"TRADER" SERVICE SHEET

694

FERRANTI A1

AC SUPERHET

SIX valves (plus rectifier) are employed in the Ferranti A1, a 2-band superhet designed for AC mains of 200-250 V.

Release date, all models: 1932.

Original prices: standard model, £23 2s.; with station names scale (as illustrated), £24 3s.; with clock, £26 5s.

CIRCUIT DESCRIPTION

Aerial input to tetrode RF amplifier **(V1, Osram VMS4)** via coupling coils **L1, L2** and single tuned circuit **L3, L4, C21.** Mains aerial coupling via **C1** is connected automatically by **S1** upon withdrawal of aerial plug.

Tuned-secondary RF transformer coupling by **L5, L6** and **L7, L8, C23** between **V1** and mixer valve **(V2, Osram VMS4)** an RF tetrode operating as frequency changer in conjunction with triode oscillator **(V3, Ferranti D4). V3** grid coils **L12** (MW) and **L13** (LW) are tuned by **C26.** Parallel trimming by **C27** (MW); series tracking by **C6, C25** (LW). Reaction by **L9, L10.** Cathode injector coupling to **V2** via **L11.**

Fourth valve **(V4, Osram VMS4)** is a third RF tetrode, and operates as intermediate frequency amplifier with double-tuned transformer couplings.

Gain control by variable potentiometer **R6** which forms a potential divider with **R3, R4, R5** and **R7** across the HT circuit and permits cathode voltage of **V1** and **V4** to be varied.

Intermediate frequency 135 kc/s.

Second detector is a triode valve **(V5, Ferranti D4)** operating on grid leak system with **C11, R8.** Provision for connection of gramophone pick-up in control grid circuit.

AF transformer coupling, via IF filter **C12, L18, C13,** between **V5** and triode output valve **(V6, Ferranti P4)** with directly heated filament. Four-position tone control by **C16, C17** and **S8, S9.** Provision for low impedance ext. LS.

GB for **V4** is obtained from drop along **R11** in cathode (filament) return path to chassis via centre-tap on separate heater secondary winding **c, d** on **T3.**

HT current is supplied by full-wave rectifying valve **(V7, Ferranti R4).** Smoothing by speaker field **L21,** in negative HT lead, and paper insulated capacitors **C18, C19, C20.**

VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted by the makers as average values when the gain control is at maximum. Voltages were measured with a Ferranti Valve Tester (1,000 ohms per volt), chassis being negative.

Value	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 VMS4	170	3·0	90	0·75
V2 VMS4	165	2·5	70	0·5
V3 D4	75	2·0	—	—
V4 VMS4	165	3·0	90	0·75
V5 D4	170	10·0	—	—
V6 P4	230	32·0	—	—
V7 R4	240†	—	—	—

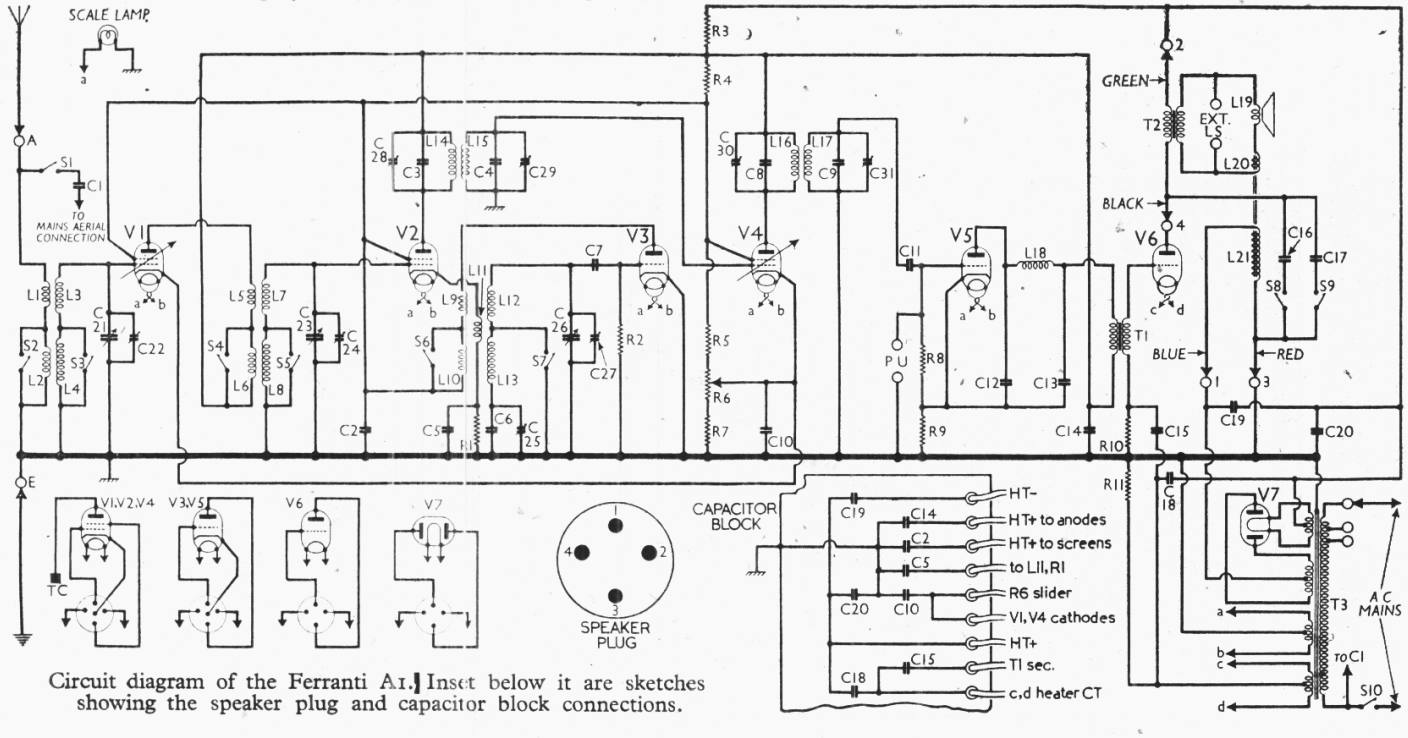
† Not quoted ; filament to chassis, approx., DC.

