"TRADER" SERVICE SHEET

1163

PILOT BM90

A.C./D.C. All-dry Portable

EMPLOYING a ferrite-rod type internal aerial, the Pilot BM90 is a 4-valve (plus metal rectifier) portable superhet designed to operate from all-dry batteries or A.C./D.C. mains of 110V and 200-250V, 40-100 c/s in the case of A.C. The waveband ranges are 185-550m and 1,200-2,000m.

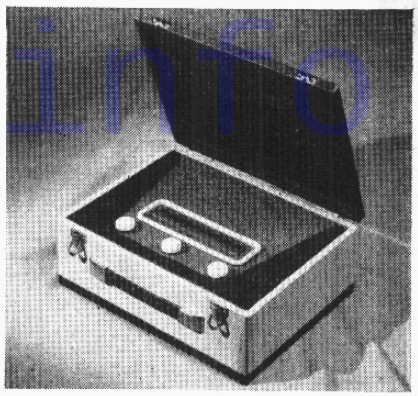
Release date and original price: June, 1954: £13 19s 9d. *Purchase tax extra.*

CAPACITORS		Values	Locations
C1	V1 C.G.	100pF	F3
C2	1st I.F. trans. tuning	100pF	B1
C3	1st I.F. trans. tuning	100pF	B1
C4	A.G.C. decoupling	0·01μF	F3
C5	V1 osc. C.G. ...	100pF	F3
C6	L.W. osc. trim. ...	450pF	F3
C7	Osc. tracker ...	630pF	G3
C8	Osc. reaction coup.	0·01μF	F3
C9	V2 S.G. decoup. ...	0·01μF	E3
C10	2nd I.F. trans. tuning ...	100pF	B1
C11	2nd I.F. trans. tuning	100pF	B1
C12	Filament decoup.	0·1μF	D2
C13	I.F. by-passes ...	100pF	E3
C14	I.F. by-passes ...	100pF	E2
C15	A.F. coupling ...	0·01μF	E3
C16*	H.T. decoupling ...	8μF	B1
C17	V3 S.G. decoupling	0·04μF	E3
C18	I.F. by-pass ...	220pF	E3
C19	A.F. coupling ...	0·01μF	E3
C20	Tone corrector ...	0·002μF	—
C21*	Filament smoothing	250μF	D3
C22*	H.T. smoothing ...	32μF	B1
C23*	H.T. smoothing ...	32μF	B1
C24	Mains R.F. by-pass	0·05μF	G3
C25‡	L.W. aerial trim....	120pF	G3
C26‡	M.W. aerial trim....	60pF	G3
C27†	Aerial tuning ...	—	A1
C28†	Oscillator tuning ...	—	A1
C29‡	M.W. osc. trim. ...	60pF	F3
C30‡	L.W. osc. trim. ...	120pF	G3

* Electrolytic. † Variable. ‡ Pre-set.

RESISTORS		Values	Locations
R1	V1 C.G.	3·3MΩ	F3
R2	V1 osc. C.G. ...	100kΩ	F3
R3	V1 filament shunt	180Ω	F3
R4	V1 S.G. feed ...	10kΩ	F3
R5	V2 S.G. feed ...	47kΩ	E3
R6	V2 filament shunt	220Ω	F3
R7	A.G.C. decoupling	2·2MΩ	F3
R8	I.F. stopper ...	47kΩ	E3
R9	Volume control ...	1MΩ	C1
R10	V3 C.G.	4·7MΩ	E3
R11	V3 filament shunt	220Ω	E3
R12	H.T. decoupling ...	3·3kΩ	E2
R13	V3 anode load ...	1MΩ	E3
R14	V3 S.G. feed ...	4·7MΩ	E3
R15	Neg. feed-back ...	10MΩ	E3
R16	V4 C.G.	2·2MΩ	D3
R17	V4 filament shunt	470Ω	D3
R18	Filament ballast ...	1·8kΩ	D3
R19	H.T. smoothing and voltage adj.	400Ω	C1
R20	H.T. smoothing and voltage adj.	2,370Ω	C1
R21	H.T. smoothing and voltage adj.	380Ω	C1
R22	V4 G.B.	220Ω	D3

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Internal aerial coils	3·8	C1
L2	Internal aerial coils	1·2	B1
L3	Osc. tuning coil ...	2·3	F2
L4	Osc. reaction coil...	1·0	F2
L5	1st I.F. trans. Pri.	10·0	B1
L6	1st I.F. trans. Sec.	10·0	B1
L7	2nd I.F. trans. Pri.	10·0	B1
L8	2nd I.F. trans. Sec.	10·0	B1
L9	Speech coil ...	2·5	—
T1	O.P. trans. Pri.	480·0	—
T1	O.P. trans. Sec.	—	—
S1-S3	Waveband switches	—	B1
S4(B)-S10(B)	Mains/battery sw.	—	B1
MR1	Westinghouse 18RA	—	G2



Appearance of the Pilot BM90.

