(EXTRACT).

# R.C.A. FIELD INTENSITY METER, TYPE 308A.

## Instructions.

### Operation.

A simplified description of the operating procedure will be given to facilitate an understanding of the detailed operating instructions which follow it.

The field intensity meter is tuned to the frequency of the incoming signal. Since the tuning capacitor of the calibrating oscillator is ganged with the receiver tuning capacitors, this initial tuning operation brings the oscillator frequency to that of the signal to be measured. The loop is then rotated to a position which reduces the pickup of the external signal to a minimum so that the calibrating oscillator signal may be introduced (through the loop) into the receiver with little or no interference from the external signal. The intensity of the oscillator signal is adjusted to a definite (and standard) value which is indicated on the output meter. The gain of the receiver is then adjusted by means of the step and variable inductance attenuators and the i-f gain control, so that the output voltage from the receiver due to the oscillator signal is a definite (and standard) value, which is also indicated on the output meter. The step and variable inductance attenuators are set to positions determined from the "LOOP CONSTANT" curves supplied with the equipment. (If, with the loop rotated for minimum pick-up, the amount of the external signal picked up is sufficiently great to interfere with the standardisation of the calibrating oscillator signal, the oscillator may be detuned approximately 5 kilocycles and the signal standardised at that frequency, without any appreciable error being introduced).

The calibrating oscillator signal is then removed, and the loop and tuning control are readjusted for a maximum pick-up of the external signal. The signal is attenuated in the receiver by means of the step and variable inductance attenuators only (the i-f gain control setting is not altered) until the output voltage (indicated on the panel meter) is the same as that previously obtained from the calibrating oscillator signal.

The product of the scale numbers indicated on the variable inductance attenuator and on the step attenuator indicates directly the value, in microvolts per meter, of the external signal field strength at the loop.

For signals near the upper and lower limits of the range of field strengths measurable with this field intensity meter, a change is made at the step attenuator control to facilitate operation of the equipment and to extend the direct indication feature. The dial plate of this attenuator may be rotated so that a given attenuator position receives a dial numeral of either 10 times or 0.1 times its normal one. Thus to maintain the standard indication on the output meter (remembering that the product of the step and variable mutual inductance attenuator settings must be made equal to the loop constan the i-f gain control must be readjusted when standardising the receiver sensitivity to give a change in sensitivity of the i-f stage of 10 times, or 0.1 times, its normal sensitivity.

Measurements of field intensities between 200 and 2,000,000 microvolts per meter are made as follows:-

1. Place the proper loop in position as described in "INSTALLATION".

2. Set the "BAND" switch to the position for the desired frequency range; set the "METER" switch to "MEASURE"; set the "SELECTOR" switch to "START" and then allow a one minute warm-up period. Set the "CAL. INPUT" and "CAL. OUTPUT - COARSE" controls to their extreme counter-clockwise positions.

3. Set the "START" control for a full-scale meter indication hot to the red line. (If a recorder is being used, do not connect it to the instrument until after this adjustment has been made).

-2-/

4. Turn the "SELECTOR" switch to "LINEAR" and adjust the "ZERO ADJ." control until the meter indication is zero - not 0 db or the red line. If a recorder is being used, it should be connected to the instrument (at the jack J2) before this adjustment is made.

Note: The correct setting for the "ZERO ADJ." control when a recorder is connected will be different from that when a recorder is not used. After a recorder has been connected or disconnected reset the "ZERO ADJ." control for zero meter indication before further measurements are taken.

5. Set the step attenuator at "100"; set the inductance attenuator at "2" and rotate the "CAL. OUTPUT - COARSE" control about 1/4 turn clockwise.

Note: The step attenuator dial plate may be rotated, thus extending the direct reading feature of the field intensity meter to the extremes of the intensity range for which it is designed. For field intensities between 200 and 2,000,000 microvolts per meter, the dial plate should be centrally set; i.e., the dial plate stops should be resting in the centre notch of the three located in the right edge of the dial plate. If the dial plate is not in this position, pull forward on the dial plate stop and rotate the dial plate to the correct position by means of the small pin provided for this purpose.

6. Rotate the "FREQUENCY" control knob until the dial pointer indicates the frequency of the signal to be measured, and then rotate it slightly in either direction until the output meter indicates a maximum output.

7. Adjust the "ANT. TRIM" control for a maximum output indication of the meter.

8. Orient the loop for a maximum output indication. If there is any doubt about the identity of the signal being tuned in, a pair of headphones should be plugged into the headphone jack for an audible response. Also the orientation of the loop gives an indication of the direction of origin of the signal wave being received.

Note: If the meter pointer goes off-scale due to the increase in the output voltage while steps 6, 7 and 8 are being performed, it may be brought back on scale by adjusting the step or the inductance attenuator, or both, to increase the attenuation of the signal.

9. It is now assumed that the desired signal is properly tuned in. Orient the loop for a minimum signal pick-up from the transmitter.

10. Turn the "METER" switch to "OUTPUT". Refer to the "LOOP CONSTANT" curve (located on the inside of the cover of the Field Intensity Meter) for the band employed and read the loop constant for the frequency of the signal being measured. Set the step and inductance attenuators so that their product of their numerical indications equals this constant. For example, if the constant is 9720, the step attenuator should be set on 1000 and the inductance attenuator on 9.72. Tune the "CAL. TRIM" capacitor for maximum meter deflection.

11. Turn the "METER" switch to the "INPUT" position and adjust the "CAL. INPUT" control for a meter indication at the red line.

12. Return the "METER" switch to the "OUTPUT" position and adjust the "CAL. OUTPUT" controls ("COARSE" and "FINE") for a meter indication at the red line.

Note: If the signal being measured is of the order of 100 millivolts per meter or more in the broadcast band, it may be that the signal obtained with the loop oriented for minimum response is appreciable compared to the signal introduced into the loop circuit by the calibrating oscillator. To check for this condition, after

completing step 12 return the "METER" switch to "MEASURE". Slightly rock the "FREQUENCY" control, noting whether the output meter changes its reading appreciably. If there is no change, proceed with step 13. If there is a change, it becomes necessary to tune approximately 5 kc. away from the transmitter frequency for calibration. In either case, it is necessary to retune in step 13. If it is necessary to tune away from the transmitter frequency, make certain to peak the signal by readjusting the "ANT. TRIM" control after the calibrating oscillator has been tuned in. No appreciable error is introduced by shifting frequency this slight amount.

