Instruction Manual

Model MAC-51Bx

Magnetic and Dual-Frequency Pipe and Cable Locator

Manufactured by
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General

Introduction

The all purpose MAC-51Bx Magnetic and Dual-Frequency Pipe and Cable Locator is the only underground locator that combines magnetic locating (for iron and steel objects) with dual-frequency cable/line tracing into one compact system. The system consists of two major units: a dual-frequency (LF and HF) transmitter and a three-mode receiver (MAG, LO and HI). The transmitter operates up to 60 hours on eight alkaline C-cell batteries; the receiver up to 120 hours on two 9-volt lithium batteries.

Figure 1-1. MAC-51Bx Magnetic and Dual-Frequency Pipe and Cable Locator

Magnetic (MAG) Locating Mode

The receiver is the only unit for operation in the Magnetic mode. Set the Mode switch to MAG, adjust the Gain control, and you have the best magnetic locator available. Operation in the Magnetic mode is explained in Sections II and III.

Switching between LO, HI and MAG modes while tracing a cable, is a unique method for unscrambling ground clutter. Gas and water pipes in the immediate vicinity of the target with a HF trace signal being applied may emit parasitic signals that can distort the cable locating null. In the magnetic mode, cast-iron water pipes and gas lines can be identified quickly and even classified as to their type by the conventional spacing of joints, which provide the strongest signals.

Cable/Line Tracing (HI/LO) Locating Modes

The MAC-51Bx transmitter simultaneously transmits 571 Hz (LF) and 82.5 kHz (HF) signals. When applied to any continuous metal conductor, the HF trace signal jumps gaskets between pipe sections and small breaks in the line. The LF trace signal does not bleed onto adjacent or crossing lines, and will stop at a complete break in the conductor. With the receiver you can select and compare received audio signals from both frequencies without having to return to the transmitter.

Setting the receiver's Mode switch to LO allows you to trace the cable, locate a complete break (where the signal disappears), and then continue tracing beyond the fault by switching to the HI mode. The approximate depth of an underground cable can be determined using the 45° null-point triangulation method. Operation of the MAC-51Bx in the LO and HI modes is explained in Sections IV and V.

Standard Accessories

Basic accessories supplied with the MAC-51Bx include a headphone jack, spare batteries holders and a conductive cable assembly with ground stake. An inductive signal clamp, mini transmitter and headphones are available as options.

Optional Inductive Signal Clamp (HI Mode only)

This option increases the versatility of the MAC-51Bx by providing a convenient method of selectively applying the trace signal to cable conductors covered with nonmetallic insulation in the HI Mode only.

It induces a strong signal to only the conductor that it is clamped around. This method allows you to put a stronger signal on a specific cable to be traced in congested areas containing cables, water and gas lines, or other conductors that may emit lower level parasitic trace signals.

Operation is simple and easy. Plug the clamp lead into the transmitter accessory jack and close the clamp around the cable. No ground connection is required. Hook-up can be made to all continuous metal pipes and cables up to three inches in diameter.

Optional Mini Transmitter

The Model MT-2 is a miniature transmitter (3 in. x 1 in.) used in combination with a MAC-51Bx receiver to trace nonmetallic pipes, pinpoint obstructions, and locate concrete septic tanks. (The Receiver's Mode switch must be set to HI.)

As the MT-2 (Mole) is pushed through a buried nonmetallic pipe, it emits a signal that can be detected at depths up to 18 feet by using the MAC-51Bx receiver. The Mole has a concave surface so it can be secured with electrical tape to a plumber or electrician's snake, or it can be closed in a pipe "PIG".

One AAA penlight alkaline battery provides up to 30 hours operation. Tightening the battery cap (CW) turns the unit on. Loosening the battery cap (CCW) until the battery moves when the MT-2 is shaken turns the unit off.

MAC-51Bx Specifications

TRANSMITTER

Operating Voltage	12V (8 alkaline C-Cell batteries)
Battery Life	60 hours (on & off usage @ 70F)
RF Output	82.5 kHz modulated at 382 Hz, Pulsed at 4.4 Hz 571 Hz pulsed at 4.4 Hz
Audio Indicator	2.58 kHz pulsed at 4.4 Hz
Weight	Approx. 5.5 lb. (2.5kg)
Operating Temp.	-13°F to 140°F (-24°C to 60°C)
Overall Size	43.5 in. x 7 in. x 5 in. (110.5cm. x 17.8 cm x 12.7 cm)

RECEIVER

Operating Voltage	9V (2 alkaline or 2 lithium batteries)
Battery Life	60 hrs, alkaline (on & off usage @ 70F) 120 hrs, lithium (on & off usage @ 70F)
Audio Output	Approx. 40 Hz idling tone from speaker Frequency of pulsing tone (increases or decreases) with signal intensity
Weight	2.64 lb. (1.20 kg.)
Operating Temp	-13°F to 140°F (-25°C to 60°C)
Overall Length	42.3 in. (107.4cm.)
Waterproof Length	34.5 in. (87.6 cm.)
Nominal Sensor Spacing	20 in. (50.8 cm.)

(Specifications subject to change without notice)

NOTE

The receiver's manual gain feature gives you a significant advantage in being able to adjust the sensitivity, based on your expertise, to optimize the locating and pinpointing of a wide range of underground targets.
You will find that as your experience in evaluating the audio indications associated with different types of targets and gain settings increases, manually adjusting the gain also becomes second nature. This minimizes search time and helps you to determine the type of target and its approximate depth. Your familiarity with various gain settings for, and the audio indications from specific types of targets will become very cost effective and personally satisfying.

Section II
Magnetic Locating Mode

Theory of Operation

In the Magnetic (MAG) mode, the MAC-51Bx receiver responds when the magnetic field strength at the two sensors, which are 20 inches apart, is different. This response consists of a change in the idling frequency of the audio signal emitted from the speaker.

Figure 2-1 illustrates an application of the locator in which it is used to detect an iron pipe marker of the type used for property identification. The magnetic field of the marker is stronger at sensor **A** than it is at sensor **B**. As a result, the frequency of the signal from the speaker is higher than the 40 Hz idling frequency which exists when the field strength is the same at both sensors.

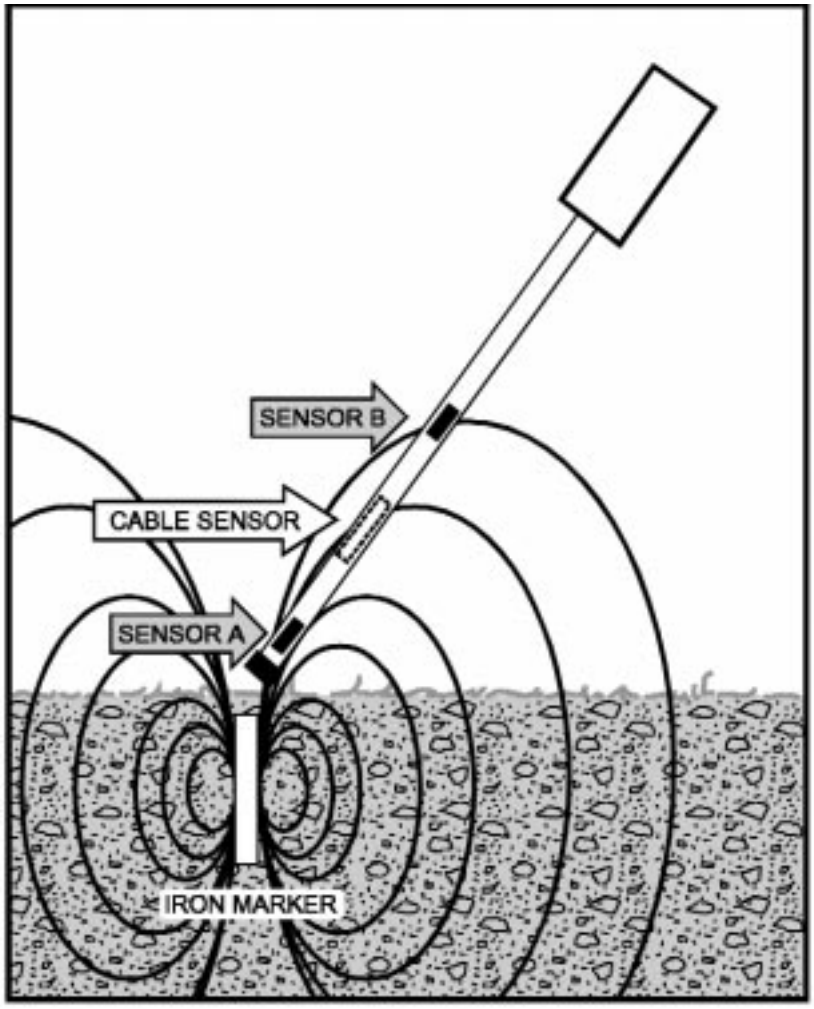


Figure 2-1. Detecting Magnetic Field of an Iron Marker

Mode Selection and Gain Setting

Set the Mode switch to MAG and adjust the Gain control for the normal range as shown in Figure 2-2.

In most areas the locator can be oriented in any direction without producing a significant change in the frequency of the tone from its idling rate. However, in some areas where magnetic disturbances are encountered from nearby structures, rocks, sand or ferrous trash, the control should be adjusted for a lower gain as illustrated in Figure 2-3.

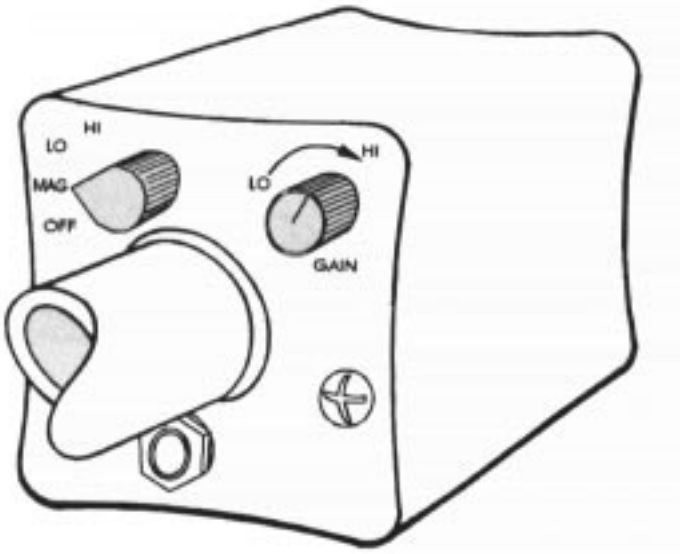


Figure 2-2. Normal Range Gain Setting

Low Gain Operation

Unwanted background signals due to nearby magnetic objects may require that the effective range of the locator be reduced. This is accomplished by turning the Gain control towards LO. Reduced range is also useful for pinpointing the location of a strongly magnetized marker (see Figure 3-2).

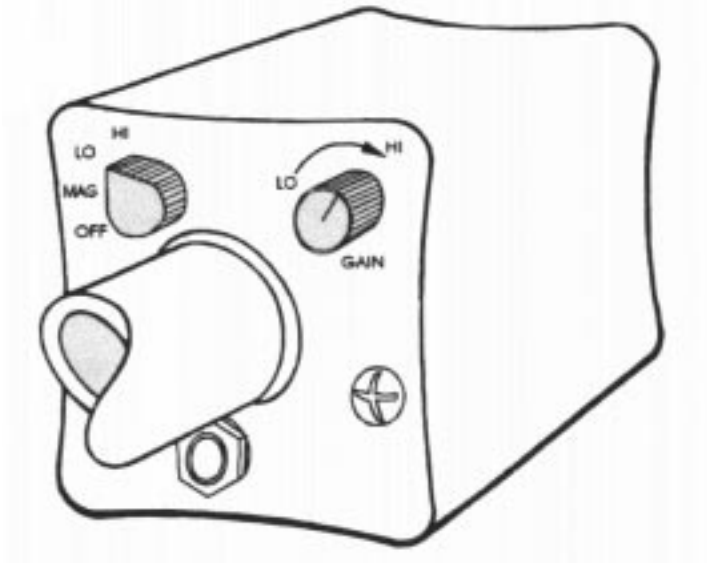


Figure 2-3. Low Range Gain Setting

High Gain Operation

The effective range of the locator is increased by turning the Gain control towards HI. A high gain setting is useful for detecting smaller targets. Due to the increased sensitivity with high gain, the pitch of the output tone may vary due to the instrument's orientation relative to the Earth's magnetic field.

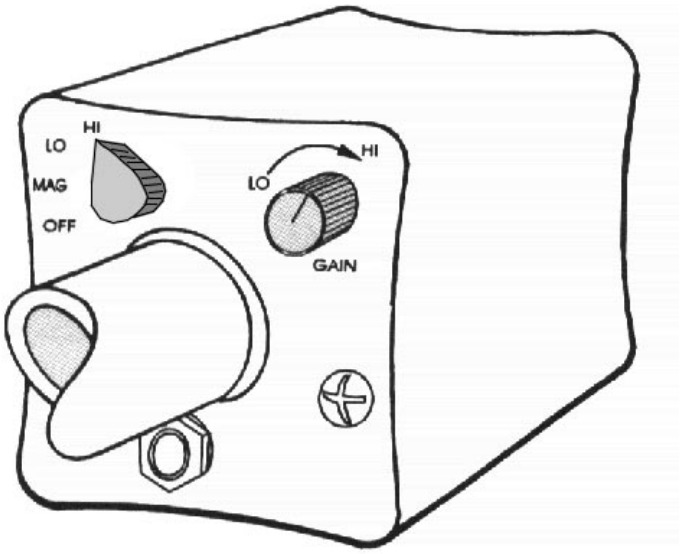


Figure 2-4. High Range Gain Setting

Search Procedure

Set the Gain control for normal operation and hold the locator just below the large end with the "box" resting comfortably on the underside of your forearm, as illustrated in Figure 2-5. Because the upper sensor is located near the area where the locator is usually held, wrist watches may produce unwanted changes in the signal frequency. Therefore, a watch worn on the wrist of the hand holding the locator should be removed. Avoid bringing the locator close to your shoes, since the might contain magnetic material.

To obtain maximum area coverage, the locator should be swept from side-to-side with the small end of the instrument kept close to the ground. A higher frequency tone from the speaker will be heard when the locator is closest to an iron or steel object.

When using a high Gain setting, avoid turning the locator about its long axis. This might produce unwanted variations in the output signal. The presence of a ferromagnetic object will be indicated by a change in the tone of the output frequency.

