

8500 Tracking System

Operator's Manual



Overview

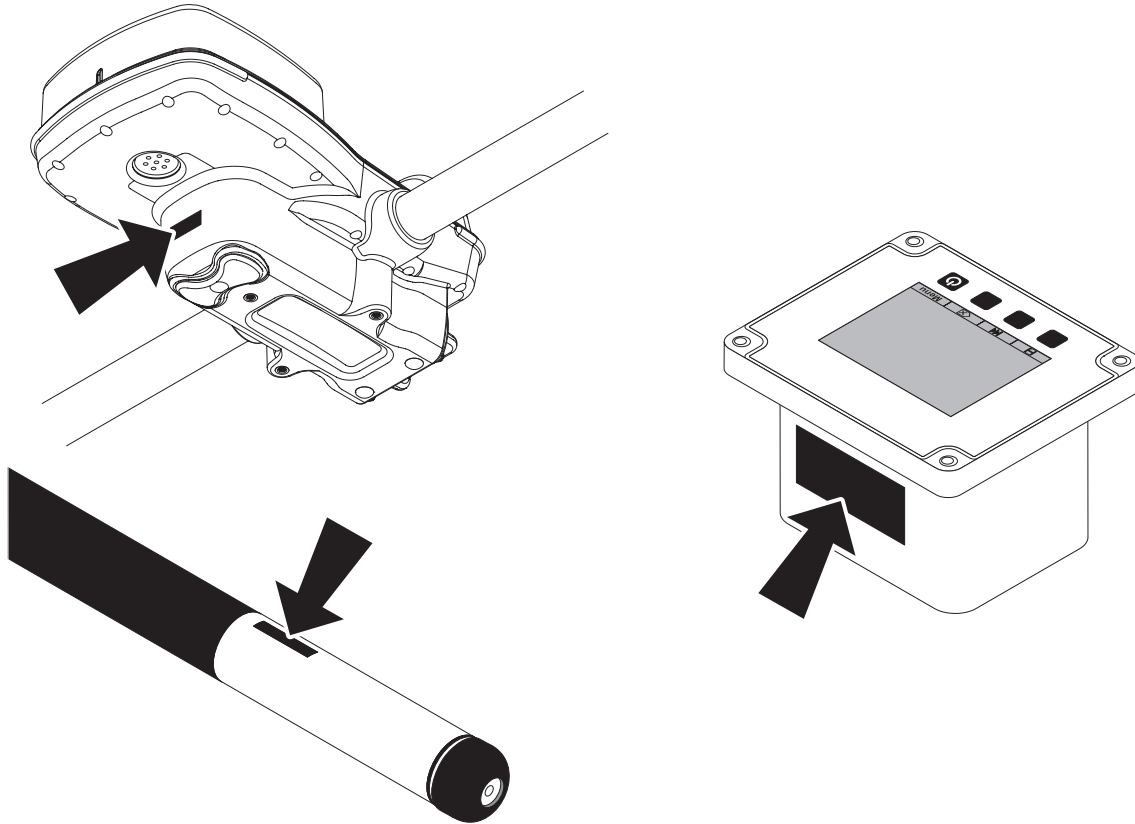


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Serial Number Location

Record serial numbers and date of purchase in spaces provided. Serial numbers are located as shown and displayed briefly in lower left corner of tracker and display screens when units are first powered up.



e12om029h.eps

Item	
date of purchase:	
tracker serial number:	
display serial number:	
accessory model and serial number:	
accessory model and serial number:	
accessory model and serial number:	



Intended Use

The 8500 tracking system consists of an 8500TK tracker, an 8500D remote display, and an 850 series beacon. The system provides advanced locating features to 30' (9 m) deep. It also provides offset locating and depth capability. The system provides projected direction information and offers a Drill-Thru guidance mode. The system can track grade drilling bores with the addition of an 850 series grade beacon and other grade drilling accessories.

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 8500 tracking 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 Electronics 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 - Internal Transmitter

FCC ID: ITQ-8500TKR

IC: 3598A-8500TKR

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.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

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



N 16819

RF Exposure Statement



WARNING This equipment has been tested for RF exposure according to FCC rules for body-worn equipment. The equipment must be operated in accordance with manufacturer expectations to insure RF exposure compliance.

In order to comply with RF exposure requirements during normal operation, this device must be held in front of the body horizontally. The antenna must be vertical in line with the body with at least 2 cm separation distance from the body.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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.

**8500 Tracking System
Operator's Manual**

Issue number 1.2/OM-11/08

Part number 053-1254

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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.
- 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 operating equipment. If you damage a utility, contact utility company.
- 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.

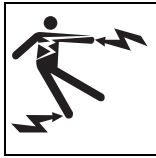
 **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

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

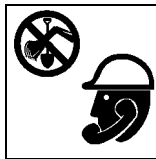
NOTICE can keep you from doing something that might damage the unit or someone's property. It can also alert you against unsafe practices.

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

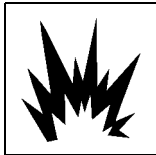
Safety Alerts



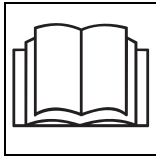
⚠ DANGER Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.



⚠ 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.



⚠ CAUTION Potential radio frequency (RF) hazard. Operating this device within 4" (100 mm) of your body may cause RF exposure levels to exceed FCC RF exposure limits and should be avoided.

Controls

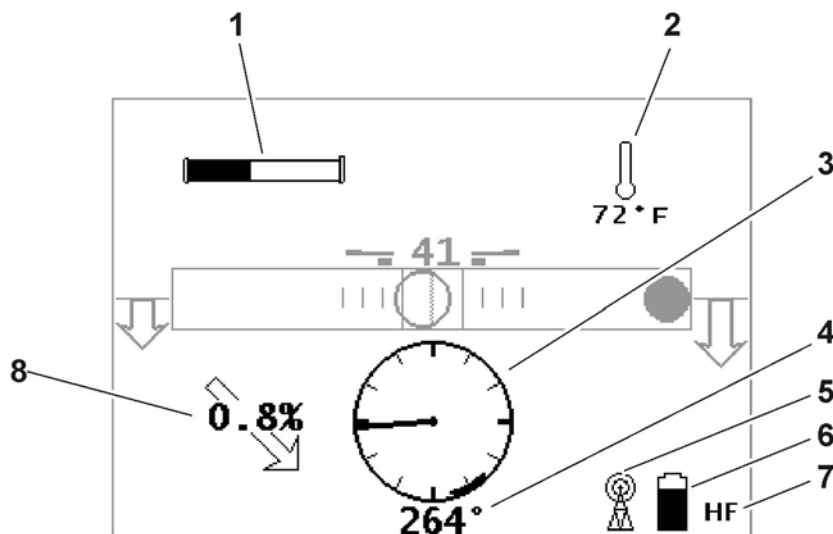
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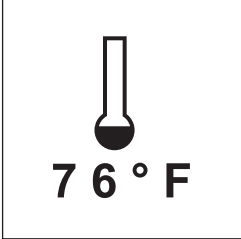
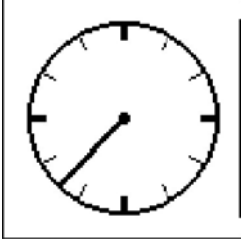
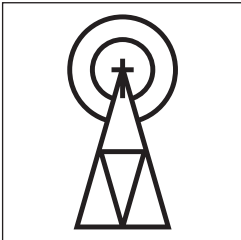
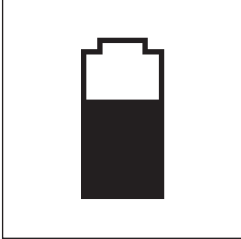
8500TK

Icons

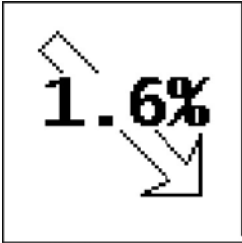


- | | |
|----------------------------------|-----------------------------------|
| 1. Beacon battery life indicator | 5. Communication indicator |
| 2. Beacon temperature | 6. Tracker battery life indicator |
| 3. Beacon roll indicator | 7. Frequency indicator |
| 4. Beacon roll value | 8. Beacon pitch |

Item	Description	Notes
<p>1. Beacon battery life indicator</p> <p>c00ic510h.eps</p>	<p>Graphically indicates battery life remaining.</p> <p>If beacon is within 5 minutes of entering sleep mode, a countdown timer will appear below icon.</p> <p>An "L" appears in the icon if a Lithium battery is installed.</p> <p>In 2-axis view (bottom icon), replace battery if either axis disappears.</p>	<p>Battery power (horizontal axis) and beacon throttle (vertical axis) are monitored in this view. See "Beacon Throttle" on page 56.</p>

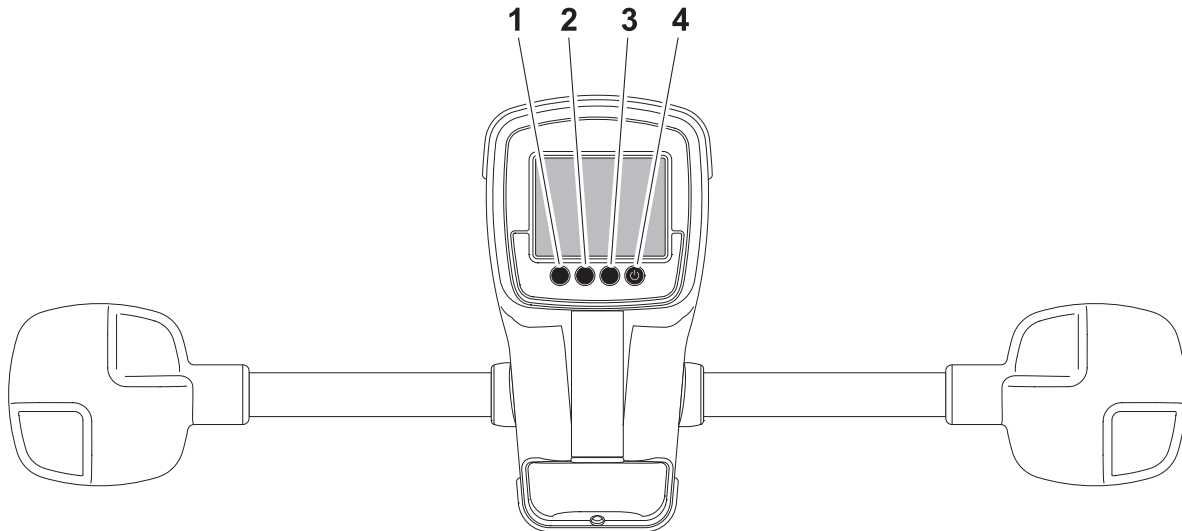
Item	Description	Notes
<p>2. Beacon temperature</p>  <p><small>c00ic500h.eps</small></p>	<p>Displays beacon temperature and flashes if temperature becomes too high.</p> <p>Icon darkens as temperature rises and temperature is displayed numerically below the icon.</p>	<p>IMPORTANT: An audible warning is activated when beacon temperature is 155°F (68°C).</p>
<p>3. Beacon roll indicator</p>  <p><small>c00ic509h.jpg</small></p>	<p>Graphically indicates beacon's roll position.</p>	
<p>4. Beacon roll value</p>	<p>Numerically displays beacon's roll position in degrees, minutes or hours.</p>	
<p>5. Communication indicator</p>  <p><small>c00ic517h.eps</small></p>	<p>Indicates tracker and display are communicating properly.</p>	
<p>6. Tracker battery</p>  <p><small>c00ic501h.eps</small></p>	<p>Indicates amount of battery power remaining for the tracker.</p> <p>Flashes when batteries need to be replaced.</p>	
<p>7. Frequency indicator</p>	<p>Displays "HF" when high frequency beacon is selected.</p> <p>Displays "LF" when low frequency beacon is selected.</p>	



