BURIED PIPE
&
CABLE LOCATION

(The Conductive Method)

With the Cable Hound DSP
by MetroTel Corp.

11640 Arbor Street Suite 100
Omaha, NE 68144

Ph: (402) 498-2964
Fax: (402) 493-5100

http://www.MetroTelCorp.com
Email: Info@MetroTelCorp.com

General

- This quick guide is intended to inform users on how to properly operate Cable/Pipe Locators.

- Users of Cable/Pipe Locators should familiarize themselves with the information contained in this quick guide before operating the unit. If operated as described, the Cable/Pipe Locator will prove to be a dependable and time saving tool.

- Cable/Pipe Locators are designed to locate and determine the depth of buried Cable/Pipes.

- Locating kits consists of a Transmitter, Receiver, Tone Probe and a Ground Rod.

- A Transmitter, when hooked up properly, will generate a locating tone on any conductive material such as telephone wire, coax or metallic pipe.

- A Receiver in conjunction with an inductive Tone Probe is used to detect the Locating Tones nulls (minimum or zero signal), which allows tracing of buried cable or metallic pipe.

Theory of Cable/Pipe Locating

- Transmitters - Transmitters are used to energize a metallic line (Cable or Pipe) with a Locating Tone by direct conductive connection to the metallic line. One lead of the Transmitter is connected to the metallic line. The other lead is connected to Earth Ground and must be perpendicular to the line and as far from the line as possible. This creates a closed circuit, which allows current to flow. This current through the metallic line produces a magnetic field. This magnetic field forms a cylindrical shape around the metallic line and is called the 'signal'. This magnetic field is produced by current flowing and not by voltage.

- Effects of Capacitance – The definition of a capacitor is an electric element having two conducting surfaces, separated by an insulating material and having the capacity to store a charge. A buried conductor is obviously one of the conducting surfaces. Although each particle of soil, sand or rock seems to

have a high resistance, there is so much of it that the ground acts as if there is a conducting layer around the conductor, and so the conductor charges up relative to earth ground. Because a large area of ground is needed to produce this effect, the buried conductor behaves as if it has a string of small capacitors along it, as shown in FIGURE 1.

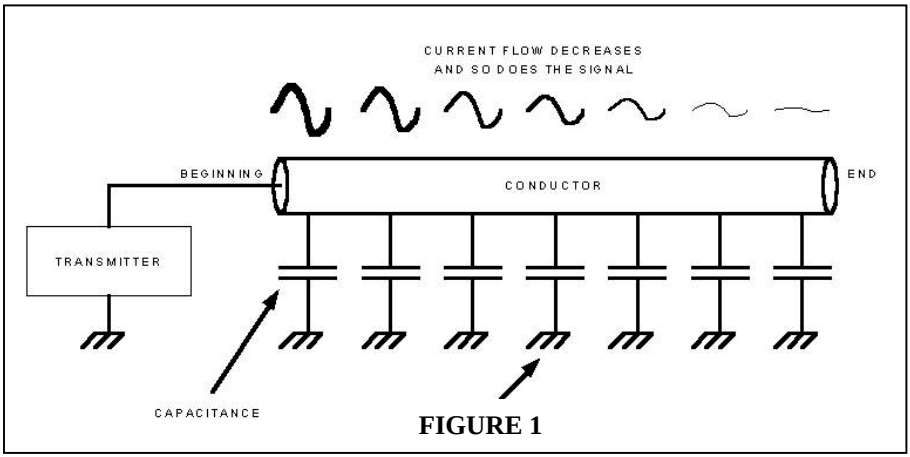


FIGURE 1

So, if an A.C. signal is applied to the buried conductor at one end, current will flow out, decreasing in magnitude (with increase in distance) as more and more leaks away. The higher the capacitance of the conductor, the greater will be the current flow. The higher the current flow the greater the signal strength, which also causes the signal to lose its strength quicker. Capacitance increases with conductor surface area, and therefore the larger the conductor or pipe, the shorter the distance the signal will be carried.

- Earth Ground Conductivity – The ability of the ground to pass current will vary locally. Clearly, wet soil is a better conductor than dry soil. The effect of good ground conductivity allows current to flow easier, and therefore, a Locating Tone in a buried metallic line is stronger, because of the good return path.

- Locating Tone Frequency – The Locating Tone Frequency is an important factor for effective tracing of metallic lines. There is no single Frequency that covers all conditions. A low frequency such as 577Hz is most useful for tracing metallic

lines over long distances. This low frequency does not couple easily to adjacent or unwanted lines. Frequencies in the 2kHz to 8kHz range are the most useful general-purpose Locating Tone frequencies. This band of frequencies is high enough to generate relatively strong magnetic fields and limits coupling to adjacent or unwanted lines, and is ideally suited for use in congested areas. A 33kHz frequency generates very strong magnetic fields around metallic lines, but it couples more easily to adjacent or unwanted lines and loses its strength over longer distances. This frequency works well for shorter distances. The higher the frequency the greater the current flow, which results in a stronger magnetic fields and/or Locating Tone.

- Nulls in the Locating Tone – A Null in the Locating Tone are minimum or no signal detected by the receiver. This occurs directly over the metallic line, and therefore what is followed when tracing a metallic line.

- The Tone Probe, used with the Receiver, has several thousand turns of wire on a ferrite core. When oriented in any direction except directly pointed at the cable/pipe, the ferrite core conducts the magnetic field through the coil of wire, causing an AC voltage with the transmitted frequency to be induced into the receiver. The Receiver picks up only the distinctive transmitted signal by filtering out electric noise and static.

Setup for Locating Cables

- **Transmitter** - Two connection procedures are illustrated in FIGURES 2 & 3 for the Transmitter. The normal connection procedure usually provides adequate output Tone and requires minimum setup time. If the Tone strength is low, a longer ground rod may be substituted for that supplied with the Cable/Pipe Locator. Often, the alternate connection procedure will provide increased output in areas where the normal connection procedure proves inadequate. With either connection procedure, terminating the far end of the cable to Earth Ground will increase current flow, which ultimately increases Tone output.

- **Normal Connection** – Shown in **FIGURE 2**

1. Connect either clip lead from the transmitter to the cable shield at the pedestal.
2. Determine general cable direction and insert ground rod into the ground approximately 15 feet from the pedestal at right angles to the cable route.
3. Connect the remaining transmitter clip lead to the ground rod.
4. Turn the Transmitter on.

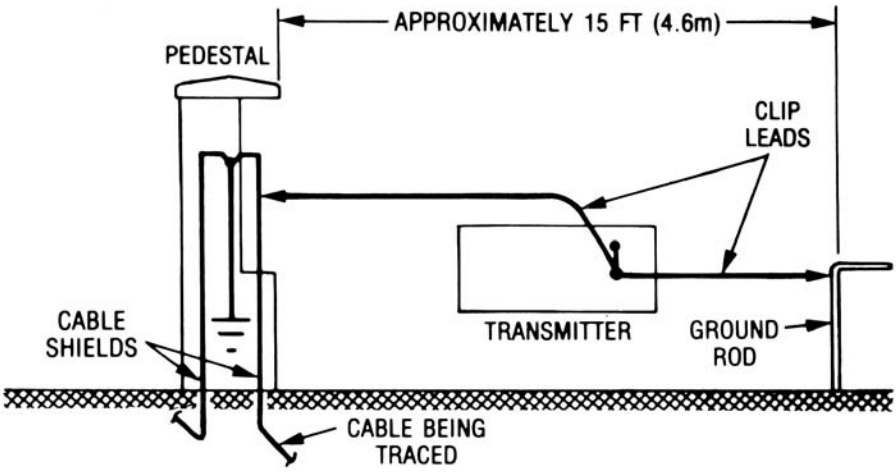


FIGURE 2

- **Alternate Connection** – Shown in **FIGURE 3**

    1. Disconnect one (or both) cable shield(s) from the pedestal ground lug.
    2. Break shield continuity to obtain two shield leads if step 1 has not already accomplished this.
    3. Connect one Transmitter clip to each shield.
    4. Turn the Transmitter on.

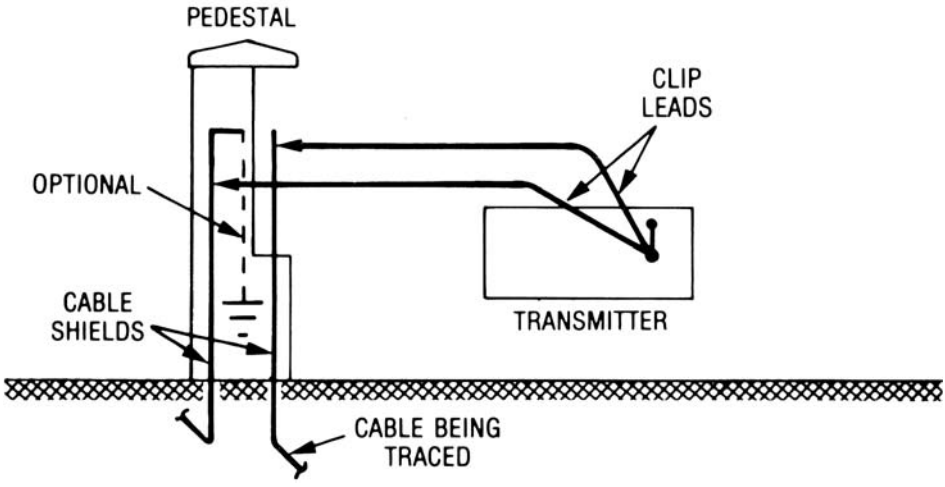


FIGURE 3

Setup for Locating Metallic Pipes

- **Normal Connection** – In most situations, the pipe will have some kind of insulation or coating around it, insulating it from the ground. In those cases the normal connection shown in **FIGURE 4** should be used.

    1. Connect either clip lead from the transmitter to the Metallic Pipe.
    2. Determine pipe direction and insert ground rod into the ground as far as possible from the pipe at right angles to the pipe route.
    3. Connect the remaining transmitter clip lead to the ground rod.
    4. If possible, terminating the far end of the pipe to Earth Ground will increase current flow, which ultimately increases Tone output.
    5. Turn the Transmitter on.

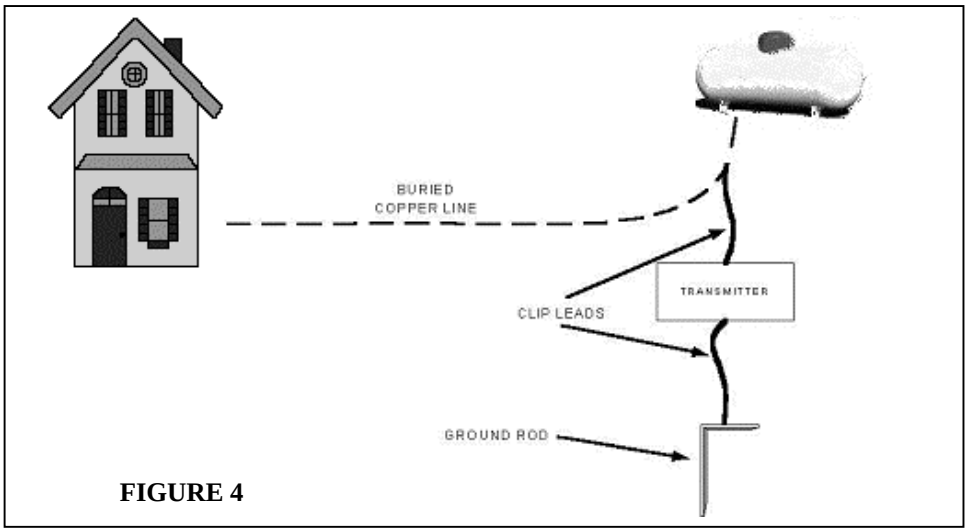


FIGURE 4

- **Pilot Wire Connection** - In some cases, bare copper tubing or pipe is used (i.e. LP Gas). In these situations, the Pilot Wire Connection method, which provides a strong signal for locating, is recommended and shown in **FIGURE 5**.

    1. Connect either clip lead from the transmitter to the Metallic Pipe.
    2. Determine pipe route and connect other clip lead to a pilot wire. The pilot wire can be any insulated metallic wire of any gauge.
    3. Run the pilot wire out approximately 50' at a right angle to the pipe route.
    4. Continue with this pilot wire parallel to the pipe route, keeping it roughly 50' away to avoid magnetic field overlap.
    5. Run the pilot wire to the far end of the pipe and make a direct connection to the pipe to create a continuous loop.
    6. Turn the Transmitter on.

