hz to 3kHz

AF outputs

MRT66: 0dBm into 600Ω
2W into 15Ω

SRC66/MRC66: 1mW (adjustable) into 300Ω handset earpiece
2W into 15Ω loudspeaker

Selectivity

Not less than 70dB adjacent channel rejection using two signal generator method

Spurious rejection

Better than 70dB for frequencies more than 25kHz off tune

Radiation

Less than 2nW into 50Ω at either aerial socket

Squelch

Noise operated, adjustable squelch provided; minimum opening level approximately 0·5µV emf.

Dual watch

Monitors the two channels set up in the A and B memory stores at approximately 5 channels/ second (about 0·2 seconds/channel).

Channel readout display is blanked out during scanning, except for the two A and B indicators (decimal points).

Receiver pauses for maximum of 5-8 seconds when signal is received on either channel; if signal duration is less than this, scanning recommences at end of signal.

During this pause, the channel readout indicates the received channel number.

Transmitter is inhibited during dual watch operation.

2 INSTALLATION AND SETTING UP

2 INSTALLATION AND SETTING UP

2.1 GENERAL

This chapter contains all the necessary information for installing a complete Sealand 66 VHF Radiotelephone system, and setting it up prior to operation.

Fig. 2.1 gives block diagrams of some typical systems. These range from the basic transmitter/receiver with a single standard control unit (a) to a comprehensive system (d) which includes full remote control from up to 5 positions, with cabin and bridge wing extension working and public correspondence operation via an exchange link unit. Supply arrangements and aerial options are indicated in Fig. 2.2.

NOTES

1. The transmitter/receiver unit has no user controls, other than supply on/off switches. The installation must therefore always include at least one control unit (either master or standard).
2. Extension facilities (other than exchange link unit) are available ONLY from master control units MRC66. Thus, for example, if the Master (i.e. main) control unit is located in the radio room, it will be necessary to use a secondary MRC66 on the bridge in order to select bridge wing extensions or loudhailers. Conversely, if the Master control were on the bridge a secondary MRC66 would be necessary in the radio room for selection of cabin extensions.

The mounting of the various units and ancillaries will be found to be straightforward. The complexity of the inter-unit cabling depends on the number of facilities included in the installation; full details are given in section 2.7.

Special attention must be paid to the installation of the aerials and feeders. The instructions given in section 2.5 must be followed carefully if satisfactory results are to be obtained.

2.2 UNPACKING

Immediately on receipt of the equipment, examine the packing case(s) for signs of damage, and inspect the contents for damage and/or shortages. In the event of damage or shortages being apparent, the Carriers and the local Redifon depot/agent must be notified within 3 days of receipt.

After inspection, partially re-pack the equipment and store in a clean, dry area until reauired for installation. Avoid storage areas subject to condensation or high temperature.

2.3 EQUIPMENT MOUNTING

Examination of the various units will indicate the method of mounting required. Units which are supplied with a mounting frame may be fitted to a bulkhead, deckhead or bench top. Remove the units and bolt the frames securely in the required positions; fixing centres are given in Fig. 2.3. Do not overlook space requirements for the installation cables.

A rack/console mounting kit, type 11219A, is available for fitting control units into a console or a standard 19 inch rack. This kit must be fitted to the control unit at the factory, or by the local depot/agent. In this form, the unit occupies 176mm (7 in) of rack height, and the handset plugs into a socket on the front panel surround. When installed in this manner the unit must be supported on slides or runners; it must not be mounted in such a way that all the weight is taken by the front panel.

The transmitter/receiver must be installed where it will be accessible for servicing, and adequate lighting and supply points for test gear must be available for this purpose. It is therefore preferable for this unit to be installed in the radio room.

All units should be located in reasonably cool and dry areas. Position the units away from doors or opening windows which may allow sea or rain water to spray on them. Avoid direct sunlight, especially on the control units, as this will obscure the channel readout displays and indicator lamps.

The transmitter/receiver and control units are all supplied with 3m (10ft) long flying leads attached. A distribution box must be mounted adjacent to each unit so that the flying leads terminate conveniently. However, where a control unit is mounted less than 6m (20ft) from the transmitter/receiver, only one distribution box will be required for the two units. Distribution boxes must be mounted with the cable entries at the bottom.

The maximum distance between the transmitter/receiver and any control unit in the Sealand 66 system should not exceed 206m (670ft), i.e. maximum cable length of 200m (650ft) between the associated distribution boxes. Note however, that in a centre-castle vessel (e.g. ferry) with centrally mounted transmitter/receiver, fore and aft mounted control units may be up to 406m (1300ft) apart.

2.4 EARTH CONNECTIONS

The main connection to the ship's earth is taken from the earthing stud on the transmitter/receiver case to a solid metal bulkhead adjacent to the unit. Use 19mm (3/4in) wide by 3·2mm (1/8in) thick or similar tinned copper braid (e.g. Redifon ref. R1). Keep the earth connection short, but allow sufficient for the unit to be hinged out from the frame for servicing or faultfinding purposes.

In addition, all ancillary units must be bonded to the ship's earth, including distribution boxes, loudhailer amplifier(s) and Duplexer (where used in the installation). Using tinned copper braid as above, connect from the earthing studs provided to a solid metal bulkhead adjacent to each unit. Keep these earth connections as short as possible.

2.5 AERIAL DETAILS

2.5.1 Standard 2 Aerial Installation

The aerials normally used are vertically mounted 50Ω VHF dipoles. These should be located in a clear area, away from the funnel and other structures. In any case, they must be stood off at least 2m (6ft) from any large metal structure which protrudes above the upper clamp band.

For duplex working it is essential that the mutual coupling between the two aerials is reduced to a minimum. The preferred method is to mount the dipoles on a common vertical axis, with a minimum space of 2m (6ft) between them. The upper dipole then serves as the single frequency aerial, i.e. transmitter output and single frequency receiver input.

If horizontal spacing is to be employed, the aerials must be at least 11m (35ft) apart in this plane; a vertical spacing of 2m (6ft) is still required. Again, the higher dipole serves as the single frequency aerial.

Fig. 2.4 gives dimensions and mounting details for a typical dipole aerial.

2.5.2 Aerial Feeders

The recommended aerial feeder cable is 50Ω type UR67 (Redifon cable ref. 1K2).* A single continuous length of cable should always be used if circumstances permit. Cable joins should be avoided if possible, but where necessary they must be made using 50Ω N-type coaxial plugs and jacks, e.g. Greenpar GE15015C1 (Redifon stores index MX502) and GE15022C1 (MX503) respectively. These must be situated in an air-conditioned area with access for servicing.

If the required feeder length is greater than 46m (150ft), Redifon Marine Division should be consulted for an alternative low loss cable.

Feeder cables supplied by Redifon Telecommunications Ltd. are already terminated at one end with the correct N-type coaxial plug. It is MOST IMPORTANT that this end is connected to the aerial, so that any necessary cutting to length is done in the radio room.

Before connecting to the aerial, smear the coaxial plug and socket threads with a suitable silicone grease, e.g. Midland Silicones type MS4 (Redifon stores index G88). This will reduce corrosion and facilitate subsequent removal of the plug from the aerial. Avoid greasing the coaxial plug centre pin or the outer sheath of the cable. Finally, weatherproof the connectors by sliding the plastic sleeves provided (type PS1) over the assembly - see Fig. 2.4.

Clip or tape the feeder cable to the aerial supports, leaving a 0·3m (1ft) diameter one turn loop of spare cable just below the aerial. In a two aerial installation, the feeders should preferably be run in separate steel tubes to the radio room. If this is not possible, then a minimum separation of 0·3m (1ft) must be maintained between the feeders, and these must be clipped or taped at regular intervals to suitable supporting structures.

Take great care to avoid damaging the feeder cable outer sheath. Do not run the cable over sharp edges, or through holes in panels without protective glands. The minimum radius to which this cable can be bent is 150mm (6in). Since the polythene insulation has a low melting point, do not run the feeders over or near hot surfaces such as steam pipes or exhaust pipes.

In the radio room, cut the feeder cables to the required length, allowing sufficient for the unit to be hinged out from the frame for servicing or faultfinding purposes. Ensure that the feeder from the higher aerial is routed to the single frequency aerial socket on the unit.
*NOTE If the Sealand 66 is being installed on a vessel which is already fitted with 75Ω aerials and feeders, a 75Ω/50Ω matching unit type 11215A must be added in series with each feeder (at the transmitter/receiver end).

2.5.3 Assembly of N-Type Coaxial Plugs

The aerial feeder cables are connected to the transmitter/receiver aerial sockets by means of 50Ω N-type coaxial plugs. It is important to note that these connectors are available in both 50Ω and 75Ω versions. These are NOT interchangeable, the former having a larger diameter centre pin than the latter. Use only 50Ω connectors in the Sealand 66 installation, e.g. Greenpar GE 15015C1 (Redifon stores index MX502).

Referring to Fig. 2.5, unscrew the clamp nut from the plug body and remove the parts shown in (A). The method of fitting the plug to the feeder cable is as follows.

(i) Strip the outer PVC sheath from the cable for a distance of 7·1mm (9/32in) as shown at (B); take care to avoid damaging the braid. NOTE. When using UR76 cable (ref. 1K5) with GE15055C10 plug (Redifon stores index MX) for Duplexer output connections, this distance must be increased to 8·7mm (11/32in).

(ii) Comb out the braid and taper inwards. Slide clamp nut and plain gasket over the outer sheath.

(iii) Fold back the braid and insert ferrule between dielectric and braid, trapping the braid between outer sheath and ferrule (C). Trim off surplus braid (D).

(iv) Cut off the dielectric to 0·4mm (1/64in) from face of ferrule (C); take care to avoid damaging the centre conductor. Twist the strands together and check that length of centre conductor protruding from dielectric is 6·0mm (15/64in).

(v) Tin the centre conductor, avoiding the use of excessive heat.

(vi) Slide rear insulator over the dielectric to butt against the ferrule.

(vii) Slide centre contact (pin) over the centre conductor. Hold contact and cable tightly together, with shoulder of contact pressed against rear insulator. Solder contact securely to centre conductor, avoiding the use of excessive heat (D). Remove surplus solder from outside of contact.

(viii) Slide plain gasket and clamp nut up to the ferrule, trapping the braid, and push the sub-assembly into the plug body as far as it will go.

(ix) Engage clamp nut in the plug body and tighten. Hold the plug and cable securely and tighten clamp nut down hard.

2.5.4 Single Aerial Installations

On some smaller ships which require single aerial working, the installation may be modified as follows.

If simplex operation only is acceptable, single aerial working can be provided by means of a diode switching circuit which is built into the transmitter/receiver. This is brought into operation by the addition of modification kit 11118B. On early equipments, up to serial no. 149, this diode switch is added separately when required (modification kit 11118A). It is always preferable for these modifications to be fitted at the factory, or by the local depot/agent. In this way, additional on-board installation work and system testing will be avoided.

Installation of the single aerial and feeder follows the general guidelines given in sections 2.5.1 and 2.5.2 above. The feeder cable is connected to the S/F aerial socket on the transmitter/receiver; no external connection is made to the D/F socket.

Where duplex operation is required with a single aerial (International band only) the installation must include a Duplexer DXU66. The aerial feeder cable is connected to the Duplexer input socket. Two additional lengths of 50Ω feeder cable, terminated at both ends with N-type coaxial plugs, are then necessary to connect the Duplexer output sockets to the S/F and D/F aerial sockets on the transmitter/receiver. Full details of Duplexer installation and connection will be found in section 2.7.7.

The use of a Duplexer introduces a 1·5dB insertion loss on the transmit band. If a long feeder cable is also employed, excessive power losses can result. For example a 46m (150ft) length of UR67 cable would introduce a further 3dB loss, resulting in a total power loss of 4·5dB between the transmitter output and the aerial.

In these circumstances, it is recommended that a colinear aerial be used. This type of aerial has a typical power gain of 3·8dB, which would offset the losses due to the Duplexer and feeder cable. Redifon Marine Division will supply details of a suitable colinear aerial for use in these installations.

NOTE. A colinear aerial could also be used in installations requiring only simplex operation (i.e. without Duplexer). However, their use is not generally recommended for 2-aerial installations due to their length.

2.6 SUPPLY CONNECTIONS

2.6.1 Primary Supply

A 3m (10ft) long 3-core screened lead is attached to the transmitter/receiver for connection of the primary supply. This may be a 45-60Hz AC supply of 110-120V (transformer windings in parallel) or 220-240V (transformer windings in series), tappings being provided in 5V steps. Voltage variations up to ±10% will not affect the equipment specification.

Before connecting to the supply, check that the links on the DC regulator board are correct for the available supply voltage - see Fig. 7.20(b) for location of this board. The protective cover must be removed for access to these links. Before replacing the cover, check the rating of fuse 7FS1; this should be 2·5A for 220-240V operation and 5A for 110-120V.

Supply connections are as follows:-

Brown:	LINE
Blue:	NEUTRAL
Yellow/Green:	EARTH
Screen:	no connection at supply end

2.6.2 Secondary Supply

A 3m (10ft) long 2-core screened lead is attached to the transmitter/receiver for connection of the secondary supply, which serves as a fail-safe supply in the event of primary supply failure. The secondary supply should be 24V DC nominal. Voltage variations up to ±10% will not affect the equipment specification; satisfactory operation will, however, be obtained with supply voltages between 18-34V.

Both poles of the secondary supply are isolated from the equipment earth. The equipment may therefore be connected to a positive earth, negative earth or floating secondary supply. Connections are as follows:-

Red:	supply POSITIVE
Blue:	supply NEGATIVE
Screen:	no connection at supply end

Operation from a nominal 48V DC secondary supply is possible, using an optional battery reversion unit 11202A (to special order only). Reference should be made to the installation instructions supplied with the unit.

2.7 SYSTEM INTERCONNECTIONS

2.7.1 Distribution Boxes

The transmitter/receiver and control units are each supplied with a pair of 3m (10ft) long screened multicore cables. Cable glands are already fitted, and the cables are terminated with fanning strips for connection to the adjacent distribution boxes.

The correct cable entry positions for each unit are indicated on the label inside the distribution box. Remove the cable glands or hole blanking plugs from the appropriate positions and insert the cables into the slots, ensuring that the gland nuts are on the inside of the box (see Fig. 2.6). Slide the glands along the cables to engage with the gland nuts; when these are tightened together the cables are locked in position.

The 4-core cable connects to terminal strip TS3, and the 36-core cable connects by means of two 18-way fanning strips to TS1 and TS2. The cable screens are connected to the earthing stud adjacent to the cable entries.

Interconnections between the distribution boxes are made by means of screened 4-core and 36-core installation cables (Redifon ref. 4R and M36C respectively). Each distribution box will accept up to 4 pairs of installation cables via 8 cable glands; blanking plugs must be fitted to any unused cable entry positions. When running these cables the usual precautions should be observed i.e. avoid damaging the cable outer sheath; do not run the cables over sharp edges or through holes in panels without protection; do not bend to a smaller radius than 150mm (6in); do not run the cables over or near hot surfaces such as steam pipes or exhaust pipes.

The label inside the distribution box indicates how the four sets of connections are arranged. These connections are listed in Table 2.1 below. All cable terminations must be made using the fanning strips supplied. The method of fitting the fanning strips is as follows (see Fig. 2.7).

(i) It is essential that the correct cable gland is fitted over the cable first; it cannot be fitted once the fanning strip is in place.

(ii) Strip the outer PVC sheath from the cable for a distance of 0·3m (12in).

(iii) Cut the overall tinned copper screen back for a distance of 0·2m (8in). Comb out the remaining braid and then twist it into the form of a "tail".

(iv) Solder an earthing flag tag (supplied) to the copper braiding "tail".

(v) Strip the PVC insulation from each core for a distance of 8mm (3/8in).

(vi) Taking each core in turn, in the order given in Table 2.1, twist the conductors and form into a hook. Solder the hook to solder lug(a).

(vii) Fold the crimping lugs (b) down over the insulation, clamping the wire and tag firmly together.

Cable	Distribution box		Core colour(s)	Function
	Term.strip	Term.no.		
36-core (M36C)	TS1	1	Red	High } 600Ω transmitter
		2	Blue	Low } audio input
		3	Green	Audio common
		4	Yellow	ELU on
		5	White	High } 600Ω receiver
		6	Black	Low } audio output
		7	Brown	+24V HT
		8	Violet	OV (volume and squelch)
		9	Orange	1 } Remote control HT lines
		10	Pink	2 }
		11	Turquoise	3 }
		12	Grey	4 }
		13	Red/blue	On/off
		14	Green/red	Transmitter power control
		15	Yellow/red	Transmitter key
		16	White/red	+10V Tx
		17	Red/black	Volume
		18	Red/brown	Squelch
	TS2	1	Yellow/blue	Dual watch
		2	White/blue	A/B line
		3	Blue/black	A/B key
		4	Orange/blue	Signal received
		5	Green/blue	Channel inhibited
		6	Grey/blue	1st digit inhibit
		7	Yellow/green	A } Units control lines
		8	White/green	B }
		9	Green/black	C }
		10	Orange/green	- }
		11	Grey/green	D }
		12	Yellow/brown	E } Tens control lines
		13	White/brown	F }
		14	Brown/black	G }
		15	Grey/brown	H }
		16	Yellow/violet	} Spare
		17	Violet/black	}
		18	White/violet	}
4-core (4R)	TS3	1	Red	+24V (logic)
		2	Blue	OV (logic)
		3	Green	L/S return & OV (lin)
		4	Yellow	Loudspeaker feed

Table 2.1 Distribution Box Connections

2.7.2 Local Loudspeaker

Master control units MRC66 require an external loudspeaker (internal speaker is used in the standard control unit). The recommended loudspeaker is Redifon type 11207A this unit being supplied with a 3m (10ft) long 2-core flying lead. For adjacent mounting, this lead is run direct into the control unit via the appropriate cable gland. Connections are made at TS8/1 and 4.

Where the loudspeaker is to be installed further from the control unit (e.g. for watchkeeping) terminate the flying lead at a suitable junction box. Run a screened 2-core installation cable (Redifon ref. 2C) from the junction box to TS8/1 and 4; the installation cable screen should be earthed to the control unit chassis. This cable should not exceed 20m (65ft) in length.

2.7.3 Cabin Extensions

Cabin extension units ECU60 and ECU61 provide both simplex and duplex facilities, and can therefore be used for intership R/T calls (this is not possible using an ELU66, which can only provide 2 frequency duplex operation). Cabin extensions are wired directly to the master control from which they are selected.

Extension type ECU61 comprises only an extension handset, without loudspeaker or calling facility. This is intended for mounting in the radio room for crew R/T calls, where calling facilities are unnecessary. Extension type ECU60 includes an internal loudspeaker, and a buzzer for calling purposes.

Each extension unit is supplied with a 3m (10ft) long screened multicore cable, terminated in a telephone wall block. The use of a screened 12-core installation cable (Redifon ref. 12C) is recommended for either type of extension. In this way, an ECU61 could be replaced by an ECU60 at a later date with no further installation work. A 6-core cable (Redifon ref. 6C) could, however, be used for the ECU61 if required. Connections are listed in Table 2.2 below; the cable screens must be earthed to the control unit chassis.

A wall mounting kit type TAI100 is available for use with cabin extension units if required.

Cabin extension	MRC66 terminal strip	Terminal no.	Wire colour(s)	Function
Extension 1	TS5	1	Yellow	Press-to-talk
		3	White	Microphone
		4	Blue/Green	Audio common (OV)
		5	Red	Earpiece (high)
		6	Turquoise	Volume control (wiper)
		7	Black	Tx Key
		8	Grey	Volume control (high)
		9	Brown	Extension in use
		10	Pink	Call extension
	TS6	9	Orange	Loudspeaker
		10	Violet	OV
Extension 2	TS6	1	White	Microphone
		2	Blue/Green	Audio common
		3	Red	Earpiece (high)
		4	Turquoise	Volume control (wiper)
		5	Black	Tx Key
		6	Grey	Volume control (high)
		7	Brown	Extension in use
		8	Pink	Call extension
	TS7	1	Orange	Loudspeaker
		2	Violet	OV
		3	Yellow	Press-to-talk
		4	Green	600Ω Tx input for base station use only (refer to Redifon Marine Division)

Table 2.2 Cabin Extension Connections

2.7.4 Bridge Wing Extensions

Bridge wing extensions ECU62 and ECU63 are wired directly to the master control from which they are selected, using a screened 6-core installation cable (Redifon ref. 6C). When using extension unit ECU62 (handset contained in waterproof box) the installation cable is run into the box via an Elkay cable gland. Connections are made to the internal terminal block, using the fanning strip supplied; instructions for fitting the fanning strip will be found in section 2.7.1. The cable screen must be earthed to the box.

Extension handset ECU63, which is not intended for permanent installation on the bridge wings, is terminated in a 6-pole Niphan weatherproof plug. The installation cable is connected to a bulkhead mounted Niphan weatherproof socket type N549/6 (Redifon stores index S736); the cable screen must be earthed to the socket casting. When the handset is not in use it should be stowed on the bridge, and the protective cap should be screwed onto the socket.

The installation cable connections at the control unit are listed in Table 2.3 below. The two cables from the bridge wings are connected together, colour to colour, using the fanning strips supplied; the cable screens must be earthed to the control unit chassis.

MRC66 terminal strip	Terminal no.	Wire colour	Function	ECU62 terminal no.	ECU63 Pin no. on bulkhead socket
TS8	5	Black	Tx key	19	6
	6	Yellow	Press-to-talk	17	5
	7	Green	Earpiece low	16	4
	8	Red	Earpiece high	15	3
	9	Blue	Microphone low	20	1
	10	White	Microphone high	18	2

Table 2.3 Bridge Wing Extension Connections

2.7.5 Bridge Wing Loudspeakers

Bridge wing loudspeakers require the use of one or more amplifiers type 11201A (5W audio output). Recommended weatherproof loudspeakers for this location are Rola Celestion type FG/C, rated at 15Ω, 8W, two of these normally being used in the installation. When connected in parallel, they present the optimum load impedance (7·5Ω) to the amplifier, and are fed with 2·5W each.

In high noise situations 8Ω loudspeakers may be used, with one amplifier type 11201A feeding each i.e. 5W audio input to each loudspeaker.

These loudspeakers are supplied with a 3m (10ft) long 2-core flying lead. When mounted adjacent to the amplifier, the lead is connected directly to the amplifier output. When mounted remote from the amplifier, terminate the loudspeaker flying lead at a suitable junction box. Run a screened 2-core installation cable (Redifon ref. 2C) from the junction box to the amplifier output; the installation cable screen should be earthed to the amplifier case.

The supply and audio input cable to the amplifier is wired directly to the control unit from which loudspeaker operation is to be selected(bridge). Use a screened 3-core installation cable (Redifon ref. 3C) and make the connections indicated in Table 2.4 below. The cable screen must be earthed to the control unit chassis.

MRC66 terminal strip	Terminal no.	Wire colour	Function
TS8	2	Green	Audio input
	3	Red	+24V supply
	4	Blue	0V

Table 2.4 Loudhailer Amplifier Input Connections

2.7.6 Exchange Link Unit

Installation of the exchange link unit is covered separately in the ELU66 handbook, no. 1007-1.

2.7.7 Duplexer

The Duplexer, type DXU66, should be installed adjacent to the transmitter/receiver, allowing for convenient positioning of the coaxial interconnections between the units. These interconnections are normally made with 50Ω coaxial cable UR67 e.g. lengths of aerial feeder cable 1K2, of maximum length 3m (10ft). These cables are terminated at both ends with 50Ω N-type coaxial plugs (Greenpar GE15015C1) two of which are supplied with the DXU66 and two with the MRT66. Instructions for fitting these plugs are given in section 2.5.3.

Alternatively, for lengths less than 1m (3ft), coaxial cable UR76 (Redifon ref. 1K5) may be used. This will necessitate the use of different coaxial plugs, e.g. Greenpar GE15055C10 (Redifon stores index MX). Fitting instructions for this type of plug are included in section 2.5.3. Note: later models may be supplied with coaxial flying leads already terminated with the correct N-type plugs.

The feeder cable from the single aerial is connected to the Duplexer input socket via the 50Ω N-type coaxial plug supplied (GE15015C1); the general installation data given in section 2.5 is applicable.

Supply and control connections to the Duplexer are made via a 3m (10ft) long 3-core screened lead attached to the Duplexer. Table 2.5 below lists the connections to be made in the transmitter/receiver unit. Note that these connections (which must be soldered) are made to pins on the circuit boards shown. The cable sheath and screen must be stripped back far enough for the cores to reach these boards without applying any strain on the pins. The cable screen must be earthed to the transmitter/receiver case.

MRT66 connection made at	Pin no.	see Fig.	Wire colour	Function	DXU66 connection TS1
Relay board (7)	11	7.18	Red	+24V supply	4
Relay board (7)	12	7.18	Blue	OV	5
Logic control board (3)	12	7.6	Yellow	Duplexer control	3

Table 2.5 Duplexer Supply and Control Connections

2.8 OPTIONAL CONNECTIONS

2.8.1 Radio Room Loudspeaker

A requirement sometimes exists for the radio operator to be able to monitor the receive side of all incoming traffic, irrespective of which control unit is in use. If this facility is required, the master control unit fitted in the radio room is modified by the addition of two links on the MRC linear board as follows:

Pin 14 to TS1/8

Pin 13 to TS8/1.

Notes

1. The loudspeaker volume will be determined by the Volume control on the selected control unit, the local control being inoperative.
2. When not required, the loudspeaker can be switched off by the ELU switch.

2.8.2 Tape Recorder

If it is required to record the receive side of incoming traffic, tape recorder connections may be made to the 600Ω receiver audio output. Using a screened 2-core installation cable (Redifon ref. 2B or 2C) connect to terminal block TS1/5 and 6, at the nearest convenient distribution box (terminal 6 is at OV, but is not earthy). The cable screen must be earthed.

If recording of transmissions is required, reference should be made to Redifon Marine Projects Division for details.

2.9 INSTALLATION CABLES

A full list of installation cables recommended for use in the Sealand 66 system is given in the table below.

Redifon cable ref.	Cable description
1K2	Coaxial feeder cable, type UR67; impedance 50Ω. 7/0·74mm (7/·029in) inner conductor, polythene dielectric, tinned copper screen and outer PVC sheath. Overall diameter 10·3mm (0·405in). Redifon stores index MX2518 [20m (65ft)]; MX2382 [30m (100ft)]; MX2383 [46m (150ft)]. Supplied with 50Ω N-type coaxial plug (MX502) already fitted one end.
1K5	Coaxial feeder cable, type UR76; impedance 50Ω. 14/0·2mm (14/·008in) inner conductor, polythene dielectric, tinned copper screen and outer PVC sheath. Overall diameter 5·0mm (0·20in). Redifon stores index MX2913.

Redifon cable ref.	Cable description
2B	2-core overall screened cable to DEF.61-12 part 5. PVC insulated 16/0·2mm (16/·008in) cores, PVC sheath and tinned copper collective screen. Core colours red, blue. Overall diameter 6·9mm (0·27in). Nato stock no. 6145-99-111-6716. Redifon stores index MX329.
2C	2-core overall screened cable to DEF.61-12 part 5. PVC insulated 16/0·2mm (16/·008in) cores, tinned copper collective screen and outer PVC sheath. Core colours red, blue. Overall diameter 6·9mm (0·27in). Nato stock no. 6145-99-111-6717. Redifon stores index MX336.
2DC*	2-core overall screened cable to Redifon specification OP10210/S. PVC insulated 23/0·2mm (23/·008in) cores, tinned copper collective screen and outer PVC sheath. Core colours red, blue. Overall diameter 8·5mm (0·33in). Redifon stores index MX207.
3C	3-core overall screened cable to DEF.61-12 part 5. PVC insulated 16/0·2mm (16/·008in) cores, tinned copper collective screen and outer PVC sheath. Core colours red, blue, green. Overall diameter 7·2mm (0·28in). Nato stock no. 6145-99-111-6724. Redifon stores index MX337.
3DC*	3-core overall screened cable to Redifon specification OP10211/S. PVC insulated 23/0·2mm (23/·008in) cores, tinned copper collective screen and outer PVC sheath. Core colours brown, blue, yellow/green. Overall diameter 9·0mm (0·35in). Redifon stores index MX371.
4R	4-core overall screened cable type 37-3-4R. PVC insulated 37/0·315mm (37/·012in) cores, tinned copper collective screen and outer PVC sheath. Core colours red, blue, green, yellow. Overall diameter 11·8mm (0·46in). Redifon stores index MX113.
6C	6-core overall screened cable to DEF.61-12 part 5. PVC insulated 16/0·2mm (16/·008in) cores, tinned copper collective screen and outer PVC sheath. Core colours red, blue, green, yellow, white, black. Overall diameter 8·7mm (0·34in). Nato stock no. 6145-99-111-6735. Redifon stores index MX339.
12B	12-core overall screened cable to DEF.61-12 part 5. PVC insulated 16/0·2mm (16/·008in) cores, PVC sheath and tinned copper collective screen. Core colours red, blue, green, yellow, white, black, brown, violet, orange, pink, turquoise, grey. Overall diameter 11·0mm (0·39in). Nato stock no. 6145-99-111-6744. Redifon stores index MX333.
12C	12-core overall screened cable to DEF.61-12 part 5. PVC insulated 16/0·2mm (16/·008in) cores, tinned copper collective screen and outer PVC sheath. Core colours red, blue, green, yellow, white, black, brown, violet, orange, pink, turquoise, grey. Overall diameter 11·0mm (0·39in). Nato stock no. 6145-99-111-6745. Redifon stores index MX2480.

Redifon cable ref.	Cable description
M36C	Miniature 36-core overall screened cable to DEF.61-12 part 4. PVC insulated 7/0·2mm (7/·008in) cores, tinned copper collective screen and outer PVC sheath. Core colours red, blue, green, yellow, white, black, brown, violet, orange, pink, turquoise, grey, red/blue, red/green, yellow/red, white/red, red/black, red/brown, yellow/blue, white/blue, blue/black, orange/blue, yellow/green, white/green, orange/green, green/blue, grey/blue, green/black, grey/green, yellow/brown, white/brown, brown/black, grey/brown, yellow/violet, violet/black, white/violet. Overall diameter 11·2mm (0·44in). Nato stock no. 6145-99-110-8643. Redifon stores index MX112.
R1	Flat tinned copper braid 19mm (3/4in) wide by 3·2mm (1/8in) thick. Redifon stores index MX2489.

* cables 2DC and 3DC required only for extensions to DC and AC supply inputs.

2.10 SETTING UP

2.10.1 Selection of Other Control Units from Master

In positions 1, 2, 3 and 4, the Service switch on the Master control unit (MRC66) energises one of four switching lines. These lines are routed via the interconnection cables to the distribution boxes, and via the attached flying leads to each additional control unit.

Ensure that these control units are switched on only in the required position of the Service switch as follows. At each control unit in turn, disconnect the brown core from TS2/8 (+24V HT); locate the appropriate core, as indicated in the table below, and connect to TS2/8. The three remaining cores of this group,together with the brown core,must be insulated and tied back (no connection to these cores).

Master control units used in a secondary role cannot select further control units, but are equivalent to standard control units with extension facilities. Disconnect the brown core from TS2/8 and the orange, pink, turquoise and grey cores from TS4/1, 2, 3 and 4. One of these four cores is then connected to TS2/8 as indicated in the table below, depending on the True Master switch position in which it is to be selected. The three remaining cores of this group,together with the brown core,must be insulated and tied back (no connection to these cores).

Service switch position in which control unit is to be selected	Core colour to be connected to TS2/8 (+24V HT)
1	Orange
2	Pink
3	Turquoise
4	Grey

2.10.2 Selection of Exchange Link Unit

Each control unit is fitted with an ELU switch, but exchange working must be available only from the radio operator's position. At the required control unit, locate the yellow core in the incoming 36-core cable and connect to TS1/6. In all other control units ensure that this core is insulated and tied back.

2.10.3 Handset Volume Adjustment

The internal volume control associated with each control unit handset is adjusted on final test at the factory, and should not normally require readjustment. Should this be necessary however, proceed as follows.

Unscrew the six nuts at the back of the control unit and withdraw the unit from its case. When a suitable input signal is available, adjust the handset volume by means of preset potentiometer 2R33 on the SRC linear or MRC linear board. Avoid the use of excessive handset levels, which may cause acoustic feedback through the handset body when duplex working is employed (e.g. on public correspondence calls).

Refit the unit in its case after adjustment, and refit all retaining nuts.

2.10.4 Private Channel Selection

Provision of the required Private channels to customer specification is normally carried out during final test at the factory, or by the local depot/agent. Selection of these channels is performed by means of special integrated circuit (IC) devices, plugged into holders on the Private channel selector board in the transmitter/receiver unit.

These IC's are prepared to Redifon specification P29768/S, and are unique to each channel. Channel IC's are available from Redifon Marine Division for any channel in the International band as well as the Private band (see next paragraph). When ordering these IC's the channel number must be specified, e.g. for channel 36 order part no. 36/P29768/S; for channel 91 order part no. 91/P29768/S. The channel number is marked on the top of the device.

On certain double frequency channels in the International and Private bands, single frequency simplex operation is sometimes required on the ship transmit frequency (e.g. for ship-to-ship communication). In this case a suffix 'A' is added to the channel number when ordering, e.g. if channel 18 is to be operated as a single frequency channel, the required channel IC is part no. 18A/P29768/S. Note that these channels can only be selected as Private channels (even though they may be in the International band) since keyboard selection of the channel number will automatically give double frequency operation. This may be clarified by the following examples.

International band:

channel 18 (selected on keyboard as 18)

transmit freq. 156·900MHz, receive freq. 161·500MHz

channel 18A (selected as P channel)

transmit and receive freqs. 156·900 MHz

Private band:

channel 91 (selected as P channel)

transmit freq. 157·575MHz, receive freq. 162·175MHz

channel 91A (selected as P channel)

transmit and receive freqs. 157·575MHz

If required, channel IC's may be prepared on board by carrying a small stock of new uncut IC's type SN7442N (e.g. Texas). The preparation of the device for the required channel is a straightforward task and this may avoid considerable delays in ordering and awaiting delivery of precut channel IC's. The pins to be removed for any required channel can be ascertained from Fig. 2.8. After cutting, offer up the IC to the appropriate diagram to check the lead configuration.

To commission a new channel, all that is necessary is to insert the channel IC into the holder on the Private channel selector board corresponding to the required P number of the channel (see Fig. 7.8). P channels should preferably be arranged in ascending order of channel number. No alignment or frequency check is necessary.

Great care must be exercised when inserting the IC, to ensure that the pins are not bent; if adjacent pins short together an incorrect channel may be selected, or the transmitter/receiver may be inhibited. It should be noted that the sockets on the Private channel selector board are designed for a maximum of six insertions.

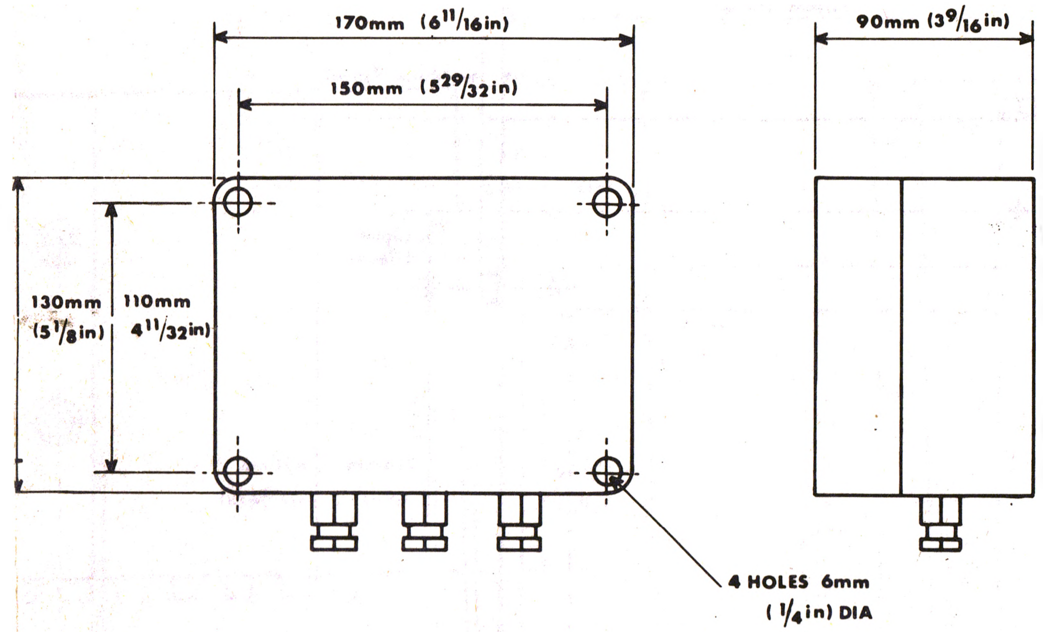
It is essential that a record of the Private channels fitted to the equipment be displayed in a prominent position adjacent to each control unit. Since these channels are displayed on the channel readout as P0-P9, this will be the only record of the actual channel numbers. Two copies of this chart may conveniently be entered in the tables provided at the end of this chapter.

P number	Channel number	Ship Tx frequency	Ship Rx frequency
P0		MHz	MHz
P1		MHz	MHz
P2		MHz	MHz
P3		MHz	MHz
P4		MHz	MHz
P5		MHz	MHz
P6		MHz	MHz
P7		MHz	MHz
P8		MHz	MHz
P9		MHz	MHz
		MHz	MHz
		MHz	MHz

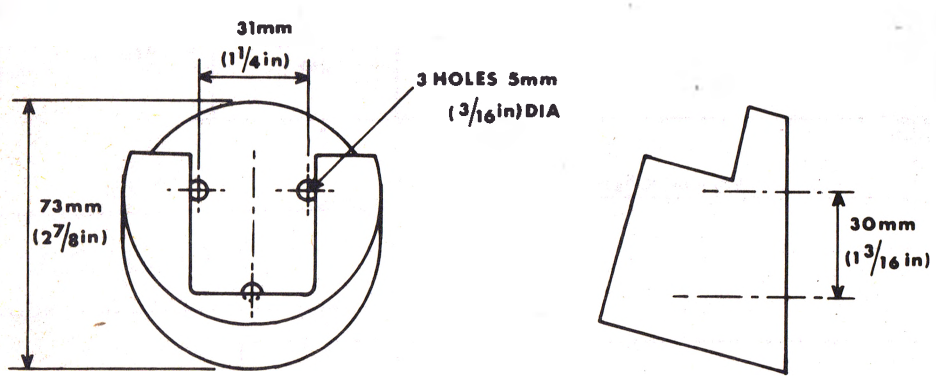
Sealand 66 Record of Private Channels Fitted

P number	Channel number	Ship Tx frequency	Ship Rx frequency
P0		MHz	MHz
P1		MHz	MHz
P2		MHz	MHz
P3		MHz	MHz
P4		MHz	MHz
P5		MHz	MHz
P6		MHz	MHz
P7		MHz	MHz
P8		MHz	MHz
P9		MHz	MHz
		MHz	MHz
		MHz	MHz

Sealand 66 Record of Private Channels Fitted

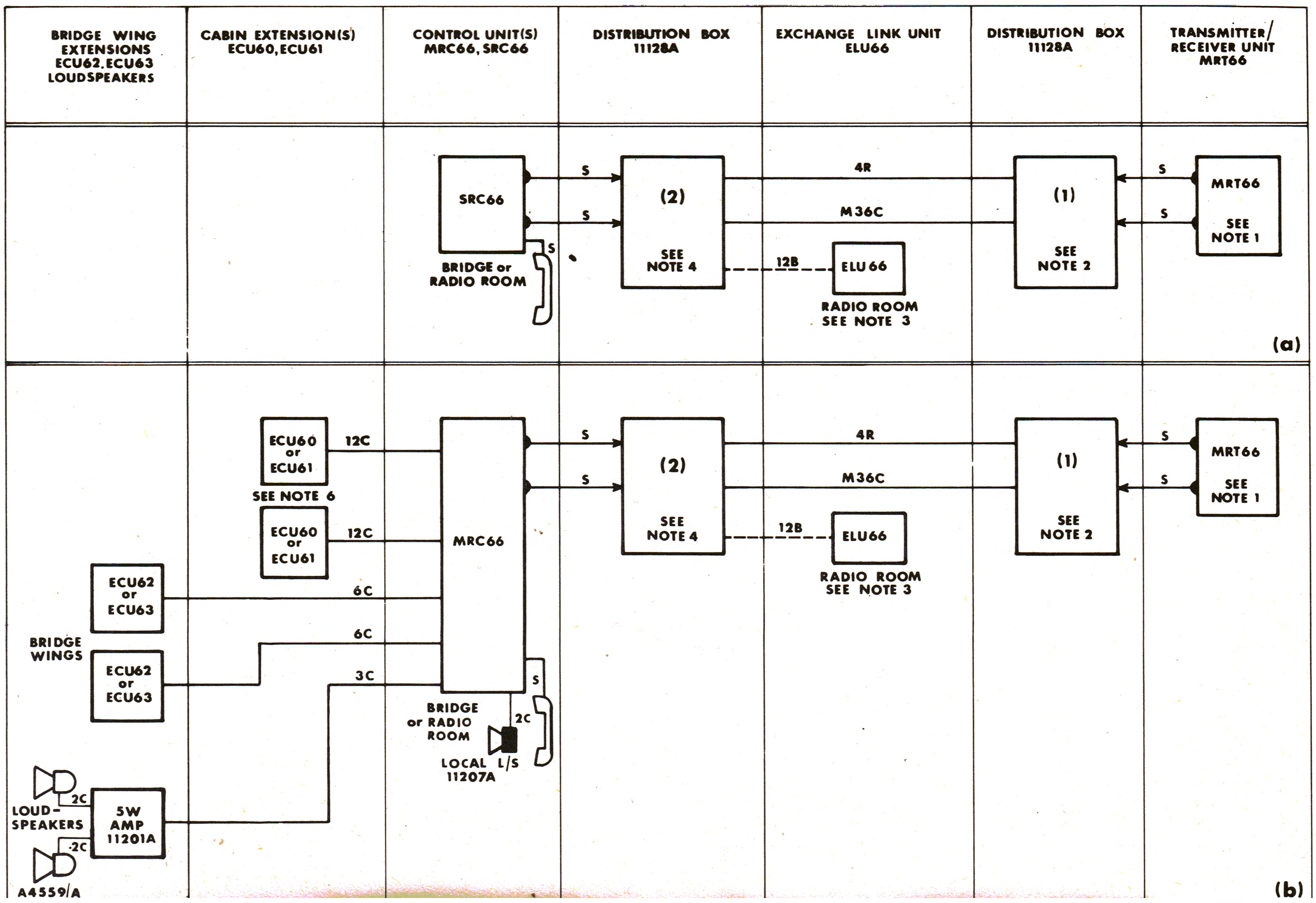


Loudhailer Amplifier 11201A

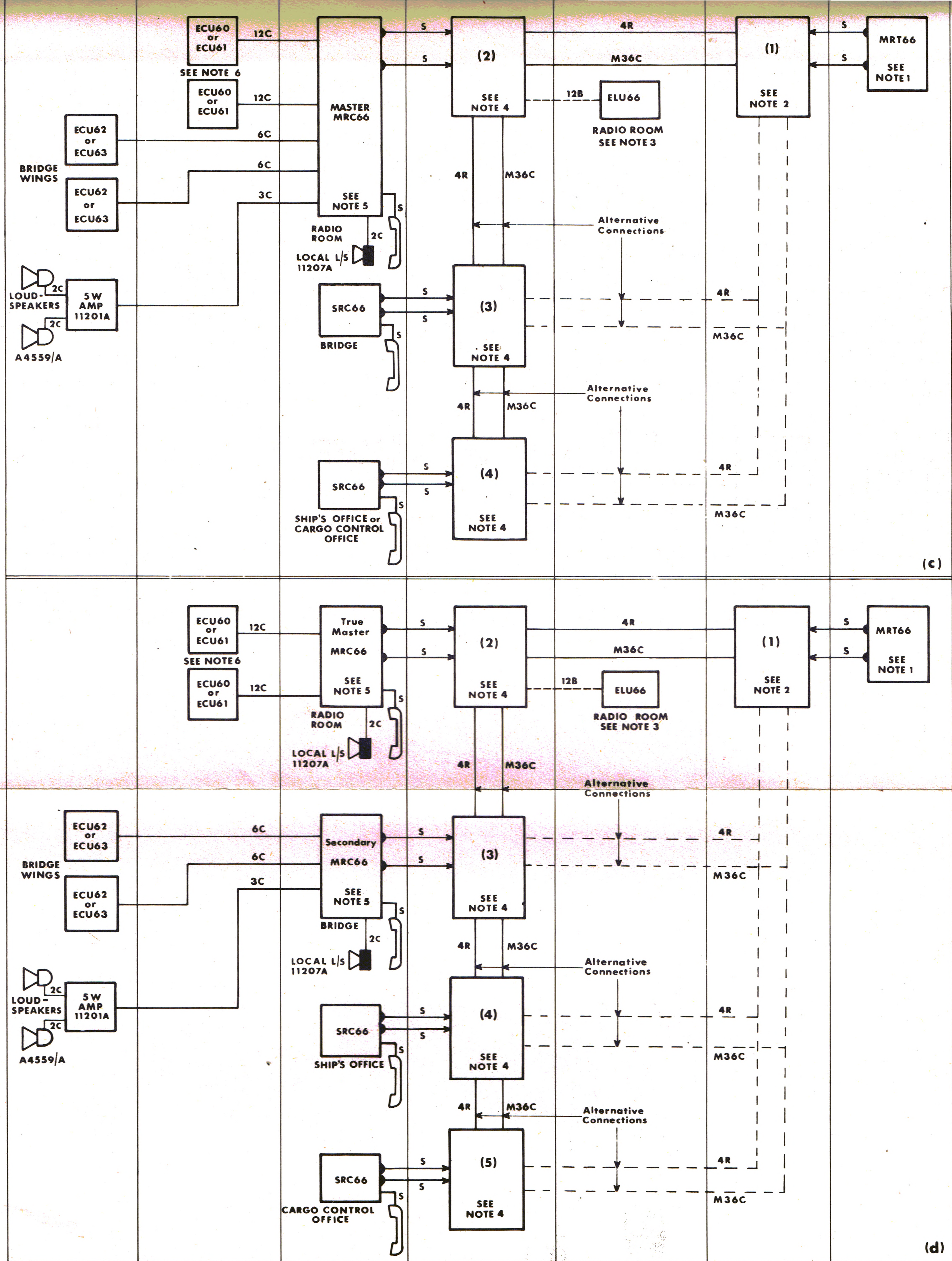


Handset Rest SGB B.107364-1

Fig.2.3(b) Fixing Centres for Sealand 66 Units



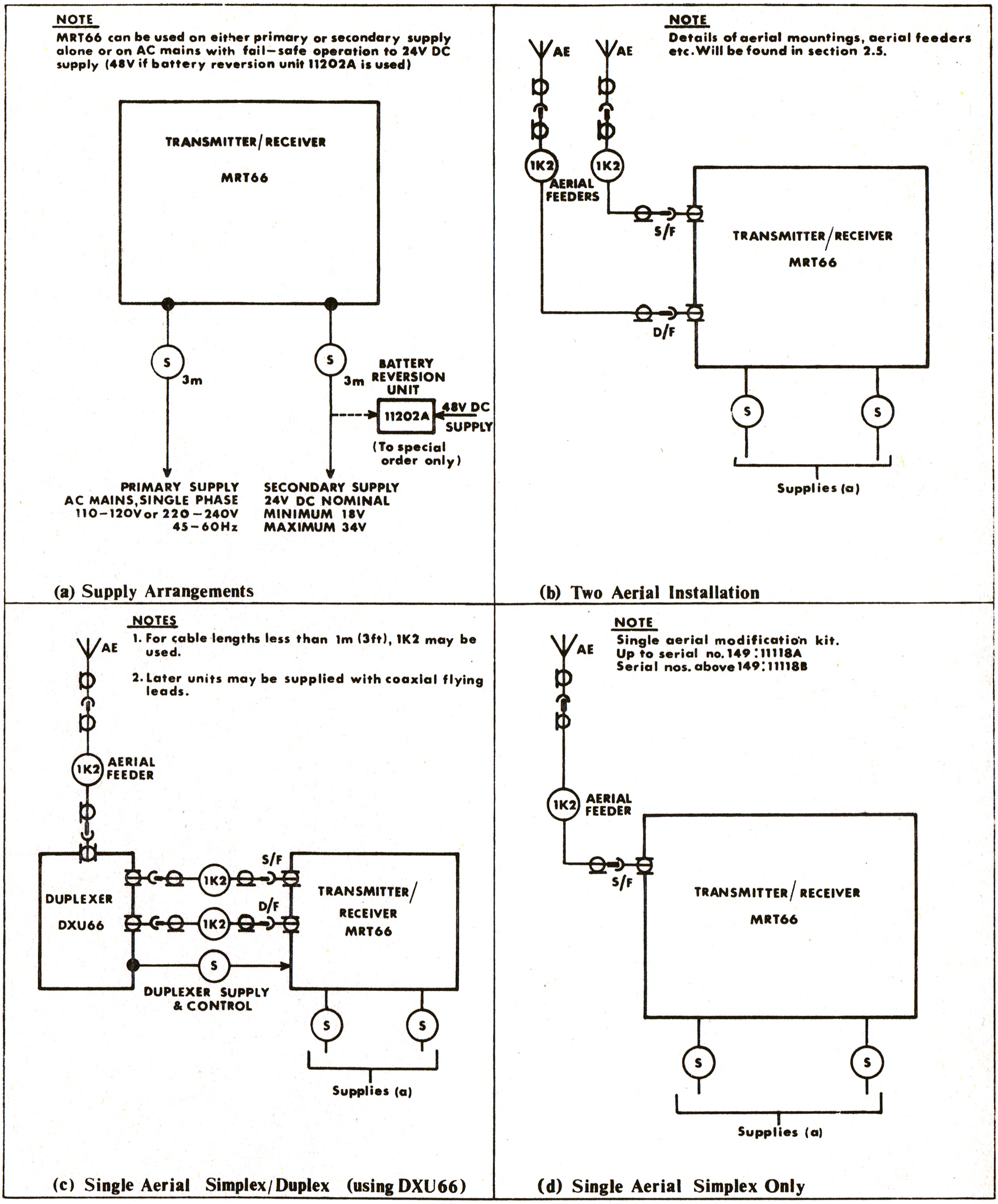
BRIDGE WING EXTENSIONS ECU62, ECU63 LOUDSPEAKERS
CABIN EXTENSION(S) ECU60, ECU61
CONTROL UNIT(S) MRC66, SRC66
DISTRIBUTION BOX 11128A
EXCHANGE LINK UNIT ELU66
DISTRIBUTION BOX 11128A
TRANSMITTER/ RECEIVER UNIT MRT66
SRC66
BRIDGE or RADIO ROOM
S
(2)
SEE NOTE 4
4R
M36C
12B
ELU 66
RADIO ROOM SEE NOTE 3
(1)
SEE NOTE 2
MRT66
SEE NOTE 1
(a)
ECU60 or ECU61
12C
SEE NOTE 6
ECU60 or ECU61
12C
MRC66
ECU62 or ECU63
6C
BRIDGE WINGS
ECU62 or ECU63
6C
3C
BRIDGE or RADIO ROOM
2C
LOCAL L/S 11207A
LOUD-SPEAKERS
2C
5W AMP 11201A
-2C
A4559/A
(b)



Typical Sealand 66 Systems

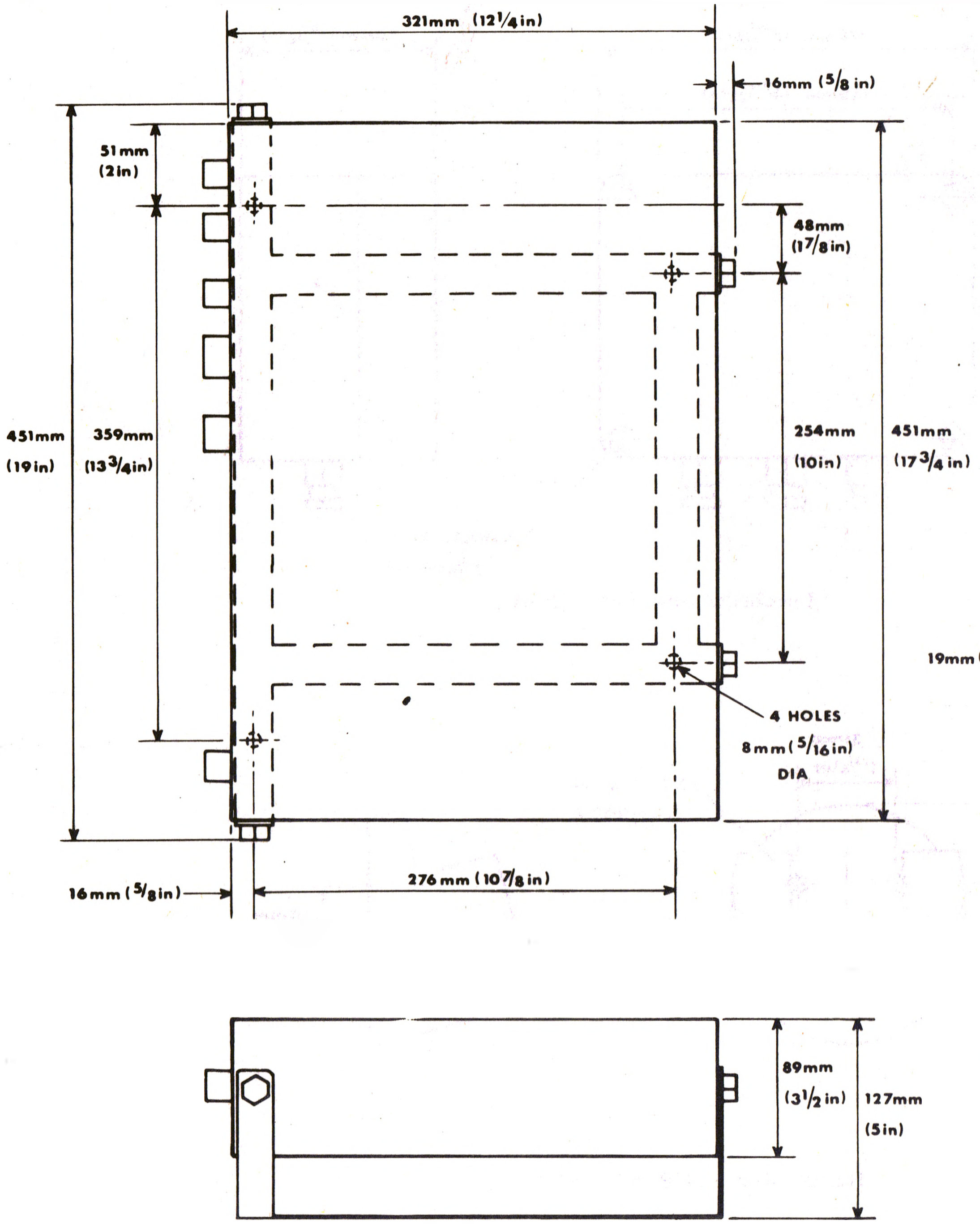
Fig.2.1

CABLE NOTES	NOTE 6	NOTE 5	NOTE 4	NOTE 3	NOTE 2	NOTE 1
Cables marked S are supplied attached to unit. For description of other cables, see section 2.9.	6C cable may be used for ECU61.	Up to 4 control units SRC66 or MRC66 can be selected from (True) master MRC66. Secondary MRC66 used only for selection of extensions; cannot select other control units. Master and Secondary roles may be reversed on installation.	Maximum cable length 200m (650ft) from Dist Box (1) to any other Dist Box in the system.	ELU66 can be selected only from radio operator's control unit.	If total cable length from MRT66 to first control unit is 6m (20ft) or less, Dist Box (1) is not required.	Supply and aerial options are shown in FIG 2.2 (a)-(d).

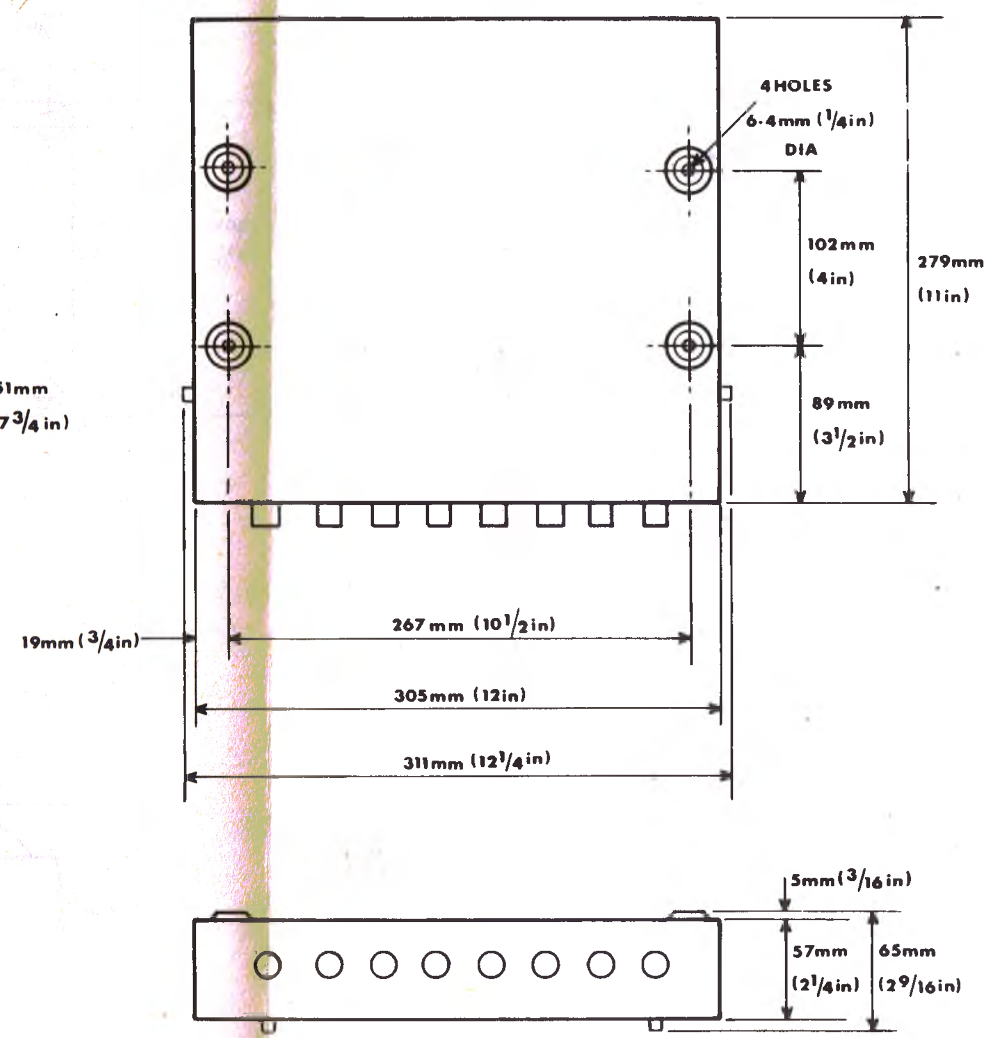


General note (S) indicates cable supplied attached to unit.

