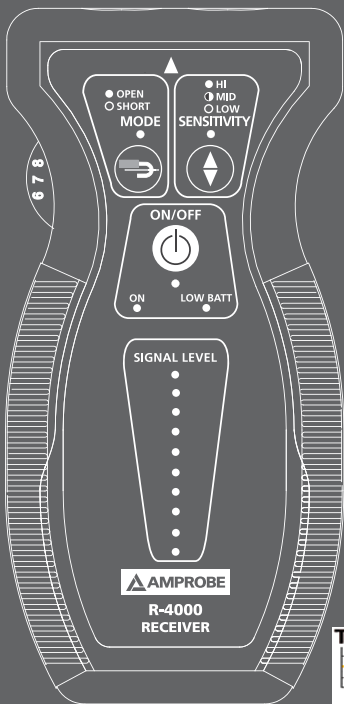




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# AT-4000-A Series Advanced Wire Tracer

## Users Manual



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# AT-4000-A Series

## Advanced Wire Tracer

Users Manual

P/N 2756641 Rev 002  
11/2013, 6001563 A  
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## **Limited Warranty and Limitation of Liability**

Your Amprobe product will be free from defects in material and workmanship for one year from the date of purchase unless local laws require otherwise. This warranty does not cover fuses, disposable batteries or damage from accident, neglect, misuse, alteration, contamination, or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on the behalf of Amprobe. To obtain service during the warranty period, return the product with proof of purchase to an authorized Amprobe Service Center or to an Amprobe dealer or distributor. See Repair Section for details. THIS WARRANTY IS YOUR ONLY REMEDY. ALL OTHER WARRANTIES - WHETHER EXPRESS, IMPLIED OR STATUTORY - INCLUDING IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, ARE HEREBY DISCLAIMED. MANUFACTURER SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM ANY CAUSE OR THEORY. Since some states or countries do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you.

## **Repair**

All Amprobe returned for warranty or non-warranty repair or for calibration should be accompanied by the following: your name, company's name, address, telephone number, and proof of purchase. Additionally, please include a brief description of the problem or the service requested and include the test leads with the meter. Non-warranty repair or replacement charges should be remitted in the form of a check, a money order, credit card with expiration date, or a purchase order made payable to Amprobe.

## **In-warranty Repairs and Replacement – All Countries**

Please read the warranty statement and check your battery before requesting repair. During the warranty period, any defective test tool can be returned to your Amprobe distributor for an exchange for the same or like product. Please check the "Where to Buy" section on [www.Amprobe.com](http://www.Amprobe.com) for a list of distributors near you. Additionally, in the United States and Canada, in-warranty repair and replacement units can also be sent to an Amprobe Service Center (see address below).

## **Non-warranty Repairs and Replacement – United States and Canada**

Non-warranty repairs in the United States and Canada should be sent to an Amprobe Service Center. Call Amprobe or inquire at your point of purchase for current repair and replacement rates.

\* (Correspondence only – no repair or replacement available from this address. European customers please contact your distributor.)

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## **PRECAUTIONS**

### **FOR PERSONAL AND INSTRUMENT PROTECTION**

#### **IMPORTANT:**

1. Before using any electrical instrument, it should be checked to make certain it is operating properly.
2. In many instances, you will be working with dangerous levels of voltages and/or current, therefore, it is important that you avoid direct contact with any uninsulated, current carrying surfaces. Appropriate insulated gloves and PPE clothing should be worn.
3. Before attaching any of the conductors, make sure the voltage presence is not beyond the range of the instrument.
4. When not in use, keep the instruments in their carrying case.
5. If the R-4000 or the T-4000-A will not be used for a period of time, remove the battery to prevent leakage in the instrument.

## **INTRODUCTION**

Amprobe is dedicated to designing and manufacturing high quality, reliable instruments for the skilled professional. The Amprobe Advanced Wire Tracer has a history of providing safe, reliable operation in tracing energized wires, locating circuit breakers and locating wires shorted to the ground. The Amprobe wire tracer has the capability of tracing non-energized wires, locating open breakers and locating open wires.

The AT-4000-A Wire Tracer Upgrade System combines both the current tracing CT-100 and the AT-2000-A series into one versatile tool providing the ability to solve virtually all your tracing problems. In addition to the above features, the receiver provides non-position sensitivity when tracing wire and the transmitter provides a visual indication to the user when the traced line is energized. The level of the signal transmission is also indicated on the LCD of the transmitter unit.

