

NUMBER FORTY-EIGHT
(VOLUME TWO)

'TRADER' SERVICE SHEETS

MULLARD MU35

UNIVERSAL SUPERHET

THE Mullard Model MU35 receiver is a table superhet for A.C. or D.C. mains. It employs valves of the Mullard Universal side-contact type, five being employed for reception and one as a rectifier, while the barretter is fitted with a similar base. Full A.V.C., noise suppression and variable tone control are provided.

CIRCUIT DESCRIPTION

Aerial input by way of fixed D.C. blocking condenser **C1**, special I.F. filter circuit **L1, C36** and **C3**, and coupling coils **L2, L3**, to capacity-coupled band-pass filter. Primary **L4, L5**, tuned by **C37**; secondary **L6, L7**, tuned by **C39**; coupling condensers **C5, C6**. Resistance **R1** shunts aerial-earth circuit, and **C2** is earth D.C. blocking condenser.

First valve (**V1, Mullard metallised FC13**) is an octode operating as frequency changer with electron coupling. Oscillator grid tuning coils **L8, L9** tuned by **C41**; anode reaction coils **L10, L11**; tracking by fixed condensers **C11 (L.W.)** and **C12 (M.W.)**.

Second valve, a variable-mu H.F. pentode (**V2, Mullard metallised VP13A**), operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **L12, L13** and **L14, L15**.

Intermediate frequency 115 KC/S.

Diode second detector forms part of separate double diode valve (**V3, Mullard metallised 2D13A**). Second diode

provides D.C. potential, developed across load resistance **R16**, which is fed back via decoupling circuits as G.B. to F.C. and I.F. valves, thus giving automatic volume control. Delay voltage is obtained from drop along **V2** cathode resistance **R12**. Rectifier diode has small negative bias so that rectification does not occur until the input signal reaches a certain value (determined by position of noise suppression potentiometer **R13** across **V2** fixed G.B. resistance **R12**). Thus, a degree of inter-station noise suppression is obtained, which, in conjunction with the A.V.C. circuit, gives a form of quiet A.V.C.

Audio-frequency output from rectifier diode is developed across **R15** and passed by way of coupling condenser **C17**, I.F. stopper **R17**, and manual volume control **R18**, to grid of triode L.F. amplifier (**V4, Mullard metallised HL13**). Gramophone pick-up sockets are isolated by D.C. blocking condensers **C20, C22**.

Resistance-capacity coupling to output pentode (**V5, Mullard Pen 26**). Fixed tone compensation in anode circuit by **C29**. Variable tone control by R.C. filter **R26, R27, C28**. Provision for connection of high-resistance external speaker across primary of speaker input transformer **T1**. Isolation by condensers **C31, C32**. Switch **S8** cuts out internal speaker.

When the receiver is used with A.C. mains, H.T. current is supplied by a half-wave rectifier (**V6, Mullard UR1**),

which operates as a resistance of low value on D.C. Smoothing by L.F. choke **L17** and electrolytic condensers **C33, C34**.

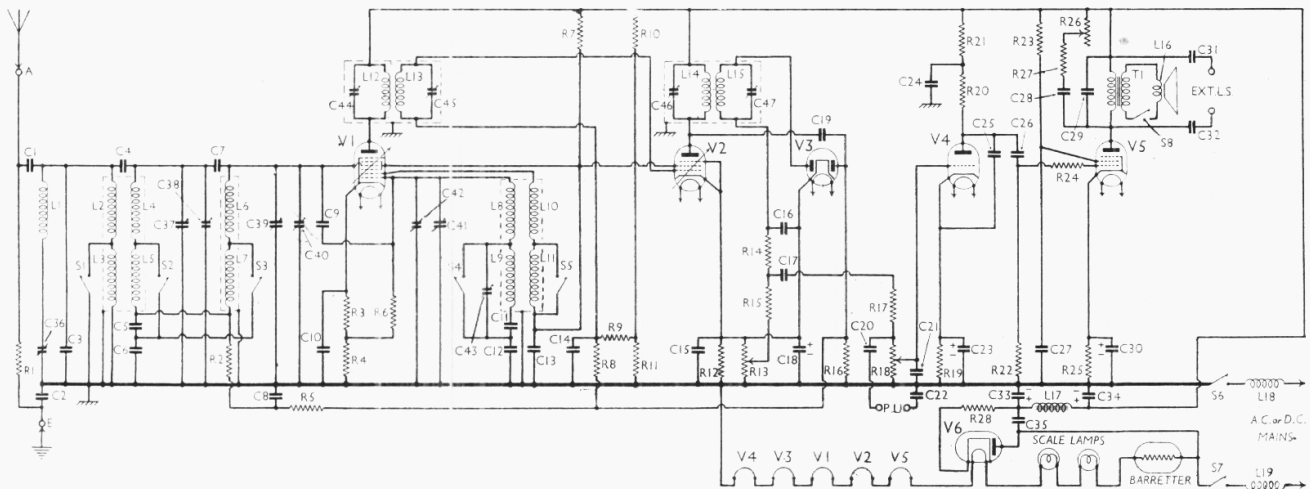
Heaters of all six valves are connected in series together with two special scale lamps and an automatic voltage regulating barretter lamp (**Philips C1**) across mains supply. H.F. chokes **L18, L19** and condenser **C35** form filter for suppressing mains-borne interference.