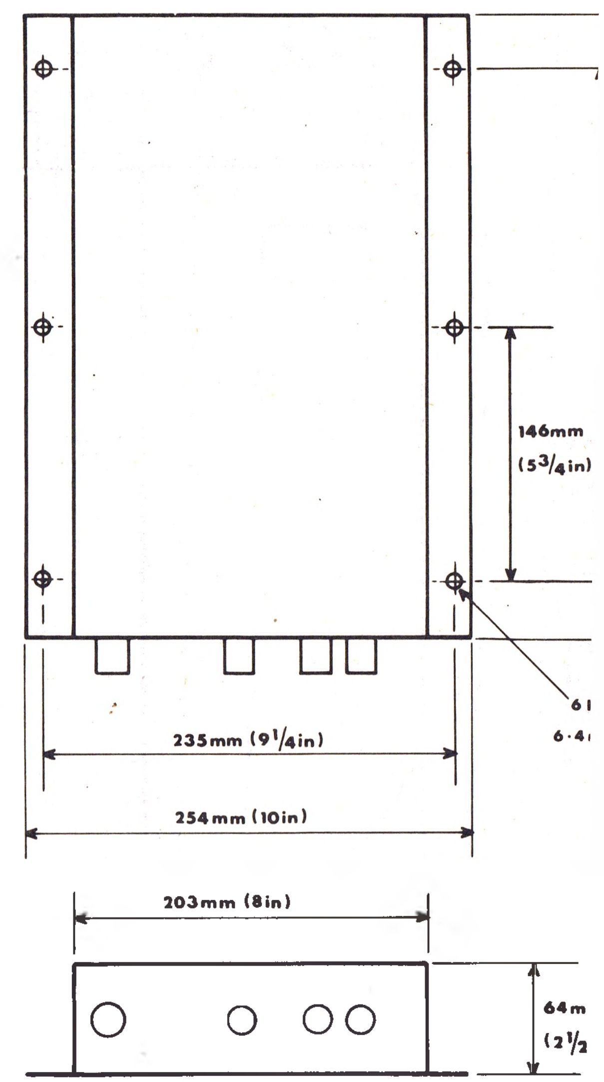
Supply Arrangements and Aerial Options



Transmitter/Receiver MRT66

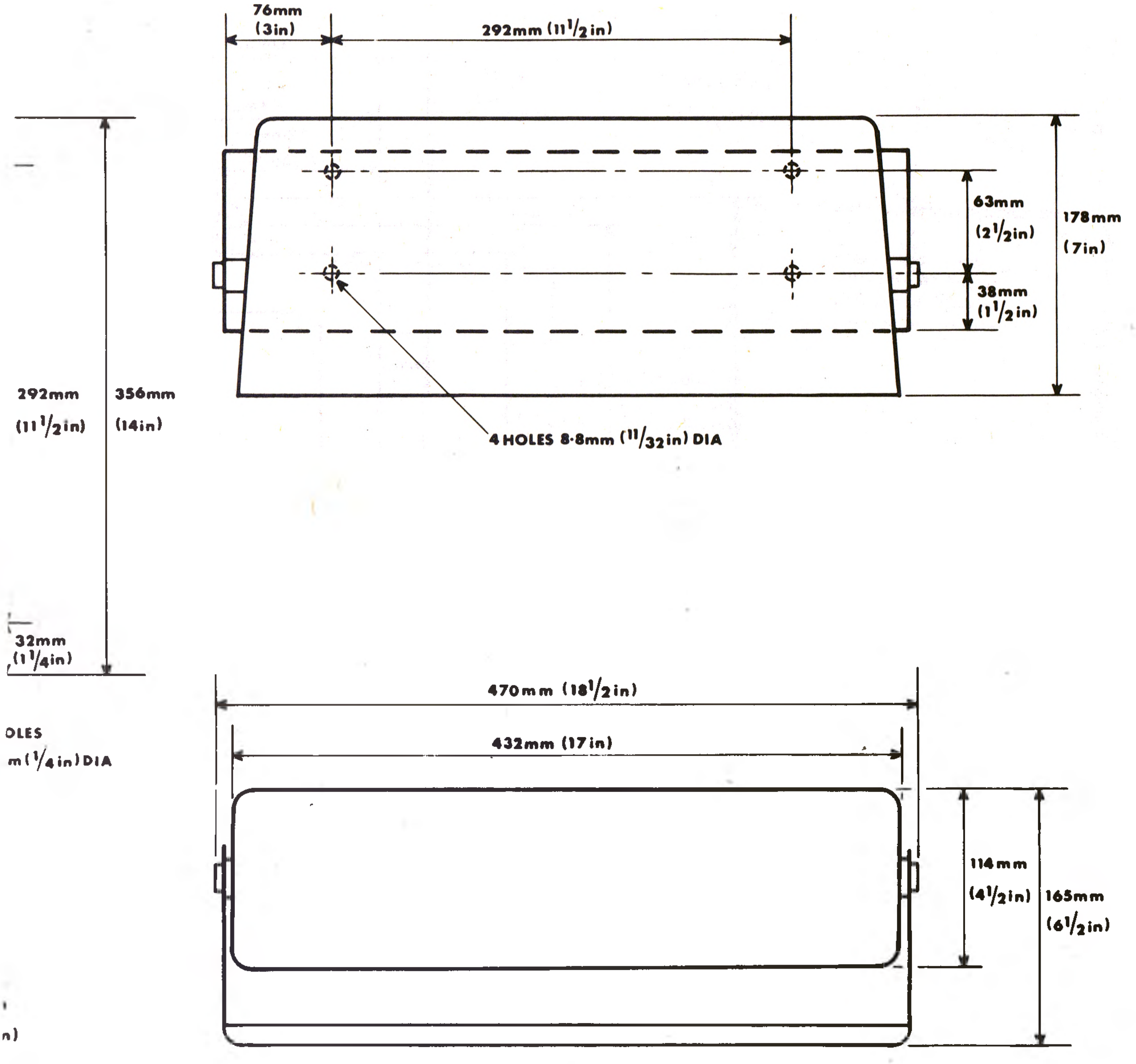


Distribution Box 11128A



Duplexer DXU66

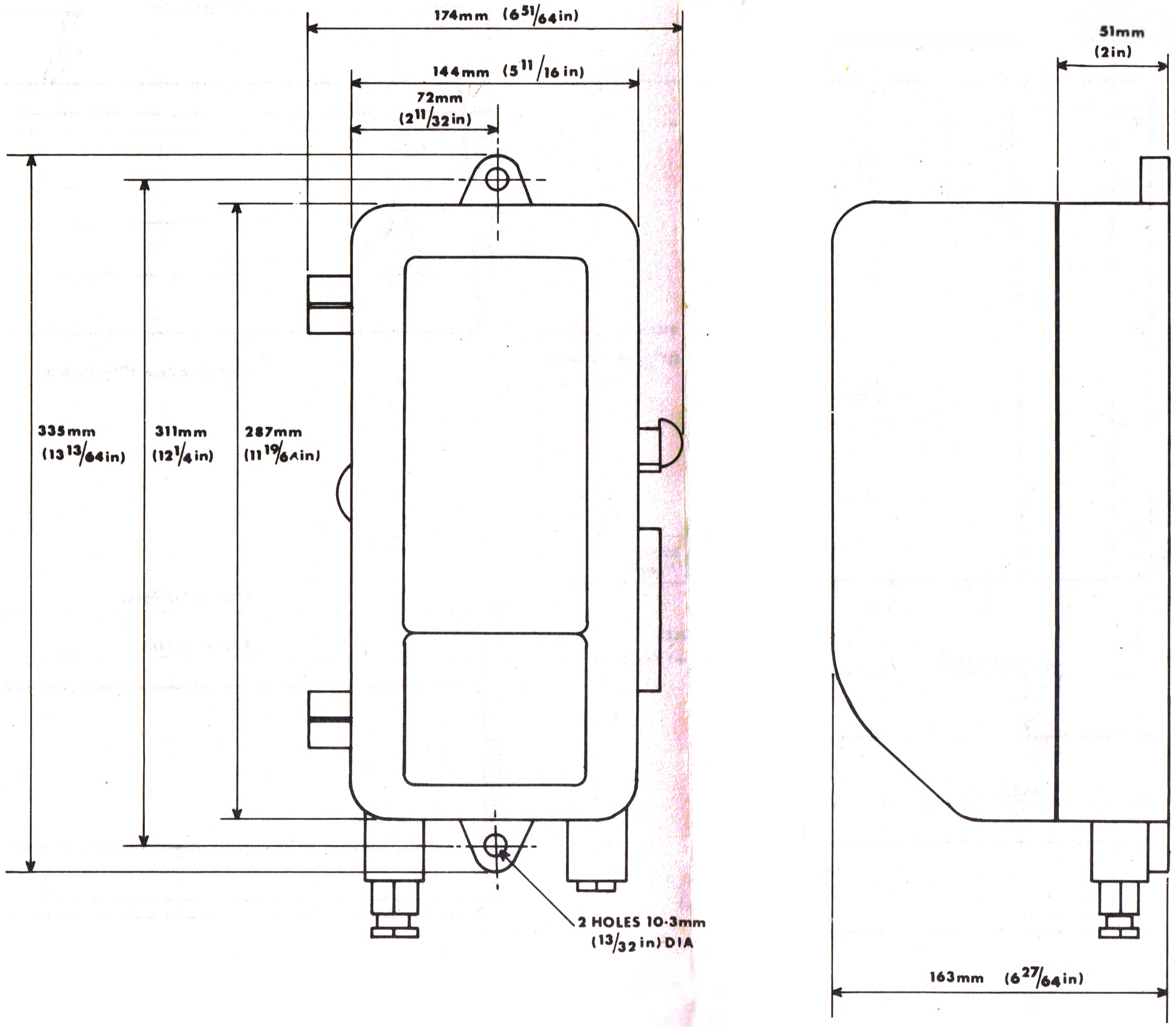
NOT TO SCALE



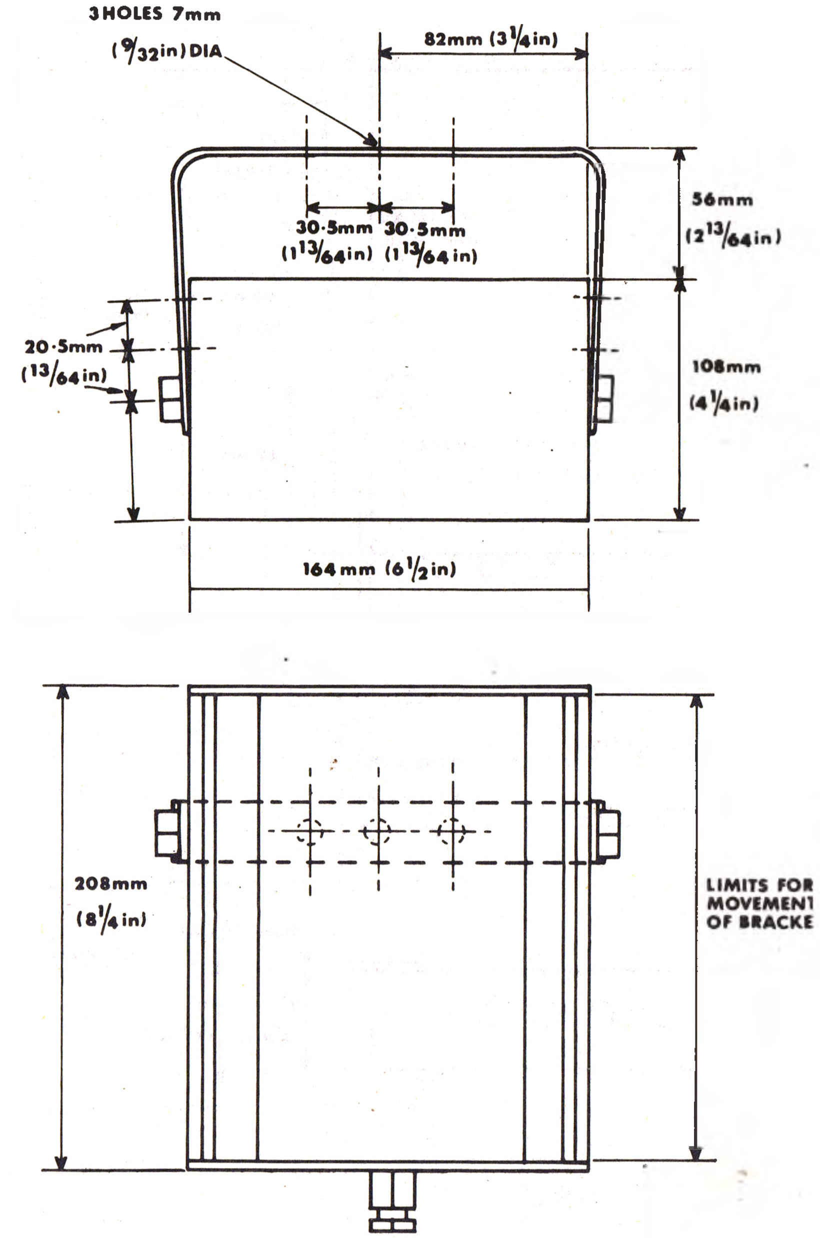
Control Unit MRC66/SRC66

Fixing Centres for Sealand 66 Units

Fig.2.3(a)

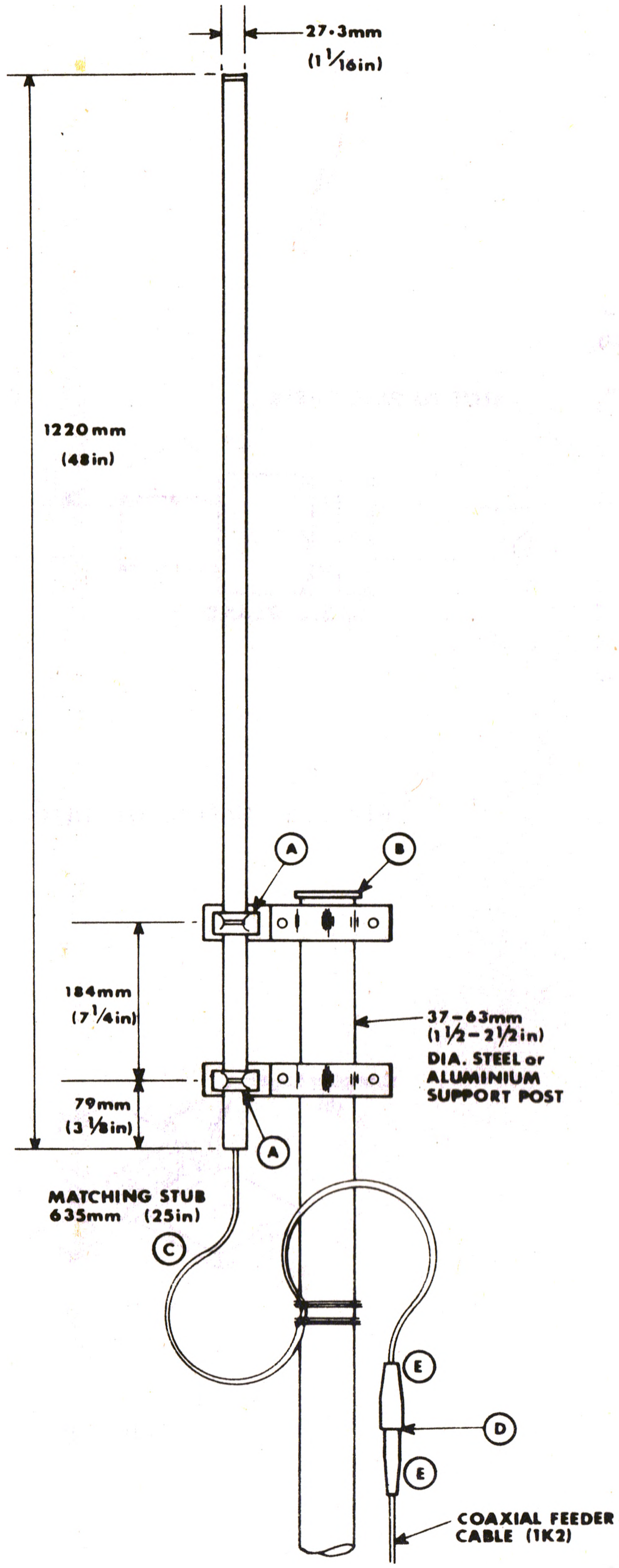


Bridge Wing Extension ECU 62



Extension Loudspeaker 11207A

NOT TO SCALE


27·3mm
(1 1/16in)
1220mm
(48in)
A
B
184mm
(7 1/4in)
37–63mm
(1 1/2–2 1/2in)
DIA. STEEL or
ALUMINIUM
SUPPORT POST
79mm
(3 1/8in)
A
MATCHING STUB
635mm (25in)
C
E
D
E
COAXIAL FEEDER
CABLE (1K2)

Notes and key

NOTES

1. Aerial type : unity gain sleeved dipole.
   Radiating element encased in parallel glass fibre tube, packed with plastic foam.
2. Weight 1·4kg (3 lb)
   Wind loading approx. 1·9kg at 100km/hr (4 lb at 60mph)
3. Frequency range 156 - 163MHz
   Impedance 50Ω
4. Resistance check: aerial type DO/50N (normally supplied) registers open circuit to DC. Alternative type may be supplied which is short circuit to DC (check with Redifon Marine Division).
5. VSWR check: with each aerial connected in turn to transmitter (50Ω) reading should not exceed 1·8:1.

KEY TO DIAGRAM

A Clamp only at coloured marker bands. Colour of these bands indicates aerial impedance : red = 50Ω

B Ensure minimum projection of support post above upper clamp.

C Matching stub terminates in 50Ω N-type jack, for connection of feeder cable. Stub length must not be altered.

D Connector threads should be coated with suitable silicone grease e.g. Midland Silicones type MS4 (Redifon stores index G88). Do not grease centre pin or outer sheath of cable.

E Protective sleeves fitted to matching stub and aerial feeder. Reduce length of sleeve fitted to feeder so that it fits inside sleeve fitted to stub. Seal with waterproof tape.

Aerial Mounting Details

Fig.2.4

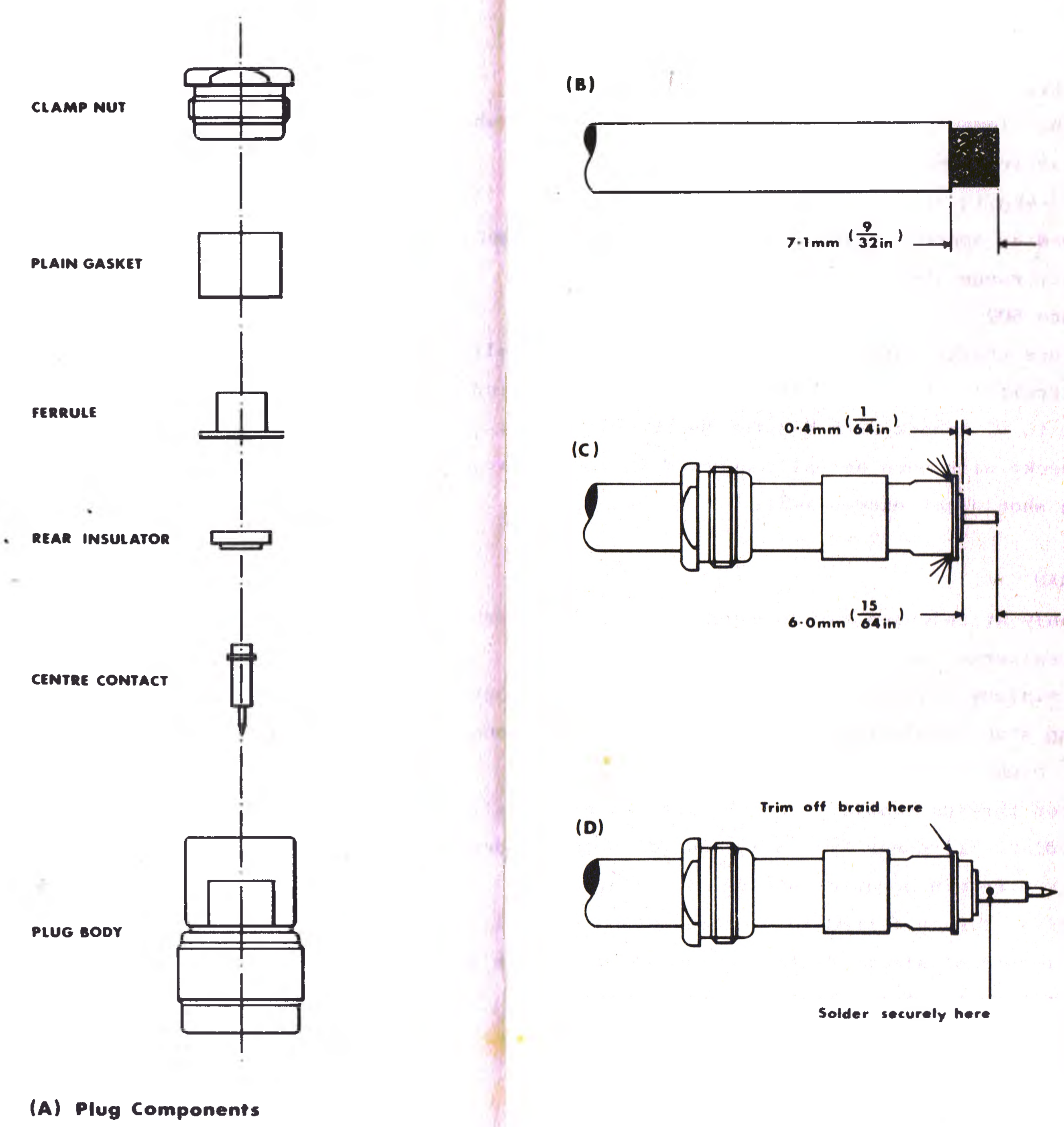


Fig.2.5 N-Type Coaxial Plug Assembly
(GE 15015C)

Figs.2.5, 2.6 and 2.7

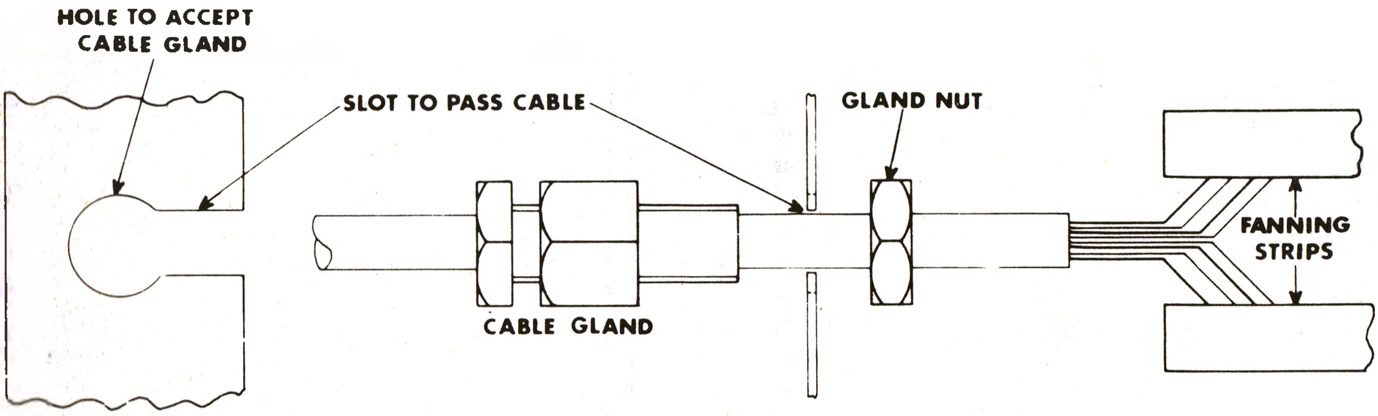


Fig.2.6 Method of Inserting Cables

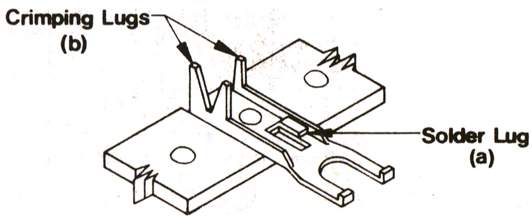
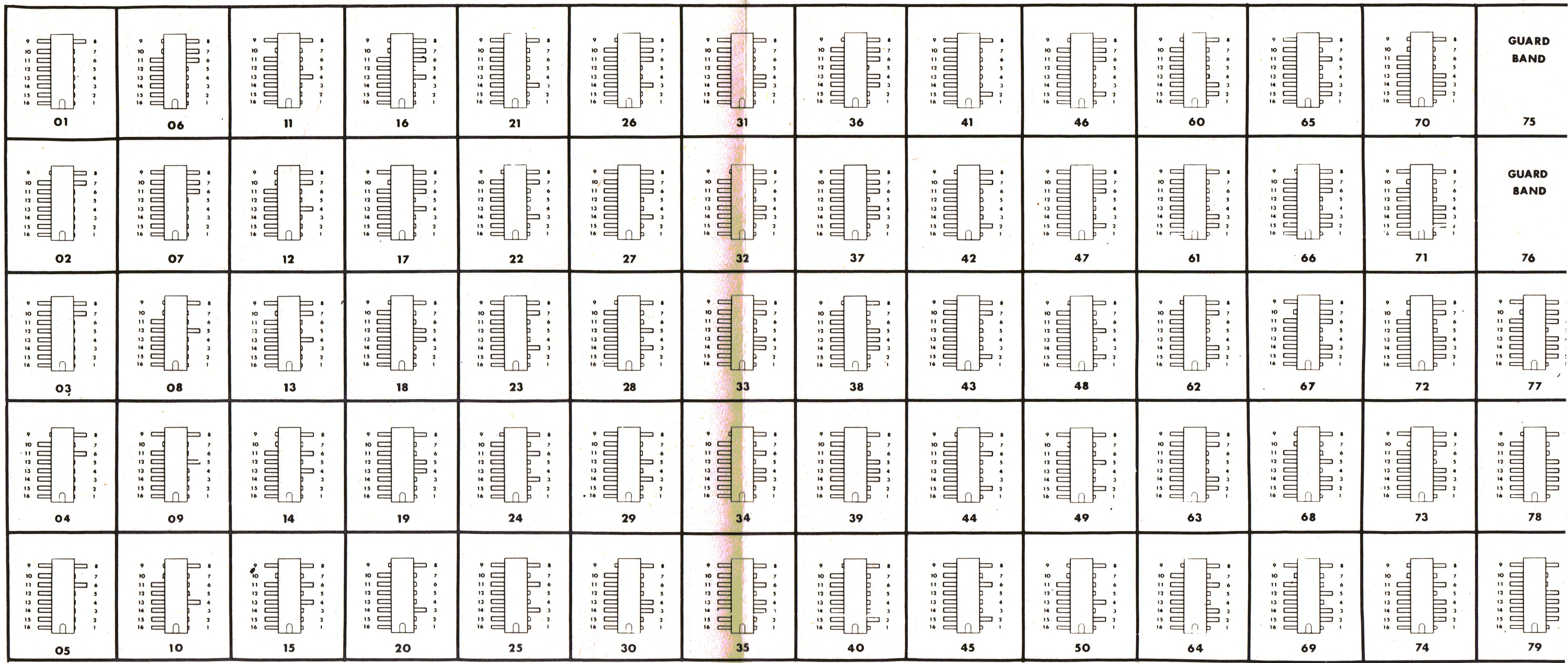


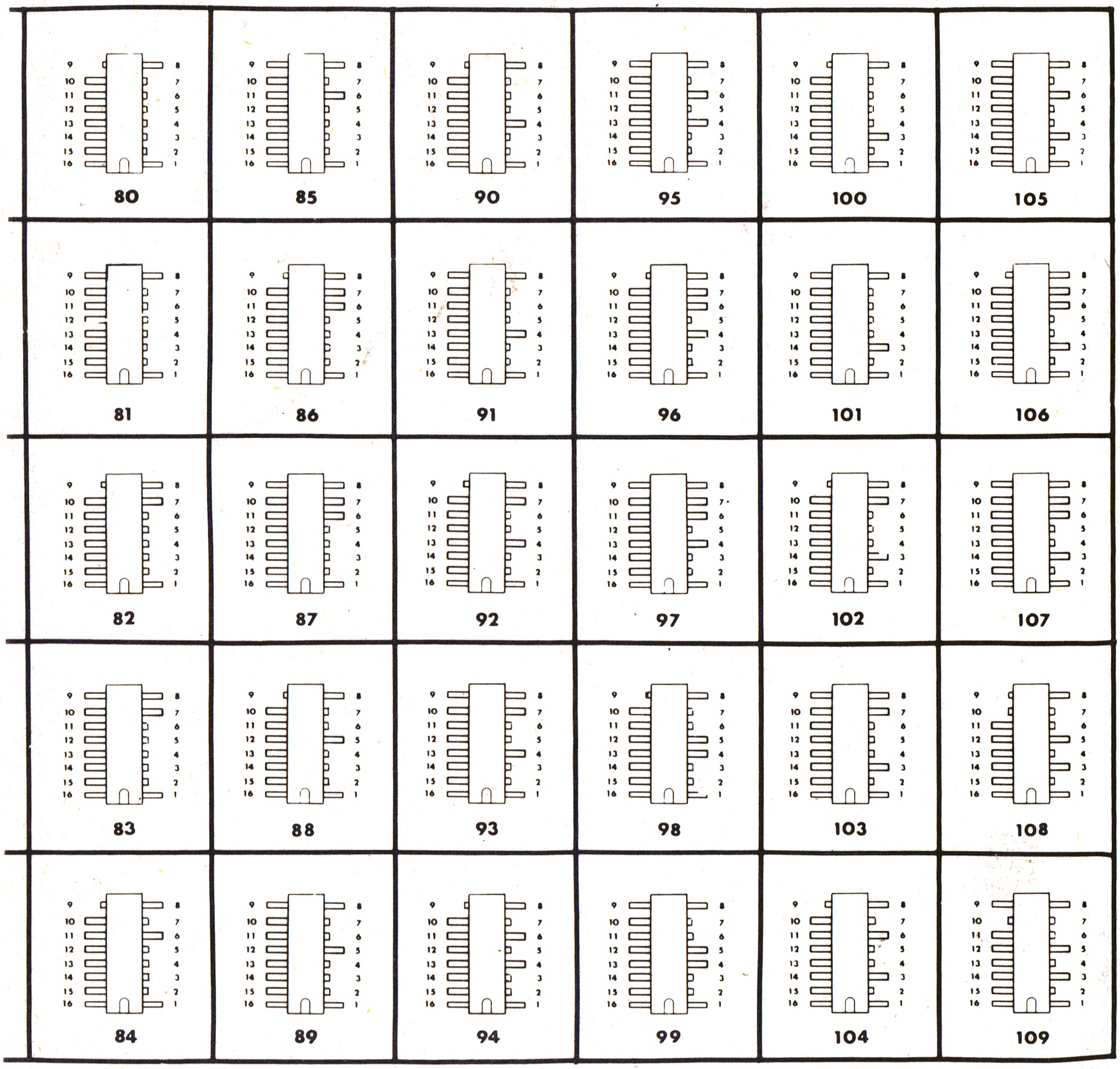
Fig.2.7 Fanning Strip Detail



Notes

NOTES

1. Channel IC's are prepared from stock devices type SN7442N (e.g. Texas).
2. IC's are viewed from top; ensure that location keyway is positioned as shown.
3. Pins shown ▯ are removed; do not remove pin 8 or pins 11-16.
4. Unwanted pins should be removed as near body as possible, using a sharp pair of side cutters or top cutters. Avoid damaging the body of the device.
5. After cutting, offer up the IC to the appropriate diagram to check the lead configuration.
6. Label should be affixed to top of IC, marked with the channel number.
Alternatively, the channel number may be signwritten in white, then 9.
coated with clear varnish.
7. An IC incorrectly cut for one channel should be coded with the actual 10.
channel number (if appropriate) and retained for possible future use.
8. Channels 01-28 and 60-88 are International and would normally be
selected directly at the keyboard. However, if single frequency
simplex operation is required on the ship transmit frequency of a 11.
double frequency channel in the International band (e.g.



for ship-to-ship communication) this can only be achieved by selecting it as a Private channel - see note 10. Channels 75 and 76 are guard bands for calling/distress channel 16, and are inhibited.

Channels 29-50 and 89-109 are Private (UK allocation) and may not be available in other countries.

Where single frequency simplex operation is required on the ship transmit frequency of a double frequency channel (International or Private) remove pin 10 from the IC, in addition to those indicated in the diagram. Add suffix 'A' to the channel number on the device.

A complete list of channel frequencies will be found in Table 3.1 (a) International and (b) Private.

Preparation of Channel IC's

Fig.2.8

3 OPERATING INSTRUCTIONS

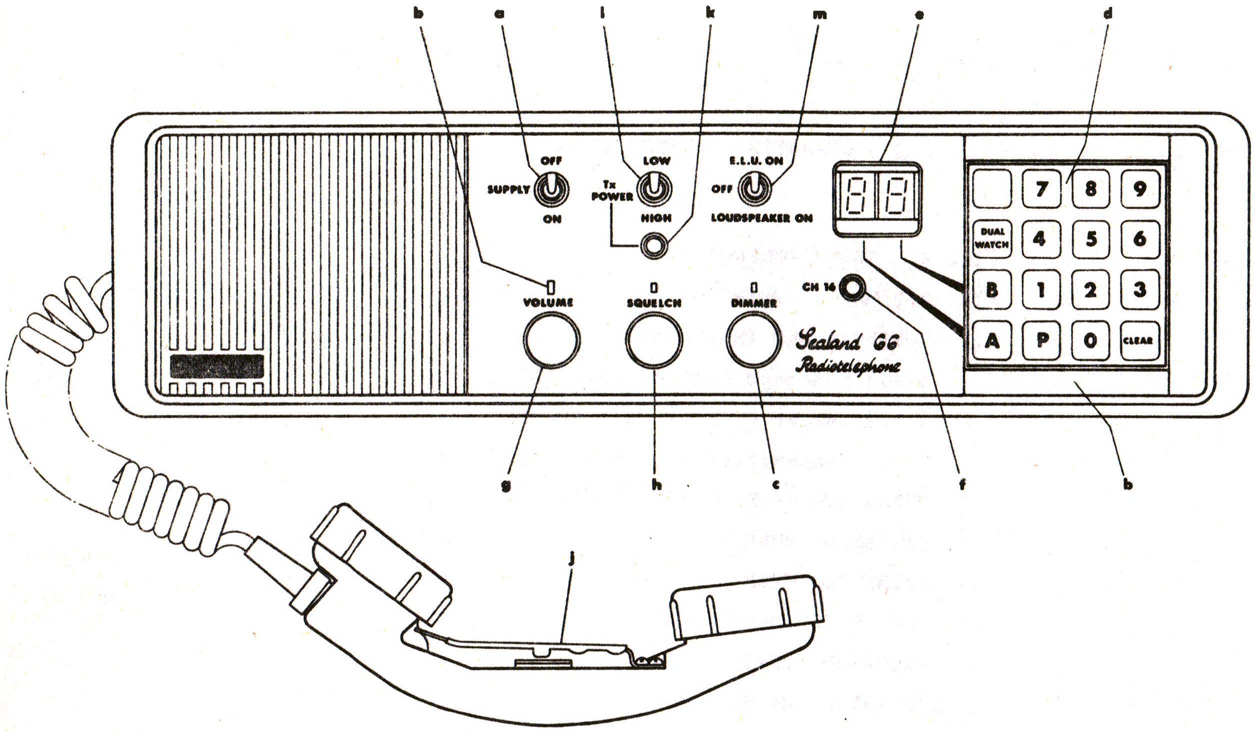


Fig.3.1 SRC66 Controls

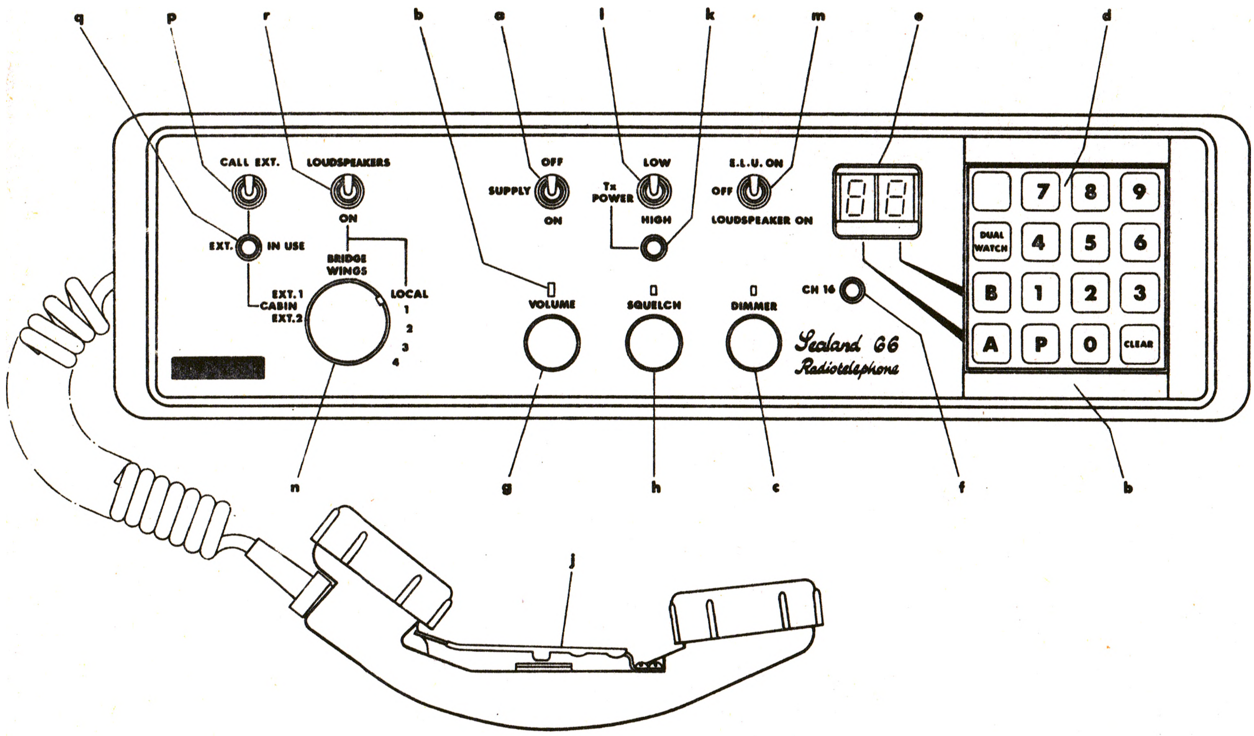


Fig.3.2 MRC66 Controls

3 OPERATING INSTRUCTIONS

3.1 CONTROLS AND INDICATIONS

3.1.1 Standard Control Unit SRC66

(a) ON/OFF SWITCH (3S6)

Switches the transmitter/receiver and control unit on, provided that the supply is switched on at the MRT66. Where the installation includes a master control unit MRC66 in addition to one or more standard control units, only the On/Off switch on the selected control unit is operative.

(b) INDICATOR LAMPS

Indication that the system is switched on is provided at the control unit by a total of six lamps as follows. Two lamps 3LP6, 3LP8 provide illumination via three "windows", enabling the operator to locate the variable controls easily in poor light. Four lamps 3LP10-3LP13 illuminate the keyboard.

(c) DIMMER CONTROL (3R3)

Adjusts the illumination of the control location "windows" and the keyboard. Also controls the brightness of the channel readout display (e) and other indicator lamps.

(d) KEYBOARD (3KB1)

The touch-keyboard controls the frequency generating circuits of the transmitter/receiver. CAUTION. Only one key must be operated at a time, using only a light pressure on the key; high pressures are neither necessary nor desirable. Do not allow sharp objects to come into contact with the keys.

In conjunction with two memory stores, the keyboard allows rapid selection of operating frequencies as follows.

A:	Selects operation on channel A (any International channel 01-28 or 60-88, or any preprogrammed Private channel 29-50 or 89-109. For frequencies see Tables 3.1 (a) and (b) respectively).
B:	Selects operation on channel B as above.
DUAL WATCH:	Selects dual watch operation on preselected channels A and B.
P:	Selects operation on up to 10 Private channels (entered as P0-P9). Private channels are preprogrammed by means of specially prepared integrated circuits (channel IC's) which are mounted in the transmitter/receiver unit (see section 2.10.4 for details).
CLEAR:	This key clears the channel data from the selected memory store A or B, enabling a new channel number to be entered.

(e) CHANNEL READOUT (3CRD1, 3CRD2)

Two numeric displays which indicate the selected channel number. On International channels, the actual channel number is displayed; Private channels are displayed as P0 - P9.

(f) CHANNEL 16 LAMP (3LP9)

In addition to the channel readout display, a separate indicator lamp is provided for calling/distress channel 16.

(g) VOLUME CONTROL (3R1)

Adjusts receiver 15Ω audio output level to the local loudspeaker (internal with SRC66, external with MRC66). The handset volume is preset, but can be adjusted if required by means of an internal preset potentiometer (see section 2.10.3).

(h) SQUELCH CONTROL (3R2)

Anticlockwise rotation of this control mutes the receiver in the absence of an incoming signal. The signal threshold is variable; further anticlockwise rotation requires progressively larger signals to demute the receiver.

(j) PRESS-TO-TALK SWITCH

Operation of this switch (on the handset) switches the transmitter on.

(k) Tx ON LAMP (3LP7)

This lamp indicates that the transmitter is on.

(l) Tx POWER SWITCH (3S7)

Selects transmitter high or low power output. In the HIGH position power output of 20-25W is obtained; on LOW this is reduced to less than 1W. On channels 15 and 17 low power output is automatically obtained regardless of the position of this switch.

(m) ELU SWITCH (3S8)

This switch has three positions as follows:-

LOUDSPEAKER ON : Normal receiver operation with audio output fed to the handset and the local loudspeaker.

OFF : Normal receiver operation with audio output fed to the handset only.

ELU ON : This position of the switch is operative only on the radio operator's control unit. Switches the exchange link unit ELU66 on, and connects it to the transmitter audio input and receiver audio output circuits, enabling public correspondence calls to be made via the VHF system. The local loudspeaker is switched off in this position.

Operating instructions for the ELU66/Sealand 66 are given in section 3.6. For further details of the unit, including operation on HF, refer to separate ELU66 handbook 1007-1.

3.1.2 Master Control Unit MRC66

Controls (a) - (m) are as described in section 3.1.1 for the standard control unit. The additional controls listed below are fitted only to the master control unit MRC66.

(n) SERVICE SWITCH (2S1)

This eight position switch is part of the MRC linear board assembly. It provides for selection of the following services -

CABIN Ext. 1 or Ext. 2 } Selects cabin extensions type ECU60 or ECU61 which may be (for example) in the radio room (for crew R/T calls) or in the ship's office. The transmitter/receiver is then operated from the selected extension. The MRC66 retains overall control of the system.

BRIDGE WINGS: Selects bridge wing extensions type ECU62 or ECU63. The MRC66 retains overall control of the system.

LOCAL: In this position, the transmitter/receiver is operated from the MRC66 handset, with full control of all facilities.

1, 2 3 or 4: These positions allow selection of up to four standard control units SRC66. Control of all facilities (except cabin extensions and bridge wings) is then transferred to the selected control unit. The MRC66 retains overall control of the system.

Note. In some installations these switch positions may be used to select secondary master control units MRC66. In this case control of ALL facilities is transferred to the selected control unit. The true master MRC66 always retains overall control of the system, however.

(p) CALL EXT. SWITCH (3S1)

When the Service switch is set to CABIN EXT.1 or EXT.2 operation of this switch operates the buzzer in the selected extension unit (ECU60 only).

(q) EXT. IN USE LAMP (3LP1)

When the cabin extension handset is lifted, a pair of contacts on the cradle switch turn this lamp on.

(r) BRIDGE WINGS LOUDSPEAKERS SWITCH (3S2)

When the ELU switch is set to LOUDSPEAKER ON and the Service switch is set to LOCAL or BRIDGE WINGS, this switch is operative. In the ON position, the loudhailer amplifier (type 11201A) is switched on, feeding receiver audio output to the bridge wings loudspeakers. Power output up to 5W is available.

3.1.3 Transmitter/Receiver Unit MRT66

AC SWITCH (6S1)
DC SWITCH (6S2)

These switch on the primary AC mains supply and the secondary DC supply respectively. If both supplies are connected, the AC supply takes precedence, with automatic changeover to the (emergency) DC supply if the primary supply fails.

INDICATOR LAMP (6LP1)

Indicates that the transmitter/receiver unit is switched on, and operating from the AC mains supply.

3.2 OPERATION FROM MASTER CONTROL UNIT

(a) Set the MRC66 controls as follows:

Service switch to LOCAL
ELU switch to LOUDSPEAKER ON
Bridge Wings Loudspeakers switch to OFF (toggle up)
Squelch control fully clockwise
Volume control to mid-position
Supply switch to ON

(b) Noise or signals may be heard in the loudspeaker, depending on the channel selection/inhibit circuits (see Note 1). If no audio is present, check that the control location "windows" and keyboard are illuminated (rotate Dimmer control fully clockwise if necessary); this will confirm that the transmitter/receiver unit is switched on.

(c) Enter the two most frequently used channels in the A and B memory stores as follows. Assume that these channels are 16 and 28, i.e. both in the International band. Touch key A, then the CLEAR key, followed by 1 and 6; touch key B, then the CLEAR key, followed by 2 and 8. Any attempt to enter a non-designated channel number on the keyboard will cause the display to flash, and transmitter/receiver operation will be inhibited.

(d) Subsequently touching key A or B will automatically select the channel entered in that memory store. The position of the decimal point indicates whether channel A or B is in use.

(e) When it is required to change one of these channels it is only necessary to touch the A or B key as appropriate, then the CLEAR key, followed by the new channel number (but see (f) below). The channel in the other memory store will remain unaltered.

(f) Operation on Private channels (see Note 2) is arranged by means of specially prepared integrated circuits (channel IC's), which are plugged into holders on the Private channel selector board in the transmitter/receiver unit. Up to 10 of these channels may be fitted, and these are selected as P0 - P9. When operation is required on a Private channel (e.g. channel 91) reference must be made to the record of channels fitted which MUST be displayed in a prominent position adjacent to each control unit (for typical chart layout, see page 2-19). On this chart, channel 91 will be listed as (say) P3. To select this channel therefore, touch key A or B as appropriate, then the CLEAR key, followed by P and 3 (see Note 3).

(g) Having selected the operating channel(s), turn the Squelch control anticlockwise until the receiver noise output is just muted. Do not rotate the control any further than necessary, otherwise weak signals in fringe areas may not be received satisfactorily.

(h) The receiver will remain muted until a signal is received on the selected channel. When this occurs, adjust the Volume control as desired.

(j) The bridge wing loudspeakers may be switched on if required by setting the Bridge Wings Loudspeakers switch to the ON position.

(k) To operate the transmitter, first select the required power output level. Note that on channels 15 and 17, the transmitter output is automatically set to low power irrespective of the Tx Power switch setting. Operation of the press-to-talk switch on the handset switches the transmitter on.

(l) On single frequency channels the receiver is switched off during transmission, and the press-to-talk switch must be released for incoming signals to be received. On double frequency channels the local/bridge wings loudspeakers are automatically switched off when transmitting. The receiver remains operational however, and duplex working may be employed, using the handset only. Note that equipments modified for single aerial working (using the internal diode switching circuit) cannot be operated in the duplex mode.

NOTES ON SETTING UP CHANNELS

1. When the system is first switched on at the transmitter/receiver, the memory stores of all control units are cleared of any previously entered channel data. This does not apply when subsequently switching between alternative control units, the channel data then being retained for instant recall.

2. If single frequency simplex operation is required on the ship transmit frequency of a double frequency channel in the International band (e.g. for ship-to-ship communication) this can only be achieved by means of the Private channel selector circuits. This must be indicated on the channel chart as an 'A' channel e.g. channel 18A, selected as (say) P4.

3. Any attempt to enter a Private channel number (e.g. 29-50 or 89-109) on the keyboard will cause the display to flash, and transmitter/ receiver operation will be inhibited.

3.3 EXTENSION WORKING

(a) The desired operating channel must first be set up as detailed in paras. 3.2 (c) - (f) above.

(b) Set the Service switch to CABIN EXT. 1 or EXT. 2.

(c) To call the extension, depress the Call Ext. switch; this will operate the buzzer in the extension unit (ECU60 only).

(d) When the extension handset is lifted, a pair of contacts on the cradle switch turn the Ext-In-Use lamp on.

(e) Cabin extension units provide both simplex and duplex facilities and can therefore be used for intership R/T calls (this is not possible using an ELU66, which can only provide 2 frequency duplex operation).

(f) The channel set up on the master control unit may also be worked by one of the bridge wing extensions, by setting the Service switch to BRIDGE WINGS.

(g) The bridge wing loudspeakers may be switched on if required; they will be switched off automatically when transmitting.

NOTE. Overall control of the system remains with the master control unit during extension working.

3.4 OPERATION FROM STANDARD CONTROL UNIT

(a) If the installation includes a master control unit, the Service switch must be set to position 1, 2, 3 or 4 to select the appropriate standard control unit. Control of all facilities (except cabin extensions and bridge wings) is then transferred to the selected control unit.

(b) Operating details are as given in section 3.2 for the master control unit. References to the Service switch and Loudhailer switch are not applicable however, since these are not fitted to standard control units.

(c) Any two channels may be entered in the A and B memory stores of the standard control unit, since these are independent of the master control A and B stores. If channels have previously been entered in the memories, these will be instantly available.

NOTES ON STANDARD CONTROL UNIT

1. Overall control of the system remains with the master control unit which therefore retains priority of operation when necessary.

2. Channels entered in the A and B memories of the master control unit are still available when LOCAL control subsequently re-selected.

3.5 DUAL WATCH OPERATION

(a) Dual watch operation is available at master or standard control units. First set the receiver for normal working as follows:

Service switch to LOCAL } Master control unit only
Bridge Wings Loudspeakers switch to OFF (Toggle up) }
ELU switch to LOUDSPEAKER ON
Squelch control fully clockwise
Volume control to mid-position
Supply switch to ON

(b) Set up the required watch channels in the A and B memory stores as detailed in paras. 3.2(c) - (f) above.

(c) Turn the Squelch control anticlockwise until the receiver noise output on channel A is just muted. Check that channel B is also muted.

(d) Touch the DUAL WATCH key. The receiver will now scan channels A and B at approximately 5 channels/second (about 0·2 seconds/channel). The channel readout display is blanked out during scanning, except for the two A and B indicators (decimal points). Should scanning not occur see notes below.

(e) When an incoming signal is detected on either channel, the receiver stops scanning and pauses for 5-8 seconds (if the signal duration is less than this, scanning recommences at the end of the signal). During this pause, the channel readout indicates the received channel number. The position of the decimal point indicates whether this channel is in the A or B memory store.

(f) If it is desired to reply to the call, touch key A or B as appropriate. Normal transmitter/receiver operation will then be obtained on this channel. The transmitter cannot be operated when the dual watch facility is in use.

NOTES ON DUAL WATCH

1. If an inhibited channel is entered in memory A or B (warning given by flashing display) then dual watch scanning will not be available. Operation of the DUAL WATCH key will simply give fixed operation on channel A or B, whicever key was last operated.

2. If the installation includes a Duplexer type DXU66, dual watch scanning will not be available if an 'A' channel in the Private band is entered in memory A or B, i.e. if it is required to receive on the ship transmit frequency of a double frequency channel in the Private band (this would necessitate operation of the duplexer bypass relays at scanning speed). Operation of the DUAL WATCH key will simply give fixed operation on channel A or B, whichever key was last operated.

3.6 EXCHANGE WORKING

Exchange working is available only at the radio operator's control unit (master or standard). The installation must include an exchange link unit ELU66, which is connected between the ship's exchange and a convenient distribution box in the Sealand 66 system.

(a) Set the ELU66 Function switch to VHF.

(b) The pre-arranged Sealand 66 operating channel is set up as described in paras. 3.2 (c) - (d) above. Note that the PAX or public correspondence link is available only on double frequency channels in the International band.

(c) With the ELU66 Exchange switch set to R/O TELEPHONE, set the control unit ELU switch to ELU ON.

(d) Call the on-board subscriber and confirm that the correspondence link is set up.

(e) Set the ELU66 Exchange switch to RADIO. This performs the following functions:

(i) The radio operator's telephone is disconnected.

(ii) The subscriber's telephone is connected to the MRT66 transmitter/receiver for the PAX call to be made via the VHF system (two frequency duplex operation only).

(iii) The MRT66 transmitter is switched on, and the Tx On lamp on the control unit lights.

(iv) The RADIO lamp on the ELU66 lights.

(v) The monitor amplifier in the ELU66 is switched on, enabling both sides of the call to be monitored (if required). The output from this amplifier is fed to an internal loudspeaker, the level being controlled by means of a front panel Volume control.

(f) On completion of the call, the subscriber replaces the telephone handset. Provided that the exchange is arranged for calling party release on the ELU line, dialling tones will not be radiated since only the radio operator, having initiated the call, can clear the exchange.

(g) Return the control unit ELU switch to the OFF or LOUDSPEAKER ON position as required. The exchange is then cleared by returning the ELU66 Exchange switch to R/O TELEPHONE.

3.7 DISPLAY BLANK OR FLASHING

The channel readout display is blanked under the following conditions:

(i) When the system is first switched on at the transmitter/receiver.

(ii) Before a channel number is entered on the keyboard (e.g. after operation of the CLEAR key).

(iii) After operation of the first key (tens) the display remains blanked until the second key (units) is operated, i.e. until a complete channel number is entered.

(iv) On dual watch operation, whilst scanning is taking place.

Conditions (i) to (iii) also cause transmitter/receiver operation to be inhibited. Dual watch scanning is indicated by the A and B indicator lamps (decimal points) being lit alternately at about 0·2 seconds/channel. When an incoming signal is received, display blanking is removed, the display then indicating the received channel number. Transmitter operation is inhibited on dual watch.

The display will flash if a non-International channel number is entered on the keyboard, e.g. guard band channels 75 or 76, Private channels 29-50 or 89-109, or any other non-designated channel number. See Table 3.1 (a) for list of International channels together with transmit and receive frequencies. Private channels must be selected as P channels, the channel code being generated by means of channel IC's (see section 2.10.4). Refer to the channel chart adjacent to the control unit for details of the Private channels fitted.

If in doubt about the reasons for blanking or flashing of the display, repeat the procedures given in paras.3.2 (c) to (f) for entry of the two required channels. Regarding operation of the keyboard keys, the following general notes should be observed:

(a) Operate only one key at a time.

(b) Press the key firmly, but without applying excessive pressure.

(c) Keep sharp objects away from the keys.

TABLE 3.1 VHF MARINE SERVICES

(a) International Channels

Channel No.	Transmit Freq. (MHz)	Receive Freq. (MHz)	Channel No.	Transmit Freq. (MHz)	Receive Freq. (MHz)
Original channels (50kHz plan)			Interleaved channels (25kHz plan)		
01	156·050	160·650	60	156·025	160·625
02	156·100	160·700	61	156·075	160·675
03	156·150	160·750	62	156·125	160·725
04	156·200	160·800	63	156·175	160·775
05	156·250	160·850	64	156·225	160·825
06	156·300	S/F	65	156·275	160·875
07	156·350	160·950	66	156·325	160·925
08	156·400	S/F	67	156·375	S/F
09	156·450	S/F	68	156·425	S/F
10	156·500	S/F	69	156·475	S/F
11	156·550	S/F	70	156·525	S/F
12	156·600	S/F	71	156·575	S/F
13	156·650	S/F	72	156·625	S/F
14	156·700	S/F	73	156·675	S/F
15*	156·750	S/F	74	156·725	S/F
16	156·800	S/F	75	Guard	Band
17*	156·850	S/F	76	Guard	Band
18	156·900	161·500	77	156·875	S/F
19	156·950	161·550	78	156·925	161·525
20	157·000	161·600	79	156·975	161·575
21	157·050	161·650	80	157·025	161·625
22	157·100	161·700	81	157·075	161·675
23	157·150	161·750	82	157·125	161·725
24	157·200	161·800	83	157·175	161·775
25	157·250	161·850	84	157·225	161·825
26	157·300	161·900	85	157·275	161·875
27	157·350	161·950	86	157·325	161·925
28	157·400	162·000	87	157·375	161·975
			88	157·425	162·025

Notes

1. These channels may be selected directly on the keyboard.
2. S/F indicates single frequency channel, i.e. receive on ship transmit frequency.
3. Certain double frequency channels may be operated single frequency simplex on the ship transmit frequency (e.g. for ship-to-ship communication). In this case a suffix 'A' is added to the channel number, e.g. channel 18A transmit and receive frequencies 156·900 MHz.
4. The Sealand 66 is not suitable for use on Continental semi-duplex (1MHz spaced) channels.

* Until 1st January 1983, transmitter power output must not exceed 1W on channels 15 and 17 (transmitter is switched automatically to low power on these channels).

(b) Private Channels (UK Allocation)

These channels may not be available in other countries.

Channel No.		Transmit Freq. (MHz)	Receive Freq. (MHz)	Channel No.		Transmit Freq. (MHz)	Receive Freq. (MHz)
50kHz plan	25kHz plan			50kHz plan	25kHz plan		
29		157·450	162·050		99	157·975	162·575
	89	157·475	162·075	40		158·000	162·600
30		157·500	162·100		100	158·025	162·625
	90	157·525	162·125	41		158·050	162·650
31		157·550	162·150		101	158·075	162·675
	91	157·575	162·175	42		158·100	162·700
32		157·600	162·200		102	158·125	162·725
	92	157·625	162·225	43		158·150	162·750
33		157·650	162·250		103	158·175	162·775
	93	157·675	162·275	44		158·200	162·800
34		157·700	162·300		104	158·225	162·825
	94	157·725	162·325	45		158·250	162·850
35		157·750	162·350		105	158·275	162·875
	95	157·775	162·375	46		158·300	162·900
36		157·800	162·400		106	158·325	162·925
	96	157·825	162·425	47		158·350	162·950
37		157·850	162·450		107	158·375	162·975
	97	157·875	162·475	48		158·400	163·000
38		157·900	162·500		108	158·425	S/F
	98	157·925	162·525	49		158·450	S/F
39		157·950	162·550		109	158·475	S/F
				50		158·500	S/F

Notes

1. These channels cannot be selected directly on the keyboard, but are selected as P channels, using channel IC's for generation of the channel code (see section 2.10.4).
2. Where permitted on the licence, specific channels in the Private band may be arranged to operate single frequency simplex on the transmit frequency (add suffix 'A' to channel no.)

TABLE 3.2 ORDER OF CHOICE (CHANNEL Nos.)

Choice	Public Correspondence	Port Operations		Intership
		S/F	D/F	
1st	26	12	20	06
2nd	27	14	22	08
3rd	25	11	18	10
4th	24	13	19	13
5th	23	09	21	09
6th	28	68	05	70
7th	04	71	07	72
8th	01	74	02	73
9th	03	10	03	69
10th	02	67	01	67
11th	07	69	04	77
12th	05	73	78	15
13th	84	17	82	17
14th	87	15	79	-
15th	86	-	81	-

4 CIRCUIT DESCRIPTION

4 CIRCUIT DESCRIPTION

4.1 BASIC SYSTEM

A block diagram of the Sealand 66 basic system is shown in Fig.4.1. It will be seen that the circuits are divided into transmitter, receiver and frequency generating functions. Briefly, the operation of these circuits is as follows.

The frequency generating system produces two separate outputs with a constant frequency difference of 10·7MHz. The actual frequencies are dependent on the channel selected by the control unit. One of these signals (in the range 145·3 - 147·8MHz) supplies local oscillator injection to the receiver circuits. The other signal (156 - 158·5MHz) drives the transmitter.

Assume that the ship transmit frequency of the selected channel is f_s. The transmitter drive signal at frequency f_s is fed via the 156 - 158·5MHz bandpass filters to the Tx driver and PA circuits. The PA output, at a level of 20-25W (high power) or 1W (low power) is fed via the aerial changeover relay and aerial filter to the single frequency aerial socket. Modulation of the transmitter signal is performed in the frequency generating circuits.

The receiver comprises two separate RF/IF strips for single frequency and double frequency channels, with common audio stages. The use of separate receiver strips permits reception of S/F and D/F channels with a single local oscillator injection frequency. The intermediate frequencies of the two strips are 10·7MHz (S/F) and 15·3MHz (D/F). The appropriate receiver strip is energised automatically according to the channel selected.

Local oscillator injection, at a frequency of f_s - 10·7MHz is fed to mixers 1 and 2 in the two receiver strips. Received signals from the S/F or D/F aerials are amplified by the respective front end amplifiers and fed to these mixers.

When a single frequency channel is selected, the received signal is fed via the aerial filter and changeover relay. The frequency of this signal is equal to the transmit frequency f_s. The wanted output from mixer 1 is the difference frequency

$f_s - (f_s - 10{\cdot}7\text{MHz})$ i.e. 10·7MHz.

This IF component is selected by a 10·7MHz crystal filter and applied to the single frequency IF amplifier. After amplification, the IF signal is demodulated and the AF component fed to the audio amplifier. Outputs are provided for the local loudspeaker and the handset earpiece.

If the selected channel is double frequency, then the received frequency f_d is 4·6MHz higher than the transmit frequency, i.e. f_s + 4·6MHz. The wanted output from mixer 2 is the difference frequency

$(f_s + 4{\cdot}6\text{MHz}) - (f_s - 10{\cdot}7\text{MHz})$ i.e. 15·3MHz.

This IF component is selected by a 15·3MHz crystal filter and applied to the double frequency IF amplifier. After amplification, the IF signal is demodulated and the AF component fed to the audio amplifier as before.

The double frequency receiver signal is normally obtained by means of a separate D/F aerial, but single aerial working can be arranged where necessary. If full duplex operation is required with a single aerial (International channels only) then a duplexer type DXU66 is connected as shown in the inset on Fig. 4.1.

Alternatively, if simplex operation only is acceptable, then single aerial working can be provided by means of an internal diode switching circuit. The diode switch is incorporated in the transmitter/receiver unit, and is simply linked in when this type of operation is specified (on some early equipments, this modification has to be added). The D/F aerial is omitted when single aerial simplex operation is employed.

4.2 CHANNEL FREQUENCY GENERATION

A block diagram of the frequency generation system is shown in Fig. 4.2. The operating frequency is determined by the voltage controlled oscillator (VCO) which forms part of a phase-locked loop. The VCO runs at the receiver local oscillator injection frequency (f_s - 10·7MHz) in the range 145·3 - 147·8MHz.

Operation of the phase-locked loop is as follows. An output from the VCO is fed to mixer 3; the second input to this mixer is obtained from the downmix oscillator via a tuned filter which selects the fourth harmonic. The mixer input frequencies are therefore:

from VCO	145·3 - 147·8MHz
downmix oscillator x4	132·75MHz

The wanted output from mixer 3 is the difference frequency, which lies in the range 12·55 - 15·05MHz. This component is selected by filters and fed to the variable divider. The channel coding information from the control unit determines the division ratio of this divider, which lies between 502 and 602. The output from the variable divider, at 25kHz, is applied to the phase comparator.

In the phase comparator, the variable divider output is compared with a standard 25kHz reference signal. This is obtained from the 3·2MHz reference oscillator by means of a ÷128 reference divider. The phase-error output from the comparator is then filtered and applied as control signal to the VCO. This control signal adjusts the VCO frequency until the variable divider output is in phase with the reference signal; the VCO system is then in lock.

One output from the VCO is fed as local oscillator injection to mixers 1 and 2 in the single frequency and double frequency receiver strips. A second VCO output is fed to mixer 4 in the transmitter; the output from a 10·7MHz oscillator is also fed to this mixer. The wanted output from mixer 4 is the sum frequency

10·7MHz + (f_s - 10·7MHz)

i.e. the ship transmit frequency f_s, which lies in the range 156 - 158·5MHz. This signal is fed via bandpass filters to the Tx driver and PA stages (Fig. 4.1).

Transmitter modulation is achieved by applying the control unit microphone signal via the AF processing circuits to the VCO control line. This modulates the VCO output, the audio modulation being transferred to the transmitter drive signal in mixer 4. The modulation is also present on the local oscillator injection signal fed to the receiver circuits; this causes receiver sidetone to be produced in the presence of a received carrier (i.e. during duplex operation).

4.3 CHANNEL CODE GENERATING SYSTEM

An overall block diagram of the channel code generating and processing systems is shown in Fig. 4.3. The control unit circuits shown on the left of the diagram are common to Master and Standard control units MRC66 and SRC66. Operation of the channel code generating system is described in sections 4.3.1 to 4.3.5 below.

4.3.1 A/B Selection

Operation of the A key sets the A/B latch IC6a, b to the A state. The dual watch circuit IC48, 49, 50 (in the MRT66) is thereby set to the A condition (dual watch oscillator switched off) and the A output from this circuit is fed back to switching circuit IC18 in the control unit. An output from the switching circuit is applied to the A/B data selectors IC16, IC17 causing them to select the channel data in memory A.

The channel readout displays are blanked until a valid channel number has been entered on the keyboard, but the A lamp (decimal point) is illuminated via lamp driver circuit TR5, 6, 9.

Similarly, operation of the B key causes the A/B data selectors IC16, IC17 to select the channel data in memory B; the B lamp is then illuminated.

4.3.2 International Channels

Assuming that operation on an International channel is required, the channel number is now entered on the keyboard using the numerical keys. Each numeral is converted to a 4-digit binary code by the encoder IC2, IC3. This code is applied on 4 lines (having binary code values of 8, 4, 2, 1) to each of the four memories IC12-IC15.

Meanwhile, assuming that key A was previously operated, the A output from the A/B latch has also been fed to the "data steering" circuit IC7-IC11. This circuit produces data entry commands which are fed in turn to IC12 (first digit following the A) and IC13 (second digit). Thus, although the binary coded figures from the keyboard are fed to the inputs of all four memories, only one memory is clocked to accept the incoming data.

This can be summarised as follows:-

Operate key A: 1st figure (tens) entered in memory IC12
2nd figure (units) entered in memory IC13.

Similarly, following operation of key B:
1st figure (tens) entered in memory IC14
2nd figure (units) entered in memory IC15.

The channel coding information from the control unit to the code processing circuits of the MRT66 is carried on a total of 8 control lines as follows:-

4 TENS control lines E-H from memory IC12 (A) or IC14 (B)
4 UNITS control lines A-B from memory IC13 (A) or IC15 (B).

When an International channel is selected, these control lines carry the channelling code directly. The code consists of two groups of 4-digit binary code, corresponding to the tens and units figures of the required channel number. The binary code digits (one to each control line) have the values shown below:-

TENS control lines : H = 80, G = 40, F = 20, E = 10
UNITS control lines: D = 8, C = 4, B = 2, A = 1

This may be clarified by the following examples. Channel 16 is encoded as 0001, 0110; channel 28 as 0010, 1000. In this code a "1" is equivalent to an energised line, "0" lines being grounded.

4.3.3 Private Channels

Private channels must be selected as P0 - P9. If a Private channel number is entered directly on the keyboard using the numerical keys, the channel read-out display flashes and the transmitter/receiver circuits are inhibited.

Operation of the P key (following the A or B) applies the "P" code 1100 to the 4 data lines at the memory inputs. The "data steering" circuit ensures that this code is entered in tens memory IC12 (A) or IC14 (B). The P number is entered in units memory IC13 (A) or IC15 (B).

Generation of the actual channelling code is performed by means of specially prepared integrated circuits (channel IC's) in the MRT66; this is described in section 4.4.2.

4.3.4 Channel Indication

The A or B channel data on the tens and units control lines is applied to two display driver circuits IC22, 24 and IC25, 23. These circuits energise the appropriate segments of the channel readout displays, thus giving visual indication of the selected channel.

4.3.5 Dual Watch

When the dual watch key is operated, latch circuit IC6c, d switches on the dual watch oscillator and timing circuits IC48, 49, 50 (in the MRT66). The A/B output from this circuit is fed back to switching circuit IC18 in the control unit. The A/B data selectors IC16, IC17 are thus switched sequentially to accept the channel data in the A and B memories. The channel code output from the control unit, on lines A-H, therefore alternates between channels A and B, at 0·2 seconds/channel.

Whilst scanning is taking place, the channel display is blanked, but the lamp driver circuit TR5, 6, 9 illuminates the A and B lamps (decimal points) alternately. When a signal is received on either channel, an output from the receiver squelch circuit is applied to the timing circuit, stopping the dual watch oscillator on A or B as appropriate (up to a maximum of 5-8 seconds). The display blanking signal is removed for the duration of this pause, thus giving visual indication of the received channel.

4.4 CHANNEL CODE PROCESSING SYSTEM

4.4.1 International Channels

An overall block diagram of the channel code generating and processing systems is shown in Fig. 4.3. The channel coding information from the control unit is applied to the transmitter/receiver unit via 4 TENS control lines E-H and 4 UNITS control lines A-D.

When an International channel is selected, the channelling code is applied direct to these control lines as described in section 4.3.2. These control lines are applied via selector switches IC15, IC16 and CMOS/TTL interfaces IC33, IC34 to the variable divider, the tens control lines being routed also via a channel interleaving circuit IC30, 31, 32. This circuit energises the I/L line if channels 60-88 (i.e. interleaved International channels) are selected. The I/L line is applied to the variable divider together with the units lines and the "modified tens" output lines from the interleaving circuit.

The information carried by these 9 control lines sets the division ratio of the variable divider, in the range 502-602. When channels 60-88 are selected (and the I/L line therefore energised) the division ratio is increased by 1 compared with channels 01-28.

The division ratio of the variable divider determines the multiple of 25kHz produced at the output of mixer 3 (Fig. 4.2) in the range 12·55 - 15·05MHz. This in turn determines the VCO frequency and hence the operating frequency of the transmitter and receiver circuits as described in section 4.2.

The simplex/duplex channel recogniser IC51, 52, 53 operates in the International band, and supplies an input via IC17 to the S/F-D/F switching circuit TR13, 14, 15 on the receiver board. This circuit then energises the single frequency or double frequency receiver strip automatically, depending on which channel is entered on the keyboard.

An additional detector circuit IC55, TR13 recognises channels 15 and 17, and automatically switches the transmitter to low power if either of these channels is selected.

An inhibit circuit IC10, 11, 54 prevents transmitter/receiver operation under the following conditions:

(i) If a Private channel number is entered on the keyboard (these must be entered as P channels - see section 4.3.3).

(ii) If a guard band channel (75 or 76) or other non-designated channel number is entered.

(iii) If channel 00 is entered, or if no channel number is entered on the keyboard.

4.4.2 Private Channels

When operation is required on a Private channel, the "P" code 1100 is applied to the TENS control lines; this is applied automatically by operation of the P key on the control unit. This code is detected by the "P" recogniser TR5, TR6. The output from this circuit switches the tens and units selectors IC15, IC16 so that they receive the channel code from the Private channel selector board.

The P number encoded on the UNITS control lines is detected by the decoder IC18, 45, 46. This circuit selects the correct plug-in channel IC on the Private channel selector board (up to 10 preset channels may be fitted). The selected channel IC then applies the required channel code to the divider control lines via selectors IC15, IC16. The channelling code is the same as that used for International channels, e.g. channel 29 is encoded as 0010, 1001, channel 87 as 1000, 0111.

Each of these channel IC's comprises an identical integrated circuit diode array. The decoding circuit IC18, 45, 46 applies HT to the paralleled anodes of the diodes contained in the selected IC (one diode to each control line). The selected IC is precut for the required channel number by disconnecting the internal diodes where "0" lines are required (by cutting the appropriate pins from the IC). Diodes not disconnected in this way apply a "1" code to the remaining control lines. Full details of channel IC preparation are given in Fig. 2.8.

Operation of the remaining circuits, including the channel interleaver, is as described for International channels. The I/L line, the tens lines modified by the channel interleaver and the units lines are applied to the variable divider. The I/L line is energised if channels 89-109 (i.e. interleaved Private channels) are selected.

The data carried by these 9 control lines sets the division ratio of the variable divider, which therefore determines the transmitter and receiver operating frequencies as before.

An additional control line from the selected channel IC (Private S/D line) supplies an input via selector IC17 to the S/F - D/F switching circuit TR13, 14, 15 on the receiver board. This circuit then energises the single frequency or double frequency receiver strip as appropriate. This latter facility enables single frequency simplex operation to be obtained on the ship transmit frequency of a normally double frequency channel if required (International or Private).

4.5 LINEAR CONTROL CIRCUITS

4.5.1 General

Linear control of the Sealand 66 is by means of positive DC voltage levels, provided by the selected control unit (MRC66 or SRC66). The controlling voltages are applied to the transmitter/receiver (MRT66) via the 4-core and 36-core interconnecting cables. Other control units in the system are prevented from loading the control lines by means of either blocking diodes or relay contacts.

The 600Ω audio transmitter input and receiver output lines are connected only to the selected control unit. The signal paths to other control units are blocked by means of field effect transistors (FET's) operated in a "pinched-off" mode. The receiver loudspeaker output is blocked by relay contacts which close only when the particular control unit is selected.

4.5.2 Supply Switching

AC mains input to the transmitter/receiver (Fig. 7.21) is connected via Mains On/Off switch 6S1 and transformer 6T1 to the DC regulator, which produces a nominal +24V DC supply rail (actual voltage of 26·4V corresponds to that of a fully charged 24V battery for compatibility). This supply (via 7FS4) is fed down the brown core of the 36-core interconnecting cable, and down the red core of the 4-core cable, to TS2/8 and TS1/9 respectively in the system master control unit.