Please read this manual carefully. Take the time to learn how the instrument operates.

## **AT-4000-A PRODUCT DESCRIPTION**

The AT-4000-A consists of two units:

T-4000-A Transmitter (32.768KHZ, 9-300 V ac or dc)

R-4000 Receiver (Non-position sensitive, Open / Short Tracing)

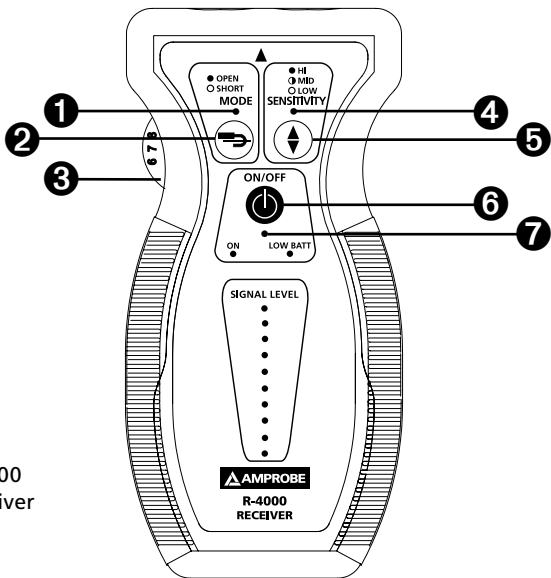
### **Unit Description**

#### **R-4000 Receiver**

It has two built-in detectors that are tuned to pick up the 32.768Khz signals generated by the T-4000-A transmitter. The R-4000 is designed to display the signal strength to enable quick locating of the conductor carrying the signal.

#### **T-4000-A Transmitter**

When connected to an energized circuit, the T-4000-A will filter the low frequencies up to 400Hz and rapidly indicate on the display that the wire is energized. When the user starts the transmission, a combination of signals is injected on top of the 50, 60, or 400Hz that causes a slight, periodic current fluctuation and allows the power line to emit its own, traceable signal. This signal can be detected back to the main generator. However, the signal will not interfere with any sensitive electronic equipment and does not require power interruption. The unit is intrinsically safe and has a 'LOW' signal transmission setting that must be used when tracing GFCI-protected circuits.

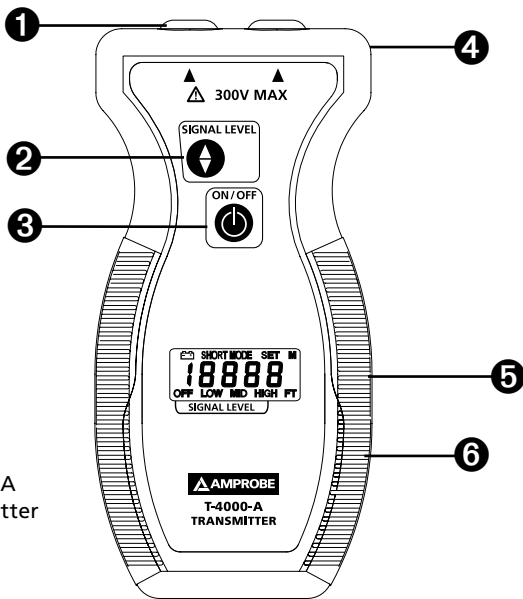


R-4000  
Receiver

- |  |   |
|--|---|
| <p><b>1</b> LED Indicator:<br/>ON - OPEN<br/>OFF - SHORT</p> <p><b>2</b> Mode control</p> <p><b>3</b> Sensitivity control thumbwheel</p> <p><b>4</b> LED Indicator:<br/>ON - High sensitivity<br/>BLINKING - Medium sensitivity<br/>OFF - Low sensitivity for breakers</p> | <p><b>5</b> Sensitivity control</p> <p><b>6</b> Power ON/OFF</p> <p><b>7</b> LED Indicator:<br/>Green - Unit ON<br/>Red - Low battery</p> |
|--|---|



T-4000-A  
Transmitter



- 1 Banana plug jack
- 2 Signal level switch
- 3 Power ON/OFF
- 4 Fuse (inside) holder
- 5 24 Volt jack
- 6 9V Battery compartment

