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"TRADER" SERVICE SHEET

601

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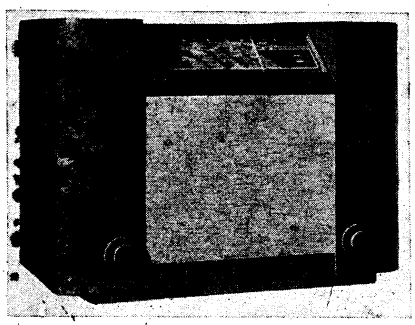
PHILIPS 747A (LATEST TYPE)

747AX AND 698A, 699A RADIOGRAMS



The appearance of the table models 747A and 747AX.

AN interesting point in the design of the latest Philips 747A receiver is the use of two separate diodes for AVC purposes in order to overcome a form of distortion sometimes found when only one diode is employed. The receiver is a 4-valve (plus rectifier) AC 3-band superhet suitable for mains of 100-250 V, 50-100 C/S.

A very similar chassis is fitted in the 747AX receiver, but this is arranged so that it can be operated on DC mains via a vibrator unit, and has a different mains input plug.

In addition, a similar chassis is employed in the 698A and 699A radiograms. This *Service Sheet* was prepared on a 747A of the latest type.

It should be noted that some of the first models which were produced had an ordinary output pentode in place of the double diode pentode and did not use two diodes for AVC, the circuit being considerably different. These models are not covered here.

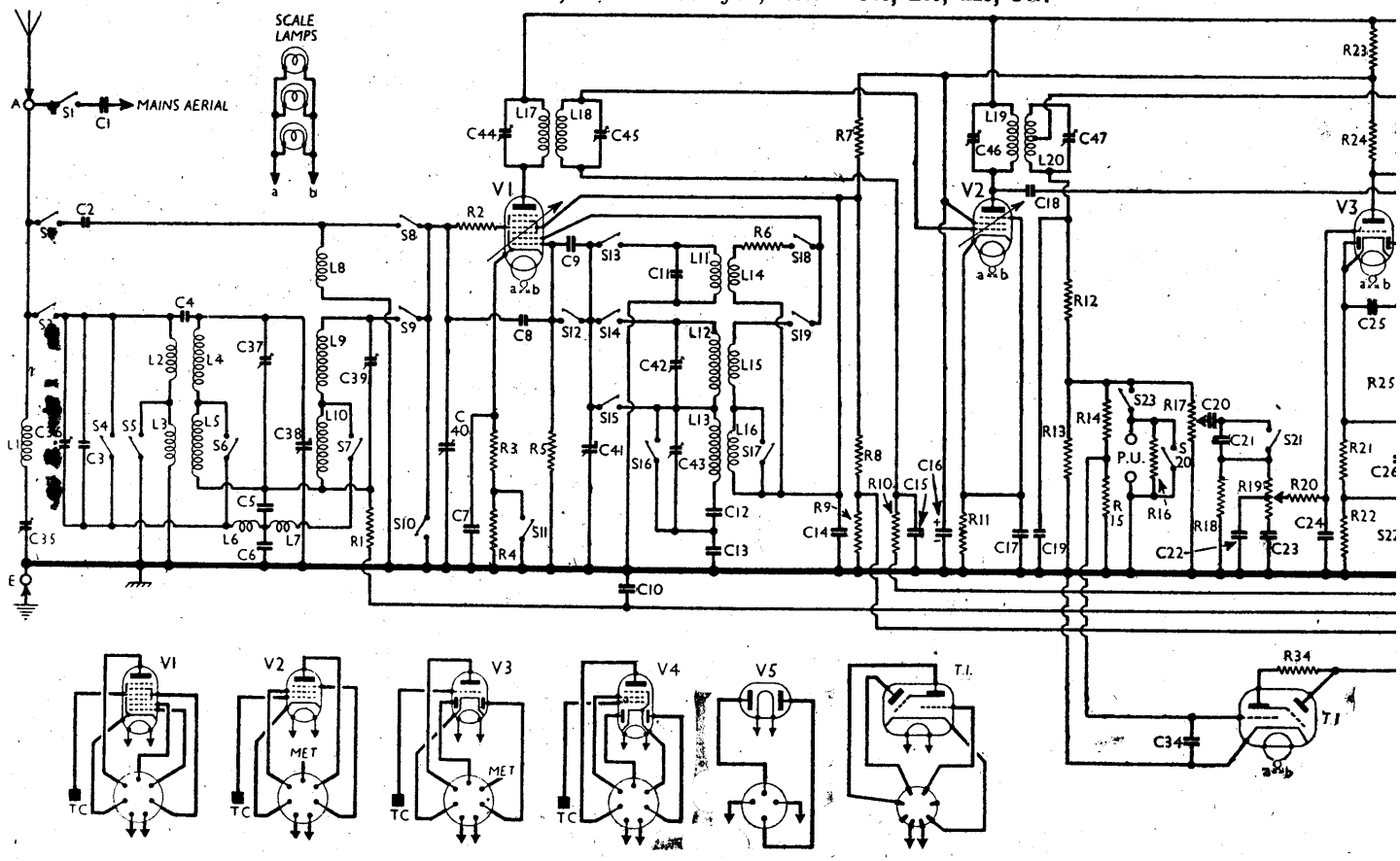
Release date, all models : August, 1937.

