



"His Master's Voice"

SERVICE MANUAL

Price One Shilling

"His Master's Voice" products are made to a standard of design and quality approved by The Gramophone Co. Ltd., registered proprietor of the trade mark

MODEL 1648

AM-FM STEREOPHONIC RADIOGRAM

SPECIFICATION

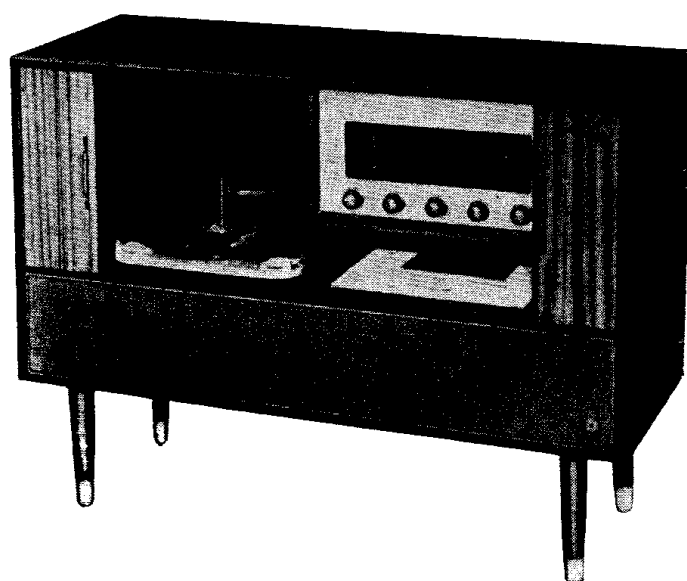
Model 1648 is a seven valve (plus metal rectifier) radiogramophone, covering VHF/FM, Medium and Long waveranges. Internal aerials are fitted, also, sockets for external aerial and earth connections. Rotary waverange switching is employed. Two audio channels are provided for gram reproduction, each channel feeding separate loudspeakers. For radio reception, the audio amplifier is switched for single-channel push-pull operation.

MAINS SUPPLY : AC mains 200-250 Volts, 50 c/s.

POWER CONSUMPTION : Radio : 62 Watts approximately.
Gram : 77 Watts approximately

OUTPUT POWER : Radio : 6 Watts. Gram : 2½ Watts (each channel)

LOUDSPEAKER (each channel) : 8 inch × 5 inch elliptical, with speech coil impedance of 3 ohms



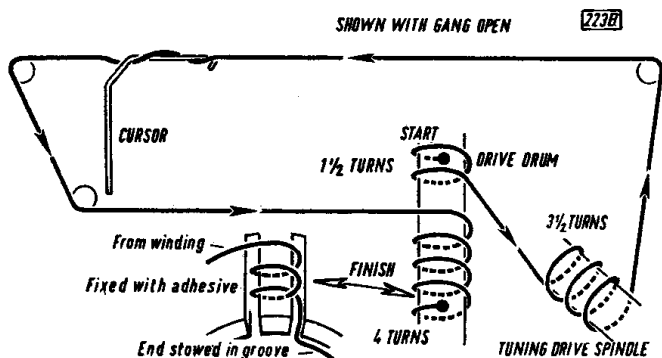
RECORD CHANGER : BSR type UA14 with BSR TC8S or Ronette Stereo 105, cartridge. Replacement styli for BSR cartridge : TC8RS (stereo LP) and TC8G (78 rpm). Replacement styli for Ronette cartridge : SA075 (stereo LP) and SA250 (78 rpm)

CABINET DIMENSIONS—overall : 40½ inches wide × 30 inches high (including legs) × 15 inches deep

ADDITIONAL FACILITIES

TAPE RECORDER SOCKETS : Recording : Low impedance outlet socket (monodic). Playback : High impedance input sockets (stereo or monodic)

EXTERNAL LOUDSPEAKERS : Sockets suitable for loudspeakers of 3 ohms impedance are provided for each channel with internal loudspeaker muting switches



