

CATALOGUE OF INFORMATION

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- 2 Table 1.1. gives a list of the text contained within this handbook to centre heading weight.

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Transmitter Specifications

Receiver Specifications

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ELECTRICAL SPECIFICATIONS

- 1 The electrical specifications of the manpack transceiver are divided into:
 - a Specifications common to transmitter and receiver.
 - b Transmitter specifications.
 - c Receiver specifications.

SPECIFICATIONS COMMON TO TRANSMITTER AND RECEIVER

- 2
 - a Type of equipment single sideband transceiver with compatible AM capability.
 - b Modes of operation
 - i A2J.
 - ii A3J on transmission and AM reception.
 - iii A3J upper sideband.
 - iv A3J lower sideband.
 - c Frequency range 2 to 29,999 MHz.
 - d Number of channels 28 000
 - e Channel spacing 1 kHz.
 - f Frequency setting by decade switches.
 - g Operational battery life before re-charging 14 hours for a cycle of 1 minute transmission and 9 minutes reception (voice).
 - h Frequency stability $\pm 1 \times 10^{-6}$ over a temperature range between -15°C and $+55^{\circ}\text{C}$.
 - j Antenna
 - i 2,315 m whip.
 - ii Open wire, 19 m long which may be reduced to 7 m by means of short circuits, so that the antenna operates on a quarter wave-length.
 - k Standing wave ratio (SWR) Less than 2.
 - m Battery unit
 - i fitted with built-in charger operating from a variable 10 V. to 30 V.d.c. supply.
 - ii can be charged either when coupled to the transceiver or separately.
 - iii composition: Nickel-cadmium.

2(m) (Continued)

- iv quantity: 12 4A-H cells.
- v charging ratio: c/10.
- vi rating 14,4 V.

TRANSMITTER SPECIFICATIONS

- | | | | |
|---|---|--|---|
| 3 | a | Transmitted power in A2 mode | |
| | b | Transmitted power in A3H mode | 20 W PEP into 50 Ohms during transmission at normal level. |
| | c | Transmitted power in A3J mode (LSB or HSB) | 6 W PEP into 50 Ohms during transmission at reduced level. |
| | d | Carrier and unwanted sideband rejection. | greater than 40 dB in A3J mode. |
| | e | Linearity (intermodulation products) | 25 dB. |
| | f | Harmonics | -40 dB with respect to peak power measured on dummy antenna). |
| | g | Dynamic af range | 15 dB approximately for constant transmitted power. |
| | h | Compression time | rise time 1,5 μ s approximately. |
| | j | Output protection | against short and open circuits. |
| | k | Continuous operation | not detrimental to the equipment. |

RECEIVER SPECIFICATIONS

4	a	Total bandwidth in A2 mode	300 Hz centred on 1 kHz at 6 dB.
	b	Total bandwidth in AM mode	3 kHz.
	c	Total bandwidth in A3J mode	2,7 kHz at 6 dB.
	d	Sensitivity in A3J mode for an input voltage of 0,4 μ V. in 500 Ohms	the signal and noise to noise ratio: 12 dB.
	e	Protection against first image frequency	90 dB.
	f	Protection against second image frequency	80 dB.
	g	Protection against first intermediate frequency	90 dB.
	h	Protection against interfering frequencies	for an interfering signal 15 ⁰ /o off tune from a wanted 2 μ V. SSB signal. The signal plus noise to noise ratio is 10 dB for an interfering signal amplitude of: 0,5 V. in the range 2 to 18 MHz. 0,4 V. in the range 18 to 25 MHz. 0,3 V. in the range 25 to 30 MHz. A SSB signal 100 dB above a wanted 2 μ V. SSB signal and 5 ⁰ /o off tune gives an output with a signal plus noise to noise ratio 10 dB.
	j	AF power output	i 10 mW in 300 Ohms with a signal distortion of less than 7 ⁰ /o. ii 20 mW in 130 Ohms.
	k	Automatic gain control	the a.f. level does not vary by more than 3 dB for an input voltage variation of 1 μ V. to 100 mW.

MECHANICAL SPECIFICATIONS

- 5 a Weight of transceiver fitted with antenna tuning unit and battery unit 7,865 kg.
- b Dimensions of transceiver fitted with antenna tuning unit and battery unit
Length 420 mm
Width 215 mm
Height 90 mm
- c Moisture fully watertight.
- d Resistance to vibration, bumps and shocks meets requirements for portable equipment.

GENERAL DESCRIPTION

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INTRODUCTION

- 1 The Manpack Transceiver Type RS B25 is an HF SSB communications transceiver suitable for carrying in the field in a harness.
- 2 The frequency range extends from 2 MHz to 30 MHz and it operates in the A2J (Morse), A3H (AM) and A3J (LSB lower sideband and HSB upper sideband) modes.
- 3 The frequency is selected by five front panel selection switches which control the output of a synthesiser giving a highly stable output. Selection is in 1 kHz steps and provides a total of 28 000 channels.
- 4 Antenna tuning is fully automatic and occurs each time a new frequency is selected and each time the transceiver is switched on.
- 5 Power for the transceiver is derived from a nickel-cadmium battery pack which provides for 12 to 15 hours operation in the A3J mode with a Transmit-Receive cycle of 1 minute to 9 minutes (normal speech).
- 6 When connected with a remote control unit the transceiver can be used by two different operators at a distance of up to 1,5 km between them.

SIMPLIFIED FUNCTIONAL DESCRIPTION

- 7 The transceiver can be conveniently divided into five separate functions as shown in Figure 2B.1 below.

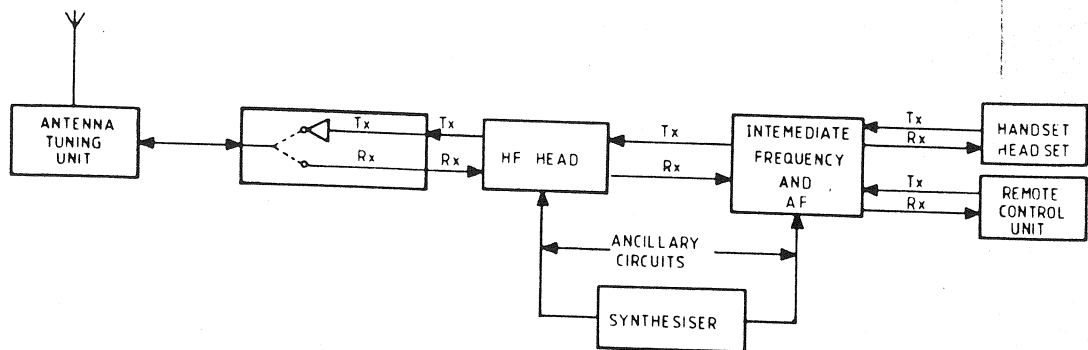


Fig. 2B.1 Simplified Block Diagram

- 8 The synthesiser provides a highly stable heterodyne frequency which is applied to the HF head and the IF section.
- 9 The HF head contains the receive and transmit r.f. amplifiers. During transmission the synthesiser is mixed with the intermediate frequency to generate the wanted r.f. signal. During reception the synthesiser output is mixed with the received r.f. signal to provide the intermediate frequency.
- 10 The i.f. section contains the i.f. amplification stages and the a.f. detector, and the modulator.
- 11 A 20 W r.f. amplifier provides two r.f. outputs, 20 W PEP or 6 W PEP into 50 Ohms in the A3H and A3J modes of operation.
- 12 The antenna tuning unit provides automatic matching of the antenna to the transceiver at all frequencies within the range 2 MHz to 30 MHz. Facilities are provided for connection to a whip antenna or an open wire antenna.

REMOTE CONTROL

- 13 When connected to a remote control unit two operators may, in turn, exchange information, transmit or receive a signal. However, the operator using the remote control cannot switch on the transceiver or select a frequency; these operations can only be carried out by the operator using the transceiver.
- 14 A block diagram of the remote control function is given in Figure 2B.2 below.

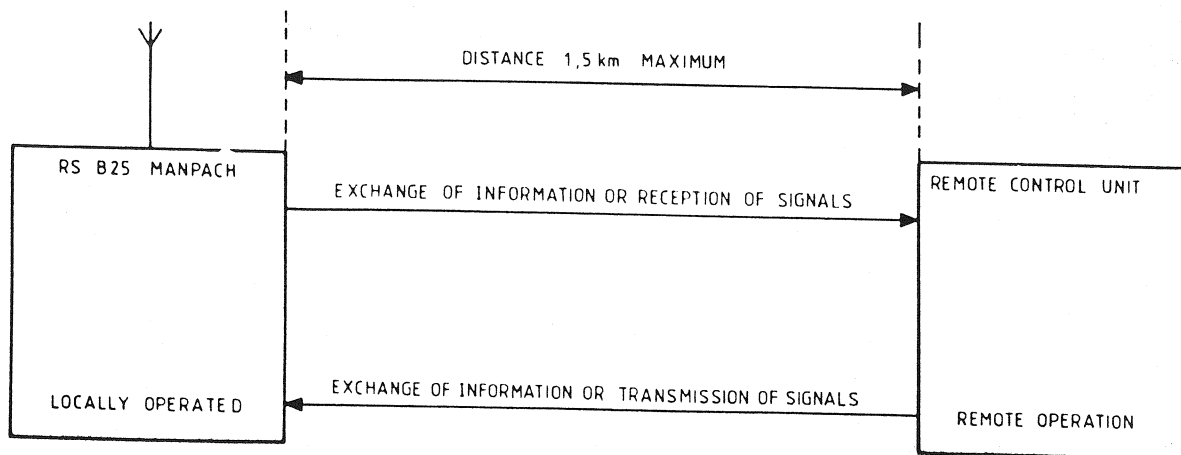


Fig. 2B.2 Remote Control Function
Block Diagram

ACCESSORIES

- 15 The complete manpack transceiver A1 includes the following accessories:
- a A2 Battery Unit.
 - b A3 Battery Unit.
 - c A4 Remote Control Unit.
 - d A5 Knee Operated Morse Keyer.
 - e A6 Open-wire Antenna.
 - f A7 Battery Charging Cable.
 - g A8 Telephone Handset.
 - h A9 Headset.
 - j A10 Harness.
 - k XXX1 Whip Antennna.
- 16 These accessories are illustrated in Figure 2B.3

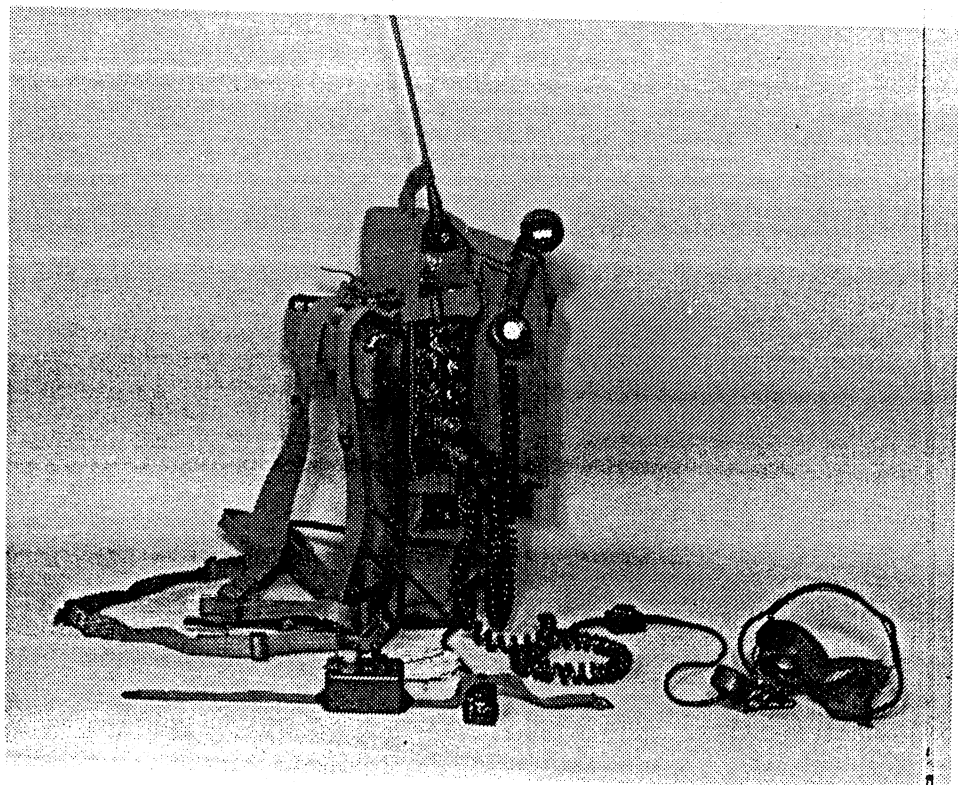


Fig. 2B.3 Manpack Transceiver and Accessories

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INTRODUCTION

- 1 The following operating instructions provide information on attaching the antenna, operating the transceiver in all modes and care and maintenance of the battery unit.
- 2 Operator maintenance is given at the end of this Part.
- 3 A separate operator's handbook is available for use in the field.
- 4 Reference to the front panel controls given in Figure 2C.1 should be made when reading the following instructions.

ANTENNA CONNECTION

- 5 Proceed as follows:
 - 1 Screw whip antenna into socket (13) on ATU.
 - 2 To connect open wire antenna unscrew knurled knob on top of whip socket (13). Insert antenna into slot behind whip socket and tighten down knurled knob.
 - 3 Before deploying wire antenna check that the correct circuit is opened as shown on the winding frame.

OPERATION OF TRANSCEIVER

- 6 To operate the transceiver, proceed as follows:
 - 1 Plug the handset into one of the sockets (19, 20). The second socket may be used to connect a headset or morse key.
 - 2 Select the required frequency of operation by means of switches (4 to 8). The frequency is read directly off the switches.
 - 3 Select the required mode of operation: HSB, LSB, AM or MORSE by means of switch (9).
 - 4 Select the antenna in use, whip or open wire, by means of switch (12) on the antenna tuning unit. Positions '——' and '50 Ohms' of switch (12) are used only in the mobile role together with 50 Ohm output socket (11) (see separate handbook).
 - 5 Switch RC selector switch (17) to remote control off 'O'.
 - 6 Switch RF selector switch (10) to 'L' (low power) or 'H' (high power) as required. This switches transceiver ON.
 - 7 Adjust volume control (16) to give the required audio level in the earpiece. To increase the level turn clockwise. When the tone in the earpiece disappears the transceiver is ready for reception. The tone indicates that automatic tuning is taking place.

6 (Continued)

- 8 Automatic tuning takes place after each change of frequency, each time the transceiver is switched on and on request by pressing switch Y (3).
- 9 To transmit press the pressel switch on the handset and speak normally into the mouthpiece. When the pressel switch is released the transceiver reverts to the receive mode.
- 10 To operate in the MORSE mode connect a morse key to any of sockets (19) or (20), leaving the handset connected to the other socket. Set mode switch (9) to MORSE and operate the morse key. If a morse key is not available the pressel switch on the handset can be used.
- 11 Moisture indicator (14) should be pink. Blue indicates that moisture has entered the equipment.

SIDETONE

- 7 The sidetone heard in the earpiece conveys the following information:
 - a Sidetone present
 - i Battery OK.
 - ii Antenna current OK.
 - b Sidetone not present
 - i 15 Minutes of operation left before battery is flat.
 - ii Antenna connection poor.
 - iii Antenna is shielded.
- 8 If the antenna is shielded by buildings etc. move the transceiver for optimum position, retune and check for sidetone. With a wire antenna check that correct circuit is open.

REMOTE CONTROL OPERATION

- 9
 - 1 Connect telephone lines from remote control unit to terminals (18) on the transceiver and the terminals on the remote control unit.
 - 2 Set RC switch (17) to position '⊙'.
 - 3 Both local and remote operators can now communicate with each other without transmitting and they are both able to receive incoming signals.
 - 4 To call each other the local operator sets switch (17) to the spring return position 'CALL', and the remote operator presses the call switch on the remote control unit.
 - 5 For either operator to transmit he must press his own pressel switch and speak into the mouthpiece. Local volume control sets level for both local and remote operators.

CLOSING DOWN THE STATION

- 10 To close down the station:
 - 1 Set RF selector switch (10) to position 'O' (off).
 - 2 Disconnect the antenna.
 - 3 Disconnect the handset and morse key.
 - 4 Stow the various accessories in the harness.

OPERATOR MAINTENANCE

- 11 a All external parts of the transceiver should be kept clean by using a soft dry cloth.
- b Special care should be taken of the handset, antenna and battery.

FAULT LOCATION AND REPAIR

- 12 The following table gives symptoms of common faults that can be investigated by the operator and rectified by the actions recommended. If these actions do not restore the equipment to a serviceable condition, the equipment must be returned for second line repair by technical personnel.

TABLE 1.1.	FAULT LOCATION	
SYMPTOMS	PROBABLE CAUSE	ACTIONS
No background noise	RF switch to 'OFF' position volume control turned down Faulty handset Faulty battery unit	Position RF switch to L or H. Increase level by turning volume control knob clockwise. Clean connector contacts, check for good aspect of the connector. Replace handset. Mount spare battery unit.
Poor receiving conditions	Damp antenna base Site unsuitable Volume control turned down Faulty handset Low battery	Wipe it dry. Change for a more open site. Increase volume control by turning knob clockwise. Replace handset. Mount spare battery unit.
Background noise does not disappear in transmission	Faulty handset	Replace handset.
Send signal not received at the far end	Site unsuitable Not in the correct mode of operation Low battery	Change for a more open site. Select the required mode of operation. Mount spare battery unit.
Send signal not heard in earpiece	Antenna disconnected	Check antenna mounting. Operator must stay clear of antenna during operation.

Further investigations are to be carried out by the maintenance personnel and not by the operator.

BATTERY PACK
CHARGING AND OPERATING INSTRUCTIONS

- 13 The RS B25 Battery Pack consists of a sealed charger unit and 12 x 1,2 Volts, 4 Amp hour nickel cadmium batteries giving 14,4 V.dc.
- 14 The batteries may be charged from an external dc. source with a voltage range of between 10 to 30 V.dc.

Charging Time

- 15 The nominal charging time is 14 hours with an ambient temperature of 15° C to 25°C.
- 16 The maximum charging time is greater than 20 000 hours within an ambient temperature higher than 0° C.
- 17 The following table shows the available capacity after storage:

TABLE 1.2	BATTERY STORAGE	CAPACITY
Percentage of Total Capacity Available	Number of Days in Store	Storage Temperature
80%	180 days	0° C
50%	70 days	20° C
50%	25 days	30° C

- 18 The Battery Pack is fitted with its own built-in charger.

Charging Instructions

- 19 To charge the Battery Pack follow the following short steps.
- 1 Disconnect the Battery Pack from the B25.
- OR
- 2 Ensure that the B25 is switched off.
 - 3 Connect the charging lead to the Battery Pack.
 - 4 Connect the opposite side of the charging lead to one of the following : taking note of Polarity. Red – Positive
Black – Negative.
 - 1 A 12 Volt vehicle battery.
 - 2 A 12 Volt Bench Type Power Supply.
 - 3 A dc. source between 10 and 30 Volts.

- 20 Leave the Battery Pack on charge for as long as possible. (A minimum of 14 hours is required to restore a completely discharged battery to full capacity).
- 21 It must be noted that no standing load must be left on these batteries ie. DO NOT leave the set on with batteries that are in a state of discharge (in other words nearly flat).

STORAGE

- 22 The VR nickel cadmium cells may be stored for very long periods at temperatures from -40°C to $+50^{\circ}\text{C}$ IN ANY STATE OF CHARGE without permanent deterioration.

SAFETY PRECAUTIONS

- 23 The nickel cadmium cell is capable of delivering approximately 40 Amps when shorted, therefore care must be taken to avoid this as a short can cause a fire hazard and also permanent damage to the battery.

MAXIMUM RIPPLE

- 24 The following graph gives the maximum ripple at 100 Hz allowable for the supply voltage to charge the battery pack.

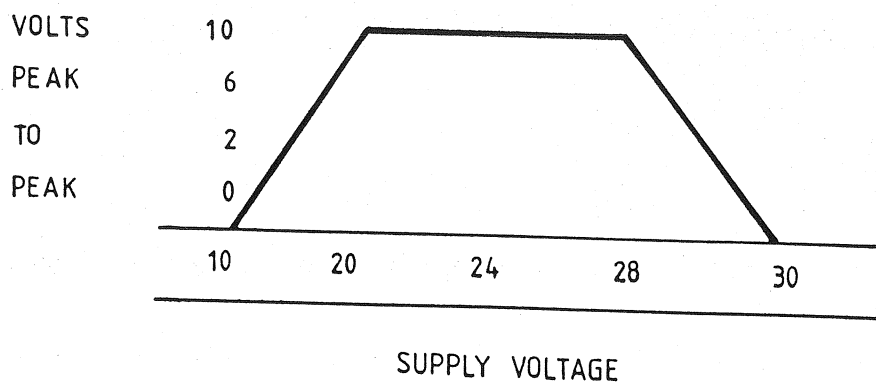


Fig. 2C.2 Battery Charging Ripple Graph

SUPPLEMENTARY INFORMATION

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- CHAPTER 1 LOGIC SYMBOLS
- CHAPTER 2 NICKEL CADMIUM BATTERIES

LOGIC SYMBOLS

CONTENTS

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INCLUSIVE OR Logic Function	2D.1.3
EXCLUSIVE OR Logic Function	2D.1.4
LOGIC NOT Function	2D.1.5
'D' Type Flip-Flop	2D.1.6

INTRODUCTION

- 1 The following paragraphs give definitions and truth tables for various logic symbols used in this equipment and are included to assist technical personnel in understanding circuits contained in the transceiver and ATU.

'AND' LOGIC FUNCTION

- 2 The AND function is shown in Fig. 2D.1.1 below:



Fig. 2D.1.1 **AND Logic Function**

The logic equation for output signal F is:

$$F = A.B$$

The truth table is as follows:

INPUTS		OUTPUT
A	B	F
High	High	High
'1'	'1'	'1'
High	Low	Low
'0'	'0'	'0'
Low	High	Low
'0'	'1'	'0'
Low	Low	Low
'0'	'0'	'0'

'NAND' LOGIC FUNCTION

- 3 The NAND function is shown in Fig. 2D. 1.2. below:



Fig. 2D.1.2 **NAND Logic Function**

3 (continued)

The logic equation for output signal F is:

$$F = A.B = A + B$$

The truth table is as follows:

INPUTS		OUTPUTS
A	B	F
High	High	Low
'1'	'1'	'0'
High	Low	High
'1'	'0'	'1'
Low	High	High
'0'	'1'	'1'
Low	Low	High
'0'	'0'	'1'

LOGIC INCLUSIVE OR FUNCTION

4 The INCLUSIVE OR function is shown in Fig. 2D.1.3 below:

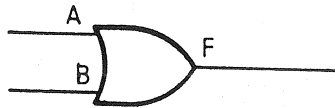


Fig. 2D.1.3 INCLUSIVE OR Logic Function

4 (continued)

The logic equation for output signal F is:

$$F = A + B$$

The truth table is as follows:

INPUTS		OUTPUT
A	B	F
High	High	Low
'1'	'1'	'0'
High	Low	Low
'1'	'0'	'0'
Low	High	Low
'0'	'1'	'0'
Low	Low	High
'0'	'0'	'1'

EXCLUSIVE OR LOGIC FUNCTION

5 EXCLUSIVE OR Logic Function is shown in Fig. 2D.1.4 below;



Fig. 2D.1.4 **EXCLUSIVE OR Logic Function**

The logic equation for output F is:

$$F = A.B + AB = A + B$$

The truth table is as follows:

INPUTS		OUTPUT
A	B	F
High	High	Low
'1'	'1'	'0'
High	Low	High
'1'	'0'	'1'
Low	High	High
'0'	'1'	'1'
Low	Low	Low
'0'	'0'	'0'

LOGIC 'NOT' FUNCTION

6 The logic NOT function is shown in Fig. 2D.1.5 below:

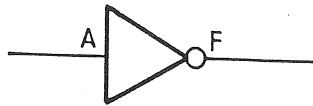


Fig. 2D.1.5 **LOGIC NOT Function**

The logic equation for output signal F is:

$$F = \bar{A}$$

The truth table is as follows:

INPUT	OUTPUT
A	F
High	Low
'1'	'0'
Low	High

D TYPE FLIP-FLOP

7 The 'D' Type FLIP-FLOP function is shown in Fig. 2D.1.6 below:

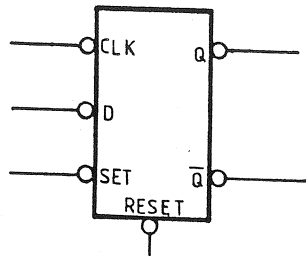


Fig. 2D.1.6 **D Type FLIP-FLOP**

- a The Q output of the D type flip-flop will go to the same level as the D input ('1' or '0') when the clock signal is active.
- b This transfer occurs only after time τ , called the transfer time, being in the order of a few nano-seconds, which in most cases can be considered negligible. The Q output is always the complement of the Q output.
- c An active input to reset terminal R forces output signal Q to '1' and Q to '0'. As long as the R input is active the clock pulses will have no effect on the Q and Q outputs.
- d An active input to set terminal S forces output signal Q to '1' and Q to '0'. As long as the S input is active the clock pulses will have no effect on the Q and Q outputs.

NICKEL CADMIUM BATTERIES

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	Fig No.
The VR Cell	2D.2.1

INTRODUCTION

- 1 The following paragraphs contain some general information on the RS B25 Batteries.

MAINTENANCE AND COMMISSIONING

- 2 Unlike the vented or open cell battery the sealed VR battery requires no maintenance and no commissioning procedure.

STORAGE

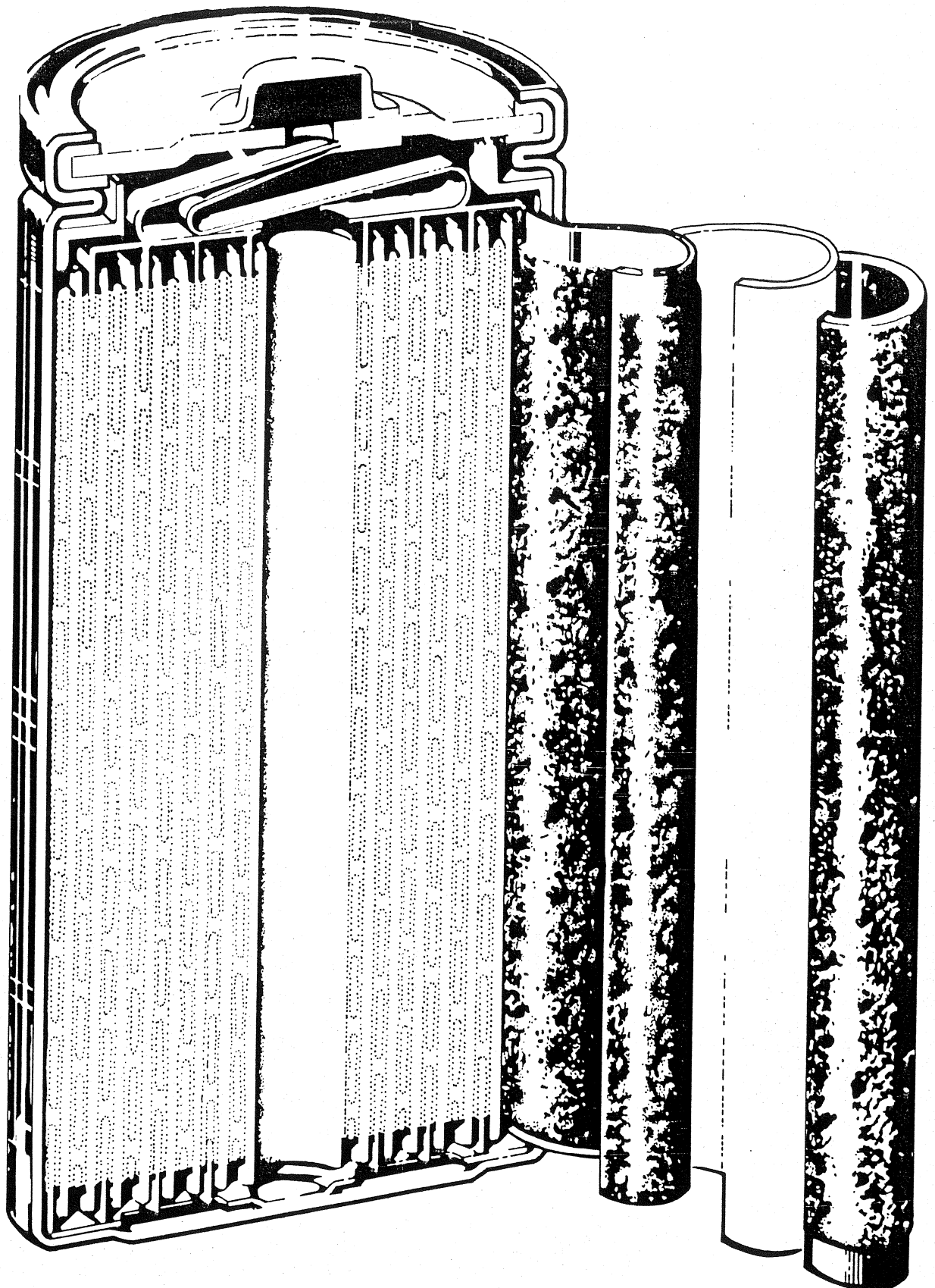
- 3 The VR sealed cells maybe stored for long periods at temperatures from -40°C to $+50^{\circ}\text{C}$ IN ANY STATE OF CHARGE without permanent deterioration.

DANGERS

- 4 VR Cells are capable of delivering very high peak discharge currents. The B25 batteries are capable of 40 Amp's when shorted out.
- 5 Due to this high current, arcing can occur and can become a fire hazard.
- 6 The VR cell is:-
 - a Free of maintenance.
 - b Compact.
 - c Shock proof.
 - d Vibration proof.

IMPORTANT POINTS

- 7 The following are some points to note about VR cells.
- 8 Loads connected across the battery must be of an intermittent nature only, that is, controlled by an external switching mechanism.
- 9 This point cannot be over stressed. So much so that it would be advantageous to explain the reasoning behind this statement.
- 10 We shall take some hypothetical values for this explanation.
- 11 The B25 battery is a 4 AH Battery and it is charged at 350 mA.
- 12 The B25 Radio draws 500 mA on receive and 3 amps on transmit.
- 13 Thus if the battery was connected to a set that was on and also connected to an external source, the charger would supply 350 mA but the battery would have to supply 150 mA to make up the 500 mA that the set is using.
- 14 Accordingly the battery would run flat.
- 15 All VR cells have a self resealing safety valve. This renders the cells safe against accidental misuse. Such as extreme over or reverse charging. The valve opens at approximately four atmospheres of internal pressure and ejects electrolyte. The pressure then falls and the valve reseals.
- 16 A cell that has ejected electrolyte should be replaced as soon as possible.



The VR Cell

SYSTEM TECHNICAL DESCRIPTION

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SYNTHESISER

INTRODUCTION

- 1 The synthesiser produces an accurate signal in the range 104,5 MHz to 132,5 MHz for use as the heterodyne frequency in the transmit and receive circuits of the transceiver. The output frequency is any whole number of kilohertz to correspond with the communication frequency selected by front panel switches.
- 2 Generation of the synthesiser frequencies is based on the use of two voltage controlled oscillators contained in two phase locked loops; main loop and secondary loop.

PRINCIPLE OF THE PHASE LOCKED LOOP

- 3 The principle of the phase locked loop is shown in Figure 3A.1.

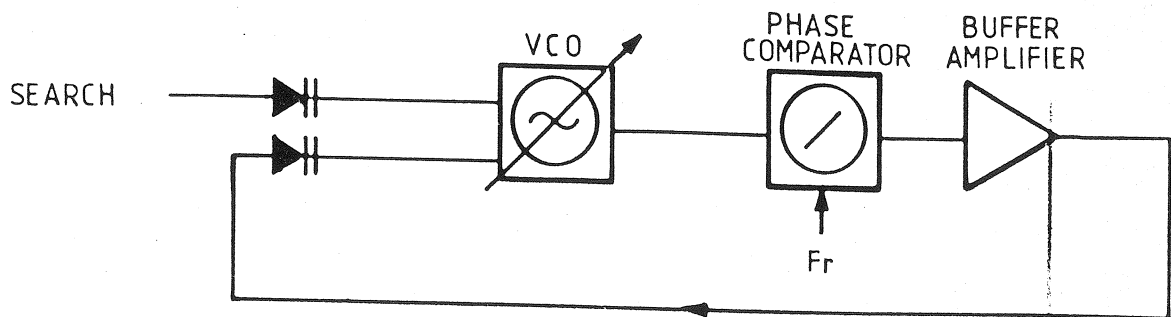


Fig. 3A.1

Basic Phase Locked Loop

- 4 The VCO output frequency is determined by the dc. voltage applied to the varicap diode anode. The capacitance of the varicap diode decreases with an increase in the dc. voltage and hence reduces the VCO frequency. Conversely, if the dc. voltage is reduced the varicap capacitance and hence the VCO frequency increases. A capacitance/voltage curve for the varicap diode is given in Figure 3A.2.
- 5 In the phase locked loop the VCO output is fed to a phase comparator together with a reference frequency F_r derived from a stable source. The output of the phase comparator is a dc. error voltage, proportional in sign and magnitude to the difference in phase between the VCO output frequency and the reference frequency F_r .

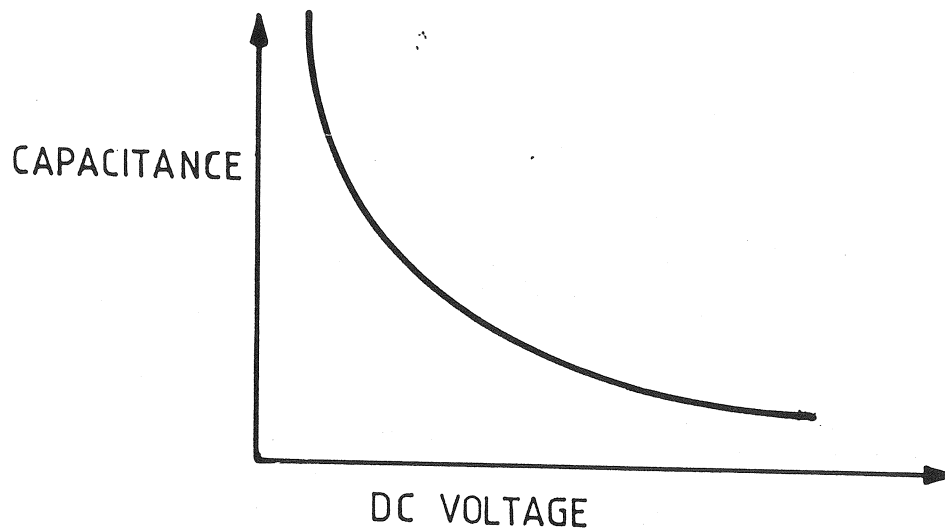


Fig. 3A.2

Varicap Diode C/V Curve

- 6 This control voltage is fed to varicap diode No 1, causing its capacitance to vary such as to bring the VCO frequency exactly into phase with that of the reference frequency.
- 7 As the loop gain is insufficient for lock when the difference in the VCO and reference frequencies is large, a second varicap diode (No 2) is used to bring the VCO frequency into locking range. A search is carried out in steps, each step applying a dc. control voltage to varicap diode No 2, until lock is achieved. Control then reverts to varicap N 1 which keeps the VCO output frequency stable.

PRINCIPLE OF OPERATION OF THE SYNTHESISER

- 8 In the RS B25 Manpack the synthesiser uses two phase locked loops:-
 - a The main loop which operates with a step of 200 kHz
 - b The secondary loop which operates within the main loop with a step of 1 kHz repeated every 200 kHz.
- 9 A block diagram of the two loops is shown in Figure 3A.3.

Main Loop

- 10 The VCO output 'F_m' is applied to the main loop mixer together with the stepped 1 kHz (repeated every 200 kHz) from the secondary loop.
- 11 The mixer output is divided by 4 and applied to a variable preset divider. The divisor of this circuit is controlled by the 10 MHz, 1 Mhz and 100 kHz frequency selector switches. The signal from this divider 'F_d' is fed to the phase comparator, to which is also fed a 25 kHz stable reference frequency 'F_r'.
- 12 If a difference in phase exists between 'F_d' and the reference frequency 'F_r' a dc. error voltage will be produced proportional in magnitude to the amount of error and in sign to a positive or negative phase difference.
- 13 If the difference in 'F_m' and 'F_r' is large a search generator also controlled by the reference frequency produces a stepped voltage which brings the VCO frequency into locking range.

Secondary Loop

- 14 The signal applied to the main mixer from the secondary loop is derived from a similar phase locked VCO as that in the main loop.
- 15 The output of this VCO is applied to the secondary loop mixer together with a 100 MHz reference signal from a crystal oscillator.
- 16 The secondary mixer output is applied to a variable preset divider, its divisor being controlled by the 100 kHz, 10 kHz and 1 kHz frequency selector switches.
- 17 The divider output 'Fd' is compared in a phase comparator with 1 kHz reference frequency 'Fr'. The error signal produced by the phase discriminator controls the frequency of the secondary loop VCO.
- 18 The following table shows the output frequencies of both VCO's for a specific frequency.

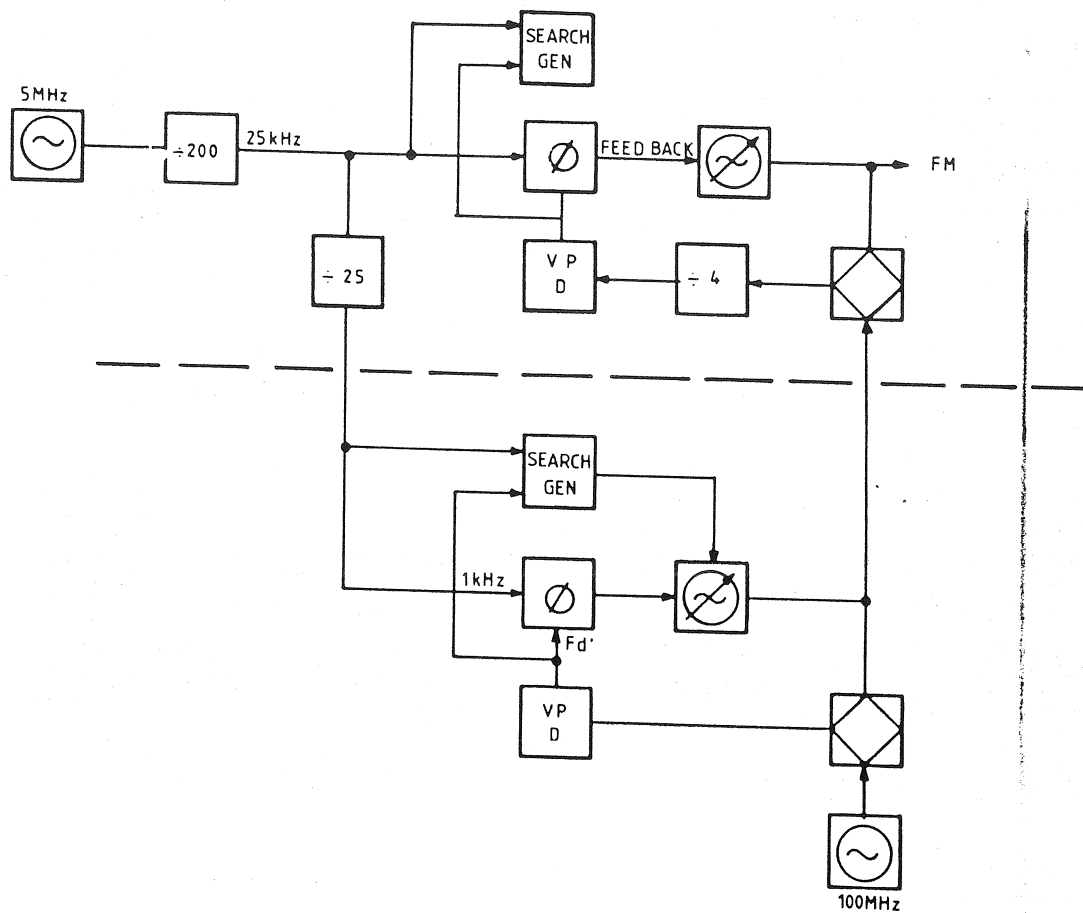


Fig. 3A.3

Main and Secondary Loops Block Diagram

FREQUENCY SETTING	FREQUENCY OF VCO	FREQUENCY OF VCO
kHz	MHz	MHz
02000	104,500	100,500
02050	104,550	100,550
02100	104,600	100,600
02199	104,699	100,699
02200	104,700	100,500
03600	105,500	100,500
05000	107,500	100,500
10000	112,500	100,500
15000	117,500	100,500
20000	122,500	100,500
29000	131,500	100,500
29999	132,499	100,699

MAIN CIRCUITS

Search Signal Generator

- 19 A search generator is provided for both main and secondary loops. A dual flip-flop frequency discriminator produces pulses from one flip-flop when 'Fm' is higher than 'Fr' and from the second flip-flop when 'Fr' is higher than 'Fm'. If the frequencies are the same no pulses are produced.
- 20 When a frequency difference is detected, the output pulses are fed to a binary counter which in turn produces clock pulses to drive a digital to analogue converter. The binary input is converted to a stepped voltage by the D/A converter. This stepped voltage controls the VCO frequency.
- 21 Figure 3A.4 shows the waveform of the stepped voltage.

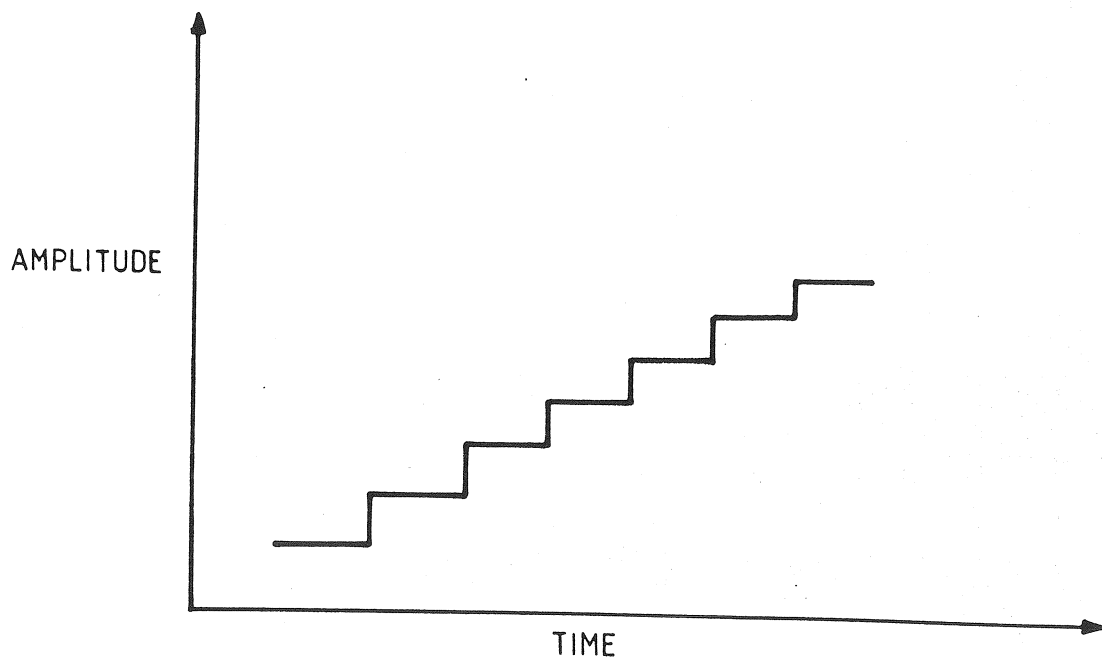


Fig. 3A.4

Stepped Voltage Waveform

Phase Comparator

- 22 The phase comparator is conventional sample and hold circuit which produces a dc. error signal proportional to the phase difference between the VCO and reference frequencies.

Variable Preset Divider

- 23 A functional block diagram of the main loop variable preset divider is shown in Figure 3A.5.
- 24 The VCO oscillator output is mixed with the received signal in the range 2–29 999 kHz, the mixer output being 102,5 MHz. This is fed via a IF bandpass filter to the transmit and receive circuits.
- 25 Frequency F2 from the VCO is set by the 10 MHz, 1 MHz and 100 kHz frequency selector switches and is expressed by the relation:—
- $$F2 = 102,5 \text{ MHz} + (2 \text{ to } 29,999 \text{ MHz})$$
- $$F2 = 104,5 \text{ to } 132,499 \text{ MHz}$$
- 26 F2 is fed to the main loop mixer together with frequency F3 from VCO.

27 Frequency F4 the mixer is set by the 100 kHz, 10 kHz and 1 kHz frequency selector switches and is expressed by the relation:

$$F4 = F2 - F3$$

Thus: the minimum value of F4

$$= 104,5 - 100,5 = 4 \text{ MHz}$$

The maximum value of F4

$$= 132,499 - 100,699 = 31,8 \text{ MHz}$$

The range of F4 varies in 200 kHz steps depending on the frequency selector switch settings.

28 Frequency F5 ($F4 \div 4$) is similarly dependent on the frequency selector switch settings and has a range of 1 to 7,95 MHz in 50 kHz steps.

29 The variable preset divider produces a fixed frequency 'Fo' of 25 kHz from any 'F5' frequency input. To achieve this output the division ratio Do must be:

$$\text{Do minimum} = 1000 \quad 25 = 40$$

$$\text{Do maximum} = 7950 \quad 25 = 318$$

Spacing of two consecutive division ratio is therefore:

$$50 \quad 25 = 2$$

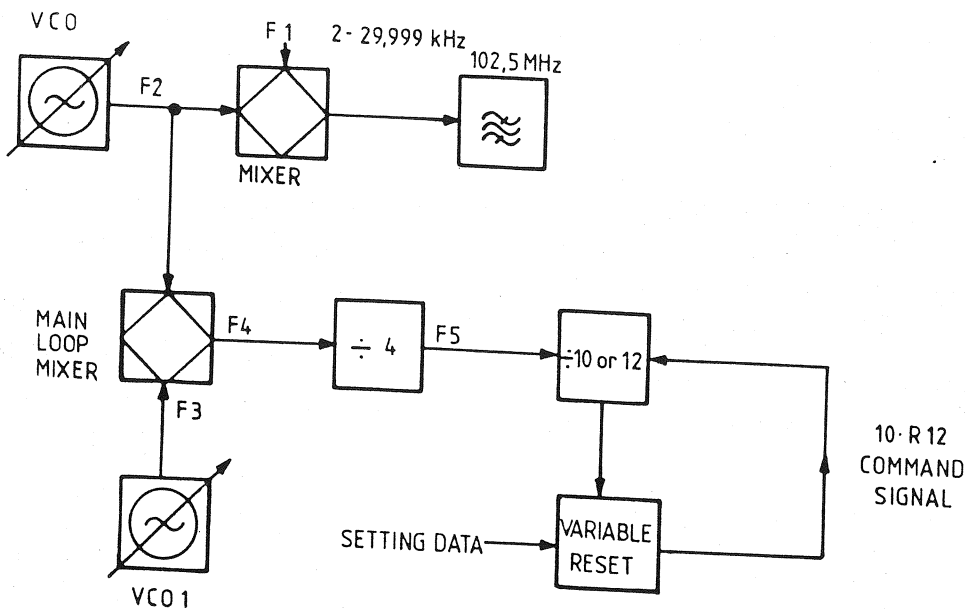


Fig. 3A.5

**Variable Preset Divider
Functional Block Diagram**

- 30 Over the whole range the division ratios are:-
40-42-44-46-48-50-52 314-216-318.
- 31 Each division ratio is obtained through a divide by ten or divide by twelve divider which determines the total number of divisions to be carried out depending on the settings of the 10 MHz, 1 MHz and 100 kHz frequency selection switches. At the end of each counter the main loop reset signal is generated.
- 32 At the beginning of the cycle the division by twelve command is generated. When the required number of division by twelve is completed the variable preset divider generates the division by ten command. The number of divisions by ten corresponds to the division rank of the divider rank of the divider less the number of divisions by twelve.
- 33 When the divisions by ten is completed an end of division signal (main-loop reset) is generated. This resets the preset divider to its initial condition.
- 34 Certain frequencies do not require division(s) by twelve but all frequencies require division by ten except 2,800 MHz.
- 35 The following table gives examples of the overall division, the rank of the divider, and the number of divisions by ten and/or twelve.

SETTING kHz	OVERALL DIVISION	DIVISION RANK	NO. OF DIVISIONS BY 12	NO. OF DIVISIONS BY 10
02000	40	4	0	4
02200	42	4	1	3
02400	44	4	2	2
02600	46	4	3	1
02800	48	4	4	0
03000	50	5	0	5
03200	52	5	1	4
03400	54	5	2	3
03600	56	5	3	2
03800	58	5	4	1
04000	60	6	0	6
048000	68	6	4	2
05000	70	7	0	7
10000	120	12	0	12
15000	170	17	0	17
20000	220	22	0	22
25000	270	27	0	27
29000	310	31	0	31
29800	318	31	4	27
29999	318	31	4	27

- 36 The theory of operation of the variable preset divider in the secondary loop is similar to that described for the main loop. The division ratios are dependent on the settings of the 100 kHz, 10 kHz and 1 kHz frequency selection switches.
- 37 Frequency F3 from VCO's varies from 100,5 MHz to 100,699 MHz every 200 kHz. As the fixed frequency applied to the secondary loop mixer is 100 MHz the division rank of the variable divider changes for each frequency setting and ranges from 500 to 699.

SYNTHESISER FUNCTIONAL DESCRIPTION

- 38 The following functional description of the synthesiser makes reference to Figure 3A.6.
- 39 The VCO in the HF Head is controlled by three dc. voltages:—
- The sub-band voltage generated by the sub-band control of the Frequency Selector.
 - The alignment voltage (pre-positioning or search) generated by the D/A converter which, in turn, is controlled by the frequency discriminator, both units of which are located on Synthesiser Board No. 2.
 - The feedback control voltage generated by the phase comparator located on Synthesiser Board No. 2.
- 40 The 25 kHz reference frequency is derived by a temperature compensated crystal oscillator (TCXO) oscillating at 5 MHz. This signal is divided by 2 and then by 100 (both dividers located on Synthesiser Board No. 2). Thus producing the reference frequency of 25 kHz required for operation of the main loop.
- 41 The 1 kHz reference frequency required for the secondary loop is derived from the 25 kHz reference frequency through a divide by 25 divider located on Synthesiser Board No. 2.

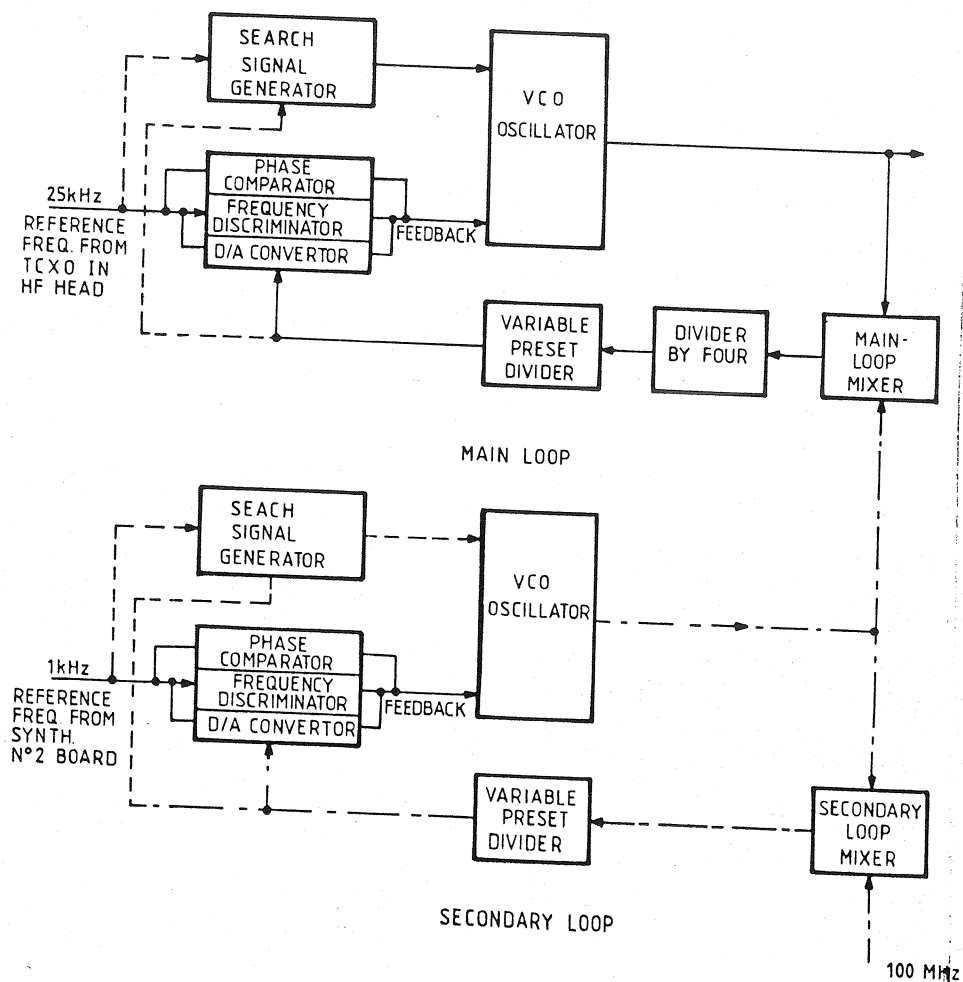


Fig. 3A.6

RS B25 Synthesiser
Functional Block Diagram

Operation of Main Loop

- 42 The 25 kHz reference frequency is applied to the phase comparator, frequency discriminator and D/A converter. A signal from the variable preset divider, located in the frequency selector is also applied to each of these units. This signal is dependent on the settings of the communication frequency.
- 43 The main loop, however, is dependent only on the 10 MHz, 1 MHz and 100 kHz (even values only) frequency selection switches.
- 44 When the frequency of the signal from the variable preset divider is very different to the 25 kHz reference frequency (e.g. on change of communications frequency) the frequency discriminator and the D/A converter produce a stepped voltage output which is applied to the alignment varicap of the VCO in the HF Head. This control voltage is produced until the feedback loop is locked. From then on the VCO is controlled by the error signal from the phase comparator.
- 45 The output frequency of the VCO will be in the range 104,5 to 132,499 MHz dependent on the settings of the frequency selector switches.
- 46 After amplification this signal is:—
- a used as a variable heterodyne frequency in the transmit and receive circuits of the transceiver.
 - b applied to the main loop mixer, located on Synthesiser Board No. 1. The mixer also receives a signal from the secondary loop in the frequency range 100,5 to 100,699 MHz dependent on the settings of the 100 kHz, 10 kHz and 1 kHz frequency selector switches. This frequency range has steps of 1 kHz repeated every 200 kHz.
- 47 The frequency of the signal from the main loop mixer varies from 4 to 31,8 MHz and is applied to a divide by 10 or 12 divider via a divide by 4 divider. The rank (or command) signal, defining a divide by 10 or a divide by 12 operation is generated by the variable preset divider which is controlled by the frequency selector switches.
- 48 The division ratio of the preset divider ranges between 4 and 31 to produce a 25 kHz signal.
- 49 This signal is applied to the phase comparator, where it is compared with the 25 kHz reference signal, any phase difference producing the feedback error signal to control the VCO.

Operation of the Secondary Loop

- 50 The 1 kHz reference signal is applied to the phase comparator, frequency discriminator and D/A converter on Synthesiser Board No. 1.
- 51 These three units also receive a 1 kHz signal from the variable preset divider in the Frequency Selector, which is controlled by the 100 kHz, 10 kHz and 1 kHz frequency selector switches.
- 52 When the difference between the 1 kHz reference frequency and the frequency from the variable preset divider is large, the frequency discriminator and D/A converter generate a stepped voltage output which is applied to the alignment varicap of VCO on Synthesiser Board No. 1. This control voltage is produced until the feedback loop is locked. From then on VCO is controlled by the error signal from the phase comparator.

- 53 The output frequency of VCO will be in the range 100,5 MHz to 100,699 MHz dependent on the settings of the frequency selection switches.
- 54 After amplification this signal is:—
- applied to the main loop mixer
 - applied to the secondary loop mixer on Synthesiser Board No. 3, which also receives a 100 MHz signal from the crystal oscillator located on Synthesiser Board No. 3.
- 55 The frequency of the signal from the secondary loop mixer varies from 500 to 699 kHz and is applied to the variable preset divider, the division ratio of which is controlled by the frequency selector switches to be in the range 500 to 699. This produces a 1 kHz output for all frequency selectors.
- 56 This signal is applied to the phase comparator on Synthesiser Board No. 1 where it is compared with the 1 kHz reference signal, any phase difference producing the feedback error signal to control VCO.

Operation of Ancillary Circuits

- 57 The ancillary circuits located on Synthesiser Board No. 3 generate the following signals:—
- A 100 MHz signal in the A2J (MORSE), A3H (AM) or A3J upper sideband modes of operation selected by the front panel mode switch. This signal acts as a fixed heterodyne signal for the transmit and receive circuits of the transceiver.
 - A 105 MHz signal in the A3J lower sideband mode of operation. This signal also acts a fixed heterodyne signal for the transmit and receive circuits of the transceiver.
 - A 2,5 MHz signal used as a fixed heterodyne signal in the transmit and receive circuits of the transceiver.
- 58 In the MORSE HSB and AM positions of the mode selector switch a +6V supply enables amplifier 203 which allows the 100 MHz through from the crystal oscillator. Filter 201 matches the signal to the output.
- 59 In the LSB mode the +6 V supply enables mixer Z02 which is fed with two signals:
- 100 MHz signal from the crystal oscillator.
 - 5 MHz signal from the TCX0 .
- 60 The sum frequency signal of 105 MHz is matched to the output by filter Z01 which is also enabled by the +6 V supply.
- 61 The 2,5 MHz signal is derived from the divide by 2 divider on Synthesiser Board No. 2.
- 62 The 1 kHz signal from the divide by 25 divider on Synthesiser Board No. 2, is used as a tone in the Morse Mode or by the antenna tuning unit during tuning.

RECEPTION CHANNEL

- 63 The received signal, in the frequency range 2 MHz to 30 MHz, from the 20 W amplifier is applied to the reception mixer in the HF head module via an input protection circuit and a 2 MHz to 30 MHz filter.
- 64 Also fed to the reception mixer is the variable heterodyne signal (104,5 MHz to 132,5 MHz) which is derived from the synthesiser through transmit/receive switching diodes.
- 65 The 102,5 MHz signal from the reception mixer is applied to the IF 2,5 MHz and 102,5 MHz mixer module via transmit/receive switching diodes and a 102,5 MHz crystal filter.
- 66 Transmit/receive switching diodes route the 102,5 MHz signal through a filter to an a.g.c. controlled amplifier and from the amplifier to the mixer.
- 67 The mixer is also fed with a fixed 100 MHz (Morse, AM or USB mode) or 105 MHz (LSB mode) heterodyne signal via an amplifier.
- 68 The mixer 2,5 MHz output signal is routed by transmit/receive switching diodes through an amplifier to the 2,5 MHz filter and IF module.
- 69 Depending on the mode of operation, transmit/receive switching diodes route the signal through an amplifier and A3H filter (AM mode) or to an amplifier and SSB and A2J filters through transmit/receive switching diodes (Morse, LSB, USB modes).
- 70 Outputs from both these circuits are applied to a common amplifier and then through transmit/receive switching diodes to a second amplifier which is controlled by the a.g.c.
- 71 Again, depending on the mode of operation, the signal is fed either to an SSB and A2J demodulator (Morse, LSB, USB modes) or an A3H detector via an impedance matching circuit.
- 72 The mode selector routes the detected output to a second mode selector on the AF board either directly to an AF amplifier (via the mode selector) or through a filter (via the mode selector). This amplifier has its gain controlled by the Volume Control.
- 73 The output from this amplifier is fed through a second amplifier to the local earphone or via the remote control amplifier to a remote control panel.

TRANSMISSION CHANNEL

- 74 When operating in the A3H or A3J (AM, LSB or USB) bands, the signal from the local or remote microphone is applied to filter networks, through transmit/receive switching diodes and the mode selector switch, on the exciter board.
- 75 In the A2J (Morse) mode the fixed 1 kHz signal from the synthesiser, modulated at the keying rate, is applied to the filter networks through the mode selector switch.
- 76 The output signal from the filter network is fed to an amplifier via a variable attenuator. The amplifier output is applied to a modulator which causes the 2,5 MHz heterodyne signal from the synthesiser to be modulated. The amplifier output also provides, through a detector and amplifier, the dc. control voltage which regulates the gain of the AF signal.
- 77 The modulator suppresses the carrier signal and the resulting SSB signal is fed to the 2,5 MHz amplifier on the exciter board via the transmit/receive switching diodes, amplifier and SSB and A2J filter and common amplifier (all mounted in the 2,5 MHz filter and IF board). The gain of the 2,5 MHz amplifier is controlled by the compressor control input, generated within the peripheral circuits.

- 78 When operated in the A3H (AM) mode, carrier re-insertion is carried out within this amplifier. A 2,5 MHz re-insertion signal from the synthesiser is applied through the mode selector switch and an amplifier.
- 79 The output signal from the 2,5 MHz amplifier is applied through the transmit/receive switching diodes to the mixer on the IF and 2,5 MHz and 102,5 MHz mixer board. The fixed heterodyne signal of 100 MHz (Morse, AM or USB mode) or 105 MHz (LSB mode) from the synthesiser is also fed to the mixer via an amplifier.
- 80 The 102,5 MHz output signal from the mixer is fed through transmit/receive switching diodes, a 102,5 MHz amplifier and a second transmit/receive switching diode circuit to the transmit mixer.
- 81 This mixer also receives the variable heterodyne signal 104,5 MHz from the synthesiser through transmit/receive switching diodes.
- 82 The resulting transmission frequency in the range 2 MHz to 30 MHz is fed via a 2–30 MHz band pass filter and pre-amplifier to the 20 Watt transmitter output amplifier.

ANCILLARY CIRCUITS

- 83 The ancillary circuits generate the following signals:—
- a AGC voltage
 - b Remote—to—local calling signal
 - c Local—to—remote calling signal
 - d Transmit/receive changeover signal.

AGC VOLTAGE

- 84 In all modes of operation the signal from the impedance matching unit on the 2,5 MHz filter and IF board, is applied to an agc. generating circuit. The output of this circuit is applied, via a matching circuit on the peripheral circuit board to amplifiers on the IF and 2,5 MHz and 102,5 MHz mixer module, and the 2,5 MHz filter and IF module as described earlier.

REMOTE—TO—LOCAL CALLING SIGNAL

- 85 A signal from the remote panel triggers the call tone generator on the AF board, the output of which is applied via an amplifier to the local earphone.

LOCAL—TO—REMOTE CALLING SIGNAL

- 86 When the CALL switch on the front panel is set to CALL—ROEP the call tone generator is triggered supplying a call tone to the remote control panel via the remote control amplifier.

TRANSMIT/RECEIVE CHANGE-OVER SIGNAL

- 87 The transmit/receive changeover circuits provide two voltage levels corresponding to the transmit (+3 V) or receive (+6 V) condition. These outputs are derived directly from a pressel switch input or antenna tuning control signal, or indirectly from the remote control panel via a comparator.

20 WATT AMPLIFIER

- 88 Received signals from the antenna tuning circuits are fed to the HF unit through transmit/receive switching diodes.
- 89 The transmission signal from the HF unit is amplified in the 20 W amplifier and applied through the antenna tuning unit to the antenna.
- 90 Ancillary circuits of the 20 W amplifier are:—
- a Power supply circuits
 - b Compressor control loops
- 91 Ancillary circuits of the antenna tuning unit are:—
- a Antenna tuning control circuits
 - b Antenna tuning feedback control loop
 - c Transmission monitoring circuits

RECEPTION CHANNEL

- 92 Depending on the position of the antenna switch the 2 MHz to 30 MHz received signal is routed as follows:—
- a 50 Ohm/Vehicle position — through antenna switch, coupler and harmonics filter (all in the antenna tuning unit) and transmit/receive switching diodes (in the 20 W amplifier) to the exciter board in the HF unit.
 - b WHIP/WIRE position — through the variable inductor (used during an antenna tuning cycle), antenna switch, harmonics filter and transmit/receive switching diodes to the HF unit.

TRANSMISSION CHANNEL

- 93 The 2 MHz to 30 MHz transmission signal, at a level of 1 mW PEP, is applied to a first push-pull stage via a phase-splitter, pre-amplifier and input matching transformer.
- 94 The output from the push-pull stage is fed via a matching transformer to a second push-pull stage, its output being applied to transmit/receive switching diodes via an output matching transformer and coupler. Each of the above circuits are contained within the 20 W amplifier module.
- 95 From the transmit/receive switching diodes the signal is fed to the antenna through the antenna tuning unit as follows:—
- a Coupler, harmonics filter and antenna switch in the 50 Ohm/Vehicle position
 - b Harmonics filter, coupler, antenna switch in the WHIP/WIRE position, 20 dB coupler and variable inductor.

ANCILLARY CIRCUITS

- 96 a Battery Supply:— the battery voltage is applied to a stabilised power supply via a current measuring circuit. This circuit is also supplied with a transmit control signal. The output from the stabilised power supply is fed via separate temperature compensated bias circuits to first and second push—pull stages.
- b Compressor Control Loops:— There are three compressor control loops as shown in Figure 3A.7
- i Current Control Loop:— The average current consumption is measured through a current measuring circuit. The resultant signal is applied to a comparator together with a constant value current reference. The error signal from the comparator is applied to the compressor amplifier located on the exciter board. The error signal therefore controls the power transmitted from the Manpack.
 - ii Output Current Control Loop:— A detector circuit provides a signal to the compressor amplifier if excessive current is being drawn by the output and reduces its gain and therefore the transmitted power.
 - iii Power Control Loop:— A signal proportional to output power is fed to a comparator together with a constant power reference signal. The resulting error signal controls the gain of the compressor amplifier and hence the power output. By using one of two power reference signal levels this circuit operates on Normal Power (20 W) or Reduced Power (6 W).

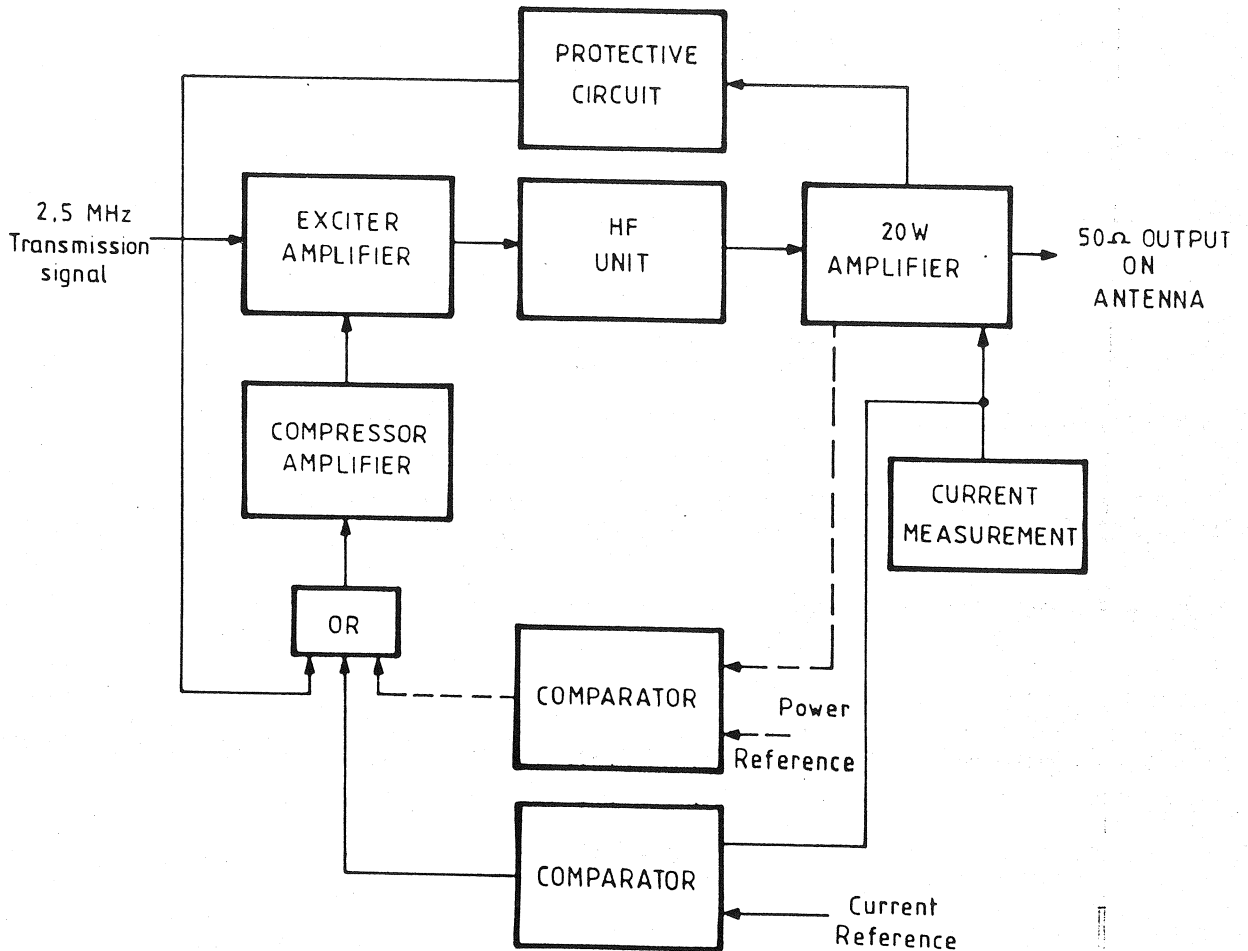


Fig. 3A.7

**Compressor Control Loop
Block Diagram**

ANTENNA TUNING UNIT

- 97 a Antenna Tuning Control Circuits:— a programme circuit, located in the peripheral circuits, is enabled by a change in any of the frequency selector switch positions, actuation of the TUNE pushbutton, or by switching the transceiver on.
- i The programme circuit generates the beginning of cycle signal which enables:—
 - The power supply circuits of the Antenna Tuning Unit.
 - The antenna tuning tone circuit in the exciter board, which applies a 1 kHz tone to the earphone.
 - The transmit/receive changeover.
 - ii The power supply circuit generates a signal which enables:—
 - A logic circuit.
 - A motor drive circuit.
 - A pre-positioning comparator.
 - A feedback comparator.
 - iii The logic circuit generates three signals which enable:—
 - The pre-positioning comparator from the beginning of cycle signal.
 - A feedback comparator signal and end of pre-positioning signal when the variable inductor reaches the pre-positioning point.
 - iv When the inductor is tuned the logic circuit generates the end of cycle signal which is applied to the programme circuit which inhibits the whole antenna tuning system after a given time. This signal is generated after receiving a signal from the motor drive circuit indicating that the inductor is tuned.
- b Antenna Tuning Feedback Control Loop:— the variable inductor is mechanically linked to the wiper of the antenna tuning potentiometer and antenna tuning drive motor:—
- i From the beginning of the cycle a fixed reference voltage is applied to the pre-positioning comparator together with the voltage from the antenna tuning potentiometer wiper. The error signal from the comparator is applied to the logic circuit.
 - ii The signal from the logic circuit is applied to the motor drive circuits causing the motor to rotate and hence the value of inductance and the wiper position varies in proportion. When the inductor reaches the pre-positioning point the feedback control cycle begins.
 - iii The reflected voltage (VR) and direct voltage (VD) derived in the 20 dB coupler, are applied to a discriminator via a phase-splitter. The two signals from the discriminator are applied to the feedback control comparator and the resulting error signal is applied to the logic circuit.

97 (continued)

- iv The signal from the logic circuit is applied to the motor drive circuit causing the motor to rotate. When the inductor reaches its exact tuning value a detector generates a signal which is fed to the logic circuit, which in turn generates a signal which causes the motor to reverse its direction of rotation.
 - v An end of cycle signal is then produced by the logic circuit. Due to inertia the inductor oscillates about the tuning point reducing in amplitude but never quite reaching a stationary condition.
 - vi The end-of-cycle signal causes the programme circuit to inhibit the antenna tuning system after a pre-determined period determined by the programme circuit.
- c Transmission Monitoring Circuits:— a signal from the coupler is applied to a matching circuit on the peripheral circuits board, when the transceiver is in the transmit mode of operation. The circuit is also enabled by a signal from the battery. In the event of a fault in the transmission circuit or the battery supply the matching circuit generates an inhibit signal which prevents retransmission of speech to the earphone.

GENERATION OF DC VOLTAGES

- 98 A convertor unit, powered from the battery box generates the various dc. voltages required by the transceiver. A charger is also incorporated in the battery box enabling the batteries to be charged from an external dc. source of between + 10 V. and + 32 V.
- 99 Convertor — a block diagram of the convertor is shown in Figure 3A.8 below:—

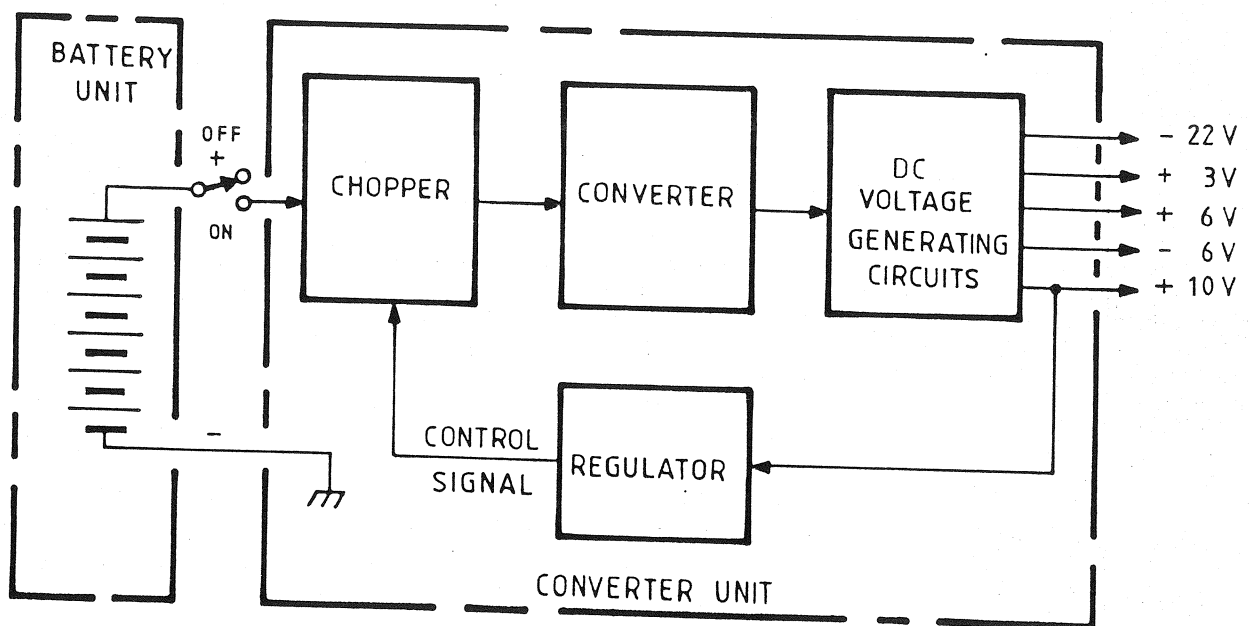
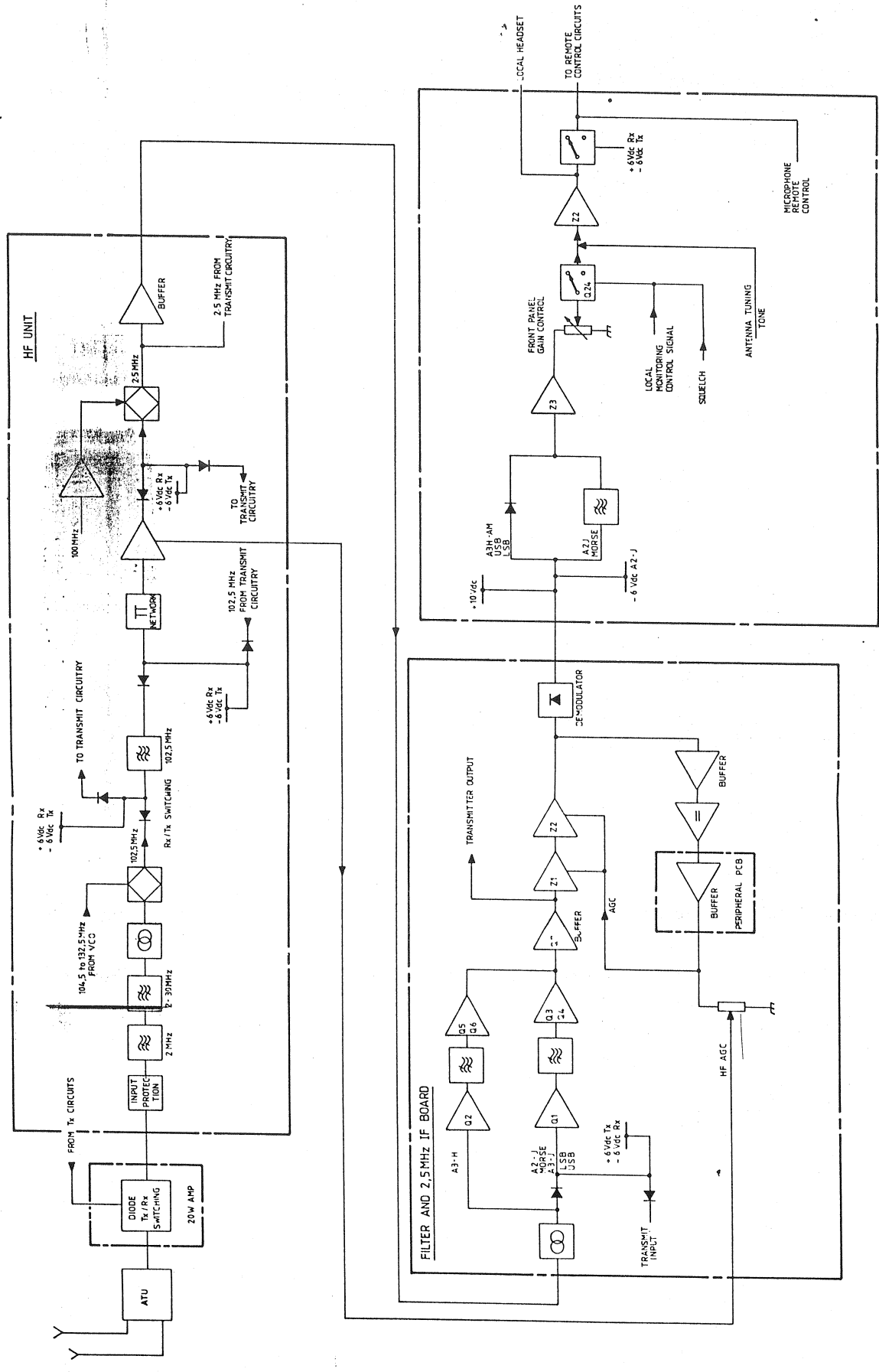


Fig. 3A.8

**Converter Unit
Block Diagram**

100 Continued

- a Supply for the charger is derived a +10 V. to +30 V. dc. source and is applied to a switching circuit and a multivibrator driver circuit which operates the switching circuit.
- b The signal from the multivibrator is applied to a comparator which is also fed with a signal from a current measuring circuit.
- c As soon as the external voltage is applied to the charger the comparator delivers a control voltage to the switching circuit, which causes the voltage generating circuits to be powered from the external voltage.
- d The amount of energy stored by the voltage generating circuit is sensed by the current measuring circuit which, at a given value of current, generates a signal which causes the comparator output to change state. This signal causes the external supply to be disconnected from the voltage generating circuits by the switching circuit.
- e The stored energy in the voltage generating circuits is now discharged into the batteries. Once the voltage generating circuits are discharged the next cycle is initiated by the multivibrator. Thus the rate of charge is controlled by the multi-vibrator.
- f If the Manpack Transceiver is left on during charging, the ON charge time should be doubled for maximum battery charge.



Receiver Path Block Diagram Fig. 3A.10

RESTRICTED/BEPERK

SYSTEM SETTING UP AND PERFORMANCE TESTING

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INTRODUCTION

- 1 The following pages contain a detailed procedure to be followed when the RS-B25 Manpack is set up and performance tested using the TRC 319-1 Test Set.

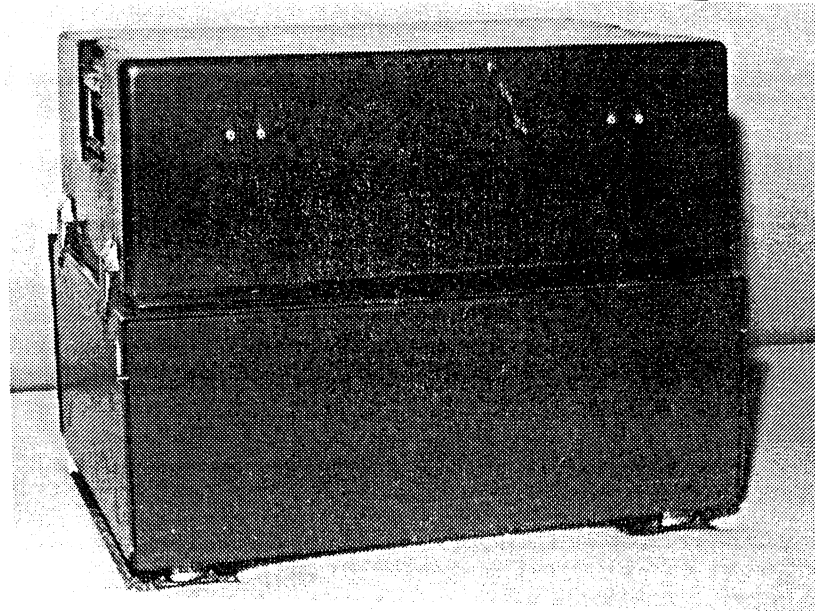


Fig. 3B.1

TRC 319 — 1 Test Set
General View

TRC 319-1 TEST SET

- 2 The TRC 319-1 Test Set has been specifically designed to test the RS-B25, 26 and C27 radio sets.

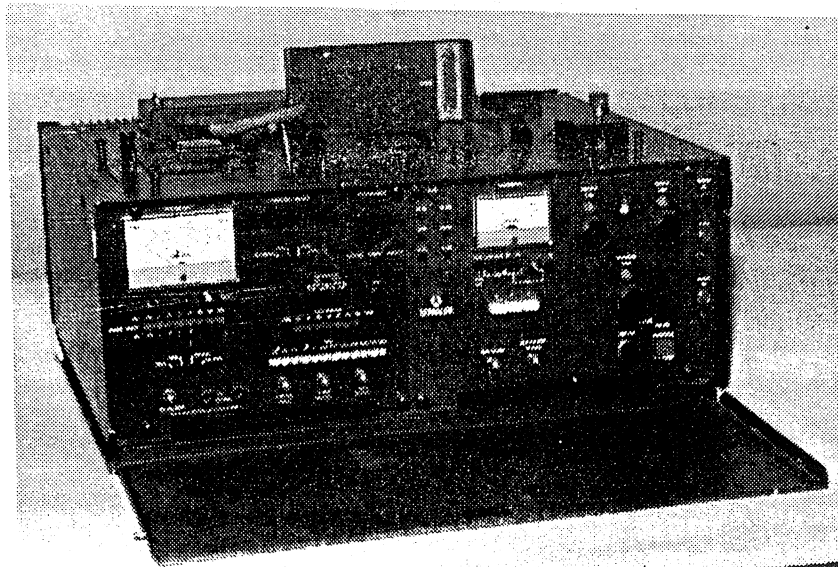


Fig. 3B.2

TRC 319 — 1
View Without Lid

- 3 It contains all the necessary power meters, frequency counters, tone and signal generators etc. to facilitate complete testing of these radios.

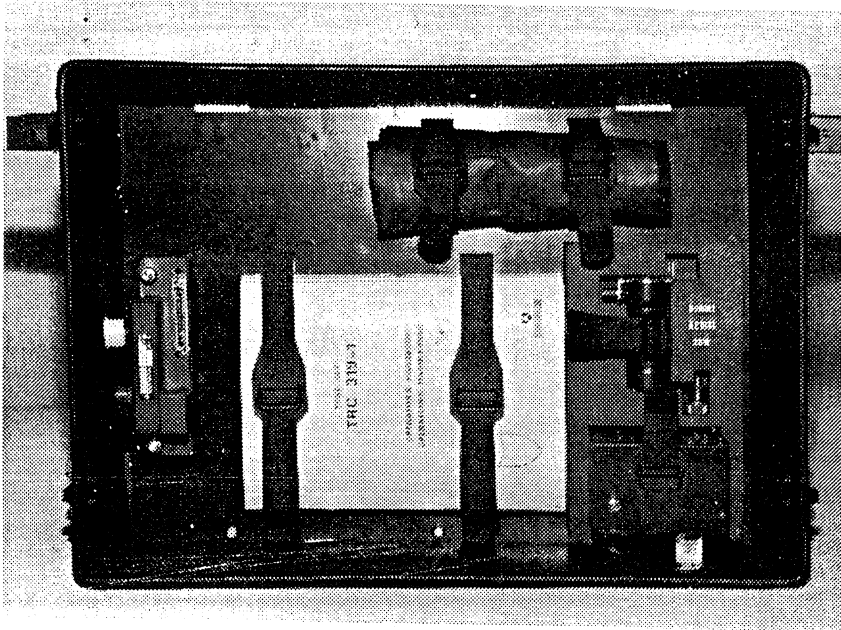


Fig. 3B.3

TRC 319 — 1
Position of Accessories in Lid

- 4 For complete information on the TRC 319-1 Test Set refer to the TRC 319-1 Operator's Handbook : 3 Volumes.

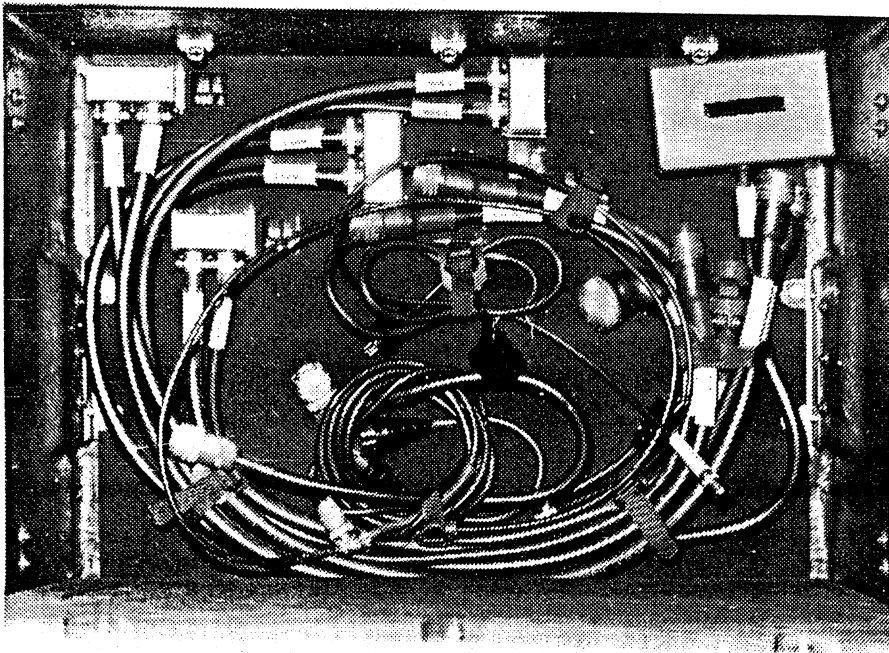


Fig. 3B.4

TRC 319 — 1
Position of Cables in Lid

TRC 319-1 TEST SET : STARTING UP PROCEDURES

Starting up Operation and Verification of the Test Set (Fig 3B.5):

- 5 1 Remove the test set upper cover and check the cables and accessories located inside the cover.

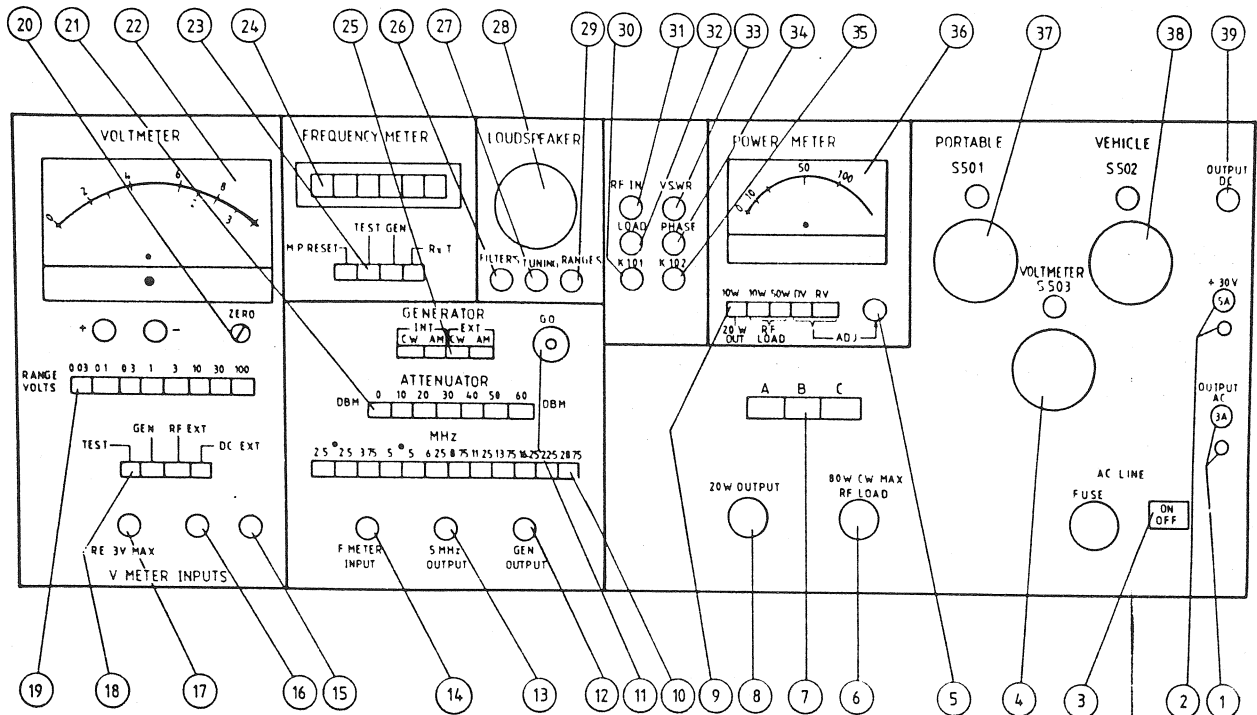


Fig. 3B.5 TRC 319 — 1
Front Panel Layout

- 2 Set the ON/OFF switch (item 3) to OFF.
- 3 Open the access door located on the test set right-hand side panel and connect cable W01 to receptacle J509. Connect the other end of cable W01 to the 220 V., 50 Hz mains (output current) Test 2A.
- 4 Set the ON/OFF switch (item 3) to ON. Check for lighting of the GO indicator lamp (item 11).
- 5 Set selector 23 to EXT. The reading off the frequency meter (item 24) should be 000000.
- 6 Test the supply voltages of the test set as follows:
 - a Set the voltmeter selector (item 18) to TEST.
 - b Set S501 (item 37) to 20.
 - c Set S502 (item 38) to 20.
 - d Adjust S503 (item 4) and check for the following readings off the voltmeter (item 22).

5 6 (continued)

S503	Reading of Voltmeter
1	+15 V.
2	- 15 V.
3	+12 V.
4	+10 V.
5	+ 5 V.

- e Press the +30 V. cut out switch (item 2).
- 7 Check for lighting of OUTPUT DC indicator lamp (item 39).
- 8 Check that, with S503 (item 4) set to the following positions, the readings listed below are obtained off the voltmeter (item 22).

S503	Reading of Voltmeter
6	+29 V.
7	+14,5 V.
8	+10 V.
9	- 8 V.
10	+ 6 V.
11	+5 V.
12	+ 3 V.
13	- 3 V.

- 9 Test the RF voltmeter, frequency meter and generator as follows:
- Set the frequency meter selector (item 23) to GEN.
 - Set the generator selector (item 25) to CW (INT or EXT).
 - Set the attenuator (item 21) to -60 dBm.
 - Set the selector of voltmeter (item 18) to GEN.
 - Select the 12 frequencies generated by the generator in turn, by means of the selector (item 10) and check that the reading off the frequency meter (item 24) corresponds to the frequency selected. Check for a reading of 0,22 V plus/minus 2 dB off the voltmeter (item 22).

NOTE: The reading off the voltmeter decreases by 20 dB (approximately) for 1 to 2 seconds between two frequency selections.

- 10 Test the modulation as follows:
- With the generator selector (item 25) on CW, INT or EXT take a reading on the voltmeter.
 - Set the selector (item 25) to AM : the voltmeter reading must increase by 1dB.

- 11 Test the beginning of cycle circuit as follows:
 - a Set S501 (item 37) to 20.
 - b Set S502 (item 38) to 2.
 - c Press selector B (item 7) and listen for the AF signal (1 000 Hz) over the loudspeaker (item 28); check that TUNING indicator lamp (item 27) lights up simultaneously.
 - d Press selector C (item 7) - the 1 000 Hz signal should disappear and the indicator lamp (item 27) should go out.
 - 12 Set the generator to 16,25 MHz by means of selector 10. Check for the lighting of RANGE indicator lamp (item 29), which should be off for any other frequency.
- NOTE:** If a fault is detected during the tests, refer to the test set technical manual.
- 13 Switch off the equipment. Set switch 3 to OFF.

DETAILS ON TEST PROCEDURES

- 6 Tests shall be carried out on the complete Manpack system (without battery for tests 1 to 10 and with battery for tests 11 and 12).

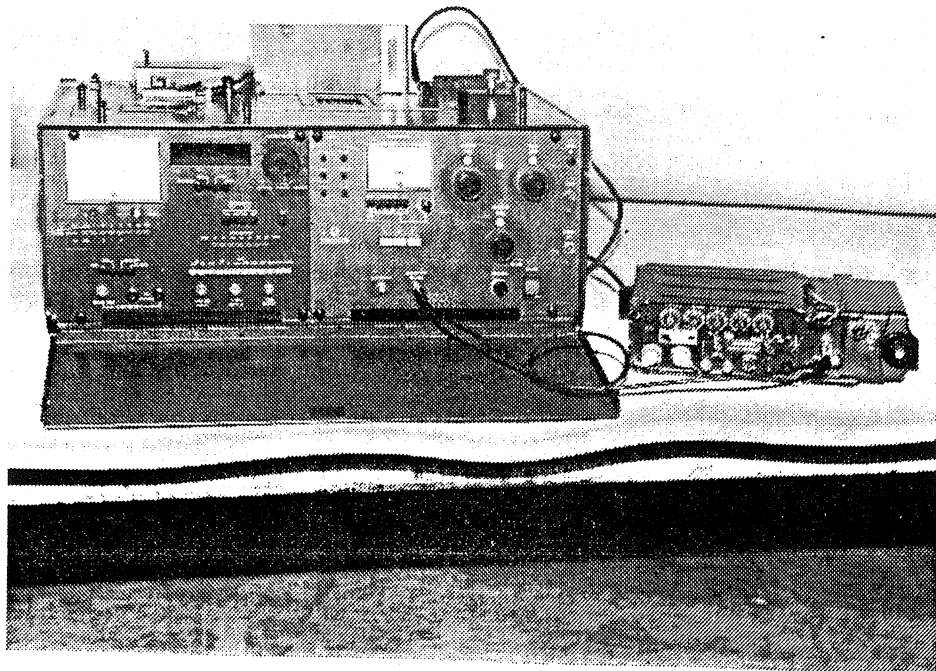


Fig. 3B.6 Connection of RS B25 SA to TRC 319 — 1

PROCEDURE

- 7 For each test specific setting up procedures are shown at the start of the test. Complete instructions for opening the equipment and the removal of modules found to be unserviceable during the tests are dealt with in Part 3D Repair.

All Sections Contain for Each Test:

- 8 A flow chart. Each block contains the number of a test. When the test has been performed, and the result is OK follow the arrow to the next test, and turn to that test to continue. If the result is not OK, follow the arrow 'NO' to the next test to be performed, or change the module specified. For instructions on removing and replacing modules refer to the illustrated instructions in Part 3D.
- 9 A diagram shows the test set and the equipment being tested. Note that all connections to be made are shown. The cables are numbered and the diagram clearly shows where both ends go.
- 10 All controls that have to be set, are overprinted in black and lights that should come on are highlighted. Extreme care must be taken that all controls are set up before performing the test. Controls that are not shown in black do not matter, and can be left in any position. In some cases a control is shown in black (such as S501) but no number is given. This means that this control will be adjusted to various positions during the test.
- 11 A short description of the test procedure to be followed. This will contain written instructions and tables of switch positions and meter readings, as applicable.

