

# SURE-LOCK<sup>®</sup>

## All Pro

### User Manual



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*This manual supersedes all previous manuals for the Heath Sure-Lock All Pro.*

# **SURE-LOCK®**

## **All Pro**

### **User Manual**

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## **FUNCTION**

The Sure-Lock® is a state-of-the-art, multi-frequency cable and pipe locator system designed to provide the operator the capability to accurately and efficiently locate underground utilities. The instrument's dual microcomputers, fixed frequencies, automatic loading feature, and outstanding transmitter power output make it especially effective for tracing a variety of conductors and for those situations where a radio frequency locator increases the likelihood of success. Virtually all buried utilities capable of signal conduction can be more accurately and conveniently located with the Sure-Lock. It also has a power-sensing feature that allows the identification, detection, and location of current-carrying power lines and cathodic protection systems.

This manual will provide the operator with information concerning the features, operation, and care of this instrument. The Sure-Lock has been designed to withstand field use and provide continuous, trouble-free operation for many years.

# TABLE OF CONTENTS

Function .....	1
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## CHAPTER I - GENERAL DESCRIPTION

Description of System Components .....	4
Transmitter .....	4
Receiver .....	4
Cable/Grounding Kit .....	4
Instruction Manual .....	4
Carrying Case .....	4
Coupler Clamp (Optional) .....	5
Sure-Lock Frequency Selection Guide .....	5
Figure 1-1 (System Components) .....	6
Sure-Lock Transmitter .....	7
Specifications .....	7
Controls .....	8
Figure 1-2 (Transmitter) .....	9
Figure 1-3 (Transmitter Side Panel) .....	9
Sure-Lock Receiver .....	10
Specifications .....	10
Figure 1-4 (Receiver) .....	11
Controls .....	12
Additional Connectors .....	14
Figure 1-5 (Receiver - Additional Connectors) .....	14

## CHAPTER II - GENERAL OPERATING PROCEDURES

Operating Procedures .....	15
Transmitter .....	15
Transmitter - Inductive Mode .....	16
One Operator Sweep - Inductive Mode .....	16
Figure 2-1 (Transmitter Alignment) .....	17
Figure 2-2 (Transmitter Alignment) .....	18
Figure 2-3 (Transmitter Alignment) .....	19
Two-Operator Sweep – Inductive Mode .....	19
Figure 2-4 (Two-Operator Sweep) .....	20
Figure 2-4 (Two-Operator Sweep) .....	20
Conductive (Direct Connect) Mode .....	21
DualJacking (Conductive Mode with Two Direct Connections - Grounding Kit) ....	22
Figure 2-6 (Correct and Incorrect Grounding Application) .....	23
Using the Coupler Clamp .....	23
Figure 2-7 (Coupler Clamp Connection) .....	25
Figure 2-8 (Coupler Clamp Connection) .....	26
Figure 2-9 (Coupler Clamp Connection) .....	26

Conductive/Inductive Mix .....	26
Using the Receiver .....	26
Figure 2-10 .....	28
Conductor Depth Procedure .....	29

**CHAPTER III - MAINTENANCE**

Battery Charging And Replacement Instructions .....	31
Low Frequency Transmitters .....	31
Receiver .....	31
Low Frequency Transmitter Fuse Replacement .....	32
Transmitter .....	32
Routine Maintenance of the Sure-Lock .....	32
Optional Accessories .....	33
Warranty and Warranty Repairs .....	35
Repair Authorization .....	36
Customer Assistance and Service Locations .....	37

# CHAPTER I

## GENERAL DESCRIPTION

### DESCRIPTION OF SYSTEM COMPONENTS

(See Figure 1-1)

#### **Transmitter**

The Sure-Lock® multi-frequency transmitter combines numerous automatic performance and self-monitoring features and includes a sealed, rechargeable battery to support its high power capabilities. It is housed in a durable ABS plastic case. The wide body design provides stability for varying conditions encountered in the field. The top panel of the transmitter is constructed of a corrosion-resistant aluminum alloy. Multi-frequency models include a 120 VAC plug-in battery charger for fully automatic charging of the transmitter battery from any discharged condition.

#### **Receiver**

Sure-Lock's multi-frequency receiver also combines numerous automatic performance and self monitoring features, all microcomputer based. All models employ automatic gain control, continuous estimated and calculated depth display, operator guidance, sealed membrane switch controls for ease of use, and frequency selection. Its housing is ergonomically balanced and constructed of ABS plastic for strength and durability. Six easily accessible, long-lasting AA batteries power the receiver. The receiver is fully sealed against rain and dust.

#### **Cable/Grounding Kit**

The cable/grounding kit consists of the following:

1. "L" Shaped grounding spike
2. Aluminum grounding plate
3. Conductive cable assembly

#### **Instruction Manual**

This manual provides instrument reference, maintenance, and warranty information.

#### **Carrying Case**

The carrying case is constructed of tough, high molecular weight polyethylene. The molded and padded interior provides protection from moisture, shock, and vibration.

---

**\*\*NOTE\*\***

THE SURE-LOCK SHOULD BE KEPT IN ITS CARRYING CASE WHEN NOT IN USE.

---

### **Coupler Clamp** (Optional)

An alternate direct method of energizing the conductor is with a coupler clamp. This device can be used with the transmitter to apply the signal to the conductor and a second clamp can be used with the receiver for very specific identification of conductors when they are selectively energized at the transmitter location. When it can be used, the coupler clamp is a very accurate means for tracing and identifying conductors because of its ability to keep signals away from interfering conductors.

The coupler clamp is a unique tool that generally enhances the separation of the signal compared to conventional methods of energizing the trace conductor. The coupler clamp is also the most effective method of isolating a conductor from interfering conductors in the area of the search. It CANNOT be used on all tracing applications. Since there is no grounding device in use with the coupler clamp, the signal must be able to travel in both directions on the conductor. If the trace conductor is a dead end or has an insulated coupling or insulated flange near the point of attachment, the coupler clamp may not function. This “break” in the continuity of the conductor creates an opening in the conductor loop that will not allow an audio frequency signal to propagate.

