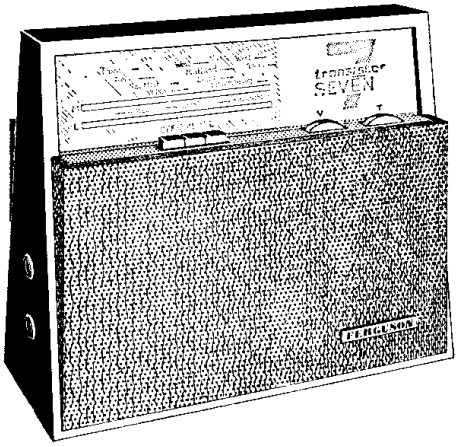
FERGUSON TRANSISTOR TABLE RADIO MODEL 433

SERVICE MANUAL



SPECIFICATION

Batteries

This receiver requires a 9 volt battery, Ever Ready PP9, Drydex DT9, GEC BB29 or Vidor T6009.

Waveranges

MW ... 183—556 metres ; L W... 1136—2040 metres.

Loudspeaker. 5 in. round 30Ω speech coil.

Case Dimensions—overall

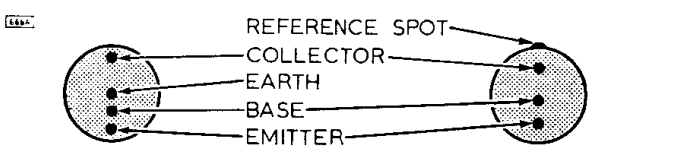
12 in. wide x 10⅛ in. high x 4 in. deep.

Power Output 600mW

Battery Consumption. 20mA for average output.

Transistors and Diodes

VT1	AF117 or OC170.		Self-oscillating mixer.
VT2	AF117 or OC170.		1st IF amplifier.
VT3	AF117 or OC170.		2nd IF amplifier.
VT4	OC71.		Audio amplifier.
VT5	OC81D.		Audio driver.
VT6	OC81	Matched pair	Push-pull output.
VT7	OC81		
W1	OA79		Overload limiter.
W2	OA90		Audio detector.



Type AF117 (OC170) Types OC71, OC81 & OC81D

Fig. 1. Transistor Connections.

SERVICE NOTES

This receiver employs germanium alloy junction (P-N-P) type transistors. This type of transistor has been used for a number of years in various applications and has proved to be a thoroughly reliable component. When the receiver requires servicing, therefore, the source of the fault is not likely to be due to transistor failure and attention should first be directed to other parts of the circuit.

Fault finding may be carried out in the usual way, but the following points should be particularly noted :—

1. Make full use of the voltage measurements given in the circuit diagram. Although the receiver will still operate when the battery voltage falls to about 6 volts, a new battery should be used for checking purposes. Distortion will be apparent if the voltage of the battery falls appreciably.

2. Apart from total current consumption, no other current measurements should be attempted. Under 'no signal' conditions, the total current consumption will be approximately 12mA. Consumption rises immediately a signal is applied, to approximately 20mA for average listening volume.

3. When a signal generator is used for circuit checking, use the direct output, and inject via a 0.1uF capacitor.

4. To check oscillator operation, measure the voltage across VT1 emitter stabilizing resistor R3. This should be approximately 1 volt. Short-circuit the oscillator section of the tuning gang and check if the voltage across R3 changes. The voltage should drop by approximately 0.2 volt. If there is no change, it may be assumed that the oscillator is not operating.

5. Transistors should not be replaced unless voltage checks, etc., indicate that replacement is necessary. Use only a Service Replacement (obtainable from our Service Depots) to ensure that the performance of the receiver is not impaired. The power output transistors are a matched pair : if one becomes faulty both must be replaced by a new matched pair.

6. Extreme care should be taken when unsoldering or soldering transistors as they can easily be damaged by excessive heat. The lead wires of a replacement transistor must not be shorter than the one removed. Do not apply the iron for longer than necessary and grip the wires with a pair of pliers to reduce heat conduction to the transistor.

