

NUMBER 134

'TRADER' SERVICE SHEETS

PHILCO 295

5-VALVE ALL-WAVE BATTERY MODEL

A SHORT-WAVE range of 16-54 metres is covered by the Philco 295 5-valve battery all-wave superhet. It has sockets for a gramophone pick-up and for the Philco all-wave aerial, while a feature of the circuit is the incorporation of a signal frequency amplifier stage.

CIRCUIT DESCRIPTION

Aerial input via coupling coils L2 (S.W.), L4 (M.W.), L6 (L.W.) to tuned circuit comprising C26 and coils L3 (S.W.), L5 (M.W.), L7 (L.W.). Filter circuit L1, C21 by-passes interference at the intermediate frequency. Provision for connection of special aerial transmission line to terminals marked "Black" and "Red."

First valve (V1, Philco 1A4E) is a variable-mu pentode operating as signal frequency amplifier with tuned secondary transformer coupling to heptode frequency changer (V2, Philco 1C6). Transformer primaries L8 (S.W.), L12 (M.W. and L.W.); secondaries L9 (S.W.), L11 (M.W.), L13 (L.W.) tuned by C31. Oscillator grid coils L14 (S.W.), L16 (M.W.), L17 (L.W.) tuned by C32; tracking by C6, C34 (S.W.), C37 (M.W.), C39 (L.W.); reaction is applied by small coil L15 and condenser C5.

Third valve, a variable-mu H.F. pentode (V3, Philco 1A4E) operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings L18, L19 and L20, L21.

Intermediate frequency 451 KC/S.

Diode second detector forms part of double diode triode valve (V4, Philco 2102). Audio-frequency component in rectified output is developed across load resistance R9 and passed via coupling condenser C12 and manual volume control R12 to C.G. of triode section which operates as L.F. amplifier. Four-point tone control is effected by means of tapping on volume control and R11, C13, C14, C15, which work in conjunction with switches S35, S36, S37. Provision for connection of gramophone pick-up across volume control by switch S34. I.F. filtering by stopper resistance R8 and by-pass condensers C10, C11, C16, C17.

D.C. potential developed across R9 is fed back

through decoupling circuits as G.B. to H.F., F.C. and I.F. valves, giving automatic volume control.

Parallel fed transformer coupling by R13, C18 and T1 to double-pentode quiescent push-pull output stage (V5, Philco 2103). Resistance R16 prevents parasitic oscillations. Fixed tone correction by R.C. filter R17, C20. Coupling to speaker by special input transformer T2. Provision for connection of low impedance external speaker across secondary winding.

COMPONENTS AND VALUES

Resistances		Values (ohms)
R1	V1 C.G. decoupling	2,000,000
R2	V2 tetrode C.G. decoupling	2,000,000
R3	V2 osc. C.G. resistance	32,000
R4	V2 osc. anode decoupling	2,000
R5	V2 osc. anode resistance	10,000
R6	V2 and V3 A.V.C. line decoupling	2,000,000
R7	V3 anode decoupling	1,000
R8	I.F. stopper	51,000
R9	V4 diode load	330,000
R10	Gram. pick-up series resistance	51,000
R11	Part of T.C. circuit	25,000
R12	Manual volume control	1,000,000
R13	V4 triode anode load	51,000
R14	V1, V2, V3, S.G.'s decoupling	20,000
R15	G.B. battery load	1,000
R16	V5 C.G. circuits stabiliser	240,000
R17	Part V5 imp. limiting filter	25,000

