GREENLEE CS-5000 Circuit Tracer Instruction Manual

GREENLEE CS-5000 Circuit Tracer Instruction Manual

Read and understand all of the instructions and safety information in this manual before operating or servicing this tool.

Contents

Important Safety Information

SAFETY ALERT SYMBOL

This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.

DANGER

Immediate hazards which, if not avoided, WILL result in severe injury or death.

WARNING
Hazards which, if not avoided, COULD result in severe injury or death

CAUTION
Hazards or unsafe practices which, if not avoided, MAY result in injury or property damage.

WARNING

Read and **understand** this material before operating or servicing this equipment. Failure to understand how to safely operate this tool could result in an accident causing serious injury or death.

WARNING

Electric shock hazard:
Contact with live circuits could result in severe injury or death.

WARNING

Electric shock and fire hazard:

- Do not expose this unit to rain or moisture.
- Do not use the unit if it is wet or damaged.
- Use only test leads or accessories that are approved for the application.
- Inspect the test leads or accessory before use. They must be clean and dry, and the insulation must be in good condition.
- Use this unit for the manufacturer’s intended purpose only, as described in this manual. Any other use can impair the protection provided by the unit.

Failure to observe these warnings could result in severe injury or death.

WARNING

Electric shock hazard:

- The transmitter Live Line indication does not function if the batteries are dead or removed.
  Test on a known live circuit before use.
- Do not apply more than the rated voltage between any two input terminals, or between any input terminal and earth ground.
- Do not contact the test lead tips or any uninsulated portion of the accessory.
- Using this unit near equipment that generates electromagnetic interference can result in unstable or inaccurate readings.

Failure to observe these warnings could result in severe injury or death.

WARNING

Electric shock hazard:

- Do not operate with the case or battery compartment open.

- Before opening the case or battery compartment, remove the test leads from the circuit and shut off the unit.

Failure to observe these warnings could result in severe injury or death

CAUTION

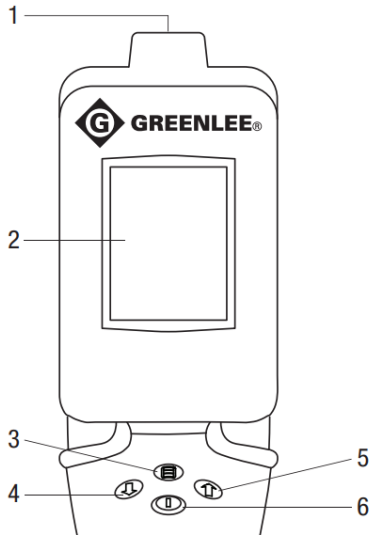
Electric shock hazard:

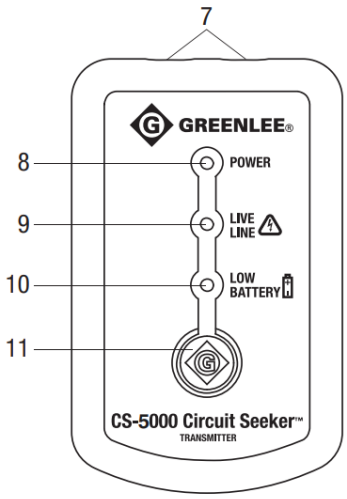
- Do not attempt to repair this unit. It contains no user-serviceable parts.
- Do not expose the unit to extremes in temperature or high humidity. Refer to “Specifications.”
- Not for use outdoors or wet locations.

Failure to observe these precautions may result in injury and can damage the unit

Identification

Receiver



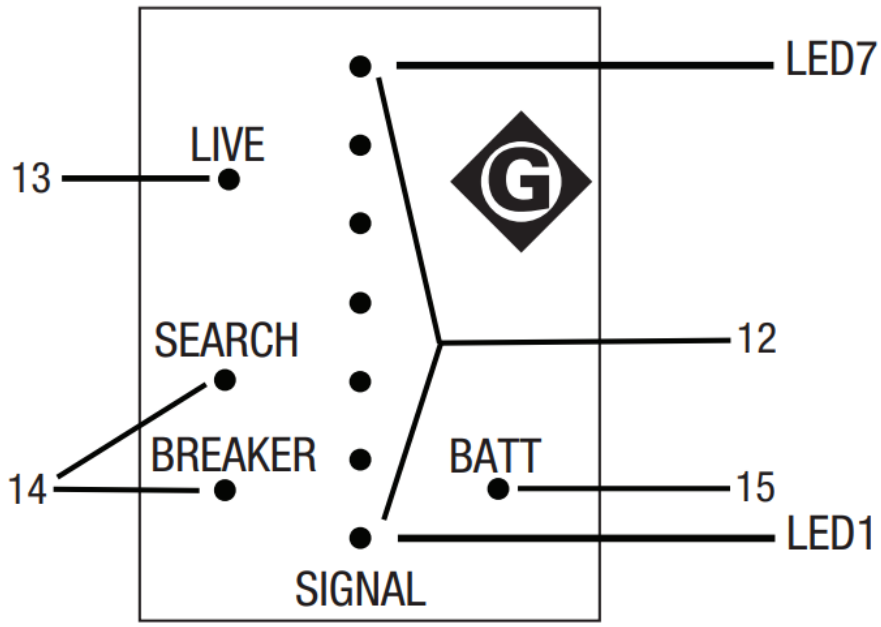


1. Sensing surface
2. Display
3. Mode Selector
4. Decrease Manual Gain
5. Increase Manual Gain
6. Power/Signal Reset push button

   Transmitter
7. Connectors (non-polarized)
8. Power LED
9. Live Line LED
10. Low Battery LED
11. Power push button

    Display LED Key

12. Relative Signal Strength (red)
13. Line Status (Live–Open) (green)
14. Mode (Breaker–Search) (green)
15. Low Battery (red)



Using the Features

Features of the Transmitter

- **Power Button:** Press and release to turn the transmitter on. Press and release to turn the transmitter off.
- **Power LED:** Indicates that the transmitter is turned on.
- **Live Line LED:** This LED illuminates when the transmitter is connected to a voltage of at least 12 VAC or 5 VDC.
- **Low Battery LED:** This LED illuminates when approximately one hour of battery life is remaining under typical use conditions. When this LED flashes, the batteries are nearly exhausted. Replace them immediately.
- **Automatic Power Off:** The transmitter will turn off after approximately four hours.