Item	Description	Notes
<p>8. Beacon pitch</p>  <p><small>c00ic508h.jpg</small></p>	<p>Displays pitch of beacon in percent grade or degrees.</p> <p>The arrow behind the value indicates whether pitch is positive or negative.</p>	

Buttons

Overview



e12om004h.eps

- | | |
|----------------|-----------------|
| 1. Soft button | 3. Soft button |
| 2. Soft button | 4. Power button |

Item	Description	Notes
1. Soft button	Function depends on selected mode and is indicated above button.	Button is also used to access quick functions.
2. Soft button	Function depends on selected mode and is indicated above button.	Button is also used for quick functions.
3. Soft button	Function depends on selected mode and is indicated above button.	Button is also used for quick functions.
4. Power button	To turn on, press once. To turn off, press for 2 seconds.	Button is also used for quick functions.



si1017a-d.eps

Quick Functions

Contrast Adjustment

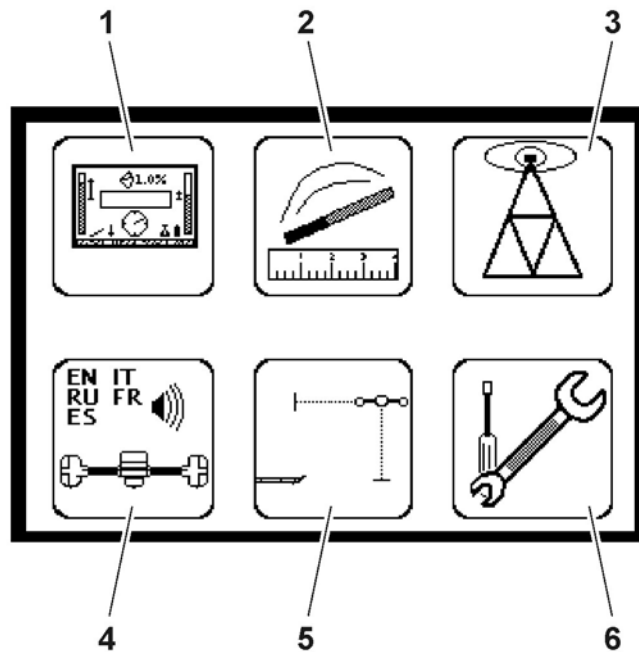
To adjust contrast, press and hold left button (1) and press button 2 to darken/increase contrast or button 3 to lighten/lessen contrast.

Backlight Toggle

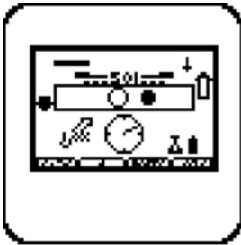

To turn backlight on and off, press and hold left button (1) and press power (4) button. Don't press power button for more than 2 seconds to avoid turning unit off.



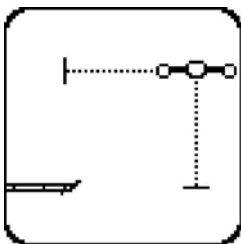

Menu

Overview



- | | |
|---------------------|--------------------|
| 1. Display settings | 4. System settings |
| 2. Beacon settings | 5. Drill-Thru mode |
| 3. Radio options | 6. Service menu |

Item	Description	Notes
<p>1. Display settings</p>  <p><small>c00ic503h.jpg</small></p>	<p>Highlight icon and press select to enter the "display settings" menu.</p>	<p>See "Display Settings" on page 21.</p>
<p>2. Beacon settings</p>  <p><small>c00ic502h.jpg</small></p>	<p>Highlight icon and press select to enter the "beacon settings" menu.</p>	<p>See "Beacon Settings" on page 21.</p>

Item	Description	Notes
<p>3. Radio options</p>  <p>c00ic505h.jpg</p>	<p>Highlight icon and press select to enter the "radio options" mode.</p>	<p>See "Radio Options" on page 22.</p>
<p>4. System settings</p>  <p>c00ic507h.jpg</p>	<p>Highlight icon and press select to enter the "system settings" menu.</p>	<p>See "System Settings" on page 22.</p>
<p>5. Drill-Thru mode</p>  <p>c00ic504h.jpg</p>	<p>Highlight icon and press select to enter the drill-thru mode.</p>	<p>See "Drill-Thru Mode" on page 43.</p>
<p>6. Service menu</p>  <p>c00ic506h.jpg</p>	<p>Highlight icon and press select to enter "service menu."</p>	<p>See "Service Menu" on page 22.</p>

Descriptions

Display Settings

Description	Notes
LCD Backlight	Controls backlight intensity. Available settings: 0 (off) to 100 (brightest, default).
LCD contrast	Controls contrast of LCD. Available settings: -20 (lighter) to 20 (darker), 0 is default.
Units	Controls displayed units of depth values, temperatures and other numbers. Available distance settings: inches, ft in (default), decimal ft, meters, centimeters.
Depth disp. time	Controls how long depth information is locked on the screen after pressing depth button. Available settings: 0-60 seconds, 5 is default.
Roll angle disp.	Controls display of numerical value of the roll indicator. Available settings: off (default), degrees, minutes, hours.
Pitch disp.	Controls display of beacon pitch indicator. Available settings: percent (default), degrees.
Battery ind. style	Controls display of beacon battery indicator. Available settings: 1-axis (default), 2-axis.



Beacon Settings

Description	Notes
Beacon freq.	Sets tracker receiving frequency. Available settings: high (default), low.
Beacon calibration	Calibrates tracker to beacon.
Roll calibration	Sets roll position for beacon equivalent to bit pointing up (12 o'clock, 0 minutes, 0°).
Pitch calibration	Sets 0.0% pitch position for grade beacon (1.0% limit).
Depth adjustment	Changes built-in adjustment of depth measurements.

Radio Options

Description	Notes
Radio power	Turns radio on and off. Available settings: on (default), off.
Channel	Sets telemetry channel Available settings: 1 (default) through 15
Tracker Control	Enables or disables thrust and rotation of drilling unit. Available settings: Rig ON, Rig OFF (default).
Tracker Control code	Selects code for Tracker Control feature corresponding to code on display.

System Settings

IMPORTANT: Warning sounds such as beacon temperature alert are always audible.

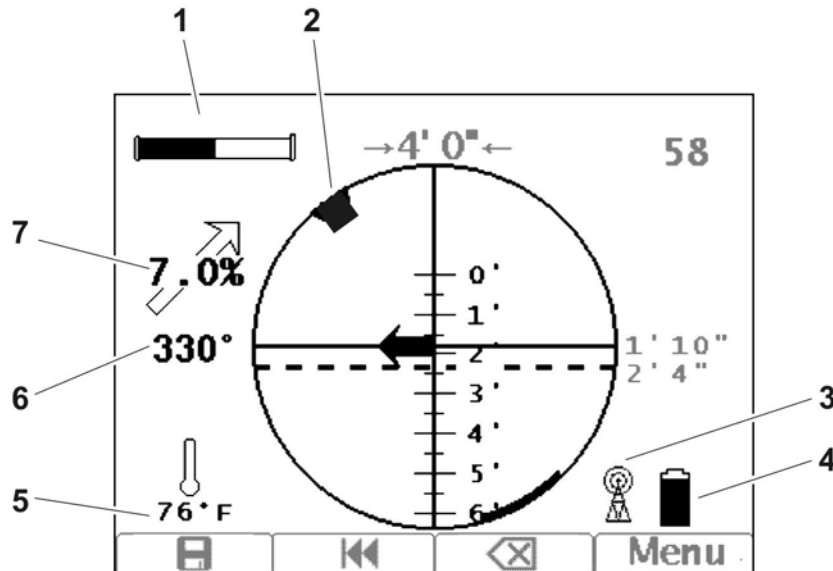
Description	Notes
Language	Controls user interface language.
Tracker sleep	Controls tracker sleep feature. Available settings: on (default), off.
Volume	Controls volume of the signal sound and sound effects. Available settings: mute, low, med, high (default).

Service Menu

Description	Notes
Versions	Lists hardware and software versions, serial number, and copyright information.
Uptime	Displays uptime and life timers.
Support	Enters support menu.
Factory	Enters factory menu. Password protected.

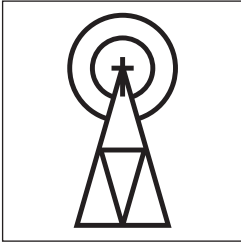
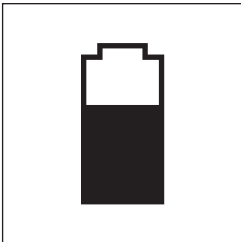
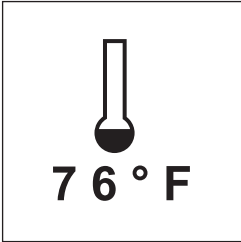

8500D

Icons



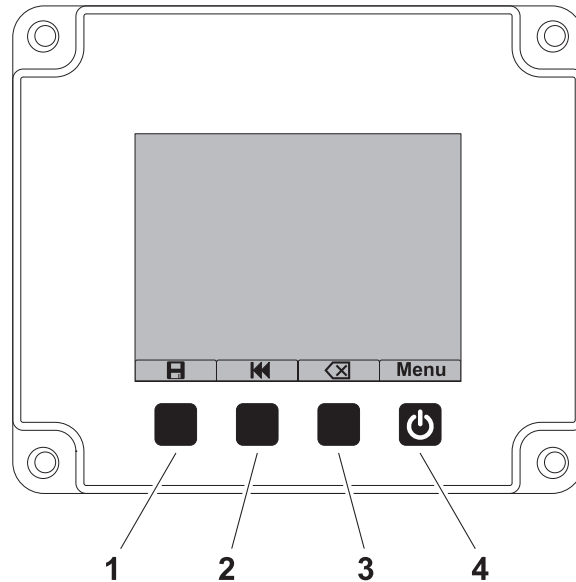
- | | |
|-----------------------------------|-----------------------|
| 1. Beacon battery life indicator | 5. Beacon temperature |
| 2. Beacon roll indicator | 6. Beacon roll value |
| 3. Communication indicator | 7. Beacon pitch |
| 4. Display battery life indicator | |

Item	Description	Notes
<p>1. Beacon battery life indicator</p> <p>c00ic510h.eps</p>	<p>Graphically indicates battery life remaining.</p> <p>If beacon is within 5 minutes of entering sleep mode, a countdown timer will appear below icon.</p> <p>An "L" appears in the icon if a Lithium battery is installed.</p> <p>In 2-axis view (bottom icon), replace battery if either axis disappears.</p>	<p>Battery power (horizontal axis) and beacon throttle (vertical axis) are monitored in this view. See "Beacon Throttle" on page 56.</p>
<p>2. Beacon roll indicator</p>	<p>Graphically indicates beacon's roll position.</p>	

