

**AMPROBE®**

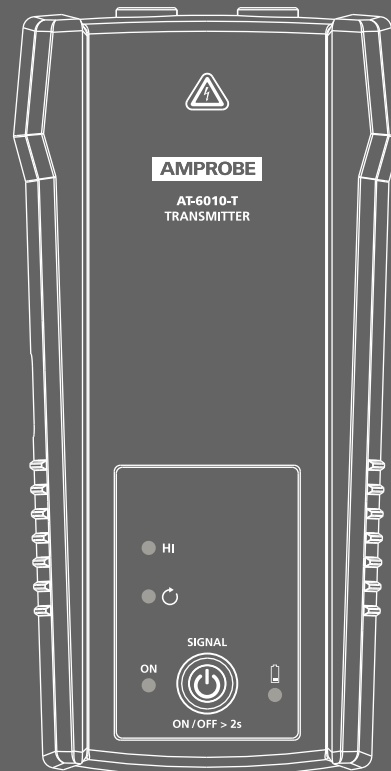
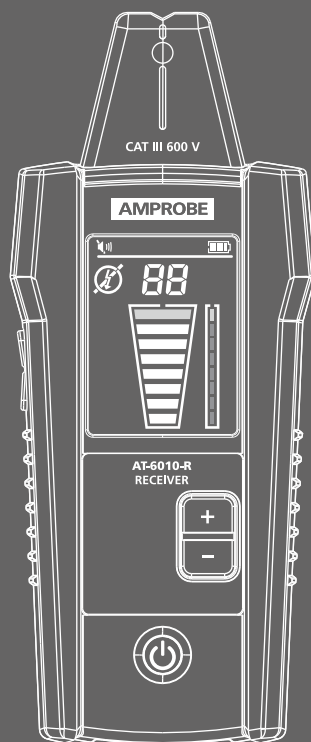
# AT-6010 Advanced Wire Tracer

## User Manual

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# **AT-6010**

## **Advanced Wire Tracer**

### **User Manual**

**English**

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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

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.

**Non-warranty Repairs and Replacement – Europe**

European non-warranty units can be replaced by your Amprobe distributor for a nominal charge.

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## 1. PRECAUTIONS AND SAFETY MEASURES

### General

For your own safety and to avoid damage to the instrument it is suggested to follow the procedures listed below:

**NOTE: Before and during measurements be diligent to follow the instructions.**

- Make sure that the electrical instrument is operating properly before use.
- Before attaching any of the conductors, make sure the voltage present in the conductor is within the range of the instrument.
- Keep the instruments in their carrying case when not in use.
- If the Transmitter or Receiver will not be used for a long time, remove the batteries to prevent leakage in the instruments.
- Use Amprobe approved cables and accessories only.

### Safety precautions

- In many instances, dangerous levels of voltage and/or current may be present. Therefore, it is important to avoid direct contact with any uninsulated current carrying surfaces. Insulated gloves and protective clothing should be worn in hazardous voltage areas.
- Do not measure voltage or current in wet, damp or dusty places.
- Do not measure voltage in the presence of gas, explosive materials or combustibles.
- Do not touch the circuit under test if no measurement is being taken.
- Do not touch exposed metal parts, such as unused terminals and circuits.
- Do not use the instrument if it appears to be malfunctioning (i.e. if you notice deformations, breaks, leakage of substances, absence of messages on the display, etc).

### SYMBOLS

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Caution! Refer to the explanation in this manual.                                                                                                                                                                                                                                                                                                                                                                                                            |
|  | WARNING HAZARDOUS VOLTAGE. Risk of electric shock.                                                                                                                                                                                                                                                                                                                                                                                                           |
|  | Consult user documentation.                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  | The equipment is protected by double insulation or reinforced insulation.                                                                                                                                                                                                                                                                                                                                                                                    |
|  | Earth (Ground).                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|  | Fuse.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|  | Battery.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|  | Certified by CSA Group to North American safety standards.                                                                                                                                                                                                                                                                                                                                                                                                   |
|  | Conforms to relevant South Korean EMC Standards.<br><b>Electromagnetic Compatibility:</b><br><b>Korea (KCC):</b> Class A Equipment (Industrial Broadcasting & Communication Equipment) <sup>(1)</sup><br><sup>(1)</sup> This product meets requirements for industrial (Class A) electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and is not to be used in homes. |
|  | Conforms to relevant Australian standards.                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  | Complies with European Directives.                                                                                                                                                                                                                                                                                                                                                                                                                           |
|  | This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste.                         |

## 1. PRECAUTIONS AND SAFETY MEASURES

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### Safety information

The product complies with:

- UL/IEC/EN 61010-1, CAN/CSA C22.2 No. 61010-1, Pollution Degree 2, Measurement CAT III 600 V MAX
- IEC/EN 61010-2-033
- IEC/EN 61010-2-032
- IEC/EN 61010-031 (test leads)
- EMC IEC/EN 61326-1

**Measurement Category III (CAT III)** is applicable to test and measure circuits connected to the distribution part of the building's low-voltage MAINS installation. This part of the installation is expected to have a minimum of two levels of over-current protective devices between the transformer and possible connecting points.

### CENELEC Directives

The instrument conforms to CENELEC Low-voltage directive 2014/35/EU and Electromagnetic compatibility directive 2014/30/EU.

### **Warnings: Read Before Using**

To avoid the possibility of electric shock or personal injury:

- Use the Product only as specified in this manual or the protection provided by the instrument may be compromised.
- Avoid working alone so assistance can be rendered.
- Test on a known signal source within the rated voltage range of the Product both before and after use to ensure the Product is in good working conditions.
- Do not use the Product around explosive gas, vapor, or in damp or wet environments.
- Inspect the Product before use and do not use if it appears damaged. Check for cracks or missing plastic. Pay particular attention to the insulation around the connectors.
- Inspect the test leads before use. Do not use if insulation is damaged or metal is exposed.
- Do not use the Product if it operates incorrectly. Protection may be impaired. When in doubt, have the Product serviced.
- Check the test leads for continuity. Replace damaged test leads before using the Product.
- Have the Product serviced only by qualified service personnel.
- Use extreme caution when working around bare conductors or bus bars. Contact with the conductor could result in electric shock.
- Do not hold the Product beyond the tactile barrier.
- Do not apply more than the rated voltage and CAT rating, as marked on the Product, between the terminals or between any terminal and earth ground.
- Remove test leads from the Product before opening the Product case or battery cover.
- Never operate the Product with the battery cover removed or the case open.
- Use caution when working with voltages above 30 V AC RMS, 42 V AC peak, or 60 V DC. These voltages pose a shock hazard.
- Do not attempt to connect to any circuit carrying voltage that may exceed the maximum range of the Product.
- Use the proper terminals, functions and ranges for your measurements.
- When using alligator clips, keep fingers behind the finger guards.
- Use only exact fuse replacement and specified replacement parts.
- When making electrical connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.

## 1. PRECAUTIONS AND SAFETY MEASURES

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- To avoid false readings that can lead to electrical shock and/or injury, replace the batteries as soon as the low battery indicator appears. Check Meter operation on a known source before and after use.
- Use only AA batteries, properly installed in the Meter case, to power the Product (see Section 5.1: Battery Replacement).
- When servicing, use only specified user serviceable replacement parts.
- Adhere to local and national safety codes. Individual protective equipment must be used to prevent shock and arc blast injury where hazardous live conductors are exposed.
- Only use the test lead provided with the Product or UL Listed Probe Assembly rated CAT III 600 V or better.
- Do not use the HOT STICK (TIC 410A) to operate the AT-6000-R Receiver at voltages above 600 V.
- Remove the batteries if the Meter is not used for an extended period of time, or if stored in temperatures above 122 °F (50 °C). If the batteries are not removed, battery leakage can damage the Meter.
- Follow all battery care and charging instructions from the battery manufacturer.
- Do not use the Product to check for absence of voltage. Please use a voltage tester instead.

This manual contains information and warnings that must be followed for safe operation and maintenance of the instrument. If the Product is used in a manner not specified by the manufacturer, the protection provided by the Product may be impaired. This Product meets water and dust protection IP52 (Receiver) and IP40 (Transmitter and signal clamp) per IEC 60529. Do NOT operate outside during periods of rainfall. The Product is double insulated for protection per EN 61010-1 to CAT III 600 V.

**CAUTION:** Do not connect the Transmitter to a separate ground in Electrically Susceptible Patient areas of a health care facility. Make the ground connection before disconnecting.

Your shipping box should include:

|                                           | AT-6010 KIT |
|-------------------------------------------|-------------|
| AT-6010-R RECEIVER                        | 1           |
| AT-6010-T TRANSMITTER                     | 1           |
| TL-6000-INTL TEST LEAD AND ACCESSORY KIT* | 1           |
| CC-6010 SOFT CARRYING CASE                | 1           |
| USER MANUAL                               | 1           |
| 1.5 V AA (IEC LR6) BATTERY                | 12          |

\*TL-6000-INTL test lead and accessory kit includes:

- 2 x 1 m test leads (red, black)
- 1 x 7 m test lead (green)
- 2 x Alligator clips (red, black)
- 2 x Outlet blade adapter (red, black)
- 2 x Outlet round adapter (red, black)

**Optional accessories:**

ADPTR-SCT Socket adapter  
HS-1 Magnetic hanger  
TL-7000-25M Test lead  
CT-400 Signal clamp

## 2. KIT COMPONENTS

### 2.1 AT-6010-R Receiver

The AT-6010-R Receiver detects the signal in wires and cables. The signal is generated by the AT-6010-T Transmitter, which is connected to the wire.

The main advantage of this method is the ability to trace the path of the particular wire using the Receiver. Since the signal is not present in any neighboring wires, the Receiver will detect only the wire that is connected to the Transmitter.

**Note:** The Receiver will NOT detect signals from a wire through metal conduit or shielded cable. Refer to Special Applications, section 4.4 "Tracing Wires In Metal Conduit" for alternative tracing methods.

