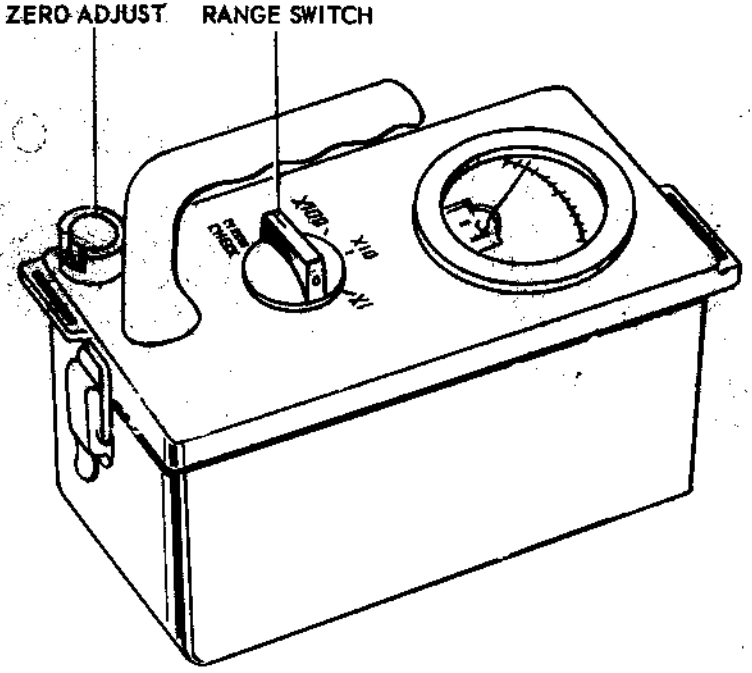
Instruction and Maintenance Manual

VICTOREEN FALLOUT DETECTION METER

MODEL 61720



THE VICTOREEN INSTRUMENT COMPANY
5806 Hough Avenue • Cleveland 3, Ohio

Form 1086-61 Part No. 61720-1 Litho U.S.A.

INTRODUCTION

The instrument described in this manual can provide you with vital information about fallout radiation in the event of nuclear attack.

This instrument is not a protective device. Special shielding - a fallout shelter - is needed if you are to be protected from fallout radiation which can cause serious damage to living tissue. 1/ But the instrument can be used as a type of "radiological ruler" to measure the degree of danger you face, making it possible for you to take certain actions in or about your home that might save your life.

Science has learned much in recent years about fallout radiation - a silent "weapon" that could threaten more Americans than the blast and heat from nuclear explosions if our Nation is ever attacked. Additional discoveries about the nature of fallout probably will make the instrument described in this manual even more valuable to you than it is today.

No person can make logical decisions if he must do it in ignorance of certain essential information. In a war emergency the most critical personal decisions and the most essential information could be related to fallout radiation.

BATTERIES.

The Model 61720 is powered by two "D" size flashlight cells (NEDA 13). The batteries will operate the instrument continuously for over 150 hours and much longer on an intermittent basis.

BATTERY INSTALLATION.

Open the instrument by snapping open the pull catch at each end of the case and separating the top from the case bottom. This exposes the battery box and battery retainer clip. Remove the retainer clip by squeezing its ends until it can be pulled out of the slots in the battery box. Insert the batteries in the battery box observing the indicated polarity. (The battery box is designed to be mechanically selective so that the batteries cannot be inserted with reversed polarity). Replace the battery retainer clip. Align the top with the case bottom and squeeze together gently. Snap the pull catches closed.

CAUTION

Do not install damaged or leaking batteries.

MEANING OF THE READINGS

To benefit most from the information obtained from these instruments you must have some understanding of the biological damage resulting from nuclear radiation. The precise effects of nuclear radiation are very complex 2/ However, a complete understanding of them is not required to use your instruments.

1/ See the Family Fallout Shelter, MP-15, Office of Civil and Defense Mobilization, Battle Creek, Michigan.

2/ See the Effects of Nuclear Weapons, U.S. Department of Defense and the U.S. Atomic Energy Commission; TB-11-22, Office of Civil and Defense Mobilization.