Note: It is well to tap the meter when using it in steps 11, 12, and 13 (especially so in step 11) to prevent sticking of the moving elements of the meter.

13. Return the "METER" switch to "MEASURE", orient the loop for maximum response, and adjust the step and inductance attenuaters for a meter reading to the red line. The product of the two attenuator settings is then the field strength of the signal being measured in microvolts per meter. For example, if the step attenuator is set on 10,000 and the inductance attenuator on 2.36, the indicated field strength is 23,600 microvolts per meter, or 23.6 millivolts per meter.

Note: The main heterodyne oscillator and loop tuning capacitors are ganged. Thus at low frequencies where the loop circuit is sharper than the i-f amplifier, it may be found that the first response obtained when the "FREQUENCY" and the "ANT. TRIM" controls have been peaked is not the true maximum. The procedure to correct this condition is to peak one, then the other returning to the first, then the second and so on until the peaks obtained have gone through a maximum and started to drop. Then return to the condition of highest output. This "rocking" procedure is normally unnecessary when calibration is made at the frequency of the received signal. Such procedure is necessary when calibration must be made off frequency as described above. At frequencies above 1500 kc., the loop circuit response is broader than the i-f amplifier response, so that only a single peaking operation should be necessary.

For measurements of signal strength between 20 and 200 microvolts per meter, the field intensity meter should be calibrated at 10 times its normal sensitivity. During operation 10, immediately after turning the "METER", switch to the "OUTPUT" position, rotate the step attenuator plate one notch counter-clockwise, and leave it at this position during all of the succeeding operations.

For measurements of signal strengths between 2 and 20 volts (2,000,000 and 20,000,000 microvolts) per meter, rotate the step attenuator dial plate one notch clockwise immediately after turning the "METER" switch to "OUTPUT" in operation 10, and leave the dial plate in this position during all of the succeeding steps.

After rotating the step attenuator plate, make certain that the step attenuator knob is at the correct position to make the product of the step attenuator and the mutual inductance attenuator numerical indications equal to the loop constant for that frequency at which the instrument is being operated.

Note: The logarithmic dial on the variable mutual inductance attenuator is engraved 2, 2.5, 3 . . . 15, 17, 2. The starting and ending figure "2" is the same figure, since the dial has made a complete revolution. This "2" represents either 2 or 20, depending upon the direction from which it is approached; when reached through 3 and 2.5, it represents 2 and when reached through 15 and 17, it represents 20. The direction of rotation is readily indicated by the dial stop.

When field intensity readings are to be taken in rapid succession at various locations, as in a field survey, it is unnecessary to calibrate for every reading. No definite time can be specified

here, for too many factors are involved, but experience will show how long an interval can be tolerated between calibrations.

Two adjustments are provided for making the response on "LOG" correspond to the decibel scale on the meter. Procedure for these adjustments is as follows: With a fairly strong, stable signal tuned in and with the step attenuator on "100", adjust the "CAL. OUTPUT" controls ("COARSE" and "FINE") for a full-scale deflection on the meter (i.e., +20 db). Change the step attenuator to "10M". The meter reading should drop to -20 db. If it does not, it is necessary to adjust the "LOG. ADJ." control on the rear apron, readjusting the "CAL. OUTPUT" control each time for a +20 db. indication at attenuator step "100", and changing the "LOG. ADJ." control until a reading of -20 db. is obtained on "10M". When this condition is satisfied, move the step attenuator to 1M." The meter should read 0 db. (red line). If it does not, the screwdriver control (R45) mounted on the main chassis must be adjusted. There is some interdependence of action of these two controls, but they operate essentially as described. By proper adjustment of these controls the -20, 0 and +20 db. points may be made exactly correct There may still be some error at intermediate output levels, but this error should never be greater than 1 db. It should be necessary to make only an occasional check on the linearity of this scale as the tubes age, or when the battery voltages change appreciably.

The setting of the "LOG. ADJ." control required for a proper indication on the decibel scale when a recorder is connected to the instrument may differ from that required when a recorder is not connected. Also, the proper setting of the "LOG. ADJ." control is dependent upon the internal resistance of the recorder. Therefore, the decibel indications should be checked for correctness, and the "LOG. ADJ." control readjusted, if necessary, each time a recorder is connected or disconnected.

To use the equipment with the logarithmic (decibel) scale it is suggested that the following procedure be used. Measure the field intensity of the station in the normal manner. Then turn "SELECTOR" switch to "LOG." and adjust the two attenuators for either 0 db. or some other convenient value on the output meter, making a record of the new attenuator settings. Thus, if it is desirable to check the calibration of the meter, it may be done at the normal zero level.

LOOP ARRANGEMENT - Each loop is used for operation on two frequency bands, the selection of the band depending on the relative position of the loop as it is plugged into the socket in the loop standard. Each loop is marked with two engraved numbers which correspond with the range numbers of the band switch. The numeral which is aligned with the black screw on the loop standard indicates the band in effect in the loop circuit.

Turn the "METER" switch to "PLATE," and the "SELECTOR" switch to "START". The meter pointed should deflect approximately to the red line (the red line indicates a plate battery voltage of 135 volts; each small division of the meter indicates 4.5 volts). Change the "METER" switch to "FIL." Again the meter pointer should deflect approximately to the red line (the red line now indicates six volts; each small meter division indicates 0.2 volts).

THERMOCOUPLE CURVE SHOWN AT REAR OF FOLDER.

# R.C.A. FIELD STRENGTH SET.

## TYPE 308A.

### Operating Instructions.

(a) Place loop in position.

(b) Connect set to power unit with cord.

(c) Connect 6 volt battery to power unit being careful that polarity is correct.

