

# G.E.C. UNIVERSAL SW4

## 3-BAND A.C./D.C. SUPERHET

**T**HE G.E.C. Universal SW4 (BC3745) is a 4-valve (plus rectifier) A.C./D.C. 3-band superhet suitable for mains of 200-250 V (25-100 c.p.s. in the case of A.C.) and has a short-wave range covering 15.8-50 metres. Provision is made for an extension speaker, and a barretter is fitted so that no adjustment need be made for mains of different voltages.

**CIRCUIT DESCRIPTION**

Aerial input on M.W. and L.W. via series condenser **C1** and coupling coil **L1** to inductively coupled band-pass filters. Primaries **L2** (M.W.) and **L3** (L.W.) are tuned by **C31**; secondaries **L7** (M.W.) and **L8** (L.W.) are tuned by **C35**. On S.W. band aerial input is via **C1** and coupling coil **L4** to single tuned circuit comprising coil **L5** and condenser **C36**.

First valve (**V1**, Osram metallised **X31**) is a triode-hexode operating as frequency changer with internal coupling. Oscillator anode coils **L10** (S.W.), **L13** (M.W.) and **L14** (L.W.) are tuned by **C41**; parallel trimming by **C36** (S.W.), **C37** (M.W.), and **C39** (L.W.); tracking by series condensers **C8** (S.W.), **C9**, **C38** (M.W.) and **C10**, **C40** (L.W.); oscillator grid circuit reaction coils **L9** (S.W.), **L11**, **L12** (M.W. and L.W.).

Second valve, a variable-mu H.F. pentode (**V2**, Osram metallised **W31**), operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C42**,

**L15**, **L16**, **C43** and **C44**, **L17**, **L18**, **C45**. Intermediate frequency, 125 KC/S.

Diode second detector is part of separate double diode valve (**V3**, Osram metallised **D41**). Audio-frequency component in rectified output is developed across load resistance **R13** and passed via coupling condenser **C16**, manual volume control **R19**, and I.F. stopper **R20** to C.G. of pentode output valve (**V4**, Osram **N31**). Fixed tone correction in anode circuit by condenser **C23**; variable tone control by R.C. filter **R24**, **C25**. Provision for connection of external low impedance speaker across secondary of output transformer **T1**.

Second diode of **V3**, fed from **V2** anode via **C18**, provides D.C. potentials which are developed across load resistances **R17**, **R18** and fed back as G.B. to F.C. (M.W. and L.W. only) and I.F. valves, giving automatic volume control. Delay voltage is obtained from H.T. potential divider **R15**, **R16**.

