EKCO SERVICE DATA

MODEL U319

See also Service News Sheets Nos.

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Model U319 is a six valve (including rectifier) superheterodyne receiver offering free tuning of A.M. signals on Long and Medium waveband and F.M. signals on the V.H.F. band (Band 2). Selection is made by a four position switch, which includes one position for gram operation.

For A.M. reception, a directional ' Ferrite ' rod aerial is fitted and provision is made for connecting an external aerial. An internal V.H.F. dipole is provided for F.M. reception in suitable localities whilst a two pin socket is fitted for connecting to the Picture Rail Aerial provided, or an external dipole if desired.

Other special features include variable tone control, compensated volume control to maintain bass response, and sockets for connecting an extension loud-speaker and a gramophone pick-up.

MAINS SUPPLY : 200–250 volts D.C. or A.C. 50–100 c/s.

MAINS CONSUMPTION : 57 watts A.M. and Gram. 62.4 watts F.M.

CONTROLS : The front controls are arranged in two concentric pairs.

Left (inner)	VOLUME ON/OFF.
,, (outer)	TONE.
Right (inner)	WAVECHANGE.
,, (outer)	TUNING.

PILOT LAMPS : 6–8 volts, 0.12 Amp.

VALVES :

V1	UCC85	V.H.F. R.F. Amplifier and Mixer.
V2	UCH81	Frequency Changer (A.M.), I.F. Amplifier (F.M.).
V3	UF89	I.F. Amplifier.
V4	UABC80	Ratio Detector (F.M.), Demodulator (A.M.) and A.F. Amplifier.
V5	UL84	A.F. Output.
V6	UY85	H.T. Rectifier.

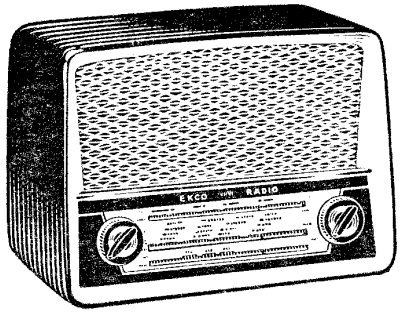
All valve bases are type B9A.

WAVEBAND COVERAGE : F.M. Band 2 (V.H.F.) 86–100 Mc/s. A.M. M.W. 187–550 Metres, 1650–550 Kc/s. L.W. 1200–2000 Metres, 250–150 Kc/s.

LOUD-SPEAKER : 7" x 4" Elliptical. 3 ohms at 400 c/s. An extension loud-speaker, if connected to the sockets provided at the rear of the receiver, should be of the low impedance type.

OUTPUT : 3 watts approximately.

INTERMEDIATE FREQUENCY : F.M. Channel 10.7 Mc/s. A.M. Channels 470 Kc/s.



CIRCUIT DETAILS

F.M. Operation

R.F. AND MIXER STAGES : F.M. signals from the dipole are passed via the V.H.F. aerial socket to the aerial coils L1.L2 and then to the cathode of V1A, operating as a grounded grid R.F. triode. Amplified signal voltages are developed across the tuned circuit L3.C3 and fed to the grid circuit of V1.B. R.F. tuning is by L3 core. V1B operates as a parallel fed oscillator, L4 core, which is ganged to L3 core, forming the variable tuning element. H.T. is fed to V1A and V1B via SW2A.

INTERMEDIATE FREQUENCY STAGES : The I.F. signal at the anode of V1B is transformer coupled by L6.L7 to the control grid of V2 heptode which operates as an I.F. amplifier on F.M. The triode section of this valve is rendered inoperative on F.M. by the switch SW2A disconnecting the H.T. feed to its anode. Amplified signals appearing at the heptode anode of V2 are fed to the grid of V3 via the transformer L11.L13. To avoid interference from signals at 470 Kc/s. the 1st A.M. I.F. primary winding is short circuited by SW2B. I.F. signals are further amplified by V3 which is coupled to the ratio detector V4A by the discriminator coils L17.L19.L20. A D.C. voltage, the amplitude of which varies with the signal modulation, is developed across R19.C45 and is fed to the suppressor grid of V3 as A.G.C.

RATIO DETECTOR : V4A operates as a conventional ratio detector in which the signal voltage across L19 is 90 degrees out of phase with that across L17 when the F.M. signal is at the mean frequency and the sum total of signal voltages at the ends of L19 are equal and opposite. L20 applies a signal voltage to the centre of L19 that is in constant phase relation with the voltage in the primary winding L17.

