

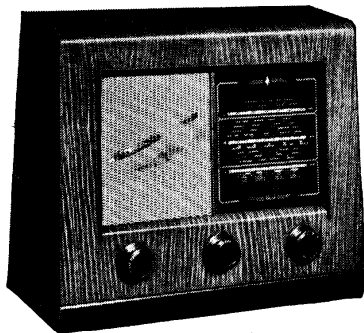
BUSH RADIO

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Service Instructions

MODEL AC.31 for A.C. Mains

MODEL DAC.31 for AC/DC. Mains



FRONT VIEW OF AC, DAC.31

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SPECIFICATION

BASIC DESIGN

A four valve (including rectifier) three waverange super-heterodyne receiver, employing Mullard Rimlock Valves, in the following sequence: Frequency Changer ECH.42 (UCH.42), I.F. Amplifier, Signal rectifier and A.V.C. delay diode EBF.80 (UBF.80). Output stage EL.41 (UL.41) feeding a high flux speaker of 8 inches diameter. For record reproduction the triode section (oscillator) of the frequency changer is used as a first audio amplifier. On the AC.31 a double wound mains transformer is used to supply the valve heaters and rectifier A.C. supplies EZ.41 (UY.41), this is replaced by a mains input unit consisting of a ballast resistor and R.F. filter, on the DAC.31. The valve types indicated in brackets are for use on the DAC.31 model. Adjustable iron dust cored coils are used on the aerial, oscillator, and I.F. circuits.

VALVES	AC.31	DAC.31
MULLARD:	Heater	Heater
"	ECH.42 6.3V.	UCH.42 14.0V.
"	EBF.80 6.3V.	UBF.80 17.0V.
"	EL.41 6.3V.	UL.41 45.0V.
"	EZ.41 6.3V.	UY.41 31.0V.

VOLTAGE RANGE

Model A.C.31.—100-127 and 200-250 volts A.C.40-100 cycles.
Model DAC.31.—200-250 volts AC/DC 40-100 cycles.

MAINS CONSUMPTION

45 watts.

SCALE LAMP

Model AC.31.—6.2 volt 0.3 Amp.
Model DAC.31.—3.5 volt 0.15 Amp.

CABINET DIMENSIONS

Height 13 $\frac{3}{4}$ ins. Depth 7 $\frac{3}{4}$ ins. Width 16 ins.

WAVE RANGES

Long Wave : 300-150 Kc/s. 1000-2000 Metres
Medium Wave : 1700-520 Kc/s. 176-575 Metres
Short Wave : 21-8.5 Mc/s. 14.3-35.5 Metres

INTERMEDIATE FREQUENCY

470 Kc/s.

CONTROLS (from L. to R.)

On/off Switch and Volume.
Tuning.
Waverange/Gramophone Switch.

GRAMOPHONE PICK-UP

The pick-up sockets are situated on the left hand side of the receiver (rear view) next to the aerial and earth sockets. (Crystal type recommended.)

AERIAL AND EARTH

Sockets for aerial and earth connections are situated on a panel on the left hand side (back view) of the receiver.

WEIGHT

14 $\frac{1}{2}$ lbs.

CAPACITORS

Reference	Value		Type	D.C. working voltage	Tolerance $\pm\%$	Part No.	Description
	mmfd.	mfd.					
C1	600	—	S.M.	350	10	AP19652	L.W. Aerial Coupling fixed tuning.
C2	85	—	S.M.	350	2	AP19644 AP19645	L.W. Aerial grid fixed tuning.
C3	—	.05	P.T.	350	20	P3770	V1 & V2, Screen decoupling.
C4	100	—	S.C.	750	20	AP17336	V1, Grid isolating capacitor.
C5	110	—	S.M.	350	2	AP17058 AP16304	1st I.F.T. Primary fixed tuning.
C6	—	.002	P.T.	500	25	P8995	P.U. tone correction circuit.
C7	110	—	S.M.	350	2	AP17058 AP16304	1st I.F.T. Secondary fixed tuning.
C8	—	.001	P.T.	500	25	P3768	V1, Osc. anode isolating capacitor.
C9	56	—	S.C.	750	20	AP18162	V1, Osc. grid capacitor.
C10	33	—	S.M.	350	2	AP17919 AP19690	L.W. Osc. fixed tuning.
C11	240	—	S.M.	350	2	AP19648 AP19649	L.W. Osc. padding capacitor.
C12	365	—	S.M.	350	1	AP19640 AP19651	M.W. Osc. padding capacitor.
C13	515	—	S.M.	350	1	AP17207 AP17175	S.W. Osc. coupling, insulating capacitor.
C14	56	—	S.C.	750	20	AP18162	A.V.C. decoupling capacitor.
C15	—	.05	P.T.	350	20	P3770	2nd I.F.T. Primary fixed tuning.
C16	110	—	S.M.	350	2	AP17058 AP16304	Signal diode filter capacitor.
C17	100	—	M.M.	350	20	P3775	2nd I.F.T. Secondary fixed tuning.
C18	110	—	S.M.	350	2	AP17058 AP16304	Signal diode filter capacitor.
C19	100	—	M.M.	350	20	P3775	Audio coupling capacitor to grid V3.
C20	—	.002	P.T.	500	25	P8995	Fixed tone control capacitor.
C21	—	.01	P.T.	500	25	P3769	V3 cathode bias decoupling.
C22	—	50	Elect.	12	—	P12662	DAC.31 only } H.T. line smoothing.
C23	—	50	Elect.	350	—	AP17168	AC.31 only } H.T. line reservoir.
C23	—	32	Elect.	350	—	AP19643	AC.31 only }
C24	—	50	Elect.	350	—	AP17168	Aerial insulating capacitor.
C24	—	32	Elect.	350	—	AP19643	True earth isolating capacitor.
C25	—	.001	P.T.	1,000	25	AP18629	P.U. Tone correction circuit. } DAC.31 only
C26	—	.01	P.T.	1,000	25	AP17939	P.U. Isolating Capacitor. }
C27	—	.005	P.T.	750	25	AP19727	H.F. Filter Capacitor. }
C28	—	.01	P.T.	750	25	AP19745	S.W. Aerial trimmer.
C29	—	.01	P.T.	750	25	AP19745	M.W. Aerial trimmer.
TC1	60-120	—	Pre-set	—	—	—	S.W. Oscillator trimmer.
TC2	4-40	—	Pre-set	—	—	AP19637	M.W. Oscillator trimmer.
TC3	60-120	—	Pre-set	—	—	—	M.W. Oscillator trimmer.
TC4	4-40	—	Pre-set	—	—	—	M.W. Oscillator trimmer.
VC1	528	—	Ganged	—	—	—	Aerial circuit tuning.
VC2	528	—	Ganged	—	—	BP17863	Oscillator circuit tuning.

