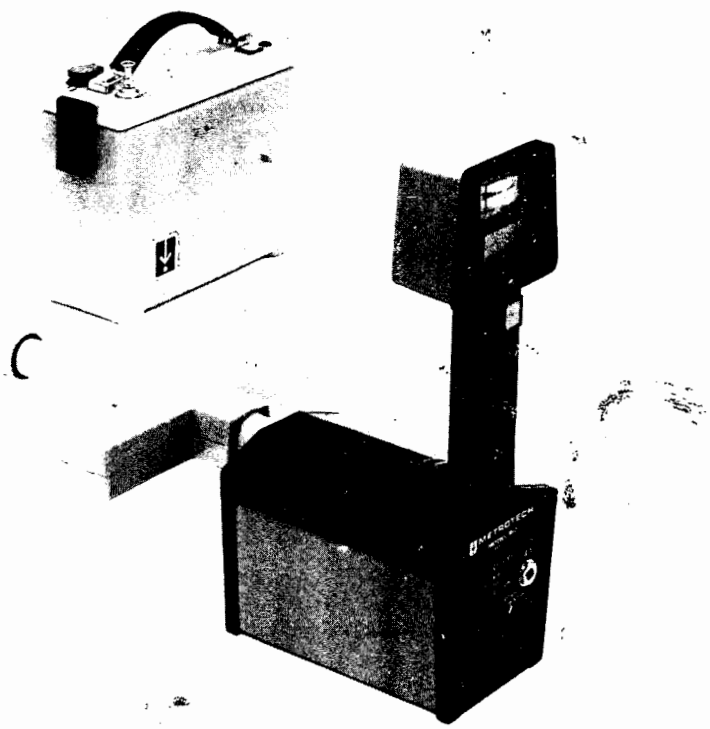
METROTECH®

MODEL 810

LINE TRACER



OPERATION MANUAL

Part # 600A001-C
Price: $5.00

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1 810 RADIO FREQUENCY LINE TRACER

The Metrotech Model 810 Radio Frequency Line Tracer is an excellent instrument for tracing water and gas distribution lines, cables, inductive locating, and blind searching. The high frequency signal is able to jump insulators and rubber gaskets often found in water and gas distribution systems. Since the radio frequency travels easily through the soil, the 810 is an ideal instrument for inductive locating. The floodlight quality of the RF signal will induce signal onto conductors 8-10 ft. on either side of the Transmitter making it an excellent instrument for blind searches.

Consisting basically of a Transmitter and a Receiver, the Model 810 offers many features for convenient and efficient use.

The Transmitter generates a signal which is applied onto the pipe or cable to be traced — referred to from now on in this manual as "the conductor". The signal travels along the conductor, becoming weaker as it gets farther away from the Transmitter. The distance that the signal travels before it becomes too weak to be detected depends on the method of connection, the type of conductor, and the surrounding soil.

When you position the Receiver over the conductor, it will detect the signal from the conductor. The Receiver's left/right guidance system and field strength display aid you in tracing. To display the depth of the conductor, you simply push a button.

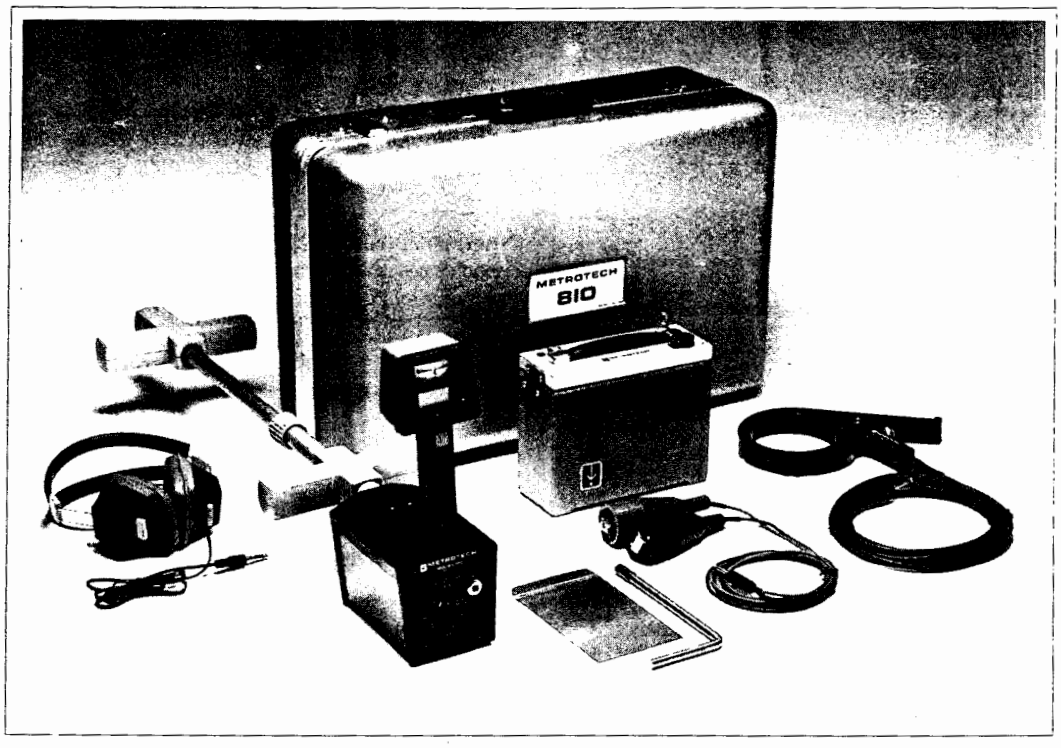

Figure 2-1: Model 810 Line Tracer: Standard and Optional Equipment

2 MODEL 810 EQUIPMENT

The Metrotech Model 810 Line Tracer consists of standard and optional equipment. All equipment is shown in Figure 2-1.

2.1 Standard Equipment

Model Number	Description	Remarks
810	Transmitter	.25 watt
810	Receiver	
800C025	Receiver (metric)	
800B004	Conductive Attachment Assembly	direct connect cable, ground spike, and ground plate
400C079	Carrying case	
600A001-B	Operation Manual	

2.2 Optional Equipment

Model Number	Description	Remarks
4820	Metroclamp and jumper cable	For use in inductive coupling mode
183045	Headphones	For use when locate site is too noisy for audio tone

Features of the Model 810 Transmitter and Receiver are discussed in detail in sections 2.4 and 2.5.

2.3 Specifications

810 Transmitter

Output Power:	**250mW**
Output Frequency:	**83.0775KHz ±.002% Crystal controlled for interference resistance**
LED Indicator (Power)	
Adequate Power:	On
Low Battery:	Off
Operating Modes:	Direct Connection, Inductive Coupling with the 4820 Mtroclamp, Inductive
Batteries :	Six NEDA 13F "D" Cells, Alkaline
Weight:	3.9 lbs (1.8 kg)
Dimensions:	8"L × 3.25" W × 6.5" H (20.3 × 10.5 × 17.2 cm)

Receiver

Trace accuracy	± 1 inch from 0 to 3 ft (91 cm) ± 3% over 3 ft (91 cm) in depth

Depth readout accuracy:	± 10% under normal conditions
Sensitivity control:	automatic, no adjustments necessary
Depth readout range:	To 13 ft (400 cm)
Batteries:	4 NEDA 1604A Alkaline (9V), IEC 6LR61 (Int'l Std.), or JIS 6AM6 (Jpn Std.)
Battery test:	Indicated on meter
Weight:	4.1 lbs (1.9 kg)
Dimensions (extended length):	32.5" × 7.25" W × 12.25" H (82.6 × 18.4 × 31.1 cm)
Temperature range:	0° to 110° F (-18° to 43° C)
Shipping weight(gross):	20 lbs (clamp: add 2 lbs) (9.1 kg (clamp: add .91 kg))
Shipping dimensions:	24.25" L × 10.5" W × 17.25" H (61.6 × 26.4 × 43.8 cm)
Modes of operation:	Direct Connection (Conductive), Inductive Coupling with Metroclamp, Inductive Connection (Indirect)

