Operators manual

RA.1771/72
HF Communications Receivers
(including RA.1773 and RA.1774)

RACAL
THE ELECTRONICS GROUP

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DANGER

LETHAL VOLTAGES

Although every reasonable precaution has been observed in design to safeguard operating personnel this warning is ...

VITAL !

ADJUSTMENTS

EXERCISE GREAT CARE

DO NOT ADJUST ALONE

If possible, when making adjustments, ensure the presence of another person capable of rendering aid.

SERVICING

SWITCH OFF

DO NOT TAMPER WITH INTERLOCKS

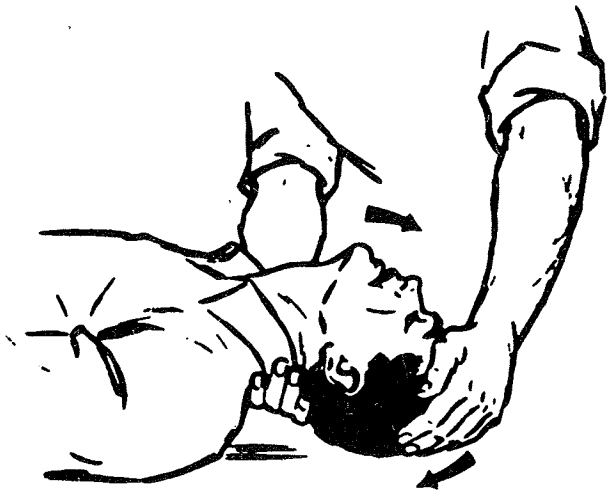
Only authorised personnel should be allowed to remove or neutralise the effect of interlocks. Do not rely on interlock switches for protection.

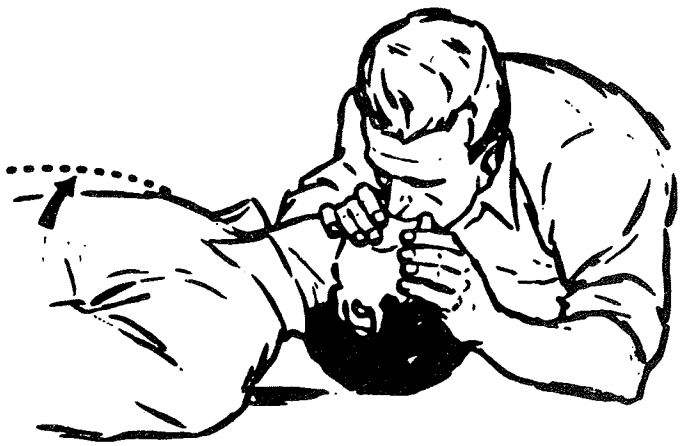
DO NOT SERVICE ALONE

If possible, when servicing, ensure the presence of another person capable of rendering aid.

SEE OVER FOR RESUSCITATION INSTRUCTIONS

FIRST AID in case of Electric Shock





1. Lay victim on his back.
2. Clear victim's mouth and throat.
3. Tilt victim's head back as far as possible and raise his head.
4. Pinch victim's nostrils.
5. Take a deep breath.
6. Cover the victim's mouth with yours and blow, watching his chest rise. Note: Blow forcefully into adults, but gently into children.
7. Move your face away to allow victim to breathe out, watching his chest fall.
8. Repeat first five to ten breaths at a rapid rate; thereafter, take one breath every three to five seconds.
9. Keep victim's head back as far as possible all the time.

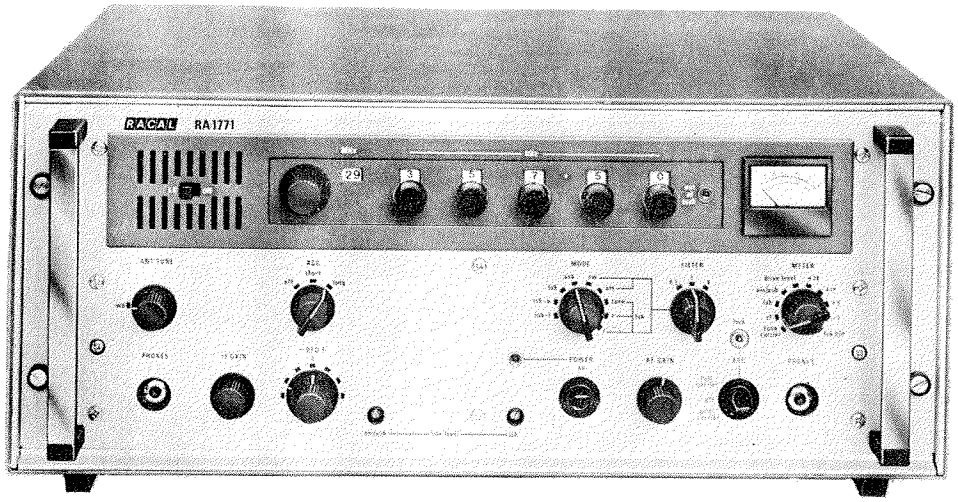
Have someone else send for a Doctor

Keep patient warm and loosen his clothing

DO NOT Give liquids until patient is conscious

HANDBOOK AMENDMENTS

Amendments to this handbook (if any), which are on coloured paper for ease of identification, will be found at the rear of the book. The action called for by the amendments should be carried out by hand as soon as possible.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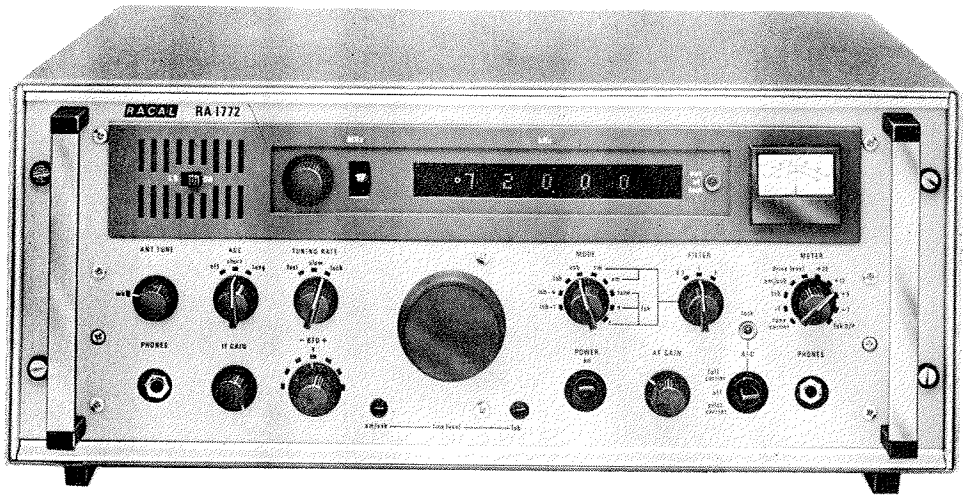
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TECHNICAL SPECIFICATION

The performance as stated in this specification is applicable to the wideband condition. If the optional RF tuning unit is fitted a nominal 20dB of protection is given at ±12½% off-tune.

Frequency Range: 15kHz - 30MHz.

Modes of Reception: A1, A2, A2H, A2J, A3, A3A, A3J, A3H with the following options:

(i) Choice of filter bandwidth.
(ii) Provision for ISB reception.
(iii) Provision for AFC
(iv) Provision for FSK.

Tuning:

RA.1771
Fully synthesized in 10Hz steps. 30-way switch for MHz selection, five rotary decadic switches for kHz and Hz selection.

RA.1772
Switched selection of 1MHz steps and a continuously tunable synthesizer in 10Hz or 100Hz steps over each 1MHz band. Electronic readout of each 1MHz band to increments of 10Hz.

Overspill:

RA.1772
20kHz at either end of each 1MHz band.
Overrun indication is provided.

Tuning Accuracy: ±5Hz relative to the frequency of the wanted signal.

Frequency Stability:

(1) The following optional alternative frequency standards may be fitted:

(a) Temperature Compensated Crystal Oscillator (TCXO).

(i) Temperature: Better than $\pm 1.5{:}10^{6}$ from -10°C to 55°C.

(ii) Long Term: $\pm 2{:}10^{7}$ over a 30 day period.

(b) Frequency Standard Type 9400

(i) Temperature: $\pm 1{:}10^{8}/°C$.

(ii) Long Term: $\pm 1.5{:}10^{7}$ over a 30 day period or $\pm 5{:}10^{9}$ per day.

(c) Frequency Standard Type 9420

(i) Temperature: $\pm 6:10^{10}/°C$.

(ii) Long Term: $\pm 1.5:10^{8}$ over a 30 day period or $\pm 5:10^{10}$ per day.

(2) Provision is made for the use of an external frequency standard.

Antenna Input:

(a) Wideband. 50 ohms to 75 ohms nominal. Coaxial BNC connector.

(b) RF tuning is available as an optional fitting within the receiver. This is provided by five automatically selected bandpass filters covering the frequency range 1MHz to 30MHz. Manual RF peak tuning is provided over each pre-selected band of frequencies. Each tuned range provides a nominal attenuation of 20dB at $12\frac{1}{2}\%$ off-tune. A low pass filter is used below 1MHz.

(c) Receiver muting is provided to protect the receiver from local emissions on the tuned frequency. The operation of the muting circuits permits 'break-in' or 'listen through' operation when keying at a rate of up to 20 bauds.

(d) The receiver will withstand without damage RF input signals of 30V (emf) continuously. A fuse and spark gap is provided for protection against higher voltages.

(e) Re-radiation with the antenna input terminated in 50 ohms is less than 10microvolts.

Sensitivity:

(a) CW and SSB (A1, A2H, A3A, A3H, A3J)
In a 3kHz bandwidth the signal-to-noise ratio is better than:

500kHz - 30MHz, 15dB with 1μV (emf) input.
50kHz - 500kHz, 15dB with 3μV (emf) input.
15kHz - 50kHz, 15dB with 10μV (emf) input.

(b) DSB (A2, A3)
In a 3kHz bandwidth the signal-to-noise ratio is better than:

500kHz - 30MHz, 15dB with 1.5μV (emf) input 70% modulated.
50kHz - 500kHz, 15dB with 5μV (emf) input 70% modulated.
15kHz - 50kHz, 15dB with 15μV (emf) input 70% modulated.

IF Selectivity:

(a) SSB (A3A, A3J)

Passband at -6dB: 250Hz to 3000Hz.
Passband at -60dB: -650 and +4100Hz

(b) ISB (A3B)

Passband at -6dB: 250Hz to 3000Hz.
Passband at -60dB: -400 and +4100Hz.

ALTERNATIVELY - SSB and ISB

Passband at -6dB: 250 to 6000Hz.
Passband at -60dB: -300 and +8000Hz.

(c) CW/MCW/AM/FSK (A1, A2, A3, A2H, A3H, F1)

Standard Receivers: In addition to the mode-selected SSB or ISB filters, up to four optional IF filters may be fitted although certain combinations of facilities will permit only three filters to be fitted. IF filters of the following nominal passbands are available:

0.3kHz, 1kHz, 3kHz, 6kHz, 8kHz, 13kHz.

Cross Modulation:

With a wanted signal greater than 300 μV emf, in a 3kHz bandwidth, an unwanted signal, 30% modulated, removed not less than 20kHz, will be greater than 300mV emf, to produce an output 20dB below the output produced by the wanted signal.

Reciprocal Mixing:

With a wanted signal of less than 100 μV emf, in a 3kHz bandwidth, an unwanted signal more than 20kHz removed will be greater than 70dB above the wanted signal level to give a noise level 20dB below the output produced by the wanted signal.

Blocking:

With a wanted signal of 1mV emf, an unwanted signal more than 20kHz removed must be greater than 500mV to reduce the output by 3dB.

Intermodulation Products:

(a) Out of Band

With two 30mV emf signals separated and removed from the wanted signal by not less than 20kHz the third order intermodulation products are not less than -85dB below either of the interfering signals and typically better than -90dB.

(b) In Band

Two in band signals of 30mV emf will produce third-order intermodulation products of not greater than -40dB.

Spurious Responses:

(a) External:

External signals, 20kHz removed from the wanted signal, must be at least 80dB above the level of the wanted signal to produce an equivalent output.

(b) Internal:

The specified sensitivity for CW and SSB is not reduced by more than 3dB as a result of any internally generated spurious signals.

AGC:

(a) Range:

An increase in input of 100dB above 2 microvolts emf will produce an output change of less than 6dB.

(b) Switches selection of AGC 'off' 'short' and 'long' time constants.

AFC: (A3A, A3B)

(a) AFC is available as an optional internal facility and is provided with a front panel switch for selecting AFC off, pilot carrier or full carrier.

(b) Capture range ± 50Hz.
Follow range ± 500Hz or beyond.
Stability: Over a temperature range of ± 10°C relative to 25°C the incoming signal is held to within ± 2Hz of its tuned frequency setting.

IF OUTPUT: (AGC ON)

1.4MHz, nominally 100mV e.m.f. into 50 ohms.

BFO Range:

±3kHz variable by a slow motion control.

Audio Characteristics:

(a) Output Levels:

(i) Line outputs, 1mW nominal into 600 ohms balanced, adjustable by preset level control on front panel to +6dBm.

(ii) Phone outputs balanced, 10mW nominal into 600 ohms.

(iii) 50mW into an internal loudspeaker which is capable of being switched in or out of operation.

(iv) Connection for external speaker 1 watt into 8 ohms.

(b) AF Response:

(i) Line outputs. Within 1dB from 100Hz to 6000Hz relative to the level of a standard 1000Hz tone.

(ii) The overall AF response will be dependent upon the IF bandwidth selected.

(c) AF Distortion:

(i) Line outputs: Not greater than 2% at specified output of 1mW nominal.

(ii) Loudspeaker outputs: Not greater than 5% at 50mW output to internal loudspeaker, and 1W output to external speaker.

(iii) Phone outputs: Not greater than 5% at specified output of 10mW nominal.

Cross Talk: (A3B)

With a wanted signal at a level of 1mV and the AF output adjusted to 1mW, the cross talk from an equal signal in the opposite sideband, at greater than 400Hz from the carrier, is not greater than -50dB relative to 1mW.

Frequency Shift Demodulation: (optional)

(a) Frequency shift range, 85Hz to 850Hz.

(b) Maximum keying speed 200 bauds.

(c) Telegraph distortion not greater than 5% up to 100 bauds.

(d) Telegraph output. Polar (double current) DC output approximately 100mA with choice of 6-0-6V or 80-0-80V. Normally positive on 'Mark'. Provision is made, by a rear panel switch, for neutral (single current) operation.

(e) Mark/space reversal is available to the operator and a 'tune' switch position is provided to permit tuning of the receiver without operating the teleprinter.

Metering:

A meter is provided on the front panel to indicate RF level, AF level to line, FSK tune, and suitable performance or supply test levels.

Front Panel Controls and Fittings:

RA.1772

MHz Frequency Control by rotary switch.
kHz Frequency Selection by rotary VFO type control.
Tuning Rate switch (Fast, Slow, Lock).
RF Tuning Control (Optional).
AGC Time Constants switch.
AFC Full Carrier/Off/Pilot Carrier (Optional)
AFC Lock Lamp (Optional)
Mode Switch
Meter Facility Switch.
Meter.
Loudspeaker.

Loudspeaker switch.
Two Headphone sockets.
IF Gain Control.
AF Gain Control.
BFO Slow Motion Control
Line Level Preset Adjusters.
Filter Switch.
Power On/Off Switch.

RA.1771
As for RA.1772 except that the kHz rotary control is replaced by five decadic switches for kHz and Hz settings.

Rear Panel Connections and Facilities:

RA.1771 and RA.1772
Antenna Input Socket.
Antenna Fuse
Power Input Socket.
Mains Voltage Adjuster Panel.
Power Input Fuse.
Standby +12V Fuse
Teleprinter Supply Fuse.
Teleprinter Supply Voltage Selector Switch.
Teleprinter Supply Polar/Neutral Switch.
Ground Terminal.
34MHz Input/Output Socket.
34MHz Internal/External Switch.
1MHz Frequency Standard Input/Output Socket.
Frequency Standard Internal/External Switch.
Local Oscillator Input/Output Socket.
Local Oscillator Internal/External Switch.
AGC Output (for diversity operation).)
Line Output(s) (2 outputs for ISB version only))
Loudspeaker Output.) Terminal
Mute Line.) Strip
FSK Input and Output)
Standby +12V Input)
+12V Output)
1.4MHz IF Output Socket (2 outputs for ISB version).

