

**TROUBLESHOOT BY REVIEWING FACTS AND CLUES****INVESTIGATE**

Gather information from Transmitter, Receiver, Site Conditions, and System Mapping. The settings and readings available to you by your transmitter and receiver will depend on the brand and model of locating instrument you have available.

**REVIEW WHAT YOU KNOW**

- ✓ Transmitter:
  - output current reading
  - applied power level/Volts
  - circuit/loop resistance/Ohms
  - frequency setting
  - method of signal application
  - placement of ground stake
- ✓ Receiver
  - Note the number and location of all signals detected on site while performing a signal sweep and search of the site.
  - Consider Detection Mode Setting \*Peak, Null, Directional, Single Peak
  - signal strength level at top dead center TDC of signal
  - directional indication of TDC, Left/Right Arrows or Directional Needle
  - sensitivity/gain setting
  - signal current level
  - orientation indication
- ✓ Target Line Characteristics
  - size of target line
  - is the targeted line conductive ?
  - does the targeted line have electrical continuity
  - normal depth of the target line
  - type of construction used to install target line
  - does the target line share a common ground with other lines
- ✓ Visual Site Survey
  - soil conditions
  - presence of other buried lines in the area
  - visible common bonding with other lines
  - topside metallic objects
- ✓ System Mapping
  - General area of line \*normally not drawn to scale
  - Off set measurements to line from a known point
  - Number of lines in the area
  - Physical make-up of the line
  - Proximity of splices, tees or turns depending on system.
  - Location of top side access point(s) to underground target line

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**PROBLEM LOCATES****PG. 3 UNABLE TO LOCATE SIGNAL****PG. 4 INSUFFICIENT SIGNAL CURRENT mA (low or no signal current produced)****PG. 5 SIGNAL INTERFERENCE FROM POWER LINES OR METAL STRUCTURES****PG. 3 MULTIPLE SIGNALS DETECTED**

**Problem Locate: UNABLE TO LOCATE SIGNAL**

**Symptoms:** Transmitter indicates that a good signal is being produced but you are unable to locate and trace the signal with your receiver.

Probable Cause:	Corrective Actions:
Transmitter or Receiver Settings	<ul style="list-style-type: none"> <li>✓ Confirm the frequency selected on your receiver is the same as the frequency as the one you chose at your transmitter.</li> <li>✓ Increase sensitivity/gain and sweep again</li> <li>✓ Try a different frequency</li> <li>✓ Change signal reception mode and try again.</li> </ul>
Interfering signals near signal transmitter	<ul style="list-style-type: none"> <li>✓ Broaden Search Area. Move further away from the transmitter and perform a larger 360 sweep. Don't predetermine or assume the buried pathway of the line. Insure all possible pathways of the target line are covered during your signal search.</li> </ul>
Target line buried at excessive depth	<ul style="list-style-type: none"> <li>✓ Use direct connection method of signal application. Find or apply the best grounding possible on site and pour water to the ground stake.</li> <li>✓ Select a low frequency below 33 kHz.</li> <li>✓ Set your transmitter on high power output. Keep in mind that most 10watt transmitters on the market are only allowed to broadcast 10 watts on frequencies of 33kHz or less. Your goal is to generate the highest amount of current possible from the transmitter. The higher the current level produced on the line the deeper it can be detected and the further the signal will travel.</li> </ul>
"open circuit" Target line has a break in electrical continuity near the transmitter	<ul style="list-style-type: none"> <li>✓ Go to the far end of the cable, wire or pipe and apply a far end ground to give the current a direct path to ground.</li> <li>✓ Move transmitter to a new location beyond the locate area to transmit a signal back towards the open point.</li> </ul>

### **Problem Locate: INSUFFICIENT SIGNAL CURRENT mA (low signal or no signal current produced)**

**Symptom:** Transmitter meter shows that no signal current or very low level of current is being produced by the transmitter. For signal transmitters without meters or current indicators, the amount of signal being received will indicate if sufficient current is being produced.

