

OM/156-PMD

OPERATION MANUAL  
For  
MINE DETECTING SET ;  
METALLIC AND NONMETALLIC  
MODEL 156-PMD  
CUBIC CORPORATION

3 May 1983

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## TABLE OF CONTENTS

	<b>Page</b>
<b>Section I. DESCRIPTION AND DATA</b>	<b>1-1</b>
1-1. Description	1-1
1-2. Tabulated Data	1-5
<b>Section II. ASSEMBLY AND DISASSEMBLY</b>	<b>2-1</b>
2-1. Assembling the Equipment	2-1
2-2. Preliminary Adjustment and Initial Checkout	2-4
2-3. Disassembly and Repacking	2-7
<b>Section III. OPERATION</b>	<b>3-1</b>
3-1 Operation with More than One Mine Detector	3-1
3-2 Operating Procedure to Search an Area	3-2
3-3 Investigation of Initial Alarms (Chirps)	3-4
3-4 Stopping	3-6
<b>Section IV. MAINTENANCE</b>	<b>4-1</b>
4-1 Operator Maintenance	4-1
4-2 Repair	4-1

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## Section I. DESCRIPTION AND DATA

### 1-1. Description.

a. General Information. The Mine Detecting Set, Model 156-PMD, shown in figure 1-1, consists of a mine detector, carrying case, carrying strap, one battery pack for use in the mine detector, and one spare battery pack. These components are described in the following paragraphs.

b. Mine Detector. The mine detector, shown in figure 1-2, is a portable dynamic system capable of detecting buried nonmetallic and metallic objects, specifically, buried antitank and antipersonnel mines. It is battery powered and stored in a carrying case when not in use. The presence of a mine is indicated audibly through a headset. The mine detector comprises the subassemblies described in paragraphs (1) through (4) below.

(1) Search Head Assembly. The search head assembly consists of two transmitting antennas, a receiving antenna and transmission lines mounted on a laminated glass cloth plate. In addition, a transmitter and a receiver are mounted in a housing on the search head. A rubber bumper is mounted around the search head as a protective device. The search head assembly generates and radiates multiple chopped radio frequency signals and receives and detects these signals.

(2) Handle Assembly. The handle assembly consists of a short handle, a long handle, a transmitter-receiver housing, and attaching hardware. The short handle is attached to the search head by means of the transmitter-receiver housing and can be adjusted and held at the most convenient angle for use by means of a friction clutch arrangement. The long handle, consisting of five nesting tubular aluminum sections, fastens to the short handle by means of a bayonet coupling. It can be extended to any intermediate length between approximately 19 inches (0.48m) and 57 inches (1.45m) and is clamped at the adjusted position by means of the knurled collets on each section. This handle is ordinarily used in the normal walking search operation, allowing the operator to hold the search head about 4 feet (1.2m) away from his body.

