LISSEN

SERVICE MANUAL FOR SUPERHETERODYNE BATTERY RECEIVER MODEL 8109

TECHNICAL SPECIFICATION

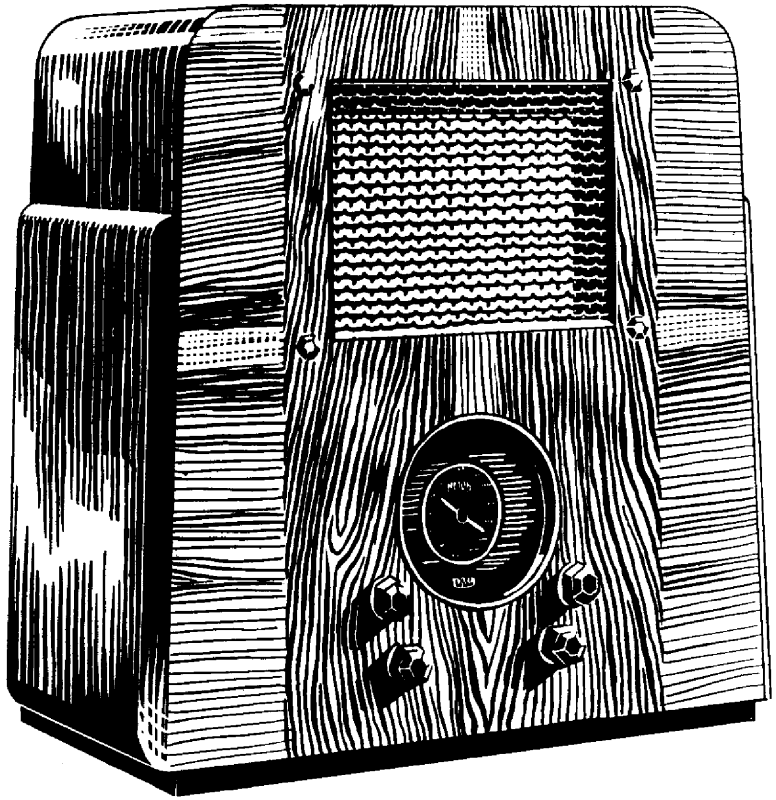
THE model "8109" battery operated superheterodyne receiver is for operation with an external elevated aerial.

It has seven tuned stages: a two stage band pass input circuit, a tuned oscillator, and four tuned intermediate frequency circuits.

The aerial is inductively coupled to the band pass filter, the two stages of which are also inductively coupled.

The oscillator circuit is tuned by a section of the gang condenser with specially shaped vanes.

The intermediate frequency transformers are tuned to a frequency of 127 kcs. (2,360.6 metres).



The band pass input circuit feeds into the frequency changer stage, for which an octode valve (V1) is employed.

This stage is coupled by the I.F. transformer T1 to the I.F. amplifier, a variable mu R.F. pentode (V2). This in turn is coupled by the second I.F. transformer T2 to the diode signal rectifier which is incorporated in the duo-diode-triode valve (V3). The other diode provides fully delayed quiet automatic volume control. Both V1 and V2 are controlled by the A.V.C. The triode section of the duo-diode-triode valve functions as an L.F. amplifier and is resistance capacity coupled to the high magnification pentode output valve (V4). This valve is transformer coupled to the permanent magnet moving coil speaker, which has a low impedance voice coil.

LISSEN LIMITED - SERVICE DEPARTMENT - ANGEL ROAD - EDMONTON - LONDON, N.18

SERVICE DATA FOR BATTERY RECEIVER MODEL 8109

GENERAL REMARKS

In the event of trouble, check the following details :—

1. Batteries, L.T. and H.T. (including G.B.) and confirm that the leads are correctly connected.

2. Valves :

(*a*) Check characteristics, or

(*b*) Substitute known good valves.

3. Locate trouble to a particular stage by :

(*a*) Checking valve operating conditions, or

(*b*) Stage by stage test with oscillator, *i.e.*, L.F., I.F., and R.F. stages, including the alignment of the tuned circuits.

4. Locate faulty component by testing with voltmeter, ammeter, ohmmeter, etc., or by substitution, as the case may be.

5. Check the alignment of the tuned circuits with an oscillator if not attended to under 3(*b*).

The following charts are given in the order they will usually be required.

