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# INSTRUCTION MANUAL

# PROTEXIMETER

# MODEL 300

DEC. 1947

THE VICTOREEN INSTRUMENT CO.

5806 HOUGH AVE., CLEVELAND, OHIO

Victoreen

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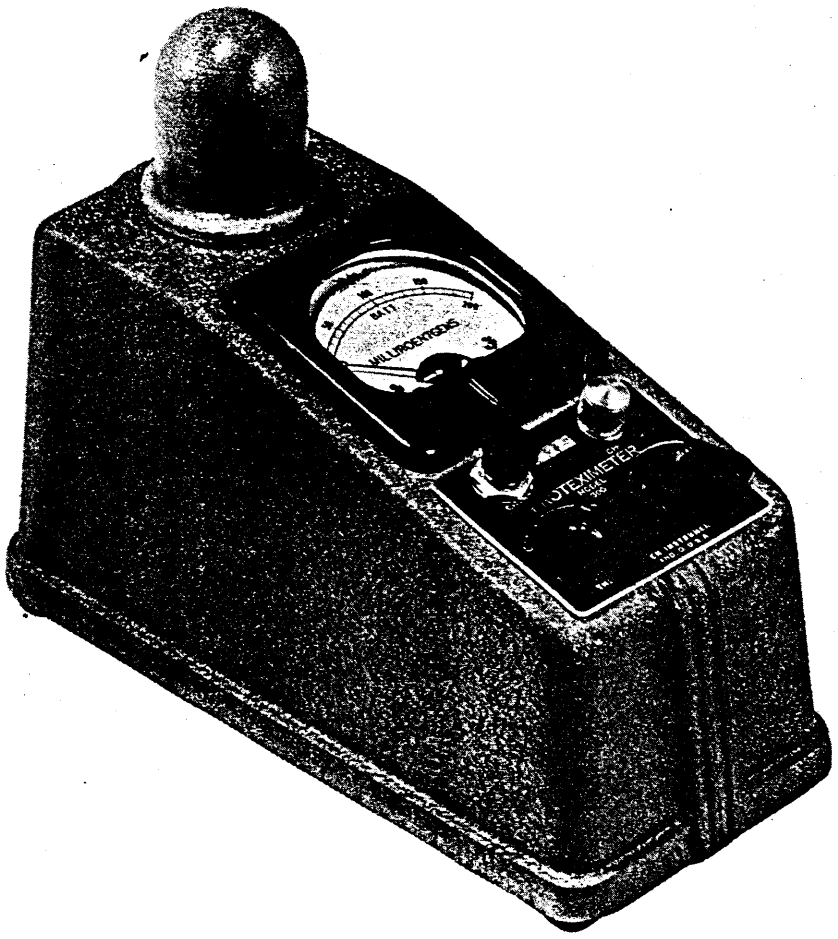


THE VICTOREEN INSTRUMENT CO. 5806 HOUGH AVE., CLEVELAND, O.

# PROTEXIMETER INSTRUCTION MANUAL

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# PROTEXIMETER INSTRUCTION MANUAL

## I - INTRODUCTION

### A. Purpose

The Victoreen proteximeter is a compact direct reading instrument designed specifically to measure accumulated scattered radiation for the protection of roentgenologists, technicians, and industrial x-ray personnel. It has also been useful in the protection of personnel operating cyclotrons, Van de Graff generators, and other sources of nuclear energy. It is intended to supplement rather than replace the Minometer pocket chamber by providing a convenient means of monitoring an area. The Proteximeter differs from the 263 and 247 survey meters in that it measures total accumulated radiation in milliroentgens.

### B. Special Features

1. Full scale reading indicates 200 milliroentgens; midscale 100 milliroentgens which is the accepted value (0.1r) for a daily tolerance dose.

2. A special chamber coating makes the instrument independent of x-ray wave length except for wall absorption effects at low energies.

3. The hermetically sealed chamber makes the calibration independent of variations in temperature, pressure or relative humidity.

