Supplement to The Wireless & Electrical Trader, October 2, 1948

"TRADER" SERVICE SHEET

880

MURPHY U102A

Covering the whole U102 Series

THE Murphy U102A is one version of a series of 8 models all based on a common design, a 4-valve (plus rectifier) 3-band superhet for A.C. or D.C. mains of 200-250 V, 25-100 c/s in the case of A.C. The S.W. range is 16.7-50 m.

This *Service Sheet* is based throughout on the U102A, from a sample of which it was prepared. The differences in the other seven models, as compared with the U102A, are described under "Associated Models" overleaf.

Release dates and original prices: U102A and TU102A, October 1947, £16 10*s*; *U102, February* 1946, £15, *increased June* 1946 *to* £16 10*s*; *U102C, April* 1946, £27; *U102R, July* 1947, £45; *A102R, October* 1946, £40; *increased April* 1947 *to* £42, *plus purchase tax in each case. TU102S and EU102 are export models.*

CIRCUIT DESCRIPTION

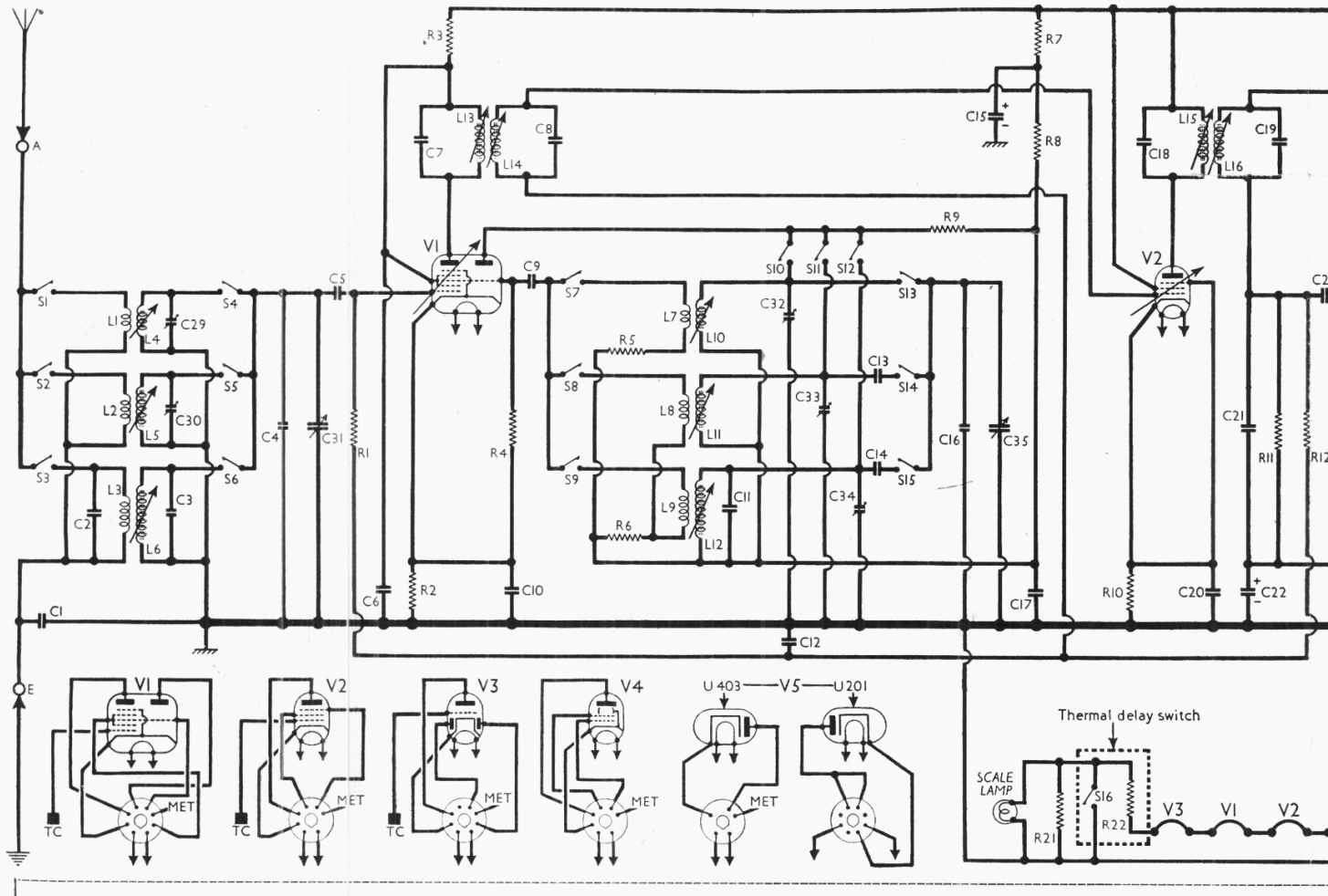
Aerial input is via coupling coils **L1** (S.W.), **L2** (M.W.) and **L3** (L.W.) to single-tuned circuits **L4, C31** (S.W.), **L5, C31** (M.W.) and **L6, C31** (L.W.), which precede a triode heptode valve **(V1, Mazda metallized TH233),** operating as frequency changer with internal coupling. Provision is made for mounting a Murphy aerial filter on the chassis, to be connected in series with the aerial lead and tuned to the wavelength of any transmitter which is located close enough to the receiver to cause whistles due to overloading.

