



# PHILCO



## Radio Service Bulletin No. 86

Published by the Philco Radio & Television Corporation of Great Britain, Ltd., Perivale, Greenford, Middlesex

### Model X.521

**TYPE CIRCUIT:** Five-valve Superheterodyne Receiver with Pentode Output (2.5 watts) for operation on Medium and Long Wavebands. Delayed A.V.C. is incorporated in the circuit, and provision is made for connecting an external speaker of the Permanent Magnet Moving Coil type having an impedance of 2-3 ohms. By reason of special design and temperature drift compensation, the Receiver has a very high degree of frequency stability.

**POWER SUPPLY:** The circuit is so arranged that connection may be made to either A.C. or D.C. mains from 200-250 volts without discrimination or adjustment, and on A.C. mains the circuit is independent of periodicity between the limits of 40-100 cycles. A type 25RE rectifying valve is employed in the Receiver, and is used as a half-wave rectifier on A.C. and as a resistance on D.C.

**WAVEBANDS: COVERAGE:** Two: (a) Medium, 200-550 metres (1,500-545.4 kilocycles); (b) Long, 1,100-1,900 metres (272.7-157.9 kilocycles).

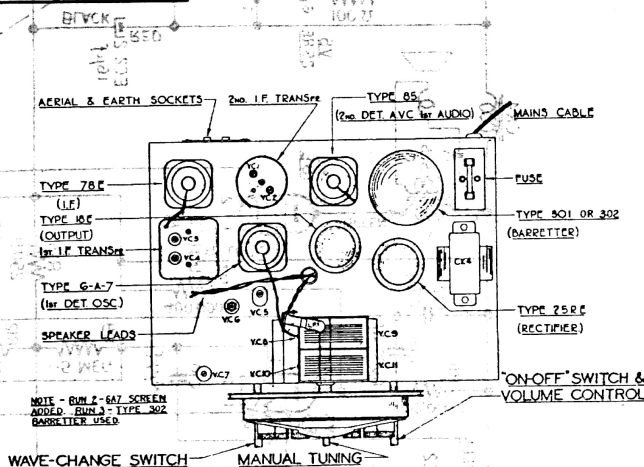
**TUNING DIAL:** Philco Automatic Dial Tuning device, glowing beam station indicator and slow motion manual drive-ratio 14-1.

**LOUD SPEAKER: Bakelite Cabinet Models**—a 6-in. diameter nickel-aluminium alloy permanent magnet moving coil speaker with curvi-linear cone is used. This speaker gives the highest efficiency audio output and greater bass response.

**Wood Cabinet Models**—an 8-in. diameter permanent magnet moving coil speaker is used.

**INTERMEDIATE FREQUENCY:** 475 Kc.

**POWER CONSUMPTION:** 85 watts approx.



TOP CHASSIS DIAGRAM

TABLE 1 — VOLTAGES

Valve socket readings to chassis taken with an 065, 077 or J3 Philco Set Tester, using the 500, 250 and 10 volts ranges. Volume control at minimum, wave-change switch in M.W. position and no aerial connected. A.C. line 230 volts, 50 cycles.

POSITION	VALVE	ANODE	SCREEN
1st Detector and Oscillator, S.2 ...	6A7	Pin 3. 230 v. Pin 5. 150 v.*	Pin 4. 70 v.
I.F. Amplifier, S.1 ...	7SE	Pin 3. 230 v.	Pin 4. 70 v.
2nd Detector, A.V.C. and 1st Audio, S.3 ...	85	Pin 3. 25 v.	—
Pentode Output, S.4 ...	18E	Pin 3. 220 v.	Pin 4. 230 v.
Half-Wave Rectifier, S.3 ...	25RE	Pins 3 & 6. 230 v. A.C. Pins 4 & 5. 240 v. D.C.	—
Barretter, B.1 ...	301 or 302	Pin 1. 230 v. A.C. Pin 2. 64 v. A.C.	—

\* Oscillator Anode Volts. Bias, 15 volts, measured between S.3/2 and chassis. <sup>7</sup>LP1, V1, V2 and V3 filaments each 6.3 volts A.C.; V4 filament, 14 volts A.C.; V5 filament, 25 volts A.C., measured between Pins 1 and 2 on each socket.

