

900R/T Series

Operator's Manual



CMW®

Issue 1.0



053-1118

Overview



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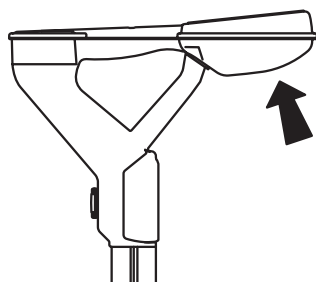
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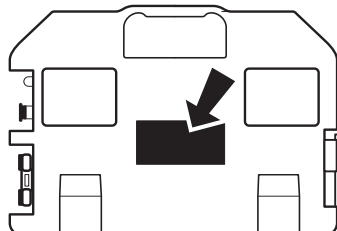
FCC Statement 4

Serial Number Location

Record serial numbers and date of purchase in spaces provided. Unit serial number is located as shown.



ss0001c.eps



Item	
date of purchase:	
receiver serial number:	
transmitter serial number:	
accessory model & serial number:	
accessory model & serial number:	
accessory model & serial number:	

Intended Use



The 950R receiver is designed to locate buried pipes, lines, and cables. Several frequencies and modes of operation are available to suit your specific locating needs. The 910R receiver is a configurable version of the 950R. Unit will not have all options described due to configuration ordered.

Available **passive** modes include 50Hz, 50P, 60 Hz, 100 Hz, 120 Hz and 60P power, radio, and 31 kHz CATV. CP1, CP2, CP3, CP4, CP5, and CP6 modes are available for searching for lines with cathodic protection.

Available **active** modes include 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and 200 kHz for use with Ditch Witch transmitters. 273 Hz, 400 Hz, 560 Hz, 815 Hz, 8.1 kHz, 33 kHz, and 100 kHz modes also are available with the 950R, but are not transmitted by the 950T or 970T.

Available beacon modes include 512 Hz, 640 Hz, 574 Hz, 29 kHz, and 33 kHz for locating non-metallic pipes.

The 950T and 970T transmitters place signals on target lines to be detected by 900 series receivers. Both units can be configured to send 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and dual (8 kHz and 29 kHz) frequencies. The 970T can also be configured to transmit 200 kHz. Both transmitters place a signal on the line through either direct connection, induction clamping, or broadcast modes.

The system is designed for operation in temperatures typically experienced in earth moving and construction work environments. Use in any other way is considered contrary to the intended use. The 900 series system should be operated only by persons familiar with its particular characteristics and acquainted with the relevant safety procedures. The system should be serviced only by Ditch Witch repair centers.

About This Manual

This manual contains information for the proper use of this equipment. Cross references such as “See page 50” will direct you to detailed procedures.

Bulleted Lists

Bulleted lists provide helpful or important information or contain procedures that do not have to be performed in a specific order.

Numbered Lists

Numbered lists contain illustration callouts or list steps that must be performed in order.

“Continued” Indicators



indicates that a procedure is continued on the next page.

FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by **The Charles Machine Works, Inc.** could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the operator's manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Foreword



This manual is an important part of your equipment. It provides safety information and operation instructions to help you use and maintain your Ditch Witch equipment.

Read this manual before using your equipment. Keep it with the equipment at all times for future reference. If you sell your equipment, be sure to give this manual to the new owner.

If you need a replacement copy, contact your Ditch Witch dealer. If you need assistance in locating a dealer, visit our website at www.ditchwitch.com or write to the following address:

The Charles Machine Works, Inc.
Attn: Marketing Department
PO Box 66
Perry, OK 73077-0066
USA

The descriptions and specifications in this manual are subject to change without notice. The Charles Machine Works, Inc. reserves the right to improve equipment. Some product improvements may have taken place after this manual was published. For the latest information on Ditch Witch equipment, see your Ditch Witch dealer.

Thank you for buying and using Ditch Witch equipment.

**900R/T Series
Operator's Manual**

Issue number 1.0/OM-5/07

Part number 053-1118

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Safety

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Guidelines

Follow these guidelines before operating any jobsite equipment:


- Complete proper training and read operator's manual before using equipment.
- Classify jobsite based on its hazards and use correct tools and machinery, safety equipment, and work methods for jobsite.
- Mark jobsite clearly and keep spectators away.
- Wear personal protective equipment.
- Review jobsite hazards, safety and emergency procedures, and individual responsibilities with all personnel before work begins.
- Replace missing or damaged safety signs.
- Use equipment carefully. Stop operation and investigate anything that does not look or feel right.
- Contact your equipment dealer if you have any question about operation, maintenance, or equipment use.


Safety Alert Classifications


These classifications and the icons defined on the following pages work together to alert you to situations which could be harmful to you, jobsite bystanders or your equipment. When you see these words and icons in the book or on the unit, carefully read and follow all instructions. **YOUR SAFETY IS AT STAKE.**



Watch for the three safety alert levels: **DANGER**, **WARNING** and **CAUTION**. Learn what each level means.

 **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

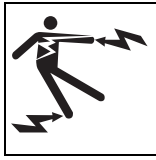
 **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Watch for two other words: **NOTICE** and **IMPORTANT**.

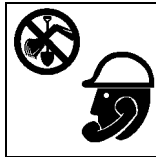
NOTICE can keep you from doing something that might damage the unit or someone's property. It can also alert you against unsafe practices.

IMPORTANT can help you do a better job or make your job easier in some way.

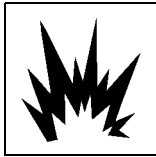
Safety Alerts

**⚠ DANGER**

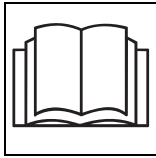
Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.

**⚠ WARNING**

Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

**⚠ WARNING**

Explosion possible. Serious injury or equipment damage could occur. Follow directions carefully.

**⚠ WARNING**

Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

**⚠ WARNING**

Moving traffic - hazardous situation. Death or serious injury could result. Avoid moving vehicles, wear high visibility clothing, post appropriate warning signs.

Controls

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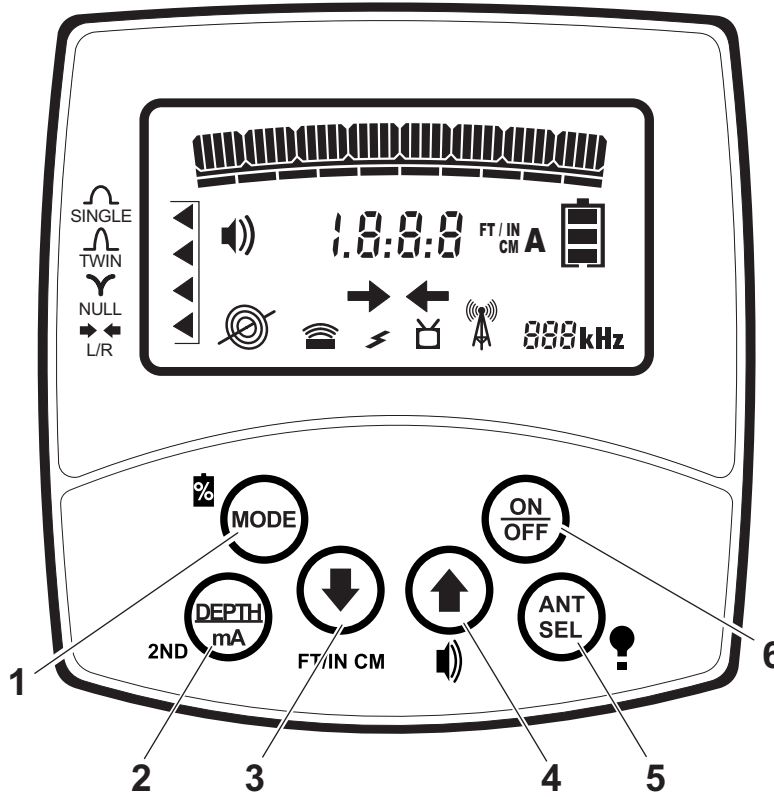
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Receiver

Single-Key Controls


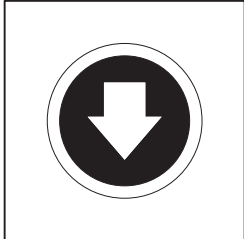
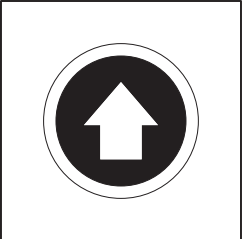

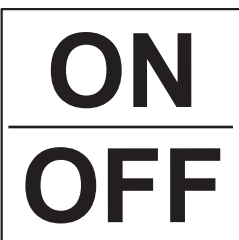


ss0003d.eps

- | | |
|---------------|-------------|
| 1. MODE | 4. Up arrow |
| 2. DEPTH | 5. ANT SEL |
| 3. Down arrow | 6. ON/OFF |


