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U.S. MARINE CORPS TECHNICAL MANUAL

DETECTING SET, INTRUSION
AN/PSR-1A

OPERATION AND MAINTENANCE

JANUARY 1968

DEPARTMENT OF THE NAVY
Headquarters U.S. Marine Corps
Washington, D. C. 20380

15 January 1968

1. This Manual is effective upon receipt and describes operation and maintenance procedures for the Detecting Set, Intrusion, AN/PSR-1A.

2. Notice of discrepancies and suggested changes to this Manual should be directed to the Commandant of the Marine Corps (Code CSY-10).

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

OFFICIAL

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Colonel, U.S. Marine Corps
Director, Technical Division
Supply Department

DISTRIBUTION: "AG"

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SECTION I

GENERAL DESCRIPTION

1.1 GENERAL

This manual describes operation and maintenance procedures for the Detecting Set, Intrusion, AN/PSR-1A, manufactured by The G. C. Dewey Corporation, New York New York. Figure 1 shows the complete detector equipment and the relationship of all major components.

1.2 PURPOSE OF EQUIPMENT

1.2.1 GENERAL. The Detecting Set, Intrusion, AN/PSR-1A, is a portable, rain-proof, rugged device designed to detect and locate personnel or vehicles. Detection of earth vibrations caused by movement of objects on the surface of the earth is the basic principle of operation.

1.2.2 USE, CAPABILITIES AND LIMITATIONS OF EQUIPMENT. The Intrusion Detecting Set is intended to provide a warning of intrusion into a specific area without the intruder being aware of detection. The system is capable of detecting any movement which results in a minute earth movement. Such a movement can be caused by human footsteps, moving vehicles, low-flying or taxiing aircraft, or any similar disturbances. The seismometer may be submerged to detect marine movements. Movements in underground tunnels are detected at the same range as surface movements. Movements inside structures such as buildings can be detected through vibrations in the structural members; however, buildings in which there is a quantity of moving machinery become too noisy for good detection.

The range of detection for ordinary use is 30 yards measured in all directions from the seismometer. Conditions existing at the time of use — such as type of terrain,

wind, degree of disturbance caused by the intruder, and interfering friendly disturbances – will have some effect on this range. The control set may be placed up to 1 mile from the seismometer without affecting range within limitations described above.

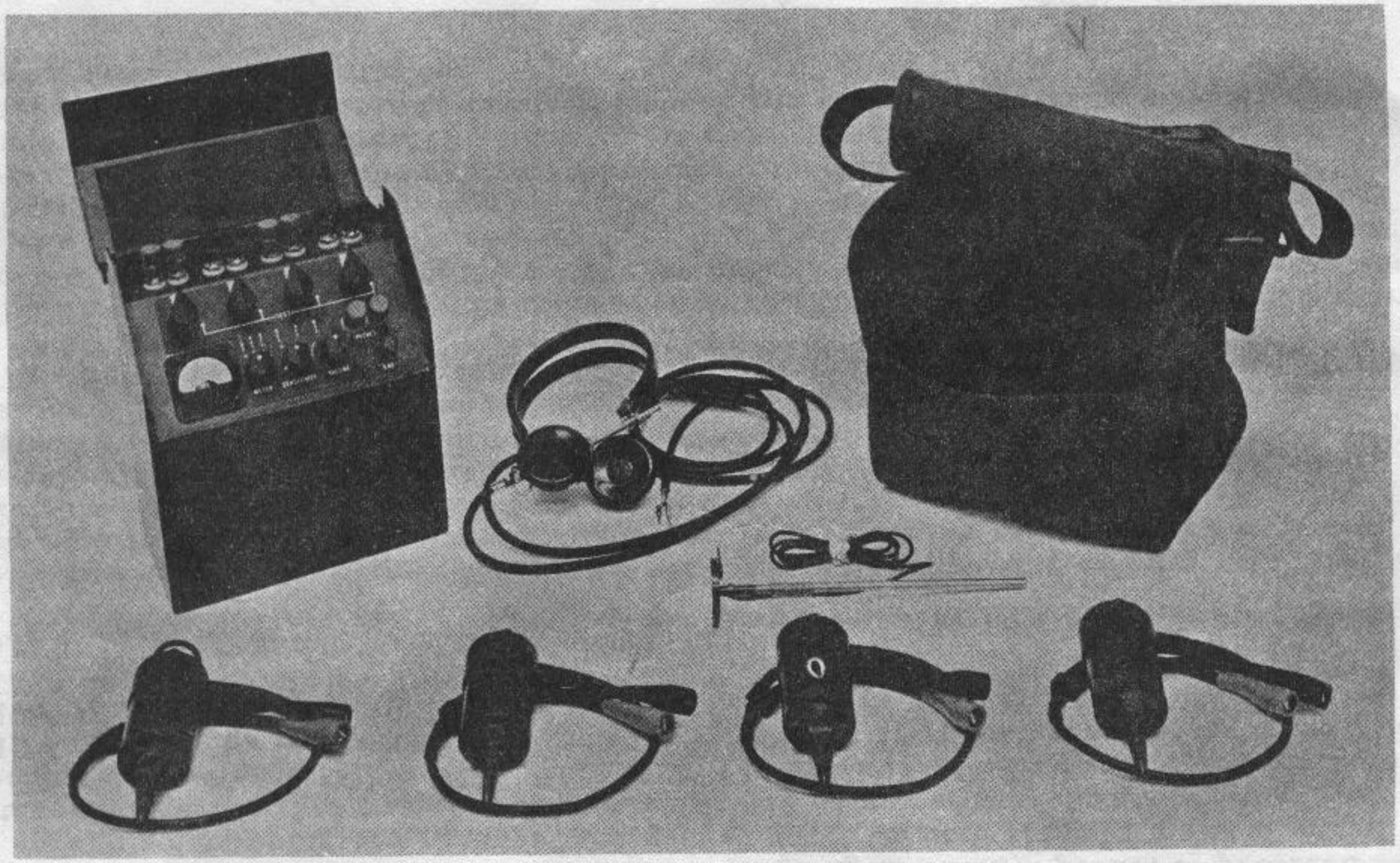


Figure 1. Intrusion Detecting Set, AN/PSR-1A

1.3 DESCRIPTION OF EQUIPMENT

1.3.1 PHYSICAL FEATURES. The control set is packaged in a water-resistant case and is carried in a canvas carrying bag in which a pocket is provided for carrying seismometers, headset and ground rod. On both sides of the bag, metal fastener connectors are provided for attaching two or more control sets together for operator convenience (Figure 1). Total weight of the unit including four seismometers is 12 pounds. The equipment is designed to operate in temperatures ranging from 0°F to 150°F, at altitudes to 10,000 feet and in a humidity of 100 percent.

1.3.2 DESCRIPTION OF MAJOR UNITS

1.3.2.1 Control Set. The control set (Figure 2) houses the seismic amplifier, audio oscillator, batteries, fuse, loudspeaker, and switching and test circuits. Input terminals on top of the control set accept lines from the seismometers. A white, erasable annotation plate on the lid of the metal case is provided for pencil-marking seismometer locations adjacent to corresponding input terminals. When changing location of seismometers, change plate notation. Terminals for the ground wire and the headset are located on the front panel.

1.3.2.2 Seismometer. Each seismometer (Figure 3) is housed in a 2-inch diameter, hermetically sealed aluminum case equipped with a 2-inch spike for insertion into the soil. The spike end of the seismometer must be down for the detector to perform properly. The top has a stress ring tie point and 18-inch leads with insulated spring clips. Within every seismometer case, a coil moves vertically inside a magnet when ground motion occurs, thereby generating minute voltages. Mechanical stops prevent damage to the moving parts by excessive shock and vibration normally encountered in tactical use and transportation.

Battery Drain		
	Quiet	2.0 ma
	Disturbed	22 ma
Batteries		Six — BA-30, 1.5 v-dc
Fuse		1/16 amp
Seismometers		Four — 20 cps, 215-ohm coil, 330-ohm damping resistor, 0.4 $\dot{v}$/inches per second
Ambient Temperature Range		$0^{o}F$ to $150^{o}F$
Altitude		
	Transporting	35,000 feet
	Operating	10,000 feet
Humidity		100 percent
Weight (less field wire)		12 pounds
Dimensions		
	Control Set (less canvas carrying case)	4-1/2 inches x 7-3/4 inches x 9 inches
	Seismometer	2-inch diameter x 4-inch length

1.5 EQUIPMENT LIST

1.5.1 EQUIPMENT SUPPLIED

- Control Set
- Four Seismometers
- Headset

- Ground Rod
- Manual
- Canvas Carrying Bag

1.5.2 EQUIPMENT REQUIRED BUT NOT SUPPLIED

1.5.2.1 Connecting Wire. A sufficient length of standard 2-conductor field wire or other equivalent 18-gage commercial wire suitable for field telephone use is satisfactory for connecting the seismometers to the control set. Loop resistance to one seismometer should not exceed 50 ohms (normally 1 mile of field wire) for peak performance.

1.5.2.2 Batteries. Batteries are not shipped installed in the battery case, as batteries may deteriorate under extreme storage conditions. Batteries should be relatively fresh for best performance. For installation, see subsection 3.5.1 (Figure 8).

