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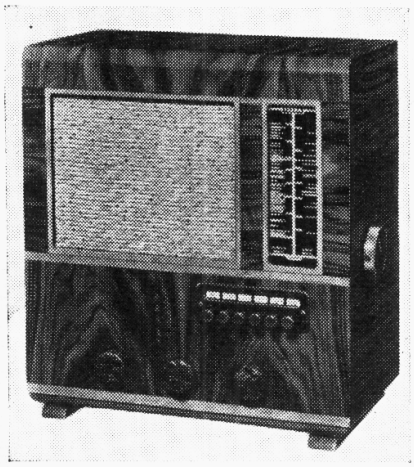
"TRADER" SERVICE SHEET

359

ULTRA 209

MECHANICAL PRESS-BUTTON TUNING



MECHANICAL press-button tuning is provided for six stations in the Ultra 209 4-valve (plus rectifier) AC 2-band superhet, which is suitable for mains of 200-260 V, 40-100 C/S. Provision is made for both a gramophone pick-up and an extension speaker, a plug and socket arrangement allowing the internal speaker to be cut out, and an alternative aerial socket is fitted for use when the receiver is very near a transmitter.

CIRCUIT DESCRIPTION

Two alternative aerial sockets **A1, A2** feed input, direct from **A1** or via small series condenser **C1** from **A2,** via intermediate frequency rejector circuit **L1, C2, C27** to coupling coil **L2** and loading circuit **L3, C4** (MW) or loading circuit **L6, C3** (LW) and single-tuned circuits **L4, C30** (MW) or **L5, C30** (LW). The loading coil circuits provide a special form of aerial coupling.

First valve (**V1, Mazda metallised AC/TH1**) is a triode hexode operating as frequency changer with internal coupling. Triode oscillator anode coils **L9** (MW) and **L10** (LW) are tuned by **C35;** parallel trimming by **C33** (MW) and **C13, C34** (LW); series tracking by **C11, C31** (MW) and **C12, C32** (LW). Reaction by grid coils **L7** (MW) and **L8** (LW). The CG resistance **R7** is connected in series with the coils at their low potential end while the CG condenser **C10** couples that point to chassis.

Second valve (**V2, Mazda metallised AC/VP2**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C36, L11, L12, C37** and **C38, L13, L14, C39.**

Intermediate frequency 470KC/S.

