

LOCATING SHEATH FAULTS AND CABLES WITH THE DYNATEL 573

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The Dynacoupler	7	SCOPE OF THE PRACTICE	
Direct Connection	7	1.01 This manual describes the features of the 573 Sheath Fault and Cable Locator, and its use in the field. Maintenance, limited to battery replace- ment, is included.	
Induction	7	1.02 Section 3 describes the equipment, and iden- tifies the controls, indicators and accessories. Section 4 details the operation of the equipment to	
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NOTICE

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except under written agreement.

locate faults in cable sheaths. Section 5 describes the operation of the equipment to trace buried cables, and determine their depth.

FEATURES OF THE 573

1.03 The transmitter generates two separate tones; one is an inaudible high frequency that is used for cable path and depth location, and also provides direction information while locating sheath faults. The second tone is subaudible, and is used only for locating sheath faults. Cable tracing tone is applied in one of three ways:

- a) by induction using the Dynacoupler, or
- b) by direct connection, or
- c) by induction using the built-in antenna.

Sheath faults are always located using a direct connection.

1.04 Tracing tone may be applied at normal level, or increased to a high level for certain soil conditions and extended cable lengths.

1.05 The Receiver is used to trace the tone along the length of the cable. The Receiver indicates tone detection with a meter, and an audible signal through a speaker. Tones are picked up through an internal antenna, an optional inductive probe, or a Dynacoupler. When locating a cable sheath fault a special Earth Contact Frame is used for detecting the fault signal.

APPLICATIONS FOR THE 573

1.06 The 573 can pinpoint the location of a sheath fault in plastic insulated (PIC) cable up to one mile in length with a resistance to ground as high as 500,000 ohms. For this purpose the transmitter generates a special coded signal. The cable is traced to the fault with the Receiver, using the Earth Contact Frame.

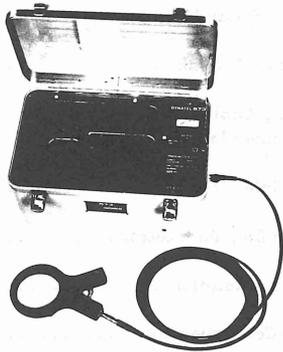


Figure 1-1. a) The Transmitter Unit (shown with a Dynacoupler attached)

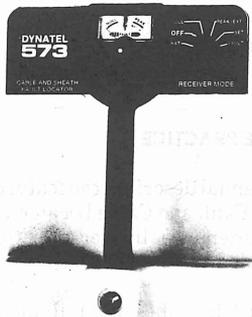


Figure 1-1. b) The Receiver Unit

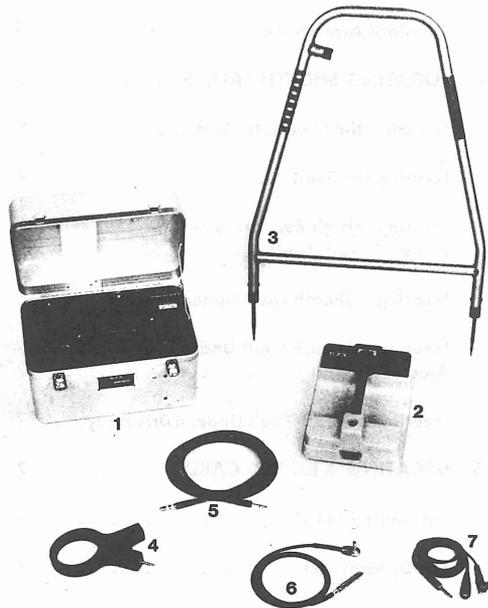


Figure 3-1. Equipment and Accessories

1.07 The 573 can trace the path of a buried cable including butt splices, slack loops, unknown laterals, service drops and encapsulated closures. Cable can be located exactly; clear or severed cable can also be found.

1.08 The 573 can also be used to determine the depth of a buried cable.

2. PRECAUTIONS AND WARNINGS

2.01 High voltage (100V AC) may exist on the transmitter output cable.

2.02 Probes on the Earth Contact Frame are pointed and care must be exercised when using the frame. Protectors should be installed on the probes when the frame is stored.

2.03 When working on joint buried plant test the cable shield with a voltage tester before and after opening shield bonds.

3. EQUIPMENT DESCRIPTION (See Figure 3-1)

3.01 The 573 consists of a Transmitter, Receiver, and an Earth Contact Frame. The Transmitter is integral with the carrying case; the Receiver is a separate unit, but is stored and carried in the case when not in use. Both of these units are made of durable yellow fiberglass for light weight and high visibility. The units are water resistant and can be used in wet weather.

3.02 The Earth Frame is constructed of heavy-gauge anodized aluminum with probes of stainless steel. It is externally rugged and the crossbar can be used to put weight on the frame to push the probes into hard ground.

