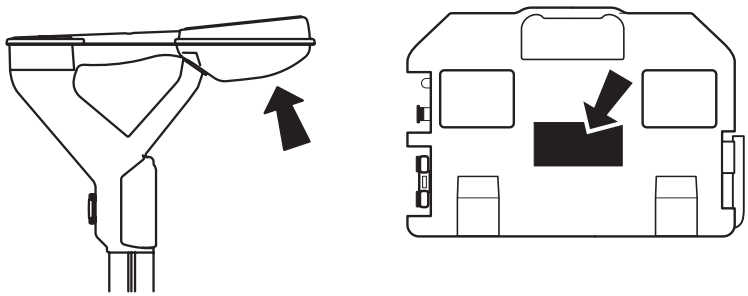
SUPPORT

SERIAL NUMBER RECORD

Record the serial numbers and date of purchase of your Subsite Electronics components in the spaces below.

Date of purchase:	
Receiver serial number:	
Transmitter serial number:	
Accessory model & serial number	
Accessory model & serial number	
Accessory model & serial number	



0001c.eps

SERVICE PROCEDURE

Notify your dealer immediately of any malfunction of Subsite Electronics equipment.

Always give model, serial number, and approximate date of purchase. This information should be recorded and placed on file by owner at time of purchase. Give detailed explanation of malfunction.

Return damaged parts to dealer for inspection and warranty consideration.

FOREWORD

This manual is an important part of your equipment. It provides safety information and operation instructions to help you use and maintain your Subsite Electronics 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 Subsite Electronics 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: Subsite Electronics
PO Box 66
Perry, OK 73077-0066
USA

The descriptions and specifications in this manual are subject to change. The Charles Machine Works, Inc. reserves the right to improve equipment. Some product improvements may have taken place after this manual was published.

Thank you for buying and using Subsite Electronics equipment.

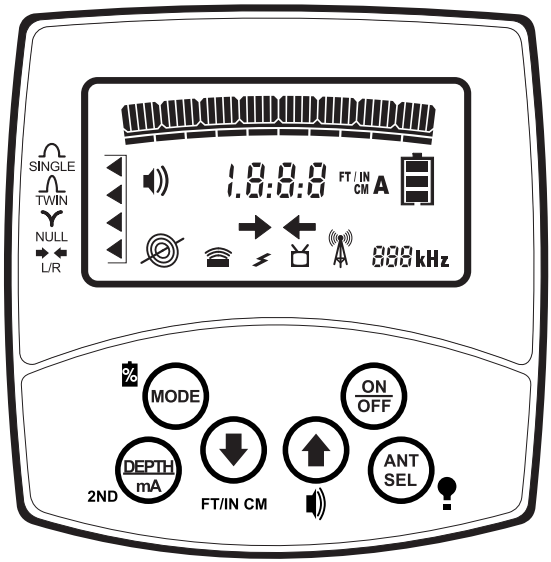
Operator's Manual
910R/950R/950T/970T

Issue No. 2.1/OP-2/05
Part Number 754-062

CONTENTS

RECEIVER

OVERVIEW



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, 60Hz, and 60P power, radio, and 31 kHz CATV.

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

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

The 950R has six keypad buttons and a display. Descriptions of the buttons and display follow.

CONTROLS (SINGLE KEY)

ON/OFF

si0005c.eps

Turns unit on and off.

- Press once to turn on.
- Press again to turn off.

ANT SEL

si0006c.eps

Selects single, twin, null, or left/right arrow antenna modes.

Up Arrow

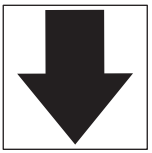

si1014a.tif

Press to increase manual gain incrementally from 20% to 80%.

If signal is below 20%, press once to raise gain (increase signal) to approximately 50%. To disable this feature:

1. Ensure that unit is off.
2. Press and hold the down arrow.
3. Turn unit on.

Down Arrow


si1015a.tif

Press to decrease manual gain incrementally from 20% to 80%.

If signal is above 80%, press once to lower gain (decrease signal) to approximately 50%. To disable this feature:

1. Ensure that unit is off.
2. Press and hold the down arrow.
3. Turn unit on.

MODE

si0007c.eps

Selects operating frequency.

DEPTH

si0008c.eps

Estimates depth of signal or shows amount of current on the target line.

- Press once to estimate depth of properly located signal source.
- Press and hold to show amount of current on the target line in milliamps (mA).

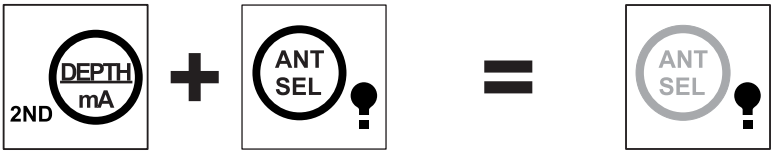
See **OPERATION** for information on locating signals.

CONTROLS (DOUBLE KEY)

Press and hold **DEPTH** and press the indicated button to use the functions below.