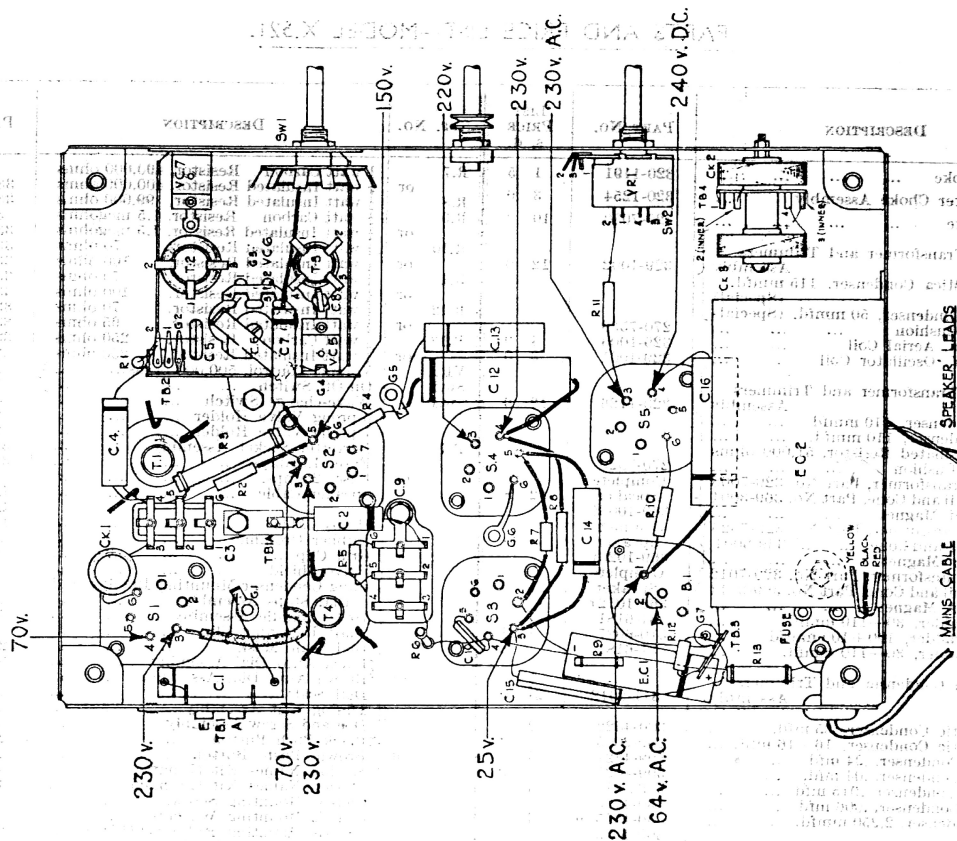
TABLE 2 — RESISTANCES OF COILS.

REF. No.	TEST PROD. 1	TEST PROD. 2	RESISTANCE (Ohms)	REF. No.	TEST PROD. 1	TEST PROD. 2	RESISTANCE (Ohms)
CK.1 ...	C.3/3	Chassis	25	T.5 Primary	V.4/3	C.3/2	700 approx.
T.2 ...	V.2 Cap	TB.2/2	Sw.1. M.W. 3.5 L.W. 45	T.5 Secondary	Output Transformer	Output Transformer	0.2†
T.1 Primary	V.2/3	C.3/2	8	Speech Coil	Lead 1	Lead 2	2†
T.1 Secondary	V.1 Cap	TB.3 tag	12	CK.4 ...	G.3/2	V.5/5	150
T.3 ...	V.2/6	Sw.1/1	Sw.1. M.W. 5 L.W. 25	CK.3 ...	TB.4/3	Sw.2/3	Sw.2. ON 2.5 OFF Infinity
T.4 Primary	V.1/3	C.3/2	12	CK.2 ...	TB.4/2	Sw.2/2	Sw.2. ON 2.5 OFF Infinity
T.4 Secondary	V.3/5	VR.1/3	51,000 approx.				

† Resistance of T.5 Secondary alone and Speech Coil alone (taken when disconnected).

NOTE.—Reference numbers for valves should be read in conjunction with the socket numbers, e.g., V.1-S.1.





