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AIR PUBLICATION
117C - 0801 - 1
(Formerly A.P.2563CJ, Vol. 1)

POWER UNIT TYPE 7262

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

I.T. Dunnett

Ministry of Defence

FOR USE IN THE

ROYAL AIR FORCE

(Prepared by the Ministry of Technology)

A.L.4, Mar. 69

AMENDMENT RECORD SHEET

To record the incorporation of an Amendment List in this publication, sign against the appropriate A.L.No. and insert the date of incorporation.

A.L.No.	AMENDED BY	DATE
1	A.L. Nos. 1-3	
2	incorporated in	Dec
3	this reprint	1968
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NOTE TO READERS

The subject matter of this publication may be affected by Defence Council Instructions, or "General Orders and Modifications" leaflets in this A.P., in the associated publications listed below, or even in some others. If possible, Amendment Lists are issued to correct this publication accordingly, but it is not always practicable to do so. When an Instruction, Servicing schedule, or leaflet contradicts any portion of this publication, the Instruction, Servicing schedule, or leaflet is to be taken as the overriding authority.

The inclusion of references to items of equipment does not constitute authority for demanding the items.

Each leaf, except the original issue of preliminaries, bears the date of issue and the number of the Amendment List with which it was issued. New or amended technical matter will be indicated by black triangles positioned in the text thus:— ◀——————▶ to show the extent of amended text, and thus:— ▶◀ to show where text has been deleted. When a Part, Section, or Chapter is issued in a completely revised form, the triangles will not appear.

The reference number of this publication was altered from A.P.2563CJ, Vol. 1 to A.P.117C-0801-1 in March 1969. No general revision of page captions has been undertaken, but the code appears in the place of the earlier A.P. reference on new or amended leaves subsequent to that date.

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LIST OF ASSOCIATED PUBLICATIONS

	A.P.
Frequency meter sets SCR—211—*A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL and AN*	33*A*1—5—19—1 (*TM*11—300)

Printed for H.M. Stationery Office by J. Looker Ltd., Poole
D/d 713257 180 4/69 **483/4**

LIST OF CHAPTERS AND PRELIMINARY MATTER

PRELIMINARIES

CHAPTERS

Note.— A list of contents appears at the beginning of each chapter

LEADING PARTICULARS

Stores Ref. *10K/19450*

Purpose of equipment ...*To enable certain test equipment to be operated from AC mains supplies instead of batteries*

Instruments for which it is suitable ...*SCR-211 -M, -N, -O, -P, -Q, -R, -T, -AA, -AC, -AE, -AF, -AG, -AH, -AJ, -AK, -AL, and later models of -B. TS-174/U, and TS-175/U. X7474 and X7475*

Output voltages and currents *135V DC at 25mA*
6V AC at 1A

Special features... ... ...*Electronic stabilization is provided for the 135V output. The mains switch, fuses and pilot lamp are housed in a small control box connected to the power unit by a flexible lead*

Power supply ... ...*May be operated on 50 to 60c/s (±5 per cent) AC at 110 to 125V or 200 to 250V*

Valves and pilot lamp ... ...

Number on diagram	*Function*	*CV No.*
V1	*Rectifier*	*493*
V2	*Series regulator valve*	*2179*
V3	*Control valve for V2*	*138*
V4	*Reference voltage tube*	*449*
LP1	*Pilot lamp, 6V, 0·1A*	*(x/959119)*

Accessories ... ...*Mains connector Type 3429/1 (10HA/8359)*

Weight ... ...*10 lb. approx.*

Overall dimensions ... ... *Width* *Depth* *Height*
8⅜ in. *7⅛ in.* *Adjustable, 5¼ to 5¾ in.*

CHAPTER 1

GENERAL AND CIRCUIT DESCRIPTION

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LIST OF ILLUSTRATIONS

Introduction

1. Power unit Type 7262 is a compact, lightweight power pack designed to fit into the battery compartment of the American-manufactured frequency meter sets SCR-211- (frequency meters BC-221-), also the TS-174/U and TS-175/U. It enables these instruments to be operated from AC supplies of 110 to 120V or 200 to 250V at 47 to 63c/s in place of the batteries normally used. It is also intended for use with British frequency meters which at the time of writing are being developed under the references X7474 and X7475.

2. It should be noted that the power unit cannot be used with all of the variants of the SCR-211-, and before attempting to install it in any specific instrument reference should be made to Chapter 2 where all suitable variants of the meter are listed, and installation instructions are provided.