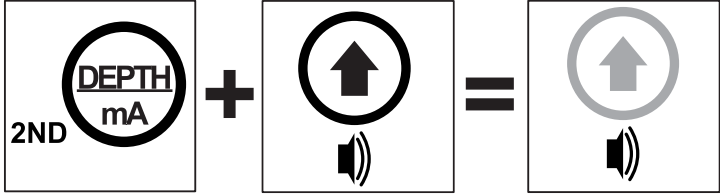
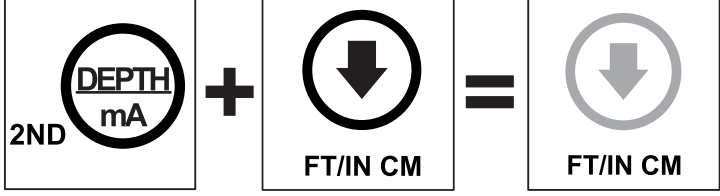
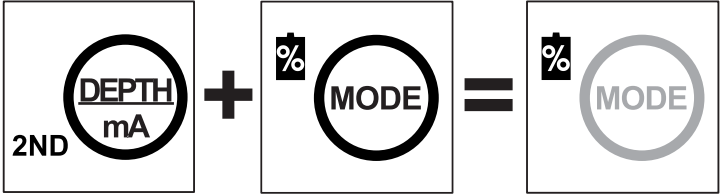

Item	Description	Notes
1. MODE 	To cycle through operating frequencies, press.	


si0007c-d.eps

Item	Description	Notes
<p>2. DEPTH</p>  <p>si0008c-d.eps</p>	<p>To estimate depth of properly located signal source, press.</p> <p>To show amount of current on the target line in milliamps (mA), press and hold.</p>	
<p>3. Down Arrow</p>  <p>e07om007a.eps</p>	<p>To decrease gain incrementally from 20% to 80%, press.</p>	<p>If signal is above 80%, press once to lower gain to approximately 50%.</p> <p>To disable this feature:</p> <ol style="list-style-type: none"> 1. Ensure that unit is off. 2. Press and hold the down arrow. 3. Turn unit on.
<p>4. Up Arrow</p>  <p>e07om006a.eps</p>	<p>To increase gain incrementally from 20% to 80%, press.</p>	<p>If signal is below 20%, press once to raise gain to approximately 50%.</p> <p>To disable this feature:</p> <ol style="list-style-type: none"> 1. Ensure that unit is off. 2. Press and hold the down arrow. 3. Turn unit on.
<p>5. ANT SEL</p>  <p>si0006c-d.eps</p>	<p>To cycle through single, twin, null, and left/right antenna modes, press.</p>	<p>4.</p>
<p>6. ON/OFF</p>  <p>si0005c-d.eps</p>	<p>To turn on, press.</p> <p>To turn off, press again.</p>	



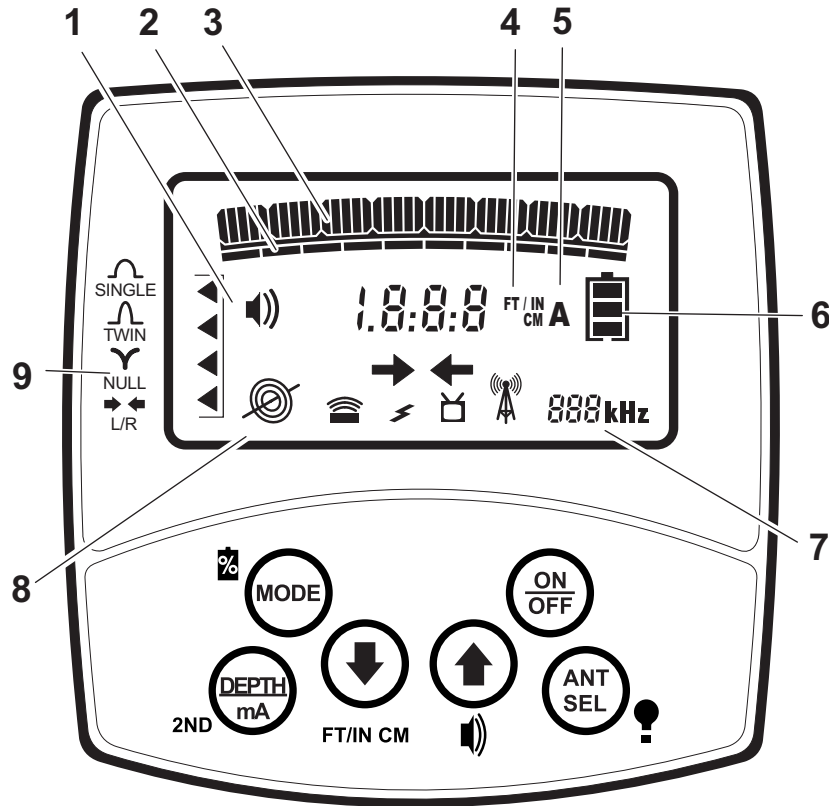
Double-Key Controls

Item	Description
<p>DEPTH + ANT SEL</p>  <p><small>ss0026c-d.eps</small></p>	<p>To turn on backlight, press indicated keys.</p>
<p>DEPTH + Up Arrow</p>  <p><small>ss0027c-d.eps</small></p>	<p>To change volume, press indicated keys.</p>
<p>DEPTH + Down Arrow</p>  <p><small>ss0028c-d.eps</small></p>	<p>To cycle through the units of measurement in which the depth displays (ft/in, in, cm, or m), press indicated keys.</p>
<p>DEPTH + MODE</p>  <p><small>ss0029c-d.eps</small></p>	<p>To show percent of battery life remaining, press indicated keys.</p>
<p>DEPTH + ON/OFF</p>  <p><small>ss0010d.eps</small></p>	<p>To cycle through audio output modes, press indicated keys.</p> <p>A-1 is the standard FM audio tone.</p> <p>A-2 is an AM audio tone.</p> <p>A-3 is a unique, mixed audio tone.</p>

Item	Description
<p>Down Arrow + ON/OFF</p>  <p>ss0011d.eps</p>	<p>To select type of gain display, press indicated buttons while turning the receiver on. Release ON/OFF button before releasing down arrow button.</p> <p>Normal (nor) gain display ranges from 1 to 80.</p> <p>Automatic (Aut) gain display keeps the gain between 40 and 60%.</p> <p>Receiver will remain in selected mode until operator changes it.</p>

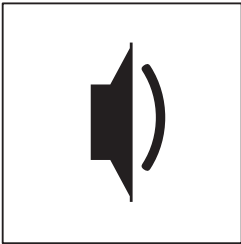


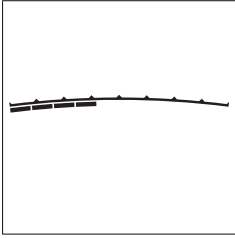
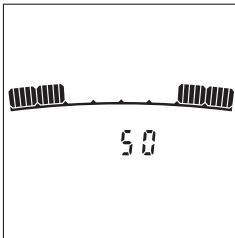
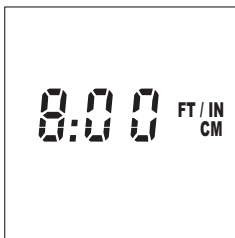
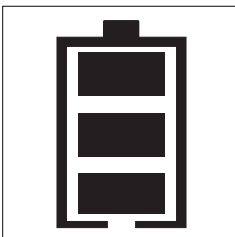
Display




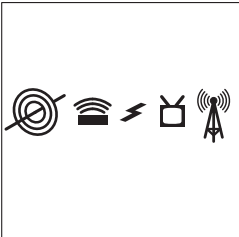
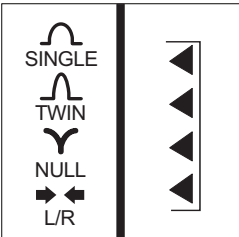
ss0004d.eps

- | | |
|--------------------|------------------|
| 1. Volume level | 6. Battery level |
| 2. Gain level | 7. Frequency |
| 3. Signal strength | 8. Mode |
| 4. Depth | 9. Antenna |
| 5. Current | |

Item	Description	Notes
<p>1. Volume Level</p>  <p>si0004h-d.cdr</p>	Indicates volume level.	IMPORTANT: Lower volume to conserve battery life.

