

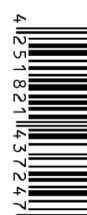


## CARLOC

### Utility Locating System

## USER GUIDE

Issue: C (08/2021) - EN  
Article number: 87077





## Consultation with Megger

The present system manual has been designed as an operating guide and for reference. It is meant to answer your questions and solve your problems in as fast and easy a way as possible. Please start with referring to this manual should any trouble occur.

In doing so, make use of the table of contents and read the relevant paragraph with great attention. Furthermore, check all terminals and connections of the instruments involved.

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This warranty does not cover wear parts, lamps, fuses, batteries and accumulators.

Megger reject all further claims under warranty, in particular those from consequential damage.

Each component and product replaced in accordance with this warranty becomes the property of Megger.

All warranty claims versus Megger are hereby limited to a period of 12 months from the date of delivery. Each component supplied by Megger within the context of warranty will also be covered by this warranty for the remaining period of time but for 90 days at least.

Each measure to remedy a claim under warranty shall exclusively be carried out by Megger or an authorized service station.

This warranty does not apply to any fault or damage caused by exposing a product to conditions not in accordance with this specification, by storing, transporting, or using it improperly, or having it serviced or installed by a workshop not authorized by Megger. All responsibility is disclaimed for damage due to wear, will of God, or connection to foreign components.

For damage resulting from a violation of their duty to repair or re-supply items, Megger can be made liable only in case of severe negligence or intention. Any liability for slight negligence is disclaimed.

Since some states do not allow the exclusion or limitation of an implied warranty or of consequential damage, the limitations of liability described above perhaps may not apply to you.

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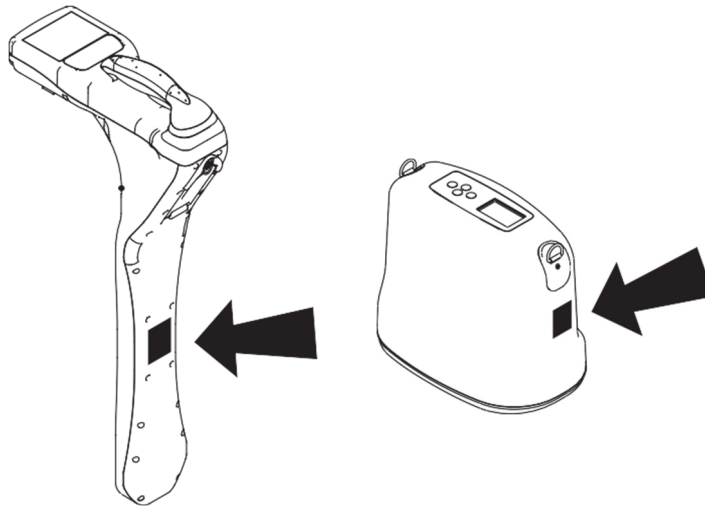
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# OVERVIEW

## Serial Number Location

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



Item	
date of purchase:	
receiver serial number:	
transmitter serial number:	

## System Components

### Receiver (RX)

Model Description	Standard Features	Important
CARLOC	Receiver: up to 100 frequencies, configuration software	
CARLOC PLUS	Receiver: up to 100 frequencies, configuration software, radio transmitter, RX/TX communication, ambient noise technology	If using with software version 22 or higher, CARLOC PLUS transmitters will need to be updated to software version 12 or higher

### Transmitter (TX)

Model Description	Standard Features	Important
CARLOC 5W	Transmitter: 5-Watt output, up to 100 frequencies, configuration software	
CARLOC 5W PLUS	Transmitter: 5-Watt output, up to 100 frequencies, configuration software, RX/TX communication	If using with software version 12 or higher, CARLOC PLUS receivers will need to be updated to software version 22 or higher
CARLOC 5W PLUS	Transmitter: 12-Watt output, up to 100 frequencies, configuration software	
CARLOC 12W PLUS	Transmitter: 12-Watt output, up to 100 frequencies, configuration software, RX/TX communication	If using with software version 12 or higher, CARLOC PLUS receivers will need to be updated to software version 22 or higher