DISMANTLING THE SET

Removing Chassis.—Before the chassis can be removed, a good deal of preparatory work is necessary. First unsolder the earthing lead from the tag on the L.H. side of cabinet, and from the earthing tag on the speaker transformer. Now remove the noise suppression control (**R13**), complete on its bracket, by undoing the two wood screws holding the latter to the top of the cabinet. At the same time the tubular condenser **C18** must be removed by undoing the screw in the clip holding it to the top of the cabinet. Now take off the mains chokes **L18, L19** by removing the four screws holding their bracket to the top of the cabinet. Loosen the clips at the L.H. side of the cabinet holding the mains lead from the connector to the chokes, and free this lead. Loosen the clip holding the speaker lead at R.H. side of cabinet. Unsolder the two wires from the speaker input transformer.

Remove the control knobs (grub screws). The larger of the two concentric controls has two grub screws.

Under the base of the cabinet will be seen four oval pieces of black insulating material, each held by one wood screw. Remove these. This reveals the four chassis fixing screws, with metal washers. Unscrew these, and be careful not to lose the rubber washers above and below the base of the cabinet, or the tubular metal distance pieces. There is also a metal earthing strip making



The circuit diagram of the Mullard MU35 universal superhet. C7 and C9 are very small condensers. R13 is the noise suppressor, R18 the volume control and R26 the tone control. R13, C18, L18, L19 and S8 are mounted on the under-side of the top of the cabinet. R24 is not included in our chassis.

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contact between the chassis and the screening material at the bottom of the cabinet. Do not forget this when replacing the set.

Removing Speaker.—This is held in position by three metal clamps, each with a nut and lock-nut. When replacing, note that the input transformer should be to the right of the chassis.

COMPONENTS AND VALUES

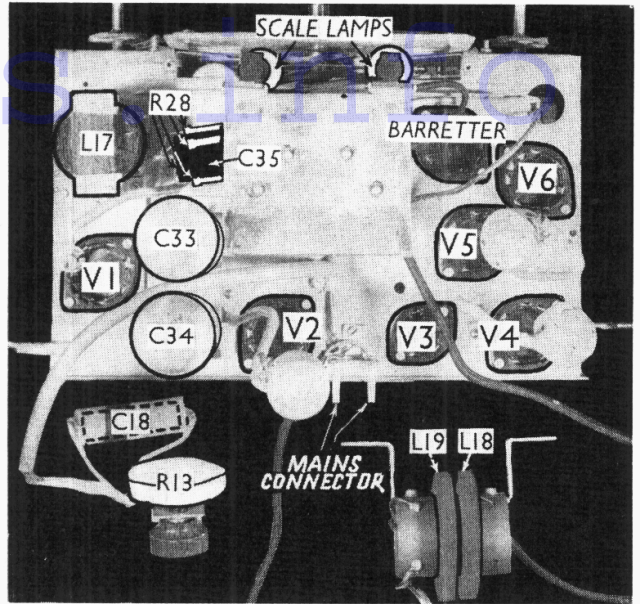
Resistances		Values (ohms)
R1	Aerial-earth shunt	200,000
R2	V1 pent. cont. grid decoupling	500,000
R3	V1 fixed G.B. resistances	250
R4		160
R5	V1 pent. cont. grid decoupling	500,000
R6	V1 osc. grid resistance	50,000
R7*	V1 and V2 S.G.'s and V1 osc. anode H.T. feed	20,000
R8	V2 cont. grid decoupling	2,500,000
R9†	Parts of special A.V.C. system applied to V2	10,000,000
R10		400,000
R11		80,000
R12	V2 fixed G.B. resistance	5,000
R13	Noise suppression control	50,000
R14	I.F. stopper	200,000
R15	V3 rectifier diode load	800,000
R16	V3 A.V.C. diode load	320,000
R17	I.F. stopper	1,000,000
R18	Manual volume control	500,000
R19	V4 G.B. resistance	5,000
R20	V4 anode resistance	200,000
R21	V4 anode decoupling	20,000
R22	V5 grid resistance	640,000
R23	V5 aux. grid H.T. feed	16,000
R24††	V5 grid I.F. stopper	1,000
R25	V5 G.B. resistance	320
R26	Variable tone control	50,000
R27	Fixed tone control resistance	100
R28‡	Ballast in main H.T. supply	200

