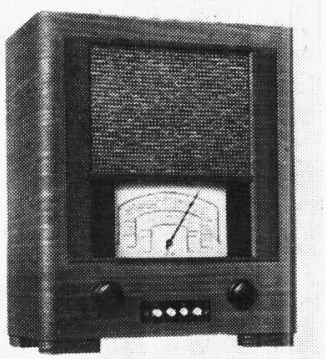
Supplement to The Wireless & Electrical Trader, April 27, 1940

"TRADER" SERVICE SHEET 462

ULTRA 301 (TABLE)

303 (CONSOLE), 305 (RADIOGRAM)



The Ultra 301 table model

THE Ultra 301 is a 3-valve (plus valve rectifier) 3-band AC superhet. The SW range is 16·5 to 50m, and the set is suitable for 200-260V, 40-100 C/S AC mains. Four press-buttons are provided for wavechange and gram switching.

Model 303 is the corresponding console receiver, and model 305 the radiogram, all models having identical chassis.

Release date: all models, Jan. 1939.

CIRCUIT DESCRIPTION

Two alternative aerial sockets are provided, **A1** and **A2**. Input from **A2** is fed via series condenser **C1** to **A1**.

Input from **A1** is via IF rejector circuit **L1, C2, C27** and coupling coil **L2** (SW), coupling components **L3, R1, C3** (MW) or coupling components **R2, C4** (LW) to single tuned circuits **L4, C31** (SW), **L5, C31** (MW) and **L6, C31** (LW).

First valve **(V1, Mazda metallised TH41)** is a triode heptode operating as frequency changer with internal coupling. Triode oscillator anode coils **L10** (SW), **L11** (MW) and **L12** (LW) are tuned by **C36**; parallel trimming by **C33** (SW), **C34** (MW) and **C13, C35** (LW); series tracking by **C10** (SW), **C11** (MW) and **C12, C32** (LW). Reaction by coils **L7** (SW), **L8** (MW) and **L9** (LW).

C9 is interposed between **L7** and **L10** to permit **L7** to be returned to chassis via **C10**, and thus provide additional reaction coupling, and at the same time to isolate **L7** from the HT circuit.

Second valve **(V2, Mazda metallised VP41)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C37, L13, L14, C38** and **C39, L15, L16, C40**.

Intermediate frequency 470 KC/S.

Diode second detector is part of double diode beam tetrode output valve **(V3, Mazda Pen 45 DD)**. Audio frequency component in rectified output is developed across load resistance **R16** and passed via **R14**, AF coupling condenser **C21**, manual volume control **R18** and grid stopper **R19** to CG of tetrode section, which provides the only AF amplification on radio.