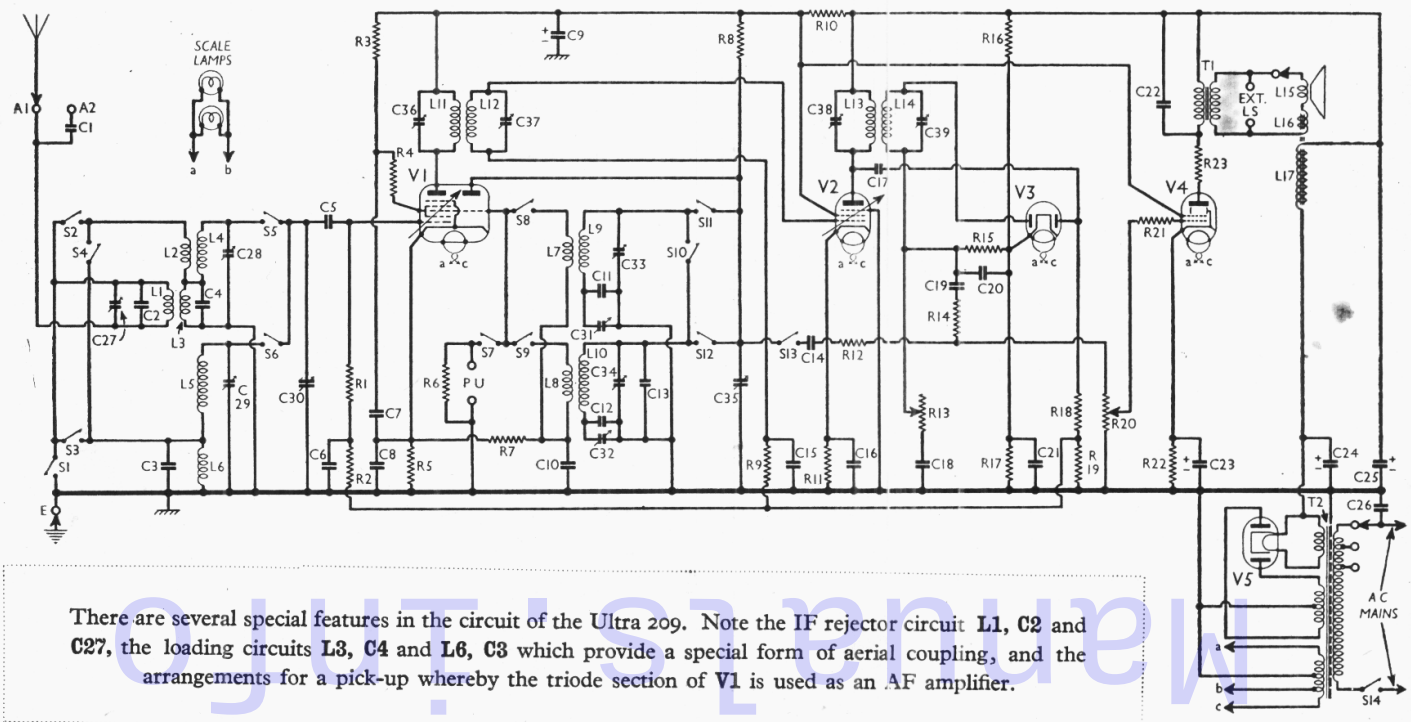
Diode second detector is part of separate double diode valve (**V3, Mazda V914**). Audio frequency component in rectified output is developed across load resistance **R15** and passed via AF coupling condenser **C19,** IF stopper resistance **R14,** manual volume control **R20,** and grid stopper **R21** to CG of beam tetrode output valve (**V4, Mazda AC/5Pen**). Variable tone control by **R13, C18** between **L14** and chassis. Fixed tone correction is given by **C22** in anode circuit of **V4.**

Special provision is made for using a gramophone pick-up, in which the triode section of **V1** becomes an AF amplifier. Via switch **S7** pick-up sockets are connected in the grid circuit of **V1** triode, the anode circuit of which is resistance-capacity coupled by **R8, C14** and **R20,** via switch **S13** and RF stopper resistance **R12,** to the output valve **V4.**

Sockets are provided for the connection of a low impedance external speaker across the secondary of the internal speaker output transformer **T1,** while a plug and socket arrangement permits the speech circuit of the internal speaker to be broken for muting purposes.

