Instruction Manual
AVTM 656621

For the

AccuTrace™ Cable Route Tracer

Catalog Number 656621

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Read the entire manual before operating.
Antes de operar este producto lea este manual enteramente.

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LIST OF ILLUSTRATIONS

Section 1
Introduction

RECEIVING INSTRUCTIONS

Check the equipment received against the packing list to ensure that all materials are present. Notify Biddle Instruments of any shortage. Telephone (215) 646-9200.

Examine the instrument for possible damage received in transit. If any damage is discovered, file a claim with the carrier at once and notify Biddle Instruments or its nearest authorized sales representative, giving a detailed description of the damage.

This instrument has been thoroughly tested and inspected to meet rigid specifications before being shipped. It is ready for use when set up as indicated in this manual.

GENERAL INFORMATION

The AccuTrace Cable Route Tracer consists of a line-energizing transmitter, a portable gun-type receiver, and other accessories. It is used to locate, trace, and measure the depth of any conductive line, such as pipe, cable, or conduit. The receiver has a telescoping detection rod making it convenient to use and to store. The transmitter and receiver are tuned as a pair, for most efficient operation.

When the transmitter is combined with the carrying case, the entire case generates an inductive field and provides increased tracing distance over other inductive transmitters. The superinductive transmitter can effectively energize deeper lines by producing a strong energizing signal for a given battery drain. Used without the carrying case, the transmitter is ideal for tight signal coupling in small tracing areas.

Section 2
Safety

This instrument and the recommended operating procedures have been designed with careful attention to safety. Biddle Instruments has made formal safety reviews of the initial design and any subsequent changes. Regardless of these efforts, it is not possible to eliminate all hazards from electrical test equipment. For this reason, every effort has been made to point out in this instruction manual the proper procedures and precautions to be followed by the user in operating the equipment and to mark the equipment with precautionary warnings where appropriate. However, it is not possible to foresee every possible hazard which may occur. It is therefore essential that the user carefully consider all safety aspects of the test before proceeding. The following general guidelines apply to all operating and service personnel.

- Safety is the responsibility of the user.
- Misuse of this equipment can be extremely dangerous.
- Do not connect the transmitter directly to an energized line.

On an energized line, only inductive coupling should be used. Treat all conductors of high-voltage power cable as a potential electric shock hazard. There is always the possibility of voltages being induced on these conductors because of proximity to energized high-voltage lines or equipment. Before making connection to the cable, make sure all temporary grounds are in place.

■ Do not use this equipment or its accessories for any purpose other than that described in this manual.

If the equipment is operated properly and all grounds correctly made, test personnel need not wear rubber gloves. As a routine safety procedure, however, some users require that rubber gloves be worn, not only when making connections to the high-voltage terminals, but also when manipulating the controls. Biddle Instruments considers this an excellent safety practice.

The following warning notice is used in this manual where applicable.

WARNING

Warning, as used in this manual, is defined as a condition or practice which could result in personal injury or loss of life.

Section 3
Specifications

ELECTRICAL

Power supply: the receiver and the transmitter are both powered by eight "AA" size alkaline batteries.

Battery life: approximately 30 hours of service before requiring replacement; using the PULSE mode of operation typically reduces battery drain 30 to 40 percent compared to transmitting continuously.

Frequency: 116 kHz

Pulse rate: 5 to 10 Hz

Output voltage, conductive mode, no load: 48 V p-p on HI, 27 V p-p on LO.

Output current, conductive mode: load dependent

$i(R) \approx 240/(R/200+1)$ mA p-p

i = output current, R = load impedance

Depth limit: 20 to 30 ft (6 to 9 m)

Range: 5 ft to 3 mi (1.5 m to 5 km)

MECHANICAL

Dimensions:

Transmitter: 11 x 4.75 x 3.5 in. (28 x 12 x 9 cm)
Receiver (extended): 27 in. (68 cm)
Carrying Case: 19 x 8 x 15 in. (48 x 20 x 38 cm)

Weight:

Transmitter: 2 lb (0.9 kg)
Receiver: 2.5 lb (1.1 kg)
Carrying Case: 6 lb (2.7 kg)
Accessory Kit: 1.75 lb (0.8 kg)

ENVIRONMENTAL

Operating temperature range: 32 to 158°F (0 to 70°C)

Storage temperature range: -149 to +174°F (-65 to +79°C)

Humidity: moisture resistant

ACCESSORIES SUPPLIED

AccuTrace is supplied with direct connection cable, ground rod, suitcase style carrying case, batteries, and instruction manual.

OPTIONAL ACCESSORIES

Ring clamp direct connection cable to provide a stronger inductive signal.

Watertight capsule transmitter for finding blockages in water pipes, such as sewer lines.

Tape-on transmitter for finding collapsed duct work.

Section 4
Controls, Indicators, and Connectors

RECEIVER

The receiver consists of the detection head and the circuit housing, which contains the lighted graph display and speaker, the operating controls, and the internal circuitry. Transmitted signals are received by the detection head, processed in the circuit housing, and output from the speaker and lighted graph display.

Operating controls allow the user to set the level of signal that is received. Figure 1 shows the receiver with labeled features.

ON-OFF/SIGNAL ADJUST - This control combines the power switch with gain adjustment to turn the instrument on and off and to vary the amplification of the detected signal.

PHONE JACK INPUT - A stereo jack transfers the audio output from the built-in speaker to an 8-ohm stereo headset.

SENSITIVITY - This two-position rotary switch has LO and HI settings.

SPEAKER - Provides a strong, clear tone to indicate the signal detected by the receiver.

LIGHTED GRAPH DISPLAY - Visually indicates detected signal strength.

DISPLAY SWITCH - Changes lighted graph display from a continuous bar to a single moving bar to increase battery life.

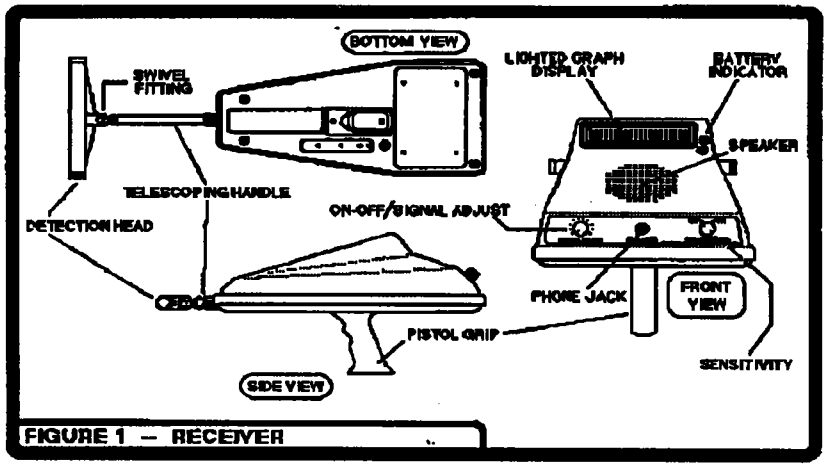


FIGURE 1 – RECEIVER

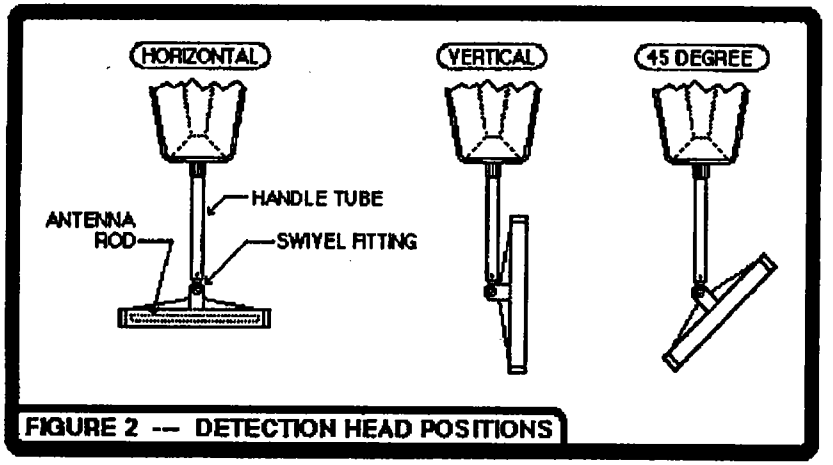


FIGURE 2 — DETECTION HEAD POSITIONS

DETECTION HEAD - A sensitive, rod-type antenna, imbedded in a molded plastic housing, detects the radiated signals from the transmitter. Mounted on a swivel, the antenna can be set in any of three operating positions, as shown in Figure 2.

BATTERY INDICATOR - A lamp located to the right of the lighted graph display continuously monitors the condition of the battery. The batteries are in usable condition when the battery indicator is green; the batteries should be replaced when the battery indicator is red.

TELESCOPING HANDLE - The detection head and swivel are mounted on a retractable handle. A knurled nut enables the operator to lock the handle securely into position.

TRANSMITTER (see Figure 3)

The transmitter is used to energize the conductive line with a signal traceable by the receiver. The generated signal may be coupled to the line either by magnetic induction from a built-in antenna or by direct conductive connection to the metallic line. A LO/HI push button allows the operator to set the transmitting signal strength. A PULSE button enables pulsing of the signal for battery conservation and easy identification of the signal.

The direct connection cable (Figure 4) is plugged into the direct connection jack on the transmitter and is used to energize conductively a metallic line. The red heavy-duty clamp is attached to the line to be energized; the smaller black clamp is used to establish a ground, if necessary.

