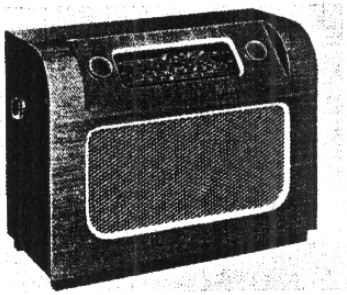
"TRADER" SERVICE SHEET

1001

FERGUSON 238A

Covering also 268RG Radiogram



A BALANCED bridge-connected negative feed-back circuit is used in the Ferguson 238A, a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 200-250V, 50-100 c/s. The waveband ranges are 16-54 m, 190-570 m and 750-2,000 m.

Model 238L is like the 238A in all respects except that it has tappings for 110-130V. It may be used on 110V, 40 c/s mains, using the 130V tapping. The 268RG employs a modified 238A chassis, the differences being explained overleaf. An A.C./D.C. companion of this series, the 238U, is covered in *Service Sheet 1000*.

Release dates and original prices: 238A and L, October 1950, £13 16s 6d; 268RG, July 1951, price to be announced. Purchase tax extra.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (S.W.), **L2** (M.W.) and "bottom" coupling capacitor **C1** (L.W.) to single tuned circuits **L3, C28** (S.W.), **L4, C28** (M.W.) and **L5, C28** (L.W.).

First valve **(V1, Mullard ECH42)** is a triode hexode operating as frequency changer with internal coupling. Oscillator grid coils **L6** (S.W.), **L7** (M.W.) and **L8** (L.W.) are tuned by **C29**. Parallel trimming by **C30** (S.W.), **C31** (M.W.) and **C32, C7** (L.W.); series tracking by **C8** (S.W.), **C9** (M.W.) and **C10** (L.W.). Reaction coupling from anode via **C12** and oscillator anode coils **L9** (S.W.), **L10** (M.W.) and **L11** (L.W.). **C11, L12** form a "boost" circuit and resonate with the S.W. reaction circuit to maintain the level of oscillation at the high wavelength end of the band.

Second valve **(V2, Mullard EF41)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C3, L13, L14, C4,** and **C14, L15, L16, C15.**

Intermediate frequency 470 kc/s.

Diode signal detector is part of double diode triode valve **(V3, Mullard EBC41),** whose second diode is connected to chassis. A.F. component in rectified output is developed across volume control **R12,** which acts as diode load, and passed via **C19** to the grid of triode section. D.C. potential developed across **R12** is fed back as bias for F.C. and I.F. stages, giving automatic gain control.

Resistance-capacitance coupling between **V3** and pentode output valve **(V4, Mullard EL41)** via **R14, C20** and **R15.** Tone correction in **V4** anode circuit by **C21.** Speech coil voltages across **T1** secondary are fed back in anti-phase via a balanced bridge circuit formed by **R10, R11, R6** and **R12** (with **R7**), thus ensuring that no negative feed-back voltage is applied to **C17** and the detector diode, which are connected

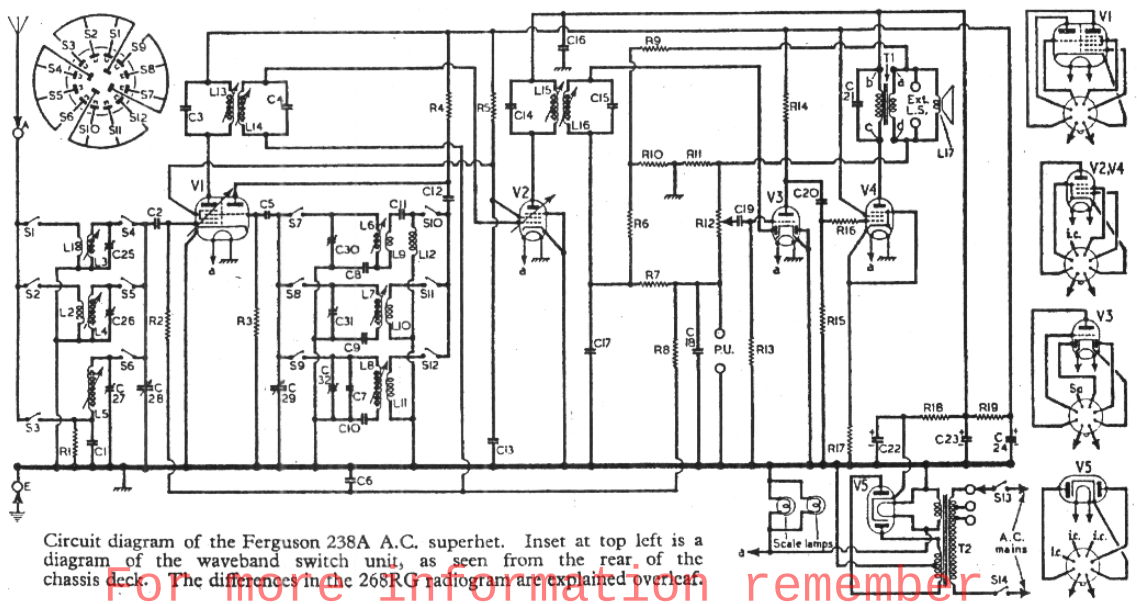
(Continued col. 1 overleaf)

