ELECTRICAL AND MECHANICAL
ENGINEERING REGULATIONS
(By Command of the Army Council)

TELECOMMUNICATIONS
Z 382

SIGNAL GENERATORS NO 1, MKS 1, 2, 2/1

GENERAL DESCRIPTION

Errata

Note: This page will be filed immediately in front of page 1, Issue 1, dated 28 Jan 47.

1. The following amendments will be made to the regulation.

2. Page 1003, Issue 1, pages 1005 and 1007, Issue 2, (Figs 1002, 1003 and 1004).

   Add note against pin 8 of A.C. MAINS SOCKET: 'TO SUPPLY EARTH'
   (Tels Z 387 Mod Instr No 2 refers).

3. Pages 1003 and 1005 (Figs 1002 and 1003) BATTERY SOCKET

   Delete 'L.T.-' and reinsert under H.T.-

4. Page 1007 (Fig 1004) PIA

   Delete circle denoting the spigot and reinsert centrally between pins 5 and 6

SIGNAL GENERATORS NO.1, MKS.1, 2, 2/1

GENERAL DESCRIPTION

Note: This information is provisional and is supplied for guidance pending the issue of more complete instructions. All errors of a technical nature should be notified in accordance with Tels. A 009.

PRELIMINARY DESCRIPTION

Electrical (see Fig.1)

1. Signal generator No.1 is a precision instrument supplying an R.F. signal of accurately known amplitude. It is a commercial equipment (Marconi instruments, type TF 144), and the commercial types corresponding to the various marks are given in Table 1.

Army mark	Marconi reference
1	TF 144F
2	TF 144G
2/1	TF 144G

Table 1 - Commercial type references

2. A triode R.F. oscillator generates a C.W. signal of frequency variable between 85kc/s and 25Mc/s in eight ranges, the frequency coverage of each range being detailed in Table 2. The output of the oscillator is loosely coupled to a ladder attenuator, the current through (and thus, indirectly, the voltage across) which is monitored by a thermocouple meter. The attenuator consists of five multiplier steps and a slide wire portion, giving an output continuously variable from 1μV to 1V. The output is taken via a coaxial cable and terminating dummy aerial to the equipment under test.

Frequency ranges
Kilocycles
85 - 200
200 - 500
500 - 1,300
1,300 - 2,500
Megacycles
2.5 - 4.5
4.5 - 8
8 - 15
15 - 25

Table 2 - Frequency ranges

3. When an amplitude-modulated signal is required, a triode A.F. oscillator generates a modulation frequency of 400c/s which is amplified and then used to plate-modulate the R.F. oscillator. Modulation depth may be varied from zero to 75%.

External modulation may be applied either directly to the R.F. oscillator or through the A.F. amplifier.

4. The instrument will operate on either mains or battery supply. A mains supply of 200 to 250V, 40 to 100c/s A.C., is required, the power consumption being 40W. Battery operation requires an H.T. supply of 200V at 30mA and an L.T. supply of 4V at 3.5A.

5. All three marks are fundamentally the same both in construction and in operation. The Mk.2 differs from the Mk.1 in some of its attenuator resistances and the output impedances are therefore slightly different; there are also very minor circuit differences. The Mk.2/1 differs from the other two models in valve types and in several component values, and has an improved thermocouple and meter arrangement.

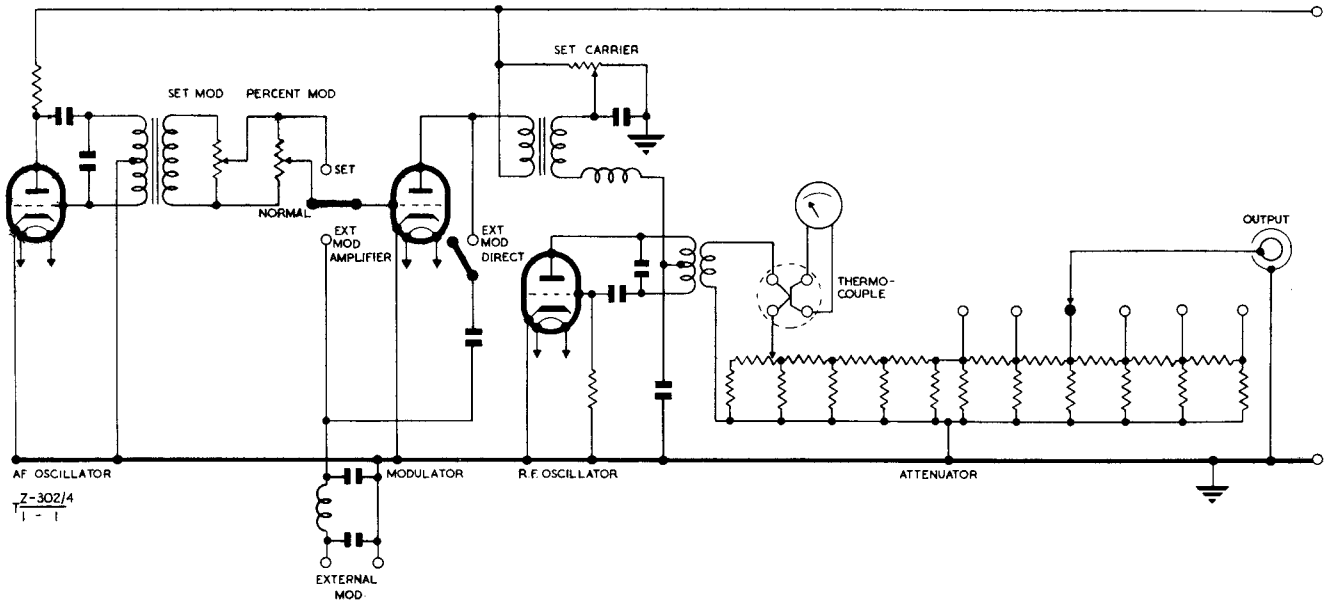


Fig. 1 - Basic circuit

Mechanical

6. The instrument is housed in a substantial screening case. The front panel and chassis are readily removable from the case after withdrawal of coin-slotted screws. Two front panel rails protect the controls, all of which are brought out to the front panel. Two carrying handles are fitted.

7. The R.F. oscillator is housed in a central aluminium casting. The coils for the various frequency ranges are mounted in a cylindrical screen, and switching is accomplished by rotating the coil unit bodily. Each coil assembly is a separate unit and may readily be removed or replaced. Beryllium copper contacts with a vigorous wiping action ensure reliable switch action.

8. The tuning condenser shaft is coupled to the control knob by an epicyclic reduction drive, and the dial is locked to the condenser shaft directly. An incremental tuning control rocks the stator of the main tuning condenser over a small angle by means of a cam and lever mechanism.

9. The monitor and attenuator circuits are separately screened and fixed to the front panel, the thermocouple being mounted in the slide wire section of the attenuator casting. To reduce contact noise the slide wire uses only a single moving contact to provide very nearly constant impedance termination in both directions, and also uses the same metal for the resistance elements and the sliding contact.

10. The multiplier section of the attenuator casting is sectionalized to ensure a low impedance earth return path and good screening. The saw cut in the attenuator casting prevents circulating currents which would give rise to errors at low outputs and high frequencies.

11. Power supply and A.F. circuits form a separate sub-assembly. The A.F. oscillato and modulation transformers are housed in subsidiary screens mounted on the chassis.

