

Instruction Manual
for
Cable Route Tracer
Catalog No. 656601

Read the entire manual before operating.

Antes de operar este producto lea este manual enteramente.

Megger.

Valley Forge Corporate Center
2621 Van Buren Avenue
Norristown, PA 19403 U.S.A.

www.megger.com

Cable Route Tracer Manual
Catalog No. 656601

Copyright © 1993 - 2003 by Megger. All rights reserved.

The information presented in this manual is believed to be adequate for the intended use of the product. If the product or its individual instruments are used for purposes other than those specified herein, confirmation of their validity and suitability must be obtained from Megger.

Table of Contents

1 INTRODUCTION.....	1
Receiving Instructions.....	1
General Information	1
2 SAFETY PRECAUTIONS.....	3
3 SPECIFICATIONS	5
4 DESCRIPTION	7
General.....	7
Function of the Controls:.....	9
Principles of Operation:	10
5 PRELIMINARY PROCEDURES.....	13
6 OPERATION	15
Peaking or Maximizing Technique.....	15
Nulling or Minimizing Technique:.....	18
Depth Measurement:.....	20
Locating Transformers, Splices, and Faults.....	23
Underground Transformers	23
T-Splices and Y-Splices.	23
Grounded Faults.....	23
Operating Suggestions and Cautions.	24
7 MAINTENANCE	27
8 TROUBLESHOOTING	29
9 WARRANTY AND REPAIRS:.....	31
WARRANTY	31
REPAIRS.....	31

List of Figures

Figure 1: Line Drawing of the Cable Route Tracer Cat. No. 656600.....	7
Figure 2: Line Drawing of the Control Panel.....	8
Figure 3: The Peaking or Maximizing Position	15
Figure 4: Peaking or Maximizing Technique viewed from above.....	16
Figure 5: Peaking or Maximizing Technique viewed from the side.....	17
Figure 6: Nulling or Minimizing Position.....	18
Figure 7: Nulling or Minimizing Technique viewed from above.....	19
Figure 8: Nulling or Minimizing Technique viewed from the side.....	19
Figure 9: Depth Measurement Positions of the Cable Route Tracer.	21
Figure 10: Nulling or Minimizing Technique for Depth Measurement, one side.....	21
Figure 11: Nulling or Minimizing Technique for Depth Measurement, opposite side.....	22
Figure 12: Depth Measurement by Surface Distance.	22
Figure 13: Battery Replacement in the Pistol-Grip Handle.....	27

1

INTRODUCTION

Receiving Instructions

Check the equipment received against the packing list to ensure that all materials are present. Notify Megger of any shortage. Telephone (610) 676-8500.

Examine the instrument for damage received in transit. If any damage is discovered, file a claim with the carrier at once and notify Megger giving a detailed description of the damage.

This instrument has been thoroughly tested and inspected to meet rigid specifications before being shipped. It is ready for use after it is unpacked and the headphones are assembled.

The complete instrument consists of the following items:

- Cable Route Tracer with battery.
- The headphones consisting of two earpieces with connection cord and headholder.

General Information

The Cable Route Tracer is an electronic instrument designed for locating tracing, and measuring the depth to ac energized underground power cables from the surface. The instrument can also be used to locate underground transformers, T-splices, Y-splices, and ground faults on unshielded cable. It is supplied as:

Catalog No. 656601 Cable Route Tracer with switchable 60 Hz filter.

The unit senses the magnitude and direction of the effective electromagnetic field generated by conductors carrying dc impulses or ac loads up to 1000 Hz. Therefore, these instruments operate on loaded 50 Hz and 60 Hz single-phase power cables. Three-phase ac power cables, dc power cables, cables surrounded by other 50 Hz or 60 Hz energized cables, and faulted cables can be traced by applying a distinctive audio frequency tone of 1000 Hz or less from a tone generator.

Megger.

2

SAFETY PRECAUTIONS

SAFETY IS THE RESPONSIBILITY OF THE USER

LA SEGURIDAD ES EL CARGO DEL OPERATOR

Since the Cable Route Tracer is used to trace cables which are energized with voltages that are hazardous and potentially lethal, all persons making or assisting in tests must use all practical safety precautions to prevent contact with energized conductors, terminals, or other equipment.

The Cable Route Tracer and recommended operating procedures have been designed with careful attention to safety. Megger has made formal safety reviews of the initial design and any subsequent changes. This procedure is followed for all new Megger products and covers areas in addition to those included in applicable ANSI standards. Regardless of these efforts, it is not possible to eliminate all hazards from electrical test equipment or to foresee every possible hazard which may occur. It is therefore essential that the user, in addition to following the safety rules in this manual, also carefully consider all safety aspects of the test before proceeding. Safety is the responsibility of the user.

Megger.

3

SPECIFICATIONS

Catalog No. 656601, Cable Route Tracer

FUNCTION:	This instrument is used to trace the route of underground cable or pipe when energized from an appropriate source, and to measure the depth below the tracing surface. It is also useful for locating underground transformers, T-splices, Y-splices, and grounded faults on unshielded cable.
TYPE:	Electromagnetic detector of ac voltage or dc impulses, with either peaking or null indications according to the orientation of a tracing coil.
INPUT SIGNALS:	a. Load-carrying 50 Hz or 60 Hz power line current at any voltage. b. Other impressed ac voltage up to 1000 Hz. c. Impulses generated from a capacitance discharge cable fault locator.
OUTPUT:	Audible and/or visual indication of relative input signal level.
SENSITIVITY:	Readily detects 1 ampere ac at a depth of 6 feet under the surface in the absence of adjacent metallic conductors.
GAIN:	Four overlapping switched sensitivity positions and a continuous 10-turn control provide an overall adjustment range of about 1000:1 at the meter output.
ACCURACY OF LOCATIONS	± 3 inches at depth of 6ft. in absence of adjacent metallic conductors. (Vertical and horizontal.)

INPUT SELECTOR:	Switchable filter to reject interfering 50 Hz/60 Hz power line frequencies from adjacent load-carrying circuits when tracing from impressed ac voltage or capacitance impulses.
STYLE:	Portable, battery operated, with pistol grip and battery test means.
CONSTRUCTION:	All transistorized electronic circuitry, enclosed in cast aluminum housing with swivel mounted tracing coil for peaking, nulling and depth measurement positions.
BATTERY:	9-volt transistor radio NEDA 1604, Eveready 216, Burgess 2U6, RCA VS323. Battery life 150 hours or more in normal use.
SIZE:	26" (66 cm.) overall, excluding headphones.;
NET WEIGHT:	2 ½ lbs. (1.1 kg.)
SHIPPING WEIGHT:	8 1/3 lbs. (3.8 kg.)

4

DESCRIPTION

General

Structurally, the Cable Route Tracer consists of a control box fastened to a pistol-grip handle, and connected through an extension arm to a swivel-mounted detection rod as shown in Figure 1. By turning the swivel, the detection rod can be set into detecting positions either parallel to the telescoping arm, perpendicular to it, or inclined at 45 degrees to it, (see Figures 3, 6, and 9). The control box contains-and shields the electronic circuitry; on its face are mounted a gain control, a selector switch, a phone jack, and a meter as shown in Figure 2. The pistol-grip handle not only serves as a means of grasping the instrument but also houses its 9 volt battery in an easily removable clip, see Figure 13. A set of high-impedance headphones completes the instrument.

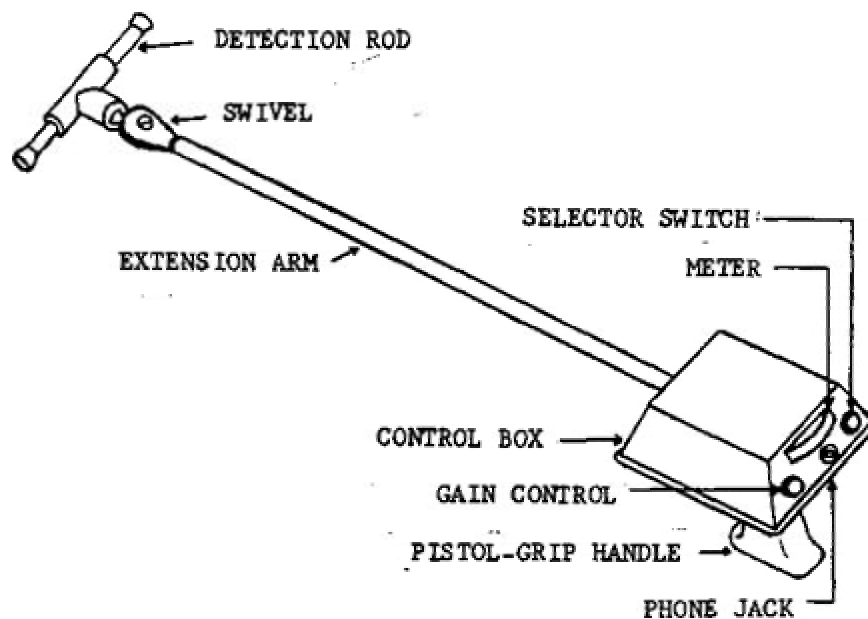


Figure 1: Line Drawing of the Cable Route Tracer Cat. No. 656601

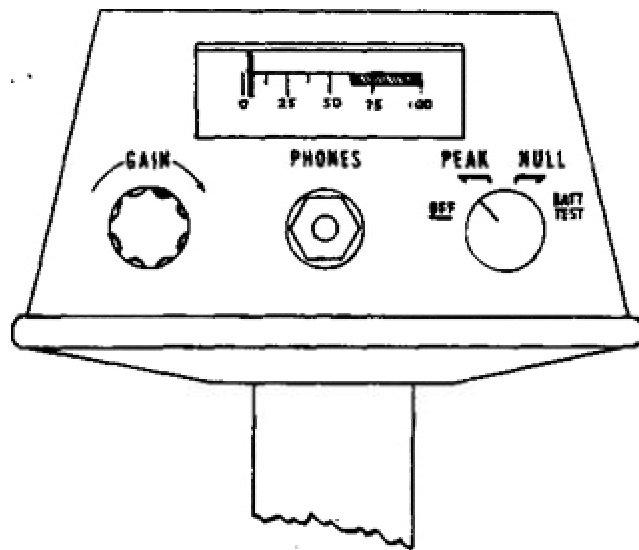


Figure 2: Line Drawing of the Control Panel.

Electrically, the detection rod is inductively influenced by the electromagnetic field associated with the current which is flowing through a cable. The signal thus received by the detection rod is amplified by the circuitry in the control box. With the gain control and the selector switch, the operator can vary the amount of amplification over a wide range, can adjust the degree of meter sensitivity, and can also test the state of the battery at any time. The amplified signal is heard at the headphones and is indicated visually by the meter.

Function of the Controls:

Gain Control:

The gain control shown in Figure 2 on page 8 is a multi-turn potentiometer which provides a smooth and continuously variable adjustment of the amplifier gain.

Selector Switch:

The selector switch at the right of the panel as shown in Figure 2 has six positions

1. In the "Off" position, the battery is disconnected and the entire circuit is turned off.
2. In the "Batt Test" position, the meter needle will indicate the condition of the battery; if the meter needle deflects into the green area at the right of the scale, the battery is good. If the meter needle falls to the left of the green area, the battery should be replaced.
3. The other four positions of the selector switch adjust the sensitivity of the meter response. The second position provides the lowest level of meter sensitivity, the fifth position provides the highest level of meter sensitivity, and the third and fourth positions provide intermediate levels. Because experience proves that the lower levels of meter sensitivity are more useful for operating in the maximizing technique (explained below) while the higher levels of meter sensitivity are more useful for operation in the minimizing technique, the second and third positions of this switch have been labeled "peak" and the fourth and fifth positions have been labeled "null".

Principles of Operation:

In searching for buried cables, the Cable Route Tracer is always carried and operated vertically: the operator grasps the instrument by the pistol-grip handle and holds it so that the detection rod is close to the earth.

The signal sensed by the detection rod is amplified by the circuitry in the control box. By adjusting the gain control, the operator can regulate the amplification of the signal. He should always adjust the gain to produce a response level at meter and headphones that is strong enough to be observed but not so strong as to saturate the circuit thereby rendering imperceptible the variations that may occur in the sensed signal.

What the detection rod senses is the electromagnetic field propagated from the energized cable. The strength of the signal sensed at the detection rod, therefore, depends primarily on three factors:

1. on the amount of current flowing through the cable,
2. on the distance between the detection rod and the cable, and
3. on the position in which the detection rod is oriented with respect to the cable.
 - a. The greater the current through the cable, the stronger will be the signal sensed by the detection rod. However, if the amount of current in a given cable remains fairly constant throughout the duration of the operator's search for the cable, this factor will not enter into the operating technique.
 - b. The distance between the detection rod and the energized cable is a factor that is varied during operation. The closer the detection rod is to the cable, the stronger will be the sensed signal. In walking toward the cable, in crossing it, and in walking away from it, the operator is varying the distance between the detection rod and the cable (as well as the orientation of the detection rod with respect to the cable - see below), and the sensed signal will vary accordingly.
 - c. Varying the orientation of the detection rod with respect to the cable at any given distance from the cable will alter the strength of the sensed signal at that point. The operator varies this orientation not only by the angle at which he sets the detection rod at its swivel but also by the positions in which he is located as he approaches, crosses, and recedes from the cable. Whenever the detection rod is aimed at the energized cable, the signal sensed by the detection rod will be at an extreme minimum level for that particular point. On the other hand, whenever the detection rod is oriented so that its length is aimed in a direction

perpendicular to the run of the cable and that its ends are equidistant from the cable, the signal sensed by the detection rod will be at an extreme maximum level for that particular point.

4. The techniques of locating or tracing a buried energized cable depend on interpreting variations in response level for controlled variations in distance from the cable, in orientation of the detection rod with respect to the cable, and in amplifier gain. Two general techniques are possible: the maximizing (or "peaking") technique, and the minimizing (or "nulling") technique. The maximizing technique requires that the detection rod be oriented so as to have maximum sensitivity when directly over the energized cable. The minimizing technique requires that the detection rod be oriented so as to have minimum sensitivity when directly over the energized cable. In both techniques an initial reference level of signal response is set by adjustment of the gain control and then variations are observed as the operator carries the instrument into positions that approach the cable that lie directly above the cable and that recede from the cable. In the maximizing technique, the variations in the operator's position as he walks (which are equivalent to variations in the distance and orientation of the detection rod with respect to the cable) cause the signal response to rise to the maximum value possible when the detection rod is directly over the cable. In the minimizing technique, the variations in the operator's position as he walks (which are equivalent to changes in orientation of the detection rod with respect to the cable) cause the signal response to fall sharply when the instrument is directly over the cable.

Megger®

5

PRELIMINARY PROCEDURES

Before attempting to operate the Cable Route Tracer some preliminary procedures are necessary:

1. Plug the headphones into the phone jack. This is optional, since the instrument may be operated without headphones; the operator need only observe the meter.
2. Turn on the Cable Route Tracer by rotating the selector switch clockwise out of the "Off" position. Allow an interval of a few seconds for the complete charging of the circuit-stabilizing capacitors; at the end of this period the meter needle will come to rest.
3. If desired, the battery may be checked at this point. To do this, turn the selector switch to "Batt Test" and observe the indication of the meter (see explanation in Section 4). When the battery test is completed, return the selector switch either to one of its "peak" or to one of its "null" positions.
4. Place the detection rod at the desired angle of orientation; perpendicular to the extension arm for the "peaking" or maximizing technique, or parallel to the extension arm for the "nulling" or minimizing technique, as described below and shown in Figures 3 and 6.
5. Grasp the instrument by the pistol-grip handle and hold it vertically so that the detection rod is within four inches of the surface of the earth. The instrument is now ready for operation.

Megger.

6

OPERATION

Peaking or Maximizing Technique

The Maximizing technique locates or traces an energized cable by seeking the line of greatest signal response. For this mode of operation, the detection rod is placed in the detented position that sets it at right angles to the extension arm as shown in Figure 3; consequently, as the instrument is held in its normal vertical position, the detection rod is horizontal and parallel to the surface of the earth. The selector switch is set to one of its "peak" positions.

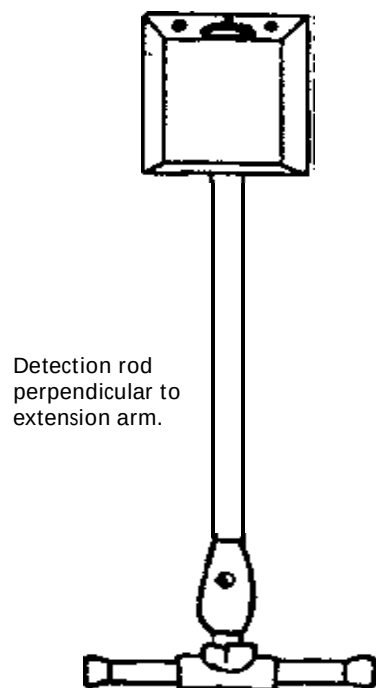


Figure 3: The Peaking or Maximizing Position

To locate the cable, the operator holds the instrument vertically and aligns the pistol-grip handle parallel to the expected direction of the cable, see Figure 4. He then adjusts the gain control for a signal level that will make the sound audible on the headphones and will deflect the meter needle to approximately half-scale (a meter reading of "50"). This will serve as an initial reference level. The

operator then scans the earth by walking laterally with the instrument and keeping the pistol-grip handle parallel to the expected run of the cable, see Figure 4. If the meter needle falls as he walks, he is walking in the wrong direction; if it rises, he is walking toward the energized cable. When the meter needle reaches full scale deflection ("100"), the gain of the amplifier must be reduced so as to provide a new reference level of half-scale deflection ("50"). Again the operator walks laterally toward the cable, and again the meter needle will rise. Each time that the meter needle reaches full scale deflection, the gain must be reduced again to provide another reference level of half-scale deflection. This process is repeated until a point is reached where the signal response no longer rises but begins instead to fall. This point of maximum or "peak" response will be located directly above the energized cable; on either side of the cable the response will fall to lesser levels, see Figures 4 and 5.

The located cable may now be traced along its entire run by the same maximizing technique. The operator keeps the instrument aligned with the pistol-grip handle parallel to the run of the cable. He sets the gain control for a reference level of half-scale deflection ("50") directly over the cable. He then walks forward and moves the instrument to his right and to his left as he walks. Each time that the detection rod crosses the energized cable, the signal response will peak to a maximum; each time that the detection rod moves to the left or to the right of the cable, the signal response will fall to lesser levels. By following the sequence of these points of maximum response, the operator traces out the line under which the cable lies.

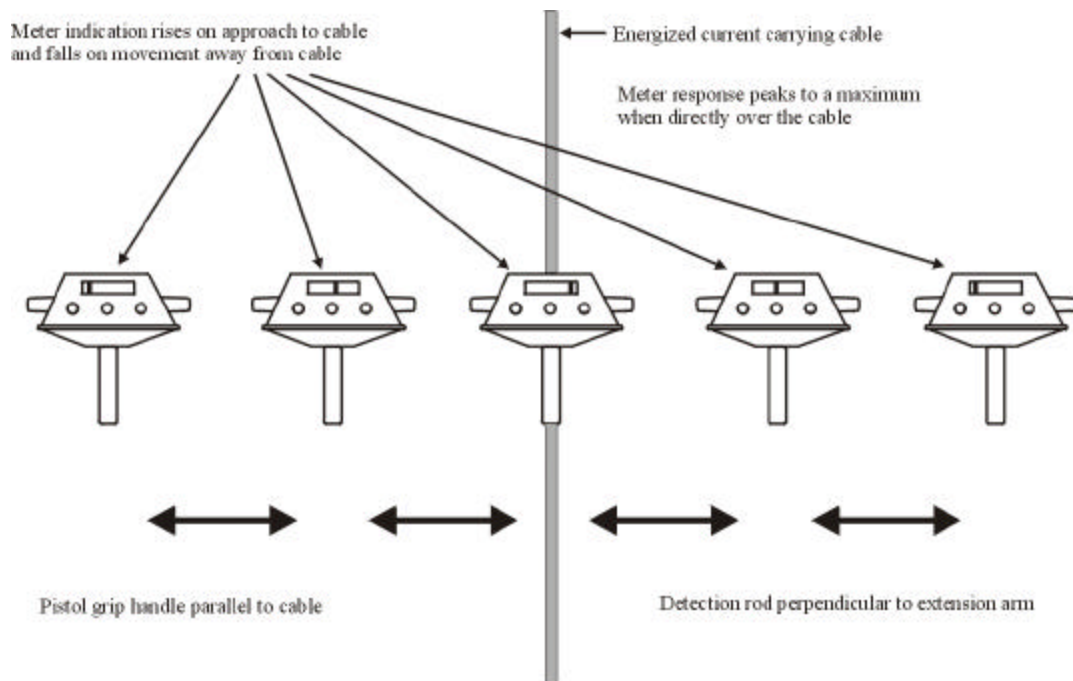


Figure 4: Peaking or Maximizing Technique viewed from above.

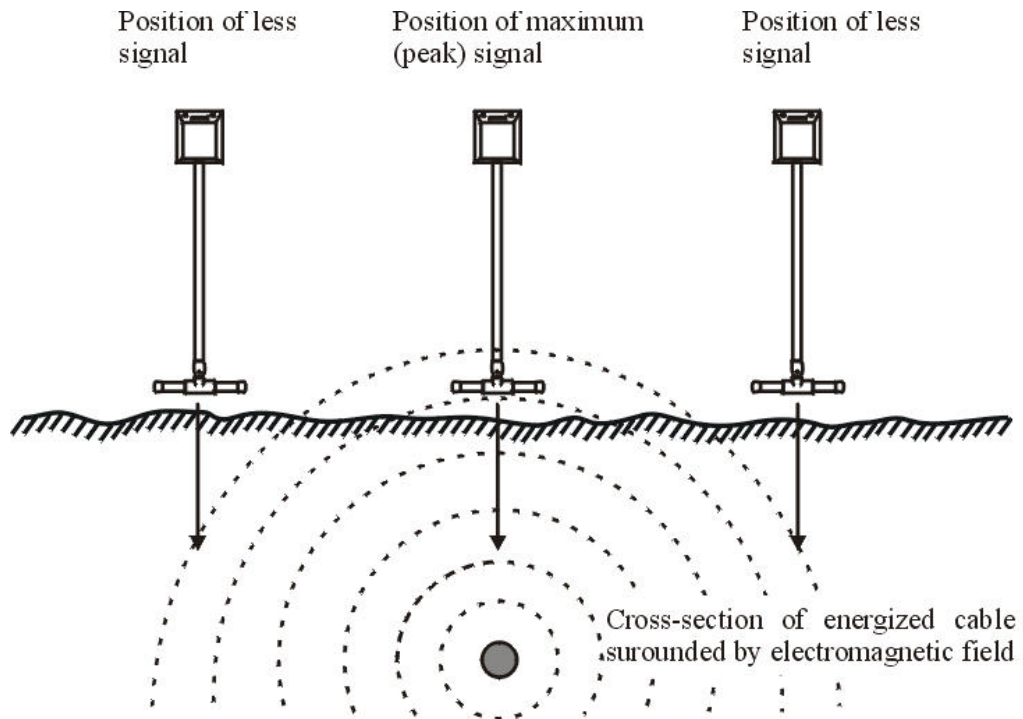


Figure 5: Peaking or Maximizing Technique viewed from the side.

Nulling or Minimizing Technique:

The minimizing technique locates or traces an energized cable by seeking the line of least signal response. For this mode of operation, the detection rod is placed in either of the detented positions that sets it parallel to the extension arm as shown in Figure 6. Consequently as the instrument is held in its normal vertical position, the detection rod likewise is vertical. The selector switch is set to one of its "null" positions.

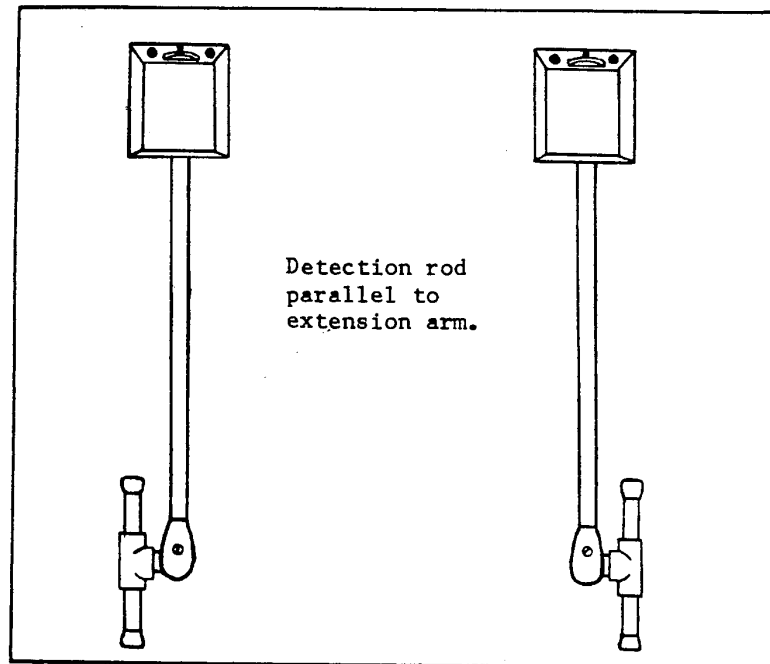


Figure 6: Nulling or Minimizing Position.

To locate an energized cable, the operator holds the instrument vertically and adjusts the gain control for a response level that will make the sound audible on the headphones and will advance the meter needle to a reading of "100" (full scale). This will serve as an initial reference level. The operator then scans the earth with the instrument, moving it in a direction which will cross over the expected run of the cable. The full-scale reference level signal will remain until the instrument crosses over the energized cable. As it crosses over the cable, the signal response will be "nulled out", that is, it will fall to a minimum level. The cable lies directly under the point where the signal response nulls out, see Figure 7 and 8, (Note: If the nulling of the signal occurs over a distance which is too great for determining accurately where the cable lies, the gain should be increased; this will sharpen the response and make the null zone narrow enough to allow precise pinpointing of the cable.

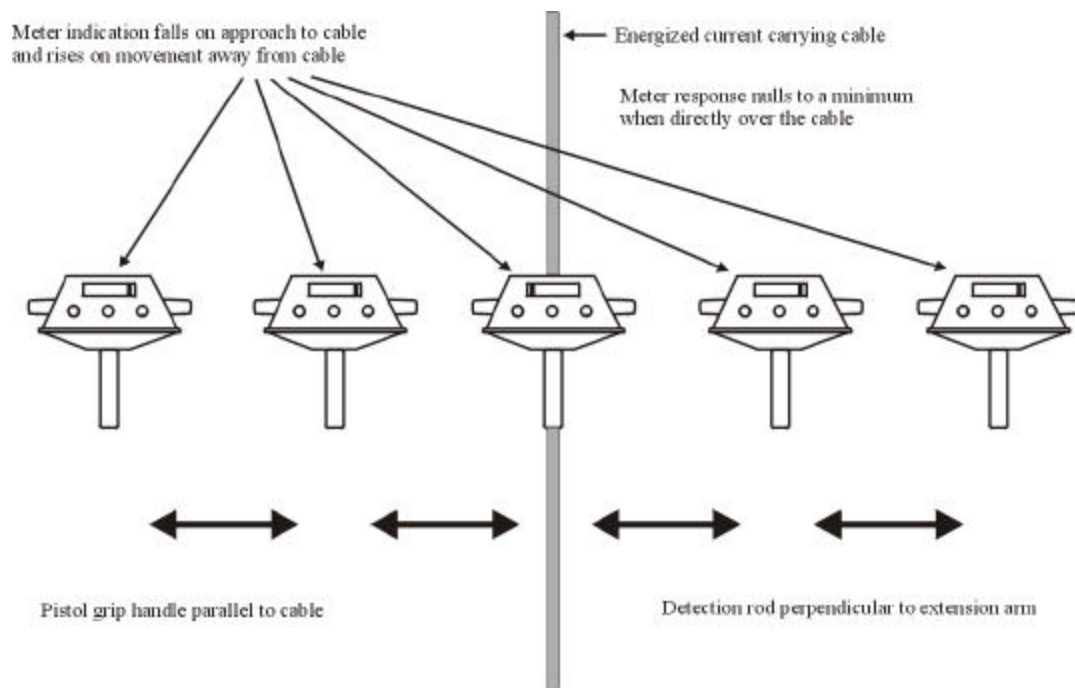


Figure 7: Nulling or Minimizing Technique viewed from above.

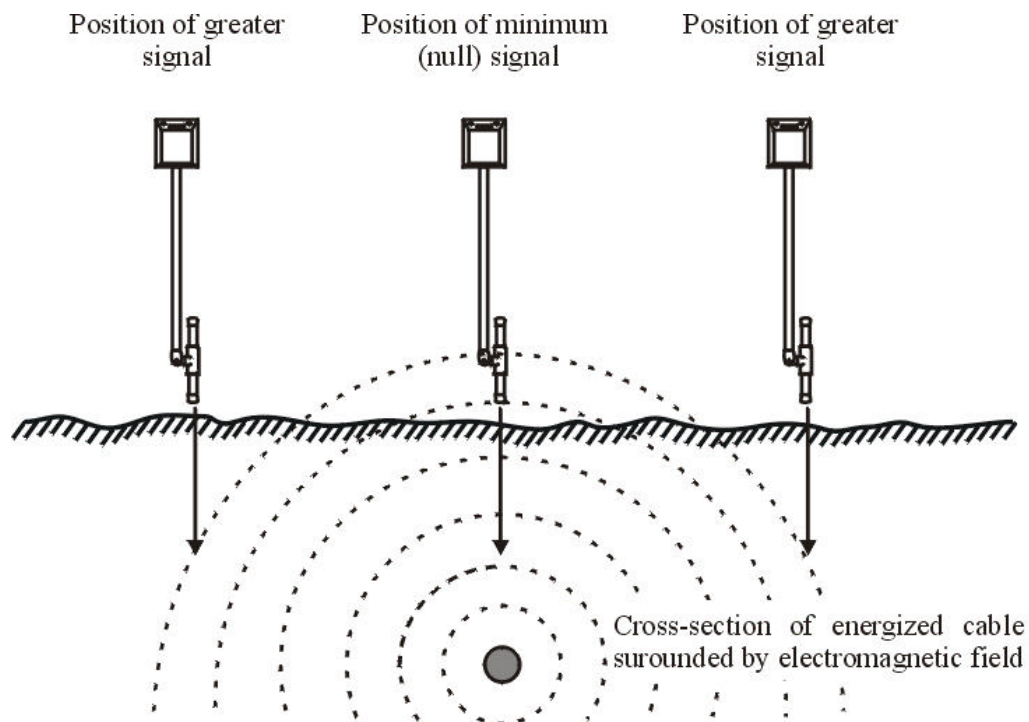


Figure 8: Nulling or Minimizing Technique viewed from the side.

Conversely, if the null zone is so sharp that it is difficult to detect it at all, the gain of the amplifier must be reduced.) Finding a sharp null point thus locates where the cable lies.

The located cable may now be traced by the same minimizing technique. By finding two null points, the operator can determine the direction in which the cable runs. He then walks with the Cable Route Tracer in the direction of the cable's run and moves the instrument to his left and to his right as he walks. Each time that the detection rod crosses over the energized cable, the signal response will null, and each time that the detection rod moves either to the right or to the left of the energized cable, the signal response will rise sharply to a high level. By following these null points, the operator traces the line under which the cable lies.

Depth Measurement:

The technique of measuring the depth of an energized cable is a combination of nulling techniques in a precise triangular relationship.

First, the operator must locate the line of the energized cable by the nulling technique shown in Figures 7 and 8. The operator marks the surface of the earth at the point of minimum signal response; this mark will lie directly above the cable.

Secondly, the operator changes the orientation of the detection rod to a 45-degree position; either the left 45-degree detent or the right 45-degree detent may be used as shown in Figure 9. The operator then holds the instrument so that the pistol-grip handle is aligned parallel to the run of the cable and adjusts, if necessary, the gain control for a full-scale reference level reading ("100") on the meter; normally it will not be necessary to readjust the gain control from the setting used previously for nulling directly over the cable. The operator then walks laterally to the side on which the high end of the detection rod is situated. (Thus in Figure 10, the operator is walking toward the left of the page, whereas in Figure 11, the operator is walking toward the right of the page.) The operator continues to walk laterally with the Cable Route Tracer, holding the detection rod as close to the ground as possible until the signal response nulls out; see Figures 10 and 11. At this point of minimum signal reception, the length of the detection rod is aimed in a line-of-sight at the cable. The operator marks the surface of the earth at this point. (Note: If the nulling of the signal occurs over an area which is too broad for determining precisely where the earth is to be marked, the amplifier's gain should be increased; increasing the gain will sharpen the response and narrow the null zone. Conversely, if the null area is so sharp that it is difficult to detect it at all, the gain of the amplifier must be reduced.

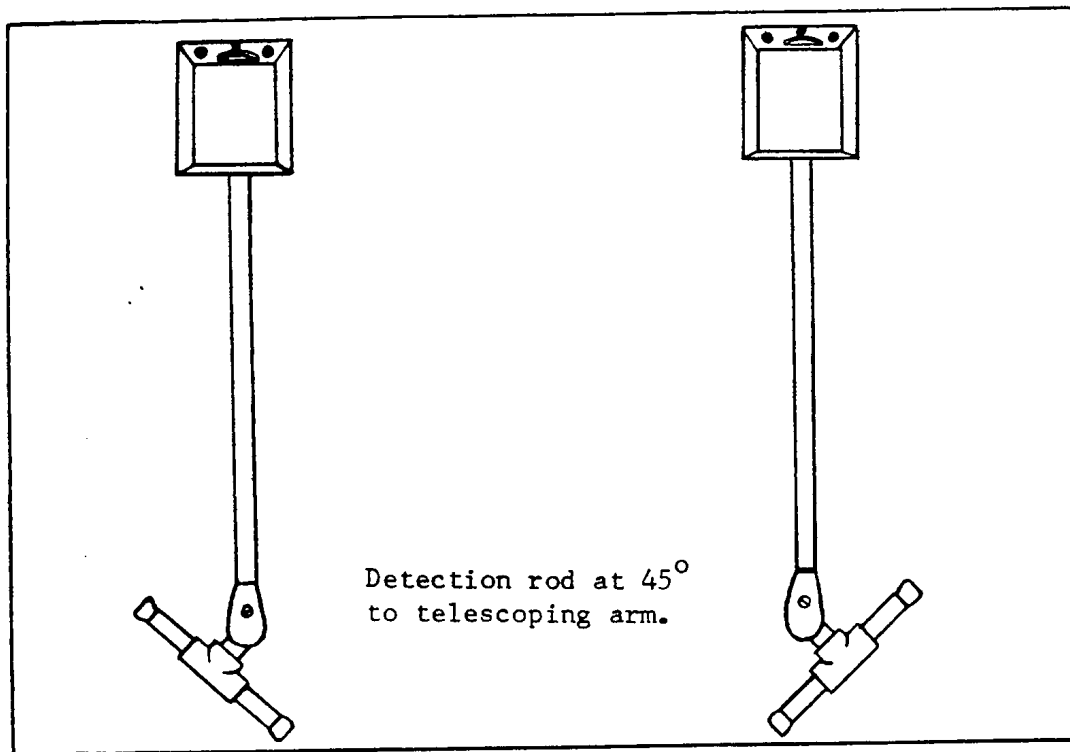


Figure 9: Depth Measurement Positions of the Cable Route Tracer.

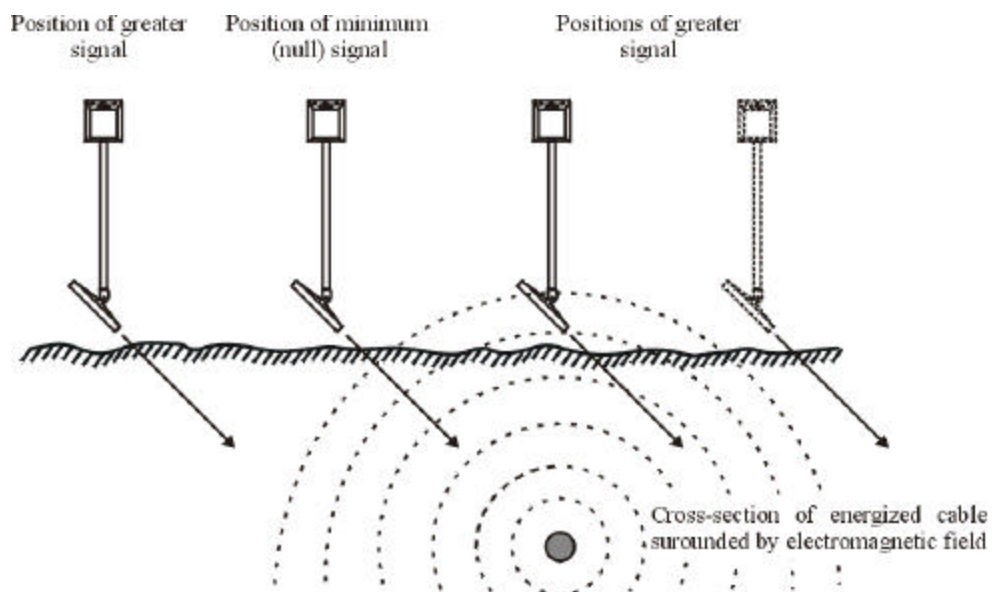


Figure 10: Nulling or Minimizing Technique for Depth Measurement, one side.

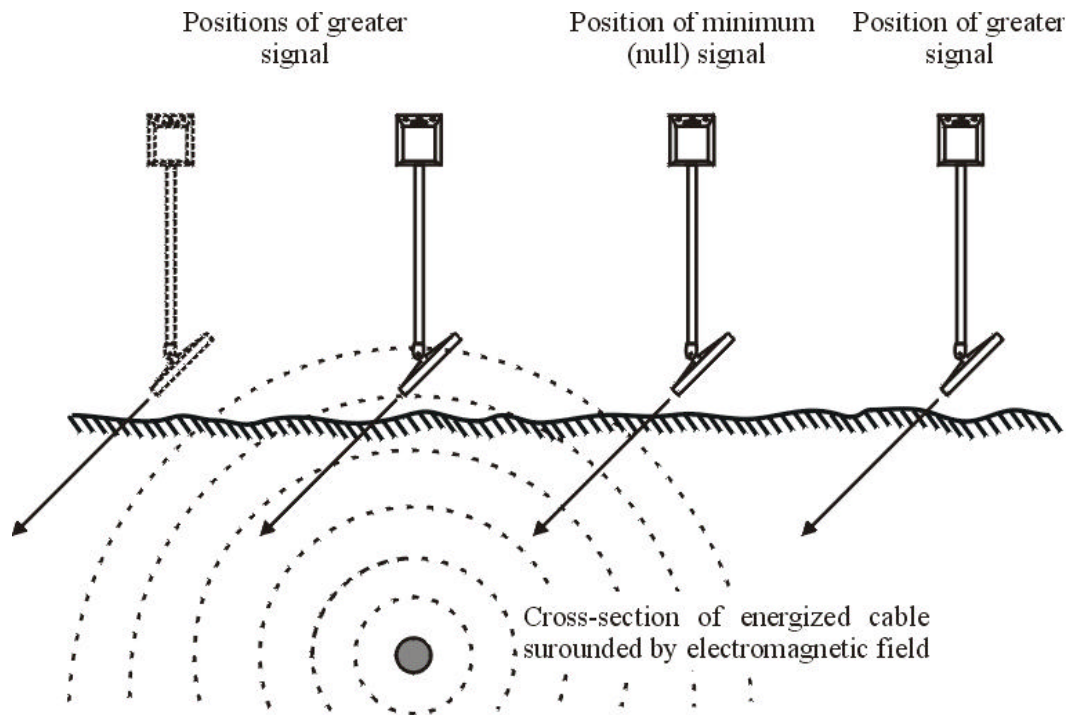


Figure 11: Nulling or Minimizing Technique for Depth Measurement, opposite side.

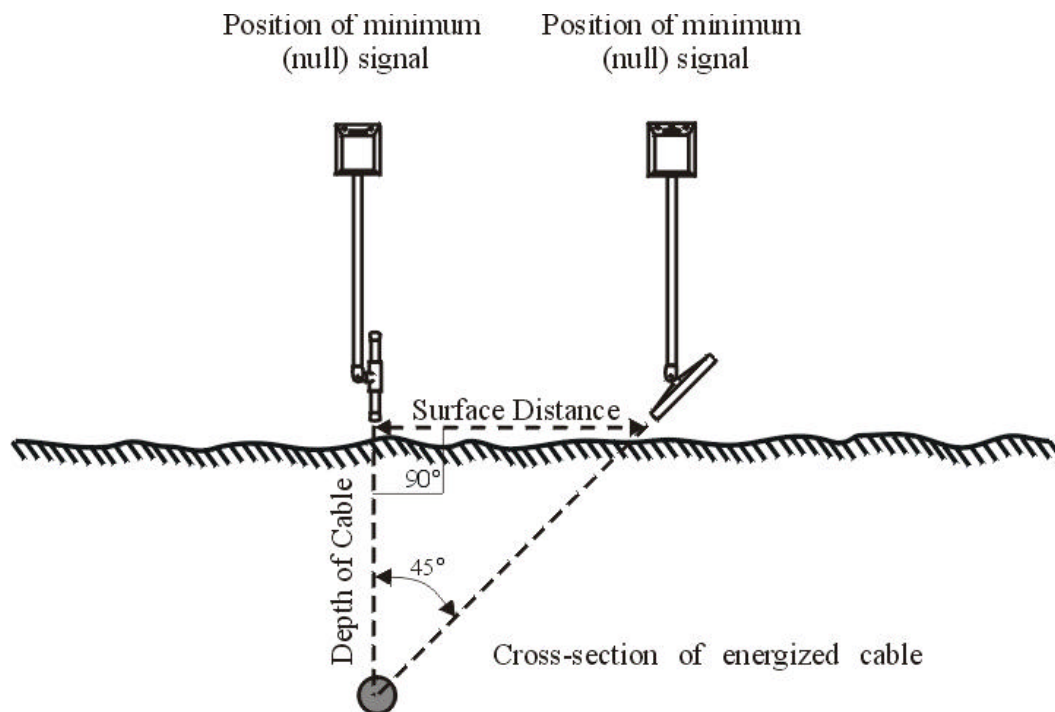


Figure 12: Depth Measurement by Surface Distance.

Thirdly, the operator measures the surface distance between the two marks which he has made on the surface of the earth. The distance between these two marks will be equal to the distance from the surface of the earth down to the cable, see Figure 12.

When taking depth measurements, it is best to check by taking two measurements, one on each side of the cable as shown in Figures 10 and 11, and then to compare the two. Normally, if these measurements are taken carefully and accurately, they will be equal. When they are not equal, this will be due to distortion of the electromagnetic field caused either by a splice, by a change in the cable's direction, or by an adjacent utility line. In such cases, the cable will lie at a depth which corresponds to the longer of the two surface measurements.

Locating Transformers, Splices, and Faults

Underground Transformers

To locate an underground transformer, the operator first locates an energized cable connected to the transformer. He then traces the cable toward the transformer by the maximizing technique described earlier (Note: The Nulling technique cannot be used for locating a transformer.) Since the electromagnetic field propagated from a transformer is many times greater than that propagated from the cable, the signal response will rise greatly as the operator walks into the vicinity of the transformer and will continue to rise until the detection rod is directly over the transformer. Each time that the increased signal response "pegs" the meter to full scale deflection, the operator must decrease the gain to bring the meter needle back onto scale. The transformer will be located under the point of maximum response.

T-Splices and Y-Splices.

To locate an underground T-splice or Y-splice, each of the three energized cables that join in the splice must first be located at some distance from the splice. Each of these lines is then traced by the maximizing technique to determine the course in which it runs. The splice will be located where the lines converge or intersect. (Note: Because of the complex patterns of the electromagnetic field near a splice, the nulling technique cannot be used reliably near a splice.) In tracing each of the lines toward the point of convergence, adjustments may have to be made on the gain control in order to compensate for different levels of current in the different lines connected to the splice.

Grounded Faults.

To locate a fault in non-shielded cable in which there is current flow to ground, the energized cable is first located. It is then traced by the maximizing technique as described above.

When the instrument passes over a fault, a notable change will be observed in the response level of the meter. This is due to a change in the line current and/or to a change in the pattern of the electromagnetic field. Occasionally this technique will also work on shielded cable where there happens to be a significant portion of the current flow which is dispelled to ground.

Operating Suggestions and Cautions.