CIRCUIT DESCRIPTION

Aerial input on MW and LW via coupling coils **L2, L3** and condenser **C4** to mixed coupled band-pass filter. Primary coils **L4, L5** are tuned by **C38;** secondaries **L9, L10** by **C40.** Coupling is effected by condensers **C6** (MW), **C5** (LW) and coils **L6, L7,** which also form part of a selectivity circuit. On SW, input is via coupling condenser **C2** to single-tuned circuit **L8, C40.** IF filtering by **L1, C35** across aerial circuit.

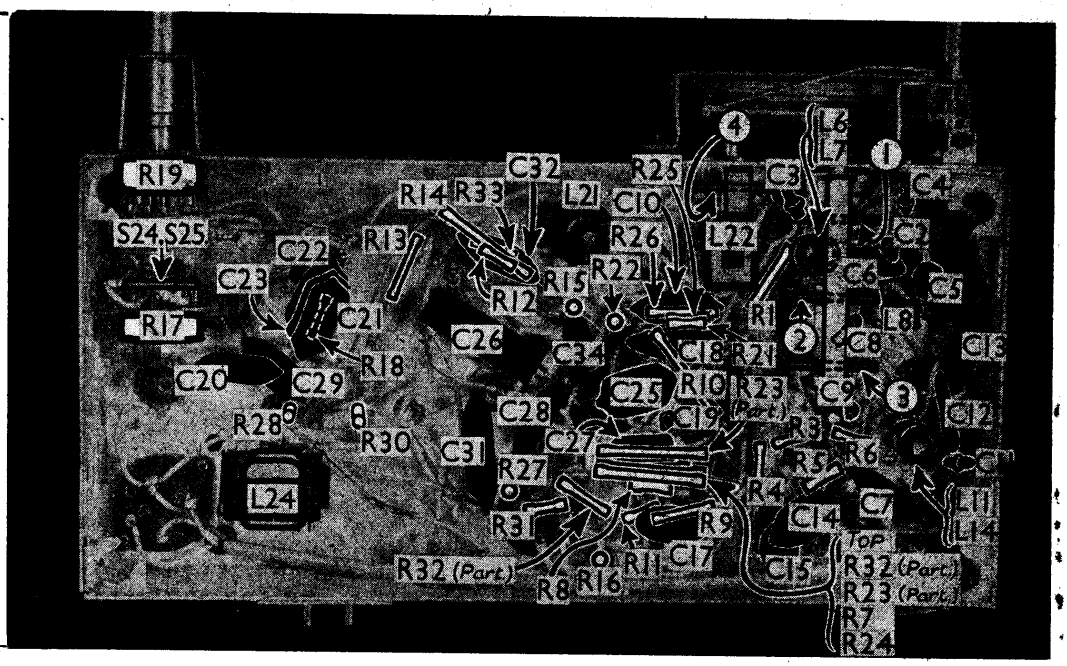
First valve **(V1, Mullard metallised FC4)** is an octode operating as frequency changer with electron coupling. Oscillator grid coils **L11** (SW), **L12** (MW) and **L13** (LW) are tuned by **C41;** parallel trimming by **C11** (SW), **C42** (MW) and **C43** (LW); series tracking by **C13** (MW), and **C12** (LW). Anode reaction by **L14** (SW), **L15** (MW) and **L16** (LW).