Figure 2-5. Searching with the Locator

Section III
Magnetic Locating Mode Application Notes

Basic Signal Patterns

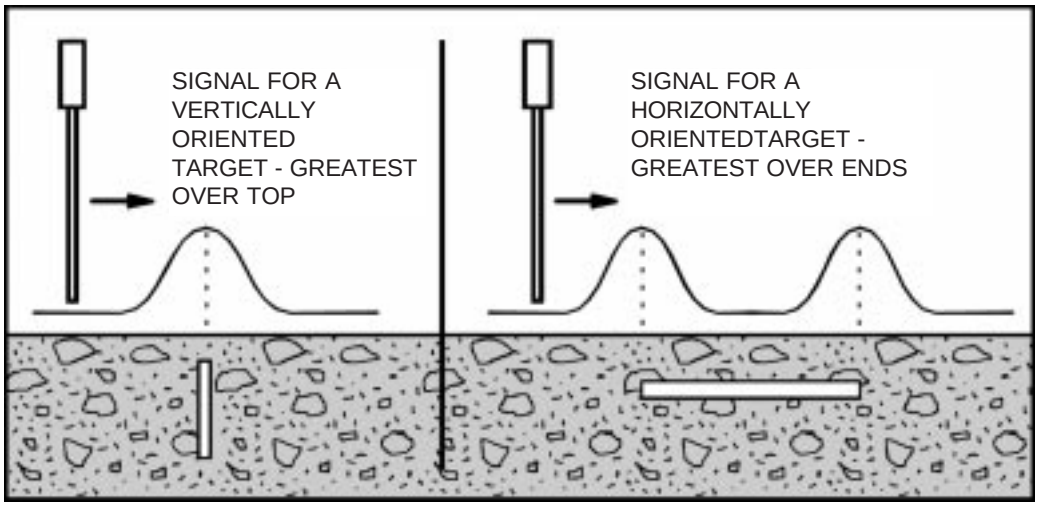


Figure 3-1. Signals from Vertical and Horizontal Targets

After you have detected the presence of a target, hold the locator vertically and move it back and forth in an “X” pattern. The peak signal occurs directly over a vertical target, and over the ends of a horizontal target. Reduce the gain setting as required to facilitate pinpointing a target.

The “X” pattern is ideal for pinpointing small objects. A standard 1-1/4 inch PK nail buried up to 12 inches can be located so precisely with this technique that it can be uncovered using a 1/2-inch star drill.

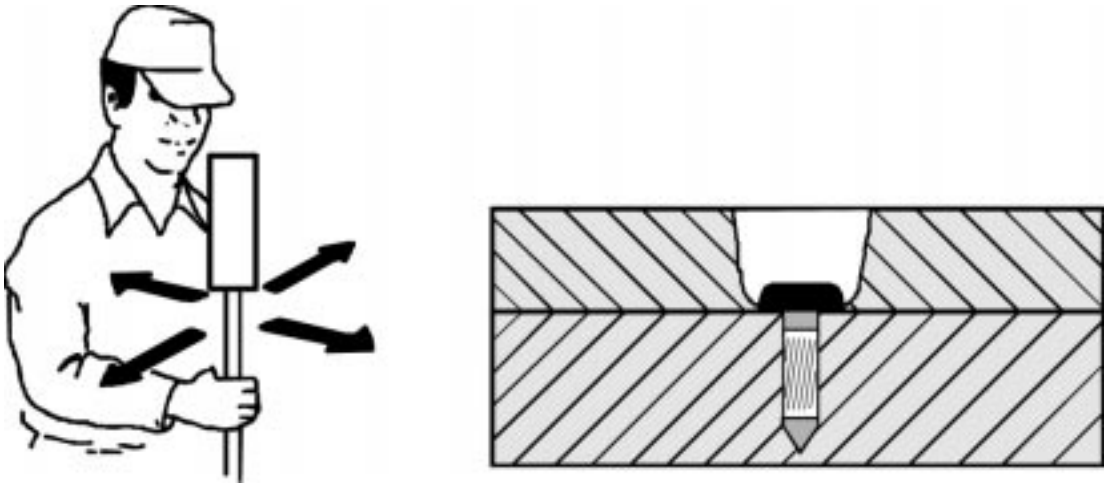


Figure 3-2. “X” Pattern Provides Precision Locating

If you find more then one signal in the vicinity of a target, just raise the locator several inches higher (this has the same effect as reducing the gain). Any signal that disappears when the locator is raised is probably not coming from the actual target. The signal from a rusty bolt or other small item will decrease much faster with distance than the signal from a larger target such as a corner marker. An 18-inch length of 3/4-inch pipe can be located at depths up to 9 feet.

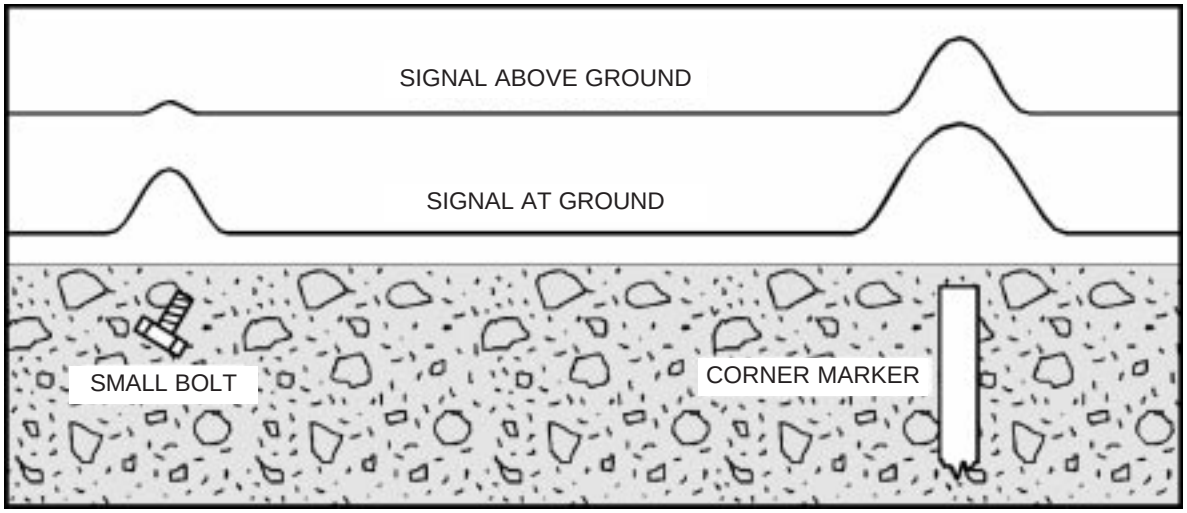


Figure 3-3. Raising the Locator Eliminates Unwanted Signals

Strongly Magnetized Markers

A strongly magnetized iron pipe at or near the surface may provide location information that is misleading.

The heavy line in Figure 3-4 represents the variation in tone frequency when the locator is moved over the pipe. When moving the instrument from A to B, the frequency of the tone increases and then suddenly decreases at B. From just beyond B the frequency of the tone increases sharply, becomes very high directly over the marker and decreases just before reaching C. From C to D the pattern is the reverse of that form A to B. It is obvious that the locator must enter the B-C region. Otherwise the marker might be assumed to be between A and B or C and D.

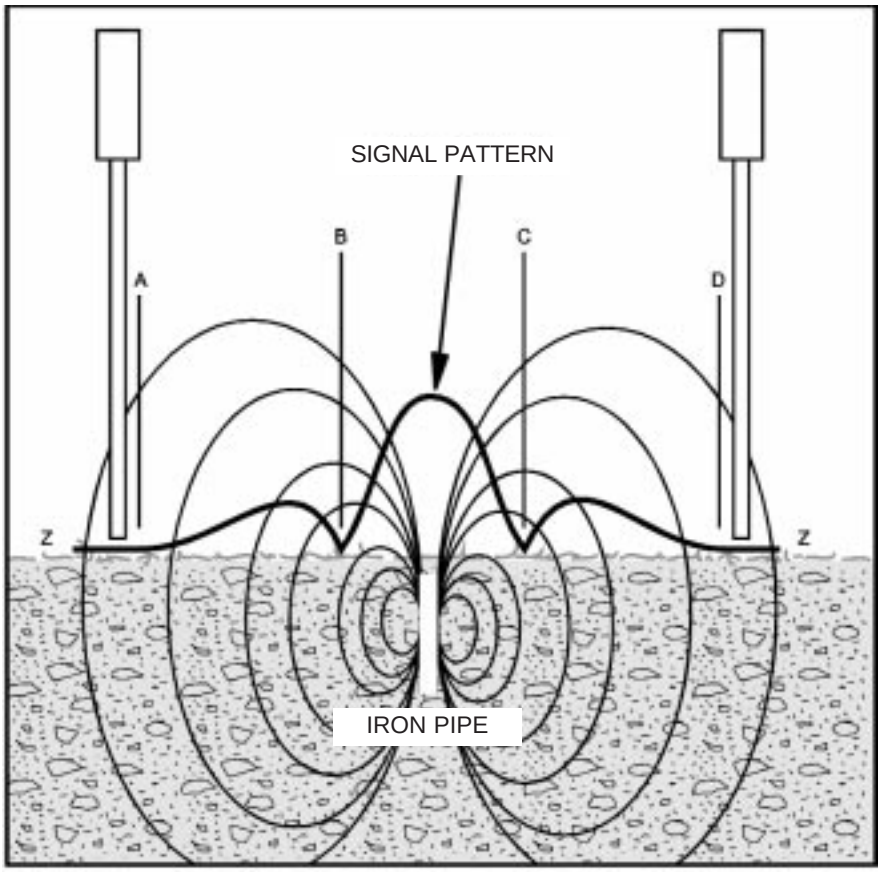


Figure 3-4. Signal Pattern from a Strongly Magnetized marker

Locating Manholes, Septic Tanks and Water Wells

The magnetic field is strongest at the edge of a shallow manhole cover. Turn the Gain control to LO and you can easily trace the edge of a cover near the surface. Locating depth ranges up to 10 feet.

The great length of a well casing provides a strong field at the surface that makes it easy to locate casings buried up to 18 feet deep.

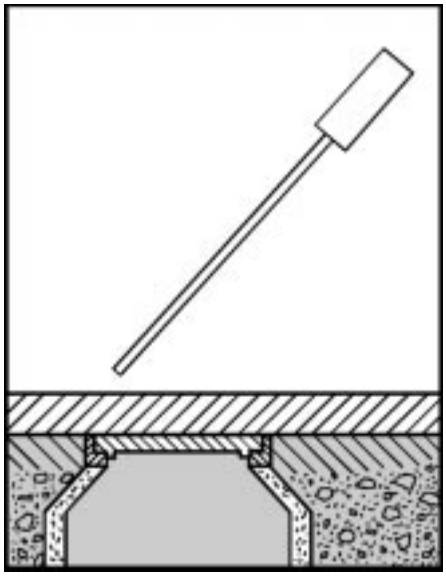


Figure 3-5. Locating Manhole Covers

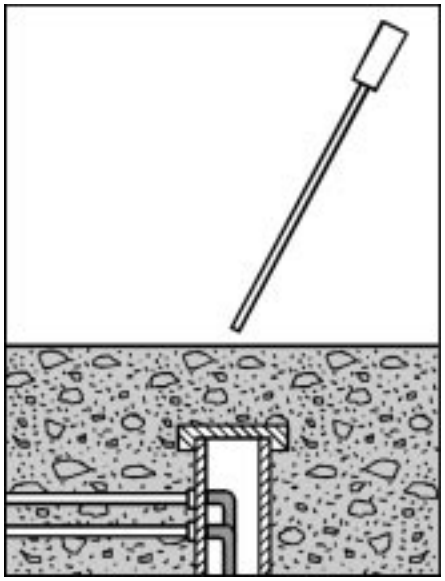


Figure 3-6. Locating Water Well Casings

The MAC-51Bx receiver can be used to precisely locate the metal handles or reinforcing bats on septic tank covers at depths up to 4 feet

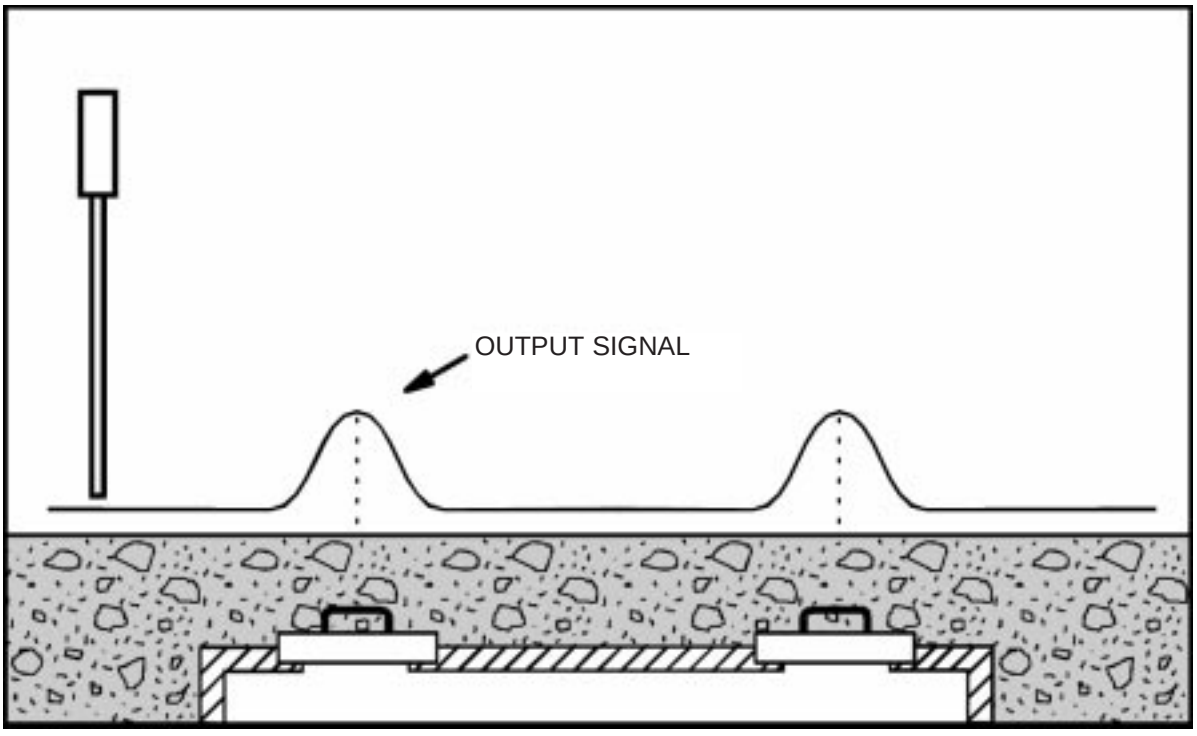


Figure 3-7. Signal Pattern Provided by Septic Tank Handles

Locating Items under Snow or Water and Tracing Barbed Wire.

The locator can be used in flooded areas - just keep the electronic unit (“can”) out of the water.

Snow poses no problem. Thrust the locator into the snow as deep as necessary to locate the target, up to the base of the “can”.