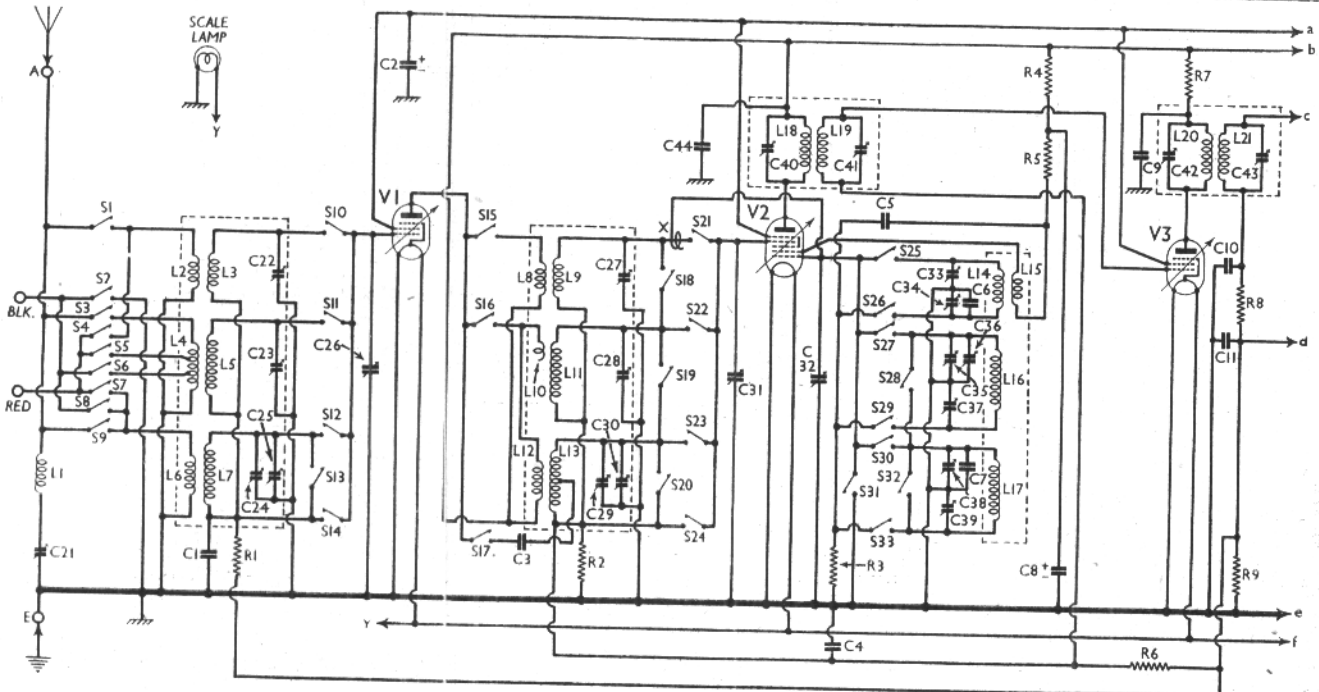
* Tapped at 215,000 O.

Condensers		Values (μF)
C1	V1 C.G. decoupling	0.05
C2*	V1, V2, V3 S.G.'s decoupling	4.0
C3	H.F. trans. cap. coupling (L.W.)	0.00041
C4	V2, V3 A.V.C. line decoupling	0.05
C5	V2 osc. anode coupling	0.00025