SECTION II

PRINCIPLES OF OPERATION

2.1 GENERAL SYSTEM OPERATION

The overall functional block diagram of the Detecting Set, Intrusion, AN/PSR-1A (Figure 6), indicates signal paths in the seismic system and operational control functions.

2.2 FUNCTIONAL OPERATION

2.2.1 SEISMOMETER. The seismometer is a permanent-magnet moving-coil transducer which translates ground movements into electrical signals. Ground movements cause the coil to move in the magnetic field, generating a minute electrical voltage. The speed of the coil movement determines the magnitude of the output voltage.

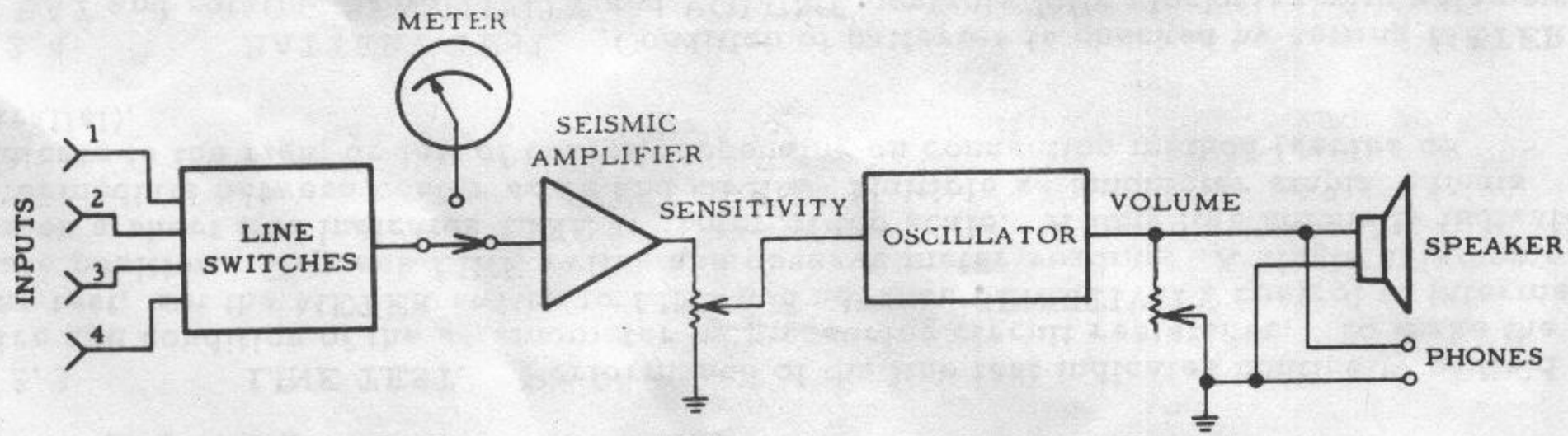


Figure 6. Functional Block Diagram

2.2.2 LINE SWITCH. The four sets of input terminals are combined to parallel internally at the control set input. Any input line may be disconnected by depressing the corresponding line switch to TEST position.

2.2.3 LINE TEST. Performance of the line test indicates continuity of field wire and condition of the seismometer by measuring circuit resistance. To make the line test, set the METER switch to LINE and advance SENSITIVITY control to intermediate position. Depress LINE switch and observe meter reading. A single seismometer on a short line indicates LINE at center of top scale. A long line normally indicates intermediate between center scale and OPEN. Multiple seismometer emplacements indicate to the right or left of center, depending on connection method (series or parallel).

2.2.4 BATTERY TEST. Condition of batteries is checked by setting METER to BAT and rotating SENSITIVITY and VOLUME controls fully clockwise with seismometer connected. This tests the battery for voltage under maximum load conditions.

2.2.5 SEISMIC AMPLIFIER. The seismic amplifier accepts low-level signals from the seismometer and amplifies them as much as 4 million times (126 db) with the SENSITIVITY knob set to MAX. Signals in a frequency range of about 15-500 cps are sensed by the seismometers. A low-pass filter located in the seismic amplifier section rejects all signals higher than 30 cps. Therefore, effective surveillance is accomplished with seismic signals in the subaudio range of 15-30 cps.

2.2.6 OSCILLATOR. Subaudio frequencies from the output of the seismic amplifier are rectified and filtered, yielding a d-c voltage which fluctuates with the amplitude of ground motion at the seismometer. This fluctuating d-c voltage is applied to a voltage-controlled audio oscillator. If the voltage remains below a preset threshhold level, the oscillator is silent. As ground motion increases, the oscillator becomes active. Oscillation frequency rises as impressed voltage rises. For large ground-motion amplitudes, the full battery supply voltage is applied, and further increases in

ground motion cease to affect pitch. For footsteps in normal range of detection, the oscillator emits audio frequency for each step and, as the intruder approaches the seismometer, the sound becomes higher-pitched and continuous. The low-impedance headset connects in parallel with the speaker when used. In this mode, the current pulses are diverted from the speaker to the headset.

SECTION III

INSTALLATION

3.1 UNPACKING THE EQUIPMENT

To avoid damaging the equipment, normal care should be used when unpacking the Intrusion Detecting Set.

3.2 INSPECTION

The initial inspection of the equipment after unpacking will consist of the following actions.

(1) Remove the metal case from the canvas carrying bag and examine for any sign of damage. There should be no dents or other indications of abuse, and any defects should be corrected before use.

(2) Raise the hinged lid at the top of the case and examine all binding posts and controls for damage. Controls should move freely.

(3) Utilizing screwdriver on ground stake assembly, loosen two captive screws on battery case cover and check for proper seating of batteries if installed. If not installed, refer to subsection 3.5. Close cover and tighten captive screws.

3.3 SITE SELECTION (FIGURE 7)

3.3.1 RANGE FOR FOOTSTEPS. Ordinary detection range for footsteps is 30 yards. A longer range is possible in dense or saturated soils. Dry or loose sand and dirt decrease the effective range. Maximum range is obtained when the SENSITIVITY control is set at the point where background noise occasionally actuates the audio signal.

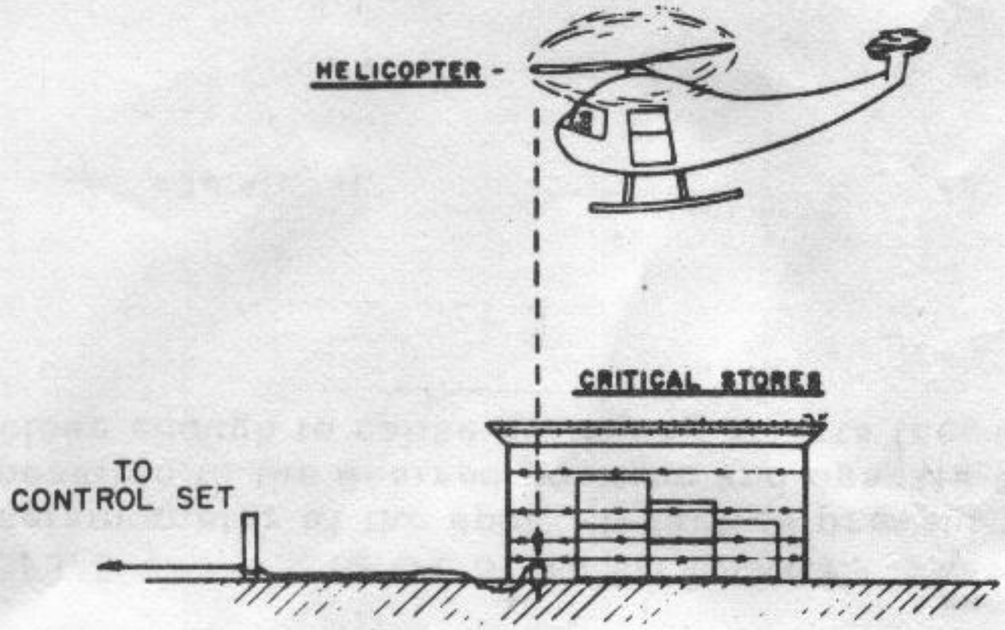
Burying the seismometer and the field wire for the first few feet from the seismometer tends to reduce background noise and increase signal, resulting in an increased usable range. The intruder's weight, speed and stealth also will affect the detection range. Approach within 5 yards of a concealed detector without actuating the detector is very difficult.

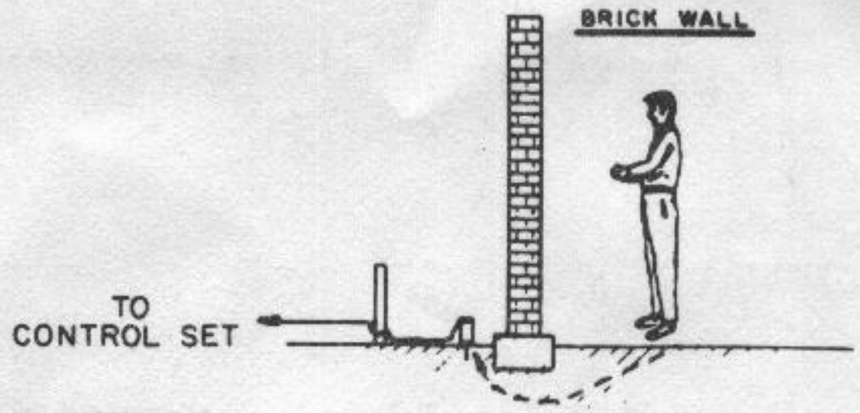
3.3.2 OBSTRUCTIONS. The seismic wave travels through rock and soil, and line-of-sight obstructions such as vegetation, terrain features, walls, and streambeds have no effect on the detection range. Similarly, disturbances in caves, tunnels and culverts can be detected.