Drive Cord—use approximately 6 feet of nylon-braided cord

BRITISH RADIO CORPORATION LTD

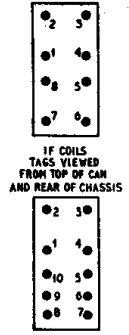
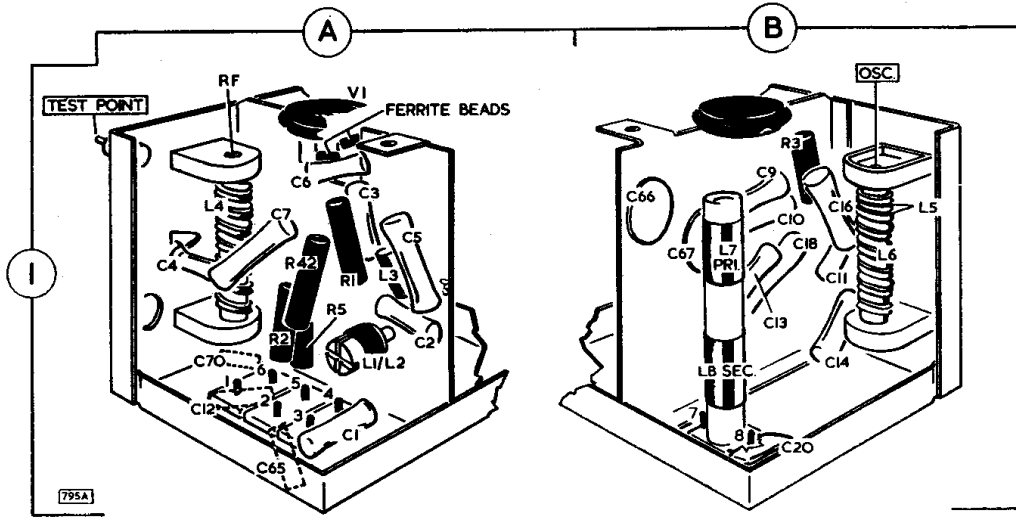
Service Depots

LONDON: Eley's Estate, Angel Road, Edmonton, N.18. Telephone: EDMonton 3060

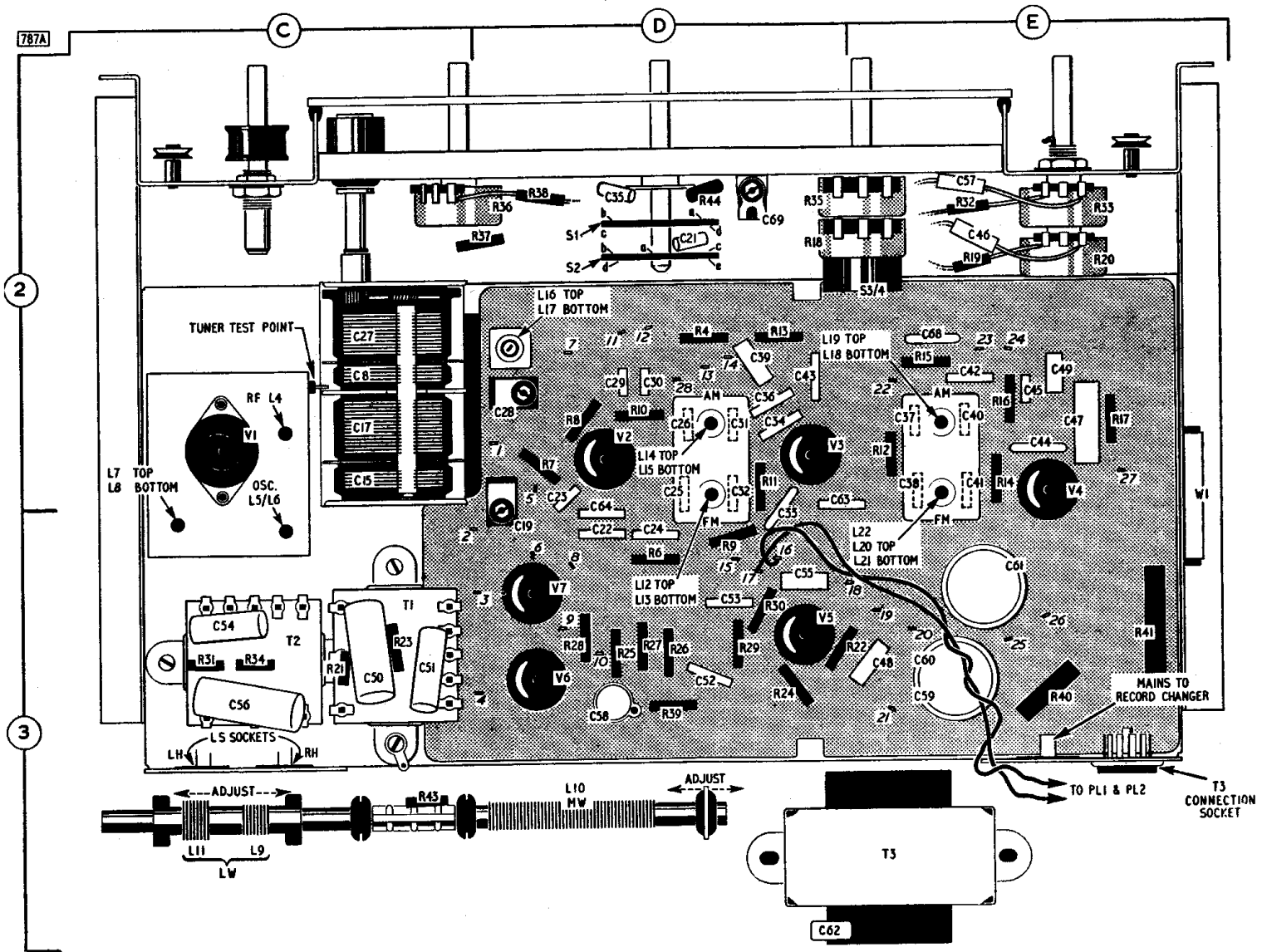
BIRMINGHAM: 24 Sheepcote Street, 15. Telephone: Midland 5291