Item	Description	Notes
<p>3. Communication indicator</p>  <p>c00ic517h.eps</p>	<p>Indicates tracker and display are communicating properly.</p>	
<p>4. Display battery life indicator</p>  <p>c00ic501h.eps</p>	<p>Indicates amount of battery power remaining for the display.</p> <p>Flashes when batteries need to be replaced.</p>	
<p>5. Beacon temperature</p>  <p>c00ic500h.eps</p>	<p>Displays beacon temperature and flashes if temperature becomes too high.</p> <p>Icon darkens as temperature rises and temperature is displayed numerically below the icon.</p>	
<p>6. Beacon roll value</p>	<p>Displays numeric value in degrees, minutes or hours.</p>	
<p>7. Beacon pitch</p>  <p>c00ic508h.jpg</p>	<p>Displays pitch of beacon in percent grade or degrees.</p> <p>The arrow behind the value indicates whether pitch is positive or negative.</p>	

Buttons

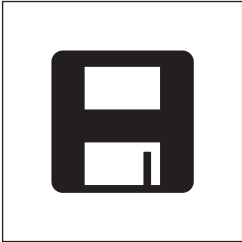
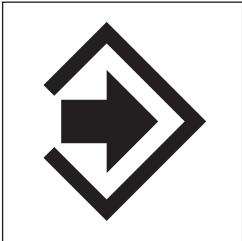
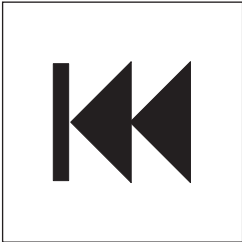

Overview

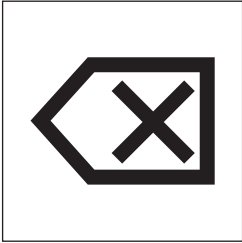



- | | |
|------------------|------------------|
| 1. Save button | 3. Delete button |
| 2. Review button | 4. Power button |

IMPORTANT:

- Some icons and functions will change when display is properly connected to TMS Plus. These are shown and explained in the following table.
- SD card must be installed and have active log file or display must be connected to TMS Plus to store, review or delete logged data.

Item	Description	Notes
<p>1. Save button</p>  <p>c00ic514h.eps</p> <p>Send button</p>  <p>c00ic076h.eps</p>	<p>Press to save data for current pipe.</p> <p>When connected to TMS Plus:</p> <p>Press to send data for current pipe to TMS Plus.</p>	<p>IMPORTANT: Display must have received a depth reading from tracker to save.</p>
<p>2. Review button</p>  <p>c00ic515h.eps</p> <p>Recall button</p>  <p>c00ic075h.eps</p>	<p>Press to review previous pipe data.</p> <p>Press again to review pipe before that.</p> <p>When connected to TMS Plus:</p> <p>Press to review target information for next pipe.</p>	

Item	Description	Notes
<p>3. Delete button</p>  <p>c00ic516h.eps</p>	<p>Press to delete previous pipe data.</p>	
<p>4. Power/Menu button</p>  <p>si1017a-d.eps</p>	<p>To turn on, press once. To turn off, press for 2 seconds.</p>	<p>Press button less than 2 seconds to access menu.</p>



Quick Functions

Contrast Adjustment

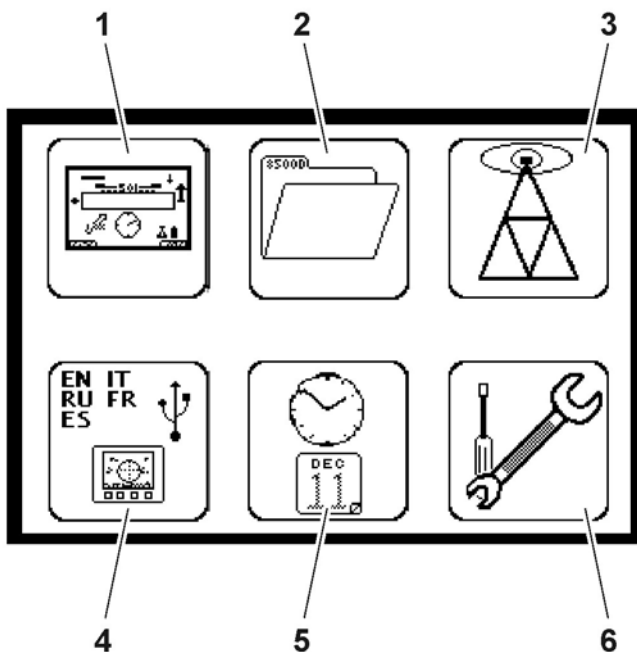
To adjust contrast, press and hold left button (1) and press button 2 to darken/increase contrast or button 3 to lighten/lessen contrast.

Backlight Toggle

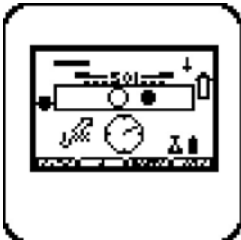
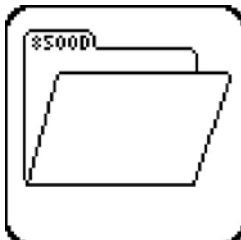
To turn backlight on and off, press and hold left button (1) and press power (4) button. Don't press power button for more than 2 seconds to avoid turning unit off.


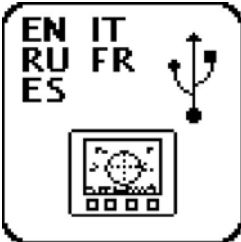
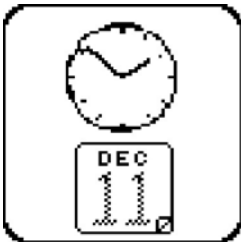

Menu

Overview



- | | |
|---------------------|-----------------------|
| 1. Display settings | 4. System settings |
| 2. File management | 5. Time/Date settings |
| 3. Radio options | 6. Service menu |

Item	Description	Notes
<p>1. Display settings</p>  <p>c00ic503h.jpg</p>	<p>Highlight icon and press select to enter the "display settings" menu.</p>	<p>See "Display Settings" on page 30.</p>
<p>2. File Management</p>  <p>c00ic511h.jpg</p>	<p>Highlight icon and press select to start new job or review saved job files.</p>	<p>See "File Management" on page 31.</p>

Item	Description	Notes
<p>3. Radio options</p>  <p>c00ic505h.jpg</p>	<p>Highlight icon and press select to enter the "radio options" mode.</p>	<p>See "Radio Options" on page 31.</p>
<p>4. System settings</p>  <p>c00ic513h.jpg</p>	<p>Highlight icon and press select to enter the "system settings" menu.</p>	<p>See "System Settings" on page 32.</p>
<p>5. Time/Date settings</p>  <p>c00ic512h.jpg</p>	<p>Highlight icon and press select to enter the "time/date settings" menu.</p>	<p>See "Date/Time Settings" on page 32.</p>
<p>6. Service menu</p>  <p>c00ic506h.jpg</p>	<p>Highlight icon and press select to enter "service menu."</p>	<p>See "Service Menu" on page 32.</p>



Descriptions**Display Settings**

Description	Notes
LCD brightness	Controls brightness. Available settings: 0 (off) to 100 (brightest, default).
LCD contrast	Controls contrast of LCD. Available settings: -20 (lighter) to 20 (darker), 0 is default.
Units	Controls displayed units of depth values, temperatures and other numbers. Available distance settings: inches, ft in (default), decimal feet, meters, centimeters.
Depth disp. time	Controls how long depth information is locked on the screen after depth is received from tracker. Available settings: 0-60 seconds, 5 is default.
Log review time	Controls how long log information is locked onscreen after pressing any logging button. Available settings: 0-60 seconds, 5 is default.
Roll angle disp.	Controls display of numerical portion of the roll indicator. Available settings: off (default), degrees, minutes, hours.
Pitch disp.	Controls display of beacon pitch indicator. Available settings: percent (default), degrees.
Battery ind. style	Controls display of beacon battery indicator. Available settings: 1-axis (default), 2-axis.

File Management

Description	Notes
Active file	Indicates name of log file that is currently active.
Load file	Displays a list of log files currently on the SD card. Select a file to make it the active log file.
Create file	Creates a new log file and makes it the active file.
Delete file	Displays a list of log files currently on the SD card. Select a file to delete it.
Delete all	Deletes all files on the SD card and formats it for use.
Make .750 files	Creates .750 files out of all log files on the SD card for import into TMS Plus. Select this before removing SD card and importing data into TMS Plus. See "TMS Plus Data Transfer" on page 57.
Upload all	Uploads all log files to TMS Plus when connected through USB cable. See "TMS Plus Data Transfer" on page 57. Follow prompts.
Auto-Log	Stores a log point every time depth information is sent from tracker. Options: disabled (default), enabled. IMPORTANT: Display must have SD card installed with valid log file active or be connected to TMS Plus.



Radio Options

IMPORTANT: In order for information on tracker and display to match, ensure units are set on the same channel.

Description	Notes
Channel	Sets telemetry channel Available settings: 1 (default) through 15
Tracker Control code	Displays code for Tracker Control feature.

System Settings

Description	Notes
Connect to TMS Plus	Activates TMS Plus connected mode.
Language	Controls displayed user interface language. Available languages include: English, German, Spanish, French, Italian, Swedish, Russian.

Date/Time Settings

Description	Notes
Time format	Controls display of time. Available settings: 12 (default), 24
Year	Sets year.
Month	Sets month.
Day	Sets day.
Hour	Sets hour.
Minutes	Sets minutes.

Service Menu

Description	Notes
Versions	Lists hardware and software versions, serial number, and copyright information.
Uptime	Displays uptime and life timers.
Support	Enters support menu.
Factory	Enters factory menu. Password protected.

System Operation

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Beacon Tracking Overview



CAUTION

Potential radio frequency (RF) hazard. Operating this device within 4" (100 mm) of your body may cause RF exposure levels to exceed FCC RF exposure limits and should be avoided.

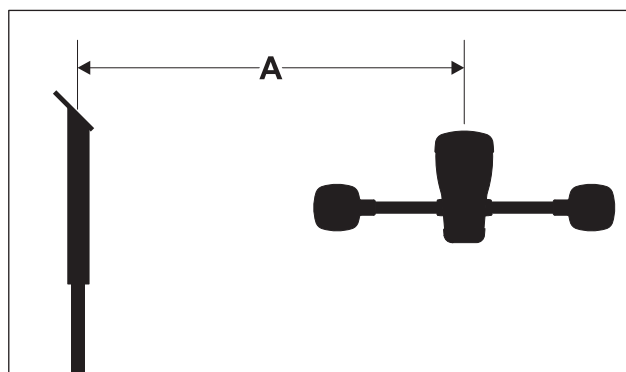
NOTICE:

- This device must not be co-located with any other radio transmitter.
- The maximum antenna gain is 2.5 dBi.

The tracker has two modes: walkover location and drill-thru. Use walkover location mode to find position of the beacon. Once tracker is in or near the beacon plane, select the depth view to determine the depth and the left/right offset. With tracker in front of and parallel to beacon, press the **L/R** button while in the main locate view to see the projected path of the beacon. In drill-thru mode, the tracker is placed along the intended bore path and provides the necessary steering corrections for the drilling unit operator to drill that path.