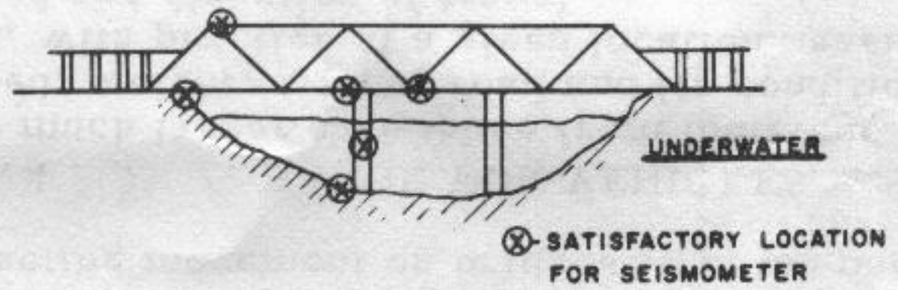
3.3.3 SURVEILLANCE OF STRUCTURES. In structures such as bridges, docks and buildings, seismic waves travel considerable distances through structural members. Range will depend upon background noise and signal path obstructions such as interposed foundation piers. An excellent, concealed seismometer location for detecting movement on bridges is in the underwater area next to a foundation pier.

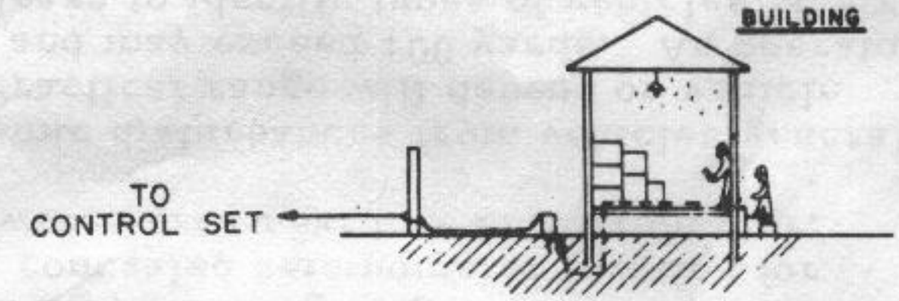
3.3.4 RANGE FOR VEHICLES. Seismic disturbances from vehicles generally are much larger than those from footsteps. Practical range will depend on vehicle speed, weight, type of road and its condition, and may exceed 100 yards. An operator can, with practice at a given location, easily learn to identify types of vehicles, their speed and direction of travel.

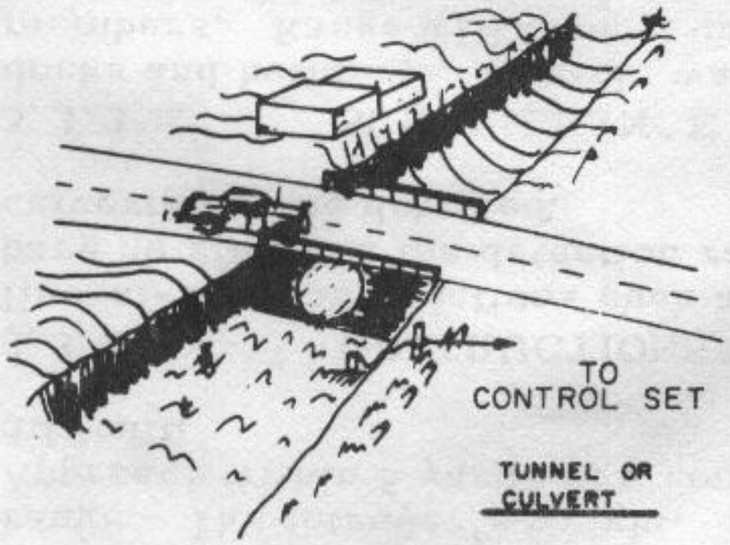
3.3.5 SPOT SURVEILLANCE. Best spot surveillance is obtained by burying a seismometer at the spot. If tactics prevent this, place the seismometer as close as possible to the desired position and operate the system with no other seismometers close enough to cause nullifying effects (see 3.3.6 below).


HELICOPTER
CRITICAL STORES
TO
CONTROL SET

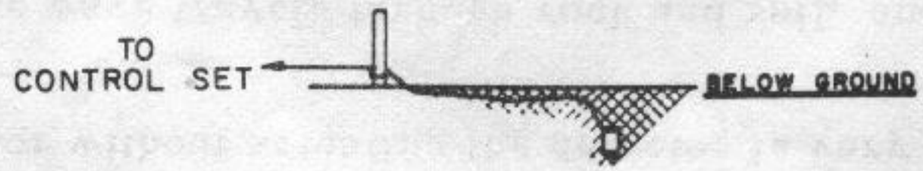

BRICK WALL
TO
CONTROL SET

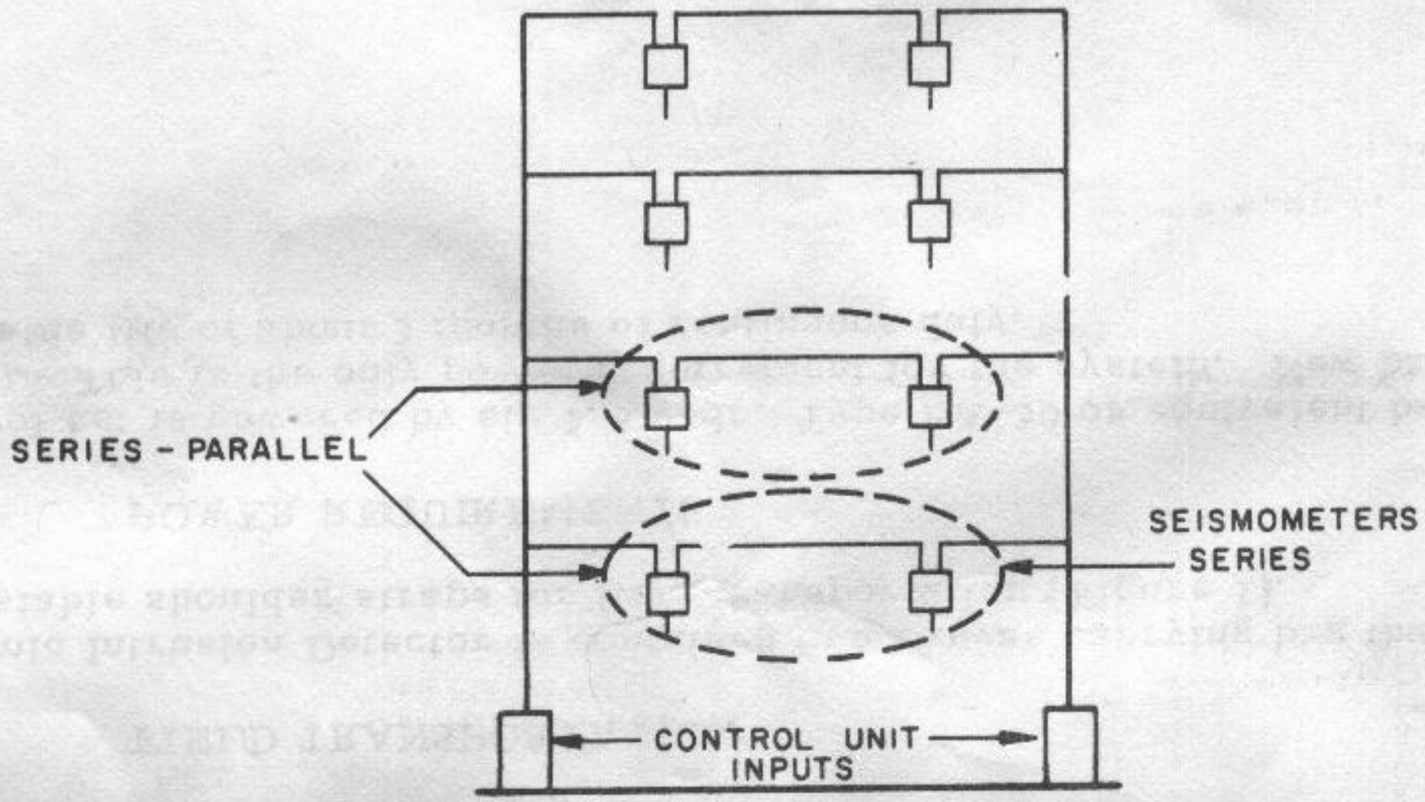

UNDERWATER
⊗-SATISFACTORY LOCATION
FOR SEISMOMETER


BUILDING
TO
CONTROL SET


TO
CONTROL SET
TUNNEL OR
CULVERT


TO
CONTROL SET
ABOVE GROUND


TO
CONTROL SET
BELOW GROUND



RECOMMENDED MULTIPLE SENSOR ARRAY ARRANGEMENT. SET UP SEISMOMETERS IN SERIES - PARALLEL AS SHOWN. WHERE PRACTICAL, LIMIT SEISMOMETERS IN SERIES TO TWO.

