FERGUSON

PERSONAL PORTABLE RECEIVER 358BT

SERVICE MANUAL

SPECIFICATION

DESCRIPTION

A personal portable receiver with built-in aerial, employing seven transistors and a crystal diode in a superheterodyne circuit incorporating a push-pull output stage.

The receiver is tuneable over the Medium wave and Long wave ranges. A personal listening socket is provided which, when in use, disconnects the loudspeaker. A socket is provided for connecting a standard car aerial.

WAVERANGE COVERAGE

Medium 580-1550 Kc/s (194-525 metres).
Long: 158-260 Kc/s (1150-1900 metres).

BATTERY POWER SUPPLY

A single miniature 9v battery, any of the following types being suitable:

Ever Ready	PP6
Drydex	DT6
GEC	BB26
Vidor	T6006

BATTERY CONSUMPTION

Approximately 30mA for average output.

LOUDSPEAKER

High flux PM, $3\frac{3}{8}$ inches diameter, 35 Ω speech coil impedance.

POWER OUTPUT

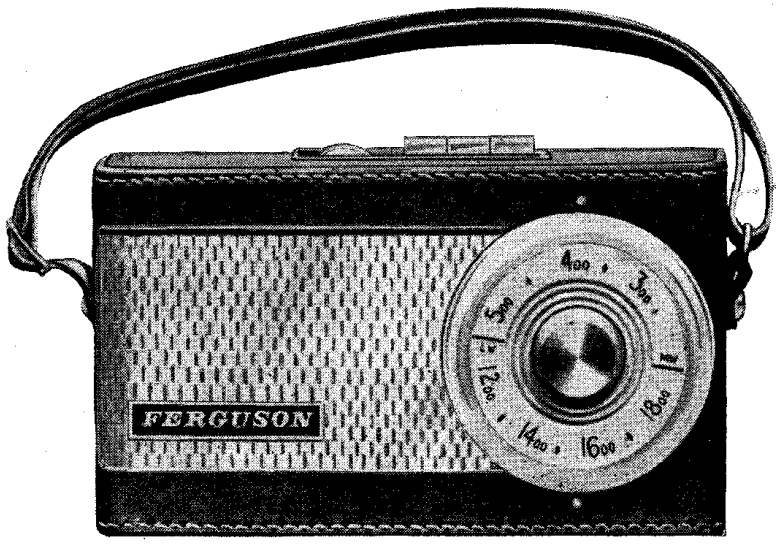
200mW.

CASE

Simulated hide, $7\frac{5}{8}$ inches long × $4\frac{1}{4}$ inches wide × $2\frac{1}{4}$ inches deep (excluding handle).

PERSONAL LISTENING SOCKET

Suitable for any earphone provided the impedance is not less than 30 Ω.



SERVICING NOTES

The receiver employs germanium alloy junction (pnp type) transistors. This type of transistor has proved to be a very reliable component and, when receiver servicing becomes necessary, the fault is unlikely to be due to transistor failure and attention should first be directed to other parts of the circuit.

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

(i) Make full use of the voltage measurements given in the circuit diagram. Although the receiver will still operate when the battery voltage is low, a new battery should be used for checking purposes.

(ii) Apart from total current consumption, no other current measurements should be attempted. Under "no signal" conditions, the total current consumption will be approximately 15 mA. Consumption rises immediately a signal is applied, to approximately 30 mA for average listening levels.

(iii) When using a signal generator for circuit checking, inject signal via an 0.1 μF capacitor and use the direct output.

(iv) To check oscillator operation, measure voltages at the emitter and base of VT1. These should be approximately as given in the circuit diagram with the emitter voltage slightly more negative then the base. Failure to oscillate is indicated when this relationship is reversed and the base voltage is more negative than the emitter.

(v) Should the output stage fail to operate, check first the switch associated with the earphone jack socket. The loudspeaker circuit in the output stage is completed via the spring contacts of this switch which should be closed with the earphone plug removed. Adjust spring tension if necessary.

