'TRADER' SERVICE SHEET 194

ULTRA 48

3-BAND A.C. SUPERHET

A SIGNAL frequency amplifier is incorporated in the Ultra 48 4-valve (plus rectifier) A.C. 3-band superhet, which has a short-wave range of 16.8-50 metres. Provision is made for an extension speaker, and there is also a sensitivity switch.

CIRCUIT DESCRIPTION

Aerial input via S.W. tapping and M.W. and L.W. coupling coils **L1, L2** to single tuned circuits **L3, C26** (S.W.), **L3, L4, C26** (M.W.), and **L3, L4, L5, C26** (L.W.).

First valve (**V1, Mazda metallised AC/VP1**) is a variable-mu R.F. pentode operating as signal-frequency amplifier with tuned-anode coupling by **L6, C30** (S.W.), **L6, L7, C30** (M.W.), and **L6, L7, L8, C30** (L.W.) to triode-hexode frequency changer valve (**V2, Mazda metallised AC/TH1**). Triode oscillator anode coils **L10** (S.W.), **L12** (M.W.), and **L14** (L.W.) are tuned by **C36**; parallel trimming by **C31** (S.W.), **C32** (M.W.) and **C13, C34** (L.W.); series tracking by **C12** (S.W.), **C33** (M.W.) and **C35** (L.W.); oscillator grid reaction coils **L9** (S.W.), **L11** (M.W.), **L13** (L.W.).

Sensitivity control on M.W. and L.W. by switch **S18** which shunts **V1** and **V2** common G.B. resistance **R5** with additional resistance **R3**, thus reducing fixed bias applied.

Single variable-mu R.F. pentode intermediate frequency amplifier (**V3, Mazda metallised AC/VP1**) operates with tuned-primary tuned-secondary transformer couplings **C37, L15, L16, C38** and **C39, L17, L18, C40.**

Intermediate frequency 456 KC/S.

Diode second detector is part of double diode output pentode valve (**V4, Mazda AC2/PenDD**). Audio-frequency component in rectified output is developed across **R17** and passed via **C16,** manual volume control **R16** and I.F. stopper **R18** to C.G. of pentode section. Fixed tone correction by anode condenser **C20.** Provision for connection of external low-impedance speaker across secondary of **T1.** Plug and socket arrangement enables internal speaker speech coil circuit to be broken.

Second diode of **V4,** fed from **V3** anode via **C19** provides D.C. potentials which are developed across **R22** and **R23** and fed back through decoupling circuits as G.B. to R.F., F.C., and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along **V4** cathode resistances **R19, R20.**

H.T. current is supplied by I.H.C. full-wave rectifying valve (**V5, Mazda UU3**). Smoothing by speaker field coil **L21** and electrolytic condensers **C21, C22.**

DISMANTLING THE SET

Removing Chassis.—If it is necessary to remove the chassis from the cabinet, remove the four control knobs (recessed grub screws) and the four bolts (with washers) holding the chassis to the bottom of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

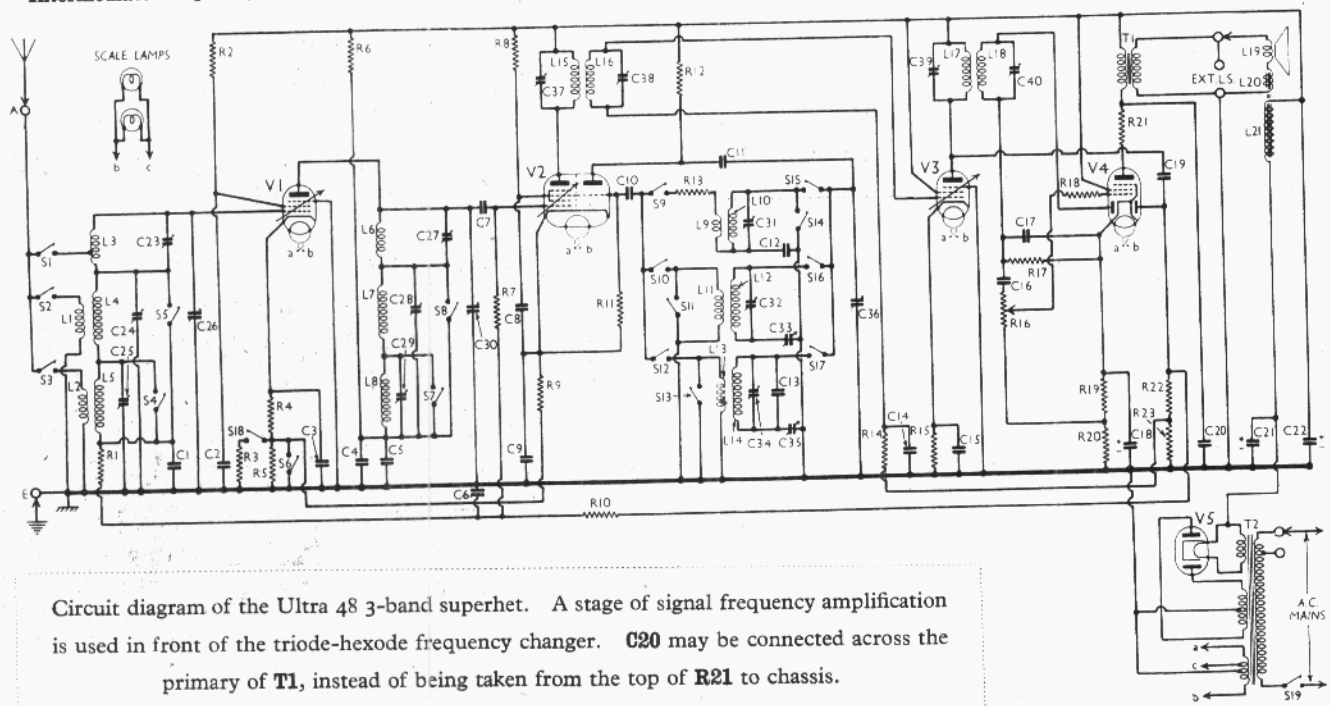
When replacing, do not forget to replace the washers on the spindles of the wave-change switch and volume control before inserting the chassis in the cabinet.