4. The three inch meter calibrated in milliroentgens has a scale which is easy to read at a distance.

5. Controls have been reduced to a minimum to simplify the operating procedure.

6. Extensive laboratory and field tests have proven the Proteximeter to be both rugged and reliable.

## II - SPECIFICATIONS

### A. Physical Characteristics

| | |
|---|---|
| Height | - 5" exclusive of chamber; 7" overall |
| Length | - 9" |
| Width | - 4" |
| Weight | - 5 pounds |
| Case | - Cast aluminum |
| Finish | - Gray crackle |
| Indicator | - 3" microammeter |
| Controls | - Power switch |
| | Battery voltage adjustment |
| | Charge button |
| | Charging rate (screwdriver) adjustment |
| Power supply | - Five type "D" flashlight cells, easily replaced |

### B. Performance Characteristics

| | |
|---|---|
| Sensitivity | - 200 milliroentgens, full scale |
| Accuracy | - ± 10% |
| Drift/Leakage | - 10 milliroentgens per day, maximum |
| Wave length | - Independent |
| Wall absorption | - 1/16" polyethylene |
| Battery life | - 300 hours continuous reading |
| | Shelf life with normal intermittent reading |
| Circuit | - VX-41A, inverted triode connection |
| Charging method | - Induced transient grid current |
| Discharging | - Gravity switch |

## III - OPERATING INSTRUCTIONS

1. Turn the power switch, lower left, to the "BATT" position.

2. Adjust the "BATTERY" knob, lower right, until the meter reading is 100.

3. Turn the power switch, lower left, to the "RUN" position.

4. Depress the "CHARGE" button, upper left, two or three times if necessary until the meter reading is zero. (See section V, D)

5. Place the instrument in the desired location for measurement.

6. Turn the power switch to the "OFF" position.

7. To obtain the total accumulated radiation, first repeat steps 1, 2, and 3. Next read the meter directly in milliroentgens and then turn the switch off. This reading may be repeated at any time without recharging.

8. The switch may be left on "RUN" to be read at a glance, however the battery life will be reduced.

## IV - ELECTRONIC DESCRIPTION

### A. Chamber

The chamber has a 1/16" polyethylene wall with a graphite conducting surface of less than 200 ohms resistance between the two points. The circuit electrode is graphite coated polystyrene connected directly to the electrometer grid of the VX-41A vacuum tube. The total chamber capacitance is 100 uufd.

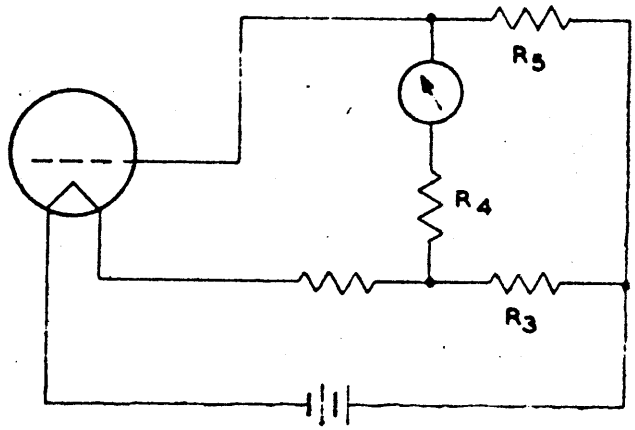
### B. Electrometer Circuit

The VX-41A electrometer tetrode is used as an inverted triode with the second (control) grid floating with the chamber anode. The output signal is taken from the first grid, the plate is connected to the first grid to provide an electrostatic shield for the control grid. The plate current is less than 10 microamperes, therefore the

plate has virtually no effect on the output meter reading.

