250R/T

Operator's Manual

CE

CMW®

Issue 1.0

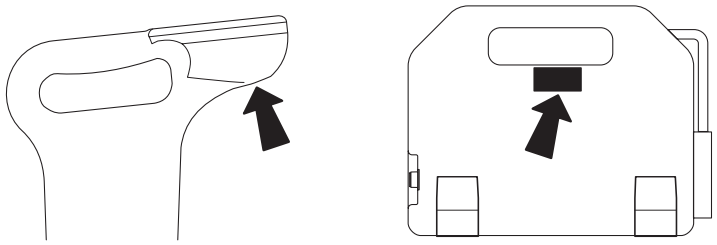
053- 1127

Overview

Chapter Contents

Serial Number Location

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



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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 system can be configured to locate pipe and cable or trace non-metallic pipe or conduit.

The 250R receiver is configured to operate in twin peak mode with one active frequency (33 kHz) as well as radio, 50P and 50S.

The 250T transmitter places signals on target lines and is used with 250R units. It is configured to send 33 kHz frequency signals. It places a signal on the line through either direct connection, induction clamping, or broadcast modes.

The unit 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 250 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 Subsite 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.

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 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 dealer. If you need assistance in locating a dealer, visit our website at **www.subsite.com** or write to the following address:

The Charles Machine Works, Inc.
Attn: Subsite
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 Subsite equipment, see your Subsite dealer.

Thank you for buying and using Subsite equipment.

250R/T
Operator's Manual

Issue number 1.0/OM-2/07
Part number 053-1127

Contents

Safety

Chapter Contents

Guidelines

- Read and follow all safety precautions.
- Do not operate equipment unless you have completed proper training and have read and understood the operator's manual.
- Before operation, ensure the equipment is in proper working order and is not damaged. Any transmitter leads should be checked for damage.

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

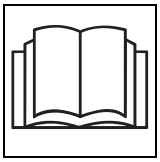
WARNING Electric shock. The connection leads may give off an electric shock when plugged into the transmitter. Avoid touching the metal ends of clips when the transmitter is switched on.

NOTICE:

- Electric shock or equipment damage can result if transmitter is connected to live electrical conductors. Observe all company and national safety procedures.
- Turn off transmitter when connecting or moving ground stake.
- Always comply with company and national safety requirements. Use correct equipment and working methods. Use and maintain proper safety equipment.

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

NOTICE: Do not use equipment in areas where flammable gases may be present or near to radio-controlled blasting operations.



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

NOTICE: Some buried utilities do not radiate a detectable signal. Always continue checking during excavation and ensure compliance with HS(G)47.

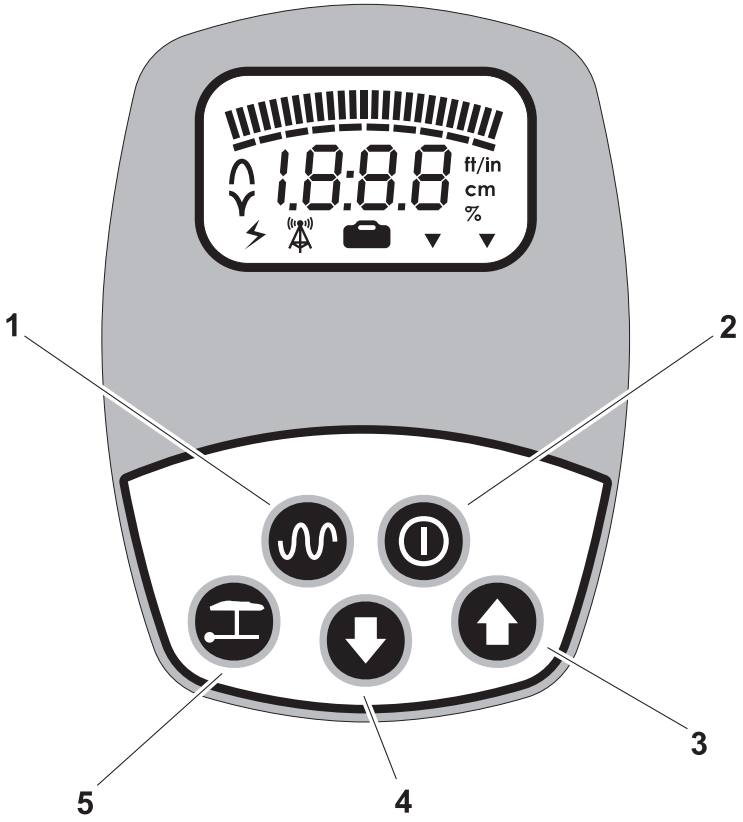
IMPORTANT: Subsite receivers and transmitters are calibrated to tolerances under strict environmental conditions. Under normal daily use, Subsite equipment does not require an annual calibration. A daily functional check is recommended and any units which have been damaged or do not appear to perform to original factory specifications should be returned to the manufacturer or authorized repair center for calibration check or repair.