To free the chassis entirely, unsolder the leads from the speaker and *when replacing,* connect them as follows, numbering the tags from bottom to top :—1, black ; 2, blank ; 3, green ; 4, yellow ; 5, red.

Removing Speaker.—To remove the speaker from the cabinet, remove one of the clamps holding it to the sub-baffle (nut and spring washer) and slacken the other two. *When replacing,* see that the transformer is pointing to the bottom right-hand corner of the cabinet (when looking from the back).

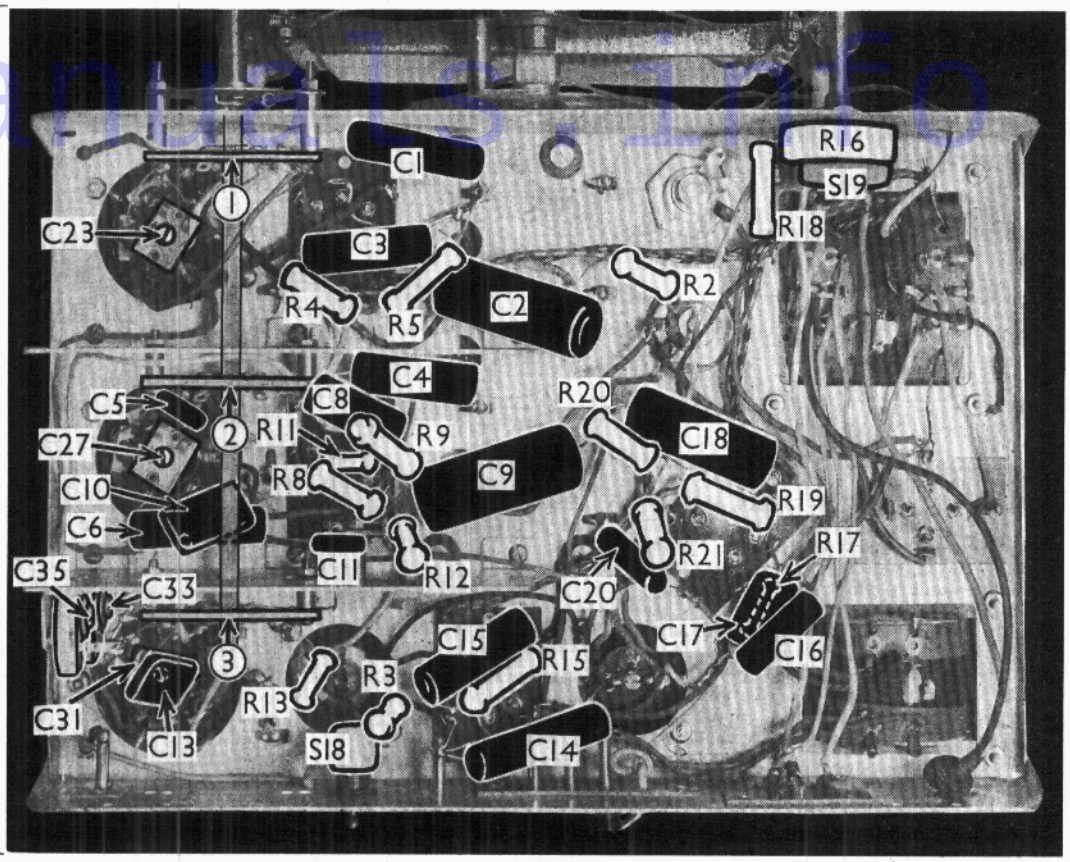
COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 C.G. decoupling	1,000,000
R2	V1 S.G. H.T. feed	30,000
R3	Sensitivity control circuit	2,000
R4	V1 fixed G.B. resistance	138
R5	V1 and V2 fixed G.B. resistance	1,000
R6	V1 anode decoupling	4,000
R7	V2 hexode C.G. resistance	1,000,000
R8	V2 hexode S.G.'s H.T. feed	30,000
R9	V2 fixed G.B. resistance	200
R10	V1 and V2 A.V.C. line decoupling	1,000,000
R11	V2 osc. C.G. resistance	25,000
R12	V2 osc. anode resistance	40,000
R13	V2 osc. C.G. S.W. stabiliser	60
R14	V3 C.G. decoupling	1,000,000
R15	V3 fixed G.B. resistance	30
R16	Manual volume control	1,000,000
R17	V4 signal diode load	500,000
R18	V4 pentode C.G. I.F. stopper	1,000
R19	V4 G.B. and A.V.C. delay voltage resistances.	138
R20		138
R21	V4 pentode anode stabiliser	60
R22	V4 A.V.C. diode load	250,000
R23		750,000



