

"TRADER" SERVICE SHEET
1029

FERGUSON 321U

A.C./D.C. Superhet

THE A.C./D.C. counterpart of the 321A, which is covered separately in *Service Sheet 1023*, the Ferguson 321U is a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. or D.C. mains of 200-250 V, 40-60 c/s in the case of A.C. The waveband ranges are 16-55 m, 190-560 m and 750-2,000 m.
Release date and original price: December 1951 £19 16s 6d.

CIRCUIT DESCRIPTION

Aerial input, R.F. tuning, oscillator tuning and intermediate frequency amplifier circuits associated with frequency changer (V1, Mullard UCH42) and I.F. amplifier (V2, Mullard UBF80) are quite straightforward.

Intermediate frequency 470 kc/s.
Diode signal detector is part of V2, audio frequency component in rectified output being developed across volume control R15, which acts as diode load, and passed via C25 to control grid of pentode valve (V3, Mullard UF41).

Second diode of V2 is fed via C17 from anode of pentode section and the voltage developed across its load resistor R10 is fed back, giving automatic gain control.

Resistance-capacitance coupling by R21, C27 and R23 between V3 and pentode output valve (V4, Mullard UL41). Voltages appearing across winding c-d of output transformer T1 are fed back, via R19, C28, R18 and R17 to V3 cathode, giving variable tone control.

The value of C27 and position of R23 are selected to produce rapid attenuation at very low frequencies, in order to offset the feedback, which becomes positive. Provision is made for the connection of a low impedance external speaker across speech coil winding e-f of T1, rotation of the speaker plug opening S18 and muting the internal speaker.

H.T. current is supplied by L.H.C. half-wave rectifying valve (V5, Mullard UY41).