* Two 40,000 Ω resistances in parallel.
 † Two 5 MΩ resistances in series.
 †† Not in our chassis.
 ‡ In our chassis, four 800 Ω resistances in parallel.

Condensers		Values (μF)
C1	Aerial blocking condenser	0.001
C2	Earth blocking condenser	0.1
C3	Part of aerial I.F. filter circuit	0.00008
C4	Top coupling, L2, L3 to L4, L5	0.00001
C5	Bandpass coupling condensers	0.025
C6		0.025
C7	Band-pass top coupling	Very low
C8	V1 pent. cont. grid decoupling	0.1
C9	Image suppression condenser	Very low
C10	V1 cathode by-pass	0.05
C11	Oscillator L.W. tracker	0.00013
C12	Oscillator M.W. tracker	0.00181
C13	V1 and V2 S.G.'s and V1 osc. anode decoupling	0.5
C14	V2 cont. grid decoupling	0.1
C15	V2 cathode by-pass	0.1
C16	I.F. by-pass	0.0001
C17	L.F. coupling to V4	0.05
C18	Noise suppressor control by-pass	25.0
C19	Coupling to V4 A.V.C. diode	0.000064
C20	Gram. pick-up blocking	0.05
C21	I.F. by-pass	0.000064
C22	Gram. pick-up blocking	0.05
C23	V4 cathode by-pass	25.0
C24	V4 anode decoupling	0.5
C25	V4 anode I.F. by-pass	0.00015
C26	L.F. coupling to V5	0.05
C27*	V5 aux. grid by-pass	1.0
C28	Tone control condenser	0.05
C29	Fixed tone compensator	0.002
C30	V5 cathode by-pass	25.0
C31	Ext. speaker blocking	0.2
C32		0.2
C33	H.T. smoothing	32.0
C34		32.0
C35	Mains H.F. by-pass	0.1
C36	Aerial filter condenser	0.000145
C37	Band-pass primary tuning	0.00043
C38	Band-pass primary trimmer	0.0000955
C39	Band-pass secondary tuning	0.00043
C40	Band-pass secondary trimmer	0.0000955
C41	Oscillator tuning	0.00043
C42	Oscillator main trimmer	0.0000955
C43	Oscillator L.W. trimmer	0.0000955
C44	1st I.F. trans. pri. tuning	0.000145
C45	1st I.F. trans. sec. tuning	0.000145
C46	2nd I.F. trans. pri. tuning	0.000145
C47	2nd I.F. trans. sec. tuning	0.000145

* Two 0.5 μF types in parallel.

Plan view of the chassis. The components normally mounted at the top of the cabinet are seen as they appear when removed with the chassis. R28 comprises four resistances in parallel, mounted round C35.



Other Components		Values (ohms)
L1	Aerial I.F. filter coil	27.0
L2	Aerial coupling coils	27.0
L3		105.0
L4	Band-pass primary coils	4.25
L5		40.0
L6	Band-pass secondary coils	4.25
L7		40.0
L8	Oscillator tuning coils	10.4
L9		28.5
L10	Oscillator reaction coils	4.5
L11		11.5
L12	1st I.F. trans.	140.0
L13		Sec. 140.0
L14		Pri. 140.0
L15	Sec. 140.0	
L16	Speaker speech coil	5.0
L17	H.T. smoothing choke	300.0
L18*	Mains disturbance chokes	2.2
L19*		2.2
T1	Speaker input trans.	Pri. 460.0 Sec. 0.6
S1-S5	Waveband switches, ganged	—
S6, S7	Mains switches	—
S8*	Internal speaker switch	—

* Not on chassis.

VALVE ANALYSIS

The voltages and currents listed in the table were obtained from a representative chassis working with a 230 V 50 c.p.s. A.C. supply, and with no aerial or earth connected. The noise suppression control R13 was turned fully clockwise (minimum suppression).