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)
R1	V2 GB resistor	900
R2	V3 CG resistor	100,000
R3	Parts of HT potential divider for anode and SG feeds	2,750
R4		7,340
R5		5,000
R6	V1, V4 gain control ...	4,920
R7	V1, V4 fixed GB ...	80
R8	V5 grid leak	500,000
R9	V5 GB (gram) resistor...	250
R10	V6 CG decoupling ...	50,000
R11	V6 GB resistor	1,150

	CAPACITORS	Values (μF)
C1	Mains aerial coupling ...	0·0003
C2	SG's HT decoupling ...	2·0
C3	1st IF transformer fixed trimmers	—
C4		—
C5	V2 cathode by-pass ...	1·0
C6	Osc. LW fixed tracker ...	—
C7	V3 CG capacitor ...	0·0003
C8	2nd IF transformer fixed trimmers	0·00021
C9		0·00021
C10	V1, V4 cathodes by-pass	0·3
C11	V5 CG capacitor ...	0·00015
C12	IF by-pass capacitors ...	0·0006
C13		0·0006
C14	Anodes HT decoupling...	2·0
C15	V6 CG decoupling ...	1·0
C16	Tone control capacitors	0·1
C17		0·2
C18	HT smoothing capacitors	2·0
C19		4·0
C20		6·0
C21†	Aerial circuit tuning ...	—
C22‡	Aerial MW trimmer ...	—
C23†	RF trans. sec. tuning ...	—
C24‡	RF trans. MW trimmer...	—
C25‡	Osc. circ. LW tracker ...	—
C26†	Oscillator circuit tuning	—
C27‡	Osc. circ. MW trimmer	—
C28‡	1st IF trans. pri. tuning	—
C29‡	1st IF trans. sec. tuning	—
C30‡	2nd IF trans. pri. tuning	0·0001
C31‡	2nd IF trans. sec. tuning	0·0001

Variable. ‡ Pre-set.



Circuit diagram of the Ferranti A1. Inset below it are sketches showing the speaker plug and capacitor block connections.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial coupling coils	0·5
L2		2·0
L3	Aerial tuning coils	6·0
L4		21·0
L5	RF trans. primary coils	2·5
L6		3·0
L7	RF trans. secondary coils	6·0
L8		21·0
L9	Oscillator reaction coils	1·7
L10		7·7
L11	V2 cathode coupling	3·6
L12	Osc. MW tuning coil	4·5
L13	Osc. LW tuning coil	16·0
L14	1st IF trans. Pri.	26·0
L15	1st IF trans. Sec.	26·0
L16	2nd IF trans. Pri.	26·0
L17	2nd IF trans. Sec.	26·0
L18	RF choke	200·0
L19	Speaker speech coil	9·0
L20	Hum neutralising coil	0·3
L21	Speaker field coil	2,000·0
T1	Intervalve trans. Pri.	500·0
	Intervalve trans. Sec.	3,000·0
T2	Speaker input trans. Pri.	250·0
	Speaker input trans. Sec.	0·3
T3	Mains trans. Pri. total	24·0
	Mains trans. Heater sec.	0·2
	Mains trans. V6 heat. sec.	0·25
	Mains trans. Rect. heat sec.	0·2
	Mains trans. HT sec., total	800·0
S1	Mains aerial switch	—
S2–S7	Waveband switches	—
S8, S9	Tone control switches	—
S10	Mains switch	—