Referring to Fig. 7.29, the supply at TS2/8 (+24V HT) is connected via the control unit On/Off switch to wafer 'a' of the Service switch S1. This switch routes the supply as described below.

In the LOCAL, BRIDGE WINGS and CABIN EXT. 1 and EXT. 2 positions of the switch, the supply is fed via D7, D8, D4 and D3 respectively to the control unit internal circuits as follows:

(i) to relay RL2, causing contacts RL2-1 and RL2-2 to change over.

(ii) to the carbon microphone bias chain R21, R25, R22, R23.

(iii) to the Tx Power switch 3S7.

(iv) via R26, R27 to zener diode D24, providing a stable +10V supply for remote volume and squelch DC controlling levels.

(v) to the collector of emitter follower TR10 associated with remote volume control.

(vi) to TR11, TR12 for control of the FET switches in the transmitter and receiver 600Ω audio lines.

(vii) via D20 to the red/blue core of the 36-core interconnecting cable (On/Off function).

The supply on the red/blue core is fed back to the transmitter/receiver, where it operates relay 7RL2 (Fig. 7.21). The relay contacts change over, applying the +24V DC supply to the switching regulator (described in section 4.10.3). The +5V and +10V outputs from this regulator energise the internal circuits in the transmitter/receiver unit.

In positions 1, 2, 3 and 4 of the Service switch (Fig. 7.29) the +24V supply is routed via the orange, pink, turquoise and grey cores respectively of the 36-core interconnecting cable. These cores are picked up by the remote control unit to be selected in each of these switch positions, the necessary connections being made during installation (section 2.10.1). The supply on the orange, pink, turquoise or grey core is then fed via the particular control unit On/Off switch to internal circuits (i) to (vii) as listed above (shown in Fig. 7.25).

Referring to Fig. 7.29 or 7.25, the supply at TS1/9 [+24V (logic)] is connected to relay contacts RL2-1. When the particular control unit is selected, these contacts change over and connect the supply to the voltage stabilising circuits TR21, TR22, D33 which power the lamp dimmer and logic supplies. In all other control units in the system, the supply at TS1/9 is routed via RL2-1 normally closed contacts and R55 to zener diode D33, thus maintaining a continuous V_{DD} supply of +10V to the memory circuits. This ensures that each control unit retains the channel data entered in its A and B memories, even when it is not providing system control.

4.5.3 Volume Control

The AF level from the receiver (Fig. 7.3) is varied by means of an integrated circuit voltage variable attenuator (IC10) at the input to the audio power amplifier. The variable volume control voltage from the control unit is fed down the red/black core of the 36-core interconnecting cable and applied to IC10 via R106. The voltage on the red/black core varies from approximately +7V for minimum volume to +1V for maximum volume.

Referring to the MRC linear circuit (Fig.7.29) the volume control voltage is derived as follows. In the LOCAL and BRIDGE WINGS positions of the master control Service switch S1f, the stable +10V supply across D24 is attenuated by R34, the Volume control 3R1 and R28. The variable voltage from the wiper of 3R1 is applied to the base of emitter follower TR10, the emitter output from this stage being applied via D26 to the red/black core and hence to the receiver.

In the CABIN EXT. 1 and EXT.2 positions of the Service switch, the local Volume control 3R1 is replaced by the Volume control on the selected extension unit (ECU60 only). Other extension units, which do not include a Volume control, cause a maximum voltage of +9V to be applied to the red/black core, giving maximum attenuation of the receiver 15Ω output.

The derivation of the volume control voltage is similar on the SRC66 except for the omission of the Service switch (see Fig. 7.25).

4.5.4 Squelch Control

The squelch circuit in the receiver (Fig. 7.3) includes a junction field effect transistor (FET) TR21, used as a variable series impedance in the potential divider TR21/R115. As the gate potential on TR21 approaches that of the source and drain the impedance of TR21 decreases, thus increasing the overall gain of the noise amplifier IC3c, d. This causes the squelch detector TR9, TR10 to "pinch-off" the muting switch TR4 (an FET) and hence mutes the receiver. The variable squelch control voltage from the control unit is fed down the red/brown core of the 36-core interconnecting cable and applied to TR21 gate via the network R118, R117, C145, R116.

At the control unit (Fig. 7.29 or 7.25) the squelch control voltage is derived by the Squelch potentiometer 3R2, which is connected across the stable +10V supply at D24. The wiper of this control is connected via D23 to the red/brown core and hence to the receiver. As the Squelch control is rotated anticlockwise, the voltage on the red/brown core increases from 0V for minimum noise amplifier gain (receiver not muted) to +10V for maximum gain.

4.5.5 Rx Audio Outputs

The loudspeaker audio from the receiver is fed via the yellow core of the 4-core interconnecting cable to TS1/8, the return path being via TS1/7 and the green core (see Fig. 7.29). In the LOCAL and BRIDGE WINGS positions of the Service switch, the loudspeaker signal is fed via relay contacts RL2-2 to bank 'a' of the ELU switch 3S8. Provided that this switch is set to LOUDSPEAKER ON, the audio is then fed via the normally-closed relay contacts RL1-1 to the local (watchkeeping) loudspeaker connected between TS8/1 and 4.

The signal is also fed via TS8/2 to the input of the bridge wings loudhailer amplifier (if used). This amplifier is switched on by the +24V (logic) supply via bank 'b' of the ELU switch 3S8 (in the LOUDSPEAKER ON position) the normally-closed relay contacts RL1-2 and the Bridge Wings Loudspeakers switch in the ON position.

When the Service switch is set to CABIN EXT.1 or EXT. 2 wafer S1a causes relay RL1 to be energised via D6 or D5. Contacts RL1-1 change over, feeding the receiver audio signal via R5 and wafer S1c to the loudspeaker in the selected extension (ECU60 only). Contacts RL1-2 open circuit the loudhailer amplifier supply, thus switching off the bridge wings loudspeakers.

The 600Ω audio output from the receiver is fed via the white and black cores of the 36-core interconnecting cable to TS1/1 and 2 (Fig. 7.29), and applied to the FET switches TR14, TR15. When the particular control unit is selected, transistor switching circuit TR11, TR12 is energised via S1a and D7, D8, D4 or D3. This circuit switches the FET's TR14, TR15 into the conducting mode, feeding the 600Ω audio to S1e. This switch then routes the audio signal via preset potentiometers R33, R6, R7 or R10 to the earpiece in the local handset, the bridge wing handset(s) or one of the cabin extension handsets.

At all other control units in the system, the switching circuit TR11, TR12 is not energised. The FET switches TR14, TR15 are therefore "pinched off", effectively disconnecting the control unit audio circuits from the 600Ω line.

At the transmitter/receiver, the receiver audio output from the muting switch TR4 (Fig. 7.3) is adjusted in level by preset potentiometer R101 and fed to integrated amplifier IC11. The output from IC11 is connected via chassis-mounted transformer 6T2 (Fig. 7.21) to the white and black cores of the 36-core interconnecting cable and thence to the control unit(s). The nominal line output level from the receiver is 0dBm for a received signal of ±3kHz deviation at 1kHz.

4.5.6 <u>Press-to-Talk</u>

The transmitter is switched on by the application of a positive voltage on the Tx key line (yellow/red core of the 36-core interconnecting cable).

At the selected control unit (Fig. 7.29) the +24V HT supply at TS2/8 is routed by wafer 'a' of the Service switch S1 as follows. On LOCAL operation the supply is reduced to approximately +21V by potential divider R20, R24 and fed to the press-to-talk switch on the local handset. On BRIDGE WINGS operation the supply is attenuated by R8, R9 and fed to the press-to-talk switch on the BRIDGE WINGS handset(s). On CABIN EXT.1 or EXT.2, the supply is attenuated by R3, R4 or R1, R2 and similarly fed to the press-to-talk switches on the respective handsets.

Operation of the press-to-talk switch on the selected handset applies approximately +20V (logic'1') to the Tx key line via D28,D10,D2 or D1, switching the transmitter on.

4.5.7 Tx Power Control

Transmitter high power output is obtained by the application of a positive voltage on the Tx power control line (green/red core of the 36-core interconnecting cable). At the selected control unit (Fig. 7.29) the +24V HT supply at TS2/8 is connected to the Tx Power switch. In the HIGH position this supply is fed via D22, to the green/red core.

At the transmitter/receiver, this "high power" instruction (logic'1') is fed to the transmitter via the logic control board, where it may be overridden by an automatic "low power" command if channels 15 or 17 are selected (see section 4.6.12).

4.5.8 Tx Audio Inputs

The 600Ω audio line from the control unit (Fig. 7.29) is applied via FET switches TR16, TR19, to the red and blue cores of the 36-core interconnecting cable.

The signal from the local (dynamic) microphone is applied to the amplifier/carbon microphone simulator TR17, TR18, TR20; R49 is the input sensitivity control. In the LOCAL position of the Service switch S1, the output from this circuit (at TR17, TR18 collectors) is fed via S1d and connected across R23 in the bias chain R21, R25, R22, R23. The output from the slider of R23 is applied via C10, S1b and C16 to the FET switch.

In the BRIDGE WINGS, CABIN EXT. 1 and EXT. 2 positions of the Service switch, the carbon microphone at the selected extension is connected via S1d to R23; microphone polarisation is provided by the bias chain R21, R25, R22, R23. The output from the slider of R23 is applied to the FET switch as before.

In the base station version of the equipment, link 33-34 (Fig. 7.29) is removed, giving direct access to the 600Ω line in the CABIN EXT. 2 position of the Service switch (S1d).

When the particular control unit is selected, transistor switching circuit TR11, TR12 is energised via S1a and D7, D8, D4 or D3. This circuit switches the FET's TR16, TR19 into the conducting mode, feeding the 600Ω audio to the red and blue cores and thence to the transmitter. At all other control units in the system, the switching circuit TR11, TR12 is not energised. The FET switches TR16, TR19 are therefore "pinched off", effectively disconnecting the control unit circuits from the 600Ω line.

4.5.9 ELU Switching

Referring to Figs. 7.29 and 7.31, bank 'b' of the ELU switch 3S8 switches the +24V (logic) supply, in the ELU ON position, to D29 and D27. D29 connects the supply via TS1/6 to the yellow core of the 36-core interconnecting cable. Note. The yellow core is connected only at the radio operator's control unit (see section 2.10.2) and ELU operation cannot be selected from any other control unit in the system.

D27 biasses the switching circuit TR11, TR12 into cut off. This "pinches off" the FET switches TR14, TR15 and TR16, TR19 effectively disconnecting the control unit circuits from the transmitter and receiver 600Ω lines.

The supply on the yellow core energises the exchange link unit circuits and switches on a pair of FET switches similar to those in the control unit (see Fig. 7.36). The transmitter and receiver 600Ω lines from the MRT66 are therefore connected only to the ELU66, enabling public correspondence calls to be made via the VHF system.

4.6 LOGIC CONTROL CIRCUITS

4.6.1 General

Logic control of the Sealand 66 is by means of fixed positive DC voltage levels (logic '1' or '0') provided by the selected control unit. The controlling voltages are applied to the transmitter/receiver via the 36-core interconnecting cable.

Other control units in the system are prevented from loading the control lines by means of blocking diodes. Channel data entered into the memories of the other control units is retained, however, and is available as soon as these control units are selected.

4.6.2 Keyboard

The touch-keyboard (Fig.7.27 or 7.31) comprises a bank of 15 single pole switches, the wipers of which are connected together and brought out to the COMM terminal. The individual switch contacts are connected to the remote logic circuits, which are energised by the pull-up resistors listed below (see Fig.7.23).

Keyboard contact	Pull-up resistor
A	R19
B	R21
DUAL WATCH	R23
CLEAR	R14
P	R4
0	R1
1	R13
2	R12
3	R11
4	R10
5	R9
6	R8
7	R7
8	R6
9	R5

In the selected control unit, the +24V (Logic) supply is connected via relay contacts RL2-1 to stabilising circuit R53, D32, D33 (Fig. 7.25 or 7.29). The "+10V switched" supply from pin 2 provides base bias to TR1 (Fig. 7.23) and this transistor then acts as a "sink" for the keyboard switched lines listed in the table above (via the COMM terminal). Operation of the keys in the selected control unit thus applies a '0' to the corresponding input lines to the A/B latch, the dual watch latch and the decimal/BCD encoder.

4.6.3 Decimal/BCD Encoder (Fig. 7.23)

All input lines to the decimal/BCD encoder IC2, IC3 are initially at +10V ('1' state). Operation of a numerical key applies a '0' to the appropriate line causing the encoder to generate the BCD code for that numeral. The outputs from the encoder, which are initially at '0', are energised ('1' output) as follows:

'1' on IC2a pin 13 = 1
'1' on IC3a pin 13 = 2
'1' on IC3b pin 1 = 4
'1' on IC2b pin 1 = 8

Thus the numerals are encoded as follows:

	IC2b pin 1	IC3b pin 1	IC3a pin 13	IC2a pin 13
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

The BCD data from the encoder is applied simultaneously to the inputs of the four memory IC's, IC12, 13, 14, 15, the steering logic ensuring that the channel data is entered only in the correct memory (see section 4.6.5).

4.6.4 'Data Present' Pulse Generator (Fig. 7.23)

The presence of BCD data from the encoder is detected by IC1a and applied to one input of IC4a. The second input to IC4a is derived from the 0 key on the keyboard. Thus when any numerical key 0 - 9 is operated, IC4a output changes from '0' to '1'.

If there is any contact bounce at the keyboard, this will be reflected in the output of IC4a as well as on the BCD data lines. In order to avoid erratic operation, the memory IC's must not be clocked until after the "key-bounce" period.

The output from IC4a is applied to network R15, C1, which delays the positive-going edge of IC4a output for approximately 10mS. The delayed '1' from this network is applied to three inputs of IC4c. Since, at this time, the remaining input of IC4c also has a '1' applied from IC4b output, IC4c output changes from '1' to '0'.

The delayed '1' from R15, C1 is also applied to the input of inverter IC4b. The '0' output from IC4b is applied to network R16, C2, C3 which introduces a further delay of 10mS (note that C3 is in parallel with C2 for timing purposes). When C2 discharges past the gate threshold, IC4c output changes back again from '0' to '1'. The output from IC4c is therefore a negative-going ('0') pulse of approximately 10mS duration, occurring 10mS after the key is operated.

Positive feedback via IC1b and C3 improves the rise time of the pulse, and the set/reset flip-flop IC5a, b squares up the pulse still further.

Thus, the output from IC5b, which is normally at '1', produces a '0' pulse 10mS wide whenever a numerical key is operated, the pulse being delayed by 10mS from the time of operation of the key. This 'data present' pulse is utilised by the steering logic to clock the appropriate memory IC and thus enter the BCD data from the encoder into that IC.

4.6.5 Steering Logic (Fig. 7.23)

The memory IC's IC12, 13, 14, 15 accept input data from the decimal/ BCD encoder output lines only when pins 5 and 6 are at the same logic level, and retain the data while the logic levels are different. One of these inputs is used by the CLEAR circuit and is normally held at '0'. To enter data therefore, the other input must be fed with a '0' while the BCD data is applied.

The first stage of the data steering function is performed by IC7a and c in conjunction with the A/B latch IC6a, b. Operation of the A key produces a '0' at pin 11 of IC6b which is applied to one input of IC7a. Similarly, operation of the B key puts a '0' on one input of IC7c.

The other input to both of these gates is fed with the 'data present' pulse from IC5b. Thus operation of any numerical key 0 - 9 causes IC7a or IC7c to produce a '1' pulse at its output. The pulse width and delay are determined by the output from IC5b, i.e. the pulse is approximately 10mS wide and is delayed by 10mS from the time of operation of the key (*). This causes the channel data from the encoder to be entered in either the A memory or the B memory.

The second stage of data steering ensures that operation of the first numerical key enters the BCD data in the tens memory IC12 or IC14. The second key enters the data in the units memory IC13 or IC15. Subsequent attempts to enter further numbers in the same memory will be ignored unless the CLEAR key is operated.

Each of the memory IC's has associated with it a "digit-filled" flip-flop. For memory A, IC10a indicates the state of the tens memory IC12 and IC10b the state of units memory IC13. IC11a and b perform the same function for memory B tens (IC14) and units (IC15).

When entering a channel number, the circuits described briefly above operate as follows. Assume that the channel is to be entered in memory A (the memory B circuits are, of course, identical).

Operation of key A produces a '0' at IC6b output which is applied to one input of IC7b. Operation of the CLEAR key applies a '0' via D3 to the other input of IC7b. A '1' thus appears at IC7b output, which is applied to pin 6 of IC12 and pin 5 of IC13. This clears the A memories, since pin 5 of IC12 and pin 6 of IC13 already have a '1' applied from the outputs of IC9b and c respectively.

The '1' at IC7b output is also applied to pin 4 of IC10a and pin 12 of IC10b ("reset" inputs), thus clearing the digit-filled indicators as well as the memories. The circuits are now ready to accept a new channel number.

Note that when the Sealand 66 is first switched on, the network C5, R25 generates a positive pulse which is applied via D10 and D12 to both A and B memories and the digit-filled indicators, clearing them of any previously entered data. A similar network C4, R18, D10 sets the A/B latch IC6a, b into the 'A' condition. This does not apply subsequently when simply selecting alternative control units in the system. In this case the V_{DD} supply at pin 25 is maintained; the memories retain the channel data entered in them and the A/B latch remains in the condition in which it was last set.

Before any numerical keys are operated, the inputs of IC9b and c are as follows:

IC9b pin 8 at '0' from output of IC7a
pin 1 at '1' from $\overline{Q}$ of IC10a
pin 2 at '1' from $\overline{Q}$ of IC10b
IC9c pin 5 at '0' from output of IC7a
pin 4 at '0' from Q of IC10a
pin 3 at '1' from $\overline{Q}$ of IC10b

When the first numerical key is operated, the output of IC7a produces a 10mS positive pulse ('1') delayed by 10mS from the time of operation of the key (see * above). Thus, for the duration of the 'data present' pulse, IC9b has a '1' applied to each input, and the output from IC9b applies a 10mS '0' pulse to pin 5 of IC12. Since pin 6 is also at '0', the BCD data from the encoder is entered in IC12 (tens). IC9c does not respond to this pulse since pin 4 is still at '0'.

The '1' pulse from IC7a is also applied to inverter IC9a which therefore applies a '0' pulse of the same duration and delay to the clock inputs of the JK flip-flops IC10a and IC10b. These flip-flops are set if the J input is high during the positive going transition of the clock pulse. This condition occurs at IC10a at the end of the 'data present' pulse (i.e. after the first digit is entered in IC12) the J input being held high by the $\overline{Q}$ output of IC10b.

IC10a is now set, indicating "digit filled". The Q and $\overline{Q}$ outputs from IC10a change over and the conditions at IC9b and c inputs are now as follows:

IC9b pin 8 at '0' from output of IC7a
pin 1 at '0' from $\overline{Q}$ of IC10a
pin 2 at '1' from $\overline{Q}$ of IC10b
IC9c pin 5 at '0' from output of IC7a
pin 4 at '1' from Q of IC10a
pin 3 at '1' from $\overline{Q}$ of IC10b

Operation of the second numerical key again applies a 'data present' pulse to IC9b and c. Thus, for the duration of this pulse, IC9c has a '1' applied to each input (IC9b does not respond to this pulse since pin 1 is at '0'). In turn IC9c applies a 10mS '0' to pin 6 of IC13, the BCD data from the encoder therefore being entered in IC13 (units).

At the end of the 'data present' pulse, IC10b is set, indicating "digit filled". The $\overline{Q}$ outputs of both flip-flops are now at '0', disabling IC9b and c. The tens and units memories of channel A are now filled and no further data pulses will be accepted.

4.6.6 Selection of Channels A/B

The A and B keys control the A/B latch IC6a, b, but selection of operation on A or B channels is governed by the A/B line fed back from the transmitter/receiver.

Operation of the A key sets the output of IC6b (Fig.7.23) to '0'; the B key gives '1' at this point. This is applied via R30 to TR3, which inverts the signal and provides line drive capability. The collector of TR3 is connected via D13 to the A/B key line (blue/black core of the 36-core interconnecting cable). This line carries a '1' for A, '0' for B.

At the transmitter/receiver, the A/B key line is connected to pin 3 on the logic control board (Fig. 7.9). This is connected via the decoupling network R84, R23, C11 to one input of IC48d in the dual watch flip-flop IC48. Provided that the other input of IC48d has a '1' applied (i.e. dual watch not selected) the output from IC48c follows the A/B key input, i.e. A = '1', B = '0'.

The output from IC48c is fed back down the A/B line (white/ blue core of the 36-core interconnecting cable) to the selected control unit: other control units will not respond to this input, due to the absence of the +10V switched supply.

At the control unit, the A/B line input is connected to TS1/1 on the remote logic board (Fig. 7.23). This signal is applied via D17, R56, R55 to the buffer stages IC18a, b. These buffers produce two complementary outputs which are fed via R53, R54 to the A/B data selectors IC16, IC17.

IC16 selects the tens data from either IC12 (A) or IC14(B) and IC17 selects the units data from IC13 (A) or IC15 (B). Channel A data is selected when pin 9 and pin 14 of the selector IC's are at '1' and '0' respectively. Channel B is selected by pin 9 = '0', pin 14 = '1'.

The selected channel data is fed via diodes D20-D27 to the 4 tens control lines E - H and units control lines A - D. These lines are fed via 8 cores of the 36-core interconnecting cable to the transmitter/receiver (see section 4.6.10).

4.6.7 Channel Readout Displays

The selected A or B channel data is applied via CMOS/TTL interfaces IC22, IC23 to the display drivers IC24, IC25. The outputs from the display drivers energise the appropriate segments of the channel readout displays to form the required numerals.

Selection of a Private (P) channel applies the code '1100' to the tens lines, i.e. the outputs from IC16 are as follows:

pin 12 at '1'
pin 11 at '1'
pin 10 at '0'
pin 13 at '0'

The 'P' code is detected by D28, D29 turning TR10 on. This turns on TR12 and TR14, which energise the extra segments of the display to form the P character.

When channel A is selected, the output from pin 4 of buffer stage IC18b is at '1'. This is applied via R60 to TR5 base; TR5 therefore conducts and turns on TR6, which lights the A lamp (decimal point in the tens display). On channel B, TR5 and TR6 are cut off. TR9 is turned on, base current flowing via the A lamp and R65, and the B lamp is therefore lit.

4.6.8 Channel 16

If channel 16 is selected, the code on the tens and units lines are as follows:-

Tens: IC16 pin 12 at '0'
pin 11 at '0'
pin 10 at '1'
pin 13 at '0'

Units: IC17 pin 12 at '0'
pin 11 at '1'
pin 10 at '1'
pin 13 at '0'

This code is detected by IC20, IC21 and the output from pin 1 of IC20b changes from '1' to '0'. This turns on TR11, and collector current flow through TR11 turns on TR13. The channel 16 lamp is therefore lit (in addition to channel 16 being displayed on the readout).

4.6.9 Dual Watch

Operation of the DUAL WATCH key on the keyboard sets the dual watch latch IC6c, d (Fig. 7.23) to give a '1' output from IC6d. This is applied as follows:

(i) via D8 to one input of IC7b and IC7d, disabling the CLEAR function
(ii) via D6 to IC1b and IC5a in the 'data present' pulse generator, preventing channel data from being entered
(iii) via R34 to one input of IC5d, blanking the display (see section 4.6.11) and
(iv) via R27 to TR2 which inverts the signal and provides line drive capability.

The collector of TR2 is connected via D11 to the dual watch line (yellow/blue core of the 36-core interconnecting cable). This line, which is normally at '1', changes to '0' when dual watch operation is selected.

At the transmitter/receiver, the dual watch line is connected to pin 2 on the logic control board (Fig. 7.9). This is connected via the decoupling network R83, R22, C10 to the dual watch circuits IC48, 49, 50. The dual watch oscillator IC50 is switched on via inverter IC48a and IC49d. The 2·5Hz output from pin 4 of IC50b is applied to IC48, which ignores the A/B key line and switches between the A and B states at the oscillator frequency.

The output from IC48c thus alternates between '1' for channel A and '0' for channel B at approximately 0·2 seconds/channel. This is fed down the A/B line (white/blue core of the 36-core interconnecting cable) to the selected control unit; other control units will not respond to this signal due to the absence of the +10V switched supply. At the control unit, the A/B line input is connected to TS1/1 on the remote logic board (Fig. 7.23) and selects alternate operation on channels A and B.

The output from inverter IC48a (Fig. 7.9) is also applied via R63 to TR9, turning this transistor on. This applies a '0' to the Tx inhibit line, which is applied to the function switching circuits on the receiver board (section 4.8.4). Transmitter operation is therefore inhibited on dual watch.

When a signal is received on either channel A or channel B, the squelch circuit (section 4.8.3) applies a 'dual watch pause' signal to pin 4 of the logic control board (Fig. 7.9). This input, which is normally at '0', changes to '1' on receipt of a signal and triggers the pause timer IC49. The output from IC49 stops the dual watch oscillator IC50 for a maximum period of 5-8 seconds (determined by C13, R), during which time the A/B line remains on this channel.

A 'signal received' instruction is also taken from the output of IC49 and fed down the orange/blue core of the 36-core interconnecting cable to the selected control unit ('1' = signal received). At the control unit, this instruction is applied via TS1/2 on the remote logic board (Fig. 7.23) to one input of IC5c. This causes the channel readout display blanking to be removed, the received channel number then being displayed (see section 4.6.11).

At the end of the pause period, timer IC49 (Fig. 7.9) is automatically reset. Oscillator IC50 is switched on again and dual watch scanning recommences. If the signal duration is less than the maximum timer period, IC49 is reset by the dual watch pause input going to '0' and scanning resumes immediately.

The dual watch latch IC6c, d (Fig. 7.23) can be reset for normal operation by any of the following functions:

(i) operation of the A key resets via D7

(ii) operation of the B key resets via D9

(iii) selection of an inhibited channel in memory A or B causes a '1' to be fed back from the transmitter/receiver on the channel inhibit line (section 4.6.10). This is applied at TS2/10 and resets the latch via D16 and TR4.

4.6.10 Inhibited Channel Recogniser

The channel data from the selected control unit is applied to the tens control lines E-H and the units control lines A-D. The lines are routed to the transmitter/receiver via 8 cores of the 36-core interconnecting cable (see Figs. 7.23 and 7.21) and connect to pins A - H on the logic control board (Fig. 7.9). The control lines are decoupled by the pi-networks shown and applied to the International/Private channel selectors IC15, IC16 (see section 4.6.14).

The data on the control lines is inspected by the inhibited channel recogniser comprising IC10, IC11, IC54 with part of IC12, IC55. The output from pin 15 of IC54 is normally at '1', turning TR7 on via R65, R61. The collector of TR7 is connected via the channel inhibited line (green/blue core of the 36-core interconnecting cable) to the selected control unit.

At the control unit, this line is connected to TS2/10 on the remote logic board (Fig. 7.23) and hence via D19 and R58 to the +10V switched HT line (present only in the selected control unit). Thus TR7 collector

(Fig. 7.9) and the channel inhibited line are normally held at '0'.

When the inhibited channel recogniser detects channels 29-59, 75, 76, or 89-99 the output from pin 15 of IC54 changes to '0' (Note: channels numbers above 100 cannot be selected on the numerical keys since only two digits are available). This output turns TR7 off and the channel inhibited line therefore carries a '1'. This performs the following functions in the control unit (Fig.7.23):-

(i) A '1' is applied to pin 8 of IC18c, causing the channel readout display to flash

(ii) The dual watch latch IC6c, d is reset via D16 and TR4, and dual watch operation is therefore not available.

At the transmitter/receiver, the '0' output from pin 15 of IC54 (Fig. 7.9) is also applied via D11, D3, R8 to the out of lock sensor in the variable divider circuit (see section 4.7.7). The '0' output from this sensor is applied to the inhibit line (pin 19) and fed to the function switching circuit in the receiver, where it inhibits transmitter and receiver operation (see section 4.8.4).

4.6.11 Display Blanking and Flashing

Before channel numbers are entered in the A or B memories, the channel readout displays are blanked. This is achieved by IC19 (Fig.7.23) which inspects the outputs of the digit-filled indicators IC10 or IC11 depending on whether channel A or channel B is selected. On channel A the output from the buffer stage IC18b is '1' whilst that from IC18a is '0'; this causes IC19 to observe the $\overline{Q}$ outputs of IC10.

In the absence of tens and/or units channel data pins 11 and/or 1 of IC19 have a '1' applied from the $\overline{Q}$ outputs of IC10a and IC10b respectively. This produces a '0' at pins 7 and/or 15 of IC19. The outputs from pins 7 and 15 are fed via CMOS/TTL interfaces IC22, IC23 to the zero blanking inputs of the tens and units display drivers (pin 5 of IC24, IC25 respectively).

The latter signal is also fed via D31 to the grey/blue core of the 36-core interconnecting cable (1st digit inhibit line). At the transmitter/receiver, this signal mutes the equipment until a complete channel number is entered (see section 4.7.7).

The channel readout display is also blanked on dual watch operation, until a signal is received. This function is performed by IC5c, d as follows. Operation of the DUAL WATCH key sets the dual watch latch IC6c, d to give a '1' output from IC6d. This is applied via R34 to one input of IC5d. The other input to IC5d is supplied by the output of IC5c whose inputs (before any signals are received) are:pin 13 at '0', pin 12 at '1'.

IC5c output is '1' under these conditions, giving a '0' at IC5d output. This blanks the display via IC18d in the flashing oscillator circuit.

When a signal is received, pin 13 of IC5c has a '1' applied. The output from IC5c changes to '0', causing IC5d output to change to '1', thus removing the display blanking.

When the dual watch latch is reset by operation of the A or B key, pin 12 of IC5c is pulled down to '0' via D7 or D9. The output from IC6d also goes to '0' on resetting, but this is not applied to IC5d input until after the delay introduced by R34, C7. This ensures that display blanking is maintained (or restored if a signal was being received) for a short period after operation of the key, and serves as an indication that dual watch has been switched off. At the end of this delay period, the displays indicate the selected A or B channel number in the normal way.

When an inhibited channel is selected, the channel readout display flashes. This function is performed by the flashing oscillator IC18c, d as follows. On an inhibited channel, the inhibit circuits in the transmitter/receiver send a "channel inhibited" signal ('1') down the green/blue core of the 36-core interconnecting cable (section 4.6.10). A '1' is thus applied via D19, R58, R57 to one input of IC18c. This switches the flashing oscillator on, the flashing rate being determined by R59, C11.

The output from this oscillator is fed via the CMOS/TTL interfaces IC22, IC23, to TR7, TR8, thus flashing the displays. D30 causes the extra segments forming the 'P' to flash if an inhibited Private channel should be selected (e.g. if a P channel position is selected, which does not have a channel IC plugged in - see section 4.6.14). The 1st digit inhibit line (via D18) overrides the 'channel inhibited' signal at IC18c input if the units memory of the selected channel (A or B) is empty. Thus the display will not start to flash until a complete channel number is entered.

4.6.12 Channel 15/17 Recogniser (Fig.7.9)

The channel data on the control lines is inspected by the channel 15/17 recogniser IC55b, TR13. The output from IC55b is normally '1' and TR13 is therefore turned off. In this condition, the high power instruction ('1') from the selected control unit which is fed down the Tx power control line (green/red core of the 36-core interconnecting cable) is passed via R62 to the Tx power level line. This switches the transmitter to the high power output condition (section 4.9.3).

When channels 15 or 17 are selected, the output from IC55b goes to '0', turning TR13 on. Thus, regardless of the Power switch position at the control unit, a '0' is applied to the Tx power level line. This ensures that only low power output is available from the transmitter on these channels.

4.6.13 Simplex/Duplex Recogniser (Fig. 7.9)

The channel data on control lines A - H is also applied to the simplex/duplex channel recogniser comprising IC51, 52, 53, with part of IC12. On duplex channels, the output from pin 7 of IC51 is '1'. The output changes to '0' when any of the following simplex channels is detected: 06, 08-17, 67-77 (channels 75 and 76 are, of course, inhibited).

A '0' output is also produced on certain channels in the Private band. However any attempt to enter these channels at the keyboard inhibits the transmitter/receiver, and this is therefore of no consequence.

The output from the simplex/duplex recogniser is applied to one input of IC17b in the simplex/duplex selector circuit (section 4.6.15).

4.6.14 Private Channel Operation

When operation on a Private channel is required, the P key on the control unit keyboard is depressed. The decimal/BCD encoder IC2, IC3 (Fig. 7.23) produces the following outputs:-

IC2b pin 1 at '1'
IC3b pin 1 at '1'
IC3a pin 13 at '0'
IC2a pin 13 at '0'

This code is applied by the steering logic circuits into the A or B tens memory and hence onto control lines E - H.

At the transmitter/receiver, transistors TR5 and TR6 (Fig. 7.9) detect the '1100' code and are turned on. The voltage level at TR5 and TR6 emitters is thus '1' on International channels and changes to '0' on Private channels. This is applied to pin 9 on the International/Private selectors IC15, IC16 and the inverse is applied via IC17d to pin 14 of these selectors.

On International channels therefore, the channel data on control lines A - H is selected and passed on via the interleaving circuit IC30, 31, 32 to the variable divider. When the P code is detected on lines E - H, selectors IC15, IC16 change over and select the channel data from the output of the Private channel selector board.

The P number encoded on the units lines A - D is applied to decoder IC18, which is fed from a 5·6V HT supply derived via R64, D15. The decoded output is fed via emitter follower buffers IC45 or IC46 to energise the appropriate channel IC. Note that this circuit will always decode the data on the units lines, but unless the 'P' code has been detected on the tens lines, the channel IC output will be ignored.

Each channel IC consists effectively of a row of diodes, one to each control line (i.e. 9 in all) the anodes being connected in parallel. The buffer IC45 or IC46 energises the selected IC by applying HT to the anodes.

These IC's, which are initially identical, are cut so as to apply the required channel code to the control lines. The channelling code is the same as that used for International channels, i.e. considering the lines in the order (tens) H - E, (units) D - A, channel 29 would for example be encoded as 0010, 1001 and channel 87 as 1000, 0111. In this code, a '1' is equivalent to an energised line (diode left connected); '0' lines are obtained by disconnecting the appropriate diodes (cutting the pins from the IC) the lines then being grounded via R30 - R37.

The Private channel data is passed on via selectors IC15, IC16, and the interleaving circuit IC30, 31, 32 to the variable divider as before.

The ninth diode (pin 10) is connected to the Private channel simplex/duplex line. This diode is left connected for duplex channels ('1') and removed for simplex ('0') the line then being grounded via R38. The Private simplex/duplex line is applied to one input of IC17a in the simpex/duplex selector circuit (section 4.6.15)

Note that if single frequency simplex operation is required on the transmit frequency of a double frequency channel in the International band (e.g. for ship-to-ship communication) this can only be achieved by selecting it as a Private channel - when selected on the keyboard, the simplex/duplex recogniser automatically classes it as a duplex channel. The removal of pin 10 from the channel IC converts the channel from duplex to simplex. Full details of channel IC preparation will be found in Fig. 2.8.

4.6.15 Simplex/Duplex Selector (Fig. 7.9)

Selection of simplex or duplex operation is controlled by IC17 as folllows. Referring to Fig. 4.4 the inputs to IC17a are:-

Pin 1 (Private S/D line) : duplex (D) = '1', simplex (S) = '0'

Pin 2 ('P' detector output): International (I) = '1', Private (P) = '0' and IC17a output = '1' except on International duplex, when it changes to '0'.

The inputs to IC17b are:-

Pin 6 (International S/D line) : D = '1', S = '0'

Pin 5 (inverted 'P' detector) : P = '1', I = '0'

and IC17b output = '1' except on Private duplex, when it changes to '0'.

These outputs are applied to the inputs of IC17c, and IC17c output is therefore '0' except on International duplex or Private duplex, when it changes to '1' i.e.

simplex = '0'

duplex = '1'

This is applied via D6 to the S/D line (pin 13) and fed to the function switching circuit in the receiver, which energises the S/F or D/F receiver strip as appropriate (see section 4.8.4).

4.6.16 Channel 00 Recogniser (Fig. 7.9)

The channel 00 recogniser IC29 inspects control lines A-H. If all these lines are at '0', the outputs from IC29a and b are both '1'. These are applied to IC30d which therefore has an output of '0' on channel 00. This is applied via IC13b, IC54 and TR7 to the channel inhibited line (green/blue core of the 36-core interconnecting cable) and this inhibits transmitter/receiver operation.

4.6.17 Interleaved Channel Recogniser (Fig. 7.9)

The tens and units control lines from selectors IC15, IC16 are routed as follows:

Units A - D via CMOS/TTL interface IC34 to the variable divider
Tens E via CMOS/TTL interface IC33 to the variable divider
Tens F, G and H to the interleaved channel recogniser (interleaver)

The interleaver modifies the tens data on these lines such that the division ratio information fed to the divider is the same for interleaved channels 60 - 109 as for the original (50kHz spaced) channels 01 - 50. It performs this function by adding 20 to channel numbers below 50 and subtracting 40 from channel numbers above 60. The interleaver outputs on the F', G' and H' lines, together with the unmodified E line, therefore provide the following information via interface IC33 to the variable divider:

Channel data on tens lines E - H		Modified channel data on lines E, F', G', H'
From keyboard	From Private channel selector (channel IC)	
0 or 60	0 or 60*	20
10 or 70	10 or 70*	30
20 or 80	20 or 80	40
-	30 or 90	50
-	40 or 100	60
-	50	70

* These are only selected as Private channels when single frequency simplex operation is required on the transmit frequency of a double frequency channel - see section 4.6.14

In addition on channels above 60, the interleaver gives a '1' output from pin 10 of IC30c. This is also fed via interface IC34 to the variable divider, where it increases the overall division ratio by 1, thus producing an interleaved channel frequency (see section 4.7.3).

4.6.18 Duplexer Switching (Fig. 7.9)

The duplex filter used in Duplexer type DXU66 is intended for use only on the International channels 01-28 and 60-88. However, channels 29 and 89 are sufficiently close to this band for them to pass through the filter. The International channel recogniser IC13, IC14 has therefore been simplified by providing it with inputs only from the tens lines. Thus the output from pin 15 of IC14 is '1' on channels 01 - 29 and 60-89 (in band) changing to '0' on channels 30-50 and 90-109 (out of band).

When a duplexer is used, link LK2 at IC47b input is disconnected. Referring to Fig.4.5 the inputs to this gate are then:-

Pin 5 (inverted +10V Tx line): Rx = '1', Tx = '0'

Pin 6 (from International channel recogniser): in band (I/B) = '1', out of band (O/B) = '0'

and the output from IC47b is therefore '0' except when transmitting on an out-of-band channel (O/B.Tx) when it changes to '1'.

The inputs to IC47c are :-

Pin 8 (from simplex/duplex selector): D = '1', S = '0'

Pin 9 (from International channel recogniser): I/B = '1', O/B = '0'

and the output from IC47c is therefore '0' except on out-of-band S/F channels (O/B.S) when it changes to '1'.

These two signals are applied to the inputs of IC47d, the output from IC47d being '1' in band, changing to '0' on out-of-band transmit or out-of-band S/F channels. This is applied via R60 to TR10 which inverts the signal and provides relay drive capability. Thus, the duplexer control output from pin 12 is '0' in band (duplexer in circuit) changing to '1' on out-of-band transmit or out-of-band S/F channels (duplexer bypassed).

When the duplexer is bypassed, the D/F receiver has no aerial feed and must therefore be disabled. This is achieved by D7, which pulls the S/D line at pin 13 down to '0' when IC47d output is at '0' on out-of-band transmit (Note: on out-of-band S/F channels the S/D line is already at '0'). The '0' on the S/D line is applied to the function switching circuit in the receiver (section 4.8.4) which removes the HT from the D/F receiver strip.

The removal of link LK2 when a duplexer is used modifies the action of the channel inhibited circuits as follows. Referring to Fig.4.6 the output from the inhibited channel recogniser IC54 is '1' on permitted channels. This turns on TR7 via R65, R61, and applies a '0' to the channel inhibited line at pin 9 (green/blue core of the 36-core interconnecting cable).

If it is required to work single frequency simplex on the transmit frequency of a double frequency channel in the Private band (e.g. channel 35A) this is achieved by fitting a channel IC prepared as detailed in Fig.2.8. On such channels, IC47c in the duplexer switching circuit applies a '1' to the cathode of D9.

On normal operation, the inverted dual watch line at IC48a output applies a '0' to D8 cathode. Thus TR11 base is grounded, allowing TR7 to be turned on by the '1' at IC54 output, i.e. this channel is permitted.

However, if dual watch operation is attempted with this channel in the A or B memory, a '1' is also applied to D8 cathode. This causes TR11 to be turned on via R66. Collector current flow through R65 then removes the base bias from TR7, turning this transistor off. This puts a '1' on the channel inhibited line.

At the control unit, this signal resets the dual watch latch, giving fixed operation on channel A or B, whichever key was last operated. This function is necessary because the duplexer bypass relays are unable to operate at the high repeition rate which would be required if dual watch operation were permitted on this channel.

4.7 PHASE-LOCKED LOOP CIRCUITS

4.7.1 Voltage Controlled Oscillator (Fig. 7.5)

The voltage controlled oscillator (VCO) is a fully encapsulated, factory sealed assembly, which is to be regarded as a replacement item. The circuit diagram of the unit is, however, given in Fig. 7.5 and shows it to comprise oscillator stage TR1 (a dual insulated gate field effect transistor, or IGFET) with a buffer amplifier TR2. A stabilised 5·6V HT line is provided by R8, D2.

The VCO runs at the receiver local oscillator frequency, lying in the range 145·3 - 147·8MHz. The actual frequency depends on the division ratio of the divider, this being determined by the channel data from the selected control unit (see Fig. 4.2).

The DC controlling signal for the VCO, derived by the phase comparator (section 4.7.5) is applied at pins 7, 8 and fed via the loop filters (section 4.7.6) to pin 1 on the VCO board. This signal is applied via filter R1, C1, L1 to the voltage variable capacitor (varactor diode) D1 in the oscillator circuit and thus controls the oscillator frequency.

The output from buffer amplifier TR2, filtered by the pi-network C12, L4, C13, is fed to a splitter network comprising R9 - R12. This network provides three 50Ω output signals which are fed via R11 to the receiver mixers, via R10 to the Tx driver and via R12 to the phase-locked loop circuits.

4.7.2 Downmixer (Fig.7.5)

The phase-locked loop signal from the VCO is fed via tuned amplifier stage TR14 to one input of the downmixer TR15. The second input to this mixer is derived from the 33·1875MHz crystal controlled downmixer oscillator TR13. The oscillator output is fed to tuned filter L14, C56, C58, L15, which selects the fourth harmonic of the oscillator frequency and passes this component (132·75MHz) to the downmixer.

The difference frequency output from the downmixer varies from 12·55 - 15·05MHz as the VCO frequency varies between 145·3 and 147·8MHz. This signal is fed via low pass filter C61, L17, C63, C64 to buffer amplifier TR16 and then to a further low pass filter C65, C67, L19, R76. These filters remove unwanted mixer products from TR15 output.

The "downmixed VCO" signal at pins 11, 12 is then fed to the variable divider.

4.7.3 Variable Divider (Fig. 7.9)

Integrated circuits IC6, IC7, IC8 together form a programmable variable divider. The ratio of this divider lies between 502-602, and depends on the channel information fed into the transmitter/receiver from the selected control unit. The logic control circuits (section 4.6) energise the appropriate control lines A-D and E-H for the desired channel number. This information is fed via the CMOS/TTL interfaces IC33, IC34 to the variable divider (UNITS data to IC8,TENS data modified by channel interleaver, to IC7).

The downmixed VCO signal (in the range 12·55 - 15·05MHz) is fed via limiting amplifier TR8 to the quad NAND gate IC5. Pulses from pin 6 of IC5 are fed into the divider system at pin 1 of IC4. The output from pin 12 of IC4 is applied to the variable divider input at pin 4 of IC8.

The interleaved channel recogniser (section 4.6.17) detects channels 60-109, and gives an output from pin 10 of IC30 if one of these channels is selected. This output is applied via CMOS/TTL interface IC34 to pin 12 of IC5. The variable divider ratio is the same as that for channels 01-50, but one pulse is notched from the output of IC5 to increase the actual division ratio by 1, and hence give an interleaved channel.

The variable divider output is taken from pin 13 of IC6. The required division ratio is continually reloaded into the system at the end of each divide cycle by means of integrated circuits IC1, IC2, IC3. The 25kHz output from the divider system is taken from pin 6 of IC2 and applied to the integrated phase comparator IC9 at pin 1.

4.7.4 Reference Oscillator (Fig. 7.9)

The reference signal for the phase-locked loop is derived from the 3·2MHz crystal controlled reference oscillator TR12 via the ÷128 integrated divider IC44. The 25kHz output from this divider is fed via CMOS/TTL interface IC34 and leadthrough capacitor C31 to pin 3 of the integrated phase comparator IC9.

4.7.5 Phase Comparator (Fig. 7.9)

The phase comparator IC9 has the following input signals:-

Pin 1 : 25kHz variable divider output from pin 6 of IC2

Pin 3 : 25kHz reference signal from the reference oscillator/divider.

The output from IC9 (at the junction of R4, R5) consists of a train of fixed amplitude 25kHz pulses, the width of the pulses varying according to the phase relationship between the two inputs. These pulses, constituting the phase error signal, are fed via leadthrough capacitor C20 to the VCO circuit to complete the phase-locked loop (see section 4.7.6).

Bias for the comparator is adjusted by means of R54, TR12 in the linear synthesiser circuit (Fig.7.5). This is fed back down the phase error line and applied via R4, R5 to pins 5 and 10 of IC9.

4.7.6 Completion of VCO Loop (Fig. 7.5)

The phase error signal from the comparator, consisting of a train of fixed amplitude, variable width 25kHz pulses, is applied at pins 7, 8. These pulses are applied via R80 to the integrating amplifier comprising TR12 and TR11. In conjunction with R54, TR12 also sets the bias for the phase comparator IC9 (Fig. 7.9) this being fed back down the phase error line.

The recovered DC output from TR11 increases with increasing pulse width of the phase error signal. This "raw" DC is fed via emitter follower TR9 to the active filters comprising TR8, TR7 and TR5 with their associated components. These filters remove unwanted 25kHz components from the error signal. They also incorporate the 3kHz roll-off for the transmitter modulation characteristic, the processed AF signal being fed into the loop filters via R38.

The filtered and smoothed DC output from TR5 emitter is applied via network R1, C1, L1, to the voltage variable capacitor (varactor diode) D1 in the VCO circuit. This controls the VCO frequency and thus completes the phase-locked loop. The controlling voltage, measured at TP1, varies from approximately +5V at the lower VCO frequency of 145·3MHz (D1 capacity about 50pF) to approximately +6V at 147·8MHz (about 35pF).

4.7.7 Out of Lock Sensor

Transistors TR1, TR2 (Fig. 7.9) form an out-of-lock sensor circuit. The phase comparator IC9 produces negative-going pulses which are applied via D1, D2 to the base of TR1. The resultant collector current pulses are integrated by R12, C5, producing a positive potential at TR2 base. The collector of TR2 is connected via leadthrough capacitor C33 to the inhibit line at pin 19. At the receiver (Fig. 7.3) this line is applied to the function switching circuit TR13, 14, 15 via pin 8. The HT supply for TR2 (Fig.7.9) is thus derived from the +24V line (Fig.7.3) via R31, D2.

Under stable loop conditions, the potential at TR2 base is insufficient to turn TR2 on, since the phase comparator pulses are of short duration. The inhibit line carries a '1' in these conditions.

However, when the phase-locked loop is out of lock e.g. during frequency changing, the pulse width average increases. This increases the potential at TR2 base, turning this transistor on. The inhibit line then carries a '0', causing the function switching circuit to inhibit the receiver via D2 and the transmitter via D3 (see section 4.8.4).

The out-of-lock sensor is also operated in the following conditions:-

(i) Before a channel number has been entered at the control unit, and all control lines A-H are therefore at '0'. This condition is detected by IC29 and passed via IC30d, IC13b to the inhibited channel recogniser IC54. The output from pin 15 of IC54 applies a '0' to the cathode of D11.

(ii) After entry of the first digit of the channel number and before entry of the second, a first digit inhibit signal is fed from the selected control unit (on the grey/blue core of the 36-core interconnecting cable) to pin 10. This signal ('0') is applied via decoupling network R74, R73, C50 to the cathode of D12.

(iii) Entry of an inhibited channel number at the control unit is detected by the inhibited channel recogniser IC54. The output from pin 15 of IC54 applies a '0' to the cathode of D11.

In any of the above conditions a '0' is applied via leadthrough capacitor C32 and D3, R8 to the base of TR1 in the out-of-lock sensor. This turns TR1 hard on, and collector current flow through R12 turns TR2 on. This applies a '0' to the inhibit line, the function switching circuit then inhibiting transmitter and receiver operation as before.

4.7.8 AF Processing (Fig. 7.5)

The AF signal from the selected source is fed into the transmitter/receiver on the 600Ω Tx audio line (red and blue cores of the 36-core interconnecting cable). This signal is applied via transformer T1 to the integrated limiting amplifier IC1. The network at IC1 input matches the impedance to the 600Ω line, and provides the necessary pre-emphasis for the transmitter modulation characteristic (TR6 is a preamplifer stage which is not used in this equipment).

Transistor TR10 sets the DC voltage at IC1 output for symmetrical limiting of the amplifier AF output. The output is applied via preset potentiometer R48 (set maximum deviation) to the frequency correction network R51, R55, C42. It is then fed via R38 to the VCO loop active filters TR8, TR7, TR5.

The processed AF signal is thus superimposed on the VCO control line, causing the VCO output to be phase modulated by the microphone signal from the selected control unit. This modulation is transferred to the transmitter signal in the Tx driver circuit (section 4.9.1).

4.8 RECEIVER CIRCUITS

4.8.1 RF and IF Stages (Fig. 7.3)

Two similar RF/IF strips are employed for single frequency and double frequency channels, with common AF stages. The appropriate RF/IF strip for the selected channel is energised by the function switching circuit (section 4.8.4).

Signals from the D/F aerial are applied direct to band pass filter L1-L4, C3-C8. Signals from the S/F aerial are fed via the transmitter aerial filter and aerial changeover relay contacts (see Figs. 7.21 and 7.14) to band pass filter L16-L19, C64-C69.

The filtered D/F aerial signal is amplified by TR1 (a dual insulated gate field effect transistor, or IFGET) and fed to mixer TR2. Local oscillator injection from the VCO is applied to this stage via buffer amplifier TR6. The IF output from this mixer (at 15·3MHz) is applied via crystal filter FL1 and tuned amplifier TR3 to the integrated amplifier IC1.

Integrated circuit IC2 comprises the following circuits: IF amplifier and limiter, differential peak detector (demodulator) and AF preamplifier. External tuned circuit L12, C32 forms part of the demodulator circuit. The output from IC2 is a low level AF signal.

The single frequency RF/IF strip is similar, except that the intermediate frequency is 10·7MHz. The AF output from IC2 (D/F) or IC6(S/F) is applied to the preset "balance" control R20. The purpose of this control is to equalise the noise levels of the two strips for equal squelch sensitivity on S/F and D/F channels. The following AF stages are common to S/F and D/F channels.

4.8.2 AF Stages

The low level AF signal from balance control R20 is filtered by two sections of the integrated quad active filter IC3. IC3a is connected as a low pass filter and IC3b as a high pass. These two filters in conjunction with the de-emphasis network R29, C47, shape the overall AF response of the receiver.

The output from the filtering/shaping network is applied to the "squelch" muting switch TR4 (described in section 4.8.3). Two outputs are taken from TR4. A preset level determined by R101 is applied to integrated amplifier IC11. The output from IC11 is fed via line transformer 6T2 (Fig. 7.21) to the receiver 600Ω audio line (white and black cores of the 36-core interconnecting cable). This line provides receiver audio output for the earpiece of the selected handset. The nominal level on the 600Ω line is 0dBm for a received signal of ±3kHz deviation at 1KHz.

The second output from TR4 is applied via a second muting switch TR20 and voltage variable attenuator IC10 (described below) to the audio power amplifier IC4. This amplifier provides an output of 2W into 15Ω for the selected loudspeaker (via the yellow and green cores of the 4-core interconnecting cable).

The voltage variable attenuator IC10 provides volume control, the attenuation varying with the voltage applied on pin 2. This voltage is derived from the selected control unit, and applied to the receiver via the red/black core of the 36-core interconnecting cable. The voltage on the red/black core varies from approximately +7V for minimum volume to +1V for maximum volume.

FET muting switch TR20 is normally turned on by R103. When the transmitter is turned on (Tx key line high) TR11 turns on and "pinches off" the FET via D20. The receiver loudspeaker output is therefore muted during transmission.

4.8.3 Squelch Circuit

The squelch amplifier comprises sections c and d of the integrated quad active filter IC3. These are connected as cascaded high pass filters with a cut-off frequency of approximately 8kHz. Between these two stages, junction FET TR21 is employed as a variable series impedance in the potential divider TR21/R115.

The squelch voltage from the selected control unit is fed down the red/brown core of the 36-core interconnecting cable and applied via the network R118, R117, C145, R116 to TR21 gate. As the voltage on the red/brown core varies from 0 to +10V (anticlockwise rotation of the Squelch control) the overall gain of the squelch amplifier increases from minimum to maximum.

The noise output from the receiver "balance" control R21 is fed via the squelch amplifier to squelch detector TR9, TR10. In the non-muted condition (minimum squelch amplifier gain) TR9 is held off by R66, and TR10 is therefore also cut off. Thus TR10 collector voltage is high, allowing the muting switch TR4 to be turned on by R31. As the squelch amplifier gain is increased, the filtered receiver noise turns TR9 on. This turns on TR10, and "pinches off" the muting switch TR4 via D1, muting the receiver.

In the presence of a received signal, the receiver noise is suppressed. The squelch detector TR9, TR10 is therefore turned off, allowing the muting switch TR4 to be turned on again by R31.

The squelch detector output at pin 20 (logic '1')is also applied to the dual watch circuit, causing the dual watch oscillator to stop scanning when a signal is received (see section 4.6.9).

4.8.4 Function Switching (Fig. 7.3)

HT switching for the S/F and D/F receiver strips is performed by switching circuit TR13, TR14, TR15. The S/D line input to this circuit (pin 9) is derived from the channel data processing circuits on the control logic board (section 4.6.15). The voltage on this line is 0V on S/F channels and +5V on D/F channels (logic '0' and '1' respectively).

On S/F channels, TR15 is cut off and TR14 is held off by R79. TR13 is turned on by the bias chain R77, R78, D6, R76, D4, thus energising the S/F receiver strip. On D/F channels, TR15 is turned on and collector current flow through R79, R80 turns TR14 on, thus energising the D/F receiver strip; TR13 is cut off by the D/F HT line via D7, R76, D4. The S/F and D/F HT rails are accessible at pins 36 and 35 respectively, for use in conjunction with the single aerial diode switching circuit (see section 4.9.4).

Transmitter HT switching is performed by TR11, TR12. The press-to-talk switch on the selected handset applies approximately +20V (logic'1')to the Tx key line (yellow/red core of the 36-core interconnecting cable). This voltage is applied on pin 34 and is fed via the network R73, C108, R71 to TR11 base, turning this transistor on. Collector current flow through R75, R74 turns TR12 on, which performs the following functions:-

(i) +10V HT is applied via pin 10 to the transmitter circuits (+10V Tx).

(ii) This supply is also fed down the white/red core of the 36-core interconnecting cable to the control unit, giving Tx On indication via 2TR13 (MRC or SRC linear board).

(iii) The FET muting switch TR20 is "pinched off" via D20, thus switching off the receiver loudspeaker output.

(iv) If a S/F channel is selected, TR13 is cut off via D5, R76, D4, thus switching the S/F receiver strip off during transmission.

When dual watch operation is selected, a 0V (logic'0') Tx inhibit output from the dual watch circuit (section 4.6.9) is applied at pin 25. This cuts off TR11 and prevents the transmitter switch TR11, TR12 from being turned on by the Tx key line; transmitter operation is therefore inhibited on dual watch.

The out-of-lock sensor (section 4.7.7) also provides an input to the function switching circuit. If the VCO loop is out of lock, or an inhibited channel is selected at the control unit, a 0V (logic'0') output from the out-of-lock sensor is applied at pin 8. This is connected via D3 to TR11 base, cutting this transistor off and preventing the transmitter switch TR11, TR12 from being turned on; it is also applied via D2 to the muting switch TR4, which is therefore "pinched off". In this condition therefore, the transmitter and receiver are both inhibited.

4.9 TRANSMITTER CIRCUITS

4.9.1 Tx Driver (Fig. 7.11)

An output from the VCO, in the range 145·3 - 147·8MHz, is applied to buffer amplifier TR1. This signal carries the required transmitter modulation as described in section 4.7.8. The output from TR1 is fed to diode ring mixer D3-D6. The second input to this mixer is derived from the crystal controlled 10·7MHz oscillator TR2 (a dual insulated gate field effect transistor, or IGFET) via buffer amplifier TR3.

The required component at the mixer output is the sum frequency, in the range 156·8 - 158·5MHz (i.e. ship transmit frequency). The mixer output is band pass filtered by L4-L6, C15-C17 to remove unwanted products, and amplified by TR4, TR5. After further band pass filtering by L9-L11, C28-C30, the signal is fed to driver amplifier TR6, TR7. Interstage matching is performed by the network C35, C33, L14, C36.

The output from TR7 is matched to 50Ω by network C40, C38, L17, C43, and fed to the power amplifier via damping network R28-R30 (2dB attenuation). The power level at the Tx driver output is approximately 100mW into 50Ω.

4.9.2 Power Amplifier (Fig. 7.14)

The Tx driver output is applied to the power amplifier comprising TR10, TR11, TR12, where the signal level is raised to 20-25W (on high power). Components X1-X5 are "microstrip" transmission lines, which form part of the interstage matching networks. X6 is a directional coupler, the secondary of which is connected to the level and mismatch detector circuit, described in section 4.9.3.

The PA output is fed via aerial changeover relay contacts RL1-1 (relay energised) and low pass aerial filter L36-L38, C80-C87, to the single frequency aerial.

In the receive condition(relay RL1 unenergised) the single frequency aerial signal is fed via the aerial filter and normally-closed contacts RL1-1 to the S/F receiver strip (section 4.8.1). Capacitor C79 and PIN diode D13 protect the S/F receiver input against high level signals from the transmitter. The PIN diode is forward biassed via R57 during transmission, and C79 therefore appears as a short circuit across the S/F receiver input.

4.9.3 Level and Mismatch Detector (Fig. 7.14)

Inputs to the transmitter level and mismatch detector, comprising TR13-TR17, are derived from the secondary of directional coupler X6. The circuit detects PA forward output power via D11. Excessive forward power turns on TR15 and collector current flow through R53, R54 turns on TR14. This transistor controls the series resistance of TR13. Any tendency for the output power level to increase produces an increase in TR13 resistance and hence reduces the HT supply to TR10 and TR11; a sensibly constant output level is therefore obtained at the power amplifier output.

Reverse power (due to mismatched or damaged aerial or feeder) is detected via voltage doubler circuit D14, D11, C73, C90. Excessive reverse power also turns on TR15 and hence controls the HT supply to TR10, TR11. These two controlling signals combine to ensure that excessive PA dissipation is avoided.

When high power is selected at the control unit, a voltage of approximately +23V (logic '1') is fed down the green/red core of the 36-core interconnecting cable (Tx power control line) to the logic control circuit in the MRT66. Provided that this "high power" instruction is not overridden by an automatic "low power" command generated by the logic control circuit (section 4.6.12), a voltage of approximately +9V is applied to the Tx power level line at pin 4. This turns on TR16 and connects preset potentiometer R50 in circuit at TR15 base. Adjustment of the transmitter high power output level is by means of this potentiometer.

On low power the Tx power level line is at 0V(logic'0'). R50 is effectively disconnected from TR15 base, enabling the detector circuit to be triggered at a lower RF level. In this case the HT supply to TR10, TR11 is reduced such that the forward power detected via X6 is less than 1W. The low power level adjustment is by means of potentiometer R56 in conjunction with TR17.

4.9.4 Single Aerial Diode Switching (Figs. 7.14 and 7.3)

When single aerial simplex only operation is required, the following connections are made:

Pin 18 (PA board) to pin 36 (receiver board)

Pin 13 (PA board) to pin 35 (receiver board)

Also the following coaxial links:

Pins 6,7 (PA board) to pins 11, 12 (PA board)

Pins 17, 16 (PA board) to C64, C63 (receiver filter, S/F section)

Pins 14, 15 (Pa board) to C3, C1 (receiver filter, D/F section)

Operation of this circuit is as follows. Referring to Fig. 7.14, when the transmitter is switched on, the PA output is fed via aerial changeover relay contacts RL1-1 (relay energised) and the aerial filter to the aerial.

In the receive condition, relay RL1 is unenergised and the aerial signal is fed via the aerial filter, the normally-closed contacts RL1-1 and C99 to the junction of D17, D16.

When an S/F channel is selected, the +10V supply is applied to pin 18 and forward biasses D17 via R69 and R67. The aerial signal is therefore connected via D17 to the S/F receiver strip. When a D/F channel is selected, D16 is forward biassed, connecting the aerial signal to the D/F receiver strip.

4.10 POWER SUPPLY CIRCUITS

4.10.1 Mains Input and DC Regulator (Fig. 7.21)

The AC mains input is applied via the Mains On/Off switch 6S1 and fuse 7FS1 to the primary of mains transformer 6T1. Tappings are provided in 5V steps for operation from 110-120V (primary windings in parallel) or 220-240V (primary windings in series).

The secondary voltage from 6T1, rectified by bridge rectifier 6D1-6D4 and smoothed by 6C1, is applied to the DC regulator circuit comprising 7TR1-7TR3 and 6TR1. The common emitter regulator transistor 6TR1 is connected in the negative rail, offering the following advantages over the more conventional positive rail regulated circuit:

(i) It allows a smaller working voltage drop across the series transistor, hence lower dissipation in this transistor.

(ii) It allows the collector (case) of the series transistor to be directly grounded, thus improving the heat dissipation.

The potential divider 7R8, 7R9, 7R10, feeds a proportion of the output voltage back to the base of 7TR3 in the differential comparator circuit 7TR2, 7TR3. The reference voltage for the comparator is provided by zener diode 7D1. Dissipation limiting for the comparator transistors is provided by 7D3, 7R7 respectively.

In operation, current flow through 7R6, 7TR2, 7D3, 7TR1 controls the impedance of series transistor 6TR1 and hence the output voltage. Thus if the output voltage tends to rise, 7TR3 is turned harder on and the voltage across 7R6 increases, reducing the base bias on 7TR2. The controlling current through 7TR2, 7D3, 7TR1 is reduced and the series impedance of 6TR1 increases, thereby stabilising the output voltage.

The regulator output voltage (adjusted by means of potentiometer 7R8) is set to be the same as that obtained from a nominal 24V battery when fully charged, i.e. 26·4V. This ensures that the voltage on the nominal +24V HT rail in the equipment is the same whether operating from the AC or DC supply input.

Should a direct short circuit develop on the regulator output line, diode 7D2 is effectively connected across zener diode 7D1. The comparator reference voltage at 7TR2 base is therefore reduced to approximately 0·6V, cutting off this transistor. Series transistor 6TR1 is therefore also cut off, switching off the regulator until the short circuit is removed.

The regulated output from this circuit is applied via 7FS3 to relay contacts 7RL1-1. The output is also connected via diode 7D4 (see note below) to the Mains indicator lamp 6LP1, and to relay 7RL1 which is therefore operated. Contacts 7RL1-2 change over and connect the 0V rail (internal chassis) to the case of the unit. Note that this connection is made only when operating from the AC mains supply.

Contacts 7RL1-1 also change over, feeding the nominal +24V supply via 7FS4 to the red core of the 4-core interconnecting cable and the brown core of the 36-core cable (see section 4.5.2).

When the selected control unit is switched on, the +24V supply is fed back down the red/black core of the 36-core cable (on/off line) and operates relay 7RL2. Contacts 7RL2-1 and 2 change over, applying the +24V supply to the Duplexer DXU66 (if used) and to the switching regulator, energising the MRT66 internal circuits.

NOTE. Diode D4 performs a dual function as follows:

(i) On initial switch-on, it permits a minimum voltage of 0·6V to be developed at the regulator output enabling the circuit to be self-starting.

(ii) If a temporary short circuit should occur on the +24V HT rail whilst operating the equipment on AC mains, 7D4 delays the drop-out of relay RL1 and thus reduces the risk of blowing the DC supply fuse 7FS2.

4.10.2 Operation from DC Supply (Fig. 7.21)

When operation from the secondary DC supply is required (i.e. mains supply fails or is not connected) the nominal 24V battery supply is connected via 7FS2 and 7L1 to relay contacts RL1-1 and 2. Surge suppressing diode D5 provides protection against transients on the supply; also, in conjunction with 7FS2, it protects the equipment against reversed supply polarity.

In the absence of mains supply, relay 7RL1 is not energised. The DC supply positive rail is therefore connected via 7RL1-1 to the red core of the 4-core interconnecting cable and the brown core of the 36-core cable. The supply negative rail is connected via 7RL1-2 to the 0V rail of the equipment (internal chassis).

Both poles of the DC supply are isolated from the case of the unit, apart from a 10kΩ leakage path provided from the negative rail (7R12). The unit may therefore be connected to a positive earth, negative earth or floating secondary supply. Decoupling of the supply is performed by 7C8 - 7C13.