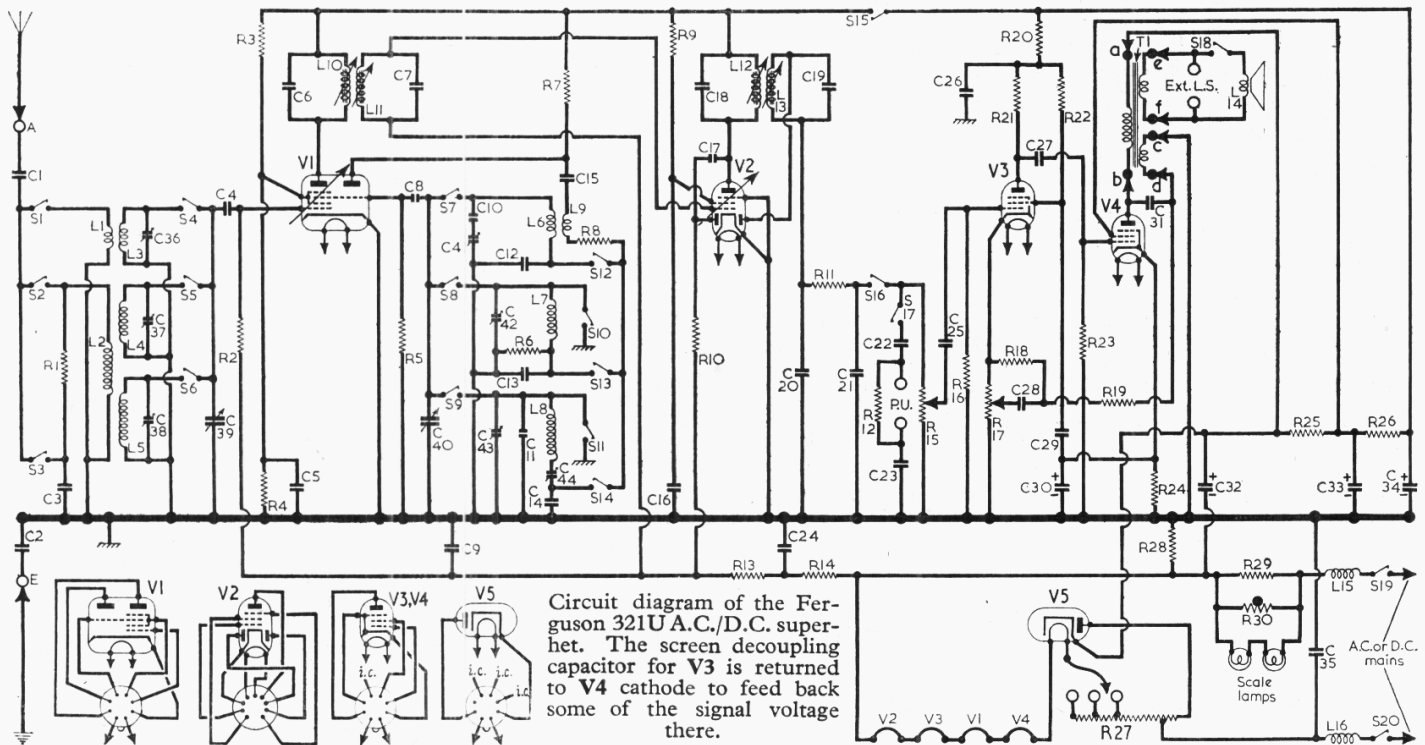
COMPONENTS AND VALUES

RESISTORS		Values	Locations
R1	M.W. aerial shunt	3.3kΩ	F3
R2	V1 C.G.	1MΩ	G3
R3	V1 H.T. pot. divider	18kΩ	G4
R4		27kΩ	G3
R5	V1 osc. C.G.	47kΩ	G3
R6	Tracker shunt	3.3kΩ	G3
R7	Osc. anode feed	22kΩ	G4
R8	Osc. stabilizer	220Ω	F3
R9	V2 S.G. feed	68kΩ	G4
R10	A.G.C. diode load	470kΩ	F4
R11	I.F. stopper	100kΩ	B2
R12	P.U. shunt	47kΩ	F4
R13	A.G.C. diode load	470kΩ	E4
R14		470kΩ	E4
R15	Volume control	500kΩ	E3
R16	V3 C.G.	3.3MΩ	F4
R17	Tone control	2.5kΩ	D3
R18	Part tone control	47kΩ	E4
R19		10kΩ	E4
R20	H.T. decoupling	100kΩ	E4
R21	V3 anode load	1MΩ	E4
R22	V3 S.G. feed	4.7MΩ	E4
R23	V4 C.G.	1MΩ	E4
R24	V4 G.B.	270Ω	E4
R25	H.T. smoothing	680Ω	D4
R26		1.5kΩ	E3
R27	Ballast resistor	1,230Ω	C2
R28	V1, V2 G.B.	33Ω	D3
R29	Scale lamp shunt	330Ω	E3
R30	Brimistor CZ1	—	E3

‡ Tapped at 130Ω + 700Ω + 200Ω + 200Ω from V5 anode.

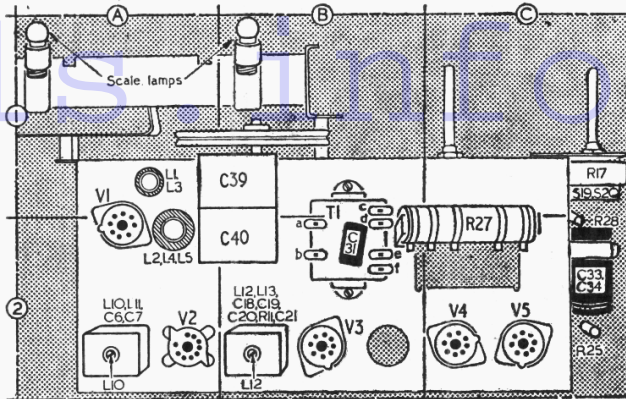
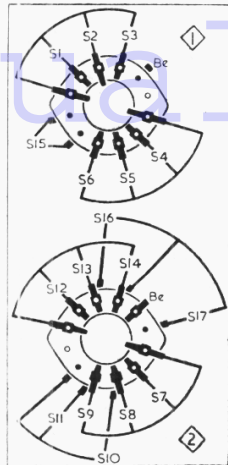
* Electrolytic. † Variable. ‡ Pre-set.
§ "Swing" value, min. to max.

