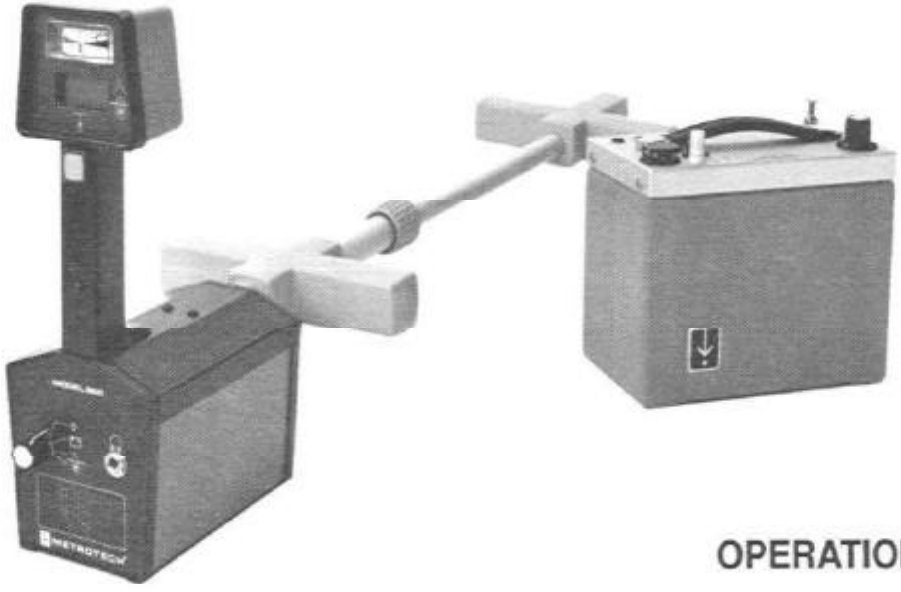
METROTECH®

MODEL 850 LINE TRACER



OPERATION MANUAL

Part #: 600A011-C
Price: $5.00

Metrotech's Mission

Metrdtech provides innovative solutions to underground locating problems by being an industry leader in the design, manufacture, and servicing of a comprehensive line of accurate, reliable and easy-to-use locators.

Through innovaton and leadership, Metrotech will increase customer productivity by satisfying our customers' need to efficiently install, protect, and maintain their undergroundplant.

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List of Illustrations

1 INTRODUCTION

The Metrotech Model 850 Audio Frequency Line Tracer is designed to trace long distance conductors, or conductors that are located in congested urban areas where conductor isolation is required. It is most often used for power, telecommunications, CATV, oil , or gas transmission applications.

The 850 Transmitter puts out a low (9820 Hz), frequency at a strong 2 watt power output, which will travel long distances without bleeding off onto adjacent conductors.

The 850 Transmitter generates a signal which is applied onto the pipe or cable (conductor). The signal travels along the conductor, becoming weaker as it gets farther from the Transmitter. The distance the signal travels before it becomes too weak to be detected depends on the method of connection, type of conductor, surrounding soil, and depth of the conductor.

When positioned over the conductor, the Receiver will detect the signal from the conductor. The Receiver's Left/Right Guidance System, field strength display, and audio tone aid you in tracing. To display, and audio tone the depth of the conductor, you simply push a button.

The Model 850's automatic impedance matching compensates for differences in soil conditions, conductor size and material.

As with all electromagnetic locating systems, this unit is designed to locate metallic conductors only. The word "conductor, pipe, or cable" refers to a metallic conductor throughout this manual.