Controls

Chapter Contents

Receiver

Single-Key Controls



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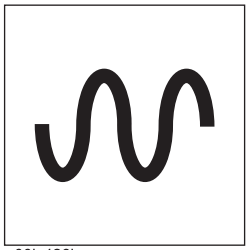
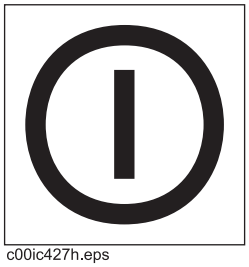
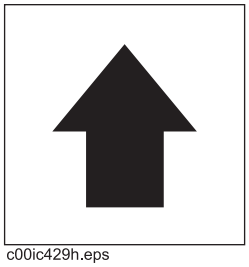
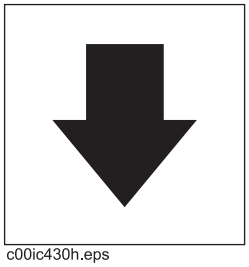
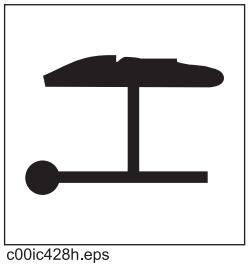
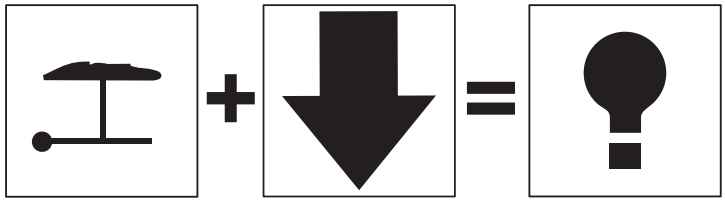
1. Mode
2. ON/OFF
3. Up arrow
4. Down arrow
5. DEPTH

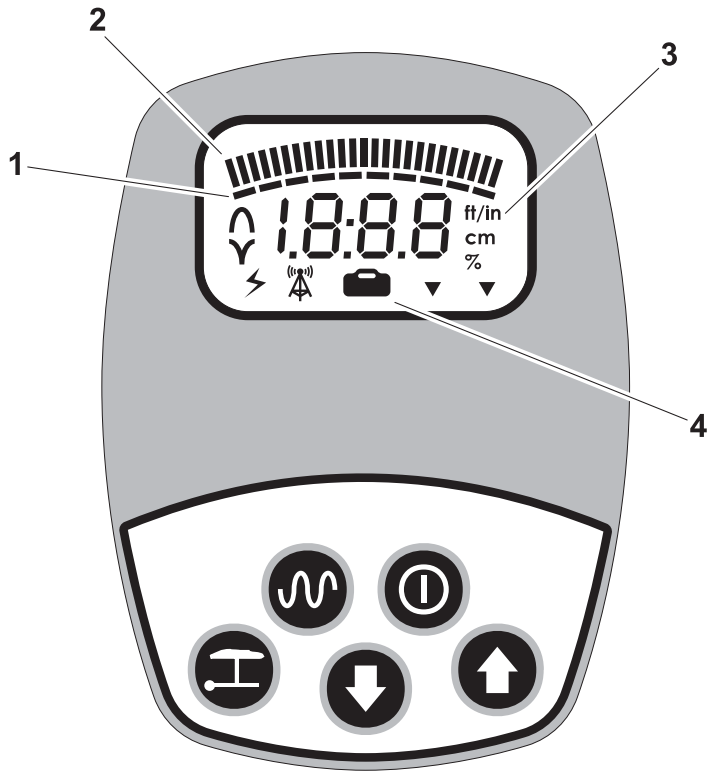
Item	Description	Notes
1. Mode  c00ic426h.eps	To cycle through operating frequencies, press.	See "Mode" on page 35.

Item	Description	Notes
2. ON/OFF  c00ic427h.eps	To turn on, press. To turn off, press again.	
3. Up Arrow  c00ic429h.eps	To increase gain, press.	
4. Down Arrow  c00ic430h.eps	To decrease gain, press.	
5. DEPTH  c00ic428h.eps	To estimate depth of properly located 33 kHz signal, press.	

Double-Key Controls

Item	Description
DEPTH + Down Arrow  c00ic441h.eps	To turn on backlight, press indicated keys.

