

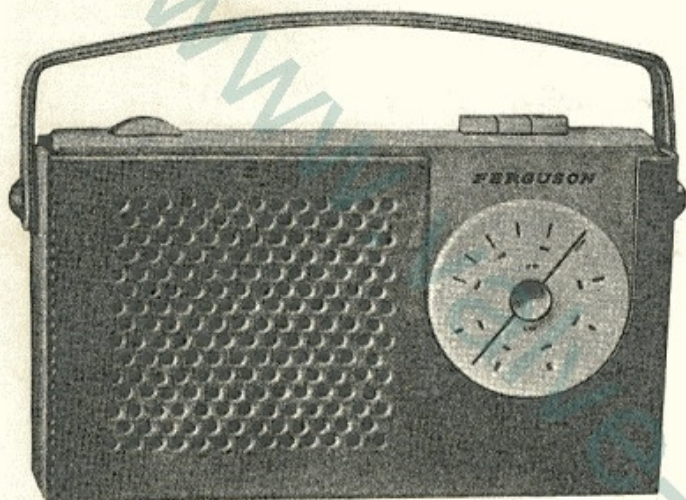
RADIO SERVICE MANUAL

FERGUSON

Transistor Portable Radio · Model 3104

FOR 6-VOLT OPERATION

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SPECIFICATION

POWER SUPPLY

Four $1\frac{1}{2}$ volt cells, the following types being suitable:
Drydex T15, Ever Ready U11, Siemens T12 and Vidor V0011.

WAVERANGES

MEDIUM: 565–185 metres (530–1620 Kc/s)

LONG: 2025–1120 metres (148–268 Kc/s)

BATTERY CONSUMPTION

Approximately 30 mA for average output.

POWER OUTPUT 400 mW.

LOUDSPEAKER $3\frac{1}{2}$ in. round, 35Ω impedance.

AERIAL

Internal—Ferrite rod.

Car aerial socket provided.

CASE DIMENSIONS $8\frac{1}{2}$ in. \times $1\frac{3}{4}$ in. \times $5\frac{1}{4}$ in.

DISMANTLING FOR SERVICE

Access to the copper side of the printed board and to the battery tube is gained by removal of the moulded back panel which is secured in position by a single captive screw.

The printed board assembly complete with speaker and gang assembly may be removed from the cabinet as follows:

Remove the back panel and battery tube. Note polarity of batteries for replacement.

Pull off the cursor tuning disc. Lay the cabinet face downwards and remove the three screws located along the edges of the printed board and one screw securing the gang mounting bracket to the cabinet.

Now tilt the assembly at the edge nearest the battery tube and remove from cabinet.

The battery contacts may be withdrawn from their slots and the aerial socket leads unsoldered for greater freedom of movement.

Note—The positive battery contact should be replaced in the slot adjacent to the aerial socket.

SERVICE NOTES

It is recommended that the battery voltage be checked *on load* before any fault tracing is attempted. Although the receiver will still operate when the battery voltage falls to about 4 volts, new batteries should be used for checking purposes.

