Power Probe IV

Users Manual

POWER PROBE®

The Next Generation of Diagnostics

Power Probe IV

Table of Contents

Introduction

Thank you for purchasing the Power Probe IV Diagnostic Electronic Circuit and Component tester. The Power Probe IV is the next generation of Power Probe Circuit Testers. Now loaded with powerful multi-meter functions, advanced diagnostic test modes, an easy to read color LCD display and a new rugged water and dust resistant housing, the Power Probe IV is designed to give you years of trouble free testing, even in the most demanding work environments.

The unique configuration of Power Probe testers gives them many advantages over using conventional test lights or multimeters for circuit testing.

(1) Since the Power Probe IV is connected to the battery, you can apply battery power or battery ground directly to the tip of the tool. You can energize and activate components to verify their correct operation. This is real dynamic component testing and the only true way to test an active component.

(2) The Power Probe IV is always connected to the vehicle's battery, so the tool maintains a permanent connection to the source power and ground voltage. Circuit voltage checks are quickly performed with just a single probe connection, unlike using two meter leads.

(3)Using the PPIV, all your voltage checks are referenced back to the source battery and account for every connection and possible voltage drop between the source and the probe tip.

(4) Automatic Voltage Drop Indication - When probing a circuit, if the voltage measured at the tip is 0.5 volts lower (or more) than the source battery voltage, the red LED will not Illuminate and no speaker tone will sound. This will instantly alert you that there is a voltage drop that may need to be investigated or repaired.

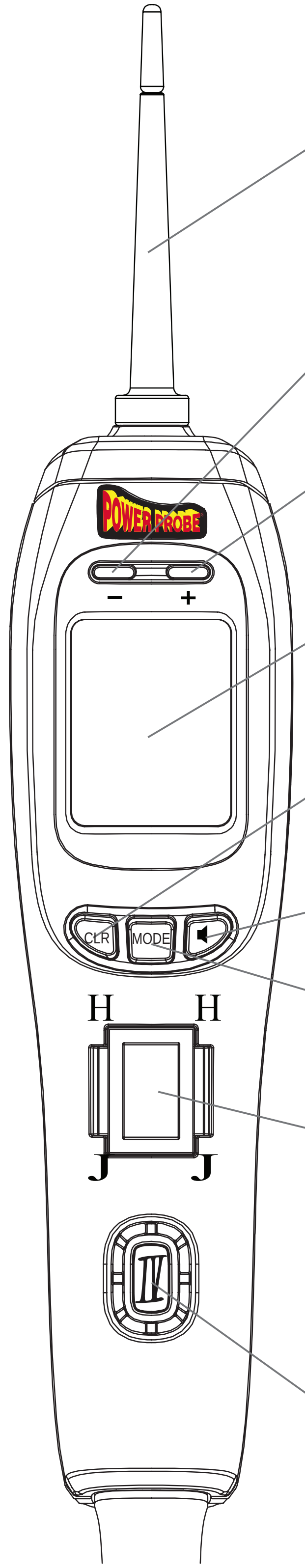
Safety

CAUTION - PLEASE READ

To avoid possible electric shock or personal injury and to avoid damage to the Power Probe or item being tested, please use the Power Probe according to the following safety procedures:

- Power Probe recommends reading this manual before using the Power Probe IV.
- This product is designed to be powered from DC power sources such as found in Automotive, Small Craft Marine and Small Craft Aviation electrical systems and will be damaged if connected to line voltage such as 115V AC power sources or 24V AC Control circuits.
- Do not connect to electrical system with higher than rated voltage specified in this manual.
- Do not test voltage exceeding the rated voltage on the Power Probe IV.
- When testing voltage exceeding 30V AC RMS, 42V AC Peak, or 60V DC, be particularly careful to avoid any electric shock.
- Check the Probe IV case for cracks or damage. Damage to the case can leak high voltage causing a potential electrocution risk.
- Check the Probe IV cables for any insulation damage or bare wires. If damaged, do not use the tool, please contact Power Probe Technical support.
- Use only shrouded leads and accessories authorized by Power Probe to minimize exposed conductive electrical connections to eliminate shock hazard.
- Do not open the Power Probe IV, no serviceable parts are inside. Opening the Power Probe IV voids the warranty. All repairs should only be performed by authorized Power Probe service centers.
- When maintaining the Power Probe, use only replacement parts specified by the manufacturer.
- Use only in well ventilated areas. Do not operate around flammable materials, vapor or dust.
- Be careful when energizing components that have moving parts, assemblies containing motors or high powered solenoids.
- Power Probe, Inc. shall not be liable for damage to vehicles or components caused by misuse.
- Power Probe, Inc. shall not be held liable for any harm caused by unintentional or intentional misuse of our products or tools.

Appearance and Controls



1 **Removable Probe Tip** -Uses standard 4mm banana type connector enabling use of different probes, leads, or extensions.

2 **LED, Green (-)** -Will light indicating a path to ground. More than 10Ω resistance and/or more than 0.5 volts on a ground circuit, the Green LED will not illuminate.

3 **LED, Red (+)** -Will light indicating (B+) Battery positive. If the circuit voltage drop is more than 0.5 volts from battery voltage, the Red LED will not illuminate.

4 **Color Screen** - Large Hi-resolution LCD display shows multiple readings on one screen.

5 **Button, Left; "CLR" Clear / Scroll Up** - Used to clear Min/Max in voltmeter modes or "Scroll Up" when navigating menus.

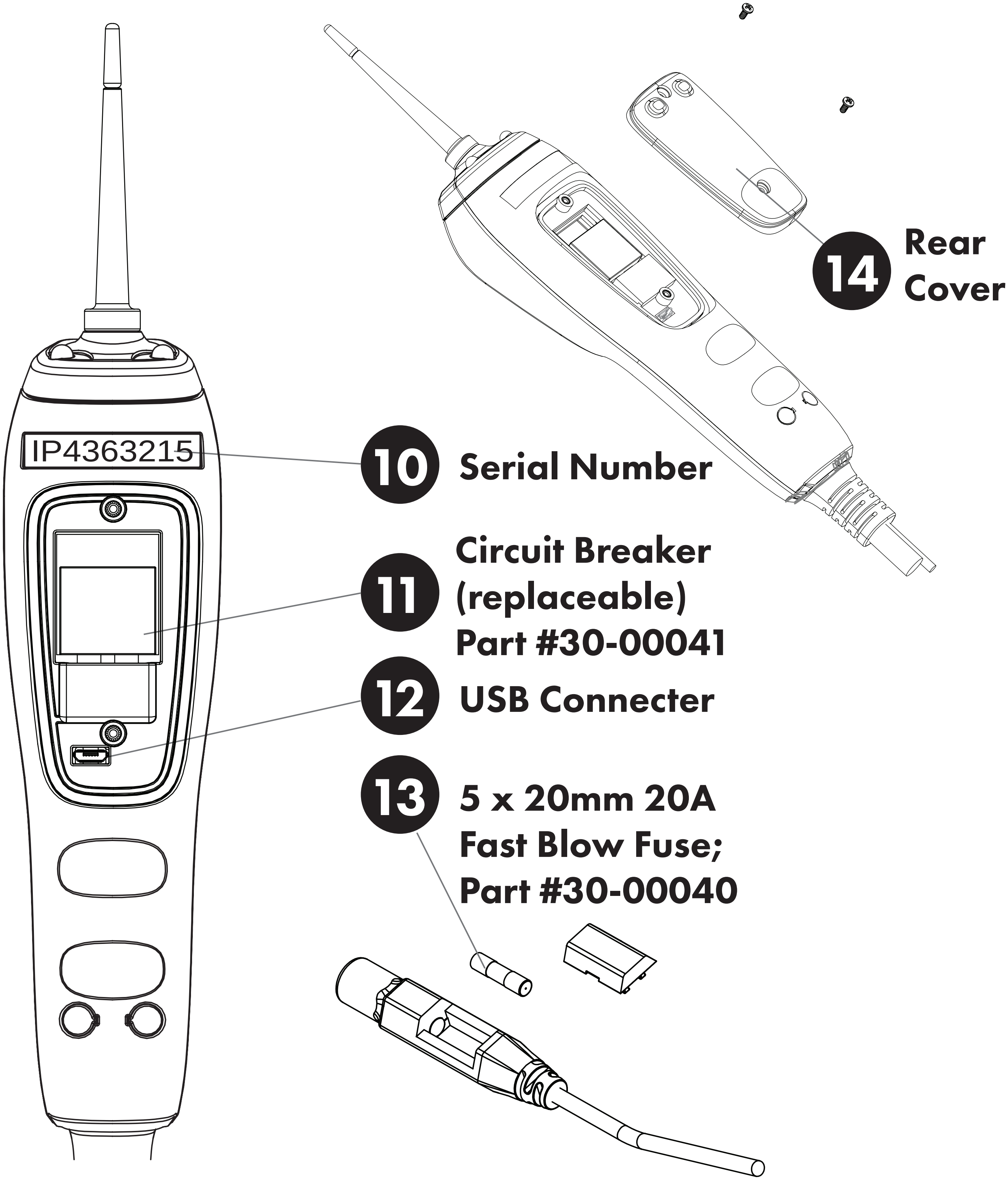
6 **Button, Right; "🔈" Mute / Scroll Down** - Used to turn the Speaker Tone On/Off or "Scroll Down" when navigating menus.

7 **Button, Center; "MODE" Select** - Used to select a test mode when navigating menus.

8 **Rocker Switch (replaceable) Part #30-00087** - When rocker switch is pressed forward(+) battery power(B+) is applied to the probe tip. When rocker switch is pressed rearward(-) battery ground(B-) is applied to the probe tip. Can only be used when in either of the DC voltmeter modes.

9 **Speaker** - Distinct tones for power(B+) or ground(B-)

Appearance and Controls



Start-Up

Operating Source Voltage
The Power Probe IV is designed to connect to and is powered by 12 to 24 VDC electrical systems and comes supplied with a 23 ft., heavy duty power cable and a Y-connector with 2 battery clips.

Connecting to the Vehicle's Battery (Voltage Source)
Connect the red clip to the positive terminal of the vehicle's battery source and the black clip to the negative or ground terminal. The Power Probe IV start-up tone will sound.

Auxiliary Ground Lead
The auxiliary ground lead provides ground to circuits and components that are not already connected to ground. It also serves as the negative lead for resistance testing. To test the auxiliary ground lead, contact the probe tip and the auxiliary ground lead together. The Green LED should illuminate. This shows that the auxiliary ground lead is working properly. If the green LED does not illuminate, check the replaceable 20 amp fuse in the auxiliary ground lead. The fuse is for protection in the event the ground lead inadvertantly contacts the battery positive.

LED Flashlight
Flashlight is a standard feature on the Power Probe IV. The two bright white LEDs are always ON making it possible to see under dashboards and in dark areas.

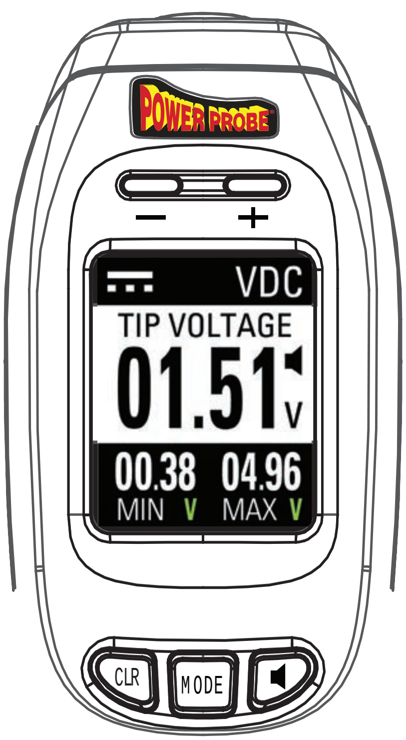
Mode Navigation

The Power Probe IV has 8 different test modes available:

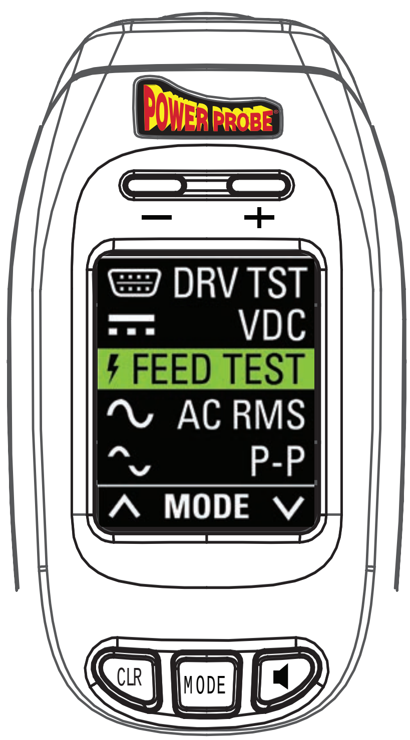
1. **VDC** – For DC voltage measurements. This is the default mode on startup. Max. 200 VDC
2. **FEED TEST** – For measuring loaded resistance in Ohms and display voltage drop.
3. **AC RMS** – For AC voltage measurements. Displays a True RMS averaged AC voltage. Max 200 VAC.
4. **P-P** – For AC voltage measurements. Displays Peak to Peak AC voltage. Max 200 VAC.
5. **Hz FRQ CTR** – For measuring signal Frequency. Also displays + and - Pulse Width.
6. **FUEL INJ** – Tests Fuel Injectors and Injector circuits.
7. **DRV TST** – Supplies safe voltage for testing computer driver circuits.
8. **PPECT** – Detects the open circuit signal from Power Probe ECT2000 to assist in locating opens.