All voltages were measured with a high resistance voltmeter with chassis as negative, and the usual precautions were taken to avoid instability when the currents of V1 and V2 were being measured.

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 FC13*	205	1.75	80	3.5
V2 VP13A	205	1.5	80	0.6
V3 2D13A	—	—	—	—
V4 HL13	70	0.5	—	—
V5 Pen 26	185	42.0	115	5.8
V6 UR1†	—	—	—	—

* Osc. anode (G2) 80 V, 1.9 mA.
 † Cathode to chassis 230 V D.C.

GENERAL NOTES

Switches.—S1, S2, S3, and S4, S5 form the two sections of the wavechange unit, and are indicated as well as is possible in the under-chassis view. Each contact comprises two spring fingers between which the moving contact slides when the switch closes. Each switch is composed of a pair of these double contacts. All the switches S1-S5 are closed on the M.W. band and open on the L.W. band.

Switches S6, S7 are of similar construction, and are in a separate unit indicated in the under-chassis view. They form the double-pole Q.M.B. mains switch, and the unit is ganged up with the wavechange assembly.

S8 is the internal speaker switch mounted at the top of the back of the cabinet. When this switch is opened, the internal speaker is switched off.

Coils.—These are in five screened tubular units of cylindrical form, seen in the under-chassis view. The coils in each unit are indicated. If a coil fault occurs, it will be necessary to fit a new complete unit, since the screens are spun on to the base of the unit, and cannot be removed. The units are held in position by clips.

In addition to the signal frequency, oscillator and I.F. transformer coils, there is an additional coil, L1, forming part of the I.F. filter in the aerial circuit, which is also indicated in the under-chassis view.

Scale Lamps.—These are special types, with S.B.C. centre contact bases. They are Philips, type 8066. As they are in series with the heater supply, failure of one or both will prevent the set working. It would probably be permissible to short out the faulty lamp temporarily while a new one is being obtained.

Extension Speaker.—This should be of the high resistance type, being connected across the primary of the speaker trans-

(Continued overleaf)

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(Continued)

former via two isolating condensers, C31, C32.

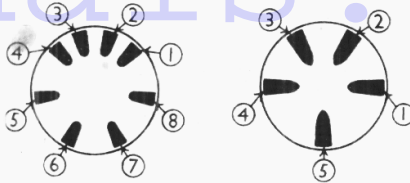
Valves.—The valves are fitted with side contact bases, all except V3 having the 8-contact base. V3 is fitted with the smaller 5-contact base. We give diagrams with the contacts numbered, as seen from the underside of the valves or valve-holders. The table below gives the connections.

Contact No.	V1 FCr3	V2 VP13A	V3 2Dr3A	V4 HL13	V5 Pen26	V6 UR1
1	M	M	D2	M	—	—
2	H	H	H	H	H	H
3	H	H	H	H	H	H
4	C, G6	C	C, M	C	C, G3	C
5	G2	G3	Di	—	—	—
6	GI	—	—	—	—	—
7	G3, G5	G2	—	—	G2	—
8	A	A	—	A	A	A
TopCap.	G4	GI	—	GI	GI	—

M = metallising. H = heater. C = cathode.
G, GI, etc. = grids. A = anode. Di, D2 = diode anodes.

Resistance R7.—This comprises two 40,000 O resistors in parallel.

Resistance R9.—Two 5 MO resistances in series (one covered with sleeving).



Diagrams of the 8- and 5-contact valve bases, as seen from beneath the valves or valve-holders. The numbering corresponds with that in the table in Col. 1.

Resistance R28.—In our chassis, four 800 O resistances in parallel, disposed round condenser C35.

Barretter.—This is a Philips type Cr, with an 8-contact base. The connections are to contacts 5 and 8.

Condenser C7.—This is a very small condenser, formed of a wire, insulated with sleeving, hooked round another bare wire.