The voltage across L19 is applied to the opposed diodes of V4A which at mean frequency produce a constant output. When the signal voltage in L17 deviates above or below the mean frequency, the phase in L19 changes relative to the degree of deviation. The total voltage, $\frac{1}{2}$ L19 $\pm$ L20 applied to one diode will, therefore increase while the other will decrease. The resultant output from the diodes will vary in direct sympathy with the deviation of the F.M. signal, i.e., in accordance with the audio content, and is fed via the I.F. filter circuit R36.C36.R14.C37 and SW1C to the volume control.

The capacitor C45 operates as a reservoir across the two diodes and assists in removing any A.M. content from the output.

A.M. Operation

R.F. MIXER STAGE : L8 and L9 are the Long and Medium wave aerial coils respectively and are located at the ends of a directional ' Ferrite ' rod aerial. Provision is made for an external aerial to be coupled into the ' bottom end ' of the aerial coils if required.

Aerial circuit waveband selection is by SW1B and SW1D and tuning by C16 with C15 as a pre-set trimmer.

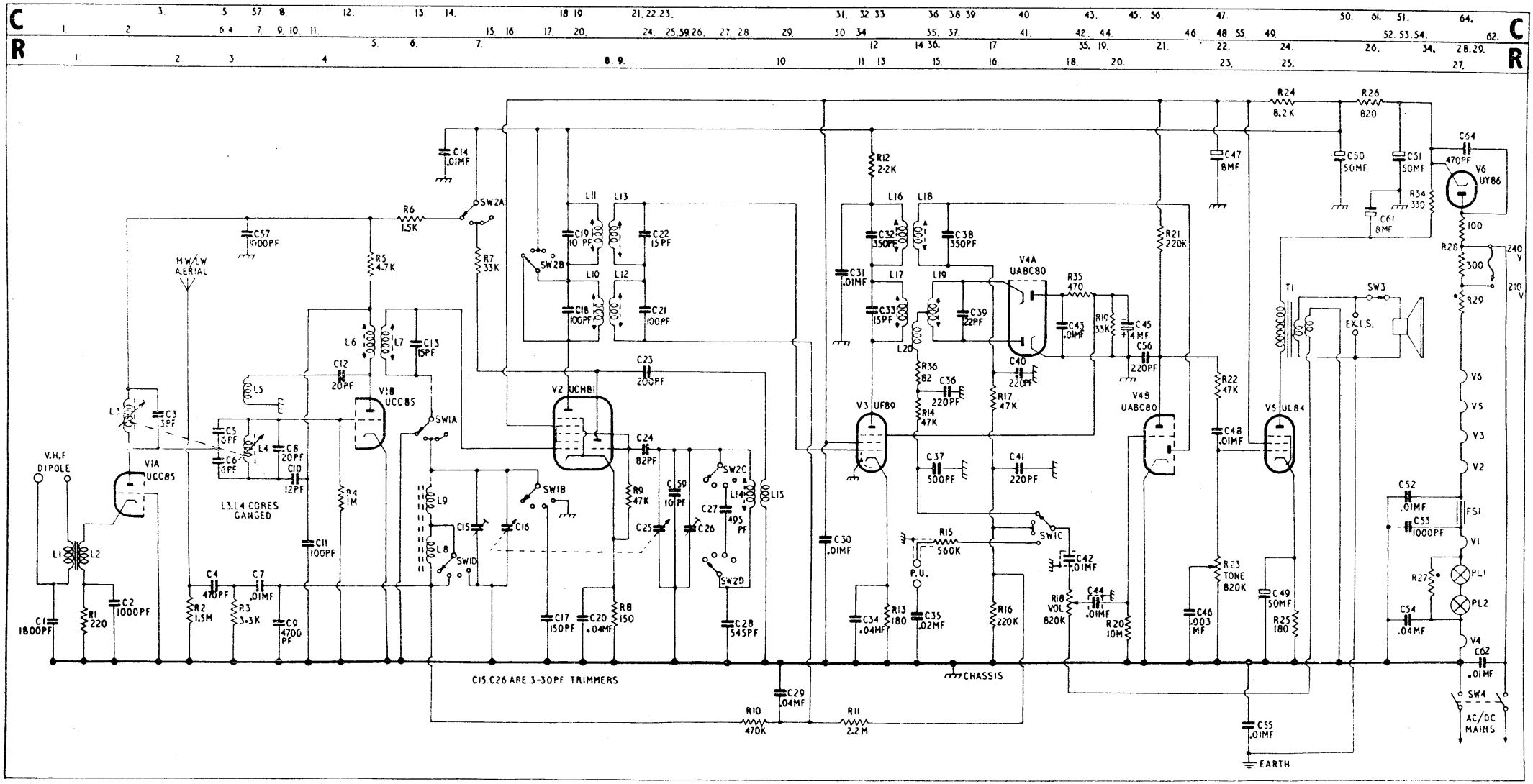
Signal voltages in the aerial circuit are fed via SW1A and L7 to the grid of V2 heptode.