### **SURE-LOCK Frequency Selection Guide**

8.1 K	Conductive locating, utilities with good continuity <ul style="list-style-type: none"><li>- Electric and communication distribution cables</li><li>- Transmission gas facilities</li><li>- Fiber optic communication cables</li></ul>
81 K	Versatile conductive or inductive locating <ul style="list-style-type: none"><li>- All utilities</li><li>- Coated pipe</li><li>- Bare steel</li></ul>
480 K	Trouble locations with poor continuity <ul style="list-style-type: none"><li>- Broken tracer wire</li><li>- Cast iron pipe</li><li>- Insulated steel pipe</li><li>- Conductive tape</li></ul>
50-60	Power mode used for electric – Primary and Secondary





Figure 1-1  
(System Components)

- |                                   |                                      |
|-----------------------------------|--------------------------------------|
| A. Transmitter                    | G. Grounding Plate                   |
| B. Receiver                       | H. Grounding Spike                   |
| C. Case                           | I. Flexicoupler 10" ID (Optional)    |
| D. Manual                         | J. Conductive Cable                  |
| E. Coupler Clamp 4" ID (Optional) | K. Conductive Cable with Popper Clip |
| F. Vehicle Charger (Optional)     | L. Wall-Mount Charge                 |

## THE SURE-LOCK TRANSMITTER

(Figure 1-2)

### **Specifications**

1. **OUTPUT FREQUENCIES:** Frequencies are selectable combinations of 8.1 kHz, 81 kHz, and 480 kHz, according to model.
2. **OUTPUT JACKS:** Multi-jacking. Single and mixed frequencies available on individual output jacks.
3. **OUTPUT MODE:** Conductive and/or inductive with automatic load matching. Conductive mode compatible with live cables carrying up to 240 VAC, 50-60 hertz, according to model.
4. **OUTPUT POWER:** Variable 0.6 or 3 watts with automatic load matching. Loads from 5 ohms to 10 K ohms.
5. **LCD:** Automatic backlighting. Indication of output power, frequency operating mode, self-test status, line voltage, load matching and battery level. LCD not available on 81 kHz model.
6. **OPERATOR INTERFACE:** Two sealed overlay membrane switches on all low frequency models. High frequency model uses one switch only.
7. **ADDITIONAL CONNECTORS:** Safety ground lug with wing-nut connects chassis and top panel to ground to prevent electrical shock.
8. **BATTERY TYPE:** Sealed lead-acid, 6 VDC on low frequency models.
9. **BATTERY LIFE:** Depending on frequency and power level selection, life is 10 - 100 hours. An automatic shutdown time of 60 minutes with no switches pressed, assures maximum battery life. Pressing both the ON/OFF and the FREQUENCY buttons simultaneously until 8.1 is shown on the LCD will turn off the Automatic Shutdown Feature.
10. **BATTERY STATUS:** Continuously indicated.
11. **BATTERY CHARGER:** 120 VAC, 50-60 hertz and as an optional accessory an external, isolated 12 VDC (vehicle source) charger. The transmitter can operate while the 12 VDC charger is connected.
12. **OPTIONAL ACCESSORIES:** Includes coupler clamps, conductive attachments, and a 12 VDC vehicle source charger.
13. **TEMPERATURE RANGE (operational):** -25 degrees Fahrenheit to 150 degrees Fahrenheit (-32 degrees Celsius to 65 degrees Celsius).

14. **DIMENSIONS:** 9 1/4" L x 5 1/2" W x 6" D (23.5 cm L x 14 cm W x 15.2 cm D), typical.
15. **WEIGHT:** 8 lbs. (3.6 kg), typical.
16. **CONSTRUCTION:** Weather resistant ABS housing meets NEMA 3S and IP 54. Housing is also shock and vibration resistant.

The Sure-Lock is shipped in a black, hard shell, high molecular weight polyethylene carrying case.

### **Controls**

The Sure-Lock low frequency transmitters have several controls and indicators with which the operator must become familiar (Figure 1-2).

1. **BATTERY CHARGER JACK:** Is used for charging the internal sealed lead-acid battery.
2. **SAFETY GROUND:** Is used to attach a safety ground cable to the transmitter housing for operator safety. A wing nut is provided for ease of connection.
3. **8.1K OUTPUT JACK:** This output is used for directly connecting the 8.1K output to the target conductor.
4. **81K/481K OUTPUT JACK:** This output is used for directly connecting the 81K/480K output to the target conductor.
5. **ALL OUTPUT JACK:** This output is used for directly connecting the 8.1K/81K/480K output to the target conductor.
6. **DISPLAY:** This display indicates the mode of operation, transmitter output power level, battery charge level and system status.
7. **CONDUCTOR DIRECTION ARROW:** The transmitter, when used inductively, must be placed with the conductor direction arrow directly over and parallel to the target conductor.
8. **ON-OFF/LEVEL SWITCH:** This switch will initially turn the transmitter power on and with subsequent presses increase its 8.1K output power level and then cycle the transmitter off. Automatic shutoff will occur in 60 minutes. Automatic shutoff can be eliminated by pressing both the ON/OFF and the FREQUENCY buttons simultaneously until 8.1 is shown on the LCD.
9. **FREQUENCY SELECT SWITCH:** This switch is used to select the output frequency(ies) generated by the transmitter.

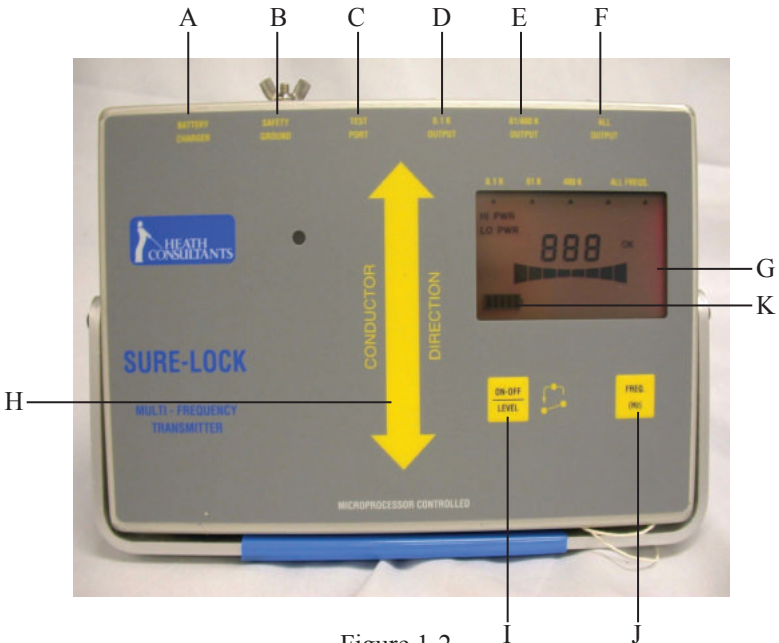


Figure 1-2  
(Transmitter)

- |                            |                              |
|----------------------------|------------------------------|
| A. Battery Charger Jack    | G. Display                   |
| B. Safety Ground Lug w/Nut | H. Conductor Direction Arrow |
| C. Test Port Connector     | I. On-Off/Power Level Switch |
| D. 8.1K Output Jack        | J. Frequency Select Switch   |
| E. 81K/480K Output Jack    | K. Battery Status Indicator  |
| F. All Output Jack         |                              |