Power Supply: 100V-125V or 200V-250V, ± 10%, 45- 65 Hz

Power Consumption: Approx. 60VA (Basic receiver)
Approx. 90VA (Fully equippped)

Environmental Conditions: The equipment is designed to meet certain of the requirements of the British Defence Specification DEF.133, L2, for ambient temperature range of:

Operating Temperature	-10°C to +55°C
Storage Temperature	-40°C to +70°C.
Relative Humidity	95% at 40°C.

Dimensions:	Rack Mounted:	Height:	178mm (7 in)
		Width:	483mm (19 in)
		Depth:	410mm (16.14 in)
	In Bench Cabinet:	Height:	220mm (8.66 in)
		Width:	495mm (19.49 in)
		Depth:	445mm (17.52 in)
Weight:	Rack Mounted:	22kg (48.4lb) approximately	
	In Bench Cabinet:	28kg (61.6lb) approximately	

ACCESSORIES

AA.660/A	Headset, 600 ohms, with ventilated ear cushions, lead and plug.
BA.45520	Bench Mounting Cabinet.
DA.47020	Ruggerdised Bench Mounting Cabinet for marine applications.
DA.46531	Ruggerdised Bench Mounting Cabinet fitted with shock mounts for mobile/ transportable applications.

OPTIONAL EXTERNAL MODULES

MM532	Audio Switching Unit.
MS540	12V Battery Module.
MS530	Bandpass Filter, 2-30MHz, for use in antenna systems.
MS561	IF Conversion Module, 1.4MHz to 100kHz.

NATO NUMBERS

RA.1771	5820-99-626-3415
RA.1772	5820-99-624-5397

CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1. The RA.1771 and RA.1772 are fully synthesized solid state communications receivers providing reception facilities for LSB/USB (A3A, A3H, A3J), AM(A3) and CW(A1). ISB (A3B), FSK(F1) and AFC facilities are provided by optional, internally fitted, modules. In addition, a manual RF tuning unit may be fitted.

2. The built-in synthesizer is phase-locked to the output of a frequency standard, which may be either internal or external, and covers the frequency range 15kHz to 30MHz in switched 1MHz bands. In the RA.1771, the kHz setting is selected by rotary decade switches, with digital indication in 10Hz increments, while in the RA.1772 the synthesizer is continuously tunable over each 1MHz band and on electronic readout indicates the kHz setting to 10Hz. Except for the method of frequency selection both receivers are designed to the same specification.

BRIEF TECHNICAL DESCRIPTION

3. Both receivers include wideband input, with RF tuning available as an optional front panel control. The MHz selection is in switched 1MHz increments and single knob tuning is provided on the RA.1772 with switched selection of FAST and SLOW tuning rates, or LOCK. In the LOCK position the synthesizer is disconnected from the manual tuning control. At the ends of each 1MHz band, the RA.1772 tuning provides a 20kHz overspill to eliminate the need for reverse tuning of the kHz control. Overspill is indicated by an illuminated lamp behind the appropriate MHz setting, above or below the setting initially selected.

4. Up to six IF bandwidth filters may be selected. Of these, two are normally sideband filters automatically selected by the MODE switch. If AFC is fitted, one of the filters must be a carrier filter. The symmetrical filters fitted are selected by a filter switch and may be chosen from the nominal filter bandwidths available, which are 0.3kHz, 1kHz, 3kHz, 8kHz and 13kHz. A slow motion BFO control is provided for CW operation. A built-in meter may be switched to indicate RF and AF levels as well as supply voltage levels. A further meter switch position provides for a tuning indication when AFC, which may be switched in or out of circuit, is fitted.

5. A switched monitor loudspeaker is provided and two front panel mounted sockets permit headphone monitoring of the sideband selected by the MODE switch. When the right hand socket is used the internal loudspeaker is muted. A coaxial antenna socket is mounted on the rear panel for the connection of a coaxial antenna feeder.

6. The built-in power unit is capable of operating from a 100-125V or 200-250V, 45-65Hz supply. For FSK operation an integral 6V-0-6V or 80V-0-80V signalling supply, selected by a rear panel switch, is also provided for the associated teleprinters.

7. A choice of three, internally fitted, frequency standards is available. The Temperature Compensated Crystal Oscillator (TCXO) provides a stability of 1.5ppm over the entire temperature range and is adequate for most services where SSB speech or wide-shift telegraphy is used, or where the operating temperature is stable. The Type 9400 frequency standard provides a higher stability to meet the requirements of narrow-shift telegraph operation, while the Type 9420 frequency standard provides a very high order of stability, both short and long term.

MECHANICAL DESCRIPTION

8. A rigid, die-cast, full-width chassis provides the basis for the main frame of the receiver. Mounted within compartments on the underside of this chassis are the mixer boards and part of the frequency generation system. Mounted on the top of the chassis is an aluminium box structure, which houses up to nine (dependent on the options fitted) printed circuit boards, each individually screened. These printed circuit boards may be hinged out and then fixed in position for maintenance purposes. Also mounted on top of the chassis is the frequency standard module and the power supply transformer. A solid-state high speed relay and a barretter are included in FSK versions of the receiver. The power supply printed circuit board is mounted on the inside of the rear panel and adjacent to this board are mounted the power supply smoothing capacitors. The power supply regulator output transistors are mounted on a heatsink attached to the rear panel. A further printed circuit board, containing logic circuits, is mounted on the inside of the front panel.

IDENTIFICATION OF VARIANTS

9. Because of the various options available, numerous differing versions of the RA.1771 and RA.1772 may be derived. In order to identify the optional facilities fitted to a particular receiver, a series of suffix characters are added to the basic type number, i.e. RA.1771 or RA.1772, on the type/serial number plate attached to the rear of the receiver chassis. The meanings of the suffix characters are described below:-

First Suffix: Alphabetical identification of symmetrical and sideband filters fitted, according to following table. Additional suffix letters will be introduced as further filter combinations are defined.

NOTE: A total of six filters may be fitted. In standard production models five symmetrical filter positions are selectable and are wired to the FILTER switch although certain combinations of facilities will limit the symmetrical filters fitted to three. For example, an ISB version with AFC is limited to three symmetrical filters as the other three filter positions are occupied by the USB, LSB and carrier filters. On the other hand, a receiver equipped with USB only, has space for five symmetrical filters since the carrier filter position may be used for a switched symmetrical filter.

First Suffix	Symmetrical Filters (kHz)					Sideband Filters (kHz)	
						USB	LSB
A	0.3	3	8	-	-	3	3
B	0.3	1	8	-	-	3	3
C	0.3	1	3	8	-	3	-
D	0.3	1	3	8	-	2.7	-
E	0.3	3	8	-	-	6	6
F	0.3	1	8	-	-	6	6
G	1	3	13	-	-	6	6
H	1	3	8	-	-	3	3

Second suffix: Frequency standard fitted.

O indicates no internal frequency standard fitted; receiver operates from external frequency standard.

S1 indicates 1.5 ppm TCXO.

S2 indicates Type 9400.

S3 indicates Type 9420.

Third suffix: RF Tuning Unit.

O indicates not fitted.

R indicates is fitted.

Fourth suffix: ISB filter identification.

O indicates not required.

B3 indicates 3kHz filter (2.7kHz minimum bandwidth).

B6 indicates 6kHz filter (5.7kHz minimum bandwidth).

Fifth suffix: Frequency Shift Keying.

O indicates FSK facility not fitted.

F indicates FSK facility is fitted.

Sixth suffix: Automatic Frequency Control.

O indicates AFC facility not fitted.

C indicates AFC facility is fitted.

'POZIDRIV' SCREWDRIVERS

Metric thread cross-head screws fitted to Racal equipment are of the 'Pozidriv' type. Phillips type and 'Pozidriv' type screwdrivers are not interchangeable, and the use of the wrong screwdriver will cause damage. POZIDRIV is a registered trade mark of G.K.N. Screws and Fasteners Limited. The 'Pozidriv' screwdrivers are manufactured by Stanley Tools Limited.

CHAPTER 2

INSTALLATION

INTRODUCTION

1. This chapter contains installation information for the RA.1771 and RA.1772 (same for each receiver) and describes the essential checks to be carried out prior to operating the receiver for the first time. All connections, except headphones, are made at the rear of the receiver.

REAR PANEL CONNECTIONS

2. A brief description of each rear panel connection is given. Refer to Fig. 3 for a rear view of the receiver.

Antenna Connection

3. Coaxial socket: for the connection of a 50 to 75 ohm unbalanced transmission line. The free plug is a Transradio BNC type BN1/5 or equivalent (Racal Part No.900038).

Power Input Socket

4. The power input connection is made via a 3-way socket and cable assembly (Racal No. BA.77207). The wire connections for the cable are given in para. 12.

Coaxial Sockets

5. NOTE: For connecting external wiring to the following coaxial sockets use 50Ω Transradio BNC plug type BN1/5 or equivalent (Racal Part No.900038).

Identification	Function
1MHz IN/OUT:	Accepts an external 1MHz frequency standard when the associated 1MHz switch is set to EXT, or provides a 1MHz output when the switch is set to INT. A single receiver may be operated using an external frequency standard or two receivers may be operated in the master/slave configuration, for diversity reception, using the frequency standard fitted to the master receiver.
LO IN/OUT:	Accepts a local oscillator signal (35.4 to 65.4MHz) when the associated switch is set to EXT (slave receiver), or provides a local oscillator output signal when the switch is set to INT (master receiver), where two receivers are interconnected for diversity reception.

Identification	Function
34MHz IN/OUT:	Accepts a 34MHz second mixer injection signal when the associated switch is set to EXT (slave receiver) or provides a 34MHz output signal when the switch is set to INT, where two receivers are interconnected for diversity reception.
MAIN IF OUT:	1.4MHz IF output for connection to external equipment. Nominal level 140mV e.m.f. into 50 ohms.
ISB IF OUT:	1.4MHz IF output - ISB version only.

Terminal Strip Connections

6. Two nine-way terminal strips are mounted on the rear panel; the connections are as follows:-

Identification		Function
TS1		
1] 2]	LINE OUTPUT MAIN IF	Audio Line output from main IF (1mW nominal into 600 ohm). SSB Receiver: USB or LSB as selected by MODE switch. ISB Receiver: USB
3	E	Earth.
4] 5]	ISB LINE OUTPUT	Audio line output from LSB channel - ISB receiver only. 1mW nominal into 600 ohm.
6	LS	Audio output to external loudspeaker. USB or LSB, as selected at front panel MODE switch. 1 watt nominal into 8 ohm.
7	E	Earth
8	FSK IN]	FSK versions only; from FSK diversity switching circuit
9	FSK OUT]	for connection to second receiver for diversity reception.

Identification		Function
TS2 1	DIV AGC	Diversity AGC connection to second receiver for diversity reception.
2	E	Earth
3.	MUTE	An earth connection to this pin mutes the receiver.
4	TEL OUTPUT	Output signal to teleprinter, FSK versions only; may be 6V-0-6V or 80V-0-80V, single or double current.
5	TEL E	Teleprinter earth.
6	+12V	+12V output (100 milliamps) for operation of ancillary units.
7	STD/+12V	Provision for an external standby +12V supply for the internal frequency standard.
8	DIV RL	Diversity relay (FSK versions only). Used in conjunction with the Racal MM532 audio switching module (see Appendix 3).
9	ISB DIV AGC	ISB diversity AGC connection to second receiver, for diversity reception, ISB version only.

Earth Terminal

7. A terminal is provided on the rear panel for connection to the earthing system of a cabinet.

PREPARATION FOR USE

General Inspection

8. (1) If the receiver is mounted in a cabinet, remove the two transit screws at the bottom of the rear flange (see Fig. 3) and then remove the front panel screws.

(2) Thoroughly check the receiver for transit damage and ensure that the unit is clean and free from packing material.

(3) Check all controls and switches for correct mechanical action.

(4) Install the receiver into the rack or table-top cabinet.

NOTE: Where the receiver is mounted in a rack or table-top cabinet in ambient temperatures above 40°C, the receiver top cover should be removed to provide additional ventilation.

Fuselinks

9. Check that the fuselinks fitted to the rear panel are serviceable and are of the correct rating, as follows:-

Fuse	Rating	Replacement
ANTENNA	500mA	Belling Lee L754
POWER	1A Slow-blow	Beswick TDC 134
STD/+12V	2A Slow-blow	Beswick TDC 134
TELEPRINTER (FSK Version only)	150mA	Belling Lee L562

Voltage Selector

10. Check that the voltage selector, located on the rear panel, is correctly set to suit the local source of a.c. power.

NOTE: The supply voltage must remain within 10% of that selected since a low voltage will cause the internal regulation circuits to trip and a high voltage will give rise to increased internal temperatures.

Rear Panel Switches

11. Check the settings of the following rear panel switches:-

(1) 34MHz to INT

(2) LO to INT

(3) 1MHz to INT if the receiver has a built-in frequency standard, EXT if operation from an external frequency standard is required.
The external 1MHz frequency standard is connected to the 1MHz IN/OUT socket, adjacent to the 1MHz switch.

(4) TEL:80V/6V (FSK versions only): Set to suit the teleprinter (see also para . 17).

(5) N + PN - (FSK versions only): Set to P (polar) for double current, N+ for single current neutral and positive, or to N- for single current neutral and negative.

Power Supply Connection

12. A free socket and cable assembly is supplied with the receiver for connections to the rear panel 3-way POWER input plug. The wire connections for the cable are as follows:-

Brown wire to	Line
Blue wire to	Neutral
Green/Yellow wire to	Earth

Phones

13. Headphones (600 ohm impedance) may be plugged into either or both of the two front panel jack sockets. Note that when the right hand jack socket is used the front panel loudspeaker becomes inoperative. The required phones jack plug is a Rendar R22600 (Racal Part No. 922117).

INITIAL SWITCH-ON

14. (1) Set the front panel POWER switch to OFF.

(2) Ensure that the voltage selector is set to suit the local a.c. supply

(3) Connect the power socket to the main source of a.c. supply.

(4) Set the POWER switch to ON.

(5) Check that the MHz dial illuminates and the kHz display (RA.1772 only) read 00000. The OUT OF LOCK lamp may flash momentarily and should then remain extinguished.

(6) Set the METER switch, in turn, to DRIVE LEVEL, +20, +12, +5 and -7; ensure that for each voltage setting the meter indication is within the green portion of the meter scale; for the DRIVE LEVEL position check that the meter indication is within the V scale brackets.

RA.1772 Tuning Check

15. (1) Set the MHz control to 3

(2) Set the TUNING RATE switch to SLOW.

(3) Slowly spin the kHz control clockwise; the kHz display should increase in 10Hz steps at a rate of 2.5kHz per turn.

(4) Slowly spin the kHz control counter-clockwise; the kHz display should decrease in 10Hz steps. As the display passes from 00000 to 99999, check that the lamp behind the 3 on the MHz dial extinguishes, and that the lamp behind the 2 illuminates.

(5) Continue to decrease the kHz display indication until it stops, at 97999.

(6) Turn the MHz control one position counter-clockwise; the illuminated 2 should move to the centre of the MHz scale and the kHz display should remain at 97999.

(7) Spin the kHz control counter-clockwise; the kHz display should decrease from 97999

(8) Spin the kHz control clockwise; the kHz display should increase to 99999, change to 00000 and then stop at 02000. As the display passes through 00000, the lamp behind on the 2 on the MHz dial should extinguish, and the lamp behind the 3 should illuminate.

(9) Turn the MHz control one position clockwise; the illuminated 3 should move to the centre of the KHz scale and the kHz display should remain at 02000.

(10) Spin the kHz control clockwise; the kHz display should increase from 02000.

(11) Set the TUNING RATE switch to FAST.

(12) Spin the kHz control in each direction in turn and check that the kHz display moves in 100Hz steps at a rate of 50kHz per turn. The '10Hz' figure should remain stationary at 0.

(13) Set the TUNING RATE switch to LOCK.

(14) Spin the kHz control in each direction in turn and ensure that the kHz display indication does not vary.

NOTE: A mechanical damper is fitted to the tuning shaft and may be adjusted to suit the users preference (see Fig. 4).