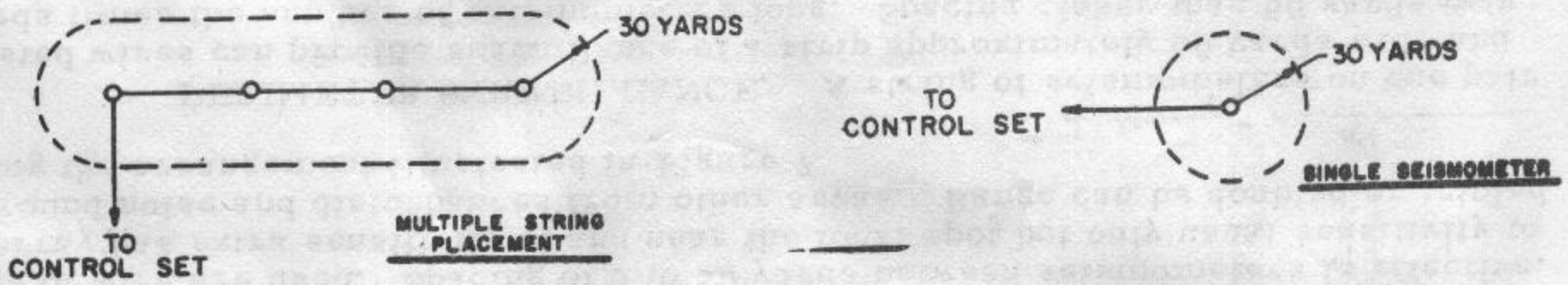


Figure 7. Seismometer Site Selection and Sensor Array Arrangement

If combat-type wire is being used, care must be taken to insure that the proper connections are being made; untwisting the wire will be the most rapid means since short lengths of wire are used. Spacing of 5 to 50 yards between seismometers is effective. This array has extra sensitivity at and near the focal spot but only usual sensitivity to background noise and disturbances from other areas. Range can be doubled or tripled by using the arrangement illustrated in Figure 7.

3.3.6 PERIMETER SURVEILLANCE. A string of seismometers on one pair of twisted wires can provide surveillance of a strip approximately 60 yards wide and 50 yards times the number of seismometers long. Spacing closer than 50 yards may be desired in some cases. Spacing of less than 20 yards in a string is not recommended for general use because of seismometer polarity problems (see preceding paragraph). As many as 10 seismometers can be used without affecting the range of an individual seismometer. Seismometers on one string may be connected in series, parallel or series-parallel but, if more than one input terminal is used, all lines should have essentially the same resistance at the input terminals. Experimenting for maximum surveillance effectiveness is recommended.

3.4 FIELD TRANSPORTATION

The Seismic Intrusion Detector is contained in a canvas carrying bag that is equipped with adjustable shoulder straps for field transportation (Figure 1).

3.5 POWER REQUIREMENTS

The control set is powered by six 1.5 v-dc, Type BA-30 or equivalent batteries (Figure 8). This is the only power requirement for the system. New batteries should have a usable life of about 3 months of continuous duty.

3.5.1 BATTERY INSTALLATION

(1) Locate the battery case cover at the rear of control set.

(2) Utilizing screwdriver on ground stake assembly, loosen the two captive screws and allow cover to hinge down, exposing battery holder.

(3) Install six batteries with the positive terminal of the batteries against the red button contacts.

(4) Close unit by tightening the two captive screws.

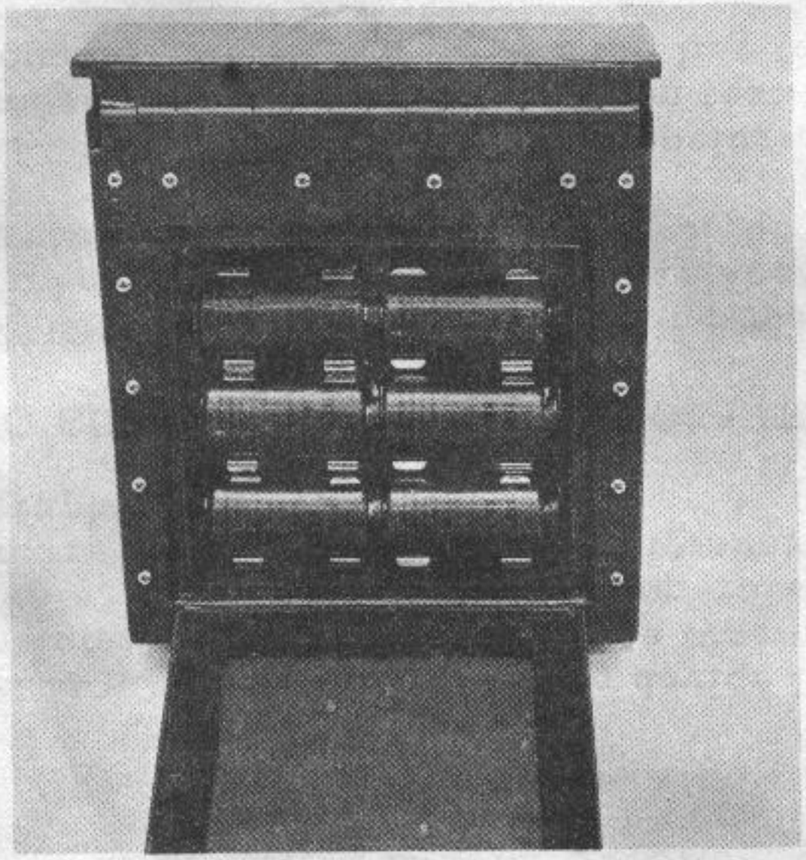


Figure 8. Battery Location

SECTION IV

OPERATING INSTRUCTIONS

4.1 GENERAL

The Intrusion Detecting Set is a lightweight, portable device for tactical field use. When properly used and maintained, it will indicate the type of intrusion and the specific area of the intruder. This equipment is simple to operate; however, it is recommended that personnel who are unfamiliar with the equipment should follow the checkout procedures listed in paragraph 5.2.

4.2 OPERATING CONTROLS AND INDICATORS (FIGURE 9)

4.2.1 INPUT TERMINALS. Four pairs of spring-loaded binding posts accept up to four separate field wires. Posts of one pair are adjacent, colored alike and marked with an identifying channel number, e.g., 1, 2, 3, or 4.

4.2.2 INPUT SELECTOR SWITCHES. Four spring-return switches allow each input to be individually removed from the circuit. When testing line (one 2-conductor field wire) for shorts and opens, this switch throws the line to the test circuit.

4.2.3 SENSITIVITY CONTROL. The knob marked SENSITIVITY controls sensitivity range of the unit and turns the unit on. The same knob when rotated fully counterclockwise in the OFF position, disconnects the batteries.

4.2.4 VOLUME. The knob marked VOLUME controls the audio volume of the set.

4.2.5 METER. A 3-position switch marked METER, used in conjunction with the indicating meter, provides battery and line tests. This switch is normally in OFF position.

4.2.6 PHONES. The front panel terminals marked PHONES accept headset pins. When the headset is connected, the speaker is disabled.

4.2.7 GROUND. The terminal marked GND accepts the ground lead.

Figure 9. Operating Controls and Indicators

4.3 OPERATING PROCEDURES

(1) Deploy seismometer in surveillance area and connect to control set with field wire (1.5.2.1). Each field wire coming to the control set from the seismometers should be connected to separate pairs of input terminals. The field wire should be tied down (Figure 10) to stationary objects at each end. In addition, the field wire should be tied to the seismometer stress ring about 2 feet from the wire end to prevent accidentally disconnecting leads from the line. If a seismometer is located at a spot where foot or vehicle traffic is expected, bury the seismometer and field wire between seismometer and stationary tie-down. Burying the seismometer in the ground 6 to 8 inches will improve range at most locations. For best performance, the seismometer spike always should point down and be within 30° of vertical.

(2) Connect ground to control set. Connect ground to terminal marked GND. If topsoil is loose, dig a hole so that the ground rod may be inserted into firm soil. In very dry country, it may be necessary to moisten the soil around the spike daily.

CAUTION

Do not operate set without a ground connection.

CAUTION

Before proceeding, insure that VOLUME control is fully counterclockwise, otherwise operator's position will be disclosed.

(3) Rotate SENSITIVITY knob about 1/4 - turn clockwise and batteries (see subsection 5. 2. 5).

(4) Rotate METER knob to LINE and test each line. Repair if fault is indicated (see subsection 5. 2. 4).

(5) Return METER switch to OFF.

(6) Rotate VOLUME control fully counterclockwise. Rotate SENSITIVITY knob fully clockwise and adjust VOLUME control slowly clockwise until squeal is audible.

(7) Slowly rotate SENSITIVITY knob counterclockwise until the squeal just subsides. Then adjust so that random disturbances cause a squeal no more frequently than one every several seconds. This insures maximum range. An intruder in the surveillance area will cause the control set to squeal for each footstep or for other ground disturbances.