(d) Allow filament of set to warm up before turning on vibrator on-off switch on power unit.

| Meter Switch | Selector Switch | Operation. |
|---|---|---|
| Plate | Start | Read approx. 150 volts. 3½ divisions passed red line. (Each small division equals 4.5. volt). |
| Filament | " | Read approx. 6 volts on red line. (Each small division equals o.2 volt). |
| Measure | " | (a) Set band switch to correct position. |
| | " | (b) Turn "Cal Input" and "Cal Output-Coarse" controls fully anti-clockwise. |
| | " | (c) Adjust "Start" control t give full scale deflec-tion on meter. |
| Measure | Linear | (a) Adjust "Zero-adj." control for zero read-ing on meter. |
| | " | (b) Set step attenuator at 100 and inductance attenuator at 2. |
| | " | (c) Turn "Cal.Output-Coarse' control ¼ turn clockwis |
| | " | (d) Tune in transmitter wit "frequency" control for maximum meter deflectio |
| | " | (e) Adjust "Ant.Trim" for maximum meter deflectio |
| | | (f) Orient loop for maximum meter deflection. |

Senior Technician,
LABORATORY.

Field Strength Measuring Set Tests.

Attached hereto is a copy of the results of the tests conducted between Type 308A Field Strength Measuring Set belonging to the Laboratory, and that belonging to the Superintendent, Wireless Branch, which is Type 308B.

2. The Field Strength Measuring Set held by the Laboratory, had, for the purpose of this test, an S.T.C. Type N Thermo Couple installed. Test No. 1 is with the existing Thermo Couple as at present in the equipment, still of the Type N series. Test No.2 was with a spare also of the Type N installed. The readings obtained by the instruments are practically identical and within the accuracies expected to be obtained from these instruments.

| Station | 308A | 308B | |
|---|---|---|---|
| 6IX | 6.9 | 6.1 | ) |
| 6PM | 12.0 | 11.0 | ) |
| 6PR | 7.3 | 6.6 | ) 11.7.49 |
| 6WN | 5.9 | 5.8 | ) |
| 6WF | 10.5 | 9.7 | ) |
| 6WA | 0.36 | 0.35 | ) |
| 6IX | 5.4 | 5.7 | ) |
| 6PM | 10.4 | 11.2 | ) |
| 6PR | 7.0 | 7.5 | ) 16.8.49 |
| 6WN | 9.8 | 10.4 | ) |
| 6WF | 10.3 | 11.3 | ) |
| 6WA | 0.32 | 0.33 | ) |

3. It will be seen that the average error is +7.2%

Divisional Engineer,
DESIGN AND MEASUREMENTS.

31. 8. 49

| Meter Switch | Selector Switch | Operation. |
|---|---|---|
| Output | Linear | (a) Set loop constant on step and inductance attenuators. |
| | " | (b) Tune "Cal. Trim" for maximum meter deflection. |
| | | (c) Detune ~~SEC~~. 16 kc. |
| Input | " | (a) Adjust "Cal. Input" for deflection to red line on meter. |
| | " | (b) Readjust "Ant.Trim" to peak signal. |
| Output | " | Adjust "Cal. Output" coarse and fine for deflection to red line on meter. |
| Measure | " | (a) Orient loop for maximum signal. |
| | | (b) Retune "Frequency" |
| | | (c) Retune "Ant.Trim". |
| | | (d) Adjust step and inductance attenuators to red line. |
| | | (e) Record value. |

(a) Place loop in position.

(b) Connect set to power unit with cord.

(c) Connect 6 volt battery to power unit being careful that polarity is correct.

(d) Allow filament of set to warm up before turning on vibrator on-off switch on power unit.

| Meter Switch | Selector Switch | Operation. |
|---|---|---|
| Plate | Start | Read approx. 150 volts. $3\frac{1}{2}$ divisions passed red line. (Each small division equals 4.5. volt). |
| Filament | " | Read approx. 6 volts on red line. (Each small division equals o.2 volt). |
| Measure | " | (a) Set band switch to correct position. |
| | " | (b) Turn "Cal Input" and "Cal Output-Coarse" controls fully anti-clockwise. |
| | " | (c) Adjust "Start" control to give full scale deflection on meter. |
| Measure | Linear | (a) Adjust "Zero-adj." control for zero reading on meter. |
| | " | (b) Set step attenuator at 100 and inductance attenuator at 2. |
| | " | (c) Turn "Cal. Output-Coarse" control $\frac{1}{4}$ turn clockwise. |
| | " | (d) Tune in transmitter with "frequency" control for maximum meter deflection. |
| | " | (e) Adjust "Ant. Trim" for maximum meter deflection. |
| | " | (f) Orient loop for maximum meter deflection. If off scale reduce signal with step or inductance attenuator or both |
| | " | (g) Orient loop for minimum pick-up. |

