

AMPROBE®

AT-6000 Advanced Wire Tracer

AT-6020

AT-6030

User Manual

English

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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. Electromagnetic Compatibility: Korea (KCC): Class A Equipment (Industrial Broadcasting & Communication Equipment) ^[1] ^[1] 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

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.

1. PRECAUTIONS AND SAFETY MEASURES

- 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.
- To avoid false readings that can lead to electrical shock and/or injury, replace or recharge 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.

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.

2. KIT COMPONENTS

Your shipping box should include:

	AT-6020 KIT	AT-6030 KIT
AT-6000-R RECEIVER	1	1
AT-6000-T TRANSMITTER	1	1
TL-6000 TEST LEAD AND ACCESSORY KIT*	1	1
CC-6000 HARD CARRYING CASE	1	1
USER MANUAL	1	1
RECHARGEABLE BATTERIES	-	12
BATTERY CHARGERS	-	3
CT-400 SIGNAL CLAMP	-	1
1.5 V AA (IEC LR6) BATTERY	12	-

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

- 2 x 1 m test leads (red, black)
- 2 x alligator clips (red, black)
- 1 x 7 m test lead (green)
- 1 x US Socket adapter

Optional accessories:

HS-1 MAGNETIC HANGER

TL-7000-25M TEST LEAD (25 m long)

HOT STICK (TIC 410A)

2.1 AT-6000-R Receiver

The AT-6000-R Receiver detects the signal in wires and cables using the following methods:

Active (using Transmitter)

The AT-6000-T Transmitter generates a signal capable of tracing either Energized or De-energized wires.

The main advantage 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.

The active tracing method is used when the Receiver is set to Quick Scan, Precision Tracing or Breaker Locating.

Passive (without Transmitter)

The passive method utilizes the Receiver by tracing Energized wires between 90-600 V AC through electromagnetic fields.

This method is both easy and convenient because it does not require the Transmitter. However, the Receiver is not selective to a particular wire and will indicate any Energized wire between 90-600 V AC.

This method is best for simple tracing applications where the wire is Energized and no other wires are located nearby.

Passive tracing method is used when the Receiver is set to Non-contact voltage (NCV) detection mode.

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.

2. KIT COMPONENTS

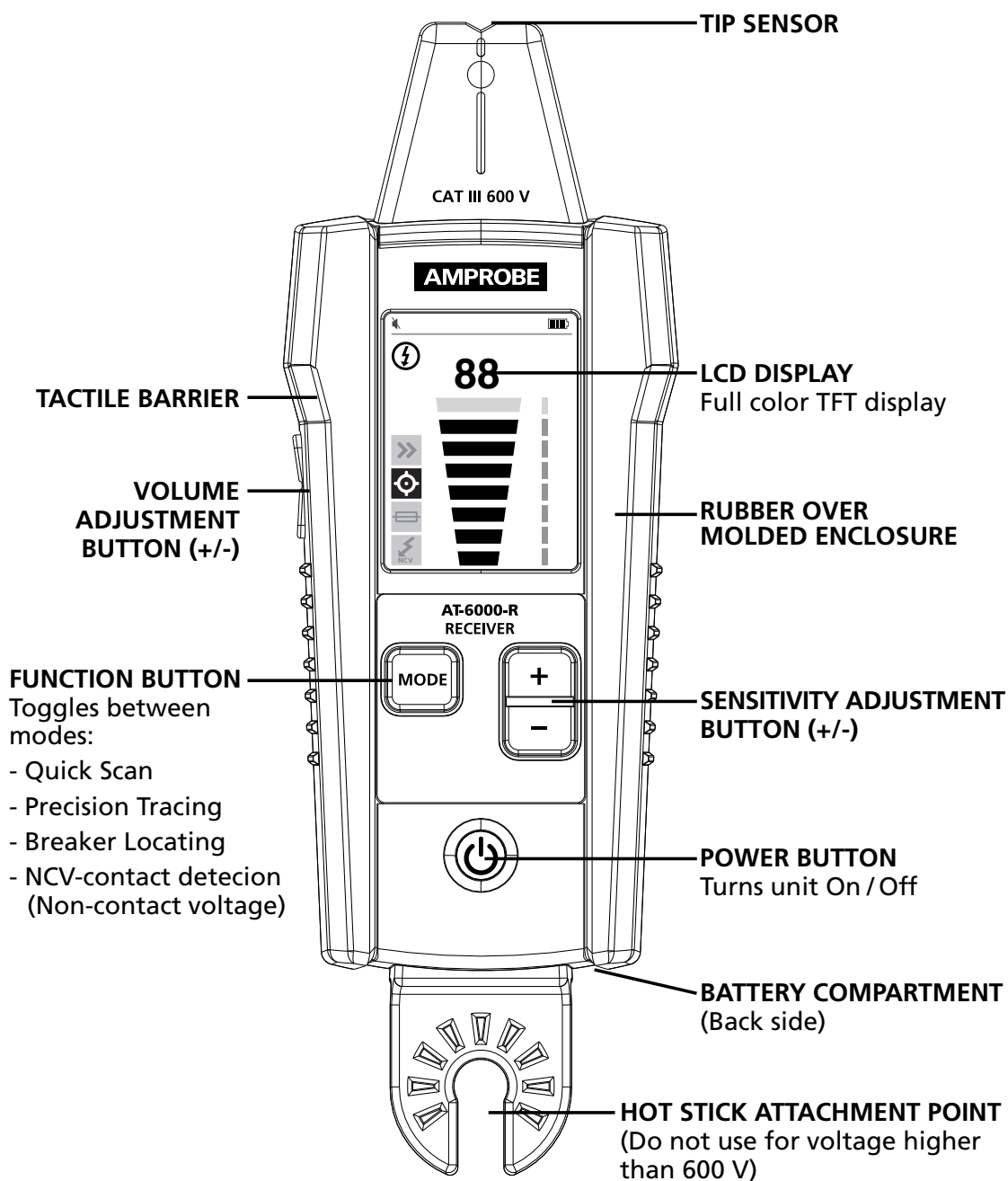


Figure 2.1: Overview of AT-6000-R Receiver

2. KIT COMPONENTS

2.2 AT-6000-T Transmitter

The AT-6000-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 the majority of the time.

Low Signal (Lo) – The LOW mode function is only appropriate for the most demanding and precise wire tracing applications, as it limits the signal level generated by the Transmitter in order to pinpoint the wire location more precisely. A lower signal level reduces coupling to neighboring wires and metal objects, which avoids misreadings due to ghost signals. A lower signal also prevents oversaturating the Receiver with a strong signal that covers too large of an area.

Loop mode – This mode is initiated by pressing and holding this Hi button for two seconds. 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 or Lo settings when using test leads?

Both HIGH and LOW modes generate a signal in all open branches of the De-energized circuit. This is useful when tracing open wires. Hi/Lo modes will NOT work on wires that are grounded on the far-end because the signal cannot be generated.

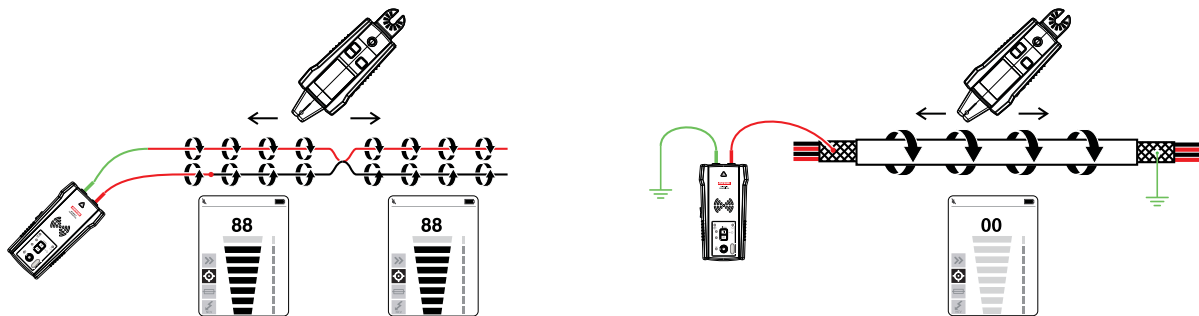


Figure 2.2a: Generating a signal with HIGH and LOW modes

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).