Those readings given in columns A and B are obtained with new (132 volts) and partially discharged (100 volts) H.T. batteries respectively.

The position of the battery plugs should give voltage readings as follows :—

Battery Leads	Measured Volts (Column A)	Measured Volts (Column B)
Red lead ..	132 volts	100 volts
Brown lead ..	$-4\frac{1}{2}$,,	$-3\frac{1}{2}$,,
Black lead ..	H.T. − socket	H.T. − socket
Yellow lead ..	See notes below	

Position of Yellow Battery Plug

The anode current of a pentode is controlled by the auxiliary grid voltage, which is applied in this case through the yellow battery lead. The auxiliary grid voltage required for the correct anode current will vary with individual valves.

For this reason the pentode valve is marked with a letter, either A, B, C or D, and the yellow battery plug should be inserted into the socket on the H.T. battery, bearing the same letter.

If at any time it is necessary to replace the output valve by one that is not lettered, the correct position for the yellow plug may be found as follows: remove all the valves but the pentode from the set and insert a milliammeter in the Red H.T. lead. Now switch on the set and adjust the position of the yellow plug until the milliammeter measures 4.5 milliamps. A new H.T. battery of 132 volts should be used for this adjustment.

OPERATING CONDITIONS OF THE VALVES

Note.—All readings are with sensitivity control at maximum, and with no signal being received. Voltages measured from the chassis.

Valve	Circuit	Column A (New H.T.)	Column B (Partially discharged H.T.)
F.C. and Osc. valve Ever Ready K80A Metallized (V1).	Anode voltage	132 volts	100 volts
	Anode current	0.3 m.a.	0.2 m.a.
	Screen voltage	60 volts	45 volts
	Screen current	1 m.a.	0.8 m.a.
	Oscillator plate voltage ..	132 volts	100 volts
	Oscillator plate current ..	0.9 m.a.	0.7 m.a.
I.F. valve Ever Ready K50M Metallized (V2).	Anode voltage	132 volts	100 volts
	Anode current	0.9 m.a.	0.7 m.a.
	Screen voltage	95 volts	72 volts
	Screen current	0.3 m.a.	0.2 m.a.
D.D. triode Ever Ready K23B Metallized (V3).	Anode voltage	90 volts	68 volts
	Anode Current	0.6 m.a.	0.5 m.a.
Pentode valve Ever Ready K70B (V4).	Anode voltage	132 volts	100 volts
	Anode current	4.5 m.a.	3.5 m.a.
	Screen voltage	Same as yellow battery plug	
	Screen current	0.7 m.a. (approx.)	0.5 m.a. (approx.)

CIRCUIT ANALYSIS

Valve	Circuit	Associated Components
F.C. valve (V1).	Anode circuit	T1 primary. C8, C26. Red H.T. lead and plug.
	Screen circuit	R1. C14, C26. Red H.T. lead and plug.
	Control grid circuit ..	Screened cable. L4, L5. C2, C5, C13, C16. R4. S2 and A.V.C. circuit.
	Oscillator anode circuit	L8. C26. Red H.T. lead and plug.
	Oscillator grid circuit ..	R2, R3. C3, C6, C7, C15. L6, L7. Screened cable. S3, S4.
I.F. valve (V2).	Anode circuit	Screened cable. T2 primary. C10, C18, C26. Red H.T. lead and plug.
	Screen circuit	R5. C17, C26. Red H.T. lead and plug.
	Grid circuit	T1 secondary, R6. C9, C16 and A.V.C. circuit.
D.D. triode valve	Triode anode circuit ..	R11. C23, C24, C26. Red H.T. lead and plug.
	Rectifier diode circuit	T2 secondary. R7, R8, R12, R13, R14. C11, C19, C20, C21. S5 and P.U. sockets.
	A.V.C. diode circuit ..	R9, R12, R13, R14. S5
	Grid circuit	R10, R12, R13, R14. C22 and S5.
Pentode valve (V4)	Anode circuit	T3 primary. R16. C25 C26. Red H.T. lead and plug.
	Screen circuit	Yellow lead and plug.
	Grid circuit	R15. C24. Brown lead and plug.