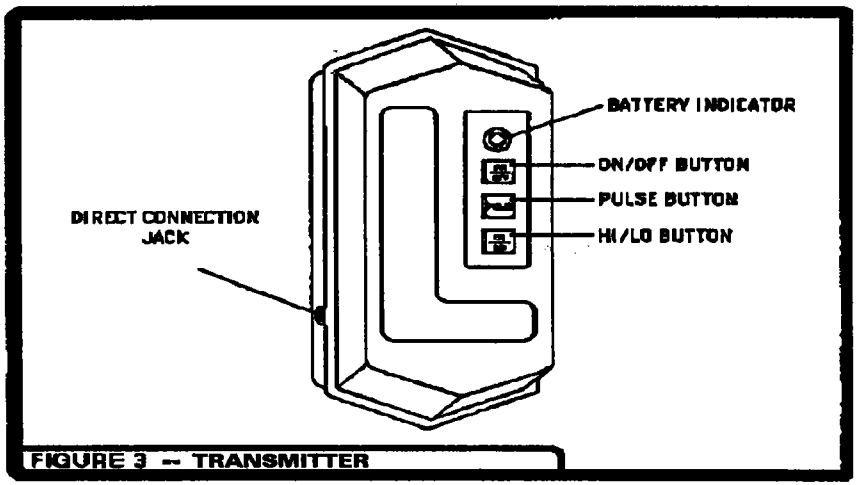


FIGURE 3 -- TRANSMITTER

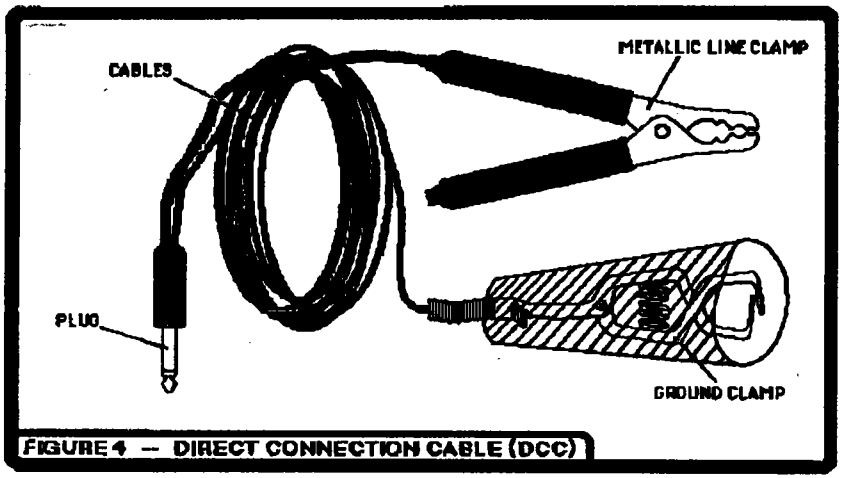


FIGURE 4 -- DIRECT CONNECTION CABLE (DCC)

Section 5
Setup and Operation

SETUP

1. Remove the receiver from the carrying case. The receiver includes eight 1.5 V batteries.
2. Test the batteries by turning the receiver on and observing the small round light to the right of the graph display. The batteries are in usable condition if the light is green; the batteries should be replaced when the light turns red.

   To replace batteries in receiver: (see Figure 5)

   Turn the receiver upside down. Remove the four Phillips-head screws that hold the battery cover and open the battery compartment. Remove the eight alkaline "AA" size batteries and replace them with fresh ones according to the polarity indicated. Replace the battery cover and the four screws.
3. Verify that the batteries are good by turning on the receiver and observing that the battery indicator is green. There should be a short, loud beep, and the lighted graph display should flash when the instrument is turned on.
4. Remove the transmitter from the carrying case.
5. Test the batteries by pressing the on/off button and observing the small round light directly above the button. The batteries are in usable condition if the light is green and should be replaced if the light turns red. Ensure that the PULSE button is up and the HI/LO button is down. The transmitter consumes the most power in this mode and will subject the batteries to the most taxing test.

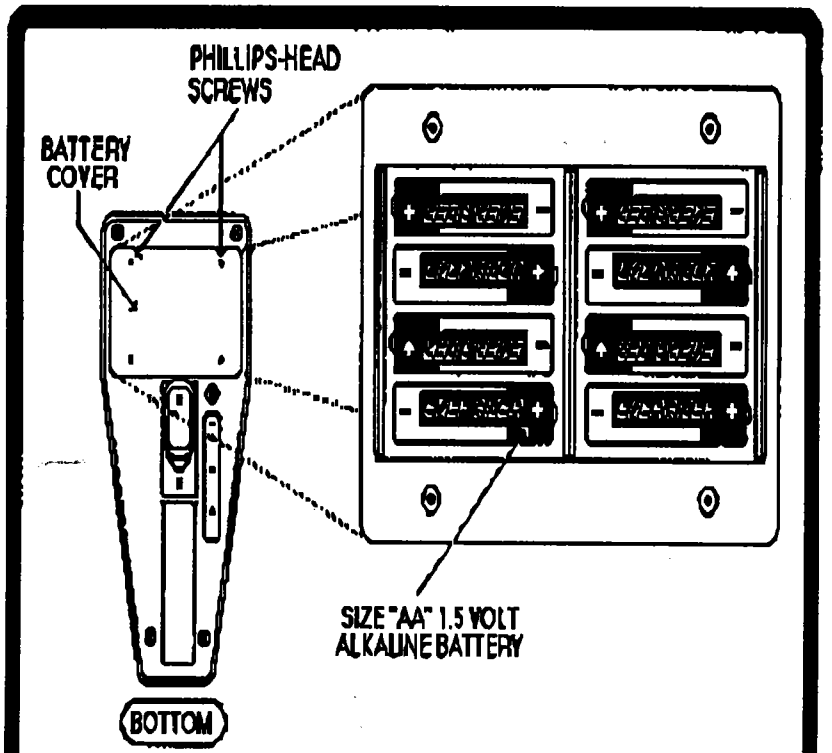


FIGURE 5 — BATTERY REPLACEMENT

To replace batteries in the transmitter: (see Figure 6)

Turn the transmitter over as shown in Figure 6 and remove the four Phillips-head screws that hold the battery cover. Open the battery compartment, remove eight alkaline "AA" size batteries and replace them with fresh ones according to the polarity indicated. Replace the battery cover and the four screws.