Triode oscillator anode coils **L10** (S.W.), **L11** (M.W.) and **L12** (L.W.) are tuned by **C35,** with parallel trimming by **C16** (all bands), **C32** (S.W.), **C33** (M.W.) and **C11, C34** (L.W.), and series tracking by **C13** (M.W.) and **C14** (L.W.). Reaction coupling by grid coils **L7** (S.W.), **L8** (M.W.) and **L9** (L.W.).

Second valve **(V2, Mazda metallized VP133)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C7, L13, L14, C8** and **C18, L15, L16, C19.**

Intermediate frequency 465 kc/s.

Diode second detector is part of double diode triode valve **(V3, Mazda metallized HL133DD),** one diode of which is unused and wired to cathode. Audio frequency component in rectified output is developed across diode load resistor **R11** and passed via A.F. coupling capacitor **C23,** manual volume control **R13** and C.G. stopper **R14**



Circuit diagram of the Murphy U102A A.C./D.C. superhet. It differs in a fair number of minor details from the original U102, or the differences between the U102A and all the other versions are explained under "Associated Models" overleaf. The thermal delay switch the scale lamp until the valve heaters have had time to warm up.

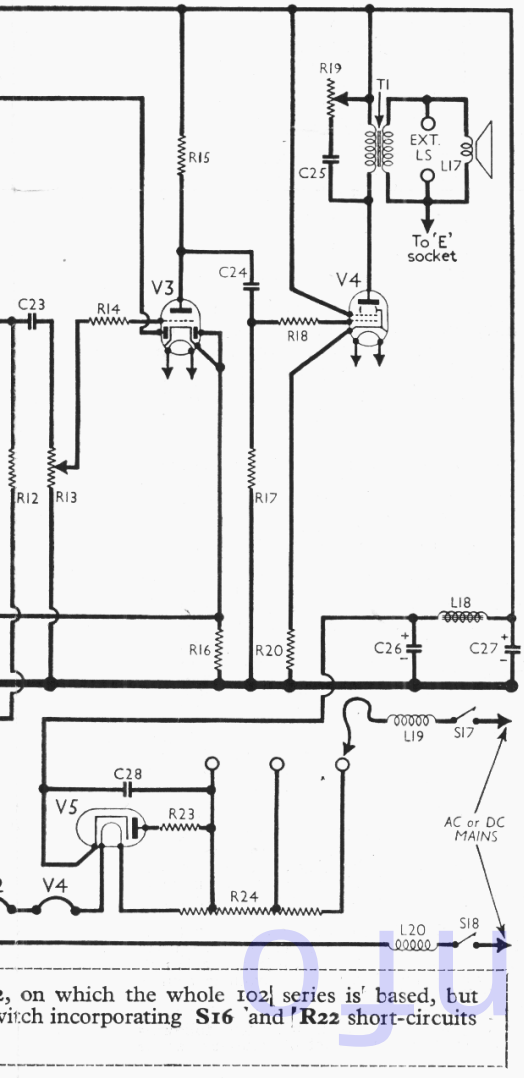
to grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C21** in diode circuit and **R14** in **V3** triode grid circuit.