The triode section of V2 operates as a conventional parallel fed tuned grid oscillator in which waveband selection is by SW2C.SW2D and tuning by C25. C26 is a pre-set trimmer. Mixing is by electronic coupling in the valve.

INTERMEDIATE FREQUENCY AND DEMODULATOR STAGES : Intermediate frequency signals at the heptode anode of V2 are transformer coupled by L10.L12 to the grid of V3.

The primary of the unwanted F.M. I.F. transformer is short-circuited by SW2B.

Amplified signals at the anode of V3 are transformer coupled to the demodulator diode of V4B by L16.L18.


V.H.F DIPOLE
MW/LW AERIAL
V1A UCC85
V1B UCC85
V2 UCH81
V3 UF80
V4A UABC80
V4B UABC80
V5 UL84
V6 UY86
T1
SW1A
SW1B
SW1C
SW2A
SW2B
SW2C
SW2D
SW3
SW4
EX.L.S.
P.U.
FS1
PL1
PL2
L3.L4 CORES GANGED
C15.C26 ARE 3-30PF TRIMMERS
CHASSIS
EARTH
AC/DC MAINS
240 V
210 V
C1 1800PF
C2 1000PF
C3 3PF
C4 470PF
C5 6PF
C6 6PF
C7 .01MF
C8 20PF
C9 4700 PF
C10 12PF
C11 100PF
C12 20PF
C13 15PF
C14 .01MF
C15
C16
C17 150PF
C18 100PF
C19 10 PF
C20 .04MF
C21 100PF
C22 15 PF
C23 200PF
C24 82PF
C25
C26
C27 495 PF
C28 545PF
C29 .04MF
C30 .01MF
C31 .01MF
C32 350PF
C33 15PF
C34 .04MF
C35 .02MF
C36 220PF
C37 500PF
C38 350PF
C39 22PF
C40 220PF
C41 220PF
C42 .01MF
C43 .01MF
C44 .01MF
C45 4MF
C46 .003 MF
C47 8MF
C48 .01MF
C49 50MF
C50 50MF
C51 50MF
C52 .01MF
C53 1000PF
C54 .04MF
C55 .01MF
C56 220PF
C57 1000PF
C59 10 PF
C61 8MF
C62 .01MF
C64 470PF
R1 220
R2 1.5M
R3 3.3K
R4 1M
R5 4.7K
R6 1.5K
R7 33K
R8 150
R9 47K
R10 470K
R11 2.2M
R12 2.2K
R13 180
R14 47K
R15 560K
R16 220K
R17 47K
R18 VOL 820K
R19 33K
R20 10M
R21 220K
R22 47K
R23 TONE 820K
R24 8.2K
R25 180
R26 820
R27
R28
R29 300
R34 330
R35 470
R36 82
L1
L2
L5
L6
L7
L8
L9
L10
L11
L12
L13
L14
L15
L16
L17
L18
L19
L20
V
S
100

The demodulator load consists of R16.R17, the latter together with C40.C41 operating as an I.F. filter. A.F. voltages are fed to the volume control via SW1C.

A.G.C. : The rectified signal voltages developed across R16 are applied across C29 and fed as bias to the control grids of V2 and V3.

A.F. AND OUTPUT STAGES : The A.F. amplifier and output stages are common to both A.M. and F.M. operation.

A.F. voltages at the volume control are fed via C44 to the triode grid of V4B, amplified by the valve and then resistance capacity coupled to the grid of the output valve. Variable tone control is provided by R23 in the grid circuit of the output valve. Coupling to the loud-speaker is by transformer. A tertiary winding on the output transformer, T1, provides negative feedback to the input of the A.F. amplifier V4B. SW3 operates as an internal loud-speaker muting switch.

POWER SUPPLIES : A.C. or D.C. mains supply are connected between chassis and anode of the rectifier valve, V6, via part of R28. The D.C. output at the cathode is smoothed and applied to the various circuits. The valve heaters are series connected, the supply volts being dropped to the required value by the Thermistor R29 and part of R28.

CIRCUIT ALIGNMENT

I.F., F.M. : Two methods are given for the alignment of the F.M. I.F. circuits (a) Visual and (b) Generator.