DEPTH + ANT SEL

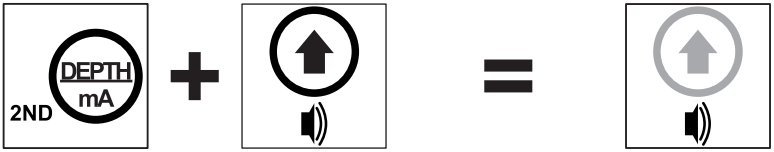
Turns on backlight.



ss0026c.eps

DEPTH + Up Arrow

Changes volume.



ss0027c.eps

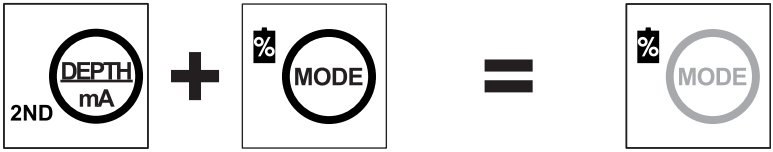
DEPTH + Down Arrow

Changes the units of measurement in which the depth displays. Available displays are ft/in, in, cm, or m.

ss0028c.eps

DEPTH + MODE

Shows percent of battery life remaining.



ss0029c.eps

DISPLAY

Mode

The receiver can be configured to operate in five modes:

- cable TV
- power
- beacon
- radio
- transmitter

The icon for the currently selected mode is shown along the bottom of the display.

IMPORTANT: Your unit might not contain all options. See your Subsite Electronics dealer for upgrade information.

Cable TV


si1006a.tif

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

Allows receiver to trace live 50 Hz or 60 Hz power lines.

IMPORTANT: Current must be flowing through the line.


si1007a.eps

Beacon

Allows receiver to trace nonmetallic pipes and conduits with 29 kHz, 33 kHz, or 512 Hz beacon.


si1008a.tif

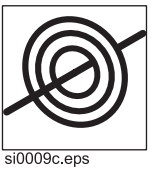
Radio

Allows receiver to trace lines that pick up and radiate very low frequency (VLF) radio waves.


si1009a.tif

Transmitter

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.


si0009c.eps

Frequency

si0010c.eps

The receiver can be configured to recognize nine transmitter frequencies: 400 Hz, 512 Hz, 560 Hz, 815 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and 200 kHz.

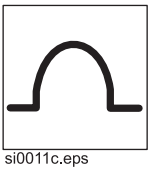
IMPORTANT: 400 Hz, 560 Hz, and 815 Hz cannot be transmitted by the 950T or 970T.

Selected frequency is displayed in the lower right corner of the display.

Antenna

The receiver has four antenna modes described below. The selected antenna mode is indicated by an arrow on the left side of the display.

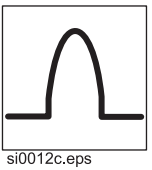
Single


si0011c.eps

Use in congested areas and to locate deeper lines. Signal strength peaks when receiver is over the line being located. Is less precise than other modes.

Twin

Gives sharper location than single antenna. Signal strength peaks when receiver is over the line being located.


si0012c.eps

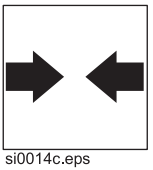
Null

Gives precise response when locating lines in uncongested areas. Signal drops to minimum strength when receiver is over the line being located. In congested areas, confirm location by using single or twin peak antenna.


si0013c.eps

Left/Right

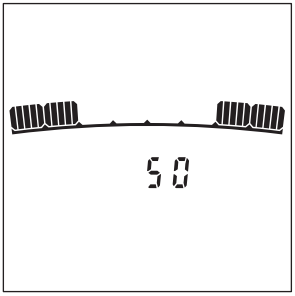
Indicates position of receiver relative to the line being located. Used primarily for active mode, but can also be used as a fore/aft indicator in beacon mode.


si0014c.eps

- Move receiver in the direction of the arrow.
- When receiver is over the line, both arrows display and two beeps sound.

Signal Strength

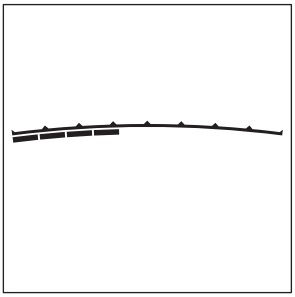
Signal strength is shown by bars at top of display and in numeric display.



ss0004c.eps

Gain

Gain (amount of signal amplification) is shown by bars below signal strength indicator. Gain increases to the right.


ss0007c.eps

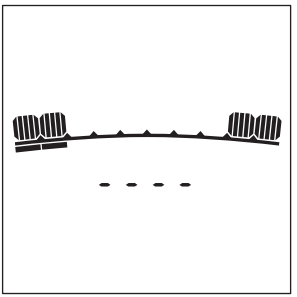
Depth

ss0008c.eps

Estimated depth displays when **DEPTH** button is pressed.

Receiver can display in four units of measurement: feet/inches, inches, cm, or m. To select units, press and hold **DEPTH** and press the down arrow.

IMPORTANT: If four dashes appear in the display, the receiver is detecting a signal above it and cannot estimate depth. This message is usually caused by interfering signals or a weak signal. Try relocating target signal.


ss1082a.eps

Current

Estimated current on target line is displayed in mA when DEPTH button is pressed and held.

The higher the number, the higher the current on the target line.

IMPORTANT: Current reading should be stable or drop as line is located, except at the ends where current may be higher.

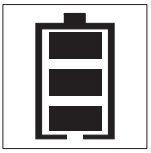
Volume Level


si0004h.cdr

Receiver has four volume levels: off, low, medium, and high. To select volume setting, press and hold **DEPTH** and press the up arrow.

IMPORTANT: Lower volume to conserve battery life.

Receiver Battery Level


ss0009c.eps

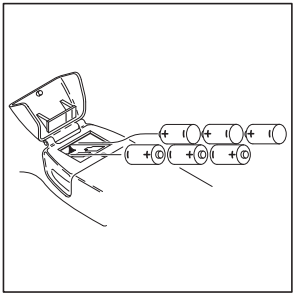
Receiver battery level is shown by battery icon on right side of display.