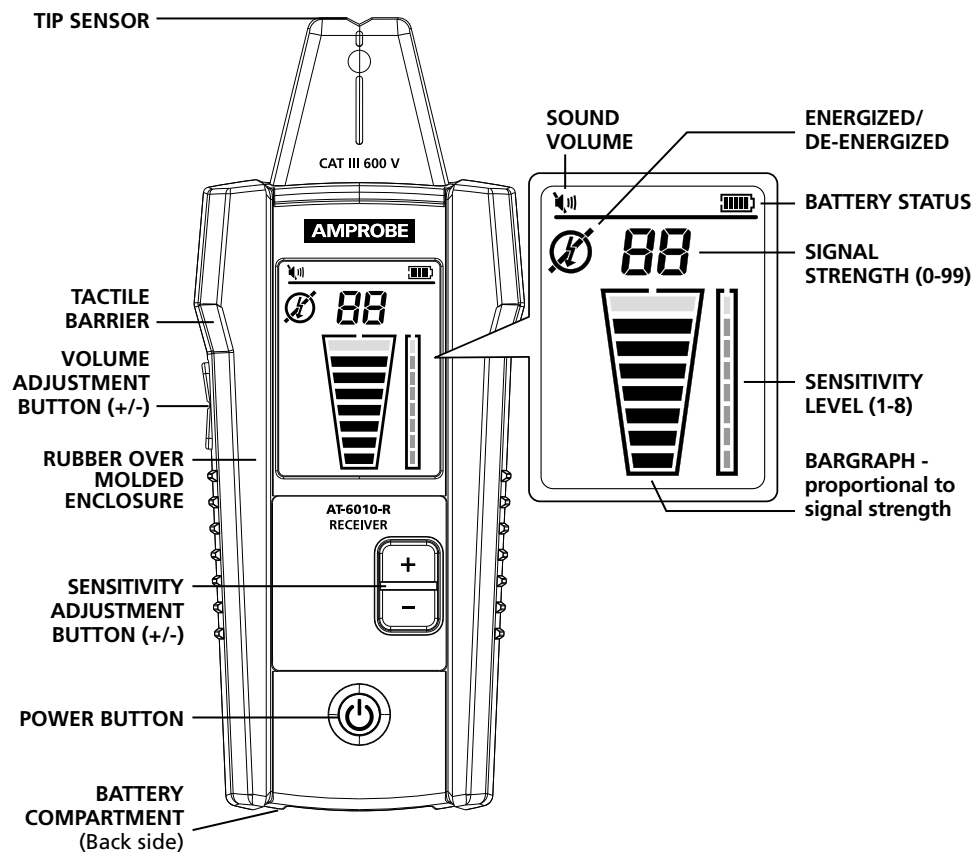


Figure 2.1: Overview of AT-6010-R Receiver

**POWER BUTTON:** Short press to turn the Receiver on. Long press >2s to turn the Receiver off.

**VOLUME ADJUSTMENT:** The volume can be changed by short presses on the volume +/- buttons. The mute and four loudness level are available. The chosen volume level will be shown on the display.

**TIP SENSOR:** The LED on the Tip Sensor will blink when a signal is detected. The stronger the signal, the faster the blinking.

**SENSITIVITY:** Press +/- buttons to adjust the sensitivity of the Receiver. Eight levels are available.

## 2. KIT COMPONENTS

### 2.2 AT-6010-T Transmitter

The AT-6010-T Transmitter works on Energized and De-energized circuits up to 600 V AC/DC in Category I through Category III electrical environments.

#### Transmitter signal modes:

**High Signal (Hi)** – The HIGH mode function is recommended for most wire tracing applications on Energized and De-energized circuits including breaker location. This function will be used majority of the time.

**Loop mode** – This mode is initiated by short pressing On/Off button. Loop LED is On when this mode is activated. It should be used when working with closed loop De-energized circuits, such as shorted wires, shielded cables or De-energized wires that are grounded on the far-end.

**How is the Loop function different from the Hi setting when using test leads?**

**HIGH mode (Hi)** generates a signal in all open branches of the De-energized circuit. This is useful when tracing open wires. Hi mode will NOT work on wires that are grounded on the far-end because the signal cannot be generated.

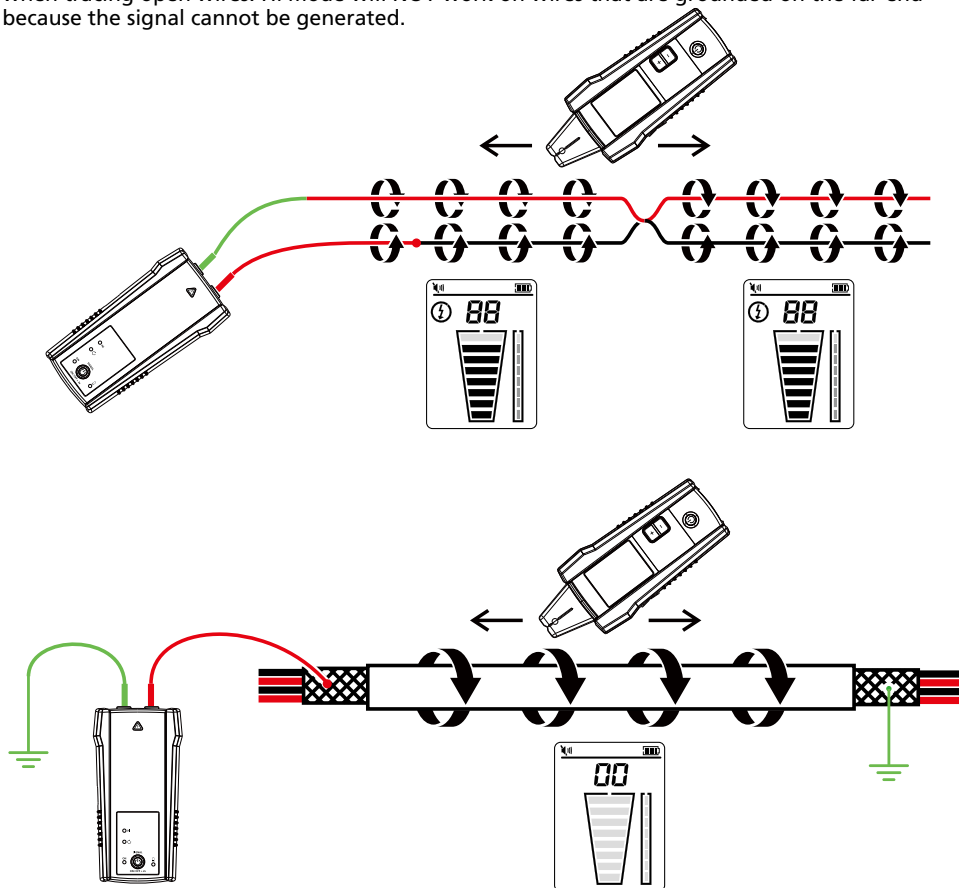


Figure 2.2a: Generating a signal with HIGH mode

**Loop mode** generates a signal (current flow) in closed loop De-energized circuits only. Loop mode is used to pinpoint the location of a short (because the current will not be able to flow in open branches) and to trace wires that are grounded on the far end (because the loop is closed via ground connection).

## 2. KIT COMPONENTS

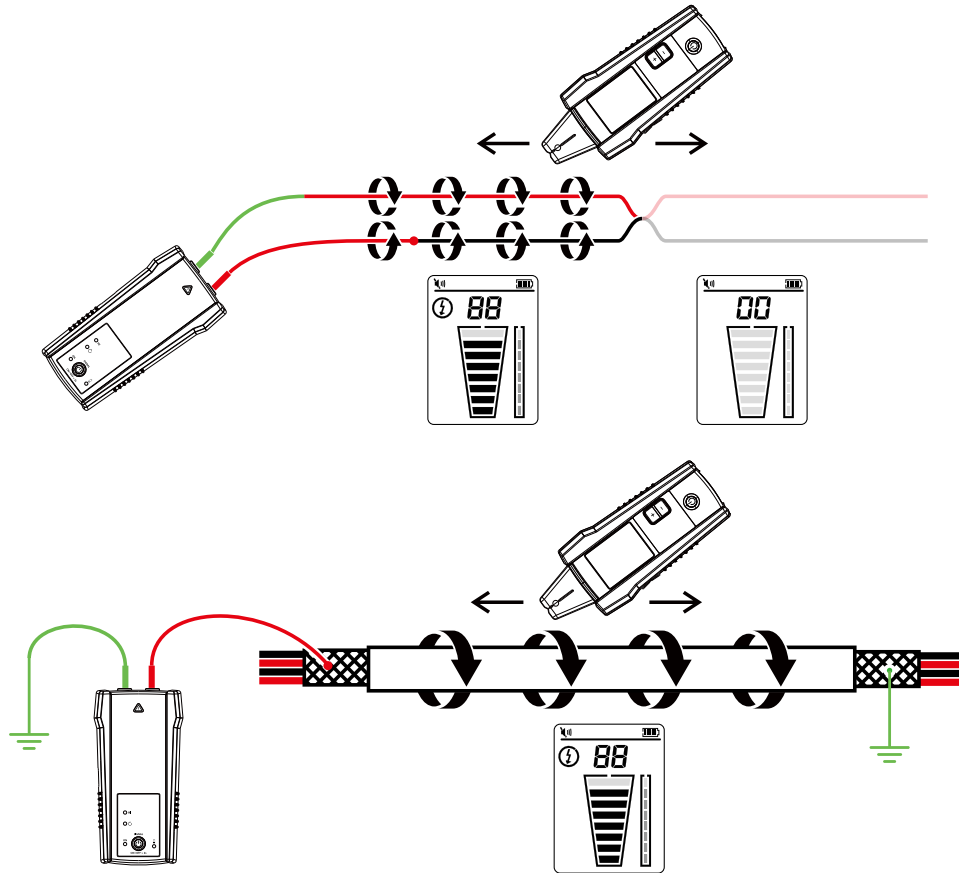


Figure 2.2b: Generating a signal in Loop mode

Note: Loop mode only works on De-energized circuits. It is automatically disabled when the Transmitter is connected to an Energized line with test leads.

### Working with the Transmitter:

When the Transmitter is on and connected to the circuit with test leads, it checks for voltage. A red Voltage Warning Indicator will light up if the Transmitter detects dangerous voltage levels above 30 V AC/DC.

### IMPORTANT!

The Voltage Warning Indicator light will blink when overvoltage (> 650 V AC/DC) is detected. In case of overvoltage immediately disconnect the Transmitter from the circuit.

This Voltage Warning Indicator is not designed to check for absence of voltage. Please use a voltage tester instead.