Refer to sections: *Testing and Measuring Operations* and *Advanced Testing Operations* for further mode descriptions and suggested applications.

To Change Mode



Press the “MODE” button



Scroll up and down the mode list using “CLR” for up and “ ” for down naviagtion

Press the “MODE” button again to select

Testing and Measuring Operations

DC Voltage Measurement in VDC Mode

In this mode, you will supply battery power or battery ground to the tip when pressing the rocker switch

VDC - VDC mode is for testing DC (direct current) voltages. Voltage testing is as easy as contacting the probe tip to a circuit and reading the display. The Power Probe IV will display the probe tip voltage in the center display.

The Power Probe IV automatically enters VDC Mode when first connected to the vehicle's battery, or to a 12-24 volt power supply. VDC Mode is the only mode that the Power Probe IV can supply battery power or ground by pressing the rocker switch.

If the Probe tip voltage is within 0.5 volts of the source battery voltage and the circuit resistance is less than 10 Ohms, the Red LED will illuminate and if the speaker is turned on, the speaker will make a high-tone.

When testing on ground circuits, as long as there is less than 10 Ohms total circuit resistance from tip to battery ground, the Green LED will illuminate and the speaker will make a low-tone.

This greatly simplifies testing as the Power Probe IV's Red/Green LEDs and speaker tones provide a quick indication if there are excessive voltage drops or circuit resistance. If the LEDs do not illuminate and there is no tone from the speaker, you know instantly there may be a circuit problem.

Minimum and Maximum (MIN/MAX) voltages are shown on the bottom of the display. To reset the MIN/MAX, press the left "CLR" button beneath the display.

VDC mode has a very high sampling rate that is good for tests where the tech is looking for glitches or deviations from the main signal. This is a very sensitive mode that can capture even the smallest voltage spikes or drop-outs without having to use a scope.

The Power Probe IV can safely measure up to 200 VDC.

Testing and Measuring Operations

Activating Components in VDC Mode

Activating Electrical Components in VDC Mode is one of the main features that make the Power Probe IV very useful when testing. Being able to apply battery power or ground right to the probe tip gives you the ability to activate and dynamically test electrical components such as lights, motors, and solenoids.

You can power up components on the vehicle or on the bench by utilizing the auxiliary ground lead. This type of dynamic component testing is the only true method to verify a components correct operation. Testing a part with a volt-ohmmeter may tell you if the part is out of spec, but you never really know if the part is good until it is operating under power.

Pressing the rocker switch forward supplies battery power to the probe tip.

Pressing the rocker switch rearward supplies battery ground to the probe tip.

The power output is circuit breaker protected. If the component being tested draws too much current, or the circuit has a shorted condition, the Power Probe IV's circuit breaker will trip protecting the tool and the circuit.

When the circuit breaker is tripped, the PPIV display will show "CIRCUIT BREAKER RESETTING" and will automatically reset itself after a few seconds.

Pressing the rocker switch in any other mode will not apply power or ground and the main screen will display a large red "X".

Testing and Measuring Operations
Power Feed Testing

FEED TEST – Power Feed Test (PFT) is used to check resistance on static circuits or voltage drops on active circuits by simply probing one connection of the circuit being tested.

PFT measures total circuit resistance from the source battery accurately whether there is voltage on the circuit or not, unlike standard multimeters. With the Aux. Ground lead, PFT can also be used like a standard ohmmeter. PFT displays both Battery and Tip voltage simultaneously for easy voltage drop testing.

In this mode, the Power Probe IV display will show:

1. - Total circuit Resistance on the center screen.
2. - Probe Tip Voltage.
3. - Battery Voltage.

The battery voltage and the tip voltage are both displayed along the bottom of the screen for easy voltage drop testing.

The circuit resistance will be calculated even with voltage applied to the circuit. To accurately test the power and ground feed resistance, the component must be removed from the circuit first. Simply unplug any component, relay, or module on the circuit, contact the probe tip to the circuit and view the circuit resistance.

PFT will display battery voltage (BATT V) from the battery clips in the lower left display area, probe tip (TIP V) voltage in the lower right display area and will provide total circuit resistance readings in the main area of the display all in one test.

Testing and Measuring Operations
Power Feed Testing

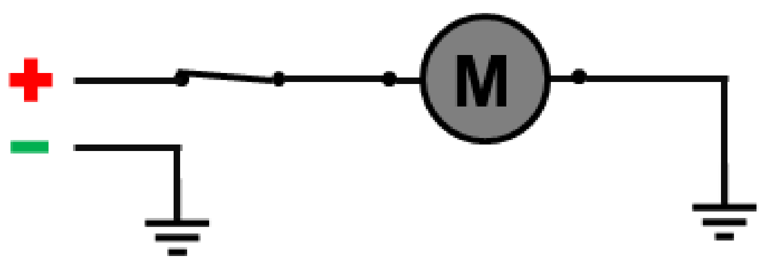
To test, first disconnect the device or load being operated from the circuit, then contact the probe tip to the circuit being tested. Removing the component from the circuit prevents the component load from affecting and altering the resistance reading.

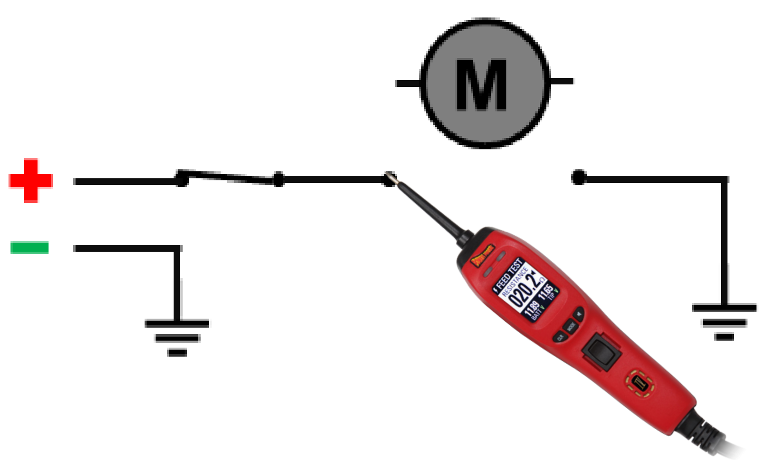
For voltage drop testing the component must be connected and observe the difference between battery voltage (BATT V) and tip voltage (TIP V)

If the circuit resistance is less than 10 Ohms the Red or Green LED will illuminate and the speaker will make a corresponding tone if the speaker is on. Any differences between battery voltage and tip voltage are easily observed.

PFT can also be used as an ohmmeter on wire or components not connected to battery power or ground. Simply connect the item being tested between the probe tip and the auxiliary ground lead and read the resistance reading in Ohms.

While it is possible to ohm check some components, it should be noted that PFT is primarily for use on wiring only and should never be connected to a solid state component such as a module.





Remove component from circuit before performing Power Feed Test

Testing and Measuring Operations
AC Voltage Measurement (RMS)

∿ **AC RMS** mode is for measuring AC (alternating current) voltages and can be used on any AC voltage or pulsed waveform signal where an RMS averaged voltage measurement is required.

Contact the probe tip to the circuit and it will display an RMS averaged AC voltage reading in the main display area while also displaying RMS Min/Max AC voltages on the bottom line.

Powering up and activating circuits with the rocker switch **can not** be performed in this mode.

Pressing the "CLR" button will reset the Min/Max readings.

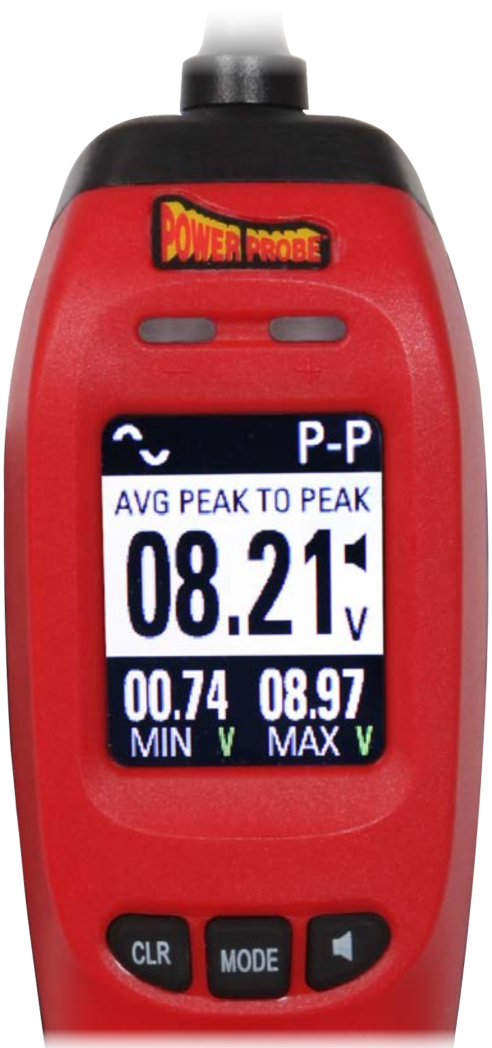
AC RMS Voltage is used in the same manner as a standard DVOM would be used to measure the averaged AC voltage in any circuit that produces AC voltage. This can be used for, but not limited to, tests such as checking alternator diode ripple, abs sensors, crank sensors, etc.

The Power Probe IV can safely measure up to 70 VAC.

WARNING

Do not use the Power Probe IV to test AC line voltage, such as a 120V wall plug. Attempting to use the Power Probe IV on AC line voltage will damage the probe and could cause personal injury.

Testing and Measuring Operations
AC Voltage Measurement (P to P)



~ **P-P** mode can be used on any AC voltage signal where a Peak to Peak (P-P) voltage measurement is required.

P-P stands for Peak to Peak AC voltage. Where AC RMS displays an averaged AC voltage, P-P does not average the reading but displays the total voltage difference from the lowest to highest voltage extreme on an AC signal.

In this mode, the display will be an AC Voltmeter that shows the Tip Voltage in the center and the Min/Max voltage readings along the bottom of the display.

The voltage displayed is the total voltage potential between the lowest and highest voltage sensed on the AC signal being measured.

Powering up and activating circuits with the rocker switch **can not** be performed in this mode.

The total Peak to Peak voltage will be shown in the main display area. The Min voltage will display lowest absolute voltage on the bottom left of the display and the Max voltage will display the highest absolute voltage on the bottom right of the display.

For example, if you have an AC signal that alternates from -50V to +50V the Power Probe IV will display a P-P voltage of 100V, a Min voltage of -50V and a Max voltage of +50V.

Pressing the “CLR” button will reset the Min/Max values.

This can be a more accurate test for signal circuits such as sensors or data communication lines where measuring the full range of the AC signal is required.

The Power Probe IV can measure P-P AC voltage from -100V to +200V or a Maximum RMS AC voltage of 70V.

Testing and Measuring Operations

Frequency Measurement

Hz FRQ CTR – Frequency Counter mode is used for measuring the frequency of an alternating voltage signal.

Contact the probe tip to the circuit and it will display the frequency in Hertz (cycles per second) in the main display area while also displaying the – Pulse Width and + Pulse Width in milliseconds on the bottom line.

The Power Probe IV can measure frequencies from 1Hz to 9999Hz.

FRQ CTR can be used for tests where frequency or pulse width are needed such as MAF sensors, wheel sensors, etc.

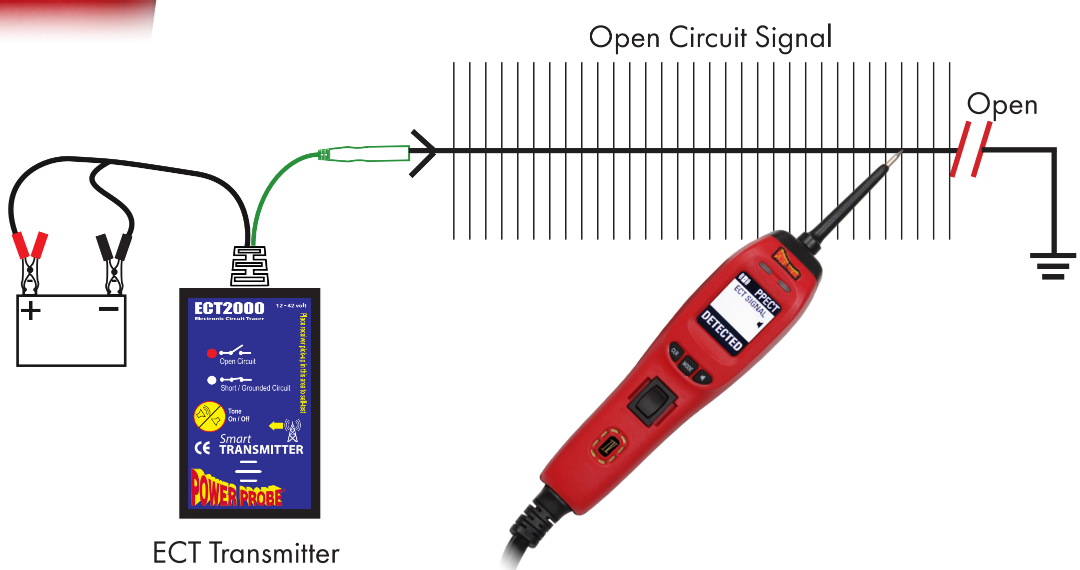
Advanced Testing Operations
PPECT Mode

((▮)) PPECT = PPECT Mode is designed to work with the Power Probe ECT2000 for locating open circuit conditions in wiring.