Operational Check

16. (1). Set the following controls as indicated:-

AGC	SHORT
MODE	USB
AFC (if fitted)	OFF
LOUDSPEAKER	ON
IF GAIN	Fully clockwise
AF GAIN	Fully counter-clockwise

(2) Turn the AF GAIN progressively clockwise and check the volume of white noise in the loudspeaker increases.

(3) Set the AGC switch to OFF.

(4) Turn the IF GAIN counter-clockwise and check that the noise in the loudspeaker decreases.

(5) Set the AGC switch to SHORT: the noise in the loudspeaker should be restored to the full level and the IF GAIN control should become inoperative.

(6) Set the AGC switch to LONG; the noise level in the loudspeaker should remain unchanged.

(7) Connect a suitable antenna to the receiver.

(8) Tune the receiver to a known signal and check for an acceptable audio output signal (refer to Chapter 3 for operating information).

TELEPRINTER DRIVE

17. The teleprinter drive circuitry of this receiver, when the telegraph voltage selector switch is set to 80V, will provide a VOLTAGE source of plus and minus 80 volts at the TELEPRINTER terminals of TS2. The teleprinter to be used must correspondingly be capable of accepting plus and minus 80 volts, and further, if the teleprinter is of the CURRENT operating type, a resistor should be included to limit the current to the designated working current. The value of this resistor is governed by the working current required and also by the line resistance. Two such teleprinters can be driven from the receiver, in which case each must be provided with a current limiting resistor. In the absence of a resistor, or in the event of a line short circuit, the maximum current which can be taken is 100 milliamps nominal, limited by the internal barretter. The series resistor used should have a minimum rating of 4 watts and should be connected in a suitable position adjacent to the teleprinter. It should not be fitted to the TELEPRINTER OUTPUT terminal of the receiver where heat dissipation would be restricted and might cause damage.

18. A table of total resistance values for a range of teleprinter currents is given below. The total resistance is the sum of the teleprinter coil resistance (typically 200 ohms) and the series resistor.

Specified Teleprinter Current (mA)	Total Resistance for each Path (ohms)	
	1 Teleprinter	2 Teleprinters
20	4000	3640
30	2600	2300
40	1820	1280
50	1450	540

19. Since the barretter has identical and independent characteristics in each of its two filaments, the total resistance values apply equally to single or double current working when related to the specified operating current of the teleprinters used.

FSK RELAY

20. The FSK relay fitted to FSK versions of this receiver is of the solid-state type and is fully described in Appendix 4 of the RA.1771/72 Maintenance Manual.

IMPORTANT NOTE For the correct operation of the receiver in the FSK mode it is essential that a current of approximately 3mA is drawn through the FSK relay. Consequently, when operating into a high impedance load, such as 6 volt teleprinter may present, an

additional load of approximately 2 kilohms must be connected across the telegraph line i.e. between TEL O/P and TEL E.

EARTH CONNECTION

21. To prevent possible interference from the FSK relay, ensure that the power supply earth is connected to the receiver power input socket (para.12) and also to the teleprinter motor supply earth lead.

TELEGRAPH SUPPLY SELECTION

22. The TEL 80V/6V and N+/P/N- switches on the rear panel of the receiver, together with the FSK TUNE, N and R positions of the MODE switch, provide the necessary requirements for the majority of teleprinters. Certain polar types of teleprinter, however, require a positive-hold voltage (idle condition) when the MODE switch is set to FSK TUNE, and also on cessation of a received transmission.

To cater for this type of teleprinter it is necessary to carry out a simple modification, as detailed below:

23. (1) Switch off and disconnect the receiver from the supply.

(2) Remove all connections from the rear panel sockets and/or terminal strips.

(3) Remove the receiver from the rack or table-top cabinet and place it on a clean working surface.

(4) Remove the overall top cover plate (if fitted).

(5) Remove the seven screws, each with a spring washer, securing the rear panel to the receiver (three at each side and one in the centre). Lower the rear panel to 'hinge' on the connecting cableform.

(6) Locate the rear of the N+/P/N-switch and identify the two pins which connect with (1) pin 11 on the FSK board and (2) D11 which is mounted on wafer SA4 of the MODE switch (the lower section of switch SH, figs. 50 and 52 of the maintenance manual, part 2).

(7) Connect and solder a BTC wire link between the two identified pins on the N+/P/N-switch, SH.

(8) Replace the rear panel.

NOTE: The addition of this link provides a positive hold voltage for the associated teleprinter when the MODE switch is set to FSK TUNE. To provide a positive hold voltage for the associated polar teleprinter on cessation of the received transmission (MODE switch set to FSK N) proceed as follows:

(9) Connect a wire link between the FSK IN and E terminals of TS1 on the rear panel of the receiver.

NOTE: Where local noise interference is experienced it may be advantageous to carry out the AGC manual override modification given in Appendix 1. The IF GAIN control may then be used to reduce the gain of the receiver until the local noise no longer triggers the associated teleprinter. The received transmission will then operate the receiver AGC in the normal way.

TRANSIT SCREWS

24. Where a receiver is mounted in a table-top cabinet, two transit screws are provided; these are painted red to assist identification and are shown in fig.3. To avoid damage to a receiver transported within a table-top cabinet, it is important to ensure that both of these screws are securely in position.

CHAPTER 3

OPERATING INSTRUCTIONS

INTRODUCTION

1. This Chapter provides operating instructions for the RA.1771 and the RA.1772. Apart from the method of tuning, the operating procedures for the two receivers are identical.

2. Before operating the receiver for the first time, ensure that it has been prepared for service in accordance with the information given in Chapter 2.

FUNCTION OF CONTROLS

3.

(1) RF TUNE:	This is an optional 'front-end' tuning facility usually only required when the receiver is operated in close proximity to strong interfering signals. It is switched out of circuit when set to WB (wide-band).
(2) AGC:	This is a three position switch. In the OFF position the receiver gain is manually controlled (IF GAIN control); the selection of FAST or SLOW AGC action is dependent upon the operating mode and the propagation conditions. In either of these two positions, the IF GAIN control is inoperative.*
(3) IF GAIN:	See (2) above.
(4) TUNING RATE (RA.1772 only):	A three position switch. In the SLOW position, rotation of the kHz control alters the frequency in 10Hz steps, whereas in the FAST position the frequency alters in 100Hz steps. In the LOCK position the receiver remains locked to the displayed frequency but the kHz control becomes inoperative.
(5) BFO:	A slow-motion BFO tuning control which provides a variable offset of up to approximately plus or minus 3kHz. The BFO is switched on by the MODE switch when set to CW.
(6) MHz Control:	The MHz Control switch, with associated scale, for selecting the MHz portion of the required operating frequency (0 to 29MHz).

* See also Appendix 1: AGC Manual Override.

(7) kHz Control:

RA.1771: Five decade frequency selection switches, each with associated digital indication.

RA.1772: A continuously tunable kHz control with associated electronic digital display.

(8) MODE:

This switch selects the mode of operation and may have up to a maximum of nine positions, as described below. The first two positions (ISB-L and ISB-U) are only operative in ISB versions, the last three positions (R, N, TUNE) are only operative in receivers fitted with the FSK facility.

ISB-L: ISB (A3B) reception with the lower sideband audio output monitored at the two PHONES sockets, the internal loudspeaker and the loudspeaker terminal on the rear panel.

ISB-U: ISB (A3B) reception with the upper sideband audio output monitored at the two PHONES sockets, the internal loudspeaker and the loudspeaker terminal on the rear panel.

LSB: Single sideband (A2H, A3A, A3H, A3J) operation with the lower sideband selected. The LSB audio output is available at the two PHONES sockets, the internal loudspeaker and the loudspeaker terminal on the rear panel.

USB: Single sideband (A2H, A3A, A3H, A3J) operation with the upper sideband selected. The USB audio output is available at the two PHONES sockets, the internal loudspeaker and the loudspeaker terminal on the rear panel.

CW: Double sideband CW (A1) operation.

AM: Double sideband AM (A2, A3) operation.

FSK: The last three positions are for FSK (A2, A2H, A2J, F1) operation.

R Reverse output polarity
N Normal output polarity

TUNE Permits tuning of the receiver without operating the teleprinter.

(9) FILTER:

Up to five IF symmetrical filter positions may be fitted dependent upon the options fitted. The switch is only in circuit for the CW, AM and FSK positions of the MODE switch.

(10) POWER ON/OFF

(11) AF GAIN: The AF GAIN control is used to adjust the audio level to the headphones, the internal loudspeaker and also the externally connected loudspeaker.

(12) AFC: An optional facility, for use with A3A and A3H operating modes, controlled by a three position switch:

Up: FULL CARRIER (A3H)

Centre: OFF

Down: PILOT CARRIER (A3A)

An associated LOCK lamp illuminates when the AFC is in operation and a carrier signal is present. The front panel meter includes an AFC scale. When the METER switch is set to TUNE CARRIER and the AFC switch is set to OFF, the meter provides an indication of receiver tuning.

When the AFC switch is set to FULL or PILOT CARRIER (as appropriate), the meter provides an indication of available hold range. It may, therefore, be used to determine whether a slight adjustment of the receiver tuning is required (due to a drift in the transmitted frequency) to maintain AFC lock.

(13) METER: A ten-position meter switch. The operative positions are dependent upon the options fitted. The positions available are as follows:

TUNE CARRIER: For accurate tuning of FULL or PILOT carrier signals, used in conjunction with the AFC switch.

RF: RF level indication, for general tuning purposes.

LSB: LSB audio output level. (ISB receiver only)

AM/USB: DSB/USB audio output level (LSB audio output level for SSB receiver).

DRIVE LEVEL: First mixer LO drive level.

+20
+12
+5
-7

Rail voltage monitoring.

FSK OUTPUT: Mark and Space FSK output voltage indication.

(14) LOUDSPEAKER ON/OFF

(15) LINE LEVEL: preset control(s)

One preset control is provided for SSB versions, two preset controls for ISB versions. The adjustment of these controls is given in paragraph 6.

RECEIVER TUNING

4. The following procedure is given as a general guide to the correct use of the controls.

5. (1) Connect a pair of headphones to either of the two front panel PHONES jacks. Alternatively, set the internal loudspeaker switch to ON.

NOTE: The internal loudspeaker is rendered inoperative when the right-hand PHONES jack is in use.

(2) Set the POWER switch to ON.

(3) Set the AFC switch (if fitted) to OFF.

(4) Set the AGC switch to LONG.

(5) Set the MODE switch as required (for FSK reception set to FSK TUNE).

(6) Set the FILTER switch to a wide bandwidth for AM reception (3,8 or 13kHz), to a narrow bandwidth for CW or FSK reception (3, 1 or 0.3kHz).

(7) For CW reception, set the BFO control to '0'.

(8) Set the RF TUNE control (if fitted) to WIDEBAND.

(9) Use the AF GAIN control to set the output to the phones or loudspeaker.

(10) Set the MHz tuning control to indicate the required frequency on the MHz dial.

(11) On the RA.1771 set the five decade kHz frequency switches to the desired frequency. On the RA.1772, set the TUNING RATE switch to FAST and spin the kHz control until the desired frequency is approached, then set the TUNING RATE switch to SLOW.

(12) Adjust the kHz tuning to identify the required signal.

(13) Adjust the RF TUNE control (where fitted) if interference is experienced, for a maximum indication on the front panel meter, with the METER switch set to RF.

(14) If AFC is fitted, set the METER switch to TUNE CARRIER and precisely adjust the kHz tuning for a minimum indication on the meter.

(15) Set the AFC switch (if fitted) to FULL CARRIER or PILOT CARRIER as appropriate. Ensure that the AFC LOCK lamp illuminates.

NOTE: Check periodically that the AFC meter indication has not drifted to either extreme end (+ or -) of the AFC scale (due to drift in the transmitted frequency). If necessary, adjust the kHz tuning, in 10Hz steps to bring the meter indication nearer to the '0' on the AFC scale.

(16) For CW operation, adjust the BFO control, as required.

(17) For FSK operation, set the MODE switch to NORMAL or REVERSE, as required.

(18) On the RA.1772, set the TUNING RATE switch to LOCK.

(19) Adjust the AF GAIN for optimum clarity and level of output.

LINE LEVEL ADJUSTMENT

6. (1) Set the following controls as indicated:

POWER switch	ON
MODE switch	USB
AFC switch (if fitted)	OFF
AGC switch	OFF
IF GAIN	Fully clockwise
METER switch	AM/USB

(2) Connect a 600Ω load across the MAIN IF LINE OUTPUT terminals (TS1 pins 1 and 2) on the rear panel.

(3) Connect the CW output from a signal generator, set to a frequency of 3.5MHz and an output level of 2μV e.m.f., to the receiver antenna socket.

(4) Set the receiver tuning controls for a frequency of 3.5MHz.

(5) Precisely adjust the receiver kHz tuning for a maximum indication on the front panel meter.

(6) Set the AGC switch to SHORT.

(7) Using a thin-bladed screwdriver, adjust the AM/USB LINE LEVEL control for a 1mW audio output level, as indicated by the red line on the upper scale of the meter.

(8) Repeat the above procedure for the adjustment of the LSB LINE LEVEL control (ISB receivers) but set the MODE switch to LSB, the METER switch to LSB and transfer the 600Ω load to the ISB LINE OUTPUT terminals (TS1 pins 4 and 5).

(9) Switch off and disconnect the signal generator.

(10) Remove the 600Ω load.

CHAPTER 4

PRINCIPLES OF OPERATION

INTRODUCTION

1. This chapter describes the basic principles of operation of the RA.1771/RA.1772, in conjunction with the block diagram Fig.1.

RF BOARD

2. Two versions of the RF board are available, namely wideband and tuned. The wideband version consists of a protection circuit, a linear RF amplifier stage and a 30MHz low-pass filter, whereas the tuned version has an additional RF tuning and protection stage.

3. (1) Wideband Version The received signal, in the frequency range 15kHz to 30MHz, is fed from the antenna to a wideband protection stage. This contains a relay to open circuit the RF input for signals which exceed approximately 3V e.m.f. at the antenna socket. This relay is also used for receiver muting and operates when an earth is connected to the rear panel MUTE terminal. After operation of the relay the receiver is protected from input signals of up to at least 30V e.m.f. with automatic recovery. A 500mA fuse provides protection from higher input voltages.

(2) Tuned Version The RF tuning unit provides added selectivity where the receiver is operated in close proximity to strong interferring signals. The additional protection stage open-circuits the input to the RF amplifier for in-band signals which exceed approximately 3V e.m.f. (at the amplifier input) and the wideband protection stage is set to operate for out-of-band signals which exceed approximately 10V e.m.f. at the antenna socket.

4. After amplification in a highly linear RF stage, the received signal is passed via the 30MHz low-pass filter to the first mixer board.

LOCAL OSCILLATOR

5. The local oscillator section of the receiver comprises the 30-way MHz selection switch and associated logic board, the HF and transfer loop boards, the kHz selection switches (RA.1771) or shaft encoder and associated display (RA.1772) and the synthesizer. The receiver tuning is accomplished by driving the local oscillator, in 10Hz steps, to a frequency between 35.4 and 65.4MHz.

6. The frequency setting information from the 30-way MHz selection switch (0 to 29MHz) is translated by the logic board into binary coded decimal (BCD) signals which are applied to the transfer and HF loop boards. This causes the frequency of one of three HF oscillators on the HF loop board to be switched in 1MHz increments for each setting of the MHz switch. The kHz decade selection switch arrangement (RA.1771) or the shaft encoder with associated display (RA.1772) provides frequency information, in BCD form, to the synthesizer, which in turn provides an output frequency in 10Hz steps over the 1MHz band, 4.6 to 3.6MHz. A kHz setting of 00000 results in an output frequency of 4.6MHz and a setting of 99999 results in an output frequency of 3.6MHz.

7. The final local oscillator output frequency, in MHz, is given by 40 - f_s + N, where f_s is the output of the synthesizer in MHz and N is the setting of the MHz switch.

8. The local oscillator signal is applied to an electronic switch which is controlled by the rear panel LO switch. In the INT position the local oscillator signal is allowed to pass through the electronic switch to the first mixer board and is also available at the LO IN/OUT socket on the rear panel. When the switch is set to EXT the internal local oscillator signal is replaced by an externally generated signal from a second receiver connected to the LO/IN OUT socket.