Much has been said about the long-range effects from exposure to radiation - increased incidence of leukemia, shortening of the life span, and genetic implication. No doubt radiation exposure will result in some increases in the small percentages of such occurrences normally expected. Other effects of radiation, called acute effects, can result in sickness or death in a relatively short time. In the event of a nuclear attack on this country it is these acute effects that must be dealt with first, and the equipment you have purchased can help you do this.

Scientists generally agree on the amount of radiation damage the body can sustain without causing sickness and death. There are so many variables concerning how radiation will affect you that a precise determination of the effects of radiation cannot be made. The total amount of radiation damage you can incur before becoming ill will depend upon such variables as the duration of the exposure, your body's ability to repair the damage, your general health, age, and vigor. These variables make it difficult to set exact figures for the individual, but ranges that will apply generally can be given.

Perhaps the most important points to remember are (1) for a dose of 100 roentgens received in a few days there probably will be no obvious effects, and you will be able to continue your normal routine; (2) when the short-term exposure exceeds about 200 roentgens you will become sick and need medical assistance; and (3) a short-term exposure of about 600 roentgens will almost certainly cause death.

Probable Acute Effects of Radiation 3/

Short-term, whole-body exposure in roentgens	Probable Effect*
0-100	No obvious effects
100-200	Minor incapacitation
200-600	Sickness and some deaths
Over 600	Few survivors

*The long-range effects, such as shortened life span, decreased resistance to disease, etc., are not considered here.

These acute effects would be modified considerably if the dose were received over a long period. A short-term dose of 600 roentgens probably would be fatal, but it would not cause death or have any noticeable external effects if the exposure were gradually acquired over a much longer period of time - 5 years, for example; the body repairs some of the damage if the exposure is received gradually, and larger doses can be accepted before the individual becomes sick or before death occurs. As an example of how this might be applied in an emergency situation: If a person restricts his total dose of radiation to 200 roentgens for the first month of exposure, 25 roentgens per week for the next 5 months, and 10 roentgens per week thereafter for the next 6 months, he would have little, if any, radiation sickness or impairment of ability to work.

You must remember that any radiation received - no matter how little - is harmful. Your body can never repair all the damage. Take every precaution necessary to keep your exposure as low as possible.

The ratemeter, when exposed where you are located, indicates the number of roentgens per hour you are receiving, just as the speedometer of an automobile indicates the number of miles per hour you are traveling. When you see your speedometer showing too high a speed for road conditions, you slow down to protect yourself. When the ratemeter indicates too high a radiation rate, you should enter and stay in a shelter to protect yourself. Both instruments are related to time. Driving 60 miles an hour for one hour will carry you for 60 miles, and if you are in a location where the dose rate is 60 roentgens per hour and remain there for one hour you will have an exposure of 60 roentgens. Since the Model 61720 presents radiation dose rate, i.e., the dose received per unit of time, you must multiply the time of exposure by the meter reading in order to determine the total dose received. For example, if the Model 61720 reads 200r for a ½ hour period of time, the instrument will have received a total of 100r.

OPERATION

ADJUSTMENTS AND READINGS.

There are three simple basic steps recommended for proper operation of the Model 61720. They are described as follows:

Step 1. ZERO ADJUST.

Turn the instrument on by turning the range switch from "OFF" to the "ZERO" position. Wait about a minute for the instrument to warm up, then turn the "ZERO" control until the meter needle indicates zero on the meter.

CAUTION

If the instrument is not zeroed properly, readings taken on any of the three ranges will be erroneous. The drift will be in an upscale direction at a very slow rate.

Step 2. CIRCUIT CHECK.

Turn the range switch counter clockwise from the "ZERO" position to the "CIRCUIT CHECK" position. This position is spring-loaded to return to "OFF". The range switch must be held in this position for the circuit check.

The meter should read in the red outlined section labelled "CIRCUIT CHECK". If it does not, either the batteries are low or trouble exists in the circuit. See the Maintenance Section of this manual for proper procedures. Make certain the instrument is zeroed before making the circuit check.

Low or dead batteries are indicated by inability to zero the instrument or by a meter reading below the check band when the range switch is in the "CIRCUIT CHECK" position.