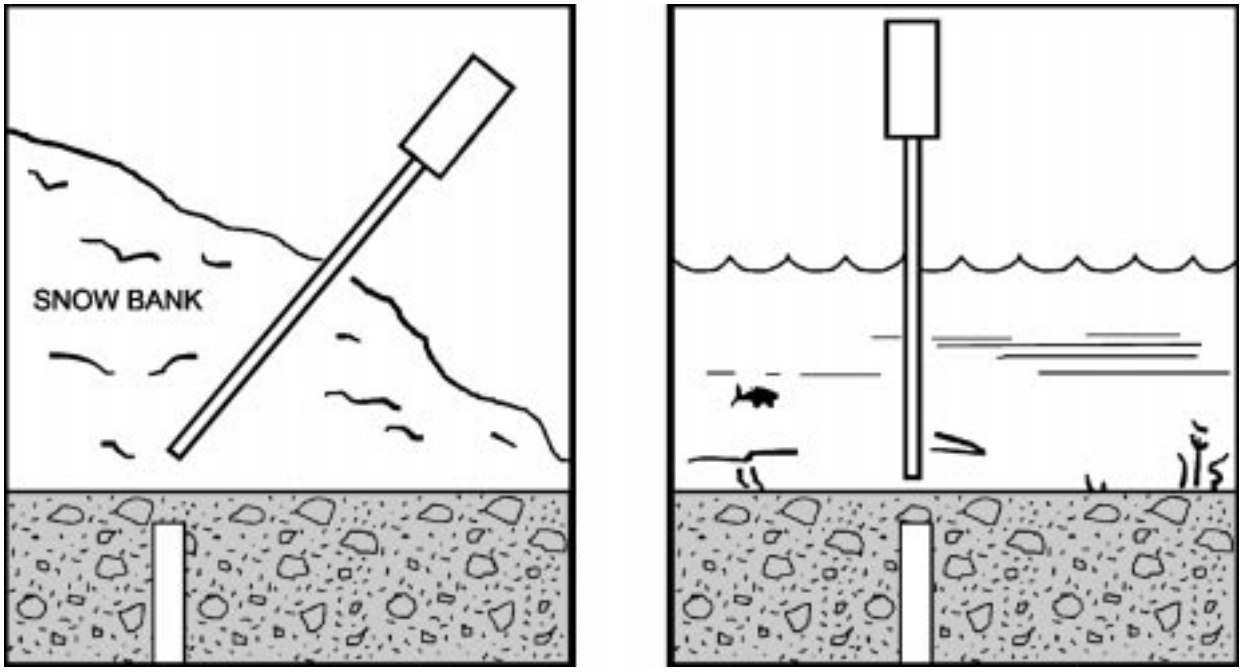


Figure 3-8. Locating Objects Under Snow or Water

You can often trace barbed wire (from old fence lines) buried just beneath the surface. Even if the wire is only a trail of rust it can still be detected neat the surface. Tip the locator a little lower than usual - but not parallel with the ground.

First, examine trees for benchmarks and bits of embedded barbed wire. The hold the locator parallel with the direction of the wire.

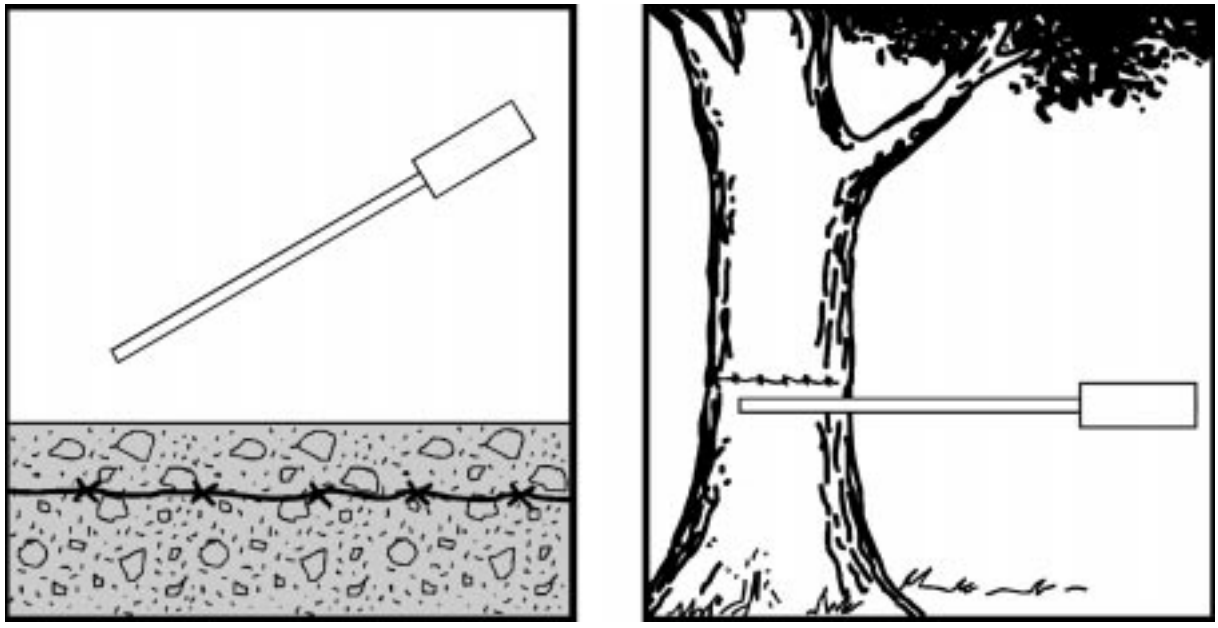


Figure 3-9. Tracing Barbed Wire from Old Fence Lines

Searching Areas Along a Chain Link Fence

Searching in the vicinity of a chain link fence requires a reduced Gain setting and also some control over the orientation of the locator. As illustrated in Figure 3-10, position the locator horizontally with its long axis perpendicular to the fence. This ensures that the upper sensor is kept away from the fence.

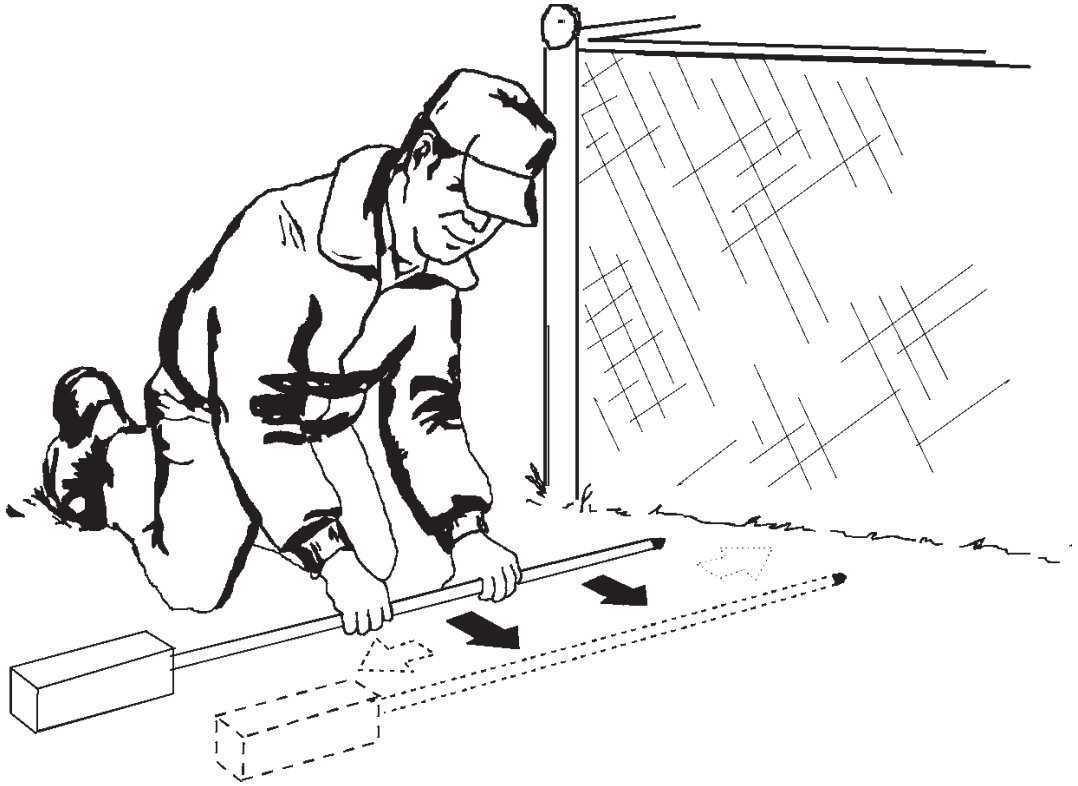


Figure 3-10. Searching in the Vicinity of a Chain Link Fence

Perform the search by moving along the fence, keeping the end a constant distance from the fence. When a point 1-5/8 inches form the end of the locator is directly over the stake, the signal will drop abruptly as shown in Figure 3-11. Any variation in the position of the locator will produce an abrupt rise in the frequency in the tone.

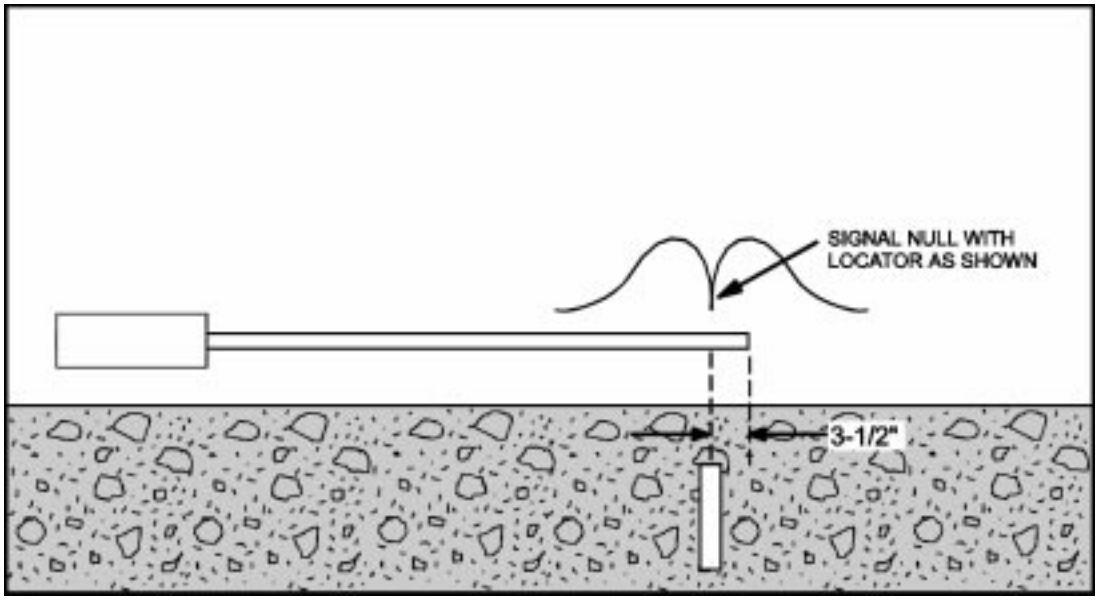


Figure. 3-11. Placement of Locator while Searching Along a Chain Link Fence

Locating Valve Boxes

Both the valve and its casing, when iron, provide strong magnetic fields which make them easy to locate. Plastic enclosures containing magnets are easily located at depths of 10 feet or more.

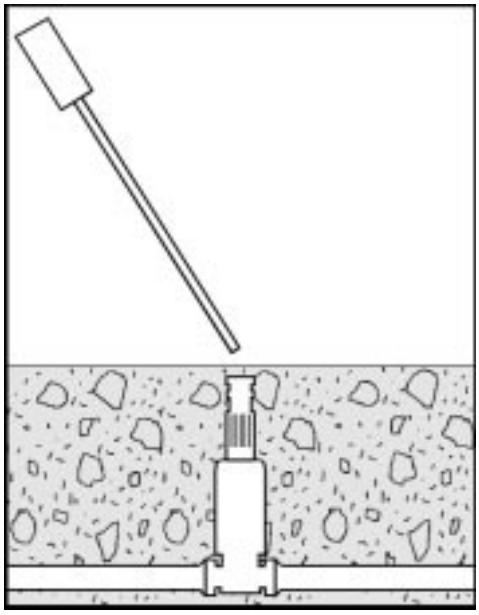


Figure 3-12. Locating Valve Boxes Boxes and Casings

Locating Cast-Iron Pipes

As illustrated in Figure 3-13, cast-iron pipes produce the strongest magnetic signals at their joints.

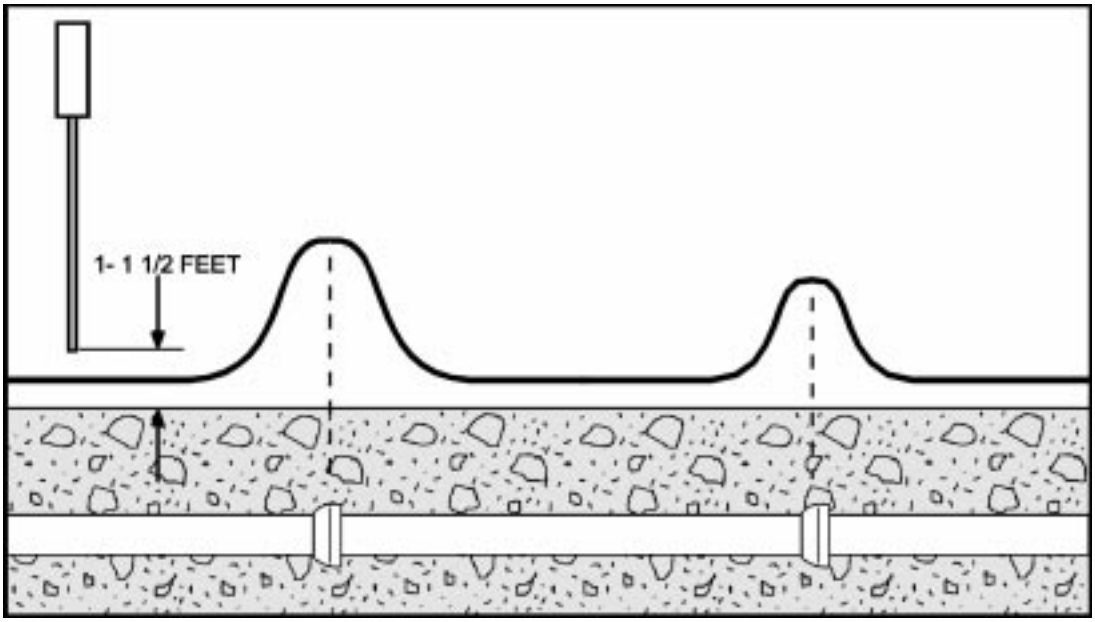


Figure 3-13. Signal Pattern Provided by Cast-Iron Pipes

The initial search should be performed as follows:

1. Set the Gain control to HI.
2. Hold the locator vertically 1 to 1-1/2 feet above the surface
3. Walk along without turning or tilting the locator.
4. Mark the locations where the maximum signals occur.
5. Return to an area of maximum signal strength and hold the locator several inches above the surface. The gain setting will probably have to be reduced during this second pass. Four-inch, cast-iron pipes can be located at depth up to 10 feet.

Locating Steel Drums

As shown on Figure 3-14, the MAC-51Bx's signal pattern will vary depending how deep the drum is buried. A fifty-five gallon drum can be located at depths up to 10 feet.