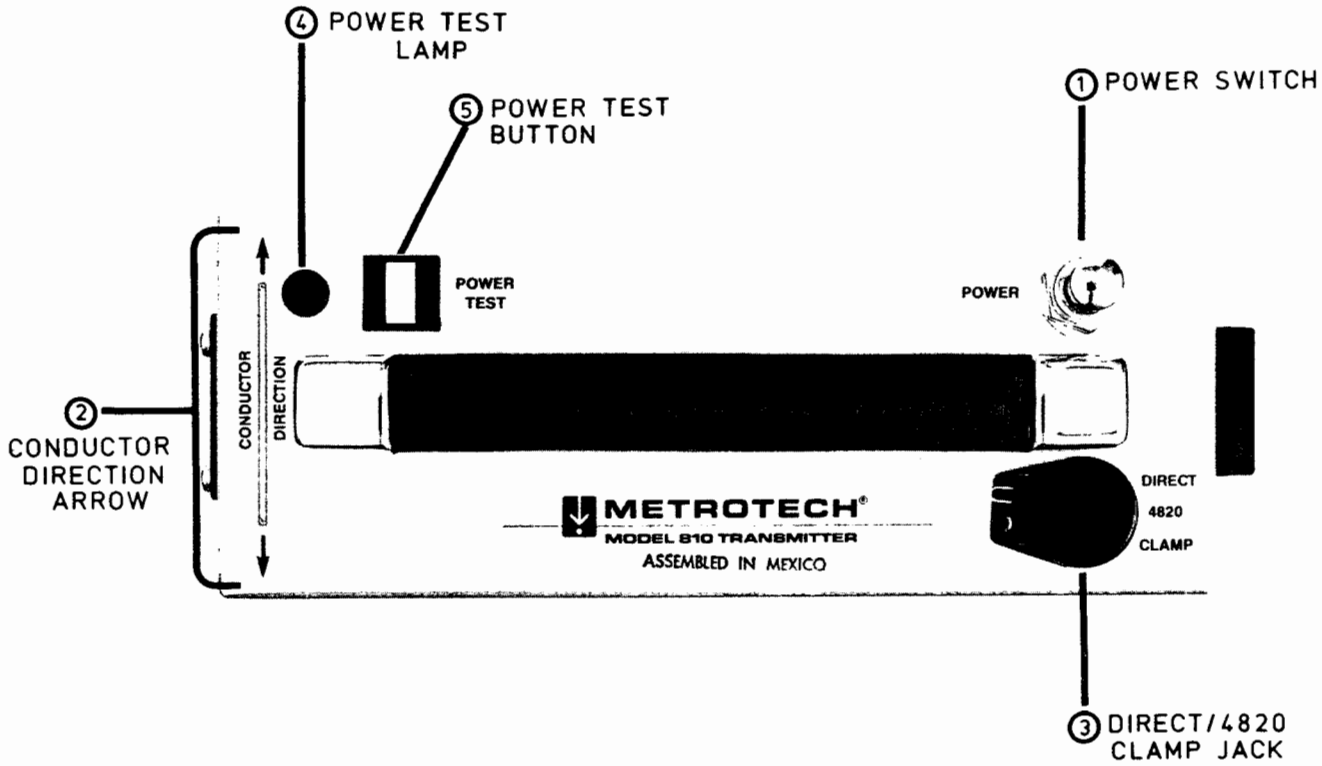

Figure 2-2: Model 810 Transmitter: Controls and Indicators

2.4 810 Transmitter: Controls and Indicators

Figure 2-2 Designation

1 **POWER on/off switch**
Pull this switch to turn the Transmitter on.

2 **CONDUCTOR DIRECTION indicator arrow**
For orienting the Transmitter when it is used in Inductive mode only. Align the Transmitter so that the arrow is parallel to the conductor.

The position of the Transmitter and the conductor direction indicator arrow are not relevant when the Transmitter is used in direct connect mode, or when the Metroclamp is used.

3 **DIRECT/4820 CLAMP output jack**
Insert either the direct connect cable or the 4820 Metroclamp cable into this jack.

The Transmitter's internal antenna is automatically disconnected when a plug is inserted into this jack.

4 **POWER TEST lamp**
Lights up when POWER TEST button is pushed if there is adequate battery power for operation.

5 **POWER TEST Button**
Push this button to determine if there is adequate battery power available for operation.

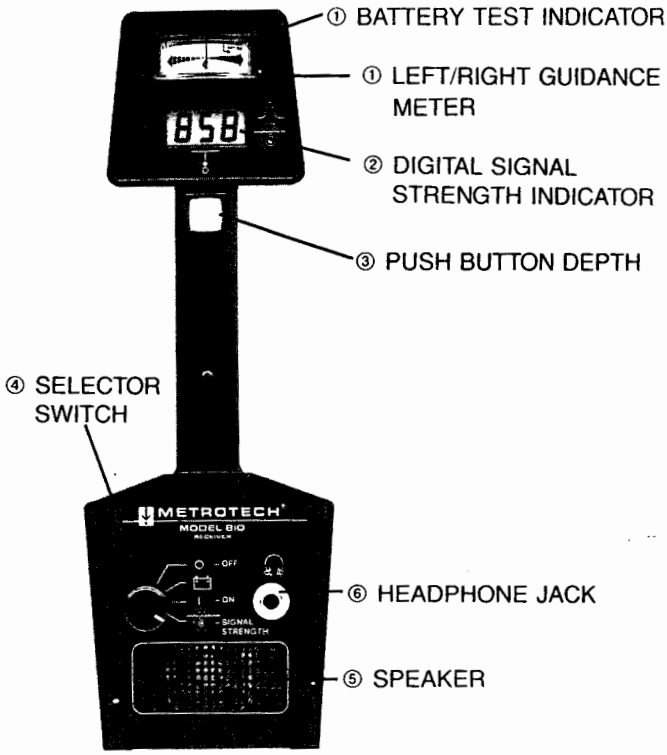

Figure 2-3: 810 Receiver (Front): Controls and Indicators

2.5 810 Receiver: Controls and Indicators

Figure 2-3 Designation

1 **LEFT/RIGHT GUIDANCE METER**
The needle indicates the direction in which you should move the Receiver to go towards the conductor. If the needle and arrow are in the right-hand (solid) portion of the meter, move the Receiver to the right.

If the needle and arrow are in the left-hand (broken arrow) portion of the meter, move the Receiver to the left

BATTERY TEST INDICATOR
When the SELECTOR SWITCH on the Receiver is turned to the Battery Test position, the needle on the meter should move to the right of the battery test arrow if there is adequate battery power. If it does not, the batteries need to be replaced.

2 **DIGITAL SIGNAL STRENGTH INDICATOR**
The signal strength is indicated on the LCD display when the selector switch is in operate mode (third position) or field strength only mode (fourth position).

The digital display indicates the strength of the signal detected.

The readout will vary according to how close the Receiver is to the conductor. The Receiver displays the highest reading when it is directly over the target conductor.

3 **PUSHBUTTON DEPTH**
In order to indicate the depth of the conductor, the selector switch must be in the third position (see item 5 below).