The Transmitter starts generating a tracing signal as soon as it is turned on. Based on the detected voltage, the Transmitter automatically switches to either:

- Energized mode (30 to 600 V AC/DC) generating 6 kHz frequency
- De-energized mode (0 to 30 V AC/DC) generating 33 kHz frequency

Energized mode uses a lower transmission frequency (6 kHz) than De-energized mode (33 kHz) to reduce signal coupling between wires. De-energized mode requires a higher frequency in order to generate a reliable signal.

## 2. KIT COMPONENTS

**Energized mode:** In Energized mode, the Transmitter draws a very low current from the Energized circuit and generates a 6 kHz signal. This is a very important feature of the Transmitter, since drawing current does not inject any signal that would harm sensitive equipment connected to the circuit. The signal is also generated in a direct path between the Transmitter and the power source, thus NOT placing a signal onto any branches enabling wiring tracing directly back to the breaker panel. Please note that due to this feature, the Transmitter has to be connected on the load side of the circuit.

**De-energized mode:** In De-energized mode, the Transmitter injects a 33 kHz signal onto the circuit. In this mode, the signal will travel through all the circuit branches because it is injected. The high frequency/low energy signal will not harm any sensitive equipment.

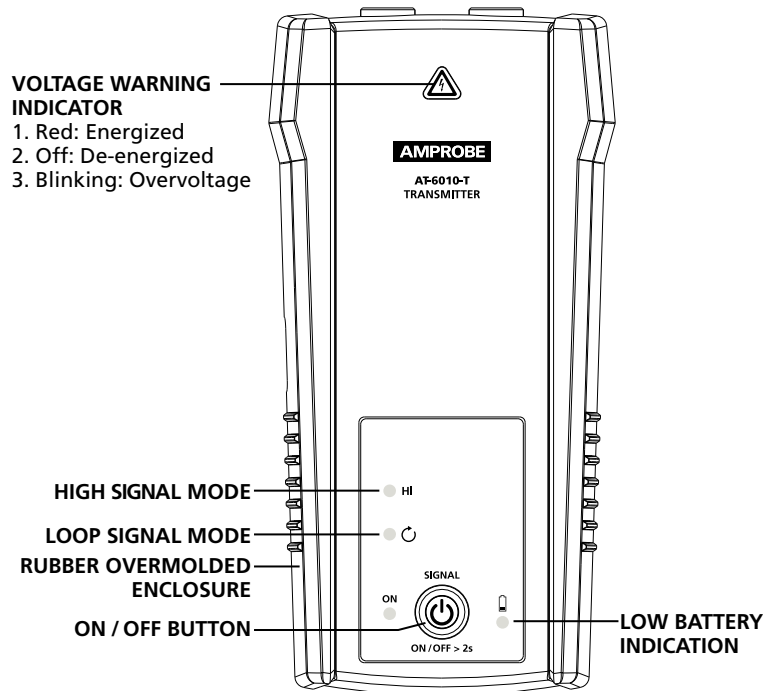


Figure 2.2c: Overview of AT-6010-T Transmitter

### ON/OFF:

- Long press >2s to turn the Transmitter on (Transmitter is automatically in HIGH mode).
- Short press ON/OFF button to switch between HIGH and LOOP mode.
- Long press >2s to turn the Transmitter off.

**VOLTAGE WARNING INDICATOR:** The warning light will be ON for Energized circuits (30 to 600 V AC/DC), OFF for De-energized circuits (0 to 30 V AC/DC), and BLINKING if an overvoltage is detected (> 650 V AC/DC).

### Low battery indication:

|              |                     |                      |
|--------------|---------------------|----------------------|
| LED OFF      | Batteries OK        | approx. 10V to 12V   |
| LED ON       | Low battery warning | approx. 9.5V to 10V  |
| LED Blinking | Replace battery     | approx. 7.3V to 9.5V |

Device will power off if voltage is below 6.9 V

## 2. KIT COMPONENTS

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### 2.3 CT-400 Signal Clamp

(optional accessory for the AT-6010)

The Signal Clamp accessory is used for applications when there is no access to the bare conductors. The clamp attachment enables the Transmitter to induce a signal through the insulation into either wires. The clamp works on low impedance closed circuits.

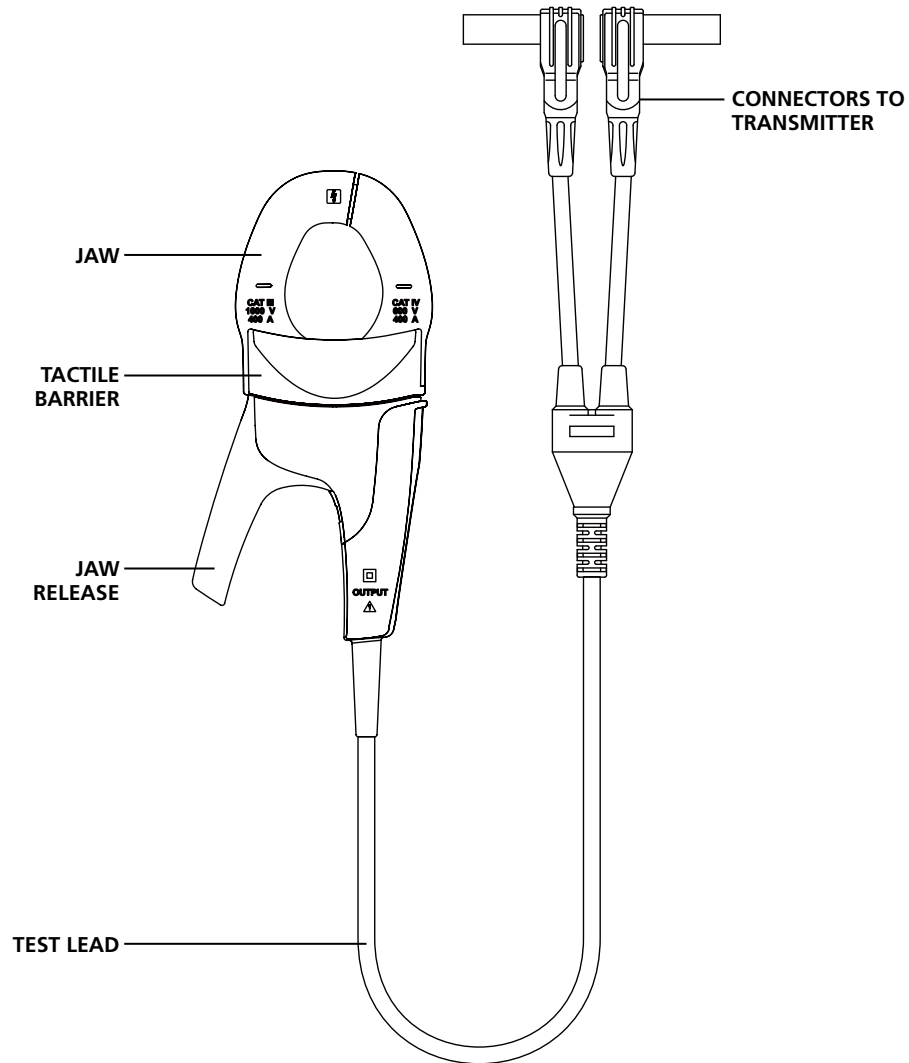


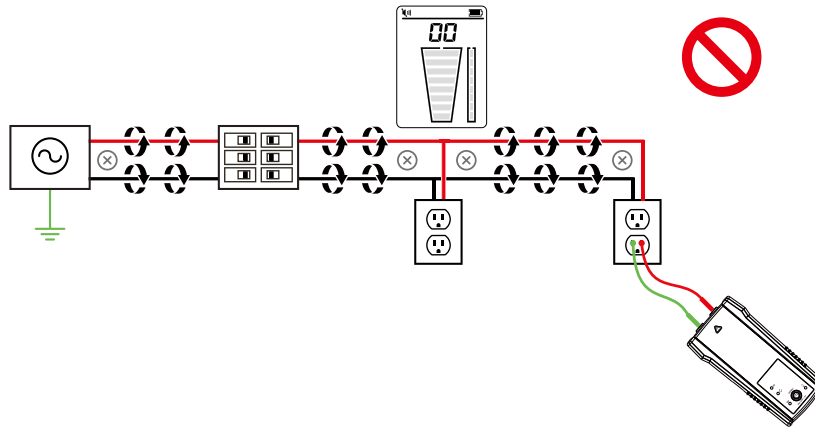
Figure 2.3: Overview of CT-400 Signal Clamp

### 3. MAIN APPLICATIONS

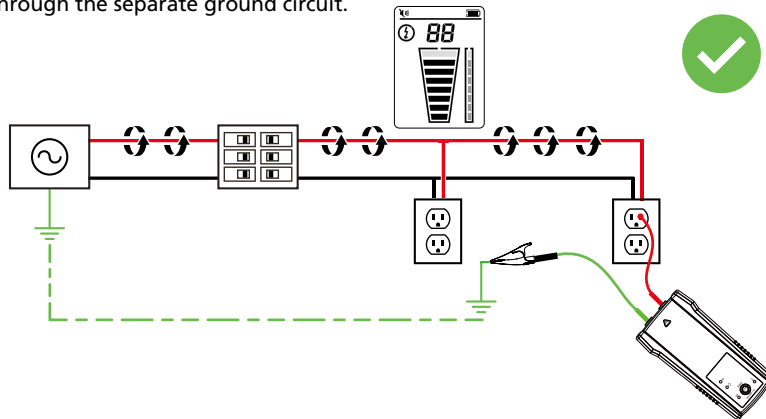
#### ⚠ ⚠ IMPORTANT NOTICE, PLEASE READ BEFORE STARTING TRACING

##### **Avoiding signal cancellation problems with a separate ground connection**

The signal generated by the Transmitter creates an electromagnetic field around the wire. This field is what is detectable by the Receiver. The clearer this signal, the easier it is to trace the wire. If Transmitter is connected to two adjacent wires on the same circuit (for example, hot and neutral wires on a Romax cable), the signal travels in one direction through the first wire and then returns (in opposite direction) through the second. This causes the creation of two electromagnetic fields around each wire with opposite direction. These opposing fields will partially or completely cancel each other out, making wire tracing difficult if not impossible.