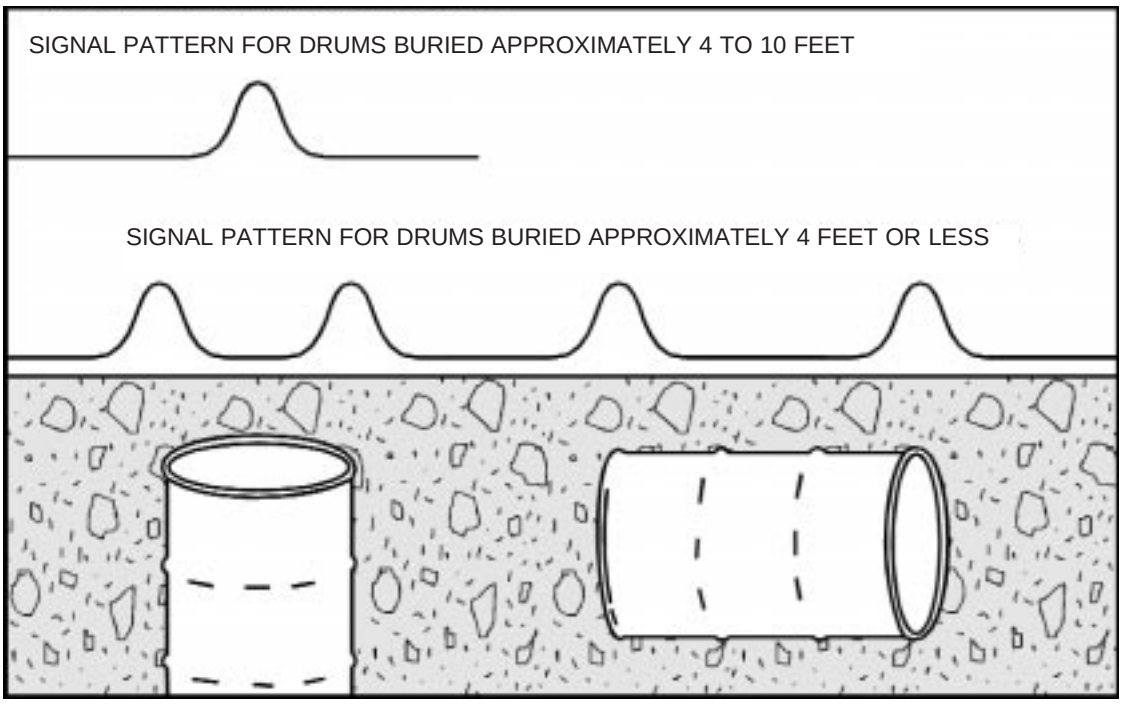


Figure 3-14. Signal Pattern Provided by Steel Drums

Additional Applications

1. The military and many local and state police departments use the MAC-51Bx to detect buried ordnance and discarded weapons.

2. People drilling in an area where hazardous material might be encountered use the MAC-51Bx to search the area prior to drilling. Other Schonstedt gardiometers are available that can be lowered down the hole for periodic checks as drilling progresses.

Other Notes

1. A burbling sound indicates the presence of an energized powerline, in the MAG Mode.

2. The instrument in the MAG Mode will not detect nonmagnetic items such as gold, silver, copper, brass, aluminum tin cans and bottle caps. In the HI and LO Modes it will detect any continuous metal, line or cable.

Section IV
Cable and Line Tracing

Theory of Operation

In the Cable and Line Tracing (HI and LO) locating modes, you must use the receiver in combination with the dual-frequency transmitter which is housed in the carrying case.

As illustrated in Figure 4-1, the transmitter is placed over and in line with any continuous metal conductor. Its two simultaneous output frequencies (HF and LF) produce alternating currents that are induced (HF) and conducted (LF), onto the conductor as tracing signals. The transmitter emits a steady beeping sound to let you know that it is operating. You can detect the two tracing signals by using the receiver's HI or LO mode. The receiver emits a siren-like sound ion both modes that decreases to a minimum pitch when the locator's tip is directly over the target conductor, and peaks on each side.

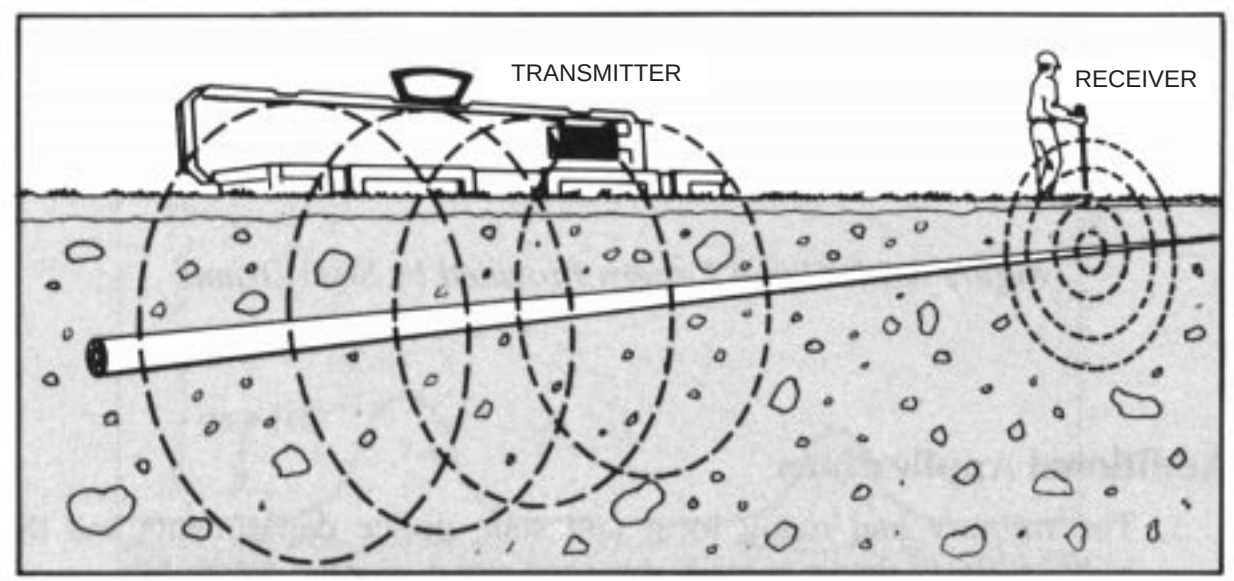


Figure 4-1. Transmitter and Receiver Placement

The tracing currents generate alternating circumferential fields around the conductor. These alternating fields induce two signals into the receiver's sensor. As the receiver is moved back and forth across the cable in a search pattern, the pitch of the audio output from the receiver increases and decreases.

The heavy line in Figure 4-2 represents the increase and decrease in pitch of the audio signal as the receiver is moved back and forth over a line or a cable excited by the transmitter. Moving from **A** to **D** causes the pitch to increase to a maximum at **B** and decrease to a minimum directly over the target. At **C** the pitch again increases and then decreases at **D**.

The MAC-51Bx can be used to trace any long conductive element such as a anode string or metalized warning tape as well as cable and pipe.

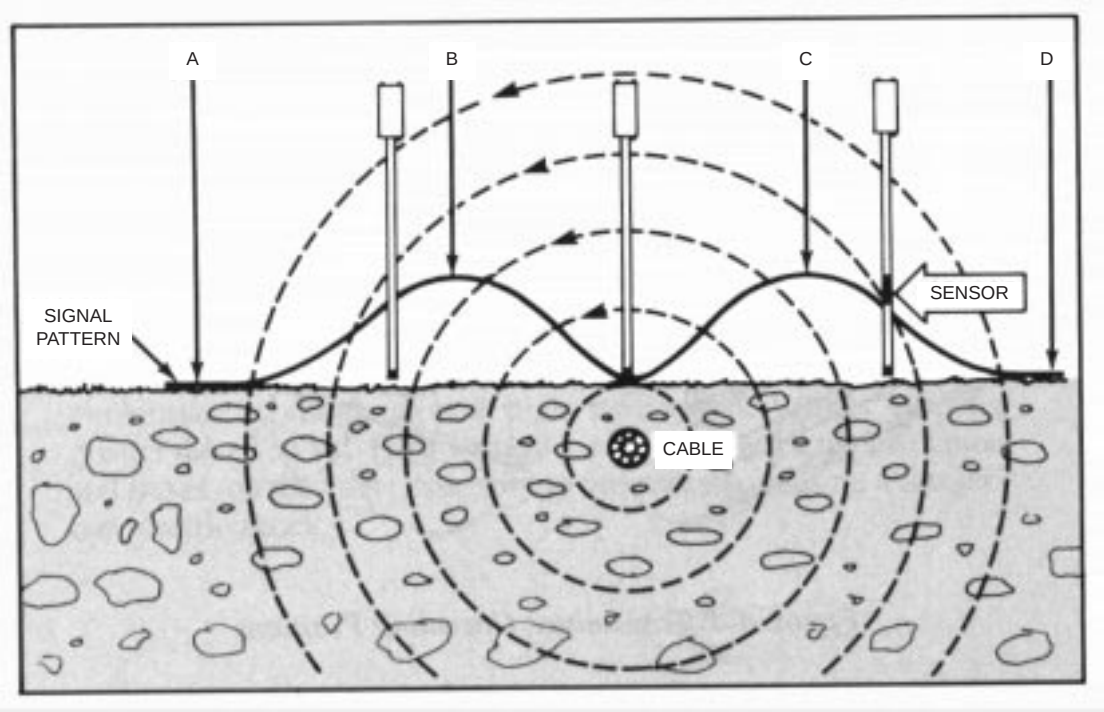


Figure 4-2. Signal Pattern from HF/LF Tracing Signals

NOTE

For convenience, all targets will be referred to as lines throughout Sections IV and V.

Transmitter, Turn-On and Battery Check

Set the ON/OFF switch to on and listen for a steady beeping sound. If a beeping is not heard, the batteries must be replaced as described on page 6-1.

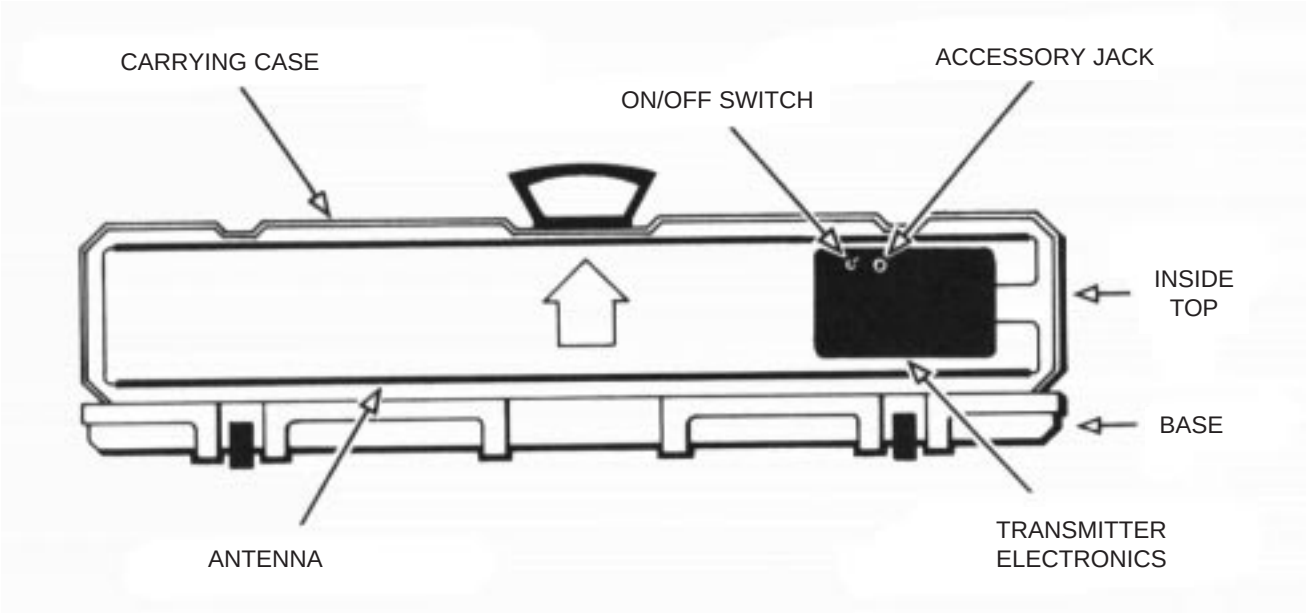


Figure 4-3. Transmitter Features

Inductive Signal Coupling (For HI Mode Only)

The most common method of applying a tracing signal is inductive coupling. With the cover open and the arrow pointing up, place the transmitter over the line as illustrated in Figure 4-4. Turn the transmitter ON/OFF switch to ON and you will hear a steady beeping sound. If not, replace the batteries.

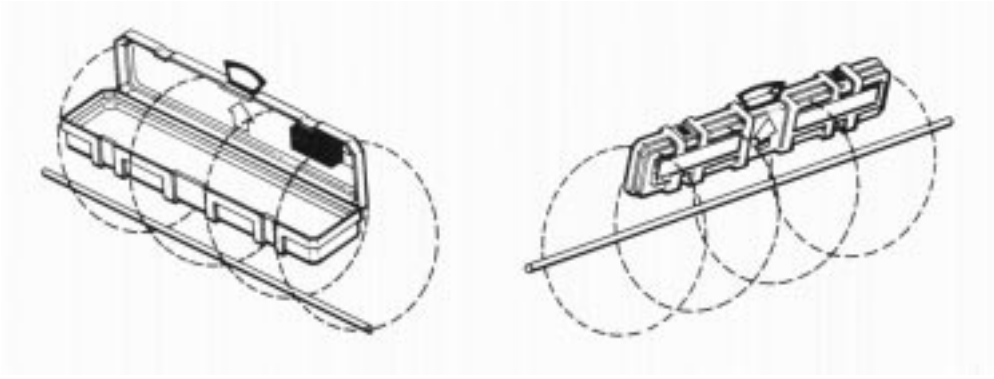


Figure 4-4. Transmitter Operating Positions

Conductive Signal Coupling (For HI and LO Modes)

If and exposed section of cable, line, or conduit is accessible, the tracing signal can be applied directly to the line. (The LF signal will not jump gaps. So keep in mind that when applying the conductive signals to a metal pipe with non-conductive joint gaskets, the LF signal only cannot be traced beyond the first joint from where the signal is applied.)

Plug the conductive cable assembly into the transmitter's accessory jack and turn the power switch to ON. (Inserting the plug automatically disables the transmitter's inductive mode and applies the exciting current to the cable clips.) Connect one cable clip to a conductive portion of the line. Drive the ground stake into the soil off to the side of the line and attach the other clip to the stake. A good electrical contact between the clips, the line, and the ground stake is very important.

WARNING

Clipping to power lines is dangerous and should not be attempted. Insulation on the clip is not designed to protect against power line voltages.

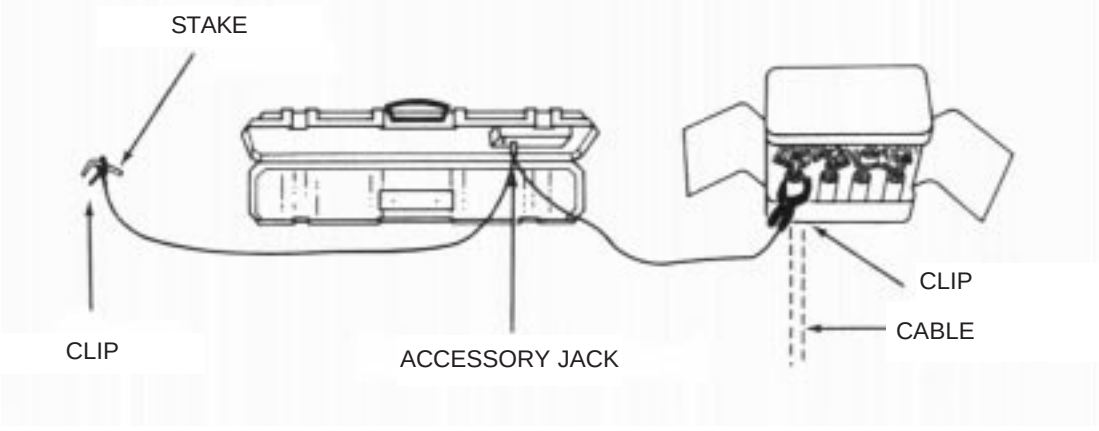


Figure 4-5. Transmitter Hookup For Conductive Coupling

Inductive Signal Coupling With Signal Clamp (For HI Mode Only)

The inductive signal clamp (optional) provides a convenient method of applying the tracing signal to electrical cables covered with non-metallic insulation. Plug the clamp lead into the transmitter accessory jack, turn on the transmitter and close the clamp around the cable. No ground connection is required. The clamp can be used on the cables up to three inches in diameter.