- Three segments mean that batteries are at full power.
- One segment means that batteries are at low power.
- No segments and a flashing outline means that you should change batteries immediately.

IMPORTANT: To see percentage of battery life remaining, press and hold **DEPTH** and press **MODE**.

SETUP

Install Batteries

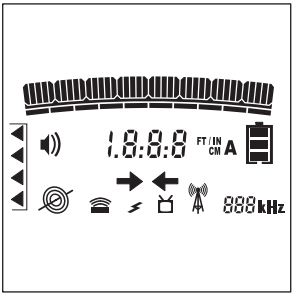

ss0028h.cdr

Use six C-cell alkaline batteries in receiver.

To install:

1. Unscrew battery cover.
2. Insert batteries as shown.
3. Close cover and tighten screw.
4. Check operation.

Check Operation



ss0010c.eps

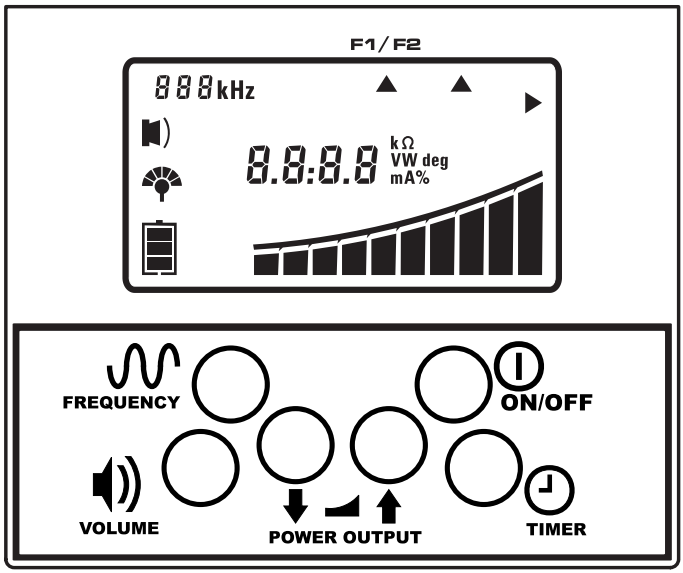
Always check that receiver is operating before leaving for jobsite and after every battery change.

To check operation:

1. Turn on receiver.
2. Entire display will light briefly.
3. Display will show battery level and last used setting.

950T TRANSMITTER

OVERVIEW



ss0011c.eps

The 950T transmitter is designed to place signals on target lines. It can be configured to send 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and dual (8 kHz and 29 kHz) frequencies. It places a signal on the line through either direct connection, induction clamping, or broadcast modes.

The transmitter has six keypad buttons and a display. Descriptions of the buttons and display follow.

CONTROLS

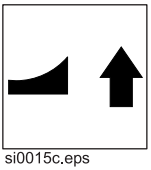
ON/OFF


si1017a.eps

Turns unit on and off.

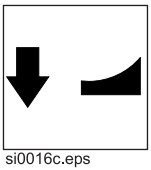
- Press once to turn on.
- Press again to turn off.

Power Output Up


si0015c.eps

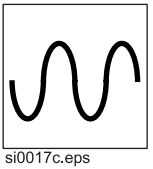
Raises power output by increments from minimum to maximum.

Power Output Down


si0016c.eps

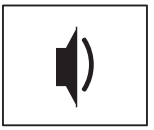
Lowers power output by increments from maximum to minimum.

FREQUENCY


si0017c.eps

Selects one of six transmitter frequencies: 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, or F1:F2 (8 kHz and 29 kHz dual).

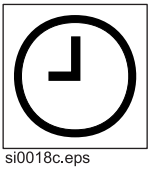
VOLUME


si0004h.cdr

Turns transmitter volume on or off.

- Press once to turn volume on.
- Press again to turn volume off.

TIMER


si0018c.eps

Sets transmitter timer.

- Press once to set timer to one hour.
- Press again to increase timer by one hour, up to a maximum of eight hours.
- For continuous use, set to zero. Press until 0:00 displays.

Transmitter will transmit a frequency for the number of hours selected and then turn itself off.

DISPLAY

Frequency

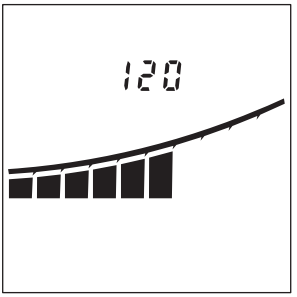
The transmitter can send six signal frequencies: 512 Hz, 1 kHz, 8 kHz, 29 kHz, and 80 kHz. Dual frequency (F1:F2) transmits both 8 kHz and 29 kHz signals.

si0010c.eps

Power Level

The transmitter has ten power levels.

In direct connect and induction clamp modes, a tone indicates satisfactory connection. The higher the number, the more current is flowing into the target line.



si0019c.eps

In broadcast mode, a beeping tone indicates that current is flowing from the transmitter.

IMPORTANT: To conserve battery life, lower the power level to the lowest usable level.

IMPORTANT: See **OPERATION** for further description of location modes.

Timer

si0020c.eps

The transmitter will shut off at one-hour increments up to a maximum of eight hours. To select shutoff time:

- Press **TIMER** button once to set timer to one hour.
- Press again to increase timer by one hour, up to a maximum of eight hours.
- For continuous use, set to zero. Press **TIMER** button until 0:00 displays.