3. The power unit provides an AC output at 6V±1 per cent for the frequency-meter valve heater supply, and a DC output electronically stabilized at 135V for the HT supply.

Structural description

4. The components are mounted on a shallow aluminium chassis and are protected from accidental damage by a metal framework (*fig.* 1). This framework also serves to locate the unit in the battery compartment of the frequency meter, and since the compartments vary in size the framework is made adjustable in height. The two upper members of the frame are made of springy strip material shaped for easy insertion in the battery compartment, and slide in channel-section vertical members of the lower framework. They are secured at the desired height by screws which pass through slots in the lower members into nuts secured to the upper ones.

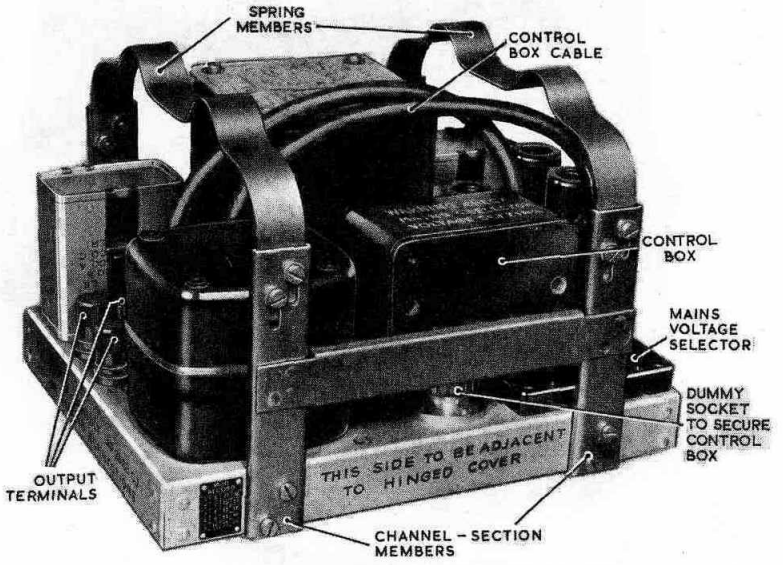

Fig. 1. Power unit Type 7262, general view

5. The mains ON-OFF switch, fuses, pilot lamp, and a three-pole plug for the mains connector are located in a small die-cast control box which is connected to the power unit chassis by a flexible cable. This enables the control box to be brought to a convenient operating position when the power unit is installed in the frequency meter, the cable passing behind the meter