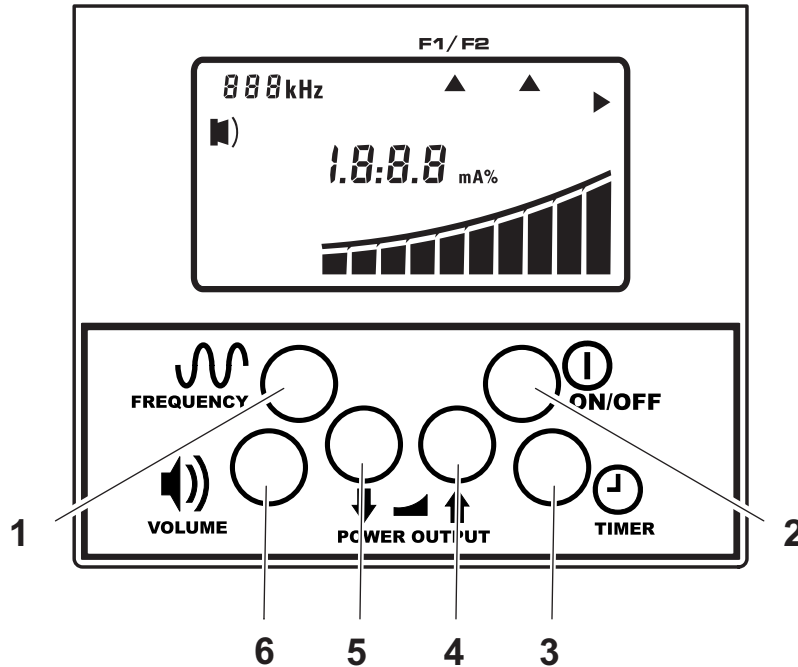
Item	Description	Notes
<p>2. Gain Level</p>  <p>ss0007c.eps</p>	<p>Graphically indicates gain level.</p>	<p>IMPORTANT: Gain increases to the right.</p>
<p>3. Signal Strength</p>  <p>ss0004c.eps</p>	<p>Numerically and graphically indicates the signal strength level.</p>	
<p>4. Depth</p>  <p>ss0008c-d.eps</p>	<p>Displays depth estimate of properly located line.</p>	
<p>5. Current</p>	<p>Displays current measurement on properly located line.</p>	<p>IMPORTANT:</p> <ul style="list-style-type: none"> • The higher the number, the higher the current on target line. • Current reading should be stable or drop as line is located, except at ends where current is higher.
<p>6. Battery Level</p>  <p>ss0009c-d.eps</p>	<p>Indicates battery level.</p> <ul style="list-style-type: none"> • Three segments indicates full battery power. • One segment indicates low power. • No segments and flashing outline indicates that batteries should be changed immediately. 	



Item	Description	Notes
<p>7. Frequency</p>  <p>si0010c-d.eps</p>	<p>Indicates frequency setting.</p>	<p>See "Frequency" on page 48.</p>
<p>8. Mode</p>  <p>ss0002d.eps</p>	<p>Indicates mode setting.</p>	<p>See "Mode" on page 45.</p>
<p>9. Antenna</p>  <p>ss0001d.eps</p>	<p>Indicates antenna configuration.</p>	<p>See "Antenna Configuration" on page 47.</p>

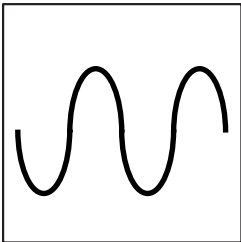
950T Transmitter

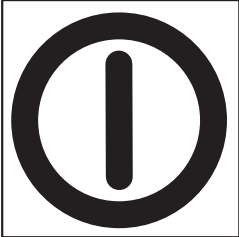
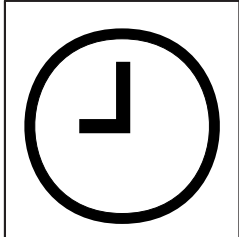
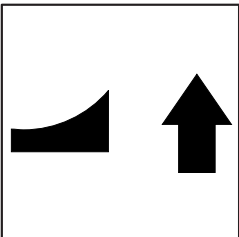
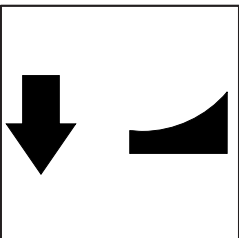
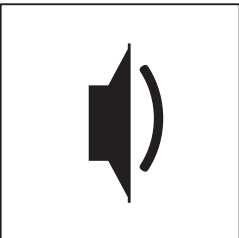
Controls



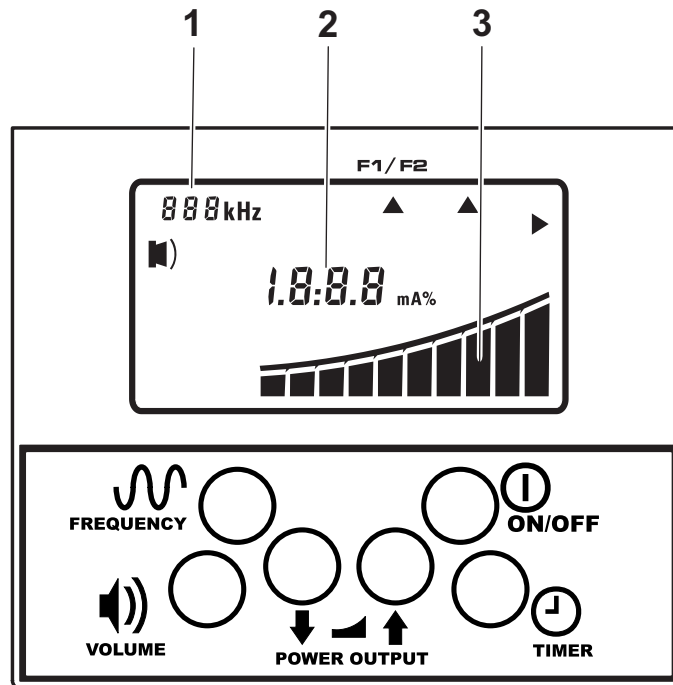
ss0005d.eps

- | | |
|--------------|----------------------|
| 1. Frequency | 4. Power output up |
| 2. On/Off | 5. Power output down |
| 3. Timer | 6. Volume |

Item	Description	Notes
1. Frequency  <p>si0017c-d.eps</p>	To cycle through available frequencies, press.	See "Frequency" on page 48.



Item	Description	Notes
<p>2. On/Off</p>  <p>si1017a-d.eps</p>	<p>To turn on, press.</p> <p>To turn off, press again.</p>	
<p>3. Timer</p>  <p>si0018c-d.eps</p>	<p>To set timer to one hour, press.</p> <p>To increase timer by one hour (up to a maximum of 8 hours), press again.</p> <p>To run continuously, press until display shows 0:00.</p>	
<p>4. Power Output Up</p>  <p>si0015c-d.eps</p>	<p>To raise power output by increments from minimum to maximum, press.</p>	
<p>5. Power Output Down</p>  <p>si0016c-d.eps</p>	<p>To lower power output by increments from maximum to minimum, press.</p>	
<p>6. Volume</p>  <p>si0004h-d.cdr</p>	<p>To turn volume on, press.</p> <p>To turn volume off, press again.</p>	

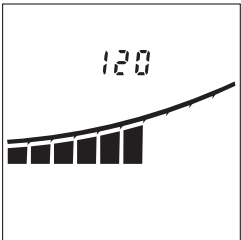
Display



ss0006d.eps

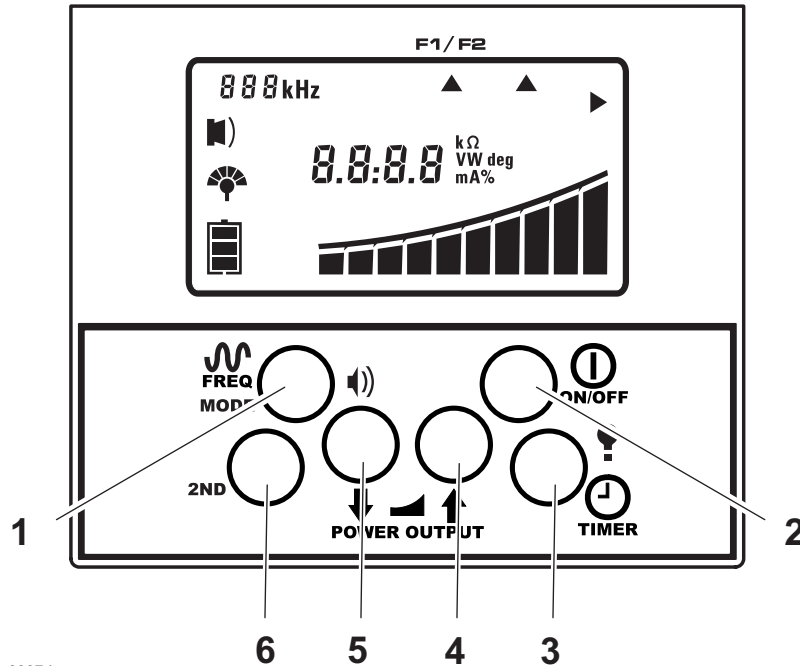
- 1. Frequency
- 2. Timer
- 3. Power level

Item	Description	Notes
<p>1. Frequency</p>  <p>si0010c-d.eps</p>	Displays selected frequency.	
<p>2. Timer</p>  <p>si0020c-d.eps</p>	Displays amount of time left on timer.	