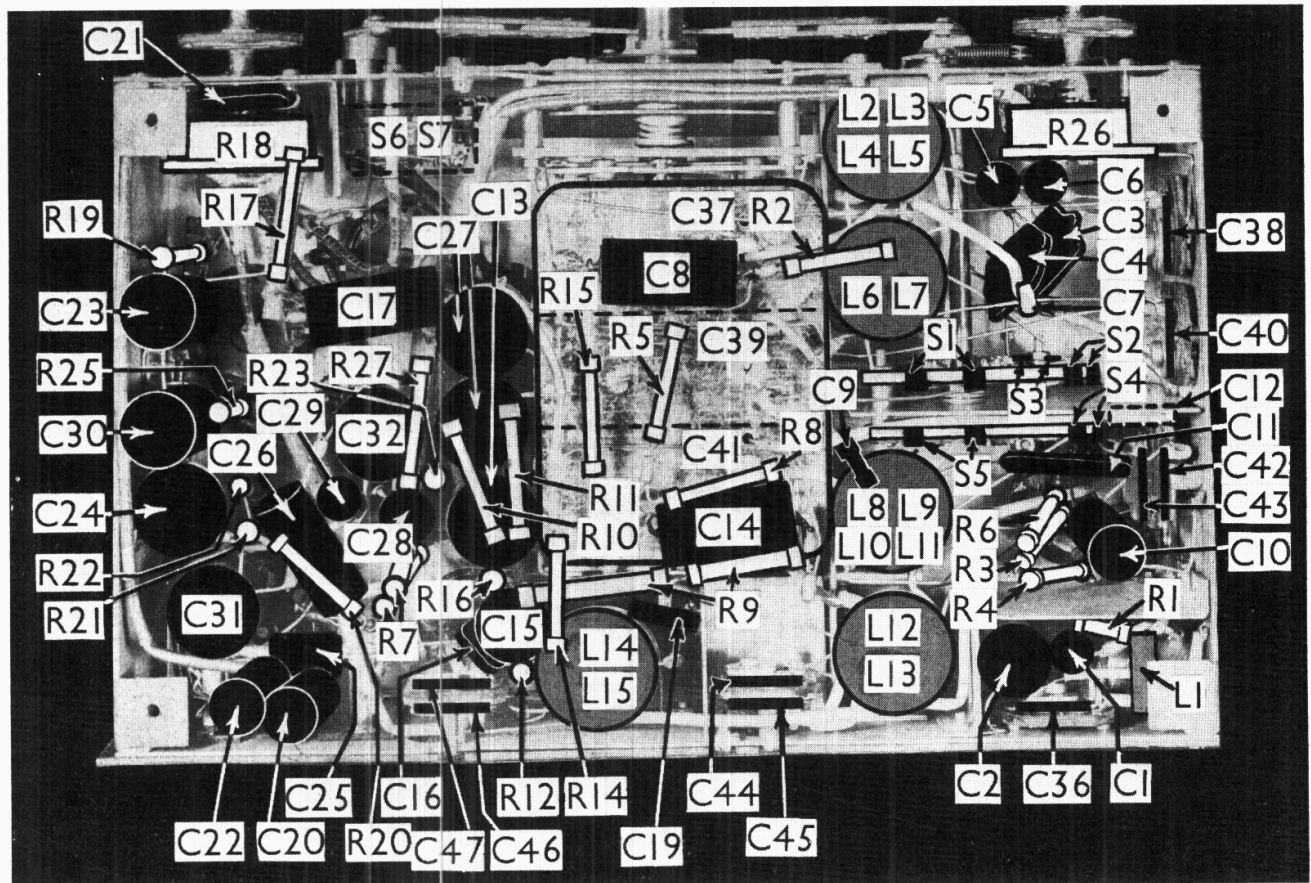
Condenser C9.—This is a very small cartridge type condenser, looking like a small resistance.

Resistance R24.—This is a grid stopper for V5, but does not occur in our chassis. It is therefore not indicated in the chassis views. Its value is 1,000 O.

Trimming Condensers.—There are nine of these, disposed round one side and the back of the chassis, and adjustable through holes in the chassis. Six of them are in double units, the remaining three being single units. In the case of the double units, a slotted screw operates the rear trimmer, and a hexagonal nut adjusts the front trimmer. The single units have the slotted screw only.

C18, R13, L18, L19, S8.—These components are all mounted beneath the top of the cabinet.

NOTE.—Care should be taken when handling this set out of its cabinet, since the chassis is not necessarily at earth potential. Precautions have been taken to prevent accidental shock when the set is in its cabinet.



Under-chassis view. C37, C39 and C41 are the main tuning condensers in a sealed casing. R7 comprises two resistances in parallel, and R9 two in series. C27 is made up of two condensers in parallel. C7 is formed of an insulated hook of wire over a bare wire, while C9 is a small cartridge-type condenser. C12 is shown dotted, as it is beneath some of the wiring and the switches in front of the small switch screen. S1, S2 and S3 are in one unit, S3 being at the bottom. S4 and S5 are in the other unit. The mains switches, S6, S7, are in a separate unit near the front of the chassis, shown by a dotted enclosure.