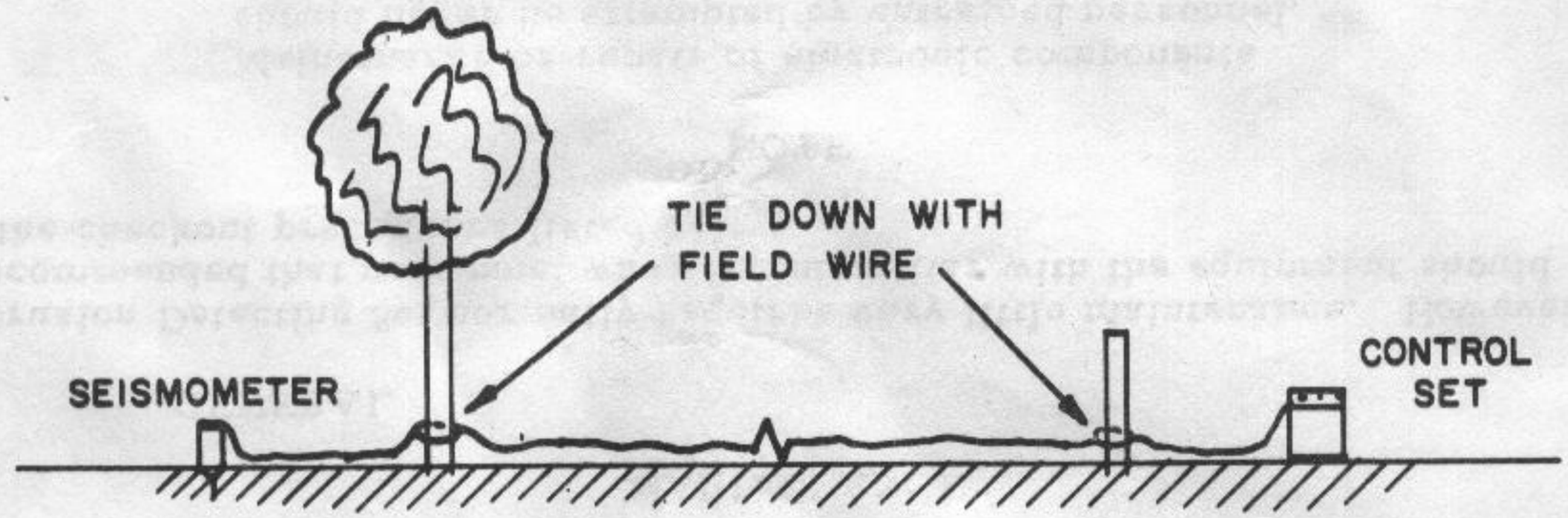


Figure 10. Field Wire Tie-Down Method

SECTION V

MAINTENANCE

5.1 GENERAL

The Intrusion Detecting Set normally requires very little maintenance. However, it is recommended that personnel who are unfamiliar with the equipment should follow the checkout procedures listed below.

NOTE

Maintenance or repair of electronic components should never be attempted by untrained personnel. Replace the component or send it to the repair unit.

5.2 CHECKOUT OF EQUIPMENT

Successful completion of the following checks indicates that the system is functioning properly and is ready for operation.

NOTE

When the Intrusion Detector is not in use, be sure that the SENSITIVITY and METER knobs are rotated to OFF position. This prevents battery drain.

5.2.1 SEISMOMETER SENSITIVITY CHECK

(1) Connect one seismometer to one pair of input terminals (adjacent terminals, same color, marked 1, 2, 3, or 4) by means of a 6-foot piece of field wire (1.5.2.1). Either polarity of the seismometer is proper. Hold the seismometer steady with the spike pointing vertically.

(2) Turn knobs marked METER, SENSITIVITY and VOLUME fully clockwise to OFF, MAX and MAX, respectively. A continuous squeal should be heard from the speaker.

(3) Slowly rotate the SENSITIVITY knob counterclockwise until the sound becomes deeper pitched and discontinuous. Continue rotating the knob to a point just short of OFF. The sound should cease. Shaking the seismometer in line with the spike should cause intermittent squeals. This indicates the normal function of SENSITIVITY.

5.2.2 HEADSET CHECK

(1) Connect the headset to the terminals marked PHONES on the front panel.

(2) Connect and hold seismometer as explained in 5.2.1 (1) and turn the knobs fully clockwise as in 5.2.1 (2). The squeal should be heard from each headset earpiece. Very-low-level noise may be heard from the speaker when the volume control is at MAX position.

5.2.3 SEISMOMETER CHECK

(1) Connect the leads of the seismometer to be tested as explained in 5.2.1 (1). Insert the seismometer spike in the ground with the spike pointing straight down.

(2) Turn the knobs fully clockwise as explained in 5.2.1 (2). Slowly rotate the SENSITIVITY knob counterclockwise until the sound just subsides. Tap the ground lightly with the foot at a distance of a few feet from the emplaced seismometer. A squeal should be heard for each tap.

(3) Remove the seismometer from the ground. Rotate the METER switch to LINE and depress the LINE switch located directly below the terminals which are in

use. The meter needle should read LINE on the top scale (Figure 11). Shake the seismometer up and down with the spike pointing down while depressing LINE switch. The meter needle should swing with the shaking. Return the METER switch to OFF.

5.2.4 SWITCH CHECK

(1) Connect the seismometer to input terminal pair 1. Insert seismometer spike in the ground and adjust SENSITIVITY control as explained in 5.2.3. A squeal should be heard for each tap of the foot.

(2) Depressing switch 1 to TEST position silences the set; depressing switches 2, 3 and 4 does not.

(3) Rotate METER switch to LINE and depress switch 1. The meter needle should indicate LINE on the top scale (Figure 11).

(4) Disconnect one seismometer clip from field wire and depress switch 1. The needle should indicate OPEN FAULT in the red zone at the right end of scale (Figure 11).

(5) Insert both ends of field wire in one seismometer clip and depress switch 1. The meter needle should indicate SHORT FAULT in the red zone at left end (Figure 11).

(6) Repeat for input terminal pairs 2, 3 and 4 using corresponding switches.

(7) Return METER switch to OFF.

5.2.5 BATTERY CHECK. Rotate SENSITIVITY knob about 1/4-turn clockwise and METER switch to BAT. The meter should indicate in the green section at right end of bottom scale (Figure 11).

5.2.6 FUSE CHECK. Remove the control set from the canvas bag, open battery cover and withdraw fuse from holder (Figure 12). Connect fuse to input terminal pair 1 with a short piece of 2-conductor field wire (1.5.2.1), using thumb and fingers to hold one conductor on each end of fuse. Rotate SENSITIVITY knob about 1/4-turn clockwise and METER switch to LINE. Depress switch 1 and observe meter reading. SHORT FAULT indicates a good fuse; OPEN FAULT indicates a burnt fuse. If open, replace with new 1/16-amp fuse.

CAUTION

Operating this set without a fastblowing 1/16-amp fuse may cause major damage to the electronic circuits in case of a voltage surge in the lines. Voltage surge may be caused by countermeasures such as connection to high voltage lines, etc.