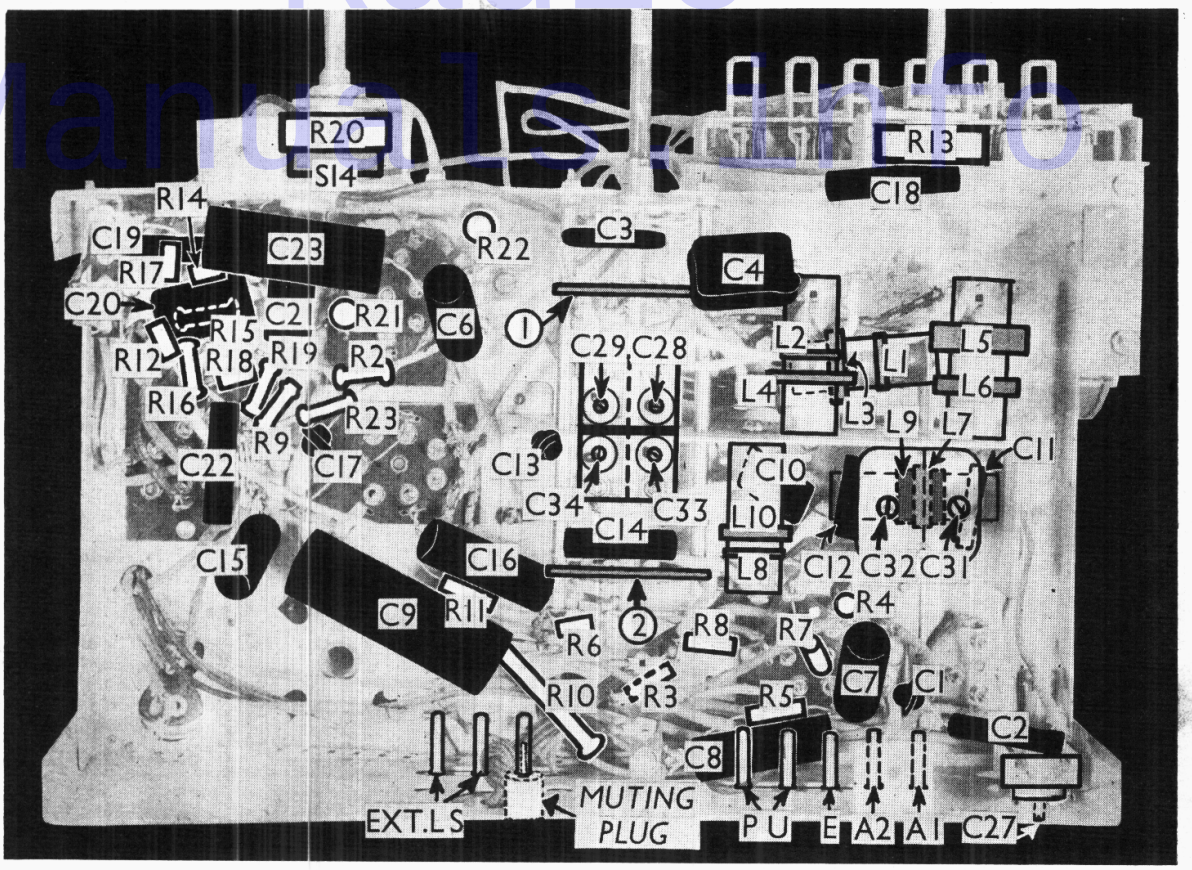
Second diode of **V3,** fed from **V2** anode via **C17,** provides DC potentials which are developed across load resistances **R18, R19,** that at their junction being fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage is obtained from potential divider comprising resistances **R16, R17,** their junction being connected to the cathode of **V3.**

HT current is supplied by IHC full-wave rectifying valve (**V5, Mazda UU4**). Smoothing by speaker field **L17** and dry electrolytic condensers **C24, C25.** Mains circuit RF filtering by condenser **C26.**



There are several special features in the circuit of the Ultra 209. Note the IF rejector circuit **L1, C2** and **C27,** the loading circuits **L3, C4** and **L6, C3** which provide a special form of aerial coupling, and the arrangements for a pick-up whereby the triode section of **V1** is used as an AF amplifier.

It will be seen in this under-chassis view that **L7** and **L9** are beneath the **C31, C32** trimmer unit — actually **L7** is wound over **L9**. Diagrams of the switch units are given on the back of this sheet.



COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	A2 aerial series condenser ..	0·00005
C2	Aerial IF rejector trimmer ..	0·002
C3	Aerial loading coils' tuning condensers	0·002
C4		0·004
C5	V1 hexode CG condenser ..	0·0002
C6	V1 hexode CG decoupling ..	0·05
C7	V1 SG RF by-pass	0·1
C8	V1 cathode by-pass	0·1
C9*	V1 anodes and SG and V2, V4 SG's decoupling..	4·0
C10	V1 osc. CG condenser	0·0002
C11	Osc. circuit MW fixed tracker ..	0·00025
C12	Osc. circuit LW fixed tracker ..	0·000045
C13	Osc. circuit LW fixed trimmer ..	0·00001
C14	V1 triode to V4 gram. coupling ..	0·004
C15	V2 CG decoupling	0·05
C16	V2 cathode by-pass	0·1
C17	Coupling to V3 AVC diode ..	0·00001
C18	Part of variable tone control ..	0·002
C19	Radio AF coupling to V4.. ..	0·01
C20	IF by-pass	0·0002
C21	V3 cathode by-pass	0·1
C22	Fixed tone corrector	0·004
C23*	V4 cathode by-pass	50·0
C24*	HT smoothing	8·0
C25*		16·0
C26	Mains RF by-pass..	0·004
C27‡	Aerial IF rejector tuning.. ..	—
C28‡	Aerial circuit MW trimmer ..	—
C29‡	Aerial circuit LW trimmer ..	—
C30†	Aerial circuit tuning	—
C31‡	Osc. circuit MW tracker	—
C32‡	Osc. circuit LW tracker	—
C33‡	Osc. circuit MW trimmer.. ..	—
C34‡	Osc. circuit LW trimmer.. ..	—
C35†	Oscillator circuit tuning	—
C36‡	1st IF trans. pri. tuning	—
C37‡	1st IF trans. sec. tuning	—
C38‡	2nd IF trans. pri. tuning.. ..	—
C39‡	2nd IF trans. sec. tuning.. ..	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	V1 hexode CG resistance	1,000,000
R2	V1 hexode CG decoupling ..	1,000,000
R3	V1 SG HT feed	10,000
R4	V1 SG RF stopper	60
R5	V1 fixed GB resistance	200
R6	V1 osc. gram. CG resistance ..	250,000
R7	V1 osc. radio CG resistance ..	25,000
R8	V1 osc. anode HT feed	40,000
R9	V2 CG decoupling	1,000,000
R10	V1 HT, and V2, V4 SG's HT feed	2,000
R11	V2 fixed GB	130
R12	RF stopper..	100,000
R13	Variable tone control	2,000,000
R14	IF stopper	100,000
R15	V3 signal diode load	500,000
R16	AVC delay voltage potential divider	1,000,000
R17		50,000
R18	V3 AVC diode load resistances	250,000
R19		750,000
R20	Manual volume control	1,000,000
R21	V4 grid stopper	1,000
R22	V4 GB resistance	140
R23	V4 anode stopper	60

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF rejector coil	4·0
L2	Aerial MW coupling coil	0·3
L3	Aerial MW loading coil	16·0
L4	Aerial MW tuning coil	2·5
L5	Aerial LW tuning coil	19·5
L6	Aerial LW loading coil	32·0
L7	Oscillator MW reaction	1·4
L8	Oscillator LW reaction	1·3
L9	Osc. circuit MW tuning coil ..	6·5
L10	Osc. circuit LW tuning coil ..	17·0
L11	1st IF trans. Pri.	13·0
L12	1st IF trans. Sec.	13·0
L13	2nd IF trans. Pri.	13·0
L14	2nd IF trans. Sec.	13·0
L15	Speaker speech coil	2·0

Continued in next column

	OTHER COMPONENTS *Continued*	Approx. Values (ohms)
L16	Hum neutralising coil	0·1
L17	Speaker field coil	1,000·0
T1	Speaker input trans. Pri. .. Sec. ..	450·0 / 0·1
T2	Mains trans. Pri., total .. Heater sec., total .. Rect. heat. sec. .. HT sec., total ..	40·0 / 0·15 / 0·3 / 460·0
S1-S6 S8-S12	Waveband switches	—
S7, S13	Gram. pick-up switches	—
S14	Mains switch, ganged R20 ..	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (six round-head wood screws) gives access to most of the components beneath the chassis.

