

# Mag 3s & 5s System

Manual

Underground Magnetics



[www.umaghdd.com](http://www.umaghdd.com)

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# MAG SYSTEM

This locating system also offers four channel license free radio telemetries between the receiver and remote display. The user can easily “pair” any two receivers and displays so that communications between the “pair” will not be interfered by other “pairs”.

This manual is intended to provide information and instructions on how to use this locating system properly. Underground Magnetics Inc. (UM) reserves the right to improve the locating system and the Operator’s Manual at any time without notice.

# 1: Introduction

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## TRANSMITTER

The Transmitter (sometimes referred to as a Sonde or Beacon) sends digital information of the transmitters pitch, roll, temperature and battery status through an FM modulated RF signal.

## RECEIVER

The Receiver receives this information and uses RF Signal to identify the transmitter's status and location.

## DISPLAY

The Display— the Receiver transmits the locating information to a remote display through a radio telemetry system.

A horizontal directional drilling machine operator can use the information from the display to guide the drill head to the desired location.



## 2: Caution

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The operator must understand safety procedures and correct operation methods before operating the HDD and the locating system.



HDD machines can cause property damage and personal injury upon striking underground power lines, gas lines, phone lines, television cables, fiber optic cables, or sewage lines. Make sure to confirm by uncovering and marking all underground utilities before crossing.



Do not use the locating system near flammable or explosive substances.



Wear proper personal protective equipment including steel-toed boots, safety gloves, helmets, reflective vests, and safety goggles.



Obey all local safety regulations.



This locating system is only a tool to assist the operator to locate the drill head. It is the operator, not the Mag locating system that is responsible for identifying the drill head location. UM is not responsible for any damage or loss caused by using the Mag system. Operators should operate the Mag system according to the manual.



If there are any questions, please contact UM at [support@undergroundmagnetics.com](mailto:support@undergroundmagnetics.com) or call customer service at (515) 505-0960

## 3: FCC and CE

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This device complies with Part 15 of the FSS Rules. Operation is subject to the following two conditions:

- ◆ This device may not cause harmful interference, and
- ◆ This device must accept any interference received ,including interference that may cause undesired operation.



Changes or modifications not expressly approved by Under-ground Magnetics Inc. will void the user's authority to operate equipment.



**Note:** This product 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 product 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 product 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 the 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.



This system is classified as Class 2 radio equipment per the R & TTE Directive and may not be legal to operate or require a license to operate in some countries. The list of restrictions and the required declarations of conformity are available in the "resources" section of the UM website.



## 4: Tips for Reading this Manual

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Here are some points to keep in mind as you read through the Mag 8 Operator's Manual.

### Page References

This question mark and textbox will tell you the page in the Operator's Manual where you can find more detailed information on the corresponding topic.



➔ The following two pages contain a short preface. This will be a quick introduction to the steps in which you will most likely use your Mag System. It will also contain page references for the later sections of the manual that contain more detailed information for the corresponding steps.

➔ The rest of the manual will contain detailed sections that follow the order of the Mag 8 Receiver and the Mag 8 menu screens

➔ It is recommended to read the entire Operator's Manual before use.

# 5: Quick Start

---

**1** Turn on receiver by holding power button until Mag logo is visible on screen



Page 12

**2** Walk bore-path and use depth forecasting to check for interference and select frequency.



Page 20

**3** Install batteries into transmitter. Install battery cap with provided battery cap tool.

**4** Turn on display by holding power button until Mag logo is visible on the screen

**5** Install transmitter into the housing.

6

Check Calibration by placing receiver (10ft/3m) away from housing, measured from inside edge of receiver to the center of the housing.



Page 18

7

If distance on receiver's screen reads anything other than (10ft/3m) perform calibration.

8

Choose locating mode either Single Point or Single Ball.



Page 53

9

Locate FLP (Front Locate Point).



Page 55

10

Locate RLP (Rear Locate Point).



Page 56

11

Locate LL (Locate Line).

Repeat steps 9 through 11 as you continue to guide the drill.



Page 56

## 6: System Highlights

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### Mag 3S & 5S Systems

- ➔ High Precision and high anti-interference Faraday shield 3D antenna structure.
- ➔ Industrial rated, gold-plated electronic modules
- ➔ High-performance DSP
- ➔ Dual locating system, functioning as two receivers independently tracking to provide better accuracy and reliability
- ➔ Locating Method—choose Single Point or Single Ball Mode



**Receiver : Mag3S or 5S**

**Display : Mag3S or 5S**

**Mag 5S Transmitters:**

Echo 50XF  
Echo 50  
Echo XMINI  
Echo ST

**Mag 3S Transmitters:**

Echo 50  
Echo XMINI  
Echo ST






# 7: Receiver

## 7.1: Specifications



<b>5S—16 System Frequencies</b>	325kHz – 41kHz
<b>3S—12 System Frequencies</b>	4kHz – 41kHz
<b>Temperature range</b>	-4° to 140°F (-20° to 60°C)
<b>Telemetry</b>	4 radio channels with range up to 3000ft (900m)*
<b>Rechargeable Lithium Battery</b>	12.5V
<b>Battery life</b>	Up to 50 hours
<b>Dimensions</b>	27" x 5" x 12" (68.5cm X13cmx30cm)
<b>Weight</b>	6.5 pounds
<b>Water Resistant</b>	IP65

## 7.2: Receiver Operation

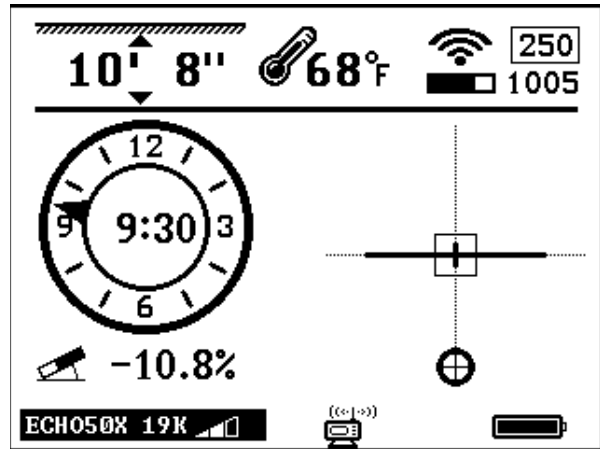
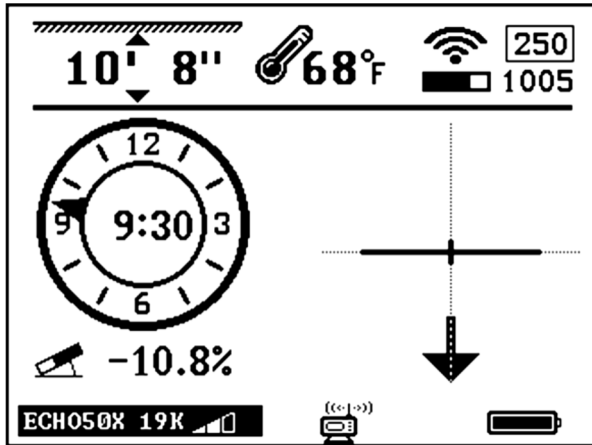
-  Power key: Press and hold to turn on or off. Tap to turn backlight on or off.
-  Up key: Move to previous cursor selection.
-  Down key: Move to next cursor selection.
-  Confirm key: Tap to confirm cursor selection. Press and hold to enter secondary page. Tap from main page to enter Bore-To mode.
-  Setup key: Tap to enter calibration page/ return to main page. Press and hold to enter setup

\* With optional Yagi Antenna

# 7: Receiver

## 7.3: Icons

### 7.3.1: Main Page Icons



250



Signal to Noise Ratio

1005



Signal strength

ECHO50X 19K



Transmitter model, frequency, and power



Visual representation of signal to noise



Transmitter temperature (flashing indicates the transmitter is overheating)

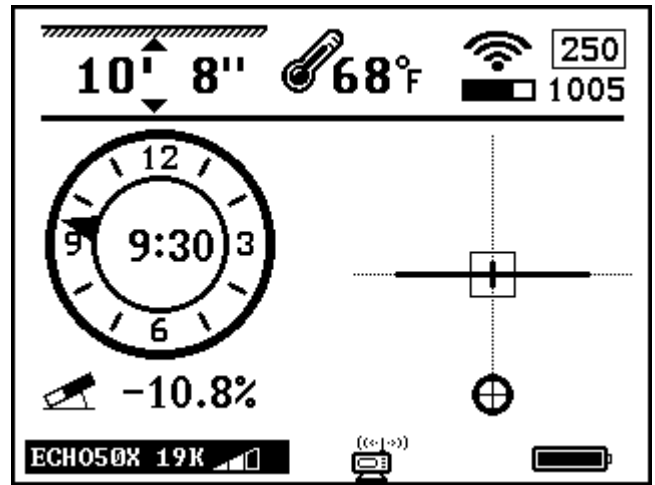
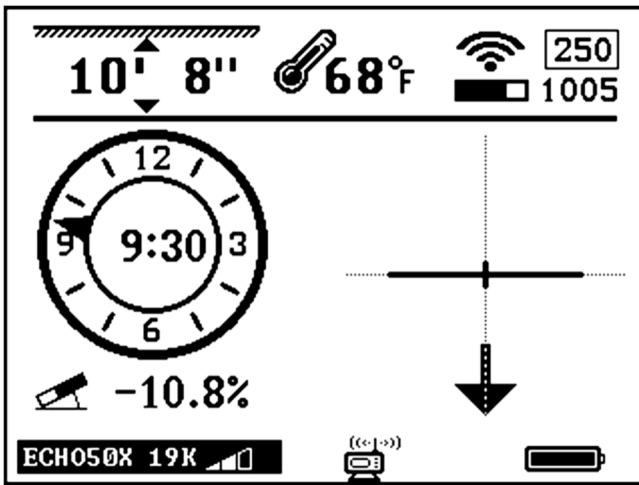
10' 8''



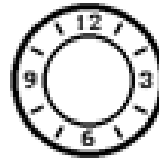
Depth when over the head



Receiver remote telemetry indicator



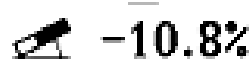
Roll indicator



Clock positions



Locate Line

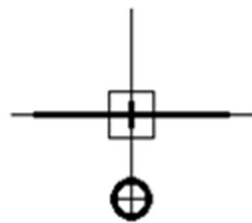


Pitch



Single Point

Direction of nearest  
Locate Point



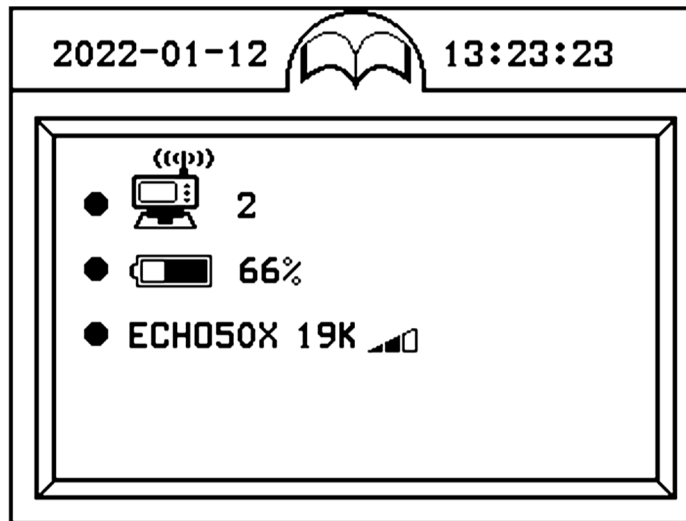
Single Ball

B1 	B26 	B8 
B23 		

To select locating modes see section **10.1.1**

### 7.3.2: Secondary Page Icons

To enter the secondary Page, press and hold 



2




Radio Channel



66%



Receiver Battery Status

ECH050X 19K 




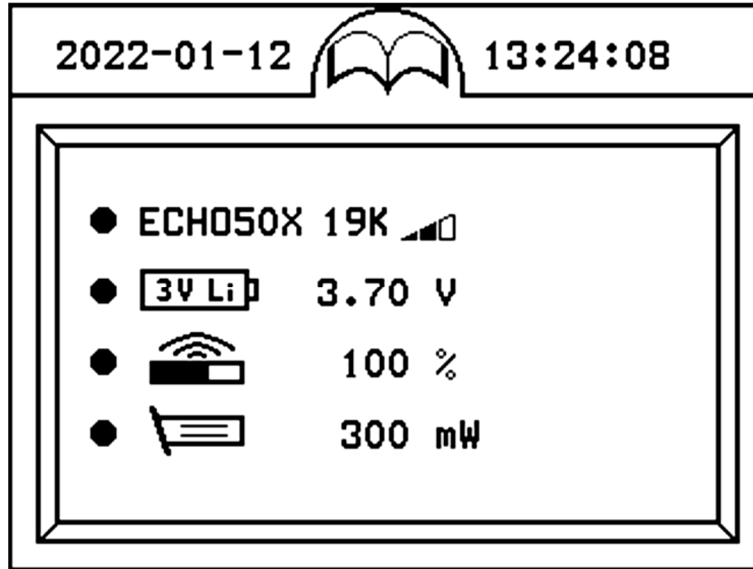
Transmitter Model, frequency and power

Tap  to enter transmitter information




### 7.3.3: Transmitter Information


From secondary page, tap  to enter transmitter information page



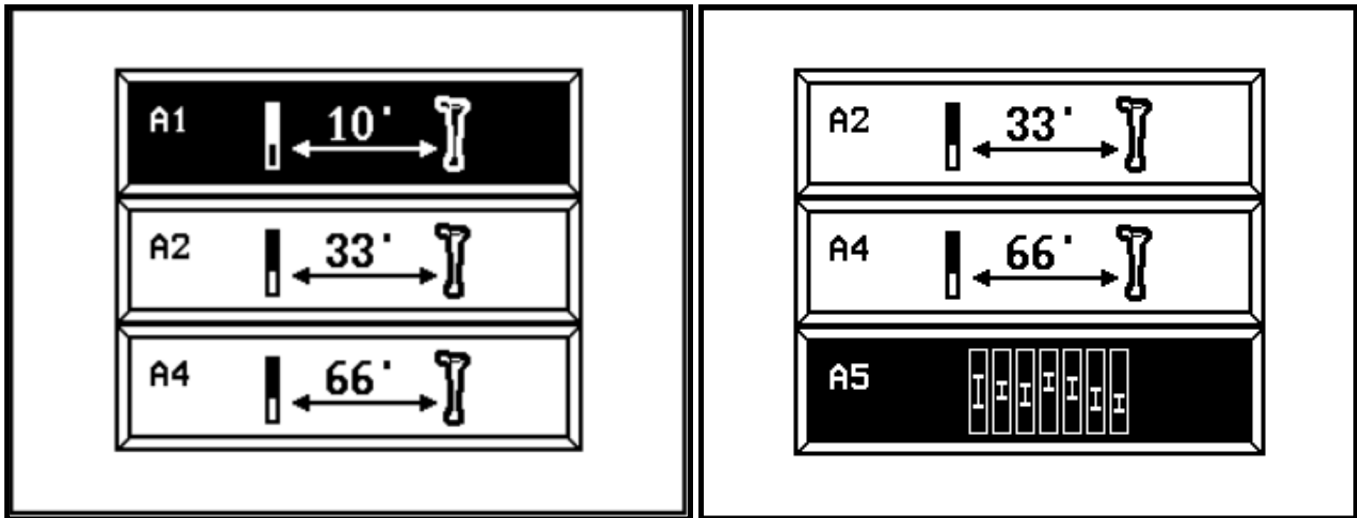
**ECH050X 19K**  Transmitter Model, Frequency and Power level

 **3.70 V** Transmitter battery voltage meter

 **100 %** Transmitter antenna health.  
(Normal range 95% to 105%)

 **300 mW** Transmitter Housing suitability.  
Note:  
Normal Power Mode below 800mW  
High Power Mode below 3000mW  
(Numbers above mW will see lower battery life).