Setup

1. Install battery in beacon.
2. Place beacon in beacon housing away from metal objects.
3. Set up beacon and tracker 10'/305 cm (A) apart, as shown.
4. Select "Beacon Calibration" in "Beacon Settings" menu and follow prompts. See page 21.



e12om041h.eps

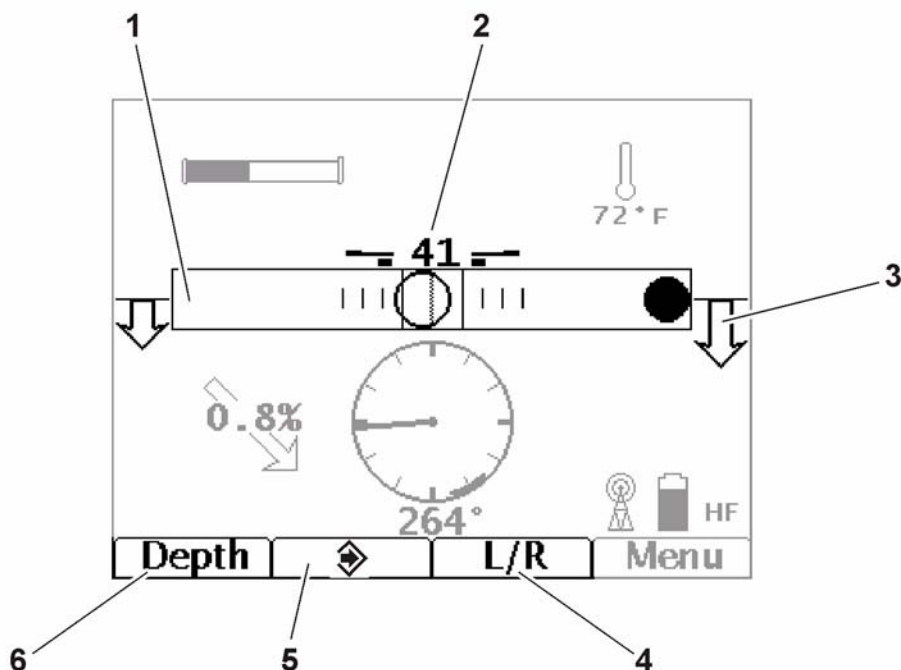
IMPORTANT:

- Error conditions will be reported onscreen below diagram.
- Pressing "clear" button will restore factory default. This will not provide accurate depth and offset measurements. Calibrate beacon and tracker properly.
- Pressing "cancel" will exit calibration menu without changing tracker's calibration.
- If using a dual-frequency beacon, calibrate both frequencies.

5. Select "Roll Calibration" in "Beacon Settings" menu and follow prompts.
6. Select "Pitch Calibration" in "Beacon Settings" menu and follow prompts.
7. Select "Depth Adjustment" in "Beacon Settings" menu and follow prompts.

Walkover Location Mode

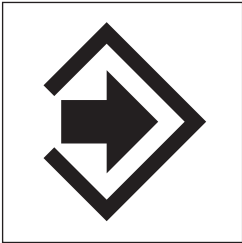
Locate Screen



e12om015h.jpg

- | | |
|----------------------|------------------------|
| 1. Field balance bar | 4. L/R button |
| 2. Signal strength | 5. Send button |
| 3. Locate arrows | 6. Depth screen button |

Item	Description	Notes
1. Field Balance Bar	Indicates tilt of tracker (hollow circle) and magnetic field balance (solid circle).	Beacon is properly located when both circles are located in the square in the center of the bar and fore/aft arrows form diamonds.
2. Signal Strength	Average signal strength is displayed numerically. Gain and signal strength bars are also displayed to each side of numeric value.	Bars get longer as number gets smaller.

Item	Description	Notes
3. Locate Arrows	Indicate fore-aft direction to move antenna pod to locate beacon plane. Arrows change to diamonds when antenna pods are in beacon plane.	Longer arrows indicate the tracker is a greater distance from beacon plane. Advanced depth features are available when both arrows or diamonds are solid.
4. L/R Button	Press and hold to display projected direction.	Tracker pods must be parallel with beacon. See "Projected Direction" on page 39.
5. Send Button  <small>c00ic076h.eps</small>	Press to send depth to remote display.	
6. Depth Screen Button	Press to enter depth screen.	

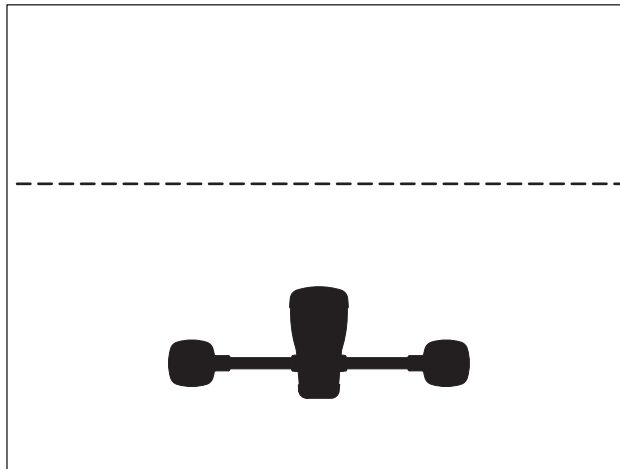
Procedure

The 8500 tracking system provides three ways to locate a beacon using walkover location mode. Choose which method to use based on your tracking situation.

Single-Point Location

If concerned with ghost signals or bore path is unknown, use single-point location to find general location of beacon.

1. Position tracker parallel (shown) to suspected bore path.
2. Walk along bore path until solid and hollow circles are approximately centered in field balance bar.
3. Rotate tracker 90° so that tracker is perpendicular to bore path.
4. Move tracker left or right to center both circles. Tracker is now roughly over the beacon.
5. To locate beacon more precisely, follow peak or advanced location procedure.

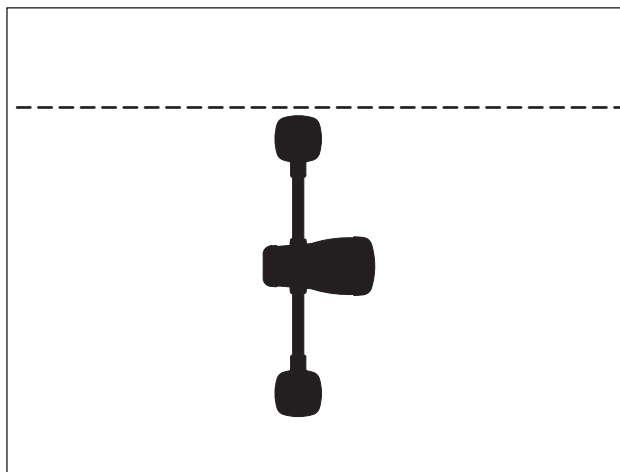


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Peak Location

If beacon depth is greater than 30' (9 m), use peak location procedure to position tracker over beacon. This procedure works well at any depth.

1. With tracker perpendicular to bore path (shown), follow locate arrows to beacon plane.
2. Move tracker laterally until signal strength is minimized.
3. Place tracker on the ground and press **SEND** button to take depth reading and send it to display.



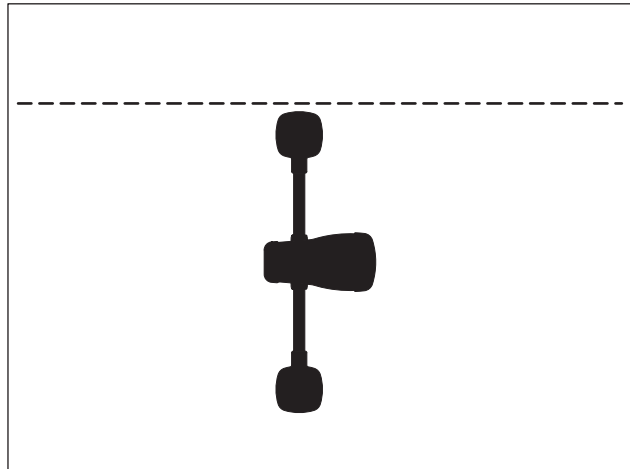
e12om043h.eps

The signal strength reading is the approximate distance from the beacon in inches. A reading of 122 means the tracker is 122" (3.1 m) from the beacon. This reading reflects how many inches the tracker is from the beacon regardless of the units setting in the display menu.

Advanced Location

If beacon depth is less than 30' (9 m), use advanced location procedure to position tracker over beacon.

1. With tracker perpendicular to bore path, follow locate arrows to beacon plane.
2. Place tracker on the ground and press **DEPTH** button. If desired, move tracker side-to-side until offset is at 0.
3. Press **SEND** button to take depth reading and send it to display. Press and hold **SEND** button for 1/2 second if 0.1" (1 cm) precision is required.



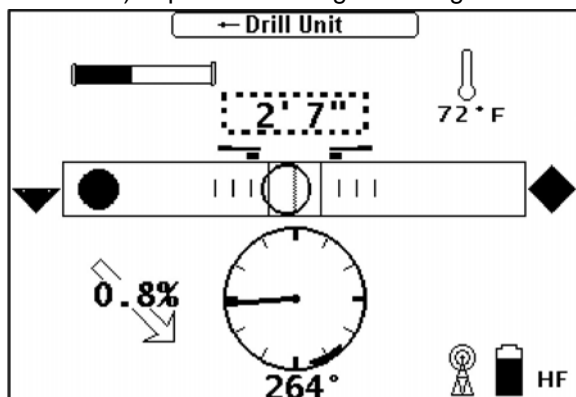
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Quick Range

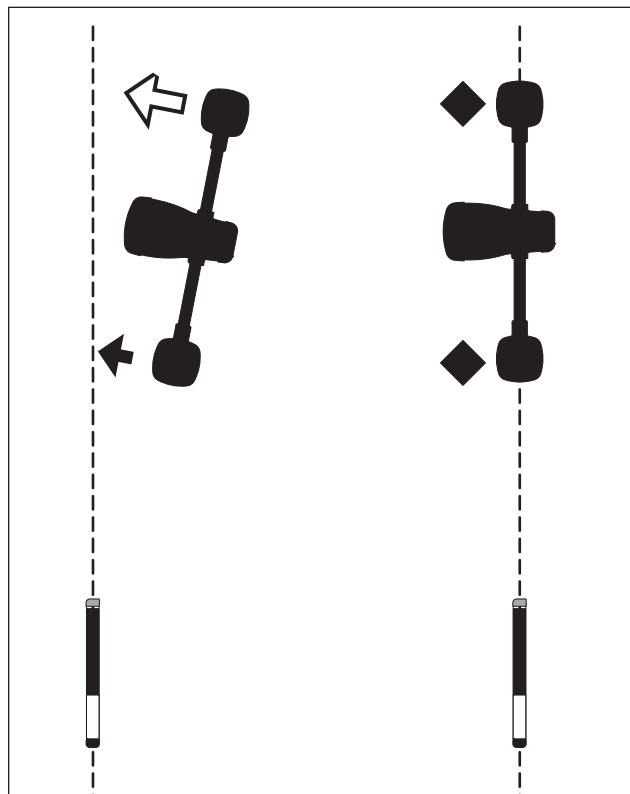
To get a quick estimate of how far away the beacon is, press the **SEND** button while the tracker is in walkover locate view. The average of the distance to the beacon for each pod will be displayed in place of the signal strength.

Projected Direction

1. Hold down the **L/R** button to switch from fore-aft arrows to left-right arrows.
2. Move approximately 10' (3 m) in front of the beacon position and rotate tracker until tracker is parallel with bore path with left antenna pod closer to drilling unit.
3. Align arrows to check beacon heading.
4. When arrows turn solid, the projected depth will be displayed in a dotted box (shown below) in place of the signal strength value.