Display



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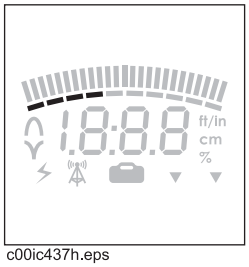
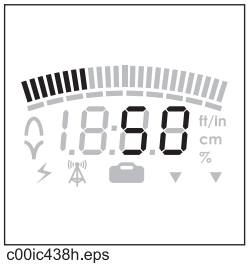
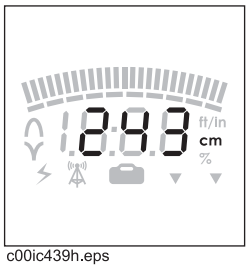
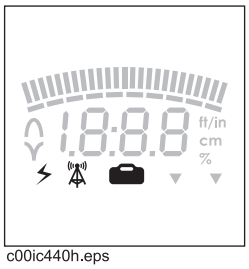
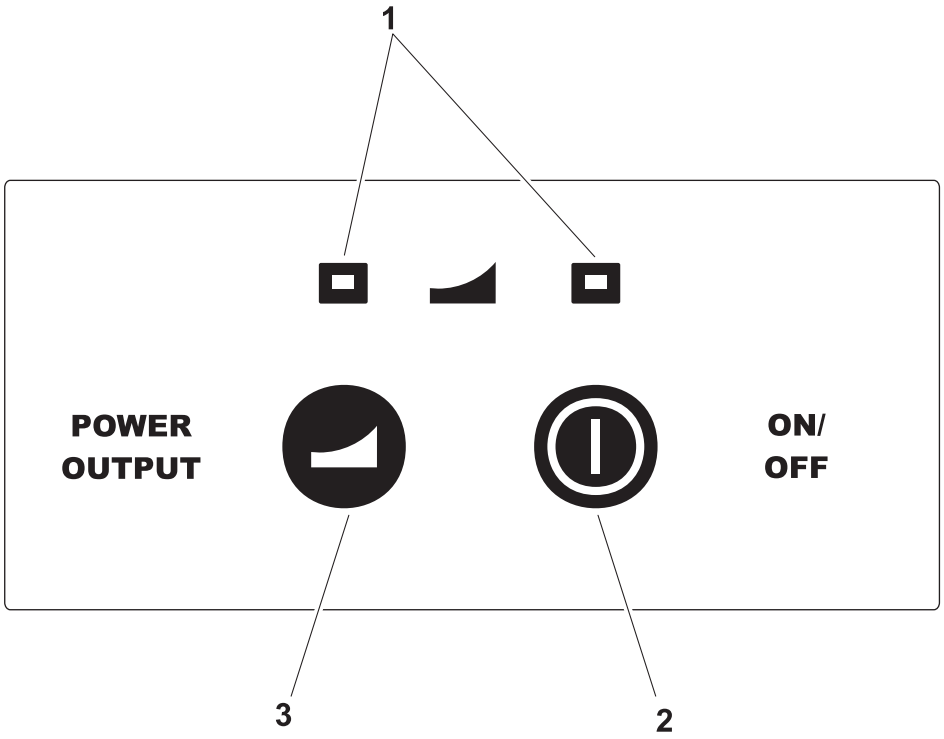
1. Gain level
2. Signal strength
3. Depth
4. Mode

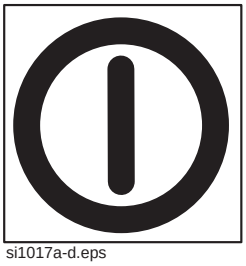
Item	Description	Notes
1. Gain Level  c00ic437h.eps	Graphically indicates gain level.	**IMPORTANT:** Gain increases to the right.

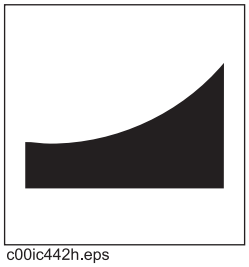
Item	Description	Notes
2. Signal Strength  c00ic438h.eps	Numerically and graphically indicates the signal strength level.	
3. Depth  c00ic439h.eps	Displays depth estimate of properly located line.	
4. Mode  c00ic440h.eps	Indicates mode setting.	See "Mode" on page 45.

Transmitter



1. LEDs
2. On/Off
3. Power level

Item	Description	Notes
1. LEDs	Green LED indicates low power. Red LED indicates high power.	**IMPORTANT:** If both LEDs are flashing, change batteries.
2. On/Off  si1017a-d.eps	To turn on, press. To turn off, press again.	

Item	Description	Notes
3. Power Level  c00ic442h.eps	To switch between low and high power, press.	

Locate

Chapter Contents

Active Location

Setup

Follow setup procedures for the type of locating you will be doing: direct connection, induction clamp, or broadcast induction. Always check receiver battery level at startup. See "Controls" on page 13.

Direct Connection

WARNING Electric shock. The connection leads may give off an electric shock when plugged into the transmitter. Avoid touching the metal ends of clips when the transmitter is switched on.

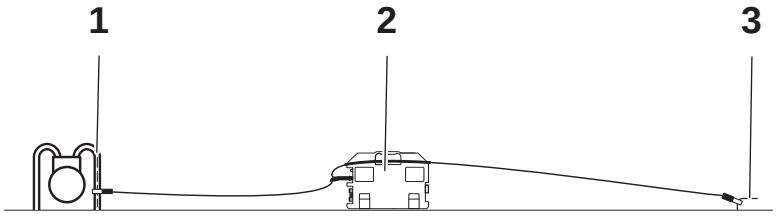
NOTICE:

- Electric shock or equipment damage can result if transmitter is connected to live electrical conductors. Observe all company and national safety procedures.
- Turn off transmitter when connecting or moving ground stake.
- Always comply with company and national safety requirements. Use correct equipment and working methods. Use and maintain proper safety equipment.