When connecting to a circuit as a load, the signal will be present anywhere between the T-4000-A and the power source. Line side or upstream, no signal will be present on wiring on the other side of the transmitter (load side or downstream). For example, a transmitter connected to a circuit breaker will produce no signal on that circuit. It will, however, cause a signal to be generated between that panel and the transformer and beyond. When connecting to a non-energized circuit, the live indication on the display will remain 'OFF'. When the user starts the transmission, the transmitter injects a combination of signals onto the conductor. The signal will travel along the conductor until it ends. There is no difference in the functional mode of the unit when tracing energized and non-energized circuits. On an open line, no current will flow, so the injected signal will present itself as a voltage spike along the wire which is detected by the R-4000 in the 'OPEN' mode. When the conductor is part of a complete circuit, the voltage causes a current to flow which produces a signal that is detected in the 'SHORT' mode. The T-4000-A contains a 9V battery. A 24V input jack accepts the B2024 rechargeable battery or the B2025 110V converter, both use when a very strong signal is necessary.

(Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.)

### **A2202 Clamp-On Transmitter Accessory**

Enables the T-4000-A to induce its signal onto a non-energized or energized circuit. Plug the A2202 into the T-4000-A and clamp it around any conductor in a non-energized circuit, or the hot wire in an energized circuit. The signal will be induced on top of the 50, 60, or 400Hz frequency which may be present. The A2202 acts like a 0.5 V battery when clamped around a conductor. On a complete circuit, this voltage will cause about 80mA of current to flow on top of the whatever frequency is present.

To increase the signal strength, loop the wire around the clamp a few times or use the B2024 battery Pack. The A2202 will allow wire tracing

without the need for direct connection. (Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.)

### **B2024 Battery Pack**

24 V Nickel-cadmium rechargeable battery pack is custom designed to be light weight, small, and durable. Used to boost the output of the T-4000-A. Consult the specs for the boost levels. Includes a self-resetable fuse. Be sure to charge fully before use.

(Do not use the B2024 when tracing energized lines.)

Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.

### **B2025 110V Converter/Recharger**

Can be used to either recharge the B2024 or directly boost the T-4000-A. To recharge the battery, leave it connected for at least 8 hours. (Do not use the B2024 when tracing energized lines.)

Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.

### **C2901 Pigtail- Banana Plug Cord set**

For use on 110 V ac receptacles.

### **C2902 Alligator-Clip Banana Plug Cord set**

For direct contact to bare conductors

### **MTL-G Grounding Test lead And Alligator Clips**

## **APPLICATION**

### **Using the R-4000 with Thumbwheel**

1. Turn on unit by pressing the ON/OFF push button.
2. Press MODE push button to select the sensitivity level

- a) OPEN Tracing: LED ON
  - b) SHORT Tracing: LED OFF
  3. Press SENSITIVITY push button to select the sensitivity level.
    - a) LOW Sensitivity: LED OFF
    - b) MEDIUM Sensitivity: LED Blinking
    - c) HIGH Sensitivity: LED ON Solid
  4. Locate the thumbwheel on the left side of the unit
    - a) Select MEDIUM Sensitivity Level
    - b) Rotate thumbwheel counterclockwise to decrease sensitivity level
    - c) Rotate thumbwheel clockwise to increase sensitivity level
- IMPORTANT: Always conclude your tracing with the "MID" or "LOW" sensitivity because the built-in detector has a 360° detection range. It will be a good idea to have the transmitter on the low signal transmission depending on the length of the wire you are tracing.
5. When tracing, move the R-4000 back and forth slowly over the path of the wire. The strongest signal confirms the path of the wire.

### **Using the T-4000-A Transmitter**

1. Make sure the voltage is not higher than 300V on the conductor you wish to trace.
2. Always connect the banana plugs to the T-4000-A before connecting to the circuit.
3. Using the alligator clip cord set, connect the banana plugs to the transmitter.
4. Connect one alligator clip to the wire you wish to trace(it doesn't matter which one as the input plugs are not polarized) and the other one to a separate ground.
5. Turn the unit 'ON' by pressing on the ON/OFF push button- The screen should display '18888' briefly. The transmission is 'OFF'

6. Select the signal transmission level (LOW, MID, HIGH) by pressing on the signal level push button. It takes about 2 seconds for the transmission to start after you last hit the push button. (Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.)
7. Trace the wire with the R-4000 receiver. The signal will stop at the break in the wire.

**IMPORTANT:** When using the T-4000-A in energized circuits with GFCI protection, always use the Low level transmission.

