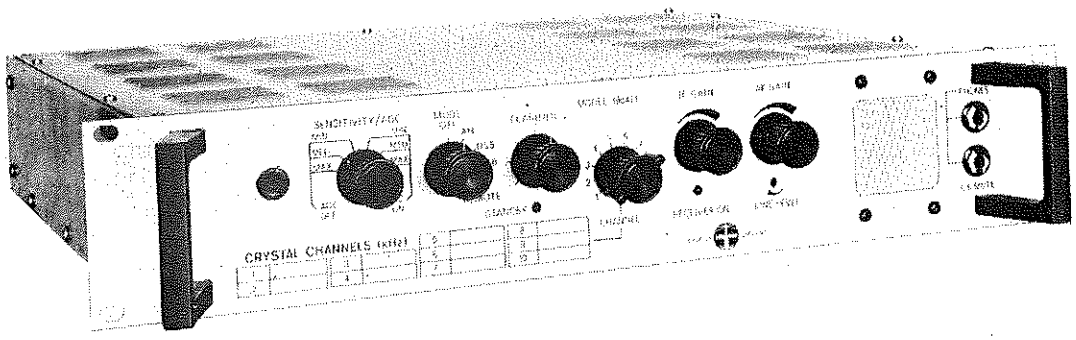
Eddystone

MF/HF
Multi-Channel Receiver

MODEL **1964** SERIES



Manufactured in England by

EDDYSTONE RADIO LIMITED
MEMBER OF MARCONI COMMUNICATION SYSTEMS LIMITED
ALVECHURCH ROAD, BIRMINGHAM B31 3PP
Telephone: 021-475 2231 Telex: 337081

ISSUE NUMBER 1 APRIL 1980

PRINTED IN ENGLAND

AMENDMENT RECORD

Amend No.	Pages subject to change	Amended by	Date
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

The Manufacturer reserves the right to modify the content of this publication as necessary to accommodate modifications, design improvements etc. Relevant Amendment Sheets will be incorporated at date of issue.

CONTENTS

Illustrations

Appendices

Data Diagrams) Bound in order at
Circuit Diagrams) rear of handbook

THIS

PAGE IS INTENTIONALLY

LEFT BLANK

Section 1

INTRODUCTION

General Description

The Eddystone Model EC1964 is a compact professional grade low-cost receiver of high versatility which can satisfy a wide range of diverse requirements including extended or remote control (* Appendix B refers). The 1964 is a multi-channel receiver with provision for tuning up to 10 pre-determined fixed frequencies over the range 1.6 - 27.5MHz. Additional coverage to 100kHz and 50MHz is also possible, but with some limitations on performance. Versions of the receiver permit reception of USB and LSB ~~reception of~~ (A3A, A3H and A3J,) and also DSB and F1 telegraphy. The receiver utilises a 483mm (19") panel to suit standard racking, and is powered from any standard 40-60Hz supply in the range 100/160-200/280V.

The selection of IF filter, detector, AGC type (Audio or Carrier/Sideband derived) and some special functions, is determined by the "Mode" switch. The "Mode" switch has four positions which are pre-programmed to customers requirements to select the appropriate circuitry for the modes required (USB, LSB, etc.). Selection of crystal frequencies for the channels required and pre-programming of the "Mode" control are described fully at Section 2, "Installation".

A double-conversion circuit design is employed with intermediate frequencies of 1.4MHz and 100kHz. Local oscillator injection is crystal controlled with the crystals being contained in a proportional oven for high stability (for channel frequencies above 20MHz, local oscillator injection is provided via a frequency multiplier circuit). Injection to the 2nd mixer is also crystal controlled, but this circuit includes a varactor tuned clarifier facility with a coverage of $\pm$ 300Hz.

Two separate audio channels are available, one for local monitoring from a headset or the internal loudspeaker, and the other for connection to standard 600Ω line circuit. Input/output facilities are provided to enable two 1964 receivers to be inter-linked by their AGC lines to give diversity operation, and also to enable remote "aerial" or "RF" muting. A 50Ω output is also provided at the final intermediate frequency (100kHz).

The aerial protection and attenuation module provides protection against unwanted RF signals upto 30V rms and minimises any damage likely to be caused by local high power radiation or lightning. Extended or remote operation of Mode, Channel, IF Gain, Clarifier, RF Mute, Aerial Attenuator, and AGC Controls, requires the fittings of the optional "remote interface adaptor" module (* Appendix B refers).

The 1964 receiver is designed to facilitate easy servicing, mainly by the provision of quick access to all test and adjustment points, and by the concept of modular construction (including the Front Panel PCB assembly) interfaced with flat ribbon-cable interconnection. The modular construction concept makes provision for fitting a variety of special modules to provide local oscillator drive, RF amplification and filtering. These additional refinements include single frequency drive, and broad-band RF amplifier, all of which allow the specific realisation of a precise and cost effective system to meet differing requirements. Space is also provided on the front panel for an extra control, which can be used for additional control of the programmable functions, or in conjunction with specially fitted modules (** Appendix B refers).

(*) Appendix B1 : : Remote Control
(**) Appendix B2 : : Special Variants.

Guarantee

All 1964 receivers are suitable for continuous use under arduous operating conditions and should require very little routine maintenance over long periods of operation. With the exception of the semi-conductors, all components are guaranteed by the Manufacturer for a period of one year from the date of purchase. The semi-conductors are all covered by a separate guarantee.

Servicing

Spares for user servicing can be supplied and helpful advice will be freely given when required. Any enquiries relating to service matters should be directed to the "Sales and Service Department", at our usual address.

Should major servicing become necessary, the receiver can, by prior arrangement, be returned to the Manufacturer for attention. Extreme care should be taken to ensure that the equipment is well protected against possible damage during transit.

Frequency Coverage

10 channels arranged in 5 pairs. Each pair of channels to be any one of the following bands:-

1.6	-	3.0MHz
3.0	-	5.7MHz
5.7	-	10.8MHz
10.8	-	20MHz
20	-	27.5MHz

Model 1964/1 covers 1.6 - 20MHz only.

Pre-tuned RF circuits are provided on each channel.

Alternatively, reception can be arranged below 1.6MHz.

Intermediate Frequencies

1400kHz and 100kHz.

Reception Modes

A3,
A3J, A3A, A3H, USB or LSB
Reception mode F1 can also be provided.

Aerial Input

50Ω unbalanced. (30V continuously applied will not damage the receiver).

Power Supplies

100/160V and 200/280V 40-60Hz. Consumption approximately 25 VA.
(Total range inc. variability of supply).

Environmental

Operational	:	-10°C to +55°C.
Storage	:	-40°C to +70°C.
Humidity	:	95% R.H. at 40°C.
		Compatible with all Marine Specifications.

Dimensions

Panel	:	483mm x 88mm
Intrusion into rack	:	420mm (including allowance for cabling)
Weight	:	10kgm.

Controls

Aerial Attenuator 0dB -20dB -40dB

IF Gain

AF Gain

Clarifier ± 300Hz range

Mode Select

Channel Select

AGC On/Off. (COMBINED AS 'SENSITIVITY/AGC' CONTROL)

LINE LEVEL

PERFORMANCE SPECIFICATION 1964/1

Noise Factor 1·6 - 20 MHz 10dB typical. (equivalent to 15dB S/N for 1µV emf in sideband modes or 15dB S/N for 5µV emf, 30% 1kHz modulation, in AM modes, manual gain).

20-27·5 MHz :- 12dB TYPICAL

IF SELECTIVITY

SSB : : -6dB 350Hz to 2700Hz
-60dB -400Hz to 3700Hz

DSB : : -6dB ±3.5kHz
-60dB ± 10kHz

Special bandwidths can also be accommodated to meet customers requirements.

Image Rejection

≥70dB below 9MHz
≥60dB below 15MHz
≥50dB below 20.00MHz
> 40dB BELOW 27·5 MHz

IF Rejection ≥100dB

In-Band Intermodulation Third order products more than 40dB below standard output. (Inputs up to 80dBµV).

Out-of Band Intermodulation The third order products produced by 2 signals removed from the wanted signal by greater than 30kHz must be greater than 80dBµV to produce a spurious equivalent to 0dBµV wanted signal.

Cross-Modulation	With a wanted carrier 60dBμV adjusted to give standard output, on unwanted signal 20kHz off-tune must be greater level than 95dBμV to produce an output 30dB below standard output.
Stability	Better than 10Hz over 0 to 40°C for frequencies below 10MHz. Better than 1ppm over 0 to 40°C for frequencies above 10MHz. (Referred to 20°C).
AGC Characteristics	Less than 2dB change in output for 90dB increase from AGC threshold (approx : 1μV).
Outputs	100kHz IF Output : 20mV into 50Ω Line Audio : 30mW into 600Ω balanced or unbalanced. Loudspeaker : 1W into 4-8Ω. Headphones : 5mW into 600Ω. Distortion on above outputs typically 1%.

NOTE : : The above figures are typical only and do not form the basis of a contractual test specification.

INSTALLATION

Pre-programming of receiver functions

The CHANNEL frequencies and MODE functions are pre-programmed by Eddystone Radio Limited to customers specific requirements. However, changes may be carried out by the customer, and in such cases, it is strongly recommended that prior consultation should be made with Eddystone Radio Limited, to establish the best method of effecting the desired change. It is emphasised that the following information is submitted as a general guide only. The relevant information concerning the necessary physical changes is given at Section 5 under the heading Maintenance.

Setting of Channel Frequencies

These are determined by the actual frequencies of the crystals (XL1-XL10) in the Oscillator Module. The field specification relevant to these crystals, is detailed in Eddystone drawing/part number 10347P. The relationship between Channel frequency and Crystal frequency is given in Table 1. This illustrates that the relationship depends on the frequency band in which the channel falls. As each band requires a different RF HEAD Module type, the relevant modules fitted must correspond with the channel frequencies. Single and double channel modules are available, and for a receiver with 10 used channels, the maximum number of 5 double channel modules will be required. It should be noted, that each module can only accept frequencies in the band specified: this may limit the overall choice of channel frequencies. The nominal band limits are given in Table 2. ALSO, WHEN A HIGH SIDE OSCILLATOR IS USED (ie R1/2) THE DIODES CORRESPONDING TO THE ASSOCIATED CHANNEL NUMBERS (ie D1 FOR CHANNEL 1) ETC, ARE FITTED ON THE 'AUTO SIDEBAND SELECTOR' BOARD. (EXCEPT IN THE CASE OF SOME SPECIAL VARIANTS)

TABLE 1

Relationship between Channel Frequency and Xtal Frequency

RANGE(S)	CRYSTAL FREQUENCY (kHz)
R1/2	Channel frequency (kHz) + 1400kHz.
R3/4	Channel frequency (kHz) - 1400kHz.
R5	$\frac{\text{Channel frequency (kHz) - 1400kHz.}}{\text{Multiplier factor } 2}$

n.b. If certain reception modes require special IF filtering (e.g. A2), the above relationship may alter. (See Appendix B2).

TABLE 2

Nominal Band Limits of RF Head Modules

RANGE	BAND LIMITS		
1	1.6	-	3.0MHz
2	3.0	-	5.7MHz
3	5.7	-	10.8MHz
4	10.8	-	20MHz
5	20	-	27.5MHz

n.b. As long as the ratio between the two required frequencies in any band does not exceed approximately 2, the above limits may be extended by about 5%. Details of other frequency bands are given in Appendix B2.

The frequency of the second local insertion oscillator is determined by the frequency separation of crystals XL11 and XL12 in the Oscillator Module. These are simultaneously varied by the CLARIFIER control to provide approximately ±300Hz tuning. In certain circumstances the actual frequencies of the crystals may vary from that given in this handbook. Accordingly, the specification for the crystals is given in Eddystone drawing/part number 10348P. The relevant data applicable to changes of frequency in 1964 Model variants are detailed in Appendix B2.

Programming of Mode Switch

The four Mode Switch positions are programmed via the diode memory on the "MODE MEMORY MODULE". The program thus formed, acts as a monitor program translating the mode selected into the necessary connections and operating functions within the receiver. Table 3, details the elements of the receiver which are programmable. The presence of a diode in the memory matrix is equivalent to a "1": the absence of a diode is equivalent to a "0".

Notes for TABLE 3

(1) Audio derived AGC is only operable when the product detector is also selected.
(2) When the filter module is by-passed, the IF filtering is determined by the 1.4MHz roofing filter and is nominally ±3.5kHz (-6dB passband). This is normally used for AM mode reception.
(3) Normally, the product detector insertion oscillator must be enabled when the product detector is selected.
(4) On all selected mode positions Vcc must be applied to the MAIN IF amplifier and detectors. This state is indicated by the illumination of the RECEIVER ON indicator.
(5) The basic (shorter) AGC time constant is automatically selected when AGC off is selected by the SENSITIVITY/AGC switch. This is necessary to reduce time delays when switching from AGC off to AGC on in the presence of a large signal.

TABLE 3 - 1964 Programmable Functions

FUNCTION	SYMBOL	CONTROLLED MODULE(S)	DIODE PRESENT, '1'	DIODE ABSENT '0'
AGC Time Constant	A	Main IF etc.	Increases AGC time constant.	Basic AGC time constant (5)
AGC Mode	B	Main IF etc.	Selects audio derived AGC (1)	Selects carrier/sideband derived AGC.
Detector Mode	C	Main IF etc.	Selects envelope detector.	Selects product detector (3)
Filter 1/2	D	Filter Module	IF Filter 1 selected (usually LSB)	IF Filter 2 selected (usually USB)
Filter 3	E	Filter Module	IF Filter 3 selected.	IF Filter 1 or 2 selected depending on 'D'.
Uncommitted	F	See Appendix 2	See Appendix 2	See Appendix 2
Filter Bypass	G	Main IF etc. & 1st/IF and Mixer	Filter module bypassed (2).	IF Filter 1, 2 or 3 selected depending on 'D' and 'E'.
Clarifier Mode	H	Oscillator	See Appendix 2	See Appendix 2
Enable Insertion Oscillator	I	Oscillator	Product detector local oscillator drive inhibited (3).	Product detector local insertion oscillator drive enabled.
Enable Receiver	J	Main IF etc.	Vcc applied to Main IF IF amplifier and detectors (4).	Receiver outputs muted.

Programming Examples

Referring to the mode examples given in Section 3 "Operation", the programs would be specified as follows:-

(X - don't care, diode presence not critical).
Mode position 1 - 'AM' - this required a ±3.5kHz filter, the basic AGC time constant, carrier/sideband derived AGC, and the envelope detector. The program would be as follows:-

A	B	C	D	E	F	G	H	I	J
0	0	1	X	X	0	1	0	1	1

Mode positions 2 and 3 - 'USB/LSB'. The relevant programs are the same, except for the selection of IF filter. This requires audio derived AGC, the product detector and insertion oscillator and either IF filter 1 (LSB) or 2 (USB).

A	B	C	D	E	F	G	H	I	J
X	1	0	1(LSB) 0(USB)	0	0	0	0	0	1

Further information on programming can be found in Appendix B2 and is available from Eddystone Radio Limited.

Power Supplies

The receiver must be disconnected from the supply before removing covers or making adjustments to the power circuits.

The receiver may be powered from any standard 40-60Hz AC supply in the range 100/160V or 200/280V.

Before connecting the receiver to either form of supply source, it is essential to note the information given below.

AC Supplies

The receiver utilizes a toroidal wound mains transformer with primary voltage tappings. The primary tappings can be easily adjusted to suit any standard AC supply by means of the external mains voltage setting switch located on the rear panel. The mains adjustment switch can be operated with a wide blade screwdriver, or with a suitable coin-shaped instrument.

Standard receivers as despatched from the Factory are suitable for 240V operation. Other voltages may be specified at the time of ordering. IT IS VERY IMPORTANT to check that the setting of the SUPPLY VOLTAGE SWITCH is set to the nominal local mains supply voltage.

NOTE! It is essential to disconnect the receiver from the mains supply prior to making primary voltage adjustments.

AC Fuse Rating

105/160V)	: :	0.5 Amp (Time-lag)
210/280V)		
Internal DC Supplies	: :	3 Amp

AC Mains Input

The AC supply connector is fitted with approximately 2 metres (78 inches) of 3 core cable which is colour coded in accordance with the current European Standard and generally complies with British Standard BS415, viz:-

LINE	: :	BROWN
NEUTRAL	: :	BLUE
EARTH	: :	GREEN/YELLOW

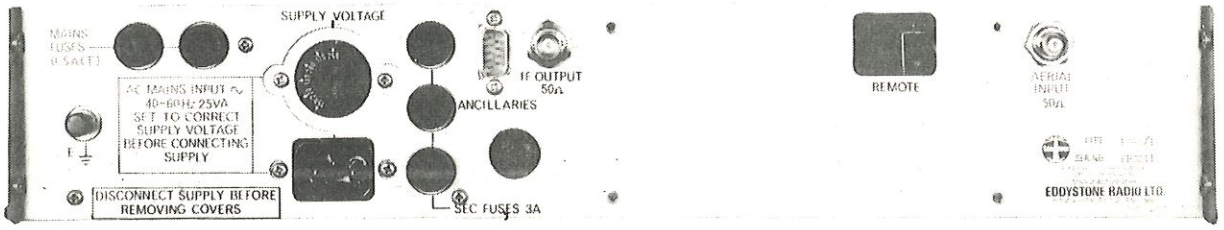
NOTE: If the colours of the wires in the mains lead of this apparatus do not correspond with the coloured markings identifying the terminals in your AC mains source connector (or mains plug) proceed as follows:-

1. The GREEN/YELLOW wire must be connected to the plug terminal marked "E" or " " coloured GREEN or GREEN/YELLOW.

2. The BLUE wire must be connected to the plug terminal marked "N" or coloured either BLUE or BLACK.

3. The BROWN wire must be connected to the plug terminal marked "L" or coloured either BROWN or RED.

A separate Earthing terminal (E ⏚) is also provided to enable the equipment chassis to be bonded to the rack earth.



NEW SHEET
ALREADY DONE

Fig. 2.1 Rear Panel View

Ancillaries Connector Inputs and Outputs

The ancillary connector is situated towards the left hand side of the rear panel (see Fig 2.1). The relevant connections are clearly illustrated at Fig 2.2.

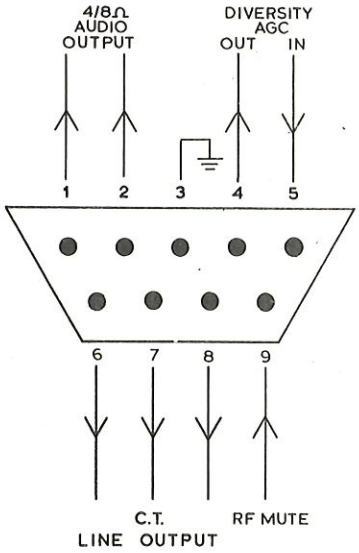
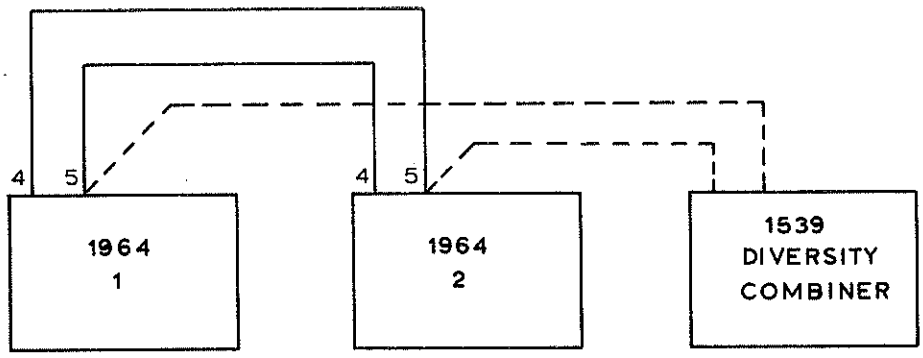


Fig. 2.2 Ancillary Connector

Pins 1 & 2 : : can be used for connection to an external loudspeaker with impedance greater than 3Ω (4-8Ω optimum range). This output is muted when a phone jack is inserted in the 'PHONES - LS MUTE' socket, as this causes the internal ground to pin 2 to be open circuited.

Pin 3 : : is a general purpose ground terminal.

Pins 4 & 5 : : are diversity AGC input and output lines which can be used to cross-link the AGC lines of two 1964 receivers, to facilitate space or frequency diversity operation. The cross-linking arrangement is shown at Fig 2.3. (See also 'Operation - Reception of Signals' and details of Pins 6, 7, 8 connections as listed below).



DIVERSITY OPERATION

Fig. 2.3 Diversity operation (via ancillaries connector).

Pins 6, 7, 8 : : are for connection to an audio line system (typically 600Ω balanced). A centre tap is also provided from pin 7. When diversity operation is being used, the line audio outputs from the two 1964 receivers can be combined as shown in figure 2.4 below.

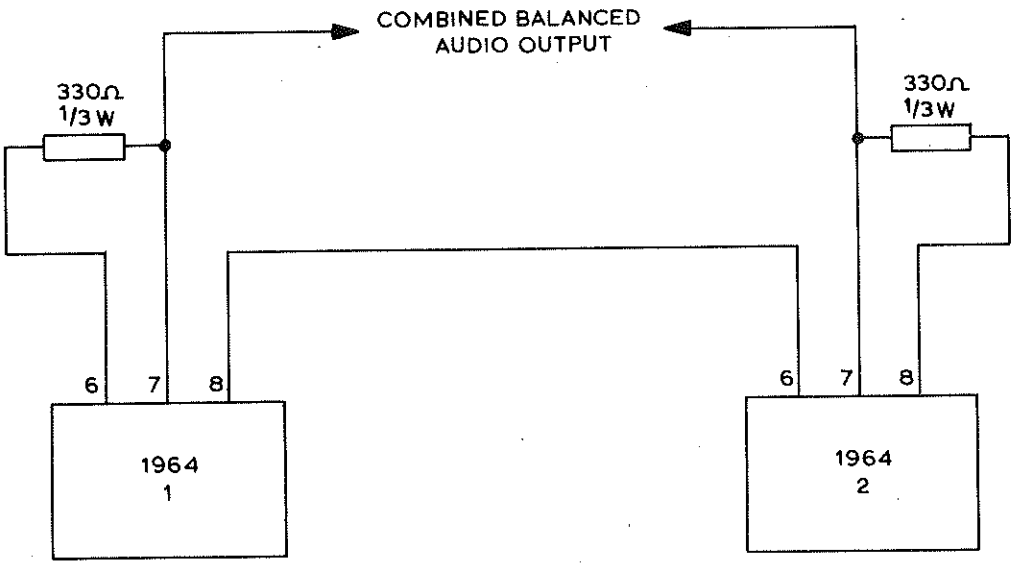


Fig. 2.4 Line audio output combining etc.

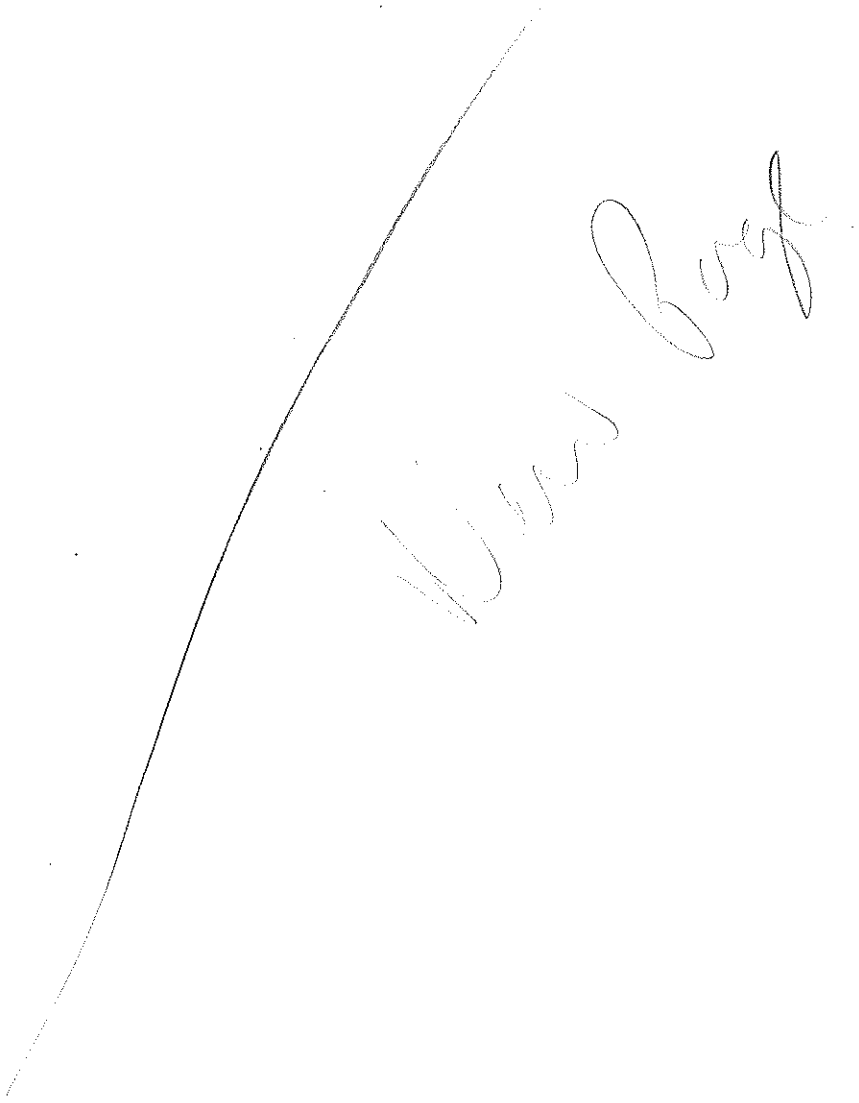
Pin 9 : : connection of a +12V DC external supply (referred to pin 3) will open circuit the aerial input connection and short circuit the input to the receiver RF amplifiers to ground (i.e. 'Aerial' or 'RF' muting). About 10mA is drawn from the 12V supply.

Other Rear Panel Connections

Nominal 50Ω matched connections are provided for the aerial input and final IF (100kHz) output. Spare BNC connectors are supplied in the accessories kit.

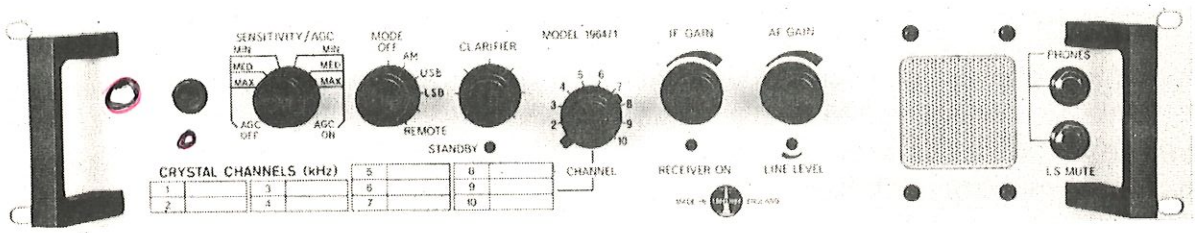
Various fittings, and an input aperture, are provided for connection of remote interface adaptors (see Appendix B1).

An unused aperture is provided adjacent to the DC fuses, which may be used in certain 1964 variants (see Appendix B2).



OPERATION

PHOTO TO BE ARTWORKED.



SENSITIVITY/AGC : : This six position rotary switch controls the level of fixed attenuation applied in series with the aerial input and also determines whether or not AGC (automatic gain control) is applied. Three levels of attenuation are provided with a choice of AGC on or off at each level. The type of AGC is determined by the pre-programming of the 'Mode' switch (see Installation). Minimum (MIN) sensitivity corresponds with 40dB fixed attenuation, Medium (MED) with 20dB attenuation and Maximum (MAX) with zero attenuation.

MODE : : This six position rotary switch selects one of four reception modes, or remote control (see Appendix B1). The Mode Switch also has an OFF position, where the receiver outputs are effectively muted, but all oscillator circuits are left operating to maintain frequency stability. In all positions, the 'STANDBY' indicator is illuminated, indicating that mains power is supplied to the receiver. When set to an operative Mode position, the 'RECEIVER ON' indicator is also illuminated (this also occurs when an operative Mode is selected by remote control, see Appendix B1). The four Mode positions are pre-programmed to customer requirements (not all four positions need be used) and the positions are marked to indicate the reception mode provided. Essentially, each position is programmed to select the IF bandwidth, detector type, agc type and any special circuits required for a particular signal type. A typical example is as follows:-

Mode position 1 :	'AM' - selects 7kHz symmetrical IF filter, envelope detector and carrier/sideband derived AGC. *
Mode position 2 :	'USB' - selects 2.4kHz USB IF Filter, product detector and audio derived AGC. *
Mode position 3 :	'LSB' - selects 2.4kHz LSB IF Filter, product detector and audio derived AGC. *

Mode position 4 : Spare - not used.

* N.B. only selected if AGC ON is also selected.

A wide variety of options are available and these are detailed in Section 2 headed 'Installation'.

CLARIFIER : : This control effectively varies the frequency of 2nd oscillator injection, thus giving an extra ± 300Hz tuning range to the nominal channel frequency.

CHANNEL : : This ten position rotary switch selects the channel frequency required; the actual frequency being printed on the adjacent 'CRYSTAL CHANNELS (kHz)' label. The frequencies are pre-set to customer requirements by the selection of the crystal frequencies used in the 1st oscillator. This is further detailed in 'Installation' (Section 2).

IF GAIN : : This control is operative when 'AGC OFF' is selected by 'SENSITIVITY/AGC' Switch, and then sets the gain of the final intermediate frequency (IF) amplifier.

AF GAIN : : This controls the level of audio output to the front panel speaker and 'PHONES' sockets and to the rear panel 4/8Ω output. It should be noted that when a jack plug is inserted into the lower socket (marked 'LS MUTE') the internal loudspeaker and 4/8Ω outputs are automatically muted.

LINE LEVEL : : This pre-set control sets the level of the rear panel output from the line amplifier (which is independent from the main audio amplifier). Access to the control is via the front panel aperture and adjustment is made with a screwdriver to give the desired line output level.

On special variants the spare control positions on the extreme left hand side of the front panel may also be used (see Appendix B2). Other operations considered more fully in 'Installation' Section 2, include 'Aerial' or 'RF muting' and diversity AGC operation.

Reception of Signals

(NOTE SOME VARIANTS MAY HAVE SLIGHTLY DIFFERENT PROCEDURES (SEE "B2"))

The desired channel frequency is selected using the CHANNEL switch and the appropriate reception mode using the MODE switch (for remote operation see Appendix B1). If AGC is selected, the SENSITIVITY/AGC and AF GAIN controls are adjusted to obtain a suitable audio output. If AGC is not used the IF GAIN will also require adjustment. When single sideband (SSB) or frequency shift keyed (FSK) signals are being received, the CLARIFIER control may need adjusting to resolve the SSB or tune the FSK signal. If the line output is being used to feed another system, it is recommended that AGC is used to stabilise the output level which can then be readily adjusted to the required level by the preset LINE LEVEL control.

For most signals it is also recommended that Maximum (MAX) sensitivity is used. However, for signals equivalent to greater than 80dBμV from a matched source, use of Medium or Minimum sensitivity will provide optimum output distortion.

When headphone operation is required, the lower 'PHONES' socket should be used which will automatically mute the internal loudspeaker and any externally connected loudspeaker. The upper jack may also be used then for a second pair of headphones or may be used alone to drive, for example, a tape-recorder, the loudspeaker(s) still being connected for the purpose of output monitoring.

In cases where the receiver is operated in the proximity of, or in conjunction with transmitters, the Aerial or RF muting facility may also be useful. Application of +12V DC (at about 10mA) to the appropriate connection of the rear panel 'ANCILLARIES' socket will open circuit the Aerial connection and short circuit the receiver RF amplifier input to ground.

Diversity AGC connections are also available from the 'ANCILLARIES' socket to enable two 1964 Receivers to be cross-linked for diversity operation (frequency or space diversity). For optimum performance in this arrangement the EDDYSTONE 1539 DIVERSITY COMBINER may be used, or a special variant of the 1964 with an inbuilt adjustment can be provided. Use of this variant adjustment facility, and any other controls on 1964 Model variants are covered in Appendix B2.

The rear panel IF output socket can be used to drive a variety of ancillary equipments such as the Eddystone 1529/1 FSK Teleprinter Drive, or Eddystone 1061A Panoramic Display Unit.

CIRCUIT DESCRIPTION

NOTES : SECTION FORMAT

1) Modular Construction

The individual reference number allocated to the various components which make up a particular circuit module will always start at "1" (e.g. R1, C1 etc.).

Each component reference in the description which follows is prefixed by the particular module reference number to facilitate the location of the component.

Five different RF TUNER Heads are used to cover the frequency range of the receiver. The actual RF Heads fitted in any one receiver depend on the channel frequencies of that receiver. Up to five RF Heads may be fitted, each being capable of tuning to two channels within the assigned range. The circuitry of each range is similar and therefore the individual components, the values of which differ from range to range, is suffixed with a number equal to the range number (see Table 2 Page 2-2).

The overall coding is as follows:-

Prefix :	1	-	Aerial Attenuator Board
	2	-	RF Tuner Head (suffixes /1 to /5)
	3	-	Auto. Sideband Selector
	4	-	1st. Mixer
	5	-	1st. IF/2nd Mixer
	6	-	Filter Module
	7	-	Main IF, AGC, Detectors, Audio
	8	-	Oven Unit
	9	-	1st. Oscillator
	10	-	1st. Oscillator Output (1964/1)
	11	-	1st. Oscillator Output (1964/2)
	12	-	Frequency Doubler (1964/2)
	13	-	Clarifier
	14	-	Front panel control board
	15	-	Mode Memory board
	16	-	Power Supply
	17	-	Miscellaneous items

For other modules see Appendix B2, Special Variants.