(vi) Replacement of the capacitors and resistors on the printed panel should where possible be made by cutting away the component to enable the replacement to be soldered to the original lead wires. When this method is impossible and connection must be made to the copper side of the panel, use a small iron, non-corrosive flux and 60-40 solder. Do not apply the iron for longer than necessary.

PRINTED PANEL REMOVAL

1. Unscrew the centre trim from the tuning scale, remove scale and washers behind.
2. Unscrew the three brass headed screws now revealed, release the back cover and remove the printed panel from the case, bottom edge first.
3. Dismount the loudspeaker, attached to the printed board by two screws. This will give complete access to all components and alignment points.

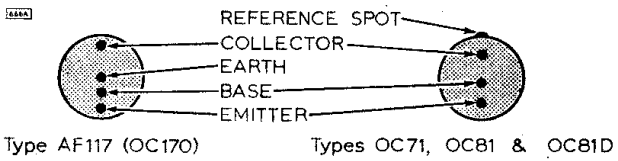


Fig. 1 Transistor Connections.

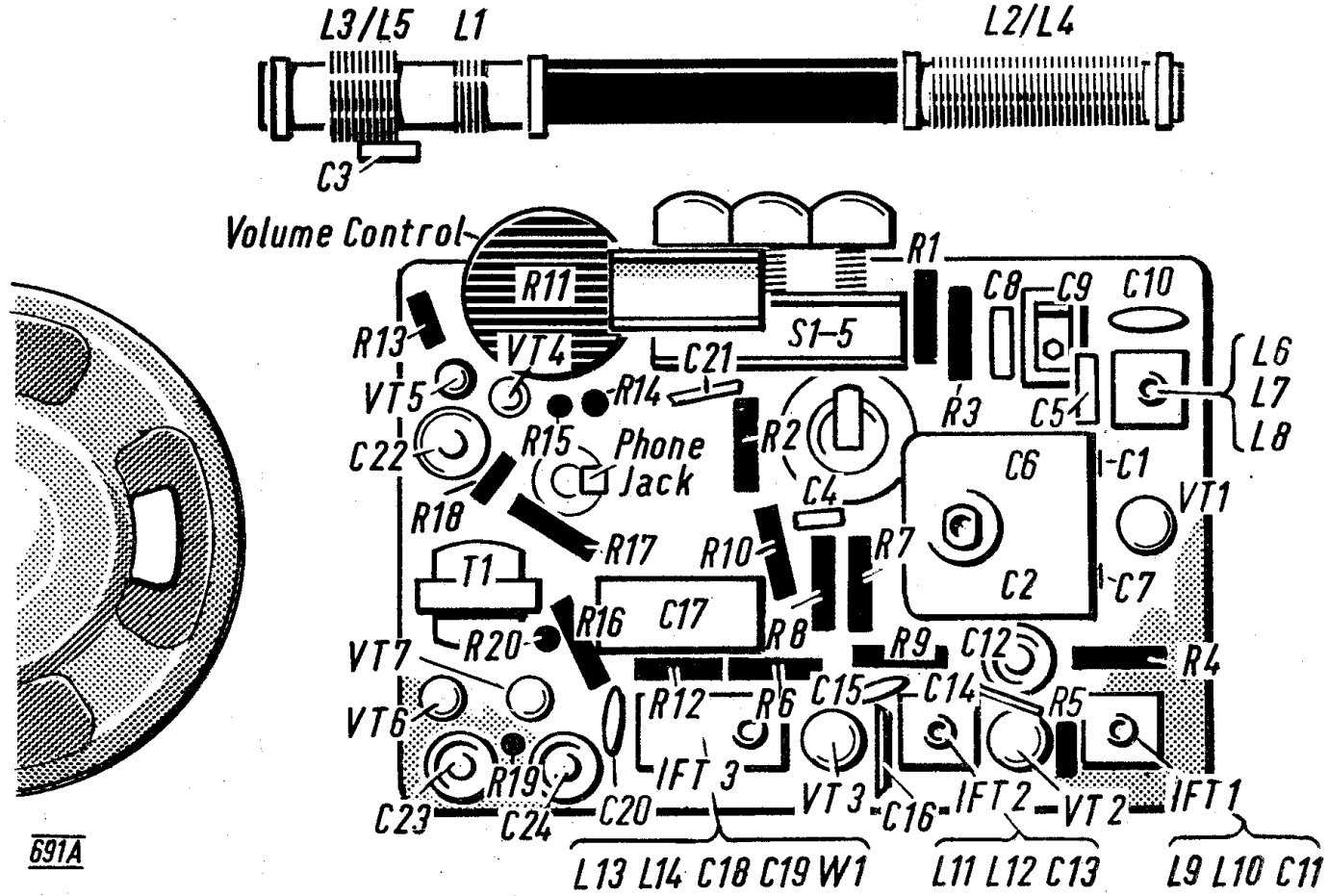


Fig. 2 Printed board showing general layout and the location of components. In some early receivers C2 was the front section of the gang with C6 behind and C1 and C7 were in the reverse positions to those shown above.

ALIGNMENT

Procedure

The printed panel assembly must first be removed from the case and the loudspeaker dismounted from the panel. See 'Printed Panel Removal' above.

Connect a Model 8 Avometer across the loudspeaker speech coil and set the receiver volume control to maximum. During alignment, keep the input signal level adjusted to maintain the output voltage between 1 volt and 1.4 volts AC.

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 μF capacitor across C2, the aerial section of the tuning gang. Adjust IFT 1, IFT 2 and IFT 3 for maximum output and repeat until no further improvement results.

In all but a few early receivers, where the reverse is the case, C2 is the section of the gang next to the printed panel and C6, the oscillator section, is nearest the spindle. With either arrangement the best injection point is afforded by the yellow lead to the ferrite rod aerial.

RF Circuits

MW must be aligned first. Inject 30% modulated signals via a loop loosely coupled to the ferrite rod aerial. Mount a temporary scale backing card to the tuning gang and inscribe on it a cursor line running through the spindle and parallel to the side of the printed board. Place the scale on the spindle, and the calibration markers on the scale can be related to the temporary cursor for alignment purposes.

Range	*Frequency*	*Cursor Position*	*Adjust*
MW	650 Kc/s	MW Pad	L6 L2 *
	1400 Kc/s	MW Trim	C7 C1
LW	220 Kc/s	LW Trim	C9 L3 *

* Adjust by sliding coil along aerial rod.

