LIMITED WARRANTY

Your AMPROBE PASAR instrument has a limited warranty against defective materials an/or workmanship for two years from date of purchase, provided in the opinion of the factory, the instrument has not been tampered with or taken apart. Should your instrument fail due to defective materials and/or workmanship during the two year period, return it along with a copy of your dated bill of sale which must identify your instrument by model number and serial number.

Above limited warranty covers repair and replacement of the instrument only and no other obligation is stated or implied. AMPROBE PASAR shall not be liable for any loss or damage arising out of the use or misuse of this product.

For your protection, please use this instrument as soon as possible. If the unit is damaged or is ever in need of repair, please call Pasar, Inc. at (303) 337-6300 to obtain a Return of Materials Authorization (RMA) number. The unit must then be securely wrapped to prevent further damage in transit, insured and sent along with a proof of purchase to:

AMPROBE PASAR
Service Division
2422 South Trenton Way
Denver, CO 80231

Outside of the U.S.A., your AMPROBE PASAR representative will assist you.

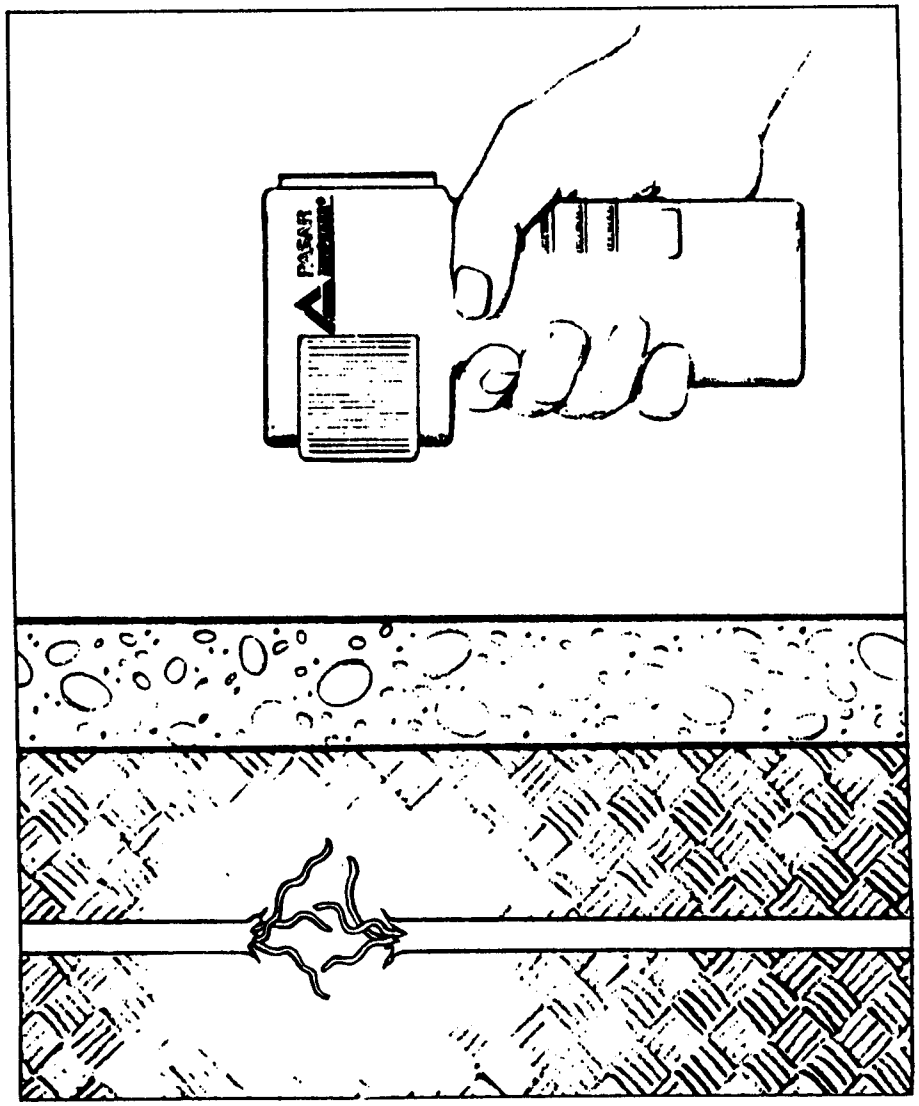
PASAR AMPROBE
DIVISION OF CORE INDUSTRIES INC. LYNBROOK NEW YORK 11563
630 MERRICK ROAD P.O. BOX 329

Made in USA
Patent Pending
#79-OT102-1
4/91

PASAR AMPROBE®

OT1000-A OPEN TRACER

INSTRUCTION MANUAL



INTRODUCTION

AMPROBE PASAR is dedicated to designing, manufacturing and marketing high quality, reliable instruments for the skilled professional. The AMPROBE PASAR Current Tracer has a history of providing safe, reliable operation in tracing energized wires, locating circuit breakers and locating wires shorted to ground. The AMPROBE PASAR Open Tracer complements the Current Tracer by adding the capability of tracing unenergized wires, locating open breakers and locating open wires. The Open Tracer and the Current Tracer together can solve a variety of problems faced daily by the professional.

Having confidence in an instrument is an important part of using the instrument. This is particularly true of an instrument designed to locate an open wire in a two acre parking lot, or one computer cable in a "rat's nest."

Invest time learning the operation of the Open Tracer to build confidence in the unit. Please read this manual carefully. Take the time to learn how the instrument operates. Test it in a variety of situations. You will soon have the confidence to use it on a daily basis to solve problems which were previously unsolvable.

TABLE OF CONTENTS

GENERAL INFORMATION

The Open Tracer consists of a Transmitter, a Probe, an Earphone and a Signal Return Cable (Fig. 1). Each has been engineered to be easy and safe to use, and to provide years of trouble free usage.