Second valve **(V2, Mullard metallised VP4B)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C44, L17, L18, C45** and **C46, L19, L20, C47.**



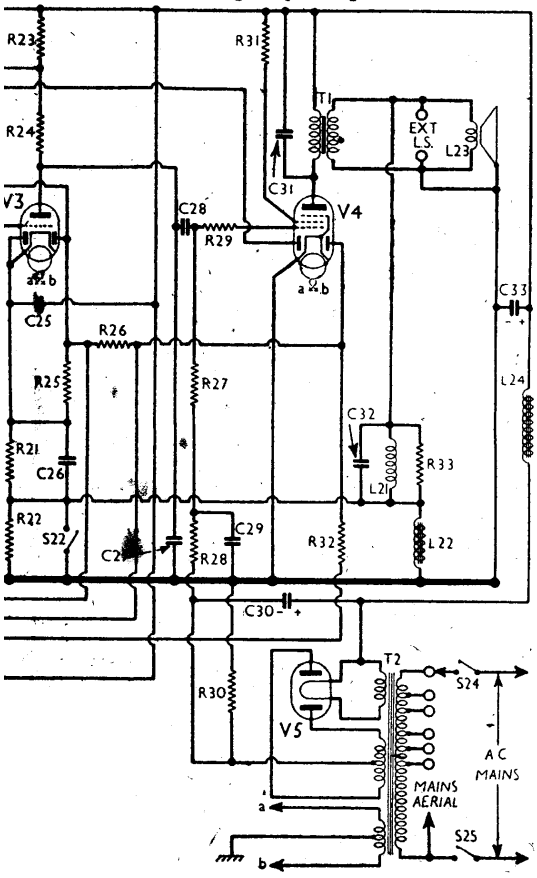
Circuit diagram of the Philips 747A AC superhet. **V3** and **V4** are both multiple valves with double diodes. One diode of **V3** is strapped to the ca directly to **V2**; the first diode of **V4** is the signal rectifier, while the second, which is biased from the junction of **R8, R9,** provides a delay ac occur in some chassis, and in early models **V4** was a pentode without diodes. Except for the mains input circuit, the circuit

Under - chassis view. In several cases, where components appear to be bunched, they are actually on small racks forming vertical assemblies. The waveband switch units are numbered 1 to 4 and indicated here by arrows. They are shown in detail in the diagrams overleaf, where they are viewed in the direction of these arrows. Resistances **R23** and **R32** each consist of two resistors.



Intermediate frequency 128 KC/S.

Diode second detector is not part of **V3** but is part of double diode pentode output valve **(V4, Mullard Pen4DD).** Audio frequency component in rectified output is developed across load resistance **R13** and passed via manual volume control **R17,** coupling condenser **C20** (and on SW **C21**), variable RC tone filter **R18, R19, C22, C23** and IF filter circuit **R20, C24** to CG of triode section of double diode triode valve **(V3, Mullard metallised TDD4),** which operates as AF amplifier.