SWITCH POSITIONS

Circuit Indication	Medium Waves	Long Waves
S1 ..	Closed	Open
S2 ..	Closed	Open
S3 ..	Open	Closed
S4 ..	Closed	Open
S5 ..	Closed when set is "on."	Open when set is "off."
S6 ..	Closed when set is "on."	Open when set is "off."
S7 ..	Closed when set is "on."	Open when set is "off."

CONDENSERS

Circuit Indication	Condenser Specification	Location	Component Number
C1 ..	Primary circuit band pass tuning condenser ..	Fig. 5	80,002
C2 ..	Secondary circuit band pass tuning condenser ..	Fig. 5	80,002
C3 ..	Oscillator circuit tuning condenser	Fig. 5	80,002
C4 ..	M/W trimmer for primary circuit of band pass ..	Fig. 5	80,002
C5 ..	M/W trimmer for secondary circuit of band pass	Fig. 5	80,002
C6 ..	M/W trimmer for oscillator circuit	Fig. 5	80,002
C7 ..	L/W trimmer for oscillator circuit	Fig. 5	78,004
C8 ..	I.F. transformer T1 primary tuning condenser	Fig. 5	77,003
C9 ..	I.F. transformer T1 secondary tuning condenser ..	Fig. 5	77,003
C10 ..	I.F. transformer T2 primary tuning condenser	Fig. 5	77,004
C11 ..	I.F. transformer T2 secondary tuning condenser ..	Fig. 5	77,004
C12 ..	.000015 mfd. mica condenser	Fig. 6	66,750
C13 ..	0.1 mfd. tubular, 350 volts D.C. working	Fig. 6	68,020
C14 ..	0.1 mfd. tubular, 350 volts D.C. working	Fig. 6	68,020
C15 ..	.0001 mfd. mica condenser	Fig. 6	66,966
C16 ..	0.1 mfd. tubular 350 volts D.C. working	Fig. 6	68,020
C17 ..	0.1 mfd. tubular 350 volts D.C. working	Fig. 6	68,020
C18 ..	.0001 mfd. mica condenser	Fig. 6	66,966
C19 ..	.0001 mfd. mica condenser	Fig. 5	66,966
C20 ..	.0001 mfd. mica condenser	Fig. 6	66,966
C21 ..	Tone control condenser ..	Fig. 6	80,003
C22 ..	.01 mfd. tubular, 450 volts D.C. working	Fig. 6	68,005
C23 ..	.0005 mfd. mica condenser	Fig. 6	66,969
C24 ..	.01 mfd. tubular, 450 volts D.C. working	Fig. 6	68,005
C25 ..	.0025 mfd. tubular, 450 volts D.C. working ..	Fig. 6	68,002
C26 ..	.01 mfd. tubular, 350 volts D.C. working	Fig. 6	68,020
C27 ..	.000005 mfd. Ceramic ..	Fig. 5	66,000

INDUCTANCES AND TRANSFORMERS

Circuit Indication	Specification	Location	Component Number
L1 ..	Aerial circuit coupling coil, 24 ohms	Fig. 5	78,000
L2 ..	Medium wave primary band pass coil, 2.3 ohms	Fig. 5	78,000
L2, L3	Long wave primary band pass coil, 17.3 ohms ..	Fig. 5	78,000
L4 ..	Medium wave secondary band pass coil, 2.3 ohms	Fig. 5	78,000
L4, L5	Long wave secondary band pass coil, 17.3 ohms ..	Fig. 5	78,000
L6 ..	Oscillator grid coil, medium wave, 2.9 ohms	Fig. 5	78,004
L6, L7	Oscillator grid coil, long wave, 6.2 ohms	Fig. 5	78,004
L8 ..	Oscillator anode coil, 45 ohms	Fig. 5	78,004
L9 ..	Speaker speech coil, 1.2 ohms	Fig. 7	85,004
T1 ..	First I.F. transformer, primary 93 ohms ; secondary, 93 ohms	Fig. 5	77,003
T2 ..	Second I.F. transformer, primary 42 ohms ; secondary, 42 ohms	Fig. 5	77,004
T3 ..	Output transformer, primary, 350 ohms ; secondary, 0.3 ohms	Fig. 6	77,013