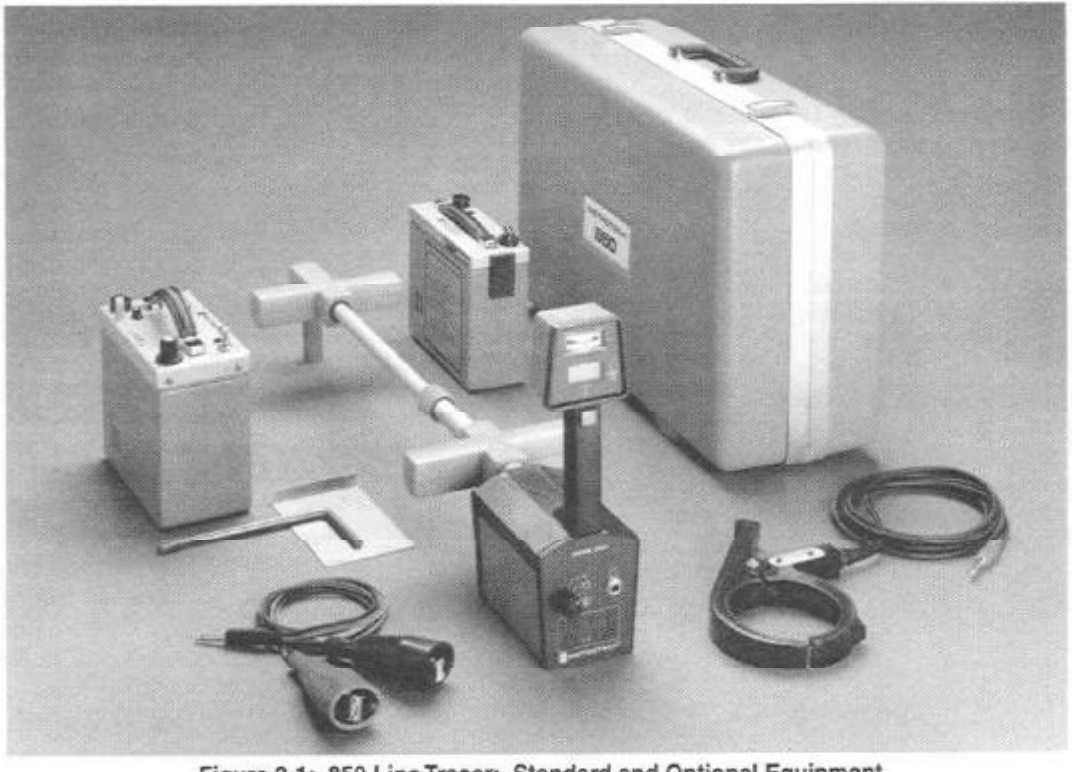

Figure 2-1: 850 Line Tracer: Standard and Optional Equipment

2 850 EQUIPMENT

The Metrotech 850 Line Tracer consists of standard and optional equipment. All equipment is shown in Figure 2-1.

2.1 Standard Equipment

Part Number	Description	Remarks
850 or	Transmitter	2 watt battery
850 or 800C029	Receiver Receiver (metric)	
800B004	Conductive Attachment Assembly	Direct Connect Cable, Ground Spike, and Ground Plate
400C079	Carrying Case	
500A278	Battery Charger	
600A011-C	Operation Manual	

2.2 Optional Equipment

Part Number	Description	Remarks
5120	Metroclamp and jumper cable	For use in inductive coupling mode
4890 (8") 4490 (4") 4290 (2")	Metroclamps	For use on conductors of up to 8 inches in diameter
183045	Headphones	For use when locate site is too noisy for audio tone
800B005	Vehicle Mount Charger	For recharging between sites
SON982	Sonde	For tracing non-metallic pipe or conduit

Features of the 850 Transmitter and Receiver are discussed in detail in Sections 2.4 and 2.5.

2.3 Technical Specifications

850 Transmitter

Output Power:	0.6W and 2W
Output Frequency:	9820Hz ± .002%, Crystal controlled for interference resistance
Impedance Matching:	Automatic, no adjustments
LED Indicator:	
Normal Operation:	Flashing
Low Battery/Malfunction:	Off
Operating Modes:	Direct Connection, Inductive Coupling with the 5120 Metroclamp, Inductive
Batteries:	Rechargeable lead-acid (6V) Charging is by 115V, 60Hz AC power source (supplied on request), or optional 12V charger.
Weight:	5.8 lbs. (2.6 kg)
Dimensions:	8"L x 4.3"W x 6.75"H (20.3 x 10.5 x 17.2 cm)

850 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"L x 7.25"W x 12.25"H (82.6 x 18.4 x 31.1 cm)
Temperature Range:	0 to 110°F (-18 to 43°C)
Shipping Weight (Gross):	23 lbs (clamp: add 2 lbs) (10.4 kg, clamp: add .91 kg)
Shipping Dimensions:	24.25"L x 10.25"W x 17 1/4" H (61.6 x 26.4 x 43.8 cm)
Modes of Operation:	Direct Connection, Inductive Coupling, Inductive

