

# **GFL-1500**

## Solar Ground Fault Locator

### Users Manual



9/2025 (English)

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## Introduction

The GFL-1500 (the Product) is a solar ground fault locator. The Product consists of a transmitter (the Transmitter), a receiver (the Receiver), a signal tracing clamp (the Clamp), a set of test leads with alligator clips, and MC4 test leads. The Product detects and locates ground faults, opens, and shorts in an energized or de-energized photovoltaic system.

The Transmitter generates a high frequency signal in a system and uses electrical measurements to identify a ground fault. The Receiver or the Clamp detects the signal to locate the fault. Use the Clamp on systems with high resistance.

The Product works on systems with voltages up to CAT III 1500 V.

## How to Contact Fluke Corporation

Fluke Corporation operates worldwide. For local contact information, go to our website: [www.fluke.com](http://www.fluke.com).

To register your product, or to view, print, or download the latest manual or manual supplement, go to our website.

+1-425-446-5500 [fluke-info@fluke.com](mailto:fluke-info@fluke.com)

## Safety Information

General Safety Information is in the printed Safety Information document that ships with the Product and at [www.fluke.com](http://www.fluke.com). More specific safety information is listed where applicable.

A **Warning** identifies hazardous conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

## The Product

Table 1 shows the items that ship with the Product. For replacement part numbers, see *Replacement Parts*.

**Table 1. Product**

<b>Item</b>	<b>Description</b>	<b>Item</b>	<b>Description</b>
<b>1</b>	The Transmitter	<b>5</b>	MC4 test leads
<b>2</b>	The Receiver	<b>6</b>	Case
<b>3</b>	The Clamp	<b>7</b>	Strap
<b>4</b>	Test leads and alligator clips	--	Batteries

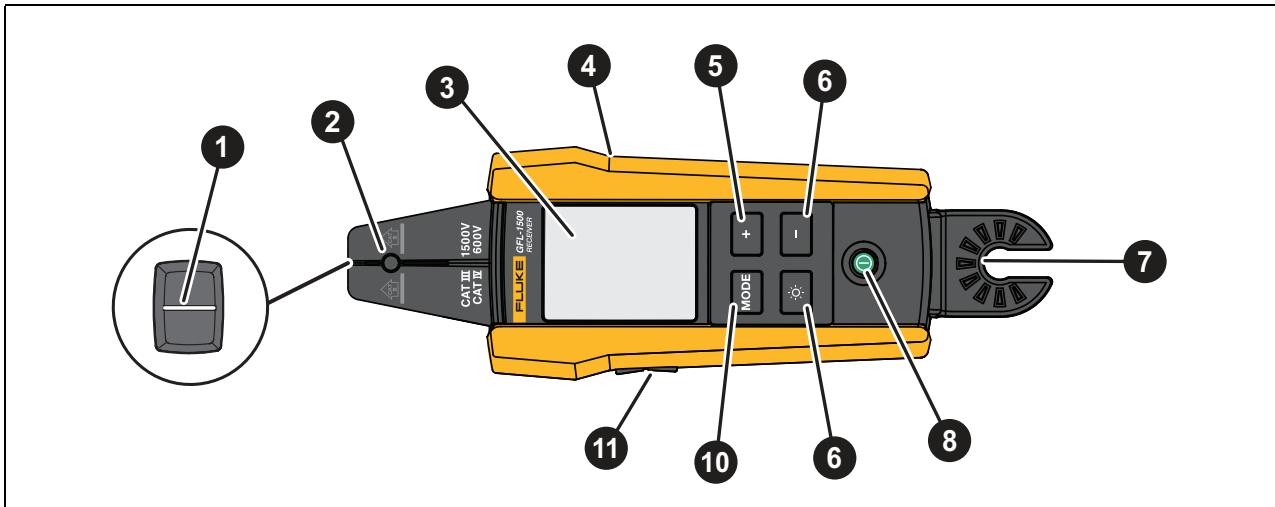
## The Receiver

Use the Receiver with the Transmitter to directly detect a signal in a wire.

### Features of the Receiver

[Table 2](#) shows the features of the Receiver.

**Table 2. Features of the Receiver**



Item	Function
❶	Align the line on top of the tip sensor with a wire or fuse to detect a signal. See <a href="#">Tip Sensor and Open Modes</a> .
❷	The LED indicator lights up when the Receiver detects a signal. The frequency of the flash is proportional to the strength of the signal.
❸	The display shows the settings, test functions, and results. See <a href="#">Receiver Display</a> .
❹	Tactile barrier.
❺	Push <b>+</b> to increase the level of sensitivity the Receiver uses to detect a signal.
❻	Push <b>-</b> to decrease the level of sensitivity the Receiver uses to detect a signal.



**Hold the Receiver behind the tactile barrier.**

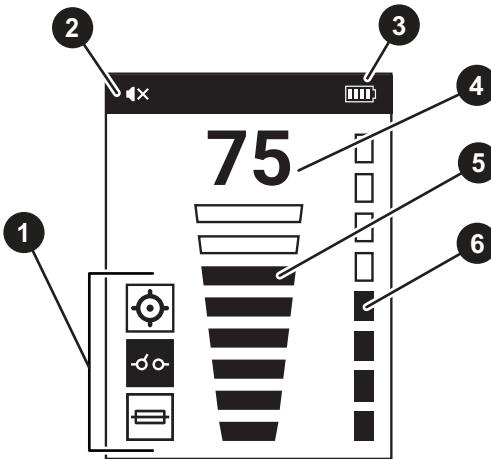
**Table 2. Features of the Receiver (cont.)**

Item	Function
7	Point to attach a hot stick (sold separately).
8	Push  to turn on and off the Receiver
9	Push  to adjust the brightness of the display.
10	Push  to select a mode. See <a href="#">Table 4</a> .
11	Adjusts the level of the volume the Product emits.

## Receiver Display

[Table 3](#) shows the items on the display of the Receiver.

**Table 3. Receiver Display**



Item	Function
1	Trace mode indicator. The icon with the black background shows the selected mode.
2	Volume level indicator.
3	Battery level indicator.
4	The strength of the signal as a number from 00 to 99.
5	The strength of the signal in number of bars.
6	The sensitivity level (1 to 8) of the Receiver.

## Use the Receiver

The Receiver can directly detect a signal in a wire.

*Note*

*The Receiver cannot detect a signal on a section of a wire that is underground.*

To use the Receiver:

1. Connect the Transmitter. See [Trace a Fault, Find a Break in a Wire](#), and [Map a System](#).
2. Turn on the Receiver.

*Note*

*Keep the Receiver >1 m (3 ft) from the Transmitter and test leads to minimize signal interference.*

3. If needed, adjust the brightness of the display and the volume.
4. Push **MODE** to select a mode. [Table 4](#) lists the Receiver trace modes and describes the applications for each mode.
5. To trace another wire in a different mode, push **MODE** to select a new mode to use.

**Table 4. Receiver Modes**

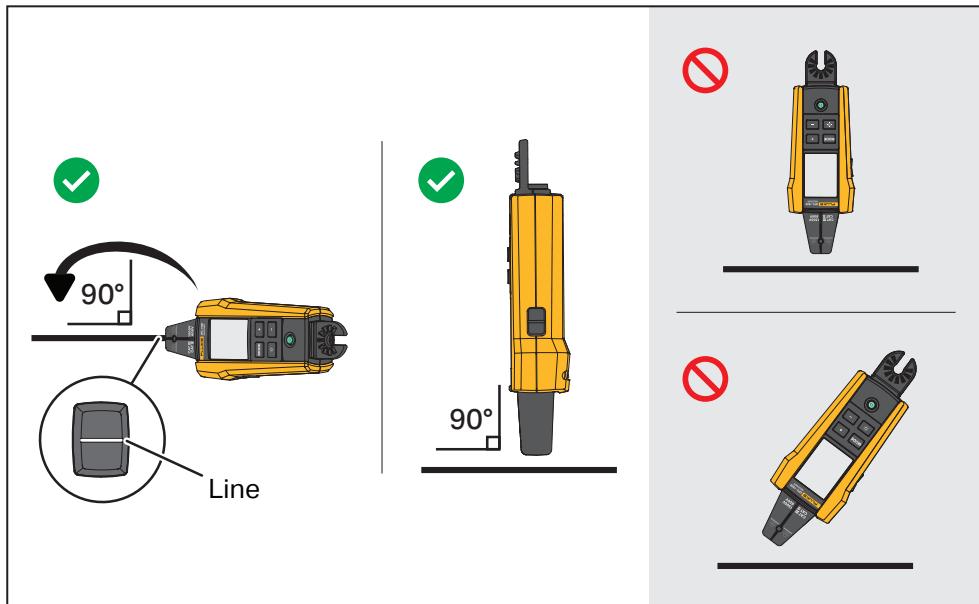
Mode	Description
Tip sensor 	Use with the <b>FAULT</b> functions on the Transmitter to locate a ground fault in an isolated string or in an open parallel circuit. See <a href="#">Tip Sensor and Open Modes</a> .  Use with the <b>MAP</b> function on the Transmitter to confirm the string layout of a PV system. The PV system must not contain a ground fault or broken wire. See <a href="#">Tip Sensor and Open Modes</a> .
Open 	Use with the <b>OPEN</b> function on the Transmitter to trace a signal in an isolated string or circuit to locate a break in a wire.
Breaker 	Use with the Transmitter to identify which fuse or breaker connects to the Transmitter. See <a href="#">Receiver Breaker Mode</a> .  Use with the <b>FAULT</b> or <b>MAP</b> functions.

## Tip Sensor and Open Modes

To use tip sensor or open modes:

1. Scan a target area with the tip sensor to find the strongest signal level.
2. To find the strongest signal level on a wire, align the Receiver perpendicular to the wire with the line on the top of the tip sensor parallel to the wire. See [Figure 1](#).
3. To verify the direction of the wire, periodically rotate the Receiver 90 degrees from side to side while the tip sensor remains perpendicular to the wire.

**Figure 1. Receiver Tip Sensor and Open Mode Alignment**

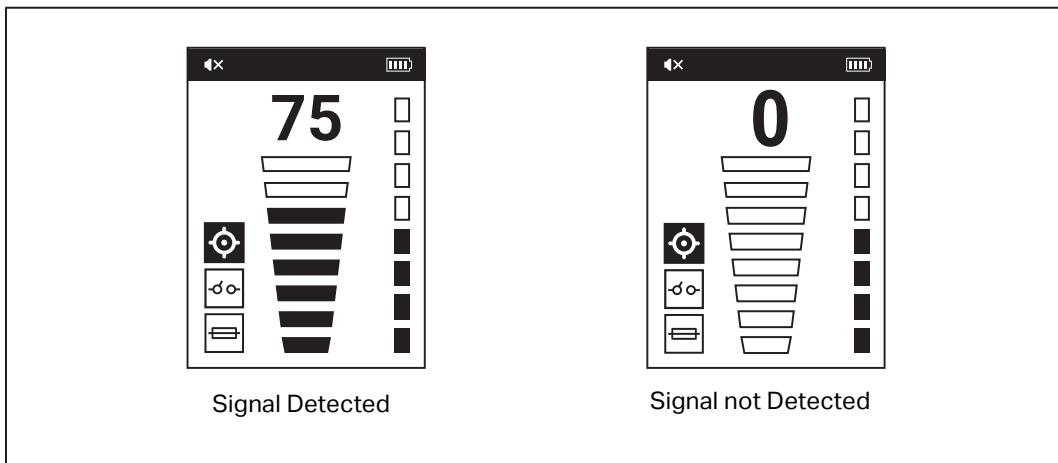


4. Periodically adjust the sensitivity to keep the signal strength near 75 %.

The signal strength indicator on the display changes. See [Figure 2](#).

5. If the signal is too strong to precisely locate the wire, decrease the sensitivity on the Receiver or use **LOW** mode on the Transmitter.

Figure 2. Receiver Tip Sensor and Open Mode Signal Strength



### Receiver Breaker Mode

Breaker mode automatically adjusts the sensitivity of the Receiver. The Receiver stores in memory the strongest signal detected. As a result, the Receiver identifies one correct breaker or fuse.

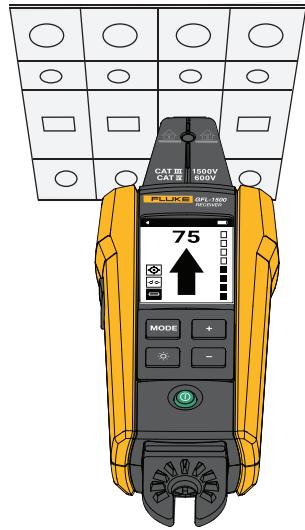
To use breaker mode:

1. Align the tip sensor perpendicular to the breaker. The line on the top of the tip sensor aligns parallel to the breakers. See [Figure 3](#).