2) Circuit and Data Diagrams

The following detailed description of the individual module circuitry should be read in conjunction with the main circuit diagram contained at the rear of this handbook. The data diagrams contain the relevant voltage and signal levels, on a module by module basis, and should be used with reference to the 'MAINTENANCE' Section of this handbook. It is emphasized that the specified levels, unless otherwise stated, are typical values only.

AERIAL ATTENUATOR BOARD : : COMPONENT PREFIX 1

This board (Module part no. LP3640/1) contains the aerial (or RF) muting relay and two relay switched 20dB attenuators. The input signal from the rear panel 'AERIAL INPUT 50Ω' socket is fed to the RF muting relay 1RLA and the protection diodes 1D1/8 inclusive (BAV10).

When a +12V DC input (at approx. 10mA) is applied to printed circuit board pins 1 or 4, 1RLA open circuits the connection to the aerial socket, and short circuits to ground the feed to the attenuator relays, thus isolating the receiver from the aerial. Board pin 1 is connected to the rear panel 'ANCILLARIES' socket to enable an external RF muting control.* Pin 4 is connected on certain receivers to provide RF muting at specific positions of the front panel 'MODE' switch (e.g. RF muting activated when 'MODE' switch set at 'OFF'). Pins 1 and 4 are diode isolated. The settings of the attenuators are controlled by the front panel 'SENSITIVITY/AGC' switch. When switched to either 'MAXIMUM' position, the attenuators are bypassed. When switched to either 'MEDIUM' position, the 20dB attenuator formed by 1R3, 1R4, 1R5 is selected by relays 1RLB and 1RLC. The previous stage (1RLB/1RLC) is still actuated when switched to either 'MINIMUM' position, but now the 20dB attenuator formed by 1R7, 1R8 and 1R9 is also selected by relays 1RLD, 1RLE.

* ON CERTAIN 'SPECIAL VARIANTS' PIN 1 IS LINKED DIRECTLY TO pin 6 AND MUTING IS ENABLED BY EXTERNAL GROUNDS AT THE LEAD TO PIN 5 OF THE TRANSISTOR. 1TR1 ACTS AS AN INVERTING BUFFER AND THE EXTERNAL MUTE INPUT IS 'PULLED UP TO +15V V/A APPROXIMATELY 10K.

RF TUNER HEADS : : COMPONENT PREFIX 2

The RF TUNER HEADS (module part nos. LP3640/2 to LP3640/6 for ranges 1 to 5 respectively), filter and amplify the input signal from the Aerial Attenuator Board. The Heads then provide the signal drive to the 1st. MIXER at the correct impedance level. All RF Heads are designed to operate with nominal 50Ω source/load impedances and are connected in parallel across 50Ω input and output bus structures.

The input signal is filtered by the bandpass tuned circuit formed by 2L1/- and, 2L2/-, and their associated tuning capacitors; 2L1/- and 2L2/- are bottom inductance coupled by 2CH1/-. This filter also matches the 50Ω source to the input of the following common emitter amplifier 2TR1/- (BFW17A or BFW30). The overall gain of the HEAD is preset by the emitter feedback resistor 2RV1. 2L3/-, and associated components in the collector of 2TR1/- provides further filtering and correct source impedance of approximately 50Ω for the next (1st. MIXER) stage.

The relevant HEAD required for the channel selected by the front panel 'CHANNEL' switch is activated by Vcc applied to either printed circuit board pin 1 or 2. This connects the HEAD input and output to the input and output buses via relays 2RLA and 2RLE respectively. If Vcc is applied via pin 1, relays 2RLB, 2RLC and 2RLD are also activated to make 2C16/-, 2C18/- and 2C21/- the effective tuning capacitors. (Otherwise these are 2C17/-, 2C19/- and 2C20/-). In this way each HEAD can be tuned to two different frequencies.

AUTO-SIDEBAND SELECTOR : : COMPONENT PREFIX 3

The Auto-Sideband Selector Board (module part no. LP3640/7) automatically selects the correct sideband filter allowing for signal spectrum inversion which occurs when the 1st. Oscillator frequency is set on the high side of the input signal frequency.

An exclusive OR logic gate 3IC1 (MC14070) is driven from the USB/LSB selector ('MODE' switch on front panel) via printed circuit board pin 11. Another input is either held low by 3R1 or, on channels where inversion occurs, is held high by a diode connected to the appropriate RF TUNER HEAD Vcc switching line (all of which are connected via this board). The diodes 3D1 to 3D10 inclusive (BAX13) are fitted as necessary when the receiver channel frequencies are being set.

Thus the output of 3IC1, buffered by 3TR1 (BC547B) selects either the USB or LSB Filter in the 'SIDEBAND FILTER MODULE' depending on both the setting of the 'Mode' switch and whether or not signal spectrum inversion is taking place. This ensures that the required sideband is received correctly (i.e. as marked on the 'MODE' switch) on all channels.

1ST MIXER : : COMPONENT PREFIX 4

The 1st. MIXER (module part no. LP3640/8) converts the input signal derived from the RF TUNER HEADS to the first IF stage frequency of 1.4MHz.

A matched quad FET package 4IC1 (U350) is used in a balanced configuration with tuned Pi-network circuits formed by 4L2, 4L3, 4C3, 4C4, 4C5 and 4C6 providing extra filtering at 1.4MHz and the correct output impedance, via transformer 4T1, for the following stage. The input signal is fed to 4IC1 via the balun 4L1 and balancing network formed by 4R1, 4R2 and 4RV1. The 1st. Oscillator drive is fed to 4IC1 by the balanced transformer 4L4.

1ST IF/2ND MIXER : : COMPONENT PREFIX 5

The 1st. IF/2nd. Mixer (module part no. LP3640/9) amplifies and filters the 1.4MHz output of the 1st. MIXER and connects this to the second IF frequency of 100kHz. A permanently connected AGC stage is also situated in the module and comes into operation with aerial input signals above about 60dBμV. The AGC stage controls the gain of the 1st. IF amplifier and limits the maximum signal level fed to the 2nd. Mixer.

The signal from the 1st. MIXER is filtered by 5L1, 5C1 and the 'roofing crystal filter' 5FL1. Depending on the receiver variant, 5FL1 may also provide the overall bandwidth on AM Mode or when only one bandwidth is required. Thus the actual crystal filter fitted depends on the receiver reception modes. On the standard 1964/1 a 7kHz filter is fitted for the reception of AM signals. The filtered signal is amplified by 5TR1 (BFX89) and 5IC1 (SL610). 5IC1 is a variable gain amplifier and is used in the AGC loop, the control voltage being generated by the detector 5IC3 (SL1623). This is fed by the output of 5IC1, amplified by the tuned load common emitter stages 5TR2 and 5TR3 (BFX89) thus completing the loop. The loop is initially set up by preset potentiometers 5RV1 and 5RV2.

The level controlled signal from 5IC1 is then fed to the double balanced mixer 5IC2 (SL641), local oscillator drive at 1.3MHz to this device being supplied by the Oscillator module. The resulting 100kHz signal is filtered by tuned circuit 5L2, 5C11.

The relay 5RLA is part of the overall bandwidth selection and is controlled by the programmable 'MODE' switch (see pages 2-2 to 2-4). When activated, 5RLA feeds the output of the '2ND MIXER' directly to the 'MAIN IF', by-passing the 'FILTER MODULE'. In this case, the attenuator formed by 5R11 and 5R12 compensates for the absence of the lossy

'FILTER MODULE'. When 5RLA is not activated, the output from the '2ND MIXER' is fed to the 'FILTER MODULE' and then to the 'MAIN IF'.

FILTER MODULE : : COMPONENT PREFIX 6

This module contains up to two crystal filters in order to provide different overall bandwidth settings. The filter selected depends on the setting of the programmable MODE SWITCH (see pages 2-2 to 2-4). The actual filters (6FL1, 6FL2) provided depend on the receiver reception modes. For the standard 1964/1 the USB and LSB filter are fitted, in which case the filter module is described as a 'SIDEBAND FILTER MODULE' (part no. LP3633). The filter selected depends on whether or not relays 6RLA and 6RLB are activated by the setting of the front panel 'MODE' switch. The respective relays are situated on printed circuit boards fitted on the ends of the module (PCB assemblies part no. LP3640/10 and /11). The filter selected is only brought into circuit when the filter by-pass circuit is not selected (see end of previous sub-section).

MAIN IF, AGC, DETECTORS, AUDIO : : COMPONENT PREFIX 7

This module (part no. LP3640/12) provides most of the receiver gain and the various AGC and detector options. The module also contains the line and high level audio amplifier circuit stages. It should be noted that the actual AGC and detector circuits brought into operation depend on the settings of the programmable 'MODE' switch (see pages 2-2 to 2-4).

The 100kHz signal derived from the 2nd. MIXER is selected from the filter by-pass link, or the 'FILTER MODULE', by relay 7RLA. This relay operates in parallel with relay 5RLA on the 1st. IF/2nd. MIXER module (as previously described). The signal is amplified by 7IC1 and 7IC2 (MC1590G) and the common emitter stage 7TR1 (BC107b). Broad filtering at 100kHz is obtained by the low Q tuned circuits formed by 7CH1/7C7, 7CH2/7C14 and 7L1/7C19. The devices 7IC1 and 7IC2 are variable gain amplifiers and are controlled by the front panel 'IF GAIN' control when any 'AGC OFF' position is selected by the front panel 'SENSITIVITY/AGC' switch. Otherwise they are controlled by the DC output of 7IC4 (741). The relay 7RLB is then activated to make this connection.

7IC4 amplifies the DC control voltages derived from a variety of AGC sources and feeds the 'SIGNAL LEVEL MUTE' module which is fitted in certain variants. Audio or sideband/carrier derived AGC is fed to 7IC4 via the voltage follower buffer stage 7IC3 (741). Various preset voltages and dual diversity AGC/balance voltages are fed directly to 7IC4. Audio AGC is generated by 7IC8 (SL1621), amplified by 7IC5 (741), and fed to 7IC3 when audio AGC is selected by the front panel 'MODE' switch activating 7RLC. The zener diode 7D6 (BZX79, C4V7) is used to prevent excessive voltage being generated when the AGC loop is opened during manual gain control. When 7RLC is not activated, 7IC3 is fed by DC produced by 7D1 (BAX13) which rectifies the 100kHz signal output of 7TR1 amplified and buffered by 7TR3, 7TR4 and 7TR5 (BC1076).

The diodes 7D2 and 7D3 are used to prevent excessive voltage being generated under open loop conditions. Two time constant options are available on this loop dependant on 7RLD. When activated by the programmable 'MODE' switch, time constants are increased by the addition of an extra capacitor (7C37).

The high level intermodulation performance of the 'MAIN IF' amplifier is determined by the preset potentiometer 7RV1; the carrier/sideband AGC loop is set up by presets 7RV2 and 7RV3; the audio AGC loop by 7RV6 and 7RV7. 7RV4 provides initial setting up for both loops.

Diversity AGC from a second receiver can be fed via the rear panel 'ANCILLARIES' socket direct to 7IC4. Diversity AGC to such a receiver is fed from 7IC3 via 7R40 and the 'ANCILLARIES' socket. For optimum diversity AGC operation, some 1964 variants also have a front panel 'DIVERSITY BALANCE' control (17RV1) which is preset to provide a small amount of receiver AGC 'balance' current to 7IC4.

The output of the final 'MAIN IF' amplifier 7TR1 feeds the IF output buffer 7TR2 (BC1076) and the envelope and product detectors. 7TR2 provides approximately 40mV rms output emf at 50Ω impedance to the rear panel (IF OUTPUT 50Ω) socket from an input signal of level sufficient to generate AGC. The envelope detector 7IC6 (CA3002) and product detector 7IC7 (SL1001A) are fed via the preset level control 7RV3 to optimise the distortion performance. Each detector output passes through a low pass filter formed by 7CH5, 7CH6, 7C53, 7C54 and 7CH7, 7CH8, 7C63, 7C64 respectively. The product detector also receives local oscillator drive at 100kHz from the 'OSCILLATOR' module; the output of the lowpass filter feeds the audio AGC generator 7IC8 via preset potentiometer 7RV6, thus limiting the use of audio AGC to reception modes using the product detector. When a programmed mode is not selected (e.g. in 'MODE' switch 'OFF' position), the +15V Vcc supply to the detectors is removed to 'mute' the receiver.

The output of either envelope or product detector is selected by the transmission gate 7IC10 (MC14016) which is controlled via the buffer pack 7IC9 (MC14049) by the setting of the front panel programmable 'MODE' switch. 7IC10 also open circuits the following audio amplifier stages from both detectors when an audio muting signal is applied across 7R68 (as occurs in receiver variants fitted with signal level muting).

The audio output of the transmission gate is fed to the line and high level audio amplifiers via the front panel preset 'LINE LEVEL' control and the 'AF GAIN' control respectively. The line level amplifier consists of an input buffer 7TR7 (UC734B) and amplifier 7IC12 (TCA760) driving transformer 7T1 which provides a balanced centre-tapped output to the rear panel 'ANCILLARIES' connector with a maximum power output of at least 30mW into 600Ω. The high level amplifier consists of an input buffer 7TR6 (UC734B) and amplifier 7IC11 (TBA8105) driving the front panel loudspeaker and headphone outputs and rear panel 'ANCILLARIES' socket 4/8Ω output (with at least 1W maximum output). Inserting a jack plug into the front panel 'PHONES - LS MUTE' socket open circuits the earth return to the internal loudspeaker and rear panel outputs, muting these provided the rear panel 'ANCILLARIES' output (pin 2) is not earthed externally.

Oscillator Module

The complete Oscillator Module (part no. LP3631) provides the local oscillator frequencies to the 1st. Mixer (frequency determined by the required channel setting), and the 2nd. Mixer (at 1.3MHz ± approx. 23Hz). The frequency of drive to the product detector exhibits a slight shift as it is derived by dividing the 1.3MHz output by 13. The 1.3MHz variation provides fine-tuning using the front panel 'CLARIFIER' control. Any of six different sub-assemblies may be fitted and are described separately as follows:

OSCILLATOR MODULE OVEN UNIT : : COMPONENT PREFIX 8

This unit (module part no. LP3640/13) contains a temperature controlled oven for all the crystals used in the Oscillator Module. The trimmer capacitors, switching diodes and associated components for the 'channel' crystals used in the '1st. Oscillator' circuit to drive the '1st. Mixer' are also contained on the associated printed circuit board.

The oven has spaces for twelve crystals; 10 for the channel crystal and 2 in a partially screened compartment for the two crystals used in the 'Clarifier' circuit.

The oven has proportional temperature control using a thermistor temperature sensor, 8THT1 in a bridge configuration, the differential bridge output driving the power differential amplifier 8IC1 (μA759). This drives the oven heater winding 8R31 via 8TR1 (BD131). Negative feedback from the emitter of 8TR1 is directed to the input bridge circuit completing the control loop. The setting of the temperature is established by adjustment of the preset potentiometer 8RV1 located in the bridge network.

Associated with every channel crystal position is a set of components forming diode switches to and from the crystal. For example for channel 1 the switching networks consist of 8D1 (BAX13) 8D11 (BAX13), 8R1, 8R11, 8R21 and 8C21, or for channel 5 the appropriate networks are formed by 8D5 (BAX13), 8D15 (BAX13), 8R5, 8R15, 8R25 and 8C25. In general the final digit of the channel number is the same as the final digit of the respective switching network component identification number. Application of +15V from the front panel 'channel' switch to the appropriate switching network brings the required crystal into circuit, all the other crystals being isolated since their switching diodes become reverse biased. Each crystal also has an independant circuit stage consisting of pi-network input and output, trimmer and tank capacitors, formed by 8C1 - C10, 8C11 - C20, 8C31 - C40 and 8C41 - C50 respectively. The trimmer capacitor is used to set the channel frequency. In certain cases the tank capacitor may also need to be altered from the nominal value. The inputs to the crystal networks are driven from the '1st. OSCILLATOR' board via ten separate lines (board pins 1 to 10). The outputs of the crystal networks are all connected together, feeding the '1st. OSCILLATOR' board via pin 21.

1ST. OSCILLATOR BOARD : : COMPONENT PREFIX 9

This board (module part no. LP3640/14) contains the basic oscillator circuitry for all crystals contained in the 'Oven Unit'. The ten 1st. Oscillator channel crystals are used in conjunction with the 'APERIODIC MAINTAINING AMPLIFIER' formed by 9TR1, 9TR2, 9TR3 and 9IC1. The crystal network output is fed to 9TR1 (40673) which provides the correct load impedance for the crystal pi-network and acts as a buffer to the following common emitter amplifier 9TR2 (BFX85).

9TR2 output drives a limiting differential amplifier 9IC1 (CA3028A) and buffer stage 9TR3 (BFX89), the output of this feeding the ten crystal networks via separate resistors R21-R30. The oscillator level is determined by the 'tail' current of 9IC1 which is preset by 9RV1 and is virtually independant of crystal frequency. The more voltage sensitive parts of the oscillator circuit are stabilized by the temperature compensated zener diode 9D1 (BZX91 C6V5).

The oscillator circuits related to the two crystals used for the '2nd. MIXER' drive consist of the transistors 9TR4 and 9TR5 (40673) and their associated components. The two resulting

frequencies are separated by 1.3MHz with the front panel 'CLARIFIER' control set to mid-range. This control supplies a DC voltage to varicap diodes 9D2 and 9D3 (MV1648) in such a way that a change in control voltage increases the frequency of one oscillator and decreases the frequency of the other thus increasing the final frequency pulling range (see 'CLARIFIER' circuit description). This, and the choice of 9C17, 9C18, 9C22 and 9C23 also helps to linearise the frequency versus control voltage characteristic. 9TR4 and 9TR5 are connected in simple capacitive tap feedback arrangements to the emitter outputs driving the 'CLARIFIER' circuit directly.

1964/1 OSCILLATOR OUTPUT BOARD : : COMPONENT PREFIX 10

This board (module part no. LP3640/15) buffers the output from the 1st. OSCILLATOR (emitter of 9TR3) and drives the local oscillator input of the 1st. MIXER. The buffer transistor 10TR1 (BFW17A) operates as an emitter follower.

1964/2 OSCILLATOR OUTPUT BOARD : : COMPONENT PREFIX 11

This board (module part no. LP3640/16) also contains the buffer described in the previous sub-section and includes a diode switching network to enable the 1st. oscillator board to drive the '1st. mixer' directly, or via a frequency doubler circuit which is used on the 1964/2 to generate oscillator frequencies above 18.6MHz to enable reception of channel frequencies above 20MHz. The diodes which effectively by-pass the frequency doubler are 11D11 and 11D12 (BAX13) which are kept at low impedance when a high voltage is present at the emitter of 11TR2 (BC547B). On a channel where the frequency doubler is required, a diode (11D1 - 11D10 BAX13) is fitted so that when that channel is selected the voltage applied to the particular crystal switching network is also fed via 11D1 - 11D10 to 11TR2, thus controlling 11TR2 and causing the emitter voltage to fall, thus reverse biasing 11D11 and 11D12. At the same time the frequency doubler is activated by Vcc applied via 11R14 which also causes the relevant switching diodes to effectively position the frequency doubler circuit between the '1st. oscillator' output and the '1st. Mixer'.

1964/2 FREQUENCY DOUBLER BOARD : : COMPONENT PREFIX 12

This board (module part no. LP3640/17) contains the Frequency Doubler mentioned in the previous sub-section. The module is activated on the appropriate channels via 11R14, as are the switching diodes 12D1, 12D2 (BAX13). When activated, the output of the '1st. oscillator' is fed to the buffer stage 12TR3 (BF324). This feeds the FET frequency doubler formed by 12TR1, 12TR2 (matched UC734B) via the balanced transformer 12L1. Broad filtering over the second harmonic range is provided by 12CH1 and 12C1 before the doubled frequency signal is fed to the 1st. MIXER via the 1964/2 oscillator output board. Preset potentiometers 12RV1, 2 and 3 are used to provide an output of low unwanted harmonic content and of the correct level; i.e. the doubler is set to give 0dB insertion gain.

CLARIFIER BOARD : : COMPONENT PREFIX 13

This board (module part no. LP3640/18) generates the 1.3MHz 2nd. MIXER drive and 100kHz product detector drive from the two oscillator circuits formed by 9TR4 and 9TR5.

The crystals for the above mentioned oscillators are selected to provide frequencies of 1.3MHz separation. Thus the 1.3MHz signal for the 2nd. MIXER is generated by mixing the two frequencies in the double balanced mixer 13IC1 (SL1641). The 1.3MHz output is selected by the low pass filter formed by 13CH1, 13CH2, 13C8, 13C9 and 13C10. The drive level to the 2nd. MIXER is set by the preset potentiometer 13RV1 through which the output is taken. An output at 1.3MHz is also taken to the quad NAND gate pack 13IC2 (MC14011) which operates as a form of Schmitt trigger and converts the low level 1.3MHz sine wave into a 12V peak to peak square wave capable of driving the following divide by 13 circuit 13IC3 (MC14526). The resulting 100kHz output is filtered by the low pass filter formed by 13CH3, 13CH4, 13C22, 13C23 and 13C24. The drive level to the product detector is set by the preset potentiometer 13RV2 through which the output is taken.

On modes where the product detector is not used, the 100kHz, output is inhibited by disabling the divide by thirteen circuit, 13IC3. This is effected by the programmable 'MODE' switch (see pages 2-2 to 2-4).

FRONT PANEL CONTROL BOARD : : COMPONENT PREFIX 14

This board (module part no. LP3640/19) contains all the front panel controls (except for certain controls used by special variants). The circuitry for the programmable 'MODE' switch and for changeover to remote control is also accommodated within the module. Sockets are provided to connect the majority of the previously described modules to the S1602 Remote Interface Adaptor (when fitted) and to the 'MODE MEMORY BOARD'. Supply lines from the 'POWER SUPPLY' also terminate at this board, from which they are distributed as required.

The controls have the following functions:-

14S1 - 'CHANNEL' Switch. This is a 1 pole 10 way switch which determines the channel frequency by applying +15V to the appropriate crystal switching network in the 'OSCILLATOR UNIT' via socket 14SK6. The switch also supplies the appropriate 'RF TUNER HEAD' via 4SK6, the 'OSCILLATOR UNIT' and 3SK1 on the 'Auto Sideband Selector' board. As previously described, 14S1 may also activate the Auto Sideband Selector and/or the frequency doubler. When 'REMOTE' is selected on the 'MODE' switch, the +15V supply to the pole of 14S1 is removed to allow the remote control circuits to take over operation.

14S2 - 'MODE' Switch. This is a two pole, six way switch which determines the operating reception mode of the receiver. When in any of the four central positions, various sections of the receiver are activated to provide correct reception of the indicated mode. The sections activated are pre-determined by the programming of the 'MODE MEMORY BOARD' (see pages 2-2 to 2-4). The board fitted depends on the receiver variant; for the standard 1964/1 and 1964/2 MODE MEMORY BOARD part no. LP3640/20 is fitted which has three positions programmed to give AM, USB and LSB reception modes. When a programmed mode is not selected, (e.g. in the 'OFF' position) the receiver audio outputs are muted by removing the Vcc supply to the 'DETECTOR' circuits via relay 14RLA. When a programmed mode is selected, a +12V supply is directed via the 'MODE MEMORY BOARD' to the required circuits. When 'REMOTE' is selected, a +12V enabling supply is directed to the S1602 Re-

mote Interface Adaptor (as is a +15V supply which is redirected from the poles of 14S1 and 14S3 respectively). The transmission gate 14IC2 (MC14016) is also enabled to feed IF GAIN and CLARIFIER voltages from the S1602 Remote Interface Adaptor (when fitted) rather than from the front panel control 14RV3 and 14RV4.

14S3 - 'AGC/SENSITIVITY' Switch. This is a two pole 6 way switch which determines the degree of RF attenuation used and whether manual gain or AGC is used. When any 'AGC ON' position is selected the switch applies +15V via 14D4 (1N4004) 14R18, 14R4 and 14SK7, to activate relay 7RLB on the 'MAIN IF' board. The relay connects the gain control input of the 'MAIN IF' amplifier (7IC1, 7IC2) to the AGC circuits. The +15V also enables the transmission gate 14IC3 (MC14016) which connects the AGC time constant control from the 'MODE MEMORY BOARD' to the time constant relay 7RLD on the 'MAIN IF' board. This ensures that the longer time constant can only be selected when AGC is on and prevents long 'hang-up' times when switching from 'manual' to 'automatic' gain. Otherwise the amplifier gain is controlled from the front panel 'IF GAIN' control. When either 'MEDIUM' sensitivity is selected, the switch applies +15V to activate the relays 1RLB and 1RLC in the AERIAL ATTENUATOR board via 14D2 (1N4004) 14R19 and 14SK1 thus providing 20dB RF attenuation. All relays (1RLB, 1RLC, 1RLD and 1RLE) are activated when any 'MINIMUM' sensitivity position is selected, this time via 14D3 (1N4004) and 14R20, giving a total of 40dB RF attenuation. When 'REMOTE' is selected on the 'MODE' switch, the +15V supply to the poles of 14S3 is removed to allow the remote control circuits to take over operation.

14RV1 - 'AF GAIN' Control. The potentiometer is positioned between the 'DETECTOR' circuits selected output from 7IC10 and the input to the high level audio amplifier, 7TR6 and 7IC11. The control is externally accessible from the front panel.

14RV2 - 'LINE LEVEL' Control. This is a front panel operator preset potentiometer positioned between the selected 'DETECTOR' circuit output from 7IC10 and the input to the line level audio amplifier, 7TR7 and 7IC12.

14RV3 - 'IF GAIN' Control. This provides the DC gain control voltage to the 'MAIN IF' amplifier (7IC1, 7IC2) via 7RLB when any 'AGC OFF' position is selected on the 'AGC/SENSITIVITY' switch. This supply is directed via the changeover transmission gate 7IC2 and is thus disconnected when 'REMOTE' is selected on the 'MODE' switch.

14RV4 - 'CLARIFIER' Control. This provides the DC frequency control voltages to the varicap diodes (9D2 and 9D3) used in the oscillator circuits prior to the 'CLARIFIER' circuit stage. This supply is directed via the changeover transmission gate 7IC2 and is thus disconnected when 'REMOTE' is selected on the 'MODE' switch.

14D5 - 'STANDBY' Indicator. This LED is driven from the +12V supply to the temperature control circuit of the 'OVEN UNIT' and is illuminated whenever a mains power supply is connected to the receiver.

14D6 - 'RECEIVER ON' Indicator. This LED is driven by the 'ENABLE RECEIVER' line from the 'MODE MEMORY BOARD' (see pages 2-2 to 2-4) and is therefore illuminated whenever a programmed mode is selected via the 'MODE' switch or by the remote control circuitry when the 'MODE' switch is in the 'REMOTE' position.

MODE MEMORY BOARD : : COMPONENT PREFIX 15

This board selects the appropriate circuitry for the required reception modes via a simple diode matrix as described in pages 2-2 to 2-4. The board fitted will thus depend on the receiver variant. For the AM, USB, LSB modes of the standard 1964/1 and 1964/2, module part no. LP3640/20 is supplied. The board (which plugs into 14SK4 on the 'Front Panel Control' board) has four inputs from the four possible mode select positions of the 'MODE' switch. These are cross-coupled, as required, by diodes (1N4004) to outputs which are connected to the various selectable circuits.

POWER SUPPLY : : COMPONENT PREFIX 16

This is a self contained unit (module part no. LP3632) which generates +15V, 2 x +12V and -6V DC supplies from the AC mains input.

The mains input is fed in via a filtered mains socket 16FL1, fuses 16FS1 and 16FS2 (0.5AT) and a voltage tap selector to the torroidal transformer 16T1. The transformer has three separate outputs. The first generates -6V via rectifier 16D1 (OSH01A/100) and voltage regulator 16D1 (MC7906). The second generates +15V and +12V via rectifier 16D2 (B40C3200/2200) and voltage regulators 16IC2 (MC7815) and 16IC3 (MC7812) respectively. The third output generates a separate +12V supply for the 'Oven Unit' via rectifier 16D3 (B40C3200/2200) and voltage regulator 16IC4 (MC7812). The three secondary outputs are protected by fuses 18FS3, 16FS4 and 16FS5, respectively (all 3A).

Section 5

MAINTENANCE

Introduction

Section 5 is sub-divided as follows:-

(1) Service Checks - it is recommended that these checks are performed at 6 to 12 monthly intervals and the re-adjustments made, if necessary, to optimise receiver performance.

(2) Fault-finding and Overall Alignment - these procedures enable comprehensive test and alignment of the complete receiver.

(3) Removal of Modules - describes the physical removal and replacement of all major modules in the receiver.

It is important that sub-sections (1) and (2) are used with reference to the Main Circuit Diagram and the Data Diagrams bound at the rear of this manual. Note that the voltage levels, gains etc., given are typical values only obtained with the test equipment described. Internal views of the receiver are given in Figs. 5.3 and 5.4 as an aid to identification of the different modules. (See Page 5-21)

MISSING DIAGRAMS

(1) SERVICE CHECKS

The following test equipment will be required:-

(i) Voltmeter with at least 20kΩ/V impedance and 25V DC f.s.d. / ohms ranges (e.g. AVO Model 8).

(ii) Signal generator of 50Ω impedance, with accurate output levels (within ± 1dB) over the frequency range 100kHz - 27.5MHz. The output should be variable over the range 0dBμV to 100dBμV (emf) with switchable amplitude modulation of 30% at 1kHz (e.g. MI TF2002).

(iii) Output power meter of 4/8/600Ω impedance and f.s.d.s of 10mW/1W/10W (e.g. MI TF893A).

(iv) Frequency counter with 1Hz resolution and better than 5Hz accuracy over range 100kHz - 26MHz with a sensitivity of at least 50mV rms and input impedance of at least equivalent to 1MΩ in parallel with 70p.

(v) Oscilloscope of 50MHz bandwidth and sensitivity of at least 100mV/cm (AC and DC) with a x10 probe giving an input impedance of at least equivalent to 10MΩ in parallel with 7-12p.

The recommended service checks are as follows:-

In all cases the receiver should be switched on and stabilized for 1 hour before checks are made.

(i) Operational check of receiver controls. If any do not operate as required refer to (2) 'Fault-finding'.

(ii) Check the 'Power Supply' final output voltages and 'CLARIFIER' and 'IF GAIN VOLTAGE' on 'Front panel Control' board.

(iii) Check the 1st. Oscillator drive at 'B' on '1st. MIXER' board. The 1st. Oscillator frequencies should be 1400kHz + 30Hz above or below the marked channel frequency, depending on the associated RF range, and, in some cases, the receiver model variant. The trimmer capacitors 8C31 to 8C40 in the 'Oven Unit' are used to adjust the frequencies of ranges 1 to 10 respectively if the above specification is not met. In the early working life of a receiver it is likely that some slight re-adjustment will be necessary. In extreme cases, the appropriate tank capacitor 8C41 to 8C50 may also need altering in value. For 1964/1 receivers or 1964/2 receivers using RF ranges 1 to 4 (i.e. up to 20MHz), the output level is adjusted by 9RV1 on the '1ST. OSCILLATOR' board (accessible via holes in the 'Frequency Doubler' and/or '1ST. OSCILLATOR' output boards). In the case of 1964/2 receivers, 9RV1 should be adjusted first and then the output level on 'doubled' channels (i.e. above 20MHz) set by 12RV3 on the 'Frequency Doubler' board, after first peaking the output using 12C1 and adjusting 12RV1 and 12RV2 for the best sinusoidal output waveform. In cases where several doubled frequencies are provided, the setting of 12C1 may have to be a compromise.

(iv) Check the '2ND. MIXER' drive at 'C' of '1st. IF/2nd. MIXER' board. The frequency should vary over the range indicated with the position of the front panel 'CLARIFIER' control. The range of DC voltage this control provides and thus the frequency variation is determined by the 'set-on-test' resistor 14R10 located on the 'Front panel control' board. This can be altered, if necessary, to obtain the correct range. Once satisfactory results are obtained, a check should be made to ensure that with the 'CLARIFIER' control at 12 o'clock, an output of 1300kHz ± approximately 30Hz is obtained. If this is not the case, the position of the knobs on the control spindle should be altered accordingly. Movement of the control by one marked division to either side of the 12 o'clock position should then cause approximately equal changes in output frequency of about 170-200Hz. The output level can be adjusted, if necessary, by 9RV1 on the left hand side of the 'CLARIFIER' board.

(v) Check the product detector drive at 'D' of 'MAIN IF, AGC, DETECTOR, AUDIO' board. This is only present when the divide by 13 circuit 13IC3 on the 'CLARIFIER' board is enabled, (i.e. 13IC3 pin 4 = 0V) as is the case when USB, LSB or in some cases, FSK modes are selected. Then the output frequency is produced by dividing the 1300kHz output by 13 and should be as indicated if section (iv) has been completed satisfactorily. The output level can be adjusted if necessary, by 9RV1 located on the right hand side of the 'CLARIFIER' board.

(vi) Check the overall sensitivity (i.e. S/N or Noise Factor). The receiver controls should be set as follows:-

SENSITIVITY/AGC	:	MAXIMUM/AGC OFF
MODE	:	TO SUIT INPUT SIGNAL USED
CLARIFIER	:	12 O'CLOCK
CHANNEL	:	1 TO 10 AS REQUIRED
IF GAIN/AF GAIN	:	AS REQUIRED

The output power meter (set at 4Ω) should be connected to the rear panel 'ANCILLARIES' connector pins 1 and 2 to act as an output indicator. The signal generator should be connected to the rear panel 'AERIAL INPUT 50Ω' BNC socket to act as a signal source. Working through the channels, one by one, the appropriate 'RF TUNER HEAD' trimmer capacitors should be adjusted for maximum output. The appropriate trimmers are identified as follows:-

(a) The switched Vcc supply leads to the 'HEADS' are 'colour coded' in accordance with the channel number viz:-

Channel No.	1	-	Vcc lead to 'HEAD' is brown
	2	-	Vcc lead to 'HEAD' is red
	3	-	Vcc lead to 'HEAD' is orange
	4	-	Vcc lead to 'HEAD' is yellow
	5	-	Vcc lead to 'HEAD' is green
	6	-	Vcc lead to 'HEAD' is blue
	7	-	Vcc lead to 'HEAD' is mauve
	8	-	Vcc lead to 'HEAD' is grey
	9	-	Vcc lead to 'HEAD' is white
	10	-	Vcc lead to 'HEAD' is black

The appropriate 'HEAD' can thus be determined by tracing the Vcc lead to its right hand side.