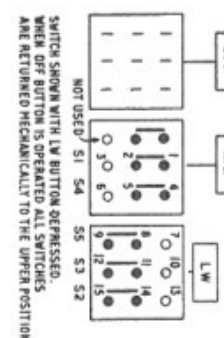
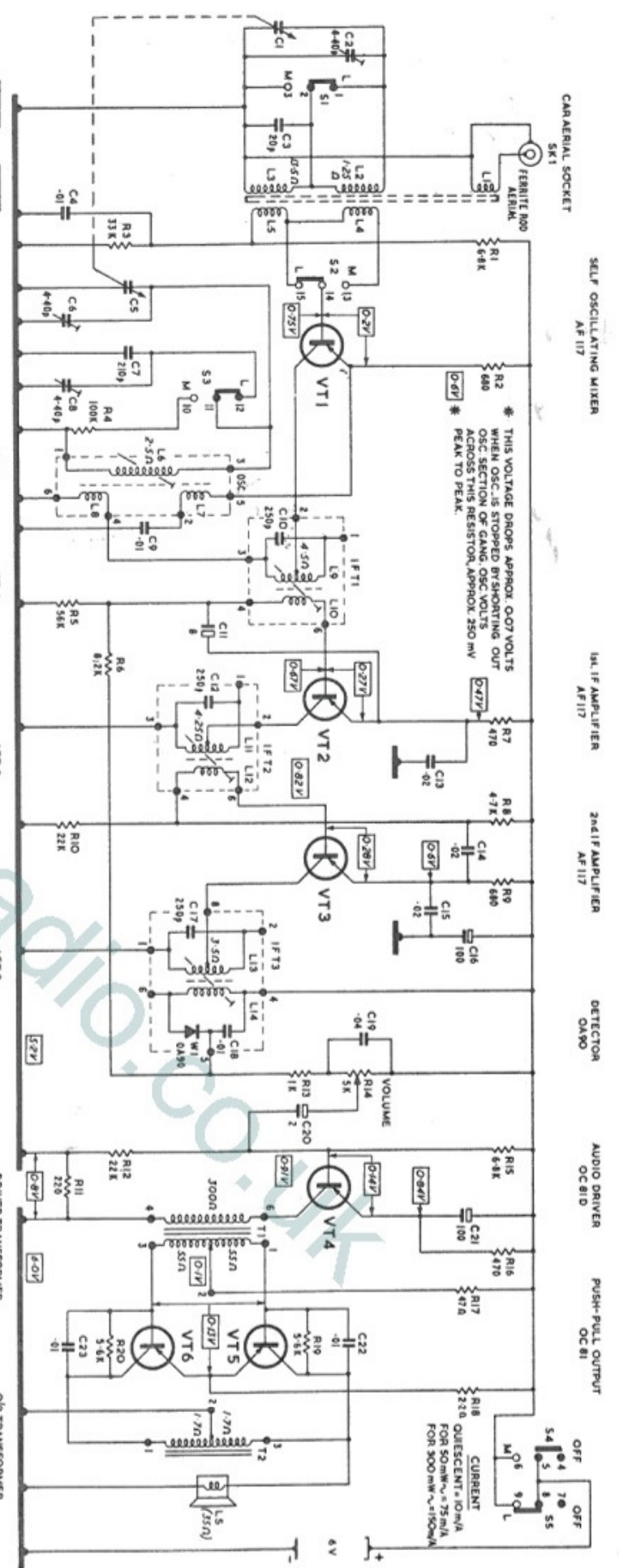
Apart from total current consumption no other current measurements should be attempted. Under "no signal" conditions the total current consumption should be approximately 10 mA. Consumption rises immediately a signal is applied.

Use battery positive as common earth for input and output test equipment to avoid shorting the supply.

OSCILLATOR CHECK. The most satisfactory method is to connect an oscilloscope across R2. With the oscillator functioning, an amplitude of approximately 250 mV (peak to peak) should be observed.

Alternatively, a DC voltmeter may be connected to the same points. A short circuit on C5 should produce a slight drop in the voltage reading, indicating that the oscillator is functioning.

AUDIO CHECK. Inject an audio test signal across the volume control (R14). An input of 10 mV should give an output reading of approximately 50 mW.



CIRCUIT DIAGRAM. DC resistances are shown against inductances where these are 1Ω or greater

CIRCUIT DESCRIPTION

L1 provides coupling for a car aerial. With the receiver switched to LW, S1 short circuits L2 and when switched to MW, it short circuits L3 and C3. C1 and C2 provide the tuning for the selected aerial coil and C3 is added on LW.

The signal from L2 or L3 is coupled inductively to L4 or L5 and applied via S2 to the base of VT1 (AF117) which functions as a self-oscillating mixer with feedback from collector to emitter provided by L8 and L7. The oscillator winding L6 is tuned by C5/C6 with C7 and C8 added on LW. R4 provides oscillator damping on MW.

