

MULLARD MAS 3

3-BAND A.C. SUPERHET

THE Mullard MAS3 receiver is an all-wave superhet with a short-wave range of 16.7-51 metres. The chassis is a 4-valve (plus rectifier) superhet type for operation on A.C. mains of 110-250 V, 50 c.p.s., and has provision for both a gramophone pick-up and an extension speaker.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling coils **L2, L3** and small condenser **C3** to capacity coupled band-pass filter. Primary **L4, L5** tuned by **C31**; secondary **L7, L8** tuned by **C33**; coupling by condensers **C4** and **C5**. I.F. filter **L1, C28** in aerial circuit. Image suppression by condensers **C29** and **C1**. On S.W. band aerial input is via condenser **C2** to single-tuned circuit comprising **L6** and **C33**.

First valve (**V1, Mullard metallised FC4**) is an octode operating as frequency changer with electron coupling. Resistance **R2** in pentode C.G. circuit prevents parasitic oscillation on S.W. Oscillator grid coils **L9** (S.W.) and **L11, L12** (M.W. and L.W.) are tuned by **C34**; parallel trimming by **C9** (S.W.), **C35** (M.W.) and **C36** (L.W.); series tracking by fixed condensers **C10** (L.W.) and **C11** (M.W.); oscillator anode reaction coils **L10** (S.W.), **L13, L14** (M.W. and L.W.). Oscillator C.G. condenser **C8** is in circuit only on S.W.

Second valve (**V2, Mullard metallised VP4B**) is a variable-mu H.F. pentode operating as intermediate frequency

passed via coupling condenser **C18** to C.G. of pentode output valve (**V4, Mullard PenA4**). Condenser **C19** in series with **C18** is short-circuited on M.W. and L.W. by switch **S29**, but on S.W. it is in circuit to provide a certain amount of bass attenuation. Condenser **C23** shunts **V4** C.G. circuit when switch **S30** is closed, thus muting the receiver. Variable tone control in **V4** anode circuit by R.C. filter **R16, R17, C21**. Provision for connection of high-impedance external speaker across part of output transformer primary winding. Condenser **C22** provides I.F. filtering in extension speaker circuit.

Second diode of **V3** fed from **V2** anode via condenser **C20**, provides D.C. potential which is developed across load resistance which is developed across load resistance **R14** and fed back through decoupling circuit **R9, C13** as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along **V4** cathode resistances **R20, R21**.

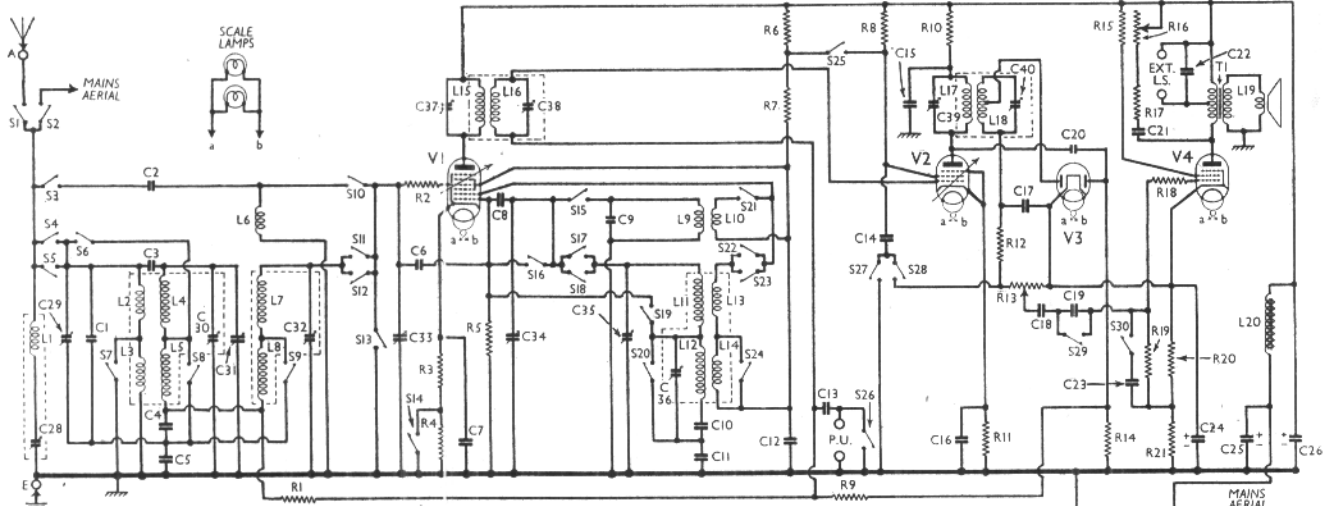
When a gramophone pick-up is used with the receiver, its output is fed into the C.G. circuit of the I.F. amplifier **V2** which then functions as a triode L.F. amplifier with the S.G. as anode. H.T. feed resistance **R8** forms anode load and condenser **C14** is coupling between amplifier and output valve.