When using the ECT2000 to find opens in wiring, the ECT Transmitter injects a specialized digital signal that is normally picked up by the wireless ECT Receiver. In some situations, such as large wiring bundles or limited access, pinpointing the ECT signal and locating the exact point of the wire failure may be difficult when using the ECT Receiver alone.

When you select the ECT Mode, the Power Probe IV is now specifically tuned to detect the ECT open circuit signal. The Power Probe IV is meant to work by direct contact to the circuit.

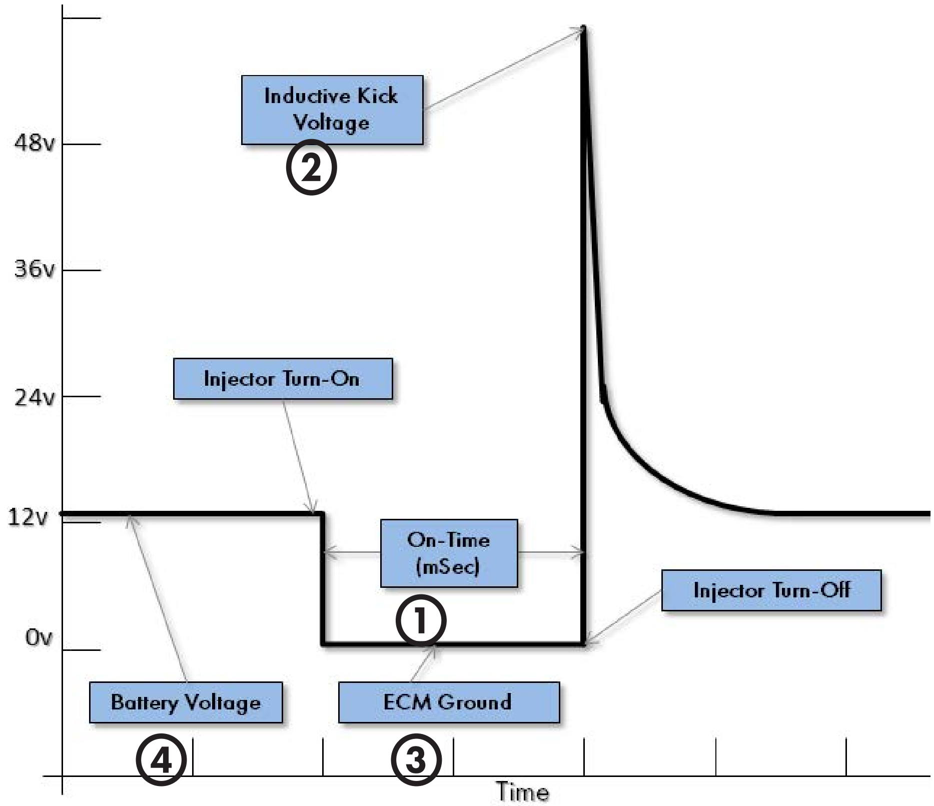
Probe and contact the circuit with the ECT signal on it and the main display will show “DETECTED” and the Red/Green LEDs will illuminate, verifying you are the correct wire. This can greatly aid in detecting opens in tight wire bundles or confined locations.



Advanced Testing Operations
Fuel Injector Mode

FUEL INJ = Fuel Injector Mode is specifically set-up for fast and easy injector circuit diagnosis. One quick connection to the circuit and the Power Probe IV will display all the needed fuel injector testing information that would normally require using an lab-scope.

Below is an example of a typical fuel injector voltage waveform on a lab scope. This is displaying a single injector pulse. The vertical axis represents the circuit voltage and the horizontal axis represents time.



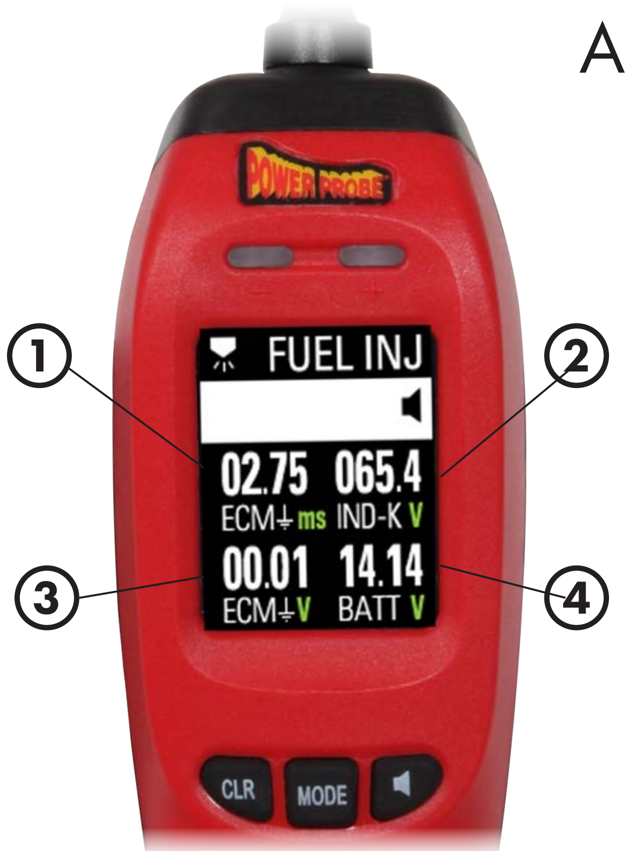
Following the waveform from left to right, you can see the circuit voltage starts near battery voltage until the injector is turned on, this is the **Injector Supply Voltage**.

Then the voltage will drop to near zero when the ECM/PCM switches to ground, or **ECM Ground Voltage**.

The windings inside of a fuel injector produce a magnetic field when the injector is energized. Each time an injector is turned off, this magnetic field collapses back into the injector windings and induces a hi-voltage spike. This voltage spike is the **Inductive Kick Voltage**.

The time between when the injector is turned on to when the injector is turned off is simply called the **Injector On-Time** and is usually expressed in milliseconds. The Power Probe IV displays each of these four data points on one screen giving a complete picture of the electrical performance of the injector and the entire injector circuit.

The Red/Green LEDs above the LCD display will blink and are sychronized with the injector signal from the ECM with a corresponding tone from the speaker output. These audible and visual cues can quickly identify any intermittent loss of signal from the ECM.



Advanced Testing Operations
Fuel Injector Mode

- Select FUEL INJ from the Power Probe IV's test menu.
- Back-probe on the negative side of the injector, either at the injector or at the PCM.
- These four data points represent the corresponding waveform points. (see pg. 15)
- When the engine is running (or cranking) the Power Probe IV's red and green indicator LEDs will blink to indicate a good signal from the ECM/PCM.
- The main screen will display complete injector circuit data for quick comprehensive injector circuit diagnoses.

① **ON ms** = Injector Pulse On-Time (milliseconds) - This is the total amount of time that the fuel injector is energized and supplying fuel to the cylinder. This can be compared to scan tool PID data to see if commanded on-time equals actual on-time

② **IND-K V** = Inductive Kick Voltage - Normal inductive kicks range between 55 and 90 volts. You should see a similar voltage number from each of injectors on the engine. Note: The height of the inductive kick is sometimes cut-off by an internal ECM diode to about 35 to 45 volts. Note: This test does not apply to hi-pressure injectors used on diesel engines and gasoline direct-injection engines.

③ **ECM⏚V** = ECM Ground Voltage - The engine computer activates each fuel injector by completing the ground circuit with an internal transistor switch. When the fuel injector is energized, the ECM ground voltage should be close to zero volts. Actual measured ECM ground voltage can vary, and may be closer to 0.5 volts because of the internal resistance of the switching transistor.

④ **INJ V** = Injector Supply Voltage - This is the battery power being supplied through the fuel injector itself. Measured voltage should be close to full battery voltage. There may be small voltage drops in the circuit, however, anything more than 0.5 volt loss from the source battery voltage should be investigated.

Advanced Testing Operations
Driver Testing

DRV TST = Driver Test Mode is design to test the drivers (transistor) inside the module's (PCM, BCM, GEM, etc.) control circuit.

More and more electrical components on modern vehicles are being turned on and off by computer modules or Electronic Control Units (ECUs). Many components, such as transmission solenoids or fuel injectors, can be switched directly from the ECU. Other high current components, like radiator fans are operated thru relays which are then controlled by the ECU. Special transistor circuits, called driver circuits, are built in to these modules that can supply, the current necessary to power these different parts.

Driver circuits' current carrying capabilities are limited and a shorted component that draws more current than it should can overload the driver circuit and cause it to fail.

When testing the control signal to a component, relay or solenoid, the module will need to have the voltage present that the component normally would supply into the module. If the component, relay or solenoid is unplugged the module will no longer be able to pull the voltage to ground and may not energize the circuit. DRV TST provides a safe voltage supply to validate the circuit or the driver inside the module without the relay or component installed.

Modern ECUs have circuits that let the ECU know if a component is actually plugged in, and the driver circuit will not energize the circuit if no component is there. Also, in order for the computer to detect output faults, like shorts or opens, the component being driven has to be within a specific resistance range or the computer also will not energize the driver circuit. When the Power Probe IV is in Driver Test Mode, it will provide the necessary voltage and pull-up resistance to ensure proper driver testing. (see product specifications pg.19)

Advanced Testing Operations
Driver Testing

Driver Testing Explained:

Suppose you had a shorted solenoid that was not working. You know the solenoid will have to be replaced, but you don't yet know if the driver circuit was damaged and you may need to also replace the module. You need a way to safely test the driver circuit without the component connected.

Driver Test Mode will supply a safe,current limited voltage that can be connected directly to the module driver output.

Connect a bi-directional scan tool to the vehicle and command the circuit being tested to an "On" state. You should see the PPIV screen respond if the driver circuit is working.

It is possible to test some driver circuits without a bi-directional scan tool, however, you will have to know what running conditions will make the circuit you are testing switch to an "On" state and then re-create those conditions to energize the circuit.

Tool Repair Operations
Rocker Switch Replacement

The Power Probe IV Rocker Switch is used constantly and arcing can occur across the switch contacts and eventually the switch can wear out.
The Power Probe IV also has an Automatic Resetting 8Amp Thermal Circuit Breaker and like the Rocker Switch, the Circuit Breaker can also wear out over time.If this occurs, the Rocker Switch and the Circuit Breaker are made to be easily field replaceable.

Replacement Rocker Switches (Part # PN005) and Circuit Breakers (Part # 30-00041) can be pur-chased from your tool dealer

Follow the instructions below to replace a worn Rocker Switch -

Locate the two slots on either side of the Rocker Switch.

Carefully remove the Rocker Switch with an appropriate pry tool or small screwdriver. Do not apply excessive force.

Position the new Rocker Switch into the switch cavity and carefully press straight down until the switch is flush with the housing.

Tool Repair Operations
Circuit Breaker Replacement

Follow the instructions below to replace a worn Circuit Breaker -

Unscrew the two retaining screws and remove the rear cover.

Using an appropriate pry tool or small screwdriver, carefully pry the Circuit Breaker towards the tip to dis-engage it from the breaker terminals. Do not apply excessive force.

Once the Circuit Breaker is loose from the terminals, carefully lift the breaker from the housing cavity.

Position the new Circuit Breaker into the housing, take care to line up the breaker spades with the breaker terminals, and press down gently until the Circuit Breaker is fully engaged into the breaker terminals.
Replace the rear cover and the two retaining screws.