The IF signal developed across the windings of the first IF transformer is then fed to the base of the first IF amplifier VT2 (AF117). This operates with base bias provided by R5 in conjunction with R6, R13 and volume control R14. The emitter is stabilized by R7. IFT2 in VT2 collector circuit couples the

signal to the second IF amplifier VT3 (AF117). IFT3 in VT3 collector circuit incorporates a crystal diode W1 (OA90) in its secondary circuit which acts as a sound detector, the audio signal being developed across R14 (the volume control).

The positive DC voltage developed across R13/R14 is fed as AGC bias to VT2 with R6 and C11 providing decoupling. No AGC is applied to VT3, its base bias being derived from the potential divider formed by R8 and R10.

C18, R13 and C19 comprise an IF filter, and from the volume control the signal is fed to the audio stages which consist of a driver VT4 feeding a push-pull output stage. From VT4 collector the signal is phase split by T1 and push-pull signals are applied to the bases of VT5 and VT6 (both OC81's).

The centre-tapped output transformer T2 feeds the loudspeaker. R19 and C22 and also R20 and C23 form negative feedback tone correction networks. R18 provides common emitter stabilization.

ALIGNMENT PROCEDURE

Remove the printed board assembly from the cabinet.

OUTPUT MEASUREMENT. Use an output meter connected in place of the loudspeaker and set to 35Ω impedance.

Alternatively, a Model 8 Avometer may be used, set to the 2.5 V AC range and connected in parallel with the loudspeaker. During alignment set the volume control to maximum and keep the input signal level adjusted, to maintain the output at 50 mW (1 to 1.4 volts).

IF CIRCUITS

Switch the receiver to MW and turn the tuning gang to minimum capacitance position. Apply a 475 Kc/s 30% modulated signal via a $0.1 \mu\text{F}$ capacitor across C1, the aerial section of the tuning gang. Adjust IFT3, IFT2 and IFT1 for maximum output and repeat until no further improvement results.

RF CIRCUITS

MW must be aligned first. Inject 30% modulated signals via a loop loosely coupled to the ferrite rod aerial.

(i) Set gang to maximum capacitance, signal generator to 530 Kc/s, and adjust L6 for maximum output.

(ii) Set gang to minimum capacitance, signal generator to 1620 Kc/s and adjust C6 (on gang) for maximum output.

Repeat (i) and (ii) until no further improvement results.