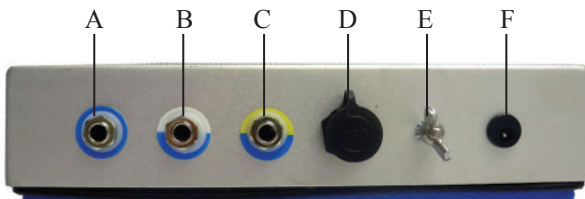


Figure 1-3  
(Transmitter Side Panel)

- |                         |                            |
|-------------------------|----------------------------|
| A. All Output Jack      | D. Test Port Connector     |
| B. 81K/480K Output Jack | E. Safety Ground Lug w/Nut |
| C. 8.1K Output Jack     | F. Battery Charger Jack    |

## **WARNING!**

### **SAFETY FIRST!**

**Check for and turn off all power sources before connecting the transmitter directly to otherwise power carrying cables.**

**Direct connection must NOT be to live 50/60 hertz power sources up to 240 VAC!! The power must be OFF!!**

### **THE SURE-LOCK RECEIVER**

(Figure 1-4)

#### **Specifications**

1. ACTIVE FREQUENCIES: 8.1 kHz with Left-Right and depth displayed.
2. PASSIVE FREQUENCIES: 50-60 hertz without Left-Right depth.
3. DYNAMIC RANGE: 124 dB, typical.
4. DEPTH RANGE: Range to 20' (240" or 610 cm) continuously displayed (estimated depth). Metric units (cm) selectable per order. Automated "calculated depth" function.
5. LEFT-RIGHT GUIDANCE: LCD indicators and audio prompts are present.
6. AUDIO RESPONSE TYPE (Passive): Variable pitch.
7. GAIN ADJUSTMENT: Automatic.
8. LCD: Automatic backlighting. Indication of signal strength, battery level, operating frequency mode, estimated and calculated depth, self-test status, speaker volume, Left-Right arrows and signal LOCK.
9. OPERATOR INTERFACE: Interface accomplished via two sealed overlay membrane switches.
10. BATTERY TYPE: Six alkaline AA cells (NEDA 15A).
11. BATTERY LIFE: 90-120 hours. Automatic shutdown occurs 90 minutes after idle (no switches pressed).
12. BATTERY STATUS: Continuous indication on the display.
13. ACCESS PORT: For coupler clamps.
14. TEMPERATURE RANGE (operational): -25 degrees Fahrenheit to 150 degrees Fahrenheit (-32 degrees Celsius to 65 degrees Celsius).
15. DIMENSIONS: 30 1/2" L x 5 1/2" W x 1 1/4" D (77.5 cm L x 14 cm W x 3.2 cm D), typical.
16. WEIGHT: 5.3 lbs (2.4 kg).
17. CONSTRUCTION: ABS plastic weather resistant housing meets NEMA 3S and IP 54 standards.
18. RUGGEDNESS: Withstands three foot drops to ground (soil).



Figure 1-4  
(Receiver)

- A. Signal Power Indicator (SPI)
- B. Left-Right Indicator
- C. Battery Status Indicator
- D. Lock Indicator
- E. On-Off/Volume Switch
- F. Bubble Level
- G. Frequency Select Switch
- H. Estimated/Calculated Depth Indicator
- I. Volume Level Indicator

## **Controls**

The receiver has several unique features, controls, and indicators with which the operator must become familiar (Figure 1-4).

1. **DISPLAY:** This display provides the operator with information concerning the location and depth of the conductor being traced. A variety of information is displayed.

- a. **Signal Power Indicator (SPI)** - The SPI provides the operator with a dual purpose numerical readout of the relative signal strength of:
  1. A normal (active) tracing mode signal using the transmitter.
  2. A passive signal produced by 50-60 hertz current flowing in the conductor. The transmitter is not used in this mode.

The readout will display from 0 - 999. As the operator gets closer to the intended conductor, the numbers increase and as the operator moves further away from the intended conductor, the numbers decrease.

---

### **\*\*NOTE\*\***

THESE SPI NUMBERS ARE RELATIVE AND DO NOT BEAR ANY SIMILARITY TO NUMBER SYSTEMS USED ON OTHER MODELS. FOR EXAMPLE, READINGS OF 164, 285, ETC., REPRESENT SUFFICIENTLY STRONG SIGNALS FOR LEFT-RIGHT AND DEPTH READINGS.

---

- b. **Left-Right Indicator** - The left-right indicator readout is a multi-segment bar graph with directional arrows that indicate the direction to the intended conductor.

As the operator approaches the conductor, the multi-segment bar graph will shorten, and, as the operator moves further away from the conductor, the bar graph will lengthen.

When the receiver is positioned directly over the intended conductor, the right and left bars and arrow will disappear from the display, but the LOCK indicator will remain on.

- c. **Battery Status Indicator** - Continuous readout appears in 20% increments of battery capacity.
- d. **On/Off Volume Switch** - This switch has two purposes in the receiver. First, it turns the receiver on. Once on, repeated pressing of this switch will step the speaker to successively higher volumes (3 levels total) and then put the receiver in a power off mode where "OFF" is shown in the display.

- e. Lock Indicator - The LOCK indicator is a unique feature of Sure-Lock. When the LOCK indicator appears on the display, the receiver is locked to the signal being generated by the transmitter. This indicator assures the operator of adequate signal strength for measurements on the conductor.

---

**\*\*NOTE\*\***

WHEN THE LOCK INDICATOR BECOMES INTERMITTENT OR DISAPPEARS FROM THE DISPLAY, THE OPERATOR HAS EXCEEDED THE MAXIMUM RANGE OF THE TRANSMITTER SIGNAL. DEPTH WILL NOT BE CALCULATED IF THE LOCK INDICATOR IS NOT STEADILY ILLUMINATED. THE TRANSMITTER SHOULD BE REPOSITIONED OR SET TO HI POWER IN ORDER TO IMPROVE THE SIGNAL STRENGTH.

---

- f. Bubble Level - The bubble level is used to manually position the receiver vertically to engage the automatic calculated depth function. The bubble level may also be used in manually cross checking calculated depth, especially uneven surfaces (Hills).
- g. Frequency Select Switch - The frequency select switch is used to toggle the receiver through its individual frequencies.
- h. Estimated/Calculated Depth Indicator - The estimated depth indicator provides a continuous reading of estimated depth in inches or centimeters for a quick, real-time reading during locating. Changing the estimated depth readings alert the operator of potential factors which may affect locating accuracy. An automatic calculated depth reading will replace the estimated depth reading when applicable.

---

**\*\*NOTE\*\***

THE SURE-LOCK IS AVAILABLE WITH THE DEPTH READOUT IN CENTIMETERS. THIS FEATURE IS PRESET AT THE FACTORY.