### 7.3.4: Calibration and Depth Forecast Page Icons



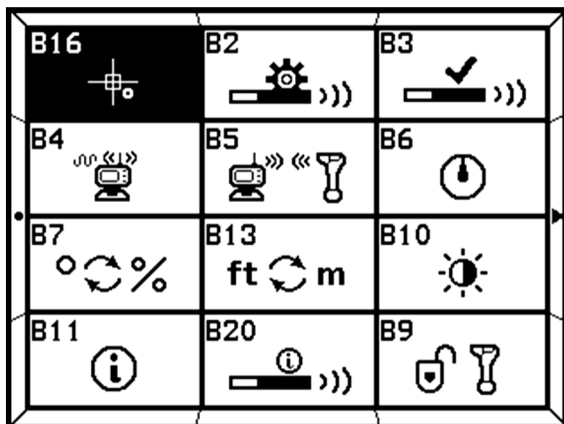
A1: 10ft calibration

A2: 33ft calibration

A4: 66ft calibration

A5: Depth Forecast

### 7.3.5: Setup Page Icons



B1: Transmitter lock/unlock

B2: Transmitter settings

B3: Receiver settings

B4: Radio channel selection

B5: Receiver and Display pairing

B6: Roll calibration

B7: Pitch and unit selection

B8: Time setting

B9: System lock/unlock

B10: Visibility control

B11: System information

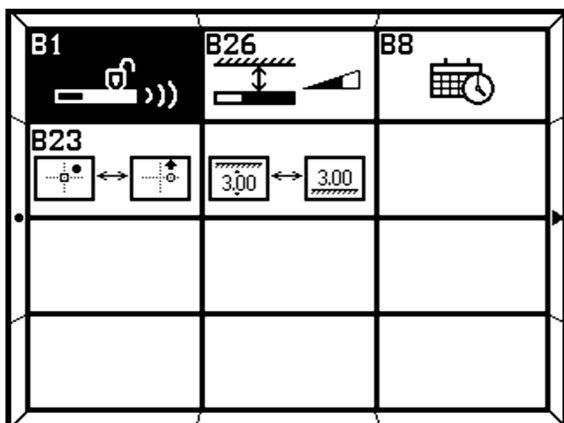
B13: Distance and unit selection

B16: Speed Control

B20: Transmitter Information

B23: Locating Mode

B26: Depth Speed



## 7.4: Calibration

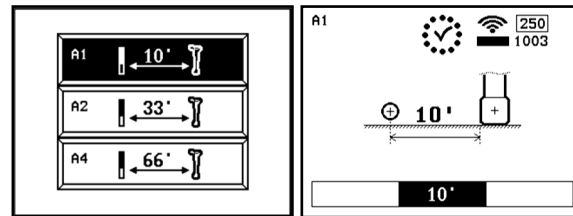
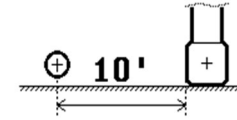


### 7.4.1: Depth Calibration

**Do not calibrate around strong active or passive interference.**

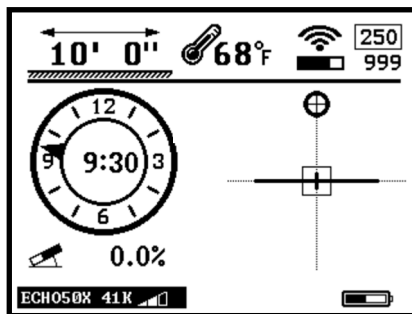
**Warning:** For example, don't calibrate around an electrical transformer (active), or on concrete with rebar and/or wire mesh (passive). These types of areas can effect the depth calibration and accuracy significantly.

1. Place transmitter inside housing flat on the ground.
2. Measure from the center of the housing, 10' to the inside edge of the locator.
3. Tap to enter calibration screen.  
Tap to enter calibration page.
4. Tap twice more to begin calibration.  
Check mark will show when complete.



**Note:** Calibrate at 10ft first before calibrating at 33ft or 66ft. Calibrating at 33ft or 66ft is not necessary unless drilling at extreme depths.

Above ground calibration check:

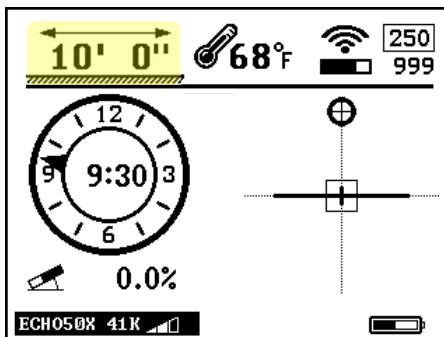


Once calibration is completed, press button to return to main screen. 10ft will be displayed in the upper left hand portion of the screen. 10' 0"

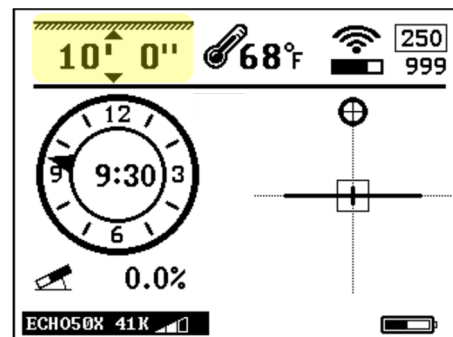
To check quality of calibration, move locator out 20' from housing and check distance. If calibration is correct, distance should be within 1". 20' 0"

After calibration, above ground distance will change to below ground distance. Below ground distance is the distance to the transmitter or, the depth when directly above the transmitter. This conversion is done automatically when the transmitter has rotated for 15 seconds.

#### ABOVE GROUND DISTANCE

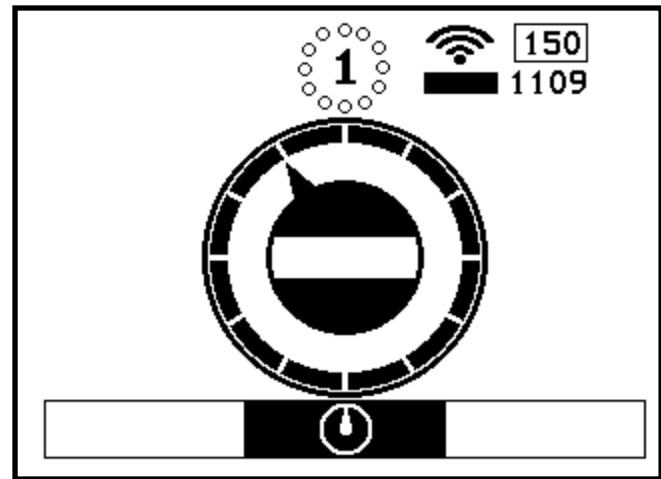
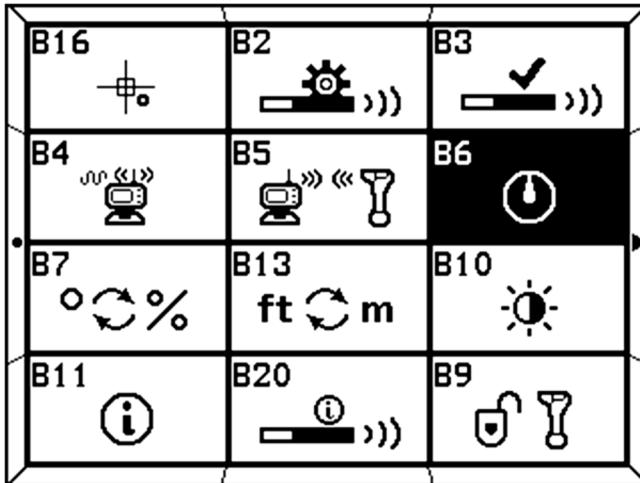
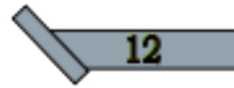


#### BELOW GROUND DISTANCE



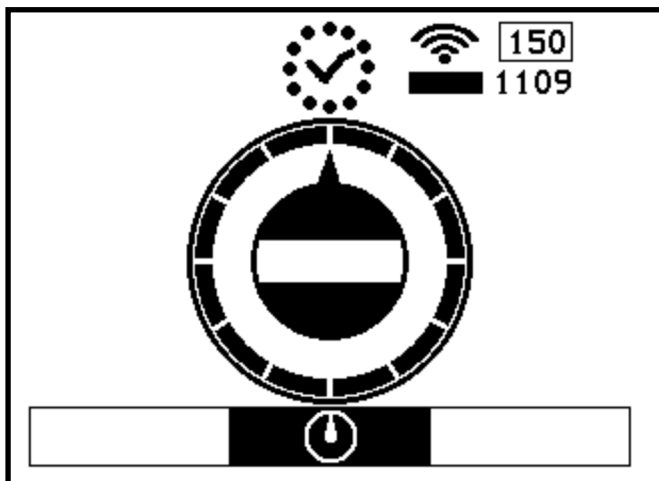
## 7.4.2: Roll Calibration

1. Place transmitter housing in a 12 o'clock position.

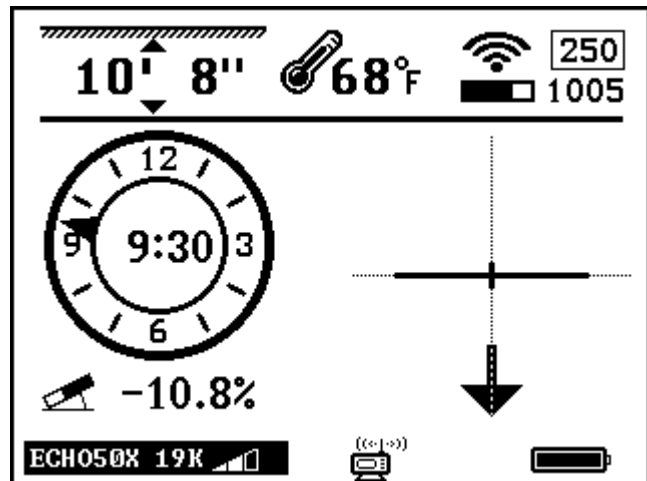


Press and hold to enter Setup page and tap to Select B6 icon.

Tap to enter Roll Calibration Page and tap or until the point is in the 12 o'clock position, Tap twice to start roll calibration and wait for calibration



Calibration Complete

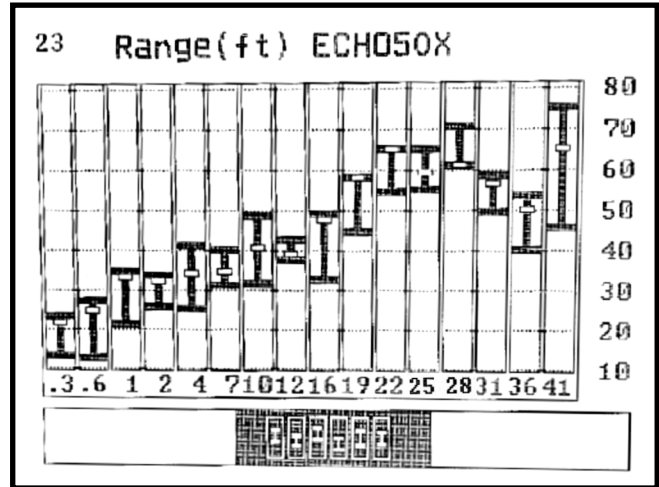
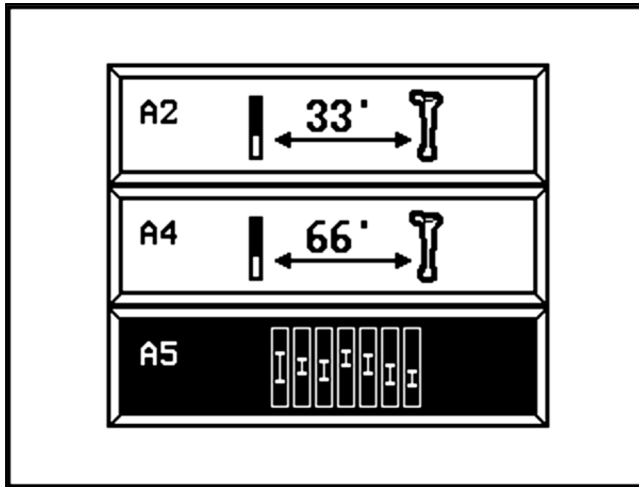




Tap to return to Main Page


## 7.5: Operation

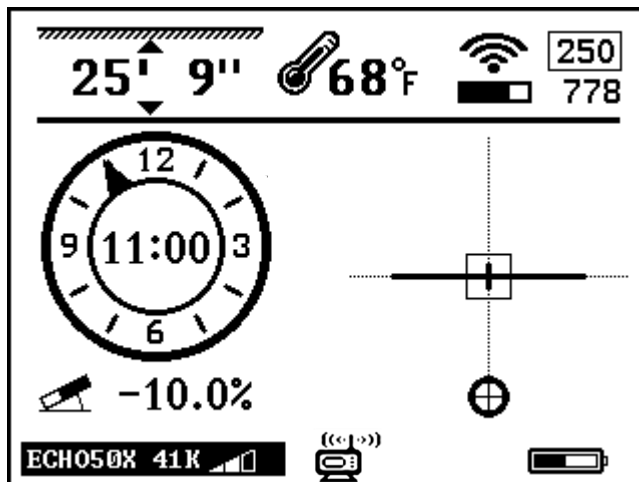


### 7.5.1: Depth Forecast during Pre-Bore Walk



Tap  to enter calibration page and tap  to select A5 icon.

Tap  to enter the Depth Forecast page. On the Y-axis is a list of various depth measurements. The X-axis shows the available frequencies. The indicator at the bottom will now cycle through each available frequency and provide potential best and worse-case depth scenarios based on the surrounding interference.

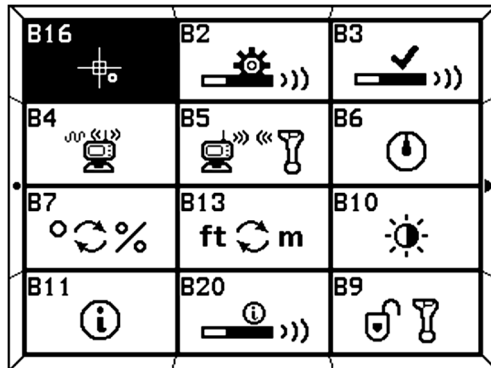



Tap  to return to Main Page.

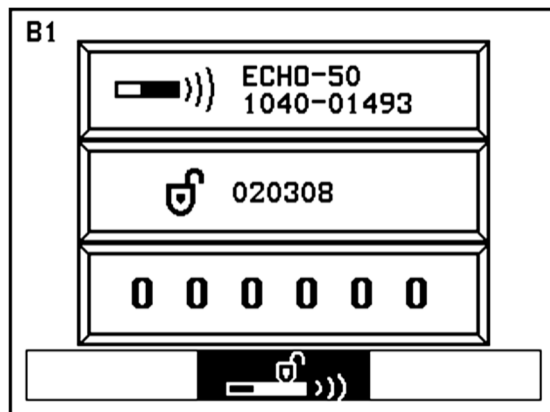
**Note:** The best-case depth forecast value is a conservative value and will be the main value used when determining interference.

## 7.5.2: Transmitter Unlock






(Process must be started within 10 minutes after the batteries have been placed in the transmitter)

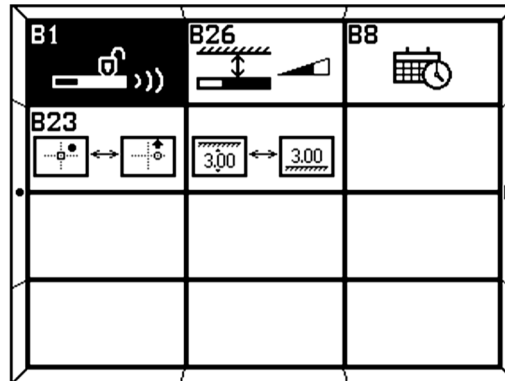




1. Press and hold  to enter Setup Page.

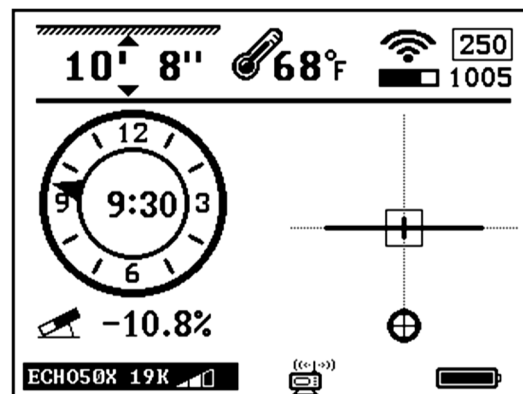



3. 1040-01493 is the transmitter identification number and 020308 is the prompt code in the diagram. Send the transmitter identification number and the prompt code to the dealer.