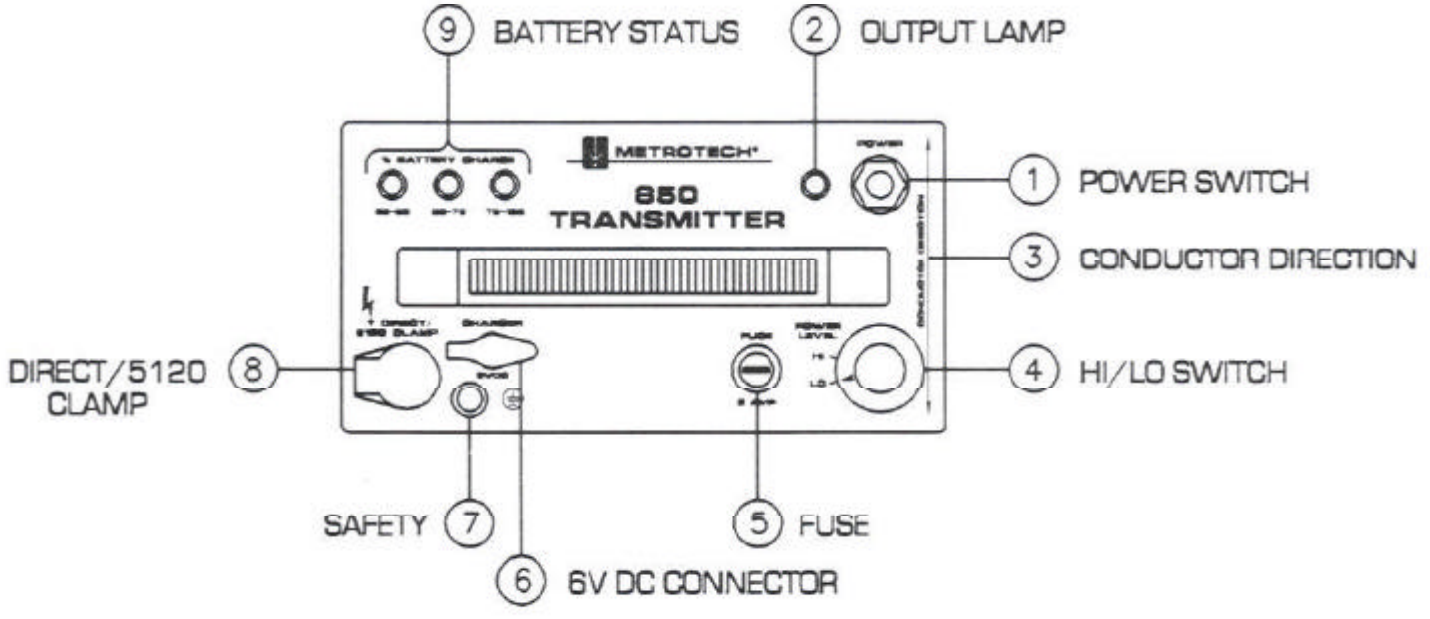

Figure 2-2: 850 Transmitter: Controls and Indicators

2.4 850 Transmitter: Controls and Indicators

Figure 2-2	Designation
1	**POWER ON/OFF SWITCH** Pull this switch to turn the Transmitter on. The battery capacity is automatically displayed for about seven seconds. Then the LED next to the power switch flashes, indicating that the Transmitter is sending the signal.
2	**OUTPUT LAMP** Blinks when the instrument is ON. If the output lamp does not blink, recharge the battery.
3	**CONDUCTOR DIRECTION arrow** Orients the Transmitter when used in Inductive mode. (Low frequency of the Model 850 Transmitter limits its inductive capability.)
4	**HI/LO SWITCH** Set the output power with the switch: LO: 0.6 watt with battery life of about 24 hrs HI: 2.0 watts with battery life of 6-8 hrs
5	**FUSE** Replaceable safety protection fuse.
6	**6V DC CONNECTOR** For battery charger input. Two chargers are available: Standard Wall Mount (110V AC) Vehicle Mount
7	**SAFETY GROUND** Transmitter chassis can be grounded if required.
8	**DIRECT/5120 CLAMP output jack** Connection point for the Direct Connect cable or the 5120 Metroclamp.
9	**BATTERY STATUS LAMPS** Indicates remaining battery capacity: 25-50% (recharge soon) 50-75% 75-100% (fully charged).

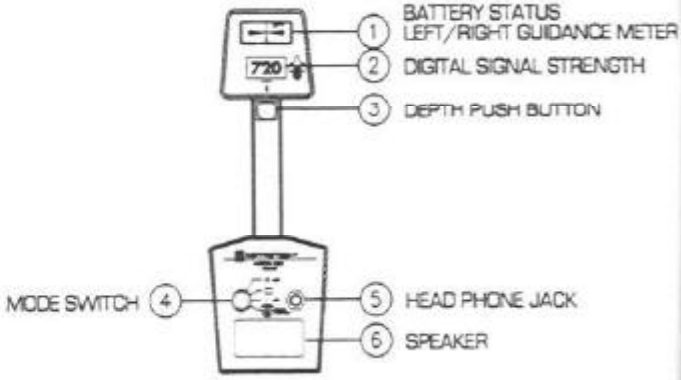

Figure 2-3: 850 Receiver: Controls and Indicators

2.5 850 Receiver: Controls and Indicators

Figure 2-3 Designation

1 **LEFT/RIGHT GUIDANCE METER**
The needle guides you toward 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 STATUS
When the Receiver is turned ON, the needle on the meter should move to the right of the battery test arrow.

2 **DIGITAL SIGNAL STRENGTH**
The signal strength is indicated on the LCD display when the MODE SWITCH is in the line tracing mode (third position) or field strength only mode (fourth position).

3 **DEPTH PUSH BUTTON**
In order to get a depth reading, the MODE SWITCH must be in the third position. Press and release this button to get a conductor depth. Within seconds, the LCD will display the depth of the conductor in inches (or centimeters).