(a) **VISUAL METHOD :** Disconnect the earthed side of the 4 μF capacitor (C45). Tune the receiver to the low frequency end of the band, switch to F.M. and adjust the volume control for minimum output. Connect an oscilloscope across R19 and inject sweep input to pin 2, V3. Tune L17 for peak response. Reconnect C45 and transfer the oscilloscope leads to the tertiary output i.e. between the junction of R14/C36 and chassis. Tune L19 for the best ' S ' waveform, re-adjusting L17 if necessary. If the alignment equipment has the facility to superimpose A.M. on the F.M. signal, the adjustment of L19 should be made for best compromise between A.M. rejection at 10.7 Mc/s and ' S ' waveform, and L17 adjustment for ' S ' waveform only.

Transfer the input to the grid of V2, preferably at the lead out from the F.M. tuner unit, disconnect C45 as before and connect the oscilloscope leads across R19. Tune L11 and L13 for maximum output consistent with flat response ±100 Kc/s of 10.7 Mc/s and symmetrical waveform. If necessary re-adjust L17 for symmetry.

Connect the input to the junction of R5.R6 on the F.M. unit. Note : This point is at H.T. potential and due care should be taken to avoid shock or damage to the equipment. Tune L6.L7 for maximum symmetrical output ensuring that the waveform is substantially flat ±75 Kc/s of 10.7 Mc/s. Re-connect C45.

(b) **GENERATOR METHOD :** An A.F. output meter or low range A.C. voltmeter, two 220K resistors, a 0–50μA meter and an F.M. signal generator for 10.7 Mc/s with a deviation ±25 Kc/s will be required. Connect the output meter across the loud-speaker leads. Turn the volume control and tone control to maximum output. Connect the two 220K resistors in series across R19 and connect the μA meter between the junction of the two 220K resistors and chassis. Tune the receiver to the low frequency end of the band. With the input to pin 2 V3 tune L17 for peak reading on the μA meter. Disconnect the μA lead from chassis and connect it to the junction of R14.C36. Tune L19 for zero reading on the μA. This should be tunable from a maximum in one direction to a maximum in the other direction.

Transfer the μA lead from the junction R14.C36 to chassis and feed the input to pin 2 V2. Tune L11.L13 for peak reading on the meter.

Connect the input to the junction R5.R6 via a 0.001 μF isolating capacitor, taking due care as this point is at H.T. potential. Tune L6 and L7 for maximum meter reading.

Disconnect the test resistors and μA meter.

I.F., A.M. : A signal generator to produce A.M. signals at 470 Kc/s and an A.F. output meter or low range A.C. voltmeter will be required.

Connect the output meter across the loud-speaker leads. Input to pin 2 V2 via a 0.1μF capacitor. Align L18.L16.L12 and L10 in that order for maximum symmetrical response.

R.F., F.M. : Check that with the gang fully closed the tuner carriage is $\frac{1}{32}$" from fully open, adjust if necessary by rotating the drive drum on the gang shaft, also check that the pointer coincides with the datum mark at the right-hand end of the scale, adjust, if necessary, by sliding the pointer along the drive cord.

Tune the receiver to 91 Mc/s and inject an F.M. signal of that frequency to the aerial socket. Adjust the core of L4 for alignment and L3 core for maximum output. Check calibration at 87 Mc/s, 94 Mc/s and 99 Mc/s and if large errors occur check that the carriage of the tuner unit is making full travel. Check that the oscillator is operating at the low frequency end of the band by tuning the receiver to 100 Mc/s and identifying an image with an input signal at 78.6 Mc/s.

R.F., A.M. : All input signals to be amplitude modulated 30 per cent at 400–1000 c/s.

Switch the receiver to M.W. band and adjust the volume control and tone control to maximum output.

Tune to 500 metres and inject a signal of 600 Kc/s to the aerial socket then adjust L9 on the ' Ferrite ' rod for maximum output. Tune to 225 metres (1333.3 Kc/s) and adjust C26 for alignment, then C15 for maximum output. Repeat as necessary.

Switch to L.W. band, tune to 1400 metres and inject a signal of 214.3 Kc/s. Adjust L8 on the ' Ferrite ' rod for maximum output.

CHASSIS REMOVAL : Disconnect the receiver from the mains supply. Remove the back cover, then pull off the front control knobs. Remove the two screws securing the rear chassis flange to the cabinet. Loosen the screw securing the ' Ferrite ' aerial bracket and lift the bracket clear. The chassis can now be withdrawn to the extent of the loud-speaker leads.

Re-assemble in the reverse order ensuring that the chassis slides into the correct locating groove each side of the cabinet.