To read the depth of the conductor, press and release this button. Within seconds, the digital window will switch from displaying the signal strength to display the depth of the conductor in inches (or centimeters).

4 **SELECTOR SWITCH**
This switch has four possible settings:

O Power Off

Battery Test
In this position, the guidance meter needle (item 1 above) must be to the right of the battery line. See Section 6 for more information on battery checking.

I Line Tracing Mode
Use this position when tracing the conductor using the left/right guidance meter, the digital signal strength indicator, the tone, and the depth display.

Field Strength Only
This position eliminates the tone and left/right guidance system and the depth measurement capability. The signal strength for pinpointing the conductor continues to be operational.

5 **SPEAKER**
The speaker in the Receiver emits a tone, which corresponds to the position of the needle on the left/right guidance meter (item 1 above):

A continuous tone (corresponding to the solid arrow of the meter) indicates that the conductor is to the right.

A broken tone (corresponding to the broken arrow) indicates that the conductor is to the left.

6 **HEADPHONE JACK**
Use the headphones to hear the tone in noisy environments.

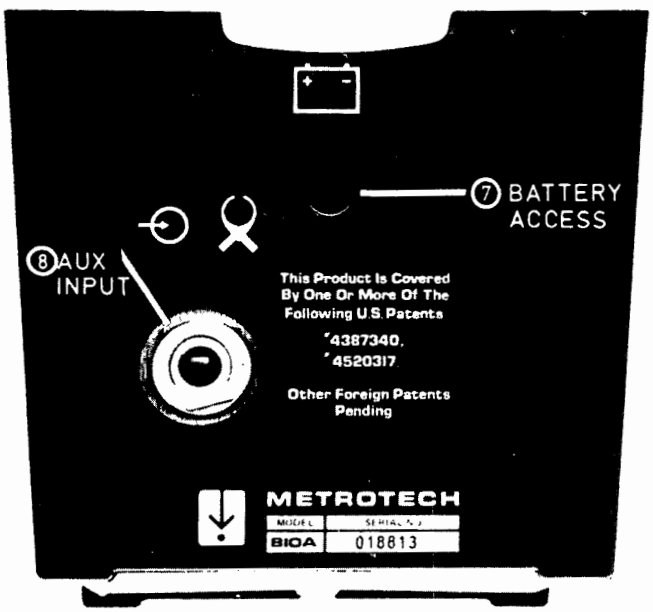

Figure 2-4: 810 Receiver (Back): Controls and Indicators

Reverse side of Receiver

Figure 2-4	Designation
7	**BATTERY ACCESS** This releases the cover so that batteries can be replaced. See Section 6 on battery maintenance.
8	**AUX INPUT (auxiliary input)** Jack for the 4820 Metroclamp plug. See Section 4.6.
9	**Extended Antenna, lock knob** (not shown) Fully extend the Receiver antenna and lock in place with the lock knob for operation and checkout procedure.

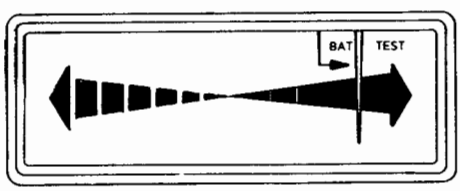

Figure 3-1: Position of Meter Needle for Battery Test

3 CHECKOUT PROCEDURE

To insure proper operation of the Model 810 line tracer, use the checkout procedure below at the following times:

- upon receiving the equipment
- before each job, preferably before you leave for the site
- if problems arise during a locate

SAFETY WARNING

- Do not connect the Transmitter directly to a live power cable. Always make sure the power to a cable is turned off before you connect the Transmitter to it.
- Do not operate the Transmitter while it is resting on or near a metal surface or large metal object. Incorrect test readings and damage to the Transmitter may result.

Checkout Steps:

1. Pull the 810 Transmitter POWER switch on.
2. Push the POWER TEST button. The POWER TEST lamp will light up if there is adequate battery power for operation of the 810.
3. Fully extend the Receiver antenna: Loosen the nut on the stem assembly and extend the stem as far as possible. Tighten the nut to secure the stem.
4. Set the Receiver function switch to battery test (second position).

   The needle on the left/right guidance meter should be to the right of the line labeled BATT TEST, as shown in Figure 3-1. The farther the needle is to the right of this line, the greater the charge in the batteries. If the needle is to the left of the line, the Receiver batteries should be replaced. See Sections 7.1 and 7.2.
5. Move the Receiver function switch to the Tracing position (third position).

6. Position the Receiver as shown in Figure 3-2. The end of the Receiver needs to be close to the Transmitter, not more than 6 inches away. The digital signal strength indicator should display 950 or above.

   Note the field strength figure; you will be using it for comparison in the next steps of the procedure.

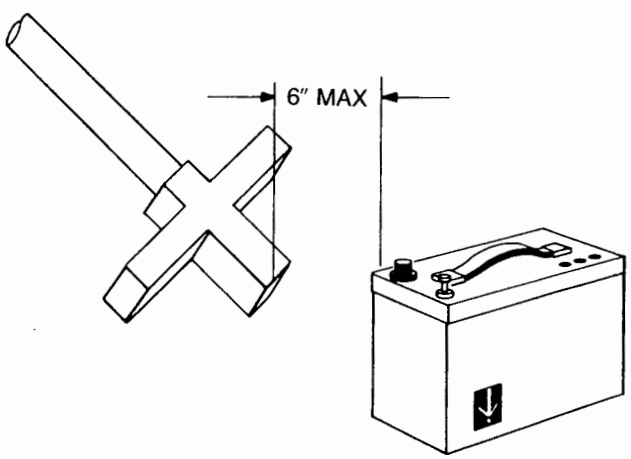

Figure 3-2: Position of the Receiver for Checkout Procedure, Step 6

7. With the Receiver Selector Switch in the line tracing mode (third position), move the Receiver back from the Transmitter 2-5 feet. Point the Receiver at the Transmitter as in Figure 3-2, the left/right guidance needle will be centered on the meter and the tone will be silent.

8. Point the Receiver to the left and right of the Transmitter center line. The needle should follow the change in direction (solid arrow and continuous tone when you move right, broken arrow and broken tone when you move left). See Figure 3-3.

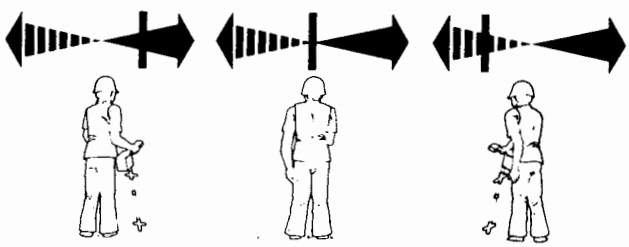

Figure 3-3: Checkout of Receiver Directional Meter

9. **Center the needle on the meter as in Step 7.**
10. When the meter is centered, press and release the depth button. A depth reading should be displayed. Although the readout will not be accurate, it will indicate that the depth capability is functioning.
11. Turn the Transmitter off by pushing the POWER switch down.

To test the conductive attachment for loose or broken wires:

1. Connect the black and red ends of the conductive attachment together. Lay the connected wires out on the floor in a circular configuration (see Figure 3-4). Plug the conductive attachment into the DIRECT/4820 CLAMP jack of the Transmitter.
2. Turn the Transmitter on by pulling the POWER switch up.
3. With the Receiver unextended, place the tip directly on one of the conductive wires.
4. Turn the selector switch on the Receiver to the fourth position (field strength only). The field strength should be the same or very close to the reading in test procedures 5 and 6 above. The reading should be constant and not fluctuate.