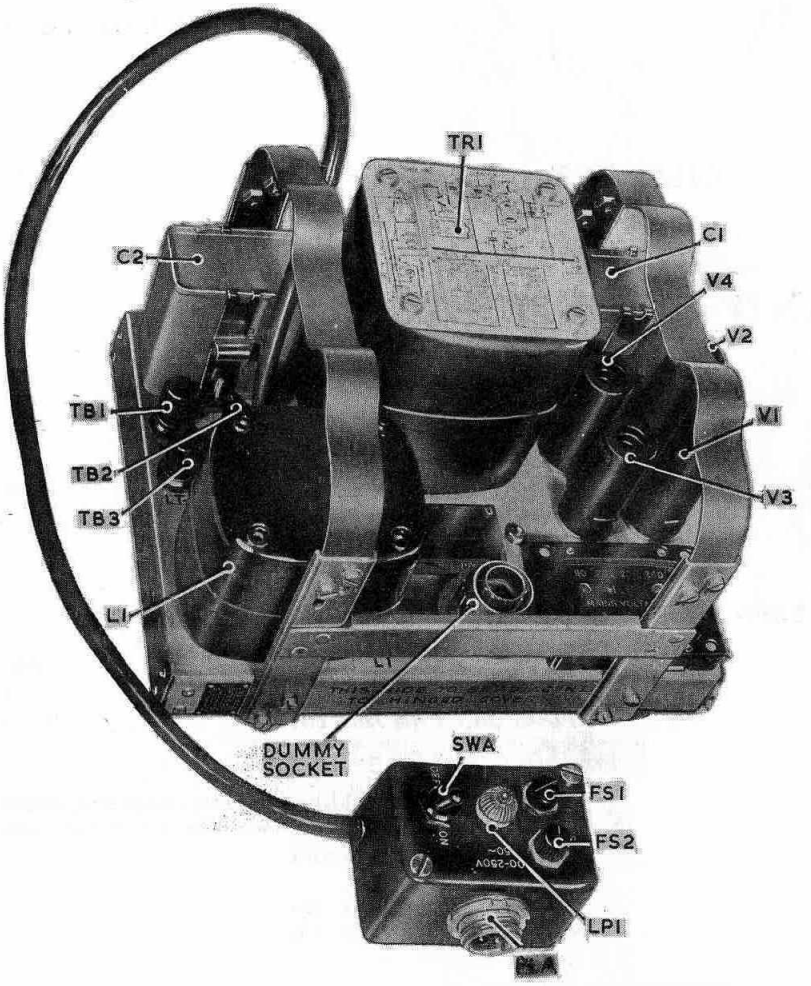

Fig. 2. Component locations, top of chassis

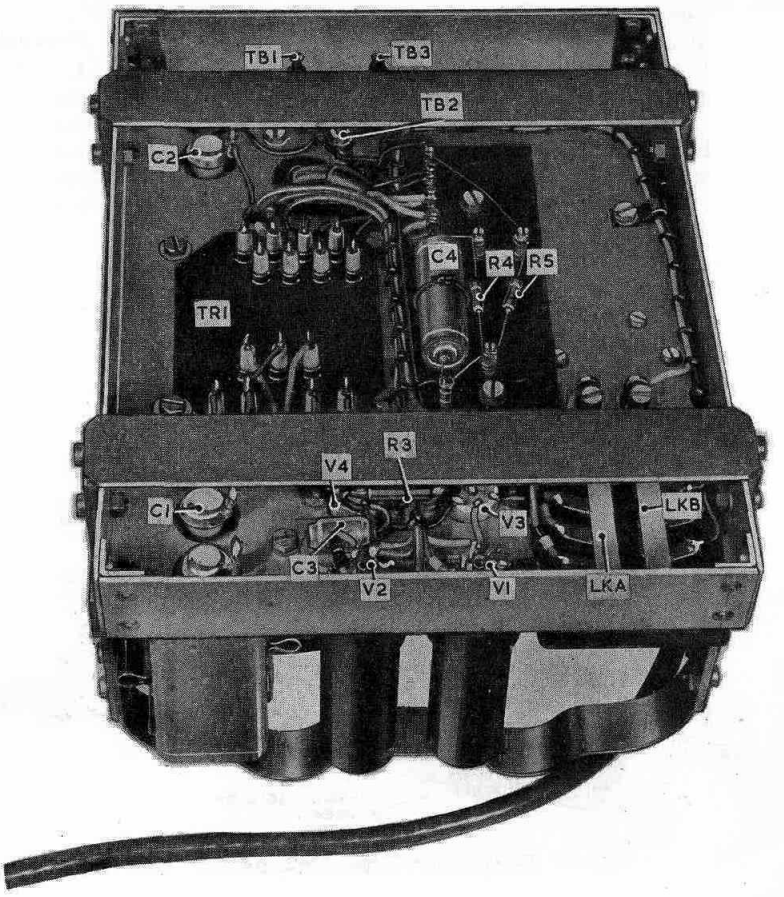

Fig. 3. Component locations, bottom of chassis

into the battery compartment. When not in use the cable is coiled up and the control box stowed in the power unit as shown in fig 1. It is secured in the stowed position by engaging the locking ring of a dummy socket on the chassis with the mains plug on the control box.

6. If the frequency meter is constantly in use at the one location it may be thought desirable to secure the control box in some convenient position. This can be done by undoing the two cheese-head screws visible on top of the control box in fig. 2, detaching the upper portion of the control box from the base plate, securing the base plate in the desired position by two screws passed through the two plain holes in the plate, and then re-installing the upper portion of the box. Note that the battery compartment lid cannot be closed unless the control box is in the stowed position; this lid must *never* be closed when the unit is switched on or the equipment will be overheated.

7. Fig. 2 and 3 show respectively the top and bottom of the chassis, and indicate the locations of all the power unit components, the reference numbers used corresponding to those used on the circuit diagram, fig. 4. All components are easily accessible when the unit is removed from the frequency meter.