MANCHESTER: Derby Street, Cheetham, 8. Telephone: Deansgate 8484

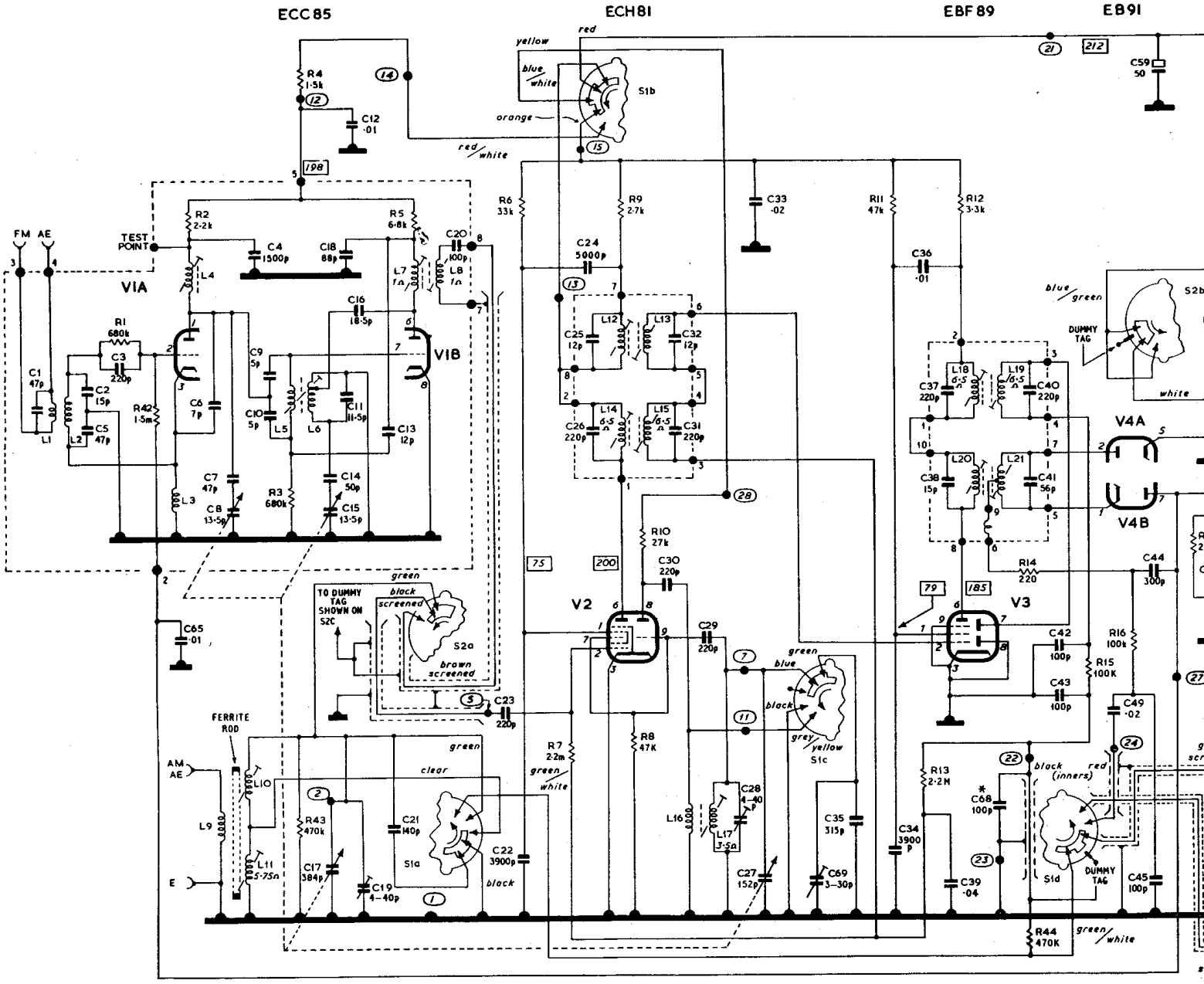
GLASGOW: 160/162 Battlefield Road, S.2. Telephone: Langside 9251/2/3/4



VHF Tuner Unit



Main Chassis, showing Component Location and Alignment adjustment, etc.