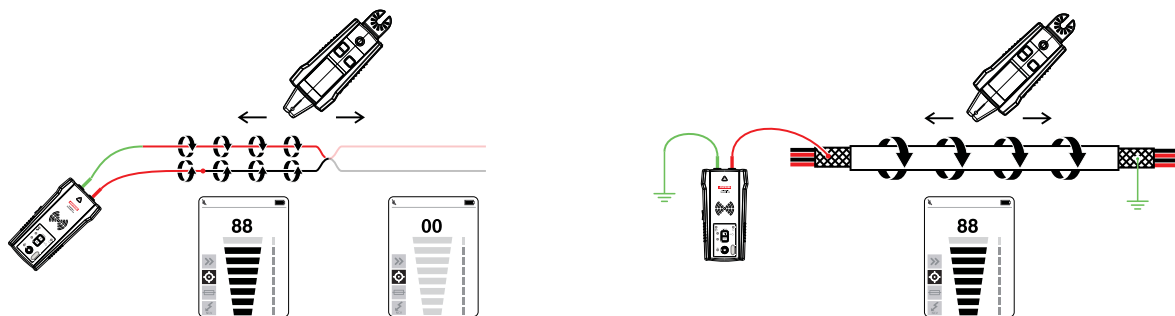


Figure 2.2b: Generating a signal in Loop mode

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.

2. KIT COMPONENTS

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.

If the High (Hi) or Low (Lo) Signal button is pressed momentarily, the Transmitter starts generating a tracing signal. 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.

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.

2. KIT COMPONENTS

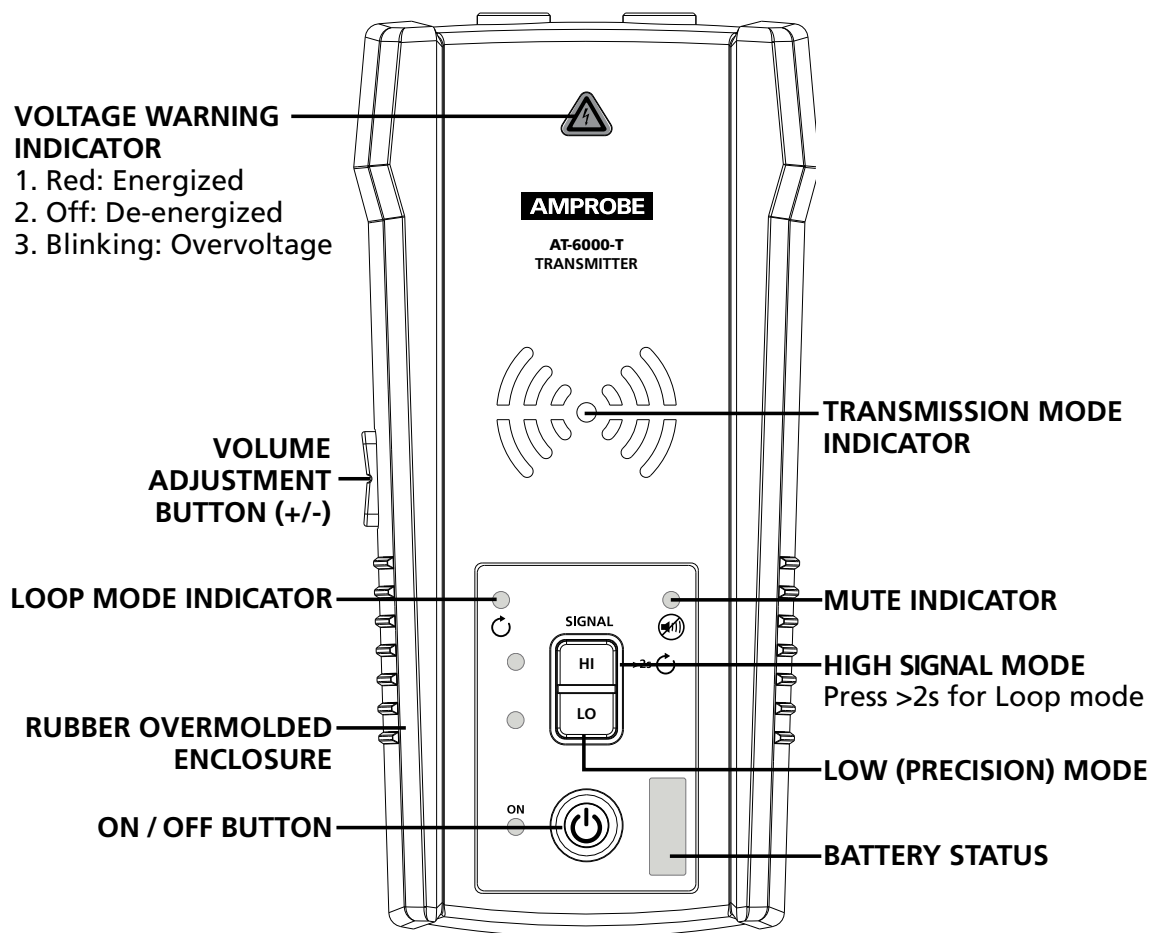


Figure 2.3: Overview of AT-6000-T Transmitter

ON/OFF: Short press to turn the Transmitter on. Long press >2s to turn the Transmitter off.

Volume adjustment: The volume can be changed by short presses on VOLUME UP/DOWN buttons. In addition to mute, four volume levels are available. The chosen volume level will be shown on LED display for a short time. If sound is muted, the MUTE LED light will be on. The sound pattern is different depending on chosen operating mode.

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

LED display: The LED diodes will blink with different rhythm depending on the chosen operating mode.

- Transmitting in HIGH mode – Fast blinking,
- Transmitting in LOW mode – Slow blinking,
- Transmitting in LOOP mode – Alternating blinking.

High mode: Short press on HI pushbutton to turn on HIGH transmitting mode. Second short press on HI button to turn off transmitting.

Low mode: Short press on LO pushbutton to turn on LOW transmitting mode. Second short press on LO button to turn off transmitting.

Loop mode: Long press (>2s) on HI pushbutton to turn on Loop mode. Short or long press on HI button to turn off Loop mode.

2. KIT COMPONENTS

2.3 CT-400 Signal Clamp

(included with AT-6030 option for AT-6020)

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.