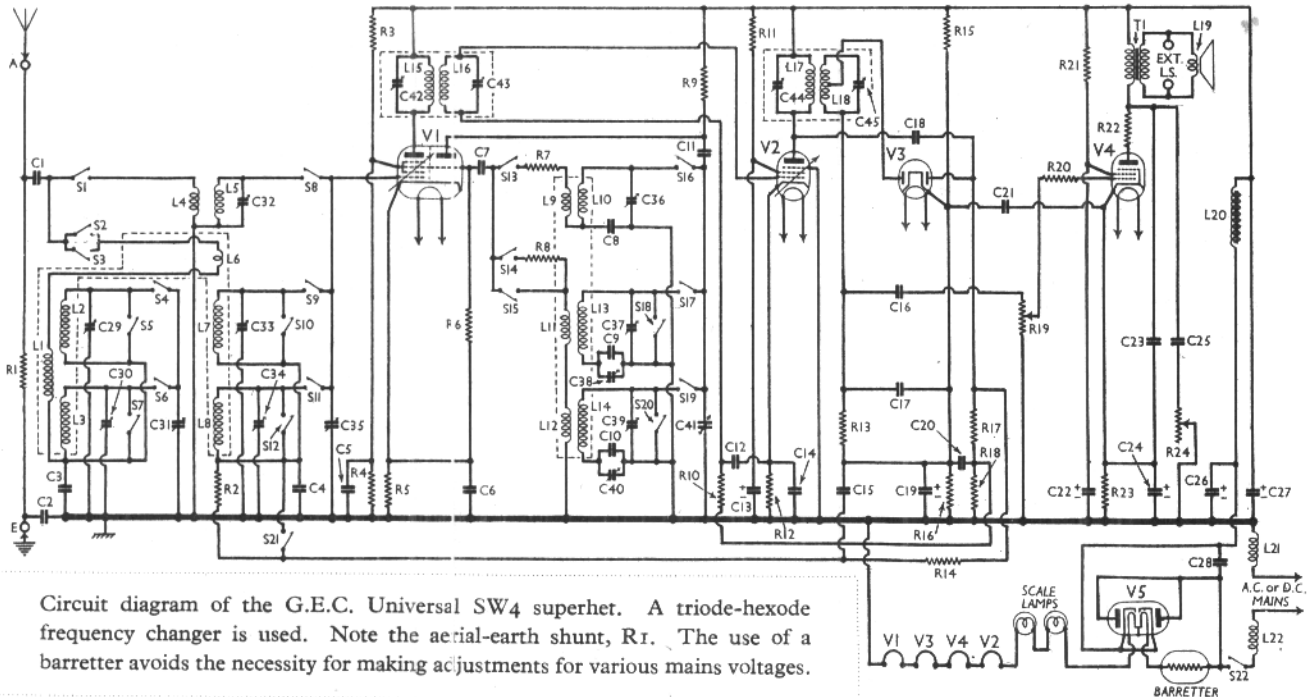
When the receiver is used with A.C. mains, H.T. current is supplied by a half-wave rectifying valve (**V5**, Osram **U30**) which, with D.C. supplies, behaves as a low resistance. Smoothing by iron-cored choke **L20** and dry electrolytic condensers **C26**, **C27**.

Valve heaters are connected in series together with scale lamps and current regulating barretter (Osram 304) across mains input circuit. Chokes **L21** and **L22** form a filter for the suppression of mains borne interference.