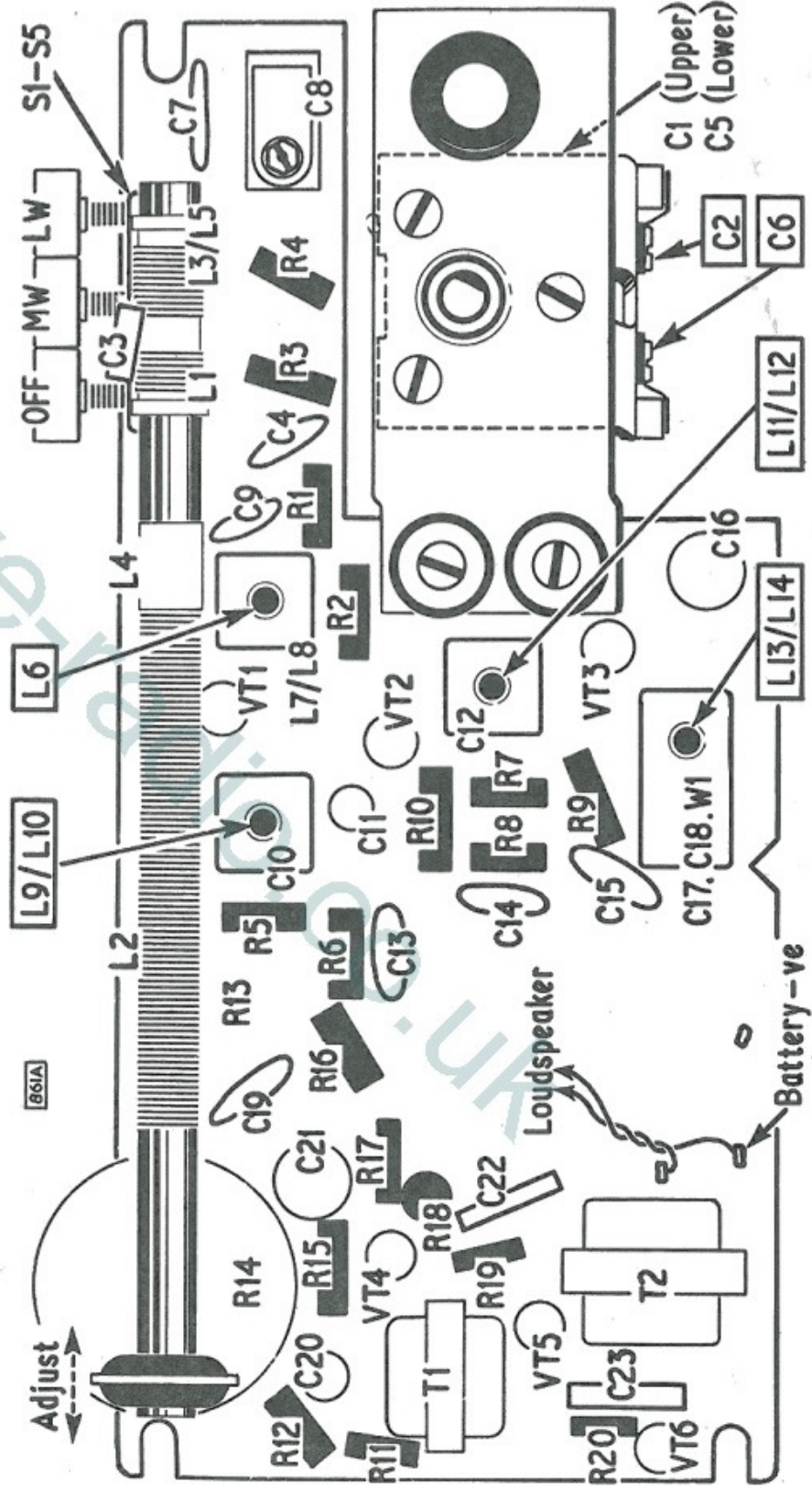
(iii) Set signal generator to 600 Kc/s, tune receiver to signal, then peak aerial coil L2 by sliding ring on ferrite rod.

(iv) Inject 1500 Kc/s signal and tune receiver to signal. Adjust C2 (on gang) for maximum output.

Repeat (iii) and (iv) until no further improvement results.

(v) Switch receiver to LW. Set signal generator to 188 Kc/s and rotate tuning gang to a position which is 90 deg. from the gang closed position (check by observing the vanes). Adjust C9 (on printed board) and L3 (on the ferrite rod) for maximum output.

Note.—Adjust L3 by sliding the coil former along the ferrite rod.



COMPONENT LAYOUT

Alignment points are shown in rectangles.

The component side of the printed board is shown with the loudspeaker removed.

COMPONENT DETAILS

RESISTORS

All $\frac{1}{4}$ Watt carbon, 10% tolerance, unless otherwise stated.