Circuit diagram of the Ultra 48 3-band superhet. A stage of signal frequency amplification is used in front of the triode-hexode frequency changer. **C20** may be connected across the primary of **T1,** instead of being taken from the top of **R21** to chassis.

Under-chassis view. Note the S.W. trimmers **C23**, **C27** and **C31** which are adjustable from beneath the chassis. **C33** and **C35** are reached from the side. The three switch units are shown in detail on page VIII. **S18** is the sensitivity switch, operated by the knob at the rear of the chassis.



CONDENSERS		Values (μF)
C1	V1 C.G. decoupling	0·05
C2	V1 S.G. by-pass	0·5
C3	V1 cathode by-pass	0·1
C4	V1 anode decoupling	0·1
C5	V1 anode decoupling	0·01
C6	V1 and V2 A.V.C. line decoupling	0·05
C7	V2 hexode C.G. condenser	0·0001
C8	V2 hexode S.G.'s by-pass	0·1
C9	V2 cathode by-pass	0·5
C10	V2 osc. C.G. condenser	0·0001
C11	V2 osc. anode condenser	0·0001
C12	Osc. S.W. tracker	0·004
C13	Osc. L.W. trimmer	0·0001
C14	V3 C.G. decoupling	0·05
C15	V3 cathode by-pass	0·1
C16	A.F. coupling to V4 pentode	0·01
C17	I.F. by-pass	0·0002
C18*	V4 cathode by-pass	50·0
C19	V4 A.V.C. diode feed	0·0002
C20	Tone corrector	0·01
C21*	H.T. smoothing	8·0
C22*	H.T. smoothing	32·0
C23‡	Aerial S.W. trimmer	—
C24‡	Aerial M.W. trimmer	—
C25‡	Aerial L.W. trimmer	—
C26†	Aerial circuit tuning	—
C27‡	V1 anode S.W. trimmer	—
C28‡	V1 anode M.W. trimmer	—
C29‡	V1 anode L.W. trimmer	—
C30†	V1 anode circuit tuning	—
C31‡	Osc. S.W. trimmer	—
C32‡	Osc. M.W. trimmer	—
C33‡	Osc. M.W. tracker	0·0006
C34‡	Osc. L.W. trimmer	—
C35‡	Osc. L.W. tracker	0·0003
C36†	Osc. circuit tuning	—
C37‡	1st I.F. trans. pri. tuning	—
C38‡	1st I.F. trans. sec. tuning	—
C39‡	2nd I.F. trans. pri. tuning	—
C40‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial M.W. coupling coil	2·0
L2	Aerial L.W. coupling coil	80·0
L3	Aerial S.W. tuning coil	0·1
L4	Aerial M.W. and L.W. coils	4·1
L5	Aerial M.W. and L.W. coils	11·8
L6	V1 anode circuit tuning coils	0·1
L7	V1 anode circuit tuning coils	4·1
L8	V1 anode circuit tuning coils	11·8
L9	Osc. S.W. grid coil	12·0
L10	Osc. anode S.W. tuning coil	0·1
L11	Osc. M.W. grid coil	1·0
L12	Osc. anode M.W. tuning coil	3·7
L13	Osc. L.W. grid coil	1·0
L14	Osc. anode L.W. tuning coil	11·0
L15	1st I.F. trans. Primary	4·2
L16	1st I.F. trans. Secondary	4·2
L17	2nd I.F. trans. Primary	4·2
L18	2nd I.F. trans. Secondary	4·2
L19	Speaker speech coil	2·0
L20	Hum neutralising coil	0·1
L21	Speaker field coil	930·0
T1	Output trans. Pri.	325·0
T1	Output trans. Sec.	0·18
T2	Mains trans. Pri. total	23·0
T2	Mains trans. Heater sec.	0·1
T2	Mains trans. Rec. heat. sec.	0·14
T2	Mains trans. H.T. sec. total	492·0
S1-17	Waveband switches	—
S18	Sensitivity switch	—
S19	Mains circuit switch, ganged R16	—