CAPACITORS		Values	Locations
C1	Aerial Series	0.001μF	F3
C2	Chassis isolator	0.005μF	G4
C3	Aerial coupling	500pF	F3
C4	V1 C.G.	200pF	G3
C5	V1 S.G. decoup.	0.1μF	G3
C6	1st I.F. trans. tuning	100pF	A2
C7		ing	130pF
C8	V1 osc. C.G.	50pF	G3
C9	A.G.C. decoup.	0.1μF	G4
C10	S.W. osc. trimmer	20pF	F3
C11	L.W. osc. trimmer	30pF	F3
C12	Oscillator trackers	3,550pF	G3
C13		560pF	G3
C14	500pF	G3	
C15	Osc. anode coupling	200pF	G3
C16	V2 S.G. decoup.	0.1μF	G4
C17	A.G.C. feed	50pF	F4
C18	2nd I.F. trans. tuning	100pF	B2
C19		ing	180pF
C20	I.F. by-passes	100pF	B2
C21	100pF	B2	
C22	P.U. isolators	0.005μF	F4
C23		0.1μF	F4
C24	G.B. decoupling	0.1μF	D4
C25	A.F. coupling	0.005μF	F4
C26	H.T. decoupling	0.1μF	E3
C27	A.F. coupling	0.003μF	E4
C28	Part tone control	0.01μF	E4
C29	Tone corrector	0.05μF	E4
C30*	V4 cath. by-pass	50μF	E4
C31	Tone corrector	115pF	B2
C32*	H.T. smoothing	32μF	D4
C33*		24μF	C2
C34*	24μF	C2	
C35	Mains R.F. filter	0.01μF	E4
C36†	S.W. aerial trim.	40pF	F3
C37†	M.W. aerial trim.	40pF	F3
C38†	L.W. aerial trim.	40pF	F3
C39†	Aerial tuning	§528pF	B1
C40†	Oscillator tuning	§528pF	B2
C41†	S.W. osc. trim.	40pF	F4
C42†	M.W. osc. trim.	40pF	F4
C43†	L.W. osc. trim.	40pF	F4
C44†	L.W. osc. tracker	350pF	G4

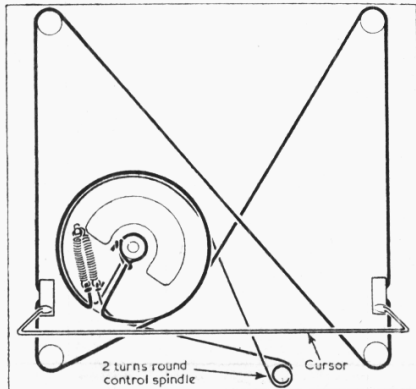


Circuit diagram of the Ferguson 321U A.C./D.C. superhet. The screen decoupling capacitor for V3 is returned to V4 cathode to feed back some of the signal voltage there.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial coupling coils	2-3	A1
L2		28-0	A2
L3		—	A1
L4	Aerial tuning coils	2-6	A2
L5		30-0	A2
L6	Oscillator tuning coils ...	—	G3
L7		2-5	G3
L8	—	15-0	G3
L9	Osc. reaction coil ...	1-0	G3
L10	1st I.F. trans. {	Pri. 8-0	A2
L11		Sec. 8-0	A2
L12	2nd I.F. trans. {	Pri. 8-0	B2
L13		Sec. 6-0	B2
L14	Speech coil ...	2-5	—
L15	Mains R.F. chokes {	3-4	D3
L16		3-4	D3
T1	O.P. trans. {	a-b... 290-0	B2
	c-d... 13-0		
	e-f... —		
S1-S17	Waveband switches	—	F3
S18	Int. L.S. switch ...	—	E4
S19-S20	Mains sw., g'd R17	—	D3



Left: Diagrams of switch units. Above: Plan view of chassis.



Drive cord system, as seen from the front.

GENERAL NOTES

Switches.—S1-S14 are the waveband switches, and S15-S17 are the radio/gram change-over switches, ganged in two rotary units. These are indicated in our underside view of the chassis, and shown in detail in the diagrams inset beside our plan view of the chassis, where they are drawn as seen from the rear of an inverted chassis. The table below them gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and C, closed.

Scale Lamps.—These are two M.E.S. types, with small clear spherical bulbs, rated at 8 V, 0.15 A.

External Speaker.—A special plug is provided at the rear of the chassis for connecting a low impedance (about 2-3Ω) external speaker.

Switches	Gram.	L.W.	M.W.	S.W.
S1	—	—	—	C
S2	C	—	—	—
S3	—	—	—	—
S4	—	—	—	C
S5	—	—	—	—
S6	—	—	—	—
S7	—	—	—	C
S8	—	—	—	—
S9	—	—	—	—
S10	—	—	—	C
S11	—	—	—	C
S12	—	—	—	C
S13	—	—	—	C
S14	—	—	—	C
S15	—	—	—	C
S16	—	—	—	C
S17	C	—	—	—

When the plug is turned a few degrees anti-clockwise in its sockets, S18 opens and mutes the internal speaker.