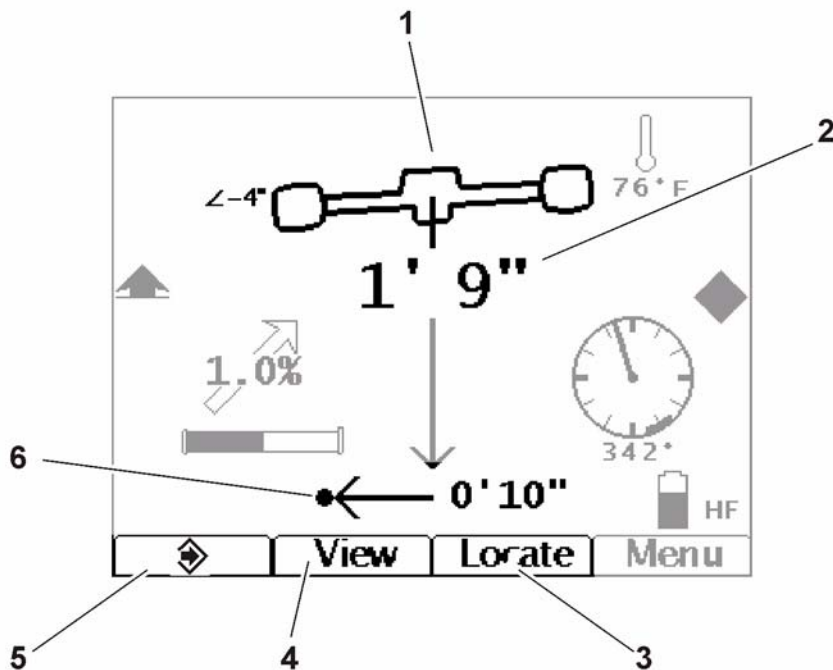


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e12om017h.eps

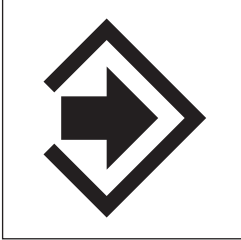
Depth Screen



e12om010h.jpg

- | | |
|---------------------------|----------------------|
| 1. Tracker tilt indicator | 4. View button |
| 2. Depth | 5. Send button |
| 3. Locate mode button | 6. Left/right offset |

Item	Description	Notes
1. Tracker tilt indicator	Graphically represents the tilt of the tracker antenna pods with a numeric reading to the left of the visual representation.	
2. Depth	Displays vertical depth measurement.	
3. Locate mode button	Press to return to locate screen.	
4. View button	Press to switch between depth and side views.	

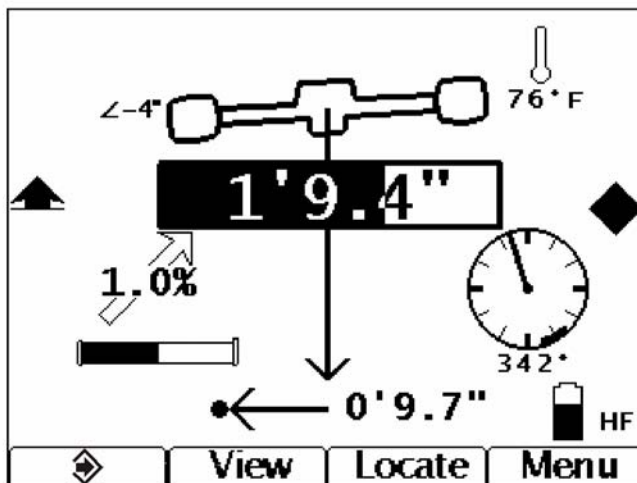
Item	Description	Notes
<p>5. Send button</p>  <p>c00ic076h.eps</p>	<p>Press to send depth to remote display.</p> <p>Press for 1/2 second to get average with 0.1" (1 cm) resolution and send depth to display.</p> <p>Continue pressing for continuous average. Release to send depth to display.</p>	
<p>6. Left/right offset</p>	<p>Indicates left/right offset with respect to center of beacon and middle of tracker handle.</p>	<p>Tracker provides both graphical and numeric offset information.</p>

Displayed Features

Advanced depth features (vertical depth, left/right offset, 0.1"/1 cm precision) are not available when any of the following conditions are met:

- Beacon is more than 30' (9 m) away from tracker
- Tracker tilt is greater than 20°
- Beacon pitch is greater than 10% and tracker tilt is greater than 5°
- Fore/aft arrows are hollow (tracker is outside the beacon plane)

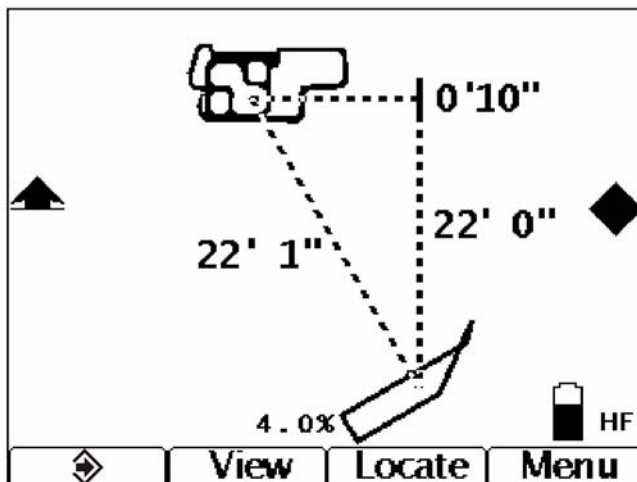
Sample Screens



Depth screen, standard view

Beacon is pitched up 1%, is offset from tracker 9.7" to the left and is 1' 9.4" deep. The tracker is tilted left 4°. Depth reading bar will become solid as values are averaged. Once it is solid, the value is locked and sent to remote display.

e12om027h.jpg



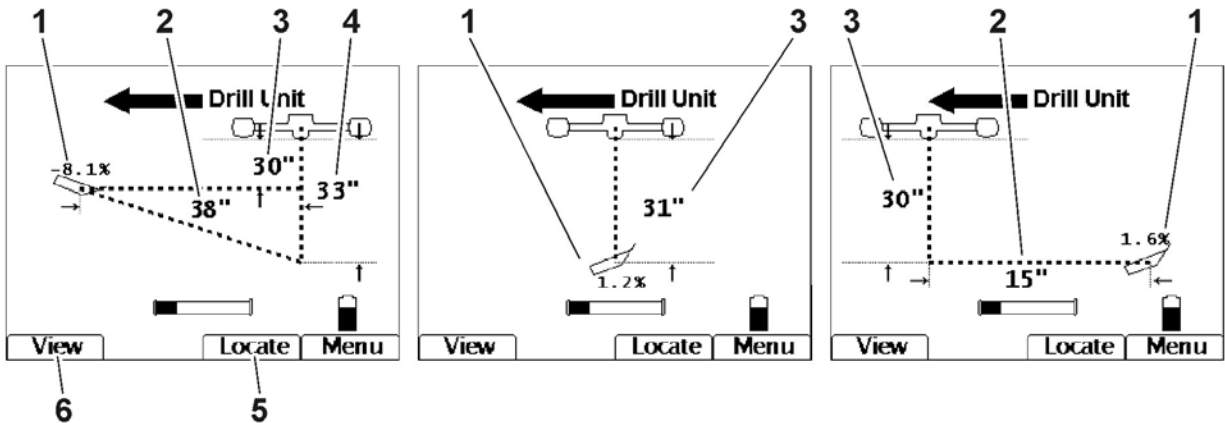
Depth screen, side view

Beacon is pitched up 4%, is 10" ahead of tracker and is 22' deep. The tracker is 22' 1" away from beacon.

e12om011h.jpg

Drill-Thru Mode

Drill-Thru View Screen

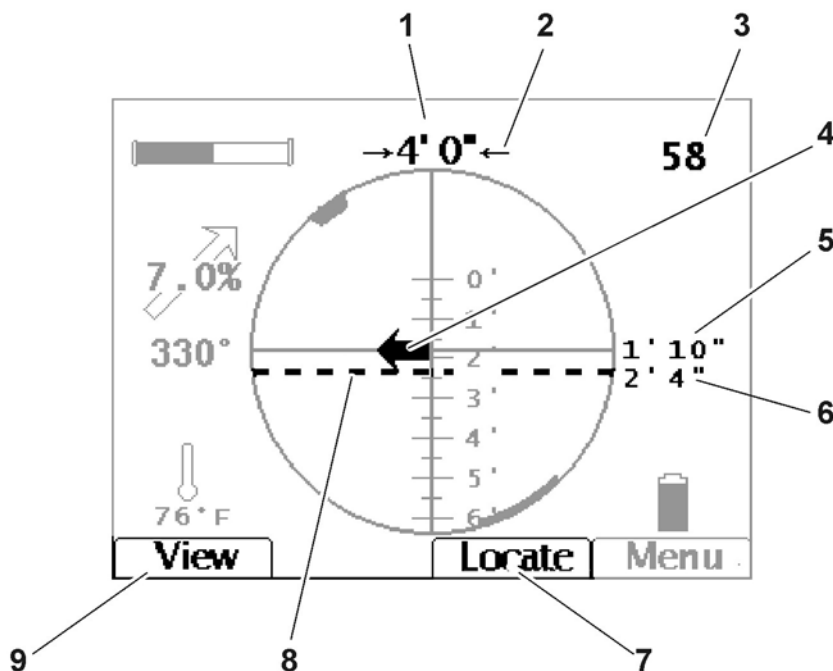


e12om028h.jpg

- | | |
|------------------------|-----------------------|
| 1. Pitch | 4. Projected depth |
| 2. Horizontal distance | 5. Locate mode button |
| 3. Current depth | 6. View button |

<p>1. Pitch</p>	<p>Displays pitch of beacon in percent grade or degrees.</p> <p>The orientation of the icon indicates whether pitch is positive or negative.</p>	
<p>2. Horizontal distance</p>	<p>Displays distance from beacon to tracker.</p>	
<p>3. Current depth</p>	<p>Displays current depth of beacon relative to tracker position.</p>	
<p>4. Projected depth</p>	<p>Displays the projected depth when beacon reaches tracker if current pitch is maintained.</p>	
<p>5. Locate mode button</p>	<p>Press to return to locate mode.</p>	
<p>6. View button</p>	<p>Press to switch between drill-thru and beacon view.</p>	

Beacon View Screen



- 1. Horizontal distance
- 2. Direction indicator arrows
- 3. Signal strength
- 4. Steering correction arrow
- 5. Projected depth
- 6. Current depth
- 7. Locate mode button
- 8. Current depth indicator
- 9. View button

1. Horizontal distance	Displays distance from beacon to tracker.	
2. Direction indicator arrows	Indicates beacon direction relative to the tracker.	Inward arrows mean the beacon is approaching tracker and outward arrows mean beacon is moving away.
3. Signal strength	Displays numeric signal strength value.	
4. Steering correction arrow	Represents the direction of steering correction needed.	
5. Projected depth	Displays the projected depth when beacon reaches tracker if current pitch is maintained.	
6. Current depth	Displays current depth of beacon relative to tracker position.	

7. Locate mode button	Press to return to locate mode.	
8. Current depth indicator	Indicates current position relative to tracker.	
9. View button	Press to switch between drill-thru and beacon view.	