(b) Each head can have up to two Vcc leads for the permitted maximum of two channels per head. The sets of trimmer capacitors which correspond to each lead is shown in Fig. 5.1. The specified S/N ratios should then be obtained on each channel. In certain cases however, it may be necessary to adjust the individual preset gain potentiometers 2RV1. These are adjusted on the following basis:-

Primarily to obtain the required S/N ratio for both channels served by that particular 'HEAD'.

Secondly, to help equalise the gains between different 'HEADS' on a given receiver to ensure that the overall AGC threshold stays in the approximate range 1-2μV (emf). Generally, gains should be equalised within about 6dB.

Maximum gain of the amplifier transistor is obtained with the potentiometer fully clockwise; on no account should the gain be increased more than is necessary to obtain the above, as this will degrade signal performance. Note that some re-adjustment of the trimming capacitors may also be necessary if the potentiometer is adjusted close to the maximum gain position.

(2) FAULT-FINDING AND OVERALL ALIGNMENT

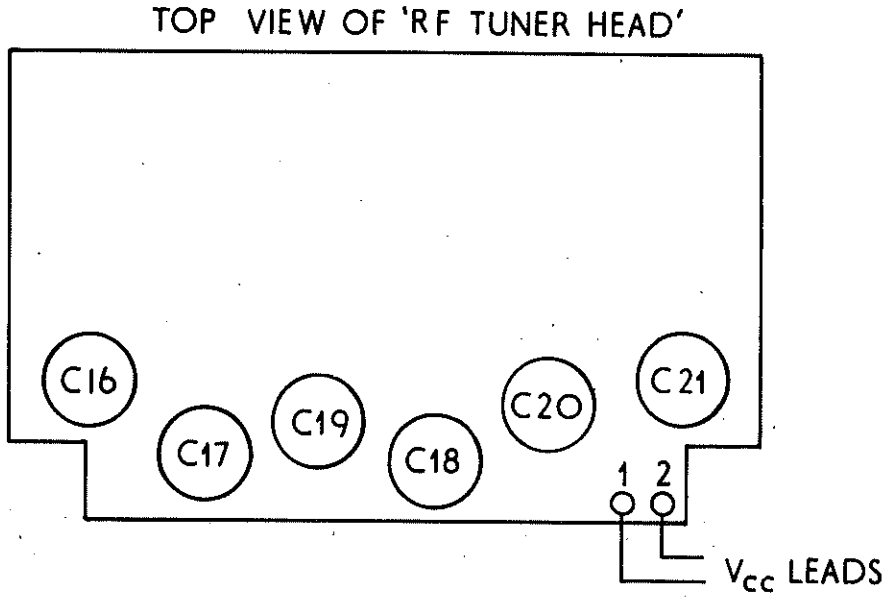
For comprehensive servicing the following extra test equipment is required:-

(i) A second signal generator as described previously (with 50Ω combiner).

(ii) A distortion factor meter (DFM) (e.g. MI TF2331).

FIG. 5.1.

'RF TUNER HEAD Vcc LEADS
AND ASSOCIATED TRIMMER CAPACITORS'



Vcc to pin	1	activates trimmers	C17, C18, C21
Vcc to pin	2	activates trimmers	C16, C19, C20

E.G. White lead to pin 1 - C17, C18, C21 on that 'HEAD' used for channel 9.

Black lead to pin 2 - C16, C19, C20 on that 'HEAD' used for channel 10.

(iii) A sinewave audio oscillator covering 10Hz - 10kHz output range with levels up to 100mV rms and harmonic distortion 0.3% at all points.

(iv) A Spectrum Analyser with a high input impedance probe for range 100Hz to 1.5MHz (e.g. MI TF2370 analyser and TK 2374 probe).

(v) A thermometer capable of reading to +65°C with ±1°C accuracy and suitable for reading 'OVEN UNIT' temperature.

(vi) An ohmmeter, preferably digital, with a range of 0-100Ω and accuracy of reading better than ±2%.

The following sub-sections detail the principal checks and alignment procedures for each module and are presented in the correct sequence for the complete test and alignment of the receiver. Should any checks fail, or if an alignment is not possible, or if an operational check fails, a fault should be suspected and fault-finding in a logical manner must be undertaken, making full use of the 'CIRCUIT DESCRIPTION (Section 4)', the Main Circuit Diagram and Data Diagrams.

(i) 'Power Supply' - CAUTION. Care must be taken when conducting fault-finding checks on this module as mains voltages are exposed when the module cover is removed.

(a) Prior to connecting the mains power supply, the DC input resistance between receiver mains input connector 'L' and 'N' pins should be checked using the 0-100Ω ohmmeter; check also that 'L' and 'N' do NOT short circuit to chassis and that the input 'E' (earth) pin is directly connected to chassis. The foregoing checks are particularly important procedures if any repair has just been made (e.g. fitting a new mains transformer).

(b) Disconnect the DC voltage output leads from pins 1-5, ensure that the rear panel 'SUPPLY VOLTAGE' switch is preset for the applied mains voltage and connect the mains supply. Check that the supply voltages 1-5 correspond with the values given on the Main Circuit Diagram. Note that the rectified DC and ripple voltages specified are only applicable when the 'Power Supply' is connected to the receiver (i.e. 'on load').

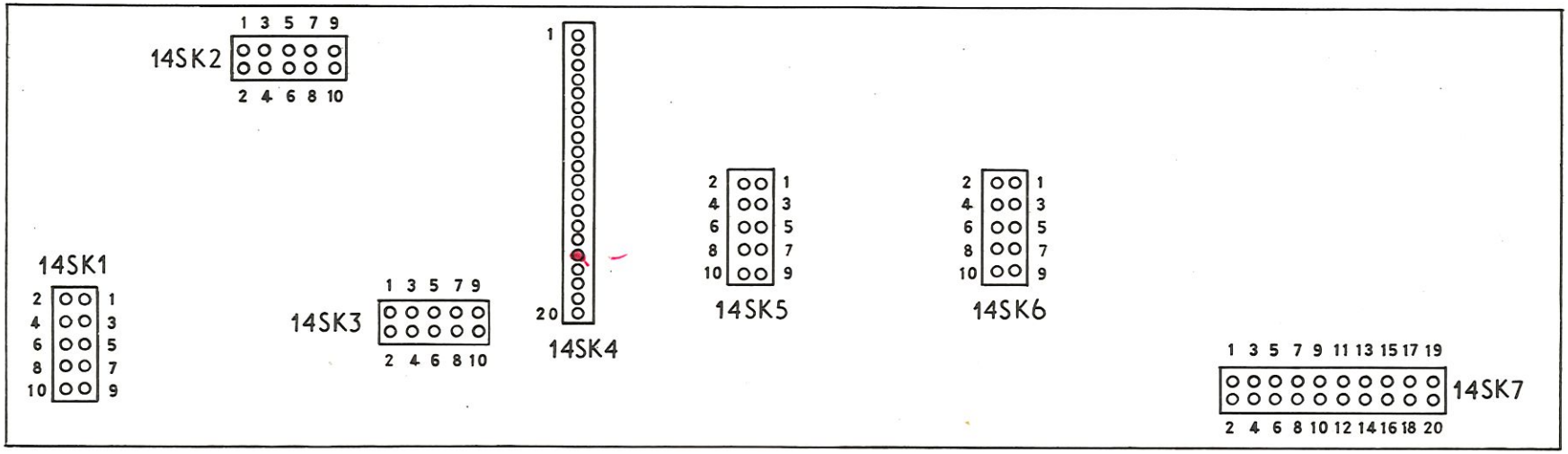
(ii) 'Front Panel Control Board' - Figure 5.2 is provided to enable identification of the pin numbers relating to the various connectors.

(a) With the DC voltage output leads from the Power Supply still disconnected, check the impedance of each lead to ground. All impedances should be very high, apart from the yellow +15V Vcc supply lead (approx. 15kΩ to ground) and the black ground lead.

(b) With the DC voltage supply leads reconnected to the Power Supply and mains applied, the 'STANDBY' LED should remain illuminated under all conditions. The 'RECEIVER ON' LED is only illuminated when a pre-programmed mode is selected via the 'MODE' switch.

FIG. 5.2. SOCKET PIN NUMBERING OF FRONT PANEL CONTROL P.C.B. CORRESPONDING TO CIRCUIT DIAGRAM

(viewed from front panel side of board)



14SK1 - Miscellaneous Outputs

14SK2 - From Remote Control 1602 Remote Interface Adaptor (when fitted)

14SK3 - Supplies to 1st. Mixer and 1st. IF/2nd. Mixer Boards

14SK4 - For 'Mode Memory Board'

14SK5 - Supplies to 'Oscillator Unit'

14SK6 - Channel switching to Oscillator Unit and RF Tuners Heads (via Auto-Sideband Selector)

14SK7 - Supplies to Main IF/AGC/DETS/Audio Board.

(c) Check that 'CLARIFIER' and 'IF GAIN' voltages vary with the setting of the appropriate controls within the ranges shown. This should occur at all 'MODE' switch settings except 'REMOTE', where the outputs of 14IC2 are isolated from the front panel control voltages.

(iii) 'Oscillator Module' - Apart from a preliminary check of the 'Oven Unit' temperature, the test and alignment procedure for this module is as described in sub-section (1) Service Checks nos. (iii), (iv) and (v). A thermometer is used to check that the internal temperature of the 'Oven Unit' is within the range 60-65°C. The temperature is set via the multi-turn preset potentiometer 8RV1; the voltmeter at 25V DC f.s.d. can be used to monitor the end of the heater winding 8R31 connected to the collector of 8TR1 to determine if an adjustment is necessary. 8RV1 will increase the temperature (heater current will rise and then the monitored voltage fall) or vice versa. The sensor end of the thermometer should be carefully placed through the taped off access hole in the top of the unit and between any crystals fitted below this hole. The tape should be replaced across the hole when the check is completed.

(iv) 'Main IF, AGC, Dets, Audio' Board - This can be comprehensively checked and aligned in standard 1964/1 and 1964/2 receivers. However, on certain special variants, not all circuit elements are used and in such cases, it is not essential that they are checked or aligned. If complete alignment is required in such situations, a standard 'Mode Memory' board (module part no. LP3640/20) will be required to replace the special 'Mode Memory' board for the duration of the following 'Main IF' board checks. When fitted, the first three positions of the 'Mode' switch after 'OFF' will correspond to 'AM', then 'USB', then 'LSB' (the forth position, just before 'REMOTE' not being used).

(a) High Level Audio Amplifier. The output power meter (set at 4Ω), DFM and oscilloscope should be connected to the rear panel 'ANCILLARIES' connector pins 1 and 2 in order to monitor and measure the audio output. Take care to return all test equipment ground leads to pin 2. With capacitor 7C55 disconnected, an input signal from the audio oscillator is fed to TP5b via a non-polarised blocking capacitor in the order of 470n. With 'AF GAIN' at maximum, an audio output should be obtained when the 'MODE' switch is set to 'AM' but not when set to 'USB' or 'LSB'.

The following specification check should also be made:-

Maximum output power before clipping (1kHz)	≥	1W
Distortion at 500mW output (1kHz)	≤	1.5%
Sinewave input level for 1W output (1kHz)	≤	30mV rms
HF -3dB point at 100mW output	≥	3kHz
LF -3dB point at 100mW output	≤	150kHz

With 7C65 disconnected, the audio input (via the 470n blocking capacitor) is transferred to TP6b. An audio output should now only be obtained when the 'Mode' switch is set to 'USB' or 'LSB' but not when set to 'AM'. The performance of the audio amplifier must remain within the above specification.

+12V DC taken via a temporary lead from the 'Front Panel Control' board +12V DC bus, should then be applied to TP12. This should mute the audio output by at least 40-50dB. The lead is then removed.

(b) Line Output Audio Amplifier. The output power meter (set at 600Ω), DFM and oscilloscope should now be transferred to the rear panel 'ANCILLARIES' connector pins 6 and 8. With the audio input signal still applied to TP6b, 'USB' or 'LSB' mode selected and the front panel 'LINE LEVEL' setting at maximum, the following specification check should be made.

Maximum output power before clipping (1kHz)	≥ 40mW
Distortion at 10mW output (1kHz)	≤ 1%
Sinewave input lead for 10mW output (1kHz)	≤ 40mV rms
HF -3dB point at 10mW output	≥ 8kHz
LF -3dB point at 10mW output	≤ 350Hz

With 10mW output at 1kHz, a check should also be made using the oscilloscope, that the output voltages across each half of the line output transformer ('ANCILLARIES' pins 6-7 and 7-8) are equal within about 1dB and half of the total output. With the receiver mains input disconnected, the impedance between line output transformer secondary and ground should be checked as ≥10MΩ.

Finally the capacitors 7C55 and 7C65 must be refitted.

(c) Main IF, AGC and Detectors. These circuit stages are aligned as one. Before starting, the product detector drive at 'D' should be checked and 56Ω resistors (similar to MULLARD type CR25) fitted between input pin A and ground and input pin B and ground. It should also be ensured that links TP2 a-b and TP2 a-c are made.

With 'AM' mode selected, 'AGC OFF' and maximum 'IF GAIN', an input signal (unmodulated) at 100kHz is applied to input 'B'. The level is increased to provide 1.1V peak to peak at TP2 (monitored with the oscilloscope). This input level is defined as the input AGC threshold level and should be in the range 15-30μV rms (p.d. across input).

Two input signals from the two generators are then fed to input pin 'B', via a 50Ω combiner, at frequencies of 101kHz and 101.6kHz. The signals should be of equal levels, each equivalent to 25mV rms (p.d. across input). The 'IF GAIN' should be decreased until a 1.1V peak to peak signal is obtained at TP2. With the spectrum analyser also connected to TP2 (via the high impedance probe) the potentiometer 7RV1 should be adjusted so that the unwanted 100.4kHz and 102.2kHz intermodulation products at TP2 are just 50dB down compared to the 101kHz and 101.6kHz components. 7RV1 should require to be somewhere close to mid-travel.

'AGC ON' is then selected and a single unmodulated input signal at 100kHz and at the threshold level measured for the particular receiver under test is applied to input 'B'. Ensuring that preset potentiometers 7RV2 and 7RV3 are both fully clockwise, and 7RV5 is at mid-travel, 7RV4 is adjusted to the point just before the 1.1V level at TP2 falls.

The input level is then increased by 20dB and 7RV3 adjusted to return the level at TP2 to approximately 1.1V peak to peak. Note; the first time this adjustment is made, the level changes very rapidly.

The input level is then decreased by 20dB and 7RV2 is adjusted until the 1.1V peak to peak level is maintained.

The adjustments in the previous two parameters are repeated until both are satisfactory. The input level should then be increased in 20dB steps from threshold level to +60dB and the level at TP2 should remain within 2dB. If this is not the case (or if the settling time at TP2 on each 20dB increase in input is sluggish) the adjustments of 7RV2, 3 and 5 should be re-established.

The 101kHz and 101.6kHz inputs and spectrum analyser are then re-connected as previously described, and a check made that the unwanted 100.4kHz and 102.2kHz intermodulation products still remain more than 40dB down compared with the wanted components (i.e. with 'AGC ON').

With a 100kHz unmodulated input at threshold level now applied to input pin 'A' and USB or LSB Mode selected, preset potentiometer 7RV5 is adjusted to give a level of 280mV peak to peak at TP4 ('AGC OFF').

With 'AGC OFF', the 'IF GAIN' is decreased from maximum until the signal level at TP4 just starts to fall. The resulting DC level at TP1 is then measured using the oscilloscope (high impedance measuring device required). With USB or LSB mode still selected, 'AGC ON' and 7RV6 fully anti-clockwise, 7RV7 is adjusted until the DC level at TP1 is 1V below that measured above.

With an input frequency of 101kHz, an audio 1kHz 'beat' signal at TP6 should be monitored with the oscilloscope. The input level is increased by 20dB and 7RV6 adjusted to obtain the original output level. The input level is then adjusted from threshold to +60dB and the signal at TP6 should remain within 2dB.

The spectrum analyser is then connected to TP6 via the high impedance probe and with the two 25mV rms inputs previously described, the unwanted 400Hz and 2.2kHz components should be greater than 40dB down compared with the 1kHz and 1.6kHz wanted components.

Finally, the levels at the diversity AGC input and output test points (TP14 and TP18) are also preset (strictly 'continuous') at the rear panel 'ANCILLARIES' socket pins 5 and 4 respectively. Also the output from the rear panel 'IF OUTPUT 50Ω' socket should be checked. The 56Ω resistors initially fitted are then removed.

(v) '1st. IF/2nd. Mixer Board' - With the link between pin 2 of the '1ST. MIXER' board and pin 2 of the '1ST. IF/2ND. MIXER' board disconnected, feed an input signal (unmodulated sinewave) at 1.4MHz into the latter pin 2. Monitor TP3 with the oscilloscope (RV1 and RV2 at mid-travel) and adjust input level to obtain 350mV peak to peak. Note that the input is filtered by the crystal filter (5FL1) and thus the input may need to be re-tuned to obtain maximum output at TP3. With this level obtained, set RV2 to obtain +2V DC at TP1. Then increase the input level to 90dBμV (emf) and adjust RV1 to obtain a 100mV peak to peak signal at TP2. Finally re-make the link between '1ST. MIXER' and '1ST. IF/2ND. MIXER' boards (for adjustment of 5L1 see next section).

(vi) '1st. Mixer Board' - It is recommended that the preset components of this unit (i.e. 4L2, 4L3 and 4RV1) are not re-adjusted by the customer. The board will be replaced completely should failure occur together with any necessary instructions relevant for the replacement. For this reason, the unit is kept as a minimal component 'daughter' board fitted to the '1ST. IF/2ND. MIXER' board. However, the overall receiver

S/N should be checked by going directly into this stage (at channel frequency ±1400kHz), with the lead from pin 'A' to the output of the 'RF TUNER HEADS' disconnected. At this time, 5L1 (on the '1ST. IF/2ND. MIXER' board) should also be adjusted to give maximum output and best overall S/N ratio. Finally, reconnect the lead from pin 'A' to the 'RF TUNER HEADS'.

(vii) 'RF Tuner Heads' - The checking and alignment of the heads is exactly as described at (1) SERVICE CHECKS part (vi).

(viii) 'Overall Checks' - In addition to checking the operation of all the controls the following checks should be made:-

(a) Outputs should be present at 'PHONES' socket without any noticeable background hum, at any setting position of the 'AF GAIN' control. When the jack plug is inserted into the socket marked 'LS MUTE', the internal loudspeaker should be muted, as should the output from pin 1 and 2 of the 'ANCILLARIES' connector, unless pin 2 of the connector is earthed externally.

(b) When a +12V DC supply (at approx. 10mA) is applied to pin 9 of the rear panel 'ANCILLARIES' connector, (ground return to pin 3) the RF mute relay 1RLA located on the 'Aerial Attenuator' board should operate and place at least 65-70dB attenuation between the 'Aerial Input 50Ω' input socket and the 'RF TUNER HEADS'. This can be checked using a test signal from the signal generator, applying the RF mute voltage and then increasing the input level to obtain the original output ('AGC OFF').

(3) REMOVAL OF MODULES

Note: In all cases, washers are fitted with the screws, pillars etc., mentioned).

(i) Removal of covers, screens etc., prior to checks and alignments described in subsections (1) and (2) of MAINTENANCE:-

(a) Top dust cover	-	held by M3 screws around perimeter; note louvre openings face towards rear of receiver.
(b) AGC screen	-	held by two M3 screws; note left hand side screw also secures cable clip of coax lead from 'Oscillator Unit'.
(c) 1ST. IF/2ND. MIXER screen	-	held by four M3 screws. Take care not to foul adjacent leads and coax lead to board through aperture in screen when re-fitting.
(d) Oscillator unit cover	-	held by four M3 screws. Take care not to foul adjacent leads and coax leads through apertures in screen when re-fitting.
(e) RF Tuner Heads cover	-	held by six M3 screws.

(f) Power Supply cover - should only be removed if fault-finding is required in that area - CAUTION mains voltages are exposed when this cover is removed. The cover is held by four M3 screws, the front two also securing cable clips around the loom to the rear panel 'ANCILLARIES' socket.

(ii) Removal of major modular assemblies.

(a) Power Supply - Remove M3 fixing screws (four to receiver chassis, two to right hand side panel and three to rear panel). Remove forward two M3 cover fixing screws to separate module away from loom and securing clips. Remove connectors to Power Supply pins 1 - 6 (front right hand side). When refitting take great care to replace in correct order (colour-code shown on MAIN CIRCUIT diagram).

(b) Oscillator Unit - Remove four M3 fixing screws to receiver chassis (from below) disconnect plugs to 'Front panel control' and 'Auto sideband selector' boards. Desolder coax leads to 'MAIN IF', '1ST. IF/2ND. MIXER' and '1ST. MIXER' boards. Take care when refitting that the ribbon cable connectors are not twisted in vertical plane when they are re-connected.

(c) Filter Module - Remove four M3 fixing screws to receiver chassis (from below). Desolder coax and single lead to module end-boards noting their position ready for refitting. Also note the position of the separate filters to ensure correct replacement (i.e. on left hand side or right hand side of receiver.

(iii) Removal of major individual boards.

(a) Main IF, AGC, Dets, Audio - First remove AGC screen as in (i) (b) then remove the three hexagonal pillars and single 3mm nut (front left hand side fixing). Desolder coax leads and leads to the loudspeaker etc., noting their positioning for refitting. Disconnect ribbon cable connector to 'Front panel control' board.

(b) 1st. IF/2nd. Mixer - First remove screen as in (i) (c) then remove the four hexagonal pillars and two 3mm nuts (front fixings). Desolder coax leads noting their positioning for refitting. Disconnect ribbon cable connector to 'Front panel control' board.

(c) 1st. Mixer - Desolder coax leads, supply lead to pin 1 and output links to pin 2 and ground noting their positioning ready for refitting. Remove three fixing nuts which secure board to '1st. IF/2nd. Mixer' board.

(d) RF Tuner Heads - First remove cover as in (i) (e). Remove two hexagonal pillars securing board required to be removed and desolder coax leads, Vcc supply leads and ground lead (on left hand side of board) noting their positions ready for refitting.

(e) Front panel control - Remove all control knobs and associated nuts securing controls to front panel of receiver. Remove single M2.5 screw securing right hand side of board to the tapped pillar on the rear of the panel. Remove all ribbon cable connectors and desolder supply leads noting their positioning ready for refitting. If other modules have already been removed the board may be removable by pulling it back into the receiver; otherwise the front panel will have to be removed (two M4 screws to each side panel and three screws to bottom chassis).

When refitting take great care that the power supply leads are reconnected to correct places and the ribbon-cable connectors are not twisted in the vertical plane. Also take care not to damage the two LED indicators. The control knobs for the 'CHANNEL' and 'CLARIFIER' controls have to be set with the receiver switched on (the 'CHANNEL' knob so that it indicates the correct channel - no end stop is provided) and the 'CLARIFIER' knob so that the '2ND. MIXER' drive is 1300kHz $\pm$ approximately 30Hz with the knob at 12 o'clock.

(f) Aerial Attenuator and Auto-Sideband Selector - First remove 'RF TUNER HEAD' cover as in (i) (e). Then remove the four M3 screws securing the channel on which all the 'RF TUNER HEADS' are fitted to the bottom chassis (from below chassis). Gently pull the complete channel / 'RF TUNER HEADS' assembly upwards, taking care not to foul any of the attached leads. The 'Aerial Attenuator' and 'Auto-Sideband Selector' boards are then exposed on the lower left hand and right hand sides of the channel respectively. The boards are each fixed by two M2.5 screws. Desolder leads to board,

noting their positioning ready for refitting; disconnect the connector to rear of 'Auto-Sideband Selector' board. Make sure the ribbon cable to this connector is not twisted in the vertical plane after reconnection.

(iv) Fitting or replacing crystals. The procedure is as follows:-

(a) Remove 'Oscillator Unit' cover as in (i) (d).

(b) Slacken the two grub screws securing the 'OVEN UNIT' lid to the rest of the oven - (take care if the receiver has recently been switched on as the unit may still be hot) and remove the oven lid by pulling it gently upwards and, when the central spigot is clear, moving the lid to one side to expose the internal crystals and packing.

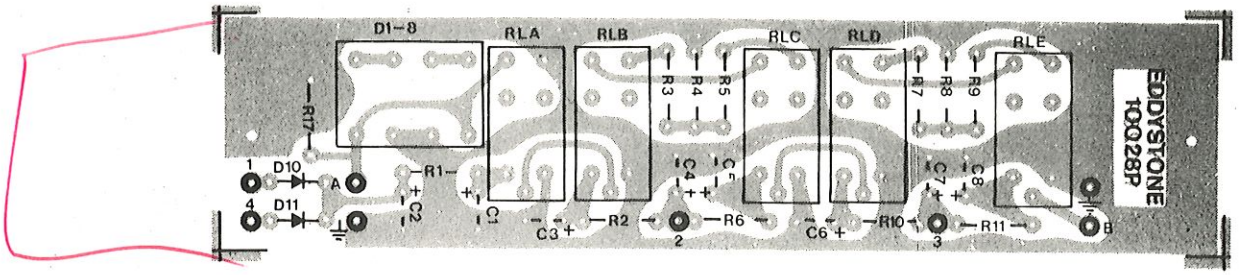
(c) The 'CLARIFIER' crystals are located in the rear partially screened section, with the lower frequency crystal clockwise in relationship to the higher frequency crystal.

(d) The 'CHANNEL' crystals are located in the remaining ten positions and are in the physical order corresponding to channels 1 to 10 in a clockwise direction from the screened 'CLARIFIER' crystal compartment.

(e) From the above identity, note the position of the crystal to be fitted or replaced. Removal/fitting is carried out by using a pair of tweezers or similar instruments. Clarifier crystals should be in the order of 9-11MHz, separated by 1300kHz and with a specification conforming to Eddystone Drawing 10348P. Channel crystals are to conform with Eddystone Drawing 10347P. Any packing material above the crystals should be carefully replaced before refitting the oven lid.

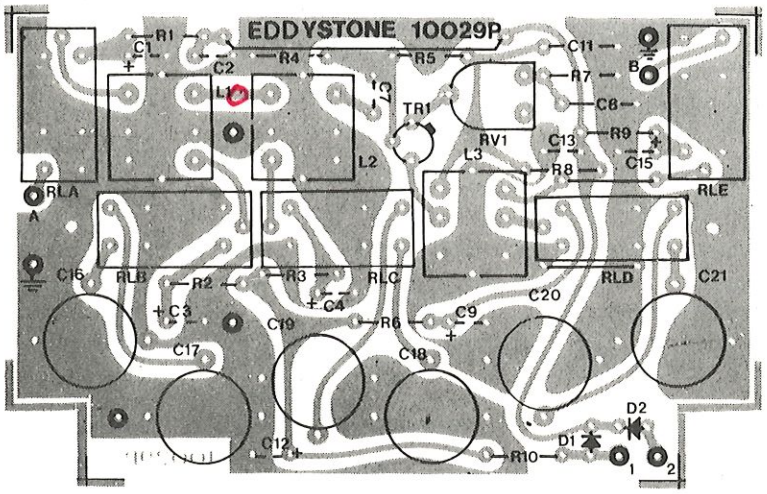
(f) If the 'CLARIFIER' crystals have been replaced, the '2ND. MIXER' drive, and the setting of 'CLARIFIER' control will require re-setting as in (1) SERVICE CHECKS part (iv).

(g) If 'CHANNEL(S)' crystals have been added or changed, the '1ST. MIXER' drive will require re-checking as in (1) SERVICE CHECKS part (iii). If a previously unused range is brought into use, the appropriate tank capacitor (8C41-50) on the 'OVEN UNIT' may also require fitting.



(1) AERIAL ATTENUATOR

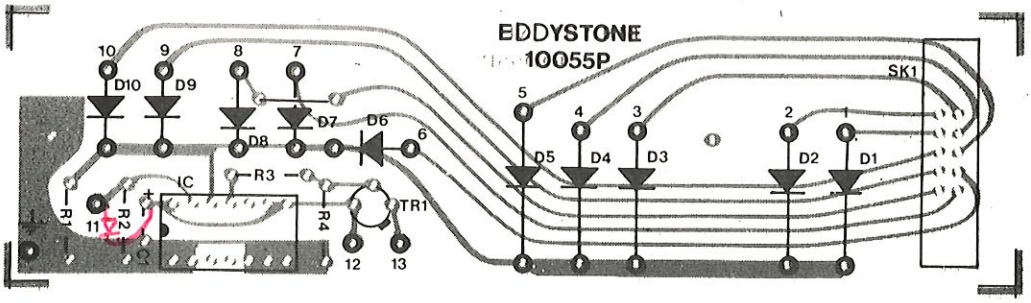
NEW BOARD.



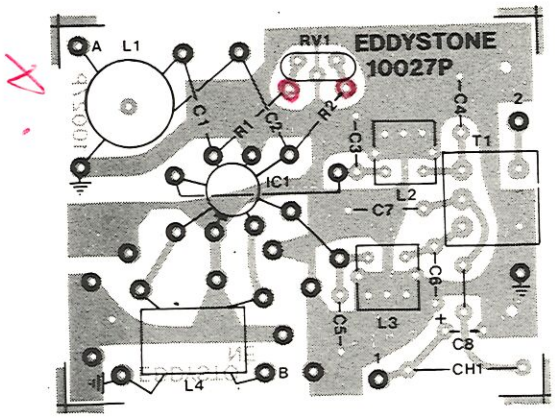
(2) RF HEAD(S) *

* TEXT REFERS TO RANGES 1-5.