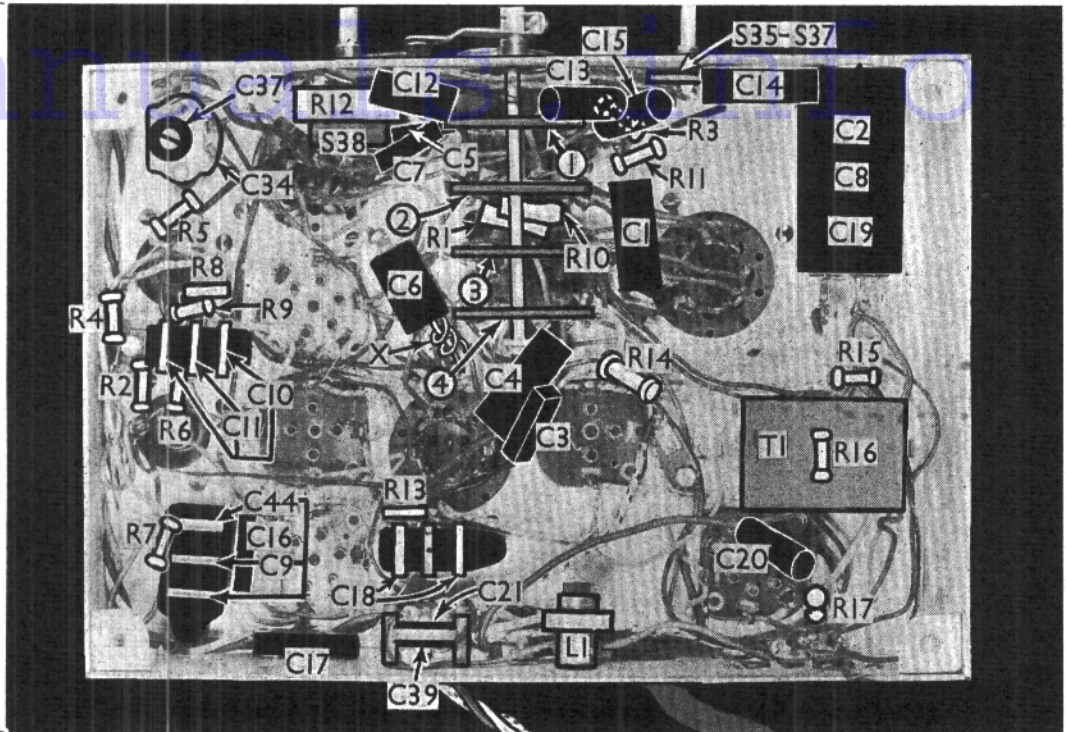
Condensers (continued)		Values (μF)
C6	Oscillator fixed tracker (S.W.)	0.00225
C7	Oscillator fixed trimmer (L.W.)	0.00005
C8*	V2 osc. anode decoupling	8.0
C9	V3 anode decoupling	0.09
C10	I.F. by-passes	0.00011
C11	L.F. coupling to vol. cont.	0.00011
C12	L.F. coupling to vol. cont.	0.001
C13	L.F. coupling to vol. cont.	0.001
C14	Parts of tone control circuit	0.01
C15	Parts of tone control circuit	0.001
C16	V4 triode C.G. I.F. by-pass	0.00011
C17	V4 triode anode I.F. by-pass	0.0008
C18	L.F. coupling to T1	0.09
C19*	H.T. supply reservoir	2.0
C20	Part V5 imp. limiting filter	0.001
C21†	Aerial I.F. filter tuning	0.000045
C22†	Aerial S.W. trimmer	—
C23†	Aerial M.W. trimmer	—
C24†	Aerial L.W. trimmers	—
C25†	Aerial L.W. trimmers	—
C26†	Aerial circuit tuning	—
C27†	H.F. trans. S.W. sec. trimmer	—
C28†	H.F. trans. M.W. sec. trimmer	—
C29†	H.F. trans. L.W. sec. trimmers	—
C30†	H.F. trans. L.W. sec. trimmers	—
C31†	H.F. trans. sec. tuning	—
C32†	Oscillator circuit tuning	—
C33†	Osc. S.W. trimmer	—
C34†	Osc. S.W. tracker	0.0006
C35†	Osc. M.W. trimmers	—
C36†	Osc. M.W. trimmers	—
C37†	Osc. M.W. tracker	0.0015
C38†	Osc. L.W. trimmer	—
C39†	Osc. L.W. tracker	0.000375
C40†	1st I.F. trans. pri. tuning	—
C41†	1st I.F. trans. sec. tuning	—
C42†	2nd I.F. trans. pri. tuning	—
C43†	2nd I.F. trans. sec. tuning	—
C44	V2 anode decoupling	0.09

* Electrolytic. † Variable. ‡ Pre-set.