TEST INSTRUCTIONS

FUNCTIONAL TESTING

12 The following Flow Chart is for the complete functional testing of the RS-B25.

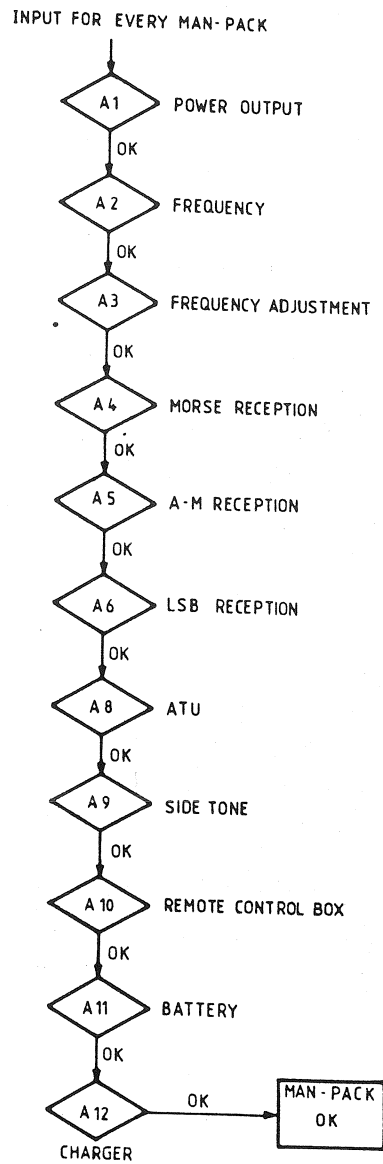


Fig. 3B.7

Complete Flow Chart for Testing the RS B25

SETTING UP PROCEDURE FOR TESTS A1 - A10

- 13 The following procedure covers the setting up of the TRC 319 and the RS-B25 for tests A1 to A10.
- 1 Dismantle the battery pack from the RS-B25.
 - 2 Set selector, .0. L H to the '0' position (position OFF).
 - 3 Put the manpack system on a flat and clean surface, with the front panel facing the operator.
 - 4 Release the two battery unit toggle fasteners.
 - 5 Disengage the toggle fasteners completely.
 - 6 While holding the transceiver unit, pivot the battery unit to the left, the front right edge acting as a hinge (this ensures withdrawal of the battery unit connector from the transceiver unit connector without damage).
 - 7 Uncouple the battery unit from the transceiver unit by disengaging the fixing lug (located on the front panel of the battery unit) from its housing (located on the front panel of the transceiver unit).
 - 8 Remove the battery unit.
- 14 Plug a tested handset into one of the RS-B25 sockets.
- 15 Connect cables W07 and W10.

TEST A1 AND A2 : POWER OUTPUT AND FREQUENCY ACCURACY

- 16 Set up RS-B25 SA and test jig as in Fig 3B.8.
- 17 Set the following frequencies on the manpack and after each press the pressel; first on low power then on high power.

20000	06666	03333	29999
11111	07777	04444	19999
02222	28888	05555	02000

RESULT

- 18 For each setting the following result must be obtained, if not follow the Flow Chart (Fig 3B.9).
- a Power meter reading:
 - Low power – 30 to 90
 - High power – 80 to 170
 - b Frequency meter
 - Manpack setting + 1 kHz
 - eg. Manpack Frequency meter
 - 20000 20001

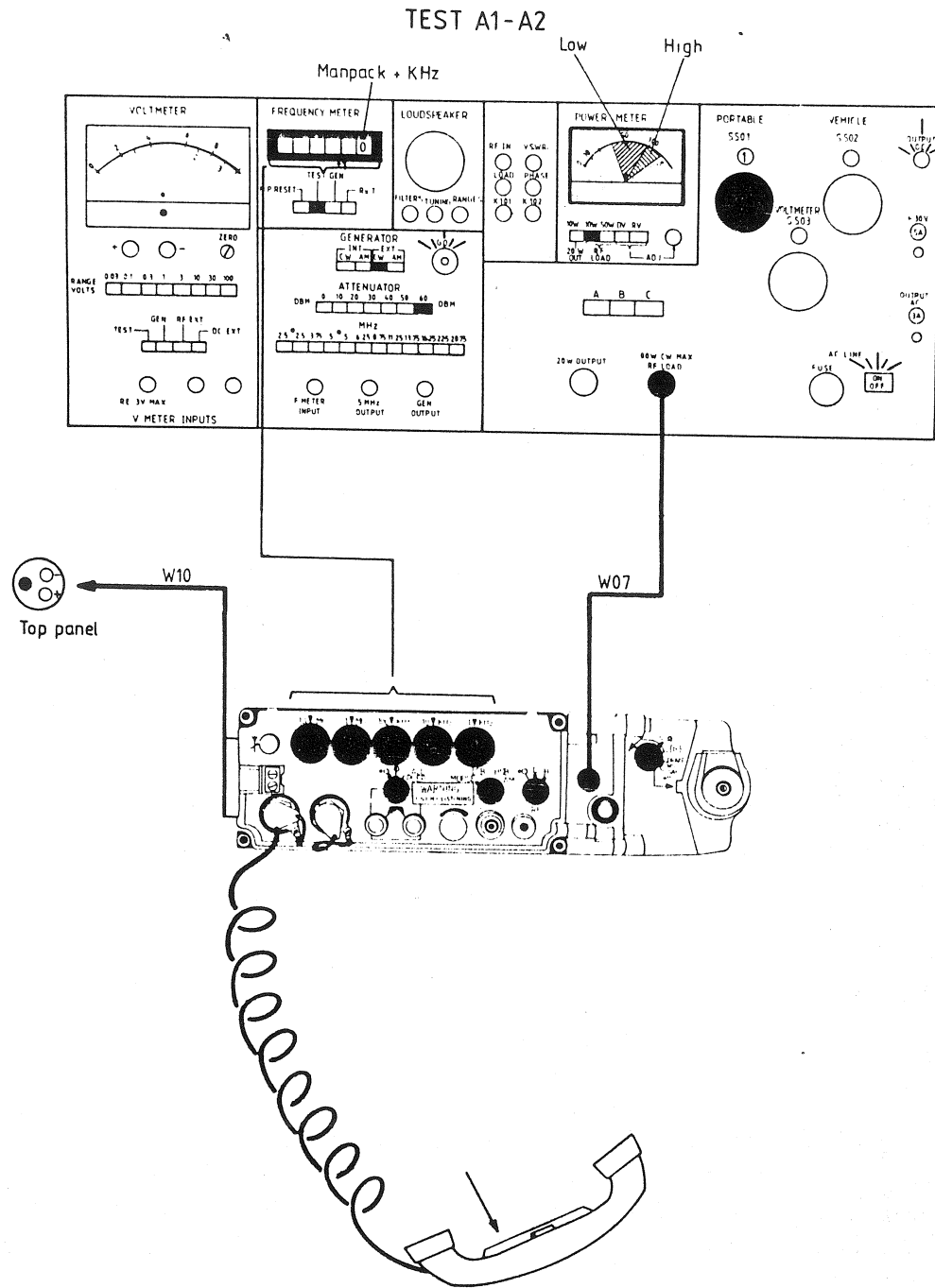


Fig. 3B.8

**Test A1 and A2
Connections and Settings**

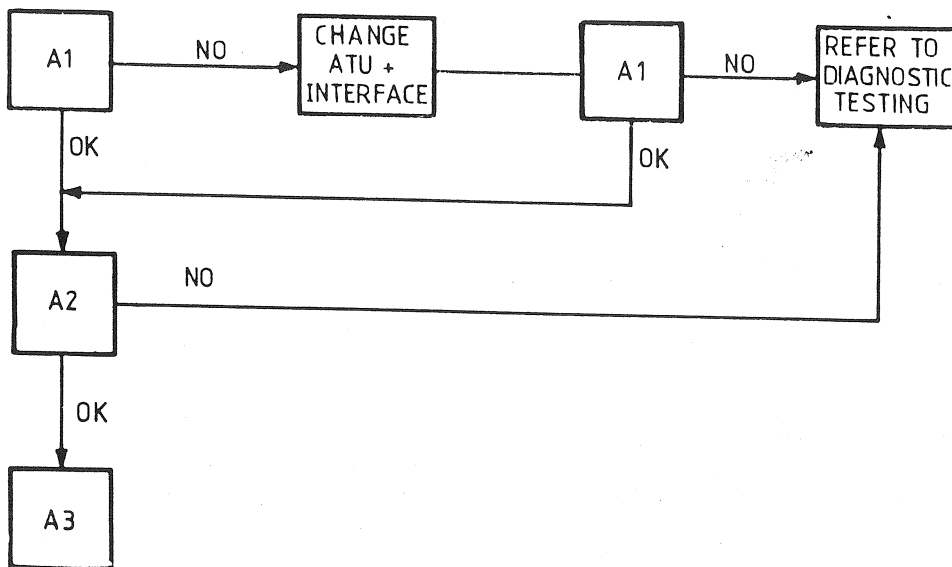


Fig. 3B.9

Test A1 and A2
Flow Chart

TEST A3 : FREQUENCY ACCURACY

19 Set up RS-B25 SA and test jig as in Fig 3B.10.

CAUTION: This test must only be conducted when the set and the test jig have been on for 30 minutes in an ambient temperature of between 20° - 25° C.

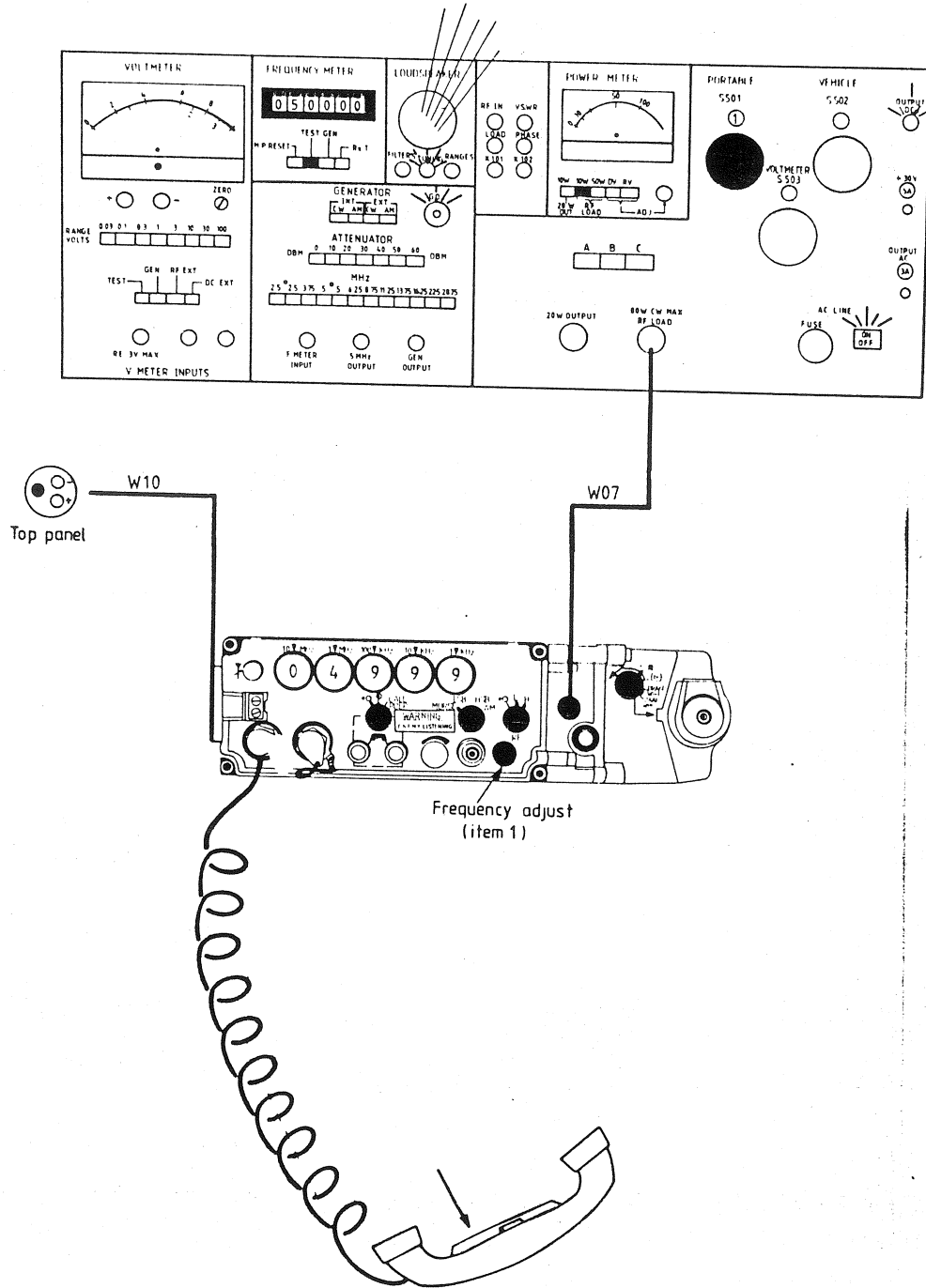


Fig. 3B.10

Test A3
Connections and Settings

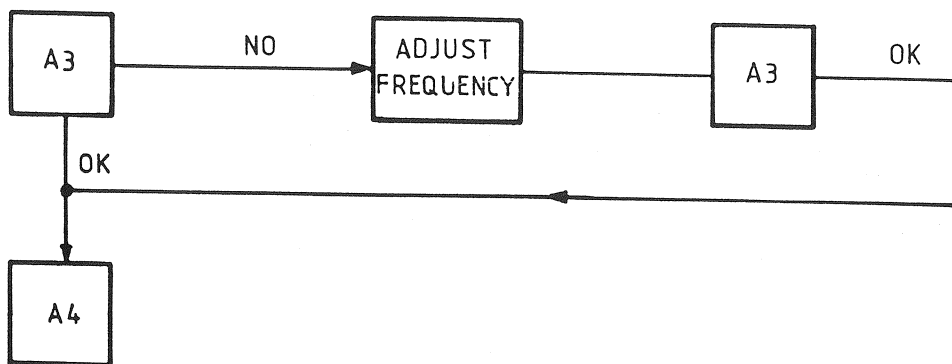


Fig. 3B.11

Test A3 Flow Chart

Set Manpack Frequency to 04999

- 20 Depress set pressel, a beating note must be heard in the earphone; simultaneously, the TUNING light must flash (lighting – extinction) at a rate of approximately 3 illuminations per second.

Frequency Adjustment (If Necessary)

- 21 Unscrew manpack plug (item 1 Fig 3B.10) using a 4 mm Allen key. After removal of this plug, a pin featuring a slot can be seen. Insert a 4 mm screwdriver in the pin slot. Depress the set pressel and turn the screwdriver in either direction to obtain a very low beating.

DO NOT EXERT UNDUE FORCE WITH THE SCREWDRIVER;

Replace plug using 4 mm Allen key.

TEST A4 : MORSE RECEPTION

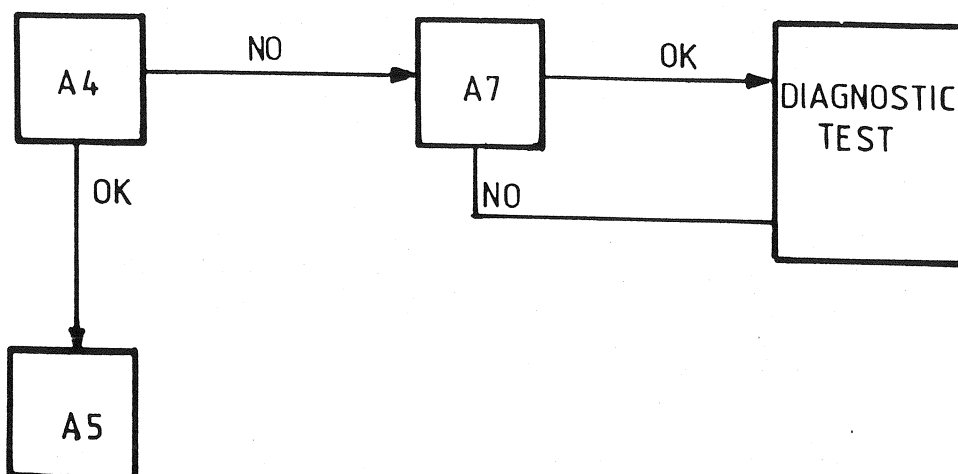


Fig. 3B.12

Test A4 Flow Chart

- 22 Prepare set up as shown in Fig 3B.13.
- 23 A tone must be heard in the earpiece.

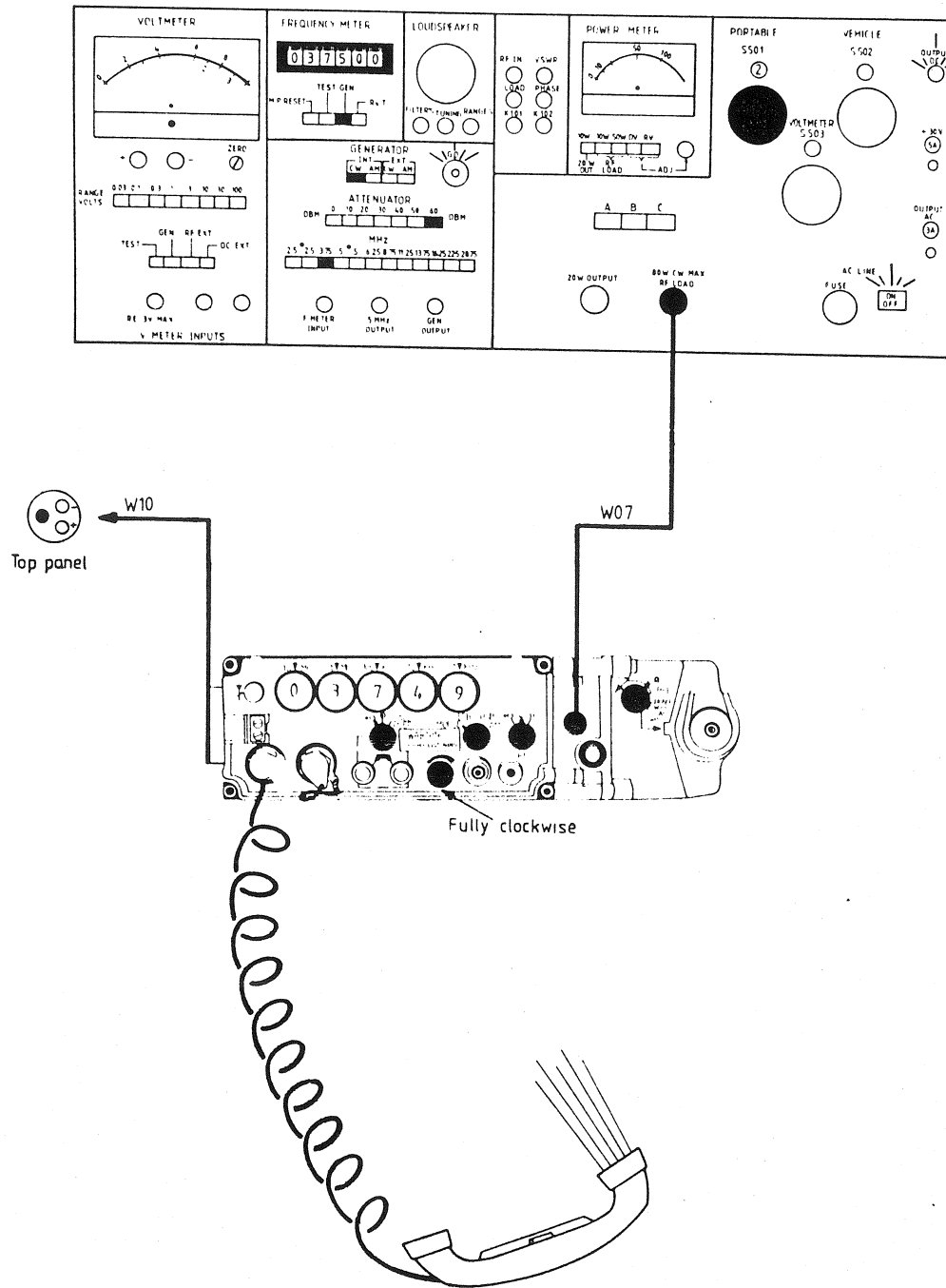


Fig. 3B.13

Test A4
Connections and Settings

TEST A5 : AM RECEPTION

- 24 Prepare set up as in Fig 3B.14.
25 A tone must be heard in the earphone.

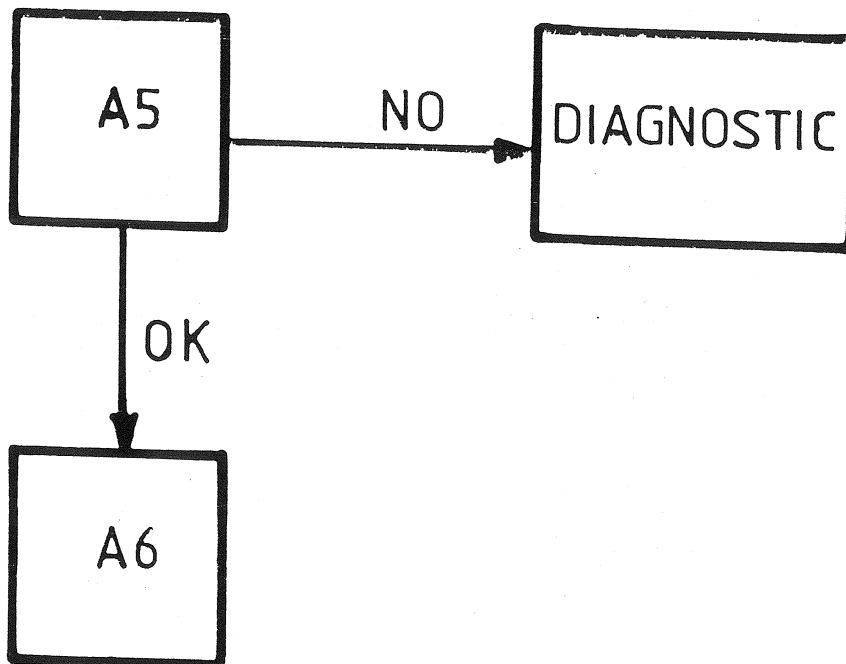


Fig. 3B.14

**Test A5
Flow Chart**

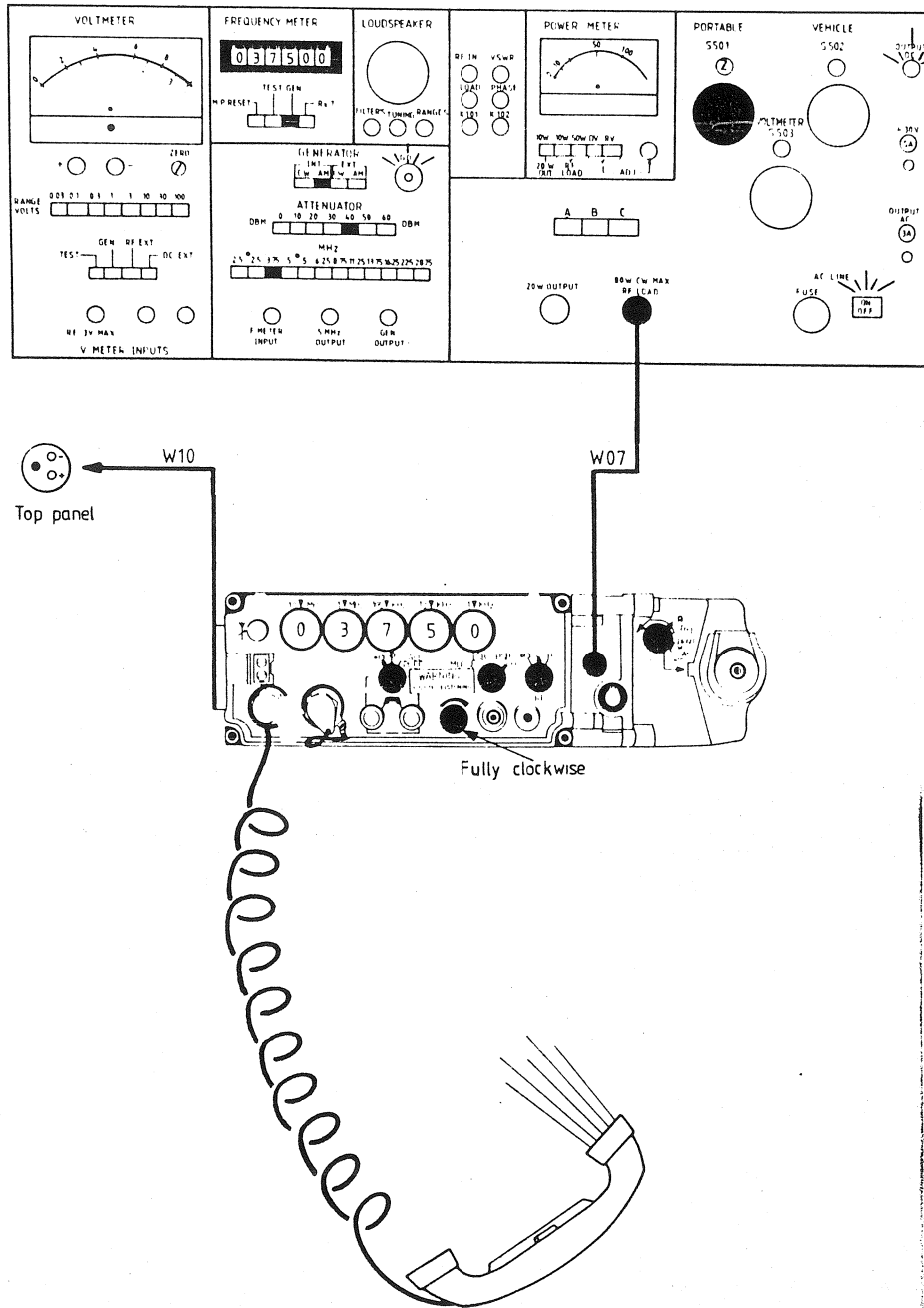


Fig. 3B.15

Test A5
Connections and Settings

TEST A6 : LSB RECEPTION

- 26 Prepare set up as shown in Fig 3B.17.
- 27 A tone must be heard in the earphone.

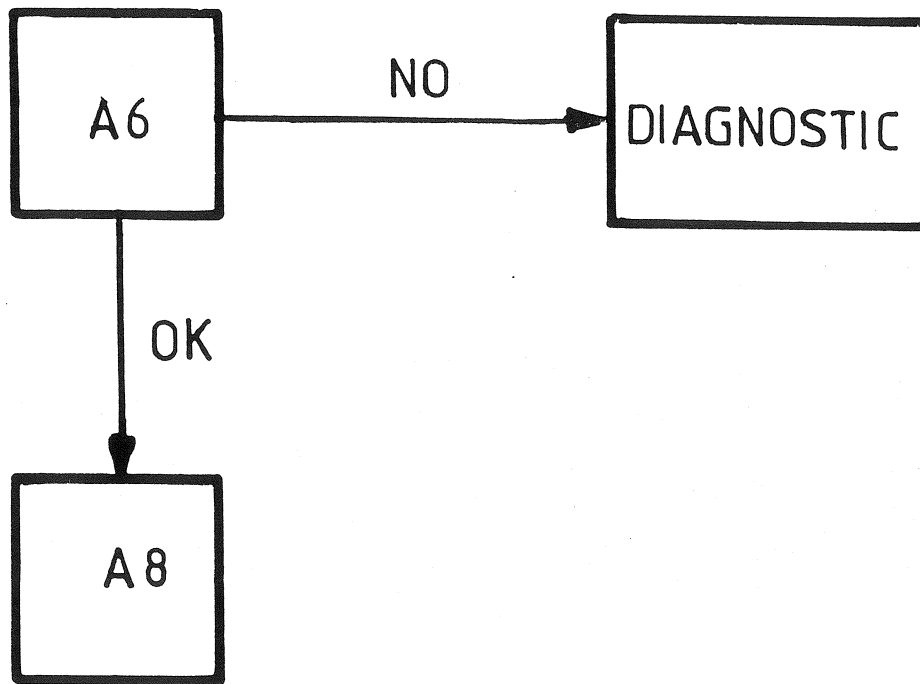


Fig. 3B.16

Test A6
Flow Chart

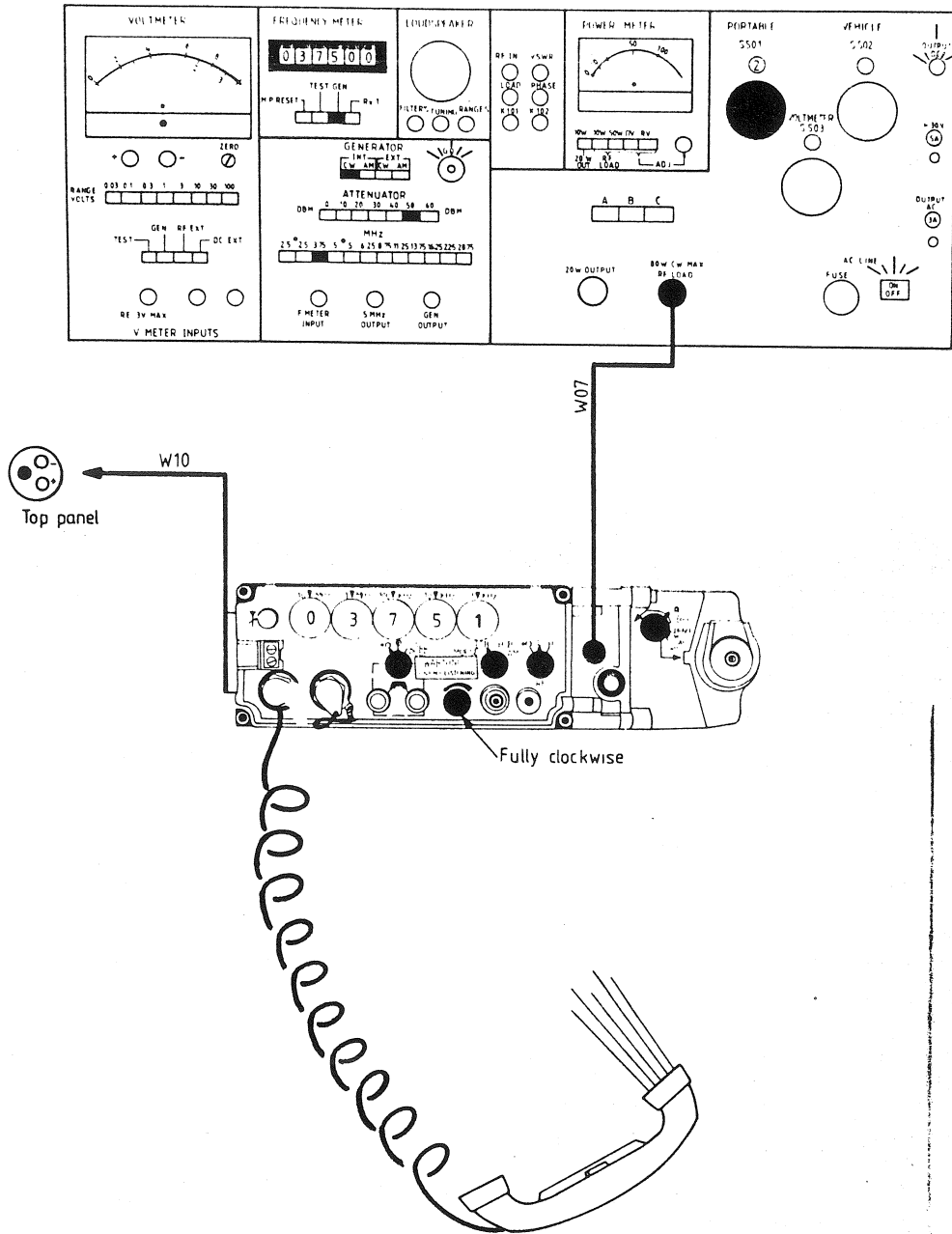


Fig. 3B.17

Test A6
Connections and Settings

TEST A7 : HSB RECEPTION

- 28 Prepare set up as shown in Fig 3B.19.
- 29 A tone must be heard in the earphone.

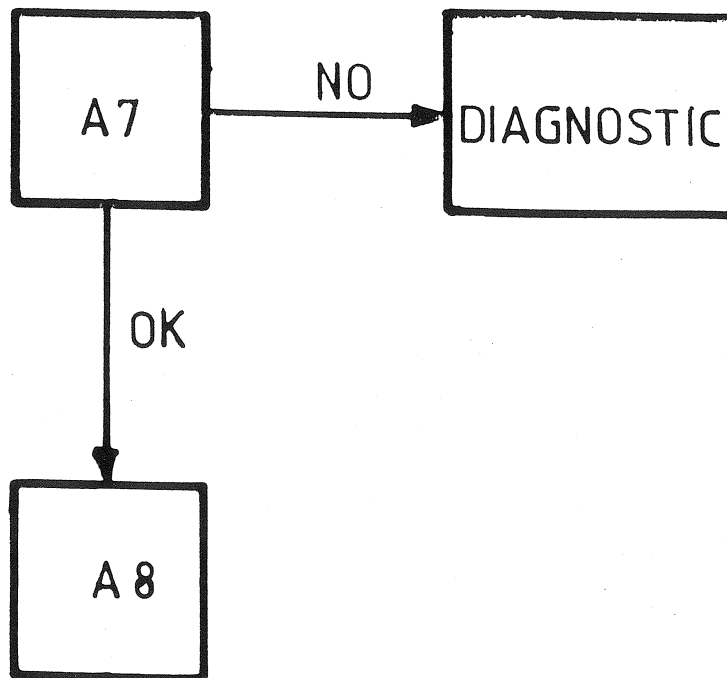


Fig. 3B.18

Test A7
Flow Chart

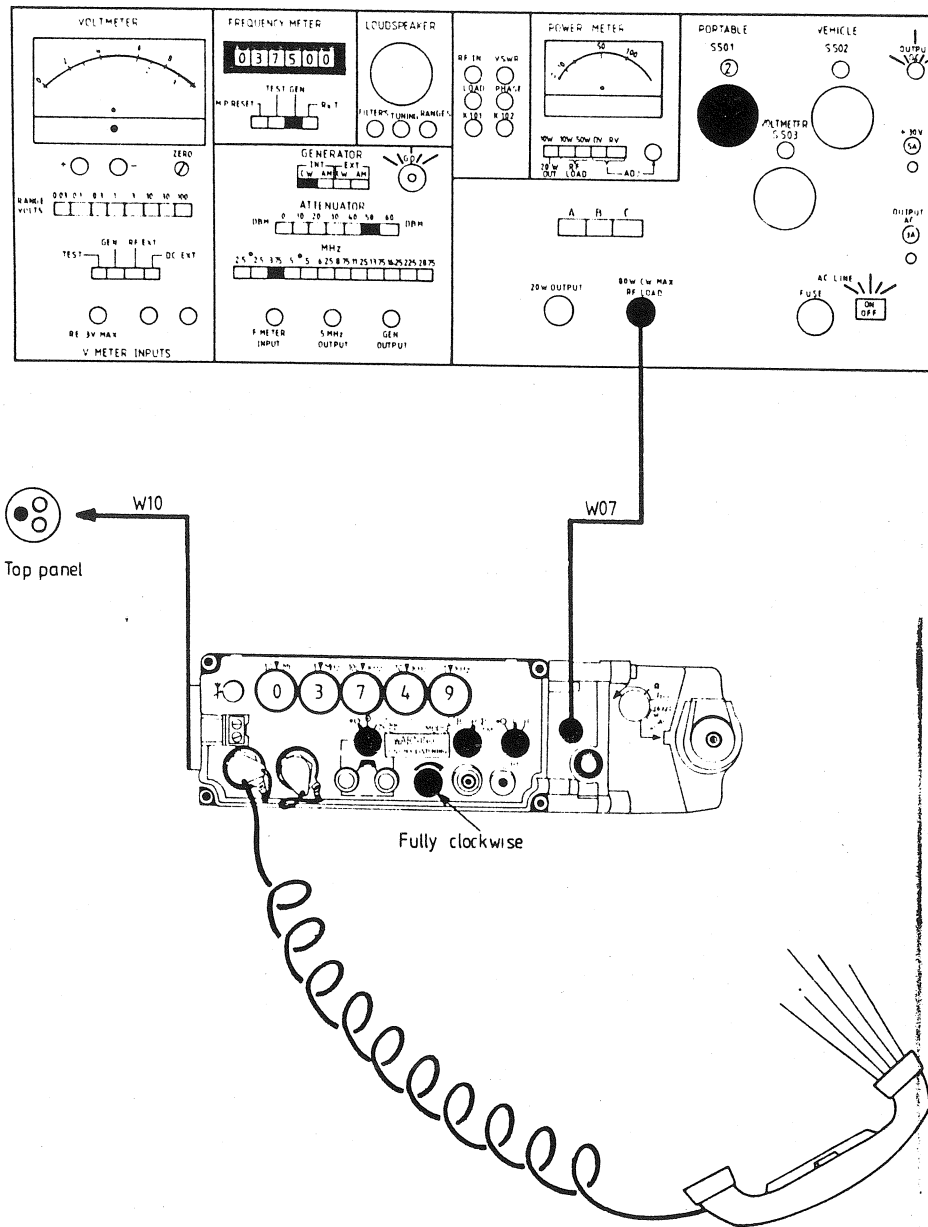


Fig. 3B.19

Test A7
Connections and Settings

TEST A8 a – A8 b AND A9 : ATU AND SIDETONE

30 Prepare set up as shown in Fig 3B.21.

Test A8a

31 Set MORSE mode.

1 After ATU tuning for each frequency of the following table:

Manpack Setting

2000 kHz
2600 kHz
3600 kHz
5600 kHz
9600 kHz
29600 kHz

2 Press the pressel on the handset and check:

- a Powermeter reading 60 to 150 on high power.
- b Powermeter reading 25 to 60 on low power.

Test A8 b

32 Set AM mode.

After tuning of ATU for each frequency of the table:

- a Press the pressel on the headset.
- b Power reading as for A8 a test.

Test A9

33 Set MORSE mode.

After ATU tuning for each frequency of the table:

- a Press the pressel on the handset.
- b A tone must be heard on the earphone.

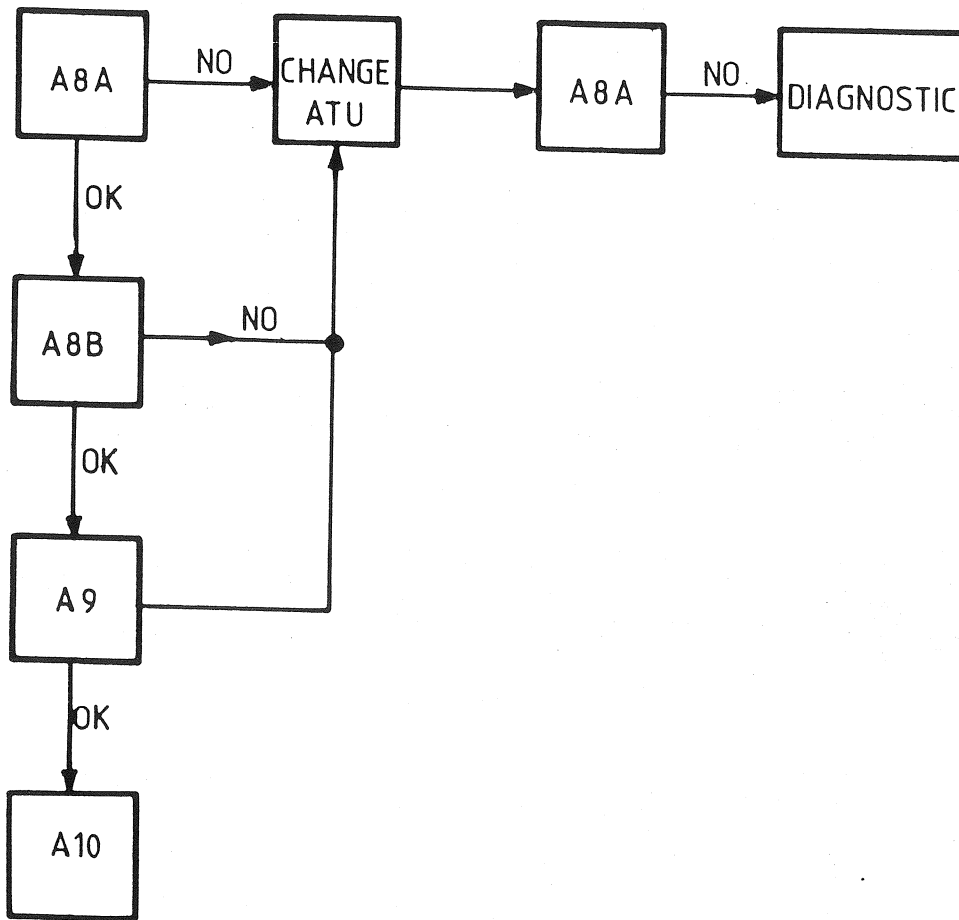


Fig. 3B.20

Test A8a — A8b and A9
Flow Chart

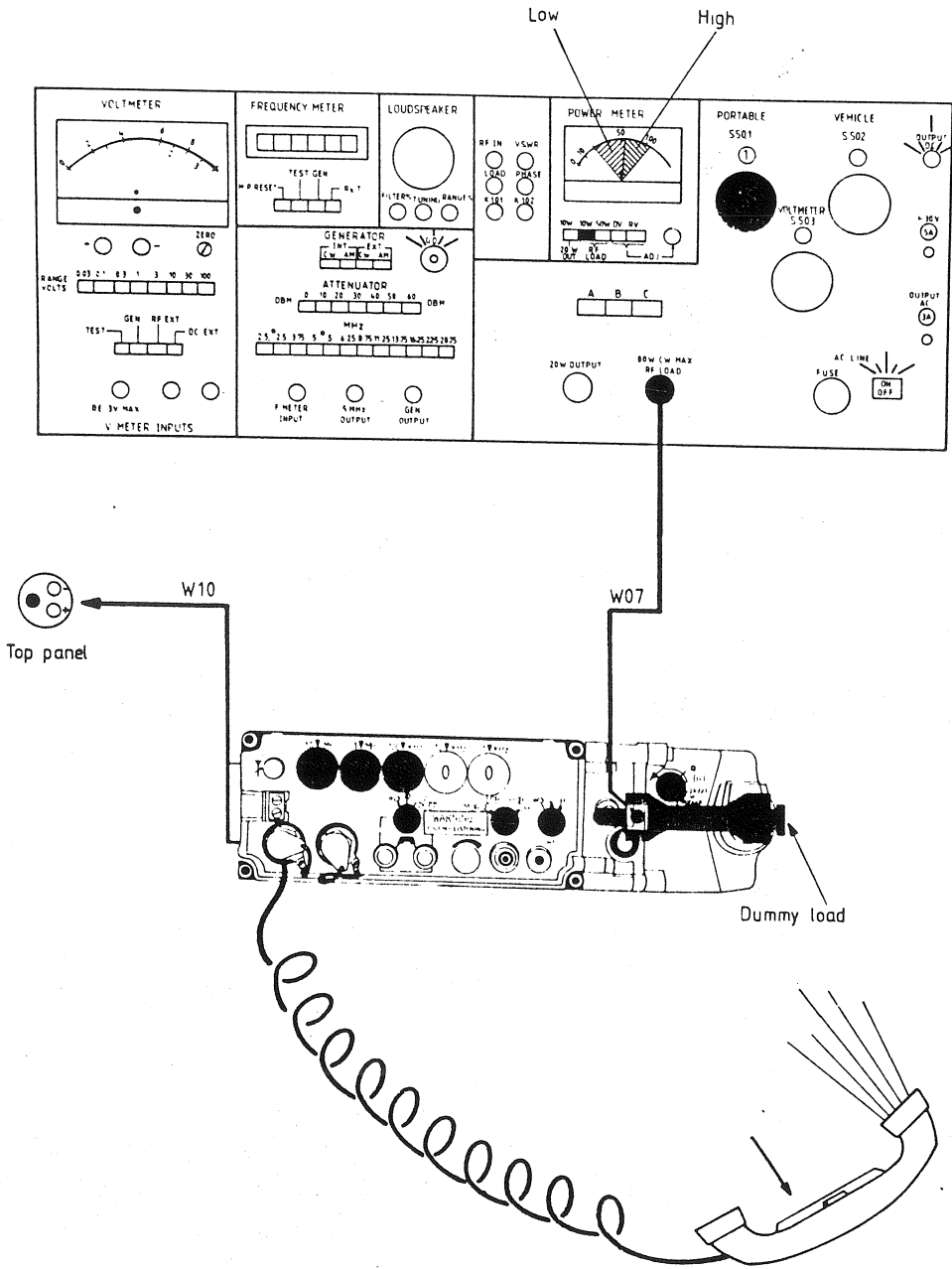


Fig. 3B.21

**Test A8a — A8b and A9
Connections and Settings**

TEST A10 : REMOTE CONTROL UNIT

- 34 Prepare set as shown in Fig 3B.23
- 35 A tone (1000 Hz) must be heard on each earphone.
- 36 Prepare set as shown in Fig 3B.24.
- 37 Press the pressel on the handset (index 2).
Powermeter reading: 30 to 80.
Release pressel switch.
- 38 Press push-button A.
A tone must be heard on the earphone 1.
Release A push-button.
- 39 Set the RC (index B) to position CALL.
A tone must be heard on earphone 2.
- 40 Set the RC switch (index B) to position .0 (END OF TEST).

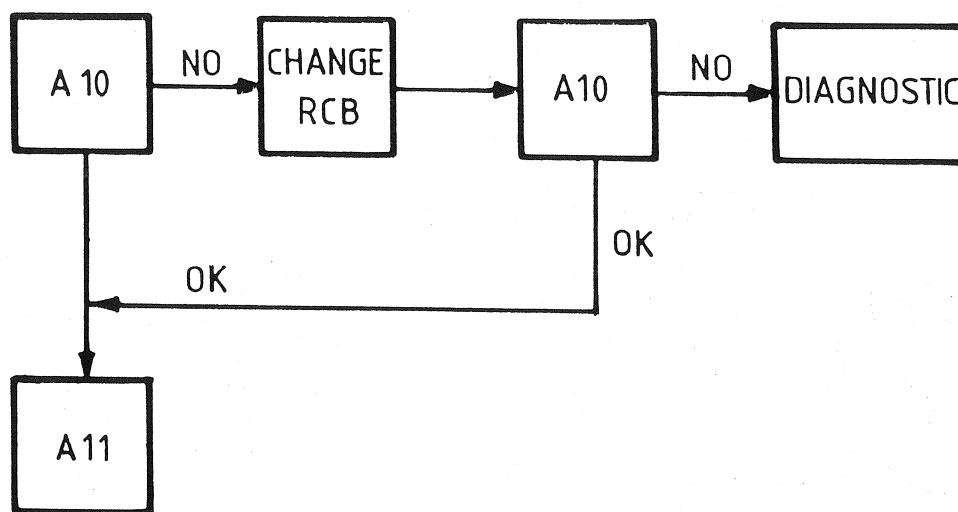


Fig. 3B.22

**Test A10
Flow Chart**

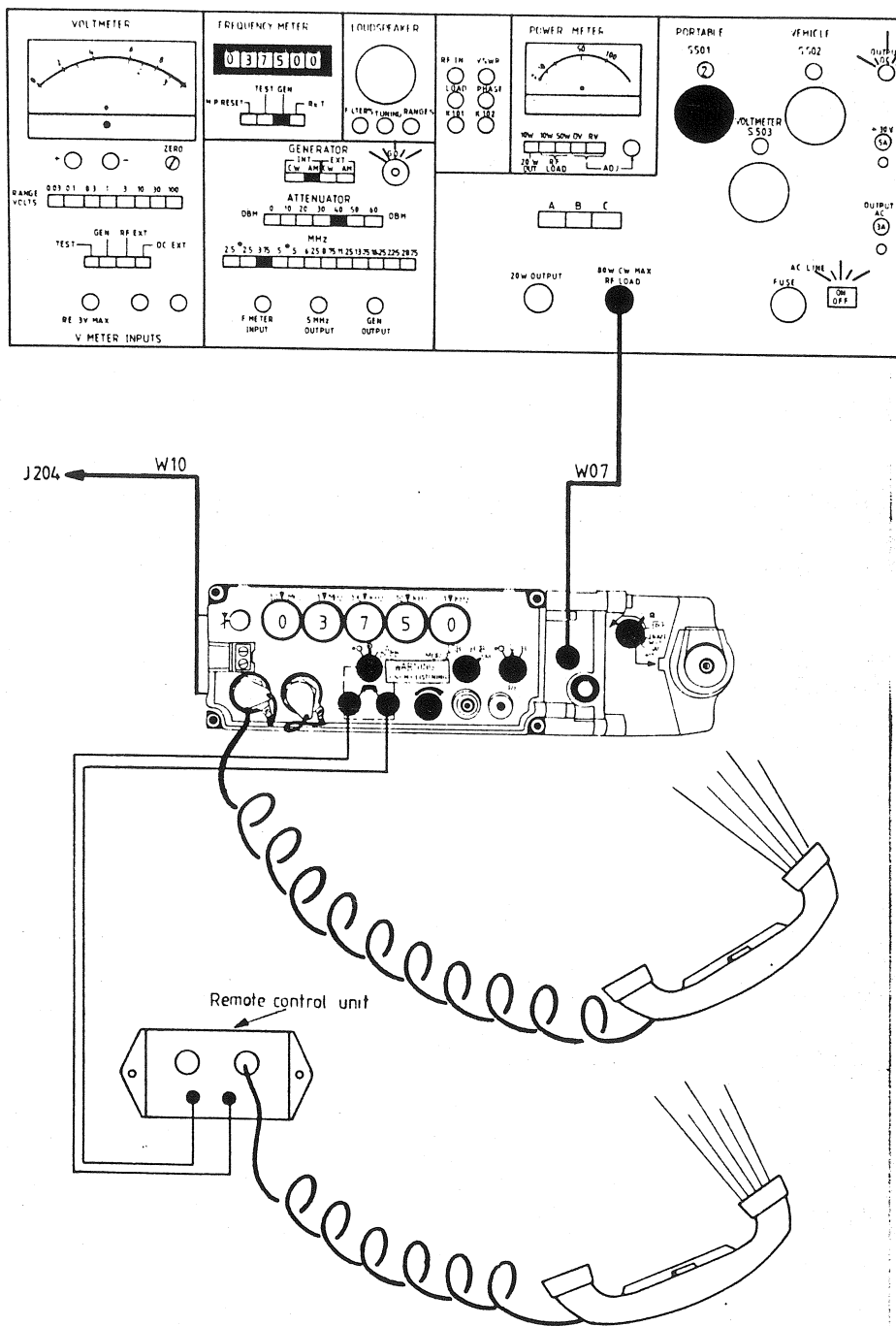


Fig. 3B.24

Test A10
Connections and Settings

TEST A11 AND A12 : BATTERY UNIT

- 41 Remove battery unit.
 - 42 Place battery unit on the test set (see Fig 3B.25).
 - 43 Prepare the TEST A11 Fig 3B.26.
 - 44 Prepare the TEST A12 Fig 3B.27.
- Connect W09 cable.
- See procedure TEST A12.

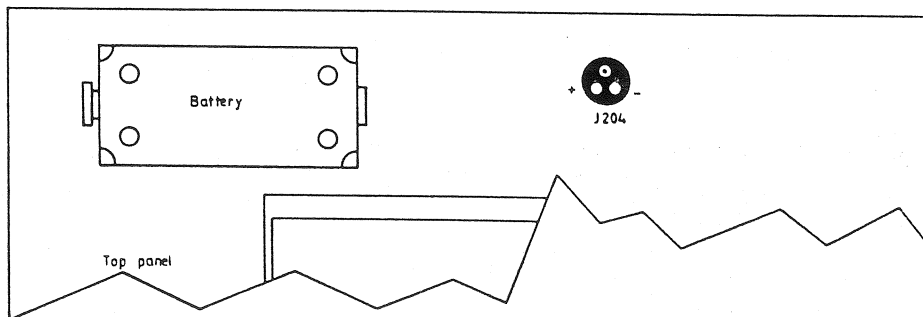


Fig. 3B.25 **Position of Battery on Test Set**

Test A11 Procedure

- 45 Prepare set up as shown on Fig 3B.26.

Voltmeter reading

+ 14 V. min

Push B + 13,5 V. min

NOTE: If voltmeter reading = 0; check fuse of battery. Change fuse if necessary.

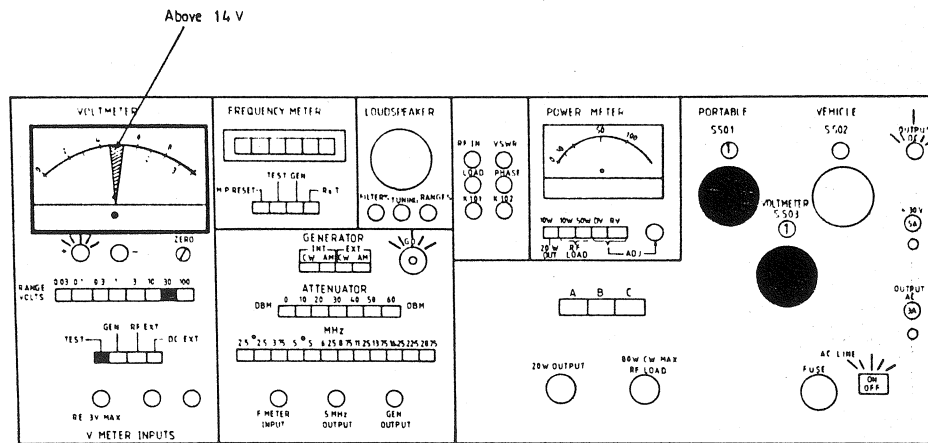


Fig. 3B.26

Test A11
Connections and Settings

Test A11 Procedure

- 46 Prepare set up as shown on Fig 3B.27.
- 47 Voltmeter reading: + 0,05 to 0.09 V.

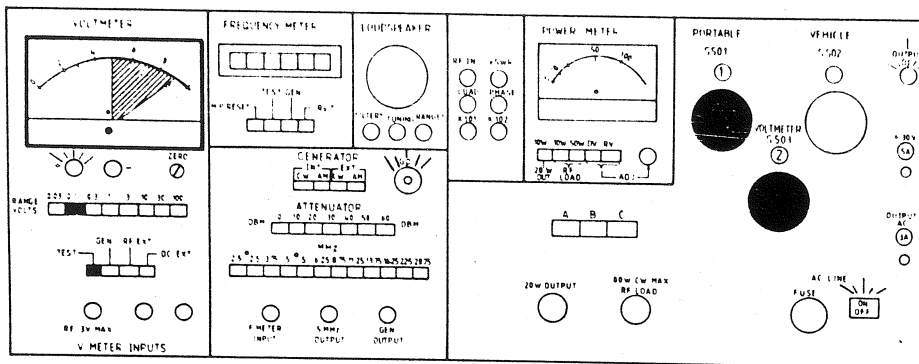
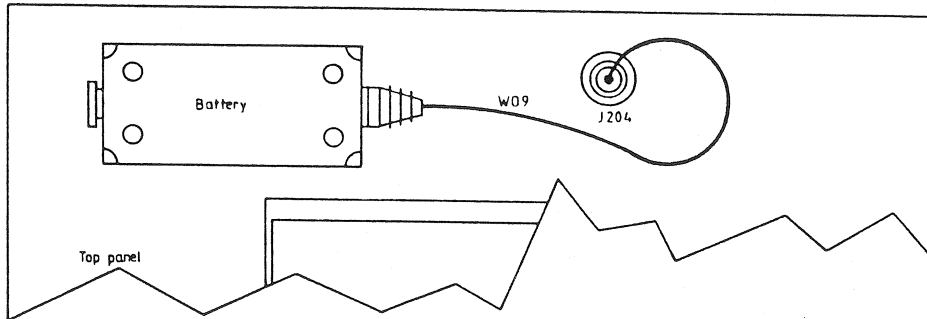


Fig. 3B.27

Test A12
Connections and Settings

- 48 This concludes the setting up and performance testing of the RS-B25 Manpack using the TRC 319-1 Test Set.

CONTENTS

CHAPTER 1 Overall Equipment: Fault Diagnosis

CHAPTER 2 Module: Fault Diagnosis

INTRODUCTION

1 The Fault Diagnosis part of this manual has been divided into two Chapters.

CHAPTER 1

2 This chapter covers the full diagnostic testing of the RS B25 down to module or PCB replacement detail using the TRC 319 Test Set.

CHAPTER 2

3 This chapter deals with the testing adjustment and verification of individual modules or P.C. boards.

4 The procedure to follow for Chapter 1 is the same as for Part 3B.

OVERALL EQUIPMENT FAULT DIAGNOSIS

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INTRODUCTION

- 1 The tests detailed in the Chapter allows the use to carry out a fault diagnosis on the RS-B25.
- 2 The Equipment required in the Test Set Type TRC 319 with its associated Technical Manual. F9 trial and error fault diagnostics a known serviceable RS-B25 would be a useful tool.
- 3 The following diagnostics procedures have been written in a logical sequence and it is recommended that the user follows the sequence.
- 4 If a module is replaced, the unserviceable module must be tested in accordance with the procedures laid down in Chapter 2.

FAULT DIAGNOSIS PROCEDURE

Test B1: Supply and Control Voltages in Transmit Mode

- 5 Prepare set up as shown in Fig. 3C.1.1.
- 6 Proceed to the tests specified in Fig 3C.1.2.
- 7 In Test 1 the Flow Chart and Test Procedure are combined.

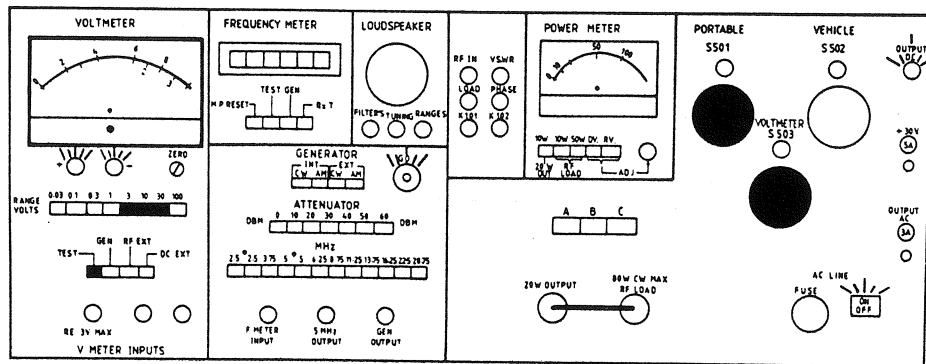
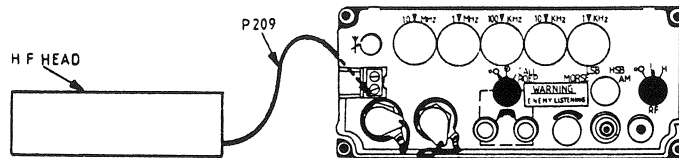


Fig. 3C.1.1

Test B1
Connections and Settings

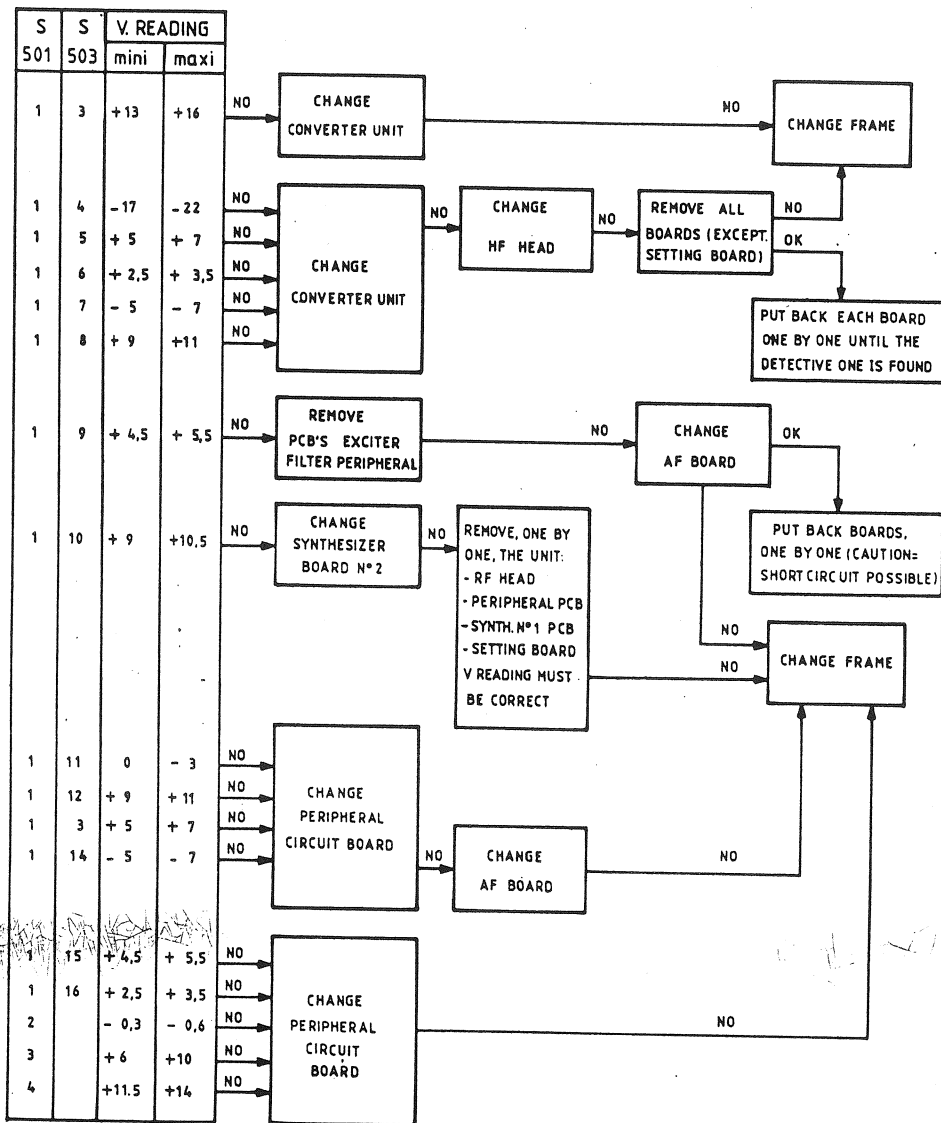


Fig. 3C.1.2

Test B1
Test Settings and Flow Chart

TESTS B2a and B2b : 1 kHz 0 and 5 MHz MASTER OSCILLATOR

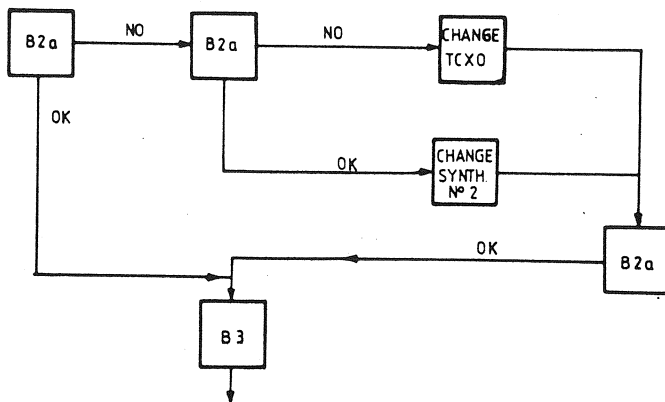


Fig. 3C.1.3

Test B2a and B2b
Flow Chart

TEST B3: HETERODYNE 100 — 105 MHz

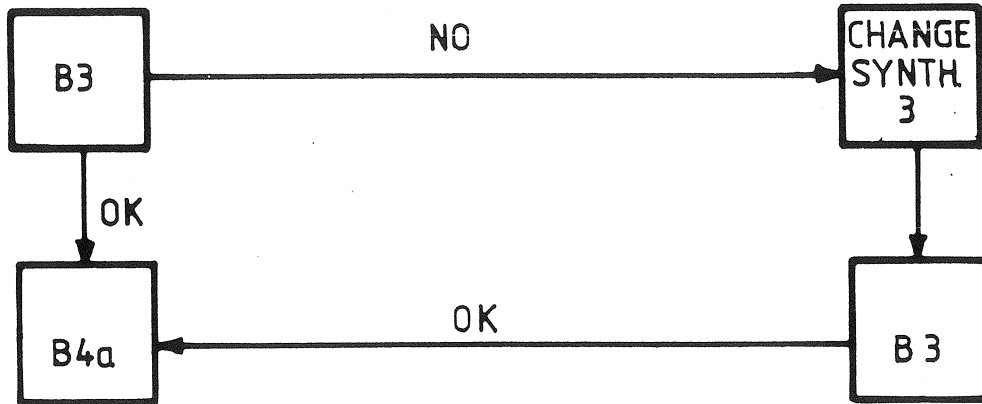


Fig. 3C.1.5

Test B3
Flow Chart

9 Prepare set up as shown in Fig 3C.1.6.

Manpack mode	Frequency meter reading	Voltmeter reading
MORSE — HSB — AM	25000 kHz + /- 1 kHz	.05 V. min.
LSB	30000 kHz + /- 1 kHz	.05 V. min.

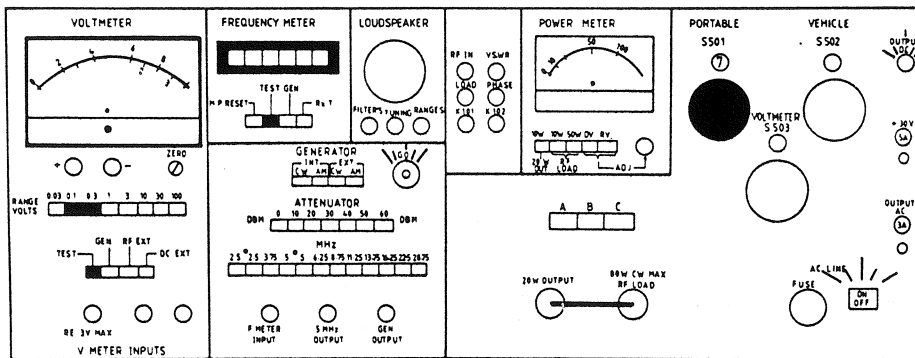
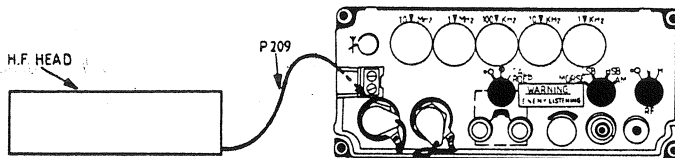


Fig. 3C.1.6

Test B3
Connections and Setting Up

TEST B4a — B4b: 2,5 MHz TRANSMISSION TEST B4c: 2,5 MHz OUTPUT EXCITER MODULATOR

- 10 Prepare set up as shown in Fig 3C.1.8. Wait 10 seconds before measurement.
- 11 Test B4a — Manpack mode: AM — Frequency meter reading: 2500 kHz
- Test B4b — Manpack mode: MORSE — Frequency meter reading: 2499 kHz
- Test B4c — Manpack mode: MORSE — Frequency meter reading: 0.02 V. min.

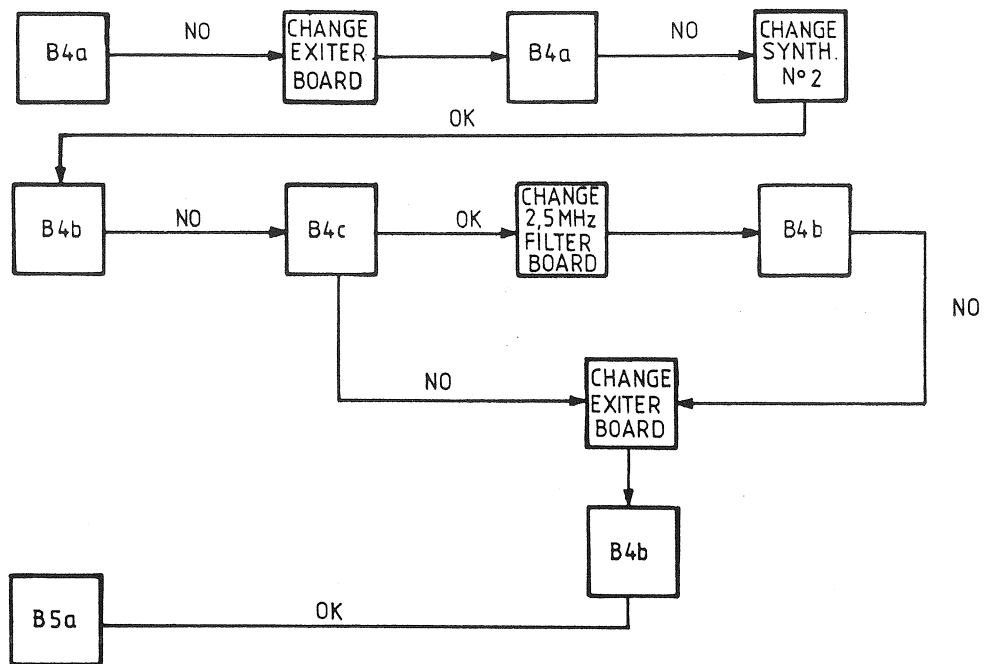


Fig. 3C.1.7

Test B4a; B4b and B4c
Flow Chart

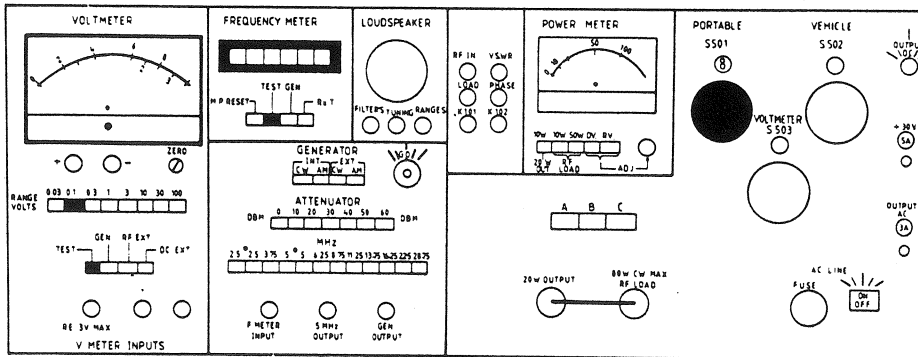
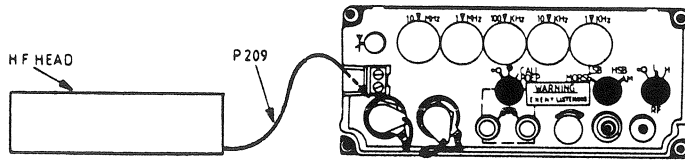


Fig. 3C.1.8 **Test B4a; B4b and B4c Connections and Setting Up**

TEST B5a : SYNTHESISER – GENERAL TEST

- 12 Prepare set up as shown in Fig 3C.1.10.
- 13 For the 11 frequencies (kHz):

20000	06666
11111	07777
02222	28888
03333	29999
04444	02000
05555	

Frequency meter reading: Manpack setting within + or – 0,1 kHz.

Voltmeter reading : 0,2 V. min.

STOP at the 1st bad frequency.

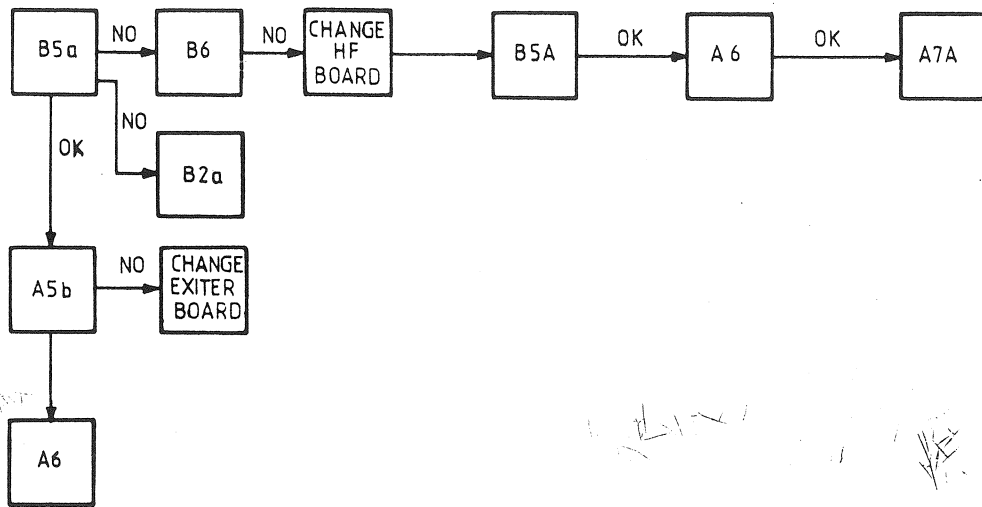


Fig. 3C.1.9

Test B5a
Flow Chart

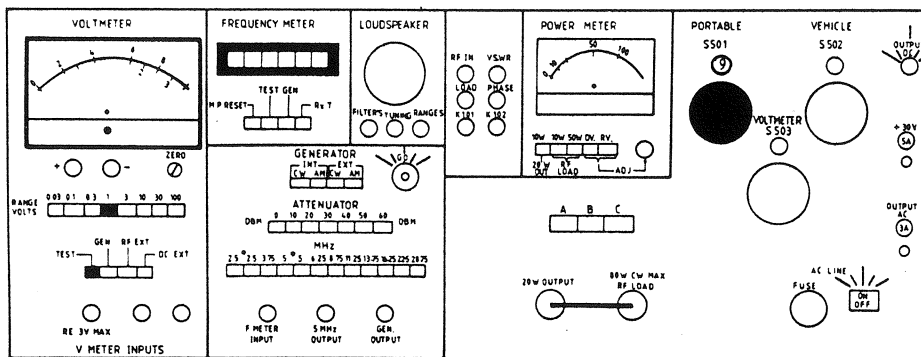
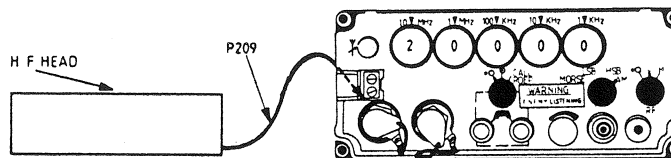


Fig. 3C.1.10

Test B5a
Connections and Setting Up

TEST B5b : RF COMPRESSOR

- 14 Prepare set up as shown in Fig 3C.1.12.
- 15 Voltmeter reading: 0,01 V. max.

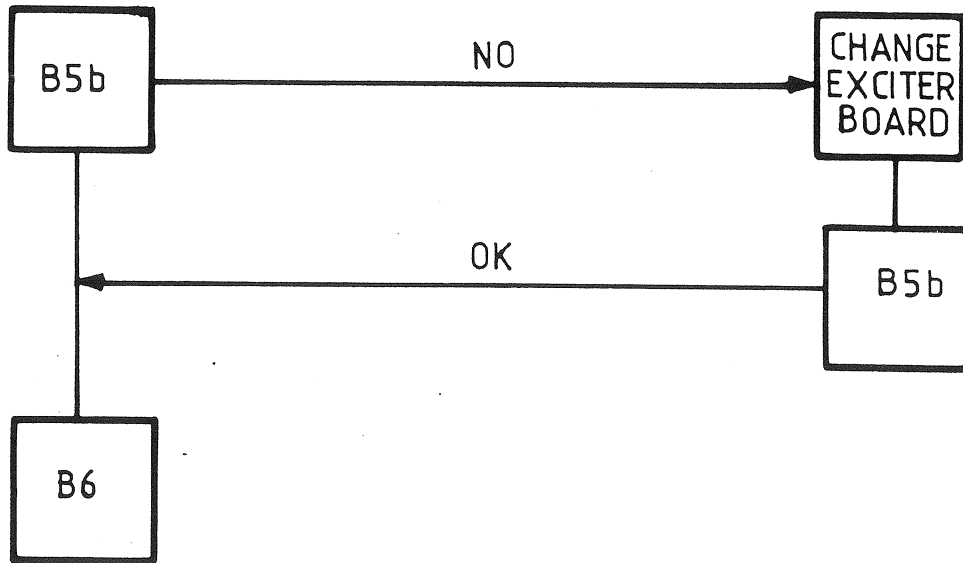


Fig. 3C.1.11

Test B5b
Flow Chart

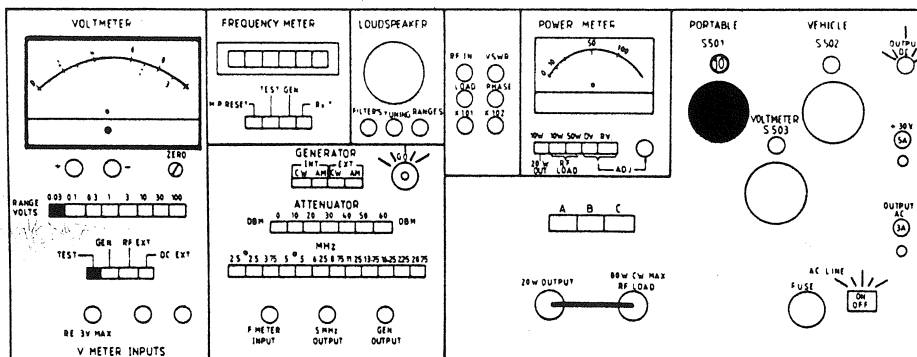
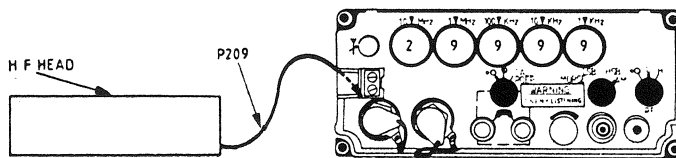


Fig. 3C.1.12

Test B5b
Connections and Setting Up

TEST B6 : CONTROL OF VCO

- 16 Prepare set up as shown in Fig 3C.1.14.
- 17 Set S501 – Wait 4 to 5 seconds before measurements.

S501	F. meter reading	V. meter reading
11	22000 kHz	0,25 V. min.
12	19000 kHz	0,25 V. min.
13	31000 kHz	0,2 V. min.

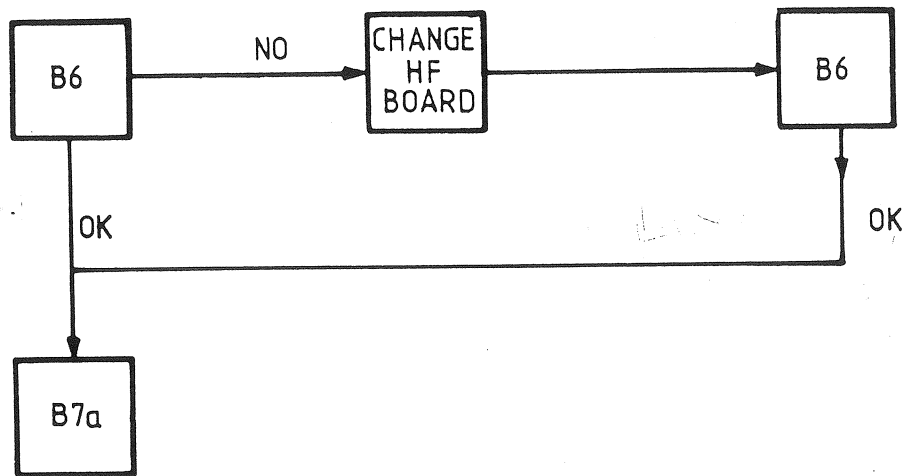


Fig. 3C.1.13

Test B6
Flow Chart

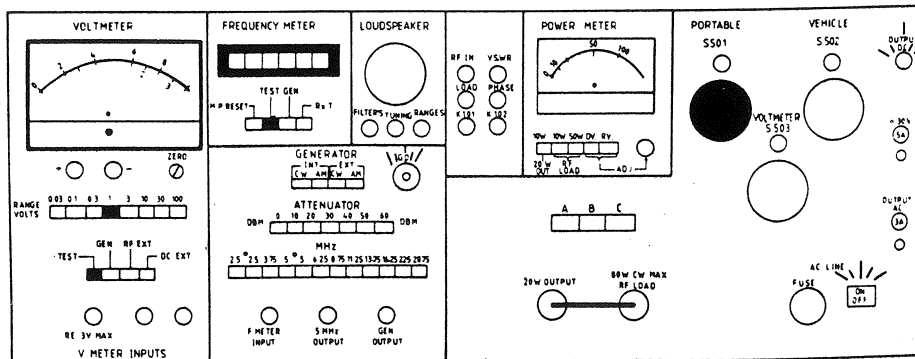
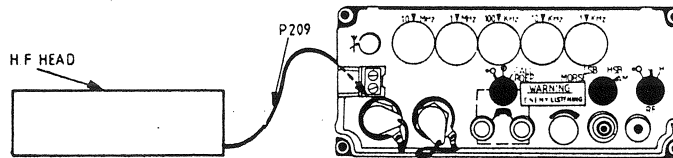


Fig. 3C.1.14

Test B6
Connections and Setting Up

TESTS B7a – B7b – B7c : SYNTHESISER SECONDARY LOOP

- 18 Prepare set up as shown in Fig 3C.1.16.
- 19 Test B7a: Frequency meter's selector on TEST.
 Does the frequency meter count?
- 20 Test B7b: Frequency meter reading (see table below).
- 21 Test B7c: Frequency meter's selector on MANPACK reset reading.
 (See table below).

Manpack setting	Frequency meter
02000	500
02111	611
02222	522
02333	633
02444	544
02555	655
02666	566
02777	677
02888	588
02999	699

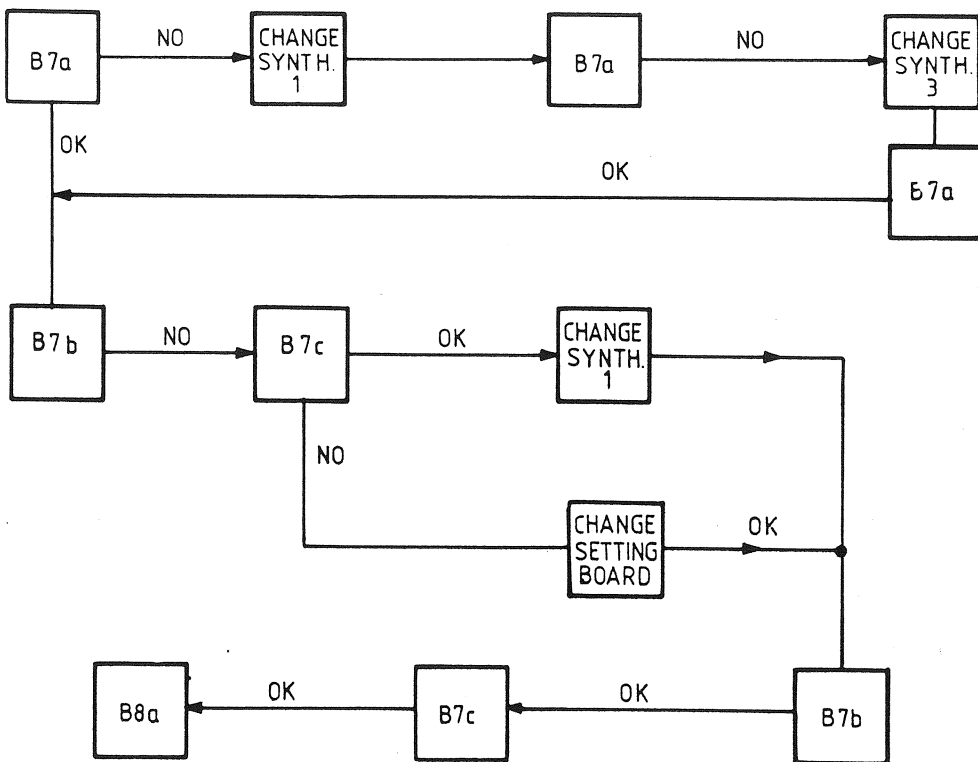


Fig. 3C.1.15 **Test B7a; B7b and B7c**
Flow Chart

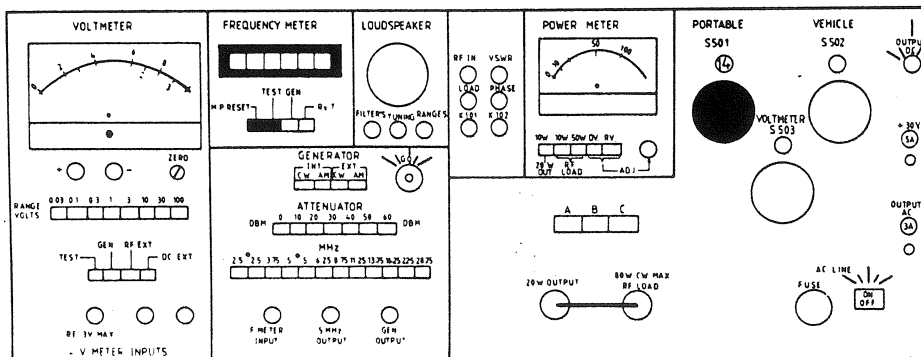
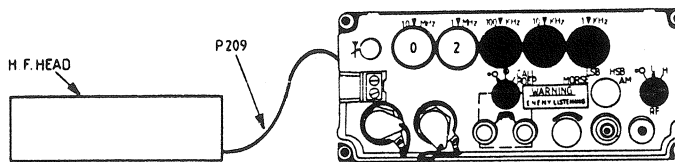


Fig. 3C.1.16

Test B7a; B7b and B7c Connections and Setting Up

TESTS B8a – B8b : SYNTHESISER MAIN LOOP

- 22 Prepare set up as shown in Fig 3C.1.18.
- 23 Test B8a: Does frequency meter count?
- 24 Test B8b: Check frequency reading using table below.

NOTE: STOP at the first bad result.

Manpack setting	Frequency meter reading
02000	100
03000	125
04000	150
05000	175
06000	200
07000	225
08000	250
09000	275
10000	300
11000	325
12000	350
13000	375
14000	400
15000	425
16000	450
17000	475
18000	500
19000	525
20000	550
21000	575
22000	600
23000	625
24000	650
25000	675
26000	700
27000	725
28000	750
29000	775

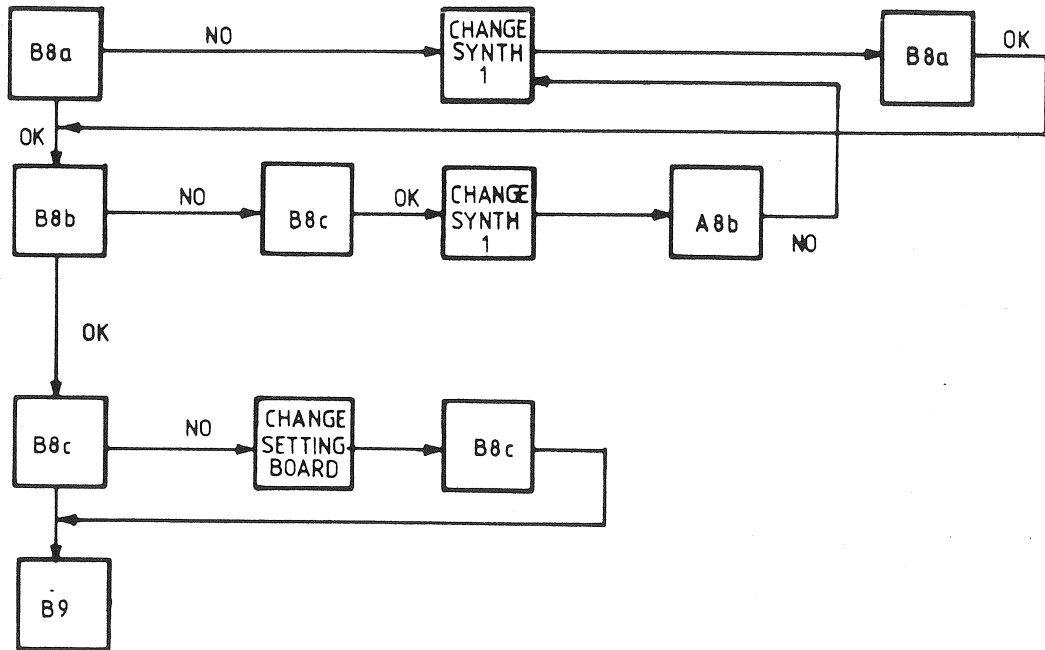


Fig. 3C.1.17

Test B8a; B8b
Flow Chart

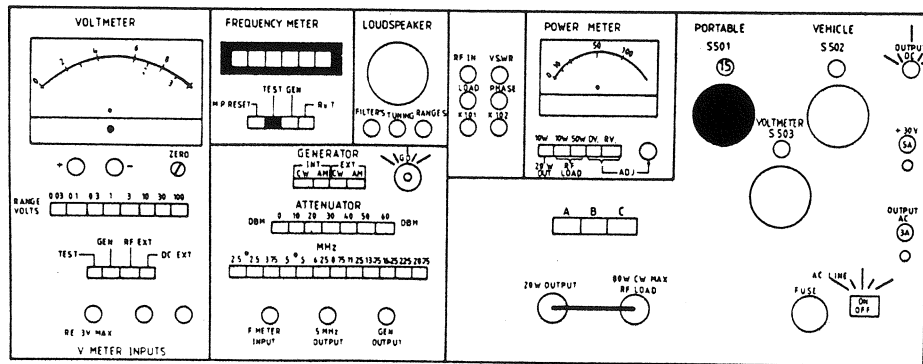
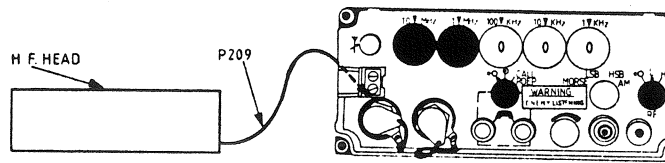


Fig. 3C.1.18

Test B8a; B8b
Connections and Setting Up

TEST B8c : SYNTHESISER MAIN LOOP

25. Prepare set up as shown in Fig 3C.1.20.
- 26 Step 1 – Frequency meter reading as per table.
- 27 Step 2 – Voltmeter reading: Inside specified zone as per table.

NOTE: STOP at the first bad result.

- 28 Test B8c uses the same flow chart as tests B8a and B8b.

Manpack setting	Frequency meter reading
02000	4
03000	5
04000	6
05000	7
06000	8
07000	9
08000	10
09000	11
10000	12
11000	13
12000	14
13000	15
14000	16
15000	17
16000	18
17000	19
18000	20
19000	21
20000	22

Table (continued)

Manpack setting	Frequency meter reading
21000	23
22000	24
23000	25
24000	26
25000	27
26000	28
27000	29
28000	30
29000	31

Manpack setting	Voltmeter reading
02000	0
02100	0
02200	+ 2 V. 0,5 V.
02300	+ 2 V. 0,5 V.
02400	+ 4,5 V. 0,5 V.
02500	+ 4,5 V. 0,5 V.
02600	+ 7 V. - 1 + 0,5 V.
02700	+ 7 V. - 1 + 0,5 V.
02800	+ 9,5 V. - 0,5 V. + 1
02900	+ 9,5 V. - 0,5 V. + 1

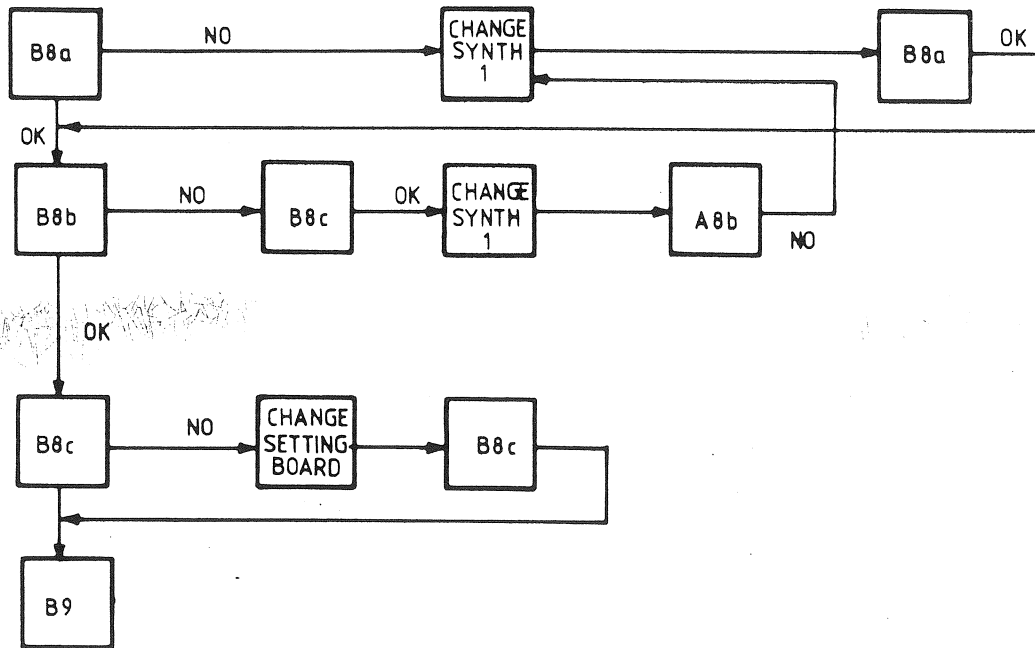


Fig. 3C.1.19

Test B8c
Flow Chart

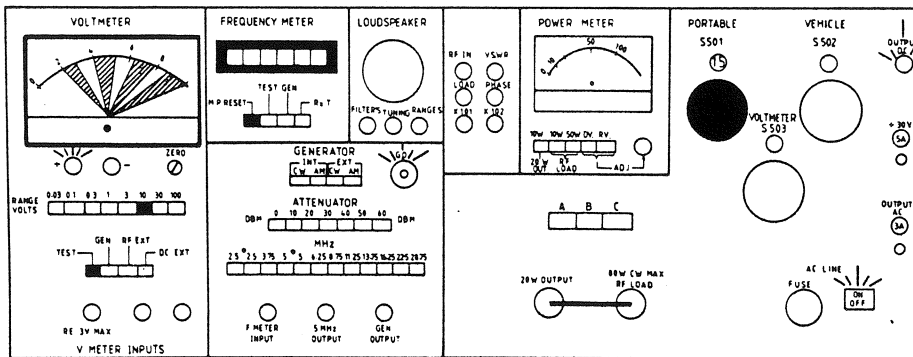
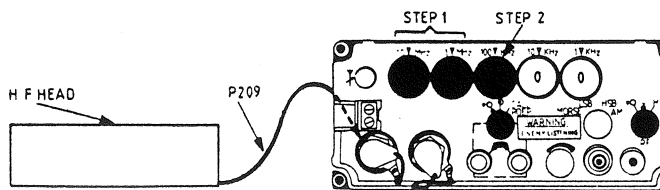


Fig. 3C.1.20

Test B8c
Connections and Setting Up

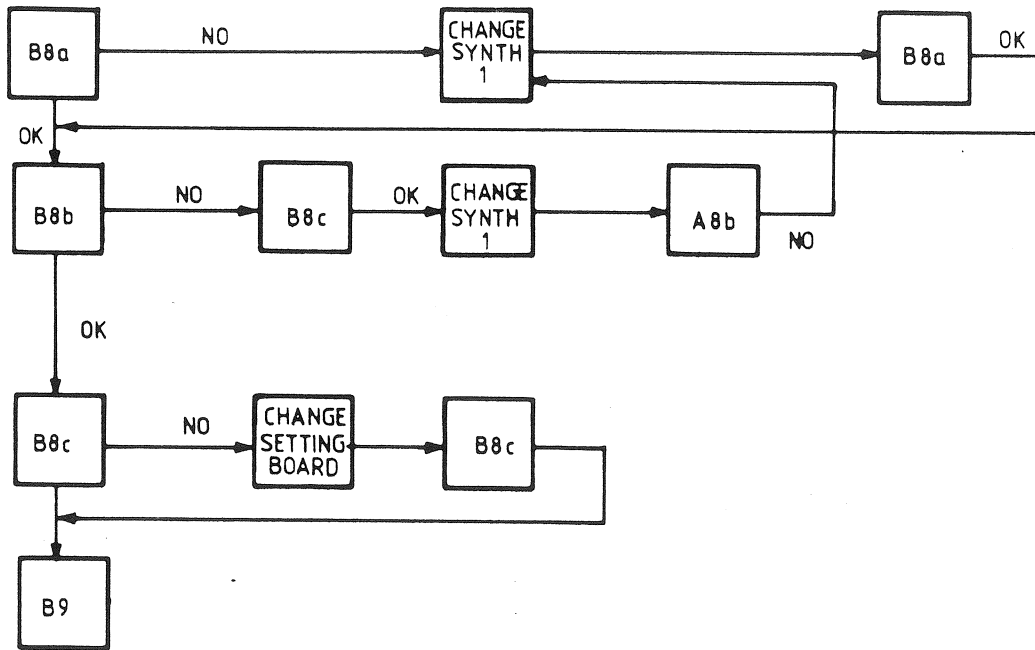


Fig. 3C.1.19

Test B8c
Flow Chart

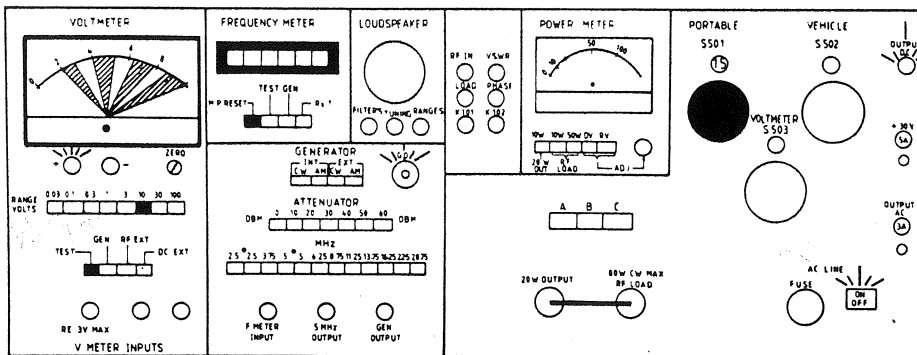
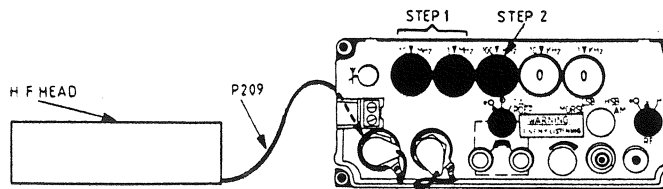


Fig. 3C.1.20

Test B8c
Connections and Setting Up

TEST B9 : SUPPLY AND CONTROL VOLTAGE IN RECEIVE MODE

- 29 Prepare set up as shown in Fig 3C.1.22.
- 30 Proceed to the tests specified in the table.