3.03 Other accessories include a Dynacoupler™ (4) that is used to induce a tone onto cable, a cable (6) to connect the Earth Contact Frame to the Receiver, a cable (5) to connect the Dynacoupler to the Transmitter, and a cable (7) which is used for a direct connection from the Transmitter to the cable.

TRANSMITTER CONTROLS AND INDICATIONS

(See Figure 3-2)

3.04 a) METER. This has three zones:

1) FAULT METER. This is used in fault locating, selected by the METER-FAULT-METER switch setting, and indicates the

relative level of the fault resistance between shield and ground. If a CLEAR (green) indication is given, the fault resistance is above 1 Megohm and is not usually considered significant. The FAULT (red) zone indicates a fault of 50,000 ohms or less. The HIGH RESISTANCE zone indicates a fault between 50,000 ohms and 1 Megohm.

2) OUTPUT. When the TRANSMITTER OUTPUT switch is set to SHEATH FAULT LOCATOR, the LOW, MEDIUM or HIGH output should be selected depending on which position gives the greatest needle deflection.

When the TRANSMITTER OUTPUT switch is set to CABLE LOCATOR, a meter reading indicates the presence of a tone. The amount of deflection is not significant.

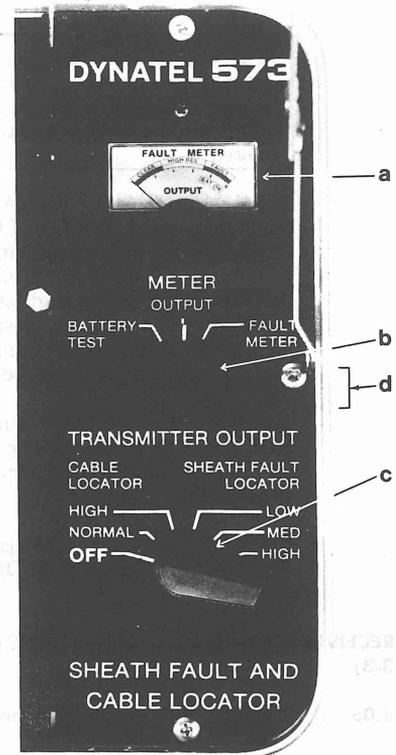


Figure 3-2. Transmitter Controls and Indicator

3) **BAT OK.** This indicates the condition of the Transmitter batteries when the METER switch is set to BATTERY TEST. See Section 6 for battery replacement information.

b) **METER switch.**

1) **OUTPUT.** Selects the TRANSMITTER OUTPUT switch.

2) **FAULTMETER.** Indicates the condition of a cable shield: CLEAR, HI RES or FAULT (to ground).

3) **BATTERY TEST.** Displays the condition of the Transmitter batteries on the METER.

c) **TRANSMITTER OUTPUT SWITCH**

1) **OFF** turns the Transmitter OFF.

NOTE

The Transmitter and Receiver are turned off automatically when the Receiver is placed in the Transmitter storage compartment and the cover is closed.

2) **SHEATH FAULT LOCATOR.** Sets the Transmitter output level, LOW, MEDIUM, or HIGH. This is used with the OUTPUT Meter scale 0 through 10. Select the position that gives the highest output on the Meter scale. If two positions give approximately the same high level, set to the lower position for battery conservation.

3) **CABLE LOCATOR.** Usually set to NORMAL for cable tracing and depth location. Set to HIGH for long distances or certain soil conditions.

d) **OUTPUT jack.** The output jack is used for a direct connection or the Dynacoupler cable.

RECEIVER CONTROLS AND INDICATIONS (See Figure 3-3)

3.05 a) **METER.** The meter has the following zones:

1) **FAULT**. When the FAULT

mode is selected and the Earth Contact Frame cord is plugged into the FAULT Connector, the striped zone (red) indicates the sheath fault is behind the operator, and the solid (green) zone indicates that the sheath fault is ahead, see Figure 4-2. (Green end of Earth Contact Frame is ahead of operator.)

2) **NULL—SET—PEAK.** This is used for tracing cable and indicates a NULL in the Null Mode (selected by the switch) to the left, and PEAK in the Peak Mode to the right. SET is used in cable depth location.

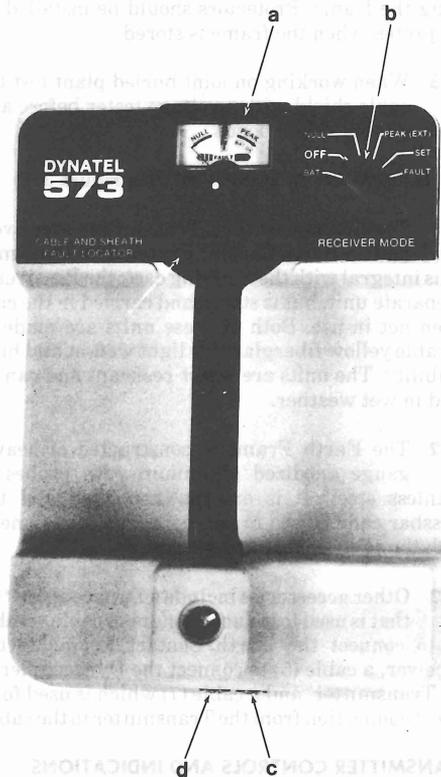


Figure 3-3. Receiver Controls and Indicators

3) **BAT OK.** This indicates the condition of the Receiver batteries when the METER switch is set to BAT.

- b) RECEIVER MODE switch.
- 1) BAT. Momentary-contact position, causes battery condition indication on the Meter.
 - 2) OFF. Turns Receiver off. Should be used whenever the Receiver is not in use to conserve the batteries.
 - 3) NULL. Used when tracing a buried cable using the NULL indication (no signal directly over the cable).
 - 4) PEAK/EXT. Used when tracing a buried cable using the PEAK indication (maximum deflection over the cable). When an external probe is plugged into the EXT jack, the peak signal is indicated. The peak antenna in the Receiver is disabled when an external probe is plugged in.
 - 5) SET. This position, together with the SET indication on the Meter is used to determine the depth of a cable.
 - 6) FAULT. Position used when tracing a sheath fault.
- c) FAULT jack. Connection for the Earth Contact Frame in the Sheath Fault Locating Mode.
- d) EXT. jack. Connection for the external probes, or the Dynacoupler.
- e) Volume Control. Adjusts meter sensitivity and the volume of the tone.

STANDARD ACCESSORIES

- 3.06 a) 3001 Dynacoupler 3" diameter
- b) 9011 Accessory Cable
- c) 9012 Transmitter Output Cable
- d) 3014 Earth Contact Frame

4. LOCATING SHEATH FAULTS

IMPORTANT: Remove bonds at both ends of the section.

4.01 This procedure locates sheath damage in a buried PIC cable. First, with the shield isolated, measure the resistance to ground using the faultmeter to confirm the fault condition. Then transmit a tone on the sheath and trace the tone with the Earth Contact Frame.

CHECKING THE SHEATH FOR DAMAGE

- 4.02 a) Connect the Transmitter to the cable shield using the direct connection method. Connect the RED lead to the shield, and the BLACK clip to the ground rod. Insert the rod in the ground in line with and away from the section to be traced, see Figure 4-1. See Paragraph 2.01.
- b) Connect the Transmitter as shown in Figure 4-1. Figure 4-2 also shows this operation.
- c) Set the METER switch momentarily to FAULTMETER at each setting. The needle will deflect into the CLEAR, HIGH

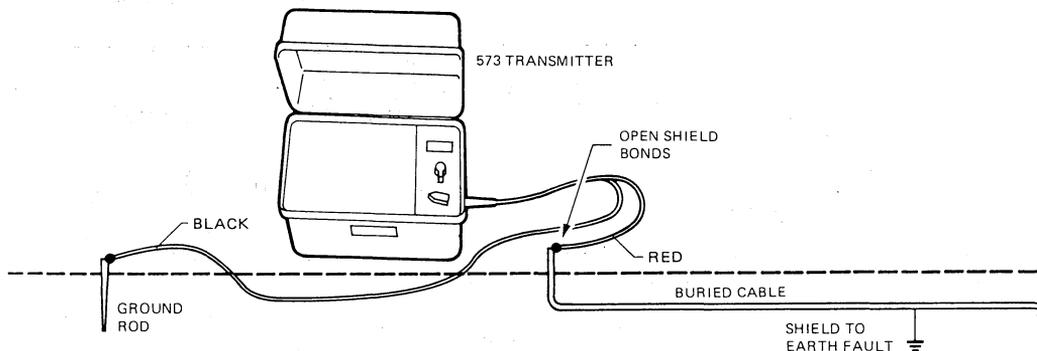


Figure 4-1. Connecting the Transmitter for a Sheath Fault

RES, or FAULT zones. This is interpreted as follows:

1) CLEAR means that there is no significant fault on the cable shield.

2) HIGH RES indicates a fault or faults of 50,000 ohms to 1 Megohm.

3) FAULT indicates a fault of less than 50,000 ohms. If this is not caused by a ground bond, a severe sheath fault is indicated.

NOTE

C.O. battery voltage on the shield due to shield to conductor leakage will cause a lower resistance fault to be indicated.

- d) Set the TRANSMITTER OUTPUT switch to LOW, MEDIUM, HIGH, whichever gives the highest reading on the Transmitter Meter.



Figure 4-2. Connecting the Transmitter to the Cable Shield

- 4.03 a) Connect the Earth Contact Frame to the Receiver FAULT Jack.
- b) Set the RECEIVER MODE switch to FAULT.
- c) Hold the Earth Contact Frame in one hand and the Receiver in the other. Insert the Frame in the ground, inserting the Frame probes to their maximum depth. Start at the transmitter ground rod.
- d) Orient the frame exactly as shown in Figure 4-3 with the green (solid) marker towards the fault, and the red (striped) marker towards the Transmitter.
- e) The Receiver needle is deflected into the green (solid) zone in the meter. This indicates that the fault is ahead of the operator, or in the green direction.
- f) Continue along the path of the cable inserting the frame in the ground. If the needle is in the Green zone, continue probing in the same direction.
- g) When the needle goes to the Red zone as the frame is inserted in the ground, the operator has gone beyond the fault.
- h) Back up until the mid-scale point is indicated. This is the point where the fault is located.
- i) Verify by turning Frame 90°. Move Frame in direction indicated by meter as in (g) above. Point of fault is directly under center of Frame when meter changes from

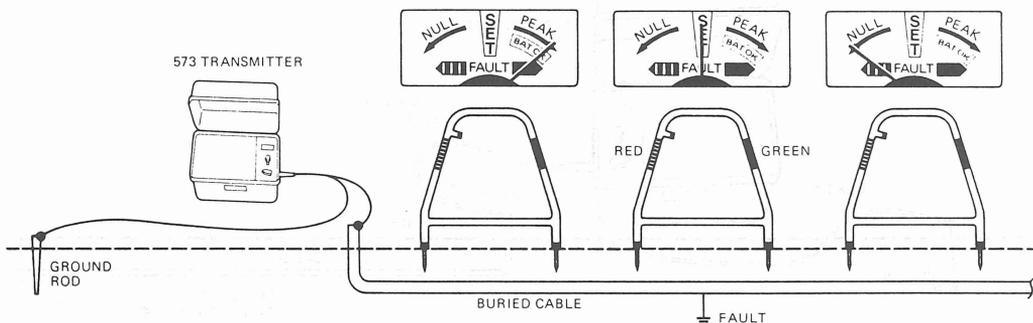


Figure 4-3. Meter Indication Around the Fault

red to green, or vice versa, with 2-3 inch movement.

NOTE

The meter will indicate the color of the Earth Frame probe which is nearest to the fault.

The fault indication is very sensitive. A very small movement over the fault will produce a large needle movement.

LOCATING A HIGH RESISTANCE OR DISTANT SHEATH FAULT

4.04 It is likely that as the operator follows the cable with the Earth Contact Frame, the meter deflection will become very small, perhaps undetectable. However, the meter indication will increase as the fault is approached. See Figure 4-4 which shows this diagrammatically.

Figure 4-4. Relative Needle Deflection and Direction Along the Cable, and Meter Reversal at the Fault



Figure 4-5.

LOCATING A SHEATH FAULT UNDER A ROADBED

4.05 When the cable is located under a roadbed, it is often possible to probe several feet to the side of the cablepath. The frame should be held parallel to the path of the cable. Meter reversal will occur perpendicular to the fault. Figure 4-5 illustrates this.

LOCATING A FAULT UNDER A LARGE AREA OF ASPHALT

4.06 If the cable is laid under a large area of asphalt such as a shopping center car park, the surface must be penetrated to locate the fault. Use nails long enough to penetrate the ground 2-3 inches below the asphalt. A special Adapter Cord Dynatel Part Number 9028 is available for this purpose.

LOCATING A SHEATH FAULT UNDER A DRIVEWAY

4.07 If a sheath fault is indicated where a cable passes under a driveway, the fault will most probably be at the edge of the roadway. To locate the exact location of the fault, step 10 to 20 feet away from the cable path. Probe with the frame, rotating it a few degrees at each probe until a meter reversal is noted. A reversal is obtained when one tip is moved less than one inch. Mark a line perpendicular to the probes of the frame. This line will intersect the cable path at the fault location. Repeat this test from the other side of the driveway to confirm the location.

5. LOCATING THE PATH OF A BURIED CABLE TRANSMITTER SET UP

- 5.01** There are three ways for the Transmitter to put tone on a buried cable.
- a) Dynacoupler, the easiest and most accurate way to put tone on a cable. Do not remove sheath grounds.
 - b) Direct Connection, applying tone directly to the shield or a conductor if it can be accessed.
 - c) Induction, placing the transmitter on the ground over the cable and inducing the tone into the cable by the loop in the Transmitter.

These methods are described in more detail:

THE DYNACOUPLER

5.02 Connect the Dynacoupler™ to the Transmitter Output Jack using the 12 foot accessory cable 5 in Figure 3-1. Place the Dynacoupler around the cable to be traced. Tone may be induced onto conductors if more convenient.

NOTE
Ensure the Dynacoupler jaws are fully closed, otherwise very little tone will be transmitted. There is no minimum cable size.

DIRECT CONNECTION

5.03 Plug the 5 foot output cable (7 in Figure 3-1) into the Transmitter Output Jack, and connect the RED clip to the cable shield or conductor. Set the Transmitter on the ground. If more signal is required, ground the BLACK clip of the cable.

NOTE
Further information on cable tracing is given in the Special Applications of this Section. There are also the following Field aids available free from Dynatel, call (408) 733-4300 for Issue Numbers 7, 11, 16.

INDUCTION

5.04 Induction method is non-standard in Indiana Bell and shall not be used.

Non- CAUTION Standard
Do NOT use the Receiver closer than 100 ft. from the Transmitter.
Ensure that the Transmitter is placed accurately over the cable, and follow the strongest signal.
Use the NORMAL level whenever possible. Use the HIGH transmit level with caution, since this will tend to put tone on other cables or pipes, including those of other utilities.

LOCATING A BURIED CABLE

5.05 TRANSMITTER. Connect the Transmitter to the cable to be traced using one of the

methods described above. Set the METER switch to OUTPUT. Set the OUTPUT switch to NORMAL. Tone is now being applied to the cable.



A
Figure 5-1. a) Receiver Unit in Operation.

5.06 RECEIVER. See Figures 5-1, 5-2. Go to the expected location of the cable (100 feet at least if the Induction Method is being used). Use either the NULL or PEAK mode. Set the RECEIVER MODE switch to the method to be used, and adjust the Volume control for a mid-range maximum reading.

5.07 The NULL Mode normally provides a very precise indication, but is also affected by other buried cables or utility pipes. The needle swings to the left end of the scale between two peaks when directly over the cable. The speaker also is quiet at this point.

5.08 The PEAK Mode gives maximum indication to the right when the Receiver is directly over the cable. Adjust the Volume control as required to keep the meter reading about mid-scale. Ensure that the handle is parallel to the path of the cable.



B
**Figure 5-1. b) Receiver Unit in NULL Mode; Note
 Thumb Operation of Volume Control Knob**

5.09 The Peak mode is not as sensitive as the Null mode, but may allow faster cable tracing, particularly around bends and the end of cut drops, etc. For confirmation of accuracy use both methods.

CABLE LOCATION IN THE NULL MODE

5.10 Set the RECEIVER MODE switch to NULL. Hold the Receiver level and in line with the cable to be traced. The cable is at the point where there is a null point between two peaks.

5.11 The VOLUME control sets both the level of speaker volume and meter sensitivity. As the Volume is increased, the null point becomes sharper.

5.12 Check the result by selecting the PEAK mode.

CABLE LOCATION IN THE PEAK MODE

5.13 Set the RECEIVER MODE switch to the PEAK/EXT position. Hold the Receiver level and in line with the cable to be traced. The cable is at the point where the tone level is highest and the meter indicates to the right of the scale.

5.14 The Volume control sets both the tone level and meter sensitivity. Set for almost full scale deflection at the cable location.

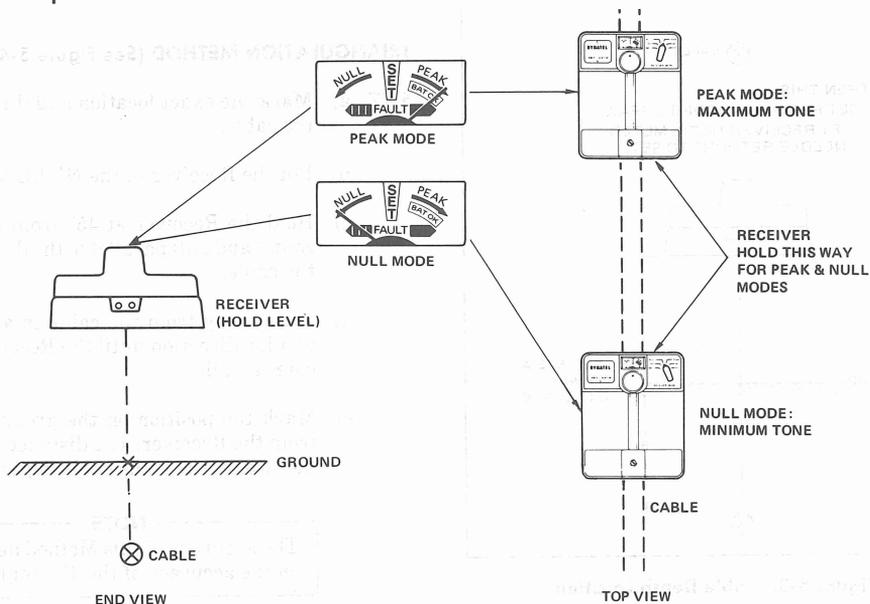


Figure 5-2. Cable Location for Peak & Null Modes

FINDING THE DEPTH OF A CABLE (See Figure 5-3)

5.15 When a cable location has been positively identified, and marked, use these procedures to locate its depth. The first procedure is for shallow cables limited to the height to which the operator can lift the Receiver and still be able to read the meter and hold the Receiver level. Otherwise, use the second method.

DIRECT MEASUREMENT METHOD (See Figure 5-3)

5.16 a) Put the RECEIVER MODE switch in the SET mode.

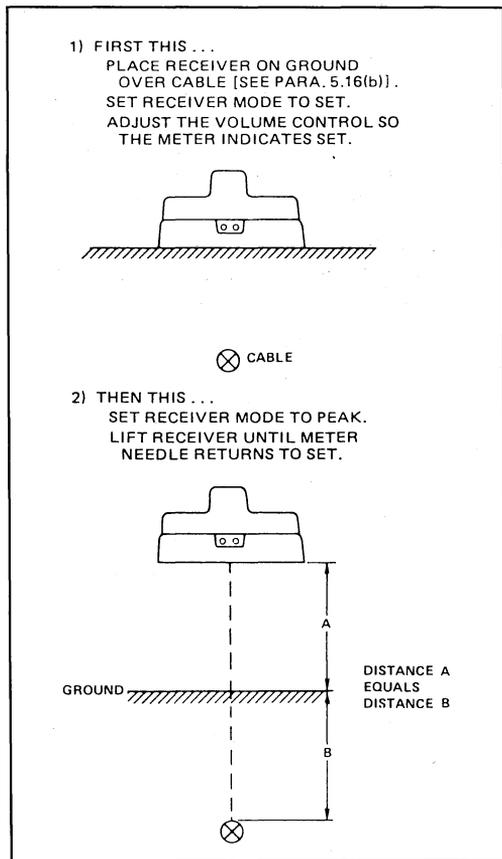


Figure 5-3. Cable Depth Location

- b) Place the Receiver on the ground exactly over the marker and aligned with the cable.
- c) Adjust the VOLUME control to center the needle in the SET zone.
- d) Set the RECEIVER MODE switch to PEAK/EXT.

NOTE

The tone level and needle deflection with increase.

- e) Raise the Receiver from the ground, keeping it aligned with the cable and level, until the needle returns to the SET zone.
- f) Measure the height of the bottom of the Receiver above the ground. This is the depth of the cable.

NOTE

If the cable is in a duct, subtract the diameter of the duct to help prevent damage to the duct.

TRIANGULATION METHOD (See Figure 5-4)

- 5.17 a) Mark the exact location and direction of the cable.
- b) Put the Receiver in the NULL Mode.
- c) Hold the Receiver at 45° from the horizontal and still parallel to the direction of the cable.
- d) Walk away from the cable in a perpendicular direction until the Receiver indicates a null.
- e) Mark the position on the ground at 45° from the Receiver. The distance between the two marks is the cable depth.

NOTE

The accuracy of this Method depends on the accuracy of the 45° angle.

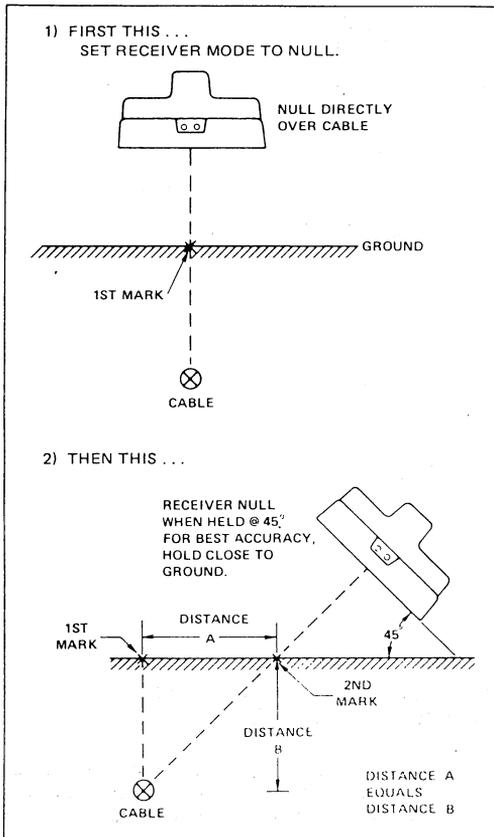


Figure 5-4. Cable Depth Location (Triangulation Method)

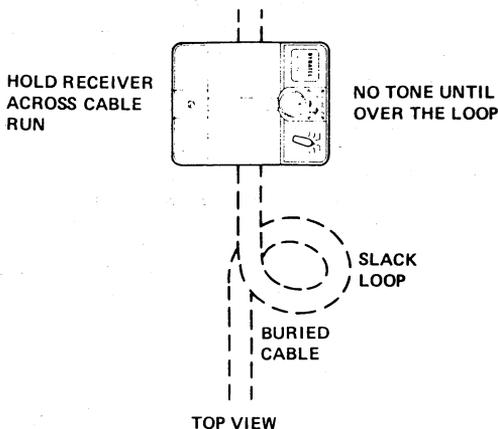


Figure 5-5. Slack Loop or Butt Splice Location

CABLE AND CONDUCTOR IDENTIFICATION

5.18 This procedure identifies one cable in a group of similar cables.

- Put a tone on the cable or conductor using the Dynacoupler, or by the direct connection method.
- At the far end, connect a Dynacoupler (4 in Figure 3-1) or Inductive Probe (Dynatel P/N 3011) to the Receiver EXT jack using the 12 foot cable (5 in Figure 3-1).
- Set the RECEIVER MODE switch to PEAK/EXT.
- Check each cable or conductor in the group, setting the meter needle deflection to about half way. Compare each cable. The one with a significantly higher reading than the others is the one required.

SPECIAL APPLICATIONS

5.19 This section gives procedures to locate cables in special situations that may be encountered in the field. Study the standard methods first, and learn the basic principles of the way in which cables are located. This part will be useful when special problems occur.

SLACK LOOPS AND BUTT SPLICES (See Figure 5-5)

5.20 First locate and mark the path of the cable. Set the RECEIVER MODE switch to PEAK/EXT, and adjust volume for a mid-scale reading when the handle is about 45° with reference to the cable. Keep RECEIVER level. Rotate until handle is perpendicular to the cable path and no tone is heard. Walk the cable path. Normally, no tone will be heard.

5.21 When the Receiver passes over a slack loop or butt splice the tone level will increase and the needle will be deflected to the right. This indicates a sudden change in the path of the cable which could be a butt splice.

5.22 This method also locates buried closures with laterals. Whenever a slack loop or splice is located, always check for unknown laterals.

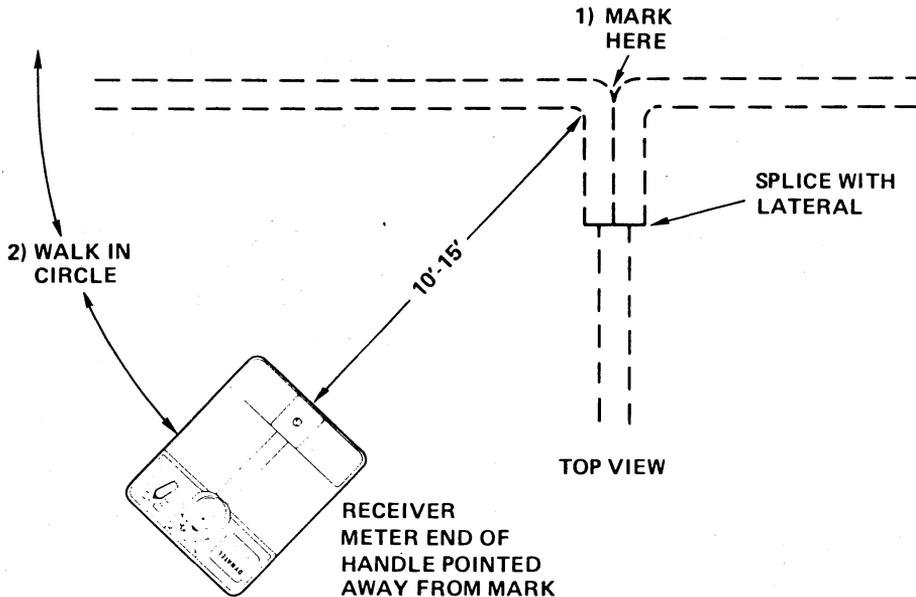


Figure 5-6. Locating Laterals, Drops from Splice, Encapsulation, Riser, etc.

UNKNOWN LATERALS (See Figure 5-6)

5.23 To check for unknown laterals from a closure, set up the Transmitter as detailed in Paragraph 5.01 through 5.04 and set the Receiver on PEAK/EXT. Locate any loops or splices as detailed in paragraphs 5.20 through 5.22. Mark each loop or splice.

5.24 With the Receiver in PEAK/EXT Mode, walk 10-25 feet away from the marker. Walk in a circle around the mark, pointing the Receiver handle at the marker at all times, exactly as shown in Figure 5-6.

NOTE

Keep the handle in line with the marker and pointed away from it, otherwise some laterals or service drops may not be located.

5.25 The Receiver tone should be just audible. When a lateral is discovered, the tone will increase and the meter needle deflect to the right. The volume will peak directly over the cable. Mark each cable discovered.

LOCATING CABLES FROM PEDESTALS OR ACCESSIBLE CLOSURES

5.26 Use the Dynacoupler to put tone on the cable to be located. Place the coupler between the common bond and the point where the cable goes underground. Use NORMAL power.

5.27 Set the Receiver to PEAK/EXT. Then circle the closure at a distance of 10-25 feet, keeping the Receiver pointed away from the closure as shown in Figure 5-6.

5.28 The Receiver will remain relatively quiet until it reaches the cable. Some tone will be heard on all cables. Identify the cable with the highest tone level. The tone will peak and the meter needle deflect to the right directly over the cable. The cable can then be followed along its length. Set the Transmitter OUTPUT switch to HIGH if this is a long section. Circle the pedestal completely to be sure that all cables are located.

SERVICE DROP PATH LOCATION

5.29 To locate the path of a service drop, use the method described in paragraphs 5.09 through

5.13. The Peak Mode is preferred. It may be more convenient to connect the transmitter directly to the protector and trace the drop away from the building.

5.30 Connect the Transmitter cable RED clip to the protector and place the Transmitter on the ground. Otherwise ground the BLACK clip. Set the Transmitter to NORMAL and trace the drop with the Receiver in PEAK/EXT or NULL.

CLEAR END LOCATION

5.31 To find the clear or severed end of a cable or service drop, put a tone on the cable with the Transmitter. If the cable is bonded or connected put the Dynacoupler between the connection and the cable to be located. If the transmitting end is clear, use the direct connection method. Set the Receiver in PEAK/EXT mode and follow the tone until it suddenly decreases. This is the end of the cable.

CABLE CONNECTION TIPS

5.32 **Risers.** To locate a cable going underground from a riser, use the Dynacoupler. Reach above the U-Guard and pull the cable away from the pole, and place the Dynacoupler around the cable. Set the Transmitter on NORMAL. Locate the cable in the usual way.

5.33 **Pressurized Cables.** To put a tone on a pressurized cable, buried or toll, locate a pressure valve. Make a direct connection to the pressure valve (RED clip) and place the Transmitter as far away from the valve as possible. It may be necessary to use the 12 foot cable for additional cable length. The range is increased by using a good separate ground. If the pressure pipe is plastic it will be necessary to induce tone directly into the cable (see Section 5.04).

6. MAINTENANCE (BATTERY REPLACEMENT)

6.01 Maintenance is limited to changing the batteries as they become exhausted. It is not feasible to attempt any field adjustment or repair to the Transmitter or Receiver.

6.02 Transmitter battery life is normally greater than 500 operating hours with the NORMAL output; 100 hours with the HIGH or FAULT output.

6.03 Receiver battery life is longer than 100 operating hours.

NOTE

To preserve the batteries, always set the mode switch to OFF when the unit is not in use.

TESTING THE BATTERIES

6.04 The Transmitter and Receiver each have a BATTERY position on the MODE or OUTPUT switches, and a green BAT OK zone on the meter. Test the battery level frequently during operation. If the needle does not deflect into the green zone, change the batteries.

REPLACING THE BATTERIES

6.05 Transmitter. The Transmitter has four lantern cells as given in Table 5-1. To replace them, follow this procedure (see Figure 6-1).

- a) Remove the Receiver from the Transmitter case.
- b) Remove the 4 screw fasteners shown in Figure 6-2 and lift out the storage tray. Remove the hold-down clamp and battery cover.
- c) Disconnect the used batteries, and connect the new batteries, as shown in Figure 6-1.

NOTE

Always replace all batteries at the same time.

The Transmitter has a protection circuit that prevents damage if the batteries are connected incorrectly. However, the Transmitter will not operate in this condition.

Table 5-1. Battery Types

Unit	No. of Batteries	Voltage	NEDA	Eveready	Burgess
Transmitter	4	6V	915	510S	F4BP
Receiver	2	9V	1602	246	2N6

6.06 Receiver. The Receiver has two carbon-zinc cells (see Table 5-1) located at the opposite end end to control panel on the handle.

- a) Loosen the battery access cover screw and remove the access cover.
- b) Disconnect each battery and replace with a fresh battery. Be sure to connect the RED lead to the positive (+) terminal and the Black lead to the negative terminal (-).
- c) Replace the cover and tighten the screw.

NOTE

Always replace both batteries at the same time.

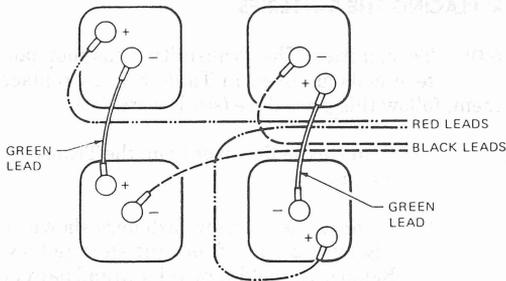


Figure 6-1. Transmitter Battery Connections



Figure 6-2. Transmitter Battery Access. For Access, Release 1/4-turn screws (arrows); lift out plastic storage well.