WARNING

Exercise caution when clamping around any power line. Under no circumstances clamp around high tension lines (lines carrying greater than 220V). High voltage can jump through the insulation and travel on the cable assembly to the operator causing a dangerous electric shock.

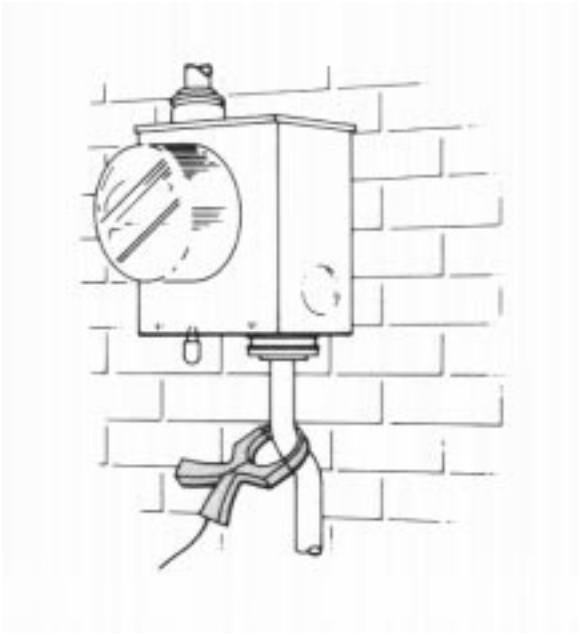


Figure 4-6. Inductive Signal Clamp Hookup

Mode Selection

Set the receiver's Mode switch to LO for tracing a particular line with a conductively applied LF signal because the signal will not bleed onto adjacent lines. Also use the LO Mode to locate a complete break. Set the Mode switch to HI for tracing a line or pipe with an inductively coupled signal, and when tracing beyond a break for verification purposes. Set the Mode Switch to MAG for locating ferrous metal targets or for verifying an energized power line. In the HI Inductive Mode, you should move the receiver at least 20 feet away from the transmitter to start tracing to avoid picking up the HF tracing signal through the air directly from the transmitter. You will have to increase the Gain as the distance between the receiver and transmitter increases.

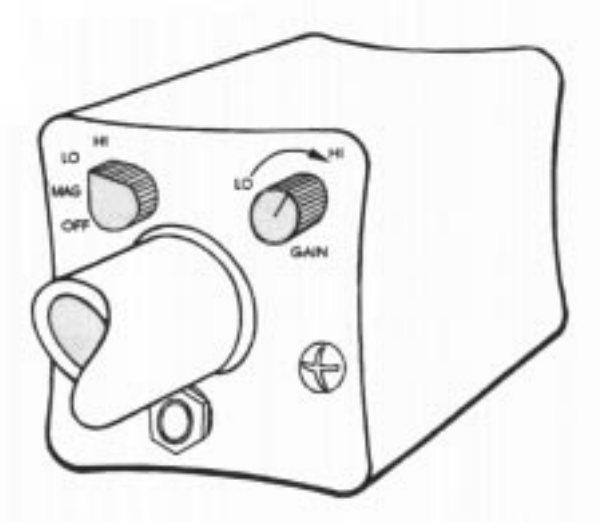


Figure 4-7. Gain Setting for Normal Range

Gain Settings for Tracing a Cable or Line

You must use the proper Gain setting to obtain an optimum width null. A null is the audio signature that lets the operator know when he is positioned directly over the target line. If you set the Gain too low, the null between the two signal peaks (highest audio pitch) will cover too large an area, making it difficult to trace the line. If the sensitivity is set too high, the null will be too narrow and very difficult for you to identify. You will find that setting the Gain to get the null width as illustrated by the medium Gain curve in Figure 4-8 is the secret to successful tracing.

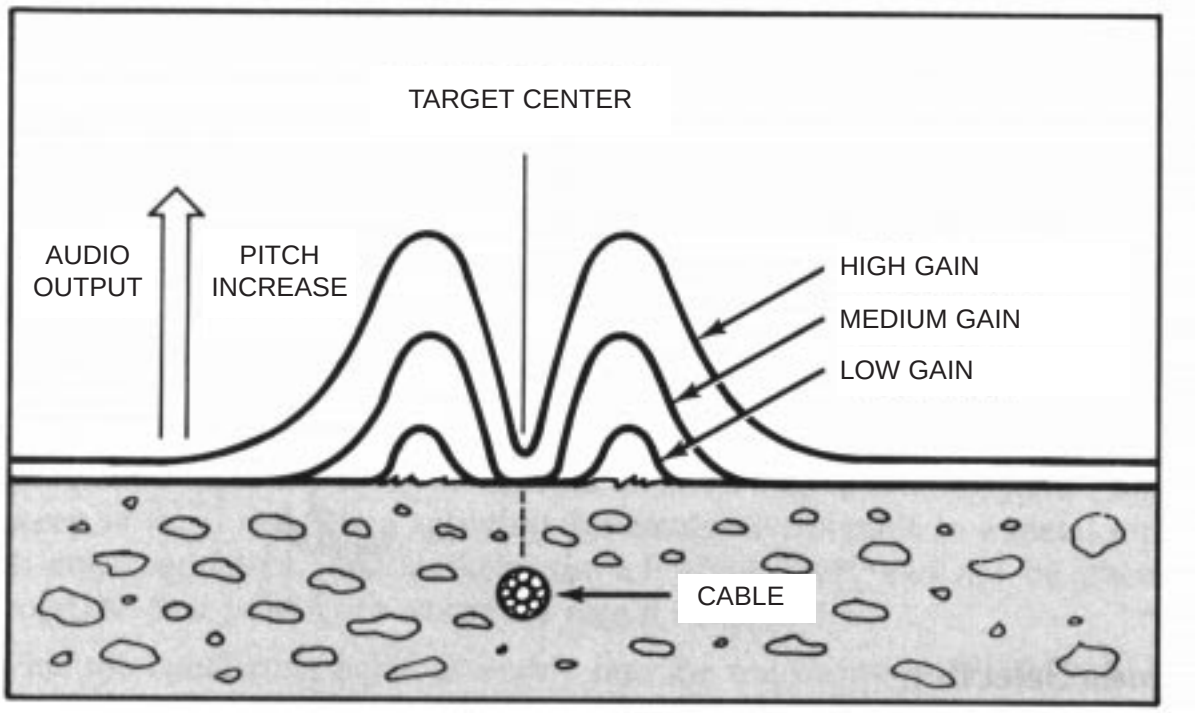


Figure 4-8. Null Shape Versus Gain Setting

Cable Tracing (HI Mode) Using Inductive Coupling

Position the transmitter over the target line and turn the power switch to ON. A steady beeping will be heard that indicates the transmitter is operational. Move approximately 20 feet away from the transmitter along the suspected target line before you start to trace the signal. This ensures that the receiver is not receiving the signal through air directly from the transmitter. Adjust the Gain control for a medium pitch signal. Hold the receiver just below the large end as illustrated in Figure 4-9.

NOTE

Do not swing the receiver when pinpointing the null. The null appears directly over the target only when the receiver is held in a vertical position. If it is held at an angle, the null will not indicate the exact location of the target line.

Hold the receiver in a vertical position with the sensor end close to the ground as you move it back and forth across the line. Adjust the Gain control until you get a good signal null (minimum pitch) when the locator's tip is directly over the line. As you move away from the transmitter, it will be necessary to keep increasing the Gain.

Figure 4-9. Inductively Coupled Tracing Signals

Conductively Applied Tracing Signals (For HI and LO Modes)

To conductively apply tracing signals, you must physically connect the transmitter's output frequencies to an exposed metal section of the line using the conductive cable assembly and the ground stake. After the two clips are connected to the line and to the ground stake (good electrical contacts are essential), the procedure for using the receiver is the same as for inductively coupled signals except that you can begin tracing right next to the transmitter.

WARNING

Clipping to power lines is dangerous and should not be attempted. Insulation on the clip is not designed to protect against power line voltages.

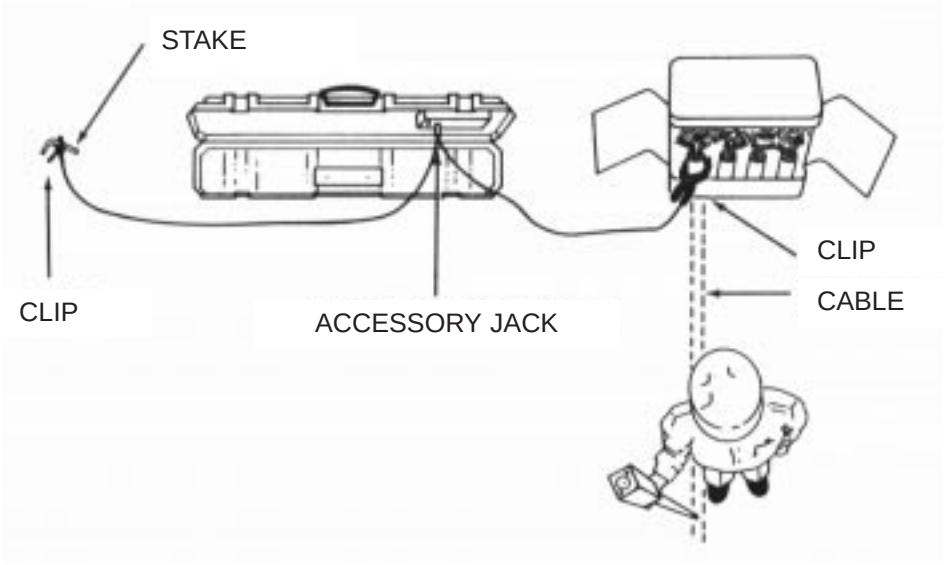


Figure 4-10. Conductively Applied Tracing Signal

Section V
Cable and Line Tracing Application Notes

Inductive Signal coupling for Cable/line Tracing in the Hi Mode

This is the easiest and quickest way of applying the tracing signal to a conductor and provides a signal strong enough to trace most cable/lines in the HI Mode. Induction does not require access to an exposed section of the line which very often is not available. The 82.5 kHz HF signal will jump the gaskets in pipe line joints, bad telephone lines bond and small sheath breaks, but its strength will fade quickly as distance from the transmitter increases when the target line (gas or water pipe) is an electrically poor or a leaky conductor (up to 500 feet from the transmitter).

Ant time an HF signal is induced on a cable/line, the same signal will be induced on nearby utility lines which may cause some confusion when trying to identify the null because it may be shifted towards a nearby line. When this happens, you can hold the receiver horizontally near the ground, as shown in Figure 5-5, and listen for a single-peak audio signal which occurs directly over the target line. You can also apply the tracing signal conductively and set the Receiver Mode switch to LO.

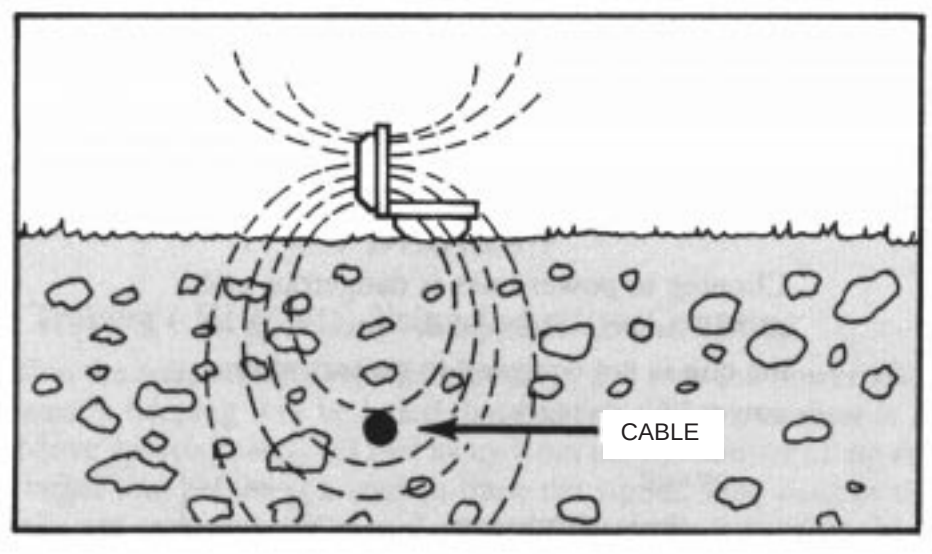


Figure 5-1. Inductive Coupling Setup

Conductive Coupling for Cable and Line tracing in HI Mode

This is the most reliable and best way to apply the strongest tracing signal to the target conductor. Like an inductively coupled signal, the 82.5 kHz HF signal will jump pipeline joint gaskets, bad telephone bonds and small sheath breaks. However, its strength will remain strong over a much greater distance and can be traced up to 2,000 feet. A good electrical contact between the clip and the conductive portion a target line is essential. If necessary, use a file to clean off rust or paint to ensure a good electrical connection. Electrical contact must also be made to the ground by using the supplied stake. For the best results, drive the stake into the ground as far off to the side of the line as the connecting cable will permit (See Figure 5-2).

WARNING

Clipping to power lines is dangerous and should not be done. Insulation on the clip is not designed to protect against power line voltages.