H.T. current is supplied by full-wave rectifying valve (**V5, Mullard DW2**). Smoothing by iron-cored choke **L20** and electrolytic condensers **C25, C26**. Mains aerial coupling by **C27**.

COMPONENTS AND VALUES

CONDENSERS		Values (μF)
C1	Image suppressor	0.00002
C2	Aerial S.W. coupling	0.000016
C3	Aerial coupling (M.W. and L.W.)	0.00001
C4	Band-pass couplings	0.016
C5		0.025
C6	Neutralising condenser	0.000002
C7	V1 cathode by-pass	0.05
C8	V1 osc. C.G. condenser	0.0001
C9	Oscillator S.W. trimmer	0.0000064
C10	Oscillator L.W. tracker	0.0007
C11	Oscillator M.W. tracker	0.00149
C12	V1 S.G.'s and osc. A decoupling	0.1
C13	A.V.C. line decoupling	0.1
C14	V2 S.G. by-pass	0.1
C15	V2 anode decoupling	0.1
C16	V2 cathode by-pass	0.1
C17	I.F. by-pass	0.0001
C18	L.F. coupling to V4	0.01
C19	Bass attenuation condenser	0.0008
C20	V3 A.V.C. diode coupling	0.0000064
C21	Part of T.C. filter	0.05
C22	Ext. speaker shunt	0.004
C23	Muting condenser	0.02
C24*	V4 cathode by-pass	25.0
C25*	H.T. smoothing	32.0
C26*		32.0
C27	Mains aerial coupling	0.0005
C28†	Aerial I.F. filter tuning	0.00017
C29†	Image suppressor	0.00003
C30†	Band-pass pri. trimmer	0.00003
C31†	Band-pass pri. tuning	0.00049
C32†	Band-pass sec. trimmer	0.00003
C33†	Band-pass sec. tuning	0.00049
C34†	Oscillator tuning	0.00049
C35†	Osc. M.W. trimmer	0.00003
C36†	Osc. L.W. trimmer	0.00003
C37†	1st I.F. trans. pri. tuning	0.00017
C38†	1st I.F. trans. sec. tuning	0.00017
C39†	2nd I.F. trans. pri. tuning	0.00017
C40†	2nd I.F. trans. sec. tuning	0.00017

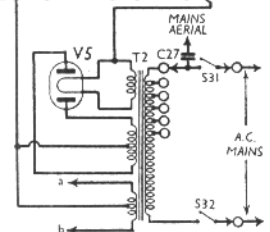
* Electrolytic. † Variable. ‡ Pre-set.



amplifier, with tuned-primary tuned-secondary transformer couplings **C37, L15, L16, C38** and **C39, L17, L18, C40**.

Intermediate frequency 128 KC/S. Diode second detector is part of separate double diode valve (**V3, Mullard metallised 2D4A**). Audio-frequency component in rectified output is developed across manual volume control **R13** and

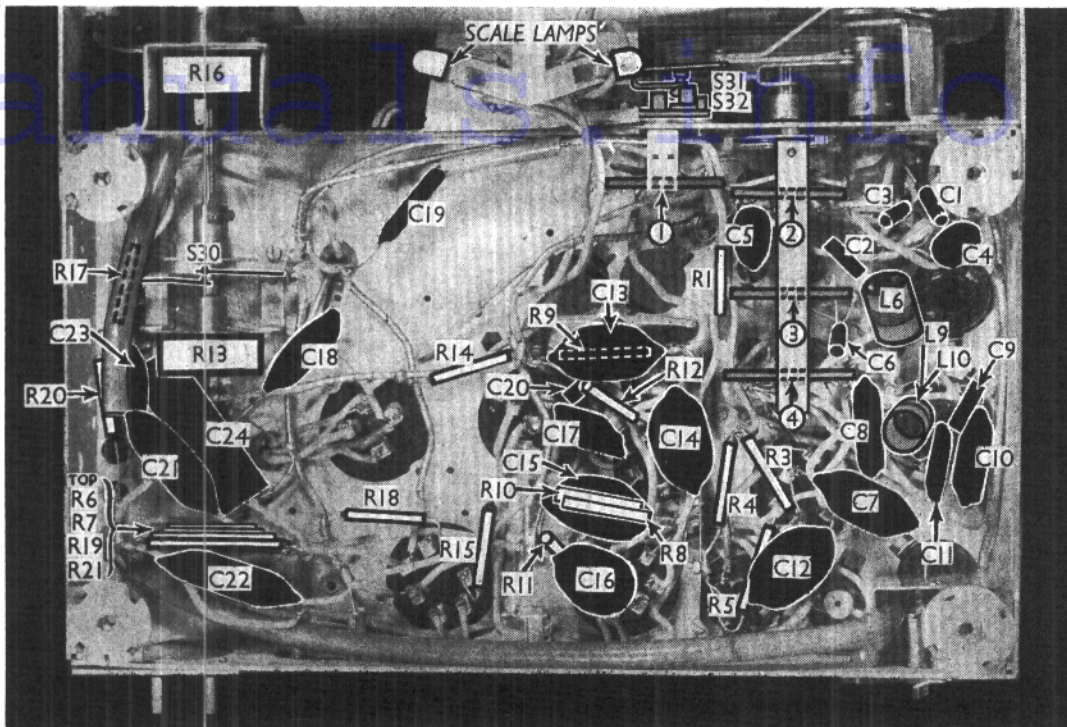
Circuit diagram of the Mullard MAS3 3-band A.C. superhet. A fairly elaborate system of switching is used. **L1, C28** form an I.F. filter, **S29** opens and attenuates the bass on the S.W. range. **S30** is a muting switch, operated by pushing in the volume control knob.



Radio

Manual

Under-chassis view. The four ganged switch units are indicated by numbers in circles, and the arrows show the directions in which they are viewed in the diagrams on page VIII. S30 is a muting switch operated by pushing in the volume control, while S31 and S32 are the mains switches, ganged with the first switch unit. Note the S.W. coils, L6 and L9, L10.



RESISTANCES		Values (ohms)
R1	V1 pent. C.G. decoupling	100,000
R2	V1 pent. C.G. stabiliser	50
R3	V1 fixed G.B. resistance	250
R4	V1 G.B. resistance (gram.)	10,000
R5	V1 osc. C.G. resistance	50,000
R6	V1, V2 S.G.'s and V1 osc. anode H.T. feed resistances	16,000
R7		20,000
R8		100,000
R9	A.V.C. line decoupling	1,000,000
R10	V2 anode decoupling	3,200
R11	V2 fixed G.B. resistance	250
R12	I.F. stopper	100,000
R13	Manual volume control	500,000
R14	V3 A.V.C. diode load	500,000
R15	V4 aux. grid stabiliser	32
R16	Variable tone control	50,000
R17	T.C. fixed min.	100
R18	V4 C.G. I.F. stopper	40,000
R19	V4 C.G. resistance	1,000,000
R20	V4 G.B. and A.V.C. delay voltage resistances.	125
R21		100

OTHER COMPONENTS (Continued)		Approx. Values (ohms)
S25-28	Radio-gram. change-over switches	—
S29	Bass attenuation switch	—
S30	Muting switch	—
S31-32	Mains circuit switches	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (four screws and washers) gives access to most of the under-chassis components.

Removing Chassis.—If it is necessary to remove the chassis from the cabinet, first remove the detachable bottom and the metal cover for the scale lamps (four round-head wood screws). Now remove the four knobs (recessed grub screws, two in each of the large knobs) and the four bolts (with washers) holding the chassis to the bottom of the cabinet. Next unsolder the speaker leads and the earthing lead to the screening plate on the bottom of the cabinet.

The chassis can now be withdrawn from the cabinet, but if it is desired to put it into operating condition it will be necessary to extend the speaker leads. When doing so, see that the top two tags are connected together and take one lead to these and the other to the bottom tag.

Removing Speaker.—To remove the speaker from the cabinet, slacken the three clamps (nuts and lock nuts). When replacing, see that the terminal panel is on the right.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 220 V, using the 220 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the

medium band and the volume control was at maximum, but there was no signal input.

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

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC4*	272	1.6	70	3.7
V2 VP4B	248	6.3	165	2.5
V3 2D4A	—	—	—	—
V4 PenA4	240	40.0	272	5.0
V5 DW2	265†	—	—	—

* Oscillator anode (G2) 65 V, 1.5 mA.
† Each anode, A.C.