**COMPONENTS AND VALUES**

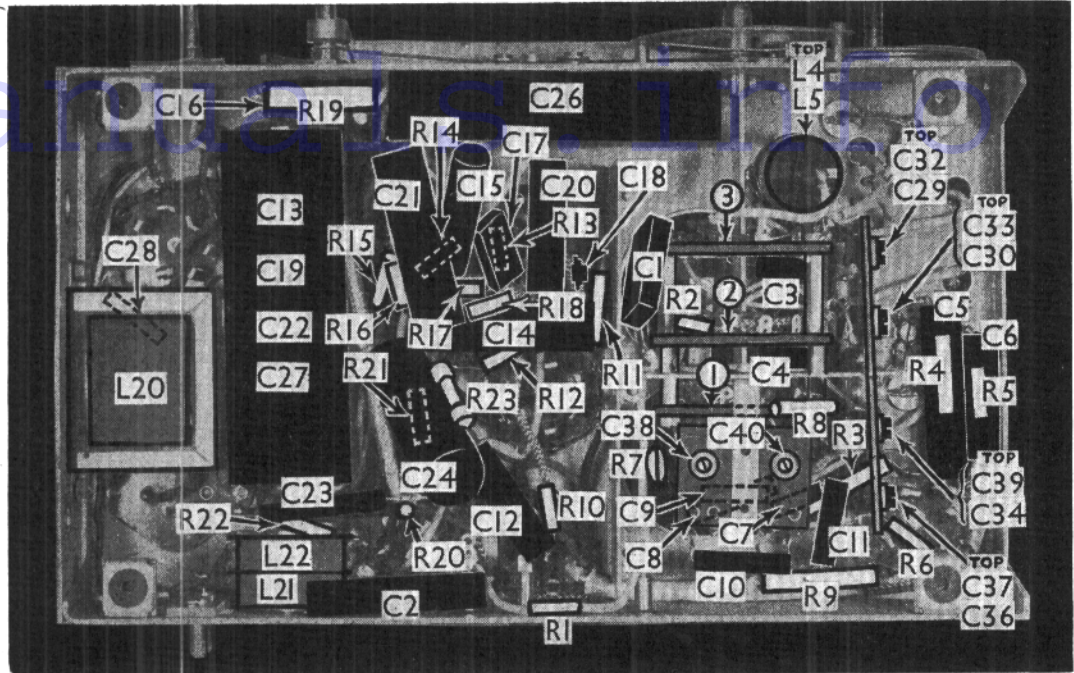
RESISTANCES		Values (ohms)
R1	Aerial-earth shunt	9,900
R2	V1 hexode C.G. decoupling	220,000
R3	V1 hexode S.G. H.T. potential divider	22,000
R4	V1 hexode S.G. H.T. potential divider	22,000
R5	V1 fixed G.B. resistance	220
R6	V1 osc. C.G. resistance	55,000
R7	V1 osc. C.G. stabiliser (S.W.)	29
R8	V1 osc. C.G. stabiliser (M.W.)	1,500
R9	V1 osc. anode resistance	33,000
R10	V2 C.G. decoupling	440,000
R11	V2 S.G. H.T. feed	22,000
R12	V2 fixed G.B. resistance	150
R13	V3 signal diode load	440,000
R14	V1 A.V.C. line decoupling	440,000
R15	A.V.C. delay voltage potential divider	99,000
R16	V3 A.V.C. diode load	6,600
R17	V3 A.V.C. diode load	660,000
R18	V3 A.V.C. diode load	220,000
R19	Manual volume control	400,000
R20	V4 C.G. I.F. stopper	55,000
R21	V4 aux. G. H.T. feed	3,300
R22	V4 anode circuit stabiliser	99
R23	V4 G.B. resistance	99
R24	Variable tone control	55,000

CONDENSERS		Values (μF)
C1	Aerial coupling condenser	0.001
C2	Earth blocking condenser	0.05
C3	Part of image suppressor	0.0026
C4	V1 hexode C.G. decoupling	0.0028
C5	V1 hexode S.G. by-pass	0.1
C6	V1 cathode by-pass	0.005
C7	V1 osc. C.G. condenser	0.0001
C8	Oscillator S.W. tracker	0.005
C9	Oscillator M.W. tracker	0.0008



Circuit diagram of the G.E.C. Universal SW4 superhet. A triode-hexode frequency changer is used. Note the aerial-earth shunt, R1. The use of a barretter avoids the necessity for making adjustments for various mains voltages.

Under-chassis view. The three switch units are indicated by numbers in circles and arrows showing the directions in which they are viewed in the diagrams on page VIII. Most of the trimmers are numbered in pairs, from top to bottom. C16 is beneath R10