The signal generated by the T-4000-A is present at all points around the circuit. The T-4000-A connected to a 110V outlet via the C2901 cord set will cause an incoming signal on the neutral wire as well as an outgoing signal on the hot wire. The close proximity of these two wires may cause the signals to cancel each other, making it difficult to trace the cable in these areas. In this case, keep the R-4000 in the high sensitivity range. (Refer to Figure 11)

At the panel breakers, the hot wire is separated from the neutral wire (where it is grounded) allowing easy circuit breaker identification. In that case, use the Low sensitivity range of the R-4000. So, if tracing the branch wiring through the walls is not necessary, use the C2901 for quicker connection. (Refer to Figure 12)

Easy tracing of wires and buried cable is accomplished by simply separating wire from the return path (ground). Instead of using the neutral wire or the conduit as the ground, use the C2902 Alligator Clip cord set and attach the grounding test lead to a separate ground such as a water pipe. (Refer to Figure 13)

## **Using the A2202 Clamp-On Transmitter Accessory**

The A2202 will allow non-contact signal indication onto energized or non-energized conductors. On energized lines, the signal will propagate downstream to the end of the circuit, provided there is a current flowing in the circuit. Non-energized lines must be grounded at both ends or made into a complete circuit. The signal strength can

be boosted significantly by using the B2024 battery Pack. (Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.)

One typical application for the A2202 is to access the hot wire at the panel in order to identify the 'downstream' loads:

1. Plug A2202 into T-4000-A. Set signal level to 'High'.
2. Clamp the A2202 around the 'hot' wire.
3. Set the R-4000 to 'OPEN' mode and trace the downstream wiring. To trace buried lines, switch to 'SHORT' mode (See Locating Outlets From The Breakers Panel on page 17)

## **FINDING OPENS**

'Opens' are dead end conductors that are not connected to anything and therefore do not pass current. To find an open, use the T-4000-A transmitter, R-4000 receiver, and the alligator clip cord set. (Refer to figure 15)

1. Plug the two banana plugs into the T-4000-A
2. Connect one of the alligator clips or the grounding test lead to a separate ground.
3. Connect the other alligator clip to the conductor.
4. Where possible, ground any other conductors sharing the same path as the Open wire.
5. Turn the T-4000-A 'ON' by pressing the ON/OFF push button and select a signal level transmission by pressing the signal level push button.
6. Turn the R-4000 'ON' by pressing the ON/OFF push button.
7. Select 'OPEN' mode by pressing the MODE push button( the LED must be 'ON'). Note: If the conductor is buried in moist soil, the 'SHORT' mode may give better results.

8. Select the 'HIGH' sensitivity by pressing the SENSITIVITY push button (the LED must be 'ON').
9. Starting from the T-4000-A, trace the conductor. The open will be at the point you begin to lose signal. At that point, select the 'MID' sensitivity mode (the LED must be 'blinking') in order to pinpoint the exact location of the Open.
10. Repeat process from the other end of the wire to make sure that you trace the right wire.

If you end up tracing the entire length of the wire without locating the open, you may be experiencing capacitive coupling, or 'Signal bleed-off' onto the adjacent conductors. This condition may be alleviated by: a) grounding all adjacent conductors; b) minimizing the distance between the point of connection and the open.

If another conductor is connected to the first conductor somewhere along its length, the signal will split between them, causing both conductors to emit half the signal each. The B2024 battery or the B2025 converter can be used to increase the signal strength. (Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.)

## **Finding Ground Faults**

A ground fault is a direct connection of the conductor to ground. A typical ground fault may cause a tripped circuit breaker or a blown fuse (in contrast to an 'open', which passes no current). In this situation, the B2024 battery can be used as the current source. The high voltage from the B2024 will overcome a high resistance fault and will produce a stronger signal. Also, you can use line voltage as the power source by connecting the T-4000-A across the breaker. (Note: When using the battery booster (B2024 or B2025) the unit will work in ultra high "U-HI" mode only. Remove the battery booster to return to normal operation.)

1. Plug the alligator clip cord set into the T-4000-A.

2. Attach one clip to the faulted wire and the other one to ground.
3. Press the signal level push button and select the appropriate level.
4. If possible, ground all adjacent conductors.
5. The R-4000 receiver can then be used to trace the wire. The signal should remain relatively constant until you pass the ground fault. At the fault, the signal from the T-4000-A will pass from the wire and disperse into the ground. For this reason, the signal strength will decrease gradually. Watch the LEDs carefully in order to locate the fault within a few inches. (Refer to Figure16)

## **Tracing Wires in Conduit**

When seeking a ground fault within metal conduit, the 'ground' is the conduit. Connect one of the clips to the conduit to complete the circuit.