FIRST MIXER BOARD

9. The local oscillator signal from the HF loop board is first filtered and amplified before being applied to a high performance mixer. The filter is switchable and a range information signal from the MHz selection switch selects a passband of 35.415 to 39.4MHz or 39.4 to 65.4MHz. The local oscillator signal is mixed with the received signal from the RF board and the difference frequency output is fed via a 35.4MHz band-pass filter to the second mixer board.

34MHz GENERATOR BOARD

10. This board generates a 34MHz injection frequency signal for the second mixer; it also contains a 1.4MHz carrier re-insertion generator, a 1.4MHz beat frequency oscillator (BFO) and a 1MHz divider.

11. The 5MHz output from the internal frequency standard is applied to a divide-by-five stage and the resulting 1MHz output is fed to an electronic switch; this electronic switch is controlled by the rear panel 1MHz switch. In the INT position the 1MHz signal is allowed to pass through the electronic switch and is also available at the rear panel 1MHz IN/OUT socket. When the switch is set to EXT, the 1MHz signal is replaced by an externally generated 1MHz signal (from a second receiver or frequency standard) connected to the 1MHz IN/OUT socket. The 1MHz signal is used as a common reference frequency for the synthesizer and the 34MHz generator; it is also used to generate the 1.4MHz carrier re-insertion signal.

12. The 34MHz generator consists of a 34MHz oscillator; this feeds a divide-by-34 stage and the resulting 1MHz output is phase-locked to the reference 1MHz signal derived from the frequency standard. The 34MHz output signal is fed to an electronic switch which is controlled by the 34MHz switch. In the INT position the 34MHz signal is allowed to pass through the electronic switch to a drive amplifier and is also available at the 34MHz IN/OUT socket. When the switch is set to EXT, the 34MHz signal is replaced by an externally generated 34MHz signal (from a second receiver) connected to the 34MHz IN/OUT socket.

13. The 1.4MHz generator consists of a divide-by-five stage followed by a selective filter. The 1MHz input is divided down to 200kHz and the filter selects the seventh harmonic to produce the required output at 1.4MHz. The BFO is a 1.4MHz LC oscillator with a front panel variable frequency control to provide a frequency variation of approximately plus and minus 3kHz.

SECOND MIXER BOARD

14. The 35.4MHz IF output from the first mixer is applied to the first IF amplifier; it is then fed via a 35.4MHz band-pass filter to a balanced mixer where it is mixed with the filtered 34MHz output from the 34MHz generator board. The 1.4MHz difference frequency output is then fed to the main IF/AF board via the selected 1.4MHz filter.

MAIN IF/AF/BOARD

15. This board contains the 1.4 MHz second IF amplifier, the audio and AGC detectors and the audio amplifiers. An envelope detector is provided for AM reception and a product detector for all other reception modes. The output from the AGC detector is used to control the gain of both the first and second IF amplifier stages; it is also available at a terminal on the rear panel for connection to a second receiver for diversity reception. The audio pre-amplifier has a muting capability and its output is inhibited when an earth is connected to the MUTE terminal on the rear panel. The audio output from the pre-amplifier is fed to the line amplifier and also to the loudspeaker amplifier (the input switching to the loudspeaker amplifier is only necessary in ISB versions of the receiver). The loudspeaker amplifier feeds both the internal loudspeaker and an external loudspeaker connected to a pair of rear panel terminals; it also feeds the two phone jacks on the front panel via suitable dropping resistors.

ISB IF/AF BOARD

16. This board, fitted to ISB versions of the receiver only, contains the lower sideband second IF amplifier, AGC and product detectors, and the audio amplifiers. It is similar to the main IF/AF board except that it does not contain an AM detector or a loudspeaker amplifier. The output from the AGC detector is used to control the gain of the first IF amplifier (AGC2) and the ISB channel IF Amplifier stage; it is also available at the ISB DIV AGC terminal on the rear panel for connection to a second receiver, for ISB diversity reception.

AUTOMATIC FREQUENCY CONTROL (AFC)

17. This is an optional facility to automatically lock the receiver frequency to that of the incoming carrier. The 1.4MHz IF output signal from the second mixer is applied to the carrier filter and then to the AFC board. When the frequency of the received signal is identical to the receiver frequency, the AFC board provides an output of exactly 1MHz. This is fed to the 34MHz generator board via an electronic switch (controlled by the AFC switch), where it is used in place of the 1MHz signal derived from the frequency standard. Any deviation in the frequency of the received signal results in a corresponding frequency deviation in the 1MHz output signal from the AFC board. Since the 34MHz second mixer injection signal is phase-locked to this 1MHz signal, the receiver frequency is automatically adjusted by the correct amount.

FSK BOARD

18. The optional FSK board contains an FSK adaptor and a diversity switching circuit. The adaptor circuit follows the variation of the FSK signal within the pass-band of the selected IF filter. The output from the diversity switch feeds a solid state high speed relay which drives the associated teleprinter from either a 6-0-6 V or an 80-0-80V telegraph supply, as selected by a rear panel switch. The 80-0-80V supply incorporates a barretter for limiting the line current.

ADDITIONAL OPERATING NOTES

USE OF RF TUNE CONTROL

1. Under normal receiving conditions the receiver may be operated set to wide-band, i.e. without r.f. tuning. Strong signals (greater than 100 mV e.m.f.) may produce cross modulation or intermodulation to give the effect or interfering signals on the wanted channel.

Should interference occur, use of the RF TUNE control may remove it since the cross-modulation level is raised by the r.f. tuner from 300 mV to 3V for signals more than $12\frac{1}{2}\%$ off tune.

CROSS TALK

2. During ISB operation with a.g.c. selected, a certain amount of independence (up to 20 dB) exists between the a.g.c. produced by the two i.f. boards to cater for differential fading of sideband signals. There is therefore a tendency in measurement for the a.g.c. to reduce the cross talk between the upper and lower sidebands. However, during operation, the wanted sideband signal produces an a.g.c. to suppress the unwanted sideband, and the true cross talk of 50 dB is realized. To achieve these true conditions during measurement, an equal signal is inserted into each sideband (see Tech. Spec. Page 5).

TUNING AN FSK SIGNAL

3. (1) Set the MODE switch to FSK TUNE.

(2) Set the receiver frequency approximately to the FSK signal it is desired to receive. Two alternating tones should be heard.

(3) Tune the receiver carefully, to decrease the pitch of both tones until one tone passes through zero beat and its pitch commences to increase.

(4) Now, adjust the receiver frequency so that both tones are as near as possible of the same pitch. The signal will then sound like a continuous tone with perhaps a warble and keying transients super-imposed.

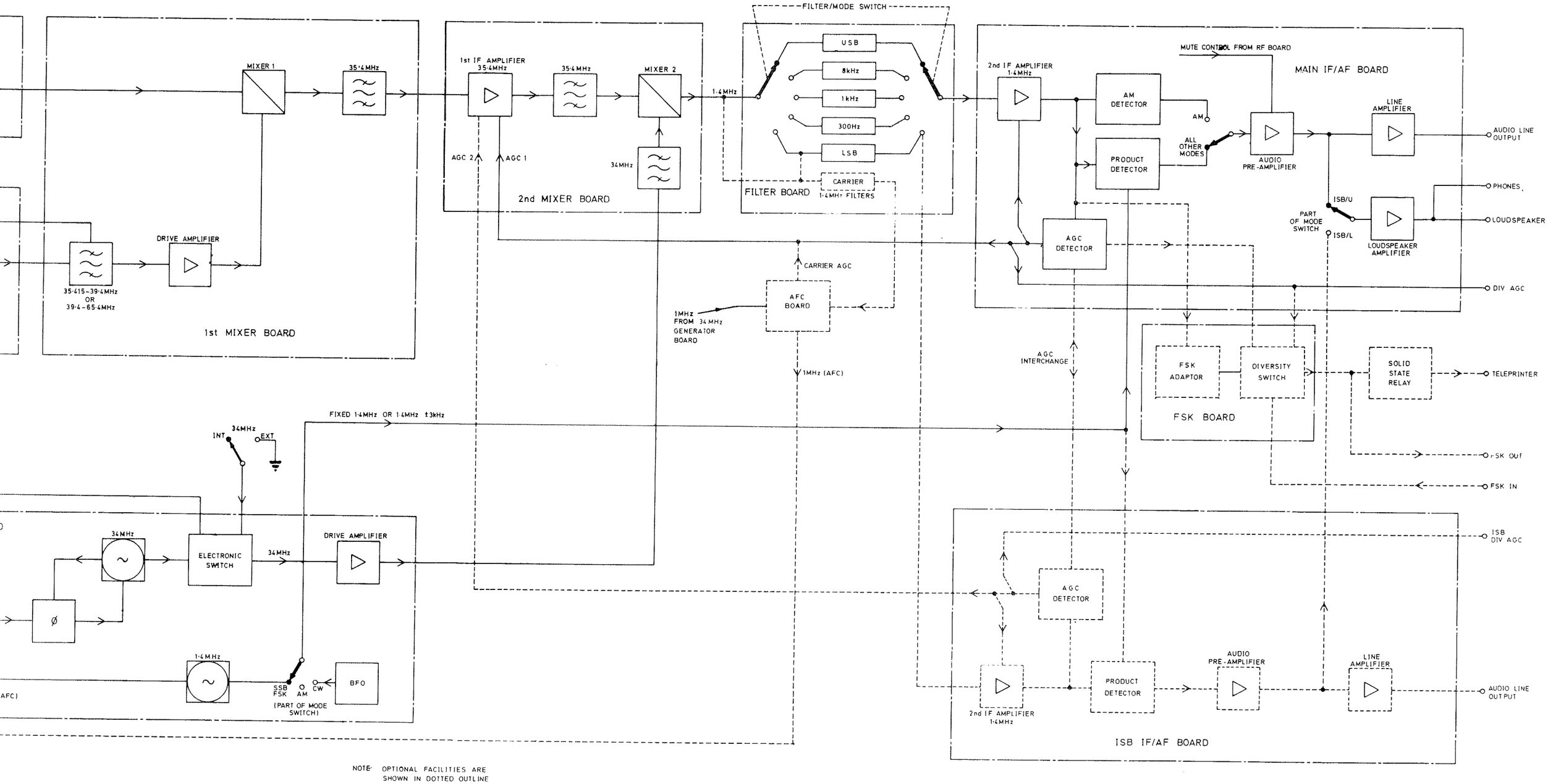
NOTE: For narrow shifts of FSK signals, this effect will be difficult to reproduce but in that case tune the receiver as near to zero beat as possible.

(5) Set the MODE switch to FSK N (normal) or FSK R (reverse) to obtain correct copy on the teleprinter.

LINE LEVEL ADJUSTMENT

4. A higher level than 1 mW may be obtained by adjustment of the AM/USB LINE LEVEL and LSB LINE LEVEL controls, but for British Post Office lines the peak level allowed is 1 mW and therefore the procedures given in paragraph 6 of Chapter 3 must be followed, with the following exception:-

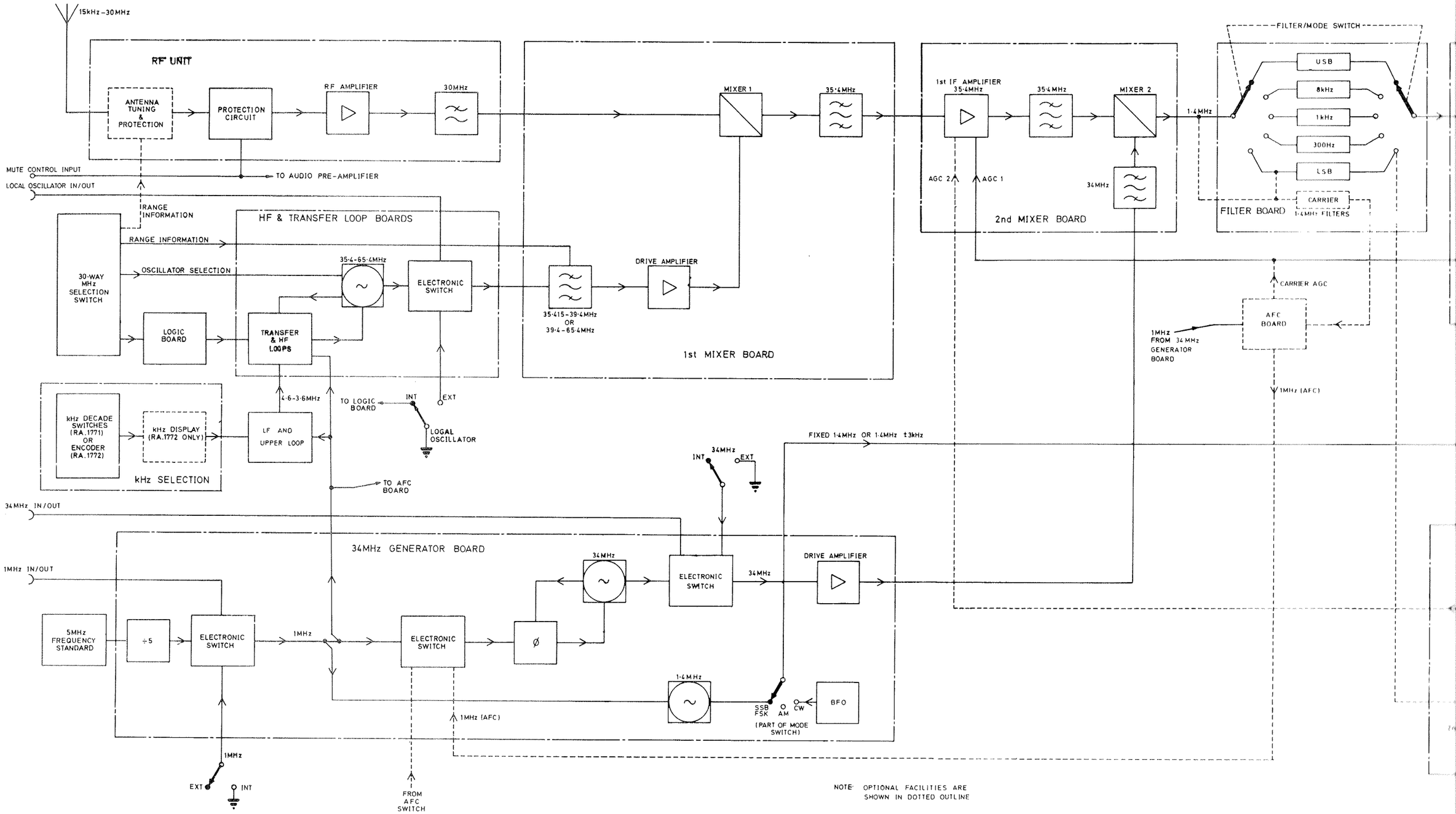
Clause 6.6 Set the AGC switch to short. Adjust the signal generator output level to 200 mV e.m.f.