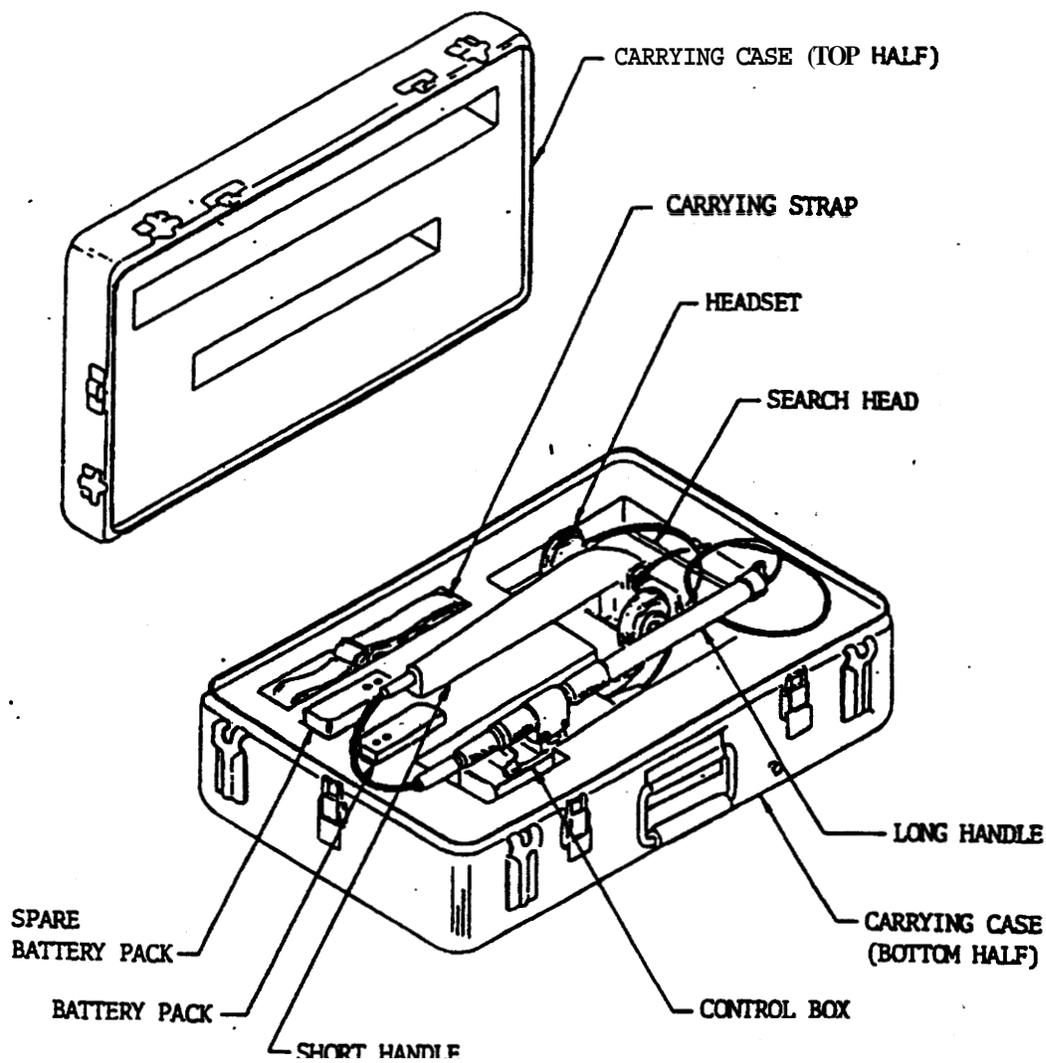


Figure 1-1. Mine Detecting Set, Model 156-PMD

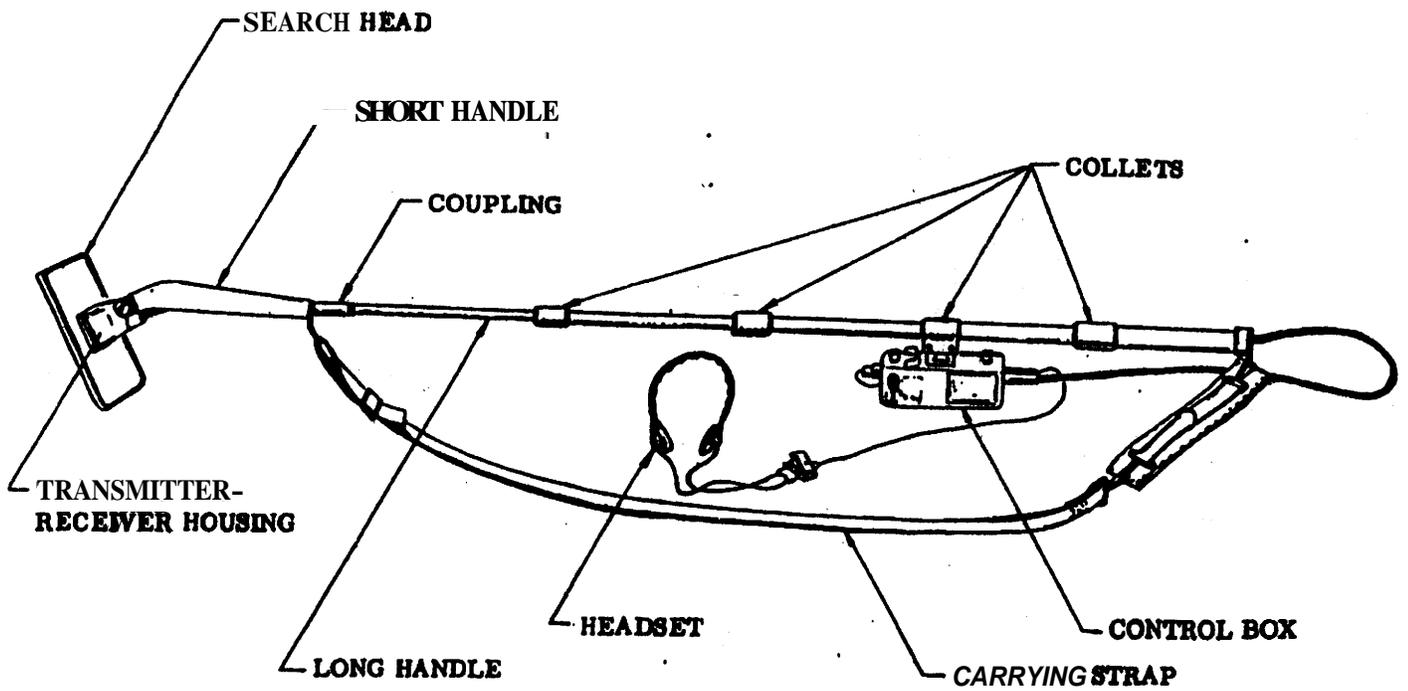


Figure 1-2. Mine Detector (Assembled)