Steel conduit will tend to attenuate the signal strength so tracing will require higher sensitivity levels and access to within a few feet of the conduit. Aluminum conduit will severely attenuate the signal and sometimes even blocking all the signal from the wire. It may be necessary to periodically access the wire in the conduit to confirm signal presence.

## **Locating Circuit Breakers Or Fuses**

Caution: Always check to make sure the line voltage DOES NOT EXCEED the range of the T-4000-A: 9-300V

1. Connect the T-4000-A to the circuit as shown in Fig.17 using either the C2901 Pigtail Cord set for 110V receptacles or the C2902 Alligator Clip cord set.
2. Turn 'ON' the unit.
3. Select a signal level by pressing on "Signal Level" push button.
4. Turn ON the R-4000 receiver.
5. Select the 'Short Range' and 'Low' sensitivity.
6. Move the Receiver in front of the outside of each circuit breaker, as shown, to determine which one has the strongest signal.



7. If two or more breakers produce the same signal strength indication. Move the receiver away slowly from each of them and watch the indication level. (Refer to Figure 17)

### **Tracing Energized Wires**

1. Connect the Alligator Clip Cord set to the T-4000-A.
2. Make sure the voltage does not exceed the T-4000-A rating.
3. Connect one alligator clip to the hot wire and the other to a separate ground. At a receptacle, use the C2901 Pigtail to access the hot wire. Use the 25' ground test lead to ground the T-4000-A. (Make the connection as shown in Figure11)
4. Turn ON the R-4000.
5. Select 'SHORT' mode.
6. Starting with Low sensitivity setting, circle the area with the R-4000 to locate the path of the wire.

### **Tracing Non-energized Lines and Finding Shorts**

If the wire you wish to trace is part of a complete circuit, or can be made into a complete circuit easily, use the following procedure. If it is not part of a complete circuit then use the "Finding Opens" procedure on page 13.

Follow the following procedure:

1. Connect the alligator clip cord set to T-4000-A.
2. Attach one alligator clip to the wire you wish to trace and the other one to ground.
3. Turn ON the T-4000-A.
4. Select the appropriate signal level.
5. Turn ON the R-4000.
6. Select the appropriate mode and sensitivity.
7. Trace the wire.

## **Locating Individual Wires in a Bundle (Energized and Non-energized Lines)**

1. Attach alligator clip set to the T-4000-A.
2. Verify that the voltage on the line does not exceed the T-4000-A rating.
3. Connect one alligator clip to the wire you wish to identify and the other to a separate ground using the 25' ground test lead.
4. Turn the R-4000 ON and select 'Low' sensitivity.
5. Set mode to "SHORT".
6. At the bundle, pull each individual wire away from the other wires as far as possible.
7. Use the R-4000 to detect the proper wire.
8. The strongest signal indicates the proper wire (Refer to Figure 18)

## **Locating Outlets From The Breakers Panel**

1. Connect the A2202 Clamp-on to the T-4000-A Transmitter and then clamp it around the conductor.
2. Set the T-4000-A to 'HIGH' signal level.
3. Set the R-4000 to 'OPEN' mode and 'LOW' sensitivity.
4. Hold the R-4000 in front of each suspected outlet or piece of equipment. If it is on the same wire as the clamp, the R-4000 will indicate it.
5. If a known outlet does not produce a signal, use the B2024 to boost the signal. (Refer to Figure 19)

**Note:** When using the battery booster (B2024 or B2025) the unit will work in ultra-high "U-HI" mode only. Remove the battery booster to return to normal operation.

## **Locating Buried Conduit or Metal Pipe**

1. Connect the A2202 clamp-on to the T-4000-A Transmitter and then clamp it around the conduit or pipe.

2. Use of the B2024 battery or the B2025 converter is recommended.
3. Set the T-4000-A to 'HIGH' mode.
4. Set the R-4000 to 'SHORT' mode and 'LOW' sensitivity.
5. Trace the conduit. (Refer to Figure 20)

Note: When using the battery booster (B2024 or B2025) the unit will work in ultra-high "U-HI" mode only. Remove the battery booster to return to normal operation.