NOTE: OPTIONAL FACILITIES ARE SHOWN IN DOTTED OUTLINE

Block Diagram : RA.1771/RA.1772 HF Communications Receiver

Fig. 1



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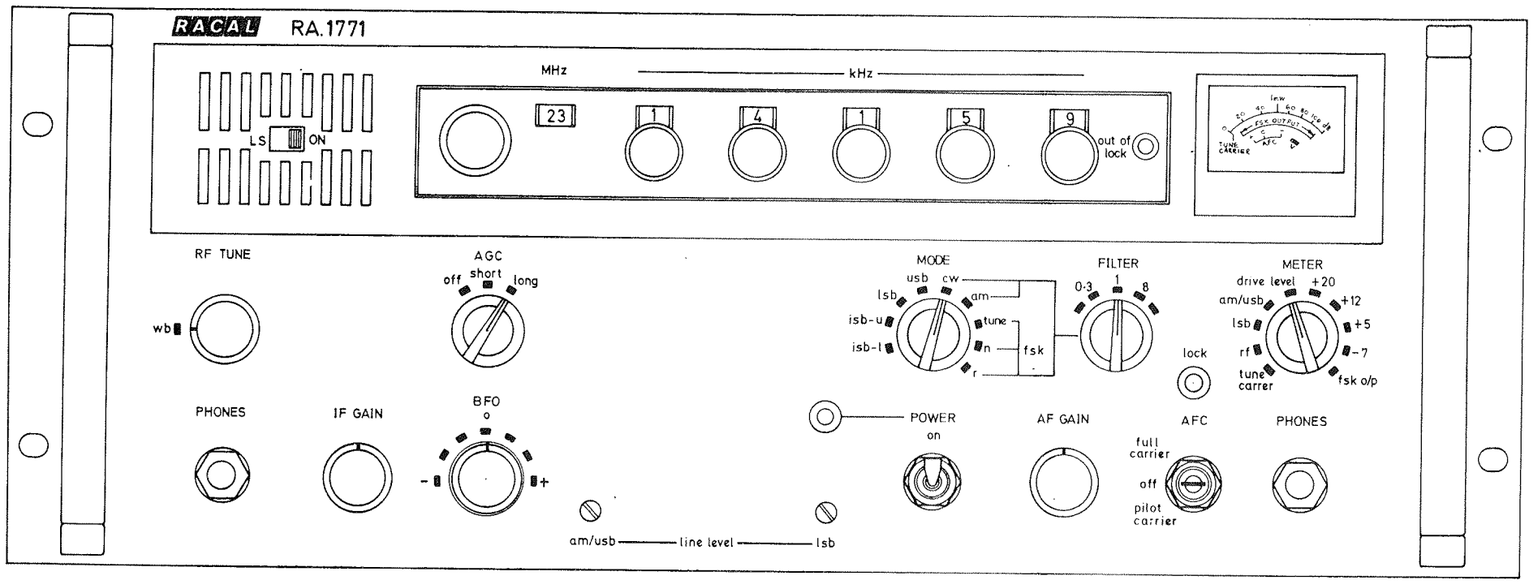
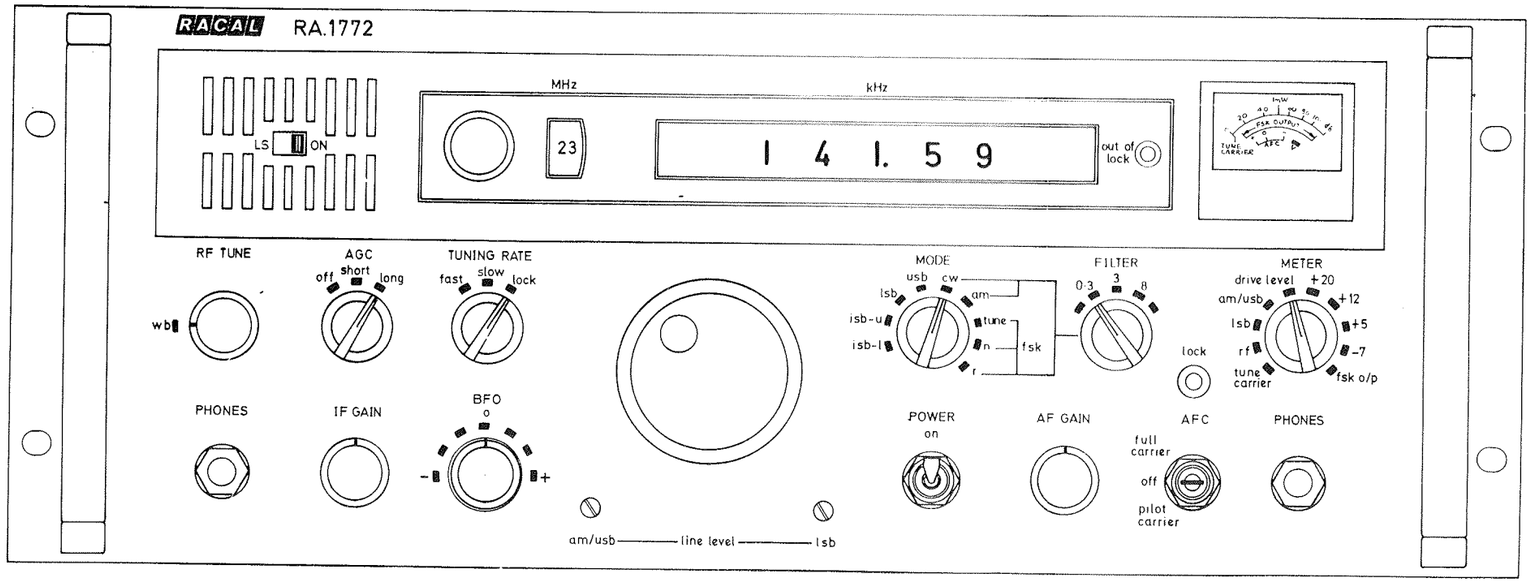
Block Diagram : RA.1771/RA.1772 HF Communications Receiver

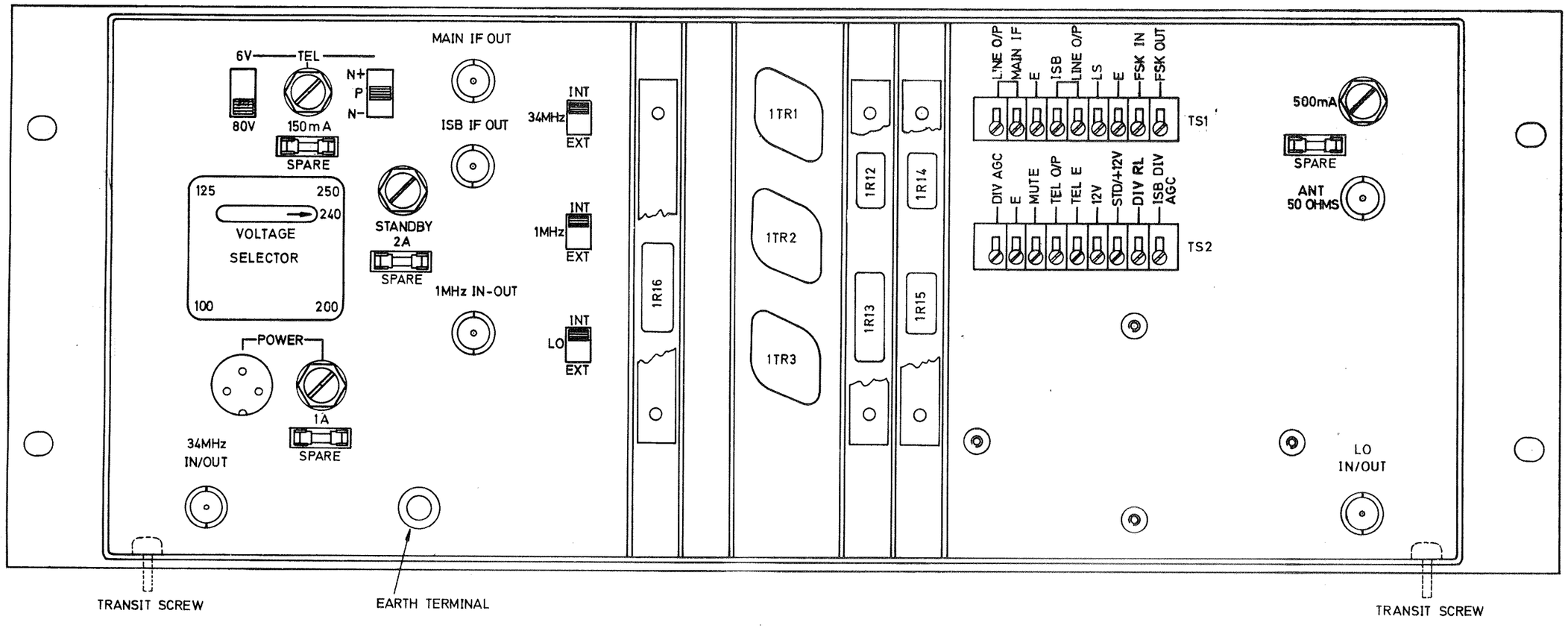




WOH3076

Layout : Front Panels

Fig. 2

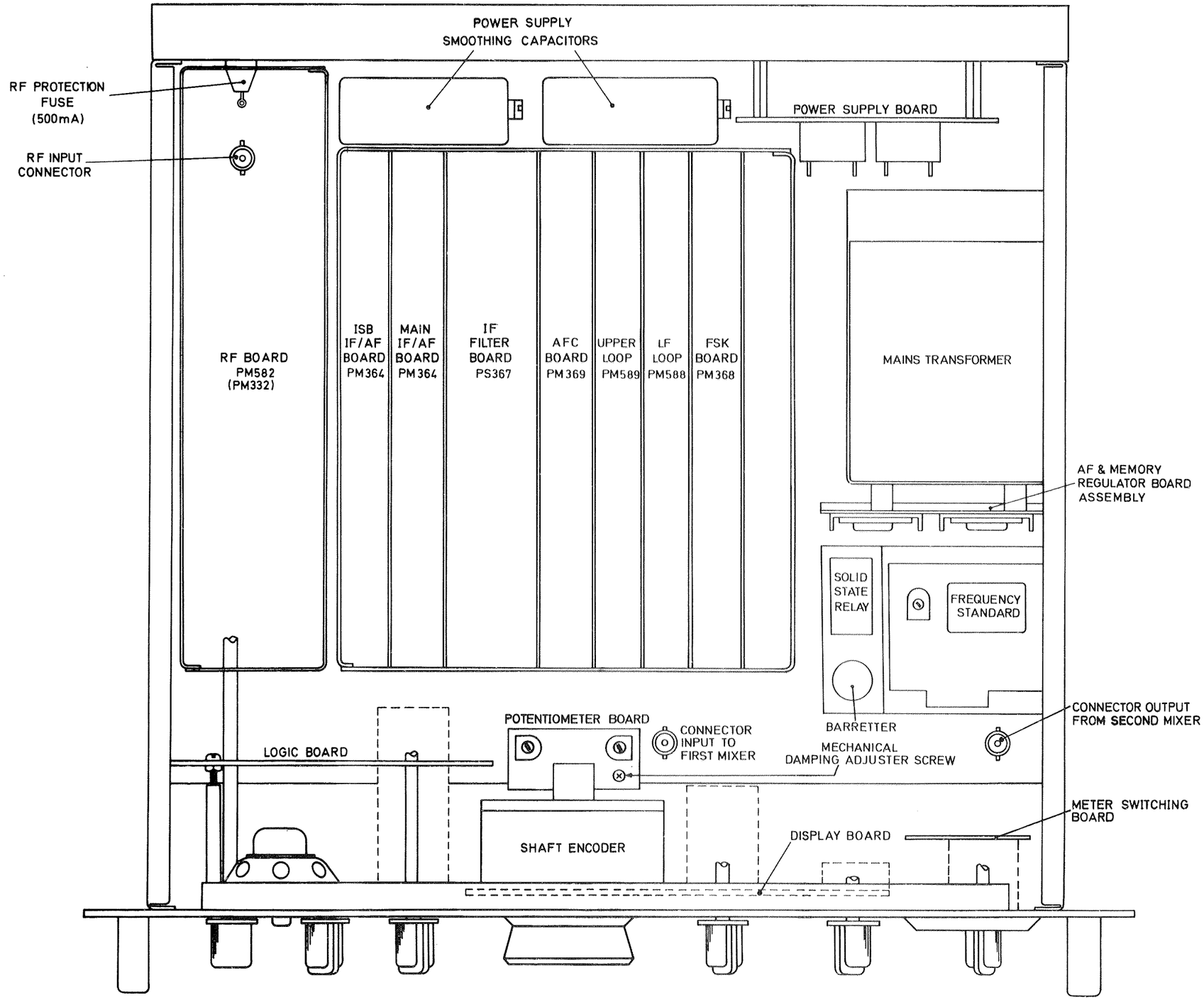


NOTE : RESISTORS 1R12 TO 1R16 FITTED TO LATER VERSIONS ONLY.

WOH3076

Layout : Rear Panel RA.1771/RA.1772

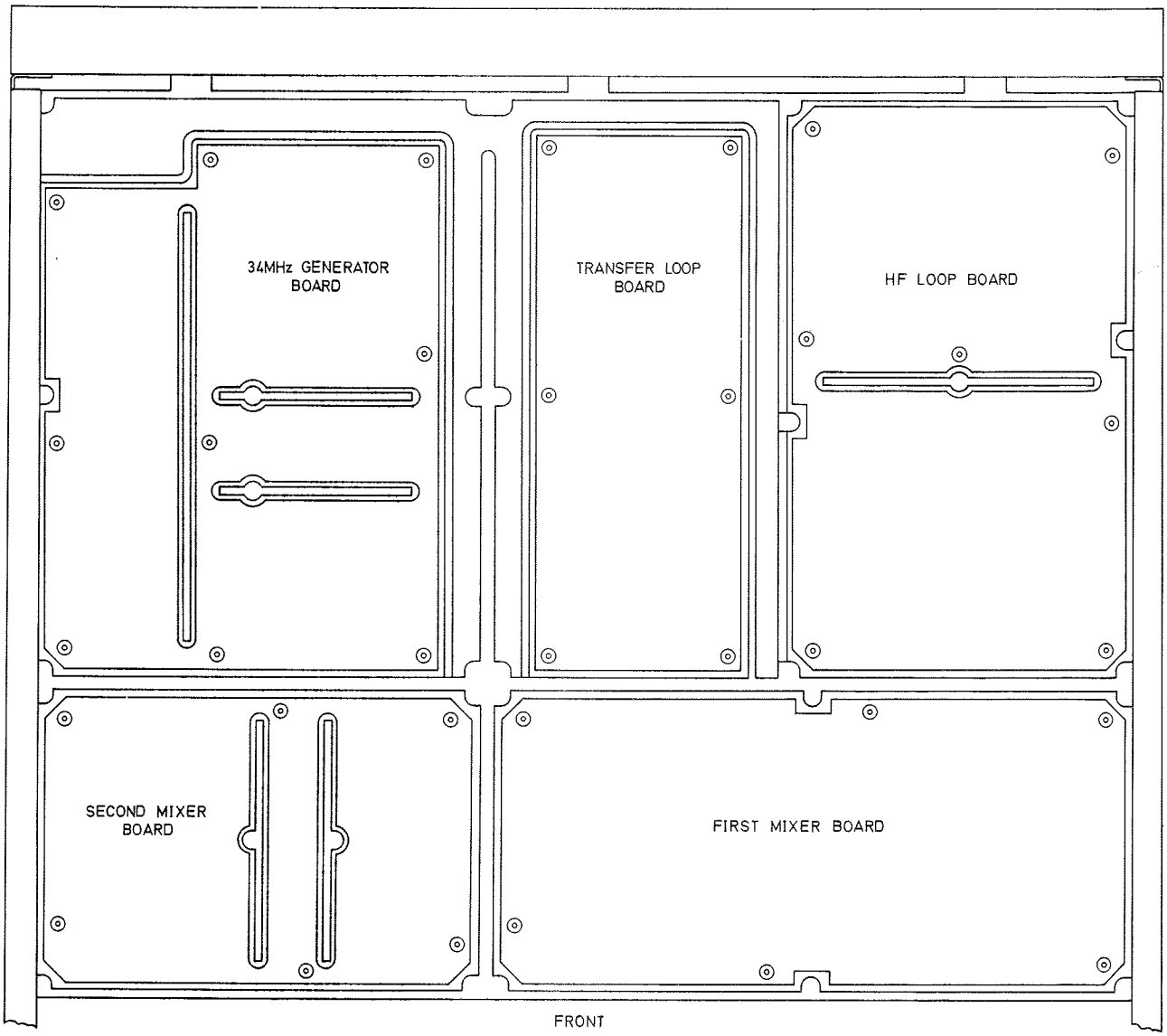
Fig. 3



WOH 3076/1

Chassis Layout : Top View RA.1772

Fig. 4



WOH3076/1 **Chassis Layout : Underside View RA.1771/RA.1772** **Fig. 5**

APPENDIX 1

AGC MANUAL OVERRIDE

INTRODUCTION

1. When the front panel AGC switch is set to SHORT or LONG, the IF gain of the receiver is automatically controlled and the IF GAIN control is inoperative. It may, under certain circumstances, be desirable to have the IF GAIN control operative in conjunction with AGC and the simple modification required to achieve this is described below.

MODIFICATION

2. The modification entails the addition of a single wire link between two tags on the AGC switch. The procedure is as follows.

PROCEDURE

3. (1) Switch off and disconnect the receiver from the supply.