C. Metering Circuit

The normal $G_1$ current, approximately 250 ua., passing through the load resistor $R_5$ provides a voltage drop equal to the filament current of 10 ma. through $R_3$. The meter with its series limiting resistor indicates zero potential difference between the negative side of $R_5$ and the negative side of $R_3$ when the chamber is fully charged. As the chamber is discharged by radiation the negative charge on $G_2$ is reduced causing an increase in current to $G_1$. This increases the voltage drop across the load resistor $R_5$, which is measured by the output voltmeter. Because this voltage charge is a linear function of the total radiation received, the meter is calibrated directly in milliroentgens.

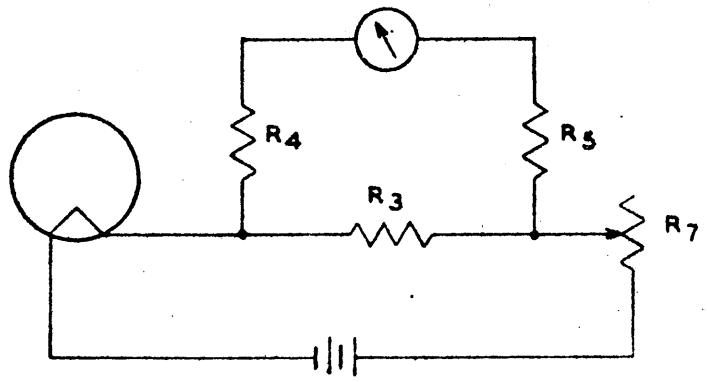



METERING CIRCUIT

D. Battery Check Circuit

The chamber tube filament current is measured by the meter when the switch is in the "BATT" position. The meter is calibrated by the series resistance $R_4$ plus $R_5$, and the shunt resistor $R_3$, such that 10 ma. current will read 100 or midscale on the meter. The

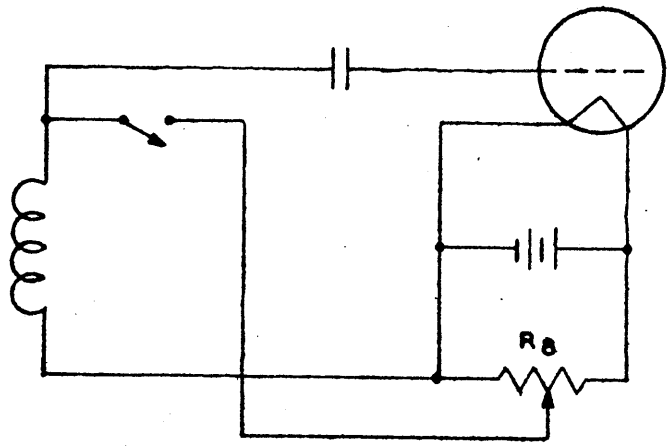
filament current is adjusted by means of the series variable resistor $R_7$.




BATTERY CHECK CIRCUIT

E. Charge Circuit

For the purpose of charging the chamber, consider $G_2$ as an anode of an ordinary diode rectifier and consider the chamber itself as a capacitor of 100 uufd. An inductance is placed in series with the capacitor and the filament of the rectifier, a voltage is applied across the inductance causing current to flow through it. The current is then suddenly interrupted, causing an induced voltage, $L \frac{di}{dt}$, to be applied to the anode of the rectifier through the capacitor. Current flows momentarily through the rectifier. If this procedure is repeated several times, the capacitance will be charged to the peak induced voltage, $L \frac{di}{dt}$. The peak voltage may be controlled by potentiometer $R_8$ by adjusting the initial voltage applied to the inductance.