---

- i. Volume Level Indicator - This 3 stage indicator relates to the speaker volume currently selected. Successive presses of the ON-OFF/VOLUME switch toggles through increasing volume, receiver power off, receiver power on and back through the 3 speaker volume levels.
- j. Speaker (not shown) - The speaker provides two distinctly separate audio tones, which correspond to the bar graph and directional arrows, to direct the operator to the intended conductor. The first tone, which is lower in pitch, corresponds to the conductor being to the left



of the operator. The second one is higher in pitch and corresponds to the conductor being to the right of the operator. When the receiver is positioned directly over the conductor, the speaker will null (produce no sound).

### **Additional Connectors**



Figure 1-5  
(Receiver - Additional Connectors)

- A. Accessory Jack
- B. Data Jack

**ACCESSORY JACK:** The accessory jack is located near the handle and is labeled ACCESS. This jack is utilized to connect to coupler clamps and other accessories.

**DATA JACK:** The Data Jack is located near the handle and is labeled DATA. This jack is used with special equipment to accomplish factory calibration. This jack is not normally used by the customer.

## CHAPTER II

# GENERAL OPERATING PROCEDURES

### OPERATING PROCEDURES

This portion of the manual is broken down into the TRANSMITTER and RECEIVER sections. The Sure-Lock works as an integrated system. In order to understand this system, the operator must understand the importance and proper use of each part of the system.

#### **\*\*NOTE\*\***

IN THIS MANUAL, THE TERM “CONDUCTOR” REFERS TO ANY METALLIC STRUCTURE TO BE TRACED. THIS MAY INCLUDE ELECTRIC LINES, CABLES, GAS LINES, WATER LINES, TRACER WIRES, ETC.

#### **Transmitter**

The most important element in properly locating a buried underground conductor is to properly energize the conductor. This is the function of the transmitter. Therefore, the operator must understand the function of the transmitter in the system and learn which mode of operation is best for any given locating assignment. The majority of the problems an operator may encounter in the field can be traced back to improper use or incorrect positioning of the transmitter.

Before using the transmitter in any of the following applications, it is essential that the operator determine if the transmitter battery has sufficient charge to complete the expected operation. To test the battery, simply turn the transmitter on and observe the percentage (%) of battery charge on the display.

A key feature of the Sure-Lock is its multi-frequency capability. A multi-frequency transmitter is capable of transmitting a single frequency or multiple frequencies simultaneously. Multiple frequency output is best used to initially select and verify which single frequency to use for a given locate.

Generally, this is accomplished by first putting the transmitter in “ALL OUTPUT” mode and then stepping through the frequency which gives the adequate SPIs and good depth can generally then be selected on both the transmitter and receiver. Multiple transmitter outputs should only be used to locate two separate conductors or to better isolate and identify the target conductor.

There are five modes of operation that can be used to energize conductors with the transmitter. These modes are:

1. Inductive or Indirect Connect
2. Conductive or Direct Connect
3. Coupler Clamp (Models 91, 58 and Flexible Clamp)
4. Conductive/ Inductive Mix
5. Dual Jacking

### **Transmitter - Inductive Mode**

The inductive mode of operation is the easiest and simplest mode of using the transmitter as no direct access to the conductor is needed. However, the operator must thoroughly understand how the transmitter functions in this mode of operation in order to avoid the locating pitfalls that can accompany this mode of operation.

There are two ways to energize the conductor using the inductive mode. They are as follows:

1. One Operator Sweep
2. Two Operator Sweep

### **One Operator Sweep - Inductive Mode**

When using the one operator sweep, the operator must know where the conductor is located at one particular point. This “starting point” may be a valve box, riser, pedestal, repair patch, etc.

When a known starting point is determined, the transmitter is turned on and the positioned directly over the top of the conductor to be traced so that the arrow is aligned with the path of the conductor (Figure 2-1).

---

#### **\*\*NOTE\*\***

THE STRONGEST SIGNAL TRANSFERS TO THE CONDUCTOR WHEN THE TRANSMITTER IS CENTERED DIRECTLY OVER THE CONDUCTOR WITH THE ARROW ALIGNED PARALLEL TO THE PATH OF THE CONDUCTOR.

---



Figure 2-1  
(Transmitter properly aligned with the conductor)

One of the pitfalls the operator must recognize is that when the transmitter is functioning in the inductive mode, other conductors in the area may also be energized. When the transmitter is functioning in this application, it is energizing the conductor with an electromagnetic signal. This signal is not only going onto the intended conductor but it is also being radiated onto the other conductors surrounding the transmitter.

These other conductors might include overhead power or telephone lines, chain link fences, guard rails, railroad tracks, or other utilities in the area of the transmitter. If the operator suspects there will be interference from other conductors, a direct mode of connection should be used to energize the conductor and to help eliminate these interfering conductors.

If signals from another conductor are causing interference during the trace, they will affect the accuracy of the locator. The operator should attempt to connect the transmitter directly to the conductor by means of a direct connect assembly (discussed later) or by means of the coupler clamp. If this is not possible, the transmitter should be positioned as shown as in Figure 2-2. With the transmitter positioned as shown, the target conductor can be energized with minimum signal placed on the interfering conductor.



Figure 2-2

(Transmitter positioned on its end directly over the interfering conductor. This position will energize the target conductor and apply minimum signal to the interfering structure)

Another common mistake that must be understood and avoided in the indirect mode of operation is AIR COUPLING. As was previously mentioned, the signal is being radiated around the transmitter. When the transmitter and receiver are not sufficiently separated, the signal may travel directly through the air to the receiver. This phenomenon can be avoided by maintaining an interval of at least 75 feet (23 m) between the receiver and transmitter at all times. If a trace is required closer than 75 feet and the conductor cannot be energized by direct connect means, the following step should be taken. Set the transmitter on its end, 1 to 2 feet to the side of the conductor (Figure 2-3). By using the transmitter in this position, the receiver can now work in closer proximity to the transmitter. With the transmitter in this position, the operator should maintain a minimum distance of 35 feet (11 m). More discussion concerning elimination and determination of air coupling will occur in the receiver portion of this manual.

Once the conductor has been energized by the proper placement of the transmitter, the operator should walk the recommended distance away from the transmitter with the receiver. The receiver should then be used to sweep the area while watching the display and listening to the distinct tone changes as receiver senses the conductor.



Figure 2-3

(Transmitter positioned on its end for closer tracing applications. This set-up will reduce the air coupling distance)

### **Two Operator Sweep - Inductive Mode**

Another method of locating a conductor inductively is by means of the two operator sweep. This method is generally used when no starting or ending point is known for a given conductor.