GENERAL NOTES

Switches.—S1 and S2 are the external and mains aerial switches behind a black bakelite panel fixed to the rear of the chassis, on the left. When the operating lever is to the left, S2 is closed and S1 open, and vice-versa.

S3-S29 are the wavechange and gramophone switches, in four ganged units. Three of these units are in one group, while the fourth is separate, and operated by an extra lever. S31 and S32, the Q.M.B. mains switches, are also ganged with this fourth unit.

S30 is the muting switch, seen in the under chassis view, which is closed when the volume control knob is pushed in.

The table (page VIII) gives the positions of S3-S29 for the various control knob settings, O indicating open and C closed. Note that some of the tags on the units are merely used as bearers.

Coils.—L1, L2-L5, L7-L8, L11-L14, and the I.F. transformers L15, L16 and L17, L18 are in six screened units on the chassis deck. The L11-L14 unit contains two trimmers at the top of the can, while

Continued overleaf

OTHER COMPONENTS		Approx. Values (ohms)	
L1	Aerial I.F. filter coil	140.0	
L2	Aerial M.W. and L.W. coupling coils.	25.0	
L3		95.0	
L4	Band-pass primary coils	4.0	
L5		40.0	
L6	Aerial S.W. tuning coil	0.05	
L7	Band-pass secondary coils	4.0	
L8		37.0	
L9	Osc. S.W. tuning coil	0.05	
L10	Osc. S.W. reaction coil	30.0	
L11	Osc. M.W. and L.W. tuning coils.	10.0	
L12		25.0	
L13	Osc. M.W. and L.W. reaction coils.	4.0	
L14		8.0	
L15	1st I.F. trans. { Pri.	140.0	
L16		{ Sec.	140.0
L17	2nd I.F. trans. { Pri.	140.0	
L18		{ Sec. total	135.0
L19	Speaker speech coil	5.0	
L20	H.T. smoothing choke	385.0	
T1	Output trans. { Pri. total	825.0	
		{ Sec.	1.3
	{ Pri. total	35.0	
T2	Mains trans. { Heater sec.	0.04	
		{ Rect. fil. sec.	0.17
		{ H.T. sec. total	360.0
S1-2	Mains aerial switches	—	
S3-24	Waveband and muting switches	—	

MULLARD MAS3—Continued

all the other units contain one trimmer each. In the case of the I.F. units, the secondary trimmers are at the tops of the cans, and the primary trimmers are mounted on the chassis.

The S.W. coils **L6** and **L9**, **L10** are on two small tubular formers beneath the chassis.

Scale Lamps.—These are two Philips M.E.S. types, with tubular frosted bulbs, Cat. No. 8,042.

External Speaker.—Two sockets at the rear of the chassis, connected across part of the primary of **T1** are provided for the connection of a high impedance (about 8,000 O) external speaker.

CIRCUIT ALIGNMENT

NOTE.—Apart from the usual equipment, a special 15 deg. jig (Code No. M.0999174) will be necessary for adjusting the gang to the standard checking point.

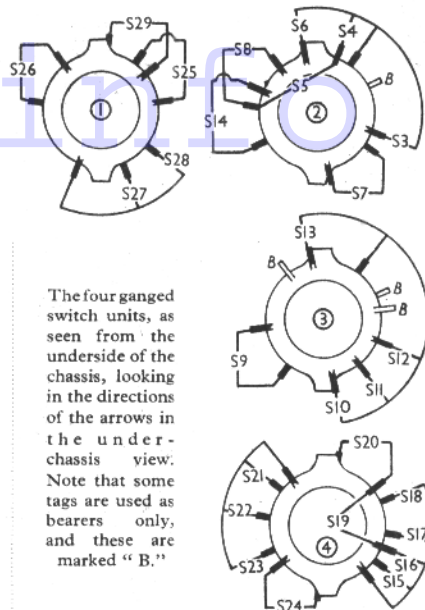
When adjusting one winding of an I.F. transformer, damping must be applied to the other winding by a shunt resistance. If the two ends of the winding to be damped are not accessible, the damping must be connected between the anode or grid side of the winding and chassis, but with a 0.1 μ F condenser in series with the resistance and on the chassis side of it.

I.F. Stages.—Connect output meter to external speaker sockets. Turn volume control to maximum, and switch set to L.W. Short-circuit **R5**, and apply a 128 KC/S signal to control grid (top cap) of **V1**, leaving existing connection undisturbed.