* On a few models C68 is 120p.

COMPONENT LOCATIONS

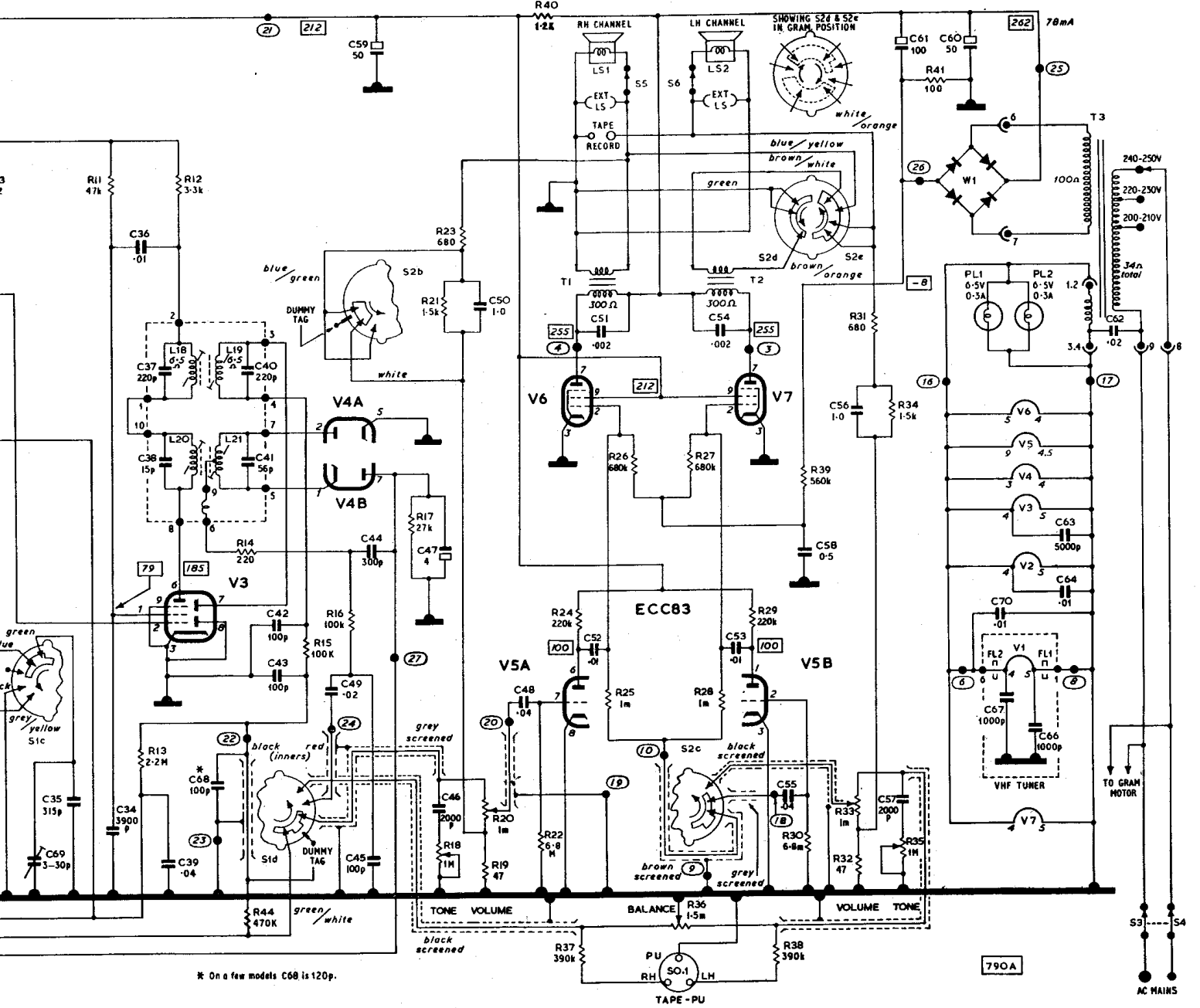
C		D		E		L		R	
C1	A1	D2, 3	C47	E2	L1	A1	R1	A1	
C2	A1	D3	C48	E3	L2	A1	R2	A1	
C3	A1	D2, 3	C49	E2	L3	A1	R3	B1	
C4	A1	D2	C50	E3	L4	A1, C2	R4	D2	
C5	A1	C2	C51	C3	L5	B1, C2	R5	A1	
C6	A1	D2	C52	D3	L6	B1, C2	R6	D3	
C7	A1	D2	C53	D3	L7	B1, C2	R7	D2	
C8	C2	D2, 3	C54	C3	L8	B1, C2	R8	D2	
C9	B1	D2, 3	C55	D3	L9	C3	R9	D3	
C10	B1	D2	C56	C3	L10	D3	R10	D2	
C11	B1	D2	C57	E2	L11	C3	R11	D2, 3	
C12	A1	D2	C58	D3	L12	D2, 3	R12	E2	
C13	B1	D2	C59	E3	L13	D2, 3	R13	D2	
C14	B1	E2, 3	C60	E3	L14	D2	R14	E2, 3	
C15	C2	D2	C61	E3	L15	D2	R15	E2	
C16	B1	D2, 3	C62	D3	L16	D2	R16	E2	
C17	C2	D2, 3	C63	DE2, 3	L17	D2	R17	E2	
C18	B1	E2	C64	D2, 3	L18	DE2	R18	DE2	
C19	D2, 3	E2	C65	A1	L19	DE2	R19	E2	
C20	B1	D2	C66	B1	L20	E2, 3	R20	E2	
C21	D2	D2	C67	B1	L21	E2, 3	R21	C3	
C22	D3	E2	C68	E2	L22	E2, 3	R22	DE3	
		C46	E2	C69	D2				
				C70	A1				