(2) Remove all connections from the rear panel sockets and/or terminal strips.

(3) Remove the receiver from the rack or table-top cabinet and place it on a clean working surface. Remove the overall top cover plate (if fitted).

(4) For tuned versions only, remove the top screening cover from the RF compartment. Locate the coupling on the RF TUNE control spindle and slacken the two screws. Withdraw the RF TUNE control spindle to disengage the coupling.

(5) Slide the receiver forward such that the bottom edge of the front panel is clear of the working surface.

(6) Remove the six screws, each fitted with a nylon washer, securing the front panel to the receiver (three at each edge, adjacent to each handle).

(7) Support the front panel assembly and remove the two recessed screws, each with a spring washer, located one adjacent to each handle.

(8) Lower the front panel assembly to 'hinge' on the connecting cableform.

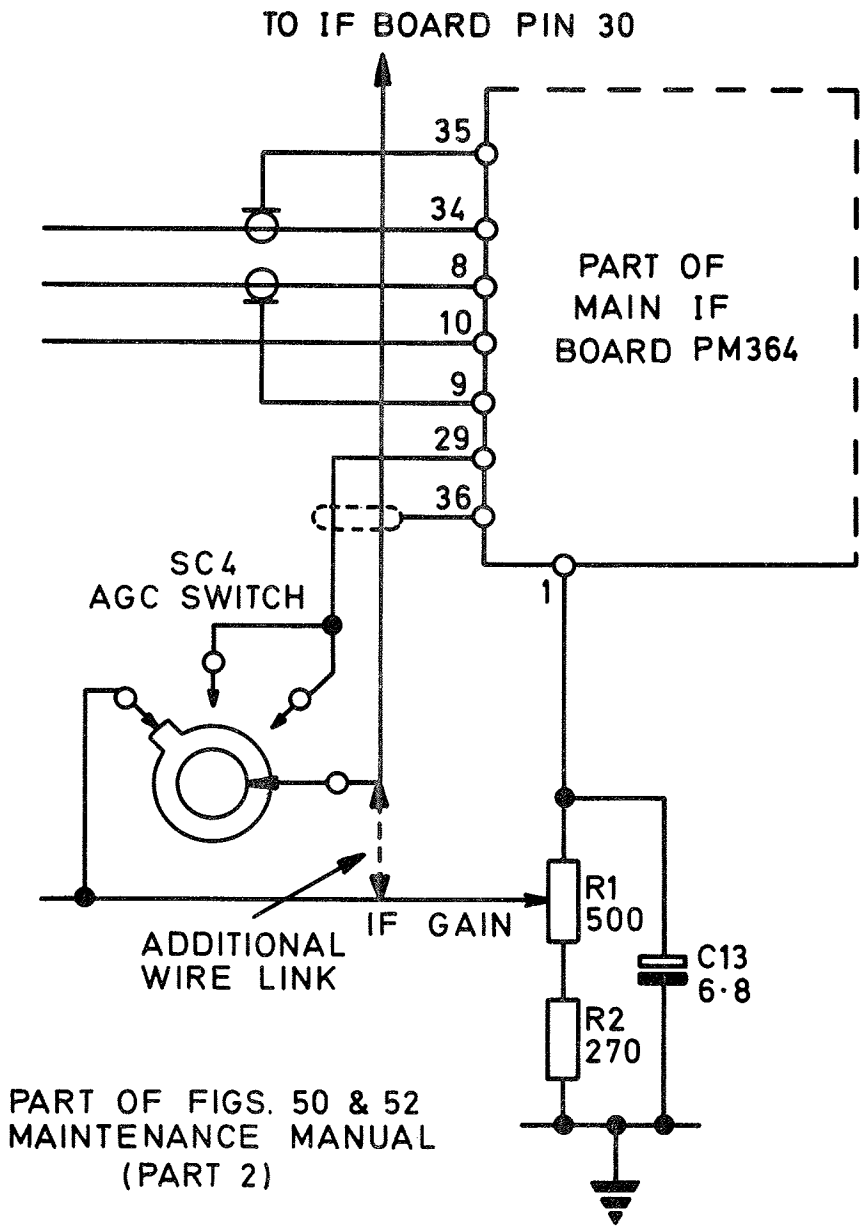
(9) Locate the rear wafer (that furthest from the front panel) of the AGC switch.

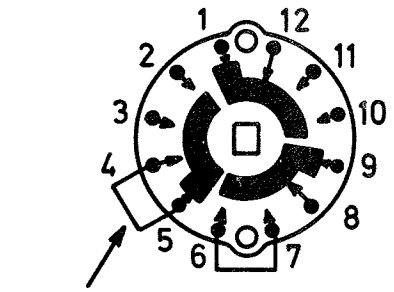
(10) With reference to Fig. App. 1.1, connect and solder a BTC wire link between tags 4 and 5.

(11) The modification to the circuit diagrams, Figs. 50 and 52 (Part 2 of the RA.1771/72 Maintenance Manual) is shown in Fig. App. 1.1.

(12) Replace the front panel assembly (and reconnect the RF TUNE control spindle, if fitted).

(13) Before returning the receiver to service, carry out a functional check to ensure that the IF GAIN control remains operative with the AGC switch set, in turn, to SHORT and LONG.





THIS IS A VIEW LOOKING FROM THE BACK OF THE AGC SWITCH. MODIFICATION APPLIES TO REAR WAFER ONLY.

WOH 3076 AGC Manual Override Modification Fig. App. 1·1

APPENDIX 2

COMMUNICATIONS RECEIVERS TYPES RA.1773 & RA.1774

INTRODUCTION

1. The RA.1773 and RA.1774 receivers consist of, respectively, the RA.1771 and the RA.1772, each fitted with the MA.1070 Connector Panel, and mounted in a Creeth Field Transit Case. The front panel view of the RA.1774 is given in Fig. App.2.1.

MA.1070 CONNECTOR PANEL

2. The MA.1070 provides for front panel access to the receiver ANTENNA socket, the SUPPLY input plug, the mute control input, the audio and teleprinter output connectors, and the earth terminal. The connections between the receiver rear panel connectors and the MA.1070 are given in Table 1.

MECHANICAL DESCRIPTION

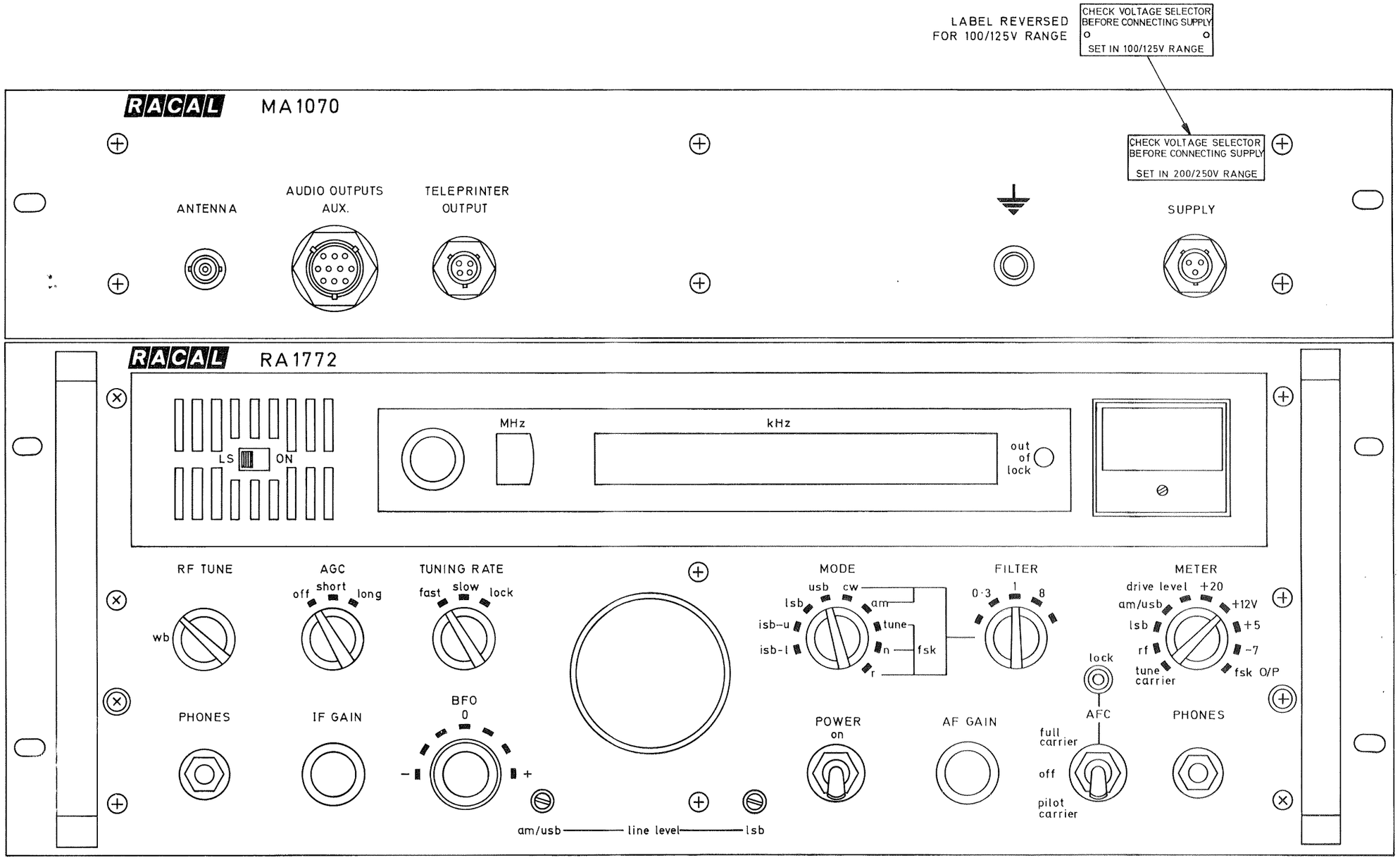
3. A diagram of the framework assembly is given in Fig. App.2.2. The receiver is secured to the framework assembly by two screws through each of the two side members, whereas the MA.1070 is secured with six screws, two at each edge and two in the centre of the panel. The framework assembly must be withdrawn from the Creeth Field Transit Case to gain access to the receiver and the connector panel.

MA.1070 CONNECTOR	RECEIVER CONNECTOR		FUNCTION
SUPPLY	POWER		
A	L		SUPPLY INPUT
B	N		
C	E		
TELEPRINTER OUTPUT	TERMINAL STRIP		
A	TS2/4 TEL O/P		OUTPUT TO TELEPRINTER
B	TS2/5 TEL E		
C	NOT CONNECTED		SPARE
D	NOT CONNECTED		
AUDIO OUTPUTS AUX.	TERMINAL STRIP		
A	TS1/1	LINE O/P MAIN IF	AUDIO LINE OUTPUT SSB: USB or LSB as selected ISB: USB
B	TS1/2		
C	TS1/3 E (SCREEN)		
D	TS1/4	ISB LINE O/P	AUDIO LINE OUTPUT ISB ONLY: LSB
E	TS1/5		
F	TS1/3 E (SCREEN)		
G	TS1/6 LS		1 WATT (8 ohm) OUTPUT TO LOUDSPEAKER
H	TS1/7 E		
J	TS2/3 MUTE		MUTE CONTROL INPUT
K	NOT CONNECTED		SPARE

TABLE 1: INTERCONNECTIONS

MA.1070 COMPONENTS LIST

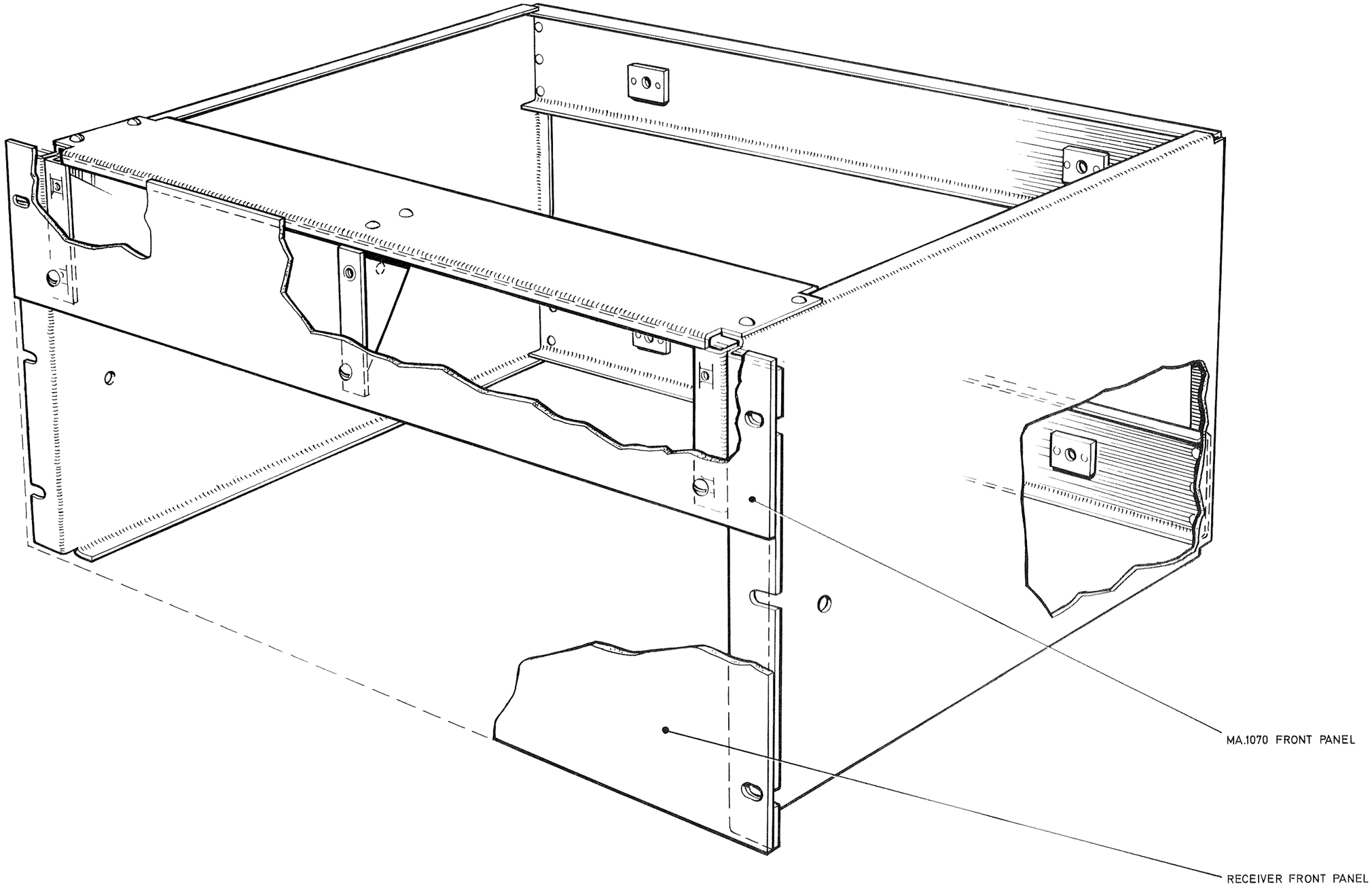
Description	Racal Part Number	Manufacturer
Socket, coaxial, bulkhead (ANTENNA)	916396	Transradio BN6/5A
Mating plug, coaxial, BNC	900038	Transradio BN1/5
Socket, bulkhead, 10-way (AUDIO)	924099	Amphenol 62G8-1AF-12-10S
Mating plug, free	924102	Amphenol 62G8-16F-12-10P
Socket, bulkhead, 4-way (TELEPRINTER)	924100	Amphenol 62G8-14F-8-4S
Mating plug, free	924103	Amphenol 62G8-16F-8-4P
Plug, bulkhead, 3-way (SUPPLY)	924101	Amphenol 62G8-14F-8-3.3P
Mating socket, free	921447	Amphenol 62G8-16F-8-3.3S
Earth Terminal	916413	Belling Lee L136/1
Earth Terminal panel fittings	924106	Belling Lee 02



WOH 4144

Layout: RA.1774 Front Panel

Fig. App.2.1



WOH4144

Framework Assembly : RA.1773/74

Fig. App. 2.2

APPENDIX 3

DIVERSITY RECEPTION

CONTENTS

ILLUSTRATIONS

APPENDIX 3

DIVERSITY RECEPTION

INTRODUCTION

1. Two receivers may be interconnected for FSK diversity reception and, by using the Racal audio switching unit MM532, for SSB/ISB diversity reception. This appendix contains the interconnection details and also a brief description of the audio switching unit. (For detailed technical information reference should be made to the RA.1771/72 Maintenance Manual).