4.10.3 Switching Regulator (Fig. 7.16)

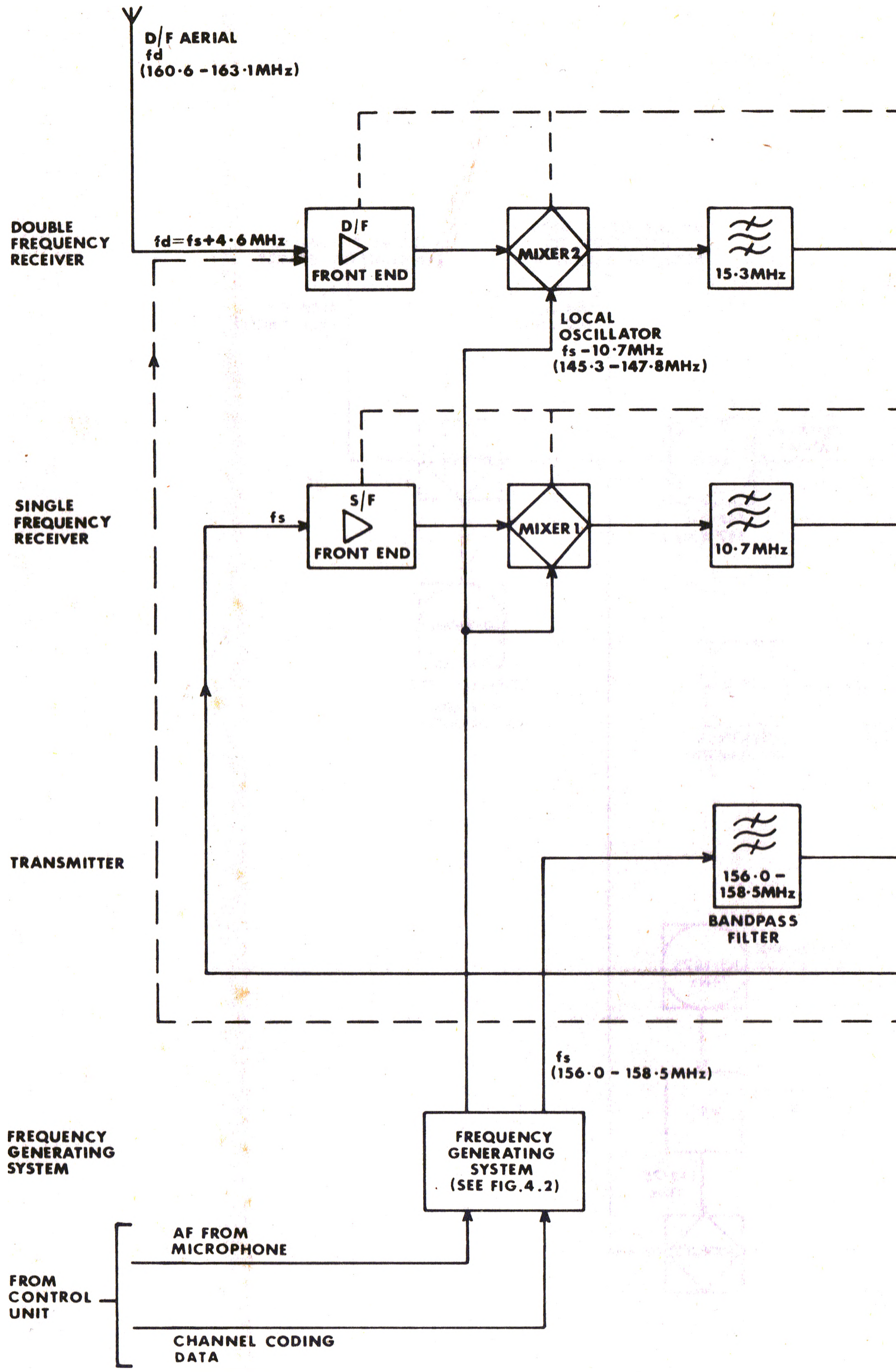
When the selected control unit is switched on, the nominal +24V HT supply (derived from either AC mains input or battery input) is applied to the switching regulator input. The supply, decoupled by L1, C6 is fed via FS1 to TR5 collector and the primary of transformer T1. The output from TR5 emitter is a smoothed and stabilised line of approximately +10V, which supplies the oscillator and switching circuits described below.

Sections a and b of integrated circuit IC1 form an oscillator running at about 37·5kHz. The oscillator output is fed via TR4 to the variable pulse width switching circuit comprising TR3, IC1c, d. Capacitor C3 is charged via TR4 at the positive edge of each cycle. The discharge rate of C3 is controlled by TR3, which therefore determines the "on" period of the pulse width circuit.

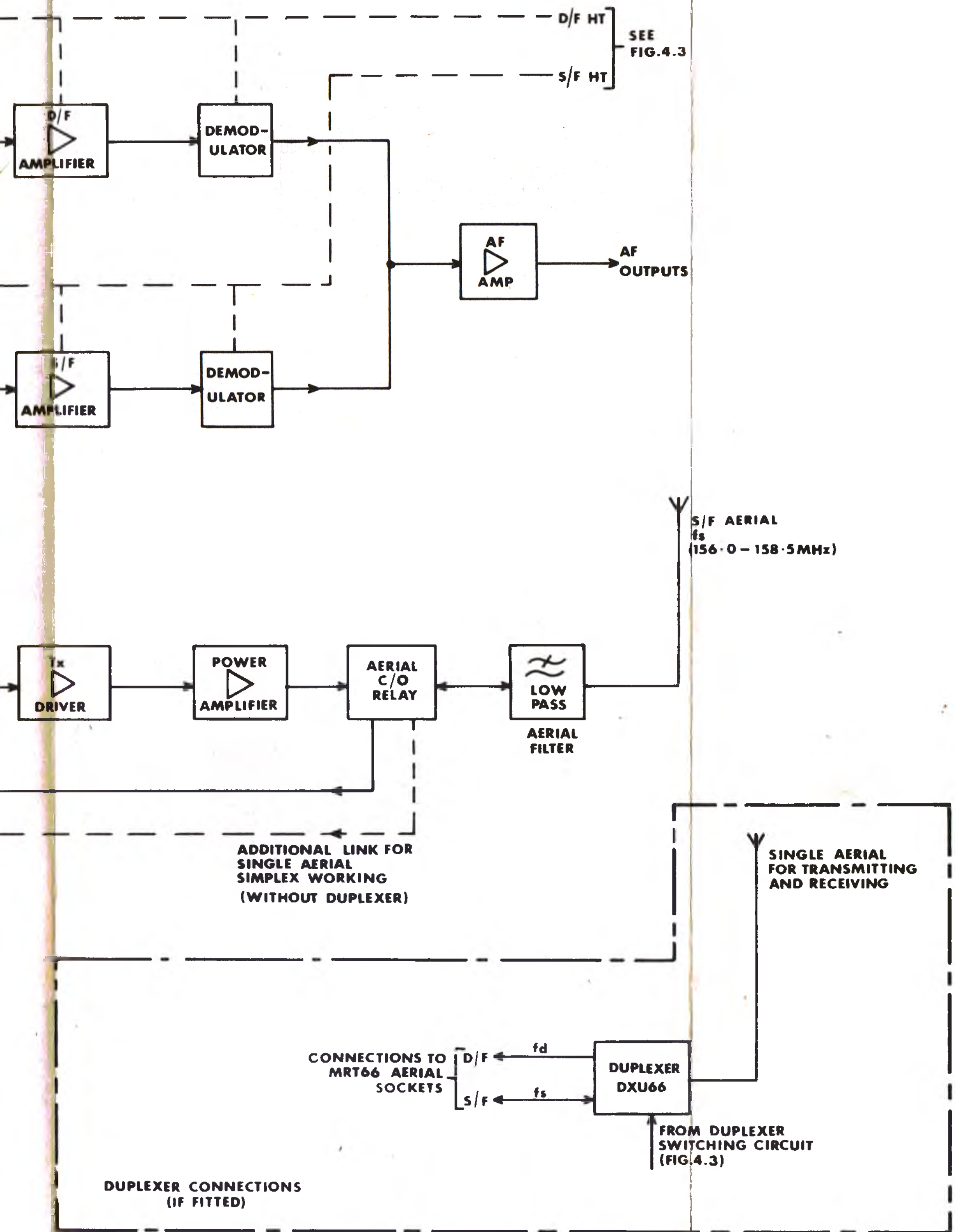
The pulses from this circuit are fed via TR1 to the +24V switching circuit TR6, TR7, TR8. Transistor TR8 switches the +24V supply to T1 primary on and off at a frequency of 37·5kHz, but with the on and off times determined by the variable pulse width switching circuit.

The rectified secondary voltage of T1 produces the +10V and +5V stabilised supply lines. Smoothing is effected by L3, C11 and L4, C10 respectively, and overvoltage protection is provided by D8 and D7.

A sample of the +5V line is fed back to comparator stage TR2, where it is compared with the reference voltage across zener diode D3. Transistor TR2 then controls the pulse width switching circuit TR3, IC1c, d which in turn controls the on/off times of T1 primary supply. This system ensures a high degree of output voltage stability over a wide range of input voltage variation.



D/F AERIAL
fd
(160·6 – 163·1MHz)
DOUBLE FREQUENCY RECEIVER
fd=fs+4·6MHz
D/F
FRONT END
MIXER2
15·3MHz
LOCAL OSCILLATOR
fs – 10·7MHz
(145·3 – 147·8MHz)
SINGLE FREQUENCY RECEIVER
fs
S/F
FRONT END
MIXER 1
10·7MHz
TRANSMITTER
156·0 – 158·5MHz
BANDPASS FILTER
fs
(156·0 – 158·5MHz)
FREQUENCY GENERATING SYSTEM
FREQUENCY GENERATING SYSTEM (SEE FIG.4.2)
FROM CONTROL UNIT
AF FROM MICROPHONE
CHANNEL CODING DATA



Sealand 66 Basic Block Diagram

Fig.4.1

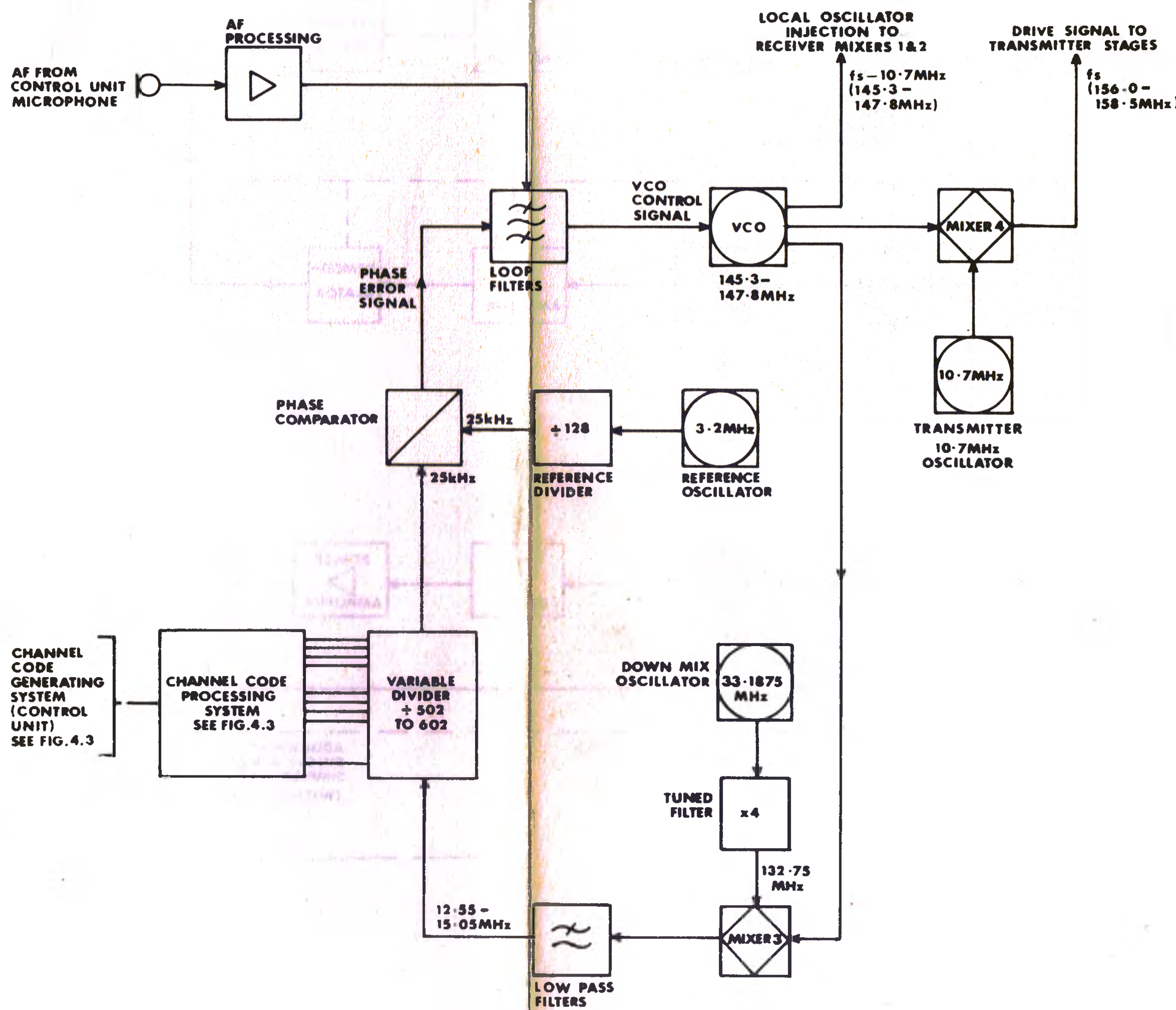
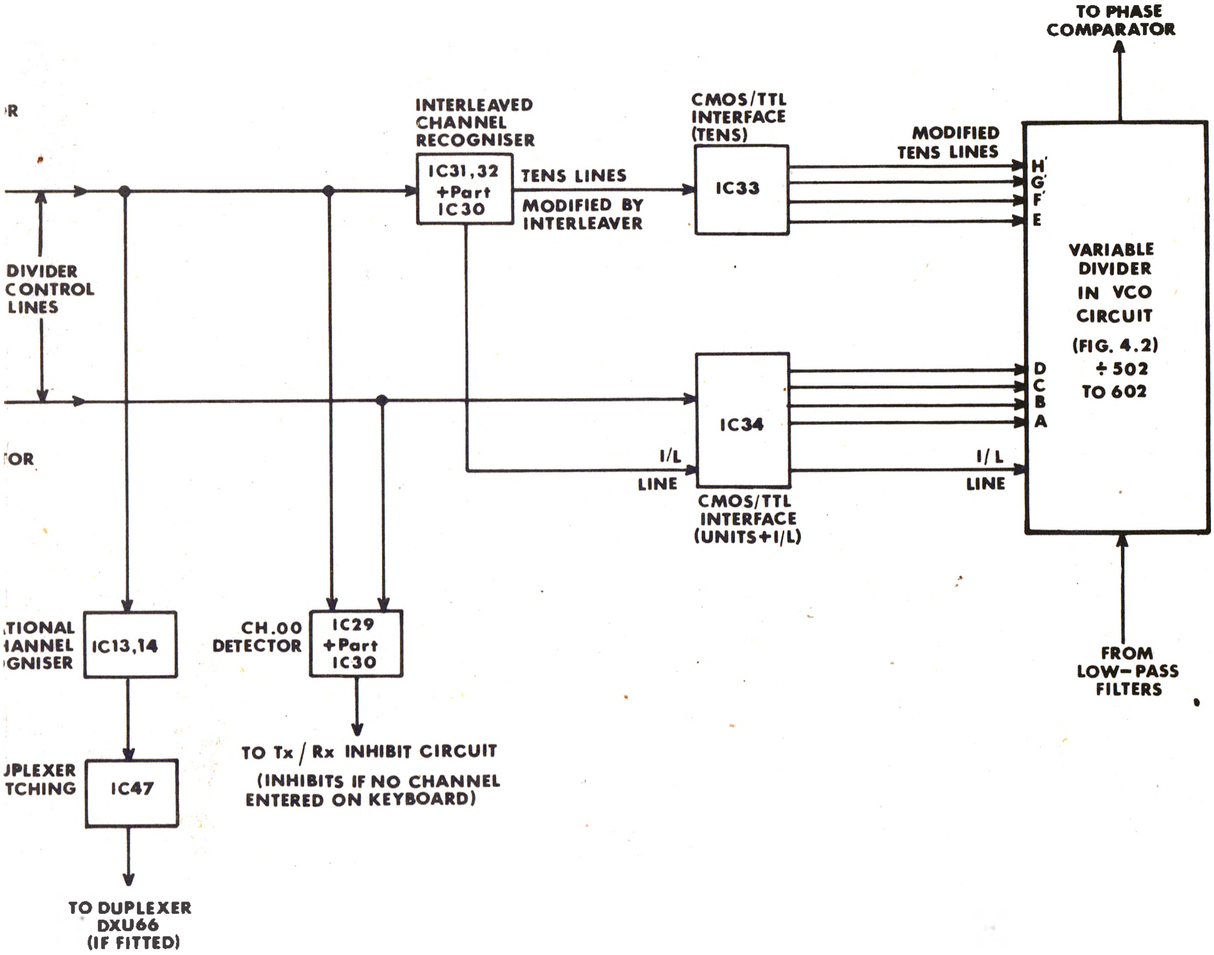
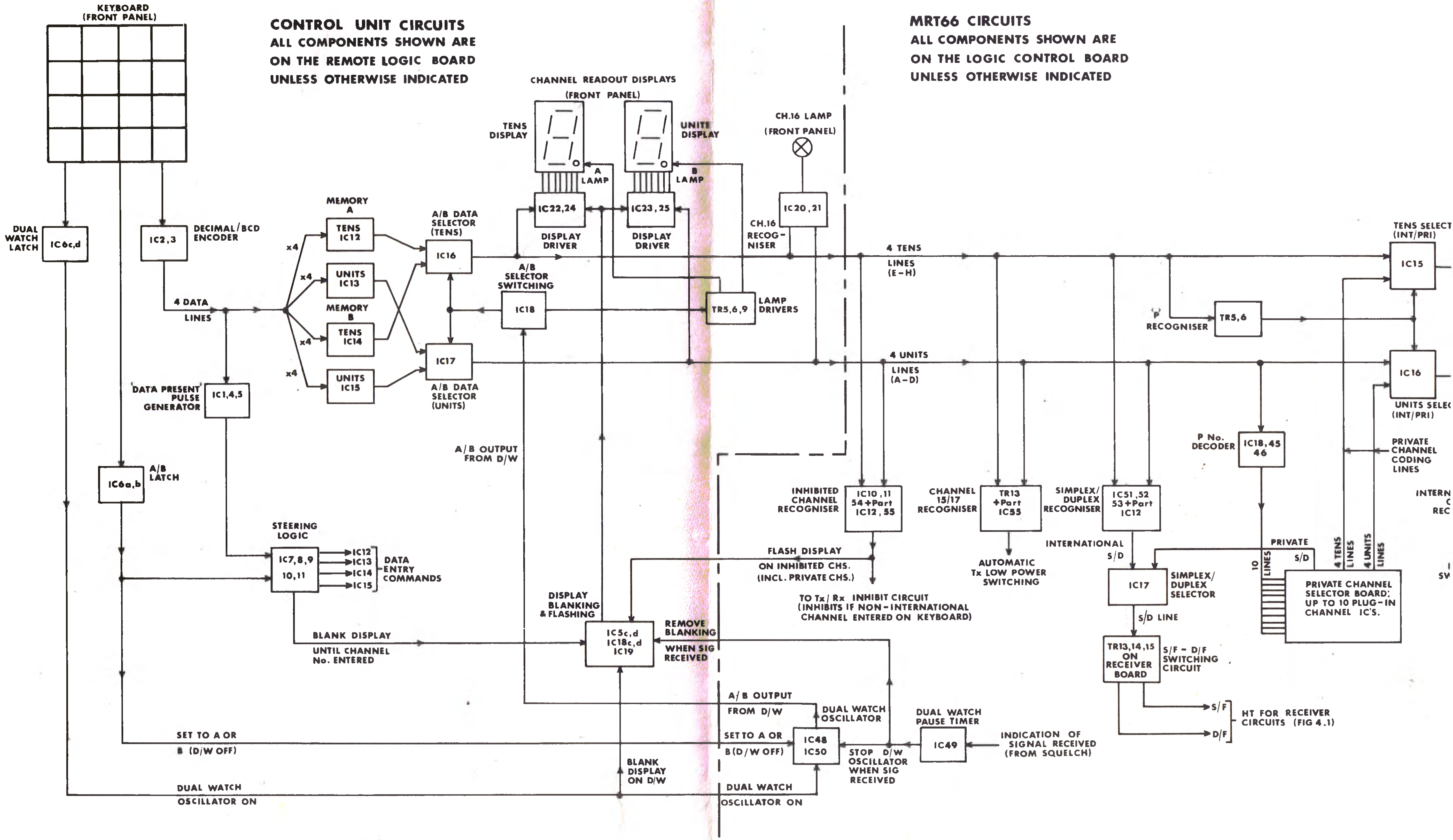


Fig.4.2 Frequency Generation Block Diagram



Channel Code Generating and Processing Block Diagram

Fig.4.3


CONTROL UNIT CIRCUITS
ALL COMPONENTS SHOWN ARE ON THE REMOTE LOGIC BOARD UNLESS OTHERWISE INDICATED
MRT66 CIRCUITS
ALL COMPONENTS SHOWN ARE ON THE LOGIC CONTROL BOARD UNLESS OTHERWISE INDICATED
KEYBOARD (FRONT PANEL)
DUAL WATCH LATCH
IC6c,d
IC2,3
DECIMAL/BCD ENCODER
4 DATA LINES
'DATA PRESENT' PULSE GENERATOR
IC1,4,5
IC6a,b
A/B LATCH
MEMORY A
TENS IC12
UNITS IC13
MEMORY B
TENS IC14
UNITS IC15
x4
A/B DATA SELECTOR (TENS)
IC16
IC17
A/B DATA SELECTOR (UNITS)
CHANNEL READOUT DISPLAYS (FRONT PANEL)
TENS DISPLAY
UNITS DISPLAY
A LAMP
B LAMP
IC22,24
IC23,25
DISPLAY DRIVER
A/B SELECTOR SWITCHING
IC18
TR5,6,9
LAMP DRIVERS
CH.16 LAMP (FRONT PANEL)
IC20,21
CH.16 RECOGNISER
A/B OUTPUT FROM D/W
STEERING LOGIC
IC7,8,9 10,11
IC12
IC13
IC14
IC15
DATA ENTRY COMMANDS
DISPLAY BLANKING & FLASHING
IC5c,d IC18c,d IC19
BLANK DISPLAY UNTIL CHANNEL No. ENTERED
REMOVE BLANKING WHEN SIG RECEIVED
BLANK DISPLAY ON D/W
SET TO A OR B (D/W OFF)
DUAL WATCH OSCILLATOR ON
4 TENS LINES (E-H)
4 UNITS LINES (A-D)
TENS SELECT (INT/PRI)
IC15
IC16
UNITS SELEC (INT/PRI)
'P' RECOGNISER
TR5,6
P No. DECODER
IC18,45 46
PRIVATE CHANNEL CODING LINES
INHIBITED CHANNEL RECOGNISER
IC10,11 54+Part IC12,55
CHANNEL 15/17 RECOGNISER
TR13 +Part IC55
SIMPLEX/DUPLEX RECOGNISER
IC51,52 53+Part IC12
FLASH DISPLAY ON INHIBITED CHS. (INCL. PRIVATE CHS.)
TO Tx/Rx INHIBIT CIRCUIT (INHIBITS IF NON-INTERNATIONAL CHANNEL ENTERED ON KEYBOARD)
AUTOMATIC Tx LOW POWER SWITCHING
INTERNATIONAL S/D
PRIVATE S/D
IC17
SIMPLEX/DUPLEX SELECTOR
S/D LINE
10 LINES
4 TENS LINES
4 UNITS LINES
PRIVATE CHANNEL SELECTOR BOARD: UP TO 10 PLUG-IN CHANNEL IC'S.
TR13,14,15 ON RECEIVER BOARD
S/F - D/F SWITCHING CIRCUIT
S/F
D/F
HT FOR RECEIVER CIRCUITS (FIG 4.1)
A/B OUTPUT FROM D/W
DUAL WATCH OSCILLATOR
SET TO A OR B (D/W OFF)
IC48 IC50
STOP D/W OSCILLATOR WHEN SIG RECEIVED
DUAL WATCH PAUSE TIMER
IC49
INDICATION OF SIGNAL RECEIVED (FROM SQUELCH)
DUAL WATCH OSCILLATOR ON

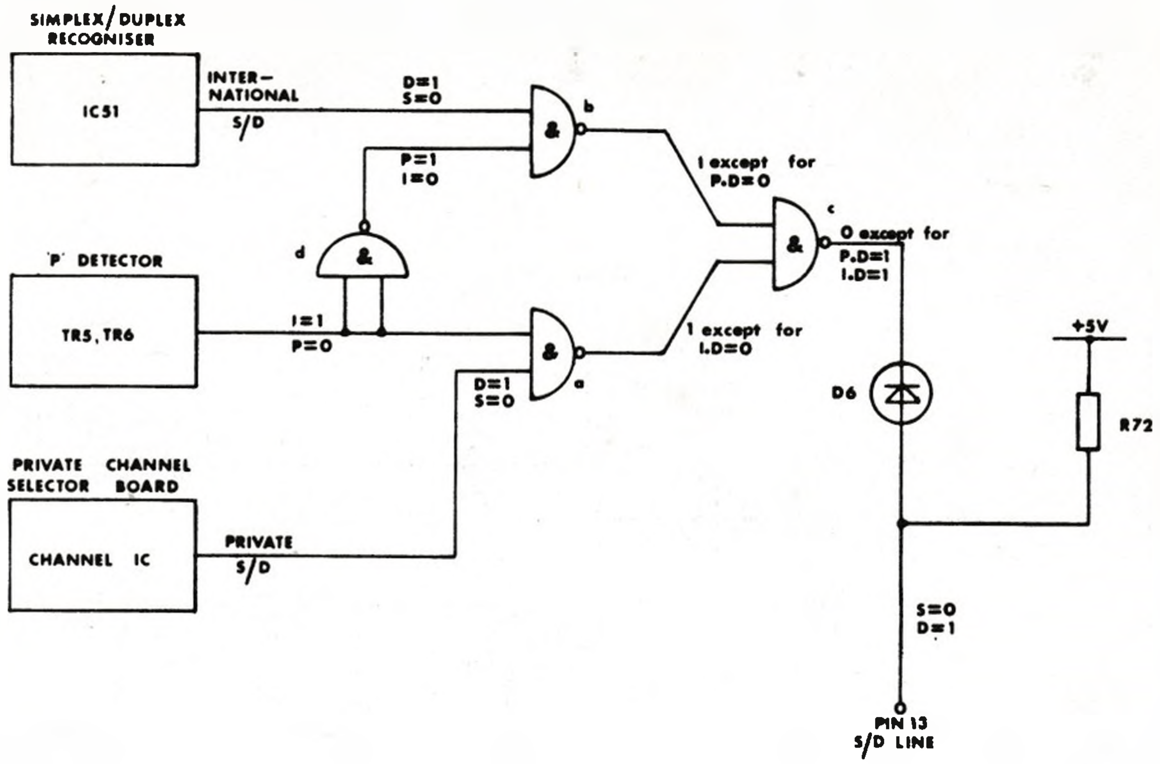


Fig.4.4 Logic Diagram for Simplex/Duplex Selector IC17

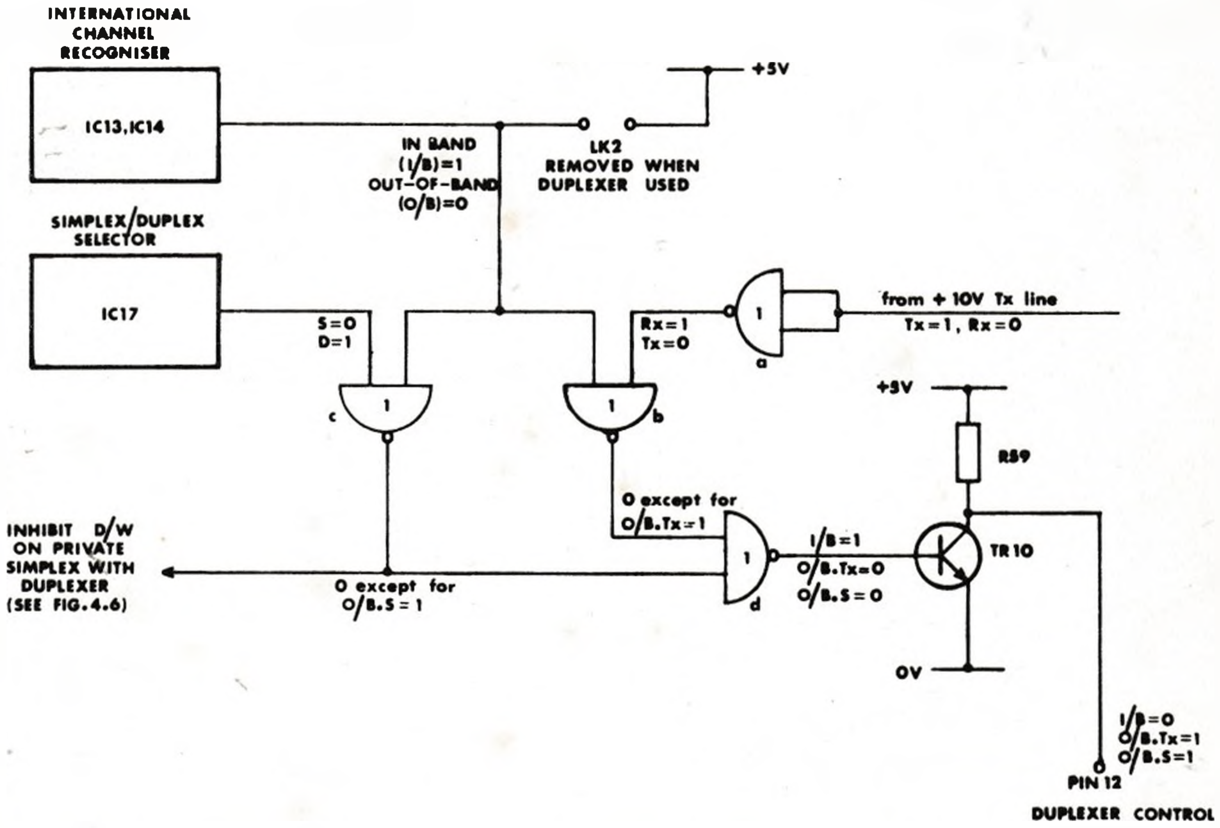
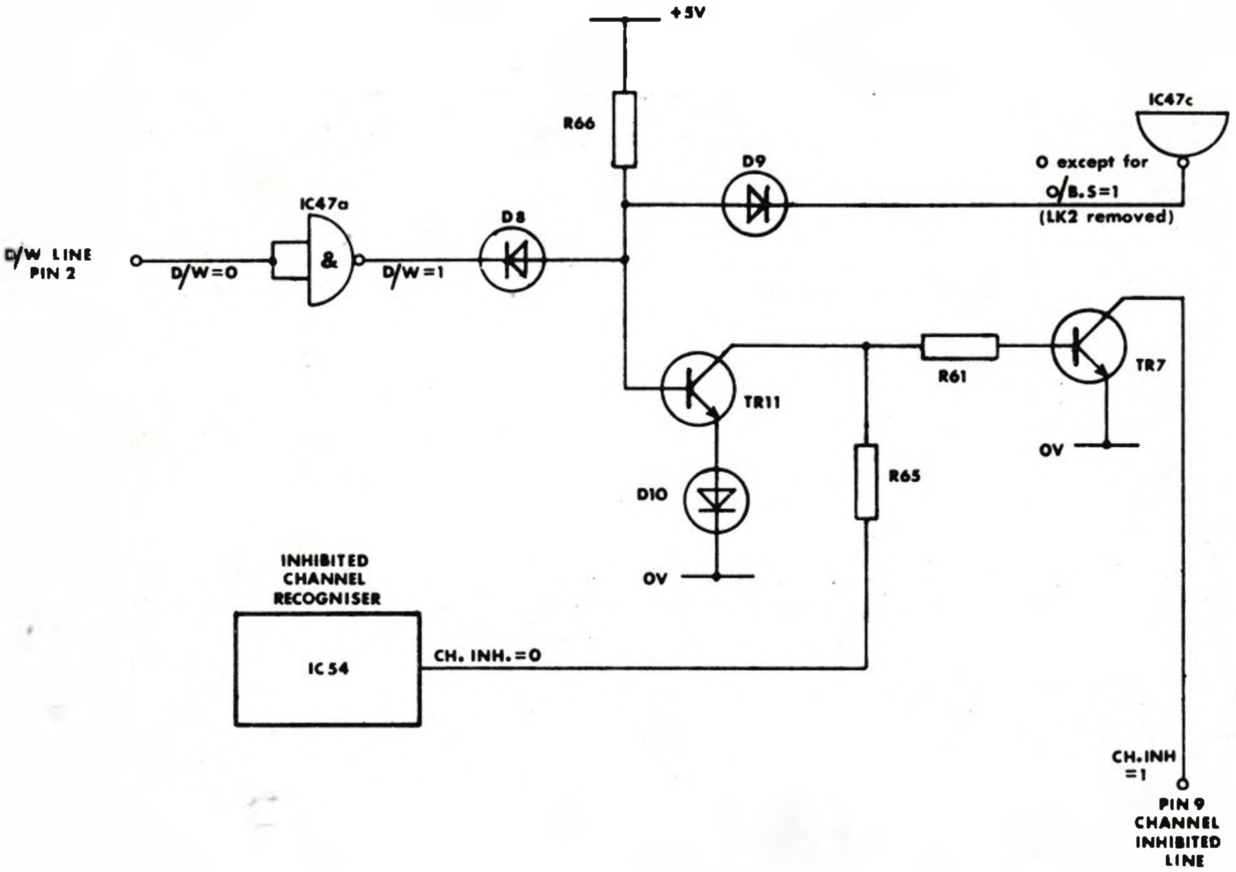


Fig.4.5 Logic Diagram for Duplexer Switching Circuit IC47, TR10



Modified Diagram for Channel Inhibit Circuit when Duplexer used

5 MAINTENANCE AND REPAIR

5.1 REPLACEMENT OF FUSES

The Sealand 66 system incorporates a total of 5 fuses all of which are contained within the transmitter/receiver unit MRT66. To gain access to the voltage regulator fuse 5FS1 (shown in Fig. 7.15), remove the back cover from the unit as follows. Unscrew the two bolts holding the control face of the unit to the mounting frame. The unit is then pivoted round on the top and bottom frame bolts (these may have to be slackened half a turn).

The voltage regulator cover is then lifted off after the removal of four 6BA screws. The recommended replacement fuse cartridge is shown in Table 5.1 below.

Fuses 7FS1, 2, 3 and 4 are located on the DC regulator board (Fig. 7.17). To gain access to these fuses, remove the front cover from the unit. The protective mains supply cover on the DC regulator board must also be removed for access to the mains fuse 7FS1. The recommended replacement fuse cartridges are shown in Table 5.1.

Ct.ref.	Function	Replacement cartridge	Rating
5FS1	+5V and +10V stabilised lines	Belling Lee L1427	1A
7FS1	AC mains input	Standard Fuse Co. C254/1·6A	2·5A for 220-240V supply 5A for 110-120V supply
7FS2	DC supply input	Standard Fuse Co. C254/5A	5A anti-surge
7FS3	+24V to MRT66 circuits & Duplexer DXU66 (if used)	Standard Fuse Co. C19F/5A	5A
7FS4	+24V to control units MRC66 and/or SRC66	Standard Fuse Co. C19/2A	2A

Table 5.1 Fuse Types and Ratings

5.2 REPLACEMENT OF LAMPS

The Mains On lamp fitted to the transmitter/receiver unit MRT66 is accessible from the control face of the unit. The lamp may be replaced after unscrewing the lens; see Table 5.2 for details of the lamp type used.

On master and standard control units MRC66 and SRC66, the following indicator lamps are accessible from the front of the unit: Ch 16, Tx On and (on MRC66 only) Ext-In-Use. These lamps may be replaced after unscrewing the lens; see Table 5.2 for details of the lamp types used.

To gain access to the lamps providing illumination for the control "windows" and keyboard, the control unit must be withdrawn from its housing. The units are retained by six studs through the back of the housing. A lamp may be replaced after pulling the lampholder away from the retaining bracket; see Table 5.2 for details of the lamp types used. Ensure that the lampholder is pushed fully home after lamp replacement.

Unit(s)	Indication(s)	Lamp type	Rating
MRT66	Mains On (6LP1)	Guest 280	28V, 24mA
MRC66 & SRC66	Ch 16 (3LP9) Tx On (3LP7)	Guest TI525B	5V, 0·06A
MRC66	Ext-In-Use (3LP1)	Guest TI525B	5V,0·06A
MRC66 & SRC66	"Windows"(3LP6, LP8) Keyboard (3LP10-LP13)	Vitality 673 E5/8 (LES)	6V, 0·36W

Table 5.2 Lamp Types and Ratings

5.3 ROUTINE MAINTENANCE

The maintenance procedures given below should be carried out at regular intervals (e.g. every 6 months).

5.3.1 Overall Checks

Examine the various units and ancillaries for mechanical damage, salt deposits, corrosion etc. Pay particular attention to the main earthing connections at the transmitter/receiver unit, as any corrosion appearing at these points can considerably reduce the performance of the equipment.

Check the tightness of all inter-unit connections at the distribution boxes. Test the master and standard control unit switching functions (as applicable) and check the handset(s) for satisfactory operation.

Provided that suitable test instruments are available, the transmitter power output and receiver sensitivity may be checked - see section 6.1 for details. If poor performance is established, which is not due to a faulty aerial or feeder, then reference should be made to the faultfinding procedures given in chapter 6. These procedures will enable the faulty circuit board or the faulty component within the suspect board to be identified.

Take care not to disturb the settings of any preset controls during these checks. The equipment is fully aligned on final test at the factory, and all preset controls are adjusted for optimum performance. No attempt should be made to retune the circuits unless the proper test instruments are available.

5.3.2 Aerials and Feeders

Examine the aerials and feeders, and check the feeder coaxial plugs with special regard to the outer (screen) connections. The following checks should be made on the feeder cables.

(a) Connect multirange testmeter (e.g. Avo model 8 or 9) switched to the Ω x 100 range, between the coaxial plug centre pin and body. The reading obtained should be greater than 100kΩ in dry conditions, assuming that the aerial is open circuit to DC (if the aerial is short circuit to DC then the feeder must be disconnected from the aerial for this test). A reading of less than 100kΩ indicates that moisture has penetrated the cable; this will cause loss of RF power.

(b) Measure the resistance between the coaxial plug body and the ship's earth. A reading of less than 100kΩ indicates damage to the cable protective sheath. If this is not located and rectified immediately it will allow moisture to penetrate the cable, causing loss of RF power as in (a).

(c) Finally check that the coaxial plugs and sockets including any which may be in series with the aerial feeders, mate securely. If necessary, regrease the connector threads using a suitable silicone grease e.g. Midland Silicones type MS4 (Redifon stores index G88). Avoid greasing the coaxial plug centre pin or the outer sheath of the cable.

5.4 OPERATION WITH DAMAGED AERIAL

In a two-aerial installation, if the upper (single frequency) aerial or feeder should become damaged, the power amplifier level and mismatch detector circuit will operate, thereby reducing the transmitter power output. In these circumstances, the lower (double frequency) aerial may be connected to the single frequency aerial socket. This will enable all essential port and pilotage operations to be obtained using single frequency channels, but double frequency operation will not be possible since this requires both aerials.

5.5 COMPONENT LOCATIONS

Access to the printed circuit boards and components in the transmitter/receiver unit MRT66 is obtained by removing the front and/or back covers from the unit. To remove the back cover, unscrew the two bolts holding the control face of the unit to the mounting frame. The unit is then pivoted round on the top and bottom frame bolts (these may have to be slackened half a turn).

Locations of the major components in the unit are shown in Figs.7.20 (a) and (b). Component locations within the various boards are also given in chapter 7, together with individual circuit diagrams for each board and an overall circuit diagram for the unit.

Master and standard control units MRC66 and SRC66 can be withdrawn from their housings for access to the printed circuit boards and components. The units are retained by six studs through the back of the housing. Component location diagrams and circuit diagrams for these units are also given in chapter 7.

If component replacement is indicated, the faulty printed circuit board may be serviced by removing the mounting screws and carefully lifting the board free from the wiring. It should not be necessary to remove the board completely from the unit, unless it is to be replaced by a new or serviced spare.

When carrying out repairs to printed circuit boards, it is essential that the procedures laid down in section 5.7 be adopted.

5.6 SEMICONDUCTOR PRECAUTIONS

Although semiconductor devices (e.g. diodes, transistors, integrated circuits) are extremely robust and have an exceptionally long life, they are easily damaged by misuse. The following precautions must be observed when working on the equipment:

(a) Low impedance devices, such as buzzers, must never be used for point-to-point wiring checks; the high transient voltages generated could easily damage transistors etc. in the circuit. An ohmmeter may be used provided that the current passed does not exceed 1mA, and that polarity is observed.

(b) When soldering semiconductor devices, heat shunts must always be applied to the lead out wires, to minimise the amount of heat from the iron reaching the component. The shunt (a pair of snipe-nosed pliers would be suitable) must not be removed before the joint has cooled.

(c) Soldering irons must always have an effective earth connection to guard against possible damage from leakage current.

5.7 REPAIRS TO PRINTED CIRCUIT BOARDS

Special care is necessary when carrying out repairs to printed circuit boards. In particular, the following points should be noted.

5.7.1 Soldering

(a) The use of soldering irons with a rating greater than 25W should be avoided. The most convenient soldering iron bit is a pencil type, not exceeding 5mm (3/16in) diameter, with the end filed at an angle.

(b) Only approved resin-cored solder to BS441, and preferably of 20swg, must be used.

(c) The printed wiring board must not be overheated by prolonged application of the soldering iron; such action could destroy the bond between the copper foil and the board.

5.7.2 Component Replacement

(a) With wire-ended components, e.g. resistors, the component should be cut out close to the board. The joints should then be heated with a freshly tinned iron, and the wires pulled out from the bottom of the board using snipe-nosed pliers or stout tweezers.

(b) With multi-spill components, e.g. integrated circuits, the joints should be heated and the solder removed using either a suction de-soldering tool or a de-soldering wick. Alternatively, the solder may be brushed off using a fairly stiff brush (e.g. a paint brush with the bristles cut to a length of about 6mm (1/4in)).

(c) When the faulty component has been removed, all solder must be cleared from the holes in the board. For this purpose a fine sewing needle may be used; the needle should first be oxidised in a flame to ensure that the molten solder does not adhere to it. Alternatively, a matchstick may be used, having first been sharpened to a point.

(d) Great care is necessary when fitting a new component. The leads must be bent to the exact centres of the holes, at the same time ensuring that the component is not damaged. If in doubt, the method of forming the wires may be copied from the faulty component. Note that with some types of resistor, it may be necessary to scrape some paint from the wires before they are formed.

(e) When inserting the leads into the holes in the circuit board, the copper foil should be supported by a finger nail close to the hole, to guard against pushing the copper away from the board.

(f) Before soldering the joints ensure that the component is pressed hard against the top of the board, and maintain this pressure until the solder has hardened. If a gap is left between the component and the board, subsequent pressure on the component will tend to push the copper away from the board.

(g) When soldering, the iron should be applied to one side of the component wire where it touches the copper track, and the solder to the other; as soon as the solder flows, the iron should be removed. When the joint has cooled the surplus wire should be cut off. See section 5.6 regarding the soldering of semiconductor devices.

(h) Before re-assembly, inspect the circuit board for drops of solder splashed over its surface.

(j) If a portion of the printed wiring is damaged, it may be cut out with a very sharp knife and replaced by a piece of insulated copper wire. This should be soldered between two points where components are soldered to the track, rather than to the foil itself.

5.8 SPARES AND SERVICE REQUESTS

When ordering spares and replacement parts for any unit in the Sealand 66 system, the information listed below must be given, to ensure prompt dispatch of the correct item(s):

(a) Type no. and serial no. of the unit as shown on the label on the back or base of the unit.

(b) Modification state of the unit as shown on the Mod. Record label (same location).

(c) Name and type no. of the PCB where applicable.

(d) Component reference as shown on the circuit diagram, together with the Redifon drawing no. of the circuit diagram.

(e) Full description of the component as shown in the Component List.

Requests for spares should be forwarded to the Marine Spares Dept. of Redifon Telecommunications Ltd. They must be accompanied by an official order giving address(es) for dispatch and billing.

Advance Spares Lists for the Sealand 66 system are available from the Marine Division of Redifon Telecommunications Ltd. A range of these are available to suit different purposes, as follows:

SLA11122 Edn. A Basic spares to comply with Merchant Shipping (Radio) Rules 1965, up to

SLA11122 Edn. C Comprehensive spares.

Requests for service should be forwarded to the Marine Service Manager of Redifon Telecommunications Ltd., giving the following information:

(a) Vessel's next port(s) of call.

(b) Estimated time of arrival.

(c) Duration of stay.

(d) Name and address of ship's agent.

7 ILLUSTRATIONS AND COMPONENT LISTS

7 ILLUSTRATIONS AND COMPONENT LISTS

7.1 TRANSMITTER/RECEIVER UNIT MRT66

7.1.1 Receiver Board Component List

RESISTORS

All resistors are ±5% 0·33W Mullard CR25 unless otherwise stated

1R1	100kΩ
1R2	27kΩ
1R3	27kΩ
1R4	150Ω
1R5	27Ω
1R6	part 1L8
1R7	1kΩ
1R8	6·8kΩ
1R9	27kΩ
1R10	100Ω
1R11	470Ω
1R12	100Ω
1R13	1kΩ
1R14	Not used
1R15	2·2kΩ
1R16	27kΩ
1R17	6·8kΩ
1R18	1·5kΩ
1R19	1·5kΩ
1R20	4·7kΩ LIN 0·2W Potentiometer Morganite 62H
1R21	4·7kΩ LIN 0·2W Potentiometer Morganite 62H
1R22	47kΩ
1R23	47kΩ
1R24	220kΩ
1R25	470kΩ
1R26	6·8kΩ
1R27	470kΩ
1R28	270kΩ
1R29	3·3kΩ
1R30	47kΩ
1R31	100kΩ
1R32	15kΩ
1R33	270kΩ
1R34	150Ω
1R35	120kΩ
1R36	Not used
1R37	15kΩ
1R38	27kΩ
1R39	Not used
1R40	150Ω
1R41	100kΩ
1R42	27kΩ
1R43	27kΩ
1R44	150Ω
1R45	27Ω

1R46	part 1L23
1R47	1kΩ
1R48	12kΩ
1R49	27kΩ
1R50	100Ω
1R51	470Ω
1R52	330Ω
1R53	330Ω
1R54	330Ω
1R55	100Ω
1R56	330Ω
1R57	6·8kΩ
1R58	27kΩ
1R59	330kΩ
1R60	10kΩ
1R61	270kΩ
1R62	10kΩ
1R63	560kΩ
1R64	270kΩ
1R65	470kΩ
1R66	15kΩ
1R67	4·7kΩ
1R68	47kΩ
1R69	470kΩ
1R70	470kΩ
1R71	3·3kΩ
1R72	3·3kΩ
1R73	4·7kΩ
1R74	330Ω
1R75	10kΩ
1R76	1kΩ
1R77	1kΩ
1R78	1kΩ
1R79	10kΩ
1R80	2·2kΩ
1R81	68kΩ
1R82	10kΩ
1R83	100Ω
1R84	47Ω
1R85	47Ω
1R86	1·8kΩ
1R87 to 1R99	Not used
1R100	150Ω

1R101	10kΩ LIN 0·2W Potentiometer Morganite 62H
1R102	47kΩ
1R103	100kΩ
1R104	15kΩ
1R105	3·3kΩ
1R106	3·3kΩ
1R107	100Ω
1R108	47Ω
1R109	3·3Ω ± 10% 5W Painton MV1A
1R110	10kΩ
1R111	100kΩ
1R112	1kΩ
1R113	10Ω
1R114	680Ω
1R115	2·2kΩ
1R116	100kΩ
1R117	47kΩ
1R118	47kΩ
1R119	4·7kΩ

CAPACITORS

Commonly used capacitors are identified as follows:

(i) 1000pF ± 10% 100V Mullard 630-02102
(ii) 0·01µF 40V Mullard 629-02103
(iii) 0·01µF ± 10% 100V Erie 8121M-100-103K-W5R
(iv) 0·1µF ± 5% 250V Siemens B32541-A3104J

1C1 to 1C8	see section 7.1.2
1C9	1000pF(i)
1C10	1000pF(i)
1C11	1000pF(i)
1C12	2-9pF 300V Trimmer Mullard 809-09002
1C13	3·9pF ± 0·25pF 63V Mullard 632-09398
1C14	2-9pF 300V Trimmer Mullard 809-09002
1C15	1000pF (i)
1C16	part 1L8
1C17	1000pF(i)
1C18	1000pF(i)
1C19	1000pF(i)
1C20	0·1µF(iv)
1C21	0·01µF(ii)
1C22	part 1L9
1C23	0·01µF(iii)
1C24	0·01µF(iii)
1C25	Not used
1C26	1µF 35V ITT TAG1·0M35
1C27	0·01µF(ii)
1C28	0·01µF(ii)
1C29	0·01µF(iii)
1C30	0·01µF(ii)

1C31	part 1L11
1C32	part 1L12
1C33	0·01µF(iii)
1C34	2·2pF ± 0·25pF 63V Mullard 632-09228
1C35	1000pF(i)
1C36	0·1µF(iv)
1C37	0·01µF(ii)
1C38	0·01µF(ii)
1C39	0·1µF(iv)
1C40	0·047µF ±5% 250V Siemens B32541-A3473J
1C41	1800pF ±2% 63V Salford PF/NB
1C42	120pF ±2% 63V Mullard 632-34121
1C43	0·047µF ±5% 250V Siemens B32541-A3473J
1C44	0·047µF ±5% 250V Siemens B32541-A3473J
1C45	4700pF ± 2% 63V Salford PF/NB
1C46	100µF 25V Mullard 016-16101
1C47	0·47µF ±5% 100V Siemens B32541-A1474J
1C48	0·47µF ±5% 100V Siemens B32541-A1474J
1C49	0·01µF(ii)
1C50	0·1µF(iv)
1C51	100µF 25V Mullard 016-16101
1C52	Not used
1C53	0·1µF(iv)
1C54	10µF 63V Mullard 016-18109
1C55	1000pF(i)
1C56	100µF 40V Mullard 016-17101
1C57	47µF 40V Mullard 016-17479
1C58	2-18pF 300V Trimmer Mullard 809-09003
1C59	1000pF(i)
1C60	1000pF(i)
1C61	2-18pF 300V Trimmer Mullard 809-09003
1C62	1000pF(i)
1C63 to 1C69	see section 7.1.2
1C70	1000pF(i)
1C71	1000pF(i)
1C72	2-9pF 300V Trimmer Mullard 809-09002
1C73	1000pF(i)
1C74	3·9pF ± 0·25pF 63V Mullard 632-09398
1C75	2-9pF 300V Trimmer Mullard 809-09002
1C76	1000pF(i)
1C77	Not used
1C78	part 1L23
1C79	1000pF(i)
1C80	0·1µF(iv)
1C81	1000pF(i)
1C82	0·1µF(iv)
1C83	0·01µF(ii)
1C84	part 1L24
1C85	0·01µF(iii)

1C86	0·1µF(iv)
1C87	0·01µF(iii)
1C88	0·01µF(iii)
1C89	1µF 35V ITT TAG1·0M35
1C90	0·01µF(ii)
1C91	0·01µF(ii)
1C92	0·01µF(iii)
1C93	part 1L25
1C94	1000pF(i)
1C95	0·1µF(iv)
1C96	0·01µF(ii)
1C97	6·8pF ± 0·25pF 63V Mullard 632-09688
1C98	0·01µF(ii)
1C99	0·1µF(iv)
1C100	1000pF(i)
1C101	1000pF(i)
1C102	150pF ±2% 63V Mullard 632-34151
1C103	1000pF(i)
1C104	1000pF(i)
1C105	150pF ± 2% 63V Mullard 632-34151
1C106	0·01µF(ii)
1C107	0·01µF(iii)
1C108	1µF 35V ITT TAG1·0M35
1C109	Not used
1C110	Not used
1C111	0·1µF(iv)
1C112	1000pF(i)
1C113	0·1µF(iv)
1C114	0·1µF(iv)
1C115	Not used
1C116 to 1C129	Not used
1C130	22µF 25V Mullard 015-16229
1C131	1000pF (i)
1C132	0·1µF(iv)
1C133	22µF 25V Mullard 015-16229
1C134	0·1µF(iv)
1C135	0·01µF(ii)
1C136	1000pF(i)
1C137	1000pF(i)
1C138	0·01µF(ii)
1C139	1000pF(i)
1C140	0·01µF(ii)
1C141	120pF ± 2% 63V Mullard 632-34121

1C142	0·01µF(ii)
1C143	22µF 25V Mullard 015-16229
1C144	22µF 25V Mullard 015-16229
1C145	2·2µF 63V Mullard 015-18228

DIODES

1D1 to 1D13	All 1N4148 ITT
1D14 to 1D19	Not used
1D20	1N4148 ITT

TRANSISTORS

1TR1	BFS28 Mullard
1TR2	To specification P29644/S Redifon
1TR3	BF115 Mullard
1TR4	E300 Siliconix
1TR5	BFS28 Mullard
1TR6	BFS28 Mullard
1TR7	To specification P29644/S Redifon
1TR8	BF115 Mullard
1TR9	BC558 Mullard
1TR10	BC548 Mullard
1TR11	BC548 Mullard
1TR12	BFX29 Mullard
1TR13	BC558 Mullard
1TR14	BC558 Mullard
1TR15	BC548 Mullard
1TR16 to 1TR19	Not used
1TR20	E300 Siliconix
1TR21	E300 Siliconix

INTEGRATED CIRCUITS

1IC1	CA3028A RCA
1IC2	CA3075 RCA
1IC3	LM3900N National Semiconductors
1IC4	SN76003N Texas
1IC5	CA3012 RCA
1IC6	CA3075 RCA
1IC7 to 1IC9	Not used
1IC10	MFC6040 Motorola
1IC11	MC1306P Motorola

INDUCTORS

1L1 to 1L4	see section 7.1.2
1L5	1·5µH Painton 58/10/0006/10
1L6	P29659/3 Redifon
1L7	P29659/3 Redifon
1L8	P29673/3 Redifon
1L9	P29668/3 Redifon
1L10	Not used
1L11	P29669/3 Redifon
1L12	P29667/3 Redifon

1L13	33µH Painton 58/10/0014/10
1L14	P29685/3 Redifon
1L15	P29657/3 Redifon
1L16 to 1L19	see section 7.1.2
1L20	1·5µH Painton 58/10/0006/10
1L21	P29659/3 Redifon
1L22	P29659/3 Redifon
1L23	P29672/3 Redifon
1L24	P29666/3 Redifon
1L25	P29665/3 Redifon
1L26	33µH Painton 58/10/0014/10

FILTERS

1FL1	P29629/3 Redifon
1FL2	P29643/3 Redifon
1FL3	FM4(Black) Vernitron
1FL4	FM4 (Black) Vernitron

7.1.2 Receiver Filter Component List

CAPACITORS

All capacitors marked* are 0·5-7pF 2000V Trimmer Oxley TUT/7/ST-R

1C1	1000pF 500V Leadthrough Erie 361/K2600
1C2	Not used
1C3	1000pF 500V Erie 801/K120051 Type 2
1C4	0·5-7pF*
1C5	0·5-7pF*
1C6	18pF ±10% 100V Erie 390/X5P
1C7	0·5-7pF*
1C8	0·5-7pF*
1C63	1000pF 500V Leadthrough Erie 361/K2600
1C64	1000pF 500V Erie 801/K120051 Type 2
1C65	0·5-7pF*
1C66	0·5-7pF*
1C67	18pF ± 10% 100V Erie 390/X5P
1C68	0·5-7pF*
1C69	0·5-7pF*

INDUCTORS

1L1	P29626/S Redifon
1L2	P29626/S Redifon
1L3	P29626/S Redifon
1L4	P29626/S Redifon
1L16	P29625/S Redifon
1L17	P29625/S Redifon
1L18	P29625/S Redifon
1L19	P29625/S Redifon

7.1.3 Linear Synthesiser Board Component List

RESISTORS

All resistors are ± 5% 0·33W Mullard CR25 unless otherwise stated

2R21	1kΩ	
2R22	6·8kΩ	
2R23	4·7kΩ	LIN 0·2W Potentiometer Morganite 62H
2R24	10kΩ	
2R25	1kΩ	
2R26	1kΩ	
2R27	3·9kΩ	
2R28	3·9kΩ	
2R29	10kΩ	
2R30	470kΩ	
2R31	330Ω	
2R32	150kΩ	
2R33	100kΩ	
2R34	2·2kΩ	
2R35	3·3kΩ	
2R36	1·5kΩ	
2R37	1·5kΩ	
2R38	100kΩ	
2R39	22kΩ	
2R40	47kΩ	
2R41	4·7kΩ	
2R42	47kΩ	
2R43	47kΩ	
2R44	2·2kΩ	
2R45	1kΩ	
2R46	1·5kΩ	
2R47	6·8kΩ	
2R48	10kΩ	LIN 0·2W Potentiometer Morganite 62H
2R49	10kΩ	
2R50	1MΩ	
2R51	100kΩ	
2R52	560Ω	
2R53	22Ω	
2R54	1kΩ	LIN 0·5W Potentiometer Morganite 90H
2R55	22kΩ	
2R56	5·6kΩ	
2R57	5·6kΩ	
2R58	100Ω	
2R59	1·5kΩ	
2R60	1kΩ	
2R61	100Ω	
2R62	220Ω	
2R63	100Ω	
2R64	2·2kΩ	
2R65	47kΩ	

2R66	10kΩ
2R67	220Ω
2R68	1kΩ
2R69	5·6kΩ
2R70	2·7kΩ
2R71	220Ω
2R72	1kΩ
2R73	1kΩ
2R74	100Ω
2R75	5·6kΩ
2R76	1·5kΩ
2R77	Not used
2R78	Not used
2R79	Not used
2R80	4·7kΩ
2R81	680Ω
2R82	22kΩ

CAPACITORS

Commonly used capacitors are identified as follows:

(i) 1000pF ± 10% 100V Mullard 630-02102
(ii) 0·01μF 40V Mullard 629-02103
(iii) 0·01μF ± 5% 250V Siemens B32541-A3103J
(iv) 0·1μF ± 5% 250V Siemens B32541-A3104J
(v) 22μF 16V ITT TAG22M16
(vi) 2-18pF 300V Trimmer Mullard 809-09003

2C22	10μF 16V ITT TAG10M16
2C23	2·2μF 35V ITT TAG2·2M35
2C24	100μF 25V Mullard 016-16101
2C25	0·01μF (ii)
2C26	0·01μF (iii)
2C27	0·015μF ± 5% 250V Siemens B32541-A3153J
2C28	0·1μF (iv)
2C29	0·01μF (iii)
2C30	68pF ± 2% 63V Mullard 632-34689
2C31	150pF ± 2% 63V Mullard 632-34151
2C32	0·1μF (iv)
2C33	0·01μF (iii)
2C34	1000pF (i)
2C35	22μF (v)
2C36	22μF (v)
2C37	330pF ± 2% 63V Mullard 632-58331
2C38	0·1μF (iv)
2C39	22μF (v)
2C40	22μF (v)
2C41	0·47μF ± 5% 100V Siemens B32541-A1474J
2C42	0·047μF ± 5% 250V Siemens B32541-A3473J
2C43	1000pF (i)
2C44	1000pF 500V Erie 801/K120051 Type 2
2C45	0·01μF ± 10% 100V Erie 8121M-100-103K-W5R
2C46	2-18pF (vi)

2C47	100pF ± 2% 63V Mullard 632-34101
2C48	12pF ± 2% 63V Mullard 632-10129
2C49	5-60pF 300V Trimmer Mullard 809-08003
2C50	1000pF 500V Erie 801/K120051 Type 2
2C51	2-18pF (vi)
2C52	1000pF (i)
2C53	0·01µF ± 10% 100V Erie 8121M-100-103K-W5R
2C54	1000pF (i)
2C55	10pF ± 2% 63V Mullard 632-10109
2C56	2-18pF (vi)
2C57	1000pF (i)
2C58	2-18pF (vi)
2C59	1000pF (i)
2C60	1000pF (i)
2C61	22pF ± 2% 63V Mullard 632-34229
2C62	0·01µF (ii)
2C63	1000pF (i)
2C64	15pF ± 2% 63V Mullard 632-10159
2C65	22pF ± 2% 63V Mullard 632-34229
2C66	1000pF (i)
2C67	1000pF (i)
2C68	0·01µF (ii)
2C69 2C70 2C71	Not used
2C72	0·01µF (ii)
2C73	22µF (v)
2C74	2·7pF ± 2% 63V Mullard 632-09278
2C75	0·01µF (ii)
2C76	0·01µF (ii)

DIODES

2D5	1N4148 ITT
2D6	1N4148 ITT

TRANSISTORS

2TR5	BC548 Mullard
2TR6	BC548 Mullard
2TR7	BC558 Mullard
2TR8	BC548 Mullard
2TR9	BC548 Mullard
2TR10	BC558 Mullard
2TR11	BC548 Mullard
2TR12	WN743 Siliconix
2TR13	BF115 Telefunken
2TR14	E300 Siliconix
2TR15	BFS28 Mullard
2TR16	BF115 Telefunken

INTEGRATED CIRCUIT

2IC1	MC1306P Motorola

INDUCTORS

2L10	560µH Cambion 3635-34
2L11	P29663/3 Redifon
2L12	P29687/3 Redifon
2L13	P29662/3 Redifon
2L14	P29657/3 Redifon
2L15	P29657/3 Redifon
2L16	15µH Painton 58/10/0012/10
2L17	2·2µH Painton 58/10/0007/10
2L18	33µH Painton 58/10/0014/10
2L19	2·2µH Painton 58/10/0007/10
2L20	Not used
2L21	1µH Painton 58/10/0005/10

TRANSFORMER

2T1	SM111 Gardners

CRYSTAL

2XL1	33·1875MHz to Redifon specification P29602

VCO ASSEMBLY

The VCO is a fully encapsulated, factory sealed assembly which is not subject to the usual maintenance/repair procedures. Individual components are therefore not listed for this unit. For these purposes, the VCO is to be regarded as a single component to Redifon drg. 010/11109A/3.