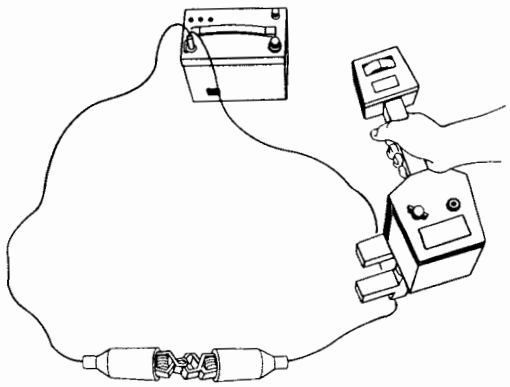

Figure 3-4: Configuration for Testing the Conductive Attachment

5. While watching the field strength readout, wiggle each connection point on the conductive attachment at the DIRECT/4820 jack and at the clamp end of each of the conductive attachment wires (red and black). The field strength should not change; any fluctuation in the reading indicates a loose or broken wire within the conductive attachment.
6. Repeat step 5 on the other conductive wire.
7. Turn the Transmitter off.

To test the 4820 Metroclamp for loose or broken wires:

1. Keeping the conductive attachment in loop configuration shown in Figure 3-5, unplug the attachment from the Transmitter and plug it into the Metroclamp jack on the back of the 810 Receiver. Position the Receiver on the floor or ground so that you can read the field strength readout.
2. Plug the 4820 Metroclamp into the DIRECT/4820 CLAMP jack of the 810 Transmitter. Then position the jaws of the Metroclamp around one of the wires of the conductive attachment (still in the loop configuration) and lay it on the floor or ground.
3. Turn the Transmitter back on.
4. Note the field strength shown on the Receiver; it should be close to that of step 4 (Conductive attachment test) above.
5. While watching the field strength readout, gently wiggle the wires at each of the connection points. Any fluctuation in the field strength readout indicates a loose or broken wire within the 4820 Metroclamp.

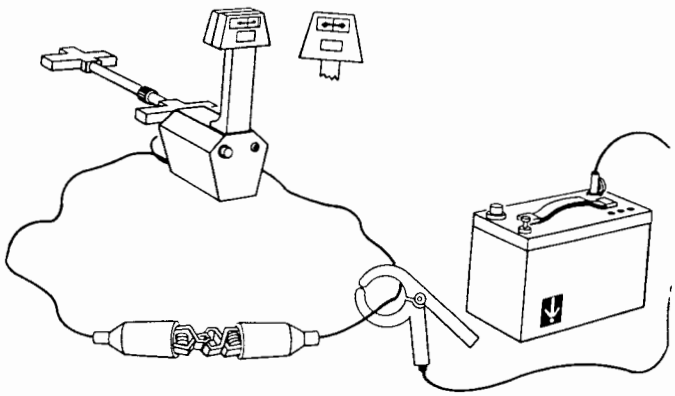

Figure 3-5: Configuration for Testing the Metroclamp

6. Turn both the Transmitter and Receiver off and unplug both the Metroclamp and the conductive attachment to avoid excessive battery loss.

See Section 7 for information on testing and replacing batteries.

If there are any questions about this procedure or the use of the instrument, contact the Metrotech Service Department at 1-800-638-7682.

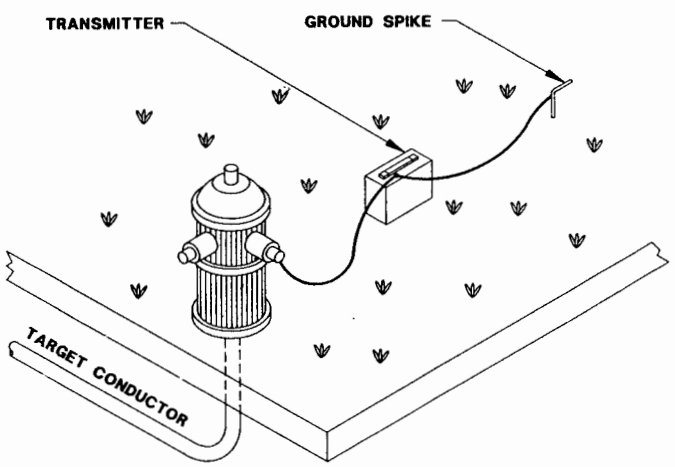

Figure 4-1: Direct (Conductive) Connection

4 OPERATION

Follow the checkout procedure described in Section 3 before operating the equipment.

To operate the 810 Line Tracer apply a signal to the conductor, and use the 810 Receiver to trace the signal.

SAFETY WARNING

- Do not connect the Transmitter directly to a live power cable. Always make sure the power to a cable is turned off before you connect the Transmitter to it.
- Do not operate the Transmitter while it is resting on or near a metal surface or large metal object. Incorrect test readings and damage to the Transmitter may result.

There are three different methods of applying signal to the conductor with one of the transmitters — **Direct Connection, Inductive Coupling with the Metroclamp, and Inductive.** A description of each method and use instructions follow below:

4.1 Transmitter - Direct (Conductive) Connection

This is the preferred mode of operation because the Transmitter is connected directly to a metallic part of the conductor allowing a strong maximum signal to reach the conductor. In this mode the Receiver can be closer to the Transmitter, and adjacent buried conductor interference is reduced.

1. With the Transmitter off, plug the Direct Connect Cable into the jack labeled DIRECT/4820 CLAMP on the 810 Transmitter.
2. Attach the RED lead of the Direct Connect Cable to an electrically clean metallic part of the targeted conductor.
3. Move the Transmitter away from the conductor in a right angle direction as shown in Figure 4-1.
4. Extend the BLACK lead of the Direct Connect Cable as far as possible from the Transmitter, maintaining a right angle orientation. At this point drive the ground spike into the ground as far as possible, and attach the BLACK lead to it. Use the ground plate only when the ground

surface is too hard to drive a spike into it. Place the plate on the ground (at right angles to the conductor) and attach the BLACK lead. To improve the conductivity of the plate put water and/or a weight on it.

5. Turn the Transmitter on by pulling the POWER switch ON.
6. Trace the signal with the 810 Receiver, see Section 4.4 for Receiver Operating instructions.

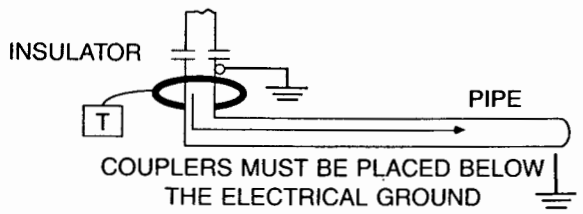

Figure 4-2: Inductive Coupling with the Metroclamp

4.2 Transmitter — Inductive Coupling with the Metroclamp

Use this method if Direct Connection is not possible, but you can position a Metroclamp around the conductor you want to trace. The Inductive Coupling method uses the 4820 Metroclamp to induce a signal onto the conductor when direct metallic contact is not possible. The clamp is placed around the target conductor. The Transmitter then induces a signal through the clamp.

When using the Metroclamp the conductor must be well grounded, i.e. with sheaths and neutrals. When tracing lines that have insulators, the insulators must be bypassed, using the supplied jumper cables.

1. With the Transmitter OFF, plug the 4820 Metroclamp cable into the DIRECT/4820 CLAMP jack.
2. Place the Metroclamp around the conductor, below the electrical ground (see Figure 4-2). Make sure that the clamp jaws are fully closed.
3. Turn the Transmitter on by pulling the POWER switch ON.
4. Trace the targeted conductor with the 810 Receiver, see Section 4.4 for Receiver Operating instructions.