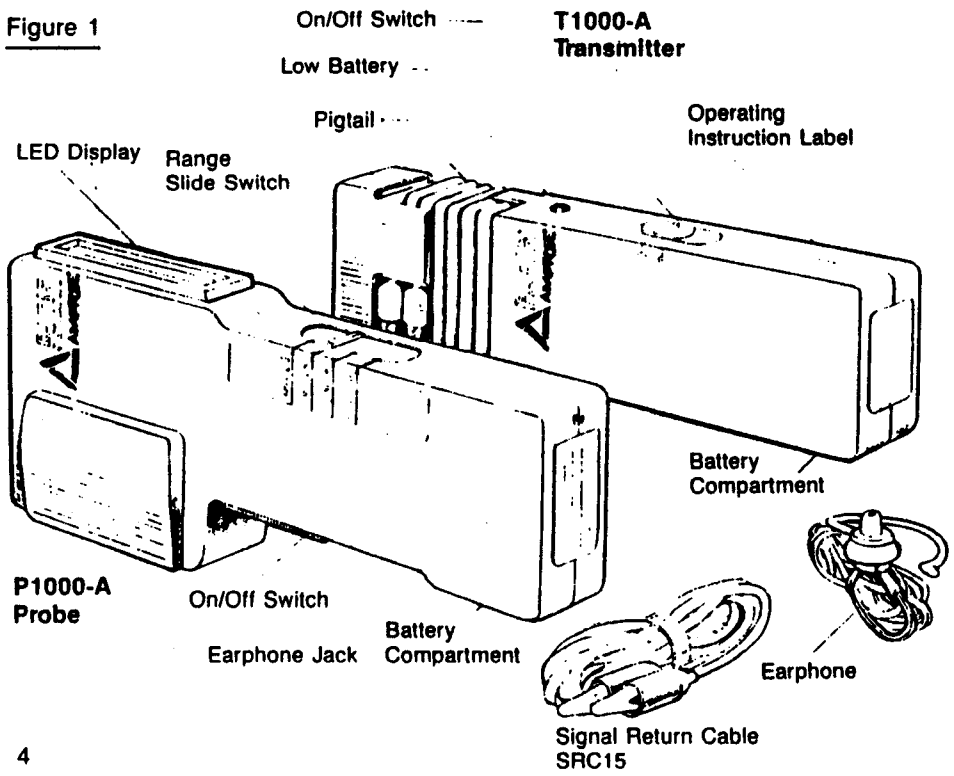
T1000-A Transmitter

The Transmitter is a crystal controlled device that puts a 455KHz signal modulated by a 1.77KHz tone on the wire to be identified. The Transmitter can drive a minimum of 1000 feet of wire.

Two leads marked by red and black insulation boots over the clips are used to attach the Transmitter to the wire or wires to be traced. Proper connection of the Transmitter is important and will be covered in the **Applications** section.

CAUTION: Do not use this instrument on energized lines.

Figure 1



P1000-A Probe

The Open Tracer P1000-A Probe utilitzes electrostatic and electromagnetic principles to detect the 455KHz signal modulated by a 1.77KHz tone produced by the Transmitter. The strength of the signal received is indicated visually and audibly by the Probe. A ten segment LED display is lit in sequence and the audible tone becomes increasingly louder as the Probe nears the conductor carrying the signal. Orientation of the Probe along the axis of the wire provides the highest LED indication (Fig. 2).

The Probe has four ranges to provide flexibility in locating opens and tracing wires.

1. **Short** -- Short Range is intended for such applicatons as identifying wires in a bundle or identifying an open circuit breaker. This range is typically up to 6 inches.*
2. **Medium** -- Medium Range is for use in the initial search process. This range is typically up to 36 inches.*
3. **Long** -- Long Range is also for use in the initial search process where more sensitivity is necessary. This range is typically up to 54 inches.*
4. **Extra Long** -- Extra Long Range has the most sensitivity and is least selective. This range is typically up to 72 inches.*

*These measurements are approximate and actual signal strength will depend upon specific application, grounding and loads on the line. If more or less gain is required, select appropriate range.

Low Battery Indication

The Transmitter has a red LED near the On/Off switch as a low battery indicator. The LED will light when the Transmitter is on and functioning properly. The LED will not light when the Transmitter is off or the battery needs replacing.

The Probe has a red LED on the signal display as a low battery indicator. The LED will light when the Probe is on and functioning properly. The LED will not light when the Probe is off or the battery needs replacing.

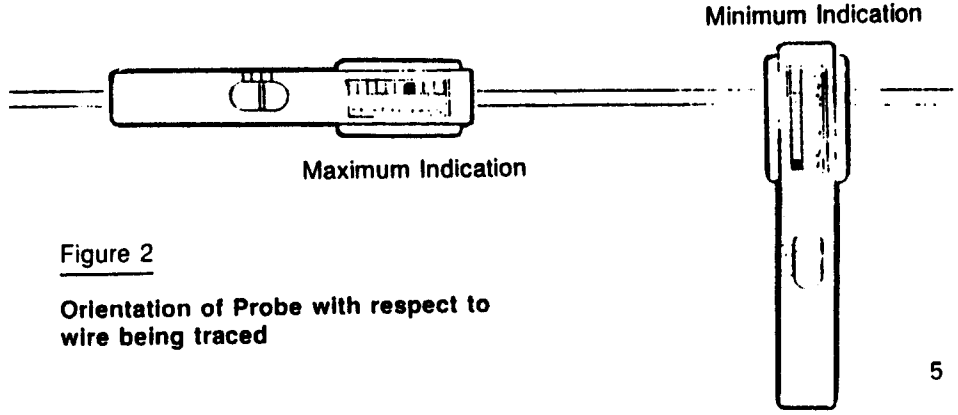
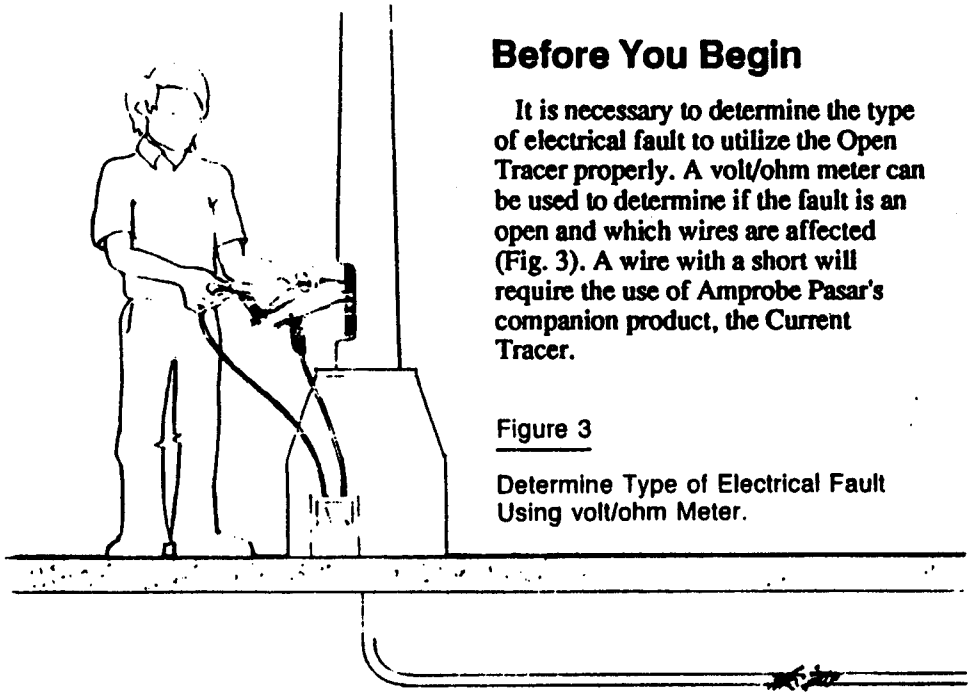