CONDENSERS (Continued)		Values (μF)
C10	Oscillator L.W. tracker ..	0.0003
C11	Oscillator anode condenser ..	0.001
C12	V2 C.G. decoupling ..	0.05
C13*	V2 S.G. by-pass ..	3.0
C14	V2 cathode by-pass ..	0.25
C15	V1 A.V.C. line decoupling ..	0.25
C16	L.F. coupling to V4 ..	0.02
C17	I.F. by-pass ..	0.0003
C18	Coupling to V3 A.V.C. diode..	0.00001†
C19*	V3 cathode by-pass ..	3.0
C20	V2 A.V.C. line decoupling ..	0.05
C21	V3 to V4 cathodes by-pass ..	0.25
C22*	V4 aux. G. by-pass ..	2.0
C23	Fixed tone corrector ..	0.002
C24*	V4 cathode by-pass ..	35.0
C25	Part of T.C. filter ..	0.02
C26*	H.T. smoothing ..	8.0
C27*	H.T. smoothing ..	24.0
C28	V5 anode-cathode by-pass ..	0.01
C29†	Band-pass M.W. pri. trimmer ..	—
C30†	Band-pass L.W. pri. trimmer ..	—
C31†	Band-pass pri. tuning ..	—
C32†	Aerial circuit S.W. trimmer ..	—
C33†	Band-pass M.W. sec. trimmer ..	—
C34†	Band-pass L.W. sec. trimmer ..	—
C35†	Band-pass sec. tuning ..	—
C36†	Osc. S.W. trimmer ..	—
C37†	Osc. M.W. trimmer ..	—
C38†	Osc. M.W. tracker ..	—
C39†	Osc. L.W. trimmer ..	—
C40†	Osc. L.W. tracker ..	—
C41†	Osc. tuning ..	—
C42†	1st I.F. trans. pri. tuning ..	—
C43†	1st I.F. trans. sec. tuning ..	—
C44†	2nd I.F. trans. pri. tuning ..	—
C45†	2nd I.F. trans. sec. tuning ..	—

\* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS (Continued)		Approx. Values (ohms)
L17	2nd I.F. trans. { Pri. ..	82.0
L18	{ Sec. ..	82.0
L19	Speaker speech coil ..	1.9
L20	H.T. smoothing choke ..	380.0
L21	Mains circuit filter chokes {	3.0
L22	{	3.0
Tr	Output trans. { Pri. ..	400.0
	{ Sec. ..	0.8
S1-21	Waveband and muting switches	—
S22	Mains switch, ganged R24 ..	—

**DISMANTLING THE SET**

**Removing Chassis.**—To remove the chassis from the cabinet, first remove the four control knobs (pull off). Next remove the two wood strips from the bottom of the cabinet (four countersunk-head wood screws) and the four bolts (with washers) thus exposed. Now remove the wood strip across the back of the cabinet (two countersunk-head wood screws), when the chassis can be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

**Removing Speaker.**—If it is desired to remove the speaker from the cabinet, remove the nuts, spring washers, washers and presspahn washers from the four bolts holding it to the sub-baffle. Alternatively, the speaker and sub-baffle may be removed together by removing the four bolts (with spring washers and washers) holding the sub-baffle to the cabinet front.

When replacing the speaker, see that the terminal strip is at the bottom.

**VALVE ANALYSIS**

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on A.C. mains of 215 V. 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, with chassis as negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 X31*	200	2.4	65	3.5
V2 W3†	200	6.1	90	5.6
V3 D4†	—	—	—	—
V4 N3†	185	30.0	175	7.4
V5 U3†	—	—	—	—

\* Oscillator anode, 85V, 3.2 mA.  
† Cathode to chassis, 230 V D.C.

**GENERAL NOTES**

**Switches.**—S1-S21 are the wavechange switches in three rotary units beneath the chassis, indicated by numbers in circles in our under-chassis view. The arrows show the directions in which the units are viewed in the diagrams on p. VIII. Note the contacts riveted to the rotors in each unit, which, with certain fixed contacts, form extra switches.

The table below gives the switch positions for the various control settings, as the knob is rotated clockwise from fully anti-clockwise. O indicates open, and C closed.

Switch	L.W.	M.W.	S.W.
S1	O	O	C
S2	O	C	O
S3	C	O	O
S4	O	C	O
S5	O	O	C
S6	C	O	O
S7	O	C	C
S8	O	O	C
S9	O	C	O
S10	O	O	C
S11	C	O	O
S12	O	C	C
S13	O	O	C
S14	O	C	O
S15	C	O	O
S16	O	O	C
S17	O	C	O
S18	O	O	C
S19	C	O	O
S20	O	C	C
S21	O	O	C