Controls (see Figs.1001 - 1004)

12. The following controls are located on the front panel of the instrument:-
(a) SUPPLY ON/OFF switch, which, when closed, completes the primary circuit of the mains transformer.
(b) RANGE switch, an 8-position switch rotating the coil turret of the R.F. oscillator section.
(c) FREQUENCY control, operating the variable 2-gang condenser C20A, and having a dial with eight calibrated scales corresponding to the eight frequency ranges and an outer scale calibrated in degrees.
(d) Locking knob, locking the main FREQUENCY control in position.
(e) INCREMENTAL TUNING control, calibrated linearly in 100 divisions, ± 50 on either side of zero; the frequency coverage of this control (for any given setting of the FREQUENCY control) corresponding to that lying between the two hair lines on either side of the indicator line on the cursor of the FREQUENCY control.
(f) SET CARRIER control, a variable resistor R6A, the setting of which controls the anode voltage of the R.F. oscillator and thus determines the output of the oscillator.
(g) MULTIPLIER switch, a 6-position switch operating the step section of the attenuator, each position being marked with a multiplication factor and a db. equivalent.
(h) OUTPUT VOLTAGE control, operating the slide wire portion of the attenuator and having a dial calibrated in terms of voltage and of dbs.
(j) SET MOD control, a variable resistor R5A which, in series with a fixed resistor, shunts the secondary winding of the A.F. oscillator transformer and thus controls the output of the oscillator.
(k) PERCENT MOD control, a variable resistor R7A in the grid circuit of the A.F. amplifier, controlling the input to the valve and thus the depth of modulation.
(l) Selector switch S2A, of which the five positions (EXT. MOD. AMPLIFIED/ EXT. MOD. DIRECT/ C.W./ INT. MOD. SET/ INT. MOD. NORMAL) arrange the circuit for:-
(i) The application of an external A.F. signal to the A.F. amplifier.
(ii) The application of an external A.F. signal direct to the oscillator.
(iii) Operation on C.W. only.
(iv) The preliminary adjustment of internal modulation.
(v) Operation with internal modulation.

13. An 6-pin plug P1A on the front panel accepts either the MAINS socket or the BATTERIES socket. A coaxial OUTPUT socket mounted immediately above the MULTIPLIER control feeds the output of the instrument to the coaxial cable and dummy aerial. Two terminals, EXTERNAL MOD and E, provide for the introduction of external modulation.

14. The monitoring meter, the dial of which is calibrated with SET CARRIER and SET MODULATION positions, and a pilot lamp are mounted on the front panel.

TECHNICAL DESCRIPTION

R.F. oscillator

15. The R.F. oscillator employs a triode valve in a Hartley circuit. The frequency is varied by means of a turret switch which brings into circuit different coils for each of the eight ranges, and within each range by a variable condenser, C20A. The coils for the next three lower frequency ranges than that in use are automatically short-circuited by auxiliary contacts. The tuning condenser has two sections, and the internal wiring of the coil unit is so arranged that a single section only is used above 1.3Mc/s, while both sections are in operation on coils of lower frequency.

16. The INCREMENTAL TUNING control provides fine frequency control over a limited range at any given setting of the FREQUENCY control. The FREQUENCY control may be locked by the clamp provided, and the INCREMENTAL TUNING control then rocks the stator plates of the main tuning condenser. The range of incremental tuning provided is indicated by the two outer hair-lines engraved on the cursor on the main dial. The INCREMENTAL TUNING dial is calibrated 50 - 0 - 50. If, for example, the FREQUENCY control is set to 350kc/s, the INCREMENTAL TUNING control covers the range 345 to 355kc/s, so that each division corresponds to 100c/s.

17. The R.F. output is fed to a coupling coil and thence to the attenuator and thermocouple. The amplitude of the R.F. current entering the attenuator is controlled by the SET CARRIER control R6A which varies the anode voltage of the oscillator.

Monitor

18. The R.F. current entering the attenuator heats the heater winding of the thermocouple, and the resulting E.M.F. across the couple operates the meter. The SET CARRIER mark at about half-scale deflection corresponds to 20mA R.F. current, while full-scale deflection is produced by about 25mA. When the meter reads SET CARRIER, the voltage delivered to the attenuator is exactly 1V.

Attenuator

19. The slide wire OUTPUT VOLTAGE section of the attenuator is similar in design to a constant-impedance ladder network, in which the series elements are wound on a single card and are provided with a sliding contact. The variation of input impedance with the slider setting is approximately $\pm$ 2%. The former of the series element is necessarily of appreciable cross-section, and an Ayrton-Perry winding is therefore adopted. The control provides a logarithmic scale; the output voltage may thus be read with equal accuracy at all parts of the scale. The shunt elements of the slide wire consist of carbon composition resistors.

20. The slide wire is terminated by the input impedance of a 6-position ladder network of 20db. steps. The resistors in this section are wound on thin mica cards. At the x100mV setting of the MULTIPLIER, (i.e., for output voltages from 0.1 to 1.0V) the use of an external load impedance much less than 500Ω may result in damage to the thermocouple; and the danger of damage is greatest at frequencies below about 6Mc/s. The MULTIPLIER switch is therefore provided with a mechanical stop controlled by a thumb lever on the panel; it is necessary to depress the lever in order to set the switch to x100mV. The Mks. 1 and 2 instruments also have a limiting resistor, R43, fitted (see Figs. 1002, 1003) as a further safeguard (see Tels. Z 307/3, Mod. Instruction).

21. The internal output and permissible load impedances are given in Table 3. The internal output impedance is independent of the slide wire setting, except in the region of 1V output, where the impedance falls somewhat. The accuracy of the attenuator, and therefore of the output voltage, will be seriously impaired if the external load impedance is less than the figures quoted. The external load impedance figures quoted represent approximately the impedance which will reduce the output voltage by 5%.

MULTIPLIER setting	Internal output impedance		Minimum permissible external load impedance
	Mk.1	Mk.2, 2/1	Mks.1, 2, 2/1
x1μV	10Ω	10Ω	200Ω
x10μV	10Ω	10Ω	200Ω
x100μV	10Ω	10Ω	200Ω
x1mV	10Ω	10Ω	200Ω
x10mV	15Ω	10Ω	300Ω
x100mV	52.5Ω Max.	52.5Ω max.	1kΩ

Table 3 - Internal output and load impedances

Modulator

22. The modulation depth in all cases is referred back to the rise in R.F. current in the tuned circuit consequent upon the heavy modulation. The SET MODULATION mark on the monitoring meter corresponds to approximately 80% peak modulation with a sinusoidal modulating wave.

23. Since the indication is in R.M.S. terms, errors in peak modulation may arise if the modulation wave form is poor. This fact must be borne in mind when using external modulation. Errors from this source do not arise when using internal modulation, since the calibration is effected by an absolute external method.

24. Internal modulation is supplied by a Hartley A.F. oscillator, giving a modulating frequency of 400c/s. The output of the oscillator is controlled by the SET MOD potentiometer R5A. With the selector switch in the INT. MOD SET position, this output is applied directly to the grid of the A.F. amplifier and thence to the modulation transformer T4A, the secondary winding of which is in series with the H.T. supply to the R.F. oscillator. With the SET MOD control adjusted until the pointer of the meter reads SET MODULATION, the depth of modulation is 80%. A smaller depth of modulation is obtained by putting the selector switch to INT. MOD. NORMAL, when a second potentiometer is brought into operation to control the input to the A.F. amplifier. This potentiometer is the PERCENT MOD control, the dial of which is

calibrated to read the percentage depth of modulation directly.

25. For external modulation, two alternative circuits are provided. In both cases the internal A.F. oscillator is prevented from oscillating by certain of the selector switch contacts. The modulation depth must be set in both cases by adjusting the input voltage. The external source of modulation is connected to the instrument via the EXTERNAL MOD and E terminals.

26. Where amplification of the applied external modulation is desired, the selector switch is set to EXT. MOD. AMPLIFIED, and the modulation is thus applied to the grid of the A.F. amplifier. The input voltage required is small and the input impedance is 0.5MΩ. About 1V input produces 15% modulation. The AMPLIFIED position is intended mainly for use with shallow modulation depths.