The dealer will give you an activation password. Use  and  to input a number and  to move to the next number spot. Tap  to move to the next number spot. Tap  once done to confirm.



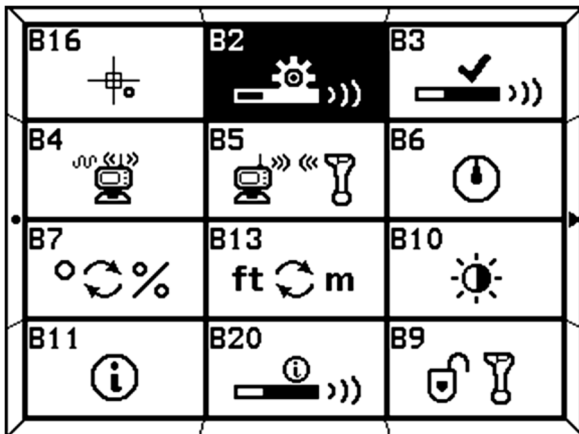
2. Tap  to scroll through the page options until B1 is highlighted. Then tap  to enter Transmitter Activation Page.



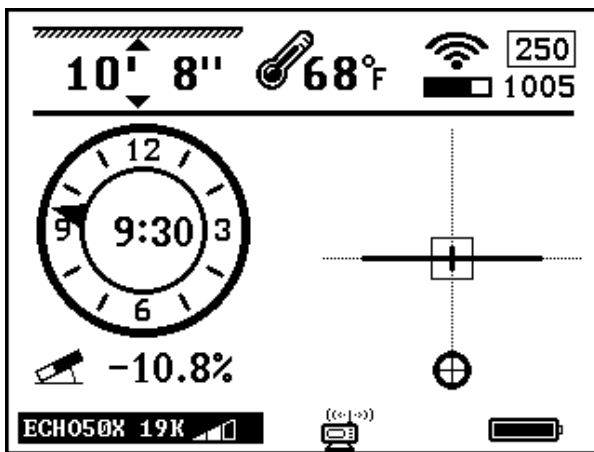
4. Tap  to return to Main Page.

### 7.5.3: Transmitter Settings

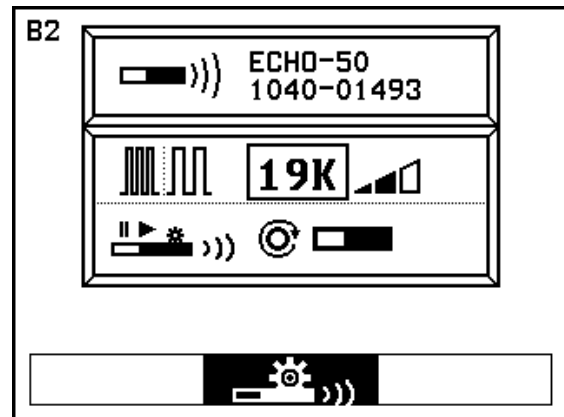
(Process must be started within 60 minutes after the batteries have been placed in the transmitter)



1. Press and hold to enter Setup Page and tap to select B2 icon.



3. Tap to return to Main Page.

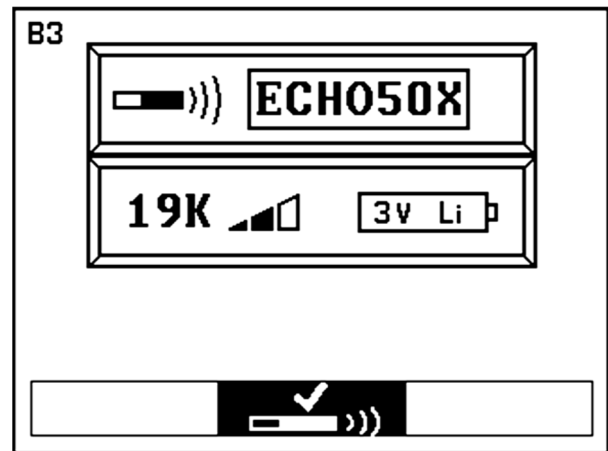
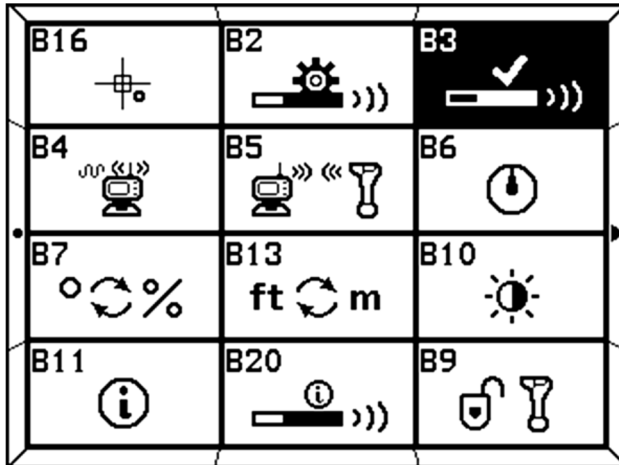




2. Tap to enter Transmitter Settings Page. The receiver and Echo transmitter will automatically pair. Then tap or and to select frequency and power level. Tap to highlight Wake Up Mode and tap to enter. Then tap or to select desired mode.





- Instant**  
(rotate the transmitter 4 degrees or change the pitch by 1 degree)
- 360 degrees**  
(rotate the transmitter a full 360° several times)
- Always on**

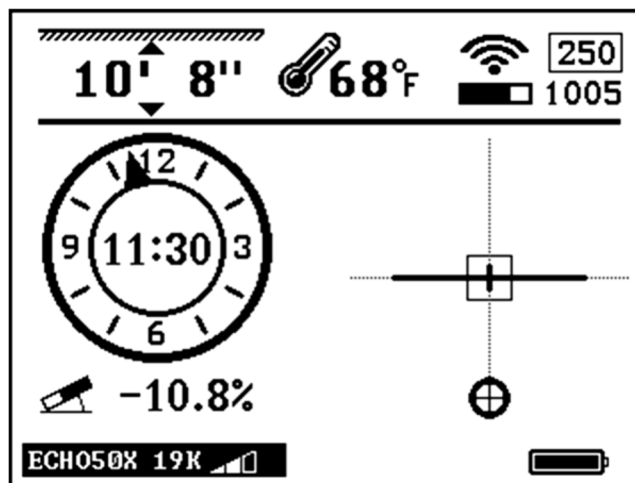
## 7.5.4: Receiver Settings


This sets the Receiver to look for what type of transmitter and at what frequency.



1. Press and hold  to enter Setup Page. Tap  to select B3 icon.

2. Tap  to enter Receiver Settings Page. Tap  or  and  to select transmitter model, frequency, power and battery select.





3. Tap  to return to Main Page.





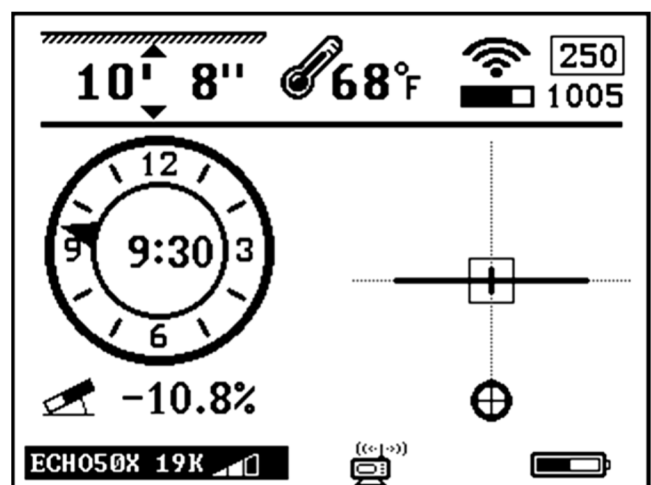
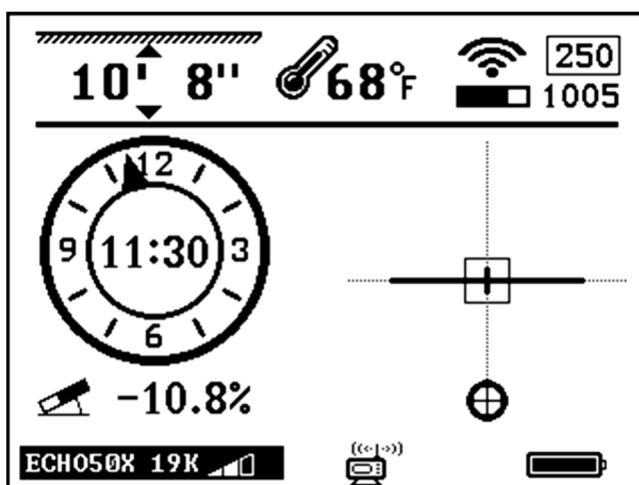
## 7.5.4: Continued

B3 allows for adjustments in the locator **but not the transmitter.** From this page, you will be able to change the frequency of the locator, the power level and select which battery type.

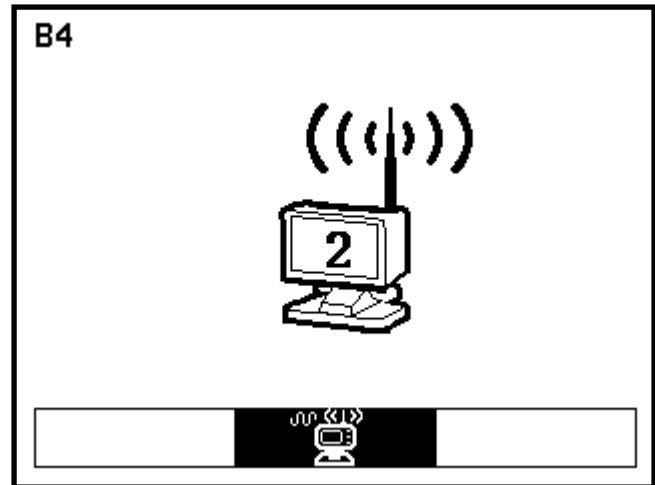
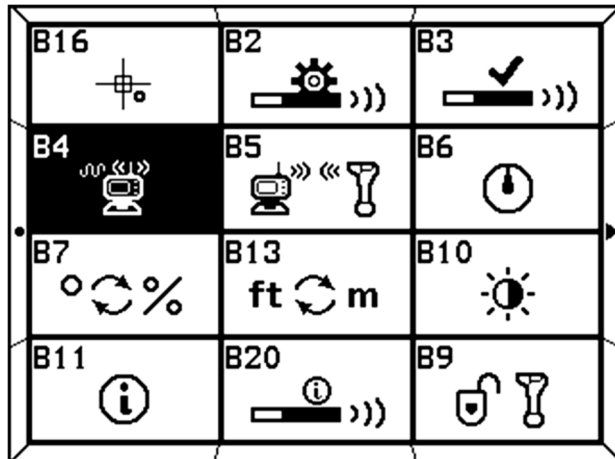
Battery setting allows the transmitter battery indicator to display the remaining battery life.



When using a primary cell,  the indicator will show full  until the battery is almost completely dead. This is a function of the chemistry of the battery which will not allow metering.




When using a rechargeable Echo Cell battery,  the meter will show full when completely charged at 4.2V. The battery will show as it meters down  until the voltage is 3.4 V (roughly 20 hours) at which time the indicator will start to flash. This is an indication that the battery needs to be recharged. Users should consider replacing Echo Cell battery every 3 to 6 months depending on the ground conditions.

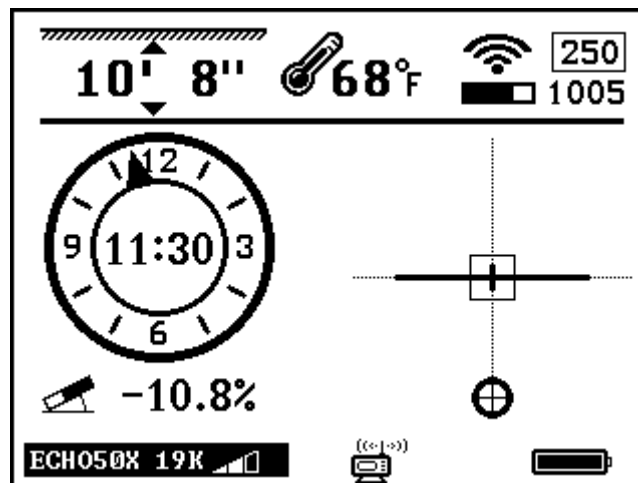



## 7.5.5: Radio Channel Selection



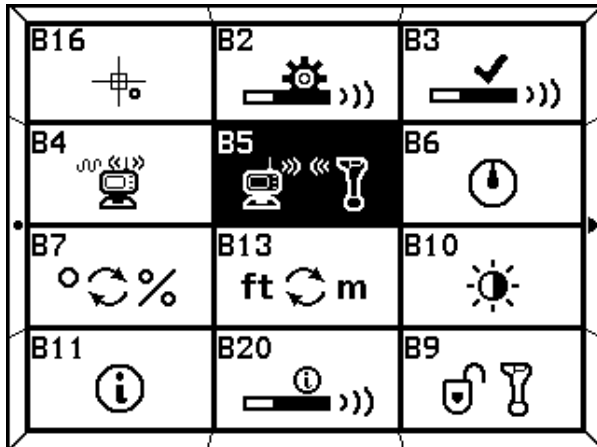
1. Press and hold  to enter Setup Page. Tap  to select B4 icon.

2. Tap  to enter Radio Channel Page. Use  or  to select radio channel.

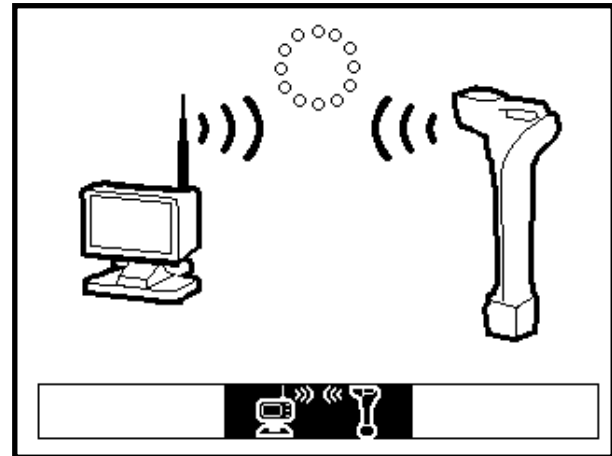


3. Tap  to return to Main Page.

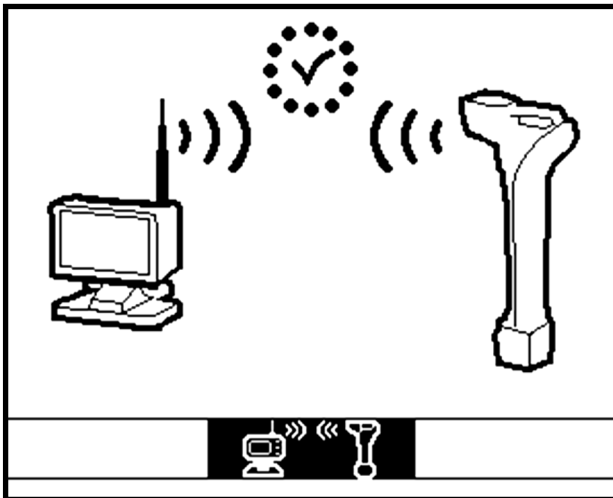
## 7.5.6: Pairing



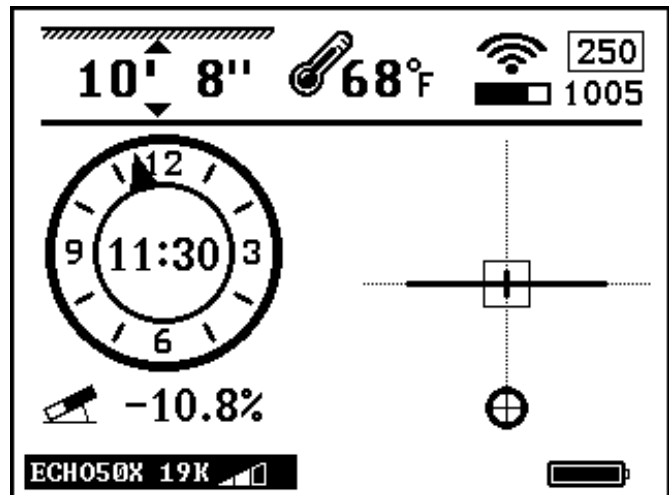
1. Press and hold to enter Setup Page. Tap to select B5 icon.