Circuit description

8. As stated earlier, power unit Type 7262 consists of two assemblies, a control box and the actual power unit assembly; these items being connected by a four-core cable. The a.c. supply is connected to poles A and B of a 3-pole plug PLA on the control box and passes through a 2-pole ON-OFF switch SWA, fuses FS1 and FS2 (each 1A) and a voltage selector LKA, LKB to the appropriate tappings on the primary of a transformer TR1. This transformer has three secondary windings, one giving an output of 250-0-250 volts which is rectified and stabilized to form the h.t. supply for the frequency meter, one giving 6·3V 2A for the heater supply to the rectifying and stabilizing valves of the power unit, and one giving 6V ± 1 per cent at 1A for the heaters of the frequency meter valves. A lamp LP1 located in the control box is connected in parallel with the latter heaters and lights when the unit is switched on.

◀ **Note . . .**

Fuses FS1 and FS2 are fuse links Ref. No. 10H/0590138 used with fuse units Ref. No. 10H/0590170. ▶

9. The a.c. output from the 250-0-250V winding is full-wave rectified by a double-diode valve V1, and the resulting d.c. output is smoothed by a single filter composed of C2 and L1. C1 is the reservoir capacitor. The final output from this circuit is stabilized at 135V by a circuit comprising V2, V3 and V4. V2 is a pentode valve which functions as a series regulator, V3 is the control valve for V2, and V4 is a gas-filled reference voltage tube.

10. Referring to the circuit diagram, fig. 4, it will be seen that the gas-filled tube V4 is connected in series with its load resistor between the cathode of V2 and earth, that is, across the output of the power unit. A steady voltage of 84V appears at the anode of V4, and it is this voltage which is used to determine the cathode potential of the control valve and which serves as fixed reference voltage for the entire stabilizing circuit. A capacitor C3 (0·01 microfarad) bypasses any a.c. component which might

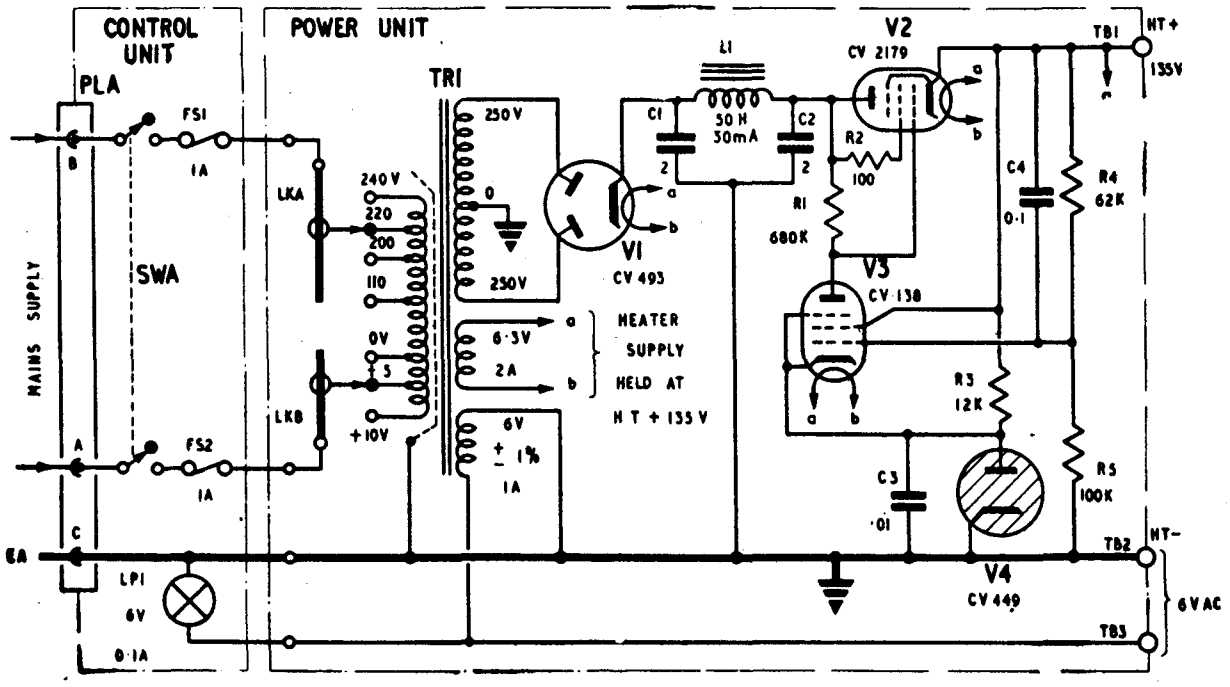

Fig. 4. Power unit Type 7262, circuit

be present at the anode of V4 and which might otherwise affect the operation of the stabilizing circuit.