## **MAINTENANCE**

### **Changing Batteries**

The battery compartment on the back of the R-4000 and the T-4000-A is designed to make it easy for the user to change the battery. A screw is added to secure the battery in case the unit is dropped. A 9 V battery is used.

1. Remove the battery cover.
2. Install a 9V Battery using the battery clip.
3. Replace the battery cover and secure it with the provided screw.

### **Changing Fuse**

1. Remove the battery cover of the T-4000-A.
2. Remove the bottom enclosure of the T-4000-A.
3. Remove the fuse. It is located on the upper end of the unit.
4. Use fuse replacement part #100721.
5. Close the bottom enclosure first, secure it with the provided screws.
6. Close the battery cover, secure it with the provided screw.

## Replacement Parts

9V Battery	9V Alkaline
Clamp-On Transmitter Accessory	A2202
Battery Pack	B2024
10V Converter/Recharger	B2025
110V Pigtail - Banana Plug Cord Set	C2901
Alligator Clip Banana Plug Cord Set	C2902
Grounding Test Lead 25-FT	MTL-G
Carrying Case AT-4000-A	CC-AT-4000
Users Manual	<a href="http://www.Amprobe.com">www.Amprobe.com</a>
Fuse 1000V 0.25A FA 6X46MM	FA6X46MM

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
LCD Segments of the T-4000-A are fading	9V battery is low in voltage	Replace the battery
R-4000 Can't detect signal	a) Wrong mode or range b) Transmitter is OFF or the signal level is too low c) Signal cancellation	a) Ensure that you are using the right mode or range. (See application notes) b) Turn ON the transmitter and select the appropriate signal level. c) Use a separate ground or separate the wires.

## **SPECIFICATIONS**

### **General**

Operating Temperature: 0 to 120° F (-18°C to 49°C)

Storage temperature: -40° to 150° F (-40° to 66°C)

Case material: ABS

Case size: 0.55" x 0.26" (14 x 6.7 mm)

### **R-4000 Receiver**

Detectors: electromagnetic coil array pick up for short mode.

Electrostatic plate pick up for open mode.

Sensitivity: Low and high programmable gain from the traced wire.

Short mode performance: Over 20' in air from the traced wire under test conditions.

Open mode performance: Over 12' from the traced wire in air under test conditions.

50HZ, 60HZ, and 400HZ Rejection: 120db

Power source: 9V alkaline battery

Display: 10 LEDs

Case: Flame retardant ABS

Weight: 0.5 Lb. (113g)

### **T-4000-A Transmitter**

Operating voltage: 9-300 volts

Operating frequency: 32.768 KHZ

Duty cycle: Transmit 2 pulses with a duration of 0.0625S each, every 0.5 seconds

Case: Flame retardant ABS

Display: LCD (Liquid Crystal Display)

Weight: 0.32 LB (143.5g)

Current output of the Signal:

Low mode: 11 mA average, 30 mA peak

Medium mode: 12 mA average, 36 mA peak

High mode: 13 mA average, 63 mA peak

Fuse: Fast acting 250 mA @ 1000V (6X46mm) P/N: FA6X46MM

Signal output (9V supply):

High setting: 0.74 V ac

Medium setting: 0.61 V ac

Low setting: 0.53 V ac

Battery: 9V alkaline- 24V jack will accept battery pack accessory (B2024 or B2025)

### **A2202 Clamp-on Transmitter Accessory**

Operating frequency: 32.768KHZ as supplied by T-4000-A

Case breakdown voltage: 3000 V

Maximum wire size: 2000 MCM or 2" diameter cable

Battery: None, power is supplied by T-4000-A

### **B2024 Battery Pack**

Type: Nickel-Cadmium rechargeable (20 AA cells)

Capacity: 24 V, 600 mah

Rechargeable time: 14 hours

Fuse: internal self-resetting

### **B2025 Recharger/Converter**

Input: 115 V ac

Output: 24 VDC @350 mah



Figure 1.

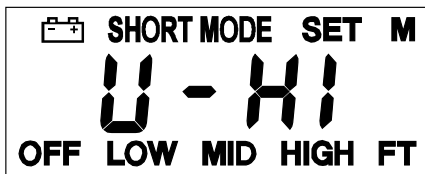


Figure 2.



Figure 3.



Figure 4.



Figure 5.





Figure 6.



Figure 7.



Figure 8.