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

○ **Power Off**

Battery Test
In this position, needle should be to the right of the battery line.

| **Line tracing mode**
Use this position for normal operation.

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 **HEADPHONE JACK**
For use in noisy environments.

6 **SPEAKER**
The speaker in the Receiver emits a tone, which corresponds to the position of the needle on the Left/Right Guidance meter. A continuous tone (corresponding to the solid arrow of the meter) indicates the conductor is to the right. A broken tone (corresponding to the broken arrow indicates the conductor is to the left.

Back of Receiver

7 **BATTERY ACCESS (Thumbscrew)**
Turn the thumbscrew to gain access to the batteries.

8 **AUX INPUT (auxiliary input)**
Point of connection for the 5120 Metroclamp.

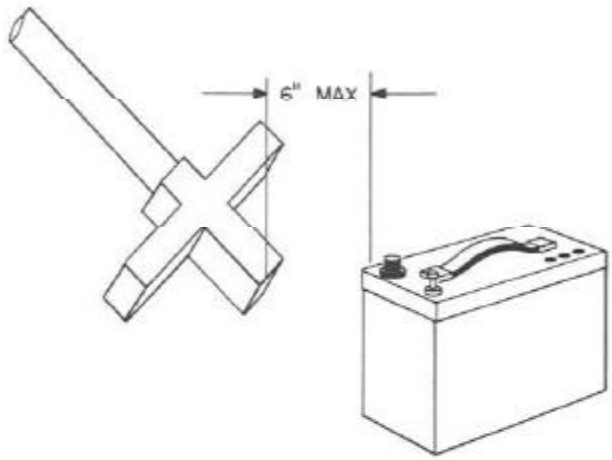

Figure 3-1: Position of the Receiver for Checkout Procedure, Step 6

3 CHECKOUT PROCEDURE

To insure proper operation of the 850 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

Checkout Steps:

1 Switch the Transmitter ON/OFF switch to the "ON" position. One of the battery charge indicator lamps should flash. For best results, the Transmitter should be at least 50% charged.

2 Within seconds the lamp next to the POWER SWITCH on the Transmitter should flash, indicating that the 850 Transmitter is ready to operate.

3 Fully extend the Receiver antenna by loosening the nut on the stem assembly and extending the stem as far as possible. Tighten the nut to secure the stem.

4 Set the Receiver MODE SWITCH to battery test (second position).

The needle on the Left/Rght Guidance meter should be to the right of the line labeled BATT TEST. 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.

5 Move the Receiver MODE SWITCH to the AUX position (fourth position).

6 Position the Receiver as shown in Figure 3-1. 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.

7 With the Receiver MODE 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 3-1, 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 continous tone when you move right, broken arrow and broken tone when you move left). See Figure 3-2.

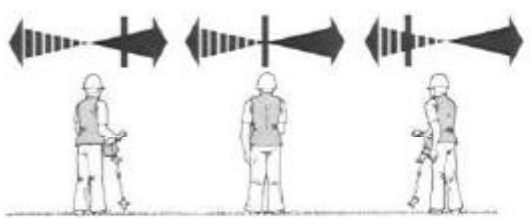

Figure 3-2: Checkout of Receiver Directional Meter

9 Center the needle on the meter as in Step 7.

10 When the needle is centered, press and release the DEPT button. A depth reading should appear.

11 Turn the Transmitter OFF by depressing the POWER SWITCH.

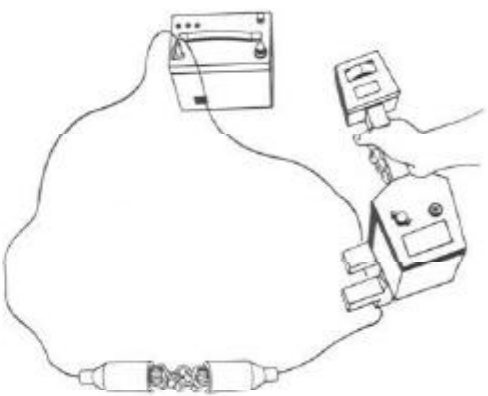

Figure 3-3: Configuration for Testing the Conductive Attachment

To test the conductive attachment for loose or broken wires:

12 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 3-3). Plug the Conductive Attachment into the DIRECT/5120 CLAMP jack of the Transmitter.

13 Turn the Transmitter on by pulling the POWER SWITCH up.

14 Place the Receiver tip directly on one of the conductive wires.

15 Turn the MODE 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.

16 While watching the field strength readout, wiggle each connection point on the Conductive Attachment at the DIRECT/5120 CLAMP 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.

17 Repeat Step 16 on the other conductive wire.

18 Turn the Transmitter OFF.

To test the 5120 Metroclamp for loose or broken wires:

19 Keeping the Conductive Attachment in the loop configuration shown in Figure 3-4, unplug the attachment from the Transmitter and plug it into the Metroclamp jack on the back of the 850 Receiver. Position the Receiver on the floor or ground so that you can read the field strength readout.