11. The h.t. current flows through the series-regulator valve V2 and is controlled by the potential applied to the grid of that valve. This potential is taken from the anode of V3 and varies according to the voltage drop across R1, the anode load of V3. Since the cathode of V3 is held as a constant potential with regard to the negative side of the h.t. supply, it follows that the potential applied to the grid of the regulator valve V2, and consequently the voltage appearing at the output terminals of the power unit, will be dependent on the bias voltage applied to the grid of the control valve V3.

12. The grid bias of V3 is taken from the junction of resistors R4 and R5, which form a potential-divider connected across the output of the regulator valve V2, therefore any decrease in the output voltage of V2, such as might be caused by a drop in the mains voltage or an increase in the load, will result in the grid of V3 becoming correspondingly more negative relative to the cathode. This change in potential is amplified in V3 and causes the V3 anode to become more positive. This in turn causes the grid of V2 to become less negative with regard to its cathode, so reducing the internal resistance of V2 and tending to increase the output voltage to its original level. In actual practice, the stabilizing circuit is capable of holding the output voltage of the unit to 135V$\pm$1 per cent under conditions of input voltage variation of up to $\pm$10 per cent and load variations between 0 and 25mA. The function of capacitor C4 is to inject a.c. ripple directly into the grid of V3. This produces anti-phase ripple at the anode of V3 which reduces the ripple at the output of V2.

13. When testing the power unit it should be borne in mind that the heaters of V2 and V3 are connected to the V2 cathode, and are consequently 135V positive with regard to the chassis. The final output voltages of the power unit are presented at three terminals on the chassis marked respectively L(HT+), (LT—) and (HT—LT+).

CHAPTER 2

INSTALLATION, FAULT DIAGNOSIS AND SERVICING

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TABLE

LIST OF ILLUSTRATIONS

INSTALLING AND USING THE POWER UNIT

1. As noted in Chap. 1, The power unit is suitable for use in conjunction with the majority of the American frequency meter sets SCR-211- (frequency meters BC-221- as listed below) and test sets TS-174/U, TS-175/U. It is also intended to be used with British test sets X7474 and X7475 which are under development at the time of writing.

2. The power units are designed to fit into the battery compartments of the above frequency meters but, while the meters have similar electrical requirements, they to some extent differ structurally, due partly to having been manufactured by different firms. This affects the installation of the power unit, but these structural variants may be sorted into four main groups, as described in para. 4 to 8. Para. 3 lists the variants with which the power unit may *not* be used.

Instruments with which the power unit cannot be used

3. In the majority of the frequency meters of the BC-211-series, automatic bias is applied to the cathode of the AF stage valve by the voltage drop across a resistor connected between the cathode and chassis. In certain earlier instruments, however, bias was taken from the 6V heater battery by connecting the cathode to the positive side of the valve heater. Using such instruments in conjunction with the power unit (which provides AC to the valve heaters) would result in the output being cathode-modulated at 50 c/s. The instruments in which battery bias was used and which, consequently, are unsuitable for use with the power unit are:—

BC-221-A, -C, -D, -E, -F, -J, -K, -L and also early models of the -B version.

BC-221-B (later models only) and -Q, also TS-174/U and TS-175/U

4. The BC-221-B and -Q may have either metal or wooden cabinets, but all the above instruments have aluminium battery trays or chassis (*fig.* 1). To install the power unit:—

(1) Open the battery compartment door (one-half turn counter-clockwise on the two fasteners). Bring the meter to the front edge of the bench so that the door can hang down vertically, leaving the opening of the battery compartment unobstructed.

(2) Withdraw the battery tray by means of the ring handle at its top edge, then disconnect the cable from the tray.

(3) If batteries are installed in the tray, remove them and place the tray in a safe place where it will be available if the meter is again to be used with batteries.

(4) Loosen the eight screws which determine the height of the spring members of the power unit chassis.

(5) Insert the power unit part-way into the battery compartment (with the control-box side towards the back of the frequency meter), and adjust the height of the spring members so that the first raised portion of the spring bears firmly against the top of the battery compartment, then withdraw the unit and tighten the four screws to clamp the front ends of the springs in this position.