2. Tap to enter Pairing Page. Tap to start pairing. (it is required that these last two steps are performed on the display at the same time.)

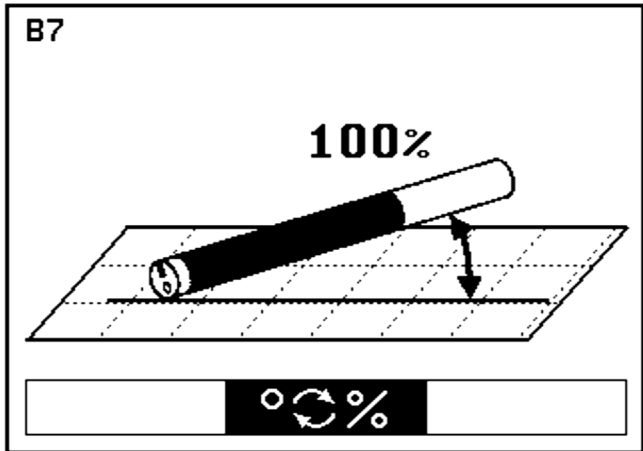
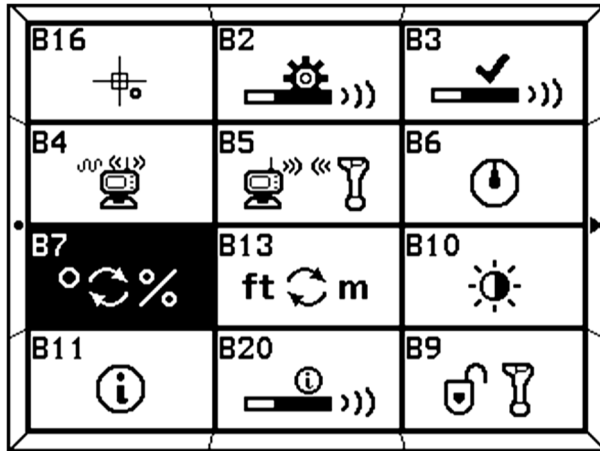





3. Pairing Complete




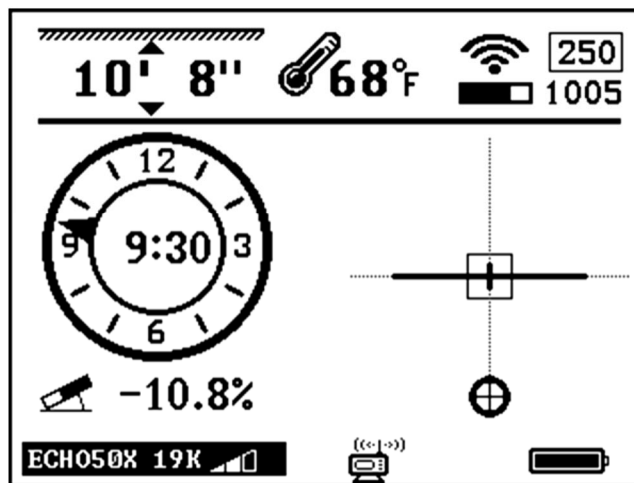
4 Tap to return to Main Page.


## 7.5.7: Pitch Unit Selection



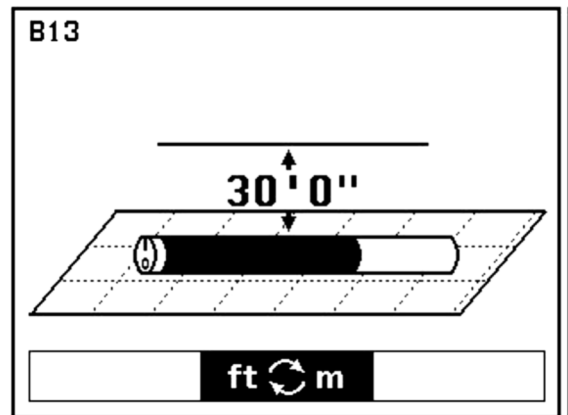
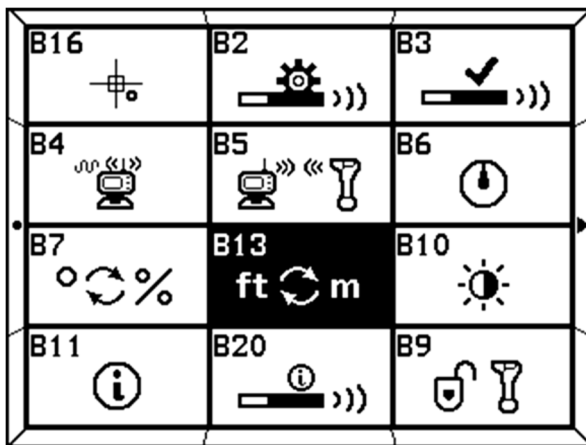
1. Press and hold  to enter Setup Page and tap  to select B7 icon. Tap  to enter Pitch Unit Selection Page.



2. Tap  to switch pitch mode.






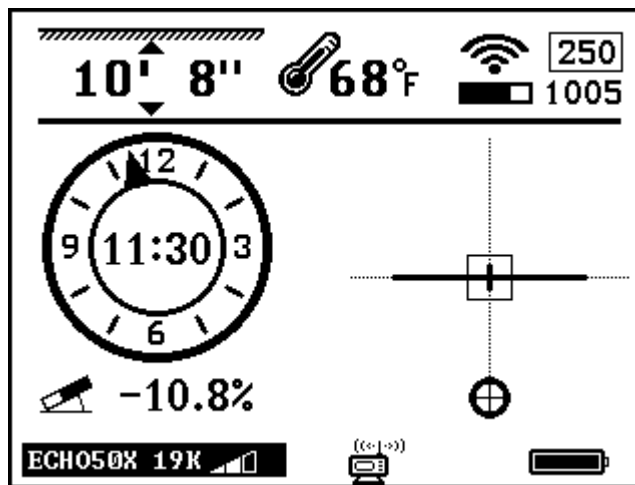
3. Tap  to return to Main Page.


## 7.5.8: Distance Unit Selection



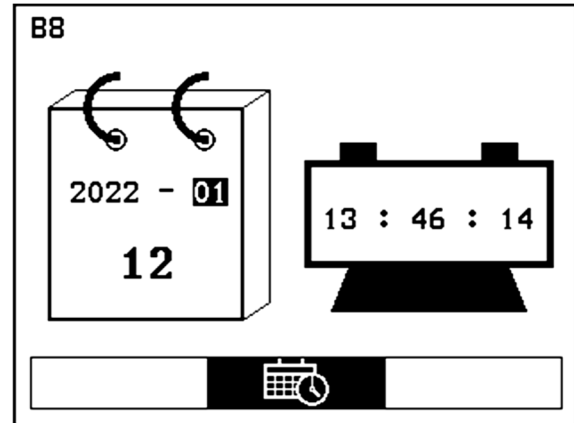
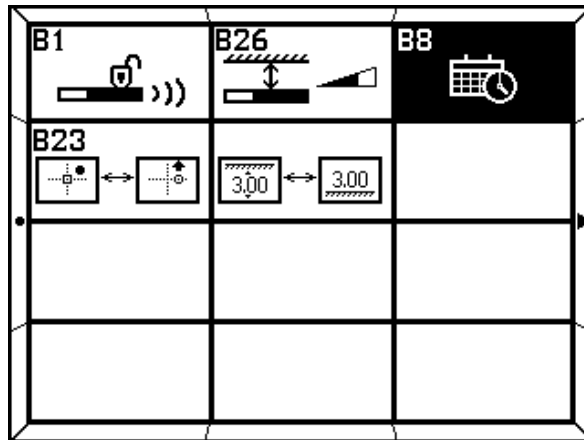
1. Press and hold  to enter Setup Page. Tap  to select B13 icon.



2. Tap  to enter Distance Unit Selection Page. Tap  or  to select unit and format.







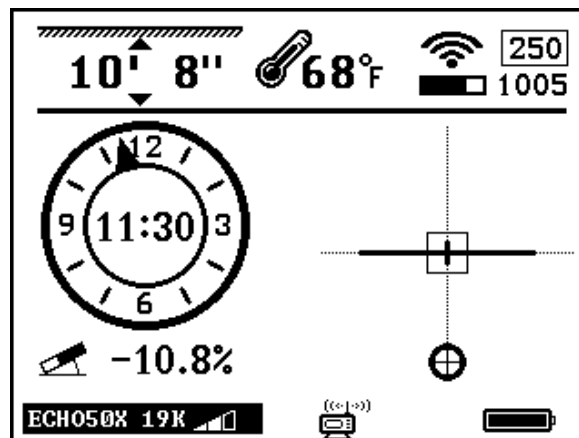
3. Tap  to return to Main Page.


## 7.5.9: Time Setting (For dealer or factory use)



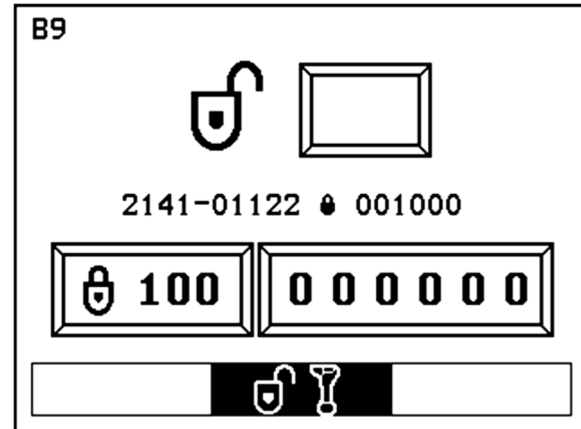
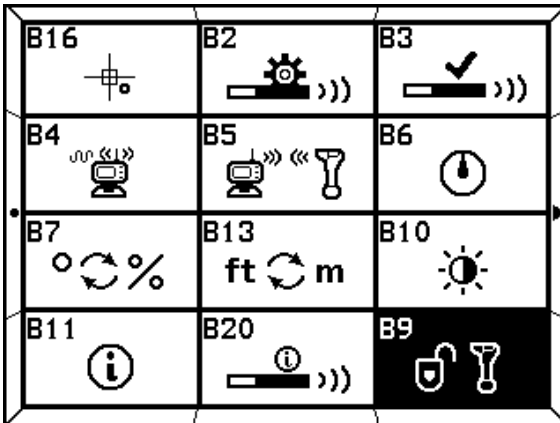
2. Press and hold  to enter Setup Page. Tap  to select B8 icon.




3. Tap  to enter Time Settings Page. Tap  to select year, month, day, hour, or minute. Tap  or  to set time.






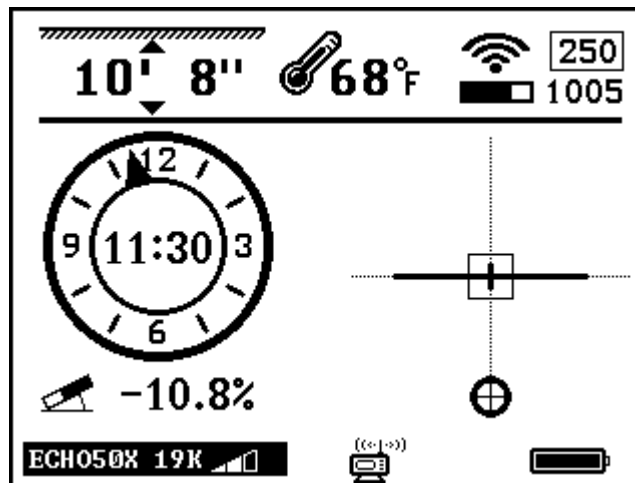
4. Tap  to return to Main Page.


## 7.5.10: System Unlock (For dealer or factory use)



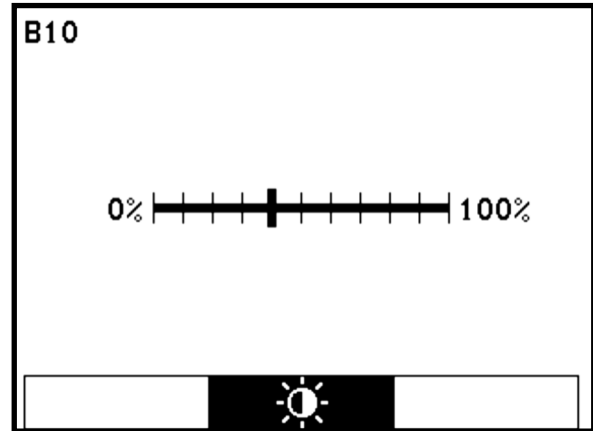
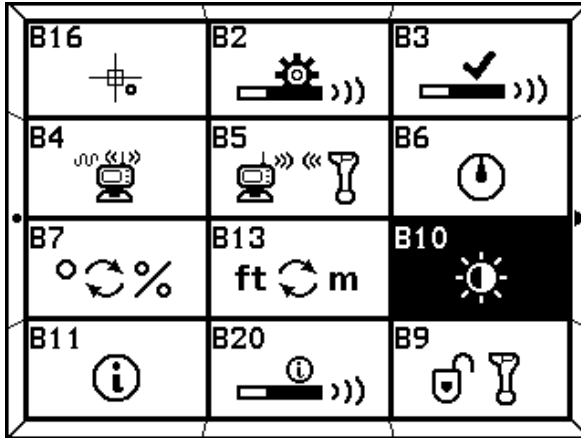
1. Press and hold  to enter Setup Page and tap  to select B9 icon. Tap  to enter System Unlock Page.




2. Tap  or  and  to input password.





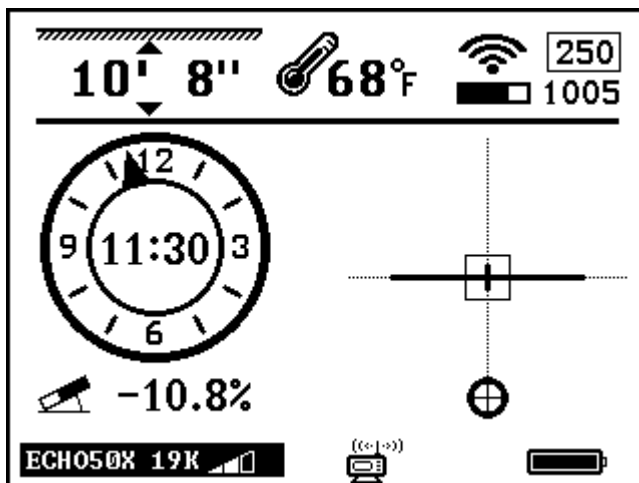
3. Tap  to return to Main Page.

## 7.5.11: Contrast Adjustment





1. Press and hold  to enter Setup Page and tap  to select the B10 icon. Tap  to enter Visibility Control.

2. Tap  and  to adjust.



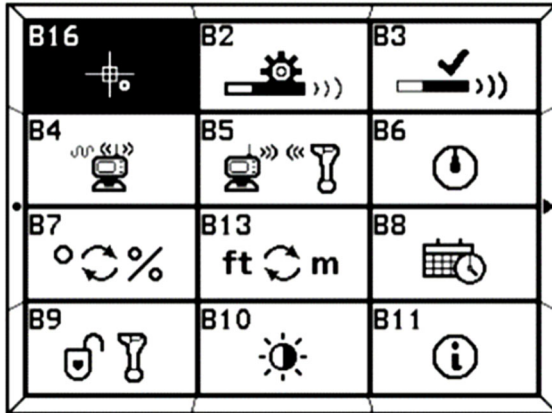
3. Tap  to return to Main Page.

### NOTE:

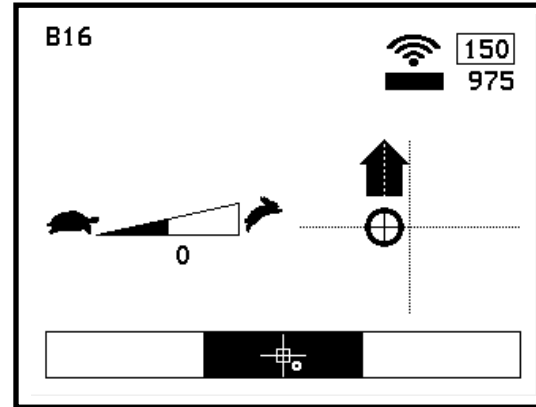
By holding both the  and  at the same time while turning the receiver on, the visibility control will reset to normal visibility.