(3) **Control Box Assembly.** The control box assembly contains the processor module with its associated electronic components and the battery pack. The control box housing is an aluminum water-tight enclosure. A gasketed steel cover secured by four latches seals the control box. The control box mounts the on/off switch, the cable to the search head, and the headset assembly. A test connector is provided for test purposes. A hook on the control box enables it to be attached to the belt and thus relieve strain on the operator's arms when operating in the prone position. Note: The shorting plug must be plugged into the test connector at all times, as removal disconnects the battery power from the system.

(a) **Processor Module.** The processor converts the output of the search head to an audio signal so that it may be heard in the headset.

(4) **Headset Assembly.** The headset provides an audible indication of the signals produced in the search head and then processed in the control box. The headset assembly consists of two earphones, joined by an adjustable stainless steel headband, and a headset cable. Rubber ear cushions are fastened over the two earphones to cut out extraneous noise and make the headset comfortable to wear. A clip is provided so that a pull on the headset cable will not place a strain on the operator's head.

c. **Carrying Case Assembly.** The carrying case assembly is used to store the mine detector, its battery packs, and the carrying strap. The case is waterproof and is fitted with inserts with cutouts into which the various components of the mine detecting set are stored when not in use. An air valve is located near the latch to the right of the handle of the carrying case. Opening the valve equalizes the air pressure within the carrying case with the air pressure outside the carrying case while the equipment is being transported by air.

d. **Battery.** Five replaceable C-size alkaline batteries in a removable holder, providing plus 7.5 Volts (nominal), are normally used to operate the equipment. (Optionally, a rechargeable lead-acid battery or a BA-5847/U lithium battery with a connector adapter can be used in place of the alkaline battery pack.)

e. Carrying Strap Assembly. A carrying strap is provided to ease operation in the standing position by effectively reducing the weight, and thus the strain on the arms. The carrying strap assembly consists of a long and a short strap to allow it to be used either in combination with a load bearing harness (suspenders), or without using a load bearing harness.

**1-2. Tabulated Data.**

a. Technical Characteristics.

RF Frequency Range	300 to 600 MHz
Audio Frequency; Search Mode	1 click every 2.5 seconds
Point Mode	3 to 150 clicks per second
Temperature Range (operating)	-30 °C to +50 °C (-25 °F to + 125 °F)
Temperature Range (storage)	-55°C to +70°C (-65°F to +155°F)
Battery Complement	Battery pack, Cubic P/N 171013, containing five replaceable standard C-size alkaline batteries. or: Rechargeable sealed lead-acid battery, Cubic P/N B-156A. or: BA-5847/U, lithium primary battery (plus adapter).
Battery Voltage	5.5 to 7.5 V
Battery Life at 20°C (70°F)	18 hours typ. for alkaline battery pack. 10 hours per charge for lead-acid battery. 20 hours typ. for lithium battery.

b. Approximate Dimensions and Weights.

Mine Detector (Assembled)	Weight: 7 lbs 11 oz (3.5kg)
Mine Detecting Set (Mine Detector in Carrying Case)	Weight: 22 lbs (10 kg)
	Dimensions: Length 24.2 in (61.5 cm) Width 16 in. (40.5 cm) Height 7.3 in. (18.5 cm)

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## Section II. ASSEMBLY AND DISASSEMBLY

### 2-I. Assembling the Equipment.

#### a. General.

(1) To a large extent, the mine detector, as contained in the carrying case, is pre-assembled as shown in figure 2-1. The short handle is attached to the search head, as is the control box to the long handle.

(2) Remove the following items from the carrying case: The search head with short handle attached, the long handle with control box attached, and one of the two batteries provided with the equipment. If the carrying strap is to be used, remove it also from the carrying case. Proceed to set up the equipment as follows.

#### b. Battery Replacement.

(1) Battery Pack Insertion. Unfasten the four latches which secure the cover to the control box. Insert the battery pack into the control box with the snap terminals up. Note arrangement of the snaps on battery plug and snap the plug onto the battery pack accordingly (See figure 2-2.). Replace cover on control box, check for proper alignment, and secure with four latches.