The D.C. potential developed across **R11** is tapped off and fed back, through a decoupling circuit **R12, C12,** as G.B. to F.C. and I.F. valves, giving A.V.C.

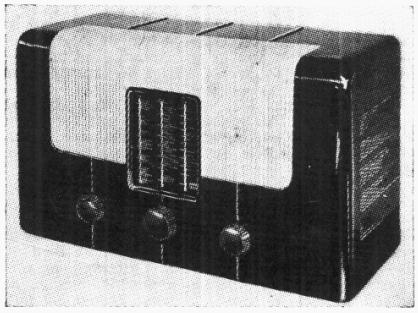
Resistance-capacitance coupling by **R15, C24, R17,** via C.G. stopper **R18,** between **V3** triode and beam tetrode output valve **(V4, Mazda metallized PEN383).** Variable tone control in **V4** anode circuit by **R19, C25** and provision for the connection of a low impedance external speaker across **T1** secondary winding.

When the receiver is operating from A.C. mains, H.T. current is supplied by half-wave rectifying valve **(V5, Mazda metallized U403),** which behaves as a low resistance with D.C. mains. Smoothing by iron-cored choke **L18** and electrolytic capacitors **C26, C27.**

Valve heaters, together with scale lamp, thermal delay switch **S16, R22,** and adjustable ballast resistor **R24,** are connected in series across mains input. Mains R.F. filtering by chokes **L19, L20** and capacitor **C28.** Earth isolation by **C1.**



, on which the whole 102 series is based, but vitch incorporating **S16** and **R22** short-circuits



The appearance of the plastic table cabinet used throughout the U102 series. The alternative U102 wooden cabinet is shown overleaf.

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)	Locations
R1	V1 hept. C.G. ...	1,000,000	P12
R2	V1 fixed G.B. ...	390	K7
R3	H.T. feed	4,700	J8
R4	V1 osc. C.G. ...	15,000	K7
R5	Oscillator stabilizing resistors ...	47	N11
R6		470	M10
R7	Oscillator H.T. decoupling ...	15,000	K8
R8		5,600	K8
R9	Oscillator shunt ...	22,000	K8
R10	V2 fixed G.B. ...	330	H7
R11	Sig. diode load ...	470,000	G8
R12	A.V.C. decoupling	2,200,000	G8
R13	Volume control ...	1,000,000	D4
R14	I.F. stopper ...	220,000	D4
R15	V3 triode load ...	47,000	F7
R16	V3 G.B.; A.V.C. delay resistor ...	1,500	G7
R17	V4 C.G. resistor ...	470,000	F8
R18	V4 C.G. stopper ...	47,000	F7
R19	Tone control ...	20,000	F6
R20	V4 G.B. resistor ...	180	F7
R21	Scale lamp shunt ...	27	H8
R22	Thermal delay heater	18·5	J5
R23	V5 surge limiter ...	47	H5
R24	Heater ballast ...	574*	C2

* Tapped at 405Ω + 84·5Ω + 84·5Ω from V5 heater.