SPACE DIVERSITY

2. For space diversity reception the two receivers are operated at the same frequency and are usually connected in the master-slave configuration, i.e. the synthesizer of the master receiver (receiver A) is used to control both receivers whilst the synthesizer of the slave receiver (receiver B) is disabled. This achieved by connecting the LO, 34MHz and 1MHz sockets of receiver A to those of receiver B, setting the LO, 34MHz and 1MHz INT/EXT switches of receiver A to INT, and those of receiver B to EXT. (The 34MHz connection is only required for receivers equipped with the AFC facility).

3. The kHz tuning control of receiver B will now have no function, and the out-of-lock lamp will illuminate to indicate slave operation. Where receivers equipped with the RF TUNE facility are employed, the MHz switch on each receiver must be set to the same frequency and the RF TUNE control on each receiver should be tuned (where required) in accordance with the tuning instructions given in Chapter 3.

4. The received signals from the two differently located or polarised antennas are ultimately compared with each other and the one with the better signal-to-noise ratio is selected. The comparison and selection circuitry for FSK diversity reception is contained on the FSK boards, whilst that for SSB/ISB diversity reception is contained in the audio switching module MM532.

FREQUENCY DIVERSITY

5. In a frequency diversity system two different frequencies are used, each carrying the same intelligence. Each receiver is operated independently (LO, 34MHz and 1MHz INT/EXT switches set to INT) and the received signal with the best signal-to-noise ratio is ultimately selected, as for space diversity described above.

FSK SPACE DIVERSITY RECEPTION

6. The interconnection diagram for FSK diversity reception is given in Fig.App.3.1. With this arrangement, two teleprinters may be operated from receiver A provided each is fitted with a current limiting resistor (see Chapter 2 paragraph 17). Should three

or four teleprinters be required, then by connecting the FSK OUT terminal of receiver A to the FSK IN terminal of receiver B, the additional teleprinter(s) may be operated from receiver B. (Again each must be fitted with a current limiting resistor.)

7. Certain installations may require SSB or ISB diversity reception in addition to the FSK facility. The interconnection diagram for SSB diversity with the FSK facility is given in Fig. 3.2, whilst that for ISB diversity reception with the FSK facility is given in Fig. 3.3. The only difference between Fig. 3.1 and Figs. 3.2, 3.3, as far as FSK diversity is concerned, is the DIV AGC connection; this is made by a relay in the audio switching module, via the DIV RL (diversity relay) terminal of receiver A, when the MODE switch of receiver A is set to any FSK position.

SSB SPACE DIVERSITY RECEPTION

8. The interconnection diagram for SSB diversity reception is given in Fig. App. 3.2. The audio switching module is mounted on the rear panel of receiver A with the orange and black flying leads connected to the +12V and E terminals respectively of TS2. The receivers are connected in the master/slave configuration as described in paragraph 2. The DIV RL and teleprinter connections are only required for FSK versions.

ISB SPACE DIVERSITY RECEPTION

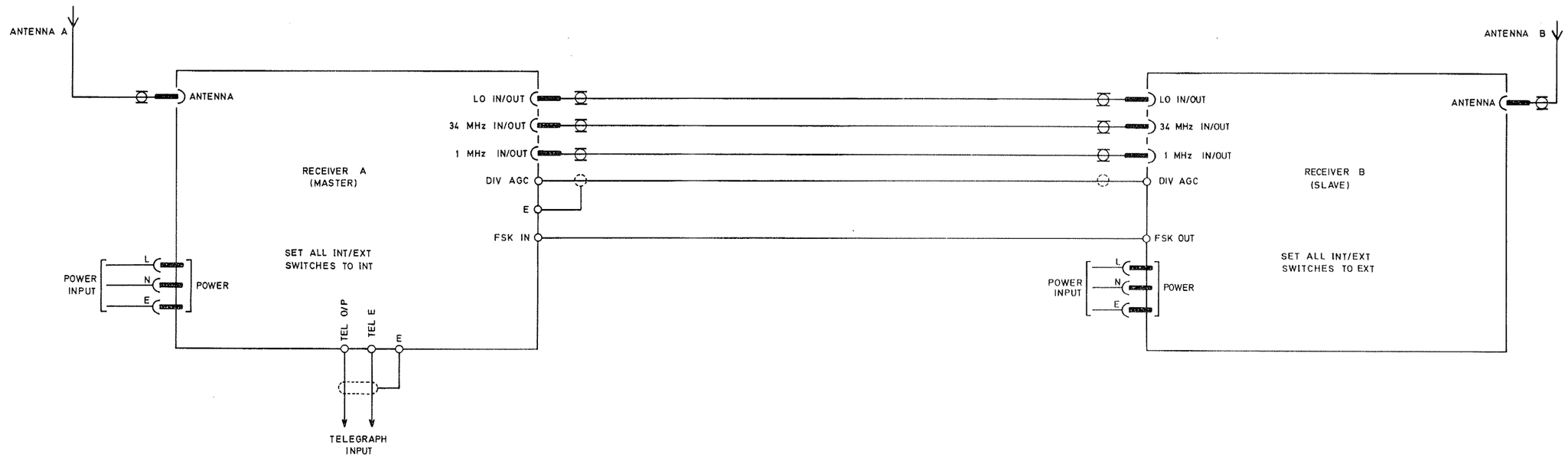
9. For ISB diversity reception, the audio switching module fitted to receiver A contains additional circuitry for the ISB (LSB) channel (see paragraph 10). As for SSB space diversity, the receivers are connected in the master/slave configuration, and the DIV RL and teleprinter connections are only required for FSK versions.

AUDIO SWITCHING UNIT MM532

10. Two versions of the audio switching unit are available; version A contains a single audio diversity combiner board for single channel (SSB) operation, whereas the B version contains a pair of boards for ISB operation. The layout diagram is given in Fig. App. 3.4.

AUDIO DIVERSITY COMBINER BOARD PM533/1

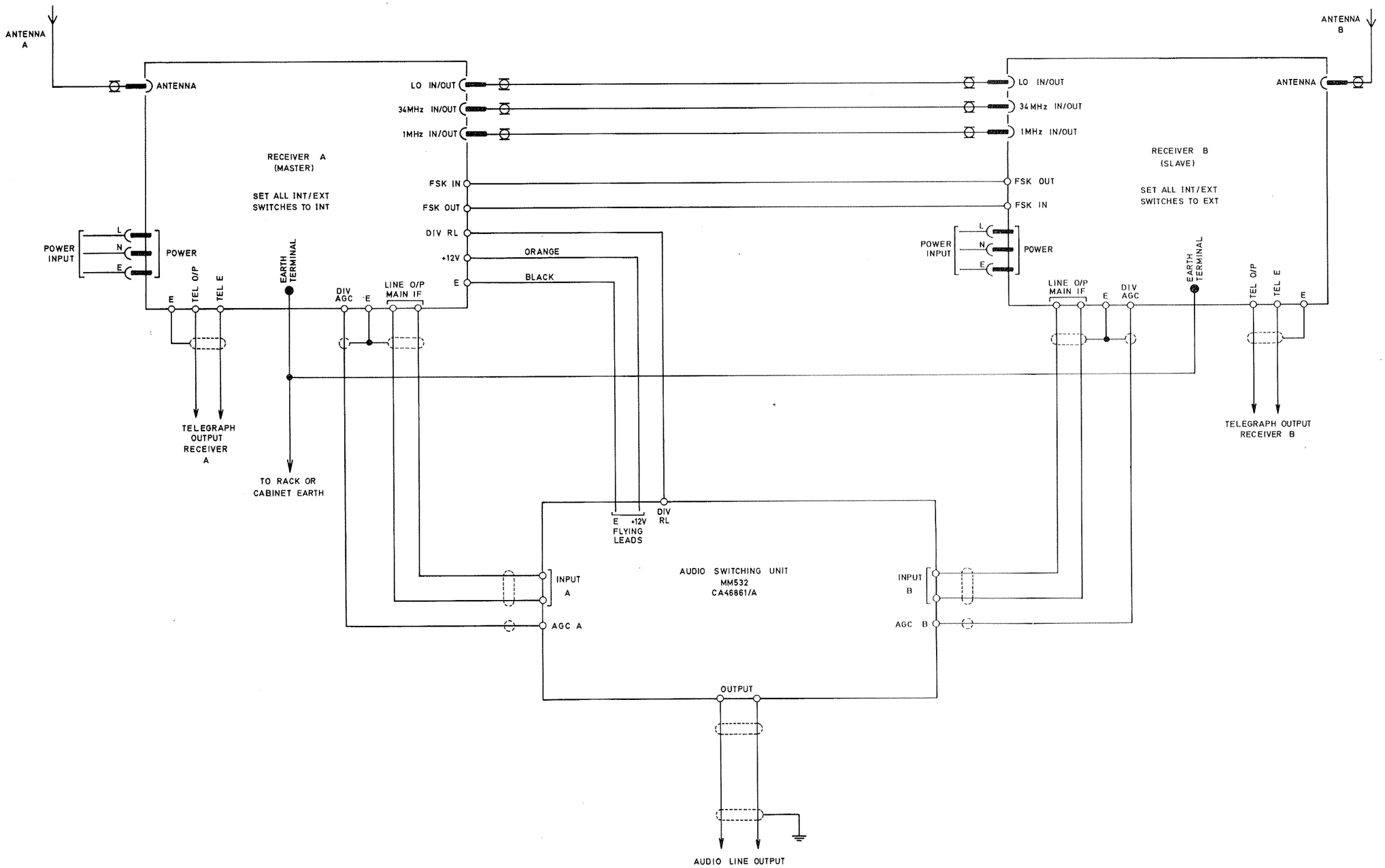
11. The audio diversity combiner circuit consists basically of an electronic switch which selects either channel A or channel B dependent on which channel has the highest level of AGC voltage. An audio signal zero-crossover detector circuit ensures that switching between channels occurs only at the zero-crossover point, to avoid the introduction of switching distortion and clicks.



WOH 3076

Interconnection Diagram: FSK Space Diversity Reception

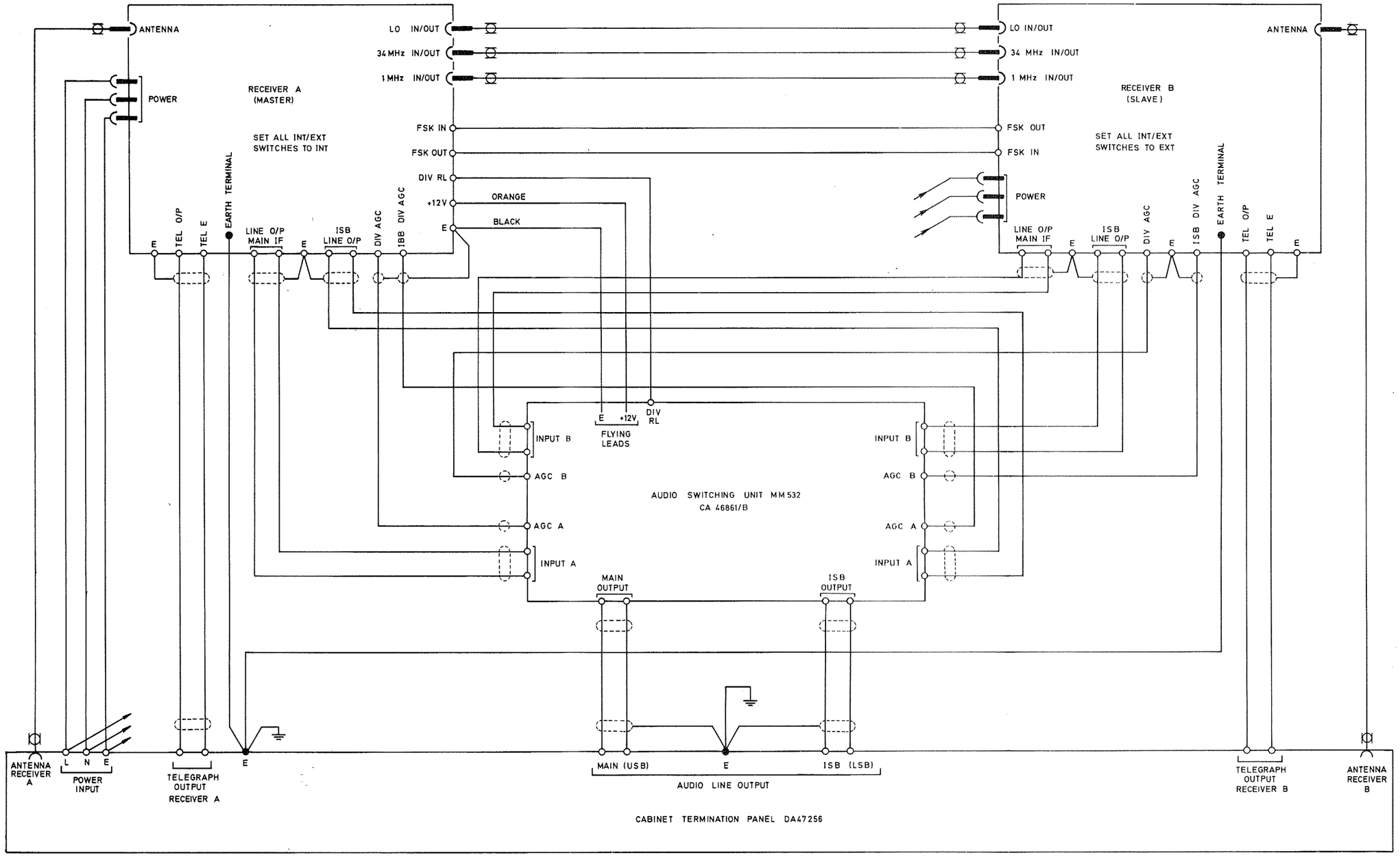
Fig. App. 3·1



WOH 3076

Interconnection Diagram: SSB Space Diversity with FSK Facility

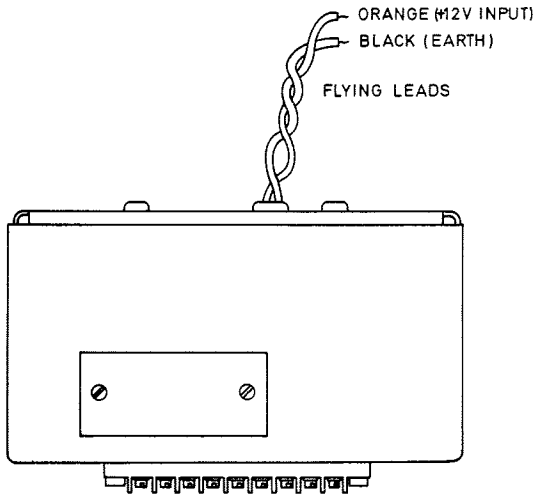
Fig. App. 3·2

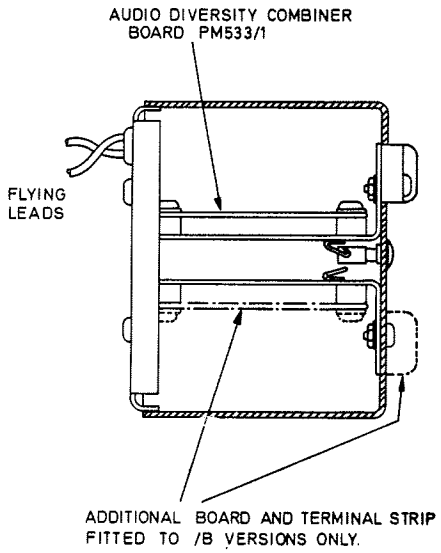


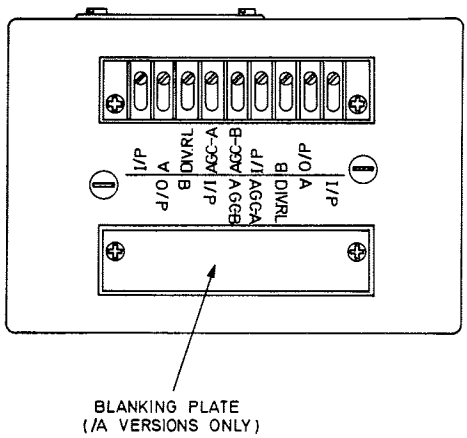
WOH 3076

Typical Installation: ISB Space Diversity Receiving Terminal with FSK Facility

Fig. App. 3·3







WOH3076 CA46861 B

Layout : Audio Switching Unit MM532 **Fig. App.3·4**

APPENDIX 4

12V BATTERY MODULE MS540

CONTENTS

ILLUSTRATIONS

APPENDIX 4

12V BATTERY MODULE MS540

INTRODUCTION

1. When the POWER switch on the RA.1772 is set from OFF to ON, the kHz portion of the digital frequency display is automatically reset to 00.000. It follows from this that should a brief interruption of the power supply input occur, the kHz portion of the receiver frequency will again be reset to zero. In order to retain the frequency setting information of the receiver during a brief interrruption of the power supply input, and so avoid a possible loss of received information, the 12V battery module is available as an optional extra.