S503	Voltmeter reading
11	+ 9 V. to + 11 V.
12	0 V.
13	+ 1,8 V. max.
14	+ 6,5 V. to + 8 V.
15	+ 1,5 V. max.
16	0 V.

- 31 For each measurement, only one switch set up is required plus one range for the whole test.

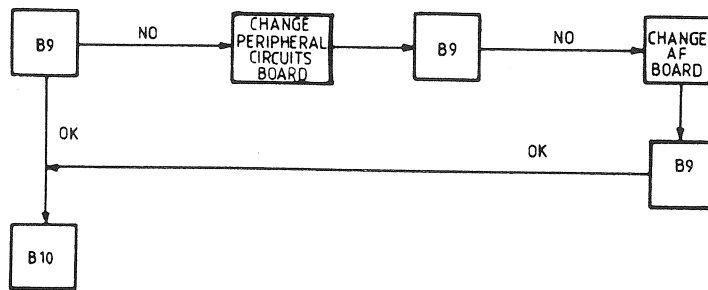


Fig. 3C.1.21

**Test B9
Flow Chart**

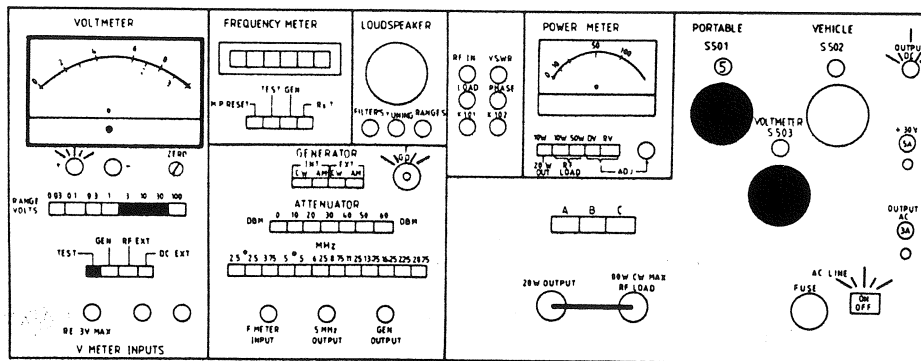
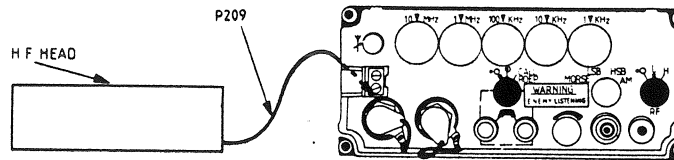


Fig. 3C.1.22

**Test B9
Connections and Setting Up**

TEST B10: RECEIVER GENERAL TEST

- 32 Prepare set up as shown in Fig 3C.1.24.
- 33 Test B10: By turning clockwise the AF control Manpack. Verify that the voltmeter reading can reach 2 V. and return to 1,5 V.

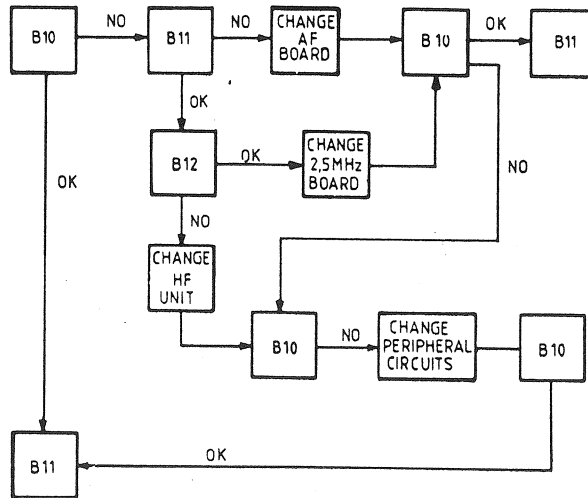


Fig. 3C.1.23

**Test B10
Flow Chart**

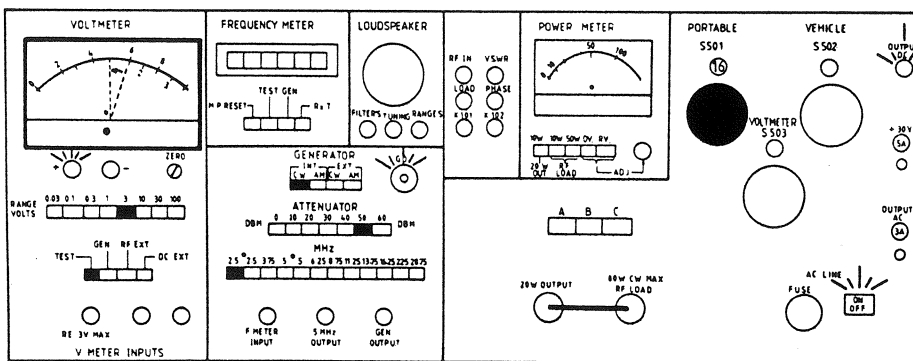
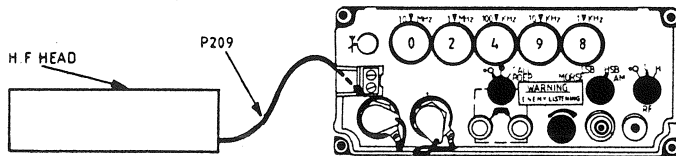


Fig. 3C.1.24

**Test B10
Connections and Setting Up**

TEST B11: AF BOARD

- 34 Prepare set up as shown in Fig 3C.1.26.
- 35 Adjust the AF control of the Manpack to set 2 V. on the voltmeter (Set Manpack to MORSE mode and LSB mode).

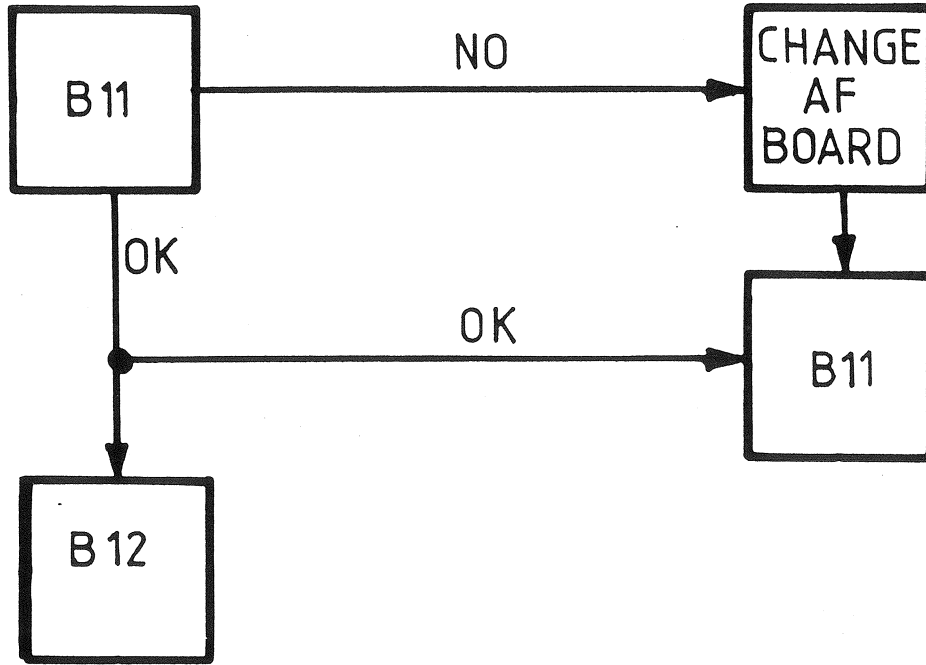


Fig. 3C.1.25

Test B11
Flow Chart

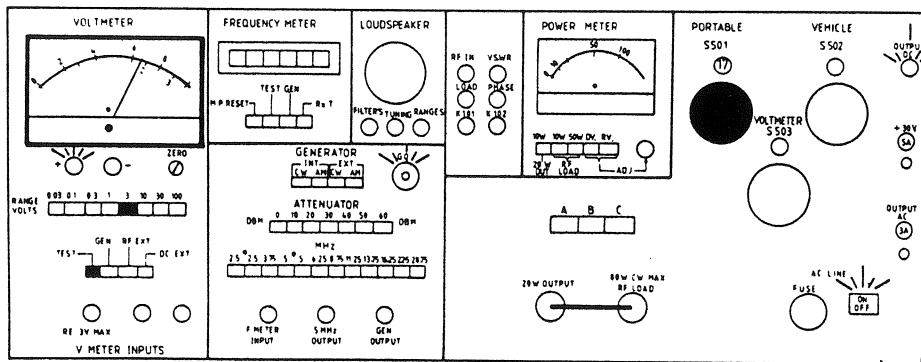
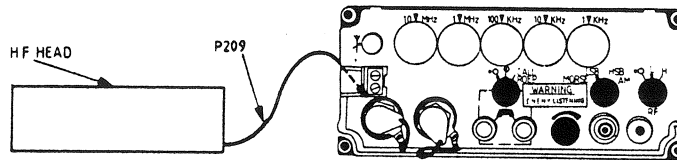


Fig. 3C.1.26

Test B11
Connections and Setting Up

TEST B12: AGC CONTROL VOLTAGE

- 36 Prepare set up as shown in Fig 3C.1.28.
- 37 Set attenuator on 0 dBm: Voltmeter reading inside the specified zone (3 V. to 5 V.).
- 38 Set attenuator on -60 dBm: Voltmeter same reading -1 dBm minimum.

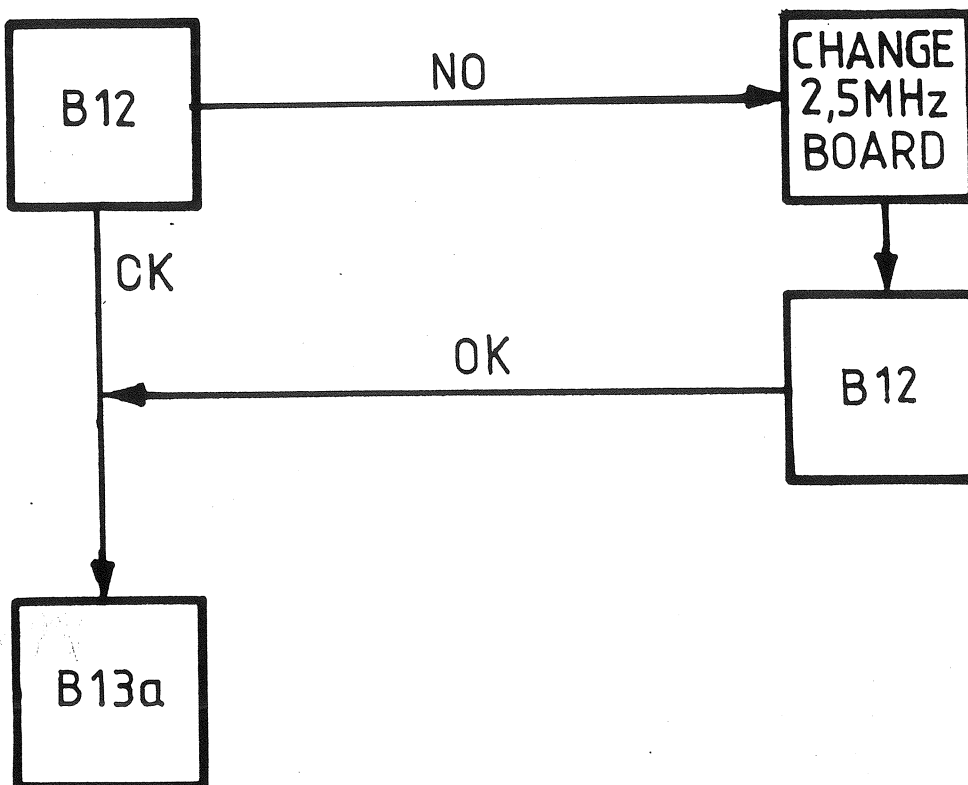


Fig. 3C.1.27

Test B12
Flow Chart

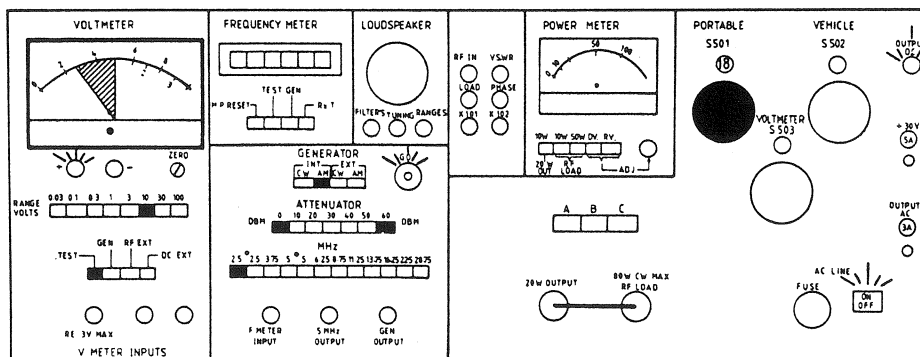
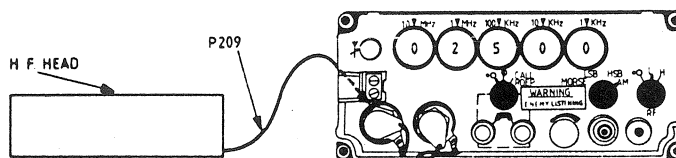


Fig. 3C.1.28

Test B12
Connections and Setting Up

TESTS B13a– B13b: SUB-RANGES CONTROL

39 Prepare set up as shown in Fig 3C.1.30.

Test B13a

Manpack setting	Voltmeter reading
02000	+3 to 3,3
02500	+2,9 to 3,2
03000	+2,6 to 2,9
04000	+2,4 to 2,6
08000	+2,1 to 2,4
10000	+1,8 to 2,1

40 Test B13b: The 'RANGE' indicator must be alight for twelve frequencies (see table below).

Manpack setting	Generator setting
02000	2,5
02500	2,5
03500	3,75
04500	5
05500	5
06500	6,25
08500	8,75
11500	11,25
13500	13,75
16500	16,25
22500	22,5
28500	28,75

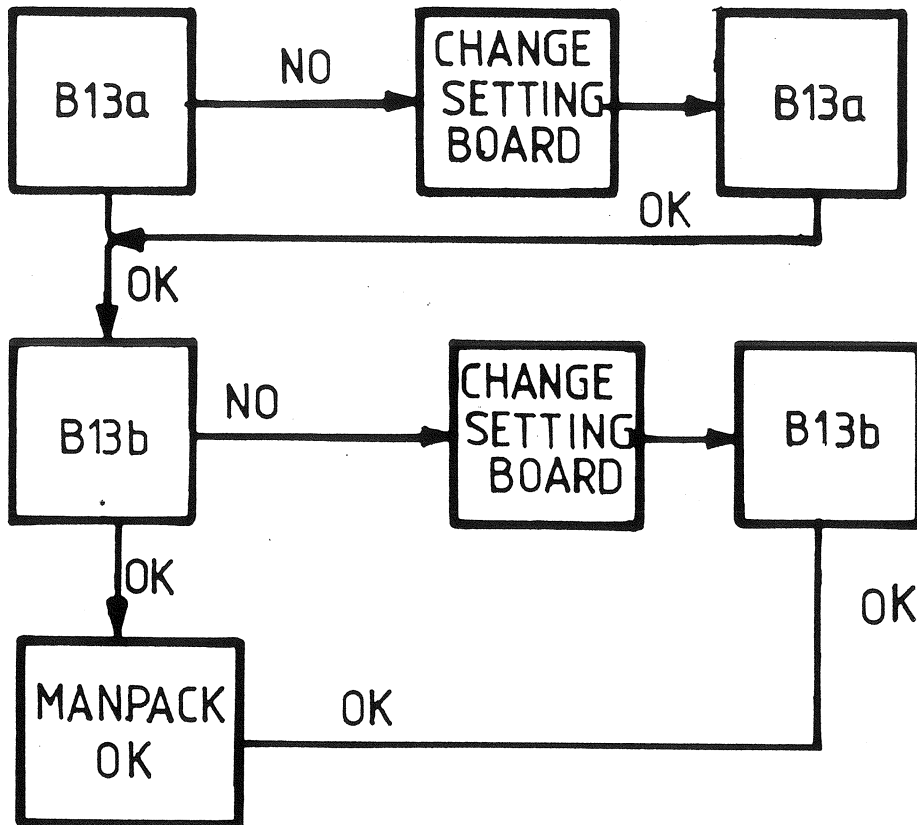


Fig. 3C.1.29

Test B13a; B13b
Flow Chart

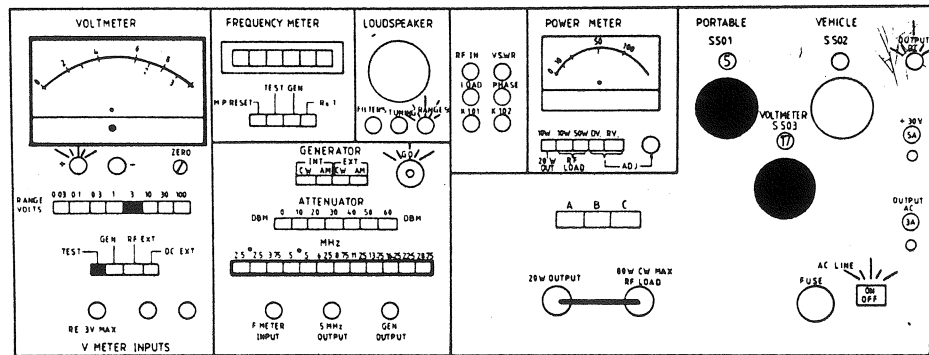
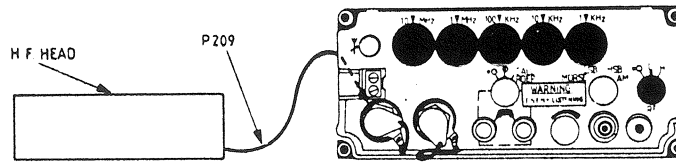


Fig. 3C.1.30

**Test B13a; B13b
Connections and Setting Up**

TEST B14 : 20 W AMPLIFIER

41 Prepare set up as shown in Fig 3C.1.32.

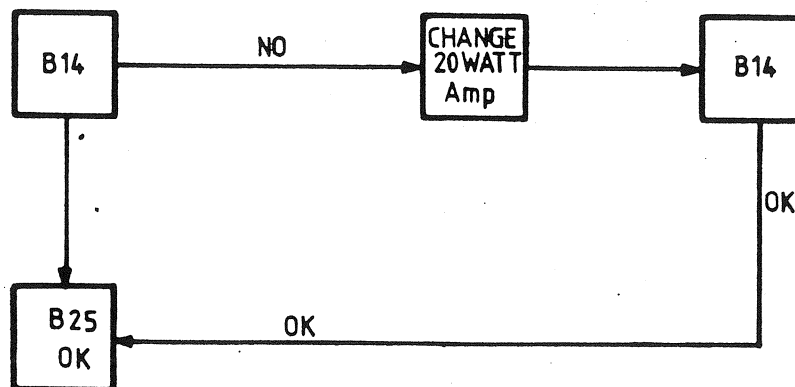


Fig. 3C.1.31

**Test B14
Flow Chart**

- 42 Step No 1: Voltmeter reading inside the specified zone 0,02 to 0,06 V.
- 43 Step No 2.

S503	Powermeter reading	Voltmeter reading
2	100 + or -1 dB	+ 0,2 V. to 0,4 V. = x Volts
*Push 'C' 2	70 + or -1 dB	x Volts
18	100 + or -1 dB	+ . 8 V. to 1,2 V. = y Volts
*Push 'C' 18	70 + or -1 dB	y Volts -0,5 dB min.
19	100 + or -1 dB	+ 0,1 V. max.
*Push 'C' 19	70 + or -1 dB	Same reading as 3 dB min.
END : ATTENUATOR ON -60 dBm		

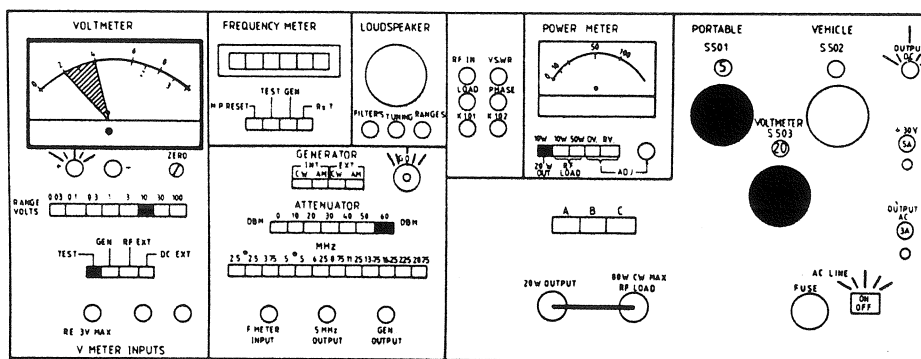
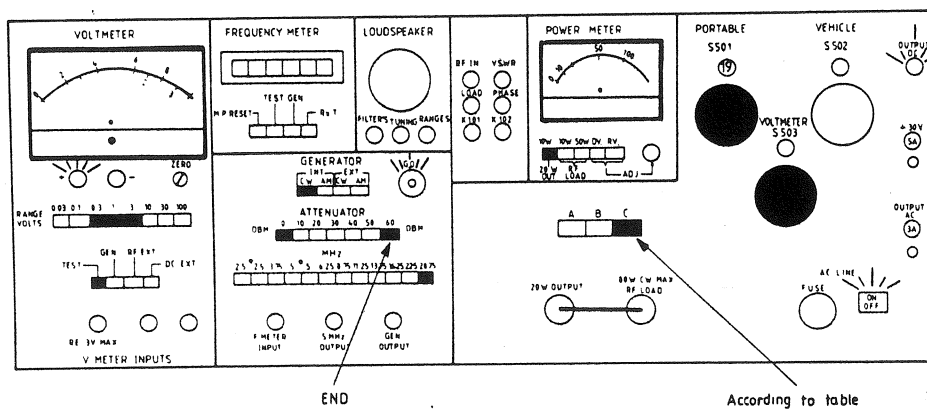


Fig. 3C.1.32

Test B14
Connections and Setting Up

- 44 Step No 3: Voltmeter reading inside the specified zone; +2V to +3,5 V.
- 45 *Maintain the pressure on 'C' button for a correct reading.
- 46 This concludes the module fault diagnosis of the RS-B25.

FAULT DIAGNOSIS

MODULE: FAULT DIAGNOSIS

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Peripheral Circuit Board: Connections to Jig	3C.2.22
Peripheral Circuit Board: Connections to Jig	3C.2.23
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INTRODUCTION

- 1 The following pages contain charts for the testing of individual PCBs or modules.
- 2 A complete list of test equipment is given and each chart will call up the equipment needed for that specific test, verification or adjustment.

LIST OF TEST APPARATUS

- 3
 - a Spectrum analyser type HP 141 T
plug in unit 8552 B
plug in unit 8553 B
 - b Powermeter type Marconi TF 2503
 - c Two tones AF generator Type Marconi TF 2005 R
 - d Synthesiser type HP 8660 A
plug in unit 86601 A
plug in unit 86631 B
 - e HF generator type HP 606 B
 - f HF generator type HP 608 F
synchroniser type HP 8708 A
 - g Distortion-meter type HP 334 A (AF voltmeter)
 - h HF voltmeter type Boonton 92 BD
 - j Multimeter
 - k Stabilised power supplies
 - l Oscilloscope type Philipps PM 3370
plug in unit PM 3372
 - m Numerical voltmeter type Schlumberger VB 1466
plug in unit VB 1479
 - n Tracking plug in unit type HP 8443 A
 - p Frequencymeter type Schlumberger FH 2521
 - q Pulse generator type Ferisol P 120
 - r Ammeter type HP 428 B
 - s Vector voltmeter type HP 8405 A

4 Please note that the following verification and adjustment procedures are for the B25 Radio and not the C25 which is the C version of the B25 Radio.

SYNTHESISER NO 3 BOARD ASSEMBLY

5 Procedure for the verification and adjustment of synthesiser No. 3 board assembly.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.9	1 Stabilised power supply, +3 V. 1 Stabilised power supply, -6 V. 1 RF synthesiser, 5 MHz, standard 1 RF generator, 100,5 MHz, standard 1 RF HF voltmeter, standard 1 Spectrum analyser, standard 1 Frequency meter, standard	1 Trimmer screwdriver

PROCEDURE

Preliminary Operations:

- 6 a Connect -6 V. stabilised power supply to terminal A6 of PCB assembly.
- b Connect +3 V. stabilised power supply to terminal A9 of PCB assembly.
- c Connect common point of stabilised power supplies to terminals A1, A13, B1, B3, B4, B6, B7, B9, B11 and B13 of PCB assembly (chassis).

Operating Procedure

- 7 This consists of the following operations:
 - a Adjustment of 100 MHz heterodyne oscillator.
 - b Adjustment of 105 MHz heterodyne.
 - c Verification of secondary loop mixer.

Adjusting the 100 MHz Oscillator

- 8 1 Connect –6 V. stabilised power supply to terminal B5 of PCB assembly.
- 2 Connect frequency meter to terminal A3 of PCB assembly.
- 3 Connect the HF voltmeter to terminal A3 of PCB assembly.
- 4 Set capacitor C13 for a frequency of 100 MHz approximately as read off the frequency meter and maximum voltage off the HF voltmeter.
- 5 Set capacitor C15 for a frequency within 99 999 950 and 100 000 050 Hz as read off the frequency meter a maximum voltage greater than or equal to 90 mV. as read off the HF voltmeter (output Z =50 Ohm).
- 6 Disconnect frequency meter and HF voltmeter from terminal A3 of the PCB assembly.
- 7 Disconnect –6 V. stabilised power supply from terminal B5 of PCB assembly.

Adjusting the 105 MHz Heterodyne

- 9 1 Connect –6 V. stabilised power supply to terminal A4 of PCB assembly.
- 2 Connect frequency meter to terminal A3 of PCB assembly.
- 3 Connect the HF voltmeter to terminal A3 of PCB assembly.
- 4 Connect spectrum analyser to terminal A3 of PCB assembly.
- 5 Connect 5 MHz RF synthesiser to terminal A5 of PCB assembly.
- 6 Set the 5 MHz RF synthesiser so that it delivers a signal with an amplitude of 220 V.rms.
- 7 Set capacitors C01 and C02 for maximum voltage as read off the HF voltmeter. Check that signal frequency read off the frequency meter is of 105 MHz plus/minus 50 Hz and that the amplitude as read off the HF voltmeter is greater than or equal to 90 mV. (output Z = 50 Ohms).
- 8 Note characteristics of signal read off the spectrum analyser set to 105 MHz.
- 9 Note characteristics of signal read off the spectrum analyser set to 100 MHz and check that attenuation is greater than or equal to 40 dB versus the 105 MHz signal.
- 10 Note the characteristics of signal read off the spectrum analyser set to 95 MHz and check that attenuation is greater than or equal to 30 dB versus the 105 MHz signal.
- 11 Disconnect frequency meter, HF voltmeter and spectrum analyser from terminal A3 of PCB assembly.
- 12 Disconnect the 5 MHz RF generator from terminal A5 of PCB assembly.
- 13 Disconnect –6 V. stabilised power supply from terminal A4 of PCB assembly.

Verifying the Secondary Loop Mixer

- 10 1 Connect the -6 V. stabilised power supply to terminal B5 of the PCB assembly.
- 2 Connect frequency meter to terminal B10 of PCB assembly.
- 3 Connect the HF voltmeter to terminal B10 of PCB assembly.
- 4 Connect RF generator set to 100,5 MHz (F1) to terminal A11 of PCB assembly.
- 5 Set the RF generator so as to obtain a signal with an amplitude of 140 mV.
- 6 Check for a frequency of 500 kHz as read off the frequency meter ($F1 - F2 = 500$ kHz, $F2 = F$ of signal at terminal A3).
- 7 Check that amplitude of signal as read off the HF voltmeter is greater than or equal to 400 mV.
- 8 Disconnect the frequency meter and HF voltmeter from terminal B10 of PCB assembly.
- 9 Disconnect the 100,5 MHz RF generator from terminal A11 of PCB assembly.
- 10 Disconnect -6 V. stabilised power supply from terminal B5 of PCB assembly.

Final Operations

- 11 a Disconnect -6 V. stabilised power supply from terminal A6 of PCB assembly.
- b Disconnect $+3$ V. stabilised power supply from terminal A9 of PCB assembly.

EXCITER PCB ASSEMBLY

12 The following procedure is for the verification and adjustment of the Exciter PCB Assembly:

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.19	1 Stabilised power supply, +6 V. 1 Stabilised power supply, -6 V. 1 Stabilised power supply, +10 V. 1 Stabilised power supply, +5 V. 1 RF generator, high stability 1 AF generator, standard 1 Spectrum analyser, standard 1 HF voltmeter, standard 1 Power supply, varying between 0 and 5 V., standard 1 Memory scope 1 AF voltmeter Multimeter	1 Load resistor, 50 Ohms, 1 Co-axial cable 1 Chopper

PROCEDURE

Preliminary Operations

- 13 a Connect +6 V. stabilised power supply to terminals B9 and B19 of PCB assembly.
- b Connect -6 V. stabilised power supply to terminals A6 and A17 of PCB assembly.
- c Connect +10 V. stabilised power supply to terminal B5 of PCB assembly.
- d Connect +5 V. stabilised power supply to terminal B13 of PCB assembly.
- e Connect common point of stabilised power supplies to terminals A1, A11, A12, A20, B1, B10 and B20 of PCB assembly (chassis).
- f Connect the high stability RF generator to terminal A19 of PCB assembly.
- g Set the RF generator so as to obtain a signal with an amplitude of 100 mV.rms. and a frequency of 2,5 MHz.

Operating Procedure

- 14 The different operating procedures to be carried out are as follows:
- a Adjustment of carrier rejection circuit in SSB transmission.
 - b Check of AF compression in SSB transmission.
 - c Check of time constant of the AF compression.
 - d Check of RF compression in SSB transmission.
 - e Check in A3H transmission.
 - f Check in MORSE transmission (A2J).
 - g Check of A3H switching.

Adjusting the Carrier Rejection Circuit in SSB Transmission

- 15
- 1 Connect AF generator to terminal A13 of PCB assembly.
 - 2 Set the AF generator so that it delivers a signal with an amplitude of 10 mV. and a frequency of 1 kHz.
 - 3 Connect the spectrum analyser and HF voltmeter to terminal A5 of the PCB assembly.
 - 4 Connect +6 V. stabilised power supply to terminals A4, A8 and A15 of the PCB assembly.
 - 5 Set the spectrum analyser to 2,5 MHz and note the value of signal as read off spectrum analyser.
 - 6 Set spectrum analyser to 2,501 MHz and note the signal value.
 - 7 Set the spectrum analyser to 2,499 MHz and note the signal value.
 - 8 Set potentiometer R57 so that the signal read off the spectrum analyser at frequencies 2,501 and 2,499 MHz may be higher than 35 dB versus the signal read with spectrum analyser set to 2,5 MHz.
 - 9 Check that the RF voltage read off the HF voltmeter is higher than or equal to 5 mV.rms.

Checking the AF Compression in SSB Transmission

- 16 1 Adjust the carrier rejection circuit in SSB transmission as indicated in para 15.
- 2 Disconnect the spectrum analyser from terminal A5 to PCB assembly.
- 3 Set the AF generator so as to obtain a voltage of 1 mV. and check that voltage read off the HF voltmeter is between 1,8 and 8 mV.
- 4 Set the AF generator so as to obtain a voltage of 10 mV. and check that the voltage read off the HF voltmeter is higher than 5 mV.
- 5 Set the AF generator so as to obtain a voltage of 100 mV. and check that voltage read off the HF voltmeter is between 10 and 25 mV.
- 6 Disconnect the HF voltmeter from terminal A5 of PCB assembly.

Checking the Time Constant of the AF Compression

- 17 1 Disconnect AF generator from terminal A13 of PCB assembly and HF voltmeter from terminal A5.
- 2 Prepare the following set up:

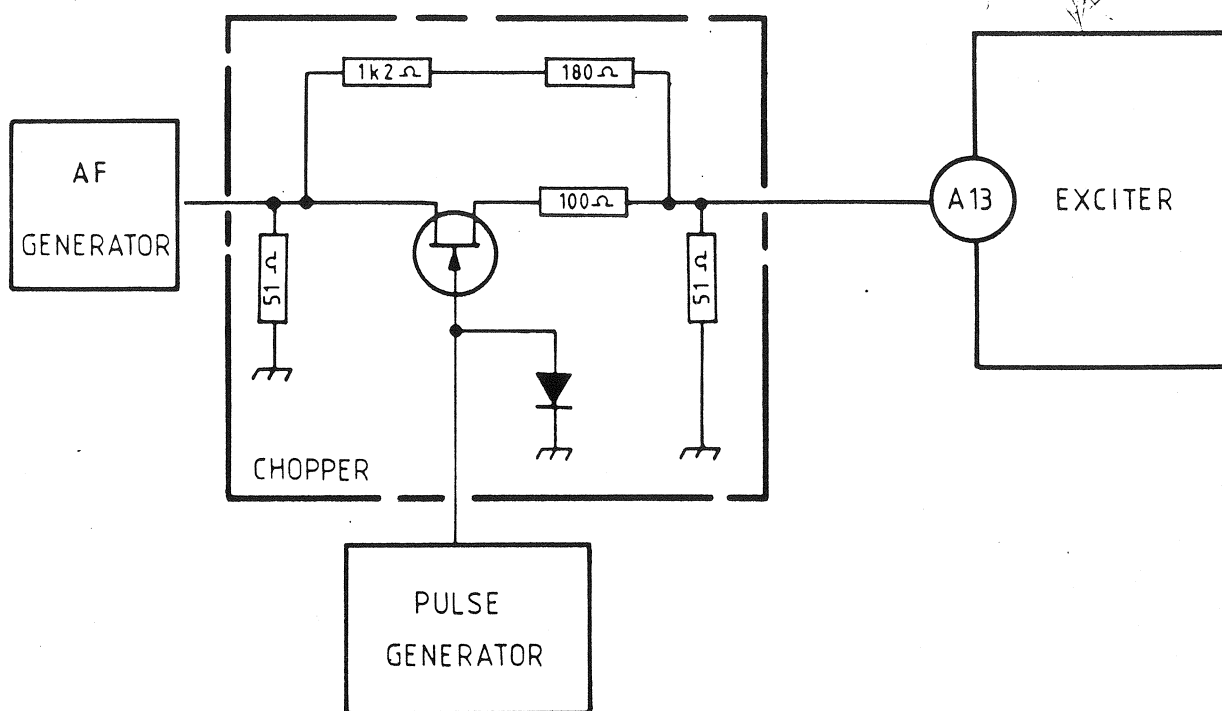


Fig. 3C.2.1

Exciter
Connections to Jig

17 (Continued)

- 3 Set the AF generator so as to obtain a signal with the following characteristics:

$$F = 1 \text{ kHz}$$

$$U = 40 \text{ mV.rms.}$$

- 4 Set the pulse generator as follows:

$$\text{Frequency: } 1/6 \text{ Hz}$$

$$\text{Duration: } 3\text{s with form factor } 1/1$$

$$\text{Output on negative channel amplitude } 0 \text{ and } -5 \text{ V.}$$

- 5 Connect oscilloscope and AF voltmeter to terminal B14 of PCB assembly.

- 6 Set the AF generator while pressing the ON pushbutton on the pulse generator so as to obtain 40 mV. off the AF voltmeter. Check that the waveform displayed on the oscilloscope is the same as the one below.

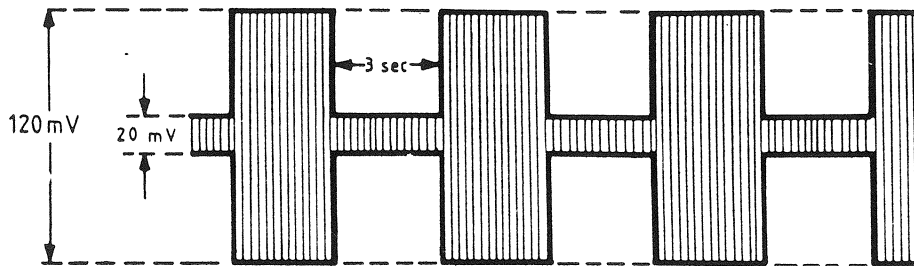


Fig. 3C.2.2

**Exciter
Wave Form**

- 7 Release 'ON' pushbutton of pulse generator.
- 8 Connect 'channel A' output of memory scope to terminal A5 of PCB assembly.
- 9 Adjust the memory scope as follows:
- | | |
|--------------------|-------------------|
| Amplitude | 20 mV. per mark |
| Scanning | 100 or 200 ms |
| Manual inscription | adjustment |
| Synch | triggered |
| Memory | x1 (or blanking). |
- 10 Press simultaneously 'ON' pushbuttons of the pulse generator and memory scope.

17 (continued)

- 11 Check that the time constant of signal displayed on memory scope is within 350 and 550 ms. The signal time constant is shown below:

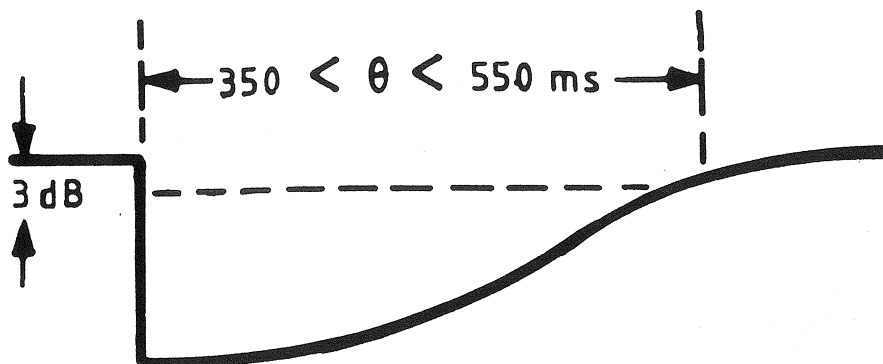


Fig. 3C.2.3

Exciter Signal Time Constant

- 12 Release the ON pushbuttons.
- 13 If need be, set resistor R37 in the PCB assembly to a value approximating 470 kOhms so as to obtain a time constant within 350 to 550 ms.
- 14 Disconnect the memory scope from terminal A5 of PCB assembly.
- 15 Disconnect chopper from terminal A13 of PCB assembly.
- 16 Disconnect voltmeter and oscilloscope from terminal B14 of PCB assembly.
- 17 Connect the AF generator to terminal A13 of PCB assembly.

Checking the RF Compression in SSB Transmission

- 18 1 Adjust the carrier rejection circuit in SSB transmission as indicated in para 15.
- 2 Check the AF compression in SSB transmission as indicated in para 16.
- 3 Check the time constant of the AF compression as indicated in para 17.
- 4 Connect terminal A2 to terminal A5 of PCB assembly by means of a co-axial cable.
- 5 Connect the variable power supply to terminal B7 of PCB assembly.
- 6 Set the variable power supply so that it delivers 0 V.
- 7 Set the AF generator so that it delivers 10 mV.
- 8 Connect the HF voltmeter to terminal B6 of PCB assembly.
- 9 With potentiometer R44 at mid-range, set potentiometer R26 successively for minimum and maximum value. Check that voltage read off the HF voltmeter varies from 3 to 20 mV. Adjust resistor R28 if need be (470 Ohms, 1 kOhm or 1,8 kOhm).

- 8 Disconnect the dc. voltmeter from terminal B8 and connect it to terminal A7 of PCB assembly.
- 9 Check for a voltage approximating -6 V. off dc. voltmeter.
- 10 Disconnect dc. voltmeter from terminal A7 of PCB assembly.
- 11 Disconnect the lead between terminal A9 and terminals A6 and A17 of PCB assembly.

Final Operations

- 22 1 Disconnect high stability RF generator from terminal A19 of PCB assembly.
- 2 Disconnect the common point of stabilised power supplies from terminals A1, A11, A12, A20, A21, B1, B10 and B20 of PCB assembly.
- 3 Disconnect the $+5$ V. stabilised power supply from terminal B13 of PCB assembly.
- 4 Disconnect the stabilised $+10$ V. power supply from terminal B5 of PCB board assembly.
- 5 Disconnect stabilised -6 V. power supply from terminals A6 and A17 of PCB assembly.
- 6 Disconnect stabilised $+6$ V. power supply from terminals B9 and B19 of PCB assembly.

SYNTHESISER NO. 1 PCB ASSEMBLY

- 23 The following procedure is used for the verification and adjustment of synthesiser No. 1 PCB.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Figs 5A.1.2	1 Stabilised power supply, $+6$ V.	1 resistor, 50 Ohm
5A.1.3	1 Stabilised power supply, $+3$ V.	1 resistor, 10 kOhm
5A.1.4	1 Stabilised power supply, -6 V.	
	1 Stabilised power supply, $+5$ V.	
	1 Stabilised power supply, $+9,5$ V.	
	1 Stabilised power supply, -22 V.	
	1 Stabilised power supply, adjustable from 0 to $+10$ V.	
	1 Frequency meter, standard	
	1 Oscilloscope	
	1 Synthesiser	
	3 Pulse generators, standard	
	1 RF voltmeter	

PROCEDURE**Preliminary Operations**

- 24 a Connect stabilised +6 V. power supply to terminal B11 of PCB assembly.
- b Connect stabilised +3 V. power supply to terminal A11 of PCB assembly.
- c Connect stabilised -6 V. power supply to terminals A2 and B7 of PCB assembly.
- d Connect stabilised +9,5 V. to terminal A5 of PCB assembly.
- e Connect stabilised -20 V. power supply to terminal B5 of PCB assembly.
- f Connect the common point of power supplies to terminals A1, A7, A9, A13, B1, B6, B8, B12 and B13 (chassis) of PCB assembly.

Operating Procedure

- 25 The different operating procedures to be carried out are as follows:
 - a Adjustment of VCO.
 - b Verification of primary loop mixer, divider by four and divider by ten or twelve.
 - c Verification of digital-to-analog convertor.
 - d Verification of phase comparator.

Adjusting the Voltage-Controlled Oscillator (VCO)

- 26 1 Set the stabilised power supply adjustable from 0 to +10 V. to 3,5 V.
- 2 Connect the adjustable stabilised power supply (set to 3,5 V.) to test terminal TP01.
- 3 Connect the +5 V. stabilised power supply to test terminal TP02.
- 4 Connect the frequency meter, oscilloscope and HF voltmeter across a 50 Ohm resistor connected to terminal A6 of PCB assembly.
- 5 Set capacitor C34 so as to obtain a signal frequency of 100,6 MHz as read off the frequency meter.

Checking the CDA Varicap Frequency Coverage

- 27 1 Set the stabilised power supply connected to TP01 (adjustable from 0 to +10 V.) so as to obtain a voltage of 0 V.
- 2 Check that signal frequency read off frequency meter is lower than 100,5 MHz (approximating 100,4 MHz).
- 3 Increase the value of voltage delivered by the adjustable power supply connected to TP01 so as to obtain +7,5 V. while checking the signal frequency read off the frequency meter. Check that frequency is greater than 100,7 MHz (approximating 100,8 MHz).

Check of the Phase Loop Varicap Frequency Coverage

- 28 1 Set the stabilised power supply connected to TP01 to 3,5 V.
- 2 Set the variable stabilised power supply connected on TP02 to 5 V.
- 3 Check that the signal frequency on terminal A6 is 100,6 MHz.
- 4 Set the variable stabilised power supply connected on TP02 to 0 V.
- 5 Check that the signal frequency on terminal A6 is less than 100,5 MHz.
- 6 Set the variable stabilised power supply connected on TP02 to 9,5 V.
- 7 Check that the signal frequency on terminal A6 is greater than 100,7 MHz.
- 8 Disconnect:
Variable power supply from test point TP01.
Stabilised +5 V. power supply from test point TP02.

Checking the Phase Loop Varicap Frequency Slope

- 29 1 Set adjustable power supply to +5 V. and connect it to test point TP02.
- 2 Connect the stabilised +5 V. power supply to test point TP01.
- 3 Note the value of signal frequency read off the frequency meter.
- 4 Vary the voltage delivered by power supply connected to test point TP02 by 1 V; note the new value of signal frequency read off the frequency meter and check that the frequency deviation is greater than 20 kHz.
- 5 Disconnect:
Adjustable power supply from test point TP02.
+5 V. stabilised power supply from test point TP01.

Adjustment of the VCO Amplifier

- 30 1 Set stabilised power supply (adjustable from 0 to 10 V.) to 3,5 V. and connect the power supply to test point TP01.
- 2 Connect the +5 V. stabilised power supply to test point TP02.
- 3 Check for a signal frequency of 100,6 MHz off the frequency meter.
- 4 Set capacitor C31 so as to obtain maximum voltage as read off the oscilloscope and RF voltmeter. Said voltage shall be at least 100 mV.
- 5 Disconnect the frequency meter, oscilloscope, RF voltmeter and 50 Ohm resistor from terminal A6 of PCB assembly.

Checking the Digital/Analog Converter

- 32 1 Adjust the VCO as indicated in para 30.
- 2 Disconnect adjustable stabilised power supply from test point TP01.
- 3 Disconnect the +5 V. stabilised power supply from test point TP02.
- 4 Connect a pulse generator to terminal B3 for PCB assembly and adjust it so that it delivers positive signals with:
- 3 μ s duration.
 - 9,5 V. amplitude positive.
 - 1 kHz repetition frequency.
- 5 Connect a pulse generator to terminal B2 of PCB assembly and adjust it so that it delivers positive signals with:
- 3 μ s duration.
 - 9,5 V. amplitude positive.
 - 1,05 kHz repetition frequency.
- 6 Connect the oscilloscope to test point TP01.
- 7 Check on oscilloscope that displayed signal has the following waveform:

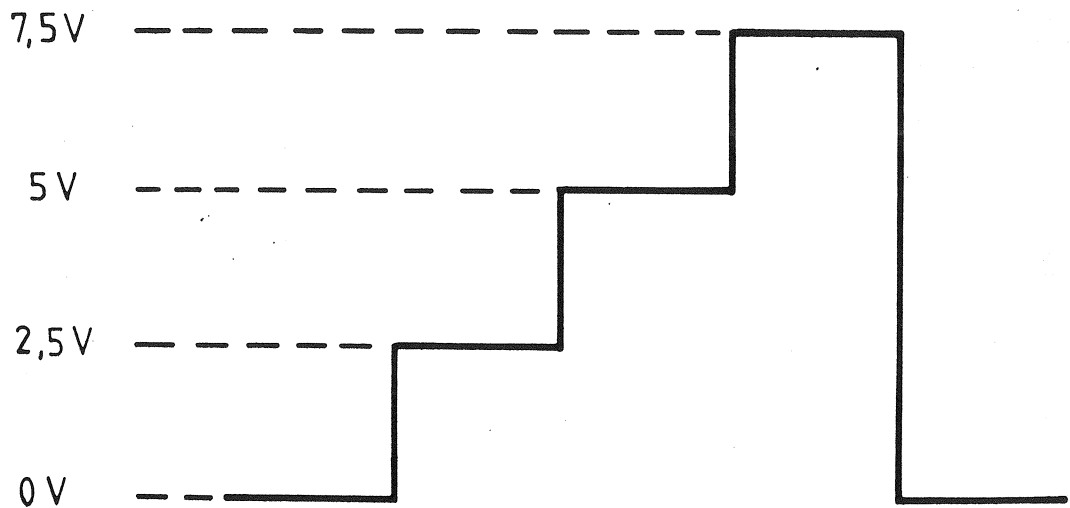


Fig. 3C.2.4

**Synthesiser 1
Wave Form**

32 Continued

- 8 Disconnect the pulse generator from terminal B2 of PCB assembly.
- 9 Connect terminal B2 of PCB assembly to terminal B3.
- 10 Check on the scope that the signal is continuous and corresponds to one of 0, 2,5, 5 or 7,5 V. steps.
- 11 Remove connection between terminals B2 and B3 of PCB assembly.
- 12 Disconnect the pulse generator from terminal B3 of PCB assembly.
- 13 Disconnect the oscilloscope from test point TP01.

Checking the Phase Comparator

- 33 1 Adjust the VCO as indicated in para 30.
- 2 Check that no stabilised power supply is connected to test points TP01 and TP02.
- 3 Connect a pulse generator to terminal A3 of PCB assembly and set it so as to obtain negative signals with:
 - 3 μ s duration
 - 9,5 V. amplitude negative.
 - 1 kHz repetition frequency.
- 4 Connect a pulse generator to terminal B2 of PCB assembly and set it so as to obtain positive signals with:
 - 3 μ s duration
 - 9,5 V. amplitude positive.
 - 1 kHz repetition frequency.

Phase-shift varying with respect to that delivered by the pulse generator connected to terminal A3 of PCB assembly.
- 5 Connect the oscilloscope to test point TP02.
- 6 Check on scope that signal is continuous and within 0 and 9,5 V.
- 7 Disconnect oscilloscope from test point TP02.
- 8 Disconnect pulse generator from terminal B2 of PCB assembly.
- 9 Disconnect pulse generator from terminal A3 of PCB assembly.

Final Operations

- 34 1 Disconnect the +6 V. stabilised power supply from terminal B11 of PCB assembly.
- 2 Disconnect the +3 V. stabilised power supply from terminal A11 of PCB assembly.
- 3 Disconnect the -6 V. stabilised power supply from terminals A2 and B7 of PCB assembly.
- 4 Disconnect the +9,5 V. stabilised power supply from terminals A5 of PCB assembly.
- 5 Disconnect the -22 V. stabilised power supply from terminal B5 of PCB assembly.
- 6 Disconnect the common point of power supplies from terminals A1, A7, A9, A13, B1, B6, B8, B12 and B13 (maximum) of PCB assembly.

SYNTHESISER NO. 2 PCB ASSEMBLY

35 The following procedure is used for the verification of the synthesiser No. 2 PCB assembly:

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Figs 5A.1.5	1 Stabilised power supply, +6 V.	1 Resistor, 12 kOhm
5A.1.6	1 Stabilised power supply, +14,5 V.	3 Diodes IN 4148
5A.1.7	1 Stabilised power supply, -6 V.	1 Changeover switch SPDT
5A.1.8	1 Stabilised power supply, +3 V.	
	1 Generator, 5 MHz	
	1 HF voltmeter	
	1 Frequency meter	
	1 Pulse generator	
	1 Digital voltmeter	
	1 AF voltmeter	

PROCEDURE

Preliminary Operations

- 36 a Carry out the following set up:

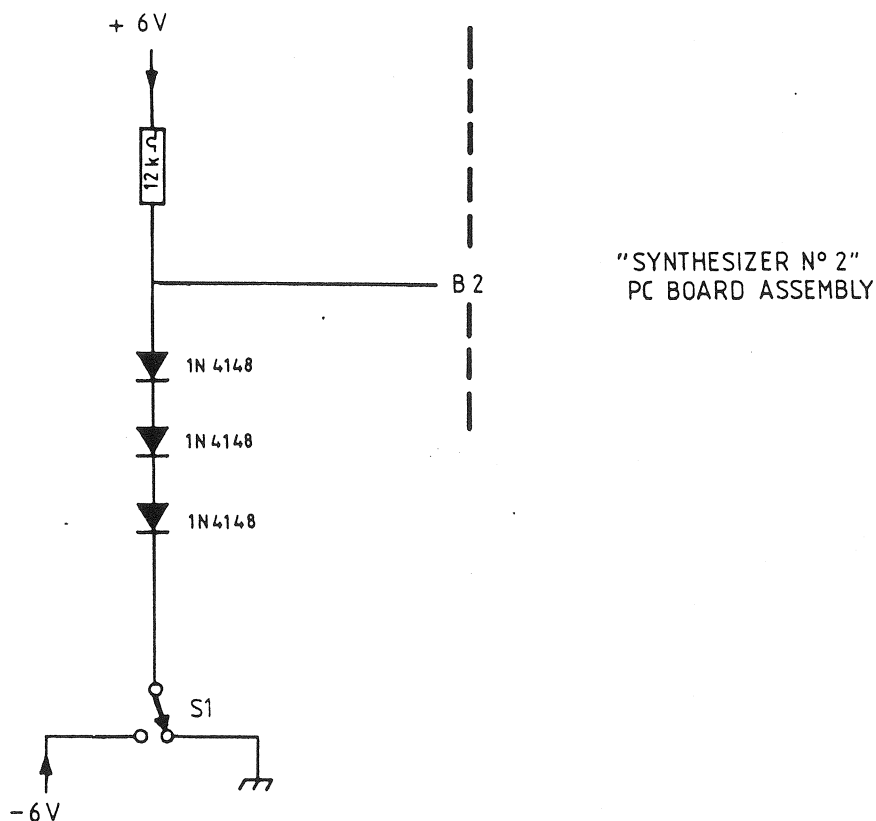


Fig. 3C.2.5

Synthesiser 2
Change Over Switch

- b Check that set-up is grounded via changeover switch S1.
- c Connect the +3 V. stabilised power supply to terminal A4 of PCB assembly.
- d Connect the +14,5 V. stabilised power supply to terminal A5 of PCB assembly.
- e Connect the -6 V. stabilised power supply to terminal A12 of PCB assembly.
- f Connect the common point of power supplies to terminals A1, A8, A10, A13, B1, B6, B7, B8 and B13 of PCB assembly (ground terminals).

Operating Procedure

37 The different operating procedures to be carried out are as follows:

- a Verification of 9,5 V. voltage stabiliser.
- b Verification of divider by 2.
- c Verification of divider by 100.
- d Verification of divider by 25.
- e Verification of digital/analog converter.
- f Verification of frequency discriminator.

NOTE The various verifications of the 'Synthesiser No 2' PCB assembly shall be carried out systematically in the order indicated above.

Checking the 9,5 V. Voltage Stabiliser

- 38 1 Connect digital voltmeter to terminal B5 of PCB assembly.
- 2 Check that dc. voltage read off digital voltmeter is within +9,025 and +9,975 V.
If need be, adjust value of resistor R08 so as to obtain a dc. voltage within this range.
- 3 Disconnect digital voltmeter from terminal B5 of PCB assembly.

Checking the Divider by Two

- 39 1 Connect a 5 MHz ac. generator to terminal B4 of PCB assembly.
- 2 Set 5 MHz ac. generator so as to obtain a signal of 220 mV.rms sine with an impedance of 50 Ohm.
- 3 Connect HF voltmeter and frequency meter to terminal A2 of PCB assembly in 50 Ohm impedance.
- 4 Connect the -6 V. power supply to external set-up by means of changeover switch S1 and check that voltage read off the HF voltmeter is lower than 5 mV.
- 5 Ground external set-up by means of changeover switch S1.
- 6 Check that:
Voltage read off the HF voltmeter is at least 50 mV. Frequency read off the frequency meter is equal to 2,5 MHz.
- 7 Disconnect the HF voltmeter and frequency meter from terminal A2 of PCB assembly.
- 8 Disconnect external set-up from terminal B2 of PCB assembly.

Checking the Divider by 100

- 40 1 Connect oscilloscope to test point TP01.
- 2 Check on scope that:
 - Pulse amplitude is of 9,5 V.
 - Pulse repetition frequency is of 25 kHz
 - Duration of pulses is within 1,6 μ s and 2,4 μ s.
- 3 Disconnect oscilloscope from test point TP01.

Checking the Divider by 25

- 41 1 Connect oscilloscope to terminal A6 of PCB assembly.
- 2 Check on scope that:
 - Pulses are positive
 - Pulse amplitude is of 9,5 V.
 - Pulse repetition frequency is of 1 kHz
 - Pulse duration is within 1,4 μ s and 2,1 μ s.
- 3 Disconnect oscilloscope from terminal A6 and connect it to terminal A7 of PCB assembly.
- 4 Check on scope that:
 - Pulses are negative
 - Pulse amplitude is of 9,5 V.
 - Pulse repetition frequency is of 1 kHz
 - Pulse duration is within 1,4 μ s and 2,3 μ s.
- 5 Disconnect oscilloscope from terminal A7 of PCB assembly.
- 6 Connect the AF voltmeter to terminal B9 of PCB assembly.
- 7 Check that voltage read off the AF voltmeter is of 100 mV.
- 8 Disconnect the audio voltmeter.

Checking the Digital/Analog Converter

- 42 1 Connect a pulse generator to terminal A9 of PCB assembly.
- 2 Trigger the oscilloscope by means of 5 MHz generator and adjust the pulse generator as follows:
- Amplitude: 9,5 V.
- Pulse repetition frequency: 28 kHz
- Pulse duration: 1,6 to 2 μ s
- 3 Connect oscilloscope to terminal B10 of PCB assembly.
- 4 Check on scope that signal characteristics are as follows:
- 128 steps
- Total amplitude: 9,5 V.
- Frequency: 3 kHz
- Amplitude of each step: 74 mV.
- The signal is shown below.

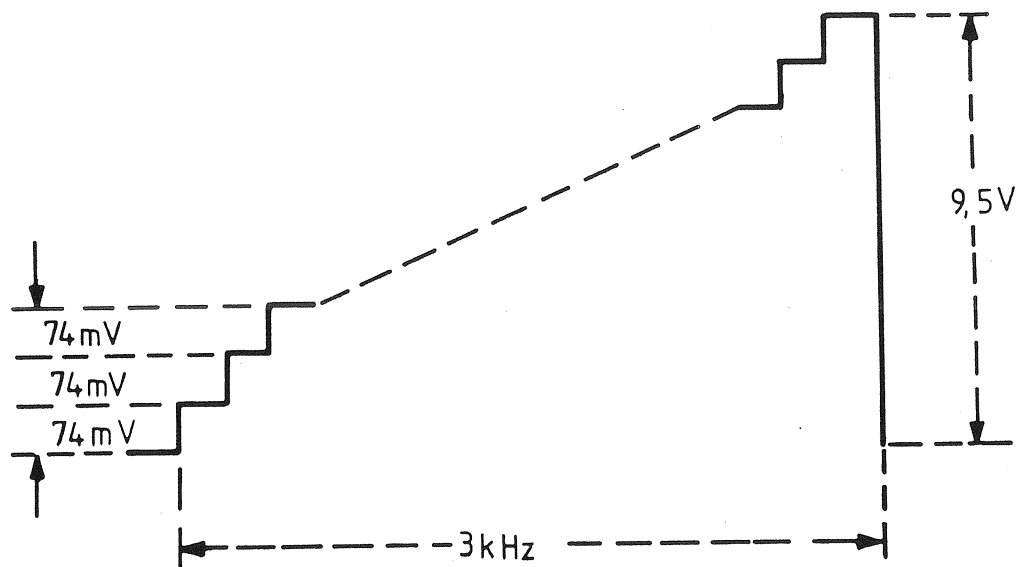


Fig. 3C.2.6

Synthesiser 2
Signal Characteristics

42 Continued

5 Set the pulse generator as follows:

Amplitude: 9,5 V.

Pulse repetition frequency: 22 kHz

Pulse duration: 1,6 to 2 μ s.

6 Check on the scope that signal characteristics are as follows:

128 steps

Total amplitude: 9,5 V.

Frequency: 3 kHz

Amplitude of each step: 74 mV.

The signal is shown below.

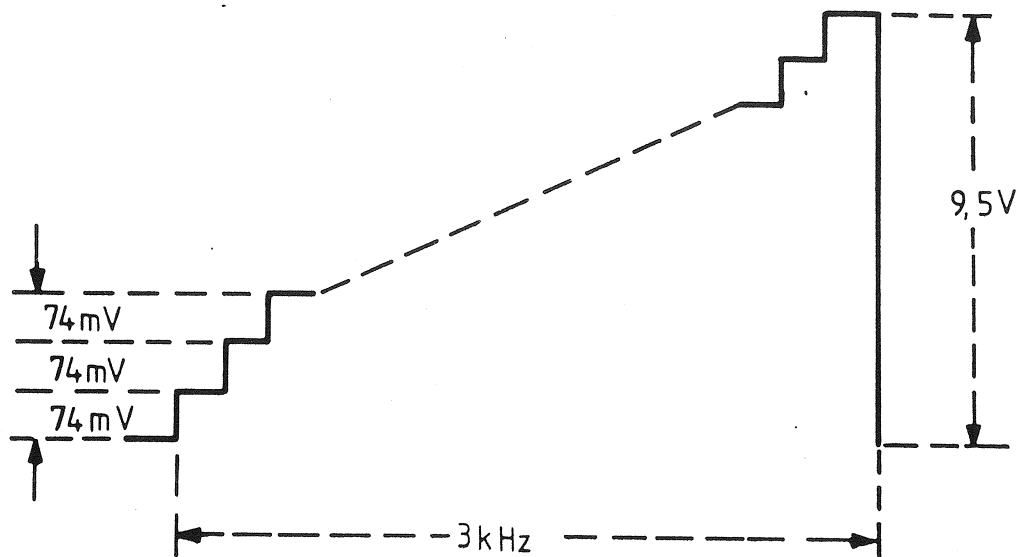


Fig. 3C.2.7

Synthesiser 2
Signal Characteristics

7 Set the pulse generator as follows:

Amplitude: 9,5 V.

Pulse repetition frequency: 25 kHz

Pulse duration: 1,6 to 2 μ s.

Check on scope for a dc. signal within 0 and 9,5 V.

Checking the Phase Discriminator

- 43 1 Check that pulse generator repetition frequency is of 25 kHz.
- 2 Disconnect oscilloscope from terminal B10 and connect it to terminal B12 of PCB assembly.
- 3 Check that signal displayed on scope is continuous and within 0 and +8,9 V. by varying the pulse generator phase versus the 5 MHz reference.
- 4 Disconnect:
 - Oscilloscope from terminal B12
 - Pulse generator from terminal B9
 - Pulse generator from terminal B4 of PCB assembly.

Final Operations

- 44 1 Disconnect the external set-up from terminal B2 of PCB assembly.
- 2 Disconnect the +3 V. stabilised power supply from terminal A4 of PCB assembly.
- 3 Disconnect the +14,5 V. stabilised power supply from terminal A5 of PCB assembly.
- 4 Disconnect the -6 V. stabilised power supply from terminal A12 of PCB assembly.
- 5 Disconnect the common point of stabilised power supplies from terminals A1, A8, A10, A13, B1, B6, B7, B8 and B13 of PCB assembly (ground terminals).

AF PCB ASSEMBLY

45 The procedure for the verification of the AF PCB assembly is dealt with below:

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.18	1 Stabilised power supply +10 V. 1 Stabilised power supply +6 V. 1 Stabilised power supply +3 V. 1 Stabilised power supply -6 V. 1 Stabilised power supply +14,5 V. 1 AF generator 1 Distortion meter 1 Oscilloscope 1 Voltmeter with an input impedance greater than 10 MOhm 1 Voltmeter or multimeter	1 Remote control unit

PROCEDURE**Preliminary Operations**

- 46 Connect the common point of stabilised power supplies to terminals A1, A20, B1 and B20 of PCB assembly.

Operating Procedure

- 47 The different operating procedures to be carried out are as follows:
- a Verification of +5 V. stabilised power supply.
 - b Verification of transmission/reception switching and MORSE control.
 - c Verification of AF amplifier.
 - d Verification of remote control.

Checking the +5 V. Stabilised Power Supply

- 48
- 1 Connect the +10 V. stabilised power supply to terminal A3 of PCB assembly.
 - 2 Connect the +6 V. stabilised power supply to terminal A8 of PCB assembly.
 - 3 Connect a dc. voltmeter to terminal A7 of PCB assembly.
 - 4 Check that voltage read off the voltmeter is within +4,5 and 5,5 V.
 - 5 Disconnect the dc. voltmeter from terminal A7 of PCB assembly.
 - 6 Disconnect the +6 V. stabilised power supply from terminal A8 of PCB assembly.
 - 7 Disconnect the +10 V. stabilised power supply from terminal A3 of PCB assembly.

Checking the Transmission/Reception Switching and MORSE Control**Preliminary Operations**

- 49
- 1 Check the +5 V. stabilised power supply as indicated in para 48.
 - 2 Connect the +10 V. stabilised power supply to terminal A3 of PCB assembly.
 - 3 Connect the +6 V. stabilised power supply to terminals A8 and A13 of PCB assembly.

Checking the Transmission/Reception Switching (beginning of Cycle)

- 50 1 Check that terminal A14 is not connected.
- 2 Connect terminal B12 to terminals A1, A20, B1 and B20 of PCB assembly (chassis terminals).
- 3 Connect the dc. voltmeter to terminal A9 of PCB assembly and check that voltage read off the voltmeter approximates 0 V.
- 4 Disconnect the dc. voltmeter from terminal A9 and connect it to terminal B6 of PCB assembly; check that voltage read off the dc. voltmeter is lower than or equal to 0,5 V.
- 5 Disconnect the dc. voltmeter from terminal B6 and connect it to terminal B8 of PCB assembly; check that voltage read off dc. voltmeter is equal or greater than 5,7 V.
- 6 Disconnect terminal B12 from terminals A1, A20, B1 and B20 of PCB assembly and connect it to terminal A7 of same board; check that voltage read off the voltmeter connected to B8 approximates 2 V.
- 7 Disconnect the dc. voltmeter from terminal B8 and connect it to terminal B6 of PCB assembly; check that voltage read off the dc. voltmeter approximates 5 V.
- 8 Disconnect the dc. voltmeter from terminal B6 and connect it to terminal A9 of PCB assembly; check that voltage read off the dc. voltmeter approximates 6 V.

Checking the Transmission/Reception Switching (Pressel Switch)

- 51 1 Connect terminal A14 to terminals A1, A20, B1 and B20 of PCB assembly (ground terminals).
- 2 Check that voltage read off the voltmeter on terminal A9 approximates 6 V.
- 3 Disconnect the dc. voltmeter from terminal A9 and connect it to terminal B6 of PCB assembly; check that voltage read off dc. voltmeter approximates 0 V.
- 4 Disconnect dc. voltmeter from terminal B6 and connect it to terminal B8 of PCB assembly; check that voltage read off dc. voltmeter approximates 2 V.
- 5 Disconnect:

Voltmeter from terminal B8 of PCB assembly.
Terminal A14 from terminals A1, A20, B1 and B20 of PCB assembly.
Terminal A12 from terminals A1, A20, B1 and B20 of PCB assembly.

Checking the Transmission/Reception Time Constant

- 52 1 Connect the dual track oscilloscope as follows:
- Channel A: terminal B8 of PCB assembly.
Channel B: terminal A9 of PCB assembly.
- 2 Connect terminal A14 to terminals A1, A20, B1 and B20 of PCB assembly.
- Check on scope that signal displayed on channel 'A' is delayed by more than 100 ms approximately with respect to signal displayed on channel 'B' on grounding of terminal A14.
- 3 Disconnect:
- Channel 'A' of oscilloscope from terminal B8 of PCB assembly.
Channel 'B' of scope from terminal A9 of PCB assembly.
Terminal A14 from terminals A1, A20, B1 and B20 of PCB assembly.

Final Operations

- 53 Disconnect the +6 V. power supply from terminals A8 and A13 of PCB assembly.
Disconnect the +10 V. stabilised power supply from terminal A3 of PCB assembly.

Checking the AF Amplifier**Preliminary Operations**

- 54 1 Check the +5 V. stabilised power supply as indicated in para 48.
- 2 Connect the +10 V. power supply to terminals A3 and A16 of PCB assembly.
- 3 Connect the +6 V. stabilised power supply to terminals A8 and B3 of PCB assembly.
- 4 Connect the -6 V. power supply to terminal B18 of PCB assembly.
- 5 Short-circuit terminals A5 and B19 of PCB assembly.

Checking the Amplifier in A3H or SSB 5

- 55 1 Set potentiometer R88 for maximum efficiency.
- 2 Connect distortion meter as a voltmeter in a 300 Ohm impedance to terminal B16 of PCB assembly.
- 3 Connect the AF generator to terminal B5 of PCB assembly.
- 4 Set the AF generator for
A signal frequency of 1 kHz.
A voltage of 1,7 V.rms as read off the distortion meter (voltmeter).
The voltage of the signal from the AF generator shall be lower than or equal to 2,5 mV.
- 5 Connect a voltmeter with a high input impedance (greater than 10 MOhm) to terminal B14 or PCB assembly and note the value of voltage read off the voltmeter.
- 6 Disconnect voltmeter from terminal B14 and connect it to terminal B19, check that voltage read off the voltmeter is substantially equal to that measured at terminal B14.
Disconnect the high impedance voltmeter from terminal B19.
- 7 Set the distortion meter so as to measure the distortion level; this shall be lower than or equal to max 3^o/o.
- 8 Set the distortion meter so that it operates as a voltmeter.
- 9 Increase the frequency of signal delivered by the AF generator until the voltage read off the voltmeter is of 1,2 V.rms (3 dB) and note the value of frequency F1.
- 10 Reduce the frequency of signal delivered by the AF generator until the voltage read off the voltmeter is again equal to 1,2 V.rms (3 dB).
Note the value of frequency F2.
Check that the frequency difference ΔF corresponding to equation.
$$\Delta F = F1 - F2 \text{ is greater than } 2,7 \text{ kHz.}$$
- 11 Set AF generator so as to obtain a signal frequency of 1 kHz.

Checking the Squelch

- 56 1 Short-circuit terminal B2 and terminals A1, A20, B1 and B20 of PCB assembly (ground terminals).
- 2 Check that voltage read off voltmeter approximates 0 V.
- 3 Disconnect the short-circuit connecting terminal B2 to terminals A1, A20, B1 and B20 of PCB assembly.

Checking the Local Monitoring Control

- 57 1 Short-circuit terminal A6 and terminals A1, A20, B1 and B20 of PCB assembly (ground terminals).
- 2 Check the voltage read off voltmeter approximates 0 V.
- 3 Disconnect the short-circuit between terminal A6 and terminals A1, A20, B1 and B20 of PCB assembly.

Checking the Amplifier in MORSE Mode

- 58 1 Connect the -6 V. stabilised power supply to terminal A2 of PCB assembly.
 - 2 Short-circuit terminals A7 and B10 of PCB assembly.
 - 3 Check that potentiometer R88 is at maximum of efficiency.
 - 4 Check that frequency of signal from AF generator is 1 kHz.
 - 5 Set the value of signal from the AF generator so that voltage read off the distortion meter be of 1,7 V.rms.
- The voltage of signal from the AF generator shall be lower than or equal to 5 mV.
- 6 Increase the frequency of signal from AF generator until the voltage displayed on the voltmeter is of 0,85 V.rms. (6 dB) and note the value of frequency F3.
 - 7 Reduce the frequency of signal from AF generator until voltage read off voltmeter is again equal to 0.85 V.rms (6 dB); note the value of frequency F4 and check that frequency difference ΔF corresponds to equation.

$$\Delta F = F3 - F4 \text{ is greater than } 300 \text{ Hz.}$$

Final Operations

- 59 1 Disconnect the AF generator from terminal B5 of PCB assembly.
- 2 Disconnect the distortion meter from terminal B16 of PCB assembly.
- 3 Disconnect short-circuits from terminals:
A7 and B10
A5 and B19 of PCB assembly.
- 4 Disconnect the -6 V. stabilised power supply from terminals A2 and B18 of PCB assembly.
- 5 Disconnect the +6 V. stabilised power supply from terminals A8 and B3 of PCB assembly.
- 6 Disconnect the +10 V. stabilised power supply from terminals A3 and A16 of PCB assembly.

Checking the Remote Control

Preliminary Operations

- 60 1 Check the +5 V. stabilised power supply as indicated in para 48.
- 2 Check the transmission/reception switching and MORSE control as indicated in para 19.
- 3 Check the amplifier as indicated in para 50.
- 4 Connect terminal B15 of PCB assembly to one of connecting terminals of a remote control unit.
- 5 Connect terminal A15 of PCB assembly to one of connecting terminals of a remote control unit.
- 6 Short-circuit terminals A5 and B19 of PCB assembly.
- 7 Connect the +14,5 V. stabilised power supply to terminal A12 of PCB assembly.
- 8 Connect the +10 V. stabilised power supply to terminals A3 and A16 of PCB assembly.
- 9 Connect the +6 V. stabilised power supply to terminals A8, A13 and A18 of PCB assembly.
- 10 Connect the -6 V. stabilised power supply to terminal B18 of PCB assembly.

Checking on Reception

- 61 1 Connect the +6 V. stabilised power supply to terminal B3 of PCB assembly.
- 2 Connect the distortion meter (set as a voltmeter in a 300 Ohm impedance) to terminal B16 of PCB assembly.
- 3 Connect an AF Generator to terminal B5 of PCB assembly.
- 4 Set the AF generator so as to obtain:
A signal frequency of 1 kHz
A voltage of 1,7 V.rms as read off the distortion meter (voltmeter).
- 5 Disconnect the distortion meter with a 300 Ohm impedance from terminal B16 of PCB assembly and connect it to the earphones connector of the remote control unit.
Check that voltage read off the distortion meter approximated 1,7 V.rms.
- 6 Connect a voltmeter to terminal B8 of PCB assembly and check the voltage read off the voltmeter is 5,7 V.
- 7 Disconnect:
Voltmeter from terminal B8 of PCB assembly. Distortion meter from 'earphones' connector of remote control unit.
AF generator from terminal B5 of PCB assembly.

Checking the Call Signal

- 62 1 Connect oscilloscope to terminal B16 of PCB assembly.
- 2 Disconnect the connection between terminal A15 of PCB assembly and one of connecting terminals of the remote control unit.
- 3 Check that characteristics of signal displayed on scope are as follows:
Frequency: 2,7 kHz approximately
Amplitude: 2 V. p-p approximately.
- 4 Disconnect oscilloscope from terminal B16 of PCB assembly.
- 5 Connect terminal A15 of PCB assembly to connection terminal of remote control unit.

Checking on Transmission

- 63 1 Short-circuit terminals 2 and 3 of remote control unit connector J01.
- 2 Disconnect the +6 V. stabilised power supply to terminal B3 of PCB assembly.
- 3 Connect the -6 V. stabilised power supply to terminal B3 of PCB assembly.
- 4 Connect distortion meter used as a voltmeter in a 300 Ohm impedance to 'earphones' connector of remote control unit.
- 5 Connect AF generator to terminal A19 of PCB assembly.
- 6 Set the AF generator so as to obtain:
Signal frequency of 1 kHz
Voltage of 150 mV.rms. as read off the distortion meter (voltmeter).
Check that voltage of signal from AF generator is less than 10 mV.
- 7 Connect a voltmeter to terminal B8 of PCB assembly and check that voltage read off the voltmeter approximates 2 V.
- 8 Disconnect:
Voltmeter from terminal B8 of PCB assembly.
Distortion meter from 'earphones' connector of remote control unit. AF generator from terminal B19 of PCB assembly.

Final Operations

- 64 1 Disconnect terminals A15 and B15 of PCB assembly from the remote control unit.
- 2 Disconnect short-circuit connecting terminals A5 and B19 of PCB assembly.
- 3 Disconnect the +14,5 V. stabilised power supply from terminal A12 of PCB assembly.
- 4 Disconnect the +10 V. stabilised power supply from terminals A3 and A16 of PCB assembly.
- 5 Disconnect the +6 V. stabilised power supply from terminals A8, A13 and A18 of PCB assembly.
- 6 Disconnect the -6 V. stabilised power supply from terminals A8, A13 and A18 of PCB assembly.
- 7 Disconnect the short-circuit connecting terminals 2 and 3 of remote control unit connector J01.

Final Operation

- 65 1 Disconnect the common point of stabilised power supplies from terminals A1, A20, B1 and B20 of PCB assembly (ground terminals).

FILTER AND 2,5 MHz IF PCB

66 The following procedure deals with the verification of the filter and 2,5 MHz IF PCB assembly.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.17	1 Stabilised power supply, -6 V. 1 Stabilised power supply, +5 V. 1 Stabilised power supply, +10 V. 1 Stabilised power supply, +6 V. 1 Spectrum analyser, fitted with a tracking generator 1 RF generator 1 AF Vacuum-tube voltmeter 1 Generator, fixed frequency 1 Frequency meter 1 Distortion meter	

PROCEDURE**Preliminary Operations**

- 67 a Connect common point of power supplies to terminals A1, A11, A12, A20, B1, B3 to B12 and B20 of PCB assembly (ground terminals).
- b Connect +ve of 5 V. stabilised power supply to terminal A10 of PCB assembly.
- c Connect -ve of -6 V. stabilised power supply to terminal A7 of PCB assembly.
- d Connect the +ve of +6 V. stabilised power supply to terminals A6 and B16 of PCB assembly.
- e Connect the +ve of +10 V. stabilised power supply to terminal B14 of PCB assembly.

Operating Procedure

- 68 a Adjusting the SSB and MORSE filter and Checking the Gain in Transmission.
- b Adjusting the A3H Filter.
- c Checking the SSB Reception.
- d Checking the A3H Reception.
- e Adjusting the HF Head AGC.

Adjusting the SSB and Morse Filter and Checking the Gain in Transmission**Switching in 'Transmission'**

- 69 1 Connect terminal A15 (OV transmission) of PCB assembly to one of ground terminals A1, A11, A12, A20, B1, B3 to B13 or B20 of PCB assembly.
- 2 Connect terminal A4 (+6 V. transmission) of PCB assembly to terminal A6 or B16 of same PCB assembly.

Adjusting the SSB and MORSE Filter

- 70 1 Connect tracking generator output to terminal A5 of PCB assembly. Set tracking generator as follows:
 - 1 Level: -30 dBm approx.
Frequency: 2,5 MHz, modulated.
 - 2 Connect spectrum analyser input to terminal A14 of PCB assembly.
 - 3 Adjust T02 and T03 for a response curve with the following parameters as read off the analyser:

Ripple: < 2 dB

6 dB Attenuation: 1 Upper frequency: $\geq 2499,7$ kHz
2 Lower frequency: ≤ 2497 kHz

40 dB Attenuation: 1 Upper frequency: $\leq 2500,4$ kHz
2 Lower frequency: ≥ 2492 kHz

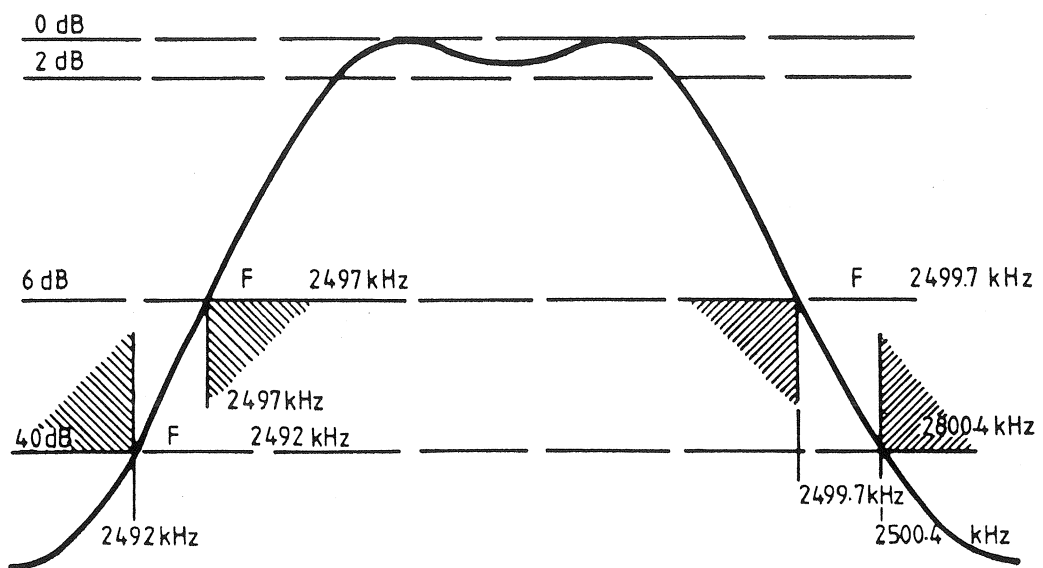


Fig. 3C.2.8

Filter + 2,5 MHz IF
Analyser Parameters

- 4 Disconnect analyser input from terminal A14 of PCB assembly.
- 5 Disconnect tracking generator output from terminal A5 of PCB assembly.

Checking the Gain in Transmission

- 71 1 Connect RF generator to terminal A5 of PCB assembly.
- 2 Set RF generator as follows:
Level: -30 dBm
Frequency: 2499 kHz
- 3 Connect the high impedance HF voltmeter to terminal A14 of PCB assembly.
- 4 Check that gain $\frac{V_o}{V_i}$ is greater than or equal to 0 dBm.
- 5 Disconnect the high impedance voltmeter from terminal A14 of PCB assembly.
- 6 Disconnect RF generator from terminal A5 of PCB assembly.
- 7 Disconnect terminal A15 of PCB assembly from ground terminals A1, A11, A12, A20, B1 to B13 or B20 of PCB assembly.
- 8 Disconnect terminal A4 of PCB assembly from terminals A6 or B16 of said PCB.

Adjusting the A3H Filter

- 72 1 Connect terminal A13 (-6 V. A3) of PCB assembly to terminal A7 of same PCB.
- 2 Connect terminal A9 (+5 V. A3) of PCB assembly to terminal A10 of same PCB.
- 3 Connect terminal A4 (+6 V. transmission) of PCB assembly to terminal A6 or B16 of same PCB.
- 4 Connect terminal A15 (0 V transmission) of PCB assembly to one of the following terminals: A1, A11, A12, A20, B1, B3 to B12 or B20 (ground terminals).
- 5 Connect tracking generator output to terminal A3 of PCB assembly.
- 6 Set tracking generator so that it may deliver a modulated signal with the following parameters:
Level: -30 dBm
Reference frequency: 2,5 MHz
- 7 Connect analyser input to terminal A14 of PCB assembly.
- 8 Set T01 for maximum voltage as read off the analyser.

72 Continued

9 Set C25 and T04 so as to obtain a response curve with the following parameters as read off the analyser:

Ripple: lower than 2 dB

3 dB Attenuation: 1 Upper frequency: ≥ 2504 kHz

2 Lower frequency: ≤ 2496 kHz

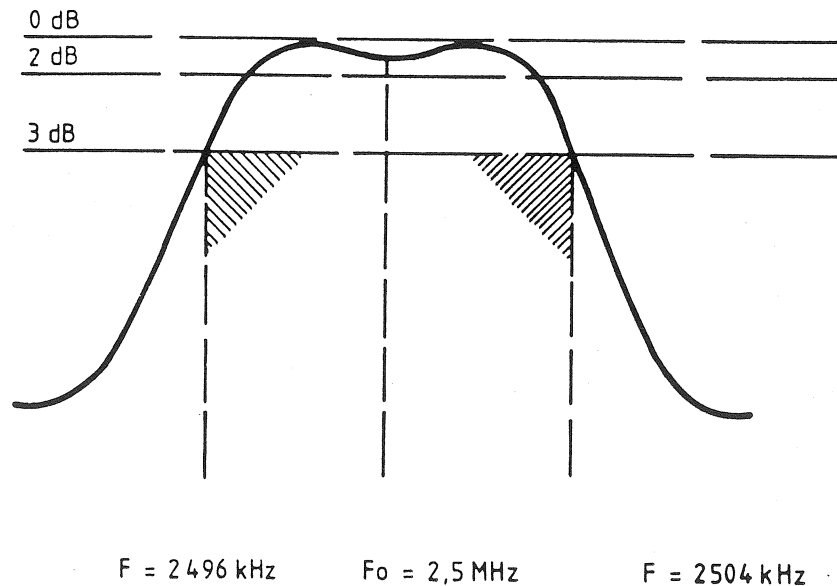


Fig. 3C.2.9

Filter + 2,5 MHz IF
Analyser Parameters

- 10 Disconnect analyser input from terminal A14 of PCB assembly.
- 11 Disconnect tracking generator output from terminal A3 of PCB assembly.
- 12 Disconnect short-circuit between terminal A15 of PCB assembly and one of terminals A1, A11, A12, A20, B1, B3 to B12 or B20 (ground terminals) of same PCB assembly.
- 13 Disconnect short-circuit between terminal A4 and terminal A6 or B16 of PCB assembly.
- 14 Disconnect short-circuit between terminal A13 and terminal A7 of PCB assembly.
- 15 Disconnect short-circuit between terminals A9 and A10 of PCB assembly.

Checking the SSB Reception

- 73 **NOTE** Prior to checking the SSB reception adjust SSB filter (para 69 and A3H filter (para 72).
- 1 Short-circuit terminal A16 (AGC input) of PCB assembly and one of terminals A1, A11, A12, A20, B1, B3 to B12 or B20 (ground terminals) of same PCB.
 - 2 Connect terminal A4 to terminal A7 of PCB assembly.
 - 3 Connect terminal A15 (+6 V. reception) to terminal A6 of B16 of PCB assembly.
 - 4 Connect fixed frequency generator (2,5 MHz \pm 2,5 Hz) to terminal B18 of PCB assembly. Set generator so that it delivers a signal with an amplitude of 100 m V.rms. (approx).
 - 5 Connect a frequency meter and an AF voltmeter A8 of PCB assembly.
 - 6 Connect a dc. voltmeter to terminal A18 of PCB assembly.
 - 7 Connect an RF generator to terminal A3 of PCB assembly.
 - 8 Set RF generator so as to obtain a signal with the following parameters.
Amplitude: 15 μ V. approx.
Frequency: 2499 kHz.
 - 9 Check that:
Frequency read off frequency meter is of 1 kHz. Voltage reading off the AF voltmeter is at least 25 mV.rms. (approx). Voltage reading off dc. voltmeter is 1,2 V. max. (AGC voltage).
 - 10 Disconnect short-circuit between terminal A16 and one of terminals A1, A11, A12, A20 (ground terminals) of PCB assembly. Disconnect dc. voltmeter from terminal A18.
 - 11 Carry out the following set-up:

73 (continued)

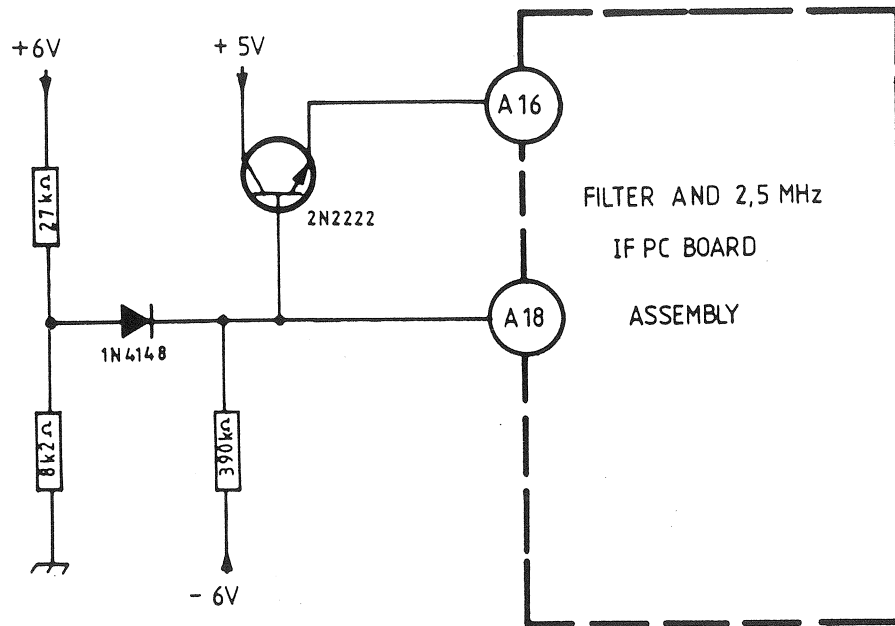


Fig. 3C.2.10

Filter + 2,5 MHz IF
Connections to Jig

- 12 Connect a distortion meter to terminal A8 of PCB assembly.
- 13 Set RF generator so as to obtain a signal with the following parameters:
Amplitude: $200 \mu\text{V}$.
Frequency: 2499 kHz.
- 14 Check that:
Frequency read off frequency meter is of 1 kHz
Voltage read off AF voltmeter is greater than or equal to 200 mV.rms. Distortion is lower than or equal to 5⁰/o.
- 15 Disconnect:
Distortion meter:
Frequency meter: From terminal A8 of PCB assembly.
AF voltmeter:
- 16 Disconnect external circuitry connecting terminals A16 and A18 of PCB assembly.
- 17 Disconnect RF generator from terminal A3 of PCB assembly.
- 18 Disconnect fixed frequency generator (2,5 MHz) from terminal B18 of PCB assembly.
- 19 Disconnect:
Short-circuit between terminal A15 and terminal A6 or B16 of PCB assembly.
Short-circuit between terminal A4 and terminal A7 of PCB assembly.

Adjusting the RF head AGC

- 74 1 Connect terminal A16 (AGC) to terminal A18 of PCB assembly via the external set-up mentioned in para 60 ('Checking the SSB Reception').
- 2 Connect terminal A4 (−6 V reception) to terminal A7 of PCB assembly.
- 3 Connect terminal A15 (+6 V reception) to terminal A6 or B16 of PCB assembly.
- 4 Connect the fixed frequency generator (2,5 MHz) to terminal B18 of PCB assembly. Set generator so as to obtain a signal amplitude of 100 mV.rms. approx.
- 5 Connect RF generator to terminal A3 and set generator so as to obtain a signal with the following parameters:

Amplitude: 200 μ V
Frequency: 2499 kHz.
- 6 Connect a dc. voltmeter to terminal B17 of PCB assembly.
- 7 Adjust potentiometer R54 so as to obtain a voltage 2,7 V as read off the dc. voltmeter.
- 8 Disconnect voltmeter from terminal B17 of PCB assembly.
- 9 Disconnect RF generator from terminal A3 of PCB assembly.
- 10 Disconnect the fixed frequency generator from terminal B18 of PCB assembly.
- 11 Disconnect short-circuit between terminal A15 and terminal A6 or B16 of PCB assembly.
- 12 Disconnect short-circuit between terminal A4 and terminal A7 of PCB assembly.
- 13 Disconnect external set-up from terminals A16 and A18 of PCB assembly.
- 14 Disconnect short-circuit between terminals A9 and A10 of PCB assembly.

Final Operations

- 75 1 Disconnect:

The + ve of + 10 V. stabilised power supply from terminal B14 of PCB assembly.

The + ve of + 6 V. stabilised power supply from terminals A6 and B16 of PCB assembly.

The −ve of −6 V. stabilised power supply from terminal A7 of PCB assembly.

The + ve of + 5 V. stabilised power supply from terminals A9 and A10 of the PCB assembly.

Disconnect common point of the stabilised power supplies from terminals A1, A11, A12, A20, B1, B3 to B12 and B20 of PCB assembly (ground terminals).

20 WATT AMPLIFIER

76 The following procedure covers the verification and adjustment of the 20 Watt Amplifier.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.21	1 Stabilised power supply, +5 V. 1 Stabilised power supply, -6 V. 1 Stabilised power supply, +10 V. 1 stabilised power supply, +14,5 V. 1 Vacuum-tube voltmeter 1 Ammeter with probe 2 RF generators with couplers 1 Wattmeter 1 Spectrum analyser	1 Screwdriver, 5 mm 2 Resistors 120 Ohm 2 SPDT switches

PROCEDURE

Preliminary Operations

77 a Prepare the following set-up:

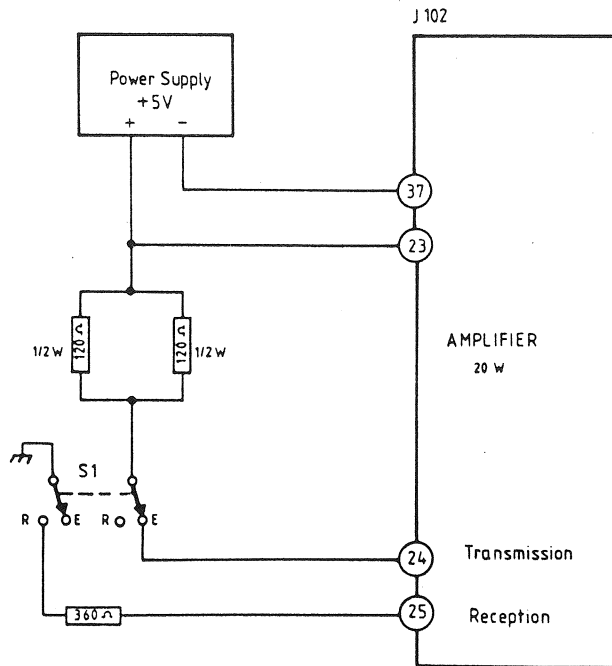


Fig. 3C.2.11

20 Watt Amplifier
Connections to Jig

b Check that change-over S1 is on 'transmission' (position E).

Operating Procedure

- 78 It is imperative to carry out the checks and adjustments in the order indicated hereafter:
- a Check and adjustment of power supply.
 - b Check and adjustment of bias currents.
 - c Check of amplifier.
 - d Check of intermodulation.
 - e Check of coupler.
 - f Check of operation in reception.
 - g Check of current measuring.
 - h Check of overdrive.

Checking and Adjusting the Power Supply

- 79
- 1 Disconnect the power supply strap (P7).
 - 2 Disconnect the biasing straps (P1 and P2).
 - 3 Connect -6 V. stabilised power supply to terminal 30 of connector J02 in the 20 W amplifier.
 - 4 Connect $+10$ V. stabilised power supply to terminal 38 of connector J102 in 20 W amplifier.
 - 5 Connect common point of -6 V. and $+10$ V. stabilised power supplies to terminal 37 of connector J102 in 20 W amplifier.
 - 6 Connect a $14,5$ V. stabilised power supply to connector J101 of 20 W amplifier.
CAUTION: Observe the correct polarities.
 - 7 Connect a dc. voltmeter across terminals 29 (+) and 37 (–) of connector J102 in 20 W amplifier.
 - 8 Check for a voltage of $13,2$ V. off dc. voltmeter. If need be, adjust potentiometer R82 by means of the 5 mm screwdriver in order to obtain the $13,2$ V.
 - 9 Disconnect dc. voltmeter from terminals 29 and 37 of connector J102 in 20 W amplifier.
 - 10 Disconnect $14,5$ V. stabilised power supply from connector J101 in 20 W amplifier.
 - 11 Disconnect $+10$ V. stabilised power supply from terminals 38 and 37 of connector J102 in 20 W amplifier.
 - 12 Disconnect -6 V. stabilised power supply from terminals 30 and 37 of connector J102 in 20 W amplifier.
 - 13 Put the power supply (P7) and biasing (P1 and P2) straps into place.

79 Continued

- 14 Connect -6 V. stabilised power supply across terminals 30 (–) and 37 (+) of connector J102 in 20 W amplifier.
- 15 Connect $+10$ V. stabilised power supply across terminals 38 (+) and 37 (–) of connector J102 in 20 W amplifier.
- 16 Connect 14,5 V. stabilised power supply to connector J101 of 20 W amplifier.