(6) Connection to the batteries was originally made by a three-core, rubber-covered cable. Identification of the wires varies in different instruments. Connect the power unit as follows:—*

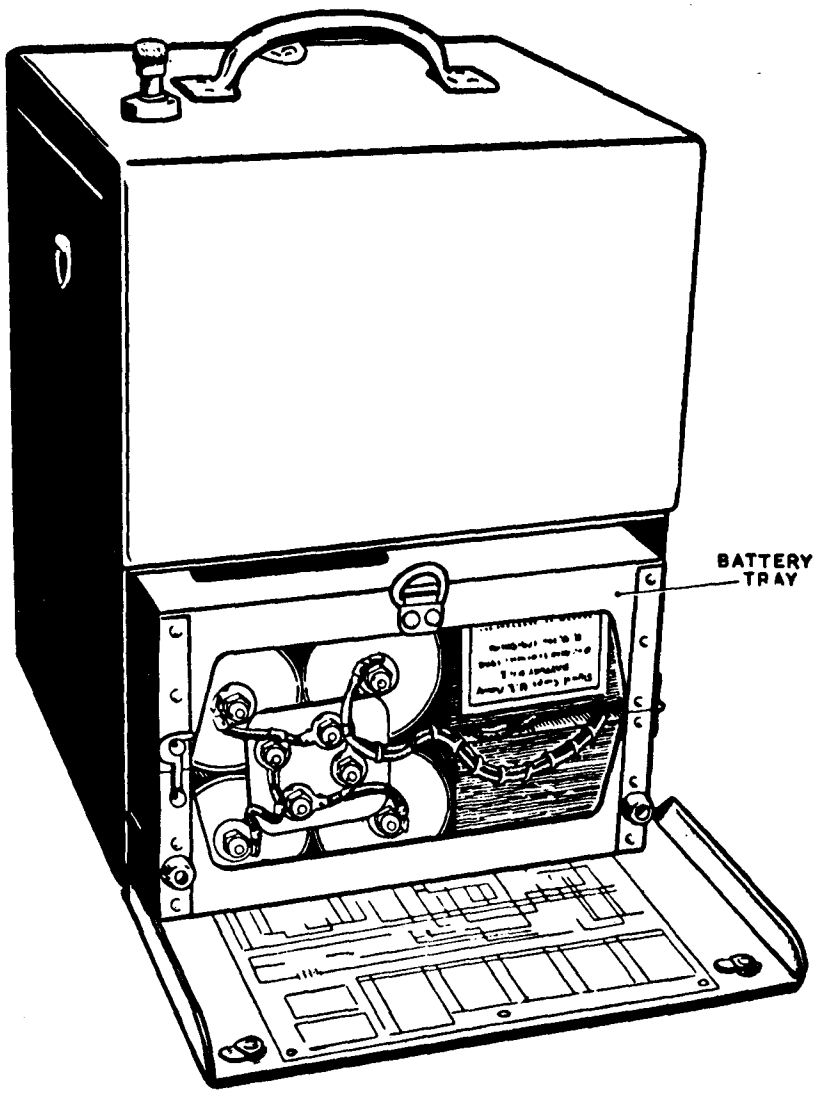

Fig. 1. Frequency meters listed in para. 4.

Wire colour code (or) Tag marking	Power unit terminal
Green B+	HT+
Black A− B−	HT− LT−
White A+	LT+

* *See also para. 7*

(7) Press the power unit fully home in the battery compartment and adjust the spring members so that the rear, raised portions bear firmly against the top of the compartment, then tighten the rear four clamping screws.

(8) When the instrument is to be used, release the control box by turning the locking-ring of the dummy socket on the chassis clockwise, as viewed from above, then lift out the control box and bring it to a suitable position beside, or in front of, the instrument.

(9) Make certain that the voltage selector is adjusted to suit the available mains supply, then connect the control box plug to the mains with a connector Type 3429/1 (10HA/8359).

(10) After switching on, allow the equipment to warm for 20 minutes before using the frequency meter.

Note . . .

To ensure adequate cooling, the battery compartment door must always be fully open when the power unit is in use.

(11) When the unit is not in use the cable may be coiled and, together with the control box, stowed within the battery compartment. Secure the control box to the dummy socket, as before, and close the battery compartment cover to exclude dust.