7.1.4 Logic Control Board Component List

RESISTORS

All resistors are ± 5% 0·33W Mullard CR25

3R1 } 3R2 }	see section 7.1.5
3R3	47kΩ
3R4 to } 3R13 }	see section 7.1.5
3R14	470kΩ
3R15	470kΩ
3R16	470kΩ
3R17	470kΩ
3R18	470kΩ
3R19	470kΩ
3R20	470kΩ
3R21	Not used
3R22	470kΩ
3R23	470kΩ
3R24	470kΩ
3R25	680kΩ
3R26	1MΩ
3R27	220kΩ
3R28	220kΩ
3R29	47kΩ
3R30	27kΩ
3R31	27kΩ
3R32	27kΩ
3R33	27kΩ
3R34	27kΩ
3R35	27kΩ
3R36	27kΩ
3R37	27kΩ
3R38	27kΩ
3R39 to } 3R41 }	Not used
3R42 to } 3R44 }	see section 7.1.5
3R45	47kΩ
3R46	1kΩ
3R47 to 3R55 }	Not used
3R56	47kΩ
3R57 } 3R58 }	Not used
3R59	1kΩ
3R60	22kΩ
3R61	33kΩ

3R62	10kΩ
3R63	68kΩ
3R64	1·5kΩ
3R65	33kΩ
3R66	150kΩ
3R67	220kΩ
3R68	150kΩ
3R69	150kΩ
3R70	330kΩ
3R71	330kΩ
3R72	47kΩ
3R73	4·7kΩ
3R74	4·7kΩ
3R75	47kΩ
3R76	47kΩ
3R77	47kΩ
3R78	47kΩ
3R79	47kΩ
3R80	47kΩ
3R81	47kΩ
3R82	Not used
3R83	47kΩ
3R84	47kΩ
3R85	47kΩ
3R86	470kΩ
3R87	Not used
3R88	100Ω
3R89	47kΩ

CAPACITORS

All capacitors marked * are 0·1µF ± 5% 250V Siemens B32541-A3104J

3C1 to 3C5	see section 7.1.5
3C6	0·1µF*
3C7	0·1µF*
3C8	0·1µF*
3C9	Not used
3C10	0·1µF*
3C11	0·1µF*
3C12	0·1µF*
3C13	10µF 16V ITT TAG10M16
3C14	0·1µF*
3C15	2·2µF 35V ITT TAG2·2M35
3C16 3C17	see section 7.1.5
3C18	150pF ± 2% 63V Mullard 632-34151
3C19	150pF ± 2% 63V Mullard 632-34151
3C20 to 3C30	see section 7.1.5
3C31 to 3C39	Not used

3C40	0·1μF*
3C41	0·1μF*
3C42	0·1μF*
3C43	0·1μF*
3C44	0·1μF*
3C45	2·2μF 35V ITT TAG2·2M35
3C46	33pF ± 2% 63V Mullard 632-34339
3C47	22μF 25V Mullard 015-16229
3C48	0·01μF 40V Mullard 629-02103
3C49	0·47μF ± 5% 100V Siemens B32541-A1474J
3C50	1μF 35V ITT TAG1·0M35

DIODES

3D1 to 3D3	see section 7.1.5
3D4 to 3D15	1N4148 ITT

TRANSISTORS

3TR1, 3TR2	see section 7.1.5
3TR3, 3TR4	Not used
3TR5	BC558 Mullard
3TR6	BC558 Mullard
3TR7	BC548 Mullard
3TR8	Not used
3TR9	BC548 Mullard
3TR10	BC548 Mullard
3TR11	BC548 Mullard
3TR12	BC548 Mullard
3TR13	BC558 Mullard

INTEGRATED CIRCUITS

3IC1 to 3IC9	see section 7.1.5
3IC10	MC14011CP Motorola
3IC11	MC14001CP Motorola
3IC12	MC14001CP Motorola
3IC13	MC14001CP Motorola
3IC14	MC14506CP Motorola
3IC15	MC14519CP Motorola
3IC16	MC14519CP Motorola
3IC17	MC14011CP Motorola
3IC18	MC14028CP Motorola
3IC19 to 3IC28	Not used
3IC29	MC14002CP Motorola

3IC30	MC14011CP Motorola
3IC31	MC14001CP Motorola
3IC32	MC14001CP Motorola
3IC33	CD4050AE RCA
3IC34	CD4050AE RCA
3IC35 to 3IC43	Not used
3IC44	CD4024AE RCA
3IC45	CA3083 RCA
3IC46	CA3083 RCA
3IC47	MC14001CP Motorola
3IC48	MC14011CP Motorola
3IC49	MC14011CP Motorola
3IC50	MC14011CP Motorola
3IC51	MC14506CP Motorola
3IC52	MC14012CP Motorola
3IC53	MC14001CP Motorola
3IC54	MC14506CP Motorola
3IC55	MC14012CP Motorola

PLUG

3PL1	8623/19/74/14/335 (way) Souriau

7.1.5 Variable Divider Board Component List

RESISTORS

All resistors are ± 5% 0·33W Mullard CR25

3R1	150Ω
3R2	1kΩ
3R3	see section 7.1.4
3R4	120kΩ
3R5	120kΩ
3R6	1kΩ
3R7	1kΩ
3R8	47kΩ
3R9	470kΩ
3R10	2·2kΩ
3R11	2·2kΩ
3R12	2·2kΩ
3R13	1·5kΩ
3R14 to 3R38	see section 7.1.4
3R39 to 3R41	Not used
3R42	1·5kΩ
3R43	330Ω
3R44	220Ω

CAPACITORS

All capacitors marked * are 1000pF 500V Leadthrough Midland Capacitors FT73/15

3C1	150pF ± 2% 63V Mullard 632-34151
3C2	1000pF ± 10% 100V Mullard 630-02102
3C3	22µF 25V Mullard 015-16229
3C4	0·01µF 40V Mullard 629-02103
3C5	1µF 35V ITT TAG1·0M35
3C6 to 3C15	see section 7.1.4
3C16	22µF 16V ITT TAG22M16
3C17	0·01µF 40V Mullard 629-02103
3C18 3C19	see section 7.1.4
3C20	1000pF*
3C21	1000pF*
3C22	1000pF*
3C23	1000pF*
3C24	1000pF*
3C25	1000pF*
3C26	1000pF*
3C27	1000pF*
3C28	1000pF*
3C29	1000pF*
3C30	1000pF*

DIODES

3D1	1N4148 ITT
3D2	1N4148 ITT
3D3	1N4148 ITT

TRANSISTORS

3TR1	BC558 Mullard
3TR2	BC548 Mullard
3TR3 to 3TR7	see section 7.1.6
3TR8	BSX20 Mullard

INTEGRATED CIRCUITS

3IC1	SN7400N Texas
3IC2	SN74H10N Texas
3IC3	SN7400N Texas
3IC4	SN74H73N Texas
3IC5	SN7400N Texas
3IC6	SN74192N Texas
3IC7	SN74192N Texas
3IC8	SN74192N Texas
3IC9	MC4044P Motorola

INDUCTOR

3L2 2·2µH Painton 58/10/0007/10

7.1.6 Private Channel Selector Board Component List

INTEGRATED CIRCUITS

Channel IC's to specification P29768/S Redifon

SOCKETS

3SK1 8623-19-64-14-335 (way) Souriau
Channel IC sockets comprise
Terminal 1938-4 (8 way) Molex
& Nest 2460 (8 way) Molex

7.1.7 Tx Driver Board Component List

RESISTORS

All resistors are ±5% 0·33W Mullard CR25

4R1	150Ω
4R2	220Ω
4R3	100Ω
4R4	22kΩ
4R5	10kΩ
4R6	220Ω
4R7	6·8kΩ
4R8	3·3kΩ
4R9	100Ω
4R10	220Ω
4R11	100Ω
4R12	10kΩ
4R13	2·2kΩ
4R14	470Ω
4R15	47kΩ
4R16	33kΩ
4R17	10kΩ
4R18	100Ω
4R19	150Ω
4R20	Not used
4R21	47Ω
4R22	1kΩ
4R23	220Ω
4R24	47Ω
4R25	1kΩ
4R26	220Ω
4R27	15Ω
4R28	270Ω
4R29	18Ω
4R30	270Ω

CAPACITORS

Commonly used capacitors are identified as follows:
(i) 1000pF ±10% 100V Mullard 630-02102
(ii) 0·01µF 40V Mullard 629-02103
(iii) 0·5-7pF 2000V Trimmer Oxley TUT/7/ST-R

4C1	1000pF(i)
4C2	1000pF(i)
4C3	47pF ± 2% 63V Mullard 632-34479
4C4	12pF ± 2% 63V Mullard 632-10129
4C5	10pF ± 2% 63V Mullard 632-10109
4C6	10pF ± 2% 63V Mullard 632-10109
4C7	5-60pF 300V Trimmer Mullard 809-08003
4C8	100pF ± 2% 63V Mullard 632-34101
4C9	100pF ± 2% 63V Mullard 632-34101
4C10	0·01µF (ii)
4C11	0·01µF(ii)
4C12	0·01µF(ii)
4C13	0·01µF(ii)
4C14	1000pF(i)
4C15	0·5-7pF(iii)

4C16	0·5-7pF(iii)
4C17	0·5-7pF(iii)
4C18	1000pF(i)
4C19	1000pF(i)
4C20	2-9pF 300V Trimmer Mullard 809-09002
4C21	1000pF(i)
4C22	1000pF(i)
4C23	1000pF(i)
4C24	1000pF(i)
4C25	1000pF(i)
4C26	1000pF(i)
4C27	1000pF(i)
4C28	0·5-7pF(iii)
4C29	0·5-7pF(iii)
4C30	0·5-7pF(iii)
4C31	1000pF(i)
4C32	1000pF(i)
4C33	1000pF(i)
4C34	1000pF(i)
4C35	2-18pF 300V Trimmer Mullard 809-09003
4C36	18pF ± 2% 63V Mullard 632-10189
4C37	1000pF(i)
4C38	1000pF(i)
4C39	1000pF(i)
4C40	2-18pF 300V Trimmer Mullard 809-09003
4C41	1000pF(i)
4C42	22µF 25V Mullard 015-16229
4C43	18pF ± 2% 63V Mullard 632-10189
4C44	0·01µF ± 10% 100V Erie 8121M-100-103K-W5R
4C45	0·01µF ± 10% 100V Erie 8121M-100-103K-W5R
4C46	0·01µF(ii)
4C47	1000pF(i)
4C48	1000pF(i)

DIODES

4D1	1N4148 ITT
4D2	1N4148 ITT
4D3	HP5082-2800 Hewlett Packard
4D4	HP5082-2800 Hewlett Packard
4D5	HP5082-2800 Hewlett Packard
4D6	HP5082-2800 Hewlett Packard

TRANSISTORS

4TR1	E300 Siliconix
4TR2	40673 RCA
4TR3	BF115 Mullard
4TR4	2N918 Texas
4TR5	40673 RCA
4TR6	2N918 Texas
4TR7	2N4427 RCA

INDUCTORS

4L1	P29733/3 Redifon
4L2	100µH Painton 58/10/0017/10
4L3	1·5µH Painton 58/10/0006/10
4L4	P29680/3 Redifon
4L5	P29680/3 Redifon

4L6	P29680/3 Redifon
4L7	P29662/3 Redifon
4L8	0·15µH Cambion 550-3399-03
4L9	P29680/3 Redifon
4L10	P29680/3 Redifon
4L11	P29680/3 Redifon
4L12	1·5µH Painton 58/10/0006/10
4L13	0·15µH Cambion 550-3399-03
4L14	P29662/3 Redifon
4L15	1·5µH Painton 58/10/0006/10
4L16	0·15µH Cambion 550-3399-03
4L17	P29662/3 Redifon

TRANSFORMERS

4T1	P29678/3 Redifon
4T2	P29677/3 Redifon

CRYSTAL

4XL1	10·7MHz to specification P29603/S Redifon

7.1.8 Power Amplifier Component List

RESISTORS

All resistors are ±5% 0·33W Mullard CR25 unless otherwise stated

4R40	220Ω
4R41	220Ω
4R42	680Ω
4R43	56Ω
4R44	100Ω
4R45	220Ω
4R46	10Ω
4R47	56Ω
4R48	0·5Ω ± 10% 2·5W CGS C3A
4R49	2·2kΩ
4R50	470Ω LIN 0·2W Potentiometer Morganite 62H
4R51	1kΩ
4R52	1·2kΩ
4R53	10kΩ
4R54	470Ω
4R55	Not used
4R56	1kΩ LIN 0·2W Potentiometer Morganite 62H
4R57	1·5kΩ
4R58	470Ω
4R59	82Ω
4R60	82Ω
4R61	5·6kΩ
4R62	39Ω
4R63	4·7kΩ
4R64	470Ω
4R65	100Ω
4R66	1kΩ

CAPACITORS

Commonly used capacitors are identified as follows:

(i) 100pF 500V Erie 801/K120051 Type 2
(ii) 1000pF ±10% 100V Mullard 630-02102
(iii) 0·1μF ± 5% 250V Siemens B32541-A3104J
(iv) 5-60pF 300V Trimmer Mullard 809-08003

4C50	1000pF(i)
4C51	5-60pF (iv)
4C52	100μF 40V Mullard 016-17101
4C53	0·01μF 40V Mullard 629-02103
4C54	1000pF(i)
4C55	1000pF(i)
4C56	1000pF(i)
4C57	1000pF(ii)
4C58	22μF 16V ITT TAG22M16
4C59	1000pF(i)
4C60	1000pF(i)
4C61	5-60pF(iv)
4C62	82pF ± 2% 63V Mullard 632-34829
4C63	82pF ± 2% 63V Mullard 632-34829
4C64	0·1μF (iii)
4C65	12pF ± 2% 63V Mullard 632-10129
4C66	22pF ± 2% 63V Mullard 632-34229
4C67	1000pF(i)
4C68	0·01μF 40V Mullard 629-02103
4C69	1000pF(i)
4C70	5-60pF(iv)
4C71	47pF ± 2% 63V Mullard 632-34479
4C72	47pF ± 2% 63V Mullard 632-34479
4C73	1000pF(ii)
4C74	5-60pF(iv)
4C75	5-60pF(iv)
4C76	1000pF(ii)
4C77	1000pF(ii)
4C78	2·2μF 63V Mullard 015-18228
4C79	100pF ± 2% 63V Mullard 632-34101
4C80 to 4C89	see section 7.1.9
4C90	1000pF(ii)
4C91	1000pF(i)
4C92	0·1μF (iii)
4C93	0·1μF (iii)
4C94	1000pF(ii)
4C95	10pF ± 5% 500V Erie 801/P100
4C96	1000pF(ii)
4C97	1000pF(ii)
4C98	1000pF(ii)

DIODES

4D10	Zener BZY88C9V1 Mullard
4D11	HP5082-2800 Hewlett Packard
4D12	1N4148 ITT
4D13	MPN3402 Motorola
4D14	1N4148 ITT
4D15	Zener BZY88C4V7 Mullard

TRANSISTORS

4TR10	2N3866 RCA
4TR11	2N5641 Motorola
4TR12	2N5643 Motorola
4TR13	MJE371 Motorola
4TR14	BC558 Mullard
4TR15	BC547 Mullard
4TR16	BC547 Mullard
4TR17	BC547 Mullard

INDUCTORS

4L30	P29639/3 Redifon
4L31	0·33μH Painton 58/10/0002/10
4L32	1·5μH Painton 58/10/0006/10
4L33	1·5μH Painton 58/10/0006/10
4L34	1·5μH Painton 58/10/0006/10
4L35	P29745/3 Redifon

FERRITE BEADS

4FB1	FX1242/B2 Mullard
4FB2	P29674/3 Redifon

RELAY

4RL1	D27-A2-A11 Davall

MISCELLANEOUS

4X1, 4X2, 4X3, 4X4, 4X5	Microstrip transmission lines formed in copper track on PCB
4X6	Output protection transformer formed in copper track on PCB

7.1.9 Aerial Filter Component List

CAPACITORS

4C80	10pF ± 5% 500V Erie 801/P100
4C81	10pF ± 5% 500V Erie 801/P100
4C82	18pF ± 5% 500V Erie 801/NPO
4C83	18pF ± 5% 500V Erie 801/NPO
4C84	18pF ± 5% 500V Erie 801/NPO
4C85	18pF ± 5% 500V Erie 801/NPO
4C86	10pF ± 5% 500V Erie 801/P100
4C87	10pF ± 5% 500V Erie 801/P100
4C88	1000pF 500V Leadthrough Erie 361/K2600
4C89	1000pF 500V Leadthrough Erie 361/K2600

INDUCTORS

4L36, 4L37, 4L38	single assembly P29743/3 Redifon

SOCKET

4SK1	GE15034P Greenpar

7.1.10 Switching Regulator Board Component List

RESISTORS

All resistors are ±5% 0·33W Mullard CR25 unless otherwise stated

5R1	2·2kΩ
5R2	330Ω
5R3	100kΩ
5R4	47kΩ
5R5	220kΩ
5R6	1kΩ LIN 0·5W Potentiometer Morganite 90H
5R7	330Ω
5R8	330Ω
5R9	6·8kΩ
5R10	6·8kΩ
5R11	120Ω
5R12	220Ω
5R13	3·3kΩ
5R14	270Ω
5R15	18Ω
5R16	1kΩ

CAPACITORS

5C1	100µF 3V ITT TAG100M3
5C2	220pF ± 2% 63V Mullard 632-58221
5C3	220pF ± 2% 63V Mullard 632-58221
5C4	0·1µF ± 5% 250V Siemens B32541-A3104J
5C5	2·2µF 63V Mullard 015-18228
5C6	680µF 40V Mullard 017-17681
5C7	1000pF ± 10% 100V Mullard 630-02102
5C8	100µF 20V Union Carbide K100J20S
5C9	1000µF 25V Erie 21104-100-0102-OT-0250
5C10	100µF 20V Union Carbide K100J20S
5C11	100µF 20V Union Carbide K100J20S
5C12	10µF 16V ITT TAG10M16

DIODES

5D1	1N4002 Texas
5D2	1N4148 ITT
5D3	Zener BZY88C4V3 Mullard
5D4	Zener BZY88C10 Mullard
5D5	EF50M1 Westinghouse
5D6	EF50M3 Westinghouse
5D7	1N4734A Motorola
5D8	1N4742A Motorola

TRANSISTORS

5TR1	BC548 Mullard
5TR2	BC558 Mullard
5TR3	BC548 Mullard
5TR4	BC548 Mullard
5TR5	2N3053 Mullard

5TR6	BFR86 Texas
5TR7	BFR79 Texas
5TR8	BDY90 Mullard

INTEGRATED CIRCUIT

5IC1	MC14001CP Motorola

INDUCTORS

5L1	P29683/3 Redifon
5L2	33µH Painton 58/10/0014/10
5L3	P29682/3 Redifon
5L4	P29681/3 Redifon

TRANSFORMER

5T1	P29684/3 Redifon

FUSE

5FS1	1A Belling Lee L1427

7.1.11 DC Regulator Board Component List

RESISTORS

All resistors are ±5% 0·33W Mullard CR25 unless otherwise stated

7R1	47kΩ
7R2	1kΩ
7R3	3·3kΩ
7R4	470Ω
7R5	100Ω
7R6	330Ω
7R7	1kΩ
7R8	1kΩ LIN 0·5W Potentiometer Morganite 90H
7R9	1kΩ
7R10	4·7kΩ
7R11	120Ω

CAPACITORS

7C1	1000pF ±10% 100V Mullard 630-02102
7C2	22µF 25V Mullard 015-16229
7C3	1000pF ±10% 100V Mullard 630-02102
7C4	0·1µF ±5% 250V Siemens B32541-A3104J
7C5	47µF 40V Mullard 016-17479
7C6	0·02µF 500V Erie 811/K800011 Type 2
7C7	47µF 40V Mullard 016-17479

DIODES

7D1	Zener BZY88C5V6 Mullard
7D2	1N4148 ITT
7D3	Zener BZY88C15V Mullard
7D4	1N4002 Motorola

TRANSISTORS

7TR1	2N5298 **RCA**
7TR2	2N3906 **Texas**
7TR3	2N3906 **Texas**

FUSES

7FS1	1·6A anti-surge Standard Fuse Co. C254/1·6A
7FS2	5A anti-surge Standard Fuse Co. C254/5A
7FS3	5A Standard Fuse Co. C19F/5A
7FS4	2A Standard Fuse Co. C19/2A

7.1.12 Relay Board Component List

RESISTORS

R12	10kΩ ±5% 0·33W Mullard CR25
R13	10Ω ±5% 0·33W Mullard CR25

CAPACITORS

7C8	680µF 40V Mullard 017-17681
7C9	0·02µF 500V Erie 811/K800011 Type 2
7C10	47µF 40V Mullard 016-17479
7C11	0·02µF 500V Erie 811/K800011 Type 2
7C12	47µF 40V Mullard 016-17479
7C13	0·02µF 500V Erie 811/K800011 Type 2

DIODES

7D5	Surge suppresser BZW70-33 Mullard
7D6	1N4148 ITT

INDUCTOR

7L1	P29852/3 Redifon

RELAYS

7RL1	P29838/2 Redifon
7RL2	P29838/2 Redifon

7.1.13 Chassis Mounted Component List

RESISTORS

6R1 10kΩ ± 5% 0·33W Mullard CR25
6R2 10kΩ ± 5% 0·33W Mullard CR25

CAPACITORS

6C1 4700µF 50V Plessey 439/1/23611/071
6C2 1000pF 500V Leadthrough Erie 361/K2600
6C3 1000pF 500V Leadthrough Erie 361/K2600
6C4 1000pF 500V Leadthrough Erie 361/K2600
6C5 1000pF 500V Leadthrough Erie 361/K2600

6C6 1000pF 500V Leadthrough Erie 361/K2600
6C7 Not used
6C8 0·47µF 100V ITT PMT2R0·47M100
6C9 0·47µF 100V ITT PMT2R0·47M100

DIODES

6D7 - 6D10 Bridge rectifier AEI PM7A2

TRANSISTOR

6TR4 RCA 2N6254

TRANSFORMERS

6T1 Redifon SR/T2860
6T2 Redifon SR/T2861

INDICATOR LAMP

6LP1 28V 24mA Guest 280

SWITCHES

6S1 Arrow 81055-BT-13
6S2 Arrow 81055-BT-13

SOCKET

6SK1 Greenpar GE15041C22

7.2 STANDARD CONTROL UNIT SRC66

7.2.1 Remote Logic Board Component List

RESISTORS

All resistors are ±5% 0·33W Mullard CR25

1R1	33kΩ
1R2	100kΩ
1R3	33kΩ
1R4	33kΩ
1R5	33kΩ
1R6	33kΩ
1R7	33kΩ
1R8	33kΩ
1R9	33kΩ
1R10	33kΩ
1R11	33kΩ
1R12	33kΩ
1R13	33kΩ
1R14	33kΩ
1R15	150kΩ
1R16	68kΩ
1R17	100kΩ
1R18	33kΩ
1R19	33kΩ
1R20	100kΩ
1R21	33kΩ
1R22	33kΩ
1R23	33kΩ
1R24	150kΩ
1R25	1MΩ
1R26	150kΩ
1R27	68kΩ
1R28	10kΩ
1R29	10kΩ
1R30	68kΩ
1R31	10kΩ
1R32	10kΩ
1R33	150kΩ
1R34	330kΩ
1R35	150kΩ
1R36	100kΩ
1R37	100kΩ
1R38	100kΩ
1R39	100kΩ
1R40	100kΩ
1R41	100kΩ
1R42	100kΩ
1R43	100kΩ
1R44	100kΩ
1R45	100kΩ

1R46	100kΩ
1R47	100kΩ
1R48	100kΩ
1R49	100kΩ
1R50	100kΩ
1R51	100kΩ
1R52	33kΩ
1R53	100kΩ
1R54	100kΩ
1R55	150kΩ
1R56	33kΩ
1R57	150kΩ
1R58	33kΩ
1R59	330kΩ
1R60	220kΩ
1R61	22kΩ
1R62	10kΩ
1R63	10kΩ
1R64	15kΩ
1R65	1·2kΩ
1R66	820Ω
1R67	2·7kΩ

CAPACITORS

All capacitors marked * are 0·1µF ± 5% 250V Siemens B32541-A3104J

1C1	0·1µF*
1C2	0·1µF*
1C3	0·1µF*
1C4	10µF 16V ITT TAG10M16
1C5	1µF 35V ITT TAG1·0M35
1C6	10µF 16V ITT TAG10M16
1C7	0·47µF ± 5% 100V Siemens B32541 - A1474J
1C8	0·1µF*
1C9	0·1µF*
1C10	0·1µF*
1C11	0·47µF ± 5% 100V Siemens B32541 - A1474J

DIODES

1D1 - 1D31 } All 1N4148 ITT

TRANSISTORS

1TR1	BC548	Mullard
1TR2	BC558	Mullard
1TR3	BC558	Mullard
1TR4	BC548	Mullard
1TR5	BC548	Mullard
1TR6	BC548	Mullard
1TR7	BC548	Mullard
1TR8	BC548	Mullard
1TR9	BC548	Mullard
1TR10	BC548	Mullard

1TR11	BC558	Mullard
1TR12	BC548	Mullard
1TR13	BSX20	Mullard
1TR14	BC548	Mullard

INTEGRATED CIRCUITS

1IC1	MC14002CP	Motorola
1IC2	MC14012CP	Motorola
1IC3	MC14012CP	Motorola
1IC4	MC14011CP	Motorola
1IC5	MC14011CP	Motorola
1IC6	MC14011CP	Motorola
1IC7	MC14001CP	Motorola
1IC8	MC14023CP	Motorola
1IC9	MC14023CP	Motorola
1IC10	MC14027CP	Motorola
1IC11	MC14027CP	Motorola
1IC12	CD4042AE	RCA
1IC13	CD4042AE	RCA
1IC14	CD4042AE	RCA
1IC15	CD4042AE	RCA
1IC16	MC14519	Motorola
1IC17	MC14519	Motorola
1IC18	MC14011CP	Motorola
1IC19	MC14506CP	Motorola
1IC20	MC14012CP	Motorola
1IC21	MC14002CP	Motorola
1IC22	CD4050AE	RCA
1IC23	CD4050AE	RCA
1IC24	SN7447AN	Texas
1IC25	SN7477AN	Texas

TERMINAL STRIPS

1TS1	8/4 - 3077 (4 way) Klippon
1TS2	8/10 - 3026 (10 way) Klippon

7.2.2 SRC Linear Board Component List

RESISTORS

All resistors are ±5% 0·33W Mullard CR25 unless otherwise stated

2R20	4·7kΩ
2R21	470Ω
2R22	470Ω ± 10% 5W Painton MV1A
2R23	1kΩ LIN 0·2W Potentiometer Morganite 62H
2R24	22kΩ
2R25	470Ω
2R26	2·2kΩ
2R27	2·2kΩ
2R28	1kΩ
2R29	10kΩ
2R30	10kΩ
2R31	10kΩ
2R32	10kΩ
2R33	1kΩ LIN 0·2W Potentiometer Morganite 62H
2R34	3·3kΩ

2R35	3·3kΩ
2R36	2·2kΩ
2R37	220kΩ
2R38	220kΩ
2R39	22kΩ
2R40	470kΩ
2R41	220kΩ
2R42	22kΩ
2R43	10kΩ
2R44	2·2kΩ
2R45	220kΩ
2R46	68Ω
2R47	10kΩ
2R48	150kΩ
2R49	2·2kΩ LIN 0·2W Potentiometer Morganite 62H
2R50	560Ω ± 10% 5W Painton MV1A
2R51	330Ω
2R52	330Ω
2R53	820Ω ± 10% 5W Painton MV1A
2R54	4·7kΩ
2R55	2·2kΩ

CAPACITORS

All capacitors marked* are 10µF 63V Mullard 016-18109

2C10	10µF*
2C11	100µF 40V Mullard 016-17101
2C12	10µF*
2C13	10µF*
2C14	10µF*
2C15	22µF 25V Mullard 015-16229
2C16	10µF*
2C17	0·1µF ± 5% 250V Siemens B32541-A3104J
2C18	100µF 25V Mullard 016-16101
2C19	100µF 25V Mullard 016-16101
2C20	100µF 25V Mullard 016-16101

DIODES

2D20	1N4148 ITT
2D21	1N4148 ITT
2D22	1N4148 ITT
2D23	1N4148 ITT
2D24	Zener BZY88C10 Mullard
2D25	1N4148 ITT
2D26	1N4148 ITT
2D27	1N4148 ITT
2D28	1N4148 ITT
2D29	BYX36-150 Mullard
2D30	1N4148 ITT
2D31	Zener BZY88C6V2 Mullard
2D32	1N4148 ITT
2D33	Zener BZY88C9V1 Mullard

TRANSISTORS

2TR10	BC547 Mullard
2TR11	BC547 Mullard
2TR12	BC557 Mullard
2TR13	BSX20 Mullard
2TR14	E112 Siliconix
2TR15	E112 Siliconix
2TR16	E112 Siliconix
2TR17	BFY51 Mullard
2TR18	BC547 Mullard
2TR19	E112 Siliconix
2TR20	BC547 Mullard
2TR21	BC547 Mullard
2TR22	2N3053 RCA

RELAY

2RL2	P29837/S Redifon

TERMINAL STRIPS

2TS1	MK8/10 - 3026 (10 way) Klippon
2TS2	MK8/10 - 3026 (10 way) Klippon
2TS3	MK8/4 - 3077 (4 way) Klippon

7.2.3 SRC Panel Mounted Component List

POTENTIOMETERS

3R1 (Volume)	10kΩ LIN 1W Erie 500/1
3R2 (Squelch)	10kΩ LIN 1W Erie 500/1
3R3 (Dimmer)	10kΩ LIN 1W Erie 500/1

TRANSISTORS

3TR1	2N3055 RCA
3TR2	2N3055 RCA

SWITCHES

3S6 (On/Off)	CKW7101 Roxburgh
3S7 (Tx Power)	CKW7101 Roxburgh
3S8 (ELU/Loudspeaker)	CKW7203 Roxburgh

KEYBOARD ASSEMBLY

3KB1	P29758/2 Redifon

LAMPS

All lamps marked* are 6V 0·36W LES Vitality 673 E5/8

3LP6 (Panel illum.)	6V 0·36W *
3LP7 (Tx On)	5V 0·06A Guest TI525B
3LP8 (Panel illum.)	6V 0·36W*
3LP9 (Channel 16)	5V 0·06A Guest TI525B
3LP10 (Keyboard)	6V 0·36W*

3LP11 (Keyboard)	6V 0·36W*
3LP12 (Keyboard)	6V 0·36W*
3LP13 (Keyboard)	6V 0·36W*

CHANNEL READOUT DISPLAYS

3CRD1 (Tens)	FDB 5V 15F KGM (Okayatron)
3CRD2 (Units)	FDB 5V 15F KGM (Okayatron)

LOUDSPEAKER

3LS1 15Ω, 3" Fane 3228

TERMINAL STRIP

3TS1 L1350/Ni (6 way) Belling Lee

7.3 MASTER CONTROL UNIT MRC66

N.B. Remote Logic Module

This module is the same as that fitted to the Standard Control Unit SRC66. See section 7.2.1 for Component List, Fig. 7.22 for PCB layout and Fig. 7.23 for Circuit Diagram.

7.3.1 MRC Linear Board Component List

RESISTORS

All resistors are ± 5% 0·33W Mullard CR25 unless otherwise stated

2R1	4·7kΩ
2R2	22kΩ
2R3	4·7kΩ
2R4	22kΩ
2R5	10Ω ± 10% 5W Painton MV1A
2R6	1kΩ LIN 0·2W Potentiometer Morganite 62H
2R7	1kΩ LIN 0·2W Potentiometer Morganite 62H
2R8	4·7kΩ
2R9	22kΩ
2R10	1kΩ LIN 0·2W Potentiometer Morganite 62H
2R11 to 2R19	Not used
2R20	4·7kΩ
2R21	470Ω
2R22	470Ω ± 10% 5W Painton MV1A
2R23	1kΩ LIN 0·5W Potentiometer Morganite 90H
2R24	22kΩ
2R25	470Ω
2R26	2·2kΩ
2R27	2·2kΩ
2R28	1kΩ
2R29	10kΩ
2R30	10kΩ
2R31	10kΩ
2R32	10kΩ
2R33	1kΩ LIN 0·2W Potentiometer Morganite 62H
2R34	3·3kΩ
2R35	3·3kΩ
2R36	2·2kΩ
2R37	220kΩ
2R38	220kΩ
2R39	22kΩ
2R40	470kΩ
2R41	220kΩ
2R42	22kΩ
2R43	10kΩ
2R44	2·2kΩ
2R45	220kΩ
2R46	68Ω
2R47	10kΩ
2R48	150kΩ
2R49	2·2kΩ LIN 0·2W Potentiometer Morganite 62H
2R50	560Ω ± 10% 5W Painton MV1A
2R51	330Ω

2R52	330Ω
2R53	820Ω ± 10% 5W Painton MV1A
2R54	4·7kΩ
2R55	2·2kΩ

CAPACITORS

All capacitors marked * are 10µF 63V Mullard 016-18109

2C10	10µF*
2C11	100µF 40V Mullard 016-17101
2C12	10µF*
2C13	10µF*
2C14	10µF*
2C15	22µF 25V Mullard 015-16229
2C16	10µF*
2C17	0·1µF ± 5% 250V Siemens B32541-A3104J
2C18	100µF 25V Mullard 016-16101
2C19	100µF 25V Mullard 016-16101
2C20	100µF 25V Mullard 016-16101

DIODES

2D1	1N4148 ITT
2D2	1N4148 ITT
2D3	BYX36-150 Mullard
2D4	BYX36-150 Mullard
2D5	1N4148 ITT
2D6	1N4148 ITT
2D7	BYX36-150 Mullard
2D8	BYX36-150 Mullard
2D9	1N4148 ITT
2D10	1N4148 ITT
2D12 to 2D19	Not used
2D20	1N4148 ITT
2D21	1N4148 ITT
2D22	1N4148 ITT
2D23	1N4148 ITT
2D24	Zener BZY88C10 Mullard
2D25	1N4148 ITT
2D26	1N4148 ITT
2D27	1N4148 ITT
2D28	1N4148 ITT
2D29	BYX36-150 Mullard
2D30	1N4148 ITT
2D31	Zener BZY88C6V2
2D32	1N4148 ITT
2D33	Zener BZY88C9V1 Mullard

TRANSISTORS

2TR10	BC547 Mullard
2TR11	BC547 Mullard
2TR12	BC557 Mullard
2TR13	BSX20 Mullard
2TR14	E112 Siliconix

2TR15	E112	Siliconix
2TR16	E112	Siliconix
2TR17	BFY51	Mullard
2TR18	BC547	Mullard
2TR19	E112	Siliconix
2TR20	BC547	Mullard
2TR21	BC547	Mullard
2TR22	2N3053	RCA

SWITCH

2S1 P29803/3 Redifon

RELAYS

2RL1 P29837/S Redifon
2RL2 P29837/S Redifon

TERMINAL STRIPS

2TS1	MK8/10-3026 (10 way)	Klippon
2TS2	MK8/10-3026 (10 way)	Klippon
2TS3	MK8/4 - 3077 (4 way)	Klippon
2TS4	MK8/4 - 3077 (4 way)	Klippon
2TS5	MK8/10-3026 (10 way)	Klippon
2TS6	MK8/10-3026(10 way)	Klippon
2TS7	MK8/4 - 3077 (4 way)	Klippon
2TS8	MK8/10-3026 (10 way)	Klippon

7.3.2 MRC Panel Mounted Component List

POTENTIOMETERS

3R1 (Volume)	10kΩ	LIN	1W	Erie 500/1
3R2 (Squelch)	10kΩ	LIN	1W	Erie 500/1
3R3 (Dimmer)	10kΩ	LIN	1W	Erie 500/1

TRANSISTORS

3TR1 2N3055 RCA
3TR2 2N3055 RCA

SWITCHES

3S1 (Call Ext)	CKW7208 Roxburgh
3S2 (B/W Loudspeakers)	CKW7201 Roxburgh
3S3 to 3S5	Not used
3S6 (On/Off)	CKW7101 Roxburgh
3S7 (Tx Power)	CKW7101 Roxburgh
3S8 (ELU/Loudspeaker)	CKW7203 Roxburgh

KEYBOARD ASSEMBLY

3KB1 P29758/2 Redifon

LAMPS

All lamps marked* are 6V 0·36W LES Vitality 673 E5/8

3LP1 (Ext.in use)	5V 0·06A Guest TI525B
3LP2 to 3LP5	Not used
3LP6 (Panel illum.)	6V 0·36W*
3LP7 (Tx On)	5V 0·06A Guest TI525B

3LP8 (Panel illum.)   6V 0·36W*
3LP9 (Channel 16)   5V 0·06A Guest TI525B
3LP10 (Keyboard)   6V 0·36W*
3LP11 (Keyboard)   6V 0·36W*
3LP12 (Keyboard)   6V 0·36W*

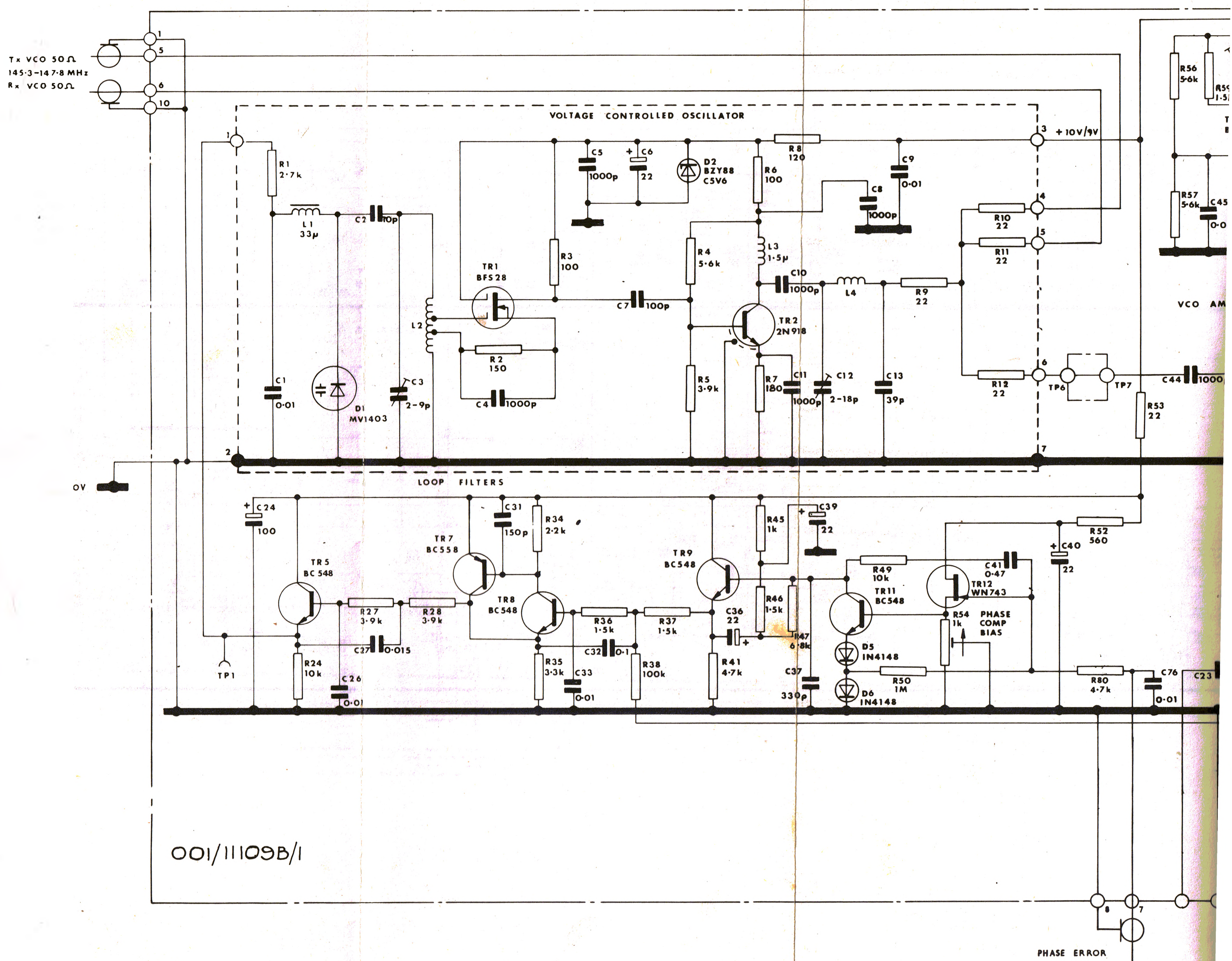
3LP13 (Keyboard)   6V 0·36W*

CHANNEL READOUT DISPLAYS

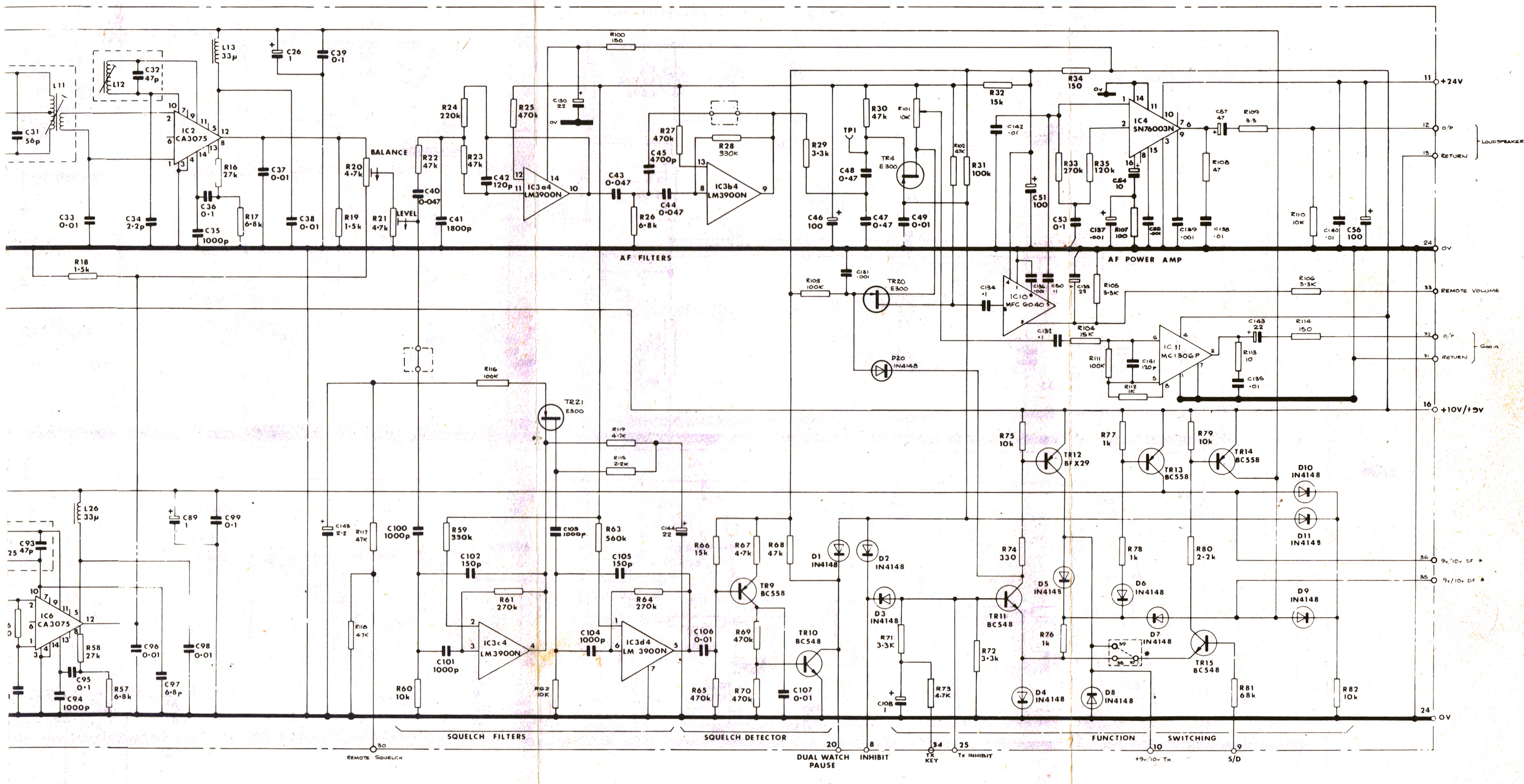
3CRD1 (Tens)   FDB 5V 15F KGM (Okayatron)
3CRD2 (Units)   FDB 5V 15F KGM (Okayatron)

TERMINAL STRIP

3TS1   L1350/Ni (6 way) Belling Lee

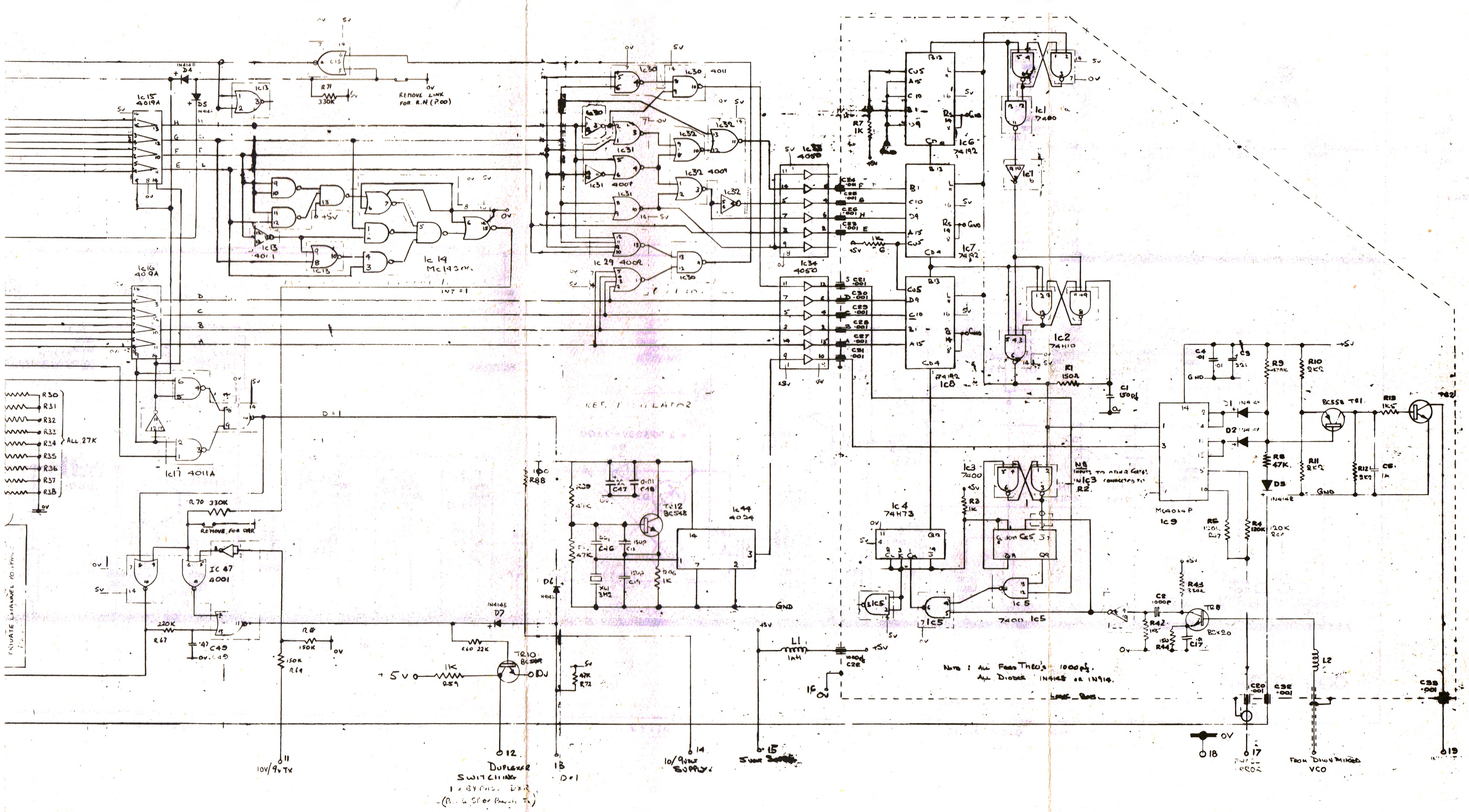


Tx VCO 50Ω
145·3–147·8 MHz
Rx VCO 50Ω
VOLTAGE CONTROLLED OSCILLATOR
+10V/9V
R1 2·7k
L1 33μ
C2 10p
C1 0·01
D1 MV1403
C3 2-9p
L2
TR1 BFS28
R2 150
C4 1000p
R3 100
C5 1000p
C6 22
D2 BZY88 C5V6
R8 120
R6 100
C9 0·01
C8 1000p
R4 5·6k
L3 1·5μ
C10 1000p
L4
R9 22
C7 100p
TR2 2N918
R5 3·9k
R7 180
C11 1000p
C12 2-18p
C13 39p
R10 22
R11 22
R12 22
TP6
TP7
C44 1000
R53 22
R56 5·6k
R57 5·6k
VCO AM
OV
LOOP FILTERS
C24 100
TR5 BC548
TR7 BC558
C31 150p
R34 2·2k
TR8 BC548
TR9 BC548
R45 1k
C39 22
R52 560
C40 22
R27 3·9k
R28 3·9k
C27 0·015
TP1
R24 10k
C26 0·01
R36 1·5k
R37 1·5k
C32 0·1
R35 3·3k
C33 0·01
R38 100k
C36 22
R46 1·5k
R47 6·8k
R41 4·7k
C37 330p
R49 10k
TR11 BC548
TR12 WN743
C41 0·47
R54 1k
PHASE COMP BIAS
D5 1N4148
D6 1N4148
R50 1M
R80 4·7k
C76 0·01
C23
001/11109B/1
PHASE ERROR



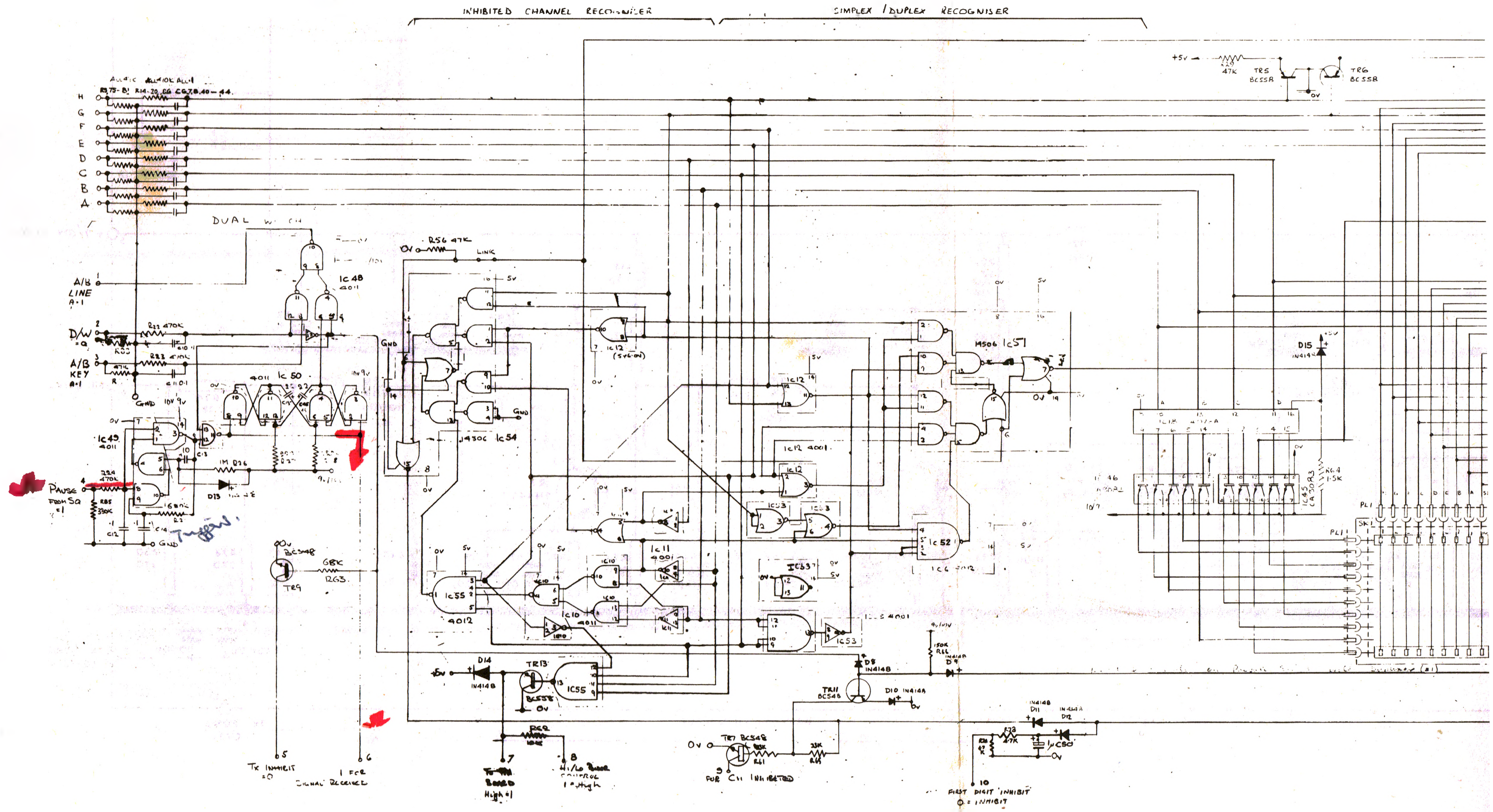
* WHEN SINGLE AERIAL MOD KIT IS USED REMOVE WIRE LINK FROM PINS 37 & 38 AND POSITION BETWEEN 37 & 39 AS SHOWN DOTTED ALSO CONNECT PINS 35 & 36 TO P.A. P.C.B. PIN 13 & 18.
FOR P.C.B.'s MK. 1-3 USE 002/1118A/M FOR OTHER P.C.B's USE THIS CIRCUIT

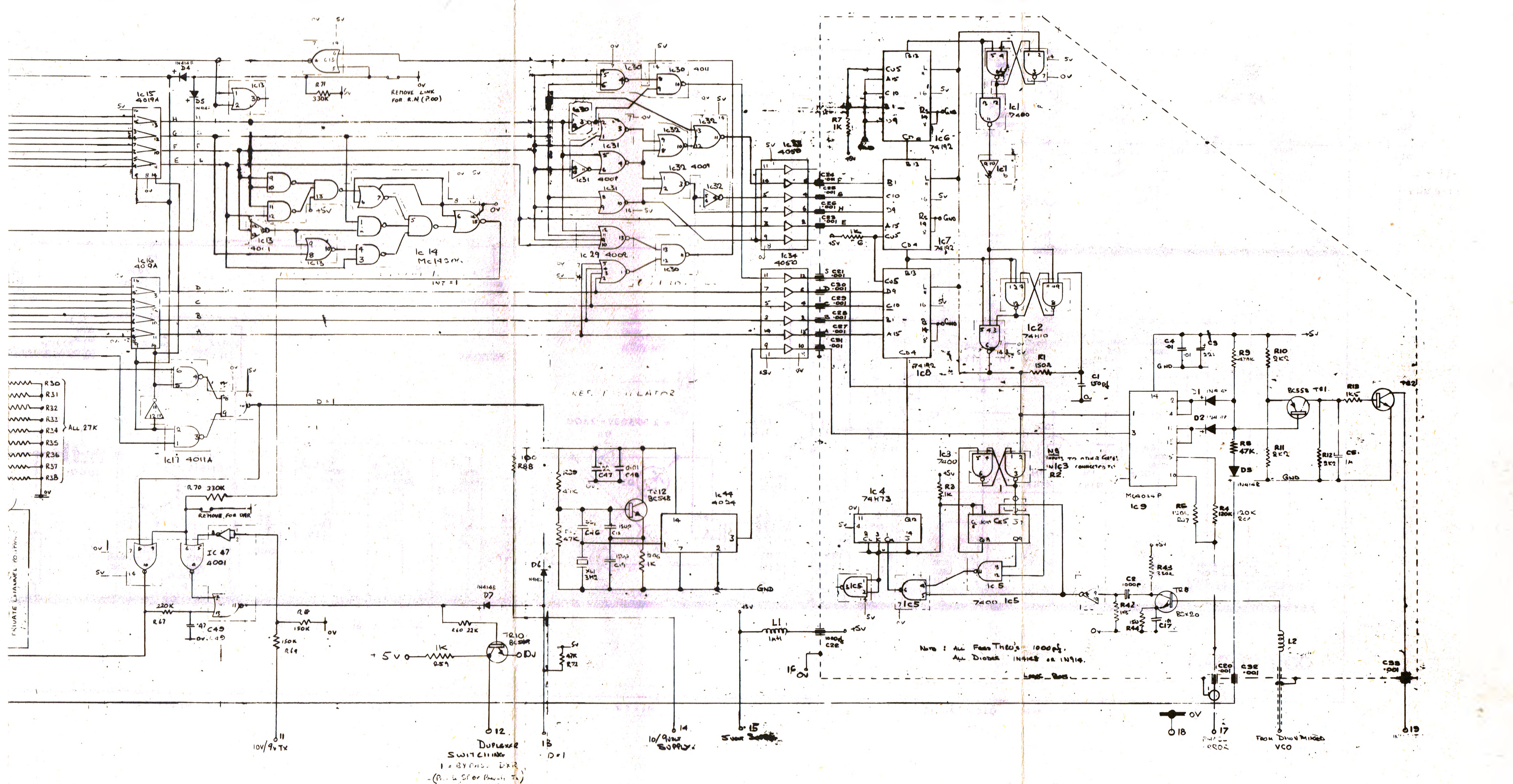
Receiver Circuit Fig.7.3



Logic Control Circuits

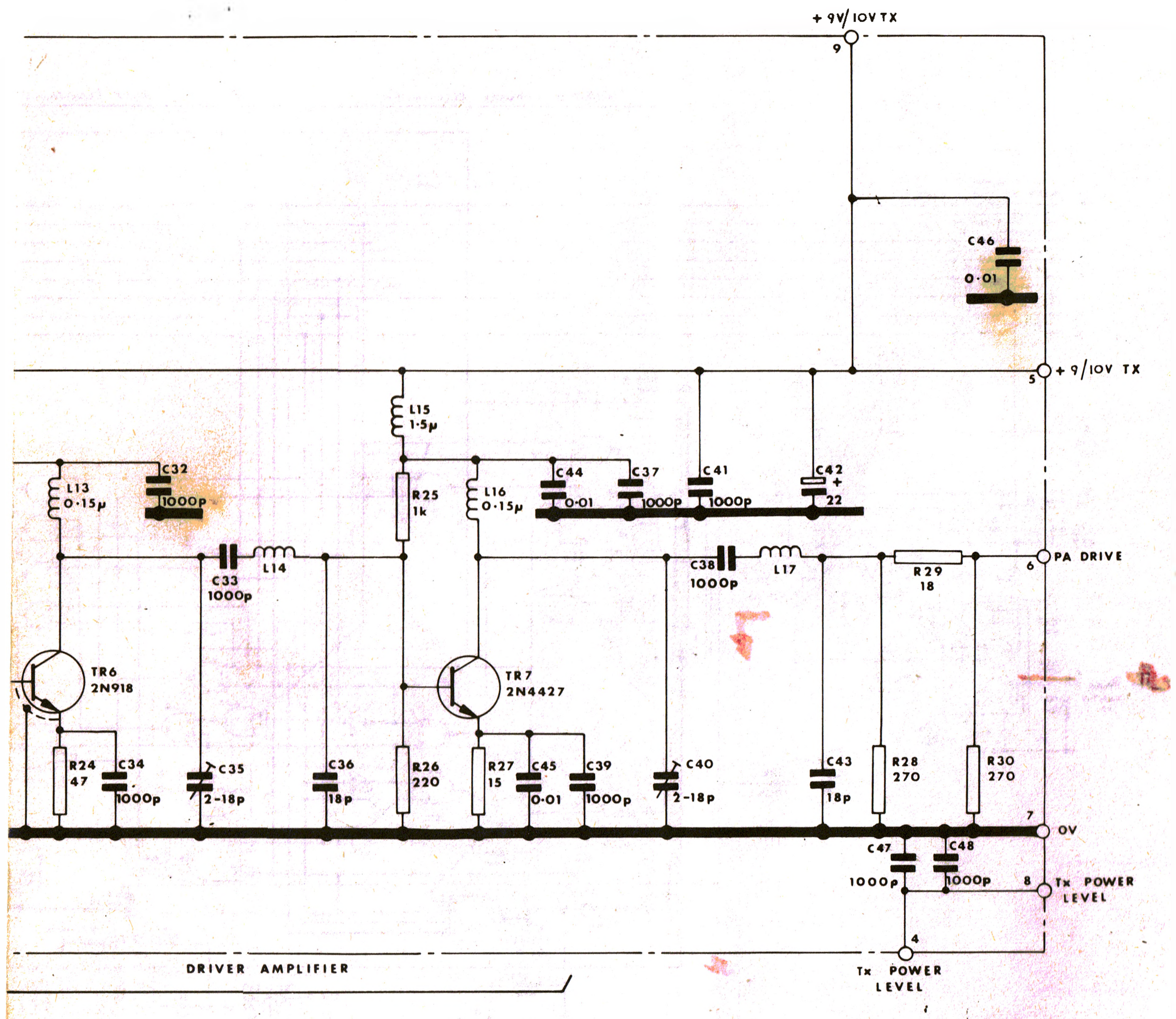
Fig.7.9


INHIBITED CHANNEL RECOGNISER
SIMPLEX / DUPLEX RECOGNISER
DUAL
A/B LINE
D/W
A/B KEY
PAUSE FROM SQ
IC 48
IC 50
IC 54
IC 57
IC 52
IC 55
TX INHIBIT
FIRST DIGIT INHIBIT