EBF89

EB91

EL84

EL84



* On a few models C68 is 120p.

L	R	R23	C3	S	TAG	1	D2	15	D3
L1 A1	R1 A1	R23 680	C3 C3	S1a-d D2	16	D3	16	D3	
L2 A1	R2 A1	R24 300	D3 D3	S2a-e D2	17	D3	17	D3	
L3 A1	R3 B1	R25 D3	D3 D3	S3-4 DE2	18	DE3	18	DE3	
L4 A1, C2	R4 D2	R26 D3	D3 D3	S5 Ext. LS	19	E3	19	E3	
L5 B1, C2	R5 A1	R27 D3	D3 D3	S6 Panels	20	E3	20	E3	
L6 B1, C2	R6 D3	R28 D3	D3 D3		21	E3	21	E3	
L7 B1, C2	R7 D2	R29 D3	D3 D3		22	E2	22	E2	
L8 B1, C2	R8 D2	R30 D3	D3 D3		23	E2	23	E2	
L9 C3	R9 D3	R31 C3	C3 C3		24	E2	24	E2	
L10 D3	R10 D2	R32 E2	E2 E2		25	E3	25	E3	
L11 C3	R11 D2, 3	R33 E2	E2 E2		26	E3	26	E3	
L12 D2, 3	R12 E2	R34 C3	C3 DE2		27	E2	27	E2	
L13 D2, 3	R13 D2	R35 DE2	DE2 CD2		28	D2	28	D2	
L14 D2	R14 E2, 3	R36 CD2	CD2 CD2						
L15 D2	R15 E2	R37 CD2	CD2 D3						
L16 D2	R16 E2	R38 D3	D3 E3						
L17 D2	R17 E2	R39 D3	D3 E3						
L18 DE2	R18 DE2	R40 E3	E3 E3						
L19 DE2	R19 E2	R41 E3	E3 A1						
L20 E2, 3	R20 E2	R42 A1	A1 C3						
L21 E2, 3	R21 C3	R43 C3	C3 D2						
L22 E2, 3	R22 DE3	R44 D2	D2						

CIRCUIT DIAGRAM

Voltage measurements, shown in rectangles, were taken with a 20,000 ohms per volt meter. DC resistances are shown against inductances where these are 1 ohm or greater.

In some receivers C18 is 100pF.

AUDIO AMPLIFIER NOTES

RADIO OPERATION. When switched to 'radio,' audio signals from the detector circuit are applied to the grid of V5A via the tone and volume control networks and C48.

V5A and B form a self-balancing paraphase amplifier, providing two antiphase outputs of equal amplitude to drive the output stage V6/7. This is achieved by taking a portion of the amplified signal at V5A anode and feeding it to V5B grid via C52, R25, S2C and C55. R28 functions as a feedback resistor and ensures that the outputs from V5A and V5B are balanced. The two antiphase signals, one at V5A anode, the other at V5B anode, are fed via C52 and C53 to the grids of V6 and V7.

V6 and V7 are operating in an unconventional class A push-pull circuit, biased by the voltage developed across R41 in the HT negative return circuit. The outputs from V6 and V7 drive the primaries of the output transformers T1 and T2. Although the audio signals developed in the primaries of T1 and T2 are in the antiphase, the secondaries are connected so that the combined outputs to the loudspeakers are additive. Any even harmonic distortion produced in the output stage is in the same phase relationship in each primary winding, and, therefore, due to the connection of the secondaries, the even harmonics are cancelled out.