Transmitter will transmit a frequency for the number of hours selected and then turn itself off.

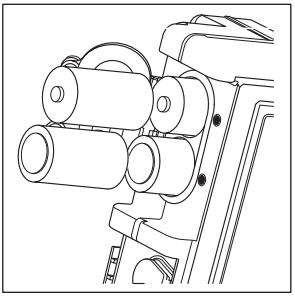
CIRCUIT BREAKER

A built-in circuit breaker will automatically disable transmitter when leads are connected to a live cable. Additionally, display will flash and transmitter will beep.

To reset circuit breaker, turn off transmitter and disconnect from cable.

SETUP

Install Batteries

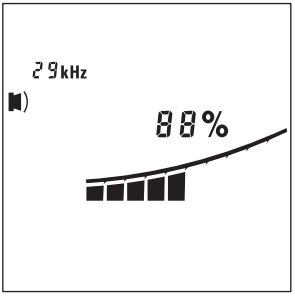

ss0012c.eps

Use eight D-cell alkaline batteries in transmitter.

To install:

1. Unscrew battery cover.
2. Insert batteries as shown.
3. Close and tighten battery cover.
4. Check operation.

Check Operation



ss0013c.eps

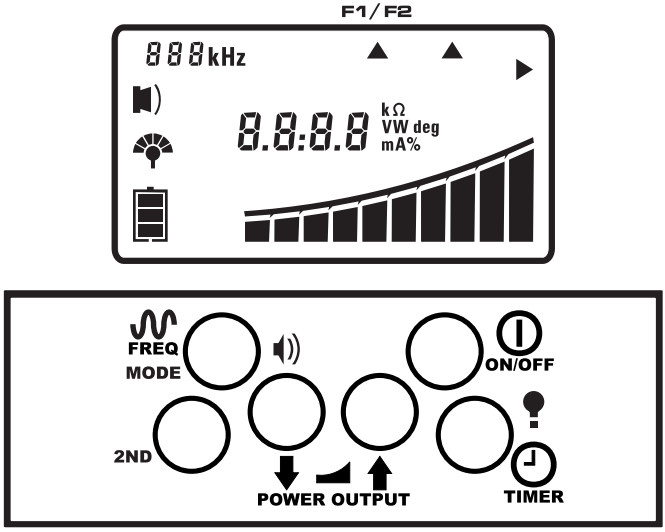
Always check that transmitter is operating before leaving for jobsite and after every battery change.

To check operation:

1. Turn on transmitter.
2. Transmitter will beep.
3. Display will show battery level percentage and last used frequency setting.

970T TRANSMITTER

OVERVIEW



ss1140h.eps

The 970T transmitter is designed to place signals on target lines. It can be configured to send 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, 200 kHz, and dual (8 kHz and 29 kHz) frequencies. It places a signal on the line through either direct connection, induction clamping, or broadcast modes.

The transmitter has six keypad buttons and a display. Descriptions of the buttons and display follow.

CONTROLS (SINGLE KEY)

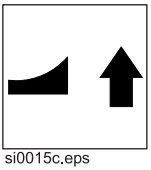
ON/OFF


si1017a.eps

Turns unit on and off.

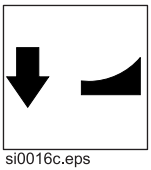
- Press once to turn on.
- Press again to turn off.

Power Output Up


si0015c.eps

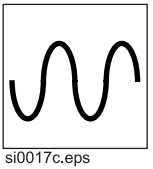
Raises power output by increments from minimum to maximum.

Power Output Down


si0016c.eps

Lowers power output by increments from maximum to minimum.

FREQUENCY


si0017c.eps

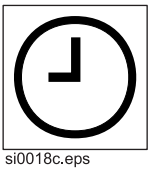
Selects one of six transmitter frequencies: 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, 200 kHz, or dual (8 kHz and 29 kHz).

2ND

si0017h.eps

Allows access to second key functions. See “Controls (Double Key)” for more information.

TIMER


si0018c.eps

Sets transmitter timer.

- Press once to set timer to one hour.
- Press again to increase timer by one hour, up to a maximum of eight hours.
- For continuous use, set to zero. Press until 0:00 displays.

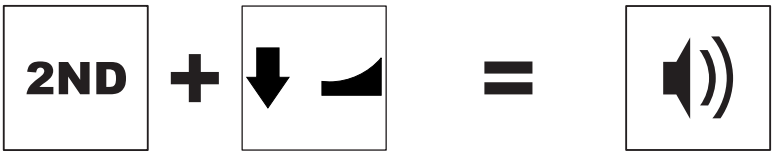
Transmitter will transmit a frequency for the number of hours selected and then turn itself off.

CONTROLS (DOUBLE KEY)

Press and hold **2ND** and press the indicated button to use the functions below.

2ND + Power Output Down

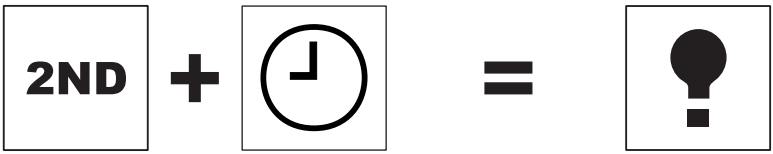
Changes volume.



ss0031c.eps

2ND + Timer

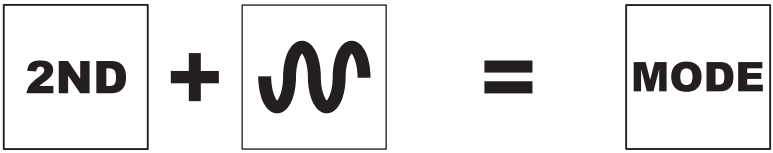
Turns on backlight. Icon will display on screen.



ss0032c.eps

2ND + Frequency

Changes mode.



ss0033c.eps

- Press once to see current in milliamps.
- Press again to see voltage generated by transmitter.
- Press again to display voltage on line.
- Press again to see resistance in ohms.