	CAPACITORS	Values (μF)	Locations
C1	Earth isolator ...	0·01	H8
C2	Aerial L.W. shunt	0·00047	M10
C3	Aerial L.W. trim....	0·000085	N10
C4	Aerial fixed trim....	0·00001	N9
C5	V1 hept. C.G. ...	0·0005	O11
C6	V1 S.G. decoup. ...	0·05	J8
C7	1st I.F. transformer tuning	0·00015	B3
C8		0·00015	B3
C9	V1 osc. C.G. ...	0·0002	K8
C10	V1 cath. by-pass ...	0·05	K7
C11	Osc. L.W. trimmer	0·00026	M11
C12	A.V.C. decoupling	0·05	J8
C13	Osc. M.W. tracker	0·0007	O12
C14	Osc. L.W. tracker...	0·000414	O11
C15*	H.T. feed decoup....	8·0	B2
C16	Osc. fixed trim. ...	0·000012	N9
C17	Osc. H.T. decoup....	0·05	K7
C18	2nd I.F. transformer tuning ...	0·00015	D3
C19		0·00015	D3
C20	V2 cath. by-pass ...	0·05	H7
C21	I.F. by-pass ...	0·0002	G8
C22*	V3 cath. by-pass ...	50·0	F8
C23	A.F. coupling ...	0·02	G8
C24	A.F. coupling ...	0·02	F8
C25	Part tone control...	0·05	F7
C26*	H.T. smoothing capacitors ...	16·0	B2
C27*		16·0	B2
C28	Mains R.F. by-pass	0·05	J5
C29‡	Aerial S.W. trim....	0·000035	O11
C30‡	Aerial M.W. trim....	0·000035	O11
C31†	Aerial tuning ...	0·000546	A2
C32‡	Osc. S.W. trim. ...	0·000035	N12
C33‡	Osc. M.W. trim. ...	0·000035	M12
C34‡	Osc. L.W. trim. ...	0·000035	M12
C35†	Oscillator tuning ...	0·000546	A2

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	Aerial coupling coils	Very low	N10
L2		0·5	N9
L3		24·0	N9
L4	Aerial tuning coils	Very low	N10
L5		2·2	N10
L6		14·5	N10
L7	Oscillator reaction coils	Very low	L8
L8		0·5	L8
L9		0·7	L8
L10	Oscillator tuning coils	Very low	L8
L11		1·2	L8
L12		1·7	L8
L13	1st I.F. trans Pri.	5·5	B3
L14	Sec.	5·5	B3
L15	2nd I.F. trans Pri.	5·5	D3
L16	Sec.	5·5	D3
L17	Speech coil ...	2·0	—
L18	Smoothing choke...	250·0	A1
L19	Mains R.F. filter chokes	5·7	G6
L20		5·7	G6
T1	Output trans. Pri. ...	110·0	E4
	Sec. ...	0·1	E4
S1-S15	W/band switches...	—	O11
S16	Thermal delay switch	—	K5
S17			
S18	Mains sw., g'd R19	—	F6

If the component numbers given in the preceding tables are used when ordering replacements, dealers should mention the fact, as these numbers may differ from those in the makers' diagram.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from 232V A.C. mains, using the 220-230V tapping on the heater ballast resistor. The receiver was tuned to the lowest wavelength on the M.W. band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400V scale of a model 7 Avometer, chassis being the negative connection.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TH233	122	2·5	122	6·8
	Oscillator			
	72	4·4		
V2 VP133	166	8·5	166	2·5
V3 HL133DD	80	1·3	—	—
V4 PEN383	160	45·0	166	12·0
V5 U403	†	—	—	—

† Cathode to chassis, 192 V, D.C.

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (with one recessed grub screw and felt washer each) from the front of the cabinet; from the rear of the cabinet remove the four long hexagonal nuts securing the vertical chassis plate to moulded projections in the front corners of the cabinet, and slide out the chassis to the extent of the speaker leads, which is sufficient for most purposes.

To free the chassis entirely, unsolder the two rubber covered leads from tags on the speaker connecting panel.

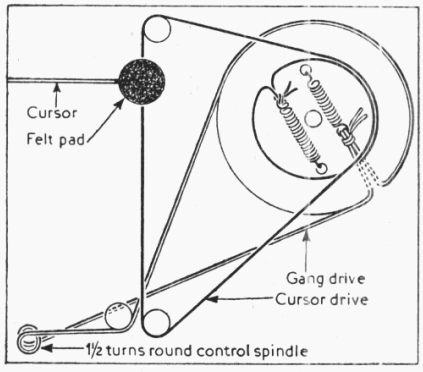
Removing Speaker.—Remove the chassis and the four 4BA nuts (with lock-washers) securing the speaker to the cabinet.

When replacing, the connecting panel should point to the top right-hand corner of the cabinet, when viewing it from the rear.

DRIVE CORD REPLACEMENT

Separate cords of differing materials are used for the main gang drive and the pointer drive. The complete system is shown in the sketch below, where it is drawn as seen from the front with the gang at maximum, after removing the scale panel. To remove it, lay the chassis face-upwards on the bench and press the top and bottom scale clamps down with the bases of the thumbs.

Gang Drive.—This should be fitted first. If the pointer drive is already in position, unhook its spring and slip the cord off its pulleys.



Sketch showing the two drive cord systems, drawn as seen from the front of the chassis after removing the scale panel, when the gang is at maximum capacitance. If the gang drive cord only is to be fitted, the cursor drive cord should be slipped off its pulleys during the operation.

Use a 33-inch length of thick woven waxed Italian hemp cord (Murphy Radio Spec. No. 935) and follow the course indicated in our sketch. The tension spring should be extended to between 1in and 1¼in.

Cursor Drive.—Use a 33-in length of thin woven waxed Italian hemp (Murphy Radio Spec. No. 936) and follow the course shown in our sketch. The tension spring should be extended to between ⅜in and 1in. Clamp the cursor on the centre of the cord, turn the gang to maximum, then clamp up the cord grip with the cursor, approximately level with the tops of the three scales, and glue on the felt pad so that it rubs against the back of the scale panel. Finally, adjust the cursor accurately, after replacing the scale panel, by turning the drive drum on its spindle.

When replacing the scale panel, first fit the rubber pads in the spaces marked out for them on the top and bottom edges of the panel, then slip these into their supporting lugs, one edge at a time.

GENERAL NOTES

Switches.—**S1-S15** are the waveband switches ganged in two rotary units on the rear face of the chassis. These units are indicated in our illustration of the tuning assembly, which is located in the bottom left-hand corner of the chassis. They are shown in detail in the diagrams in Col 3, where they are drawn as seen from the rear.

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

S16 is a "Thermatrol" bi-metal thermal delay switch, with which is associated the wire-wound heating element **R22.** It short-circuits the scale lamp to by-pass the initial current surge, and should remain closed until 8 to 18 seconds after switching on the receiver.

It may be adjusted by turning the screw (clockwise to increase the delay, or vice versa), but in general it is better to replace faulty specimens. The adjustment should be checked when the receiver has cooled off, which means waiting 30 minutes after switching off.

S17, S18 are the Q.M.B. mains switches, ganged with the variable tone control **R19.**

Tuning Assembly.—All the R.F. and oscillator tuning components and adjustments are grouped in the bottom left-hand rear corner of the chassis, the gang being just above them. This assembly is indicated in our rear view of the chassis, but the assembly is shown in detail in the separate illustration in col. 4.

Scale Lamp.—This is an Osram M.E.S. type lamp, with a small clear spherical bulb, rated at 3.5V, 0.15A. It is shunted by **R21,** and protected from the initial switching surge by a "Thermatrol" delay switch. Note that the scale lamp rating changes in other versions than the U102A.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (about 3 Ω) external speaker.

Switch Table

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	C	—	—
S14	—	C	—
S15	—	—	C

ASSOCIATED MODELS

Our sample receiver was a model U102A, and our *Service Sheet* has been based entirely on that version of the series. The differences in other versions as compared with the information given through this Sheet are as follow:—

U102.—Cabinet may be plastic, like U102A, or wood. The thermal delay switch **S16, R22** is omitted. The scale lamp (rated at 6.2v, 0.3A) is still shunted by **R21,** whose value, however, becomes 57 Ω, but is included in the negative H.T. lead to chassis, **V3** heater also being joined directly to chassis.

R19, C25 are replaced either by a 47,000 Ω resistor or a 0.02 μF capacitor, which shunts **T1** primary. **C4** may be 9 pF or 12 pF, **C16** may be 10 pF, **C11** may be 0.00027 μF, and there may be a 620 Ω 4W resistor in **V5** cathode lead to **L18.**

R8 may be 1,000 Ω, **R5** 51 Ω, **R11** and **R17** may be 390,000Ω, **R12** 1,800,000 Ω, **R23** may be wire-wound, and **C16, C26, C27** may all be in the same unit. The mains switches **S17, S18** are usually combined with the volume control **R13,** but where supplies were short a toggle switch was used, operated by a trip lever on **R13** spindle.