Specs

Product Specifications

Min Operating Voltage	8 VDC
Max Operating Voltage	30 VDC
Max Tip Voltage	450 Volts
Probe Tip Resistance to Ground	130K Ohms
Computer Safe	0.1mA floating tip
Voltage Measurement	-100 to 200 VDC / VAC (70 VAC RMS)
Voltage Resolution	-99.99 to 99.9 V – 0.01V (10mV) 100.0 to 199.9 V – 0.1V (100mV)
Glitch Capture	>380µS Min Pulse Width
Power Feed Test	< 30 mA
Resistance Measurement	0.1 Ohms to 10K Ohms
Frequency Measurement	1Hz to 9999Hz
Driver Test	50 Ohm Pull Up on Tip Driver On Range: 50mV to 1V
ECT Signal Detection	2 sec.
Fuel Injector Mode	LED Flash @ Min 35V @ 100µS Pulse
Red LED Response	Within 0.5V BATT V and < 10 Ohms
Green LED Response	< 10 Ohms
Circuit Breaker	8 Amp Thermal – Auto Reset
Breaker Trip Response	8 Amps = No Trip 10 Amps = 20 min. 15 Amps = 6 sec. 25 Amps = 2 sec. Short Circuit = 0.3 sec.
Operating Temperature	-20°C (-4°F) to 50°C (122°F)
Storage Temperature	-40°C (-40°F) to 65°C (149°F)

ECT3000

ELECTRONIC CIRCUIT TRACER

USER'S MANUAL

Diagnose Electrical Circuits Fast

- Locate Shorts
- Locate Opens
- Test Intermittent Problems

POWER PROBE®

Power Probe Tek

CE

Contents

Contents

Congratulations

Thank you for choosing the Power Probe "ECT3000" (Electronic Circuit Tracer- 3000)

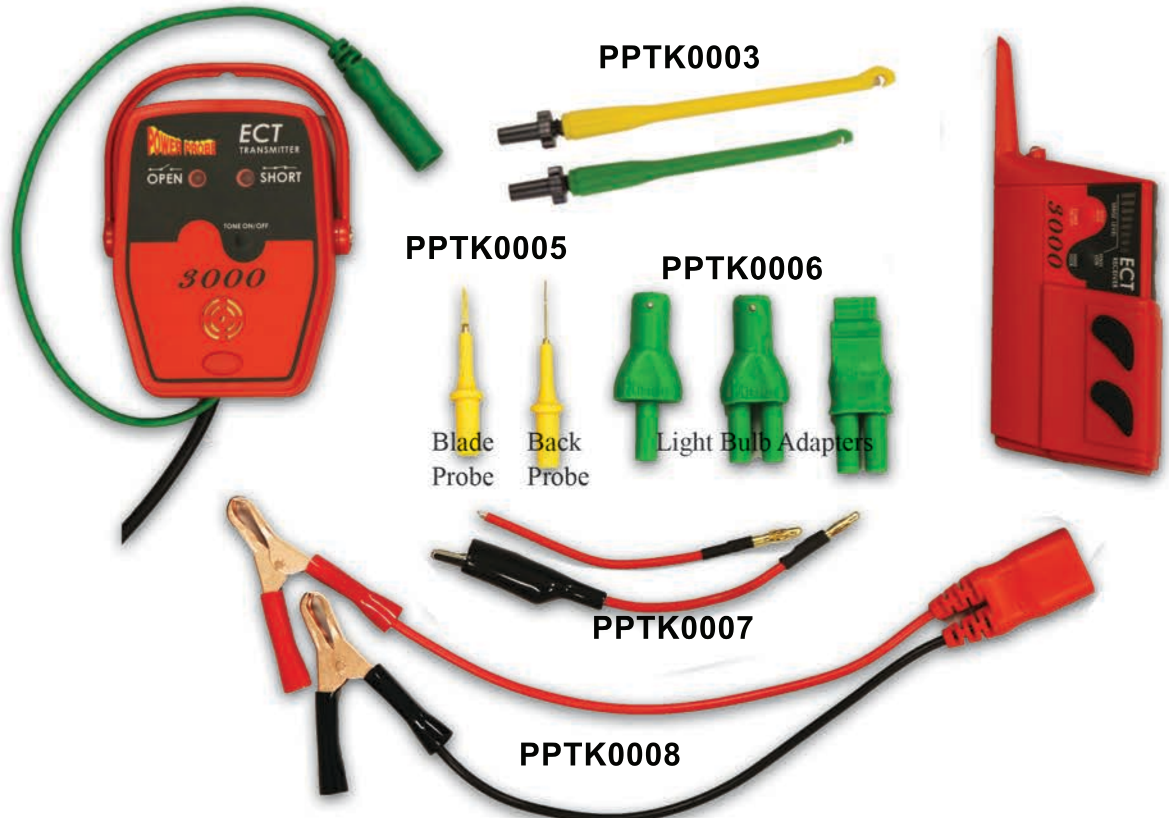
The ECT3000 helps quickly locate wiring shorts and opens. The ECT3000 operates just like the trusted Power Probe ECT3000 now with many improvements in functions and features to increase circuit testing accuracy and speed. This instruction booklet will give you some valuable diagnosing tips gathered from the field and from our testing lab. This instruction booklet has convenient references that will take you to appropriate pages that provide more information and clarification. Taking the time to read this instruction booklet carefully will give you valuable insight to these detailed techniques in tracing automotive circuits.

We designed the ECT3000 as a quick solution to your automotive circuit problems. The ECT3000 consists of 2 main components. An Intelligent transmitter and a Intelligent receiver along with a set of connection adapters that will help you:

- Locate short circuits without unnecessarily removing plastic panels, molding, and carpet.
- Trace wires to see where they lead
- Find open circuits, switches or breaks in wires
- Trace and locate the cause of a severe battery drain
- Test and find intermittent conditions
- Check continuity with the assistance of the Power Probe III, IV, or Hook

These features are extremely handy for the professional technician. An appropriate schematic or wiring diagram is always useful and many times necessary when tracing circuits. The better you understand your circuit, the better the ECT3000 can assist you.

Parts



INCLUDED

ECT3000B

Blade Probes | PPTK0005

Light Bulb Adapters | PPTK0006

Piercing Probe | PPTK0003

Alligator Clip Adapter And
Wire Adapter | PPTK0007

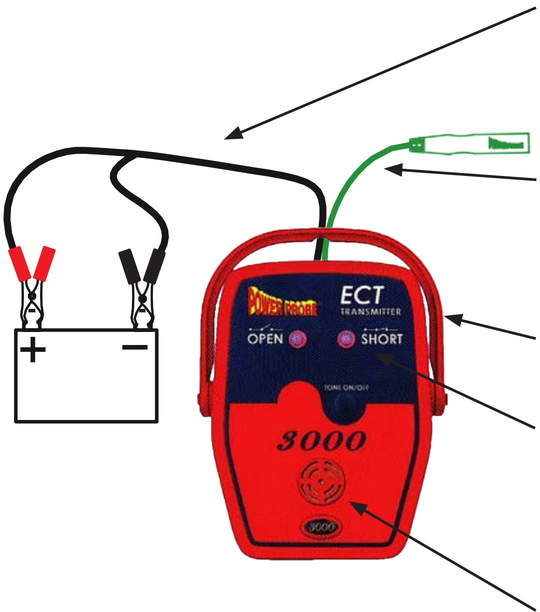
Battery Hook Up Clip Set | PPTK0008

All banana jacks/plugs are standard 4mm mkaing other test leads or adapters usable with this product.

** See PG. 16 for application

The ECT3000 Transmitter

The transmitter is designed to generate Grounded Circuit signals and Open Circuit signals. The grounded and the open circuit signals are very different from each other, so it is very important to understand the differences in each signal type. (see “Characteristics of the Short/Grounded Circuit Signal” pg. 8 and Characteristics of the Open Circuit Signal” pg. 9)



Power Lead
The 20 ft. power lead of the Intelligent transmitter supplies power by connecting directly to the vehicles battery and the long length provides easy access to circuits throughout the vehicle. The RED clip connects to the positive side of the battery and the BLACK clip connects to the negative. It can be connected to a power source from 12 to 24 volts.

Signal Lead
The signal lead with the green banana jack, plugs into the assortment of adapters, probes, and clips that are provided for you in the ECT3000 kit. These accessories simplify connecting to your circuit.

Moveable Hanger / Stand
Provides multiple convenient mounting options when testing.

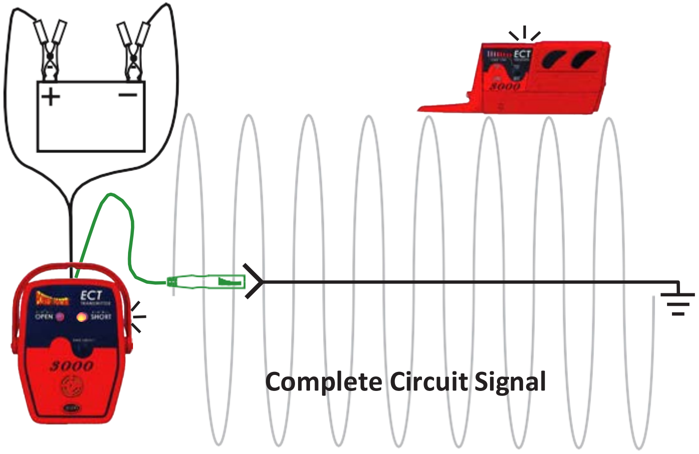
Circuit Status LED indicators
Indicates current circuit staus - Short / Open.**Tone On/Off - Toggle Tone**
“Tone On/Off” button toggles the tone of the transmitter’s speaker on or off.
The toggle tone feature of the Intelligent transmitter gives you the ability to detect changes in the circuit to detect intermittent problems. (See “Circuit Wiggle and Flex Test” pg. 26)

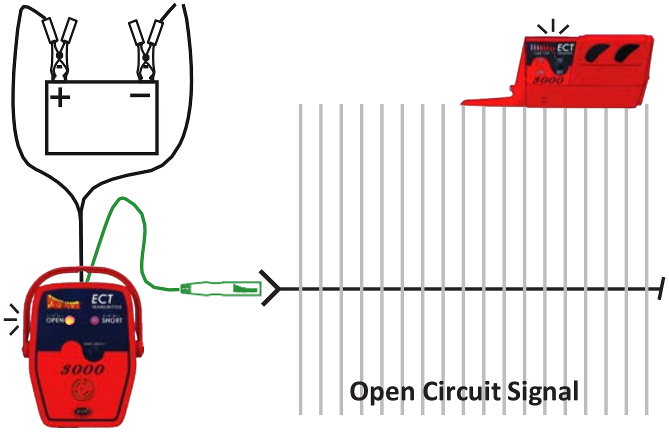
Speaker
Provides Audible circuit status indication.

After connecting the transmitter's 20 ft. power lead to the vehicle's battery, a signal is generated through the green signal wire and banana plug. This is connected to the circuit you want to trace. The signal will radiate along the circuit, which you can detect by using the receiver. There are two types of circuit signals that the transmitter generates. They are the Grounded Circuit SIGNAL and the OPEN CIRCUIT SIGNAL.

It is very important to familiarize yourself with both of these signals and how they work in your circuit. The "Grounded Circuit signal" and the "open circuit signal" are different from each other, which you should understand. (See: "Characteristics of the Short/Grounded Circuit Signal" pg.. 8 and "Characteristics of the Open Circuit Signal" pg. 9&10)

The 2 main features of the ECT3000 is that it transmits a signal into a circuit with the transmitter and then you trace it with the receiver . The easiest way to insure that you are following the problem circuit is to isolate it from other parallel circuits.





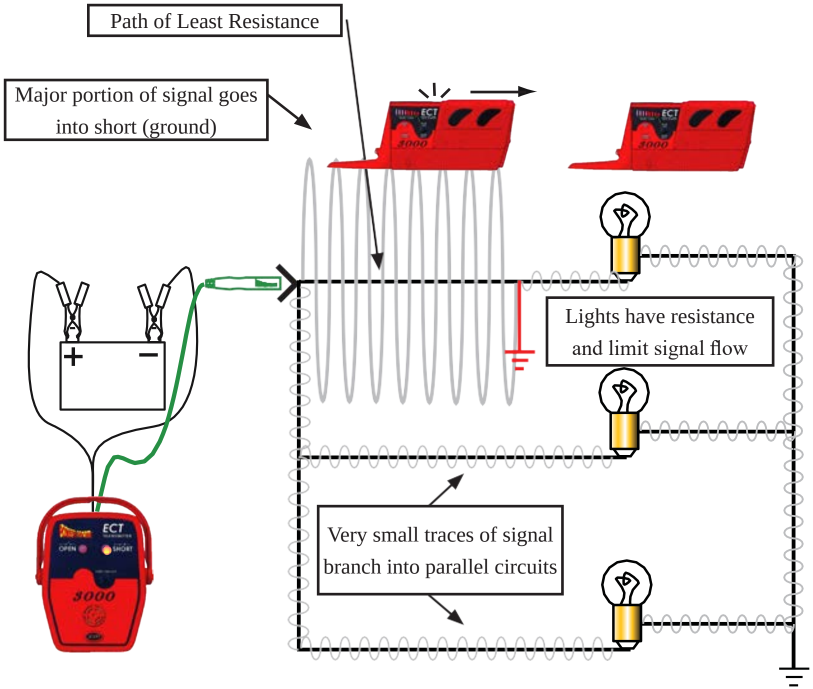
Characteristics of the Short/Grounded Circuit Signal:

1. Strongest when flowing exclusively through one wire

When the signal is conducting through only one wire, the signal strength is at its maximum because 100% of the signal is traveling through that wire exclusively to return back to the negative side of the battery. If the signal branches out to parallel circuits, its strength divides and of course is weaker in each branch of the divided circuit. But when the signal recollects through the single negative cable to return to the battery, the signal strength is at its maximum again because 100% of the signal is concentrated through the single negative battery cable. (see "Isolate the Circuit You are Tracing" pg. 18)

2. Travels the path of least resistance

In case of a short circuit that blows its fuse reliably, you can sometimes get away with not having to isolate the circuit. The majority of the signal will follow the path of least resistance through the short and then back to the battery. In fig.1, you can see the majority of the signal travels right to the short circuit. You can also see only a small portion of the signal running through parallel wires.