Checking and Adjusting Bias Currents

- 80 1 Connect ammeter probe to strap (P3) located in transistor Q07 collector circuit. Note the value of bias current read off the ammeter.
- 2 Disconnect ammeter probe from strap P3 located in transistor Q07 collector circuit.
- 3 Connect ammeter probe to strap P4 located in transistor Q11 collector circuit. Note value of bias current read off the ammeter.
- 4 Check that:

Bias current of transistors Q07 and Q11 are within 40 and 60 mA. The sum of bias currents approximates 100 mA. If need be, adjust potentiometer R01 by means of the 5 mm screwdriver so as to obtain the above-mentioned values.
- 5 Connect ammeter probe to strap P5 located in transistor Q16 collector circuit. Note the value of bias current read off ammeter.
- 6 Disconnect ammeter probe from strap P5 located in transistor Q16 collector circuit.
- 7 Connect ammeter probe to strap P6 located in transistor Q17 collector circuit. Note value of bias current read off the ammeter.
- 8 Check that:

Bias current of transistors Q16 and Q17 is within 40 to 60 mA Sum of all bias currents approximates 100 mA
If need be, adjust potentiometer R26 by means of 5 mm screwdriver so as to obtain above-mentioned values.
- 9 Disconnect ammeter.

IMPORTANT NOTE

If current from collector of a transistor is not within the specifications, DO NOT replace the faulty transistor alone. Always replace the transistors by matched pairs (Q07 and Q11 or Q16 and Q17).

Check of Amplifier in Transmission

- 81 1 Check power supply (see para 79) and bias currents (see para 80).
- 2 Connect a RF generator to terminal 17 of connector J102 in 20 W amplifier.
- 3 Connect a wattmeter to connector J105 on 20 W amplifier (load impedance: 50 Ohm).
- 4 Adjust RF generator so as to obtain a frequency of 2 MHz. Adjust the RF generator output signal level so as to obtain a mean power of 10 W off the wattmeter.
- Compute ratio: $\frac{\text{Output Power}}{\text{Input Power}}$. This shall be equal or greater than 43 dB input power (0.5 mW maximum).
- 5 Connect ammeter probe to power supply input line 20 W amplifier. Check for a power supply current value not exceeding 3 A off the ammeter.
- 6 Disconnect ammeter probe from power supply input line of 20 W amplifier.
- 7 Connect ammeter probe to strap P3 of transistor Q07 collector circuit. Note the value of collector current as read off ammeter.
- 8 Disconnect ammeter probe from strap P3 and connect it to strap P4 of transistor Q11 collector circuit. Note the value of collector current read off ammeter.
- 9 Check that:
- Values of collector currents are equal, to within 20 mA.
- 10 Disconnect ammeter probe from strap P4.
- 11 Connect ammeter probe to strap P5 of transistor Q16 collector circuit. Note the value of collector current read off ammeter.
- 12 Disconnect ammeter probe from strap P5 and connect it with strap P6 of transistor Q17 collector circuit. Note the value of collector current as read off ammeter.
- 13 Check that:
- Values of collector currents are equal to within 200 mA.
- 14 Disconnect ammeter probe from strap P6.
- 15 Adjust RF generator so as to obtain a signal frequency of 30 MHz. Adjust RF generator output level so as to obtain a mean power of 10 W as read off wattmeter. Input power shall be within 0,5 and 2 mW.
- Compute ratio: $\frac{\text{Output Power}}{\text{Input Power}}$. This shall be equal or greater than 43 dB.

81 (continued)

- 16 Connect ammeter probe to power supply input line of 20 W amplifier. Check for a power supply current value of 3,5 A maximum off the ammeter.
- 17 Disconnect ammeter probe from strap P7 of 20 W amplifier.
- 18 Connect ammeter probe to strap P3. Note collector current (Q07) off ammeter.
- 19 Disconnect ammeter probe from strap P3 and connect it to strap P4. Note the collector current (Q11) reading off ammeter.
- 20 Check that:
Values of collector currents are equal, to within 20 mA.
- 21 Disconnect ammeter probe from strap P4.
- 22 Connect ammeter probe to strap P5 and note collector current (Q16) off ammeter.
- 23 Disconnect ammeter probe from strap P5 and connect it to strap P6. Note value of collector current (Q17) off the ammeter.
- 24 Check that:
Values of collector currents are equal to within 200 mA.
- 25 Disconnect ammeter probe from strap P6.
- 26 Disconnect RF generator from terminal 17 of connector J102 on 20 W amplifier.
- 27 Disconnect wattmeter from test connector J105 on 20 W amplifier.

Checking the Intermodulation

- 82 1 Check:
Power Supply (see para 79)
Bias current (see para 80)
Amplifier (see para 81)
- 2 Using coupler, connect two RF generators to terminal 17 of connector J102 on 20 W amplifier.
- 3 Connect a wattmeter loaded by 50 Ohm to test connector J105.
- 4 Adjust the RF generators so that frequency of generated signals are 1 kHz apart, within the 25 and 30 MHz band.
- 5 Increase level of signal delivered by each RF generator so as to obtain a mean output power of 10 W.
- 6 Connect a spectrum analyser via a coupler to test connector J105 and wattmeter. Check that intermodulation spectral lines are greater than 25 dB.
- 7 Disconnect spectrum analyser from test connector J105.
- 8 Disconnect both generators fitted with coupler from terminal 17 of connector J102.

Checking the Coupler

- 83 1 Check:
- Power supply (see para 79)
 - Bias current (see para 80)
 - Amplifier (see para 81)
- 2 Connect wattmeter to test connector J105.
- 3 Connect RF generator to terminal 17 of connector J102.
- Adjust RF generator so as to obtain:
- Signal frequency: 2 MHz
 - Signal level: 10 W mean power as read off wattmeter.
- 4 Connect a dc. voltmeter across terminals 26 (+) and 37 (–) of connector J102 on 20 W amplifier. Check for a voltage approximating 1 V. off the voltmeter (VD).
- 5 Disconnect dc. voltmeter from terminals 26 (+) and 37 (–) of J102 and connect it across terminals 27 (+) and 37 (–) of connector J102. Check for a voltage of 100 mV. at most off the voltmeter (VR).
- 6 Proceed to same checks 3, 4 and 5 for a signal frequency of 30 MHz generated by RF generator the results must be similar.
- 7 Disconnect dc. voltmeter from terminals 27 (+) and 37 (–) of connector J102 on 20 W amplifier.
- 8 Decrease the signal generator output level to a minimum.
- 9 Disconnect the wattmeter load from J105.
- 10 Connect the Ammeter probe to power supply input line.
- 11 Increase the signal generator level tuned to 2 MHz for a current of 2,5 A measured on the ammeter.
- 12 With the dc. voltmeter connected to pin 27 of J102 measure the VR voltage, approximately 0,9 V.
- 13 Repeat steps 11 and 12 but for a frequency of 30 MHz and 3 A measured on the ammeter, VR measured approximately 0,5 V.
- 14 Decrease signal generator level to a minimum.
- 15 Disconnect dc. voltmeter from pin 27 of J102.
- 16 Disconnect wattmeter from J105.
- 17 Disconnect RF generator from 17 of J102.

Checking Isolation of Tx/Rx Switching Device

- 84 1 Check:
- Power supply (see para 79)
 - Collector current (see para 80)
 - Amplifier (see para 81)
 - Intermodulation (see para 82)
 - Coupler (see para 83)
- 2 Connect wattmeter to test connector J105 of 20 W amplifier.
- 3 Connect an RF generator to terminal 17 of connector J102 on 20 W amplifier. Adjust RF generator so as to obtain:
- Signal frequency: 2 MHz
 - Signal level: 10 W mean power off wattmeter.
- 4 Connect a low power wattmeter to terminal 1 of J102.
- 5 Check for power less than 10 mW as read off wattmeter.
- 6 Disconnect wattmeter from test terminal 1 of connector J102 on 20 W amplifier.
- 7 Carry out the same checks for a frequency (signal delivered by RF generator) of 30 MHz.
- 8 Disconnect:
- Both wattmeters
 - RF generator from terminal 17 of connector J102.

Check of Current Measuring

- 85 1 Connect RF generator on terminal 17 of J102.
- 2 Connect a dc. voltmeter between terminals 22 (+) and 28 (-).
- 3 Connect the ammeter probe to strap P7.
- 4 Increase signal generator level tuned to 2 MHz for a current of 3 A measured on the ammeter.
- 5 The voltage measured across pins 22 and 28 of J102 must be 0,33 V.
- 6 Disconnect:
- Ammeter
 - Signal generator
 - DC voltmeter.

Check of Overdrive

- 86
- 1 Connect a dc. voltmeter between pin 31 (+) and 41 (–) of J102.
 - 2 Set the switch of the external set up to reception.
 - 3 Connect the ammeter probe to power supply input line.
 - 4 Connect the signal generator, tuned to 2 Mhz, to terminal 17 of J102 and adjust the level for 3 V. read on the dc. voltmeter connected to pins 31 and 41 of J102.
 - 5 Measure the current on the ammeter, which must read between 1 and 2 A.
 - 6 Repeat step 4 for a frequency of 30 MHz.
 - 7 Measure the current on the ammeter which must be between 3 and 4,5 A.
 - 8 Disconnect:
 - The signal generator
 - The dc. voltmeter
 - The ammeter probe.

Final Operations

- 87
- a Disconnect:
 - The –6 V. stabilised power supply from terminals 30 and 37 of connector J102 in 20 W amplifier.
 - The +10 V. stabilised power supply from terminals 38 and 37 of connector J102 in 20 W amplifier.
 - The + 14,5 V. stabilised power supply from connector J101 of 20 W amplifier.
 - b Disconnect 20 W amplifier from external set-up.

CONVERTOR UNIT

- 88 The following procedure covers the verification and adjustment of the convertor unit.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.23	1 Stabilised power supply, +14,5 V. adjustable within +10 V. and 20 V. 1 dc. Voltmeter	1 Resistor, 82 Ohm 1 Resistor, 120 Ohm 1 Resistor, 150 Ohm 1 Resistor, 220 Ohm 1 Resistor, 390 Ohm 2 Resistors, 68 Ohm 2 Resistors, 33 kOhm

PROCEDURE

Preliminary Operations

- 89 a Prepare the following set-up:

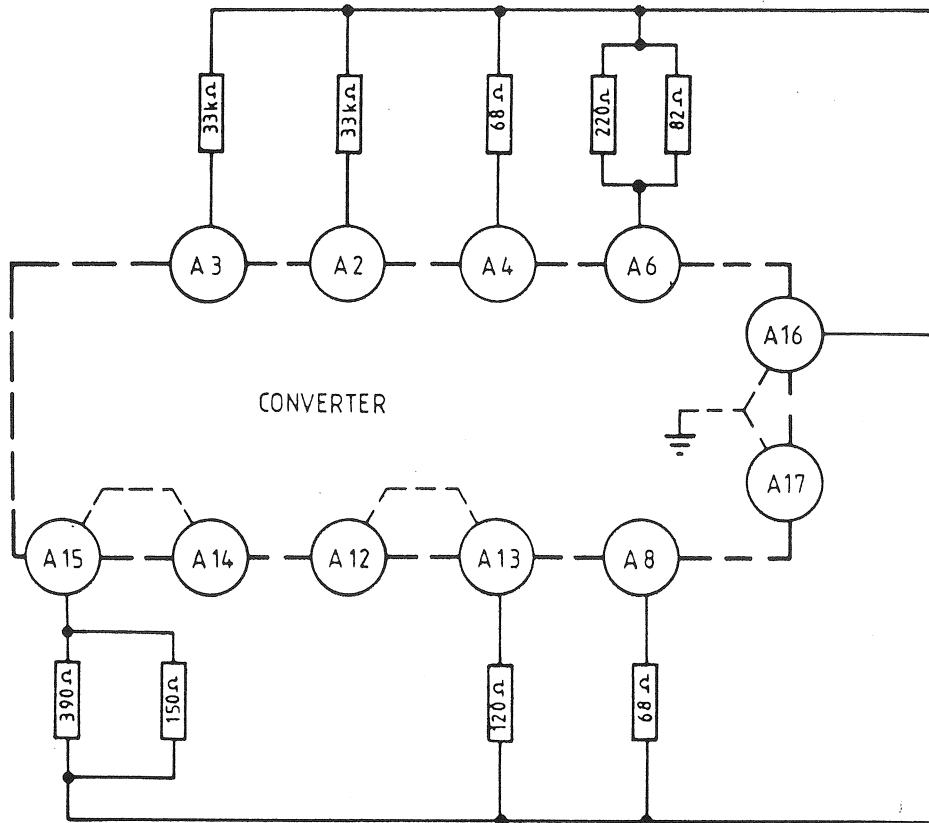


Fig. 3C.2.12

**Converter
Connections to Jig**

- b Connect the -ve of +14,5 V. stabilised power supply to terminals A16, A17, B2, B3.... B18 or B19 (ground terminal).
- c Connect the +ve of +14,5 V. stabilised power supply to terminal A18 or A19.

Operating Procedure

- 90 This paragraph deals with:
- a Adjustment and check of stabiliser.
- b Verification of convertor unit.

Adjusting and Checking the Stabiliser

- 91 1 Connect a dc. voltmeter across terminals A14 or A15 (+) and A17, B2, B3 ... B18 or B19 (ground terminal).
- 2 Adjust potentiometer R21 so as to obtain a voltage of +9,9 to +10,1 V. as read off dc. voltmeter. Said voltage is the reference voltage U/0.
- 3 Adjust stabilised power supply connected across terminals A18 and A16, A17, B2, B3 ... B18 or B19 so as to obtain a voltage of +12 V. Check that voltage read off dc. voltmeter is equal to U/0 (reference voltage) $\pm 1^0/0$.
- 4 Adjust stabilised power supply connected across terminals A18 or A19 and A16, A17, B2, B3 ... B18 or B19 so as to obtain a voltage of +19 V. Check that voltage read off dc. voltmeter is equal to U/0 (reference voltage) to within $1^0/0$.
- 5 Adjust stabilised power supply connected across terminals A18 or A19 and A16, A17, B2, B3 ... B18 or B19 so as to obtain a voltage of 14,5 V. Check that voltage read off dc. voltmeter is equal to reference voltage U/0 (voltage within 9,9 and 10,1 V).

Verification of Converter Unit

- 92 1 Disconnect dc. voltmeter from terminals A14 or A15 and A16, A17, B2, B3 ... B18 or B19 (ground terminal).
- 2 Connect dc. voltmeter across terminals A3 (–) and A16, A17, B2, B3 ... B18 or B19 (ground, +ve).
- 3 Check for a voltage within –17,6 and –26,4 V. as read off dc. voltmeter.
- 4 Disconnect dc. voltmeter from terminal A3 (–) and connect it to terminal A2 (–).
- 5 Check for a voltage within –17,6 and –26,4 V. as read off dc. voltmeter.
- 6 Disconnect dc. voltmeter from terminal A2 (–) and connect it to terminal A12 or A13 (–).
- 7 Check that voltage read off dc. voltmeter is within –5,7 and –6,3 V.
- 8 Disconnect dc. voltmeter from terminals A12 or A13 (–) and A16, A17, B2, B3 ... B18 or B19 (ground, +ve).
- 9 Connect dc. voltmeter across terminals A4(+ve) and A16, A17, B2, B3 ... B18 or B19 (ground, –ve).
- 10 Check that voltage read off dc. voltmeter is within 2,8 and +3,1 V.
- 11 Disconnect dc. voltmeter from terminal A4 and connect it to terminal A6.
- 12 Check that voltage read off dc. voltmeter is within 2,8 and 3,1 V.
- 13 Disconnect dc. voltmeter from terminal A6 and connect it to terminal A8.
- 14 Check that voltage read off dc. voltmeter is within +5,7 and 6,3 V.

92 (continued)

- 15 Disconnect dc. voltmeter from terminals A8 and A16, A17 B2, B3 ... B18 or B19 (ground, -ve).
- 16 Connect terminal A4 to one of terminals A16, A17, B2, B3 ... B18 or B19.
- 17 Check that converter unit is switched off.
- 18 Disconnect short-circuit between A4 and one of terminals A16, A17, B2, B3 ... B18 or B19. Check voltage readings off dc. voltmeter as indicated in following chart.

Terminal + of DC voltmeter	Terminal - of DC voltmeter	Value to be Obtained
A16, A17, B2, B3 ... B18 or B19	A3	0 V approx.
	A2	
	A12 or A13	
A4	A16, A17, B2, B3 ... B18 or B19	
A6		
A8		
A14 or A15		

- 19 Disconnect +ve of +14,5 V. stabilised power supply then reconnect it with terminal A18 or A19.
- 20 Check that:
 - Converter is switched on.
 - Output voltages read off dc. voltmeter are the same as those mentioned hereafter:
- 21 Connect terminal A6 to one of terminals A16, A17, B2, B3 ... B18 or B19.

Terminal + of DC voltmeter	Terminal - of DC voltmeter	Value to be Obtained (in volts)
A16, A17, B2, B3 ... B18 or B19	A3	within - 17.6 and - 26.4
	A2	within - 17.6 and - 26.4
	A12 or A13	within - 5.7 and - 6.3
A4	A16, A17, B2, B3 ... B18 or B19	within + 2.835 and + 3.165
A6		within + 2.835 and + 3.165
A8		within + 5.7 and + 6.3
A14 or A15		within + 9.9 and + 10.1

-
- 92 Continued
- 22 Check that converter is not operating.
- 23 Disconnect short-circuit between terminal A6 and one of terminals A16, A17, B2, B3 ... B18 or B19.
- Check output voltages read off dc. voltmeter as indicated in table No. 1 above.
- 24 Disconnect the +ve of + 14,5 V. stabilised power supply then reconnect it to terminal A18 or A19.
- 25 Check that:
- Converter is switched on
Output voltages read off dc. voltmeter are the same as those mentioned in table No. 2.
- 26 Connect terminal A8 to one of terminals A16, A17, B2, B3 ... B18 or B19.
- 27 Check that converter is not operating.
- 28 Disconnect short-circuit between terminal A8 and one of terminal. A16, A17, B2, B3 ... B18 or B19.
- Check output voltages read off dc. voltmeter as indicated in table No. 1.
- 29 Disconnect the +ve of + 14,5 V. stabilised power supply then reconnect it to terminal A18 or A19.
- 30 Check that:
- Converter is switched on
Output voltages read off VTVM are the same as those mentioned in table No. 2.

92 (continued)

- 31 Connect terminal A12 or A13 to one of terminals A16, A17, B2, B3 ... B18 or B19.
- 32 Check that converter is not operating.
- 33 Disconnect short-circuit between terminal A12 or A13 and one of terminals A16, A17, B2, B3 ... B18 or B19. Check output voltages read off dc. voltmeter as per table No. 1.
- 34 Disconnect the +ve of +14,5 V. stabilised power supply then reconnect it to terminal A18 or A19.
- 35 Check that:
- Converter is switched on
Output voltages read off dc. voltmeter are the same as those mentioned in table No. 2.
- 36 Connect terminal A14 or A15 to one of terminals A16, A17, B2, B3 ... B18 or B19.
- 37 Check that converter is not operating.
- 38 Disconnect short-circuit between terminal A14 or A15 and one of terminals A16, A17, B2, B3 ... B18 or B19.
- Check output voltages read off dc. voltmeter as indicated in table No. 1.
- 39 Disconnect the +ve of +14,5 V. stabilised power supply then reconnect it to terminal A18 or A19.
- 40 Check that:
- Converter is switched on
Output voltages read off dc. voltmeter are the same as those mentioned in table No. 2.
- 41 Disconnect dc. voltmeter.

NOTE Prior to any troubleshooting or fault-repair, check that voltage across test terminal TP01 and ground approximates +20,6 V. (said voltage depends upon the load).

Final Operations

- 93 1 Disconnect the +ve of +14,5 V. stabilised power supply from terminal A18 or A19.
- 2 Disconnect the -ve of +14,5 V. stabilised power supply from terminal A16, A17, B2, B3 ... B18 or B19 (ground terminals).
- 3 Disconnect convertor from external set-up.

REMOTE CONTROL UNIT

94 The following procedure covers the verification and adjustment of the remote control unit.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.24	1 Milliammeter 1 AF Generator 1 Stabilised power supply, 15 V. 2 AF Voltmeters	3 Loads, 600 Ohm 1 Resistor, 1 kOhm 1 Capacitor 1 μ F

PROCEDURE

95 The following operations shall be carried out:

- a Adjustment of 'transmit-receive' changeover.
- b Check of transmit channel gain.
- c Check of receive channel gain.

Adjusting the Transmit/Receive Changeover

Preliminary Operations

96 1 Prepare the following set-up:

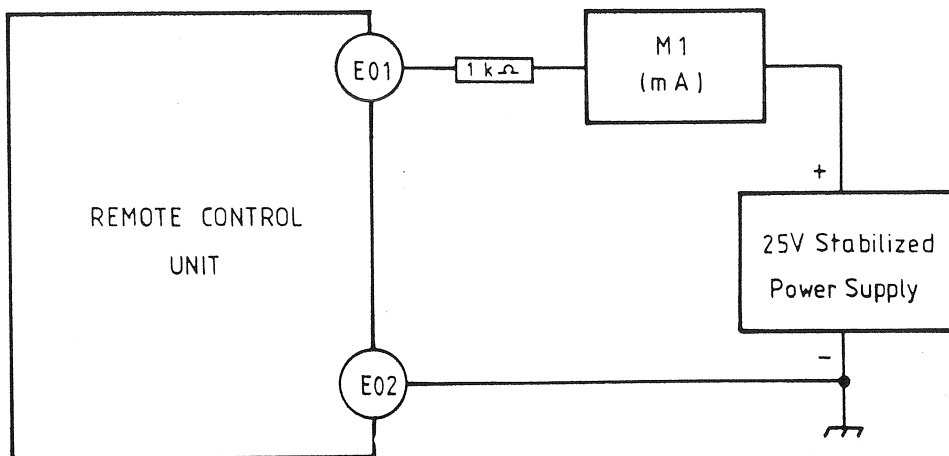


Fig. 3C.2.13

Remote Control Unit
Connections to Jig

Operating Procedure

97 a Adjustment in Transmission Operation

- 1 Short-circuit terminals 2 and 3 of connector J01 on remote control unit.
- 2 Adjust potentiometer R04 so as to obtain a current within 7,9 and 8,1 mA as read off milliammeter M1.
- 3 Disconnect short-circuit between terminals 2 and 3 of connector J01.

b Adjustment in Reception Operation

- 1 Check that terminal 2 of connector J01 is not connected (terminal 'open-circuited').
- 2 Adjust potentiometer R06 so as to obtain a current within 3,9 and 4,1 mA as read off milliammeter M1.

Final Operation

- 98 Disconnect remote control unit from external set-up.

Checking the Transmit Channel Gain

99 1 Preliminary Operations

Prepare the following set-up:

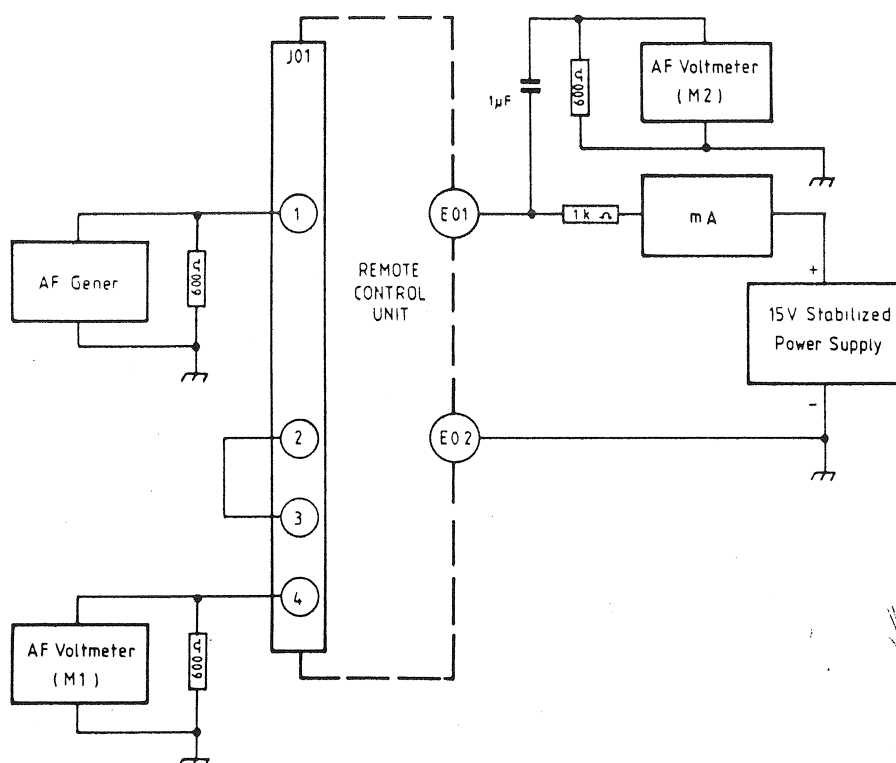


Fig. 3C.2.14

Remote Control Unit Connections to Jig

Operating Procedure

- 100 1 Adjust AF generator so as to obtain:
- A signal frequency of 1 kHz
 - A signal level high enough to note:
 - Voltage delivered by AF generator (U/0)
 - Voltage read off AF voltmeter AM2 (U/1)
- 2 Compute the gain between voltages U/1 and U/0.
- This shall be within 21 and 28 dB.
- 3 Adjust AF generator so as to obtain:
- A signal frequency of 1 kHz
 - A signal level high enough to note:
 - Voltage delivered by AF generator (U/2).
 - Voltage read off AF voltmeter M1 (U/3).
- 4 Compute the gain between voltages U/3 and U/2.
- This shall be within 14 and 25 dB.
- Check the call facility. Depress call switch: the current through the milliammeter must fall to zero.

Final Operation

- 101 Disconnect remote control unit from external set-up.

Checking Receive Channel Gain

102 a Preliminary Operations:

Prepare the following set-up:

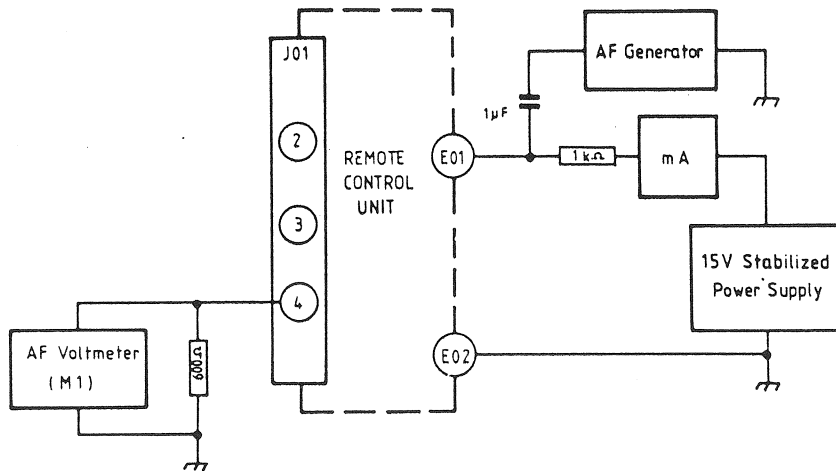


Fig. 3C.2.15

Remote Control Unit Connections to Jig

Operation Procedure

- 103 1 Adjust AF generator so as to obtain:
 - A signal frequency of 1 kHz
 - A signal level high enough to note:
 - Voltage delivered by AF generator (U/0).
 - Voltage read off voltmeter M1 (U/1).
- 2 Compute the gain between voltages U/0 and U/1.
 - This shall be within -14 and -12 dB.

Final Operation

- 104 Disconnect remote control unit from external set-up.

HF HEAD

105 The following procedure covers the verification and adjustment of the HF Head.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.14	1 Stabilised power supply, +2,57 V. 2 Stabilised power supplies, +6 V. 1 Stabilised power supply, -6 V. 1 Stabilised power supply, +9,5 V. 1 Stabilised power supply, +10 V. 1 Stabilised power supply, -22 V. 2 Stabilised power supplies, adjustable within 0 to 10 V. 1 HF Voltmeter 1 Frequencymeter 1 RF generator 1 tracking generator	1 Split connector, with shorting links 1 Manpack transceiver with Synthesiser Unit

PROCEDURE

106 Verification and adjustment of the HF head consist in:

- a Checks and adjustment of the VCO
- b Checks and adjustment of transmit and receive channels.

NOTE These require the use of a Manpack transceiver with a synthesiser unit in good operating condition.

Checking and Adjusting the VCO

Preliminary Operations

- 107 1 Check that terminals 2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 (ground terminals) are correctly connected. Connect them if need be.
- 2 Connect the +ve of +10 V. stabilised power supply to terminal 8 of connector J01 in HF head. Connect the -ve of said power supply to ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).
- 3 Connect the +ve of +9,5 V. stabilised power supply to terminal 17 of connector J01 of HF head. Connect the -ve of said power supply to ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).
- 4 Connect the +ve of +20 V. stabilised power supply to terminal 4 of connector J01 in HF head. Connect the +ve of said power supply to ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).

107 Continued

- 5 Connect a stabiliser power supply adjustable from 0 to 10 V. across terminals 1(+) and 3(−) or 1(+) and 2(−) of connector J01 in the HF head. Said power supply simulates the VCO alignment voltage.
- 6 Connect a stabilised power supply adjustable from 0 to 10 V. across terminals 5(+) and 6(−) or 7 of connector J01 in HF head. Said stabilised power supply simulates the VCO clamping voltage.
- 7 Connect a HF voltmeter and a frequency meter across terminals 9 and 10 or 11 (chassis) of connector J01 in HF head.

Operating Procedure

Adjustment in Upper Band

- 108 1 Adjust stabilised power supply connected across terminals 5(+) and 6(−) of connector J01 (control voltage simulation) so as to obtain a voltage of +1 V.
- 2 Adjust stabilised power supply connected across terminals 1(+) and 3(−) or 1(+) and 2(−) of connector J01 (alignment voltage simulation) so as to obtain a voltage of 0V.
- 3 Adjust inductor L405 so as to obtain a frequency of 121,480 and 121,520 MHz as read off the frequency meter. Check that voltage off HF voltmeter approximates 300 mV.
- 4 Adjust stabilised power supply connected across terminals 1(+) and 3(−) or 1(+) and 2(−) of connector J01 (alignment voltage simulation) so as to obtain a voltage of 9 V. and at 5(+) and 6(−) a voltage of 7 V.
- 5 Check for:
 - A frequency of $134 \leq F \leq 134,5$ MHz off the frequency meter.
 - A voltage approximating 300 mV off the HF voltmeter.

Check in Lower Band

- 109 1 Check that the stabilised power supply connected across terminals 1(+) and 3(−) or 1(+) and 2(−) of connector J01 (alignment voltage simulation) delivers a voltage of 9 V.
- 2 Check that the stabilised power supply connected across terminals 5(+) and 6(−) of connector J01 (phase control voltage simulation) delivers a voltage of 4 V.
- 3 Connect terminal 13 of connector J01 to ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).
- 4 Check for:
 - A frequency greater than 124 MHz off the frequency meter.
 - A voltage approximating 250 mV off the HF voltmeter.

109 Continued

- 5 Adjust the stabilised power supply connected across terminals 1(+) and 3(−) or 1(+) and 2(−) of connector J01 (alignment voltage simulation) so that it delivers a voltage of 0 V.
- 6 Check for:
 - A frequency less than 100,5 MHz off the frequency meter.
 - A voltage approximating 250 mV off the HF voltmeter.
- 7 Disconnect HF voltmeter from terminal 9 of connector J01 and connect it to terminal 'S HET' on the HF head VCO unit.
- 8 Check that voltage read off HF voltmeter is greater than 1,5 V.
- 9 Disconnect HF voltmeter from 'S HET' terminals and ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).
- 10 Disconnect short-circuit between terminal 13 of connector J01 and ground terminals (2, 3, 6, 7, 10, 11, 12, 22, 24, 26 and 28 of connector J01).

NOTE Above-mentioned values allow for the effect of HF head shield when in situ.

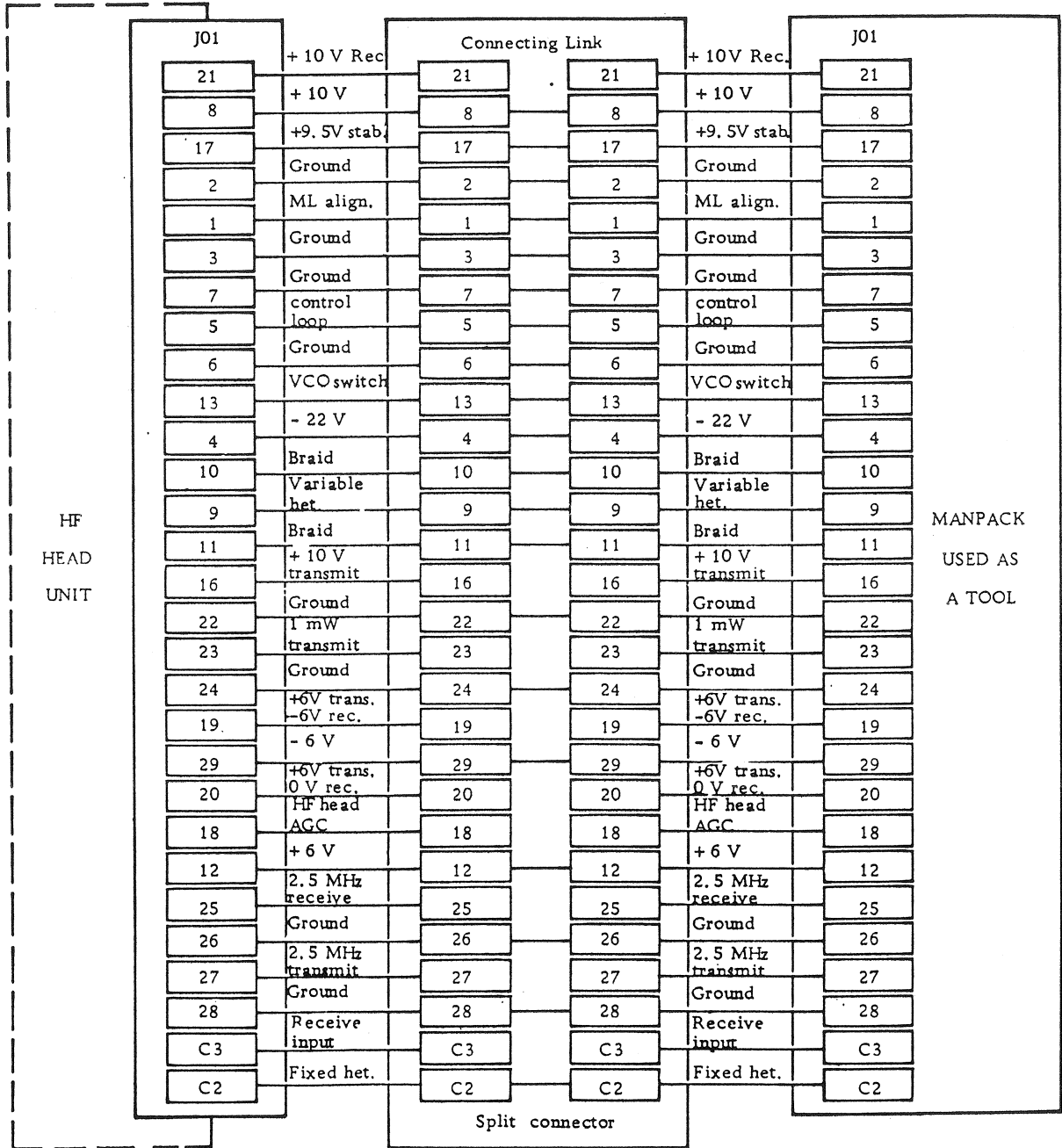
Final Operations

- 110 1 Disconnect frequency meter from terminals 9 and 10 of connector J01 in HF head.
- 2 Disconnect:
 - Stabilised power supply from terminals 5(+) and 6(−) of connector J01.
 - Stabilised power supply from terminals 1(+) and 3(−) or 1(+) and 2(−) of connector J01 in HF head.
- 3 Disconnect:
 - −ve of −22 V. stabilised power supply from terminal 4 of connector J01.
 - + ve of −22 V. stabilised power supply from ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).
- 4 Disconnect:
 - +ve of +9,5 V. stabilised power supply from terminal 17 of connector J01.
 - −ve of +9,5 V. stabilised power supply from ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).
- 5 Disconnect:
 - + ve of + 10 V. stabilised power supply from terminal 8 of connector J01.
 - −ve of +10 V. stabilised power supply from ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01).
- 6 If need be put ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of connector J01) in their initial configuration.

Adjustment and Checking of 'Transmit-Receive' Channel

111 1 Preliminary Operations

Prepare the following set-up, using the split connector and a Manpack transceiver as tools.



Operating Procedure

Adjustment and Check of Receive Channel

- 112 1 Check that terminals 2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 (ground terminals) are properly connected. If not, connect them.
 - 2 Connect the +ve of +10 V. stabilised power supply to terminal 21 of split connector (HF head side). Connect the -ve of same power supply to terminal 2 of the split connector.
 - 3 Connect the +ve of +6 V. stabilised power supply to terminals 19 and 20 of the split connector (HF head side). Connect the -ve of same power supply with ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of the split connector on HF head side).
 - 4 Only for the B version. Adjust R328 for a current in the 10 volts supply line between 9 and 11 mA.
 - 5 Connect an HF generator across terminal C3 of the split connector (HF head side) and ground terminals 2, 3, 6, 7, 10, 11, 22, 24, 26 and 28 of the split connector on HF head side).
 - 6 Connect a HF voltmeter terminating in 50 Ohm across terminal 25 of the split connector (HF head side) and ground terminal 26 of the split connector.
 - 7 Switch on the Manpack transceiver used as a 'tool'.
 - 8 Select 02,500 MHz by means of frequency selectors located on Manpack transceiver.
 - 9 Set HF generator as follows:
Signal frequency = 2,5 MHz
Signal Level (U/0) = 2 mV.
 - 10 Set:
Variable capacitors C344, C222, C235, C246
Variable inductor L203
Cores of transformers T203 and T306 so as to obtain maximum voltage off the HF voltmeter (voltage U/1).
- NB.** Only for B version; adjust L01 for a maximum read off the HF voltmeter.
- 11 Compute the gain of receive channel using the following formula:

$$G = 20 \text{ Log } \frac{U1}{U0}$$
- The gain should approximate 30 dB.

112 (continued)

- 12 Connect the +ve of 2,57 V. stabilised power supply to connector terminal 18 (AGC) of split connector (HF head side). Connect -ve of same stabilised power supply to terminal 26 of the split connector (HF head side).
- 13 Set potentiometer R214 so as to obtain a receive channel gain of 24 dB.
$$G = 20 \text{ Log } \frac{U1}{U0}$$
- 14 Disconnect 2,57 V. stabilised power supply from terminals 18 and 26 of split connector (HF head side).
- 15 Select 29,999 MHz by means of selector switches located on Manpack transceiver used as a 'tool'.
- 16 Set HF generator as follows:
Signal frequency = 29,999 MHz
Signal level = 2 mV.
- 17 A version:
Adjust C306 for a maximum reading of the HF voltmeter.
B version:
Adjust L301, L303, L305 and L306 for a maximum reading of the HF voltmeter.
- 18 Switch off the Manpack transceiver.
- 19 Disconnect HF voltmeter terminating in 50 Ohm from terminals 25 and 26 of the split connector.
- 20 Disconnect HF generator from terminal C3 and ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28) of the split connector.
- 21 Disconnect +6 V. stabilised power supply from terminal 20 and ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28) of the split connector.
- 22 Disconnect +6 V. stabilised power supply from terminal 19 and ground terminals (2, 3, 6, 7, 10, 11, 22, 24, 26 and 28) of split connector.
- 23 Disconnect +10 V. stabilised power supply from terminals 21 and 2 of split connector.

Adjustment and Check of Transmit Channel

- 113 1 Connect the +ve of +10 V. stabilised power supply to terminal 16 of the split connector (HF head side). Connect the -ve of said power supply to terminal 22 of the split connector (HF head side).
- 2 Connect the -ve of -6 V. stabilised power supply to terminal 19 of the split connector (HF head side). Connect the +ve of said power supply to terminal 24 of the split connector (HF head side).
- 3 Connect tracking generator output across terminals 27 (signal) and 28 (chassis) of the split connector (HF head side).

4 Connect:

A frequency meter	Across terminals 23 and
A HF voltmeter	22 or 23 and 24 of the
Spectrum analyser input	split connector (HF head side).

NOTE Overall matching impedance presented by the measuring instruments shall be equal to 50 Ohm.

- 5 Set tracking generator so as to obtain a signal with:
 Frequency aligned with 2,5 MHz (as read off frequency meter).
 Amplitude equal to 14 mV (U/0).
- 6 Switch 'On' Manpack transceiver used as a tool.
- 7 Select 02,500 MHz by means of frequency selectors located on transceiver.
- 8 Set:
- | | |
|--|---|
| Variable capacitor C223 | So as to obtain |
| Variable inductors L311, L312,
L313, L314 | maximum voltage on
the HF voltmeter (U/1). |
| Core of transformer T204. | |

- 9 Compute the transmit channel gain using the formula

$$G = 20 \text{ Log } \frac{U_1}{U_0}$$

The gain should approximate 24 dB.

NOTE If need be, adjust resistor R231 so as to obtain this gain value.

113 (continued)

- 10 Modulate frequency of signal from tracking generator about 2,5 MHz (with a constant signal amplitude of 14 mV).
- 11 Check on spectrum analyser that the filter parameters are as follows:
Variation in the band: 2 dB (if need be, adjust capacitor C223)
Passband at 3 dB 6,5 kHz
Passband at 40 dB 25 kHz
- 12 Disconnect the tracking generator.
- 13 Connect two RF generators across terminals 27 (signal) and 28 (chassis) of split connector RF head side).
- 14 Set RF generator so as to obtain a signal with:
Frequency of 2,499 MHz and 2,5 MHz.
Level of 10 mV.
- 15 Check on spectrum analyser that wave form displayed is identical with that shown below:

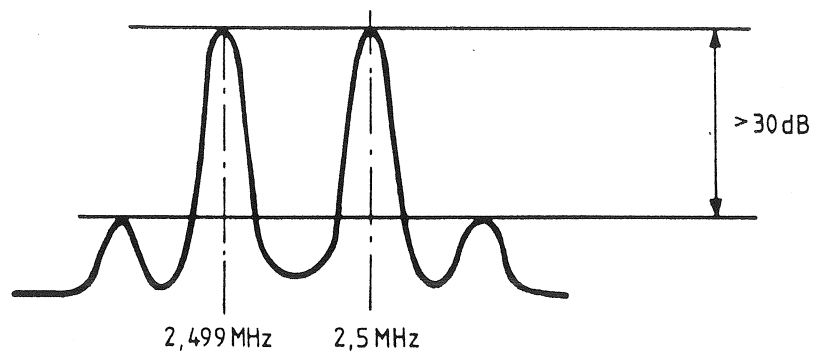


Fig. 3C.2.16

**HF Head
Analyser Waveform**

If need be, adjust resistor R231 so as to obtain a level greater than 30 dB (see fig. above).

113 (continued)

- 16 Note the value of voltage read off HF voltmeter ('U').
- 17 Check that gain computed by means of formula $G = 20 \text{ Log } \frac{U1}{10 \text{ mV}}$ is greater than 24 dB.
- 18 Disconnect the one RF generator from terminals 27 and 28 of the split connector (HF head side).
- 19 Set the remaining RF generator so as to obtain a signal with:
 - Frequency aligned with 29,999 MHz
 - Amplitude equal to 10 mV (U/2).
- 20 Select 29,999 MHz by means of frequency selector on the Manpack transceiver used as a 'tool'.
- 21 Note the value of voltage read off HF voltmeter (U/3).
- 22 Compute the gain, using formula: $G = 20 \text{ Log } \frac{U3}{U2}$. Said gain should approximate 24 dB.
- 23 Switch off the transceiver.
- 24 Disconnect:
 - Frequency meter from terminals 23 and 22
 - HF voltmeter or 23 and 24 of the split
 - Tracking generator input connector (HF head side)
- 25 Disconnect tracking generator output from terminals 27 and 28 of the split connector (HF head side).
- 26 Disconnect short-circuit between terminal 20 of the split connector (HF head side) and ground terminals (2, 3, 6, 7, 10, 11, 22, 23, 24, 26 and 28 of the split connector; HF head side).
- 27 Disconnect the -6 V. stabilised power supply from terminals 19 and 24 of the split connector (HF head side).
- 28 Disconnect the +10 V. stabilised power supply from terminals 16 and 22 of the split connector (HF head side).

Final Operations

- 114 Disconnect the HF head unit and the Manpack transceiver from the split connector.

BATTERY UNIT

115 The following procedure covers the verification and adjustment of the battery unit.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref fig 5A.1.25	1 Stabilised power supply, adjustable within 5 V. and 40 V. 1 Ammeter 1 dc. voltmeter 1 Stabilised power supply, +15 V. 1 Stabilised power supply, +16 V.	1 Load resistor, 25 Ohm

PROCEDURE

Operating Procedure

116 Operations shall be carried out in the following order:

- a Check of battery unit.
- b Opening of battery unit.
- c Disassembly of charger.
- d Opening of charger.
- e Adjustment of charger alone.

Checking the Battery Unit

Input check

117 1 Prepare the following set-up:

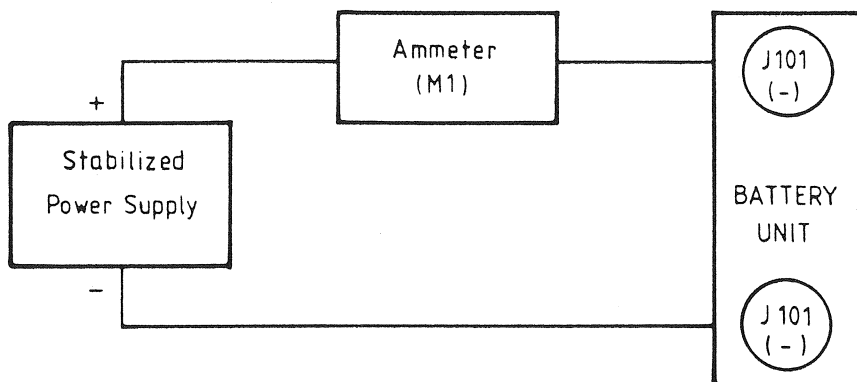


Fig. 3C.2.17

**Battery Unit
Connections to Jig**

117 Continued

- 2 Adjust stabilised power supply so that it delivers a voltage of 32 V.
- 3 Check that current read off ammeter approximates 300 mA.
- 4 Adjust stabilised power supply so that it delivers a voltage of 10 V.
- 5 Check that current read off ammeter M1 approximates 1,1 A.
- 6 Adjust stabilised power supply so that it delivers a voltage of 9 V.
- 7 Check for a current approximating zero off ammeter M1.
- 8 Adjust stabilised power supply so that it delivers a voltage of 15 V.
- 9 Disconnect stabilised power supply from ammeter M1 and connector J01 (—). Connect power supply as above but reverse polarities.
- 10 Check that current read off ammeter M1 approximates zero.
- 11 Disconnect stabilised power supply from ammeter M1 and connector J01 (—). Connect stabilised power supply as indicated in set-up.

Output Check

- 118 1 Proceed to input checks as indicated in para 117.
- 2 Connect a dc. voltmeter across terminals + and — of J102.
- 3 Check that dc. voltmeter pointer deviates in right direction when stabilised power supply is adjusted so as to deliver a voltage of 15 V.

NOTE Value read off voltmeter depends upon charge of batteries.

119 Reference to Part 3D must be carried out for the following procedures.

Opening the Battery Unit

120 Proceed to open the battery unit.

Removal of the Charger

121 Remove the charger. Refer to part 3D for special disassembly and re-assembly procedures.

Opening the Charger

122 Open the charger.

Adjusting the Charger Alone

- 123 1 Check that battery unit is not connected with external set-up mentioned in para 104.
- 2 Prepare the following set-up while checking that stabilised power supplies are on 'OFF':

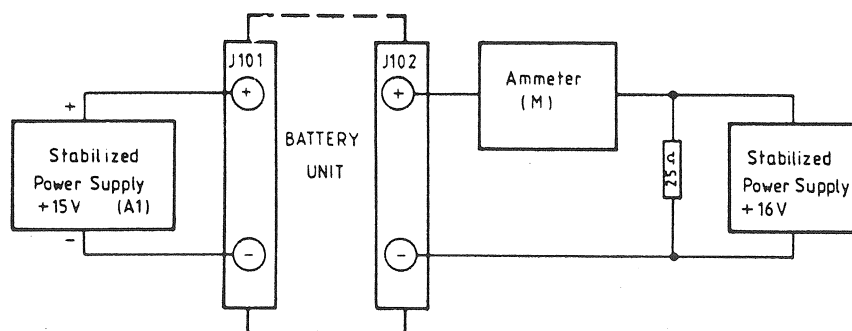


Fig. 3C.2.18

Battery Unit Connections to Jig

CAUTION Always switch on the power supplies in the following order:

- 3 Switch on the +16 V. stabilised power supply.
- 4 Switch on the +15 V. stabilised power supply.
- 5 Adjust resistor R03 so as to obtain an output current of 400 mA as read off ammeter.
- 6 Adjust stabilised power supply A1 so that it delivers a voltage of 9,5 V.
- 7 Adjust resistor R08 so as to obtain an output current of 0 mA as read off ammeter.
- 8 Disconnect battery unit from external set-up.

PERIPHERAL CIRCUITS BOARD

124 The following procedure is used for the verification and adjustment of the peripheral circuits.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref fig 5A.1.26	1 Stabilised power supply, + 6 V. 1 Stabilised power supply, +14,5 V. 1 Stabilised power supply, +13,2 V. 1 Stabilised power supply, +5 V. 1 Stabilised power supply, +3 V. 1 Stabilised power supply, -6 V. 1 Stabilised power supply, +10 V. 1 Stabilised power supply, adjustable from 0 to 15 V. 1 dc. voltmeter	1 Resistor, 47 Ohm 1 Resistor, 820 Ohm 1 Resistor, 5 kOhm 2 Resistors, 150 Ohm 1 Resistor, 220 Ohm 1 Resistor, 620 Ohm 1 Resistor, 430 Ohm 1 Resistor, 180 Ohm 1 Resistor, 22 kOhm 1 Resistor, 33 kOhm 3 Resistors, 4,7 kOhm 1 Resistor, 316 Ohm 1 Resistor, 12 Ohm 1 Resistor, 46,4 Ohm 1 Resistor, 1 kOhm 1 Resistor, 10 kOhm 1 Resistor, 470 Ohm 1 Resistor, 390 Ohm 1 Resistor, 24 kOhm 1 IC _μ 741 1 SPDT Switch

PROCEDURE

125 The operations shall be carried out in the following order:

- a Check of transmit/receive changeover.
- b Check and adjustment of RF compressor.
- c Check of AGC amplifier.
- d Check of local monitor control.

Preliminary Operations

- 126 1 Connect the +ve of +6 V. stabilised power supply to terminal A8 and the -ve of same power supply to ground terminals (A2, A22, B2 and B22).
- 2 Connect the +ve of +14,5 V. stabilised power supply to terminal B14 and the -ve of same power supply to ground terminals (A2, A22, B2 and B22).
- 3 Connect the +ve of +13,2 V. stabilised power supply to terminal A16 and the -ve of same power supply to ground terminals (A2, A22, B2 and B22).
- 4 Connect the +ve of +3 V. stabilised power supply to terminal A14 and the -ve to ground terminals (A2, A22, B2 and B22).

126 Continued

- 5 Connect the +ve of +3 V. stabilised power supply to terminal A11 and the -ve to ground terminals (A2, A22, B2 and B22).
- 6 Connect the -ve of -6 V. stabilised power supply to terminal B11 and the +ve to ground terminals (A2, A22, B2 and B22).
- 7 Connect the positive of +10 V. stabilised power supply to terminal A6 and the -ve to ground terminals (A2, A22, B2 and B22).

Operating Procedure

Checking the Transmit/Receive Switching

Preliminary Operations

127 Prepare the following set-up:

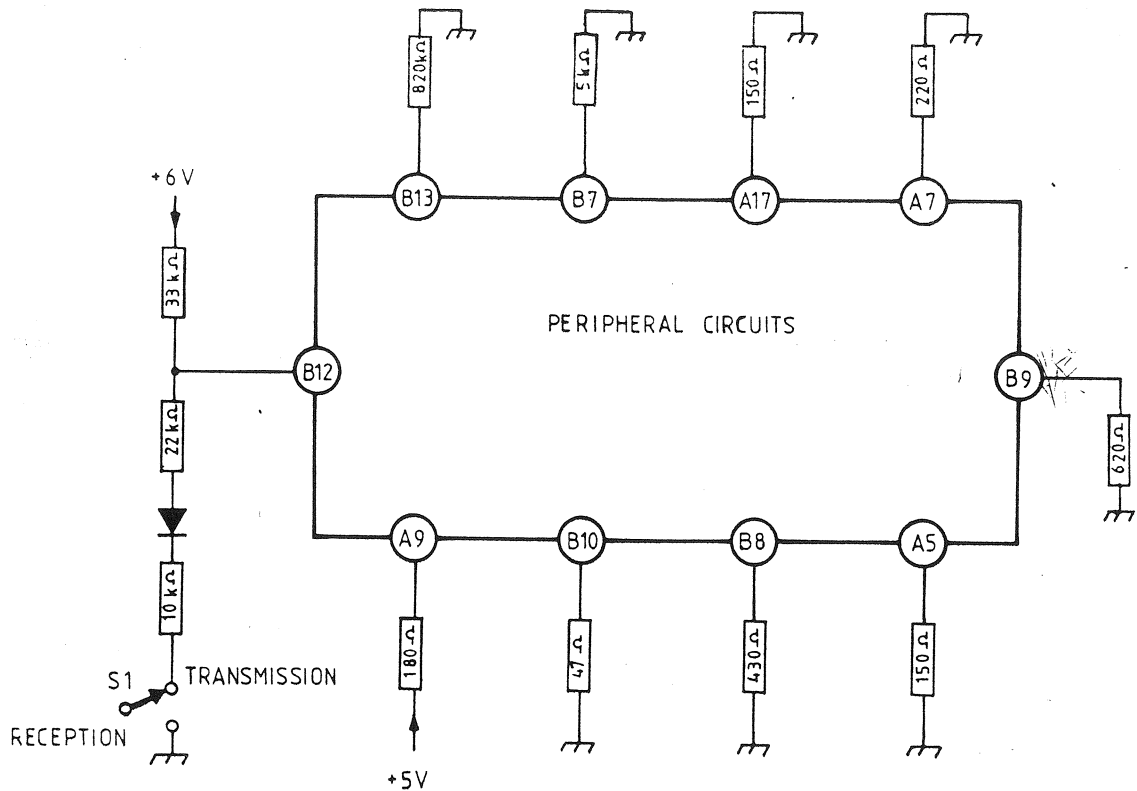


Fig. 3C.2.19

**Peripheral Circuit Board
Connections to Jig**

Reception Operation

- 128 1 Check that changeover S1 is on 'Reception'.
- 2 Connect a voltmeter in series with a 4,7 k resistor to the various terminals mentioned in table hereafter, in which the polarities to be observed and the values to be obtained are also indicated.

Terminal to which the +ve of Voltmeter is Connected	Terminal to which the -ve of Voltmeter is Connected	Value to be obtained
A2, A22, B2 or B22	B7	-6 V.
B13		+6 V.
B8		+10 V.
B9	A2, A22, B2 or B22	+6 V.
A9		2,5 V.
A7		
A5		0 V.
A17		
B10		

- 3 Disconnect the voltmeter from the test terminals to which it is connected.

Transmission Operation

- 129 1 Set changeover S1 to transmission.
- 2 Connect the voltmeter in series with a 4,7 k resistor to the various terminals mentioned in table hereafter in which the polarities to be observed and the values to be obtained are also indicated:

Terminal to which the +ve of Voltmeter is connected	Terminal to which the -ve of Voltmeter is connected	Value to be obtained
B7	A2, A22, B2 or B22	+6 V.
	B13	-6 V.
	B8	
A2, A22, B2 or B22		0 V.
	B9	
A9		+5 V.
A7	A2, A22, B2 or B22	+6 V.
A5		+10 V.
A2, A22, B2 or B22	A17	-6 V.
B10	A2, A22, B2, or B22	≥1,6 V

- 3 Disconnect voltmeter from test terminals to which it is connected.

Final Operations

- 130 Disconnect the 'peripheral circuits' PCB assembly from external set-up.

Checking and Adjusting the RF Compressor

Preliminary Operations

- 131 1 Prepare the set-up shown in para 127.
- 2 Check that changeover S1 of external set-up is on transmission.
- 3 Prepare the following external set-up:

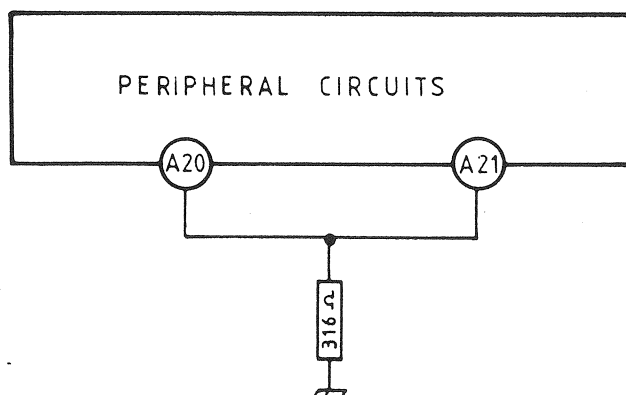


Fig. 3C.2.20

**Peripheral Circuit Board
Connections to Jig**

Operating Procedure

- 132 1 Checking Control Range of Potentiometer R57.
- 2 Connect a dc. voltmeter across terminals B17 and A2, A22, B2 or B22.
- 3 Set R57 to minimum. Check that voltage read off the dc. voltmeter is within 7,1 and 8,1 V.
- 4 Set potentiometer R57 to maximum. Check that voltage off the dc. voltmeter is within 9,2 and 10.15 V.
- 5 Disconnect the dc. voltmeter from terminals B17 and A2, A22, B2 or B22.

Checking the Normal Power/Reduced Power Control

- 133 1 Connect a dc. voltmeter across terminals B17 and A2, A22, B2 or B22.
- 2 Connect terminal A13 to one of terminals A2, A22, B2 or B22.
- 3 Set potentiometer R57 to minimum. Check that voltage read off the dc. voltmeter is within 2,6 and 3 V.
- 4 Disconnect short-circuit between terminal A13 and one of terminals A2, A22, B2 or B22.
- 5 Disconnect the dc. voltmeter from terminals B17 and A2, A22, B2 or B22.

Adjusting Z02 Offset

- 134 1 Check that changeover S1 of external set-up is on transmission.
- 2 Connect a stabilised power supply adjustable from 0 to 10 V. across terminal B17 and one of terminals A2, A22, B2 or B22. Adjust power supply so that it delivers a voltage of 0 V. Prepare the following set-up:

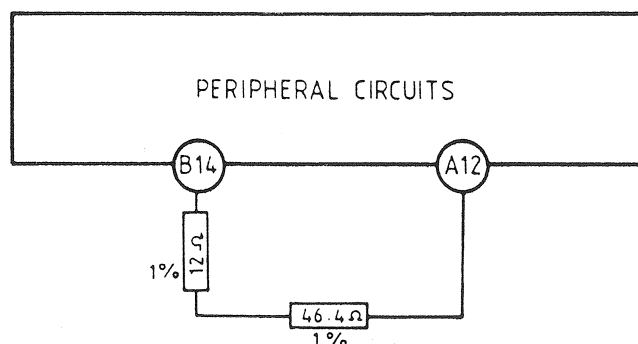


Fig. 3C.2.21

Peripheral Circuit Board
Connections to Jig

- 3 Connect a dc. voltmeter in series with a 1 k resistor across terminal B18 and one of terminals A2, A22, B2 or B22.
 - 4 Adjust potentiometer R51 so as to obtain a voltage within -1 V. and $+10$ V. mV. off the HF voltmeter.
- CAUTION:** Do not alter further the setting of potentiometer R51.
- 5 Disconnect external set-up from across terminals A12 and B14.
 - 6 Disconnect the dc. voltmeter from terminals B18 and A2, A22, B2 or B22.
 - 7 Disconnect the stabilised power supply from terminals B17 and A2, A22, B2 or B22.

Compressor and Gain Control Zero Setting

- 135 1 Check that changeover S1 of external set-up is on transmission.
- 2 Connect a stabilised power supply adjustable from 0 to 10 V. across terminal B17 and one of terminals A2, A22, B2 or B22. Adjust said power supply so that it delivers a voltage of 0 V.

135 Continued

Prepare the following set-up:

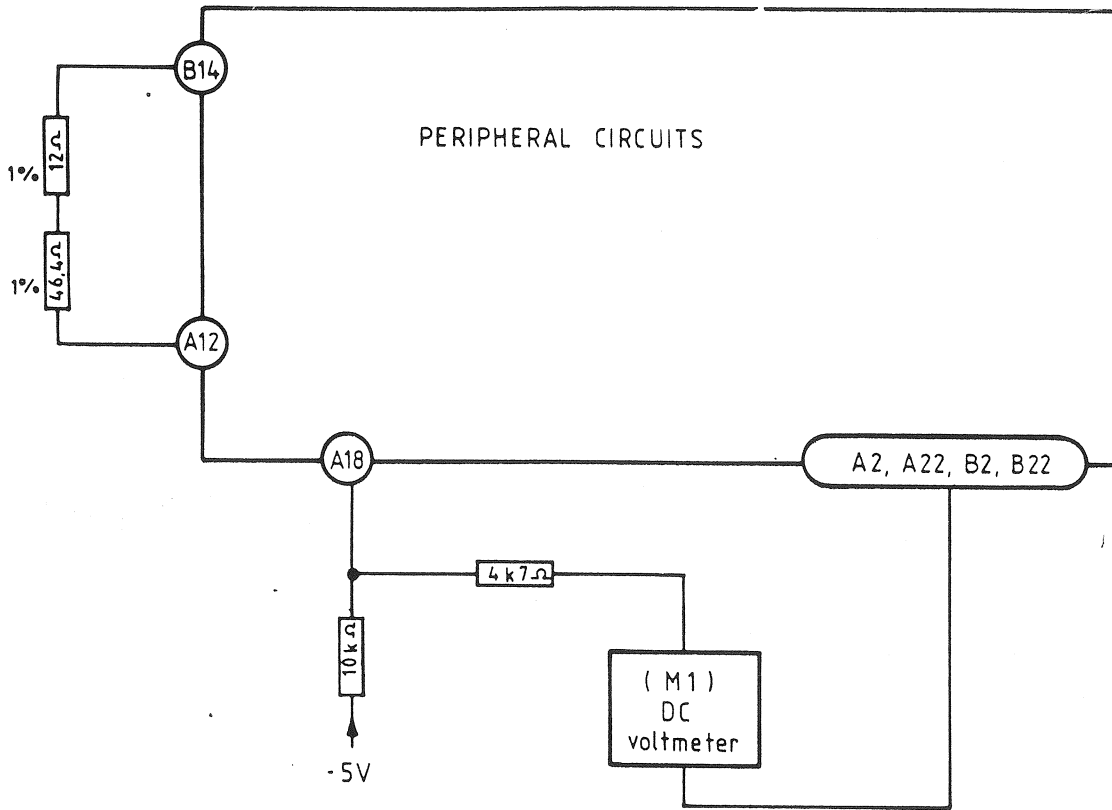


Fig. 3C.2.22

**Peripheral Circuit Board
Connections to Jig**

- 3 Note the value of voltage U/O off the voltmeter (M1).
- 4 Disconnect external set-up between terminals A20 and A21.

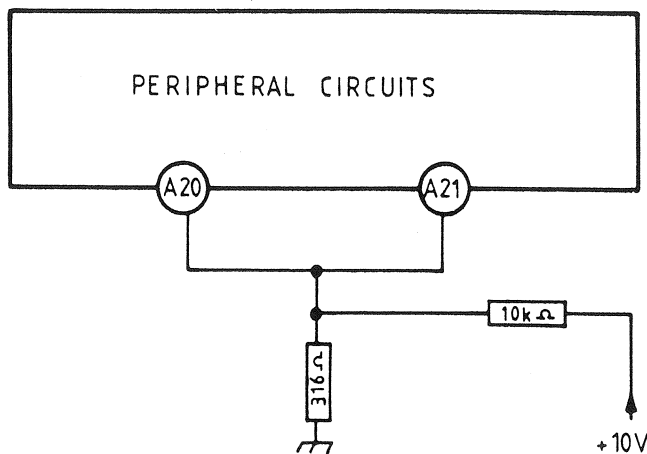


Fig. 3C.2.23

**Peripheral Circuit Board
Connections to Jig**

- 136 1 Note the value of voltage U/1 off the dc. voltmeter (M1).
- 2 Check that:
 $U/1 - U/0 = \Delta V$ with ΔV within 7,2 and 8 V.
- 3 Disconnect terminal A20 from terminal A21.
- 4 Disconnect terminal A12 from terminal B14.
- 5 Disconnect A18 from A2, A22, B2 or B22.
- 6 Disconnect stabilised power supply from terminals B17 and A2, A22, B2 or B22.

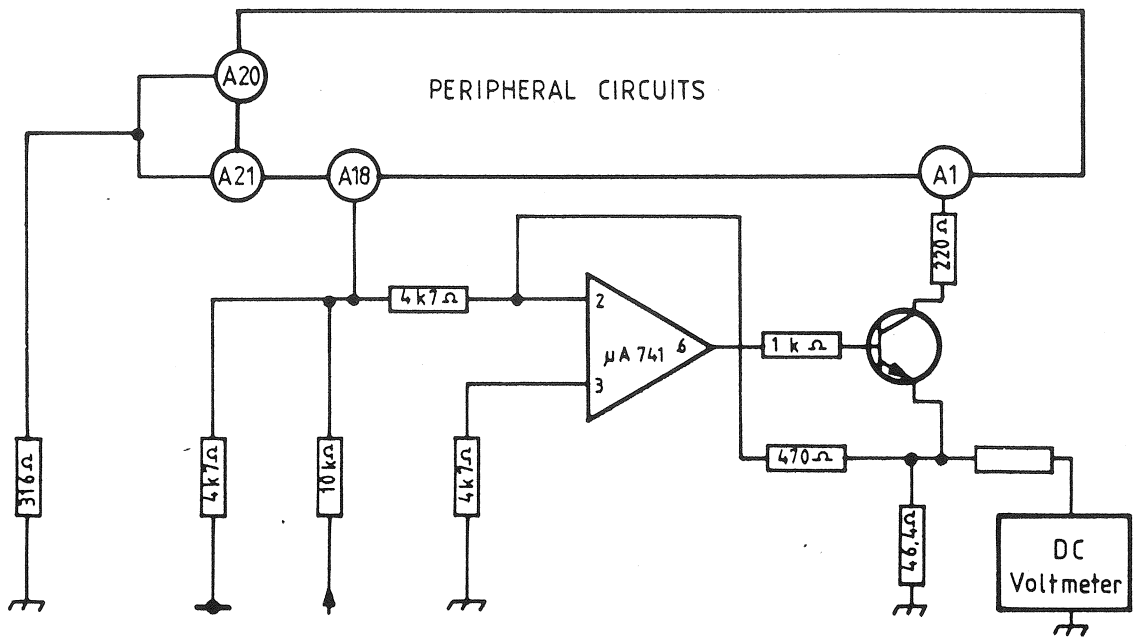


Fig. 3C.2.24

Peripheral Circuit Board
Connections to Jig

Checking Potentiometer R82 Setting Range (Power Regulation):

- 137 1 Connect a stabilised power supply adjustable from 0 to 10 V. across terminals B17 and one of terminals A2, A22, B2 or B22. Adjust it so as to obtain a voltage of 7 V. ± 10 mV.
- 2 Prepare the following set-up:

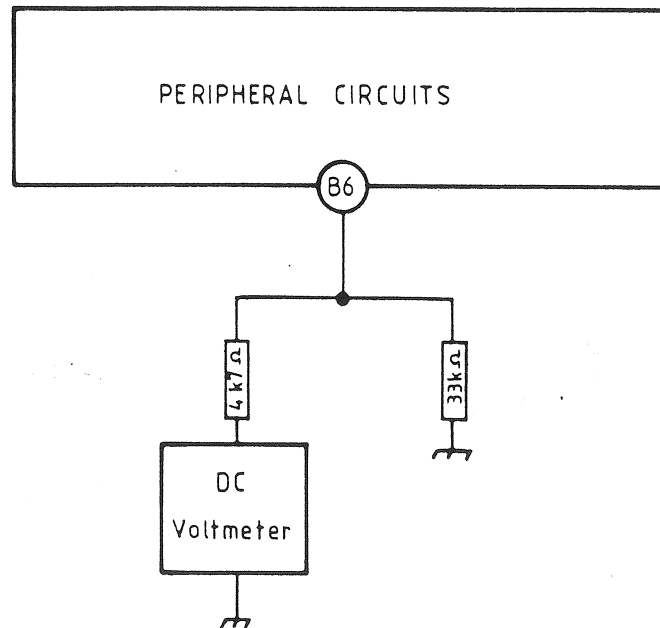


Fig. 3C.2.25

**Peripheral Circuit Board
Connections to Jig**

- 3 Adjust potentiometer R83 so as to obtain maximum voltage off the dc. voltmeter (U/0).
- 4 Disconnect the dc. voltmeter from external set-up.
- 5 Connect the dc. voltmeter across terminals A12 and B14 (U/1 is the voltage read).
- 6 Disconnect the dc. voltmeter from terminals A12 and B14 and connect it to terminal B18 in series with a 1 k resistor and one of terminals A2, A22, B2 or B22 (ground terminals).
- 7 Check that ratio: $\frac{U/2}{U/1}$ is within 5,8 and 6,3 V.
- 8 Disconnect the dc. voltmeter from terminals B18 and A2, A22, B2 or B22 and connect it as indicated in above-mentioned set-up.
- 9 Adjust potentiometer R83 so as to obtain minimum reading off the dc. voltmeter (U/3).
- 10 Disconnect the dc. voltmeter from external set-up.

137 Continued

- 11 Connect the dc. voltmeter across terminals A12 and B4 (let U/4 be the voltage across said terminals).
- 12 Check that voltage is within 0,2 and 0,3 V.
- 13 Disconnect the dc. voltmeter from terminals A12 and B14.
- 14 Disconnect external set-ups between:
Terminals A20 and A21.
Terminals A18 and A12.
- 15 Disconnect the stabilised power supply from terminals B17 and A2, A22, B2 or B22.

Final Operations

- 138 Disconnect the 'peripheral circuits' PCB from the external set-up.

Checking the AGC Amplifier**Preliminary Operations**

- 139 1 Prepare the set-up described in para 127 (called preliminary operations).
- 2 Check that changeover S1 in external set-up is on Reception.
- 3 Connect a +10 V. stabilised power supply across terminals A3 (+) and A2, A22, B2 or B22 (-).
- 4 Prepare the following set-up:

Operating Procedure

- 140 1 Check that voltage off the dc. voltmeter is within 0,3 and 0,45 V.
- 2 Connect a +10 V. stabilised power supply to terminal A4 and terminal A2, A22, B2 or B22 (ground) through a 390 k resistor.
- 3 Check that voltage off the dc. voltmeter is within 1,2 and 1,5 V.
- 4 Disconnect the +10 V. stabilised power supply from terminals A4 and A2, A22, B2 or B22.

Final Operations

- 141 1 Disconnect the +10 V. stabilised power supply from terminal A3(+) and A2, A22, B2 or B22(-).
- 2 Disconnect the 'Peripheral circuits' PCB from the various external set-ups.

Checking the Local Control

Preliminary Operations

- 142 1 Prepare the set-up mentioned in para 127.
- 2 Check that changeover S1 of external set-up is on 'Transmission'.
- 3 Connect a +12,6 V. stabilised power supply across terminals B14 and A2, A22, B2 or B22 (ground).

Operating Procedure

Battery

- 143 1 Prepare the following set-up.

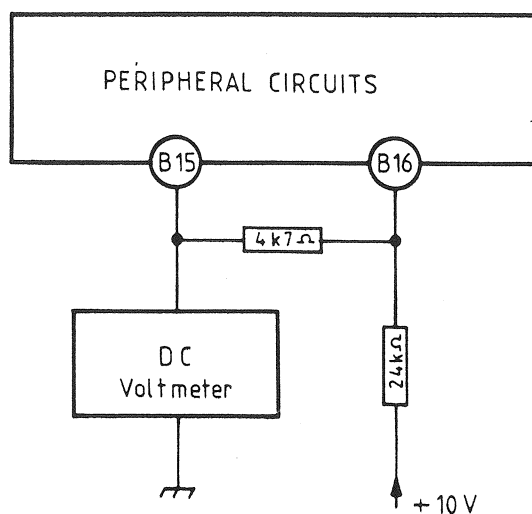


Fig. 3C.2.26

Peripheral Circuit Board Connections to Jig

- 2 Check for a voltage within 5,95 to 6,15 V. off the dc. voltmeter.
- 3 Disconnect the dc. voltmeter from the external set-up.
- 4 Connect the dc. voltmeter across terminals A10 and A2, A22, B2 or B22. Check that voltage off the dc. voltmeter is within 6,3 and 6,9 V.
- 5 Adjust the stabilised power supply connected across terminals B14 and A2, A22, B2 or B22 (ground) so that it delivers 11,5 V.
- 6 Check for a voltage within -6,5 and -5,3 V. off the dc. voltmeter.
- 7 Disconnect the dc. voltmeter from terminals A10 and A2, A22, B2 or B22.
- 8 Adjust the stabilised power supply connected across terminals B14 and A2, A22, B2 or B22 so as to obtain a voltage of 12,6 V.
- 9 Disconnect the PCB assembly from the external set-up connecting terminals B15 and B16.

Weak Transmission

- 144 1 Prepare the following set-up:

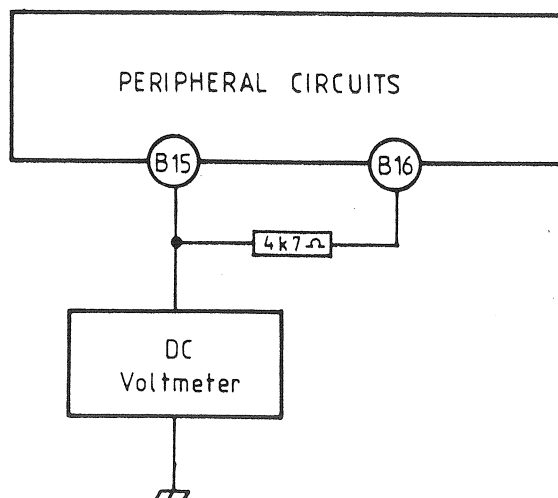


Fig. 3C.2.27

**Peripheral Circuit Board
Connections to Jig**

- 2 Check for a voltage within $-5,3$ and $-6,5$ V. off the dc. voltmeter.
- 3 Disconnect the PCB assembly from the external set-up connecting terminals B15 and B16.

Final Operations

- 145 1 Disconnect the stabilised power supply from terminals B14 and A2, A22, B2 or B22 (ground).
- 2 Disconnect the PCB assembly from the external set-up.

Checking the Antenna Tuning Cycle

- 146 This shall be carried out by means of a test set during the overall check.

Final Operations

- 147 1 Disconnect:
 - ve of -6 V. stabilised power supply from terminal B11.
 - +ve of -6 V. stabilised power supply from terminals A2, A22, B2 or B22 (ground).
- 2 Disconnect:
 - +ve of $+3$ V. stabilised power supply from terminal A11.
 - ve of $+3$ V. stabilised power supply from terminals A2, A22, B2 or B22 (ground).

147 Continued

3 Disconnect:

+ve of +5 V. stabilised power supply from terminal A14.

-ve of +5 V. stabilised power supply from terminals A2, A22, B2 or B22 (ground).

4 Disconnect:

+ve of +13,2 V. stabilised power supply from terminal A16.

-ve +13,2 V. stabilised power supply from terminals A2, A22, B2 or B22 (ground).

5 Disconnect:

+ve of +14,5 V. stabilised power supply from terminal B14.

-ve of +14,5 V. stabilised power supply from terminal A2, A22, B2 or B22.

6 Disconnect:

+ve of +6 V. stabilised power supply from terminal A8

-ve of +6 V. stabilised power supply from terminal A2, A22, B2 or B22 (ground).

ANTENNA TUNING UNIT

148 The following procedure is used for the verification and adjustment of the antenna tuning unit.

DOCUMENTS	TEST EQUIPMENT	TOOLS
Ref Fig 5A.1.22	1 Tracking generator 1 dc. voltmeter 1 Differential voltmeter 1 RF Millivoltmeter 1 Phasemeter with two probes 1 Dual-trace oscilloscope 2 Wattmeters 2 Stabilised power supplies, +3 V. 1 Stabilised power supply, +5 V. 1 Stabilised power supply, +13,2 V. 1 Stabilised power supply, +14 V.	3 Resistors, 16,5 Ohm 1 Resistor, 50 Ohm 1 Resistor, 1 kOhm 1 Resistor, 3,3 kOhm 1 Resistor, 100 kOhm 2 Co-axial cables 1 Connector, split with shorting links 1 Capacitor-inductor adaptor link 1 Soldering iron Solder 1 Manpack transceiver in operating condition

PROCEDURE

149 The operations shall be carried out in the following order:

- a Adjustment of bandpass filter.
- b Adjustment of all-pass filter.
- c Adjustment of discriminator zero.
- d Check of presetting.
- e Check of RF current coupler.

Adjusting the Band-pass Filter:

- 150 1 Set selector 'WHIP-WIRE-VEHICLE-50 OHM' to 50 Ohm.
- 2 Connect tracking generator output to co-axial connector J02 (source impedance = 50 Ohm).
- 3 Connect:
- 1 HF voltmeter.
 - 1 Spectrum analyser (tracking generator input) with output '50 Ohm'.
- CAUTION:** Total output impedance shall be of 50 Ohm.
- 4 Set frequency of signal delivered by tracking generator to 38,3 MHz.
- 5 Set inductor L02 for minimum voltage on the HF voltmeter.
- 6 Set frequency of signal delivered by tracking generator to 55 MHz.
- 7 Set indicator L03 so as to obtain minimum voltage as read off HF voltmeter.
- 8 Modulate frequency of signal from tracking generator from 2 to 65 MHz.
- 9 Check that curve on the spectrum analyser (tracking generator) is as shown below.

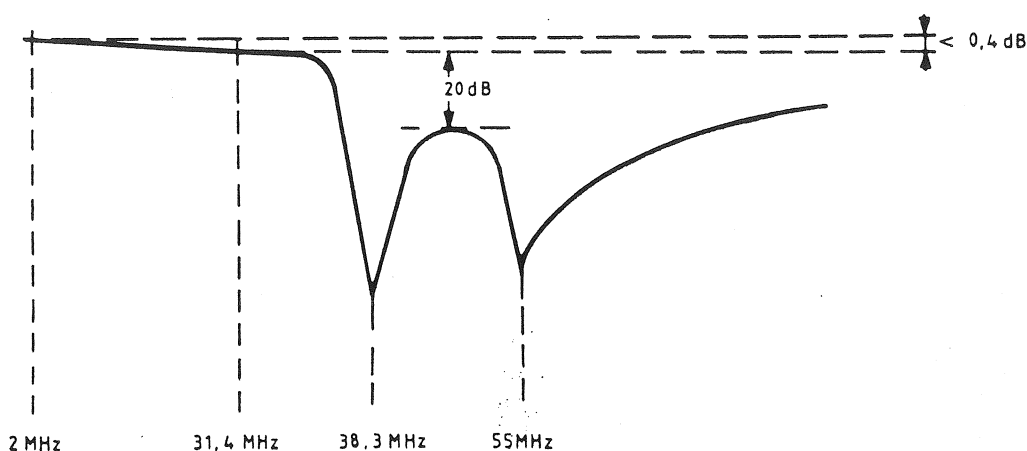


Fig. 3C.2.28

ATU
Analyser Curve

Check that attenuation between 2 and 30 MHz is 0,4 dB at most.

- 10 Disconnect:
- Tracking generator output from co-axial connector J02. Tracking generator input (spectrum analyser) and HF voltmeter from '50 Ohm' output.

Adjusting the All-Pass Filter

- 151 1 Disconnect the cables from Vr and Vd of printed circuit.
- 2 Prepare the following set-up:

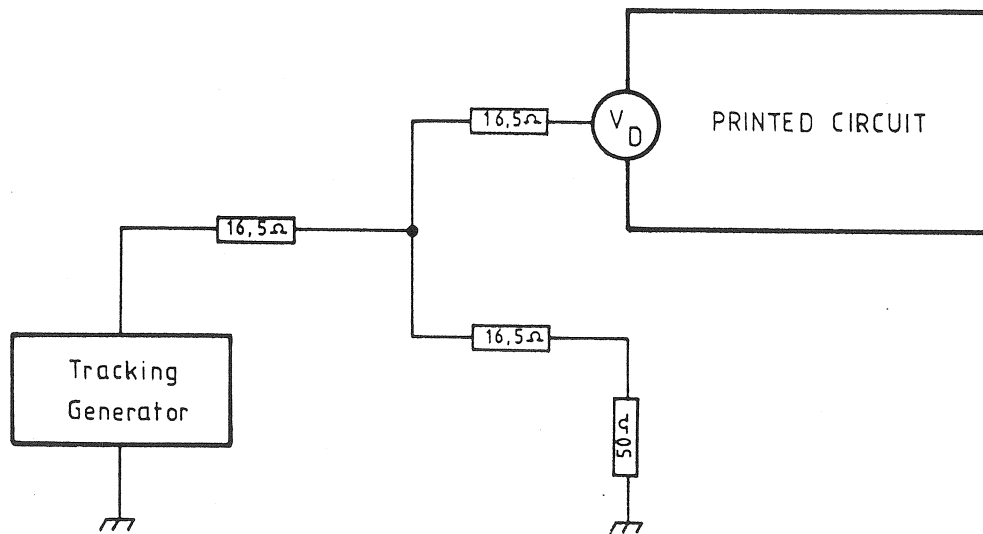


Fig. 3C.2.29

ATU
Connections to Jig

- 3 Disconnect links TP08 and TP05 from printed circuit.
- 4 Connect an RF millivoltmeter to test terminal TP03 of printed circuit.
- 5 Set frequency of signal delivered by tracking generator to 17 MHz (output impedance = 50 Ohm).
- 6 Set variable inductor L03 on the printed circuit for a minimum voltage on the RF millivoltmeter.
- 7 Put link TP08 back to its initial position.
- 8 Connect:
 - 1st probe of phasemeter across test point TP01 of printed circuit and ground (terminal 12 of connector J02).
 - 2nd probe of phasemeter across test point TP03 of printed circuit board and ground (terminal 12 of connector J02).
- 9 Set variable inductor L01 so as to obtain a phase shift of 180° off the phasemeter.
- 10 Disconnect the phasemeter from test points TP01, TP03 and ground, and RF millivoltmeter from TP03.

151 Continued

- 11 Disconnect the external set-up connected to terminal Vd of printed circuit.
- 12 Prepare the following set-up:

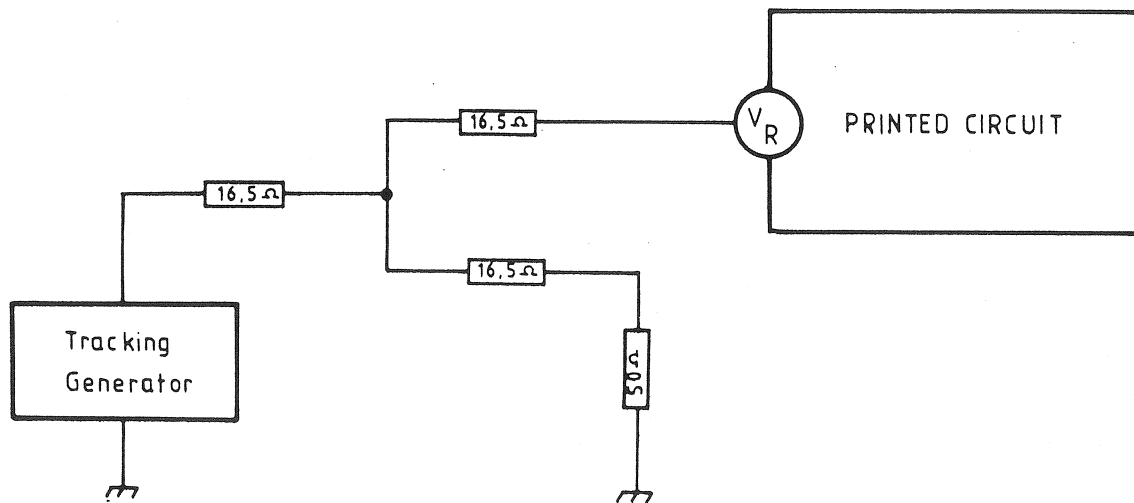


Fig. 3C.2.30

ATU
Connections to Jig

- 13 Set frequency of signal delivered by tracking generator to 3,9 MHz.
- 14 Connect the RF millivoltmeter with test terminal TP04 of printed circuit.
- 15 Set variable inductor L04 of printed circuit so as to obtain minimum voltage as read off RF millivoltmeter.
- 16 Put link TP05 back to initial position.
- 17 Disconnect the RF voltmeter from test terminal TP03 of printed circuit.
- 18 Connect:
 - 1st probe of phasemeter across test point TP02 of printed circuit and ground (terminal 12 of connector J02).
 - 2nd probe of phasemeter across test point TP04 of printed circuit and ground (terminal 12 of connector J02).
- 19 Set variable inductor L02 so as to obtain a phaseshift of 180° as read off phasemeter.
- 20 Disconnect the phasemeter from test points TP02, TP04 and ground.
- 21 Disconnect external set-up connected with terminal Vr of printed circuit.

Adjusting the Discriminator 0 V

- 152 1 Disconnect links from terminals Vr and Vd of printed circuit.
- 2 Prepare the following set-up:

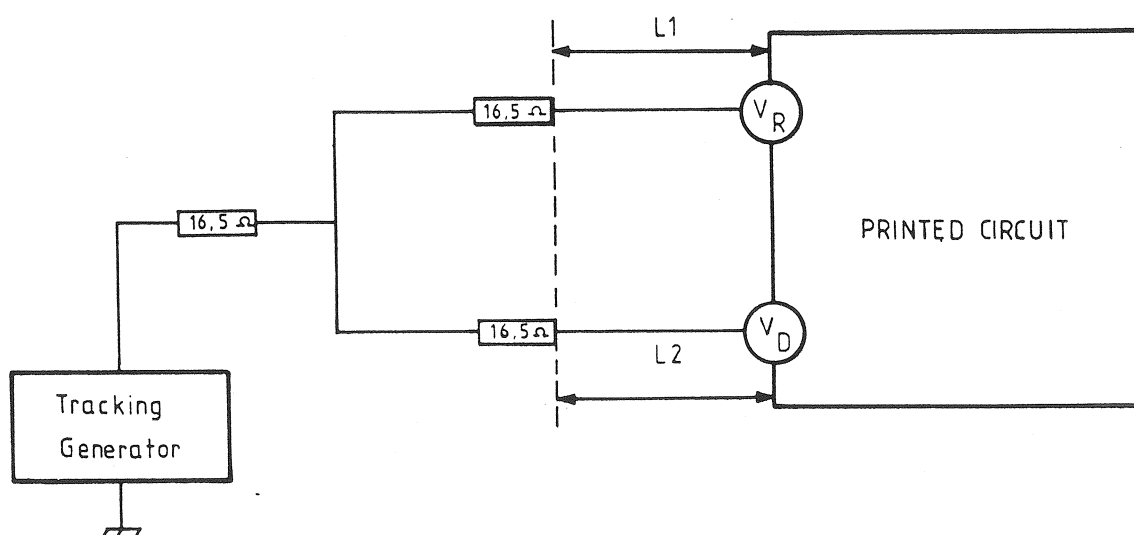


Fig. 3C.2.31

ATU
Connections to Jig

CAUTION Co-axial cables L1 and L2 shall be equal lengths to within 1 cm.

- 3 Adjust tracking generator so as to obtain:
 - Signal frequency : within 2 to 30 MHz.
 - Signal level : 3 V.rms.
- 4 Connect a differential voltmeter across test points TP16 and TP17 of printed circuit.
- 5 Adjust potentiometer R25 so as to obtain a voltage of 0 V. \pm 30 mV. as read off differential voltmeter.
- 6 Disconnect differential voltmeter from test points TP16 and TP17.
- 7 Disconnect external set-up from terminals Vr and Vd of printed circuit.
- 8 Connect links with terminals Vr and Vd of printed circuit.

Checking Presetting

- 153 1 Disconnect 'potentiometer Wiper' link from PCB and short circuit the pin on the PCB to ground.
- 2 Connect:
+ve of +14 V. stabilised power supply to terminal 8 of connector J02.
-ve of +14 V. stabilised power supply to terminal 12 of connector J02.
- 3 Connect:
+ve of +13,2 V. stabilised power supply to terminal 2 of connector J02.
-ve of +13,2 V. stabilised power supply to terminal 12 of connector J02.
- 4 Connect a 1 k resistor across terminals 16 and 12 of connector J02.
- 5 Connect:
+ve of +3 V. stabilised power supply to terminal 1 of connector J02.
-ve of +3 V. stabilised power supply to terminal 12 of connector J02.
- 6 Connect:
Channel 'a' of dual-trace oscilloscope to test terminal TP25.
Channel 'b' of dual-trace oscilloscope to test terminal TP22.
- 7 Check that:
Motor rotates up to limit-stop.
Logic state 1 is displayed on oscilloscope channel 'a'.
Logic state 0 is displayed on oscilloscope channel 'b'.
- 8 Connect:
+ve of +3 V. stabilised power supply to terminal 'potentiometer mid-point' of printed circuit.
-ve of +3 V. stabilised power supply to terminal 12 of connector J02.
Remove short circuit from solder pin on PC.
- 9 Check that:
Motor turns in reverse direction up to the other limit stop.
Logic state 1 is displayed on oscilloscope channel 'a'.
Logic state 0 is displayed on oscilloscope channel 'b'.

153 (continued)

10 Disconnect:

Channel 'a' of oscilloscope from test terminal TP25.

Channel 'b' of oscilloscope from test terminal TP22.

11 Disconnect:

+ve of +3 V. stabilised power supply from terminal 'potentiometer cursor' of printed circuit.

-ve of +3 V. stabilised power supply from terminal 12 of connector J02.

12 Disconnect +3 V. stabilised power supply from terminals 1 and 12 of connector J02.

13 Disconnect 1 k resistor from terminals 16 and 12 of connector J02.

14 Disconnect the +13,2 V. stabilised power supply from terminals 2 and 12 of connector J02.

15 Disconnect the +14 V. stabilised power supply from terminals 8 and 12 of connector J02.

16 Connect link to terminal 'potentiometer cursor' of printed circuit.

17 Connect antenna tuning unit to a Manpack transceiver in operating condition. Connect connectors J02 of antenna tuning unit under test to connector J02 of Manpack transceiver (with antenna tuning unit removed) via a split connector fitted with shorting links.

18 Connect a wattmeter to '50 Ohm' output (M1) as shown below.

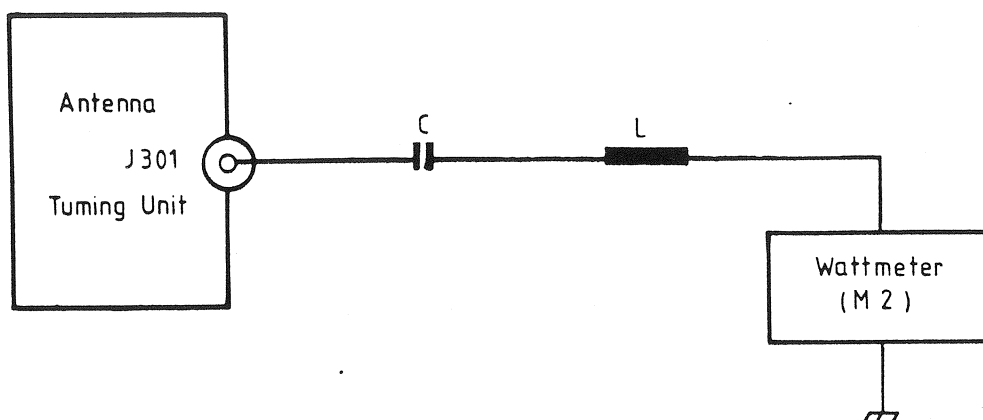


Fig. 3C.2.32

ATU
Connections to Jig

153 (continued)

- 19 Set selector S301 'WHIP-WIRE-VEHICLE-50 OHM' in antenna tuning unit under test to '50 Ohm'.
- 20 Select 02,500 MHz on Manpack transceiver used as a tool.
- 21 Switch on Manpack transceiver and set it for operation in MORSE transmission (A2-J).
- 22 Note value of transmitted power P1 read off wattmeter M1.
- 23 Set selector 'WHIP-WIRE-VEHICLE-50 OHM' in antenna tuning unit under test to 'WHIP'.
- 24 Note value P2 of transmitted power read off wattmeter M2.
Check that difference ΔP between P1 and P2 approximates 3 dB.
- 25 Set selector S301 'WHIP-WIRE-VEHICLE-50 OHM' in antenna tuning unit under test to '50 Ohm'.
- 26 Select 29,999 MHz on Manpack transceiver used as a tool.
- 27 Note value P3 of transmitted power read off wattmeter M1.
- 28 Set selector S301 'WHIP-WIRE-VEHICLE-50 OHM' in antenna unit under test to 'WHIP'.
- 29 Note value P4 of transmitted power read off wattmeter M2.
Check that difference ΔP between P3 and P4 is of 3 dB at most.
- 30 Select 02,000 MHz on Manpack transceiver used as a tool.
- 31 Set selector S301 'WHIP-WIRE-VEHICLE-50 OHM' in antenna tuning unit under Test to 'WIRE'.
Check that motor moves up to limit stops and stops.
- 32 Set Manpack transceiver used as a tool to 'OFF'.
- 33 Disconnect:
External set-up from terminal J301 of antenna tuning unit.
Wattmeter from '50 Ohm' output.
- 34 Disconnect antenna tuning unit under test from split connector which connects it with Manpack transceiver used as a tool.

Checking the RF Current Test Sensor

154 1

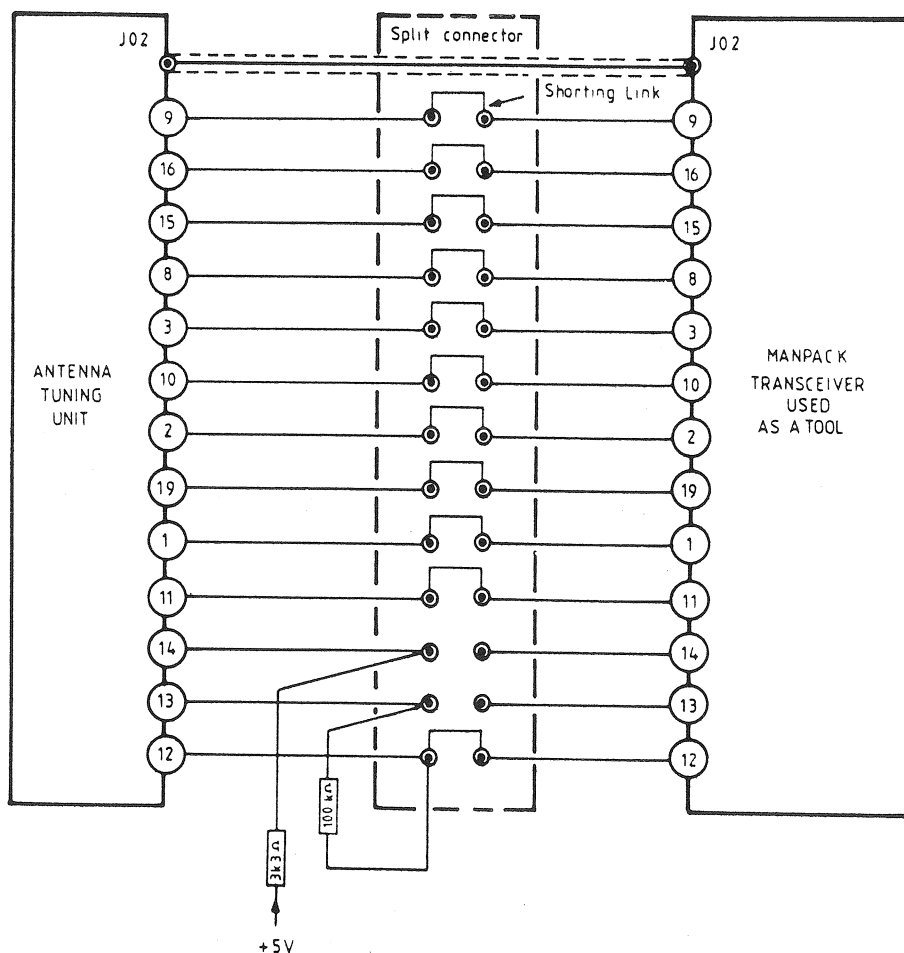


Fig. 3C.2.33

ATU Connections to B25

- 2 Switch on Manpack transceiver and check that it is not in transmission operation.
- 3 Connect a dc. voltmeter across terminals 12 and 13 of split connector (antenna tuning unit side).
- 4 Set selector S301 'WHIP-WIRE-VEHICLE-50 OHM' in antenna tuning unit under test to 50 Ohm.
- 5 Check that voltage read off dc. voltmeter approximates 4,5 V.
- 6 Select 02,000 MHz on Manpack transceiver.
- 7 Set Manpack transceiver used as a tool to transmission.
- 8 Check that voltage read off dc. voltmeter approximates 6,5 V.
- 9 Set Manpack transceiver used as a tool to 'OFF'.
- 10 Disconnect antenna tuning unit under test from split connector.
- 11 Disconnect set-ups from the split connector.