DRIVE CORD DETAILS

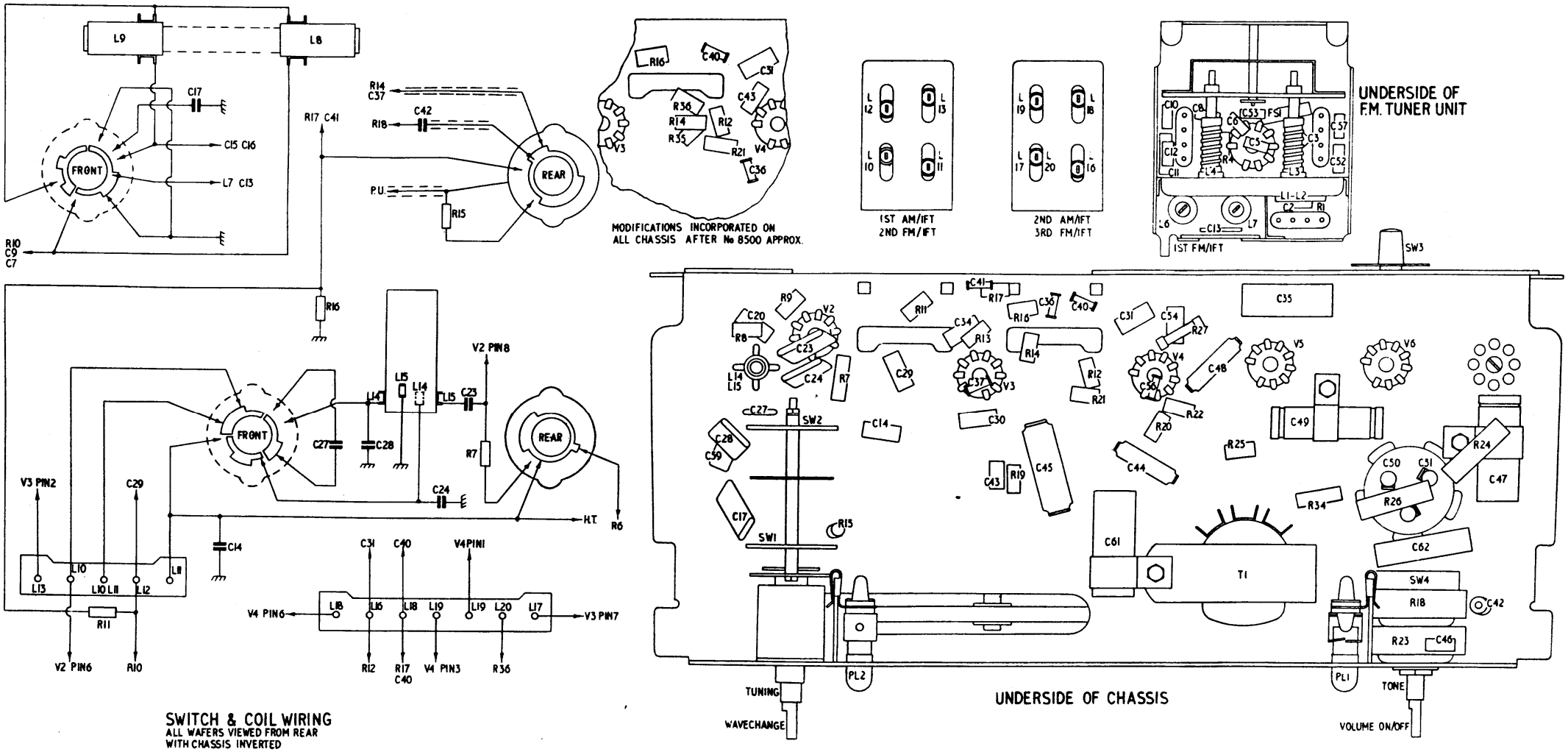
POINTER DRIVE : A length of nylon cord of approximately 41 inches is required, with a small loop tied in one end. Commence with the loop attached to the free end of the spring then pass the cord clockwise round pulley ' A,' clockwise over pulley 'B', two turns clockwise round the drive spindle then thread the end behind the other portions of the drive and clockwise round the drive drum to finish in a knot at the spring so that the latter is tensioned slightly. The pointer is placed in the approximate position and adjusted to the datum mark at the right hand end of the scale by sliding along the cord. Seal all knots with adhesive.

F.M. UNIT DRIVE : Replacement of this drive necessitates the complete removal of the F.M. tuner unit and should not be undertaken unless facilities are available to re-align the F.M. circuits.

In earlier production models a wire drive was fitted but this has been replaced by nylon cord.

A length of approximately 10 inches is required together with a securing nipple. The correct length is available from Ekco Service Dept., see Spare Parts List.

To proceed, disconnect the seven leads from the terminal blocks at the side and rear of the unit, remove the four screws securing the unit mounting bracket from beneath the chassis and withdraw the unit complete. Remove the four screws securing the unit cover to the underside of the unit and remove the cover.