RESISTANCES

Circuit Indication	Resistance Value	Colour Code			Location	Component Number
		Body	Tip	Dot		
R1	110,000 ohms (½ watt) ..	Br.	Br.	Y.	Fig. 6	71,962
R2	1,100 ohms (½ watt) ..	Br.	Br.	R.	Fig. 6	71,967
R3	110,000 ohms (½ watt) ..	Br.	Br.	Y.	Fig. 6	71,962
R4	66,000 ohms (½ watt) ..	Blue	Blue	Or.	Fig. 6	71,964
R5	110,000 ohms (½ watt) ..	Br.	Br.	Y.	Fig. 6	71,962
R6	1.1 megohms (½ watt) ..	Br.	Br.	G.	Fig. 6	71,900
R7	110,000 ohms (½ watt) ..	Br.	Br.	Y.	Fig. 5	71,962
R8	Volume control 0.5 megohms	—	—	—	Fig. 5	81,006
R9	1.1 megohms (½ watt) ..	Br.	Br.	G.	Fig. 6	71,900
R10	1.1 megohms (½ watt) ..	Br.	Br.	G.	Fig. 6	71,900
R11	51,000 ohms (½ watt) ..	G.	Br.	O.	Fig. 6	71,968
R13	Sensitivity control 280 ohms ..	—	—	—	Fig. 6	82,008
R14	250 ohms (½ watt) ..	R.	G.	Br.	Fig. 6	71,960
R15	510,000 ohms (½ watt) ..	G.	Br.	Y.	Fig. 6	71,944
R16	16,000 ohms (½ watt) ..	Br.	Blue	Or.	Fig. 6	71,966

Colour Code : Bl. = Black ; Br. = Brown ; G. = Green ; O. = Orange ; R. = Red ; Y. = Yellow.

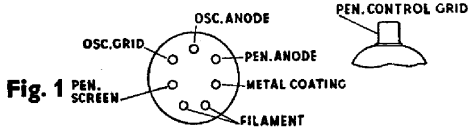


Fig. 1

PLAN OF VALVE HOLDER V1
BATTERY FREQ. CHANGER & OSC.