To avoid the cancellation effect, a separate ground connection method should be used. The red test lead of the Transmitter should be connected to the hot wire of the circuit you wish to trace, and the green lead to a separate ground, such as water pipe, ground stake, metal grounded structure of the building, or outlet ground connection of an outlet on a different circuit. It is important to understand that an acceptable separate ground is NOT the grounding terminal of any receptacle on the same circuit as the wire you wish to trace. If hot wire is Energized and the Transmitter is properly connected to a separate ground, the red LED on the Transmitter will light up. The separate ground connection creates maximum signal strength because the electromagnetic field created around the hot wire is not being cancelled by a signal on the return path flowing along an adjacent wire (hot or neutral) in the opposite direction, but rather through the separate ground circuit.



### 3. MAIN APPLICATIONS - TRACING ENERGIZED AND DE-ENERGIZED WIRES

#### 3.1 Tracing – Energized and De-energized Wires

##### Connecting test leads to the Transmitter

1. Connect the green and red test leads to the Transmitter (polarity does not matter).
2. Using provided test leads accessories, connect the red test lead to the wire being traced, Energized or De-energized. For receptacles, make sure to connect the test lead to the line (hot) wire. For Energized systems the signal will ONLY be transmitted between the load-side to which the Transmitter is connected and the source of power (see Figure 3.1a).
3. Connect the green wire to a separate ground (metal building structure, metal water pipe, or ground wire on a separate circuit).

**\*Note:** Please note that if working with GFCI protected circuits, this method will trip the GFCI protection. Refer to Special Applications, section 4.1 "GFCI-Protected Circuit Wire Tracing" for alternative tracing methods.

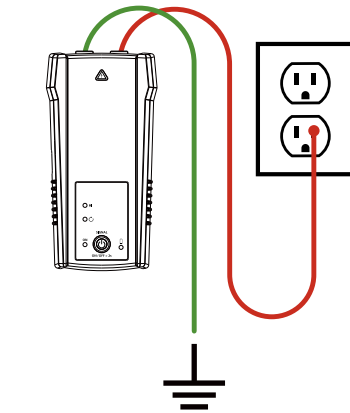


Figure 3.1a: Proper connection with separate ground

**TIP:** The Transmitter, with the red test lead, can be directly connected to the live wire of the working electrical equipment under load (motor, electronics, etc). Tracing can be performed without needing to turn off the equipment or switching power off.

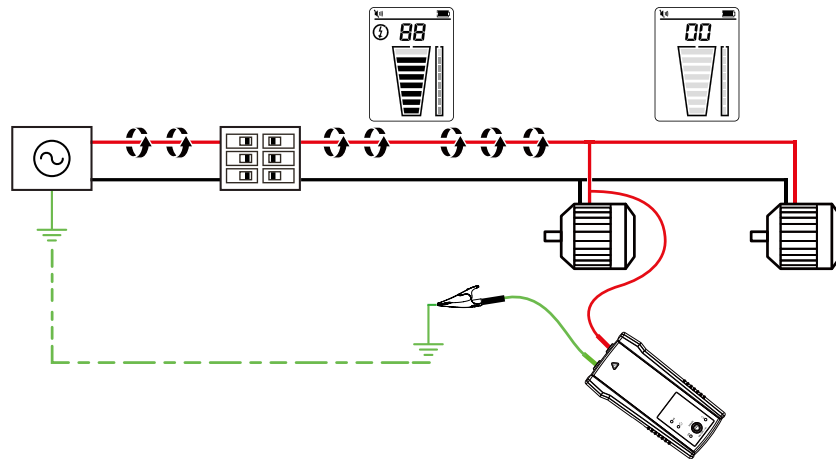


Figure 3.1b: Connecting Transmitter to Energized working system

##### Setting up the AT-6010-T Transmitter

1. Press ON/OFF key to turn on the Transmitter.
2. Verify that the test leads are properly connected; the red LED voltage status light should be on for circuits with voltage above 30 V AC/DC, and it should be off for De-energized circuits below 30 V AC/DC.  
**Note:** Make sure to use the separate ground connection as described above.
3. HIGH signal mode is automatically activated when the Transmitter is turned on. The LED on the Transmitter should appear as in Figure 3.1c.

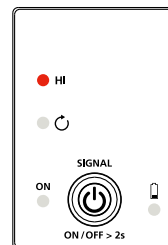


Figure 3.1c: Transmitter indicator showing signal in HIGH mode

### 3. MAIN APPLICATIONS - TRACING ENERGIZED AND DE-ENERGIZED WIRES

#### Using the AT-6010-R Receiver in Tracing Mode

Use Receiver to precisely pinpoint the wire location or the place of the fault. The Receiver will indicate detected signal strength using a two digit readout, bar graph and sound.

1. Turn the Receiver on. Tracing mode is automatically activated.
2. Scan target area with the Tip Sensor to find the highest signal level. While tracing, periodically adjust sensitivity to keep the signal strength near 50. Increase or decrease sensitivity by pressing + or - on the keypad.
3. For best results while tracing Energized wires, align groove on the Tip Sensor with wire direction as shown in Figure 3.1d. Signal may be not detected if not properly aligned. To verify wire direction, periodically rotate the Receiver 90 degrees. Signal strength will be the highest when wire is aligned with the Tip Sensor groove.

Depending on the detected signal, the Receiver automatically switches to either Energized ⚡ or De-energized ⚡ mode, and displays this information on the LCD. No manual setup is necessary.

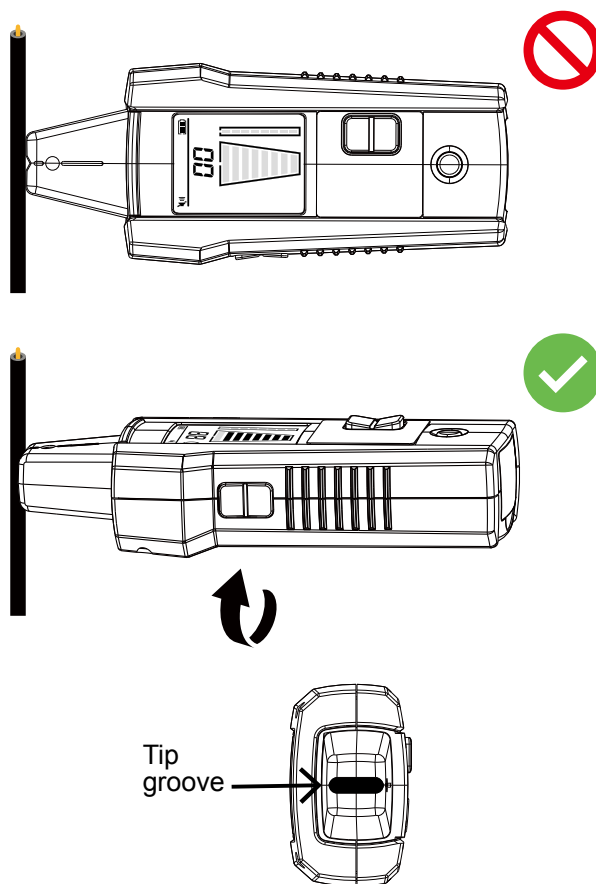


Figure 3.1d: Aligning the Tip Sensor groove

**Note:** For best results, keep the Receiver at least 3 feet from the Transmitter and test leads to minimize signal interference.

### 3. MAIN APPLICATIONS - TRACING ENERGIZED AND DE-ENERGIZED WIRES

#### 3.2 Identifying Breakers and Fuses (Energized and De-energized)

**Note:** For breaker locating, a simplified direct connection to hot and neutral wires can be used because these wires are separated at the breaker panel. There is no risk of signal cancellation effect if wires are at least a few inches away from each other. However, the separate ground connection (section 3.1) should be used for superior results specifically if wires need to be traced in addition to breaker identification.

The simplified direct connection to hot and neutral wire will NOT trip the GFCI circuit.

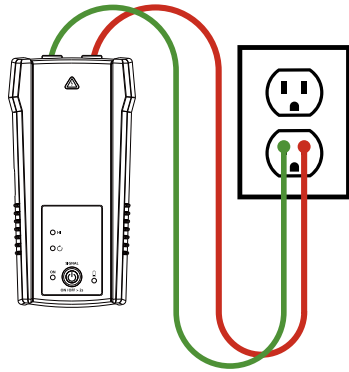


Figure 3.2a: Simplified direct connection

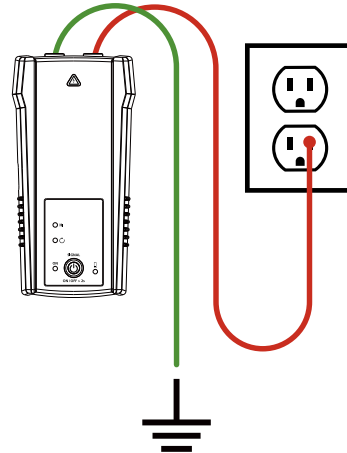


Figure 3.2b: Separate ground connection (Preferred)

#### Connecting the test leads

1. Connect the Transmitter using either simplified direct connection or separate ground connection.
2. If the simplified direct connection method is used, connect the test leads directly to the hot and neutral wires. While locating a breaker, wires will not be traceable as the signals will cancel each other out.
3. For separate ground connection, connect the red lead to the line (hot) wire on the load side of the system. The wire can be energized or de-energized. Connect the green lead to a separate ground, such as a metal building structure, metal water pipe, or ground wire on a separate circuit.

**TIP:** The Transmitter, with the red test lead, can be directly connected to the live wire of the working electrical equipment under load (motor, electronics, etc). Tracing can be performed without needing to turn off the equipment or switching power off.

### 3. MAIN APPLICATIONS – LOCATING BREAKERS

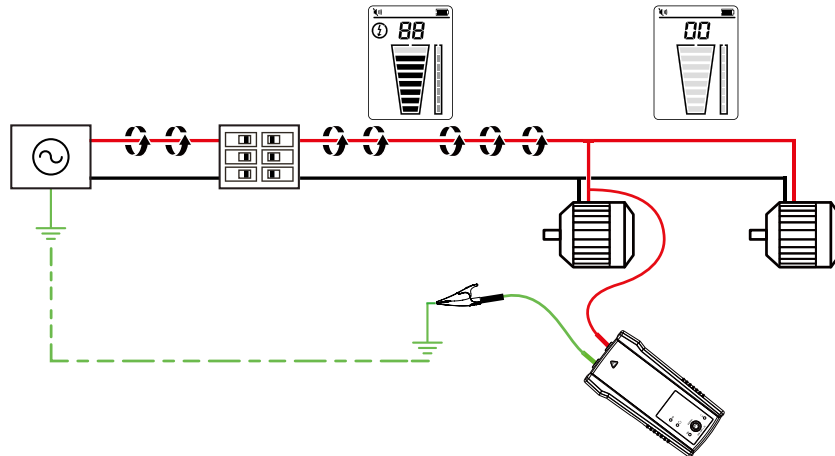


Figure 3.2c: Connecting Transmitter to Energized working system

#### Setting up the AT-6010-T Transmitter

1. Press the ON/OFF key to turn on the Transmitter.
2. Verify that the test leads are properly connected. The red LED voltage status light will illuminate for Energized circuits with a voltage above 30 V AC/DC. If the voltage is De-energized, the light will be off.
3. HIGH signal mode is automatically activated when Transmitter is turned on.

