



## **THE ARROW<sup>™</sup>**

### **UTILITY SAFETY TOOL**



**OPERATION MANUAL**  
**OCTOBER 1998**

Part#: 10078  
Price: \$5.00



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**"WHAT ARE THE  
CONTROLS ON  
THE ARROW™ FOR?"**

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**1 ON/OFF** - Squeeze & hold the deadman switch to turn the ARROW™ on. Continuous pressure is needed to maintain power.

**2 GAIN CONTROL** - Used to pinpoint the line. Increase gain if signal is weak; decrease if signal is strong. 

**3 FREQUENCY SWITCH**

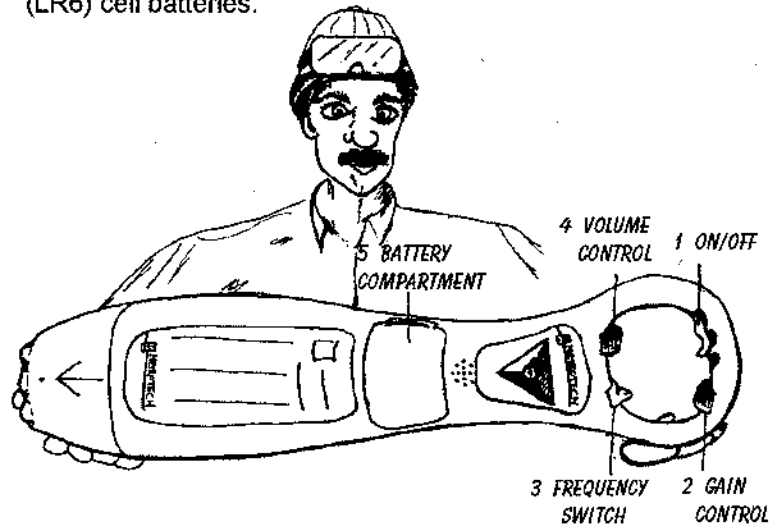
 **RADIO** - Detects re-radiated radio signals if present on buried lines.

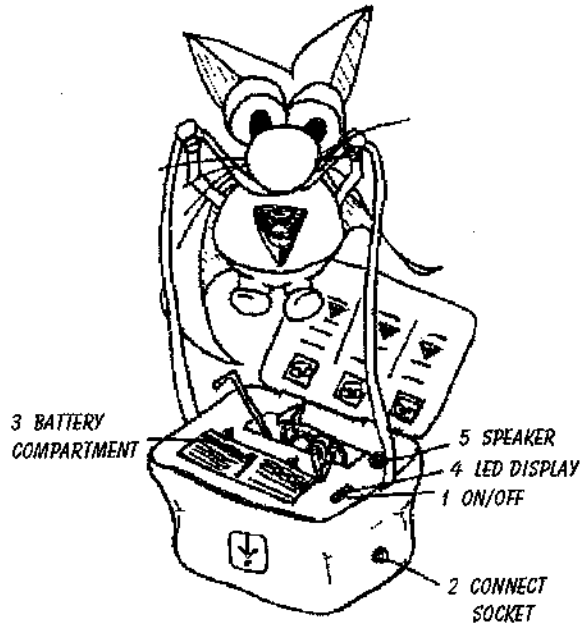
 **ACTIVE** - Detects lines radiating the activated transmitter signal.

 **POWER** - Detects 50/60Hz present on many lines.

**4 VOLUME CONTROL** - Adjust volume as necessary.

**5 BATTERY COMPARTMENT** - Open the access cover to replace 10 AA (LR6) cell batteries.





**"WHAT ARE THE CONTROLS ON  
THE TRANSMITTER FOR?"**

1 ON/OFF - When the On/Off button is pressed, an induction signal is radiated.

2 CONNECT SOCKET - Direct connection clips & Inductive clamps are connected here, located on the side of the transmitter.

3 BATTERY COMPARTMENT - Open the access cover to replace 6 D(LR20) cell batteries. Use the line to help orient the Transmitter for inductive locating.

4 LED DISPLAY - Replace batteries when the LED flashes 6 times followed by 6 audible pulses. If batteries are low, the LED flashes continuously and a low-pitched tone is heard.

5 SPEAKER - When Transmitter's first turned on, you hear a rapid, high pitched tone. When using the direct connect method, a tone change indicates the quality of your connection - the lower the pitch, the better your connection; the higher the pitch, the poorer your connection.