GENERAL NOTES

Switches.—**S1** is the jack-type switch associated with the aerial socket and mains aerial capacitor **C1**. **S1** closes when the aerial plug is withdrawn from its socket.

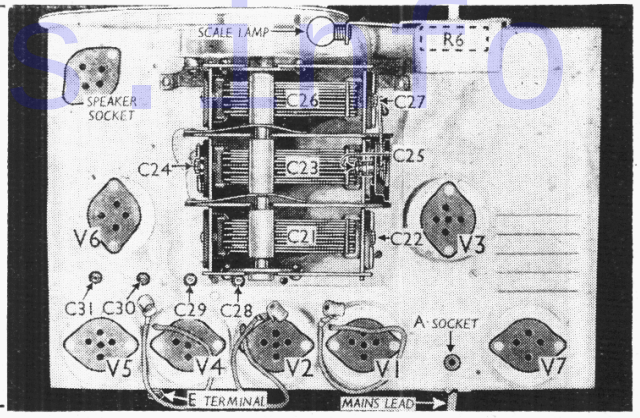
S2-S7 are the waveband switches, mounted in pairs on their coil bases and operated by a spindle running across the centre of the chassis. They are identified in our under chassis view; they all close on MW, and open on LW.

S8, S9 are the tone control switches, in a four-position rotary unit mounted on the speaker grill. In the four positions, either; both; or neither closes, connecting **C16**; or **C17**; or both together; or neither, across the output circuit.

S10 is the QMB mains switch, operated in a third position of the **S2-S7** switch control spindle.

Coils.—All the RF, oscillator and IF coils are in five rectangular screening containers beneath the chassis. They are identified in our under-chassis view, where the metal covers have been removed to reveal them. The covers are normally held in position by wires slipped through holes provided for that purpose. Each coil assembly, excepting the IF units, consists of two tubular formers, one being located inside the other.

Plan view of the chassis. Trimmers and trackers are mounted on either side of the gang unit. The aerial plug, for socket **A**, must be long enough to operate **S1**, seen in the under-chassis view below.



The RF choke **L18** is mounted unscreened on one of the side members beneath the chassis.

Scale Lamp.—This is an MES type lamp rated at 3.5 V, 0.3 A, and is connected across one half of the **V1-V5** heater winding. In order to facilitate renewal, the lamp is mounted on a lever which is riveted to the gain control cover so that it may be swivelled, raising the lamp.

External Speaker.—Two terminals are provided on the speaker frame for connecting an external speaker of about 15-25Ω impedance.

Tone Control Capacitors.—The two capacitors **C16, C17** are in a single tubular container mounted on the speaker input transformer **T2.** In later chassis a single 0.1 μF capacitor only may be used.

Multi-capacitor Block.—**C2, C5, C10, C14, C15, C18, C19** and **C20** are all paper insulated capacitors contained in a multiple assembly beneath the chassis, connections being effected by nine flexible leads emerging from the case in a row along one side. These outlets are indicated in our under-chassis view, to show their position, but the internal connections of the block are given in the diagram inset beneath the main circuit diagram overleaf. It will be seen that outlets 5 and 6, counting from front to rear, are joined together and to **C10** inside the unit. The points to which the leads go in the receiver are briefly indicated in the diagram. One side of **C2, C5, C10, C14** and **C20** is common and goes to chassis via the casing.

Speaker Plug.—This has four pins arranged to fit the 4-pin English valve holder, which forms the socket, mounted on the chassis deck. The colour coding of the leads is indicated in the circuit diagram, while the numbers there refer to the pin numbers in the sketch of the plug, drawn as seen from the free ends of the pins, inset beneath the circuit diagram.

Potential Divider R3-R7.—**R3, R4** and **R5** are three sections of a wire-wound unit mounted beneath the chassis on the side of the capacitor block. **R6** and **R7** complete the potential divider. In some chassis, **R6** may be 5,000 Ω, and **R7** may be dispensed with. The spindle of **R6** must be isolated from chassis.