Item	Description	Notes
<p>3. Power Level</p>  <p>si0019c.eps</p>	<p>Displays selected power level.</p>	<p>In direct connect and induction clamp modes, a tone indicates satisfactory connection.</p> <p>In broadcast mode, a beeping tone indicates that current is flowing from transmitter.</p>

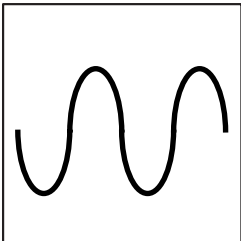
970T Transmitter

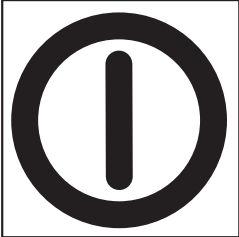
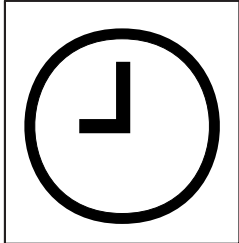
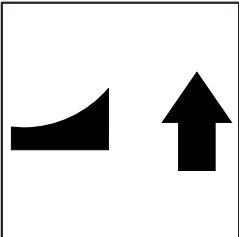
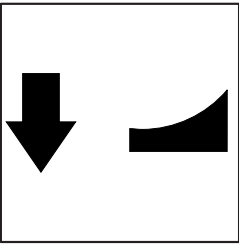
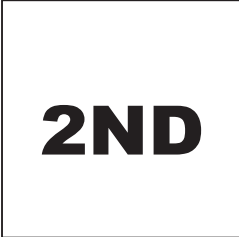
Single-Key Controls



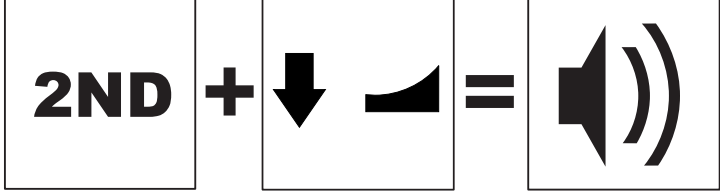
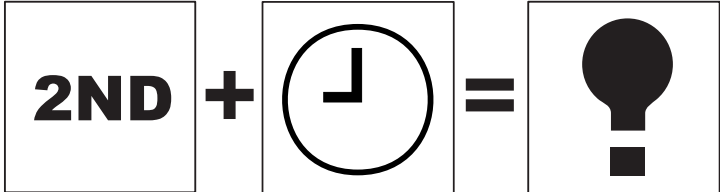
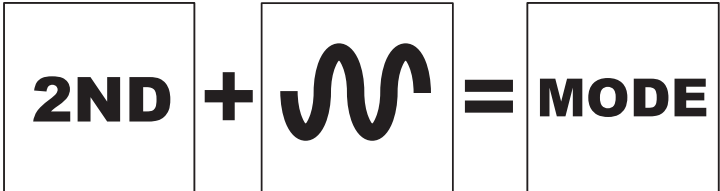
ss0007d.eps

- | | |
|--------------|----------------------|
| 1. Frequency | 4. Power output up |
| 2. On/Off | 5. Power output down |
| 3. Timer | 6. 2nd |

Item	Description	Notes
1. Frequency  <small>si0017c-d.eps</small>	To cycle through available frequencies, press.	See "Frequency" on page 48.

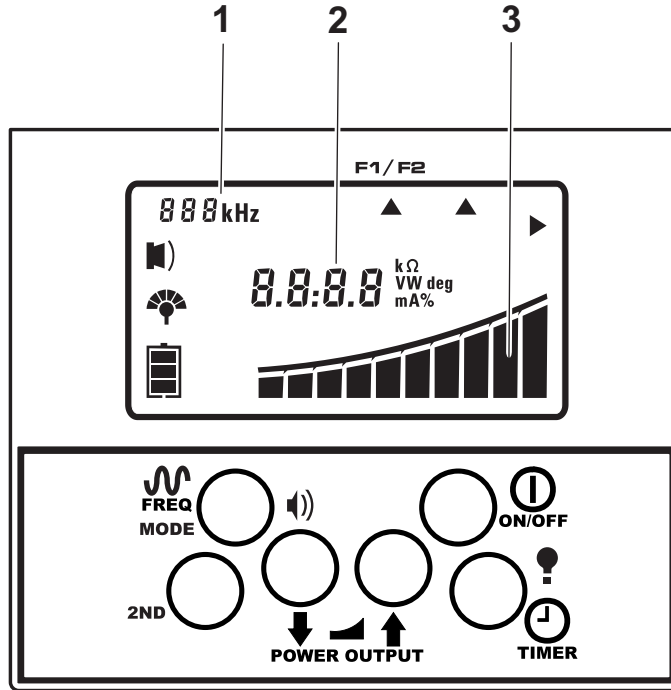
Item	Description	Notes
<p>2. On/Off</p>  <p>si1017a-d.eps</p>	<p>To turn on, press.</p> <p>To turn off, press again.</p>	
<p>3. Timer</p>  <p>si0018c-d.eps</p>	<p>To set timer to one hour, press.</p> <p>To increase timer by one hour (up to a maximum of 8 hours), press again.</p> <p>To run continuously, press until display shows 0:00.</p>	
<p>4. Power Output Up</p>  <p>si0015c-d.eps</p>	<p>To raise power output by increments from minimum to maximum, press.</p>	
<p>5. Power Output Down</p>  <p>si0016c-d.eps</p>	<p>To lower power output by increments from maximum to minimum, press.</p>	
<p>6. 2nd</p>  <p>si0017h-d.eps</p>	<p>To turn volume on, press.</p> <p>To turn volume off, press again.</p>	

Double-Key Controls

Item	Description
<p>2nd + Power Output Down</p>  <p>ss0031c-d.eps</p>	<p>To change volume, press indicated keys.</p>
<p>2nd + Timer</p>  <p>ss0032c-d.eps</p>	<p>To turn on backlight, press indicated keys.</p> <p>To turn backlight off, press indicated keys again.</p>
<p>2nd + Frequency</p>  <p>ss0033c-d.eps</p>	<p>To see current in milliamps, press indicated keys once.</p> <p>To see voltage generated by transmitter, press indicated keys again.</p> <p>To display voltage on line, press indicated keys again.</p> <p>To see resistance in ohms, press indicated keys again.</p>





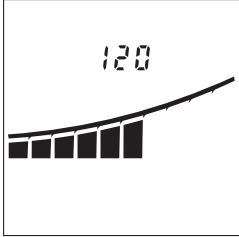
Display



ss0008d.eps

- 1. Frequency
- 2. Timer
- 3. Power level

Item	Description	Notes
<p>1. Frequency</p>  <p>si0010c-d.eps</p>	Displays selected frequency.	
<p>2. Timer</p>  <p>si0020c-d.eps</p>	Displays amount of time left on timer.	

Item	Description	Notes
<p>3. Power Level</p>  <p>si0019c.eps</p>	<p>Displays selected power level.</p>	<p>In direct connect and induction clamp modes, a tone indicates satisfactory connection.</p> <p>In broadcast mode, a beeping tone indicates that current is flowing from transmitter.</p>



Locate

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- Setup 32
- Technique 36
- Special Situations 38

Passive 39

- Setup 39
- Technique 39
- Special Situations 41

Beacon 42

- Setup 42
- Technique 42

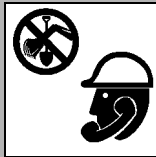


Active Location

Setup

Follow setup procedures for the type of locating you will be doing: direct connection, induction clamp, connecting to live power with live power adapter, or broadcast induction.

Direct Connection



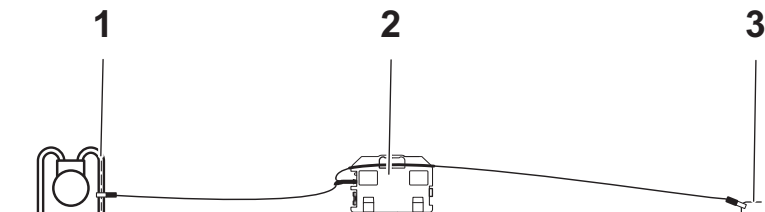
⚠ WARNING

Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

NOTICE:

- Electric shock or equipment damage can result if transmitter is connected to live cable. Contact qualified utility personnel and follow all standards and requirements for disconnecting and grounding lines.
- A built-in circuit breaker will automatically disable transmitter when leads are connected to a live cable. Display will flash and transmitter will beep. Turn off transmitter and disconnect from cable to reset breaker.