Control voltage for cathode-ray tuning indicator **(T.I., Mullard TV4)** is obtained from potential divided **R14, R15,** across **R13,** and decoupled by condenser **C34.**

One diode of **V3** is strapped to the cathode; the second, fed from **V2** anode via **C18,** provides DC potential which is developed across load resistance **R25** and fed back through decoupling circuit as GB to IF valve, to provide undelayed automatic volume control for this stage. AVC to **V1** is delayed, however, by a rather complicated system. The controlling bias potential is that at the second (delay) diode of **V4** which is positively biased, via its load resistance **R32,** from potential divided **R23, R7, R8, R9.** While no signal is being received a very small voltage drop will occur, due to the diode current, as the internal resistance of the diode is low compared with **R32.** This condition is maintained until the negative potential of **V3** AVC diode rises, due to the strength of an incoming signal, to a value sufficient to neutralise, via **R26,** the opposite polarity of **V4** delay diode, after which normal AVC action will occur in proportion to the strength of the signal. On SW, **V1** is not AVC controlled.

Resistance-capacity coupling by **R24, C28** and **R27,** via grid stopper **R29,** between **V3** triode and pentode section of **V4.** GB for **V4** is obtained from drop along **R30** in HT negative lead to chassis. Fixed tone correction in anode circuit by **C31.** Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T1.**

Negative feed-back circuit **C32, L21, R33** between secondary of **T1** and cathode circuit of **V3** is coupled (except on SW and Gram.) by **R22, L22. S22** short-circuits these two latter on SW and Gram.

HT current is supplied by full-wave rectifying valve **(V5, Philips 1821).** Smoothing by iron-cored choke **L24** and large capacity electrolytic condensers **C30, C33.** Provision for mains aerial coupling via **S1, C1,** the lever of **S1** covering the aerial socket when the switch is closed.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 pent. CG decoupling	100,000
R2	V1 pent. CG stopper ...	32
R3	V1 fixed GB resistance...	250
R4	Radio muting on gram.	10,000
R5	V1 osc. CG resistance ...	50,000
R6	V1 osc. anode SW stabiliser	50
R7	Parts V1, V2, SG's, V1 osc. anode, and V3 triode anode HT feed; V4 AVC delay diode pos. bias potentiometer ...	10,000
R8		32,000
R9		64,000
R10	V2 CG decoupling ...	2,000,000
R11	V2 fixed GB resistance...	400
R12	IF stopper	250,000
R13	V4 signal diode load ...	1,600,000
R14	T.I. control potential divider	5,000,000
R15		1,600,000
R16	Pick-up shunt	100,000
R17	Manual volume control	500,000
R18	Part of variable TC filter	800,000
R19	Variable tone control, total	600,000
R20	IF stopper	160,000
R21	V3 triode GB resistance	3,200
R22	Part negative feed-back circuit	20
R23	Part of pot. with R7, R8 and R9	10,000*
R24	V3 triode load resistance	100,000
R25	V3 AVC diode load ...	500,000
R26	V3 AVC diode and V4 delay diode coupling ...	1,000,000
R27	V4 pent. CG resistance...	500,000
R28	V4 pent. CG decoupling	320,000
R29	V4 pent. CG stopper ...	1,000
R30	V4 GB resistance ...	125
R31	V4 SG HT feed	50
R32	V4 delay diode load ...	9,000,000†
R33	Part negative feed-back circuit	800
R34	T.I. anode HT feed ...	2,000,000

* Two 20,000 Ω in parallel. † One 5 MΩ and one 4 MΩ in series

the cathode, while the other provides AVC voltage lay action for AVC to V1. Minor modifications circuit of the 747AX is identical.