Figure 2

Orientation of Probe with respect to wire being traced

APPLICATIONS



Before You Begin

It is necessary to determine the type of electrical fault to utilize the Open Tracer properly. A volt/ohm meter can be used to determine if the fault is an open and which wires are affected (Fig. 3). A wire with a short will require the use of Amprobe Pasar's companion product, the Current Tracer.

Figure 3

Determine Type of Electrical Fault Using volt/ohm Meter.

Getting Started

Cable tracing is a process of elimination and needs to be approached patiently and systematically in order to achieve the best results. Take a few minutes to study pages 6, 7, and 8 to help you get started with the Open Tracer applications that follow.

Field Strength Created by Transmitter

Figure 4 illustrates the field around the wire being driven by the Transmitter. The cross section shows the strongest field directly over the buried cable. The strength of the field above the surface will vary with the distance to the cable.

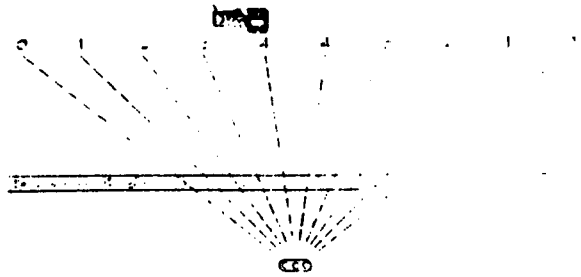


Figure 4

Field Strength Created By Transmitter

Buried Wires Cross Section

Probe's LED Response to Field Created by Transmitter

As the cable lies deeper in the soil, fewer of the Probe's LEDs will light, with a drop to zero where the cable is open or exceeds approximately 6 feet beneath the surface (Fig. 5).

Figure 6 illustrates the field created by the Transmitter at the end of an open wire as perceived by the Probe. It is important to note that the field does not terminate precisely at the end of the wire. Due to the "antenna effect" caused by the signal on the wire, the field will extend slightly beyond where the wire ends or is open. Take this into consideration while tracing, and slide the Probe's range switch to the position that most precisely indicates where the wire ends or the open is located.

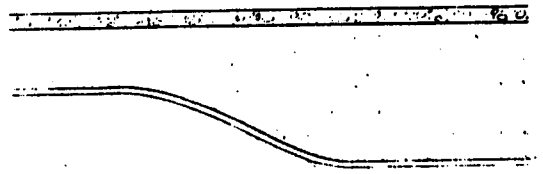
Keep in mind that ground conditions, such as dryness or dampness of the soil, or mineral content, for example, vary from location to location. These conditions may cause you to need to switch the Probe's range to more or less sensitivity in order to decide the direction in which to trace.

Remember that setting the Probe to maximum sensitivity is not always desirable. You may have to slide the range switch to a more selective gain level to narrow down the path of the cable you are tracing.

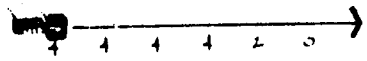
Constant Height

Figure 5

LED Strength of Probe

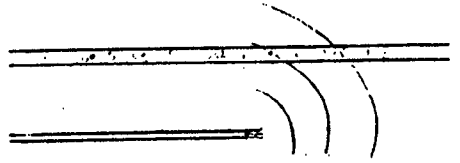


Wire Going Deeper Underground



Constant Height

Figure 6



Buried Wire (Long Section)

Systematic Method of Tracing

Think of an imaginary wagon wheel with a diameter of 12 to 20 feet (6 to 10 ft. radius), the Open Tracer Transmitter attached at the hub, and imaginary spokes radiating from the center (Fig. 7).