To set up transmitter for direct connection:



ss0014c-d.eps

1. Carefully push ground stake (3) into ground.
2. Plug cable into transmitter (2).
3. Connect black lead to ground stake.
4. Connect red lead to line (1).
5. Turn on transmitter and check battery level.
6. Choose frequency and shutoff time. See "Frequency" on page 48.

NOTICE: Turn off transmitter when connecting or moving ground stake.

Induction Clamp



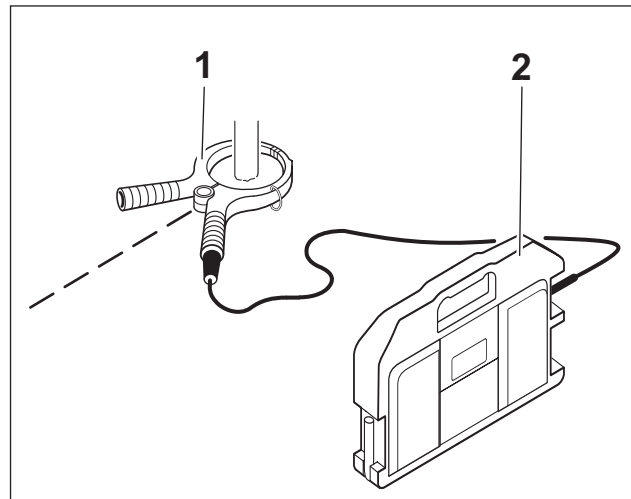
WARNING

Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

NOTICE: Electric shock or equipment damage can result if transmitter is connected to live cable. Contact qualified utility personnel and follow all standards and requirements for disconnecting and grounding lines.

To set up transmitter for use with induction clamp:

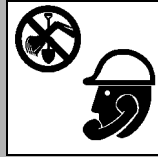
1. Plug cable into transmitter (2).
2. Place clamp (1) around line.
3. Turn on transmitter.
4. Check battery level.
5. Choose frequency and shutoff time. See "Frequency" on page 48.



ss0016c-d.eps



Connecting to Live Power with Live Power Adapter



⚠ WARNING

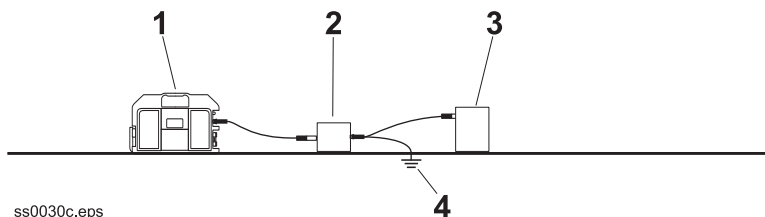
Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

NOTICE:

- Do not operate equipment unless you are properly qualified to work on live power conductors.
- Use personal protective equipment rated for voltage and current of power conductor being connected to as defined by OSHA standards when using live power adapter.
- Do not connect to a conductor with a voltage greater than 480V.

To set up transmitter for use with live power adapter:

1. Verify that transmitter (1) is turned off.
2. Connect live power adapter (2) to the transmitter.
3. Connect live power adapter black lead to the ground stake (4).
4. Connect live power adapter red lead to live power conductor (3).
5. Turn on transmitter.
6. Select frequency greater than 8 kHz (29 kHz is preferred).
7. Adjust power level as needed.
8. Check battery level.



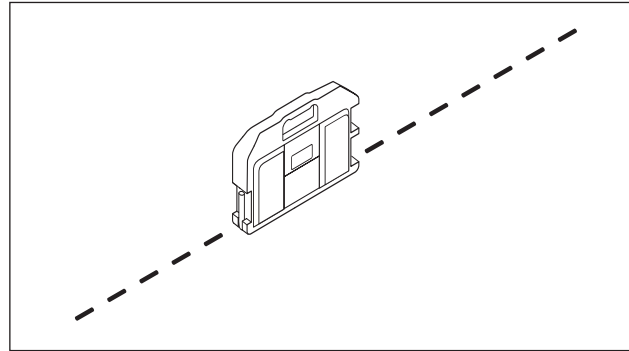
IMPORTANT: When finished locating the line, turn off transmitter, disconnect live power adapter red lead from live power conductor, disconnect live power adapter black lead from ground stake, and disconnect live power adapter from transmitter.

Broadcast Induction

To set up transmitter for broadcast induction:

1. Remove cable, stake, clamp and any other metal objects from transmitter.
2. Place transmitter parallel to and directly above suspected line as shown.

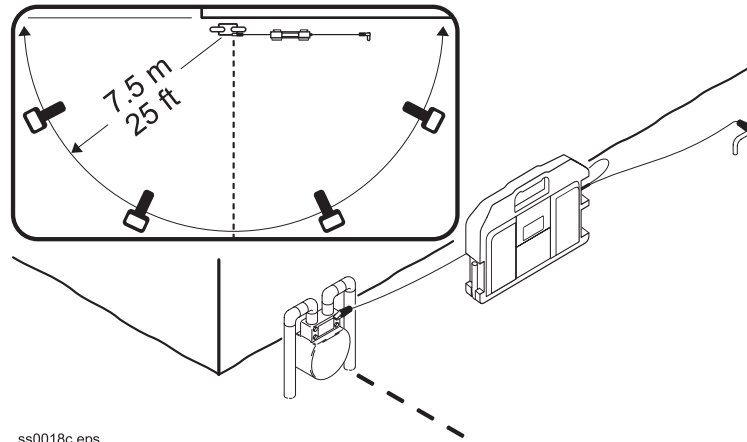
Note: Transmitter must be parallel to object, as shown, in order to produce the best signal.



ss0017c-d.eps

3. Turn on transmitter.
4. Check battery level.
5. Choose frequency and shutoff time. See "Frequency" on page 48.



Technique

IMPORTANT: Follow steps 1-3 for all types of active location. For reference, the illustration above shows direct connection method. If using broadcast induction, ensure that transmitter is in line with and above suspected line, as shown on previous page.

1. Walk in an arc approximately 25' (7.5 m) around transmitter.
2. Hold the receiver so that the handle points toward the transmitter, as shown.
3. Identify location of line by finding the spot with the best signal response.

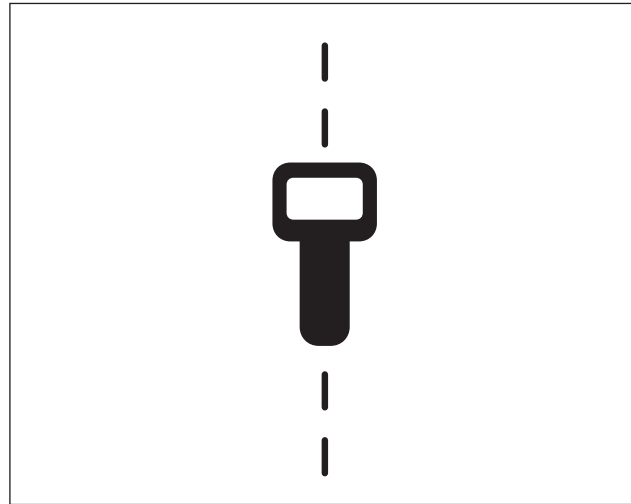


4. Rotate the receiver to determine which direction the line runs.

IMPORTANT: Receiver indicates the best signal when the handle lines up with the target line.

5. Press **DEPTH** button when the line has been located.
6. Continue to trace the line and take depth estimates every few paces.

IMPORTANT: Current measurement can be used as a line identifier when transmitter is connected to target line. Current on the target line should be higher than current on another line that is picking up signal inductively from target line.



ss1080a-d.eps



7. Retrace the line and mark with appropriate flags or paint.

Mark the Line

Sweep, focus, and trace all detected signals in the area. Mark line paths with colored paint or flags. See the chart below for standard color markings for line locations.

Utility	Color	Marking Symbol
electric	red	-E-
gas/oil	yellow	-G-
communications	orange	-TEL- or -TV-
water	blue	-W-
sewer	green	-S-

Special Situations

Situation	What to try
Signal is lost.	Walk in a circle to detect a tee or bend in the line.
Signal varies from low to high and is unstable.	Mark as a hand-dig area.
You are near a power line and are receiving interference.	Sweep the area in 50 Hz or 60 Hz power mode. If receiver gives a strong signal response, a power line is interfering with transmitter signal.
Receiver does not function properly.	Receiver gain could be set too high or low. Lower or raise gain to locate the line. See "Controls" on page 13.
Target line has connections to other lines.	Disconnect target line from other lines or use direct connect or induction clamp to focus signal on target line.
Signal is transferring to other lines.	<ul style="list-style-type: none"> • Lower the frequency. • Lower the power level. • Use direct connection, if possible, or use induction clamp. • Move the ground stake away from the target line and away from other buried lines. • Apply signal at the point where the target line is farthest from the other lines.

Passive Location

Setup

Follow setup procedures for the type of locating you will be doing. Always check receiver battery level at startup. See "Controls" on page 13.

NOTICE: Lines with no A/C current flowing through them are hard to detect and may be hazardous because they may still have voltage potential. To locate, turn on an appliance to cause current to flow and use active search methods.

Technique

Survey the Site

Make a visual check of the site for signs of buried lines such as:

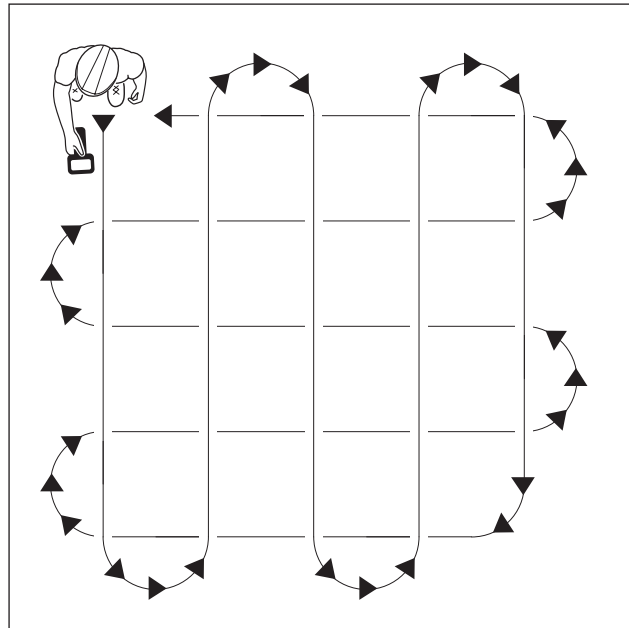
- recent trenching
- buried line markers
- overhead lines that run down pole and underground
- gas meters
- valve sights
- drains or manhole covers



Sweep the Site

Search the site by walking a grid pattern while holding receiver close to the ground.

NOTICE: Keep receiver vertical.



ss1076a-d.eps

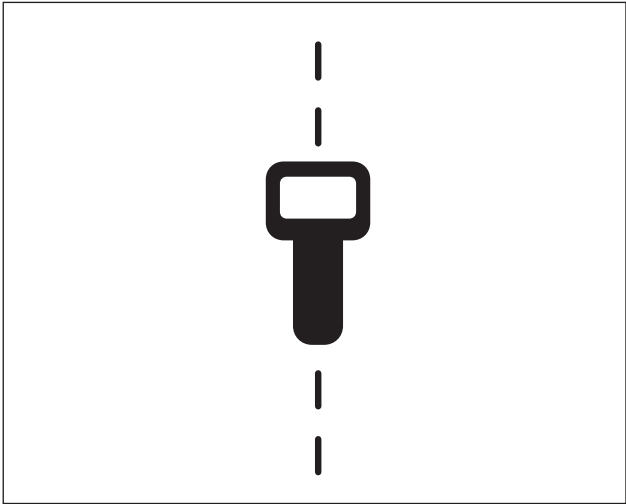
Focus the Signal

Move receiver over detected signal to find best signal response. If using a peak antenna mode, rotate receiver until signal is best. Best signal indicates line direction.

Trace the Line

Walk along the suspected path while moving the receiver from side to side across the area.

IMPORTANT: Keep receiver handle parallel to the suspected line path.



ss1080a-d.eps



Mark the Line

Sweep, focus, and trace all detected signals in the area. Mark line paths with colored paint or flags. See the chart below for standard color markings for line locations.

Utility	Color	Marking Symbol
electric	red	-E-
communications	orange	-TEL- or -TV-

Special Situations

Situation	What to try
Signal is lost.	Walk in a circle to detect a tee or bend in the line.
Signal varies from low to high and is unstable.	Mark as a hand-dig area.
Receiver does not function properly.	Receiver gain could be set too high or low. Lower or raise gain to locate the line. See "Controls" on page 13.

Beacon Location

Trace metallic pipes or conduits by locating and following a beacon signal.

IMPORTANT: Large metal objects and other signals (such as railroad signals or overhead power lines) will distort signal.

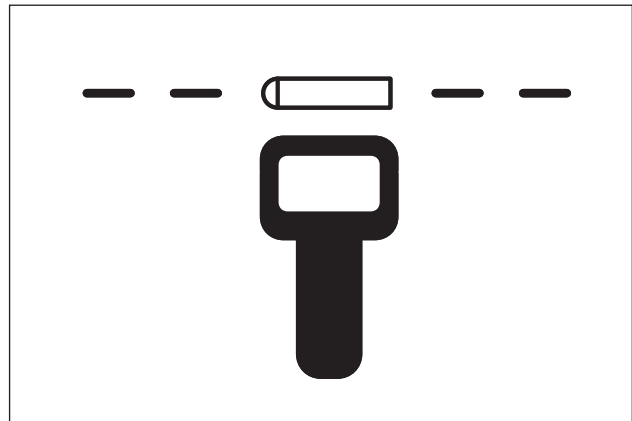
Setup

To set up for beacon location:

1. Follow instructions for installing beacon battery.
2. Turn on receiver to ensure that beacon is functioning properly.
3. Attach beacon to plumber's snake or flex rod.

Technique

1. Turn on receiver.
2. Set antenna configuration and signal source, and select beacon frequency.
3. Place beacon into the pipe and move it down the pipe.
4. To locate beacon, circle over its approximate location in the pipe.
5. To identify the location of beacon, find the spot with the strongest signal response.
6. Rotate the receiver to determine which direction beacon runs.



ss1081a-d.eps

IMPORTANT: Receiver indicates the best signal when handle is perpendicular to the beacon.

7. Press **DEPTH** button.

NOTICE: When estimating depth with a beacon in nonmetallic pipe, depth shown will be to the center of the beacon, not to the top of the pipe.

8. Continue to track the beacon and take depth readings. Mark pipe location with paint.

Locating Concepts

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- Twin Peak 47
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Signal Type

The 910R and 950R can detect three types of signals:

- Active signals that are placed on a target line with a transmitter.
- An active signal from a beacon.
- Passive signals that reside on the target line.

Active

There are three ways to place active signals on a target line with a transmitter:

- Direct connection (preferred method) requires a connection to be made directly onto target line.
- Induction requires placing an optional induction clamp around target line.
- Broadcast method uses a built-in antenna to broadcast a signal onto lines near the transmitter.

Beacon

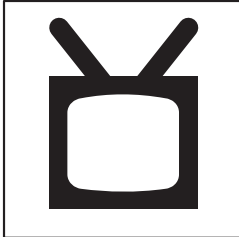
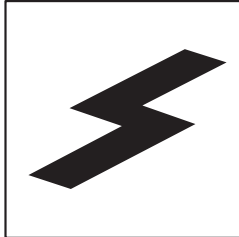


Beacon signals allow non-metallic pipe or conduit tracing.

Passive

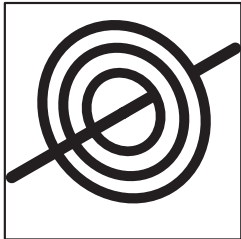
Power line signals can be detected passively without a transmitter.

Mode

The 910R and 950R receivers have five available mode options. Depending on configuration, your unit might not have all five options.

Mode	Description	Notes
Cable TV  <small>si1006a-d.tif</small>	Allows receiver to passively trace cable TV lines (31 kHz) as long as TV is on.	IMPORTANT: If TV is off, use a transmitter and actively locate line.
Power  <small>si1007a-d.eps</small>	Allows receiver to trace live 50 Hz or 60 Hz power lines.	IMPORTANT: Current must be flowing through the line.
Beacon  <small>si1008a-d.tif</small>	Allows receiver to trace nonmetallic pipes and conduits with 29 kHz, 33 kHz, or 512 Hz beacon.	
Radio  <small>si1009a-d.tif</small>	Allows receiver to trace lines that pick up and radiate very low frequency (VLF) radio waves.	



Mode	Description	Notes
<p>Transmitter</p>  <p>si0009c-d.eps</p>	<p>Allows receiver to trace lines that have had a 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, or 200 kHz signal placed on them by a transmitter or a 400 Hz, 560 Hz or 815 Hz signal placed on them by line management systems.</p>	

Receiver Gain Level

The receiver gain setting controls the sensitivity to the signal.

Action	Result	Effect
increasing gain	more sensitive to signal	allows location farther away from signal source
decreasing gain	less sensitive to signal	stabilizes signal

Antenna Configuration

The 910R and 950R receivers have four antenna configuration options.

Single Peak

Uses one horizontal antennas to detect signal. Response is highest at strongest signal.

Twin Peak

Uses two horizontal antenna to detect signal. Response is highest at strongest signal.

Null

Uses a vertical antenna to detect signal. Search width is narrower than peak. Response is lowest when receiver is over the line.

Left/Right

Uses a combination of one horizontal antenna and one vertical antenna to detect signal. Displays arrows to guide the operator to the line.



IMPORTANT: It is best to verify left/right location using twin peak antenna.

Advantages/Disadvantages

Read the descriptions below and determine the antenna configuration that best fits your job.

Antenna	Advantages	Disadvantages
single peak	more range	less precise
twin peak	most precise	less range
null	sharp response	easily distorted in congested areas
left/right	easy to use for most locating jobs	easily distorted in congested areas

Frequency

Transmitter

The 950T transmitter can send the following frequency signals: 512 Hz, 1K, 8K, 29K, 80K, and F1:F2 (8K and 29K dual).

In addition to the frequencies above, the 970T transmitter can be configured to send 200K signals.

Advantages/Disadvantages

Read the general statements below to help determine the transmitter frequency that best fits your job:

- Lower frequencies travel farther than higher frequencies.
- Higher frequencies couple onto lines more easily.
- Higher frequencies also couple onto lines other than the target line more easily.

Receiver

The standard 950R receiver is configured to display information in the six transmitter frequencies listed above for the 950T, as well as 33 kHz (EML) and 50 Hz or 60 Hz (power).

Optional receiver frequencies include: 31 kHz (CATV), 29 kHz (beacon), 33 kHz (beacon), 512 Hz (beacon), 400 Hz, 560 Hz, 815 Hz, 200 kHz, 60P, 50P, and radio. Additionally, the optional CP1, CP2, CP3, CP4, CP5, CP6 frequencies passively locate the cathodic protection on some lines. See your dealer for upgrade information.

Common Signal Problems

Distortions in the electromagnetic field around a line can affect location accuracy. Tees, bends, parallel lines, crossing lines, or large metallic objects can distort signals.

IMPORTANT: If target depth and location are critical, confirm by hand-digging or vacuum excavation.

Learn to recognize the following kinds of distortion:

Shadows

Shadows, also called blind spots, often happen when a metallic object partially obstructs the signal, or a signal from a parallel line interferes with target signal.

False Signals

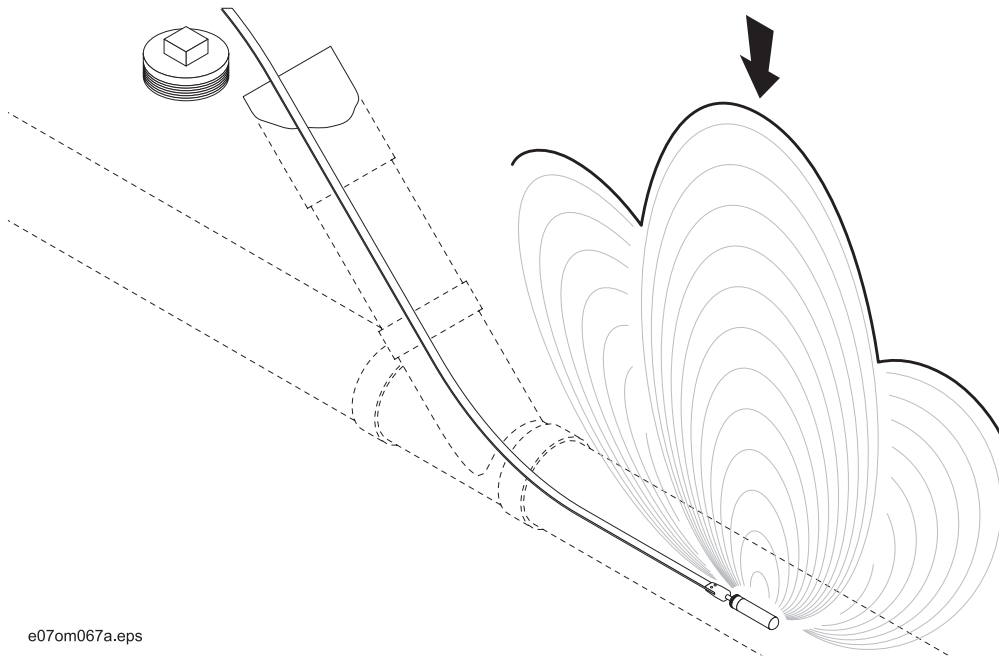
False signals describe situations where the receiver indicates a line location where there is no line. False signals often happen when a line tees or bends, runs parallel to the target line, or crosses the target line.



IMPORTANT: Generally, the receiver shows less distortion in twin peak antenna configuration.

Secondary (Ghost) Signals

A typical beacon signal pattern shows a main signal and two weaker secondary signals. Identify beacon location at the main signal. Familiarity with beacon signal patterns will lessen the effect of ghost signals.



e07om067a.eps

Service

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General Care

Under normal operating conditions, receiver and transmitter need only minor maintenance. Following these care instructions can ensure longer equipment life:

- Do not drop the equipment.
- Do not expose the equipment to high heat (such as in the rear window of a vehicle).
- Clean equipment with a damp cloth and mild soap. Never use scouring powder.
- Do not immerse in any liquid.
- Inspect housing daily for cracks or other damage. If housing is damaged, contact your equipment dealer for replacement.
- Do not mix new and used batteries.

As Needed

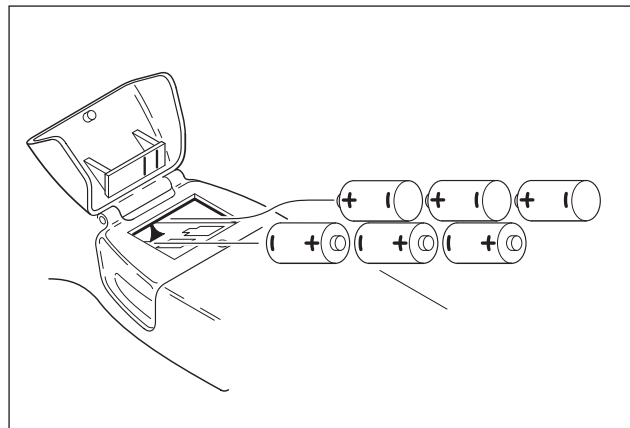
Location	Task	Notes
Receiver Unit	Change batteries	6 "C" alkaline
Transmitter Unit	Change batteries	8 "D" alkaline

Receiver Unit

Change Batteries

Use two C-cell alkaline batteries in receiver.

1. Remove battery cover.
2. Insert batteries as shown.
3. Install and tighten battery cover.
4. Check operation.



ss0028h-d.cdr

Transmitter Unit

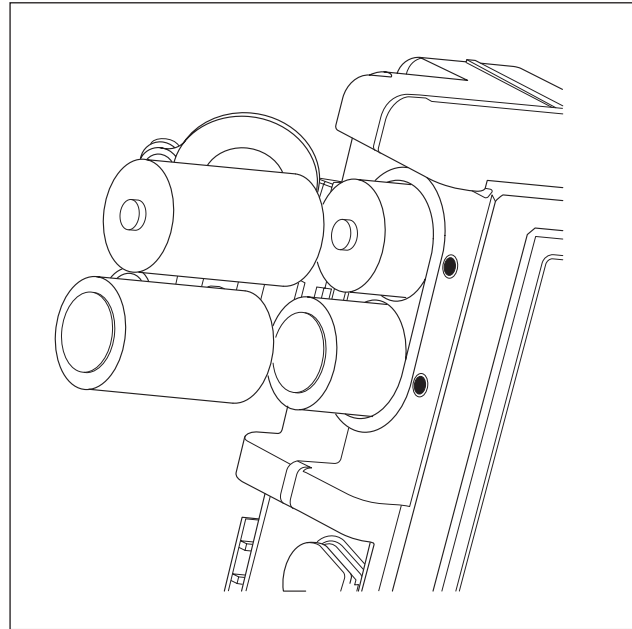
Change Batteries

Use six C-cell alkaline batteries in transmitter.

1. Open battery cover.
2. Insert batteries as shown.

IMPORTANT: Do not mix new and used batteries.

3. Close and tighten battery cover.
4. Check operation. If battery light is flashing when unit is turned on, then one battery is incorrectly installed or batteries are weak.