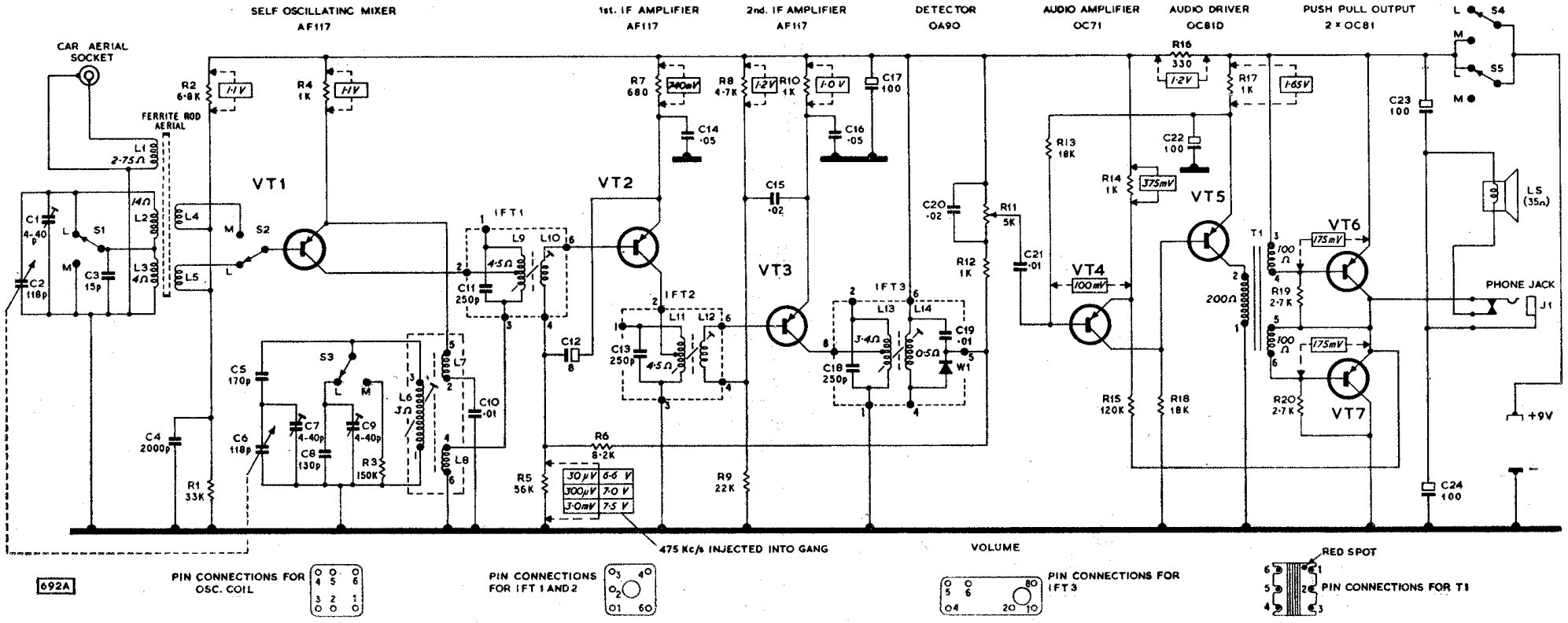


Fig. 3 Circuit Diagram. Figures in rectangles indicate voltages measured with a 20,000 Ω/volt meter. DC resistance readings are also shown against inductances where these are 1 Ω or greater.

CIRCUIT DESCRIPTION

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 tertiary winding **L6** which injects the local oscillator signal is tuned by **C5, C6** and **C7**, shunted by **C8** and **C9** on LW and by **R3** on MW. **R4** provides emitter stabilizing and **R1, R2** and **C4** base bias.

The IF signal developed across the windings of the first IF transformer is then fed to the base of the first IF amplifier **VT2** (AF 117). This operates with base bias provided by **R5** in conjunction with **R6**, volume control **R11** and **R12**. The emitter is stabilized by **R7**.

IFT2 in **VT2** collector circuit couples the signal to the second IF amplifier **VT3** (AF 117). 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 **R11**, the volume control.

The positive DC voltage developed across **R11** is fed as AGC bias to **VT2** with **R6** and **C12** providing decoupling. No AGC is applied to **VT3**, its base bias is derived from the potential divider formed by **R8** and **R9**.

R12 and **C20** comprise an IF filter, and from the volume control the signal is fed to the audio stages which consist of an audio amplifier and a driver feeding a push-pull output stage. The amplified signal at the collector of **VT4** (OC71) is developed across **R18** and applied to **VT5**. From **VT5** collector the signal is phase split by **T1** and push-pull signals are applied to the bases of **VT6** and **VT7**.

The output transistors are biased to class B conditions, a small standing current being permitted, however, to minimise crossover distortion. When the signal is applied, the transistors conduct alternately, the supply voltage being effectively centre tapped by the 100μF reservoir capacitors **C23** and **C24**. The loudspeaker has a speech coil impedance of 35 Ω and a matching transformer is not required.

Negative feedback is applied to the emitter of **VT4** from the output stage via **R15, R19** and **R20**, connected between collectors and bases of the output transistors, provide tone correction.