1. For extreme accuracy in locating a cable, the operator must be careful to hold the Cable Route Tracer in a perfectly vertical position, that is, the extension arm must be straight up and down, or perpendicular to the surface of the earth.
2. For extreme accuracy in depth measurements, not only must the instrument be held in a perfectly vertical position, but also the detection rod must be held as close as possible to the earth's surface. Otherwise the triangular relationship illustrated in Figure 12 will not be maintained.
3. When using the maximizing technique, it is important to remember that the pistol-grip handle must be aligned parallel to the cable. If it is misaligned, the response will fail; if it is misaligned so badly as to be perpendicular to the cable, there will be no response.
4. When using the minimizing technique, the operator should distinguish carefully between two different types of decreases in response. When the response "nulls out" quickly and sharply, the detection rod is crossing over an energized cable; -when, however, the response merely falls slowly and gradually, the detection rod is moving away from the cable at such a distance that the electromagnetic field no longer exerts much influence upon it.
5. The maximizing and minimizing techniques can conveniently serve as checks on each other. Locating a cable, for example, by a null response (minimizing) will verify its location by a peak response (maximizing).
6. Because a null response is generally sharper and more defined than a peak response, it is usually easier to accurately pinpoint the location of a cable by nulling than by peaking; however, for coarse tracing, peaking is usually faster, although less precise than nulling.
7. In some situations, due to depth, low current levels, or three-phase fields, the signal differential can be very small as the operator crosses over the cable on the surface. This will tend to flatten and broaden the response characteristics of signal reception in the peaking or maximizing mode. In such cases, the easiest way to achieve precise location of the cable by the maximizing technique is to adjust the gain control so that the highest peak response moves the meter needle to "100"; this will occur in the general area directly above the cable. The operator then moves the instrument laterally to one side of the cable until the response falls to "75"; he marks the ground at that

point. He then moves the instrument laterally to the other side of the cable until the response again falls to "75"; he marks the ground at that point also. The cable will be located midway between these two marks.

8. When several sources of electromagnetic radiation are present in the same vicinity, the maximizing technique is generally more reliable than the minimizing.
9. Whenever possible, current should be raised to a high level in the line which one seeks to locate or trace; for example, by increasing the load on the line. This will strengthen the electromagnetic radiation from the line and will make it easier to- locate and trace the line.
10. Whenever possible, current should be cut off or reduced in nearby lines which are not to be located or traced. This will eliminate or lessen the possibility of interfering patterns of electromagnetic radiation emanating from them.

Megger.

7

MAINTENANCE

Since the Cable Route Tracer uses solid-state circuitry, nothing needs maintenance or replacement except the battery. The battery is a 9-volt transistor-radio type. Its life expectancy in the instrument is approximately 150 hours. The battery should be replaced whenever the battery test procedure indicates that its voltage is low. Replace with NEDA type 1604 or equivalent. If ordering batteries from us, specify Part No. 1484.

To replace the battery, the knurled nut at the end of the pistol-grip handle must be loosened and the battery-clip must be removed from the handle (Figure 13). The battery-connector is then unplugged from the battery, and the battery is removed from the battery clip. A new battery is installed by reversing these procedures.

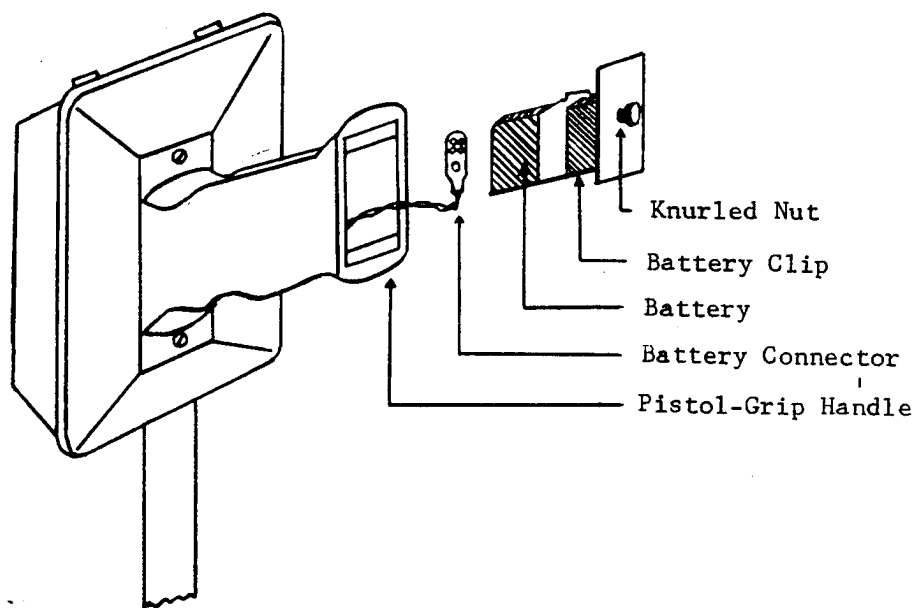


Figure 13: Battery Replacement in the Pistol-Grip Handle.

Megger.

8

TROUBLESHOOTING

The performance of the Cable Route Tracer should be evaluated by application to an energized conductor in a known route and carrying a current of at least one ampere at a distance of three feet.

If the Cable Route Tracer fails to respond when operated in accordance with the procedures given in Section 6, test the battery by turning the selector switch fully clockwise to the "Battery Check" position. If the pointer does not come to rest in the green portion of the scale, install a new battery.

If there is a visual response on the meter but no audible response from the headphones when the instrument is applied to an energized conductor in accordance with the procedures given in Section 6, check the connecting cord and plug for broken wires or loose connections. If there is no visible defect, the earphones should be replaced.

If there is an audible response but no visual response on the meter, when operated in accordance with the procedures given in Section 6, open the housing and check the selector switch for broken wires or loose connections.

If there is no other visual or audible response when checked in accordance with the procedures previously given in Section 6, open the housing and check wiring to the printed circuit board, the gain adjust attenuator, and to the coil in the probe.

If any damage or defect is discovered by the foregoing process, repairs should not be attempted unless they can be accomplished by qualified personnel. If no damage or defects are evident or if repairs cannot be performed by qualified personnel, the instrument and headphones, with their respective carrying cases, should be carefully packed and shipped prepaid to us at the address listed in Section 9, Warranty and Repairs. A record should be included of any of the items omitted from the shipment per instructions listed in Section 1.

Megger.

9

WARRANTY AND REPAIRS

WARRANTY

All products supplied by Megger are warranted against all defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. Equipment returned to the factory for repair will be shipped Prepaid and Insured. The warranty does not include batteries, lamps or tubes, where the original manufacturer's warranty shall apply. WE MAKE NO OTHER WARRANTY.

The warranty is void in the event of abuse or failure by the customer to perform specified maintenance as indicated in the manual.

REPAIRS

Megger maintains a complete instrument repair service. Should this instrument ever require repairs, we recommend it be returned to the factory for repair by our instrument specialists. When returning instruments for repairs, either in or out of warranty, they should be shipped Prepaid and Insured, and marked for the attention of the Instrument Service Manager.

Ship to:

Attn: Instrument Service Manager
Megger
Valley Forge Corporate Center
2621 Van Buren Avenue
Norristown, PA 19403 U.S.A.

Megger.