27. Where the external modulation is to be applied directly, the selector switch is put to EXT. MOD. DIRECT and the modulation is then fed to the primary of the modulating transformer. Direct modulation must be used where deep modulation is required and for accurate fidelity determinations. The input impedance is 6kΩ, and an input of 25V will give a modulation depth of 40%.

Power supplies

28. The internal power supply circuit for mains operation follows standard practice, using a full-wave valve rectifier and associated smoothing equipment. The SUPPLY ON/OFF switch is inoperative on battery operation, but in some cases the battery lead supplied is fitted with a switch.

Note: The next page is Page 1001.

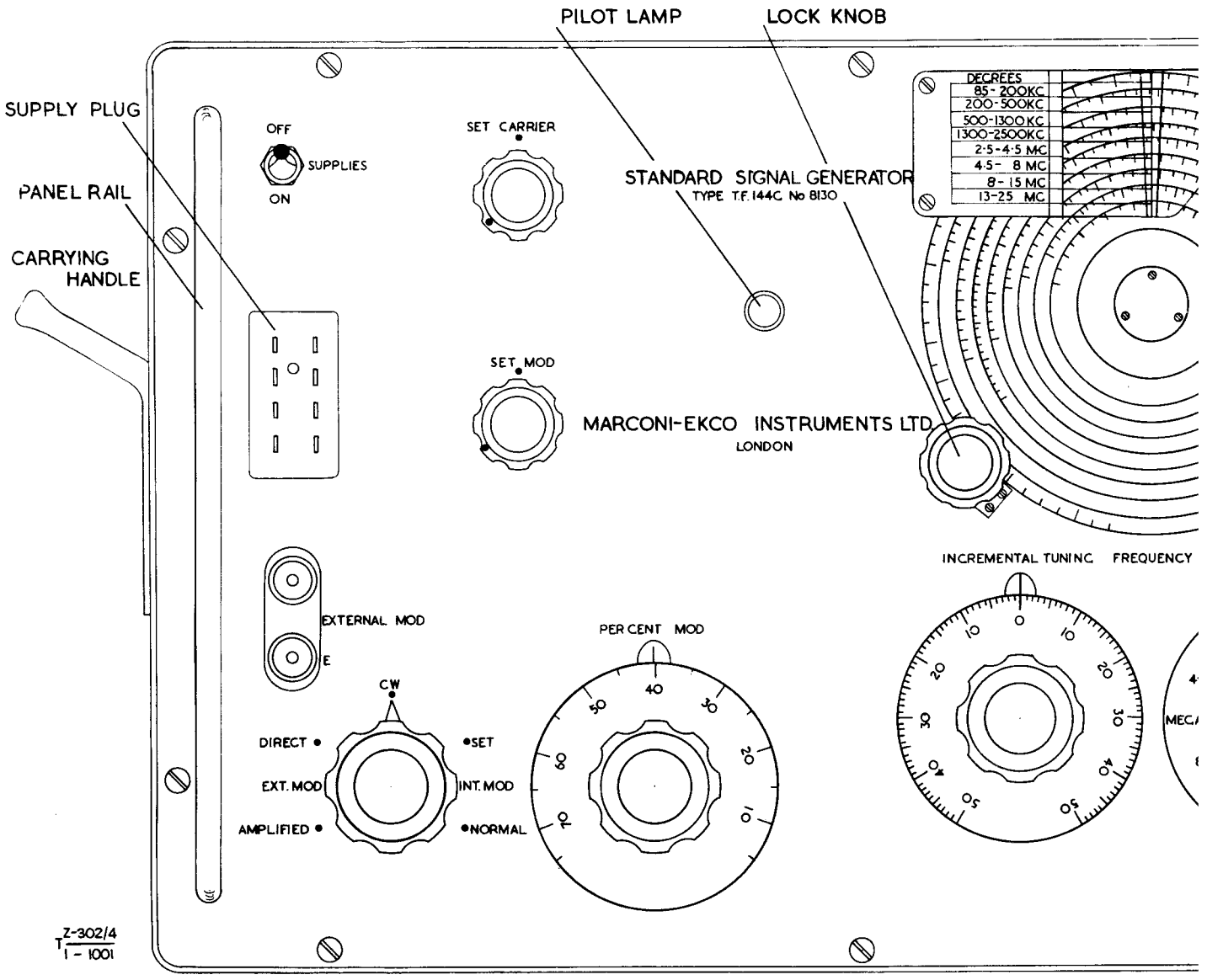
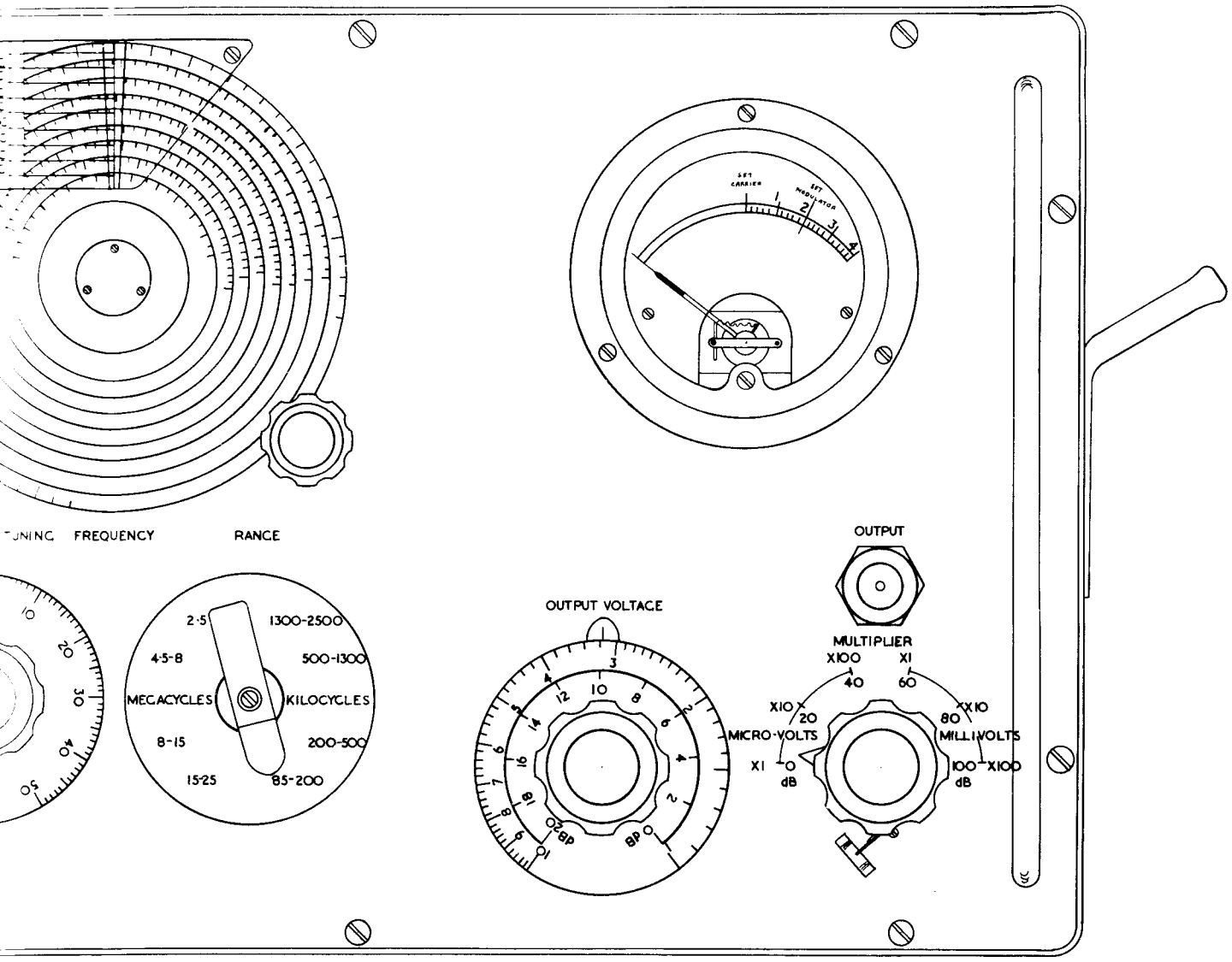