To perform the two operator sweep, turn on the transmitter and receiver. One operator carries the transmitter while the other operator carries the receiver. Both operators line up so that both the receiver and transmitter are aligned as in Figure 2-4. The operators must maintain a sufficient distance between themselves to avoid air coupling. The operators slowly move across the search area and in the direction of the suspect conductor. The operator with the transmitter must make sure to hold the instrument so that the ARROW on the transmitter is aligned parallel to the suspected path of the conductor. Once the line is located (Figure 2-5), the transmitter can then be placed over the conductor and the conductor traced by using the same procedures as described for the one operator sweep. It must be noted that once a conductor is located, it is up to the operator to verify that this is the intended conductor. This may be accomplished by tracing the conductor to a junction point on the conductor such as a valve, junction box, pedestal, etc.





Figure 2-4  
(Operators properly positioned to begin the two operator sweep)

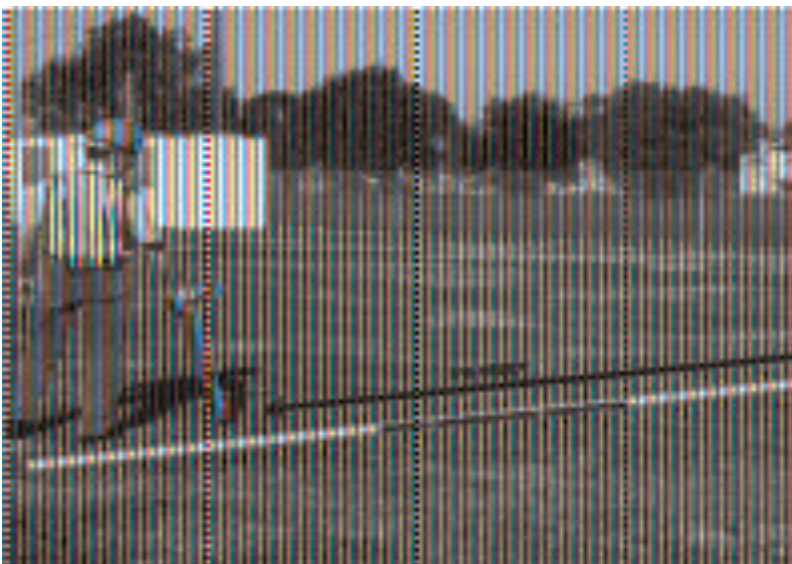


Figure 2-5  
(Two operator sweep. The operators have energized and located the conductor)

### **Conductive (Direct Connect) Mode**

Whenever possible, the conductive method is preferred for energizing the conductor. By using a direct hookup, the operator can help eliminate locating mistakes often associated with the inductive method, i.e., energizing other structures and air coupling.

By using a direct energizing method, the operator helps isolate the target connector from other conductors in the area and will generally receive a better signal with which to conduct the locate.

The Sure-Lock comes with a direct connection cable/grounding kit consisting of grounding cables, grounding plate, grounding spike, and bridging cable.

### **WARNING!**

### **SAFETY FIRST!**

**Check for and turn off all power source(s) before connecting the transmitter directly to power carrying cables.**

**Direct connection must NOT be to live 50/60 hertz power sources up to 240 VAC. The power must be OFF!!**

**Be certain the transmitter POWER is off before handling the clips on the conductive assembly. The Sure-Lock transmitter can deliver 100 volts of signal which is capable of producing electrical shock if not carefully handled.**

To energize the conductor with the direct connect mode, the operator should first plug the cable(s) into the output jack located on the side of the transmitter. The **RED** cable should then be connected to the conductor to be traced. A good connection to the conductors is essential for a clear, strong signal. Any rust, corrosion, or paint should be removed in order to obtain a good metal to metal contact.

The **BLACK** cable is then extended as far away from the conductor as the cables will allow. It is then attached to a suitable grounding source such as the spike or grounding plate. The spike should be firmly driven into the soil. The ground plate may be pushed vertically into the soil or laid flat on the ground if soil penetration is not permitted, such as with concrete. If the plate is laid flat on the concrete or blacktop, it is advisable to wet the concrete in order to obtain a good ground. **A GOOD GROUND IS ESSENTIAL!** It is generally advisable to ground perpendicular to the structure being traced. The operator



must be aware at all times of where the grounding cables run and what is used as a ground. The cables are carrying the full signal current, and, if the operator should ground over the top of or close to another conductor, the other conductor may be energized and jeopardize the locate (Figure 2-6). If a foreign structure such as a chain link fence is being used for ground, that structure will also be energized and could confuse the operator. Always be aware of the importance and function of the ground in the **DIRECT CONNECT** application.

---

**\*\*NOTE\*\***

REMEMBER THAT THE SIGNAL ON THE GROUND WIRE IS AS STRONG AS THE SIGNAL ON THE CONDUCTOR.

---

Once the conductor is energized using the direct connect method, the operator may use the receiver to search for the signal using the same techniques described in the one operator sweep. Since there is now a direct connection to the conductor, the inductive antenna on the transmitter is not active. The operator can now work closer to the transmitter and not be affected by air coupling. It should be understood that the operator will start picking up signals near the grounding cables as they are radiating the same signal carried by the target conductor.

**Dual Jacking – (the Conductive Mode with two direct connections – grounding kits)**

As with the single Conductive (direct connect) method as illustrated in Figure 2-6, the operator may perform two direct connections as follows:

With the Sure-Lock, the operator may use two direct connections using two frequencies – 8.1 and 81 kHz. The operator will need two direct connect (grounding) cables to perform this function.

With a single hook-up as illustrated in Figure 2-6, the Sure-Lock direct connection attachment is plugged into one of two output jacks, the 8.1 and 81 kHz ranges. The red lead is attached to the pipe/cable and the black lead is attached to the grounding spike.

The same procedure is followed when attaching two separate direct connection attachments to two individual utilities – for example gas and electric services. Therefore, the operator will have one set of direct connection attachments plugged into the 81 kHz output jack and the second set plugged into the 8.1 kHz output jack.

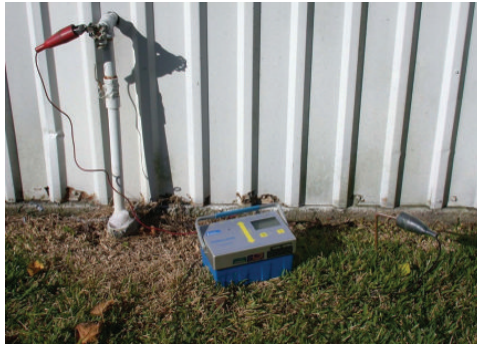
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**\*\*NOTE\*\***

THE TRANSMITTER PRIOR TO ATTACHING THE DIRECT CONNECTIONS (TWO GROUNDING CABLES) MUST BE SET IN THE ALL OUTPUT FREQUENCY MODE SO THAT THE OPERATOR WILL BE ABLE TO SWITCH BACK AND FORTH BETWEEN THE 8.1 AND 81 kHz RANGES/ FREQUENCIES.

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Two coupler clamps (see USING DUAL COUPLER CLAMPS, page 24) can also be used in Dual Jacking.