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

Do not use equipment in areas where flammable gases may be present or near to radio-controlled blasting operations.

To set up transmitter for direct connection:



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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.

Induction Clamp

WARNING Electric shock. The connection leads may give off an electric shock when plugged into the transmitter. Avoid touching the metal ends of clips when the transmitter is switched on.

NOTICE:

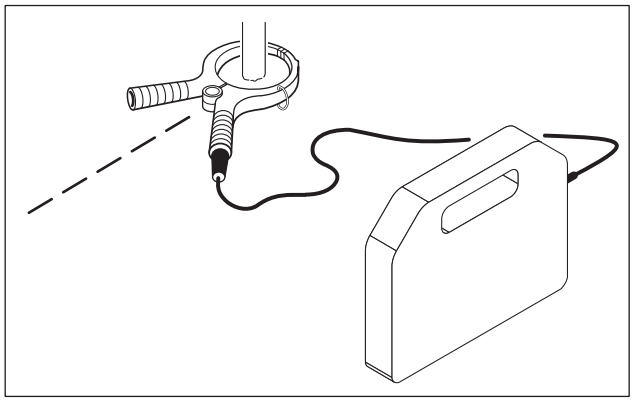
- Electric shock or equipment damage can result if transmitter is connected to live electrical conductors. Observe all company and national safety procedures.
- Turn off transmitter when connecting or moving ground stake.
- Always comply with company and national safety requirements. Use correct equipment and working methods. Use and maintain proper safety equipment.

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

Do not use equipment in areas where flammable gases may be present or near to radio-controlled blasting operations.

To set up transmitter for use with induction clamp:

1. Plug cable into transmitter.
2. Place clamp around line.
3. Turn on transmitter.



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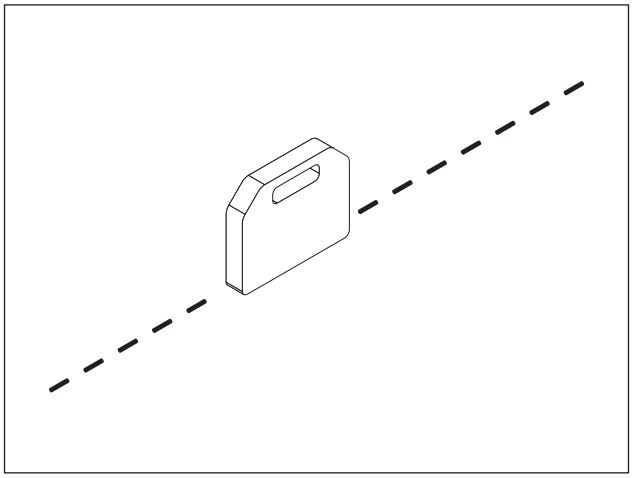
Broadcast Induction

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.

3. Turn on transmitter.



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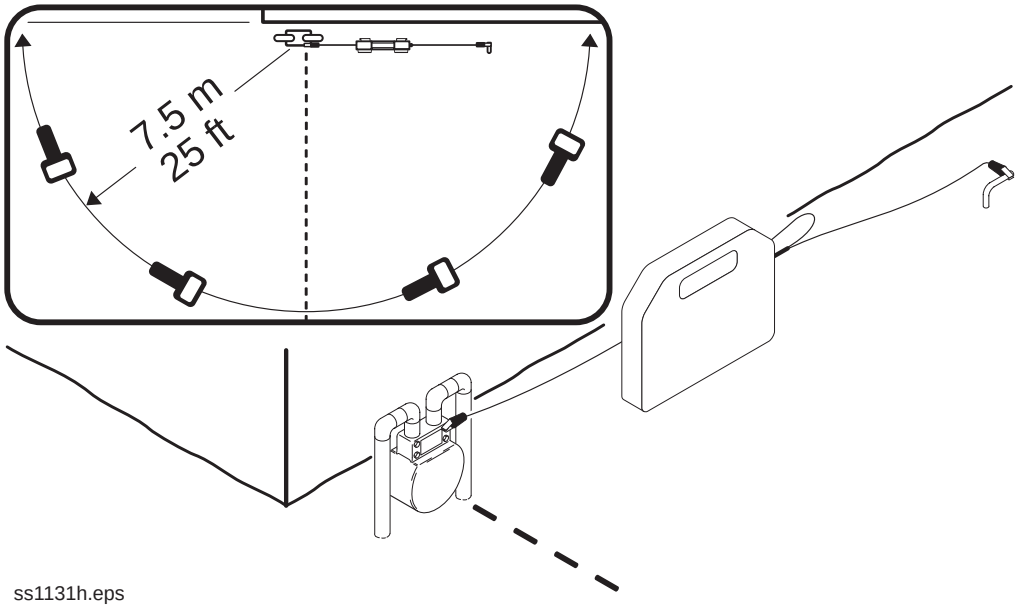
Technique