Procedure

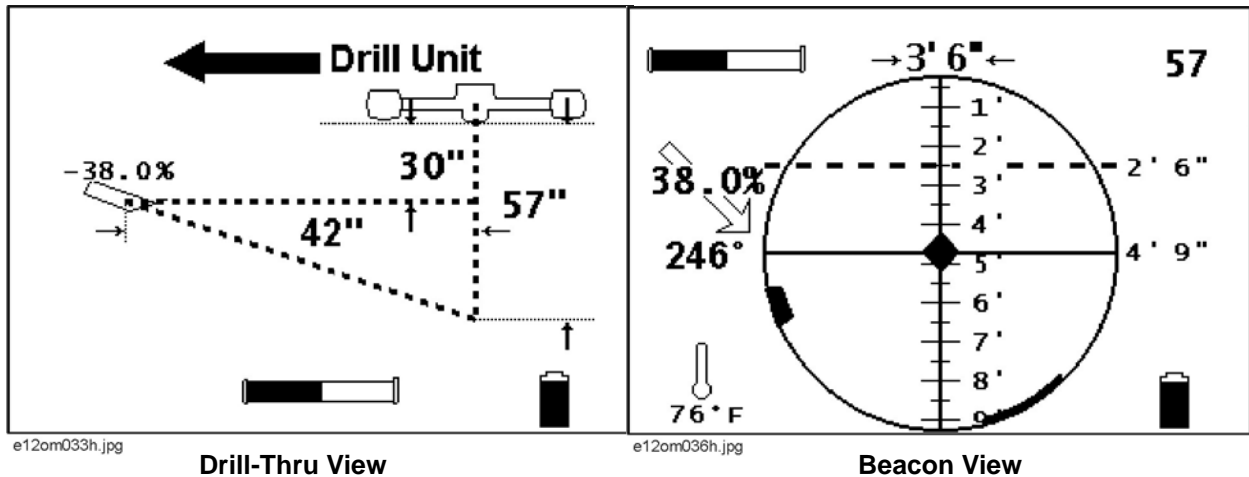


⚠ WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

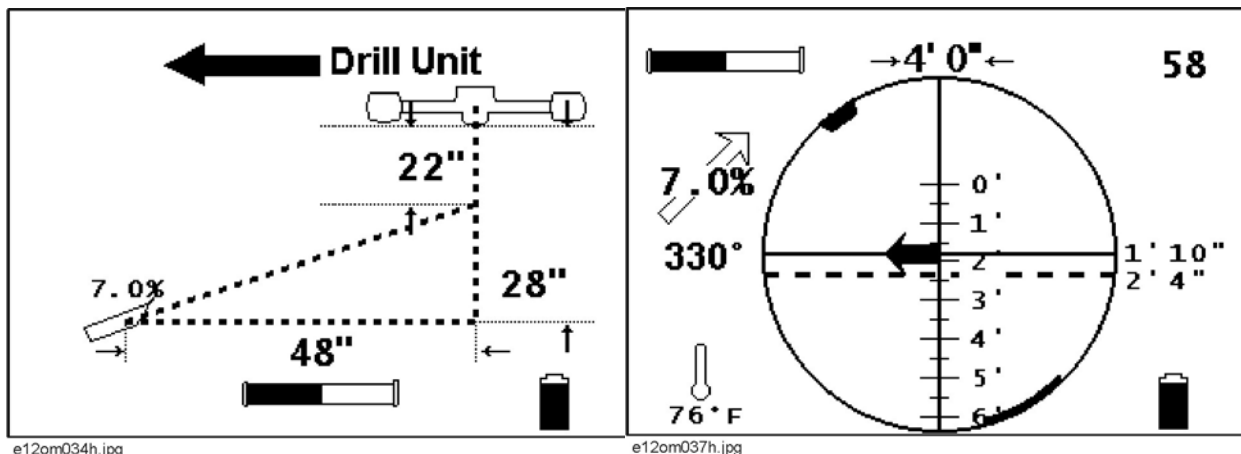
NOTICE: If location and depth are critical, confirm by hand-digging.

- Place tracker on the ground along intended bore path with left pod closest to drilling unit.
- Drill as usual.
 - While beacon is on the drilling unit side of tracker, a left/right steering correction arrow, current depth, horizontal distance and projected depth are provided.
 - After beacon passes under tracker, current depth and horizontal distance are provided. Projected depth and the left/right steering arrow are no longer provided.

Sample Screens



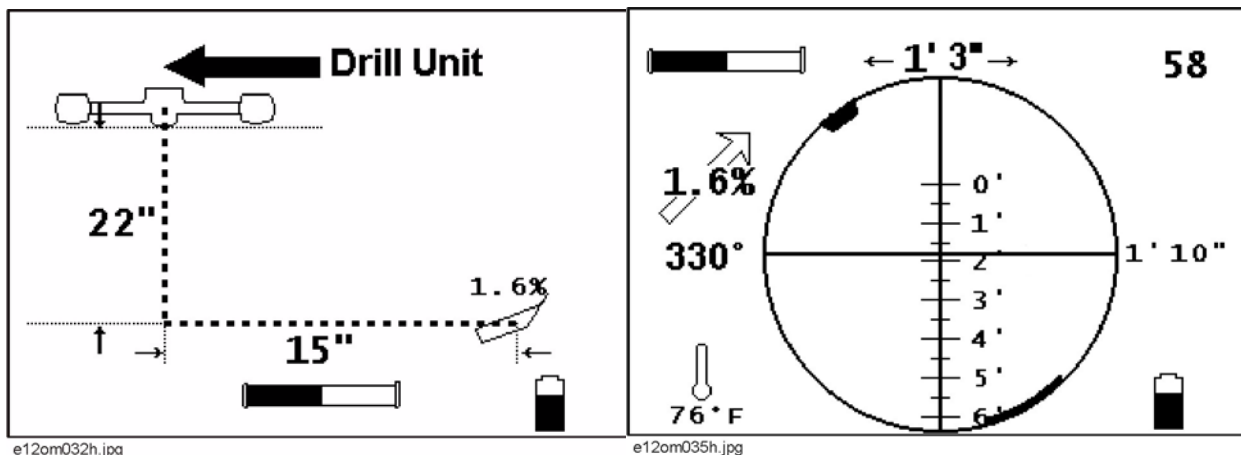
Beacon is approaching tracker pitched down 38%. Beacon is 30" (2' 6") deep and the projected depth at tracker is 57" (4' 9"). The horizontal distance to the tracker is 42" (3' 6"). The beacon is on the projected path as indicated by the diamond in the center of the Beacon View.



Drill-Thru View

Beacon View

Beacon is approaching tracker pitched up 7%. Beacon is 28" (2' 4") deep and the projected depth at tracker is 22" (1' 10"). The horizontal distance to the tracker is 48" (4'). The beacon must be steered to the left to pass under the tracker as indicated by the arrow in the center of the Beacon View. The arrow will get longer as beacon gets farther off target and shorter as it gets closer to the target path.



Drill-Thru View

Beacon View

Beacon is past tracker pitched up 1.6%. Beacon is 22" (1' 10") deep and the horizontal distance from the tracker is 15" (1' 3").

Tracking Concepts

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Ghost Signal Responses 50



Theory of Operation

System Overview

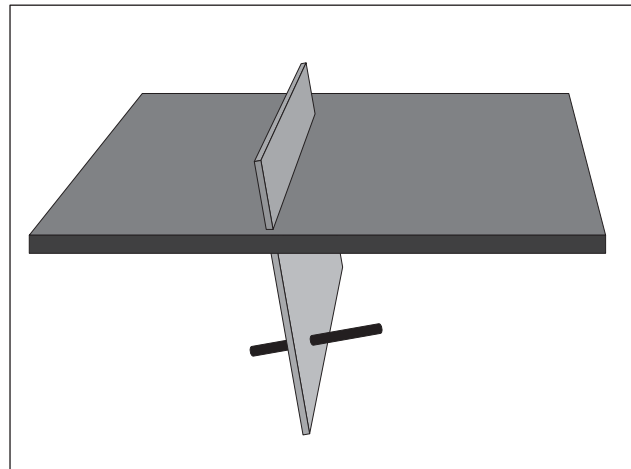
The 8500 tracking system uses a magnetic field generator in an 850 series beacon and two receiving antenna pods in an 8500TK advanced tracker to determine beacon position. The tracker detects the generated magnetic field and calculates the beacon's position. Downhole information is relayed from the beacon to the tracker. The tracker sends all received and calculated data to a remote display over a radio link.

The dual antenna pod design provides the ability to approach the beacon location without encountering ghost signals and can determine the beacon's location and heading. When placed along the intended bore path, the tracker can be used in Drill-Thru mode to provide the beacon's current depth, projected depth at the tracker location, horizontal distance (range) and horizontal steering correction.

Beacon Plane

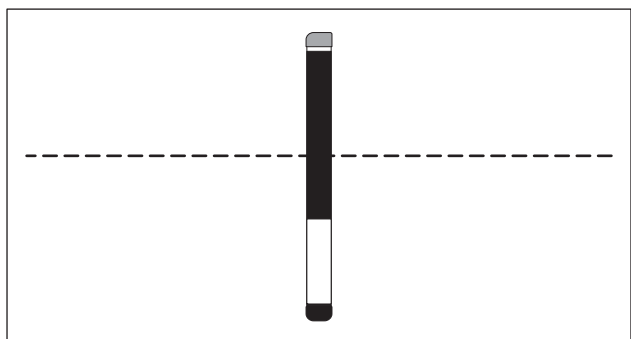
The 8500TK locates the beacon plane perpendicular to the center of the beacon. Once the tracker is within range of the beacon and within the beacon plane, the advanced depth calculations of the tracker are enabled.

The beacon plane extends outward from the center of the beacon and runs perpendicular to the beacon as shown. Because of this, the ground level location may be slightly in front of or behind the true vertical position of the beacon's center. This is only apparent at extreme pitches and increasing depths. For example, at 30' (9 m) deep and 10% pitch, the beacon plane and vertical plane will be approximately 3' (914 mm) apart at ground level. The tracker calculates this difference and presents it in the depth mode side view.



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Beacon plane: side view

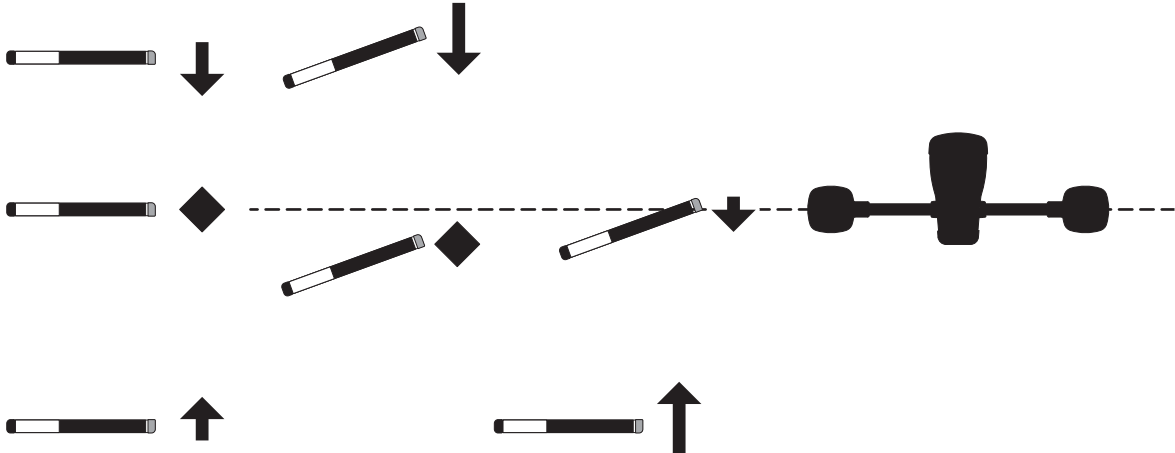


e12om019h.eps

Beacon plane: top view

Drill-Thru

The tracker calculates the beacon's current depth, horizontal distance to the tracker and the predicted depth at the tracker position. The tracker allows you to drill toward, under and away from the tracker while providing depth and horizontal distance. The horizontal steering guides the operator to the intended bore path, assuming a straight line along the tracker.