Other Components		Approx. Values (ohms)
L1	Aerial I.F. filter coil	17.0
L2	Aerial S.W. coupling coil	0.5
L3	Aerial S.W. tuning coil	0.1
L4	Aerial M.W. coupling coil	35.0
L5	Aerial M.W. tuning coil	2.5
L6	Aerial L.W. coupling coil	115.0
L7	Aerial L.W. tuning coil	15.0



Under-chassis view. C34 is beneath C37, and both are adjustable through a hole in the chassis deck. X is a small coupling consisting of 1½ turns of one wire round another. The figures in circles indicate the switch units and the arrows show the direction in which they were viewed in drawing up the diagrams on page VIII.



Other Components (continued).		Approx. Values (ohms)
L8	H.F. trans. S.W. primary	5·0
L9	H.F. trans. S.W. secondary	0·1
L10	Small coupling	Very low
L11	H.F. trans. M.W. secondary	2·5
L12	H.F. trans. M.W. and L.W. primary	115·0
L13	H.F. trans. L.W. secondary	15·0
L14	Oscillator S.W. tuning coil	0·1
L15	Osc. anode reaction coil	0·4
L16	Oscillator M.W. tuning coil	2·0
L17	Oscillator L.W. tuning coil	6·0
L18	1st I.F. trans. (Pri.)	8·0
L19	(Sec.)	12·0
L20	2nd I.F. trans. (Pri.)	12·0
L21	(Sec.)	8·0

Other Components (continued).		Approx. Values (ohms)
L22	Speaker speech coil	2·0
T1	Intervolve trans. (Pri.)	650·0
	(Sec. total)	6,000·0
T2	Speaker input trans. (Pri. total)	500·0
	(Sec.)	0·2
Sr-S33	Waveband and muting switches	—
S34	Gram. pick-up switch	—
S35-S37	Tone control switches	—
S38	L.T. and H.T. switch, ganged	—
X	Small coupling	—

DISMANTLING THE SET

Removing Chassis.—If it is necessary to remove the chassis from the cabinet, first remove the batteries and the back. Now remove the five control knobs (pull off), and the four bolts (with washers) holding the chassis to the bottom of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

When replacing, do not forget the rubber washers between the chassis and the bottom of the cabinet.

To free the chassis entirely, unsolder the leads from the speaker. **When replacing,** connect the leads as follow, numbering the tags from bottom to top:— 1, blank; 2, green; 3, green/white; 4, white; 5, blank.

Removing Speaker.—To remove the speaker from the cabinet, unsolder the leads and remove the nuts and washers from the four bolts holding it to the sub-baffle. **When replacing,** see that the transformer is on the right.

VALVE ANALYSIS

Valve voltages and currents given in the table below were measured with a battery reading 165 V, with the volume control at maximum and the receiver tuned to the lowest wavelength on the medium band. There was no signal input.

Voltages were measured on the 1,200 V scale of an Avometer, with chassis as negative.

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 1A4E	165	0·0	25	0·2
V2 1C6*	165	0·3	25	0·6
V3 1A4E	165	0·0	25	0·2
V4 2102	90	1·3	—	—
V5 2103	162†	6·7†	165	3·8

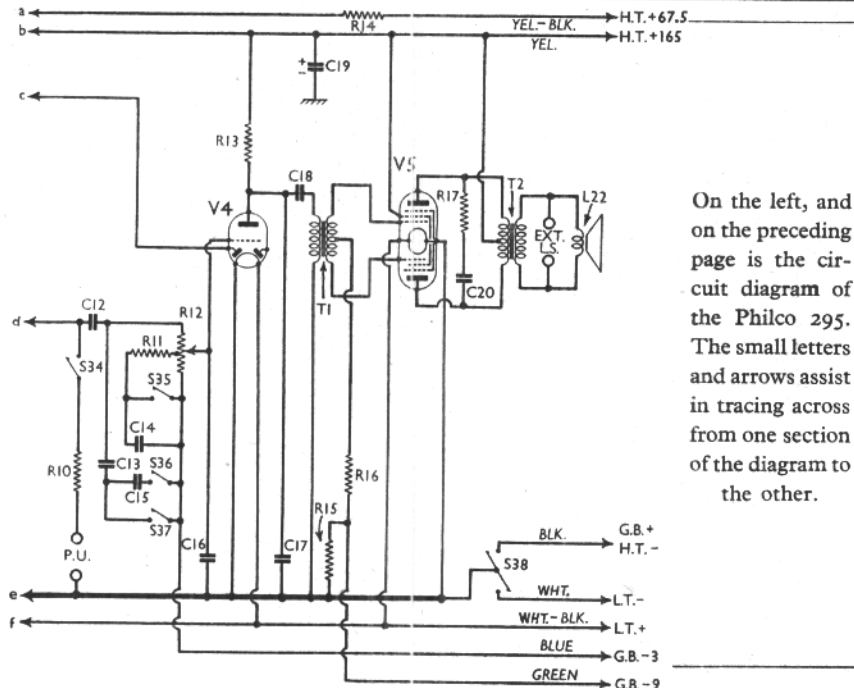
* Osc. anode (G2), 130 V, 2·2 mA.
† Each anode.