S.M. Silvered Mica. P.T. Paper Tubular. M.M. Moulded Mica S.C. Silvered Ceramic.

RESISTORS

Reference	Value in Ohms.	Rating in Watts	Part No.	Description
R1	27,000	$\frac{1}{2}$	P6718	DAC.31 only : V1 and V2 Screens and Osc. section decoupling.
R1	39,000	$\frac{1}{2}$	P6760	AC.31 only : V1 and V2 Screens and Osc. section decoupling.
R2	680,000	$\frac{1}{4}$	P7073	V1, Grid A.V.C. feed resistor.
R3	680,000	$\frac{1}{4}$	P7073	V1, Osc. section grid returns on P.U.
R4	330	$\frac{1}{4}$	P6233	V1, Cathode bias.
R5	47,000	$\frac{1}{4}$	P6779	V1, Osc. grid leak.
*R6	10,000	$\frac{1}{2}$	P6610	V1, Osc. anode load.
R7	100	$\frac{1}{4}$	P6107	V1, Osc. stabiliser on S.W.
R8	1.5 meg.	$\frac{1}{4}$	P7157	A.V.C. decoupling.
R9	47,000	$\frac{1}{4}$	P6779	Signal diode filter.
R10	680,000	$\frac{1}{4}$	P7073	Part of A.V.C. feed to delay diode.
R11	20 megs.	$\frac{1}{4}$	P14545	Part of A.V.C. delay voltage Pot.
R12	330,000	$\frac{1}{4}$	P6989	Signal diode load.
R13	47,000	$\frac{1}{4}$	P6779	V3, Grid stabiliser.
R14	180	$\frac{1}{2}$	P6178	V3, Cathode bias.
R15	1,500	6	AP19642	AC.31 only : H.T. line smoothing.
R15	1,000	6	AP19726	DAC.31 only : H.T. line smoothing.
R16	1 meg.	$\frac{1}{4}$	P7115	Aerial static discharger.
R17	200+200+1030	15	AP19725	Heater circuit ballast. } DAC.31 only
R18	250	4	AP18039	V4 anode limiter. }
R19	75	4	AP18192	Scale lamp shunt. }
VR1	0.5 meg.	—	CP19636	Volume Control with switch S7.

A tolerance of $\pm 20\%$ is permissible on all resistors with the exception of R14, R15 and R17, rated at 5%. R1 & R19, 10%; and R11 33 $\frac{1}{3}\%$.

*AC.31 only. On later receivers, R6 is 22K, 1 watt, 10%, Part No. P6699.

ALIGNMENT PROCEDURE

TEST EQUIPMENT REQUIRED

Signal Generator (for R.F. and I.F. alignment).
 Frequency range : 150 Kc/s. to 21 Mc/s. Calibration accuracy $\pm 1\%$.
 Modulation : 400 cycles at 30%.
 Output Wattmeter 50 to 1000 milliwatts.
 Standard Dummy Aerial, comprising a 200 mmfd. capacitor for L.W. and M.W. and a 400 ohm. non-inductive resistor for the S.W. band.

auxiliary calibration scale. When aligning the R.F. section of the receiver, the signal generator should be connected to the aerial socket. On I.F. alignment an isolating capacitor of .01 mfd. will be required to ensure that the A.V.C. line is not short circuited, it should be connected in series with the signal generator output lead.