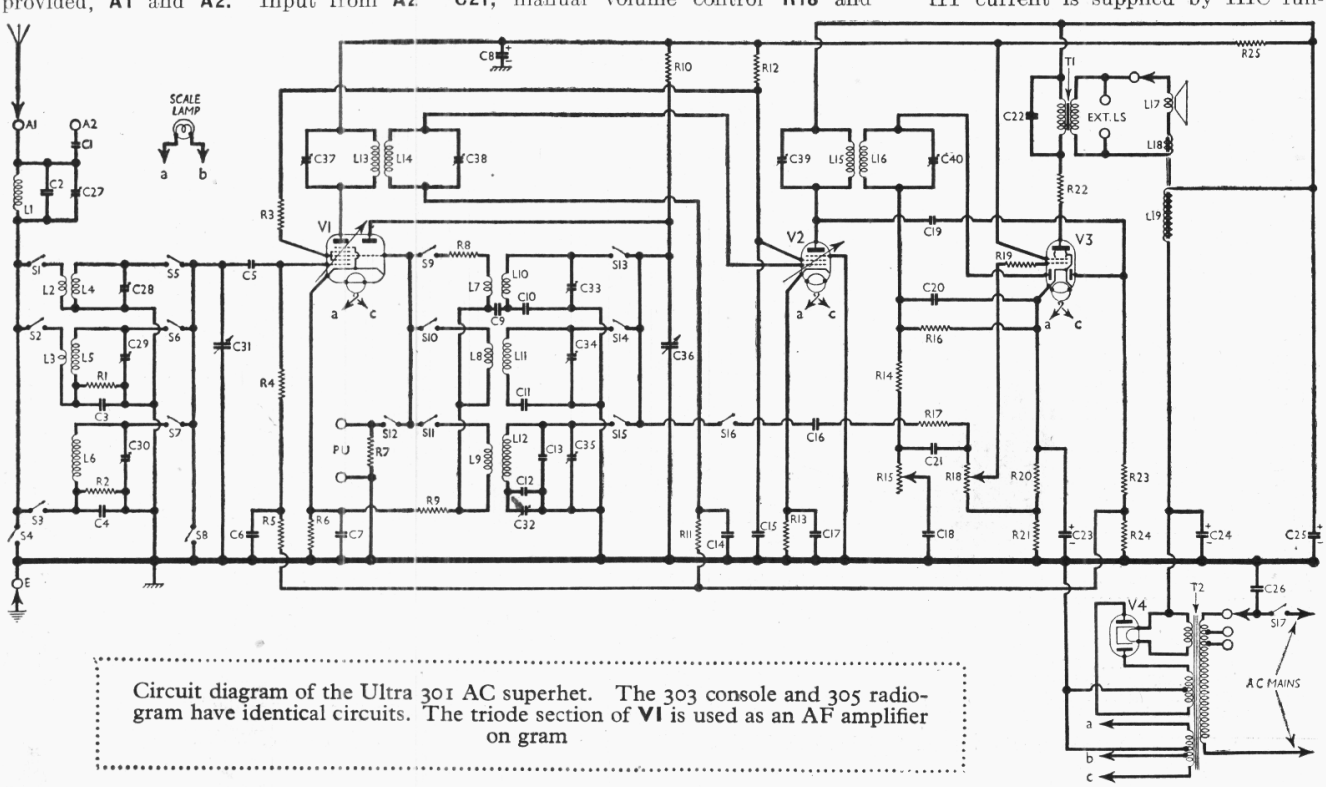
Variable tone control by **R15, C18** across **C21, R18**. Fixed tone correction by **C22** in tetrode anode circuit. Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T1**, while a plug and socket arrangement permits internal speaker speech coil circuit to be broken if desired to mute internal speaker.

Second diode of **V3**, fed from **V2** anode via **C19**, provides DC potentials which are developed across load resistances **R23, R24**. That across **R24** is fed back through decoupling circuits as GB to FC and IF valves to give automatic volume control.

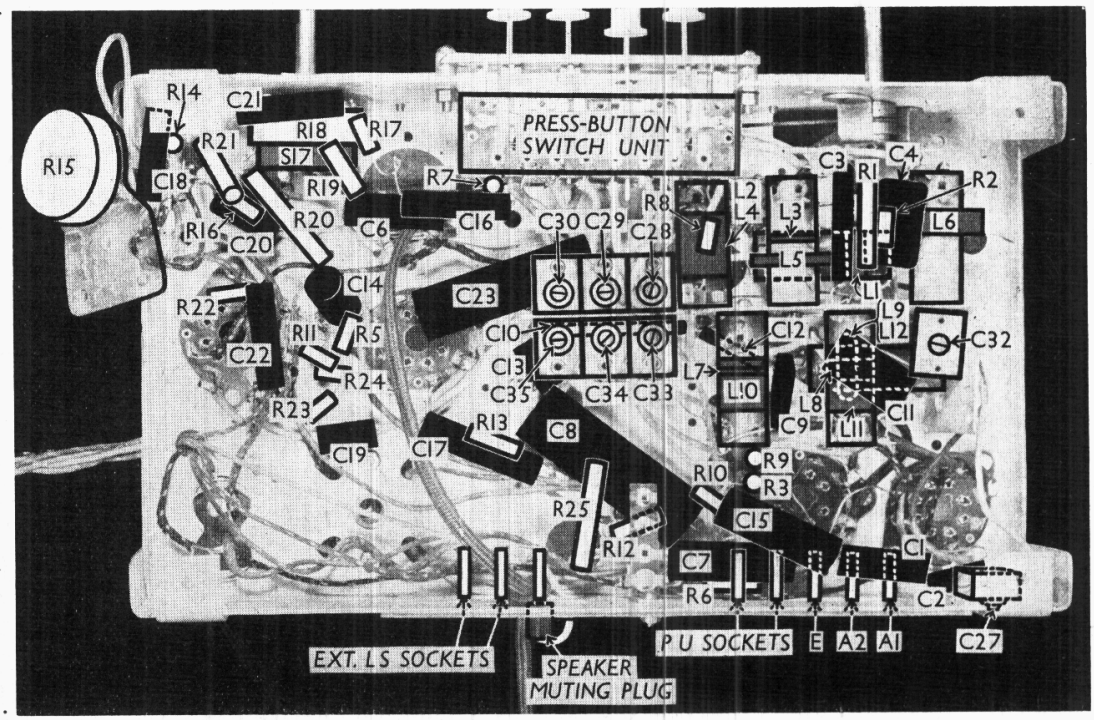
When the "Gram" switch button is pressed, the pick-up sockets are connected between **V1** triode CG and chassis via switch **S12**, and the oscillator section of **V1** becomes an AF amplifier. The pick-up sockets are shunted by **R7**, which operates as CG resistance and prevents the control grid from becoming open circuited should the pick-up be disconnected when the receiver is switched over to gram.