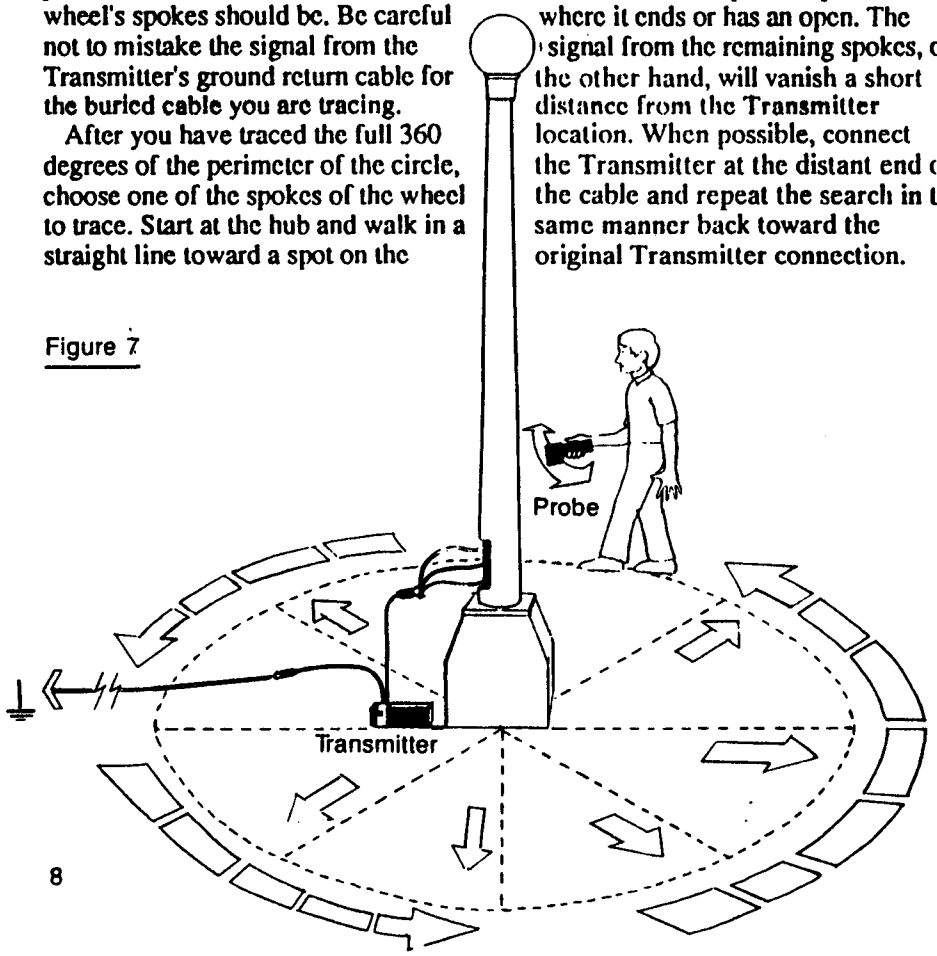
Holding the Probe horizontal to the surface being searched and at a constant height, walk the perimeter of the imaginary wheel. You will be approximately 6 to 10 feet away from the hub. Note the LED readings of the Probe and the locations at which they take place. The locations of the highest signal readings along the perimeter will determine where the wheel's spokes should be. Be careful not to mistake the signal from the Transmitter's ground return cable for the buried cable you are tracing.

After you have traced the full 360 degrees of the perimeter of the circle, choose one of the spokes of the wheel to trace. Start at the hub and walk in a straight line toward a spot on the perimeter where you previously noted that a high LED level (high signal strength) registered on your Probe.

As you walk, wave the Probe left to right at a constant height (without rotating it) from the surface you are tracing (Figs. 10 & 11). Mark the spot where signal is lost. Repeat this procedure with other "spokes" whose locations were chosen as a result of where you noted you received high signal strength along the circle's perimeter.

Normally, the Probe will receive LED readings in the direction along the true conductor up to the point where it ends or has an open. The signal from the remaining spokes, on the other hand, will vanish a short distance from the Transmitter location. When possible, connect the Transmitter at the distant end of the cable and repeat the search in the same manner back toward the original Transmitter connection.

Figure 7

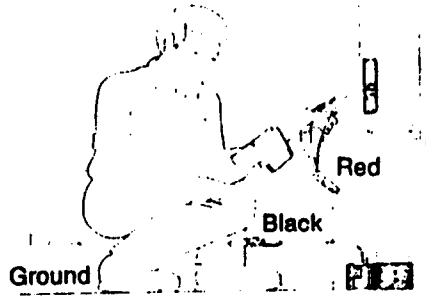


Locating Open Wires

1. Verify that the open wire is unenergized.
2. Connect the red clip from the Transmitter to the open wire or wires (Fig. 8).
3. Connect the black clip from the Transmitter to the remaining wires, and to the Signal Return Cable (15 foot black wire supplied).
4. Connect other end of Signal Return Cable to a remote, separate ground. (NOTE: Using a remote separate ground minimizes confusing readings caused by coupling of the 455KHz signal.) Turn Transmitter on.
5. Change the slide switch to the Medium Range. Use Long or Extra Long if Probe indicates less than 3 lights.
6. Hold the Probe 2-3 inches from the red clip and pull the On/Off trigger. The LED will move to the highest position accompanied by an audible tone indicating that the Probe and Transmitter are working properly.
7. Hold the Probe horizontal to the surface being searched at a constant height and scan the area (Fig. 9).

Figure 8

Connect lead with red clip to open wire(s). Connect lead with black clip to remote separate ground.



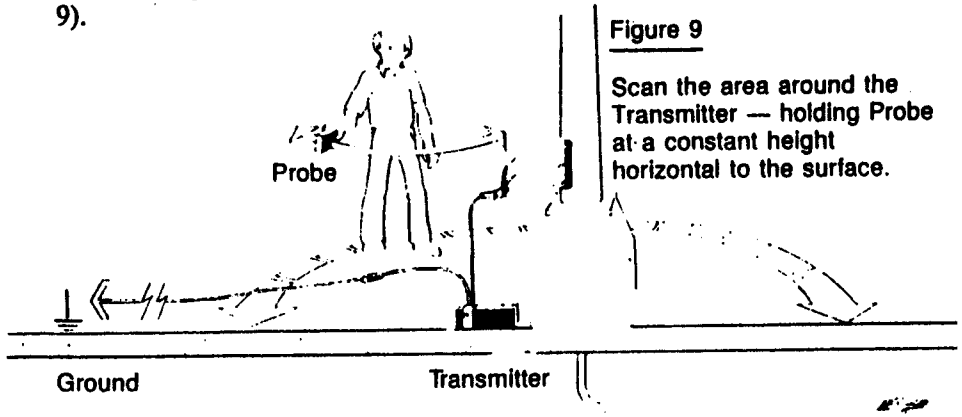
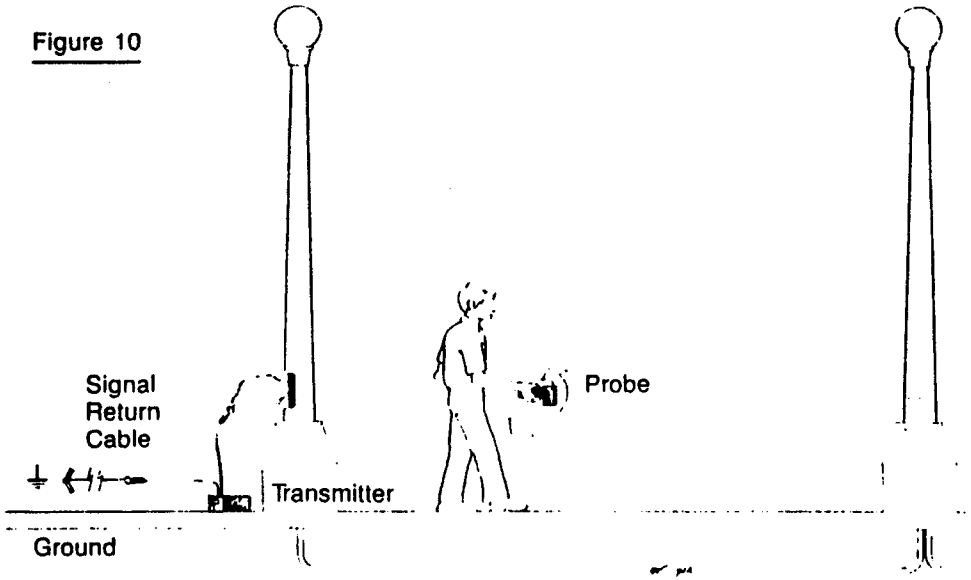