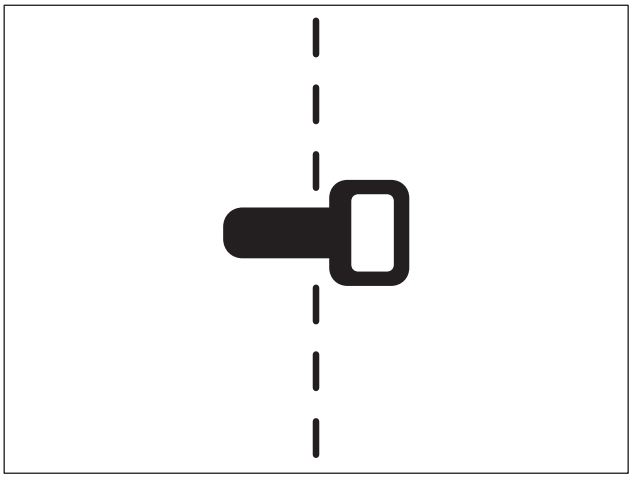


ss1131h.eps

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

5. Set receiver on the ground.
6. Press depth button when the line has been located.

IMPORTANT: When estimating depth for pipe, depth shown is to the **center** of the pipe.

7. Continue to trace the line and take depth estimates every few paces.
8. 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.

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 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. Also ensure that receiver is set to the correct mode.
Target line has connections to other lines.	Disconnect target line from other lines.
Signal is transferring to other lines.	• 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

Turn on receiver and choose power or radio frequency. Always check receiver battery level at startup.

NOTICE: Lines with no AC 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

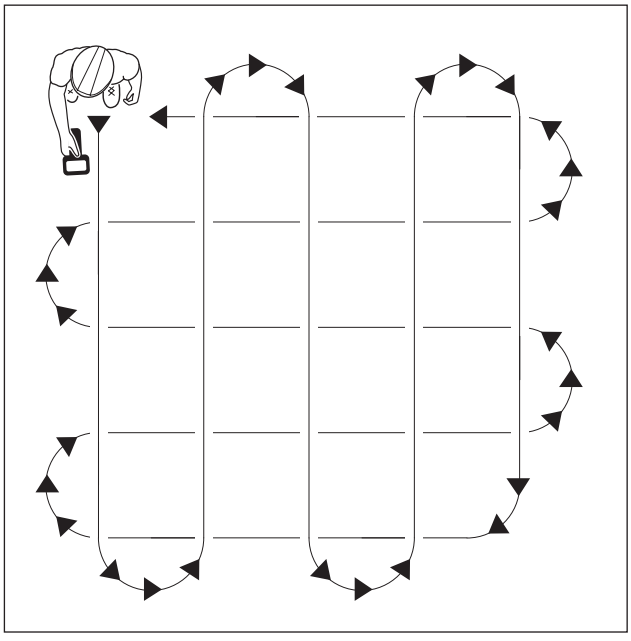
Make a visual check of the site for signs of buried lines such as:

- 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.



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Focus the Signal

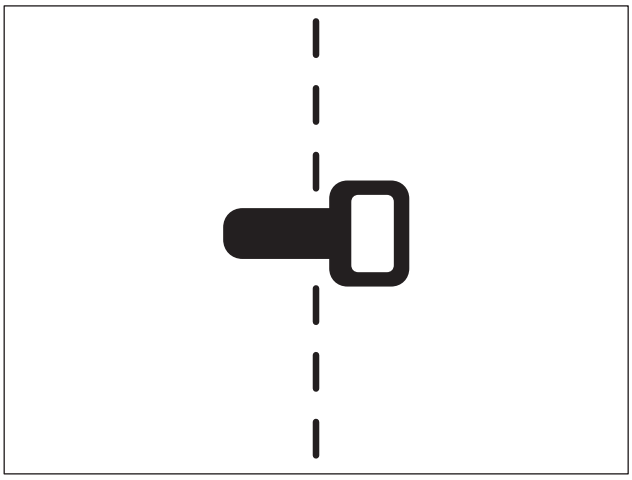
Move receiver over detected signal to find best signal response. Rotate receiver until signal is strongest. Best signal indicates line direction.

NOTICE: Keep receiver level.

Trace the Line

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

IMPORTANT: Keep receiver handle **perpendicular** 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.

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.	Check the transmitter connection. If connection is good and signal is still 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 (Sonde) Location

Trace metallic or non-metallic pipes or conduits by locating and following a beacon (sonde) 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 (sonde) location:

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

Technique

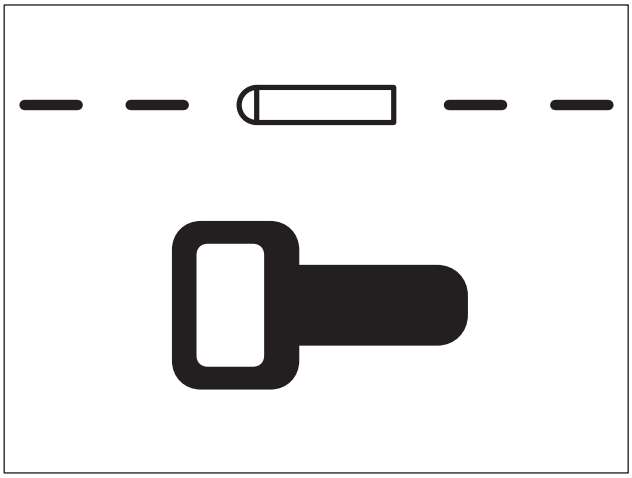
1. Turn on receiver.
2. Set antenna to peak and frequency to beacon (sonde) mode.
3. Place beacon (sonde) into the pipe and move it down the pipe.
4. To locate beacon (sonde), circle over its approximate location in the pipe.
5. To identify the location of beacon (sonde), find the spot with the strongest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

   IMPORTANT: Receiver indicates the best signal when handle is parallel with and directly over the beacon (sonde).

7. Press the depth button.

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

8. Continue to track beacon (sonde). Mark pipe location with paint.



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Locating Concepts

Chapter Contents

Signal Type

The 250R can detect two types of signals:

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

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 (Sonde)

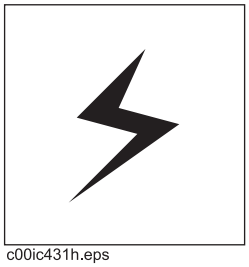
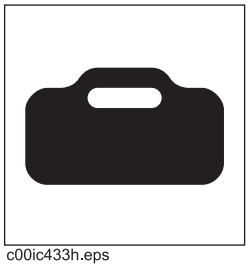
Beacon (sonde) signals allow metallic and non-metallic pipe tracing.

Passive

Power line signals can be detected passively without a transmitter.

Mode

The 250R receiver has three available mode options.

Mode	Description	Notes
Power  c00ic431h.eps	Allows receiver to trace live 50 Hz power lines.	**IMPORTANT:** Current must be flowing through the line.
Radio  c00ic432h.eps	Allows receiver to trace lines that pick up and radiate very low frequency (VLF) radio waves.	
Transmitter  c00ic433h.eps	Allows receiver to trace lines that have had a 33 kHz signal placed on them by a transmitter.	
Beacon (Sonde)	Allows receiver to trace 33 kHz beacon (sonde) signals.	

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

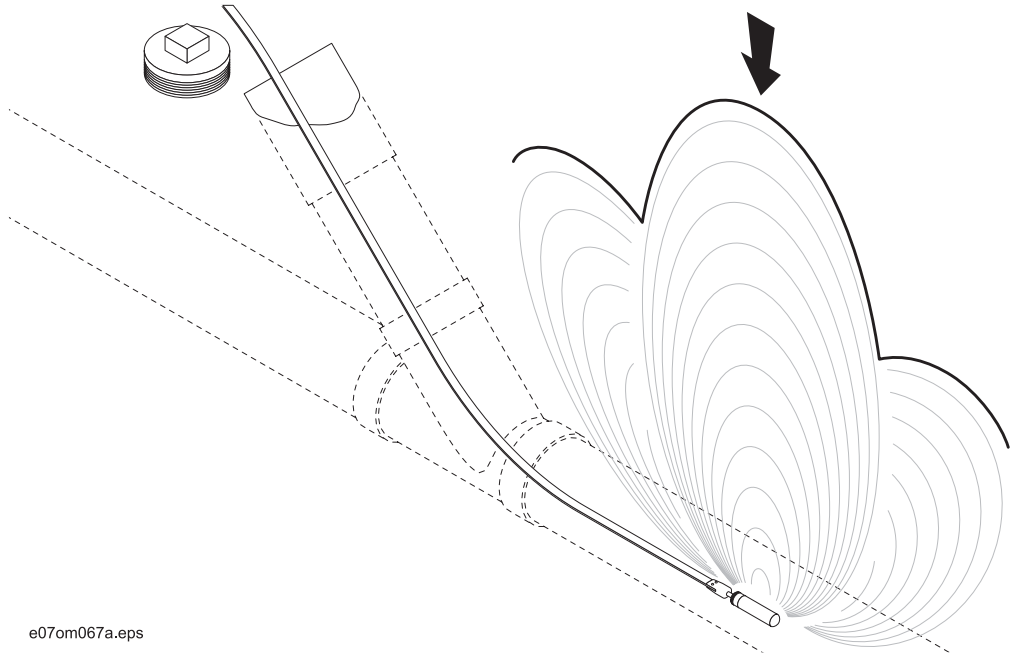
False Signals

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 peak antenna configuration.