Resistance-capacity coupling by **R10, C16, R17** and the manual volume control **R18** via switch **S16** is employed for pick-up amplification between **V1** triode and tetrode section of **V3**.

HT current is supplied by IHC full-



Circuit diagram of the Ultra 301 AC superhet. The 303 console and 305 radiogram have identical circuits. The triode section of **V1** is used as an AF amplifier on gram



Under-chassis view. Diagrams of the press-button switch unit are overleaf. Some of the coil units are hidden, and are dotted in this illustration. Note the internal speaker muting plug

wave rectifying valve **(V4, Mazda metallised UU6).** Smoothing by speaker field **L19** and dry electrolytic condensers **C24, C25.** Mains RF filtering by **C26.**

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	A2 series condenser... ...	0·00005
C2	Aerial IF rejector fixed trimmer	0·002
C3	Aerial MW coupling condenser	0·004
C4	Aerial LW coupling condenser	0·002
C5	V1 heptode CG condenser...	0·00005
C6	V1 heptode CG decoupling	0·05
C7	V1 cathode by-pass... ...	0·1
C8*	V1; and V2, V3 SG's decoupling	4·0
C9	Part osc. SW reaction coupling	0·0002
C10	Osc. circuit SW tracker ...	0·004
C11	Osc. circuit MW tracker ...	0·000318
C12	Osc. circ. LW fixed tracker	0·00006
C13	Osc. circ. LW fixed trimmer	0·00001
C14	V2 CG decoupling	0·05
C15	V1; V2 SG's RF by-pass ...	0·1
C16	V1 triode to V3 AF coupling	0·004
C17	V2 cathode by-pass... ...	0·1
C18	Part of variable tone control	0·002
C19	Coupling to V3 AVC diode	0·00001
C20	IF by-pass	0·0002
C21	AF coupling to V3 tetrode	0·01
C22	Fixed tone corrector ...	0·004
C23*	V3 cathode by-pass... ...	50·0
C24*	HT smoothing condensers	8·0
C25*		16·0
C26	Mains RF by-pass	0·004
C27‡	Aerial IF rejector tuning...	—
C28‡	Aerial circuit SW trimmer	—
C29‡	Aerial circuit MW trimmer	—
C30‡	Aerial circuit LW trimmer	—
C31†	Aerial circuit tuning ...	—
C32‡	Osc. circuit LW tracker ...	—
C33‡	Osc. circuit SW trimmer ...	—
C34‡	Osc. circuit MW trimmer ...	—
C35‡	Osc. circuit LW trimmer ...	—
C36†	Oscillator circuit tuning ...	—
C37‡	1st IF trans. pri. tuning ...	—
C38‡	1st IF trans. sec. tuning ...	—
C39‡	2nd IF trans. pri. tuning ...	—
C40‡	2nd IF trans. sec. tuning ...	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	Aerial MW coupling resistance	1,000
R2	Aerial LW coupling resistance	10,000
R3	V1 SG stabiliser	60
R4	V1 heptode CG resistance ...	1,000,000
R5	V1 heptode CG decoupling ...	1,000,000
R6	V1 fixed GB resistance ...	200
R7	PU shunt	250,000
R8	Osc. SW reaction stabiliser ...	30
R9	V1 osc. CG resistance ...	25,000
R10	V1 triode anode HT feed ...	40,000
R11	V2 CG decoupling	1,000,000
R12	V1, V2 SG's HT feed... ...	10,000
R13	V2 fixed GB resistance ...	115
R14	IF stopper	100,000
R15	Variable tone control ...	2,000,000
R16	V3 signal diode load	500,000
R17	Part V1 triode to V3 AF coupling	100,000
R18	Manual volume control ...	1,000,000
R19	V3 tetrode grid stopper ...	480
R20	V3 tetrode GB and AVC delay potential divider ...	140
R21		115
R22	V3 tetrode anode stabiliser...	60
R23	V3 AVC diode load resistances	250,000
R24		750,000
R25	V1, and V2, V3 SG's HT feed	2,000