Removing Chassis.—If it is necessary to remove the chassis from the cabinet, remove the three knobs at the front of the cabinet (recessed grub screws) and unscrew the six press-buttons (with felt washers). Next remove the tuning knob and its coupling at the side of the cabinet (screw accessible from the inside of the cabinet), the round-head wood screw holding the scale assembly to the front of the cabinet and the four bolts (with spring and claw 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 that each press-button will have to be re-set to the required station.

To free the chassis entirely, unsolder the

speaker leads and *when replacing*, connect them as follows, numbering the tags from bottom to top :—1, no external connection; 2, yellow/black; 3, yellow/green; 4, yellow/white; 5, yellow/blue; 6, yellow/red; 7, yellow.

Removing Speaker.—The speaker can be removed from the cabinet by removing two of the clamps holding it to the sub-baffle (nuts and spring washers) and slackening the other one. *When replacing*, see that the transformer is on the right and connect the leads as 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 225 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 AC/TH1 ..	208	3·3	117	8·7
	Oscillator			
	70	2·5		
V2 AC/VP2 ..	255	11·0	208	3·3
V3 V914 ..	—	—	—	—
V4 AC/5Pen ..	235	35·0	208	5·8
V5 UU4 ..	302†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—S1-S6 and **S8-S12** are the wave-band switches, while **S7** and **S13** are the radiogram switches. All are included in two ganged rotary units beneath the chassis, indicated in our under-chassis view and shown in detail in the diagrams in col. 3.

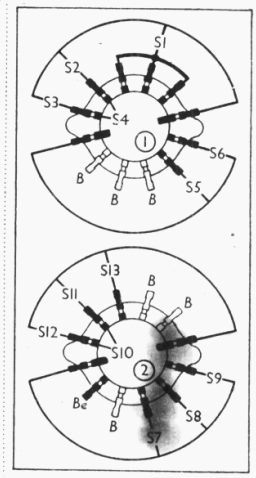
The table in column two gives the switch positions for the three control settings, starting from anti-clockwise. A dash indicates open, and **C**, closed.

Actually there are four positions of the control knob, but the fourth is not intended to be used on this receiver.

TABLE AND DIAGRAMS OF THE SWITCH UNITS

Switch	Gram.	MW	LW
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	—	—

Diagrams of the switch units, drawn as seen from the direction of the arrows in the under-chassis view. A table of the switch positions is on the left.



S14 is the QMB mains switch, ganged with the volume control **R20.**

Coils.—L1-L10 are in pairs in five tubular unscreened units beneath the chassis, and are indicated in our under-chassis view. The IF transformers **L11, L12** and **L13, L14** are in two screened units, with the associated trimmers, mounted on the chassis deck.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (about 2 O) external speaker. A plug and socket device permits the internal speaker to be muted.

Scale Lamps.—These are two MES types, rated at 4·5 V, 0·3 A, run in parallel across a tapping on the heater secondary of **T2.**

Condensers C24, C25.—These are two dry electrolytics in a tubular metal can on the chassis deck, the can being the common negative. The positive connections project beneath the chassis and are marked with coloured spots; that with the red spot belonging to **C24** (8μF), and that with the yellow spot belonging to **C25** (16 μF).

Condenser C4.—This condenser is made up of two condensers connected in parallel.

CIRCUIT ALIGNMENT

IF Stages.—Connect a signal generator to the control grid (top cap) of **V1** and chassis, feed in a 470 KC/S (638·3 m) signal and adjust **C39, C38, C37** and **C36** in that order for maximum output. Now connect the high potential lead of the signal generator to the **A1** socket, switch the set to LW, tune the set to 950 m, feed in the 470 KC/S signal and adjust **C27** for *minimum* output.

RF and Oscillator Stages.—Leave the high potential lead of the generator connected to **A1** and the other lead to chassis.