#### *Note*

*Different breaker or fuse designs, height, or internal contact structure may affect the precision of breaker or fuse identification. For best results, remove the breaker or fuse panel cover, and do the scan on the wires instead of the breakers or fuses.*

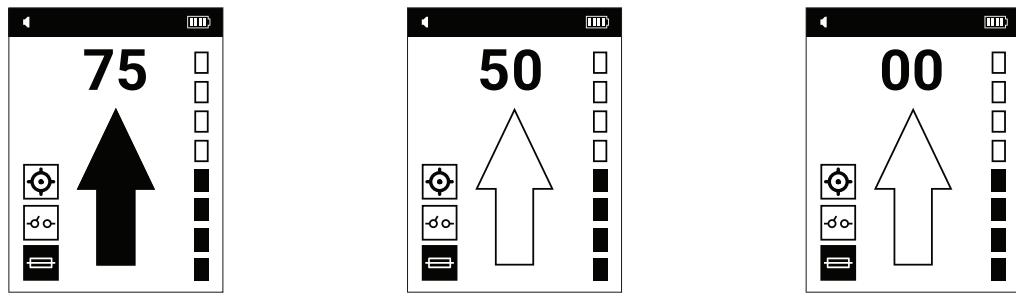
**Figure 3. Receiver Breaker Mode Alignment**



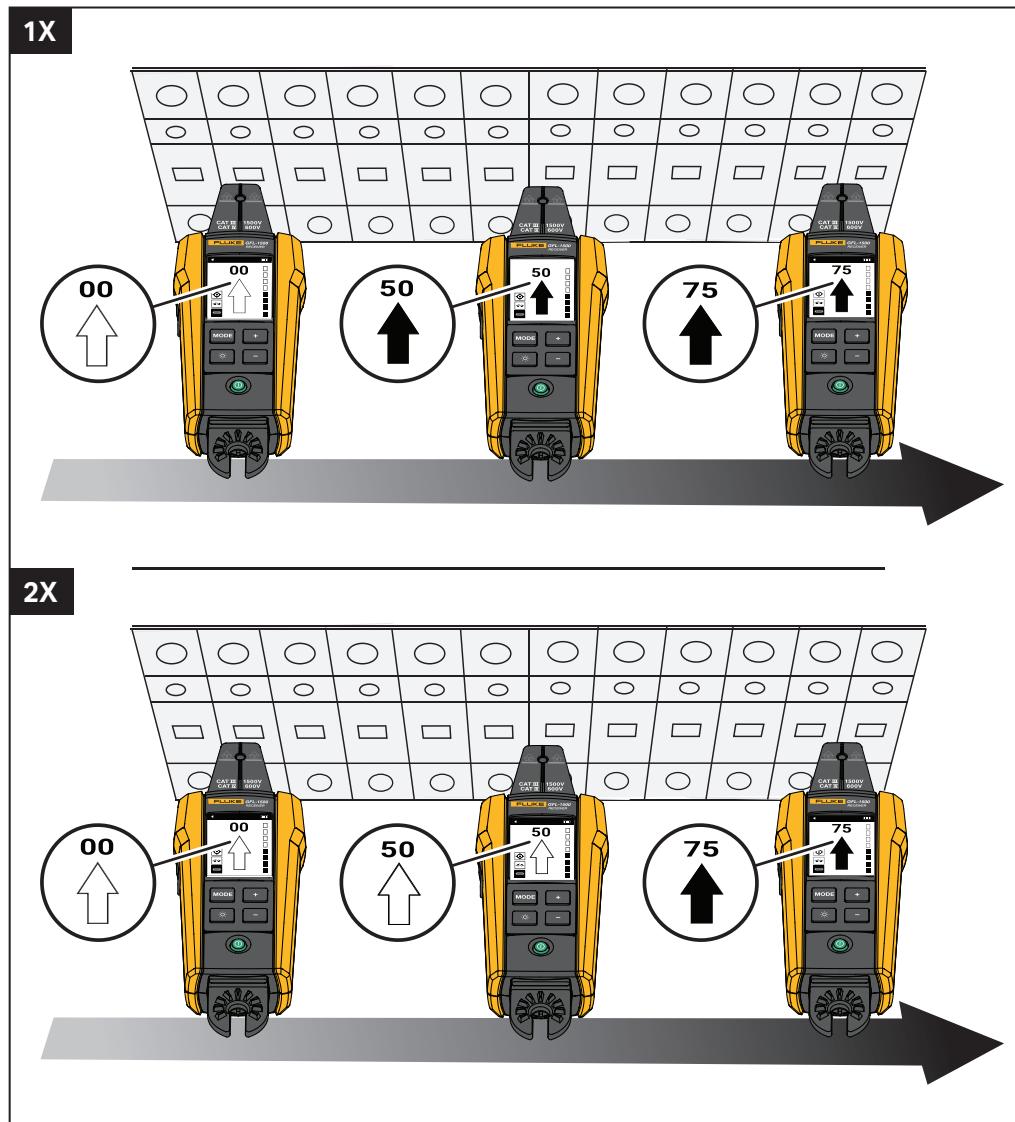
2. Scan each breaker or fuse multiple times until the arrow on the display shows solid for only one breaker or fuse. For best results, scan at the output of the breaker or fuse. The order you scan the breakers or fuses does not matter.

The signal strength indicator on the display changes. See [Figure 4](#). For a breaker mode application, see [Figure 5](#).

**Figure 4. Receiver Breaker Signal Strength**



**Figure 5. Receiver Breaker Mode Application**



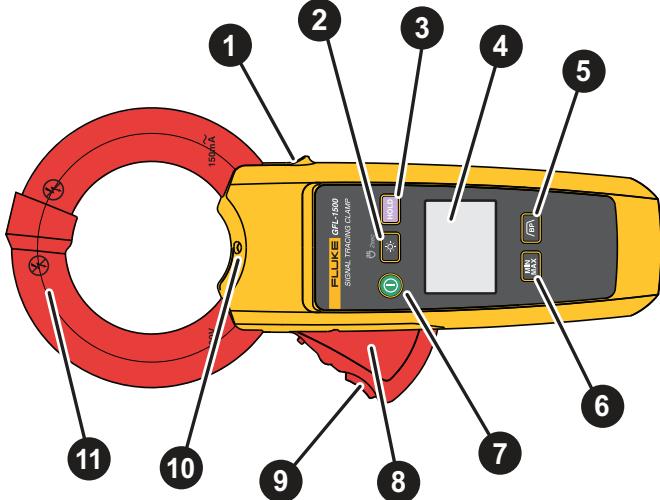
## The Clamp

Use the Clamp on systems with high resistance.

### Features of the Clamp

Table 5 shows the features of the Clamp.

**Table 5. Features of the Clamp**



Item	Function
1	Tactile Barrier.  <b>⚠⚠ Warning</b> <b>Hold the Clamp behind the tactile barrier.</b>
2	Push  to turn on and off the backlight of the display.  Push and hold  for 2 seconds to turn on and off the spotlight (10).
3	Push <b>HOLD</b> to retain the results and show <b>HOLD</b> on the display.  Push <b>HOLD</b> again to clear the results and remove <b>HOLD</b> from the display.
4	The display shows the measured value, unit, function, and battery level. See <i>Clamp Display</i> .

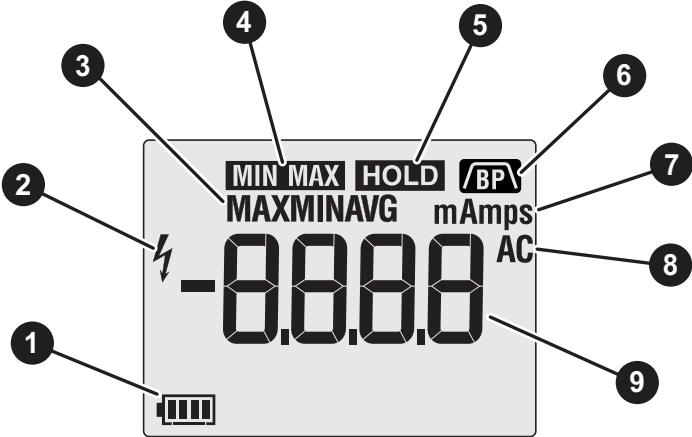
**Table 5. Features of the Clamp (cont.)**

Item	Function
⑤	Push <b>BP</b> to activate the band pass filter to filter out leakage capacitive paths for more reliable results. Filters to only use 30 Hz to 70 Hz.
⑥	<p>Push <b>MIN MAX</b> :</p> <p>1x to show the minimum measurement on the display.</p> <p>2x to show the maximum measurement on the display.</p> <p>3x to show the average measurement on the display.</p> <p>See <a href="#">Table 6</a>.</p>
⑦	Push <b>①</b> to turn on and off the Clamp.
⑧	Jaw trigger. Use with the jaw unlock button <b>(⑨)</b> to unlock and open the jaw <b>(⑪)</b> .
⑨	The jaw unlock button. Use with the jaw trigger <b>(⑧)</b> to unlock and open the jaw <b>(⑪)</b> .
⑩	With the spotlight enabled, illuminates the jaw area of the Clamp to increase visibility.
⑪	The jaw.

## Clamp Display

Table 6 shows the items on the display of the Clamp.

Table 6. Clamp Display



Item	Function
①	Battery level indicator.
②	High voltage indicator.
③	<b>MAX</b> , <b>MIN</b> , or <b>AVG</b> shows based on the number of times you push <b>MIN MAX</b> on the Clamp. See <a href="#">Table 5</a> .
④	Shows with <b>MIN MAX</b> enabled. See <a href="#">Table 5</a> .
⑤	Shows with <b>HOLD</b> enabled. See <a href="#">Table 5</a> .
⑥	Shows with <b>∫/BP</b> enabled. See <a href="#">Table 5</a> .
⑦	Unit of measure
⑧	Shows the measurement is in AC.
⑨	The measured value.

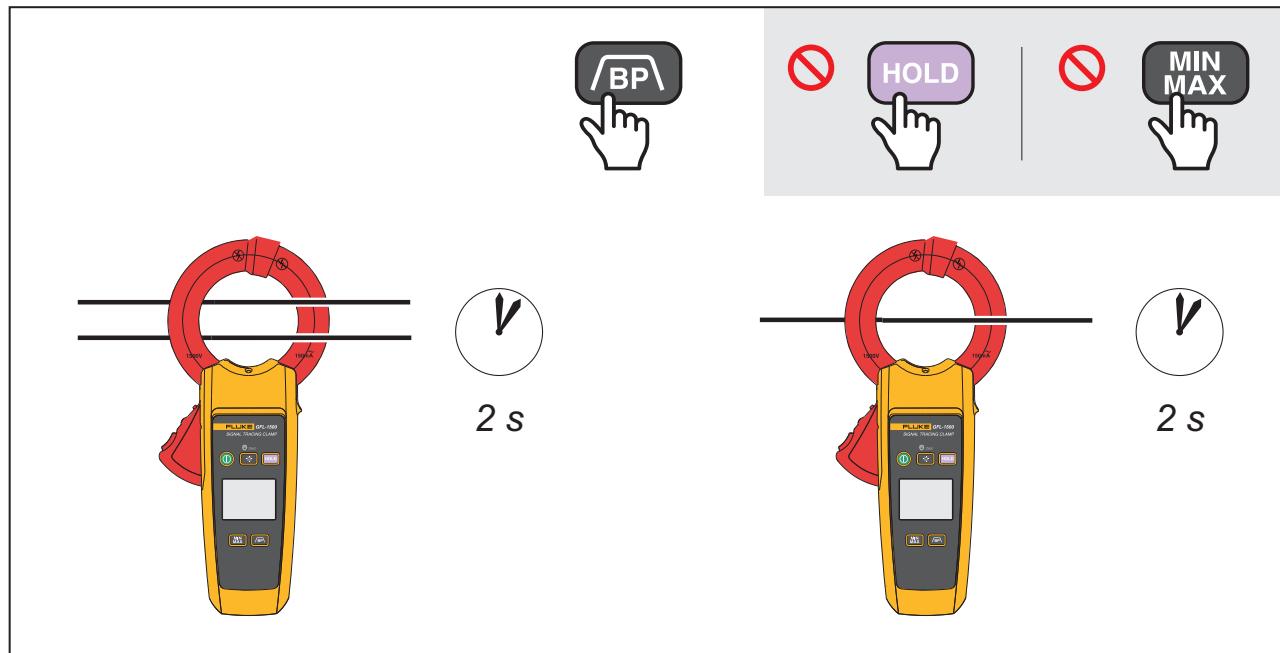
## Use the Clamp

Use the Clamp with the Transmitter to trace a ground fault or to map a system.

To use the Clamp:

1. Connect the Transmitter. See [Trace a Fault](#) and [Map a System](#).
2. Correctly align the insulated wires in the Clamp. See [Figure 6](#).
3. Turn on the Clamp.
4. With the Transmitter in array mode, push **/BP\**.
5. Hold the Clamp still for 2 seconds for the measurement to stabilize.

**Figure 6. Clamp Alignment**



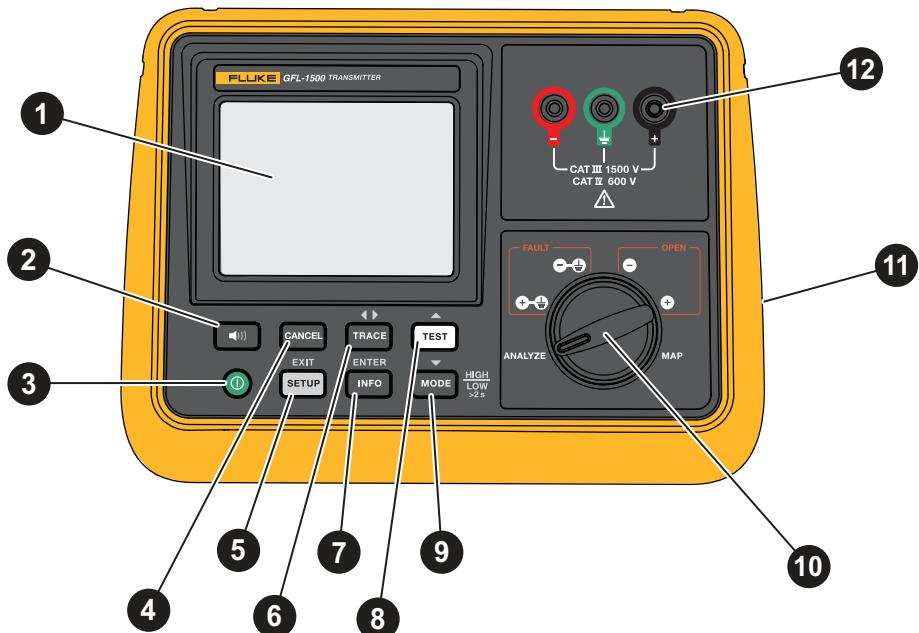
## The Transmitter

The Transmitter generates a signal on an energized or de-energized circuit.

### Features of the Transmitter

Table 7 shows the features of the Transmitter.