7. If the DC resistances of some inductors are measured in circuit, two readings can be obtained depending on which way round the meter is connected. The higher readings are shown in the circuit diagram.

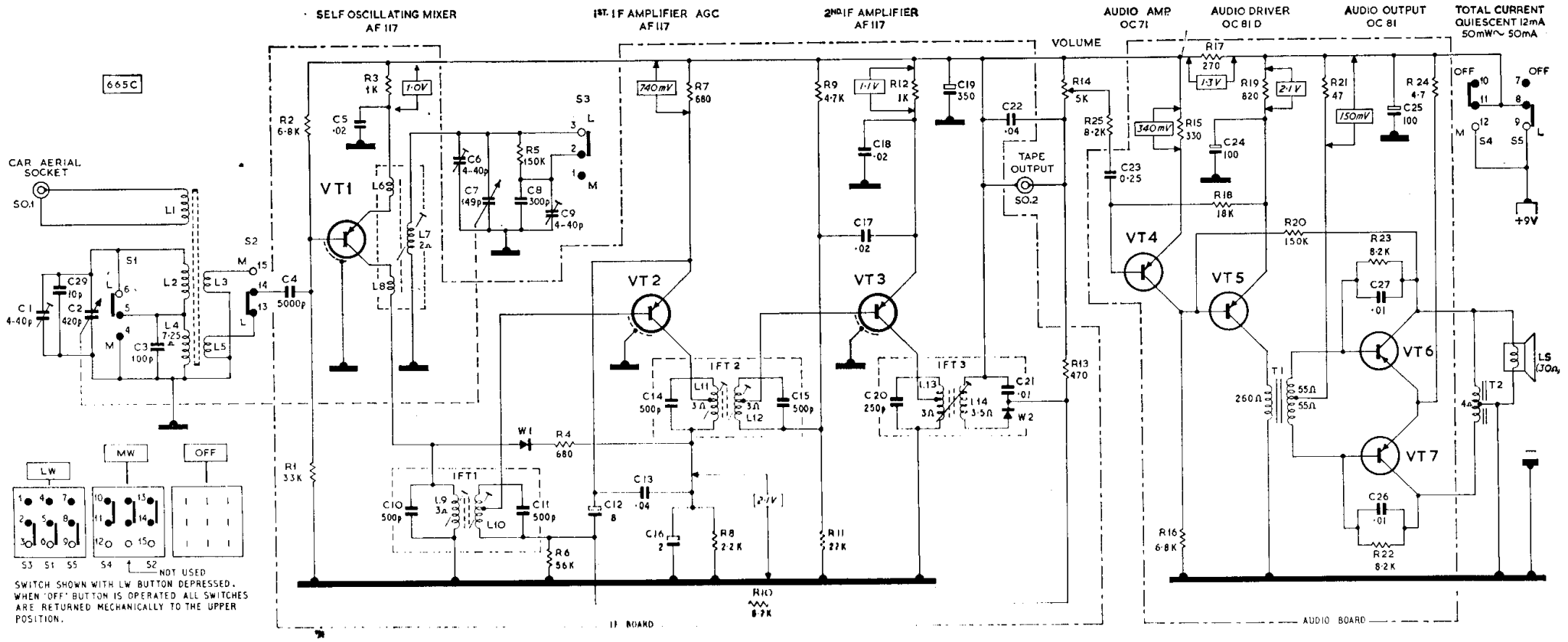


Fig. 2. Model 433 circuit diagram. Figures in rectangles indicate voltages measured with a 20,000 ohm/voltmeter. DC resistance readings are shown against inductances where these are 1 ohm or greater. On earlier models L3 is shunted by a 470pF capacitor mounted on the ferrite rod aerial.

CIRCUIT DESCRIPTION

With the receiver switched to LW **S1** short circuits **L2**, and when switched to MW it short circuits **L4** and **C3**. **C1, C2** and **C29** provide the tuning for the selected aerial coil and **C3** is added on LW.