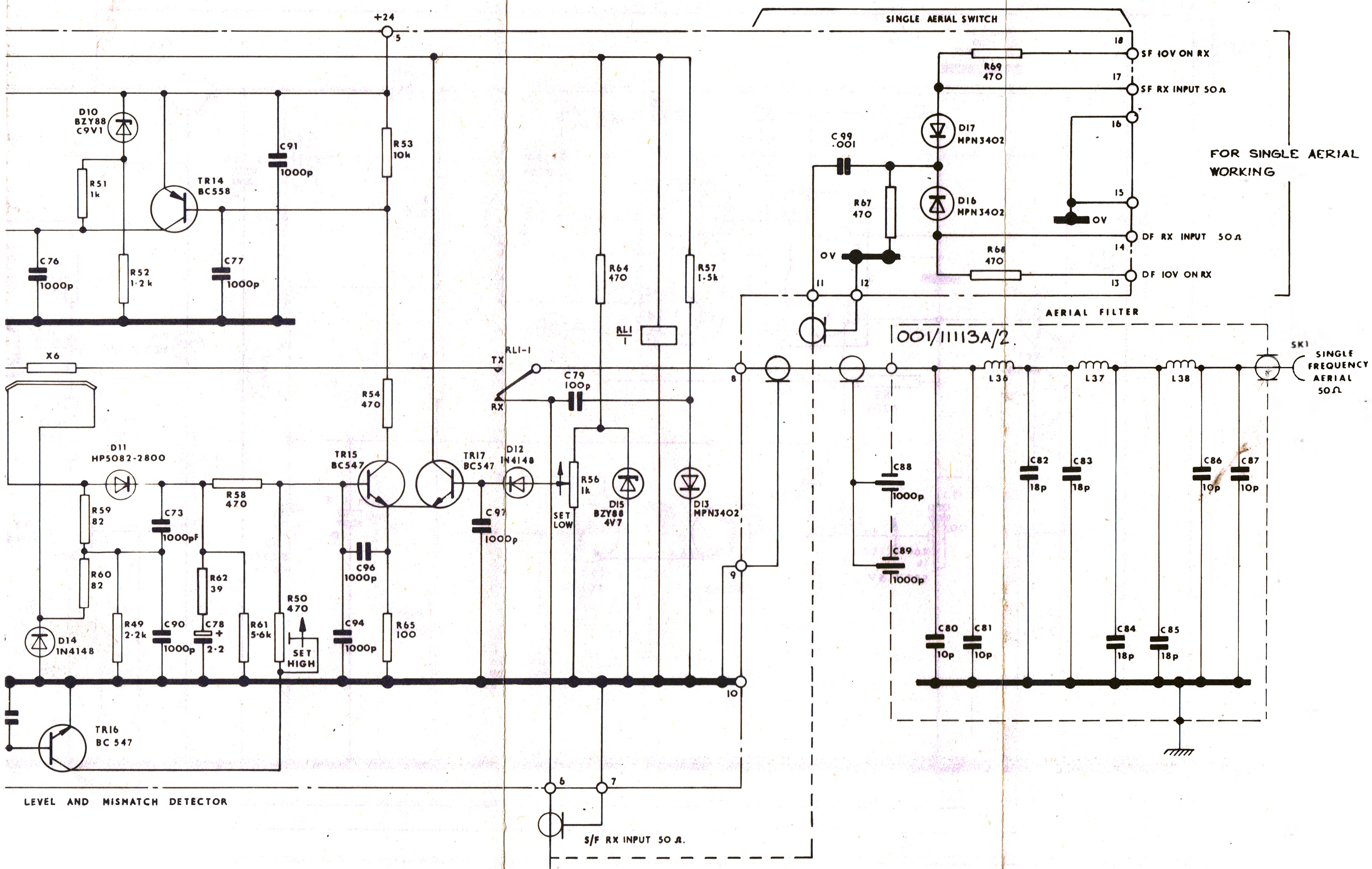


Logic Control Circuits

Fig.7.9

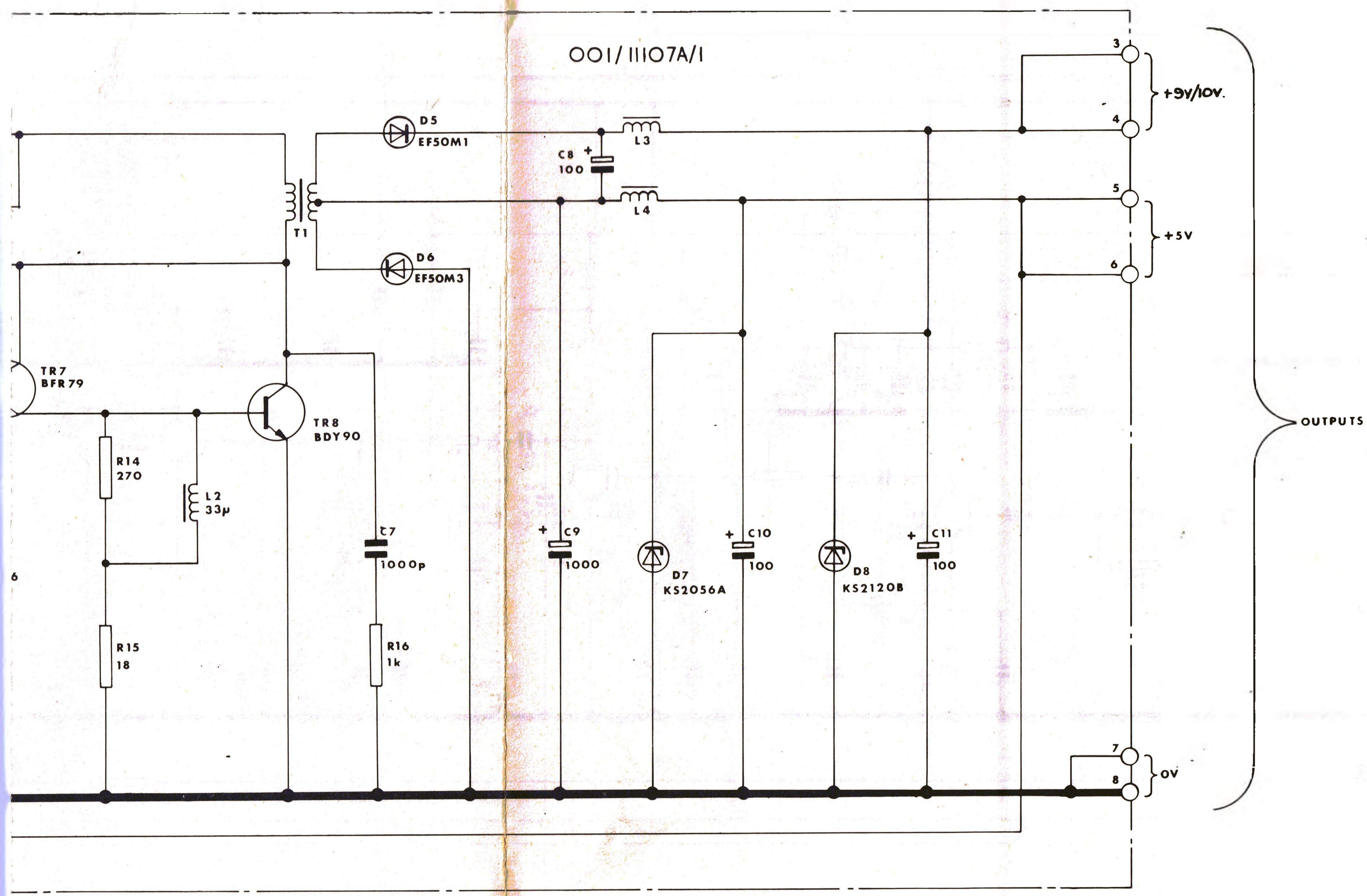


Tx Driver Circuit Fig.7.11

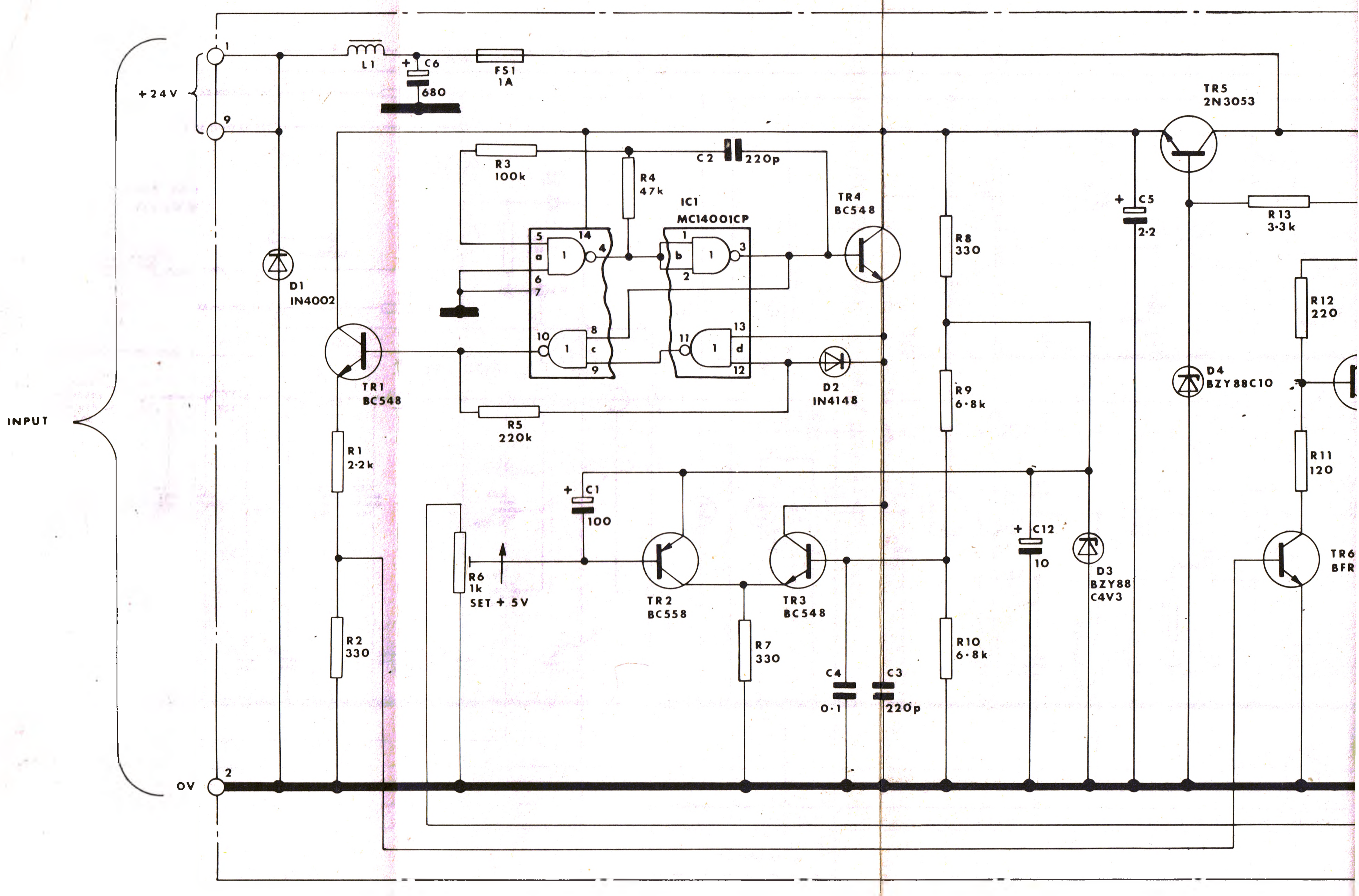


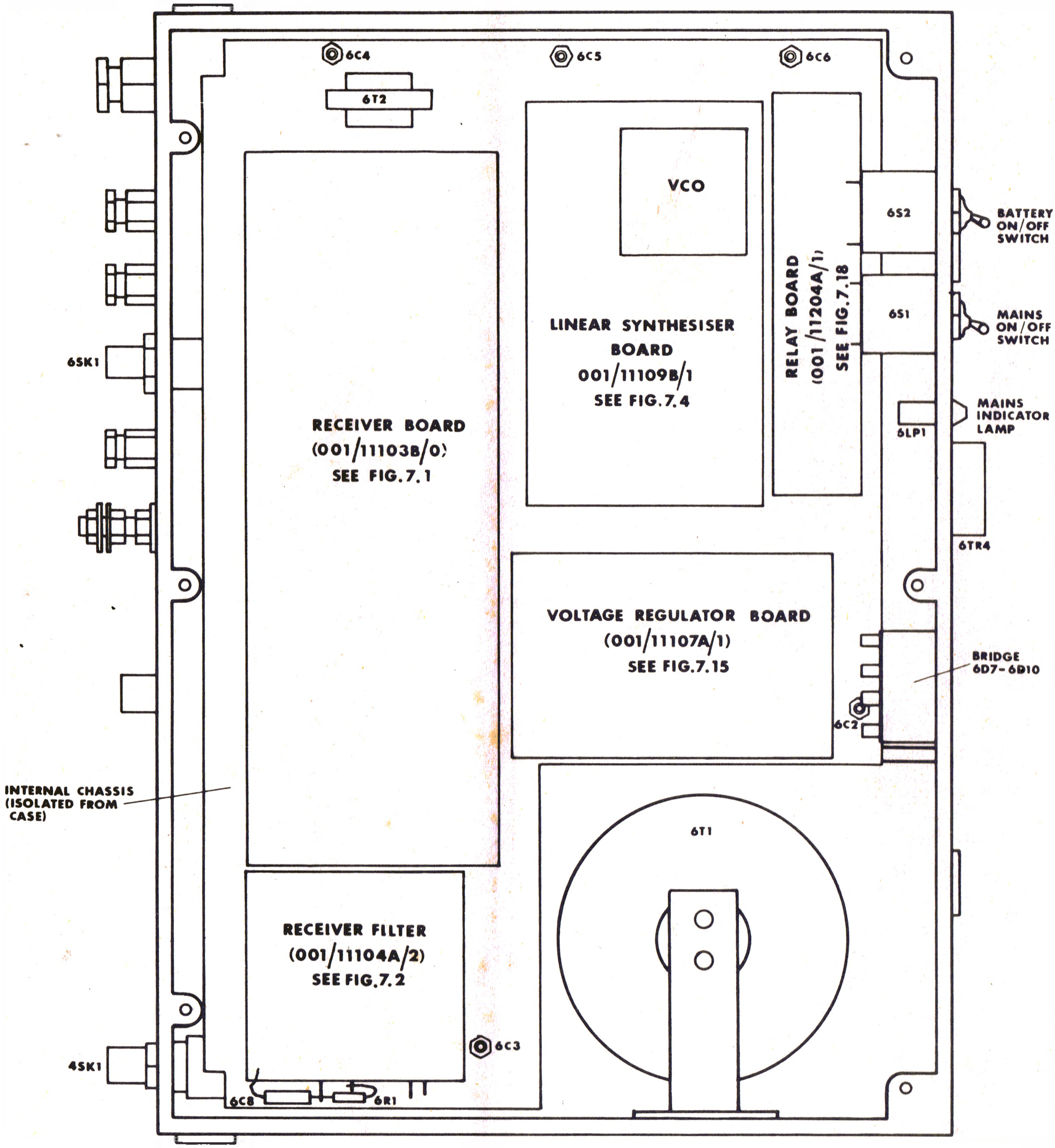
Power Amplifier Circuit

Fig.7.14

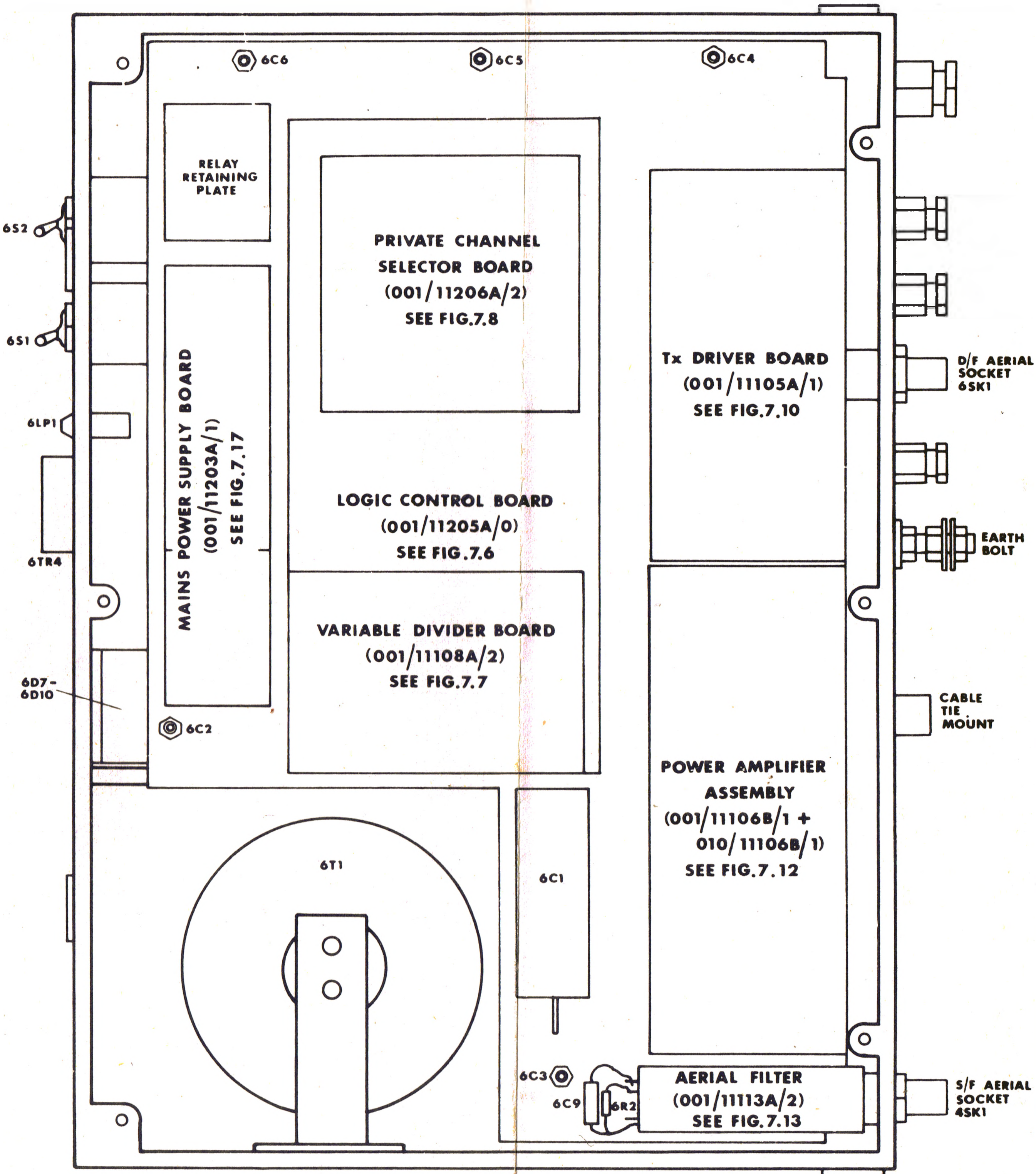


Voltage Regulator Circuit Fig.7.16


+24V
INPUT
0V
L1
C6
680
FS1
1A
R3
100k
R4
47k
C2
220p
IC1
MC14001CP
TR4
BC548
TR5
2N3053
C5
2·2
R13
3·3k
R8
330
R12
220
D1
IN4002
TR1
BC548
R5
220k
D2
IN4148
R9
6·8k
D4
BZY88C10
R11
120
R1
2·2k
C1
100
C12
10
R6
1k
SET + 5V
TR2
BC558
TR3
BC548
D3
BZY88
C4V3
TR6
BFR
R2
330
R7
330
C4
0·1
C3
220p
R10
6·8k

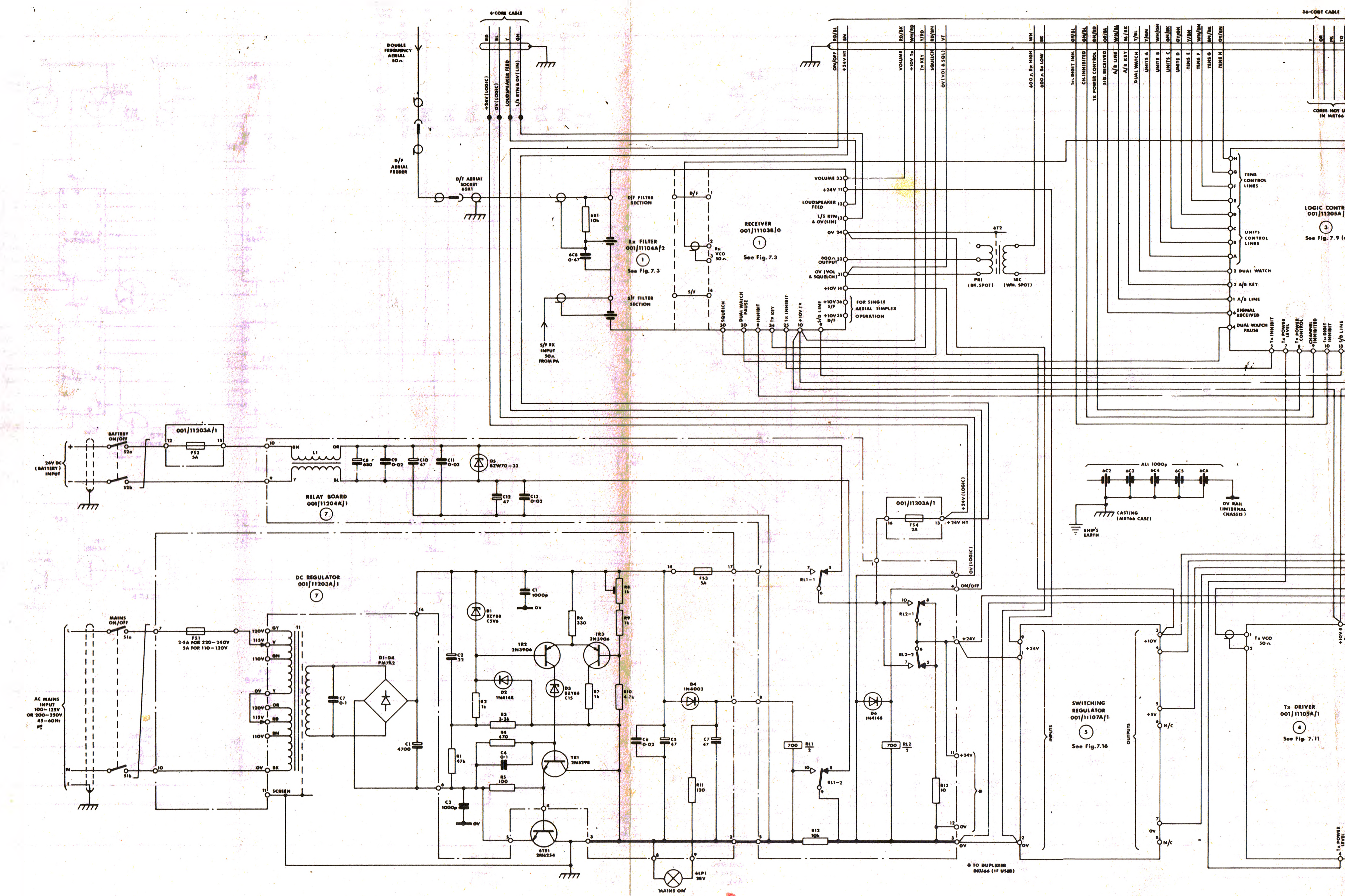

6C4
6C5
6C6
6T2
VCO
LINEAR SYNTHESISER BOARD
001/11109B/1
SEE FIG.7.4
RELAY BOARD
(001/11204A/1)
SEE FIG.7.18
6S2
6S1
BATTERY ON/OFF SWITCH
MAINS ON/OFF SWITCH
MAINS INDICATOR LAMP
6LP1
6TR4
6SK1
RECEIVER BOARD
(001/11103B/0)
SEE FIG.7.1
VOLTAGE REGULATOR BOARD
(001/11107A/1)
SEE FIG.7.15
BRIDGE
6D7-6D10
6C2
INTERNAL CHASSIS
(ISOLATED FROM
CASE)
6T1
RECEIVER FILTER
(001/11104A/2)
SEE FIG.7.2
6C3
4SK1
6C8
6R1

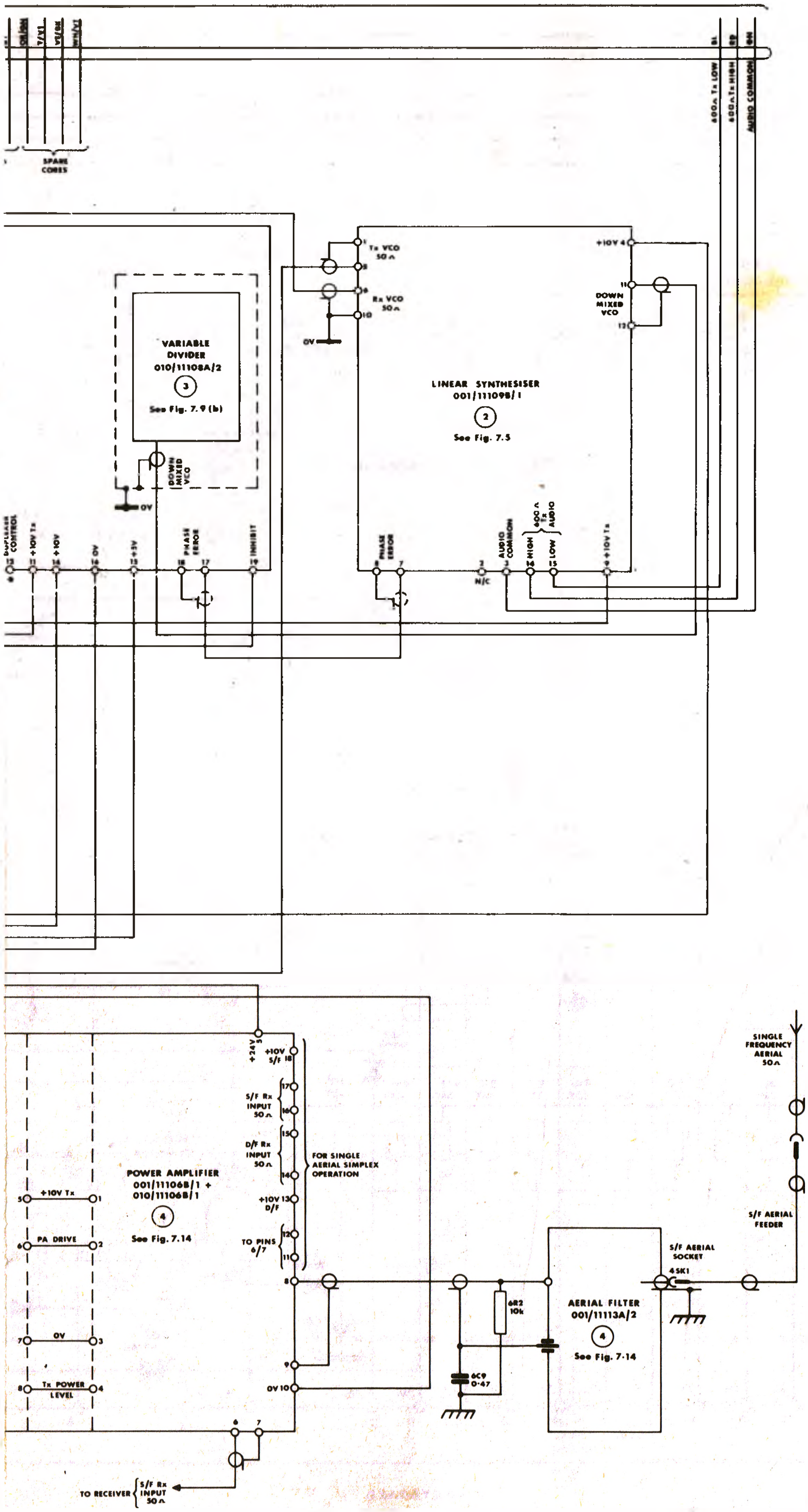
(a) Front View



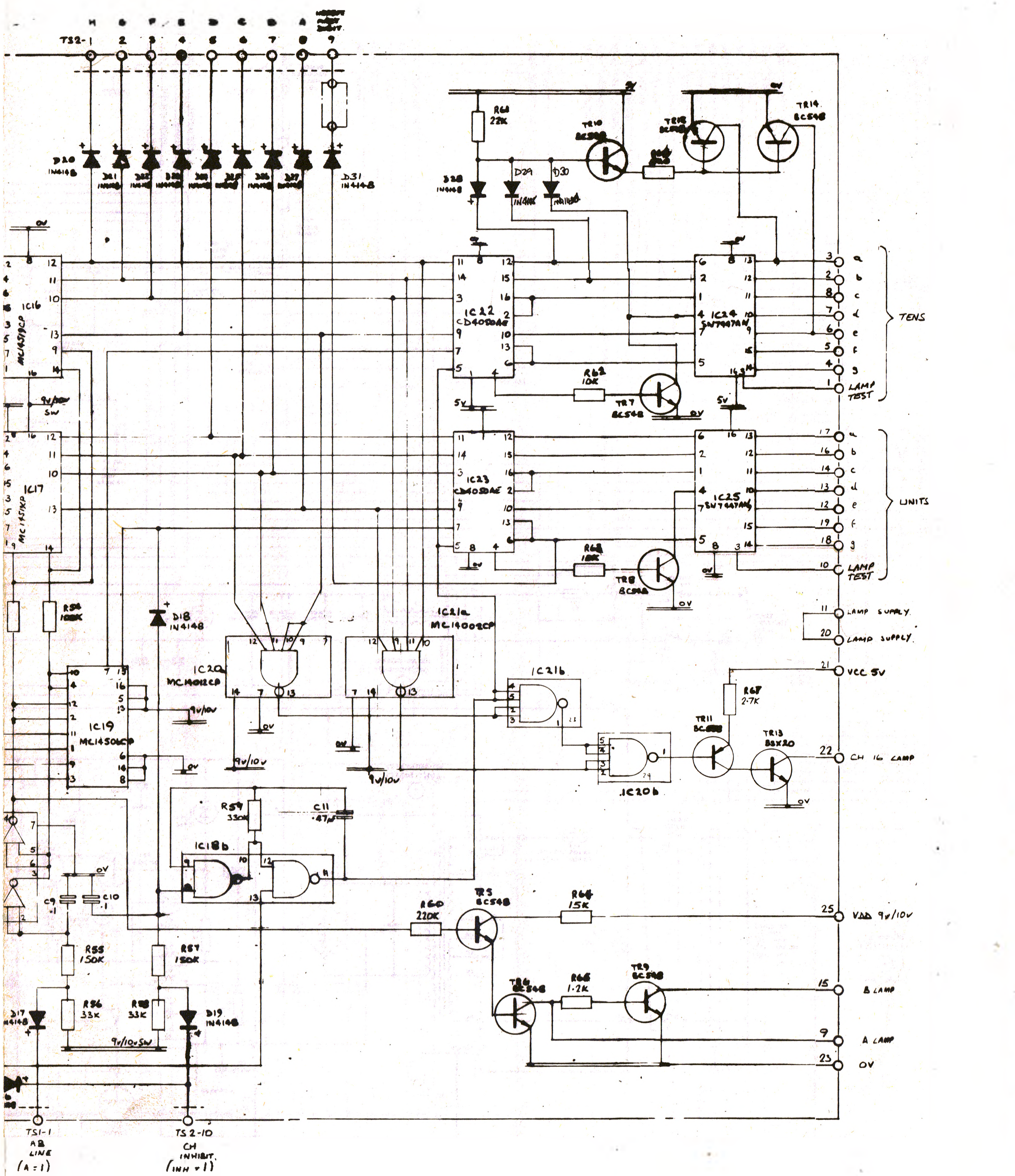
(b) Back View

Fig 7.20 Location of Major Components MRT66

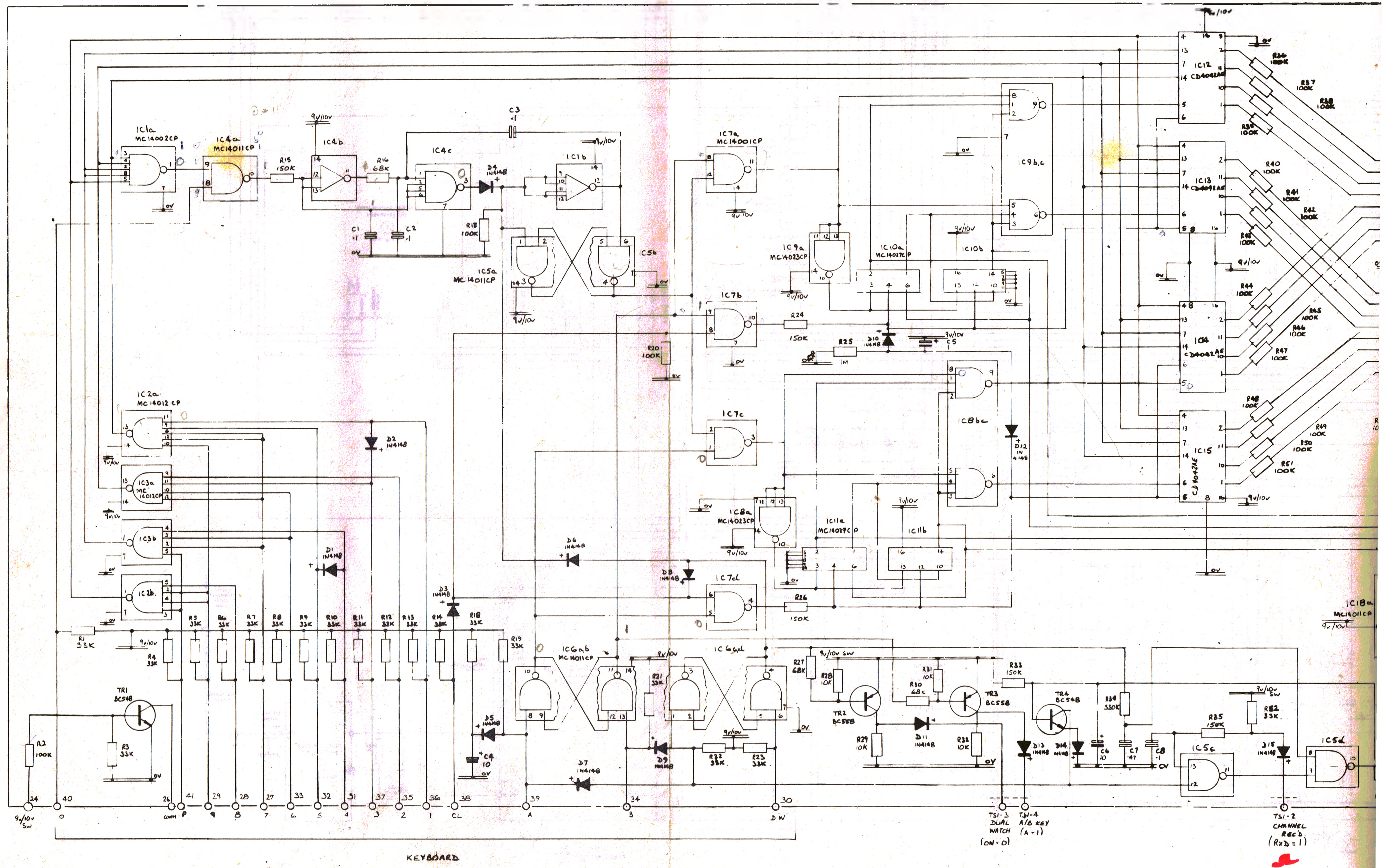

4-CORE CABLE
36-CORE CABLE
DOUBLE FREQUENCY AERIAL 50Ω
D/F AERIAL FEEDER
D/F AERIAL SOCKET 6SK1
+24V (LOGIC)
0V (LOGIC)
LOUDSPEAKER FEED
L/S RTN & 0V (LIN)
D/F FILTER SECTION
Rx FILTER
001/11104A/2
See Fig. 7.3
S/F FILTER SECTION
S/F RX INPUT 50Ω FROM PA
RECEIVER
001/11103B/0
See Fig. 7.3
Rx VCO 50Ω
VOLUME
+24V
LOUDSPEAKER FEED
L/S RTN & 0V (LIN)
600Ω OUTPUT
0V (VOL & SQUELCH)
+10V
FOR SINGLE AERIAL SIMPLEX OPERATION
SQUELCH
DUAL WATCH PAUSE
INHIBIT
Tx KEY
Tx INHIBIT
+10V Tx
S/D LINE
ON/OFF
+24V HT
600Ω Rx HIGH
600Ω Rx LOW
1st DIGIT INH.
CH. INHIBITED
Tx POWER CONTROL
SIG. RECEIVED
A/B LINE
A/B KEY
DUAL WATCH
UNITS A
UNITS B
UNITS C
UNITS D
TENS E
TENS F
TENS G
TENS H
CORES NOT USED IN MRT66
TENS CONTROL LINES
UNITS CONTROL LINES
LOGIC CONTROL
001/11205A/1
See Fig. 7.9
SIGNAL RECEIVED
DUAL WATCH PAUSE
Tx INHIBIT
Tx POWER LEVEL
Tx POWER CONTROL
CHANNEL INHIBITED
1st DIGIT INHIBIT
S/D LINE
PRI (BK. SPOT)
SEC (WH. SPOT)
6T2
BATTERY ON/OFF
24V DC (BATTERY) INPUT
001/11203A/1
FS2 5A
RELAY BOARD
001/11204A/1
D5 BZW70-33
ALL 1000p
CASTING (MRT66 CASE)
SHIP'S EARTH
0V RAIL (INTERNAL CHASSIS)
FS4 2A
+24V HT
+24V (LOGIC)
0V (LOGIC)
ON/OFF
MAINS ON/OFF
AC MAINS INPUT 100-125V OR 200-250V 45-60Hz
FS1 2·5A FOR 220-240V 5A FOR 110-120V
SCREEN
D1-D4 PM7A2
DC REGULATOR
001/11203A/1
D1 BZY88 C5V6
TR2 2N3906
TR3 2N3906
D2 1N4148
D3 BZY88 C15
TR1 2N5298
6TR1 2N6254
FS3 5A
D4 1N4002
D6 1N4148
6LP1 28V
'MAINS ON'
TO DUPLEXER DXU66 (IF USED)
SWITCHING REGULATOR
001/11107A/1
See Fig. 7.16
INPUTS
OUTPUTS
Tx DRIVER
001/11105A/1
See Fig. 7.11
Tx VCO 50Ω

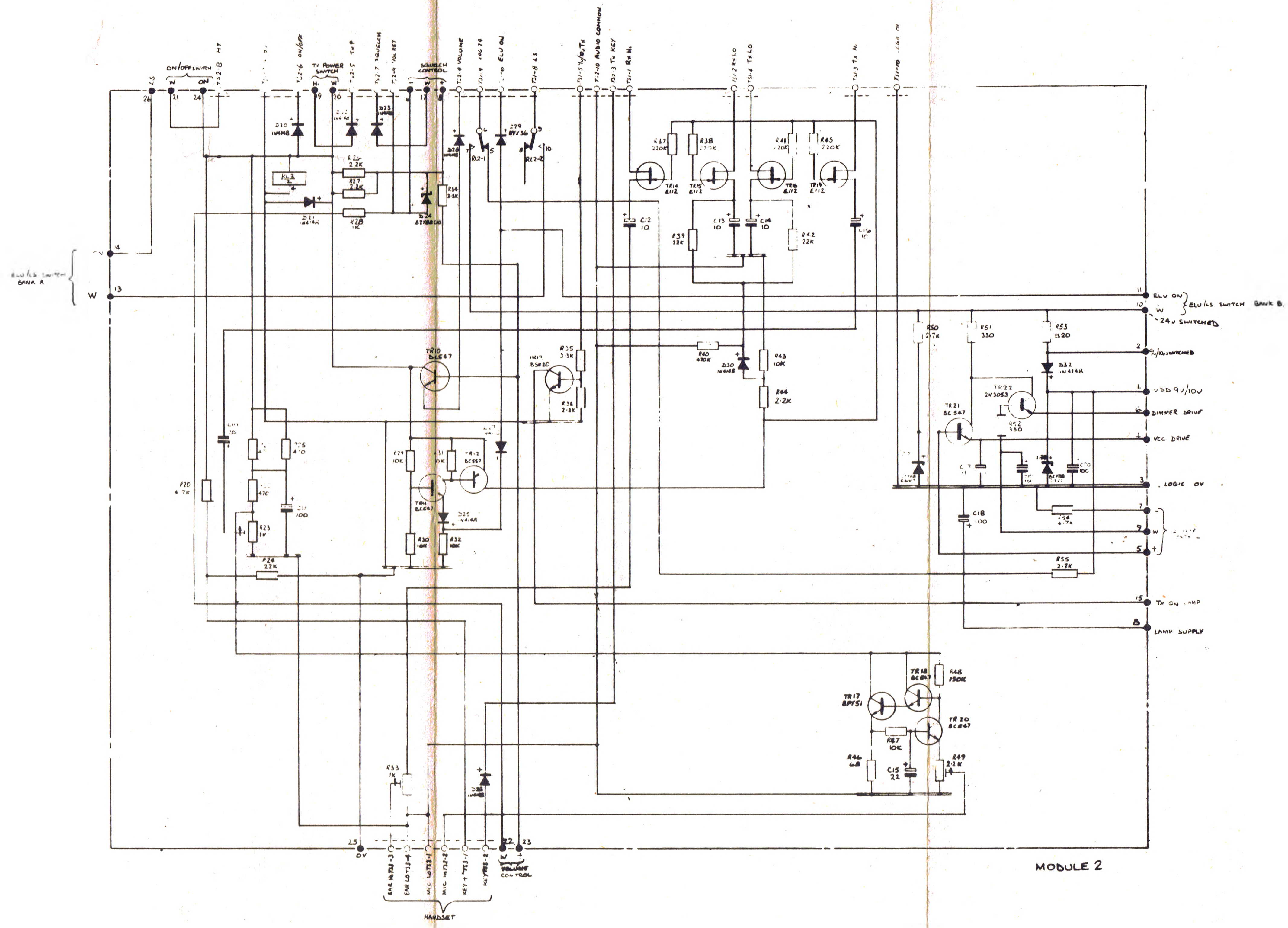


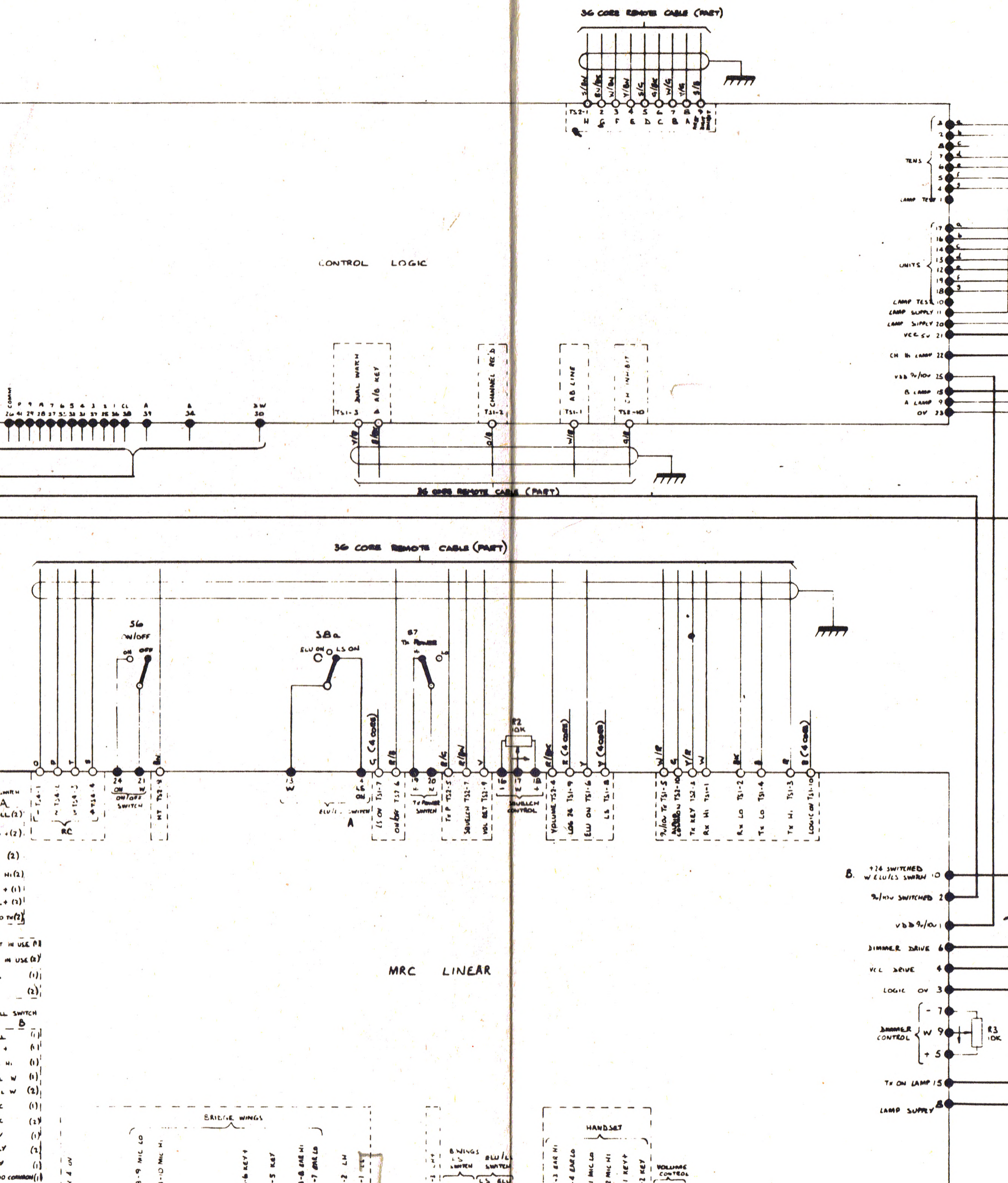
Interconnection Diagram MRT 66 Fig. 7.21



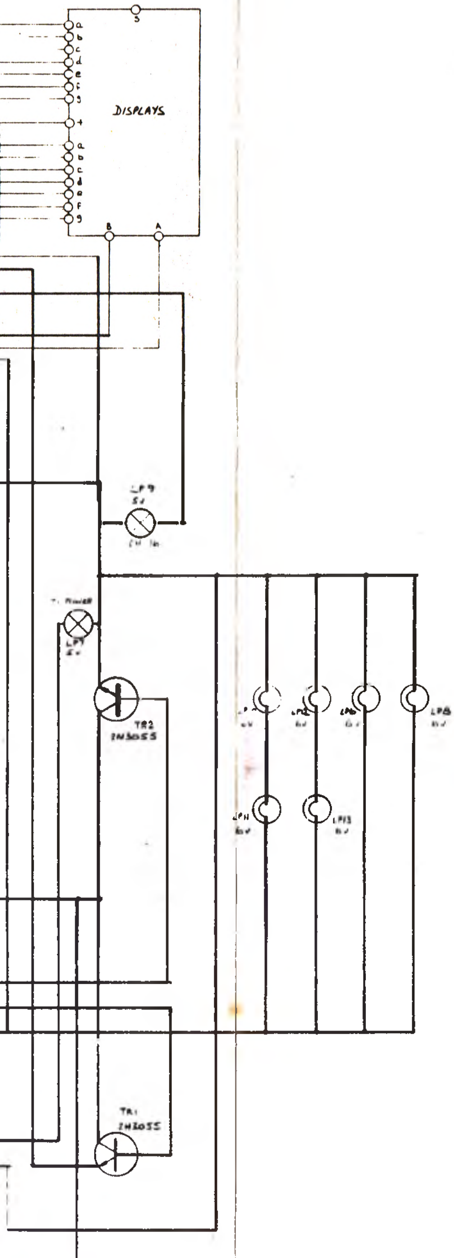
Remote Logic Circuit Figure 7.23


KEYBOARD
TSI-2 CHANNEL RECD. (RxD = 1)
TSI-3 DUAL WATCH (ON = 0)
TSI-4 A/B KEY (A = 1)
IC1a MC14002CP
IC4a MC14011CP
IC2a MC14012CP
IC3a MC14012CP
IC7a MC14001CP
IC5a MC14011CP
IC6ab MC14011CP
IC8a MC14023CP
IC9a MC14023CP
IC10a MC14027CP
IC11a MC14027CP
IC12 CD4042AE
IC13 CD4042AE
IC14 CD4042AE
IC15 CD4042AE
IC18a MC14011CP
TR1 BC548
TR2 BC558
TR3 BC558
TR4 BC548


MODULE 2
HANDSET
ELU ON
24V SWITCHED
LOGIC 0V
LAMP SUPPLY
0V



36 CORE REMOTE CABLE (PART)
CONTROL LOGIC
TENS
UNITS
LAMP TEST
LAMP SUPPLY
DUAL WATCH
A/B KEY
CHANNEL REC'D
AB LINE
CH INH-BIT
36 CORE REMOTE CABLE (PART)
36 CORE REMOTE CABLE (PART)
S6
ON/OFF
ON/OFF SWITCH
S8a
ELU ON
LS ON
S7
TX POWER SWITCH
R2
10K
SQUELCH CONTROL
RC
A
B.
+24 SWITCHED W ELU/LS SWITCH
VDD 9v/10v
DIMMER DRIVE
VCC DRIVE
LOGIC OV
DIMMER CONTROL
R3
10K
TX ON LAMP
LAMP SUPPLY
MRC LINEAR
BRIDGE WINGS
HANDSET
VOLUME CONTROL



NOTES :

1/ THE 4 CORE & 36 CORE REMOTE CABLES ARE FITTED AT THIS STAGE. REMAINING CABLES ARE FITTED ON INSTALLATION

2/ 4 CORE REMOTE CABLE CONNECTIONS :-

B TO TS1 - 10 }
R " " - 9 } LINEAR PCB
Y " " - 8 }
G " " - 7 }

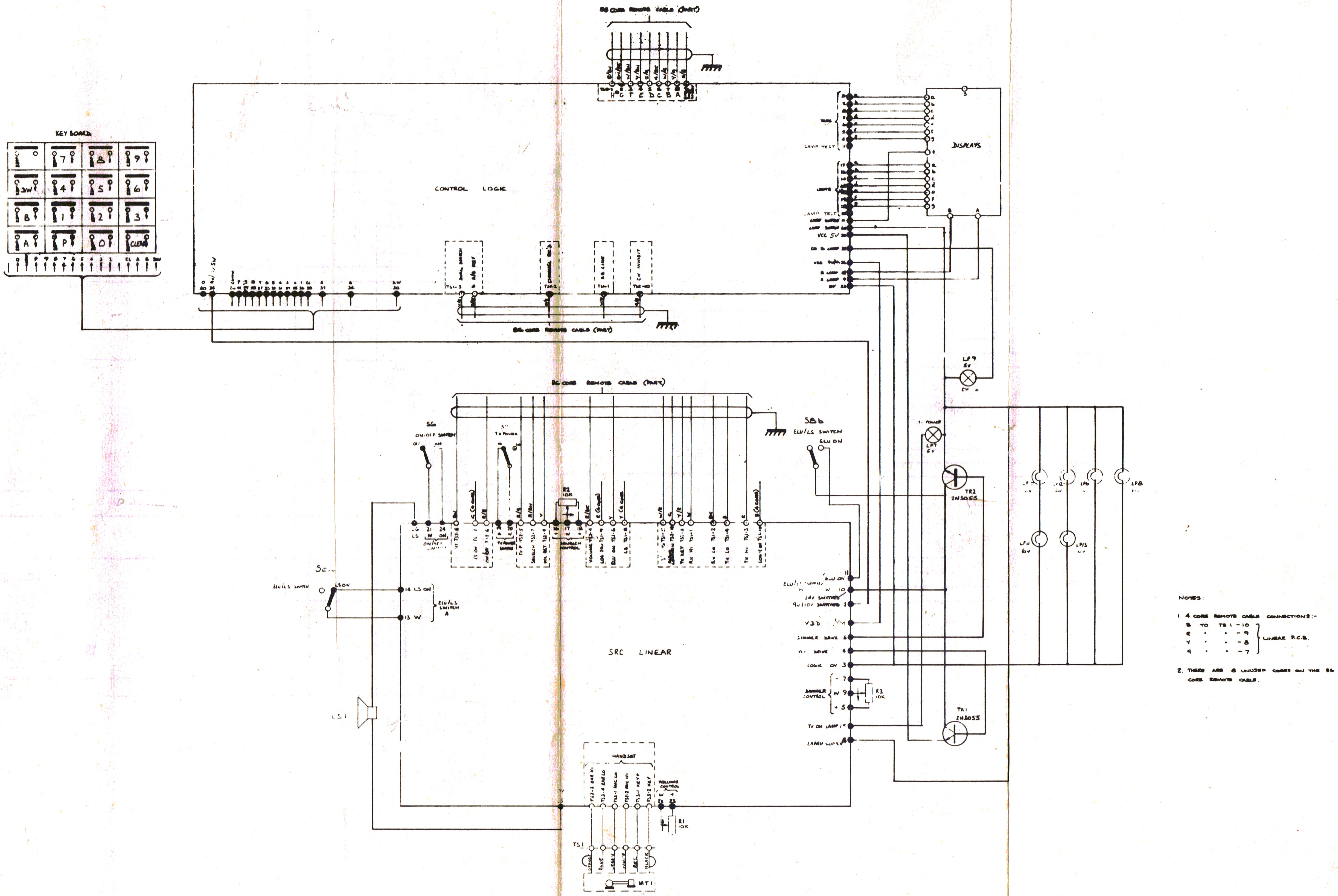
3/ THERE ARE 4 UNUSED CORES ON THE 36 CORE REMOTE CABLE. THERE IS 1 UNUSED CORE ON BOTH THE 2 - 12 CORE CABIN EXTENSION CABLES

4/ LOUDSPEAKER CONNECTIONS :-

B TO TS8 - 4 }
R " " - 1 } LINEAR P.C.B.

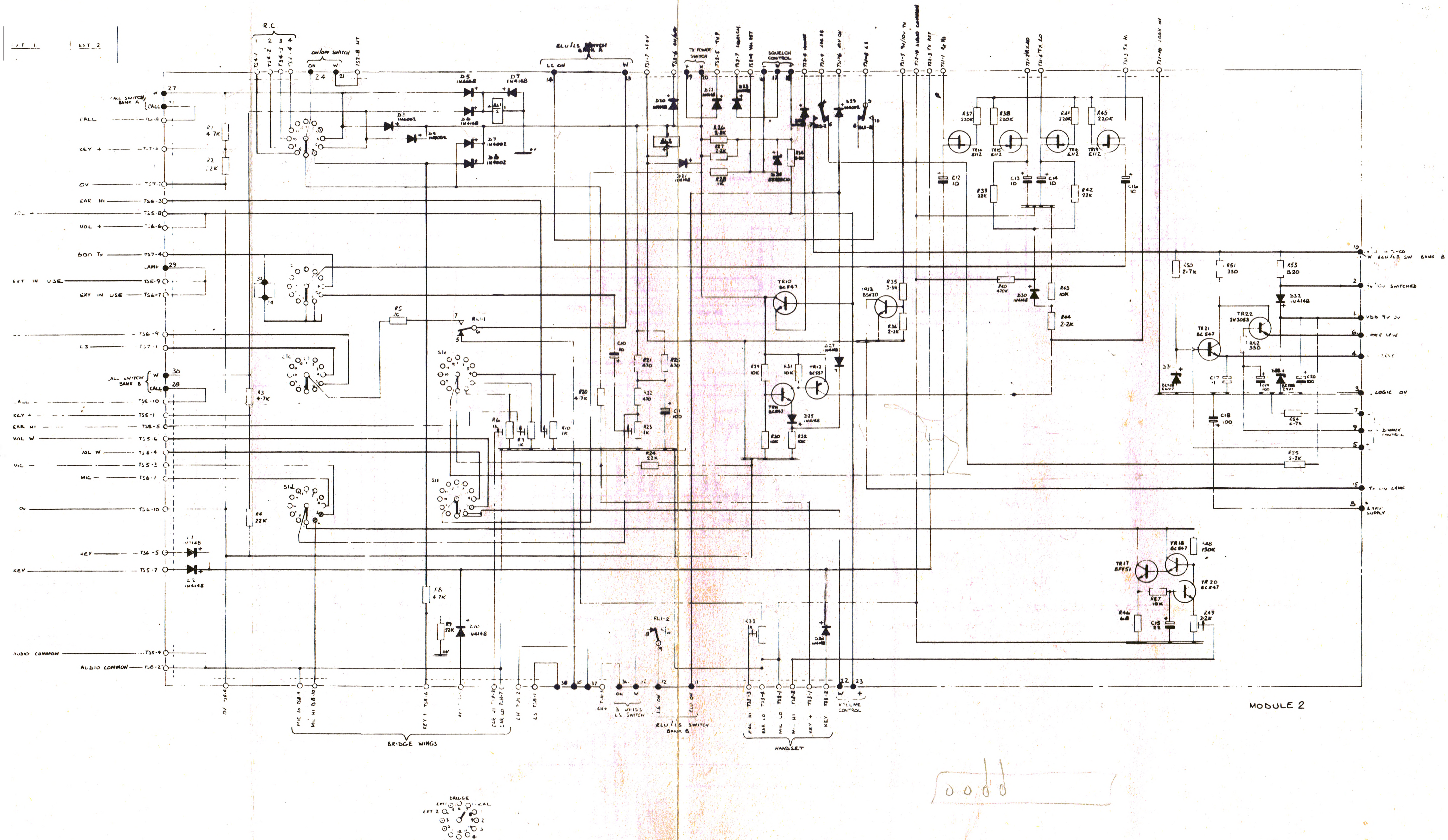
LOUDHAILER CONNECTIONS :-

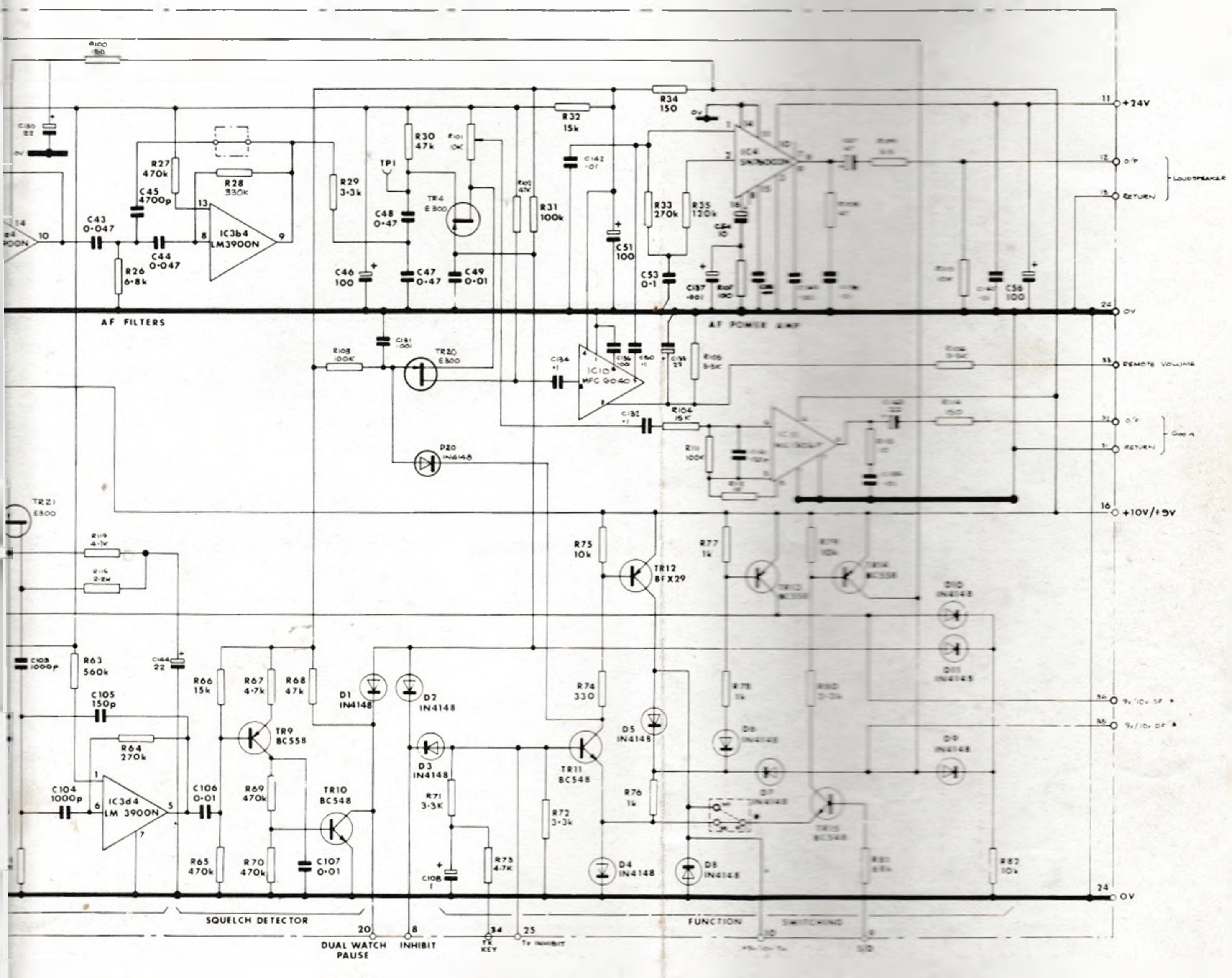
B TO TS8 - 4 }
R " " - 3 } LINEAR P.C.B
G " " - 2 }



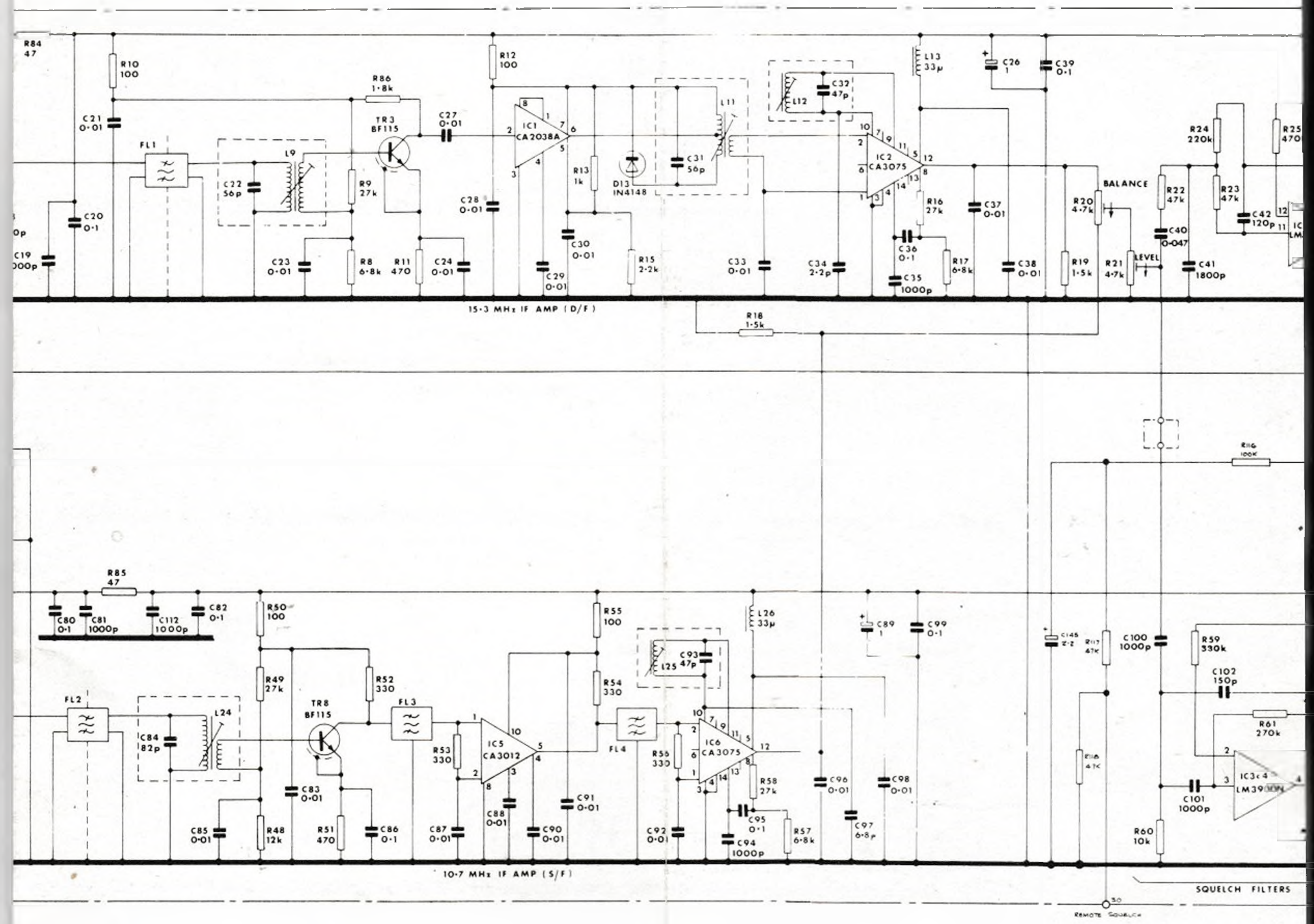
Interconnection Diagram SRC66

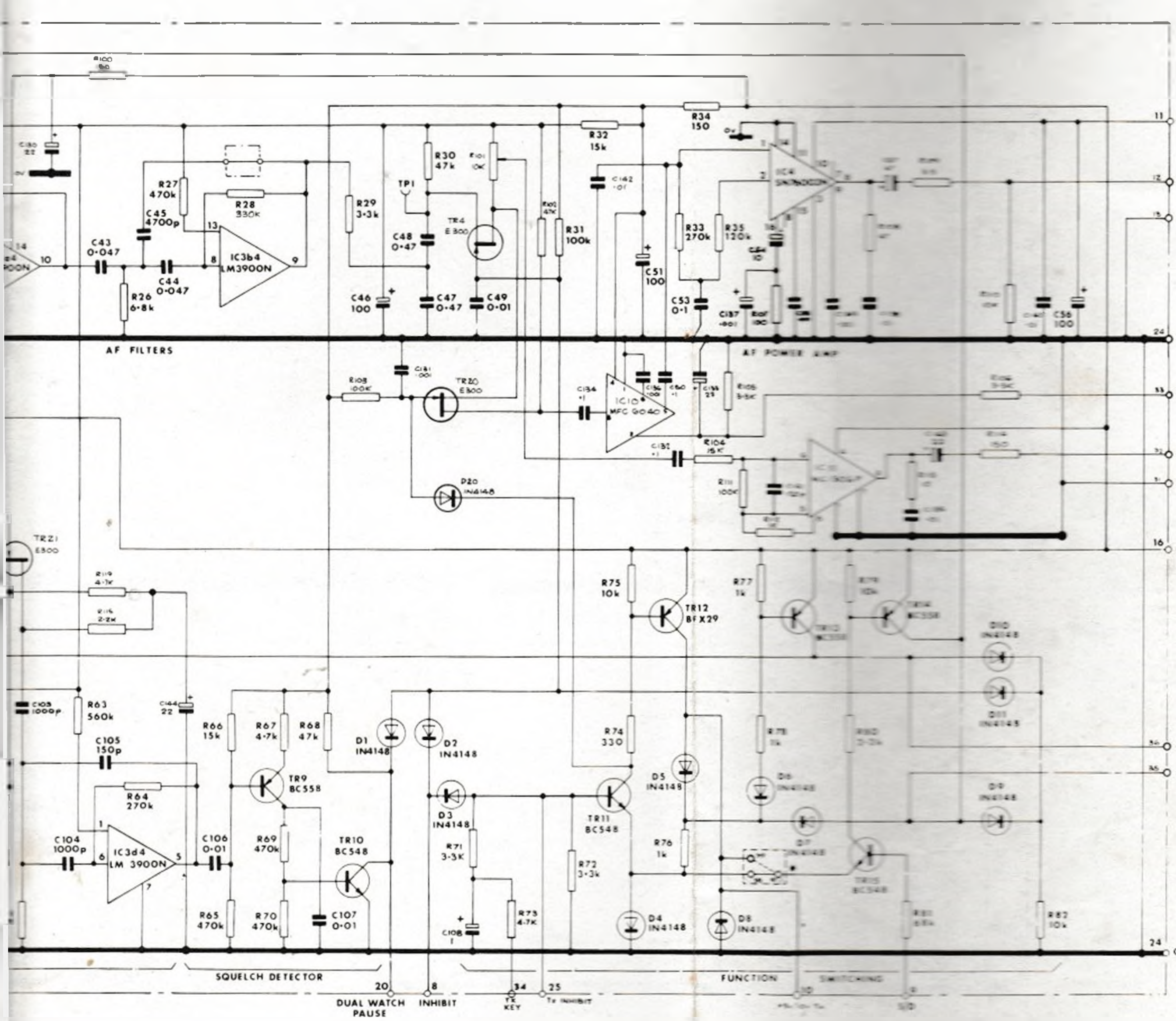
Fig. 7.27


MODULE 2
BRIDGE WINGS
HANDSET

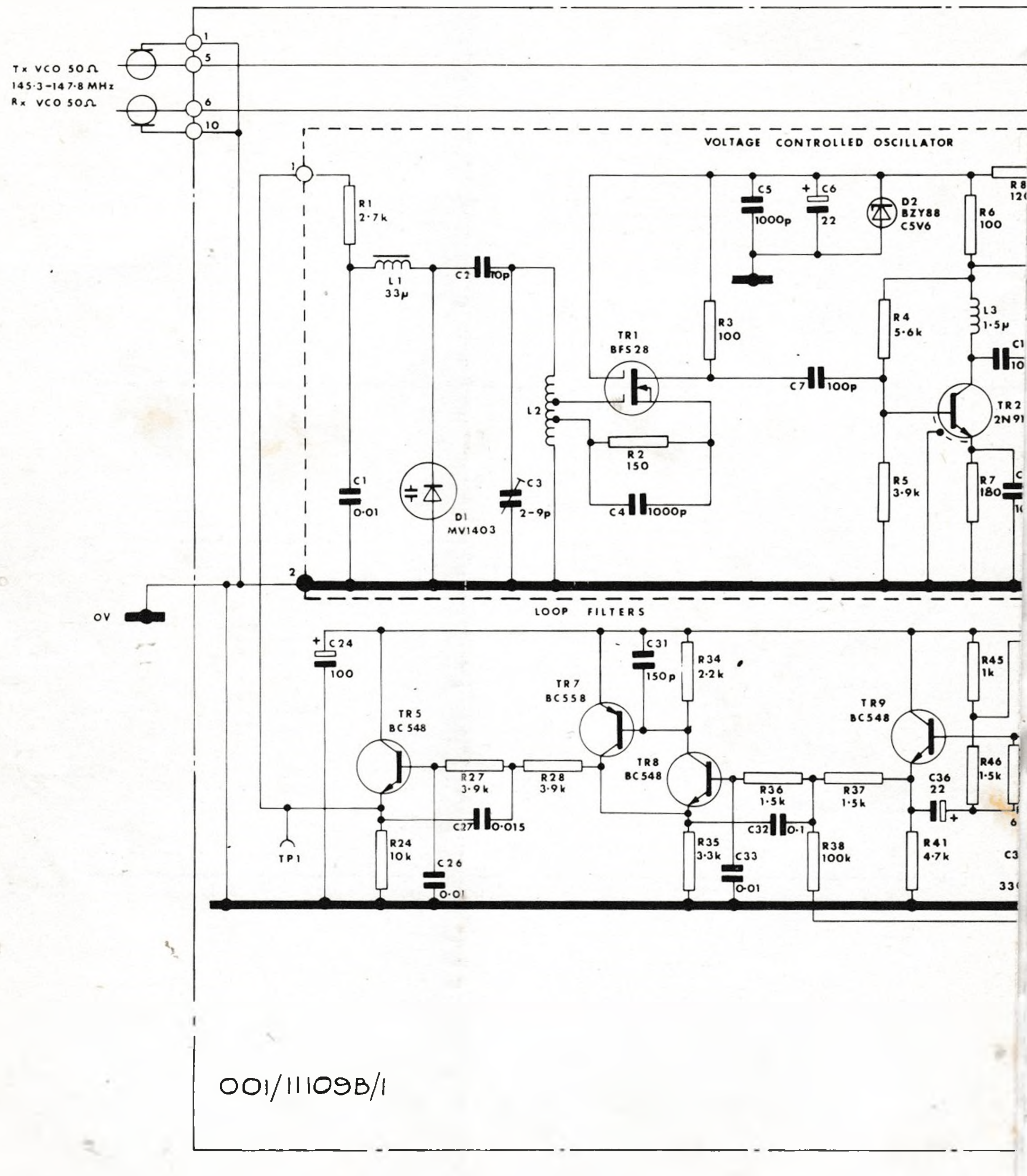


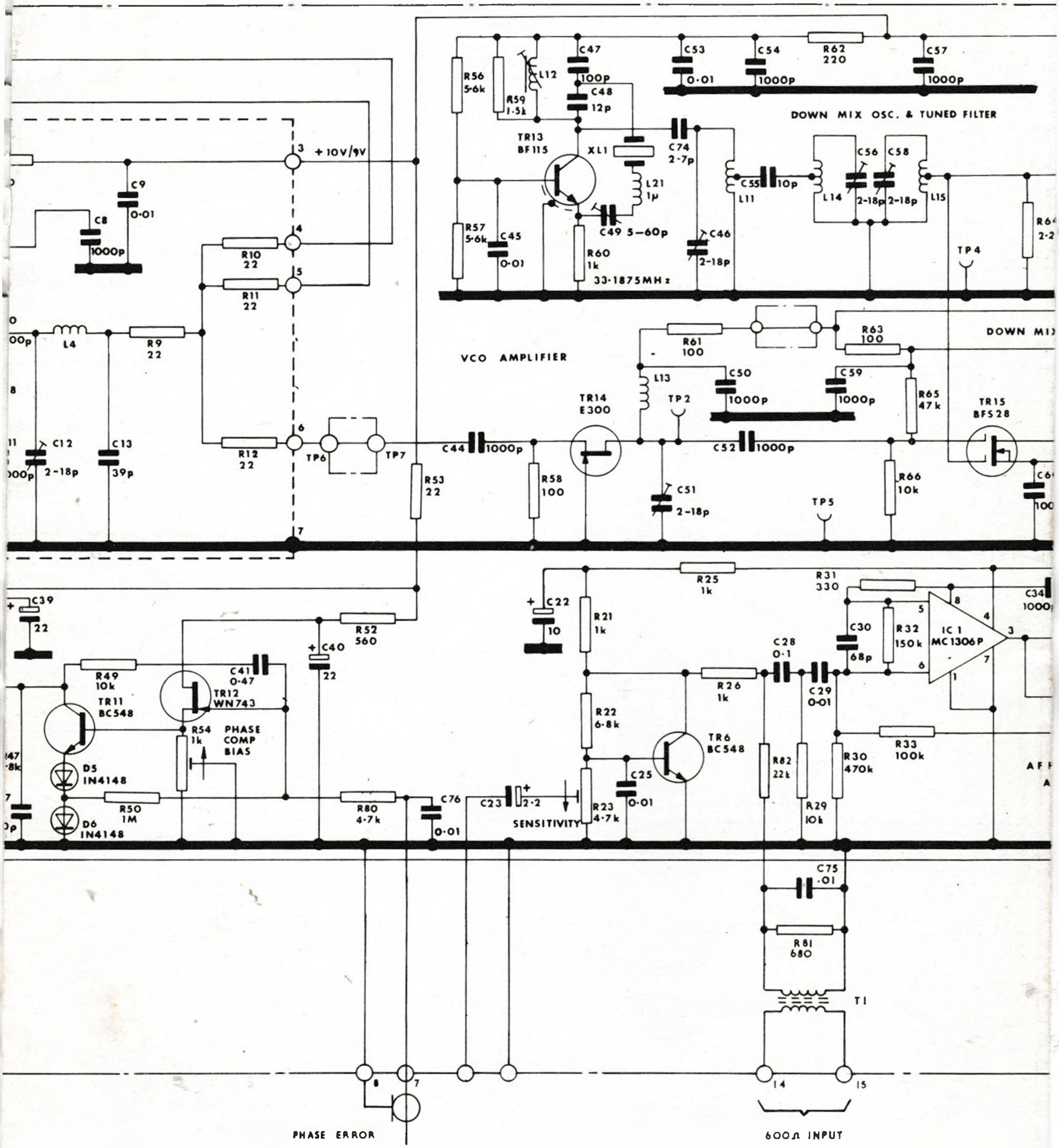
Receiver Circuit Fig.7.3

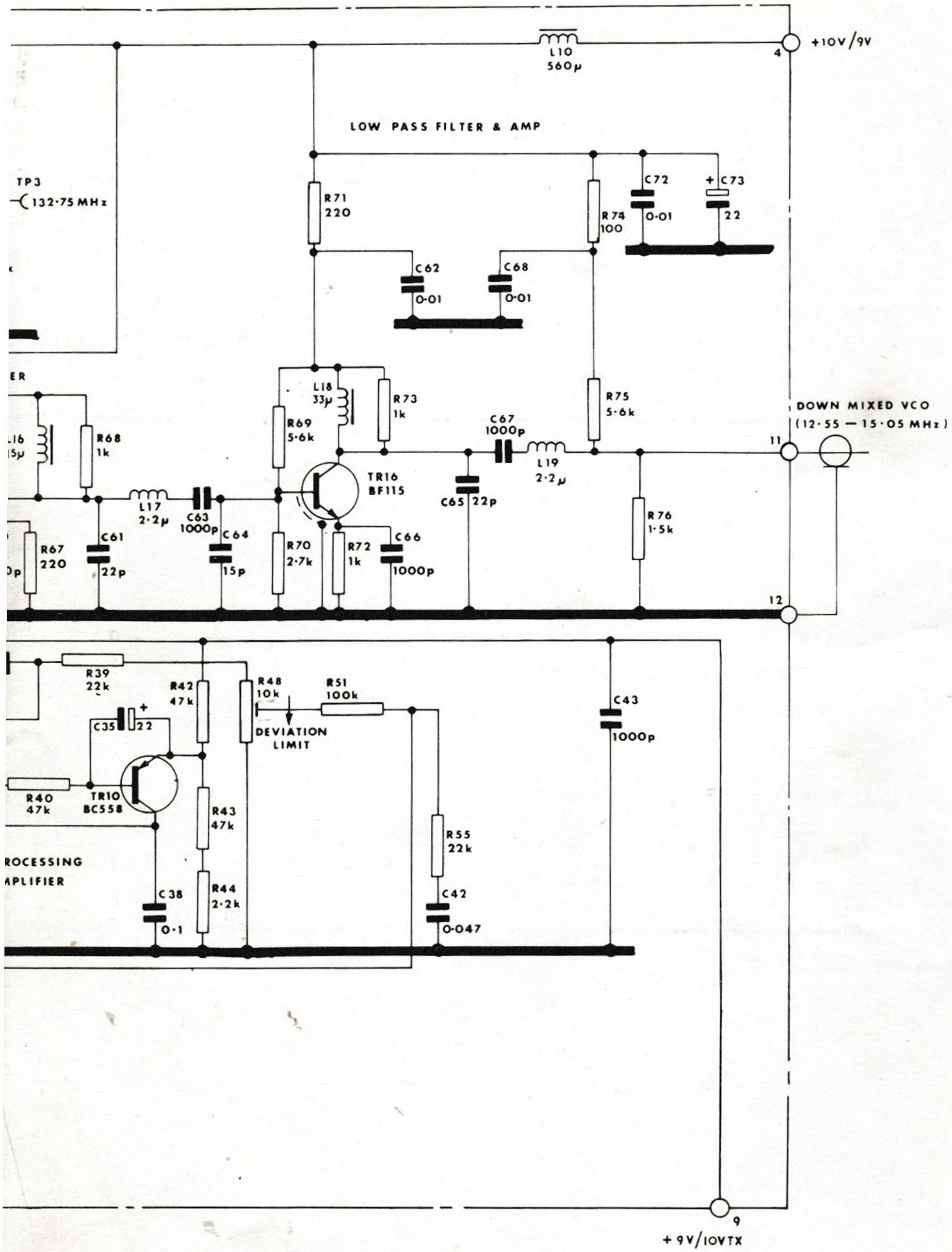

R84 47
R10 100
C21 0·01
R86 1·8k
TR3 BF115
C27 0·01
R12 100
IC1 CA2038A
L11
L12
C32 47p
L13 33µ
C26 1
C39 0·1
FL1
L9
C22 56p
R9 27k
D13 IN4148
C31 56p
IC2 CA3075
R24 220k
R25
C20 0·1
C19
C28 0·01
R13 1k
BALANCE
R22 47k
R23 47k
C42 120p
C40 0·047
C23 0·01
R8 6·8k
R11 470
C24 0·01
C29 0·01
C30 0·01
R15 2·2k
C33 0·01
C34 2·2p
C36 0·1
C35 1000p
R16 27k
R17 6·8k
C37 0·01
C38 0·01
R19 1·5k
R20 4·7k
R21 4·7k
LEVEL
C41 1800p
15·3 MHz IF AMP (D/F)
R18 1·5k
R116 100K
R85 47
C80 0·1
C81 1000p
C112 1000p
C82 0·1
R50 100
R55 100
L26 33µ
C89 1
C99 0·1
C146 2·2
R117 47K
C100 1000p
R59 330k
R49 27k
R52 330
TR8 BF115
FL3
R54 330
L25
C93 47p
C102 150p
FL2
L24
C84 82p
R53 330
IC5 CA3012
FL4
R56 330
IC6 CA3075
R58 27k
C96 0·01
C98 0·01
R118 47K
R61 270k
IC3 LM3900N
C101 1000p
C83 0·01
C88 0·01
C91 0·01
C95 0·1
C85 0·01
R48 12k
R51 470
C86 0·1
C87 0·01
C90 0·01
C92 0·01
C94 1000p
R57 6·8k
C97 6·8p
R60 10k
10·7 MHz IF AMP (S/F)
SQUELCH FILTERS
30
REMOTE SQUELCH