COMPONENTS AND VALUES

	RESISTORS	Values	Locations
R1	L.W. aerial shunt...	27kΩ	H3
R2	V1 hex. C.G. ...	1MΩ	H4
R3	V1 osc. C.G. ...	47kΩ	H4
R4	Osc. H.T. feed ...	27kΩ	H4
R5	V1, V2 S.G. feed ...	27kΩ	F3
R6	Neg. feed-back ...	560kΩ	E4
R7	I.F. stopper ...	100kΩ	E4
R8	A.G.C. decoupling	1MΩ	E3
R9	Negative feed-back pot. divider ...	100Ω	E4
R10		270Ω	E4
R11		270Ω	E3
R12	Volume control ...	500kΩ	D2
R13	V3 C.G.	20MΩ	E4
R14	V3 anode load ...	220kΩ	F4
R15	V4 C.G.	680kΩ	E4
R16	V4 C.G. stopper ...	4·7kΩ	E4
R17	V4 G.B.	150Ω	E4
R18	H.T. smoothing ...	470Ω	F3
R19		1·2kΩ	F3

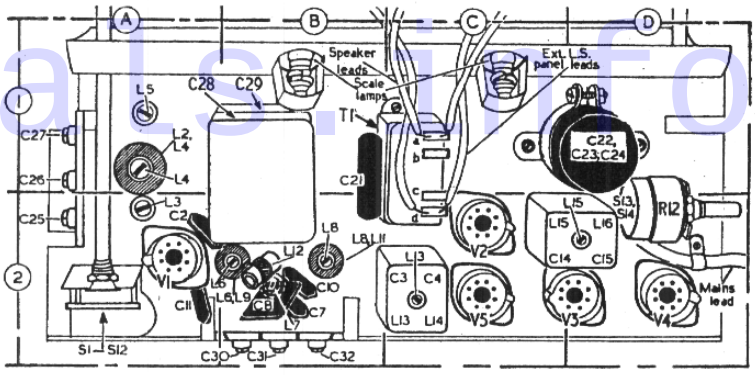
	CAPACITORS	Values	Locations
C1	L.W. aerial coup....	0·0025μF	H3
C2	V1 hex. C.G. ...	200pF	A2
C3	1st I.F. trans. tuning ...	100pF	C2
C4		100pF	C2
C5	V1 osc. C.G. ...	50pF	H4
C6	A.G.C. decoupling	0·1μF	G4
C7	L.W. osc. trimmer	30pF*	B2
C8	S.W. osc. tracker...	0·008μF	B2
C9	M.W. osc. tracker...	605pF	G4
C10	L.W. osc. tracker...	155pF	B2
C11	S.W. boost ...	100pF	A2
C12	Osc. anode coupling	200pF	H4
C13	V1, V2 S.G. decoup.	0·1μF	F3
C14	2nd I.F. trans. tuning	100pF	D2
C15		180pF	D2
C16	H.T. decoupling ...	0·1μF	F3
C17	I.F. by-passes ...	100pF	E4
C18		100pF	E3
C19	A.F. coupling ...	0·002μF	E4
C20		0·01μF	E4
C21	Tone corrector ...	0·02μF	B1
C22*	H.T. smoothing ...	16·0μF	D1
C23*		24·0μF	D1
C24*		8·0μF	D1
C25†	S.W. aerial trim....	50pF	A2
C26†	M.W. aerial trim....	50pF	A1
C27†	L.W. aerial trim....	50pF	A1
C28†	Aerial tuning ...	528pF	B1
C29†	Oscillator tuning ...	528pF	B1
C30†	S.W. osc. trimmer	50pF	B2
C31‡	M.W. osc. trimmer	50pF	B2
C32‡	L.W. osc. trimmer	50pF	B2

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Ferguson 238A A.C. superhet. Inset at top left is a diagram of the waveband switch unit, as seen from the rear of the chassis deck. The differences in the 268RG radiogram are explained overleaf.