PRELIMINARY

The receiver and signal generator should be switched on 10 minutes before commencing alignment, use the lowest input from the signal generator consistent with a reasonable output and with the volume control at maximum. Check the position of the pointer in relation to the tuning condenser, with the plates fully meshed, the pointer should coincide with the datum line as printed on the main and

I.F. ALIGNMENT (470 Kc/s.)

Set the tuning condenser to maximum capacity and connect the signal generator to V2 pin 6. Switch the receiver to the medium waverange and tune the Secondary and Primary of the second I.F.T. in the order given, for maximum output. Transfer the signal generator output to V1 pin 6 and tune the Secondary and Primary of the first I.F.T. in the order given, decreasing the signal generator output as the circuits approach resonance. Peak each circuit once only.

R.F. ALIGNMENT

Operation	Waverange	Signal Generator frequency	Receiver set to frequency	Adjust
1	L.W.	1400M. (214 Kc/s.)	1400M.	Cores of L10 Osc., and L4/5 Aerial, for maximum output.
2	—	—	—	Check calibration.
3	M.W.	500M. (600 Kc/s)	500M.	Cores of L8/9. Osc., and L3 Aerial for maximum output.
4	M.W.	200M. (1500 Kc/s)	200M.	Trimmers TC4. Osc., and TC2 Aerial, for maximum output.
5	Repeat operations (3) and (4)			Check calibration.
6	S.W.	30M. (10 Mc/s.)	30M.	Cores of L6/7 Osc., and L1/2 Aerial, for maximum output.
7	S.W.	15M. (20 Mc/s.)	15M.	Trimmers TC3. Osc., and TC1 Aerial, for maximum output.
8	Repeat operations (6) and (7)			Check calibration.

NOTE.—The auxiliary calibration scale is attached to the rear of the drive drum, and should be used when calibrating the receiver when it is removed from the cabinet.

VALVE VOLTAGES

Input 230 volts A.C. 50 cycles. Receiver set to medium waverange, with no signal input. All measurements taken on an Avometer Model 7, with chassis negative; 1000 volt range for H.T. and 10 volt (or appropriate range) for Cathode measurements.

Valve Type	Electrode	Pin No.	Voltage		Current mA.	
			AC.31	DAC.31	AC.31	DAC.31
V1	Hexode Anode	2	230	140	2	1.5
ECH.42	Oscillator Anode	3	120	100	5	3.8
UCH.42	Screen	5	60	50	3	2.1
	Cathode	7			10	7.5
V2	Anode	6	230	140	4	3.4
EBF.80	Screen	1	60	50	1.5	1.2
UBF.80	Cathode	3			5.5	4.6
V3	Anode	2	220	130	32	36
EL.41	Screen	5	230	140	5	7
UL.41	Cathode	3 & 7	6.8	7.7	37	43
V4	Anode	2-6	300 A.C.	210 A.C.		
EZ.40	Cathode	7			53	55
UY.41						

COILS & TRANSFORMERS

Reference	D.C. resistance in ohms	Part No.	Description
L1	0.5	BS19792	S.W. Aerial coupling.
L2	Less than 0.5 ohms		S.W. Aerial Tuning.
L3	7	BS19710	M.W. Aerial Tuning.
L4	50	BS19711	L.W. Aerial Coupling.
L5	20		L.W. Aerial Tuning.
L6	Less than 0.5 ohms	BS19715	S.W. Oscillator Tuning.
L7	0.5	BS17259	S.W. Oscillator Coupling.
L8	1		M.W. Oscillator Coupling.
L9	5	BS19714	M.W. Oscillator Tuning.
L10	5		L.W. Oscillator Tuning.
L11	3	AS16196	R.F. Filter Chokes. (DAC.31 only)
L12	3		
1st I.F.T.	(P) 12.5 (S) 12.5	ES16447	Primary 1st I.F. Transformer. Secondary 1st I.F. Transformer.
2nd I.F.T.	(P) 12.5 (S) 12.5		ES16448
T1	(P) 410 (S) Less than .5 ohms	AS19697	Primary Ind. at 400 cycles 5V. No load on Sec. is 5H with 36 mA. D.C. } Output Transformer
T2	45 140 0.9 0.4	DS19700	Total Primary H.T. Secondary Rectifier Heater Secondary AC 31 only V1 to V3 Heater Secondary } Mains Transformer

DISMANTLING

Set the tuning control so that the pointer is approximately in the mid-position on the tuning scale and lift the pointer driver off the carriage. Unsolder the speaker connection, and unscrew the pilot lamp holder from the

rear of the scale reflector plate. Remove the three control knobs from the front of the receiver and unscrew the four screws securing the chassis to the cabinet ; withdraw chassis from cabinet.

FITTING CORD DRIVE

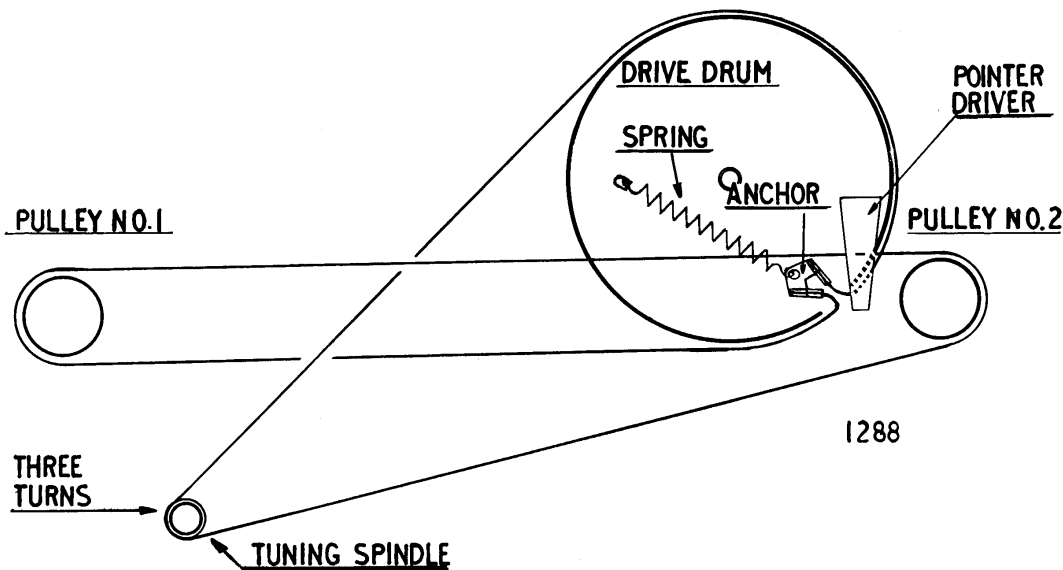
Part Numbers

Cord and Anchor for Tuning Drive	AS19704
Drive Pressure Spring	P1941
Pointer and Carriage	BS16426
Pointer Driver	AP16296

With the plates of the tuning condenser fully meshed the drive drum should be set so that the auxiliary pointer coincides with the Datum line on the scale attached to the rear of the drive drum.

The length of the drive cord after clenching in the anchor is 36 3/8 inches. Hook the cord and anchor to the drive pressure spring and attach the opposite end of the

spring to the drive drum. Pass the cord through the opening on the edge of the drive drum and over pulley No. 1 and round pulley No. 2, take three turns round the tuning spindle in a clockwise direction, and pass the cord between items (3) and (4) indicated on diagram and continue for half a turn round the drive drum back to the drive pressure spring. Clip the pointer driver to the cord but do not clench. Replace the chassis in the cabinet, set the pointer to the datum line to be found on the right hand edge of the L.W. and S.W. scales, drop the pointer driver into the pointer carriage and clench clip tightly on pointer driver.



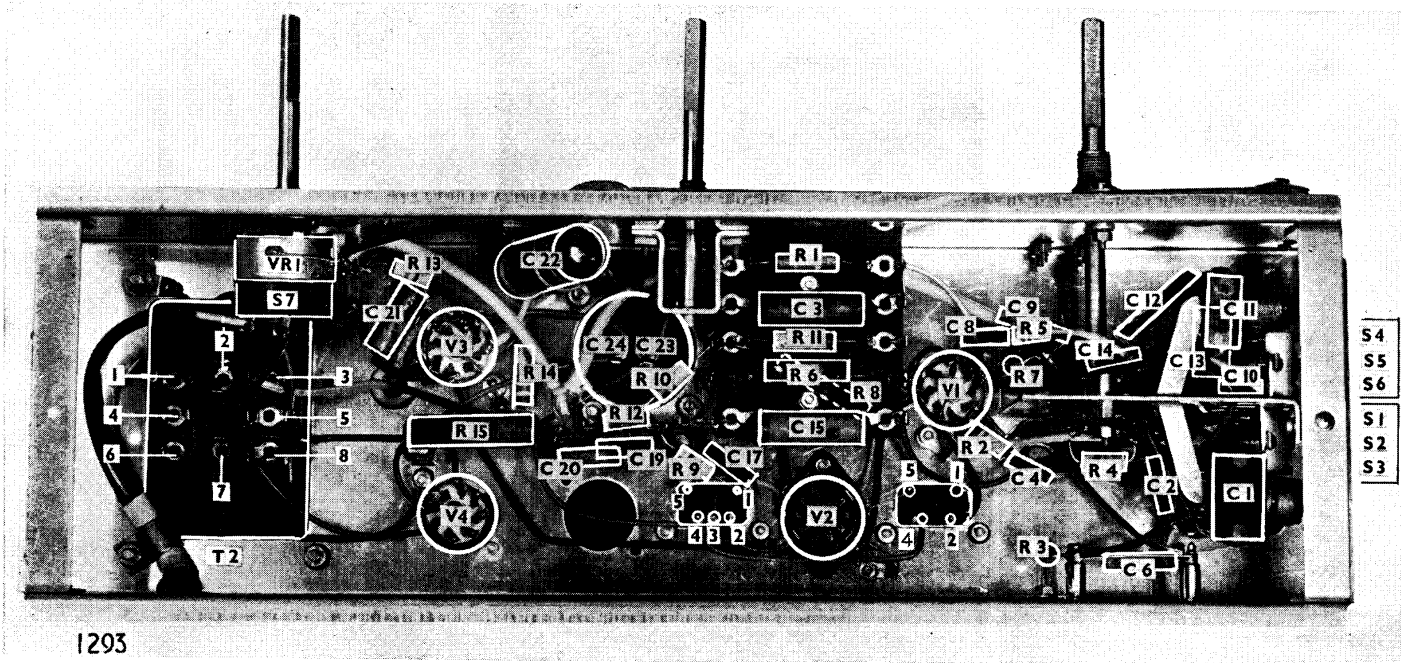
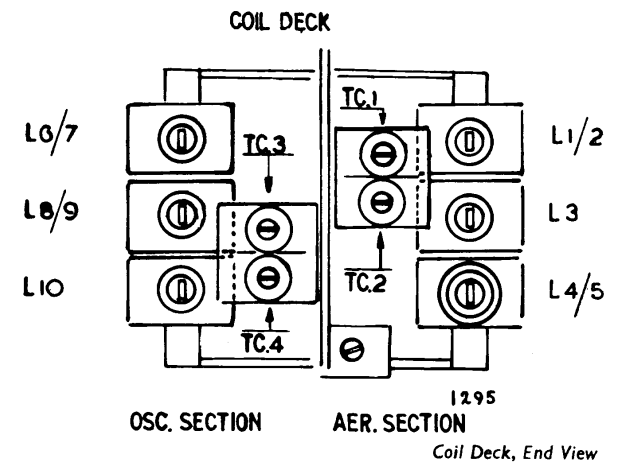