CHARGE CIRCUIT

## V - FIELD SERVICE NOTES

### A. Battery Replacement

1. Replace batteries when the meter cannot be set to 100 -- Step 2 in the operating instructions.

2. Remove the four screws and the bottom plate.

3. Insert a screwdriver between two batteries and pry one out. The others will slide out easily.

4. Observe the polarity marks near the contacts and slide the replacement batteries in place.

### B. Performance Test

1. Use the performance test if, after a reasonable period of time, the meter shows no indication of radiation.

2. Follow operating instructions 1, 2, and 3.

3. Turn the instrument upside down momentarily to discharge the chamber.

4. The meter reading should be greater than 200 milliroentgens.

5. Recharge the chamber as shown in the operating instructions.

6. If the meter reading, Step 4 above, is less than 200 milliroentgens, replace the chamber.

### C. Drift or Leakage Test

1. Follow the operating procedure through Step 4.

2. Place the instrument in a location known to be free of radiation except for normal background.

3. Turn the power switch off.

4. After 8 hours, read the meter -- Step 7 in the operating instructions.

5. If the meter reading is greater than 20 milliroentgens, replace the chamber.

D. Charging Rate Adjustment

1. Adjustment of the charging rate is necessary when the meter does not read zero after the charging button has been pressed several times in Step 3 of the operating instructions.

2. Remove the cap on the "CHG. ADJ." control, upper right.

3. Turn the instrument upside down momentarily to discharge the chamber.

4. To decrease the charge, turn the screwdriver adjustment clockwise.

5. To increase the charge, turn the screwdriver adjustment counter clockwise.

6. Recharge the chamber as described in the operating instructions.

E. Chassis Removal

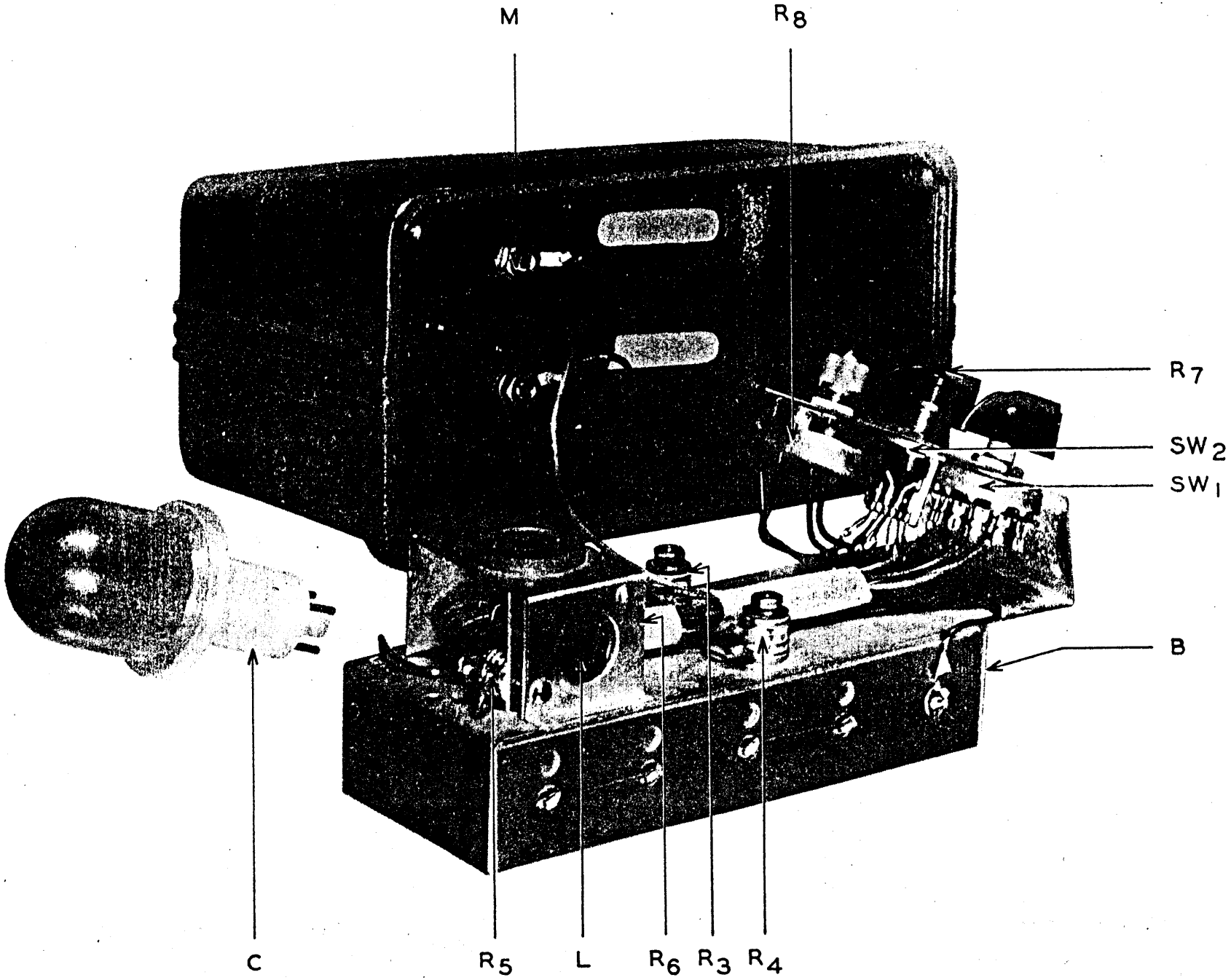
1. Remove the chamber.