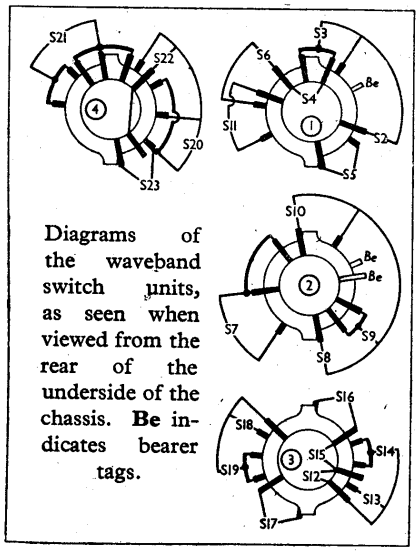
	CONDENSERS	Values (μF)
C1	Mains aerial condenser	0·0005
C2	Aerial SW series cond.	0·000016
C3	Image suppressor (fixed)	0·00002
C4	MW and LW aerial coupling	0·00001
C5	Parts band-pass coupling	0·016
C6	Parts band-pass coupling	0·025
C7	V1 cathode by-pass	0·05
C8	Small coupling	0·000002
C9	V1 osc. CG condenser	0·0001
C10	V1 AVC line decoupling	0·1
C11	Osc. circuit SW trimmer	0·0000064
C12	Osc. circuit LW tracker	0·0007
C13	Osc. circuit MW tracker	0·00149
C14	V1 SG and osc. anode RF by-pass	0·1
C15	V2 CG decoupling	0·001
C16*	V2 SG and V3 triode anode decoupling	32·0
C17	V2 cathode by-pass	0·1
C18	Coupling to V3 AVC diode	0·00002
C19	IF by-pass	0·00005
C20	AF coupling to V3 triode	0·005
C21	SW AF coupling to V3 triode	0·00025
C22	Parts variable TC filter	0·00025
C23	Parts variable TC filter	0·00064
C24	IF by-pass	0·0001
C25	RF by-pass	0·0016
C26*	V3 cathode by-pass	50·0
C27	IF by-pass	0·0004
C28	V3 triode to V4 AF coupling	0·02
C29	V4 CG decoupling	0·125
C30*	Part HT smoothing	32·0
C31	Fixed tone corrector	0·002
C32	Part negative feed-back	0·05
C33*	Part HT smoothing	32·0
C34	T.I. feed decoupling	0·05
C35‡	Aerial IF filter tuning	0·00017
C36‡	Image suppression adjuster	0·00003
C37‡	Band-pass Pri. MW trimmer	0·00003
C38†	Band-pass primary tuning	0·00049
C39‡	Band-pass sec. MW trimmer	0·00003
C40†	Band-pass secondary and SW aerial tuning	0·00049
C41†	Oscillator circuit tuning	0·00049
C42‡	Osc. circuit MW trimmer	0·00003
C43‡	Osc. circuit LW trimmer	0·00003
C44‡	1st IF trans. pri. tuning	0·00017
C45‡	1st IF trans. sec. tuning	0·00017
C46‡	2nd IF trans. pri. tuning	0·00017
C47‡	2nd IF trans. pri. tuning	0·00017

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF filter coil	140·0
L2	Aerial band-pass coupling coils	40·0
L3	Aerial band-pass coupling coils	100·0
L4	Band-pass primary coils	4·5
L5	Band-pass primary coils	48·0
L6	Band-pass coupling coils	1·0
L7	Band-pass coupling coils	1·0
L8	Aerial SW tuning coil	0·05
L9	Band-pass secondary coils	4·5
L10	Band-pass secondary coils	48·0
L11	Osc. circuit SW tuning coil	0·05
L12	Osc. circuit MW tuning coil	12·0
L13	Osc. circuit LW tuning coil	35·0
L14	Osc. anode SW reaction coil	40·0
L15	Osc. anode MW reaction coil	4·5
L16	Osc. anode LW reaction coil	9·0
L17	1st IF trans. Pri.	135·0
L18	1st IF trans. Sec.	135·0
L19	2nd IF trans. Pri.	135·0
L20	2nd IF trans. Sec., total	135·0
L21	Parts negative feed-back circuit	175·0
L22	Parts negative feed-back circuit	3·0
L23	Speaker speech coil	3·5
L24	HT smoothing choke	375·0
T1	Speaker input trans. Pri.	800·0
	Speaker input trans. Sec.	0·4
T2	Mains trans. Pri., total	43·0
	Mains trans. Heater sec.	0·05
	Mains trans. Rect. ht. sc.	0·15
	Mains trans. HT sc., total	245·0
S1	Mains aerial switch	—
S2-S22	Waveband switches	—
S23	Gram. PU switch	—
S24	Mains switches, ganged R17	—
S25	Mains switches, ganged R17	—