**"BEFORE I BEGIN MY LOCATE,  
HOW DO I TEST MY EQUIPMENT TO  
MAKE SURE IT'S OPERATING PROPERLY?"**

1. Find a site free of interference from buried cables, overhead lines, structural steel, etc.. Choose a known line at your test site. This will become your benchmark for measurement accuracy. Choose:

- A utility approximately 3 feet in depth
- A utility with an access point for direct connection
- Establish the signal and depth of this line
- Mark the site for future reference
- Use the information gained from this line for instrument test comparison

2. Be sure and check your batteries - on both Transmitter and Receiver. If battery power is low, replace them.

3. Check operating features:

**Signal Strength (Receiver)**

Apply a signal onto your line. Turn the ARROW™ ON. Move the ARROW™ back and forth over your line. Listen for your known signal.

**Direct Connect Leads**

Check for loose or broken wire. With the Transmitter OFF, plug the direct connect leads into the Transmitter and attach them to each other. Turn both the Transmitter and ARROW™ ON. Note the signal strength. Pull on the wires near the attachment points (clip and jack). Signal fluctuation indicates loose or broken wires.

## **"HOW DOES THE ARROW™ WORK?"**

The ARROW™ detects three types of signals, and will respond when it is over a line carrying one of the following:



**RADIO** signal - these are electronic noise signals that go deep into the soil and are re-radiated onto buried lines.



**ACTIVE** signal - this is a specific signal that is placed onto the line by the Transmitter using direct connect (clips), indirect (clamp), or induction (transmitter box) methods.



**POWER** signal - this is the frequency of alternating electrical current that can be found on many lines, especially loaded electric power cables.



## "HOW DO I USE THE ARROW™?"

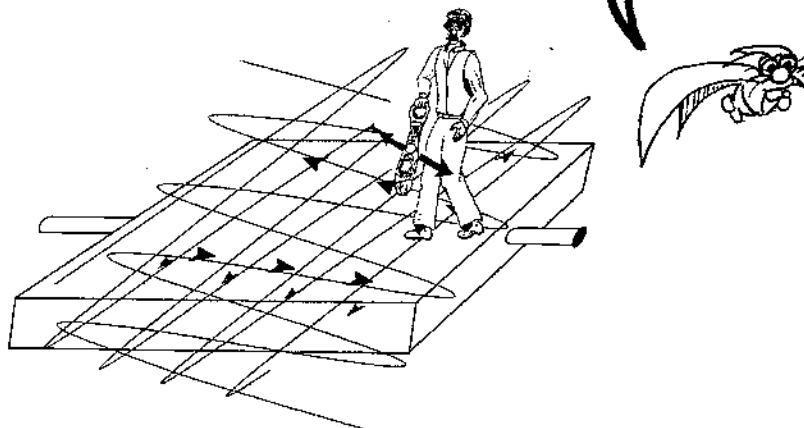
### BASIC INSTRUCTIONS

#### AREA SEARCH

Sweeping is useful when you have defined the general area where you expect your line is located.

1. Hold the ARROW™ upright, grasp the handle activating the deadman's switch. Continuous tone for one second means batteries are O.K. If batteries need to be replaced, the ARROW™ will shut down.
2. Turn the Frequency Switch  on the ARROW™ to Power  or Radio .
3. Rotate the gain control  to its maximum position.
4. Keeping the ARROW™ vertical, slowly move back and forth across and beyond the suspected area, sweeping in two directions. When a line is detected, adjust the gain for a more narrow response.

A SMOOTH  
HORIZONTAL MOTION WILL YIELD THE  
BEST RESULTS. TRY TO AVOID SWINGING THE  
ARROW™.



## BASIC INSTRUCTIONS

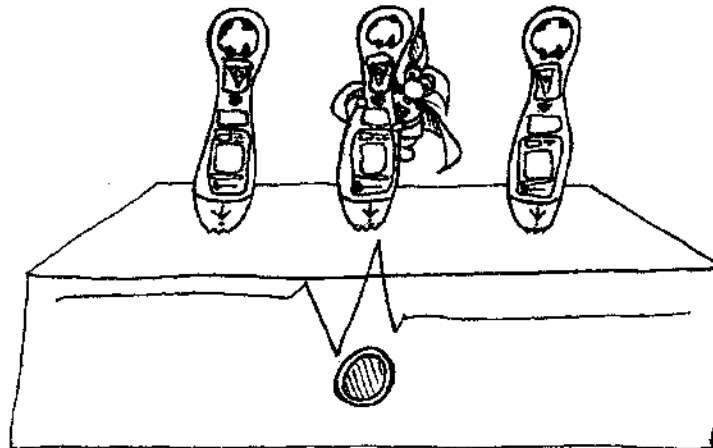
### TUNING & ADJUSTING

Use the tuning and adjusting technique to locate the exact position and direction of your line.

Set the ARROW™ to either Radio  or Power. 