#### Using the AT-6010-R Receiver

1. Turn the Receiver on. Tracing mode is automatically activated.
2. Align the groove on the Tip Sensor with the breaker lengthwise (See Figure 3.2d).
3. Scan all breakers in any order to find a breaker with the highest signal. Adjust sensitivity by pressing + or - on the keypad to show the signal strength near 50 for the breaker with the highest signal. After any sensitivity adjustment rescan all breakers to find the one with the highest signal level.

**Important note: Differentiation in breaker designs, height and internal contact structure may affect the precision of breaker identification. For most reliable results, remove the breaker panel cover and perform a scan on the wires instead of the breakers.**

Depending on the detected signal, the Receiver automatically switches to either Energized ⚡ or De-energized ⚡ mode, and displays this information on the LCD.

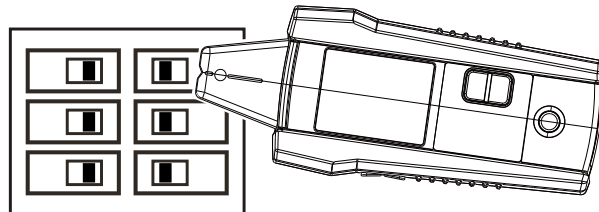


Figure 3.2d: Aligning the Tip Sensor groove with the breaker

## 4. SPECIAL APPLICATIONS

### 4.1 GFCI-Protected Circuit Wire Tracing: Connecting the AT-6010-T Transmitter to GFCI Protected Circuits

Connecting the Transmitter to an Energized GFCI protected circuit using a separate ground method will trip the GFCI protection. Use the following methods to work with GFCI protected circuits. For a De-energized GFCI-protected outlet that is not tripped, you can connect test leads directly to the outlet contacts using the De-energized Tip Sensor mode.

**Method 1** – Bypass the GFCI circuitry to avoid tripping GFCI:

(for Energized GFCI-protected outlets only)

- Remove the protective receptacle wall plate.
- Using the alligator clip, attach the red test lead to the screw to connect the Energized hot wire to the receptacle.
- Connect the green test lead using a separate ground method.
- Perform tracing as described in sections 3.1 or 3.2.

**Method 2** – Do NOT use separate ground to avoid tripping GFCI:

(for GFCI-protected outlets and breakers)

- Connect the Transmitter with the test leads to the Neutral and Hot wires.
- Perform tracing as described in sections 3.1 or 3.2.

Note: This type of connection causes signal coupling and reduces signal strength. If the signal is too weak or untraceable, use Method 3.

**Method 3** - De-energize the circuit:

(for GFCI-protected breakers)

- Connect the Transmitter directly to the wire as described in section 3.1.
- Perform tracing as described in sections 3.1 or 3.2.

### 4.2 Finding Breaks/Opens

It is possible to pinpoint the exact location where a wire is broken, even if the wire is located behind walls, floors or ceilings.

1. Make sure that wire is De-energized.
2. Use the steps described in section 3.1 to connect the Transmitter and perform tracing.
3. For best results, ground all De-energized wires that run in parallel with the black test lead.

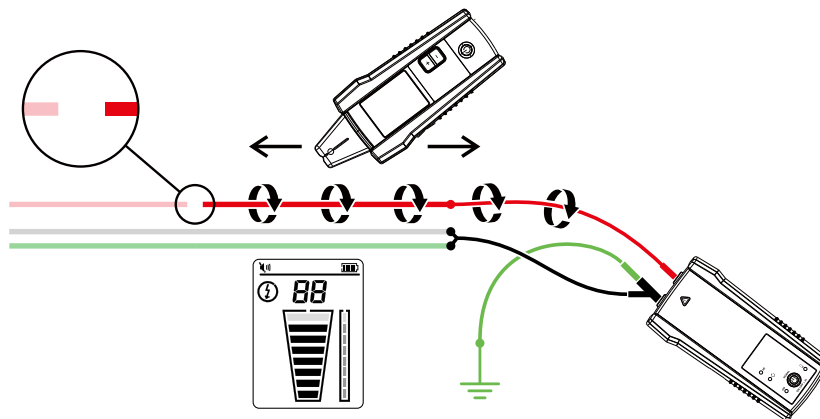


Figure 4.2: Locating a break or open

#### 4. SPECIAL APPLICATIONS

The tracing signal generated by the Transmitter is conducted along the wire as long as there is continuity in the metal conductor. To find a fault, trace the wire until the signal stops. To verify the fault's location, move the Transmitter to the other end of the wire and repeat, tracing from the opposite end. If signal stops at the exact same location, the fault has been located.

**Note:** If the place of the fault is not found, the result may be a high resistance break (partially open circuit). Such a break would stop higher currents from flowing but will conduct the tracing signal through the break. Such faults will not be detected until the wire is completely open.

##### 4.3 Finding Shorts

Shorted wires will cause a breaker to trip. To correct this, disconnect the wires and make sure the ends of the wires on both sides of the cable are isolated from each other and other wires or loads.

1. Connect the Transmitter with the test leads to the circuit as shown in Figure 4.3.
2. Switch the Transmitter to Loop mode by short press of On/Off button. Verify that the Loop LED is ON.
3. Turn on the Receiver. Tracing mode is automatically activated.

Start tracing the cable until the signal stops. To verify the place of the fault, move the Transmitter to the other end of the wire and repeat tracing from the opposite end. If the signal stops at the exact same location the fault has been located.

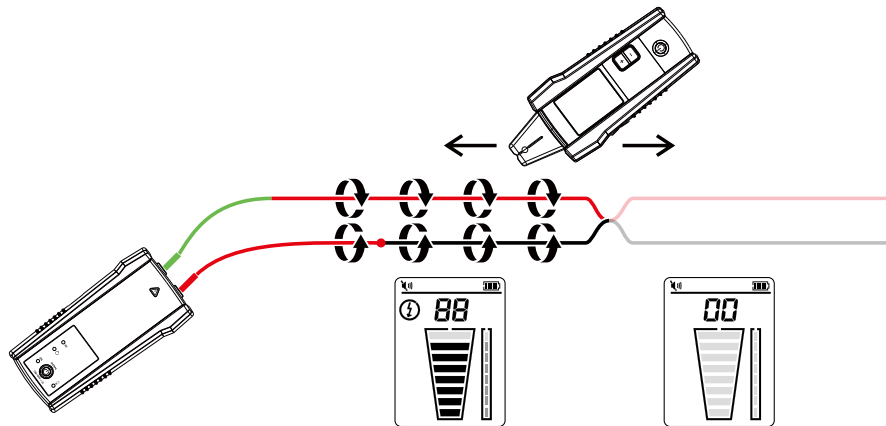


Figure 4.3: Tracing a cable to find shorts

**Note:** This method will be affected by signal cancellation effect. Expect a relatively weak signal.

##### 4.4 Tracing Wires in Metal Conduit

The Receiver is unable to pick up the signal from a wire through a metal conduit. The metal conduit will completely shield the tracing signal.

**Note:** The Receiver will be able to detect wires in a non-metallic conduit. For these applications follow general tracing guidelines.

To trace wires in a metal conduit:

1. Turn on the Receiver. Tracing mode is automatically activated.
2. Open junction boxes and use the Receiver Tip Sensor to detect which wire in the junction box is carrying the signal.
3. Move from junction box to junction box to follow the path of the wire.

**Note:** Applying a signal directly to the conduit will send the signal through all the conduit branches, making tracing a particular conduit path impossible.

## 4. SPECIAL APPLICATIONS

### 4.5 Tracing Non-Metallic Pipes and Conduits

The Transmitter can indirectly trace plastic conduits and pipes using the following steps:

1. Insert fish tape or wire inside the conduit.
2. Connect the Transmitter with the red test lead to the fish tape and the green ground wire to a separate ground (see section 3.1 for further set-up instructions).
3. Turn on the Receiver and trace the conduit. Tracing mode is automatically activated.
4. The Receiver will pick up the signal conducted by the fish tape or wire through the conduit.

### 4.6 Tracing Shielded Wires

Shielded wire prevents the Receiver from detecting a tracing signal when following the standard user instructions. To effectively trace shielded wire, follow these procedures.

**If shielded wire is grounded at the far-end:**

1. Switch the Transmitter to Loop mode by short press of On/Off button. Verify that the Loop LED is ON.
2. Disconnect the ground on the near-end of the shielded wire and connect the shield to one of the terminals of the Transmitter (polarity does not matter) with a test lead.
3. Connect the second output of the Transmitter to a separate ground.
4. Turn on the Receiver and trace the shield. Tracing mode is automatically activated.

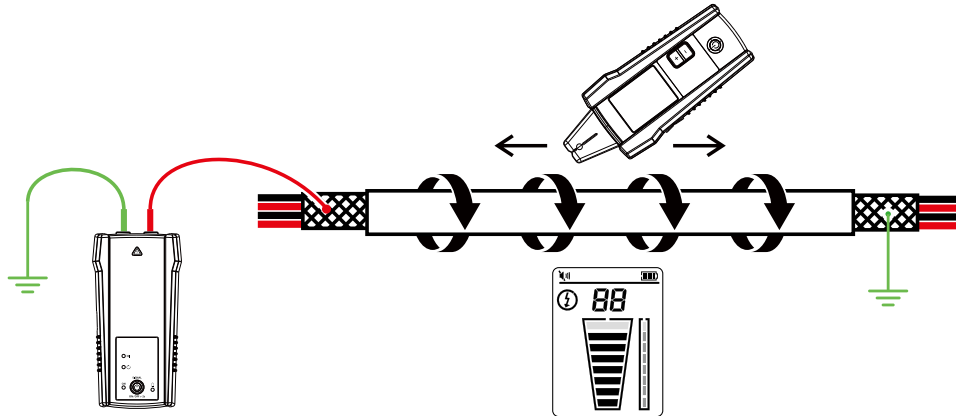


Figure 4.6a: Tracing a shielded wire grounded at the far-end

**If shielded wire is disconnected from ground at the far-end:**

1. Connect the Transmitter directly to the wire as described in section 3.1.
2. Disconnect the ground on the near-end of the shielded wire and connect the shield to one of the terminals of the Transmitter (polarity does not matter) with a test lead.
3. Connect the second output of the Transmitter to a separate ground.
4. Turn on the Receiver and trace the shield. Tracing mode is automatically activated.