OPERATION

Read and understand the safety section before operating the instrument.

To trace a metallic line with the receiver, the line must be energized with a signal that the receiver is capable of detecting. Once the line is properly energized, the receiver can locate and trace the line because of its direction and signal level distinguishing capabilities. The transmitter generates this signal and enables two methods of energizing the line, inductively and conductively. When finding and tracing metallic lines, the transmitter should always be set to energize the line in one of these two modes. When the transmitter is combined with the carrying case, the entire case generates an inductive field far superior to the transmitter by itself or any other pipe/cable locator.

Energizing a Line Inductively (Figure 7)

Inductively energizing the line has the advantage of not requiring a mechanical connection to the line to be traced. With this method, the transmitter can energize a buried line without the need to uncover it.

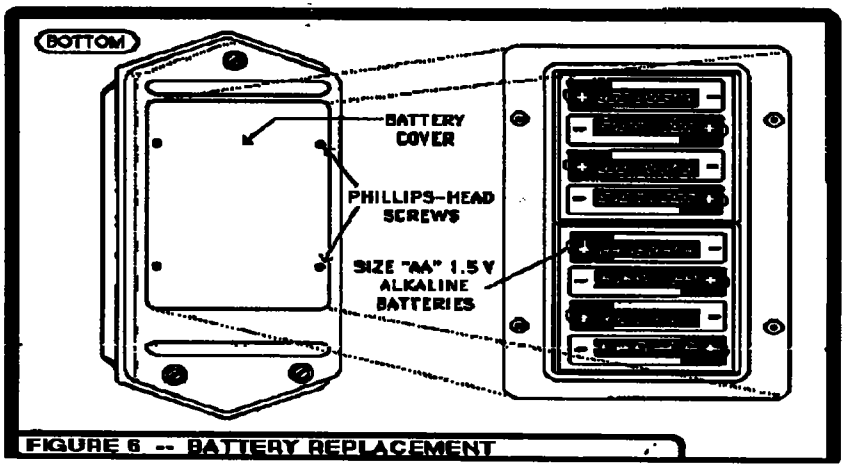


FIGURE 6 -- BATTERY REPLACEMENT

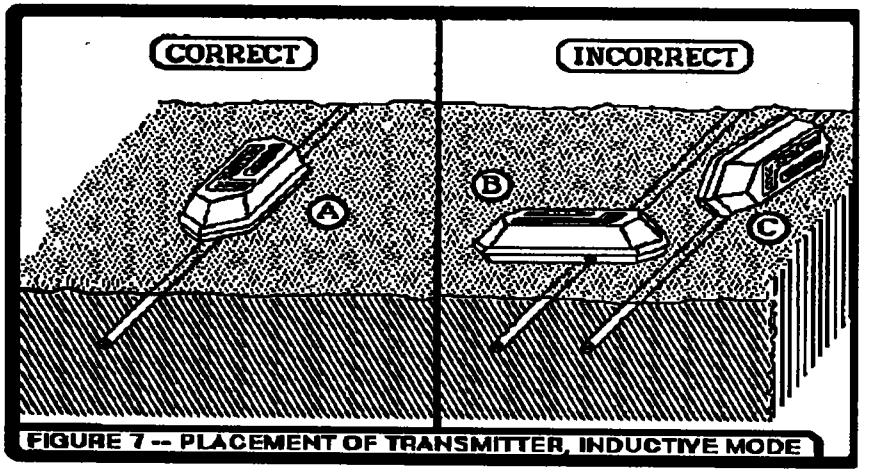


FIGURE 7 -- PLACEMENT OF TRANSMITTER, INDUCTIVE MODE

A. Standard Inductive Coupling

If the location of part of the desired line is known, simply position the transmitter case lengthwise over the line as shown in Figure 7. Ensure that nothing is plugged into the direct connection jack (this will not allow the built-in antenna to transmit energy). To minimize air signal along the line, the operator may rotate the carrying case about 15 degrees with respect to the line. The line is now energized and ready to be traced.

B. Superinductor Inductive Coupling

1. Turn on the transmitter and place it in its carrying case in normal storage position.
2. Press the PULSE button and set the HI/LO switch to HI. This causes a corresponding maximum signal output.
3. Close and latch the carrying case. The transmitter is now transmitting.

Energizing a Line Conductively (Figure 8)

WARNING

When the line to be traced is an electric cable, it should be treated as a possible source of high voltage. Before connecting the test leads, verify that the cable is de-energized and apply temporary ground connections using accepted industry techniques. Do not connect the instrument to an energized cable. The temporary grounds used should be removed after the instrument is connected to the cable.