L9
L8
C17
C15 C16
L7 C13
FRONT
REAR
R10
C9
C7
R14
C37
C42
R18
R17 C41
P.U.
R15
R16
C40
C31
R36
R14
R12
R35
R21
C43
C36
V3
V4
MODIFICATIONS INCORPORATED ON
ALL CHASSIS AFTER No 8500 APPROX.
1ST AM/IFT
2ND FM/IFT
2ND AM/IFT
3RD FM/IFT
1ST FM/IFT
UNDERSIDE OF
F.M. TUNER UNIT
SW3
V2 PIN8
L15
L14
L13
C23
C27
C28
C24
R7
H.T.
R6
C14
V3 PIN2
C29
L10
L11
L13
L12
R11
V2 PIN6
R10
C31
C40
V4 PIN1
V4 PIN6
L16
L18
L19
L20
L17
V3 PIN7
R12
R17
C40
V4 PIN3
R36
SWITCH & COIL WIRING
ALL WAFERS VIEWED FROM REAR
WITH CHASSIS INVERTED
C41
R17
R9
C20
R8
V2
C23
C24
R7
R11
C34
R13
C29
V3
C37
R16
C36
C40
R14
R12
R21
C31
C54
R27
V4
C48
V5
V6
C35
C49
R24
C47
C50
C51
R26
R34
C62
C61
T1
SW4
R18
C42
R23
C46
PL1
TONE
VOLUME ON/OFF
C27
SW2
C28
C59
C14
C30
C43
R19
C45
C44
R25
R20
R22
C17
SW1
R15
PL2
TUNING
WAVECHANGE
UNDERSIDE OF CHASSIS

In earlier models the drive wire was attached via a small hole in the insulated panel between the upper runner and the chassis and in later models the drive cord is attached via a small hole in the insulated panel between the runners, in the latter case the pulley ' C ' is offset from the chassis by a $\frac{3}{8}$" spacer. The new cord should be passed through the hole in the insulated panel from which the old cord is removed. Make a half inch loop in one end of the cord, seal the knot with adhesive, then holding the cord taut make a mark $6\frac{5}{8}$" from the end of the loop. Press the tuner carriage forward against the tension of the spring and thread the free end of the cord through the required hole in the front of the unit then through the corresponding holes in the carriage bracket and insulated panel. The eyelet should now be threaded on to the cord so that the shank faces the front of the unit. Tie a small knot at the $6\frac{5}{8}$" mark, seal with adhesive and pull the cord so that this knot is slightly embedded into the eyelet and the shank of the latter enters the hole in the insulated panel. Release the carriage and ensure that it is free to travel to the full extent of the guides. Apply a trace of light grease if necessary.

Replace the cover and re-assemble the unit on to the receiver chassis and re-connect the seven leads. Pass the looped cord two turns clockwise round the gang spindle and secure to the drive drum grub screw. Re-fit the retaining washer over the end of the gang spindle.

Carry out final adjustments and alignment as described previously.

SERVICE NOTES : (a) The adjustment on the mains input resistor must be correctly set for the supply to which the receiver is to be connected. (b) The chassis is connected to one side of the mains and care should be taken to ensure that, on A.C. mains supply the ' neutral ' lead is connected to the chassis connection. On earthed negative D.C. supplies the chassis connection should be to the ' earthed ' side of the supply. With earthed positive D.C. supplies the chassis will be ' live.'' (c) The ' on/off ' switch is a double pole type and, in the event of failure should be replaced by a similar type. (d) To avoid excessive hum when connecting a pick-up it is recommended that a two core screened lead be used and the inner conductors connected to the P.U. sockets in the usual manner whilst the screening should be connected to the ' Earth ' socket of the receiver. (e) When replacing the electrolytic capacitor C45 care should be taken to avoid reversing the polarity (see circuit diagram). (f) Should it be necessary to replace the screw securing the ' Ferrite ' rod aerial bracket to the loud-speaker baffle, care must be taken to avoid using a screw longer than that originally fitted, as it could protrude through the baffle and, being connected to chassis, become a source of electric shock to the user.

CHASSIS DIVERGENCIES : Some or all of the following circuit differences may exist in receivers having a Serial No. below 8500. Dealers are not recommended to effect any of these modifications unless required by local circumstances.

(a) R16 may be 1M.
(b) C27 may be 510pF.
(c) R34, C61 and C62 have been added in later models.
(d) R3 may be 22K.
(e) R35, R36 and C64 have been added in later models.
(f) C45 may be 8μF.
(g) Nylon cord is used to replace the wire drives of earlier chassis.