Continued overleaf

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial coupling, M.W. and L.W.	0.3
L2	Band-pass M.W. primary ..	3.55
L3	Band-pass L.W. primary ..	19.6
L4	Aerial coupling, S.W. ..	1.12
L5	Aerial circuit tuning, S.W. ..	0.01
L6	Image suppression coil ..	Very low
L7	Band-pass M.W. secondary ..	3.55
L8	Band-pass L.W. secondary ..	19.6
L9	Osc. S.W. grid coil ..	0.45
L10	Osc. S.W. anode coil ..	0.01
L11	Osc. M.W. and L.W. grid coils,	
L12	total ..	3.0
L13	Osc. M.W. anode coil ..	3.25
L14	Osc. L.W. anode coil ..	11.5
L15	1st I.F. trans. { Pri. ..	82.0
L16	{ Sec. ..	82.0

G.E.C. UNIVERSAL SW4—Continued

**S22** is the Q.M.B. mains switch, ganged with the tone control, **R24**.

**Coils.**—**L1-L3, L6-L8** and **L9-L14** are in two screened units on the chassis deck, while **L4, L5** are on a tubular former beneath the chassis. The I.F. transformers, **L15, L16** and **L17, L18** are in two further screened units on the chassis deck, with their associated trimmers. **L21** and **L22** are two chokes mounted side by side beneath the chassis.

**Scale Lamps.**—These are two Osram M.E.S. types, rated at 6.5 V, 0.3 A.

**External Speaker.**—Sockets are provided at the rear of the chassis for a low impedance (2 to 4Ω) external speaker.

**H.F. and Osc. Trimmers.**—There are eight of these, mounted on vertical paxolin panels to the right of the switch units as shown in our under-chassis view. They are identified in pairs, from top to bottom.

**Osc. Trackers.**—The two pre-set trackers, **C38**, and **C40**, are on a separate horizontal panel beneath the chassis.

**Condensers C13, C19, C22, C27.**—These are four dry electrolytics in a single carton beneath the chassis, with a common negative (black) lead. The green lead is the positive of **C22** (2μF), the yellow lead to the screen of **V2** the positive of **C13** (3μF), the yellow lead to the cathode of **V3** the positive of **C19** (3μF) and the red lead the positive of **C27** (24μF).

**C26** (8μF) is in a separate unit behind the front of the chassis.

CIRCUIT ALIGNMENT

**I.F. Stages.**—Connect signal generator to grid (top cap) of **V1** and **E**. Switch set to M.W. and turn gang to maximum. Feed in a 125 KC/S signal, and adjust

**C45, C44, C43** and **C42** for maximum output, keeping input low.

**H.F. and Oscillator Stages.**—Connect signal generator to A and E sockets via a dummy aerial. Switch set to M.W. and tune to 214 m. on the scale. Feed in a 214 m. signal, and adjust **C37** for maximum output. If two peaks are obtained, that produced with **C37** nearer its minimum position will probably be the correct one. Next adjust **C33** and **C29** for maximum output.

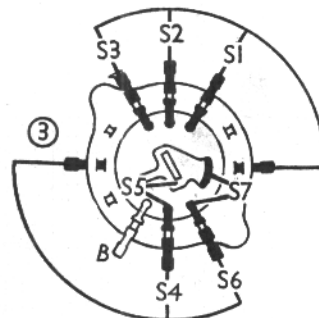
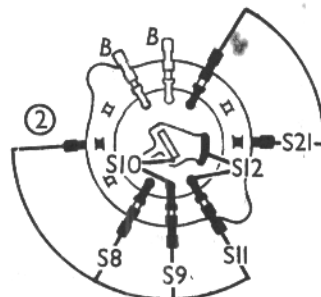
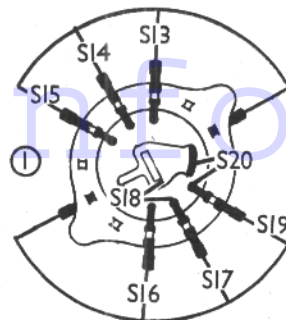
Feed in a 500 m. signal, tune it in, and adjust **C38** for maximum output, rocking the gang condenser at the same time to obtain optimum results.