FREQUENCY SELECTOR PCB

155 The following procedure is used for the verification and adjustment of the frequency selector PCB assembly.

DOCUMENTS

Ref Fig

TEST EQUIPMENT

1 Stabilised power supply, 9,5 V.
1 Sine-wave generator
1 Frequency meter
1 Pulse generator
1 Oscilloscope with dual-trace unit
1 Ohmmeter

TOOLS

Mechanical device indicating position of frequency selectors

PROCEDURE

156 The following checks and adjustments shall be carried out:

- a Adjustment of secondary loop reset pulse.
- b Check of dividing ratio of secondary loop variable ratio divider.
- c Adjustment of main loop reset pulse.
- d Check of 'C command' of main loop variable ratio divider.
- e Check the dividing ratio of main loop variable ratio divider.
- f Check of antenna tuning cycle starting command.
- g Check of sub-band commands for vehicle-mounted version.
- h Check of presetting USB-band signal.
- j Check of 'VCO changeover' signal.

Preliminary Operations

- 157 1 Fit the mechanical device, intended for indicating position of the 10 MHz, 1 MHz, 100 kHz, 10 kHz and 1 kHz selectors and for selecting the frequency, on the 'Frequency Selector' PCB.
- 2 Connect the +ve of +9,5 V. stabilised power supply to terminal B7 of PCB assembly.
- 3 Connect the -ve of stabilised power supply to ground terminals (A2, A7, A8, A17, B2, B10 and B17) of PCB assembly.

Operating Procedure**Adjusting the Secondary Loop Reset Pulse**

- 158 1 Connect sine-wave generator to terminal A4 (SLH) of PCB assembly.
- 2 Adjust sine-wave generator so as to obtain:
Signal amplitude: 100 mV Peak to Peak.
Signal frequency: 500 kHz.
- 3 Set:
10 MHz and 1 MHz selectors to 0.
100 kHz selector to 1.
10 kHz and 1 kHz selectors to 9.
- 4 Connect an oscilloscope to terminal B6 of PCB assembly.
- 5 Check that amplitude of pulse on oscilloscope is greater than 8 V.
- 6 Adjust resistor R07 of PCB assembly so that width of pulse read off oscilloscope be within 2,8 and 3,2 μ s.
- 7 Disconnect:
Oscilloscope from terminal B6.
Sine-wave generator from terminal A4.

Checking the Dividing Ratio of Secondary Loop Variable Ratio Divider

- 159 1 Connect a sine-wave generator to terminal A4 (SLH) of PCB assembly,
- 2 Adjust sine-wave generator so as to obtain:
Signal Amplitude: 100 mV.
Signal Frequency: 500 kHz.
- 3 Set the 10 MHz, 100 kHz, 10 kHz and 1 kHz selectors to 0.
- 4 Connect a frequency meter to terminal B6 of PCB assembly.
- 5 Check that signal frequency read off frequency meter is of 1 kHz.

NOTE In this case, the dividing ratio is 500 with the 100 kHz, 10 kHz and 1 kHz selectors set to 0.

159 Continued

- 6 Table below shows the dividing ratio and frequency of signal from the sine-wave generator required to obtain a signal frequency of 1 kHz as read off frequency meter, versus the state selected by means of the 100 kHz, 10 kHz and 1 kHz selectors.

Signal Frequency Read off Frequencymeter	Selected State			Dividing Ratio	Frequency of Signal from Sine-Wave Generator (in kHz)
	100 kHz	10 kHz	1 kHz		
1 kHz	0	0	0	500	500
	0	0	1	501	501
	0	0	2	502	502
	0	0	3	503	503
	0	0	4	504	504
	0	0	5	505	505

159 Continued

Signal Frequency Read off Frequencymeter	Selected State			Dividing Ratio	Frequency of Signal from Sine-Wave Generator (in kHz)
	100 kHz	10 kHz	1 kHz		
1 kHz	0	0	6	506	506
	0	0	7	507	507
	0	0	8	508	508
	0	0	9	509	509
	0	1	9	519	519
	0	2	9	529	529
	0	3	9	539	539
	0	4	9	549	549
	0	5	9	559	559
	0	6	9	569	569
	0	7	9	579	579
	0	8	9	589	589
	0	9	9	599	599
	1	9	9	699	699
	2	9	9	599	599
	3	9	9	699	699
	4	9	9	599	599
	5	9	9	699	699
	6	9	9	599	599
	7	9	9	699	699
	8	9	9	599	599
	9	9	9	699	699

159 Continued

- 7 Disconnect:
Frequency meter from terminal B6.
Sine-wave generator from terminal A4.

Adjusting the Main Loop Reset Pulse

- 160 1 Connect a pulse generator to terminal A5 (MLH) of PCB assembly.
- 2 Adjust pulse generator so as to obtain:
Signal amplitude: 10 V.
Signal frequency: 850 kHz.
Form factor: 1/1.
- 3 Set:
10 MHz selector to 2.
1 MHz selector to 9.
100 kHz, 10 kHz and 1 kHz selectors to 0.
- 4 Connect an oscilloscope to terminal A6 of PCB assembly.
- 5 Check that amplitude of signal read off oscilloscope is greater than 8 V.
- 6 Adjust resistor R08 of PCB assembly so that the width of signal off oscilloscope may be within 1,4 to 1,8 μ s.
- 7 Disconnect:
Oscilloscope from terminal A6.
Pulse generator from terminal A5.

Checking the 'C Command' of Main Loop Variable Ratio Divider

- 161 1 Connect a pulse generator to terminal A5 (MLH) to PCB assembly.
- 2 Adjust said generator so as to obtain:
Signal amplitude: 10 V.
Signal Frequency: 850 kHz.
Form Factor: 1/1.

161 Continued

3 Set:

10 MHz selector to 2.

1 MHz selector to 9.

100 kHz, 10 kHz and 1 kHz selectors to 0.

4 Connect dual trace oscilloscope as follows:

Channel A: connected to terminal A5.

Channel B: connected to terminal B8.

Trigger oscillator with signal available at terminal A6 of PCB assembly.

5 Table below shows the shape of signals displayed on oscilloscope in correct operation versus the position of the 100 kHz selector.





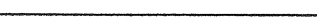





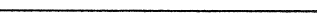



Position of 100 kHz Selector	Wave Forms Displayed on Oscilloscope
0	Channel A "1" 
1	Channel B "0" 
2	Channel A 
3	Channel B "1"  "0" 
4	Channel A 
5	Channel B "1"  "0" 
6	Channel A 
7	Channel B "1"  "0" 
8	Channel A 
9	Channel B "1"  "0" 

Fig. 3C.2.34

Frequency Selector Waveforms

6 Disconnect:

Channel A of oscilloscope from terminal A5.

Channel B of oscilloscope from terminal B8.

Synchronization of oscilloscope from terminal A6.

Pulse generator from terminal A5.

Checking the Dividing Ratio of Main Loop Variable

Ratio Divider

- 162 1 Connect a pulse generator with terminal A5 (MLH) of PCB assembly.
- 2 Adjust pulse generator so as to obtain:
Signal amplitude: 10 V.
Signal frequency: 100 kHz.
Form factor: 1/1.
- 3 Set:
1 MHz selector to 2.
10 MHz, 100 kHz and 1 kHz selectors to 0.
- 4 Connect a frequency meter to terminal A6 of PCB assembly.
- 5 Check that signal frequency read off frequency meter is 25 kHz.

NOTE: In this case, the dividing ratio is 4 for a frequency selection corresponding with '02,000' (kHz).

- 6 Table below shows the value of dividing ratio and of frequency from pulse generator required to obtain a frequency of 25 kHz as read off frequency meter, versus state selected by means of the 10 MHz and 1 MHz selectors.

Signal Frequency Read off Frequency Meter (in kHz)	Selected State		Dividing Ratio	Frequency of Signal from Pulse Generator (in kHz)
	10 MHz	1 MHz		
	0	1		
25	0	2	4	100
	0	3	5	125
	0	4	6	150
	0	5	7	175
	0	6	8	200
	0	7	9	225
	0	8	10	250
	0	9	11	275
	1	0	12	300
	1	1	13	325
1	2	14	350	

162 Continued

Signal Frequency Read off Frequency Meter (in kHz)	Selected State		Dividing Ratio	Frequency of Signal from Pulse Generator (in kHz)
	10 MHz	1 MHz		
25	1	3	15	375
	1	4	16	400
	1	5	17	425
	1	6	18	450
	1	7	19	475
	1	8	20	500
	1	9	21	525
	2	0	22	550
	2	1	23	575
	2	2	24	600
	2	3	25	625
	2	4	26	650
	2	5	27	675
	2	6	28	700
	2	7	29	725
	2	8	30	750
	2	9	31	775

7 Disconnect:

Frequency meter from terminal A6.

Pulse generator from terminal A5.

Checking the Antenna Tuning Cycle Starting Command

- 163
- 1 Connect an Ohmmeter across terminals B11 and A2, A7, A8, A17, B2, B10 or B17 (ground terminals).
 - 2 Set the 10 MHz selector successively to 0, 1 and 2. Check for presence of a transient ground off ohmmeter on each change in position of the 10 MHz selector.
 - 3 Set the 1 MHz selector successively to 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Check for presence of a transient ground off ohmmeter each time the position of 1 MHz selector is modified.
 - 4 Set the 100 kHz selector successively to 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Check for presence of a transient ground off ohmmeter each time the position of 100 kHz selector is modified.
 - 5 Set the 10 kHz selector successively to 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Check for presence of a transient ground off ohmmeter each time the position of 10 kHz selector is changed.
 - 6 Disconnect the ohmmeter from terminals B11 and A2, A7, A17, B2, B10 or B17 (ground terminals).

Checking the Sub-Band Commands for Vehicle-Mounted Version

164 This shall be carried out as follows:

- 1 Set the 100 kHz, 1 MHz and 10 MHz selectors to 0 Ohm.
- 2 Connect the ohmmeter across terminals B16 and A2, A7, A8, A17, B2, B10 or B17 (ground terminals). Check that resistance read off ohmmeter is 0 Ohm. Disconnect ohmmeter.
- 3 Connect the ohmmeter across terminals A9 and A2, A7, A8, A17, B2, B10 or B17 (ground terminals).
Check that resistance read off ohmmeter is 0 Ohm. Disconnect ohmmeter.
- 4 Connect ohmmeter across terminals A16 and A2, A7, A8, A17, B2, B10 or B17 (ground terminals). Check that resistance read off ohmmeter is ∞ . Disconnect ohmmeter.
- 5 Connect the ohmmeter across terminals B13 and A2, A7, A8, A17, B2, B10 or B17 (ground terminals). Check that resistance read off ohmmeter is of 0 Ohm. Disconnect ohmmeter.
- 6 Connect ohmmeter across terminals B14 and A2, A7, A8, A17, B2, B10 or B17 (ground terminals). Check that resistance read off ohmmeter is ∞ . Disconnect ohmmeter.
- 7 Table below shows the resistance across ground terminals (A2, A7, A8, A17, B2, B20 or B17) and terminals B16, A9, A16, B13 and B14, depending on position of the 100 kHz, 1 MHz and 10 MHz selectors.

164 Continued

Selected State			Resistance across Ground Terminals (A2, A7, A8, A17, B2, B10 or B17) and terminals :				
10 MHz	1 MHz	100 kHz	B16	A9	A16	B13	B14
0	0	0	0	0	∞	0	∞
0	1	0	0	0	∞	0	∞
0	1	1	0	0	∞	0	∞
0	1	2	0	0	∞	0	∞
0	1	3	0	0	∞	0	∞
0	1	4	0	0	∞	0	∞
0	2	4	0	0	0	0	∞
0	2	5	∞	0	0	0	∞
0	2	6	∞	0	0	0	∞
0	2	7	∞	0	0	0	∞
0	2	8	∞	0	0	0	∞
0	2	9	∞	0	0	0	∞
0	3	0	∞	∞	0	0	∞
0	4	0	0	∞	0	0	∞
0	5	0	0	∞	∞	0	∞
0	6	0	∞	∞	∞	0	∞
0	7	0	∞	∞	∞	0	∞
0	8	0	∞	0	∞	0	∞
0	9	0	∞	0	∞	0	∞
1	0	0	0	0	∞	∞	∞
2	0	0	0	0	∞	∞	0

Checking the Presetting Sub-Band Signal

- 165 1 Connect the Ohmmeter across terminal B15 and one of ground terminals (A2, A7, A8, A17, B2, B10 or B17).
- 2 Table below shows the resistance read off ohmmeter versus the state selected.

Selected State			Resistance read off Ohmmeter (in k Ω)	Selected State			Resistance read off Ohmmeter (in k Ω)
10 MHz	1 MHz	100 kHz		10 MHz	1 MHz	100 kHz	
0	0	0	1.54	0	2	9	1.33
0	1	0	1.54	0	3	0	1.05
0	1	1	1.54	0	4	0	0.862
0	1	2	1.54	0	5	0	0.862
0	1	3	1.54	0	6	0	0.678
0	1	4	1.54	0	7	0	0.678
0	2	4	1.54	0	8	0	0.678
0	2	5	1.33	0	9	0	0.678
0	2	6	1.33	1	0	0	0.562
0	2	7	1.33	2	0	0	0.562
0	2	8	1.33				

- 3 Disconnect ohmmeter from terminals B15 and A2, A7, A8, A17, B2, B10 or B17.

Checking the 'VCO Changeover' Signal

166 1 Connect the ohmmeter across terminal A12 and one of ground terminals (A2, A7, A8, A17, B2, B10 or B17).

2 Table below shows the resistance read off ohmmeter versus the state selected.

Selected State			Resistance read off Ohmmeter	Selected State			Resistance read off Ohmmeter
10.MHz	1 MHz	100kHz		10 MHz	1 MHz	100kHz	
0	0	0	0	0	2	9	0
0	1	0	0	0	3	0	0
0	1	1	0	0	4	0	0
0	1	2	0	0	5	0	0

Selected State			Resistance read off Ohmmeter	Selected State			Resistance read off Ohmmeter
10 MHz	1 MHz	100kHz		10 MHz	1 MHz	100 kHz	
0	1	3	0	0	6	0	0
0	1	4	0	0	7	0	0
0	2	4	0	0	8	0	0
0	2	5	0	0	9	0	0
0	2	6	0	1	0	0	0
0	2	7	0	2	0	0	∞
0	2	8	0				

3 Disconnect ohmmeter from terminals A12 and A2, A7, A8, A17, B2, B10 or B17.

Final Operations

- 167
- 1 Disconnect the -ve of stabilised power supply from ground terminals (A2, A7, A8, A17, B2, B10 and B17) of PCB assembly.
 - 2 Disconnect the +ve of +9,5 V. stabilised power supply from terminal B7 of PCB assembly.
 - 3 Remove the mechanical device indicating the position of PCB assembly selectors.
- 168 This concludes the verification and adjusting procedures.

PART 3D

REPAIR

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GENERAL

- 1 This part deals with the removal and replacement of standard modules or P.C. Boards.

STANDARD EXCHANGE OF THE BATTERY UNIT

- 2 The following chart describes the removal and replacement of the Battery Unit.

Documents	Test Equipment	Tools
Not applicable	Not applicable	Not applicable
Spare part		
A battery unit		

PROCEDURE

3 Preliminary Steps – Safety Requirements

Set the .O, L, H selector on the transceiver front panel to 'O'.

Disconnect the antenna tuning unit.

Put the Manpack system on a flat and clean surface, with the front panel facing the operator.

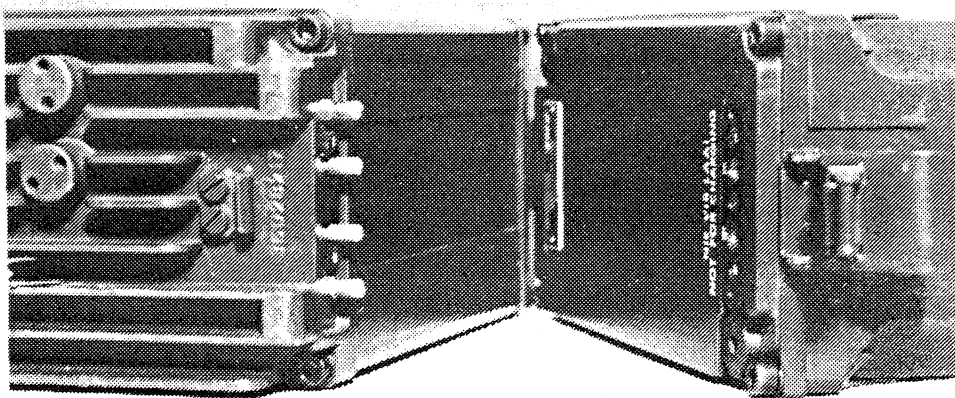


Fig. 3D.1.

Removal of Battery Pack

4 Dismantling

- 1 Release the two battery unit toggle fasteners.
- 2 Disengage the toggle fasteners completely.
- 3 While holding the transceiver unit, pivot the battery unit to the left, the front edge acting as a hinge (this ensures withdrawal of the battery unit connector from the transceiver unit connector without damage).
- 4 Uncouple the battery unit from the transceiver unit by disengaging the fixing lug (located on the front panel of the transceiver unit).
- 5 Remove the battery unit.

5 Remounting

- 1 Couple the battery unit with the transceiver unit by engaging the fixing lug (located on the front panel of the transceiver unit).
- 2 Put the front right edge of the battery unit against the front left edge of the transceiver unit.
- 3 While holding the transceiver unit, pivot the battery unit to the right (which permits plugging the battery unit connector into the transceiver unit connector without damage).
- 4 Put the rear toggle fastener into its initial position.
- 5 Lock the rear toggle fastener.
- 6 Put the front toggle fastener into its initial position.
- 7 Lock the front toggle fastener.

STANDARD EXCHANGE OF THE ANTENNA TUNING UNIT

- 6 The following chart describes the standard exchange of antenna tuning unit.

Documents	Test Equipment	Tools
Not applicable	Not applicable	One Allen key for hexagon socket head screws, size 4mm.
Spares		Silicone grease S14
One antenna tuning unit		Dry cloth

PROCEDURE**7 Preliminary Steps – Safety Requirements**

Set the .O, L, H selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna tuning unit.

Put the Manpack transceiver on a flat, clean surface, with front panel facing the operator.

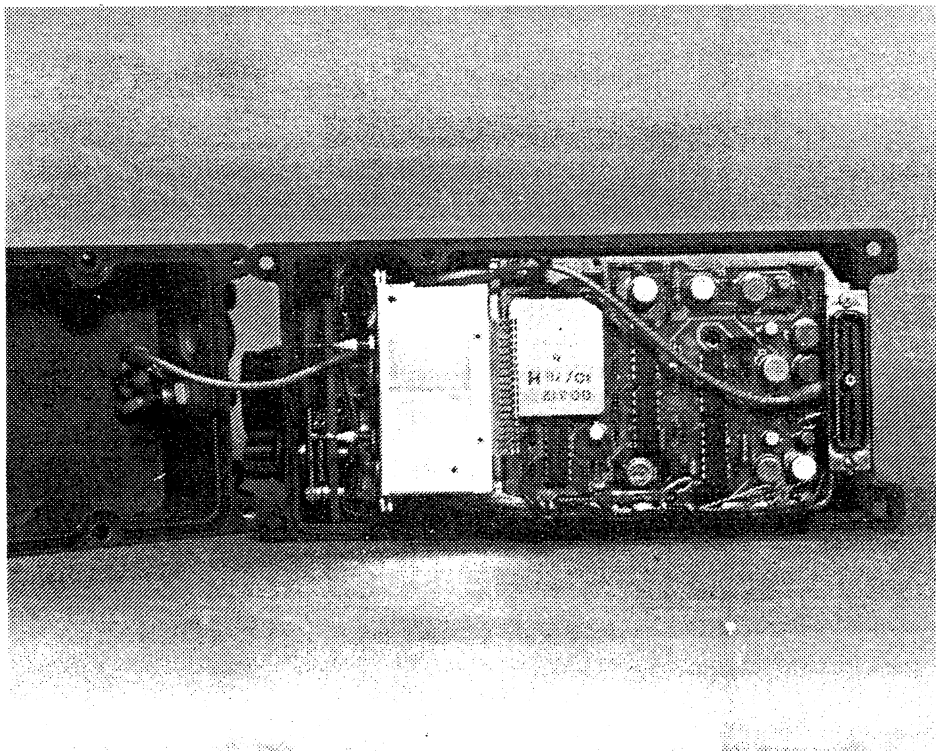


Fig. 3D.2,

Removal of ATU**8 Dismantling**

- 1 Remove the four fixing screws of the antenna tuning unit by means of the 4mm hexagon key.
- 2 Withdraw the antenna tuning unit from the transceiver unit, by pulling perpendicularly to the transceiver unit (left to right).
- 3 Remove the antenna tuning unit.

9 Remounting

- 1 Remove the sealing gasket adjacent to the antenna tuning unit connector.
- 2 Clean the sealing gasket with a clean, dry cloth.
- 3 Coat the sealing gasket with Silicone grease.
- 4 Put the sealing gasket back into place and remove excess grease with a dry, clean cloth.
- 5 Put the antenna tuning unit back into place.
- 6 Tighten the four fixing screws by means of the 4mm Allen key.
- 7 Dry out the Manpack transceiver (see para 105).

REMOVAL AND REMOUNTING OF THE TRANSCEIVER UNIT PROTECTIVE COVER

- 10 The following chart describes the removal and remounting of the transceiver unit protecting cover.

Documents	Test equipment	Tools
Para 2 Para 6	Not applicable	One Allen key for hexagon socket heat screws, size 4mm.
Spares		
Not applicable		Silicone grease Dry cloth

PROCEDURE**11 Preliminary Steps – Safety Requirements**

Set the .O, L, H selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna unit.

Put the Manpack transceiver on a flat, clean surface, with front panel facing the operator.

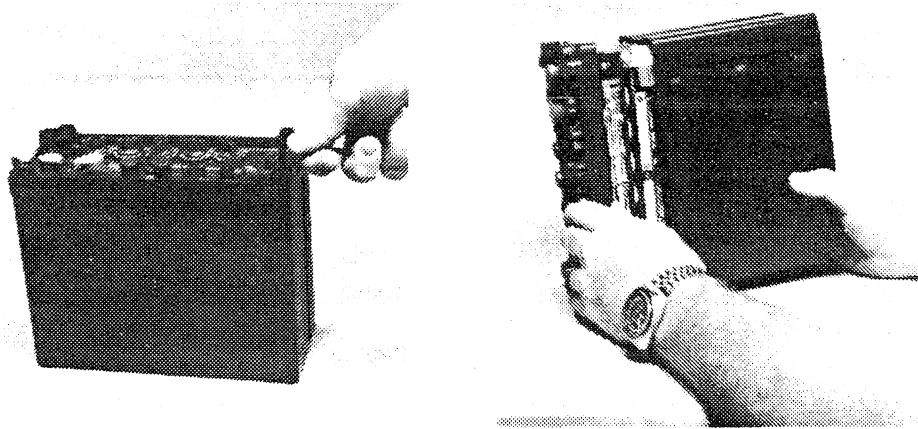


Fig. 3D.3.

Removal of Protective Cover

12 Dismantling

- 1 Remove the battery unit (see para 2).
- 2 Remove the antenna tuning unit (see para 6).
- 3 Loosen the four fixing screws on the front panel, by means of the 4mm Allen key.
- 4 Remove the transceiver from the case by pulling it out horizontally.
- 5 Withdraw and remove seal.

13 Remounting

- 1 Clean the seal by means of a dry, clean cloth.
- 2 Grease the seal with Silicone grease.
- 3 Put the seal into its initial position and remove excess grease with a dry, clean cloth.
- 4 Introduce the transceiver into its protective case.
- 5 Check that transceiver is in its initial position.
- 6 Tighten the four fixing screws by means of the Allen key.
- 7 Remount the antenna tuning unit (see para 6).
- 8 Remount the battery unit (see para 2).
- 9 Dry out the Manpack assembly (see para 105).

STANDARD EXCHANGE OF THE 20 WATT AMPLIFIER

14 This chart describes the standard exchange of the 20 watt amplifier.

Documents	Test Equipment	Tools
Para 2	Not applicable	One 4 mm Allen key for hexagon head socket screws
Para 6		Dry cloth
Spares		
20 W amplifier		

PROCEDURE

15 Preliminary Steps – Safety Requirements

Set the .O, L, H selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna unit.

Put the Manpack transceiver on a flat, clean surface, with front panel facing the operator.



Fig. 3D.4,

**Standard Exchange of the
20 Watt Amplifier**

16 Dismantling

- 1 Remove the battery unit (see para 2).
- 2 Remove the antenna tuning unit (see para 6).
- 3 Loosen the four fixing screws of the 20 W amplifier by means of the 4 mm Allen key.
- 4 Withdraw the 20 W amplifier from the transceiver unit.

17 Remounting

- 1 Remove the seal.
- 2 Clean the seal by means of a dry and clean cloth.
- 3 Grease the seal with Silicone grease.
- 4 Put the seal into its initial position and remove excess grease with a dry, clean cloth.
- 5 Put the 20 W amplifier into its initial position.
- 6 Tighten the four fixing screws of the 20 W amplifier by means of the 4 mm Allen key.
- 7 Remount the antenna tuning unit (see para 6).
- 8 Remount the battery unit (see para 2).
- 9 Dry out the Manpack assembly (see para 105).

STANDARD EXCHANGE OF THE HF HEAD

- 18 The following chart describes the procedure for the standard exchange of the HF Head.

Documents	Test equipment	Tools
Para 2 Para 6 Para 10	Not applicable	One 4 mm Allen key for hexagon socket head screws One 5 mm screwdriver
Spares One HF Head		Silicone grease S 14 Dry cloth

PROCEDURE**19 Preliminary Steps – Safety Requirements**

Set the .O, L, H selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna unit.

Put the Manpack transceiver on a flat, clean surface, with front panel facing the operator.

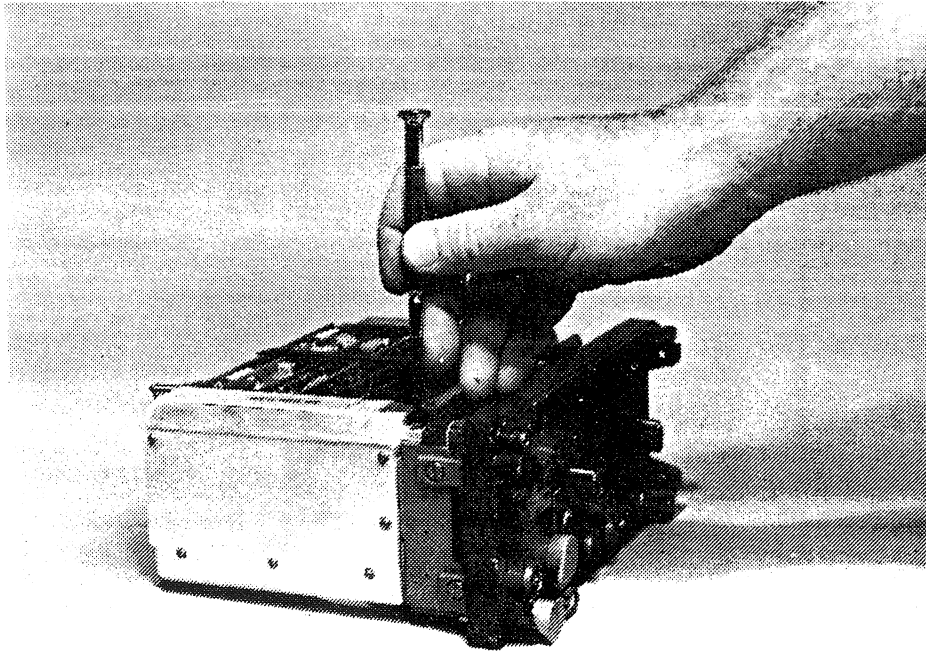


Fig. 3D.5. **Standard Exchange of the HF Head**

20 Dismantling

- 1 Remove the battery unit (see para 2).
- 2 Remove the antenna tuning unit (see para 6).
- 3 Remove the transceiver protective housing (see para 10).
- 4 Loosen both HF head fixing screws by means of the 5 mm screwdriver.
- 5 Withdraw and remove the 2 fixing screws and washers.
- 6 Withdraw and remove the HF head.

21 Remounting

- 1 Put the HF head in its initial position.
- 2 Put both HF head fixing screws and washers in their initial position.
- 3 Tighten both fixing screws by means of the 5 mm screwdriver.
- 4 Remount the transceiver protective housing (see para 10).
- 5 Remount the antenna tuning unit (see para 6).
- 6 Remount the battery unit (see para 2).
- 7 Dry out the Manpack assembly (see para 105).

STANDARD EXCHANGE OF THE CONVERTOR UNIT

- 22 The following chart gives the procedure to be followed for the standard exchange of the convertor unit.

Documents	Test equipment	Tools
Para 2 Para 6 Para 10	Not applicable	One 4 mm Allen key for hexagon socket head screws One 5 mm screwdriver
Spares		Silicone grease S14
One convertor unit		Dry cloth

PROCEDURE

23 Preliminary Steps – Safety Requirements

Set the .O, L, H selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna unit.

Put the Manpack transceiver on a flat, clean surface, with front panel facing the operator.

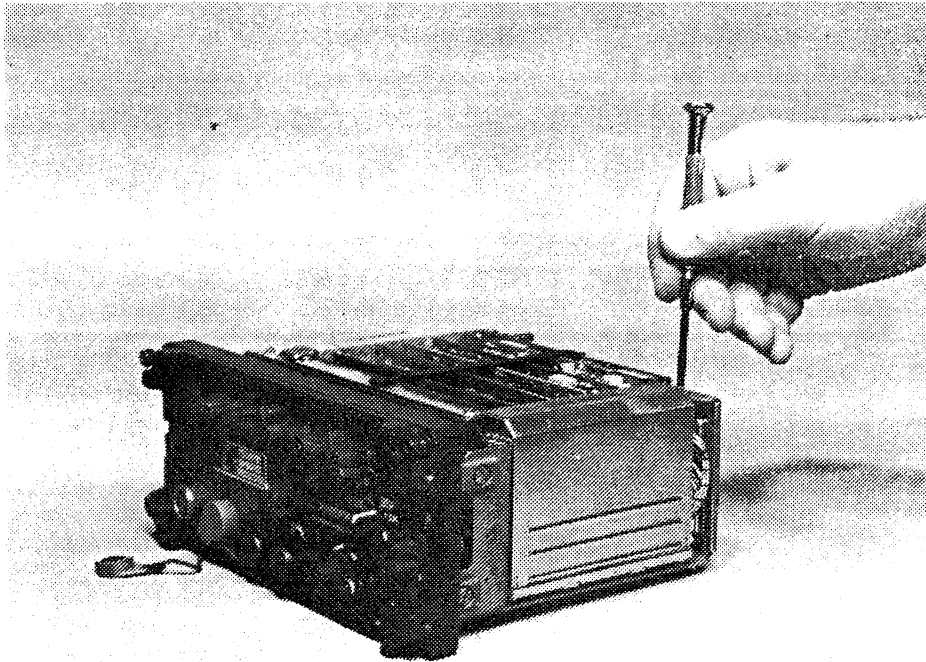


Fig. 3D.6.

Standard Exchange of the Converter

24 Dismantling

- 1 Remove the battery unit (see para 2).
- 2 Remove the antenna tuning unit (see para 6).
- 3 Remove the transceiver protective housing (see para 10).
- 4 Loosen the convertor unit fixing screws by means of the 5 mm screwdriver.
- 5 Withdraw and remove the fixing screws and washers while noting their initial location.
- 6 Withdraw and remove the convertor unit.

25 Remounting

- 1 Put the convertor unit in its initial position.
- 2 Put both fixing screws and washers in their initial position.
- 3 Tighten both fixing screws by means of the 5 mm screwdriver.
- 4 Remount the transceiver protective housing (see para 10.)
- 5 Remount the antenna tuning unit (see para 6).
- 6 Remount the battery unit (see para 2).
- 7 Dry out the Manpack assembly (see para 105).

STANDARD EXCHANGE OF THE FREQUENCY SELECTOR PC BOARD ASSEMBLY

- 26 The following chart describes the procedure for the standard exchange of the setting selector PC board assembly.

Documents	Test equipment	Tools
Para 2 Para 6	Not applicable	One 4 mm Allen key for hexagon socket head screws.
Para 10		One 5 mm screwdriver.
Spares		One PC board assembly extractor with 126 mm center-to-center spacing.
One setting selector		Silicone grease S14.
PC board assembly		Dry cloth

PROCEDURE**27 Preliminary Steps – Safety Requirements**

Set the .O, L, H selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna unit.

Put the Manpack transceiver on a flat, clean surface, with front panel facing the operator.

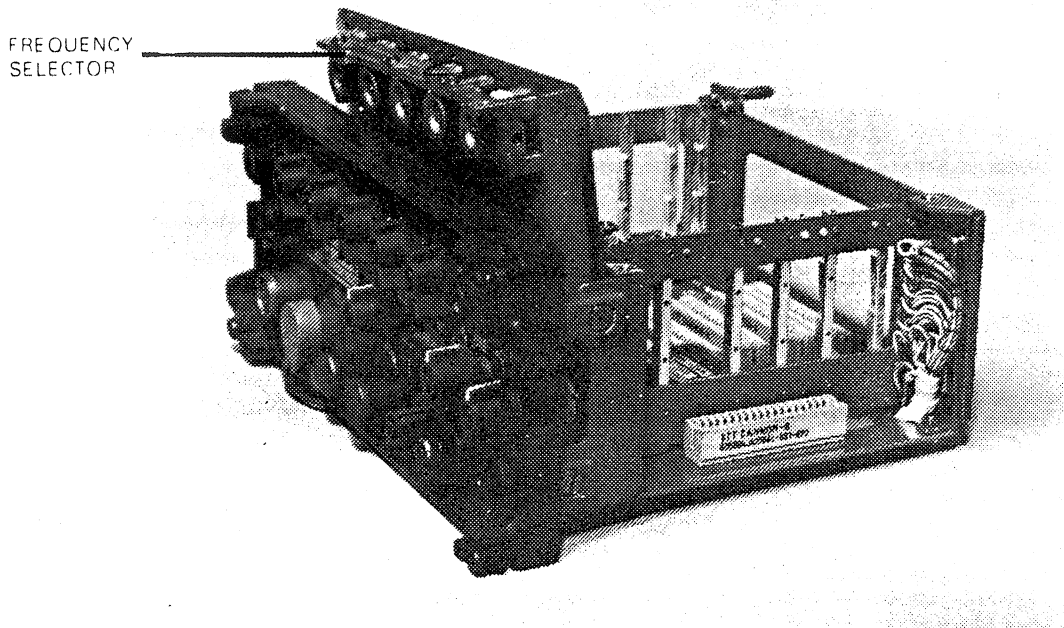


Fig. 3D.7.

Standard Exchange of the Frequency Selector PCB Assembly

28 Dismantling

- 1 Remove the battery unit (see para 2).
- 2 Remove the antenna tuning unit (see para 6).
- 3 Remove the transceiver protective housing (see para 10).
- 4 On the transceiver front panel set the '10 MHz', '1 MHz', '100 MHz', '10 kHz' selectors to 'O'.
- 5 Loosen the PC board assembly fixing screws by means of the 5 mm screwdriver. Withdraw and remove both fixing screws and washers.
- 6 Put the PC board assembly extractor in place.
- 7 Withdraw and remove the setting selector PC assembly from the transceiver.

29 Remounting

- 1 Check that the selector of the setting selector PC board assembly and those of the transceiver unit are in their initial position (slot on PC board switches downward).
- 2 Put the setting selector PC board assembly into its initial position.
- 3 Put both PC board assembly fixing screws and washers in their initial position.
- 4 Tighten both fixing screws by means of the 5 mm screwdriver.
- 5 Remount the transceiver protective housing (see para 10).
- 6 Remount the antenna tuning unit (see para 6).
- 7 Remount the battery unit (see para 2).
- 8 Dry out the Manpack assembly (see para 105).

STANDARD EXCHANGE OF A PRINTED CIRCUIT BOARD ASSEMBLY

30 The following chart deals with the procedure for the standard exchange of the following PC board assemblies.

Peripheral Circuits

Filter and 2.5 MHz IF Circuit

Exciter

AF

Synthesiser No. 3

Synthesiser No. 2.

Documents	Test equipment	Tools
Para 2 Para 6 Para 10	Not applicable	One Allen key for 4 mm hexagon socket head screws. One 3 mm screwdriver.
Spares		One PC board assembly extractor, center-to-center spacing 126 mm.
PC board assembly of same part number		Silicone grease S14 Dry cloth

PROCEDURE

Preliminary Steps – Safety Requirements

31 Set the 'O, L, H' selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna tuning unit.

Put the Manpack system on a flat and clean surface, with the front panel facing the operator.

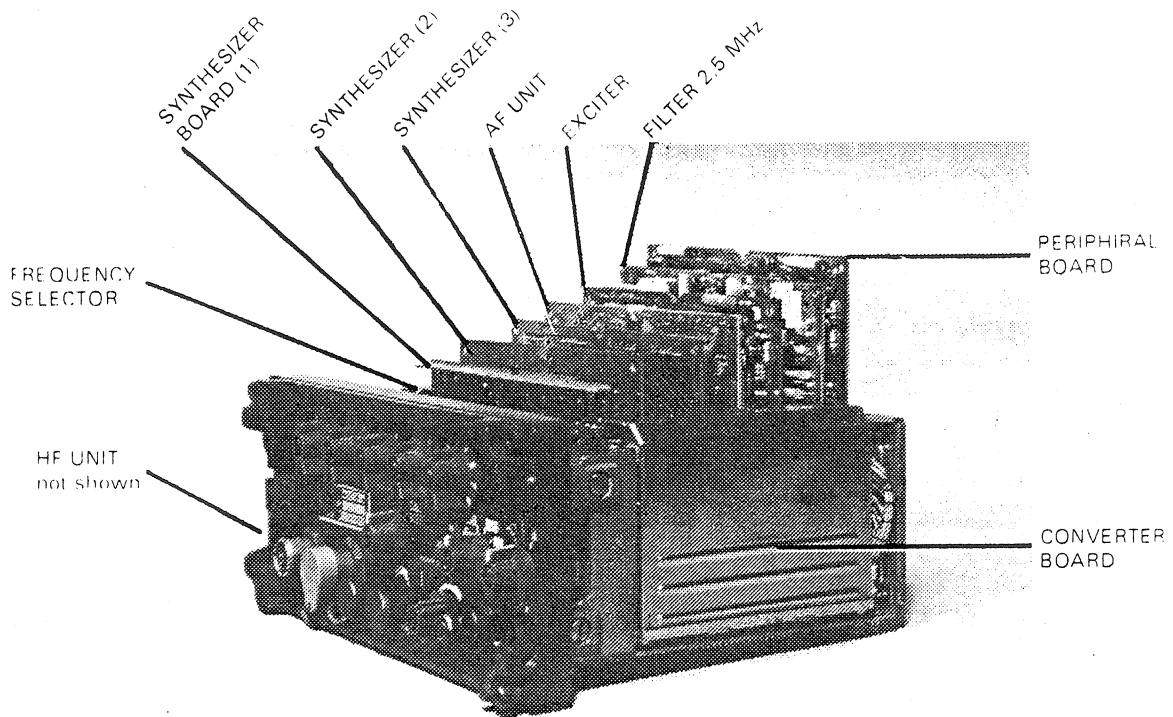


Fig. 3D.8.

Standard Exchange of PC Boards**32 Dismantling**

- 1 Remove the battery unit (see para 2).
- 2 Remove the antenna tuning unit (see para 6).
- 3 Remove the transceiver protective housing (see para 10).
- 4 Remove the screw securing the holding strip by means of the 3 mm screwdriver.
- 5 Withdraw and remove the holding strip.
- 6 Put the PC board assembly extractor into place.
- 7 Withdraw and remove the PC board assembly.

33 Remounting

- 1 Put the selected PC board assembly into its initial position.
- 2 Put the holding strip into its initial position.
- 3 Tighten the holding strip securing screw by means of the 3 mm screwdriver.
- 4 Remount the transceiver unit protective housing (see para 10).
- 5 Remount the antenna tuning unit (see para 6).
- 6 Remount the battery unit (see para 2).
- 7 Dry out the Manpack system (see para 105).

STANDARD EXCHANGE OF THE SYNTHESISER PRINTED CIRCUIT BOARD ASSEMBLY

NO 1

34 The following chart describes the procedure for the standard exchange of the synthesiser No. 1 board.

Documents	Test equipment	Tools
Para 2 Para 6 Para 10	Not applicable	One Allen key for 4mm hexagon socket head screw. One 3 mm screwdriver.
Spares		One PC board assembly extractor, centre-to-centre spacing 126 mm.
PC board assembly of same part No.		Silicone grease S14. Dry cloth

PROCEDURE

35 Preliminary Steps – Safety Requirements

Set the 'O, L, H' selector on the transceiver front panel to 'O'.

Disconnect the antenna in use from the antenna tuning unit.

Put the Manpack transceiver on a flat, clean surface, with front panel facing the operator.

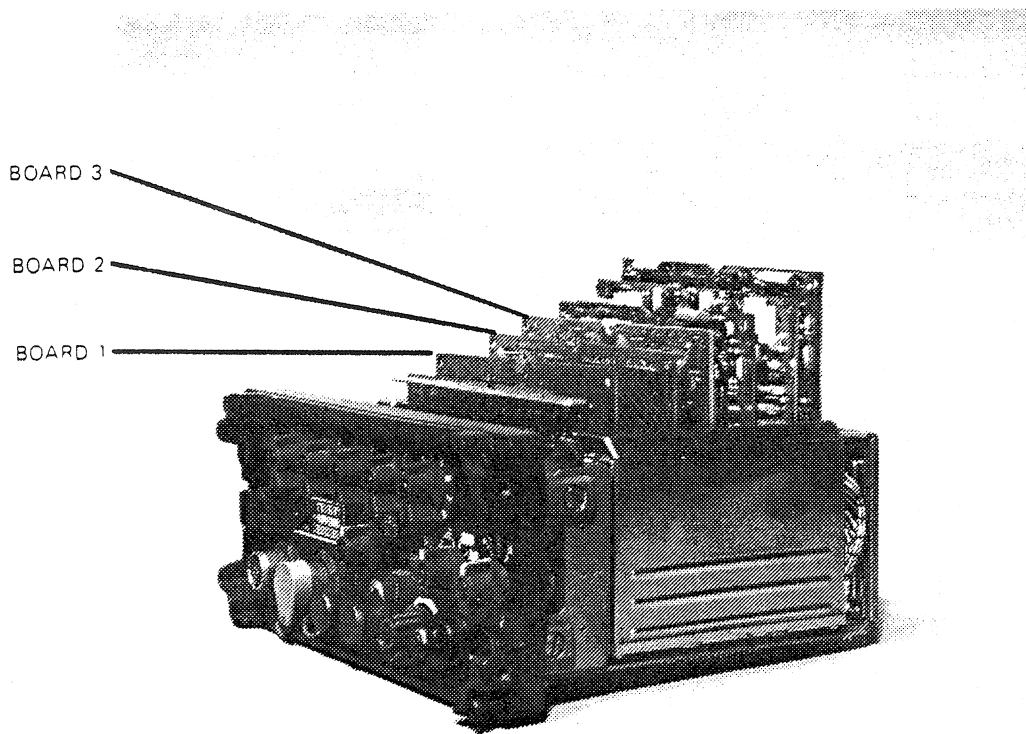


Fig. 3D.9.

Standard Exchange of the Synthesiser

36 Dismantling

- 1 Remove the battery unit (see para 2).
- 2 Remove the antenna tuning unit (see para 6).
- 3 Remove the transceiver protective housing (see para 10).
- 4 Remove the screw securing the holding strip by means of a 3 mm screwdriver.
- 5 Withdraw and remove the holding strip.
- 6 Remove the 3 screws and washers securing the PC board assembly by means of the 3 mm screwdriver.
- 7 Put the PC board assembly extractor into place.
- 8 Withdraw and remove the PC board assembly.

37 Remounting

- 1 Put the PC board assembly into its initial position.
- 2 Put in and tighten the 3 screws and washers securing the PC board assembly.
- 3 Put the holding strip into its initial position.
- 4 Tighten the holding strip fixing screw by means of the 3 mm screwdriver.
- 5 Remount the transceiver protective housing (see para 10).
- 6 Remount the antenna tuning unit (see para 6).
- 7 Remount the battery unit (see para 2).
- 8 Dry out the Manpack system (see para 105).

STANDARD EXCHANGE OF THE CONVERTOR PC BOARD ASSEMBLY

- 38 The following chart deals with the standard exchange of the convertor PC board assembly.

Documents	Test equipment	Tools
Para 22	Not applicable	See preferred tools in Para 22.
Spares		One 3 mm screwdriver
PC board assembly of same part number		One convertor extractor

PROCEDURE**Preliminary Steps – Safety Requirements**

Remove the convertor unit as recommended in Para 22.

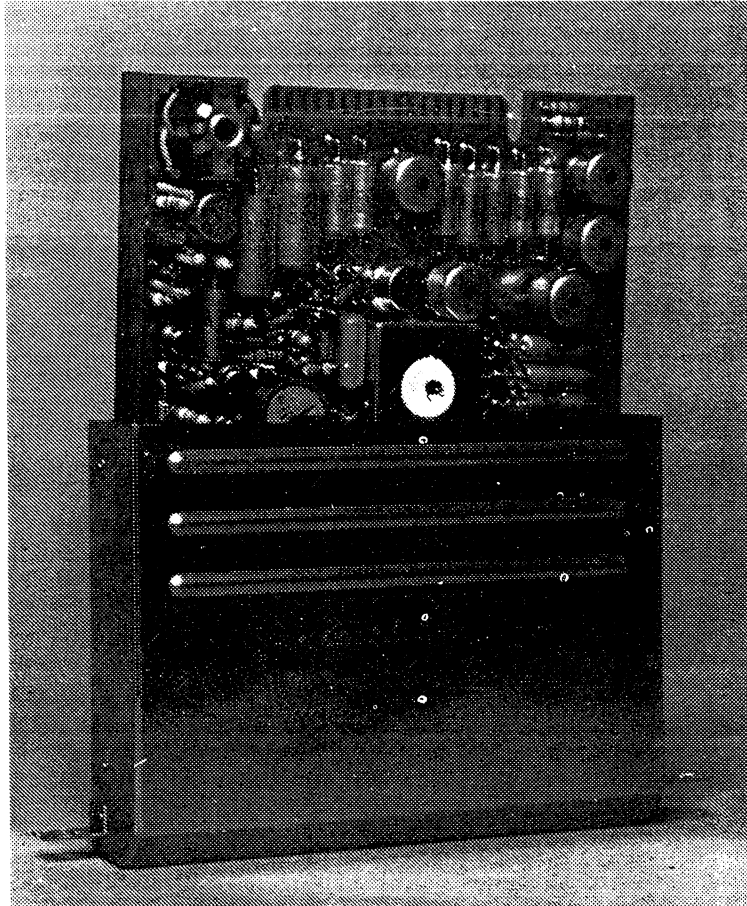


Fig. 3D.10.

Standard Exchange of Converter PCB**39 Dismantling**

- 1 Loosen and remove the 4 fixing screws of the protective cover by means of a 3 mm screwdriver.
- 2 Withdraw and remove the protective cover.
- 3 Put the convertor extractor into place.
- 4 Withdraw and remove PC board assembly.

40 Remounting

- 1 Put the PC board assembly in its initial position.
- 2 Put the protective cover in its initial position.
- 3 Tighten the 4 fixing screws of the protective cover by means of the 3 mm screwdriver.
- 4 Remount the convertor unit as recommended in Para 22.

STANDARD EXCHANGE OF THE VOLTAGE – CONTROLLED OSCILLATOR

PC BOARD ASSEMBLY IN THE HF HEAD

- 41 The following chart describes the procedure for the standard exchange of the VCO PC board from the HF head.

Documents	Test equipment	Tools
Para 18	Not applicable	See the preferred tools in section para 18. One 2 mm screwdriver
Spares		One pair of tweezers
One PC board assembly of same part number		One 30 W soldering iron Solder

PROCEDURE

- 42 Preliminary Steps – Safety Requirements

Remove the HF head as recommended in Para 18.

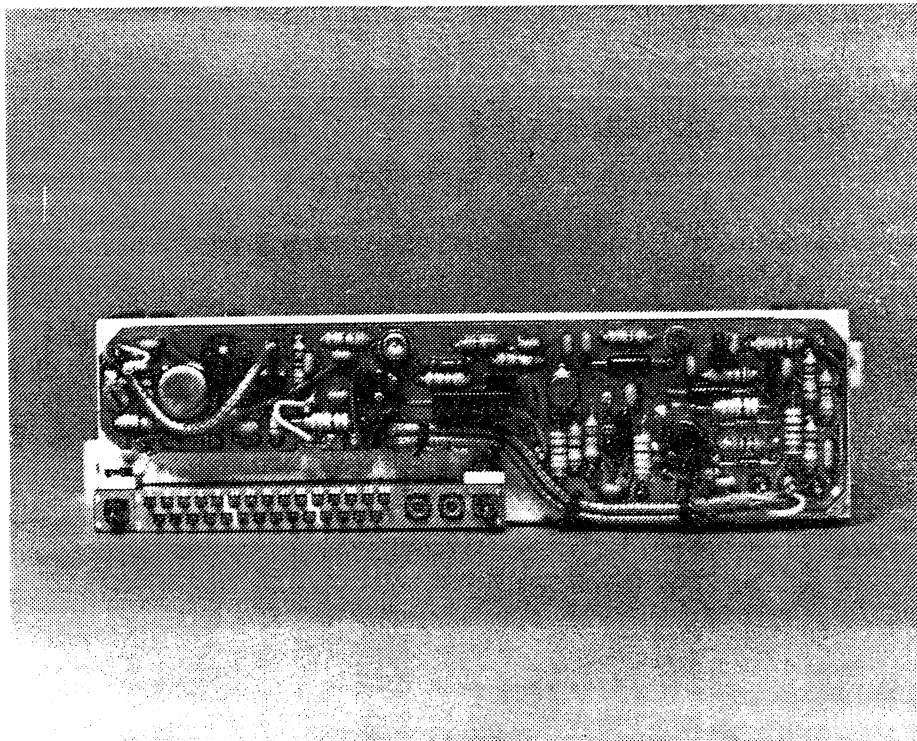


Fig. 3D.11.

Standard Exchange of V.C.O. PCB

43 Dismantling

- 1 Loosen the 5 fixing screws of the VCO protective cover by means of the 2 mm screwdriver.
- 2 Withdraw and remove the 5 fixing screws and washers.
- 3 Withdraw and remove the VCO protective cover.
- 4 Loosen the 3 fixing screws of the PC board assembly by means of the 2 mm screwdriver.
- 5 Withdraw and remove the three fixing screws and washers.
- 6 Remove the PC board assembly from its initial position.
- 7 Spot the connection going to the PC board assembly.
- 8 Unsolder connections of the PC board assembly.
- 9 Withdraw and remove PC board assembly.

44 Remounting

- 1 Solder the connection to the PC board assembly in the places previously spotted.
- 2 Put the PC board assembly in its initial position.
- 3 Fit the 3 fixing screws of the PC board assembly by means of the 2 mm screwdriver.
- 4 Tighten the 3 fixing screws of the PC board assembly by means of the 2 mm screwdriver.
- 5 Put the protective cover in its initial position.
- 6 Put the 5 fixing screws and washers of the VCO protective cover in their initial position.
- 7 Tighten the 5 fixing screws of the VCO protective cover by means of the 2 mm screwdriver.
- 8 Remount the HF head as recommended in Para 18.

**STANDARD EXCHANGE OF THE INPUT PROTECTION CIRCUITS PC BOARD ASSEMBLY
IN THE HF HEAD**

- 45 The following chart describes the procedure for the standard exchange of the input protection circuit PC board of the HF head.

Documents	Test equipment	Tools
Para 18	Not applicable	See preferred tools in para 18
One 2 mm screwdriver		One 3 mm screwdriver
Spares		One open-ended spanner (4 mm)
One PC board assembly of same part number		One pair of tweezers One 30 W soldering iron Solder

PROCEDURE

- 46 **Preliminary Steps – Safety Requirements**

Remove the HF head as recommended in Para 18.

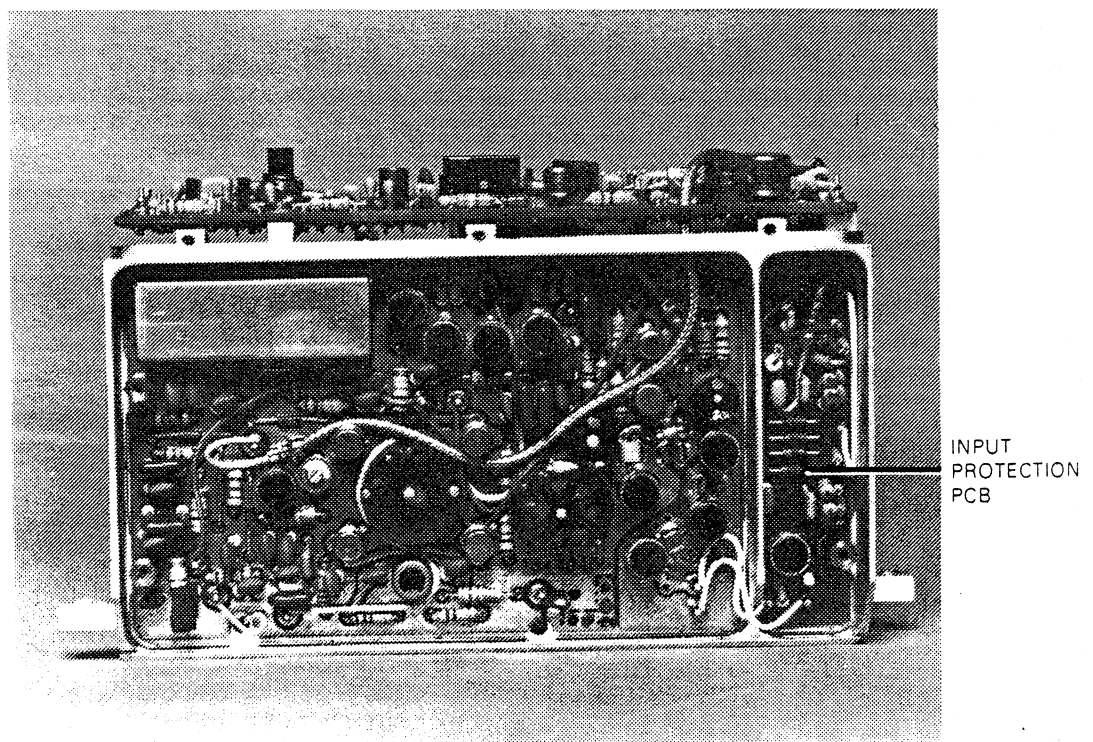


Fig. 3D.12.

**Standard Exchange of the
Input Protection PCB**

47 Dismantling

- 1 Loosen the 6 fixing screws of the protective cover by means of the 2 mm screwdriver.
- 2 Withdraw and remove the protective cover.
- 3 Withdraw and remove the protective cover.
- 4 Spot the connections of the PC board assembly.
- 5 Unsolder the connections.
- 6 Loosen the fixing screw of the PC board assembly by means of the 3 mm screwdriver.
- 7 Withdraw and remove the fixing screw and washer.
- 8 Unscrew the fixing stud by means of the 4 mm open-ended spanner.
- 9 Withdraw and remove the stud and washer.
- 10 Note the initial location of the PC board assembly.
- 11 Withdraw and remove the PC board assembly.

48 Remounting

- 1 Put the PC board assembly in its initial position.
- 2 Put the stud and washer in their initial position.
- 3 Tighten the fixing stud by means of the 4 mm open-ended spanner.
- 4 Put the fixing screw and washer in their initial position.
- 5 Tighten the fixing screw by means of the 3 mm screwdriver.
- 6 Solder the connections to the PC board assembly in the previously spotted position.
- 7 Put the protective cover in its initial position.
- 8 Put the 6 fixing screws and washers of the protective cover in their initial position.
- 9 Tighten the 6 fixing screws of the protective cover by means of the 2 mm screwdriver.
- 10 Remount the HF head as recommended in Para 18.

STANDARD EXCHANGE OF THE TRANSMIT/RECEIVE BOARD ASSEMBLY
IN THE HF HEAD

49 The chart below describes the procedure to be followed for the standard exchange of the transmit receive PC board on the HF unit.

Documents	Test equipment	Tools
Para 18	Not applicable	See preferred tools in Para 18 One 2 mm screwdriver One 4 mm open-ended spanner
Spares		One pair of tweezers
One PC board assembly of same part number		One 30 W soldering iron Solder

PROCEDURE

50 Preliminary Steps – Safety Requirements

Remove the HF head as recommended in Para 18.

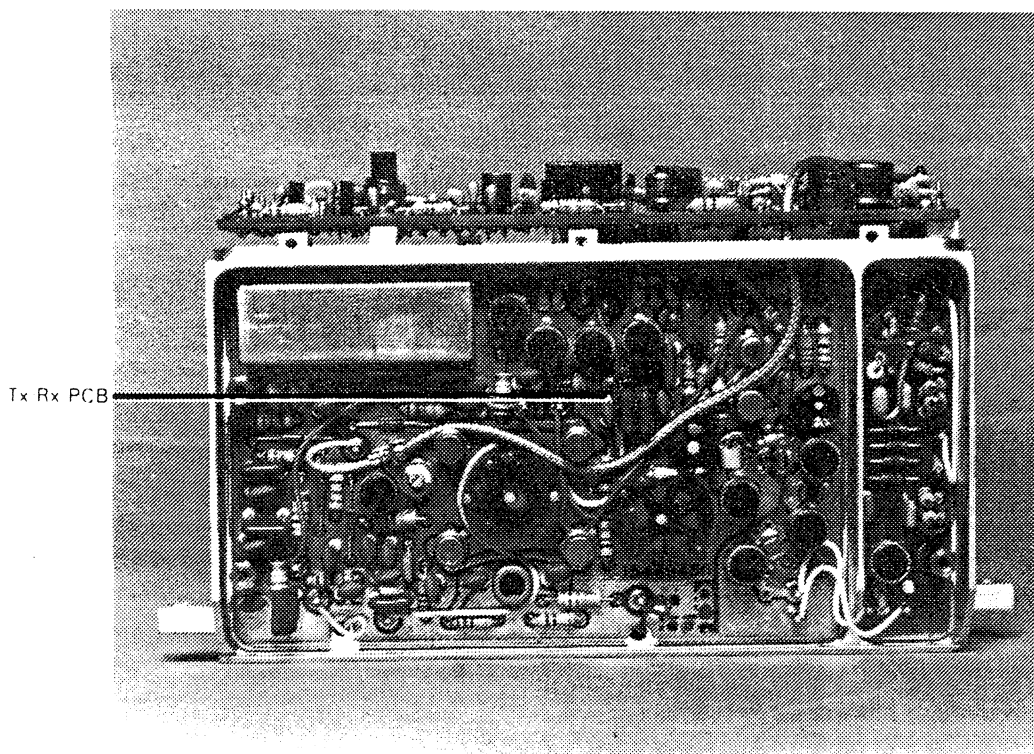


Fig. 3D.13,

Standard Exchange of the Tx Rx PCB

51 Dismantling

- 1 Loosen the 6 fixing screws of the protective cover by means of the 2 mm screwdriver.
- 2 Withdraw and remove the 6 fixing screws and washers.
- 3 Withdraw and remove the protective cover.
- 4 Spot the connections of the PC board assembly.
- 5 Unsolder the connections.
- 6 Loosen the 2 fixing screws of the PC board assembly by means of the 2 mm screwdriver.
- 7 Withdraw and remove the 2 fixing screws and washers.
- 8 Unscrew the 2 fixing studs by means of the 4 mm open-ended spanner.
- 9 Withdraw and remove the 2 studs and washers.
- 10 Note the initial position of the PC board assembly.
- 11 Withdraw and remove the PC board assembly.

52 Remounting

- 1 Put the PC board assembly in its initial position.
- 2 Put the 2 fixing studs and washers in their initial position.
- 3 Tighten the 2 fixing studs by means of the 4 mm open-ended spanner.
- 4 Put the 2 fixing screws and washers in their initial position.
- 5 Tighten the 2 fixing screws by means of the 2 mm screwdriver.
- 6 Solder the connections to the PC board assembly in their previously spotted position.
- 7 Put the protective cover in its initial position.
- 8 Put the 6 fixing screws and washers of the protective cover in their initial position.
- 9 Tighten the 6 fixing screws of the protective cover by means of the 2 mm screwdriver.
- 10 Remount the HF head as recommended in Para 18.

**STANDARD EXCHANGE OF THE MIXER CIRCUIT IN THE TRANSMIT/RECEIVE
PC BOARD OF THE HF HEAD**

53 The following chart describes the procedure for the exchange of the mixer on the transmit/receive PCB from the HF head.

Documents	Test equipment	Tools
Para 18 Para 49	Not applicable	See preferred tools in Para 18 and 49
Spares		
One mixer of same part number		

PROCEDURE

54 Preliminary Steps – Safety Requirements

Remove the transmit/receive PC board assembly as recommended in Para 49 of this section.

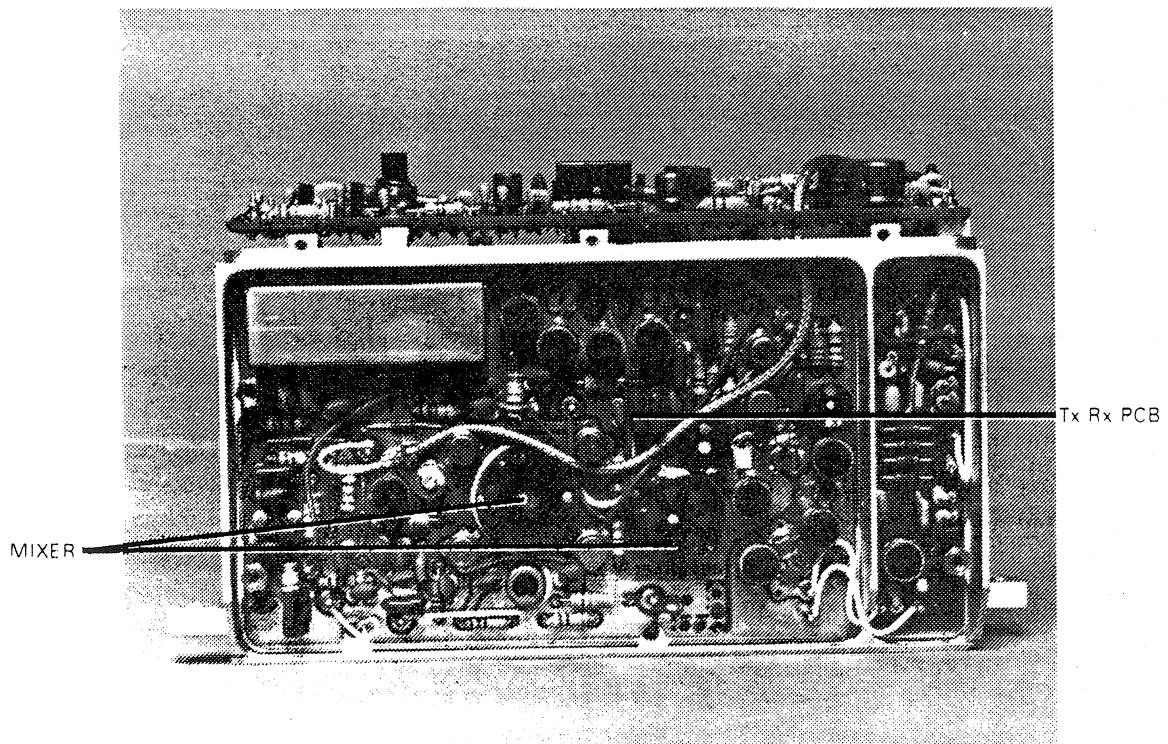


Fig. 3D.14.

**Standard Exchange of the Mixer
on the Tx Rx PCB**

55 Dismantling

- 1 Remove the solder from the fixing lugs of the mixer protective cover.
- 2 Withdraw and remove the protective cover of the mixer.
- 3 Note carefully the position of the 'mixer' printed circuit.
- 4 Remove the solder from the lugs connecting the mixer with the transmit/receive printed board assembly circuits.
- 5 Withdraw and remove the 'mixer' printed circuit.

56 Remounting

- 1 Put the 'mixer' printed circuit in its initial position.
- 2 Solder the 'mixer' connecting lugs onto the transmit/receive printed board assembly circuits.
- 3 Put the mixer protective cover in its initial position.
- 4 Solder the fixing lugs of the mixer protective cover.
- 5 Remount the transmit/receive PC board assembly as recommended in Para 49 of this section.

STANDARD EXCHANGE OF THE IF 102,5 AND 2,5 MHz PC BOARD ASSEMBLY**IN THE HF HEAD**

- 57 The following chart describes the exchange of the filter IF 102.5 and 2.5 MHz board assembly from the HF head.

Documents	Test equipment	Tools
Para 18	Not applicable	See preferred tools in Para 18 One 2 mm screwdriver One 4 mm open-ended spanner One pair of tweezers
Spares		One 30 W soldering iron
One PC board assembly of same part number		Solder

PROCEDURE**58 Preliminary Steps – Safety Requirements**

Remove the HF head as recommended in Para 18.

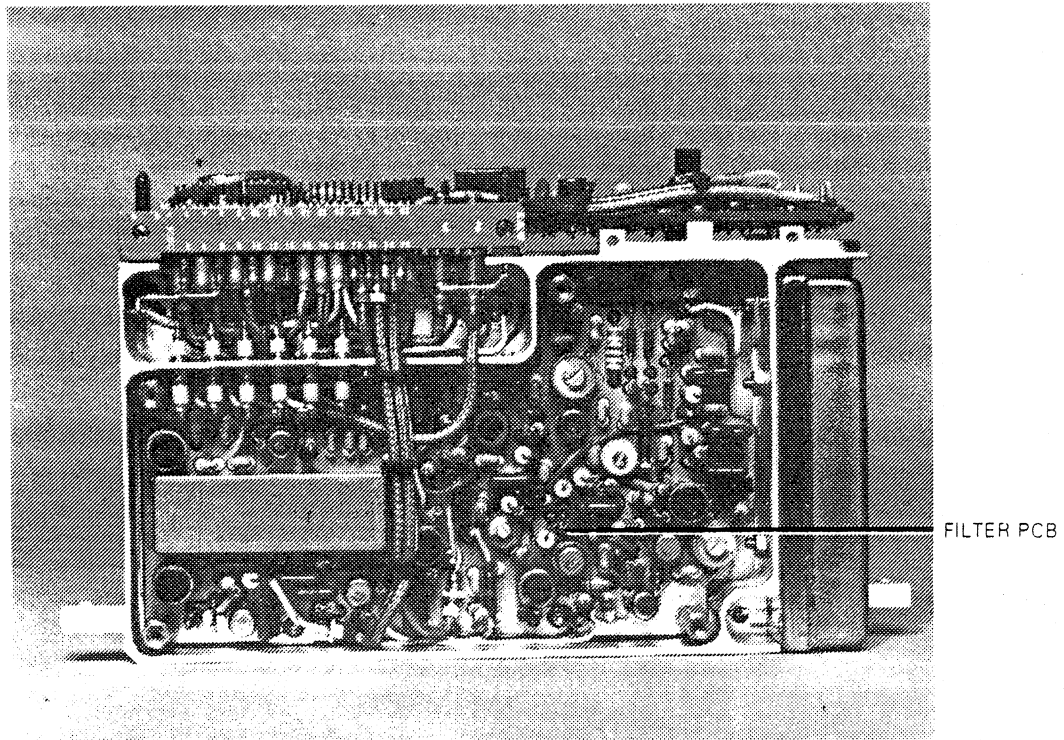


Fig. 3D.15.

Standard Exchange of the Filter IF 102,5 & 2,5 MHz PCB

59 Dismantling

- 1 Loosen the 4 fixing screws of the filter IF 102.5 and 2.5 MHz protective cover.
- 2 Withdraw and remove the 4 fixing screws and washers of the Filter IF 102.5 and 2.5 MHz protective cover.
- 3 Withdraw and remove the protective cover.
- 4 Spot the connections of the PC board assembly.
- 5 Unsolder the connections.
- 6 Unscrew the 4 fixing spacers by means of the 4 mm open-ended spanner.
- 7 Withdraw and remove the 4 spacers and washers.
- 8 Note the initial position of the PC board assembly.
- 9 Remove the PC board assembly by lifting it by the side opposite the HF head connector.
- 10 Remove the PC board assembly.

60 Remounting

- 1 Put the PC board assembly in its initial position.
- 2 Put the 4 spacers and washers into place.
- 3 Tighten the 4 spacers by means of the 4 mm open-ended spanner.
- 4 Solder the connections to the PC board assembly in the previously spotted positions.
- 5 Put the filter IF 102.5 and 2.5 MHz protective cover in its initial position.
- 6 Put the 4 fixing screws and washers of the protective cover in their initial position.
- 7 Tighten the 4 fixing screws of the protective cover by means of the 2 mm screw-driver.
- 8 Remount the HF head as recommended in Para 18.

**STANDARD EXCHANGE OF THE MIXER CIRCUIT IN THE IF 102,5 AND 2,5 MHz
PC BOARD ASSEMBLY IN THE HF HEAD**

- 61 The following chart describes the procedure for the standard exchange of the filter IF 102.5 and 2.5 MHz PC board mixer from the HF unit.

Documents	Test equipment	Tools
Para 18 Para 57	Not applicable	See preferred tools in Para 18 and 57
Spares		
One mixer of same part number		

PROCEDURE**62 Preliminary Steps – Safety Requirements**

Remove the filter IF 102.5 and 2.5 MHz PC board assembly as recommended in Para 57 of this section.

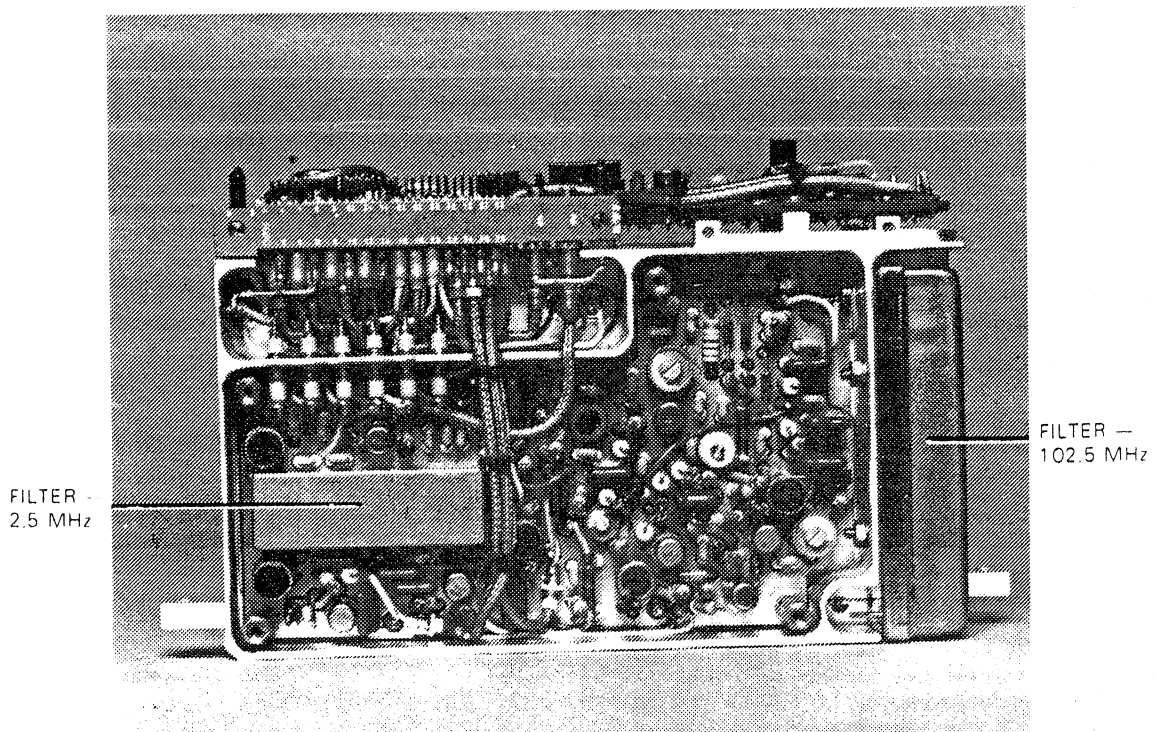


Fig. 3D.16. **Standard Exchange of the Filter on the Filters IF 102,5 & 2,5 MHz PCB**

63 Dismantling

- 1 Remove solder from the fixing lugs of the mixer protective cover.
- 2 Withdraw and remove the protective cover of the mixer.
- 3 Note carefully the position of the 'mixer' printed circuit.
- 4 Remove solder from the lugs connecting the 'mixer' with the filter IF 102.5 and 2.5 MHz printed board assembly circuits.
- 5 Withdraw and remove the 'mixer' printed circuit.

64 Remounting

- 1 Put the 'mixer' printed circuit in its initial position.
- 2 Solder the 'mixer' connecting lugs onto the filter IF 102.5 and 2.5 MHz printed board assembly circuits.
- 3 Put the mixer protective cover in its initial position.
- 4 Solder the fixing lugs of the mixer protective cover.
- 5 Remount the IF 102.5 and 2.5 MHz PC board assembly as recommended in Para 57.

STANDARD EXCHANGE OF THE 102,5 MHz CRYSTAL FILTER IN THE HF HEAD

- 65 The following chart deals with the standard exchange of the 102,5 MHz crystal filters from the HF head.

Documents	Test equipment	Tools
Para 18	Not applicable	See preferred tools in Para 18 One 2 mm screwdriver One 4 mm open-ended spanner
Spares		One pair of tweezers
One 102.5 MHz crystal filter of same part number		One 30 W soldering iron Solder

PROCEDURE

- 66 Preliminary Steps – Safety Requirements

Remove the HF head as recommended in Para 18.

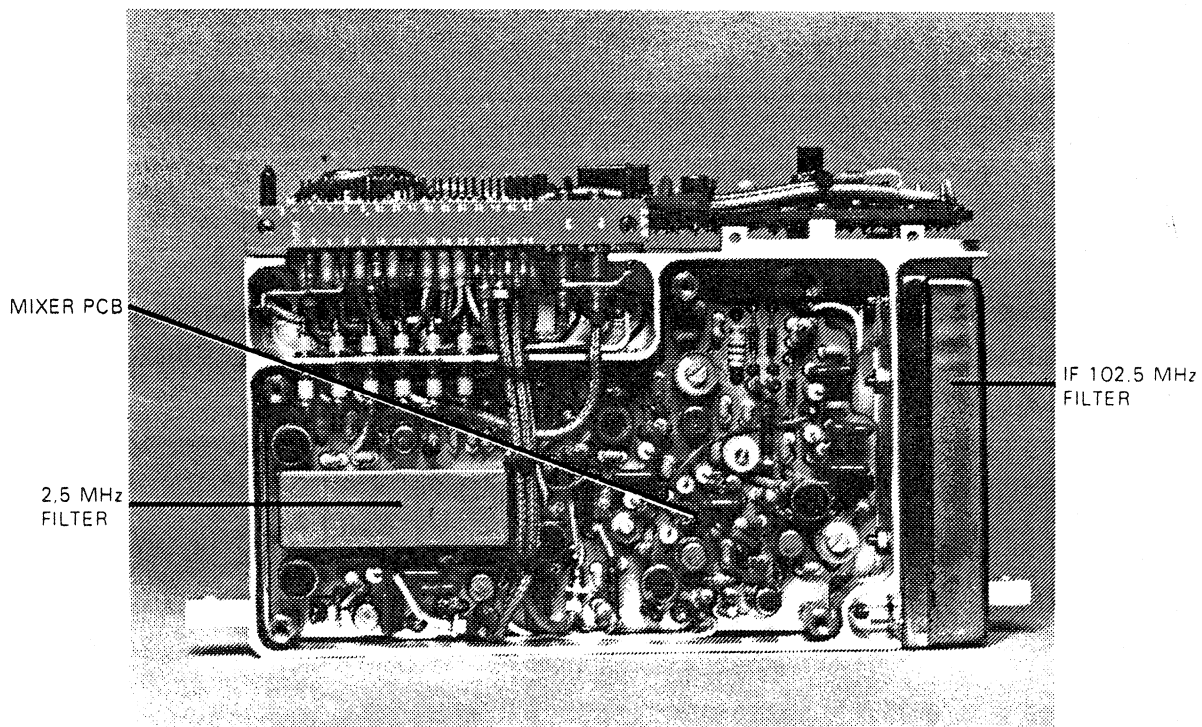


Fig. 3D.17.

Standard Exchange of the Mixer on the Filters IF 102,5 & 2,5 MHz PCB

67 Dismantling

- 1 Loosen the 4 fixing screws of the filter IF 102.5 - 2.5 MHz protective cover by means of the 2 mm screwdriver.
- 2 Withdraw and remove the 4 fixing screws and washers of the 102.5 - 2.5 MHz protective cover.
- 3 Withdraw and remove the protective cover.
- 4 Spot the connections coming from the PC board assembly filter IF 102.5 - 2.5 MHz and going to the 102.5 MHz crystal filter.
- 5 Unsolder both connections going to the 102.5 MHz crystal filter.
- 6 Loosen the 6 fixing screws of the transmit/receive protective cover by means of the 2 mm screwdriver.
- 7 Withdraw and remove the 6 fixing screws and washers.
- 8 Withdraw and remove the transmit/receive protective cover.
- 9 Spot the connections coming from the 102.5 MHz crystal filter and going to the transmit/receive PC board assembly.
- 10 Unsolder the connection from the transmit/receive PC board assembly.
- 11 Loosen both fixing nuts of the 102.5 MHz crystal filter by means of the 4 mm open-ended spanner.
- 12 Withdraw and remove both fixing nuts.
- 13 Withdraw and remove both lock washers.
- 14 Note the position of the 102.5 MHz crystal filter.
- 15 Withdraw the 102.5 MHz crystal filter carefully, taking care not to damage the connection of the crystal filter.
- 16 Put down the 102.5 MHz crystal filter.
- 17 Note the position of the connections going to the 102.5 MHz crystal filter.
- 18 Unsolder the 102.5 MHz crystal filter remaining connection.

68 Remounting

- 1 Solder the connection to the 102.5 MHz crystal filter.
- 2 Put the 102.5 MHz crystal filter back to its initial position.
Take great care not to damage the connection while putting it back into place.
- 3 Put both lock washers into place.
- 4 Tighten both fixing nuts by means of the 4 mm open-ended spanner.

- 68 Continued
- 5 Solder the connection coming from the crystal filter and going to the transmit/receive PC board assembly in the place previously spotted.
 - 6 Put the transmit/receive protective cover in its initial position.
 - 7 Put the 6 fixing screws and washers of the transmit/receive protective cover in their initial position.
 - 8 Tighten the 6 fixing screws of the transmit/receive protective cover by means of the 2 mm screwdriver.
 - 9 Solder both connections coming from the IF 102.5 - 2.5 MHz PC board assembly and going to the 102.5 - 2.5 MHz crystal filter.
 - 10 Put the IF 102.5 - 2.5 MHz protective cover in its initial position.
 - 11 Put the 4 fixing screws and washers of the IF 102.5 - 2.5 MHz in their initial position.
 - 12 Tighten the 4 fixing screws of the protective housing by means of the 2 mm screwdriver.
 - 13 Remount the HF head as recommended in Para 18.
 - 14 Note the position of the 102.5 MHz crystal filter carefully, taking care not to damage the connection of the crystal filter.

STANDARD EXCHANGE OF A SWITCH IN THE TRANSCEIVER FRONT PANEL

69 This chart describes the standard exchange of the front panel switches.

Documents	Test equipment	Tools
Para 10	Not applicable	See preferred tools in Para 10.
Para 26		See preferred tools in Para 26.
Spares		One 7 mm screwdriver One 12 mm tubular spanner
One switch of same part number		Silicone grease S14 One 30 W soldering iron Solder

NOTE: The front panel of the transceiver unit is fitted with the 3 following switches:

- 'O—O—H' or power selector switch
- 'MORSE — LSB — HSB — AM' or operating mode selector switch
- 'O—O—CALL/ROEP' or configuration selector switch.

The standard exchange procedure is the same for all these switches.

PROCEDURE**70 Preliminary Steps – Safety Requirements**

- 1 Dismount the protective cover of the transceiver unit as recommended in Para 10.
- 2 Dismount the setting selector PC board assembly as recommended in Para 26.

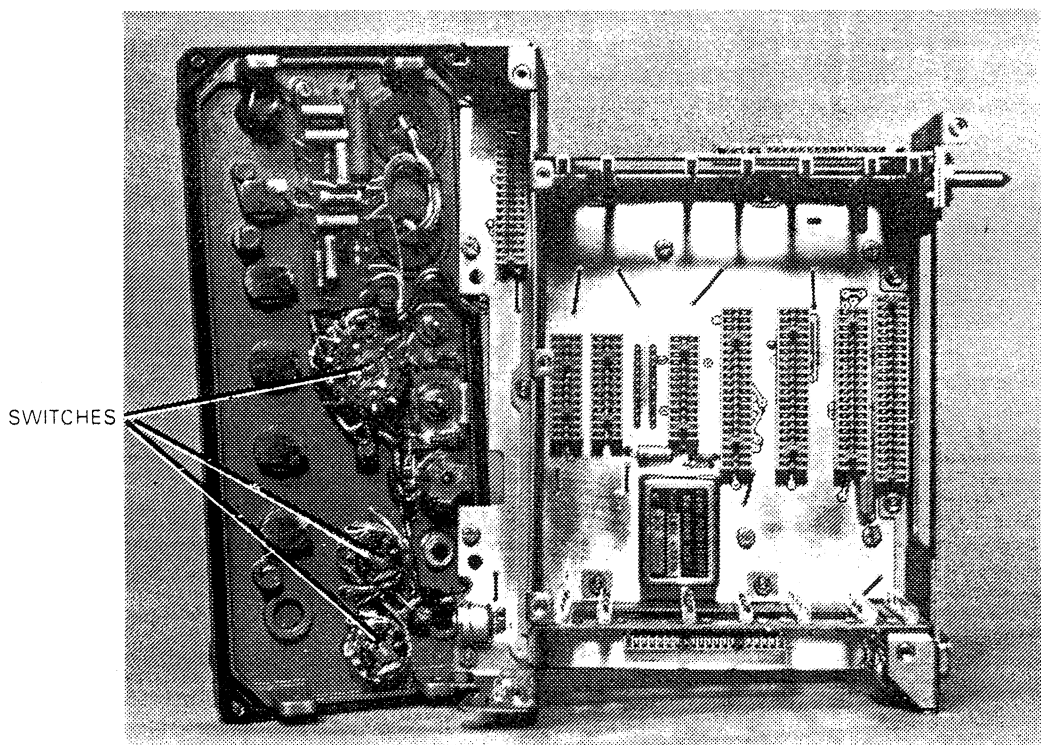


Fig. 3D.18.

**Standard Exchange of the
Front Panel Switches****71 Dismantling**

- 1 Note the exact position of the switch to be dismantled.
- 2 Loosen the centre fixing screw of the control knob by means of the 5 mm screwdriver.
- 3 Withdraw and remove the centre fixing screw and washer.
- 4 Withdraw and remove the control knob.
- 5 Loosen the 4 fixing screws of the front panel by means of the 7 mm screwdriver.
- 6 Withdraw and remove the 4 screws and washers.
- 7 Disengage the front panel of the transceiver unit, taking care not to damage the connectors (swing the front panel so that the lower edge acts as a hinge held by the wiring).

71 Continued

- 8 Spot the connections going to the switch.
- 9 Unsolder the connections.
- 10 Loosen the centre fixing nuts of the switch by means of the 12 mm tubular spanner.
- 11 Withdraw and remove the centre fixing nut.
- 12 Withdraw the switch by pulling it from the rear side of the front panel. Put it down.
- 13 Withdraw and remove the seal.

72 Remounting

- 1 Clean the seal with a dry cloth.
- 2 Grease the seal with silicone grease S14, wipe off the surplus grease with a dry cloth.
- 3 Put the seal into place.
- 4 Put the switch into the place previously noted.
- 5 Put the switch back to its initial position.
- 6 Fasten the switch by tightening the centre nut by means of the 12 mm tubular spanner.
- 7 Solder the connections to the switch in the places previously spotted.
- 8 Remount the front panel on the transceiver unit, taking care not to damage the connectors.
- 9 Put the 4 fixing screws and washers into their initial position.
- 10 Tighten the fixing screws of the front panel by means of the 7 mm screwdriver.
- 11 Put the control knob into its initial position.
- 12 Put the centre fixing screw and washer into their initial position.
- 13 Tighten the centre fixing screw by means of the 5 mm screwdriver.
- 14 Remount the setting selector PC board assembly as recommended in Para 26.
- 15 Remount the protective cover of the transceiver unit as recommended in Para 10.

STANDARD EXCHANGE OF THE VOLUME CONTROL POTENTIOMETER IN THE FRONT PANEL

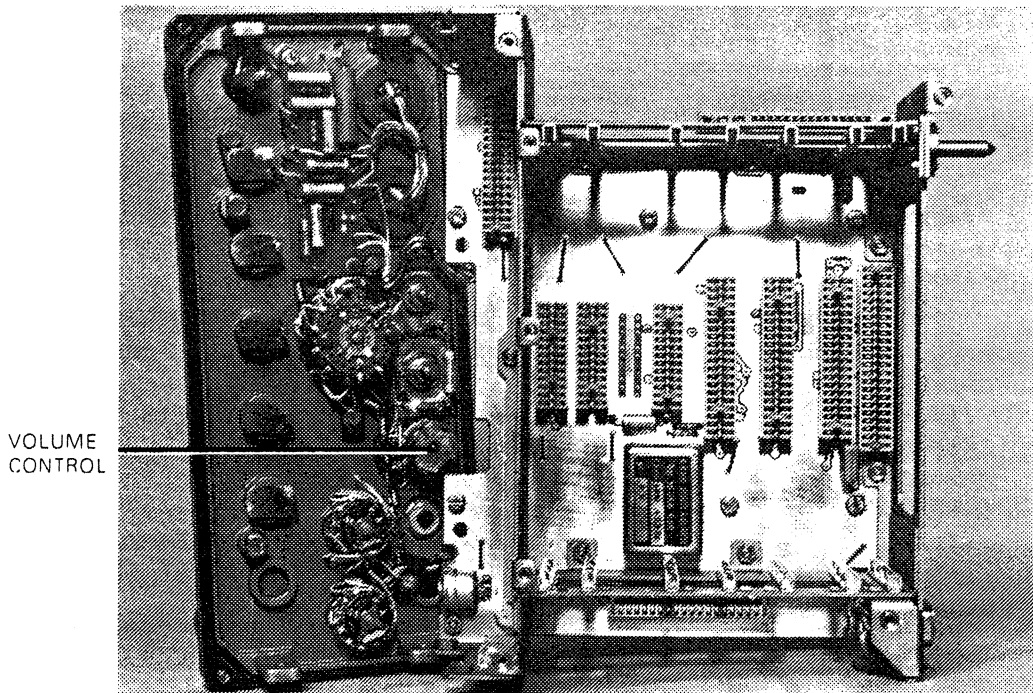
73 The following chart describes the procedure for the standard exchange of the volume control potentiometer.

Documents	Test equipment	Tools
Para 10	Not applicable	See preferred tools in Para 10.
Para 26		See preferred tools in Para 26.
Spares		One 7 mm screwdriver One 12 mm tubular spanner Silicone grease S14 One 30 W soldering iron Solder

PROCEDURE

74 Preliminary Steps – Safety Requirements

- 1 Dismount the transceiver protective cover as recommended in Para 10.
- 2 Dismount the setting selector PC board assembly as recommended in Para 26.



Standard Exchange of the Volume Control

Fig. 3D.19.

75 Dismantling

- 1 Turn the control knob of the volume control potentiometer fully anti-clockwise.
- 2 Note the position of the control knob.
- 3 Loosen the centre fixing screw of the control knob by means of the 5 mm screwdriver.
- 4 Withdraw and remove the centre fixing screw and washer.
- 5 Withdraw and remove the control knob.
- 6 Loosen the 4 fixing screws of the front panel by means of the 7 mm screwdriver.
- 7 Withdraw and remove the 4 fixing screws and washers.
- 8 Disengage the transceiver unit front panel, taking care not to damage the connectors.
- 9 Spot the connections going to the potentiometer.
- 10 Unsolder the connections.
- 11 Unscrew the centre fixing nut of the potentiometer by means of the 12 mm tubular spanner.
- 12 Withdraw and remove the centre fixing nut.
- 13 Withdraw the potentiometer by pulling it from the rear side of the front panel.
- 14 Withdraw and remove the seal.

76 Remounting

- 1 Clean the seal with a dry cloth.
- 2 Grease the seal with silicone grease S14, wipe off the excess grease with a dry cloth.
- 3 Put the seal back into place.
- 4 Turn the potentiometer axis anti-clockwise until it reaches stop position.
- 5 Put the potentiometer into its initial position.
- 6 Fasten the potentiometer by tightening the centre nut by means of the 12 mm tubular spanner.
- 7 Solder the connections to the potentiometer in the places previously spotted.
- 8 Remount the front panel onto the transceiver unit, taking care not to damage the connectors.
- 9 Put the 4 fixing screws and washers of the front panel into their initial position.
- 10 Tighten the 4 fixing screws of the front panel by means of the 7 mm screwdriver.
- 11 Put the control knob into its initial position.
- 12 Put the centre fixing screw and washer back into their initial position.
- 13 Tighten the centre fixing screw by means of the 5 mm screwdriver.

76 Continued

14 Remount the setting selector PC board assembly as recommended in Para 26.

15 Remount the protective cover of the transceiver unit as recommended in Para 10.

STANDARD EXCHANGE OF THE PC BOARD ASSEMBLY IN THE 20 W AMPLIFIER

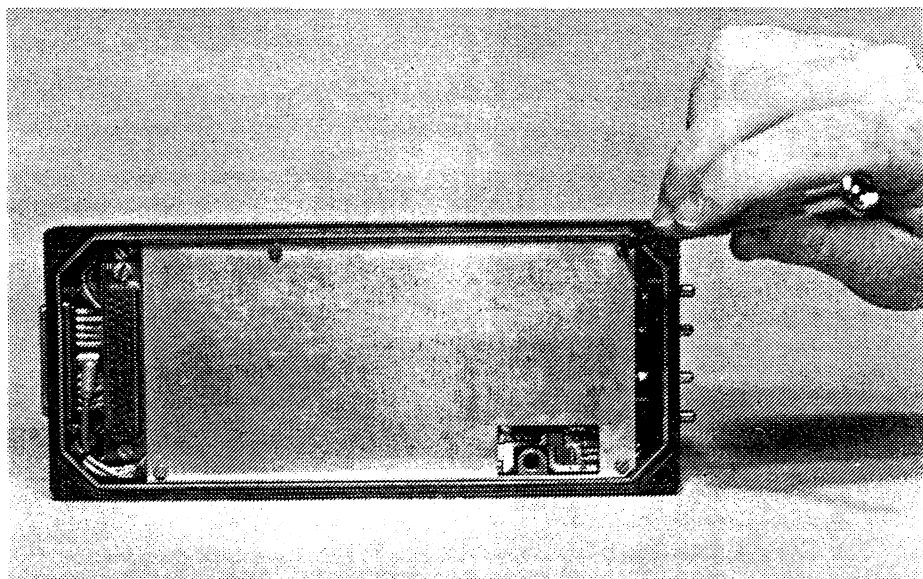
77 The chart below describes the standard exchange of the 20 Watt Amplifier PC Board assembly.

Documents	Test equipment	Tools
Para 14	Not applicable	See preferred tools in Para 14
Spares		One 4 mm screwdriver One 5 mm screwdriver One 5 mm open-ended spanner One special spanner for power transistors DOW-CORNING 340 grease One soldering iron Solder

PROCEDURE

78 Preliminary Steps - Safety Requirements

Dismount the 20 W Amplifier as recommended in Para 14.



**Standard Exchange of the
20 Watt Amp PCB**

Fig. 3D.20.

79 Dismantling

- 1 Loosen the 4 fixing screws of the screening plate by means of the 4 mm screwdriver.
- 2 Withdraw and remove the 4 fixing screws and washers.
- 3 Withdraw and remove the screening plate.
- 4 Spot the connections going to the PC board assembly.
- 5 Disconnect the connections.
- 6 Loosen the 4 fixing studs by means of the 5 mm open-ended spanner.
- 7 Withdraw and remove the 4 fixing studs and washers.
- 8 Loosen the 4 fixing nuts of the power transistors by means of the special spanner.
- 9 Withdraw and remove the fixing nuts of the power transistors.
- 10 Loosen and remove the binding screws of transistors Q6 and Q14 by means of the 5 mm screwdriver.
- 11 While holding the 20 W amplifier in position, push on the power transistors so as to disengage the PC board assembly.
- 12 Withdraw and remove the PC board assembly.
- 13 Note in which parts of the unit white DOW-CORNING 340 grease has been put on the power transistors and diodes.

80 Remounting

- 1 Clean the unit thoroughly.
- 2 Put some DOW-CORNING 340 grease in places previously spotted.
- 3 Put the PC board assembly back into its initial position.
- 4 Tighten the binding screws of transistors Q6 and Q14 by means of the 5 mm screwdriver.
- 5 Clean and grease the power transistor nut seals with silicone grease S14. With a dry, clean cloth wipe off the excess grease. Put the seals into their initial position.
- 6 Put the 4 power transistor nuts and seals in their initial position and tighten them with the special spanner for power transistors.

CAUTION: The tightening torque shall not exceed 15 kg/cm.

- 7 Put the 4 fixing studs and washers into their initial position.
- 8 Tighten the 4 fixing studs by means of the 5 mm open-ended spanner.
- 9 Solder the connections going to the PC board assembly in the place previously spotted.

- 80 Continued
 - 10 Put the screening plate and washers into its initial position.
 - 11 Put the 4 fixing screws of the screening plate into their initial position.
 - 12 Tighten the 4 fixing screws of the screening plate by means of the 4 mm screwdriver.
 - 13 Remount the 20 W amplifier as recommended in Para 14.

STANDARD EXCHANGE OF REAR PLUG J103 IN THE 20 WATT AMPLIFIER

81 The following chart describes the procedure for the standard exchange of the 20 Watt amplifier connector J103.

Documents	Test equipment	Tools
Para 14	Not applicable	Tools mentioned in Para 14
Spares		Special connector locating template with a 35.5 mm tubular spanner
1 Connector with same part number		Soldering iron Solder PRC 1201 Q compound Tweezers

PROCEDURE

82 Preliminary Operations - Safety Instructions

Disassemble the '20 Watt Amplifier' as explained in Para 14.