The signal from **L2** or **L4** is coupled inductively to **L3** or **L5** and applied via **S2** and **C4** to the base of **VT1** (AF117) which functions as a self-oscillating mixer with feedback from collector to emitter circuit provided by **L6** and **L8**. The tertiary winding **L7** is tuned by **C6, C7, C8** and **C9**. **R5** in series with **C8** and **C9**, is shorted when **S3** is in the LW position. **R3** provides emitter stabilizing and **R1** and **R2** base bias.

The 475 Kc/s signal developed across the windings of the double tuned IF transformer **IFT1** is then fed to the first IF amplifier **VT2** (AF117). This operates with base bias provided by **R6**, in conjunction with **R10, R13** and volume control **R14**, and emitter stabilizing by **R7**. Another double tuned IF transformer **IFT2** in **VT2** collector circuit couples the signal to the 2nd IF amplifier **VT3** (AF117). **IFT3**, a single tuned IF transformer, incorporates a crystal detector **W2** in its secondary circuit.

When the receiver is tuned to a very strong signal, overloading is avoided by **W1** and **R4** connected in series. **VT2** is controlled by the main AGC system but on the reception of a strong signal the feedback circuit of **W1** and **R4** acts as a supplementary AGC line, effectively damping the first two IF stages and preventing overloading. The reservoir formed by **C16** and **R8** provides a standing bias to control the operating level of **W1**. The main AGC line feeds a positive bias developed from the rectified signal at **W2** via **R10** and **L10** to **VT2**. No AGC is applied to the second IF amplifier **VT3**, its base bias being derived solely from the potential divider formed by **R9** and **R11**.

The audio stages comprise an amplifier and a driver feeding a push-pull output stage. The audio voltage developed across the volume control **R14** is applied to **VT4** (OC71) through **R25** and **C23** and may also be used for tape recording. It should be noted that tape output level is unaffected by the volume control setting. **R13** and **C22** comprise an IF filter. The amplified signal is developed across **R16** and applied to **VT5** (OC81D) base. The phase splitting transformer **T1** in **VT5** collector circuit applies anti-phase signals to the bases of **VT6** and **VT7** (both OC81) which function in push-pull and together drive the centre-tapped output transformer **T2** which feeds the loudspeaker. **R22** and **C26** and also **R23** and **C27** form negative feedback tone correction networks. **R24** provides common emitter stabilization.

The loudspeaker has an impedance of 30Ω and feedback is applied from the speech coil to the base of the driver via **R20**. **C19** and **C25** are, respectively, supply decoupling capacitors for the IF and audio printed boards.

PRINTED BOARD TAG CONNECTIONS

1. To C3 on ferrite-rod aerial (earth).
2. To C7 on tuning gang and S3 (contact 3) on LW switch.
3. To S2 (contact 14) on MW switch.
4. To tag 7 on audio printed board (earth).
5. To bottom of volume control R14.
6. 7V to top of volume control R14 and tag 9 on audio printed board.
7. To tag 4 on IF printed board.
8. To R25 on control panel assembly.
9. 7V to tag 6 on IF printed board.
10. To battery negative terminal and upper (earthed) loudspeaker connection.
11. To battery positive and switches S4 and S5.
12. To switches S4 and S5 (contacts 8 and 11).
13. To lower loudspeaker connection.
14. To output transformer T2.

CHASSIS REMOVAL

Remove the two large brass screws from the underside of the cabinet. The cabinet back may now be withdrawn by pulling it out at the bottom and easing it downwards out of the groove at the top of the cabinet.

Carefully pull off the tag connectors from the printed boards. (To facilitate reassembly, it is advisable to note the colours of the leads and their respective tag numbers). Withdraw both the printed boards.

The ferrite-rod and tuning assembly is secured by four 4BA nuts and washers: remove them and ease the plate over the screws, drawing it downwards to release the controls and push-buttons from the control escutcheon.

To remove the unit completely, pull off the loudspeaker tag connections and unsolder the leads to the Tape-Out and Car Aerial sockets.

To remove the tuning scale and control escutcheon, unscrew the three PK screws and lift out.

To remove cabinet front, take out two small brass screws from the underside of the cabinet and a countersunk screw through each wood block which support the tuning assembly, then push out.