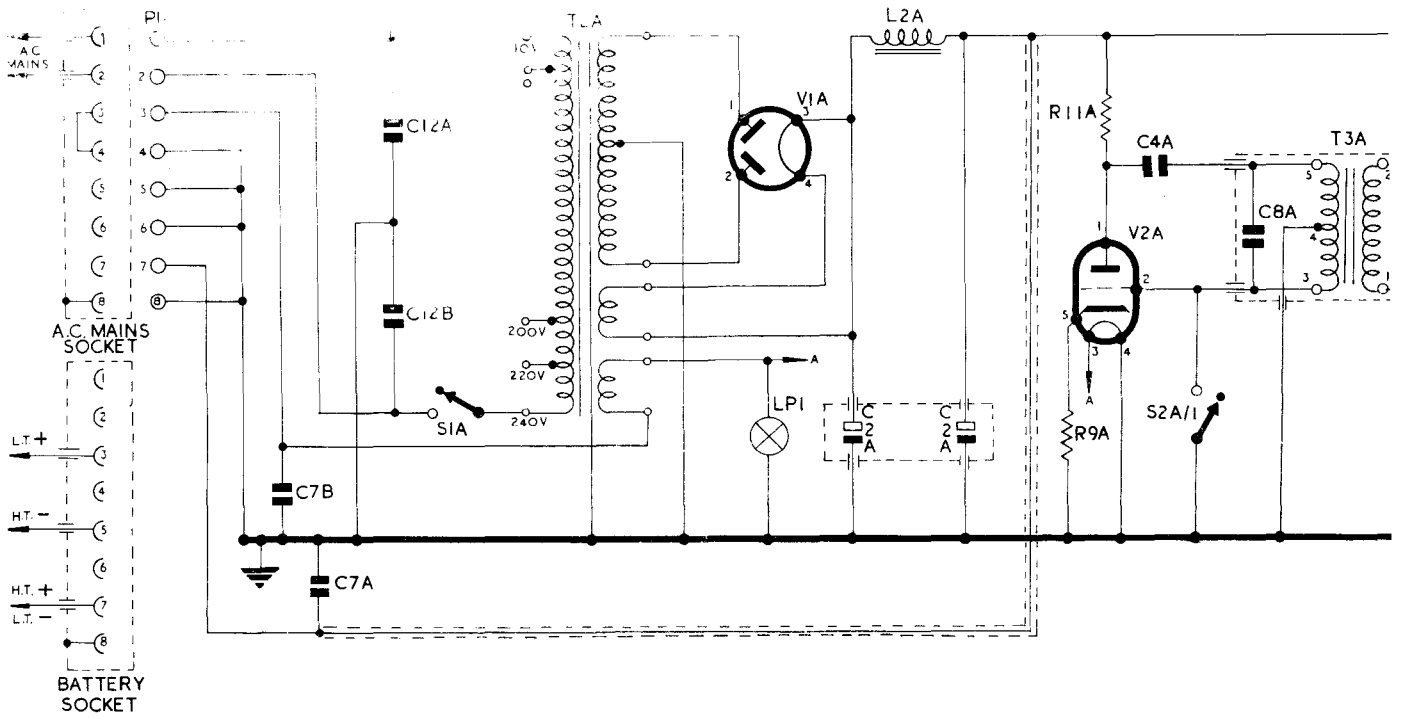
Fig.1001 - Front p

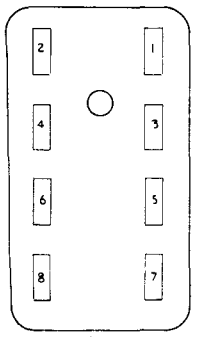


01 - **Front panel**

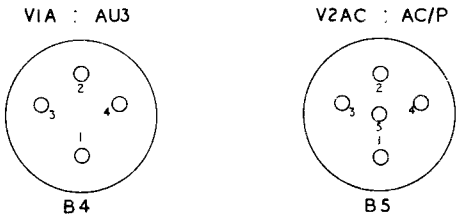
Table 1001 - Details of components

Circuit reference	Type, function or value	
	INDUCTORS	
L1	Chokes, A.F., No. 139 45H	(Tropical)
L2	Chokes, A.F., No. 139A:45H	(Non-tropical)
L3	Chokes, A.F., No. 121 :6mH	(Incorporating R16)
L4	Chokes, R.F., No. 128 :6.2mH	
L5	Inductances, oscillator, No. 23A	(15-25 and 8-15Mc/s)
L6	Inductances, oscillator, No. 23B	(4.5-8 and 2.5-4.5Mc/s)
L7	Inductances, oscillator, No. 23C	(1,300-2,500kc/s and 500-1,300kc/s)
L8	Inductances, oscillator, No. 23D	(200-500kc/s and 85-200kc/s)
	TRANSFORMERS	
T1	Power, 40VA, No.2 : Primary 200-250V	(Tropical)
T2	Power, 40VA, No.2A : Primary 200-250V	(Non-tropical)
T3	Oscillator, A.F., No.4	
T4	Modulator, No.12	
	SWITCHES	
S1	On/off, S.P., No.2	(SUPPLY ON/OFF)
S2	8-pole, 5-position, No.1	(Selector)
S3	On/off, D.P., No.20 : 250V, 5A	(SUPPLY ON/OFF)
-	Turrets, coil, No.4	(RANGE)
	LAMPS	
LP1	6V, 0.3A, No.1 or 6V, PL or 6.5V T : MES cap	
	SOCKETS	
SK1	Sockets, 8-point, No.3	(Mains/battery input)
SK2	Sockets, coaxial, No.2	(Dummy aerial)
	PLUGS	
PL1	Plugs, 2-point, No.11 or 3-point, No.7	(Mains)
PL2	Plugs, 8-point, No.3	(Mains/battery input)
PL3	Plugs, single, No. 58	(Battery)
	VALVES	
V1	F.W. rectifier : UU4, UU5 (AU3A)	
V2	Triode : AC/P	
V3	F.W. rectifier : MU12/14 (AU3)	
V4	Triode : ML4	





P1A
(LOOKING AT PINS)
A.C. MAINS AND
BATTERY SOCKETS
(LOOKING AT BACK)

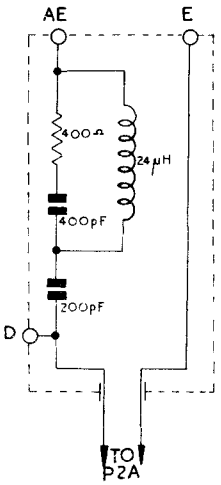


VALVE BASES: BOTTOM VIEW

MODULATION SWITCH S2A	
SWITCH SETTING	CONTACTS CLOSED
EXT. MOD. AMPLIFIED	NUMBERS 1, 4, 8
EXT. MOD. DIRECT	NUMBERS 1, 5, 6, 7
C.W.	NUMBERS 7, 8
INT. MOD. SET	NUMBERS 2, 8
INT. MOD. NORMAL	NUMBERS 3, 8

S1A	SUPPLIES ON/OFF SWITCH
R5A	SET MOD. CONTROL
R6A	SET CARRIER CONTROL
R7A	PERCENT MOD. CONTROL
A3A	MULTIPLIER CONTROL AND OUTPUT CONTROL