#### 4. SPECIAL APPLICATIONS

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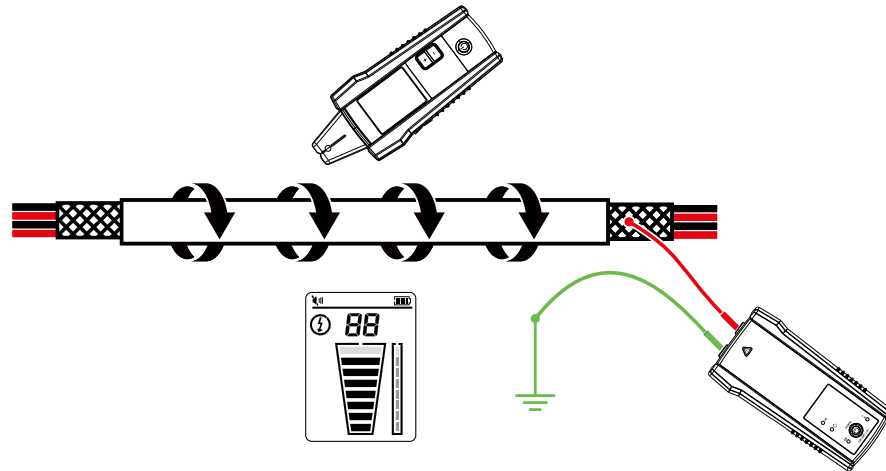


Figure 4.6b: Tracing a shielded wire disconnected from the ground at far-end

#### 4.7 Tracing Underground Wires

The AT-6010 can trace Energized and De-energized wires underground the same way it can locate wires behind walls or floors. Follow general wire tracing instructions in section 3.

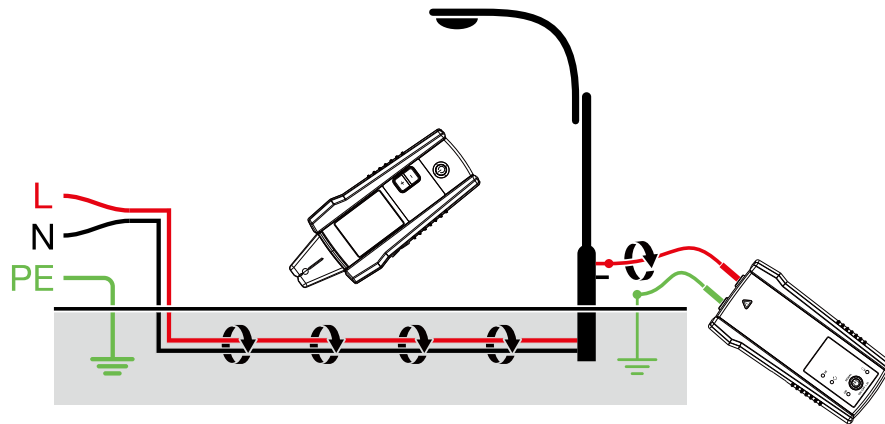


Figure 4.7: Tracing underground wires

#### 4.8 Tracing Low Voltage Wires and Data Cables

The AT-6010 can trace data, audio and thermostat cables (to trace shielded data cables, refer to section 4.6).

##### Trace data, audio, and thermostat cables

1. Connect the Transmitter using the separate ground method described in section 3.1.
2. Turn on the Receiver and trace the wire. Tracing mode is automatically activated.

## 4. SPECIAL APPLICATIONS

### 4.9 Sorting Bundled Wires

#### Identify a specific wire in a bundle

1. Connect the Transmitter as described in section 3.1. If connecting to an Energized wire, make sure the Transmitter is connected on the load side.
2. Turn on the Receiver. Tracing mode is automatically activated.
3. One at a time, pull each wire away from the others and touch it with the Tip Sensor. The strongest signal indicates the proper wire in the bundle.
4. Adjust the Receiver sensitivity as required with +/- buttons.

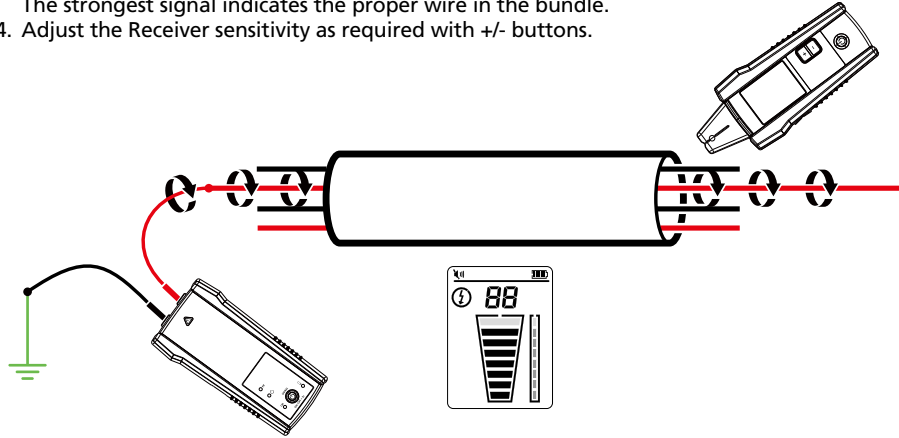


Figure 4.9: Identifying a specific wire in a bundle

### 4.10 Mapping a Circuit using Test Leads Connection

Mapping a circuit can be only performed on a De-energized circuit when using test leads connection.

1. Switch the breaker to the OFF position.
2. Set up the Transmitter and Receiver as described in the section 3.1.
3. Scan face plates of receptacles and wires connecting loads with the Tip Sensor of the Receiver
4. All the wires, receptacles and loads that have a strong signal as indicated by the Receiver are connected to the breaker.

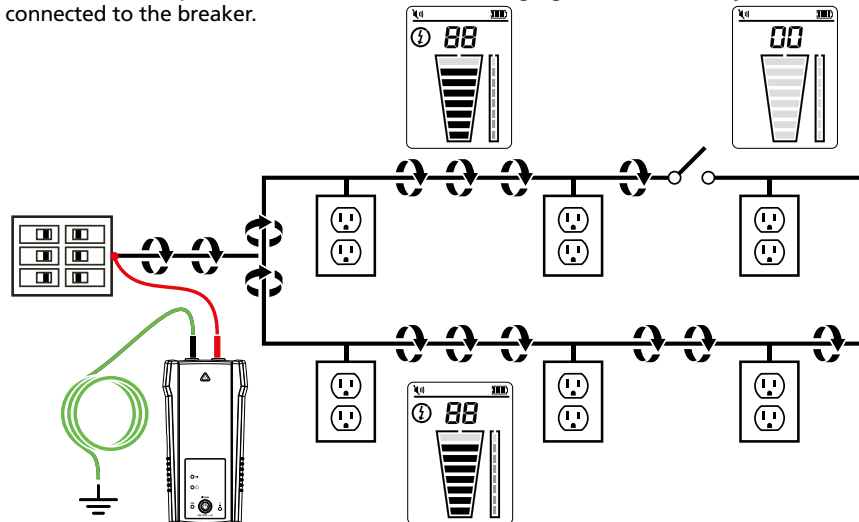


Figure 4.10: Mapping a circuit using test leads connection

## 4. SPECIAL APPLICATIONS

### 4.11 Tracing Breakers on Systems with Light Dimmers

Light dimmers can produce a significant amount of electrical “noise” that consists of multi-frequency signals. In some rare situations, the Receiver can misread this noise, often called a “ghost” signal, as a Transmitter - generated signal. Therefore, the Receiver may provide wrong readings.

When locating breakers or fuses on systems with light dimmers, the dimmer should be off (the light switch is off). This prevents the Receiver from indicating a wrong breaker/fuse.

### 4.12 Signal Clamp (optional accessory) - Closed Loop Circuits

**Closed loop, De-energized and low impedance circuits**

The clamp accessory is used for applications where there is no access to a bare conductor to connect the test leads. When the clamp is connected to the Transmitter, it enables the Transmitter to induce a signal to the Energized or De-energized wire through the insulation. Typical applications of the Signal Clamp include tracing conduits or shields grounded on both ends. For signal cables and De-energized wires or loads, temporarily ground the circuit on both ends to perform tracing.

#### Connecting the Signal Clamp

1. Connect the CT-400 test leads to the terminals of the Transmitter (polarity does not matter).
2. Clamp the CT-400 Signal Clamp around the conductor. To increase the signal strength, wind a few turns of the conductor wire around the clamp if possible.

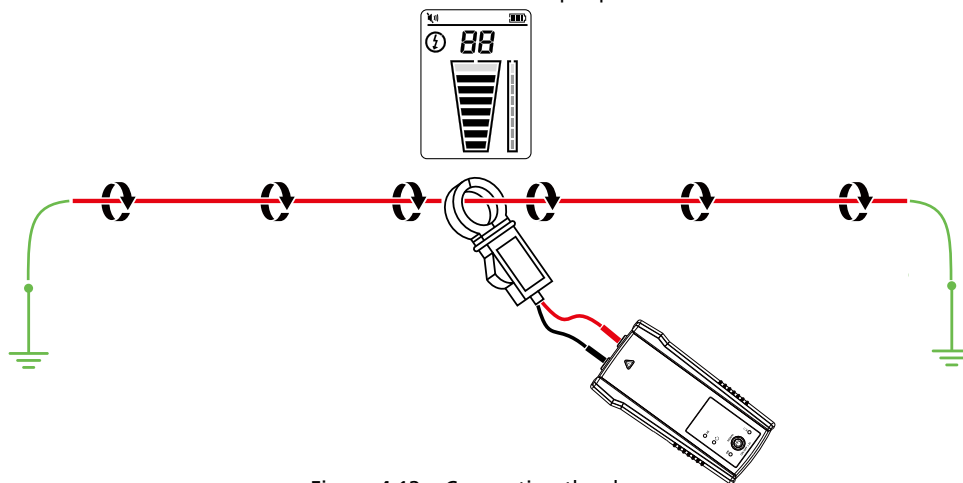


Figure 4.12a: Connecting the clamp

#### Setting up the AT-6010-T Transmitter

1. Press the ON/OFF key to turn on the Transmitter. The red LED voltage status indicator should be OFF when the clamp is connected and when working with either Energized or De-energized systems.
2. Short press ON/OFF button to select the Loop mode on the Transmitter (LOOP red LED will be ON). The clamp mode generates a boosted 6 kHz signal in order to provide superior tracing results. The LED on the Transmitter should appear as in Figure 4.12b.