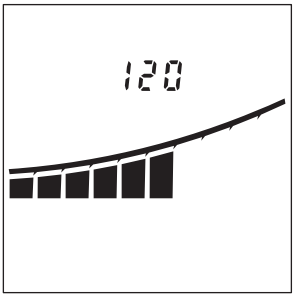
DISPLAY

Frequency

si0010c.eps

The transmitter can be configured to send seven signal frequencies: 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and 200 kHz. Dual frequency (F1:F2) transmits both 8 kHz and 29 kHz signals.

Power Level



si0019c.eps

The transmitter has ten power levels.

In direct connect and induction clamp modes, a tone indicates satisfactory connection. The higher the number, the more current is flowing into the target line.

In broadcast mode, a beeping tone indicates that current is flowing from the transmitter.

IMPORTANT: To conserve battery life, lower the power level to the lowest usable level.

IMPORTANT: See **OPERATION** for further description of location modes.

Timer

si0020c.eps

The transmitter will shut off at one-hour increments up to a maximum of eight hours. To select shutoff time:

- Press **TIMER** button once to set timer to one hour.
- Press again to increase timer by one hour, up to a maximum of eight hours.
- For continuous use, set to zero. Press **TIMER** button until 0:00 displays.

Transmitter will transmit a frequency for the number of hours selected and then turn itself off.

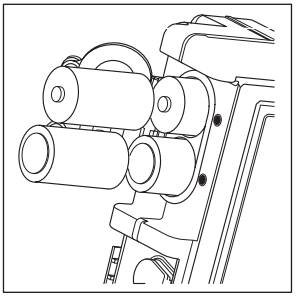
CIRCUIT BREAKER

A built-in circuit breaker will automatically disable transmitter when leads are connected to a live cable. Additionally, display will flash and transmitter will beep.

To reset circuit breaker, turn off transmitter and disconnect from cable.

SETUP

Install Batteries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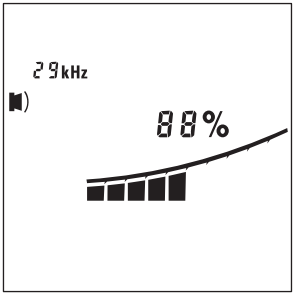
Use eight D-cell alkaline batteries in transmitter.

To install:

1. Unscrew battery cover.
2. Insert batteries as shown.
3. Close and tighten battery cover.
4. Check operation.

Check Operation



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Always check that transmitter is operating before leaving for jobsite and after every battery change.

To check operation:

1. Turn on transmitter.
2. Transmitter will beep.
3. Display will show battery level and last used frequency setting.

SAFETY

Follow these guidelines before operating any jobsite equipment:

- Read and follow all safety precautions.
- Complete proper training and read operator’s manual before using equipment.
- Use equipment only as directed.
- Contact One-Call (888-258-0808) and any utility companies which do not subscribe to One-Call. Have all underground pipes and cables located and marked before sweeping area.
- Classify jobsite based on its hazards and use correct tools and machinery, safety equipment, and work methods for jobsite.
- Wear personal protective equipment.
- Check that equipment is in good condition, and test leads are clean and have no cracked insulation.
- Contact your Subsite Electronics 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 machine, 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 machine 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

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

NOTICES:

- Electric shock or equipment damage can result if transmitter is connected directly to live cable. Have qualified personnel disconnect both ends of cable before working or use live power adapter.
- Turn off transmitter when connecting or moving ground stake.
- If target depth and location are critical, confirm by hand-digging.
- Do not operate transmitter with a worn keypad. Electric shock can occur.
- 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.

⚠ WARNING Electric shock. This device produces electric current that could cause death or serious injury. Use proper procedures.

⚠WARNING Explosion possible. Do not operate transmitter near explosive devices or blasting operations.

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

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

OPERATION

This section contains basic information about choosing signal type and antenna configuration, avoiding and correcting common signal problems, and three types of locating.

CHOOSE SIGNAL TYPE

The 950R can detect two types of signals:

- **Active signals** are placed on a target line with the transmitter and detected by the receiver. As an option, an active signal from a **beacon** can also be detected by the receiver.
- **Passive signals** reside on the target line and are read by receiver.

Read the descriptions on the next page and determine the signal type to use for your job.

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 sends current into lines near the transmitter.

Beacon

If equipped, trace non-metallic pipes or conduits by locating and following a 29 kHz beacon signal.

Passive

Some utility lines emit detectable signals that are picked up from the environment. These passive signals can be power signals or radio signals.

CHOOSE ANTENNA CONFIGURATION

The 950R receiver has four antenna configurations:

Single Peak

Uses one horizontal antenna 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 single 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

CHOOSE FREQUENCY

Transmitter

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

The 970T transmitter can be configured to send the following frequency signals: 512 Hz, 1K, 8K, 29K, 80K, 200K, and F1:F2 (8K and 29K dual).

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. See your Ditch Witch Subsite dealer for upgrade information.