Table 7. Features of the Transmitter



Item	Function
1	The display shows menu selections and test results. See <a href="#">Transmitter Display</a> .
2	Push  to adjust the volume.
3	Push  to turn on and off the Product.
4	Push <b>CANCEL</b> to cancel an action.
5	Push <b>SETUP</b> once to open the setup menu and activate the secondary functions of the buttons as marked above the buttons. Push <b>SETUP</b> again to exit the setup menu. See <a href="#">Transmitter Setup Menu</a> .
6	
7	
8	
9	
10	
11	
12	

**Table 7. Features of the Transmitter**

Item	Function
⑥	Push <b>TRACE</b> to trace a fault, locate a break in a wire, or to map a system.
⑦	Push <b>INFO</b> to see more information on the screen.
⑧	With <b>ANALYZE</b> selected on the rotary knob, push <b>TEST</b> to analyze the system. See <i>Analyze a System</i> .
⑨	Push <b>MODE</b> to select the mode: array, unit, or auto.  Push and hold <b>MODE</b> for 2 seconds to toggle between <b>HIGH</b> and <b>LOW</b> amplitude mode. <b>LOW</b> mode is not available in unit mode.  See <i>Transmitter Modes</i> .
⑩	Use the rotary knob to select the type of test to do. See <i>Rotary Knob Functions</i> .
⑪	The battery compartment is on the back.
⑫	Input jacks for the test leads.

## Transmitter Display

When you turn on the Transmitter for the first time, the screens show in English. To change the language selection, see *Transmitter Setup Menu*.

The users manual shows English screens in examples and translates the explanations as appropriate in tables or text.

*Note*

*Text that shows in English on the buttons and the rotary knob functions shows in English in the UI.*

## Transmitter Setup Menu

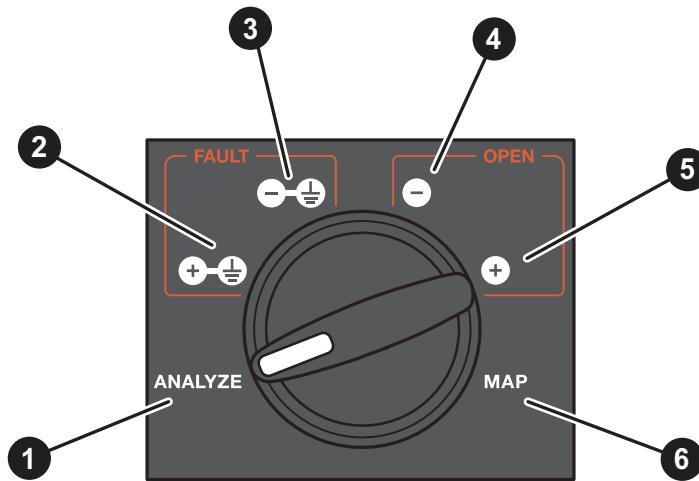
To change the brightness level of the display:

1. Push **SETUP** to open the setup menu and activate the secondary functions above the other keys.
2. Push **TEST** (  ) or **MODE** (  ) to highlight a menu item, and push **INFO** ( **ENTER** ) to select the item.
3. Use the secondary functions to make adjustments.
  - a. To change the brightness of the display, push **TEST** (  ) or **MODE** (  ) to select a brightness level.
  - b. To change the language selection, push **TEST** (  ) or **MODE** (  ) to highlight a language.
  - c. To update the firmware, see TruTest™ Software available on our website.
  - d. To change a module number, push **TRACE** (  ) to toggle between the ones and tens columns and **TEST** (  ) or **MODE** (  ) to change a value).
4. Push **INFO** ( **ENTER** ) to return to the setup menu.
5. With all changes set, push **SETUP** ( **EXIT** ) to exit the setup menu and deactivate the secondary functions.

## Rotary Knob Functions

Table 8 shows the functions on the rotary knob of the Transmitter.

**Table 8. Rotary Knob Functions**



Item	Function
❶	In <b>ANALYZE</b> function, the Transmitter measures hazardous voltage on the positive, negative, and ground terminals. See <a href="#">Analyze a System</a> .
❷	In <b>FAULT</b> function, the Transmitter: <ul style="list-style-type: none"> <li>• Generates a signal that flows from positive to a ground fault.</li> <li>• Monitors hazardous voltage between the positive and ground terminals.</li> </ul> See <a href="#">Figure 7</a> .
❸	In <b>FAULT</b> function, the Transmitter: <ul style="list-style-type: none"> <li>• Generates a signal that flows from negative to a ground fault.</li> <li>• Monitors hazardous voltage between the negative and ground terminals.</li> </ul> See <a href="#">Figure 7</a> .

**Table 8. Rotary Knob Functions (cont.)**

Item	Function
4	<p>In <b>OPEN (−)</b> function, the Transmitter:</p> <ul style="list-style-type: none"> <li>Generates a signal that flows from the negative terminal on the Transmitter to a break in an isolated circuit.</li> <li>Monitors hazardous voltage between the negative and ground terminals.</li> </ul> <p>See <a href="#">Figure 8</a>.</p>
5	<p>In <b>OPEN (+)</b> function, the Transmitter:</p> <ul style="list-style-type: none"> <li>Generates a signal that flows from the positive terminal on the Transmitter to a break in an isolated circuit.</li> <li>Monitors hazardous voltage between the positive and ground terminals.</li> </ul> <p>See <a href="#">Figure 8</a>.</p>
6	<p>In <b>MAP</b> function, the Transmitter:</p> <ul style="list-style-type: none"> <li>Generates a signal that flows from the positive terminal to the negative terminal of the Transmitter through an isolated circuit.</li> <li>Monitors hazardous voltage between the positive and negative terminals.</li> </ul> <p>See <a href="#">Figure 9</a>.</p>

Figure 7. FAULT Signal Flow

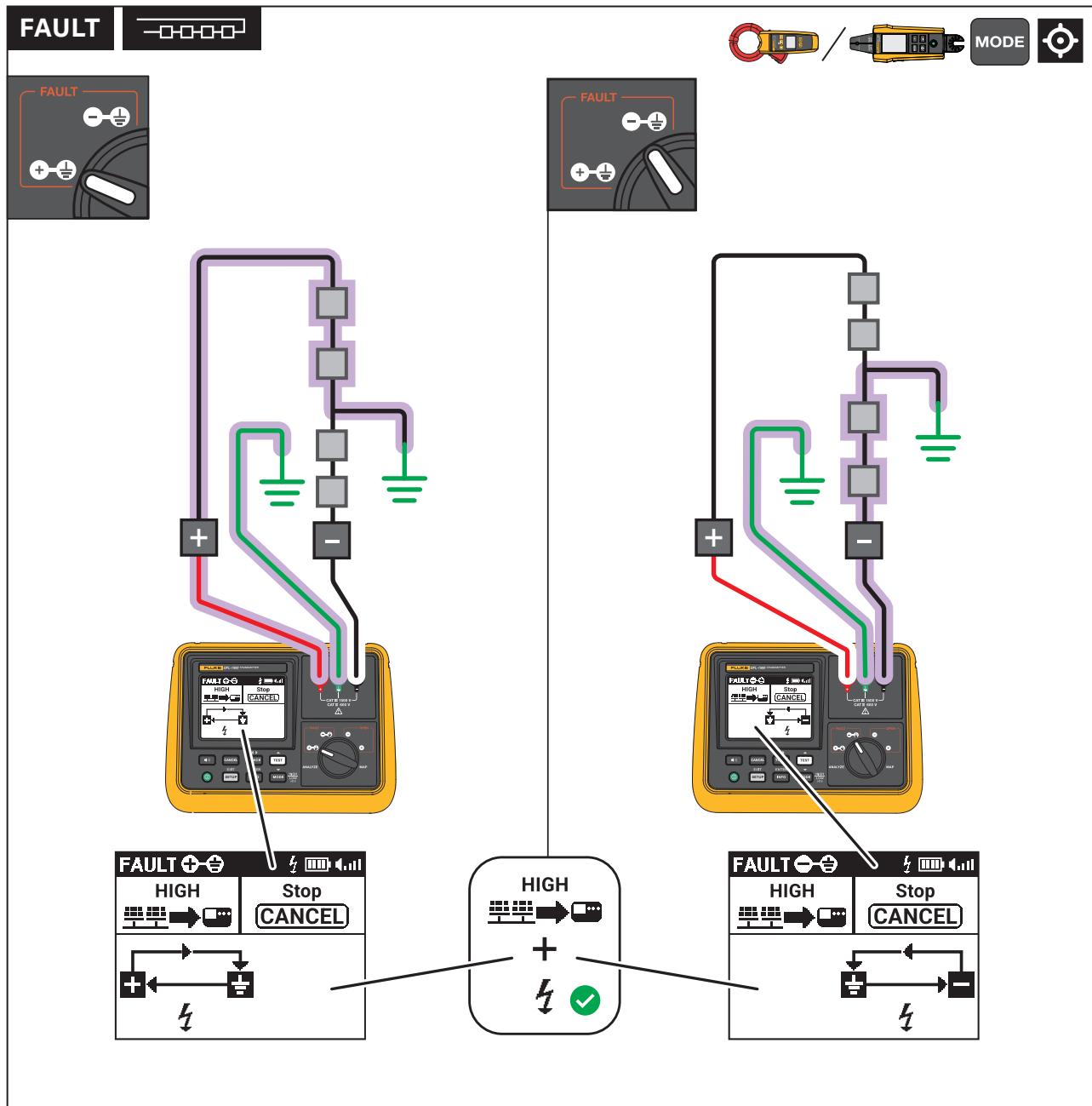


Figure 8. OPEN Signal Flow

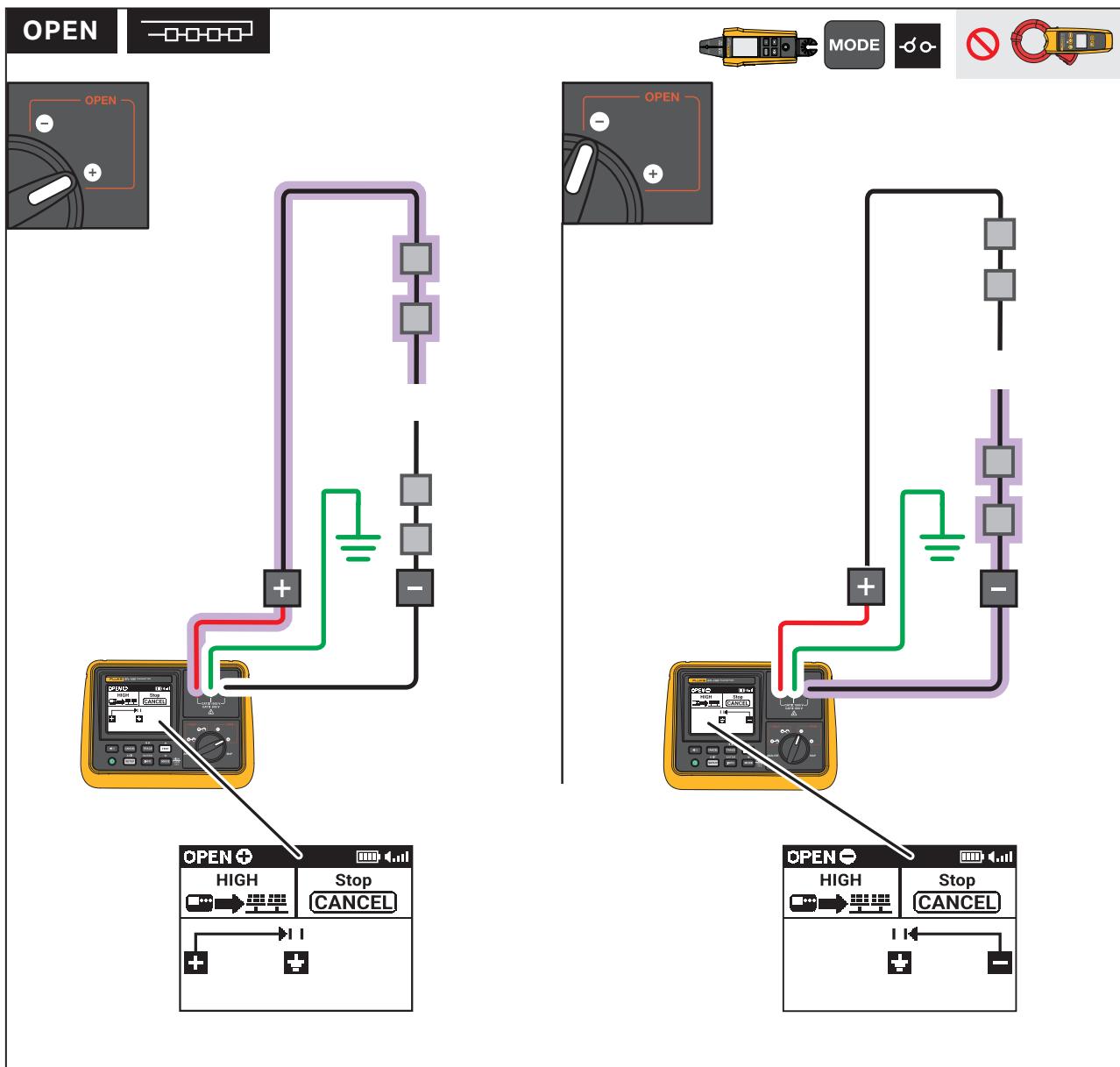
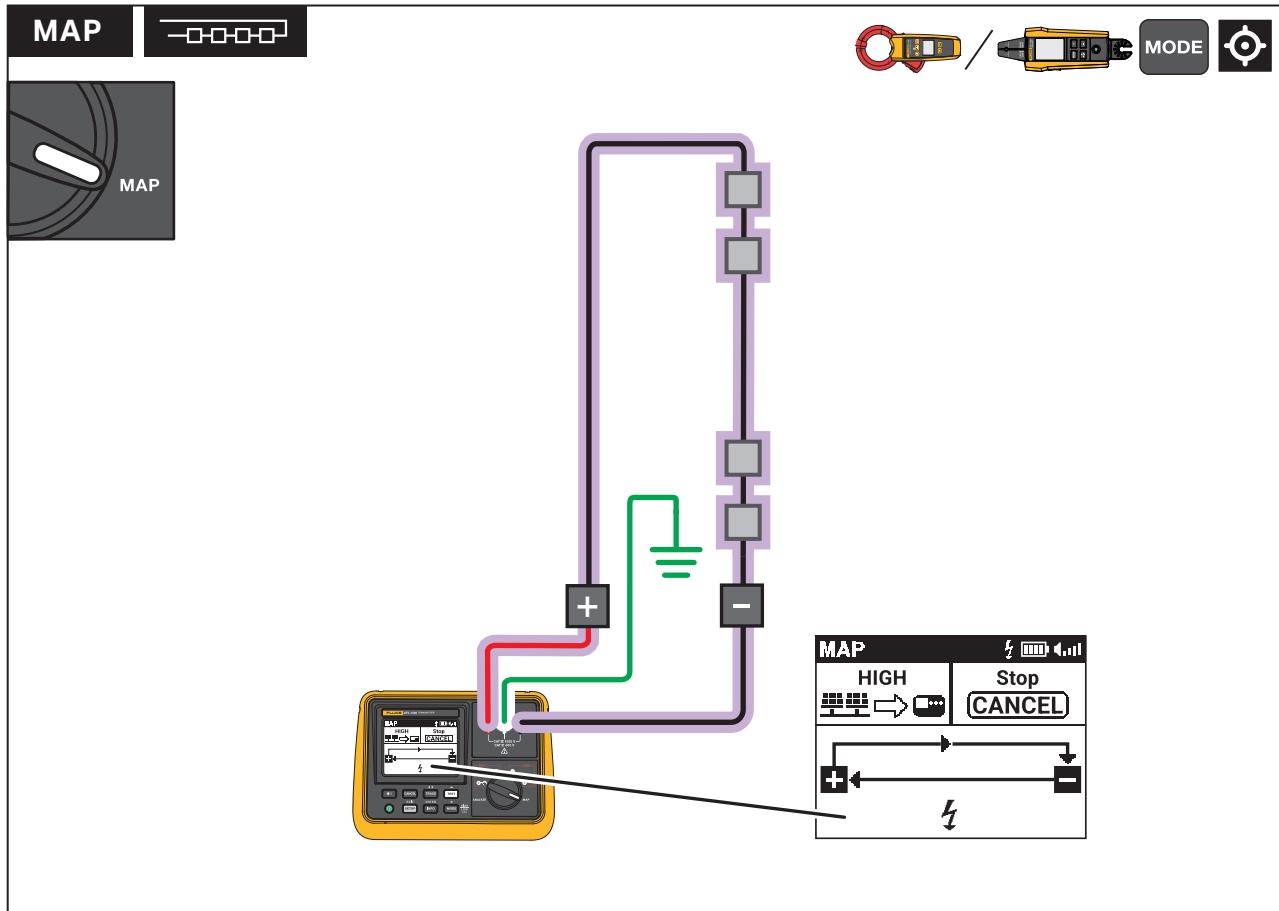


Figure 9. MAP Signal Flow



## Analyze a System

The **ANALYZE** function provides key diagnostic measurements such as estimated fault resistance and voltage to ground.

To analyze a system:

1. Isolate the dc system from ground. See [Isolate the DC System from Ground](#).
2. Select the workflow that most closely matches the System to trace. See [System Workflows](#).
3. Connect the Transmitter correctly based on the workflow of the type of system to trace. See [System Workflows](#).
4. On the Transmitter:
  - a. Push **①**.
  - b. Turn the rotary knob to **ANALYZE**.
  - c. Push **TEST**.

The **ANALYZE** results screen shows. See [Table 9](#). The results do not save in the Transmitter. When the rotary knob turns to another function, do another test to see the results screen again.

Table 9. ANALYZE Results Screens

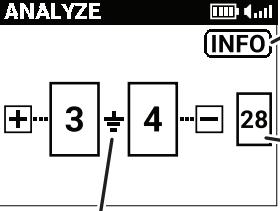
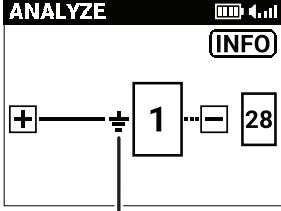
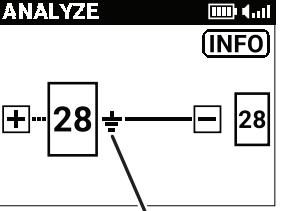
Possible results screens

Item	Function
❶	FAULT shows when the Transmitter detects a traceable hard ground fault, which is defined as the ground fault resistance approximation (❷) is ( $\approx <10\text{ k}\Omega$ ).
❷	Ground fault resistance approximation. The greater the resistance the more difficult it is to trace a fault.
❸	High voltage detected.
❹	Battery level indicator.
❺	Volume level indicator.

**Table 9. ANALYZE Results Screens (cont.)**

Item	Function
6	Push <b>INFO</b> to toggle between the <b>ANALYZE</b> results screen and the <b>ANALYZE</b> modules screen. See <a href="#">Table 10</a> .
7	VOC: Voltage open circuit (positive to negative).
8	A solid line indicates a traceable hard ground fault. A dashed line indicates a fault with a high resistance that may be difficult to trace. No line shows when the Transmitter does not detect a fault or the Transmitter cannot determine if a fault is present.
9	Voltage negative to earth (ground).
10	Voltage positive to earth (ground).
11	For all system workflows except for a single-fused combiner box or string inverter, if the absolute value of: <ul style="list-style-type: none"> <li>• VPE &gt; VNE, use <b>FAULT</b>  to trace a fault.</li> <li>• VNE &gt; VPE, use <b>FAULT</b>  to trace a fault.</li> </ul> For a single-fused combiner box or string inverter system, see <a href="#">Single-Fused Combiner box or String Inverter</a> .
12	Traceable hard fault detected. See <a href="#">Trace a Fault</a> .
13	High resistance fault detected. May be traceable. If difficult to trace, reduce the fault resistance. See <a href="#">Troubleshoot a Workflow</a> .
14	No fault detected. <b>Do not trace. Trace results may be inconsistent.</b>
15	High resistance and capacitance detected. The Transmitter is unable to determine the presence of a fault. <b>Do not trace. Trace results may be inconsistent.</b>

**Table 10. ANALYZE Modules Screens**

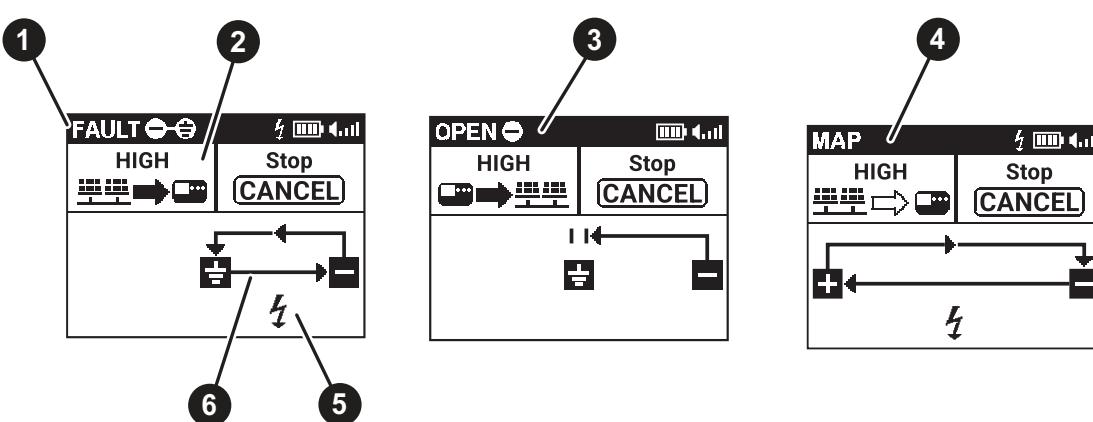




Item	Function
①	Push <b>INFO</b> to toggle between the ANALYZE modules screen and the ANALYZE results screen.
②	Total number of modules entered in the setup menu. If the number of modules do not show, push <b>SETUP</b> to enter the number of modules. See <i>Transmitter Setup Menu</i> .
③	The approximate location of the fault in relation to the number of modules. In this example, the fault is approximately between modules 3 and 4 in the string with the fault.
④	The fault is in the system before the first module in the string.
⑤	The fault is in the system after the last module in the string.

## FAULT, OPEN, and MAP Screens

Table 11 show the information on the FAULT, OPEN, and MAP screens.

Table 11. FAULT, OPEN, and MAP screens



Item	Function
①	Name of the function selected on the rotary knob. In this example, the FAULT  function is selected on the rotary knob.
②	Selected mode. See <a href="#">Transmitter Modes</a> .
③	OPEN  function screen.
④	MAP function screen.
⑤	The hazardous voltage indicator on the active terminals.
⑥	The active terminals and the signal path.

## Transmitter Modes

The Transmitter has different modes that may make it easier to detect a signal. Table 8 shows the modes of the Transmitter.

The Transmitter emits different tones for array and unit modes to indicate something changed in the system.

If you hear the tone change:

1. Check the connections and the array.
2. If you are in array mode, change to unit mode.
3. If you are in unit mode, change to array mode.

**Table 12. Transmitter Modes**

Item	Description
①	<p><b>HIGH</b> array mode.</p> <p>The array mode generates a high-amplitude signal by sourcing the voltage from the array.</p> <p>When to use:</p> <ul style="list-style-type: none"> <li>• This is the default mode for the <b>FAULT</b> functions.</li> <li>• May be used with the <b>MAP</b> function.</li> </ul>
②	<p><b>LOW</b> array mode.</p> <p>The array mode generates a low-amplitude signal by sourcing the voltage from the array.</p> <p>When to use:</p> <ul style="list-style-type: none"> <li>• Use with the <b>FAULT</b> functions when: <ul style="list-style-type: none"> <li>○ The <b>ANALYZE</b> results indicate the presence of a fault in the system, but the signal is unstable.</li> <li>○ The signal is too high for the Receiver or the Clamp to detect consistently.</li> </ul> </li> <li>• May be used with the <b>MAP</b> function.</li> </ul>

Table 12. Transmitter Modes (cont.)

Item	Description
③	<p><b>HIGH</b> Unit mode.</p> <p>Unit mode generates a signal by injecting a voltage from the Transmitter.</p> <p>When to use:</p> <ul style="list-style-type: none"> <li>• This is the default mode for the <b>OPEN</b> function.</li> <li>• Use with the <b>FAULT</b> functions when the <b>ANALYZE</b> results indicate the presence of a fault in the system, but the hazardous voltage symbol does not show on the <b>FAULT</b> screen.</li> <li>• May be used with the <b>MAP</b> function.</li> </ul> <p><i>Note</i></p> <p><i>There is no <b>LOW</b> Unit mode.</i></p>
④	<p>Auto mode.</p> <p>The double arrows show as the Transmitter determines which mode to select.</p> <p>Auto mode selects:</p> <ul style="list-style-type: none"> <li>• Array mode when the Transmitter detects a voltage <math>\geq 30</math> V.</li> <li>• Unit mode when the Transmitter detects a voltage <math>&lt; 30</math> V.</li> </ul> <p>This is only recommended for use with the <b>MAP</b> function.</p> <p>Auto mode may not be effective in systems with high capacitance.</p>

## Ground Fault Overview

For the Product to detect and locate a fault in a system:

- The fault must be active in the system.
- You must be able to identify any parallel branches in the system.
- You must know which system workflow most closely matches the system to trace and how to trace a fault on the system. See [System Workflows](#).
- You must isolate the dc system from ground. See [Isolate the DC System from Ground](#).

## Trace a Fault

To locate a ground fault:

1. Isolate the dc system from ground. See [Isolate the DC System from Ground](#).
2. Select the system workflow that most closely matches the system of the fault to trace. See [System Workflows](#).
3. Connect the Transmitter based on the workflow of the type of system to trace. See [System Workflows](#).
4. Use the **ANALYZE** function to detect a ground fault. See [Analyze a System](#).
5. Select the correct **FAULT** function to use to trace the fault. See [Table 9](#).
6. Select the correct mode on the Transmitter. See [Transmitter Modes](#).
7. Verify the active terminals. See [Verify Active Terminals](#).
8. Use the Receiver or the Clamp to (see [System Workflows](#)):
  - a. Identify the branch that contains the fault.
  - b. Locate the fault on the branch that contains the fault.

The signal stops at the point of the fault.

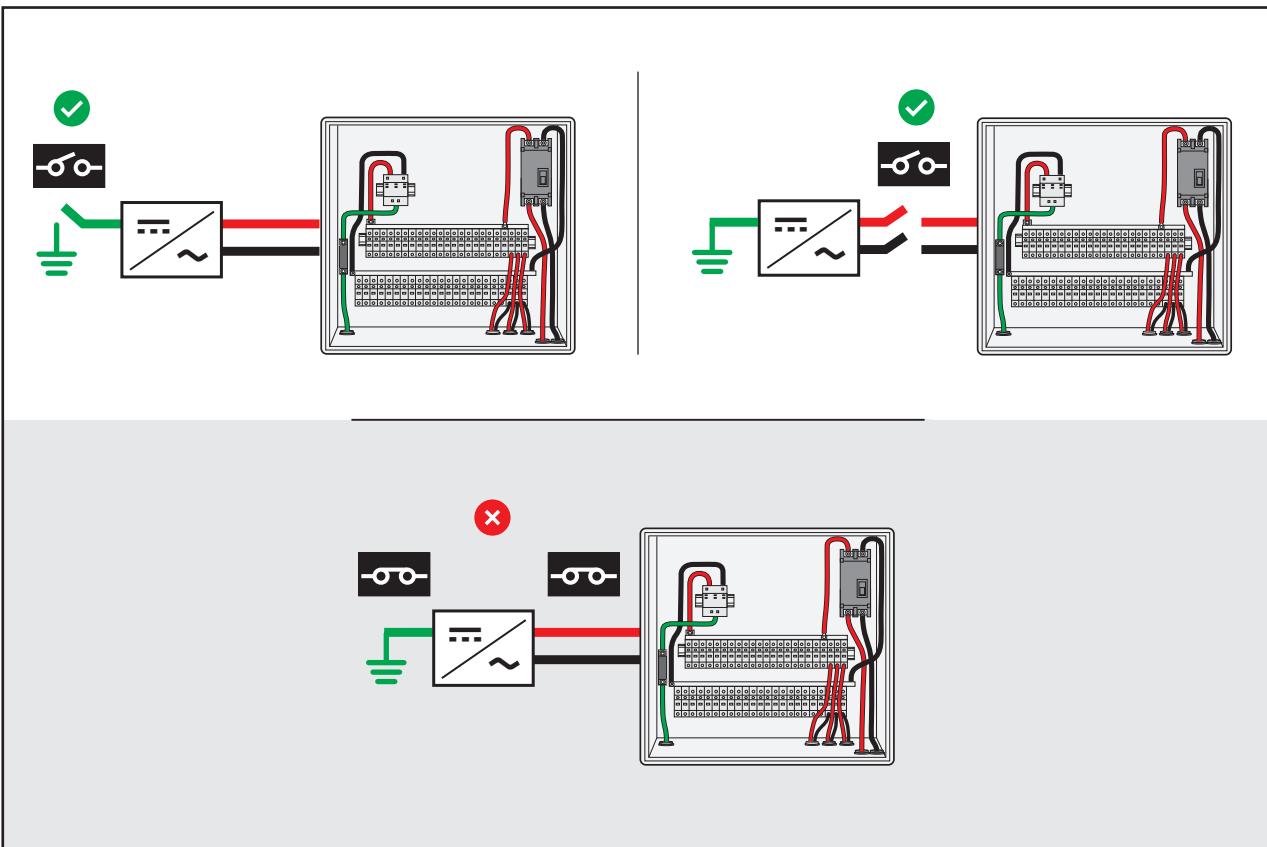
## Isolate the DC System from Ground

The positive and negative wires of the dc system must be isolated from ground to locate a fault.

To isolate the System from ground (See [Figure 10](#)):

- Turn off the inverter and confirm the ground fault protection device (GFPD) is on an open circuit.  
Or,
- Disconnect the positive and negative conductors to the inverter from the sub-array.
  - Open the load break disconnect (LBD).
  - Or,
  - Remove the positive and negative conductors from their terminals.

**Figure 10. Isolate the System from Ground**



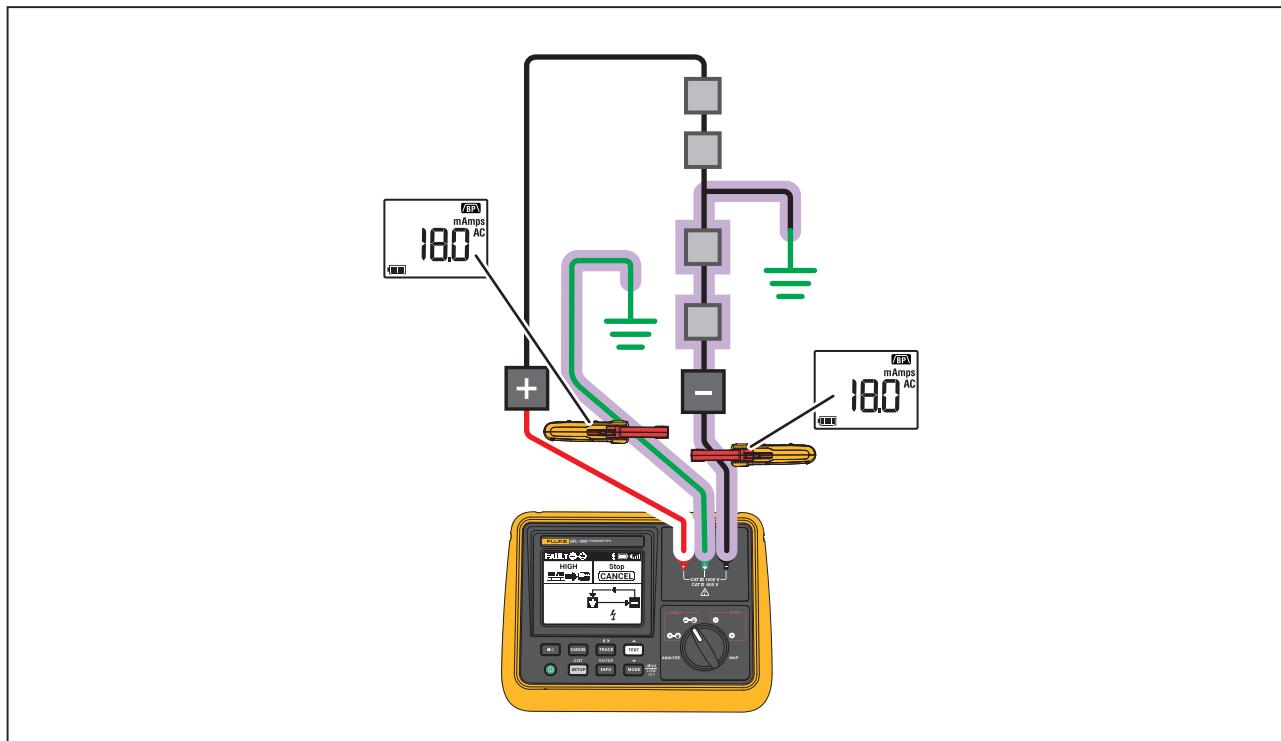
## Verify Active Terminals

Before you trace a fault, use the Clamp on the test leads near the terminals of the Transmitter to verify the Transmitter sends the signal on the active terminals.

If the results do not show as expected, see [Troubleshoot a Workflow](#).

Figure 11 shows how to verify a signal near the terminals. In this example, the Transmitter generates a signal from negative to ground. No signal is detected on the positive terminal.

**Figure 11. Signal Near Terminals**



## System Workflows

Use the type of system workflow and the suspected issue to determine how to locate a fault.

### Isolated string

**Applies to:** Applies to all systems on which a single string can be isolated. On a system with parallel branches, you must be able to isolate a string.

**Issue:** A possible fault on a single string.

**Goal:** Trace an isolated string to locate a fault.

To trace a fault on an isolated string:

1. Isolate the dc system from ground. See [Isolate the DC System from Ground](#).
2. Directly connect the Transmitter to the isolated string. See [Figure 12](#).

In this example, the Transmitter generates a signal from negative to ground.

3. Use the **ANALYZE** function to detect a ground fault. See [Analyze a System](#).
4. Select the correct **FAULT** function to use to trace the fault. See [Table 9](#).
5. Select the correct mode on the Transmitter. See [Transmitter Modes](#).
6. Verify the active terminals. See [Verify Active Terminals](#).
7. Push **TRACE**, and use the Clamp or the Receiver to follow the signal from the active terminal to the fault. See [Figure 12](#).

In this example, trace from the negative terminal to the fault.

### Underground Faults

Ground faults often occur on underground conductors and may occur on a homerun.

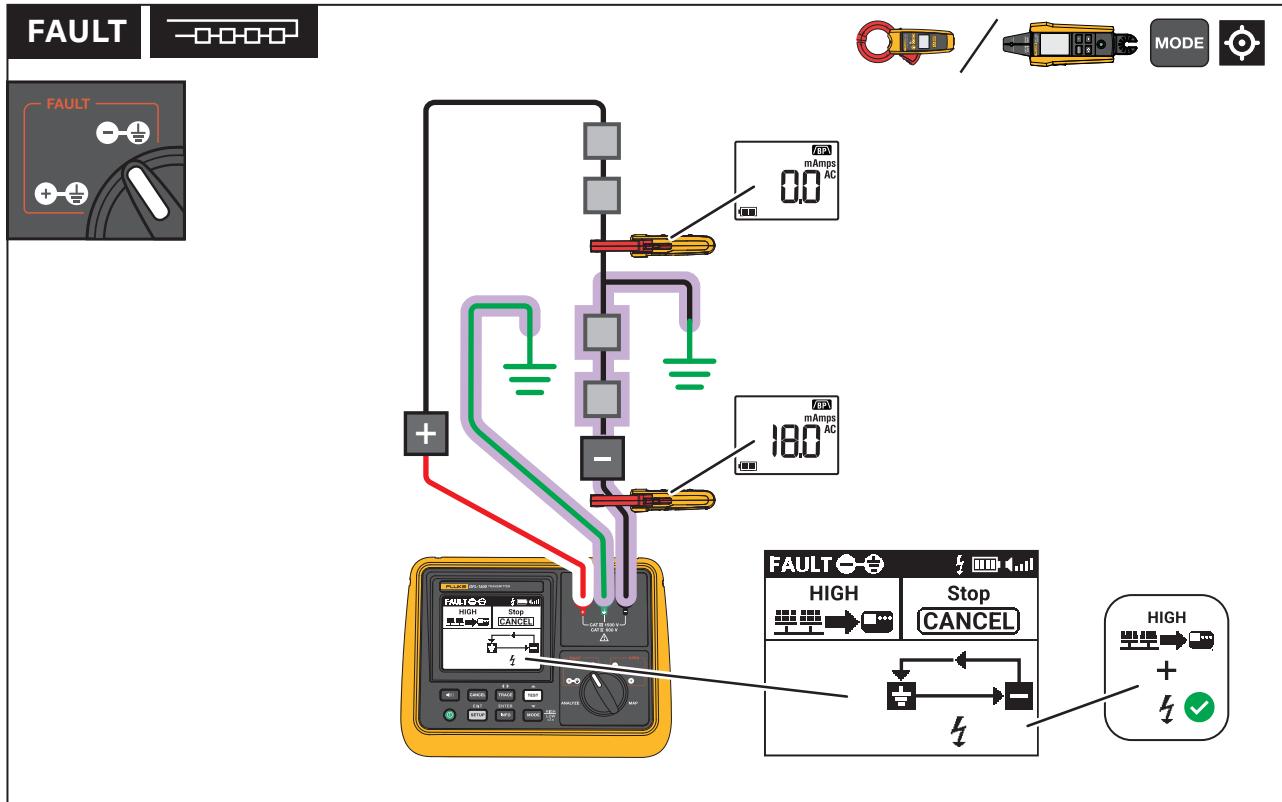
Measure immediately before and after the underground section to determine if the fault is underground.

If you detect the signal on the circuit before the underground section but do not detect the signal after the underground section, the fault is located in the underground section.

#### *Note*

*The Receiver and the Clamp are unable to identify the exact fault location in an underground section.*

**Figure 12. Isolated String Direct Connection**



### Double-Fused Combiner box or String Inverter

**Applies to:** Combiner boxes or string inverters with parallel branches bused together that have easy disconnects (fuses) on positive and negative buses.

**Issue:** A possible fault in a combiner box or string inverter.

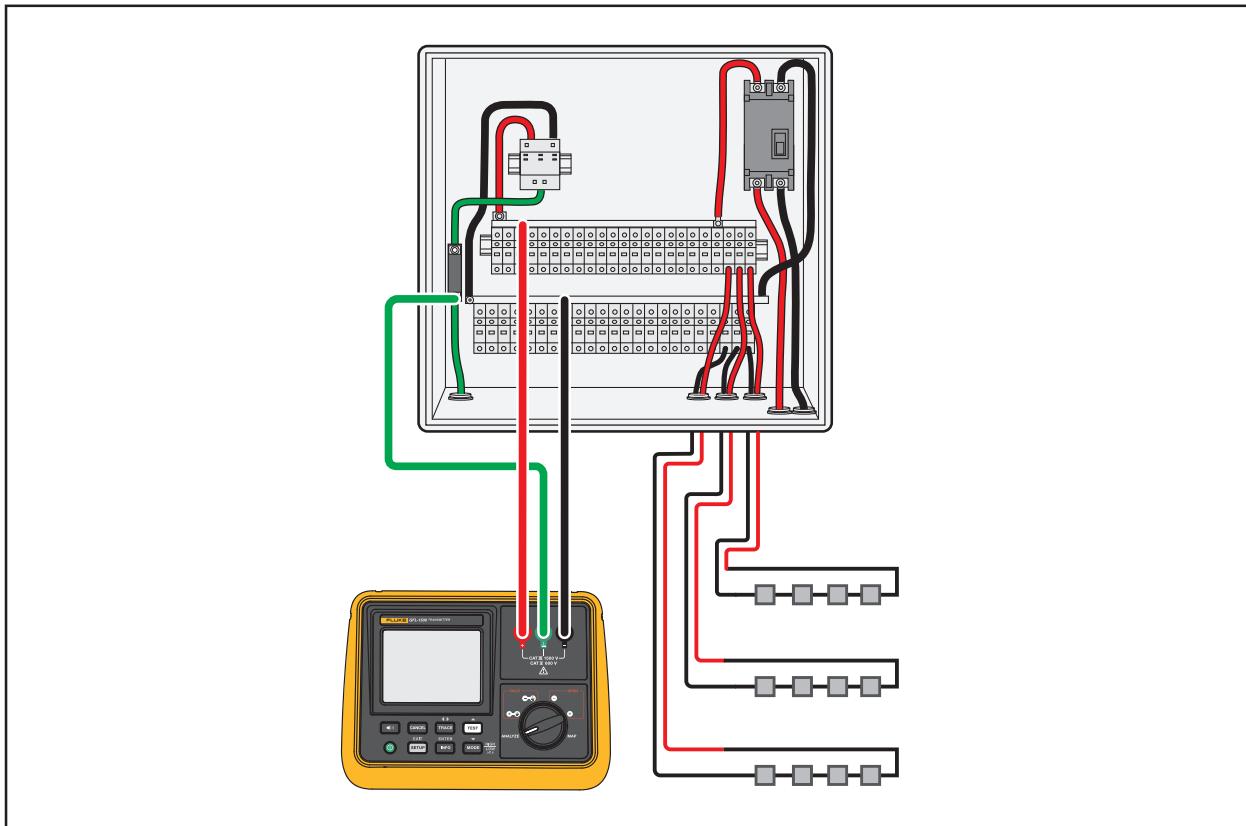
**Goal:** Start at the combiner box or string inverter, identify a faulted branch, and locate a fault on a string on the faulted branch.

To locate a fault in a double-fused combiner box or string inverter:

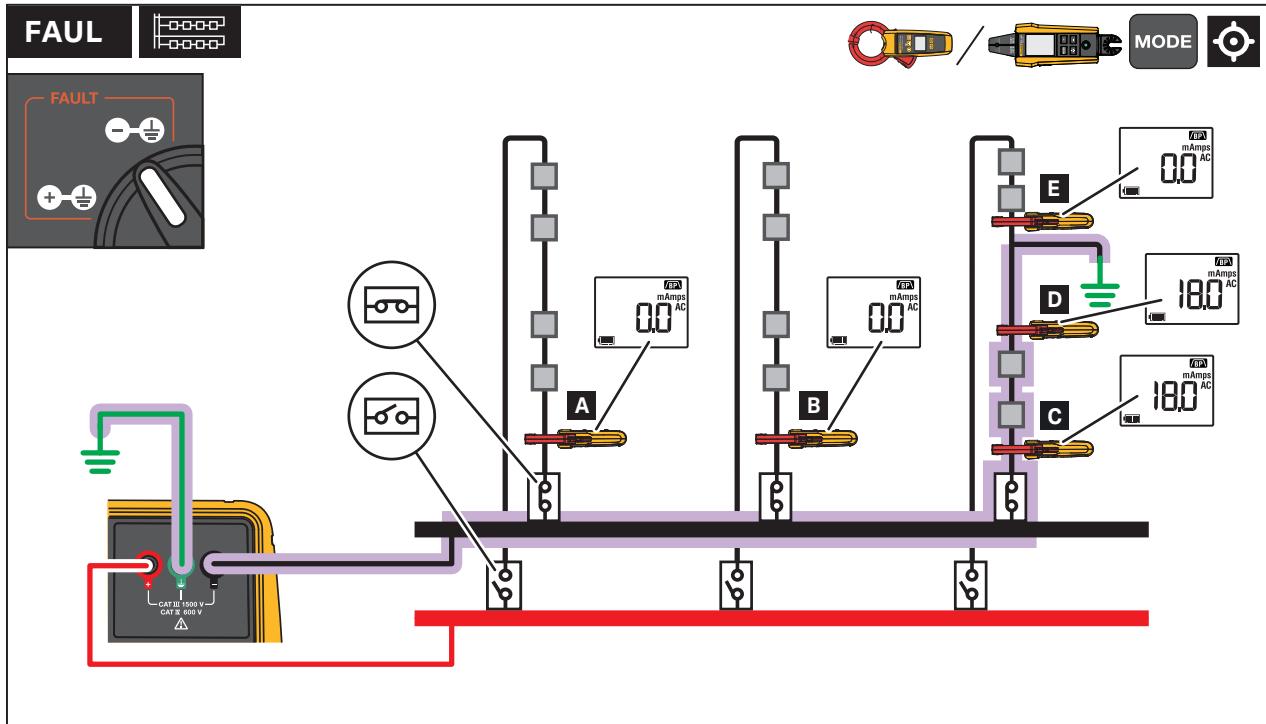
1. Isolate the dc system from ground. See [Isolate the DC System from Ground](#).
2. Connect the Transmitter to a double-fused combiner box. See [Figure 13](#).
3. Use the **ANALYZE** function to detect a ground fault. See [Analyze a System](#).
4. Select the correct **FAULT** function to use to trace the fault. See [Table 9](#).

5. Select the correct mode on the Transmitter. See [Transmitter Modes](#).
6. Verify the active terminals. See [Verify Active Terminals](#).
7. Identify the branch that contains the fault.
  - a. Disconnect the parallel branches on the side the signal does not transmit on. This breaks parallel loops and focuses the signal on the branch with the fault. See [Figure 14](#).  
In this example, the Transmitter generates a signal from negative to ground.
  - b. Push **TRACE**, and use the Clamp or the Receiver to locate the branch with the fault. See steps A, B, and C in [Figure 14](#).
8. Locate the fault on the branch that contains the fault.
  - a. Keep the same disconnections on one side of all parallel branches.
  - b. Push **TRACE**, and use the Clamp or the Receiver to follow the signal from the active terminal to the fault. See steps C, D, and E in [Figure 14](#).  
In this example, trace from the negative terminal to the fault.

**Figure 13. Double-Fused Combiner Box Connection**



**Figure 14. Locate a Fault with Open Fuses**



### Single-Fused Combiner box or String Inverter

**Applies to:** Combiner boxes or string inverters with parallel branches bused together that have easy disconnects (fuses) on only one bus. Note, most single-fused combiner boxes have fuses on the positive side.

**Issue:** A possible fault in a combiner box or string inverter.

**Goal:** Start at the combiner box or string inverter, identify a faulted branch, and locate a fault on a string on the faulted branch.

To locate a fault in a single-fused combiner box or string inverter:

1. Isolate the dc system from ground. See [Isolate the DC System from Ground](#).
2. Connect the Transmitter to a single-fused combiner box. See [Figure 15](#).
3. Use the **ANALYZE** function to detect a ground fault. See [Analyze a System](#).

4. If the voltage measures >30 V on the side without the fuses, use the FAULT function for that side. Because most single-fused combiner boxes have fuses on the positive side, typically use FAULT .
5. Select the correct mode on the Transmitter. See [Transmitter Modes](#).
6. Verify the active terminals. See [Verify Active Terminals](#).
7. Identify the branch that contains the fault.
  - a. Disconnect the parallel branches on the side the signal does not transmit on. This breaks parallel loops and focuses the signal on the branch with the fault. See [Figure 14](#).  
In this example, the Transmitter generates a signal from negative to ground.
  - b. Push **TRACE**, and use the Clamp or the Receiver to locate the branch with the fault. See steps A, B, and C in [Figure 14](#).
8. Locate the fault on the branch that contains the fault.
  - a. Keep the same disconnections on one side of all parallel branches.
  - b. Follow the signal from the active terminal to the fault.  
In this example, trace from the negative terminal to the fault.
9. If the voltage measures <30 V on the side without the fuses:

Turn the rotary knob to the side without the fuses, and select unit mode. Pros: All disconnections may be made at the combiner box or string inverter. Cons: You cannot use the BP filter in the Clamp if results are unclear.

Or,

Use the FAULT function on the side with the fuses, and select array mode. Pros: You can use the BP filter in the Clamp if results are unclear due to system capacitance. Cons: Requires access to quick connectors on an isolated string and to move the Transmitter to those connectors.

10. Verify the active terminals. See [Verify Active Terminals](#).
11. Place the Clamp around the positive and negative wires in a branch to confirm which branches are balanced (0 mA) and do not have a fault. A branch that contains a fault is unbalanced.

12. Push **TRACE**, and use the Clamp to locate the branch with the fault. See steps A, B, and C in [Figure 16](#).

In this example, the Transmitter generates a signal from negative to ground.

13. Move the Transmitter and connect only to the branch that contains the fault. See step D in [Figure 16](#).

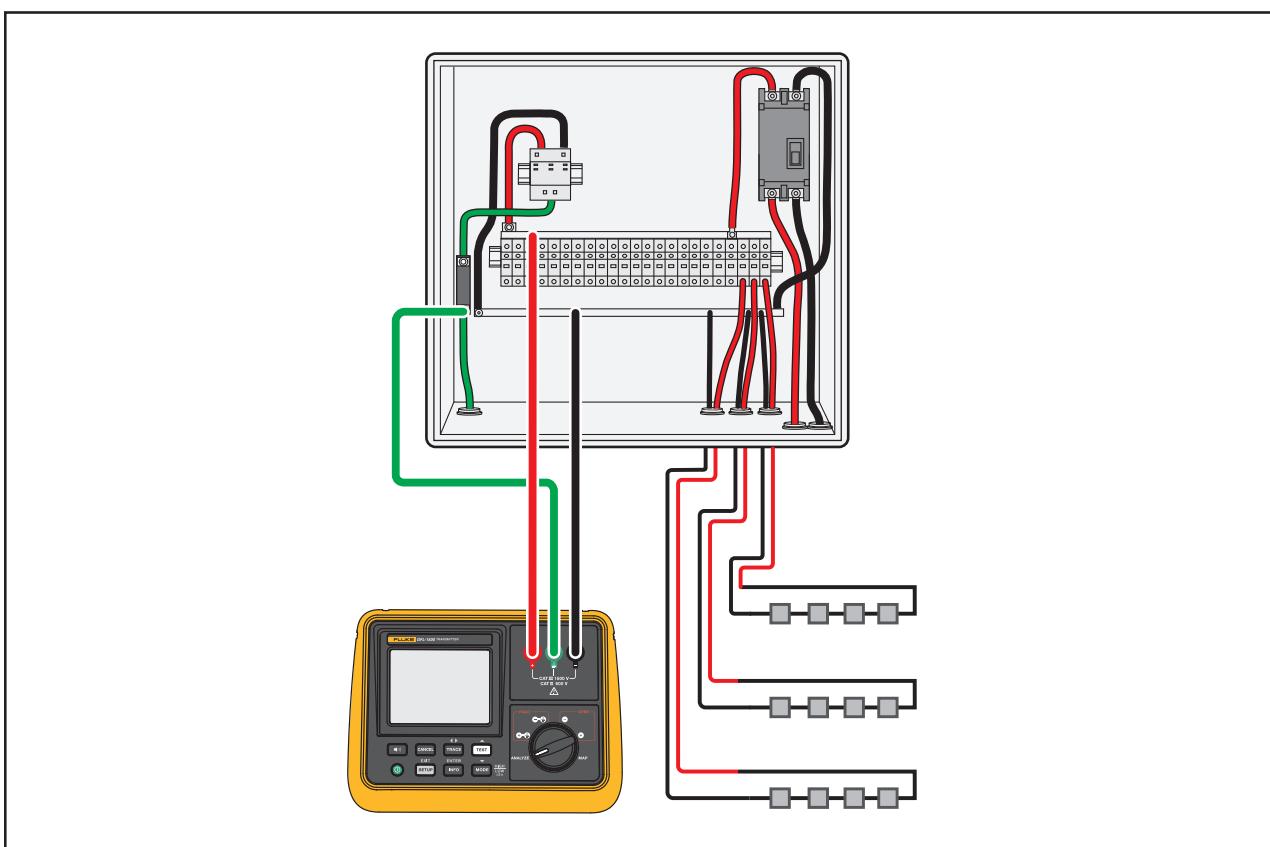
Or,

Disconnect all the parallel branches on one side. See [Figure 14](#). This breaks parallel loops and focuses the signal on the branch with the fault.

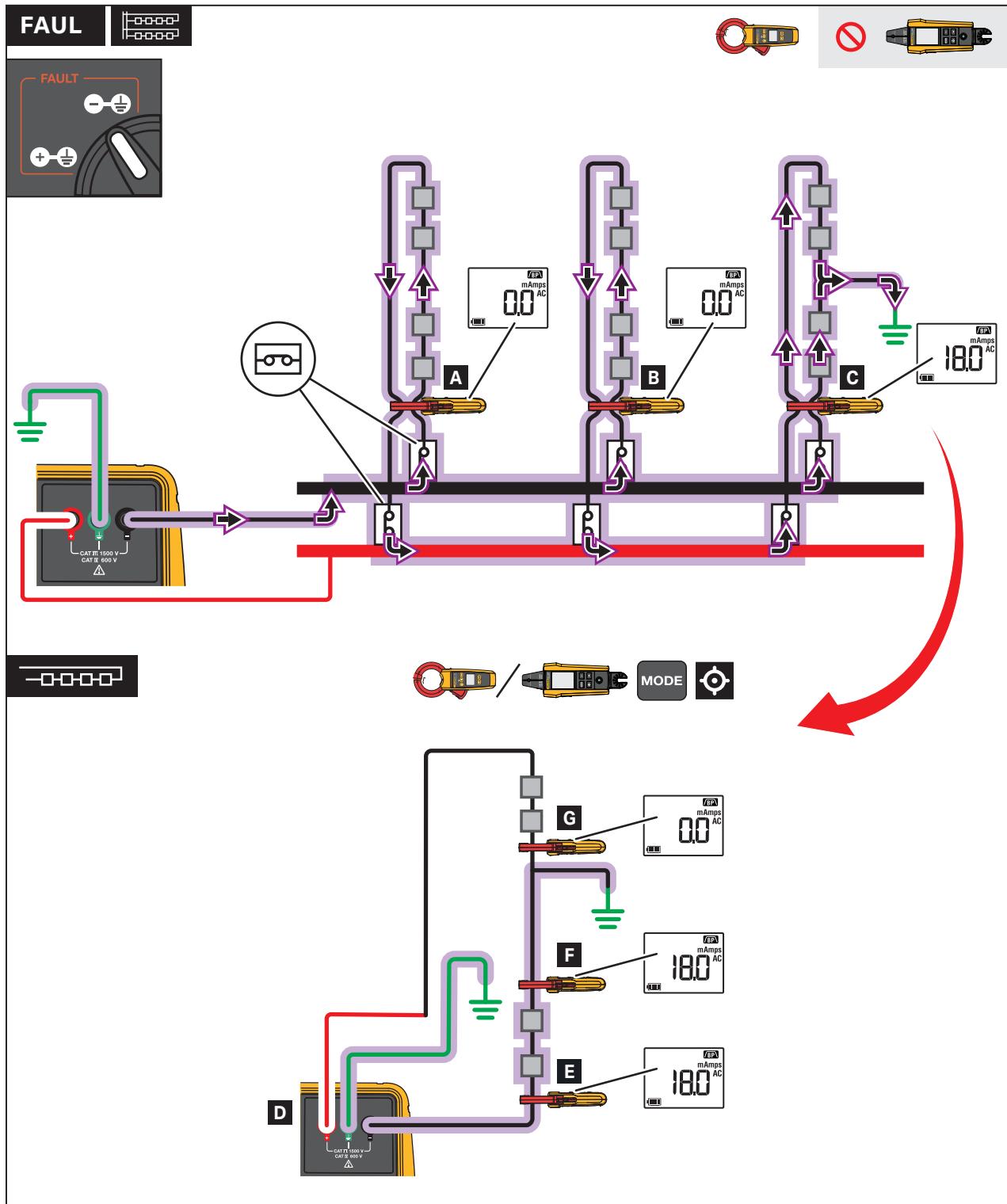
14. Push **TRACE**, and use the Clamp or the Receiver to follow the signal from the active terminal to the fault. See steps E, F, and G in [Figure 16](#) or steps C, D, and E in [Figure 14](#).

In this example, trace from the negative terminal to the fault.

**Figure 15. Single-Fused Combiner Box Connection**



**Figure 16. Locate a Fault with Closed Fuses**



## Central Inverter with Branched Combiner Boxes

**Applies to:** A central inverter or combiner box with multiple upstream combiner boxes. Parallel branches in each combiner are bused together.

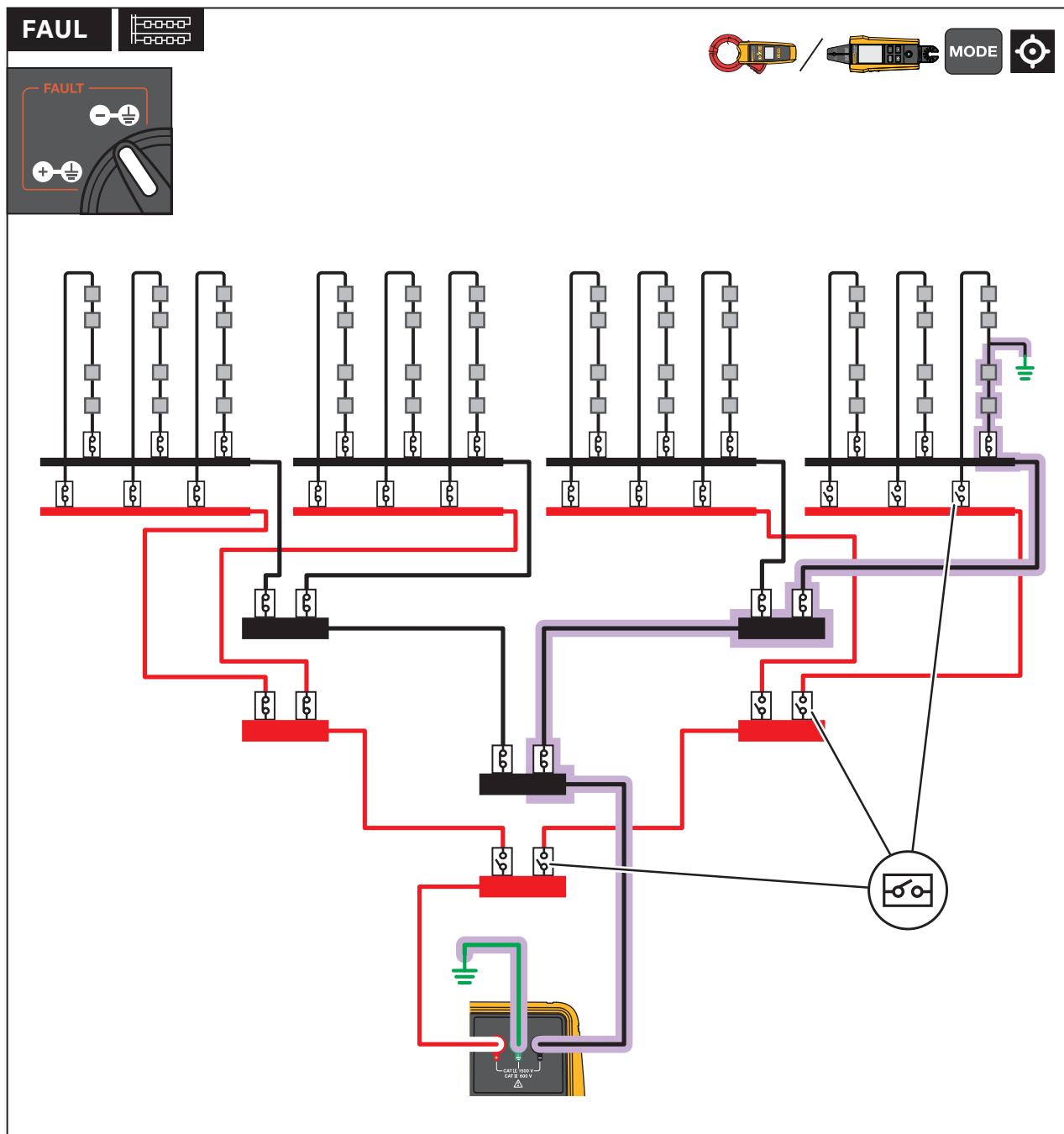
**Issue:** A possible fault in an array, but the fault is not yet isolated to a single combiner box.

**Goal:** Start at a central inverter or combiner box with multiple upstream combiner boxes. Locate the combiner box with the fault, then the branch that contains the fault, and then the fault on an isolated string.

To locate a fault in a central inverter with branch combiner boxes:

1. Isolate the dc system from ground. See [Isolate the DC System from Ground](#).
2. Connect the Transmitter to the positive and negative dc buses of the central inverter or furthest downstream combiner box with a suspected fault. Connect the Transmitter ground to an available ground point in the system. See [Figure 17](#).
3. Use the **ANALYZE** function to detect a ground fault. See [Analyze a System](#).
4. If the combiner boxes are double-fused, follow the rest of the instructions in [Double-Fused Combiner box or String Inverter](#) for each upstream combiner box until you locate the fault.
5. If the combiner boxes are single-fused, follow the rest of the instructions in [Single-Fused Combiner box or String Inverter](#) for each upstream combiner box until you locate the fault.

**Figure 17. Locate an Upstream Fault**



## Trunk Bus

**Applies to:** Trunk bus. Accessible quick connects for the positive and negative of individual branches.

**Issue:** A possible fault is in the array.

**Goal:** Start at a load break disconnect. Locate the branch with the fault and then the fault on the isolated string.

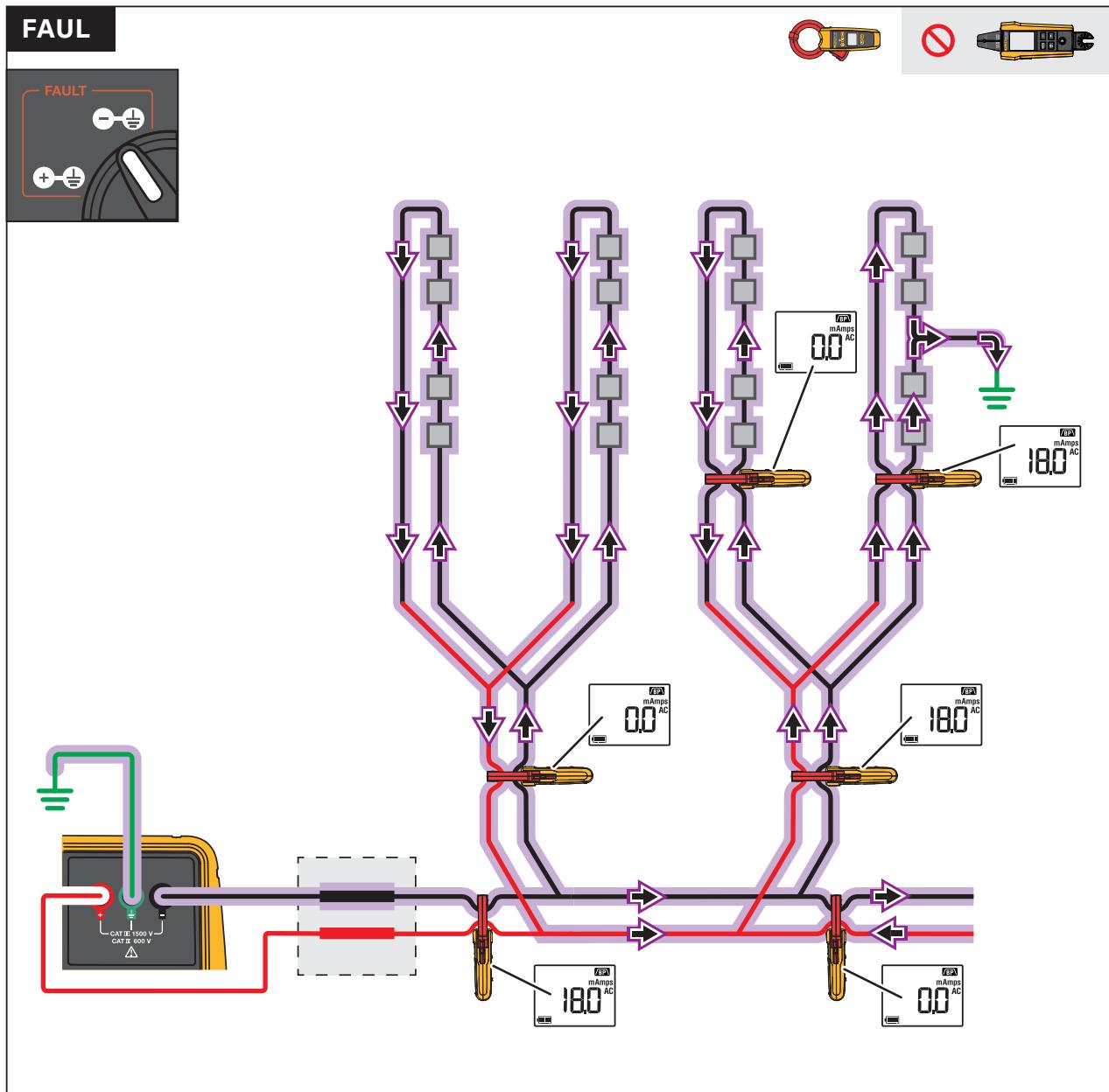
To locate a fault in a trunk bus system:

1. Isolate the dc system from ground. See [Isolate the DC System from Ground](#).
2. Connect the Transmitter to the positive and negative buses of the LBD with a possible fault, and connect the Transmitter ground to an available ground point in the system. See [Figure 18](#).
3. Use the **ANALYZE** function to detect a ground fault. See [Analyze a System](#).
4. Select the correct **FAULT** function to use to trace the fault. See [Table 9](#).
5. Select the correct mode on the Transmitter. See [Transmitter Modes](#).
6. Verify the active terminals. See [Verify Active Terminals](#).
7. Push **TRACE**, and use the Clamp to locate the branch with the highest signal.

Balanced branches typically measure 0 mA and do not have a fault. A branch that contains a fault is unbalanced. See [Figure 18](#).

8. Repeat at each branch that splits from the trunk until you locate the branch that contains the fault.
9. Move the Transmitter and connect only to the branch that contains the fault.
10. To trace the isolated string, follow the instructions in [Isolated string](#).

**Figure 18. Trace a Trunk Bus System**



## Troubleshoot a Workflow

First, verify:

- The dc system is isolated from ground. See [Isolate the DC System from Ground](#).
- The test leads are connected securely to the Transmitter.
- The Transmitter is connected to the positive, negative, and ground in the system.
- The Transmitter beeps and the active terminals and the signal path shows on the display. See [FAULT, OPEN, and MAP Screens](#).
- On systems with parallel branches:
  - One side of all branches are disconnected.
  - Or,
  - You moved the Transmitter to connect to an isolated string.

Other possible issues:

The **ANALYZE** results indicate the presence of a fault, but you cannot detect a signal in the system. Cause: You may have a high resistance fault.

- Use **LOW** array mode. Less current may provide a more stable signal.
- Attempt to reactivate the fault in one or more ways.
  - Spray the array with water to lower the fault resistance.
  - Jiggle wires where poor insulation is suspected.
  - Adjust the tracker system if you suspect wires are pinched at a certain position.

**ANALYZE** the system again to see if the estimated fault resistance is lower than before. Then trace the fault.

The signal does not lead to the fault. Signal or imbalance is observed in multiple branches. Cause: You may have leakage from capacitance in the system.

- Do not use the Receiver. Use the Clamp with the BP filter enabled.
- Verify the Transmitter beeps and the active terminals and signal path show on the display. See [FAULT, OPEN, and MAP Screens](#).
- Use an array mode.

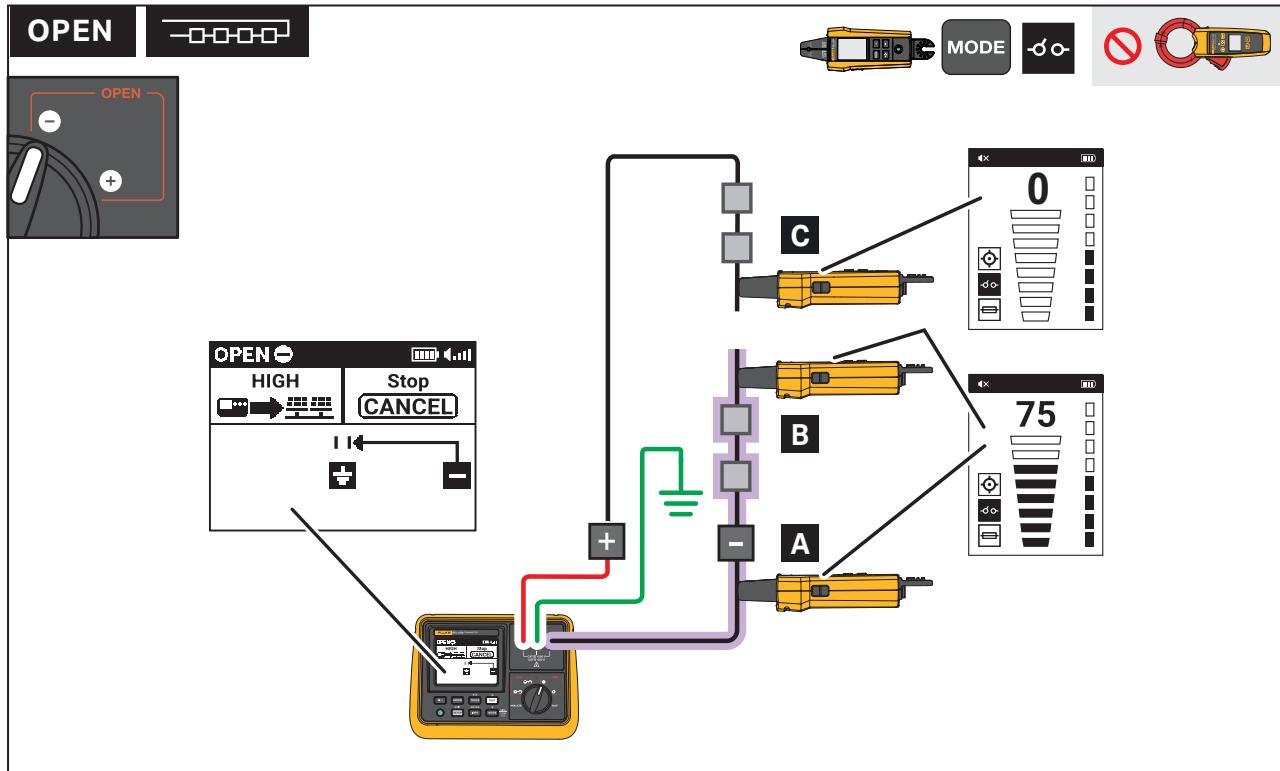
## Find a Break in a Wire

The Receiver may be used with the Transmitter to locate a break on an isolated string.