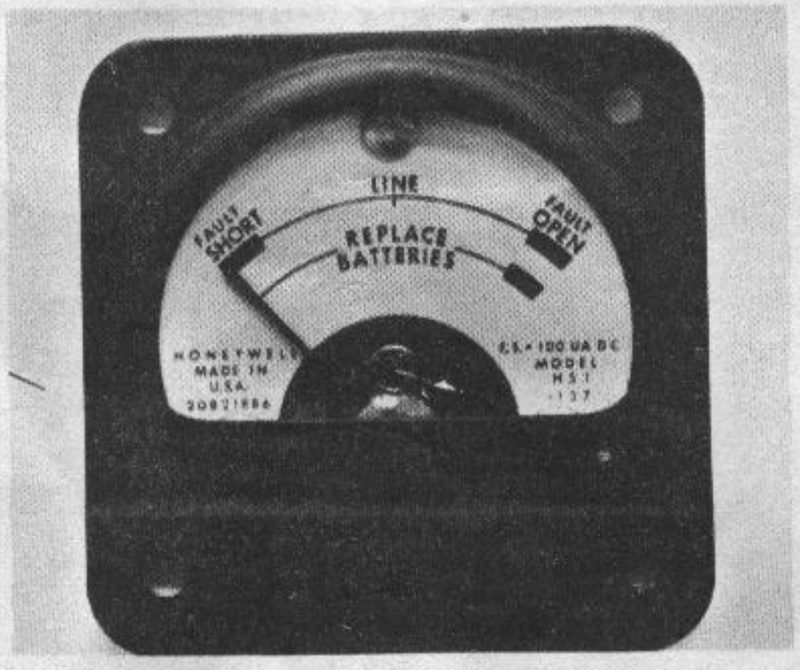


Figure 11. Meter Indicator

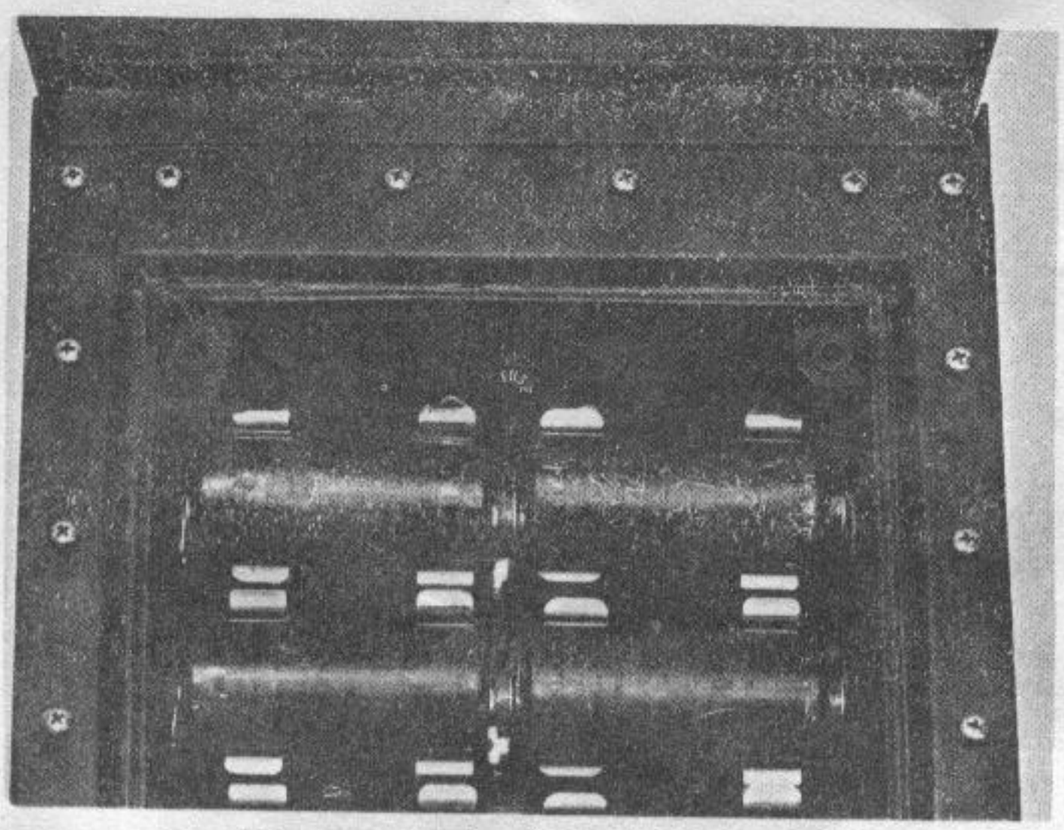


Figure 12. Fuse Location

5.3 TROUBLE ISOLATION

5.3.1 SEISMOMETERS. Seismometers may be checked in accordance with checkout procedures listed in paragraph 5.2. Repair of any component within the body of the seismometer should not be attempted at any echelon. Seismometers which become inoperative should be replaced.

5.3.2 CONTROL UNIT

5.3.2.1 Field Check. The checkout procedures described in paragraph 5.2 provide a field check for proper operation of the Intrusion Detector. If the unit fails to pass tests described, it must be removed from service and returned to the repair area where support facilities are available.

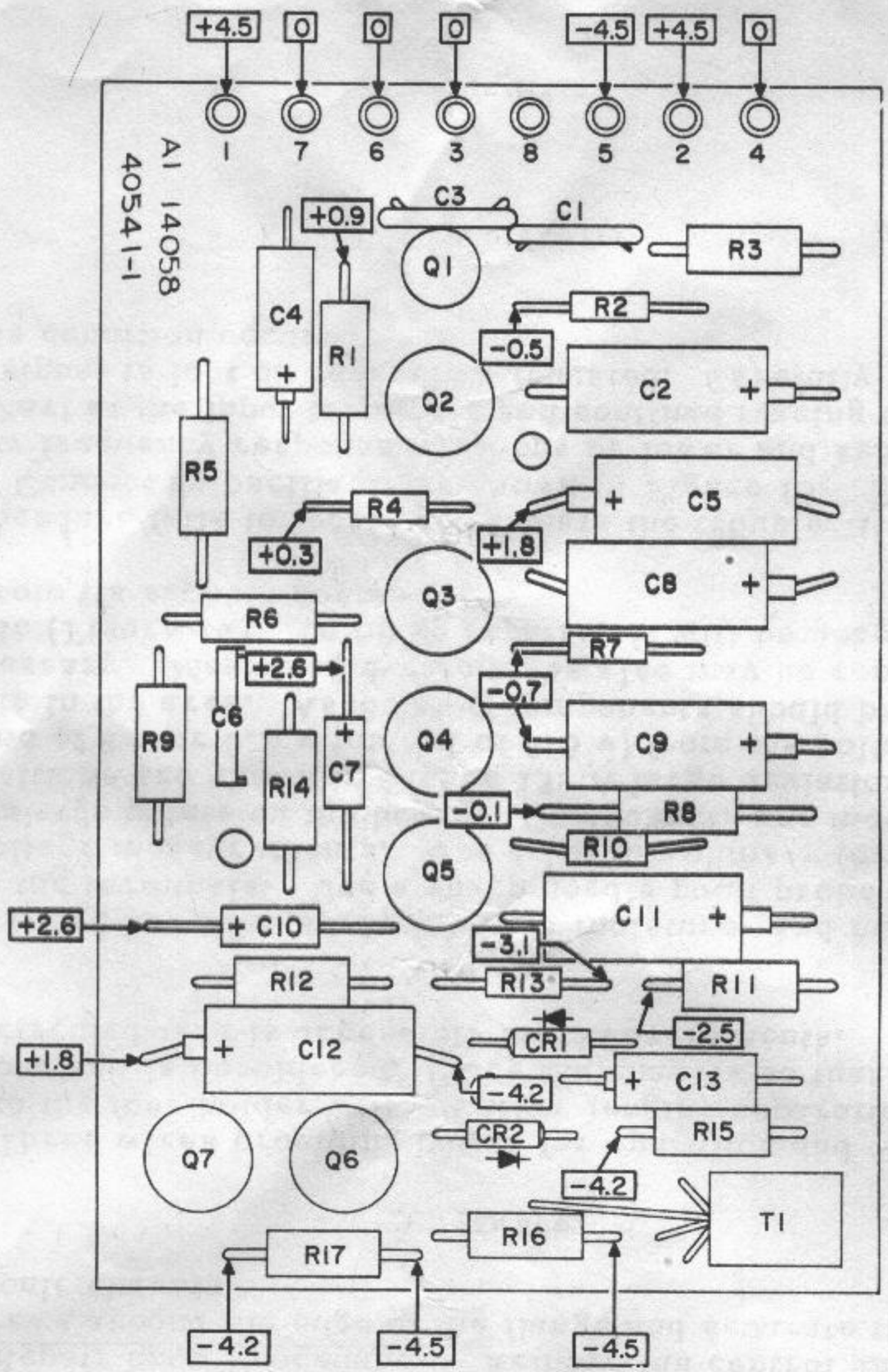
5.3.2.2 Repair Shop Procedures. Remove the control unit from its carrying bag. Remove the screws around the edge of the flange and separate the battery compartment from the electronic chassis.

NOTE

Three wires providing power for operation and two wires to the fuse holder will not allow lengthy separation unless one end is unsoldered. Place the chassis so that the printed circuit board is accessible for measurements.

The component board has been sprayed with a moisture- and fungus-resistant varnish which insulates the terminals. Use a sharp needle point probe to penetrate the varnish when making voltage measurements. Use a 10,000-ohms/v (or more) voltmeter to check the d-c voltage points on the board. Components are mounted on one side of the board; their positions are shown in Figure 13. A large deviation of 30 percent or more (e.g., 4 v instead of 8 v or 0.2 v instead of 0.5 v) from the voltages shown in Figure 13 indicates trouble in the area. Associated components should be carefully inspected and replaced if necessary. Measured d-c voltages also may be compared with those shown on the schematic (Figure 14). To make repairs, it will be necessary to remove the circuit board from its support posts.

If the above procedure fails to locate and isolate the trouble, it is necessary to perform signal tracing. Connect an oscillator as shown in Figure 15. To do this, an oscilloscope with a low frequency response of 20 cps or lcwer and sensitivity of 10 mv/cm is also needed. Start at the input terminals and continue tracing the signal through each stage until the signal is lost or severely attenuated. Carefully check components in any stage where this condition occurs.