2. Remove all knobs and nuts from the control panel.

3. Remove the four feet and bottom plate.

4. Remove one screw in the battery channel.

5. Slide the chassis out the bottom.


M
R8
R7
SW2
SW1
B
C
R5
L
R6
R3
R4

THE VICTOREEN INSTRUMENT CO.

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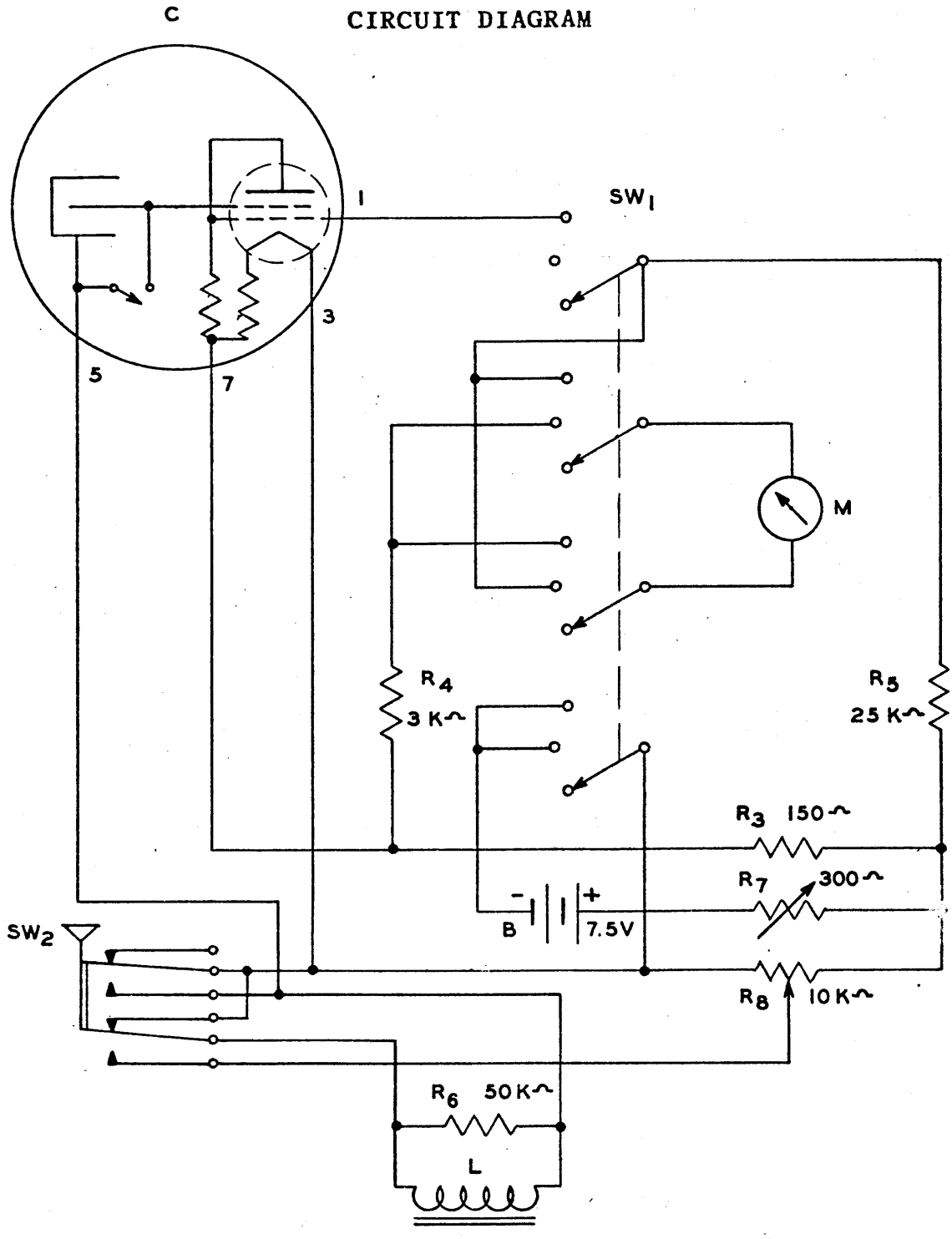
# PROTEXIMETER