Ref.	Value	Tol.	Rating	Function and Part No.
R1	6.8K Ω			Part VT1 base bias potentiometer
R2	680 Ω			VT1 emitter stabilizing
R3	33K Ω			Part VT1 base bias potentiometer
R4	100K Ω			MW oscillator damping
R5	56K Ω			VT2 base bias
R6	8.2K Ω			AGC decoupling
R7	470 Ω			VT2 emitter stabilizing
R8	4.7K Ω			Part VT3 base bias potentiometer
R9	680 Ω			VT3 emitter stabilizing
R10	22K Ω			Part VT3 base bias potentiometer
R11	220 Ω			Supply dropper
R12	22K Ω			Part VT4 base bias potentiometer
R13	1K Ω			IF filter
R14	5K Ω	Log. Pot.		Volume control Y20212/3
R15	6.8K Ω			Part VT4 base bias potentiometer
R16	470 Ω			VT4 emitter stabilizing
R17	47 Ω	5%		VT5/6 base bias R82401
R18	2.2 Ω	20%		VT5/6 emitter stabilizing R82002
R19	5.6K Ω	5%		NFB tone correction R83404
R20	5.6K Ω	5%		

CAPACITORS

All 350V DC wkg. 20% tolerance, unless otherwise stated.

Ref.	Value	Tol.	Rating	Function and Part No.
C1*	170pF		Variable	Aerial tuning
C2*	4-40pF		Pre-set	Aerial trimmer
C3	20pF	5%		LW aerial tracking
C4	.01 μ F	-20 + 80%		VT1 base bias bypass
C5*	110pF		Variable	Oscillator tuning
C6*	4-40pF		Pre-set	Oscillator trimmer
C7	210pF	\pm 5%		LW oscillator trimmer { C86602 N90438
C8	4-40pF		Pre-set	
C9	.01 μ F	-20 + 80%		VT1 emitter bypass
C10	250pF	2%		IFT1 primary tuning
C11	8 μ F		ELEC 6V	AGC decoupling E89001
C12	250pF	2%		IFT2 primary tuning
C13	.02 μ F	-20 + 80%		VT2 emitter bypass
C14	.02 μ F	-20 + 80%		VT2 base bias decoupling
C15	.02 μ F	-20 + 80%		VT3 emitter bypass
C16	100 μ F		ELEC 9V	Supply decoupling E89105
C17	250pF	2%		IFT3 primary tuning
C18	.01 μ F	20%		IF filter
C19	.04 μ F	-20 + 80%		
C20	2 μ F		ELEC 6V	VT4 base coupling E89002
C21	100 μ F		ELEC 9V	VT4 emitter bypass E89105
C22	.01 μ F	-20 + 80%		NFB tone correction
C23	.01 μ F	-20 + 80%		

* Swing value. Part No. Y90291

INDUCTORS AND TRANSFORMERS

Ref.	Description	Part No.
L1	Car aerial coupling coil	Included in rod aerial assembly Y90310
L2	MW aerial tuning	
L3	LW aerial tuning	
L4	MW base coupling	
L5	LW base coupling	
L6, 7, 8	MW-LW oscillator coil	Y90387
L9, 10	IFT 1	Y50370
L11, 12	IFT 2	Y50109
L13, 14	IFT 3	Y33872
T1	Audio driver transformer	Y33860
T2	Audio output transformer	Y90313

MISCELLANEOUS

Ref.	Description	Part No.
S1	Wavechange switch	X50090/2
S2		
S3		
S4-5	On/off switch	
LS	Loudspeaker	16018/1
W1	OA90 detector (Included in IFT3)	
SKT1	Car aerial socket	N90418

SPARE PARTS LIST

Description	Part No.
Battery fixing:	
Spring	Z50327
Cap	Z50328
Positive contact	Z90292
Battery tube	Z90417
Cabinet assembly:	
Cabinet—blue	W90300/Blue
Cabinet—red	W90300/Red
Back panel—blue	W90286
Back panel—red	W90286/1
Carrying case	W90386
Fixing screw (back panel)	Z90302
Captive washer for above	Z90427
Printed board fixing screw (3)	SZ7D06
Washer for above (3)	90470
Tuning scale	N90434
Tuning dial	Y90290

The manufacturers reserve the right to vary specifications or use alternative materials as may be deemed necessary or desirable at any time



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