ARROWS ON A3A SHOW DIRECTION OF ROTATION FOR INCREASED OUTPUT FROM P2A (OUTPUT PLUG)



DUMMY AERIAL SUPPLIED WITH INSTRUMENT

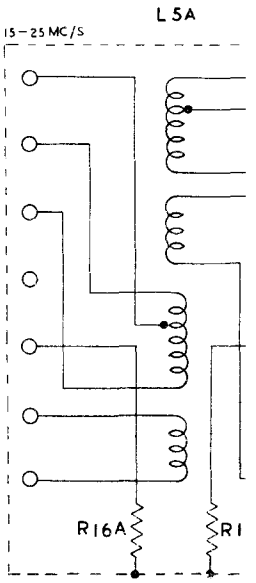


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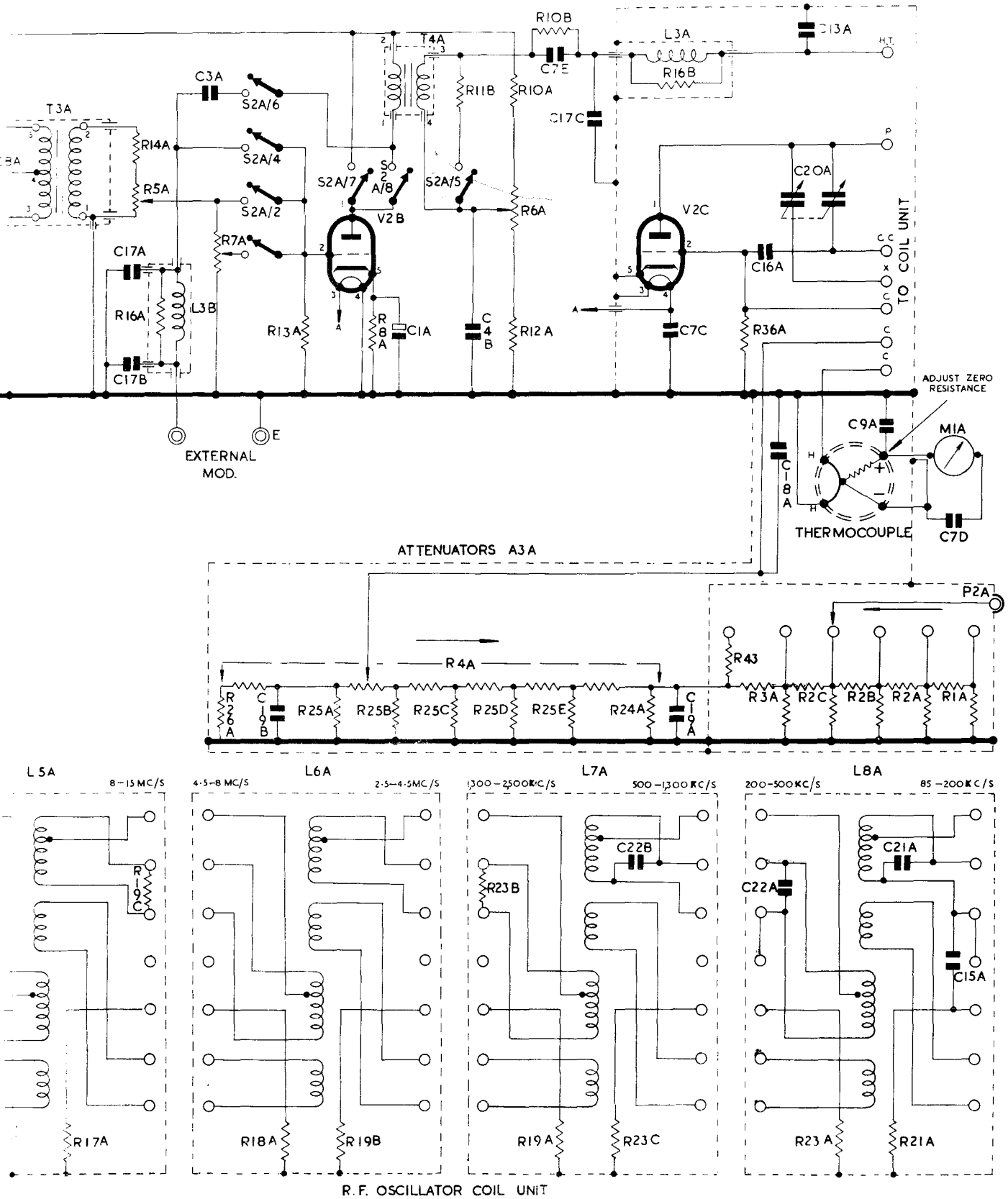
Fig. 1002 - Circuit diagr

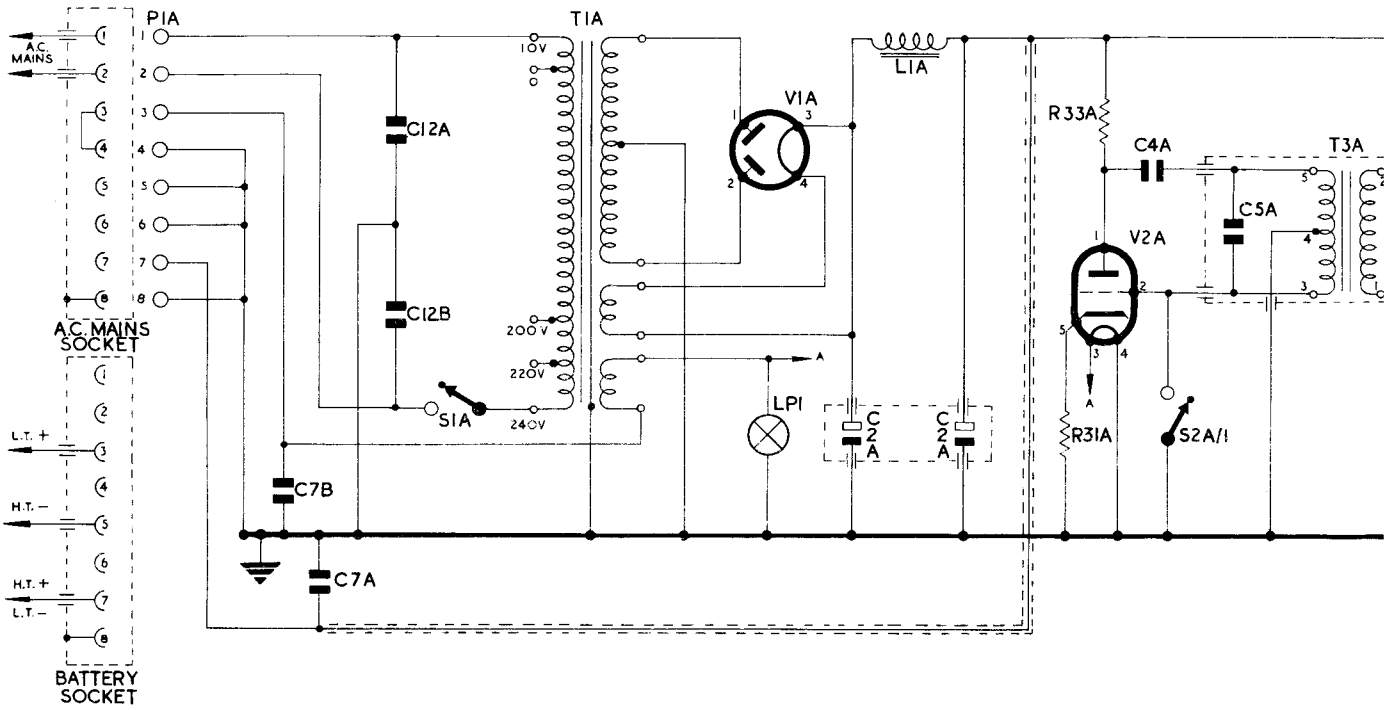


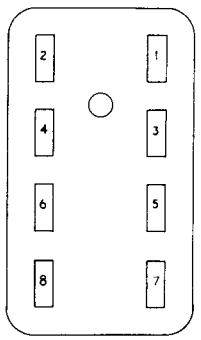
it diagram (Mk.1)

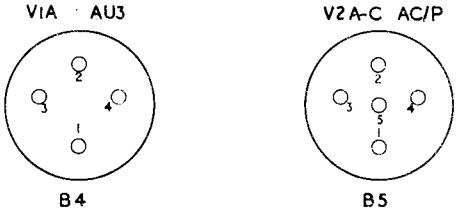
Table 1001 (contd.)