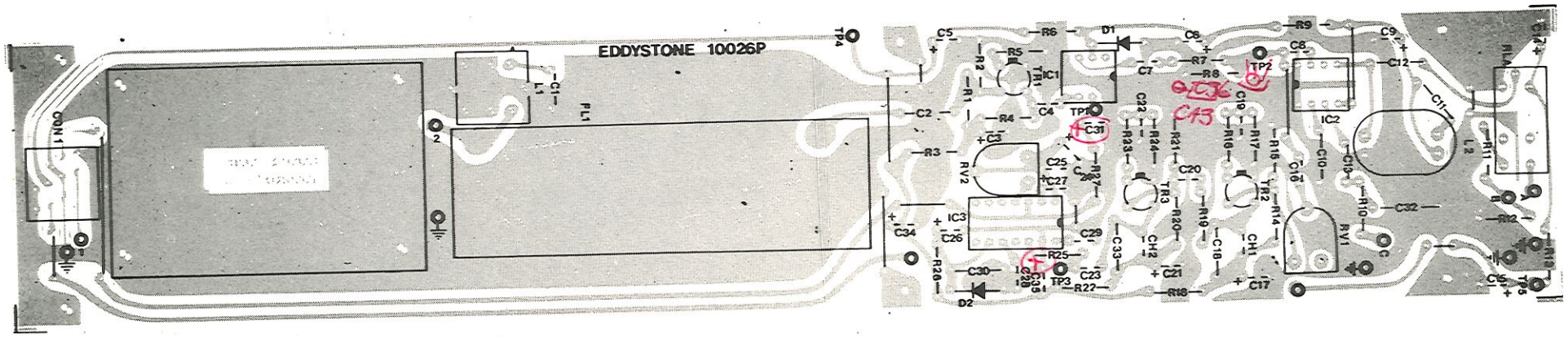
(NB PLATED THROUGH HOLES USED)



(3) AUTO SIDEBAND SELECTOR

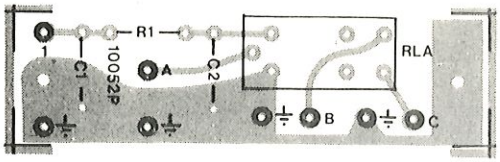


(4) 1ST. MIXER

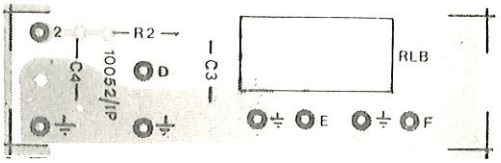


(5) 1ST. IF/2ND. MIXER

*ILLUSTRATED SLIGHTLY LESS THAN ACTUAL SIZE

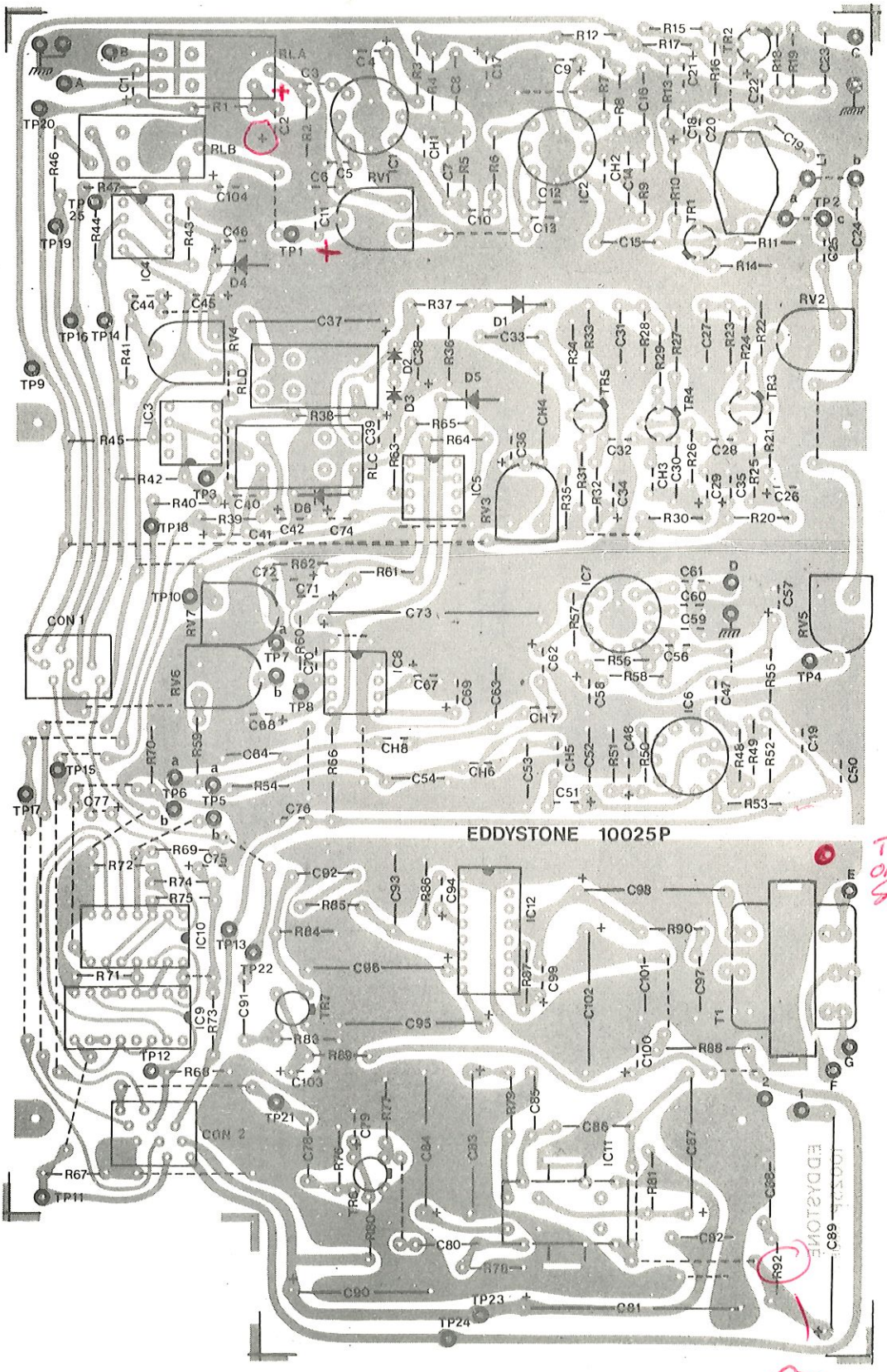


(6) SIDEBAND FILTER (LSB)

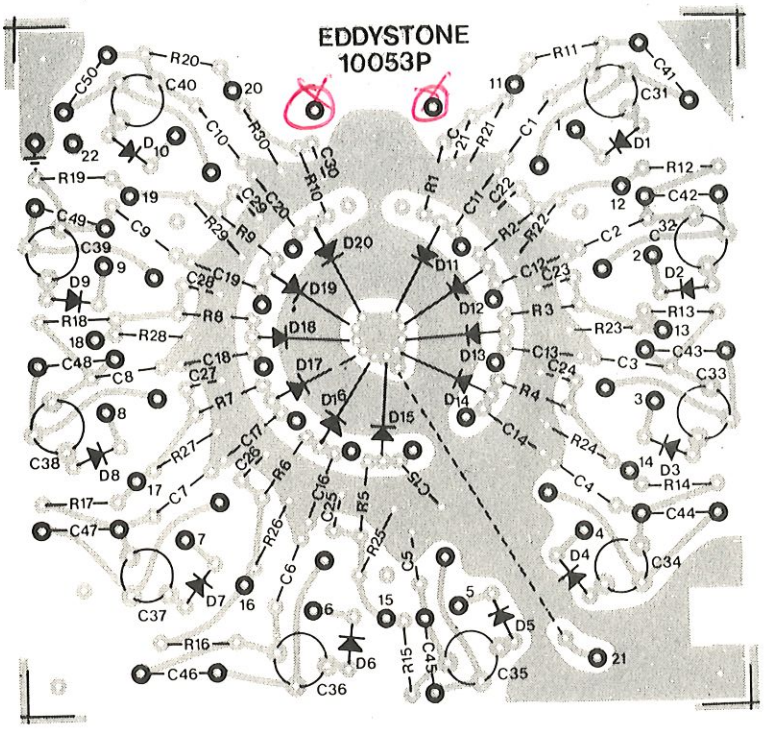


(6) SIDEBAND FILTER (USB)

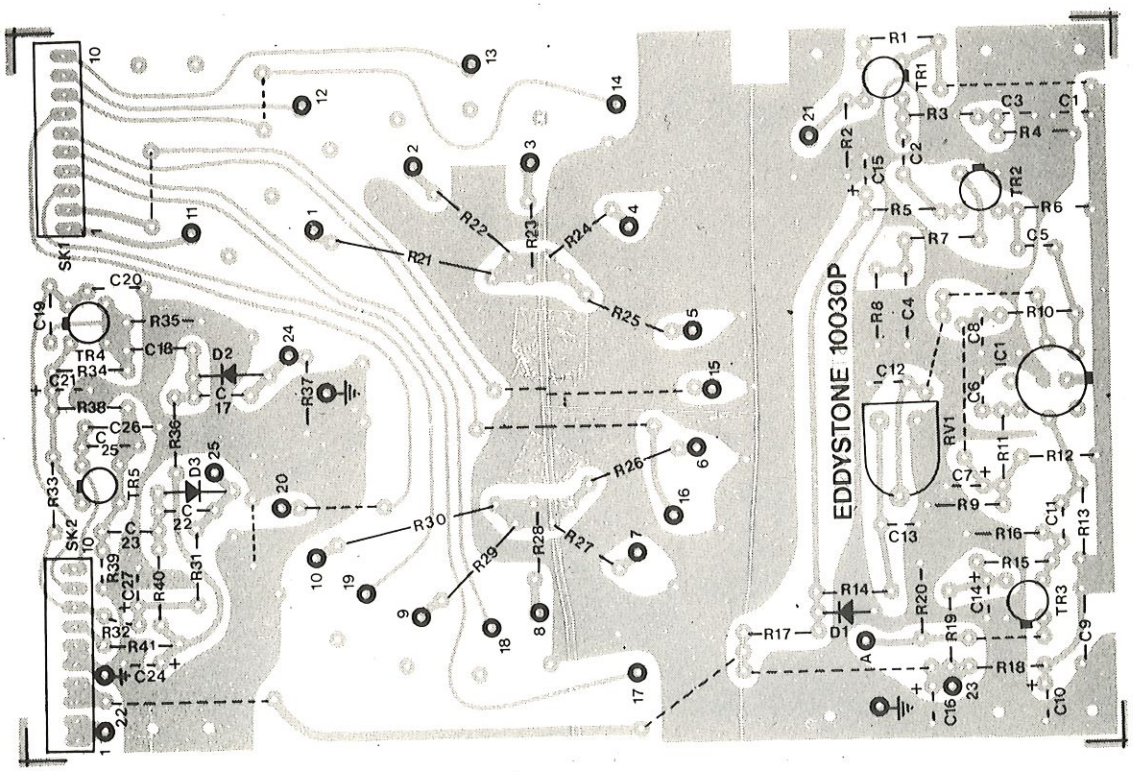
(7) MAIN IF; AGC; DETECTOR & AUDIO BOARD



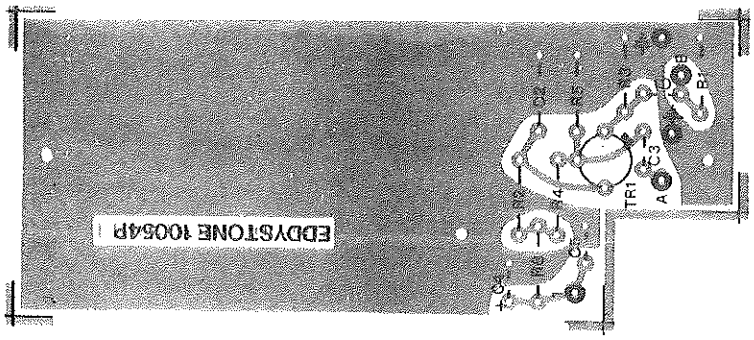
TI ORIENTATION SPOT.



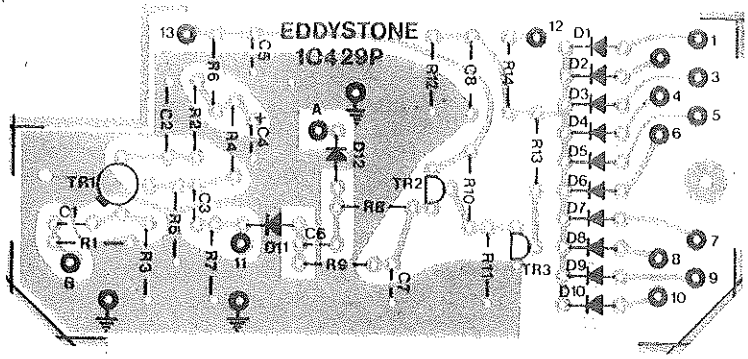
(8) OVEN MODULE



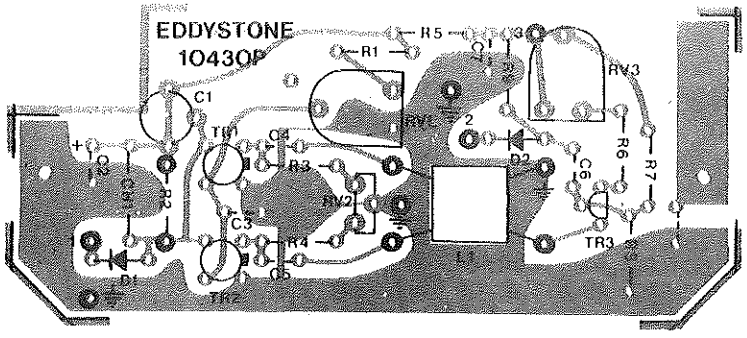
(9) OSCILLATOR BOARD



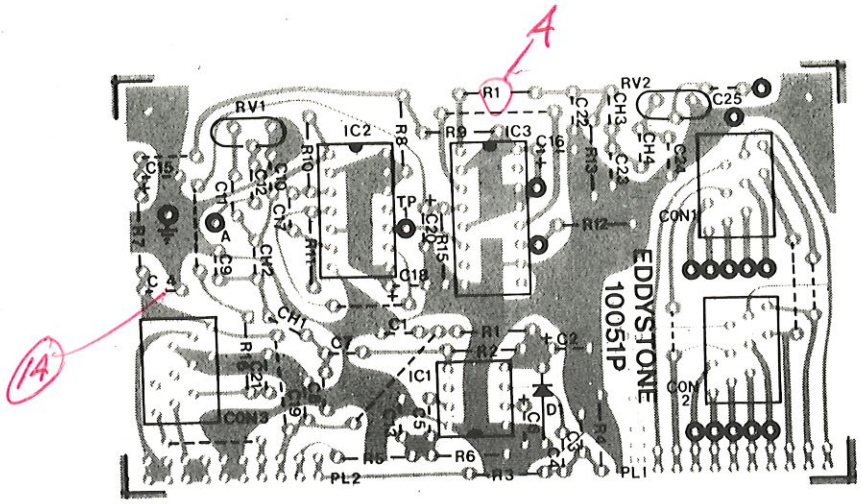
(10) 1964/1 OSCILLATOR OUTPUT



(11) 1964/2 OSCILLATOR OUTPUT

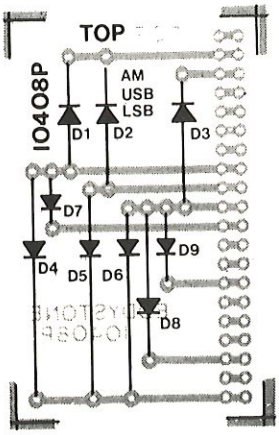


(12) 1964/2 FREQUENCY DOUBLER

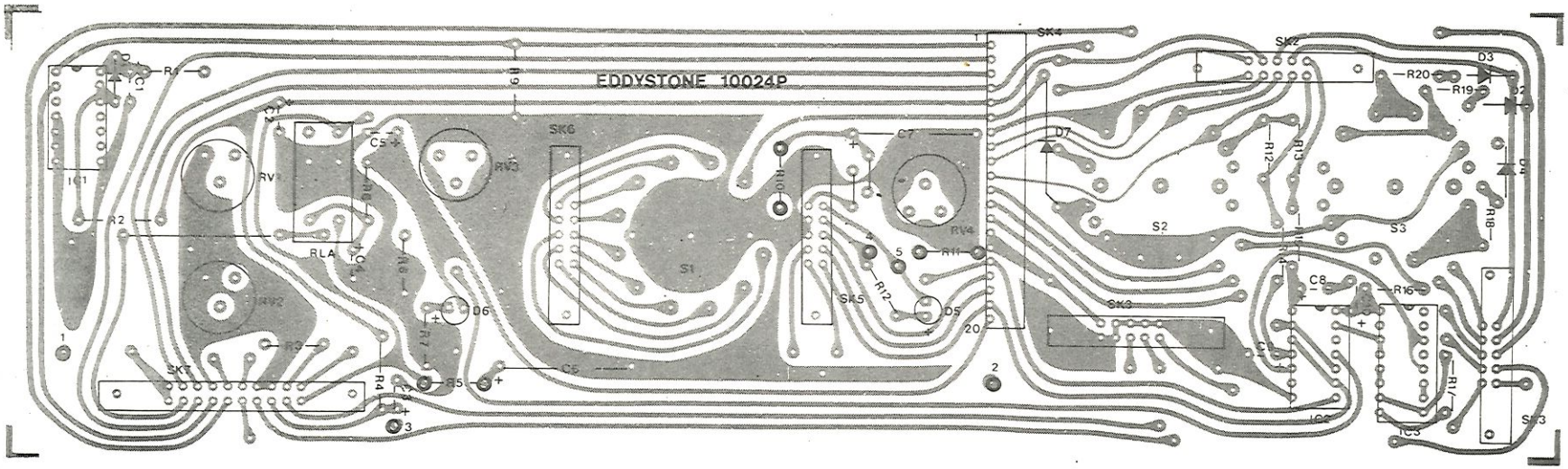


(13) CLARIFIER BOARD

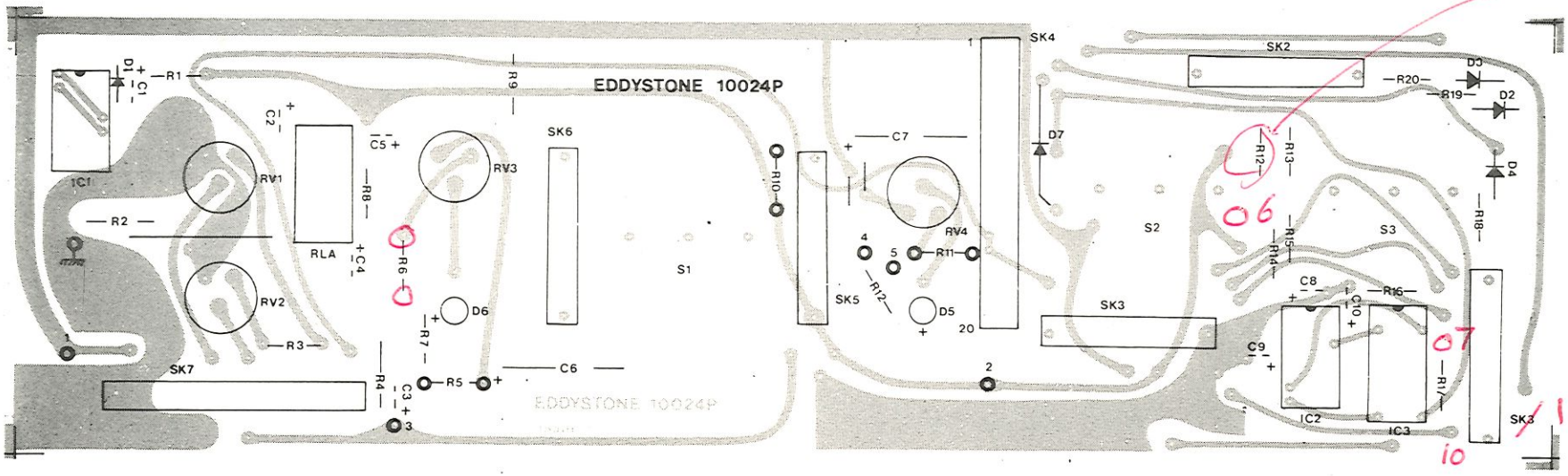
(14) CONTROL BOARD : : PAGE 5-20 REFERS



(15) MODE MEMORY BOARD



(14) CONTROL BOARD (DOUBLE-SIDED) TOP TRACK



R12A

06

07

10

(14) BOTTOM TRACK

(NB PLATED THROUGH HOLES USED)

ALL VIEWS FROM LEGEND SIDE

*ILLUSTRATED SLIGHTLY LESS THAN ACTUAL SIZE

COMPONENTS LIST

Location Code

Each component reference in the Lists which follow is prefixed by a number which will assist in the location of the particular component. All components for a particular circuit module are uniquely identified by the prefix number which corresponds with the individual module number (refer to page 4-1 for further amplification).

The overall coding is as follows:-

Prefix :	1	-	Aerial Attenuator Board
	2	-	RF Tuner Head (suffixes /1 to /5)
	3	-	Auto. Sideband Selector
	4	-	1st. Mixer
	5	-	1st. IF/2nd. Mixer
	6	-	Filter Module
	7	-	Main IF, AGC, Detectors, Audio
	8	-	Oven Unit
	9	-	1st. Oscillator
	10	-	1st. Oscillator Output (1964/1)
	11	-	1st. Oscillator Output (1964/2)
	12	-	Frequency Doubler (1964/2)
	13	-	Clarifier
	14	-	Front panel control board
	15	-	Mode Memory board
	16	-	Power Supply
	17	-	Miscellaneous items

For other modules see Appendix B2, Special Variants.

Replacement Spares

spares should be ordered by quoting the complete circuit Reference, including the Module Prefix (where applicable), the Component description and the part number where this is given in lists.

From time to time, components of the types specified may be unavailable, and in such circumstances, equivalent types may be fitted or supplied as replacements. All orders and enquiries should be directed to the address below, quoting the Model and Serial Number of the equipment in all communications.

EDDYSTONE RADIO LIMITED,
SALES AND SERVICE DEPT.,
ALVECHURCH ROAD,
BIRMINGHAM B31 3PP,
ENGLAND.

TELEPHONE : 021-475-2231
TELEX : 337081
CABLES : EDDYSTONE BIRMINGHAM

Capacitors

Ref	Head	Value	Type	Tolerance	Wkg Voltage
1C 1		1µ	Tantalum	20%	35V
1C 2		1µ	Tantalum	20%	35V
1C 3		1µ	Tantalum	20%	35V
1C 4		1µ	Tantalum	20%	35V
1C 5		1µ	Tantalum	20%	35V
1C 6		1µ	Tantalum	20%	35V
1C 7		1µ	Tantalum	20%	35V
1C 8		1µ	Tantalum	20%	35V
2C 1	ALL	1µ	Tantalum	20%	35V
2C 2	ALL	10n	Disc Ceramic	20%	25V
2C 3	ALL	1µ	Tantalum	20%	35V
2C 4	ALL	1µ	Tantalum	20%	35V
2C 5	/1	27p	~~NOT FITTED~~ Polystyrene	±3p	160V
2C 5	/2	27p	Polystyrene	±3p	160V
2C 5	/3	27p	Polystyrene	±3p	160V
2C 5	/4		NOT FITTED		
2C 5	/5		NOT FITTED		
2C 6	/1	27p	~~NOT FITTED~~ Polystyrene	±3p	160V
2C 6	/2	27p	Polystyrene	±3p	160V
2C 6	/3	27p	Polystyrene	±3p	160V
2C 6	/4		NOT FITTED		
2C 6	/5		NOT FITTED		
2C 7	ALL	10n	Disc Ceramic	20%	25V
2C 8	ALL	100n	Polycarbonate	20%	100V
2C 9	ALL	1µ	Tantalum	20%	35V
2C10	/1	27p	~~NOT FITTED~~ Polystyrene	±3p	160V
2C10	/2	27p	Polystyrene	±3p	160V
2C10	/3	27p	Polystyrene	±3p	160V
2C10	/4		NOT FITTED		
2C10	/5		NOT FITTED		
2C11	ALL	100n	Polycarbonate	20%	100V
2C12	ALL	1µ	Tantalum	20%	35V
2C13	ALL	10n	Disc Ceramic	20%	25V
2C14	ALL		NOT FITTED		
2C15	ALL	1µ	Tantalum	20%	35V
2C16	/1	8/135p	Trimmer 8633P		
2C16	/2	8/135p	Trimmer 8633P		
2C16	/3	8/135p	Trimmer 8633P		
2C16	/4	7.5/80p	Trimmer 10623P		
2C16	/5	7.5/80p	Trimmer 10623P		
2C17	/1	8/135p	Trimmer 8633P		
2C17	/2	8/135p	Trimmer 8633P		
2C17	/3	8/135p	Trimmer 8633P		
2C17	/4	7.5/80p	Trimmer 10623P		
2C17	/5	7.5/80p	Trimmer 10623P		

Capacitors continued....

Ref	Head	Value	Type	Tolerance	Wkg Voltage
2C18	/1	8/135p	Trimmer 8633P		
2C18	/2	8/135p	Trimmer 8633P		
2C18	/3	8/135p	Trimmer 8633P		
2C18	/4	7.5/80p	Trimmer 10623P		
2C18	/5	7.5/80p	Trimmer 10623P		
2C19	/1	8/135p	Trimmer 8633P		
2C19	/2	8/135p	Trimmer 8633P		
2C19	/3	8/135p	Trimmer 8633P		
2C19	/4	7.5/80p	Trimmer 10623P		
2C19	/5	7.5/80p	Trimmer 10623P		
2C20	/1	8/135p	Trimmer 8633P		
2C20	/2	8/135p	Trimmer 8633P		
2C20	/3	8/135p	Trimmer 8633P		
2C20	/4	7.5/80p	Trimmer 10623P		
2C20	/5	7.5/80p	Trimmer 10623P		
2C21	/1	8/135p	Trimmer 8633P		
2C21	/2	8/135p	Trimmer 8633P		
2C21	/3	8/135p	Trimmer 8633P		
2C21	/4	7.5/80p	Trimmer 10623P		
2C21	/5	7.5/80p	Trimmer 10623P		
3C 1		10µ	Tantalum	20%	25V
4C 1		100n	Polycarbonate	20%	100V
4C 2		100n	Polycarbonate	20%	100V
4C 3		820p	Silver Mica	2%	350V
4C 4		2n7	Silver Mica	2%	200V
4C 5		820p	Silver Mica	2%	200V
4C 6		2n7	Silver Mica	2%	200V
4C 7		100n	Polycarbonate	20%	100V
4C 8		1µ	Tantalum	20%	35V
5C 1		1500p	Polystyrene	2%	63V
5C 2		100n	Polycarbonate	20%	100V
5C 3		22µ	Tantalum	20%	16V
5C 4		10n	Disc Ceramic	20%	25V
5C 5		10µ	Tantalum	20%	16V
5C 6		22µ	Tantalum	20%	16V
5C 7		10n	Disc Ceramic	20%	25V
5C 8		10n	Disc Ceramic	20%	25V
5C 9		22µ	Tantalum	20%	16V
5C10		100n	Polycarbonate	20%	100V
5C11		3900p	Polystyrene	2%	63V
5C12		100n	Polycarbonate	20%	100V
5C13		10n	Disc Ceramic	20%	25V
5C14		1µ	Tantalum	20%	35V
5C15		1µ	Tantalum	20%	35V
5C16		10n	Disc Ceramic	20%	25V
5C17		22µ	Tantalum	20%	16V
5C18		330p	Polystyrene	2%	160V

Capacitors continued.....

Ref	Value	Type	Tolerance	Wkg Voltage
5C19	10n	Disc Ceramic	20%	25V
5C20	10n	Disc Ceramic	20%	25V
5C21	22µ	Tantalum	20%	16V
5C22	10n	Disc Ceramic	20%	25V
5C23	10n	Disc Ceramic	20%	25V
5C24	100µ	Electrolytic	+80%-20%	10V
5C25	10n	Disc Ceramic	20%	25V
5C26	22µ	Tantalum	20%	16V
5C27	1µ	Tantalum	20%	35V
5C28	10n	Disc Ceramic	20%	25V
5C29	10n	Disc Ceramic	20%	25V
5C30	100n	Polycarbonate	20%	100V
5C31	10µ	Tantalum	20%	16V
5C32	470p	Polystyrene	2%	160V
5C33	330p	Polystyrene	2%	160V
5C34	10µ	Tantalum	20%	16V
5C35	10µ	Tantalum	20%	16V
5C36 *	2200p	Polystyrene	2%	63V
6C 1	100n	Polycarbonate	20%	100V
6C 2	100n	Polycarbonate	20%	100V
6C 3	100n	Polycarbonate	20%	100V
6C 4	100n	Polycarbonate	20%	100V
7C 1	1µ	Tantalum	20%	35V
7C 2	1µ	Tantalum	20%	35V
7C 3	10n	Disc Ceramic	20%	25V
7C 4	22µ	Tantalum	20%	20V
7C 5	10n	Disc Ceramic	20%	25V
7C 6	10n	Disc Ceramic	20%	25V
7C 7	8n2	Polystyrene	2%	63V
7C 8	100n	Polycarbonate	20%	100V
7C 9	22µ	Tantalum	20%	20V
7C10	10n	Disc Ceramic	20%	25V
7C11	1µ	Tantalum	20%	35V
7C12	10n	Disc Ceramic	20%	25V
7C13	10n	Disc Ceramic	20%	25V
7C14	8n2	Polystyrene	2%	63V
7C15	100n	Polycarbonate	20%	100V
7C16	100n	Polycarbonate	20%	100V
7C17	68µ	Electrolytic	+80%-20%	25V
7C18	10µ	Tantalum	20%	25V
7C19	3n9	Polystyrene	2%	63V
7C20	10n	Disc Ceramic	20%	25V
7C21	1µ	Tantalum	20%	35V
7C22	10µ	Tantalum	20%	25V
7C23	100n	Polycarbonate	20%	100V
7C24	100n	Polycarbonate	20%	100V
7C25	10n	Disc Ceramic	20%	25V
7C26	10µ	Tantalum	20%	25V

Capacitors continued.....

Ref	Value	Type	Tolerance	Wkg Voltage
7C27	100n	Polycarbonate	20%	100V
7C28	10n	Disc Ceramic	20%	25V
7C29	10µ	Tantalum	20%	25V
7C30	3n9	~~Polystyrene~~ SILVER MICA.	2%	~~63V~~ 50V
7C31	100n	Polycarbonate	20%	100V
7C32	10n	Disc Ceramic	20%	25V
7C33	100n	Polycarbonate	20%	100V
7C34	10µ	Tantalum	20%	25V
7C35	1µ	Tantalum	20%	35V
7C36	10µ	Tantalum	20%	25V
7C37	100µ	Electrolytic	+80%-20%	10V
7C38	47µ	Electrolytic	+80%-20%	10V
7C39	1µ	Tantalum	20%	35V
7C40	1µ	Tantalum	20%	35V
7C41	1µ	Tantalum	20%	35V
7C42	1µ	Tantalum	20%	35V
7C43		NOT FITTED		
7C44	~~47µ~~ 22	~~Electrolytic~~ TANTALUM	± 20% ~~+80%-20%~~	16V ~~10V~~
7C45	10µ	Tantalum	20%	16V
7C46	10µ	Tantalum	20%	16V
7C47	10n	Disc Ceramic	20%	25V
7C48	22µ	Tantalum	20%	16V
7C49	100µ	Electrolytic	+80%-20%	25V
7C50	10n	Disc Ceramic	20%	25V
7C51	22µ	Tantalum	20%	20V
7C52	100n	Polycarbonate	20%	100V
7C53	47n	Polycarbonate	20%	100V
7C54	10n	Polycarbonate	20% ~~10%~~	100V
7C55	10µ	Tantalum	20%	25V
7C56	10n	Disc Ceramic	20%	25V
7C57	100µ	Electrolytic	+80%-20%	25V
7C58	22µ	Tantalum	20%	20V
7C59	10n	Disc Ceramic	20%	25V
7C60	10n	Disc Ceramic	20%	25V
7C61	10n	Disc Ceramic	20%	25V
7C62	22µ	Tantalum	20%	20V
7C63	47n	Polycarbonate	20%	100V
7C64	10n	Polycarbonate	20%	100V
7C65	10µ	Tantalum	20%	25V
7C66	4µ7	Tantalum	20%	20V
7C67	100µ	Electrolytic	+80%-20%	10V
7C68	100µ	Electrolytic	+80%-20%	10V
7C69	220µ	Electrolytic	+80%-20%	10V
7C70	1n	Disc Ceramic	20%	500V
7C71	680n	Tantalum	20%	35V
7C72	22µ	Tantalum	20%	16V
7C73	1000µ	Electrolytic	20%	~~16V~~ 10V
7C74	10µ	Tantalum	20%	16V
7C75	22µ	Tantalum	20%	20V

Ref	Value	Type	Tolerance	Wkg Voltage
7C76	10n	Disc Ceramic	20%	25V
7C77	1µ	Tantalum	20%	35V
7C78	100n	Polycarbonate	20%	100V
7C79	22µ	Tantalum	20%	16V
7C80	100n	Polycarbonate	20%	100V
7C81	680µ	Electrolytic	+80%-20%	10V
7C82	100n	Polycarbonate	20%	100V
7C83	220µ	Electrolytic	+80%-20%	10V
7C84	100µ	Electrolytic	+80%-20%	10V
7C85	10n	Polycarbonate	20%	100V
7C86	1n8	Polystyrene	2%	63V
7C87	100µ	Electrolytic	+80%-20%	25V
7C88	100n	Polycarbonate	20%	100V
7C89	470µ	Electrolytic	+80%-20%	25V
7C90	220µ	Electrolytic	+80%-20%	16V
7C91	100n	Polycarbonate	20%	100V
7C92	220n	Polycarbonate	20%	100V
7C93	4n7	Polystyrene	2%	63V
7C94	10µ	Tantalum	20%	16V
7C95	220µ	Electrolytic	+80%-20%	10V
7C96	100µ	Electrolytic	+80%-20%	10V
7C97	150n	Polycarbonate	20%	100V
7C98	100µ	Electrolytic	+80%-20%	25V
7C99	10µ	Tantalum	20%	25V
7C100	100n	Polycarbonate	20%	100V
7C101	100n	Polycarbonate	20%	100V
7C102	220µ	Electrolytic	+80%-20%	16V
7C103	22µ	Electrolytic	+80%-20%	16V
8C 1	100p	Polystyrene	±2p	160V
8C 2	100p	Polystyrene	±2p	160V
8C 3	100p	Polystyrene	±2p	160V
8C 4	100p	Polystyrene	±2p	160V
8C 5	100p	Polystyrene	±2p	160V
8C 6	100p	Polystyrene	±2p	160V
8C 7	100p	Polystyrene	±2p	160V
8C 8	100p	Polystyrene	±2p	160V
8C 9	100p	Polystyrene	±2p	160V
8C10	100p	Polystyrene	±2p	160V
8C11	100p	Polystyrene	±2p	160V
8C12	100p	Polystyrene	±2p	160V
8C13	100p	Polystyrene	±2p	160V
8C14	100p	Polystyrene	±2p	160V
8C15	100p	Polystyrene	±2p	160V
8C16	100p	Polystyrene	±2p	160V
8C17	100p	Polystyrene	±2p	160V
8C18	100p	Polystyrene	±2p	160V
8C19	100p	Polystyrene	±2p	160V
8C20	100p	Polystyrene	±2p	160V

Capacitors continued.....