Features of the Receiver

The receiver is designed to be held in the user's hand. The hand and body act as a ground plane reference, which improves the sensitivity of the receiver. Without this ground plane reference, the range of the receiver can be significantly reduced.

Relative Signal Strength indicators: This indicator is a series of red LEDs in a vertical strip that illuminate starting from the bottom to the top when signal from the transmitter is sensed. No LEDs means the signal is too low to detect at the current gain setting. All seven LEDs will be illuminated when the signal is approximately equal to the maximum signal\ received. Lower signal levels will illuminate fewer LEDs.

Line Status: is LIVE when the transmitter is connected to a circuit powered by at least 12 VAC or 5 VDC. Line Status is OPEN when the transmitter is connected to a de- energized line. The green LIVE LED will illuminate it receives a LIVE signal from the transmitter.

Power Button: Press and release to turn the receiver on. Press and hold to turn the receiver off.

This button also serves as Signal Reset. The Signal Reset is used to re-establish a baseline gain to the present signal level. If no signal is present, the gain is set to the highest level. Press momentarily to reset the receiver gain at any time.

Mode Selector button toggles the receiver between Breaker Mode and Search Mode. The receiver is in Breaker Mode when it is initially powered on.

In Breaker Mode, weaker signals are ignored. A higher magnification factor is used for the Relative Signal Strength portion of the display. A smaller signal range is required to change the display from one LED to seven LEDs. Small changes in signal strength can be easily observed.
This mode is usually best for identifying circuit breakers and fully accessible conductors. It can also be useful for tracing circuits or objects that are very close to the receiver, and for locating the exact location of a break or short in a conductor.

In Search Mode, a wider range of signal strength is displayed. A lower magnification factor is used for the Relative Signal Strength portion of the display. A larger signal range is required to change the display from one LED to seven LEDs. This mode is usually best for locating and tracing circuits, except when the traced object is very close to the receiver.
There is overlap between the gain ranges of the Breaker Mode and Search Mode. The recommended mode usually gives the desired results. Some applications may be found where the alternate mode is preferred.

Gain Methods: Automatic or Manual Gain methods can be used to trace conductors.
Refer to the “Using different Gain methods to trace” section below for details.

Using Different Gain Methods to Trace

The Auto Gain method is the easiest to use and is the default method of tracing indicated by the the “SEARCH” or “BREAKER” green LED on the CS-5000 receiver blinking about 2 times per second. Upon powering the unit, the receiver gain is initially set to maximum. When the transmitter signal is detected, the gain is automatically decreased in proportion to the signal strength. The detected signal is constantly monitored, and the gain is reduced further if a stronger signal is detected. Gain is never increased when using Auto Gain. It is possible to lose the signal if the receiver is moved too far from the actual path of the conductor. In these cases, momentarily press the Power/Signal Reset button to return the gain to maximum. This will restore maximum signal strength on the display and allow location of the true path of the conductor. This step may be repeated several times when tracing a circuit.

The Manual Gain method is useful when making comparisons between the signals on two different circuit breakers. It can also be used while tracing to provide a fixed signal reference.
Varying signal strength sometimes requires frequent resetting when using the Auto Gain method.

To switch from using the Auto Gain method to the Manual Gain method, press either the Manual Gain or Manual Gain on the receiver while a signal is being received. The current mode LED, “SEARCH” or “BREAKER”, stops blinking and stays illuminated. The receiver gain will remain at its present value. Press Manual Gain to increase the signal reference. Press Manual Gain decrease the signal reference. The CS-5000 Manual Gain method uses several thousand steps to cover its full range. This allows very precise control of the gain. To make large changes in the Manual Gain setting, momentarily press the Power/Signal Reset button to align the Manual Gain which will reset the current signal level. To establish a wide search window, momentarily press the Power/Signal Reset button when the receiver is a distance away from the traced conductor. A greater distance will produce a wider window. To establish a narrow search window, momentarily press the Power/Signal Reset button when the receiver is close to the traced conductor.

Low Battery Indication: The red “BATT” LED is illuminated when approximately one hour of battery life is remaining under typical use conditions.

Automatic Power Off: The receiver will turn off after 30 minutes of inactivity. Activity means a change in signal level

or pressing of the Power/Signal Reset button.

Theory of Operation

The CS-5000 transmitter is intended for connection to an electrical line (up to 600 volts) or other metallic object. The transmitter signal consists of a controlled frequency with a specific modulation and timing that is different for live and open circuits. This composite signal gives it a specialized signature.

The transmitter signal generates a corresponding magnetic or electrostatic field signature around the conductor being traced. This field signature is present the entire length of the conductor, including breakers, fuses, switchgear, and transformers.

The CS-5000 receiver is tuned and programmed to pick up only the field signatures produced by the transmitter. To be received, the signal must have this exact frequency, modulation, and timing.
This feature greatly reduces the possibility of interference from electrical noise, which is often caused by lamps, appliances, fluorescent fixtures, or machinery that is on the same line.

Both the transmitter and the receiver are microprocessor-controlled for maximum ease of use and accuracy.

Basic Operation
These instructions provide the user with a basic understanding of how the unit functions. These tests are best performed at a desk or bench.

Transmitter

1. Push and release the Power button. The Power LED illuminates, indicating unit power and signal being sent.
2. Plug the unit into any energized outlet. The LIVE LINE LED also illuminates, indicating that the transmitter is connected to an energized circuit.
3. The transmitter is left on for the Receiver test. When finished with the Receiver test, unplug the unit. Push and release the Power button to turn the unit off.

Receiver

1. Push and release the **Power/Signal Reset** button to turn the receiver on.
2. The Relative Signal Strength LEDs will all be illuminated, indicating the receiver is searching for a signal. The display will indicate the unit is set to “BREAKER MODE” by the green LED under BREAKER.
3. Push and release the **Mode Selector** button. The green LED will change from BREAKER to SEARCH. This button toggles between the two available settings. Whenever this button is pushed, the signal strength automatically resets.
4. Push and release the up or down arrow button.
5. Push and hold the **Power/Signal Reset** button to turn the receiver off.

Using the Transmitter and Receiver as a Set

1. Connect a cord to the transmitter. Push and release the **Power** button.
2. Hold the receiver approximately six inches from the cord, and then push and release the receiver’s **Power/Signal Reset** button. The Relative Signal Strength Indicator will have all 7 red LEDs illuminated and there will be an audible signal.

3. Push and release the Mode Selector button to toggle to “SEARCH MODE.” Moving the unit back and forth or to and from the transmitter cord will demonstrate how the Relative Signal Strength LEDs operate. The tracing method is set to Auto Gain so it will fine tune, creating less range but more definition as you get closer to the transmitter cord. The Relative Signal
   Strength LEDs can be reset to full level at any time by pushing and releasing the **Power/ Signal Reset** button.
4. With all Relative Signal Strength LEDs illuminated, push the Manual Gain or Manual Gain which will change from the Auto Gain method to the Manual Gain method. The green “BREAKER” or “SEARCH” LED will change from blinking to solid.
   Push Manual Gain to reduce the number of Relative Signal Strength LEDs illuminated, or Manual Gain to increase the number of Relative Signal Strength LEDs illuminated. The signal will remain at the same fixed reference setting until the unit is reset using the **Power/ Signal Reset** button.
5. Push and hold the **Power/Signal Reset** button to turn the receiver off. Momentarily push the
   Power button to turn the transmitter off.

Identifying Circuit Breakers or Fuses

The CS-5000 can identify which circuit breaker or fuse controls a circuit. It can also identify which panel contains the circuit breaker or fuse when there are several panels in the installation.

This procedure is most effective when the circuit is live because the transmitter signal is much stronger on live circuits. If the panel controlling an open circuit can not be found using this procedure, trace the circuit from the transmitter to the panel. Refer to the “Tracing Circuits and Metallic Objects” section. Note that the transmitter must be connected using a separate ground for best tracing results.

If the breaker or fuse can not be identified with the panel cover in place, remove the panel cover and place the receiver’s sensing surface in contact with each wire feeding a breaker or fuse.

Connecting the Transmitter

1. To identify the breaker or fuse controlling a standard North American receptacle, connect the adapter assembly to the transmitter. Insert the plug into the receptacle. Go to step 3.
2. To identify the breaker or fuse controlling other receptacles or circuits, use the appropriate test leads and accessories. Refer to “Typical Applications.” Always connect to the ground or neutral first, and then to the energized conductor.
3. Press and release the transmitter’s Power button.

Using the Receiver

1. Press and release the receiver’s Power button. The green BREAKER LED will start blinking indicating that the unit is looking for a signal. If the transmitter signal is detected, the transmitter Relative Signal Strength LEDs will illuminate. The green LIVE LED will illuminate if the transmitter is connected to an energized circuit. The LIVE LED will be off if the transmitter is connected to a de-energized or grounded circuit.
2. When there is only a single electrical panel for service, it is not necessary to use “SEARCH MODE” to locate the panel. Proceed to step 3. If there are multiple panels of service, take thereceiver to the vicinity of the circuit breaker panel. Press the Mode Selector button to place the receiver in Search Mode. If a signal is received, move the receiver toward the panel to produce an increase in signal strength. Sweep the receiver around all

four edges of the panel door to locate the strongest signal. If there is more than one panel, repeat this process on all panels without resetting the receiver. The panel with the strongest signal contains the circuit breaker or fuse that is connected to the transmitter.

3. Open the panel door. Press the Mode Selector button to place the receiver in Breaker Mode.
   Move the receiver over all the breakers in the panel. The sensing surface of the receiver should be in contact with the circuit breakers. Move the receiver in a straight line so it passes over the same area of each breaker in the panel. The receiver may detect signal on several breakers during this first pass as the Auto Gain adjusts to the strongest signal.
4. Move the receiver slowly over all the breakers in the panel. The breaker or fuse providing the strongest signal (the most LEDs on the Relative Signal Strength display) is the one powering the circuit that is connected to the transmitter. If there is more than one breaker with a strong signal, sweep the receiver across the entire face of each of these breakers to find the precise location of the strongest signal.

If there is any doubt as to which is the correct breaker or fuse due to unusual breaker design, mixed types of breakers in the panel, wiring, or the possibility that two breakers are feeding the same circuit, remove the panel trim and place the receiver's sensing surface against each wire where it connects to the breaker.

IMPORTANT: Panel trim can distort the signal when locating breakers on the outside corners of the panel. This can cause the CS-5000 receiver to sense a stronger signal level on the adjacent breaker instead of the correct breaker in the corner. Before turning off or labeling any breaker next to the corner breaker, confirm it is it is the correct breaker by removing panel trim and repeating the slow sweep of all breakers in the panel. To verify the correct active breaker, place the receiver's sensing surface against each wire where it connects to the breaker.

You can also continue to follow the power line by locating the remote main breaker in the same fashion. Since the signal is on a single-phase circuit, you can even find which leg of the breaker is feeding the transmitter.

Tracing Circuits and Metallic Objects / Finding Breaks and Shorts

The CS-5000 can perform a variety of tracing tasks on live circuits, open circuits, and other metallic objects. It can also locate breaks and shorts in circuit conductors. These operations can be performed on most wiring in shielded/metallic/non-metallic conduit using a separate ground.
When tracing open lines that are in metallic conduit, the conduit acts as a shielding object and makes it very difficult for the transmitter signal to penetrate the conduit wall.
The connection and operation of the CS-5000 are similar for all these applications.

Connecting the Transmitter
The transmitter should use a separate ground unless it is connected to a live, GFCI-protected circuit. A separate ground means connecting the transmitter to a ground that is physically separated from the area of the wire to be traced. Conduit, outlet boxes, and wire trays carrying the trace line do not create a separate ground path. If a separate or earth ground is not readily available, a capacitive or "soft" ground to a metal chair or table may be used. Sensitivity and range are reduced.

Use of a "hard" separate ground connection with a GFCI-protected circuit will cause the GFCI device to trip. Tracing these circuits must be done with the transmitter connected to the line and neutral, or using a "soft" ground.

Tracing a dead electrical circuit: Connect the transmitter to the ungrounded ("hot") conductor.
If this conductor has an open, the transmitter may be connected to the neutral or ground conductor. However, these conductors are more likely to have multiple connections that can make tracing very difficult.

Tracing coax cable and other low-voltage wiring: Disconnect the cable at the point to be connected to the transmitter. If the cable has a shield, connect the transmitter to this shield. Otherwise, connect the transmitter to

any convenient conductor. The cable may be grounded or ungrounded at the far end, opposite the transmitter. The signal will be stronger if the far end is grounded.

Tracing metallic conduit: The CS-5000 can trace metallic conduit if the conduit is grounded only at the circuit breaker panel. Conduit in contact with metal will create multiple ground paths, which cannot be traced.

Finding breaks and shorts: Trace the conductor to the location where the signal disappears. This will be the location of the break or short. Breaker Mode can be used to locate the break or short more precisely

1. Connect the transmitter using the appropriate test leads and accessories. Refer to “Typical Applications.” Always connect to the ground or neutral first, and then to the energized conductor.
2. Press and release the transmitter’s **Power** button.

Using the Receiver

The CS-5000 receiver incorporates multi-directional signal detection circuitry. It is not necessary to rotate the receiver when following the path of the traced object.

Press and release the receiver’s **Power** button. Use the **Mode Selector** button to place the unit in “SEARCH MODE.” Begin tracing near the transmitter, pressing the **Power/Signal Reset** button any time the signal becomes weak, Scan the area with a sweeping motion across the suspected path of the traced object until you locate the signal. The receiver can pick up the signal radiating directly from the transmitter, instead of the signal on the traced object. Trace a short distance from the transmitter, and then press and release the **Power/Signal Reset** button. Use the Manual Gain down button to lower the gain if all seven LEDs are illuminated in a wide scan area. Use the Manual Gain up button to increase the gain if the signal becomes weak. Continue to adjust the gain as you follow the conductive path.

The receiver will indicate you are within tracing distance using the Relative Signal Strength LEDs.
If the signal is lost, press and release the **Power/Signal Reset** button to reset the gain to the highest level.

Sorting Bundled Wires

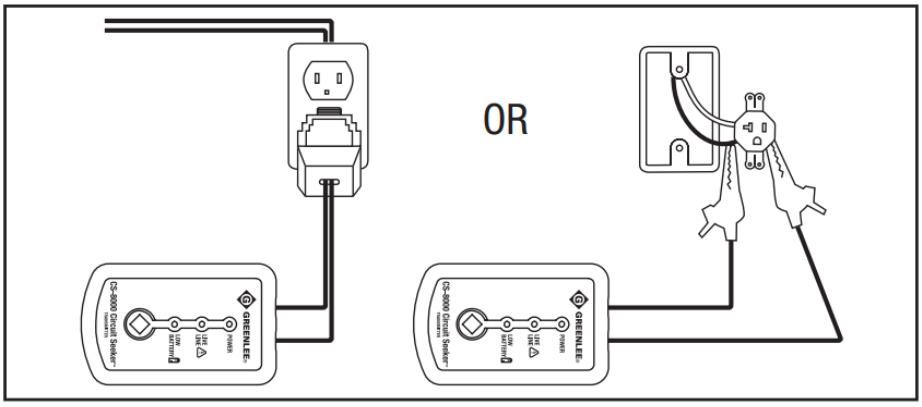
The CS-5000 can sort unenergized wires that are bundled or run in the same conduit.

1. Connect the transmitter to the wire to be identified. Use a separate ground as described in the “Tracing Circuits and Metallic Objects” section above.
2. Proceed to the other end of the bundle. Set the receiver to Breaker Mode. Hold the receiver against each wire, pressing the Power/Signal Resetany time all 7 LEDs are illuminated.
3. Hold the receiver against every wire a second time. The receiver should only show a strong signal on one wire. This is the wire connected to the transmitter.

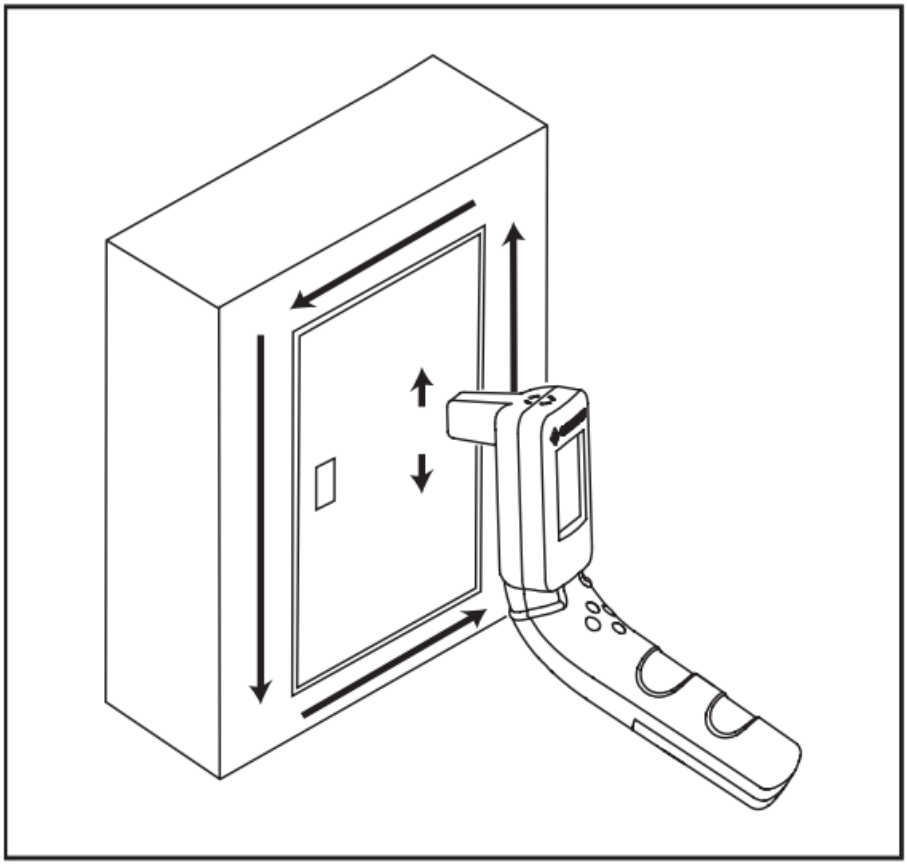
Note: If coupling between the wires makes it impossible to identify the wire connected to the transmitter, return to the transmitter end of the bundle. Connect all wires to the separate ground except the wire to be identified. Repeat steps 2 and 3.

Typical Applications

Locating Breakers

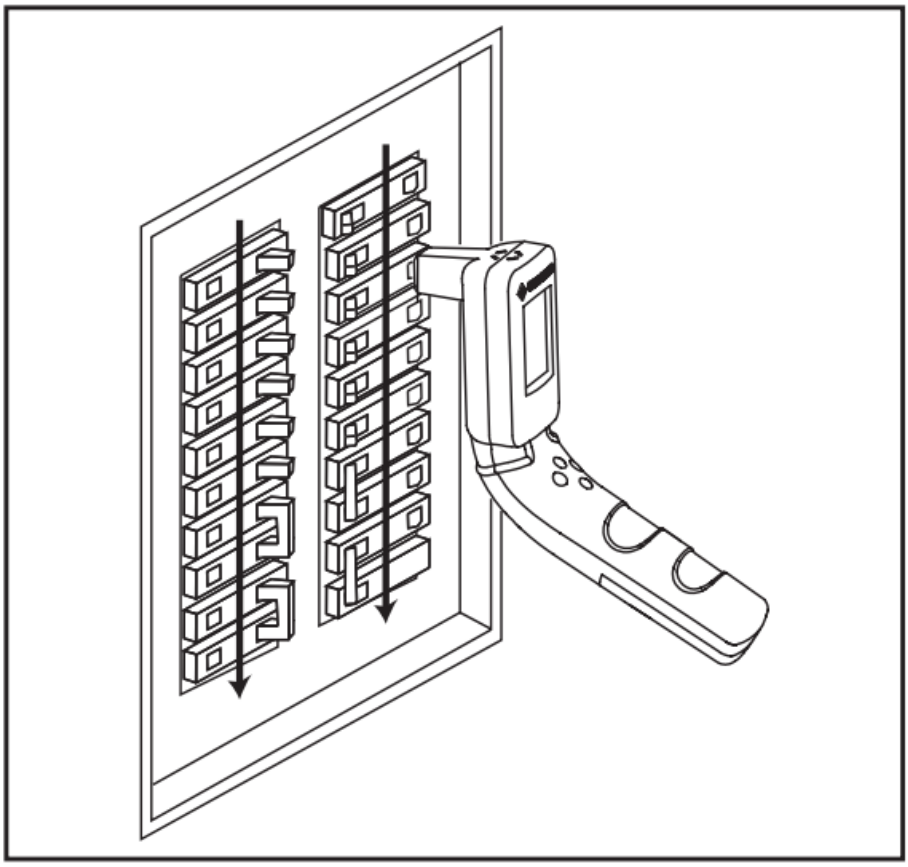


Locating the correct panel



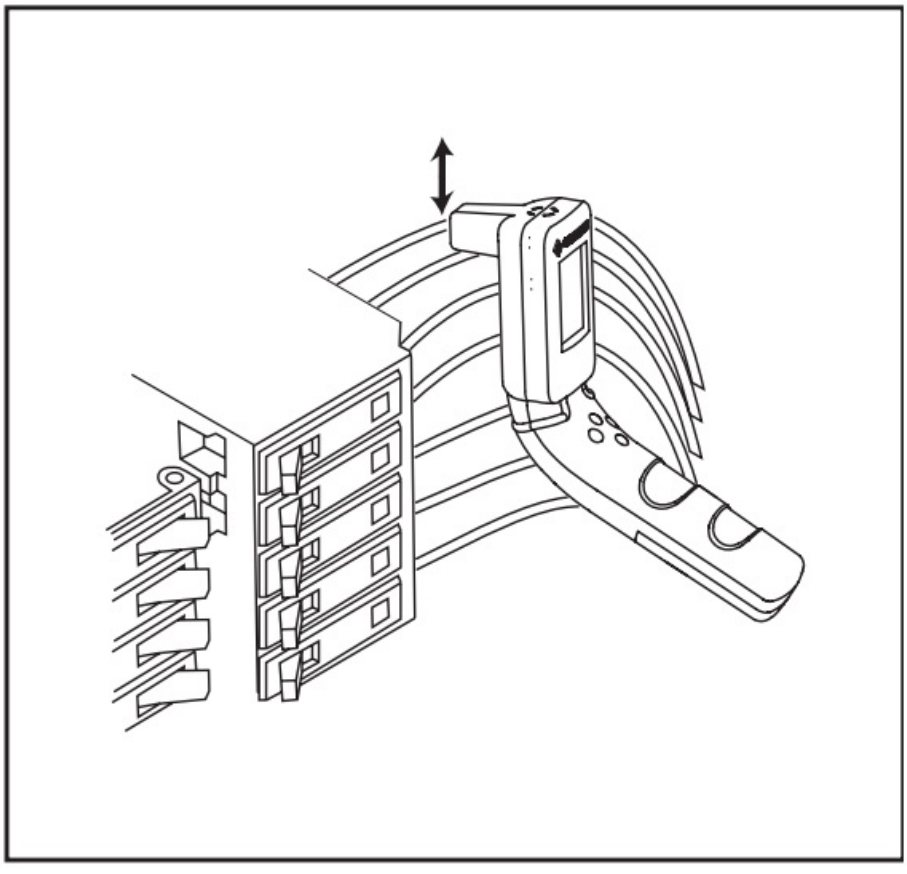
Search Mode

Scanning the breakers



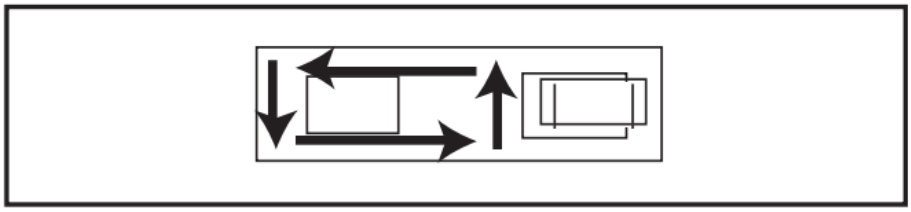
Breaker Mode

Checking the signal on the wire



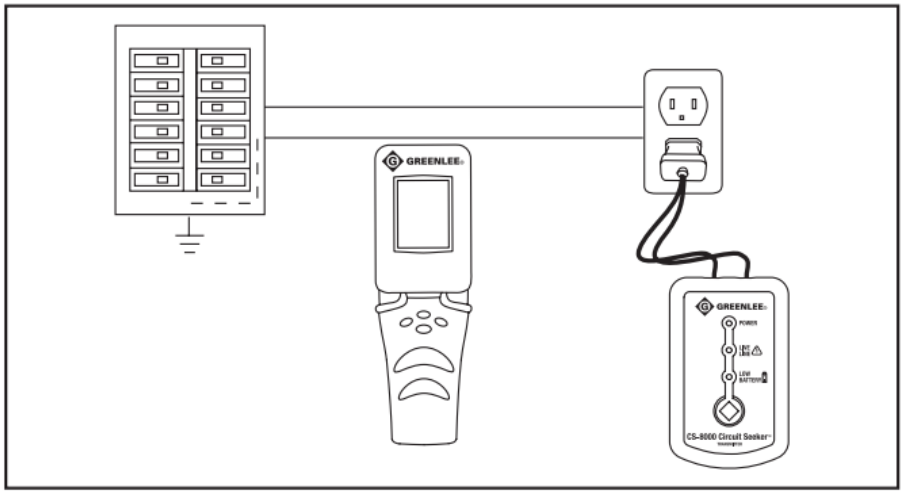
Breaker Mode

Finding the strongest signal on the breaker.

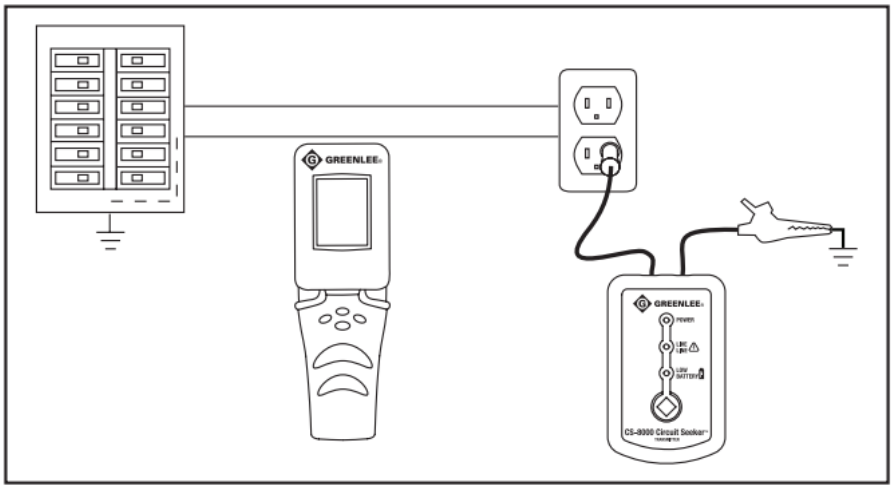


Tracing Circuits and Conduit

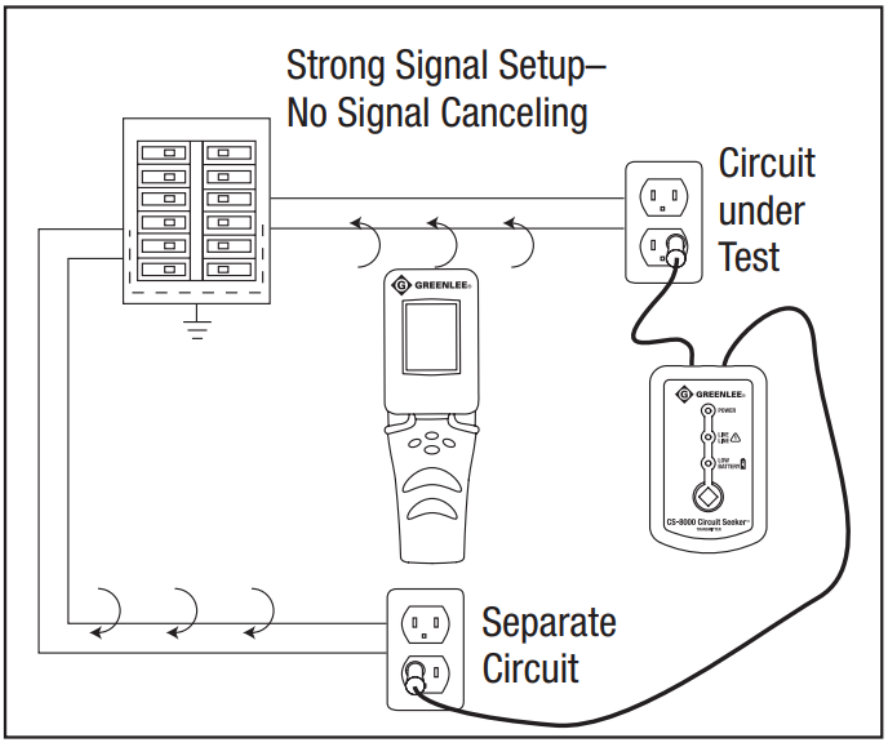
Tracing live GFCI-protected circuits



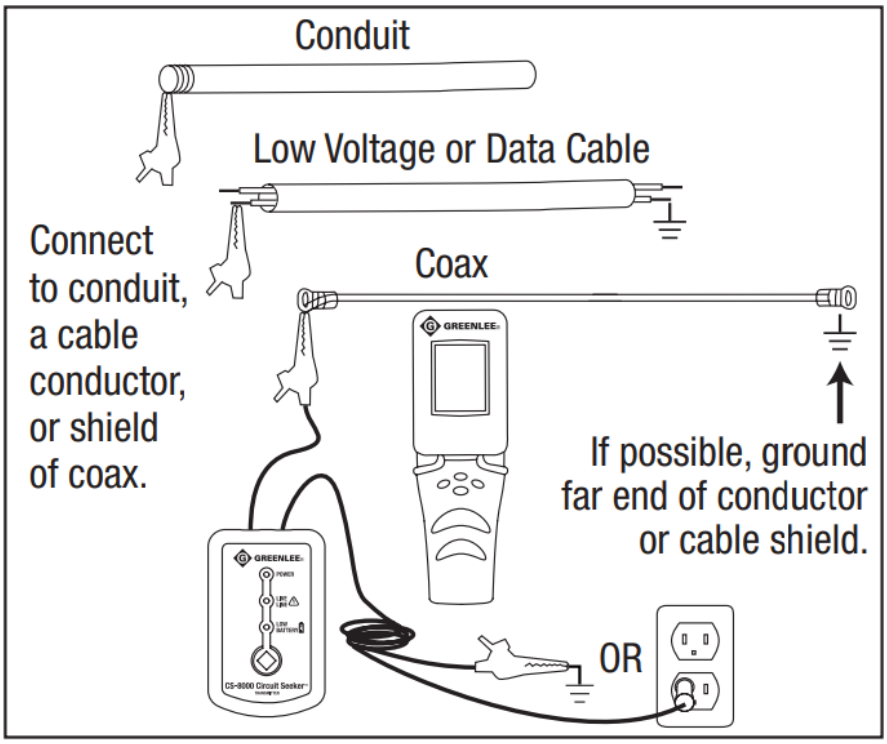
Tracing a circuit using a separate ground to a metallic object



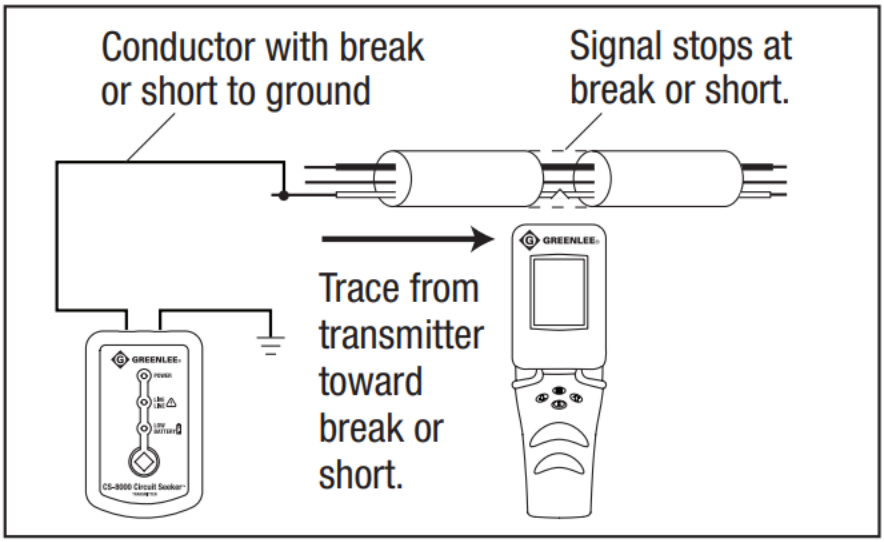
Tracing a circuit using a separate ground to a different branch circuit



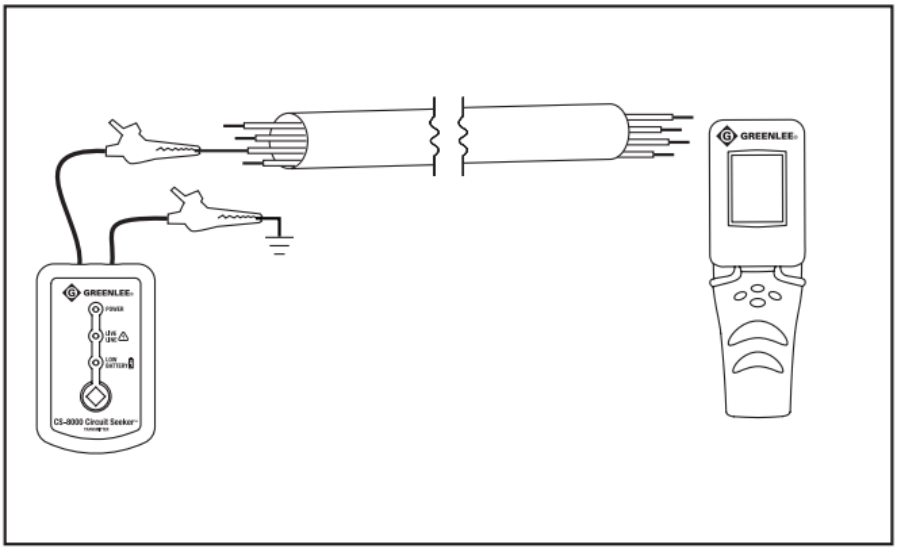
Tracing conduit, data (or other low voltage cable), or coax



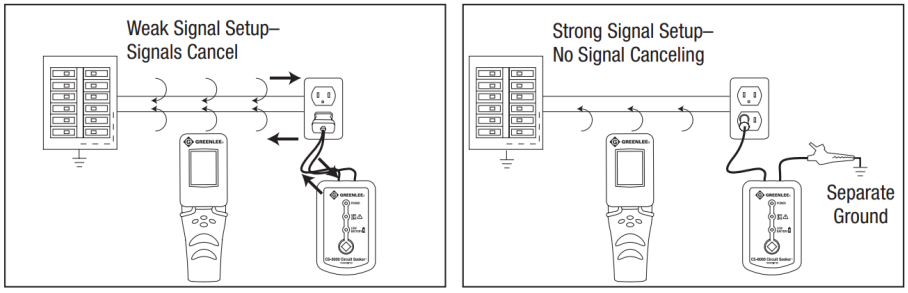
Finding Breaks or Shorts



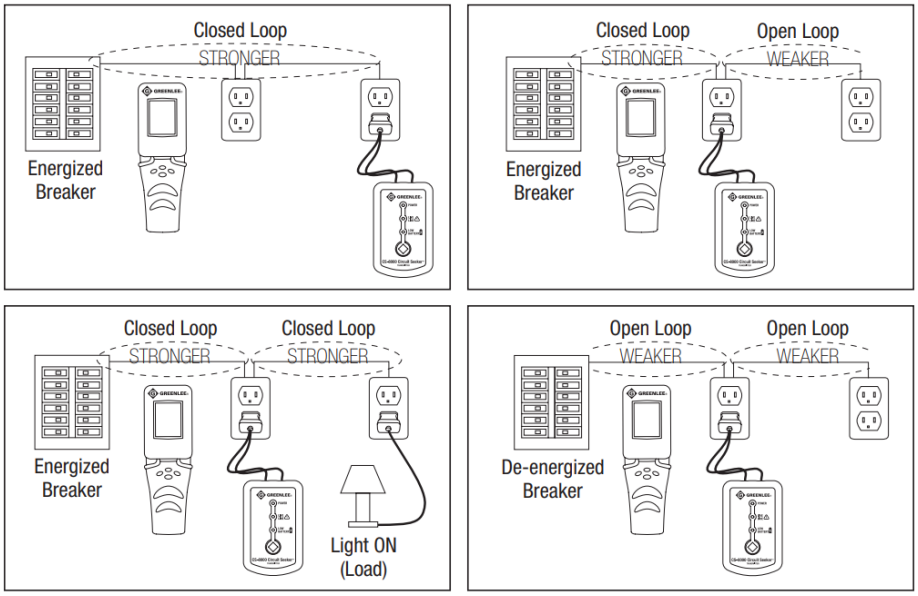
Sorting Wires



Tracing Signal Cancellation



Connecting for Best Signal



Specifications

Operating Conditions:

- **Temperature:** 0 ºC to 50 ºC (32 ºF to 122 ºF)
- **Relative Humidity (non-condensing):** 80% maximum for temperatures up to 31 ºC (88 ºF), decreasing linearly to 50% maximum at 49 ºC (120 ºF) Indoor use only
- **Altitude:** 2000 m (6500 ft) maximum
- **Pollution Degree:** 2

Storage Conditions (remove batteries):

- **Temperature:** -29 ºC to 60 ºC (-20 ºF to 140 ºF)
- **Relative Humidity (non-condensing):** 0% to 70%
- **Transmitter Operating Voltage:** 0 to 600 volts, AC/DC
- **Transmitter Operating Current:** 280mA
- **Transmitter Operating Frequency:** 15.15 kHz

Tracing Range:

- **Live Line Mode:** Up to 6 m (20 ft) from circuit
- **Open Line Mode:** Up to 3 m (10 ft) with a metallic connection to ground; 0.3 to 0.9 m (1 to 3 ft) with a capacitive ground reference

Auto Power Off Intervals:

- **Transmitter:** 4 hours
- **Receiver:** 30 minutes without signal

Power Supply:

- **Transmitter:** Two 1.5 V AA batteries
- **Receiver:** Two 1.5 V AA batteries

E.M.C. Standards:

- **CISPR 11:**2009 compliant (Class B device)
- **IEC 61000-4-5:2008, IEC 61000-4-3:**2006, IEC 61000-4-4:2004,
- **IEC 61000-4-5:2005, IEC 61000-4-6:**2008 Safety

Standards:

- UL61010-1 Ed. 1, UL 61010-2-030 Ed. 3, CAN/CSA-C22.2 No. 61010-1-12, **CAN/CSA-C22.2 No. 61010-2-030:**12

Overvoltage Protection: Category III, 600V AC/DC

Overvoltage Installation Categories

These definitions were derived from the international safety standard for insulation coordination as it applies to measurement, control, and laboratory equipment. These overvoltage categories are explained in more detail by the International Electronically Commission; refer to either of their publications:IEC 1010-1 or IEC 60664.

Overvoltage Category I
Signal level. Electronic and telecommunication equipment, or parts thereof. Some examples include transient-protected electronic circuits inside photocopiers and modems.

Overvoltage Category II
Local level. Appliances, portable equipment, and the cicuits they are plugged into. Some examples include light fixtures, televisions, and long branch circuits.

Overvoltage Category III
Distribution level. Permanently installed machines and the circuits they are hard-wired to.
Some examles include conveyor systems and the main circuit breaker panels of a building’s electrical system.

Overvoltage Category IV
Primary supply level. Overhead lines and other calbe systems. Some examples include cables, meters, transformers, and other exterior equipment owned by the power utility

Statement of Conformity

Greenlee Tools, Inc. is certified in accordance with ISO 9001:2008 for our Quality Management Systems. The instrument enclosed has been checked and/or calibrated using equipment that is traceable to the National Institute for Standards and Technology (NIST).

Maintenance

CAUTION

Electric shock hazard:

- Do not attempt to repair this unit. It contains no user-serviceable parts.
- Do not expose the unit to extremes in temperature or high humidity. Refer to “Specifications.”

Failure to observe these precautions may result in injury and can damage the unit.

Battery Replacement

 **WARNING**

Electric shock hazard:

Before opening the case or battery compartment, remove the test leads from the circuit and shut off the unit.

Failure to observe this warning could result in severe injury or death.

1. Disconnect the unit from the circuit. Turn the unit off.
2. Remove the screw from the battery cover.
3. Remove the battery cover.
4. Replace the batteries (observe polarity).
5. Replace the cover and the screw.

Cleaning
Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents.

Replacement Parts

Cat./UPC No	Description	Qty
08435	Transmitter unit	1
08436	Receiver unit	1
08437	Carrying case	1
CS-5000-LK	Test Lead Kit (CS-5000)	1

Description

The Greenlee CS-5000 Circuit Seeker™ Circuit Tracer identifies and traces either live or unenergized circuits. It also locates faults or opens in a circuit, identifies specific circuit breakers, and traces circuits including those shorted to ground. The CS-5000 consists of a receiver, a transmitter, and accessories for connecting the transmitter to the circuit being traced or identified.

The CS-5000 receiver incorporates multi-directional signal detection circuitry and can be held at any 90 degree increment with respect to the wire or circuit breaker being traced.

Safety

Safety is essential in the use and maintenance of Greenlee tools and equipment. This instruction manual and any markings on the tool provide information for avoiding hazards and unsafe practices related to the use of this tool. Observe all of the safety information provided.

Purpose of This Manual

This instruction manual is intended to familiarize all personnel with the safe operation and maintenance procedures for the Greenlee CS-5000.

Keep this manual available to all personnel.

Replacement manuals are available upon request at no charge at www.greenlee.com.

Do not discard this product or throw away!
For recycling information, go to **www.greenlee.com.**

Lifetime Limited Warranty

Greenlee Tools, Inc. warrants to the original purchaser of these goods for use that these products will be free from defects in workmanship and material for their useful life, excepting normal wear and abuse.
This warranty is subject to the same terms and conditions contained in Greenlee Tools, Inc.'s standard one-year limited warranty.

For all Test Instrument repairs, contact Customer Service at 800-435-0786 and request a Return Authorization.

For items not covered under warranty (such as items dropped, abused, etc.), a repair cost quote is available upon request.

Note: Prior to returning any test instrument, please check replaceable batteries or make sure the battery is at full charge.

All specifications are nominal and may change as design improvements occur. Greenlee Tools, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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Documents / Resources

	GREENLEE CS-5000 Circuit Tracer [pdf] Instruction Manual CS-5000 Circuit Tracer, CS-5000, Circuit Tracer

References

- Professional. Nothing Less.™ | Greenlee
- User Manual