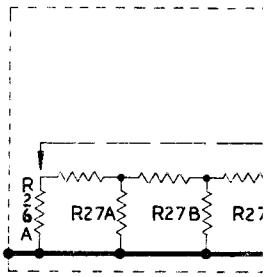
Circuit reference	Type, function or value
	METERS
M1	Meters, test, No.13
M2	Meters, test, No.13A
	THERMOCOUPLES
-	25mA, No.1, Vacuum type (Mks.1, 2)
-	25mA, No.2, Vacuum type (Mk. 2/1)
	CONDENSERS
C1	25µF, 25V D.C. wkg., Electrolytic, metal case
	or 25µF, 25V D.C. wkg., Electrolytic, aluminium case
C2	8+ 8µF, +50% -20%, 500V D.C. wkg., Electrolytic
C3	4µF, ± 10%, 250V D.C. wkg.) or
C4	1µF, ± 15%, 250V D.C. wkg.)
C3, C4	4+1+1µF, ± 10%, 350V D.C. wkg.
C5	0.25µF, ± 10%, 350V D.C. wkg.
C6	0.2 µF, ± 20%, 350V D.C. wkg.
C7	0.1 µF, ± 10%, 350V D.C. wkg.
C8	0.01µF, ± 15%, 450V D.C. wkg.
C9	0.01µF, ± 10%, 350V D.C. wkg.
C10	0.01µF, ± 10%, 350V D.C. wkg.
C11	0.005µF, ± 15%, 350V D.C. wkg.
C12	0.002µF, ± 15%, 350V D.C. wkg.
C13	0.0015µF, ± 2%, 350V D.C. wkg.
C14	0.0001µF, ± 5%, 350V D.C. wkg.
C15	0.0001µF, ± 10%, 350V D.C. wkg.
C16	0.0001µF, ± 2%, 350V D.C. wkg.
C17	0.0001µF, ± 15%, 350V D.C. wkg.
C18	0.00003µF, ± 10%, 500V D.C. wkg.
	or 0.00004µF, ± 2%, 500V D.C. wkg.
	or 0.00002µF, ± 5%, 500V D.C. wkg.
	or 0.000005µF, ± 1pF, 500V D.C. wkg.
	or 0.000002µF, ± 1%, 500V D.C. wkg.
C19	0.00001µF, ± 20%, 500V D.C. wkg.
	or 0.000005µF, ± 1pF, 500V D.C. wkg.
	or 0.00002µF, ± 5%, 500V D.C. wkg.
	or 0.000002µF, ± 1%, 500V D.C. wkg.
C20	0.00125 + 0.000305µF, variable, split stator
C21	0.000025µF, ± 5%, 500V D.C. wkg.
C22	0.000015µF, ± 5%, 500V D.C. wkg.
C23	0.0001µF, ± 5%, 350V D.C. wkg.
C24	25µF, ± 15% 350V D.C. wkg.
C25	0.002µF, ± 5%, 350V D.C. wkg.

Note: This Issue, Pages 1005 to 1008, supersedes Pages 1005 to 1008, of Issue





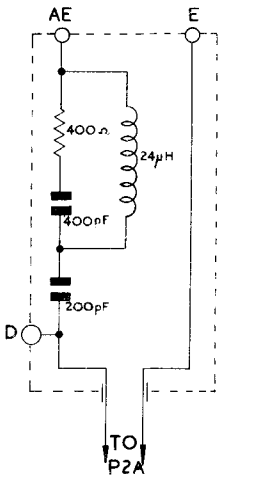




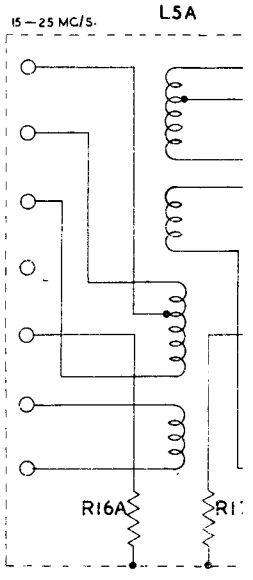
MODULATION SWITCH S2A	
SWITCH SETTING	CONTACTS CLOSED
EXT. MOD. AMPLIFIED	NUMBERS 1, 4, 8
EXT. MOD. DIRECT	NUMBERS 1, 5, 6, 7
C.W.	NUMBERS 7, 8
INT. MOD. SET	NUMBERS 2, 8
INT. MOD. NORMAL	NUMBERS 3, 8

S1A	SUPPLIES ON OFF SWITCH
R5A	SET MOD. CONTROL
R6A	SET CARRIER CONTROL
R7A	PERCENT MOD. CONTROL
A1A	MULTIPLIER CONTROL
A A	OUTPUT CONTROL

ARROWS ON A1A AND A2A SHOW DIRECTION OF ROTATION FOR INCREASED OUTPUT FROM P2A (OUTPUT PLUG)