+4.5
0
0
0
-4.5
+4.5
0
1
7
6
3
8
5
2
4
A1 14058
405411
C3
C1
+0.9
Q1
R3
R2
C4
R1
-0.5
Q2
C2
R5
R4
+0.3
+1.8
Q3
C5
C8
R6
R7
+2.6
-0.7
C6
R9
R14
C7
Q4
C9
-0.1
R8
R10
Q5
C11
+2.6
C10
-3.1
R12
R13
R11
-2.5
CR1
+1.8
C12
C13
-4.2
CR2
R15
Q7
Q6
-4.2
T1
R16
R17
-4.2
-4.5
-4.5

Parts List No.	Reference Symbol	Quantity
25	T1	1
26	Q1	1
27	Q2-Q7	6
28	C2, C5, C8, C9, C11, C12	6
29	C13	1
30	C7, C10	2
31	C1, C3	2
32	C6	1
33	C4	1
34	R1	1
35	R8, R15, R16, R17	4
36	R5, R6, R9, R14	4
37	R3	1
38	R4, R7, R10	3
39	R13	1
40	R11, R12	2
41	R2	1
42	CR1, CR2	2

Figure 13. PC Board (Front Side) with Measured D-C Voltages

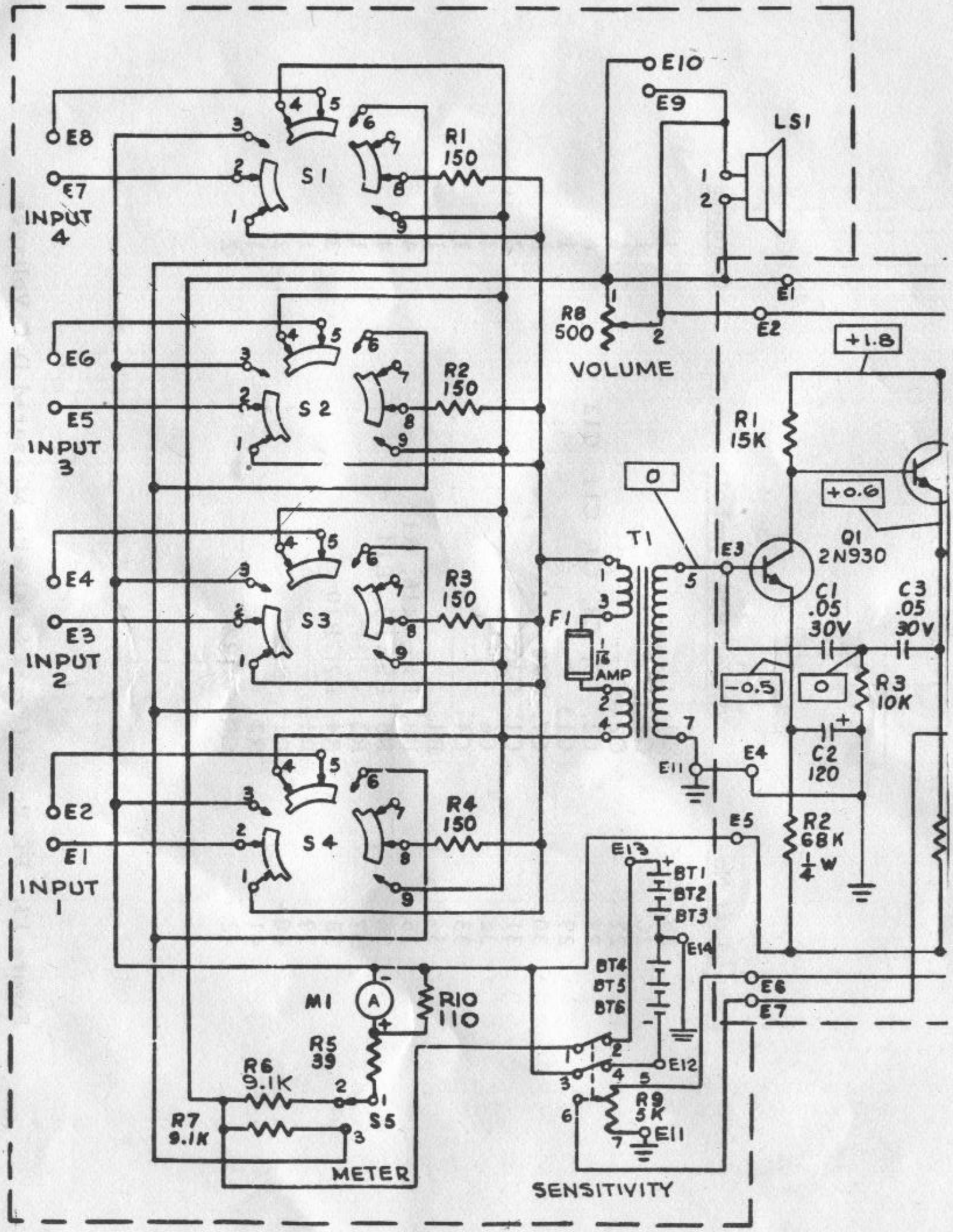
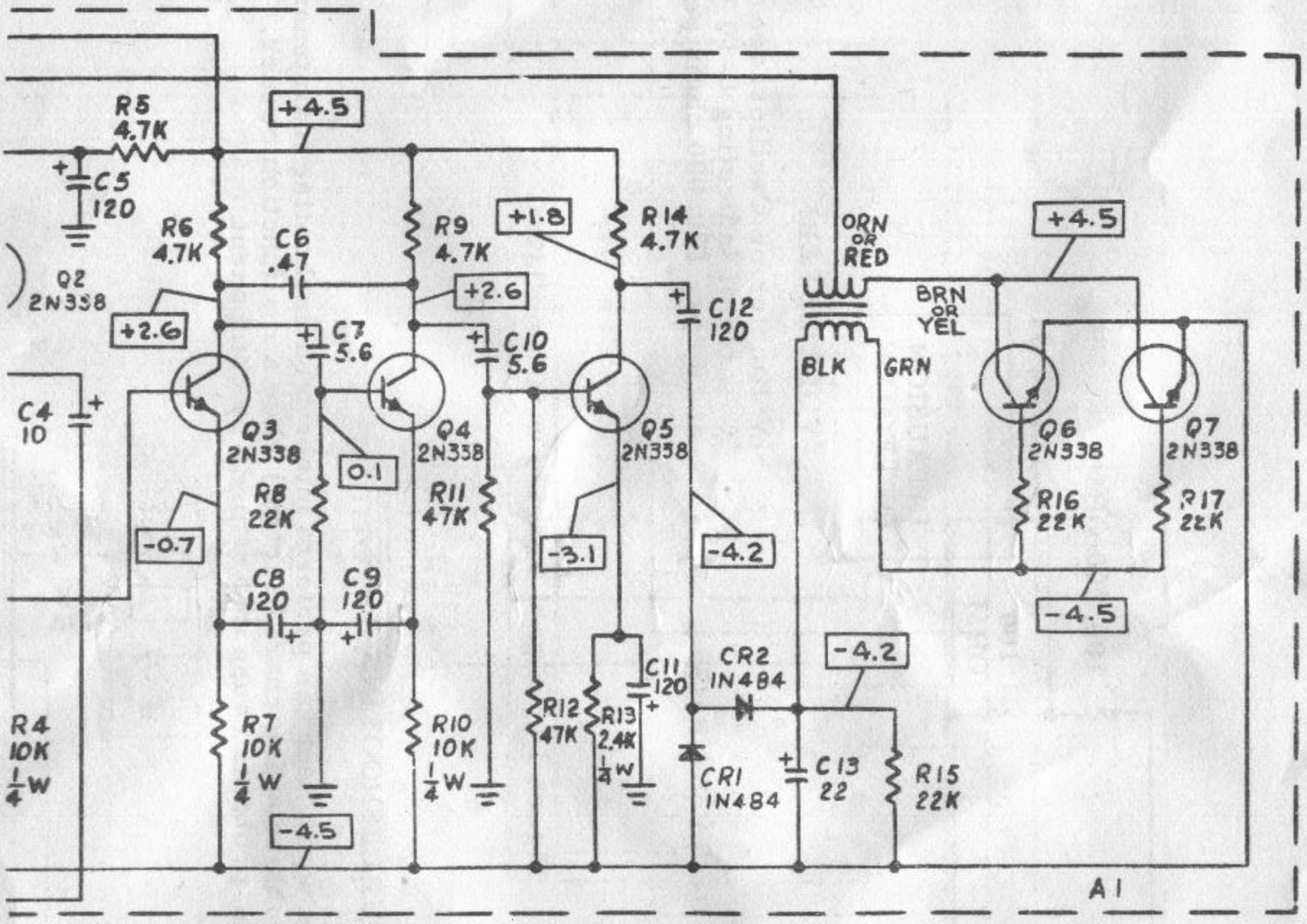
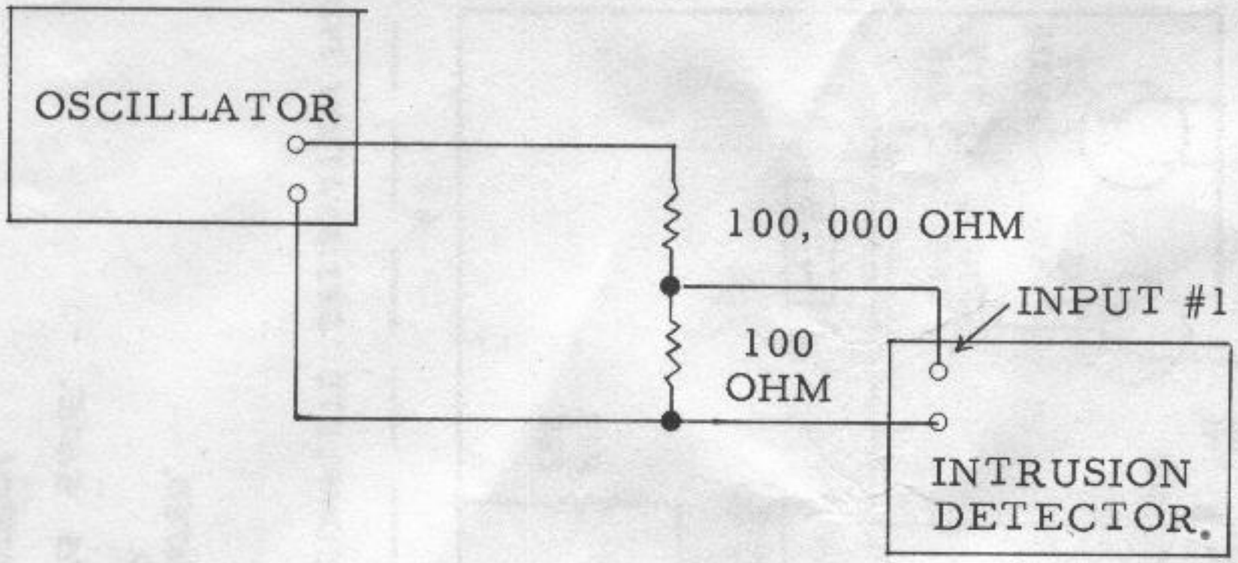