Alternative Valves.—**V1, V2** and **V4** may be Mazda AC/VP1's, and **V6** may be Osram PX4. Any of the Osram valves quoted may of course equally be Marconi types.

Chassis Divergencies.—As mentioned previously, **C16** and **C17** may be replaced by a single 0.1 μF capacitor, reducing the tone control action to two positions only; **R6** may be 5,000 Ω, and **R7** omitted. **R7** may also occupy a different position in the chassis from that shown in our photograph. **R10** may be mounted on **T1.**

Our chassis was fitted with a large diameter rotary circular scale, but other chassis may have a horizontal scale which slides left and right on metal runners. Special models had an electric clock in front of the speaker cone, just above the tone control knob.

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (recessed grub screws);
withdraw the speaker plug from its socket on the chassis deck;
remove the four bolts holding chassis to bottom of cabinet.

To remove screens from **V1, V2** and **V4** the clamping bracket must first be removed (two slotted screws at rear of chassis).

Removing Speaker.—Remove the three coloured tone control leads from the three terminals in a vertical row on the right of the speaker frame;
remove the six wood screws holding the metal cross-brace to the sides of the cabinet, and the four wood screws holding the speaker rim to the sub-baffle.

When replacing, the transformer should be on the left.

Connect the yellow tone control lead to the top terminal, red to the middle one, and black to the bottom one.

CIRCUIT ALIGNMENT

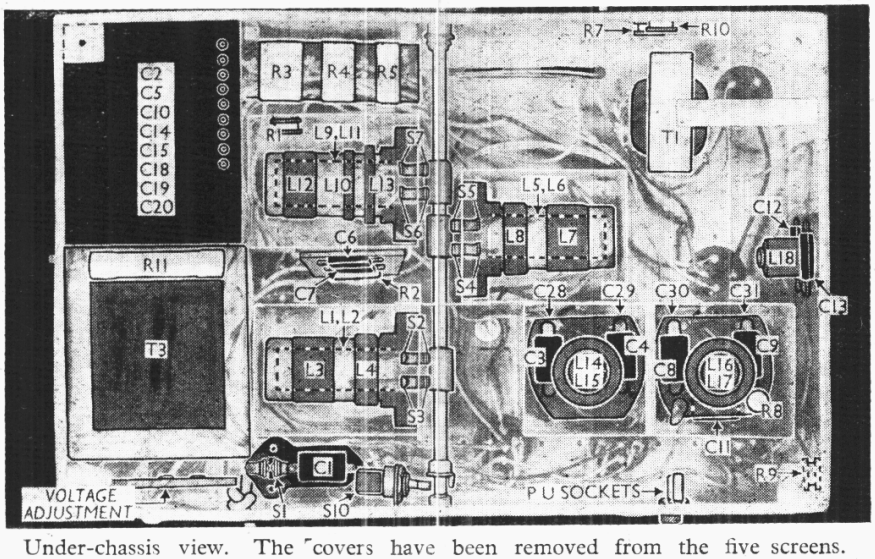
For all alignment operations, set the gain control so that not more than 7 V is measured between the slider and chassis.

IF Stages.—Connect signal generator to fixed vanes of **C23** and chassis, feed in a 135 kc/s (2,222 m) signal, slacken **C29** several turns, and adjust **C31** and **C30** for maximum output. Feed in a 140 kc/s (2,143 m) signal, and adjust **C28** for maximum output. Feed in a 130 kc/s (2,308 m) signal, and adjust **C29** for maximum output. Now sweep input from 125 kc/s (2,400 m) to 145 kc/s (2,069 m) and check for symmetrical peaks, repeating if necessary.

RF and Oscillator Stages.—Connect signal generator via a 0.0002 μF capacitor to **A** and **E** connections.

MW.—Switch set to MW, tune to 200 m, feed in a 200 m (1,500 kc/s) signal, and adjust **C27** for maximum output, selecting the peak involving the lesser trimmer capacitance if two are found. Tune to 228 m, feed in a 228 m (1,316 kc/s) signal, and adjust **C22** and **C24** for maximum output. Feed in a 540 m (555.5 kc/s) signal, tune it in and adjust the scale for correct calibration. Check calibration at 228 m, and if badly out repeat the whole process.

LW.—Switch set to LW, feed in a 1,807 m (166 kc/s) signal, tune it in and adjust **C25** for maximum output while rocking the gang for optimum results.



Under-chassis view. The covers have been removed from the five screens.

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