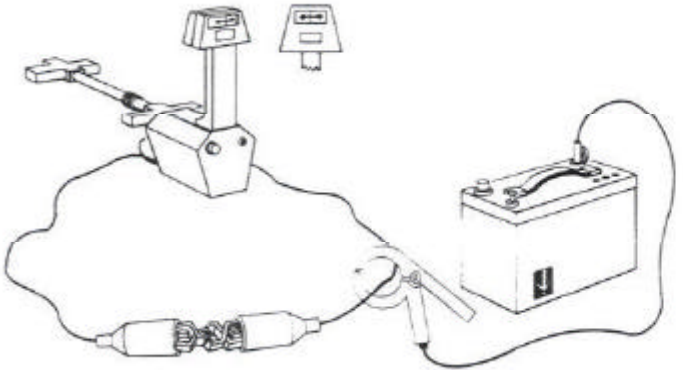

Figure 3-4: Configuration for Testing the Metroclamp

20 Plug the 5120 Metroclamp into the DIRECT/5120 CLAMP jack of the 850 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.

21 Turn the Transmitter back ON.

22 Note the field strength shown on the Receiver; it should be close to that of step 15 above.

23 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 5120 Metroclamp.

24 Turn both the Transmitter and Receiver off and unplug both the Metroclamp and the Conductive Attachment to avoid excessive battery loss.

See Section 6 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: 1-800-638-7682.

4 OPERATION

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

To operate the 850 Line Tracer use the Transmitter to apply a signal to the conductor, and use the Receiver to trace the signal.

⚠ DANGER - ELECTRICAL SHOCK

When making a direct connection to a live power cable, always be sure the power to the cable is turned OFF by using a voltimeter to check for active electrical power. (Live secondary power can be located safely using an inductive clamp.)

⚠ WARNING - ELECTRICAL SHOCK

The 850 Transmitter generates up to 170 volts AC p-p. To avoid electrical shock, handle the conductive leads one at a time when the Transmitter is ON.

⚠ CAUTION - INACCURATE INFORMATION

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 the signal to the conductor with one of the Transmitters - Direct Connection, Inductive Coupling, and Inductive. A description of each method and use instructions follow below:

4.1 Transmitter - Direct Connection

This is the preferred mode of operation because the Transmitter is connected directly to a metallic part of the conductor (hydrant, meter, riser, valves, sheath, tracer wire) allowing a strong maximum signal to reach the conductor. In this operating mode the Receiver can be closer to the Transmitter. Adjacent buried conductor interference is reduced.

1 With the Transmitter OFF, plug the Direct Connect Cable into the jack labeled DIRECT/5120 CLAMP on the 850 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 on next page.

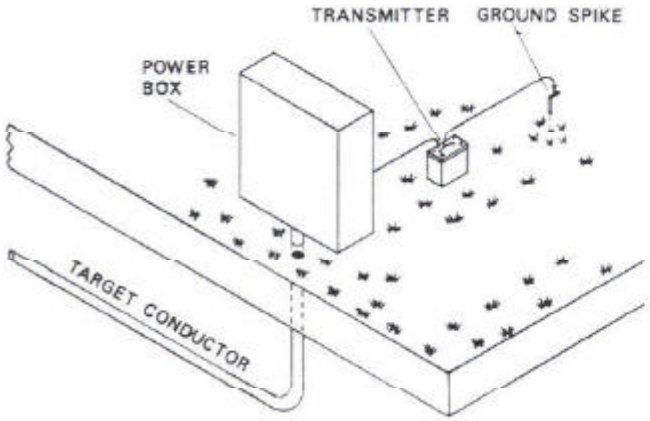

Figure 4-1: Direct Connection

4 Extend the BLACK lead of the Direct Connect Cable as far as possible from the Transmitter, maintaining the 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 Set the HI/LO SWITCH. Pull the POWER SWITCH "ON". The battery indicator lights will flash for several seconds. The Transmitter functions best with a charge of at least 50%. The power output light will begin flashing to indicate that the unit is in the operating mode and functioning properly.

6 Trace the signal with the Receiver, see Section 4.4 for Receiver Operating Instructions.

4.2 Transmitter - Inductive Coupling with a 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 5120 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 grounded at both ends. When tracing lines that have insulators, the insulators should be bypassed, using the supplied jumper cables. Bonding and grounding at terminations is often "standard practice" in industries that use cable, but do not assume this to be the case.

1 With the Transmitter OFF, plug the 5120 Metroclamp cable into the DIRECT/5120 Clamp jack.

2 Place the Metroclamp around the conductor, below the electrical ground. (See Figure 4-2). Make sure that the clamp jaws are completely closed.