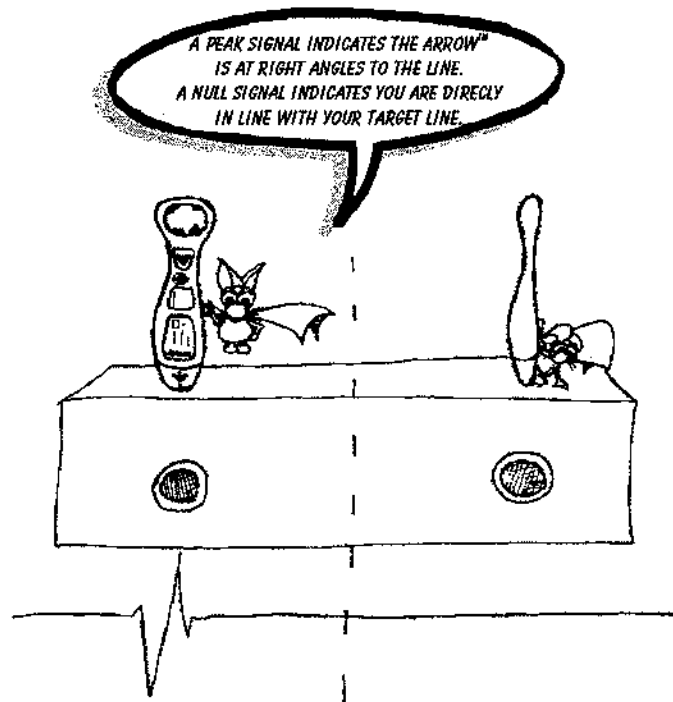
Keeping the ARROW™ vertical, find the center of the line by moving the ARROW™ back and forth over the line until the tone reaches its highest pitch.

FOR A CRISP, NARROW RESPONSE, ADJUST THE GAIN  
AS YOU MOVE THE ARROW BACK AND FORTH PERPENDICULARLY  
ACROSS THE LINE.



## TUNING & ADJUSTING

**Find the direction** of the line by rotating the ARROW™ in either direction over the line's center.



**Trace the line** by moving the ARROW™ side to side across the line as you walk forward, adjusting the gain  as necessary. Make sure the tone is heard when over the line, and not at either side of the line.

**Verify the identity of the line** by tracing the line back to a point where the line can be identified - terminals, valves, and junction boxes.

There are lines that do not radiate power signals. These lines can be located by turning the ARROW™ to Radio.  Listen for external radio signals which are re-radiated by the line.

## **"HOW DO I USE THE ARROW™ AND TRANSMITTER TOGETHER?"**

The following always applies when using the ARROW™ and Transmitter together.

1. Operating the ARROW™ in the Power  and Radio  modes indicates the position of the line. Verify your line's identity by applying a signal from the Transmitter, and then trace it with the ARROW™ in the Active mode. 
2. Check the battery by turning the Transmitter on. A low-pitched, rapid pulse tone means the batteries are low and need to be replaced. The transmitter will automatically shut down after 6 pulses/LED flashes when the batteries need replacing.
3. Use the Direct Connect (clips) mode wherever possible. This is the most accurate form of locating.
4. Apply the Transmitter signal (with clips, clamps or induction) at a place where you've verified the line's identity - a spigot, valve, terminal, etc...

**NOTE:** Never assume a buried line is straight. Trace the entire line to be certain.

Never assume the first response to a signal is the line to be traced. The Transmitter signal may transfer onto lines other than the one being traced. Always carry out a search in a circle around the Transmitter, noting the position of all lines leaving the circle. Reduce the gain  and repeat the search until the ARROW™ locates only the line carrying the applied signal.

## BASIC INSTRUCTIONS

## DIRECT CONNECT (CLIPS)

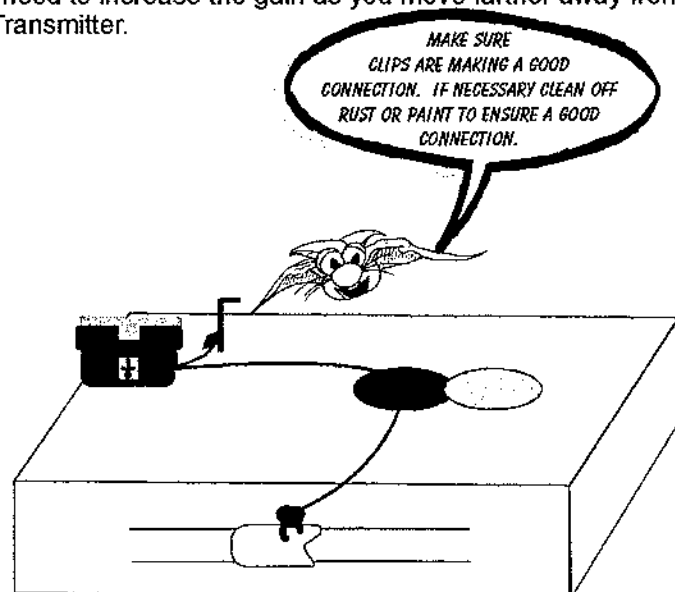
9

The Direct Connect method should be used whenever possible. This method permits you to see the utility you are connecting to and easily verify its identity.