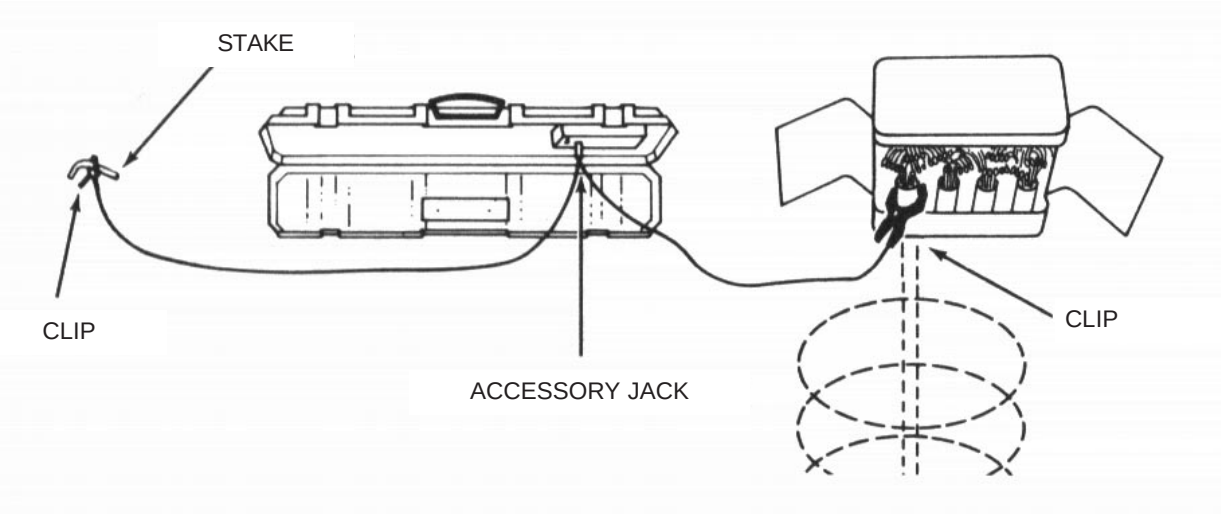


Figure 5-2. conductive Coupling Setup

Conductive Coupling for Cable and Line Tracing in the LO Mode

Use conductive coupling and the LO Mode for locating a cable or line when there are other nearby targets, and to find a complete break. You can also use the LO mode to trace a single cable or a line for distances up to 4,000 feet. A good electrical contact between the clip and the conductive portion the target line is essential. You must remove any rust or paint to ensure a good electrical connection. Electrical contact must also be made by driving the ground stake into the ground as far off to the side of the line as the cable will permit. The 571 Hz LF signal will not travel beyond a fault and will not bleed off onto adjacent cables/lines and pipes. As indicated in Figure 5-3, you can verify the type of target (magnetic or nonmagnetic) in the MAG Mode, trace the cable using the LO Mode to locate the break (where the signal disappears), and continue tracing beyond the break in the HI Mode.

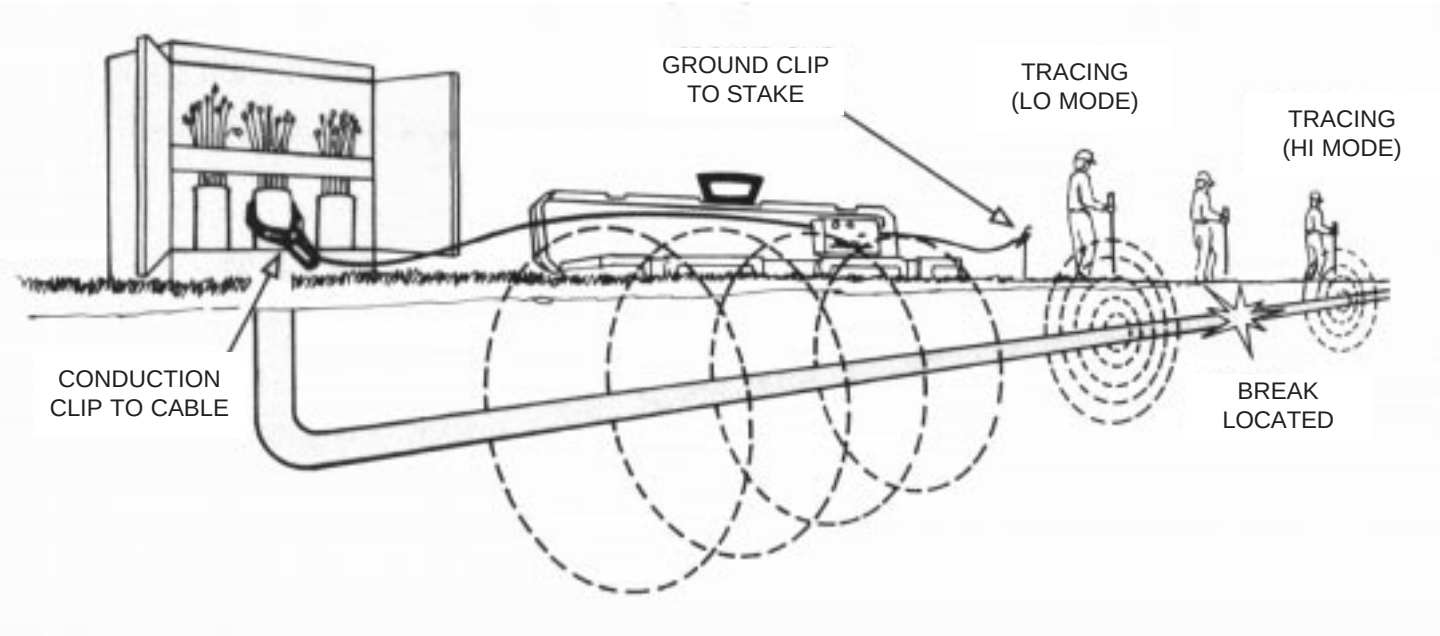


Figure 5-3. Coductive Coupling for Break Locating

Dealing with clutter Signals (HI Mode)

When using induction to apply the tracing signal, an effective method of reducing interference caused by parasitic signals from an adjacent line is to fins a second spot on the line that has a good clean null (equal strength lobes on both sides). Move the transmitter to this spot. Confirm that this is the target line by backtracking with the receiver to the first site of the transmitter and checking for a null. This procedure of leapfrogging the transmitter is also the standard method for extending the tracing range on electrically poor or leaky lines.

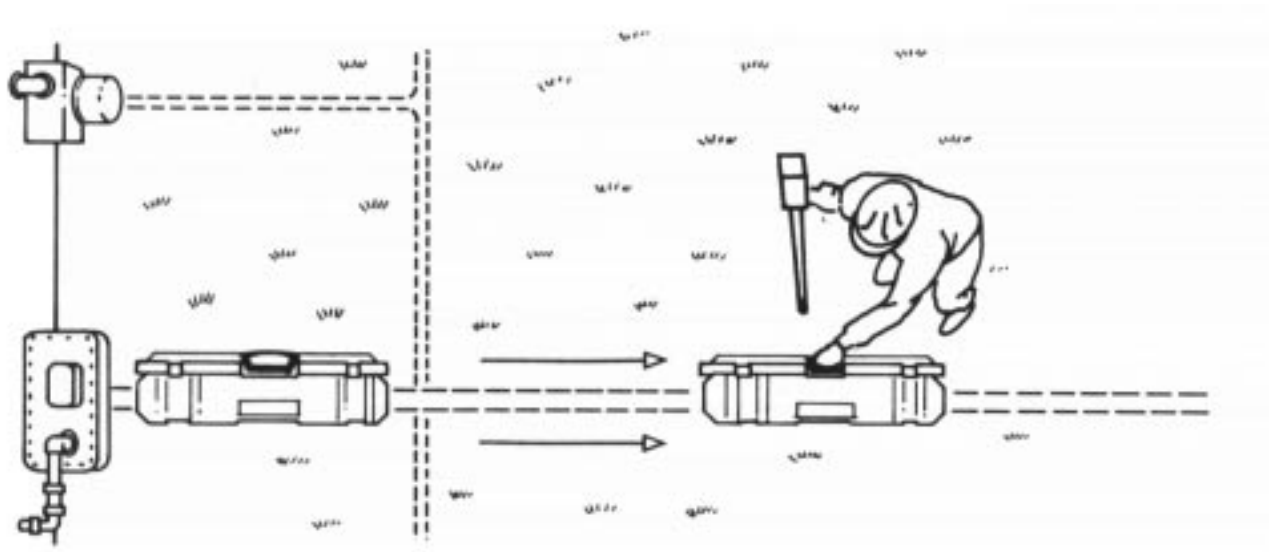


Figure 5-4. Repositioning Transmitter to Reduce Interference

Single-Lobe Identification (HI Mode)

A second line parallel to the line being traced will emit a parasitic signal but at a reduced strength. Interaction of these signals results in unequal side lobes, which cause a large null off to one side of the target line as indicated by signal pattern curve A in Figure 5-5. To accurately trace a line under this condition will require practice. An alternate method is to hold the receiver in a horizontal position perpendicular to the line and listen for a single high pitch audio signal that occurs directly over the line as indicated by signal pattern B.

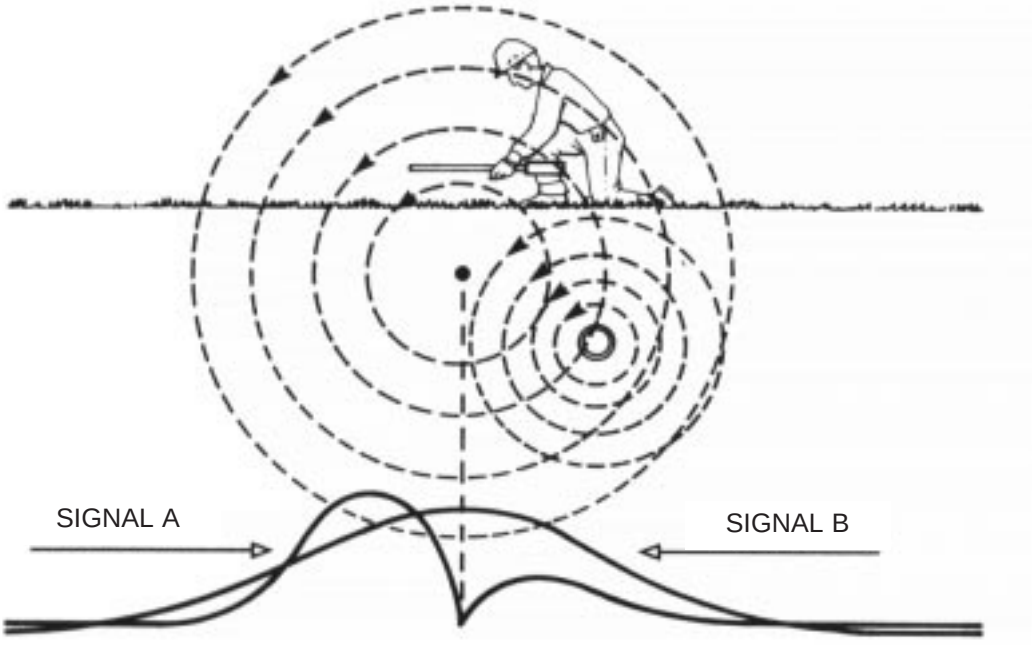


Figure 5-5. Single Lobe Identification Technique

Bends and Junctions (HI and LO Mode)

A variation of the two-line, single-lobe identification problem just described, occurs when the line being traced has a bend or junction. As the receiver is brought near a bend or junction, the tracing signal becomes difficult to interpret. When this occurs, walk a 20-foot circle around the spot where the signal becomes confusing to detect the null that will indicate the line's new direction. However, to be certain that it is the new direction and not a junction, complete the circle to check for a second null that will indicate if the line has a branch.

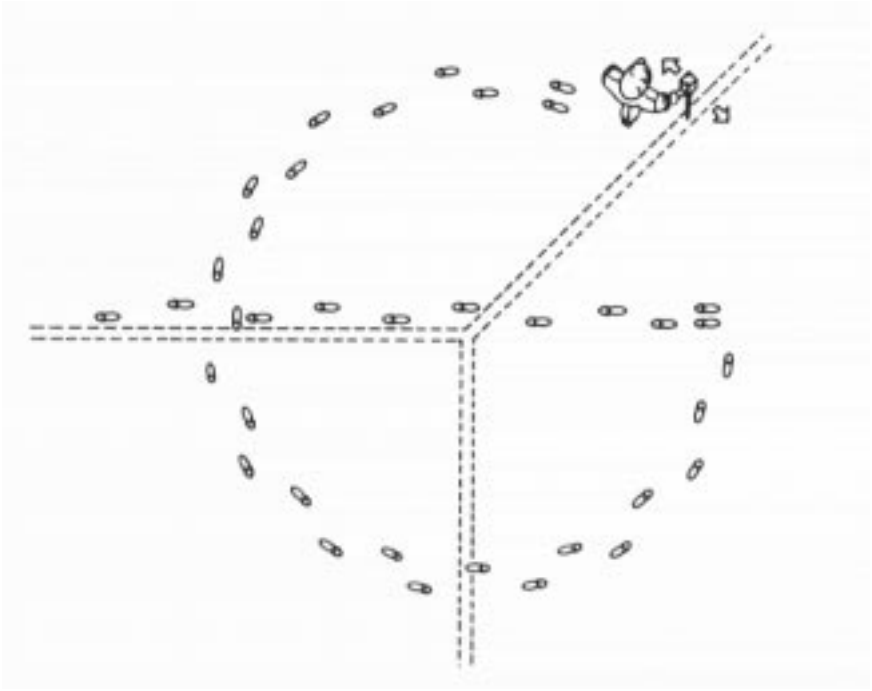


Figure 5-6. Identification of Bends and Junctions

Signal spreading (HI Mode)

Target lines that are poorly insulated from ground such as gas pipes, water pipes and anode strings may cause signal spreading to occur over long distances from the transmitter, even when the tracing signal is being applied conductively. This condition is prevalent when ground water is present. The signal also spreads to nearby lines and into the soil itself. When this situation is encountered, the transmitter must be moved closer to the section of the line to be traced and the signal must be applied conductively if possible.

Signal spreading can also occur even when lines are well insulated. The tracing signal can travel into buildings via the ground or the shield of a line and transfer to the shields of other lines leaving the building. Signal spreading can be minimized by placing the transmitter as far as possible from the building.

NOTE

If the target is a continuous metal conductor, such as a cable, you can eliminate most signal spreading by conductively applying the tracing signal and using the receiver in the LO Mode.

Magnetic (MAG) Mode Aids in Interpreting Ground Clutter

The MAC-51Bx has a unique feature designed to help you unscramble underground clutter. It is the option of switching to the MAG mode for a different indication of what other category of targets are in the immediate vicinity. In this mode,

cast-iron water and gas pipes can be readily identified and even classified as to type by the conventional spacing of joints. Power mains 50/60 Hz service drops can also be identified by a burbling sound that peaks when the receiver is directly over the power line, as long as it is actively carrying electrical power. As you become more familiar with the MAC-51Bx System, you will find that switching between MAG, HI and LO modes becomes an invaluable tracing aid when underground cutter is encountered.

Isolators and Signals Path Continuity (HI Mode)

The tracer current must travel in a closed loop. When it leaves the line being traced, it loops back, one way or another, to the beginning of the line. If the current cannot complete its loop the locating system will not operate. You should be aware of this system requirement when tracing lines that have electrical isolators installed.

Electrical isolators are sometimes placed in a gas line at the meter to provide an electrically open circuit which stops the flow of galvanic current and reduces corrosion. If you are inductively exciting this type of line by placing the transmitter close to the meter, you must place a shorting wire on the pipe to bypass the isolator. This allows the tracing current to return to the pipe through the earth ground of the building. An alternate method is to move the transmitter down line a few yards away from the building to a point where the gas pipe riser provides a current return path, or to place the inductive signal clamp on the line below the isolator.