3. A 4 KHz Polarized Signal

The fact that the Grounded Circuit signal is a 4 KHz polarized signal provides directional information for the receiver to pick up. This capability to indicate the direction to the short or ground takes the guesswork out of tracing grounded circuits. (See "Direction to the Short" pg. 15)

4. Carries a current of only 100 mA.

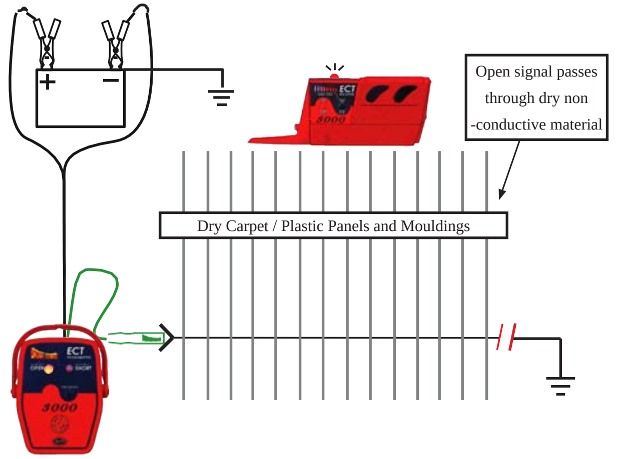
When generating a Short/Grounded Circuit signal, a maximum of 100 milliamp flows from the signal lead. This keeps you safe from damaging sensitive computer circuits.

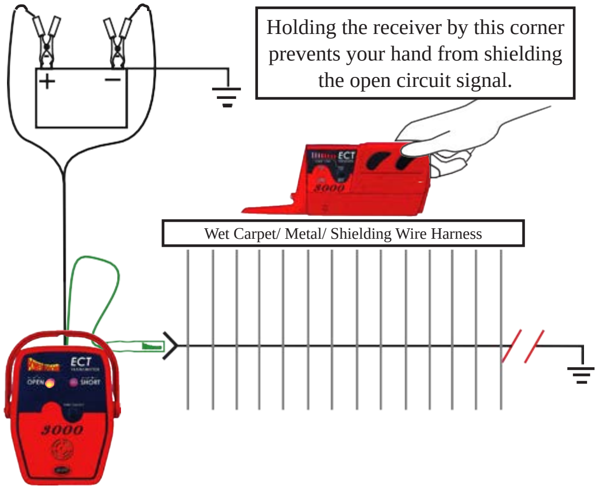
Characteristics of the Open Circuit Signal are:

1. **Transmits through NON Conductive Materials**
The signal that the ECT transmits when tracing open circuits, radiates what is called an E-field. We will refer to an E-field in this manual as an "Open Circuit Signal".
The open circuit signal radiates from wires and passes through non conductive material such as dry carpet, plastic panels or plastic molding. The receiver is used to detect these signals so you can trace and locate the open or break in the circuit.
(See "Locking the Sensitivity" pg. 14)

2. **Easily Shielded by Conductive Materials**
The open circuit signal is however easily shielded by conductive materials such as metal, wet carpet, neighboring wires in a harness and even your hand. This means that if conductive materials are between the transmitting wire and the receiver, the open circuit signal will not penetrate through and therefore not be detected by the receiver. So it is necessary to be aware of possible shielding issues and try to avoid them as much as possible.

A great alternative to the receiver in detecting open circuit signals is to use the Power Probe III, IV, or Hook by direct contact.
(see "Verify an Open Circuit" pg. 23)





3. Signal Capacitive Coupling to Parallel Floating Circuits
Another characteristic of the open circuit signal is that it will capacitive couple to parallel floating circuits. (See: “Bench Tracing a Wire Harness” pg. 24)

4. Travels to ALL Open Ends
In Fig. 1 we are injecting an open circuit signal into a parallel circuit that has three wires. Two of those wires lead to open switches and the other leads to the open/break. As you can see the open circuit signal travels to all open ends. This makes it necessary to isolate the problem circuit away from the others.

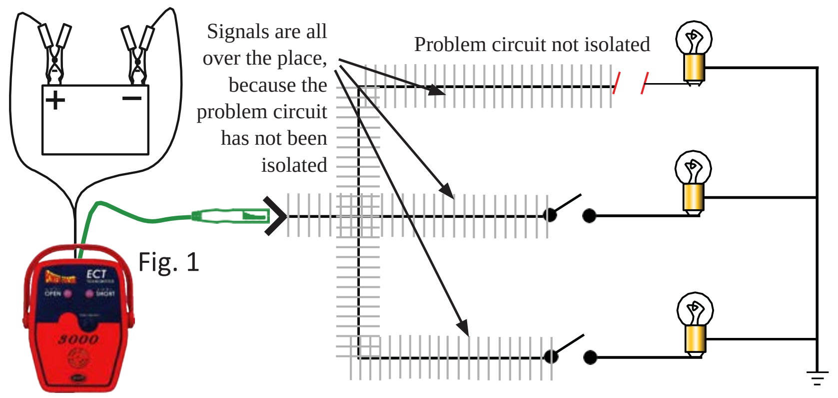


Fig. 1

5. Can only be present in a circuit when there is a resistance greater than 100 ohms
(See: Open Circuit Signal vs Grounded Circuit Signal” pg. 22)

6. Has NO Polarity
The open circuit signal does not have a polarity therefore the ECT receiver gives no direction indication as to a break in the wire. You will need to logically reason the direction of the break in the circuit and then continue to trace it.

7. 8 Volt amplitude and 4 kilo-Hertz signal
The 4 Kilo-Hertz signal of the open circuit signal can be detected by the receiver. (See: “Locking the Sensitivity for Open Circuits” pg. 14) You can also use the Power Probe III, or Power probe IV for open circuit signal detection by direct contact. (See: “Verify an Open Circuit” pg. 23)

The ECT3000 Receiver

The receiver is designed to detect the “Grounded Circuit signals” and the open circuit signals from the transmitter.

Auto shut-off feature
The receiver will automatically shut-off within 10 minutes when it is NOT receiving a signal.

The “Open & Short Pick-Up” located on the side of the receiver housing is to sense and detect complete and open circuit signals.

The “Power On/Off / Sense High Button performs three functions:
1. It turns the receiver ON and enters “pulse mode” (see “Pulse Mode” pg. 12)
2. It increases the receiver signal sensitivity. (greater distance range)
3. Turns off the receiver

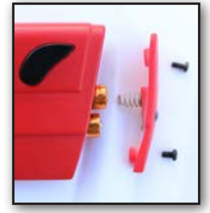
The “Sense Lock / Sense Low Button performs two functions:
1. It locks the receiver to the Open or Shorted circuit signal.
2. It turns receiver signal sensitivity down. (tighter distance range)

The “Wire Harness Probe” is for probing a harness to detect the open circuit signal. (See “Tracing Circuits that are Shielded” pg.21)

The “Direction to Short/ Ground” indicators point you in the direction to the short or ground of the complete circuit. (See “Direction to the Short Circuit” pg. 15)

The “Open Circuit” LED on the housing indicates when it is receiving an open circuit signal.

Battery Installation

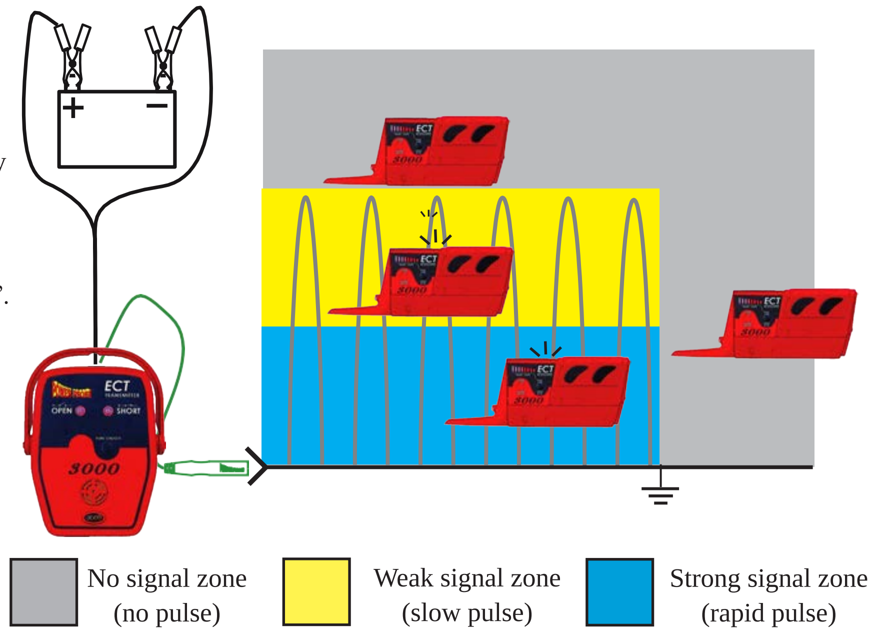


1. To install the batteries, carefully remove two battery covers screws, remove the battery cover on the bottom of the receiver housing and insert (2) AAA batteries into the battery compartment. Be sure the polarity of the batteries are correct then replace the battery cover.

Testing the SMART Receiver

To test the ECT receiver, connect the ECT transmitter to the vehicle's battery, turn on the receiver by pressing the "Power On/Off / Sense High" button. Place the "Open & Short Pick-Up" of the receiver on top of the green signal lead. The receiver should detect the open circuit signal and indicate this by the open circuit LED indicator flashing and pulsing a beeping tone.

To test the receiver for the "Short/Grounded Circuit signal" connect the green signal lead to the negative post of the battery. Then you can test the Grounded Circuit signal by placing the "Open & Short Pick-Up" of the receiver parallel to the green signal lead. The receiver should detect the "Grounded Circuit signal" and show the direction to ground by the "Direction to Short or Ground" indicators.



Pulse Mode

When you first turn on the receiver it enters into "Pulse Mode". "Pulse Mode" is great for the initial detection of the transmitting signal. You can also get a feel for the strength of the transmitting signal.

As you place the "Open and Short Pick-Up" near a transmitting signal, an LED indicator will blink repeatedly along with an audible beep.

When the Receiver is in "pulse mode":

1. It detects both "grounded" and "open" circuit signals.
2. It picks up and determines strong from weak signals by the pulse frequency rate.
3. The sensitivity is ready to be locked in, by pressing the "Sense Lock / Sense Low" button.
4. It detects and displays the direction to ground or a short circuit.

While in "pulse mode" and then pressing the "Sense Lock / Sense Low" button, the receiver's sensitivity will now be locked and no longer be in "Pulse Mode".

The Receiver's Reception Sensitivity:

When the receiver is in "pulse mode" you can lower it progressively closer to the transmitting signal and hear the increase in the pulse frequency as it passes each of the 8 sensitivity levels. The fastest pulse frequency is when you are nearest to the transmitting signal. Once you press the "Sense Lock / Sense Low" button the reception sensitivity is locked into that distance (plus/minus a couple of inches) from the transmitting circuit.

In order to lock the reception sensitivity of the receiver, two conditions must be met.

1. The receiver must be in "Pulse Mode".
2. The receiver must be receiving a signal

When these two conditions are met, you can now press the "Sense Lock / Sense Low" button to lock the distance of the receiver and reception sensitivity.

Adjusting the receiver's sensitivity:

Pressing either the "Sense High' or "Sense Low" buttons on the receiver will either increase or decrease the receiver's sensitivity distance. The "Sense Level" LED bar graph display indicates the set sensitivity range. Eight LEDs lit means the most signal range and will pickup signals up to approx. 8 inches. One LED lit means the least signal range, approx. 1 inch. This can be changed at any time after the intitial signal lock, and can be used to approximate the distance from the receiver that the problem wire is. This feature can also be used to increase and decrease the signal tolerance as you trace a circuit through a vehicle. You may have to increase range to read through a larger obstacle, while a tighter range will allow you to follow individual wires or circuits more accurately.

Locking the Sensitivity for Short/Grounded Circuits

To lock the receiver's sensitivity for short/grounded circuits, it must be turned on and in "pulse mode". Hold the "Open & Short Pick-Up" of the receiver parallel and as near to the wire as you can while achieving the most rapid pulse rate. (See: Fig. A) Now press the "Sense Lock/Sense Low button". The receiver is now locked into the strong "Grounded Circuit signal" and will ignore weaker parallel circuit signals. If you need to readjust the receiver's sensitivity so that it will pick up weaker circuit signals and be more sensitive, press the "Power On/Off / Sense High" button to return to increase sensitivity.