MECHANICAL DESCRIPTION

2. The battery module consists of a small metal box housing a re-chargeable nickel-cadmium battery and a printed board. The module is mounted on the rear panel of the receiver and is held in place with two screws. The main power supply input is connected to the module POWER I/P plug and the POWER O/P socket, on a flying lead, is connected to the receiver POWER plug. Two further flying leads provide for the connection of the 12V output to the receiver +12V/STD terminal (red) and the +12V input from the receiver +12V terminal (orange). A battery ON/OFF switch and a DATE OF LAST CHARGE label are included. The layout of the module is given in Fig. App. 4.1.

TECHNICAL DESCRIPTION

3. A brief technical description only is given. For detailed information and circuit details reference should be made to the RA.1771/72 maintenance manual.

4. A 5 kHz free running astable multivibrator, powered from the receiver +12V supply, produces a square-wave output signal of approximately 12V peak-to-peak. This is applied to a current pump circuit and the resultant +15V (approximately) output is routed to the battery via the ON position of the BATTERY ON/OFF switch, and also to the receiver via an electronic switch and the +12V/STD terminal.

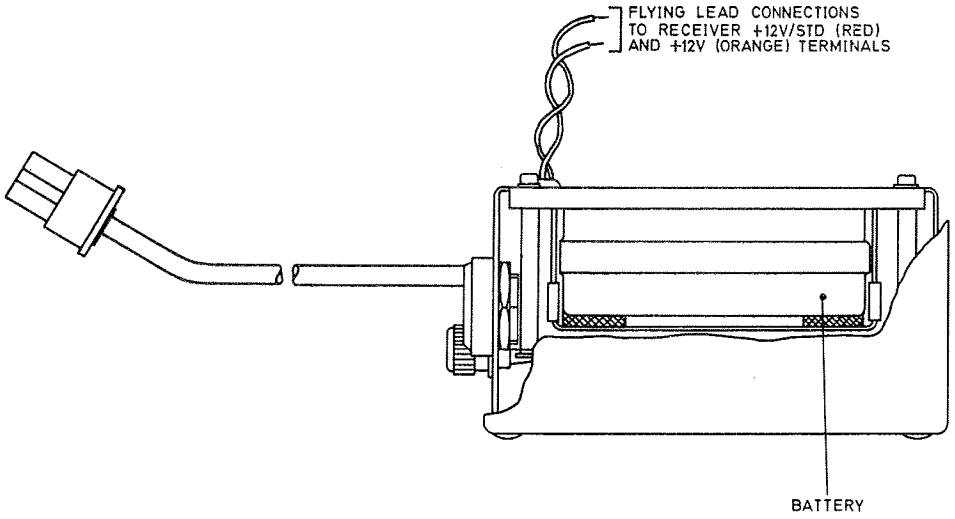
5. The electronic switch is controlled such that in the event of a power failure the battery is allowed to discharge through the electronic switch to provide a +12V output to the receiver +12V/STD terminal. If, however, the receiver POWER switch is set to OFF and the power input subsequently fails or is disconnected, then the electronic switch prevents the battery discharging into the external circuitry.

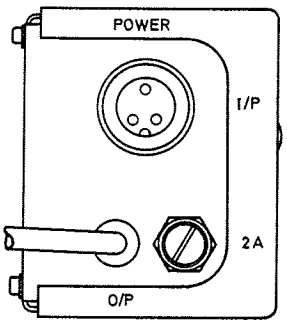
IMPORTANT NOTE It is essential that the receiver POWER switch is set to OFF before the receiver is disconnected from the main source of power. Failure to observe this precaution will result in a simulated power failure and the battery will become fully discharged in approximately 30 minutes.

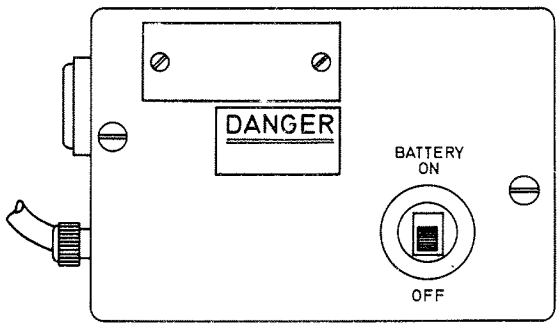
6. Should the on-load battery output voltage fall (during a power failure) to approximately 10V, then the electronic switch changes state and the battery is isolated. The electronic switch maybe reset only by restoring the power supply and switching on the receiver.

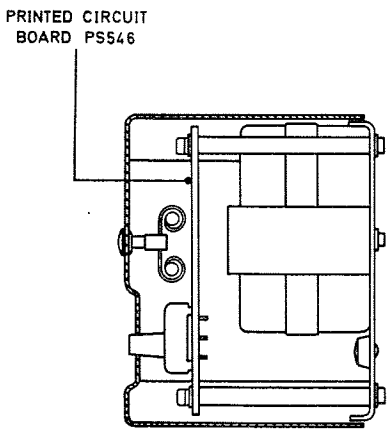
7. When the BATTERY ON/OFF switch is set to OFF, the battery is disconnected from the electronic switch.

WARNING Lethal voltages exist within this module. Switch off and disconnect the supply before removing the module cover.









SECTIONAL VIEW

Layout
12V Battery Module MS540

Fig. App. 4·1

APPENDIX 5

ISB-SSB CONVERSION

INTRODUCTION

1. In ISB versions of the RA.1770 series of receivers, the USB IF output appears at the MAIN IF OUT socket and the LSB IF output appears at the ISB IF OUT socket, regardless of the position of the MODE switch. Similarly, the USB audio line output appears at the LINE O/P MAIN IF terminals and the LSB audio line output appears at the ISB LINE O/P terminals, regardless of the position of the MODE switch.

2. This Appendix describes a simple modification to convert an ISB receiver to an SSB receiver, where the IF output (USB or LSB, as selected by the MODE switch) appears at the MAIN IF OUT socket and the corresponding audio line output appears at the LINE O/P MAIN IF terminals. Once the modification is carried out, the ISB IF/AF board, together with the ISB IF OUT socket, the ISB LINE O/P terminals and the LSB LINE LEVEL control, serve no useful function.

MODIFICATION INSTRUCTIONS

3. (1) Switch off and disconnect the receiver from the supply.

(2) Remove all external connections from the rear panel sockets and/or terminal strips.

(3) Remove the receiver from the rack or table-top cabinet and place it on a clean working surface.

(4) Remove the overall top cover plate (if fitted) and the cover plate over the central box structure.

(5) Raise the filter board PS367 and remove the link connecting board pins 19 and 21 (Figs. 24 and 25 of the RA.1771/72 Maintenance Manual).

(6) Add a wire link between pins 19 and 20 on the filter board. Replace the board.

(7) Raise the ISB IF/AF board PM364. Remove the red lead connected to board pin 8. Fit an insulating sleeve over the end of the removed lead. Replace the ISB IF/AF board.

(8) Slide the receiver forward such that the bottom edge of the front panel is clear of the working surface.

(9) Remove the six screws, each fitted with a nylon washer, securing the front panel to the receiver (three at each edge, adjacent to each handle).

(10) Support the front panel assembly and remove the two recessed screws, each with a spring washer, located one adjacent to each handle.

(11) Lower the front panel assembly to 'hinge' on the connecting cableform.

(12) Locate the third wafer (from the front panel) of the MODE switch, SA3.

(13) With reference to Fig. 50 or 52 (RA.1771/72 Maintenance Manual) connect a wire link between contacts 3 and 4 on the lower side of wafer SA3, i.e. the LSB and USB contacts.

(14) Replace the front panel assembly and the top cover plate(s).

(15) Before returning the receiver to service, carry out a functional check to ensure correct SSB operation.

APPENDIX 6

13kHz IF OUTPUT FOR SPECTRUM ANALYSIS

INTRODUCTION

1. This appendix describes a simple modification to ISB versions of the receiver to provide a 13kHz IF output for spectrum analysis using an RF Display Unit, such as the Racal RA.1766. The ISB IF/AF board (LSB channel) is used as a panoramic amplifier, and the 13kHz IF output signal is made available at the ISB IF OUT socket on the rear panel. This modification may only be carried out on receivers that do not contain the AFC facility.

MODIFICATION PROCEDURE

2. (1) Switch off and disconnect the receiver from the supply.

(2) Remove all connections from the rear panel sockets and/or terminal strips.

(3) Remove the receiver from the rack or table-top cabinet and place it on a clean working surface. Remove the overall top cover plate (if fitted).

(4) For tuned versions only, remove the top screening cover from the RF compartment. Locate the coupling on the RF TUNE control spindle and slacken the two screws. Withdraw the RF TUNE control spindle to disengage the coupling.

(5) Slide the receiver forward such that the bottom edge of the front panel is clear of the working surface.

(6) Remove the six screws, each fitted with a nylon washer, securing the front panel to the receiver (three at each edge, adjacent to each handle).

(7) Support the front panel assembly and remove the two recessed screws, each with a spring washer, located one adjacent to each handle.

(8) Lower the front panel assembly to 'hinge' on the connecting cableform.

(9) Locate the front wafer (that nearest the front panel) of the AGC switch.

(10) With reference to Fig. App. 6.1, connect and solder a BTC wire link between tags 4 and 5.

(11) Replace the front panel assembly (and reconnect the RF TUNE control spindle, if fitted).

(12) Remove the cover plate from the board compartments and raise the filter board PS367. Secure the board in the upright position.

(13) Install a 13kHz filter (part number BD 45253) in position FL6 on the filter board.

(14) Connect and solder wire links (three off) between the following pins on the filter board:

Pin 17 to Pin 18
Pin 19 to Pin 20
Pin 22 to Pin 24

(15) Unsolder and remove the coaxial cable from pins 6 and 7 on the filter board. Fit an insulating sleeve over the ends of the removed cable.

(16) Unsolder and remove the coaxial cable from pins 4 and 5 on the filter board; reconnect this cable to pins 6 and 7 (screen to pin 7) on the filter board.

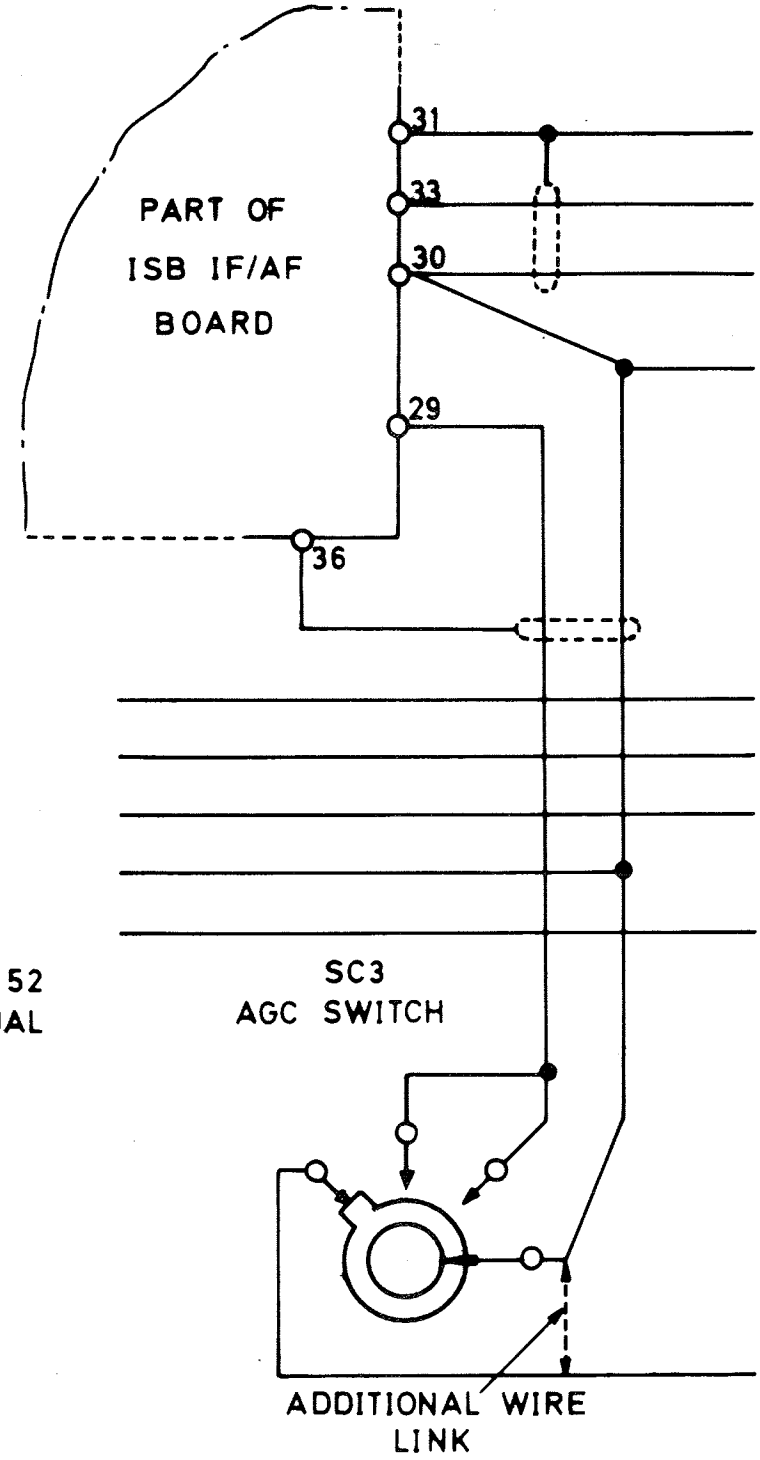
(17) Return the filter board to its compartment.

(18) Raise and secure the main IF/AF board. Unsolder and remove diode D1. Return the board to its compartment.

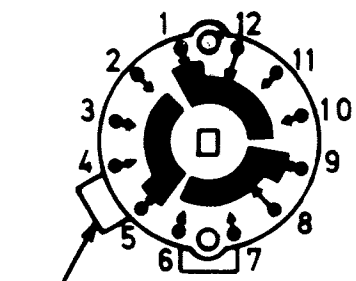
(19) Raise and secure the ISB IF/AF board. Unsolder and remove diode D1. Return the board to its compartment, and replace the cover plate.

(20) Replace the receiver overall top cover plate (if fitted) and return the receiver to the rack or table-top cabinet.

(21) Before returning the receiver to service, carry out a functional check to ensure correct operation.



PART OF FIGS. 50 & 52
MAINTENANCE MANUAL
(PART 2)



THIS IS A VIEW LOOKING FROM THE BACK OF THE AGC SWITCH.
MODIFICATION APPLIES TO FRONT WAFER ONLY.

WOH 5125

Wiring Change: AGC Switch Fig. App6·1

RACAL COMMUNICATIONS LIMITED, BRACKNELL, BERKSHIRE

AMENDMENT TO

RA.1771/72 HF COMMUNICATIONS RECEIVERS OPERATORS MANUAL

CHAPTER 3

Page 3-5 Paragraph 6

Add the following sentence to sub paragraph (6):-

See paragraph 4 in the Additional Operating Notes at the end of Chapter 4, for the setting-up procedure when the line output is connected to BPO lines.