	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	Aerial coupling coils	—	H3
L2		1·2	A1
L3		—	H3
L4	Aerial tuning coils	3·0	A1
L5		26·0	H3
L6		—	B2
L7	Oscillator tuning coils	1·6	G4
L8		9·5	B2
L9		—	B2
L10	Oscillator reaction coils	1·6	G4
L11		3·0	B2
L12	S.W. boost coil	—	B2
L13	1st I.F. trans. (Pri.)	8·0	C2
L14	1st I.F. trans. (Sec.)	8·0	C2
L15	2nd I.F. trans. (Pri.)	8·0	D2
L16	2nd I.F. trans. (Sec.)	6·0	D2
L17	Speech coil	2·8	—
T1	Primary	310·0	C1
	Secondary	—	
	Primary, total	66·0	
T2	Heater sec.	—	—
	H.T. sec., total	594·0	
S1-S12	Waveband switches	—	A2
S13, S14	Mains sw., g'd R12	—	D2



Plan view of the chassis. The output transformer tags are coded as in the circuit.

Circuit Description—*continued*

across the zero potential corners of the bridge, while half the available feed-back voltage, that across **R11**, is applied to **V3** grid.

H.T. current is supplied by 1.H.C. full-wave rectifying valve **(V5, Mullard EZ40)**. Smoothing by electrolytic capacitors **C22, C23** and **C24** and resistors **R18, R19. V5** is connected to the same heater winding on **T2** as the other valves.

GENERAL NOTES

Switches.—**S1-S12** are the waveband switches, ganged in a single 3-position unit on the chassis deck. This is indicated in our upper-chassis illustration, and shown in detail in the diagram inset in the top left-hand corner of the circuit diagram overleaf, where it is drawn as seen from the rear of a chassis standing on its base.

The table below gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the control. A dash indicates open, and **C**, closed.

Switch	S.W.	M.W.	L.W.
S1	C	—	—
S2	—	C	—
S3	—	—	C
S4	C	—	—
S5	—	C	—
S6	—	—	C
S7	C	—	—
S8	—	C	—
S9	—	—	C
S10	C	—	—
S11	—	C	—
S12	—	—	C

S13, S14 are the Q.M.B. mains switches, ganged with the volume control **R12.**

Scale Lamps.—These are two Osram lamps, with small clear spherical bulbs and M.E.S. bases, rated at 6.5 V, 0.3 A.

External Speaker.—Two sockets are mounted on a panel at the rear of the cabinet (top right) for the connection of a low impedance (2-3Ω) external speaker.

Drive Cord Replacement.—About 30 inches of high-grade fishing line, plaited and waxed, is required for a new drive cord, which should be run as shown in our underside drawing of the chassis.

T1 Connections.—As negative feed-back voltages are taken from the output transformer secondary it is important, if the leads are unsoldered, that they are reconnected in the right "sense," as otherwise positive feed-back will result. The four connections are coded in our circuit diagram and again in our plan view of the chassis.

Radiogram Modifications.—In the radiogram model 268RG, a radio/gram change-over switch is added, and while a 330kΩ resistor shunts the P.U. sockets, a 2.2MΩ resistor is inserted between the "live" socket and **R12.**

The radio/gram switch is in three sections. One of these is a 2-way switch connecting the volume control to **R7** for radio, or to the P.U. socket (via the added resistor) for gram. Another similar section shunts a 500pF capacitor from **V4** anode to chassis for radio, or from **V4** anode to **V3** anode for gram. The third short-circuits an added 4.7kΩ resistor inserted in **V1** cathode lead while working on radio. On gram the valve is thus muted.