VOLTAGE AND CURRENT DATA

VALVE	F.M. or A.M.	ANODE		SCREEN		CATHODE	
		V	mA	V	mA	V	mA
V1A UCC85	F.M.	190 (	m easu	red at	juncti	on R6/L	3)
V1A	A.M.	—	—	—	—	—	—
V1B	F.M.	165 (	measu	red at	juncti	on R5/L	6)
V1B	A.M.	—	—	—	—	—	—
V2 UCH81	F.M.	214	9.3	127	6.4	2.4	15.7
V2	A.M.	239	3.1	125	9.2	2.6	12.3
V2 triode	A.M.	87	4.3 (	Both r	eading	s 0 on F.	M.)
V3 UF89	F.M.	190	9.3	127	3.6	2.3	12.9
V3	A.M.	210	9.3	125	3.8	2.5	13.1
V4 UABC80	F.M. (Triode)	58	0.27	—	—	—	—
V4	A.M. (Triode)	58	0.26	—	—	—	—
V5 UL84	F.M.	240	40.5	127	2	8.35	42.5
V5	A.M.	250	40.5	125	1.5	8.2	42
V6 UY85	F.M.	233*	105*	—	—	251	87
V6	A.M.	235*	95*	—	—	261	76

Readings taken with Avo Model 8 (20,000 ohms per volt). All readngs D.C. except * which are A.C. Voltages are positive with respect to chassis.i

VALVE BASE DATA

VALVE	PINS								
	1	2	3	4	5	6	7	8	9
V1 UCC85	A"	G"	K"	H	H	A'	G'	K'	S
V2 UCH81	G2.G4	G1	K.G5.S	H	H	A	G3	At	Gt
V3 UF89	S	G1	K	H	H	S	A	G2	G3
V4 UABC80	A"'d	A"d	K"d	H	H	A'd	Kt.Kd	G	At
V5 UL84	IC	G1	K.G3	H	H	IC	A	IC	G2
V6 UY85	IC	IC	K	H	H	IC	IC	IC	A

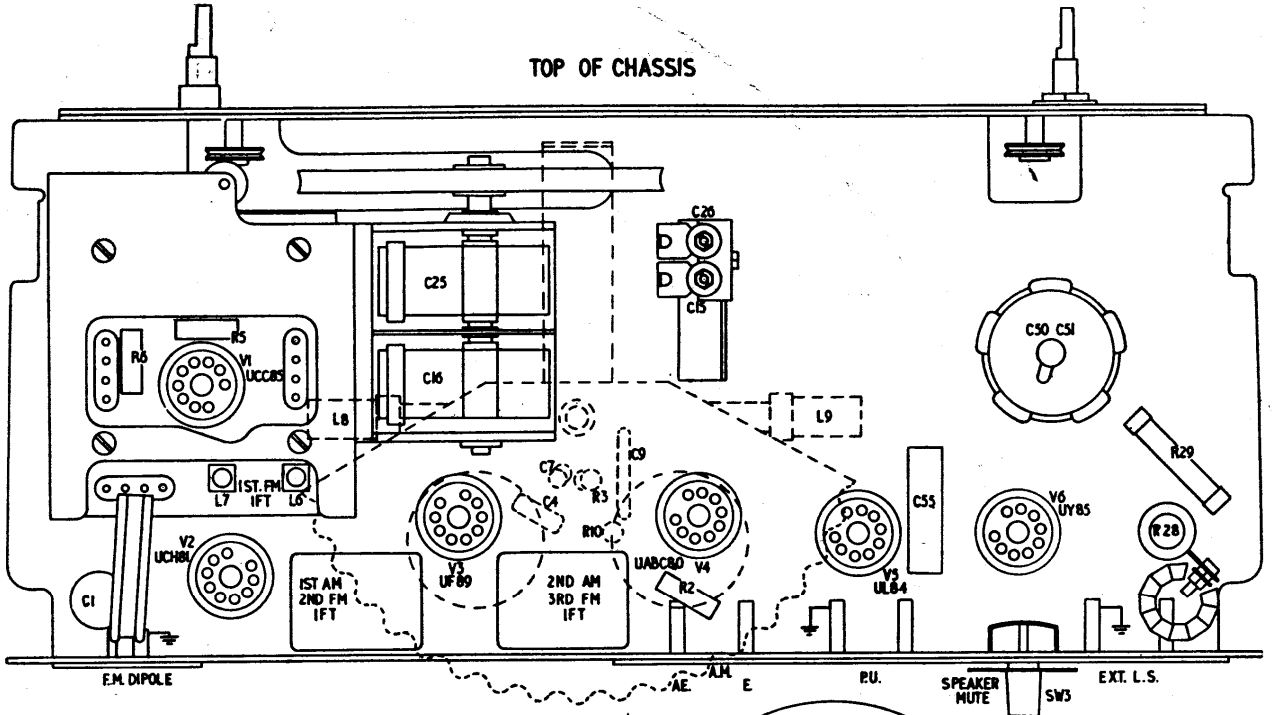
Miscellaneous Components	Part No.
' Ferrite ' rod	B49298
' Ferrite ' Sleeve, FS1	B49338
Knob (Tone)	DP24654/A
Knob (Tuning)	DP24654/B
Knob (Volume)	C49752
Knob (Wavechange)	C49861
Loud-speaker	D107775
Drive Cord (pointer)	B107637/1
Drive Cord (F.M. Unit)	B108229
Eyelet for F.M. unit drive Cord	56479/1
Retaining Washer for F.M. drive	A108255
Mains Dropping Resistor, R28, 100 + 300 ohms	B107234