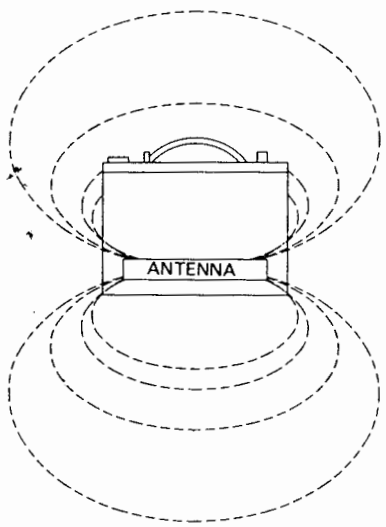

Figure 4-3: Signal Field Generated by Transmitter When in Inductive Use

4.3 Transmitter — Inductive (Indirect Method)

If you cannot make a direct connection onto the conductor, or use the Metroclamp, use the internal antenna of the Transmitter to induce signal onto the conductor. See Figure 4-3.

This is the least preferred method of inducing signal onto a conductor because the signal is broadcast through the soil and the air and can be picked up by other conductors in the area. In this mode the signal radiates from an antenna inside the bottom of the Transmitter housing and couples to the conductor by electromagnetic induction.

1. Find a place over the target conductor that is at least 100 ft. away from where you will be searching with the Receiver. (If the Transmitter is very close to the Receiver, more signal may reach the Receiver by air coupling than by coupling through the conductor).

   Position the Transmitter over the buried conductor, making sure that the CONDUCTOR DIRECTION arrow is parallel to the conductor. (See Figure 4-4.)

2. Turn the Transmitter on by pulling the POWER switch ON.
3. Trace the signal with the 810 Receiver as described in the following section.

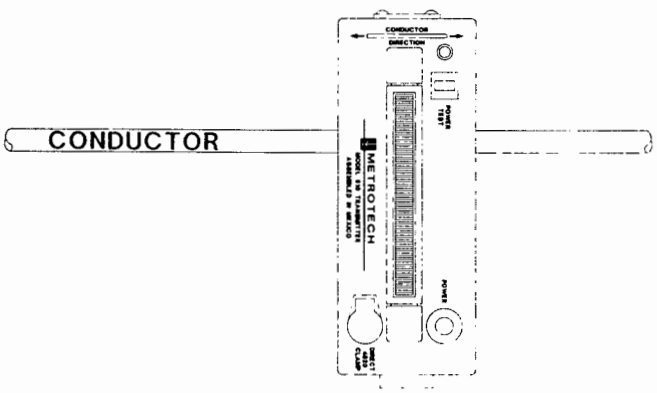

Figure 4-4: Position of Transmitter for Inductive (Indirect Method) Use

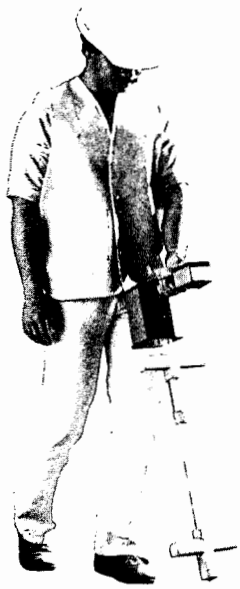

Figure 4-5: Position of Receiver for Tracing

4.4 Using the Receiver

The following describes the method of using the Receiver with any of the three methods of applying the signal.

1. Loosen the nut on the Receiver stem assembly and extend the stem as far as possible. Tighten the nut to secure the stem.
2. Turn the Receiver power switch to "ON" (third position).
3. Go to the search area, holding the Receiver as shown in Figure 4-5. Sweep the area, moving the Receiver from side to side.
4. The visual indicators and audio tone on the 810 Receiver will guide you toward the conductor. The needle on the Left/Right Guidance meter will move to the right and the tone will be steady if the conductor is to your right. The needle will move to the left and the tone will pulse if the conductor is to your left. The signal (or field) strength on the digital display (LCD) will rise as you approach the conductor.

   As you close in on the location of the conductor, the meter needle will move toward the center, the signal strength on the LCD will get higher and the tone will become silent. When the Receiver is directly over the conductor, the needle is in the center of the meter, the field strength is at its peak number, and the tone is silent. See Figure 4-6.
5. To determine the direction of the conductor, stop and vertically rotate the Receiver to the left and right. The highest signal strength reading indicates the direction of the conductor.

   Continue to trace the conductor in the direction indicated by the indicators on the Receiver. If the signal strength drops abruptly, the conductor may have changed direction or stopped.

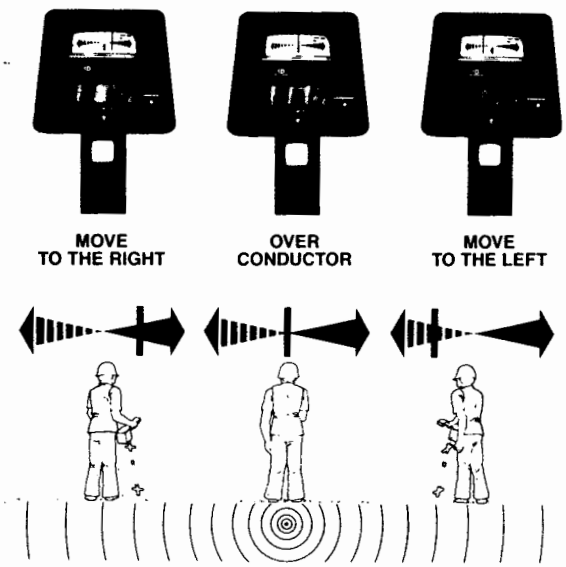

Figure 4-6: 810 Receiver Guidance System

6. To verify the conductor's location, press the depth button. A stable depth reading should appear on the LCD. See Figure 4-8. If the display is blank, you are no longer over the conductor. If illogical or blinking numbers appear on the LCD, you may be over an interfering conductor, or a conductor that is beyond the depth range of the instrument (13 ft). See Section 4.7 for more information on determining depth.
7. When you have pinpointed the conductor's location, mark it as required. See Section 4.5 for APWA color markings.
8. When you have finished the locate, turn the Receiver off, loosen the nut and retract the Receiver's stem.Turn the Transmitter off. Put all components back into the carrying case.

4.5 Marking the Conductor

The following color markings have been established by the American Public Works Association (APWA):

Conductor	Color
Electric power lines, cables, or conduits	red
Communication lines, cables, or conduits	orange
Gas, oil, petroleum, or other gaseous materials	yellow
Storm and sanitary sewers; drain lines	green
Water, irrigation, or slurry lines	blue

Note: If you have any questions regarding marking requirements or procedures, please call your local One Call Center.