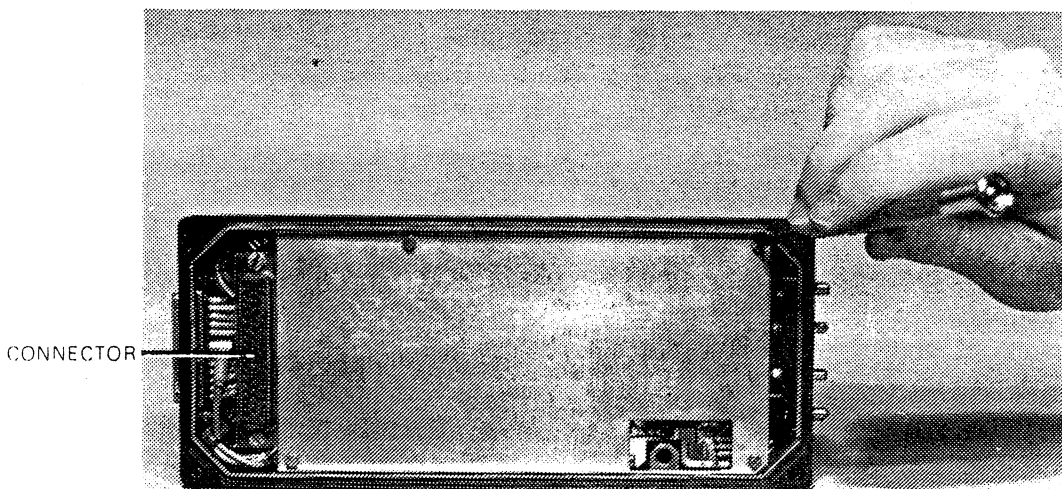


Fig. 3D.21.

**Standard Exchange of the
20 Watt Amp Connector**

83 Disassembly

- 1 Remove the PRC 1201 Q compound from plug J103 by means of tweezers.
- 2 Identify the connections terminating in rear plug J103.
- 3 Unsolder the connections terminating in rear plug J103 by means of the soldering iron.
- 4 Loosen the attaching nut of rear plug J103 by means of the 35.5 mm tubular spanner.
- 5 Withdraw and remove the attaching nut.
- 6 Withdraw and remove rear plug J103.

84 Reassembly

- 1 Put rear plug J103 in the initial position.
- 2 Put the attaching nut of rear plug J103 into place.
- 3 Put into place the special connector locating template in the '20 W Amplifier' and the 35.5 mm tubular spanner.
- 4 Tighten the attaching nut of the rear plug J103 by means of the 35.5 mm tubular spanner.
- 5 Withdraw and remove:
35.5 mm tubular spanner
Special connector locating template of the rear plug.
- 6 Solder the connections normally terminating in plug J103 as per arrangement previously noted.
- 7 Coat rear plug J103 with PRC 1201 Q compound.
- 8 Wait for PRC 1201 Q compound to dry up (this should take about 8 hours at approximately 20° C).
- 9 Reassemble the '20 W Amplifier' as explained in Para 14.

STANDARD EXCHANGE OF THE VARIABLE INDUCTOR IN THE ANTENNA TUNING UNIT

85 The following chart deals with the standard exchange of the variable inductor and opening of the antenna tuning unit.

Documents	Test equipment	Tools
Para 6	Not applicable	Tools mentioned in Para 6
Spares		3.2 mm Allen key 4 mm Allen key 4 mm screwdriver
1 Variable inductor, same part number		Soldering iron Solder

PROCEDURE

86 Preliminary Operations - Safety Instructions

Disassemble the 'Antenna Tuning Unit' as explained in Para 6.

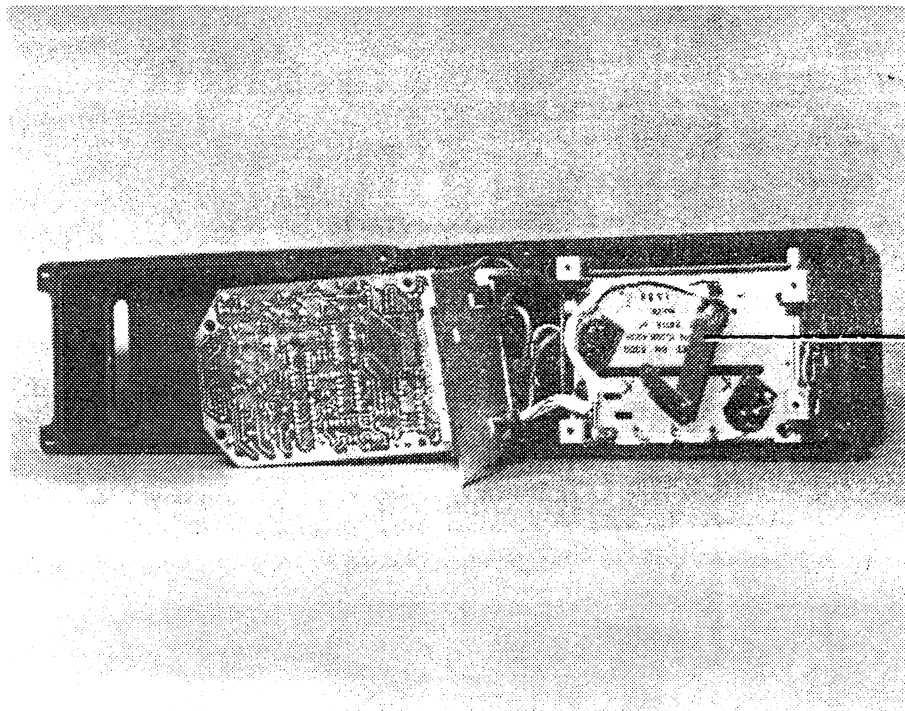


Fig. 3D.22, **Standard Exchange of the Variable Inductor and Opening of the ATU**

87 Disassembly

- 1 Loosen the 6 attaching screws from the metal cover of the 'Antenna Tuning Unit' by means of the 3.2 mm Allen key.
- 2 Withdraw the metal cover of the antenna tuning unit with care so as not to damage the leads.
- 3 Unsolder:
 - Orange lead
 - Yellow lead
 - White coaxial lead (with red mark)
 - White coaxial lead (with blue mark)
 - White coaxial lead in the loom terminating in the printed circuit.
- 4 Loosen the two connectors attaching screws by means of the screwdriver, withdraw and remove the two attaching screws.
- 5 Loosen the two attaching screws of the printed circuit by means of the 4 mm screwdriver.
- 6 Lift the printed circuit.
- 7 Release the two spacers without loosening the nuts.
- 8 Loosen the two attaching screws of the metal plate by means of the 4 mm screwdriver and withdraw the metal plate.
- 9 Loosen the four attaching screws of the inductor by means of the 4 mm Allen key.
- 10 Lift the variable inductor and unsolder the purple lead and the large white lead normally terminating in the variable inductor.
- 11 Withdraw and remove the variable inductor.

88 Reassembly

- 1 Place the variable inductor inside the antenna tuning unit.
- 2 Solder the purple lead and the large gauge white lead normally terminating in the variable inductor.
- 3 Put the variable inductor in its initial position.
- 4 Tighten the four attaching screws of the inductor by means of the 4 mm Allen key.
- 5 Put the metal plate back to its initial position.
- 6 Tighten the two attaching screws of the metal plate by means of the 4 mm screwdriver.
- 7 Secure the two spacers.

88 Continued

- 8 Put the printed circuit back to its initial position.
- 9 Tighten the two attaching screws of the printed circuit by means of the 4 mm screwdriver.
- 10 Tighten the two attaching screws of the connector by means of the 4 mm screwdriver.
- 11 Solder:
 - Orange lead
 - Yellow lead
 - White coaxial lead (with red mark)
 - White coaxial lead (with blue mark)
 - White coaxial lead in the loom, terminating normally in the printed circuit.
- 12 Carefully put the metal cover back into its initial position and be sure not to damage the wiring.
- 13 Tighten the 6 attaching screws of the metal cover by means of the 3.2 mm BTR spanner.
- 14 Reassemble the antenna tuning unit as explained in Para 6.

OPENING AND CLOSING OF THE BATTERY UNIT AND STANDARD EXCHANGE OF THE

FUSE

- 89 The following chart describes the procedure for the opening and closing of the battery unit and standard exchange of the fuse.

Documents	Test equipment	Tools
Para 2	Not applicable	3.2 mm Allen key
Spares		
Not applicable		

PROCEDURE

- 90 Preliminary Operations - Safety Instructions

Disassemble the 'Battery Unit' as explained in Para 2.

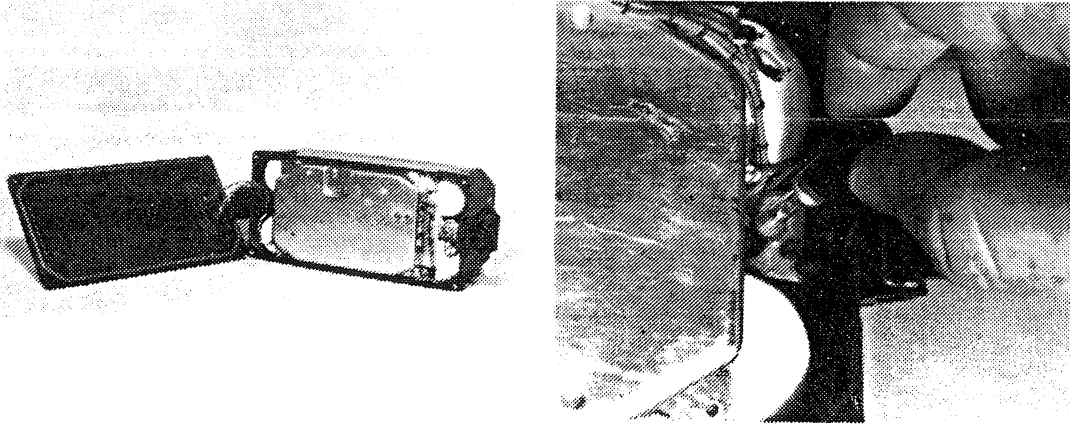


Fig. 3D.23

Opening and Closing the Battery Box and Standard Fuse Adjustment

91 Opening the Unit

- 1 Loosen the four cover attaching screws by means of the 3.2 mm Allen key.
- 2 Remove the cover from the battery unit.

NOTE: The fuse is then accessible. Proceed to standard exchange of the fuse if need be.

92 Closing the Unit

- 1 Put the battery unit cover back to its initial position.
- 2 Tighten the four cover attaching screws by means of the 3.2 mm Allen key.
- 3 Reassemble the battery unit as explained in Para 2.

STANDARD EXCHANGE OF THE BATTERIES IN THE BATTERY UNIT

93 The following chart deals with the standard exchange of the Batteries in the Battery Unit.

Documents	Meters	Tools
Para 2 Para 89	Not applicable	Tools mentioned in Para 89
Spares		4 mm screwdriver
1 Battery, with same part number		Soldering iron

PROCEDURE**94 Preliminary Operations - Safety Instructions**

- 1 Disassemble the battery unit as explained in Para 2.
- 2 Open the battery unit as explained in Para 89.

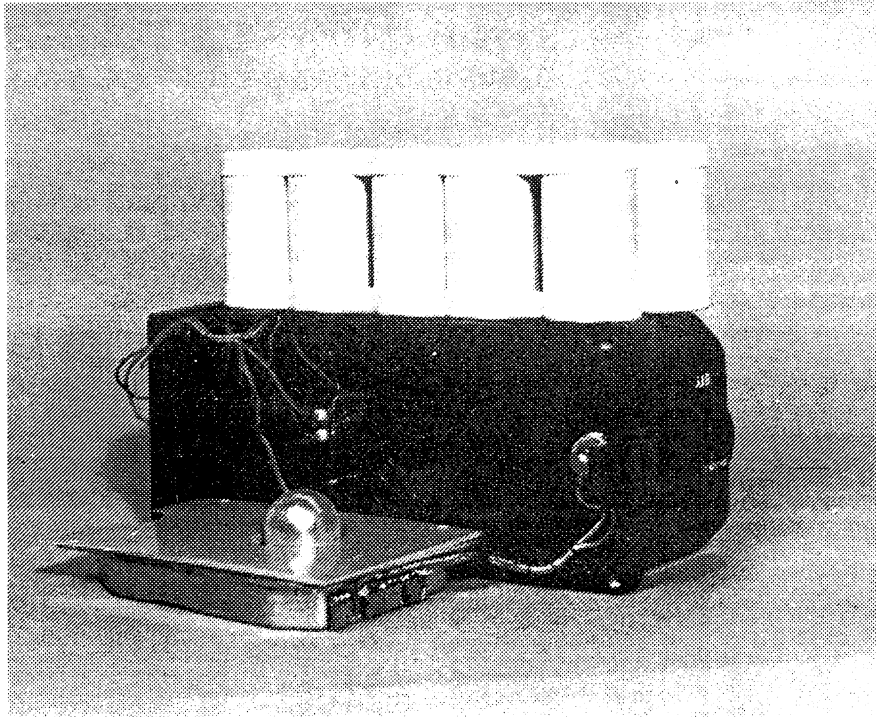


Fig. 3D.24

Standard Exchange of the Batteries**95 Disassembly**

- 1 Loosen the four attaching screws of the charger by means of the 4 mm screwdriver.
- 2 Remove the charger from the chassis so that the batteries may be accessible.
- 3 Unsolder the red lead originating from the batteries and terminating in the fuse.
- 4 Unsolder the blue lead coming from the batteries and terminating in the cover.
- 5 Withdraw and remove the batteries from the battery unit.

96 Reassembly

- 1 Put the batteries back to their initial position.
- 2 Solder the blue lead coming from the batteries and normally terminating in the cover.
- 3 Solder the red lead coming from the batteries and terminating in the fuse.
- 4 Put the charger back to its initial position.
- 5 Tighten the four attaching screws of the charger by means of the 4 mm screwdriver.
- 6 Close the battery unit as explained in Para 89.
- 7 Reassemble the battery unit as explained in Para 2.

STANDARD EXCHANGE OF THE CHARGER IN THE BATTERY UNIT

- 97 The following chart describes the procedure for the standard exchange of the charger in the battery unit.

Documents	Meters	Tools
Para 2 Para 89	Not applicable	Tools mentioned in Para 89
Spares		4 mm screwdriver
1 Charger, with same part number		Soldering iron Solder

PROCEDURE**98 Preliminary Operations - Safety Instructions**

- 1 Disassemble the battery unit as explained in Para 2.
- 2 Open the battery unit as explained in Para 89.

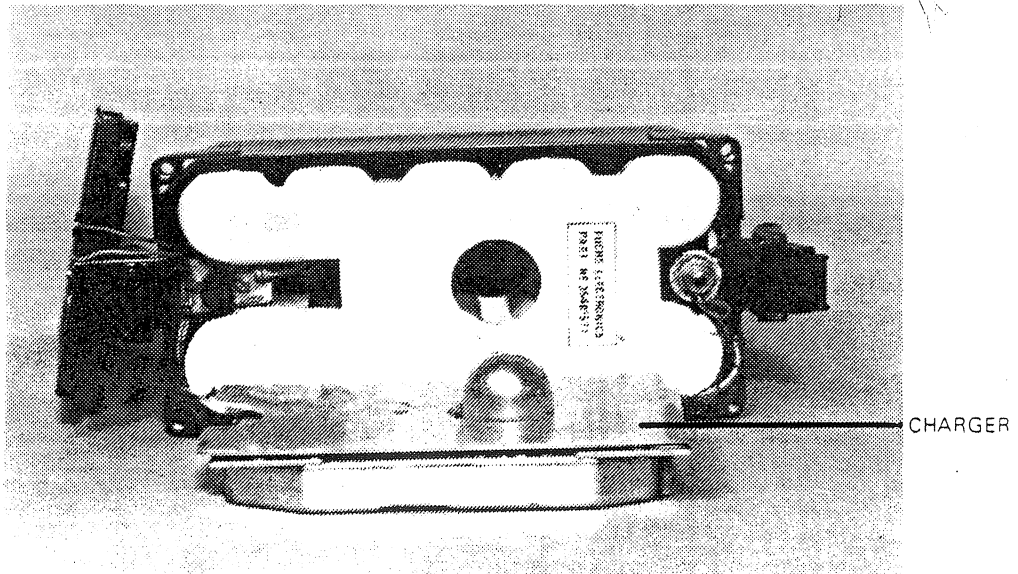


Fig. 3D.25

Standard Exchange of the Charger Unit

99 Disassembly

- 1 Identify the leads terminating in the charger.
- 2 Unsolder the leads terminating in the charger.
- 3 Loosen the four attaching screws of the charger by means of the 4 mm screwdriver.
- 4 Withdraw and remove the charger.

100 Reassembly

- 1 Put the charger back to its initial position.
- 2 Tighten the four attaching screws of the charger by means of the 4 mm screwdriver.
- 3 Solder the leads terminating in the charger as per arrangement previously noted.
- 4 Close the battery unit as explained in Para 2.

OPENING AND CLOSING OF THE CHARGER IN THE BATTERY UNIT

101 The following chart describes the procedure for the opening and closing of the charger in the battery unit.

Documents	Meters	Tools
Para 2 Para 89 Para 97	Not applicable	Tools mentioned in Para 89 and 97 Special device for disassembly of the charger cover.
Spares		Temperature controlled heating plate
1 charger cover, with same part number		2.5 mm screwdriver 150 W soldering iron

PROCEDURE**102 Preliminary Operations - Safety Instructions**

- 1 Disassemble the battery unit as explained in Para 2.
- 2 Open the battery unit as explained in Para 89.
- 3 Remove the charger as explained in Para 97.

103 Disassembly

- 1 Put the special tools for the disassembly and reassembly of the charger cover on the temperature - controlled heating plate.
- 2 Set the temperature-controlled heating plate between 70 and 80°C.
- 3 Wait for one hour (approx).
- 4 Put the charger on the special device for disassembly and reassembly of the charger cover.
- 5 Screw the two charger attaching screws onto the special device by means of the 2.5 mm screwdriver.
- 6 Wait for 10 minutes (approx).
- 7 Withdraw the cover as follows:

Melt the solder securing the cover to the charger by means of the 150 W soldering iron. Separate the cover from the charger proper by pulling the unsoldered ends by means of the 2.5 mm screwdriver.
- 8 Remove the cover.

104 Reassembly

- 1 Put the new cover in place.
- 2 Secure the cover onto the charger by soldering the ends with the 150 W soldering iron.
- 3 Loosen the two attaching screws of the charger on the special device by means of the 2.5 mm screwdriver.
- 4 Withdraw and remove the charger from the special device.
- 5 Set the temperature-controlled heating plate to 'off'.
- 6 Wait until the charger panels reach room temperature.
- 7 Assemble the charger as explained in Para 97.
- 8 Close the battery unit as explained in Para 89.
- 9 Reassemble the battery unit as explained in Para 2.

DRYING OF THE MANPACK TRANSCEIVER

105 The following chart gives details of the drying of the Manpack.

Documents	Meters	Tools
Not applicable	Not applicable	4 mm Allen key
Spares		Dryer
Not applicable		S14 Rhodorsil silicone grease

PROCEDURE

106 Preliminary Operations - Safety Instructions

CAUTION: Make sure that the MANPACK transceiver is switched off.

107 Operating Procedure

- 1 Unscrew the dummy plug on the front panel of the MANPACK Transceiver by means of the 4 mm Allen key.
- 2 Unscrew the second dummy plug on the rear panel of the antenna tuning unit by means of the 4 mm Allen key.
- 3 Plug the dryer into the two nozzles provided for this purpose.
- 4 Blow dry air through the MANPACK transceiver.
- 5 Grease the dummy plug seals with S14 Rhodersil silicone grease.
- 6 Unplug the dryer from the two nozzles of the MANPACK transceiver.
- 7 Screw the dummy plug normally located on the MANPACK transceiver front panel by means of the 4 mm Allen key.
- 8 Screw the dummy plug normally located on the rear panel of the antenna unit by means of the 4 mm Allen key.

GENERAL CARE

- 108 Prior to any operation with the MOS circuits, take the following care:

Make sure the operator is wearing bracelets connected to the ground via a circuit-breaker.

Short-circuit all terminals in the MOS circuit prior to any operation.

- 109 Cleanse all the new soldered joints systematically with alcohol.
- 110 Before fitting new seals, coat them systematically with Rhodersil silicone grease.
- 111 Use a soldering iron with the following specifications:

Output power: 40 W

Setup, comprising the soldering iron, grounded

Straight, flat bit with an end of 2 mm at most.

MANPACK TRANSCEIVER TYPE RS-B25

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CHAPTER 1 UNIT TECHNICAL DESCRIPTION (MOD STATE B)

TO BE ISSUED LATER:

CHAPTER 2 UNIT TECHNICAL DESCRIPTION (MOD STATE C)

CHAPTER 3 UNIT TECHNICAL DESCRIPTION (MOD STATE D)

UNIT TECHNICAL DESCRIPTION (MOD STATE B)

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SYNTHESISER

INTRODUCTION

- 1 The technical description of the Synthesiser is divided into the following parts. Figure references of the circuit diagrams for each part are also listed:-
 - a Generation of the 5 MHz, 2,5 MHz, 25 kHz and 1 kHz reference signals. Figure 5A.1.1, 1.5, 1.6.
 - b Generation of the 100 MHz and 105 MHz fixed heterodyne signals. Figures 5A.1.9, 1.13.
 - c Operation of the main loops. Figures 5A.1.2, 1.3, 1.5, 1.7, 1.12, 1.14, 1.15.
 - d Operation of the secondary loop. Figures 5A. 1.2, 1.9, 1.15.
- 2 Simplified in-text diagrams are included where appropriate to aid the understanding of particular circuits.

GENERATION OF 5 MHz, 2,5 MHz, 25 MHz AND 1 kHz REFERENCE SIGNALS

5 MHz Reference Signal (Figure 5A.1.1)

- 3 All the reference signals are derived from the TCXO (temperature compensated crystal oscillator) which produces a 5 MHz sinewave signal with a peak-to-peak amplitude of 220 mV, adjusted by R104 (See Figure 5A.1.1).
- 4 The output of the TCXO is applied to the following circuits:-
 - a Pin A5 of Synthesiser Board No. 3.
 - b Pin B4 of Synthesiser Board No. 2.
 - c Pin 3 of the Divide by Two Module Z02 on Synthesiser Board No. 2.

2,5 MHz Reference Signal (Figure 5A.1.6)

- 5 The 5 MHz signal at pin 3 (E) of the divide by two module is applied to the base of buffer transistor Q01. The signal at the collector of Q01 triggers the conventional Eccles-Jordan multivibrator circuit consisting of transistors Q02, Q03 and the associated components.
- 6 Two outputs from the collector of Q03 are fed to the bases of cascade connected transistors Q04 and Q05, acting as buffers. The output at pin 8 (S2) is a 2,5 MHz squarewave signal and is used to clock the divided by 100 circuit on Synthesiser Board No. 2.
- 7 Another output, from the collector of Q02 in the Eccles-Jordan circuit, is filtered by L01, C02 and C03, and provides a 2,5 Mhz signal at pin 9 (S1). This signal is applied to Q01 in Synthesiser Board No. 1 which, when gated by a 2,5 MHz control signal from the exciter board, is fed as a 2,5 MHz fixed heterodyne signal to the transmit and receive circuits via pin A2.

25 kHz Reference Signal (Figure 5A.1.5)

- 8 The 2.5 MHz signal from S2 on the divide by two module is fed to pin 3 of dual D type flip-flop Z04 in the divide by 100 circuit.
- 9 The divide by 100 circuit consists of dual D type flip-flops Z04, Z05, Z011 and gates 1 and 4 of quad NOR gate Z06.
- 10 Flip-flops 1 and 2 of Z04 from a conventional divide by four circuit, the output of which clocks the divide by five circuit, consisting of Z05, NOR gate 1 of Z06 and flip-flop 1 of Z07. The clocking rate is 625 kHz.
- 11 When conventionally connected the three flip-flops would form a divide by 64 counter (8×2^3). Connection of the NOR gate between the Q outputs of flip-flops Z05, 1 and 2, causes the counter to be reset to zero after each fifth count.
- 12 The Q output of flip-flop Z07 No. 1 (pin 1) therefore produces a signal at 125 kHz which is used to clock a second divide by five counter, consisting of Z07 flip-flop No. 1, NOR gate 4 of Z06 and flip-flops Nos. 1 and 2 of Z11. The output at the Q output of Z11 flip-flop No 2 (pin 13) is a clock signal of 25 kHz.
- 13 The output of NOR gate 4 of X06 (pin 11) is differentiated by C16, R17 and the resulting 25 kHz pulse, with a pulse length of 2 us, is applied to frequency discriminator Z12, Z15 and to frequency comparator Z03. The frequency discriminator provides the coarse control of the VCO and the phase comparator provides the fine control of the VCO.

1 kHz Reference Signal (Figure 5A.1.5)

- 14 The 1 kHz reference signal required for operation of the secondary loop is derived from a divide by 25 circuit which in turn consists of two divide by five circuits, identical to those described in the generation of the 25 kHz reference signal.
- 15 The 25 kHz signal from Z11 pin 13 clocks the divide by five circuit consisting of flip-flops 1 and 2 of Z13, NOR gate 1 of Z14 and flip-flop 1 of Z16.
- 16 An output signal of 5 kHz at Z16 pin 1 is used to clock the second divide by five circuit consisting of flip-flop 2 of Z16, NOR gate 1 of Z14 and flip-flops 1 and 2 of Z21. The output at Z21 pin 1 is a 1 kHz sine wave which, after filtering by R24, R25, R26 and C22, C23, is fed to the transceiver circuits via p.c.b. pin B9.
- 17 The output of NOR gate 4 of Z14 (pin 3) is differentiated by C24, R23 and inverted by NOR gate 3 of Z14. The output, fed to p.c.b. pin A7, is a negative pulse at 1 kHz with a pulse length of between 3 and 4 us. This signal is inverted by NOR gate 2 of Z14 and fed as a negative pulse to p.c.b. pin A6. Both these signals are required for operation of the secondary loop.

GENERATION OF 100 MHz AND 105 MHz FIXED HETERODYNE SIGNALS

- 18 Both the 100 MHz and 105 MHz signals are derived from the 100 MHz crystal oscillator mounted on Synthesiser Board No. 3.
- 19 The oscillator circuit diagram is given on Figure 5A.1.13 and operates as follows:-
- a Crystal oscillator Y01, operated in the series mode, is connected to the emitter of transistor Q01 via module pin 2 and to the emitter of transistor Q02 via module pin 6.
 - b The oscillator consists of Q01, Q02 and the associated circuits and comprises a selective feedback, emitter coupled oscillator.
 - c Variable capacitors C13 and C16 on Synthesiser Board No. 3 are adjusted to set the oscillator frequency at precisely 100 MHz.
 - d The oscillator output at the collector of Q02 is applied to the base of buffer amplifier Q03. The collector output of Q03 is applied to the primary winding of matching transformer T01.
 - e The secondary output of T01, at 100 MHz is applied via module pin 14 to:-
 - i pin 11 of 100 MHz amplifier Z03 (generation of 100 MHz fixed heterodyne signal)
 - ii pin 6 of 100 MHz amplifier Z03 (generation of 100 MHz output to secondary loop)
 - iii pin 6 of 105 MHz mixer Z02 (generation of 105 MHz fixed heterodyne signal)

Generation of 100 MHz Fixed Heterodyne Signal (Figure 5A.1.9)

- 20 When the front panel diode Selector switch is set to one of the three positions MORSE, HSB or AM, the -6 V.d.c. supply, from the converter is applied to p.c.b. pin B5 of synthesiser Board No. 3.
- 21 This voltage, filtered by R00 and C05, is applied to pin 8 of module Z03 thus enabling the 100 MHz amplifier.
- 22 The 100 MHz amplifier (Figure 5A.1.12) consists of transistors Q10 and Q11 and the associated circuits. The 100 MHz input from oscillator module Z04 is applied to pin 6. The amplified output at pin 1 is applied to pin 16 of the filter matching module Z01.
- 23 Only transformer T02 and resistor R17 in the filter matching module are used and the 100 MHz signal is fed via pin 15 to output pin A3 of Synthesiser Board No. 3. as the fixed heterodyne signal.

Generation of 105 MHz Fixed Heterodyne Signal (Figure 5A.1.9)

- 24 When the front panel mode selector switch is set to the LSB position, the - 6 V.d.c. supply, from the converter unit is applied to pin A4 of Synthesiser Board No. 3.
- 25 This voltage, filtered by R01 and C03 is applied to pin 11 of module Z02 thus enabling the 100 MHz mixer.
- 26 A circuit diagram of the 105 MHz mixer is given in Figure 5A.1.11.
- 27 The 100 MHz signal from oscillator module Z04 is applied to pin 6 of the mixer module and thus to a matching amplifier comprising transistors Q01, Q02 and the associated circuits.
- 28 The collector output of Q01 is applied to the primary winding of transformer T01.
- 29 A 5 MHz reference signal from Synthesiser Board No. 2 (paragraphs 3 and 4) is applied to matching amplifier Q03 via module pin 8 and the collector output of Q03 is applied to the centre tap of transformer T02.
- 30 The two signals (100 MHz and 5 MHz) are mixed in the conventional ring mixing circuit comprising diodes CR01 - CR04, producing components at 105 MHz and 95 MHz. The 105 MHz component is selected in the secondary winding of transformer T02 and is fed via pin 14 to pin 10 of the filter matching module Z01.
- 31 After matching in transistor amplifier Q01, Q02 and associated circuits the 105 MHz signal is fed via pin 13 to a 105 MHz filter consisting of crystal filter FL01 and its associated circuits. This filter suppresses spurious frequencies and passes only the fundamental frequency of 105 MHz. The filter inputs and outputs are matched by variable capacitors C01 and C02.
- 32 The filter output is applied to pin 3 of the filter matching unit where the signal is matched by amplifier Q03, Q04, the associated circuits and transformer T01. The 105 MHz signal is fed via pin 15 to output pin A7 of Synthesiser Board No. 3 as the fixed heterodyne signal.

GENERATION OF THE 100 MHz OUTPUT TO SECONDARY LOOP (FIGURE 5A.1.9)

- 33 The 100 MHz signal appearing at pin 11 of the 100 MHz amplifier module Z03 from the 105 MHz mixer module, is applied to the amplifier comprising transistors Q01 and Q02 and their associated circuits.
- 34 The 100 MHz output signal at pin 16 is used in the secondary loop.

OPERATION OF THE MAIN LOOP

- 35 The operation of the main loop is described in nine discrete circuits. A list of each circuit and its function follows and is succeeded by a detailed description of each of these circuits.
- a Main loop voltage controlled oscillator (VCO).
 - b VCO output amplifier.
 - c Main loop mixer - mixes VCO output signal with signal from secondary loop.
 - d Divide by four circuit - divides the signal from the main loop mixer.
 - e Divide by 10 or 12 circuit - division depends on the order to divide by 10 or 12, and divides the frequency of the signal from the divider by four. The order to divide by 10 or 12 originates from the variable preset divider (sub-paragraph f).
 - f Variable preset divider - generates a division 'rank' and the divide by 10 or 12 order, depending on the setting of the 100 kHz, 1 MHz, and 10 MHz frequency selector switches, in order to obtain a signal frequency of 25 kHz.
 - g Frequency discriminator - generates an alignment (search) signal resulting from the difference between the 25 kHz reference frequency and signal frequency of 25 kHz from the variable preset divider. This search signal is stabilised and stored once the frequency from the variable preset divider is equal to the 25 kHz reference signal.
 - h Phase comparator - generates a feedback control error signal resulting from the comparison between the reference signal and the signal from the variable preset divider. This error signal controls the phase of the VCO oscillator.
 - j VCO sub-band control circuit - the signal from this circuit pre-positions the VCO within a low (2 - 199,9 MHz) or high (20 - 29,9 MHz) sub-band depending on the setting of the frequency selector switches.

VOLTAGE CONTROLLED OSCILLATOR (FIGURE 5A.1.14)

- 36 The VCO is located on the VCO board in the HF Unit. It is a Colpitt's oscillator comprising field effect transistor Q401 connected in a source follower configuration, its associated circuits, and the tuned inductor L406 with the three varicaps CR403, CR404 and CR405.
- 37 Frequency control of the oscillator is achieved by varying the dc. control applied to the varicap diodes. This feedback voltage is applied to pin 5 of J1, filtered by inductors L402, L404 and capacitor C403 and controls R101, R102, capacitor C101 and diodes CR101 and CR102, is incorporated in the feedback loop.
- 38 The alignment voltage, applied to pin 1 of J1, is filtered by inductor L403 and controls varicap diode CR403. A corrector network consisting of diodes CR401, CR402, resistors R401, R402 and capacitor C401 is incorporated in the feedback loop.
- 39 The sub-band prepositioning voltage is applied via pin 13 of J1 and filter C402, C405 and C411 to the varicap diodes CR403 and CR404. Capacitor C414 provides dc. isolation between varicap diode CR405 and varicap diodes CR403 and CR404. Capacitors C407 and C412, provide dc. isolation between the varicaps and transistor oscillator Q401, and ac. coupling between transistor Q401 and the tuned circuit.

- 40 The VCO delivers a signal varying in frequency from 104,5 MHz to 132,499 MHz depending on the frequency selector switch setting (2 MHz to 29,999 MHz).

NOTE Depending on the frequency setting the sub-band control voltage pre-positions the oscillator:-

- a in the low sub-band from 104,5 MHz to 122,499 MHz (setting 2 MHz to 19,999 MHz).
- b in the high sub-band from 122,5 MHz to 132,499 MHz (setting 20 MHz to 29,999 MHz).

- 41 The output signal from the VCO at the source of FET Q401 is coupled to the amplifier by capacitor Q416.

VCO OUTPUT AMPLIFIER (FIGURE 5A.1.14)

- 42 The VCO output amplifier is located on the VCO board of HF Unit.
- 43 It comprises MOS tetrode type transistor Q402 in common source configuration and its associated circuits. The output from inductor L406 appears at pin 9 and J1 on the HF Unit and is also buffered by transistor mixer Q403 and applied to the transmit/receive mixer as the variable heterodyne frequency (104,5 MHz to 132,5 MHz).

MAIN LOOP MIXER (FIGURE 5A.1.3)

- 44 The main loop mixer is located in the Main Loop Mixer Module which is part of synthesiser Board No. 1.
- 45 The variable heterodyne frequency from the VCO output amplifier is applied to pin 6 of the main loop mixer and so to matching amplifier Q02, Q03 and the associated circuits, the matching transformer T02.
- 46 This signal, which varies from 104,5 MHz to 132,499 MHz, appears across the primary of T03 (1 and 2).

- 47 A signal from the secondary loop, varying in frequency between 100,5 MHz and 100,699 MHz (depending on the setting of the 100 kHz, 10 kHz and 1 kHz frequency selector switches) is applied to the primary winding of transformer T04 (1 and 2) via pin 16 of the module. The following table indicates the secondary loop signal frequency for each setting of the frequency selector switches.

100 kHz SETTING	10 kHz SETTING	1 kHz SETTING	SIGNAL FREQUENCY
0	0	0	100,5 MHz
0	5	0	100,550 MHz
1	0	0	100,600 MHz
1	9	9	100,699 MHz
2	0	0	100,5 MHz
3	9	9	100,699 MHz
4	0	0	100,5 MHz
5	9	9	100,699 MHz
6	0	0	100,5 MHz
7	9	9	100,699 MHz
8	0	0	100,5 MHz
9	9	9	100,699 MHz

DIVIDE BY 4 CIRCUIT (FIGURE 5A.1.4)

- 48 Mixing of the two signals takes place in the conventional ring mixer comprising diodes CR01 - CR04.
- 49 The signal appearing in the secondary winding of transformer T03 varies between 4 MHz and 31,3 MHz over the setting range 2 MHz to 29,99 MHz. This signal is applied to buffer amplifier Q01 and its associated circuits, via a filter consisting of inductor L01 and capacitors C09, C10 and C11.
- 50 The output signal, from matching transformer T01 in the collector circuit of Q01, is applied via capacitor C03 to pin 9 of the module.

DIVIDE BY FOUR CIRCUIT (FIGURE 5A.1.4)

- 51 The output signal from the main loop mixer is applied to pin 8 of the divide by four circuit Z06. This circuit consists of a dual of two divide by two circuits connected in cascade.
- 52 Transistor Q01 is a buffer amplifier which matches the signal to the first divide by two circuit, which comprises transistors Q02, Q04 and the associated circuits connected as an Eccles Jordan type flip-flop.
- 53 The output signal at the collector of transistor Q04, the frequency of which varies between 2 MHz and 15,9 MHz depending on the setting, triggers the second divide by two circuit.
- 54 This circuit is also an Eccles Jordan type flip-flop consisting of transistors Q03, Q05 and associated circuits. The signal at the collector of Q05, varying in frequency between 1 MHz and 7,95 MHz, is fed via module pin 6 to the divide by 10 or 12 circuit.

DIVIDE BY 10 OR 12 CIRCUIT (FIGURE 5A.1.2)

85 The divide by 10 or 12 circuit (module Z04) is located on Synthesiser Board No. 1. A schematic diagram of this integrated circuit is shown in Figure 1.

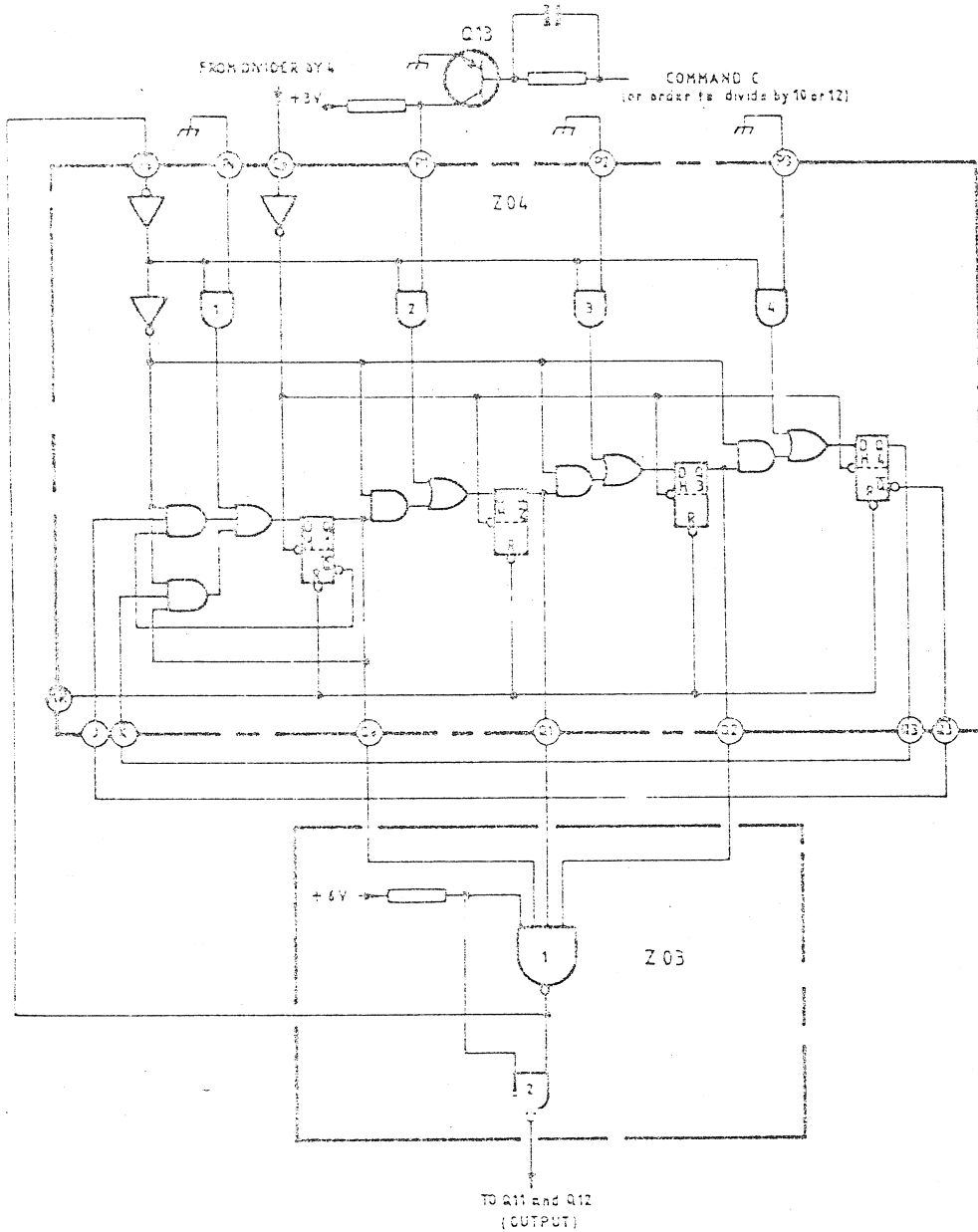


Fig. 1 Schematic Diagram of Divide by 10 or 12 Circuit

56 The 1 MHz to 7.95 MHz signal from module Z06 is the common clock for the four flip-flops of Z04. The circuit will divide by 10 or 12 four flip-flops of Z04. The circuit will divide by 10 or 12 variable preset divider (paragraph 58).

- a When the command signal is at logic '0' Q13 is cut off applying a logic '1' to one input of AND gate No. 2. On completion of the count NAND gate 1 of module Z03 produces a logic '1' output which, when applied to the second input of AND gate No. 2 forces the D input of flip-flop No. 2, to logic '1', while the D inputs of the remaining three flipflops are at logic '0'. The state of the four flip-flops is shown in the following table.

CLOCK PULSE	FF No. 1	FF No. 2	FF No. 3	FF No. 4
1	X	—	X	X
2	X	X	X	—
3	X	X	X	X
4	—	X	X	X
5	X	—	X	X
6	X	X	—	X
7	X	—	X	—
8	X	X	—	X
9	—	X	X	—
10	—	—	X	—

X = Change of state

Figure 2 illustrates how the output of Z03 gate 2 goes to logic '1' after a count of 10.

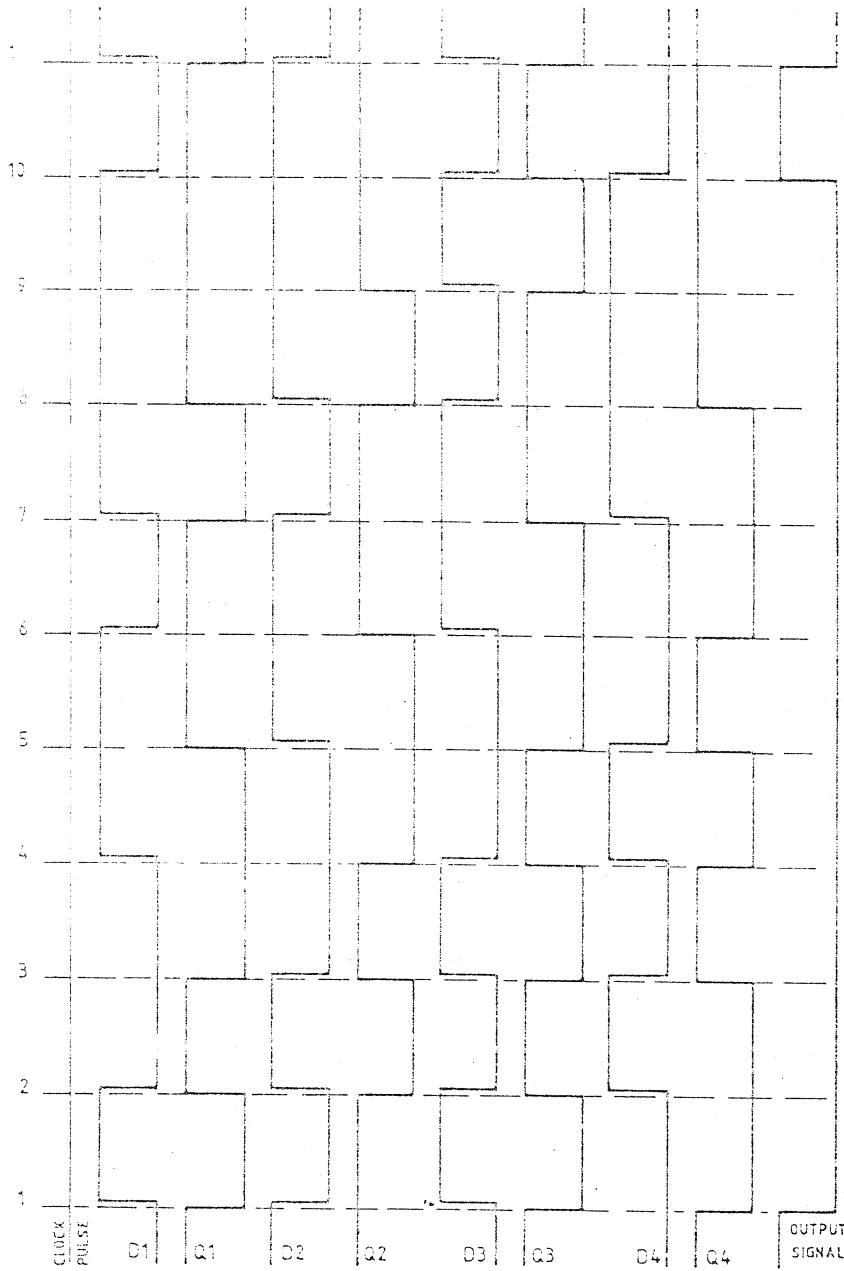


Fig. 2 Count of 10 Timing Diagram

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58 (continued)

- b. When the command signal is at logic '1' G13 conducts applying a logic '0' to one input and AND gate No. 2. On completion, of the count, or just before the beginning of the count, the D inputs to all flip-flops is logic '0'. The state of the flip-flops during the count is shown in the following table:-

CLOCK PULSE	FF NO. 1	FF NO. 2	FF NO. 3	FF NO. 4
1	X	X	X	-
2	X	-	-	-
3	X	X	-	-
4	X	X	X	-
5	X	X	X	X
6	-	X	X	X
7	X	-	X	X
8	-	X	-	X
9	X	-	X	-
10	X	X	-	X
11	-	X	X	-
12	-	-	X	X

Figure 3 illustrates how the output of Z03 gate 2 goes to logic '0' after a count of 12.

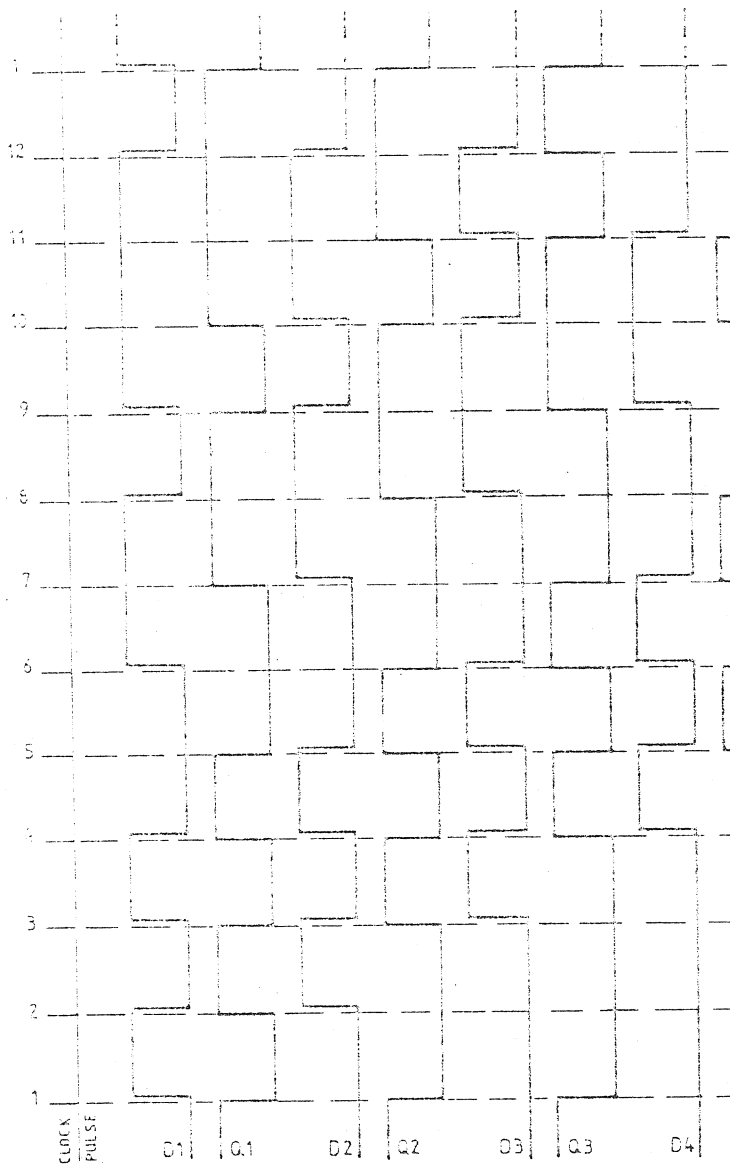


Fig. 3

Count of 12 Timing Diagram

57 The output signal from the divide by 10 or 12 circuit (divide by 10 - logic '1', divide by 12 - logic '0') is applied to output pin A12 of the Synthesiser Board No. 1 via buffer amplifiers Q11, Q12 connected in cascade.

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VARIABLE PRESET DIVIDER (FIGURE 5A.1.15)

55 The variable preset divider consists of the following modules.

- a Z11 - divide by 10
- b Z12 - NOR gate and inverter
- c Z13 - Dual D type flip-flop
- d Z07 - Quad NOR gates
- e Z05 - Half of quad gates.

These modules are located on the Frequency Selector Board.

59 Module Z11 is an integrated divide by 10 circuit a schematic diagram of the module being shown in Figure 4.

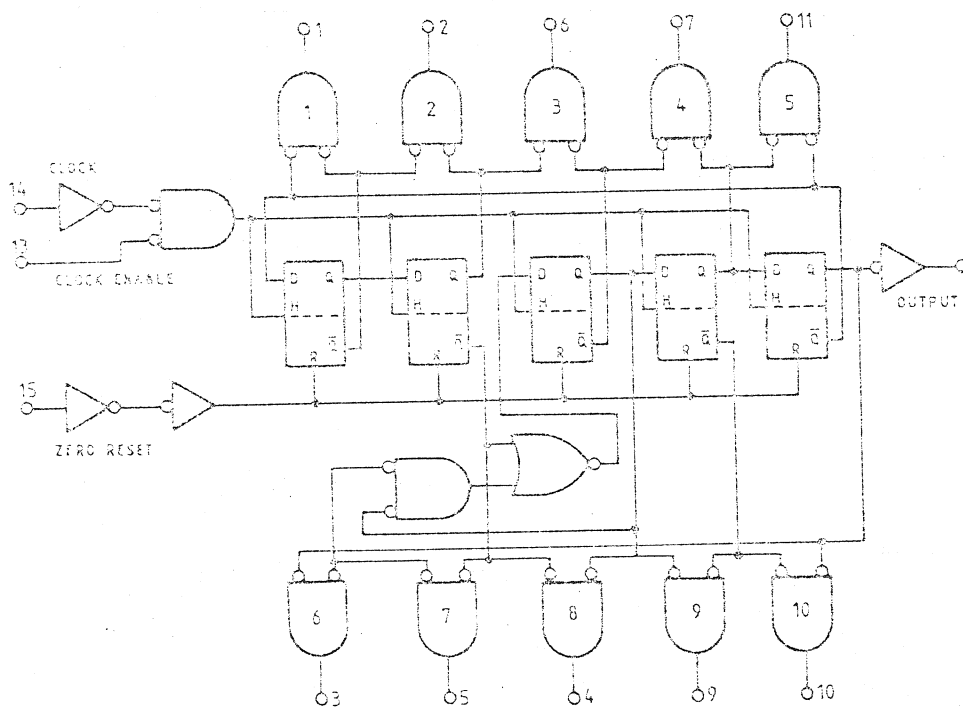


Fig. 4 Schematic Diagram of Divide by 10 Circuit

- 60 The module is clocked at pin 14 by the Main Loop Heterodyne signal, derived from Synthesiser Board No. 1, and applied to pin A5 of the Frequency Selector.
- 61 At each logic '1' clock pulse the counter advances causing the output of one of the 10 output AND gates to go to logic '1'. Only one AND gate is at logic '1' at a time. The remaining outputs remaining at logic '0'. Table 1 below illustrates the counting sequence for successive clock pulses.

TABLE SA.1.1. DIVIDE BY 10 CLOCK SEQUENCE		1	2	3	4	5	6	7	8	9	10
Gate 1	Enable	—	—	—	—	X	—	—	—	—	—
	Log. Lev. of terminal 1	0	0	0	0	1	0	0	0	0	0
Gate 2	Enable	X	—	—	—	—	—	—	—	—	—
	Log. Lev. of terminal 2	1	0	0	0	0	0	0	0	0	0
Gate 3	Enable	—	—	—	—	—	—	X	—	—	—
	Log. Lev. of terminal 3	0	0	0	0	0	0	1	0	0	0
Gate 4	Enable	—	—	X	—	—	—	—	—	—	—
	Log. Lev. of terminal 4	0	0	1	0	0	0	0	0	0	0
Gate 5	Enable	—	—	—	—	—	—	—	—	X	—
	Log. Lev. of terminal 5	0	0	0	0	0	0	0	0	1	0
Gate 6	Enable	—	—	—	—	—	—	—	—	—	X
	Log. Lev. of terminal 6	0	0	0	0	0	0	0	0	0	1
Gate 7	Enable	—	—	—	—	—	X	—	—	—	—
	Log. Lev. of terminal 7	0	0	0	0	0	1	0	0	0	0
Gate 8	Enable	—	X	—	—	—	—	—	—	—	—
	Log. Lev. of terminal 8	0	1	0	0	0	0	0	0	0	0
Gate 9	Enable	—	—	—	—	—	—	—	X	—	—
	Log. Lev. of terminal 9	0	0	0	0	0	0	0	1	0	0
Gate 10	Enable	—	—	—	X	—	—	—	—	—	—
	Log. Lev. of terminal 10	0	0	0	1	0	0	0	0	0	0

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- 62 Output 12 of Z11 is not used and the clock enable input at pin 13 is held at logic '1'. The reset signal at pin 15 is derived from module Z12 as described later.
- 63 A functional block diagram of the Variable Preset Divider is shown in Figure 5.

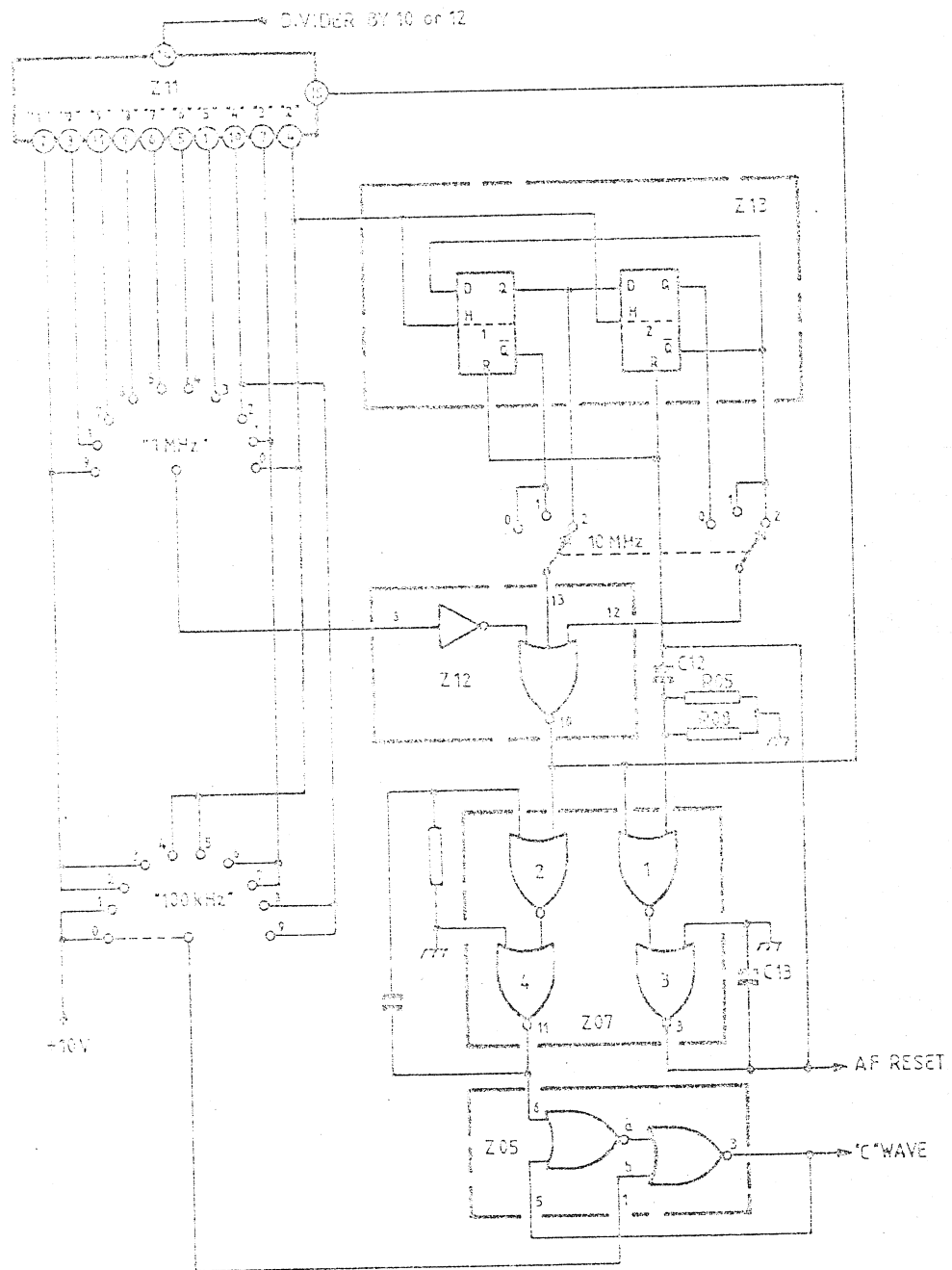


Fig. 5 Functional Block Diagram of Variable Preset Divider

- 64 The clock signal from the divide by 10 or 12 circuit is applied to pin 14 of module Z11. The number of clock pulses required to produce a logic '1' at each output of module Z11 is shown on Figure 6.
- 65 Output pin 4 of Z11 goes to logic '1' at every 2nd, 12th, 22nd ... clock pulse and provides the clock pulse for dual D type flipflop module Z13.
- 66 The 10 MHz frequency selector switch selects the Q and Q outputs of the flip-flops of Z13 and applies them to pins 12 and 13 of the NOR gate in module Z12. For the reset signal to the divide by ten module Z11 to be active (logic '1') all three inputs of the NOR gate must be at logic '0'.
- 67 Enabling timing diagram: Figure 6 below, shows the logic levels of the Q and Q outputs of Z12, and hence the inputs 12 and 13 of the NOR gate of Z12 for each position of the 10 MHz frequency selector switch.

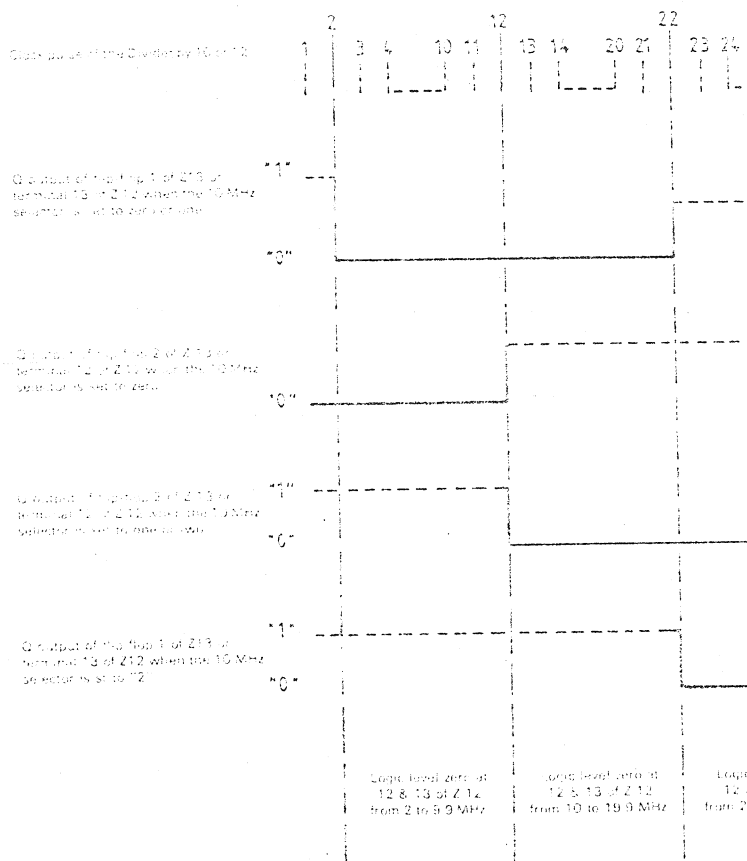


Fig. 6 Enabling Timing Diagram

- 68 The logic level of the third input of the NOR gate of Z12 is dependent on the position of the 1 MHz frequency selector switch. When a clock pulse appears at the output of Z11, corresponding to this position, a logic '1' appears at Z12 pin 8 and therefore a logic '0' at the third input of the NOR gate.

- 69 When all three inputs to the NOR gate are at logic '0', a logic '1' appears at pin 10 of Z12, which causes divide by 10 circuit Z11 to reset to zero.
- 70 At the same time this logic '1' signal triggers the monostable multivibrator formed by NOR gates 1 and 3 of Z07 and time constant capacitor C12 and resistors R05, R03. The resulting logic '1' pulse provides the main loop reset at pin A5 of the Frequency selector and also resets the flip-flops of Z13. The reset signal returns to logic '0' after an interval defined by the values of C12, R05 and R03.
- 71 The divider is reset to its initial state and waits for the next clock pulse from the divide by 10 or 12 circuit to start the next cycle.
- 72 Generation of the division rank or command signal C, which orders divide by 10 or 12, is also derived from the logic '1' signal at Z12 pin 10 (see paragraph 69).
- 73 This logic '1' triggers a second monostable multivibrator formed by NOR gates 2 and 4 of Z07 and time constant components C06, R06. The resulting positive pulse produces a logic '0' at the 'a' input to NOR gate 3 of Z05. The 'b' input of gate 3 is dependant on the setting of the 100 kHz frequency selector switch. As long as the logic level of the selected output of Z11 is at zero, the 'b' input of gate 3 will also be at zero, producing a command signal C = '1' which corresponds to divide by 12.
- 74 When the selected output of Z11 is at logic '1' input 'b' of gate 3 will also be at logic '1' causing C to go to logic '0' which corresponds to divide by 10.
- 75 Generation of command signal C for different positions of the 100 kHz frequency selector switch is shown in Figure 7 below.

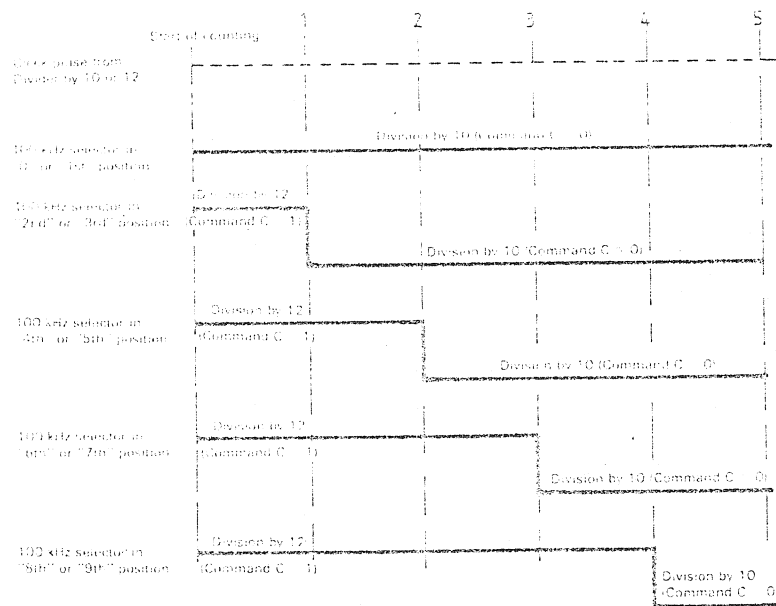


Fig. 7. Generation of Command Signal C

FREQUENCY DISCRIMINATOR AND D/A CONVERTER (FIGURE 5A.1.5)

76 The frequency discriminator and D/A converter are located on Synthesiser Board No. 2 and consists of the following modules:-

- a Z12 - dual D type flip-flops
- b Z15 - dual NOR gates
- c Z17 - binary counter
- d Z22 D/A converter

77 A schematic diagram of the frequency discriminator and D/A converter are shown in Figure 8 below.

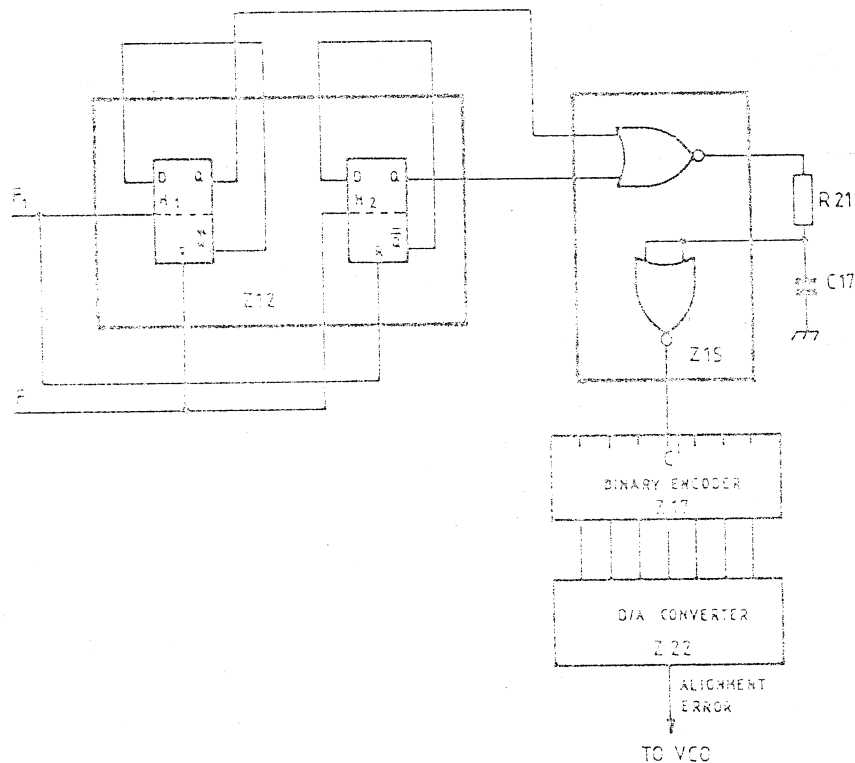


Fig. 8 Schematic Diagram of Frequency Discriminator and D/A Converter

78 The purpose of this circuit is to provide the alignment (search) signal to control the VCO.

79 The 25 kHz reference signal F_r from the divide by 100 circuit clocks flip-flop No. 1 of module Z12 and provides the zero reset for flip-flop No. 2. The output signal F_0 from the variable preset divider clocks flipflop No. 2 of Z12 and provides the zero reset signal for flipflop No. 2.

80 If frequency F_r is higher than frequency F_c , the Q output of flip-flop No. 1 will change state with each clock pulse and the Q output of flip-flop No. 2 will remain at logic '0'. The signal from the Q output of flip-flop No. 1 is buffered by NOR gates 1 and 2 of Z15 and shaped by R21, C17 and applied to the clock input (pin 1) of binary counter Z17.

81 If frequency F_c is higher than frequency F_r , the Q output of flip-flop No. 2 will change state with each dock pulse and the Q output of flip-flop No. 1 will remain at logic '0'. The Q output of flip-flop same NOR gates and shaping circuit.

82 When frequency F_r and frequency F_0 are equal both flip-flops will remain in the reset condition i.e. the Q outputs of both flip-flops will be at logic '0'.

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- 83 Z17 is a 7-bit counter providing up to 27 (128) output combinations depending on the number of clock pulses applied.
- 84 The outputs from the binary counter are fed to the inputs of D/A converter Z22 which consists of the resistance network shown in Figure 5A.1.8.
- 85 Module Z22 converts the binary data into a stepped voltage. This voltage can have up to a maximum of 128 steps and is used to control the main loop VCO.

PHASE COMPARATOR (FIGURE 5A.1.7)

- 86 The phase comparator is located on Synthesiser Board No. 2 and consists of module Z03, sampling FET Q02, temperature compensated FET amplifier Q03 and the associated circuits.
- 87 The 25 kHz reference signal from the divide by 100 circuit is applied to the base of buffer transistor Q01 in module Z03 via pin 1. The signal at the collector of Q01 is applied to the sawtooth waveform generator consisting of capacitor C01, transistors Q02, Q03, Q04 and the associated circuits. Transistors Q05 and Q06 act as buffers for the sawtooth waveform to the following stages.
- 88 Figure 9 below shows the sawtooth waveform, derived from the 25 kHz reference signal, that appears at pin 15 of Z03.

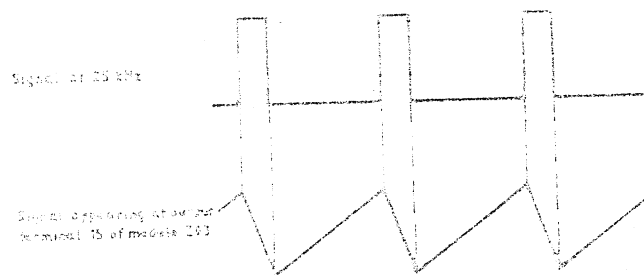


Fig. 9 Sawtooth Waveform from Phase Comparator

- 89 This sawtooth signal is applied to the sample and hold circuit comprising MOS FET Q02 and capacitor C13 (Figure 5A.1.5).
- 90 When the main loop reset signal, at pin A9, is active (see paragraph 70), sampling transistor Q02 conducts causing hold capacitor C13 to charge to the instantaneous value of the sawtooth voltage. When the reset signal returns to logic '0' Q02 is cut off and the voltage across C13 is stored.
- 91 The voltage across capacitor C13 is applied to the temperature compensated amplifier comprising transistor Q03 (Figure 5A.1.7) and transistors Q07, Q08, Q09 and the associated circuits of module Z03. The voltage at the common emitters of Q08 and Q09 is filtered by capacitors C04, C05, C06, C07 and resistors R10, R11, R12 to suppress the 25 kHz component.
- 92 The output voltage S at pin 10 of Z03 is the feedback error signal for the VCO. When the VCO is locked to the correct frequency the charge across capacitor C13, and therefore the error signal, remains constant and the VCO frequency remains constant.

93 Derivation of the feedback control error signal is shown in Figure 10 below:

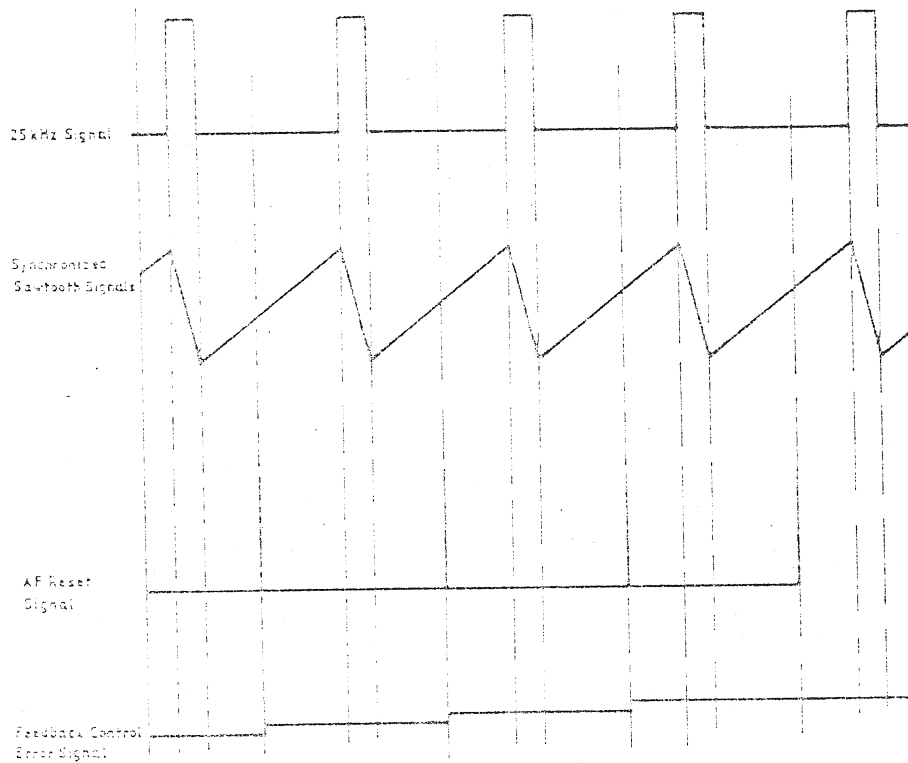


Fig. 10 Derivation of Feedback Control Error Signal

SUB-BAND CONTROL DEVICE (FIGURE 5A.1.15)

- 94 The subband control device prepositions the VCO in one of two sub-bands.
 - a The first or low sub-band prepositions the VCO when the frequency setting is in the band 2 MHz to 19,9 MHz.
 - b The second or high sub-band pre-positions the VCO when the frequency setting is in the band 20 MHz to 29,9 MHz.

95 The principle of sub-band control generation is shown in Figure 11 below.

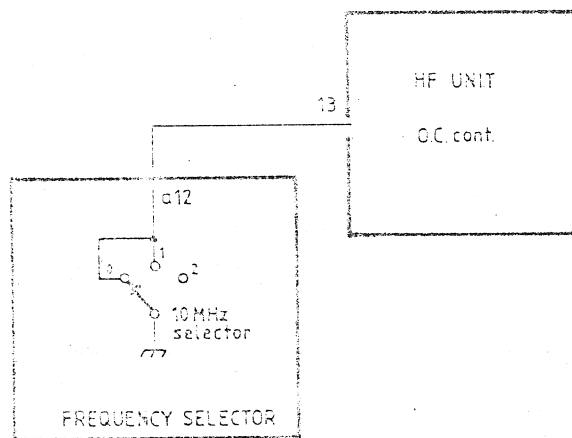


Fig. 11 Generation of SSB-band Control

- 96 When the 10 MHz selector switch is in position 0 or 1, a logic level '0' appears at pin 13 of the HF Unit, enabling the VCO to be pre-positioned in the low sub-band.
- 97 When the 10 MHz selector switch is in position 2, a logic level '1' appears at pin 13 of the HF Unit, enabling the VCO to be pre-positioned in the high sub-band. Control is effected by changing the V_{in} level of the VCO varicap diode.

OPERATION OF THE SECONDARY LOOP

- 98 The operation of the secondary loop is described in six discrete circuits. A list of each circuit and its function follows and is succeeded by a detailed description of each of these circuits:
- a Secondary loop voltage controlled oscillator (VCO').
 - b VCO output amplifier.
 - c Secondary loop mixer - mixes secondary loop VCO' output with 100 MHz reference signal.
 - d Variable preset divider - generates a division 'rank' depending on the setting of the 100 kHz, 10 kHz, 1 kHz frequency selector switches, in order to obtain a signal frequency of 1 kHz.
 - e Frequency discriminator - generates an 'alignment' (search) signal resulting from the frequency difference between a reference signal and a signal from the variable preset divider. This signal gives a course control of VCO' frequency.
 - f Phase comparator - generates a feedback control signal resulting from the comparison between the reference signal and the signal from the variable preset divider. This signal gives a fine control of VCO' frequency.

VOLTAGE CONTROLLED OSCILLATOR (VCO') (FIGURE 5A.1.2)

- 99 The secondary loop VCO' is located on Synthesiser Board No. 1. It comprises transistor Q07 connected in a common base configuration and its associated circuits. Varicap diode CR02 is controlled by the feedback error signal derived from the phase comparator.
- 100 Varicap diode CR01 is controlled by the alignment (search) voltage which is derived from the frequency discriminator and D/A converter. Capacitor C23 provides dc. blocking between the two varicaps and capacitor C33 provides dc. blocking between the varicaps and transistor Q07.
- 101 The VCO' generates a signal varying in frequency between 100,5 MHz to 100,699 MHz depending on the setting of the 100 kHz, 10 kHz and 1 kHz frequency selector switches. This signal appears at the emitter of transistor Q07 and is coupled by resistor R35 and capacitor C24 to the emitter of amplifier Q06.

VCO' OUTPUT AMPLIFIER (FIGURE 5A.1.2)

- 102 This amplifier is located on Synthesiser Board No. 1 and comprises transistor Q06 and the associated circuits. The tuned circuit, L02, C31, in the collector circuit of Q06 is tuned to produce frequencies in the band 100,5 MHz to 100,699 MHz at the output, depending on the setting of the 100 kHz, 10 kHz and 1 kHz frequency selector switches.

103 Two outputs are supplied from the amplifier:-

- a via R44 to pin 16 of main loop mixer module Z05
- b via pin A6 of Synthesiser Board No. 1 as the secondary loop heterodyne frequency.

SECONDARY LOOP MIXER (FIGURE 5A.1.9)

104 The secondary loop mixer is located on Synthesiser Board No. 3 and comprises the ring modulator mixer, consisting of transformers T02, T03 and diodes CR01 to CR04, and the buffer amplifier Q01.

105 The heterodyne frequency from the VCO amplifier, varying in frequency between 100,5 MHz and 100,808 MHz, is applied via pin A11 of the p.c.b. to the primary winding of transformer T03. A fixed 100 MHz signal from 100 MHz amplifier module Z03 is applied to the primary winding of transformer T02.

106 The resulting frequency from the mixer varies from 699 Hz to 500 kHz and is taken from the centre-tap of the secondary winding of transformer. Q06 is a buffer amplifier which matches the output of the mixer with the variable preset divider via pin B10 of the p.c.b.

VARIABLE PRESET DIVIDER (FIGURE 5A.1.15)

107 The variable preset divider is located on the frequency Selector Board and comprises the following modules:-

- a Module Z01 - hex-inverter buffers
- b Module Z02 - divide by N counter
- c Module Z03 - dual 4 input NOR gates
- d Module Z04 - divide by N counter
- e Module Z05 - gates 1 and 2 of quad 2 input NOR gates
- f module Z06 - divide by N counter.

108 The secondary loop heterodyne frequency, varying from 500 kHz to 699 kHz, depending on the setting of the 100 kHz, 10 kHz and 1 kHz frequency selection switches, is derived from the secondary loop mixer and applied to pin A4 of the p.c.b.

109 Transistors Q01 and Q02 are connected in parallel to form a buffer stage for the heterodyne signal. The collector outputs are the clock signal for the divide by N counter, module Z02. Counters Z04 and Z06 are identical to Z02 and a description of the module follows.

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110 A schematic diagram of the divide by N counter is given below in Figure 12.

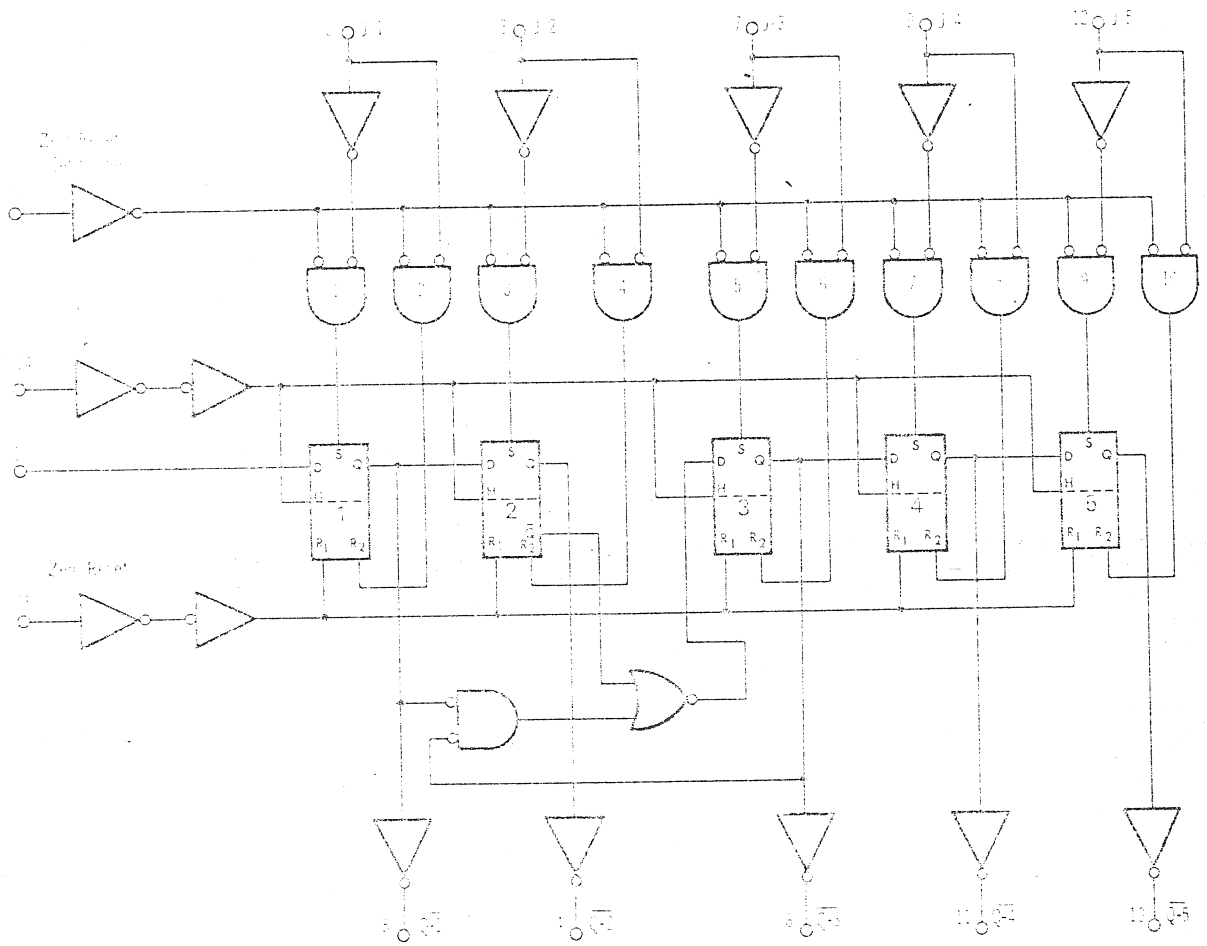


Fig. 12

Schematic Diagram of Divide by N Counter

111 For normal operation the counter counts to a maximum of 5 but when the Q5 output at pin 13 is connected to the set input of flipflop No. 1 at pin 1, the counter is able to count to 10. When the preset enable input at pin 15 is active (logic '1') the data at the JAM inputs (pins 4, 3, 7, 9 and 12) are enabled and preset the counter. The reset input at pin 15 is held permanently at logic '0' and has no function.

112 The variable preset divider is shown in schematic form in Figure 13 below:-

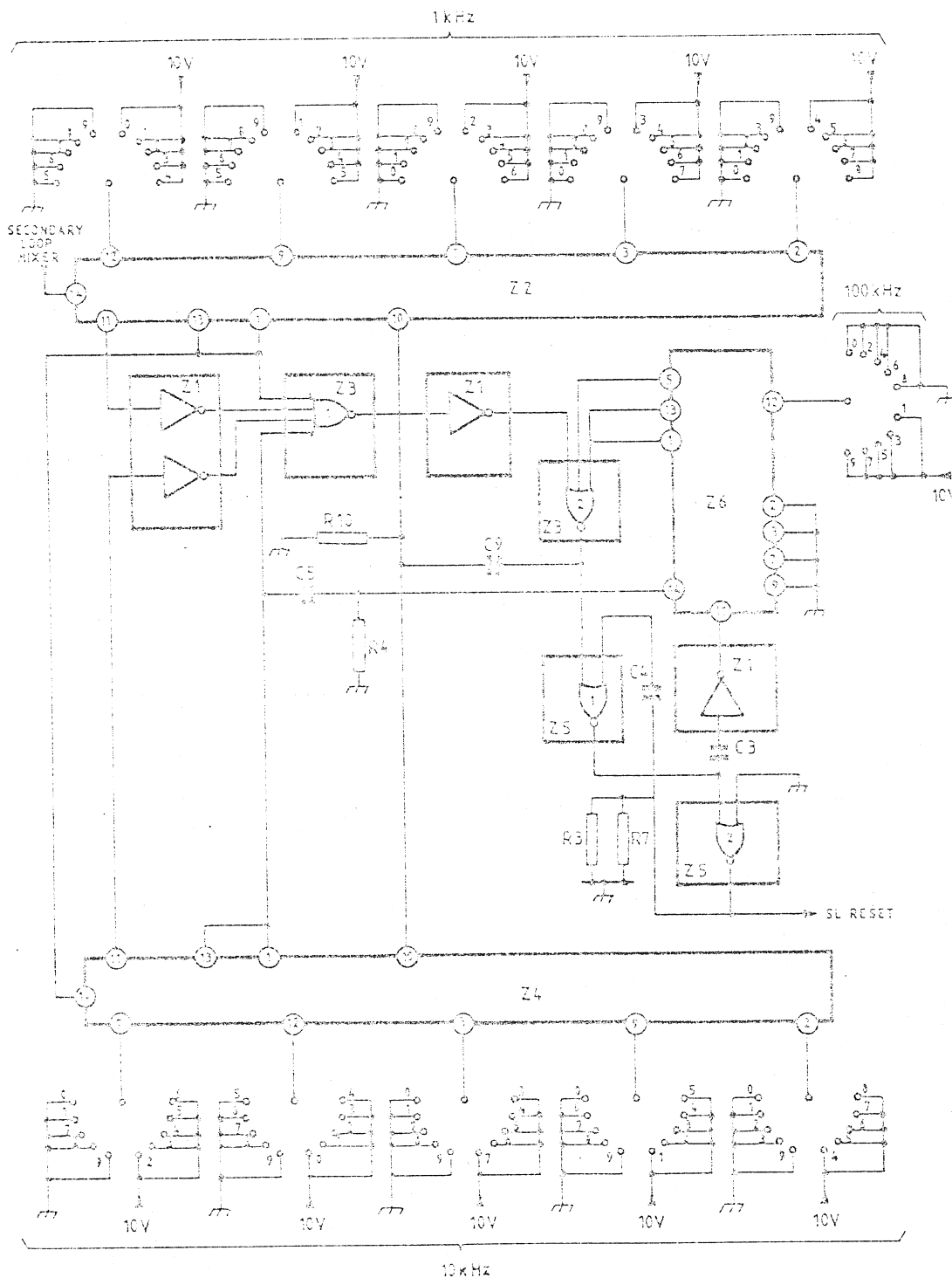


Fig. 13 Schematic Diagram of Variable Preset Divider

- 113 When module Z02 pin 10 goes to logic '0' the Q outputs of the flip-flops in the counter are set to a logic level defined by the setting of the 1 kHz frequency selector switch.
- 114 The Q5 output of Z02 at pin 13 clocks counter module Z04 at pin 14. The Q outputs of this counter are set to a logic level defined by the setting of the 10 kHz frequency selector switch when preset input at pin 10 is at logic '1'.
- 115 NOR gate 1 of module Z03 is fed with the following four outputs of modules Z02 and Z04.
- Z03 pin 2 - Q4 from Z02, inverted by Z01
 - Z03 pin 3 - Q5 from Z04
 - Z03 pin 4 - Q5 from Z02
 - Z03 pin 5 - Q4 from Z04, inverted by Z01.
- 116 When each of the above inputs to the NOR gate are at logic '0' the gate is enabled and a logic '1' appears at gate output pin 1. This enabling therefore depends on the setting of the 1 kHz and 10 kHz frequency selector switches. Examples of the extreme settings (1 kHz = 0, 10 kHz = 0 and 1 kHz = 1, 10 kHz = 1) are now shown.
- 117 Enabling of NOR gate 1 by the setting '0,0' is shown below in Figure 14.

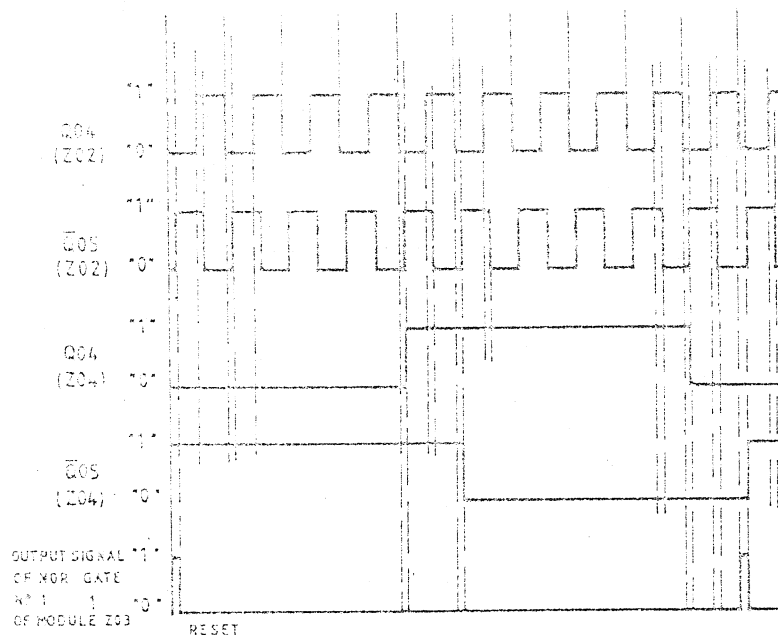


Fig. 14 Enabling Timing Diagram for Setting 10 kHz = 0, 1 kHz = 0

118 From Figure 14 it can be seen that NOR gate 1 of module Z03 is enabled:-

- Between the reset pulse and the first counting pulse.
- Between the 100th and the 101st counting pulse.
- Between the 200th and 201st counting pulse.
- Between the 300th and 301st counting pulse etc.

NOTE Change in the setting of the 1 kHz switch offsets the enabling pulse between the 1st and 10th clock pulses.

119 Enabling of NOR gate 1 by the setting '9.9' is shown below in Figure 15.

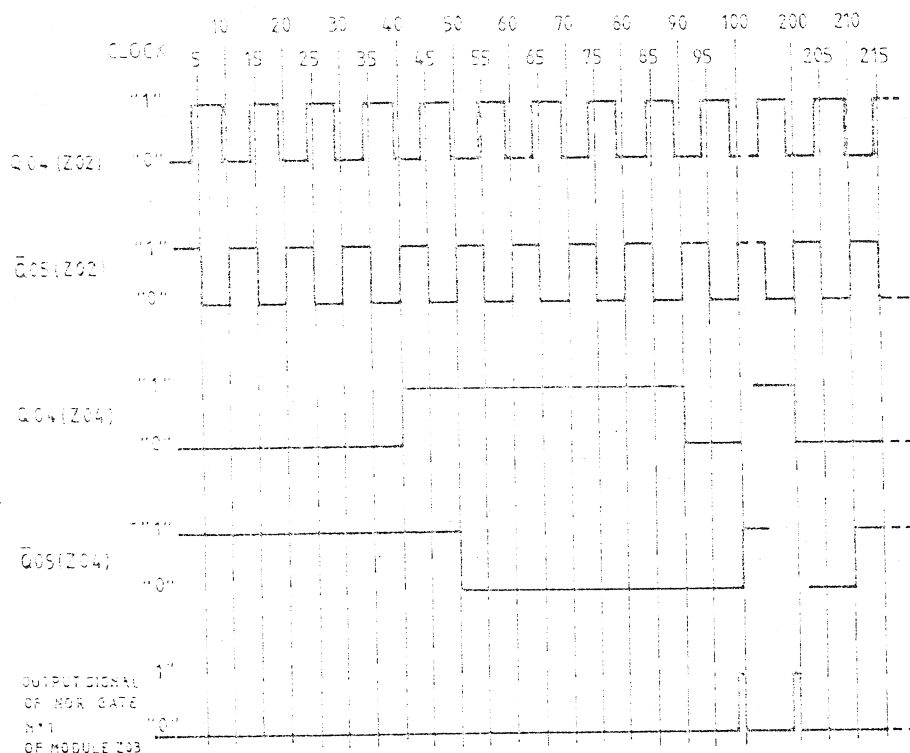


Fig. 15 Enabling Timing Diagram for Setting 10 kHz = 9, 1 kHz = 9

120 From Figure 15 it can be seen that NOR gate 1 of module Z03 is enabled:-

- Between the 99th and 100th counting pulses.
- Between the 199th and 200th counting pulses.
- Between the 299th and 300th counting pulses.

NOTE A change in the setting of the 10 kHz switch offsets the enabling pulse between the 10th and 100th clock pulses in 10 pulse steps.

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- 121 It should be remembered that the state of a flip-flop changes on the front edge of the clock pulse. The transit time between blocking and setting is negligible.
- 122 The logic '1' at Z03 pin 1 is inverted by Z01 and applied as a logic '0' to input pin 10 of NOR gate 2. Input pins 11 and 12 are derived from the Q1 and Q5 outputs respectively from counter module Z06. Input pin 9 of gate 2 is permanently enabled (logic '0').
- 123 On positions 0, 2, 4, 6 and 8 of the 100 kHz frequency selector switch, Q5 output is set to logic '0' when a logic '0' reset is present. On positions 1, 3, 5, 7 and 9 of the 100 kHz selector, Q5 output is forced to logic '1' when a logic '1' reset is present.
- 124 Figure 16 shows the waveform of the signals appearing at the Q1 (pin 5) and Q5 (pin 13) outputs of counter module Z06 for an even setting of the 100 kHz selector.

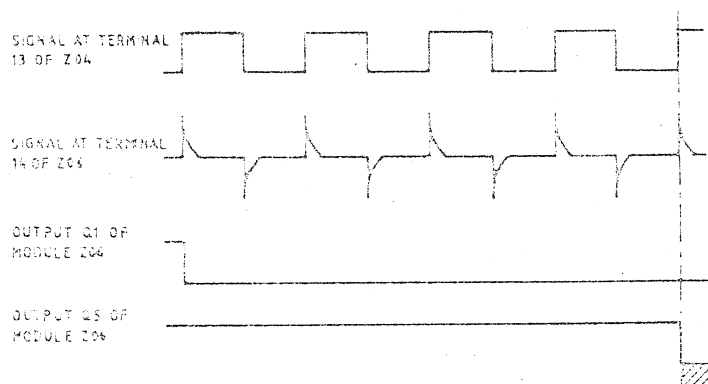


Fig. 16 Enabling with Even Setting of 100 kHz Selector

- 125 It can be seen from Figure 16 that NOR gate 2 of module Z03 is enabled (logic '0') between the 5th and 6th clock pulses.
- 126 Figure 17 shows the waveform of the signals appearing at the Q1 and Q5 outputs of Z06 for an odd setting of the 100 kHz selector.

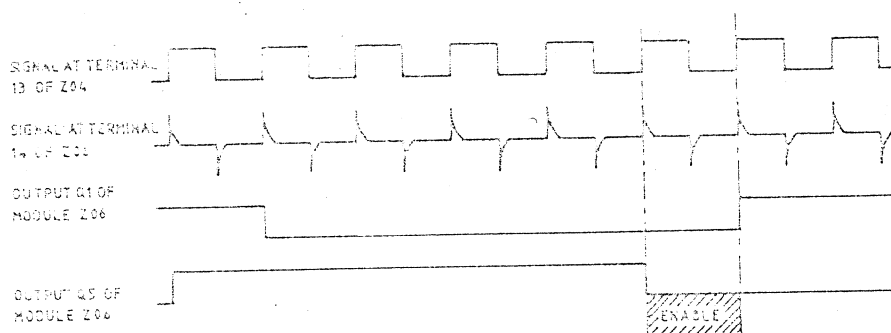


Fig. 17 Enabling with Odd Setting of 100 kHz Selector

- 127 It can be seen from Figure 17 that NOR gate 2 of module Z03 is enabled (logic '0') between the 6th and 7th clock pulses.
- 128 NOR gate 2 is fully enabled when all inputs are at logic '0'. This occurs after a number of pulses from the secondary loop mixer, this number being determined by the settings of the 100 kHz, 10 kHz and 1 kHz frequency selector switches.

129 The minimum number of pulses from the secondary loop mixer required to enable NOR gate 2 of Z03 is obtained with the following settings:-

- a 100 kHz setting - even
- b 10 kHz setting - 0
- c 1 kHz setting - 0

This condition is illustrated in Figure 18.