UNDER CHASSIS DIAGRAM—MODEL X.521.

### ALIGNMENT PROCEDURE.—MODEL X.521.

Before leaving the Factory, all Philco Receivers are accurately aligned, but if misalignment is suspected through damage, no alteration must be made without instruction in the correct adjustment of the trimming and padding condensers. It should be carried out only with the aid of an accurately calibrated Signal Generator, and for this purpose the PHILCO ALL-PURPOSE SET TESTER MODEL 077 or 077E is recommended. Connect the Output Meter across the Primary of the Output Transformer, i.e., green and white leads. Turn wave-change switch clockwise (M.W. position) and volume control fully clockwise.

**DIAL CALIBRATION:** In order to adjust this Receiver correctly, the dial must be aligned to track properly with the tuning condenser. To do this, proceed as follows: Open tuning condenser to fullest extent, insert a .006 in. feeler gauge under the heel of the moving vanes and close tuning condenser on to gauge.

With tuning condenser in this position, check that indicator reads on index point (under letter "A" in word "LENINGRAD").

Remove feeler gauge.

**INTERMEDIATE FREQUENCY:** The I.F. trimmers (VC's 1, 2, 3 and 4) must first be carefully adjusted by feeding in a 475 Kc. signal from the Signal Generator via a Standard Dummy to the grid cap of the 6A7 valve (with grid lead connected) and the Signal Generator earthed to the Receiver earth socket. Adjust the Signal Generator Attenuator to give a half-scale reading on the Output Meter. The I.F. trimmers must then be adjusted for maximum output.

Transfer Signal Generator lead via the Standard Dummy to the Aerial socket.

**MEDIUM WAVES:** Set dial at 1,400 Kc. (dot at 214 metres); feed in a signal of 1,400 Kc. and trim VC's 10 and 8 in that order for maximum output.

Feed in and tune a signal of 600 Kc. (500 metres). Rock tuning condenser and pad VC.6 (screw) for maximum output. Readjust VC.10 at 1,400 Kc. Repeat the above operation until no further improvement results.

**LONG WAVES:** (a) With wave-change switch in M.W. position, feed in and tune a 1,050 Kc. (285.7 metres) signal—this corresponds to West of England Regional. Keep dial in this position and turn wave-change switch counter-clockwise (L.W. position).

(b) Feed in a signal of 232 Kc. (1,293 metres)—this corresponds to Luxembourg—and adjust VC's 5 and 7 in that order for maximum output.

(c) Feed in and tune a signal of 160 Kc. (corresponding to dot under letter "T" in word "BUDAPEST"). Rock tuning condenser and pad VC.6 (nut) for maximum output.

Repeat operations (a) and (b).

Repeat operations (c) (a) and (b) in that order until no further improvement is obtainable.

ALTERNATIVELY, the L.W. alignment may be carried out as follows:—

Turn wave-change switch to L.W. position (counter-clockwise rotation) and set dial so that indicator reads on dot above letter "R" in word "LUXEMBOURG." Feed in a signal of 240 Kc. and trim VC's 5 and 7 in that order for maximum output.

Set dial so that indicator reads on dot under letter "T" in word "BUDAPEST," and feed in a signal of 160 Kc. Rock tuning condenser and pad VC.6 (nut) for maximum output. Readjust VC.5 at 240 Kc. Repeat the above operation until no further improvement is obtainable.

**NOTE.**—For accurate coincidence of medium and long wave stations on Automatic Dial Push Buttons the first method of alignment should be carried out.

Check calibration.

PARTS AND PRICE LIST—MODEL X.521.