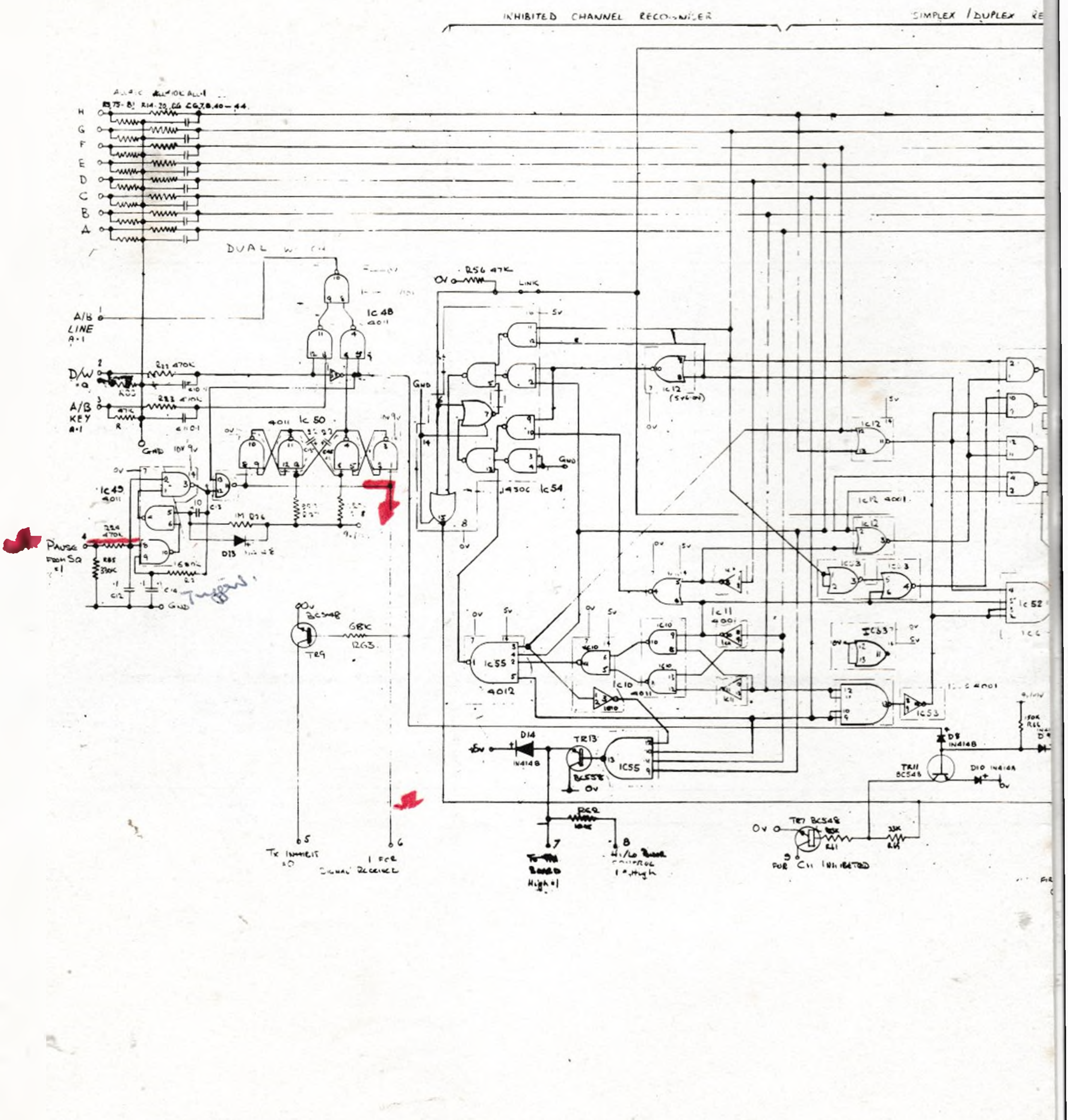
Receiver Circuit Fig.7.3

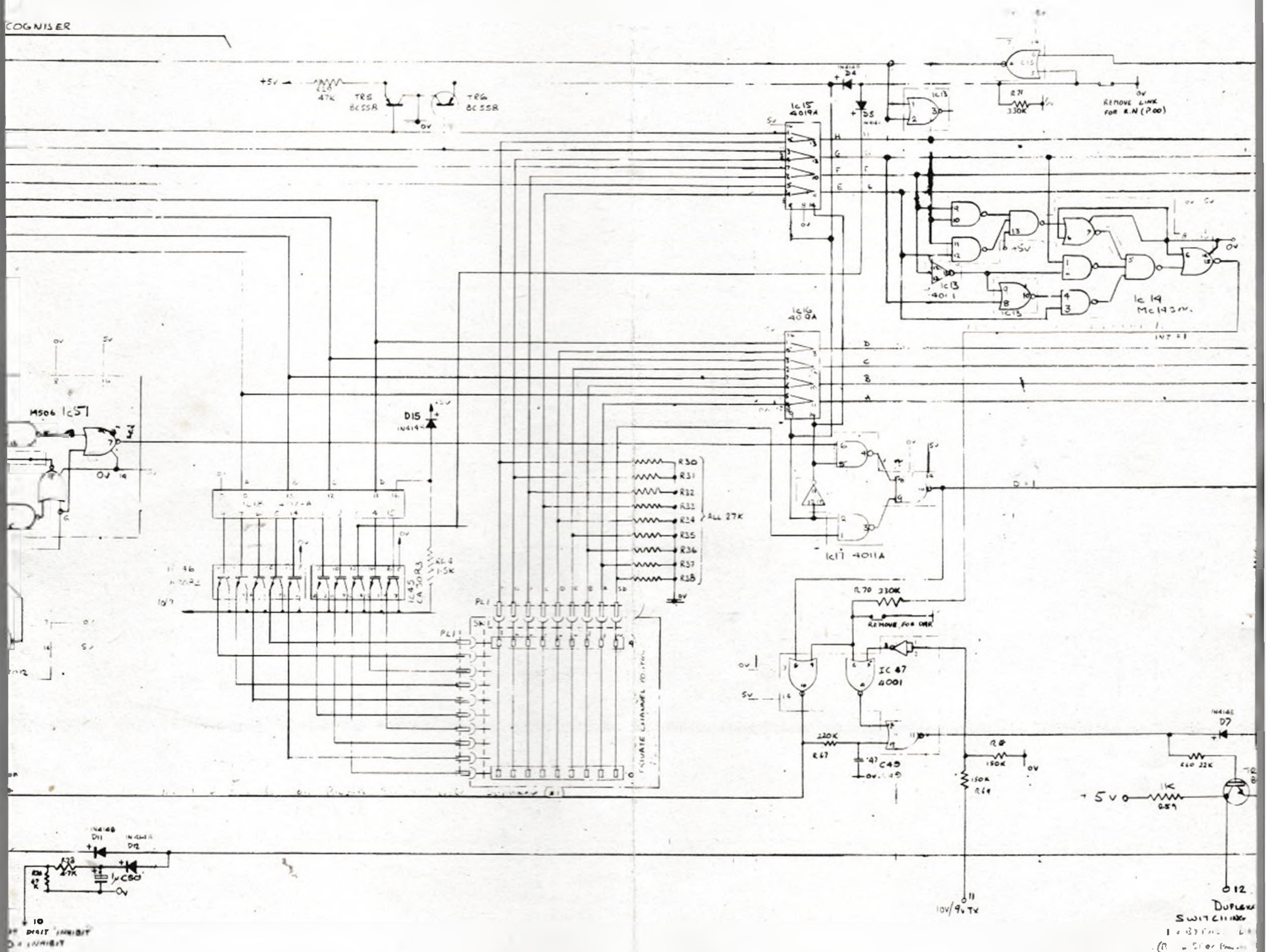

Tx VCO 50Ω
145·3–147·8 MHz
Rx VCO 50Ω
VOLTAGE CONTROLLED OSCILLATOR
LOOP FILTERS
0V
R1 2·7k
L1 33μ
C2 10p
C1 0·01
D1 MV1403
C3 2–9p
L2
TR1 BFS28
R2 150
C4 1000p
R3 100
C5 1000p
C6 22
D2 BZY88 C5V6
C7 100p
R4 5·6k
R5 3·9k
R6 100
L3 1·5μ
TR2
R7 180
C24 100
TR5 BC548
R27 3·9k
R28 3·9k
C27 0·015
R24 10k
C26 0·01
TP1
TR7 BC558
C31 150p
R34 2·2k
TR8 BC548
R36 1·5k
R37 1·5k
C32 0·1
R35 3·3k
C33 0·01
R38 100k
TR9 BC548
R45 1k
R46 1·5k
C36 22
R41 4·7k
001/11109B/1

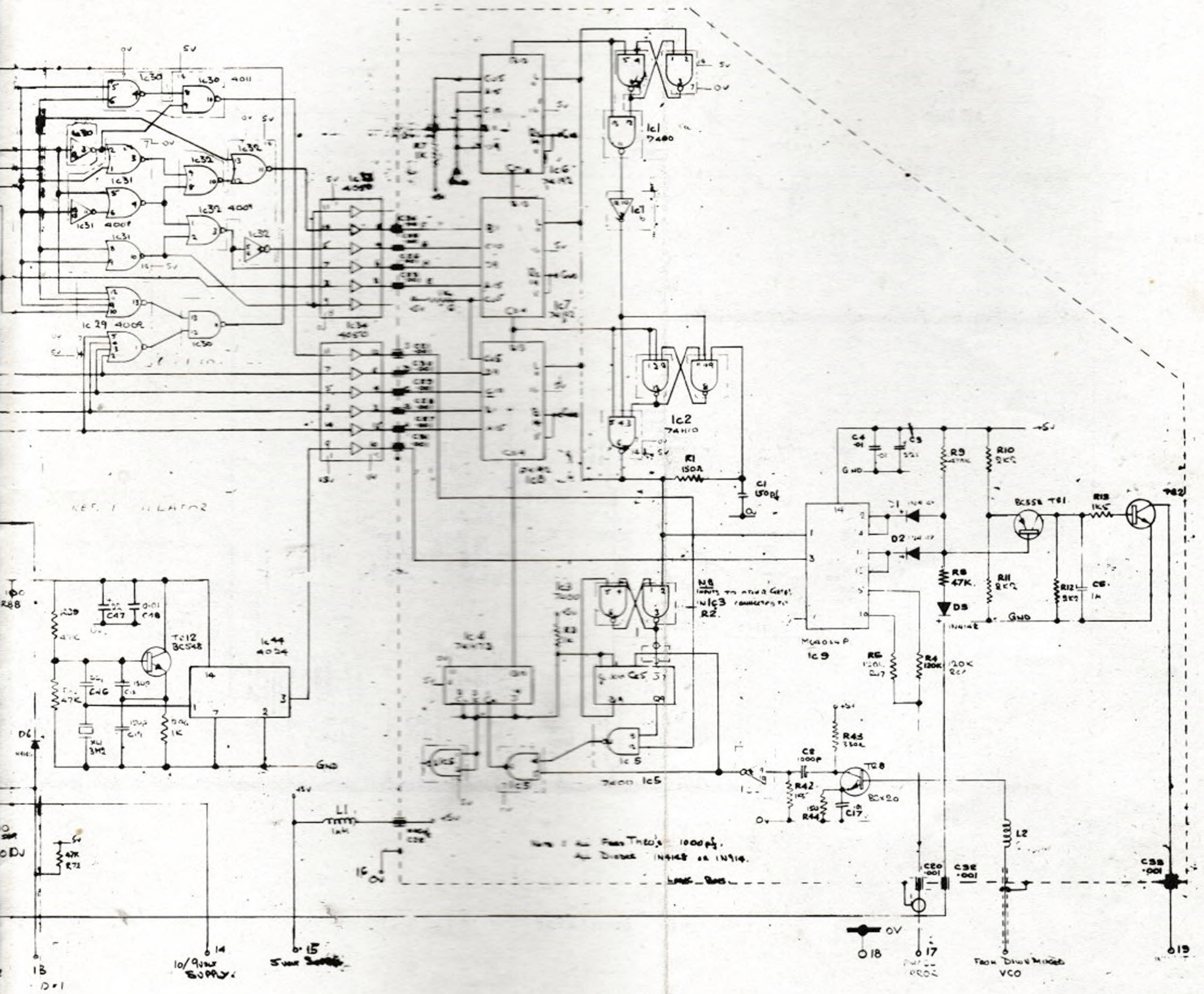

DOWN MIX OSC. & TUNED FILTER
VCO AMPLIFIER
DOWN MIX
R56 5·6k
R59 1·5k
L12
C47 100p
C48 12p
C53 0·01
C54 1000p
R62 220
C57 1000p
TR13 BF115
XL1
C74 2·7p
L21 1μ
C49 5–60p
C55 10p
L11
C56
C58
L14
2–18p
2–18p
L15
R57 5·6k
C45 0·01
R60 1k
33·1875MHz
C46 2–18p
TP4
R64 2·2
+10V/9V
C9 0·01
C8 1000p
R10 22
R11 22
R12 22
L4
R9 22
C12 2–18p
C13 39p
TP6
TP7
R53 22
C44 1000p
R58 100
TR14 E300
R61 100
L13
TP2
C50 1000p
C59 1000p
R63 100
R65 47k
TR15 BFS28
C52 1000p
C51 2–18p
TP5
R66 10k
C39 22
R52 560
C40 22
C22 10
R21 1k
R25 1k
R31 330
C34 1000
R49 10k
C41 0·47
TR11 BC548
TR12 WN743
R54 1k
PHASE COMP BIAS
D5 1N4148
D6 1N4148
R50 1M
R80 4·7k
C76 0·01
C23 2·2
SENSITIVITY
R23 4·7k
R22 6·8k
C25 0·01
TR6 BC548
R26 1k
C28 0·1
C29 0·01
C30 68p
R32 150k
IC 1 MC1306P
R82 22k
R29 10k
R30 470k
R33 100k
C75 ·01
R81 680
T1
PHASE ERROR
600Ω INPUT



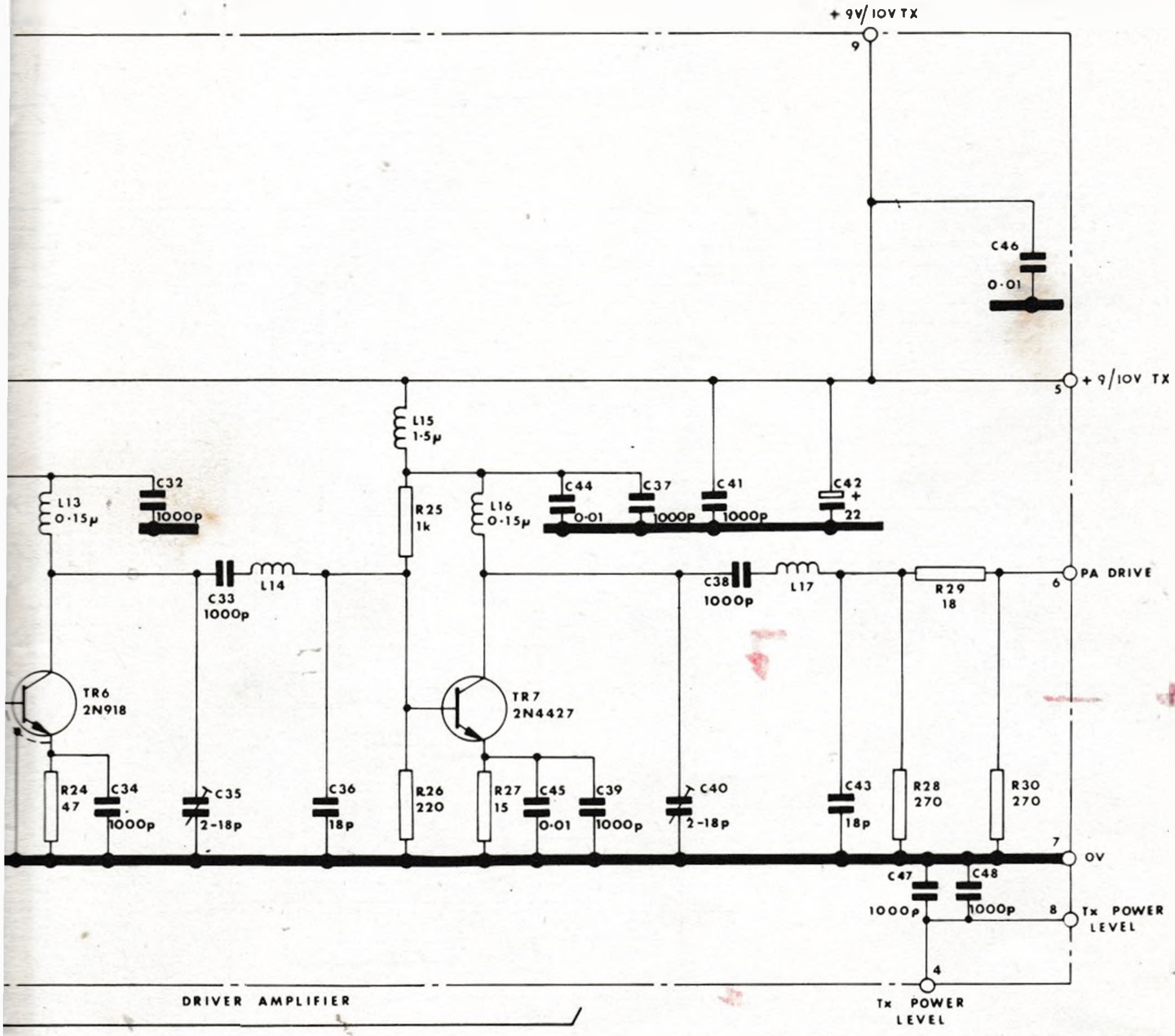
Linear Synthesiser Circuit Fig.7.5


INHIBITED CHANNEL RECOGNISER
SIMPLEX / DUPLEX
DUAL WATCH
A/B LINE
D/W
A/B KEY
PAUSE FROM SQ
IC 48 4011
IC 50
IC 49 4011
IC 54
IC 55 4012
IC 12 4001
IC 53
IC 52
TR9 BC548
TR13
TR11 BC548
TR7 BC548
D13
D14 1N4148
D8 1N4148
D10 1N4148
R56 47K
LINK
GND
Tx INHIBIT
1 FOR SIGNAL RECEIVED
Hi/Lo POWER CONTROL 1=High
FOR CH INHIBITED

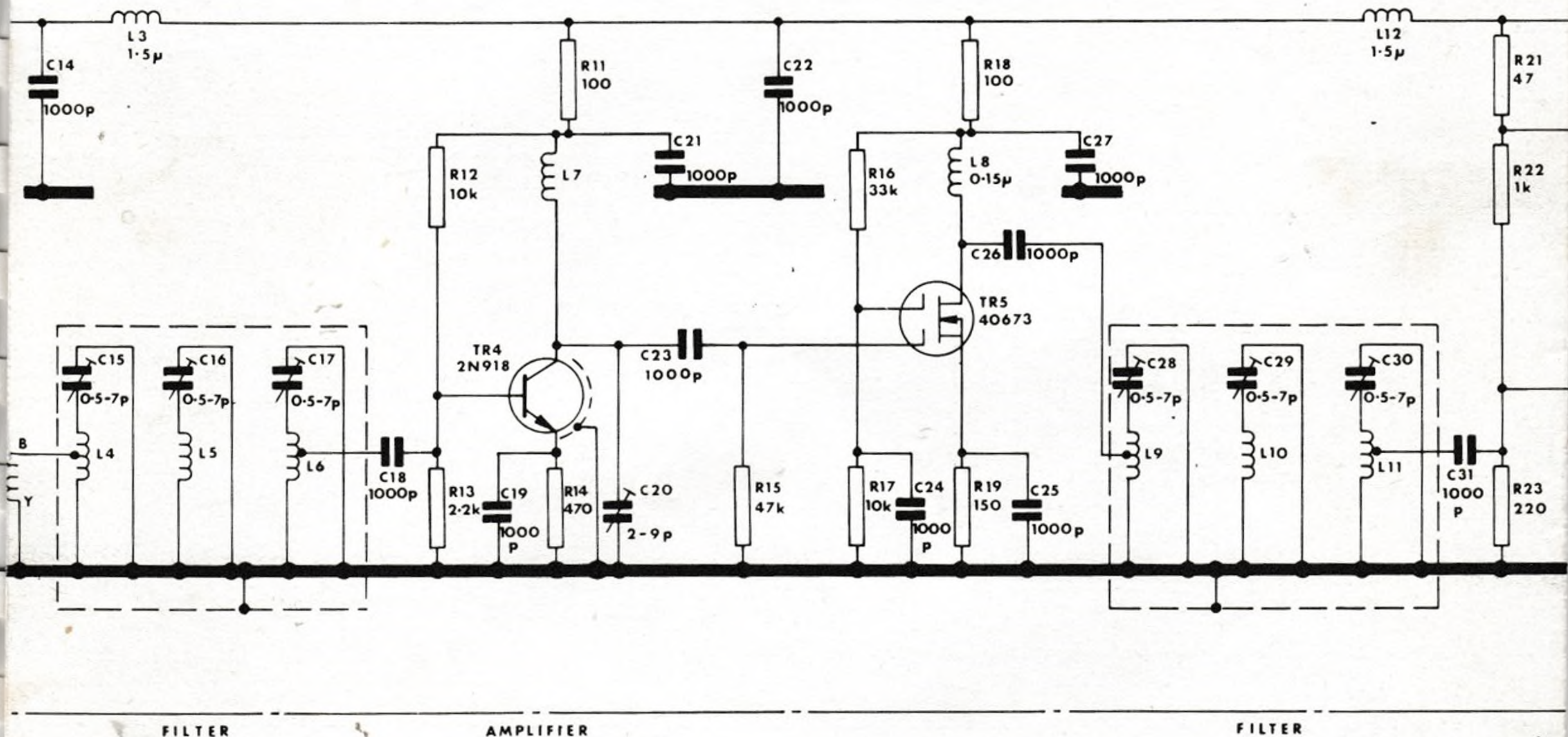

COGNISER
IC15 4019A
IC16 4019A
IC17 4011A
IC13 4011
IC14 MC14 …
IC47 4001
M506 IC51
IC45 CA3083
D15 1N4148
TR5 BC558
TR6 BC558
47K
REMOVE LINK FOR R.N (P.00)
R71 330K
R30
R31
R32
R33
R34
R35
R36
R37
R38
ALL 27K
R70 330K
REMOVE FOR DMR
R67 220K
C49
R8 150K
R64 150K
R59 1K
R60 22K
D7
D4
D5
D11
D12
R28 47K
C50
+5V
0V
5V
PL1
SK1
PRIVATE CHANNEL POSITION
10V/9V TX
DUPLEX
SWITCHING
DIGIT INHIBIT



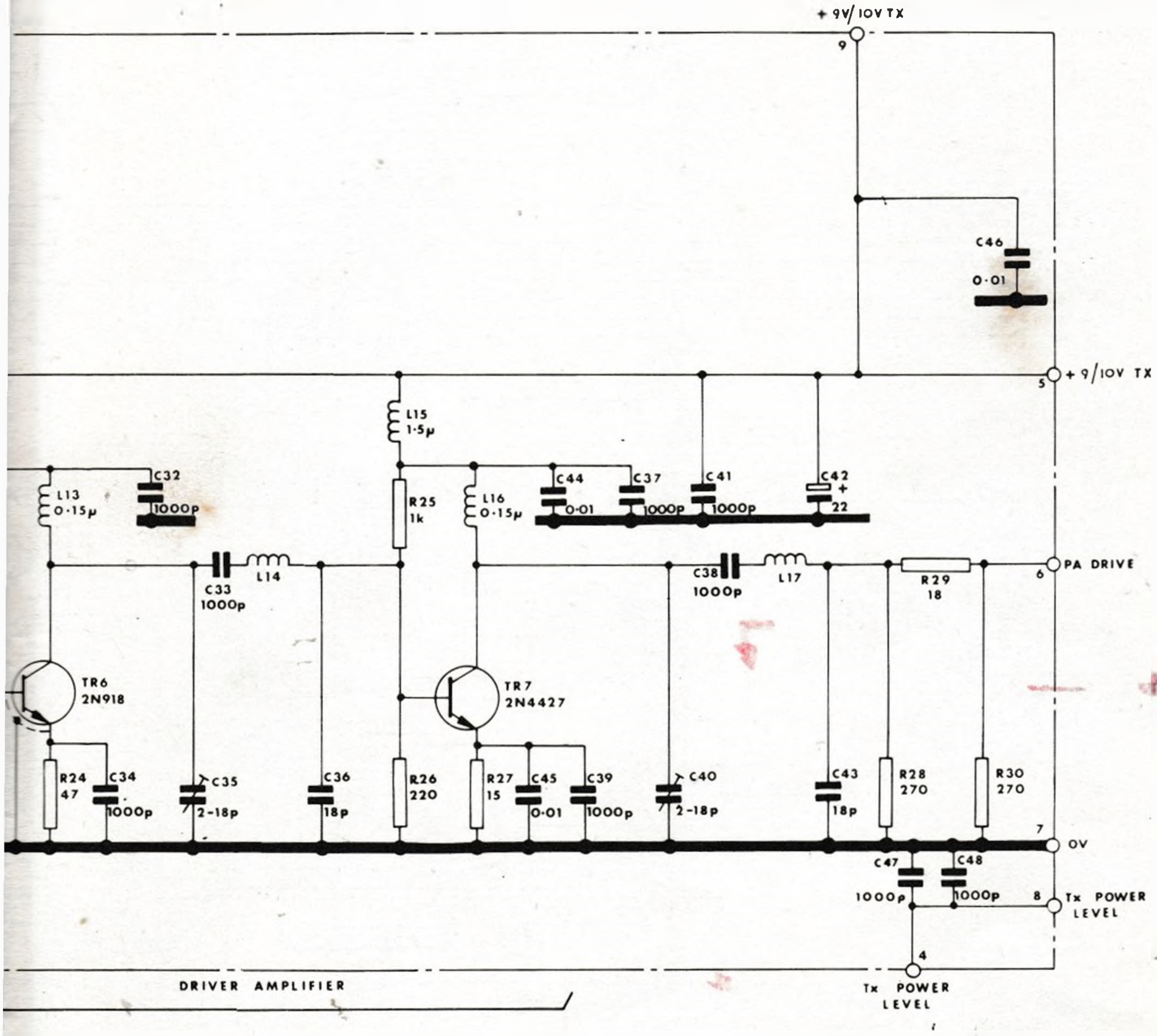
Logic Control Circuits Fig.7.9



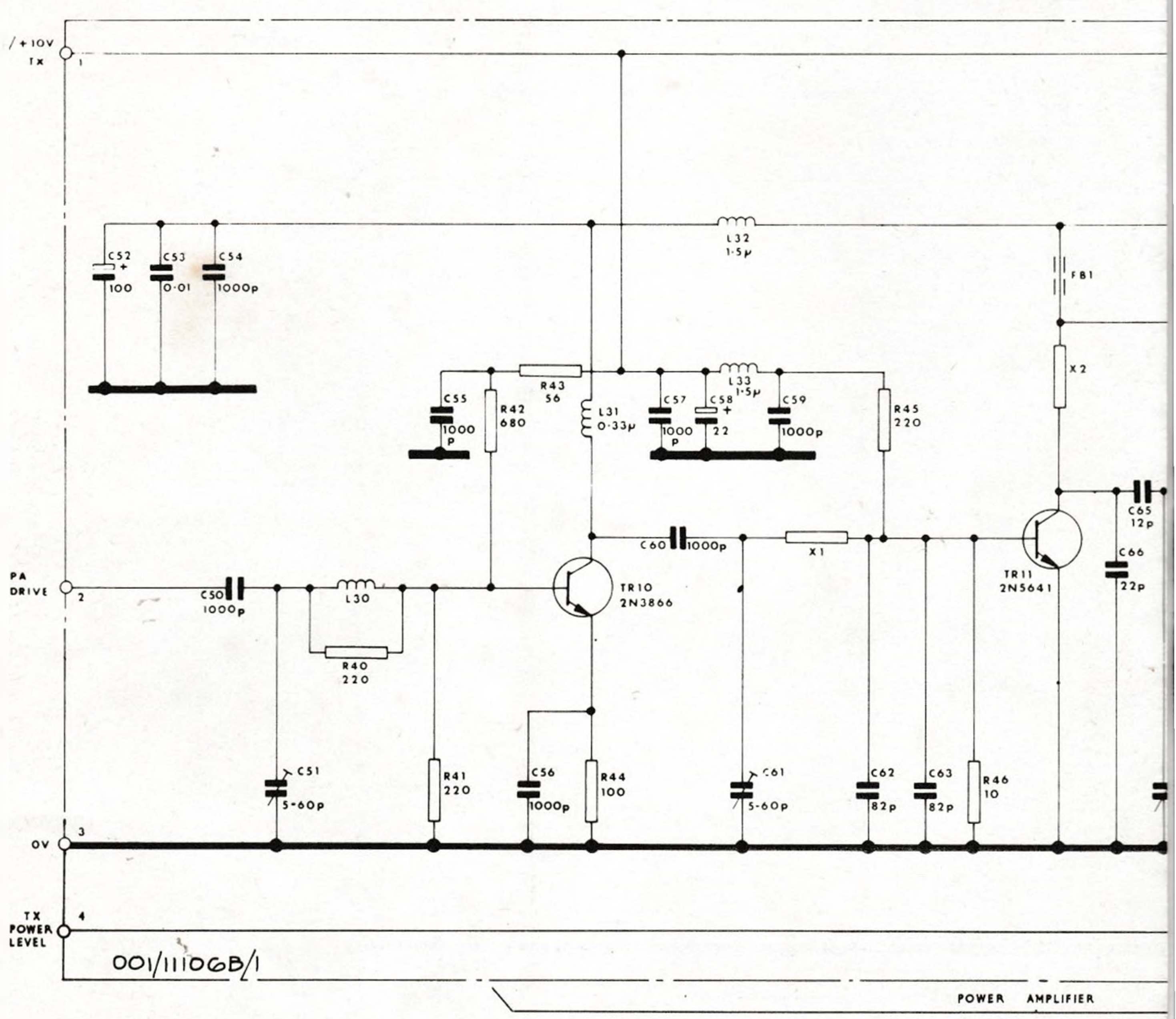
Tx Driver Circuit Fig.7.11



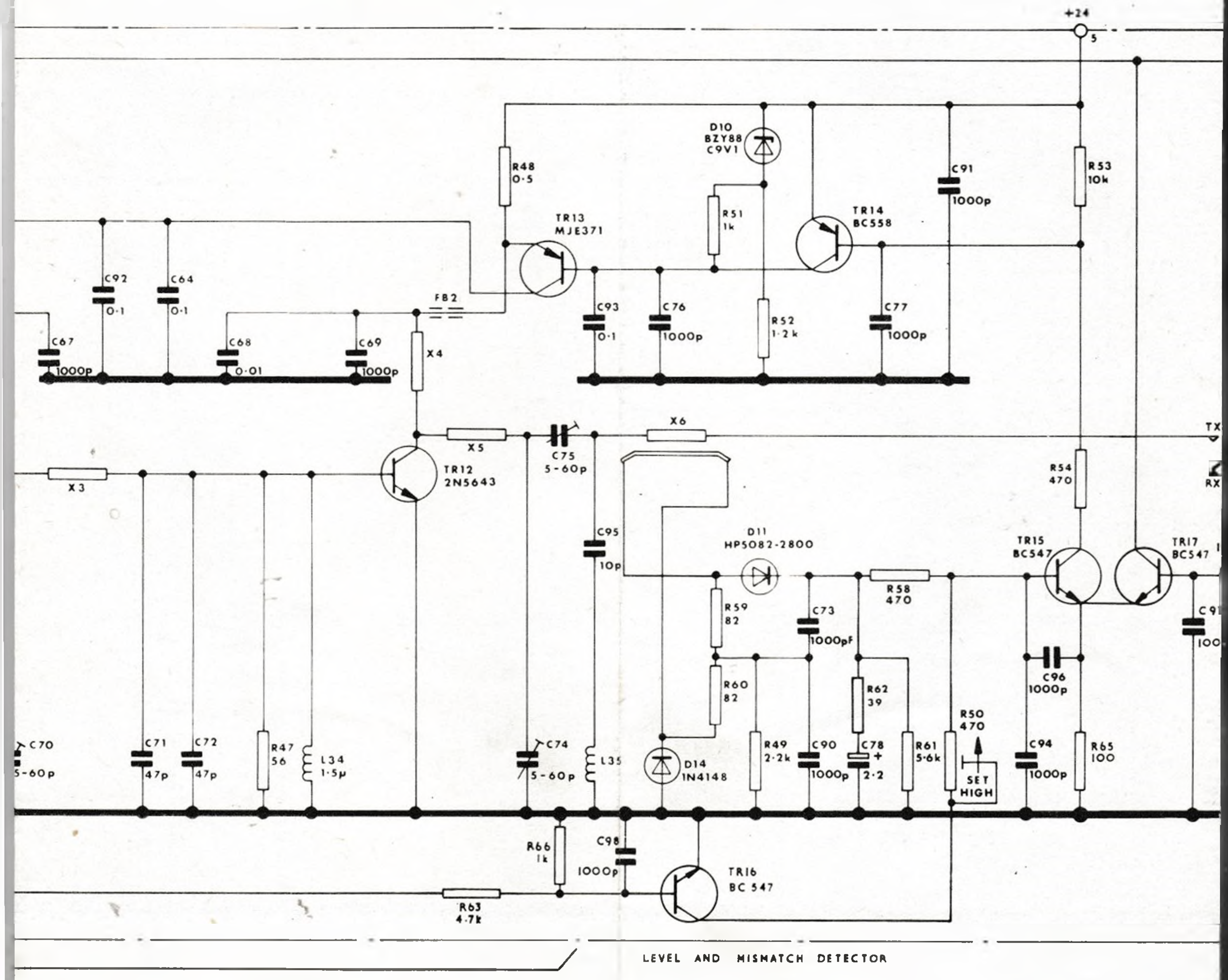
C14
1000p
L3
1·5μ
R11
100
C22
1000p
C21
1000p
R12
10k
L7
R18
100
C27
1000p
R16
33k
L8
0·15μ
C26
1000p
TR5
40673
L12
1·5μ
R21
47
R22
1k
C15
0·5-7p
C16
0·5-7p
C17
0·5-7p
B
Y
L4
L5
L6
C18
1000p
TR4
2N918
C23
1000p
R13
2·2k
C19
1000
P
R14
470
C20
2-9p
R15
47k
R17
10k
C24
1000
P
R19
150
C25
1000p
C28
0·5-7p
C29
0·5-7p
C30
0·5-7p
L9
L10
L11
C31
1000
P
R23
220
FILTER
AMPLIFIER
FILTER



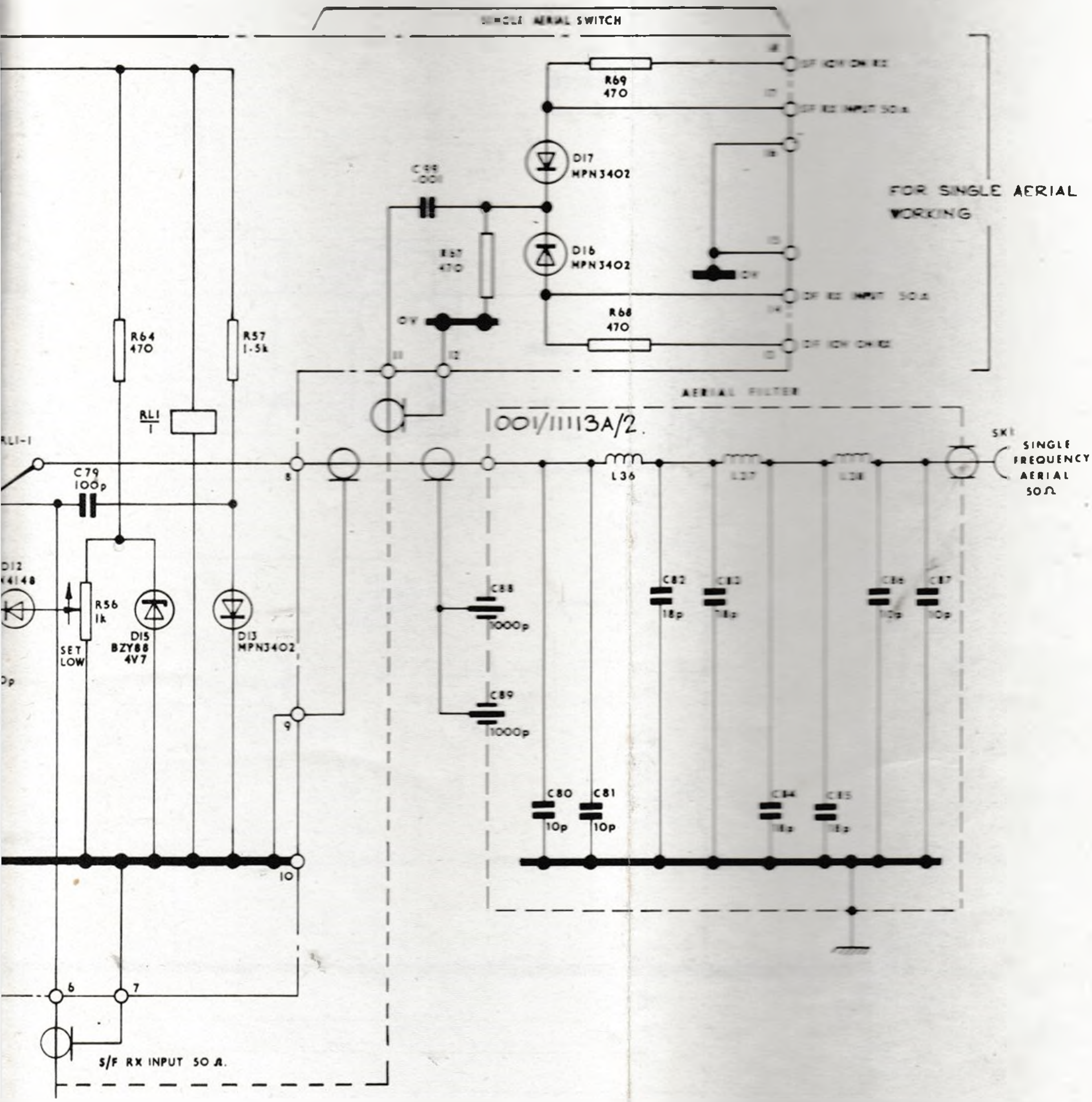
Tx Driver Circuit Fig.7.11



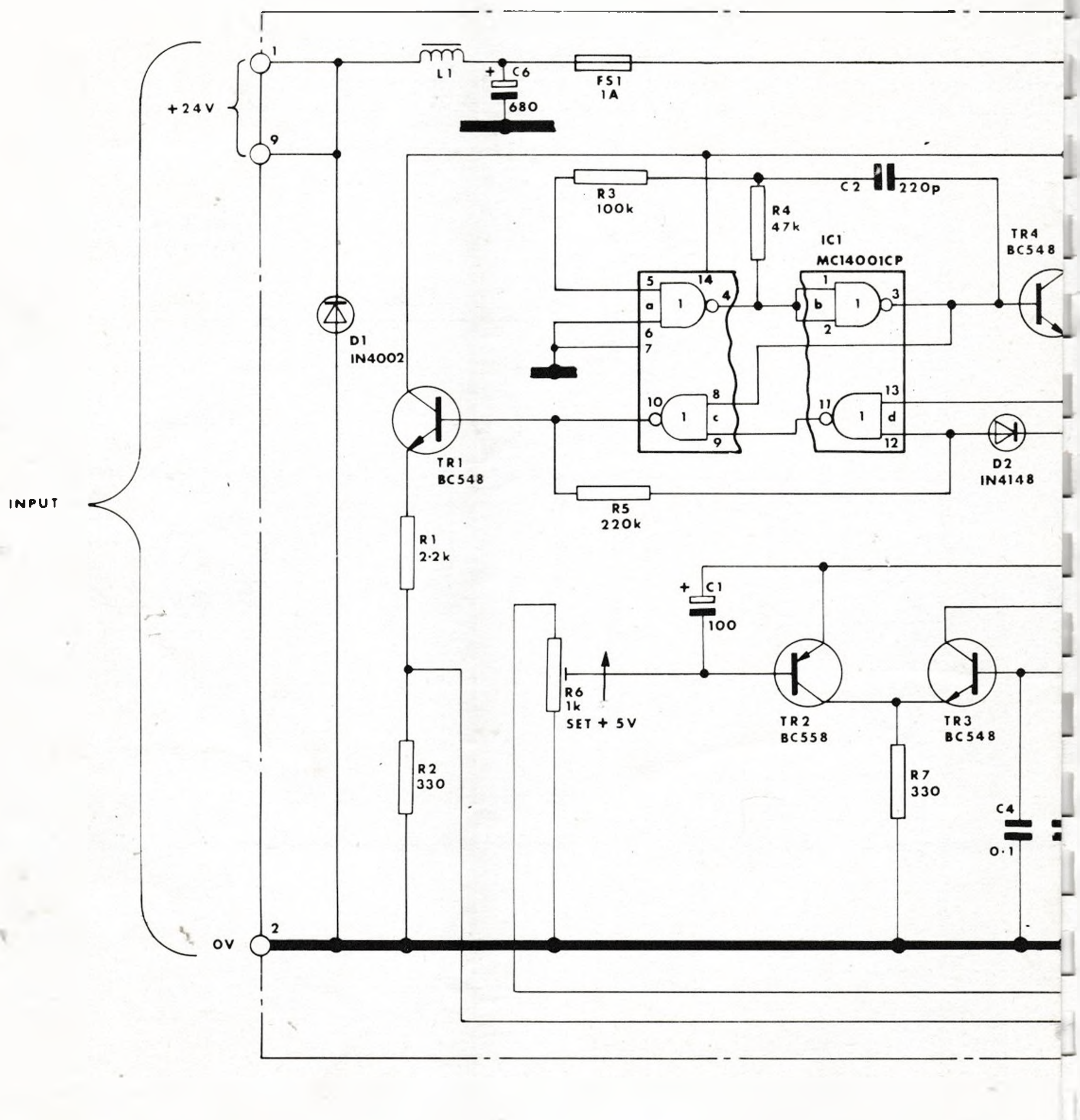
/+10V
TX
1
C52
100
C53
0·01
C54
1000p
L32
1·5µ
FB1
X2
R43
56
C55
1000
P
R42
680
L31
0·33µ
C57
1000
P
C58
22
L33
1·5µ
C59
1000p
R45
220
C65
12p
C66
22p
C60
1000p
X1
TR11
2N5641
PA
DRIVE
2
C50
1000p
L30
R40
220
TR10
2N3866
C51
5-60p
R41
220
C56
1000p
R44
100
C61
5-60p
C62
82p
C63
82p
R46
10
0V
3
TX
POWER
LEVEL
4
001/11106B/1
POWER AMPLIFIER



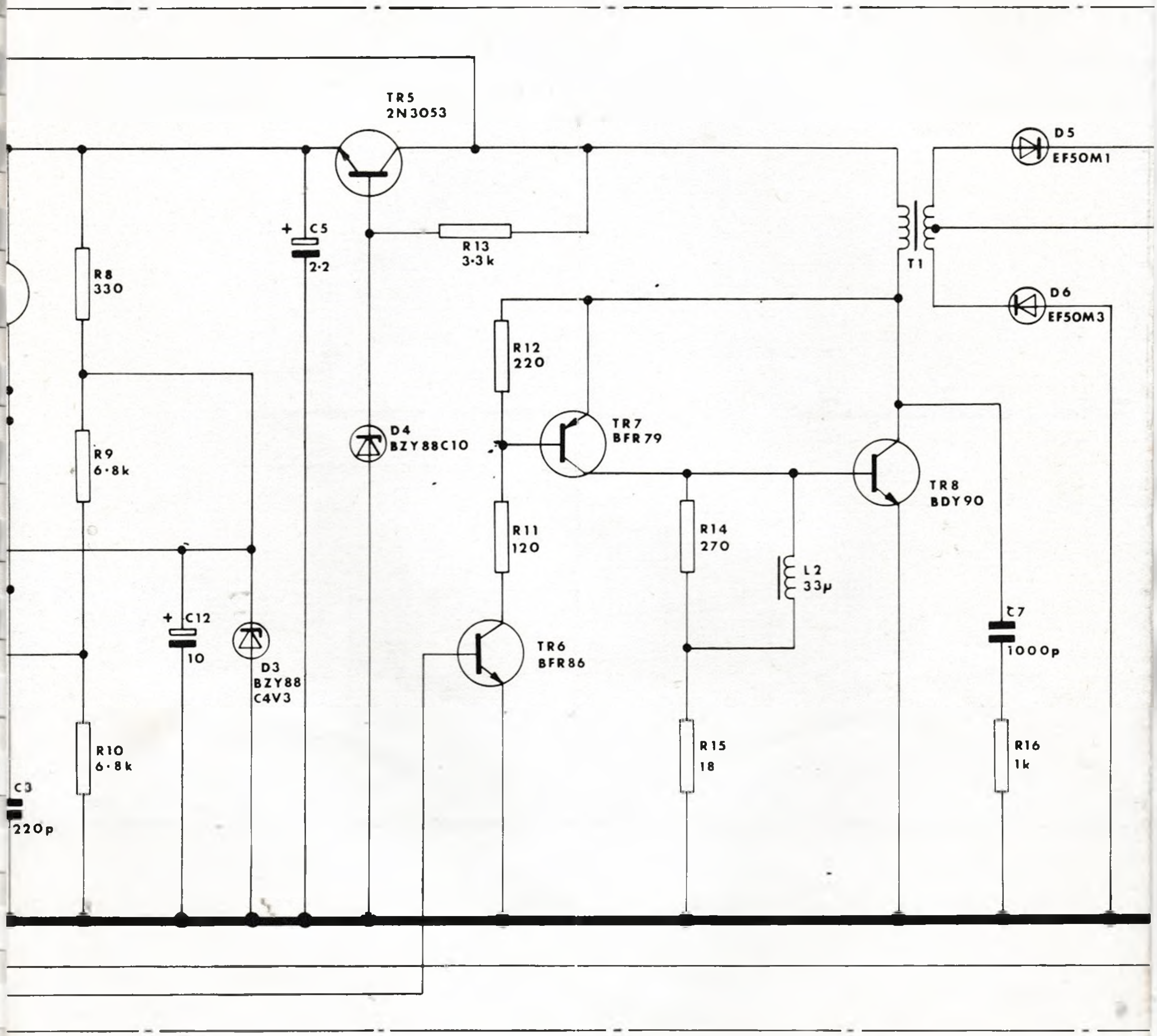
+24
5
D10
BZY88
C9V1
R48
0·5
R51
1k
TR13
MJE371
TR14
BC558
C91
1000p
R53
10k
C92
0·1
C64
0·1
FB2
C93
0·1
C76
1000p
R52
1·2k
C77
1000p
C67
1000p
C68
0·01
C69
1000p
X4
X6
TX
X5
C75
5-60p
X3
TR12
2N5643
RX
R54
470
C95
10p
D11
HP5082-2800
TR15
BC547
TR17
BC547
R58
470
R59
82
C73
1000pF
C96
1000p
R60
82
R62
39
R50
470
C70
5-60p
C71
47p
C72
47p
R47
56
L34
1·5µ
C74
5-60p
L35
D14
1N4148
R49
2·2k
C90
1000p
C78
2·2
R61
5·6k
SET
HIGH
C94
1000p
R65
100
R66
1k
C98
1000p
TR16
BC 547
R63
4·7k
LEVEL AND MISMATCH DETECTOR



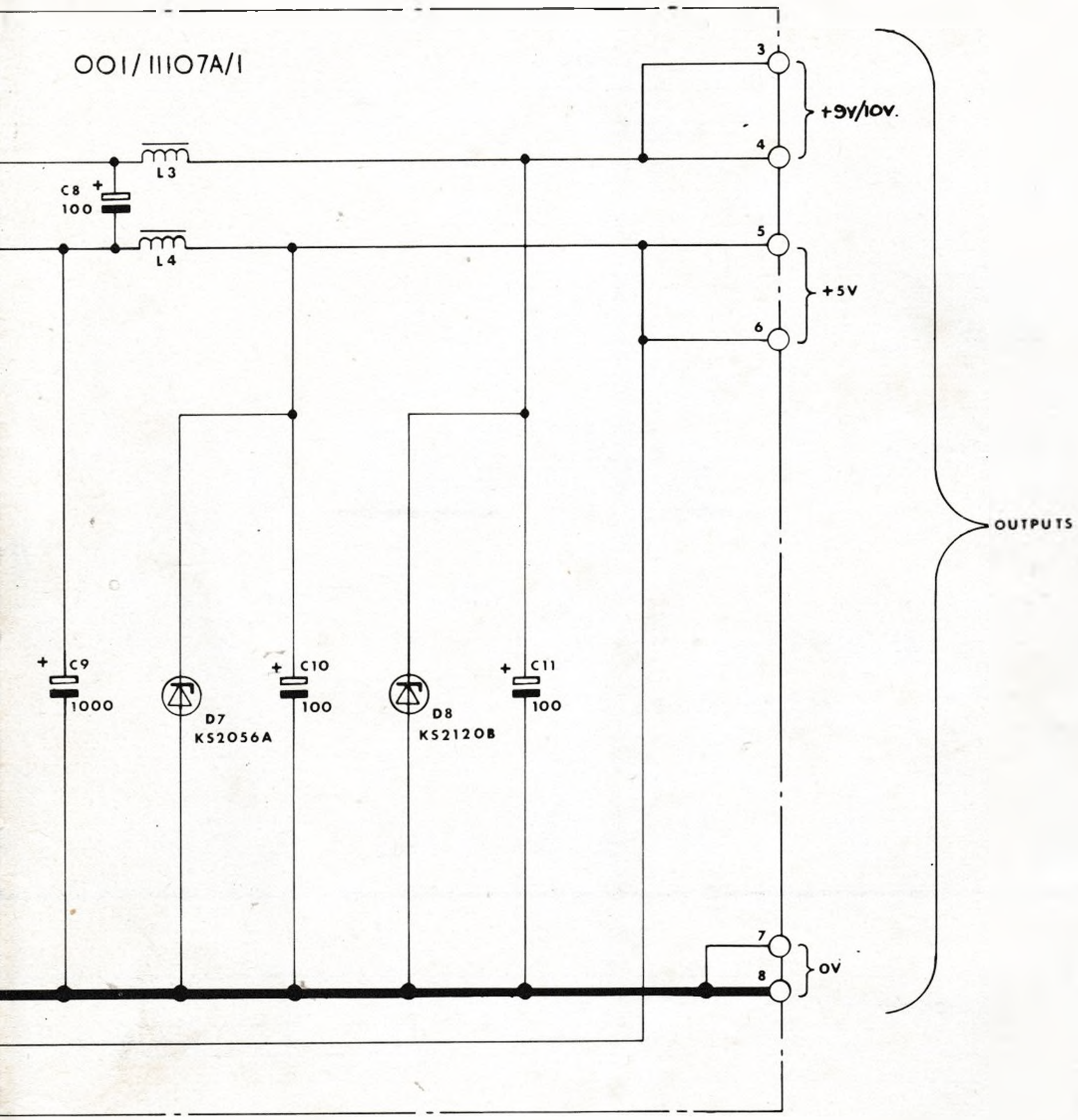
Power Amplifier Circuit Fig.7.14



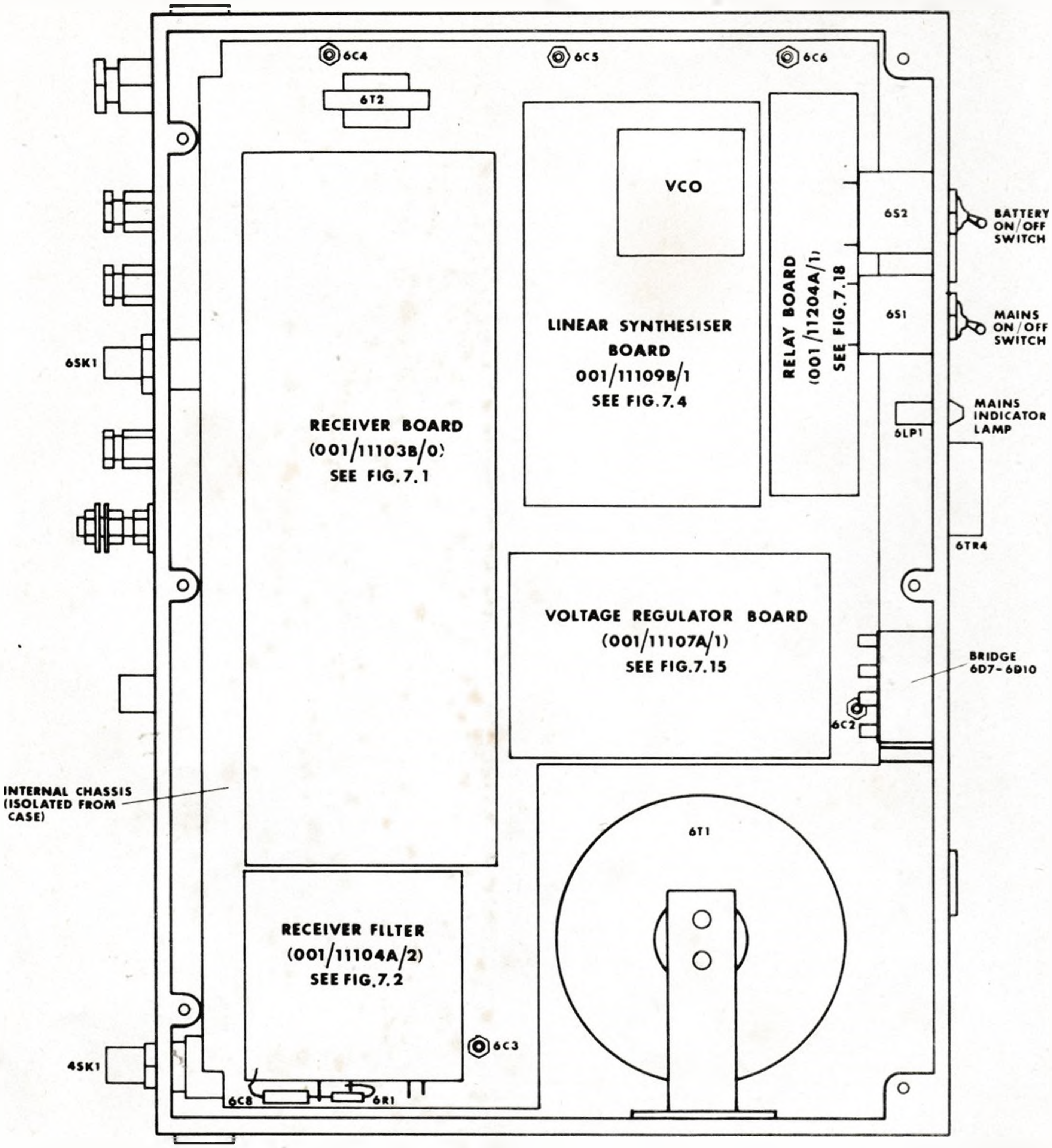
+24V
INPUT
0V
1
9
2
L1
C6
680
FS1
1A
R3
100k
R4
47k
C2
220p
IC1
MC14001CP
TR4
BC548
D1
IN4002
TR1
BC548
R5
220k
D2
IN4148
R1
2·2k
C1
100
R6
1k
SET + 5V
TR2
BC558
TR3
BC548
R2
330
R7
330
C4
0·1



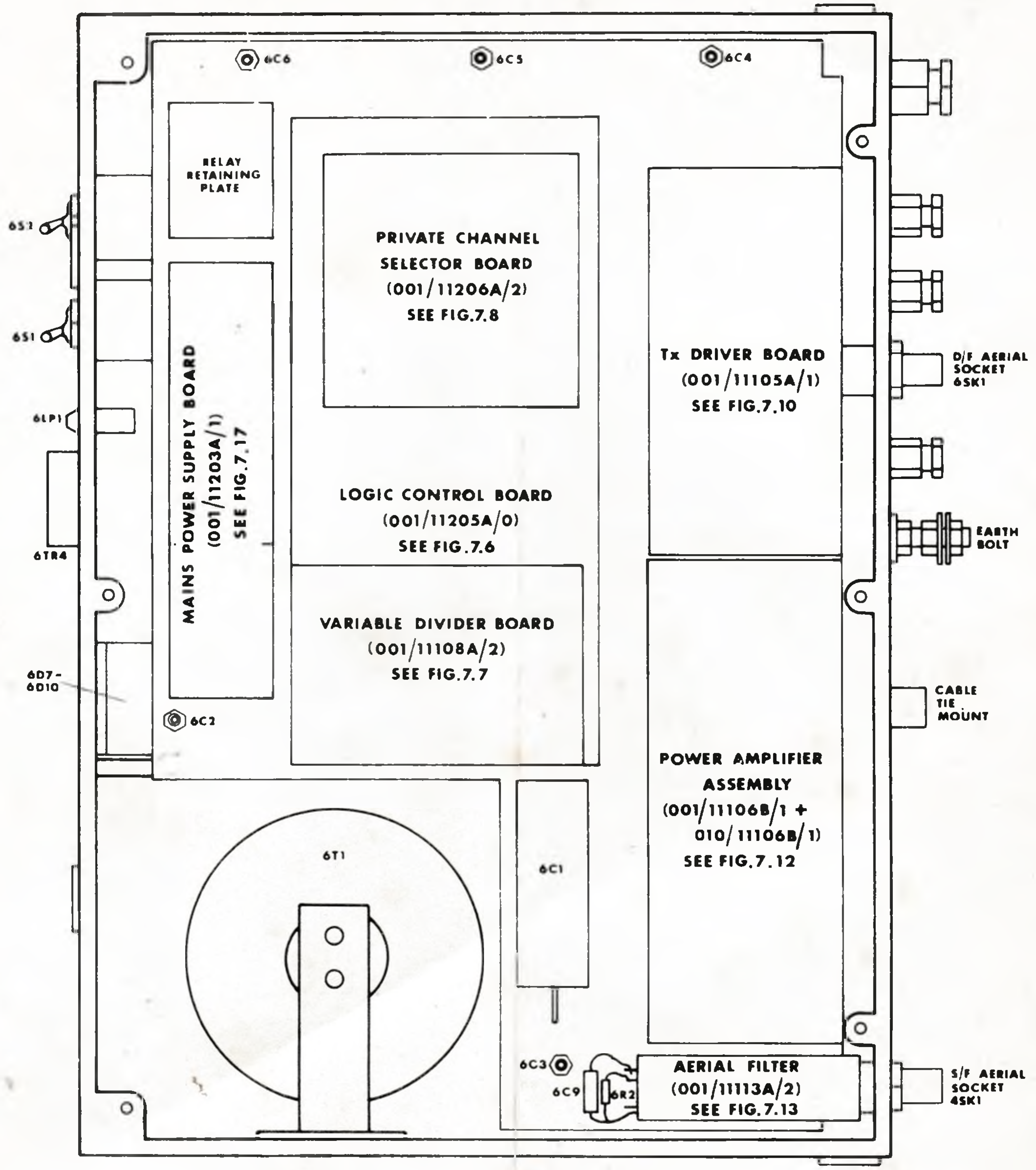
TR5
2N3053
D5
EF50M1
C5
2·2
R8
330
R13
3·3k
T1
D6
EF50M3
R12
220
TR7
BFR79
D4
BZY88C10
R9
6·8k
TR8
BDY90
R11
120
R14
270
L2
33μ
C12
10
D3
BZY88
C4V3
TR6
BFR86
C7
1000p
R10
6·8k
R15
18
R16
1k
C3
220p