To apply the signal, plug the direct connect lead into the socket on the side of the Transmitter. Attach the red lead directly to the line. Connect the black lead to a ground stake placed at least 1 meter or more away from and perpendicular to the probable line. Turn the Transmitter on. The Transmitter will emit a rapid, high pitched tone upon start-up. A tone change indicates the quality of your connection. The lower the pitch, the better your connection; the higher the pitch, the poorer your connection. If you have a poor connection, check the metal-to-metal contacts of the clips to the line and to the ground rod.

Trace the line using the ARROW™ in the Active mode. 

Adjust the gain control  for a more narrow response. You may need to increase the gain as you move farther away from the Transmitter.



## BASIC INSTRUCTIONS

## INDIRECT

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Indirect is a good way of placing the Transmitter signal on an energized or de-energized line. Please remember, when using the inductive clamp, the line **MUST BE GROUNDED AT BOTH ENDS**. (INDUCTIVE CLAMP)

**CAUTION:** There are potential dangers when connecting to power cables. If you are not qualified or certified to work in an energized cabinet, **DO NOT PROCEED**. Seek assistance from a qualified technician. A line that looks to be dangerous should not be touched, with or without an inductive clamp.

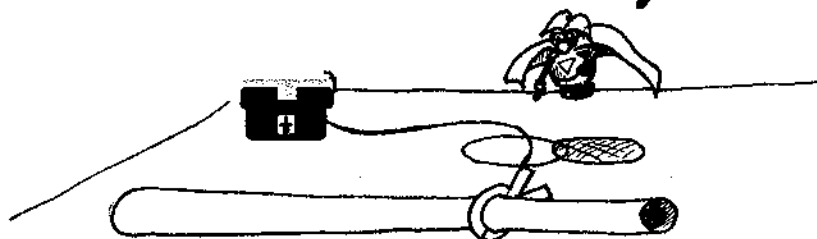
To apply the signal, plug the Clamp lead into the socket on the side of the Transmitter. Close the inductive clamp around a line that is grounded at both ends. Turn the Transmitter on.

**Please Remember:** When hooking to live power via an inductive clamp, be certain clamp is connected around the power line, not directly onto the power line.

The signal is induced onto the line through the inductive clamp, and follows its path to the ground.

You can now trace the line using the ARROW™ in the Active mode. 

YOU DO NOT  
NEED A GROUND CONNECTION WHEN  
USING THE INDUCTIVE CLAMP. THE LINE  
PROVIDES IT FOR YOU.



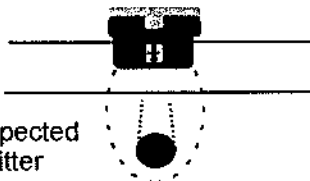
## BASIC INSTRUCTIONS

## INDUCTION

11

Induction is a convenient way of **(TRANSMITTER BOX)** applying the Transmitter signal to a line when direct or indirect modes are unavailable. **Please Note:** Direct connection will always result in more superior results.

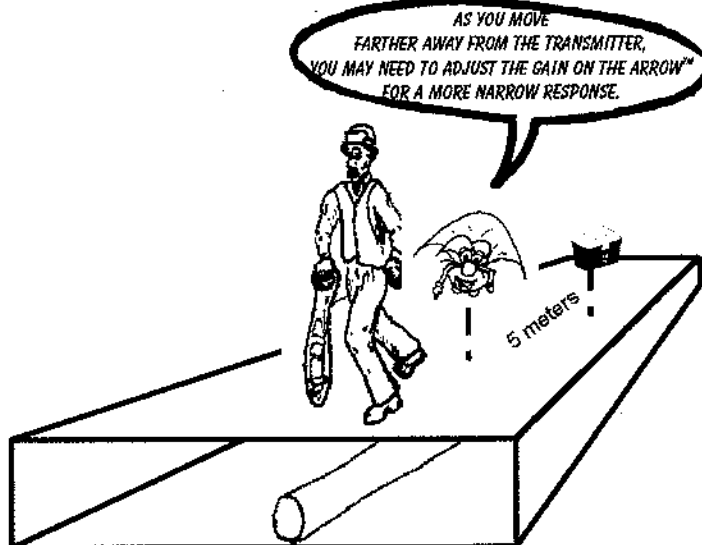
Place the Transmitter on the ground across the known path of the line. For correct Transmitter placement, use the marking on the battery cover and the arrow on the front of the Transmitter. Place these markings directly in line with the suspected route of the target line. The Transmitter radiates a locating signal onto the line.