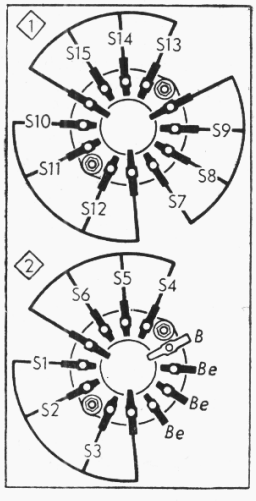
U102C.—Console version of U102, and all foregoing modifications apply to it except that sometimes the tone control **R19, C25** is retained, but **R19** then becomes 15,000 Ω or 50,000 Ω.

EU102.—Export model for mains of 105-130v and 200-250v. **R8** becomes 1,000 Ω, and tone control **R19, C25** is replaced by 47,000 Ω resistor which shunts **T1** primary. Heater circuit is arranged as shown in the diagram in col. 4 with a 2-pin shorting plug for voltage adjustment and the scale lamp in the negative H.T. lead to chassis, **R21** becoming 15 Ω.

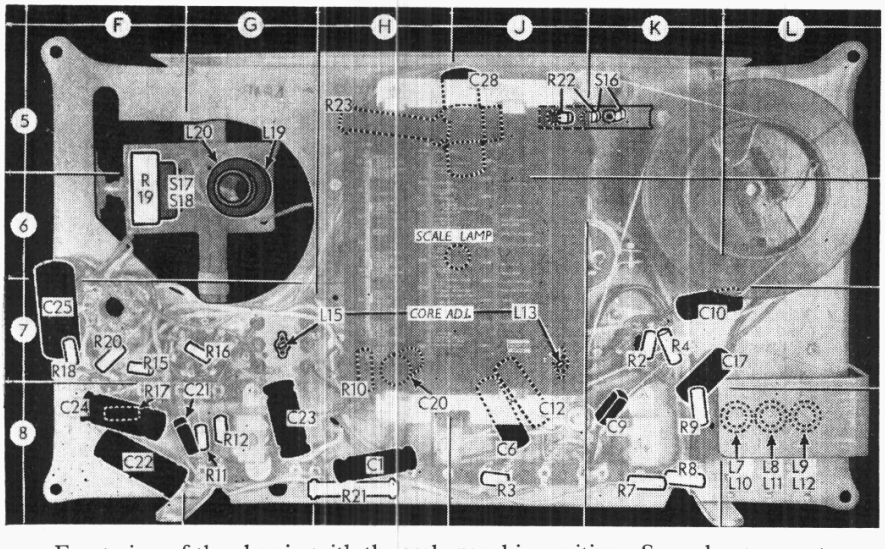
In addition, **V4** becomes a Mazda Pen 384, and **V5** becomes a U201. **R20** is changed to 100 Ω. The mains switches **S17, S18** are in a toggle unit operated by a trip lever on the volume control **R13** spindle.

TU102A.—Tropicalised model, containing modifications given for EU102, with the following differences: the tone control remains as in

Switch Diagrams



Diagrams of the two waveband switch units, drawn as seen from the rear of the chassis as indicated in our separate illustration of the tuning assembly in Col. 4. The associated table is in Col. 2.



Front view of the chassis, with the scale panel in position. Several components are shown dotted through the scale panel, which must be removed to permit adjustment of **L13** core. **R19** and the mains R.F. chokes **L19, L20** are actually on the rear side of the chassis, but they are seen here through the speaker recess.

U102A. The mains switches **S17, S18** are ganged with **R13** instead of **R19**, as in the U102A. **L18** has a D.C. resistance of 120 Ω, and **C16, C26, C27** may all be in one container.

Sockets are provided for a high impedance pick-up via a pair of 0.01 μF capacitors to the ends of **R13**. The heater circuit is like that in the EU102 (shown in the diagram below) except that the scale lamp arrangements are the same as in the U102A.