In either SHORT  
or OPEN MODE,  
the unit is non  
position sensitive

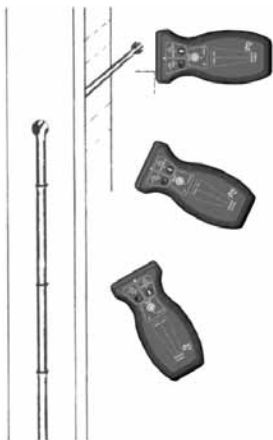


Figure 9.

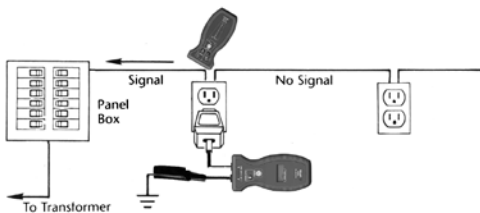


Figure 10.

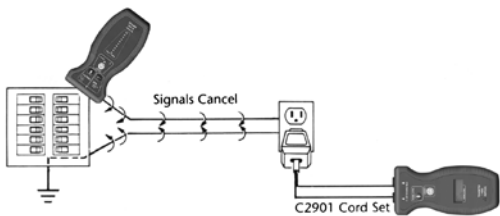


Figure 11.

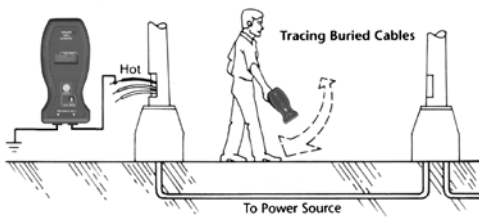


Figure 12.

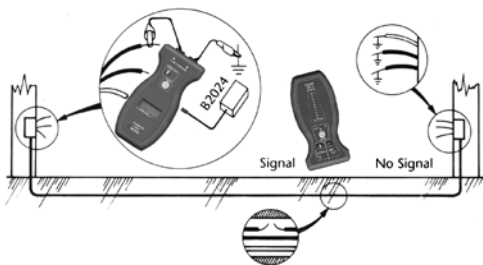


Figure 13.

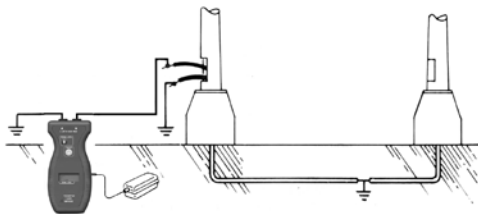


Figure 14.

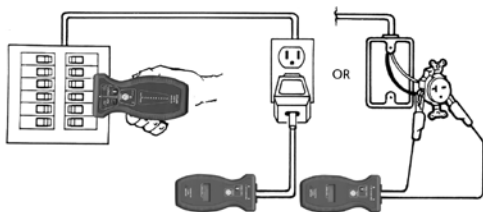


Figure 15.

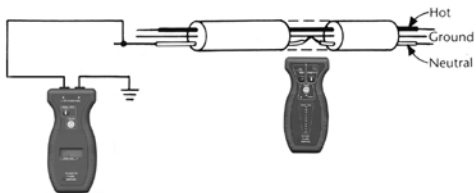


Figure 16.

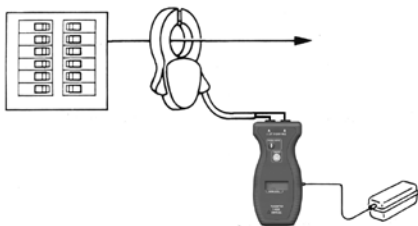


Figure 17.

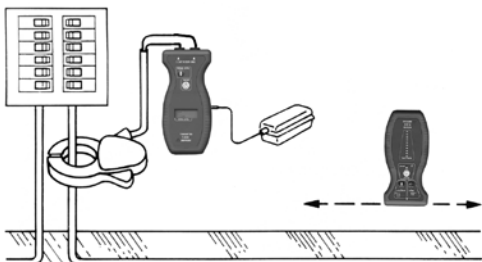


Figure 18.



Figure 19.



Figure 20.

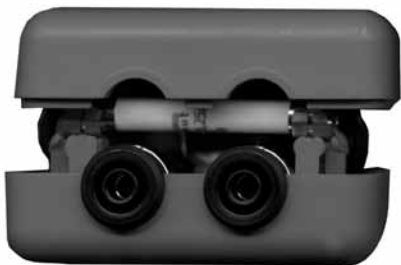


Figure 21.