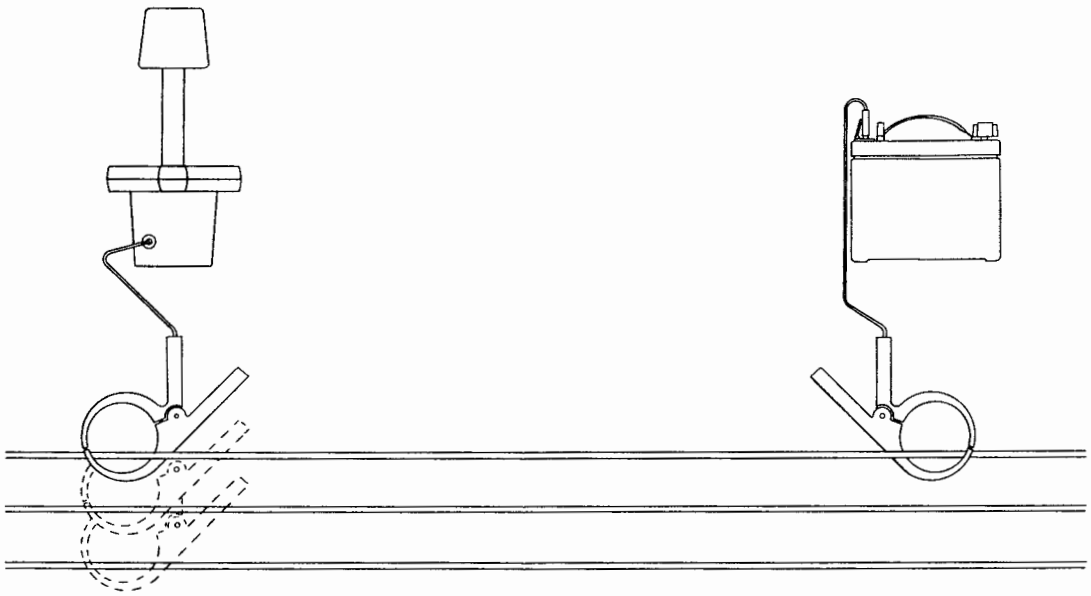

Figure 4-7: Position of Metroclamps When Using Two

4.6 Conductor Identification Using a Second 4820 Metroclamp

When exposed multiple conductors are present, for example in conduits or ducts, use the method described below to identify a specific conductor.

1. Plug a second Metroclamp cable into the jack marked AUX INPUT on the back of the Receiver.
2. Set the selector switch on the Receiver to the fourth position: SIGNAL STRENGTH.
3. Place the Metroclamp around each conductor in succession,making sure that the jaws are fully closed. The conductor with the highest field strength reading is the target conductor. (Figure 4-7)

   Note: This method will work only if there is no cross bonding on the length of the conductor between the conductor and the Receiver.

4.7 Determining the Depth of a Buried Conductor

To determine the depth of a conductor accurately the 810 should be operated in the Direct Connection mode and the field strength (strength of signal) must be greater than 500. Keep in mind that depth measurements are affected by soil conditions, overhead lines, and adjacent conductors.

1. First determine the location of the conductor using any of the methods described above (Direct Connection, Inductive Coupling, Inductive Method). Mark the conductor, using the appropriate color as described on the previous page.
2. Make sure the Receiver antenna is fully extended; otherwise, the depth reading will be incorrect.
3. Facing in the direction of the conductor, place the end of the antenna on the ground directly above the conductor, holding the Receiver at right angles to the ground. (See Figure 4-8.)
4. Press and release the orange depth pushbutton on the handle of the Receiver. Within seconds, the digital display will show the depth of the conductor in inches or centimeters, depending on the instrument version.

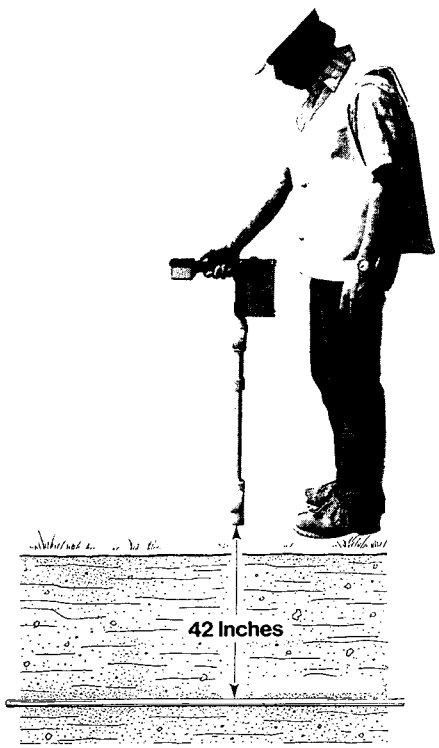

Figure 4-8: Position of Receiver for Determining Depth

5 GROUND SURVEY PROCEDURE

5.1 Applications

Regulations at construction sites often require a ground survey before any excavation is undertaken in the presence of underground utilities such as power, telephone, CATV, gas and water lines.

5.2 Locating Conductors

When undertaking a ground survey, use one of the three modes of operation (Direct Connect most accurate) to locate the known (if any) utilities and mark their location on the ground. Then, using the Inductive mode (Operation section 4.3, Inductive Method), two operators—one carrying the transmitter, the other operating the receiver — move in parallel across and then down the survey area. (The operator with the receiver must move sideways, facing the second operator with the transmitter. The transmitter operator faces the direction in which he is moving as shown in Figure 5-1). The LCD reading on the Receiver will indicate the presence of a conductor under the ground as the operator passes over it. Mark the location of each conductor along your survey path. After executing this procedure in both directions, go back and trace the path of each of the conductors you have marked.

5.3 Subdividing Large Search Areas

If you are working in a large search area, subdivide it into several smaller areas. Then sweep through each smaller area thoroughly before going on to the next one.

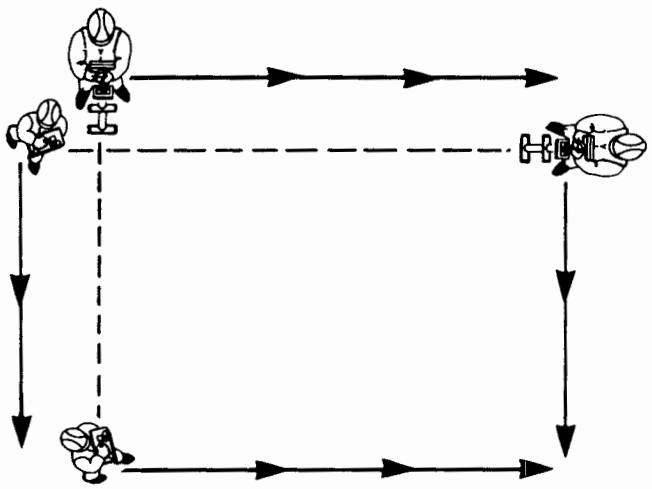

Figure 5-1: Locating Conductors: Parallel Pattern

6 TRACING TECHNIQUES AND HELPFUL INFORMATION

Many variables affect the process of locating a cable. The following gives guidelines for various problem situations.

6.1 Soil Conditions

Generally, the effect of soil types on line tracing is as follows:

Soil Type	Effect on Line Tracing
moist, compact	ideal
dry, sandy, rocky	little or no moisture content creates a poor tracing environment
alkaline; high iron content	poor tracing environment, inaccurate depth readings

6.2 Adjacent Conductors

If the field strength reading drops off more on one side of a conductor than it does on the other the Receiver may be picking up interference from an adjacent or parallel conductor. Try to confirm the exact location of the adjacent conductors and compare the signal strength on each one. In most cases the conductor with the stronger signal is the target conductor.

Place your ground lead so that it does *not cross over any adjacent conductors,* but is as far away from your target conductor as possible, and is extended in the same direction in which you are tracing.

Note evidence of other underground utilities in the area, such as transformers, pedestals, hydrants, meters, etc. which indicate the presence of other underground conductors.

6.3 Metroclamp: Ground Requirements

If you are using the Metroclamp around a cable, both ends of the target conductor must be grounded to insure sufficient field strength. Power lines and telephone sheaths are assumed to be grounded.

If the conductor is a pipe which has an insulated joint, such as a gas pipe with a meter, use the jumper cable. Attach each end of the jumper cable on opposite sides of the insulator.

6.4 Grounding: Safety

If you use the direct connect method, be sure that there is no power flowing through the target conductor. If you use the Metroclamp on energized lines, follow established safety procedures.