VALVE ANALYSIS

Valve voltages and currents given in the table (col. 3) are those measured in our receiver when it was operating on mains of 220 V, using the 200-220 V tapping on the mains transformer. The set was tuned to the lowest wavelength on the medium band and both the volume and sensitivity controls were at maximum (the latter down) but there was no signal input.

Voltages were measured on the 1,200 V scale of an Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 AC/VP1	265	3·6	235	0·8
V2 AC/TH1*	285	2·5	180	2·8
V3 AC/VP1	285	23·0	285	6·3
V4 AC/2Pen/DD	270	36·0	285	7·5
V5 UU3	345†	—	—	—

* Oscillator anode, 100 V, 3·6 mA.
† Each anode, A.C.

GENERAL NOTES

Switches.—**S1-S17** are the wavechange switches, ganged in three rotary units beneath the chassis, and indicated in our under-chassis view. The arrows show the directions in which the units are seen in the diagrams on page VIII. Note that some of the tags are blank, and there is a fourth setting of the control knob. The table (page VIII), gives the switch positions for the three control settings, starting from fully anti-clockwise. O indicates open, and C, closed.

S18 is the Q.M.B. sensitivity switch, which closes when the knob is depressed.

S19 is the Q.M.B. mains switch, ganged with the volume control **R16**.

Continued overleaf

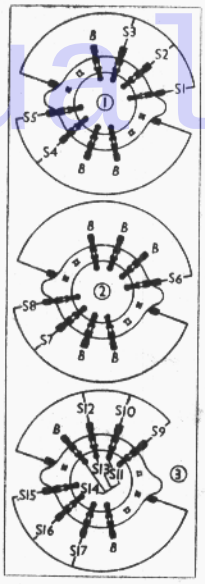
ULTRA 48—*Continued*

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

Coils.—**L1-L5, L6-L8, L9-L14** and the I.F. transformers **L15, L16** and **L17, L18** are in five screened units on the chassis deck. The trimmers in the first three units are reached through holes near the bottom of the cans. Their positions are roughly indicated by arrows in the plan chassis view. The I.F. trimmers are at the tops of their respective cans. Most of the units also contain one or more condensers and resistances, which may be identified by their marked values or colour coding.

Scale Lamps.—These are two Osram 4·5 V 0·3 A M.E.S. types, wired in parallel and run from a tapping on the **T2** heater secondary.

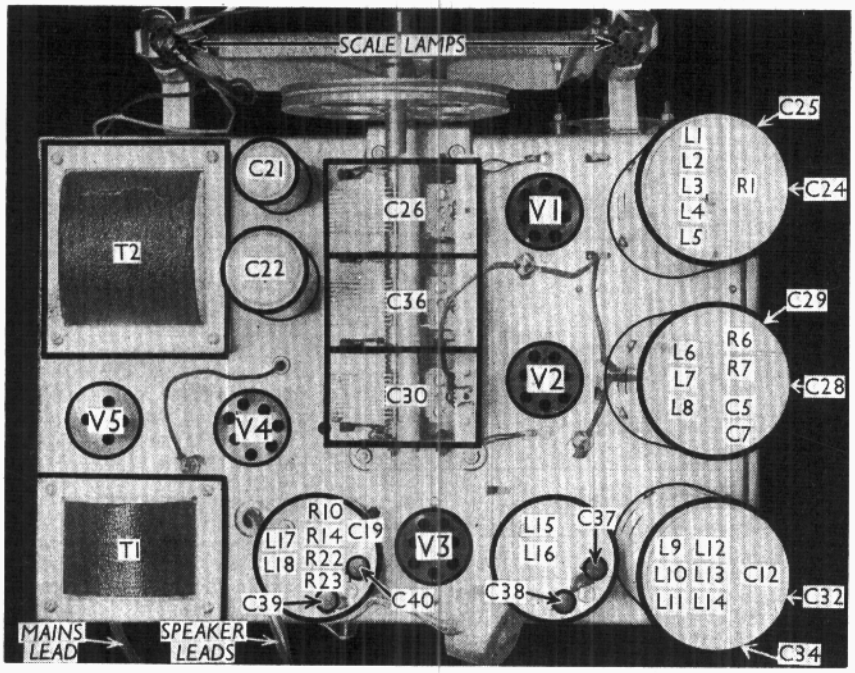
External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2—4 O) external speaker, such as the Ultra 30 (chassis model) or 45 (cabinet model). The internal speaker can be cut out, if desired, by the plug and socket to the left of the external speaker sockets.