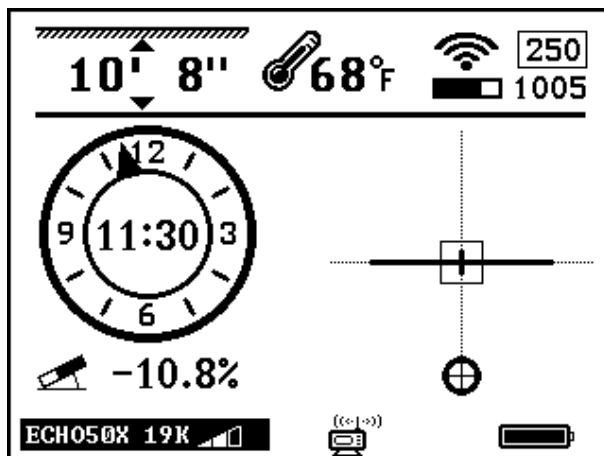
## 7.5.12: Ball Speed Control



1. Press and hold to enter Setup Page and tap to enter the Speed Control Page.



2. Tap and to adjust speed.

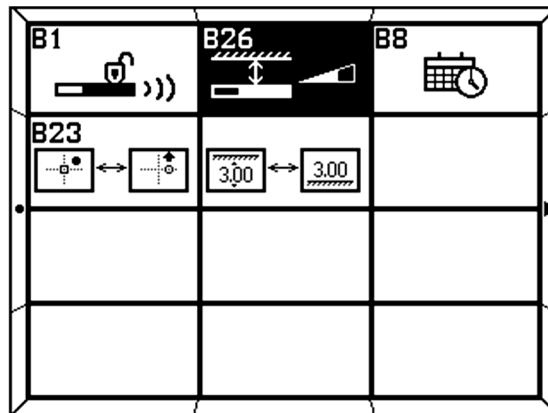


3. Tap to return to Main Page.

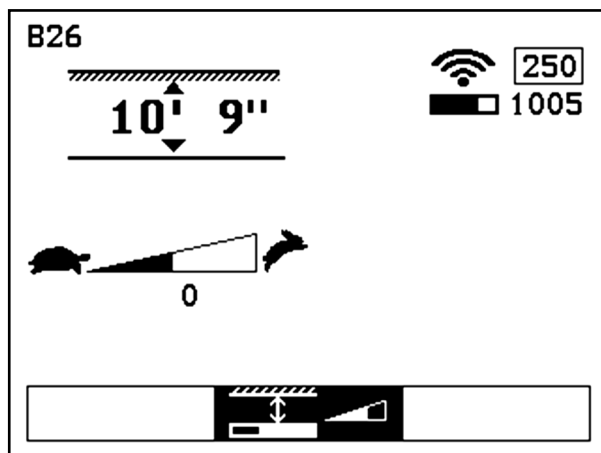
### NOTE:

Adjusting the speed control enables operators to more easily fine tune the left-right ball and bore indicator when drilling at extreme depths.

## 7.5.13: Depth Speed Adjustment



1. Press and hold to enter Setup Page. Tap until you move to the second Setup Page and select B26.
2. Tap to enter Depth Speed Adjustment Page.
3. Tap to adjust speed of depth displayed.



4. Tap to return to the Main Page.

### NOTE:

Adjusting Depth Speed allows the operator to control the depth readout when at extreme depths or high interference areas.

In these situations, depth readout can become erratic or bounce up and down making it difficult to pinpoint depth.

Slowing the speed of the depth readout will improve accuracy.

When over the top of the transmitter, adjust the speed until the desired speed is displayed.

## 7.6 Receiver Maintenance

- The receiver uses rechargeable lithium batteries. The receiver will automatically shut off if no key is pressed for over a period of 20 minutes or if there is no information received from the transmitter. It is strongly recommended that the batteries are taken out of the receiver if it is not being used for a long period of time to avoid potential corrosion.
- The receiver is an electronic measurement device. Severe shock and impact can damage the housing and the electronics inside the housing.
- Keep the receiver away from excessive heat to avoid damages to the plastic housing and the electronics inside the housing.
- Do not soak the receiver in excessive amounts of water.








## 8 Display

### 8.1 Display Specifications



<b>Radio frequency</b>	915MHz
<b>Water resistant</b>	IP65
<b>Temperature range</b>	-4° to 140°F
<b>Telemetry</b>	4 radio channels with range up to 3,000 ft. (900m)*
<b>Power</b>	Rechargeable Lithium batteries
<b>Battery life</b>	Up to 50 hours
<b>Screen</b>	Industrial rated LCD graphic display
<b>Dimensions</b>	7.5" x 5" x 7.5"
<b>Weight</b>	3.3 pounds

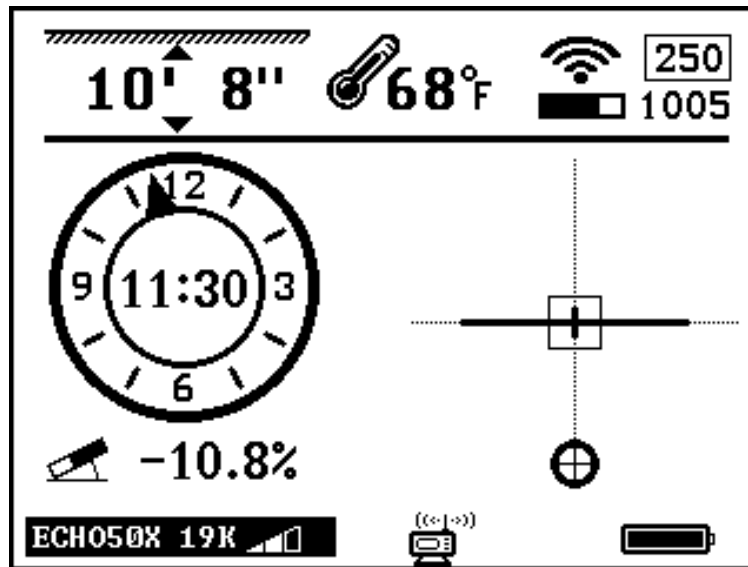
### 8.2 Display Operations

-  Power key: Press and hold to turn off. Tap to select level of backlight.
-  Up key: Move to previous cursor selection.
-  Down key: Move to next cursor selection.
-  Confirm key: Tap to confirm cursor selection. Press and hold to enter secondary page.
-  Setup key: Tap to return to main page. Press and hold to enter setup page.

\* With optional Yagi Antenna

## 8.3 Display Icons

### 8.3.1 Main Page Icons



ECHO50X 19K

- Transmitter model and frequency

1005

- Transmitter signal strength



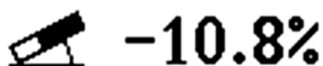
- Signal to noise ratio bar and noise number



- Signal to noise ratio bar and noise number



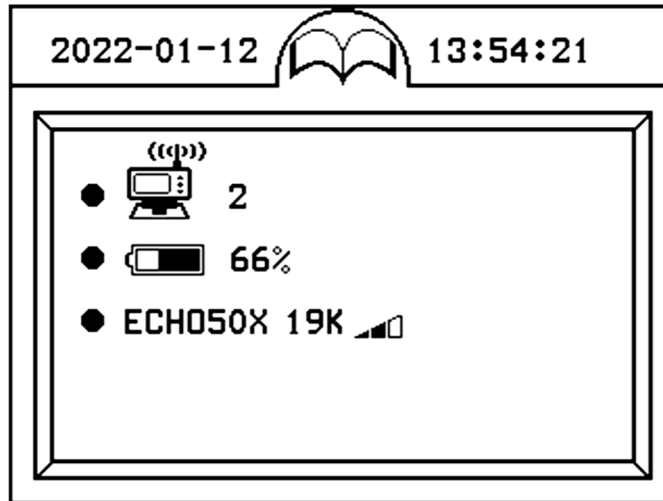
- Distance between transmitter and receiver





- Transmitter Pitch

### 8.3.2 Secondary Page Icons

To enter the Secondary Page, press and hold 

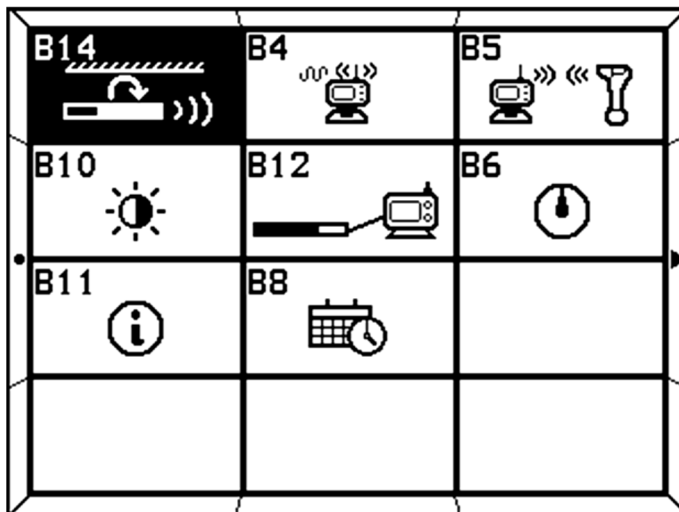


 ECH050X 19K  Transmitter model, frequency, and power

 66% Display battery status

 2 Radio channel

### 8.3.3 Setup Page Icons



B4: Radio Channel Selection

B5: Receiver and Display pairing

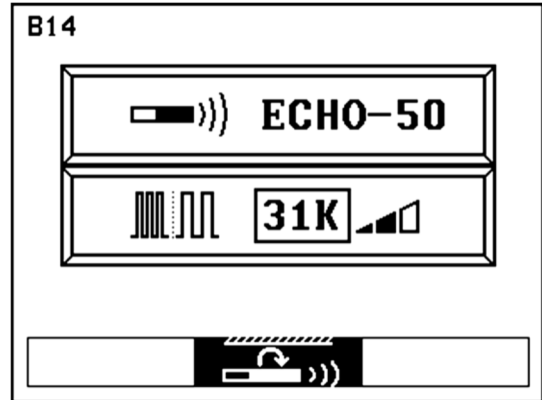
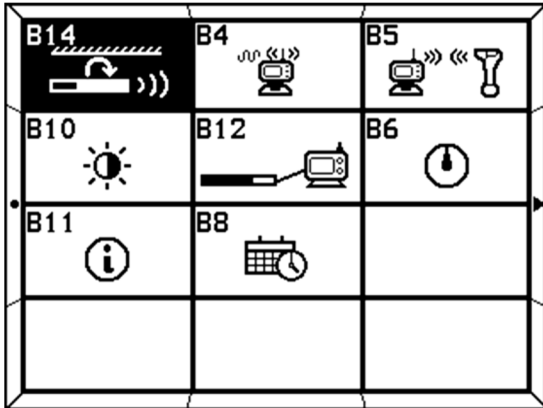
B10: Visibility Control

B11: System Info

B12: Display Communication mode

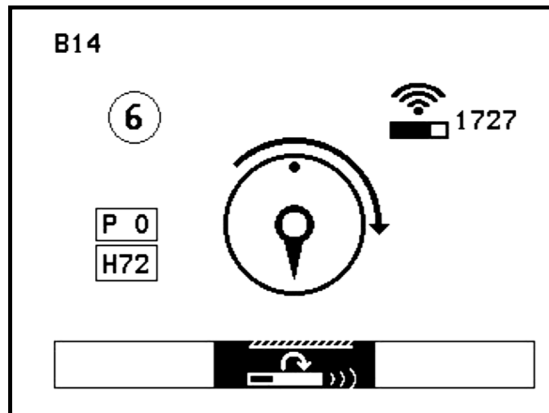
B14: Down hole Echo mode change

## 8.4 Down Hole Echo Mode Change



1. Press and hold to enter Setup Page. Tap to enter Down Hole Echo Mode Change Page.

2. Use or to select desired frequency and power levels. Tap to begin mode change process.



Roll indicator



Steps remaining



Target dot



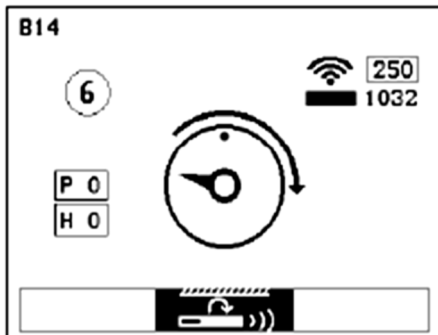
Instructions

**H72**

Hold: hold this roll position until it counts down to 0

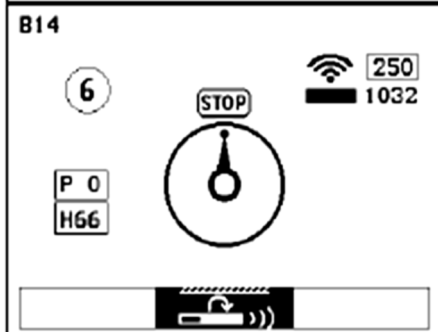
**P 0**

Proceed: time left to proceed in process by rotating to new roll position in sequence.

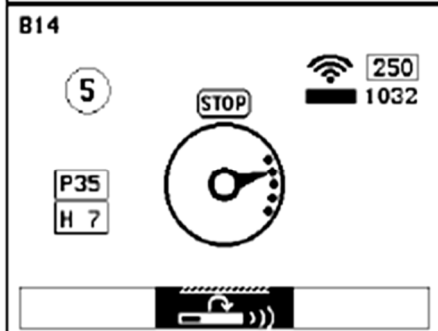


Rotate drill head until roll indicator points toward target dot.

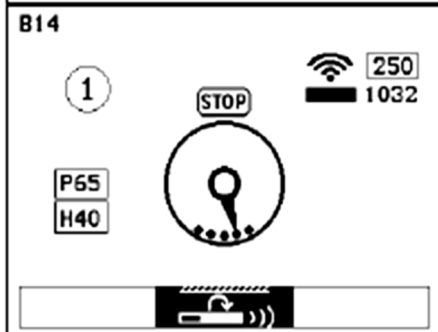
Instructions will change from the clockwise arrow to “STOP”



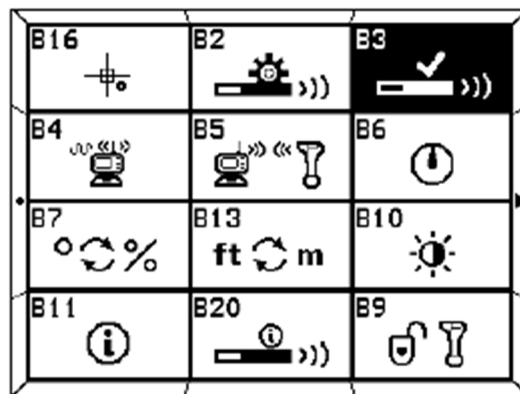
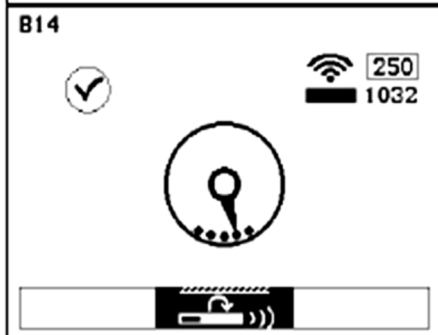
Rotate drill head to next position in sequence before “P” counts down to 0 or the sequence will be cancelled.



If the next step has the target dots in the same place as the previous step, rotate the drill head one entire rotation until the roll indicator lines up with the target dots again.

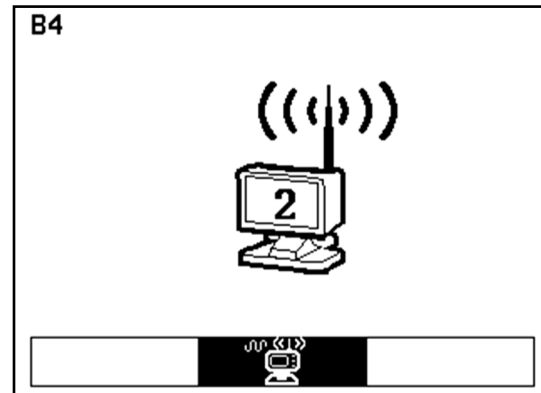
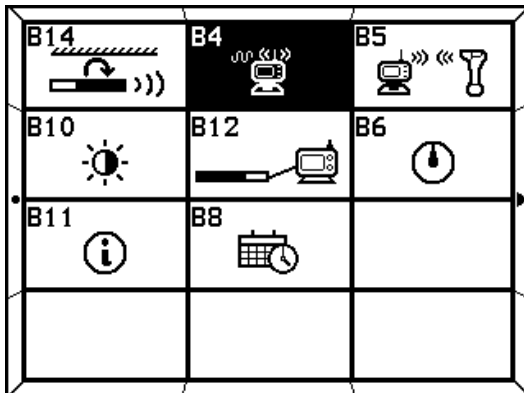




Once all six steps of the sequence are complete, change the Transmitter Settings on the receiver (B3) to match the new frequency and power levels.