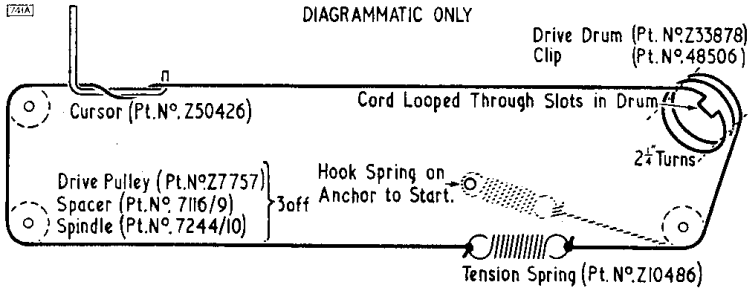


Fig. 3. Tuning drive cord viewed from front of chassis with gang fully closed. Use 30 inches of nylon braided cord.

COMPONENTS LOCATION

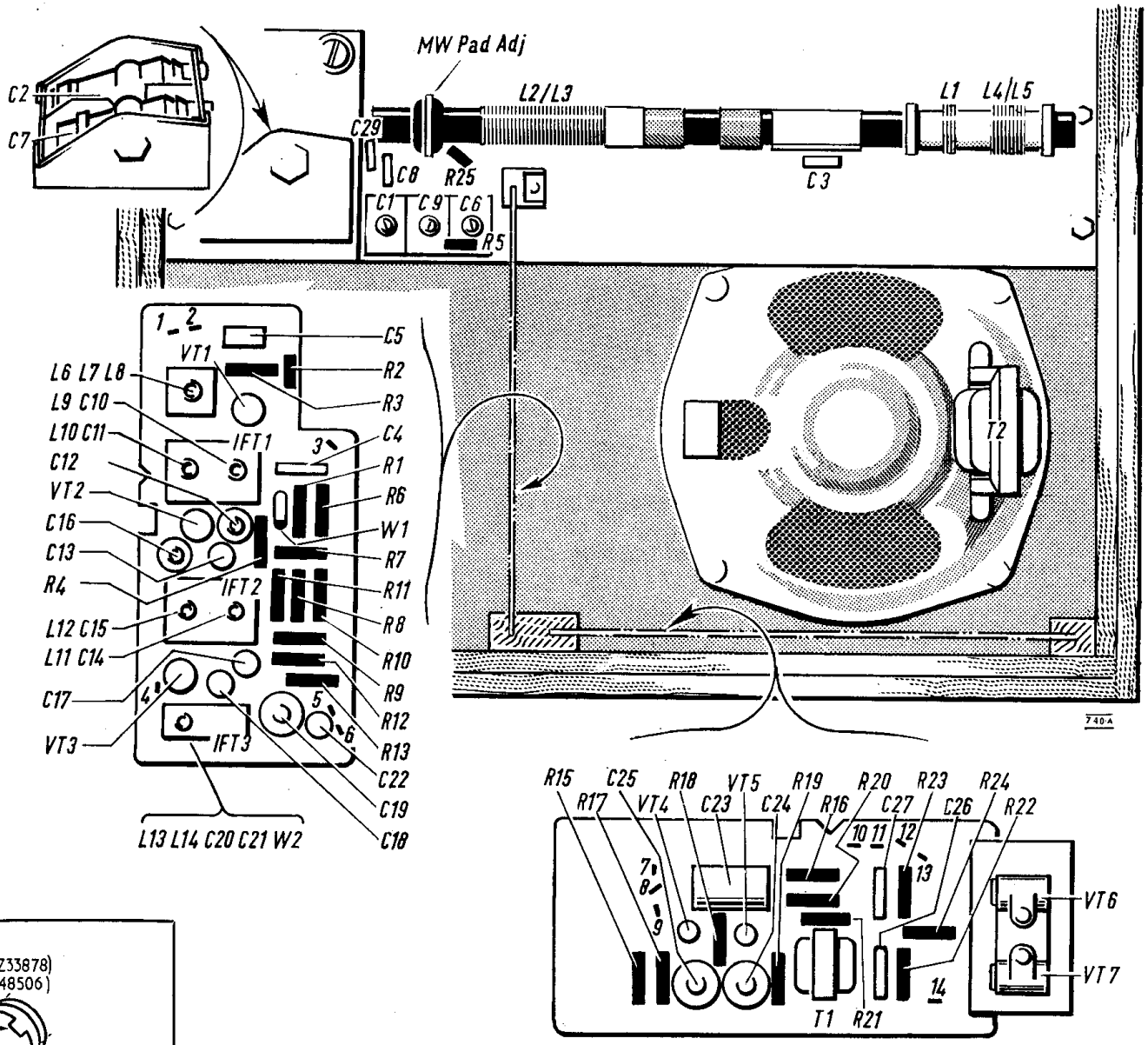


Fig. 4. View of the receiver chassis with the printed boards withdrawn from their mountings. VT6 and VT7 are coated with silicone grease to ensure effective heat transfer and are mounted in a heat sink. Also shown are the positions of trimmers and coil adjustments used for alignment.

CIRCUIT ALIGNMENT

Remove the receiver from its case.

A signal from a suitable generator, 30% amplitude modulated by an AF signal, is required for circuit alignment. Tuning indication is best obtained either with an output meter having an impedance of 30—40Ω and connected across the loudspeaker terminals with the loudspeaker disconnected or a Model 8 Avometer, set to the 2.5V AC range, connected in parallel with the loudspeaker.

Throughout alignment the signal input level to the receiver should be adjusted to maintain the audio output at approximately 50 mW (1 volt AC) with the volume control set at maximum in order to avoid alignment error due to AGC action.