The three switch units, seen from the underside of the chassis, looking in the direction of the arrows in the under-chassis view. **S11, S13** and **S14** are formed by a shorting plate fitted to the rotor of the third unit. The fourth (fully clockwise) position of the control knob is not used.

Trimmers.—**C23, C27** and **C31** are adjusted from beneath the chassis. **C33** and **C35** can be reached from the left side of the chassis. All the other trimmers are inside their respective coil cans, and are adjustable through holes provided in them.

Condenser C20.—In our model this is connected from the top of **R21** to chassis, but in later chassis it is taken from the top of **R21** to the H.T. positive line. This modification should be carried out on chassis received for service. Merely disconnect one end of **C20** from chassis, and connect it to the screening grid tag of **V4** holder.



Plan view of the chassis. Most of the coil units contain additional condensers or resistances. The positions of the trimmers of the right-hand units are indicated by arrows.

Anti-Static Aerials.—It is pointed out that when an anti-interference aerial with low impedance coupling is used, it is necessary to connect a 0·01 μF condenser in series with the aerial lead and the aerial socket of the set in order to avoid short-circuiting the A.V.C. on the S.W. band.

CIRCUIT ALIGNMENT

With the gang condenser at maximum, pointer should coincide with top left-hand white line of scale.

I.F. Stages.—Turn gang condenser to maximum. Connect a signal generator to **A** and **E** sockets, and an output meter to the external L.S. sockets, and feed in a 456 KC/S signal. Adjust **C39, C40, C38, C37** in that order for maximum output, reducing input progressively as the circuits come into line.

R.F. and Oscillator Circuits.—M.W.—Feed in a 200 m. signal, tune to 200 m. on the scale, and adjust **C32** for maximum output, then **C28.** Feed in a 270 m. signal, tune to 270 m. on scale, and adjust **C24** for maximum output. Feed in a 500 m. signal, tune to 500 m. on scale and adjust **C33** for maximum output, rocking the gang meanwhile for optimum results. Calibration should be accurate to plus or minus 7 metres.

L.W.—Feed in a 1,000 m. signal, tune to 950 m. on scale, and adjust **C34** for maximum output. Then adjust **C29** and **C25.** Feed in a 1,700 m. signal, tune to 1,700 m. on scale, and adjust **C35** for maximum output, rocking the gang meanwhile for optimum results.

S.W.—Feed in a 17·1 m. (17·55 MC/S) signal, and tune to 17·1 m. on scale. Screw up **C31** fully, then unscrew it slowly until the second peak (least capacity) is reached. Adjust accurately on this peak. Then adjust **C23** and **C27** for maximum output. Fixed tracking is employed on this band. Check calibration against actual stations.

R.M.S. MEMBERSHIP NOW 2,600

THE February, 1937, issue of the *Philco Serviceman* is the second birthday number, R.M.S. having been formed in February, 1935. In the first year 530 members were obtained, while in 1936-7 the membership jumped to 2,490. Already this figure has been increased to nearly 2,600.

These figures must be particularly gratifying to the originators of the R.M.S. scheme, particularly in view of the fact that only those who have certain service qualifications, and possess suitable equipment, are accepted for membership.

It is emphasised that, although R.M.S. is run from Philco headquarters at Perivale, membership is not restricted to Philco dealers, but is open to non-Philco dealers and independent service engineers, and we know from the literature which is sent out regularly that much useful general information, besides the Philco service material, is available to members.

Printed in Great Britain as a supplement to *The Wireless Trader* for the proprietors and publishers, *The Trader Publishing Co., Ltd.*, Dorset House, Stamford Street, London, S.E.1, by Sanders Phillips & Co., Ltd., The Baynard Press, Chryssell Road, London, S.W.9. Every Saturday.