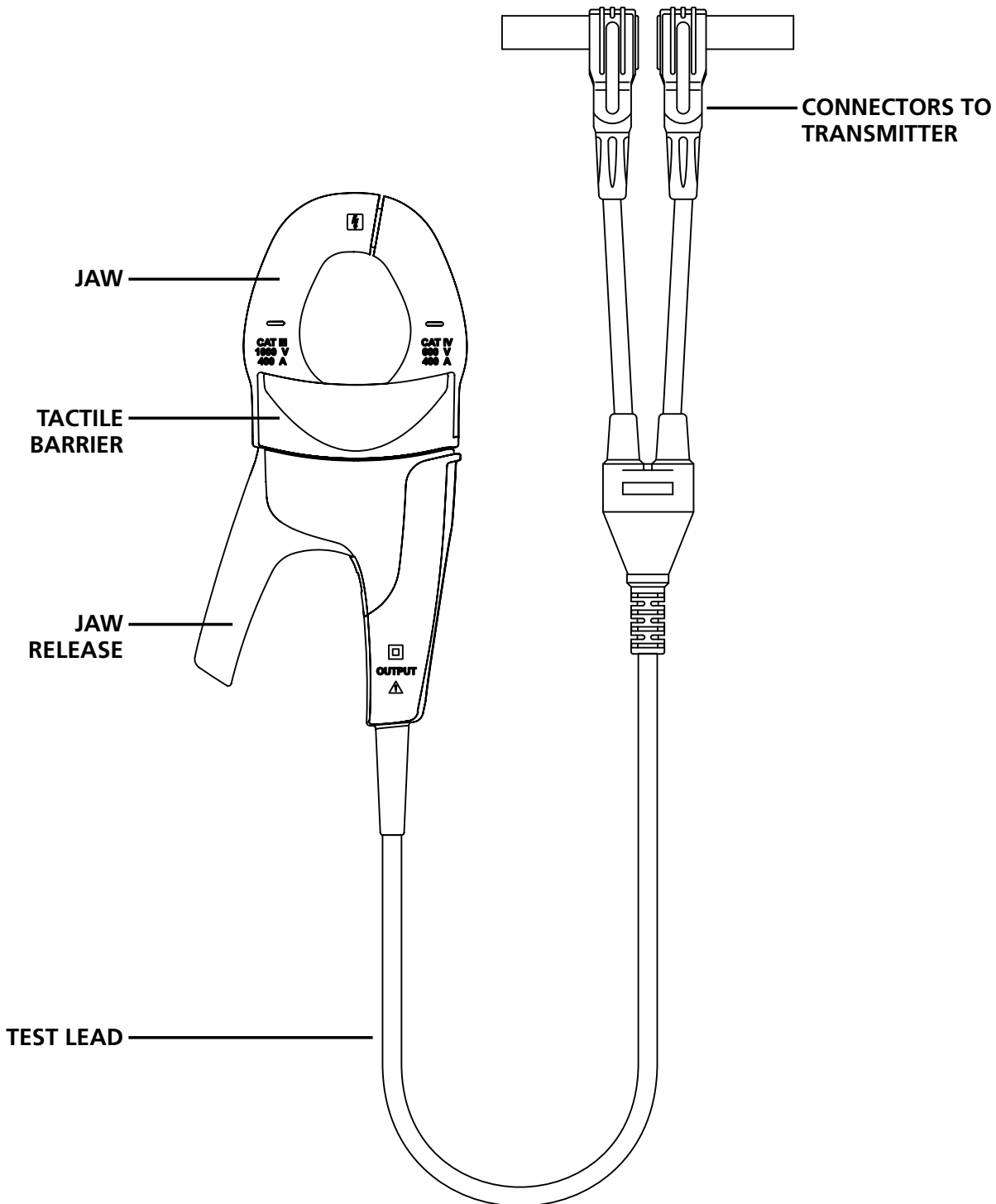


Figure 2.4: Overview of CT-400 Signal Clamp

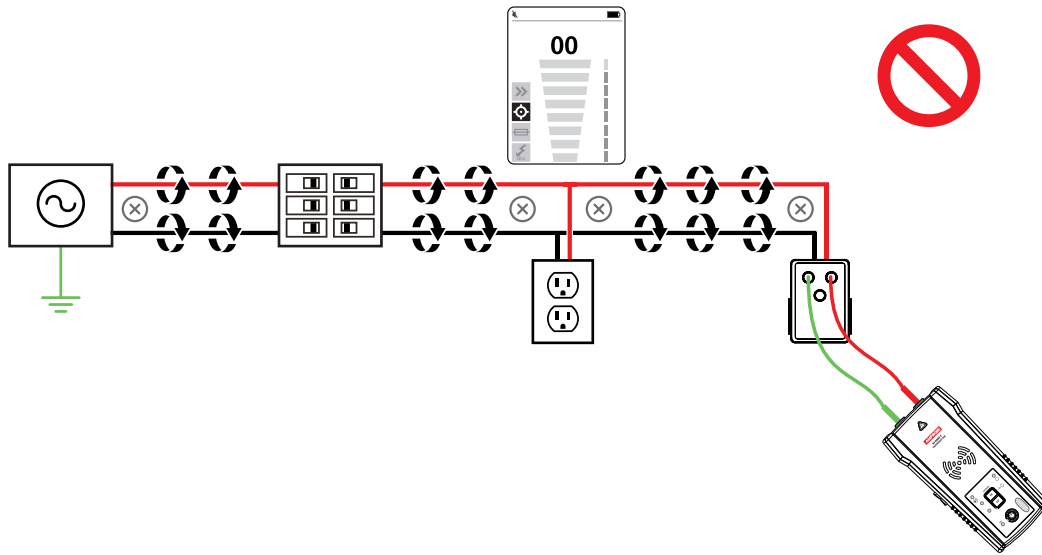
3. MAIN APPLICATIONS

⚠⚠ IMPORTANT NOTICE, PLEASE READ BEFORE STARTING TRACING

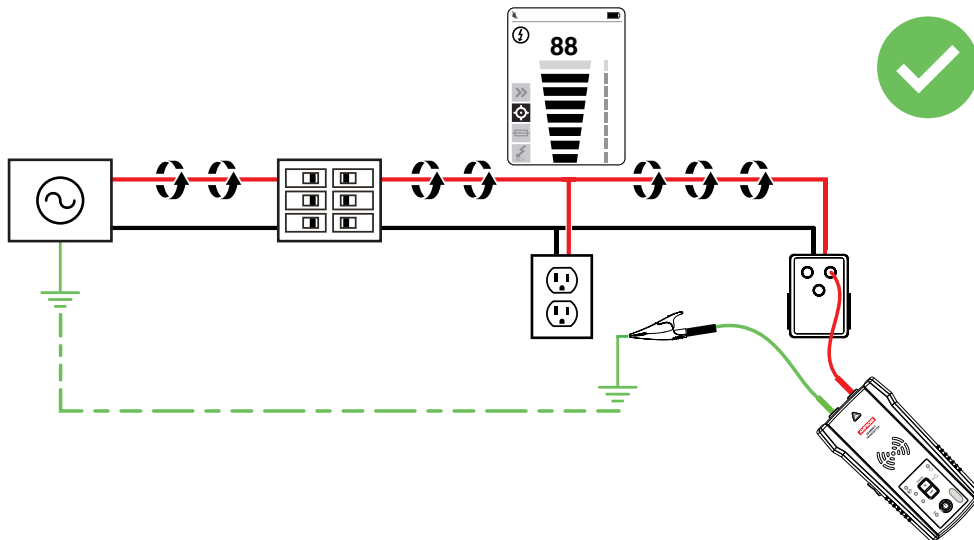
Avoiding signal cancellation problems with a separate ground connection

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. Plug the socket adapter onto the receptacle and connect the red lead to the Energized hot wire (on the load side of the system). 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.

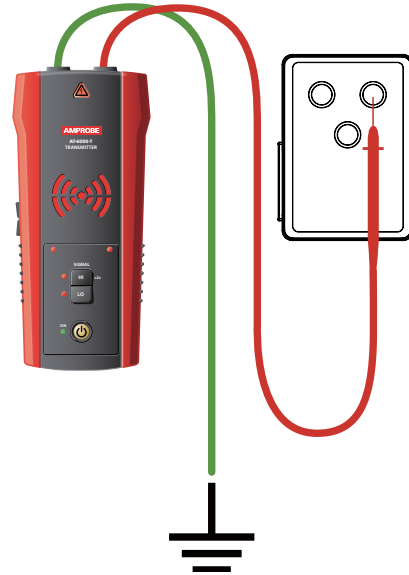


Figure 3.1a: Proper connection with separate ground

Setting up the AT-6000-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. Select HIGH signal mode by pressing HI for most applications. Screen will appear as shown in Figure 3.1b. The LED display will quickly begin to blink.

Note: The LOW signal precision mode can be used to limit the signal level generated by the Transmitter in order to more precisely pinpoint wire location. A lower signal level reduces coupling to neighboring wires and metal objects and helps to avoid misreading due to ghost signals. A lower signal also helps to prevent oversaturating the Receiver with a strong signal that covers too large an area. The LOW mode function is only used for the most demanding and precise wire tracing applications.



Figure 3.1b: Transmitter indicator showing signal in HIGH mode

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

Using the AT-6000-R Receiver in Quick Scan Mode

Quick Scan mode detects wires at a longer distance (between a wire and the Receiver) but with less precision than Precision Tracing or Breaker modes. This feature is used to verify that the tracing signal is present and to quickly follow the path of the wire. Switch to Precision Tracing mode to precisely pinpoint the wire, or to Breaker mode to locate a breaker.

1. Press ON/OFF push button to turn on the Receiver. It will automatically start in Quick Scan mode, which is the default.
2. Scan a target area with the Tip Sensor to find a signal, then begin tracing the detected wire. Increase or decrease sensitivity of the Receiver by pressing + or - on the keypad as necessary.
3. For best results while tracing Energized wires, align groove on the Tip Sensor with wire direction as shown in Figure 3.1c and 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.