Step 3. RANGE SELECTION AND READING.

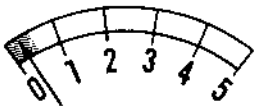
Turn the range switch to the "X100, X10, or X1" range as necessary to obtain an upscale reading on the meter.

3/ See Emergency Exposures to Nuclear Radiation, TB-11-1, and Medical Aspects of Nuclear Radiation, TB-11-24, Office of Civil and Defense Mobilization.

The meter reading observed must be multiplied by the factor indicated by the position of the range switch to obtain the radiation dose rate in roentgens per hour (r/hr).

EXAMPLE:

METER READING	3.8
RANGE	X100
INTENSITY OF RADIATION	380 r/hr



READINGS SHOULD NOT BE TAKEN WITH POINTER INDICATING IN LOWER 10% OF SCALE (SHADED IN ILLUSTRATION). TURN TO NEXT MOST SENSITIVE RANGE UNTIL POINTER INDICATES IN UPPER 90% OF SCALE (UNSHADED).

Another example is a meter reading of 2.4 on the "X10" range which indicates a dose rate of 24 roentgens per hour while the same reading obtained with the instrument turned to the "X100" range corresponds to 240 r/hr.

It is recommended that the instrument be kept turned off, except for periods where frequent readings are required, in order to conserve battery life. The "ZERO" or "CIRCUIT CHECK" may be performed at any time, whether the instrument is in a radiation field or not.

TECHNICAL DESCRIPTION

The VICTOREEN Model 61720 is a portable monitoring instrument which measures gamma radiation dose rates as high as 500 roentgens per hour. It is designed to be used in determining radioactive contamination levels that may result from an enemy attack or other nuclear disasters.

Instrument accuracy on any of its three ranges is within ±15% of the true dose rate from CO^{60} gamma radiation. This accuracy is maintained throughout a temperature range of -20°F to +125°F, relative humidities to 100% and at altitudes from sea level to 25,000 feet.

SENSING ELEMENT.

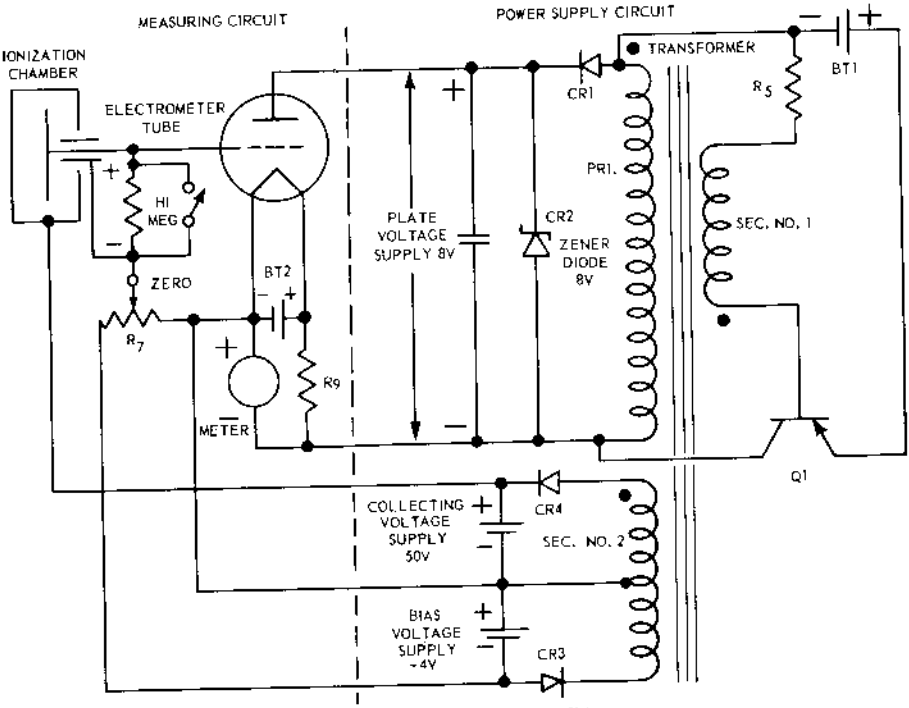
The detecting element in the Model 61720 is an hermetically sealed ionization chamber. This chamber is located in the lower front portion of the instrument, to make the instrument equally sensitive to radiation from the bottom and front. The ionization chamber is hermetically sealed to eliminate changes in sensitivity due to changes in air pressure resulting from altitude changes, temperature changes, and moisture effects.