(Correct - Grounding Application)



(Incorrect - Grounding Application)

Figure 2-6

### **Using the Coupler Clamp**

Models 91 (HPN 58212524), 58 (HPN 56212309), Flexible Clamp (HPN 100725-0)

Another direct means of energizing the conductor is with a coupler clamp. This device can be used with the transmitter to apply the signal to the conductor, or a second clamp can be used with the receiver for very specific identification of conductors when they are selectively energized at the transmitter location. When it can be used, the coupler clamp is a very accurate means for tracing and identification because of its ability to keep signals away from interfering conductors.

1. **INSTRUCTIONS FOR SINGLE COUPLER CLAMP USE:** Before using the coupler clamp, refer to the coupler clamp applications section which starts on the next page.
  - a. Plug the coupler clamp into the appropriate output jack on the transmitter. Each accessory is color coded and corresponds with its appropriate color coded input jack on the transmitter. Model 91 for 8.1K color coded yellow/blue, model 58 for 81K color coded white/blue.
  - c. Attach the coupler clamp around the conductor to be traced making sure the “jaws” of the clamp are fully closed. The contact points of the coupler clamp must not touch the conductor.
  - d. Turn on the receiver and begin the search allowing the receiver to guide you to the conductor per instructions under Using the Sure-Lock Receiver, page 26.
2. **USING DUAL COUPLER CLAMPS:** This method of operation is especially useful for energizing and identifying a conductor running with other conductors, i.e., manhole-to-manhole traces, manhole-to-cable vault, etc.

To utilize this method, two coupler clamps are necessary and direct access is required at both the transmitter and receiver locations.

- a. Position the first coupler clamp around the conductor being traced.
- b. Plug the first coupler clamp into the direct accessory output jack of the transmitter and turn the transmitter on.
- c. Plug the second coupler clamp into the “ACCESS” jack located on the front of the receiver and turn the receiver on.
- d. Now begin to search for the energized conductor by attaching the coupler clamp around the conductor(s) in question and observe the SPI readings on the display. The conductor showing the highest SPI will be the conductor being energized by the transmitter at the other end of the locate run.

Typical application instructions and diagrams for using the coupler clamps models 91 and 58:

The coupler clamp is a unique tool that generally enhances the separation of the signal as compared to conventional methods of energizing the trace conductor. The coupler clamp is also an effective method of isolating a conductor from interfering conductors in the area of search. It CANNOT be used on all tracing applications. Since there is no grounding device in use with the coupler clamp, the signal must be able to travel in both directions on the conductor. If the trace conductor is a dead end or has an insulated coupling or insulated flange near the point of attachment, the coupler clamp may not function. This “break” in the continuity of the conductor creates an opening in the conductor loop that will not

allow the signal to propagate.

In such situations, this conductor loop must be closed. The coupler clamp comes equipped with a bridging cable which can be used for this purpose. This cable is used to “bridge” the break in continuity. The cable can be attached to bridge an insulated coupling or insulated flange such as might occur on a cathodically protected gas line with the insulator at the meter set (Figure 2-7). Caution must be taken when using the bridging cable in such situations and it may be used only after obtaining permission. It **MUST** be removed after the locate is completed.

In the event that the point of attachment is at the termination or dead end of a conductor, the termination point must be grounded away from the directional run of the conductor. Once this is accomplished, the signal is allowed to travel and the coupler clamp will now function (Figure 2-8). Both ends of the conductor may need to be connected to earth ground.

The coupler clamp is an ideal device for tracing cables as a direct connect hook-up is often not possible without having to enter pedestals or junction boxes and without making a metal-to-metal contact. The jaws on the coupler clamp must be closed and completely encircle the conductor in order to function properly (Figure 2-9).



(Correct - Bridging cable attached around the insulator bridges the break in the conductor loop)



(Incorrect - Signal cannot flow due to a break)

Figure 2-7



(Correct - Grounding attachment allows signal to flow)



(Correct. - The coupler clamp jaws are closed around the conductor. The conductor is energized)



(Incorrect - Terminated end (open circuit). The signal will not flow)



(Incorrect - The coupler clamp jaws are clamped to the conductor. The conductor is not energized)

Figure 2-8

Figure 2-9

### **Conductive/ Inductive Mix**

Proper use of the transmitter output is necessary to obtain a mixed output. Mixed outputs are only available with the transmitter set to “ALL OUTPUT” mode. With no conductive cables attached, the transmitter operates inductively for all frequencies selected.

Attaching a conductive cable to a respective output will switch that output from inductive to conductive mode. The other outputs will still be operating in the inductive mode.

### **Using the Receiver**

A correct understanding of the transmitter’s use is important to assure proper signals at the receiver’s location. As a highly developed computerized instrument, the Sure-Lock is capable of providing remarkable accuracy in a wide range of field situations.

1. ONCE THE CONDUCTOR IS PROPERLY ENERGIZED:

- a. Turn the receiver on and select the appropriate frequency matching that on the transmitter.
- b. Verify the battery capacity on the receiver is sufficient for the intended operational time. The battery test indication will read in 20% increments of available voltage in the batteries.
- c. The operator should slowly sweep the receiver as it searches for the conductor. The operator will notice the following visual and audio indications on the display and from the built-in speaker:
  - i. LOCK INDICATOR: As the operator enters the signal field, the LOCK indicator will appear on the display. This assures that the sufficient signal is available from the conductor for all receiver functions.
  - ii. LEFT-RIGHT INDICATOR: A multi-segmented bar graph will appear on the display with the directional arrows to guide the operator to the conductor. In conjunction with the directional arrows, special tones will come from the speaker.

One tone, which is lower in pitch, corresponds to the conductor being to the left of the operator. Another tone is higher in pitch and corresponds to the conductor being to the right of the operator. When the receiver is positioned directly over the conductor, the speaker will null (produce no sound).

The VOLUME switch may be used to adjust the loudness as desired.

- iii. SIGNAL POWER INDICATOR: SPI numbers will appear on the display panel. These numbers will range from 0 - 999. As the operator nears the conductor, the numbers will increase and as the operator moves away from the conductor, the numbers will decrease. The numbers are the highest when the operator is nearest to the conductor and when the receiver is lined up with it (Figure 2-10).
- iv. CONTINUOUS DEPTH: The estimated depth indicator provides a continuous reading of estimated depth for a quick, real-time reading during locating. Unexpected estimated depth readings alert the operator of potential factors which may affect locating accuracy. Refer to Additional Factors Affecting Depth Readings, page 30, for Conductor Depth Procedure.