RECOGNIZE COMMON SIGNAL PROBLEMS

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

NOTICE: 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 signal, or a signal from a parallel line interferes with target signal.

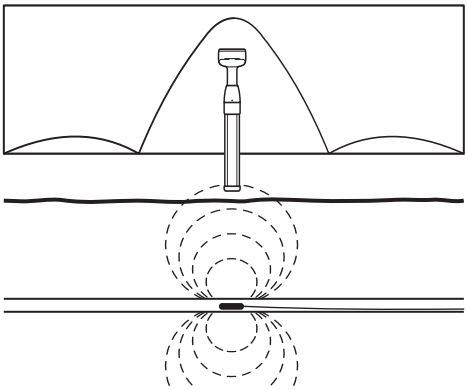
False Signals

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.



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LOCATE LINE: ACTIVE LOCATION

Setup

Follow setup procecudures 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

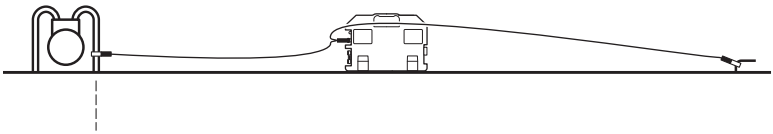
WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

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

To set up transmitter for direct connection:

1. Drive ground stake.
2. Plug cable into transmitter.
3. Hook black lead to ground stake.
4. Hook red lead to line.
5. Turn on transmitter.
6. Check battery level.
7. Choose frequency and shutoff time. See “Choose Frequency” earlier in this chapter.

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



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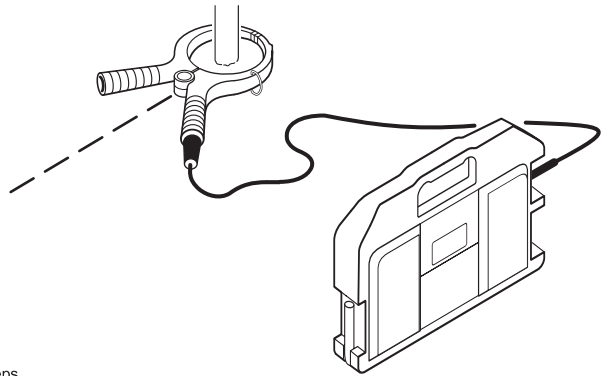
Induction Clamp

⚠ 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 directly to live cable. Contact qualified utility personnel and follow all local standards and restrictions for disconnecting and grounding lines.

To set up transmitter for use with induction clamp:

1. Plug cable into transmitter.
2. Place clamp around line.
3. Turn on transmitter.
4. Check battery level.
5. Choose frequency and shutoff time. See “Choose Frequency” earlier in this chapter.



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Connecting to Live Power with Live Power Adapter

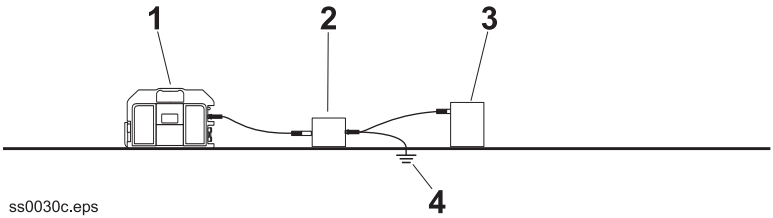
⚠ WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

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.



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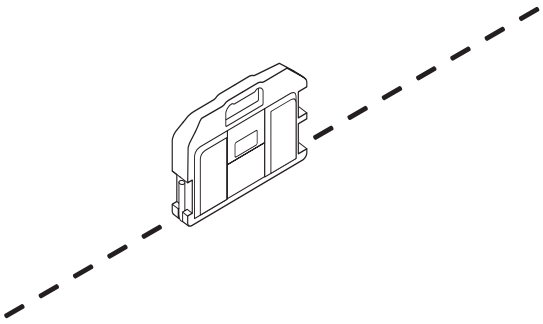
IMPORTANT: When finished locating the line, turn off transmitter, disconnect live power adapter red lead from live power conductor, disconnect live power adapter black lead from ground stake, and disconnect live power adapter from transmitter.

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.
3. Turn on transmitter.
4. Check battery level.
5. Choose frequency, power level, and shutoff time. See “Choose Frequency” earlier in this chapter.



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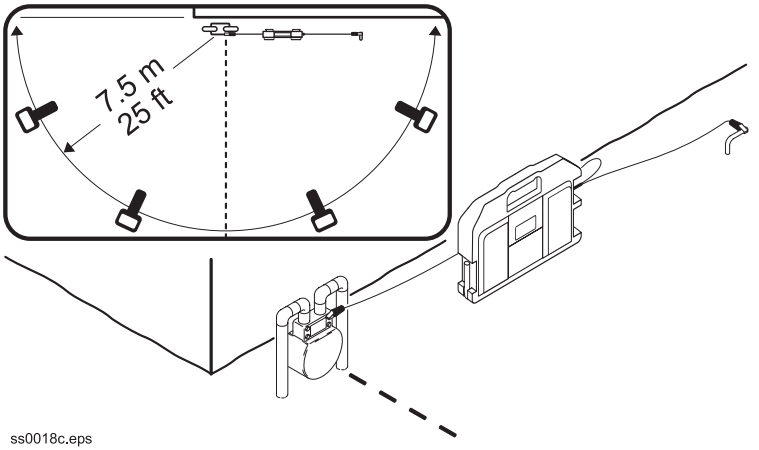
Technique

IMPORTANT: Follow steps 1-3 for all types of active location. For reference, the illustration below 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 strongest signal response.