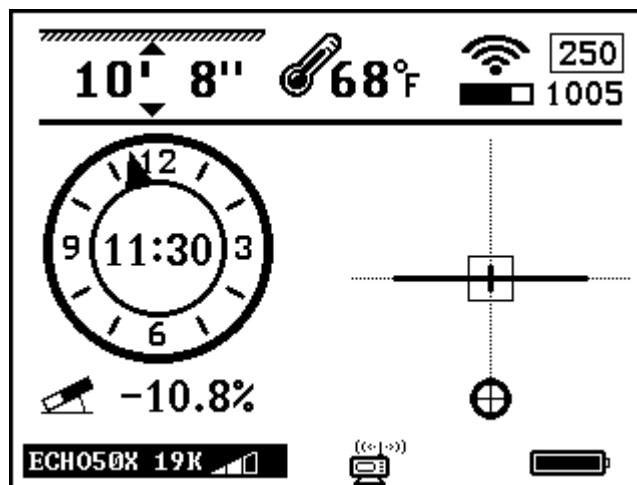



## 8.5: Radio Channel Selection



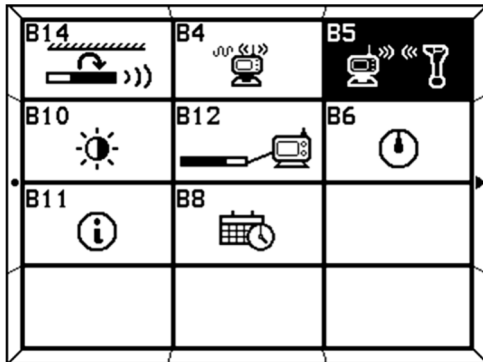
1. Press and hold  to enter Setup Page. Tap  to enter Radio Channel Page.


2. Use  to select radio channel.

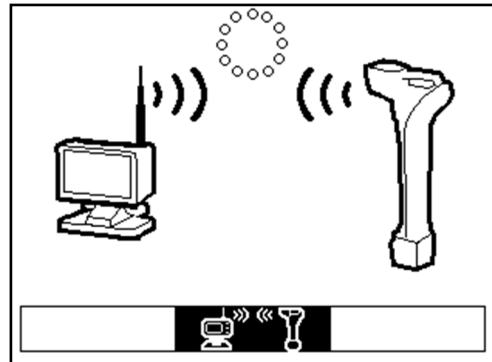



3. Tap  to return to Main Page

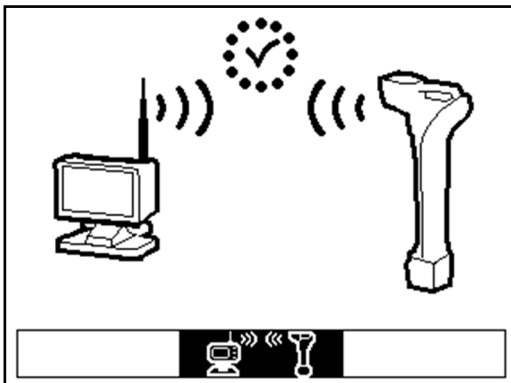
## 8.6: Pairing



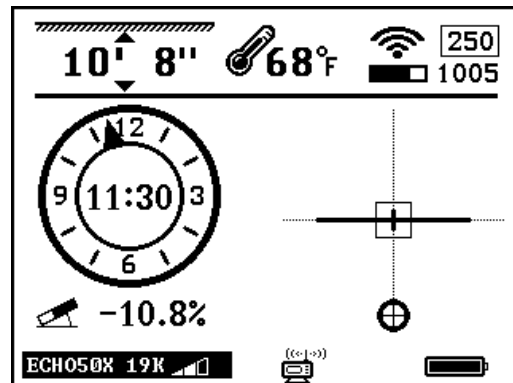
1. Press and hold  to enter Setup Page. Tap  to select B5 icon. Tap  to enter Radio Registration Page.




2. Tap  to start pairing. (It is required that the following procedure is performed on the receiver at the same time)

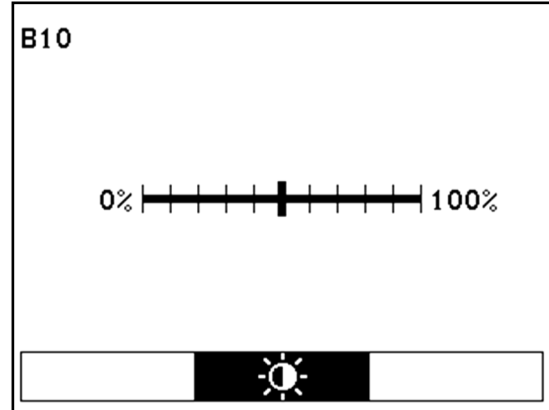
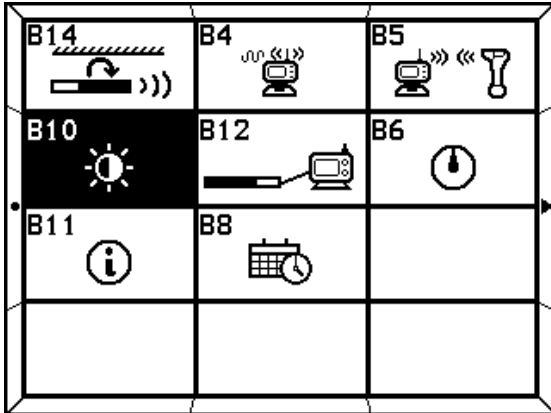





3. Pairing is complete





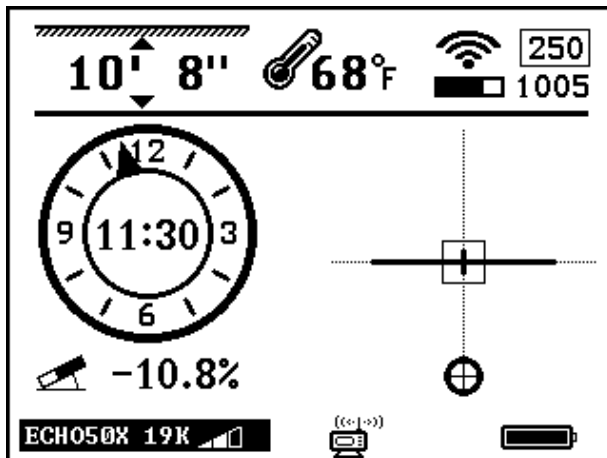
4. Tap  to return to Main Page


## 8.7: Contrast Adjustment





1. Press and hold  to enter Setup Page. Tap  to select B10 icon. Tap  to enter Visibility Control Page.

2. Tap  and  to adjust.

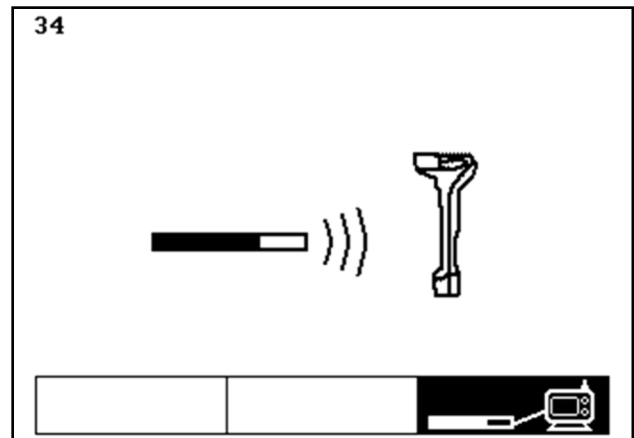
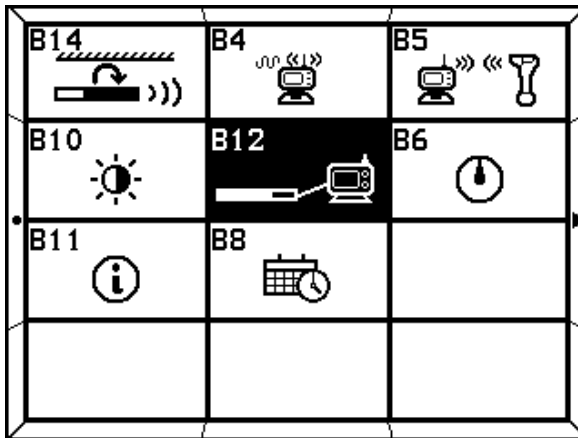


3. Tap  to return to Main Page

### NOTE:

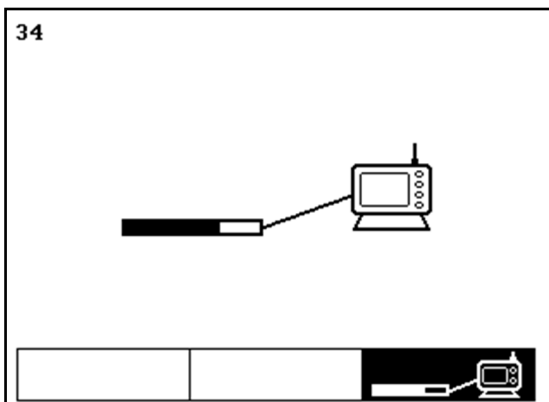
By holding both  and  at the same time while turning the receiver on, the visibility control will reset to normal visibility.

## 8.8: Communication Mode

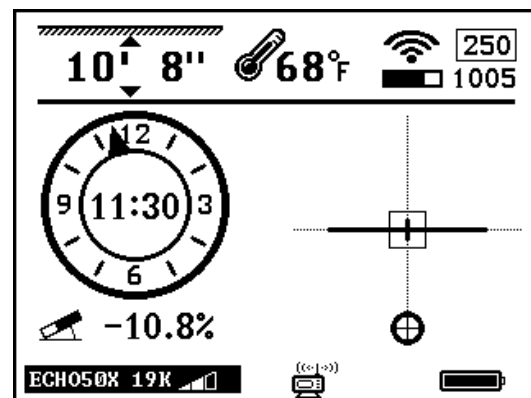


1. Press and hold to enter Setup Page. Tap to select B12 icon. Tap to enter Communication Mode Page.

2. The default communication mode will be wireless communication.



3. Press to switch to cable mode.



4. Tap to return to Main Page

## **8.9: Display Maintenance**

- The display uses rechargeable lithium batteries. The display will automatically shut off if no key is pressed for over a period of 20 minutes or if there is no information received from the receiver. It is strongly recommended that the batteries are taken out of the display if it is not being used for a long period of time to avoid potential corrosion.
- The display is an electronic measurement device. Severe shock and impact can damage the housing and the electronics inside the housing.
- Keep the display away from excessive heat to avoid damages to the plastic housing and electronics inside the housing.
- Do not submerge the display in excessive amounts of water.

# 9: Transmitter

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## 9.1: Introduction

The transmitter provides drill head temperature, clock position pitch, battery status and locating signal. The transmitter transmits signals at .3kHz, .6kHz, 1kHz, 2kHz, 4kHz, 7kHz, 10kHz, 12kHz, 16kHz, 19kHz, 22kHz, 25kHz, 28kHz, 31kHz, 36kHz and 41kHz. The transmitter will enter a “sleep” mode after 15 minutes without rotation. It takes 10 seconds to “wake up” once the transmitter is rotated.

**NOTE:** If drilling in adverse soil conditions (i.e. rock), normal C cell batteries will experience battery chatter. This can greatly reduce battery life. To prevent this, use your provided double C lithium or UM Rechargeable Echo Cell Kit.



## 9.2: Specifications

### Echo XMINI



Dimensions	1" X 8" (2.5 cm x 20.3 cm)
Frequency	2 frequencies 19kHz and 30kHz
Depth Range	60ft (18m)
Power	(1) 18650 rechargeable lithium battery
18650 (3.7V)	18 hours
Temperature	Under 190° F (87° C)
Battery Voltage	2.7V—4.2V

### Echo ST

Dimensions	.78" X 6.3" (1.98 cm x 16 cm)
Frequency	31kHz
Depth Range	60ft (18m) - Normal Mode
Power	(1) 16340 rechargeable lithium battery
18650 (3.7V)	18 hours
Temperature	Under 190° F (87° C)
Battery Voltage	2.7V—4.2V



## Echo 50



<b>Weight</b>	<b>1.5lbs</b>
<b>Dimensions</b>	<b>1.25" X 15" (3.2 cm x 38 cm)</b>
<b>Frequency</b>	<b>12 frequencies 4kHz-41kHz</b>
<b>Depth Range</b>	<b>90ft/ 130ft / 130ft</b>
<b>Power</b>	<b>Echo Cell Kit (21700) or Lithium Battery (261020)</b>
<b>21700 (4.2v)</b>	<b>Normal Power: 50 hours High Power: 12 hours</b>
<b>261020 (3.7v)</b>	<b>Normal Power: 60 hours High Power: 15 hours</b>
<b>Temperature</b>	<b>Under 220° F (104° C)</b>

<b>Dimensions</b>	<b>1.25" X 15" (3.2 cm x 38 cm)</b>
<b>Frequency</b>	<b>16 frequencies .32kHz-41kHz</b>
<b>Depth Range</b>	<b>Normal Power: 131ft High Power: 164ft</b>
<b>Power</b>	<b>Echo Cell Kit (21700) or Lithium Battery (261020)</b>
<b>21700 (4.2v)</b>	<b>Normal Power: 50 hours High Power: 12 hours</b>
<b>261020 (3.7v)</b>	<b>Normal Power: 60 hours High Power: 15 hours</b>
<b>Temperature</b>	<b>Under 220° F (104° C)</b>

## Echo 50XF





## Echo 60



<b>Dimensions</b>	<b>1.25" X 19" (3.2 cm x 48 cm)</b>
<b>Frequency</b>	<b>12 frequencies 4kHz-41kHz</b>
<b>Depth Range</b>	<b>Normal Power: 131ft (40m) High Power: 196ft (60m)</b>
<b>Power</b>	<b>(2) 261020 non-rechargeable lithium batteries (2) 21700 rechargeable lithium</b>
<b>261020 (3.7v)</b>	<b>Normal Power: 120 hours High Power: 30 hours</b>
<b>21700 (4.2v)</b>	<b>Normal Power: 100 hours High Power: 25 hours</b>
<b>Temperature</b>	<b>Under 190° F (121° C)</b>
<b>Battery Voltage</b>	<b>8.4V—12.6V</b>

## Echo 70

<b>Dimensions</b>	<b>1.42" X 15.94" (3.6 cm x 40.5 cm)</b>
<b>Frequency</b>	<b>12 frequencies 4kHz-41kHz</b>
<b>Depth Range</b>	<b>Normal Power: 164ft (50m) High Power: 230ft (70m)</b>
<b>Power</b>	<b>(3) 18650 rechargeable lithium batteries</b>
<b>18650 (3.7V)</b>	<b>Normal Power: 60 hours High Power: 15 hours</b>
<b>Temperature</b>	<b>Under 250° F (121° C)</b>
<b>Battery Voltage</b>	<b>8.4V—12.6V</b>



## Echo 90

<b>Dimensions</b>	<b>1.42" X 18" (3.6 cm x 45.7 cm)</b>
<b>Frequency</b>	<b>12 frequencies 4kHz-41kHz</b>
<b>Depth Range</b>	<b>Normal Power: 230ft High Power: 295ft</b>
<b>Power</b>	<b>(2) 18650B2 rechargeable lithium batteries</b>
<b>18650B2 (3.7V)</b>	<b>Normal Power: 80 hours High Power: 20 hours</b>
<b>Temperature</b>	<b>Under 250° F (121° C)</b>
<b>Battery Voltage</b>	<b>5.6V—8.4V</b>



## Echo 110

<b>Dimensions</b>	<b>1.42" X 24" (3.6 cm x 60.9 cm)</b>
<b>Frequency</b>	<b>12 frequencies 4kHz-41kHz</b>
<b>Depth Range</b>	<b>Normal Power: 295ft High Power: 360ft</b>
<b>Power</b>	<b>(3) 18650B2 rechargeable lithium batteries</b>
<b>18650B2 (3.7V)</b>	<b>Normal Power: 120 hours High Power: 30 hours</b>
<b>Temperature</b>	<b>Under 250° F (121° C)</b>
<b>Battery Voltage</b>	<b>8.4V—12.6V</b>



### 9.3: Digital Information

- **Pitch:** From -100% to +100% with 0.1% resolution within the range of -45% to +45% and 1.0% resolution outside of that range.
  - **Roll:** 24 transmitter roll positions.
  - **Battery:** Install batteries positive side down and install battery cap with provided battery cap tool.
    - **Lithium:** Echo Power Cell will show full until completely dead.
    - **Eco Cell Kit:** Rechargeable Lithium Echo Cell Kit will meter battery life while discharging.
- Note:** See 7.5.4 to select battery style that will be used in transmitter.
- **Temperature:** When the transmitter is overheating, temperature indication in the receiver's display flashes. If temperature reaches over 190° transmitter may be permanently damaged.