Trace the line using the ARROW™ in the Active mode. 

Adjust the gain control  for the most precise response.

Always place the Transmitter at least 5 meters away from the ARROW™, otherwise the ARROW™ may pick up signals direct from the Transmitter instead of from the line.



**"WHAT TIPS CAN YOU RECOMMEND  
TO MAKE LOCATING WITH THE  
ARROW™ AND TRANSMITTER EASIER?"**

•Using the Direct Connect method,  
apply the Transmitter signal at a  
meter or spigot, and trace with the ARROW™

**LOCATING PIPES**

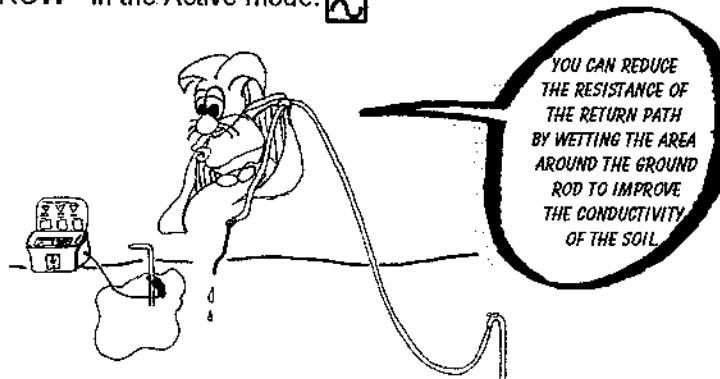
•Connect the Transmitter signal to a valve at the junction of the  
branch and main, and trace with the ARROW™

•To trace plastic, gas or water pipes, connect the Transmitter signal to  
the tracer wire. **Remember, when using tracer wire, the far end of  
the tracer wire must be grounded.** Or send the signal through the  
pipe by inserting the appropriate Sonde. An alternate method is to  
insert a snake or fishtape into the pipe, plug the direct connect lead  
into the Transmitter and connect it to one end of the snake or  
fishtape.

•Improve your ground by - increasing the surface area of the ground  
by using a larger ground stake or several linked together; use existing  
objects for your ground i.e. stop sign pole, metal fence, etc...

•Use the Inductive Clamp if the end of the line is grounded.

•If there is no access point to the line, carry out an ARROW™ search  
in the Power  and Radio  modes. If this fails to give any  
response, induce the Transmitter signal and trace the line with the  
ARROW™ in the Active mode. 



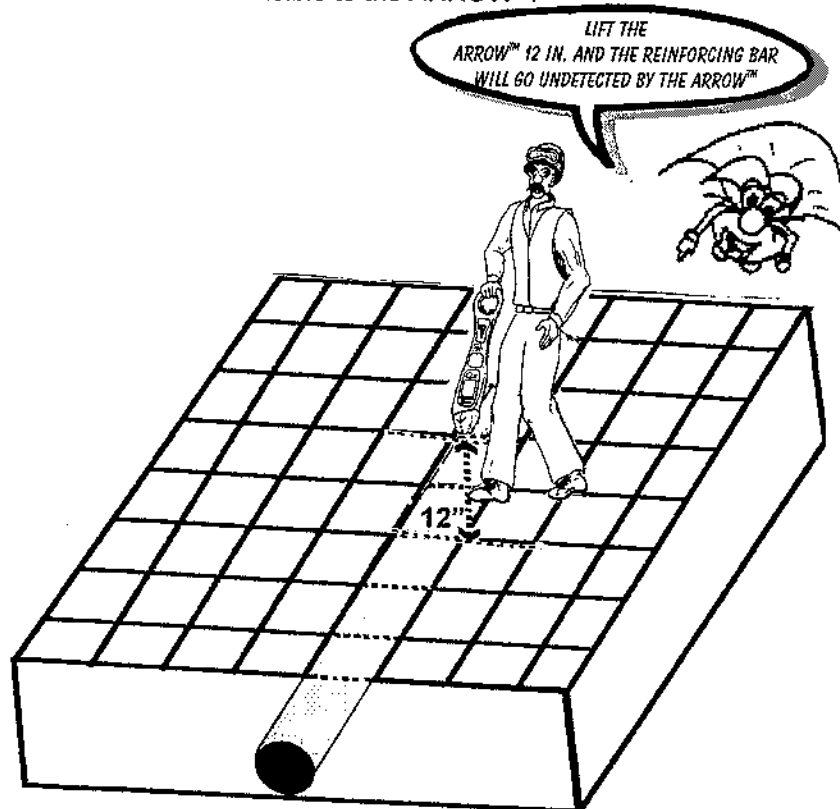
### PROCESS OF ELIMINATION

If it is not possible to identify the line being searched, carry out an ARROW™ search in the Power  and Radio  modes, marking the position of **all lines** located. Trace each one back to an above ground termination point where its identity can be verified - telecom, power, water, etc...