Locking the Sensitivity for Open Circuits

To adjust the receiver so that it is at its most sensitive setting in open circuit tracing. First turn on the receiver. It is now in "pulse mode". Hold it as close to the open circuit as you can while receiving the most rapid pulse frequency.
Now lift the receiver about 4 inches away from the circuit and press the "Sense Lock/Sense Low" button. (See: Fig. B) At this level you should be able to pick up the open circuit signal in that circuit and eliminate other signals that could be capacitive coupling into neighboring floating circuits and causing you problems.
If you need to adjust the receiver so that the reception sensitivity is more sensitive, press the "Power On/Off / Sense High" button or the "Sense Lock/Sense Low" button to adjust sensitivity up or down. Adjust until you achieve the proper setting for your application.

Fig. A

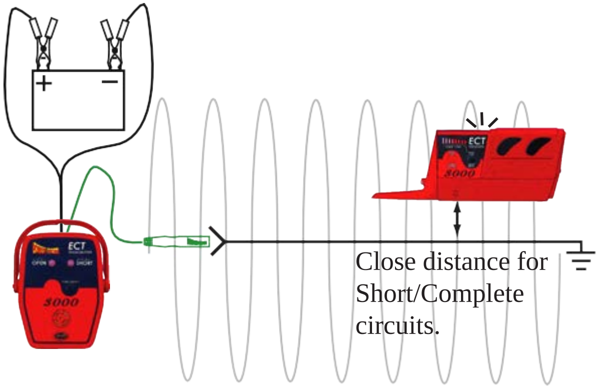
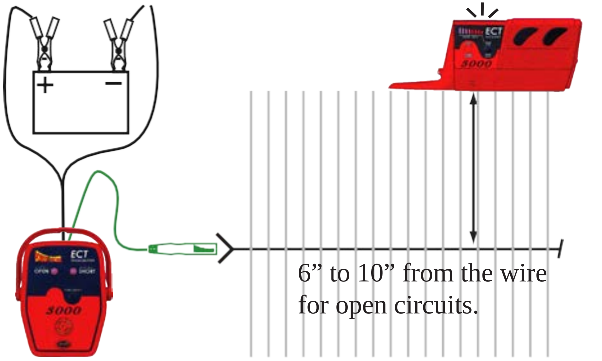


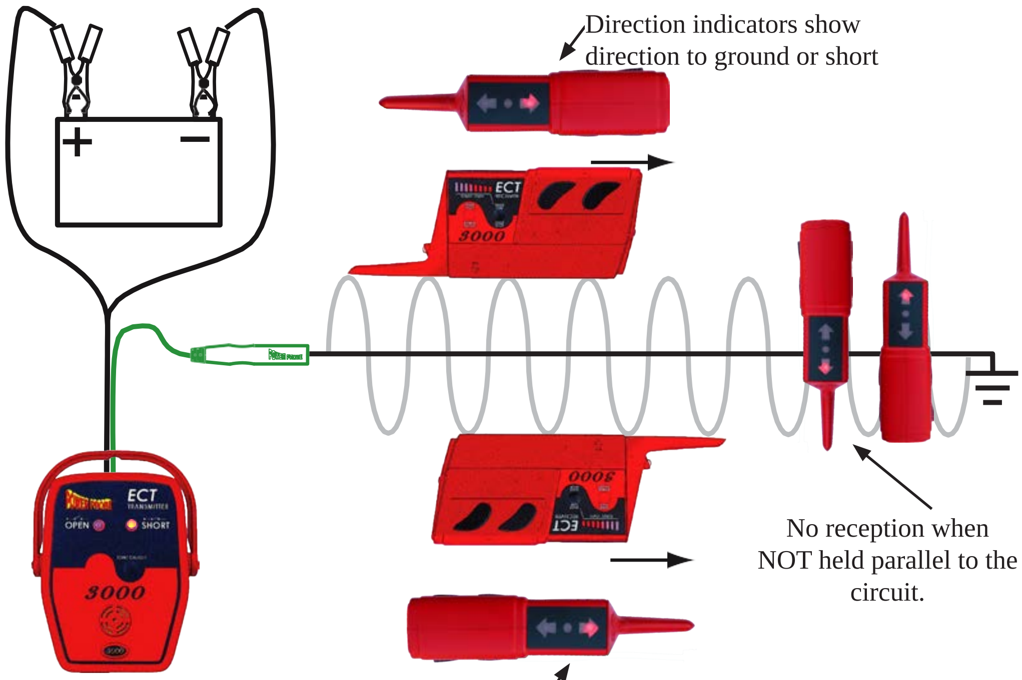
Fig. B



Direction to the Short

The Short/Grounded Circuit signal is polarized. This gives the receiver the information it needs to show you the direction to the short or the direction to ground. When you place the receiver's
"Open & Short Pick-Up" parallel to the wire of the Grounded Circuit signal, "Direction to Short/Ground" indicator will point you in the direction to ground. If you were to flip the receiver in the opposite direction it will detect the polarity change, the "Direction to Short/Ground" indicator will flip, and it will still point you in the direction to ground. Keep in mind that the receiver's "Open & Short Pick-Up" must be held parallel to the circuit for the "Direction to Short/Ground" to indicate.

The ECT3000 works equally well with either positive chassis ground or negative chassis ground. The only thing you need to keep in mind is, when tracing short circuits the receiver always points you towards the minus of the battery so if you have a short between your wiring and the chassis is a positive ground system, you just need to trace in the opposite direction the LED is pointing!



How to Use the Adapters in Diagnosing Circuits

Connection Accessories:

Included in the ECT3000 are the following connection accessories.

- Alligator Clip: for connecting onto any conductor such as a wire or a terminal.
- Blade Probe: for tapping into fuse socket terminals and connectors.
- Back Probe: for back probing connectors.
- Piercing Probe: for tapping into wires by piercing through the insulation.
- Light Bulb Socket Adapters: 3 common types for connecting easily to light bulb socket terminals. There are times when the short or open tail or brake light circuit is located nearer to the bulb socket. It is here where you may find it much easier to diagnose the circuit by injecting a signal into the light socket directly.
- Universal Wire Adapter: for making your own custom connector.

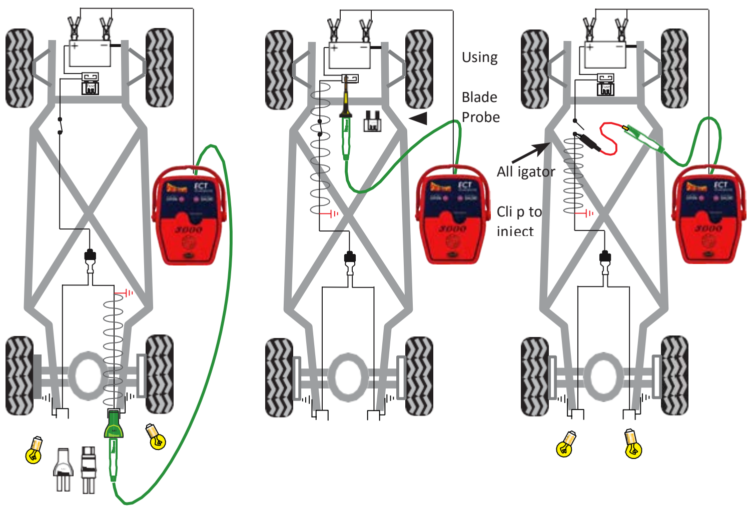


Fig.1 There are times when a short or open circuit is located closer to the tail light or brake light circuit. It is here where you may find it much easier to diagnose the circuit by injecting a signal into the light socket directly. The bulb socket adapters provide a quick and easy way to connect to bulb socket terminals.

Fig.2 Other times it maybe necessary to inject the signal at the fuse panel using the flat blade adapter.

Fig.3 Using the alligator clip adapter on an already exposed wire or the piercing probe are other options.

How to Trace Out a Short Circuit to Chassis Ground

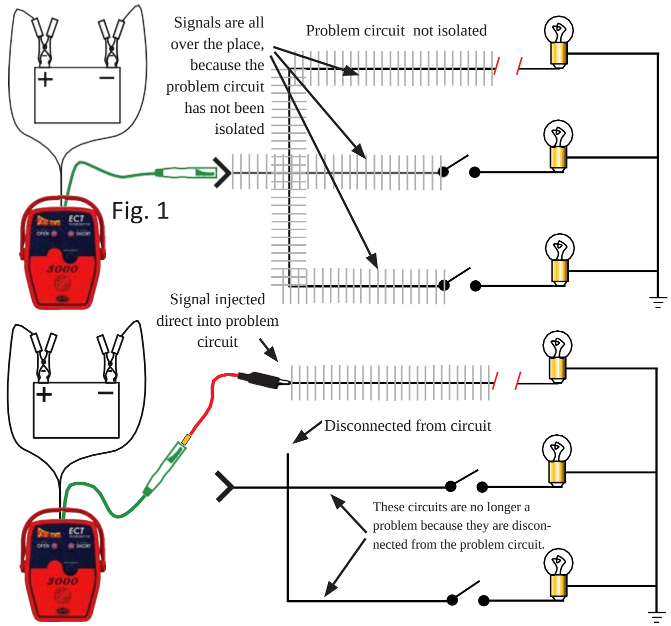
A direct short to chassis ground that blows a fuse, is one of the simplest circuits to trace for one simple reason. The majority of the “Grounded Circuit Signal” travels THROUGH THE SHORT CIRCUIT TO CHASSIS GROUND making it easy to trace. This sometimes eliminates the need for isolating the circuit.

1. Remove the blown fuse
2. Connect the transmitter’s “power lead” to the vehicles battery
3. Connect the “signal lead” to the shorted terminal of the fuse panel using the Blade probe.
4. Turn on the receiver. It will be in “pulse mode”.
5. Place the “Open & Short Pick-Up” about 2” from the wire harness and parallel to the shorted wire until the “Direction to Short or Ground” indicator beeps rapidly.
6. Press the “Sense Lock/Sense Low” button.
7. Trace the circuit in the direction of the indicator until you loose the signal.
8. If you reach an obstacle remove it or work through it. Remember to ISOLATE THE CIRCUIT YOU ARE TRACING. Inspect the circuit and verify the short. (See: “Verify a short circuit to ground” pg. 18)
9. Isolate the short circuit you are tracing and reconnect the “signal lead directly to the new found part of the shorted wire. (See: “Isolate the Circuit you are Tracing” pg. 18)
10. Continue to follow the signal until you loose it.
11. Inspect the circuit and verify the short.
12. Repeat steps 7 through 10 until you find the cause of the short circuit.
13. Once you fix the short, reconnect all the sections of the circuit you had disconnected earlier.

Isolate the Circuit You are Tracing

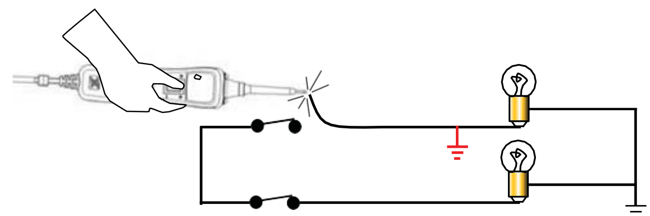
Isolating the circuit you want to trace is absolutely necessary when using “Open Circuit Signals”. It is always good to disconnect the circuit you are tracing away from other parallel circuits. Once you isolate the troubled circuit, you can then connect the transmitter’s signal lead exclusively to your selected circuit. Connecting exclusively to your ISOLATED circuit insures that the SIGNAL is confined in just that one single circuit. The signal strength remains constant throughout the isolated circuit. This makes the circuit easier to trace. You also eliminate confusion of the signal branching off to other areas that will lead you astray. When you are finished diagnosing, don’t forget to reconnect the isolated circuit.

Isolating a short/grounded circuit is best done by removing the loads in the circuit. This accomplishes two things: 1. It assures that 100% of the signal is being transmitted down the wire you are tracing, 2. if the circuit goes intermittent, the transmitter will alert you. (See: “Circuit Wiggle & Flex Test” pg. 26



Verify a Short Circuit to Ground

One of the best tools for verifying a short circuit to ground is the Power Probe 1, 2, or 3. To verify a short circuit connect the Power Probe to the circuit and press the power switch forward. If the Power Probe’s circuit breaker trips, you have verified the short.