### 9.4: Transmitter Maintenance

- Do not place the transmitter near excessive temperature over 190°F.
- Do not apply excessive pressure, shock or vibration on the transmitter.
- Take the battery out of the transmitter after use.
- Clean the spring and cap on the battery compartment when necessary.
- Regularly check the sealing ring on the battery cover. Replace if necessary.

# 10: Locating Methods

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One major advantage of the Mag system is its simplicity. Once the receiver and the transmitter are paired, the operator is not required to push any buttons to pinpoint the location, direction or depth of the transmitter.

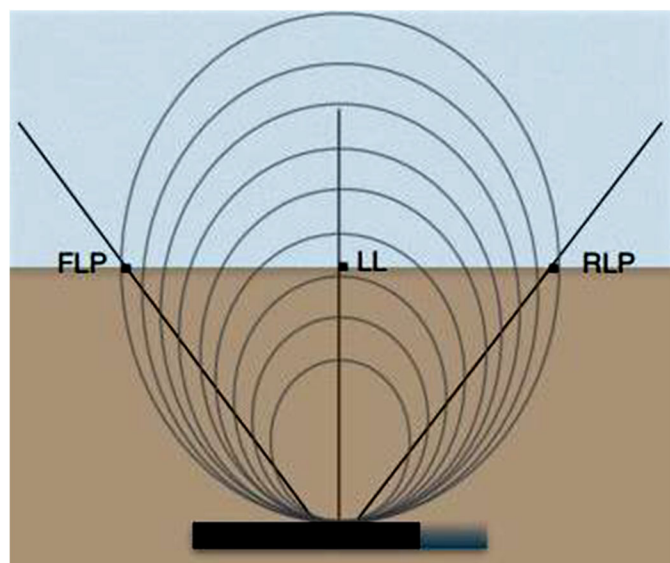
## 10.1: Three Point Locating

### 10.1.1: The Basics

The Mag receiver locates the transmitter by pinpointing three specific locations along the transmitter's magnetic field. The front locate point (FLP) ahead of the transmitter, the rear locate point (RLP) behind the transmitter and the locate line (LL) above the transmitter.

For the most accurate location and depth of the transmitter, both the FLP and the RLP should be located before locating the LL. The front and rear locate points, when lined up, indicating the exact direction of the transmitter.

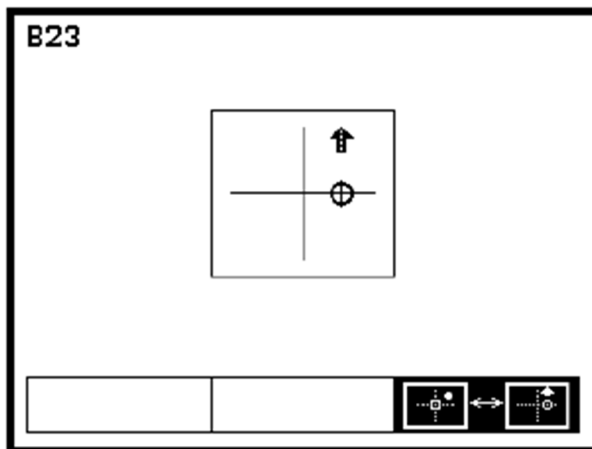
If the transmitter is level, the locate line will be located directly in-between the two points.



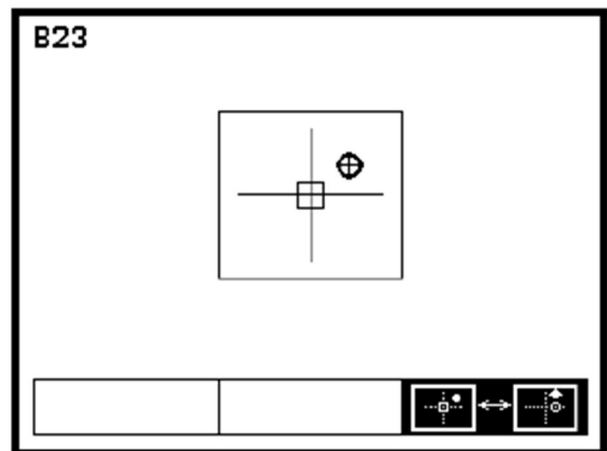
### 10.1.1: Continued

Underground Magnetics offers a unique and versatile Graphical User interface. This allows the operator to choose between two GUI methods, Single Point or Single Ball. Single Point displays arrows leading you to the closest locate point, Single Ball shows the location of the closest locate point with a ball only. Move in the direction of the ball to pinpoint the location.

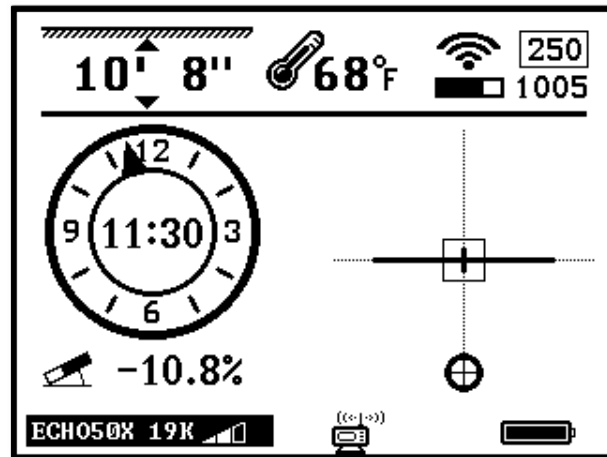
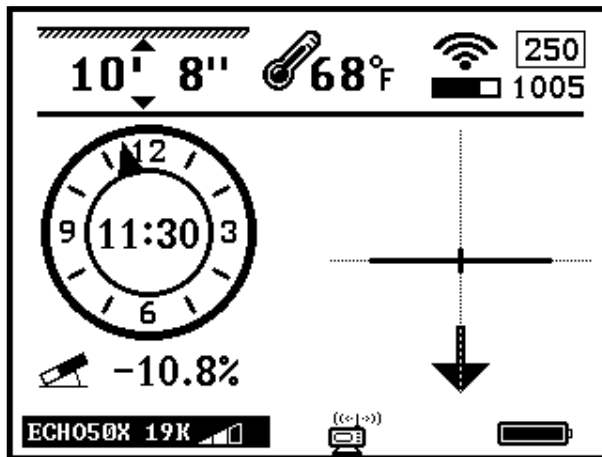
This next section will show in detail these two methods and how to use them. The screens below show the same location over the head, one in Single Point and the other in Single Ball.



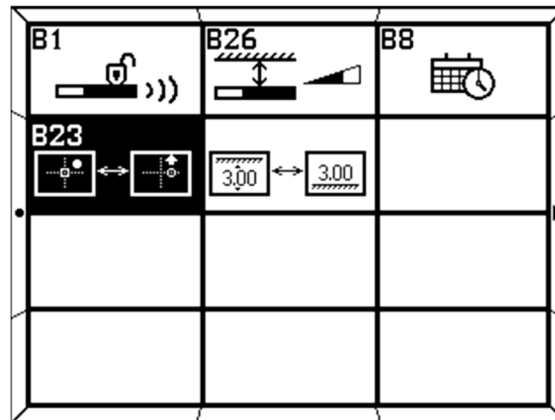
Single Point Locating Mode



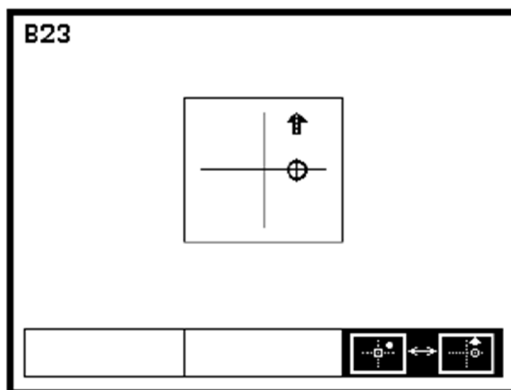
Single Ball Locating Mode



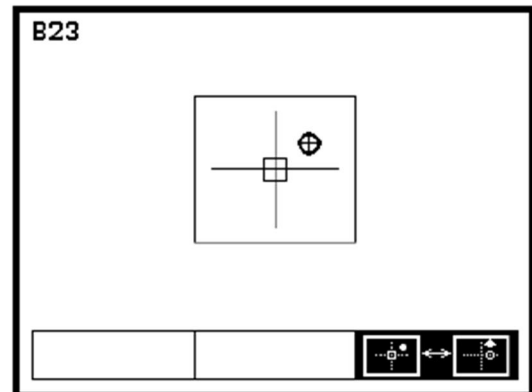
## 10.1.1: Continued - Single Point, Single Ball Selection Page



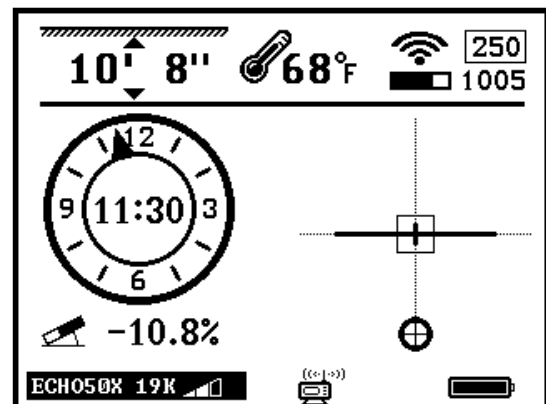
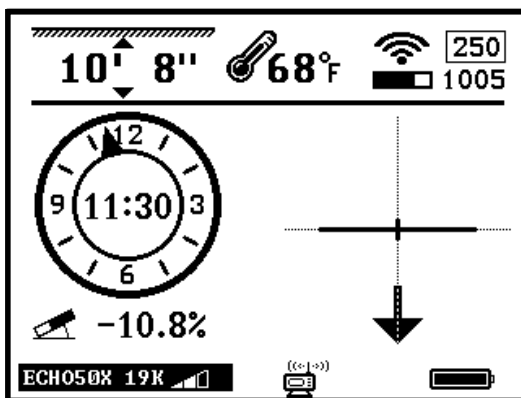
1. Press and hold to enter Setup Page. Tap until you move to the Second Setup Page and select B23.
2. Tap to enter Single Point, Single Ball Selection Page.
3. Tap to choose either Single Point or Single Ball locating modes.



Single Point Locating Mode

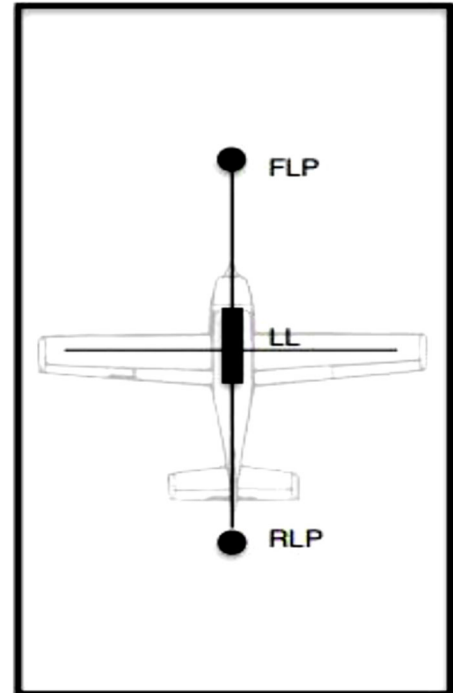


Single Ball Locating Mode

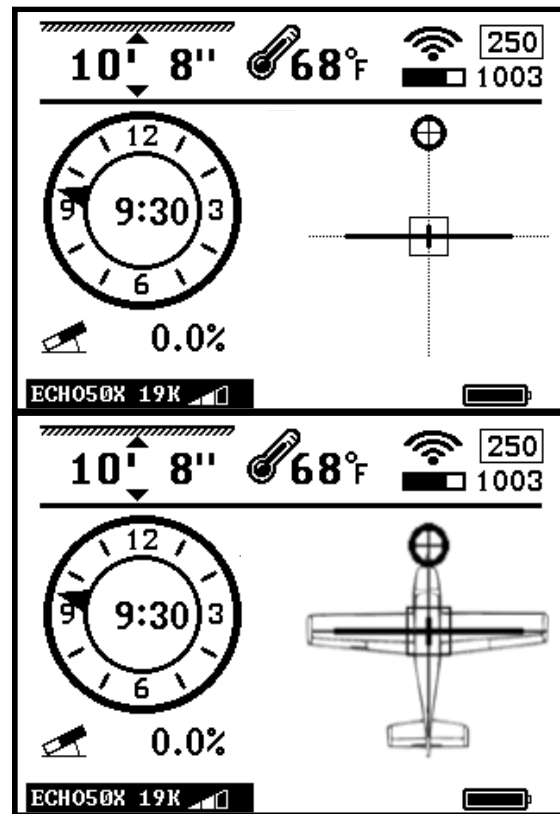
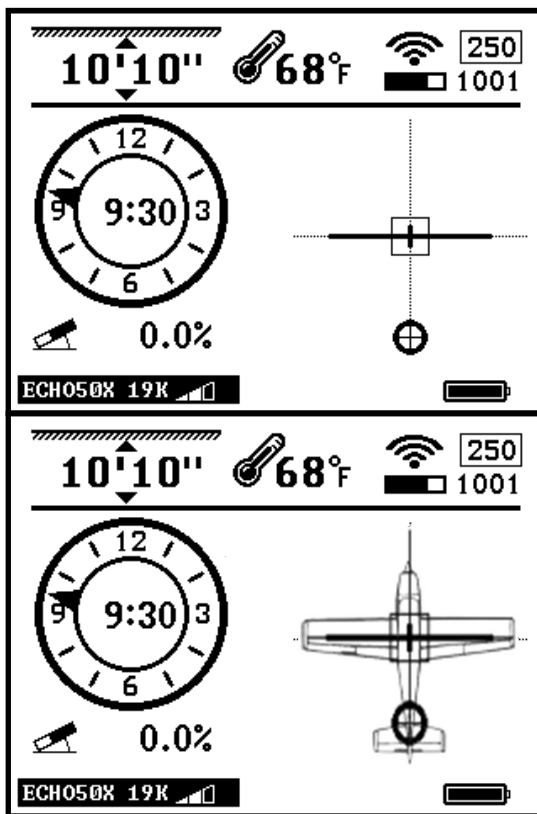


### 10.1.2: Find the Transmitter

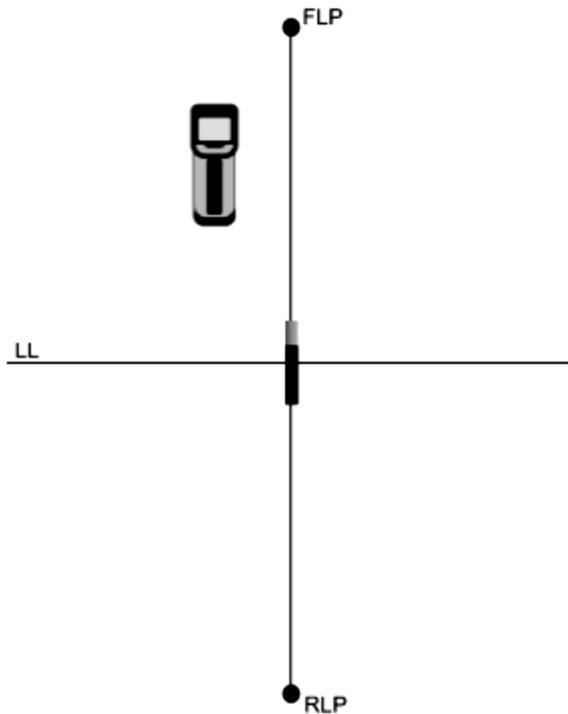
The Locate Line (LL) extends left and right of the transmitters center. Because of the physics of the locators magnetic field, the LL can look the same several feet to the right or left of the transmitters actual location. This is why it is important to at least locate the front locate point (FLP) first before moving back to locate the head. For pinpoint location, find both the FLP and RLP before moving over the head. Draw a string line between the FLP and the RLP and your head will be directly in line and in between these points.