DUMMY AERIAL SUPPLIED WITH INSTRUMENT



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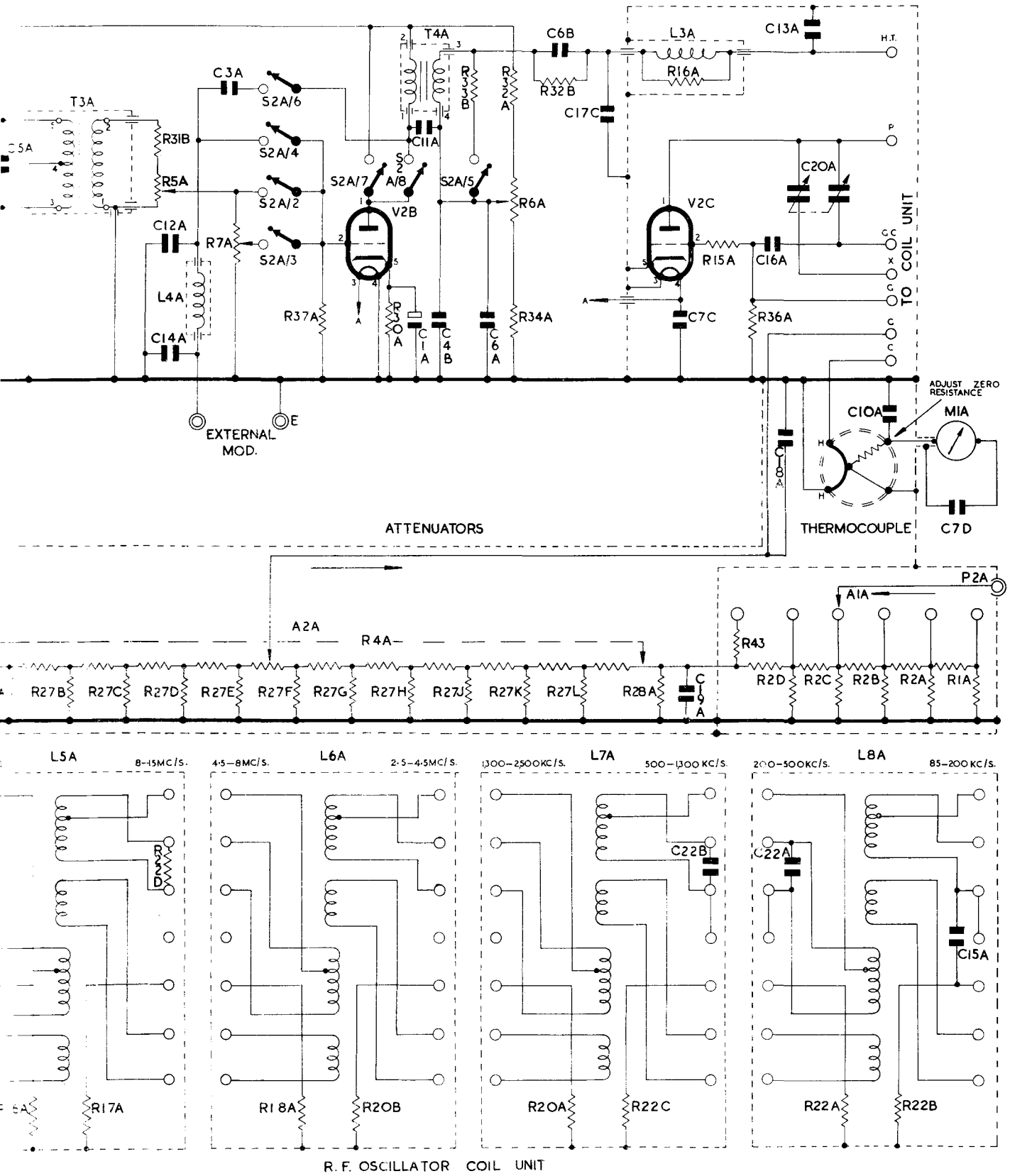
2-1003

Fig. 1003 - Circuit di

Distribution - Class 9

ce, of Issue 1, dated 28 Jan. 1947. Fig. Nos. 1003 and 1004 have been amended.

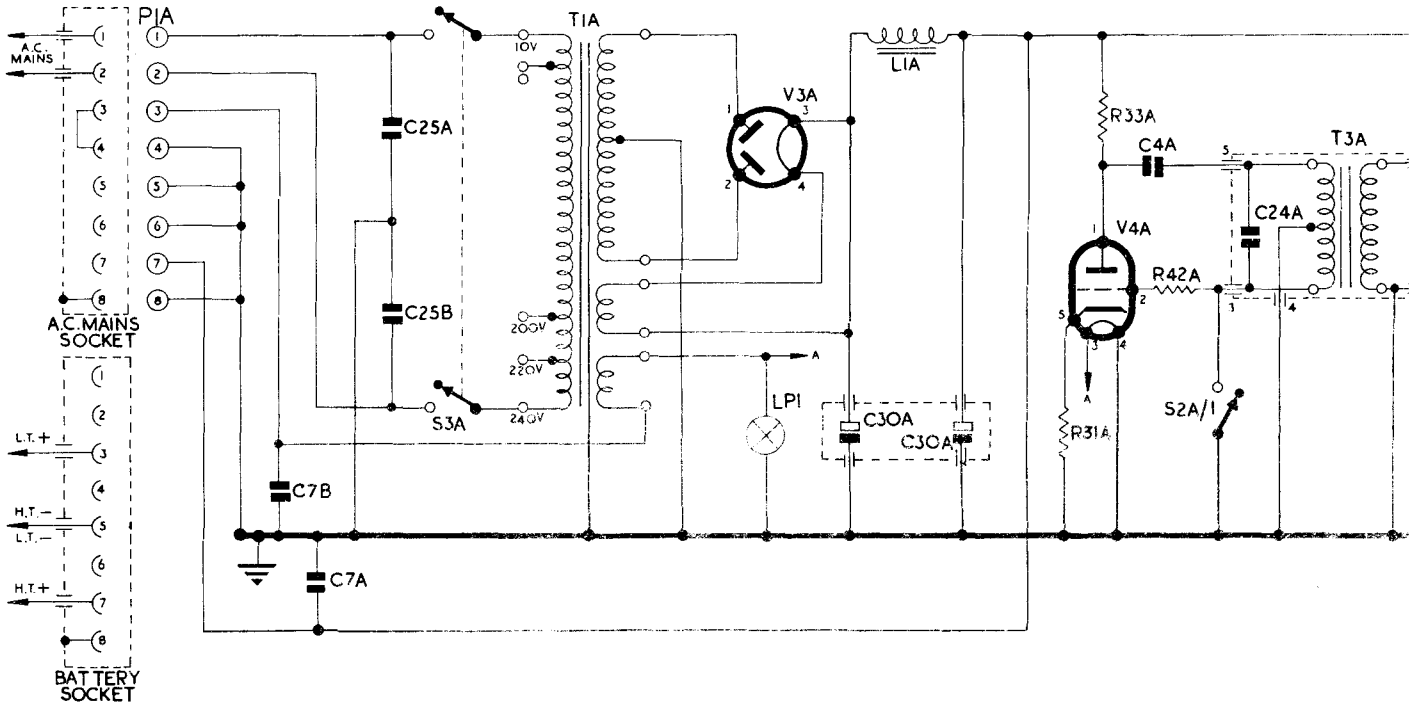


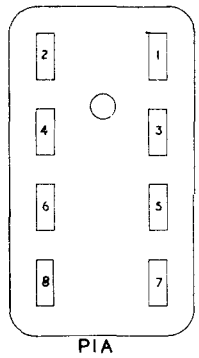
Circuit diagram (Mk. 2)

- Class 930. Code No. 4

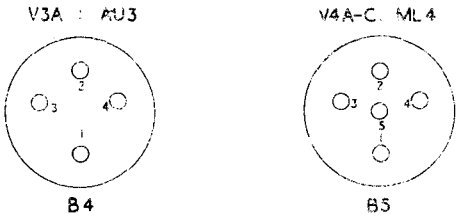
Table 1001 - (contd)

Circuit reference	Type, function or value
	CONDENSERS (contd.)
C26	0.0001μF, ± 15%, 350V D.C. wkg.
C27	0.0001μF, ± 20%, 500V D.C. wkg.
C28	0.001μF, ± 5%, 350V D.C. wkg.
C29	0.01μF, ± 25%, 350V D.C. wkg.
C30	8 + 8μF + 50% - 20%, 500V D.C. wkg.
	ATTENUATORS
A1	Tapped, R.F., No. 2
A2	Variable, R.F., No. 2
A3	Variable, R.F., No. 2A
A4	Variable, R.F., No. 3
	RESISTORS
R1	99 + 11Ω
R2	99 + 12.22Ω
R3	146.03 + 19Ω
R4	264.6Ω, tapped at every 22.05Ω
R5	5kΩ, 3W, variable
R6	25kΩ, 3W, variable
R7	50kΩ, 3W, variable
R8	600Ω, ± 10%, 1W
R9	1kΩ, ± 10%, 1W
R10	5kΩ, ± 10%, 1W
R11	10kΩ, ± 10%, 1W
R12	20kΩ, ± 10%, 1W
R13	1MΩ, ± 10%, 1W
R14	1kΩ, ± 20%, 1W
R15	27Ω, ± 10%, ¼W
R16	10kΩ, ± 10%, ¼W
R17	15kΩ, ± 10%, ¼W
R18	20kΩ, ± 10%, ¼W
	or 22kΩ, ± 10%, ¼W
R19	25kΩ, ± 10%, ¼W
R20	27kΩ, ± 10%, ¼W
R21	40kΩ, ± 10%, ¼W
	or 39kΩ, ± 10%, ¼W
R22	47kΩ, ± 10%, ¼W
R23	50kΩ, ± 10%, ¼W
R24	200Ω, ± 5%, ¼W
R25	300Ω, ± 5%, ¼W
R26	94.5Ω, + 0%-5%, ¼W
R27	500Ω, ± 2½%, ¼W
R28	670Ω, less than 5%, ¼W
R29	470Ω, ± 10%, ½W