Voltage Regulator Circuit Fig.7.16

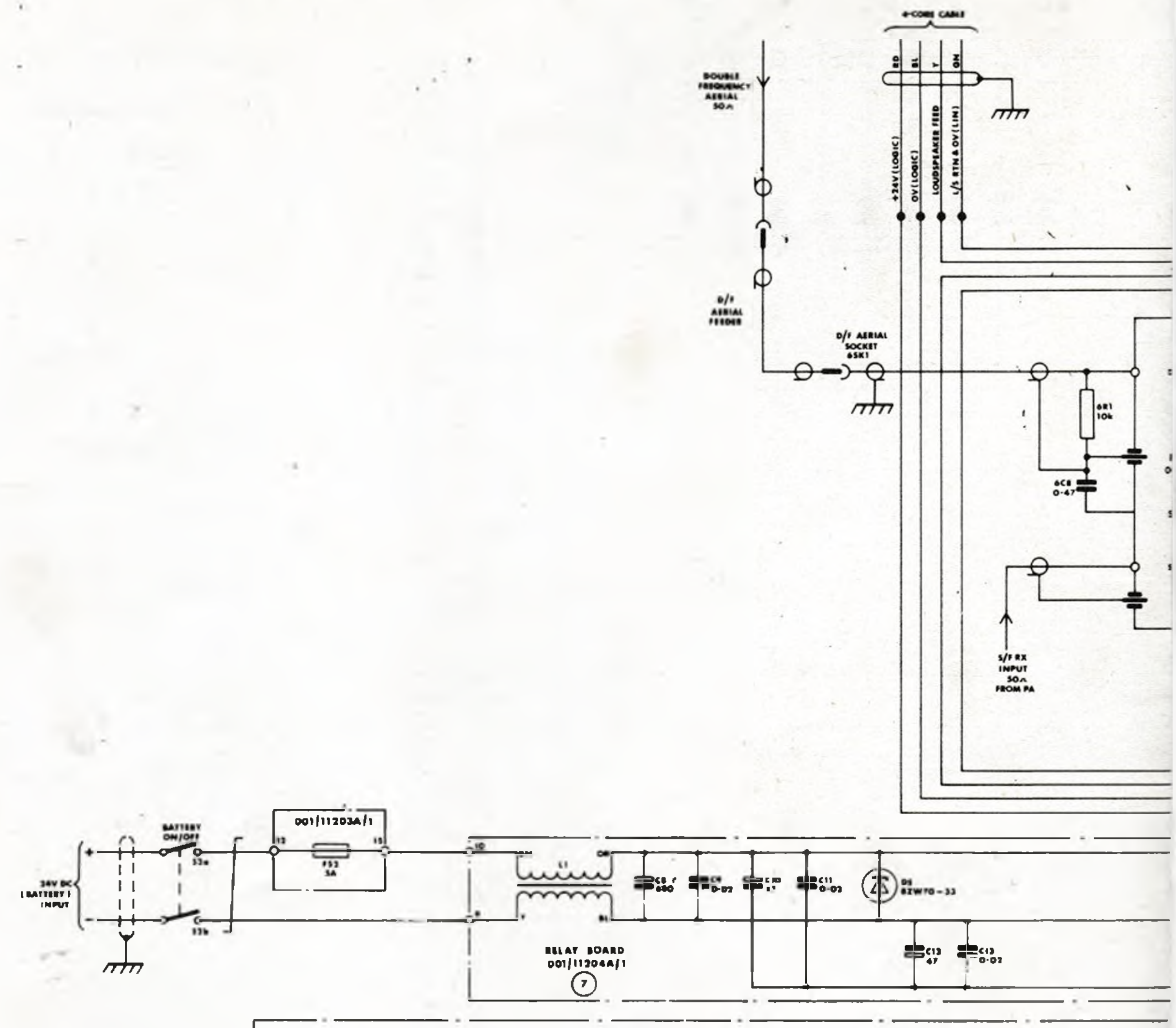

6C4
6C5
6C6
6T2
VCO
6S2
BATTERY ON/OFF SWITCH
RELAY BOARD (001/11204A/1) SEE FIG.7.18
6S1
MAINS ON/OFF SWITCH
LINEAR SYNTHESISER BOARD 001/11109B/1 SEE FIG.7.4
6SK1
RECEIVER BOARD (001/11103B/0) SEE FIG.7.1
MAINS INDICATOR LAMP
6LP1
6TR4
VOLTAGE REGULATOR BOARD (001/11107A/1) SEE FIG.7.15
BRIDGE 6D7-6D10
6C2
INTERNAL CHASSIS (ISOLATED FROM CASE)
6T1
RECEIVER FILTER (001/11104A/2) SEE FIG.7.2
6C3
4SK1
6C8
6R1

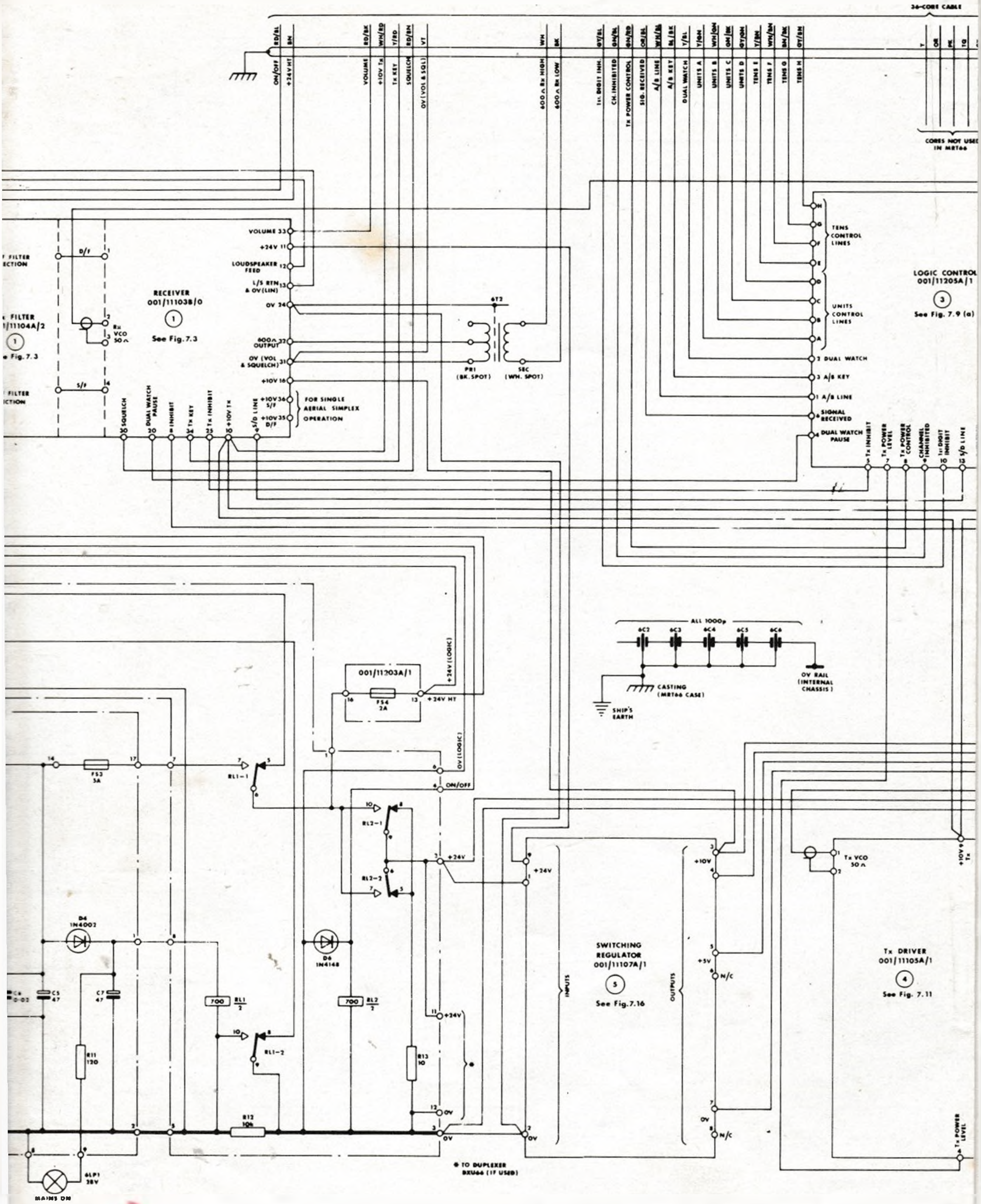
(a) Front View



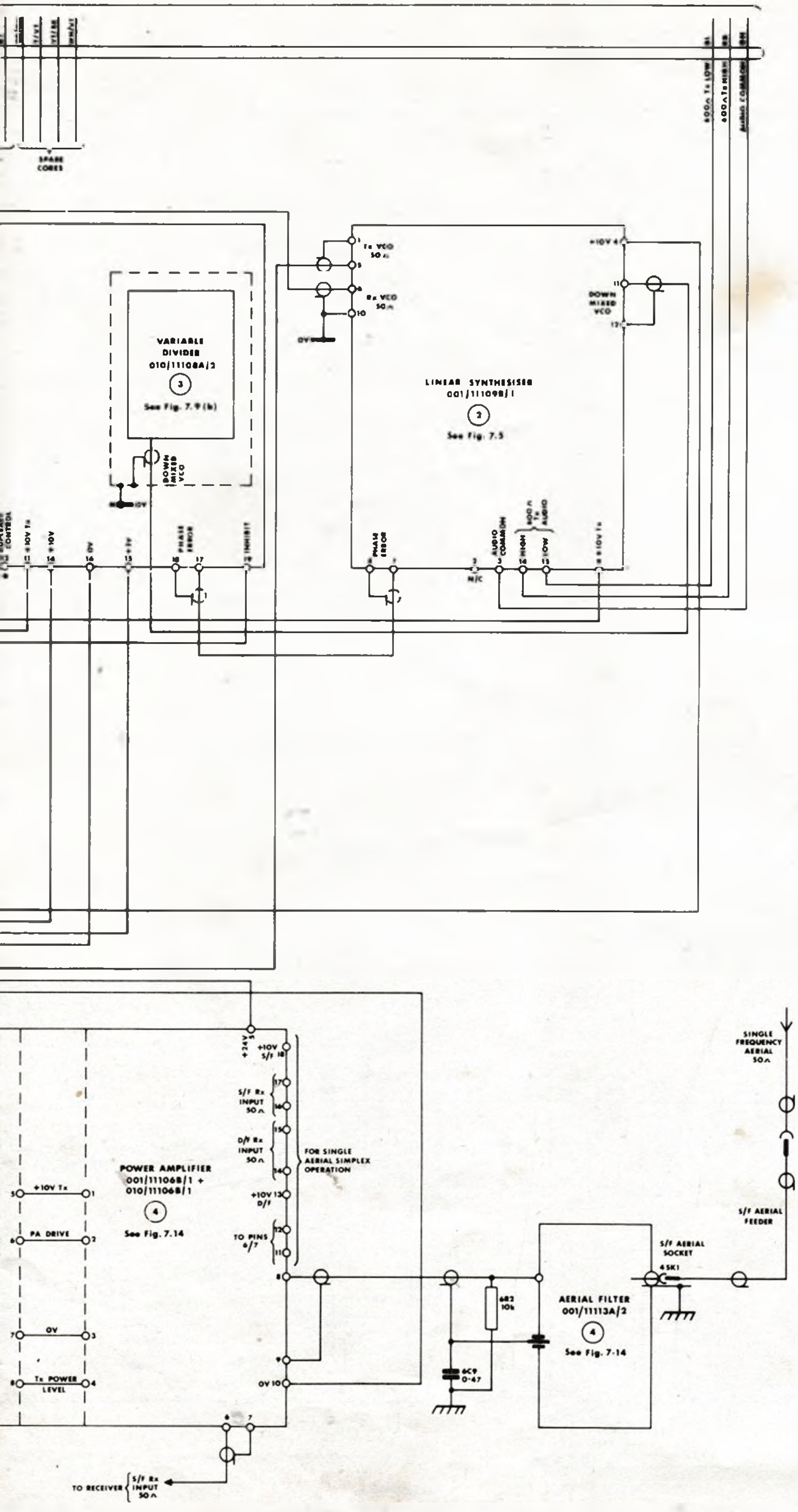
(b) Back View

Fig 7.20 Location of Major Components MRT66

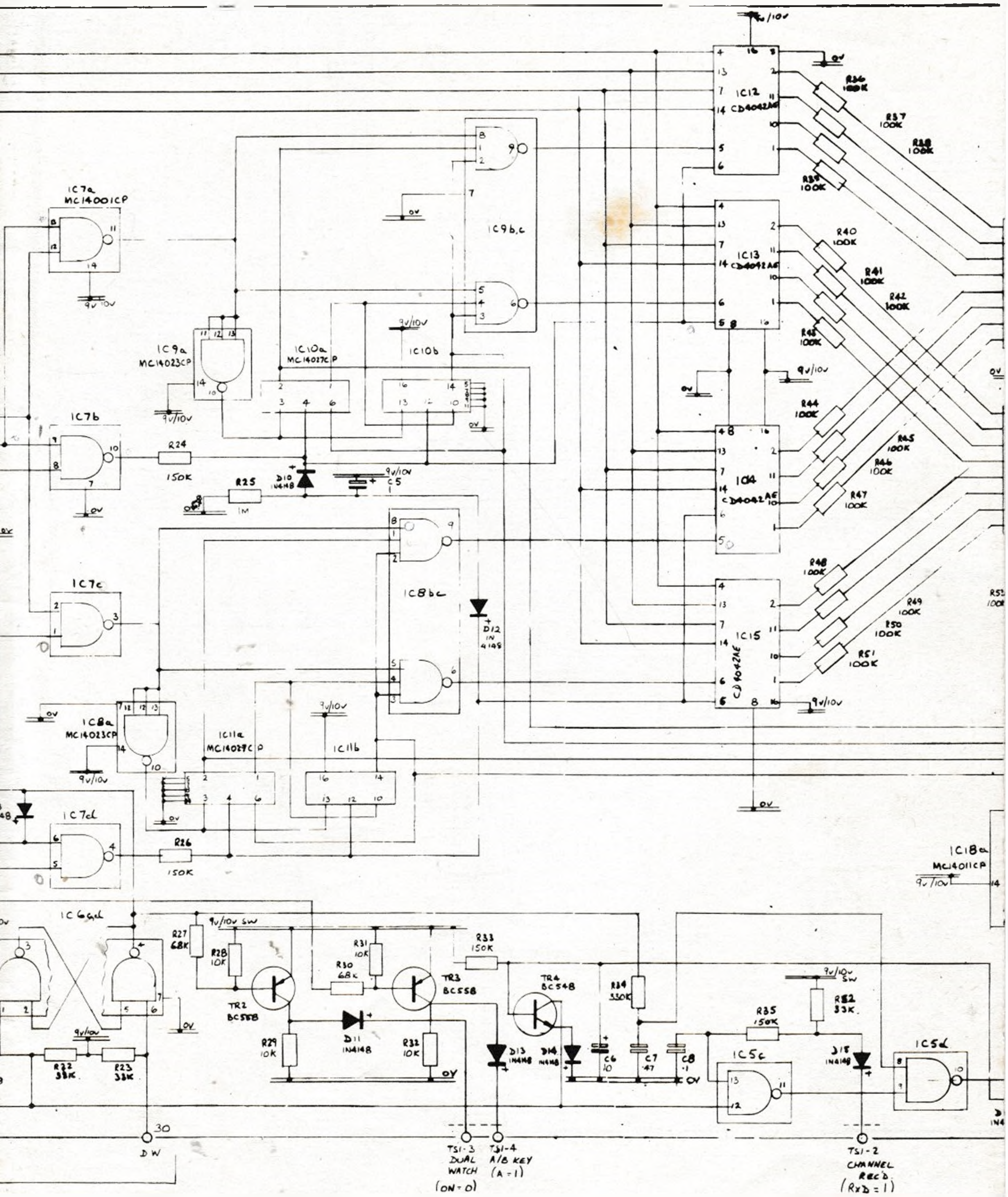

4-CORE CABLE
RD
BL
Y
GN
DOUBLE FREQUENCY AERIAL 50Ω
+24V (LOGIC)
0V (LOGIC)
LOUDSPEAKER FEED
L/S RTN & 0V (LIN)
D/F AERIAL FEEDER
D/F AERIAL SOCKET 6SK1
6R1 10k
6C8 0·47
S/F RX INPUT 50Ω FROM PA
BATTERY ON/OFF
24V DC (BATTERY) INPUT
001/11203A/1
FS2 5A
S3a
S3b
L1
C8 680
C9 0·02
C11 0·02
D5 BZW70-33
C12 47
C13 0·02
RELAY BOARD 001/11204A/1
7
DC REGULATOR 001/11203A/1
MAINS ON/OFF
S1a
S1b
AC MAINS INPUT 100-125V OR 200-250V 45-60Hz
FS1 2·5A FOR 220-240V 5A FOR 110-120V
120V
115V
110V
0V
GY
V
GN
Y
OR
RD
BN
BK
SCREEN
T1
D1-D4 PM7A2
C7 0·1
C1 4700
C2 22
C1 1000p
0V
D1 BZY88 C5V6
D2 1N4148
D3 BZY88 C15
R1 47k
R2 1k
R3 2·2k
R4 470
R5 100
R6 330
R7 1k
C4 0·1
C3 1000p
TR1 2N5298
TR2 2N3906
TR3 2N3906
6TR1 2N6254



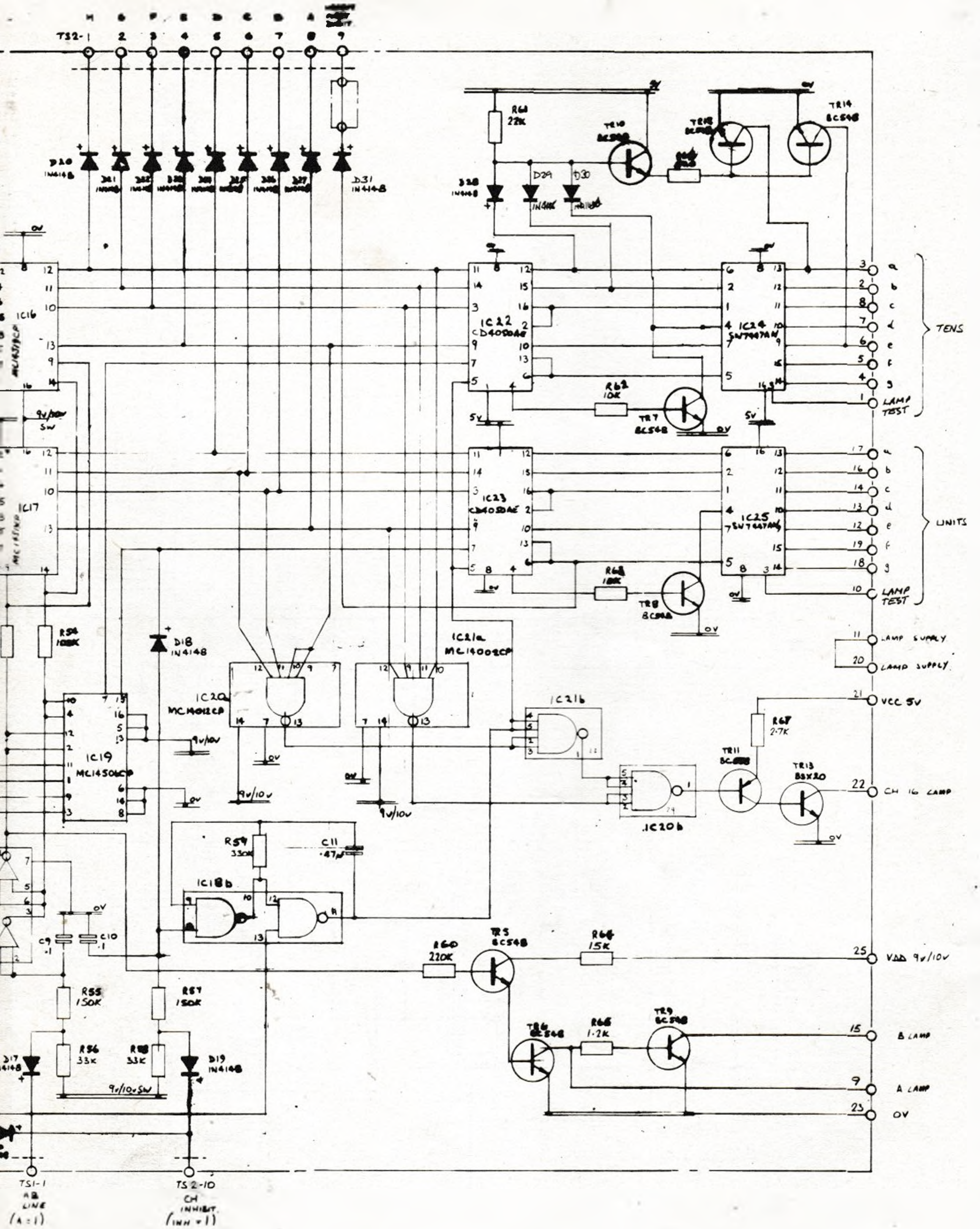
34-CORE CABLE
CORES NOT USED IN MRT66
LOGIC CONTROL 001/11205A/1
3
See Fig. 7.9 (a)
TENS CONTROL LINES
UNITS CONTROL LINES
DUAL WATCH
A/B KEY
A/B LINE
SIGNAL RECEIVED
DUAL WATCH PAUSE
Tx INHIBIT
Tx POWER LEVEL
Tx POWER CONTROL
CHANNEL INHIBITED
1st DIGIT INHIBIT
S/D LINE
RECEIVER 001/11103B/0
1
See Fig. 7.3
VOLUME
LOUDSPEAKER FEED
L/S RTN & OV (LIN)
600Ω OUTPUT
OV (VOL & SQUELCH)
FOR SINGLE AERIAL SIMPLEX OPERATION
SQUELCH
PRI (BK. SPOT)
SEC (WH. SPOT)
6T2
ALL 1000p
CASTING (MRT66 CASE)
SHIP'S EARTH
OV RAIL (INTERNAL CHASSIS)
001/11203A/1
FS4 2A
FS3 5A
+24V HT
+24V (LOGIC)
OV (LOGIC)
ON/OFF
RL1-1
RL1-2
RL2-1
RL2-2
D4 1N4002
D6 1N4148
R11 120
R12 10k
R13 50
SWITCHING REGULATOR 001/11107A/1
5
See Fig. 7.16
INPUTS
OUTPUTS
Tx DRIVER 001/11105A/1
4
See Fig. 7.11
Tx VCO 50Ω
TO DUPLEXER BXU66 (IF USED)
6LP1 28V
MAINS ON



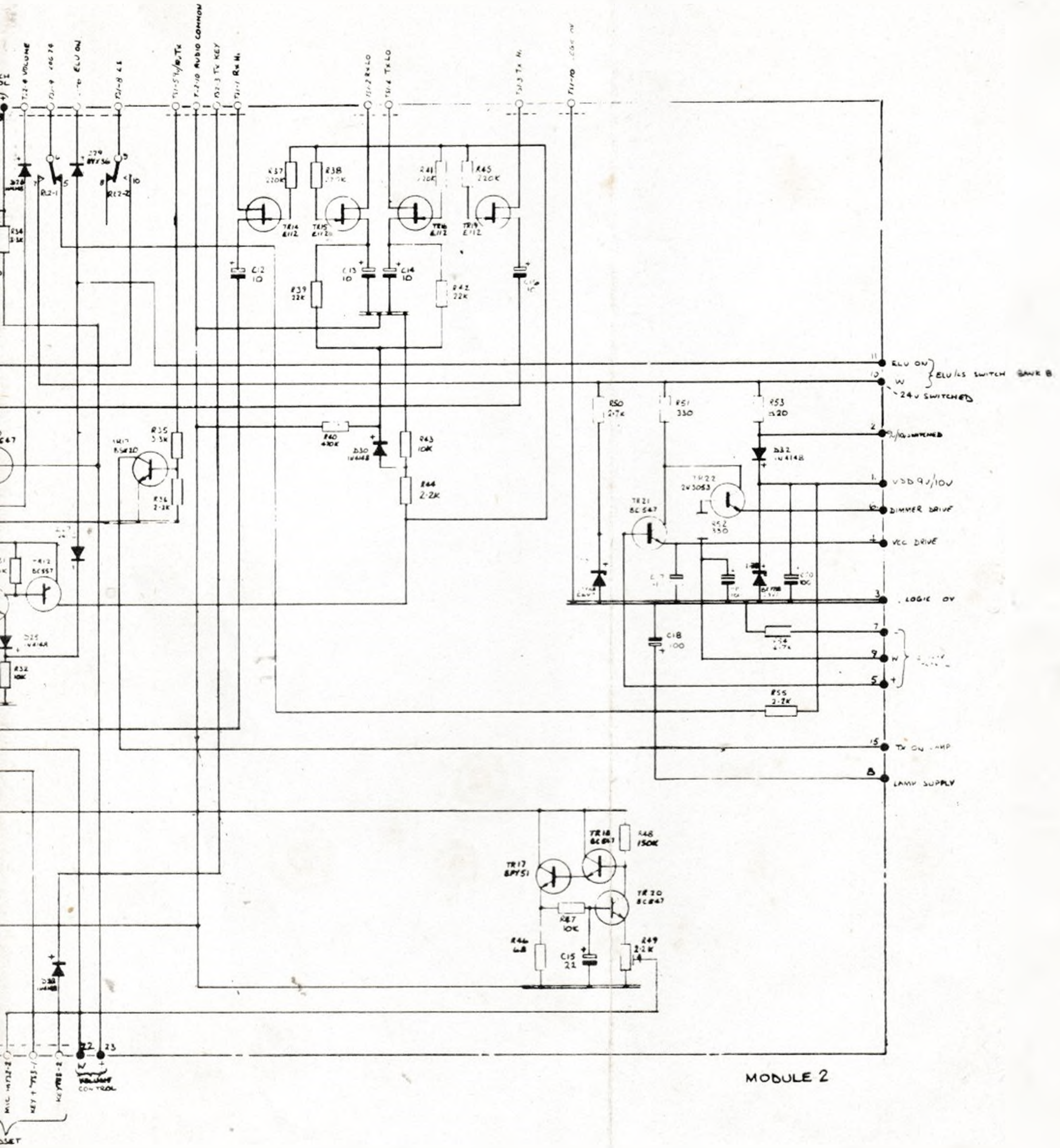
Interconnection Diagram MRT 66 Fig. 7.21



IC12 CD4042AE
IC13 CD4042AE
IC14 CD4042AE
IC15 CD4042AE
IC7a MC14001CP
IC7b
IC7c
IC7d
IC9a MC14023CP
IC9b,c
IC10a MC14027CP
IC10b
IC8a MC14023CP
IC8bc
IC11a MC14027CP
IC11b
IC6c,d
IC5c
IC5d
IC18a MC14011CP
R24 150K
R25 1M
R26 150K
R27 68K
R28 10K
R29 10K
R30 68K
R31 10K
R32 10K
R33 150K
R34 330K
R35 150K
R52 33K
R22 33K
R23 33K
R36 100K
R37 100K
R38 100K
R39 100K
R40 100K
R41 100K
R42 100K
R43 100K
R44 100K
R45 100K
R46 100K
R47 100K
R48 100K
R49 100K
R50 100K
R51 100K
D10 1N4148
D11 1N4148
D12 1N4148
D13 1N4148
D14 1N4148
D15 1N4148
TR2 BC558
TR3 BC558
TR4 BC548
C5 1
C6 10
C7 ·47
C8 ·1
9v/10v
9v/10v SW
0v
30
DW
TS1-3 DUAL WATCH (ON=0)
TS1-4 A/B KEY (A=1)
TS1-2 CHANNEL REC'D (RxD=1)

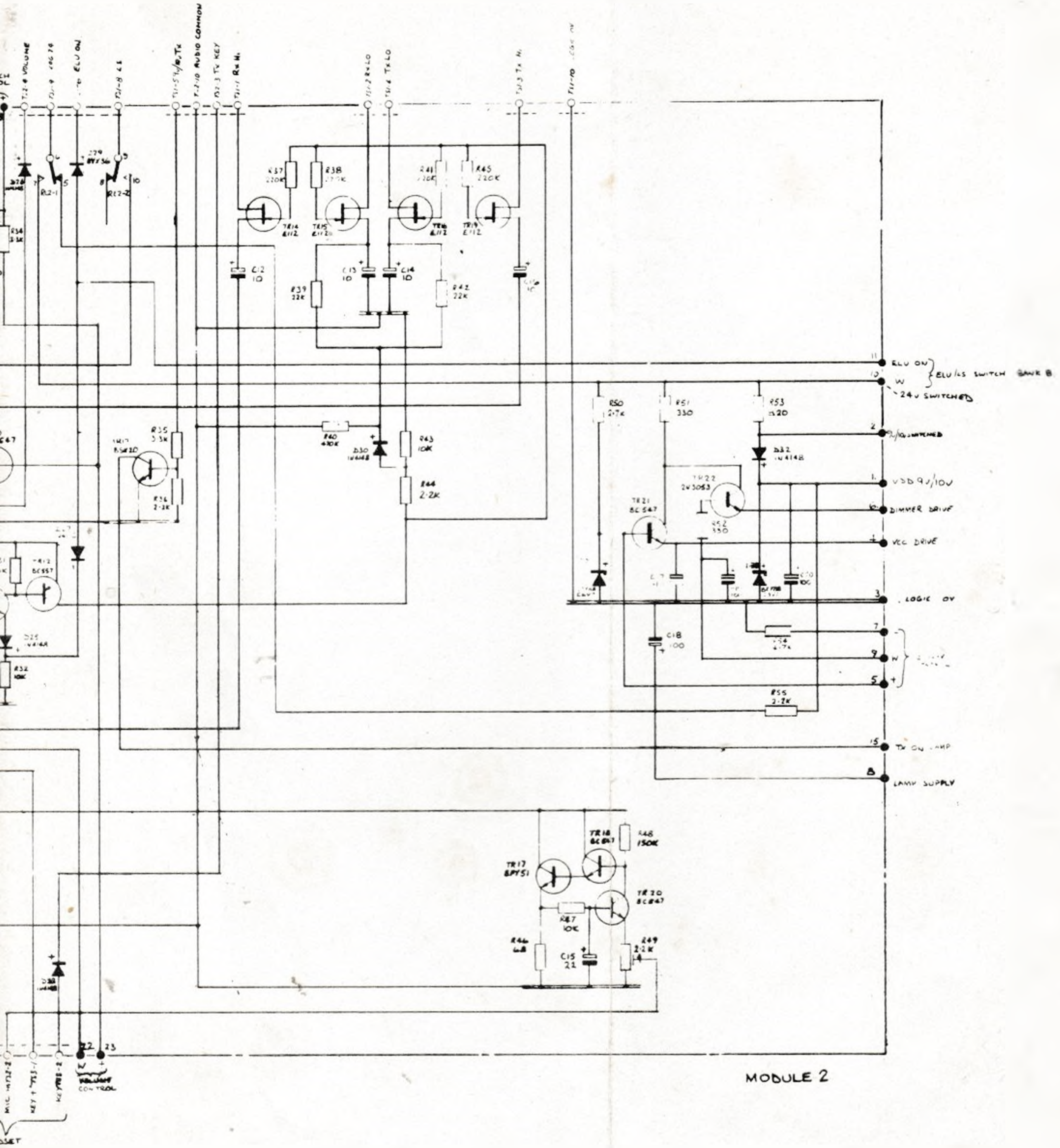


Remote Logic Circuit   Figure 7.23



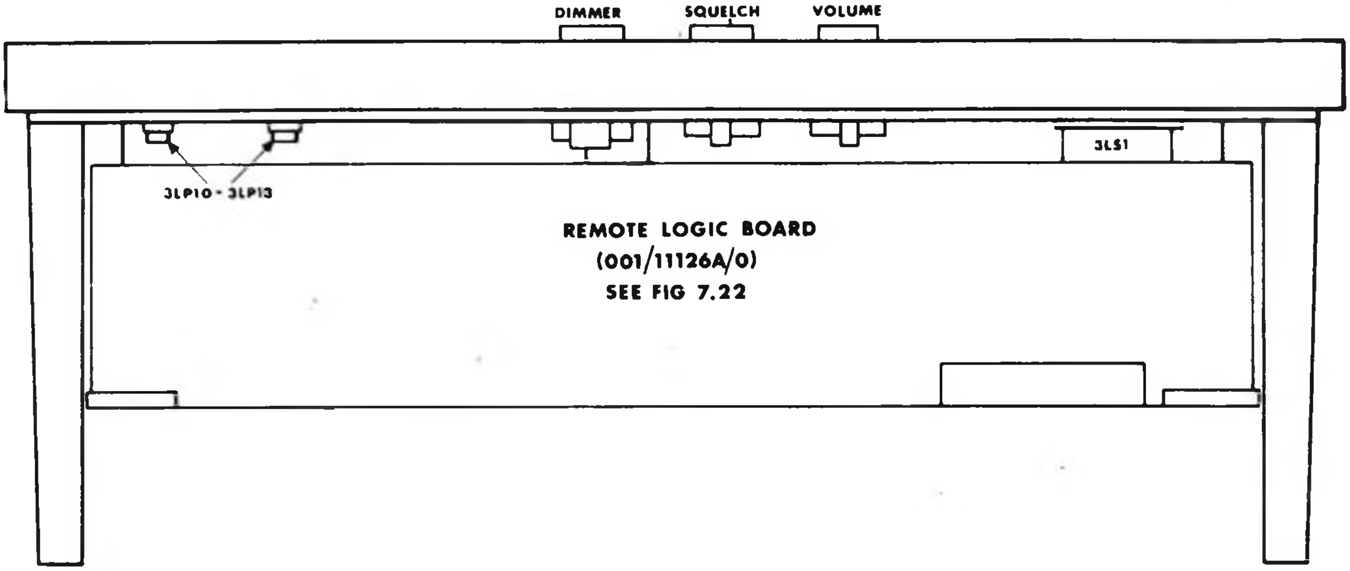
SRC Linear Circuits

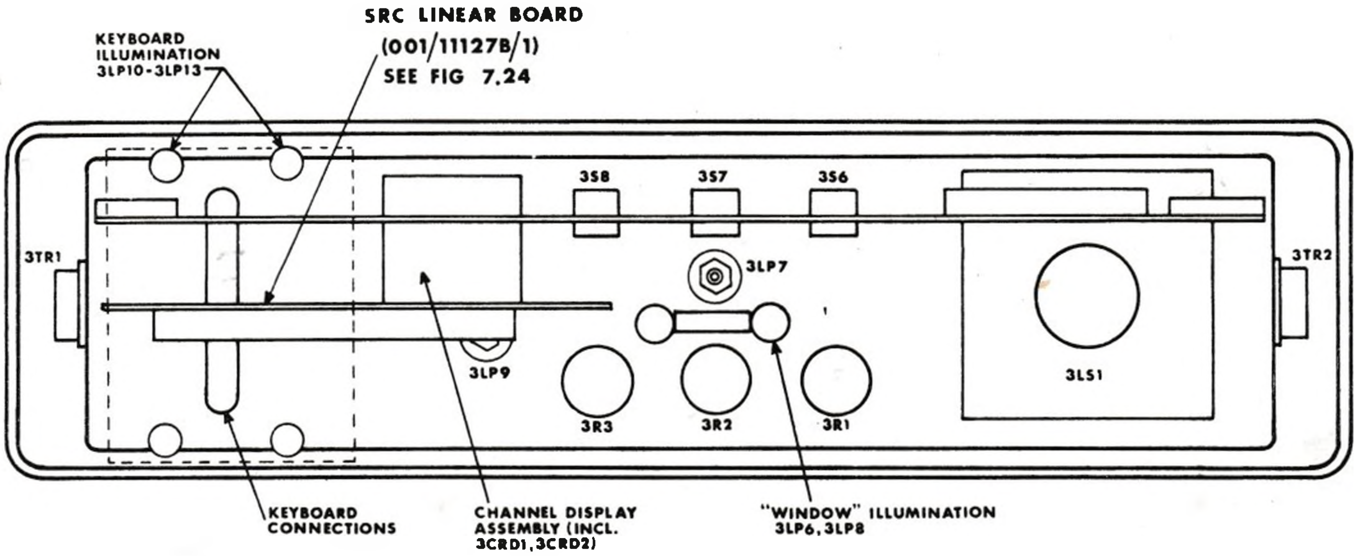
Fig. 7.25



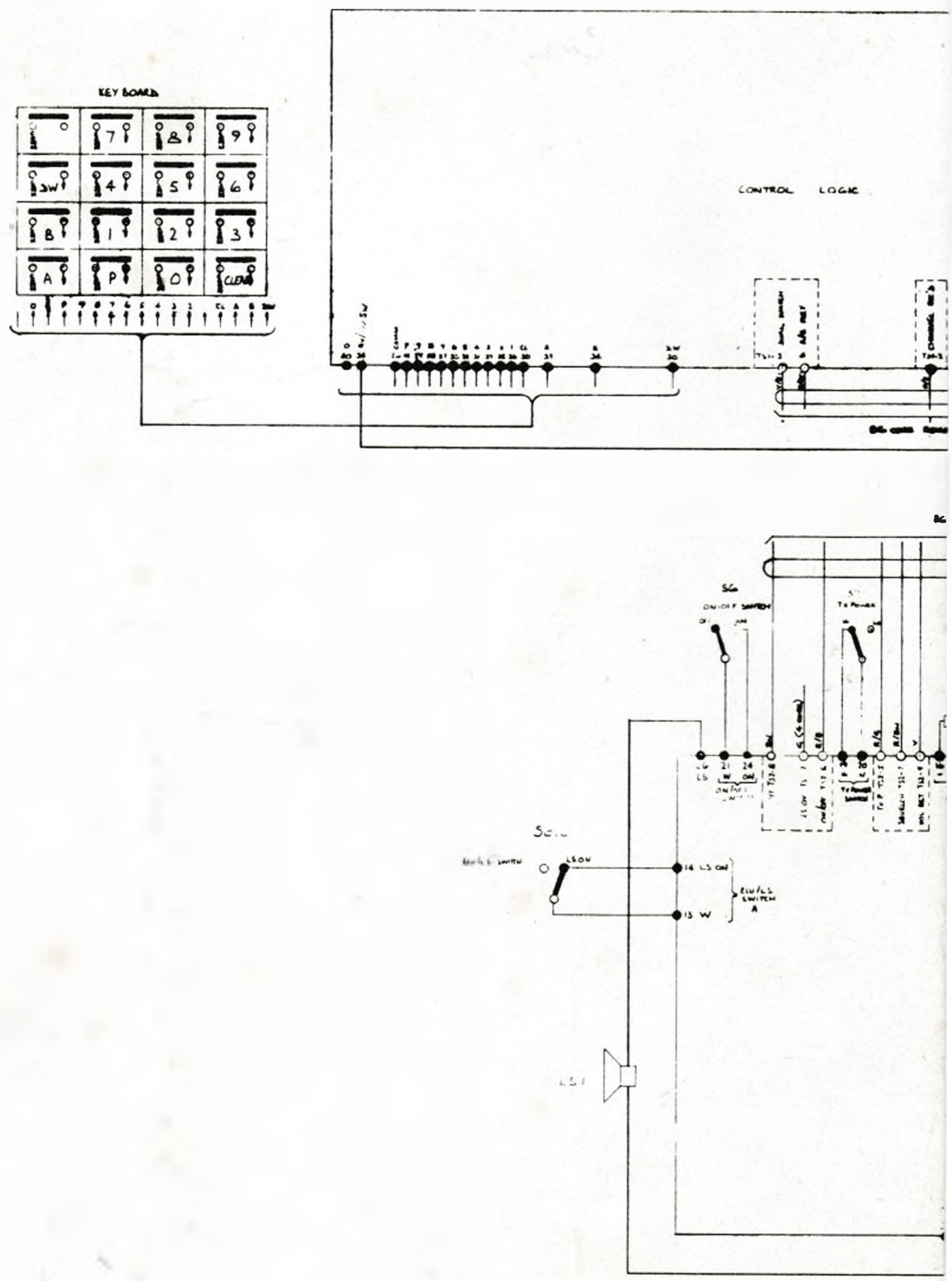
SRC Linear Circuits

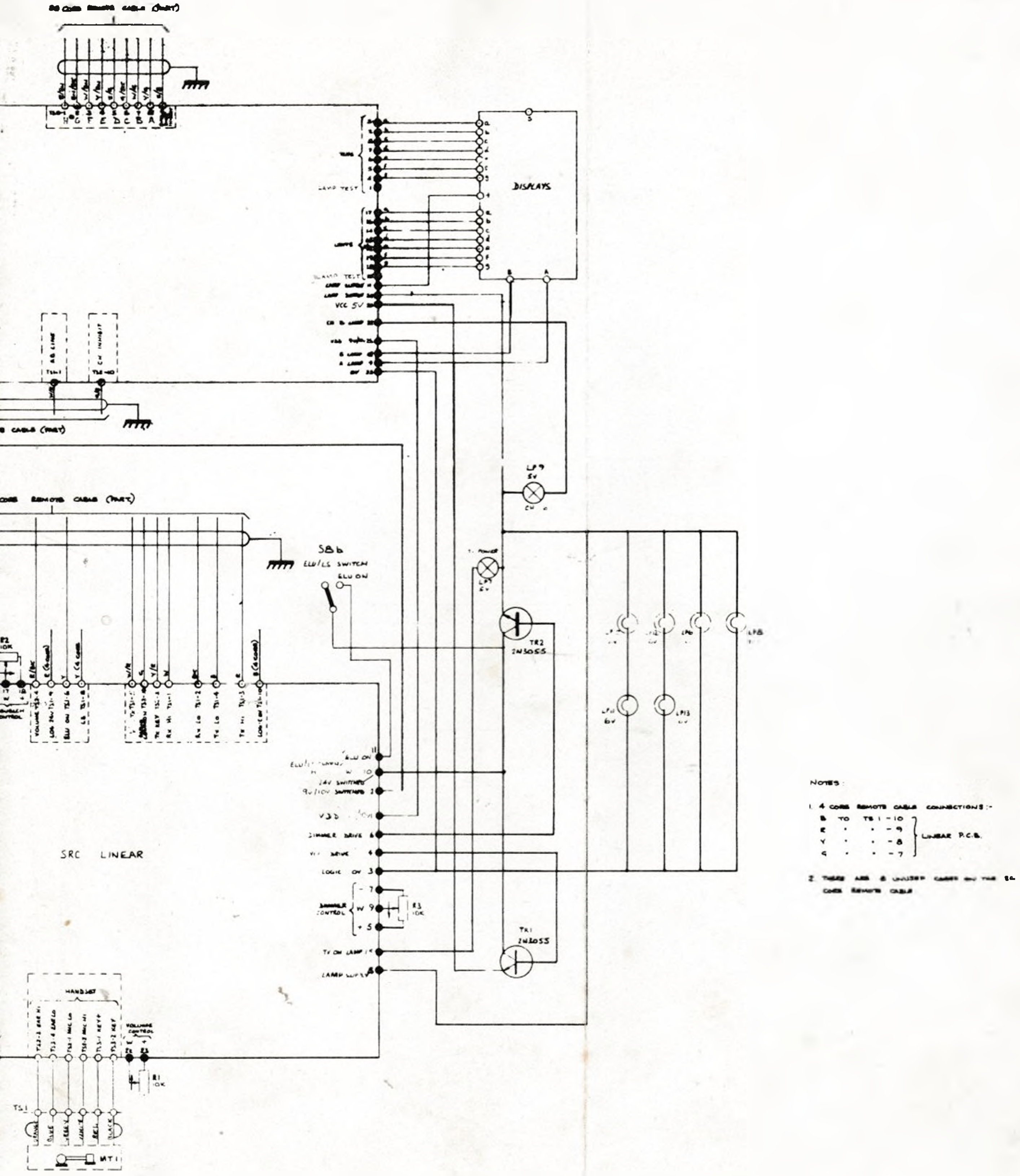
Fig. 7.25





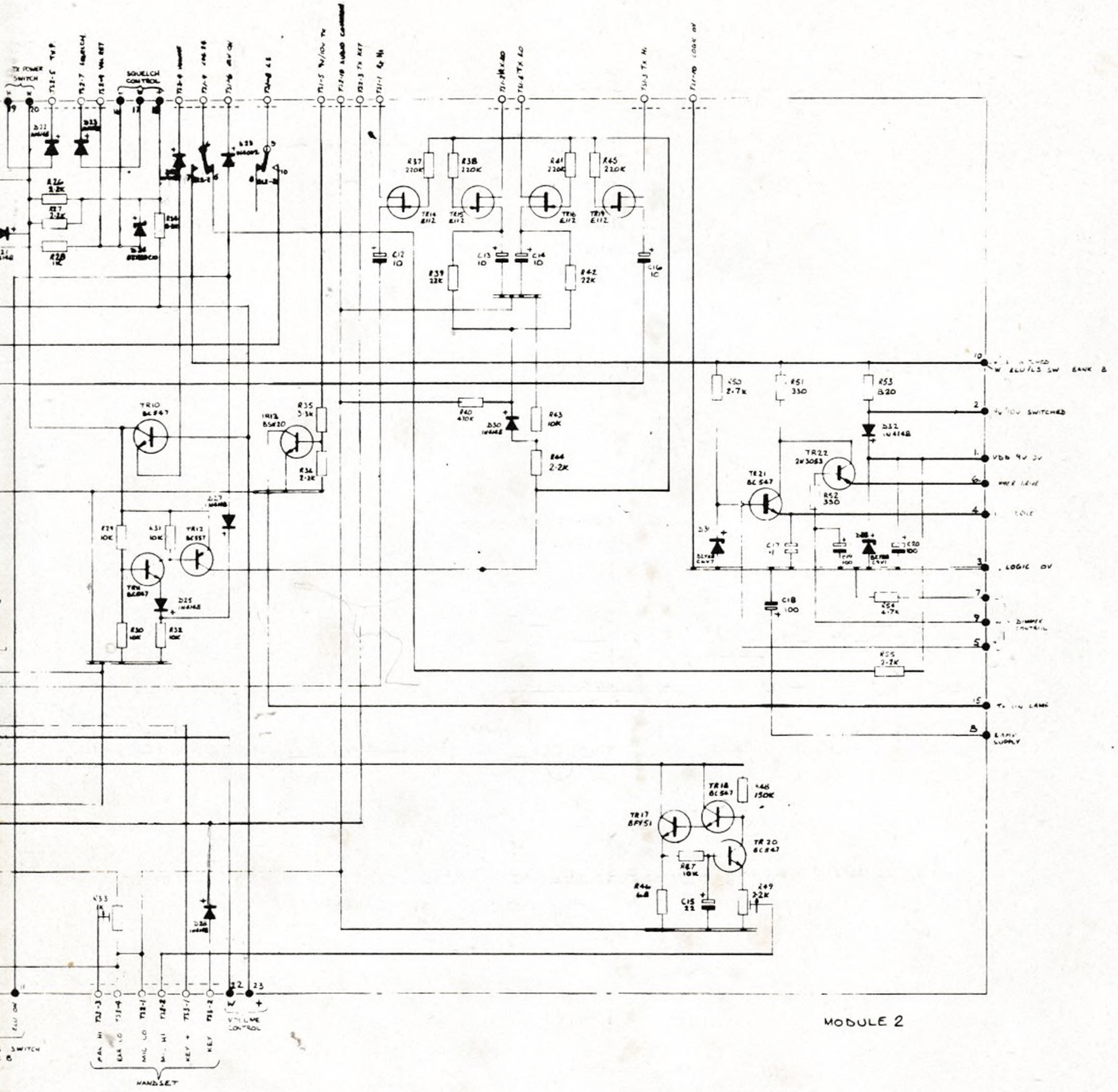
Location of Major Components SRC66


KEY BOARD
CONTROL LOGIC
LS ON
W
LS1

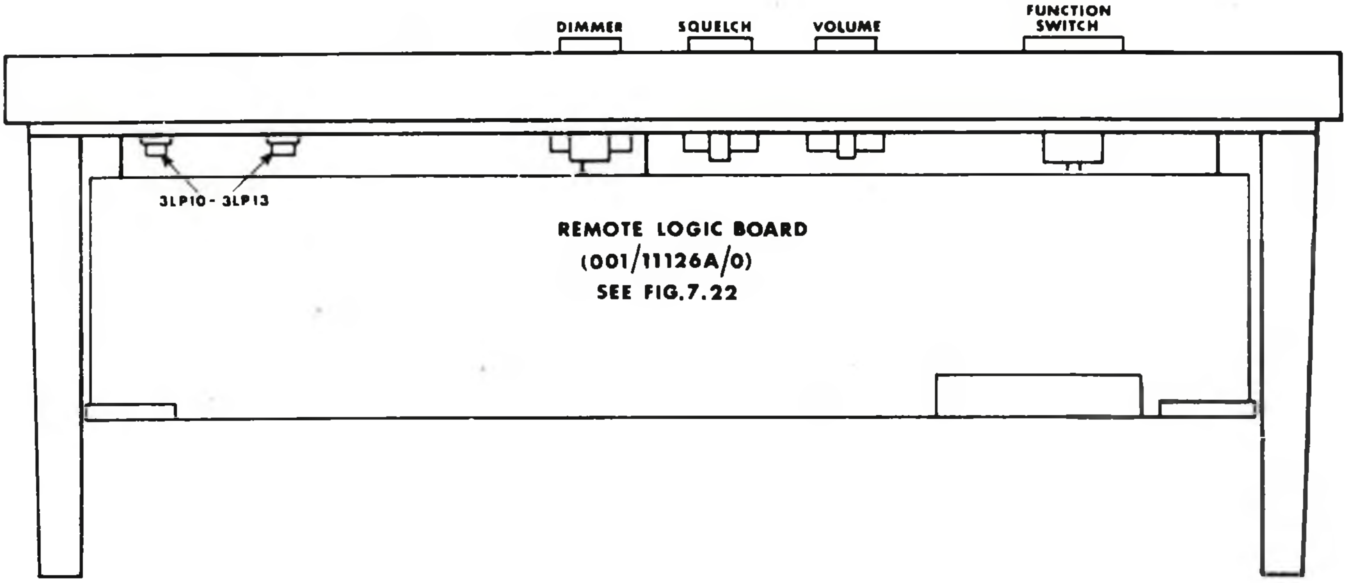


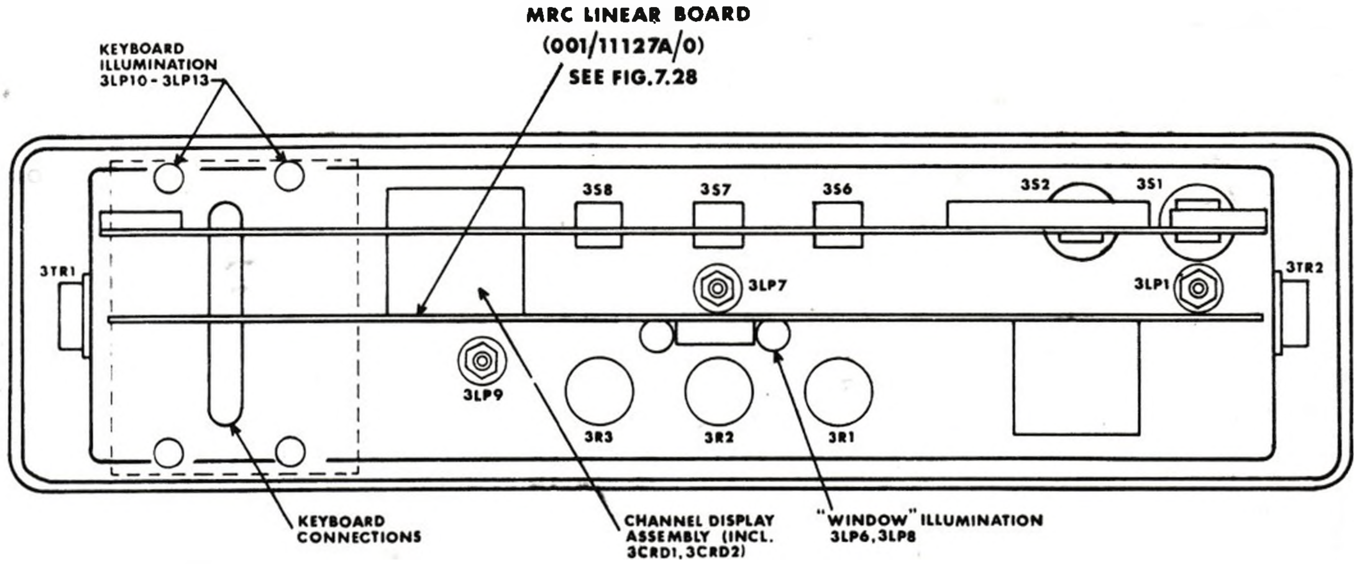
Interconnection Diagram SRC66

Fig. 7.27

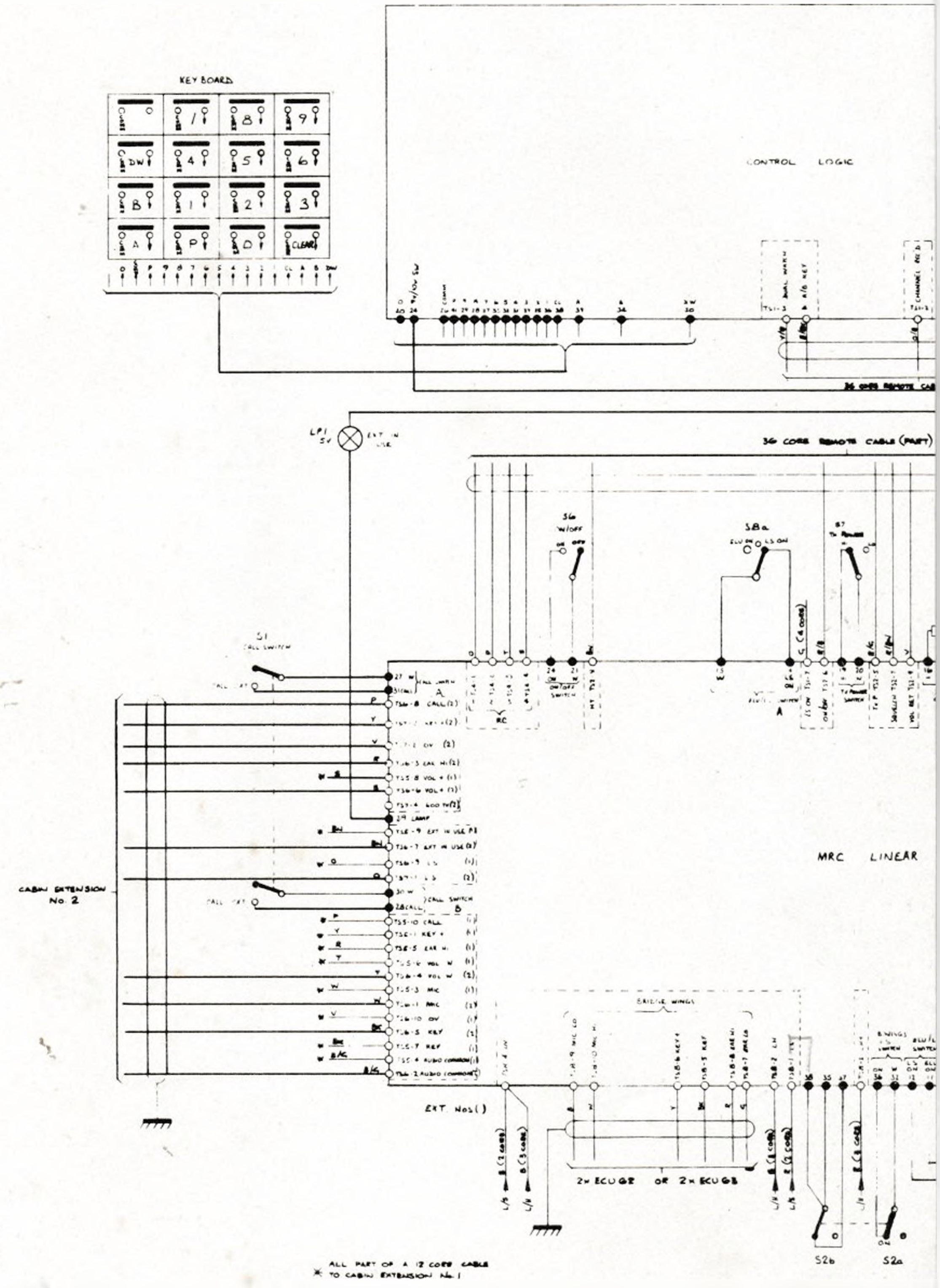


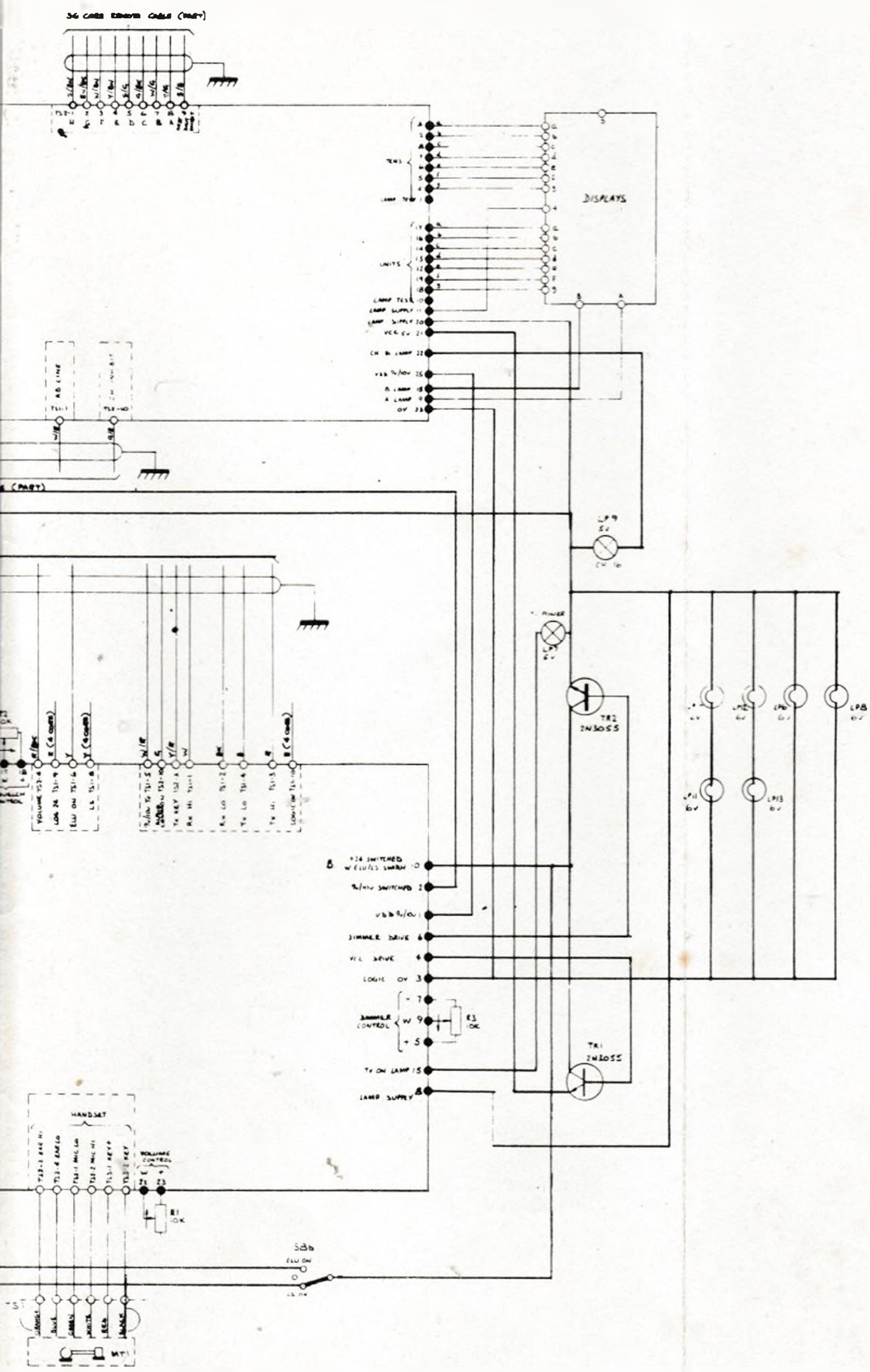
MRC Linear Circuits Fig 7.29





Location of Major Components MRC66


KEY BOARD
CONTROL LOGIC
36 CORE REMOTE CABLE (PART)
LP1
S1
CALL SWITCH
S6
S8a
S7
MRC LINEAR
CABIN EXTENSION No. 2
BRIDGE WINGS
EXT. Nos ( )
2x ECUG2 OR 2x ECUG3
S2b
S2a
ALL PART OF A 12 CORE CABLE TO CABIN EXTENSION No. 1



NOTES :

1/ THE 4 CORE & 36 CORE REMOTE CABLES ARE FITTED AT THIS STAGE. REMAINING CABLES ARE FITTED ON INSTALLATION.

2/ 4 CORE REMOTE CABLE CONNECTIONS :-

B TO TS1 - 10
R TO TS1 - 9
Y TO TS1 - 8
G TO TS1 - 7
} LINEAR PCB

3/ THERE ARE 4 UNUSED CORES ON THE 36 CORE REMOTE CABLE. THERE IS 1 UNUSED CORE ON BOTH THE 2 - 12 CORE CABLE EXTENSION CABLES

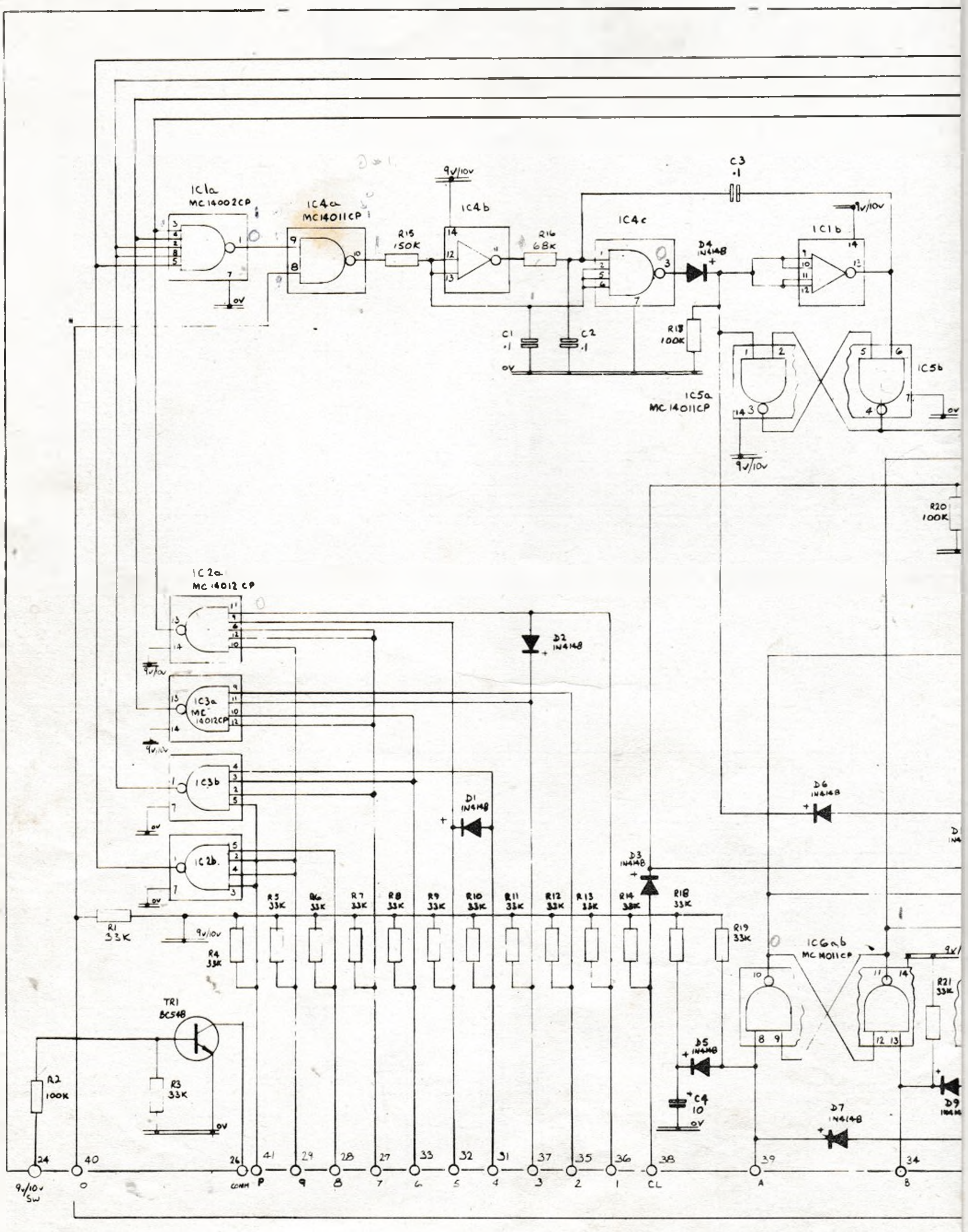
4/ LOUDSPEAKER CONNECTIONS :-

B TO TS8 - 4
R TO TS8 - 1
} LINEAR PCB

LOUDHAILER CONNECTIONS :-

B TO TS8 - 4
R TO TS8 - 3
G TO TS8 - 2
} LINEAR PCB

Interconnection diagram MRC66 Fig. 7.31


IC1a
MC14002CP
IC4a
MC14011CP
IC4b
IC4c
IC1b
C3
·1
R15
150K
R16
68K
D4
1N4148
R18
100K
C1
·1
C2
·1
IC5a
MC14011CP
IC5b
R20
100K
IC2a
MC14012CP
IC3a
MC14012CP
IC3b
IC2b
D1
1N4148
D2
1N4148
D3
1N4148
D6
1N4148
R1
33K
R2
100K
R3
33K
R4
33K
R5
33K
R6
33K
R7
33K
R8
33K
R9
33K
R10
33K
R11
33K
R12
33K
R13
33K
R14
33K
R18
33K
R19
33K
R21
33K
TR1
BC548
IC6ab
MC14011CP
D5
1N4148
D7
1N4148
C4
10
9v/10v
0v
9v/10v SW
0
COMM
P
9
8
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2
1
CL
A
B
24
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KEYBOARD