Secondary (Ghost) Signals

A typical beacon (sonde) 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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Service

Chapter Contents

General Care

Under normal operating conditions, receiver needs 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

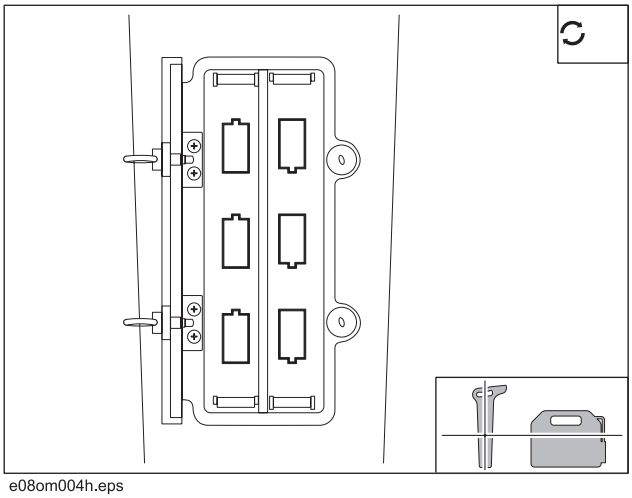
Location	Task	Notes
Receiver Unit	Change batteries	6 "C" batteries
Transmitter Unit	Change batteries	6 "D" batteries

Receiver Unit

Change Batteries

Use six C-cell alkaline batteries in receiver.

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



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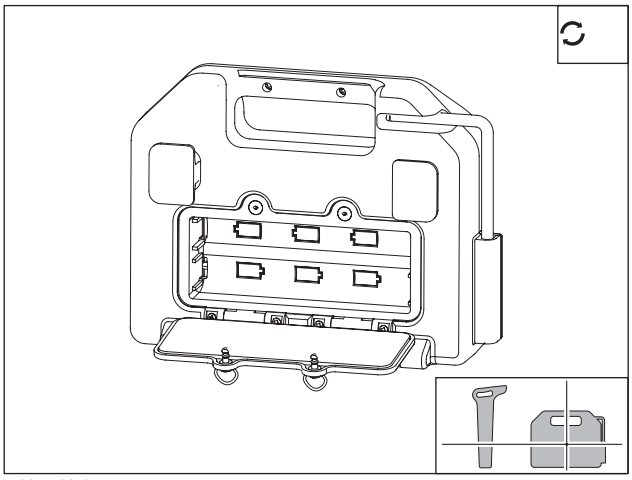
Transmitter Unit

Change Batteries

Use six D-cell alkaline batteries in transmitter.

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



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Transmitter Error Messages

Red LED with No Tone

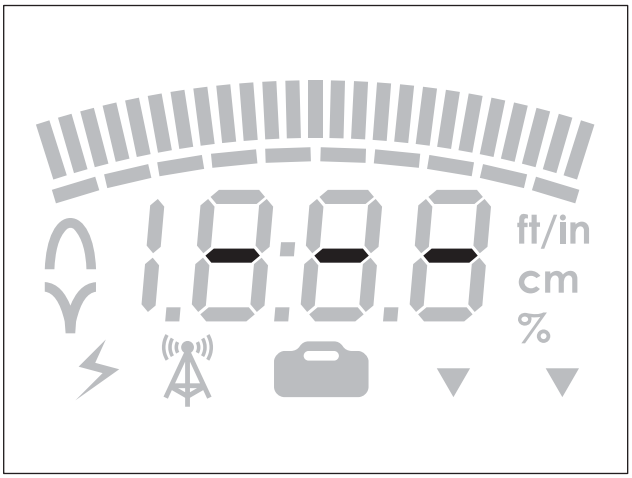
If red LED flashes with no tone in direct connect or induction clamp mode, the unit has detected a short in one of the leads or on the target line.

Receiver Error Messages

Three Dashes

If three dashes appear in the display when pressing the depth button, one of the following could be possible:

- The receiver is detecting a signal above it and cannot estimate depth. This message is usually caused by interfering signals. Try relocating target signal.
- Line is too deep for depth estimate. Mark as hand-dig area.
- Line is too shallow for depth estimate. Select lowest usable transmitter power level or lift receiver high enough to return display to normal operation. Relocate line and verify with null antenna.