Ref	Value	Type	Tolerance	Wkg Voltage
8C21	10n	Disc Ceramic	20%	25V
8C22	10n	Disc Ceramic	20%	25V
8C23	10n	Disc Ceramic	20%	25V
8C24	10n	Disc Ceramic	20%	25V
8C25	10n	Disc Ceramic	20%	25V
8C26	10n	Disc Ceramic	20%	25V
8C27	10n	Disc Ceramic	20%	25V
8C28	10n	Disc Ceramic	20%	25V
8C29	10n	Disc Ceramic	20%	25V
8C30	10n	Disc Ceramic	20%	25V
8C31	2-30p	Trimmer 8735P		
8C32	2-30p	Trimmer 8735P		
8C33	2-30p	Trimmer 8735P		
8C34	2-30p	Trimmer 8735P		
8C35	2-30p	Trimmer 8735P		
8C36	2-30p	Trimmer 8735P		
8C37	2-30p	Trimmer 8735P		
8C38	2-30p	Trimmer 8735P		
8C39	2-30p	Trimmer 8735P		
8C40	2-30p	Trimmer 8735P		
8C41	39p	Polystyrene	±2p	160V
8C42	39p	Polystyrene	±2p	160V
8C43	39p	Polystyrene	±2p	160V
8C44	39p	Polystyrene	±2p	160V
8C45	39p	Polystyrene	±2p	160V
8C46	39p	Polystyrene	±2p	160V
8C47	39p	Polystyrene	±2p	160V
8C48	39p	Polystyrene	±2p	160V
8C49	39p	Polystyrene	±2p	160V
8C50	39p	Polystyrene	±2p	160V
8C51	100n	Polycarbonate	20%	100V
8C52	100n	Polycarbonate	20%	100V
9C 1	10n	Disc Ceramic	20%	25V
9C 2	10n	Disc Ceramic	20%	25V
9C 3	10n	Disc Ceramic	20%	25V
9C 4	47n	Polycarbonate	20%	100V
9C 5	10n	Disc Ceramic	20%	25V
9C 6	10n	Disc Ceramic	20%	25V
9C 7	10µ	Tantalum	20%	25V
9C 8	10n	Disc Ceramic	20%	25V
9C 9	100n	Polycarbonate	20%	100V
9C10	10µ	Tantalum	20%	25V
9C11	10n	Disc Ceramic	20%	25V
9C12	10n	Disc Ceramic	20%	25V
9C13	10n	Disc Ceramic	20%	25V
9C14	10µ	Tantalum	20%	25V
9C15	10µ	Tantalum	20%	25V
9C16	1µ	Tantalum	20%	35V

Ref	Value	Type	Tolerance	Wkg Voltage
9C17	33p	Polystyrene	±2p	160V
9C18	100p	Polystyrene	±2p	160V
9C19	56p	Polystyrene	±3p	160V
9C20	150p	Polystyrene	±2%	160V
9C21	10µ	Tantalum	20%	16V
9C22	15p	Polystyrene	1%	160V
9C23	150p	Polystyrene	2%	160V
9C24	22µ	Tantalum	20%	16V
9C25	56p	Polystyrene	±3p	160V
9C26	150p	Polystyrene	±2%	160V
9C27	22µ	Tantalum	20%	16V
10C 1	10n	Disc Ceramic	20%	25V
10C 2	100n	Polycarbonate	20%	100V
10C 3	10n	Disc Ceramic	20%	25V
10C 4	1µ	Tantalum	20%	35V
10C 5	100n	Polycarbonate	20%	100V
11C 1	10n	Disc Ceramic	20%	25V
11C 2	100n	Polycarbonate	20%	100V
11C 3	10n	Disc Ceramic	20%	25V
11C 4	1µ	Tantalum	20%	35V
11C 5	10n	Disc Ceramic	20%	25V
11C 6	10n	Disc Ceramic	20%	25V
11C 7	10n	Disc Ceramic	20%	25V
11C 8	100n	Polycarbonate	20%	100V
12C 1	4.5/20p	Trimmer 7289P		
12C 2	1µ	Tantalum	20%	35V
12C 3	10n	Disc Ceramic	20%	25V
12C 4	10n	Disc Ceramic	20%	25V
12C 5	10n	Disc Ceramic	20%	25V
12C 6	10n	Disc Ceramic	20%	25V
12C 7	10n	Disc Ceramic	20%	25V
13C 1	10n	Disc Ceramic	20%	25V
13C 2	1µ	Tantalum	20%	35V
13C 3	22p	Polystyrene	±1p	160V
13C 4	10n	Disc Ceramic	±20%	25V
13C 5	10n	Disc Ceramic	20%	25V
13C 6	1µ	Tantalum	20%	35V
13C 7	10n	Disc Ceramic	20%	25V
13C 8	68p	Polystyrene	2%	160V
13C 9	220p	Polystyrene	±2p	160V
13C10	68p	Polystyrene	±2p	160V
13C11	10n	Disc Ceramic	±20%	25V
13C12	10n	Disc Ceramic	20%	25V
13C13	22p	Polystyrene	±1p	160V
13C14	10n	Disc Ceramic	±20%	25V
13C15	1µ	Tantalum	20%	35V

Capacitors continued....

Ref	Value	Type	Tolerance	Wkg Voltage
13C16	1µ	Tantalum	20%	35V
13C17	10n	Disc Ceramic	20%	25V
13C18	1µ	Tantalum	20%	35V
13C19	10n	Disc Ceramic	20%	25V
13C20	1µ	Tantalum	20%	35V
13C21	10n	Disc Ceramic	20%	25V
13C22	680p	Polystyrene	2%	63V
13C23	2n2	Polystyrene	2%	63V
13C24	680p	Polystyrene	2%	160V
13C25	10n	Disc Ceramic	20%	25V
14C 1	10µ	Tantalum	20%	25V
14C 2	1µ	Tantalum	20%	35V
14C 3	1µ	Tantalum	20%	35V
14C 4	1µ	Tantalum	20%	35V
14C 5	1µ	Tantalum	20%	35V
14C 6	150µ	Electrolytic	20%	16V
14C 7	150µ	Electrolytic	20%	16V
14C 8	10µ	Tantalum	20%	25V
14C 9	10µ	Tantalum	20%	25V
14C10	10µ	Tantalum	20%	25V
16C 1	470µ	Electrolytic	+80%-20%	25V
16C 2	10µ	Tantalum	20%	25V
16C 3	6800µ	Electrolytic	+80%-20%	25V
16C 4	10µ	Tantalum	20%	25V
16C 5	6800µ	Electrolytic	+80%-20%	25V
16C 6	10µ	Tantalum	20%	25V
16C 7	10µ	Tantalum	20%	25V

Resistors

All resistors are 5% tolerance 0.3W rating CR25 unless otherwise stated.

Ref	Head	Value Ohms	Rating W
1R 1		33	
1R 2		33	
1R 3		68	
1R 4		18	
1R 5		68	
1R 6		33	
1R 7		68	
1R 8		18	
1R 9		68	
1R10		33	
1R11		33	

Ref	Head	Value Ohms	Rating W
1R12		2M2	
2R 1	ALL	470	
2R 2	ALL	470	
2R 3	ALL	470	
2R 4	/1	470	
2R 4	/2	470	
2R 4	/3	470	
2R 4	/4	1K8	
2R 4	/5	1K8	
2R 5	/1	470	

Resistors continued.....

Ref	Head	Value Ohms	Rating W
2R 5	/2	470	
2R 5	/3	470	
2R 5	/4	1K5	
2R 5	/5	1K5	
2R 6	ALL	470	
2R 7	ALL	270	
2R 8	ALL	10	
2R 9	ALL	470	
2R10	ALL	10	
2R11	/1	180K	
2R11	/2	120K	
2R11	/3	Not Fitted	
2R11	/4	Not Fitted	
2R11	/5	Not Fitted	
2R12	/1	180K	
2R12	/2	120K	
2R12	/3	Not Fitted	
2R12	/4	Not Fitted	
2R12	/5	Not Fitted	
2R13	/1	180K	
2R13	/2	120K	
2R13	/3	Not Fitted	
2R13	/4	Not Fitted	
2R13	/5	Not Fitted	
3R 1		33K	
3R 2		33K	
3R 3		10K	
3R 4		47K	
4R 1		47	0.4W
4R 2		47	0.4W
5R 1		1K8	
5R 2		220	
5R 3		47	
5R 4		270	
5R 5		100	
5R 6		120	
5R 7		100	
5R 8		560	
5R 9		22	
5R10		100	
5R11		470	
5R12		470	
5R13		33	
5R14		18K	
5R15		5K6	

Ref	Value Ohms	Rating W
5R16	120	
5R17	560	
5R18	47	
5R19	100	
5R20	3K3	
5R21	1K2	
5R22	47	
5R23	120	
5R24	390	
5R25	100	
5R26	270	
5R27	680	
5R28 *	330	
6R 1	33	
6R 2	33	
6R 3	1K	
6R 4	1K8	
6R 5	1K	
6R 6	1K8	
7R 1	33	
7R 2	3K3	
7R 3	100	
7R 4	47	
7R 5	470	
7R 6	100	
7R 7	100	
7R 8	47	
7R 9	1K	
7R10	4K7	
7R11	1K2	
7R12	47	
7R13	47	
7R14	180	
7R15	33K	
7R16	15K	
7R17	47	
7R18	680	
7R19	68	
7R20	47	
7R21	56K	
7R22	15K	
7R23	270	
7R24	180	
7R25	1K2	
7R26	27K	
7R27	8K2	

Resistors continued.....

Ref	Value Ohms	Rating W
7R28	180	
7R29	180	
7R30	47	
7R31	47	
7R32	1K8	
7R33	2K7	
7R34	680	
7R35	1K	
7R36	100K	
7R37	3K3	
7R38	33	
7R39	33	
7R40	10K	
7R41	15K	
7R42	10K	
7R43	4K7	
7R44	27K	
7R45	270	
7R46	4K7	
7R47	33	
7R48	22K	
7R49	10K	
7R50	10K	
7R51	1K	
7R52	1K	
7R53	100	
7R54	1K	
7R55	100	
7R56	3K3	
7R57	100	
7R58	3K3	
7R59	820	
7R60	1K	
7R61	3K9	
7R62	3K9	
7R63	2K2	
7R64	1K8	
7R65	220	
7R66	390	
7R67	47K	
7R68	47K	
7R69	47K	
7R70	47K	
7R71	1K5	
7R72	470	
7R73	220	
7R74	1K	
7R75	3K3	
7R76	100K	

Ref	Value Ohms	Rating W
7R77	470	
7R78	~~1K~~ 47K	
7R79	18	
7R80	100	
7R81	100	
7R82	1	
7R83	100K	
7R84	470	
7R85	4K7	
7R86	68	
7R87	100	
7R88	22 (w.w.)	3W
7R89	100	
7R90	1	
8R 1	2K7	
8R 2	2K7	
8R 3	2K7	
8R 4	2K7	
8R 5	2K7	
8R 6	2K7	
8R 7	2K7	
8R 8	2K7	
8R 9	2K7	
8R10	2K7	
8R11	2K7	
8R12	2K7	
8R13	2K7	
8R14	2K7	
8R15	2K7	
8R16	2K7	
8R17	2K7	
8R18	2K7	
8R19	2K7	
8R20	2K7	
8R21	1K	
8R22	1K	
8R23	1K	
8R24	1K	
8R25	1K	
8R26	1K	
8R27	1K	
8R28	1K	
8R29	1K	
8R30	1K	
8R31	Heater Winding	
8R32a	2K2	0.4W
8R32b	3K3	0.4W
8R33	1K	0.4W

Ref	Value Ohms	Rating W
8R34	150	
8R35	1K	0.4W
8R36	0.47	2.5W
9R 1	6K8	
9R 2	2K7	
9R 3	220	0.4W
9R 4	1K5	
9R 5	3K3	
9R 6	220	0.4W
9R 7	47	0.4W
9R 8	470	
9R 9	6K8	
9R10	3K3	
9R11	3K3	
9R12	3K3	
9R13	470	0.4W
9R14	470	
9R15	10K	
9R16	10K	
9R17	820	
9R18	56	
9R19	100	
9R20	270	
9R21	1K2	
9R22	1K2	
9R23	1K2	
9R24	1K2	
9R25	1K2	
9R26	1K2	
9R27	1K2	
9R28	1K2	
9R29	1K2	
9R30	1K2	
9R31	1M	
9R32	10K	
9R33	100	
9R34	39K	
9R35	22K	
9R36	1M	
9R37	1M	
9R38	39K	
9R39	22K	
9R40	1M	
9R41	2K2	
9R42	680	

Ref	Value Ohms	Rating W
10R 1	100	
10R 2	47	
10R 3	100	
10R 4	3K9	
10R 5	1K5	
10R 6	47	
11R 1	100	
11R 2	47	
11R 3	100	
11R 4	5K6	
11R 5	2K7	
11R 6	47	
11R 7	3K3	
11R 8	1K8	
11R 9	1K8	
11R10	2K2	
11R11	10K	
11R12	3K3	
11R13	120K	
11R14	47	
12R 1	10K	
12R 2	2K2 A.O.T.	
12R 3	1K	0.4W
12R 4	1K	0.4W
12R 5	150	
12R 6	82	
12R 7	4K7	
12R 8	18K	
12R 9	3K3	
13R 1	390	
13R 2	680	
13R 3	820	
13R 4	330	
13R 5	820	
13R 6	330	
13R 7	1K	
13R 8	100	
13R 9	100	
13R10	47K	
13R11	47K	
13R12	10K	
13R13	1K2	
13R14	12K	

Resistors continued....

Ref	Value Ohms	Rating W
13R15	10K	
13R16	1K	
14R 1	220	
14R 2	1K	
14R 3	10K	
14R 4	33	
14R 5	8K2 A.O.T.	
14R 6	1K	
14R 7	680	
14R 8	33	
14R 9	47K	

Ref	Value Ohms	Rating W
14R10	6K8 A.O.T.	
14R11	1K A.O.T.	
14R12	47K	
14R13	47K	
14R14	1K	
14R15	1K	
14R16	220	
14R17	47K	
14R18	470	
14R19	330	
14R20	120	

14R12A
680R.

Potentiometers

Ref	Head	Value	Law	Type	Function
2RV 1	ALL	47Ω	Lin	Pre-set	
4RV 1		47Ω	Lin	Pre-set	
5RV 1		47k	Lin	Pre-set	
5RV 2		10k	Lin	Pre-set	
7RV 1		10k	Lin	Pre-set	
7RV 2		470k	Lin	Pre-set	
7RV 3		1k	Lin	Pre-set	
7RV 4		4k7	Lin	Pre-set	
7RV 5		1k	Lin	Pre-set	
7RV 6		470	Lin	Pre-set	
7RV 7		4k7	Lin	Pre-set	
8RV 1		1k	Lin	Pre-set	Multi-turn

Potentiometers continued....

Ref	Value	Law	Type	Function
9RV 1	4k7	Lin	Pre-set	
12RV 1	4k7	Lin	Pre-set	
12RV 2	1k	Lin	Pre-set	
12RV 3	47	Lin	Pre-set	
13RV 1	1k	Lin	Pre-set	
13RV 2	1k	Lin	Pre-set	
14RV 1	10k	Log	Pot	AF GAIN
14RV 2	10k	Lin	Pre-set	LINE LEVEL
14RV 3	10k	Log	Pot	IF GAIN
14RV 4	10k	Lin	Pot	CLARIFIER

Thermistors

Ref	Type
8TH1	VA1066S

Diodes

Ref	Head	Type	Manufacturer	Circuit Function
1D 1		BAV10	Mullard	
1D 2		BAV10	Mullard	
1D 3		BAV10	Mullard	
1D 4		BAV10	Mullard	
1D 5		BAV10	Mullard	
1D 6		BAV10	Mullard	
1D 7		BAV10	Mullard	
1D 8		BAV10	Mullard	
1D 9		1N4004	Mullard	
1D10		1N4004	Mullard	
1D11		1N4004	Mullard	
2D 1	ALL	1N4004	Mullard	
2D 2	ALL	1N4004	Mullard	
3D 1		BAX13	Mullard	
3D 2		BAX13	Mullard	
3D 3		BAX13	Mullard	
3D 4		BAX13	Mullard	
3D 5		BAX13	Mullard	
3D 6		BAX13	Mullard	
3D 7		BAX13	Mullard	
3D 8		BAX13	Mullard	

Diodes continued.....

Ref	Type	Manufacturer	Circuit Function
3D 9	BAX13	Mullard	
3D10	BAX13	Mullard	
3D11	1N4004	Mullard	
7D 1	BAX13	Mullard	
7D 2	BAX13	Mullard	
7D 3	BAX13	Mullard	
7D 4	BZX79 C12	Mullard	
7D 5	BZX79 C6V2	Mullard	
7D 6	BZX79 C4V7	Mullard	
8D 1	BAX13	Mullard	
8D 2	BAX13	Mullard	
8D 3	BAX13	Mullard	
8D 4	BAX13	Mullard	
8D 5	BAX13	Mullard	
8D 6	BAX13	Mullard	
8D 7	BAX13	Mullard	
8D 8	BAX13	Mullard	
8D 9	BAX13	Mullard	
8D10	BAX13	Mullard	
8D11	BAX13	Mullard	
8D12	BAX13	Mullard	
8D13	BAX13	Mullard	
8D14	BAX13	Mullard	
8D15	BAX13	Mullard	
8D16	BAX13	Mullard	
8D17	BAX13	Mullard	
8D18	BAX13	Mullard	
8D19	BAX13	Mullard	
8D20	BAX13	Mullard	
8D21	1N4004	Mullard	
9D 1	BZX91	Mullard	
9D 2	MV1648	Motorola	
9D 3	MV1648	Motorola	
* 9D 4	5082-4850	LED	'OVEN WARNING'
11D 1	BAX13	Mullard	
11D 2	BAX13	Mullard	
11D 3	BAX13	Mullard	
11D 4	BAX13	Mullard	
11D 5	BAX13	Mullard	
11D 6	BAX13	Mullard	
11D 7	BAX13	Mullard	
11D 8	BAX13	Mullard	
11D 9	BAX13	Mullard	
11D10	BAX13	Mullard	
11D11	BAX13	Mullard	

Diodes continued.....

Ref	Type	Manufacturer	Circuit Function
12D 1	BAX13	Mullard	
12D 2	BAX13	Mullard	
13D 1	BZX99 C6V2	Mullard	
14D 1	1N4004	Mullard	
14D 2	1N4004	Mullard	
14D 3	1N4004	Mullard	
14D 4	1N4004	Mullard	
14D 5	5082-4850	LED	STANDBY
14D 6	5082-4850	LED	RECEIVER ON
14D 7	1N4004	Mullard	
15D 1	1N4004	Mullard	
15D 2	1N4004	Mullard	
15D 3	1N4004	Mullard	
15D 4	1N4004	Mullard	
15D 5	1N4004	Mullard	
15D 6	1N4004	Mullard	
15D 7	1N4004	Mullard	
15D 8	1N4004	Mullard	
15D 9	1N4004	Mullard	
16D 1	OSHO1A-100	Mullard	Rectifier
16D 2	C3200/2200	Semikron	Rectifier

Transistors

Ref	Head	Type	Manufacturer	Circuit Function
2TR 1	/1	BFW17A	Mullard	
2TR 1	/2	BFW17A	Mullard	
2TR 1	/3	BFW17A	Mullard	
2TR 1	/4	BFW17A	Mullard	
2TR 1	/5	BFW30	Mullard	
3TR 1		BC547B	Mullard	
5TR 1		BFX89	Mullard	
5TR 2		BFX89	Mullard	
5TR 3		BFX89	Mullard	
7TR 1		BC1076B	Mullard	
7TR 2		BC1076B	Mullard	
7TR 3		BC1076B	Mullard	
7TR 4		BC1076B	Mullard	
7TR 5		BC1076B	Mullard	
7TR 6		UC734B	~~Siliconix~~ UNION CARBIDE	

Transistors continued.....

Ref	Type	Manufacturer	Circuit Function
8TR 1	BD131	Mullard	
9TR 1	40673	RCA	
9TR 2	BFX89	Mullard	
9TR 3	BFX89	Mullard	
9TR 4	40673	RCA	
9TR 5	40673	RCA	
10TR 1	BFW17A	Mullard	
11TR 1	BFW17A	Mullard	
11TR 2	BC547B	Mullard	
11TR 3	BC547B	Mullard	
12TR 1	UC734B	Sillconix UNION CARBIDE	
12TR 2	UC734B	Sillconix "	
12TR 3	BF324	Mullard	

Integrated Circuits

Ref	Type	Manufacturer	Circuit Function
3IC 1	MC14070CP	Motorola	
4IC 1	U350	~~Sillconix~~ SILICONIX	
5IC 1	SL601C	Plessey	
5IC 2	SL641C	Plessey	
5IC 3	SL1623C	Plessey	
7IC 1	MC15906	Motorola	
7IC 2	MC15906	Motorola	
7IC 3	MC17741	Motorola	
7IC 4	MC17741	Motorola	
7IC 5	MC17741	Motorola	
7IC 6	CA3002	RCA	
7IC 7	SL1001A	Plessey	
7IC 8	SL1621C	Plessey	
7IC 9	MC14049CP	Motorola	
7IC10	MC14016CP	Motorola	
7IC11	TBA810S	SGS	
7IC12	TCA760A	Mullard	
8IC 1	µA759UIC	Fairchild	
9IC 1	CA3028A	RCA	
13IC 1	SL1641C	Plessey	
13IC 2	MC14011CP	Motorola	

Integrated Circuits continued.....

Ref	Type	Manufacturer	Circuit Function
13IC 3	MC14526CP	Motorola	
14IC 1	MC14016CP	Motorola	
14IC 2	MC14016CP	Motorola	
14IC 3	MC14049CP	Motorola	
16IC 1	MC7906CP	Motorola	
16IC 2	MC7815CP	Motorola	
16IC 3	MC7812CP	Motorola	
16IC 4	MC7812CP	Motorola	

Major Spares

Ref	Description	Part No.
	MODULES:-	
1	Aerial Attenuator Board	LP3640/1
2	RF Tuner Heads Range 1	LP3640/2
	2	LP3640/3
	3	LP3640/4
	4	LP3640/5
	5	LP3640/6
3	Auto-Sideband Selector	LP3640/7
4	1st. Mixer	LP3640/8
5	1st. IF/2nd. Mixer	LP3640/9
6	Filter Module (6FL1-6FL2)	Page 4-4 Refers
	Filter Module Relay Boards (6RLA)	LP3640/10
	Filter Module Relay Boards (6RLB)	LP3640/11
7	Main IF, AGC, Detectors, Audio Module	LP3640/12
	Oscillator Module (complete assembly)	LP3631
8	Oscillator Module Oven Unit	LP3640/13
9	1st. Oscillator Board	LP3640/14
10	1964/1 Oscillator Output Board	LP3640/15
11	1964/2 Oscillator Output Board	LP3640/16
12	1964/2 Frequency Doubler Board	LP3640/17
13	Clarifier Board	LP3640/18
14	Front Panel Control Board	LP3640/19
15	Mode Memory Board	Page 4-10 Refers
16	Power Supply Module	LP3632

Ref	Description		Part No.
	SWITCHES:-		
14S1	'Channel' 1 pole 10 way		10346P
14S2	'Mode' 2 pole 6 way		10345P
14S3	'AGC/Sensitivity' 2 pole 6 way		10345P
	TRANSFORMERS:-		
4T1	Wideband type BT9		10491P
7T1	Line Audio Output		D5400
16T1	Mains		10282P
	FILTERS:-		
5FL1	1.4MHz 7kHz at 3dB		10584P
6FL1	USB) * Dependant on)	Page 4-4 refers	9047P *
	USB) option)		9049P *
6FL2	LSB) * Dependant on)	Page 4-4 refers	9048P *
	LSB) option)		9050P *
	CRYSTALS:-		
8XL1-XL10	Channel Crystals		10347P
~~13XL1~~ 8XL11	Clarifier		10348P
~~13XL2~~ 8XL12	Clarifier		10348/1P
	RELAYS:-		
1RL A-E	(5 off) each RH12		8445P
2RL A-E	each RH12		8445P
6RL A-I	each RH12		8445P
7RL A-D	each RH12		8445P
	THERMOSTAT:-		
8THT1	Otter		9412P
	CHASSIS & MISCELLANEOUS:-		
17FL1	Filtered Mains Connector		9715P
1	Voltage Selector Switch		10585P
5	Fuse Holders (FS 1-5)		9458P
17FS1)	0.5A Delay fuse)		
17FS2)	20mm)		9714P
17FS3-5	3 x 3A fuse		6709P

Ref	Description	Part No.
17PL1	Ancillaries Connector	10588P
17SK1	IF Output 50Ω Socket	10587P
17SK2	Aerial Input 50Ω Socket	10587P
17JK1	Phone Jack Socket	6660P
17JK2	LS Mute Jack Socket	6660P
	Earth Terminal (rear panel)	6371P
*	SEE BELOW FOR RIBBON CABLE CONNECTOR DETAILS.	
17R1-R2	2 x 560Ω CR25 Resistor	
17R3	22Ω CR25 Resistor	
17LS1	Loudspeaker 2" x 3" eliptical (8Ω)	8657P
1 x	Crystal Oven Unit (12 crystal capacity)	D5502
12 x	Crystal Socket	6375P
	ACCESSORIES:-	
1 x	Mains Lead Assembly	D4815
1 x	9 way connector with Cover (Ancillary)	10611P
1 x	Plug 50Ω BNC	8012P
2 x	0.5A (T) Fuses	9714P
3 x	3 Amp Fuses	6709P
1 x	Box Spanner (knobs)	9057P

* RIBBON CABLE CONNECTOR DATA:-

Module Reference (5)

CON 1 Part No. 10612P Connects to 14SK3 Part No. 10616P

Module Reference (7)

CON 1 Part No. 10612/3P) Connects to
CON 2 Part No. 10612/4P) 14SK7 Part No. 10617P

Module Reference (13)

CON 1 Part No. 10612/1P Connects to 14SK5 Part No. 10616P
CON 2 Part No. 10612/2P Connects to 3SK1 Part No. 10616P
CON 3 Part No. 10612/1P Connects to 14SK6 Part No. 10616P

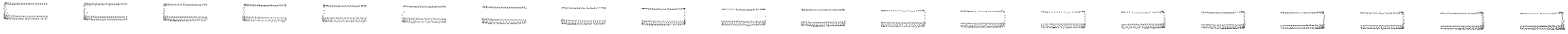
Ref	Description	Part No.
NOTES TO RIBBON CABLE LENGTH (TOTAL "CON" ASSEMBLY)		

PART NO.	RIBBON CABLE
10612P	43 mm
10612/1P	240 mm
10612/2P	370 mm
10612/3P	150 mm
10612/4P	53 mm

X

NEW LENGTHS

APPENDIX A



APPENDIX B

Appendix B1 1964 REMOTE CONTROL

For remote control operation, 1964 series receivers must be fitted with 1602 Remote Interface Adaptors. Various versions of the adaptor are available for interfacing with different types of remote control systems. Custom variations can be provided for special systems.

1602/1

This adaptor is used with systems which present all control data in latched, parallel form and is therefore the appropriate adaptor for use with the EDDYSTONE REMOTE CONTROL SYSTEM (see separate publication). Nearly all functions of the receiver can be controlled and a limited amount of revertive status data from the receiver itself is provided. The following control lines can be provided via a standard 25 way 'D' connector.

6 lines	Clarifier		) Data provided in pure binary seq-
5 lines	IF gain or Mute Level or BFO		) uence, the 1602/1 providing the nec-
			essory D/A conversion.
4 lines	Channel	-	BCD coded for 10 channels
2 lines	Mode	-	Binary coded for 4 modes including 'ST-ANDBY'
2 lines	Sensitivity	-	Binary coded for MIN/MED/MAX.
1 line	AGC	-	On/off
1 line	Ancillary	-	On/off (e.g. Audio Mute if fitted)
1 line	RF Mute	-	On/off
1 line		-	Ground

1 line reverts a +5V DC signal when receiver is switched on and switched to 'REMOTE'
1 line reverts a +5V DC signal from an ancillary circuit (e.g. Audio Mute if fitted).

The control lines can be driven by standard L.S. TTL logic or by a switch to ground. In the latter case the current flow to ground is in the order of 0.5m A and when open circuit the inputs are pulled up to +5V via a 10kΩ resistor.

1602/2

This adaptor is used with systems which provide a mixture of latched parallel data and serial data. A limited number of receiver functions can be controlled as follows: (Via a standard 25 way 'D' connector).

2 lines	Clarifier	-	One line to indicate direction of change required, the other to 'clock' change.
4 lines	Channel	-	BCD coded for 10 channels
2 lines	Mode	-	Binary coded for 4 modes including 'STANDBY'
2 lines	Sensitivity	-	Binary coded for MIN/MED/MAX.
1 line	RF Mute	-	On/off
1 line		-	Ground

1 line reverts a +5V DC signal when receiver is switched on and switched to 'REMOTE'

When switched to 'REMOTE' the receiver automatically switches to AGC 'ON' with the IF gain control inoperative.

The control voltages etc. required are as for the 1602/1.

Appendix B2 1964 Special Variants

(Note certain receivers may contain one or more of the variations listed).

VARIATION 1

Receivers for FSK only:- The first mode position is used to select circuitry suitable for FSK only. Other modes will generally just give different IF bandwidths if required. The programming of the mode switch (see table 3, page 2.3) enables the local Insertion oscillator to provide 'zero beat' tuning of the FSK transmission. If only one bandwidth is provided the filter bypass connection is also activated.

VARIATION 2

Receivers provided with Diversity Balance preset control (beneath cover on Left hand side of front panel):- This is provided to optimise the diversity agc characteristics of two receivers connected as in fig. 2.3, page 2.7, but without 1539 Diversity Combiner. With the interconnection arrangement, the 1964 Diversity Balance controls are set as follows:-

An equal level signal of approx. 30dBμV emf, is fed into both receivers at their required operating frequencies. The IF output levels are monitored on suitable meter(s) or oscilloscope(s).

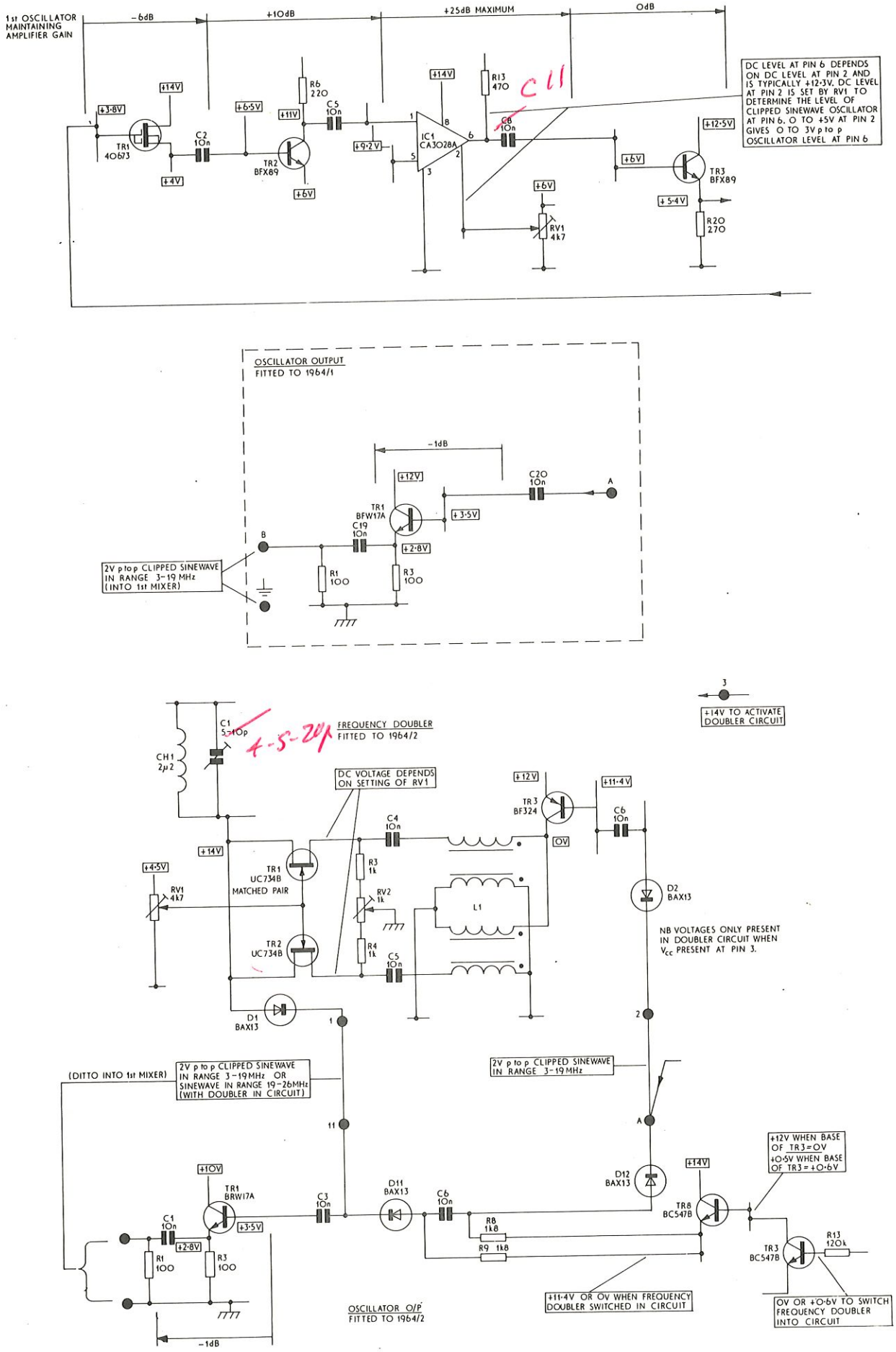
Starting with both Diversity Balance controls fully anti-clockwise, one control only is adjusted so that both IF output levels are equalized. If this is not successful then (again starting with both controls anti-clockwise) the other control is adjusted to obtain equalized outputs. Once successful the input level can be adjusted over the whole AGC range to check that equal IF output levels are obtained at each point (within about 6dB). Slight readjustment may be necessary to obtain this.

N.B. When 1964 receivers are supplied as diversity pairs, the above adjustment is already made and should only require occasional checking and slight readjustment as necessary. A Diversity AGC link cable (as Fig. 2.3, page 2.7 but with a ground interconnection, pin 3 to pin 3, and without provision for the 1539 Diversity Combiner) is provided. Care should be taken to maintain these connections if any other Ancillary Connector Outputs are used.