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

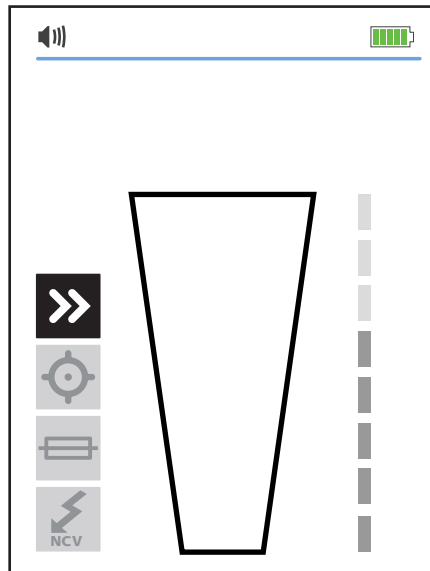


Figure 3.1c: Signal not detected

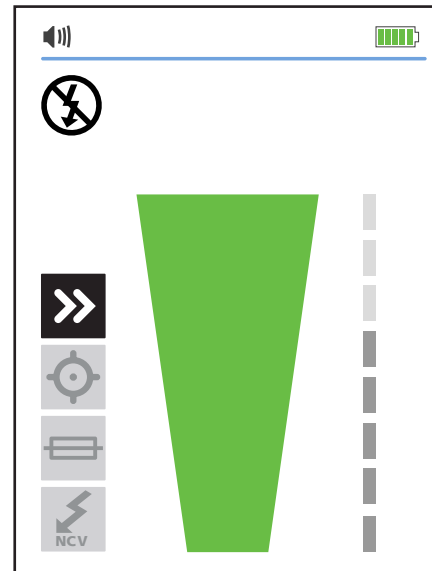


Figure 3.1d: Signal detected

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

Using the AT-6000-R Receiver in Precision Tracing Mode

Use Precision Tracing mode 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. Press the MODE button until the Precision Tracing function is selected.
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. If the signal is too strong for precise locating, change the Transmitter to LOW mode.
3. For best results while tracing Energized wires, align groove on the Tip Sensor with wire direction as shown in Figure 3.1e. 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.

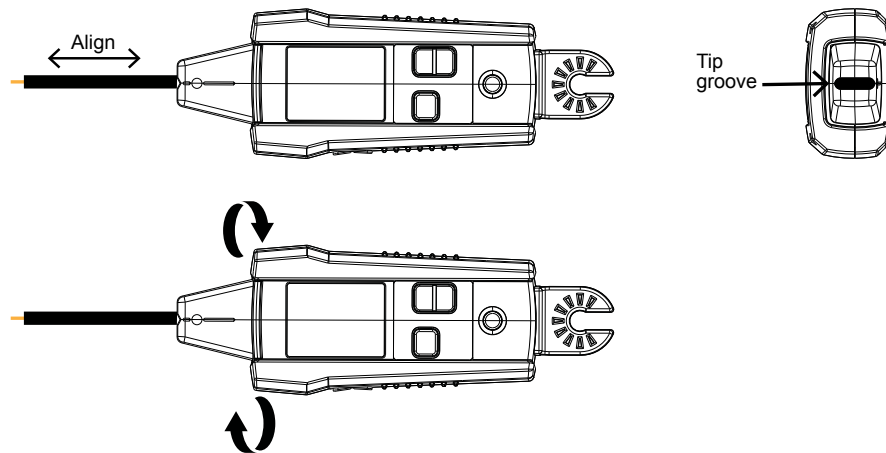


Figure 3.1e: Aligning the tip sensor groove

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

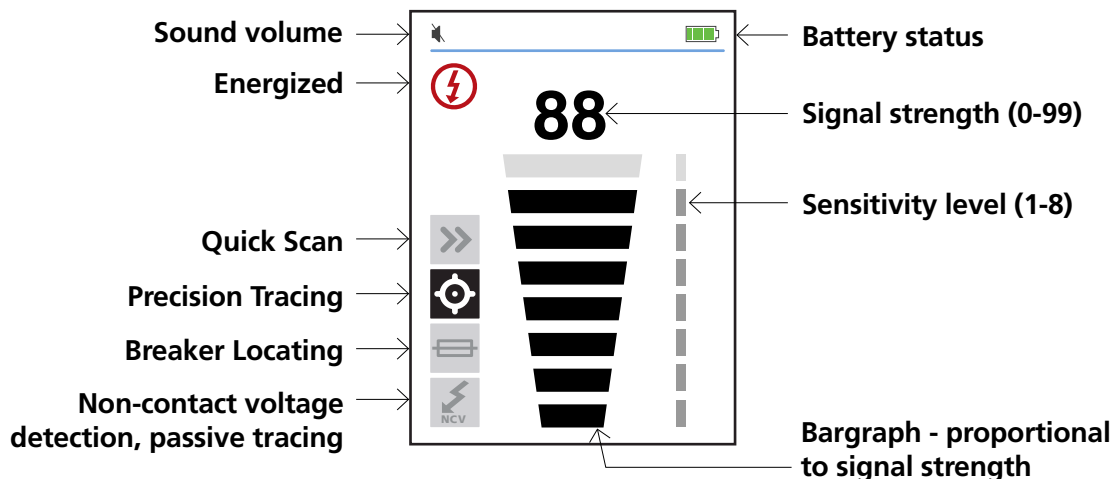


Figure 3.1f: Screen display

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

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

Breaker mode automatically adjusts the sensitivity of the Receiver. As a result, the Receiver will pinpoint and indicate just one correct breaker. This enhancement helps to remove signal strength analysis from the breaker identification process that is typical for less advanced wire tracers.

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 (see pg. 11) 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, first connect the red lead to the Energized hot wire on the load side of the system. The signal will ONLY be transmitted between the outlet to which the Transmitter is connected and the source of power.
4. Connect the green lead to a separate ground, such as a metal building structure, metal water pipe, or ground wire on a separate circuit.

Setting up the AT-6000-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. Select the HIGH signal mode for Breaker Locating.

3. MAIN APPLICATIONS – LOCATING BREAKERS

Using the AT-6000-R Receiver

1. Press the ON/OFF push button to turn on the Receiver and continue pressing the MODE button until Breaker Locating mode is selected.
2. Align the groove on the Tip Sensor with the breaker lengthwise (See Figure 3.2c).
3. Scan all breakers in any order. Breakers can be scanned multiple times. The Receiver records the highest signal level and will automatically adjust sensitivity. The Receiver may beep and the green arrow may light up several times during this step.
4. Locate the breaker by scanning all breakers again; the Receiver should indicate only one breaker.

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.

If more than one breaker is indicated during the last step, continue scanning the indicated breakers until only one is positively identified.

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. The automatic sensitivity adjustment can be reset or adjusted using the +/- buttons.

Usage Tip: The accuracy of breaker identification results can be verified by switching the Receiver to Precision Tracing mode and checking that the signal level of the breaker identified by the Receiver is the highest among all the breakers.

Before starting the next locating process for new circuit or a branch, connect the Transmitter and reset the Receiver by either pressing + button to select high sensitivity or switching the Receiver off and then on.

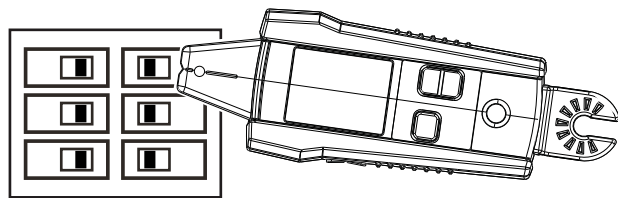


Figure 3.2c: Aligning the Tip Sensor groove with the breaker

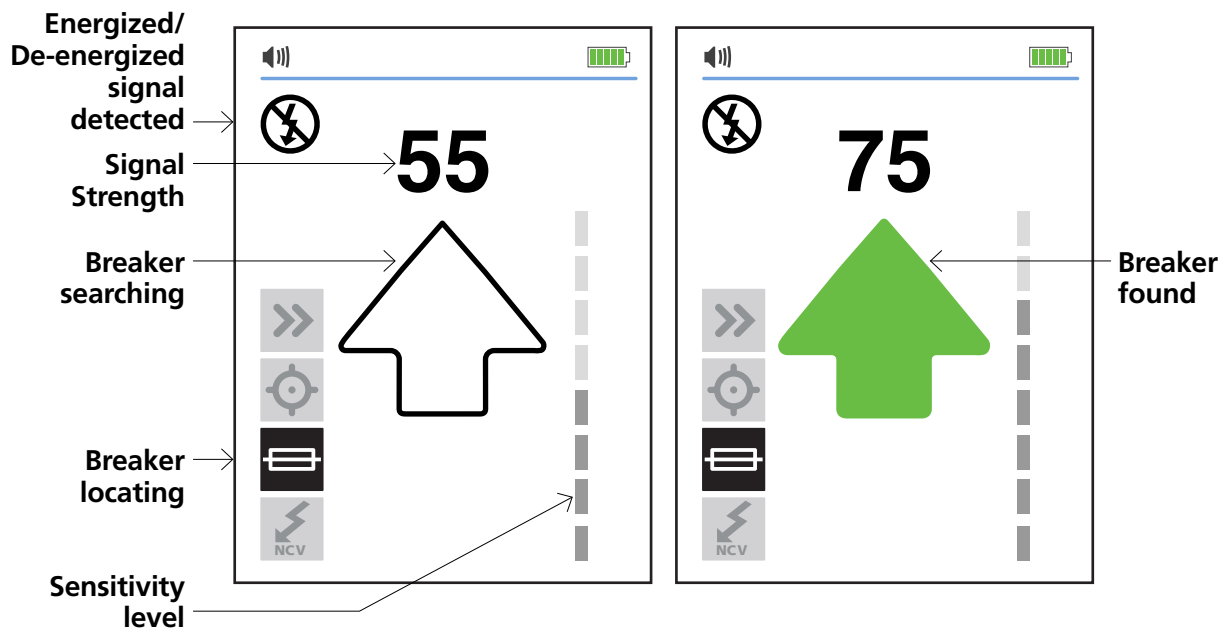


Figure 3.2d: Reading the Receiver screen

3. MAIN APPLICATIONS – LOCATING BREAKERS

3.3 Non-contact Voltage Mode (NCV) and Passive Tracing

The NCV (Non-Contact Voltage) mode is used to verify if the wire is Energized and to perform tracing without the use of the Transmitter. The Receiver will detect and trace an Energized cable if the voltage is between 90 V and 600 V AC and between 40 and 400 Hz. No current flow is necessary.