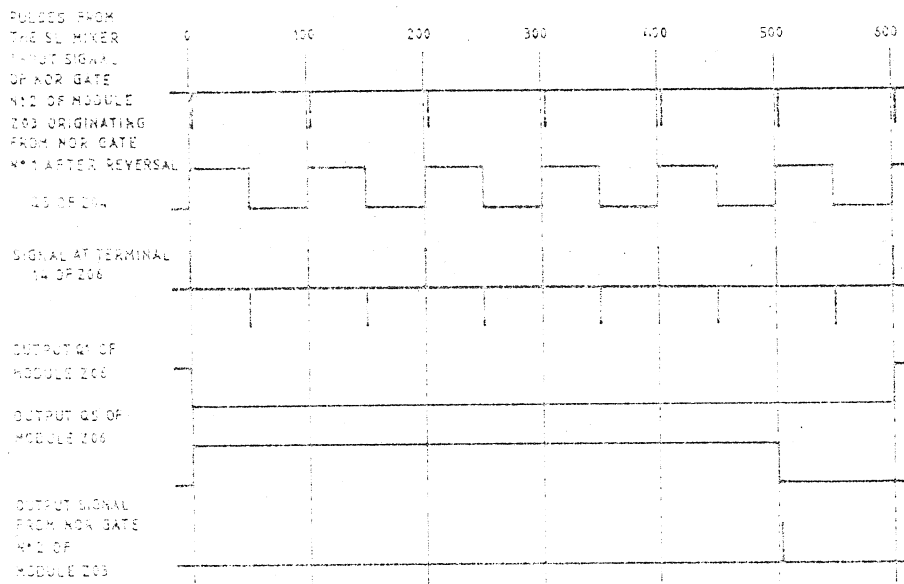


Fig. 18 Enabling with Setting of 100 kHz-even, 10 kHz-0, 1 kHz-0

130 In this case the output of gate 2 at pin 13 is logic '1' between the 500th and 501st pulses from the secondary loop mixer. This logic '1' is applied as follows:-

- a As the reset pulse at pin 10 modules Z02 and Z04.
- b As the triggering pulse of the monostable multivibrator consisting of NOR gates 1 and 2 of module Z05 and the time constant resistors R03, R07 and capacitor C04, which define the length of the secondary loop reset signal.

131 The reset pulse for Z03 is derived from the output of NOR gate 1 of module Z05 via inverter module Z01.

132 In the example given above in Figure 18 the variable preset divider carries out a division of 500.

133 The maximum number of pulses from the secondary loop mixer required to enable NOR gate 2 of module Z03 is obtained with the following settings:-

- a 100 kHz setting - odd
- b 10 kHz setting - 9
- c 1 kHz setting - 9

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134 The input at pin 10 of gate 2 of module Z03 is at logic '0' between the following pulses from the secondary loop mixer:-

- 99th and 100th
- 199th and 200th
- 299th and 300th
- 399th and 400th
- 499th and 500th
- 599th and 600th
- 699th and 700th

135 As the 100 kHz selector is set to an odd number position. The other two inputs of NOR gate 2 (pins 11 and 12) will be at logic '0' between the 600th and 700th pulses from the secondary loop mixer. The variable preset divider thus carries out a division by 699.

FREQUENCY DISCRIMINATOR AND D/A CONVERTER (FIGURE 5A.1.2)

136 The frequency discriminator and D/A converter are located on Synthesiser Board No. 1. It consists of two dual D type flip-flop modules Z01 and Z02.

137 A schematic diagram of the frequency discriminator and D/A converter are given in Figure 19 below:-

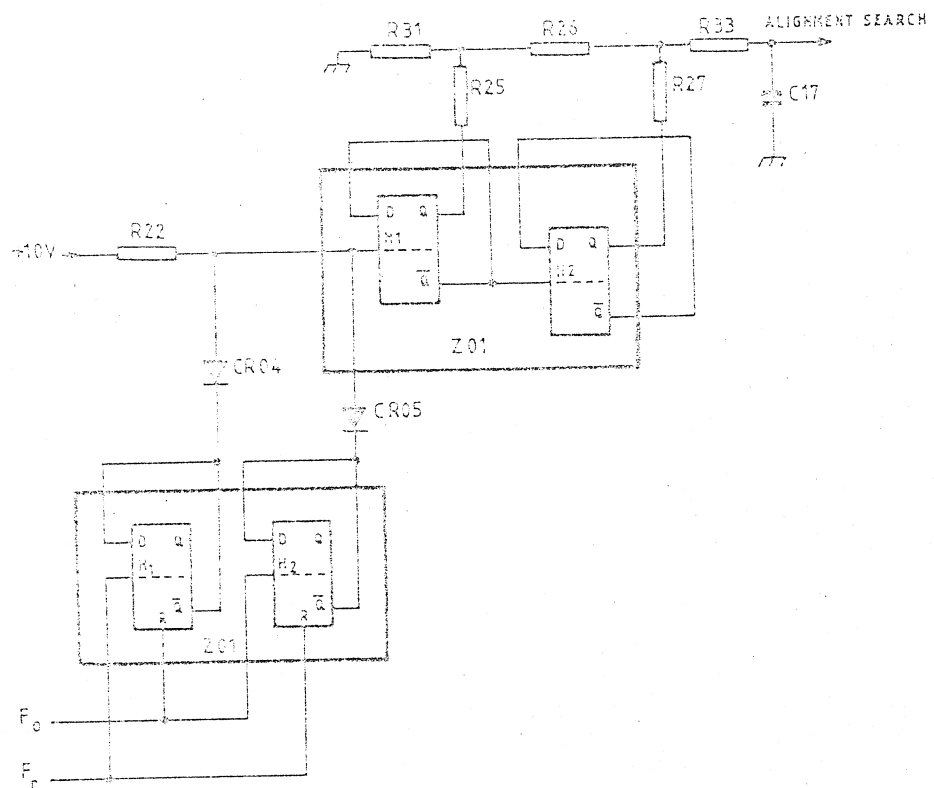


Fig. 19 Schematic Diagram of Frequency Discriminator and D/A Converter

- 138 The purpose of the frequency discriminator and D/A converter is to provide an alignment (search) voltage to coarse control of the frequency of the VCO'.
- 139 Reference signal Fr (1 kHz) from the divide by 25 circuit on Synthesiser Board No. 2 is the clock signal for flip-flop No. 1 and the reset signal for flip-flop No. 2 of module Z01. The output of the variable preset divider frequency Fo is the clock signal for flip-flop No. 2 and the reset signal for flip-flop No. 1 of module Z01.
- 140 If reference frequency Fr is higher than signal frequency Fo, the Q output of flip-flop No. 1 changes state on each clock pulse while the Q output of flip-flop No. 2 remains at logic level '1'.
- 141 When the Q output of flip-flop No. 1 is at logic '0' diode CR04 conducts and applies a logic '0' to the clock input of flip-flop No. 1 of module Z02. When the Q output of flip-flop No. 1 (Module Z01) is at logic '1' diode CR04 is cut-off and a logic '1' is applied to the clock input of flip-flop No. 2 of module Z02.
- 142 When the signal frequency Fo is higher than the reference frequency Fr the reverse situation to that described in paragraphs 140 and 141. That is, the Q output of flip-flop No. 2 of module Z01 changes state on each clock pulse while the Q output of flip-flop No. 1 remains at logic '1'. The Q logic levels of flip-flop No. 2 are passed to the clock input of flip-flop No. 1 in module Z02 by diode CR05.
- 143 If frequency Fo is equal to Fr the two flip-flops of module Z01 do not change state and both Q outputs remain at logic '0'.
- 144 The D/A converter consists of dual D type flip-flop module Z02 and the voltage divider comprising resistors R25, R26, R27 and R31.
- 145 In the absence of clock pulses applied to module Z02 (when Fo = Fr) the C outputs of both flip-flops are at logic '0' i.e. the alignment voltage is zero (1st step).
- 146 The front edge of the first clock pulse causes the state of flip-flop No. 1 (Module Z02) to change i.e. Q output = logic '1', Q output = logic '0'. This is an alignment voltage (2nd step) of 2,5 V.
- 147 The front edge of the second clock pulse causes the state of flip-flop No. 1 (Module Z02) to change thus causing the state of flip-flop No. 2 to change i.e. No. 2 Q output = logic '1', No. 1 Q output = logic '0'. This is an alignment voltage (3rd step) of +5V.
- 148 The front edge of the third clock pulse causes the state of flip-flop No.1 to change i.e. Q output changes to logic '1' and the Q output changes to logic '0'. This produces no change in the state of flip-flop No. 2. The alignment voltage (4th step) is 7,5 V.
- 149 The front edge of the fourth clock pulse causes the Q output of both flip-flops in module Z02 to be reset to logic '0'.

PHASE COMPARATOR (FIGURE 5A.1.2)

- 150 The phase comparator is located on Synthesiser Board No. 1 and consists of transistors Q01 and Q05 and the associated circuits. Its operation is the same as that described for the main loop phase discriminator in paragraphs 86-93.
- 151 A brief summary of its operation follows:-
- a Transistor Q01 is the 1 kHz reference signal amplifier.
 - b Transistors Q02 and Q03 and capacitor C05 comprise the sawtooth generator (integrator).
 - c Transistor Q04 is a FET used as a sampling circuit.
 - d Capacitor C05 is the storage (hold) capacitor.
 - e Transistor Q05 is an output buffer stage.
- 152 The output signal from the phase comparator is the feedback control error signal which produces fine control of the frequency of VCO'.

RECEIVING CHANNEL

- 153 Operation of the reception channel is described under the following headings:-
- a Receive Circuits in the HF Head.
 - b Receive Circuits in the Filter and 2,5 MHz IF Board.
 - c Receive Circuits in the AF Board.

RECEIVE CIRCUITS IN THE HF HEAD (FIGURE 5A.1.16)

- 154 The received signal from the 20 W amplifier is fed via pin C3 of connector J01 of the HF Head to the input protection circuit. This circuit provides protection against excessive dc. and ac. voltages as well as protection against image frequency interference.
- 155 DC. voltage protection is provided by coupling capacitor C10 and ac. voltage protection is provided by the clipping action of diodes CR104, CR105 and CR106 (+ve half cycles) and diodes CR101, CR102 and CR103 (-ve half cycles). The threshold voltage above which clipping takes place is defined by the zener diodes CR102 and CR106.
- 156 The image frequency (220 MHz approx) is rejected by the filter circuit L102 and C107. A high pass filter consisting of C102, C104 and inductor L101 eliminates signals below 2 MHz.
- 157 The output signal from the protection circuit is applied to a 2 MHz to 30 MHz bandpass filter located on the transmit/receive mixer board. The filter comprises inductors L301, L303, L305 and L306 and capacitors C301, C302, C304, C307 and C308.
- 158 Matching transformer T302/T303 (centre tapped) applies the signal to the gates of FET's Q303 to Q306 connected in a mixer configuration. The sources of each pair (Q303, Q304 and Q305, Q306) are connected to the secondary windings of mixer transformer T304, the primary winding of which is supplied with the variable heterodyne frequency (104,5 kHz to 132,5 MHz). The bias voltage of Q303 to Q306 is set by resistor R328.

- 160 The variable heterodyne frequency at J01 pin 9 is buffered by Q403 on the VCO board and switched to mixer transformer T304 when +6 V Rx is applied to the anode of diode CR301. The +6 V Rx voltage also forward biases diode CR107, thus enabling the Rx signal from the mixer, but also reverse biases diodes CR302, CR311 and CR312 thus disabling the transmission circuits.
- 161 After mixing of the received signal and the variable heterodyne signal a 102,5 MHz signal appears across the secondary winding of transformer T306. This signal is fed, via enabled diode CR307, to 102,5 MHz crystal filter FL01 and a pi-filter located on the IF, 2,5 MHz and 102,5 MHz Mixer Board. Diode CR201 is enabled by the +6 V Rx voltage. At the same time the transmission circuits are disabled by the reverse biasing of CR202.
- 161 The pi-filter comprises:—
- Fixed capacitor C212
 - Variable inductor L203
 - Variable capacitor C222
- 162 The 102,5 MHz output signal from the pi-filter is applied to the transistor amplifier comprising FET's Q202 and Q204. These transistors are controlled by the a.g.c. voltage applied to J01 pin 18, from the peripheral circuits and buffered by transistor Q201. The a.g.c. threshold level is set by resistor R214.
- 163 Diode CR204 is forward biased by +6 V Rx thereby allowing the 102,5 MHz signal to be applied to the primary winding of mixer transformer T201. The transmission circuits are disabled by the reverse bias on diode CR205 by +6 V Rx.
- 164 A fixed frequency signal of 100 MHz (during A2J Morse, A3H AM or A3J LSB modes) or 105 MHz (during A3J LSB mode) is applied to J01 pin C2 of the HF head. This signal is amplified by Q205 and applied to the centre tap of the second mixer transformer T202.
- 165 The mixer circuit is a conventional diode ring modulator comprising diodes CR206, CR207, CR2111, CR212 and transformers T201 and T202.
- 166 After the mixing process of the 102,5 MHz IF signal and the appropriate fixed heterodyne signal a signal at 2,5 MHz is developed across the secondary winding of transformer T202.
- 167 The 2,5 MHz signal is buffered by transistor Q206 and applied via matching transformer T203 and J01 pin 25 of the HF Head to the Filter and 2,5 MHz IF Board.

RECEIVE CIRCUITS IN THE FILTER AND 2,5 MHz IF BOARD (FIGURE 5A.1.17)

- 168 The 2,5 MHz signal at pin A3 of the Filter and 2,5 MHz IF Board, is applied to the input matching circuit consisting of transformer T01, capacitor C02 and resistor R05.
- 169 In the A2J (Morse), A3J (LSB or USB) mode of operation, the received signal is applied to the base of amplifier Q01 via diode CR02. This diode is enabled by the presence of -6 V Rx from board pin A4 at its cathode. This same voltage cuts off diode CR01 thereby inhibiting the transmission circuit.

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- 170 The signal at the collector of Q01 is filtered by SSB filter FL01 and applied to the matching circuit consisting of transformer T03 and transistors Q03 and Q04. The resulting signal is applied to the base of transistor Q07.
- 171 In the A3H (AM) mode of operation, the received signal is applied to the base of transistor Q02. Transistors Q02, Q05 and Q06 are enabled by -6 V Rx from board pin A13, which also inhibits transistors Q01, Q03 and Q04.
- 172 The signal at the collector of amplifier Q02 is filtered by FL02 and applied to the matching circuit consisting of transformer T04 and transistors Q05 and Q06. The output signal is applied to the base of transistor Q07.
- 173 The 2.5 MHz signal at the base of emitter follower Q07 is applied to the two stage amplifier consisting of operational amplifiers Z01 and Z02 and their associated circuits. The transmit circuits are inhibited by reverse biasing diode CR05 with -6 V Rx .
- 174 Amplifier Z01 is controlled by the a.g.c. voltage at board pin A16.
- 175 In the A2J (Morse) or A3J (LSB or USB) mode of operation the output from amplifier Z02 is applied to the demodulator circuit, consisting of Z03 and the associated circuits, together with the fixed 2.5 MHz heterodyne signal at board pin B18. The demodulated signal at Z03 pin 6 is fed to the AF board via diode CR04 and board pin A8. Diode CR04 is made to conduct due to the presence of -6 V at board pin A7.
- 176 In the A3H (AM) mode of operation the output from amplifier Z02 is applied to buffer amplifier Q12, Q13 and the associated circuits. The output from Q12, Q13 is rectified by detector diode CR07 and applied to the AF output via board pin A8 via diode CR04. This diode will be enabled by $+5\text{ V A3}$ at its anode. Diode CR04 will conversely be cut-off.
- 177 The output from Q12 and Q13 is also used to generate the a.g.c. voltage as described in paragraphs 240 to 248.

RECEIVE CIRCUITS IN THE AF BOARD (FIGURE 5A.1.18)

- 178 The AF signal from the Filter and 2.5 MHz IF Board is applied to pin B5 of the AF Board.
- 179 When in the A3H (AM) or A3J (LSB or USB) mode of operation the AF signal is fed via CR11 to the input of operational amplifier Z03. CR11 is caused to conduct by the $+10\text{ V}$ applied to the anode and the $+5\text{ V}$ applied to the cathode.
- 180 On reception of a signal in the A2J (Morse) mode the a.f. signal is fed through a filter network consisting of C13, R31, R33, R34 and transistors Q07, Q12 and their associated circuits. The filtered signal is then coupled via C33 to amplifier Z03. Transistors Q07 and Q12 are enabled by the $+5\text{ V A2J}$ at p.c.b pin B10. The gain of Z03 is preset by potentiometer R38.
- 181 The output from Z03 is fed via pin A5. The front panel volume control and pin B19 to the operational amplifier Z02. This signal is enabled by FET Q24 in the absence of the Local Monitoring Control signal or the squelch input.
- 182 The output signal from Z02 is applied to the local headset via p.c.b. pin B16 and to the headset of the remote station via the remote control amplifier Q03 and through Q08. FET Q08 is switched on by the presence of $+6\text{ V Rx}$ from p.c.b. pin B3.

TRANSMISSION CHANNEL

- 183 Operation of the transmission channel is described under the following headings:—
- a Transmission Circuits in the Exciter Board and the Filter and 2,5 MHz IF Board.
 - b Transmission Circuits in the HF Head.
 - c Power Circuits.

TRANSMISSION CIRCUITS IN THE EXCITER BOARD AND THE FILTER AND 2,5 MHz IF BOARD (FIGURES 5A.1.17 & 5A.1.19)

- 184 In the A3H (AM) or A3J (LSB or USB) modes of operation the signal from the local microphone at p.c.b. pin A13, or at pin A14 from the remote transceiver, is applied to a filter network consisting of resistor R32 and capacitor C21 through FET Q01. Q01 conducts when +6 V Tx is present.
- 185 In the A2J (Morse) mode a 1 kHz signal from the synthesiser is applied to buffer amplifier Q08. The signal at the emitter of Q08 is applied to FET Q02 which conducts in the presence of the A2J control signal. This signal also modulates the 1 kHz tone at the keying rate. FET Q01 is held out off by -6 V A2J.

NOTE In any mode of operation the signal applied to the filter network is also applied to the local earphone via p.c.b. pin B14 and the operational amplifier Z02 on the AF Board.

- 186 The output signal from the filter network is applied via C24 to the input of amplifier Z02. The offset level of the input is preset by potentiometer R57. The output from Z02 is fed to modulator Z03 pin 1. Also fed to the modulator on pin 8 is the 2,5 MHz fixed heterodyne frequency from the synthesiser.
- 187 A variable attenuator, consisting of resistor R36 and the drain/source resistance of FET Q11, controls the input signal to Z02. This is achieved by applying a dc. control voltage to the gate of Q11 which in turn controls the drain source resistance.
- 188 A modulated 2,5 MHz IF signal from the modulator at pin 9 is applied to amplifier Q14 and Q15. The output signal from the amplifier is rectified by diodes CR12 and CR13. The dc. output being amplified by Q06 and Q05.
- 189 This dc. control voltage, which is proportional to the 2,5 MHz output from the modulator, drives the gate to FET Q11 hence controlling the AF input signal and therefore the modulation level to modulator Z03.
- 190 The suppressed carrier modulated signal, from pin 6 of modulator Z03, is fed via diode CR24 to pin A5 of the Exciter Board and thence to the filter and 2,5 MHz IF Board via pin A5.

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- 191 With +6 V Tx present, diode CR01 conducts and the transmission signal is fed to the base of transistor Q01. As in the case for reception, transistors Q01, Q03, Q04, Q07, SSB filter FLC1 and the associated circuits are used as a 2,5 MHz IF amplifier.
- 192 The output signal from buffer amplifier Q07 is switched to pin A14 of the Filter and 2,5 MHz IF Board, through diode CR05 which is caused to conduct by the presence of +6 V Tx.
- 193 The carrier suppressed transmission signal is applied directly to input pin A2 of the Exciter Board, and thence to operational amplifier Z01 via diode CR11, which conducts due to the presence of +6 V Tx at the anode.
- 194 When operating in the A3H (AM) mode the carrier has to be re-inserted, the circuit description of this process is now described.
- 195 The 2,5 MHz fixed heterodyne signal from the synthesiser is applied to the buffer amplifier comprising transistors Q12 and Q13 via p.c.b. pin A19 and switching diode CR16, made to conduct by the presence of +5 V A3 at pin B17. The 2,5 MHz signal at the collector of Q12 (gain controlled by R44) is applied to input terminals 5 and 6 of operational amplifier Z01, superimposing it on the signal appearing at pin A2, as described earlier.
- 196 The gain of Z01 is adjusted by the compressor control voltage at pin B7, described later in the section on Ancillary Circuits.
- 197 The transmission signal from Z01 is applied to HF Head via p.c.b. pin B6.

TRANSMISSION CIRCUITS IN THE HF HEAD (FIGURE 5A.1.20)

- 198 The 2,5 MHz signal from the Exciter Board is applied to buffer amplifier Q207, on the IF and 2,5 MHz and 102,5 MHz Mixer Board, through pin 27 of connector J01 in the HF Head.
- 199 The 2,5 MHz signal in the secondary winding of matching transformer T204 is applied to input terminals E1 and E2 of mixer transformer T202 located in the 102,5 MHz mixer.
- 200 A fixed heterodyne signal of 100 MHz (Morse, AM and USB modes) or 105 MHz (LSB mode), derived from the synthesiser is applied to the base of transistor amplifier Q205 through pin C2 of connector J01 on the HF Head. The output signal from this amplifier is applied to point R9, the centre tap of mixer transformer T202.
- 201 This mixer is also described in the section on receive circuits in the HF Head, paragraph 165.
- 202 After mixing the 102,5 MHz transmission signal in the secondary winding of transformer T201 is switched via diode CR205 to the base of amplifier Q203. CR205 conducts due to the presence of -6 V Tx. At the same time the reception circuits are inhibited because diode CR204 is reverse biased.
- 203 The gain of Q203 and hence the gain of the transmission channel, is adjusted by R231. The output signal is filtered by the 102,5 MHz bandpass filter consisting of C223, L204 and C217, suppressing unwanted spurious signals.
- 204 Diodes CR201 and CR202, switched on by the presence of -6V Tx, allow the 102,5 MHz signal through crystal sideband filter FLC1 to the Transmit/Receive Mixer Board. The presence of -6V Tx enables diodes CR311 and C312 which allows the transmission signal through to terminal E2 of mixer transformer T307.

- 205 A variable heterodyne frequency (104,5 MHz to 131,999 MHz), the value of which is dependent on the setting of the 10 MHz, 1 MHz, 100 kHz, 10 kHz and 1 kHz frequency selector switches, is derived from the synthesiser via pin 9 of connector J01 on the HF Head. It is amplified by transistor Q403, on the VCO Board, and switched to the centre tap of mixer-transformer T307 by diode CR302. This diode is enabled by the presence of -6 V Rx.
- 206 The mixer consisting of transformers T305, T306, diodes CR303, CR304, CR305 and CR306 resistors R322, R323, R324 and R325, capacitors C343, C345, C346 and C347, is a conventional ring modulator circuit.
- 207 A modulated transmission signal, the frequency of which varies between 2 to 29,999 MHz depending on frequency selector switch settings, appears in the secondary winding of transformer T305. A low pass filter (2 to 29,999 MHz) consisting of inductors L311, L312, L313, L314 and capacitors C331, C332, C335, C336 and C337 suppresses all frequencies above 30 MHz.
- 208 The output from the filter network is applied to the input of the 20 W amplifier via push-pull amplifier Q301 and C302, and pin 23 of connector J01 on the HF Head.

TRANSMISSION CIRCUITS IN THE 20 WATT AMPLIFIER (FIGURE 5A.1.21)

- 209 The 1 mW PEP transmission signal from the HF Head is applied to a phase splitting amplifier through pin 17 of connector J102 on the 20 W amplifier.
- 210 Inductor L08 matches the signal to the phase splitting amplifier which consists of complementary transistors Q03, Q04 and the associated circuits. The amplifier is class A biased, negative feedback being provided by resistors in the emitter circuit of each transistor. (R14, R16, R18 for Q03 and R15, R17, R19 for Q04). Inductors L01 and L03 are RF chokes.
- 211 The collector load for the amplifier consists of capacitors C06, C11 and transformer T01. Capacitors C04 and C05 provide HF negative feedback. The signal in the secondary winding of T01 is applied in anti-phase to the bases of push-pull transistors Q07 and Q11 via matching resistor networks R33, R34 and R35, R36. This amplifier is biased to class AB.
- 212 The base bias voltage is delivered by balancing transformer T02, HF being decoupled to ground through C13.
- 213 Transmission line transformer T04, matched by balancing transformer T05, comprises the collector load of transistors Q07 and Q11. The collector dc. supply of these transistors is derived from transformer T03, as is the collector base negative feedback through R41 for Q07 and R44 for Q11.
- 214 The output signal from the secondary winding of transformer T04 is applied to the bases of transistors Q16 and Q17 which constitute a class AB push-pull amplifier. Base bias for the amplifier is derived from transformer T05, capacitors C27 and C31 providing HF decoupling.
- 215 DC. power for the collectors of Q16 and Q17 is derived from transformer T06, as is the collector base negative feedback through R34 for Q16 and R35 for Q17.
- 216 Another transmission line transformer T07 provides the collector load for these transistors. The output from T07 is applied to the transmit/receive channel selector through the coupler (both these circuits are described later under Ancillary Circuits). The signal from the coupler is used to provide power regulation and amplifier protection.

- 217 The transmission signal, at 20 W PEP, from the channel selector is applied to the antenna (or 50 Ohm connector) via the Antenna Tuning Unit, described under Ancillary Circuits.

ANCILLARY CIRCUITS

- 218 Operation of the Ancillary Circuits, which are common to both the reception and transmission channels are described under the following headings:--
- a Transmit/Receive Switching Circuit.
 - b Transmit/Receive Generating Circuit.
 - c Transmit/Receive Channel Selector Circuits.
 - d Antenna Tuning Unit.
 - e AGC Voltage Generating Circuits (Rx Only).
 - f Compressor Control Generating Circuits (Tx Only).
 - g DC. Voltage Generating Circuits (Tx Only).
 - h Variable Inductor Control Circuits (used during Antenna Tuning Only).
 - i Mode Selection Circuits.
 - k Converter and Ancillary dc. Voltage Generating Circuits.
 - l Transmission Control and Battery Charge Control Inhibition Circuit.
 - m Remote Control Circuits.
 - n Charger Circuit (independent of transmit or receive condition).

TRANSMIT/RECEIVE SWITCHING CIRCUIT (FIGURE 5A.1.20)

- 219 This circuit generates the transmit/receive control voltages which select the transmit circuits and inhibit the receive circuits (+3 V transmit) during transmission, and select the receive circuits and inhibit the transmit circuit (+6 V receive) during reception. The selected voltage is fed to p.c.b. pin B8 of the AF Board.
- 220 During reception diodes CR13 and CR07 are cut off by the presence of +6 V at p.c.b. pin A13 and the +6 V appears at p.c.b. pin B8.
- 221 During reception +3 V appears at p.c.b. pin B8 under one of two conditions.
- a When the microphone pressel switch is pressed 0V is applied to diode CR13 causing it to conduct and supply the +3 V.
 - b The signal from the comparator Z01 (0V) is applied to diode CR13 causing it to cut off during remote transmit operation. This again produces +3 V at p.c.b. pin B8.
- 222 The transmit/receive changeover at p.c.b. pin B8 is delayed with respect to the input from the pressel switch. The delay period is defined by the time constant R93, R97 and C47. The delay is necessary when operating in the A2J (Morse) mode.

TRANSMIT/RECEIVE VOLTAGE GENERATING CIRCUIT

- 223 These circuits are mounted on the Peripheral Circuits Board and the various voltages originate from the switching circuits described previously in paragraphs 219 to 222.
- 224 The +6 V Tx and -6 V Rx signals at pin B7 are generated from the transistor network consisting of Q01, Q02, Q03, Q04, Q05 and Q08. When the transceiver is in the receive condition the control signal at pin B12 is at +6 V. As a result transistor Q02 conducts (Q08, Q01 cut-off) and +6 V through R05 switches Q05 on. This applies -6 V at B11 through Q05 to B7.
- 225 In the transmit mode the changeover signal is at 0V which switches transistors Q08 and Q01 on. Transistor Q02 is cut-off and Q03 switched on. This causes -6 V to be applied to Q04 base via resistor R04. Q04 switches on and applied +6 V to B7.
- 226 The +3 V Tx at pin A7 and the +6 V Rx at pin B9 are produced by the switching network consisting of transistors Q12, Q13, Q14 and Q16. The network is controlled by the collector voltage by Q04, Q05.
- 227 When in the receive mode -6 V is applied through resistor R11 to the base of transistor Q12 causing Q12 and Q13 to switch on, the latter applying +6 V Rx to pin B9. At the same time diode CR01 is reversed biased, ensuring transistor Q14 remains cut-off.
- 228 When in the transmit mode +6 V is applied through diode CR01 and resistor R12 to the base of Q14 which conducts. 0V is applied through Q14 to pin B9 and through R22 to the base of Q13, which conducts and applies +6 V to pin A7.
- 229 A third switching network, comprising transistors Q23, Q24, Q25 and Q26, generates the +10 V Rx applied to pin B8 and the +10 V Tx applied to pin A5. Control of the network is by the collector voltage of transistors Q13 and Q14. In the receive mode +6 V at the collector of Q14 switches on Q23 which in turn switches on Q24 which applies +10 V from pin A6, through Q24 to pin B8.
- 230 In the transmit mode, 0V at Q23 base causes Q23 and Q24 to be switched off thus removing +10 V from pin B8. At the same time +6 V Tx at the collector of transistor Q05 causes Q25 and Q26 to switch on and apply +10 V from pin A6 through Q26 to pin A5.
- 231 The fourth switching network, comprising transistors Q06, Q07, Q11, Q15, Q17, Q21 and Q22, enable the following circuits depending whether +6 V Rx or -6 V Tx is applied to pin B13:—
- a +3 V Rx at pin A9.
 - b -6 V Tx at pin B10.
- Both these voltages are used in the 20 W amplifier.

TRANSMIT/RECEIVE CHANNEL SELECTOR CIRCUITS (FIGURE 5A.1.21)

- 232 The channel selector comprises the following components located in the 20 W amplifier.
- a Inductors L9, L12, L13 and L14.
 - b Capacitors C45, C47, C51, C52 and C54.
 - c Diodes CR07, CR08 and CR11.
 - d Resistor R38.

- 233 As soon as the transceiver is switched on +3 V (TR) is applied to the selector through pin 23 of connector J102. (+3 V (TR) is derived from the converter as described in paragraphs 277.
- 234 The antenna signal is fed through the Antenna Tuning Unit, connector J105, C52 and diode CR07 to the HF Head. CR07 is forward biased by 0V at its cathode from pin 25 of connector J102.
- 235 During transmission diode CR11 is forward biased by +3 V at pin 24 of connector J102, thus allowing the transmission signal from the 20 W amplifier through to the antenna via the Antenna Tuning Unit.
- 236 The +3 V is also fed to diode CR08, via R88 and L9. The diode is forward biased and shorts the receive input to the HF Head to earth.

ANTENNA TUNING UNIT (FIGURE 5A.1.22)

- 237 The following circuits in the Antenna Tuning Unit are common to both transmit and receive modes of operation:—
- a A harmonic filter comprising inductors L202 and L203, and capacitors C201 through C205.
 - b Coupler T301 (included in the transmission control inhibiting circuit).
 - c Coupler T101 (included in the feedback control of variable inductor L201).
 - d Variable inductor L201.
 - e Antenna Selector Switch.
- 238 A full description of the operation of the Antenna Tuning Unit is given in paragraphs 264 to 274.

AGC VOLTAGE GENERATING CIRCUITS (FIGURE 5A.1.17)

- 239 During reception in all modes an automatic gain control (AGC) voltage is generated on the Filter and 2,5 MHz IF Circuit Board and the Peripheral Circuits Board. The circuit is shown in simplified form on Figure 20.

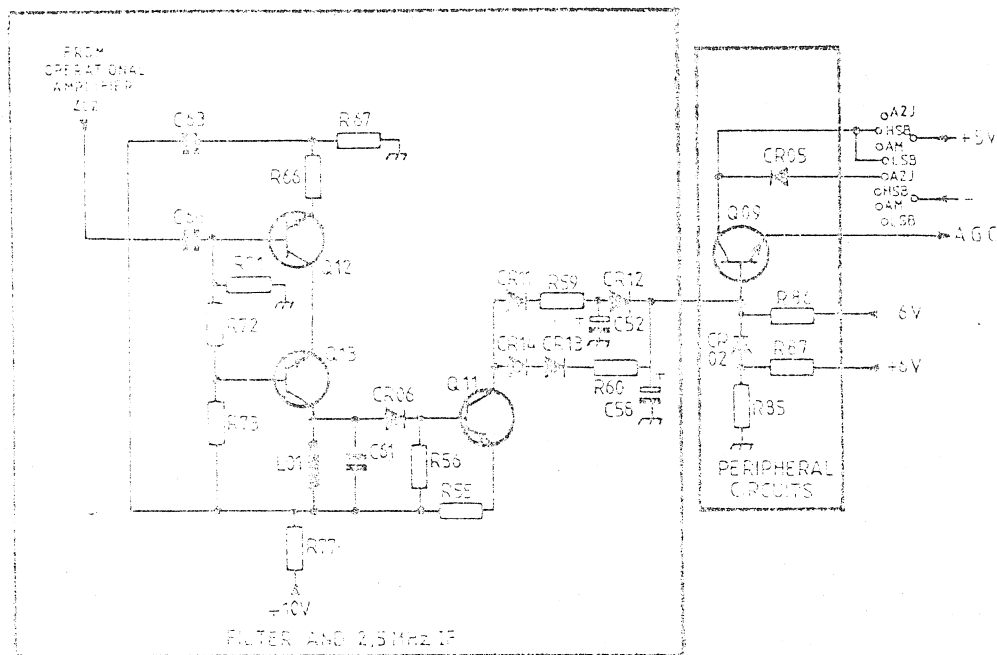


Fig. 20 AGC Voltage Generating Circuit

- 240 The received signal from operational amplifier Z02 on the Filter and 2,5 MHz IF Board is applied to the bases of buffer amplifier Q12 and Q13. The output at the collector of Q13 is detected by CR06 the resulting negative voltage being applied to the base of dc. amplifier Q11.
- 241 A dc. voltage proportional to the level of the received signal is applied to two time constant dc. circuits. One is a short time constant which reacts to transients such as interference signals, and the other is a long time constant that reacts to slow fades.
- 242 On reception of a steady state signal the time constant is determined by resistor R59 and capacitor C52. Diodes CR11 and CR12 conduct and the voltage across capacitors C52 is applied almost fully across capacitor C58.
- 243 When a transient (high level) signal is received the time constant is determined by resistor R88 and capacitor C53. When the threshold level of diodes CR13 and CR14 are reached the voltage across C58 rises above its original value.
- 244 Because the voltage across C58 is now higher than the voltage across C52, diode CR12 is reverse biased inhibiting the long time constant circuit.
- 245 A dc. voltage proportional to the received signal (steady state or transient) is applied to the base of transistor Q09 on the Peripheral Circuits Board. Operation of this transistor depends on the mode of operation.
- 246 When in the A2J (Morse) or A3J (LSB or USB) modes Q09 is used in the common collector configuration and the collector powered from +5 V. An AGC voltage is then generated at the emitter at low impedance.
- 247 In the A3H (AM) mode the collector of Q09 is not powered and the base-emitter junction is used as a diode. The bias level is set by the voltage divider consisting of resistors R85 and R87. When this bias level is reached by the AGC input voltage the AGC output is delivered at the emitter of Q09.

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- 248 In all modes of operation the AGC voltage is applied to:—
- a The base of amplifier Q201 on the IF and 2,5 MHz and 102,5 MHz Mixer Board in the HF Head (Figures 5A.1.14). The threshold level of AGC operation can be controlled by the potentiometer R214 in the emitter of Q201.
 - b The operational amplifiers Z01 and Z02 located on the Filter and 2,5 MHz IF Board.

COMPRESSOR CONTROL GENERATOR CIRCUITS

- 249 The compressor control signal is generated by three different circuits:
- a A protection circuit connected to the power amplifier, located in the 20 W Amplifier.
 - b A circuit which is controlled by the output from the coupler in the 20 W Amplifier and a power reference.
 - c A circuit which is controlled by the output current of the stabilised power supply in the 20 W Amplifier, and a current reference.

PROTECTION CIRCUIT (FIGURE 5A.1.21)

- 250
- a The transmission signal from the collector of power transistor Q16 is detected by CR13 and applied to the base of transistor Q10. The output signal from the amplifier is applied to OR gate diode CR14, the other components of the OR gate originating from the other compressor control circuits.
 - b The compressor control signal appears at pin 01 of connector J102 on the 20 W Amplifier.

COUPLER CONTROLLED CIRCUIT (FIGURE 5A.1.21)

- 251 a Coupler T11 and T12 located in the 20 W Amplifier supplies two voltages:—
- i V_D — proportional to direct power
 - ii V_R — proportional to reflected power
- b The V_R is rectified by CR06, filtered by R92, C44, and applied to pin 26 of connector J102. V_D is applied to pin 27 of connector J102 via a similar circuit consisting of CR12, R94, C46.
- c The two voltages are summed in the summing circuit consisting of resistors R41, R44 and R46 on the Peripheral Circuits Board.
- d The summed signal is applied to pin 3 of operational amplifier Z01. The gain of Z01 is determined by the ratio of resistors R45 and R53.
- e The output of Z01 is applied to two different circuits:—
- i V_D, V_R peak signal.
 - ii V_D, V_R mean signal.
- f V_D, V_R peak signal is applied to pin 3 of comparator Z03 and a power reference signal is applied to pin 2. This reference signal is derived from a voltage divider connected across the output of the stabilised power supply in the 20 W Amplifier.
- i When the power selector switch is in the HIGH position the voltage divider consists of R56, R57 (variable) and R62.
 - ii When the power selector switch is in the LOW position the voltage divider consists of R56, R57, R62, CR11 and R91 (grounded through pin A13).
- g The output of comparator Z03 is the compressor control signal and is fed to pin A18 via OR gate diode CR03.
- h A fraction of the output voltage, taken from the junction of R92, R93 and varying with the V_D, V_R mean value, is applied to input pin 2 of operational amplifier Z04. This input also receives a voltage through OR gate diode CR12 from comparator Z02. Pin 2 of Z04 receives a fixed reference voltage generated by a voltage divider connected across the output of the stabilised power supply in the 20 W Amplifier
- i Operational amplifier Z04 and its associated circuits operate as an integrator comparator. The output from this circuit is the compressor control signal applied to pin A18 via OR gate diode CR04.

OUTPUT CURRENT CONTROLLED CIRCUIT (FIGURE 5A.1.21)

- 252 a The current absorbed by the stabilized power supply in the 20 W amplifier is fed through two precision, low value resistors (R46 and R47). The current is grounded through pin 28 of connector J102 and resistors R36 and R42 on the Peripheral Circuits Board.
- b The voltage developed across R42 is applied to input pin 3 of comparator Z02 on the Peripheral Circuits Board. A reference voltage from the battery (pin B14) is applied to pin 2 of Z02.
- c The output from Z02 is applied to OR gate diode CR12 and so to input pin 3 of comparator Z04, the action of which has been described in paragraph 251.

D.C. VOLTAGE GENERATING CIRCUITS (FIGURE 5A.1.21)

- 253 The various d.c. voltages required for operation of the power circuits are derived from the 13,5 V stabilised power supply located in the 20 W amplifier.
- 254 This power supply comprises the following components:—
- a Operational amplifier Z02 and the associated circuits.
- b Transistor amplifiers Q13 and Q15.
- c Ballast transistor Q14.
- d Protection transistor Q12.
- 255 During transmission a fixed reference voltage, derived from +10 V Tx, is applied to input pin 3 of amplifier Z02. Diode CR05 stabilizes the voltage.
- 256 Input 2 of Z02 is fed with a sample of the stabilised 13,5 V output, adjustable by potentiometer R82. Amplifier Z02 operates as an integrator comparator. Any variation in the input voltage at pin 2 is fed to amplifier Q13, Q15 to the ballast transistor Q14.
- 257 Transistor Q12 is an overcurrent protection device which, under normal conditions is cut-off. If the current through resistors R46 and R47 rises sufficiently to cause the base-emitter voltage of Q12 to increase then Q12 will conduct. This will cause a reduction in the base voltage of ballast transistor Q14 which will in turn reduce the 13,5 V supply.
- 258 The stabilized 13,5 V supply is applied to the preamplifier Q03, Q04, to amplifier Q07 and to power amplifier Q16 and Q17. The base bias voltage of amplifiers Q07 and Q11 is generated by a temperature compensated stabilized power supply consisting of transistors Q01, Q02 and their associated circuits. Transistor Q02 is connected between the 13,5 V supply and ground.
- 259 The base-emitter voltage of Q02 varies with temperature in the same manner as the base-emitter voltages of transistors Q07 and Q11. Power for Q07 and Q11 is supplied via ballast transistor Q01 depending on the base bias voltage of Q02 through potentiometer R01.
- 260 As the base bias current of power transistors Q16 and Q17 must be constant with temperature, a temperature-compensated biasing circuit is provided. This is comprised of operational amplifier Z01, transistors Q05, Q06 and the associated circuits.

- 261 Z01 operates as a comparator amplifier. A temperature compensated reference voltage is applied to input pin 3 of Z01, derived through heat-sinked diode CR03. The power supply voltage and -6 V Tx is applied to input pin 2 of Z01. Any variation in the input voltage is amplified and applied to the base of transistor Q06.
- 262 Transistor Q05 is a protection device which under normal conditions is out-off by the presence of -6 V Tx . If the -6 V Tx supply fails Q05 is driven to saturation thus grounding the input of comparator Z01 which in turn suppresses the bias voltage to power transistors Q16 and Q17.
- 263 Further protection for the power amplifier is provided when in the absence of -6 V Tx the stabilised power supply and the temperature-compensated bias power supplies are inhibited.

VARIABLE INDUCTOR CONTROL LOOP (FIGURE 5A.1.22)

- 264 The variable inductor, in the Antenna Tuning Unit, matches the output of the 20 W amplifier to the WHIP/WIRE antenna output. The control loop operates in two cycles:
- Pre-positioning cycle.
 - Feedback control cycle.
- 265 The tuning cycles are initiated by any of the following operations:
- Switching the equipment 'ON'.
 - Pressing the front panel TUNE pushbutton.
 - Alteration of the communication frequency by moving the position of any frequency selector switch.
- 266 When a tuning cycle is initiated by any of the above operations, a logic '0' is applied momentarily to pin A15 (I_D) of the Peripheral Circuits Board. When the logic '0' is removed, timer Z05 produces a logic '1' (beginning of cycle) signal at pin 14 which is fed via p.c.b. pin A19 to the AF Board (Figure 5A.1.18) at p.c.b. pin B12.
- 267 Transistor Q23 is switched on, which in turn causes transistor Q16 to saturate. Q23 causes the transmit/receive system to change to transmit and Q16 enables the $+15\text{ V A3}$ supply. This allows the transceiver to transmit in the A3H (AM) mode during the tuning cycle, regardless of the operating mode selected by the front panel MODE switch.
- 268 The beginning of cycle signal is also fed to the Exciter Board at p.c.b. pin B2. This causes transistor Q09 to conduct and apply a 1 kHz from the synthesiser, via p.c.b. pin B12, capacitor C03, transistor Q09, diode CR05 and p.c.b. pin B15 to the AF amplifier Z02 on the AF Board. The signal from the AF amplifier is fed to the local earphone.
- 269 A third output of the beginning of cycle signal is fed, via pin 1 of connector J02 on the Antenna Tuning Unit, to the base transmitter Q02. This causes Q02 to saturate and thus transistor Q01 conducts and applies $+12,7\text{ V.d.c.}$ to voltage regulators Q14 and Q03.
- 270 Voltage regulator Q14 supplies prepositioning and feedback control comparator Z01 at pin 10.

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- 271 Voltage regulator Q03 supplies +5 V to:—
- The two flip-flops of module Z03 (pin 14).
 - The D input (pin 12) of flip-flop No. 1 of Z03.
 - The quad NAND gate Z02 (pin 14).
 - The repeater potentiometer, driven by the motor.
 - The sub-band device via R37, R40 and pin 16 of connector J102.

A resistor network (R09, R12, R13, R14 and R15), located on the Frequency Selector Board, selected by the 10 MHz, 1 MHz and 100 kHz frequency selector switches, delivers a prepositioning voltage at pin 16 of connector J102. This voltage is applied to the input (pin 4 of Z01) of prepositioning comparator No. 1 via inductor L06.

- 272 Flip-flops 1 and 2 of module Z03 are reset by +5 V at pins 1 and 13 after a period determined by the time constant due to resistor R15 and capacitor C05. Thus the Q outputs go to logic '0' and the \bar{Q} outputs go to logic '1'. The logic '1' at Z03 pin 8 enables the prepositioning comparator at Z01 pin 2.

PREPOSITIONING CYCLE

- 273 a The variable inductor L201 is mechanically linked to the driving motor and the repeater potentiometer. The wiper of the potentiometer delivers a d.c. voltage proportional to the value of inductance of L201. This d.c. voltage is compared with the d.c. voltage from the sub-band device (set by the frequency selectors) in comparator No. 1 of module Z01.
- b The comparator delivers one of a two-state signal in order to drive the motor-inductor assembly in such a direction that the voltage delivered by the potentiometer wiper is equal to the preset voltage. When both comparator input voltages are equal the comparator changes state and delivers a signal to start the feedback control cycle and therefore and the prepositioning cycle.
- The two inputs to comparator No. 1 are fed via the differential windings of inductor L06 which eliminates the effects of spurious pulses.
 - The output of the comparator at pin 9 is shaped by R35 and C21, inverted by gate 1 of Z02 and applied to inverter gate 2 of Z02 and to the base of transistor Q07.
 - Q07 enables or inhibits the sign-reversing switch transistors, in the power supply circuit of the motor, Q12 (ground) and Q04 (+ve supply).
 - The signal from the second inverter (gate 2 of Z02) is applied to the base of transistor Q06 which enables or inhibits the sign-reversing switch transistors in the power supply circuit of the motor, Q11 (ground) and Q05 (+ve supply).

273 Continued

- v This signal causes:—
- 1 The motor power supply to be reversed.
 - 2 The \bar{Q} and Q outputs of flip-flop No. 1 to change state. Q at logic '0' inhibits the prepositioning comparator. The Q output of logic '1' enables feedback control loop comparator No. 2 of Z01.
 - 3 Enables end of cycle NOR gate 4 of Z02 at pin 9.
 - 4 Causes a logic '1' at the D input (pin 2) of flip-flop No. 2 in module Z03. (Although both flip-flops have the same clock origin, the output state does not change due to the time delay introduced into the D input by capacitor C17 and resistor R34).

FEEDBACK CONTROL CYCLE

- 274 a The 20 dB coupler (T101 and T102) generates two voltages, a direct voltage V_D and a reflected voltage V_R which are related to the HF current flowing through the coupler. Each voltage is fed to a separate phase shift network.
- b The V_D phase shift network consists of resistors R101, R04 and R07, inductors L01 and L03, and capacitors C03 and C06. It is tuned by L01 and L03 to 3.9 MHz and shifts the phase of V_D from 140° to 305° within the band 2 — 29,999 MHz.
- c The V_R phase shift network consists of resistors R02, R05 and R011, inductors L02 and L04, and capacitors C04 and C07. It is tuned to 17 MHz and shifts the phase of V_R from 50° to 215° in the band 2 — 29,999 MHz:—
- Total Phase Shift is thus 90° in the band 2 — 29,999 MHz.
- d The signal from each phase shifter is applied to a phase discriminator consisting of transformer T01, diodes CR02 and CR03, resistors R16, R17, R22 to R25 (balancing potentiometers) and capacitors C13 and C14.
- e The signals from the phase discriminator are applied to the input (pins 6 and 7) of comparator No. 2 (feedback control loop) of module Z01 via inductor L05 (acts in the same manner as inductor L06).
- f The signal from comparator No. 2 switches the motor power supply in the same way as in the prepositioning cycle, since the circuit is common to both functions.
- g Reversal of the sign of the input signal to comparator No. 2 causes:—
- i Reversal of operation of control transistors Q06 and Q07.
 - ii The state of the \bar{Q} and Q outputs of flip-flop No. 2 to change. The logic '0' at the \bar{Q} output is applied to NOR gate 3 of module Z02.
- h The logic '0' at NOR gate 3 output produces a logic '0' end of cycle signal at the output of NOR gate 4 and thus at pin 10 of connector J102.
- j This signal is applied to pin 1 of timer Z05 (see paragraph 266) which inhibits the output of Z05 pin 14 (beginning of cycle) when Z05 has timed out. The feedback control cycle is then stopped.
- k Transistor Q13 also initiates an end of cycle signal when the motor reaches a limit stop. Operation of either limit stop short circuits the motor producing dynamic braking and an initiating pulse to the base of Q13.

MODE SELECTION CIRCUIT (FIGURE 5A.1.15)

- 275 When the preset switch is operated 0V is applied to the base of transistor Q22, on the AF Board, via p.c.b. pin A14 and diode CR12. Transistor Q22 conducts and applies +6 V from p.c.b. pin A13 to p.c.b. pin A9. This enables the circuits involved in A2J mode operation on the Exciter Board.

CONVERTER CIRCUIT AND GENERATION OF AUXILIARY D.C. VOLTAGES (FIGURE 5A.1.23)

- 276 Auxiliary d.c. voltages required by the transceiver are generated by the Converter circuit from the d.c. voltage derived from the battery. The following converter description is described under the headings:—
- a Operation of the free running converter.
 - b Operation of the chopper.
 - c Operation of the chopper control circuit.

OPERATION OF THE FREE RUNNING CONVERTER

- 277 The converter is of the conventional free—running type and consists of transistors Q05, Q06, the associated circuits and transformer T02. It operates at a frequency of approximately 17,000 kHz.
- a The RC network, R06 and C05, enables an unbalance to be produced in the base circuit of transistor Q05. This allows the converter to start from the application of 14,5 V battery supply.
 - b Separate transformer windings of T02, in the collector circuits of each transistor generate positive feedback signals which are applied to the base of transistors Q05 and Q06.
 - c Voltages generated in the four secondary windings of transformer T02 are full wave rectified and filtered to provide the following d.c. voltages:—
 - 22 V (A)
 - 22 V (B)
 - +3 V (S)
 - +3 V (TR)
 - +6 V
 - 6 V
 - +10 V

OPERATION OF THE CHOPPER

- 278 The chopper is included in the output voltage stabilising loop. Its function is to provide the supply voltage for the converter, thus making the output voltages independent of the loads and the battery voltage. The chopper consists of transistors Q01, Q02, the associated circuits, diodes CR01 and CR04, transformer T01 and capacitor C06.
- a When the +14,5 V battery supply is applied to the converter, capacitor C06 charges through the primary winding of T01 and diode CR04. Transistor Q02 is cut-off.
 - b When the converter switches a positive synchronous pulse from pin 15 of the transformer T02 is applied to the base of transistor Q02 via C02, causing the transistor to conduct.
 - c This applies 0V to the anode of CR04 causing it to cut off.
 - d The +14,5 V battery supply is now applied directly across the primary winding of transformer T01. The voltage induced in the secondary winding of T01 maintains Q02 in the conducting condition.
 - e The -6 V applied to the base of transistor Q01 causes it to conduct. The current through Q01 and diode CR04 is fed through the secondary winding of T01 which generates a constant control voltage which is applied to the base of Q02.
 - f At the same time the current through the primary winding of T01, and therefore in the collector circuit of Q02, increases.
 - g After a period θ , determined by the impedance of Q01, the collector/emitter resistance of transistor Q02 increases. Time θ varies with the impedance of Q01 which in turn is related to the base bias voltage of the latter. This base voltage, however, is kept constant by stabilising loop describe in paragraph 279.
 - h The collector/emitter resistance of Q02 increases and the voltage from the secondary winding of transformer T01 decreases. This reduction of voltage is applied to Q02 causing it to cut off, thus isolating CR04 from ground.
 - j Voltage V_0 , across the primary winding of T01 is equal to:—
V battery +V induced in the primary.
 - k Voltage V_0 causes diode CR04 to conduct and capacitor C06 to charge. The voltage across C06 is applied to the converter. In closed loop operation the average value of the voltage across C06 is applied to the converter.

OPERATION OF THE CHOPPER CONTROL CIRCUIT

- 279 The chopper control circuit consists of transistors Q03, Q04 and the associated circuits.
- a The +10 V d.c. voltage from the converter, stabilised by zener diode CR03, is the reference voltage of emitter follower Q03.
 - b The voltage at the emitter of Q03 is applied via R11 and potentiometer R21 to the base of comparator Q04. Comparison of the portion of the +10 V converter output with the reference voltage produces a signal proportional to any error between the two signals. This control signal is applied via R01 to the base of transistor Q01 which controls the switching of the converter.
 - c Stability of the loop is ensured by the RC network R08 and C01.

GENERATION OF AUXILIARY D.C. VOLTAGES

280 There are two auxiliary voltages generated:—

−9,5 V Stabilised

+5 V

a +9,5 V.d.c. (Figure 5A.1.23)

The battery voltage is applied to pin A5 of Synthesiser Board No. 2 and thus to voltage regulator Z01. The output voltage is set by potentiometer R08. The voltage at pin B5 powers:—

- i The VCO board in the HF Head.
- ii Synthesiser Board No. 1 (pin A5).
- iii Frequency Selector Board (pin B7)

b +5 V.d.c. (Figure 5A.1.23)

The +10 V and +0 V from the converter are applied to the regulator Q21 (emitter follower) and the associated circuits. The +5 V.d.c. voltage at the emitter of Q21 is applied to pin A7 of the AF Board and is applied to:—

- i Pin A10 of the Filter and 2,5 MHz IF Board.
- ii Pin B13 of the Exciter Board.
- iii A moving contact of the mode selector.

Depending on the position of the mode selector the +5 V is applied as follows:—

- iv In the MORSE mode the A2J 5 V signal is applied to:—
 - a Pin A3 of the Peripheral Circuits Board.
 - b Pin B10 of the AF Board.
- v In the HSB or LSB mode the SSB 5 V signal is applied to pin B5 of the Peripheral Circuits Board.
- vi In the AM mode the A3 5 V signal is applied to:—
 - a Pin B6 of the AF Board.
 - b Pin B17 of the Exciter Board.
 - c Pin A9 of the Filter and 2,5 MHz IF Circuit Board.

TRANSMISSION CONTROL AND BATTERY CHARGE CONTROL INHIBITING CIRCUIT

- 281 The HF transmission current is fed through the coupler in the Antenna Tuning Unit (Figure 5A.1.22). This coupler consists of transformer T01, resistors R301, R302, capacitor C303 and diode CR301.
- 282 A d.c. signal proportional to the HF current appears at pin 13 of connector J02. This voltage is applied to the transistor logic OR circuit, consisting of Q27 and Q31, via pins B15 and B16 of the Peripheral Circuits Board. The battery +ve supply from pin B14 is also applied to the base of transistor Q27.
- 283 Under normal conditions, with the battery voltage and the transmission correct, both Q27 and Q31 are cut-off. The output at the emitters of these two transistors is applied to comparator Q32 and the associated circuits. The reference voltage at the base of Q32 is derived from resistors R103 and R102.
- 284 Transistor Q32 is driven into saturation and a voltage greater than +5 V is delivered at the collector of Q32. This signal causes FET Q24 on the AF Board to conduct, with diode CR16 cut-off (Figure 5A.1.18).
- 285 If the battery voltage is low (Q27 saturated) or there is no transmission (Q31 saturated) then transistor Q32 will be cut off. The lower voltage at pin A10 of the Peripheral Circuits Board will cause CR16 on the AF Board to conduct thereby cutting off FET Q24. This will prevent the sidetone being fed to the local earphone.

REMOTE CONTROL CIRCUITS (FIGURE 5A.1.24)

- 286 The remote control circuits allow the following operations:—
- Transmission of incoming signals to the remote operator.
 - The transmission of AF signals received from the remote operator.
 - Transmission of a call signal from the transceiver to the remote operator.
 - Reception of a call signal from the remote operator.
- 287 The remote control circuits consist essentially of:—
- A current generator.
 - A comparator.
 - A call signal generator.
 - A remote control inhibiting circuit.
- 288 The constant current generator consists of transistor Q02 and the associated circuits. It is powered when selector switch S3 on the front panel is set to or 'CALL' position.
- 289 The constant current generator drives the comparator and the remote set via the telephone line.

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290 Current in the telephone line is determined by the mode of operation of the remote set as follows:--

- a 0 mA (open circuit) when a call from the remote set is transmitted via the transceiver.
- b 4 mA on reception of a signal by the remote set.
- c 8 mA on transmission of a signal from the remote set.

291 a Reception of a Signal

The comparator consists of the operational amplifier Z01 and the associated circuits. A current of 4 mA, determined by the remote control set, is applied to Z01 via pin A12. The signal at the output of Z01 cuts off diode CR07 and no signal is transmitted to the switching circuits. The line current is modulated by the AF signal from amplifier Z02 via the remote control amplifier Q03.

b Transmission of a Signal

Comparator Z01 receives a current of 8 mA determined by the remote set. The 0V output from Z01 forward biases diode CR07 which passes the signal from the remote set to the Exciter Board.

c Transmission and Reception of a Call Signal

The call signal generating circuit is shown in Figure 21 below:--

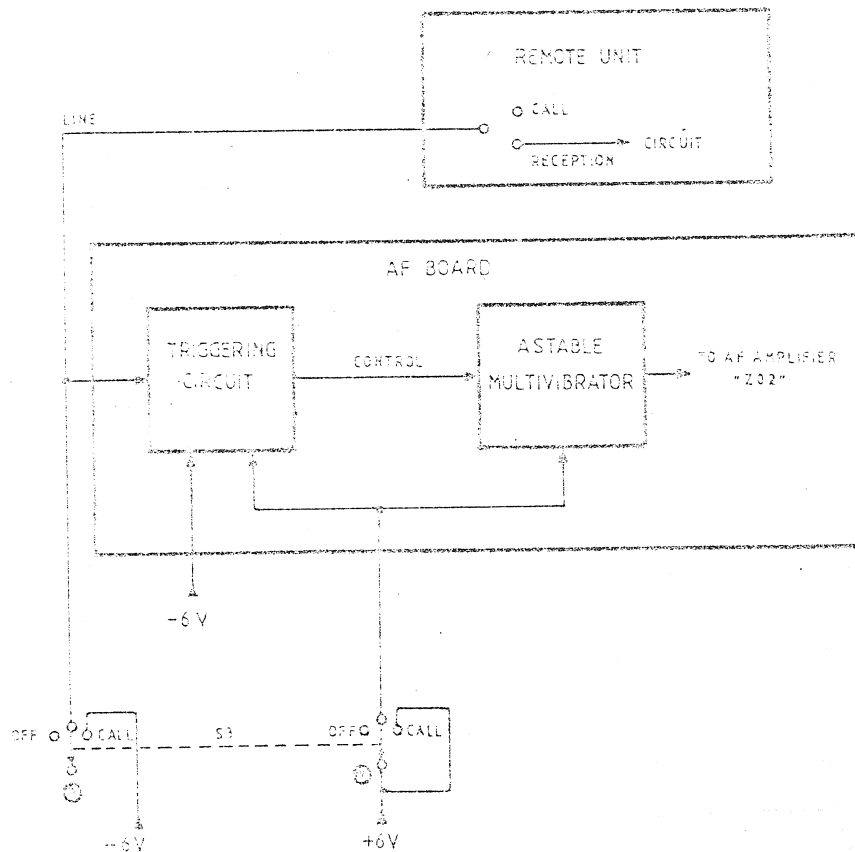


Fig. 21 Block Diagram of the Call Signal Generating circuit

231 Continued

The circuit comprises a triggering circuit and an astable multivibrator tone generator:-

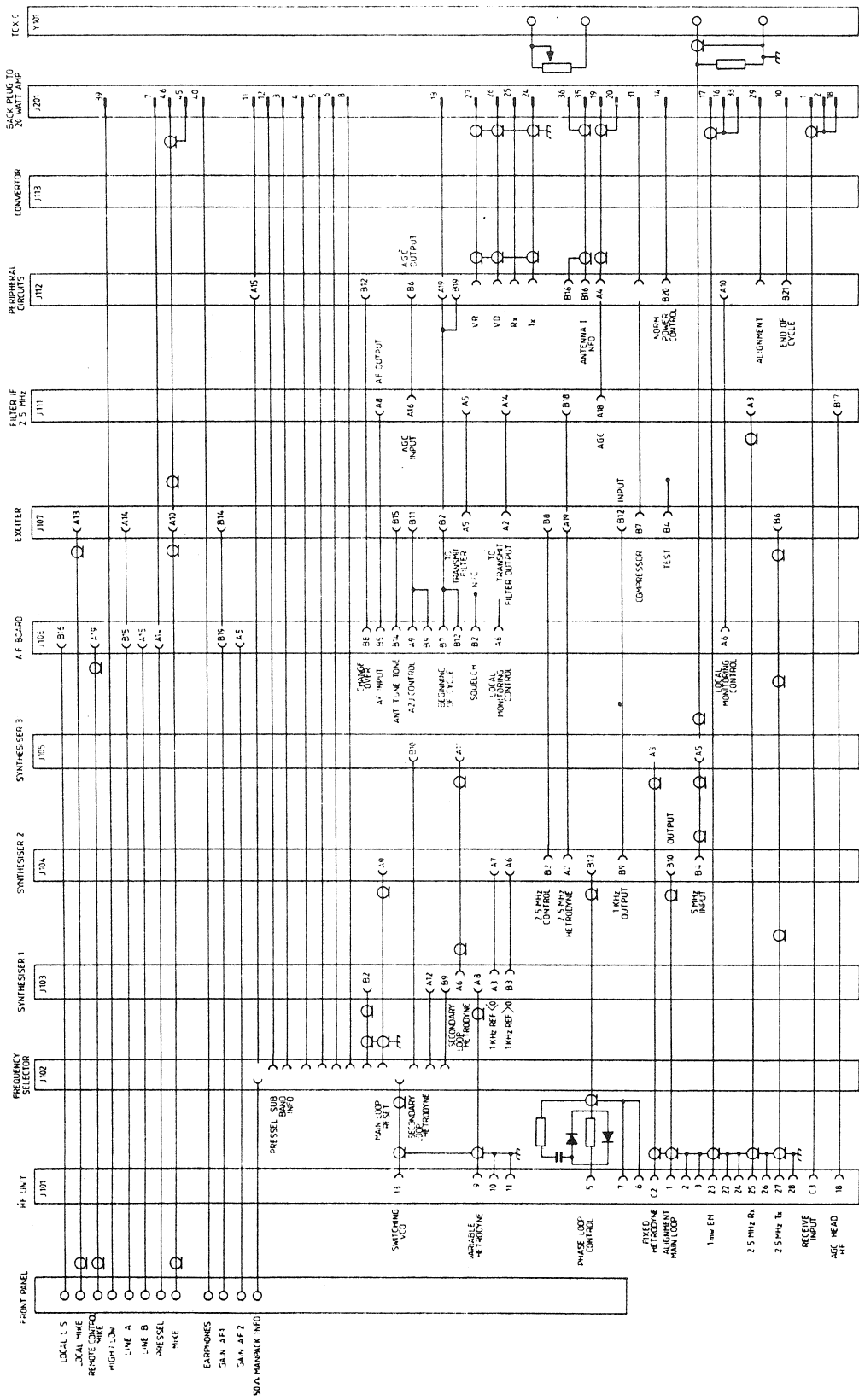
- i When switch S3 on the front panel, is switched to position (⊖) or 'CALL', power is applied to the triggering circuit and the tone generator.
- ii When S3 is in the 'CALL' position or when selector switch S01 on the remote set is in the 'CALL' position, the triggering circuit generates an enabling pulse for the tone generator.
- iii The tone output is fed via AF amplifier Z02 to the local earphone and to the remote set earphone.
- iv The triggering circuit consists of transistors Q11, Q25 and Q26. In the absence of a call Q11 conducts. In the presence of a call Q11 is cut off by -6 V from pin 518.
- v The positive voltage at the collector of Q11 enables the Abraham-block multivibrator consisting of transistors Q13, Q14 and the associated circuits.
- vi A square wave signal of approximately 3 kHz from the multivibrator is applied to pin 7 of amplifier Z02.
- vii The tone is applied to local and remote earphones as previously described.

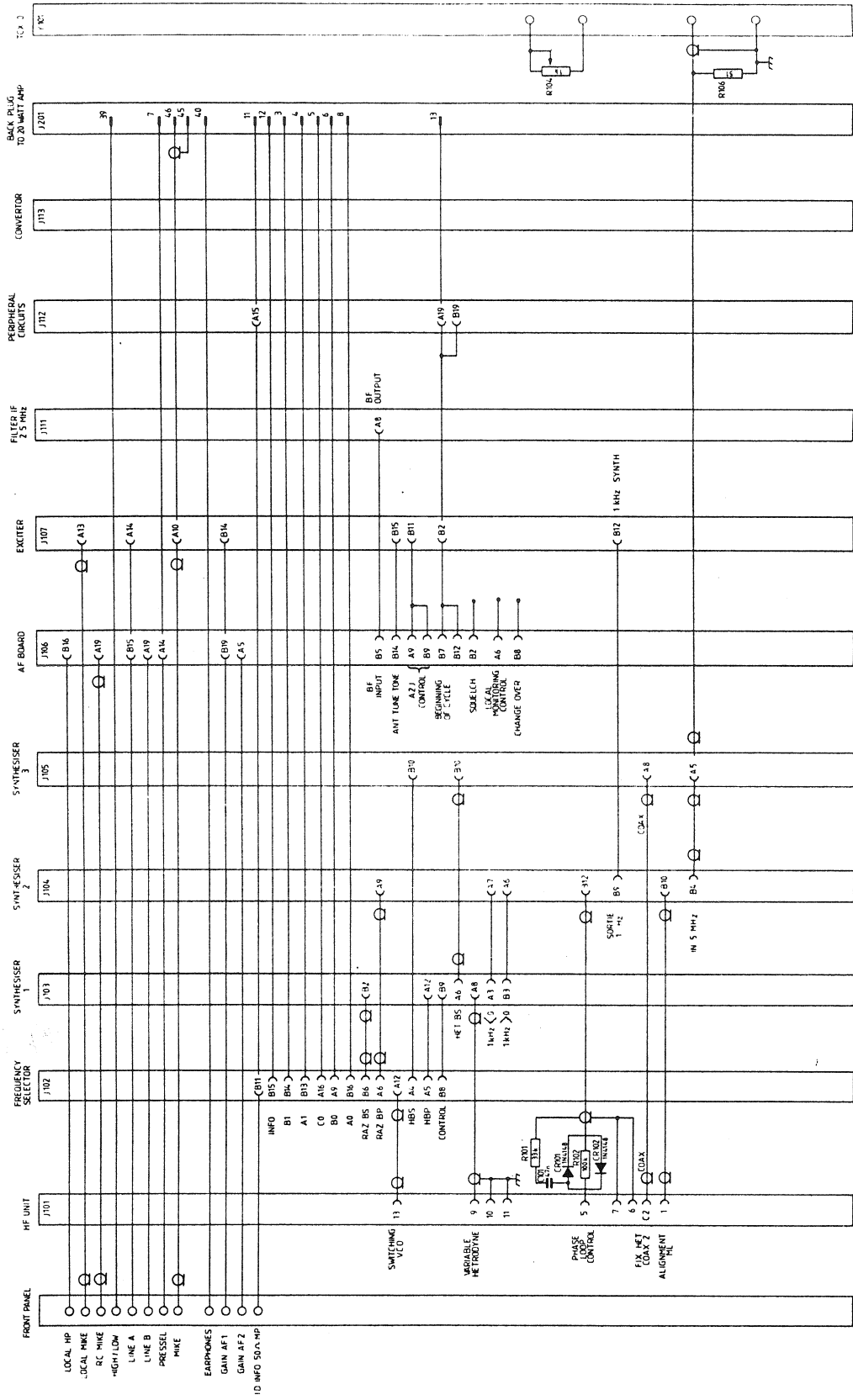
BATTERY CHARGER (B VERSION) (FIGURE 5A.1.25)

- 292 On the application of a 10 to 30 V.d.c. supply to the battery charger through socket J101 it passes through a reverse voltage protection diode CR102 and a balanced filtering network comprising of C103 and L3 which are mounted on the charger case.
- 293 The 10 to 30 V.d.c. is then further filtered by C1 and L1 which are mounted on the PC Board.
- 294 The voltage is then applied directly to the collectors of transistors Q7, Q5, Q4 and Pin 3 of IC1.
- 295 Transistor Q7 is a driver series regulator which regulates the voltage to the multivibrator transistors Q1 and Q2 and to pin 8 of IC1.
- 296 Upon connection of an external d.c. source the multivibrator delivers a squarewave to pin 5 of IC1. This squarewave from the multivibrator synchronises the operation of each cycle.
- 297 The frequency of the square wave delivered by the multivibrator is controlled by R3. The frequency of the multivibrator governs the charging rate.
- 298 The voltage from IC1 drives transistor Q4 into saturation. One of the two primary windings of transformer T1 is fed through diode CR5 which is now conductive.
- 299 The resulting induced voltage in the second primary winding of transformer T1 creates a positive feedback to the base of transistor Q5 causing it to conduct.
- 300 As Q5 is saturated the external d.c. voltage is almost entirely retransmitted across the primary winding of T1 owing to the decay voltage of transistor Q5.

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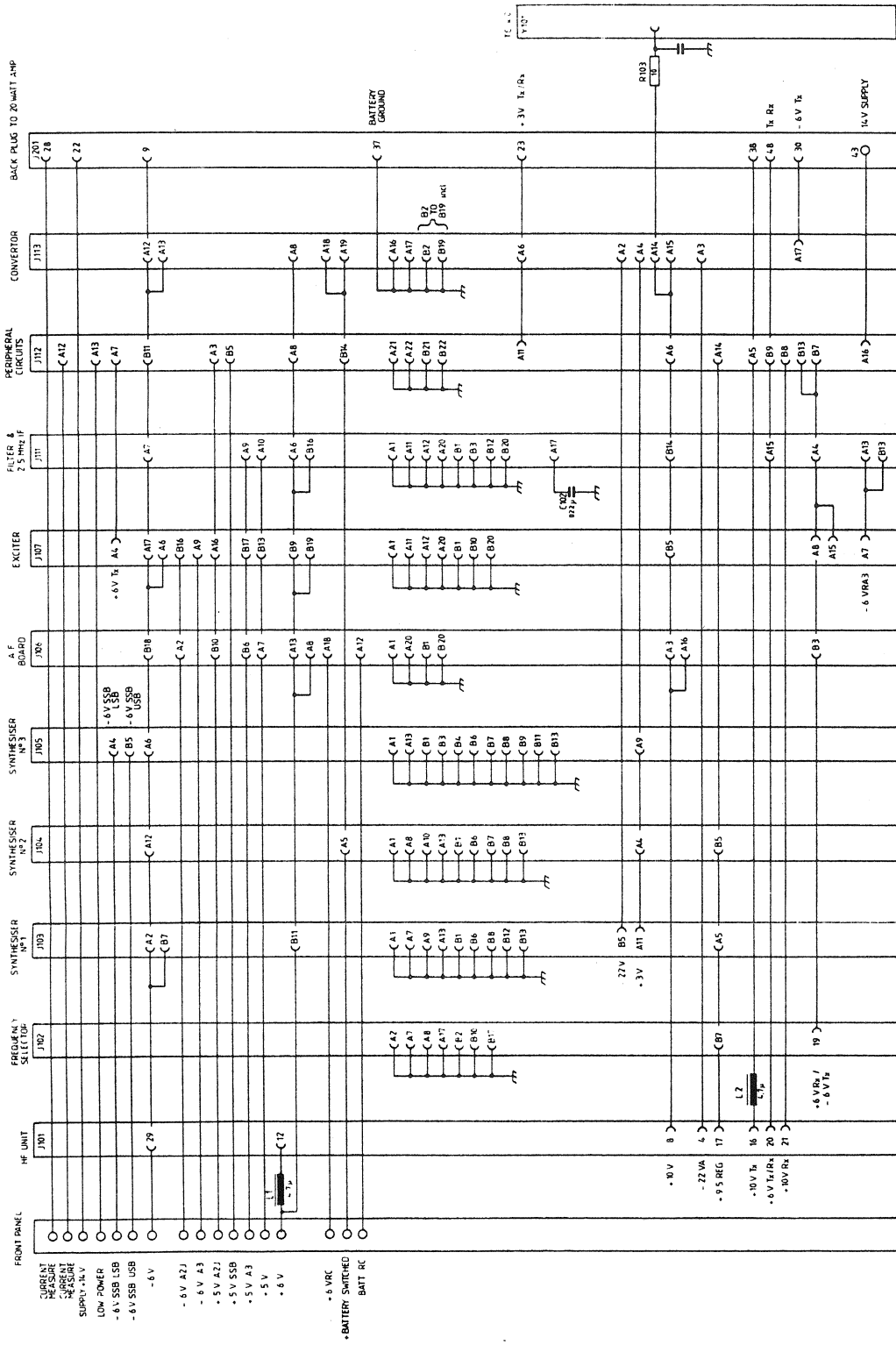
- 301 The magnetising current in the primary winding of T1 increases thus causing the voltage across R17 to increase.
- 302 This increase in voltage is applied to the input of IC1 at pin 6 via diode CR4 and transistor Q3.
- 303 This voltage varies with the value of the magnetising current and increases as a ramp up to switching of comparator IC1.
- 304 Transistor Q4 is now cut off and thus Q5 is also cut off. This cut off period determines the pulse length.
- 305 At this instant the power stored ($\frac{1}{2} L I^2$ which is constant irrespective of the external input voltage) in the secondary winding of transformer T1 is rectified by CR7, smoothed by inductor L2 and capacitors C11 and C12 and fed into the battery via diode CR101 which protects the battery from any charger failures.
- 306 The charger operating cycle is restored to its initial state and a new cycle is initiated by the next square wave signal delivered by the multivibrator.
- 307 In normal operation transistor Q6 is cut off. If the base voltage becomes negative with respect to the emitter voltage a positive voltage from the collector is applied to the input terminal 6 of the comparator, owing to the conduction of Q5. The signal from comparator Z1 will now cut off Q4 inhibiting operation of the charger.

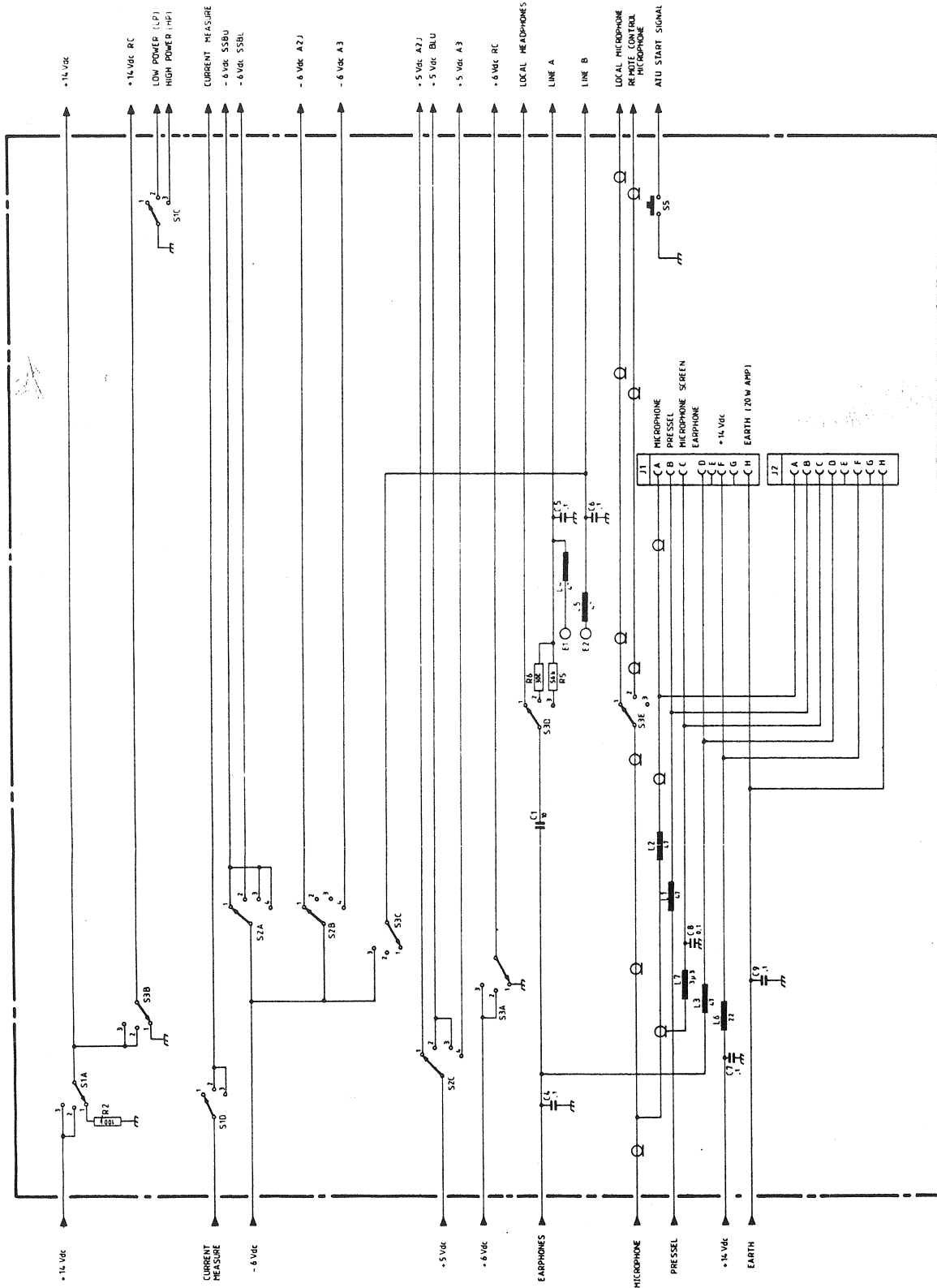




RS-B25 Interconnections

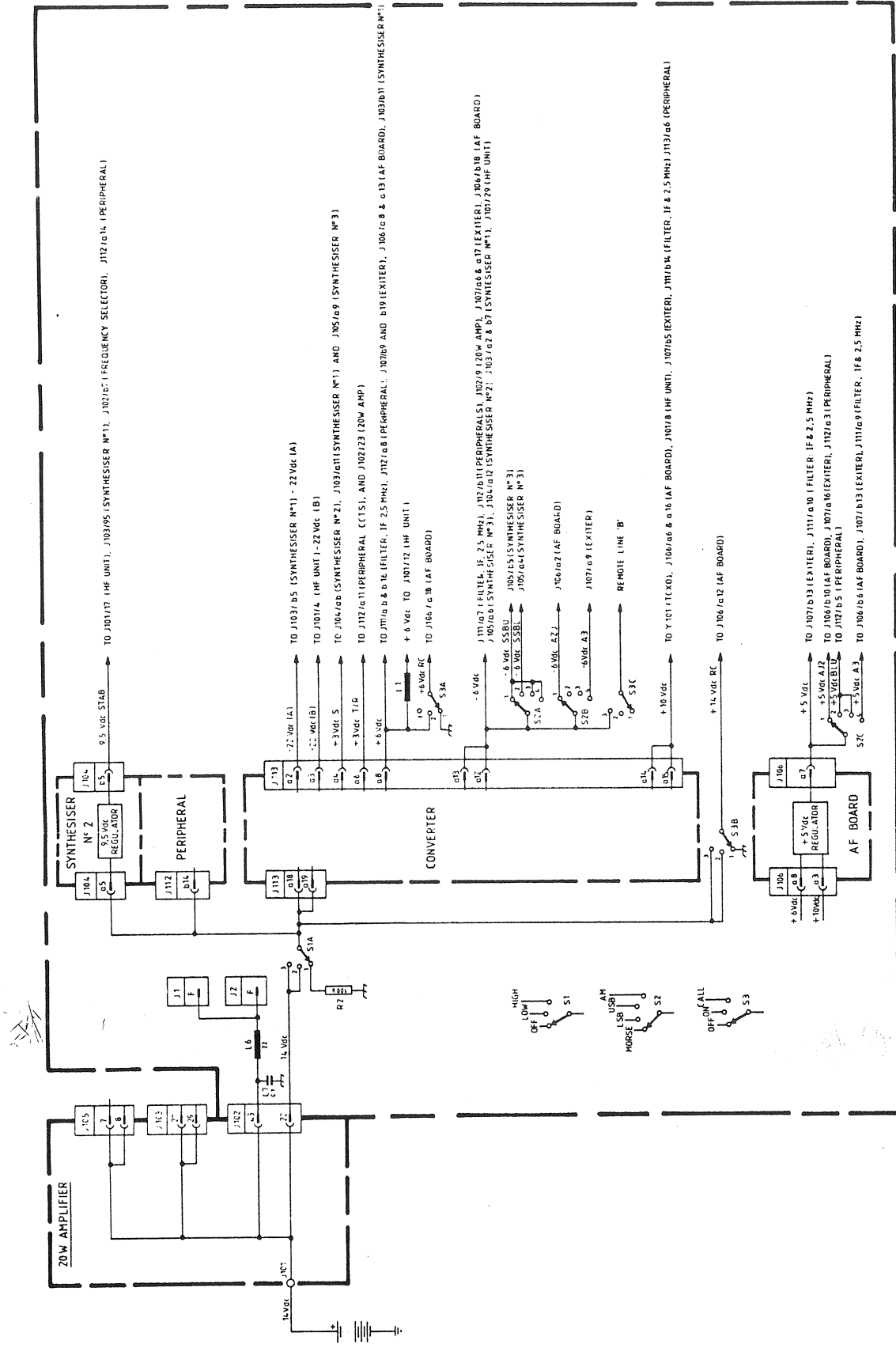
Fig. 5A.1.1 (Sheet 2)



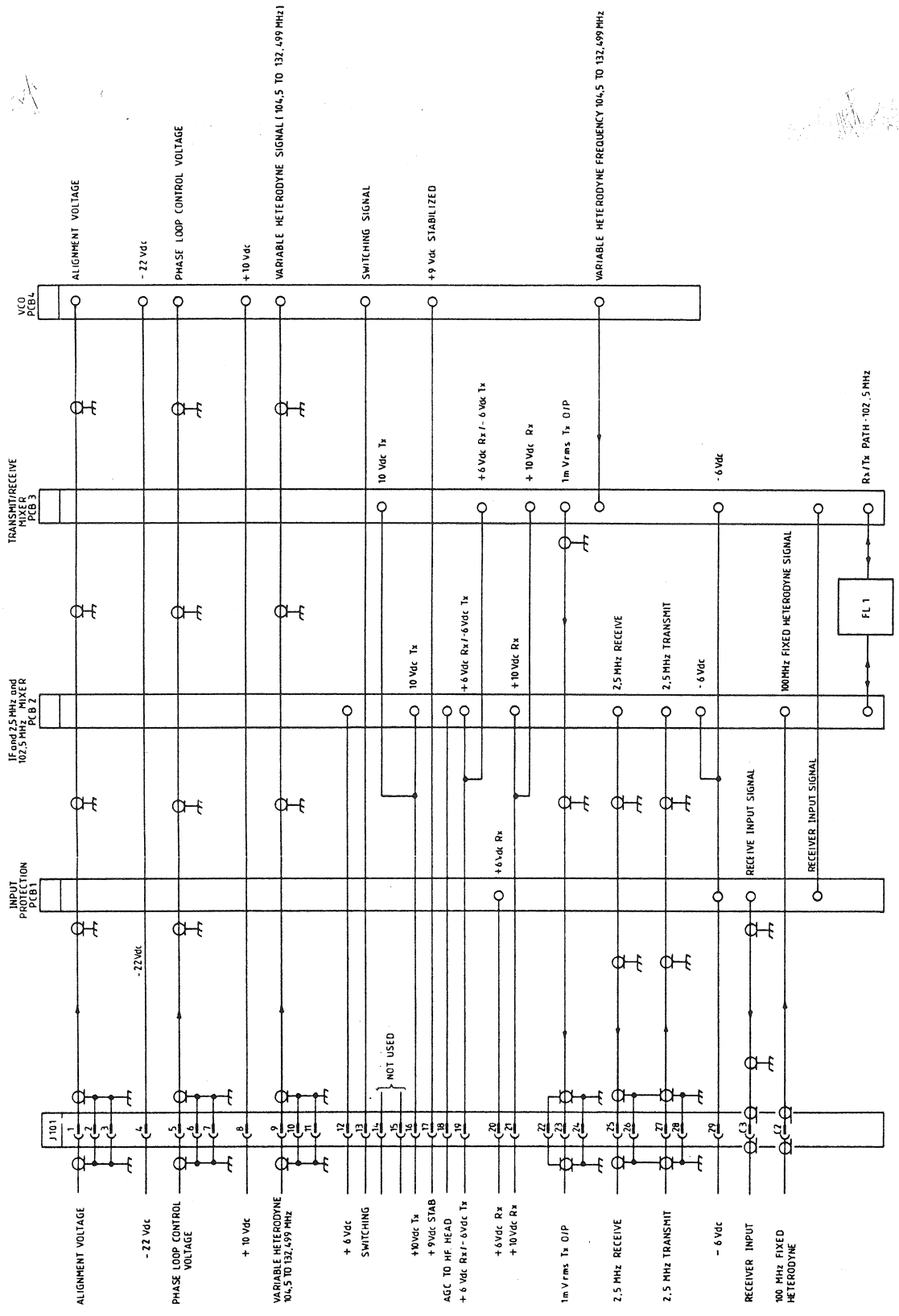


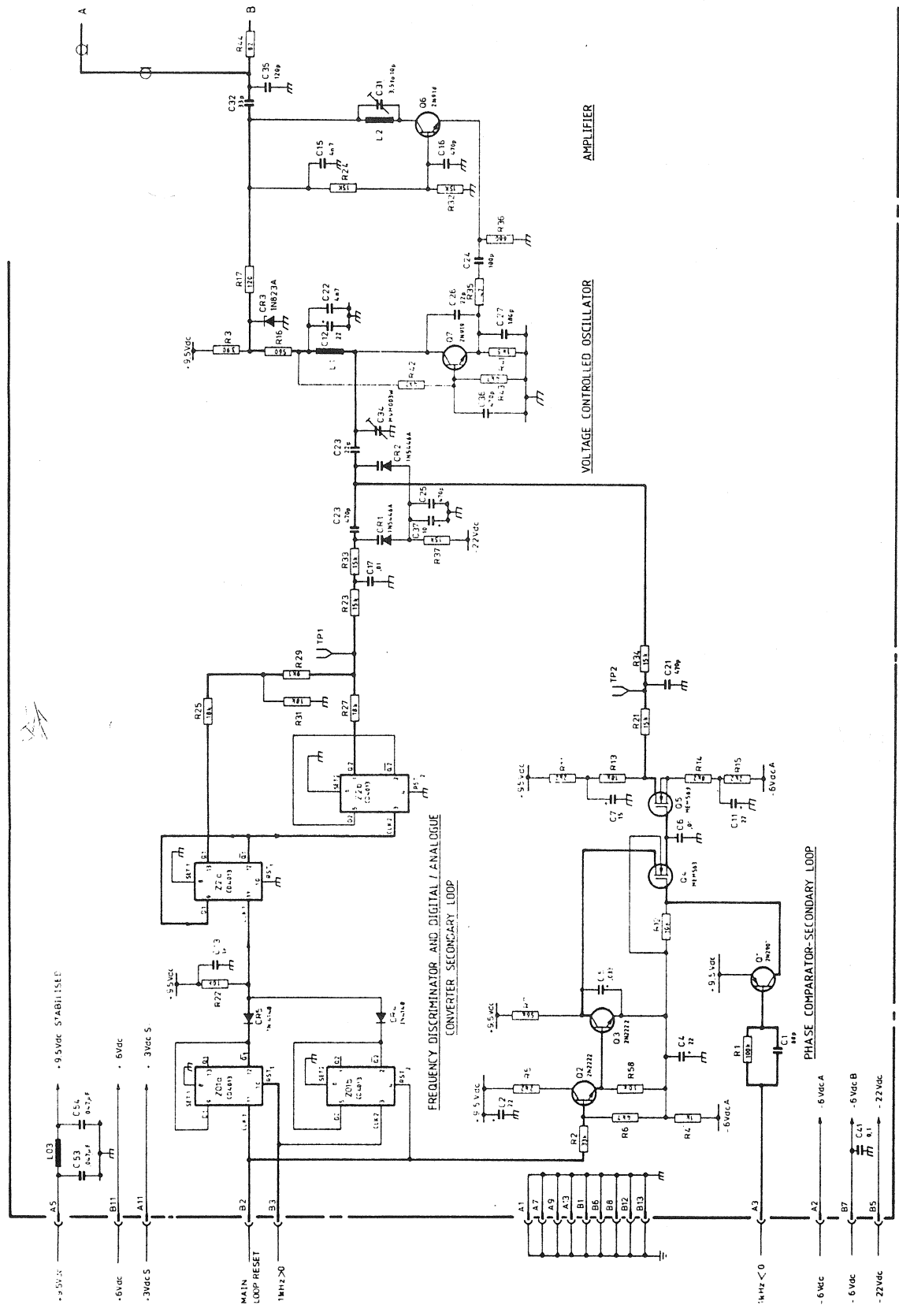
RS-B25 Interconnections

Fig. 5A.1.1 (Sheet 4)

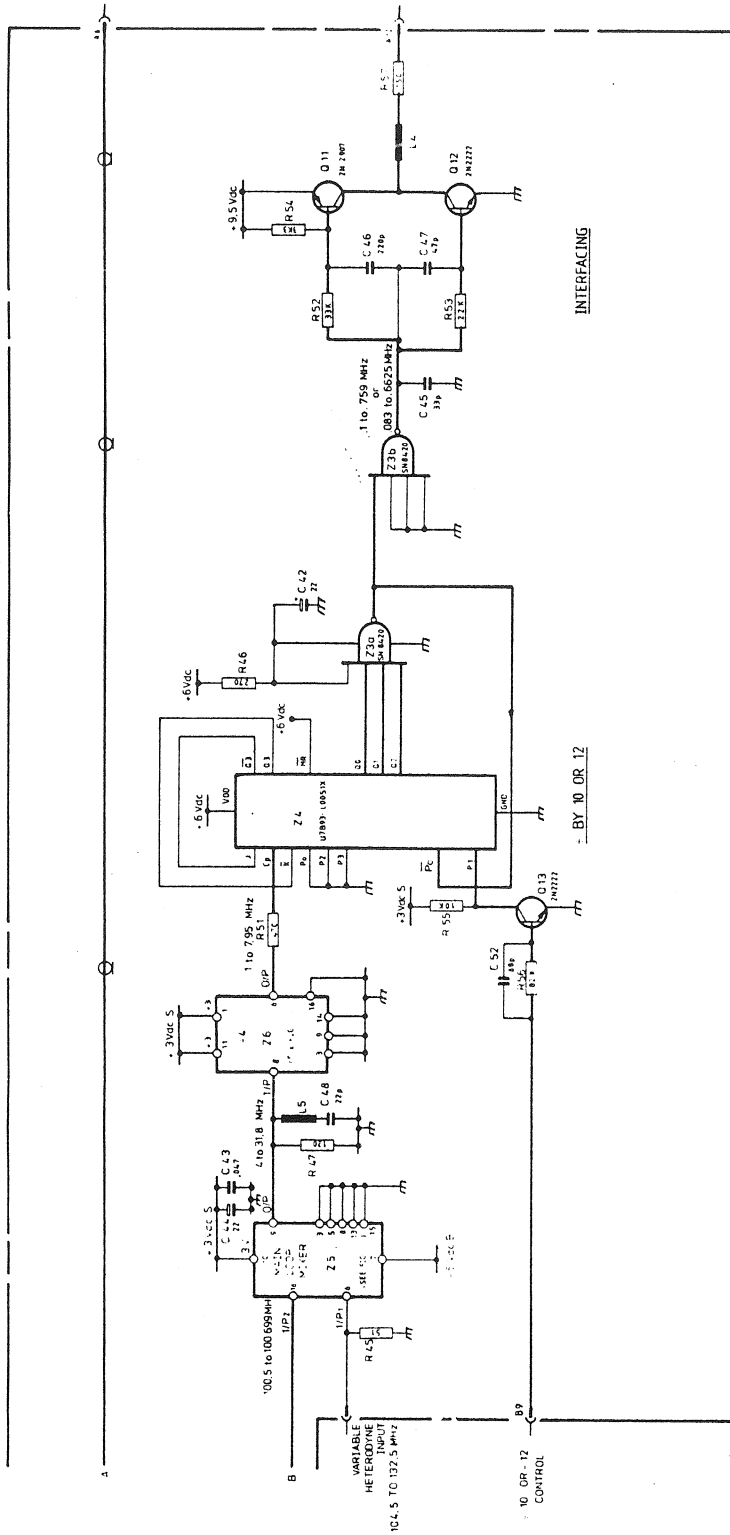


RS-B25 Interconnections



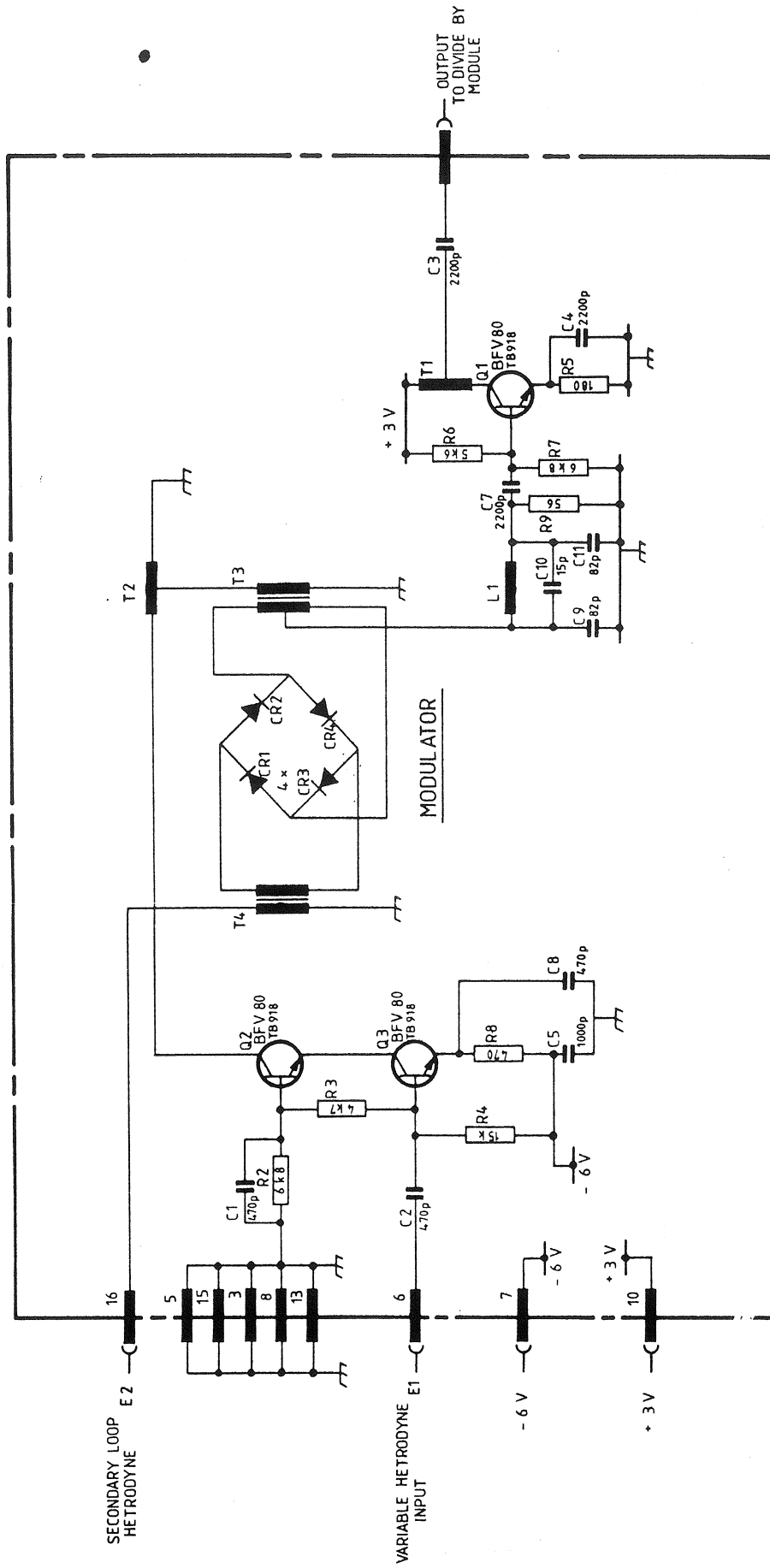


Synthesiser Board No. 1 Interconnections

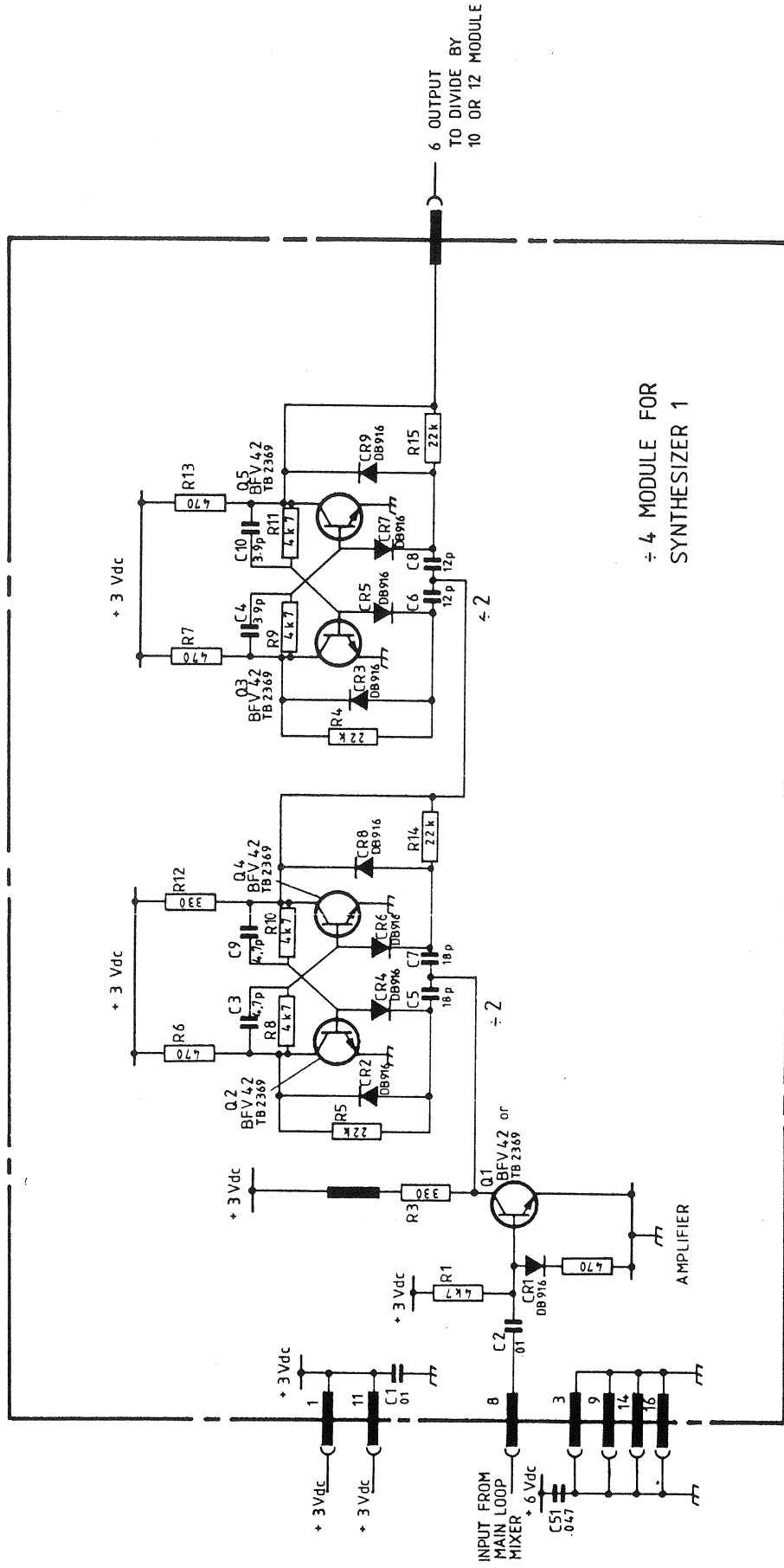


Synthesiser Board No. 1 Interconnections

Fig. 5A.1.2 (Sheet 2)