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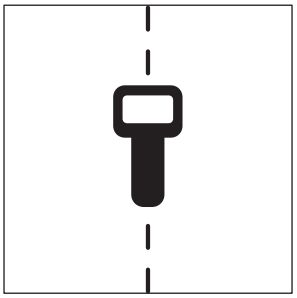
4. Rotate the receiver to determine which direction the line runs.

   IMPORTANT: Receiver indicates the strongest signal when the handle lines up with the target line.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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 that current on another line that is picking up signal inductively from target line.

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

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 such as unstable depth readings, blank display, etc.	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. Lower gain to locate the line.
Target line has connections to other lines.	Disconnect target line from other lines or use induction clamp to focus signal on target line.
Signal is transferring to other lines.	• 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.
Four dashes appear on the display and signal strength and gain bars flash.	Transmitter power level is set too high and/or line is too shallow for depth estimate. Select lowest usable transmitter power level or raise receiver high enough to return display to normal operation.

LOCATE LINE: BEACON

Trace non-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) can distort signal.

Setup

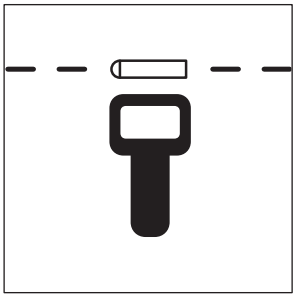
To set up for beacon location:

1. Follow beacon manufacturer’s instructions on battery installation and testing beacon operation.
2. 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 the beacon into the pipe and move it down the pipe.
4. To locate the 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 the beacon runs.

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

LOCATE LINE: PASSIVE LOCATION

Setup

To set up for passive location, turn on receiver and choose the best frequency and antenna configuration for your job. See “Choose Frequency” and “Choose Antenna Configuration” earlier in this chapter.

Always check receiver battery level at startup.

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

Technique

Survey the Site

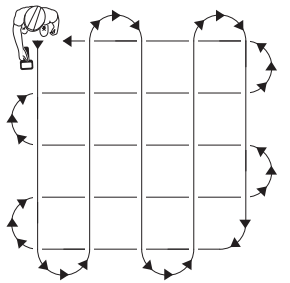
Make a visual check of the site for signs of buried lines such as:

- 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.

IMPORTANT: Keep the receiver vertical.



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Focus the Signal

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

Trace the Line

Walk along the suspected path while moving the receiver back and forth across the area.

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

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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.
Receiver does not function properly.	Receiver gain could be set too high or low. Lower or raise gain to locate the line.
Four dashes appear on the display and signal strength and gain bars flash.	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.
Four dashes appear on the display when **DEPTH** button is pressed.	The receiver is detecting a signal above it and cannot estimate depth. This message is usually caused by interfering signals. Try relocating target signal.

CARE AND ERROR CODES

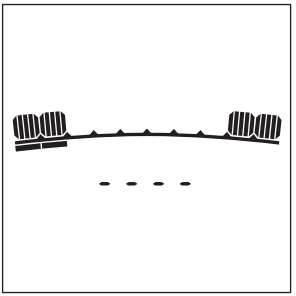
Under normal operating conditions, receiver needs only minor maintenance. Following these care instructions can ensure longer equipment life.

GENERAL CARE

- Do not drop the equipment.
- Do not expose the equipment to high heat (such as in the rear window of a car).
- 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 Subsite Electronics dealer for replacement.

ERROR CODES

If four dashes appear in the display when pressing the **DEPTH** button, the receiver is detecting a signal above it and cannot estimate depth. This message is usually caused by interfering signals. Try relocating target signal.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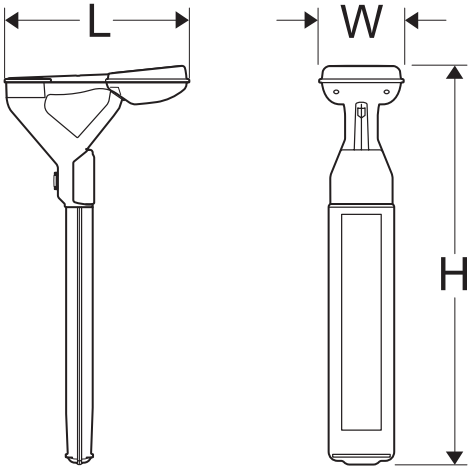
If four dashes appear on the display and signal strength and gain bars flash, transmitter power level is set too high and/or line is too shallow for depth estimate. Select lowest usable transmitter power level or lift receiver high enough to return display to normal operation.

SPECIFICATIONS

950 RECEIVER



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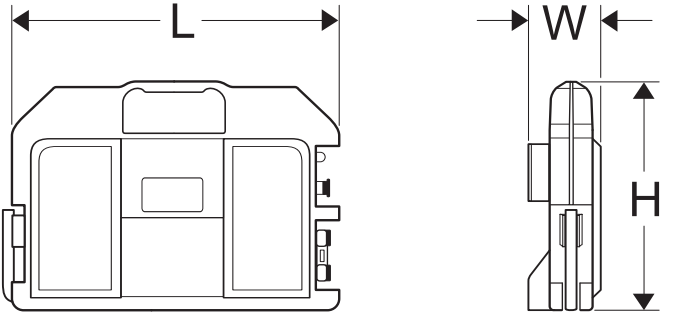
Dimensions	**U.S.**	**Metric**
Length	12.8 in	32.5 cm
Width	5.9 in	14.5 cm
Height	27.8 in	70.5 cm
Operating weight	4.5 lb	2 kg