REF. No.	DESCRIPTION	PART No.	LIST PRICE s. d.	REF. No.	DESCRIPTION	PART No.	LIST PRICE s. d.		
CK.1	Aerial Choke ...	\$20-1191	1 5	R.7	1 watt Carbon Resistor, 490,000 ohms	6097	8		
CK.2	Mains Filter Choke Assembly ...	\$20-1254	3 0	R.8	1 watt Insulated Resistor, 400,000 ohms	339-2026	8		
CK.3				R.9	1 watt Carbon Resistor, 99,000 ohms	330-2012	8		
CK.4	L.F. Choke ...	\$20-7030	10 3	R.10	1 watt Carbon Resistor, 1.5 megohms	33-1188	8		
T.1	1st I.F. Transformer and Trimmers Assembly	329-1002	12 0	R.11	1 watt Insulated Resistor, 1.5 megohms	339-2029	8		
VC.3						R.10	1 watt Insulated Resistor, 70 ohms	330-2036	8
VC.4						R.11	1 watt Insulated Resistor, 100 ohms	339-2008	8
C.17	Silvered Mica Condenser, 115 mmfd. (Special)			R.11	1 watt Insulated Resistor, 70 ohms	330-2036	8		
C.18	Ceramic Condenser, 50 mmfd. (Special)			R.12	1 watt Insulated Resistor, 100 ohms	339-2008	8		
T.2	Coil Can Cushion ...	270-7539		R.13	1 watt Insulated Resistor, 70 ohms	330-2036	8		
T.3	M. & L.W. Aerial Coil ...	329-1000	4 0	R.13	1 watt Insulated Resistor, 65 ohms	339-2007	8		
T.4	M. & L.W. Oscillator Coil ...	329-1001	3 0	R.13	1 watt Carbon Resistor, 250 ohms	330-1000	8		
VC.1	2nd I.F. Transformer and Trimmers Assembly	320-1126	18 0	VR.1	Volume Control, 500,000 ohms ...	33-5212	4 3		
VC.2						Sw.2	On-Off Switch ...		
C.19	Mica Condenser, 110 mmfd. ...			Sw.1	Wave-change Switch ...	42-1321	2 9		
C.20	Mica Condenser, 110 mmfd. ...			B.1	6-prong Valve Holder ...	27-6036	1 0		
R.14	1 watt Insulated Resistor, 51,000 ohms				7-prong Valve Holder ...	27-6037	1 0		
T.5	Coil Can Cushion ...	270-7529			Barretter-Socket Assembly ...	380-5199	1 6		
or T.5	Output Transformer, Part No. 329-7020	Complete			Fuse, 1.5 amps. ...	380-5019	4		
or T.5	Speech Coil and Cone, Part No. 369-3001	Complete	32 8		Fuse, 2 amps. ...	45-2121	4		
VC.5	Permanent Magnet ...	369-1008†			Speaker Cable ...	LO-1041	1 0		
VC.6	Output Transformer, Part No. 329-7020	Complete			Mains Cable ...	LO-1069	2 2		
VC.7	Speech Coil and Cone, ...	369-1020†			Rubber Grommet ...	270-7341	1		
VC.8	Permanent Magnet ...	369-1012†			Grid Clip ...	28-2214	doz. 6		
VC.9	Single Padder, 30—110 mmfd. ...	31-6181	8		Valve Shield ...	28-2726	3		
VC.10	Double Padder, 100+100 mmfd. ...	310-6027	1 4		Gang Condenser Mounting Bracket and Dial Stops Assembly ...	389-5048	3 11		
VC.11	Single Padder, 30—110 mmfd. ...	31-6181	8		Drive Spindle Assembly ...	389-5003	4		
EC.1	Two-gang Condenser and Trimmers Assembly	311-2012	21 0		Shaft Retaining Clip ...	28-2043	1		
EC.2							Dial Scale Mask ...	279-5000	9
C.1	Electrolytic Condenser, 25 mfd. ...	300-4022	1 9		1 Black Auto Dial Assembly ...	389-5007	30 0		
C.2	Electrolytic Condenser, 16+16 mfd. ...	309-2005	6 6		1 Brown Auto Dial Assembly ...	389-5049	30 0		
C.3	Tubular Condenser, .04 mfd. ...	309-4221	1 0		Dial Scale ...	279-5001	2 4		
C.4	Tubular Condenser, .04 mfd. ...	309-4021	9		Tuning Belt Assembly ...	389-5010			
C.5	Moulded Condenser, .015 mfd. ...	3793-8U	1 3		Dog and Screw Assembly ...	389-5008	9		