BC-221-M, -N, -O, -P, -R, and -T, also -AA with metal cabinet

5. In the above instruments a strip-metal battery clamp and a wiring harness is used (*fig.* 2).

(1) Open the battery compartment, and release the battery clamp by unscrewing the two countersunk screws, one in the side and one in the bottom of the battery compartment.

(2) Remove the batteries and clamp, placing the clamp in a safe place so that it may be available if batteries are again to be used.

(3) Proceed to install the power unit as in para. 4, operations (4) to (6).

(4) Connect as follows:—

Frequency meter terminal board	Power unit terminal
B+	HT+
A− B−	HT− LT−
A+	LT+

(5) Proceed as in para. 4, operations (7) to (11).

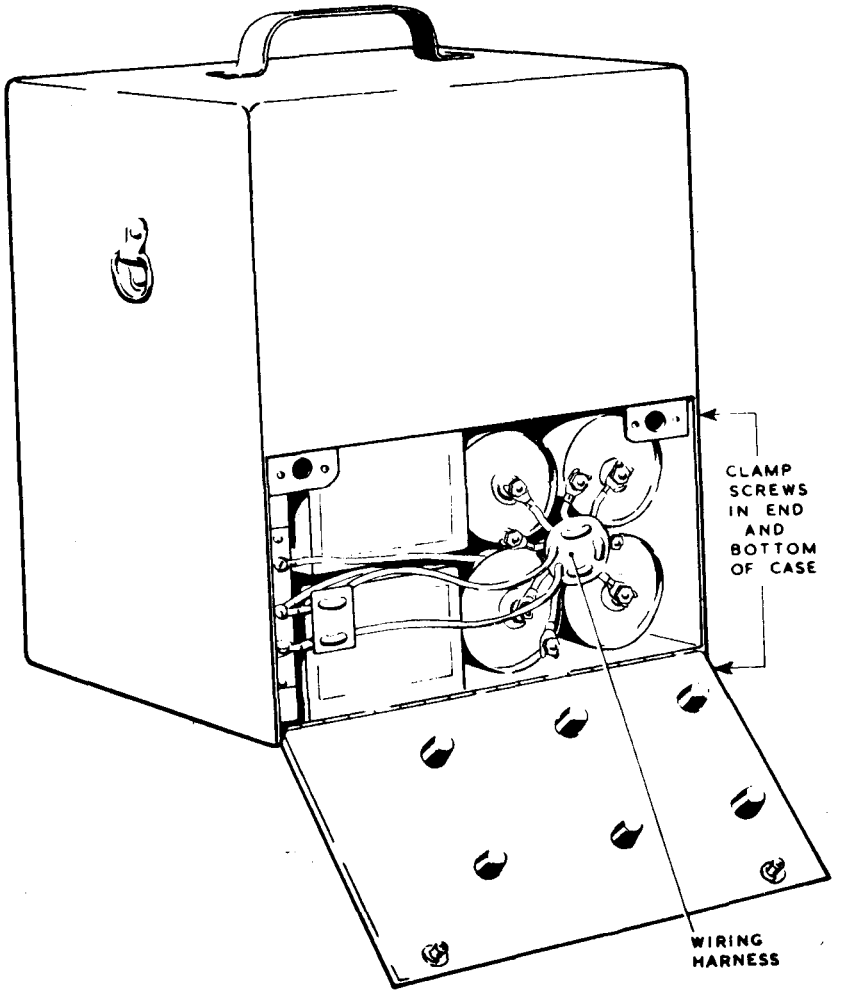

Fig. 2. Frequency meters listed in para. 5.

BC-221-AA (with wooden cabinet), -AC, -AE, -AF, -AG, -AH, -AJ, -AK, -AL

6. In the above frequency meters the batteries are secured in position by a battery-retaining board (*fig.* 3) and are connected by means of a fibre connecting board and a wiring harness.

(1) Open the battery compartment door and bring the instrument to the edge of the bench so that the door may hang down vertically; otherwise the thickness of the door will obstruct the opening of the battery compartment.

(2) Undo the captive screw

which secures the battery-retaining board to a pillar within the compartment, and remove the board.

(3) Remove and disconnect the batteries (if installed).

(4) The battery compartment will now be empty with the exception of a terminal board at the left-hand side (as viewed from the back) and the pillar towards the right-hand side. Leave the terminal board in position, but remove the pillar by means of two spanners, one applied to a square bolt head located within the small compartment at the bottom front of the case, and one applied to the long hexagonal nut with which the captive screw of the battery-retaining board engages.