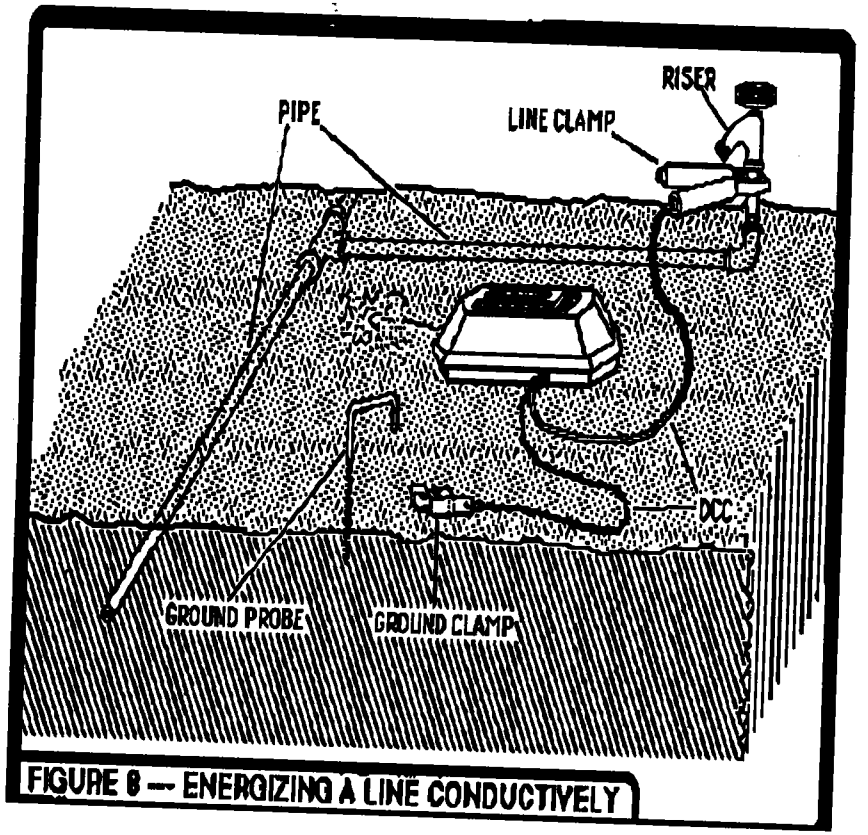


FIGURE 8 — ENERGIZING A LINE CONDUCTIVELY

Although this method requires direct mechanical connection to the line, energizing conductively has an important advantage over inductive energizing. Conductive energizing results in more highly defined signal coupling. The signal does not spread to other conductive lines in the vicinity of the line to be traced.

Figure 8 shows a simple diagram of the hook-up. After plugging the direct connection cable into the jack, connect the line clamp to the line to be traced. The user can do one of two things with the ground clamp, depending on the amount of signal that is to energize the line. For a strong, long-tracing signal, the ground clamp should be connected to a ground probe that is firmly planted into the ground. For less energizing of the line, the ground clamp can be set aside.

WARNING

Do not short the ground clamp to the line clamp or to the line to be energized.

After connecting the transmitter to the pipe/cable, set the signal level by using the HI/LO push-button switch.

Tracing Metallic Lines Using Signal Nulls

This method of tracing uses nulls, locations in the signal field around the pipe where no signal is detected by the receiver.

1. Set the detection head of the receiver to the vertical position as shown in Figure 2. Position the receiver vertically with the detection head near the ground (Figure 9). When tracing a line, a null (no signal) will occur when the detection head points at the line.

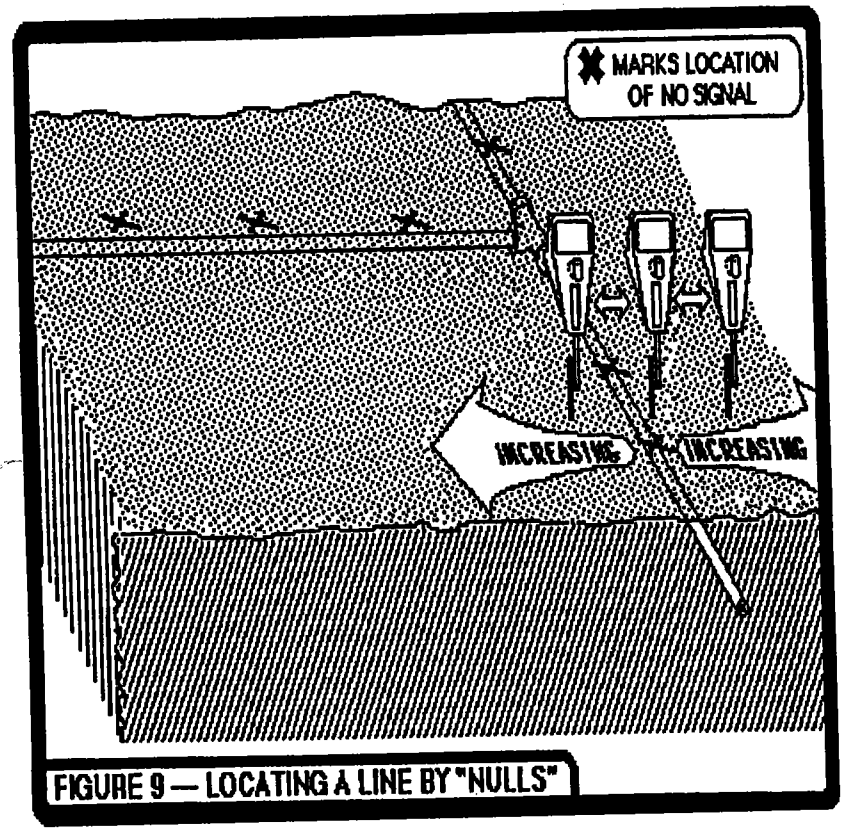


FIGURE 9 — LOCATING A LINE BY "NULLS"

2. Set the SENSITIVITY control to LO and turn the SIGNAL ADJUST control so that the graph display reads half-scale. If the graph display cannot be set to half-scale on LO, then set the SENSITIVITY control to HI.
3. Walk in the direction that causes the meter reading to increase. If the meter reading becomes full scale, then reset the reading to half-scale using SIGNAL ADJUST.
4. Continue walking until the signal level sharply decreases and no signal is detected. This null means that the detection head is pointed at or near the line. Turn up the signal adjust until signal is detected again and continue moving in the same direction until a null is once again obtained. Repeating these steps will allow reducing the null width to an inch or two.
5. Mark the spot of the null on the ground and move away, using the same method as before to locate the null at other spots. As the nulls are traced, the course of the line will be traced. The metallic line rests directly below the line of null spots.

Tracing Metallic Lines Using Signal Peaks

This method uses peaks, locations in the field where the receiver detects a maximum signal.

1. Set the detection head of the receiver into the horizontal position as shown in Figure 2. Position the receiver vertically with the detection head near to and parallel with the ground (Figure 10). When a peak (maximum signal) is received, the detection head points at the line, centering the receiver over the line.

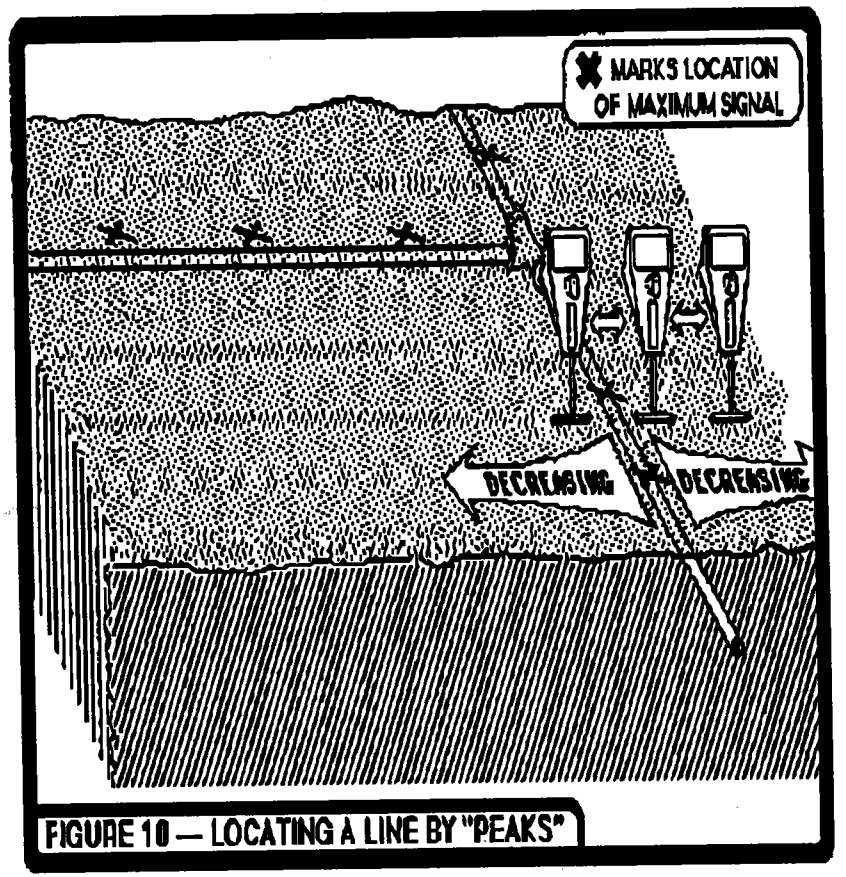


FIGURE 10 — LOCATING A LINE BY "PEAKS"

2. Set the SENSITIVITY control to LO and turn the SIGNAL ADJUST control so that the graph display reads half-scale. If the graph display cannot be set to half-scale on LO, then set the SENSITIVITY to HI.
3. Walk in the direction that results in an increasing meter reading. If the meter reading becomes full-scale, reset the reading to half-scale using the signal adjust.
4. Continue walking until the signal level begins to decrease. At this point, the peak has been passed. By positioning the detection head over the spot where the peak is, the handle tube will be pointing at the metallic line.
5. Rotate the receiver to detect the maximum possible peak. This will position the detection head so that it is at right angles with the direction of the line, as shown in Figure 11. With the detection head in that position, the receiver is detecting the maximum signal possible for that location.
6. Mark the spot of the peak on the ground and move forward or backward, using the same method to locate the peaks at other spots. As the peaks are traced, the course of the line is traced. The metallic line rests directly below the line of peaks.

Measuring the Depth of the Line

At any time during tracing, the operator can measure the depth of the line being traced. The receiver indicates depth by using the field nulls that are created around the line when it is energized.

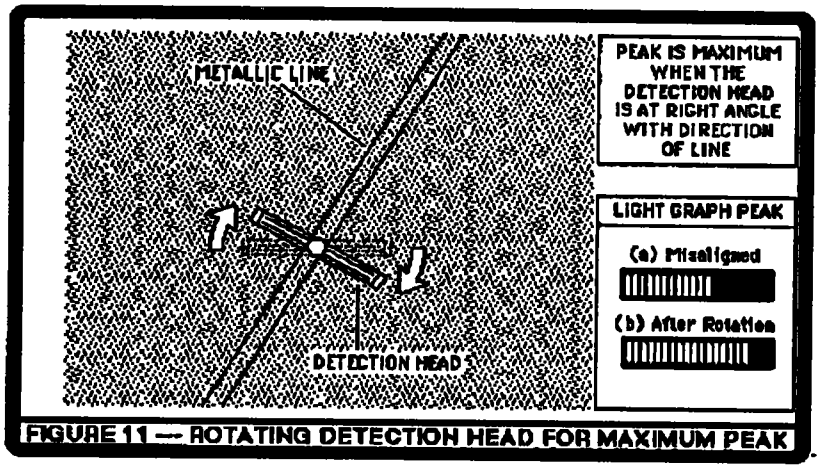


FIGURE 11 — ROTATING DETECTION HEAD FOR MAXIMUM PEAK

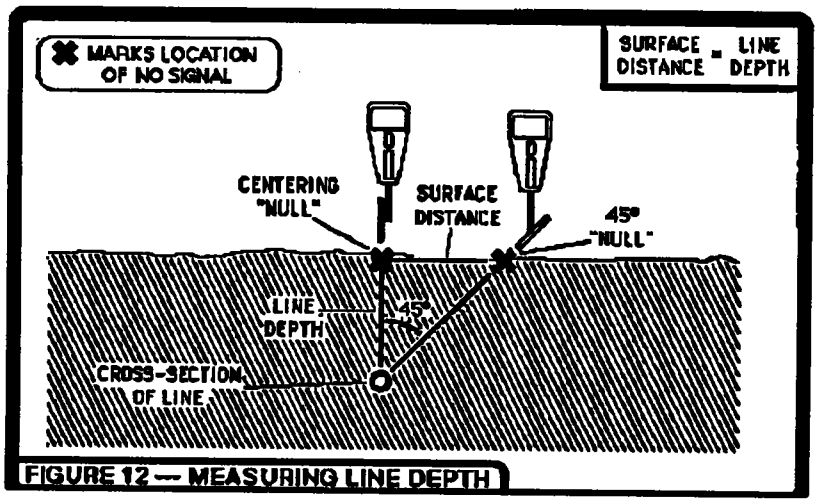


FIGURE 12 — MEASURING LINE DEPTH

1. Mark the spot where you want to measure the line depth. Locate this spot using either the null or peak method of tracing. Figure 12 shows this location being found using the null method.
2. Set the detection head to the 45 degree position as shown in Figure 2.
3. Hold the receiver vertical and move it to the right or left of the center mark until a 45-degree null is located. Be sure that the null is narrow, so that the results of the surface measurement will not be inaccurate. Make a mark at the 45-degree null.
4. Measure the distance between the center mark and the 45-degree null mark. This is the surface distance, which by geometry, is also the line depth.
5. To confirm the depth measurement the user can repeat the above procedure on the other side of the center mark. This will give two measurements which can be compared and averaged.

OPERATING NOTES

Metallic Masses

When energizing a pipe or cable, avoid setting the transmitter down on or within a foot of large masses of metal. This will load the transmitter and make it difficult or impossible to pick up the line with receiver.

Nearby Parallel Lines

When two pipes lie close together and only one is to be traced, use the direct connection method, whenever possible. This method minimizes the spread of excessive signal through the air and from one pipe to another. However, if direct connection with the pipe is impossible, energize the desired pipe inductively as shown in Figure 13. Pipe A and pipe B are close enough to each other that normal placement of the transmitter to energize pipe A also energizes pipe B (Figure 13a). The operator, locating 20 or 30 ft down the line, may be tracing pipe B instead of pipe A. To avoid this problem, prop the transmitter up and face the bottom toward pipe A, as shown in Figure 13b. The radiated signal points at pipe A, and no signal reaches pipe B.

Touching Lines

When water and gas pipes and electrical cables are in contact at a common point such as a water heater or a ground connection there will be some transfer of signal from line to line. The operator should be aware that, in this case, the receiver may locate a line other than the desired one. For example, the receiver may trace a gas line instead of a water line that was intentionally energized.