(2) Battery Pack Removal. Battery pack replacement should be accomplished when the voltage has dropped to below 5 Volts. The absence of any sound in the headset is a signal to the operator that the battery voltage has dropped to 5 Volts or less and the system is no longer operating. Remove the control box cover, unsnap the battery plug from the battery pack and remove the battery pack from the control box.

(3) Battery Replacement. Remove the five C-size batteries from their holder and insert fresh ones. Make sure the batteries are correctly installed by observing the polarities indicated on the holder.

NOTE: At temperatures below about 0°C (32°F) the use of lithium battery BA-5847/U is recommended for better service life.

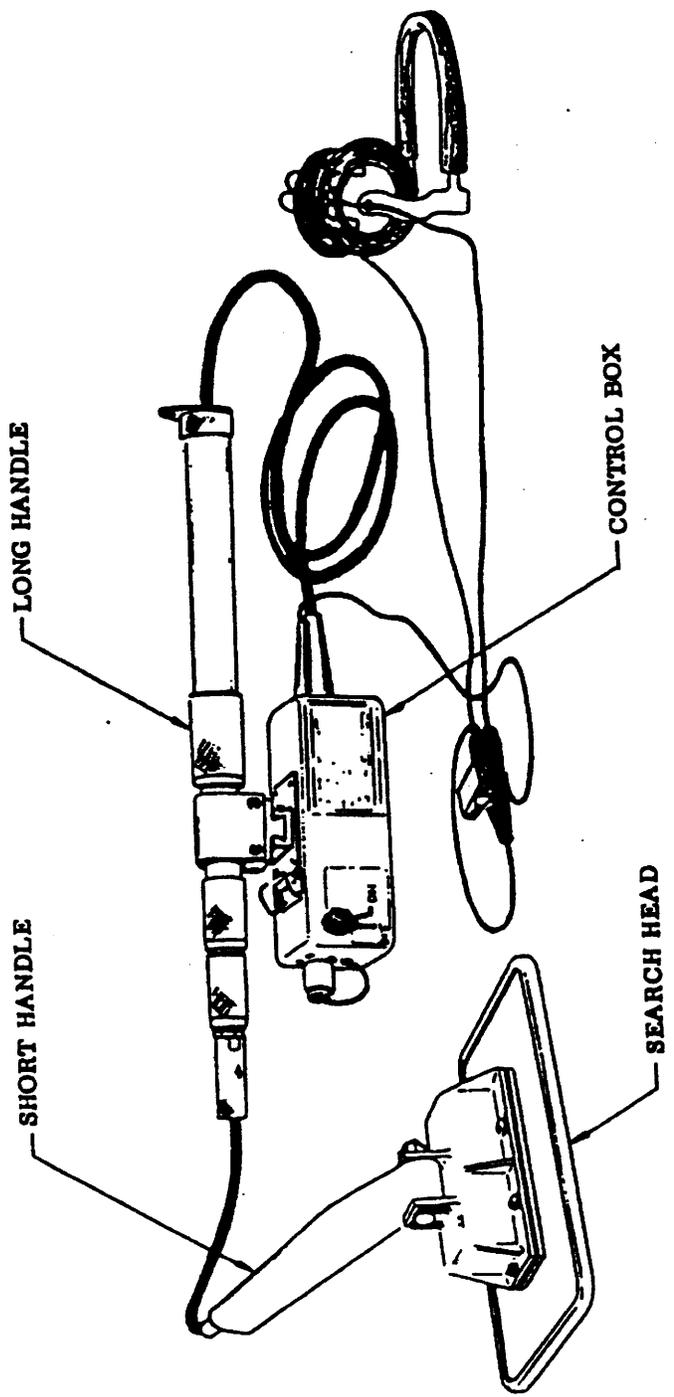


Figure 2-1. Mine Detector (Before Assembly)