MW.—Switch the set to MW, tune it to 200 m, feed in a 200 m (1,500 KC/S) signal and adjust **C33** and **C28** for maximum. Feed in a 500 m (600 KC/S) signal, tune it in and adjust **C31** for maximum output, while rocking the gang for optimum results.

LW.—Switch the set to LW, tune it to 1,000 m, feed in a 1,000 m (300 KC/S) signal and adjust **C34** and **C29** for maximum output. Feed in a 1,700 m (176·5 KC/S) signal, tune it in and adjust **C32** for maximum output, while rocking the gang for optimum results.

MECHANICAL UNIT

This is a De Jur Amsco unit of simple construction, with nothing in it which is likely to get out of order. There are six press-buttons, and each one is adjustable to any station.

The principle is very similar to that of the Mechomatic Model 11 described on page 1 of *Radio Maintenance* dated June 4, 1938, and readers are referred to this for full details.

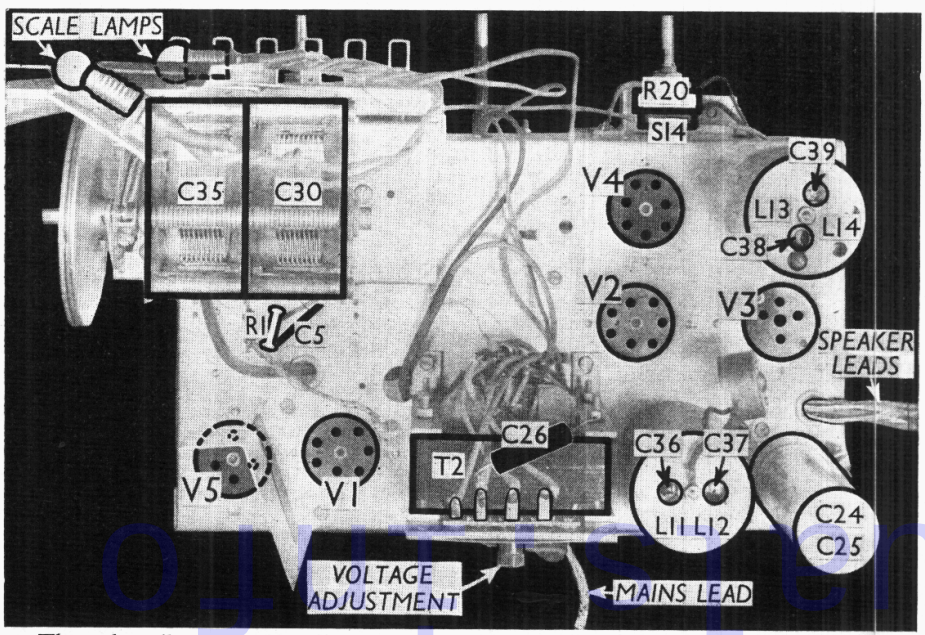
The gang condenser spindle is connected by means of a bell-crank and a system of connecting links to a metal pressing of curved formation which is pivoted on two end plates so as to be rotatable. Rotation of the metal pressing also rotates the gang.

Each of the six plungers carries an adjustable metal contact plate whose leading edge, when a button is depressed, makes contact with, and rotates, the metal pressing to an extent depending on the angle of the leading edge of the contact plate relative to the axis of the plunger.

By adjusting the contact plate, it is possible to rotate the metal pressing, and hence the gang, to any pre-determined point.

The press buttons, on being slightly unscrewed, free their associated contact plates, which can then be adjusted, and subsequently clamped up by tightening the press buttons again.

Station selection is simple. The particular button which is to receive a given station is first unscrewed slightly. The required station is then tuned in manually, and, holding the manual knob firmly to prevent movement of the gang, the button is pushed in to its fullest extent. The button is then allowed to return to its "out" position, and is finally screwed up to clamp the contact plate.



The only coils on the chassis deck are the IF transformers L11, L12 and L13, L14.

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