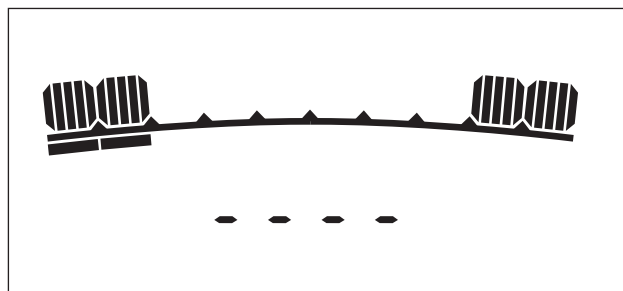
ss0012c-d.eps



Error Codes

Four Dashes during Depth Check

Receiver is detecting a signal above it and cannot estimate depth. This message is usually caused by interfering signals. Try relocating target signal.



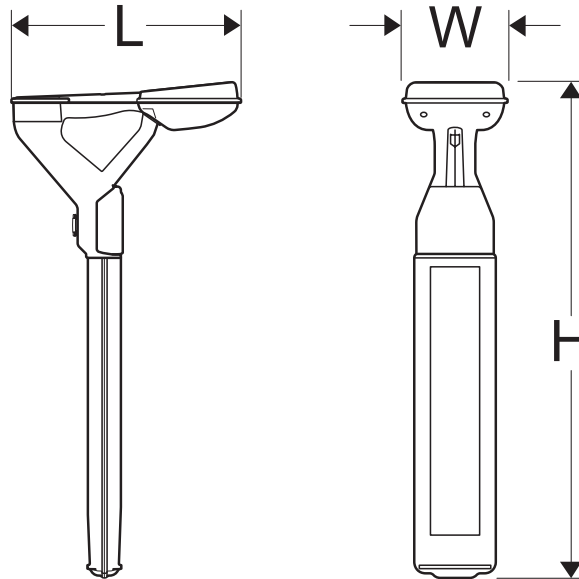
ss1082a-d.eps

Four Dashes and Flashing Signal Strength and Gain Bars

Transmitter power level is set too high and/or line is too shallow for depth estimate. Select lowest usable transmitter power level or lift receiver high enough to return display to normal operation.

Specifications

910R/950R Receivers

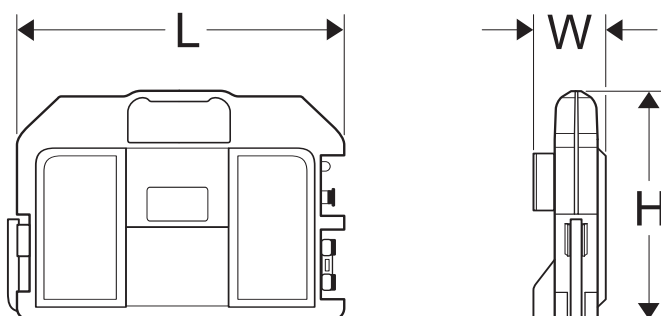


ss0003c.eps

Dimensions		U.S.	Metric
H	Height	27.8"	70.5 cm
L	Length	12.8 "	32.5 cm
W	Width	5.9"	14.5 cm
	Weight	4.5 lb	2 kg
Operation		U.S.	Metric
Operating temperature range		-4°F to 122°F	-20°C to 50°C
Antenna configurations: single peak, twin peak, null, left/right (line only)			
Audio output: speaker			
LCD backlight: LED (green)			
External ports: RS-232 serial			
Batteries			
Type: 6 C-cell alkaline			
Life (intermittent use at 70°F/21°C): approximately 50 hours			
Battery saver: unit shuts off after 5 minutes of inactivity			



950T/970T Transmitters



ss0015c.eps

Dimensions		U.S.	Metric
H	Height	11"	28 cm
L	Length	14"	35.5 cm
W	Width	4.2"	10.7 cm
	Weight	7.25 lb	3.3 kg
Operation		U.S.	Metric
Operating temperature range		-4°F to 122°F	-20°C to 50°C
Maximum power output: 3 watts (950T), 5 watts (970T)			
Standard operating modes: 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and dual (8 kHz and 29 kHz). Optional operating mode (970T only): 200 kHz.			
Timer: unit runs continuously or shuts off after running for a selected hour interval (8-hour maximum).			
Batteries			
Type: 8 D-cell alkaline			
Life (continuous use at power level 2): approximately 40 hours (950T), approximately 80 hours (970T)			

System Operation

Operating Modes and Frequencies

Active line, standard: 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and dual (8 kHz and 29 kHz).
 Active line, optional: 400 Hz, 560 Hz, 815 Hz, 200 kHz.

Passive line, standard: 50 Hz, 60 Hz.
 Passive line, optional: 50P power, 60P power, 31 kHz.

Beacon, optional (locate/depth only): 512 Hz, 29 kHz, 33 kHz.

Radio, optional (locate only)

Locating Ranges	U.S.	Metric
Lines	15'	4.6 m
Beacons	10'	3 m
Depth Estimate Tolerances*	U.S.	Metric
Passive line $\pm 10\%$	0.5-10'	0.15-3 m
Active line $\pm 3\%$	0.2-5'	0.06-1.5 m
Active line $\pm 5\%$	5-10'	1.5-3 m
Active line $\pm 10\%$	10' and deeper	3 m and deeper
Beacon $\pm 5\%$	0.5-10'	0.15-3 m



* Locators are calibrated to these tolerances under ideal test field conditions. Actual operating field conditions may have signal distortions or may contain noise sources which result in depth range that is less than specified.

Support



Procedure

Notify your dealer immediately of any malfunction or failure of Ditch Witch equipment.

Always give model, serial number, and approximate date of your equipment purchase. This information should be recorded and placed on file by the owner at the time of purchase.

Return damaged unit to dealer for inspection and warranty consideration if in warranty time frame.

All repairs must be done by an authorized Ditch Witch repair facility. Repairs done elsewhere will void warranty consideration.

Resources

Publications

Contact your Ditch Witch dealer for publications and videos covering safety, operation, service, and repair of your equipment.

Training

For information about on-site, individualized training, contact your Ditch Witch dealer.

Warranty

Limited Product Warranty Policy

Warranty Periods

New Product

A twelve-month period starts on the date of delivery to the end user:

trackers, remote displays, receivers, transmitters, radars, fault finders

A six-month period starts on the date of delivery to the end user:

directional and locate beacons

A three-month period starts on the date of delivery to the end user:

accessories: cables, clamps, canoes, bags, and adapters

Used Product (Cosmetics)

A three-month warranty starts on the date of delivery to the end user on used and refurbished products sold from Ditch Witch Electronics dealers. Used products are non-returnable.

Service and Repair

A one-month warranty on **labor** starts on the date the unit is repaired, and a three-month warranty on **parts** starts on the date the unit is repaired for all products.

Extended Warranty

The extended warranty may be purchased at the time the equipment is sold or anytime within the original warranty period. The extension is for an additional twelve or twenty-four months, for a total coverage of twenty-four to thirty-six months. Exclusions: All beacons and accessories.

Details and Exclusions



- The warranty includes only Ditch Witch Electronics products and accessories that are manufactured and distributed by Ditch Witch Electronics. The warranty compensates on defects in material or workmanship.
- Defects will be determined through inspection by Ditch Witch Electronics or authorized repair centers. Original purchaser must make the defective item available for inspection within 30 days of the date the part fails.
- The warranty is limited to replacement of the defective part. The replacement part may be new or remanufactured. Repair and installation of defective part will be at no charge when product or item is delivered to Ditch Witch Electronics or an authorized repair center. The product or item will be returned at no charge for return freight.
- The warranty periods do not represent the useful life of Ditch Witch Electronics products and accessories.
- If Ditch Witch Electronics products are purchased for commercial purposes, as defined by the Commercial Code, no warranties extend beyond the specific terms set forth in this limited warranty. All other provisions of this limited warranty apply, including the duties imposed.
- Ditch Witch Electronics products have been tested to deliver acceptable performance in most conditions.
- This limited warranty applies to the original purchaser only. Some states or jurisdictions do not allow exclusion or limitation of incidental or consequential damages, so above limitation may not apply. This limited warranty gives original purchaser specific rights that vary from state to state or jurisdiction to jurisdiction.
- Each serial-numbered piece of equipment must be registered by the selling dealer to determine warranty start date.
- When a registration is not received, the Ditch Witch Electronics shipping date is used to establish the warranty period start date.
- Product inspection and estimates may require that the unit be disassembled and tested.
- Out-of-warranty inspection costs include labor accrued at the full labor rate plus return freight.
- Approved out-of-warranty repair costs include parts, labor accrued at full labor rate, plus return freight.