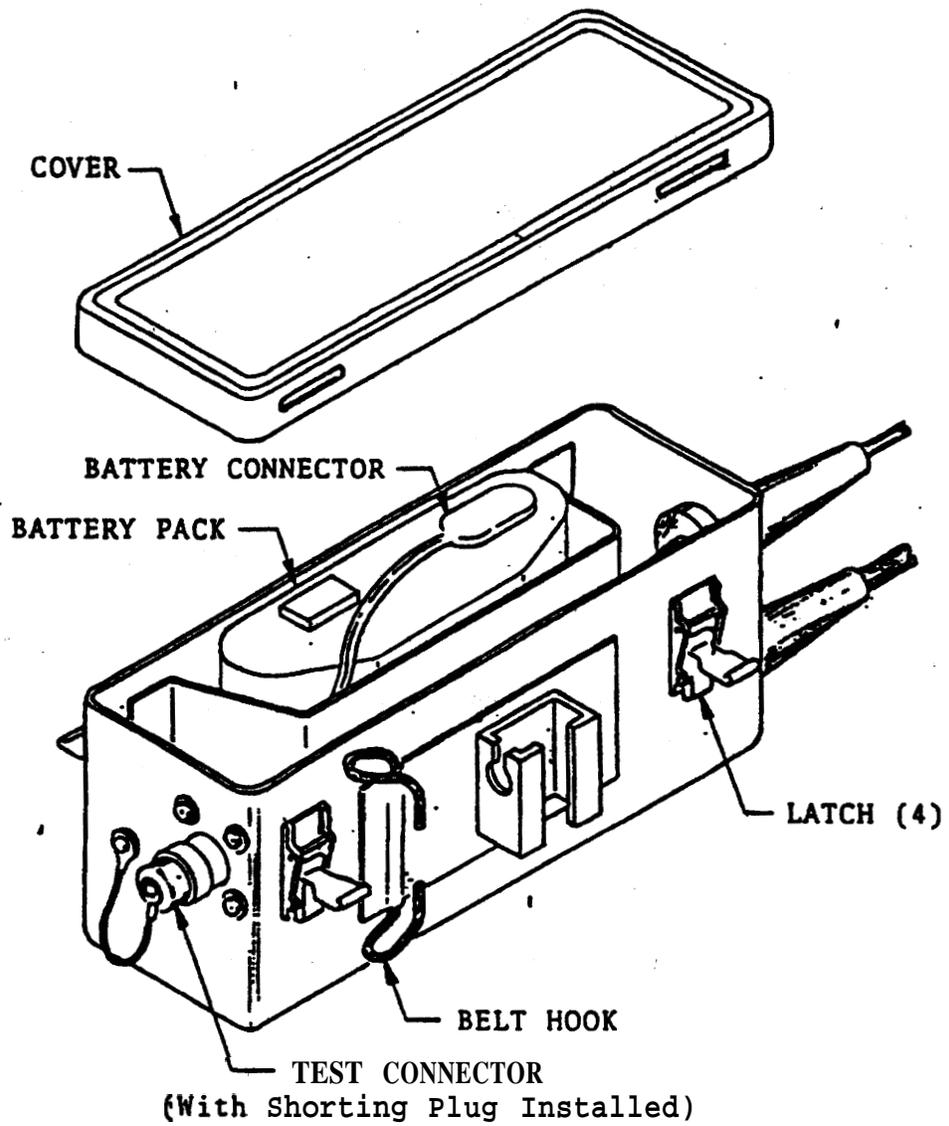


Figure 2-2. Control Box (Cover Removed)

c. Handle and Carrying Strap.

(1) Long handle Attachment. Attach the long handle to the short handle by means of the quick-disconnect bayonet coupling. Engage and compress spring-loaded coupling and twist 1/4 turn clockwise.

(2) Carrying Strap Attachment. The carrying strap assembly is comprised of a long strap and a short strap. If the carrying strap is used, snap the hook of the long strap around the handle just below the coupling. Attach the short strap across the chest between the right and left straps of the suspenders. Attach the snap at the other end of the long strap to the ring in the center of the short strap. (See figure 2-3.) If suspenders are not worn, the short strap can be attached to the end of the long strap and the remaining end of the short strap can then be snapped to the attachment eye at the top of the long handle. (See figure 1-2.)

d. Headset.

Put on the headset with the headband forward. Adjust headband so that the rubber ear cushions press against the ears with just enough pressure to create a partial seal against outside noises. Fasten the spring clip on the headset cable to the clothing, allowing enough slack between headset and clip so that the head can be turned without adding pressure to the ear cushions.

**2-2. Preliminary Adjustment and Initial Checkout.**

a. Preliminary Adjustment.

Preliminary adjustment comprises adjustment of the short handle to the desired angle for operation and extension of the long handle to its full length.

(1) Extend the long handle by loosening collets approximately 1/2 turn in the opposite direction as indicated by the arrow, adjusting sections to full length, and tightening (direction indicated by arrow) collets. Start at the top collet (largest diameter) and hold on to the handle section immediately above the collet being used.



**Figure 2-3. Mine Detector Operation in Standing Position**

(2) With the search head resting on the ground, move the short handle the angle desired, against the friction produced by the friction clutch.