Figure 9

Scan the area around the Transmitter — holding Probe at a constant height horizontal to the surface.

Figure 10



Move in the direction of the strongest signal — mark the spot where the signal drops to zero.

8. Watch the LED display carefully for changes in signal strength. Move in the direction that provides the highest LED indication.

9. Hold the Probe at a constant height and scan from side to side. Always move in the direction that gives the highest LED indication (Fig. 10).

10. Change the slide switch as necessary to Long Range or Extra Long Range for the maximum sensitivity.

11. Mark the spot where the signal drops to zero. This indicates that the end of the open wire has been crossed.*

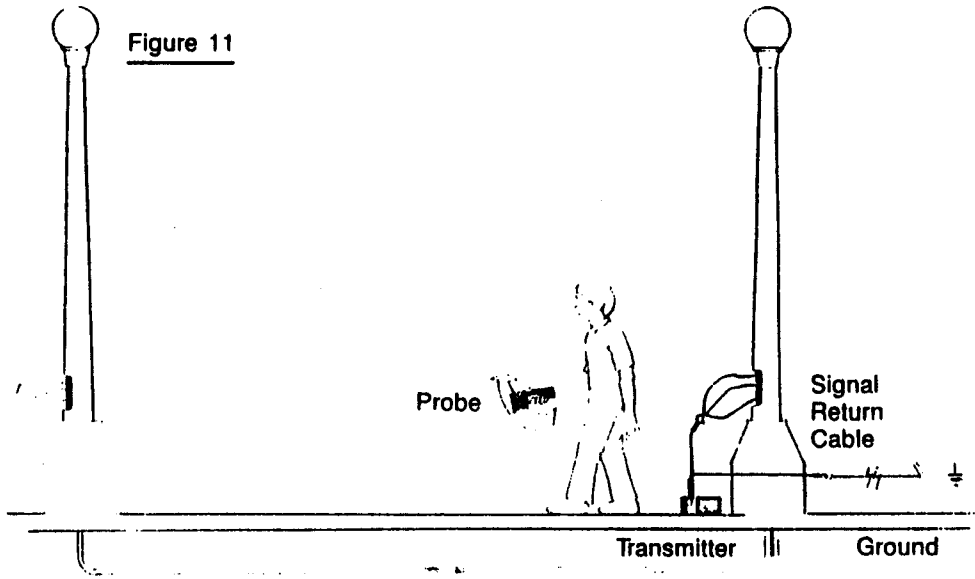
12. If possible, relocate the Transmitter to the opposite end of the open wire and trace the wire from the other end, again marking the spot where the signal is lost (Fig. 11). The signal should be lost near where the first spot is marked. The open will most likely be centered between the two spots (Fig. 12).

13. After beginning to dig, hold the Probe at a constant height from the bottom of the hole and move it around to pinpoint the location of the open (Fig. 12).

14. Change the slide switch to get the maximum selectivity. Continue to dig until the open wire is located.

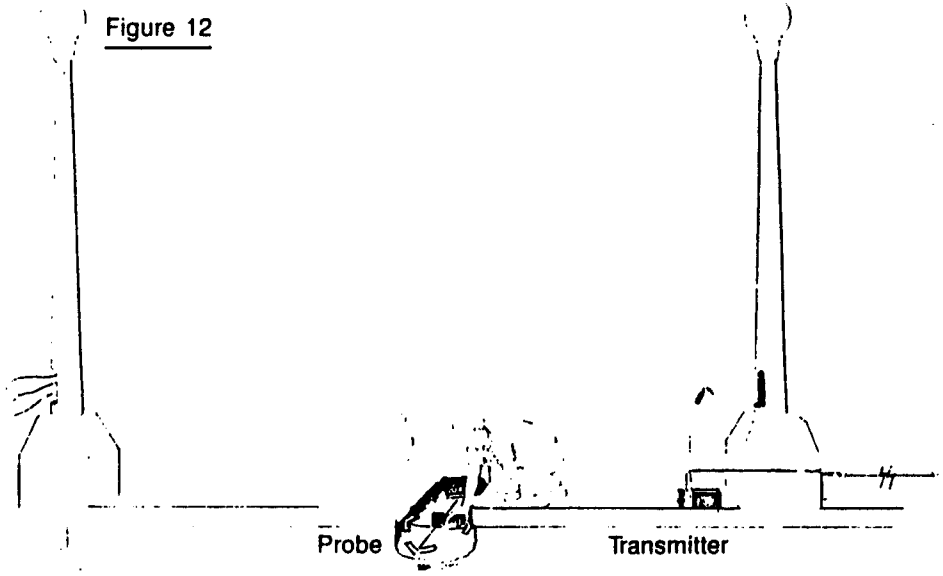
*NOTE: See **Operating Hints** section.