Shunt **C39** with a 25,000 O resistance, and adjust **C40** for maximum output. Remove shunt. Shunt **C38** with a 10,000 O resistance and 0.1 μ F condenser in series. Adjust **C37** for maximum output.

SWITCH TABLE

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



The four ganged switch units, as seen from the underside of the chassis, looking in the directions of the arrows in the under-chassis view. Note that some tags are used as bearers only, and these are marked "B."

Remove shunt. Shunt **C40** with a 25,000 O resistance and adjust **C39** for maximum output. Remove shunt. Shunt **C37** with a 10,000 O resistance and 0.1 μ F condenser in series. Adjust **C38** for maximum output. Remove shunt, and also the short circuit across **R5**.

H.F. and Oscillator Stages.—Shunt **L15** with a 25,000 O resistance. Earth the chassis, and turn **C28** so that it is almost at maximum. Fit the 15 deg. jig by slipping the boss over the locating pin just above the condenser spindle. The jig ensures that when the condenser is turned so that it bears upon it, the vanes are advanced exactly 15 degrees, which is the standard trimming position.

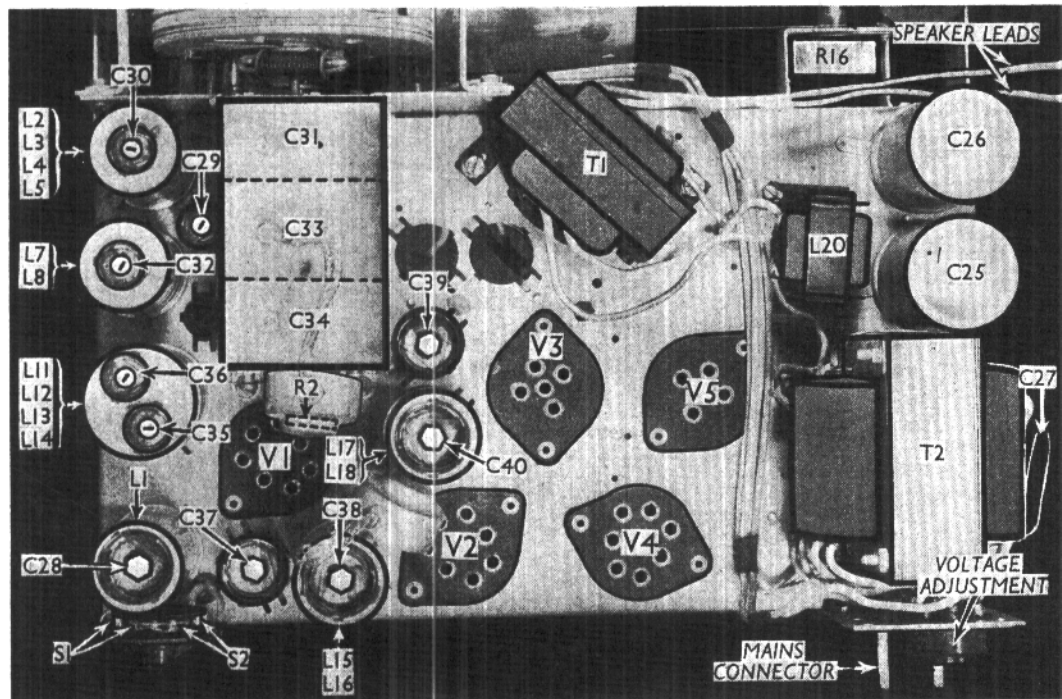
M.W.—Switch to M.W. Turn condenser until it bears on jig. Apply a 1,442 KC/S (208 m.) signal to the aerial socket via a standard artificial aerial.

Adjust **C35**, **C30** and **C32** for maximum output.

L.W.—Switch to L.W. Turn condenser until it bears on jig. Apply a 395 KC/S (760 m.) signal, and adjust **C36** for maximum output. Remove damping across **L15**. There is no S.W. adjustment.

I.F. Filter.—Switch set to L.W. and set tuning condenser to maximum (2,000 m.). Apply a 128 KC/S signal, and adjust **C28** for minimum output.

Image Freq. Filter.—Switch set to M.W. Apply a 774 KC/S (403 m.) signal to the aerial socket and tune it in. Without altering the tuning, apply a strong 1,000 KC/S (300 m.) signal, and adjust **C29** for minimum output.



Plan view of the chassis. Note the new type of trimmers at the tops of the various coil units, and, in the case of C29, C37, C39, on the chassis deck. R2 is inside the top cap screen of V1. C27 is at the side of T2.