IF CIRCUITS. Switch receiver to MW and turn gang to minimum. Apply a 475 Kc/s modulated signal through a 0.1μF capacitor across the aerial section of the tuning gang. Adjust L13/14, L12 and L11, L10 and L9 in that order for maximum output. Repeat in the same order until no further improvement is obtained.

RF CIRCUITS. MW must be aligned first. Signals should be injected via a loop loosely coupled to the ferrite rod aerial.

Calibration check points are clearly marked on the scale and correspond to the frequencies given in the table below.

	Range	Cursor Position	Adjust
MW	1400 Kc/s	MW Trim	C6 C1
	600 Kc/s	MW Pad	L7 L2†
LW	220 Kc/s	LW Trim	C9 L4*

* Adjust by sliding coil along aerial rod.

† Slide ring along aerial rod.

SPARE PARTS LIST

Description	Part No.
Battery connector	N33850
Battery retainer	Y50457
Cabinet (brown)	V50415
Cabinet (white)	V50415/1
Cabinet covering material-brown	NR/73/PD/78/55-Brown
Cabinet covering material-white	NR/73/PD/78/55-White
Control escutcheon	X50422
Cursor	Z50426
Drive cord (spring Z10486)	33963
Drive drum (clip 48506)	Z33878
Drive pulley–3 (spacer 7116/9, spindle 7244/10)	Z7757
Ferrite aerial rod support (2)	Z25864
Gang bolt (1)	Z3386/1
Gang bolt (2)	Z3386
Knob, tuning (clip 37309)	Y27353/3
Printed circuit support pillar	Z33883/1
Scale	N50420
Screw (2) securing V/control	SZ614
Spacer (2) securing V/control	Z50454
Socket fixing clip (S01)	48150

CAPACITORS

350V DC working, 20% tolerance, unless otherwise stated.