### WHEN CONCRETE REINFORCING BARS CAUSE INTERFERENCE

Any long piece of metal in the ground will re-radiate the Power,  Radio  and Transmitter  signals.

In the case of reinforcing bars (or lengths of discarded cable), the signals are undetectable at depths where lines are buried: 20+ inches. When near the surface, reinforcing bars are easily detected and form unwanted interference when tracing deeper lines. The solution is to lift the ARROW™ 12 inches above the ground. By doing so, the distance to the shallow reinforcing bars is increased, reducing their signal, and making them seem invisible to the ARROW™.

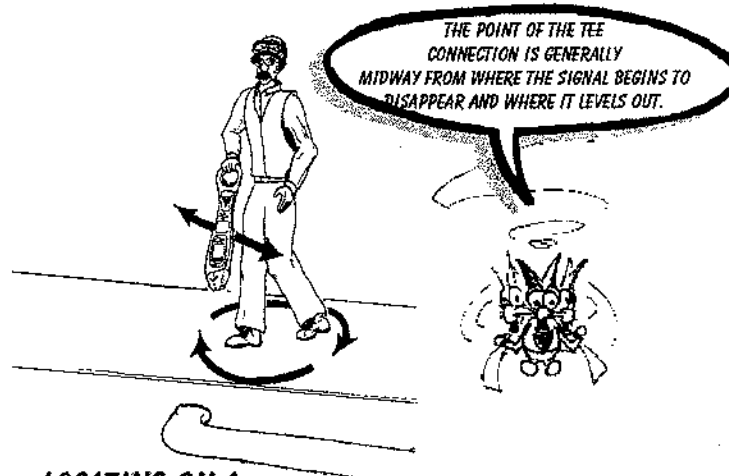


## LOCATING TEE CONNECTIONS

If, while tracing a line, the signal suddenly disappears, you may have located a tee connection or dead end.

To verify this, return to the point where your signal first disappeared. Stand in place, increase your gain and sweep from side to side as you slowly pivot your body. If you find a point where the signal strength returns, you've located a bend and can resume tracing in the new direction.

If you pivot all the way around (360°) and you still receive no signal, you've reached a dead end. Use visual cues to verify your information.



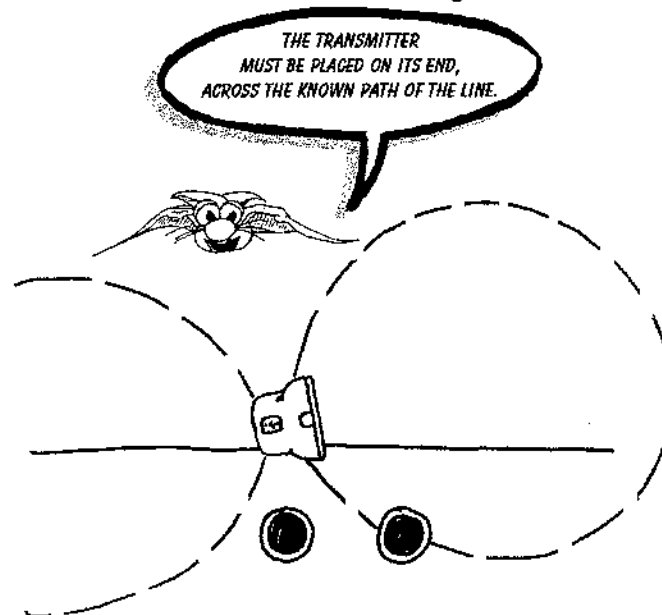
## LOCATING ON A GAS DISTRIBUTION SYSTEM

To locate short gas services on a gas distribution system, you should temporarily ground the end of the service. This can be accomplished by connecting a jumper cable to a ground spike where the pipe or tracer wire comes out of the earth. Be sure to remove the ground connection after completing the locate so as not to defeat the cathodic protection system.