Plate I

Underneath View of AC.31



COIL DECK CONNECTIONS

To remove the coil deck from the chassis, turn the wave-change switch to the "gram" position and unscrew the switch locating plate from the chassis, withdraw switch operating bar from the coil deck. Remove the three screws securing the coil deck to the chassis, and unsolder the following wires.

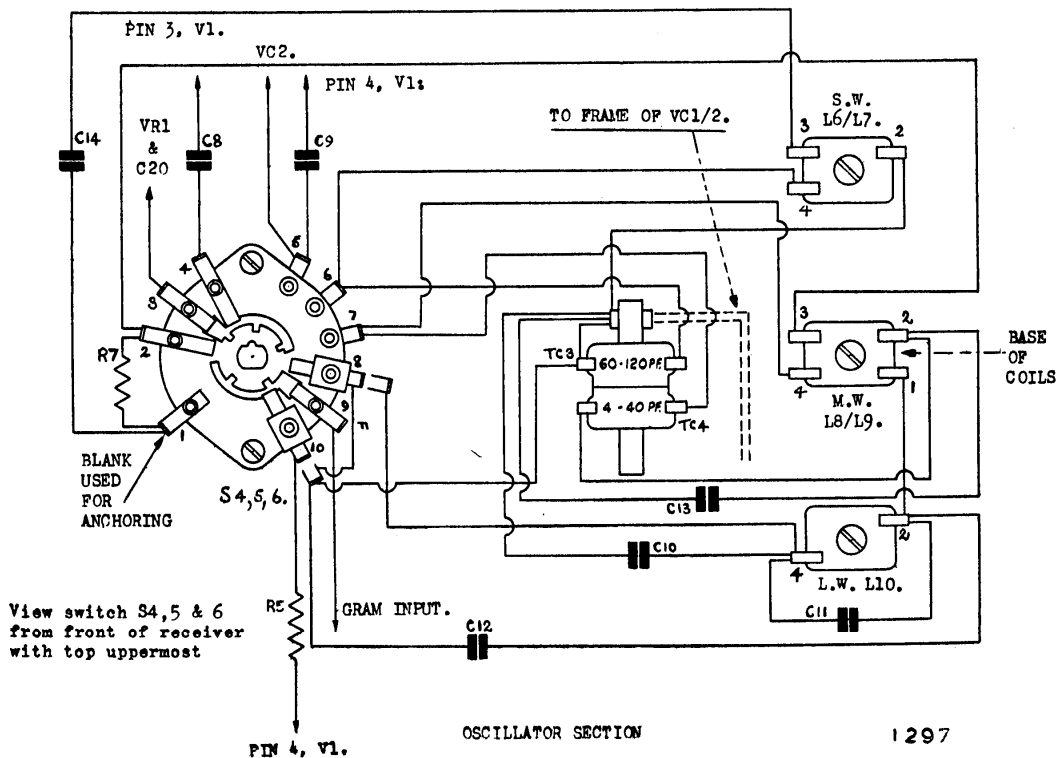
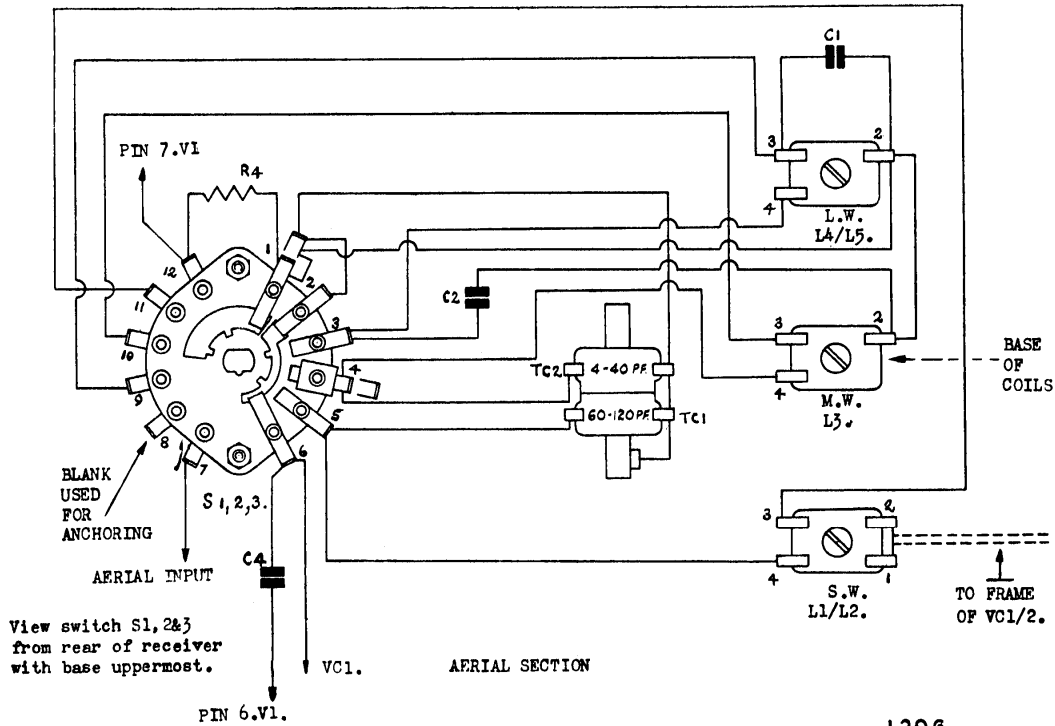
- (4) Remove lead connecting pick-up input socket and switch S.4, 5, 6. Tag No. 9.
- (5) Remove EARTHING braid connecting Osc. Deck to VC2 frame.