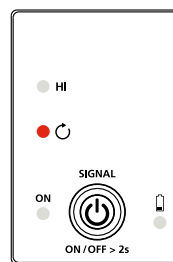


Figure 4.12b: Transmitter indicator showing signal in Loop mode

## 4. SPECIAL APPLICATIONS

### Using the AT-6010-R Receiver

1. Turn on the Receiver. Tracing mode is automatically activated.
2. Hold the Receiver with the Tip Sensor facing the target area.
3. Scan the target area with the Tip Sensor to find the highest signal level. While tracing, periodically adjust the sensitivity to keep the signal strength near 50. Increase or decrease the sensitivity by pressing + / - on the keypad.
4. Receiver Positioning: For best results while tracing Energized wires, align the groove on the Tip Sensor with the wire direction as shown. The signal may be lost if not properly aligned.
5. To verify the wire direction, periodically rotate the Receiver 90 degrees. Signal strength will be highest when wire is aligned with the Tip Sensor groove.

### 4.13 Signal Clamp (optional accessory) - Mapping Circuits

The clamp accessory can be used to map loads to the specific breakers on both Energized and De-energized circuits. There is no need to disconnect the power.

1. Connect the CT-400 test leads to the terminals of the Transmitter (polarity does not matter) and select HIGH mode.
2. Clamp the CT-400 around the hot (line) wire at the breaker panel.
3. Set Receiver sensitivity to the maximum level by pressing + button.

Scan the face plates of receptacles and wires by touching them with the Tip Sensor of the Receiver. All the wires, receptacles and loads that the Receiver indicates by reading a signal are connected to the breaker.

**Note:** Expect a relatively weak signal. For best performance, install new batteries to the Transmitter. Use the "Mapping a circuit using test leads connection" method if a much stronger signal is required.

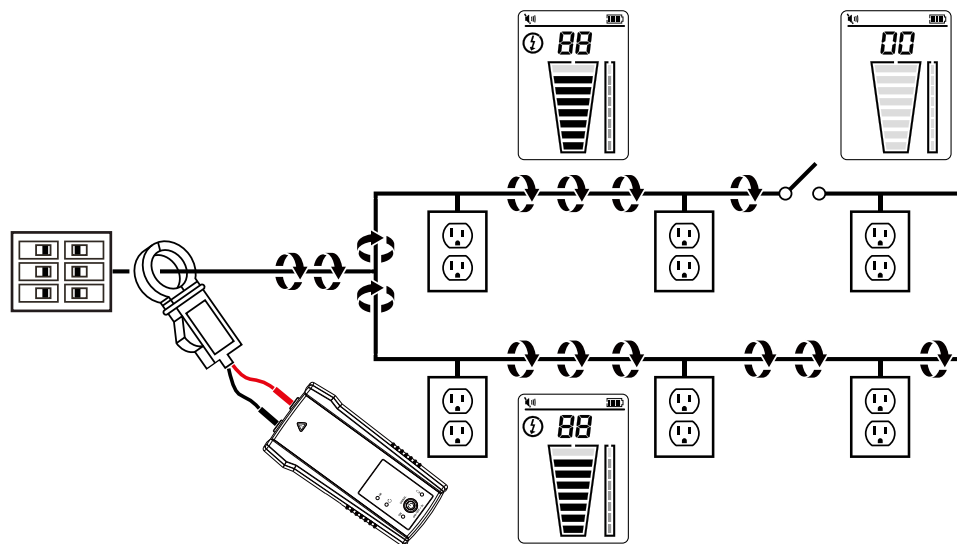


Figure 4.13: Using the Signal Clamp to map loads to specific breakers

## 5. MAINTENANCE

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### 5.1 Battery Replacement

#### Changing the Transmitter Batteries

The battery compartment on the back of the Transmitter is designed to make it easy for the user to change the batteries. A screw is added to secure the battery in case the unit is dropped. Eight (8) AA alkaline batteries should be used.

**Note: Batteries do not come pre-installed in the Transmitter.**

1. Make sure that the Transmitter is turned off and disconnected from the circuit.
2. Use a star screw driver to unscrew the battery compartment screws.
3. Remove the battery cover.
4. Install batteries.
5. Replace the battery cover and secure it with the screws.

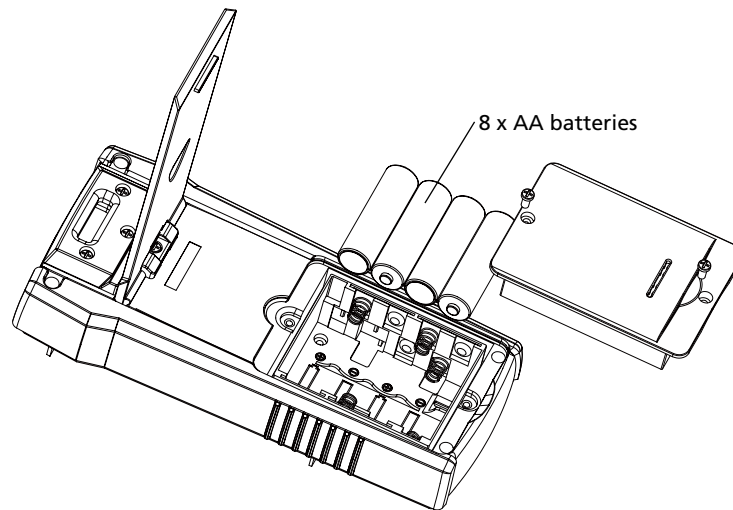


Figure 5.1a: Changing the Transmitter batteries

## 5. MAINTENANCE

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### Changing the Receiver Batteries

The battery compartment on the back of the Receiver is designed to make it easy for the user to change the batteries. Use four (4) AA 1.5 V alkaline batteries.

**Note: Batteries do not come pre-installed in the Receiver.**

1. Make sure that the Receiver is turned off.
2. Use a screw driver to unscrew the captive screw.
3. Remove the battery cover.
4. Install batteries.
5. Replace the battery cover and secure it with the provided screw.

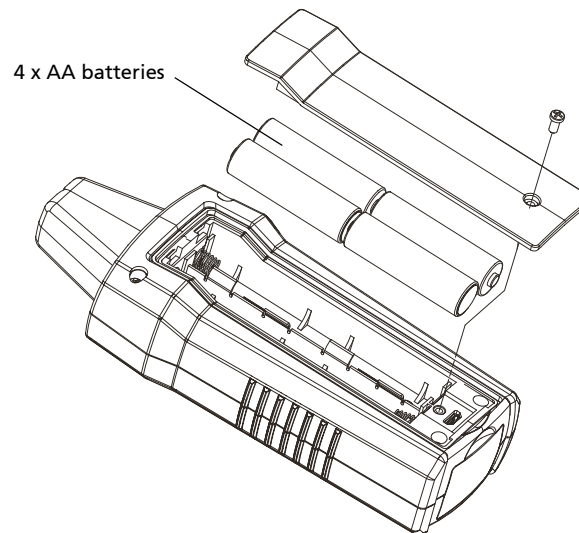


Figure 5.1b: Changing the Receiver batteries

## 5. MAINTENANCE

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### 5.2 Fuse Replacement

#### Transmitter Fuse Replacement:

**⚠ ⚠ Warning:** To avoid shock, injury, or damage to the Transmitter, disconnect test leads before opening case.

1. Disconnect all test leads from the Transmitter.
2. Make sure the Transmitter is turned off.
3. Use a star screw driver to unscrew the tilt-stand screws.
4. Remove the battery door and remove all batteries.
5. Use a star screw driver to unscrew holding screws.
6. Remove the back cover by pulling it upwards.
7. Remove the fuse from the fuse holder.
8. Insert the new fuse (1.6 A, 700 V MAX, FAST Ø 6X32 mm) in the fuse holder.
9. Insert the back cover, secure it with the holding screws and tighten with a star screw driver.