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**WHEN LOCATING  
IN CONGESTED AREAS**

If you suspect coupling from adjacent conductors is causing interference in the signal picked up by the ARROW™, increase the strength of the signal placed on your line by any of the following:

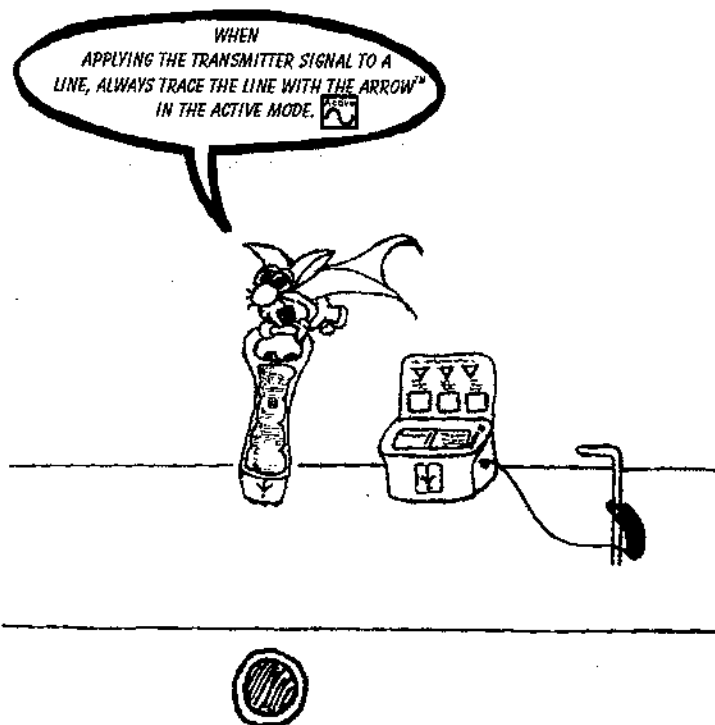
1. Change to a different connection point or connection mode.
2. Move the Transmitter to a less congested area.
3. Improve the ground connection or move the grounding point.
4. Determine the location of the interfering lines. Then check to be sure that neither the direct connect lead or the ground cable crosses over any of the interfering lines. Reposition them if necessary.
5. If you are using the induction mode, decrease the interfering signal by changing the position of the Transmitter. Find the location of the interfering line. Stand the Transmitter on its end (vertically) over the interfering line. This will reduce or eliminate the signal on this line.



Telephone, power and CATV  
sometimes use a common ground.  
If other lines are connected  
to your target line, placing a signal on the target can  
cause all the lines to carry the same signal. This makes it  
difficult to identify the target line.

**FOR COMMON  
BONDED CONDUCTORS**

To verify you are tracing the targeted line, note the tone strength at a known location of the line. As you trace, any change in the tone over the line should be gradual. If the signal **abruptly** changes, you are probably no longer over your target line.

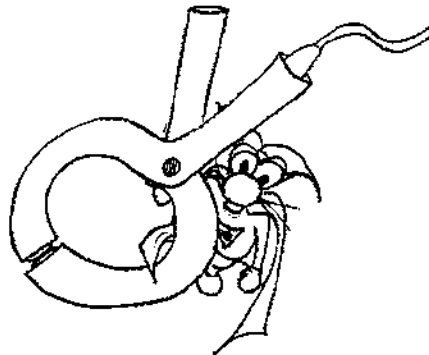


**"WHAT EQUIPMENT CAN I PURCHASE  
TO USE WITH THE ARROW™ AND  
TRANSMITTER?"**

In situations where direct connection is not effective, the Inductive Clamp safely applies the transmitter signal to a line of up to 76mm (4 in.) diameter.

**INDUCTIVE CLAMP**  
**P/N 4435**

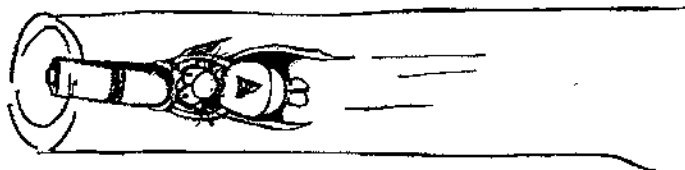
When a line is energized with an Inductive Clamp, all current runs through it, making it clearly identifiable as the line with the signal.



**SONDES**

SEE PART NUMBERS PAGE 19

Transmitting Sondes are small self-contained watertight transmitters for insertion into non-metallic pipes or ducts. The Sonde radiates a signal which can be located from the surface by the ARROW™.



**"WHO DO I CONTACT IF MY  
EQUIPMENT ISN'T FUNCTIONING  
PROPERLY?"**

Should your equipment begin to malfunction, check all batteries. If, after replacing all batteries, your equipment continues to malfunction, contact one of the Metrotech Customer Service departments listed below.