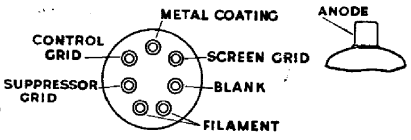


Fig. 2

PLAN OF VALVE HOLDERS V2
BATTERY SCREENED H.F. PENTODES

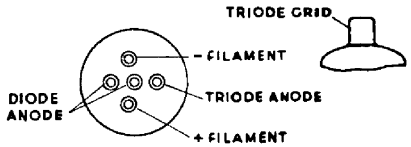


Fig. 3

PLAN OF VALVE HOLDER V3
BATTERY DUO-DIODE-TRIODE

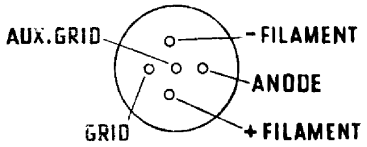


Fig. 4

PLAN OF VALVE HOLDER V4
BATTERY PENTODE OUTPUT VALVE

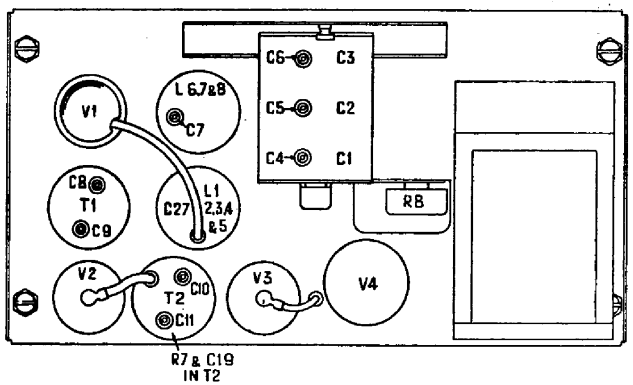


Fig. 5

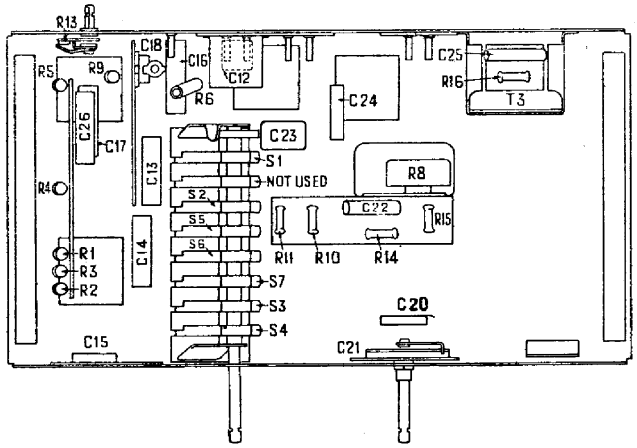


Fig. 6

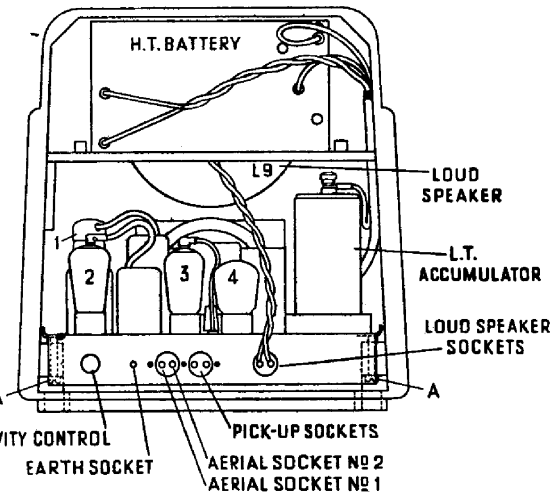
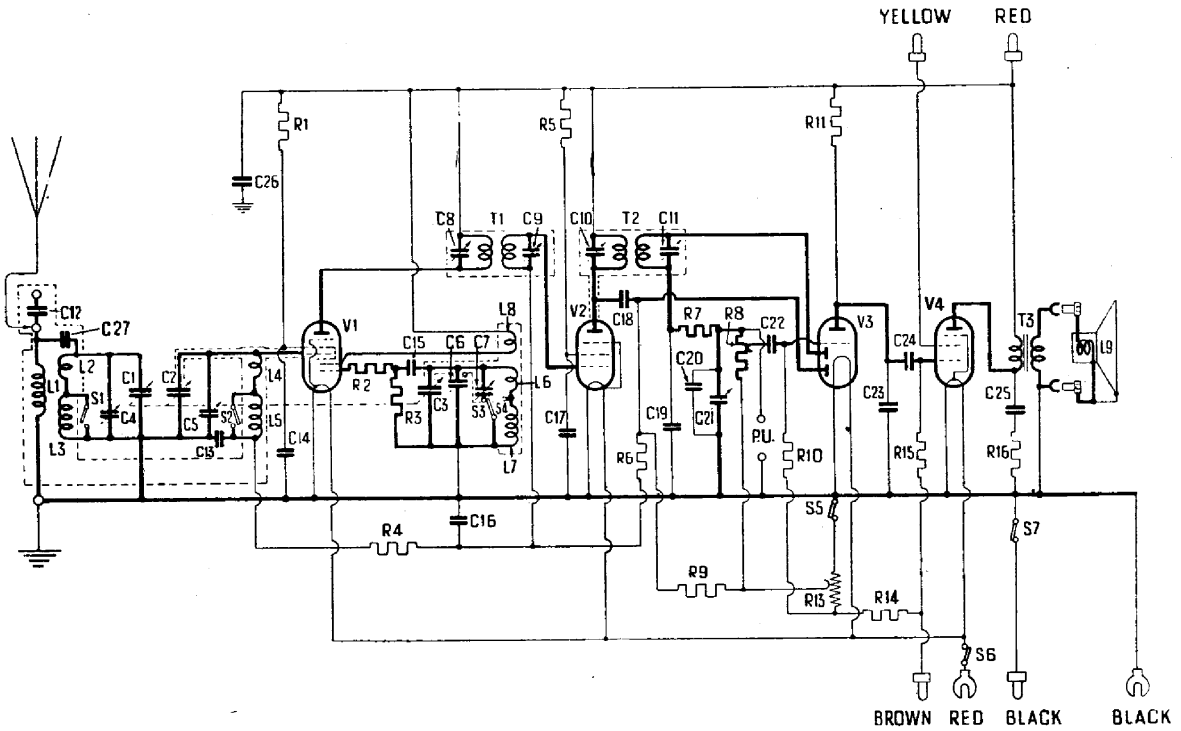


Fig. 7



—WWWW— WIRE WOUND RESISTANCE.
—ΠΠΠ— COMPOSITE RESISTANCE.
========= SCREENED LEAD.