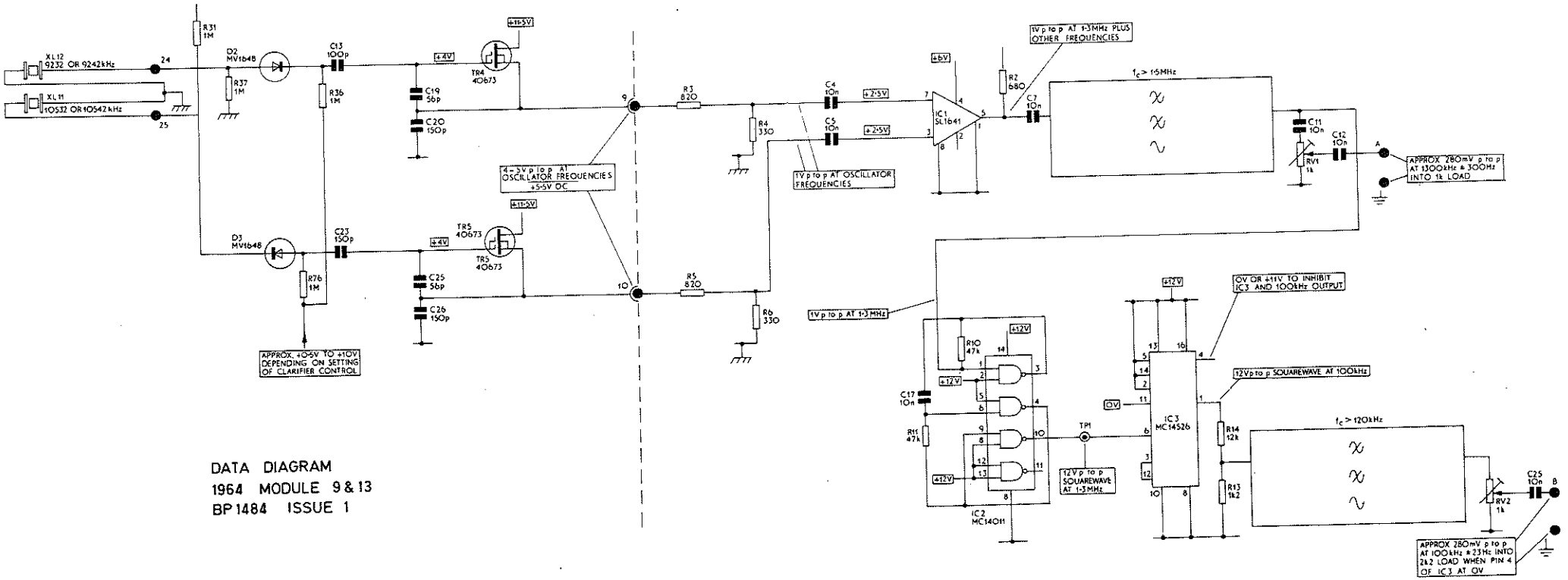
VARIATION 3

Mute Switch (circuit reference 18)

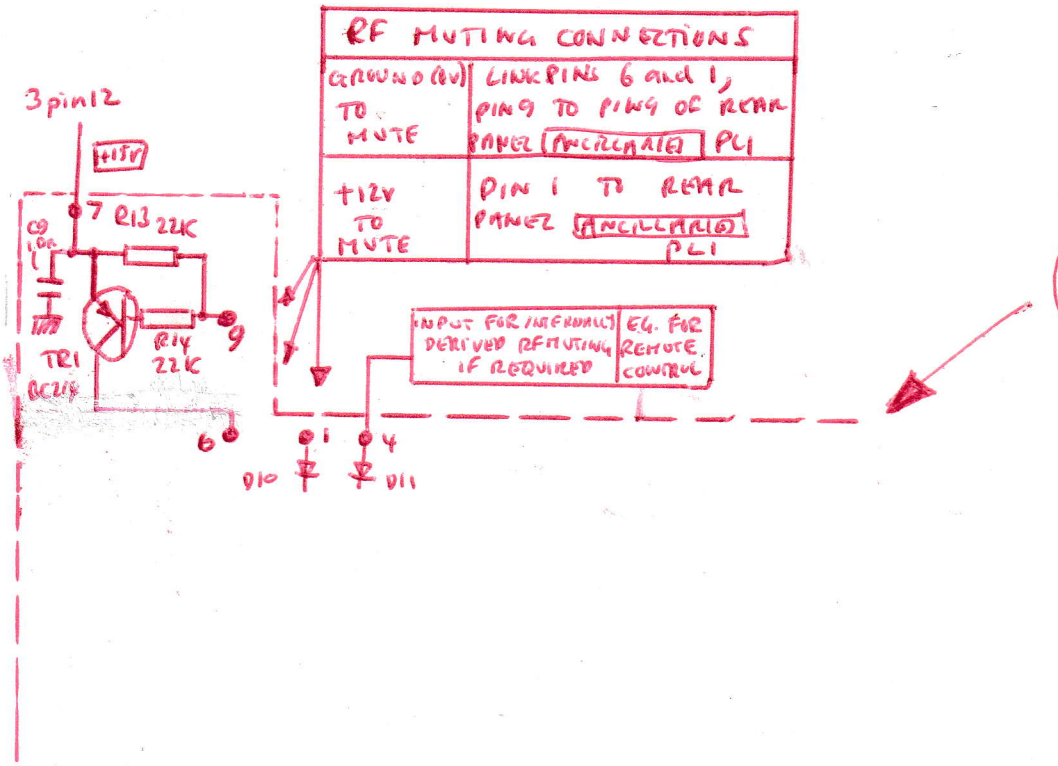
This circuit provides automatic muting of the receiver audio outputs when the input signal level is below a preset level. This level is set by the front panel 'MUTE LEVEL' control and corresponds to an input level of approximately 1mV (emf from 50Ω) with the control fully anti-clockwise and less than 1μV (emf from 50Ω) with the control fully clockwise in the 'OFF' position. The LED indicator below the knob shows when the receiver is unmuted.

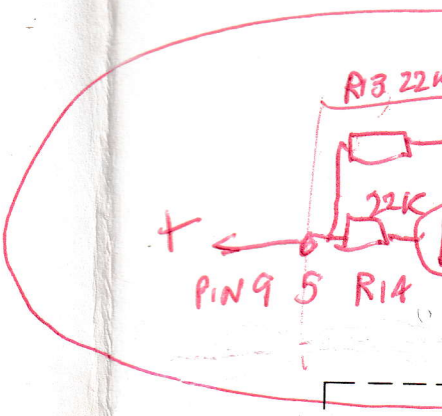


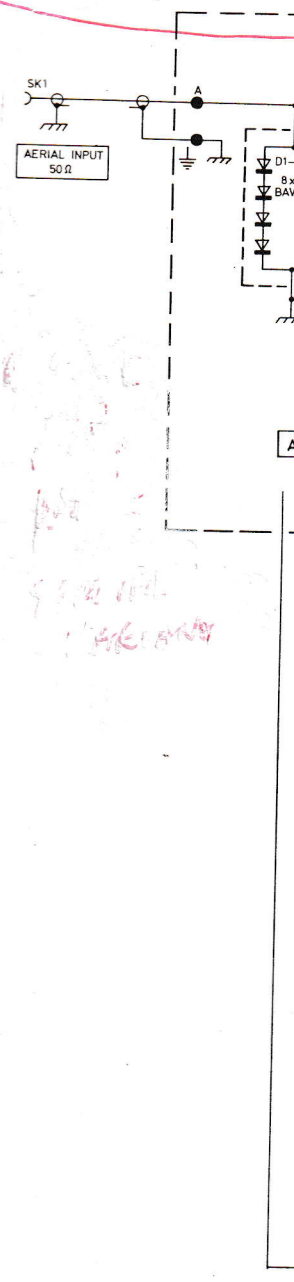
DATA DIAGRAM
1964 MODULE 9,10 & 11
BP 1483 ISSUE 1



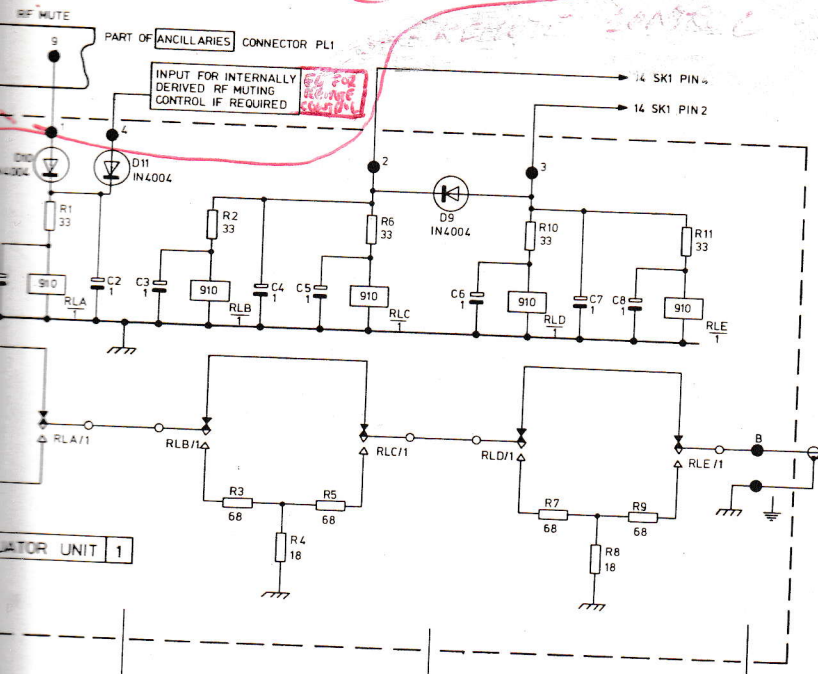
DATA DIAGRAM
1964 MODULE 9 & 13
BP 1484 ISSUE 1


RF MUTING CONNECTIONS
GROUND (0V) TO MUTE
LINK PINS 6 and 1, PIN 9 TO PIN 9 OF REAR PANEL ANCILLARIES PL1
+12V TO MUTE
PIN 1 TO REAR PANEL ANCILLARIES PL1
3 pin 12
+15V
7
R13 22K
C9 100n
TR1 BC239
R14 22K
9
6
INPUT FOR INTERNALLY DERIVED RF MUTING IF REQUIRED
E.G. FOR REMOTE CONTROL
1
4
D10
D11


R3 22K
22K
PIN 9 5 R14


SK1
A
AERIAL INPUT
50Ω

10n C9 + CONNECTION 0V TO MUTE ? (RACAL)



RF HEAD	R4	R5	TR1	CH1	C16-21 INCL.	R11
1	470	470	BFW17A	1μH	8/135p	180k
2	470	470	BFW17A	0·33μH	8/135p	120k
3	470	470	BFW17A	100nH APPROX	8/135p	NOT FITTED
4	1k8	1k5	BFW17A	30nH APPROX	7·5/80p	NOT FITTED
5	1k8	1k5	BFW30	10nH APPROX	7·5/80p	NOT FITTED

NB. SINGLE CHANNEL HEADS HAVE COMPONENTS RLB, RLC

RF TUNER HEADS RANGES 1-5

INPUT BUS

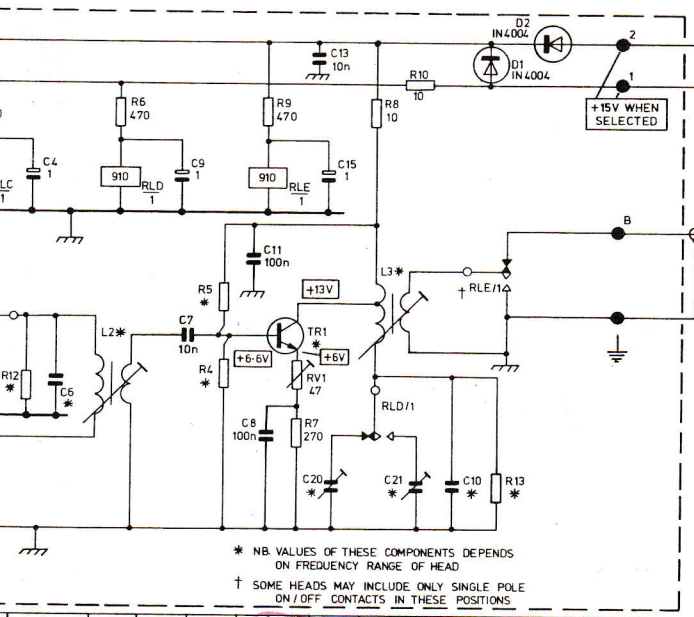
UP TO 5 RF HEADS OF ANY PERMUTATION OF RANGES MAY BE FITTED BETWEEN THE INPUT AND OUTPUT BUS LINES IN ANY RECEIVER

27p

0dB OR −20dB WHEN APPROX.+10V ON PIN 2 (SENSITIVITY SWITCH IN MEDIUM OR MINIMUM POSITION)

0dB OR −20dB WHEN APPROX.+10V ON PIN 3 (SENSITIVITY SWITCH IN MINIMUM POSITION)

APPROX 0dB

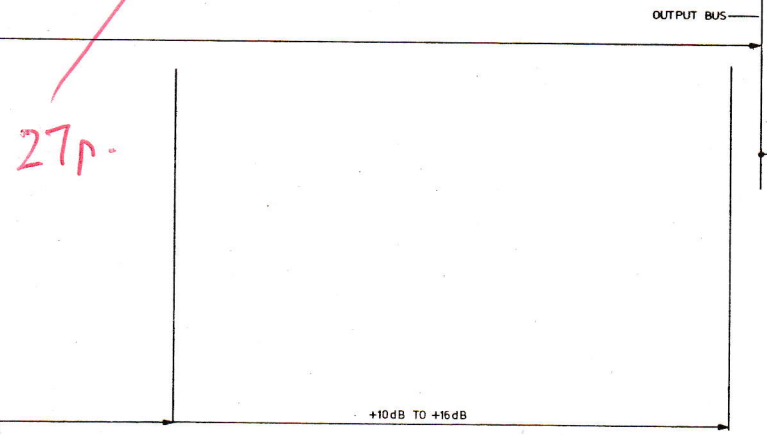


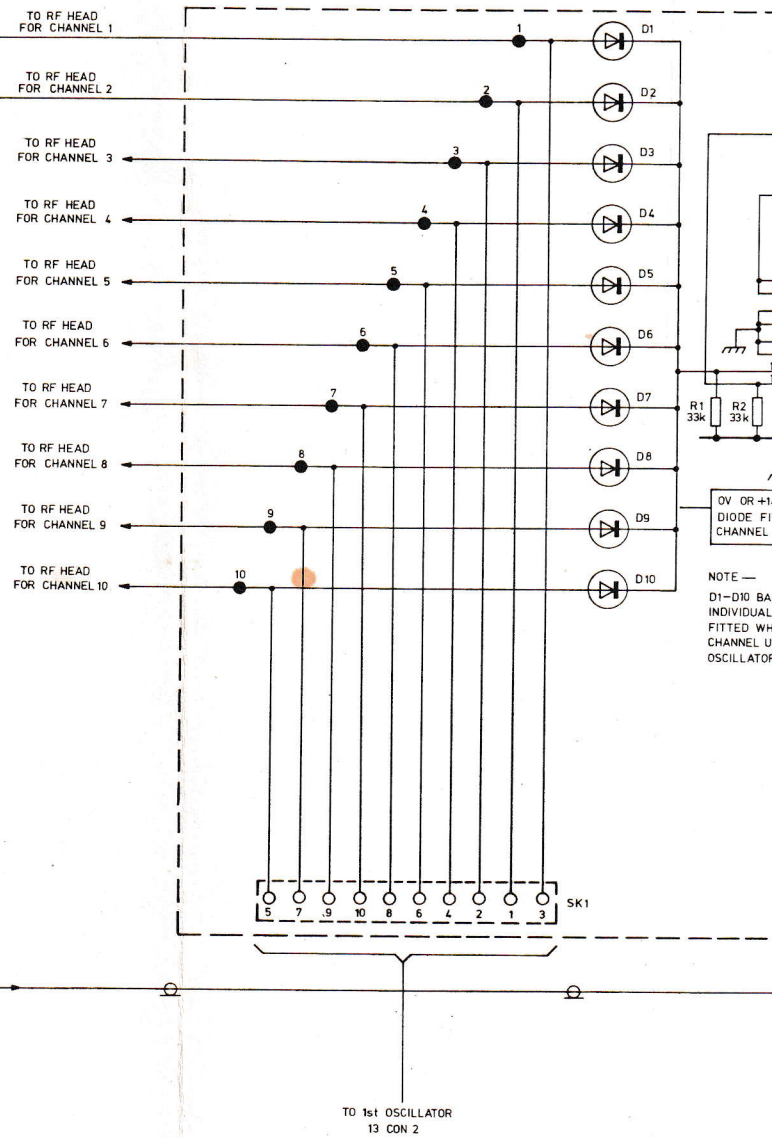
* NB. VALUES OF THESE COMPONENTS DEPENDS ON FREQUENCY RANGE OF HEAD

† SOME HEADS MAY INCLUDE ONLY SINGLE POLE ON/OFF CONTACTS IN THESE POSITIONS

C16-21 INCL.	R11	R12	R13	C5, C6, C10	L1	L2	L3	APPROX. FREQ. RANGE	COMPONENT SUFFIX
8/135p	180k	180k	180k	NOT FITTED	D5384	D5385	D5386	1·6–3·0 MHz	/1
8/135p	120k	120k	120k	27p	D5387	D5388	D5389	3·0–5·7 MHz	/2
8/135p	NOT FITTED	NOT FITTED	NOT FITTED	27p	D5390	D5391	D5392	5·7–10·8 MHz	/3
7·5/80p	NOT FITTED	NOT FITTED	NOT FITTED	NOT FITTED	D5393	D5394	D5395	10·8–20·0 MHz	/4
7·5/80p	NOT FITTED	NOT FITTED	NOT FITTED	NOT FITTED	D5396	D5397	D5398	20·0–27·5 MHz	/5

COMPONENTS RLB; RLC; RLD; C17; C18; C21; R2; C3; R3; C4; R6; C9; C12; R10 & D1 ALL ABSENT



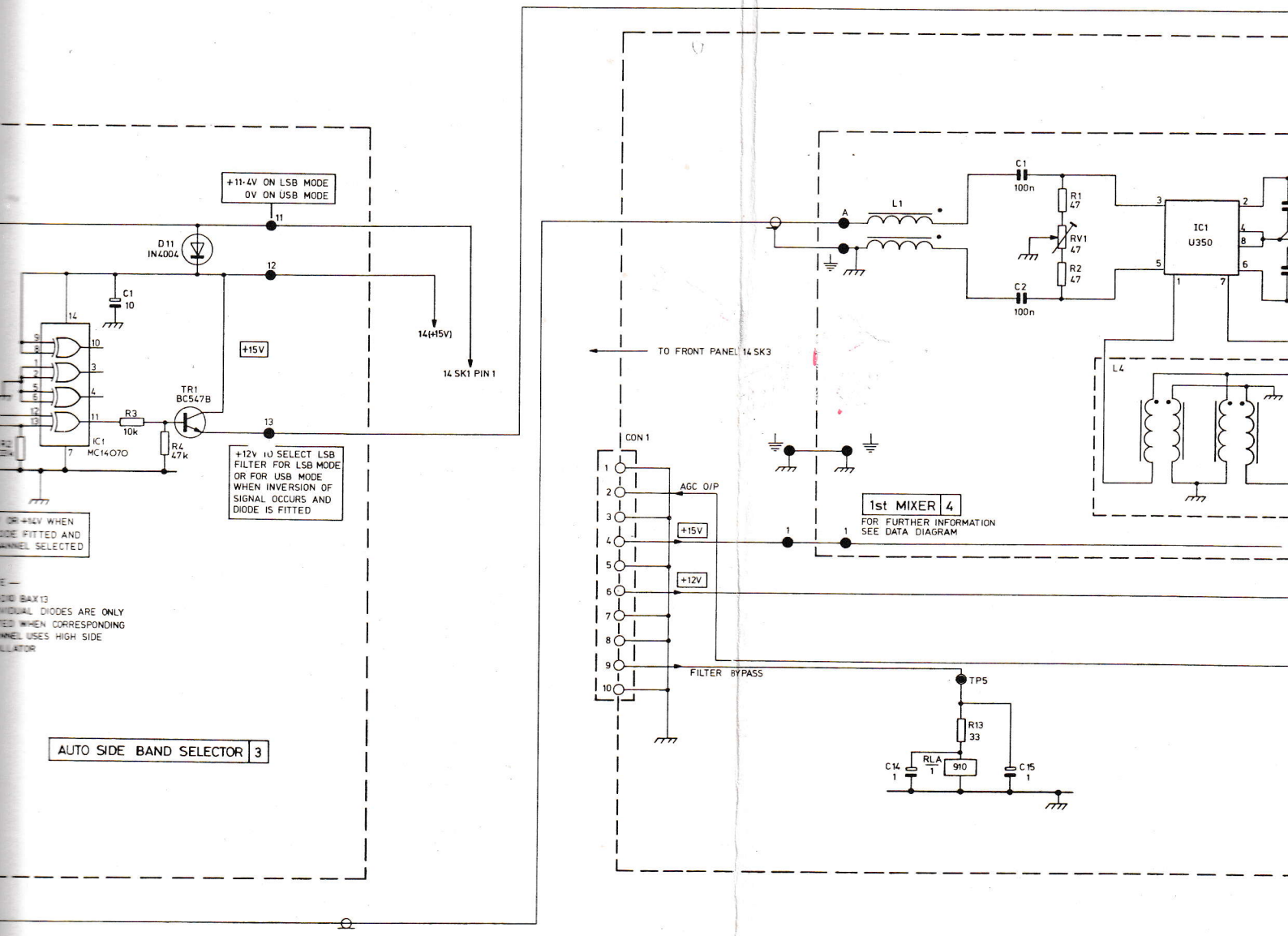


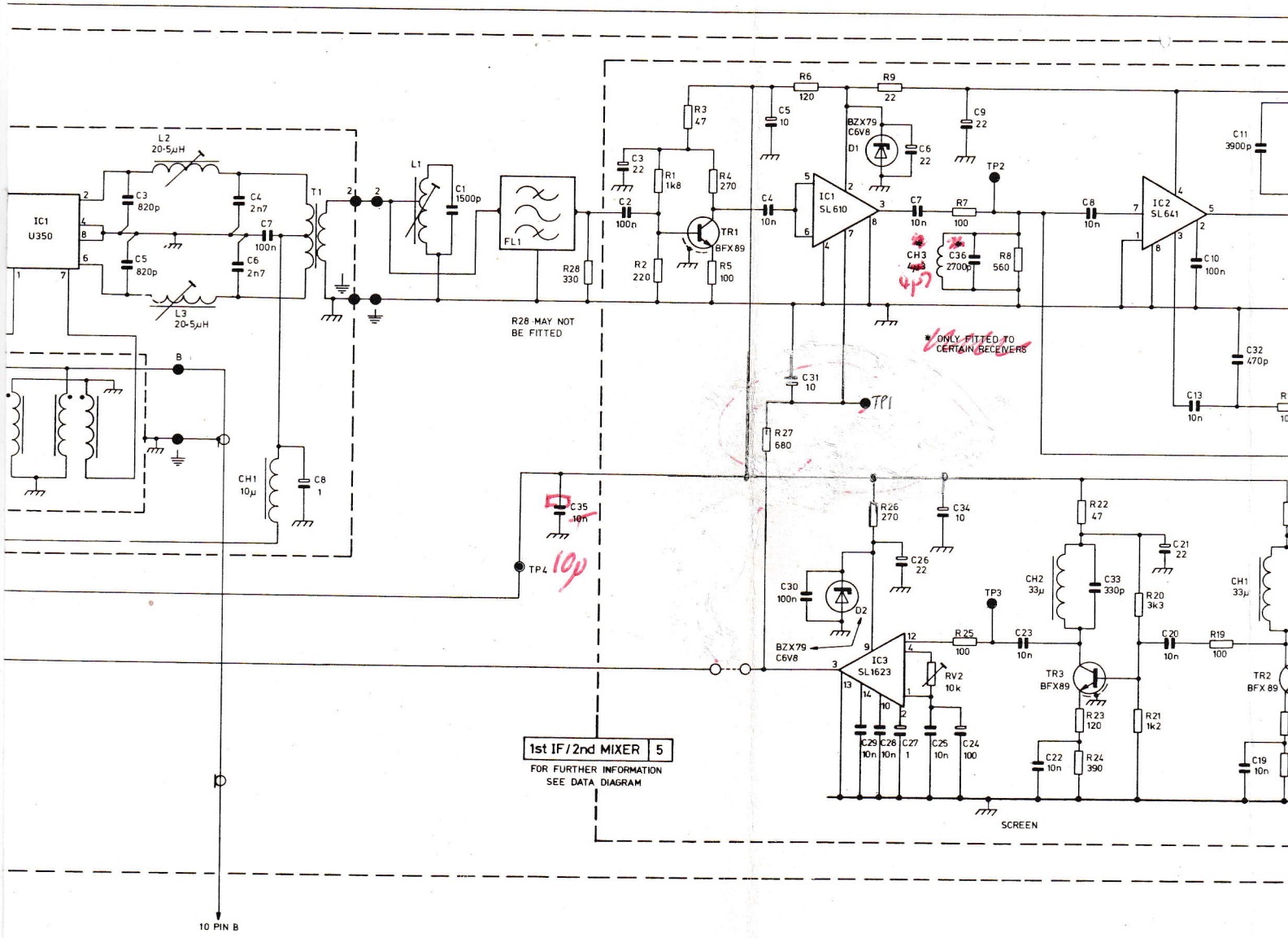
NOTE —

D1–D10 BA
INDIVIDUAL
FITTED WH
CHANNEL U
OSCILLATOR

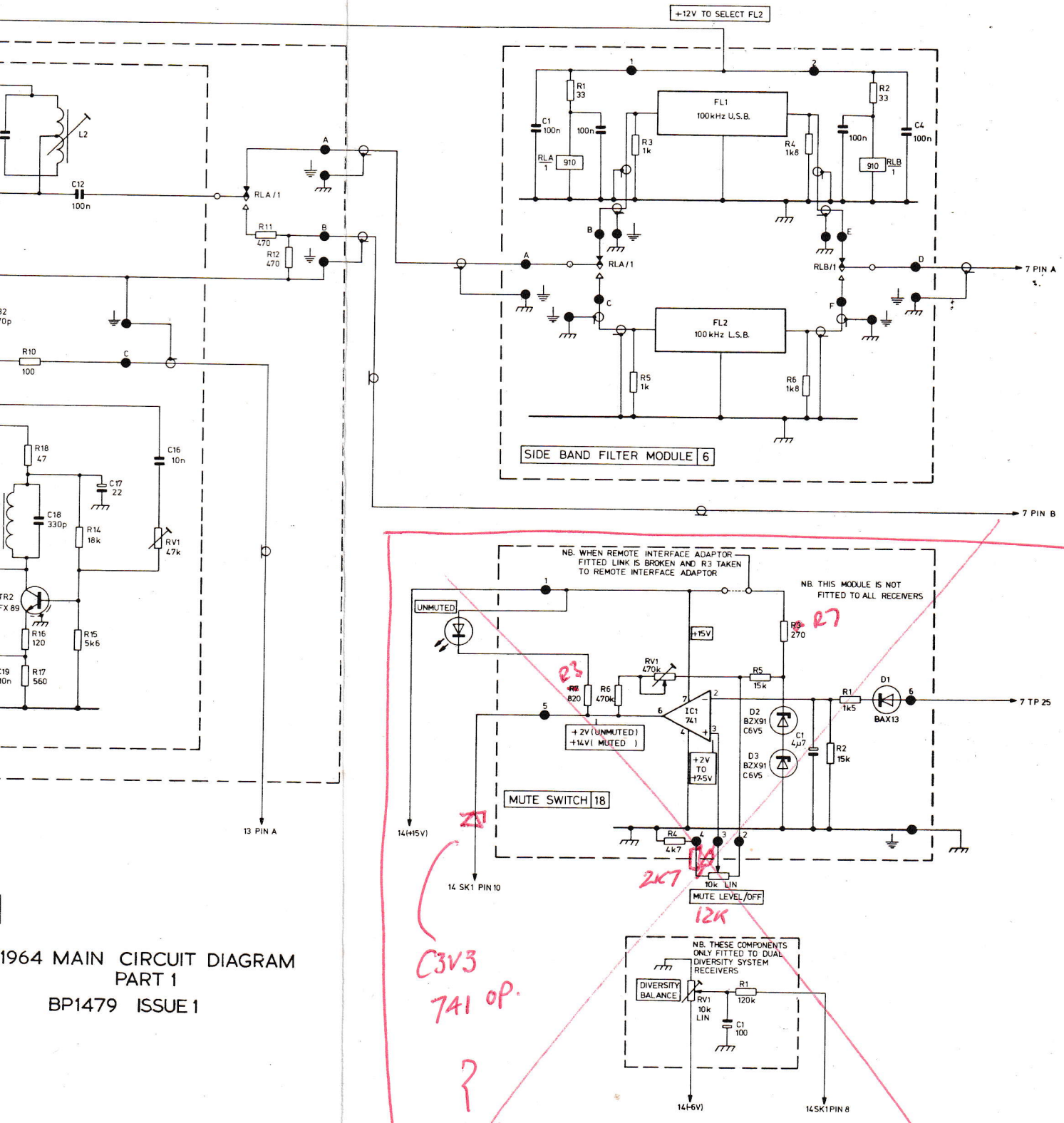
0V OR +1
DIODE FI
CHANNEL

27p

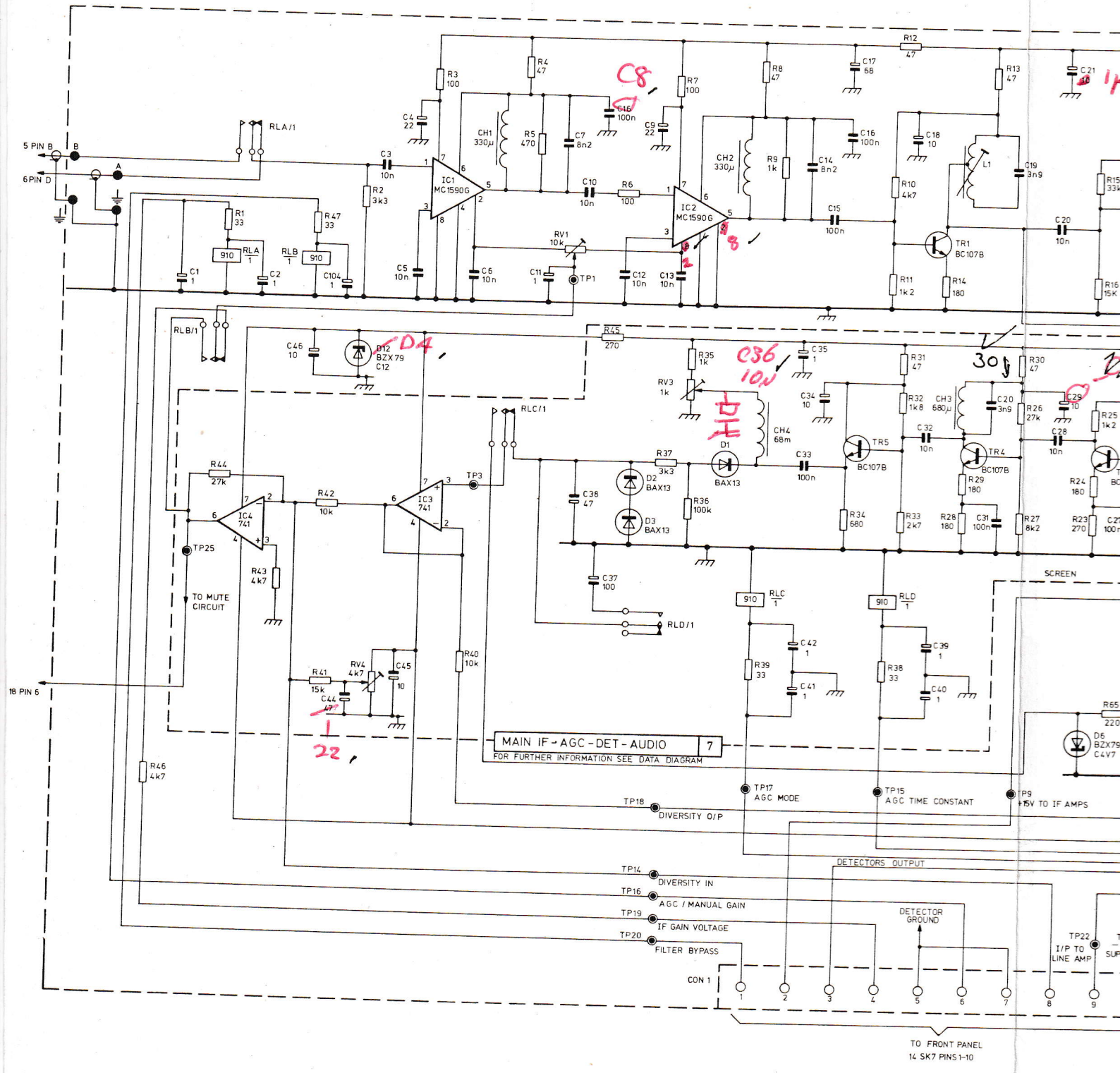

+11·4V ON LSB MODE
0V ON USB MODE
D11
IN4004
C1
10
+15V
14(+15V)
14 SK1 PIN 1
TR1
BC547B
R3
10k
R4
47k
IC1
MC14070
+12V TO SELECT LSB FILTER FOR LSB MODE OR FOR USB MODE WHEN INVERSION OF SIGNAL OCCURS AND DIODE IS FITTED
AUTO SIDE BAND SELECTOR 3
TO FRONT PANEL 14 SK3
CON 1
AGC O/P
+15V
+12V
FILTER BYPASS
L1
C1
100n
R1
47
RV1
47
R2
47
C2
100n
IC1
U350
L4
1st MIXER 4
FOR FURTHER INFORMATION
SEE DATA DIAGRAM
TP5
R13
33
C14
1
RLA
910
C15
1