GENERAL NOTES

Switches.—S1-S34 are the waveband and gramophone switches in four ganged assemblies beneath the chassis. For the sake of clarity in the circuit diagram the contacts have been separated into single-pole units which are shown in the separate switch diagrams. These show the contact arrangements as seen looking at the underside of the chassis from the rear. The table (p. viii) gives the switch positions for the various settings of the control knob, O indicating open and C closed.

S35-S37, the tone control switches, are in a separate rotary assembly also shown diagrammatically. Here again, the contacts have been separated into single-pole units. With the control knob in its fully anticlockwise position (normal) S35 is closed. In the next

(Continued overleaf)



On the left, and on the preceding page is the circuit diagram of the Philco 295. The small letters and arrows assist in tracing across from one section of the diagram to the other.

PHILCO 295 (Continued)

position (bass boost) all switches are open, in the third position (top cut 1) S36 is closed, and in the fully clockwise position (top cut 2) both S36 and S37 are closed.

S38 is a 3-point Q.M.B. switch used for L.T. and H.T. switching. It is ganged with the manual volume control R12.

Switch	L.W.	M.W.	S.W.	Gram.
S1	O	O	C	O
S2	O	O	C	O
S3	O	O	C	O
S4	O	O	C	O
S5	O	O	C	O
S6	O	O	C	O
S7	O	O	C	O
S8	O	O	C	O
S9	O	O	C	O
S10	O	O	C	O
S11	O	O	C	O
S12	O	O	C	O
S13	O	O	C	O
S14	O	O	C	O
S15	O	O	C	O
S16	O	O	C	O
S17	O	O	C	O
S18	O	O	C	O
S19	O	O	C	O
S20	O	O	C	O
S21	O	O	C	O
S22	O	O	C	O
S23	O	O	C	O
S24	O	O	C	O
S25	O	O	C	O
S26	O	O	C	O
S27	O	O	C	O
S28	O	O	C	O
S29	O	O	C	O
S30	O	O	C	O
S31	O	O	C	O
S32	O	O	C	O
S33	O	O	C	O
S34	O	O	C	O

Coils.—All tuning coils, with the exception of the I.F. filter coil L1, are in five screened units mounted on the chassis deck. L1 is beneath the chassis, at the rear.
Condensers.—C2, C8 and C19 are respectively 4, 8 and 2½F dry electrolytics in a single cylindrical metal can beneath the chassis. The can is the common negative connection, while the positive connections are taken out to colour-coded tags. The blue tag is

Diagrams of the wave-change and gramophone switches, as seen from the rear of the underside of the chassis. The units are numbered in accordance with the under-chassis view.