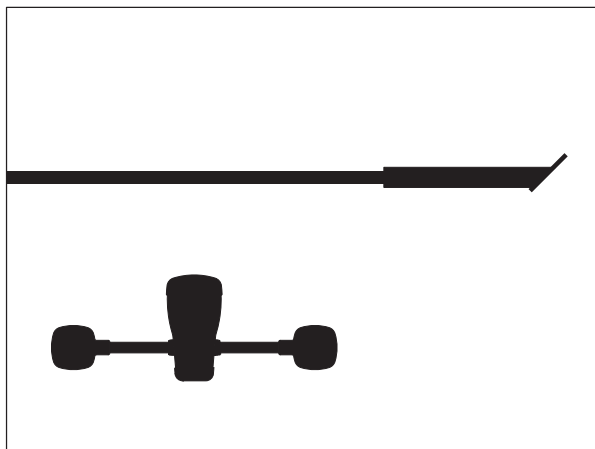
e12om016h.eps

Sample beacon positions and resulting horizontal steering correction arrows.

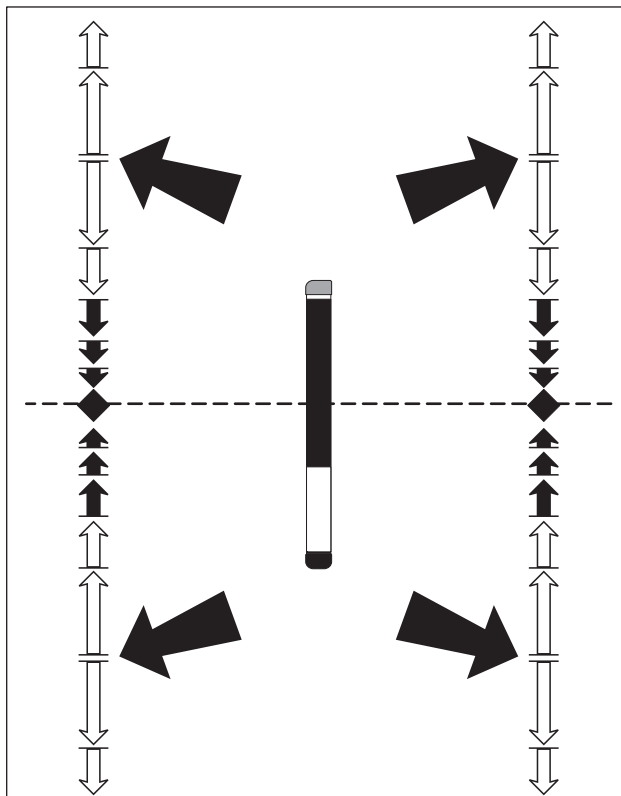
Ghost Signal Responses

The locate arrows will change direction and point away from the beacon (as shown) as the tracker reaches a ghost signal. The distance from the beacon plane to the ghost signals increases with increasing depth.

To avoid locating ghost signals, rotate tracker parallel to bore path (shown below) and watch the solid circle in the field balance bar to get near the beacon plane.



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e12om018h.eps

Systems and Equipment

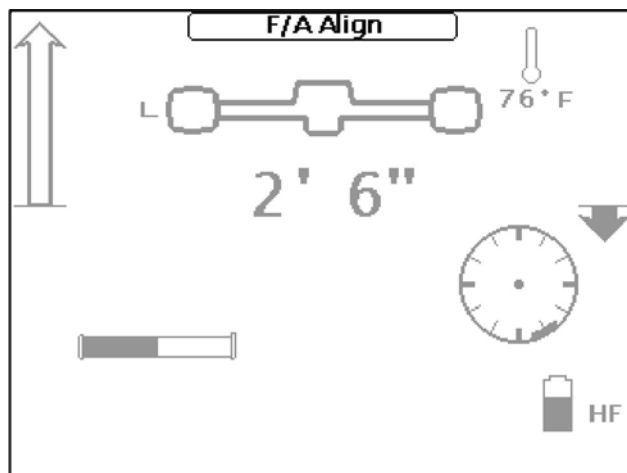
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 - Beacon throttle56
- TMS Plus Data Transfer 57**
 - Via cable57
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8500TK Status Messages

Messages that communicate tracking system information requiring user intervention or provide important operation information appear in the top center area of the display as shown.



e12om005h.jpg

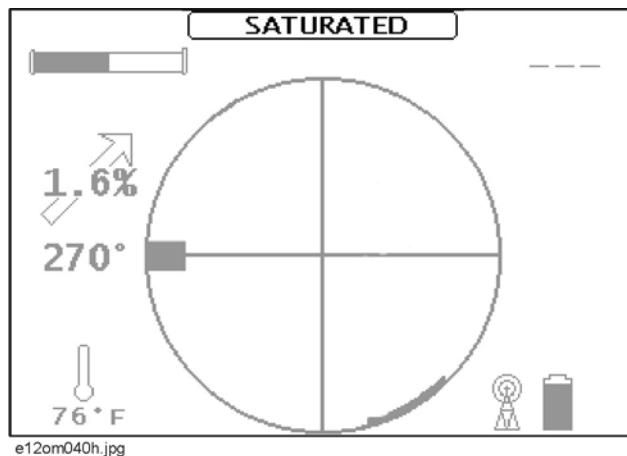
Message	Description	Solution
SATURATED	Signal from beacon or other noise is too large to receive accurate signal.	Move tracker away from beacon (at least 2'/610 mm) or eliminate noise source.
Auto-Gain Active...	Tracker's auto-gain feature is active. Some features and data values will stop updating until auto-gain is complete.	Wait until message disappears.
Beacon Regulating	Beacon is adjusting its output to provide a stable signal. Depth values and beacon calibration are unavailable while beacon is regulating.	Wait until message disappears.
BEACON BATT LOW	Beacon battery voltage is low.	Replace Power Stick or lithium beacon batteries.
BEACON POWER LOW	Beacon is close to being unable to provide a stable output signal (is out of throttle).	<ol style="list-style-type: none"> 1. Replace Power Stick beacon battery. 2. Use lithium beacon battery. 3. Change to compatible beacon housing or call your Ditch Witch dealer.
TILT	The tracker can no longer compensate for its position when calculating depth and offset values. This occurs when the tilt of the tracker is greater than 20° or the beacon pitch is greater than 10% and the tracker tilt is greater than 5°.	Adjust tracker so it is closer to level until message disappears.

Message	Description	Solution
No Comm	Beacon signal is too weak to communicate with tracker.	<ol style="list-style-type: none"> 1. Ensure beacon and tracker are operating at same frequency. 2. Move tracker within range of beacon. 3. Ensure beacon is not asleep.
Out of Range	Beacon is out of range for requested features. Beacon must be within within 30' (9 m) of tracker for advanced features.	Move tracker within 30' (9 m) of beacon.
TRACKER BATT LOW	Tracker batteries are low and unit will soon shut off.	Replace tracker batteries.
F/A Align	Tracker is too far out of the beacon plane to enable advanced depth features while in depth screen.	Use fore/aft arrows to move within beacon plane.
Beacon Rolling...	Beacon is rolling.	Stop rolling beacon for more accurate readings.
BEACON MEM ERROR	Calibration memory of beacon has been corrupted.	Return beacon for service.
BEACON HOT	Beacon is reporting temperature above 155°F (68°C). Permanent damage is imminent. An audible alert will also sound.	Stop rotation, pull back 3' (915 mm) and continue drilling fluid flow until beacon cools down.
HIGH NOISE	The signal-to-noise ratio is too low for tracker to receive reliable data from beacon. Depth calculation and beacon calibration are disabled.	Eliminate noise source or switch beacon and tracker operating frequencies.



8500D Status Messages

Messages that provide important operation information appear in the top center area of the display as shown.



Message	Description	Solution
SATURATED	Signal from beacon or other noise is too large to receive accurate signal.	Move tracker away from beacon (at least 2'/610 mm) or eliminate noise source.
Auto-Gain Active...	Tracker's auto-gain feature is active. Some features and data values will stop updating until auto-gain is complete.	Wait until message disappears.
BEACON BATT LOW	Beacon battery voltage is low.	Replace Power Stick or lithium beacon batteries.
BEACON POWER LOW	Beacon is close to being unable to provide a stable output signal (is out of throttle).	<ol style="list-style-type: none"> 1. Replace Power Stick beacon battery. 2. Use lithium beacon battery. 3. Change to compatible beacon housing or call your Ditch Witch dealer.
No Comm	Beacon signal is too weak to communicate with tracker.	<ol style="list-style-type: none"> 1. Ensure beacon and tracker are operating at same frequency. 2. Move tracker within range of beacon.
DISPLAY BATT LOW	Display batteries are low and unit will soon shut off.	Replace display batteries.
Beacon Rolling...	Beacon is rolling.	Stop rolling beacon for more accurate readings.
BEACON MEM ERROR	Calibration memory of beacon has been corrupted.	Return beacon for service.

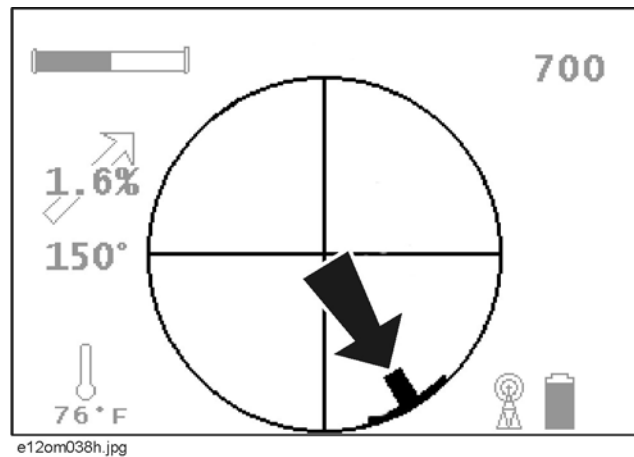
Message	Description	Solution
BEACON HOT	Beacon is reporting temperature above 155°F (68°C). Permanent damage is imminent.	Stop rotation, pull back 3' (915 mm) and continue drilling fluid flow until beacon cools down.

850 Series Beacons

Sleep

850 series beacons enter sleep (power-saving) mode after 20 minutes of inactivity. Rotate the beacon at least 3 times at 1 rotation per second to wake the beacon.

To enter Express Sleep mode, roll beacon to the Express Sleep window (shown) and leave it inactive. Beacon will enter power-saving mode after only 5 minutes.