(3) When using the carrying strap for operation in the standing position, adjust the length of the carrying strap to a comfortable length that will not restrict the required swinging motion.

b. Initial Checkout. To check the mine detector for proper operation, proceed as follows:

(1) Hold the search head approximately 5 feet (1.5m) above the ground, then set the switch from OFF to the ON position and listen for the metronome clicks in the headset (1 click every 2.5 seconds). The mine detector is now operating in the SEARCH mode.

(2) Bring the search head down near ground level and listen for switchover to the POINT mode, indicated by a sudden change in click rate (between 3 and 150 clicks per second).

(3) Moving the search head away from the ground, the system will automatically reset to the SEARCH mode within 4 seconds after leaving the vicinity of the ground, but only if the minimum POINT mode rate of 3 clicks per second can be heard in the headset.

(4) If no clicks can be heard at all, the batteries may be low or discharged. Substitute battery pack with the spare one in the carrying case.

(5) Set the switch to the OFF position.

NOTE: (For BA-5847/U only.) At temperatures below 5°C (40°F) or after prolonged usage at high temperatures the starting voltage of the lithium battery may be below the minimum voltage required for equipment operation, although the battery is not dead or defective. To restore the battery voltage, set the switch to ON and wait 1 to 2 minutes. then set the switch to OFF and repeat initial checkout as described above.

### **2-3 Disassembly and Repacking.**

To disassemble the equipment for storage in the carrying case proceed as follows:

- (1) If the carrying strap is attached, unhook it at top and bottom.
- (2) Collapse the long handle, using the same procedure as for handle extension but in reverse order, i.e. starting at the bottom collet (smallest diameter)
- (3) Detach long handle from the short handle by pushing down and twisting the coupling 1/4 turn counterclockwise.
- (4) Remove the battery pack from the control box. (See paragraph 2-1.b.)
- (5) Place each item into the compartment allotted to it in the carrying case (figure 1-1).
- (6) Close the carrying case. The top section should fit on evenly and snugly without forcing; if it does not, check for proper placement of the contents, fouled cables etc.
- (7) Secure the six latches.
- (8) Close the air pressure relief valve.

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## Section III. OPERATION

### **WARNING**

At all times during operation clicks should be heard in the headset, either at metronome rate or higher. If clicks disappear, stop operation immediately, as the mine detector is no longer operating due to low battery voltage or possible equipment failure.

### **CAUTION**

To maintain an acceptable level of operating proficiency and gain familiarity with the output sounds in point and search mode, A mine detector operator should have a minimum of two hours per week in test bed operation when he is not operating regularly in combat conditions. The test bed should contain at least one dummy target, such as an empty wooden or plastic container with minimum dimensions of 6" long x 4" wide x 4" deep (15 x 10 x 10cm), buried with its surface 2" (5cm) below the ground surface.

### **3-1. Operation with More than One Mine Detector.**

Maintain a minimum distance of 20 feet (6m) between operators when more than one mine detector is being operated in the same area. This will prevent signals from other mine detectors in the area from interfering with return signals from mines.

### 3-2. Operating Procedure to Search an Area.

#### CAUTION

Immediately prior to each use of the mine detector, check its operation by setting the switch to the ON position while allowing the search head to rest on the ground with no movement for about thirty seconds. After this time, any slight movement of the search head should cause a switchover from search to point mode, as indicated by a higher click rate. Set the switch to the OFF position and Proceed as described in following paragraphs.

a. While swinging the search head at a height of approximately 3 inches (7.5cm) above the ground over homogenous soil (free from known anomalies such as metal, tree roots; ruts, mounds, etc.) set the switch from OFF to ON. This action not only applies power to the equipment, but also starts the initialization period used by the processor to form an estimate of the background signal level and background variations, based on the signals returned from the soil.

b. A click should be heard in the headset at intervals of 2.5 seconds, indicating the system is operating in the SEARCH mode. These clicks also function as a metronome and will make it easy to sweep the search head at the optimum sweep rate by synchronizing sweep direction reversals with the clicks. (See figure 3-1.)

c. While keeping the search head approximately 3 inches (7.5cm) above the ground, depending upon the surface condition of the terrain, sweep the search head from side to side at a sweep rate such as to make each change of sweep direction (sweep end points) coincide with a metronome click. (Sweep rate is approximately 7 feet (2.1m) in 2.5 seconds). With each sweep, advance a distance of no more than 4 inches (10 cm) or about half the width of the search head. (See figure 3-1.) Ensure that the search head is parallel to the ground at all times as tilting the search head will produce a signal similar to a mine signal. Operation in the prone position is the same, except the sweep rate is approximately 3.5 to 4 feet (1 to 1.2m) in 2.5 seconds.