Figure 11



Follow the same procedure from the opposite direction.

Figure 12



Scan the hole in cross fashion to verify the position of the open wire.

Locating Open Breakers

1. Verify that the receptacle is unenergized.
2. Connect the Transmitter to the black and white wires of the receptacle in question.
3. Turn the Transmitter on and verify operation with the Probe. This is a good time to check the signal with the Probe. Start with the Short Range position. If there are no loads connected to the line you will get a strong signal (5-10 lights). Otherwise, use the Medium Range. You should now get between 5-10 lights.
4. Move the Probe over each breaker while pulling the trigger. The open breaker will give the highest LED indication (Fig. 13).
5. Other breakers in the panel may exhibit a signal due to coupling, but the open breaker will give the strongest indication of the signal. It may be necessary to remove the panel cover and hold the Probe near each black wire in the case of strong signal coupling.
6. CAUTION: Disconnect the Transmitter from the receptacle before resetting the breaker.

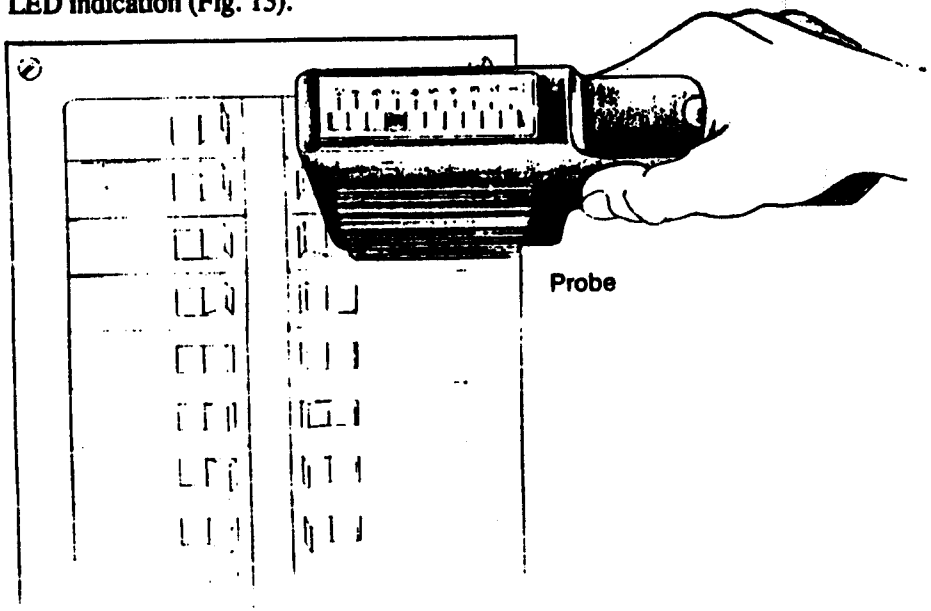
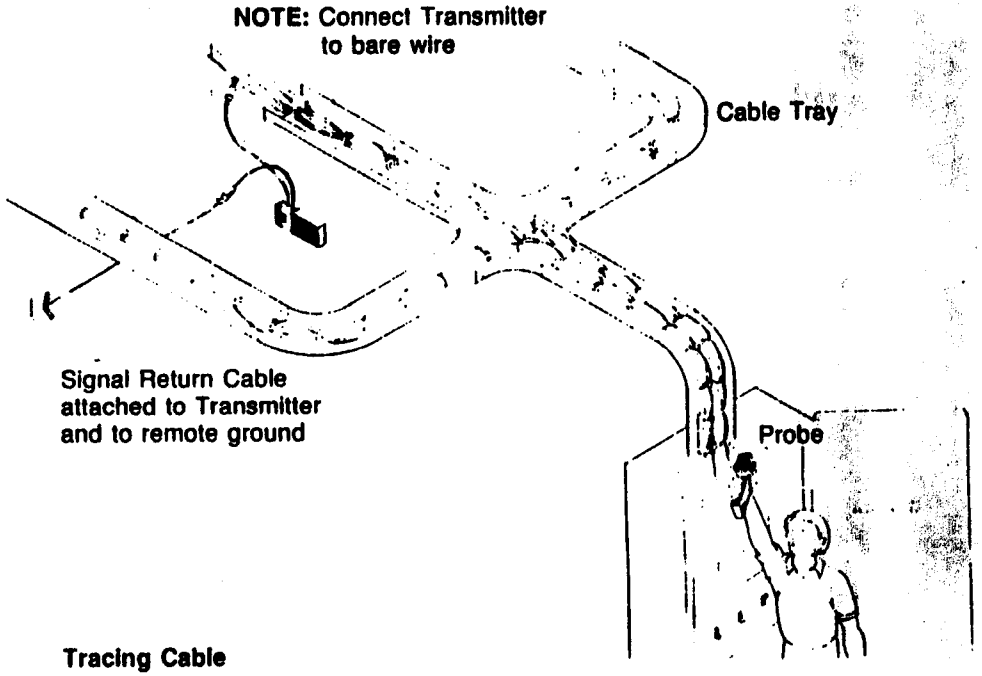


Figure 13

Locating Open Breakers

Tracing Cable and Cabling

1. Verify that the cable to be traced is unenergized.
2. Connect the Transmitter's red clip to wire or wires in the cable.
3. Connect the black clip to the Signal Return Cable (15 foot jumper cable).
4. Connect the other end of the Signal Return Cable to a remote ground.
5. Turn the Transmitter on and verify operation with the Probe.
6. Change the slide switch to the range that gives maximum usable sensitivity (5-10 lights).
7. Hold the Probe near each cable and identify the cable with the strongest signal (Fig. 14).