ELECTRONIC CIRCUITRY.

All electrical components which make up the circuitry are fastened to a printed circuit board. The circuitry serves to measure the minute current from the ionization chamber which indicates the presence of ionizing radiation. The high impedance components are housed in a gasketed light-tight metallic enclosure for protection and shielding.

METER AND CONTROLS.

The Model 61720 uses a ruggedized, sealed meter to insure water-tightness, shock and vibration resistance. Two controls are provided. One control is a range switch which turns the instrument on, checks its operation and serves to select the proper range. The second is a zero control which is used to adjust the instrument to assure proper reading.



Simplified Schematic Circuit Diagram

OPERATOR'S MAINTENANCE

BATTERY REPLACEMENT.

Battery replacement is performed in the same manner as Battery installation.

PRECAUTIONS

DO NOT USE CLEANING SOLVENTS ON THE PLASTIC PARTS. To clean the case, use soap and water. If the batteries have leaked, remove the case bottom and fill with warm water. The battery spillage will be loosened in a short while and can be rinsed out.

HIGH IMPEDANCE CIRCUITRY.

The "Hi-Meg" resistors, electrometer tube, ceramic switch-wafer, and chamber feed-thru and guard-ring comprise the high impedance circuitry of the Model 61720. Any accumulation of dirt or grease on these parts will contribute to leakage currents that will cause upscale readings which will be most evident on the X1 range. Therefore, it is desirable that these parts be handled as little as possible.

SEMI-CONDUCTOR COMPONENTS (DIODES AND TRANSISTORS).

The semi-conductor components used in the Model 61720 may be damaged by prolonged exposure to excessive heat. When replacing any of these

components the soldering operations should be accomplished as quickly as possible. Holding the lead between the component and the soldering point with a pair of pliers will decrease the heat transmitted to the component during the soldering operation.

ELECTROMETER TUBE.

When checking for a possible open filament of the electrometer tube, be certain to use an ohmmeter which has an output current of less than 10 ma. For example, a Simpson Multimeter on Range RX1 will deliver approximately 125 ma and will burn out the filament of the electrometer tube if used to measure the filament resistance on that range.

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE.

Preventive maintenance procedures should be carried out once a month when the instrument is in use, and about once every six months when the instrument is in storage.

a. Remove the batteries, clean battery contacts and battery terminals if necessary and remove any corrosion present.
b. Replace the batteries making certain that all batteries make good contact and exceed minimum voltage.
c. Follow steps described in the **OPERATION** section of the manual to check performance of the instrument.

BATTERIES SHOULD BE REMOVED FROM THE INSTRUMENT IF IT IS TO BE STORED MORE THAN A FEW WEEKS. STORE BATTERIES IN THE SAME BOX WITH THE INSTRUMENT SO THEY WILL BE ON HAND WHEN NEEDED.

DISASSEMBLY FOR CORRECTIVE MAINTENANCE.

CAUTION

Corrective maintenance should be performed only by a competent electronic technician or licensed radio or television service company.

a. Release the snap action catches and remove the instrument from the case bottom.
b. Remove the retaining clip and batteries from the battery box.
c. Remove the four screws which secure the battery box to the instrument top. Swing the battery box away from the circuit board. Wiring between the battery box and the circuit board prevents complete separation of the battery box.
d. Remove the four screws and spacers which secure the chamber to the instrument top.

Note: At this point the instrument (with batteries) will operate on ZERO and CIRCUIT CHECK ranges and the circuit board is completely exposed for trouble shooting.

e. Remove the meter nuts.
f. Remove the knob from the ZERO control. It is not necessary to remove the range switch knob.
g. Remove the circuit board. This is most easily accomplished by pressing on the ZERO control shaft and applying a slight pressure at the meter studs.
h. Remove the nuts, washers, and lockwashers from the top of the circuit shield box.
i. Remove the circuit shield box. The instrument is now completely disassembled.