Switch Table and Diagrams

Switch	SW	MW	LW	Gram.
S2	C	—	—	—
S3	—	C	C	C
S4	—	—	—	C
S5	—	C	—	—
S6	C	C	—	C
S7	—	C	—	C
S8	C	—	—	—
S9	—	C	C	—
S10	—	—	—	C
S11	C	C	C	—
S12	—	C	C	—
S13	C	—	—	—
S14	—	C	C	—
S15	—	—	—	C
S16	—	C	—	—
S17	—	C	—	—
S18	C	—	—	—
S19	—	C	C	—
S20	C	C	C	—
S21	—	C	C	C
S22	C	—	—	C
S23	—	—	—	C



Diagrams of the waveband switch units, as seen when viewed from the rear of the underside of the chassis. **Be** indicates bearer tags.

DISMANTLING THE SET

The cabinet is fitted with a detachable bottom, upon removal of which access may be gained to most of the components in the under-chassis compartment.

Removing Chassis.—Remove the four control knobs (recessed grub screws, two in each of the large knobs);

remove the four bolts (with washers) holding the chassis to the bottom of the cabinet;

unsolder the earthing lead to the screen on the bottom of the cabinet;

unsolder from the tuning indicator holder the leads going to the scale lamps;

from the speaker and its transformer **T1** unsolder the leads connecting them to chassis;

free the scale lamp leads from the two cleats holding them to the sub-baffle, and remove the entire scale assembly (four round-head wood-screws with washers).

Chassis and scale assembly may now be withdrawn from the cabinet.

When replacing chassis, take the speaker lead with green paint on it to the secondary (wide-spaced contacts) right-hand or rear contact on the transformer and to tags 1 and 2 (numbering from left to right when viewed from rear) on the speaker connecting panel; take the red-painted lead of the primary pair to the primary (close-spaced contacts) right-hand or rear contact.

It is important that the two painted leads mentioned should be connected respectively to primary and secondary contacts at the same end of the transformer. If one pair is reversed, negative feed-back will become positive, and the receiver will become unstable.

When replacing the control knobs, the large knob engraved with a white spot should go on the left-hand (tone-control) spindle.

Removing Speaker.—Remove the chassis as already described so far as necessary to give access to the speaker and free its leads;

slacken the four clamps (nuts, lock-nuts and washers) holding it to the sub-baffle, and swivel the clamps.

When replacing, the connecting panel should be at the top, and the leads should be connected as previously described.

Model 747AX

Removing Converter Unit.—After removing the back cover from the receiver, the unit will be seen suspended from the top of the cabinet. At about the centre of its length is a join where the solid cap overlaps the perforated main body;

slacken the two milled head screws holding the cap to the body at the join;

grasp the cap with the left hand, and the body with the right hand, and ease the two sections slightly apart, when they will slip out of the two slotted brackets holding them to the top of the cabinet.

The left-hand (cap) portion contains the vibrator and its six connecting prongs, and the right-hand (body) portion the input and smoothing components.

To free the body (which is attached to the mains input panel of the receiver by a 5-way cable) entirely, remove the two set-screws from the two bottom corners of the upper section of the panel.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 231 V, using the 220 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.