AERIAL SECTION

OSCILLATOR SECTION

- (1) Remove screened lead connecting switch S.4, 5, 6, Tag No. 3 to Tag panel on centre of chassis (i.e., C20 and VR1).
- (2) Remove .001 capacitor C8, connecting switch S.4, 5, 6, Tag No. 4, and valve holder V1. Tag No. 3.
- (3) Remove lead connecting switch S.4, 5, 6, Tag No. 5 to VC2 stator at capacitor end. Also capacitor C9 Osc. grid condenser, from valve holder V1, Tag No. 4.

- (1) Remove lead and capacitor connecting switch S.1, 2, 3, Tag No. 6, to VC1 stator and capacitor C4.
- (2) Remove lead connecting switch S.1, 2, 3, Tag No. 7 to aerial input socket.
- (3) Remove resistor R2 and lead from 1st I.F.T. Sec, pin No. 1, from Tag No. 8, switch S.1, 2, 3.
- (4) Remove lead connecting switch S.1, 2, 3, Tag No. 12, to V1 pin No. 7.
- (5) Remove screened lead connecting L1/2 contact No. 1 and 2 to frame of VC1.



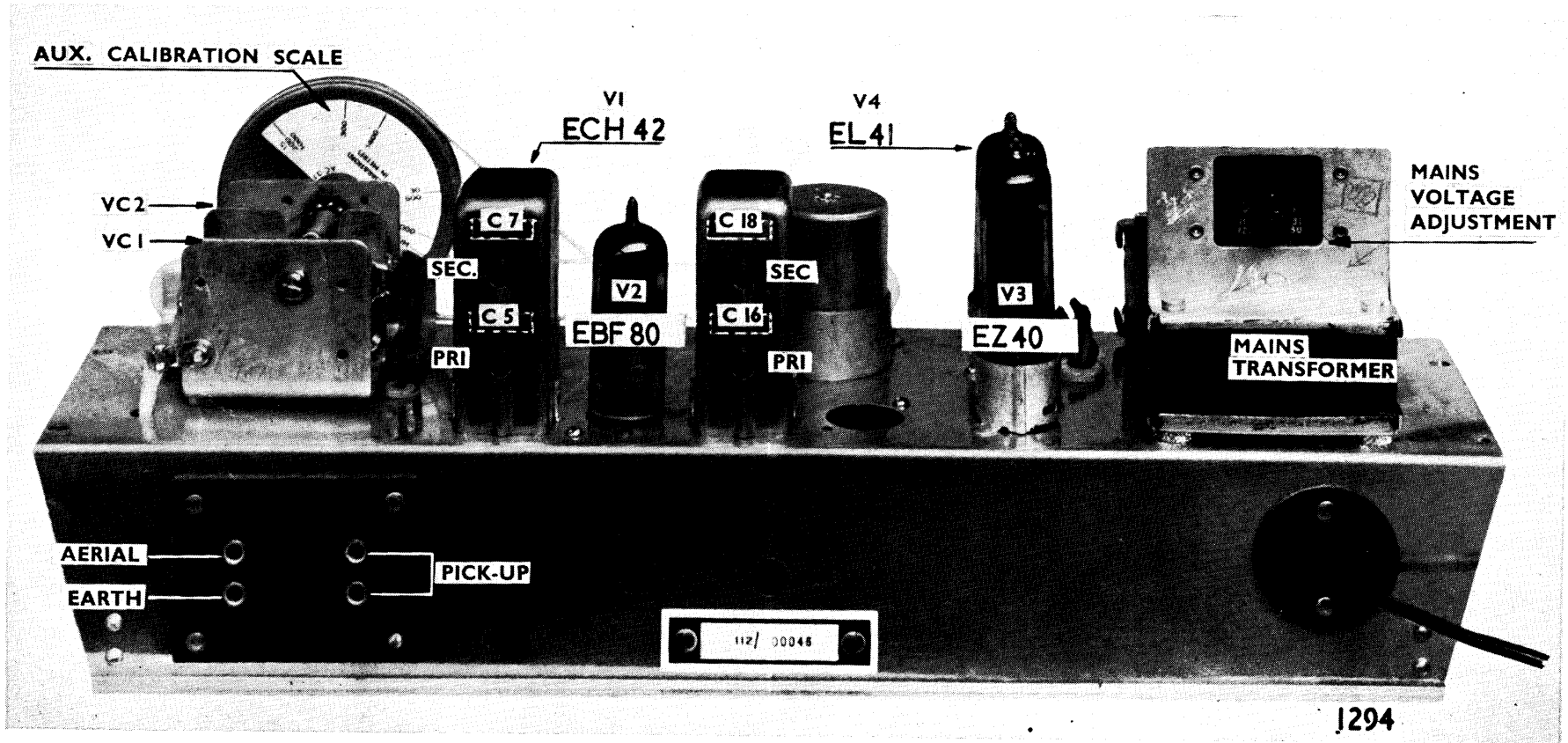


Plate 2

Top View of AC.31

GRAMOPHONE PICK-UP

The waverange switch should be set to the GRAM. position when the receiver is being used for record reproduction. A good quality pick-up should be used, preferably of the "crystal type," a recommended one being the ACOS. GP19, for which a suitable correction circuit is included in the receiver. A "screened" lead having the minimum possible length should be used for the pick-up

connections. The inner conductor is connected to the top P.U. socket, whilst the screening, forming the outer conductor is connected to the lower P.U. socket. The pick-up manufacturers' instructions should be observed if an alternative pick-up is used to that recommended. An input of approximately 0.5 volt R.M.S. is required to fully load the amplifier.