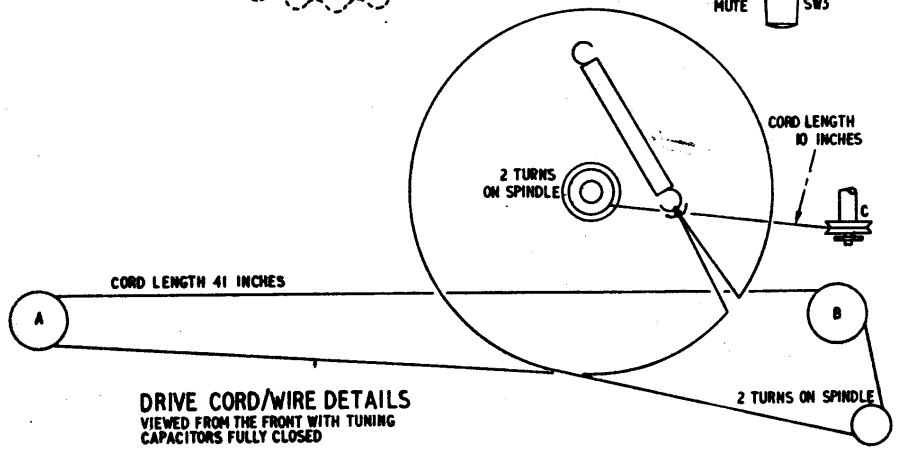
D.C. RESISTANCE OF WINDINGS

Circuit Ref.	Component	Ohms	Part No.
L1	F.M. Aerial Coil Primary	*	DP23003
L2	F.M. Aerial Coil Secondary	*	
L3	V1A Anode Coil	*	DP24033
L4	V1B Grid Coil	*	DP24038
L5	Osc. Primary Coil	*	
L6	1st F.M. I.F. Primary	*	DP24035
L7	1st F.M. I.F. Secondary	*	DP24036
L8	L.W. Aerial Coil	1.5	DP24742
L9	M.W. Aerial Coil	8	DP24741
L10	1st A.M I.F. Primary	10	DP24640/A
L12	1st A.M. I.F. Secondary	10	
L11	2nd F.M. I.F. Primary	*	DP24642/A
L13	2nd F.M. I.F. Secondary	*	
L14	A.M. Osc. Secondary	2	DP24687
L15	A.M. Osc. Primary	1	
L16	2nd A.M. I.F. Primary	6	DP24641/A
L18	2nd A.M. I.F. Secondary	6	
L17	Discriminator Coil Primary	*	DP24644/A
L19	Discriminator Coil Secondary	*	
L20	Discriminator Coil Tertiary	*	
T1	Output Transformer Primary	335	SA5609/A
	Secondary	*	
	Tertiary	*	

* Less than 1 ohm.

Errata: V6 on Circuit Diagram, page 2, should be UY85.





DRIVE CORD/WIRE DETAILS
VIEWED FROM THE FRONT WITH TUNING CAPACITORS FULLY CLOSED

SERVICE DEPT., E. K. COLE Ltd.,
Somerton Works, Arterial Road,
Southend-on-Sea
'Phone: Southend 42296
Head Office: Ekco Works, Southend-on-Sea

SCOTTISH SERVICE DEPOT:
17, Cadogan Street,
Glasgow, C.2.
'Phone: Central 3633/4

NORTHERN SERVICE DEPOT:
115, Jersey Street,
Ancoats
'Phone: Collyhurst 4421/3.

MIDLAND SERVICE DEPOT:
11, Brook Street,
Birmingham, 3
'Phone: Central 2505/6