C.6	Tubular Condenser, .006 mfd. ...	30-4125	9		1 Black Push Button ...	279-4001	9		
C.7	Mica Condenser, 2,250 mmfd. ...	30-1055 or 300-1072	1 2		1 Brown Push Button ...	279-4005	9		
C.8	Ceramic Condenser, 220 mmfd. (Special)	309-1121	1 0		Station Names Kit (7 names)	409-5000	1 3		
C.9	Ceramic Condenser, 25 mmfd. (Special)	309-1105*	1 0		Station Names Kit (21 names)	409-5001	1 3		
C.10	Ceramic Condenser, 250 mmfd. (Special)	309-1124	1 0		Chassis Mounting Screws ...	W-1335	doz. 2		
C.11	Ceramic Condenser, 220 mmfd. (Special)	309-1127	1 0		Chassis Mounting Washers ...	29-2089	doz. 2		
C.12	Tubular Condenser, .0008 mfd. ...	30-4335	9		Chassis Mounting Rubbers (Thick) ...	270-7451	2		
C.13	Mica Condenser, 800 mmfd. ...	300-1005	10		Chassis Mounting Rubbers (Thin) ...	270-7579	2		
C.14	Ceramic Condenser, 15 mmfd. (Special)	309-1120	1 0		Rubber Mounting Cups ...	270-7374	2		
C.15	Moulded Condenser, .05+.05 mfd. ...	3615-DG	1 10		1 Black Wave-change Knob, Grub Screw and Spring ...	270-4193	8		
C.16	Mica Condenser, 140 mmfd. ...	300-1212	6		1 Black Plain Knob, Grub Screw and Spring ...	270-4187	8		
R.1	Mica Condenser, 100 mmfd. ...	309-1008	7		1 Brown Wave-change Knob, Grub Screw and Spring ...	270-4199	8		
R.2	Tubular Condenser, .25 mfd. ...	30-4134	1 6		Spring ...	270-4189	8		
R.3	Tubular Condenser, .04 mfd. ...	309-4021	9		Knob Grubscrew ...	WB-346	doz. 4		
R.4	Tubular Condenser, .04 mfd. ...	309-4021	9		Knob Lock Nut ...	WN-301	1		
R.5	Tubular Condenser, .04 mfd. ...	309-4021	9		Knob Spring ...	280-5262	doz. 4		
R.6	Mica Condenser, 6,000 mmfd. ...	30-1043 or 300-1007	2 2		Red Wander Plug ...	380-5087	3		
R.7	Tubular Condenser, .065 mfd. ...	309-4117	1 8		Black Wander Plug ...	380-5015	3		
R.8	Tubular Condenser, .04 mfd. ...	309-4221	1 0	LP.1	Pilot Lamp ...	34-2141	1 0		
R.9	1 watt Insulated Resistor, 99,000 ohms	330-2012	8	V.1	Type 78E Variable-mu H.F. Pentode				
R.10	1 watt Insulated Resistor, 100,000 ohms	339-2023	8	V.2	Type 6A7 Variable-mu Heptode Valve	8315-E	10 6		
R.11	1 watt Carbon Resistor, 20,000 ohms	33-1178	8	V.3	Type 85 Double Diode Triode Valve	34-2002	11 6		
R.12	1 watt Insulated Resistor, 25,000 ohms	339-2020	8	V.4	Type 18E Pentode Output Valve	7532	9 0		
R.13	1 watt Carbon Resistor, 51,000 ohms	4237	8	V.5	Type 25RE Rectifier Valve	7209-E	10 6		
R.14	1 watt Insulated Resistor, 99,000 ohms	330-2012	8	B.1	Type 301 Barretter ...	340-9000	7 0		
R.15	1 watt Carbon Resistor, 150,000 ohms	33-1183	8		Type 302 Barretter ...	340-9002	7 0		
R.16	1 watt Insulated Resistor, 150,000 ohms	330-2058	8		Instruction Manual ...	399-3076	—		
R.17	1 watt Insulated Resistor, 150,000 ohms	339-2024	8		Automatic Dial Buttons Adjusting Tool	289-1028	9		
R.18	1 watt Carbon Resistor, 1.5 megohms	33-1188	8						
R.19	1 watt Insulated Resistor, 1.5 megohms	339-2029	8						

† When ordering Speaker parts, the letter which will be found in the part number of the Speaker must also be given.

\* Only fitted to some models when necessary.

† Bakelite Cabinet Models. ‡ Wood Cabinet Models.

Above prices do not apply in Eire.