CIRCUIT DESCRIPTION

The aerial input coils **L1** (L.W.) and **L2** (M.W.) are mounted on opposite ends of a length of ferrite rod to form the internal aerial, and are tuned by **C27. S1** closes to short-circuit **L1** for M.W. operation.

Heptode valve **(V1, Brimar 1R5)** operates as frequency changer with electron coupling. Oscillator grid coil **L3** is tuned by **C28** for both M.W. and L.W. operation. Parallel trimming by **C29** (M.W.) and **C6, C29, C30** (L.W.); series tracking on both bands by **C7.** Reaction coupling from oscillator anode via **L4** and the common impedance of **C7.**

Second valve **(V2, Brimar 1T4)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C2, L5, L6, C3** and **C10, L7, L8, C11.**

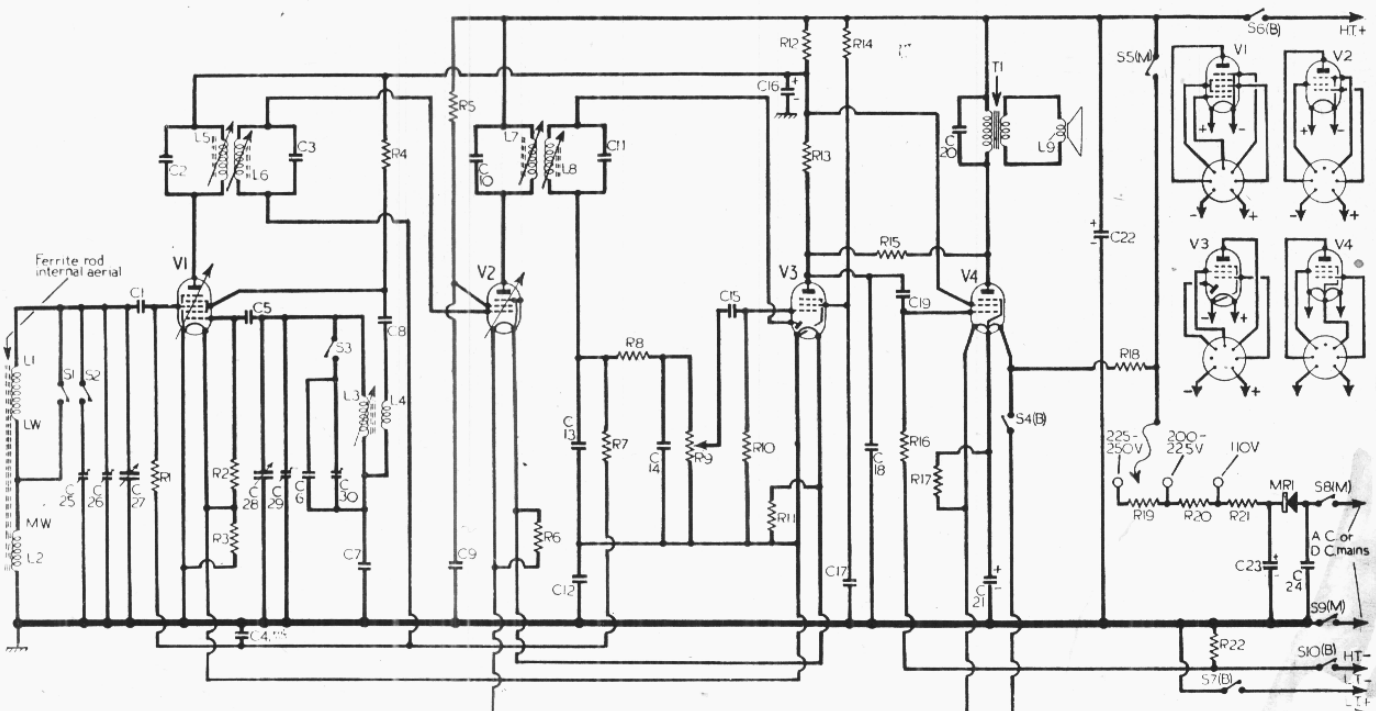
Intermediate frequency 470 kc/s.