Note: For safety, always verify that wires are De-energized with an additional tester before working with them.

NCV mode operation

1. Press ON/OFF push button to turn on the Receiver.
2. Continue pressing MODE button until the Non-Contact Voltage function is selected.

Passive tracing

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 sensitivity by pressing + or - on the keypad.

Verifying if wire is Energized

Hold the Receiver with the Tip Sensor against the wire. For precise pinpointing of hot wire versus neutral wire, increase or decrease sensitivity by pressing + or - on the keypad.

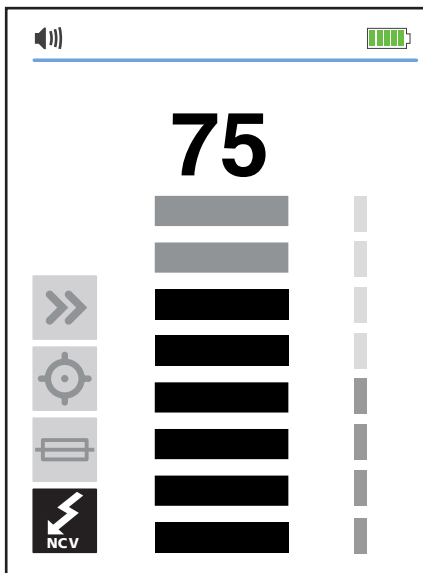


Figure 3.3: Voltage detection in NCV mode using Tip Sensor

4. SPECIAL APPLICATIONS

4.1 GFCI-Protected Circuit Wire Tracing: Connecting the AT-6000-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 the Quick Scan or Precision Tracing sections.

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 one of the following modes: Quick Scan, Precision Tracing or Breaker Locating.

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 wire tracing modes (Quick Scan and Precision).
- Perform tracing as described in one of the following modes: Quick Scan, Precision Tracing or Breaker Locating.

4.2 Finding Breaks/Opens

It is possible to pinpoint the exact location where a wire is broken using the Precision Tracing mode, 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 the Precision Tracing mode 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.

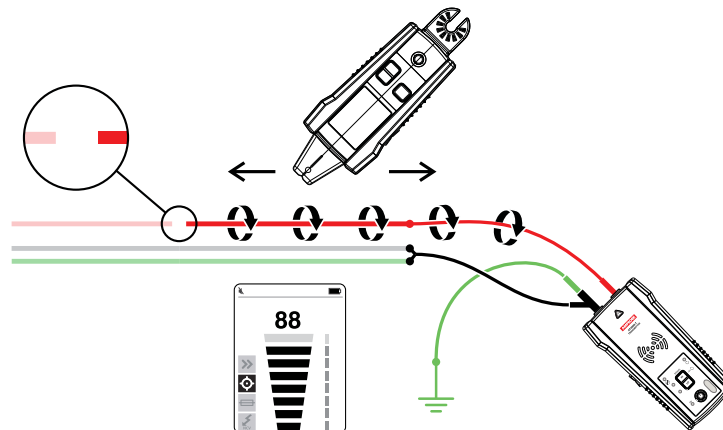


Figure 4.2: Locating a break or open

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. Turn the Transmitter to Loop mode by pressing HIGH button for two seconds. Verify that the Loop LED is ON.
3. Setup the Receiver to a wire tracing mode (either Quick Scan or Precision Tracing).

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.

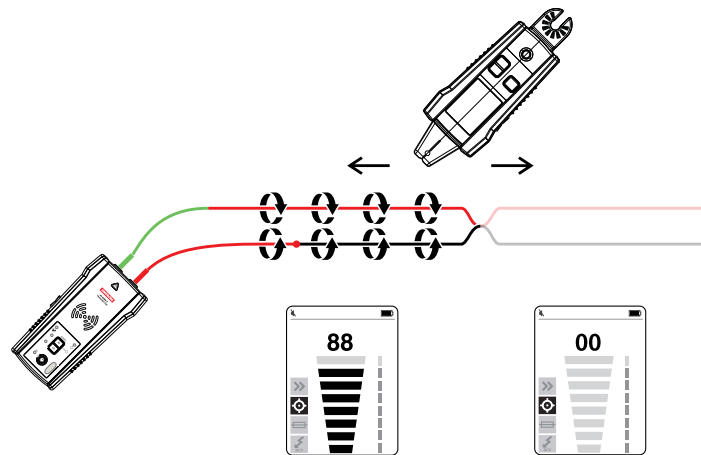


Figure 4.3: Tracing a cable to find shorts

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. Use the Quick Scan or Precision Tracing modes.
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 wire tracing section 3.1 for further set-up instructions).
3. Set the Receiver to Quick Scan or Precision Tracing modes to trace the conduit.
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. Setup Transmitter in Loop mode by pressing HIGH button for two seconds. 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. Set the Receiver to a wire tracing mode to trace the shield (refer to section 3.1).

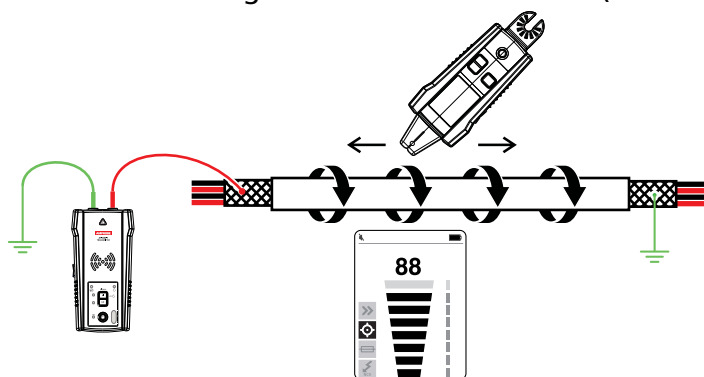


Figure 4.6a: Tracing a shielded wire grounded at the far-end

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

1. Set the Transmitter to a wire tracing mode (see 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. Set the Receiver to a wire tracing mode to trace the shield.

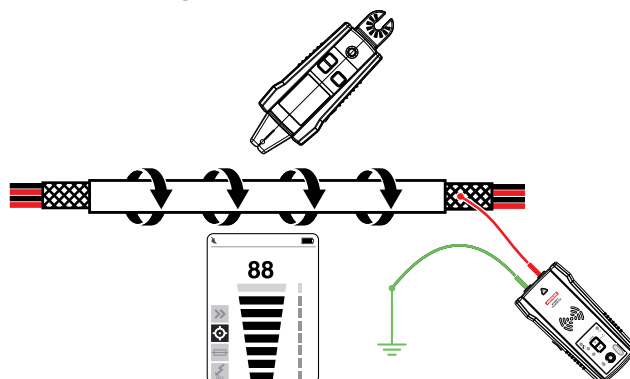


Figure 4.6b: Tracing a shielded wire disconnected from the ground at far-end

4. SPECIAL APPLICATIONS

4.7 Tracing Underground Wires

The AT-6000 can trace Energized and De-energized wires underground the same way it can locate wires behind walls or floors.

Perform tracing using a separate ground connection. The HOT STICK (TIC 410A) attachment can be used to make tracing more ergonomic and convenient.