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF rejector coil ...	4·0
L2	Aerial SW coupling coil ...	0·15
L3	Aerial MW coupling coil ...	0·3
L4	Aerial SW tuning coil ...	Very low
L5	Aerial MW tuning coil ...	3·0
L6	Aerial LW tuning coil ...	20·0
L7	Oscillator SW reaction ...	8·5
L8	Oscillator MW reaction ...	1·0
L9	Oscillator LW reaction ...	1·25
L10	Osc. circuit SW tuning coil	Very low
L11	Osc. circuit MW tuning coil	6·5
L12	Osc. circuit LW tuning coil	18·0
L13	1st IF trans. Pri. ...	13·0
L14	1st IF trans. Sec. ...	13·0
L15	2nd IF trans. Pri. ...	13·0
L16	2nd IF trans. Sec. ...	13·0
L17	Speaker speech coil... ...	2·0
L18	Hum neutralising coil ...	0·2
L19	Speaker field coil	1,000·0
T1	Speaker input. trans. Pri.	420·0
	Sec.	0·6

	OTHER COMPONENTS (*Continued*)	Approx. Values (ohms)
T2	Mains trans. Pri., total ...	40·0
	Heater sec., total	0·1
	Rect. heat. sec.	0·1
	HT sec., total ...	450·0
S1-S11	Waveband switches ...	—
S13-S15		
S12,S16	Radio/gram change switches	—
S17	Mains switch, ganged R18...	—

DISMANTLING THE SET

The cabinet is fitted with a detachable bottom, upon removal of which (four round-head wood screws) access may be gained to most of the components beneath the chassis.

Removing Chassis.—Remove the two control knobs (recessed grub screws) from the front of the cabinet;

remove the four bolts (with claw washers and lock-washers) holding the chassis to the bottom of the cabinet.

The chassis can now be withdrawn to the extent of the speaker and tone control leads, which is sufficient for most purposes.

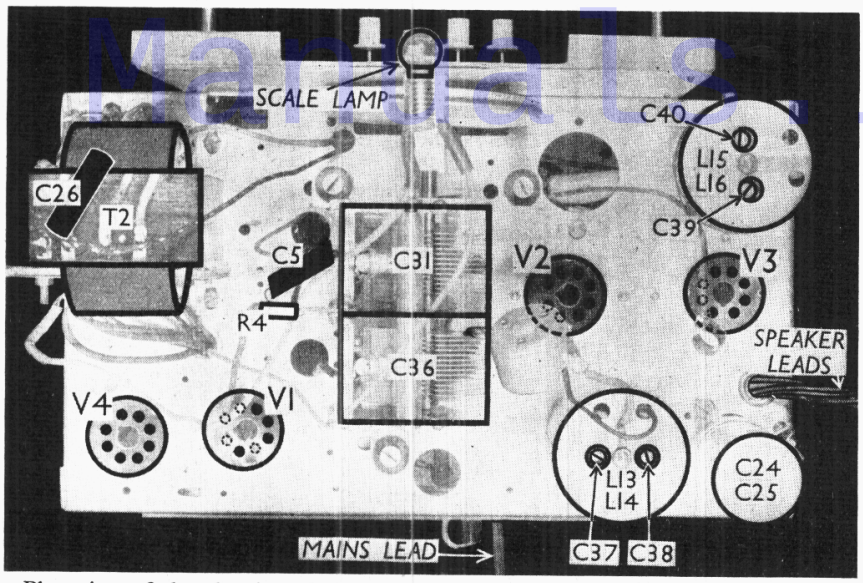
To free chassis entirely, unsolder from the connecting strip on the speaker the six leads connecting it to chassis;

remove the tone control knob (recessed grub screw) from the right-hand side of the cabinet;

remove the three small round-head wood screws holding the tone control mounting bracket to the side (inside) of the cabinet.

When replacing, connect the speaker leads as follows, numbering the tags on the connecting strip from left to right when viewed from the rear of the receiver:

1, no external connection;
2, red lead with white tracer;
3, green lead with pink tracer;
4, brown lead with pink tracer;



Plan view of the chassis. Only the IF units and their trimmers are above the chassis; the remaining coils and trimmers being beneath.

5, blue lead with pink tracer;
6, black lead with pink tracer;
7, plain yellow lead.

Fit a felt washer to each of the three control spindles, between the knob and the cabinet.