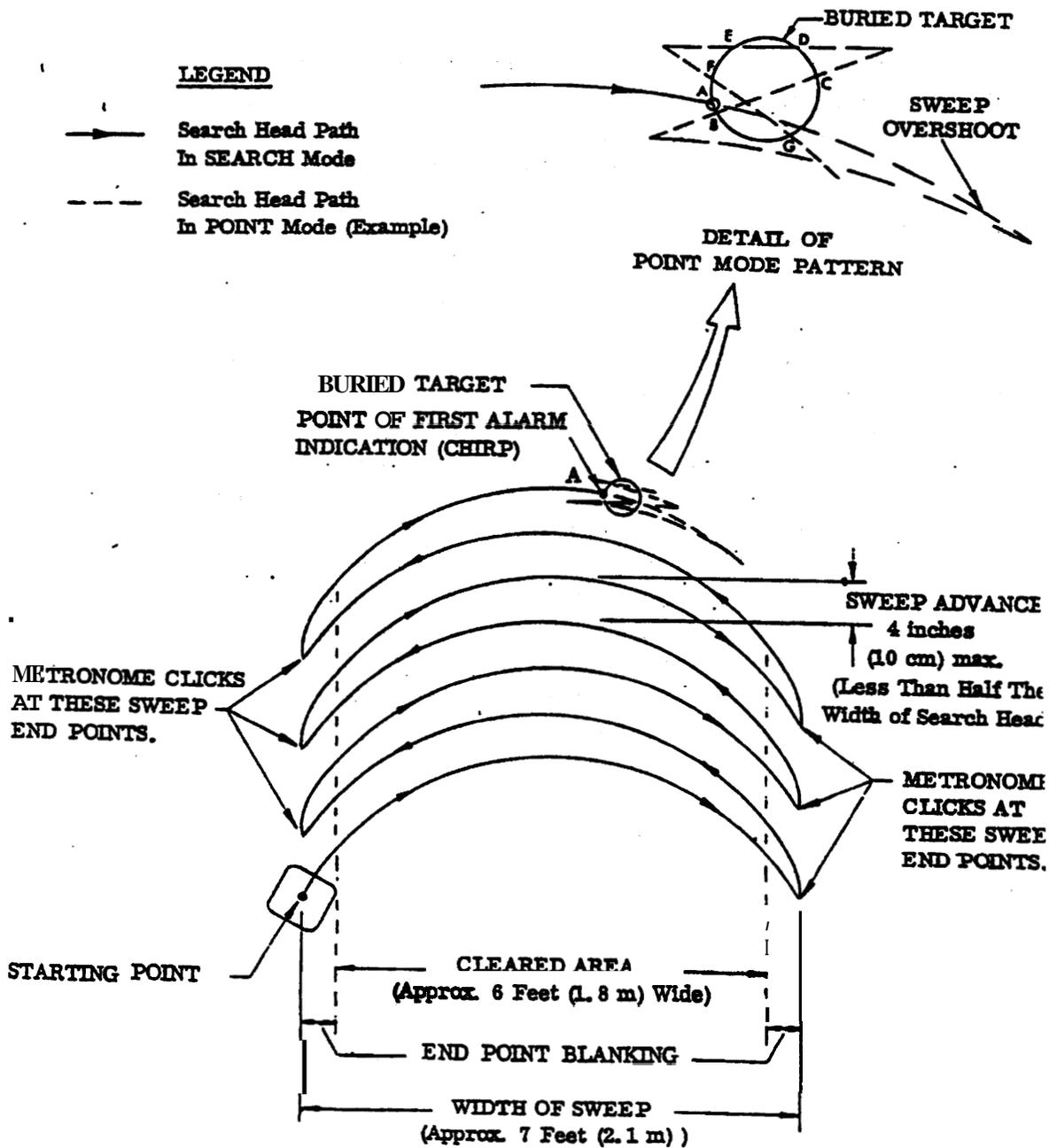


Figure 3-1. Sweep Pattern for SEARCH and POINT Modes  
(Standing position)

NOTE: At each end point, a distance of about 6 inches ( 15cm) is blanked out. This feature prevents alarms caused by tilting of the search head at the sweep reversals, observed as a natural tendency in most operators.

d. A sudden short-duration increase of the click rate (chirp) followed by a lower click rate (anywhere between 3 and 150 clicks per second) indicates an initial alarm and simultaneous automatic switchover to the POINT mode, when the search head is swept over an anomaly in the soil, such as at point A in figure 3-1.