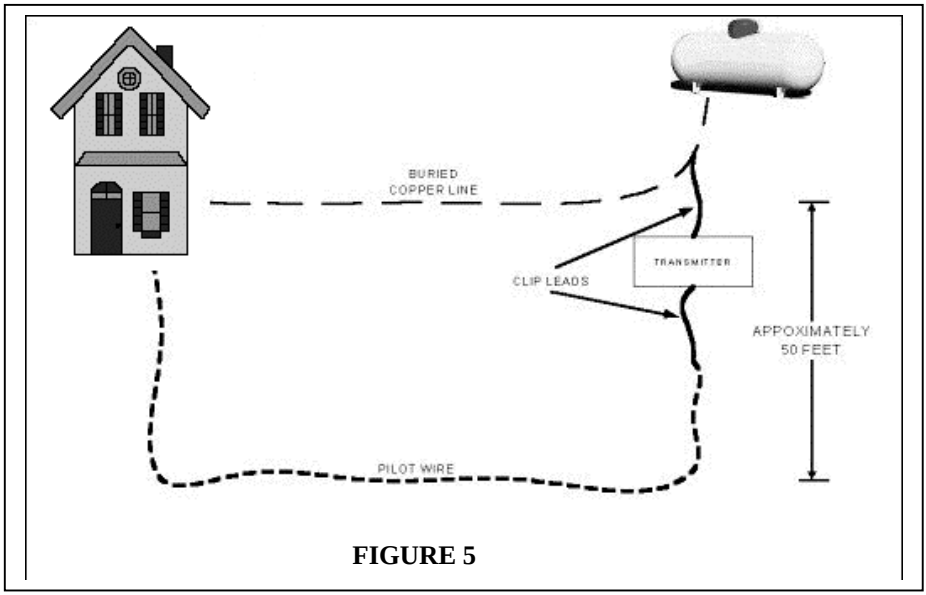
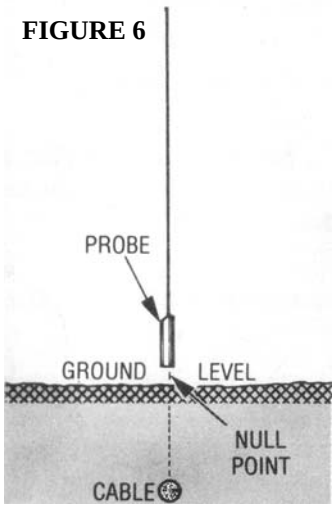


FIGURE 5

Detecting the Nulls in the Locating Tone

- A Null in the Locating Tone is when the Tone is at its minimum.
- The Null point is found directly above the cable or pipe.
- Sway the Tone Probe back and forth close to the ground in a pendulum motion until the Probe is in a null position.
- Mark this point. The Cable/Pipe is directly below. See **FIGURE 6**.
- Following the Null in the locating tone allows tracing the route of the buried Cable or Pipe.

FIGURE 6



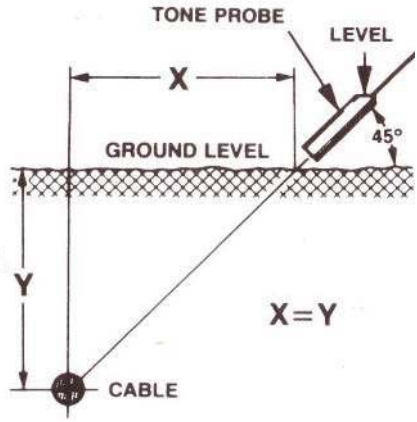


FIGURE 7

Determining Cable/Pipe Depth

- Once the path of the Cable/Pipe has been marked, hold the probe at a 45° angle (use the bubble level) near ground level.

- Move away from the original null position at right angles to the cable route.

- When the tone nulls out again, the distance between the original and new null position is the same as the cable depth. See **FIGURE 7.**

Troubleshooting Locating Problems

- Weak or no Tone – Make sure a good electrical connection is made. Contact surface may need sanding prior to connection.

- Weak Tone – A longer ground rod may need to be substituted for that supplied with the cable locator.

- No Tone – Check battery indicator and replace batteries if needed.

- Weak or no Tone – Ground Rod is not inserted all the way into the ground.

- Weak or no Tone – Ground Rod is not inserted 90 degrees from the cable/pipe route. Make sure the cable/pipe route is determined prior to inserting Ground Rod.

- Weak or no Tone – Ground Rod is not inserted far enough from cable/pipe route. Add additional insulated wire of any type or gauge to extend Ground Rod from cable/pipe route.

- Weak or no Tone – If the far end of the cable/pipe is accessible, terminate the far end to Earth Ground. This will provide a stronger return path, maximizing the signal.

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