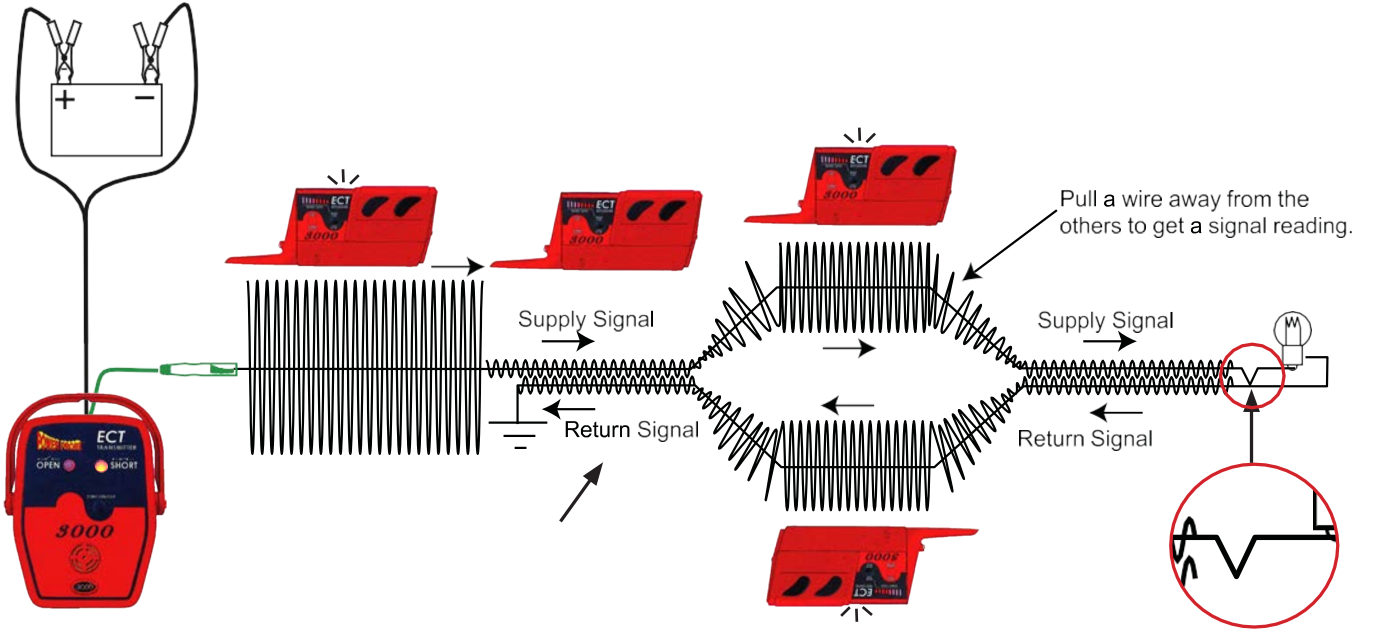
IMPORTANT

Be careful not to power up circuits that are connected to the vehicles onboard computer. You may have to unplug the computer or electronic modules when performing short circuit verification on electronic systems.

Short Circuit Inside a Wire Harness

A common occurrence inside of wiring harnesses is that there are two wires running close and parallel to each other. One wire is the positive wire that flows one way and the ground wire that flows back the opposite direction. When the signal source runs closely parallel to the signal return, as in this case, they cancel each other and the signal strength is considerably reduced.

You can pull one wire at a time away from the other wires, creating some distance between them. As you hold the wire away from the other wires, the signal canceling effect is removed in that area and the signal strength will increase in the wire. You can now get a reading off of the wire with the receiver by holding it parallel to the receiver's pick-up area. Take note of the directional indicator of the receiver. Check for the other wire that indicates the opposite direction. You can now assume that both wires are in the same circuit. Trace both wires as a pair along the harness until you find the problem. (see illustration)



Reception Distance and What that Means.

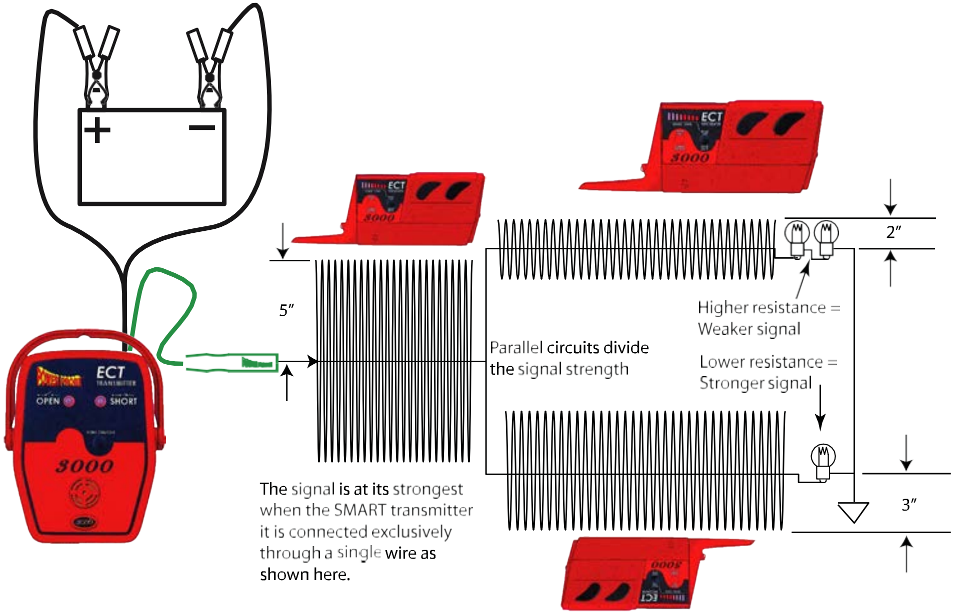
When tracing parallel circuits, you can determine if a one wire has a stronger "Grounded Circuit signal" present over another wire. The wire that has a stronger signal carries a larger current. This means the circuit that has the stronger signal also has a lower resistance compared to the other parallel branch. Just knowing this information can come in handy when determining the fault of a circuit.

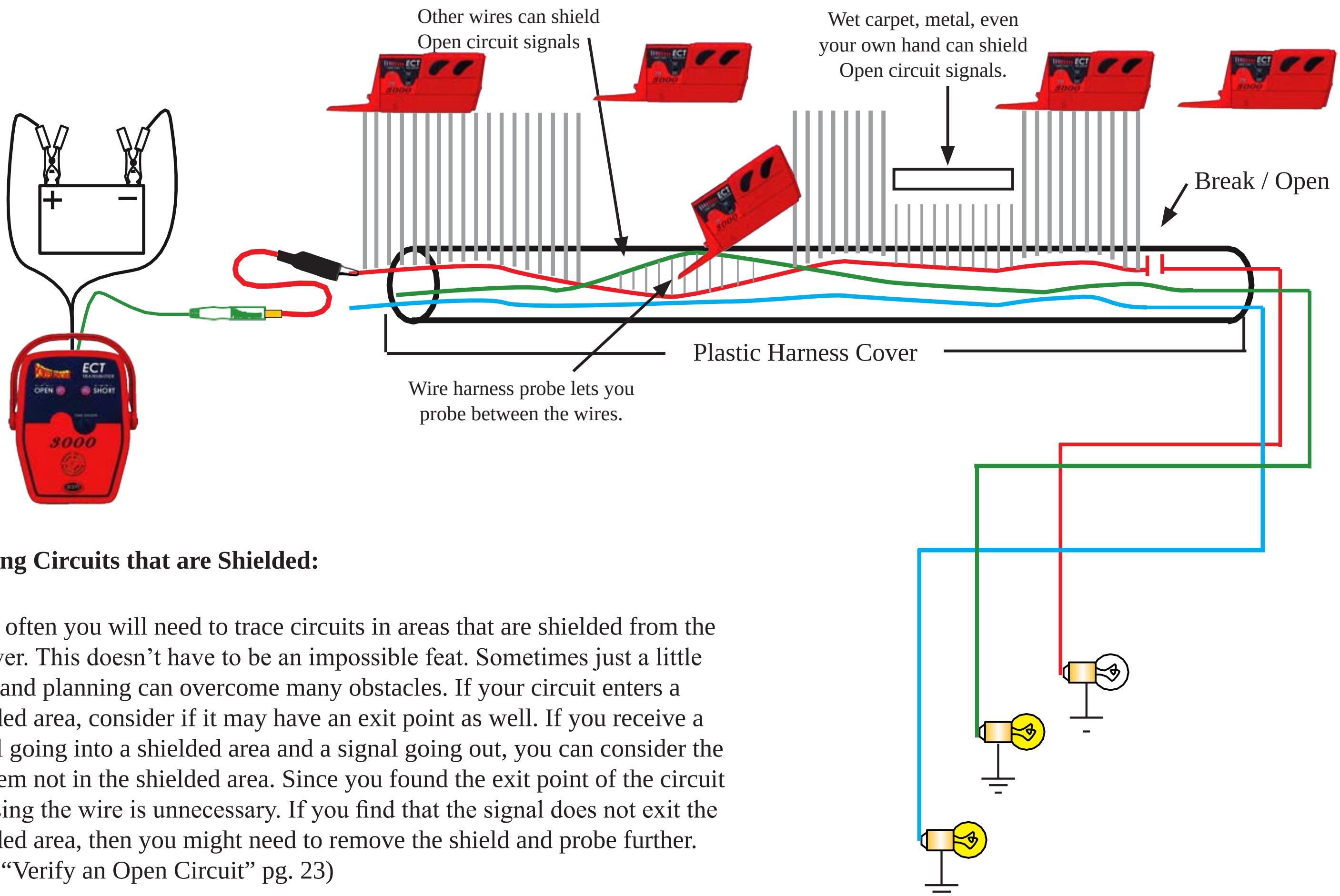
Once the receiver is locked into the Short/Grounded Circuit signal, (see "Locking the sensitivity of short/grounded circuits") note the distance of the pick-up area to the wire as you slowly lower it down near to the wire. For example, you will notice the receiver's indicator comes on about 2 inches with one wire and 3 inches with the other wire. The wire that makes the receiver come on 3 inches away is transmitting a stronger signal than the circuit that makes the receiver come on only 2 inches away.

That's important to know so you can understand and determine which wire has a stronger signal.

This is why it is always recommended to isolate your troubled circuit. Isolating your circuit insures that you are following the correct circuit and it avoids confusion with other parallel wires or circuits.

(See "Isolating the Circuit"pg. 18)





Tracing Circuits that are Shielded:

Quite often you will need to trace circuits in areas that are shielded from the receiver. This doesn't have to be an impossible feat. Sometimes just a little logic and planning can overcome many obstacles. If your circuit enters a shielded area, consider if it may have an exit point as well. If you receive a signal going into a shielded area and a signal going out, you can consider the problem not in the shielded area. Since you found the exit point of the circuit exposing the wire is unnecessary. If you find that the signal does not exit the shielded area, then you might need to remove the shield and probe further. (See: "Verify an Open Circuit" pg. 23)

Open Circuit Signal vs Grounded Circuit Signal

Open circuit signals can only be present in a circuit when there is a resistance of about 100 ohms or greater. (Figure A)
If a switch was to close in this circuit, (Figure B) the open circuit signals would cease to emit and the short/ Grounded Circuit signal would replace it. The transmitter will also sound a tone that tells you that the circuit has just made contact with ground. (Tip: Wiggling and pulling wires that have an open circuit signal on them can lead you to the problem. This is done by the transmitter alerting you if the circuit you are pulling on makes contact to a grounded circuit.)
(See: “Circuit Wiggle & Flex Test” pg. 26)
The point here is that Short/Grounded Circuit signals take priority over open circuit signals. So be sure your open circuit that you are tracing does not have any kind of continuity to ground present.

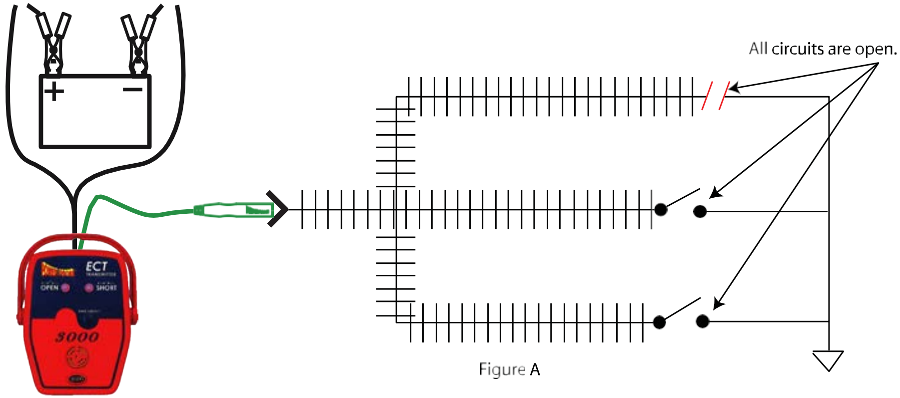


Figure A

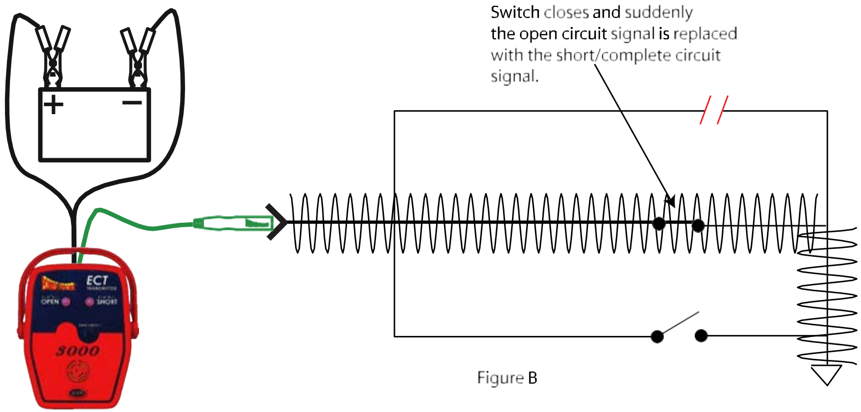


Figure B

How to Trace out an Open Circuit:

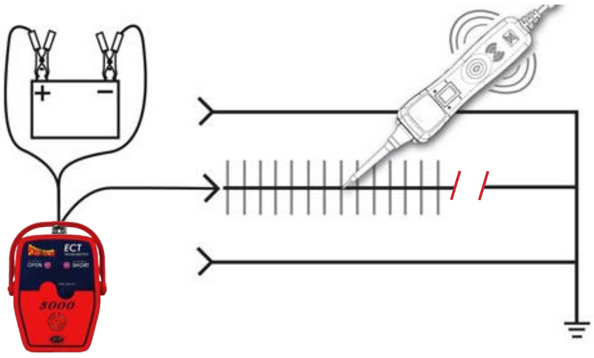
An open circuit does not complete a path to ground. The cause for an open circuit can vary from an open switch, unplugged connector, bad connections and breaks in wires.