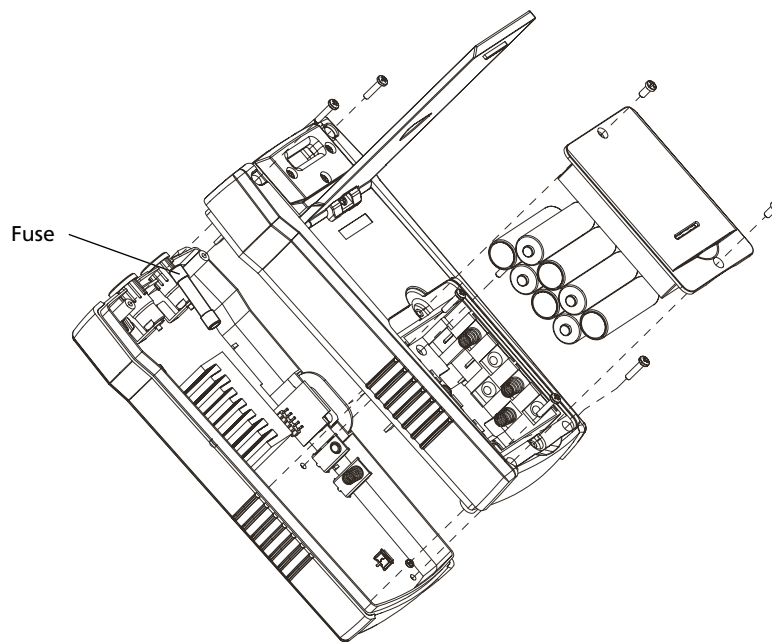


Figure 5.2: Transmitter fuse replacement

## 6. SPECIFICATIONS

| Features                                  | AT-6010-R                                                                                                                                                                                                                                                 | AT-6010-T                                                                                                                       | CT-400                                                                 |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Measurement Category</b>               | CAT III 600 V                                                                                                                                                                                                                                             | CAT III 600 V                                                                                                                   | CAT IV 600 V,<br>CAT III 1000 V                                        |
| <b>Operating Voltage</b>                  | 0 to 600 V AC/DC                                                                                                                                                                                                                                          | 0 to 600 V AC/DC                                                                                                                | 0 to 1000 V AC                                                         |
| <b>Operating Frequency</b>                | Energized: 6.25 kHz<br>De-Energized: 32.768 kHz                                                                                                                                                                                                           | Energized: 6.25 kHz<br>De-Energized: 32.768 kHz                                                                                 | Wire tracing: 32.768 kHz<br>AC current measurement:<br>45 Hz to 400 Hz |
| <b>Hazardous Voltage Detection</b>        | N/A                                                                                                                                                                                                                                                       | > 30 V AC/DC                                                                                                                    | N/A                                                                    |
| <b>Signal Indications</b>                 | Numeric bar graph display<br>and audible beep                                                                                                                                                                                                             | LEDs                                                                                                                            | N/A                                                                    |
| <b>Response Time</b>                      | Tip Sensor (Energized /<br>De-energized): 500 ms<br>Battery voltage monitoring:<br>5 sec                                                                                                                                                                  | Line voltage monitoring:<br>1 sec<br>Battery voltage monitoring:<br>5 sec                                                       | Instantaneous                                                          |
| <b>Current Output of Signal (typical)</b> | N/A                                                                                                                                                                                                                                                       | <b>Energized circuit:</b><br>HI mode: 60 mA RMS<br><b>De-energized circuit:</b><br>HI mode: 130 mA RMS<br>Loop mode: 160 mA RMS | 1 mA/A for AC current<br>measurement with<br>multimeter                |
| <b>Signal Voltage Output (nominal)</b>    | N/A                                                                                                                                                                                                                                                       | <b>De-energized circuit:</b><br>HIGH: 33 V RMS, 140 Vp-p<br><b>With CT-400:</b><br>Loop model:<br>31 V RMS, 120 Vp-p            | <b>De-energized circuit:</b><br>2.4 V RMS, 24 Vp-p                     |
| <b>Range Detection (open air)</b>         | <b>Tip Sensor (Energized):</b><br>Max distance via air:<br>up to 20 ft (6.1 m)<br>Pinpointing:<br>approx. 1.97 in (5 cm)<br><b>Tip Sensor (De-energized):</b><br>Max distance via air:<br>up to 14.7 ft (4.5 m)<br>Pinpointing:<br>approx. 1.97 in (5 cm) | N/A                                                                                                                             | N/A                                                                    |

## 6. SPECIFICATIONS

### General specifications

| Features                         | AT-6010-R                                                                                                                                                                                                                                                                                                                                       | AT-6010-T                                                                                                                                                                                                                                                                                                                                       | CT-400                                                                                                                                                                      |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Display Size                     | LCD 2.5 in (6.35 cm)                                                                                                                                                                                                                                                                                                                            | LEDs                                                                                                                                                                                                                                                                                                                                            | N/A                                                                                                                                                                         |
| Display Dimensions (W x H)       | 1.45 x 1.93 in (36.72 x 48.96 mm)                                                                                                                                                                                                                                                                                                               | N/A                                                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                         |
| Display Type                     | Segment LCD                                                                                                                                                                                                                                                                                                                                     | LEDs                                                                                                                                                                                                                                                                                                                                            | N/A                                                                                                                                                                         |
| Display Color                    | Black and white                                                                                                                                                                                                                                                                                                                                 | Operating mode LEDs: red<br>Battery status LED: red                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                         |
| Booting Time                     | < 3 sec                                                                                                                                                                                                                                                                                                                                         | < 2 sec                                                                                                                                                                                                                                                                                                                                         | N/A                                                                                                                                                                         |
| Backlight                        | Yes                                                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                         |
| Operating Temperature            | -4 °F to 122 °F<br>(-20 °C to 50 °C)                                                                                                                                                                                                                                                                                                            | -4 °F to 122 °F<br>(-20 °C to 50 °C)                                                                                                                                                                                                                                                                                                            | 32 °F to 122 °F<br>(0 °C to 50 °C)                                                                                                                                          |
| Operating Humidity               | 45%:-4 °F to <50 °F<br>(-20 °C to <10 °C)<br>95%:50 °F to <86 °F<br>(10 °C to <30 °C)<br>75%:86 °F to <104 °F<br>(30 °C to <40 °C)<br>45%:104 °F to 122 °F<br>(40 °C to 50 °C)                                                                                                                                                                  | 45%:-4 °F to <50 °F<br>(-20 °C to <10 °C)<br>95%:50 °F to <86 °F<br>(10 °C to <30 °C)<br>75%:86 °F to <104 °F<br>(30 °C to <40 °C)<br>45%:104 °F to 122 °F<br>(40 °C to 50 °C)                                                                                                                                                                  | 95%:50 °F to <86 °F<br>(10 °C to <30 °C)<br>75%:86 °F to <104 °F<br>(30 °C to <40 °C)<br>45%:104 °F to <122 °F<br>(40 °C to <50 °C)                                         |
| Storage Temperature and Humidity | -4 °F to 158 °F<br>(-20 °C to 70 °C), <95% RH                                                                                                                                                                                                                                                                                                   | -4 °F to 158 °F<br>(-20 °C to 70 °C), <95% RH                                                                                                                                                                                                                                                                                                   | -4 °F to 140 °F<br>(-20 °C to 60 °C), <95% RH                                                                                                                               |
| Operating Altitude               | 0 to 6561 ft (2000 m)                                                                                                                                                                                                                                                                                                                           | 0 to 6561 ft (2000 m)                                                                                                                                                                                                                                                                                                                           | 0 to 6561 ft (2000 m)                                                                                                                                                       |
| Transient Protection             | N/A                                                                                                                                                                                                                                                                                                                                             | 6.00 kV (1.2/50µs surge)                                                                                                                                                                                                                                                                                                                        | N/A                                                                                                                                                                         |
| Pollution Degree                 | 2                                                                                                                                                                                                                                                                                                                                               | 2                                                                                                                                                                                                                                                                                                                                               | 2                                                                                                                                                                           |
| IP Rating                        | IP 52                                                                                                                                                                                                                                                                                                                                           | IP 40                                                                                                                                                                                                                                                                                                                                           | IP 40                                                                                                                                                                       |
| Drop Test                        | 3.28 ft (1 m)                                                                                                                                                                                                                                                                                                                                   | 3.28 ft (1 m)                                                                                                                                                                                                                                                                                                                                   | 3.28 ft (1 m)                                                                                                                                                               |
| Power Supply                     | 4 x AA (alkaline)                                                                                                                                                                                                                                                                                                                               | 8 x AA (alkaline)                                                                                                                                                                                                                                                                                                                               | N/A                                                                                                                                                                         |
| Power Consumption (typical)      | 70 mA                                                                                                                                                                                                                                                                                                                                           | Hi mode: 70 mA<br>Loop mode with Clamp: 90 mA<br>Consumption without signal transmission: 10 mA                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                         |
| Battery Life (typical)           | Approx. 25 h                                                                                                                                                                                                                                                                                                                                    | Hi mode: approx. 25 h<br>Loop mode: approx. 18 h                                                                                                                                                                                                                                                                                                | N/A                                                                                                                                                                         |
| Low Battery Indication           | Yes                                                                                                                                                                                                                                                                                                                                             | Yes                                                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                         |
| Fuse                             | N/A                                                                                                                                                                                                                                                                                                                                             | 1.6 A, 700 V, fast-acting, Ø 6x32mm                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                         |
| Maximum conductor size           | N/A                                                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                                                                                                                                                                                             | 1.26 in (32 mm)                                                                                                                                                             |
| Dimensions (L x W x H)           | Approx. 7.2 x 2.95 x 1.69 in (183 x 75 x 43 mm)                                                                                                                                                                                                                                                                                                 | Approx. 7.2 x 3.66 x 1.97 in (183 x 93 x 50 mm)                                                                                                                                                                                                                                                                                                 | Approx. 5.9 x 2.75 x 1.18 in (150 x 70 x 30 mm)                                                                                                                             |
| Weight (batteries installed)     | Approx. 0.6 lb (0.27 kg)                                                                                                                                                                                                                                                                                                                        | Approx. 1.25 lb (0.57 kg)                                                                                                                                                                                                                                                                                                                       | Approx. 0.25 lb (0.114 kg)                                                                                                                                                  |
| Certifications                   |     |     |   |

## 6. SPECIFICATIONS

### Accessory specifications

| Features                         | TL-6000-INTL                                                                                                                                                                                 |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement Category             | CAT III (test leads)<br>CAT IV (alligator clips)<br>CAT II (outlet adapters)                                                                                                                 |
| Operating Voltage and Current    | 1000 V, 16 A max. (red/green leads)<br>600 V, 16 A max. (black lead)<br>600 V, 10 A max. (alligator clips)<br>300 V, 10 A max. (outlet adapters)                                             |
| Operating Temperature            | 32 °F to 122 °F (0 °C to 50 °C)                                                                                                                                                              |
| Operating Humidity               | 95%: 50 °F to <86 °F (10 °C to <30 °C)<br>75%: 86 °F to <104 °F (30 °C to <40 °C)<br>45%: 104 °F to <122 °F (40 °C to <50 °C)                                                                |
| Storage Temperature and Humidity | -4 °F to 140 °F (-20 °C to 60 °C), <95% RH                                                                                                                                                   |
| Operating Altitude               | 0 to 6561 ft (2000 m)                                                                                                                                                                        |
| Pollution Degree                 | 2                                                                                                                                                                                            |
| IP Rating                        | IP 20                                                                                                                                                                                        |
| Drop Test                        | 3.28 ft (1 m)                                                                                                                                                                                |
| Dimensions                       | Red/black leads: 3.28 ft (1 m)<br>Green lead: 22.97 ft (7 m)<br>Alligator clips: approx. 3.74 x 1.77 x 0.94 in (95 x 45 x 24 mm)<br>Outlet adapters: 2.83 x 0.71 x 0.71 in (72 x 18 x 18 mm) |
| Weight                           | Approx. 0.78 lb (0.356 kg)                                                                                                                                                                   |
| Certifications                   |                        |