Probable Causes:	Corrective Actions:
Poor Transmitter Connection	<ul style="list-style-type: none"> <li>✓ Check your direct connection point to insure metal to metal contact is being made between metal clip and target line. Move the connection clip back and forth on the connection point until a good metal to metal contact is made.</li> <li>✓ Remove rust or paint from the connection point if necessary.</li> <li>✓ Choose a different point of connection to the target line.</li> <li>✓ *For Tracer Wire: strip back wire coating to a clean and corrosion free part of the wire and re-connect the clip.</li> </ul>
Poor Grounding Conditions	<ul style="list-style-type: none"> <li>✓ Improve grounding conditions.</li> <li>✓ Insure you have a good ground connection between the transmitter lead and temporary ground stake.</li> <li>✓ Poor water in the hole made by the ground stake and reset ground stake in the hole, deeper if possible.</li> <li>✓ Try using a better grounding source like a shovel, probe bar, nearby metal sign post or multiple ground stakes attached by a jumper lead. The more metal to earth contact made by your ground source the better the chances of generating a good signal.</li> </ul>
Transmitter Settings or Application	<ul style="list-style-type: none"> <li>✓ Increase power output level</li> <li>✓ Set Transmitter and Receiver Frequency to a higher frequency and try again. *caution, higher frequencies increases your chance for signal bleed-off creating multiple signals which can interfere with your locate. If a more conductive line is buried near your target line it can steal your high frequency signal.</li> <li>✓ Change method of signal application. If direct connection is not working try inductive ring clamp or inductive broadcast.</li> </ul>
Broken direct connection leads (no signal)	<ul style="list-style-type: none"> <li>✓ Check leads by connecting clips together and check the output meter to verify high current levels are achieved.</li> <li>✓ For transmitters without an audio or visual indication of current level, connect leads together and lay them in a circle of the ground and use receiver over the wires to determine if signal is present. If leads are broken you will need to replace or repair the leads. A break in the connection leads normally occur at the connection point between wire and metal clip.</li> </ul>
Non Conductive Line: Target line may not conductive even though the top side access point is metallic. (can't find tracer wire at surface)	<ul style="list-style-type: none"> <li>✓ Check available records or local resources to make sure line is conductive</li> <li>✓ Try exploratory excavation using safe methods. This includes hand tools, vacuum excavation technology or safe probing.</li> <li>✓ Find another connection point</li> <li>✓ If records or research indicate a non-conductive line is buried with a tracer wire, safely hand excavate around the point where the pipe enters the ground. Often times tracer wires are cut off at ground level.</li> </ul>

### **Problem Locate: SIGNAL INTERFERENCE FROM POWER LINES OR METAL STRUCTURES**

**Symptoms:** This often happens in areas with a lot of electrical activity. Signal interference is identified by one or more of these systems. Ghost signals beneath overhead power lines, Signal strength reading is jumpy, pulsing signal and or providing an erroneous depth measurement. **TIP:** Setup transmitter outside the area of interference.

Probable Cause:	Corrective Actions:
Equipment Settings	<ul style="list-style-type: none"> <li>✓ Set receiver to Twin Peak reception mode if possible. There are 2 reception coils or aerials activated in this mode. The upper aerial is placed at a known point above lower sensor located near the ground and acts as a filter when it detects stronger signals coming from lines above the receiver. The receiver will only acknowledge signals that come in stronger at the bottom aerial and filters signals it detects from above.</li> <li>✓ Check ground, *do not ground to the wire on the side of a utility pole or any ground wire with other wires attached to it.</li> <li>✓ Try a different Frequency and try again. Choose an odd number frequency if available on your transmitter. The ambient background noise created by electrical activity in the area causes interference to certain signal frequencies. There is an optimum frequency choice for any given locate scenario.</li> </ul>
Signal interference caused by a fence or guardrail.	<ul style="list-style-type: none"> <li>✓ If near a fence or guardrail, set the receiver to peak mode and lift receiver to a height where the bottom of the receiver is at a point that is about half the height of the fence or guardrail. This should shield the interfering signal coming from the fence or guardrail.</li> </ul>

### Problem Locate: **MULTIPLE SIGNALS DETECTED**

**Symptoms:** Multiple signals detected on site during your target signal search. Some signals are defined some are faint. My meter reads signal peak but my directional indicators. TIP: Multiple signals can cause the locating technician to choose the wrong signal as the target line. Never assume that the line you are directly connected to will be the only line carrying your signal.

Probable Cause:	Corrective Actions:
Suggestions for identifying target line when multiple signals are present.	<ul style="list-style-type: none"> <li>✓ Utilize your receiver's current reading option and take a current measurement over each signal. In theory the signal with the greatest current level, measured in milliamps, should be your target line.</li> <li>✓ Change transmitter and receiver frequency to your available current direction frequency. The signal that has the arrow pointing away from the transmitter should be your target line.</li> <li>✓ Trace the signals out to see where they go.</li> </ul>
Temporary ground stake placed over adjacent line	<ul style="list-style-type: none"> <li>✓ Insure you are using an independent ground stake.</li> <li>✓ Move the location of your independent ground stake. Placing over an adjacent line can create an unwanted signal on the adjacent line.</li> </ul>
Signal frequency setting	<ul style="list-style-type: none"> <li>✓ Change to a different frequency and compare results. Reasoning: Higher frequency signals will bleed-off to nearby lines which then re-broadcast a weaker signal with lower current levels. In areas of common bonded lines, unwanted signals are produced on unwanted conductors that are directly attached to your target line. Sometimes the signal strength of the unwanted signals created by common bonding can be reduced by increasing the signal frequency. Try both and compare results.</li> </ul>
Other utilities lines in the area are sharing a common ground or bond.	<ul style="list-style-type: none"> <li>✓ Isolate your target line from any common bond if you can do it safely and have permission from the utility owner and your employer. *for safety reasons never disconnect the ground wire on any electric line.</li> </ul>

## NOTES: