ELECTROM INSTRUMENTS

GDL-201
GROUND FAULT DETECTOR / LOCATOR
OPERATIONS MANUAL

OPERATIONS MANUAL
CABLE TRACER
ELECTROM MODEL GDL-201

I. GENERAL INFORMATION

This operation manual provides information on the principal of operation, assembly, and basic uses of the GDL-201 cable tracer/short locator.

II. SAFETY

The GDL-201 operates on a 9-volt transistor battery and does not pose any personal danger to the user by coming in contact with the leads. The GDL-201 must not be connected to energized lines as this will damage the transmitter.

III. DESCRIPTION AND FUNCTION

The Electrom Cable Tracer Model GDL-201 is comprised of two components, a low voltage, low frequency audio transmitter which sends a signal along the cables to be traced, and a hand-held receiver with headphones to follow the signal the length of the cables being traced.

When the transmitter leads are connected to two cable leads it will generate a signal, providing there is a circuit through either a load or resistive short between the two cables. If an open cable exists, the transmitter will not generate a signal ot follow unless the open option is used. The open option amplifies the GDL signal to create a broadcast antenna of the open wire. When the receiver reaches the open, the signal will disappear.

IV. COMPONENT ASSEMBLY

Remove test leads from the case and plug into transmitter output jack. Connect both lead clips together. Remove and assemble the two silver probes, then insert into “toggle switch” end of receiver handle. Assembly is complete when the headphone plug is inserted into “label” end of handle.

V. OPERATION CHECK

With the component assembly complete, move the receiver toggle switch to the ON position and place the rubber probe tip against the transmitter leads. Increase the sensitivity level until a strong signal is heard on the headphones. If no signal is heard, the batteries of each unit should be replaced. There is on 9 volt transistor battery for the transmitter and one for the receiver. (The GDL-201 uses only alkaline batteries.)

VI. USE OF THE GDL-201 CABLE TRACER / SHORT LOCATOR

A. Disconnect line voltage from the cables to be traced.

B. Connect the transmitter test leads to the two cables.

C. Check for a signal at the test leads; this indicates a circuit to trace.

D. Set the frequency adjustment on the transmitter for one of the four different tones for easy recognition.

E. Follow the signal along the cable to the load or short to the second cable.

F. Repair or eliminate any faults as they are identified before attempting to locate the next problem.

VII. USE OF THE CABLE / TRACER / OPEN OPTION

A. Specific Conditions

1. De-energize the cables to be traced.
2. With the open option, the GDL will locate an open in single or multiple conductor unshielded cable.
3. A low resistance Earth Ground is of utmost importance.

B. Procedures

1. Remove the receiver probe with rubber tip from the extension and install the open option probe which is located in the lower left corner of the case lid.

2. With the ¼ inch phone plug, connect the open cable module to the transmitter.

3. Connect the ¼ inch phone plug form the test leads to the open cable module.

4. Connect one test lead to one end of the cable being traced.

5. Connect all wires at the opposite end to ground including the conductor wire being traced.

6. Connect the other test lead to ground.

7. Check for a signal at the test lead connected to the cable being traced.

8. Follow the signal along the cable until it disappears. The signal will disappear at the open. If the signal continues the length of the cable, an open is not present.

9. Follow the same procedure with each conductor in the cable.

10. If no open is found, check the earth ground. EARTH GROUND IS VERY IMPORTANT.

VIII. LOCATION OF RESISTIVE FAULTS TO GROUND

Connect the transmitter test leads tot the cable and to earth ground, then use the same procedure as in Section VI to follow the signal through the resistive or solid fault to ground.

IX. USE OF THE GDL-201 ON ENERGIZED DC CONTROL CABLES

The GDL-201 can be used on energized DC cables under 1000 volts, to trace, or detect and locate resistive paths to ground. Both cable tracing and fault location are accomplished in the same manner as on dead cables.

For more information on DC ground fault locating, call or write:

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OPERATIONS MANUAL
GDL-201 GROUND DETECTOR / LOCATOR

I. PRINCIPALS OF OPERATION

The GDL-201 is designed to assist in the detection and location of ground faults or shorts on energized DC systems. This is accomplished through the use of two components, a transmitter which generates an audio frequency (AF), low current signal, and a receiver with headphones which tracks that signal as it travels along the cable through a completed circuit and back to the transmitter.

A. AUDIO FREQUENCY OSCILLATOR

The signal is generated by a 9 volt battery which energizes the transmitter when the leads are plugged into the ¼" phone jack (figure 1).

Figure 1 - Transmitter

Leads should be removed when not in use to maximize battery life.

Once plugged in, the transmitter will not generate a signal until the two leads are connected together (figure 2).

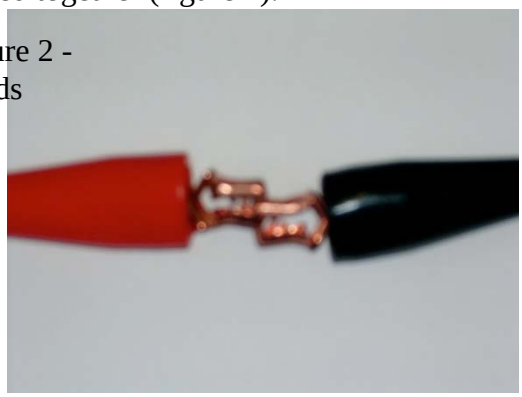


Figure 2 - Leads

This creates a circuit (dead-short) and starts the signal oscillator. The transmitter will operate on DC systems to 1000 volts but is not designed to operate on AC energized circuits. NEVER CONNECT THE TRANSMITTER TO AN ENERGIZED AC LINE. The AF signal is carried by a very low current to protect most relay systems and still send the signal hundreds of yards wiht0out noticeable attenuation. When a resistance (R) completes the ciruit between the two test leads, the signal will diminish proportionately to the R value and is still audible at 5000 Ohms. The transmitter frequency can be varied from 350 Hz to 1550 Hz. The low frequency is best used where capacitive coupling is apparent. IE., twisted pairs in common ducts or conduit. Adjust frequency for application by turning the frequency adjustment knob to one of four positions (figure 3).

Figure 3

B. AUDIO FREQUENCY RECEIVER

A nine volt transistor battery also powers the receiver and is controlled by a toggle switch on the handle just above the sensitivity (volume) control (figure 4).

Figure 4

The sensitivity control will compensate for the variable resistances on the transmitter circuit. The non-metallic probe with rubber tip is “operator safe” in energized applications, and the headphones make the signal easily heard in loud environments. AC fields such as transformers, motors, etc., may cause a 60 cycle “hum” that will break the frequency band of the receiver and should be avoided when possible.

II. COMPONENT ASSEMBLY

The GDL-201 comes in a portable carrying case to protect the components.

A. Plug the lead set into the trasmitter jack (this turns the trasmitter on) and connect leads clips together.

B. Remove black receiver handle and two silver probe sections from the case. Connect both probe sections together with a “twist” (figure 5). Insert assembled probe in “toggle switch” end of handle and insert headphone jack into the opposite end. Move toggle switch to “on” position.

Figure 5

C. Place receiver probe tip adjacent to the transmitter leads (figure 6), set receiver sensitivity to an acceptable volume level.

Figure 6

D. Four different dual tone frequencies can be produced by adjusting the transmitter frequency control.

E The transmitter battery is located on the left side of the transmitter box and is easily replaced by removing the old battery and inserting a new one. The receiver battery can be replaced by removing the battery cover on the back of the receiver. Replace batteries with “Long Life” alkaline 9 volt transistor type batteries.

III. APPLICATIONS

The GDL is a very versatile test instrument. The two basic concepts for which is was designed are highlighted below.

A. DE-ENERGIEZED CABLE TRACING AND IDENTIFYING

Cable tracing is accomplished by creating a completed circuit with the wires to be traced. The key is to have a completed circuit. After connecting transmitter leads to the wires being traced, a signal will be heard if there is a completed circuit. The receiver will trace the entire loop of the circuit.

B. ENERGIZED DC CABLES

Caution must always be used when working with energized cables, and the GDL-201 transmitter MUST NEVER BE CONNECTED TO AN ENERGIZED AC LINE!

DC ground faults begin with creepage of current from a circuit of one polarity to another, I.e. negative to positive. The conductor of this creepage is often earth grounds which could be metal enclosures, framework, trays, etc. Often several faults, sometimes referred to as “nuisance grounds”, are present on a circuit. When added together, these nuisance grounds can create a significant fault, thus each of these grounds must be cleared to resolve the problem.

IV. ANALYZING THE CIRCUIT UNDER TEST

Analyze the circuit under test. A print of the circuit is the best way to become familiar with the system. This will show the location of line conditioners, fault indicators and monitors which may interfere with the AF produced by the GDL-201.

A. LINE CONDITIONERS

Capacitors, commonly used as line conditioners, are often connected to shunt stray AC to ground as they will allow AC but not DC to pass to ground. The GDL-201 transmits an AC signal which sees the capacitor as a low resistance path to ground. Disconnection these line conditioners should not pose a problem when done for brief periods, and switches can be installed to allow quick disconnects.

B. FAULT INDICATORS AND MONITORS

One common fault indication method on DC circuits is use of an incandescent lamp between the positive or negative bus, and earth ground. The low resistance of the light bulb provides a direct path to ground for the transmitter signal. Simply removing the bulb will eliminate the ground. Another such fault indicator/mon9itor method is a meter connected between two 30,000 OHMS is beyond the sensitivity range of the instrument.

C. CAPACITTIVE COUPLING

When two or more wires are intertwined or braided together, the phenomenon known as capacitive coupling can and will transfer the AF signal from one wire to the next, even though they are not physically tied together. If the sigrnal transfers to another wire, the second wire must have more significant ground than the first. Current will seek the path of least resistance and any line that has a signal present must have path to ground or th signal would not have coupled to it. A common situation is unused cables being tied directly to ground on one or both ends. This is the “worst case” example of capacitive coupling. It may be necessary to disconnect these cables from ground during fault locating.

V. PROCEDURES FOR FAULT DETECTION

Connect one lead from the transmitter to a clean unpainted ground point. The remaining lead is then connected to the positive or negative battery bus. Hold the receiver probe next to either transmitter line. If a strong signal is not heard, move the test lead to the other battery bus. If a strong signal is present, note the receiver sensitivity setting.

AF SIGNAL ATTENUATION.

Once the transmitter leads are connected into the system and the signal volume is set in accordance with step II-C, remove both leads and clip them together (dead short). If the intensity of both signals are very similar, but the fault indicator showed only minimal grounding, this would indicate a line conditioner still in the circuit. If left in, much time could be spent tracking that very strong signal, only to find a capacitor to ground (see LINE CONDITIONERS in section IV-A). A very large difference between the two signals w2ould indicate a true ground fault situation as most grounds are not a dead short.

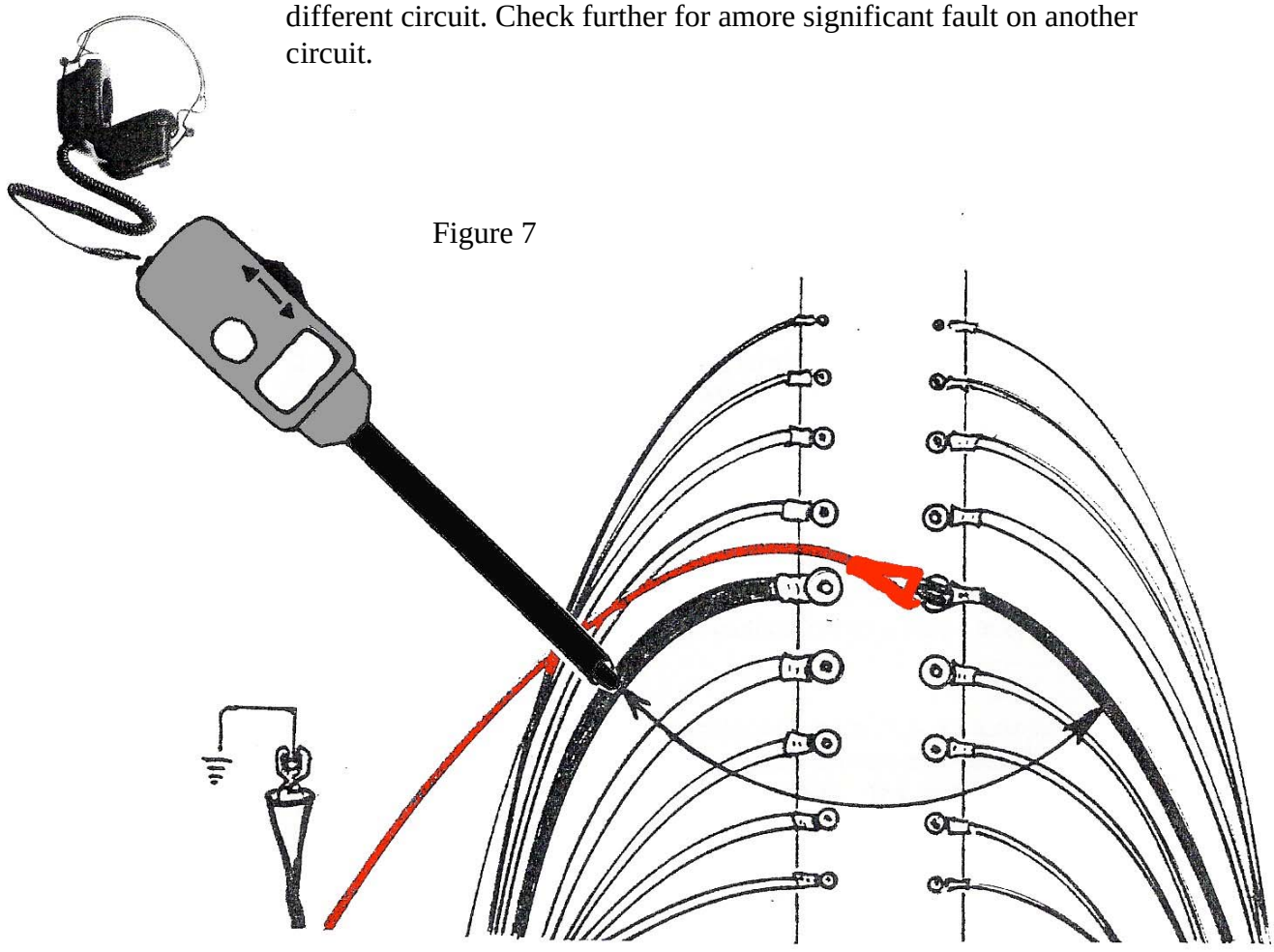
VI. GROUND FAULT LOCATING

Pinpointing the ground fault requires locating the circuit with the lowest R value fault. Signals may sound similar on two or more circuits, but the strongest signal should be followed first. Often the circuit cannot be disconnected and a procedure must be followed to find the right cables and locate the fault.

A. STARTING WITH ONE CIRCUIT

With the transmitter connected to earth ground and to the circuit with the loudest apparent signal, select a point 10 to 12 inches on either side of the test clip connection (figure 7). Determine which direction the signal seems to be traveling, I.e., toward the battery or toward the load. Moving the transmitter closer to the problem will help determine the direction of travel of the AF signal. If the signal appears the same on either side of the test clip, the ground fault may be located on a different circuit. Check further for amore significant fault on another circuit.

Figure 7



B. MAKING NOTE OF THE FINDINGS

At this stage a note pad and the circuit print would be helpful for locating the fault. The load is a convenient point at which to make the next test to determine on which line the fault is located. Move the transmitter to the suspected equipment. Connect one transmitter lead ot either side of the load. With the receiver, determine which direction the AF signal appears to be traveling. By process of elimination the fault can be located.

VII. COMMENTS AND TIPS

Success with the GDL is a combination of understanding the instrument and the circuits under test. Learn through experience with its use.

A. TRUST THE SIGNAL. Use the basic laws of electricity. The signal will not be on a line that doesn't lead to ground.

B. LOOK AT SUSPECTED PROBLEM AREAS FIRST. Save time by using the GDL-201 to assess known problem spots first.

C. TEST, CLEAN-UP, and ELIMINATE ONE CIRCUIT AT A TIME. The same rule applies here as in fixing a leaky roof – PATCH THE BIGGEST HOLE FIRST.

D. IGNORE STRAY AND NUISANCE GROUND SIGNALS. This is done by concentrating on the strongest AF signal only.

1. Nuisance Grounds. Seldom is there just one ground fault on an entire DC system. More frequently there are many small individual faults throughout the system. These "nuisance grounds" may not be a serious problem individually but can make locating significant faults difficult. The optimum time to eliminate nuisance faults is before a major fault occurs.

2. Stray Signals. The transmitter will sometimes produce stray or "ghost" audio frequency signals that are deflected off the steel cabinet and travel through the air. The receiver will detect these low intensity signals when the sensitivity control is set too high. The control should be set at a point where these are as faint as possible while still detecting the original signal.

E. FIND LOW RESISTANCE FAULTS FIRST. The low resistance faults are the most severe, but also the easiest to detect and locate. The receiver must be taken to the breaker panel or distribution block for circuit location by scanning each line at the connection and noting which circuit has the LOUDEST signal and in which direction the signal appears to be traveling.

F. ISOLATE THE CIRCUIT. IF interference form grounds on other circuits become too difficult to ignore, the fault may be easily located by isolating the circuit under test. This assures only one strong signal to follow to ground.

G. USE THE GDL-201 FREQUENTLY. Use the GDL-201 frequently on suspect equipment for early

H. TROUBLE SHOOTING THE GDL-201. Check the batteries in the transmitter and receiver first. Then follow these procedures before calling for service.

1. Quick check for receiver: With headset on and receiver assembled, hold probe adjacent to an energized fluorescent light. If receiver is operating, a 60 cycle hum will be heard.

2. When the 2 transmitter leads are connected together, a faint audible tone is emitted from the transmitter.

3. Make sure probes are firmly inserted (with a twist) into the proper end of the receiver handle. Also, make sure the test lead plug is firmly seated in the transmitter jack.

4. Check for loose connections in the transmitter and receiver.