1. Connect the transmitter's power lead to the vehicle's battery.
2. Connect the SMART transmitter's signal lead to the open circuit.
3. Turn on the receiver. It will be in "pulse mode".
4. Place the "Open & Short Pick-Up" near and parallel to the open wire until the "Open Circuit" LED indicator blinks and beeps. (be careful to hold the receiver from the outer edge to prevent your hand from shielding the signal)
5. Lift receiver away from the open circuit so that the pulse of the "Open Circuit" indicator slows down but doesn't stop completely.
6. Press the "Sense Lock/Sense Low" button.
7. Hold the receiver near to the open circuit and while the "Open Circuit" indicator is ON steady, follow the path of the circuit or wire until you lose the signal.
8. If you reach an obstacle, remove it or work through it. Remember to ISOLATE THE CIRCUIT YOU ARE TRACING. Inspect the circuit and verify the open circuit. (See" "Verify an Open Circuit" below.)
9. Continue Steps 7-8 until you find the open or break in the circuit.

Verify an Open Circuit:

One of the best methods for verifying an open circuit is using a Power Probe circuit tester together with the transmitter. Since the transmitter's open circuit signal delivers 8 volts and a 4 kHz signal, it can be easily detected by directly contacting the Power Probe III or IVto the wire of the transmitting circuit.

Contact the probe of the Power Probe III or IV to the open circuit with the open circuit signal applied to it. You should hear the 4 kHz tone from the Power Probe III speaker. If you don't hear the 4 kHz tone, inspect the circuit closer to determine why. If you hear the 4 kHz tone, you are on the correct circuit.Testing the open circuit with transmitter together with the Power Probe III has advantages over just a continuity test. This is because the transmitter's toggle tone feature will alert you if the open circuit makes contact with an intermittent grounded circuit.



(See: "Circuit Wiggle & Flex Test" pg. 26)

Bench Tracing a Wire Harness

There are cases where you may have a wire harness removed from the vehicle, sitting on the bench, and tracing an open circuit. Wire harnesses that are removed from the vehicle's electrical system have only floating wires in them. The open connectors of the harness are connected neither to positive nor negative therefore all of the harness's circuits are open and floating. It is important to be aware that the open circuit signal will capacitive couple into floating circuits that run parallel and next to the transmitting signal wire. (See Figure A). Floating circuits that couple the open circuit signal also transmit the signal too and will even couple back to the wire you want to trace. This prevents the receiver from locating the break in the wire because all the wires are transmitting signals. You can be easily led down the wrong circuit if you are not aware of this.
To correct this problem, you need to tie all parallel floating open circuits to either ground or a positive voltage (see Figure B).
All neighboring wires and circuits must have some potential of ground or positive on them to prevent capacitive coupling from occurring.

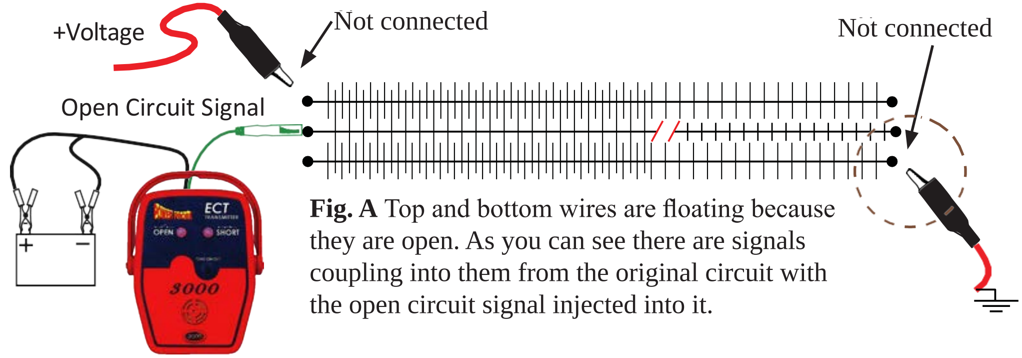


Fig. A Top and bottom wires are floating because they are open. As you can see there are signals coupling into them from the original circuit with the open circuit signal injected into it.

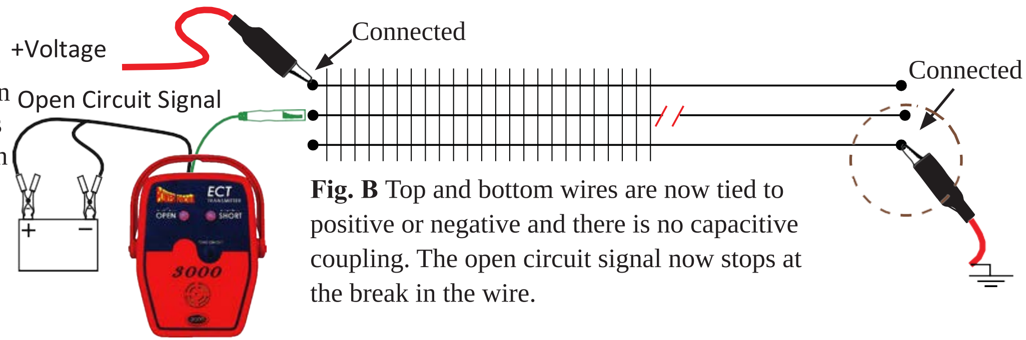
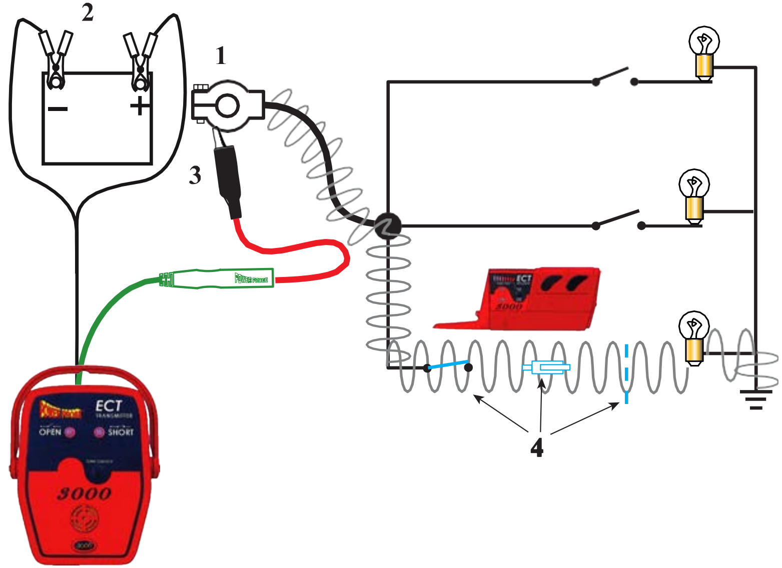


Fig. B Top and bottom wires are now tied to positive or negative and there is no capacitive coupling. The open circuit signal now stops at the break in the wire.

It is recommended to trace OPEN circuits while the IGNITION is turned ON. This will supply a positive voltage on certain circuits that can potentially capacitive couple. It is also a good idea to keep all of the vehicle's electrical loads (light bulbs, relays, motors, etc.) CONNECTED while tracing OPEN circuits. This keeps certain neighboring circuits grounded, which also prevents them from capacitive coupling.

Tracing out Battery Drains or Current Draw



When you have a battery or current draw that is drawing enough current to drain the battery over night or a couple of days, you have a condition that the ECT3000 can assist you in. In cases like this you can inject a signal into the main positive battery cable after removing it from the positive battery post. Now you can follow the signal along its path and look for the possible cause of the battery drain.

Tracing battery drains are a little different than tracing a short or open circuit. When you are tracing battery drains you are not looking for a loss of signal, you are simply following the circuit path and unplugging wires and components along the way to give you clues to the problem.

To trace battery drains and get nearer to the location of the current draw:

1. Disconnect the positive terminal from the vehicle's battery. (You will need to consult your vehicle's owner manual for proper battery disconnecting instruction. Some vehicles require that voltage potential be maintained at all times on certain components for instance, radios, onboard computers, memory, CPUs, etc.)
2. Connect the transmitter's 20ft power lead to the positive and negative post of the battery.
3. Connect the signal lead to the disconnected positive terminal. Trace the circuit that is transmitting the strong signal with the receiver. (The directional indicators only show you the direction to ground. It will not stop at the fault.)
4. Disconnect the wire and components along the circuit path to narrow down the cause of the current draw.

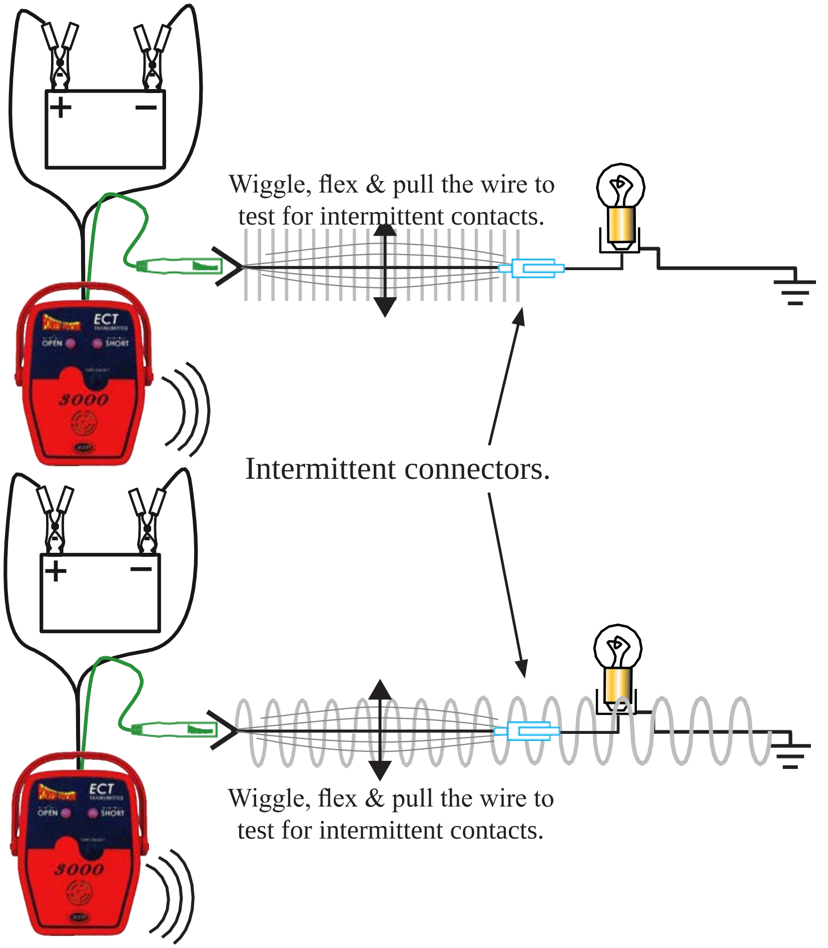
Circuit Wiggle & Flex Test

At times it's necessary to check for intermittent connection problems. The circuit wiggle test allows you to wiggle, twist, pull, push and flex wires or connectors and observe a circuit change. The transmitter monitors the condition of the circuit and alerts you to a change.

For instance, if you are injecting an open circuit signal into an open circuit and you wiggle the wires, it might make contact inside of a broken wire or a loose connector. The transmitter will sound off at the instant the open circuit makes contact with a connection or ground. At this point you can keep flexing and wiggling the wire to locate the problem.

If you are injecting an isolated Grounded Circuit and the wires you wiggle causes it to loose contact, it will instantly sound-off, alerting you to the fact that the circuit has lost its connection to ground.

As the transmitter is sounding, you can press the "Tone On/Off" button and the tone will toggle off. When you toggle it off, as it is alerting you to an open circuit, it now silently monitors the open circuit until it makes contact with ground again.



Index

TRANSMITTER

Min Operating Voltage: 6 VDC
Max Operating Voltage: 48 VDC
Working Current: <200mA
Working Frequency: 4KHz
Max Operating Temp: 50°C
Max Storage Temp: 70°C
Max Operating Relative humidity: 80% (Non-condensation)
Max Storage Relative humidity: 80% (Non-condensation)
Altitude: <2000m

RECEIVER

Power Supply: 2 X 1.5V AAA
Working Current: When not signal be detected <15mA
Power Consumption When Power Off: <10uA
Max Operating Temp: 50°C
Max Storage Temp: 70°C
Max Operating Relative humidity: 80% (Non-condensation)
Max Storage Relative humidity: 80% (Non-condensation)
Altitude: <2000m