3 Follow steps 3-5 Direct Connection

4 Trace the signal with the Receiver, see Section 4.4 for Receiver Operating Instructions.

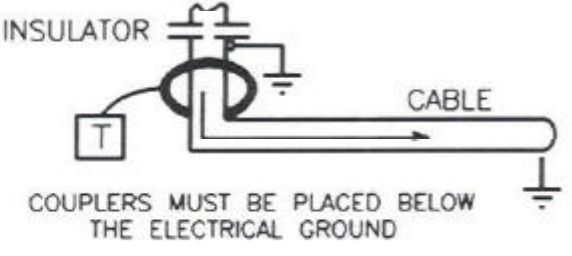

Figure 4-2: Inductive Coupling with the Metroclamp

4.3 Transmitter - Inductive 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.

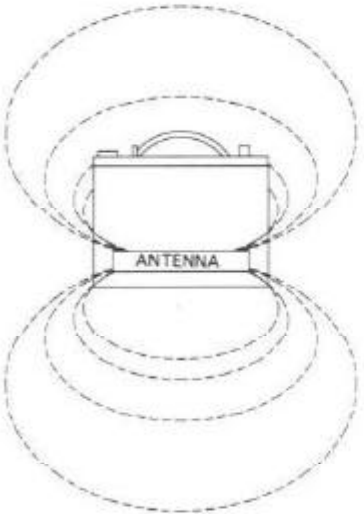

Figure 4-3: Signal Field Generated by Transmitter When In Inductive Mode

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.

Due to the low audio frequency of the 850 Transmitter, Metrotech does not recommend using the 850 for Inductive tracing unless there is visible evidence of the conductor - such as a U-guard on telephone pole, or the conductor is less than three feet underground and you can position the Transmitter directly over it.

1 Find a place over the target conductor that is at least 30 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).

   To determine if you are air coupling, raise the Receiver above the target conductor. If the signal strength does not decrease you are air coupling. Move further away from the Transmitter.

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

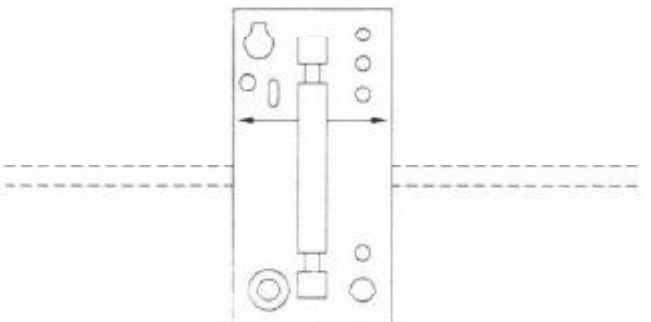

Figure 4-4: Position of Transmitter for Inductive Use

2 Pull the POWER SWITCH "ON". Set the output power level to LO if the received signal is weak, then set it to HI.

3 Trace the signal with the Receiver as described in the following section.

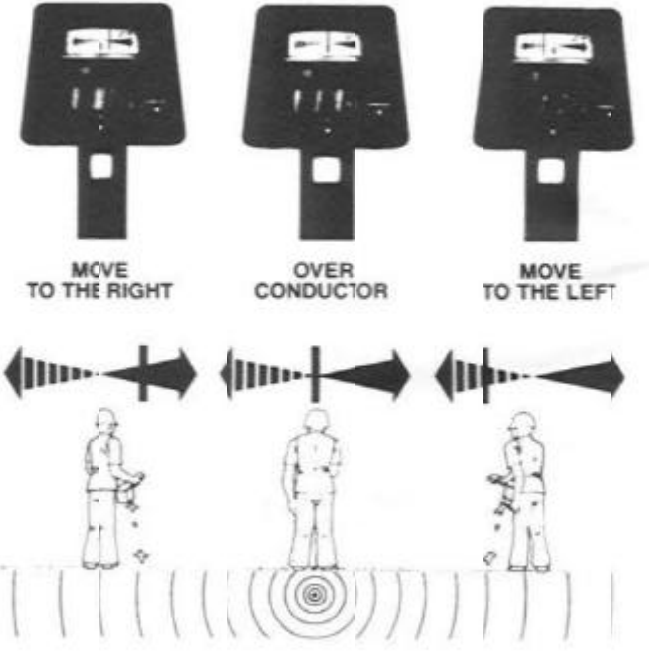

Figure 4-5: 850 Receiver Guidance System

4.4 Using the Receiver

The following describes using the Receiver with any of the three methods of applying 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 MODE SWITCH to the third position.

3 Go to the search area. Hold the Receiver in a comfortable position in front of you and sweep the area, moving the Receiver from side to side.

4 The Left/Right Guidance, Signal Strength, and audio tone 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 will peak and the tone will be silent. See Figure 4-5.

5 To determine the direction of the conductor, stop and rotate the Receiver on its vertical axis. The highest signal strength reading indicates the direction of the conductor.