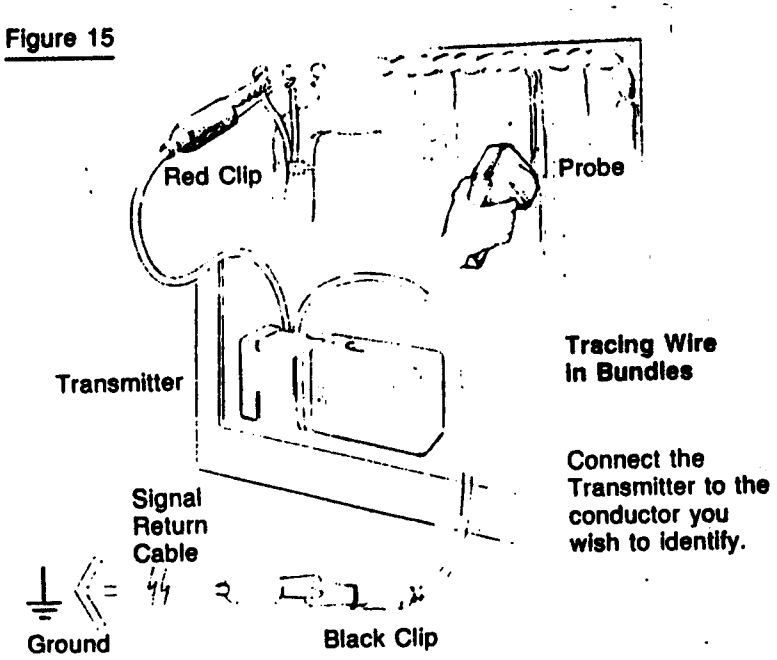
Tracing Cable

Figure 14

Tracing Individual Wires in Bundles

1. Verify that the wire to be traced is unenergized.
2. Connect the Transmitter's red clip to the wire in the bundle that is to be identified.
3. Connect the Transmitter's black clip to the Signal Return Cable.
4. Connect the other end of the Signal Return Cable to a remote ground.
5. Turn the Transmitter on and verify operation with the Probe.
6. Hold the Probe close to each wire and pull the trigger. The wire to which the Transmitter is attached will give the strongest signal.
7. Change the slide switch to the range which obtains the most selectivity.
8. In cases of extreme coupling, ground the other wires in the bundle, if possible (Fig.15).

Figure 15



Tracing Wire in Bundles

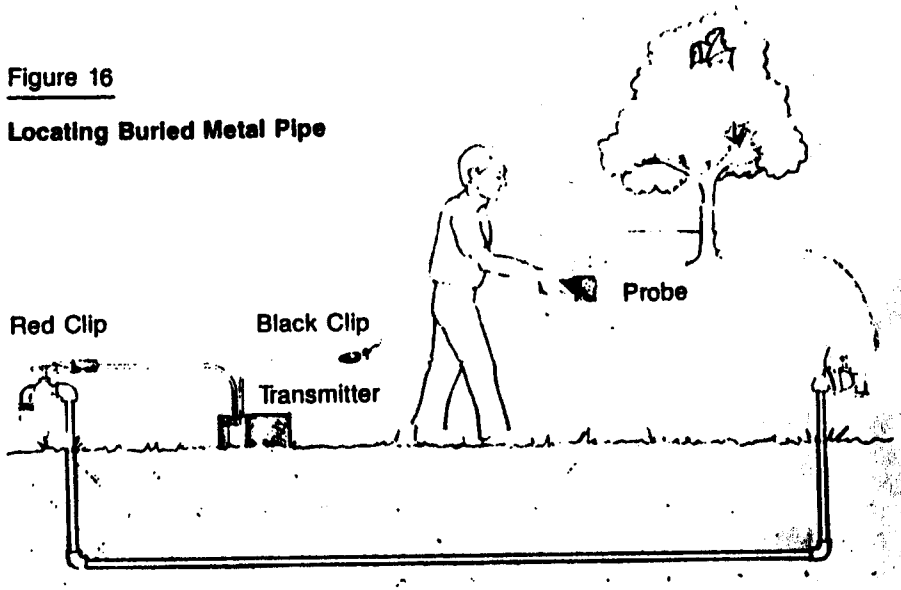
Connect the Transmitter to the conductor you wish to identify.

Locating Buried Metal Pipe or Metal Conduit in Concrete Floors

1. Attach an external wire to one end of the metal pipe to be traced.
2. Loop the wire away from area of the buried pipe.
3. Connect the Transmitter's red clip to the pipe.
4. Connect the Transmitter's black lead to the external wire.
5. Turn the Transmitter on and verify operation with the Probe.
6. Hold the Probe at a constant height from the surface.
7. Scan the area.
8. Follow the line that gives the strongest indication (Fig. 16).

Figure 16

Locating Buried Metal Pipe



THEORY OF OPERATION

The basic operating principle of the Open Tracer product is the detection by the Probe of electrostatic and electromagnetic fields generated by the Transmitter.

The Transmitter introduces a 455KHz signal modulated by a 1.77KHz tone and an additional 1.77KHz signal onto an unenergized conductor.

The Probe has the capability to detect electrostatic and electromagnetic fields. A specially designed pickup unit in the Probe has plates to sense electrostatic fields and twin coils to detect electromagnetic fields.

Normally, a wire will produce both electrostatic and electromagnetic fields. When the Transmitter is connected to a wire the Probe can detect the change in voltage on the wire with its electrostatic detectors, due to capacitive coupling.

Conversely, a circuit that has capacitance resembles a closed loop circuit. When the Transmitter injects a signal on this type of circuit, a strong electromagnetic field is produced, due to the charging and discharging of the circuit. This field is picked up by the Probe's twin electromagnetic coils.

In Short Range, the Probe can detect the electrostatic field 0 to 6 inches from the conductor energized by the Transmitter. In Medium, Long and Extra Long Ranges, the Probe can detect the Transmitter's electrostatic and electromagnetic fields for distances of at least 6 feet from the conductor.

A 10 segment LED display and an audible tone indicates the strength of the signal detected by the Probe.

APPENDIX

Operating Hints

Never use the Open Tracer Transmitter on powered lines

Locating opens in underground cables

It is important to note that the open will not be exactly where the Probe's signal display drops to zero, except in Short Range. The drive signal will radiate from the wire in a manner illustrated by figures 4 and 6 on pages 6 and 7 of the instruction manual.