6.5 Distribution Systems

To locate gas services on a gas distribution system, you must be sure that the service is grounded. This can be accomplished by temporarily connecting a jumper cable to a ground spike at the end of a service, where the pipe comes out of the earth.

6.6 Deep Conductor

Signals picked up by the Receiver from deep buried cables are weaker and not a directionally distinct as those from cables closer to the surface. The meter reading will only change by small increments in relation to moving the Receiver antenna.

Using the Inductive (Indirect) Method of coupling signal to the conductor may be difficult if the target conductor is buried six feet or more, or is set in recent backfill. For best results, use the Direct (Conductive) Connection method of coupling signal to the targeted conductor (Section 4.1).

6.7 What is the Field Strength of the Signal?

When the signal is applied to the conductor using any of the three methods described in Section 4, an electromagnetic field is created around the conductor. The Receiver measures the strength of this field, displaying it on the digital meter.

The field strength decreases as you move away from the target conductor and as you go farther away from the Transmitter. For optimum tracing accuracy, the field strength should be between 975 and 500.

Measurement accuracy is affected by the ratio of the conductor diameter compared to how deep the conductor is buried. For example, a conductor with a diameter of one foot should have two feet of top fill to ensure an accurate measurement. Figure 6-1 shows how the distortion of the signal field at the ground surface affects the depth measurement for conductors at shallow depths.

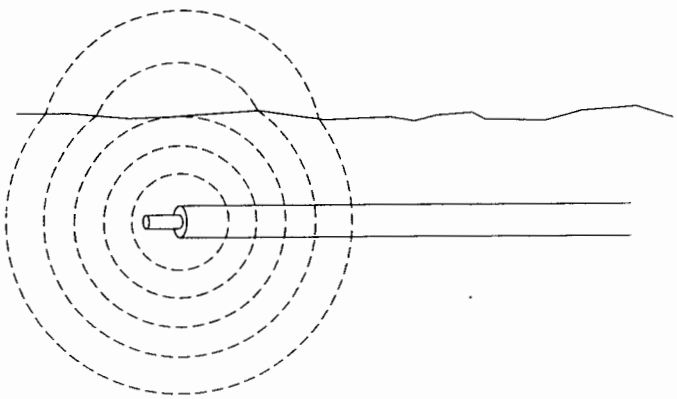

Figure 6-1: Distortion of Signal Field on Shallow Pipe

6.8 "Ghost" Conductor due to Adjacent Conductor

If there is another conductor near the target conductor, it too may pick up the signal from the Transmitter. When this occurs, there will seem to be a trace — a "ghost" trace — between the two conductors.

A ghost trace can be detected by noting the following:

1. When the Left/Right Guidance meter needle changes direction (crossing the center line) and the tone changes from broken to solid or solid to broken and the Left/Right meter needle moves in the same direction as *you* are moving. (Normally, the Left/Right needle moves in the opposite direction.)
2. The field strength reading will drop as you move toward the "ghost" conductor. (Normally, field strength would increase.)
3. If you take a depth measurement over a "ghost" conductor, you will get a random or illogical reading, or no reading at all.

The Receiver reads a "ghost" conductor when each coil on each side of the cross section of the antenna receives the same amount of signal from two separate conductors.

The location of the "ghost" will vary, according to the soil conditions and the size, depth, and conductivity of any adjacent conductors. Figure 6-2 is one example.

To re-establish the correct trace, backtrack and search the area in a 180-degree arc.

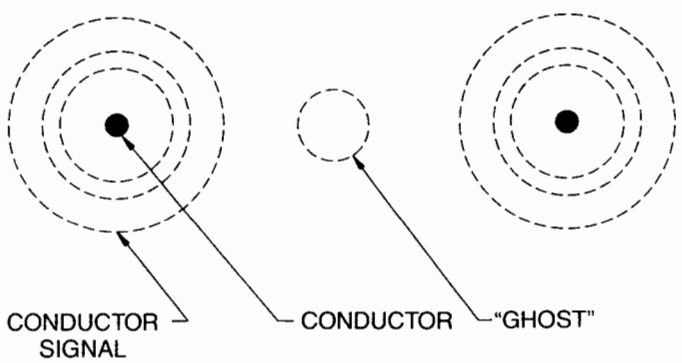

Figure 6-2: "Ghost" Appears Midway Between Two Adjacent Conductors that are Similar in Size and Depth

6.9 Completing the Circuit Path

The circuit path between the point at which the Transmitter signal couples to the conductor and where the Receiver is being held over the conductor has to be complete. Otherwise, very little Transmitter signal will reach the Receiver. If you suspect a break in the circuit path, look for disconnected leads, circuit breakers and open switches. It is essential to provide a good ground when setting up the Transmitter.

Power lines and telephone sheaths are assumed to be grounded. If the conductor is a pipe which has an insulated joint, such as a gas pipe with a meter, use the jumper cable. Attach each end of the jumper cable on opposite sides of the insulator. See Figure 6-3.

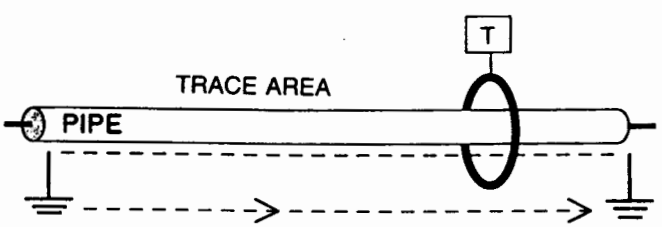

Figure 6-3: Ground on Either Side of the Trace Area

6.10 Common Bonded Conductors

Power, CATV, and telephone cable sometimes use a common ground bond. If other conductors are connected to your target conductor, putting a signal on the target can cause all the conductors to carry the same signal. This makes it difficult to identify the target conductor.

To verify that you are tracing the targeted conductor, note the field strength and depth readings at a known location of the conductor. As you trace, any change in field strength or depth reading should be gradual. If either reading changes abruptly you are probably no longer over your targeted conductor.

6.11 Congested Areas

In a urban or otherwise congested locate area it really is a jungle under there. It is not uncommon for water, gas, power, or telephone utilities to use common trenching. Every congested situation is different; there are too many variables for us to cover here. Use good judgement and locating skills to carefully determine where other conductors are in you locate area, and what effect they may be having on your tracing situation. Make use of comparison depth and field strength readings to determine and confirm that you are tracing you targeted conductor.

If you suspect that coupling from adjacent conductors is causing interference in the signal picked up by the Receiver *try*

increasing the strength of the signal received from the Transmitter and decreasing the strength of signal from the interfering conductors by:

1. Changing to a different transmitter coupling point or coupling mode.
2. Improving the grounding connection or moving the grounding point.
3. Determine the location of the adjacent conductors. Then check to be sure that neither the direct connect cable or the ground cable cross over any of the adjacent conductors. Re-position them if necessary.
4. If you are using the Inductive (Indirect) mode, you may be able to decrease the amount of interfering signal by changing the orientation of the transmitter to the targeted conductor. Determine the location of the interfering conductor. Place the transmitter, turned on its end with the bottom facing the targeted conductor, over the interfering conductor as shown in Figure 6-4.