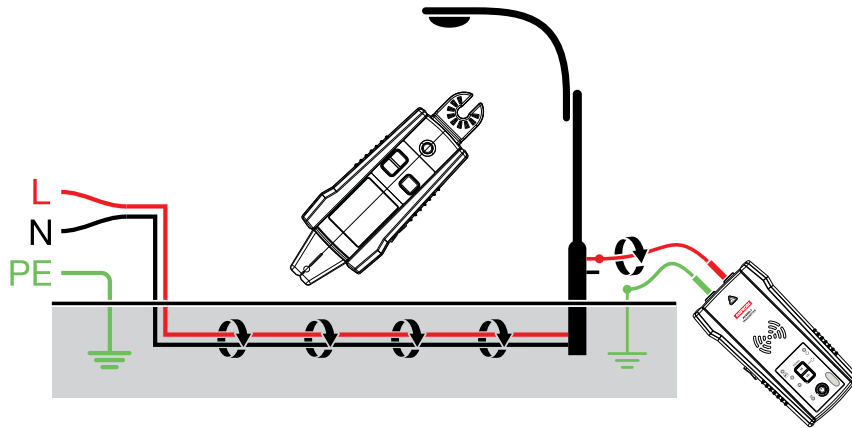


Figure 4.7: Tracing Underground Wires

4.8 Tracing Low Voltage Wires and Data Cables

The AT-6000 can trace data, audio and thermostat cables (to trace shielded data cables, refer to section 4.6 "Tracing Shielded Wires").

Trace data, audio, and thermostat cables

1. Connect the Transmitter using the separate ground method (see section 3.1).
2. Set the Receiver to a wire tracing mode and trace the wire.

4.9 Sorting Bundled Wires

Identify a specific wire in a bundle

1. Connect the Transmitter and set to a wire tracing mode. If connecting to an Energized wire, make sure the Transmitter is connected on the load side.
2. Select a wire tracing mode on the Receiver.
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.

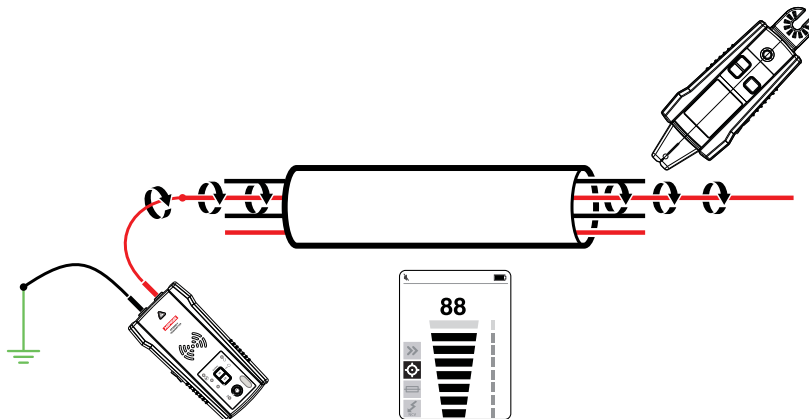


Figure 4.9: Identifying a specific wire in a bundle

4. SPECIAL APPLICATIONS

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 Precision Tracing 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.

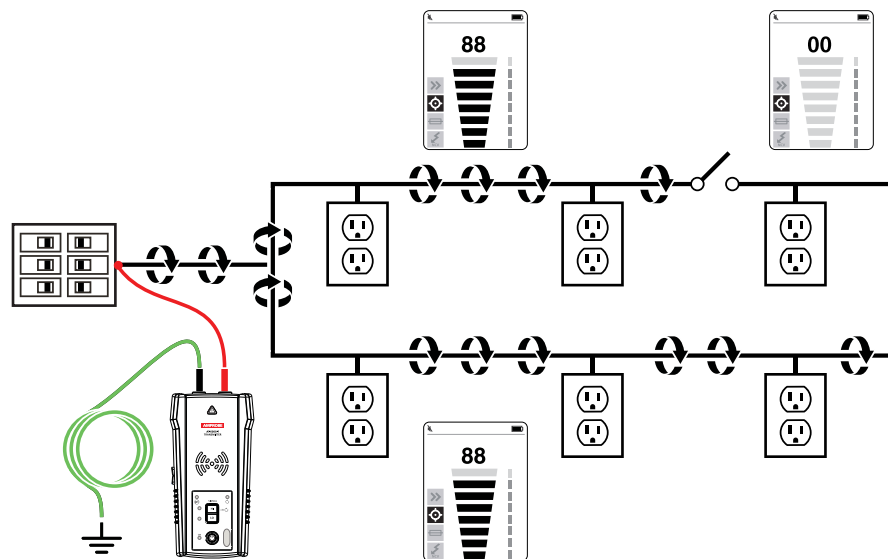


Figure 4.10: Mapping a circuit using test leads connection

4.11 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 - 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.

4. SPECIAL APPLICATIONS

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.

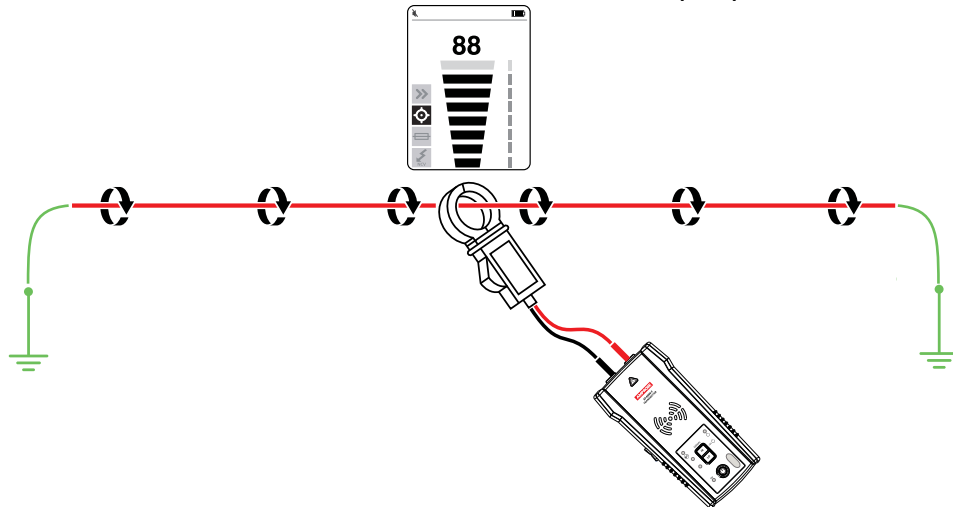


Figure 4.12a: Connecting the clamp

Setting up the AT-6000-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. Press HIGH signal mode and hold pushbutton for >2 seconds to select the Loop mode on the Transmitter. The clamp mode generates a boosted 6 kHz signal in order to provide superior tracing results. The screen on the Transmitter should appear as in Figure 4.12b.



Figure 4.12b: Transmitter indicator showing signal in Loop mode

Using the AT-6000-R Receiver

1. Press the ON/OFF push button to turn on the Receiver.
2. Select either Quick Scan or Precision Tracing mode.
3. Hold the Receiver with the Tip Sensor facing the target area.
4. 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.
5. 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.
6. 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. SPECIAL APPLICATIONS

4.13 Signal Clamp - 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. Select Quick Scan mode on the Receiver with the highest sensitivity level.

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 in the Quick Scan mode are connected to the breaker.