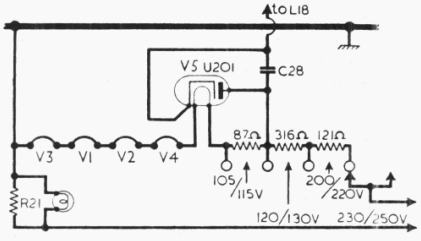


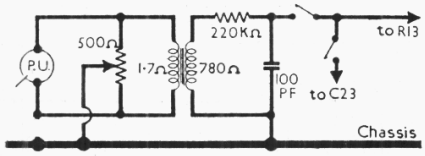
Diagram of the heater circuit employed in the EU102 receiver. A 6.3 V. 0.3 A. scale lamp is fitted, shunted by a 15 Ω resistor (**R21**), and a two-pin voltage adjustment plug is used to join adjacent tappings on the heater ballast resistor.

TU102S.—Tropicalized model generally like the **TU102A**, but with wavebands of 13-37 m (S1), 36-97 m (S2), 190-550 m (M), resulting in considerable changes in the tuning circuits. The tone control **R19, C25** is replaced by a 47,000 Ω resistor which shunts **T1** primary. **C23** becomes 0.005 μF.

The heater circuit is like that in the EU102 (shown in the diagram above). Some models had no pick-up sockets, and the mains switches **S17, S18** may be combined with the volume control **R13.**

A102R.—This is a radiogram using a chassis in general like the U102, with a Garrard AC7 motor, for operation on A.C. mains only, 40-60 c/s. It has an 8in speaker whose 700 Ω field winding replaces **L18.** The low impedance pick-up is coupled by a transformer whose circuit is shown in the diagram in col. 5. In later versions, the 220,000 Ω resistor was omitted from the secondary, and the capacitor became 0.00026 μF. In some cases, depending on the type of pick-up used, this becomes 0.00063 μF or 0.00068 μF.

R15 is fed via **R7,** which becomes 6,800 Ω. **R8** becomes 8,200 Ω and is fed from the junction of **R7, R15** and **C15,** via a section of the radiogram change-over switch to mute radio. **C23** becomes 0.01 μF. In some models, a 10in permanent magnet speaker was used, when **L18** was restored, and the tone control may be like that in the U102 or the U102A. The mains switches **S17, S18** are in a toggle unit operated by a trip lever on the volume control **R13** spindle, and the heater circuit is like that in the U102.



The low impedance pick-up matching circuit employed in the radiogram versions A102R and U102R.

U102R.—This is like the A102R, but it is equipped with a Garrard U5A motor and may thus be used on A.C. or D.C. mains. It should be noted that the motor requires adjusting quite apart from the receiver when the mains are changed, and that this setting is different for A.C. and D.C. mains of the same voltage.

CIRCUIT ALIGNMENT

These operations must be carried out with the chassis on the bench, and before access can be gained to some of the adjustments the glass scale must be removed by pressing the top edge of the curved backing plate toward the chassis with one hand and lifting out the scale with the other hand. A non-metallic screwdriver must be used when adjusting the U102A I.F. transformer dust-cores, and a 7BA box spanner or a non-metallic screwdriver (depending on the type of core stem fitted) when adjusting the R.F. and oscillator cores, and the TU102A I.F. cores.

I.F. Stages.—Connect signal generator, via an 0.1μF capacitor in the "live" lead, to control grid (top cap) of **V2** and the **E** socket, switch set to M.W., turn the volume control and gang to maximum and fully unscrew **L15** and **L16** cores (location references G7, D3). Feed in a 465 kc/s (645.16m) signal, and adjust the cores of **L15** and **L16** for maximum output.

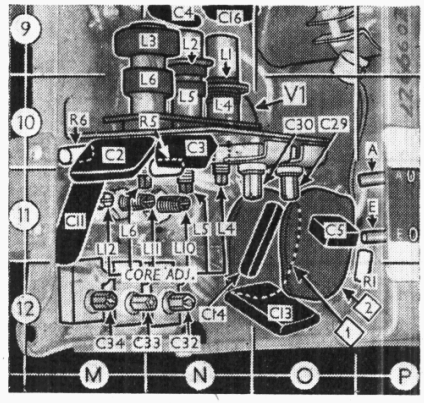
Transfer "live" signal generator lead to control grid (top cap) of **V1,** fully unscrew the cores of **L13, L14** (J7, B3), feed in a 465 kc/s signal, and adjust the cores, in the order described, for maximum output. Finally, disconnect "live" signal generator lead and replace tuning scale in its spring clip.