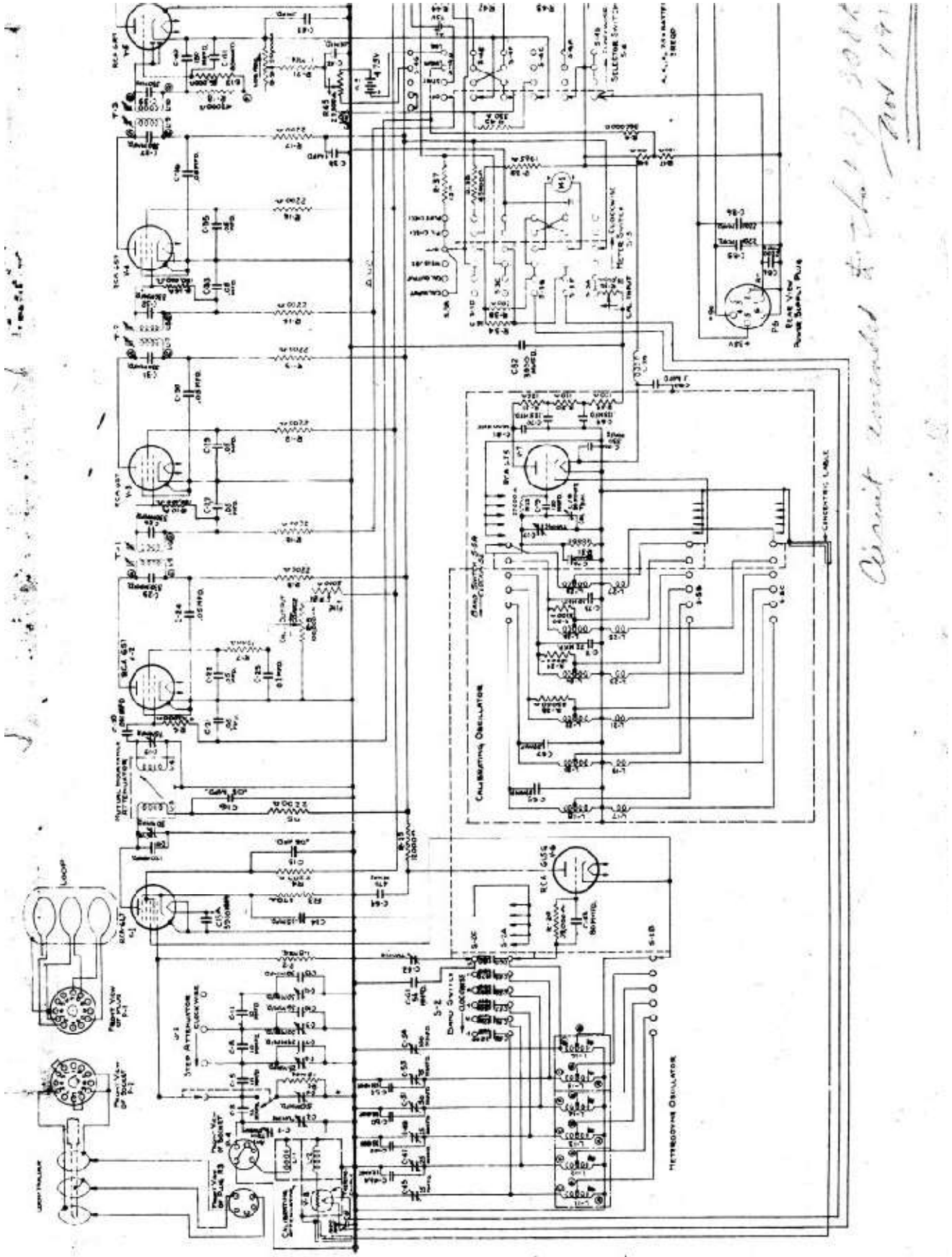
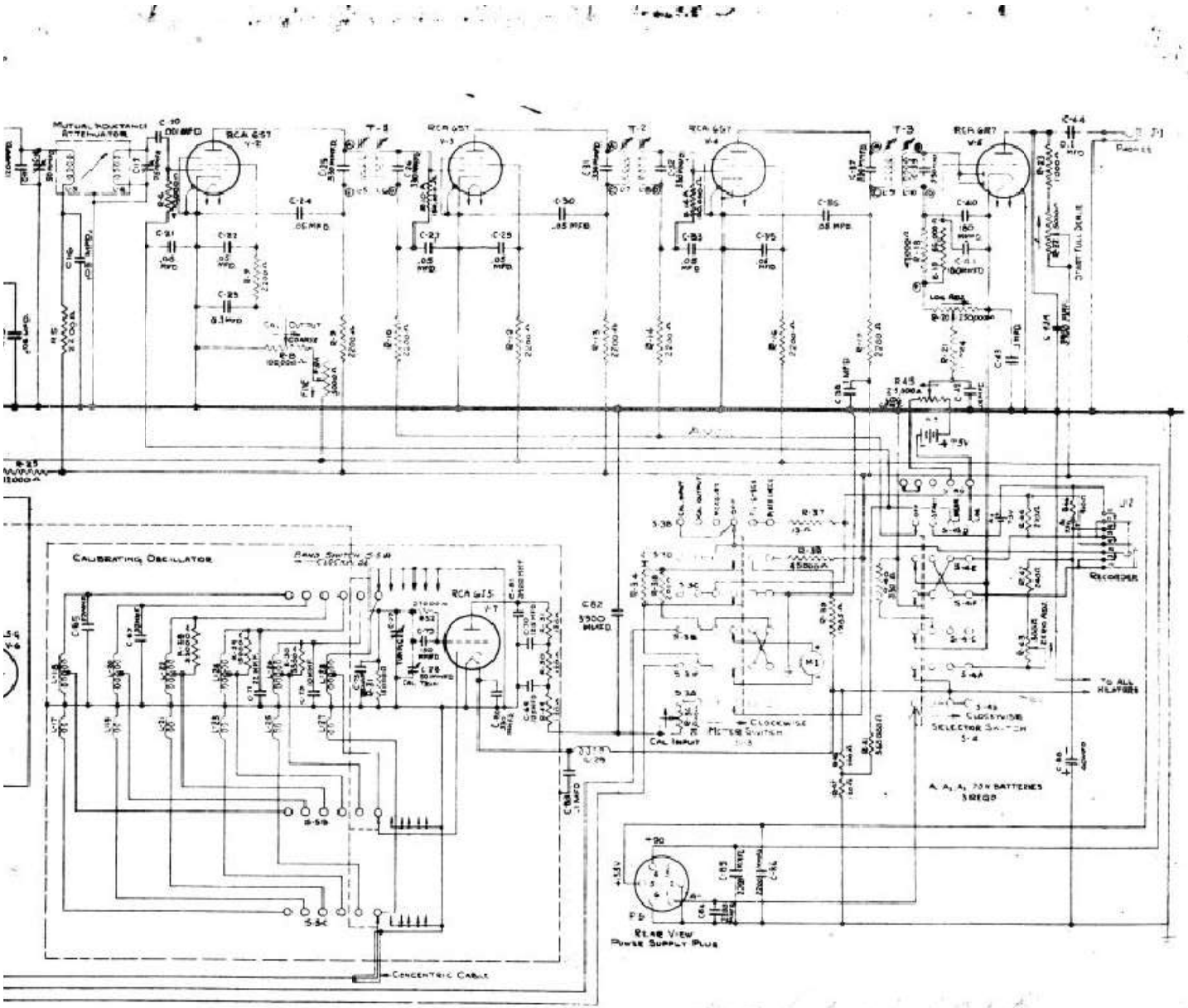


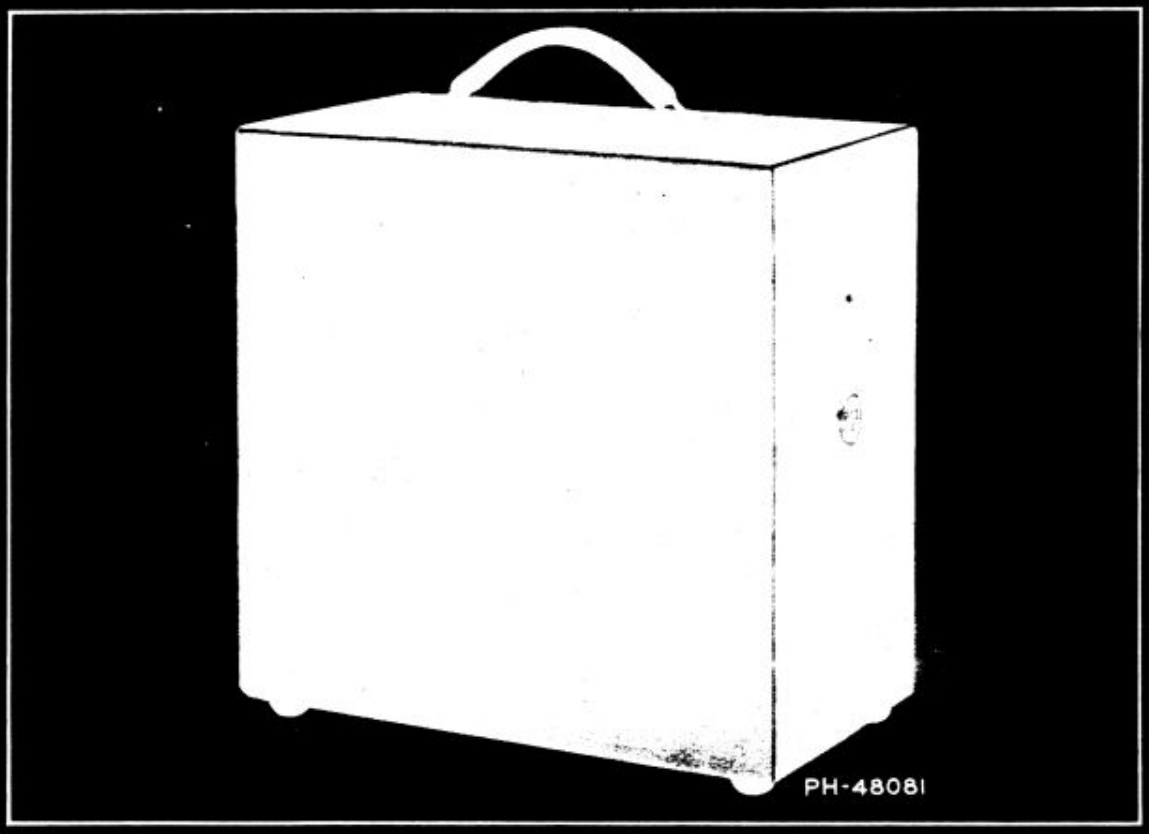
FIGURE 9 – FIELD INTENSITY METER
(Schematic T-256319)


CALIBRATING OSCILLATOR
CONCENTRIC CABLE
REAR VIEW
POWER SUPPLY PLUG
TO ALL HEATERS
RECORDER
CLOCKWISE
SELECTOR SWITCH
CAL INPUT

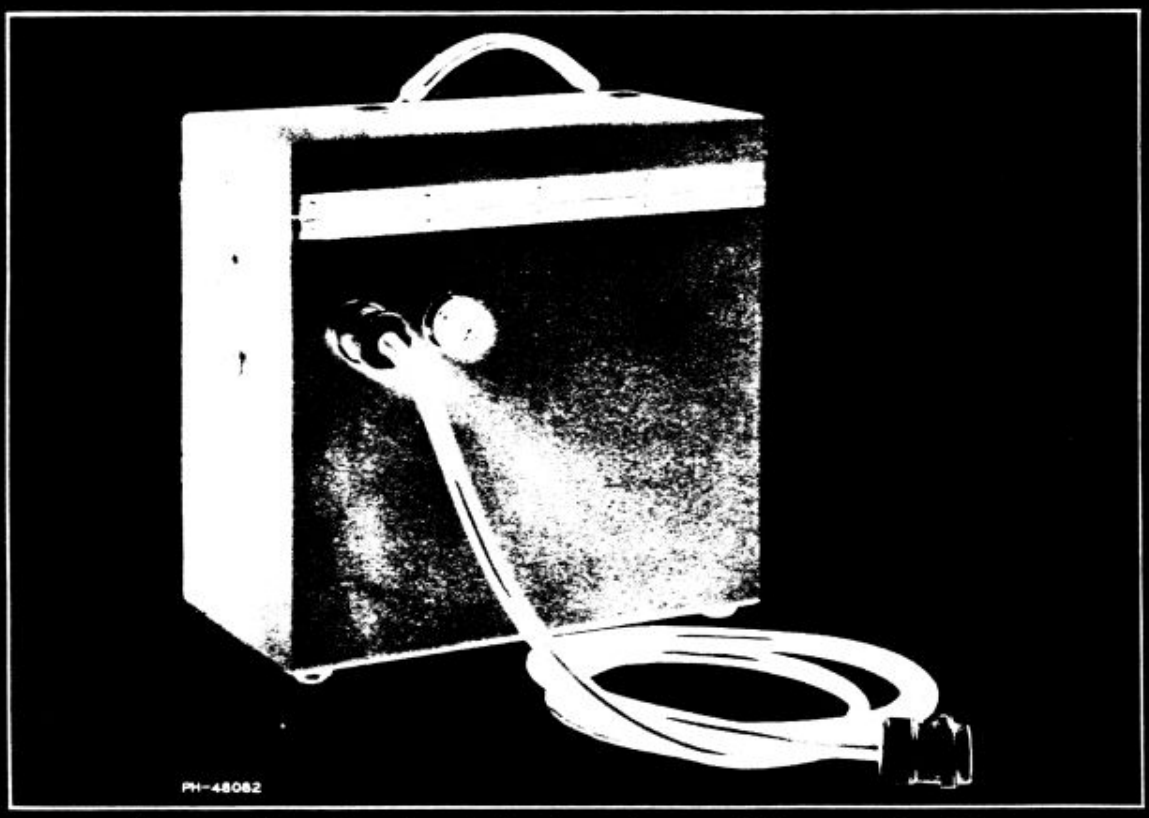
# VIBRATOR POWER UNIT

TYPE 93-A

Manufactured by
RCA VICTOR DIVISION
of
RADIO CORPORATION OF AMERICA
Camden, New Jersey, U. S. A.




*A. Front View*




*B. Rear View Showing Cable Attachment (Cable not Supplied)*

*FIGURE 1 - TYPE 93-A VIBRATOR POWER UNIT*

# TYPE 93-A VIBRATOR POWER UNIT
# MI-7519

## ELECTRICAL CHARACTERISTICS

Output -

| | Sw. Pos. | Volts | Ma |
|---|---|---|---|
| * 1 | "HI" | 150 | 45 |
| * 2 | "LO" | 150 | 30 |
| 3 | "HI" or "LO" | 90 | 7.3 |

** Voltage controlled by regulator tube. Current values are maximum assuming no load on 90-volt tap.*

Hum Level . . . . . Less than 2 millivolts on full (150-v) outputs

Regulator Tube . . . . . .RCA-VR-150-30

Power Source . . One 6-volt, 38-ampere hour, non-spill type storage battery

Fuse Rating . . . . . 10 amperes

Bias Facilities . . . Space provided for bias batteries up to 22-1/2 volts (3 Burgess Type 5540 or 1 Burgess Type 5156, or equivalent)

## MECHANICAL SPECIFICATIONS

Dimensions . . . . . 14" (height) x 13-1/2" (width) x 7-1/2" (depth)

Weight (net) . . . . . 16 pounds

Weight of storage battery . . . . . 20 pounds

Case . . . . . Aluminum, finished in blue-gray wrinkle lacquer

## DESCRIPTION

The Type 93-A Vibrator Power Unit is a compact portable device designed primarily to accompany certain types of radio test equipment which must be operated in locations where no a-c line facilities are available. It is essentially an energy-conversion unit, furnishing high d-c voltage for plate excitation from a 6-volt storage battery. A suitable compartment is provided in the case to accommodate the storage battery; space also is available internally for bias batteries up to 22-1/2 volts where required (see "Electrical Characteristics"). Plate, bias, and filament leads are brought out to two receptacles which are wired in parallel, permitting use of two pieces of test equipment such as field-intensity and noise meters simultaneously.

Direct current at high potential is produced by means of a vibrating-type mechanical interrupter and rectifier used in conjunction with a step-up transformer. A conventional filter on the rectified output reduces the hum level to a very low value. The voltage-regulator tube (RCA-VR-150-30) main-

tains a steady drop of 150 volts and is connected across the output of the filter through a tapped resistor, one section of which may be short-circuited by the "HI-LO" toggle switch ("HI" position) to utilize the maximum output load current. Lower output voltages may be procured across the regulator tube through the other series resistor which is of a value to provide 90 volts at 7.3 ma. The latter source is essentially non-regulated.

## INSTALLATION

To prepare the unit for operation, it is necessary only to install the storage battery. Bias batteries also should be installed if required by the equipment to be operated; otherwise the leads provided for connection to these batteries should be left taped. The connection diagram of Figure 4 indicates the correct arrangement of all battery leads with respect to color coding. All batteries should be secured in position with the clamps provided.

In the event that this unit is to be employed with equipment for which no interconnecting cable is available, it will be necessary to construct a suitable cable. Figure 4 shows the terminal arrangement of the outlet receptacles and should be carefully followed in wiring the associated cable connector. The connector should be procured from RCA under Stock No. 16821. There also will be cases, such as with the RCA Type TMV-75-B Field-Intensity Meter, where an existing battery cable may be employed merely by substituting the above plug connector.

At installation, a general inspection of the unit should be made, making certain that the regulator tube is undamaged and properly seated and that the vibrator polarity is correct. The negative (-) side of the vibrator should be located nearest the case; that is, farthest from the regulator tube.

## OPERATION

Upon completing the installation, including interconnection with the equipment to be operated, apply power to the latter and wait until the tube filaments in the equipment are fully heated before throwing the vibrator unit power switch to the "ON" position.

***CAUTION** - THE FOREGOING SEQUENCE IS VERY IMPORTANT. IF POWER IS APPLIED TO THE VIBRATOR UNIT WITHOUT LOAD, EITHER WITH NO EQUIPMENT ATTACHED OR BEFORE ALLOWING SUFFICIENT TIME FOR THE TUBES OF THE ASSOCIATED EQUIPMENT TO HEAT, THE VOLTAGE-REGULATOR TUBE WILL BE OVERLOADED. SUCH OPERATION MAY DAMAGE THE TUBE AND SHORTEN ITS LIFE.*

Throw the "HI-LO" toggle switch to the position indicated by the load current requirement. The resistor in series with the regulator tube is of a value such that the tube operates at its maximum current on a fully-charged storage battery when the output load is 30 ma. Under this condition, the switch should be placed in the "LO" position. A portion of the series resistor is short-circuited upon throwing the switch to the "HI" position, thus increasing

the load current rating to approximately 45 ma. For proper regulation with smaller loads, the value of the series resistor should be increased.

*NOTE - The above load currents of 90 and 45 ma, respectively, are applicable only when no load is being taken from the 90-volt tap. Any output drawn from the latter tap is essentially non-regulated and the voltage obtained will depend upon the load resistance. At 7.5-ma drain, the output potential will be approximately 90 volts.*

As the storage-battery discharges, a point will be reached where the voltage-regulator tube will cease to function. It will be possible in cases where the "LO" setting is being used to continue regulation by shifting to the "HI" position. This expedient, however, will not suffice except for short periods of time and it is always best to keep the battery in a well-charged condition.