**Metrotech Worldwide Headquarters**

**Western United States Service Center**

488 Tasman Dr., Sunnyvale, CA 94089

Toll Free for U.S. And Canada only: 1-800-638-7682

International inquiries: Tel: 1-408-734-1400; Fax: 1-408-734-1415

e-mail: [service@metrotech.com](mailto:service@metrotech.com) internet: [www.metrotech.com](http://www.metrotech.com)

**Metrotech Eastern United States Service Center**

1824 Murfreesboro Rd., Ste. 104

Nashville, TN 37217

Tel: 1-800-624-6210

International inquiries Tel: 1-615-366-7323; Fax: 1-615-360-9855

e-mail: [service@metrotech.com](mailto:service@metrotech.com) internet: [www.metrotech.com](http://www.metrotech.com)

**Metrotech European Service Center**

Seba Dynatronic

Dr.-Herbert-lann-Str. 6

D-96148 Baunach, Germany

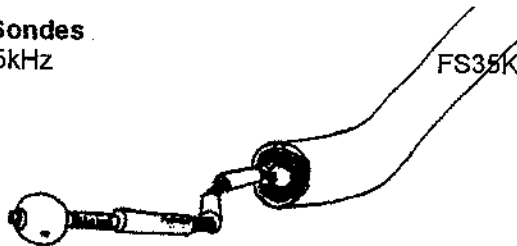
Tel: +49 09544-680; Fax: +49 09544-2273

e-mail: [service@sebadyn.de](mailto:service@sebadyn.de) internet: [www.sebadyn.de](http://www.sebadyn.de)

**PART NUMBERS TO ASSIST YOU  
WHEN ORDERING EQUIPMENT**

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|                                    |         |
|------------------------------------|---------|
| ARROW™                             | 10091   |
| Transmitter                        | 10094   |
| Inductive Clamp                    | 4435    |
| Direct Connection Lead             | 400B108 |
| Ground Stake                       | 500B128 |
| Ground Extender                    | 10089   |
| Transmitting Small Sondes<br>35kHz | SON350  |
| Flexi-Sondes<br>35kHz              | FS35K   |

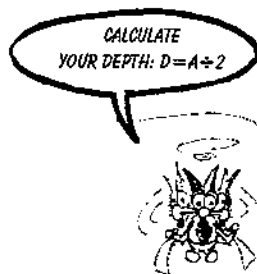


Metrotech also manufactures and develops high performance underground locator instruments for the telecommunications, water, gas, electric and cable television industries. Our product line includes Line Locators, Pipe and Cable Locators, Fiber Optic Line Locators, Cable Sheath Fault Locators, Magnetic Locators, 50/60Hz Detectors, Valve Box/Pedestal Locators, Water Leak Detectors, and a complete family of Sonde technology.

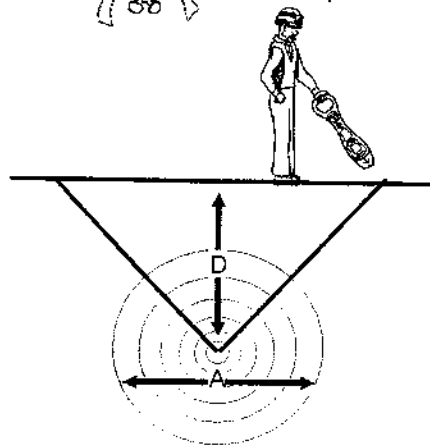
## LOCATING TERMS TO BE AWARE OF: 20

|                   |                                                                                     |
|-------------------|-------------------------------------------------------------------------------------|
| Active Signal     | A signal applied to the line with the Transmitter                                   |
| Line              | The metallic cable or pipe you are tracing                                          |
| Direct Connection | Application of an active signal onto a line using clips                             |
| Induction         | A signal radiated from the antenna inside the Transmitter and induced onto the line |

### Triangulation



The most accurate method of determining depth. After the center of the line is found, tilt the ARROW™ 45° away from the line. Adjust the gain until you reach the border between peak and null tones. While maintaining a 45° angle, move away from the line until your tone disappears. Mark the position and repeat on the other side.



## **LOCATING TERMS TO BE AWARE OF: 21**

Congested Area

An area where there are two or more lines buried close together.

Target Line

The line you are placing the Transmitter signal upon and is to be traced using the ARROW™

Gain

The ability of the ARROW™ to receive a signal - weaker signals can be detected by increasing the gain



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# **DISCLAIMER**

When connecting to live power via an inductive clamp, be certain clamp is connected around the power line, and not directly onto the power line. Please follow all your own company's safety standards, and all OSHA requirements.

There are no warranties, expressed or implied, including any warranty of merchantability beyond those stated herein.

# **WARRANTY**

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 thereof 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 factory or approved Metrotech service center. 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 the purchase price. Metrotech assumes no liability for removal or installation costs, consequential damages, or contingent expenses of any other nature.