## CIRCUIT DIAGRAM



PROTEXIMETER

APPENDIX

## LIST OF REPLACEABLE PARTS

| Ref. | Part No. | Component | Description | Function | Spare Parts Kit * | Manufacturer |
|---|---|---|---|---|---|---|
| B | 263-17 | Battery | 7½V #2 cells | A & B | 250 | Ray-O-Vac |
| C | 300-3 | Chamber | Polyethyline sealed | Detector-amplifier | 3 | Victoreen |
| L | 300-18 | Inductance | Choke (hearing aid) | Charger | 2 | Standard Trans. |
| M | 200-27 | Meter | 0-100 ma. 2000 | Indicator | 1 | Hickok |
| R3 | 185-167 | Resistor | 150 ohm Bobbin ¼W | Meter Bias | 5 | Shallcross |
| R4 | 185-168 | Resistor | 3,000 ohm Bobbin ¼W | Meter calibration | 5 | Shallcross |
| R5 | 185-169 | Resistor | 25,000 ohm Bobbin ¼W | Output load | 5 | Shallcross |
| R6 | 185-56 | Resistor | 50,000 ohm ± 5% ½W | Coil shunt | 5 | Allen-Bradley |
| R7 | 300-58 | Pot | 300 ohm linear taper | Battery adj. | 5 | Internat'l Res. |
| R8 | 300-41 | Pot | 10,000 ohm linear taper | Charging adj. | 5 | Mallory |
| SW1 | 300-13 | Switch | Rotary, 4 circuit 3 position (Off-on Battery Run) | | 1 | Mallory |
| SW2 | 300-14 | Switch | D.P.D.T. Push Button | Charging | 1 | Mallory |
| | 70-46 | Feet | Felt ½" | | 10 | T-R Brawley |
| | 120-30 | Knob | Bar pointer | Battery adjustment | 1 | Gen. Cement |
| | 120-30 | Knob | Bar pointer | Off-Battery Run | 1 | Gen. Cement |
| | 300-24 | Insulator | Mica board | Battery channel | 15 | Victoreen |
| | 300-47 | Socket | Octal (8 prong) | Chamber | 1 | Amphenol |
| | 300-53 | Cap | Knurled | Charging adjustment | 1 | Victoreen |
| | 300-57 | Contact | Spring clip | Battery contact | 25 | Victoreen |
| | 300-65 | Cover | Plastic | Waterproof | 40 | Giller Prods. |
| | 300-67 | Manual | Instruction | | | Victoreen |
| | | Screwdriver | 1/8" blade | | 1 | |
| | | Wrench | | | 1 | |

* NOTE: The spare parts kit is designed to service 10 instruments under field operating conditions in accordance with United States Atomic Energy Commission specifications, and contains parts as listed above.