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

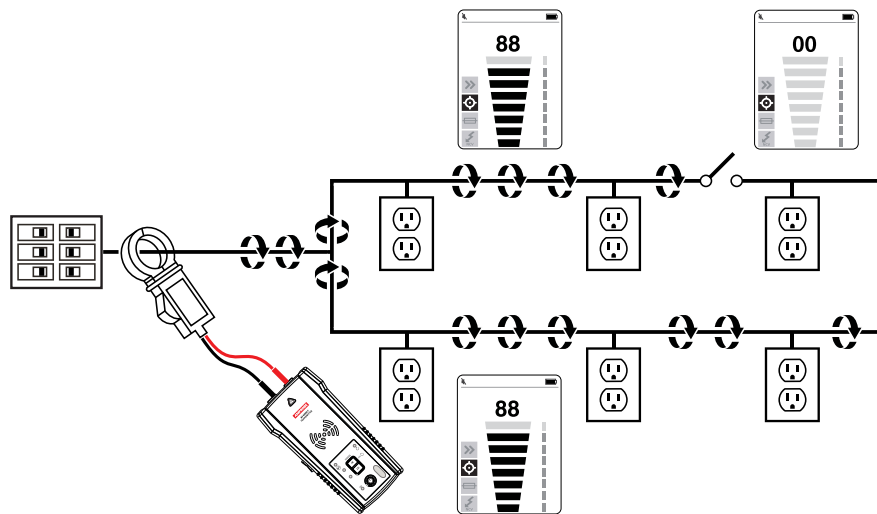


Figure 4.13a: Using the Signal Clamp to map loads to specific breakers

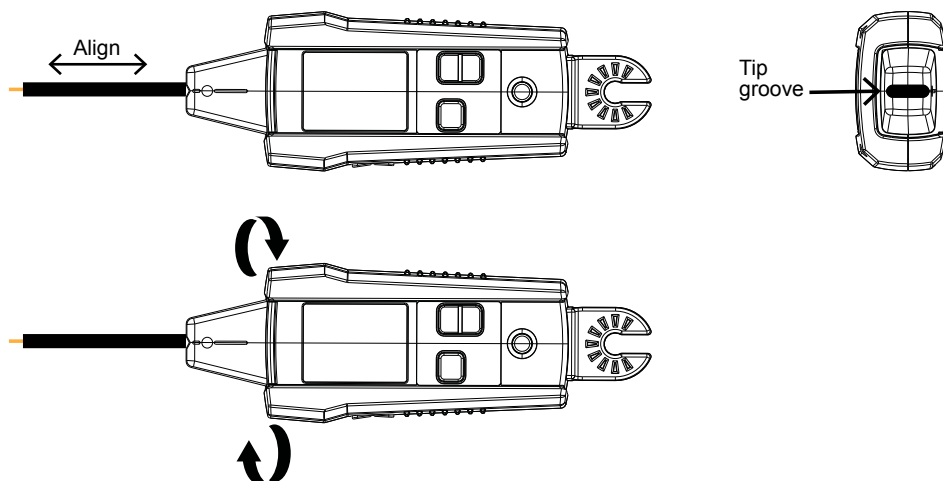


Figure 4.13b: Aligning the Tip Sensor groove

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

5. MAINTENANCE

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 or rechargeable NiMH batteries may be used. NiMH batteries need to be removed to be charged.

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.

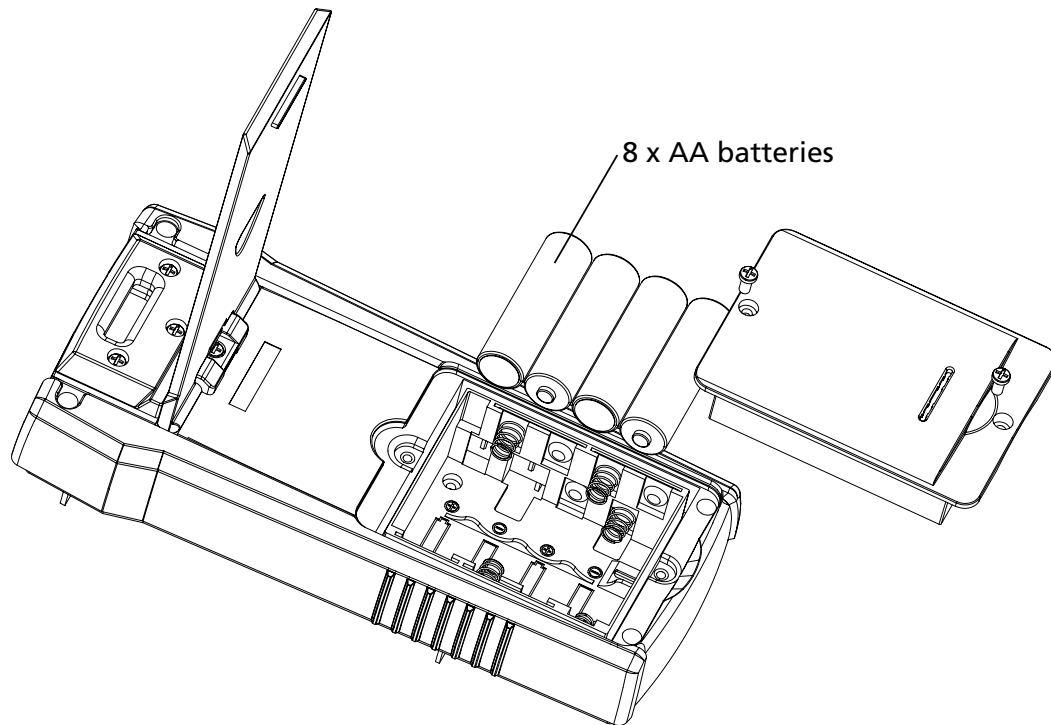


Figure 5.1: Changing the Transmitter batteries

5. MAINTENANCE

Manual Selecting of Transmitter Battery Type

The type of batteries being used-Alkaline or rechargeable NiMH-are recognized automatically during power up of the device or may be defined manually by the user.

Set battery type as alkaline:

1. Make sure that the Transmitter is turned off.
2. Press and hold the VOLUME UP (+) button.
3. While volume up button is pressed, press the POWER ON button. The chosen battery type will be alkaline.

Set battery type as rechargeable NiMH:

1. Make sure that the Transmitter is turned off.
2. Press and hold the VOLUME DOWN (-) button.
3. While volume down button is pressed, press the POWER ON button. The chosen battery type will be rechargeable NiMH.

If the battery type is not defined manually, it will be recognized automatically. Automatic battery type recognition draws more current and can be unreliable if inadequate or old batteries are used. The automatic battery recognition can also be unreliable if the rechargeable batteries have not been charged in over one month.

Transmitter Battery Status

Related to 8 AA batteries same type and connected in series.

BATTERY TRESHOLD ALKALINE

Device will power off if voltage is below 6.9 V

Battery empty – RED LED blinking if voltage is > 7.3 V and < 9.4 V

0-10% - RED LED is ON for voltages > 9.6 V and < 9.9 V

10-40% - Two yellow LEDs are ON for voltages > 10 V and < 10.8 V

40-75% - Three green LEDs are ON or voltages > 10.9 V and < 12 V

> 75% - Four green LEDs are ON for voltages > 12 V

BATTERY TRESHOLD NiMH

Device will power off if voltage is below 6.9 V

Battery empty – RED LED blinking if voltage is > 7.1 V and < 7.3 V

0-10% - RED LED is ON for voltages > 7.4 V and < 7.6 V

10-40% - Two yellow LEDs are ON for voltages > 7.7 V and < 8.5 V

40-75% - Three green LEDs are ON or voltages > 8.6 V and < 9.7 V

> 75% - Four green LEDs are ON for voltages > 9.8 V

5. MAINTENANCE

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. Four (4) AA 1.5 V alkaline or 1.2 V rechargeable batteries may be used.

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.

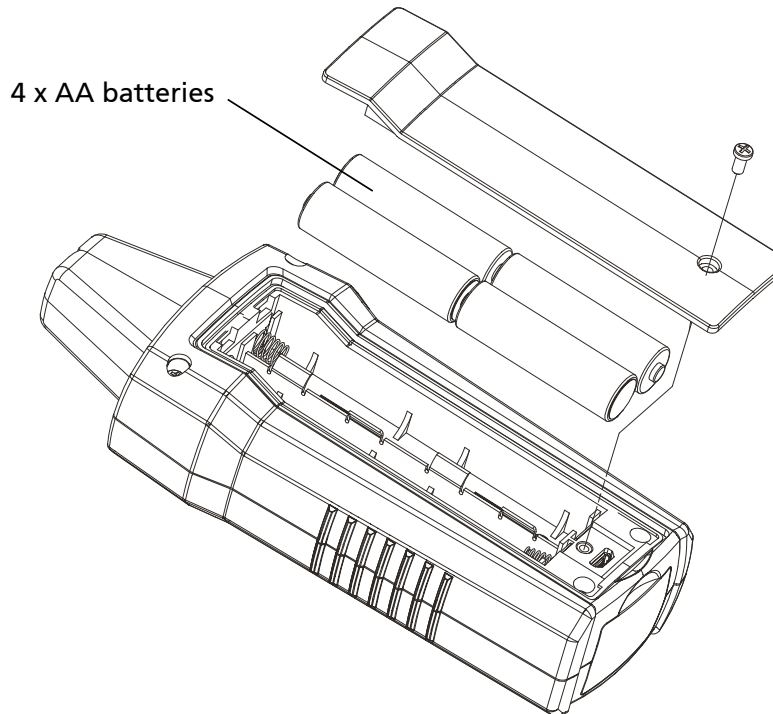


Figure 5.2: Changing the Receiver batteries

Note: The Receiver automatically recognizes if batteries are alkaline or rechargeable and adapts the battery indication to provide the right information.

Old rechargeable batteries and certain alkaline batteries may not provide accurate battery level indication. Turn on the device while holding the volume + button to automatically adjust battery indication for rechargeable or alkaline batteries.

5. MAINTENANCE

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 as shown in figure 5.3.
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.