### **3-3 Investigation of Initial Alarms (Chirps).**

a. After a chirp has signaled the presence of a possible mine with the switchover to POINT mode, the click rate drops to a lower rate (anywhere between 3 and 50 clicks per second). Quickly return the search head to the approximate location where the alarm first occurred and sweep the search head from side to side over the area in short slow sweeps of 1.5 to 2 feet (0.5 to 0.6m) in length. An increase in click rate will be heard from the headset as the side of the search head passes over the edge of the buried object. (The click rate response sounds similar to a Geiger Counter.) The click rate will decrease when the search head is centered over the object and will increase again as the other side of the search head passes over the other edge of the buried object. By moving the search head slightly forward or backward from sweep to sweep, the outline of a large buried object can be exactly determined. (For example: In figure 3-1, higher click rates are obtained at points B through G.) As long as an alarm indication, signified by a higher click rate, is periodically encountered, automatic reset to the SEARCH mode will not occur. However, when leaving the area of the buried object, the click rate drops to about ??? clicks per second and then stops after 3.5 seconds. Automatic reset to the SEARCH mode occurs when the POINT mode clicks stop. If operations are continued, start sweeping immediately after automatic reset to SEARCH mode occurs and synchronize sweeps again with the metronome clicks (one click every 2.5 seconds).

b. If after a chirp a repeatable alarm indication cannot be obtained in POINT mode, investigate the same area again in SEARCH mode. Repeatable chirps obtained in the same spot indicate a possible mine.

c. When a chirp is obtained, it does not always indicate the presence of a mine, but could also be caused by tilting the search head, touching the ground or a clump of wet high grass with the search head, passing over an area with ruts or ridges on the surface, or by sudden variation of soil moisture or consistency. Investigation of these various anomalies is further discussed in paragraphs d, e and f below.

d. Generally, if caused by tilting or touching the ground, it will not be possible to get additional alarm indications (increases in click rate) over any particular spot in the area where the chirp was first obtained. Thus, while in POINT mode, the click rate will remain low and automatic reset to **SEARCH** mode will occur after 3.5 seconds. Start sweeping immediately after the low click rate stops and synchronize sweeps again with the metronome clicks, but always sweep again over the spot where the chirp was previously obtained.

e. If a chirp is caused by touching a clump of high grass or by a surface rut or ridge, the area around the clump should be investigated by slowly moving the search head over the area surrounding the clump of grass while in POINT mode. A repeatable increase in click rate indicates a probable mine.

Passing the search head over surface ruts or ridges is in effect the same as tilting the search head and can cause a chirp. (Note that ridges can also be formed by the border of a grassy or vegetated area). As mines could be buried in ruts or under ridges, these areas should be investigated with the mine detecting set in the POINT mode, by moving the search head in short sweeps parallel to the rut or ridge. If no increase in click rate can be heard, the chirp was caused passing over the ridge. A mine should resent a alarm indication regardless of the direction of the sweep.

NOTE: It should be remembered that automatic transition from POINT to **SEARCH** mode will occur after 3.5 seconds if no increase in click rate is periodically obtained. If more time is needed to investigate an area, the mine detector can be kept in the POINT mode by tilting the search head, after about 3 seconds have passed without an increase in click rate. This tilt method can also be used to force the mine detector into the POINT mode when needed or desired to investigate an area suspected of possibly hiding a mine.

f. Occasionally an area is encountered where it is difficult to keep the mine detector in the SEARCH mode, that is, as soon as a sweep, is started following the automatic reset to SEARCH mode, a chirp is heard again. This could be due to a sudden change in soil characteristics and can be countered as follows: Step back about 3 feet (1m) into the area previously cleared and set the switch to the OFF position. Then set the switch to the ON position following the standard search procedures described in paragraph 3-2, and sweep the area again. If an area without visible anomalies consistently seems to produce a large number of false alarms, the mine detector can effectively be made less sensitive by sweeping at a slightly higher distance above the ground.

### **3-4 Stopping.**

To shut down the equipment, set the switch to the OFF position. Always set the switch to the OFF position when the mine detector is not in use, even for short periods of time.

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## Section IV. MAINTENANCE

### **4-1. Operator Maintenance**

The operator is not required to repair a faulty mine detecting set. Failure of the mine detector to operate is usually remedied by replacement of the battery with a good one. Lower level maintenance is limited to inspection and cleaning of all components of the mine detecting set before and after each use to ensure availability of the equipment when needed and to prolong its useful life.

When damage to the equipment is noted or operation cannot be restored with a known good battery report the discrepancy to the proper authority.

### **4-2 Repair**

For repair or replacement of the parts and components of the mine detecting set by authorized maintenance personnel refer to the Maintenance Manual **MM/156-PMD**.