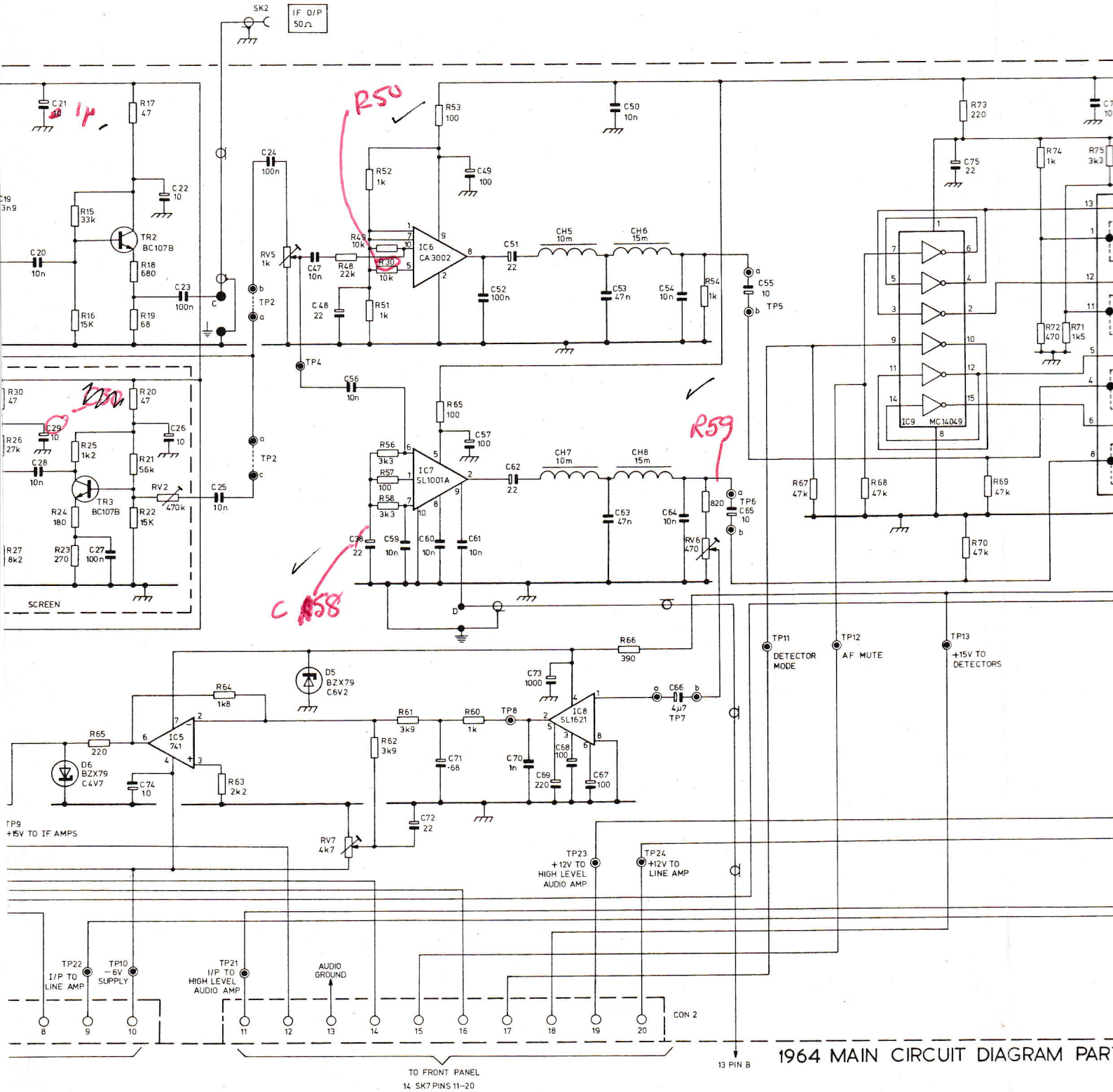


NOTE - ALL COMPONENTS OUTSIDE IDENTIFIED MODULES HAVE CIRCUIT REFERENCE 17

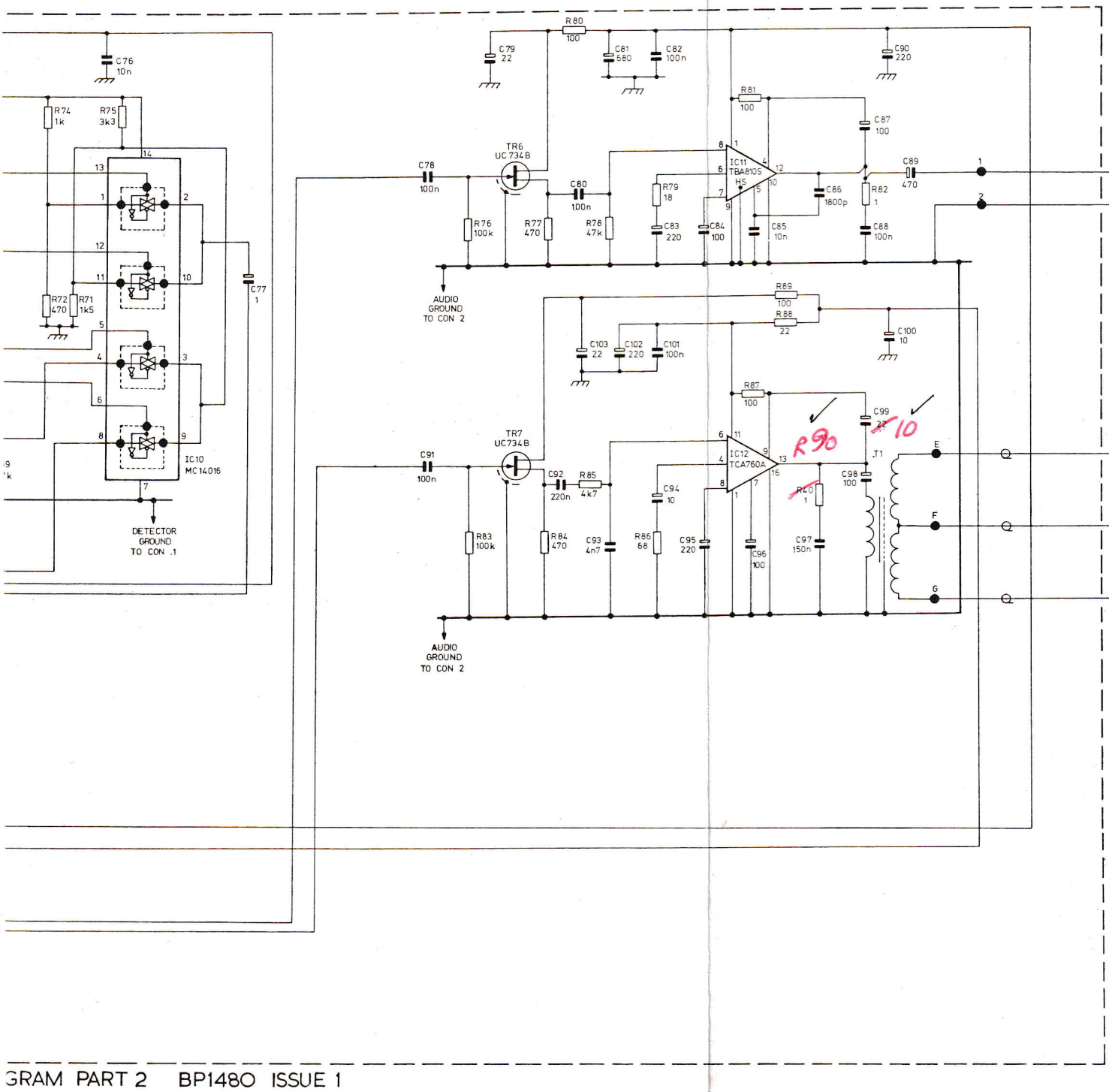


1964 MAIN CIRCUIT DIAGRAM
PART 1
BP1479 ISSUE 1

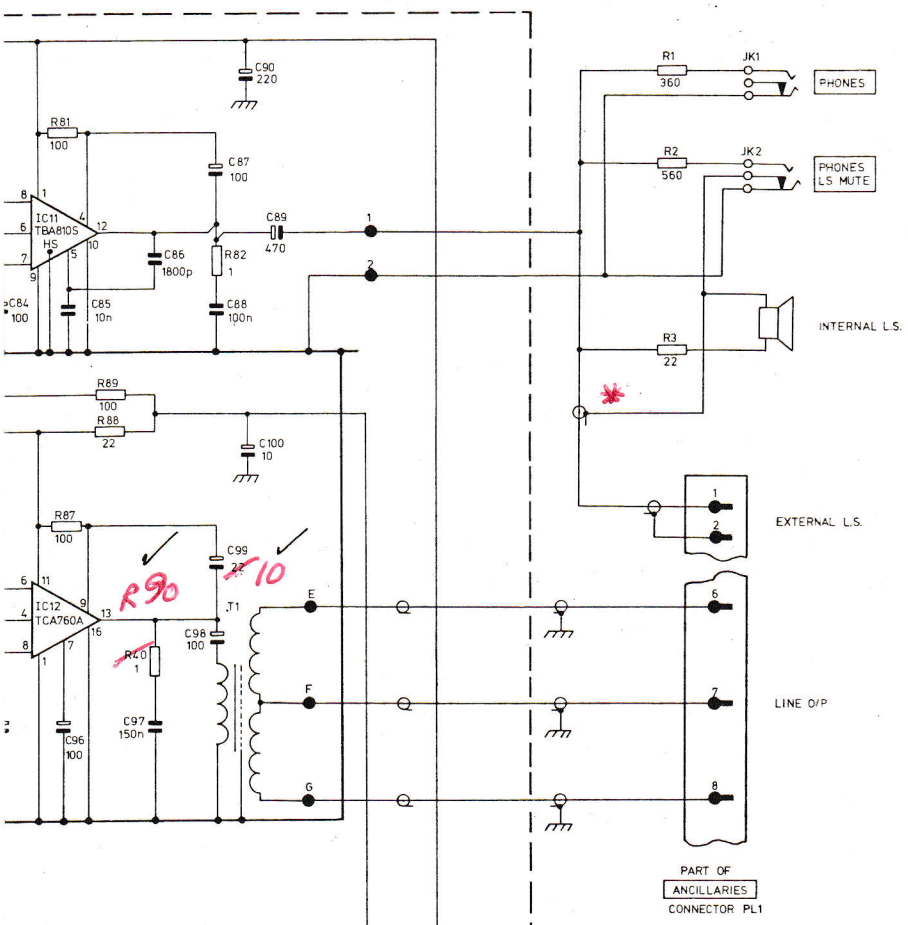

5 PIN B
6 PIN D
RLA/1
RLB/1
RLC/1
RLD/1
IC1 MC1590G
IC2 MC1590G
IC3 741
IC4 741
TR1 BC107B
TR4 BC107B
TR5 BC107B
D1 BAX13
D2 BAX13
D3 BAX13
D12 BZX79 C12
D6 BZX79 C4V7
TP1
TP3
TP9 +15V TO IF AMPS
TP14 DIVERSITY IN
TP15 AGC TIME CONSTANT
TP16 AGC / MANUAL GAIN
TP17 AGC MODE
TP18 DIVERSITY O/P
TP19 IF GAIN VOLTAGE
TP20 FILTER BYPASS
TP22 I/P TO LINE AMP
TP25
TO MUTE CIRCUIT
18 PIN 6
SCREEN
DETECTORS OUTPUT
DETECTOR GROUND
CON 1
TO FRONT PANEL
14 SK7 PINS 1-10
MAIN IF - AGC - DET - AUDIO 7
FOR FURTHER INFORMATION SEE DATA DIAGRAM



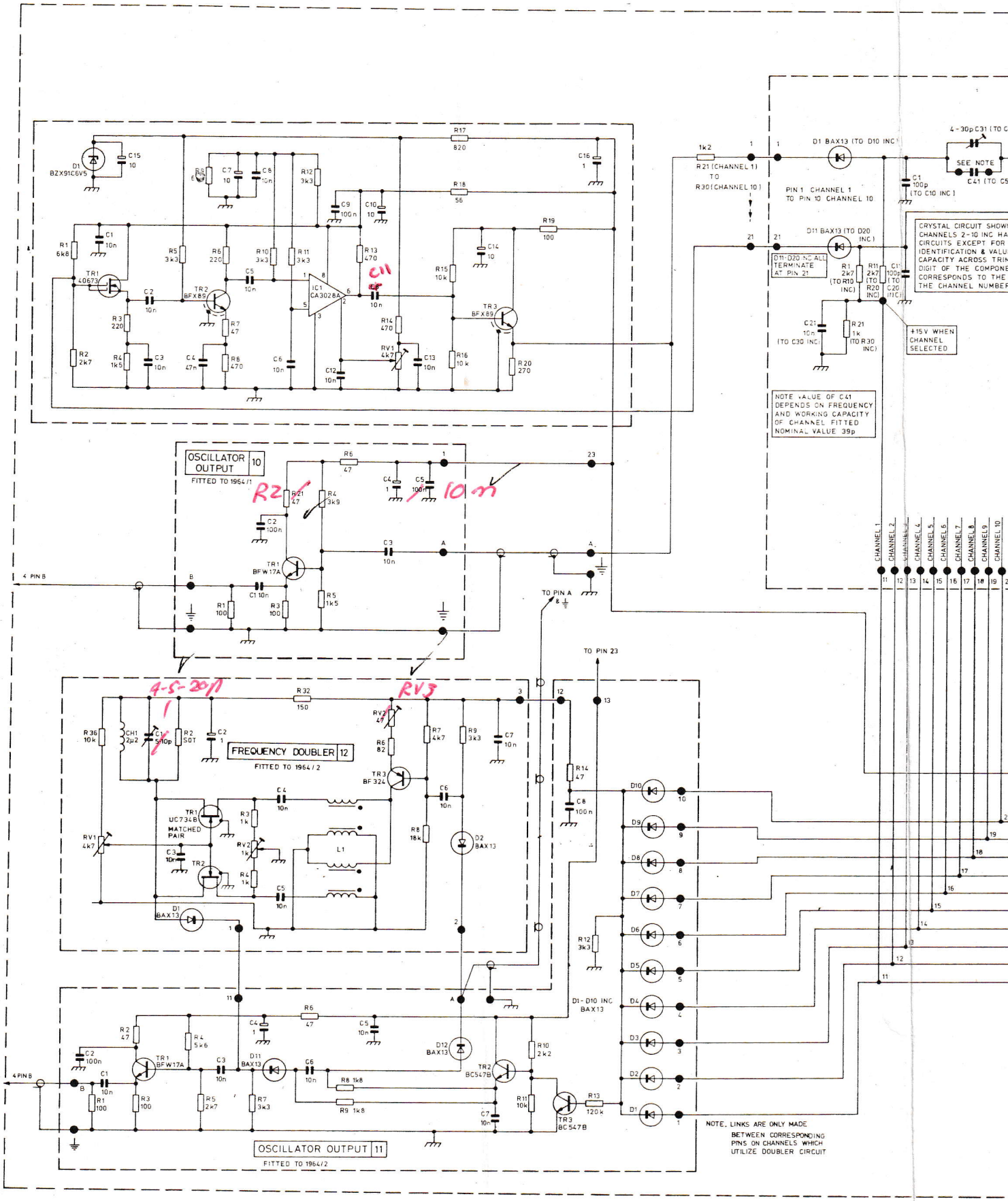
1964 MAIN CIRCUIT DIAGRAM PAR

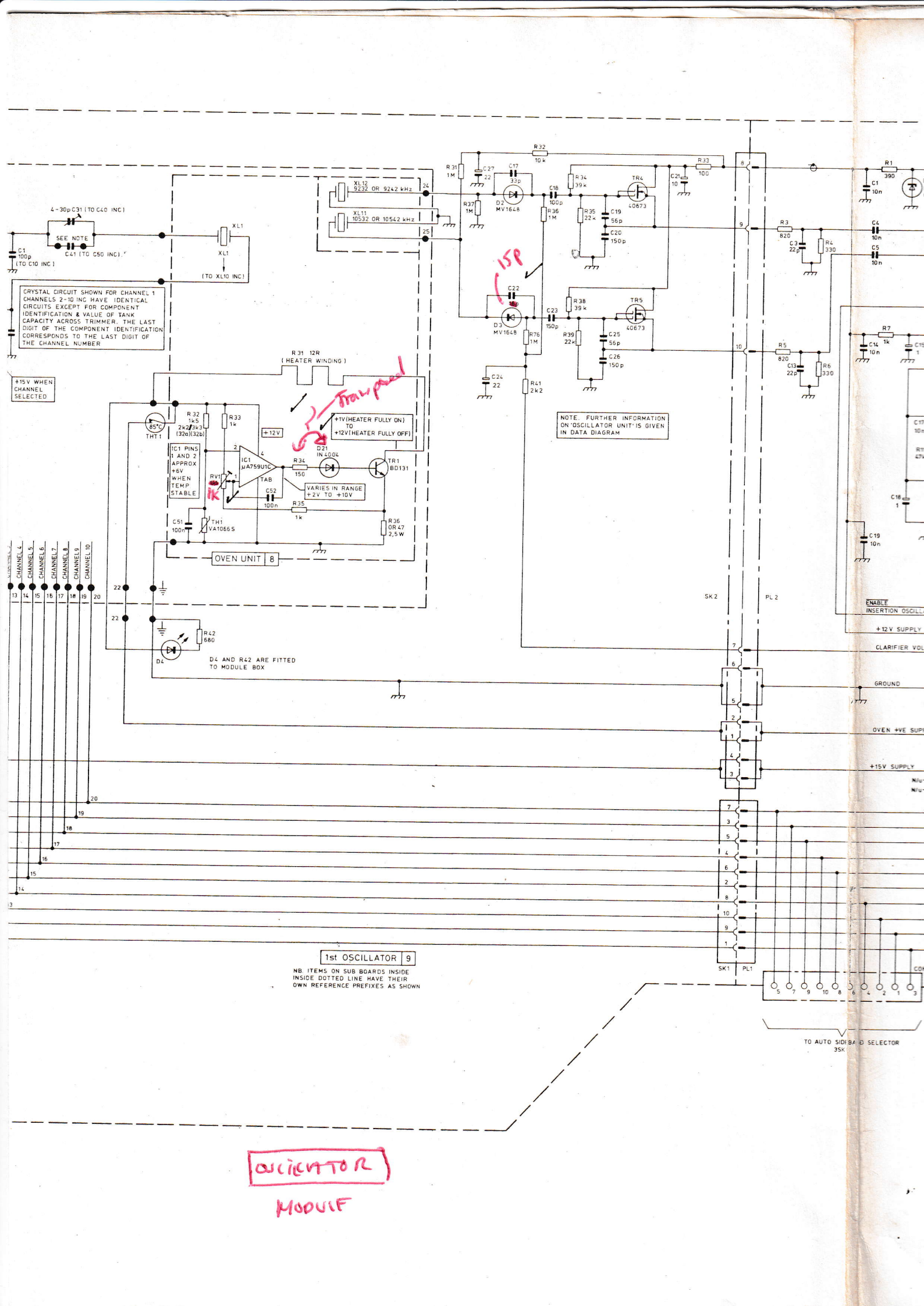


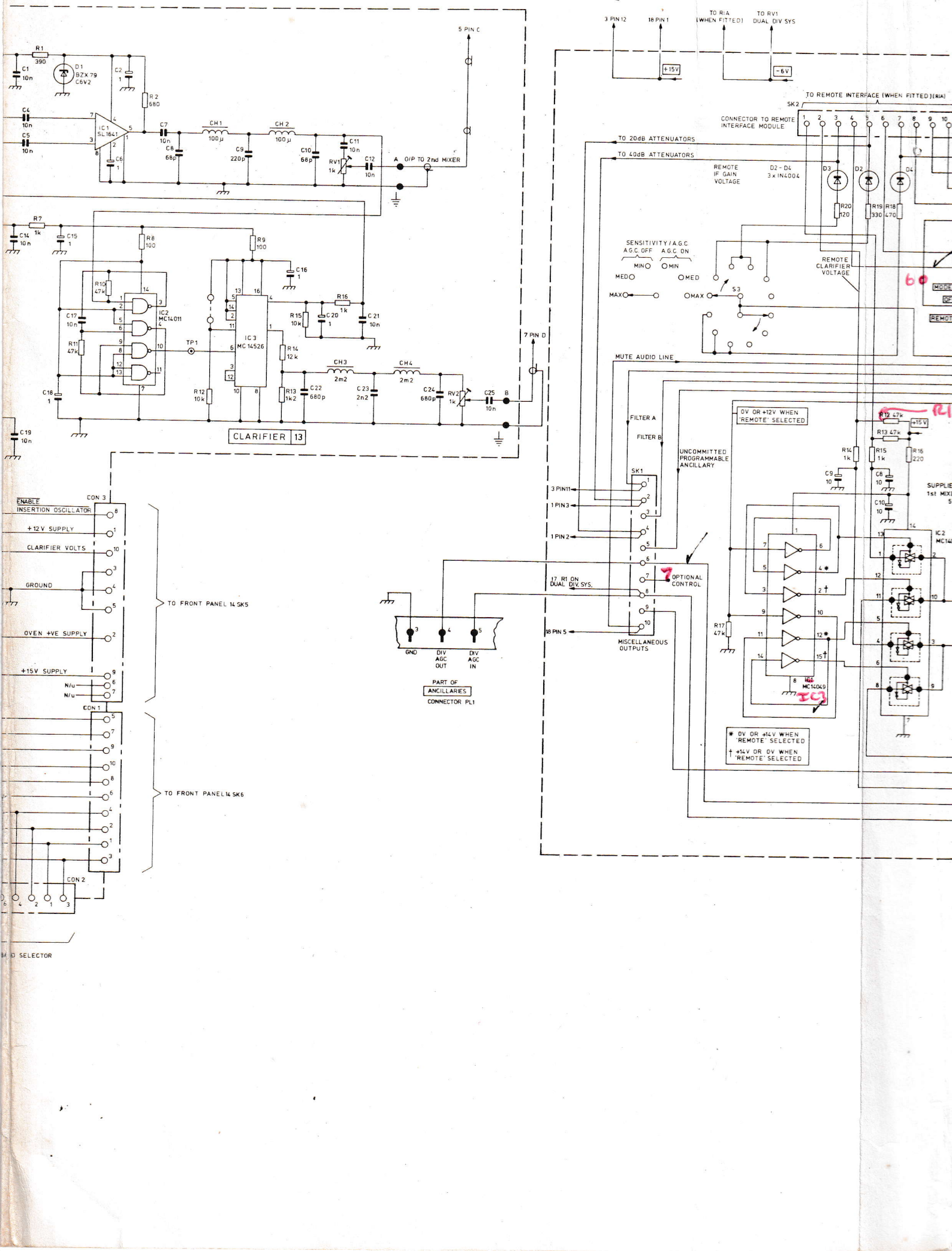
GRAM PART 2 BP1480 ISSUE 1

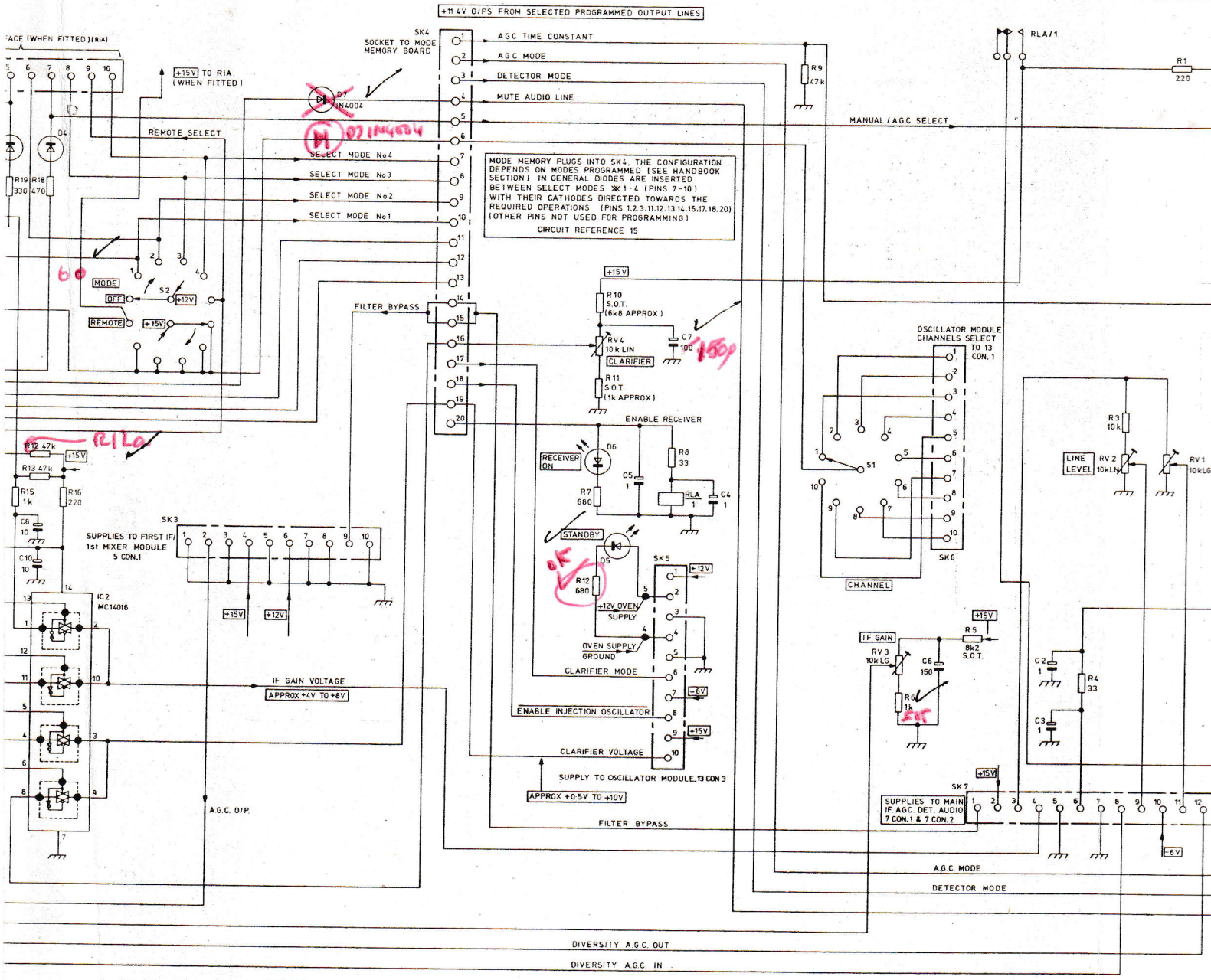


* ON VARIANTS WHERE THE EXTERNAL LS OUTPUT CANNOT BE MUTED, THE SCREENED OUTER OF THIS CABLE IS CONNECTED DIRECTLY TO GROUND.

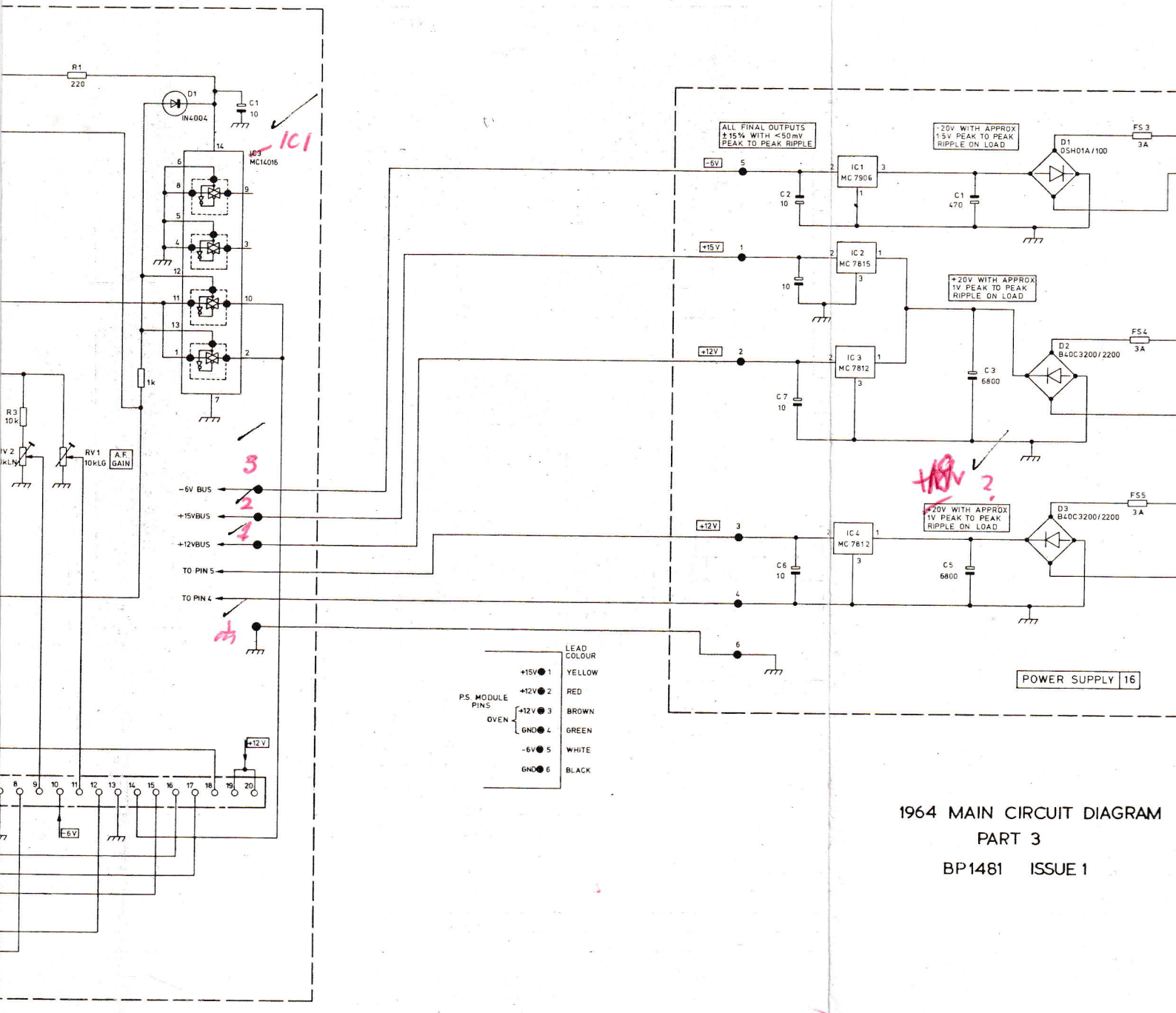

OSCILLATOR OUTPUT 10
FITTED TO 1964/1
FREQUENCY DOUBLER 12
FITTED TO 1964/2
OSCILLATOR OUTPUT 11
FITTED TO 1964/2
4-5-2011
RV3
R2
10k
TO PIN 23
TO PIN A
4 PIN B
D1 BAX13 (TO D10 INC)
D11 BAX13 (TO D20 INC)
PIN 1 CHANNEL 1 TO PIN 10 CHANNEL 10
D11-D20 INC ALL TERMINATE AT PIN 21
+15V WHEN CHANNEL SELECTED
NOTE VALUE OF C41 DEPENDS ON FREQUENCY AND WORKING CAPACITY OF CHANNEL FITTED NOMINAL VALUE 39p
SEE NOTE
CRYSTAL CIRCUIT SHOWN
CHANNEL 1
CHANNEL 2
CHANNEL 4
CHANNEL 5
CHANNEL 6
CHANNEL 7
CHANNEL 8
CHANNEL 9
CHANNEL 10
D1-D10 INC BAX13
NOTE, LINKS ARE ONLY MADE BETWEEN CORRESPONDING PINS ON CHANNELS WHICH UTILIZE DOUBLER CIRCUIT


4-30p C31 (TO C40 INC)
SEE NOTE
C41 (TO C50 INC).
C1 100p (TO C10 INC)
XL1
XL1 (TO XL10 INC)
CRYSTAL CIRCUIT SHOWN FOR CHANNEL 1 CHANNELS 2-10 INC HAVE IDENTICAL CIRCUITS EXCEPT FOR COMPONENT IDENTIFICATION & VALUE OF TANK CAPACITY ACROSS TRIMMER. THE LAST DIGIT OF THE COMPONENT IDENTIFICATION CORRESPONDS TO THE LAST DIGIT OF THE CHANNEL NUMBER
XL12 9232 OR 9242 kHz
XL11 10532 OR 10542 kHz
R31 1M
C27 22
C17 33p
D2 MV1648
R32 10k
C18 100p
R34 39k
TR4 40673
R33 100
C21 10
R37 1M
R36 1M
R35 22k
C19 56p
C20 150p
15P
C22
D3 MV1648
C23 150p
R38 39k
TR5 40673
R76 1M
R39 22k
C25 56p
C26 150p
C24 22
R41 2k2
R31 12R (HEATER WINDING)
+15V WHEN CHANNEL SELECTED
Transpond
+1V(HEATER FULLY ON) TO +12V(HEATER FULLY OFF)
D21 IN4004
THT1 85°C
R32 1k5 2k2/3k3 (32a)(32b)
R33 1k
+12V
IC1 PINS 1 AND 2 APPROX +6V WHEN TEMP STABLE
IC1 µA759U1C
TAB
RV1 1K
R34 150
TR1 BD131
VARIES IN RANGE +2V TO +10V
C52 100n
R35 1k
C51 100n
TH1 VA1066S
R36 OR 47 2,5W
OVEN UNIT 8
NOTE. FURTHER INFORMATION ON 'OSCILLATOR UNIT' IS GIVEN IN DATA DIAGRAM
R1 390
C1 10n
R3 820
C3 22p
R4 330
C4 10n
C5 10n
R5 820
C13 22p
R6 330
R7 1k
C14 10n
C19 10n
ENABLE
INSERTION OSCILL
+12V SUPPLY
CLARIFIER VOL
GROUND
OVEN +VE SUPP
+15V SUPPLY
CHANNEL 4
CHANNEL 5
CHANNEL 6
CHANNEL 7
CHANNEL 8
CHANNEL 9
CHANNEL 10
D4
R42 680
D4 AND R42 ARE FITTED TO MODULE BOX
SK2
PL2
SK1
PL1
1st OSCILLATOR 9
NB. ITEMS ON SUB BOARDS INSIDE INSIDE DOTTED LINE HAVE THEIR OWN REFERENCE PREFIXES AS SHOWN
TO AUTO SIDEBAND SELECTOR 3SK
OSCILLATOR MODULE