Reassembly of the instrument is the reverse of the disassembly procedure.

IMPORTANT

Before beginning reassembly make certain the range switch and both switch wafers are oriented in the OFF position.

TROUBLE SHOOTING.

The majority of the electrical components of the Model 61720 are standard parts familiar to electronic technicians and are readily checked by conventional means. The electrometer tube, the "Hi-Meg" resistors, the ion chamber insulator and the ceramic switch section are the only components requiring special precaution. These components are all part of the high resistance input circuit. **THE INSULATING PORTIONS OF THESE FOUR COMPONENTS SHOULD NOT BE HANDLED.** They should be touched only with clean tools when repairs are made. If surface leakage on any of these items is suspected, cleaning with clean alcohol using a clean camel hair brush is recommended. Avoid solder flux splattering on these components when repairs are made.

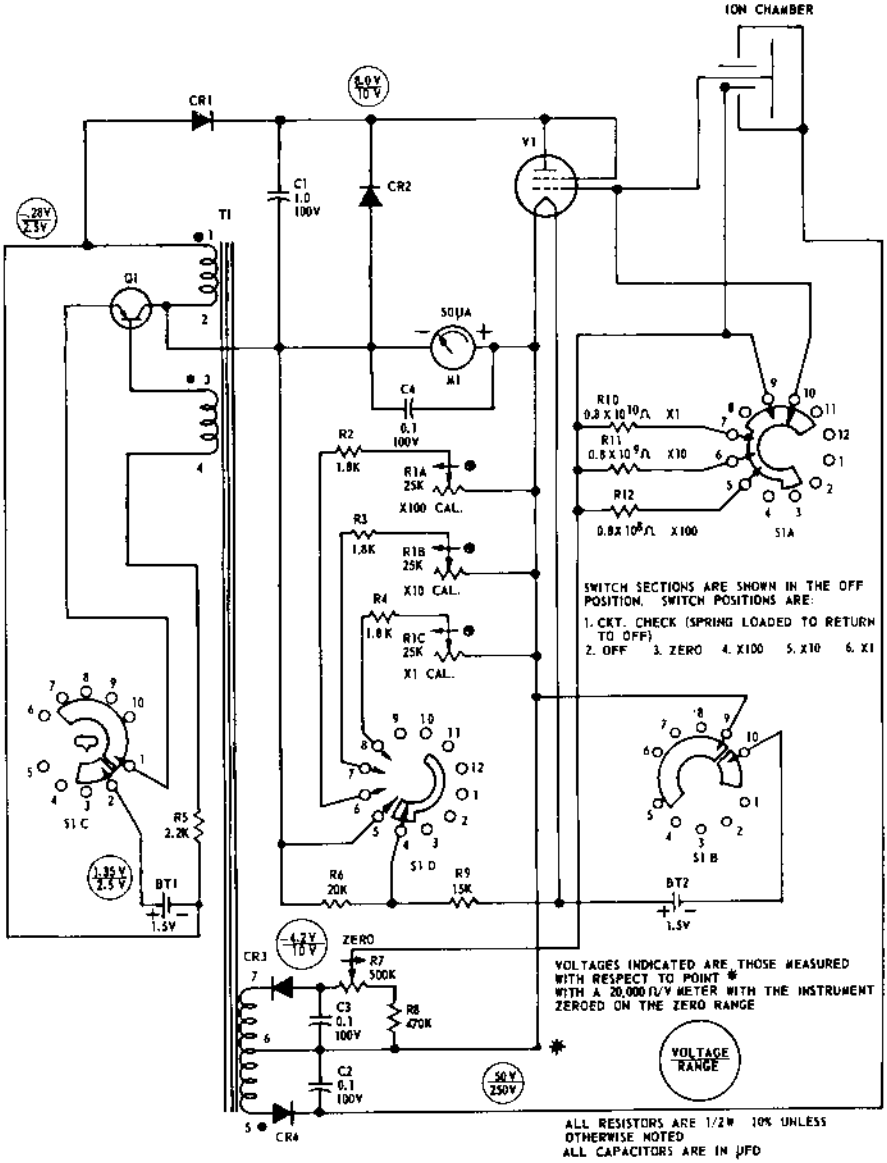
All batteries as well as the measuring circuit are checked by the "CIRCUIT CHECK". If trouble exists, batteries should be checked with any voltmeter having a sensitivity of 1000 ohms/volt or more. The "D" cells, BT1 and BT2, should read higher than 1.2 volts.