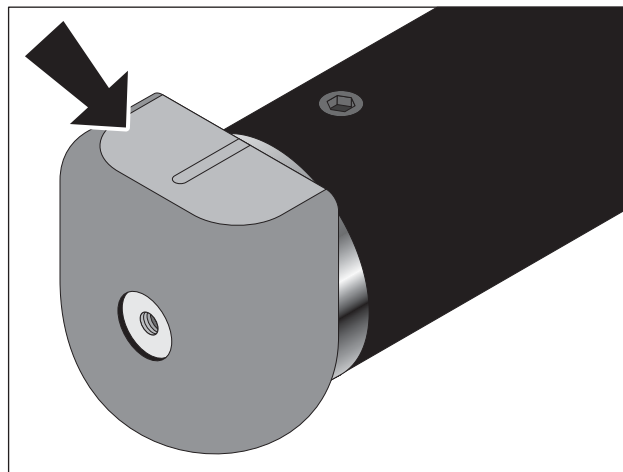
Dual Frequency

Select operating frequency when batteries are inserted or downhole.

Select at Power Up

The orientation of the flat top on the forward isolator when batteries are installed determines frequency.

- If flat top (shown) is up, beacon will operate at 11.2 kHz.
- If flat top is down, beacon will operate at 1.75 kHz.



Switch Downhole

1. Allow the beacon to enter sleep mode.
2. Wake the beacon within one minute of entering sleep mode and beacon will switch frequencies.

Beacon Throttle

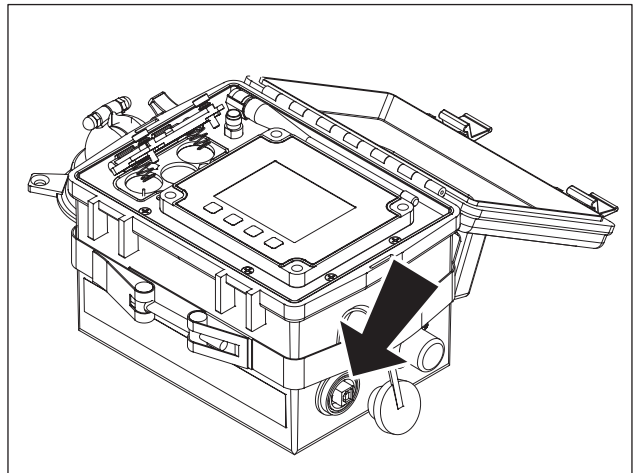
The beacon continuously monitors and adjusts its output power in order to maintain a constant signal strength. Beacon housing properties, battery chemistry and battery voltage impact the beacon's ability to maintain this output. Beacon throttle is a measure of the remaining time a beacon will be able to maintain its output level.

When beacon battery life indicator (see page 14) is in 2-axis view, battery power is shown on the horizontal axis and beacon throttle is shown on the vertical axis.

TMS Plus Data Transfer

Via Cable

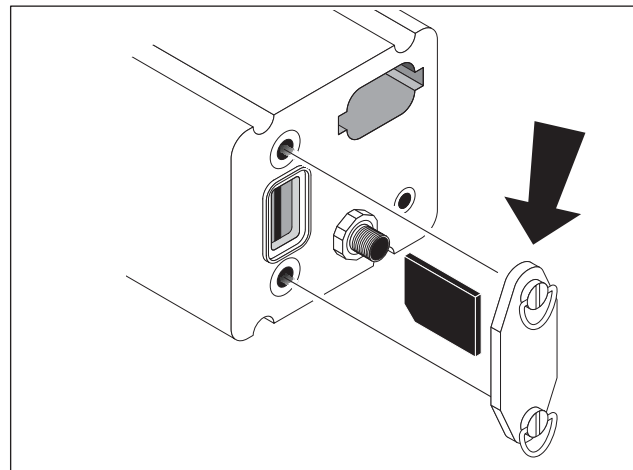
Follow prompts in TMS Plus. Connect cable at connector (shown).



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Via SD Card

1. Remove cover (shown).
2. Press SD card down. Card will pop up.
3. Remove card from slot.
4. Transfer data to TMS Plus and install SD card in display.
5. Install cover.



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Service

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General Care

Under normal operating conditions, tracking system components 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.
- Remove battery if storing for an extended period.

As Needed

Location	Task	Notes
Tracker	Change batteries	6 "C" alkaline
Display (in Case)	Change batteries	6 "C" alkaline
Beacon	Change batteries	1 Lithium or Power Stick

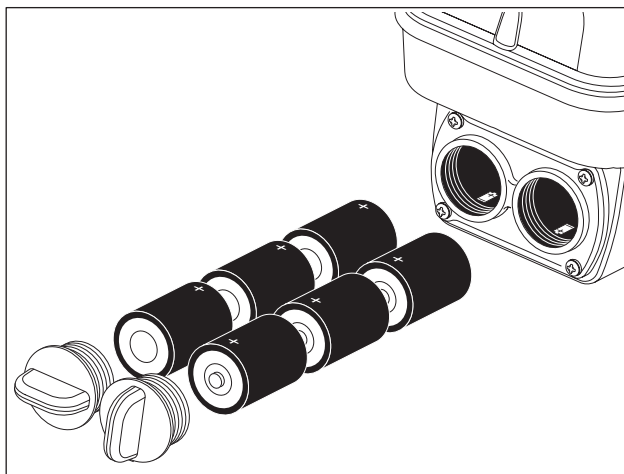
Tracker

Change Batteries

IMPORTANT: Do not mix new and used batteries. Do not mix battery brands.

Use six C-cell alkaline batteries in tracker.

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



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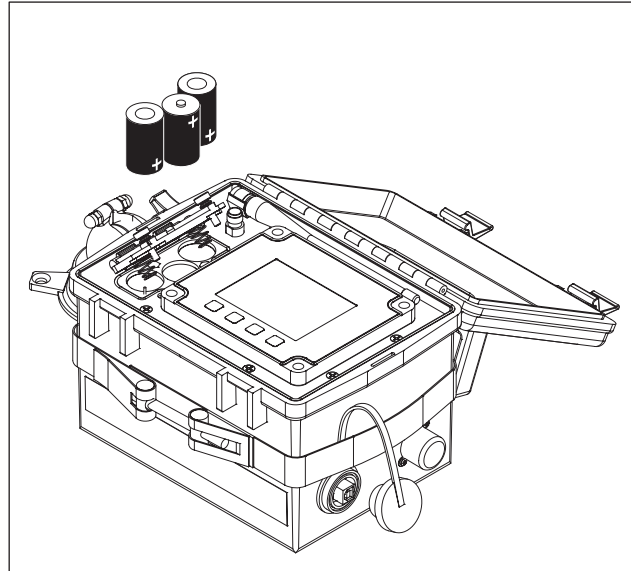
Display (in Case)

Change Batteries

IMPORTANT: Do not mix new and used batteries. Do not mix battery brands.

Use 6 C-cell alkaline batteries in cased display.

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



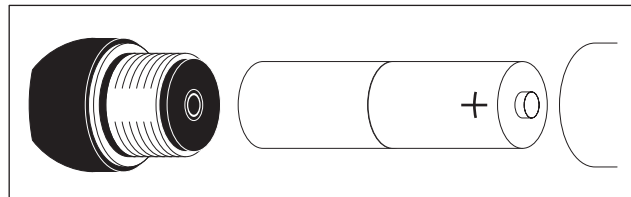
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Beacon

Change Battery

Use one lithium or one Power Stick battery in beacon.

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



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Specifications



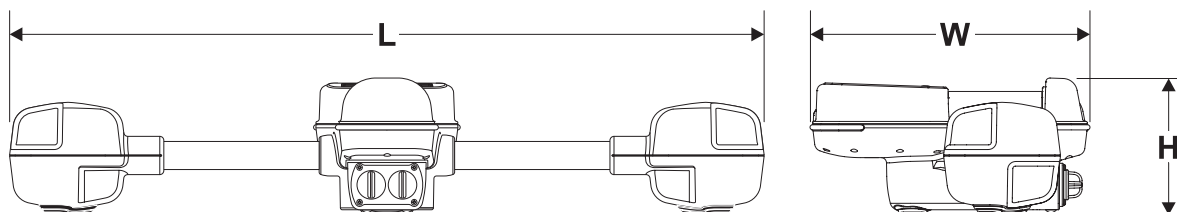
Chapter Contents

8500TK 64

8500D 65

850 Beacons 66

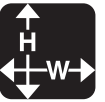
8500TK



e12om001h.eps

Dimensions		U.S.	Metric
H	Height	6.4"	163 mm
L	Length	13.2"	335 mm
W	Width	35.5"	902 mm
	Operating weight	8.3 lb	3.8 kg
Operation		U.S.	Metric
Operating temperature range		-4°F to 122°F	-20°C to 50°C
Operating modes: 1.75 kHz beacon, 11.2 kHz beacon			
U.S. radio channels: 14			
U.S. radio frequency: 466 MHz (U.S.)			
Non-U.S. radio channels: 2 (Canada), 4 (Australia), 15 (Euro Harmonic)			
Non-U.S. radio frequency: 464 MHz (Canada), 472 MHz (Australia), 434 MHz (Euro Harmonic)			
Radio range (U.S., Canada, Australia)		1 mi	1.61 km
Radio range (Euro Harmonic)		2000'	609.6 m
Batteries			
Type: 6 C-cell alkaline			
Life (use at 70°F/21°C): approximately 8 hours			
Battery saver: unit shuts down after 5 minutes if no key is pressed and no beacon communication is detected. This feature can be disabled in a menu setting.			

8500D



Module Only	U.S.	Metric
Operating weight	2.5 lb	1.1 kg
Power input: 6.5V DC - 16V DC @ approximately 150 mA		
Interface connectors: USB-B		
Data storage: SD card		
U.S. radio channels: 14		
U.S. radio frequency: 466 MHz (U.S.)		
Non-U.S. radio channels: 2 (Canada), 4 (Australia), 15 (Euro Harmonic)		
Non-U.S. radio frequency: 464 MHz (Canada), 472 MHz (Australia), 434 MHz (Euro Harmonic)		
Radio range (U.S., Canada, Australia)	1 mi	1.61 km
Radio range (Euro Harmonic)	2000'	609.6 m
Module with Case		
Operating weight	6.5 lb	3.0 kg
Type: 6 C-cell alkaline		
Life (intermittent use at 70°F/21°C): approximately 20 hours		
Interface: USB-B		
Antenna: TNC female		

850 Series Beacons



e12om008h.eps

Dimensions		U.S.	Metric
L	Length	17.6"	447 mm
W	Width	1.5"	38 mm
	Weight	2.2 lb	998 g
Operation		U.S.	Metric
Operating frequency: 1.75 kHz, 11.2 kHz			
Roll: 60 positions (every 6 degrees)			
Depth range			
	850B/850BG	50'	15.2 m
	850BH/850BGH	60'	18.3 m
	850BD/850BGD (11.2 kHz)	50'	15.2 m
	850BD/850BGD (1.75 kHz)	30'	9.1 m
	850BHD/850BGHD (11.2 kHz)	60'	18.3 m
	850BHD/850BGHD (1.75 kHz)	40'	12.2 m
Maximum temperature		176°F	80°C
Maximum fluid pressure		60 psi	4 bar
Pitch			
	850 series: 1% increments up to 100%		
	850 grade series: 0.1% increments up to 100%		
Batteries			
Type: 1 CC lithium or 1 CC Power Stick			
Life (intermittent use at 70°F/21°C): approximately 20 hours (10 hours with H option)			
Battery saver: unit shuts off after 20 minutes of inactivity or 5 minutes of inactivity in Express Sleep window.			

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 Electronics repair facility. Repairs done elsewhere will void warranty.

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.