CONNECTIONS TO MAINS TRANSFORMER T2.

The external connections to the mains transformer are made to tags situated on the base of the transformer. These tags numbers are shown on Plate 1, the connections are as follows:—

Part No. DS19700	}	Tag No. 1.	To chassis.
		" " 2.	To pin No. 1, V3.
		" " 3.	To pilot lamp holder.
		" " 4.	To power switch S7.
		" " 5.	To power switch S7.
		" " 6.	To pin No. 8, V4.
		" " 7.	To pin No. 1, V4.
		" " 8.	To pin Nos. 2 and 6, V4.

CONNECTIONS TO I.F. TRANSFORMERS.

The external connections to the I.F. transformers are made to tags situated on the base of the I.F. transformer. The tag numbers are shown on Plate 1, the connections are as follows:—

1st I.F.T. Part No. ES16447	}	Tag No. 1.	To C15 and to R12, via Tag No. 8 switch S1, 2, 3.
		" " 2.	To pin No. 2, V1.
		" " 4.	To pin No. 4 2nd I.F.T. and H.T. + Ve.
		" " 5.	To pin No. 2, V2.
2nd I.F.T. Part No. ES16448	}	Tag No. 1.	To C17 and R19.
		" " 2.	Blank.
		" " 3.	To pin No. 6, V2.
		" " 4.	To pin No. 4 1st I.F.T. and H.T. + Ve.
		" " 5.	To pin No. 7, V2.

WARNING

When servicing the DAC.31 Receiver remember that one side of the electricity supply is connected to the chassis and may, under certain conditions, be "live." Do not connect any earthed equipment or a direct earth to the

chassis without first isolating it by a fixed capacitor of approximately .005 mfd. Care should be taken in handling the chassis.

PART NUMBERS

The following part numbers are not shown elsewhere in these Service Instructions. When ordering replacements please quote:

- (1) Type and serial number of receiver.
- (2) Part number and description of item.
- (3) Quantity required.