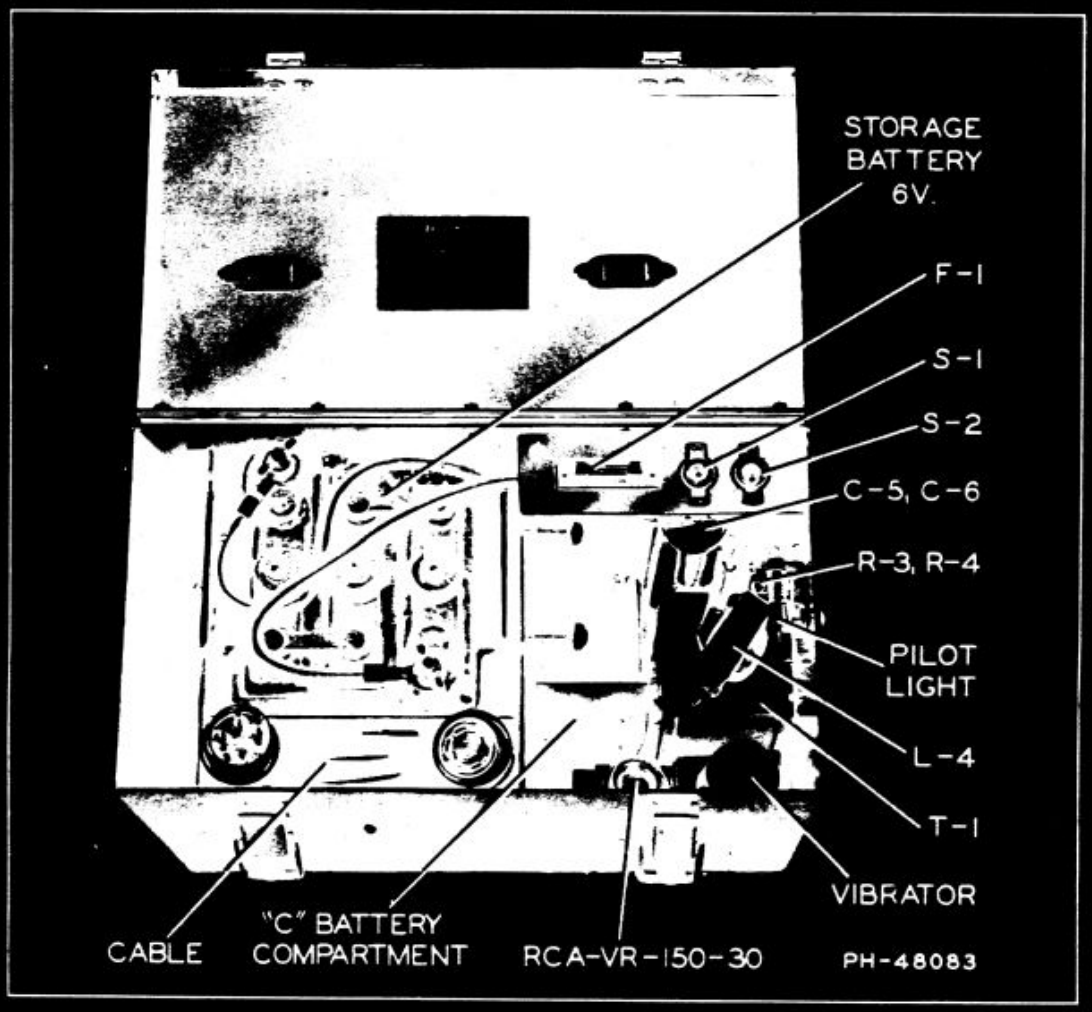



*FIGURE 2 - TYPE 93-A VIBRATOR POWER UNIT*
*(Top Interior View - Cable shown is not supplied)*

## PARTS LIST

The following parts list is included to facilitate procuring replacements. In ordering such parts, the description and stock number (or drawing number) always should be specified.

| Item | Description | Stock No. |
|---|---|---|
| C-1 | Capacitor (included with T-1) | |
| C-2, C-3 | Capacitor, 2-0.01 mfd | 12233 |
| C-4 | Capacitor, 1000 mmfd | 12635 |
| C-5, C-6 | Capacitor, electrolytic, 2-16 mfd | 18272 |
| C-7 | Capacitor, same as C-4 | |
| F-1 | Fuse, 10 amperes | 6148 |
| L-1 | Coil, r-f choke, Drawing K-67410-9 | |
| L-2 | Reactor (included with T-1) | |
| L-3, L-4 | Reactor, filter | 5066 |
| R-1, R-2 | Resistor, 56 ohms, 1/4 watt | 13220 |
| R-3, R-4 | Resistor, 1600 ohms, 25 watts | 18281 |
| R-5 | Resistor, 8200 ohms, 1/2 watt | 14250 |
| S-1 | Switch, power | 30558 |
| S-2 | Switch, "HI-LO" | 7900 |
| T-1 | Transformer, vibrator (including C-1 & L-2) | 18273 |
| | **MISCELLANEOUS** | |
| | Battery, storage, 6-volt, 38-ampere hour, non-spill | MI-8204 |
| | Receptacle, power input | 16818 |
| | Elastic Tip | 18282 |
| | Handle | 30925 |
| | Pilot Lamp | 5226 |
| | Socket, tube | 33084 |
| | Socket, vibrator | 12241 |
| | Vibrator | 12236 |

## MAINTENANCE

**CIRCUIT CONTINUITY** - Schematic and connection diagrams of the instrument (see Figures 3 and 4) are included for purposes of circuit analysis and continuity check. The schematic symbol number of each part is repeated on the connection diagram and photographs to facilitate identification by means of cross reference. Nominal values also are shown on these diagrams to aid in locating causes for failure in operation.

**FUSE REPLACEMENT** - A small 10-ampere cartridge fuse is used in the battery-supply circuit. This fuse is intended for protection of the entire instrument and, therefore, should not be shorted out or replaced by one of a higher rating. A fuse failure should be carefully investigated before making a replacement, since, with fuses of accepted quality, there usually is a definite reason for the breakdown. In the greater percentage of cases, such failure is due to a fault in the apparatus protected as, for instance, from sticking vibrator contacts or a short-circuited electrolytic capacitor. Occasionally, a fuse may open because of the heat generated at one of its clip contacts; these clips therefore should be kept clean and in secure contact with the fuse.