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

6 To verify the conductor's location, press the depth button. A stable depth reading should appear on the LCD. If the display is blank, you are no longer over the conductor. If irrational 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).

7 When you have pinpointed the condutor's location, mark it as required. See Section 4.7 for APWA color markings.

8 When you have finished the locate, turn the Receiver OFF, loosen the nut and retract the Receiver stem.

9 Turn the Transmitter OFF and put all components back into the carrying case.

4.5 Determining the Depth of a Conductor

To determine the depth of a conductor accurately, the 850 field strength must be greater than 500. Keep in mind that depth measurements are affected by soil condition, overhead lines, and adjacent conductors. In congested areas it is perferable to use Direct Connect when determing depth.

1 First determine the location of the conductor using any of the methods described above (Direct Connection, Inductive Coupling, or Inductive Method).

2 Make sure the Receiver antenna is fully extended, otherwise, the depth reading will be incorrect.

3 Facing in the direction of the conductor, touch the antenna tip to the ground directly above the conductor, with the Receiver at right angles to the ground. (See Figure 4-6.)

4 Press and release the DEPTH BUTTON 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 4-6: Determining the Depth of a Conductor

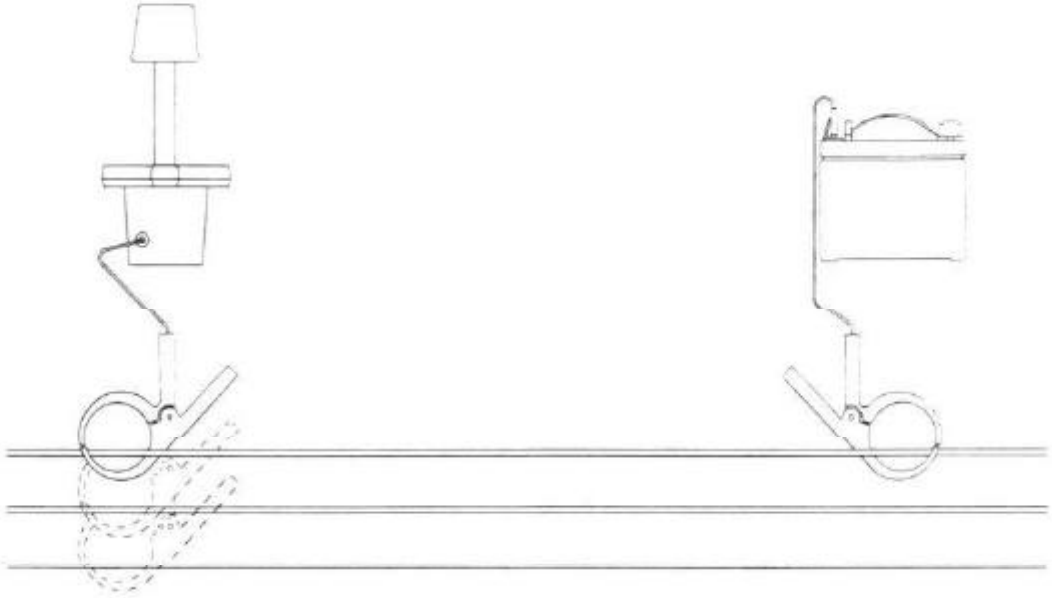

Figure 4-7: Position of Metroclamps When Using Two

4.6 Conductor Identification Using a Second 5120 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 Receiver MODE SWITCH to the fourth position - Field Strength only. Turn the Transmitter ON.

3 Place the Metroclamp around each conductor in succession, marking sure that the jaws are fully closed. The conductor with the highest field strength reading is the target conductor. (Figure 4-7)

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

4.7 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
communications 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.

5 TRACING TECHNIQUES AND HELPFUL INFORMATION

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

5.1 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, or rocky	little or no moisture content creates a poor tracing environment
alkaline, high iron content	poor tracing environment

5.2 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. Confirm the exact location of the adjacent conductors. 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 perpendicular to the direction in which you are tracing.

5.3 Pipes with Insulated Junctions

Note that a low frequency signal will not cross insulated joints. Therefore, the Model 850 is not suitable for tracing in areas where these conditions exist.

5.4 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.

5.5 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.

5.6 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.

5.7 Deep Conductor

Signals picked up by the Receiver from deep buried cables are weaker and not as 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 three feet or more, or is set in recent backfill. For best results, use the Direct Connection method of coupling signal to the targeted conductor. (Section 4.1)

5.8 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 on 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.

5.9 "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 needle changes direction and the tone changes from broken to solid or solid to broken and the Left/Right Guidance meter needle moves in the same direction as you are moving. (Normally, the Left/Right Guidance 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.

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

5.10 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.