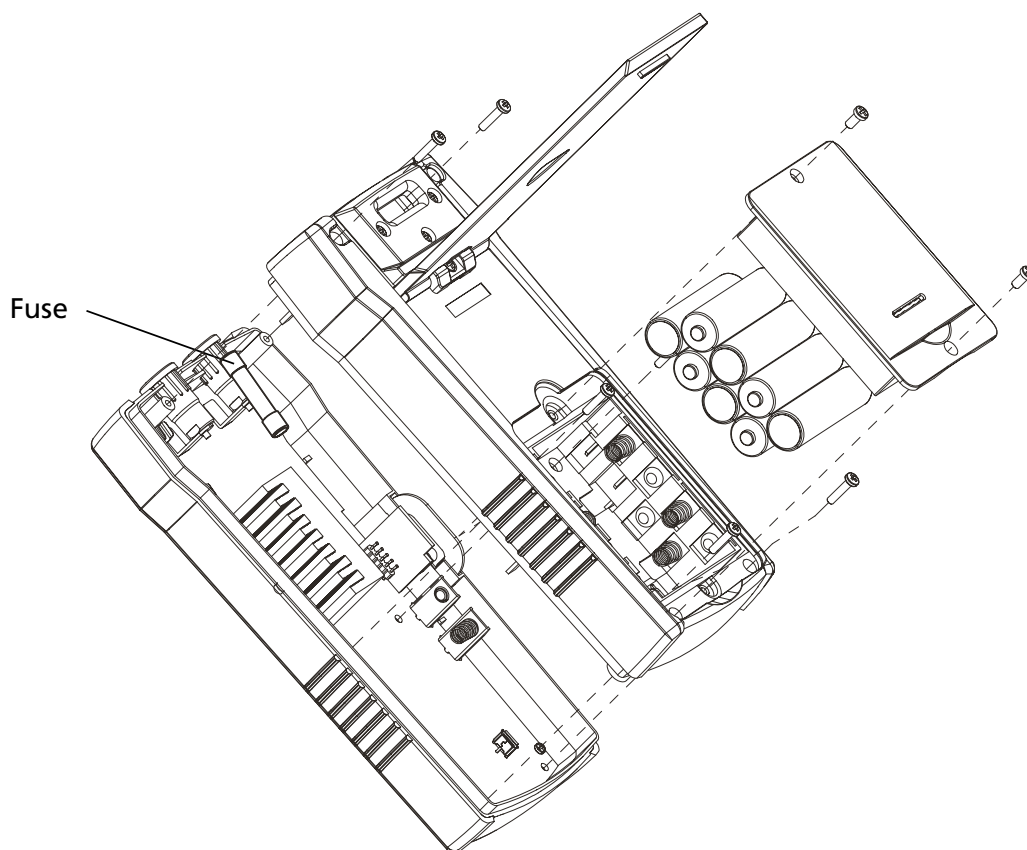












Figure 5.3: Transmitter fuse replacement

6. SPECIFICATIONS

Features	AT-6000-R	AT-6000-T	CT-400
Measurement Category	CAT III 600 V	CAT III 600 V	CAT IV 600 V, CAT III 1000 V
Operating Voltage	0 to 600 V AC/DC	0 to 600 V AC/DC	0 to 1000 V AC
Operating Frequency	Energized: 6.25 kHz De-Energized: 32.768 kHz	Energized: 6.25 kHz De-Energized: 32.768 kHz	Wire tracing: 32.768 kHz AC current measurement: 45 Hz to 400 Hz
Hazardous Voltage Detection	See NCV detection	> 30 V AC/DC	N/A
Signal Indications	Numeric bar graph display and audible beep	LEDs and audible beep	N/A
Response Time	Tip Sensor (Energized / De-energized): 500 ms NCV: 500 ms Battery voltage monitoring: 5 sec	Line voltage monitoring: 1 sec Battery voltage monitoring: 5 sec	Instantaneous
Current Output of Signal (typical)	N/A	Energized circuit: HI mode: 60 mA RMS LO mode: 30 mA RMS De-energized circuit: HI mode: 130 mA RMS LO mode: 40 mA RMS Loop mode: 160 mA RMS	1 mA/A for AC current measurement with multimeter
Signal Voltage Output (nominal)	N/A	De-energized circuit: LOW: 29 V RMS, 120 Vp-p HIGH: 33 V RMS, 140 Vp-p With CT-400: Loop model: 31 V RMS, 120 Vp-p	De-energized circuit: 2.4 V RMS, 24 Vp-p
Range Detection (open air)	Tip Sensor (Energized): Max distance via air: up to 20 ft (6.1 m) Pinpointing: approx. 1.97 in (5 cm) Tip Sensor (De-energized): Max distance via air: up to 14.7 ft (4.5 m) Pinpointing: approx. 1.97 in (5 cm) NCV detection (40 to 400 Hz): Max. sensitivity: 90 V, up to 6.56 ft (2 m) Min. sensitivity: 600 V, up to 0.39 in (1 cm)	N/A	N/A

6. SPECIFICATIONS

General specifications

Features	AT-6000-R	AT-6000-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 Resolution	240(RGB) x 320 pixels	N/A	N/A
Display Type	TFT-LCD (262 K)	LEDs	N/A
Display Color	True, 16bit/color	Operating mode LEDs: red Battery status LEDs: green, yellow, red	N/A
Booting Time	< 3 sec	< 2 sec	N/A
Backlight	Yes	N/A	N/A
Operating Temperature	-4 °F to 122 °F (-20 °C to 50 °C)	-4 °F to 122 °F (-20 °C to 50 °C)	32 °F to 122 °F (0 °C to 50 °C)
Operating Humidity	45%: -4 °F to <50 °F (-20 °C to <10 °C) 95%: 50 °F to <86 °F (10 °C to <30 °C) 75%: 86 °F to <104 °F (30 °C to <40 °C) 45%: 104 °F to 122 °F (40 °C to 50 °C)	45%: -4 °F to <50 °F (-20 °C to <10 °C) 95%: 50 °F to <86 °F (10 °C to <30 °C) 75%: 86 °F to <104 °F (30 °C to <40 °C) 45%: 104 °F to 122 °F (40 °C to 50 °C)	95%: 50 °F to <86 °F (10 °C to <30 °C) 75%: 86 °F to <104 °F (30 °C to <40 °C) 45%: 104 °F to <122 °F (40 °C to <50 °C)
Storage Temperature and Humidity	-4 °F to 158 °F (-20 °C to 70 °C), <95% RH	-4 °F to 158 °F (-20 °C to 70 °C), <95% RH	-4 °F to 140 °F (-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 or NiMH rechargeable)	8 x AA (alkaline or NiMH rechargeable)	N/A
Power Consumption (typical)	110 mA	Hi/Lo mode: 70 mA Loop mode with Clamp: 90 mA Consumption without signal transmission: 10 mA	N/A
Battery Life (typical)	Approx. 16 h	Hi/Lo mode: approx. 25 h 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	ADPTR-SCT	TL-6000
Measurement Category	CAT II	CAT III (test leads) CAT IV (alligator clips)
Operating Voltage and Current	0 to 120 V AC, 4 A, max.	1000 V, 16 A max. (red/green leads) 600 V, 16 A max. (black lead) 600 V, 10 A max. (alligator clips)
Operating Frequency	50 Hz to 60 Hz	N/A
Operating Temperature	32 °F to 122 °F (0 °C to 50 °C)	32 °F to 122 °F (0 °C to 50 °C)
Operating Humidity	95%: 50 °F to <86 °F (10 °C to <30 °C) 75%: 86 °F to <104 °F (30 °C to <40 °C) 45%: 104 °F to <122 °F (40 °C to <50 °C)	95%: 50 °F to <86 °F (10 °C to <30 °C) 75%: 86 °F to <104 °F (30 °C to <40 °C) 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	-4 °F to 140 °F (-20 °C to 60 °C), <95% RH
Operating Altitude	0 to 6561 ft (2000 m)	0 to 6561 ft (2000 m)
Pollution Degree	2	2
IP Rating	IP 40	IP 20
Drop Test	3.28 ft (1 m)	3.28 ft (1 m)
Dimensions	Approx. 2.95 x 1.97 x 2.56 in (75 x 50 x 65 mm)	Red/black leads: 3.28 ft (1 m) Green lead: 22.97 ft (7 m) Alligator clips: approx. 3.74 x 1.77 x 0.94 in (95 x 45 x 24 mm)
Weight	Approx. 0.125 lb (0.057 kg)	Approx. 0.75 lb (0.34 kg)
Certifications	