Switch set to L.W., and tune to 1,000 m. on scale. Feed in a 1,000 m. signal, and adjust **C39**, then **C34** and **C30** for maximum output. It will be found that there is no confusion about the adjustment of **C39**, since there will be only one peak.

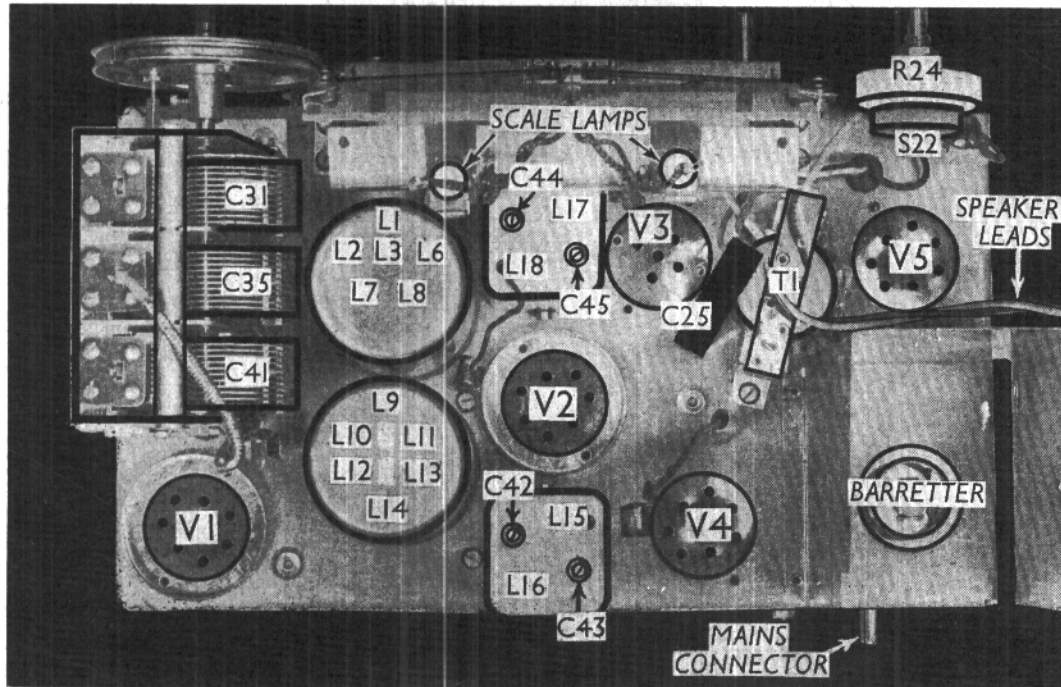
Feed in an 1,818 m. (165 KC/S) signal, tune it in, then adjust **C40** for maximum output, rocking the gang meanwhile for optimum results.

On the S.W. range, there are adjustable aerial and oscillator trimmers, but a fixed oscillator padder is used. Hence adjustments are carried out near the lower wavelength (higher frequency) end of the range only.

Switch set to S.W., tune to 18 MC/S on scale, feed in an 18 MC/S signal, and adjust **C36** and **C32** for maximum output. If **C36** gives two peaks, the correct one must be chosen. To check whether this has been done, after adjusting **C36** and **C32**, increase the generator output considerably and rotate the gang slowly towards maximum capacity. At a position equal to the original ganging frequency minus twice the intermediate frequency (18.0.25, or 17.75 MC/S) another signal will be indicated on the output meter. This shows that **C36** is correctly adjusted.



Switch diagrams, looking from the underside of the chassis in the directions indicated by the arrows on page VII.



Plan view of the chassis. All the coils, with the exception of **L4** and **L5** are in the four screened units shown. The trimmers for the gang condenser are beneath the chassis.