Left



Lock



Right

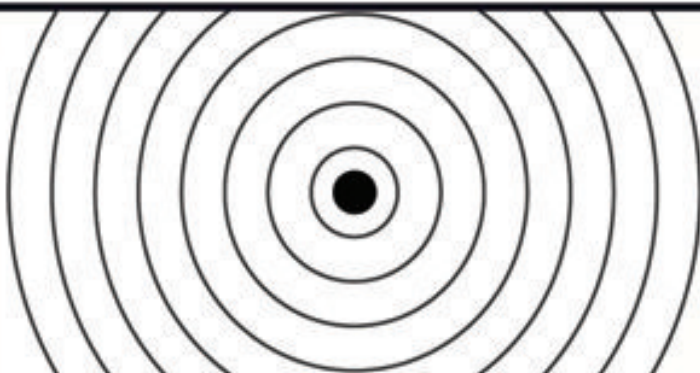


Figure 2-10

When the operator has pinpointed the exact location of the conductor (using the above indicators) and the receiver is positioned directly above the conductor, the following will occur:

- a. The LOCK indicator will remain active on the LCD display.
- b. The left-right arrows and segmented bar graph will disappear from the display.
- c. The audio left-right tones will null (produce no sound).
- d. The SPI will show the highest relative number on the display.
- e. The estimated depth will be displayed.

Each of these indications gives the operator valuable information about the conductor being traced. It is an indication that the conductor has NOT been pinpointed if ALL the above do not occur.

### **Conductor Depth Procedure**

Once the conductor has been pinpointed using the audio and visual indicators as previously described, the operator may then perform a calculated depth indication reading.

The operator should follow these procedures to obtain a calculated depth reading:

1. While maintaining a vertical position, rest the tip of the probe on the ground directly over the conductor with the receiver blade perpendicular to the conductor.
2. Hold the receiver in a vertical position with the bubble in the bubble level centered. It must not angle away from, toward, or to the left or right of the operator.
3. The operator should then hold this position for approximately five seconds to obtain an automatic calculated depth calculation.
4. The operator should then see the CLC followed by a number appearing on the display. This number will remain displayed for several seconds and will indicate the depth in inches (or centimeters, optional) to the CENTER of the conductor. The receiver features automatic return to search mode and estimated depth.
5. It is good practice to take at least 2-3 depth readings as a cross check. To repeat a depth reading, maintain a vertical position.

If a depth indication does not appear on the display or there is not logical sequence to the numbers, it usually means the following:

- a. "Ghost Signal" (jittery L/R and SPIs).
- b. Air-coupling to the transmitter.
- c. Interference from other conductors.
- d. Exceeding the 240" (610 cm) depth limit.



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**\*\*NOTE\*\***

THIS CONDITION MAY BE EVALUATED USING TWO METHODS. ONE METHOD IS BY PIVOTING THE RECEIVER 180 DEGREES WHICH MAY PRODUCE DEPTH READING WHICH DIFFER BY 10%. SUCH DIFFERENCES UP TO 15-20% MAY BE AVERAGED AND WHICH CAN BE THE RESULT OF A TILTED CONDUCTOR WHICH OCCURS NATURALLY WHERE A FORWARD OR RE-VERSE GRADE EXISTS. DIFFERENCES GREATER THAN 20% INDICATE INACCURATE DEPTH READINGS. A SECOND METHOD IS SOMETIMES CALLED THE "LIFT TEST" AND INVOLVES TAKING A STANDARD CALCULATED DEPTH READING AND THEN LIFTING THE RECEIVER UP A KNOWN DISTANCE AND OBSERVING THE NEW CALCULATED DEPTH READING ON THE DISPLAY. THE UPDATED CALCULATED DEPTH READING SHOULD INCREASE BY THE DISTANCE THAT THE RECEIVER WAS RAISED. PIVOTING THE RECEIVER MAY ALSO BE USED WITH THE LIFT TEST.

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These results may also indicate that the operator should reposition the transmitter or go to a different transmitter mode of operation to energize the conductor.

#### Factors Affecting Depth Readings

1. Interfering conductors in the area.
2. Type and conductivity of soil.
3. Receiver not centered on target.
4. Depth of burial versus size of target.
5. Insufficient signal to retain a steady LOCK before or during calculated depth readings.
6. Changing conductor depth or a tilted conductor at the reading location.
7. Frequency selection (lower frequencies preferred).
8. Grounding method.

The above factors should always be taken into consideration when taking a calculated depth reading with the receiver. If not, calculated depth may have inaccuracies greater than 20% of the actual value.

## CHAPTER III MAINTENANCE

### BATTERY CHARGING AND REPLACEMENT INSTRUCTIONS

#### Low Frequency Transmitters

The Sure-Lock low frequency transmitters are equipped with a re-chargeable, 6 VDC, maintenance free, fully sealed lead-acid battery. The instrument includes a convenient 120 VAC wall mount charger which is capable of fully recharging the transmitter battery overnight with no danger of overcharging if left on continuously.

#### IMPORTANT:

1. Charging Procedure:
  - a. Turn the transmitter off when using the 120 VAC wall mount charger. If the vehicle source (12 VDC) charger is used, the transmitter may be either on or off.
  - b. Plug the 120 VAC charger cable into the BATTERY CHARGER jack on the transmitter panel.
  - c. Plug the wall mount charger into a 110-130 VAC 50-60 Hz receptacles.
  - d. The charge level cannot be accurately gauged with the Battery Test feature during a charge. The test function is only valid two or more hours after charging is discontinued.
  - e. While circumstances may occasionally limit the time generally available for charging an instrument, charge planning should be based on overnight and longer charging/float periods.

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#### **\*\*NOTE\*\***

CONTINUOUS FLOAT CHARGING IS IDEAL AND ASSURES MAXIMUM BATTERY CYCLE LIFE ESPECIALLY WHEN THE BATTERY HAS BEEN DISCHARGED TO LESS THAN 50%. FOR BEST PERFORMANCE, THE BATTERY SHOULD BE ATTACHED TO ITS CHARGER WHEN NOT BEING USED.

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#### Receiver

The receiver functions with six alkaline AA batteries which are furnished and readily available and replaceable (HPN 8303311). They are NOT rechargeable.

1. Replacement Instructions:
  - a. Loosen the screw and remove the battery access door located on the bottom of the receiver.

- b. Remove the six exhausted batteries by depressing and lifting the positive ends of the batteries (opposite the spring ends) to avoid damaging the springs.
- c. Install the six new batteries by first observing the correct polarity and inserting the negative ends first to compress the springs. Push the batteries into place.
- d. Replace the battery access door.
- e. Turn on the receiver and verify the correct battery voltage on the display.

## **LOW FREQUENCY TRANSMITTER FUSE REPLACEMENT**

### **Transmitter**

(High frequency models are not fused)

The Sure-Lock low frequency transmitters contain a 2 amp, 250 volt, 3 AG fast-blow fuse.