Ref.	Value	Tol.	Volts	Function	Part No.
C 1*	4-40pF	Pre-set		MW aerial trimmer	
C 2	420pF	Variable		Aerial tuning	Y33811
C 3	100pF	5%		LW aerial tracking	
C 4	5000pF			VT1 base coupling	
C 5	0.02μF		150V	VT1 emitter bypass	
C 6*	4-40pF	Pre-set		MW oscillator trimmer	
C 7	149pF	Variable		Oscillator tuning	
C 8	300pF	2%		LW oscillator trimming	
C 9*	4-40pF	Pre-set			
C10	500pF	2½%		L9 tuning	
C11	500pF	2½%		L10 tuning	
C12	8μF	Elect.	6V	AGC decoupling	
C13	0.04μF		150V	VT2 emitter decoupling	
C14	500pF	2½%		L11 tuning	
C15	500pF	2½%		L12 tuning	
C16	2μF	Elect.	6V	W1 bias	
C17	0.02μF		150V	VT3 emitter decoupling	
C18	0.02μF		150V	VT3 emitter bypass	
C19	350μF		9V	Supply decoupling	Y13229/38
C20	250pF	2½%		L13 tuning	
C21	0.01μF		150V	IF filter	
C22	0.04μF				
C23	0.25μF		150V	VT4 audio coupling	
C24	100μF	Elect.	12V	VT5 emitter bypass	
C25	100μF	Elect.	12V	Supply decoupling (Audio board)	
C26	0.01μF			NFB tone correction	
C27	0.01μF				
C29	10pF	2%		MW aerial trimming	

*Mica insulator, Phosp. bronze plate (3), Paxolin plate (3), Washer (3), Screw (3) — Pre-set trimmer bank: Z50066, Z50067, Z50068, WP6S1, SB6C04

RESISTORS

Carbon type ¼ Watt 10% tolerance unless otherwise stated.

Ref.	Value	Tolerance	Function	Part No.
R 1	33KΩ		VT1 base bias potential divider	
R 2	6.8KΩ			
R 3	1KΩ		VT1 emitter stabilizing	
R 4	680Ω		Aux. AGC feed	
R 5	150KΩ		MW oscillator damping	
R 6	56KΩ		VT2 base bias	
R 7	680Ω		VT2 emitter stabilizing	
R 8	2.2KΩ		W1 bias	
R 9	4.7KΩ		Pt. VT3 base bias pot. divider	
R10	8.2KΩ		AGC decoupling	
R11	22KΩ		Pt. VT3 base bias pot. divider	
R12	1KΩ		VT3 emitter stabilizing	
R13	470Ω		IF filter	
R14	5KΩ	Log. pot.	Volume control	Y20211/1
R15	330Ω	5%	VT4 emitter load	
R16	6.8KΩ		VT4/5 coupling	
R17	270Ω	5%	DC dropper and decoupling	
R18	18KΩ	5%	Audio stabilizing	
R19	820Ω	5%	VT5 emitter stabilizing	
R20	150KΩ		Audio feedback	
R21	47Ω	5%	VT6/7 base bias	
R22	8.2KΩ		NFB tone correction	
R23	8.2KΩ			
R24	4.7Ω	5%	VT6/7 emitter stabilizing	
R25	8.2KΩ		VT4 audio coupling	

INDUCTORS AND TRANSFORMERS

Ref.	Function		Part No.
L 1	Car aerial coupling	Ferrite rod aerial	Y33852
L 2	MW aerial		
L 3	MW coupling to VT1		
L 4	LW aerial		
L 5	LW coupling to VT1		
L 6-7-8	Oscillator coils		Z33873
L 9-10	IFT 1		Y33870
L11-12	IFT 2		Y33871
L13-14	IFT 3		Y33872
T1	Driver transformer		Z33860
T2	Output transformer		X33874

MISCELLANEOUS

Ref.	Function	Part No.
S1—5	*Push-button switch	X33809/1
LS	Loudspeaker	Y16021/13/9
S01	Car aerial socket	Z33936/1
S02	Tape socket	N33683

* Buttons (3), Springs (3) separately available.

THORN ELECTRICAL INDUSTRIES LIMITED

FERGUSON RADIO CORPORATION LTD., Great Cambridge Road, Enfield, Middlesex

Service Depots

LONDON : Eley's Estate, Angel Road, Edmonton, N.18. *Telephone: EDMonton 3060*
BIRMINGHAM : 24 Sheepcote Street, 15. *Telephone: Midland 5291*
MANCHESTER : Thorn House, Derby Street, Cheetham, 8. *Telephone: Deansgate 8484*
GLASGOW : 160/162 Battlefield Road, S.2. *Telephone: Langside 9251/2/3/4*