Removing Speaker.—First remove the two round-head wood screws from the right and left ends of the elliptical speaker frame;

slacken the four clamp nuts (with lock washers) holding the speaker to the sub-baffle;

swivel the clamps aside and withdraw speaker.

When replacing, the transformer should be at the bottom.

If the leads have been unsoldered they should be connected as indicated above.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 236 V, using the 220-240 V tapping on the mains transformer. 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 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TH41	225 (Oscillator) 76	3·8 2·7	116	8·7
V2 VP41	270	6·3	116	5·3
V3 Pen45DD	250	39·0	225	6·8
V4 UU6	318†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—S1-S16 are the wavechange and radio-gram switches, in a double-sided press-button unit beneath the chassis. It is indicated in our under-chassis view, and diagrams of each side of it are given in col. 3. The table below gives the switch positions when each of the four buttons are pressed. A dash indicates open and **C**, closed.

S17 is the QMB mains switch, ganged with the volume control **R18.**

Coils.—L1; L2, L4; L3, L5; L6; L7, L10; L8, L11 and L9, L12 are in seven unscreened tubular units beneath the chassis. The IF transformers **L13, L14** and **L15, L16** are in two screened units on the chassis deck, with their associated trimmers.

Scale Lamp.—This is an Osram MES type rated at 4.5V, 0.3A. It is run from a tapping on the heater secondary of **T2.**

External Speaker.—Two sockets are provided at the rear of the chassis for a low resistance (about 20) external speaker. On the left of these sockets is a plug on a flying lead which fits into a third socket. When this plug is withdrawn, the speech coil circuit of the internal speaker is broken, thus muting it.

Condensers C24, C25.—These are two dry electrolytics in a single metal can on the chassis deck, the can being the common negative connection. The red tag is the positive of **C24** (8μF) while the plain tag is the positive of **C25** (16μF).

Trimmers.—Apart from the four IF trimmers (two in each coil unit), there is the IF rejector trimmer adjusted from the left-hand corner of the back of the chassis, six trimmers in a bank in the centre beneath the chassis, and one tracker, also beneath the chassis.

Tone Control R15.—This is mounted on a bracket, and its spindle projects through one side of the cabinet. It is shown on the left of our under-chassis view.

Resistance R19.—This is given as 5000 by the makers, but was 4800 in our chassis.

SWITCH TABLE

Switch	SW	MW	LW	Gram.
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	—
S16	—	—	—	C

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator via a 0.1μF condenser to control grid (top cap) of **V1** and chassis. Turn gang to maximum, press MW button, and feed in a 470 KC/S signal. Adjust **C40, C39, C38** and **C37** in turn for maximum output. Repeat these adjustments.

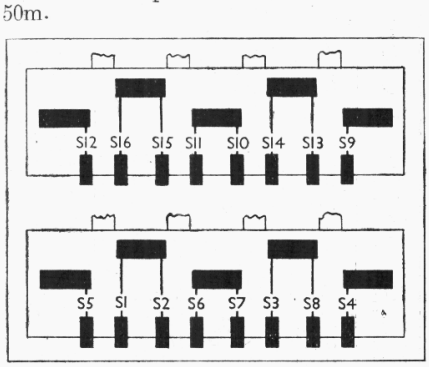
IF Rejector.—Connect signal generator to **A1** and **E** sockets, feed in a strong 470 KC/S signal, and adjust **C27** for *minimum* output.

RF and Oscillator Stages.—Connect signal generator to **A1** and **E** sockets, via a suitable dummy aerial. With gang at maximum, pointer should be horizontal.

MW.—Press MW button, tune to 200m on scale, feed in a 200m (1,500 KC/S) signal, and adjust **C34** for maximum output. Feed in a 250m (1,200 KC/S) signal, tune it in, and adjust **C29** for maximum output, rocking the gang slightly if necessary.

LW.—Press LW button, tune to 1,000m on scale, feed in a 1,000m (300 KC/S) signal, and adjust **C35** for maximum output. Feed in a 1,300m (230 KC/S) signal, tune it in, and adjust **C30** for maximum output, rocking the gang slightly if necessary. Feed in a 1,700m (176.5 KC/S) signal, tune it in, and adjust **C32** for maximum output, while rocking the gang for optimum results.

SW.—Press SW button, tune to 19m on scale, feed in a 19m (15.8 MC/S) signal, and adjust **C33,** then **C28,** for maximum output. Check at 30m and 50m.



Two views of the press-button switch unit. Above, the side seen looking at the underside of the chassis; below, the side facing the chassis deck