DISMANTLING THE SET

Removing Chassis.—Pull off two front control knobs, and, slackening the two grub screws securing the metal coupler to the volume control spindle, disengage it;
release the A and E, P.U., and Ext. L.S. brackets from the sides of the cabinet;
release the mains transformer from bottom of cabinet (held by two wood screws);
unsolder the two leads from the speech coil tags on the speaker;
remove the two chassis fixing bolts from the ends of the rear chassis member;
remove two wood screws securing top of scale backing plate to cabinet, and withdraw chassis.

CIRCUIT ALIGNMENT

I.F. Stages.—Remove chassis from cabinet and stand it on bench so that adjustments are easily accessible. Disconnect **C2** (location reference A2) from its junction on **C28** and connect the signal generator to the free end of **C2** and chassis. Switch set to M.W. and turn gang and volume controls to maximum. Feed in a 470 kc/s (638.3 m) signal and adjust the cores of **L16** (F4), **L15** (D2), **L14** (F4) and **L13** (C2), reducing the input as the circuits come into line to avoid A.G.C. effects. Remove "live" lead from **C2** and reconnect the free end of **C2** to **C28.**

R.F. and Oscillator Stages.—As the tuning scale remains fixed in the cabinet when the chassis is removed, reference must be made during alignment to the three calibration marks on the bottom edge of the scale backing plate. In our chassis these calibration marks took the form of holes drilled through the backing plate, and they will be numbered from 1-3 (looking at the front of the chassis and counting from left to right) in the following instructions.

Check that with the gang at maximum capacitance the cursor coincides with calibration mark 3. This may be adjusted by slackening the two grub screws on the drive drum.

S.W.—Switch set to S.W., tune to calibration mark 1, feed in a 18.75 m (16 Mc/s) signal and adjust **C30** (B2) and **C25** (A2) for maximum output. Tune to calibration mark 2, feed in a 52.2 m (5.75 Mc/s) signal and adjust the cores of **L6** (B2) and **L3** (A2) for maximum output. Repeat these adjustments until no further improvement results.

M.W.—Switch set to M.W., tune to calibration mark 1, feed in a 212 m (1,415 kc/s) signal and adjust **C31** (B2) and **C26** (A1) for maximum output. Tune to calibration mark 2, feed in a 555.5 m (540 kc/s) signal and adjust the cores of **L7** (B2) and **L4** (A1) for maximum output Repeat these adjustments until no further improvement results.

L.W.—Switch set to L.W., tune to calibration mark 1, feed in a 845 m (355 kc/s) signal and adjust **C32** (B2) and **C27** (A1) for maximum output. Tune to calibration mark 2, feed in a 1,935 m (155 kc/s) signal and adjust the cores of **L8** (B2) and **L5** (A1) for maximum output. Repeat these adjustments until no further improvement results.

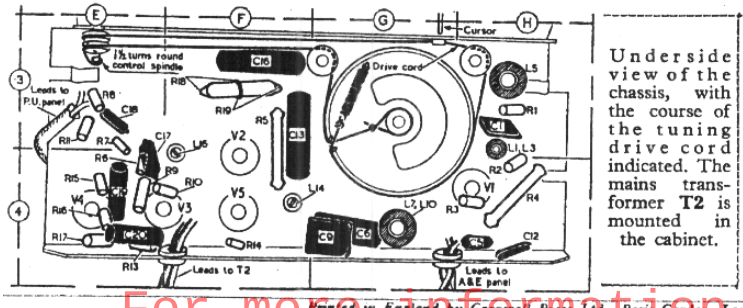
VALVE ANALYSIS

Valve voltages and currents given below are derived from the manufacturer's information and are representative figures taken from receivers which were operating on 225 V A.C. mains. The receivers were tuned to the highest wavelength end of M.W., with the volume controls set at maximum, but there was no signal input.

Voltage measurements, with the exception of cathode readings, were taken on the 400 V scale of a model 7 Avometer, chassis being the negative connection.

Valves	Anode V	Anode mA	Screen V	Screen mA	Cath. V
V1 ECH42	212·5	2·28	67·0	3·58	—
	Oscillator 95·8	4·02			
V2 EF41	229·5	5·88	67·0	1·7	—
V3 EBC41	67·6	0·59	—	—	—
V4 EL41	218·6	32·8	229·5	4·73	5·45
V5 EZ40	250·0†	—	—	—	256·1

† A.C. each anode.



Underside view of the chassis, with the course of the tuning drive cord indicated. The mains transformer **T2** is mounted in the cabinet.

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