E8
E7
INPUT 4
E6
E5
INPUT 3
E4
E3
INPUT 2
E2
E1
INPUT 1
S1
S2
S3
S4
S5
R1 150
R2 150
R3 150
R4 150
E10
E9
LS1
E1
E2
RB 500
VOLUME
+1.8
R1 15K
+0.6
Q1 2N930
0
T1
E3
5
C1 .05 30V
C3 .05 30V
-0.5
0
R3 10K
C2 120
E4
E11
E5
R2 68K 1/4 W
E13
BT1
BT2
BT3
E14
BT4
BT5
BT6
E6
E7
E12
R9 5K
E11
F1
1/16 AMP
M1
A
R10 110
R5 39
R6 9.1K
R7 9.1K
METER
SENSITIVITY

Figure 14. Wiring Schematic



NOTES: UNLESS OTHERWISE SPECIFIED

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH SUBASSEMBLY DESIGNATION A1.
2. RESISTANCE VALUES ARE IN OHMS
3. CAPACITANCE VALUES ARE IN MICROFARADS
4. RESISTORS ARE 1/2 WATT UNLESS OTHERWISE INDICATED.
5. CAPACITORS ARE 10 V UNLESS OTHERWISE INDICATED.
6. SWITCHES ARE VIEWED FROM THE SHAFT END
7. VARIABLE RESISTORS ARE VIEWED FROM WIRING SIDE.
8. BATTERIES ARE 1.5V.
9. MEASUREMENTS MADE WITH SENSITIVITY CONTROL MINIMUM & VOLUME CONTROL MAXIMUM.



OSCILLATOR:

20 cps
Output Adjustable 0-10 Volts RMS

VOLTMETER:

Voltmeter or Oscilloscope
Capable of Indicating 0-10 Volt RMS
at 20 cps, 100, 000 ohms per volt

Figure 15. Signal Tracing with Oscillator

5.4 TROUBLESHOOTING

The operator of this equipment can perform minor troubleshooting maintenance by referring to the troubleshooting chart (Table 1) when a malfunction occurs. This chart includes the trouble, probable cause and remedy by component.

Table 1

TROUBLESHOOTING CHART

Component	Trouble	Probable Cause	Remedy
Battery	Weak, faulty or leaking; drained or short-lived	Improper seating or polarity, dirty battery holder	Check and/or replace batteries; clean holder
Control Unit	Dead set; no sound	Faulty batteries, short or open circuit, foreign matter, faulty fuse, blown fuse	Check and/or correct faulty item and clean set, replace fuse
Headset	Dead headset, no sound	Open or short in headset leads	Check headset leads and remove dirt or foreign matter

Table 1 (Contd)

Component	Trouble	Probable Cause	Remedy
Meter	No meter reading; needle fails to move	Sensitivity control not rotated clockwise, faulty batteries, input not in "test" position	Check sensitivity setting, check and/or replace battery, operate without use of meter
Connecting Lines (Wires)	Lines open, short or erratic; reduced range of signals	Poor connection at input terminals, broken or crimped wire, faulty terminal, loose strand of wire or break in insulation, faulty seismometer	Localize trouble, check probable causes, assure good connections, check terminals, change seismometer
Seismometer	Dead seismometer, no reception, overactive seismometer, loose spike on seismometer	Faulty line, improper placement of seismometer, broken seismometer lead or clip. Overactiveness caused by rooting or burrowing animals or blowing grass or brush; loose spike caused by frequent use or abuse	Check seismometer orientation; check leads, clips and lines; change seismometer. For overactiveness, bury leads and seismometer; relocate seismometer; for loose

			spike, tighten spike on stud & clamp with set screw located at flared portion of spike
Control Set Case	Moisture in case	Leaking seal; Loose screws	Open case and dry in sun or dry with heating unit at 135°F; return to maintenance area when practical

Table 2

5.5 PARTS LIST

PL NO.	Item Name	Mfr Code	Mfr Part No.	Federal Stock No.
1	Intrusion Detecting Set	14058	50513-502	6655-880-1997
4	Bag, Intrusion Detector	14058	40569-1	
5	Rod, Ground	14058	40540-501	
7	Wire, Electrical	81349	MWC14-19UO	6145-164-7033
8	Headset, Electrical	14058	40567-1	
8A	Earphone	14058	40567-2	
8B	Cable Assembly, Telephone	14058	40567-3	
8C	Headband, Headset	14058	40567-4	
9	Transducer, Motional Pickup	14058	40568-1	
9A	Cable Assembly, Special-Purpose	14058	40568-2	
9B	Clip, Electrical	14058	40568-3	
9C	Clip, Electrical	14058	40568-4	
19				
21	Gasket, Loudspeaker	14058	30697-1	
22	Seal	14058	30699-1	
23	P-C Board Component Assembly	14058	50512-501	
24	Printed Circuit Board	14058	40541-1	
25	Transformer, Audio Frequency	14058	40557-1	
26	Transistor	81349	2N930	5960-226-8579

27	Transistor	81349	2N338	
28	Capacitor, Fixed, Electrolytic	14058	40554-3	
29	Capacitor, Fixed, Electrolytic	14058	40554-2	
30	Capacitor, Fixed, Electrolytic	14058	40554-4	
31	Capacitor, Fixed, Ceramic	14058	40553-1	
32	Capacitor, Fixed, Ceramic	14058	40555-1	
33	Capacitor, Fixed, Electrolytic	14058	40554-1	
34	Resistor, Fixed, Composition	81349	RC20GF153J	5905-279-2616
35	Resistor, Fixed, Composition	81349	RC20GF223J	5905-171-2004
36	Resistor, Fixed, Composition	81349	RC20GF472J	5905-279-3504
37	Resistor, Fixed, Composition	81349	RC20GF103J	5905-185-8510
38	Resistor, Fixed, Composition	81349	RC07GF103J	5905-683-2238
39	Resistor, Fixed, Composition	81349	RC07GF242J	5905-683-7724
40	Resistor, Fixed, Composition	81349	RC20GF473J	5905-254-9201
41	Resistor, Fixed, Composition	81349	RC07GF683J	5905-681-8853
42	Semiconductor Device, Diode	14058	40556-1	
43	Knob	96906	MS91528-1P2B	5355-616-9604
44	Knob	96906	MS91528-1C2B	
45	Meter, Arbitrary Scale	14058	40558-1	
46	Post, Binding	14058	40563-2	

Table 2 (Contd)

PL NO.	Item Name	Mfr Code	Mfr Part No.	Federal Stock No.
47	Post, Binding	14058	40563-1	
48	Post, Binding	14058	40564-1	
49	Screw, Machine	14058	30707-1	
50	Transformer, Audio Frequency	14058	40556-1	
51	Washer, Lock	96906	MS-35338-78	
52	Nut, Plain Hexagon	96906	MS35649-44	
53	Nut, Plain Hexagon	96906	MS35649-84	
54	Washer, Flat	80205	NAS620-3L	
55	Loudspeaker	14058	40565-1	
56	Resistor, Variable, Composition	14058	40561-1	
57	Resistor, Variable, Composition	14058	40562-1	
58	Switch, Rotary	14058	40560-1	
59	Switch, Rotary	14058	40559-1	
61	Screw, Machine	14058	30833-1	
62	Resistor, Fixed, Composition	81349	RC20GF151J	5905-299-1541
63	Resistor, Fixed, Composition	81349	RC20GF390J	5905-195-5546
64	Resistor, Fixed, Composition	81349	RC20GF912J	5905-249-4200
67	Resistor, Fixed, Composition	81349	RC20GF111J	5905-279-3515

68	Holder, Battery	14058	40548-1	
69	Fuseholder	14058	30703-1	
70	Fuse, Cartridge	81349	M23419-2-006	5920-892-9826
72	Washer, Lock	99237	AN-935B3	
73	Washer, Lock	96906	MS35338-80	
75	Gasket, Battery Case	14058	40547-1	
76	Cover, Battery Case	14058	40544-502	
78	Washer, Non-Metallic	14058	30695-1	
79	Screw, Machine	14058	30708-1	
80	Spacer	14058	30693-1	
81	Screw, Captive	14058	30700-1	
82	Washer, Seal	14058	30704-1	
83	"O" Ring	96906	MS28775-008	
84	Ring, Retaining	96906	MS16632-4018	
85	Washer, Flat	96906	MS15795-803	