R.F. and Oscillator Stages.—The top and bottom edges of the glass scale are marked with four short vertical lines, and the left-hand one should coincide with the left-hand edge of the scale backing plate. With the gang at maximum the cursor should be horizontal and coincident with the low wavelength ends of the three scales. It may be adjusted in position by rotating the drive drum on the gang spindle after slackening its grub screw. Connect "live" signal generator lead to **A** socket, via a suitable dummy aerial.

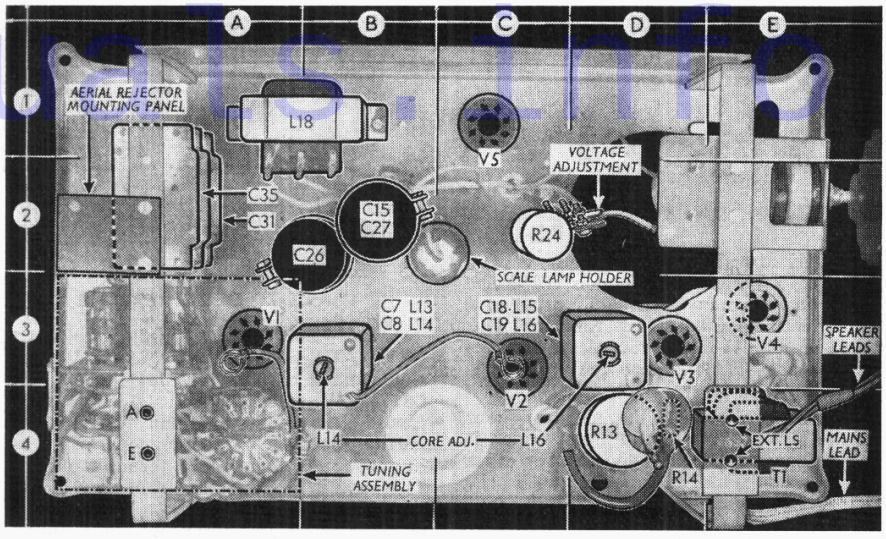
S.W.—Switch set to S.W., tune to 42m on scale, feed in a 42m (7.14 Mc/s) signal, and adjust the cores of **L10** and **L4** (N11) for maximum output. Tune to 19.7m on scale, feed in a 19.7m (15.25 Mc/s) signal, and adjust **C32** and **C29** (N12, O11) for maximum output. Repeat these operations until no improvement results.

M.W.—Switch set to M.W., tune to 500m on scale, feed in a 500m (600 kc/s) signal, and adjust the cores of **L11** and **L5** (M11, N11) for maximum output. Tune to 220m on scale, feed in a 220m (1,363 kc/s) signal, and adjust **C33** and **C30** (M12, O11) for maximum output. Repeat these operations until no improvement results.

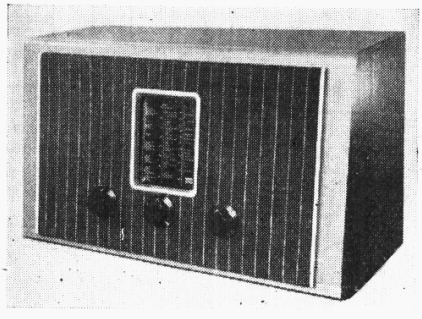
L.W.—Switch set to L.W., tune to 1,900m on scale, feed in a 1,900m. (158 kc/s) signal, and adjust the cores of **L12** and **L6** (M11) for maximum output. Tune to 1,000m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C34** (M12) for maximum output. Repeat these operations until no improvement results.



Three-quarter view of the rear lower left-hand corner of the chassis, showing the positions of all components in the tuning assembly and indicating the R.F. and oscillator trimmer and core adjustments involved in circuit alignment.



Rear view of the chassis, showing the positions of all components except those in the tuning assembly, which is the subject of a detailed view at the foot of column 4. The paxolin panel above this assembly is removed when an aerial filter is fitted. The scale lamp holder is a push-fit in a large rubber grommet on the chassis deck.



The alternative wooden cabinet version of the U102 receiver.

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