Drive Cord Replacement.—There are two separate cords for tuning drive and cursor drive. The former requires about two feet of fine gauge nylon braided glass yarn, and the latter about five feet of normal gauge plaited flax fishing line. The method of running these two cords is shown in the sketch in col. 1 where they are viewed from the front with the gang at minimum.

CIRCUIT ALIGNMENT

The following adjustments may be made without removing the chassis from its cabinet, access to the under-chassis trimmers and core adjustments being gained by removing the cabinet base cover (six wood screws).

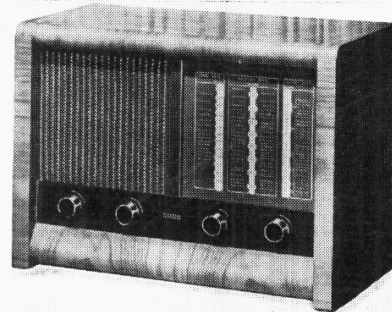
I.F. Stages.—Connect output of signal generator to junction of C39 and C4, and turn volume control and gang to maximum. Switch set to M.W., feed in a 470 kc/s (638.3 m) signal and adjust the cores of L13 (location reference F4), L12 (B2), L11 (G4) and L10 (A2) for maximum output.

R.F. and Oscillator Stages.—Check that with the gang at maximum capacitance, the cursor coincides with the tops of the tuning scales and is horizontal. Transfer signal generator leads to A and E sockets via a suitable dummy aerial.

L.W.—Switch set to L.W., tune to 857 m (spot on scale), feed in an 857 m (350 kc/s) signal and adjust C43 (F4) and C38 (F3) for maximum output. Tune to 1,875 m, feed in a 1,875 m (160 kc/s) signal and adjust C44 (G4) for maximum output. Repeat these adjustments until no further improvement results.

M.W.—Switch set to M.W., tune to 200 m (spot on scale), feed in a 200 m (1,500 kc/s) signal and adjust C42 (F4) and C37 (F3) for maximum output. Check calibration at 517 m (580 kc/s) and if there is a large error check the capacitance of C13, replacing it if it falls outside a tolerance of ±1%. If C13 is not faulty it may be found necessary to replace the coil unit L6, L7, L8, L9.

S.W.—Switch set to S.W., tune to 17.7 m (spot on scale), feed in a 17.7 m (17 Mc/s) signal and adjust C41 (F4) and C36 (F3) for maximum output, "rocking" the gang when adjusting C36 to obtain optimum results. Check calibration at 50 m (6 Mc/s) and if there is a large error replace C12 (tolerance ±5%) or the coil unit.



VALVE ANALYSIS

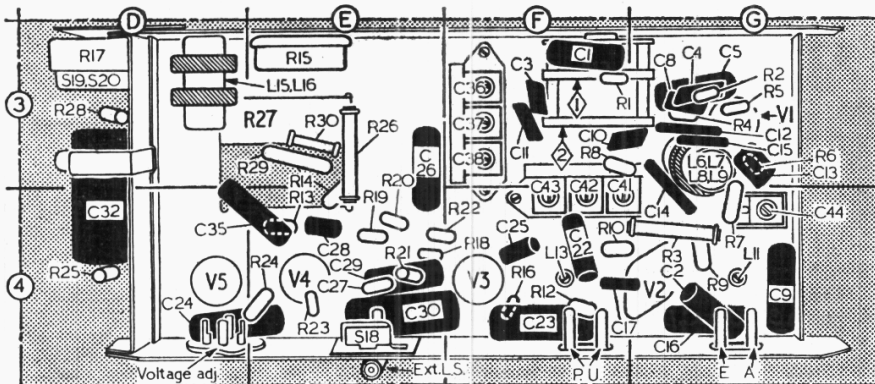
Valve voltages and currents given in the table below are derived from the manufacturer's information and were measured on a receiver which was operating from 230 V A.C. mains.

Voltage readings were taken on the 10 V and 400 V ranges of a Model 7 Avometer, chassis being the negative connection. The voltage drop across R28 was 2.1 V.

Valve	Anode		Screen		Cath.
	V	mA	V	mA	
V1 UCH42	184	2-3	75	4-7	—
	Oscillator	75			
V2 UBF80	184	3-7	82	1-5	—
V3 UF41	*	0-16	*	*	0-25
V4 UL41 ...	228	40-0	212	7-0	12-5
V5 UY41 ...	220†	—	—	—	232-0

* Readings very low.

† A.C. voltage.



Underside view of the chassis. C27 (E4) is shown white in error.