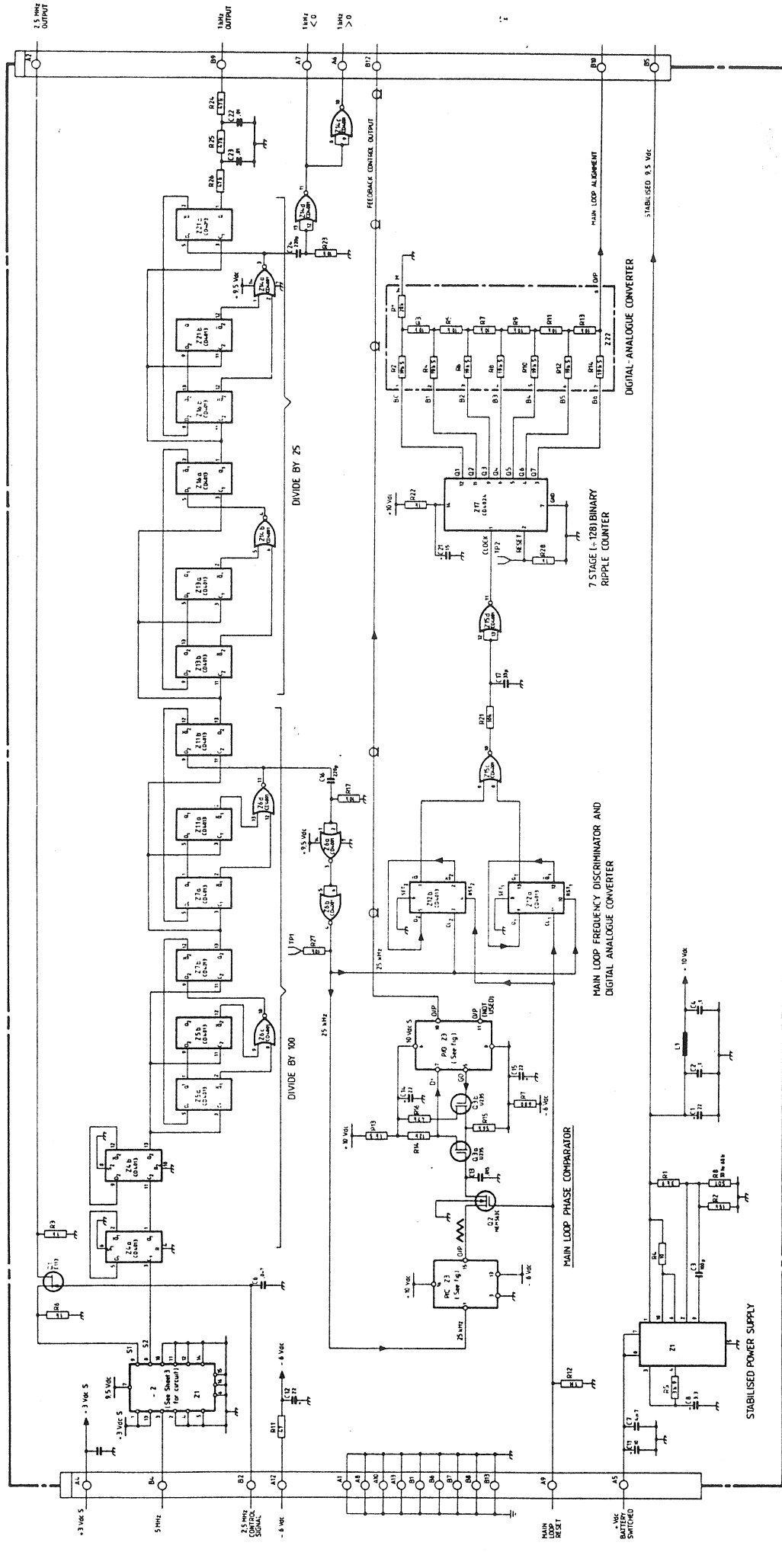


Synthesiser Board No. 1
Main Loop Mixer Module

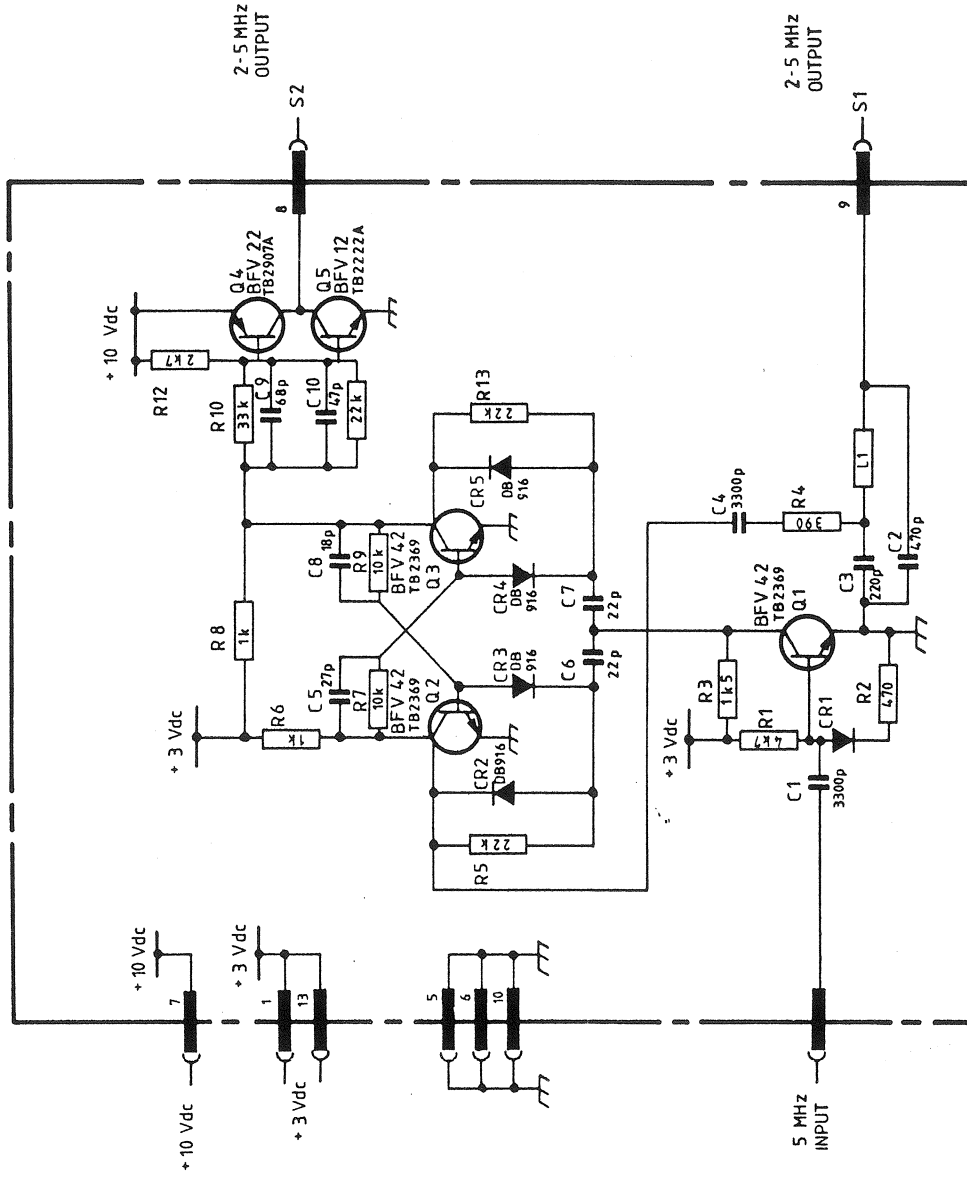


Synthesiser Board No. 1
Divide by Four Module

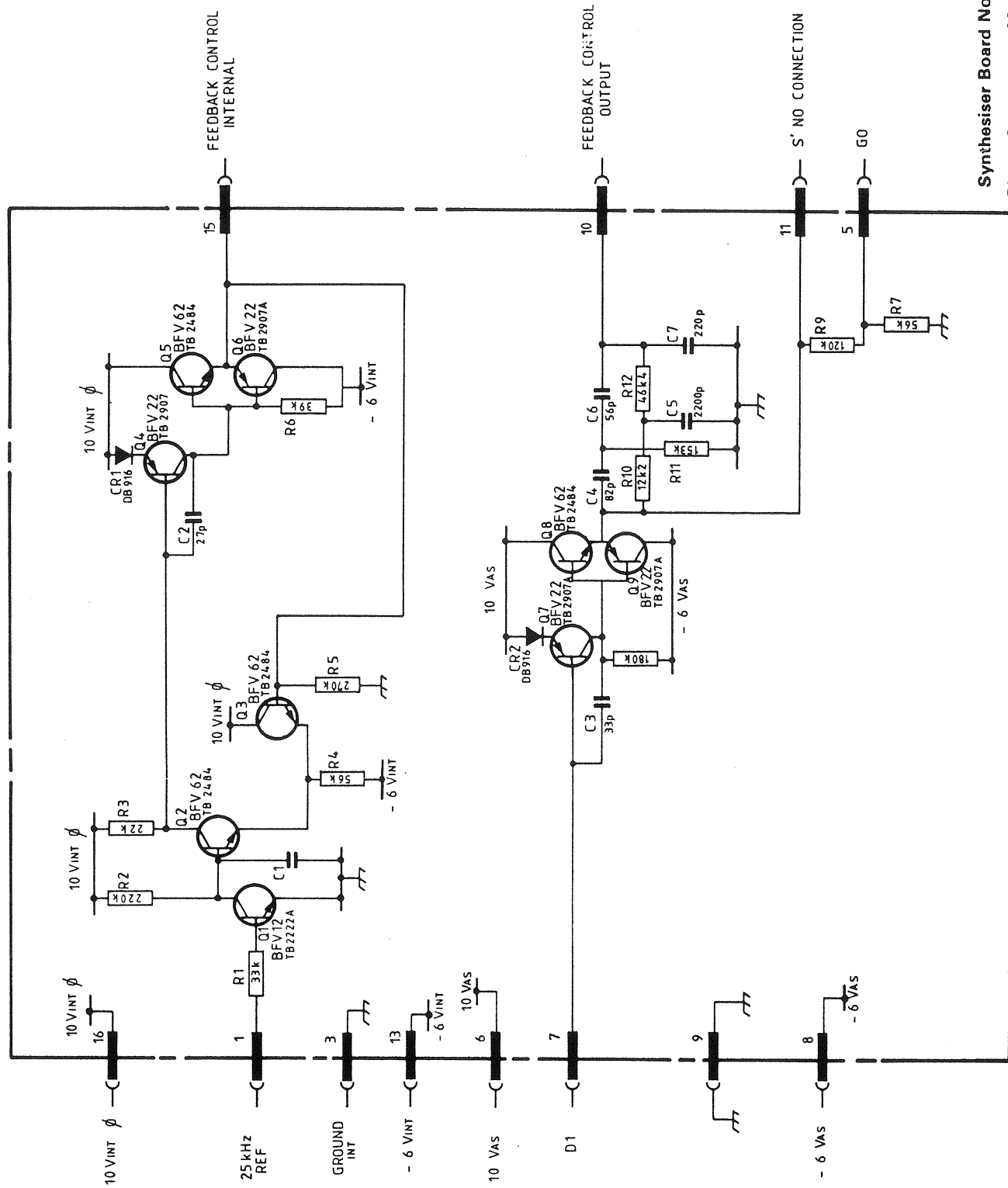
Fig. 5A.1.4



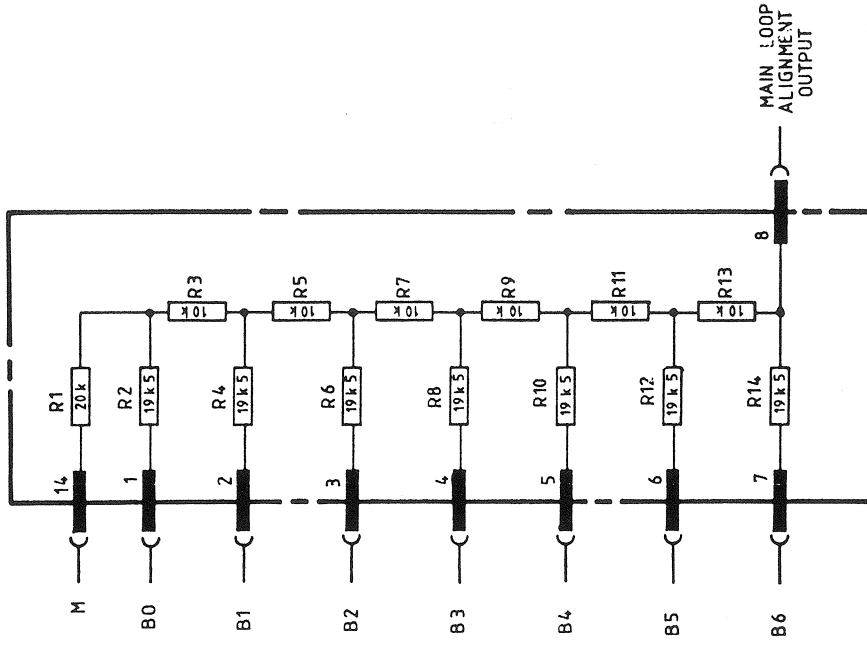
Synthesiser Board No. 2
Circuit Diagram



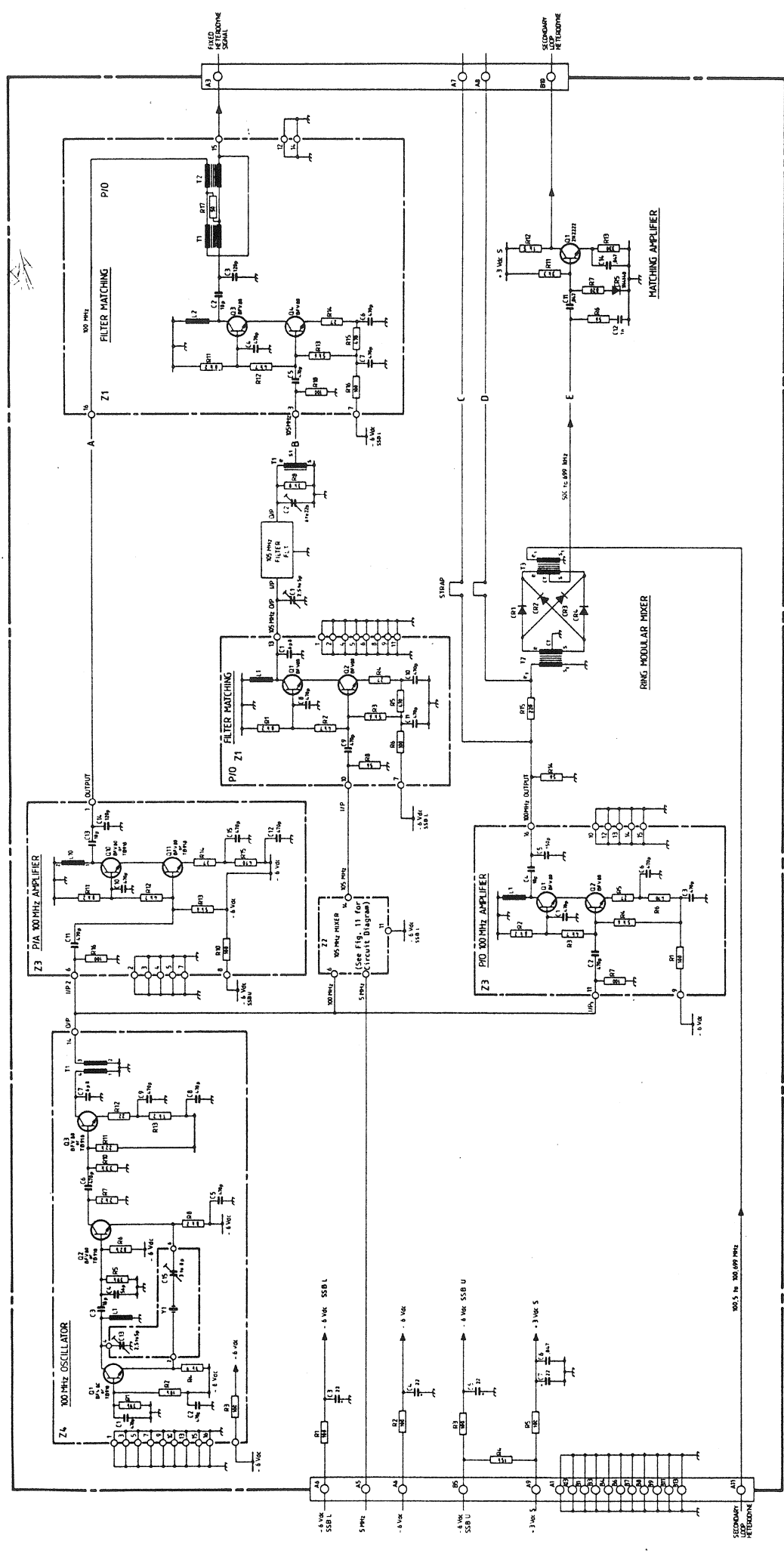
Synthesiser Board No. 2
Divide by Two Module



Synthesiser Board No. 2
Phase Comparator Module

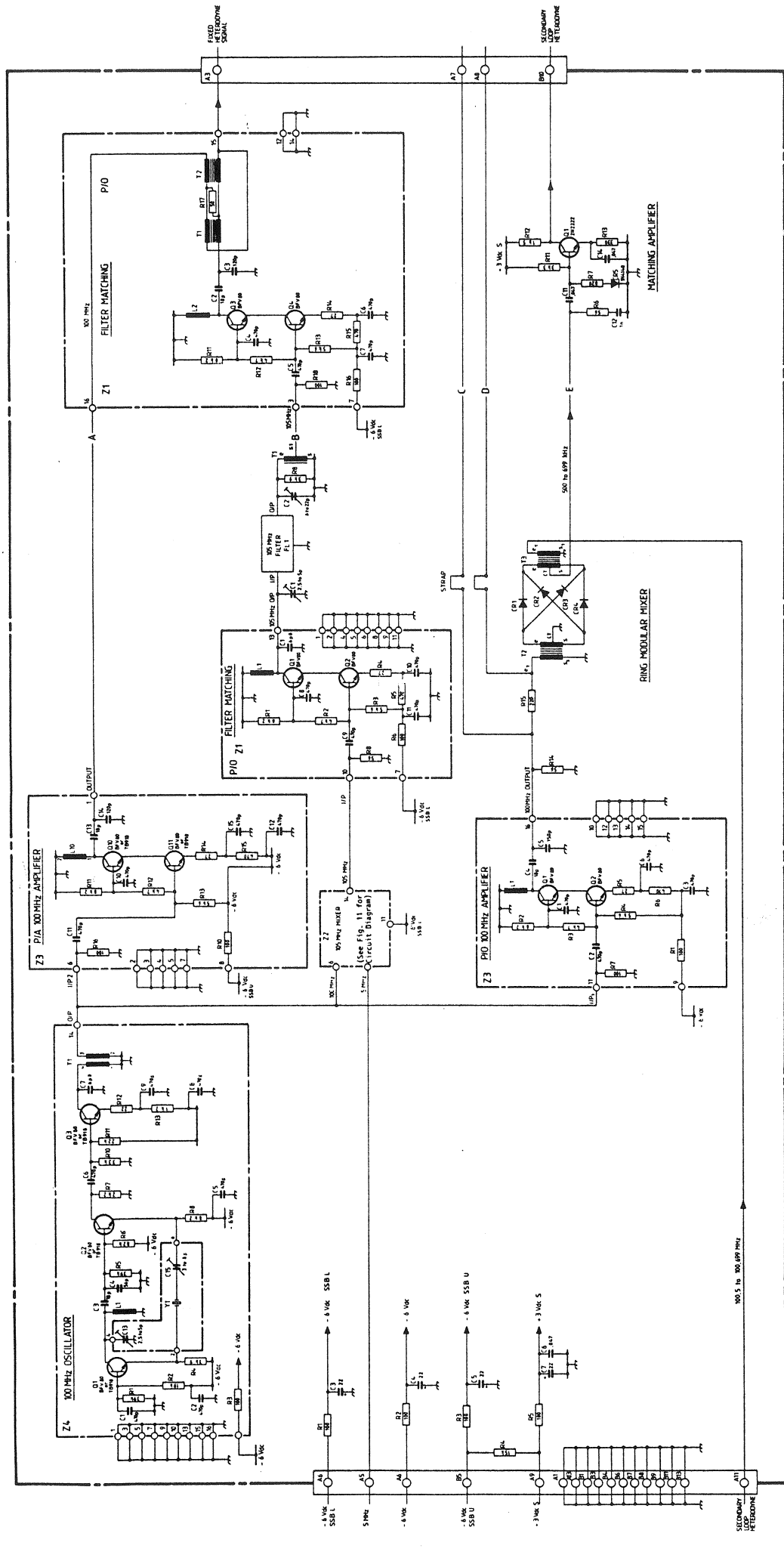


Synthesiser Board No. 2
D/A Converter Module



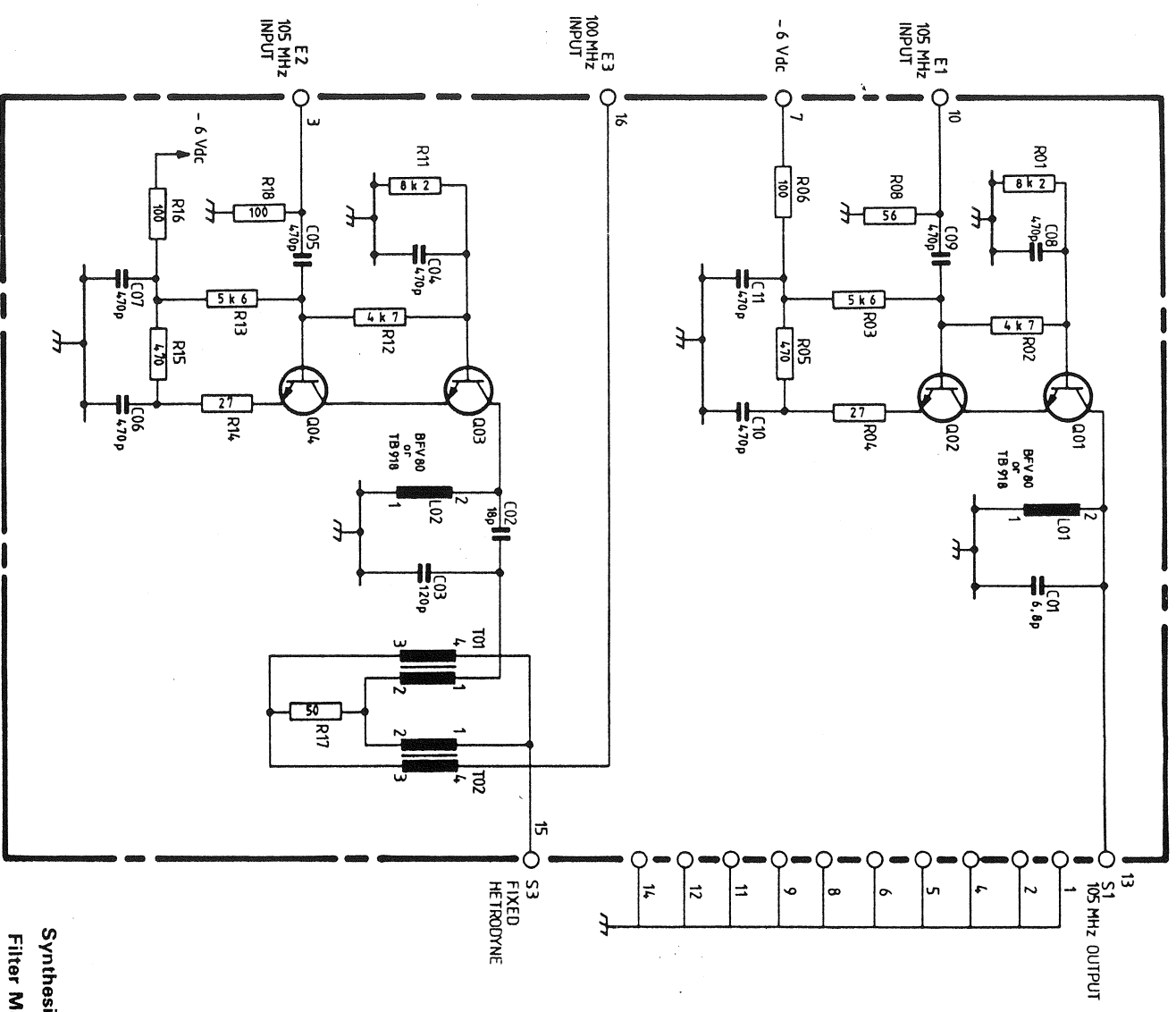
Synthesiser Board No. 3
Circuit Diagram

Fig. 5A.1.9

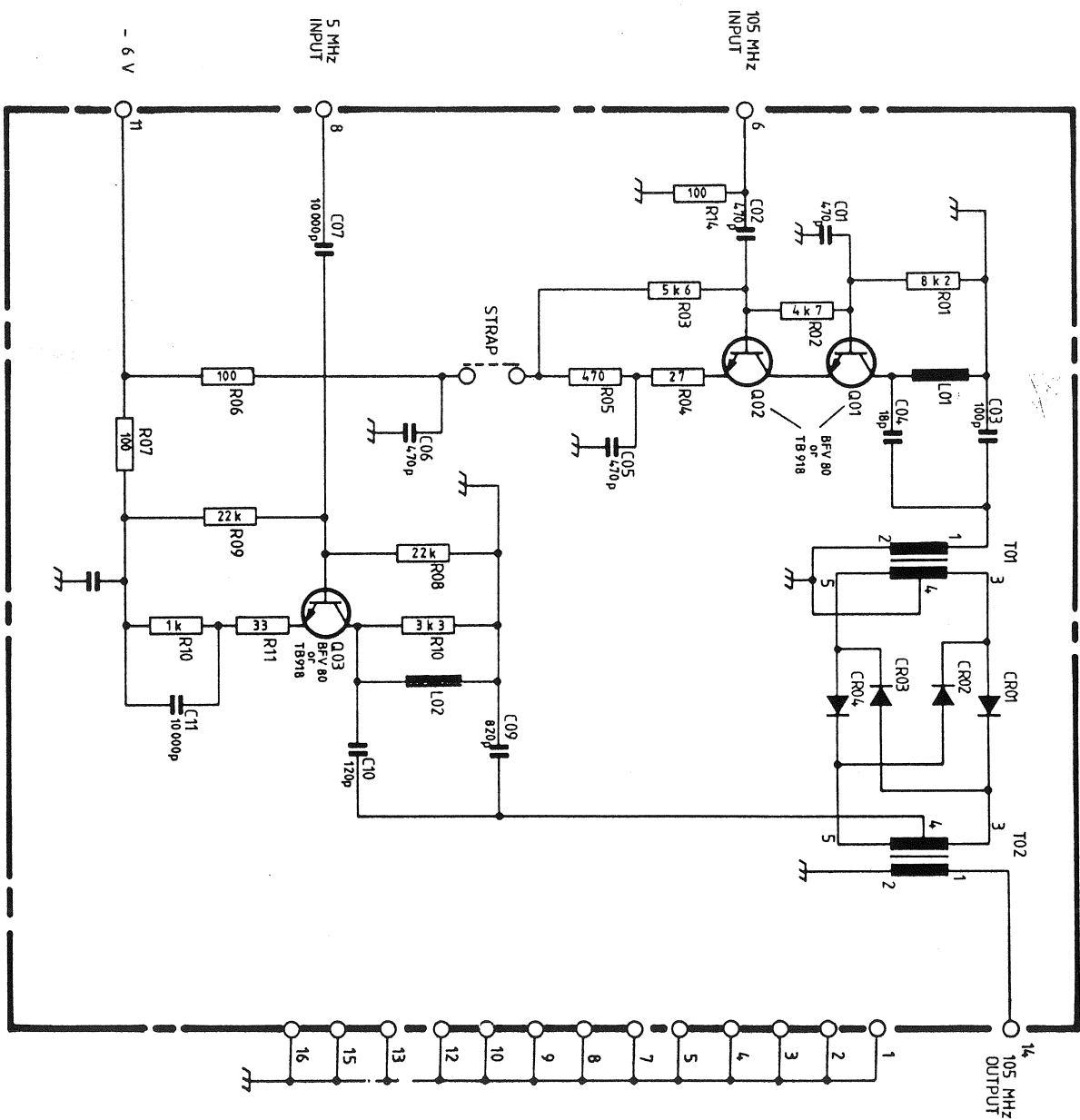


Synthesiser Board No. 3
Circuit Diagram

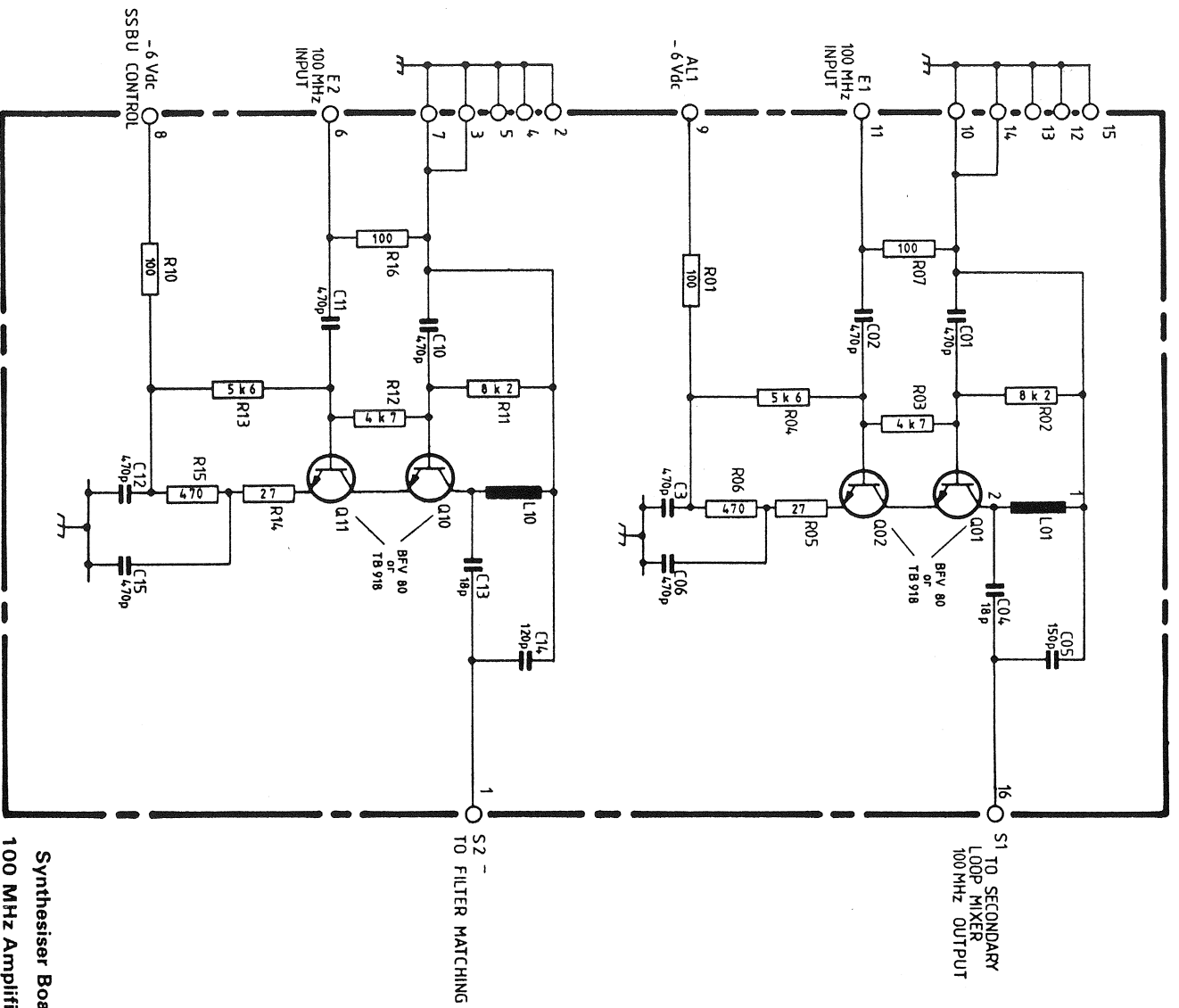
Fig. 5A.1.9



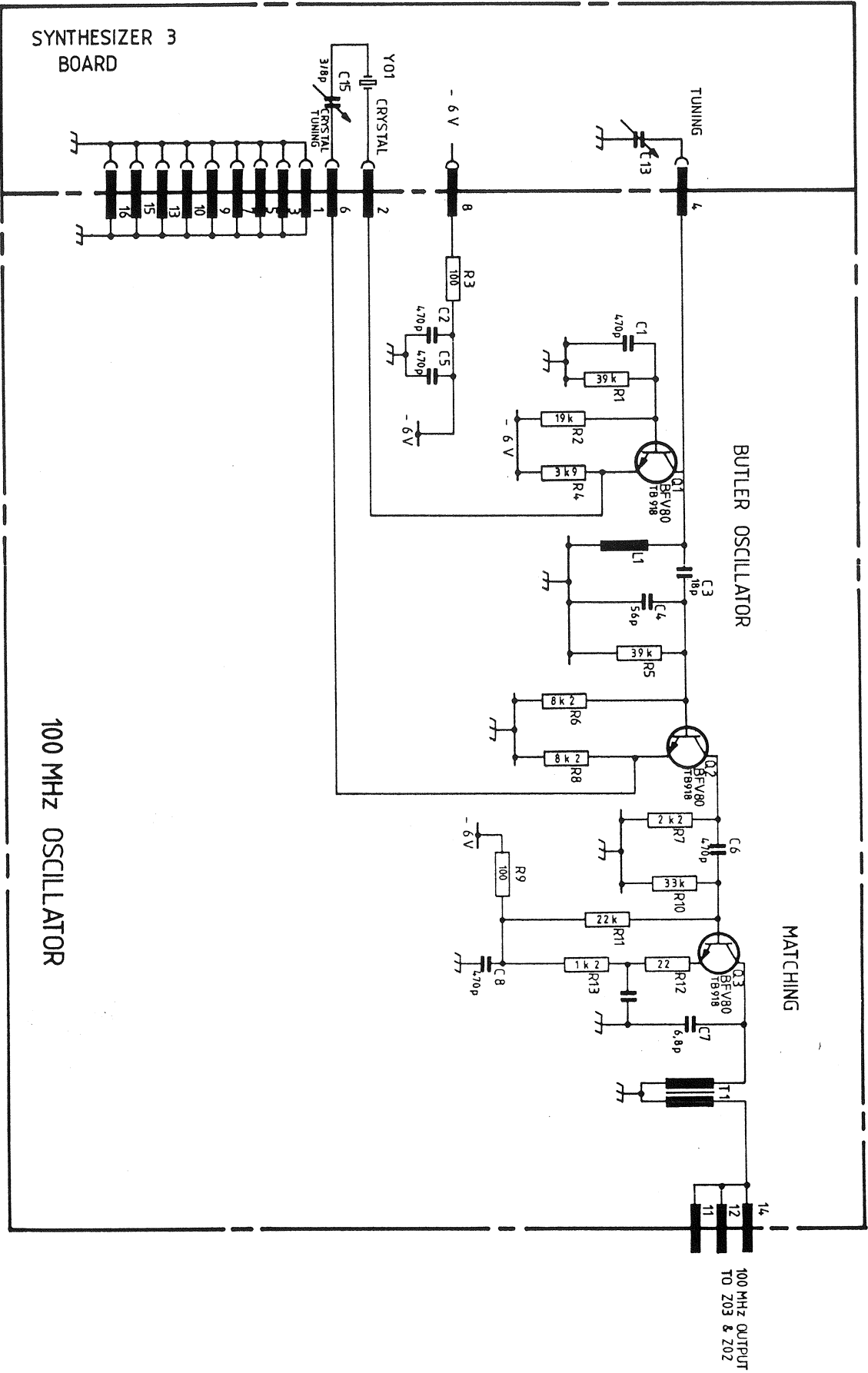
Synthesiser Board No. 3
Filter Matching Module



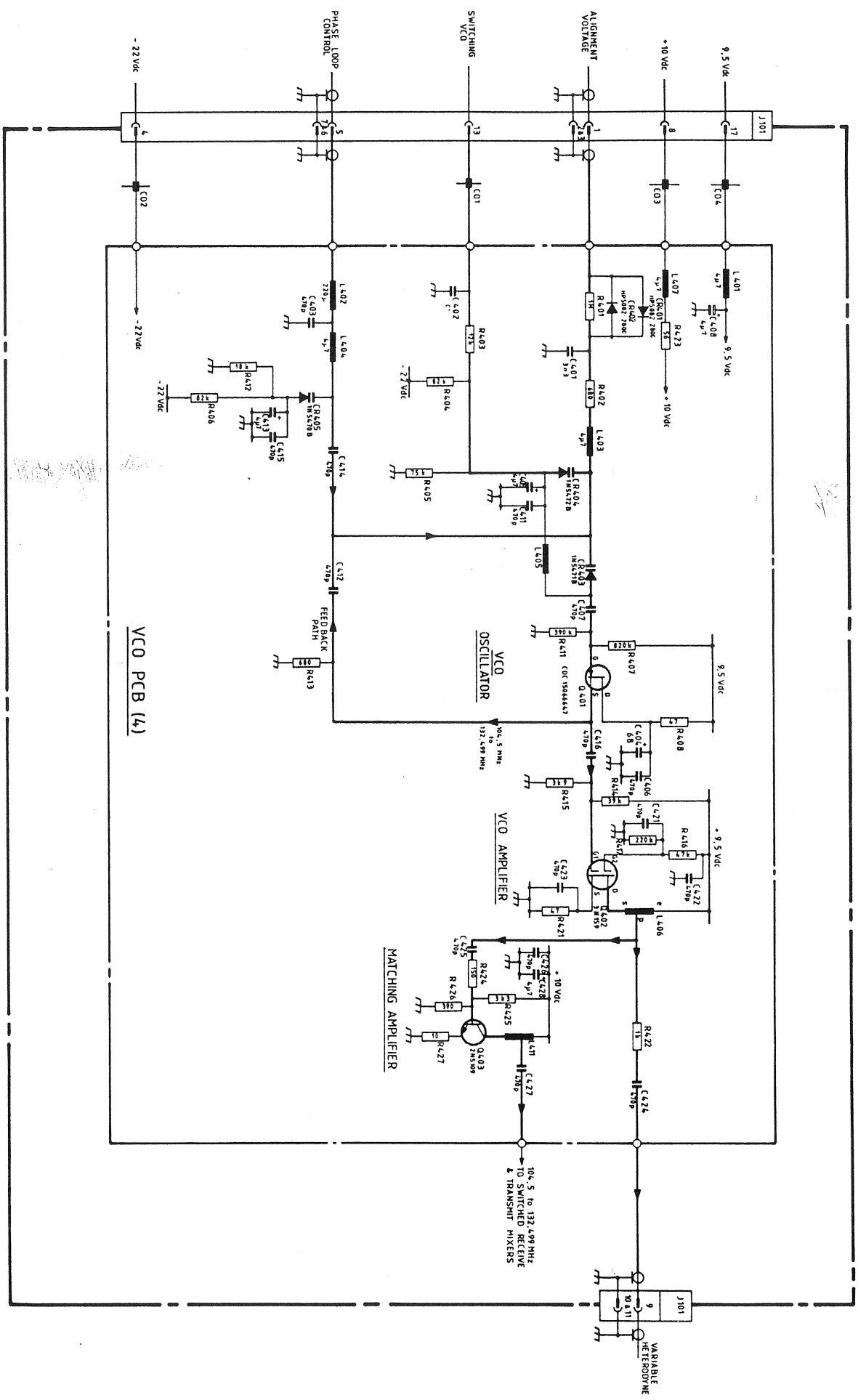
Synthesiser Board No. 3
105 MHz Mixer Module



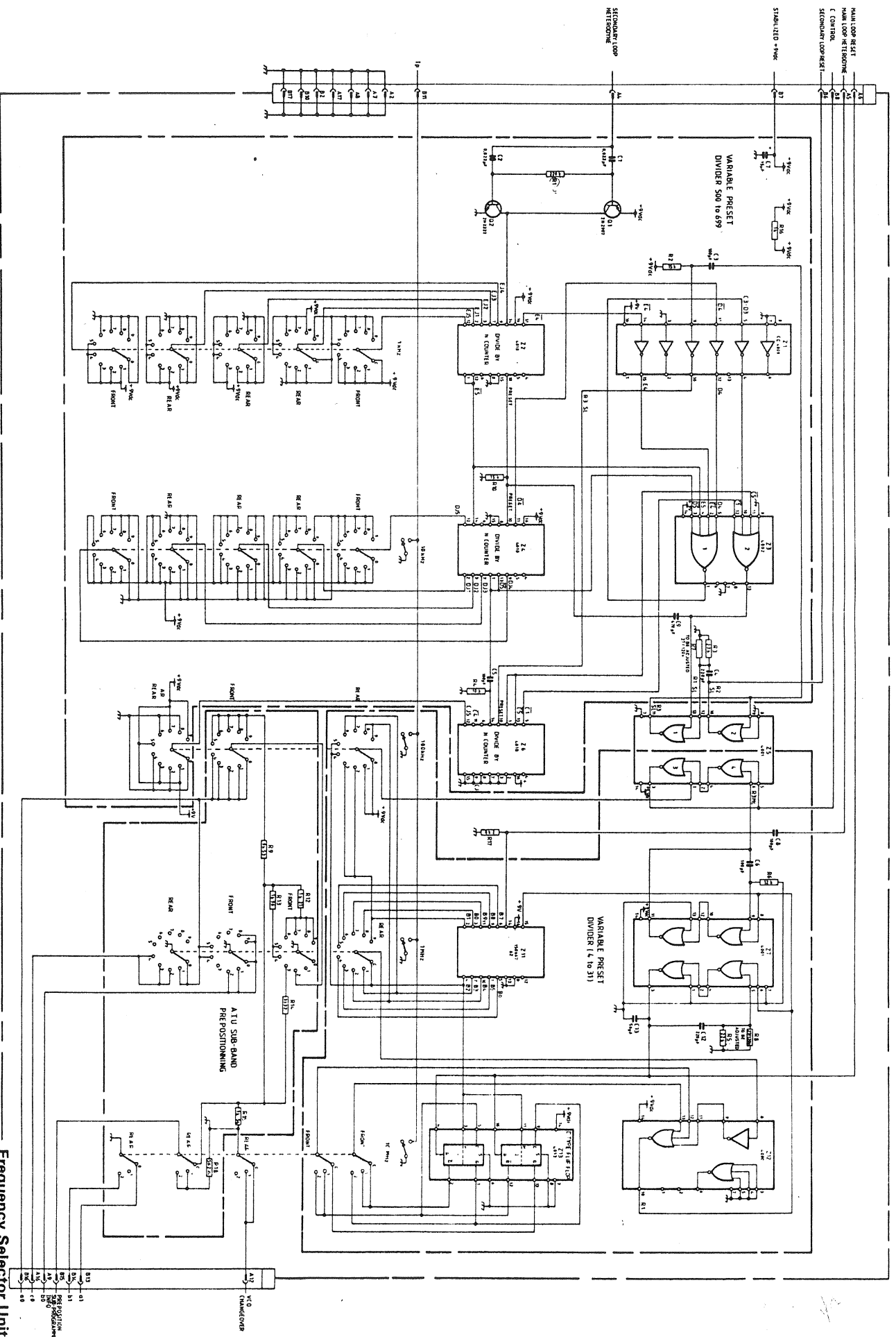
Synthesiser Board No. 3
100 MHz Amplifier Module



Synthesiser Board No. 3
100 MHz Oscillator Module



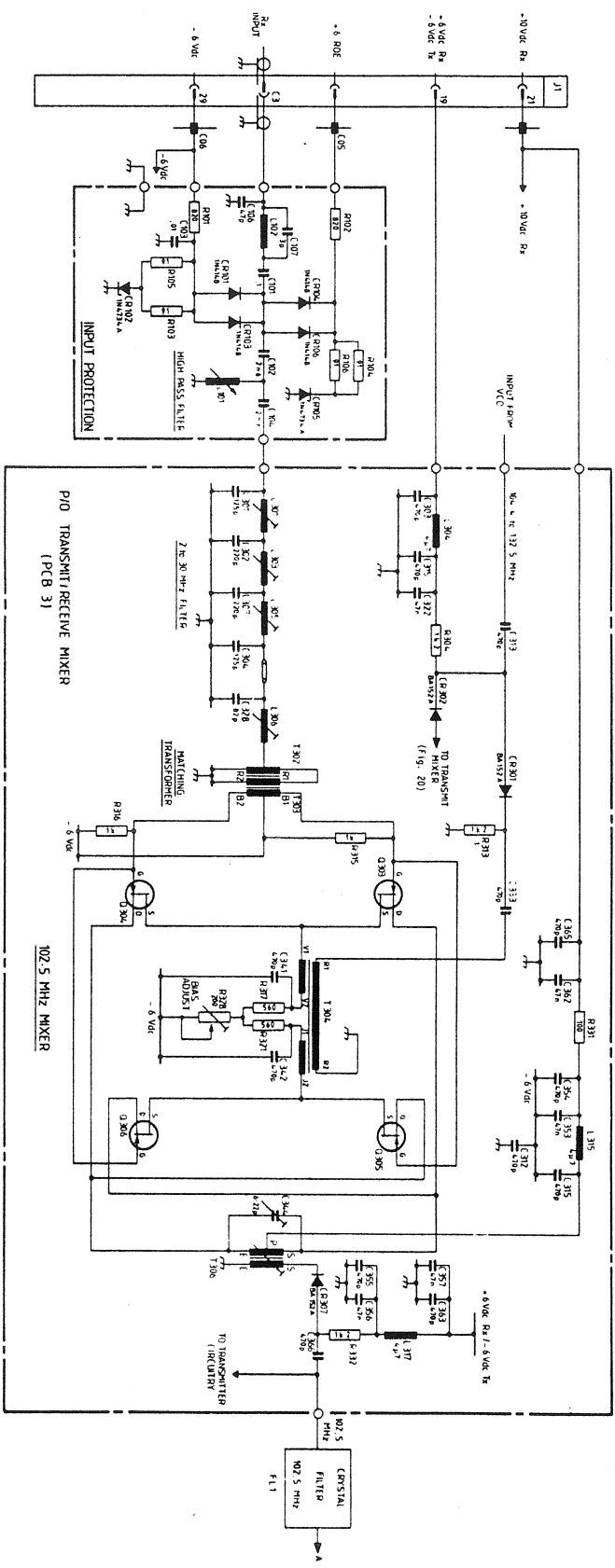
HF Unit
Circuit Diagram



Frequency Selector Unit Schematic Diagram

Fig. 5A.1.15

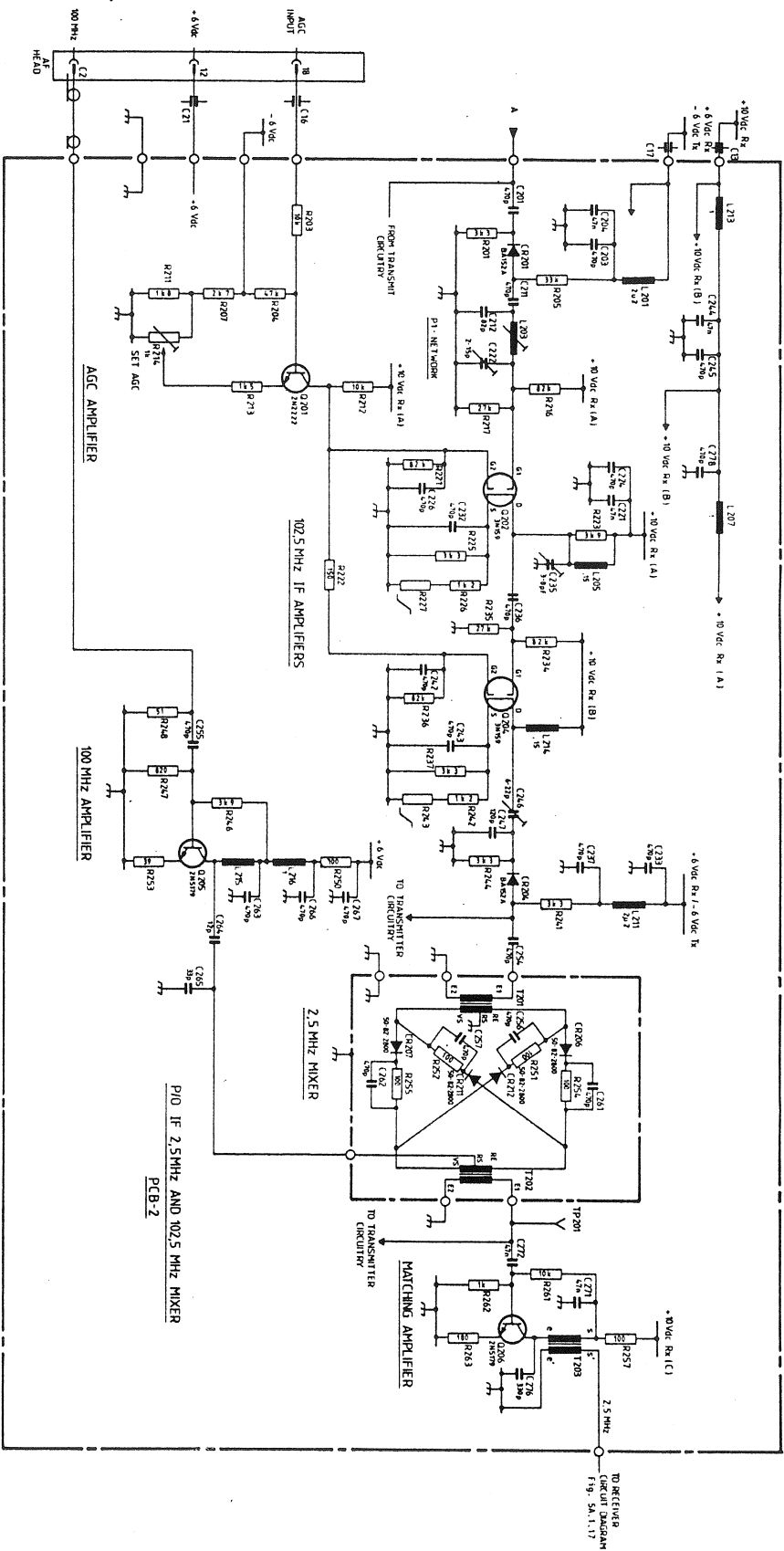
RESTRICTED/BEPERK



NOTES

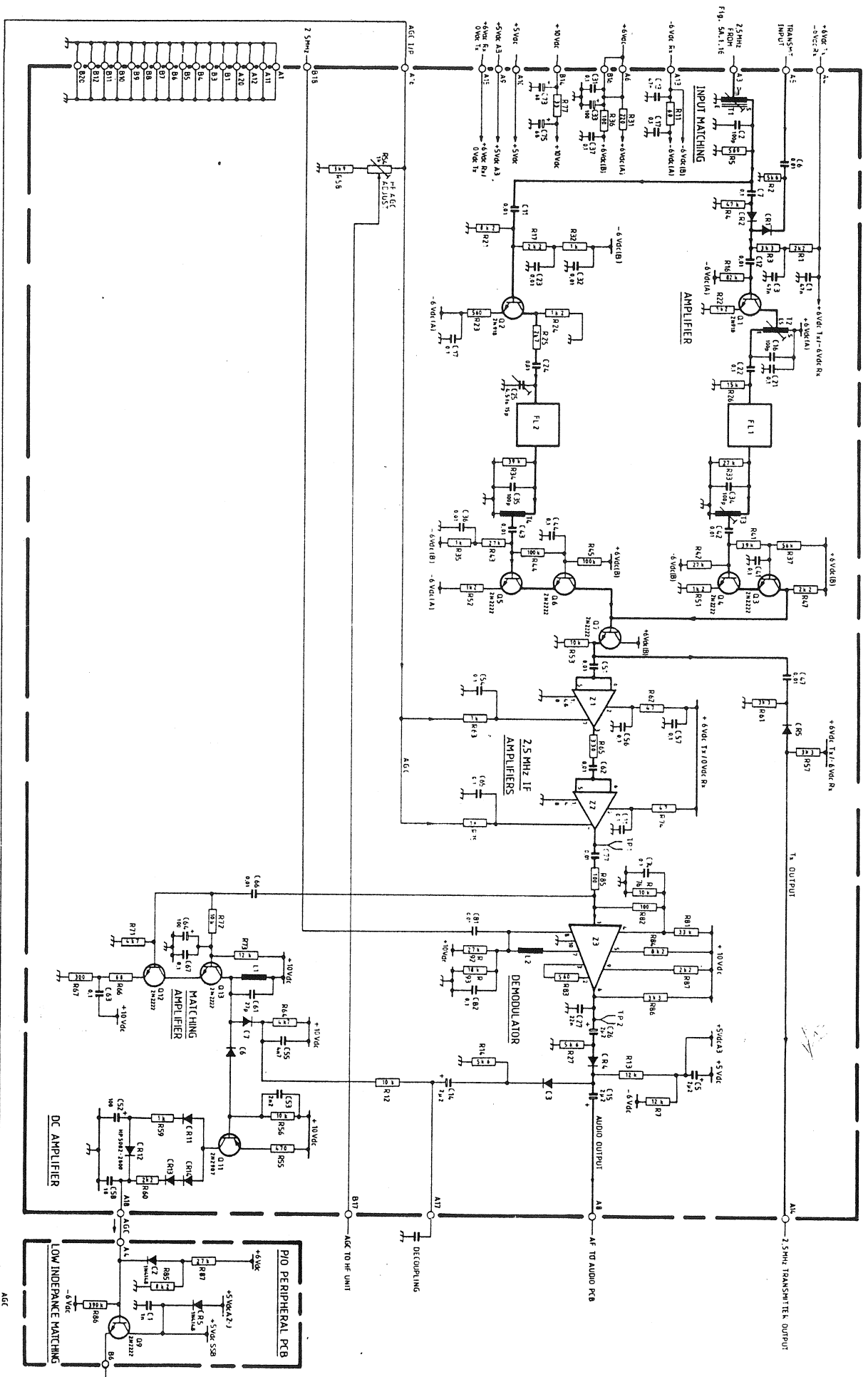
1. ALL P.T. BEARDS ON THIS CIRCUIT ARE CONTAINED IN THE DRAWING.
2. ALL RESISTANCES ARE IN OHMS UNLESS OTHERWISE STATED.
3. ALL CAPACITANCES ARE IN MICRO-FARADS UNLESS OTHERWISE STATED.

Receiver Circuit Diagram



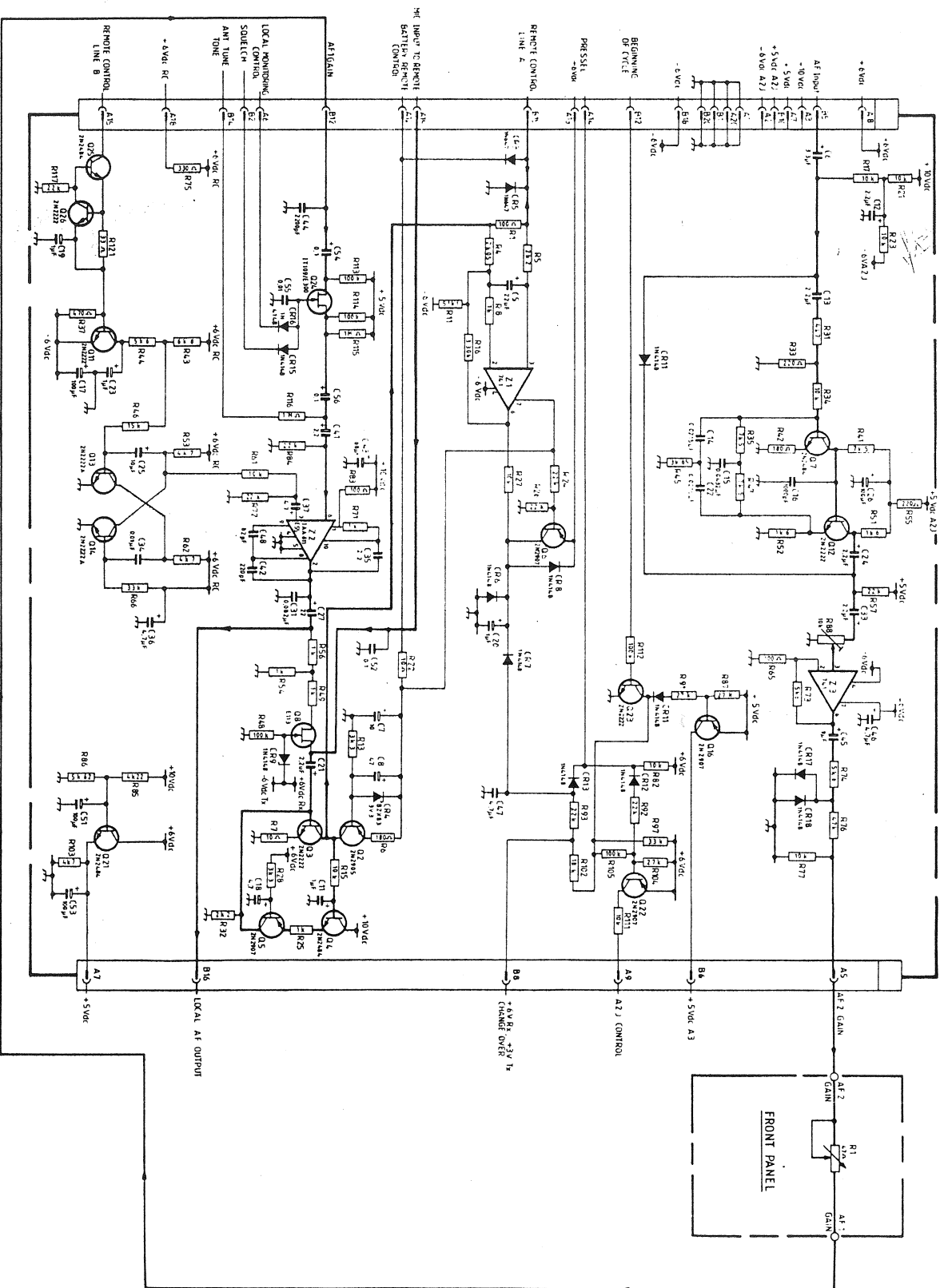
NOTES: 1 ALL PC BOARDS ON THIS CIRCUIT ARE CONTAINED IN THE HF HEAD
 2 ALL RESISTANCES ARE IN OHMS
 3 ALL CAPACITANCES ARE IN MICRO-FARADS UNLESS OTHERWISE STATED

Receiver Circuit Diagram



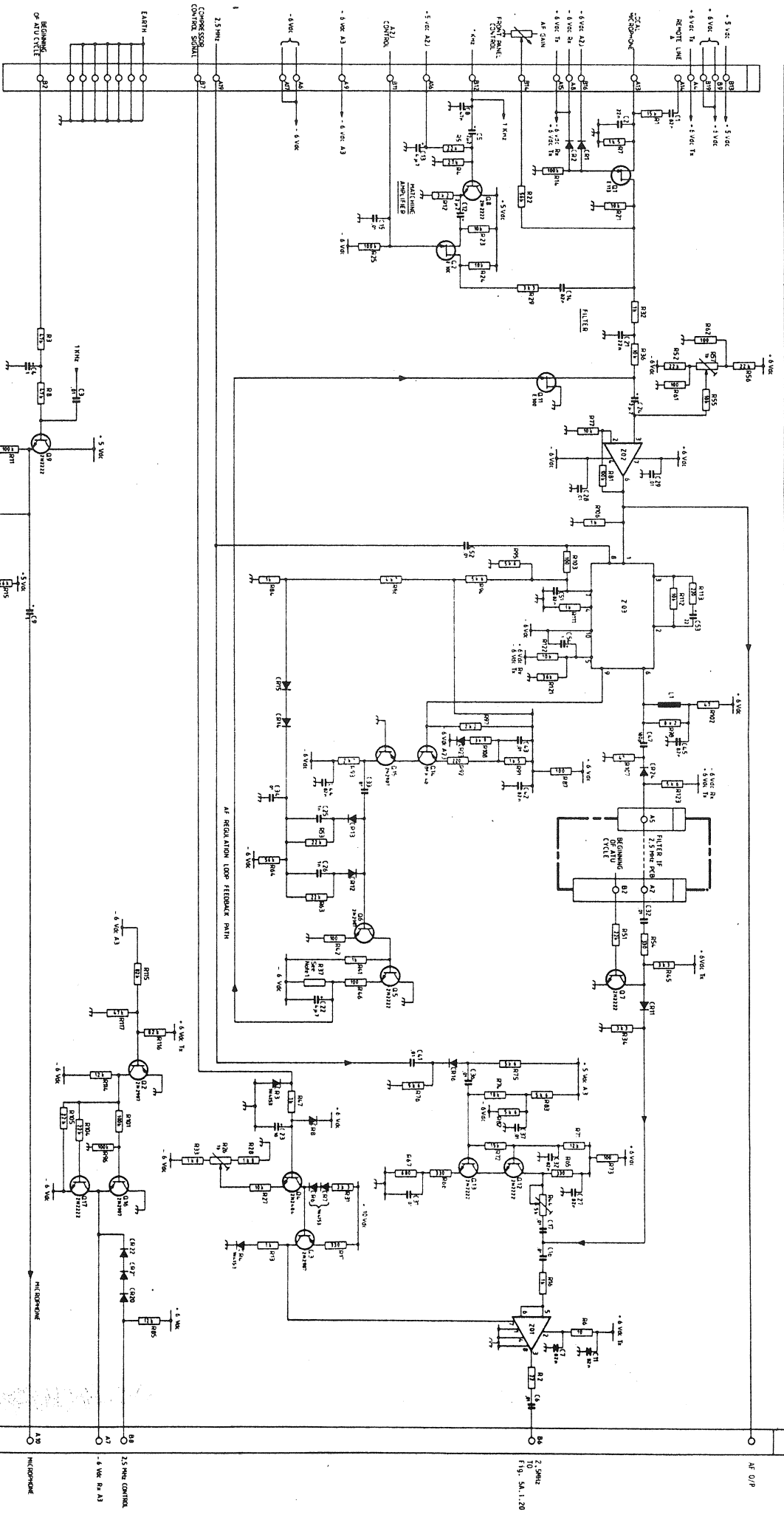
Filter and 2.5 MHz IF Board
Circuit Diagram

Fig. 5A.1.17

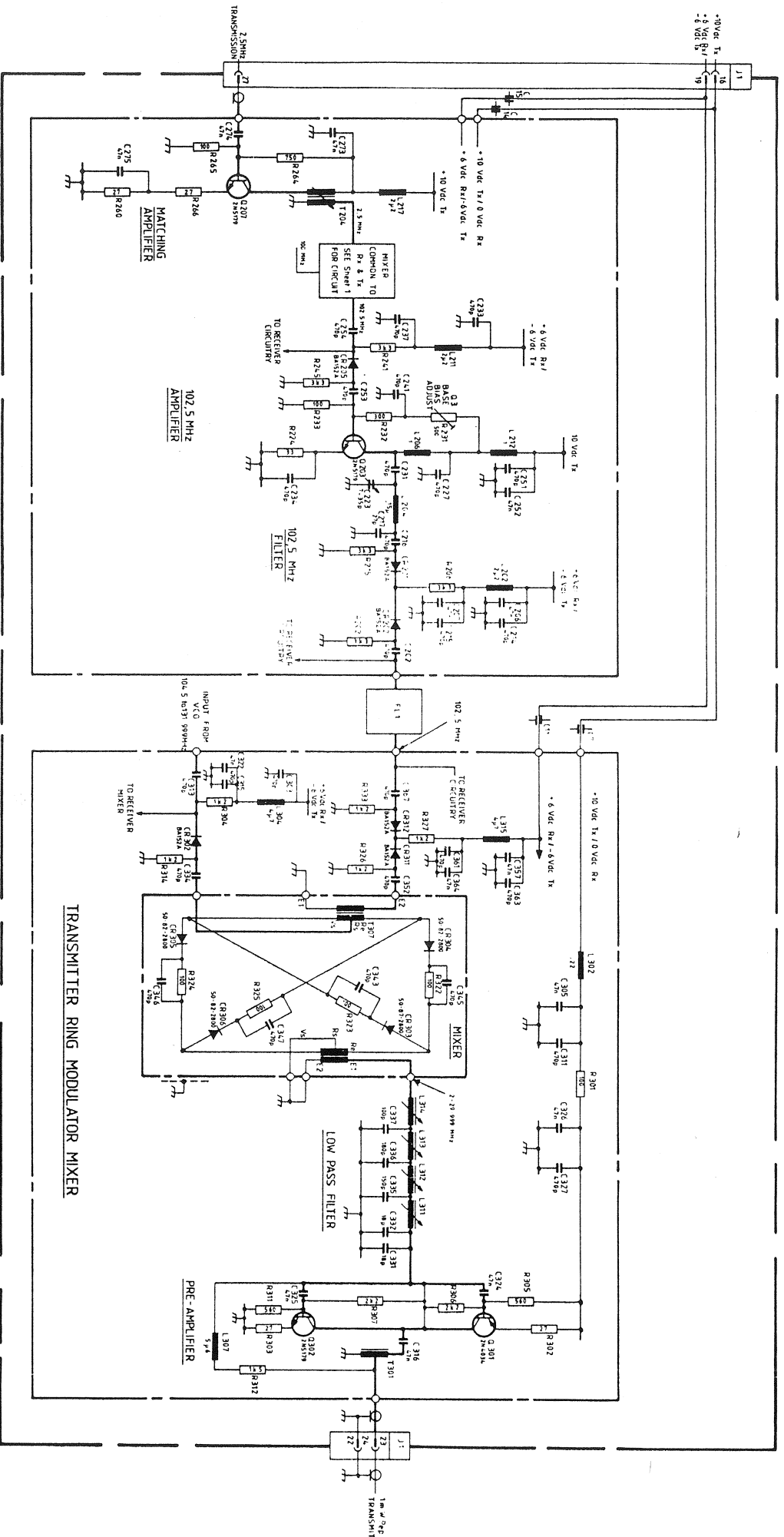


AF Board Circuit Diagram Fig. 5A.1.18

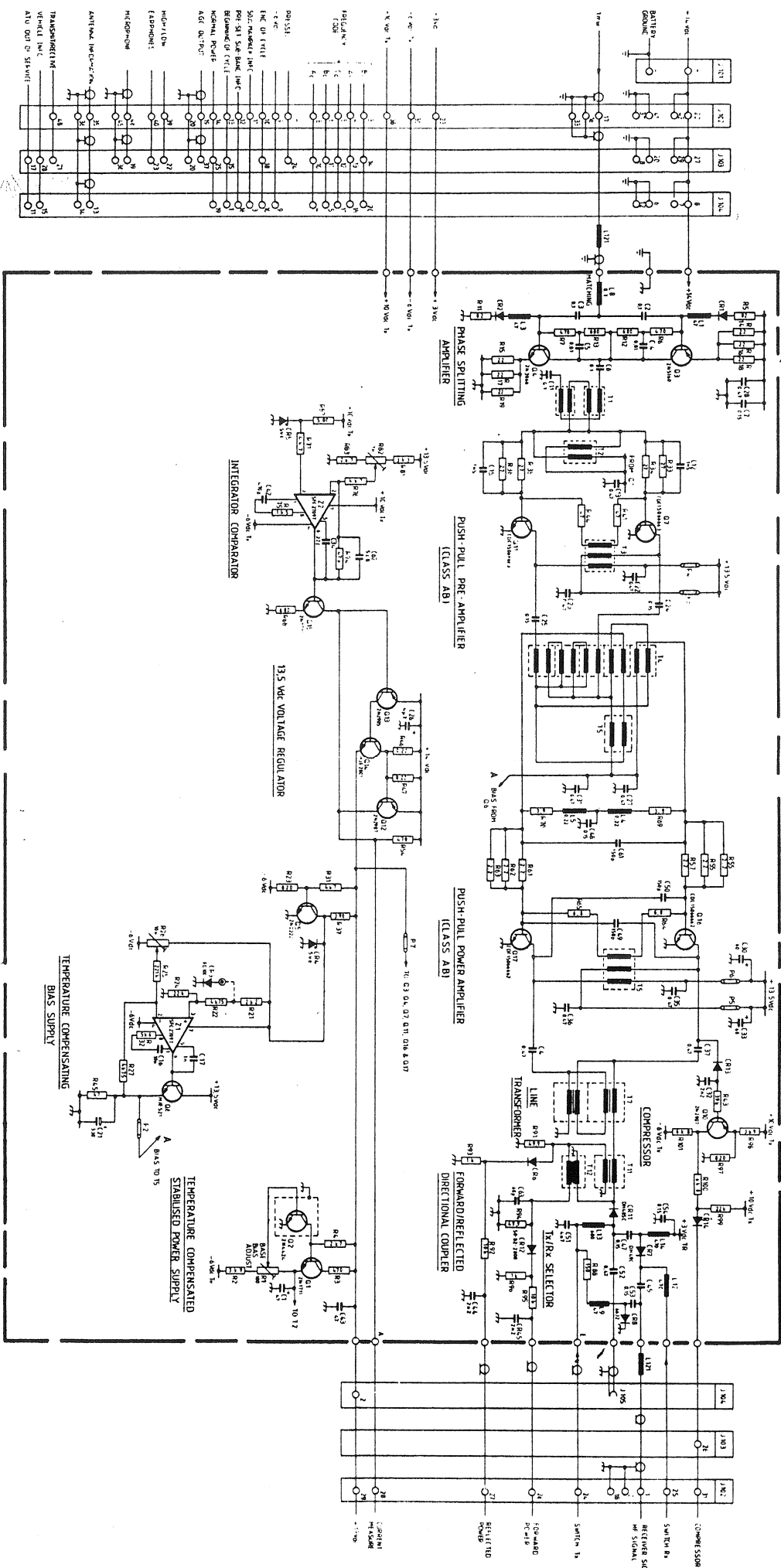
4554	4555	4556	4557	4558	4559	4560	4561	4562	4563	4564	4565	4566	4567	4568	4569	4570	4571	4572	4573	4574	4575	4576	4577	4578	4579	4580	4581	4582	4583	4584	4585	4586	4587	4588	4589	4590	4591	4592	4593	4594	4595	4596	4597	4598	4599	4600	4601	4602	4603	4604	4605	4606	4607	4608	4609	4610	4611	4612	4613	4614	4615	4616	4617	4618	4619	4620	4621	4622	4623	4624	4625	4626	4627	4628	4629	4630	4631	4632	4633	4634	4635	4636	4637	4638	4639	4640	4641	4642	4643	4644	4645	4646	4647	4648	4649	4650	4651	4652	4653	4654	4655	4656	4657	4658	4659	4660	4661	4662	4663	4664	4665	4666	4667	4668	4669	4670	4671	4672	4673	4674	4675	4676	4677	4678	4679	4680	4681	4682	4683	4684	4685	4686	4687	4688	4689	4690	4691	4692	4693	4694	4695	4696	4697	4698	4699	4700
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

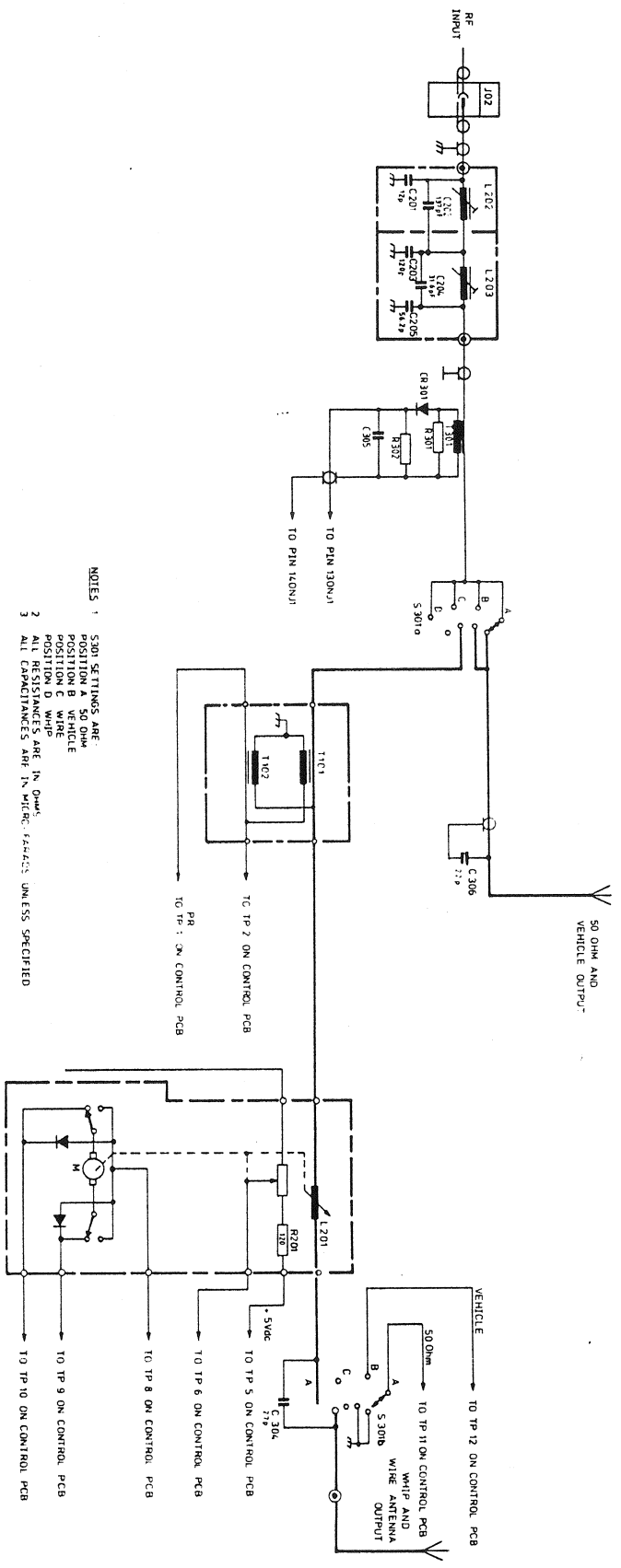


Exciter Board
Circuit Diagram



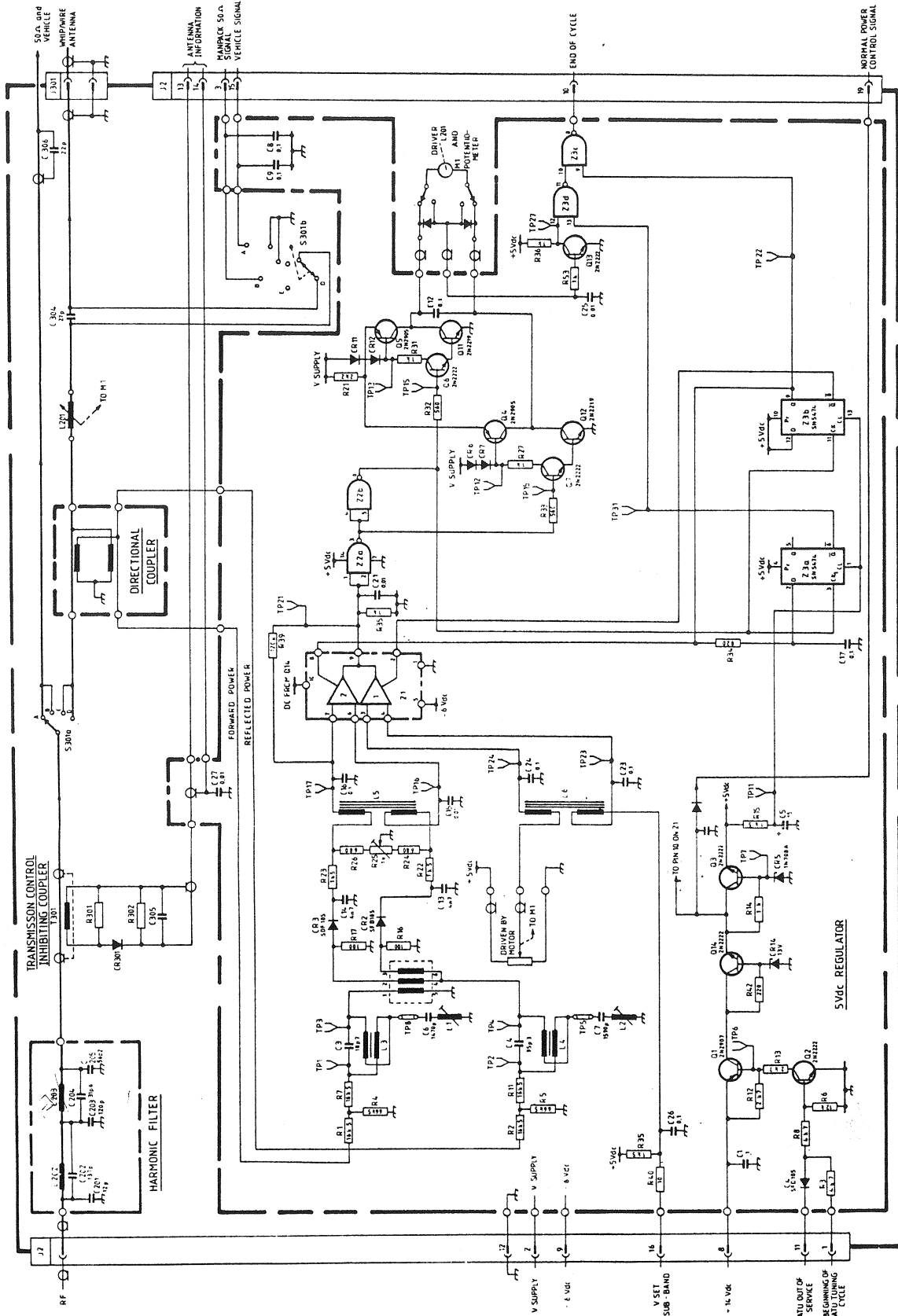
Transmission Circuits in the HF Head





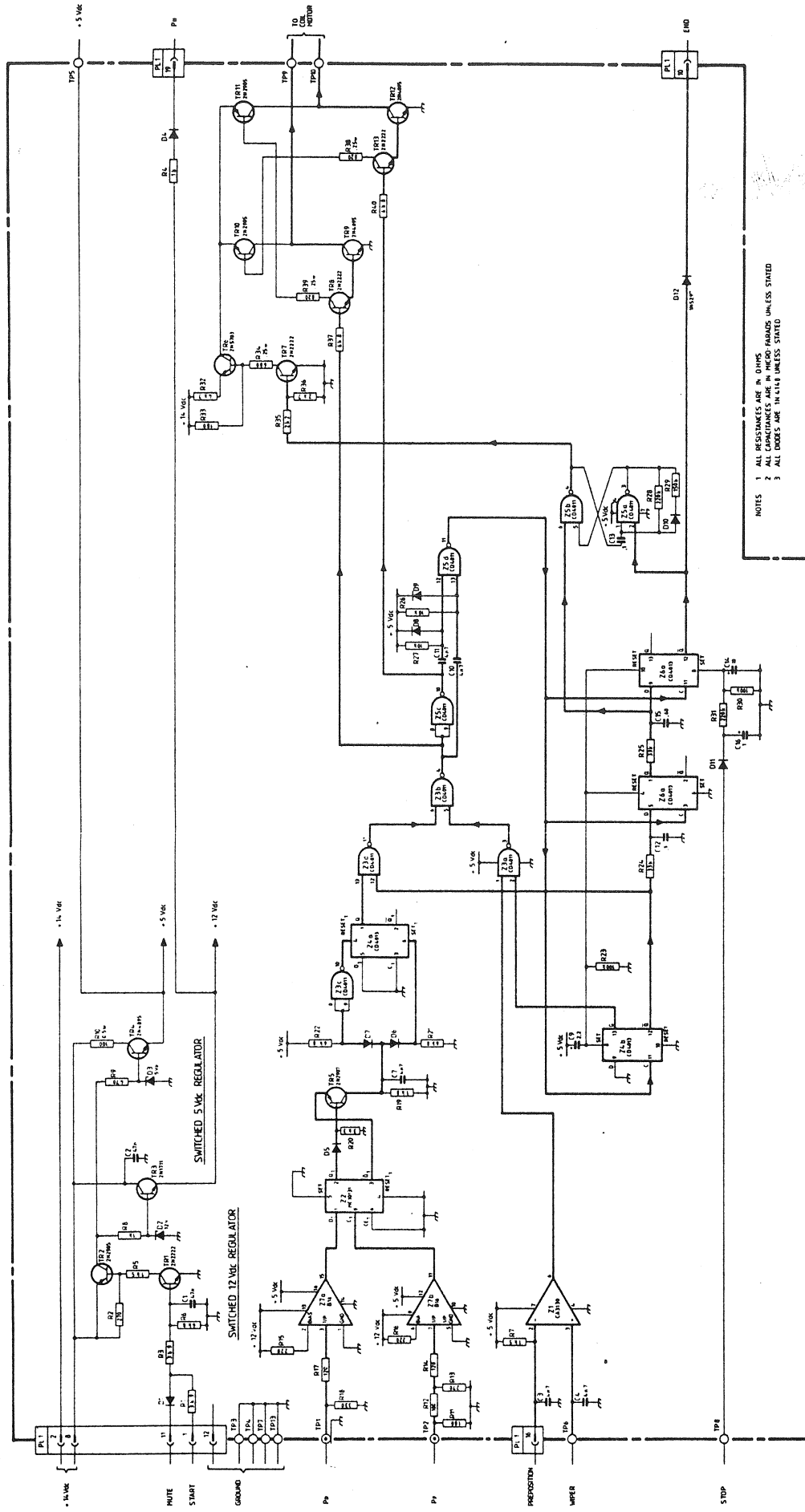
- NOTES:
1. 50 Ohm SETTINGS ARE:
 POSITION A: 50 Ohm
 POSITION B: VEHICLE
 POSITION C: WHIP
 POSITION D: WHIP
 2. ALL RESISTANCES ARE IN Ohms
 3. ALL CAPACITANCES ARE IN MICRO-FARADS UNLESS SPECIFIED

Antenna Tuning Unit

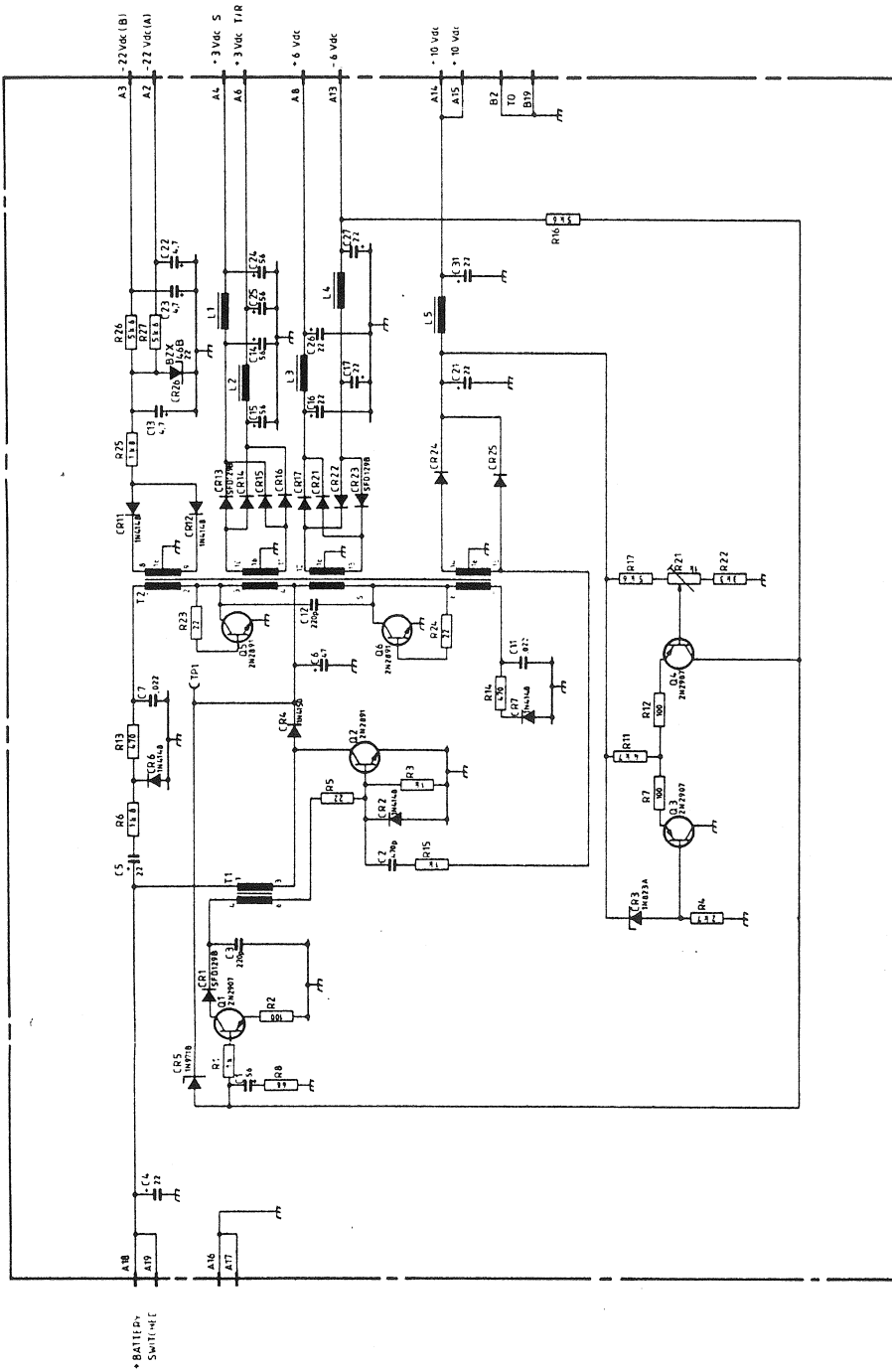


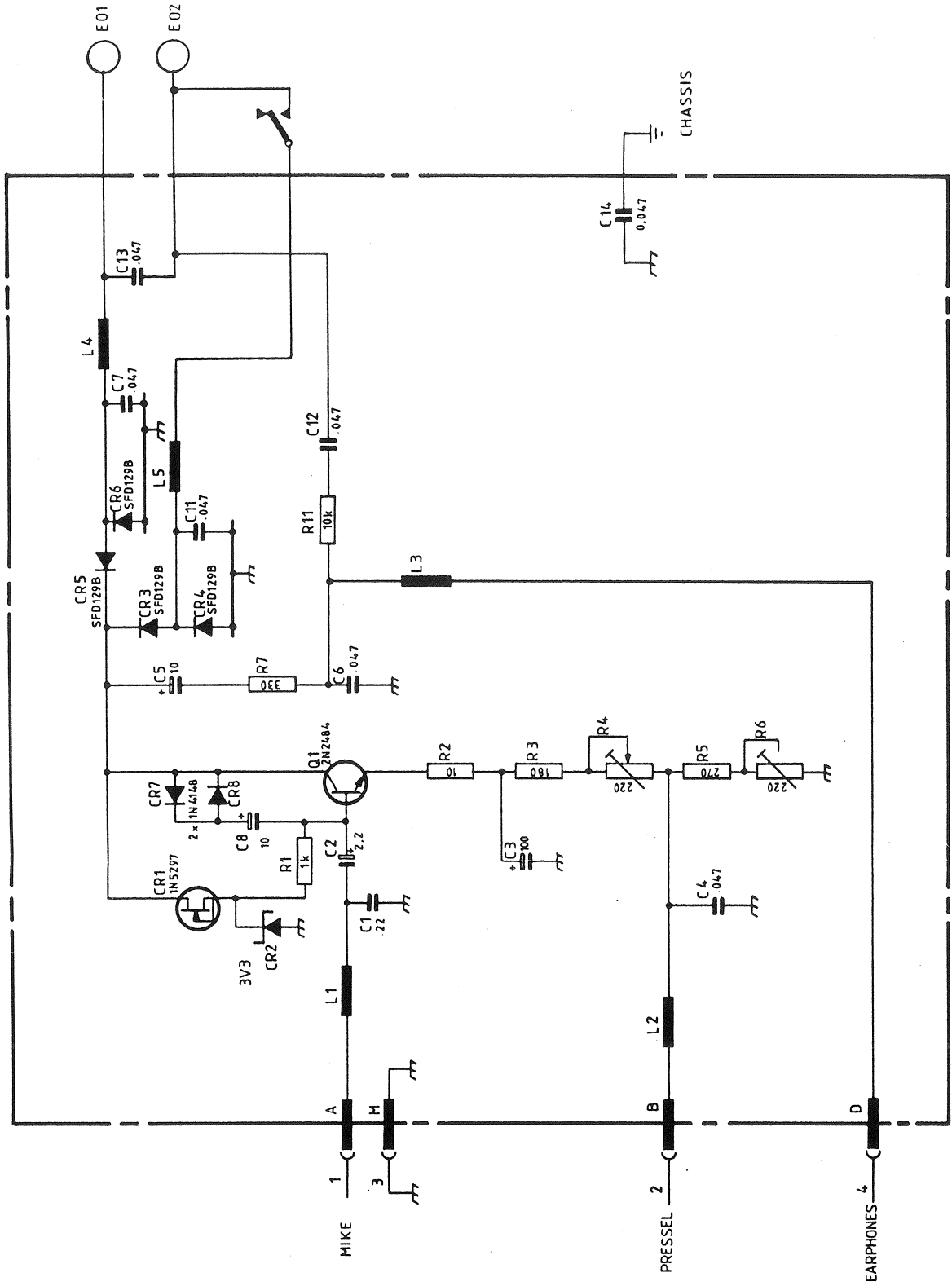
Antenna Tuning Unit

Fig. 5A.1.22 (Sheet 2)



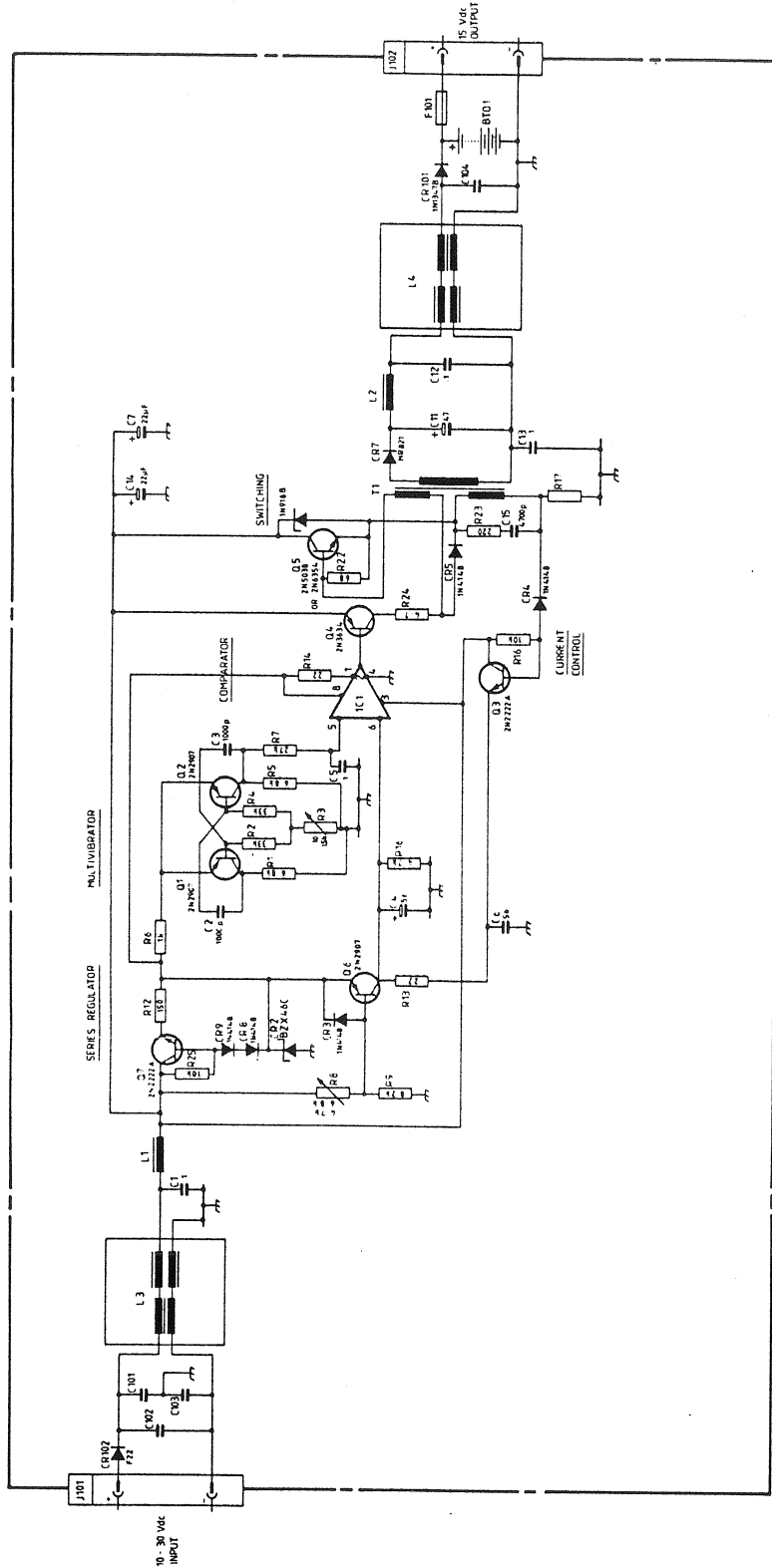
NOTES
1 ALL RESISTANCES ARE IN OHMS
2 ALL CAPACITANCES ARE IN PICO FARADS UNLESS STATED
3 ALL DIODES ARE IN 1N4148 UNLESS STATED





Remote Control Unit

Fig. 5A.1.24



Charger Unit

Fig. 5A.1.25