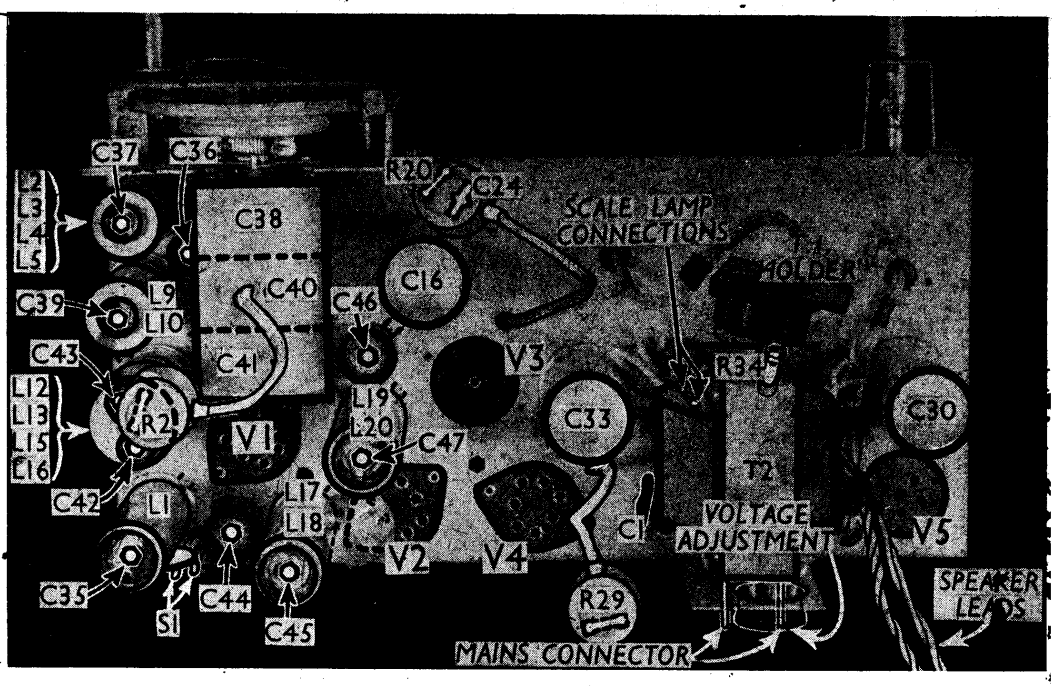
Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC4	265	1·4	82	4·7
	Oscillator		—	—
	76	1·9	—	—
V2 VP4B	265	7·4	155	2·4
V3 TDD4	62	0·8	—	—
V4 Pen4DD	245	34·0	265	6·0
V5 1821	275†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—S1 is the mains aerial switch, mounted on a bracket at the rear of the chassis, just above the **A** and **E**



Plan view of the chassis. Note the components mounted in **V1**, **V3** and **V4** top cap connectors. The speaker input transformer **T1** is not shown, but it may be mounted on the speaker or baffle or, in some cases, on the front right-hand corner of the chassis below **T.I.** holder. **R34** is mounted directly on the tags of the **T.I.** holder. In the 747AX model an additional panel is mounted above the mains connection panel shown in this illustration.

sockets. Two contacts of the switch unit are blank, while the other two forming the switch are *closed* when the lever control is moved so as to cover the aerial socket.

S2-S23 are the waveband and pick-up switches, ganged in four rotary units beneath the chassis. These are indicated in our under-chassis view, and are shown in detail in the diagrams in col. 2, where they are drawn as seen when viewed from the rear of the underside of the chassis. There is a good deal of interconnection between the switches, particularly on the fourth unit, which we have indicated as clearly as possible.

The table (col. 2) gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

S24 and **S25** are the QMB mains switches, ganged with the volume control **R17.**

Scale Lamps.—These are three Philips MES types, with frosted tubular bulbs, type 8042-07.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (5.5 O) external speaker.