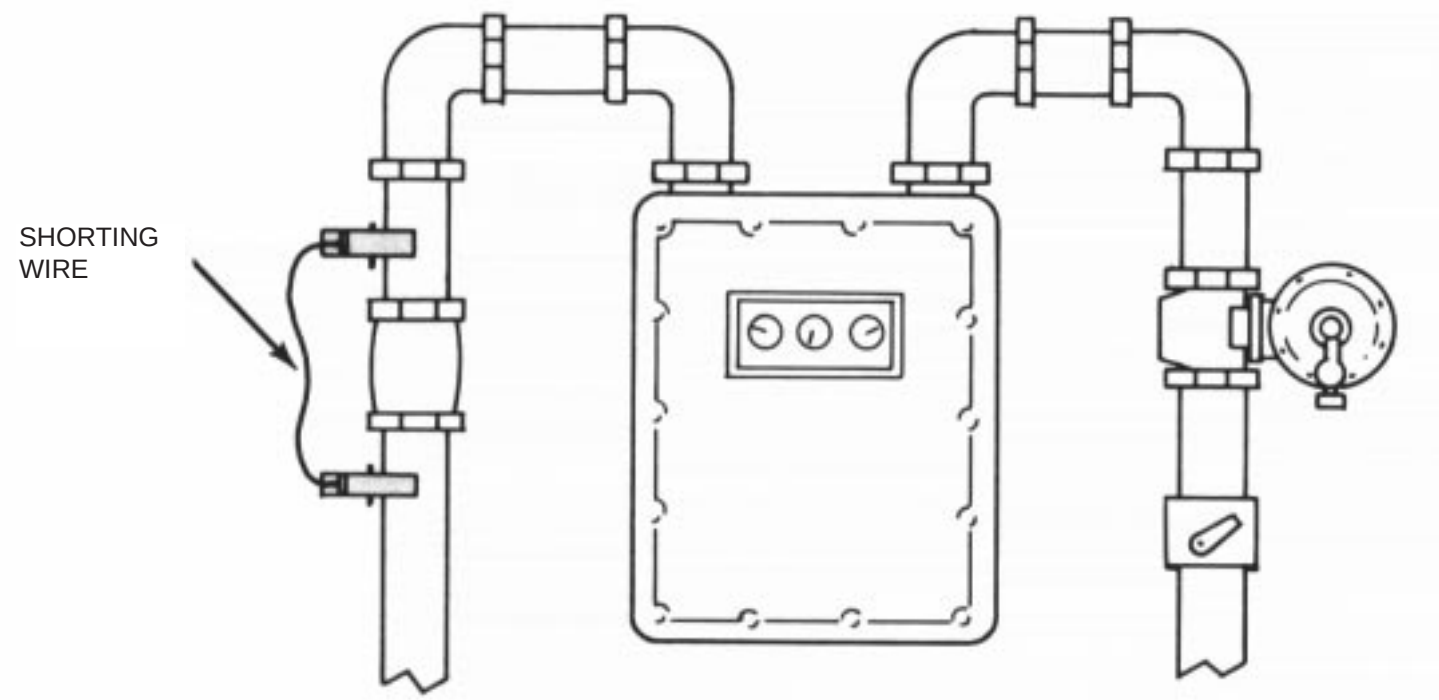


Figure 5-7 Shorting Wire in Place to Bypass an Isolator

Isolators and Inductive Excitation (HI Mode)

Electrical isolation sometimes occurs inadvertently on phone cables entering a pedestal because the cable's shield is not grounded. In most jurisdictions, grounding the shield inside the pedestal is not required unless the cable shares a trench with power cables. If there is no ground wire, it is recommended that a wire and clips, as shown in Figure 5-8, be connected from the cable shield to the pedestal before inductively coupling the transmitter's signals to the target cable. This will greatly improve the strength of the induced tracing signal.

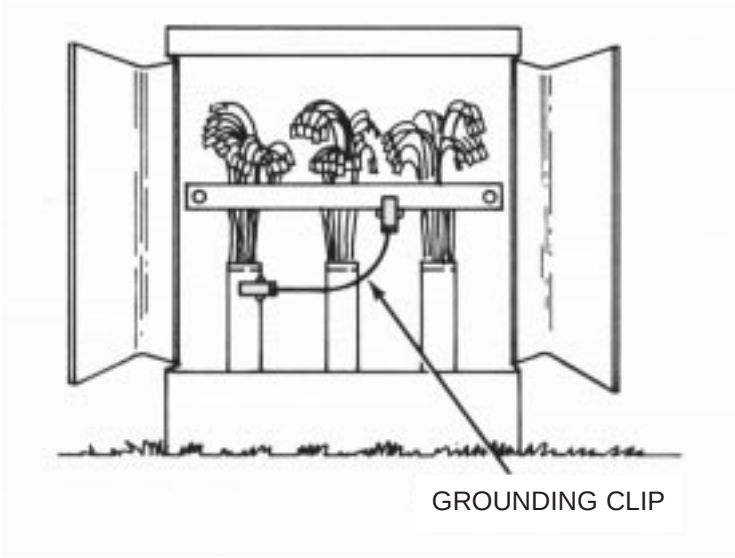


Figure 5-8. Pedestal with Grounding Clip Installed

Isolators and Conductive Excitation (HI and LO Modes)

When conductively connecting trace signals to a phone cable from a pedestal, electrical isolation of the shield is an advantage. If a ground wire is providing a good path from the shield to earth ground through the pedestal, the trace current will use it to complete the return loop to the transmitter grounding stake instead of going down the target line. So if there is a ground wire in place, disconnect it from pedestal before connecting the conductive cable clip to the shield to ensure that a strong tracer current is applied to the cable.

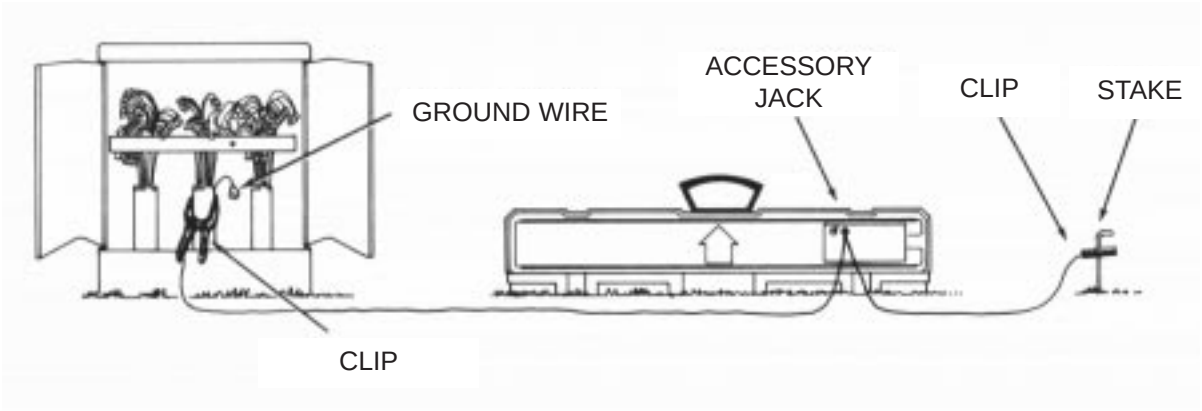


Figure 5-9. Pedestal with Ground Wire Removed

Determining Target Depth by Triangulation

The receiver can be used for the traditional triangulation method to determine the approximate depth of a target as illustrated in Figure 5-10. However, when using this method it is necessary to take into account the fact that the center of the cable-sensor is located 11 inches up the receiver tube from the black tip. When the position of the target has been determined by the null, mark the spot (#1) on the ground. Hold the receiver tip on the ground at this spot, slant the instrument at a 45° angle and slowly move directly back, to one side, from the target until a second null is obtained. Now mark a spot (#2) on the ground that is directly below a point 11 inches up the receiver tube from the black tip. Measure the distance between spot #1 and spot #2. This measurement indicates the approximate depth of the target.

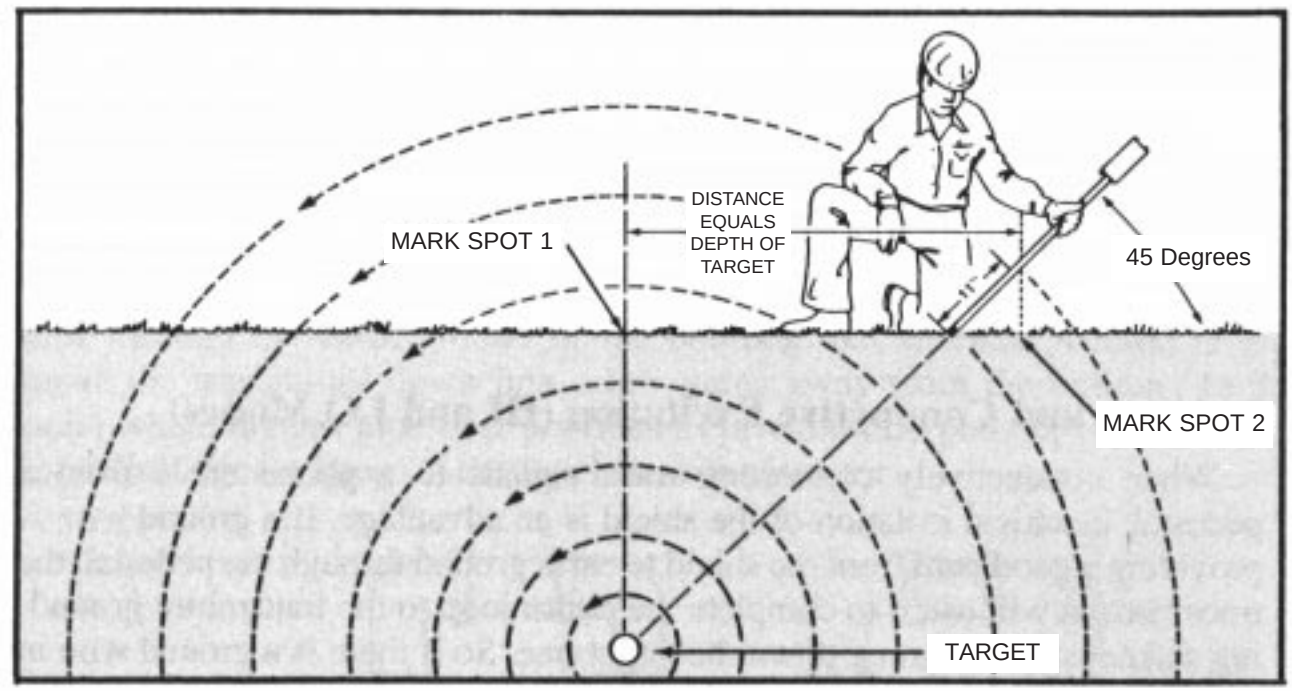


Figure 5-10. Determining Approximate Depth of Target

NOTE

You should always take a depth reading on both sides of the line. If the measured distances between spots #1 and #2 on both sides of the line are not the same, there is a good chance that a nearby line is causing the two measurements to be different. Move further along the line and repeat the depth reading procedure until the measurements are the same on both sides of the line. Once two very similar measurements are obtained, the calculated depth of the cable will always be within 4 to 6 inches of its actual depth. “Simple geometry calculations never give an incorrect indication of depth.” Push-Button depth indications provided by some products are affected by soil composition, salinity, and moisture content and have been reported to be off by up to 2-1/2 feet.

Section VI
Maintenance

The MAC-51Bx system is built to give trouble-free operation. Normally, maintenance is limited to the occasional replacement of batteries. In the event that a malfunction does occur, refer to the appropriate Troubleshooting Guide on page 6-3. They list a few possible problems that can generally be corrected in the field so that you will be able to continue using the locator without interruption.

Replacement of Receiver Batteries

The receiver is powered by two lithium 9-Volt batteries carried in the battery holder as illustrated in Figure 6-1 (alkaline batteries may also be sued). The unit is shipped with a spare set if lithium batteries stores in the carrying case. Access to the batteries is obtained by removing the two knurled nuts and sliding off the cover. ***Always replace both batteries.***

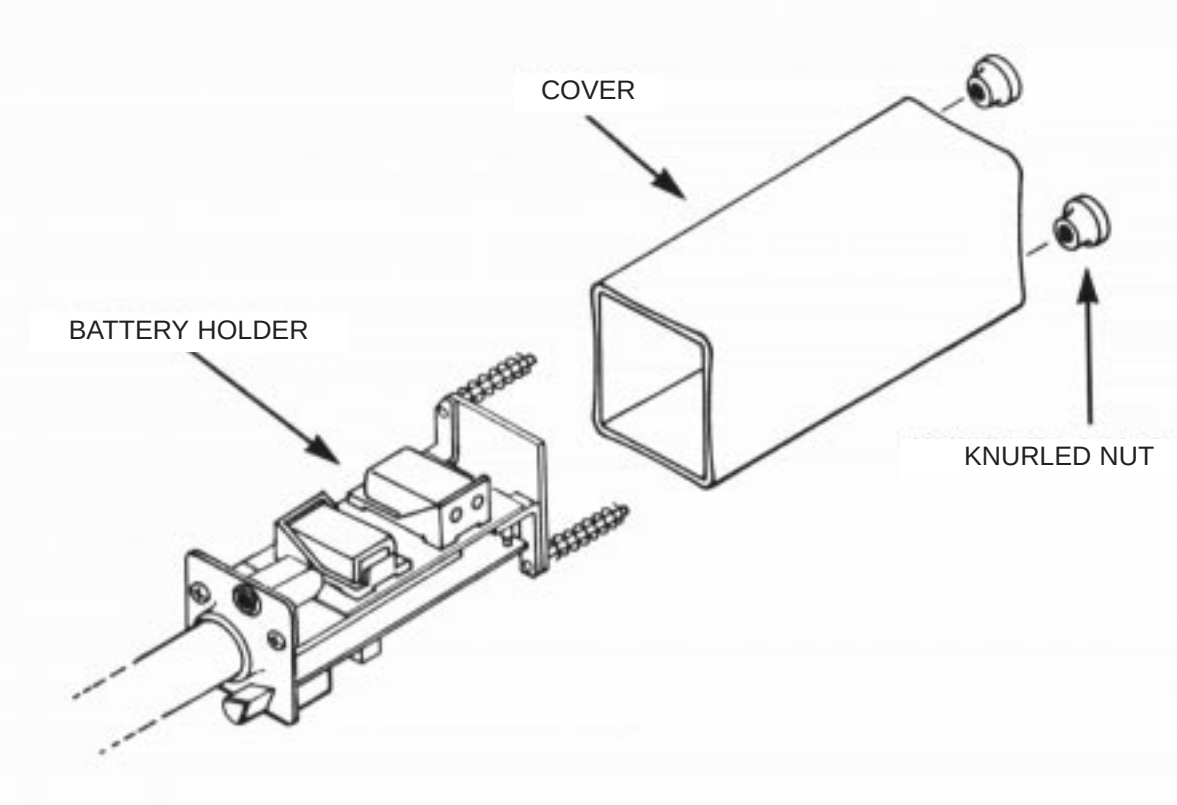


Figure 6-1. Exploded view of Receiver Electronic Unit

Replacement of Transmitter Batteries

The transmitter is powered by eight alkaline C-Cell batteries located in a battery holder. Access to the batteries, as illustrated in Figure 6-2, is obtained by removing the two knurled nuts, the battery holder cover, and the spare battery cover. The eight batteries are connected in series. The proper polarities for the batteries, their removal, and installation sequences are indication Figure 6-2. **Batteries must be removed and installed in the order shown.**