1. Replacement Instructions for Transmitter Fuse-
  - a. Turn the transmitter upside down and lay the top panel on a soft surface to prevent damaging the top panel's surface. Locate the two end screws of the transmitter that hold the transmitter bottom in place.
  - b. Loosen each screw three turns.
  - c. Lift up and remove the transmitter bottom housing.
  - d. Completely remove the two end screws.
  - e. Lift up the internal antenna/battery subassembly and set it down with its' antennas face down. The printed circuit board (PCB) should now be on top.
  - f. The fuse is located near the edge of the PCB and is marked F1. Locate and replace the fuse with a 2 amp, 250 volt, 3 AG fast-blow fuse.
  - g. Reposition the antenna/battery subassembly onto the top panel and start the two end screws. DO NOT TIGHTEN.
  - h. Verify that the cables or harness are not caught between the top panel and the edge of the housing.
  - i. Replace the transmitter bottom housing onto the top panel and tighten the two end screws.
  - j. Turn the transmitter on and verify the battery level indication and test on both LO and HI power modes if applicable.

## **ROUTINE MAINTENANCE OF THE SURE-LOCK**

The Sure-lock is a rugged, durable instrument designed and manufactured to withstand the rigors of day-to-day field use. It is, however, an electronic instrument and should be treated as such.

It is suggested that when the Sure-Lock is not in use, it should be kept in its carrying case and stored in a cool, dry area. If left in a vehicle, avoid exposure to extremes in weather conditions. Avoid storage in an area where direct sunlight shines on the display as this may discolor the LCD over time.

Should the instrument become dirty or wet, wipe it down with a damp or dry cloth. Caution should be taken in using cleaning compounds on the face of the transmitter and the receiver. Certain harsh, gritty cleansers can mar or damage the lettering on these units. Mild soap and water is recommended.

The direct connection attachments should be periodically inspected to make sure there are no frayed or broken cables. The clamps should be inspected to assure a good contact is being made between the jaws.

When the direct connect cables are being removed from the transmitter, grab the plug itself. Do not remove by pulling the cable.

For greater visibility, it is suggested that when working in the street or around traffic, a traffic cone be placed next to the transmitter. It is also suggested that the operator wear a protective safety vest and hard hat when conducting any locate.

With proper maintenance, the Sure-Lock should provide many years of trouble-free service.

## **WARNING!**

### **SAFETY FIRST!**

**Check for and turn off all power source(s) before connecting the transmitter directly to power carrying cables.**

**Be certain the model of Sure-Lock used is capable of being directly connected to live 50-60 Hz power sources up to 240 VAC.**

**Be certain the transmitter POWER is off before handling the clips on the conductive assembly. The Sure-Lock transmitter can deliver 100 volts of signal which is capable of producing electrical shock if not carefully handled.**

## **OPTIONAL ACCESSORIES**

Coupler Clamp Model 58 (HPN 56212309), Model 91 (HPN 58212524) and Flexible Clamp (HPN 100725-0). Standard or optional according to model.

1. 12 VDC BATTERY CHARGER (HPN 6710777): Used to charge the transmitter battery from a 12 VDC power source such as a vehicle's cigarette lighter. Optional with all model types.
2. PLUNGER BAR (HPN 1900480): The plunger bar provides a superior temporary grounding source which can be quickly and easily inserted and removed to enhance the signal strength in the conductive mode. The plunger bar has a 1/2" steel tempered rod (40" long) and an insulated "piston action" handle which provides shock resistance for the operator. Optional with all model types.

For more information concerning any of these options, please contact Heath Consultants Incorporated at the address, phone number, or Web Site as found in section CUSTOMER ASSISTANCE AND SERVICE LOCATIONS, page 31 of this manual.

Obviously, we cannot discuss every application of the Sure-Lock in this manual. We at Heath Consultants Incorporated suggest you become familiar with the Sure-Lock by practicing with it at a known location of an underground pipe or cable. Practice using the transmitter in both the inductive and conductive modes of operation. Practice with the receiver so that you become thoroughly familiar with the controls and understand what the tones and displays are indicating concerning the conductor being traced and other conductors that may be in the area.

The Sure-Lock is a unique instrument capable of extreme accuracy, but it is "only as good as the operator". Take the time to perform the locate properly in order to obtain the optimum results from this instrument.

For information concerning a pipe or cable locating school, please contact Heath Consultants at 1-800-HEATH-US (1-800-432-8487) or on the web at [www.heathus.com](http://www.heathus.com)

## **WARRANTY AND WARRANTY REPAIRS**

The Sure-Lock instruments are warranted for two years.

All other instruments and products manufactured by Heath Consultants Incorporated are warranted to be free from defects in material and workmanship for one year from the date of shipment.

The Plunger Bar (handle only) is warranted to be free from defects in material and workmanship for 90 days.

The warranty on authorized repairs in the Houston Factory Service Center (FSC) is ninety (90) days materials and thirty (30) days labor. This repair warranty does not extend any other applicable warranties.

This warranty covers only failures due to defects in materials or workmanship which occur during normal use. It does not cover failure due to damage which occurs in shipment, unless due to improper packing, or failures which result from accident, misuse, abuse, neglect, mishandling, misapplication, alteration, modification, or service other than at a Heath Consultants warranty repair location

Battery and damage from battery leakage and all expendable items such as plunger bar rods are excluded from this warranty.

Heath Consultants' responsibility is expressly limited to repair or replacement of any defective part, provided the product is returned to an authorized warranty repair location, shipped pre-paid, and adequately insured. Return shipping and insurance will be at no charge to the purchaser.

We do not assume liability for indirect or consequential damage or loss of any nature in connection with the use of any Heath Consultants products.

There are no other warranties expressed, implied, or written except as listed above.

## **RETURN AUTHORIZATION (RA)**

The following suggestions will expedite the repair of your instrument:

1. Contact Heath Customer Service at 1-800-432-8487 for a RA #.
2. Package carefully, using the original shipping carton and cushions if available, and return all components.
3. Specify your complete shipping and billing addresses.
4. Specify the instrument or product name, model number, and serial numbers on all correspondence.
5. Include a brief description of the problem you are experiencing and specify the person and phone number to be contacted for information.

**CUSTOMER ASSISTANCE, MANUFACTURING AND SERVICE  
LOCATIONS**

**CORPORATE HEADQUARTERS**

**Heath Consultants Incorporated**

9030 Monroe Road  
Houston, Texas 77061  
Phone: (713) 844-1300  
Fax: (713) 844-1309

**MANUFACTURING AND WARRANTY SERVICE CENTERS**

**Heath Consultants Factory Service Center**

9030 Monroe Road  
Houston, Texas 77061  
Phone: (713) 844-1350  
Fax: (713) 844-1398



*Heath Consultants Incorporated operates under a continual product improvement program and reserves the right to make improvements and/or changes without prior notification.*

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**[www.heathus.com](http://www.heathus.com)**



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