Also, a cable may suddenly go deeper in the ground which will result in a decrease of the Probe's signal display. See figure 5 on page 7 of the instruction manual.

If you have access to both ends of an open cable, try tracing from both directions to locate the open. You should find the open at the same spot from either direction.

Ground the Open Tracer Transmitter for best results

The strength of the Transmitter's injected signal depends on how well the Transmitter is connected to ground. Select a suitable ground for the tracing needs at hand. For example: If there is concern that capacitive coupling may take place in an area like a building laced with rebar, reduce the Transmitter's signal strength -- thereby reducing the coupling effect -- by using a "light" ground like a metal chair or filing cabinet, or by unhooking the ground completely.

However, for maximum signal strength outside for underground tracing if there is no concern for coupling, use a "good" ground like a water pipe.

Rule of thumb:

"light" ground -- metal chair, filing cabinet, screwdriver planted in the earth

"medium" ground -- car body, metal sign planted in the earth

"good" ground -- water pipe

When only one conductor is open in a multi-conductor cable

Any conductors in a cable that are not open should be shorted together and grounded, if possible, to reduce coupling of the signal from the driven wire to the other conductors and beyond the open.

Locating opens inside metal conduit or shielded cable

The Transmitter's signal will couple to a metal conduit or shield and continue past the break. This makes the location of the open difficult to pinpoint with the Probe unless the conduit or shield itself is severed. However, the Open Tracer can be used to trace the path of the conduit or cable. First, use a capacitance meter to measure the capacitance of a ten foot test length of the same type of wire. Next, measure the capacitance of the open wire. Divide this number by the test length reading and multiply by 10. This should give you the number of feet to the open. There must not be any branch connections off the wire being tested or there will be too large a capacitance reading for this method.

Tracing metal conduit in concrete floors

When tracing metal conduit in concrete floors it is best to connect the Open Tracer Transmitter to an unenergized wire in the conduit. The conduit will reduce the signal strength, however, it is usually sufficient. If you need more strength, you may drive the conduit directly with the Transmitter.

The stronger signal, however, will tend to couple to rebar and other metal objects.

The Open Tracer cannot follow the path of a metal conduit covered with metal meshing or decking, although it can trace the path at points where the conduit can be accessed.

Locating open circuit breakers

Connect the black clip of the Transmitter to any convenient ground and the red clip to the unenergized hot lead at the receptacle. Check the red Transmitter clip for a strong signal with the Probe in Short Range. Any loads on the powerline will prevent the Short Range from detecting a signal. You may either disconnect the loads on the line or use Medium Range. (The Short Range method is preferable because the signal detected does not tend to couple as much as the one detected by Medium Range.) **DISCONNECT THE TRANSMITTER BEFORE RESETTING THE BREAKER.**

Loads on the line, such as ballasts, should be opened to prevent coupling.

Moisture in the soil may affect the signal being transmitted and it may be necessary to change the slide switch to a range that provides higher sensitivity.

Questions & Answers

What will the Open Tracer do for me?

- Trace opens in direct burial cable over 6 feet underground
- Pinpoint breaks in unshielded heating cable
- Follow the path of unenergized conductors within buried conduit
- Locate sprinkler solenoid valves and wiring
- Identify receptacles connected to unenergized circuits
- Locate buried metal pipe or conduit even within concrete slabs
- Identify and follow conduit containing telephone cables
- Locate open circuit breakers with panel covers in place
- Identify and follow computer cables
- Pinpoint individual wires within bundles
- Trace opens inside plastic conduit

Will the Open Tracer interfere with sensitive electronic equipment?

The output of the Transmitter is in the low milliwatt range and will not interfere with sensitive electronic equipment.

Can opens due to oxidation be detected in aluminum conductors?

Aluminum oxide may conduct the Transmitter's signal across the open making it impossible to detect.

Can the Open Tracer find a hairline break in a conductor?

It may be difficult to pinpoint a hairline break or fracture in a conductor due to coupling of the signal across the break.

Can the Open Tracer locate an open inside metal conduit?

The Transmitter's signal will couple to the metal conduit making an open in the conduit difficult to pinpoint unless the conduit itself is also severed.

Will the Open Tracer pinpoint a short to ground or a conductor to conductor short?

No. The Amprobe Pasar Current Tracer will pinpoint a short to ground.

Maintenance

The Open Tracer has no user accessible adjustments. The unit is sealed. Opening the unit will break the seal and void the WARRANTY. To operate the unit, simply turn the Transmitter on and hold the Probe near the red clip and pull the Probe's On/Off trigger. In each range the LED display will give a full scale indication. Replace the 9 volt alkaline battery in either the Transmitter or the Probe by sliding the battery cover down and removing the battery from the unit, (the battery cover remains on the unit). Use a 9 volt battery of the same type. The batteries should be removed if the Open Tracer is to be stored for an extended period of time.

The unit may be repaired by mailing it postpaid via UPS or Air Parcel Post to:

Amprobe Pasar
2422 So. Trenton Way
Denver, Colo. 80231
Attn: Service Division

Please enclose a note requesting repair.

Specifications OT1000-A Open Tracer

General

Operating Temperature	0 to 120 degrees F
Storage Temperature	-40 to 150 degrees F
Weight with Case	4 lbs.

T1000-A Transmitter

Case	ABS Plastic
Battery	9 volt alkaline
Battery Life	24 hours continuous
Output	455KHz modulated by a 1.77KHz tone
Range	1000 ft. minimum
Power Consumption	80 MW

P1000-A Probe

Case	ABS Plastic
Battery	9 volt alkaline
Range	Short up to 6"
	Medium up to 36"
	Long up to 54"
	Extra Long up to 72"

R.O.I. SALES CO.

Fax Transmittal

To: Amprobe
Attn: Millie
Subject: J.A. Sexauer
Date: April 21, 1999
Pages: 1, including this cover sheet.

Millie:

Can you please send me 12 copies of the instruction manual for the OT1000A.

Thanks.

From the desk of...

Beth

R.O.I. Sales Co., Inc.
420 Route 46 East
Fairfield, NJ 07004

(973) 808-6300
Fax: (973) 808-1888