Diode signal detector is part of diode pentode valve **(V3, Brimar 1S5).** Audio frequency component in its rectified output is developed across volume control **R9,** which operates as diode load, and is passed via **C15** to pentode section. I.F. filtering by **C13, R8, C14.**

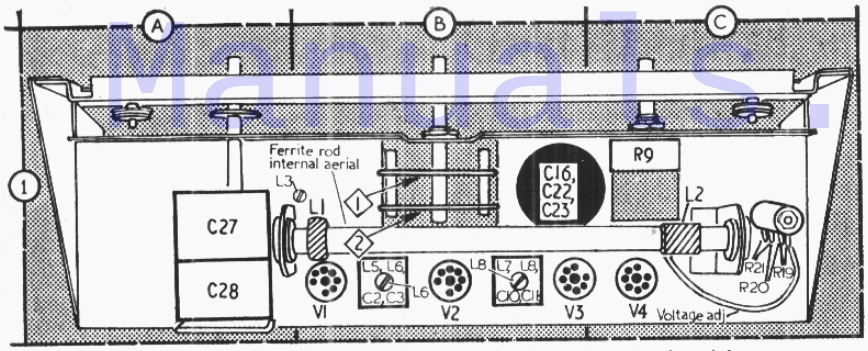
D.C. potential developed across **R8, R9** is fed back as bias to **V1** and **V2,** giving automatic gain control.

Resistance-capacitance coupling via **R13, C19** and **R16** between **V3** and pentode output valve

(*Continued col.* 1 *overleaf*)



Circuit diagram of the Pilot BM90. The mains/battery switches bear the suffix **(M)** or **(B)** to indicate that they close for mains or battery operation respectively.



Plan view of the chassis showing the ferrite-rod internal aerial.

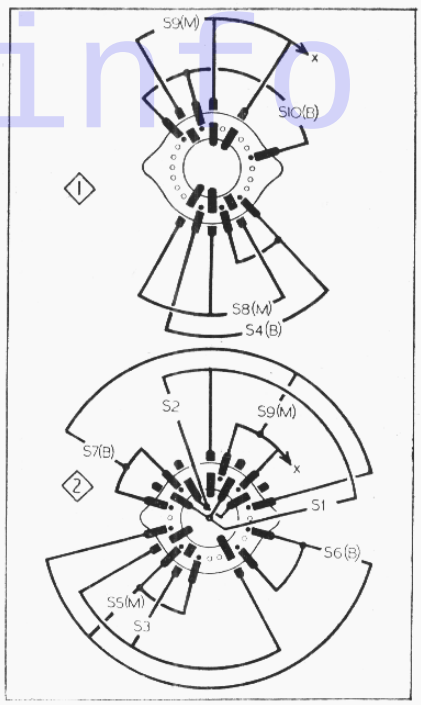


Diagram of the waveband and mains/battery switch units. **S9(M)** consists of two switches in series, one on each unit, the common connection between them being indicated by the arrow labelled **x** on each unit.

Circuit Description—*continued.*

(V4, Brimar 3V4). Tone correction by **C20** in **V4** anode circuit and by negative feed-back between the anodes of **V4** and **V3** via **R15.**

For battery operation, power supplies are carried by mains/battery switches **S4(B), S6(B), S10(B),** which close in that position as indicated by the suffix **(B).** For mains operation **S5(M), S8(M)** and **S9(M)** close. In the "off" position all the switches open.

Mains H.T. current is supplied by metal rectifier **(MR1, Westalite 18RA)** which is cooled by surface contact with the chassis and dispenses with the normal cooling fins. Smoothing by **R19, R20, R21,** which are also used for voltage adjustment, and electrolytic capacitors **C22, C23.** Filament current for mains operation is taken from the H.T. circuit via **R18.**

The filaments are series-connected for both mains and battery operation. Bias is obtained from the appropriate points in the filament chain. For the purpose of battery economy the bias applied to **V4** is supplemented by the voltage dropped across **R22** in the H.T. negative lead to chassis. **R3, R6, R11** and **R17** by-pass the H.T. current from the valves past the filaments.

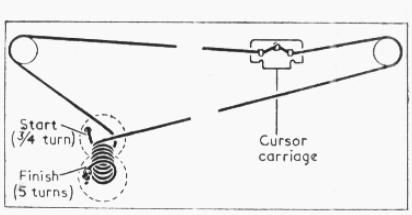
CIRCUIT ALIGNMENT

I.F. Stages.—In order to make the under-chassis I.F. adjustments accessible the chassis should be withdrawn from its carrying case. Switch receiver to M.W. and turn gang to maximum. Connect output of signal generator, via an 0.1μF capacitor in each lead, to control grid (pin 6) of **V1** and chassis. Feed in a 470 kc/s (638.3m) signal and adjust the cores of **L8** (location reference B1), **L7** (E3), **L6** (B1) and **L5** (F3) for maximum output.

R.F. and Oscillator Stages.—Replace chassis in carrying case. Transfer signal generator leads to a loop consisting of three or four turns of wire placed about 12 inches from the internal aerial coils.

M.W.—Switch receiver to 500m, feed in a 500m (600 kc/s) signal and adjust the core of **L3** (B1) for maximum output. At the same frequency slide the internal aerial winding **L2** (B1) along the ferrite rod for maximum output. Tune receiver to 200m, feed in a 200m (1,500 kc/s) signal and adjust **C29** (F3) and **C26** (G3) for maximum output.

L.W.—Switch receiver to 1,200m, feed in a 1,200m (250 kc/s) signal and adjust **C30** (G3) and **C25** (G3) for maximum output. Tune receiver to 1,800m, fed in a 1,800m (166.7 kc/s) signal and slide the internal aerial winding **L1** (C1) along the ferrite rod for maximum output.



Sketch of the drive cord system as seen from the rear of the chassis with the gang at minimum capacitance.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those derived from the manufacturers' information. They are the averages of readings taken on a number of receivers, which were operated from A.C. mains of 225V with their voltage adjustments set to the 225-250V tappings. The receivers were tuned to a point at the highest wavelength end of M.W. where there was no signal input.

Voltages were measured on the 10V and 400V ranges of a Model 7 Avometer, chassis being the negative connection. The voltage measured across **C23** was 265V, and across **C16** was 75V. The voltage measured between chassis and the junction of **R18** and **V4** filament was 6V, and between chassis and the junction of **R18** and **S5(M)** was 85V. The total H.T. current was 12mA.

Valve	Anode		Screen	
	V	mA	V	mA
V1 1R5	80	1·1	50	1·4
V2 1T4	85	1·6	60	0·6
V3 1S5	15	0·09	10	0·03
V4 3V4	82	6·0	85	1·2

GENERAL NOTES

Switches.—**S1-S3** are the waveband switches and **S4(B)-S10(B)** are the mains/battery change-over switches ganged in two rotary units on the chassis deck. These units are indicated in our plan illustration of the chassis and shown in detail in the diagram in column 3, where they are drawn as seen from the rear of an upright chassis. **S1** closes for M.W. operation, and **S2, S3** close for L.W. operation. **S4(B), S6(B),** and **S7(B) S10(B)** all close for battery operation as indicated by the suffix **(B)** and **S5(M), S8(M)** and **S9(M)** close for mains operation. All the switches open in the "off" position.

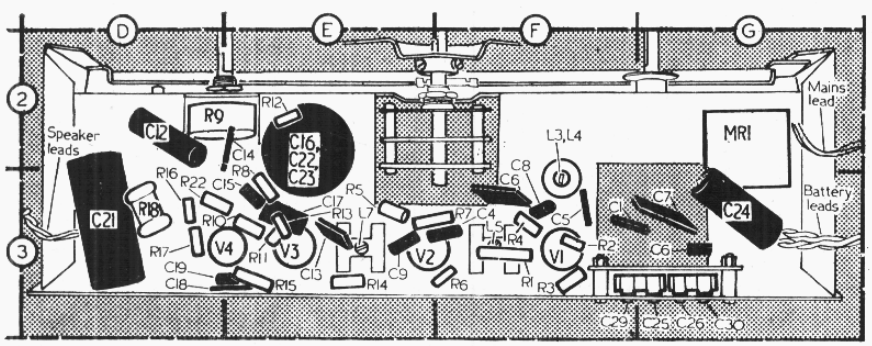
Batteries.—The batteries recommended by the manufacturers are as follows: H.T., Ever-Ready B138 or Vidor L5536, rated at 90V; L.T., Ever-Ready AD42 or Vidor L5058, rated at 7.5V.

Drive Cord Replacement.—About 3ft of nylon-braided glass yarn is required for a new drive cord. It should be run as indicated in the sketch of the drive cord system (col. 1), where it is viewed from the rear of the chassis with the gang at minimum capacitance.

Dismantling.—To gain access to the chassis, the two captive bolts securing two rubber feet to the rear edge of the carrying case base cover should be unscrewed, and the base cover slid off. The chassis can then be released by removing the four 4BA nuts securing the ends of the scale backing plate assembly to the carrying case.

Modifications.—To improve the quality of reproduction, later versions of the receiver on which this service sheet was prepared incorporate the following modifications. The bias on **V4,** which was originally made higher than normal in the interests of H.T. battery economy, is reduced by short-circuiting **R22.** The screen of **V4** is connected to the H.T. positive line instead of to the junction of **R12** and **R13.**

In earlier models an additional switch, which closed for mains operation, was connected in the lead between **S4(B), V4** filament and **R18.** An additional switch, which closed for battery operation, was also connected in series with the lead from the L.T. positive plug and **S4(B).** A 110pf capacitor was also connected across **L1.**



Underside view of the chassis. All the R.F. and oscillator adjustments are identified in locations B1, F3 and G3.

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