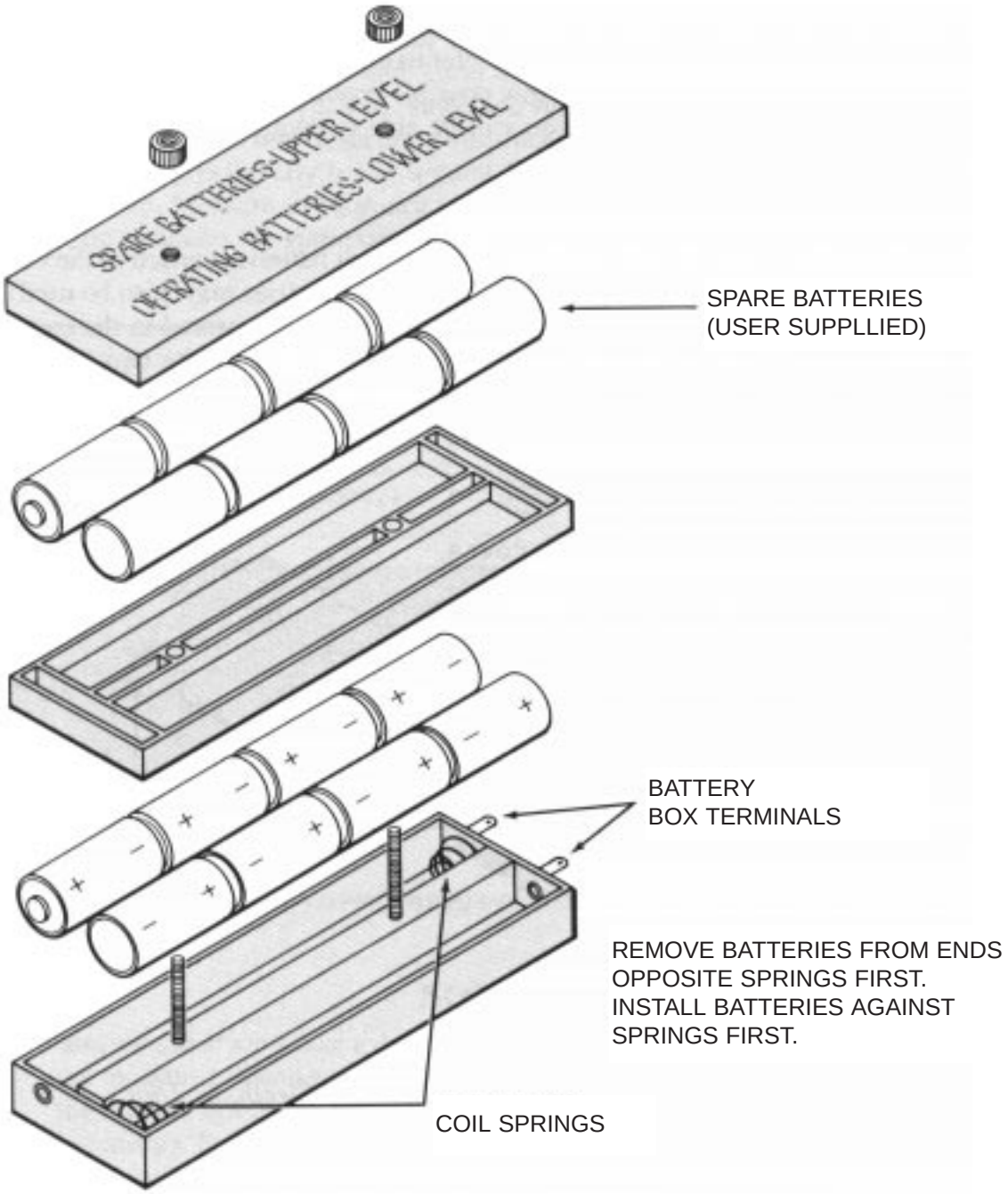


Figure 6-2. Replacement of Transmitter Batteries

Receiver Troubleshooting Guide

Symptom	Possible Cause	How to Check	How to Fix
Dead	Dead Batteries	Replace	-
	Batteries not making contact	Check for contact corrosion	Clean contacts
	Battery leakage	Do not remove*	Return unit to factory
Intermittent	Batteries not making good contact	Check for corrosion	Clean contacts
Uncontrollable screaming	Weak batteries	Replace	-

* Most battery manufacturers' warranties cover the cost of repair or replacement of any device damaged by their batteries. Removing batteries that leak will void their warranty.

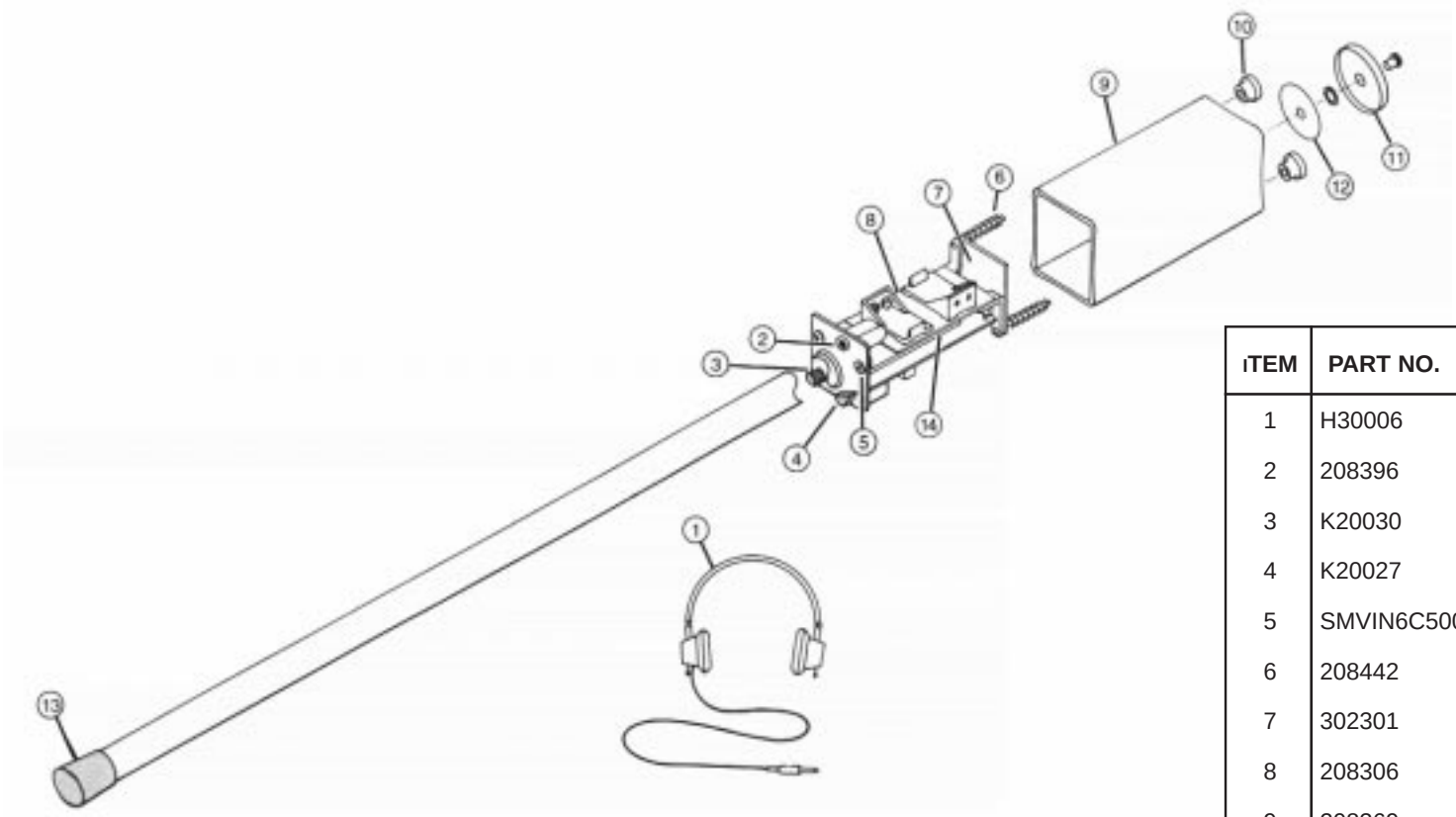
Transmitter Troubleshooting Guide

Symptom	Possible Cause	How to Check	How to Fix
No Sound	Dead Batteries	Replace	-
	Batteries not making contact	Check for contact corrosion	Clean contacts
	Broken wires	Visually inspect	
	Battery leakage	Do not remove*	Return unit to factory
Intermittent sound	Batteries not making good contact	Check for corrosion	Clean contacts

* Most battery manufacturers' warranties cover the cost of repair or replacement of any device damaged by their batteries. Removing batteries that leak will void their warranty.

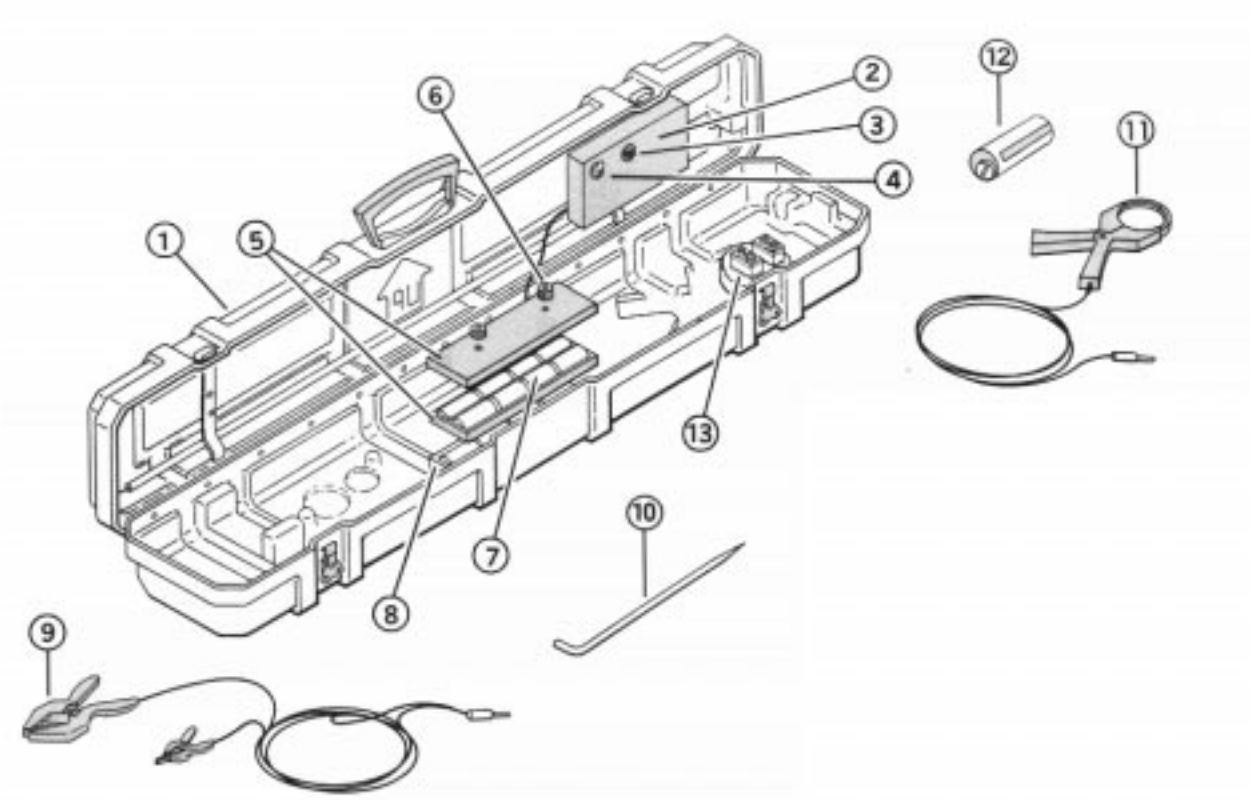
Service Information

If the locator need service, please return it to the factory along with the following information: Name, Address, Where Purchased, Date and Description of Trouble(s). A telephone estimate will be provided prior to service work being done. See shipping information on Page 6-6.



ITEM	PART NO.	DESCRIPTION
1	H30006	HEADSET (OPTIONAL)
2	208396	PHONE JACK ASSY.
3	K20030	KNOB, ROUND (VOLUME)
4	K20027	KNOB, POINTER
5	SMVIN6C500	SCREW, MOUNTING (2)
6	208442	GROUND SPRING (2)
7	302301	SPEAKER MODULE
8	208306	BATTERY HOLDER & BD ASSY.
9	208369	COVER WITH LABEL
10	K20021	KNURLED KNOB (2)
11	207215	CAP KIT WITH SCREEN
12	206006	SCREEN
13	208212	CRUTCH TIP (BLACK)
14	302284	CHASSIS
15	208406	INTERFACE CABLE ASSY.

Figure 6-3. MAC-51Bx Receiver Repair Parts



ITEM	PART NO.	DESCRIPTION
1	402320	INSTRUMENT CARRYING CASE
2	302303	ELECTRONICS BOX
3	208431	JACK, ACCESSORY
4	208432	SWITCH, ON-OFF
5	301674	BATTERY HOLDER/COVER
6	205252	KNURLED NUT (2)
7	B11009	BATTERY, C TYPE (8)
8	207315	BATTERY CASE
9	302307	CONDUCTIVE CLAMP
10	208263	GROUND STAKE
11	301646	INDUCTION CLIP*
12	MT-2	MINI-TRANSMITTER (MOLE)*
13	B11014	BATTERY, 9V LITHIUM (2 SPARE)
14	L55002-1	LATCH
15	L55002-2	LATCH KEEPER

Figure 6-4. MAC-51Bx Transmitter Repair Parts

Limited Warranty

The Schonstedt Instrument Company (Schonstedt) warrants each product of its manufacture to be free from defects in material and workmanship subject to the following terms and conditions. The warranty is effective for three years after shipment by Schonstedt to the original purchaser.

Our obligation under the warranty is limited to servicing or adjusting any product returned to the factory for this purpose and to replacing any defective part thereof. Such product must be returned by the original purchaser, transportation charges prepaid, with proof in writing, to our satisfaction, of the defect. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. Prior to repair on this instance, a cost estimate will be submitted.

Service or shipping information will be furnished upon notification of the difficulty encountered. Model and serial numbers must be supplied by the user. Batteries are specifically excluded under warranty.

Schonstedt shall not be liable for any injury to persons or property or for any other special or consequential damages sustained or expenses incurred by reason of the use of any Schonstedt product.

FOR SERVICE OR REPAIR

Please ship locator (in its case) to:

Schonstedt Instrument Company
4 Edmond Road
Kearneysville, WV 25430

PATENTS

Manufactured under the following Patents: United States: 2,916,696; 2,981,885; 3,894,283; 3,909,704; 3,961,245; 3,977,072; 4,110,689; 4,161,568; 4,163,877; 4,258,320; 4,388,592; and Design 255552. Canada: 637,963; 673,375; 1,006,915; 1,037,121; 1,141,003; 1,177,891 and 1,206,091. Great Britain: 1,446,741; 1,446,742; 1,494,865 and 2,012,430B. France: 2,205,671 and 81 12295, Germany: 25 51 968.0-09; 25 55 630; and 29 01 163. Japan: 1,595,127 and 1,413,844. Other patents pending.