CAPACITORS

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

Ref.	Value	Tol.	Rating	Function	Part No.
C 1	4–40pF		Trimmer	Aerial trimmer	Y50368
C 2	118pF		Variable	Aerial tuning	
C 3	15pF	5%		LW aerial tracking	
C 4	2000pF			VT1 base bias bypass	
C 5	170pF	2½%		Oscillator padder	Y171R12
C 6	118pF		Variable	Oscillator tuning	Y50368
C 7	4–40pF		Trimmer	Oscillator trimmer	
C 8	130pF	5%		LW oscillator trimming	P131R25
C 9	4–40pF		Trimmer		Z25547
C10	0.01µF		200V	VT1 emitter bypass	
C11	250pF			L9 tuning	
C12	8µF		ELEC 6V	AGC decoupling	Y13222/7
C13	250pF			L11 tuning	
C14	0.05µF		200V	VT2 emitter bypass	
C15	0.02µF		200V	VT3 emitter decoupling	
C16	0.05µF		200V	VT3 emitter bypass	
C17	100µF		ELEC 9V	Supply decoupling	Y13229/36
C18	250pF			L13 tuning	
C19	0.01µF			IF filter	
C20	0.02µF		200V		
C21	0.01µF			VT4 audio coupling	
C22	100µF		ELEC 9V	VT5 emitter bypass	Y13229/35
C23	100µF		ELEC 9V	Audio coupling	Y13229/36
C24	100µF		ELEC 9V		Y13229/36

RESISTORS

All ¼ watt carbon 10% tolerance unless otherwise stated.

Ref.	Value	Tol.	Rating	Function	
R 1	33K Ω			VT1 base bias potential divider	
R 2	6.8K Ω				
R 3	150K Ω	20%		MW oscillator damping	
R 4	1K Ω			VT1 emitter stabilizing	
R 5	56K Ω			VT2 base bias	
R 6	8.2K Ω			AGC decoupling	
R 7	680 Ω			VT2 emitter stabilizing	
R 8	4.7K Ω			VT3 base bias potential divider	
R 9	22K Ω				
R10	1K Ω			VT3 emitter stabilizing	
R11	5K Ω	Log Pot		Volume control	Y20212/1
R12	1K Ω			IF filter	
R13	18K Ω			Audio stabilizing	
R14	1K Ω			VT4 emitter load	
R15	120K Ω			Audio feedback	
R16	330 Ω			DC dropper and decoupling	
R17	1K Ω			VT5 emitter stabilizing	
R18	18K Ω			VT4/5 coupling	
R19	2.4K Ω	5%		NFB tone correction	
R20	2.4K Ω	5%			

INDUCTORS & TRANSFORMERS

Ref.	Description	Part No.
L 1	External aerial coupling	
L 2	MW aerial tuning	
L 3	LW aerial tuning	Y50114
L 4	MW coupling to VT1	
L 5	LW coupling to VT1	
L 6		
L 7	Oscillator coils	Y50111
L 8		
L 9	IFT 1	Y50370
L10		
L11	IFT 2	Z50109
L12		
L13	IFT 3	Y33872
L14		
T1	Audio driver transformer	Z50086

SPARE PARTS LIST

Description	Part No.
Battery connector	Z50112
Cabinet	W50096
Car aerial socket	Z33936
Decorative screw (holding tuning dial)	Y50105
Escutcheon	Y50101
Printed board fixing screws (3)	Z50102
Spacers (3) (for above)	Z50103
Tuning dial	Z50104

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

MISCELLANEOUS

Ref.	Description	Part No.
S1–S3	Wavechange switch	X50090
S4–S5	On/off switch	
J1	Phone jack	Z32209
LS	Loudspeaker 35 Ω impedance	16018/1
W1	Audio detector	(OA90)

TRANSISTORS & CRYSTAL DIODES

Ref.	Type	Function
VT1	AF117	Self oscillating mixer
VT2	AF117	1st IF amplifier
VT3	AF117	2nd IF amplifier
VT4	OC71	Audio amplifier
VT5	OC81D	Audio driver
VT6	OC81	Audio output
VT7	OC81	
W1	OA90	Detector

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