When switched to AM, negative feedback is applied to V5A grid via R23 and S2b. On FM, S2b switches a tone correcting network, C50/R21, into the feedback line.

GRAMOPHONE OPERATION. When switched for record reproduction, the audio stages form two separate and identical amplifiers, one for each channel. The separate signals from the PU are fed to the left and right-hand channel amplifiers via R38 and R37 and are balanced by R36.

The LH channel signal is applied to V5B grid via the volume and tone control networks and C55. The amplified signal at the anode is coupled by C53 to V7 grid. V7 drives the audio output transformer T2 which feeds LS2, the LH channel loudspeaker.

Negative feedback is applied to V5B grid from T2 secondary via R31 and tone correction network R34/C56. The RH channel amplifier is identical in operation to the LH, except that the PU input is fed to the volume (R20) and tone (R18/C46) control networks via S1d. T1 drives the RH channel loudspeaker LS1 and feedback is via R23, R21 and C50.

ALIGNMENT DATA

Note : A hexagonal trimming tool must be used for the IF transformer cores ; tune to the outer peak in all cases.

Where two coil adjustments are located in the same former the shape of the hexagonal trimming tool allows each core to be adjusted independently from the top or bottom of the chassis.

IF ALIGNMENT — AM CIRCUITS

Switch receiver to MW, turn gang to minimum capacitance position and volume control to maximum. Inject a 470 Kc/s modulated signal through a .01 μ F capacitor at V2 control grid and adjust L19, L18, L15 and L14 for maximum output.

RF ALIGNMENT — AM CIRCUITS

MW must be aligned first. 30% modulated signals to be injected via a loop loosely coupled to the ferrite-rod aerial. With the tuning gang at maximum, set cursor to the right-hand edge of the scale opening. Pad and Trim markers are provided on MW and a calibration check point on LW.

Range	Frequency	Cursor Position	Adjust
MW	580 Kc/s	Pad Marker	L17, L10*
	1460 Kc/s	Trim Marker	C28, C19

* Adjust by sliding ring along aerial rod.

LW	220 Kc/s	{ Tune to Signal Check Calibration }	C69, L11†
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† Adjust by sliding COIL FORMER along aerial rod.

IF ALIGNMENT — FM CIRCUITS

Use a signal generator providing Band II coverage, also 10.7 Mc/s AM (30% modulated) and 10.7 Mc/s FM signals

(25 Kc/s deviation) at an impedance of 75 Ω . Throughout alignment the signal input to the receiver should be adjusted to maintain an audio output of about 100 mW.

1. Switch to VHF and allow to warm up for at least ten minutes. Set the Volume control 90° back from maximum and the Tone control to maximum treble.
2. Inject 10.7 Mc/s FM signal via 400 pF capacitor to V2 control grid and adjust L20, L21, L13 and L12 for maximum output.
3. AM rejection check
 - (a) Switch generator to 10.7 Mc/s AM and tune L21 for minimum output.
 - (b) Switch generator to 10.7 Mc/s FM and check that FM output has been retained. If maximum AM rejection does not coincide with maximum FM output, L21 should be tuned for maximum rejection at the expense of a slight reduction in FM output.
4. Unscrew the core of L8 in the VHF tuner unit so that it protrudes from the former by approximately $\frac{1}{4}$ in.
5. Inject 10.7 Mc/s FM signal to the tuner TEST POINT. Adjust L7 for maximum output and then peak L8.

RF ALIGNMENT — FM CIRCUITS

Check that the cursor coincides with the edge of the scale opening when the tuning gang is fully closed.

1. Adjust tuning control to set cursor to 91 Mc/s on scale.
2. Inject 91 Mc/s FM signal at the aerial sockets and tune in signal by adjusting L6. If two peaks occur within the tuning range, that obtained with the core nearest the top of the former must be chosen.
3. Adjust L4 for maximum audio output with the core towards the bottom of the former.

DISMANTLING FOR SERVICE

1. Remove control knobs. These are a "push" fit on the spindles.
2. Remove cabinet back, detach internal FM aerial plug and remove the aerial panel from rear of cabinet. Remove plugs from socket panels on rear of chassis. The relative positions of the loudspeaker plugs should be noted for reassembly to the correct amplifier channels.
3. Unclip ferrite-rod aerial from its support bracket, then unbolt mains transformer from floor of cabinet and unsolder pilot lamp leads from transformer tags before lifting out.
4. Remove two woodscrews and clamps securing rear of chassis to its mounting board and then withdraw it sufficiently to enable the 3-core lead from the Tape Playback/Record panel to be unsoldered from the tag panel mounted on the front chassis plate. The chassis may then be lifted out of the cabinet by tilting it to clear the tape socket panel and obstructing leads.