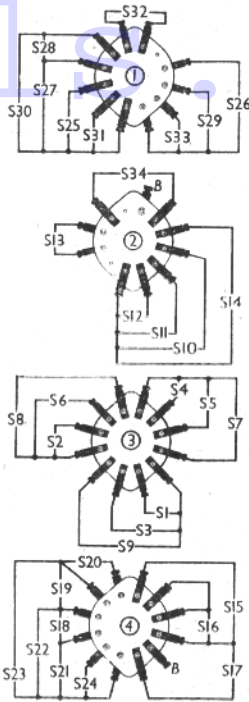
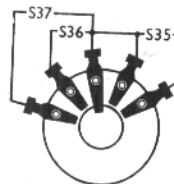


Diagram of the tone control switch unit, seen from the rear of the underside of the chassis.



the positive of C2, the yellow tag the positive of C8, and the plain tag the positive of C19.

C18 is a mica dielectric condenser in a black moulded case. The centre tag is used only as a bearer.

Scale Lamp.—A Philco 2 V type with a special bayonet cap.

External Speaker.—Soldering tags are provided on the internal speaker input transformer for the connection of a low-impedance (2 O) external speaker.

Battery Leads and Voltages.—The following coding for the battery leads is employed:—White, L.T. negative; white-black, L.T. positive; black, H.T. negative and G.B. positive; yellow-black, H.T. positive 67.5 V; yellow, H.T. positive 165 V; blue, G.B. negative 3 V; green, G.B. negative 9 V.

H.T. Battery.—The recommended H.T. battery is a Philco-Siemens Full-o'-Power 165 V combined H.T. and G.B. type, number 1287.

CIRCUIT ALIGNMENT

I.F. Transformers.—Adjust signal generator to 451 KC/S and feed output between V2 control grid (top cap) and chassis, first removing normal grid connection. Set wavechange switch control to M.W., gang condenser to minimum capacity, volume control to maximum, and tone control to normal. Adjust I.F. trimmers C43, C42, C41, C40 in that order to obtain maximum reading on output meter.

I.F. Filter.—Transfer signal generator lead via a dummy aerial to the aerial socket and replace V2 grid lead. Feed in 451 KC/S signal and adjust C21 (screw) for minimum output.

Signal Frequency and Oscillator Circuits.—First set gang condenser to minimum capacity (vaues fully out) and check that indicator reads on index line (above 1,500 KC/S). Set wavechange switch to L.W., gang to 290 KC/S and adjust C39 (nut) to three-quarters of a turn from tight. Feed in a 290 KC/S signal (aerial socket) and adjust trimmers C38, C29, C30, C24, C25 for maximum output. There are two trimmers each on the aerial and H.F. coils and these enable very fine adjustments to be made. If C39 is too tight, violent oscillation may occur. Feed in and tune a 160 KC/S signal. Rock gang and adjust tracker C39 for maximum output. Re-adjust trimmer at 290 KC/S and tracker at 160 KC/S until no further improvement is obtainable.

Set wavechange switch to M.W. and gang to 1,400 KC/S. Feed in a 1,400 KC/S signal and trim C35 and C36 for maximum output. Both should be reasonably tight. Trim C28 and C23 for maximum output. Feed in and tune a 600 KC/S signal. Rock gang and adjust tracker C37 (screw) for maximum output. Re-adjust trimmers at 1,400 KC/S and tracker at 600 KC/S until no further improvement results.

Set wavechange switch to S.W. and gang to 18 MC. Substitute a 400 O resistance for the dummy aerial, and feed in 18 MC signal, adjusting C33 for maximum output. To avoid adjusting to the image frequency, the signal input should be kept low and C33 should first be screwed up tight and then slowly unscrewed until the second peak (minimum capacity) is obtained. To overcome the effect of "locking" when trimming the signal frequency circuits a 21 plate variable condenser (approx. 0.00035 µF) is shunted across C32 section of gang and tuned for the 18 MC signal (about half open). Then trimmers C27 and C22 are adjusted for maximum output, after which the shunt capacity is removed and C33 retrimmed. Check for image frequency, which should be weaker than the fundamental at approximately 17.1 MC. Feed in and tune 6 MC signal. Rock gang and adjust tracker C34 (nut). Re-adjust trimmers at 18 MC and tracker at 6 MC until no further gain can be obtained. Finally, check the calibration.

Plan view of the chassis. All trimmers with the exception of C21 and C39 are clearly marked.