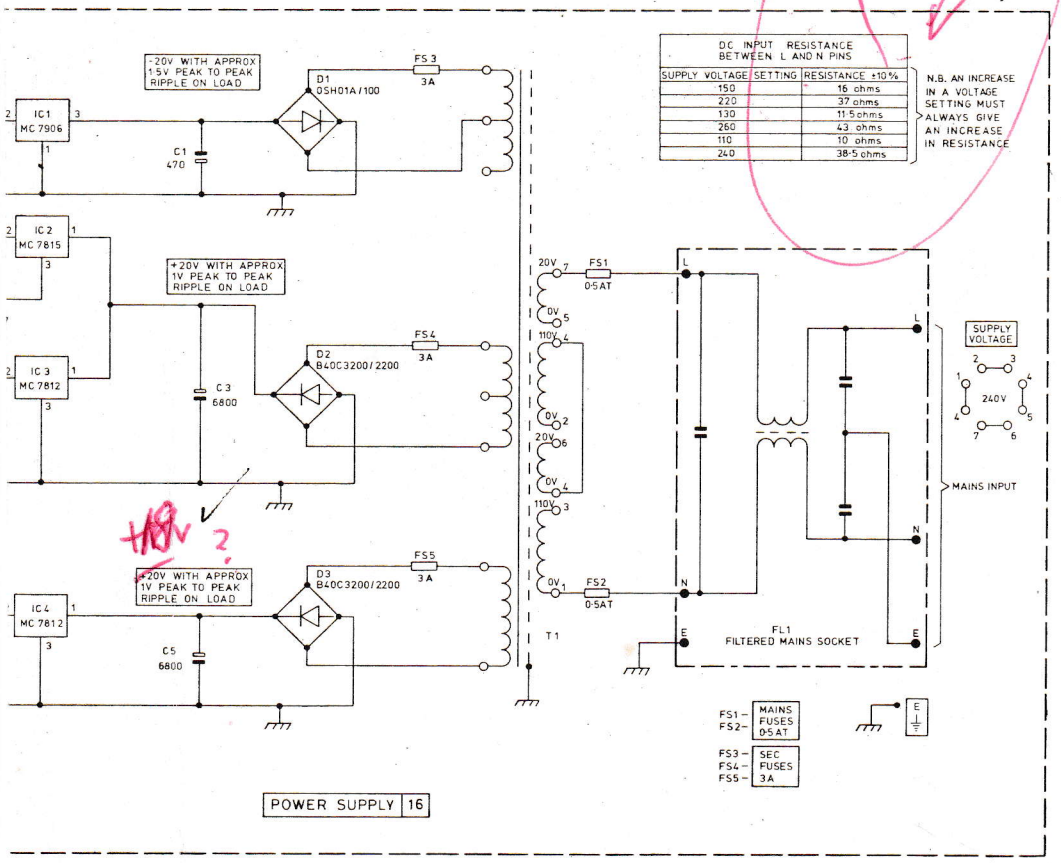

CLARIFIER 13
5 PIN C
7 PIN D
A O/P TO 2nd MIXER
B
TP1
IC1 SL1641
IC2 MC14011
IC3 MC14526
CH1
CH2
CH3
CH4
2m2
100µ
TO FRONT PANEL 14 SK5
TO FRONT PANEL 14 SK6
CON 3
CON 1
CON 2
ENABLE INSERTION OSCILLATOR
+12V SUPPLY
CLARIFIER VOLTS
GROUND
OVEN +VE SUPPLY
+15V SUPPLY
N/u
N/u
3 PIN 12
18 PIN 1
+15V
TO RIA (WHEN FITTED)
TO RV1 DUAL DIV SYS
-6V
TO REMOTE INTERFACE (WHEN FITTED) (RIA)
SK2
CONNECTOR TO REMOTE INTERFACE MODULE
TO 20dB ATTENUATORS
TO 40dB ATTENUATORS
REMOTE IF GAIN VOLTAGE
D2 - D4 3 x IN4004
SENSITIVITY / A.G.C.
A.G.C. OFF
A.G.C. ON
MIN
MED
MAX
S3
REMOTE CLARIFIER VOLTAGE
MUTE AUDIO LINE
FILTER A
FILTER B
UNCOMMITTED PROGRAMMABLE ANCILLARY
0V OR +12V WHEN 'REMOTE' SELECTED
SK1
3 PIN 11
1 PIN 3
1 PIN 2
17 R1 ON DUAL DIV SYS.
18 PIN 5
OPTIONAL CONTROL
MISCELLANEOUS OUTPUTS
GND
DIV AGC OUT
DIV AGC IN
PART OF ANCILLARIES CONNECTOR PL1
* 0V OR +14V WHEN 'REMOTE' SELECTED
† +14V OR 0V WHEN 'REMOTE' SELECTED
IC4 MC14049
IC3
SUPPLIE
1st MIX
SELECTOR



FRONT PANEL / CONTROL MODULE 14



1964 MAIN CIRCUIT DIAGRAM
PART 3
BP1481 ISSUE 1



DC INPUT RESISTANCE BETWEEN L AND N PINS		
SUPPLY VOLTAGE	SETTING	RESISTANCE ±10%
150		16 ohms
220		37 ohms
130		11·5 ohms
260		43 ohms
110		10 ohms
240		38·5 ohms

N.B. AN INCREASE IN A VOLTAGE SETTING MUST ALWAYS GIVE AN INCREASE IN RESISTANCE

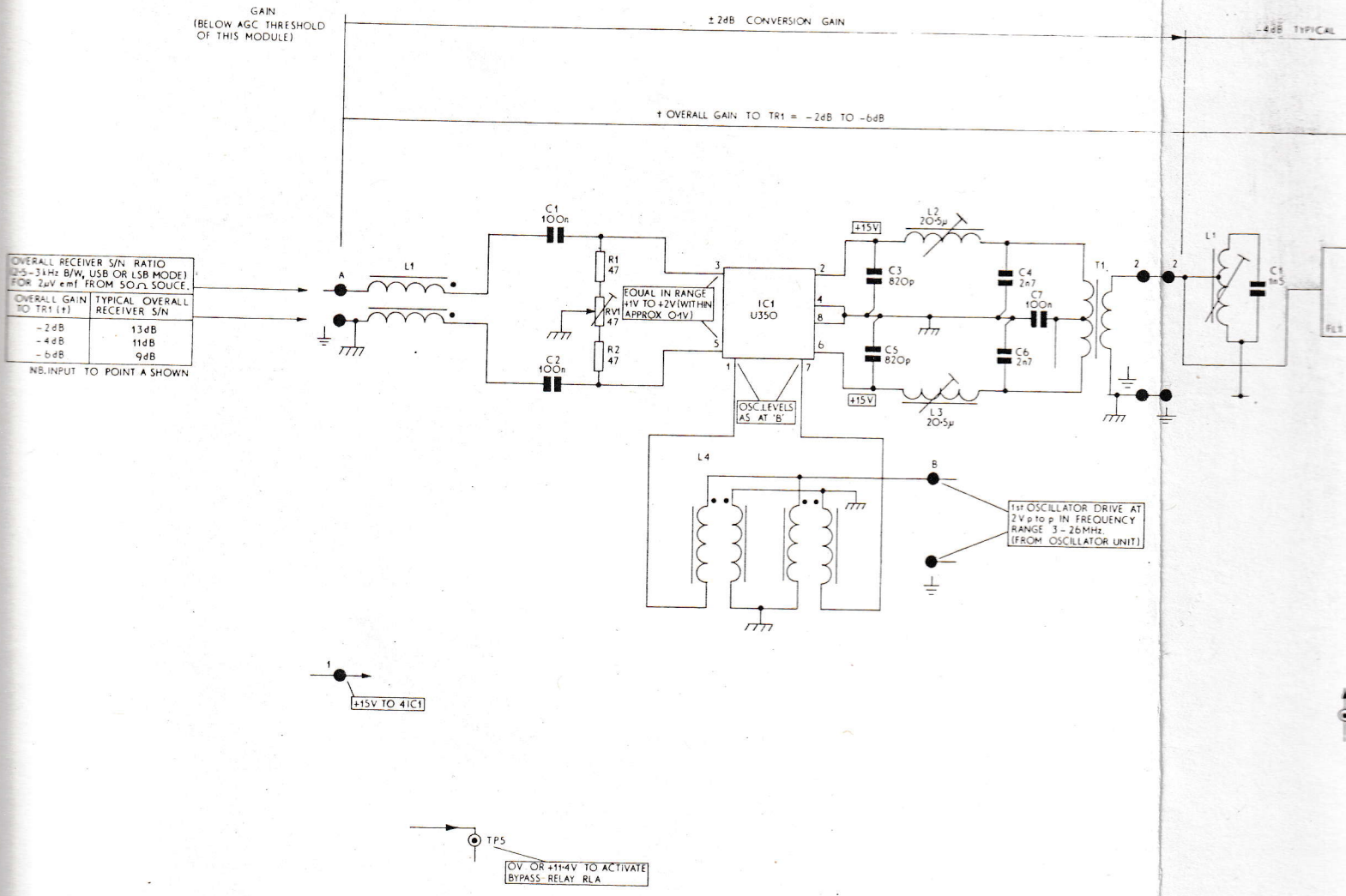
take average value and make tolerance ±15%.

150 – 13
220 – 30
130 – 8
260 – 35·5
110 – 7
240 – 31

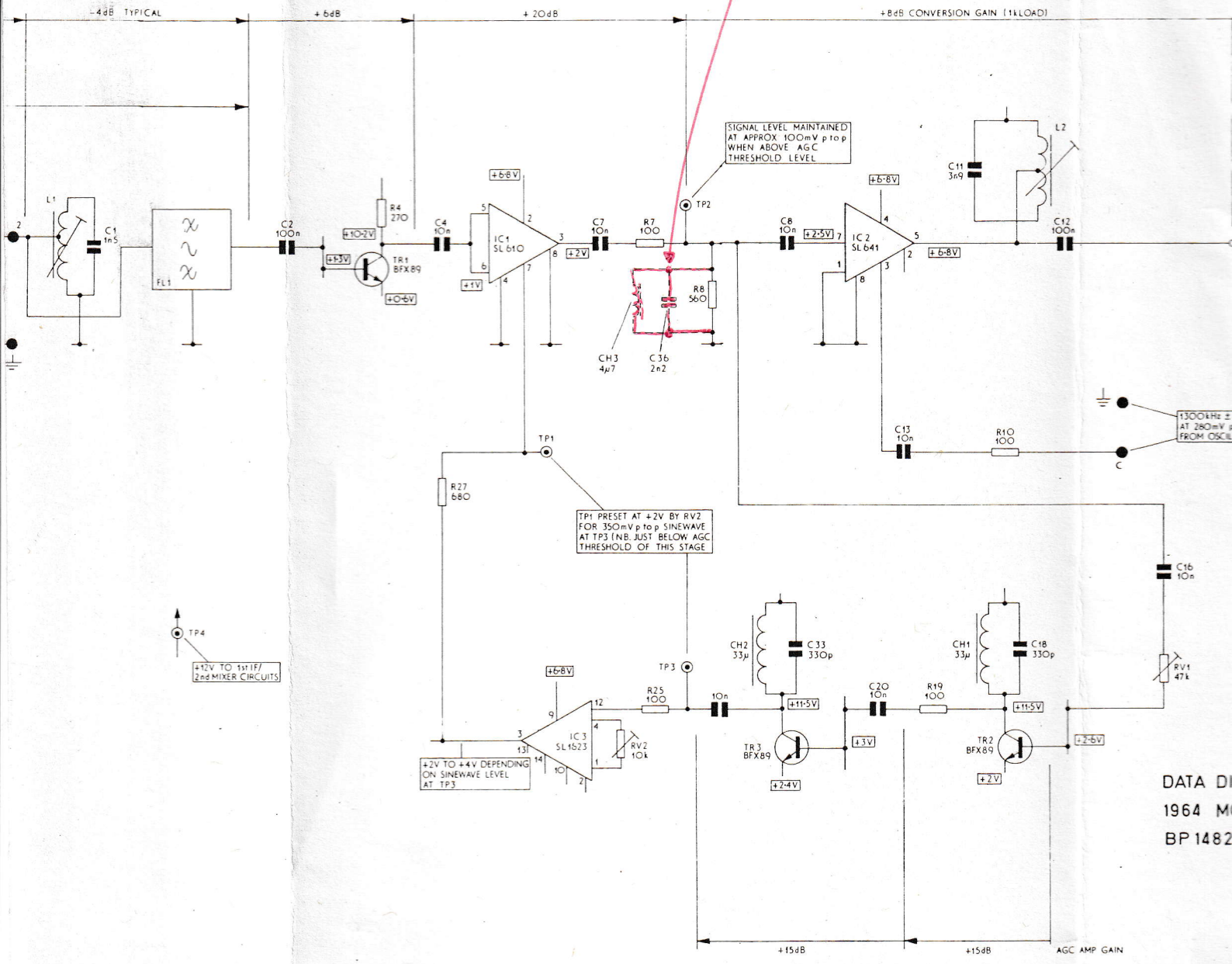
×1·5

17·5
33·5
10
~~25~~
39
8·5
35

1964 MAIN CIRCUIT DIAGRAM
PART 3
BP1481 ISSUE 1

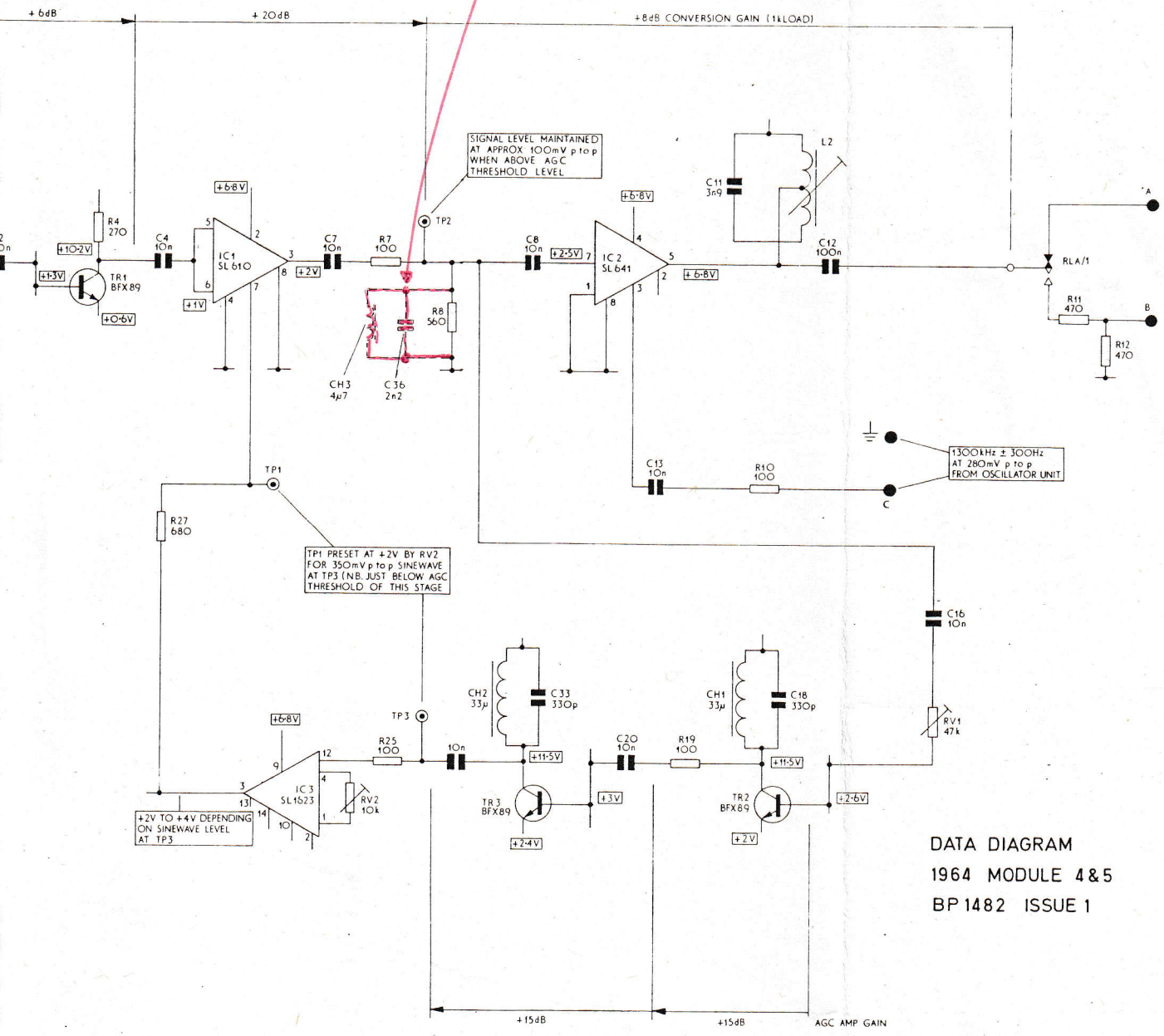

GAIN
(BELOW AGC THRESHOLD OF THIS MODULE)
± 2dB CONVERSION GAIN
- 4dB TYPICAL
† OVERALL GAIN TO TR1 = - 2dB TO - 6dB
OVERALL RECEIVER S/N RATIO (2·5 - 3 kHz B/W, USB OR LSB MODE) FOR 2μV emf FROM 50Ω SOUCE.
OVERALL GAIN TO TR1 (†)
TYPICAL OVERALL RECEIVER S/N
- 2dB
13dB
- 4dB
11dB
- 6dB
9dB
NB. INPUT TO POINT A SHOWN
A
L1
C1 100n
C2 100n
R1 47
RV1 47
R2 47
EQUAL IN RANGE +1V TO +2V (WITHIN APPROX 0·1V)
IC1 U350
+15V
L2 20·5μ
C3 820p
C5 820p
C4 2n7
C7 100n
C6 2n7
L3 20·5μ
T1.
L1
C1 tm5
OSC. LEVELS AS AT 'B'
L4
B
1st OSCILLATOR DRIVE AT 2V p to p IN FREQUENCY RANGE 3 - 26MHz. (FROM OSCILLATOR UNIT)
+15V TO 4IC1
TP5
0V OR +11·4V TO ACTIVATE BYPASS RELAY RLA

please fill in dotted lines

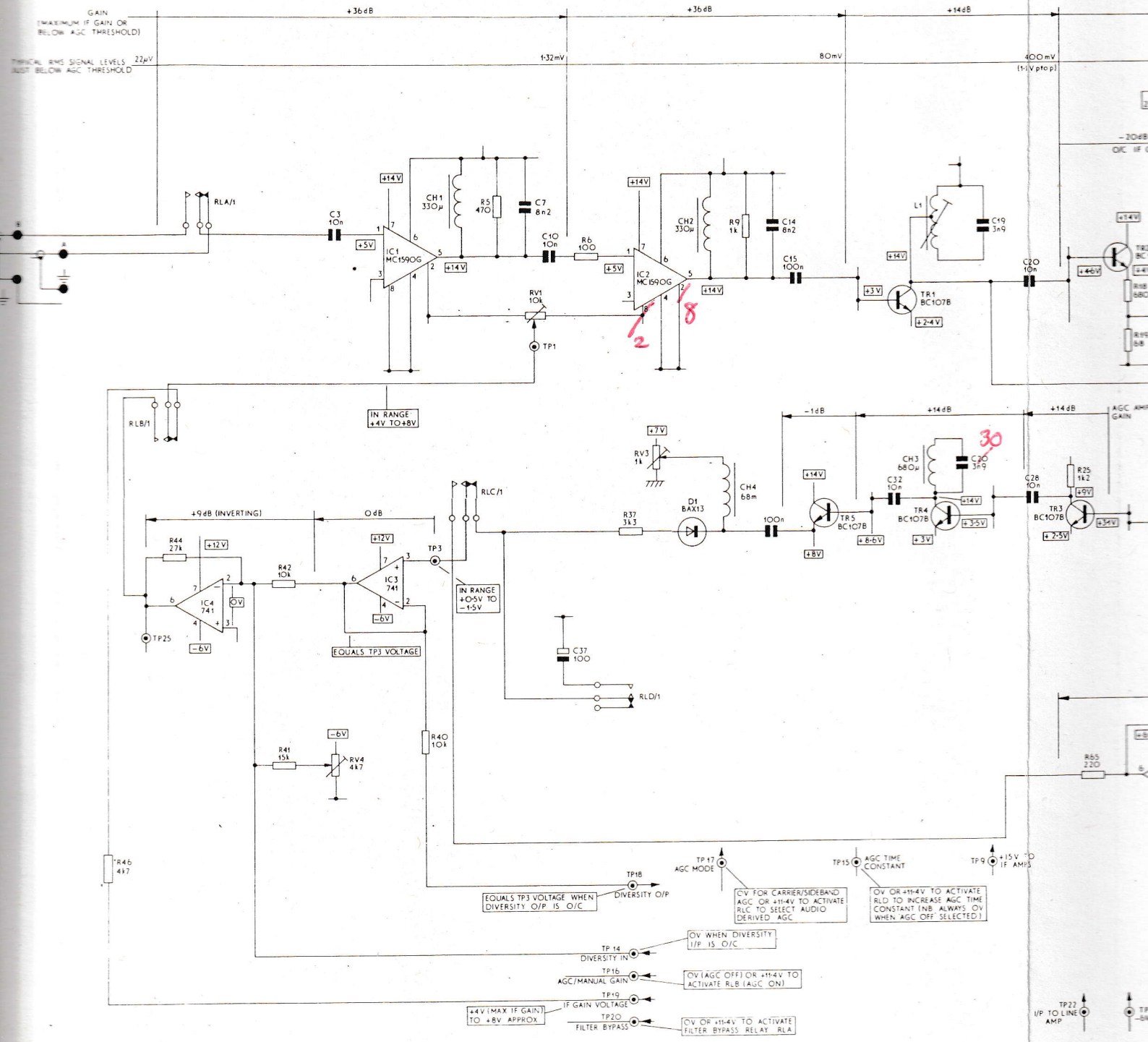


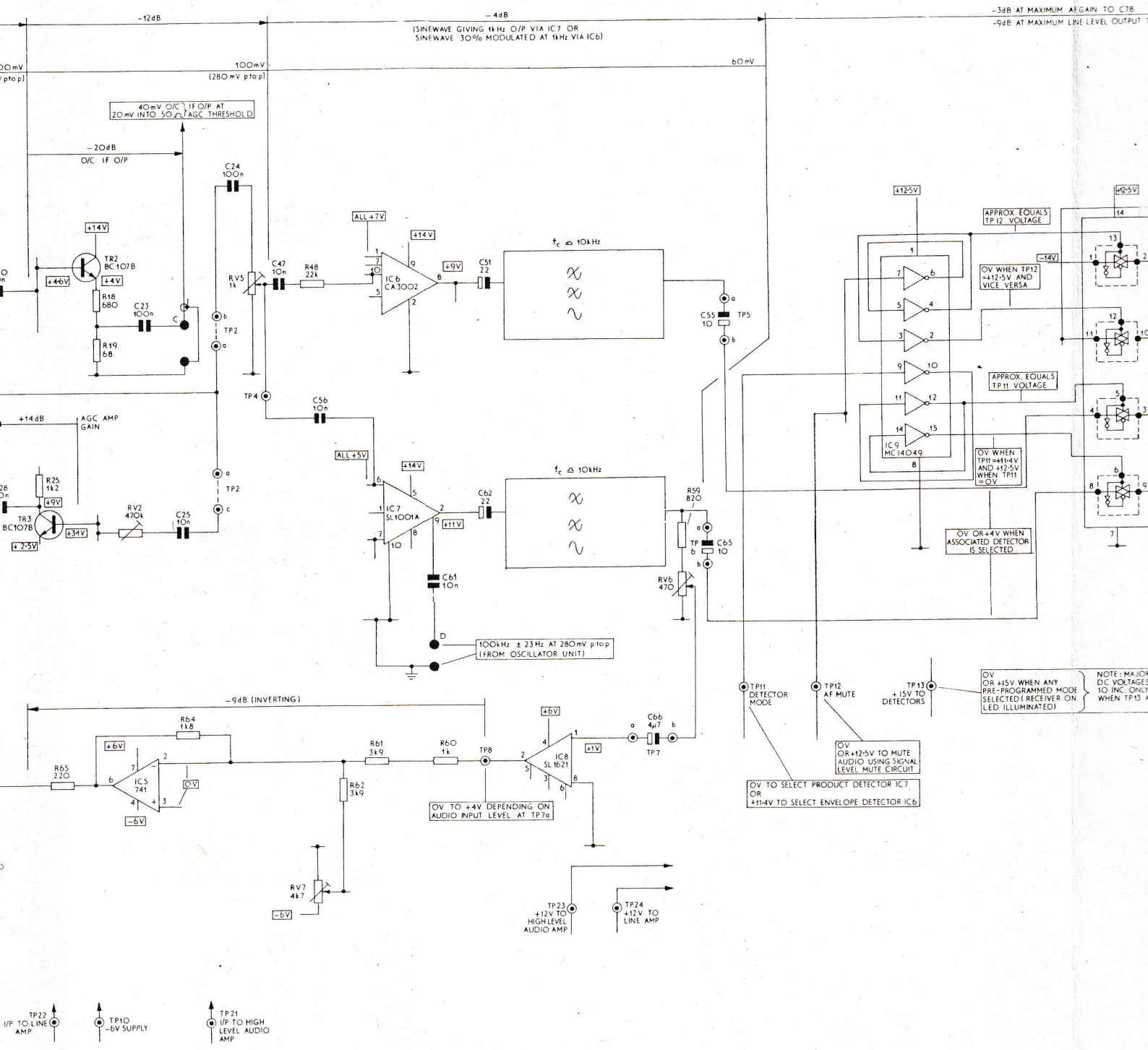
DATA DI
1964 M
BP 1482

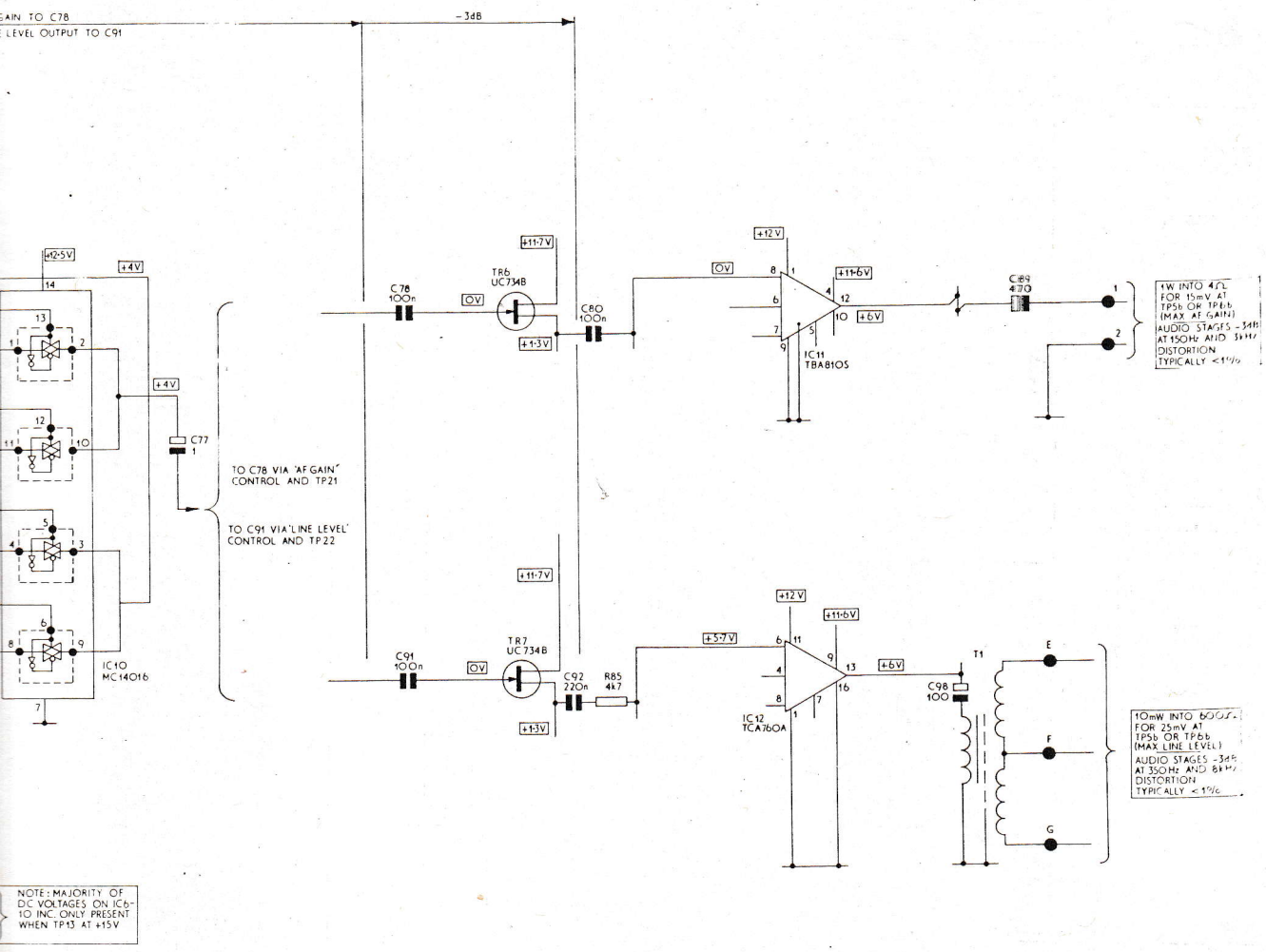
please fill in dotted lines



DATA DIAGRAM
1964 MODULE 4&5
BP 1482 ISSUE 1


GAIN (MAXIMUM IF GAIN OR BELOW AGC THRESHOLD)
+36dB
+36dB
+14dB
TYPICAL RMS SIGNAL LEVELS JUST BELOW AGC THRESHOLD
22µV
1·32mV
80mV
400mV (1·1V p to p)
RLA/1
C3 10n
+5V
+14V
IC1 MC1590G
CH1 330µ
R5 470
C7 8n2
C10 10n
R6 100
IC2 MC1590G
CH2 330µ
R9 1k
C14 8n2
C15 100n
RV1 10k
TP1
L1
C19 3n9
C20 10n
+3V
TR1 BC107B
+2·4V
+4·6V
IN RANGE +4V TO +8V
RLB/1
+7V
RV3 1k
CH4 68m
D1 BAX13
R37 3k3
100n
−1dB
+14dB
+14dB
TR5 BC107B
+8·6V
+8V
CH3 680µ
C30 3n9
C32 10n
TR4 BC107B
+3·5V
+3V
C28 10n
R25 1k2
+9V
TR3 BC107B
+3·1V
+2·5V
RLC/1
+9dB (INVERTING)
0dB
R44 27k
+12V
IC4 741
0V
−6V
TP25
R42 10k
IC3 741
TP3
IN RANGE +0·5V TO −1·5V
EQUALS TP3 VOLTAGE
C37 100
RLD/1
R41 15k
RV4 4k7
R40 10k
R46 4k7
R65 220
TP18
EQUALS TP3 VOLTAGE WHEN DIVERSITY O/P IS O/C
DIVERSITY O/P
TP17 AGC MODE
0V FOR CARRIER/SIDEBAND AGC OR +11·4V TO ACTIVATE RLC TO SELECT AUDIO DERIVED AGC
TP15 AGC TIME CONSTANT
0V OR +11·4V TO ACTIVATE RLD TO INCREASE AGC TIME CONSTANT (NB ALWAYS 0V WHEN 'AGC OFF' SELECTED)
TP9 +15V TO IF AMPS
TP14 DIVERSITY IN
0V WHEN DIVERSITY I/P IS O/C
TP16 AGC/MANUAL GAIN
0V (AGC OFF) OR +11·4V TO ACTIVATE RLB (AGC ON)
TP19 IF GAIN VOLTAGE
+4V (MAX IF GAIN) TO +8V APPROX
TP20 FILTER BYPASS
0V OR +11·4V TO ACTIVATE FILTER BYPASS RELAY RLA
TP22 I/P TO LINE AMP


-12dB
-4dB
(SINEWAVE GIVING 1kHz O/P VIA IC7 OR SINEWAVE 30% MODULATED AT 1kHz VIA IC6)
-3dB AT MAXIMUM AF GAIN TO C78
-9dB AT MAXIMUM LINE LEVEL OUTPUT
100mV
(280 mV p to p)
60mV
40mV O/C IF O/P AT 20mV INTO 50Ω AGC THRESHOLD
-20dB
O/C IF O/P
C24 100n
+14V
TR2 BC107B
+4·6V
+4V
R18 680
C23 100n
R19 68
TP2
ALL +7V
RV5 1k
C47 10n
R48 22k
IC6 CA3002
+9V
C51 22
fc ≙ 10kHz
C55 10
TP5
TP4
C56 10n
+14dB
AGC AMP GAIN
R25 1k2
TR3 BC107B
+3·1V
+2·5V
RV2 470k
C25 10n
ALL +5V
IC7 SL1001A
+11V
C62 22
R59 820
TP
C65 10
RV6 470
C61 10n
D
100kHz ± 23Hz AT 280mV p to p (FROM OSCILLATOR UNIT)
+12·5V
APPROX EQUALS TP12 VOLTAGE
OV WHEN TP12 =+12·5V AND VICE VERSA
-14V
APPROX. EQUALS TP11 VOLTAGE
IC9 MC14049
OV WHEN TP11 =+11·4V AND +12·5V WHEN TP11 =OV
OV OR +4V WHEN ASSOCIATED DETECTOR IS SELECTED
-9dB (INVERTING)
R64 1k8
+6V
R65 220
IC5 741
OV
-6V
R61 3k9
R60 1k
TP8
R62 3k9
IC8 SL1621
+1V
C66 4µ7
TP7
OV TO +4V DEPENDING ON AUDIO INPUT LEVEL AT TP7a
RV7 4k7
TP11 DETECTOR MODE
TP12 AF MUTE
TP13 +15V TO DETECTORS
OV OR +15V WHEN ANY PRE-PROGRAMMED MODE SELECTED (RECEIVER ON LED ILLUMINATED)
NOTE : MAJOR DC VOLTAGES TO INC. ONLY WHEN TP13
OV OR +12·5V TO MUTE AUDIO USING SIGNAL LEVEL MUTE CIRCUIT
OV TO SELECT PRODUCT DETECTOR IC7 OR +11·4V TO SELECT ENVELOPE DETECTOR IC6
TP23 +12V TO HIGH LEVEL AUDIO AMP
TP24 +12 V TO LINE AMP
TP22 I/P TO LINE AMP
TP10 -6V SUPPLY
TP21 I/P TO HIGH LEVEL AUDIO AMP



NOTE: MAJORITY OF DC VOLTAGES ON IC6-10 INC. ONLY PRESENT WHEN TP13 AT +15V

DATA DIAGRAM

1964 MODULE 7

BP1485 ISSUE 1