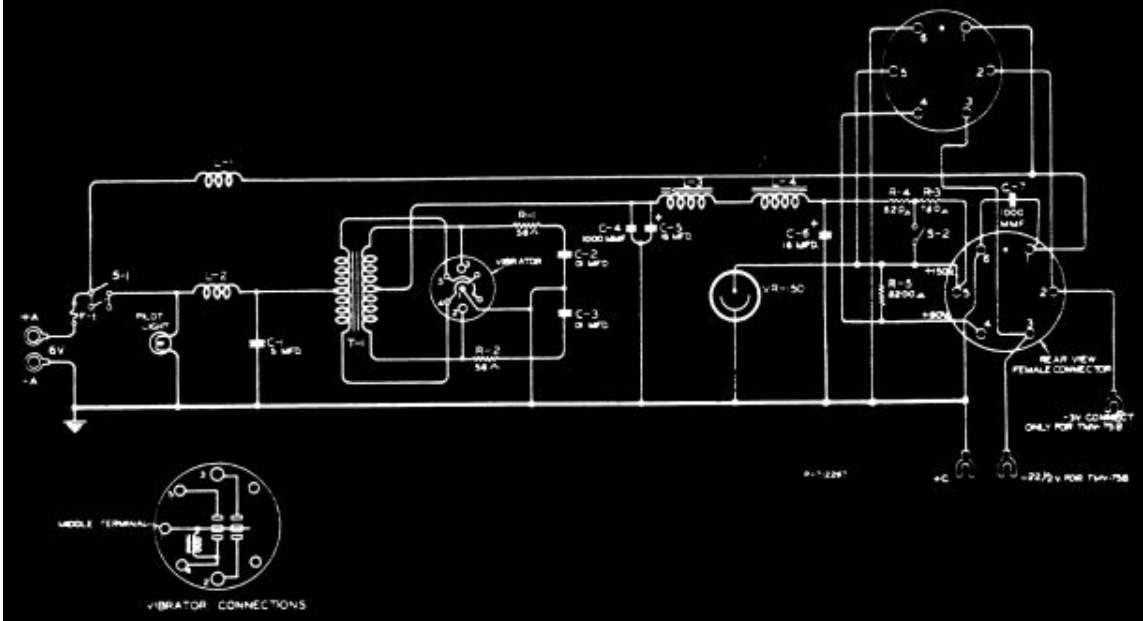



*FIGURE 3 - SCHEMATIC CIRCUIT DIAGRAM*

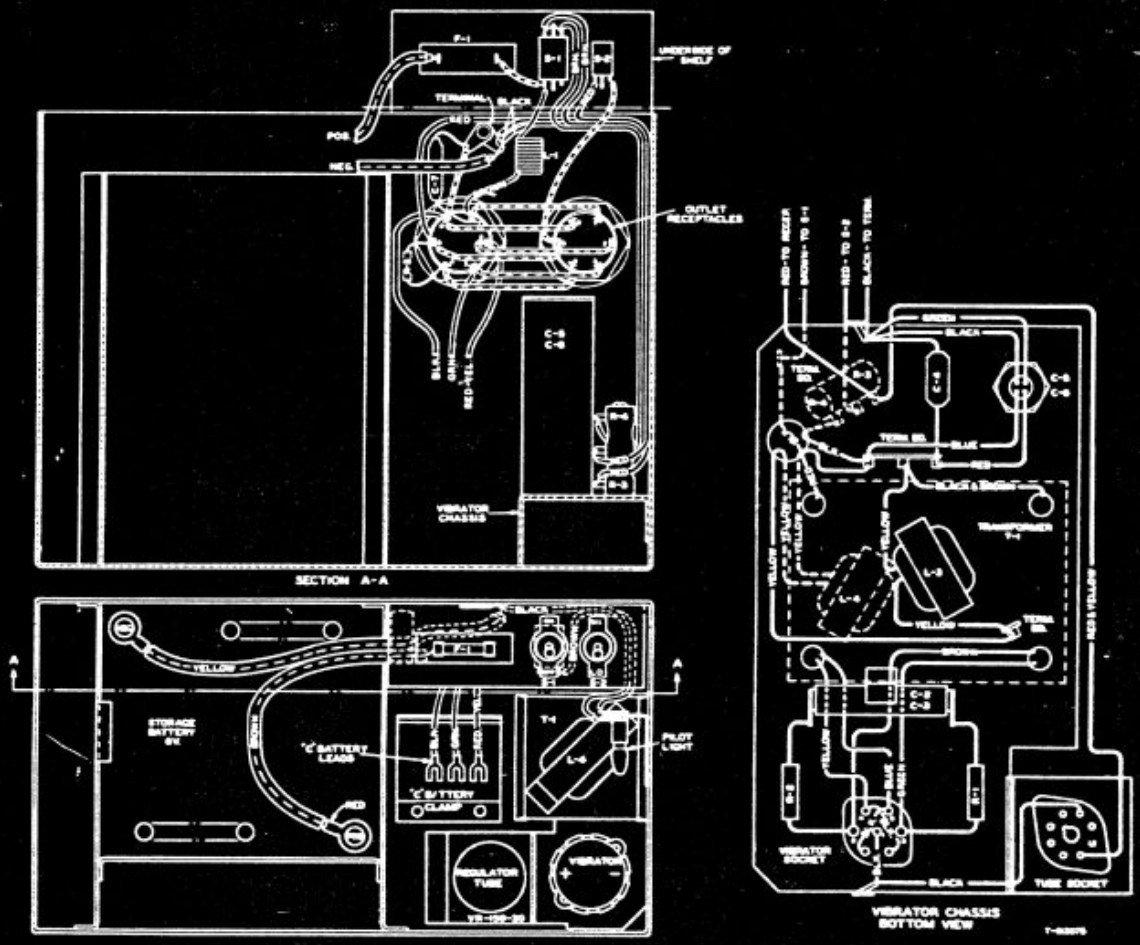



*FIGURE 4 - CONNECTION DIAGRAM*