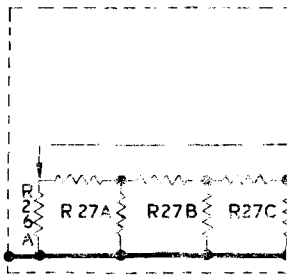




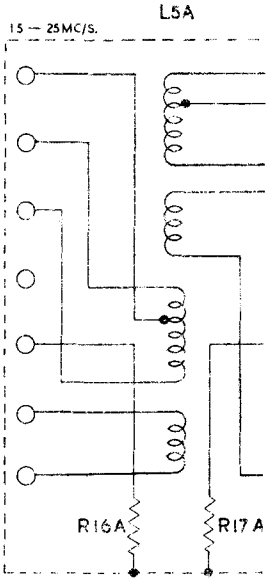
P1A
LOOKING AT PINS A.C. MAINS AND BATTERY SOCKETS (LOOKING AT BACK)

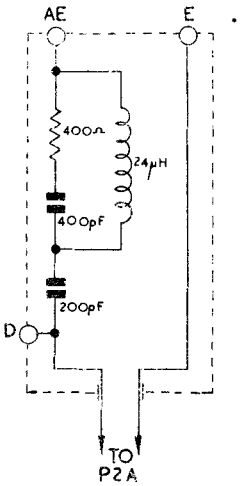


VALVES BASES: BOTTOM VIEW



L5A





DUMMY AERIAL SUPPLIED WITH INSTRUMENT

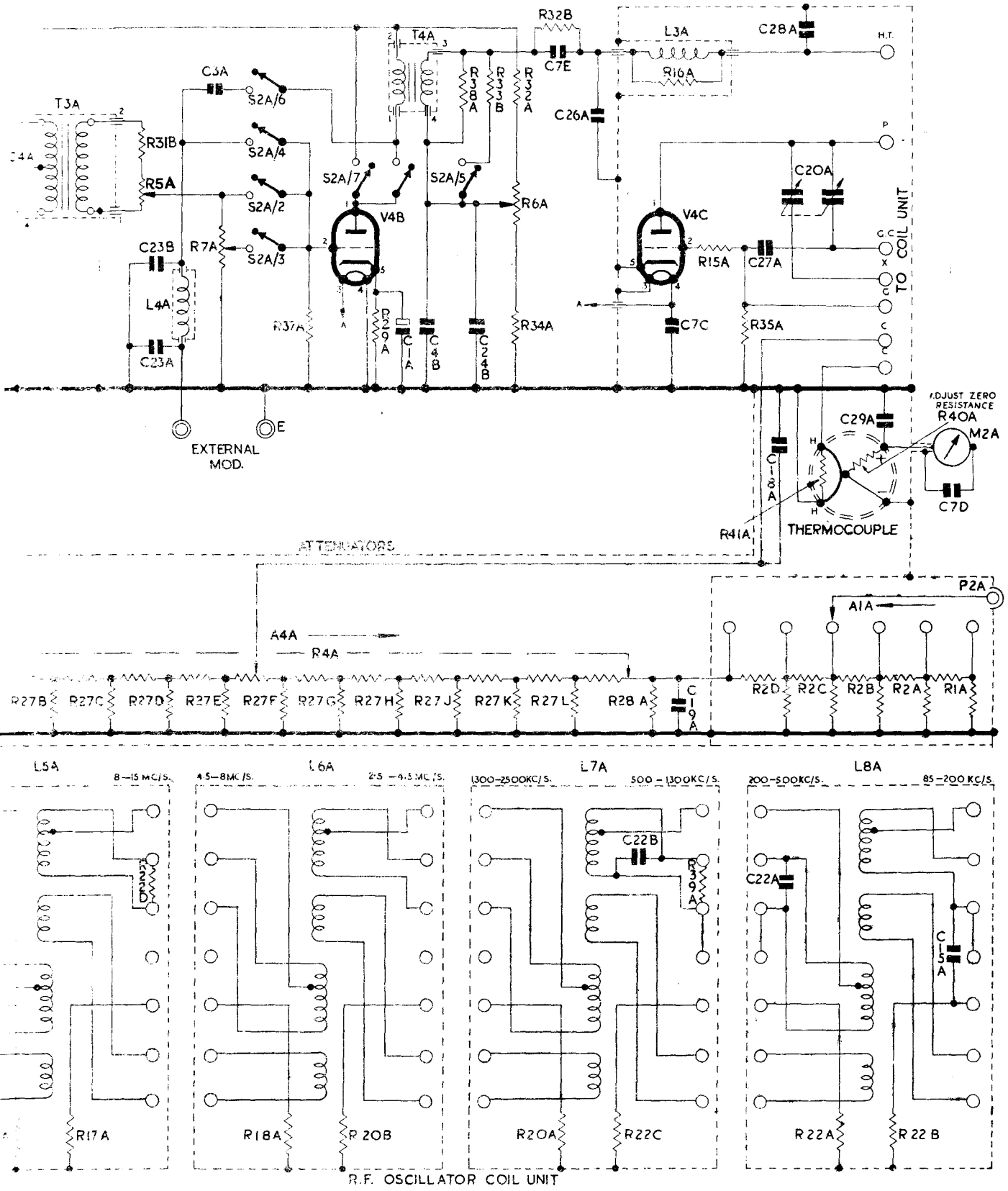
MODULATION SWITCH S2A	
SWITCH SETTING	CONTACT CLOSED
EXT. MOD. AMPLIFIED	NUMBERS 1. 4. 8.
EXT. MOD. DIRECT	NUMBERS 1. 5. 6. 7.
C.W.	NUMBERS 7. 8.
INT. MOD. SET	NUMBERS 2. 8.
INT. MOD. NORMAL	NUMBERS 3. 8.

S1A	SUPPLIES ON/OFF SWITCH
R5A	SET MOD. CONTROL
R6A	SET CARRIER CONTROL
R7A	PERCENT MOD. CONTROL
A1A	MULTIPLIER CONTROL
A4A	OUTPUT CONTROL

ARROWS ON A1A AND A4A SHOW DIRECTION OF ROTATION FOR INCREASED OUTPUT FROM P2A (OUTPUT PLUG)

$T\frac{Z-302/4}{2-1004}$

Fig. 1004 - Circuit dia



...it diagram (Mk. 2/1)

Table 1001 - (contd.)

Circuit reference	Type, function or value
	RESISTORS (contd.)
R30	560 or 680Ω, ± 10%, ½W
R31	1kΩ, ± 10% ½W
R32	3.3kΩ, ± 10%, ½W
R33	10kΩ, ± 10%, ½W
R34	22kΩ, ± 10%, ½W
R35	220kΩ, ± 10%, ½W
R36	270kΩ, ± 10%, ½W
R37	1mΩ, ± 10%, ½W
R38	47kΩ, ± 20%, ½W
R39	250kΩ, ± 10%, ¼W
R40	Approx. 4 in. of wire, electric, X, cupro-nickel, 0.0076 (wound in calibration).
R41	82Ω or 100Ω or 120Ω or 150Ω or 220Ω, ± 10%, ½W,
R42	220Ω, ± 20%, ¼W (not fitted on all models)
R43	270Ω, ± 10%, ½W

L/M.E.8/153

END