Circuit malfunctions may be traced with the aid of the schematic circuit diagram. Voltage measurements shown on this diagram are measured with the respect to point* and are those obtained with a voltmeter having a sensitivity of 20,000 ohms per volt. Such voltage checks should be taken with the instrument range switch turned to the "ZERO" range and with the zero control adjusted so that the instrument reads zero.

The following troubles and corrective action are presented as an aid to trouble shooting:

TROUBLE SHOOTING CHART

Trouble and Cause	Corrective Action
NO READING:	
Filament Battery Low	Replace the Battery
Corroded Battery Contacts	Clean or Replace the Contacts
Metet Damaged	Replace Meter
Chamber Damaged	Replace Chamber
Open Connection	Inspect Solder Joints
METER WILL NOT ZERO: ***(Reads Upscale)***	
Transformer Defective	Replace Transformer
METER WILL NOT ZERO ***(Reads Downscale)***	
Power Supply Battery Low	Replace Battery
Corroded Battery Contacts	Clean or Replace Contacts
Defective Tube	Check Tube Filament
Transformer Defective ***(Transformer Does Not "Sing")***	Replace Transformer
INSTRUMENT READS LOW:	
Calibration Control Disturbed	Check Calibration
Defective Tube	Replace Tube
Meter Damaged	Replace Meter
Defective Chamber	Replace Chamber
Dirty High Resistance Components	Clean High Resistance Components
INSTRUMENT READS HIGH:	
Calibration Control Disturbed	Check Calibration
Damaged "Hi-Meg" Resistor	Replace "Hi-Meg" Resistor
Dirty High Resistance Components	Clean High Resistance Components
INSTRUMENT READS UPSCALE ON X1 RANGE:	
(More than 3 to 5 Divisions No Radiation Present)	Clean ceramic switch with clean alcohol using a camel hair brush and mildly bake dry for several hours using a low wattage light bulb. Reassemble instrument immediately after removing lamp.



Schematic Circuit Diagram

REPLACEABLE PARTS LIST

Electrical Components

Circuit Symbol	Description	Victoreen Part No.	Quantity Per Equipment
C1	Capacitor: 1 ufd; 100V	21-89	1
C2, C3	Capacitor: 0.1 ufd; 100V	21-205	2
C4	Capacitor: 0.1 ufd; 100V	21-195	1
CR1	Diode: PA305A (or equiv.)	489-18	2
CR2	Diode: Zener	52-28	1
CR3	Same as CR1	———	—
CR4	Diode:	52-30	1
M1	Meter Assembly: 0-50 ua d. c.	720-110	1
Q1	Transistor	23-18	1
R1A	Potentiometer: 25K-25K-25K ½W 20%	22-24	1
R1B	Section of R1	———	—
R1C	Section of R1	———	—
R2	Resistor: 1.8K; ½W; 10%	185-347	3
R3	Same as R2	———	—
R4	Same as R2	———	—
R5	Resistor: 2.2K; ½W; 10%	185-657	1
R6	Resistor: 20K; ½W; 5%	185-135	1
R7	Potentiometer: 500K; ½W; 10%	22-25	1
R8	Resistor: 470K; ½W; 10%	185-259	1
R9	Resistor: 15K; ½W; 10%	185-393	1
R10	Resistor: Hi-Meg 0.8×10^{10} ohms; ½W; 10%	185-1415	1
R11	Resistor: Hi-Meg 0.8×10^{9} ohms; ½W; 10%	185-1414	1
R12	Resistor: Hi-Meg 0.8×10^{8} ohms; ½W; 10%	185-1413	1
S1A	Ceramic Wafer	720-116	1
S1B	Section of S1A	———	
S1C	Phenolic Wafer	720-166	1
S1D	Section of S1C	———	———
T1	Transformer: Pulse Ass'y	720-104	1
V1	Electrometer Tube	35-134	1
	Ionization Chamber	61720-135	1
BT1	Battery: 1.5V NEDA Type 13	263-17	2
BT2	Same as BT1	———	