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	
Operating modes (some optional*)			
	Active line: 400 Hz*, 512 Hz, 560 Hz*, 815 Hz*, 1 kHz, 8 kHz, 29 kHz, 80 kHz, 200 kHz*, 33 kHz (EML)		
	Beacon (locate/depth only): 512 Hz*, 29 kHz*, 33 kHz*		
	Passive line: 50 Hz, 60 Hz, 50 P power*, 60 P power*, 31 kHz*		
	Radio: passive locate only, no depth available*		
Locating ranges			
	Lines	15 ft	4.6 m
	Beacons	10 ft	3 m
Maximum depth ranges**			
	Passive line ±10%	.5 - 10 ft	.15 - 3 m
	Active line ±3%	.2 - 5 ft	.06 - 1.5 m
	Active line ±5%	5 - 10 ft	1.5 - 3 m
	Active line ±10%	10 ft and deeper	3 m and deeper
	Beacon ±5%	.5 - 10 ft	.15 - 3 m
LCD backlight		LED (green)	
External ports		RS-232 serial	

**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 estimate accuracy that is less than specified.

Batteries	
Batteries	6 C-cell alkaline
Battery life (continuous use at 70°F [21°C])	approximately 50 hours
Battery saver	unit shuts off after 5 minutes of inactivity

950 TRANSMITTER



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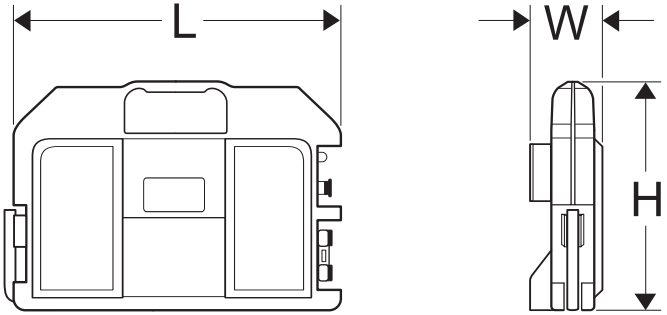
Dimensions	**U.S.**	**Metric**
Length	14 in	355 mm
Width	4.2 in	107 mm
Height	11 in	280 mm
Operating weight	7.25 lb	3.3 kg
Operation	**U.S.**	**Metric**
Operating temperature range	-4°F to 122°F	-20°C to 50°C
Maximum power output	3 watts	3 watts
Operating modes: 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, and dual (8 kHz and 29 kHz)		
Timer: unit runs continuously or shuts off after running for selected hour interval (8-hour maximum)		
Batteries		
Batteries	8 D-cell alkaline	
Battery life (continuous use at power level 2)	approximately 40 hours	

970 TRANSMITTER



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Dimensions	**U.S.**	**Metric**
Length	14 in	355 mm
Width	4.2 in	107 mm
Height	11 in	280 mm
Operating 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	5 watts	5 watts
Operating modes (some optional*) : 512 Hz, 1 kHz, 8 kHz, 29 kHz, 80 kHz, 200 kHz*, and dual (8 kHz and 29 kHz)		
Timer: unit runs continuously or shuts off after running for selected hour interval (8-hour maximum)		
Batteries		
Batteries	8 D-cell alkaline	
Battery life (continuous use at power level 2)	approximately 80 hours	

WARRANTY

Ditch Witch Subsite/Subsite Electronics Limited Product Warranty Policy

Warranty Periods

New Product

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

- Trackers: 750 Tracker
- Transmitters: 300ST, 950T, 970T
- Fault Finders: AF1, FT12
- Trench Depth Meter
- Remote Displays: 750 Display
- Receivers: 300SR, 910R, 950R, EML

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

- Beacons: 11B, 86B, 86BH, 86BHL, SBRP, 822B, 88B, 910B

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

- Beacons: BI
- Accessories: cables, clamps, canoes, cases, and adapters

Used Product (Cosmetics)

A three-month warranty starts on the date of delivery to the end user. (Non-returnable) All used products have an RS added after the serial number.

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 within thirty days of ownership. The extension is for an additional twenty-four months, for a total coverage of thirty-six months.

Details and Exclusions

- The warranty includes only Ditch Witch Subsite/Subsite Electronics products and accessories that are manufactured and distributed by Ditch Witch Subsite/Subsite Electronics. The warranty compensates on defects in material or workmanship.
- Defects will be determined through inspection by Ditch Witch Subsite/Subsite 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 removal of defective part and installation will be at no charge when product or item is delivered to Ditch Witch Subsite/Subsite 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 Subsite/Subsite Electronics products and accessories.
- If Ditch Witch Subsite/Subsite Electronics products are purchased for commercial purposes, as defined by the commerical code, no warranties extend beyond the specific terms set forth in this limited warranty. All other provisions of this limited warranty apply, including duties imposed.
- Ditch Witch Subsite/Subsite Electroinics 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.
- The Ditch Witch Subsite/Subsite Electronics Equipment Registration Form must be completed for each serial numbered product and submitted to Ditch Witch Subsite/Subsite Electronics. The information on the form is used to establish the warranty period start date.

- When the Ditch Witch Subsite/Subsite Electronics Equipment Registration Form is not processed and received by Ditch Witch Subsite/Subsite Electronics, the Ditch Witch Subsite/Subsite 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.

Revision F, October 2003