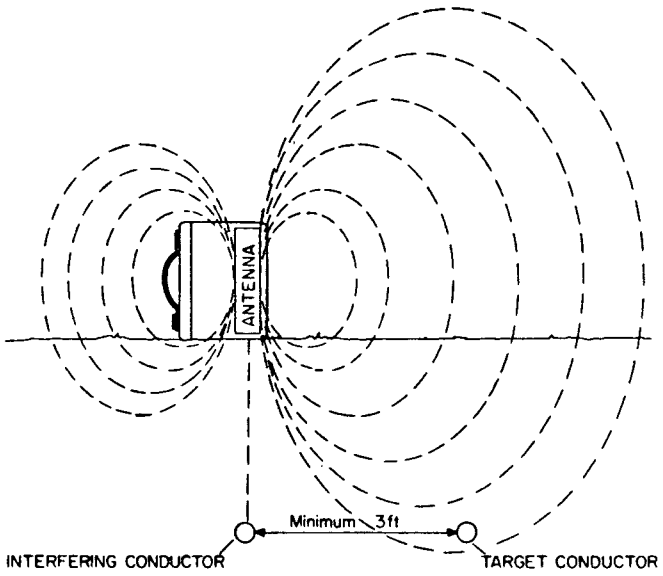

Figure 6-4: Position of Transmitter for Minimum Interference

6.12 Tracing Long Runs

Signals picked up by the receiver get weaker as you move further and further away from the transmitter coupling point, especially on long pipe runs. To get a stronger signal, move the transmitter coupling point closer to the receiver. If forced to use the Inductive Indirect mode, your tracing job will be easier if an assistant follows behind with the transmitter as you trace with the receiver.

6.13 Locating a Service Lateral

After you have traced the main, you may want to go back and locate the service laterals off the main. Service lateral traces are easiest to conduct in the Inductive Mode. Two operators are required for this procedure — Operator 1 remains stationary holding the Receiver as if to trace (Figure 4-5) over and parallel to the main. Operator 2, carrying the Transmitter (with the power on) and maintaining a minimum of 100 ft. between himself and the Receiver, walks parallel but 5 feet from the main on the side he expects to find the service laterals as shown in Figure 6- 5. The field strength reading on the Receiver will increase as Operator 2 crosses over the service lateral with the Transmitter. Each time the field strength reading increases, Operator 1 signals Operator 2 and he/she marks the lateral locations on the ground.

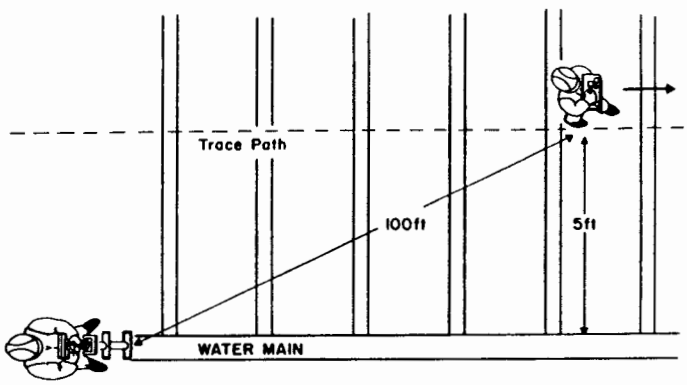

Figure 6-5: Locating Service Laterals

6.14 Locating a Bend or Dead End

While tracing a line, you may find that the meter reading drops off suddenly, and that there is no distinct reading when the receiver antenna is moved left or right. Stand in place and continue sweeping the antenna from side to side but at the same time slowly pivot your body.

If you find a pivot angle at which the meter reading picks up again, it means you've located a bend and can resume tracing in the new direction.

If you pivot all the way around (360 degrees), without getting any noticeable meter reading, it means you've reached a dead end where the conductor ends.

6.15 Valves, Manhole Covers, Tees and Risers

If the meter reading suddenly increases and then falls back while tracing a pipe you have probably passed over a buried valve, manhole cover, tee, or riser.

7 MAINTENANCE

The only routine maintenance required for the Model 810 equipment is to test or replace the batteries in the Transmitter and the Receiver. Both possess battery test features, making it easy to check the condition of the batteries at any time.

We recommend checking the Transmitter and Receiver batteries before each use, preferably before leaving for the job site.

7.1 Checking and Replacing the 810 Receiver Batteries

1. Have ready four 9 volt NEDA 1604A, IEC 6LR61 (Int'l Std),or JIS 6AM6 (Jpn Std) alkaline cells.
2. Set the selector switch on the Receiver to the battery test position (second position).
3. In order for the Receiver to function properly, the needle must be to the right of the BATT TEST line. The farther the needle is to the right of this line, the higher the charge in the batteries.
4. If the needle is to the left of the BATT TEST line, the batteries need replacing. Pull the BATTERY ACCESS latch on the reverse side of the Receiver. Replace all four cells, making sure that the batteries are installed with the positive (+) end to the positive terminals.
5. Close the battery access panel, ensuring that there are no wires caught between the Receiver body and the access panel. Make sure the latch is securely fastened.

7.2 Checking and Replacing the 810 Transmitter Batteries

Check the 810 Transmitter batteries by pressing the POWER TEST button. The POWER TEST Light will light up if the batteries are good. If you need to replace the batteries, follow the following steps:

1. Have ready six NEDA 13F D Cell alkaline batteries.
2. Release the latch on the side of the transmitter. Lift the transmitter lid and remove the cover section.
3. Carefully lift the battery housing up and out of the transmitter case, being careful not to break or damage the attached red and black leads. Set the housing on the edges of the transmitter case.
4. Remove all six batteries from the battery housing.
5. Insert six new batteries into the battery housing, using the guide glued in the base of the housing for battery position. Make sure the raised portions of the battery ends are in good contact with the positive battery contacts of the battery housing.
6. Replace the housing back into the transmitter. Replace the cover, close the lid, and latch it closed.
7. Pull the POWER TEST switch ON. The POWER TEST light should go on.

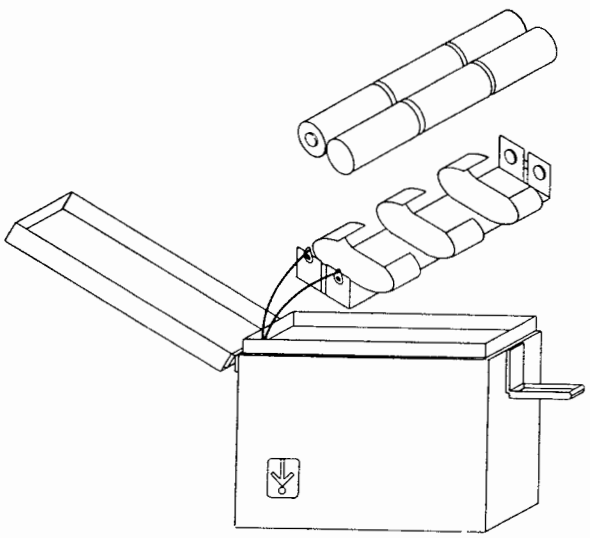

Figure 7-1: Replacing the 810 Transmitter Batteries

7.3 Basic Preventive Maintenance

Always store the Model 810 equipment and accessories in the carrying case when not in use. Do not leave any Model 810 equipment in direct sunlight for prolonged periods. The Model 810 is designed for rugged outdoor use, but rough handling should be avoided. Keep the equipment dry and free of grit.

If the equipment does not function properly, replace or recharge the batteries as described in the sections above. If the equipment still malfunctions, call one of our service centers for assistance:

METROTECH SERVICE CENTERS
670 National Ave.
Mountain View, CA 94043
CA Telephone: 415/940-4926
Telephone: 800/638-7682

1824 Murfreesboro Road, Ste. 104
Nashville, TN 37217
TN Telephone: 615/366-7323
Telephone: 800/624-6210

Additional Metrotech Instruments: Fiber Optic Cable Locating System, Fiber Optic Test Equipment, Cable Fault Locating Instruments, Pipe and Cable Locators, Leak Detectors, Iron and Steel Locators, and Valve Box Locators, Underwater Line Tracer.