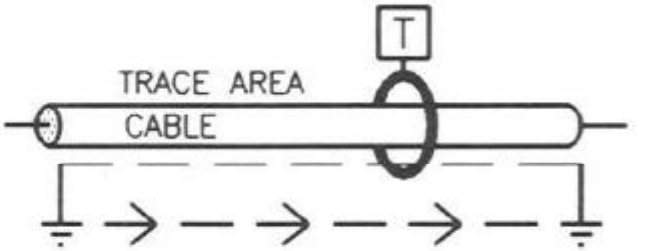

Figure 5-1: Ground on Either Side of Trace Area

5.11 Common Bonded Conductors

Telephone, power, and CATV sometimes use a common ground. 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 you are tracing the targeted conductor, note the field strength and depth readings at a known location of the targeted 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.

5.12 Congested Areas

In urban or otherwise congested areas 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 your 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 your targeted conductor.

6 MAINTENANCE

6.1 850 Receiver Calibration

The centerline, signal strength, and depth of your 850 Receiver has been calibrated to factory specified tolerances. It is to your advantage to monitor the performance of your 850 Receiver on a weekly basis.

Metrotech recommends using a known conductor of which you know both the location and the depth to test your 850 Receiver, for example, a buried service line at your work location. If the Receiver gives significantly different centerline, signal strength, or depth information from what you know to be true, it should be re-calibrated by Metrotech or a Metrotech-authorized Service Center.

6.2 Replacing the 850 Receiver Batteries

1 Have ready four 9 volt NEDA 1604, IEC 6LR61 (Int'l Std), or JIS6AM6 (Jpn Std) alkaline batteries.

2 Set the MODE SWITCH 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 STATUS 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 STATUS line, the batteries need replacing. Turn the BATTERY ACCESS thumbscrew on the back 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.

6.3 Recharging the 850 Transmitter Battery

We recommend that you recharge the Transmitter battery daily.

Check the Transmitter battery condition as follows:

1 Pull the POWER SWITCH "ON". One of the BATTERY STATUS lamps will light, indicating the charge remaining:

25-50% (recharge now),
50-75%,
or 75-100% (fully charged).

If no indicators light up, less than 25% of the charge remains.

2 Calculate the operating time required. When used at LO power, the battery will last:

about 24 hours on a full charge
12-18 hours on a 50%-75% charge
6-12 hours on a 25%-50% charge

3 When the battery needs to be recharged, plug the battery charger lead into the 6V DC CONNECTOR on the top panel of the Transmitter (See Figure 2-2.)

Alternatively, use the optional Vehicle Mount Charger to recharge the battery while en route to or from a site. The Vehicle Mount Charge recharges at a rate of one to one - one hour of charging provides one hour of locating time.

The Transmitter battery requires about 14 hours to recharge fully.

If the Transmitter fails to operate, check the battery fuse:

Check the black fuse holder on the top panel of the 850 Transmitter to see if the fuse is blown. Replace it if necessary with a 250V 3Amp 3AG SLO/BLO fuse.

If the battery fails to recharge:

It should be replaced. Since the Transmitter battery is difficult to replace, Metrotech recommends that it be replaced by a Metrotech dealer or one of Metrotech's Service Centers. Please be advised that if your 850 Line Tracer is no longer under warranty, there will be a minimum service charge if you send it to a Service Center.

6.4 Metrotech Service Centers

Always store the Model 850 equipment and accessories in the carrying case when not in use. Do not leave equipment in direct sunlight for prolonged periods. The Model 850 is designed for rugged outdoor use, but rough handling should be avoided. Keep the equipment dry, clean 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, contact a Metrotech Service Center:

Metrotech West Coast Service Center
488 Tasman Drive
Sunnyvale, CA 94089
1-800-638-7682

Metrotech East Coast Service Center
1824 Murfreesboro Road
Suite 104
Nashville, TN 37217
1-800-624-6210

Seba Dynatronic - European Service Center
Mess-und Ortungstechnik GmbH
Industriestr. 6
D-96148 Baunach, Germany
49 9544-680

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WARRANTY

THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY, BEYOND THOSE STATED HEREIN.

Metrotech warrants its equipment to be free from defects in workmanship and material under normal and proper use and service for one year from date of purchase by original user. Metrotech assumes no obligation to repair or replace equipment which has been altered or repaired by other than a Metrotech-approved procedure, been subject to misuse, misapplication, improper maintenance, negligence, or accident; has had its serial number or any part there of altered, defaced or removed; or been used with parts other than those approved by Metrotech. Warranty does not include batteries. Expendable items such as fuses and lamps are excluded.

Any detection product proved defective under this warranty will be repaired or replaced free of charge at the Metrotech Corporation factory or approved Metrotech repair station. The equipment should be returned to our factory by prepaid transportation after requesting and receiving return authorization from our Service Department.

Metrotech's obligations are limited to repair or replacement of broken or defective parts which have not been abused, misused, altered, or accidentally damaged, or at the option of Metrotech, to refund of the purchase price. Metrotech assumes no liability for removal or installation costs, consequential damages, or contingent expenses of any other nature.