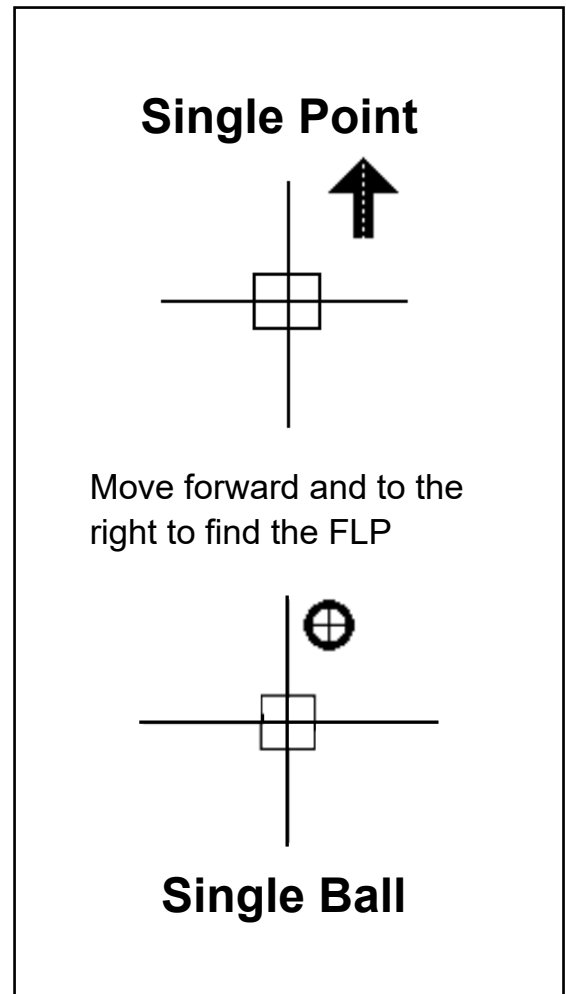
Think of the transmitter as the shape of an airplane. The FLP is the nose and the RLP the tail. Find the FLP and the RLP and the center of the transmitter is centered over the wings.



## 10.1.2: Finding the Front Locate Point



**Actual position of receiver  
to transmitter**



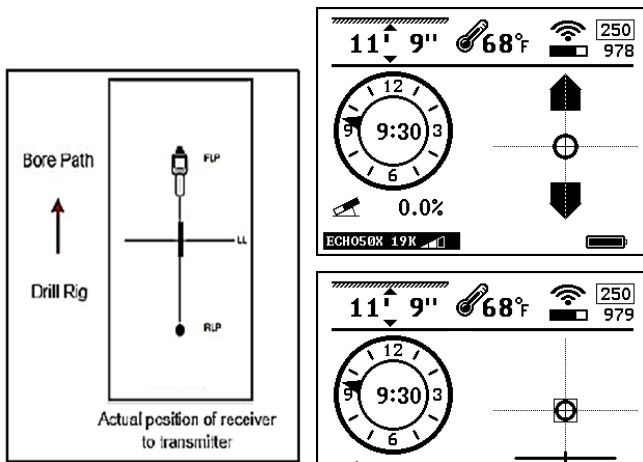
**Receiver View**

In this scenario the transmitter is behind you and you are walking toward the FLP.

Notice how the arrow that indicates the nearest locate point is slightly to the right and has a narrow base. Its position lets you know the FLP's right-left information relative to the receiver. The width of the base lets you know how close or far the FLP is from you. A skinnier base means you are further away, and a completely filled in base means you're about to cross the FLP.

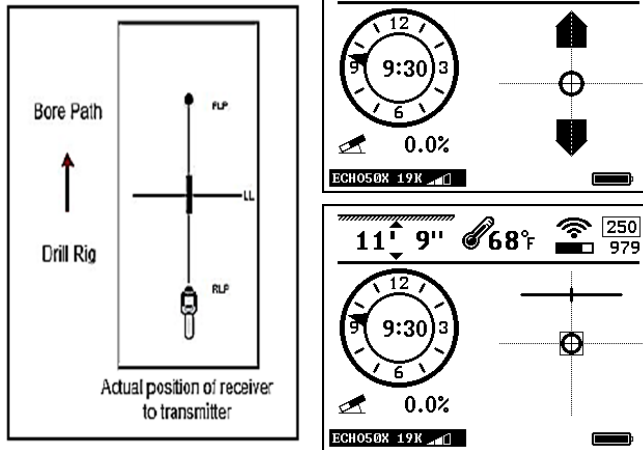


## 10.1.2: Locating FLP, RLP and LL

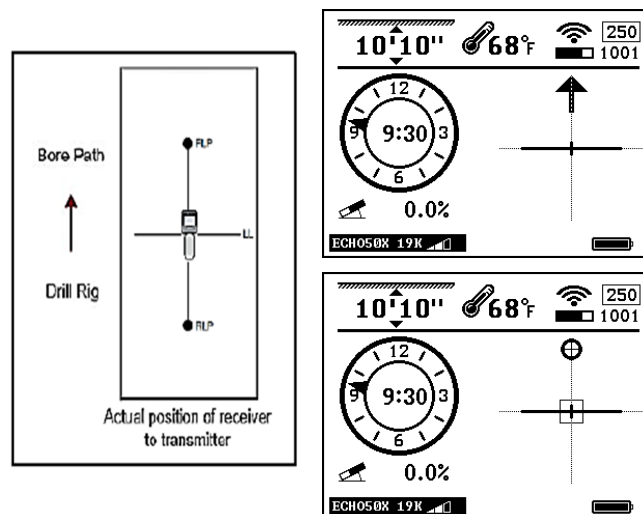


The FLP is a point in front of the transmitter. Think of it as the sight at the end of a rifle. This is the direction of the transmitter.

Locate it by putting the ball in the square. In Single point, move in the direction of the arrow until the ball appears.




Next, find the RLP. The RLP is a point behind the transmitter and will look just like the FLP. Find it the same way by moving back until the arrows point back and the ball appears in the square.



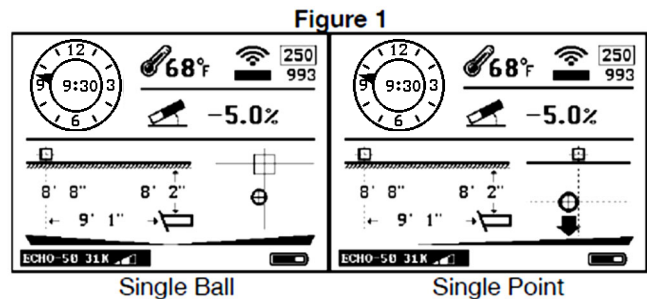
Then, imagine a line that runs through the FLP and RLP. Walk along that line until the LL indicator on the receiver screen enters the square. You are now above the LL or head

### 10.1.3: Tracking on the Fly

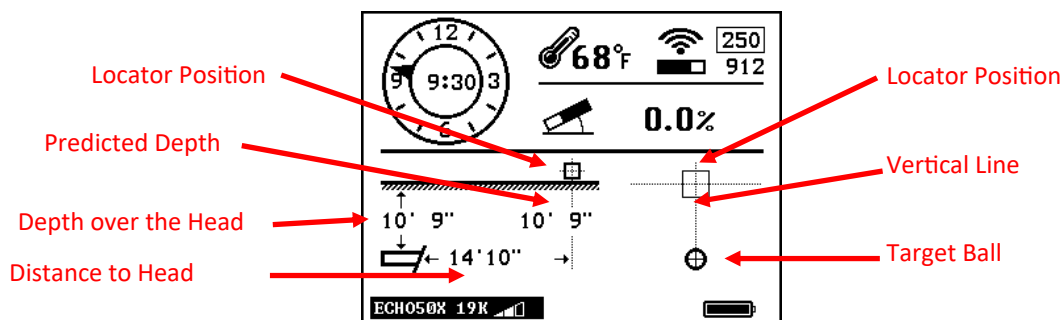
Tracking on the fly may be used once the bore path is established and level. This tracking method will increase locating speed and in turn the speed at which the bore can be completed. Activate the Bore-To screen by pressing the enter  button at anytime. To return to normal walkover mode, simply press the enter button again. For more accurate left right sensitivity, always stay out front of the FLP when using Bore-To.

Note: Both the operator of the drill and the locator see the same screen in both modes, this way minimal communication is needed between the two operators. Simply keep the Target Ball centered and you're headed directly to the receiver.

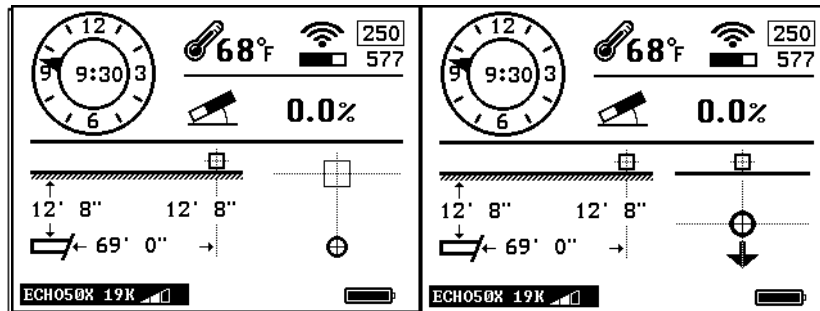
Depth is displayed in real time correcting for pitch changes giving both operators the ability to see the **Predicted Depth** of the head if drilled all the way to the receiver. In Figure 1 view, you'll notice the head is 9'1" behind the locator and headed slightly left of center. Because the pitch is minus 5%, the calculated depth will be 8'8" deep when the transmitter arrives.



The process for tracking on the fly is quite simple, after the first rod or two and after establishing line and desired pitch, move forward of the FLP the same distance as one rod length. In other words, if you are using 10' drill pipe, move 10' ahead of the last FLP. Place the locator on the desired bore path and point the locator where you want to go. If the transmitter is pointing directly at your locator, you will see the **Distance to the Head** and the **Target Ball** directly on the **Vertical Line** indicating you're heading directly at the locator. Keep pitch at the desired angle to show the correct **Predicted Depth** and **Depth over the Head**.



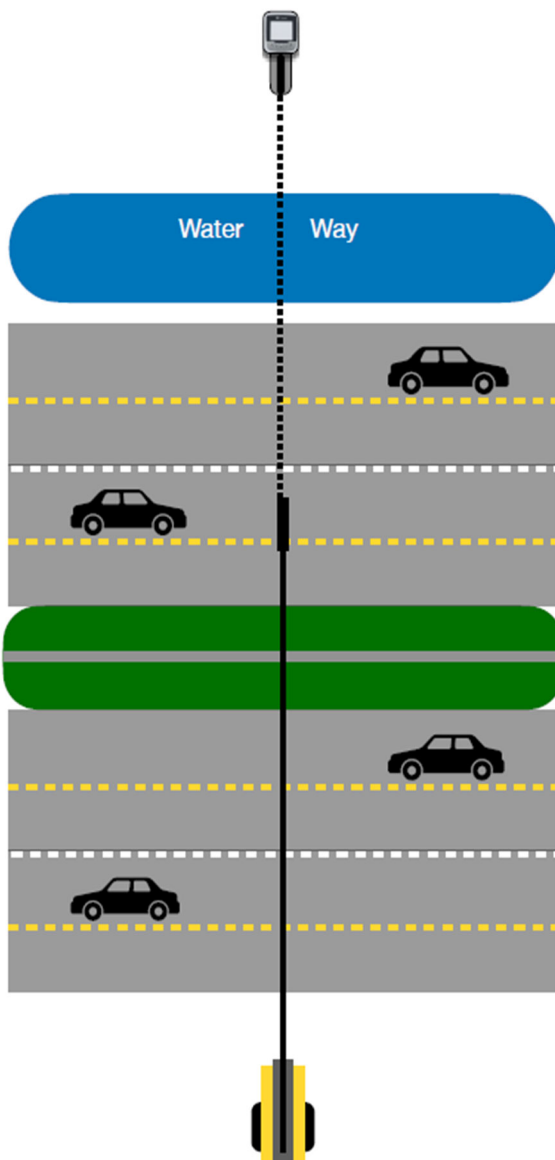
## 10.1.4: Bore-To



Single Ball

Single Point


The Bore-To feature on the Mag system is very powerful. Operators can expect to receive good right-left steering, pitch and roll information as far out as 100ft.



It is important to note that the depth is only a reference.

As distance between the transmitter and receiver decreases, the accuracy increases.

Never cross existing utilities while in Bore-To mode without exposing and verifying visually their location.

To switch the receiver to Bore-To mode, tap the enter  button from the main page.

To return to Walkover mode, simply tap enter again.

The display screen on both the receiver and the remote display will look the same.

# 11: Battery and Charger

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Mag receivers use rechargeable lithium batteries.



This lithium rechargeable battery comes with a special charger. Any use of other lithium rechargeable battery or charger for the receiver may cause fire, explosion, leaking or other damages.



Store the battery at the room temperatures; 59-77° F (15-25°C). Extreme high or low temperatures will shorten the battery life.

- Do not submerge the battery in water or any other liquids.
- Do not throw the battery into fire.
- Do not disassemble the battery.
- Avoid any kind of damage to the battery.
- Please dispose of lithium properly.



When charging the battery, the red light will shine. When charging is complete, a green light will shine

## 12: Warranty Policy

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Underground Magnetics (UM) warrants that it will either repair or replace any product that fails to operate in conformity to UM's published specifications at the time of shipment due to a defect in materials or workmanship during the warranty period for that product, subject to the terms set forth below.

Warranty Period: All UM Transmitters, One year from date of purchase. Receivers, Remote Displays, Battery Chargers and Rechargeable Batteries (receiver and display) one year from the date of purchase. Software One year from date of purchase. Other Accessories Ninety days from date of purchase. Service/Repair Ninety days from date of repair. For software products, UM warrants that it will update any defective software to bring it into material compliance with UM's specifications for such software. The above warranties only apply to new products purchased directly from UM or from a UM authorized dealer. The ultimate determination of whether a product qualifies for warranty replacement shall be at UM's sole discretion. Exclusions: Transmitters that have exceeded the maximum temperature, as indicated by the system. Defect or damage caused by misuse, abuse, improper installation, improper storage or transport, neglect, accident, fire, flood, use of incorrect fuses, contact with high voltages or injurious substances, use of system components not manufactured or supplied by UM, failure to follow the operator's manual, use other than that for which the product was intended or other events beyond the control of UM. Any transmitter used with an improper housing, or damage caused to a transmitter from improper installation into or retrieval from a housing. Damage during shipment to UM. Any modification, opening up, repair or attempted repair of a product, or any tampering or removal of any serial number, label or other identification of the product, will void the warranty. UM does not warrant or guarantee the accuracy or completeness of data generated by HDD locating systems. The accuracy or completeness of such data may be impacted by a variety of factors, including (without limitation) active or passive interference and other environmental conditions, failure to calibrate or use the device properly and other factors. UM also does not

## 12: Warranty Policy continued

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warrant or guarantee, and disclaims liability for, the accuracy and completeness of any data generated by any external source that may be displayed on a UM device, including (without limitation) data received from a drill rig. UM may make changes in design and improvements to products from time to time. UM shall have no obligation to upgrade any previously manufactured UM product to include any such changes. THE FOREGOING IS THE SOLE WARRANTY FOR UM PRODUCTS. UM DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE. IMPLIED WARRANTY OF NON-INFRINGEMENT, AND ANY IMPLIED WARRANTY ARISING FROM COURSE OF PERFORMANCE, COURSE OF DEALING, OR USAGE OF TRADE, ALL OF WHICH ARE HEREBY DISCLAIMED. In no event shall UM or anyone else involved in the creation, production, sale or delivery of the UM product, including but not limited to indirect, special, incidental, or consequential damages, or for any cover, loss of information, profit, revenue or use, based upon any claim for breach of warranty, breach...

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