CIRCUIT DIAGRAM

REMOVING THE CHASSIS FROM THE CABINET

First the batteries should be disconnected and removed from the cabinet. Now the knobs should be removed by a direct forward pull.

Next the four fixing bolts (A in Fig. 7) at the underside of the cabinet should be removed.

The speaker plugs are now pulled from their sockets and the chassis may be withdrawn from the cabinet.

The loudspeaker may also be removed by taking out its four fixing bolts.

It should be noted that to get access to the underside of the chassis, it is only necessary to remove the metal baseplate of the cabinet, which is held in place by four wood screws.

This plate forms part of the electrical screening, and care should be taken when replacing it that good electrical contact is made, through the copper strip at one corner of the cabinet base.

To ensure this, the baseplate is slightly "warped" so that when screwed home the corner will be tightly pressed against the copper strip. Care must be taken that the side with the bare metal corners is uppermost.

REMOVING THE I.F. TRANSFORMERS

Unsolder the leads from the contacts at the base of the transformers, in the case of T2 there are also two lead-out wires.

Remove the two 4 B.A. nuts on the underside of the chassis and the transformer may now be removed.

REMOVING THE BAND PASS COIL AND THE OSCILLATOR COIL

The coil screens are held in position by 4 B.A. nuts, remove these. Unsolder from the gang the leads from the top of the screens, release the screened cable earthing clips and carefully withdraw the screens.

To remove the coils complete, unsolder the lead-out wires from the underside of the chassis. The coils are held in position by single screws, accessible from the underside of the chassis and located between switches S1 and S2 for the band pass coil, and between switches S6 and S7 for the oscillator coil.

ADJUSTING THE TUNED CIRCUITS

Tuned circuits

(*a*) Tuned primary and secondary of I.F. transformers T1 and T2.

(*b*) Tuned oscillator circuit.

(*c*) Band pass input, two tuned circuits.

I.F. circuits (127 kcs., 2,360.6 metres)

The I.F. transformers should be adjusted before the band pass and oscillator circuit.

A modulated signal of 127 kcs. is applied between the frequency changer control grid and the chassis, via a .002 mfd. condenser. The lead to the control grid terminal is removed and a 0.5 megohm resistance is connected between this valve terminal and the chassis. An output meter is connected across the primary of the output transformer.

When adjusting the primary trimmer of either transformer, a 50,000 ohms resistance is connected across the secondary, and when adjusting the secondary it is connected across the primary.

Adjust the trimmers in the following order, for a maximum reading on the output meter.

(*a*) T2 secondary trimmer C11 (resistance across primary, White and Red leads).

(*b*) T2 primary trimmer C10 (resistance across secondary, Yellow lead and blank tag).

(*c*) T1 secondary trimmer C9 (resistance across primary, Red and Blue leads).

(*d*) T1 primary trimmer C8 (resistance across secondary, Yellow and Green leads).

Band pass input and oscillator circuits

Rotate the gang till the pointer is at the higher wavelength end of the scale. Push a flat-ended rod through the hole in the side of the gang cover and against the vanes. Now rock the vanes by means of the rotor drive until it is felt that the rotors are fully in mesh. If the pointer does not coincide with the two index marks at the top and bottom of the scale, release the centre fixing screw and move the pointer into this position.

Apply a modulated signal of 196 metres to the aerial terminal, switch the receiver to the medium waves, the gang being rotated till the pointer is at the lower wavelength end of the scale.

Adjust the trimmers for a maximum reading on the output meter, in the following order :—

(*a*) C6.
(*b*) C5.
(*c*) C4.

Switch the receiver to the long waveband, rotate the condenser drive so that the pointer registers 1,300 metres. Apply a signal of this wavelength and then adjust trimmer C7 for maximum output.

NOTES

This space is reserved for recording any further information you may find useful. If advice is required at any time the Lissen Service Dept. will be pleased to help you.