Mechanical Components

Description	Function	Victoreen Part No.	Quantity Per Equipment
Case Bottom Ass'y	Bottom of Inst. Case	61720-130	1
Gasket	Chamber-Case Bottom Seal	720-158	1
Knob	Zero Adjust	720-107	1
Battery Retainer Clip	Holds Batteries in Box	720-121	1
Battery Contact	Elect. Connections to Batt.	700-68	4
Battery Box	Holds Batteries	700-66	1
"O" Ring Shaft Seal	Zero Adj. Shaft Seal Switch Index	710-42	2
Tube Socket	Holds Electrometer Tube	720-122	1
Knob, Range	Selector Switch	710-85	1
Meter Gasket	Cast Top-Meter Seal	700-63	1
Switch Index	Positions Range Switch	720-106	1
"O" Ring	Handle—Case Top Seal	46-25	1
Case Gasket	Case Top-Case Bottom Seal	720-157	1
Handle	Inst. Carrying Handle	720-114	1
Case Top	Top of Instrument Case	720-111	1
Instruction Manual	Operating & Maintenance Instructions	61720-1	2
Spacer	Ion Chamber to Ckt. Brd. Spacer	720-175	4
Spacer	Guard Ring to Ckt. Brd. Spacer	720 117	1
Switch Drive Shaft	Connects Switch Index to Switch Wafers	720-126	1
Shield Box	Shields High Impedance Ckt.	720-123	1
Grommet	Holds Switch Drive Shaft in Shield Box	373-75	1
Chamber Contact Spring	Connects Chamber Center Electrode to Elect. Tube Grid	720-153	1

WARRANTY

The VICTOREEN INSTRUMENT COMPANY warrants this instrument to be free from defects in material and workmanship for a period of 90 days from date of shipment to the purchaser. In the event defects in material or workmanship should develop under normal conditions of operation during this warranty period, the buyer may return the instrument to the factory for repairs at the expense of VICTOREEN, excluding transportation costs.

Our responsibility under this warranty is limited to servicing or adjustment of any instrument returned to the factory for that purpose and to replacement of defective parts which are found to be so upon our examination and to our satisfaction. All instruments returned for repair must be accompanied by an explanation of the trouble experienced and return shipping instructions.

INSTRUCTIONS FOR USE OF THE VICTOREEN MODEL 61720 FALLOUT DETECTION METER

PLACE THIS CARD IN A CONVENIENT LOCATION NEAR THE INSTRUMENT, READY FOR IMMEDIATE USE IN CASE OF EMERGENCY.

Step 1. ZERO ADJUST

Turn range switch from "OFF" to "ZERO". Wait a moment for the instrument to warm up. Turn the "ZERO" control knob until meter needle indicates zero.

Step 2. CIRCUIT CHECK

Turn the range switch counter-clockwise from "ZERO" to "CIRCUIT CHECK" (this position is spring loaded and must be held in position for the circuit check). The meter should read in the red outlined section labelled "CIRCUIT CHECK".

Step 3. RANGE SELECTION AND READING

Turn the range switch to "X100, X10 or X1" range as necessary to obtain an upscale reading on the meter. The meter reading must be multiplied by the number indicated by the position of the range switch to obtain the radiation dose rate in roentgens per hour (r/hr).

Example:

Meter Reading	3.8
Range	X100
Intensity of Radiation	380r/hr

Use Ratemeter to Find Area of Least Radiation Dose Rate

Multiply the instrument reading by time (in hours) spent at a particular radiation level to determine effects of radiation.

PROBABLE ACUTE EFFECTS OF RADIATION

Short-term, whole-body exposure in roentgens	Probable Effect*
0-100	No obvious effects
100-200	Minor incapacitation
200-600	Sickness and some deaths
Over 600	Few survivors

**The long-range effects, such as shortened life span, decreased resistance to disease, etc., are not considered here.*