RECORD CHANGER REMOVAL. Unsolder pick-up leads from 5-way tag panel on underside of mechanism and disconnect motor supply leads by removing them from the terminal block fixed to the central cabinet support. Pivot clips on the transit screws to enable them to pass through motor board and lift the unit out of the cabinet.

REPLACEMENT PARTS LIST

AM-FM aerial socket panel	29763
FM 2-pin aerial plug	9291
Cabinet	V50800
Cabinet back	W50795
Chassis LS socket panel assy.	50157
Chassis power socket panel assy.	50158
Control knobs :	
Balance, Tone }	Y25493/9
Tuning, Volume }	Y25493/10
Wavechange	37302
Clip (for above)	
Cursor	Y60099
Felt washer (for above)	18450/1
Drive cord tension spring	10486
Drive drum	29535
Clip (for above)	37309
Lampholder	13300/2
PU plug (cover 16576)	7554
Scale	V50802
Fixing bracket (for above)	10218
Scale diffuser	29534
Clip (for above)	29666
PVC strip behind diffuser	17669/3
Tuner unit and gang mounting grommets (8)	33684
Tuner unit and gang fixing bolts (6)	3386
Tuning drive spindle assy.	29532

CAPACITORS

All 350 Volts working, 20% tolerance, unless otherwise stated

Ref.	Value	Rating	Function and Part No.
C1	47pF	5%	L1 tuning
C2	15pF	5%	Part L2 tuning
C3	220pF		V1A grid coupling
C4	1500pF		V1A HT decoupling
C5	47pF	5%	Part L2 tuning
C6	7pF	±1pF	Part V1A neutralizing
C7	47pF	5%	C8 padder
C8	Variable		VHF amp tuning*
C9	5pF	±1pF	} Oscillator/mixer signal injection
C10	5pF	±1pF	
C11	11.5pF	2 1/2%	
C12	.01uF	10%	L6 tuning
C13	12pF	2 1/2%	V1 HT decoupling
C14	50pF	5%	Part V1B IF—mixer feedback coupling
C15	Variable		C15 padder
C16	18.5pF	±1pF	VHF oscillator tuning*
C17	Variable		Part VHF oscillator feedback coupling C185XH35
C18	88pF or 100pF	2 1/2%	L10, L11 tuning*
C19	4-40pF		Part V1B IF—mixer feedback coupling
C20	100pF	10%	C17 trimmer 25547
C21	140pF	2 1/2%	L8 tuning
C22	3900pF	10%	Part L10, L11 tuning (LW)
C23	220pF		V2 heptode screen decoupling
C24	5000pF		V2 heptode grid coupling
C25	12pF	5%	V2 heptode neutralizing
C26	220pF	2 1/2%	L12 tuning
C27	Variable		L14 tuning
C28	4-40pF		AM oscillator tuning*
C29	220pF		MW oscillator trimmer 25547
C30	220pF		AM oscillator grid coupling
C31	220pF	2 1/2%	AM oscillator feedback coupling
C32	12pF	5%	L15 tuning
C33	.02uF		L13 tuning
C34	3900pF	10%	V2 and V3 HT RF bypass
C35	315pF	1%	V3 screen grid decoupling
C36	.01uF		Part L16 tuning (LW)
C37	220pF	2 1/2%	V3 neutralizing
C38	15pF	5%	L18 tuning
C39	.04uF	150V	L20 tuning
C40	220pF	2 1/2%	AGC time constant
C41	56pF	5%	L19 tuning
C42	100pF		L21 tuning
C43	100pF		IF filter (AM)
C44	300pF	5%	} FM IF bypass
C45	100pF		
C46	2000pF		IF filter and FM de-emphasis
C47	4uF	Elec	Part tone control RH channel
C48	.04uF	150V	Ratio detector stabilizer 13210
C49	.02uF	150V	V5A grid coupling
C50	1.0uF	150V	FM AF coupling
C51	.002uF	350V AC	NFB tone correction
C52	.01uF		Phase correction—RH channel
C53	.01uF		V6 grid coupling
C54	.002uF	350V AC	V7 grid coupling
C55	.04uF	150V	Phase correction—LH channel
C56	1.0uF	150V	V5B grid coupling
C57	2000pF		NFB tone correction—LH channel
C58	0.5uF	150V	Part tone control—LH channel
C59	50uF	Elec	V6, V7 grid bias decoupling
C60	50uF	Elec	HT smoothing 13238/15
C61	100uF	Elec	HT reservoir 13229/14
C62	.02uF		Mains RF bypass
C63	5000pF		V3 heater RF bypass
C64	.01uF		V2 heater RF bypass
C65	.01uF	10%	V1A AGC line decoupling
C66	1000pF	+20—80%	} V1 heater RF bypass
C67	1000pF	+20—80%	
C68	100pF (120pF)		Part IF filter (AM)
C69	3-30pF		LW oscillator trimmer 13937
C70	.01uF	10%	V1 heater RF bypass