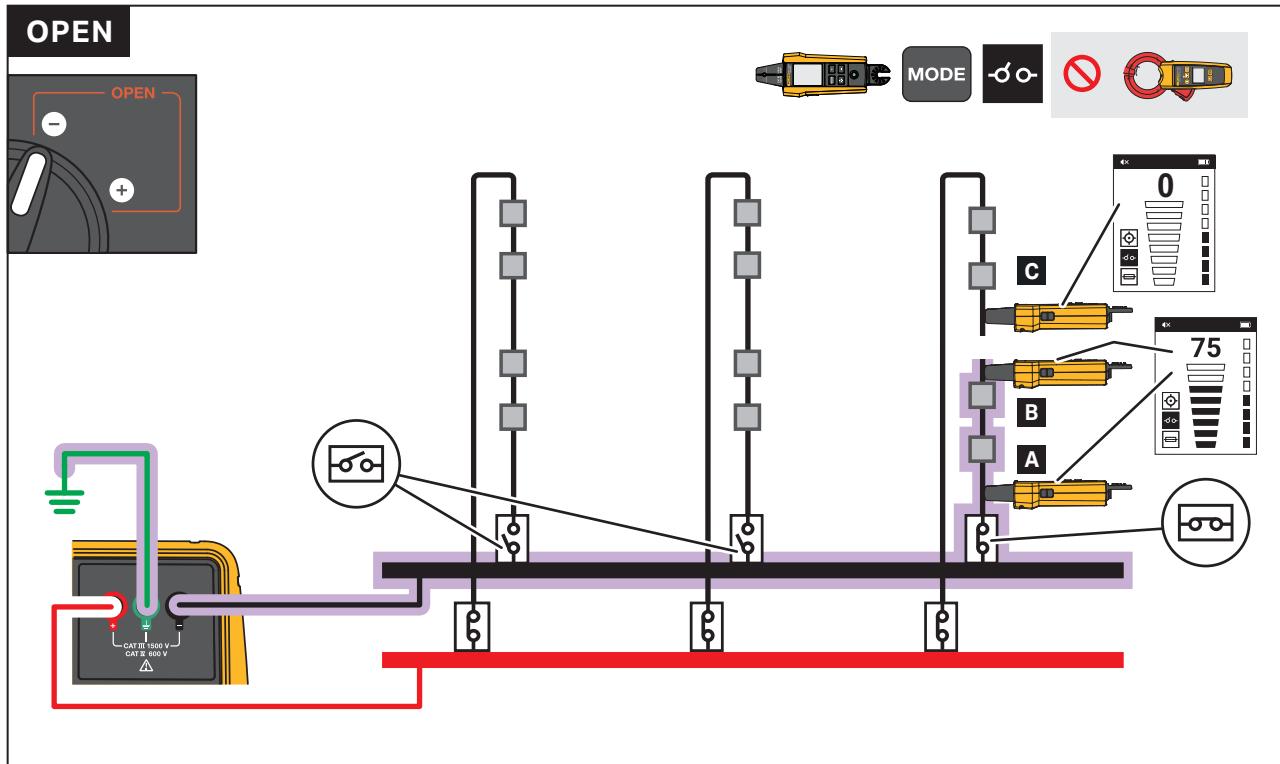
To locate a break in a wire:

1. Connect the Transmitter
  - a. Move the Transmitter and connect only to the branch that contains the open. See [Figure 19](#).  
Or,
  - b. Disconnect all the parallel branches on one side. See [Figure 20](#). This breaks parallel loops and focuses the signal on the branch with the fault.
2. Select the correct **OPEN** function based on which side of the disconnections you made.  
In these examples, the Transmitter generates a signal from negative to the break in the wire.
3. Push **TRACE**, and use the Receiver to follow the signal from the active terminal to the break in the wire. See [Figure 20](#).  
In this example, trace from the negative terminal to the break in the ground.

**Figure 19. Locate a Break with a Direct Connection**



**Figure 20. Locate a Break with Open Fuses**



## Map a System

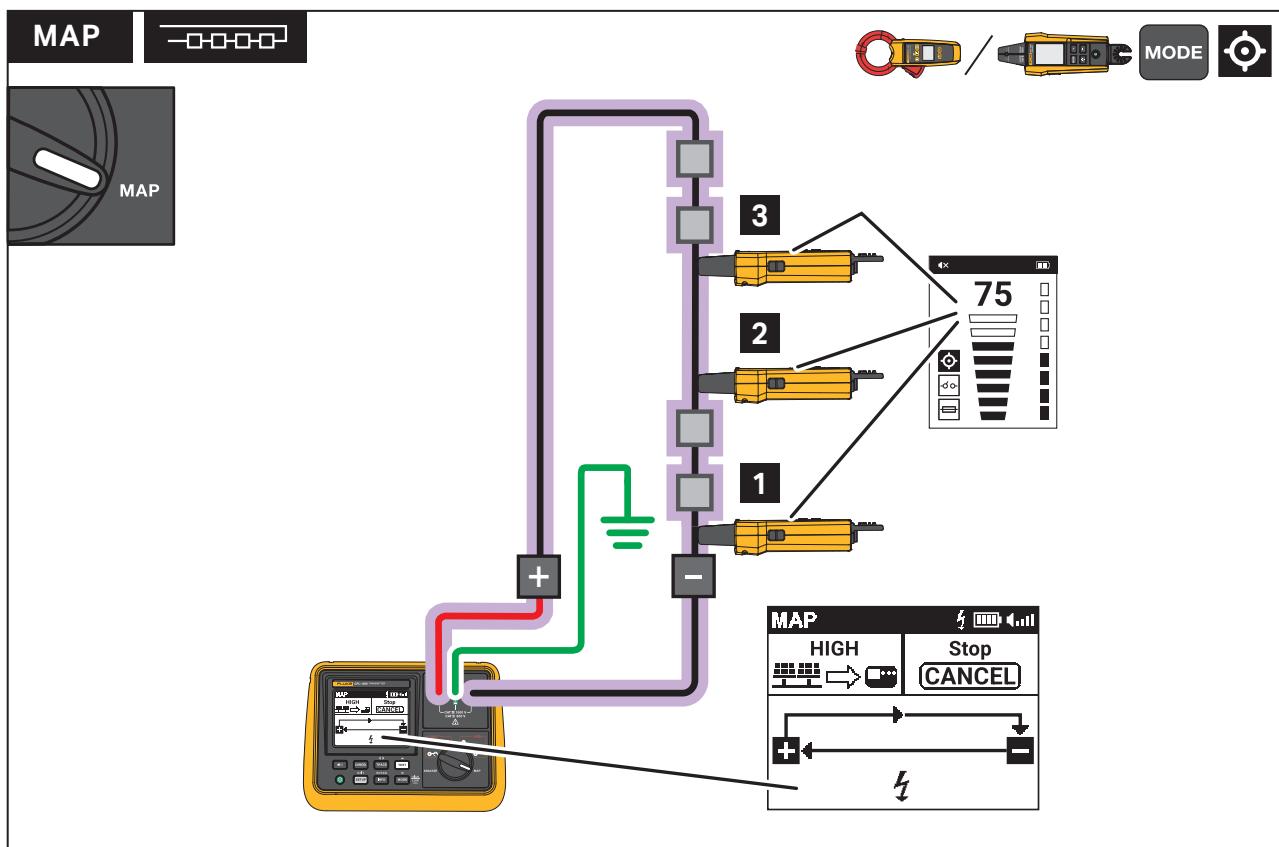
The Clamp or the Receiver may be used with the Transmitter to map a system.

To map a system:

1. Connect the Transmitter to the system. See [Figure 21](#).
2. Select the **MAP** function, push **TRACE**, and use the Receiver or the Clamp to follow the signal to map the system.

[Figure 21](#) shows how to map an isolated string in a system.

**Figure 21. Map an Isolated String**



## Replacement Parts

Table 13 is a list of the replacement parts. To order parts, see [How to Contact Fluke Corporation](#).

**Table 13. Replacement Parts**

Item	PN
FLK-GFL-1500 Receiver	6050955
FLK-GFL-1500 Clamp	6047762
Test Lead Set Black/Red	5590592
Alligator Clips Set	6078023
Test Leads Straight Angle Set Red/Green/Blue	6078010
TLPV-UTool, Solar Connector Unlock	5591306
Batteries (2AA IEC LR6 Alkaline)	376756

## Maintenance

The Product requires little maintenance.

### **Warning**

**To prevent possible electrical shock, fire, or personal injury:**

- Remove all probes, test leads, and accessories before the battery door is opened.
- Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.
- Be sure that the battery polarity is correct to prevent battery leakage.
- Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.
- Have an approved technician repair the Product.
- Repair the Product before use if the battery leaks. Battery leakage may create a shock hazard or damage the Product.
- Remove the batteries if the Product is not used for an extended period of time, or if stored in temperatures above 50 °C. If the batteries are not removed, battery leakage may result.
- The battery door must be closed and locked before you operate the Product.
- Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.

## Clean the Product

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

## Battery Replacement

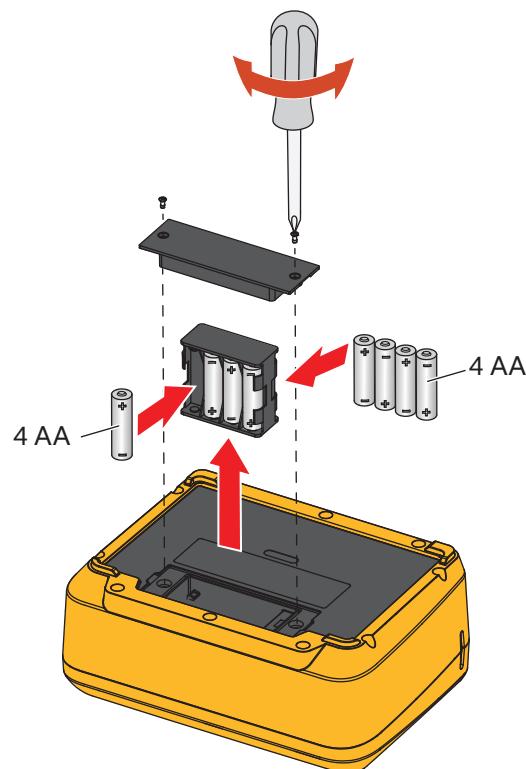
Alkaline batteries ship with the Product, but do not come installed in the Product. If desired, use NiMH rechargeable batteries in the Product. To charge NiMH batteries, remove the batteries from the Product.

To install or replace the batteries in the Product, turn off and disconnect the Product from the system and install new batteries with the correct polarity.

### Transmitter Battery Replacement

[Figure 22](#) shows how to replace the batteries in the Transmitter.

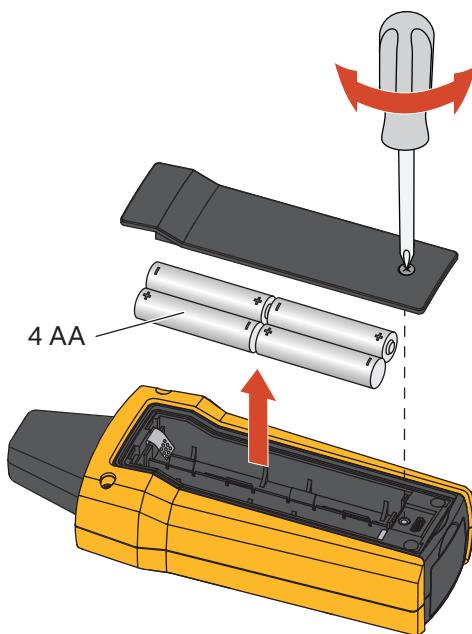
**Figure 22. Transmitter Battery Replacement**



## Receiver Battery Replacement

[Figure 23](#) shows how to replace the batteries in the Receiver.

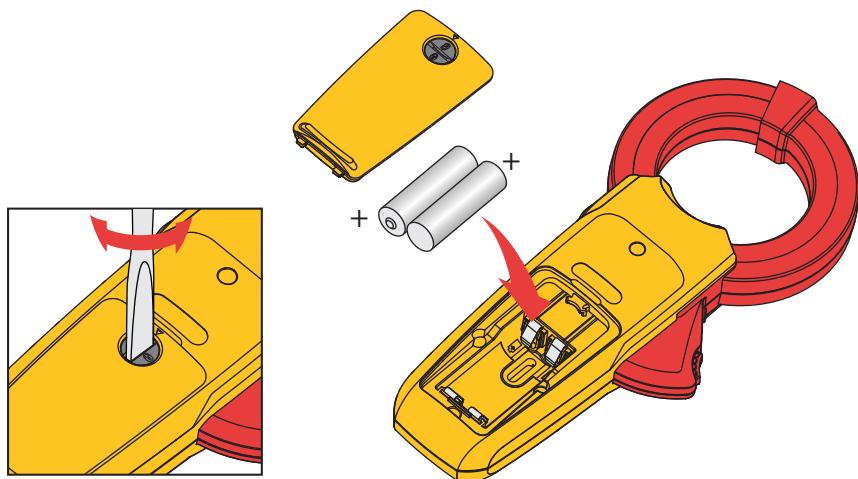
**Figure 23. Receiver Battery Replacement**



## Clamp Battery Replacement

Figure 24 shows how to replace the batteries in the Receiver.

**Figure 24. Clamp Battery Replacement**



## Product Disposal

Dispose of the Product in a professional and environmentally sound manner:

- Delete personal data on the Product before disposal.
- Remove batteries that are not integrated into the electrical system before disposal and dispose of batteries separately.
- If this Product has an integral battery, put the entire Product in the electrical waste.