Common Part Numbers

Bearing (including Tuning spindle)	BS19705
Cabinet	EP19608
Cabinet Fret	BP19729
Coil Deck (complete less switch operating bar)	ES19708
Coil Deck "Aerial section"	BS19849
Coil Deck "Oscillator section"	BS19854
Iron Dust core (for Aerial and Oscillator coils)	AP17109
Pulley Bracket (left hand front view)	AP19702
Pulley Bracket	AP19703
Switch Wafer (for aerial section)	AP19638
Switch Wafer (for Oscillator section)	AP19639
Tuning Scale	DP19631
Valveholder "Novel"	P3938
Valveholder "B8A"	{ AP17088
	{ AP17391

DAC.31 Part Numbers

Cabinet Back	AS19719
Knob (Volume On/Off)	AP16212
Knob (Tuning)	AP15820
Knob (Waveband)	BP16546
Mains Input Unit, comprising Panel, R17 and R18, C29 and R.F. Filter Coil	DS19718
Operating Instructions	AP19908
Speaker P.M. 6½ inches dia.	CP19673

AC.31 Part Numbers

Cabinet Back	EP19626
Knob (Volume On/Off)	CP16419
Knob (Tuning)	CP16420
Knob (Waveband)	CP16421
Knob Skirt (one required for each knob)	BP16418
Knob Clip (one required for each knob)	AP16423
Operating Instructions	AP19627
Speaker, 6½ inches P.M.	CP19635

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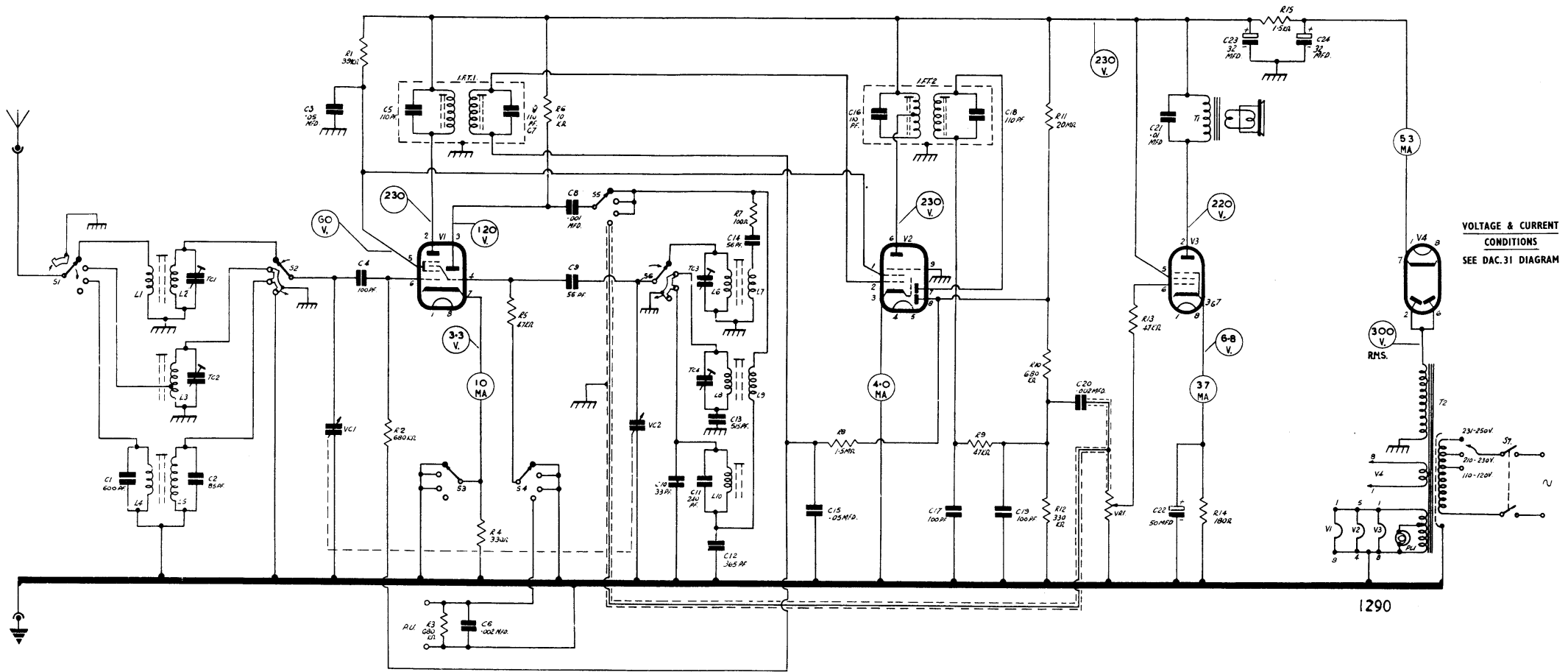
POWER ROAD, LONDON, W.4

Cables : Supasetz, London

Telegrams : Supasetz, Chisk. London

Telephone : Chiswick 6491/9

AC.31 CIRCUIT DIAGRAM



VOLTAGE & CURRENT
CONDITIONS
SEE DAC.31 DIAGRAM