* Part of Tuning Gang Assembly. Part No. 29591

MISCELLANEOUS

Ref.	Function and Description	Part No.
LS1-LS2	Loudspeaker, 3Ω speech coil	16012/17
PL1-PL2	Scale lamps 6.5V 0.3A	33755
S1-S2	Wavechange switch	29646/1
S5	RH loudspeaker muting switch	29543
S6	LH loudspeaker muting switch	29693
S7a-b	Headphone switch	50630
S01	Tape—PU socket panel (cable grip 6878/9)	29778
S02	Headphone socket	50622
W1	HT rectifier	33426

RESISTORS

All 1/2 Watt carbon, 20% tolerance, unless otherwise stated

Ref.	Value	Rating	Function and Part No.
R1	680KΩ	10%	V1A grid leak
R2	2.2KΩ	10%	V1A HT feed
R3	680KΩ	10%	V1B grid leak
R4	1.5KΩ	10%	V1 HT feed
R5	6.8KΩ		V1B HT feed
R6	33KΩ	10%	V2 heptode screen grid feed
R7	2.2MΩ		V2 heptode grid leak and AGC feed
R8	47KΩ	10%	V2 triode grid leak
R9	2.7KΩ	10%	V2 heptode anode feed
R10	27KΩ	10%	V2 triode anode feed
R11	47KΩ	10%	V3 screen grid feed
R12	3.3KΩ	10%	V3 anode feed
R13	2.2MΩ		AGC time constant
R14	220Ω	10%	Ratio detector tertiary series
R15	100KΩ		Part IF filter (AM)
R16	100KΩ		Part IF filter (FM)
R17	27KΩ	10%	Ratio detector load
R18	1MΩ	A/Log Pot	Tone control—RH channel 13141/1
R19	47Ω	10%	V5A NFB injection
R20	1MΩ	Log Pot	Volume control—RH channel 13126
R21	1.5KΩ		NFB tone correction — RH channel
R22	6.8MΩ		V5A grid leak
R23	680Ω	10%	NFB series
R24	220KΩ	10%	V5A anode load
R25	1MΩ	10%	V5A/B paraphase coupling
R26	680KΩ	10%	V6 grid leak
R27	680KΩ	10%	V7 grid leak
R28	1MΩ	10%	V5A/B paraphase coupling
R29	220KΩ	10%	V5B anode load
R30	6.8MΩ		V5B grid leak
R31	680Ω	10%	NFB series
R32	47Ω	10%	V5B NFB injection
R33	1MΩ	Log Pot	Volume control—LH channel 13126
R34	1.5KΩ		NFB tone correction — LH channel
R35	1MΩ	A/Log Pot	Tone control—LH channel 13141/1
R36	1.5MΩ	Lin Pot	Balance control 13128
R37	390KΩ	10%	Pick-up feed—RH channel
R38	390KΩ	10%	Pick-up feed—LH channel
R39	560KΩ	10%	V6, V7 negative grid bias feed
R40	1.2KΩ	10%	HT smoothing
R41	100Ω	5% 3W	V6, V7 grid bias
R42	1.5MΩ	10%	V1A AGC feed
R43	470KΩ	10%	L10, L11 damping
R44	470KΩ	10%	AM audio attenuator (fixed)

INDUCTORS

Ref.	Function	Part No.
L1	} VHF aerial input	29232
L2		
L3	RF choke	29280
L4	VHF amplifier tuning	25835
L5	VHF oscillator tuning	} 29230
L6	VHF oscillator feedback	
L7	} 1st FM IF	} 29233
L8		
L9	Aerial coupling MW and LW	} Ferrite rod assembly 29667
L10	MW ferrite rod aerial	
L11	LW ferrite rod aerial	
L12	} 2nd FM IF	} 29654
L13		
L14	} 1st AM IF	} 25829
L15		
L16	} Medium and Long wave oscillator	} 29655
L17		
L18		
L19	} 2nd AM IF	} 29655
L20		
L21	} FM ratio detector	} 29655
L22		

TRANSFORMERS

Ref.	Function	Part No.
T1	RH channel output	29392
T2	LH channel output	29392
T3	Mains transformer	29542

The manufacturers reserve the right to vary specifications or use alternative materials as may be deemed necessary or desirable at any time