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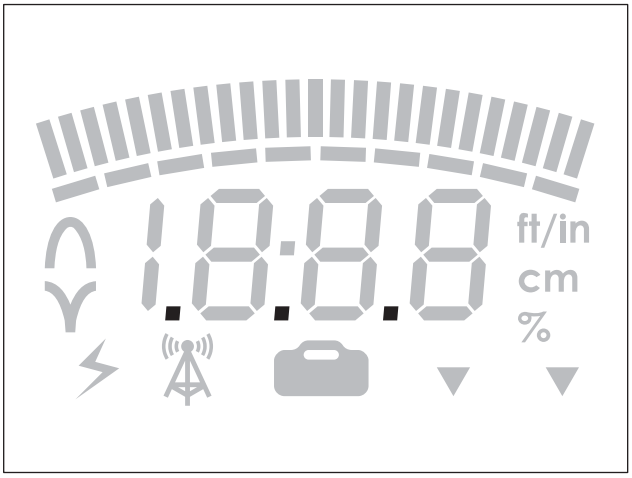
Three Dots

If three dots appear in the display when pressing the depth button, contact your equipment dealer.



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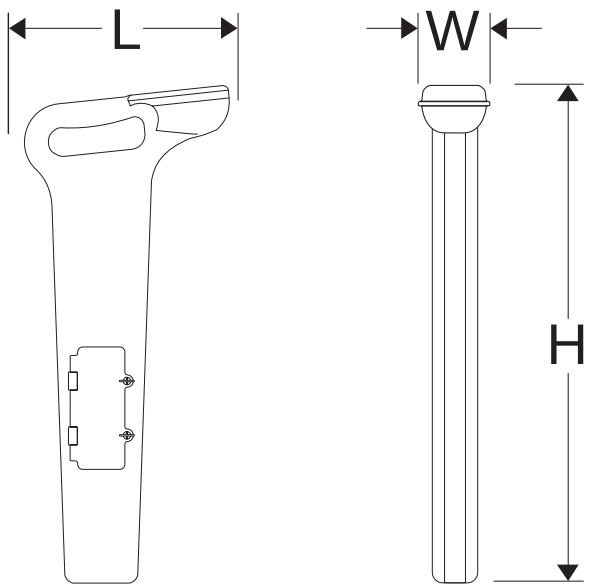
Specifications

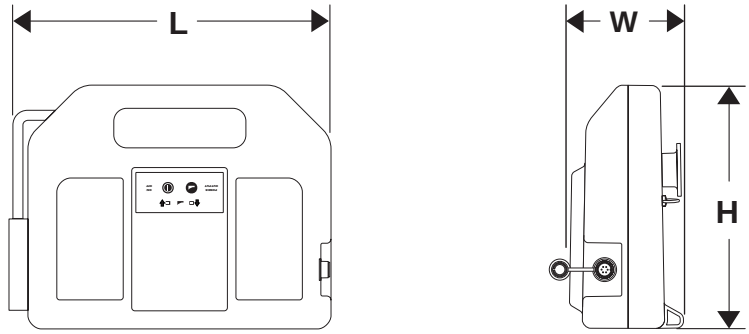
250 Receiver



ss1127h.eps

Dimensions		U.S.	Metric
H	Height	27.5”	700 mm
L	Length	11.5”	290 mm
W	Width	4”	100 mm
	Weight	5 lb	2.3 kg
Operation		**U.S.**	**Metric**
Operating temperature range		-4°F to 122°F	-20°C to 50°C
Antenna configurations: twin peak			
Audio output: speaker			
LCD backlight: LED (green)			
Batteries			
Type: 6 C-cell alkaline			
Life (intermittent use at 70°F/21°C): approximately 40 hours			
Battery saver: unit shuts off after 5 minutes of inactivity			

250 Transmitter



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Dimensions		**U.S.**	**Metric**
H	Height	9.25”	235 mm
L	Length	12.25”	311 mm
W	Width	4.5”	114 mm
	Weight	5 lb	2.3 kg
Operation		**U.S.**	**Metric**
Operating temperature range		-4°F to 122°F	-20°C to 50°C
Maximum power output: 1 watt			
Standard operating mode: 33 kHz			
Batteries			
Type: 6 D-cell alkaline			
Life (continuous use at low power level): approximately 150 hours			

System Operation

Operating Modes and Frequencies		
Active line: 33 kHz		
Passive line (locate only): 50 Hz		
Beacon (Sonde) (locate/depth only): 33 kHz		
Radio (locate only)		
Locating Ranges		
Lines	15'	4.6 m
Beacons (Sondes)	10'	3 m
Depth Estimate Tolerances*		
Active line ±5%	0.5-10'	0.15-3 m
Active line ±10%	10' +	3 m +
Beacon (Sonde) ±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 Subsite 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 Subsite repair facility. Repairs done elsewhere will void warranty consideration.

Resources

Publications

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

Training

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

Warranty

Limited Product Warranty Policy

Warranty Periods

New Product

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

receivers, transmitters, radars, fault finders

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

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 Subsite 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 Subsite products and accessories that are manufactured and distributed by Subsite. The warranty compensates on defects in material or workmanship.
- Defects will be determined through inspection by Subsite 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 Subsite 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 Subsite products and accessories.
- If Subsite 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.
- Subsite 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 Subsite 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, September 2006