(5) The parts which have been removed from the battery compartment comprise:—
1 long bolt.
1 wooden pillar.
1 long hexagonal nut.
1 large washer (some instruments).
1 wooden battery-retaining board with captive screw.
1 fibre connecting board.
These items should be put carefully aside for re-use in the event of battery operation being required.

(6) Install the power unit as in para. 4, connecting the terminal board terminals to the power unit terminals as follows:—

Terminal board	Power unit
B+	HT+
AB	HT− LT−
A+	LT+

BC-221-modified in Britain to remove the original battery-connecting and securing devices

7. In these modified instruments, which may be of any of the types listed in para. 4 to 6, the battery-securing devices (trays, clamps, pillars, retaining boards) have been removed, as have the connecting boards, wiring harnesses and terminal boards, and it will be found that the battery compartment is empty with the exception of a 3-core cable, 2 ft. in length.

8. Install the power unit as described in para. 4, connecting it as follows:—

Wire colour code	Power unit terminal
Red	HT+
Black	HT− LT−
Green	LT+

FAULT DIAGNOSIS

9. Power unit Type 7262 being a comparatively simple piece of equipment, there should be no particular difficulty in locating the cause of any defect which may occur. Table 1 suggests probable causes for the more likely symptoms.

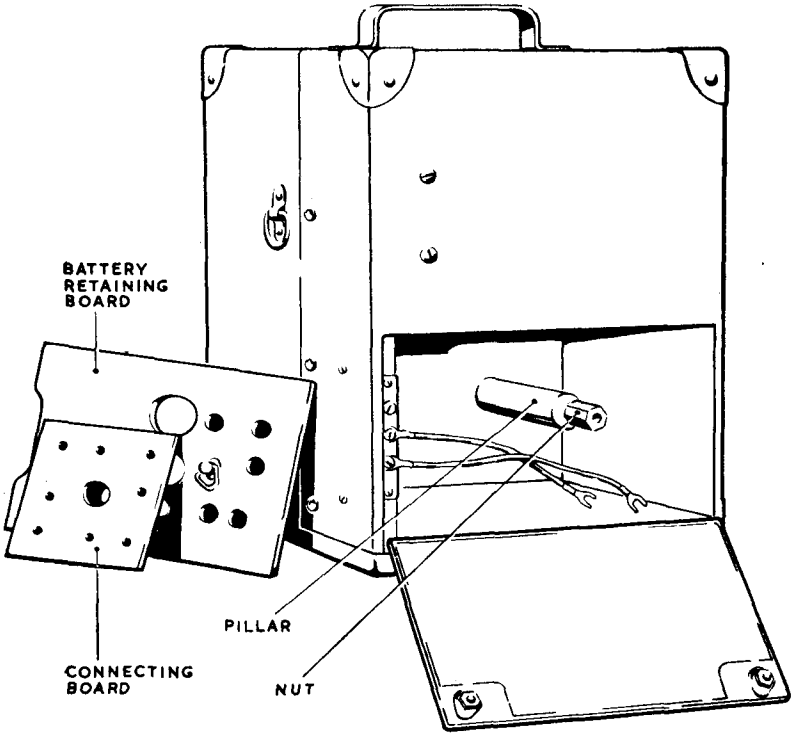

Fig. 3. Frequency meters listed in para. 6

TABLE 1

Fault diagnosis

Symptom	Probable cause
LP1 does not light	Check the output of the power unit. If the output is correct, renew LP1.
No output, LP1 does not light	Open circuit in mains supply; defective mains connector, fuse FS1, FS2; voltage selector screws not making contact; defective transformer TR1.
Heater supply correct, no HT supply	Defective rectifier V1; defective regulator valve V2; break-down in capacitor C1 or C2; L1 open-circuited.
HT output voltage low	Probably R4 or C4 short-circuited.
HT output voltage high (up to 300V under no-load conditions)*	Any defect (e.g. short-circuit or breakdown) in V3 or V4. Short-circuit in C3 or R5.

*Due to the regulation characteristics of the unit, the output voltage under load with the stabilizer circuit disabled would probably be between 150 and 175V.

SERVICING

10. From the illustrations in Chap. 1 it will be seen that the renewal of any component is a comparatively simple matter. So long as the specified components are used no adjustments should be necessary when valves or other components are renewed.