Resistances R23, R32.—**R23** consists of two 20,000 O resistors in parallel, and **R32** of a 4 MO and 5 MO in series.

Components R2, R20, C24 and **R29.**—**R2** is inside the top cap connector of **V1**, **R20** and **C24** are inside the top cap connector of **V3**, and **R29** is inside the top cap connector of **V4.**

V4 Connections.—The Pen4DD has a 7-pin base with connections differing from usual. The anode and cathode are interchanged, so that pin 2 is cathode and pin 6 is anode.

Chassis Divergencies.—We have examined circuit diagrams of the 747A and 747AX, and neither agrees entirely with our own chassis, which resembles most nearly the 747AX. The early 747A chassis had an ordinary pentode for **V4,** and not a double diode pentode, and this, of course, affects the AF end of the set considerably.

Some of the values for components do not agree with the makers' figures for the 747AX, but the differences are not important.

R33 may be 320 O, **L22** may not be present, and **C25** may not be present.

The radiogram models are similar in the main, but again certain component values in the AF end may be different.

To cover all the divergencies here would be very confusing, and, working from the *Service Sheet,* the competent engineer should not find serious difficulty in following any of the divergent chassis.

The main difference between the chassis of the 747A and that of the 747AX is in the arrangement of the mains input panel. The panel of the 747A has two prongs mounted on it, to accept the mains connector, and a circular voltage adjustment device just below the prongs.

On the 747AX there are two panels, one mounted directly above the other. The lower one carries several connecting prongs, each solid and much smaller than the two on the 747A, and the voltage adjustment device. The upper panel carries five pins in a row at the bottom and two filter condensers at the top. The mains connector is reversible, for AC or DC, and the row of prongs on the upper panel are engaged only for DC operation. The cable from the converter unit is connected only to the upper panel.

CIRCUIT ALIGNMENT

It is not necessary to remove the chassis when aligning; merely place the receiver on its left side, and remove the bottom plate and the back of the cabinet.

IF Stages.—Connect up an earth wire, switch set to LW, turn volume and tuning controls to maximum. Connect signal generator via a 0.032 μF condenser to control grid (top cap) of **V1** (leaving existing top cap connection) and chassis. Feed in a 128 KC/S signal.

Connect a 25,000 O resistor and 0.1 μF condenser in series, between top cap of **V2** and chassis. Adjust **C44** for maximum output. Connect the resistor and condenser between anode of **V1** and chassis, and adjust **C45** for maximum output. Connect the resistor and condenser across **L20,** and adjust **C46** for maximum output. Connect resistor and condenser between anode of **V2** and chassis, and adjust **C47** for maximum output.

Seal trimmers with wax, remove resistor and condenser, and signal generator coupling condenser.

RF and Oscillator Stages.—If chassis has not been removed from cabinet, the usual method employing a 15 degree jig cannot be used. In this case, ordinary scale settings may be used, providing calibration is not suspected of being inaccurate.

MW.—Switch set to MW, turn volume control to maximum, and tune to 208 m on scale. Connect signal generator to **A** and **E** sockets via a dummy aerial, and feed in a 208 m (1,442 KC/S) signal. Connect 25,000 O resistor and 0.1 μF condenser in series between top cap of **V2** and chassis. Adjust **C42, C39** and **C37** for maximum output. Readjust **C39,** then **C42,** and then seal all three trimmers.

LW.—Switch set to LW. Feed in a 395 KC/S (760 m) signal, tune it in, and adjust **C43** for maximum output, then re-seal.

Image Suppressor.—Switch set to MW. Feed in a strong 1,000 KC/S (300 m) signal, tune set to 403 m on scale, adjust **C36** for *minimum* output, and re-seal.

IF Filter.—Switch set to LW, feed in a strong 128 KC/S signal, turn tuning condenser to maximum, and adjust **C35** for *minimum* output, then re-seal.

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