Air Signals

When energizing a line inductively, the transmitter generates a signal through the air which the receiver can easily detect. This phenomenon can become confusing when the operator tries to trace a line within a 15-ft radius of the transmitter. If possible, line tracing should be done outside of that radius. If the operator finds himself without a choice, then three things can be done to minimize the effect of air-radiated signals:

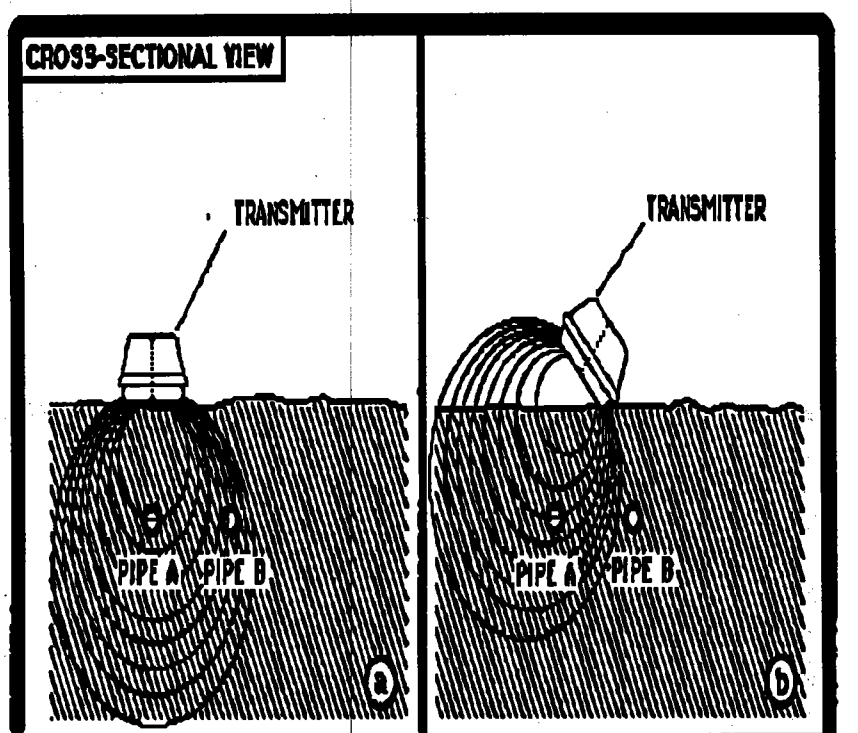
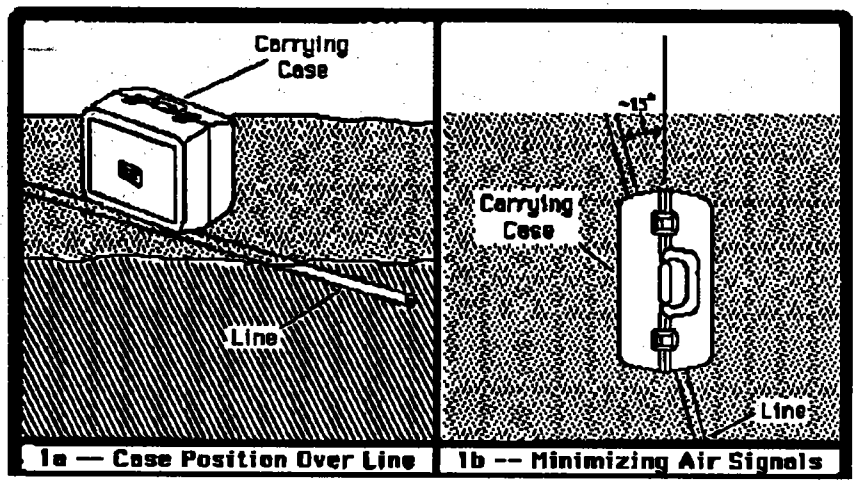


FIGURE 13 — POSITIONING TRANSMITTER TO AVOID SIGNAL SPREAD

1. Use conductive energizing. This method creates no air-radiated signals that the receiver can detect.
2. Turn the SIGNAL ADJUST control on the receiver down as low as possible for the peaking method and work with minimal signal levels.
3. If the transmitter is oriented directly with the line, then the air signals will be maximized along the line. To avoid this, rotate the transmitter 10 or 15 degrees off the direct line.



1a — Case Position Over Line | 1b -- Minimizing Air Signals

Section 6
Service

REPAIR

Biddle Instruments offers a complete repair service and recommends that its customers take advantage of this service in the event of any equipment malfunction. Please indicate all pertinent information including problem symptoms and attempted repairs. The catalog number and serial number of the equipment should also be specified. Equipment returned to the factory for repair must be shipped prepaid and insured and marked for the attention of the Repair Department.

PREPARATION FOR STORAGE AND SHIPMENT

Remove batteries before shipment or long-term storage. Place the instrument in its carrying case and pack in a carton or box with adequate dunnage in accordance with best commercial practice. Use original shipping carton if available. Seal container with waterproof tape. Store in a clean, dry place. Storage temperature should not exceed the range of -149 to +174°F (-65 to +79°C).

WARRANTY

Products supplied by Biddle Instruments are warranted against defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. Equipment returned to the factory for repair must be shipped prepaid and insured. This warranty does not include batteries, lamps, or other expendable items, where the original manufacturer's warranty shall apply. We make no other warranty. The warranty is void in the event of abuse (failure to follow recommended operating procedures) or failure by the customer to perform specific maintenance as indicated in this manual.