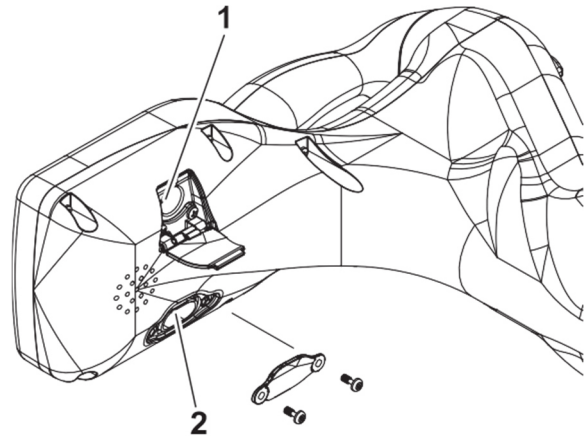


# Accessory Ports

## Receiver (RX)

### Accessory Port (1)

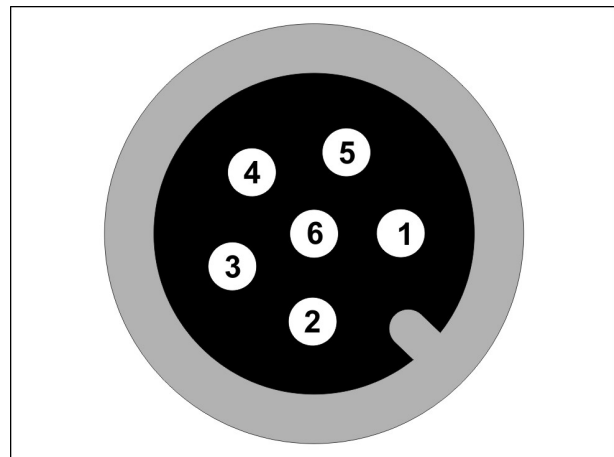
This port is intended to be used with only Megger approved accessories such as the fault finding probe. Only use accessories that meet the specifications of Megger.



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### Accessory Port (1) Pinout

Pin	Description
1	3.0Vdc (50mA max)
2	Digital input/output OR UART Rx (115.2 kbps) (logic 3.0Vdc)
3	Digital input/output OR UART RX (115.2 kbps) (logic 3.0Vdc)
4	Analog input (0-3.0Vdc) (Accessory ID)
5	Digital input/output OR Analog input (logic 3.0Vdc)
6	Common



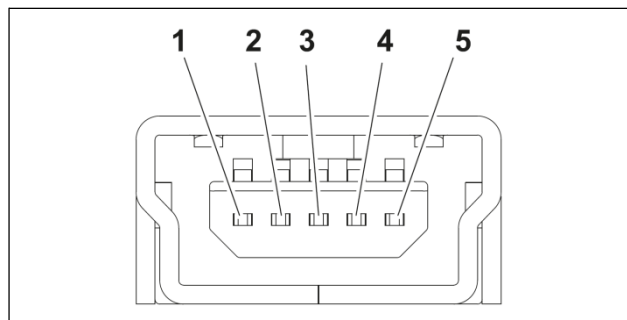
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**Mini-USB Port (2):**

This port is intended to be used for connecting to a PC to update software and change the user configuration of the receiver using the PC software.

**Mini-USB Port (2) Pinout**

Pin	Description
1	VBUS
2	USB Data -
3	USB Data +
4	N/C
5	Device ground



This USB port does not provide 5Vdc on pin 1, but the receiver is powered by the 5Vdc from the PC USB while connected to the PC. Only connections to safety certified devices are allowed (e.g. IEC61010-1, UL/ IEC 62368-1).

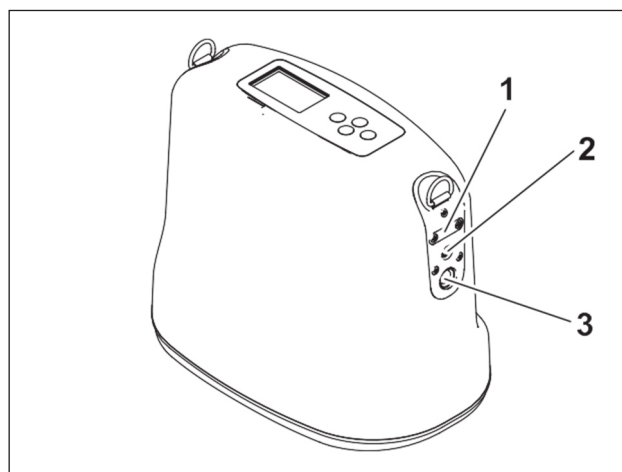
**IMPORTANT:** Always replace sealed cover over USB connector after use.

**Transmitter (TX)**

The transmitter has three auxiliary ports:

1. Mini-USB port
2. External power connector port
3. Active location device port

**IMPORTANT:** All leads, test probes, and external circuits that connect to the transmitter must provide reinforced electrical insulation to protect the user and must meet the requirements of the safety standard IEC 61010-1:2010.



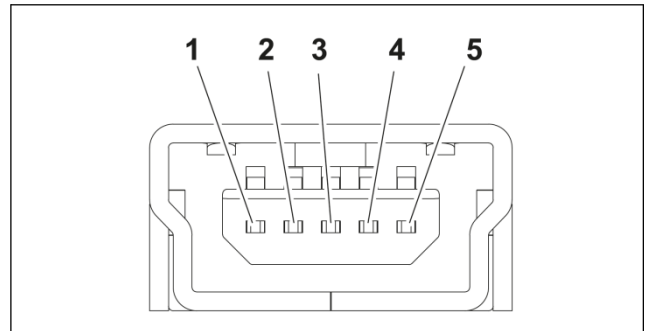
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**Mini-USB Port (1):**

This port is intended to be used for connecting to a PC to update software and change the user configuration of the transmitter using the PC software.

**Pinout**

Pin	Description
1	VBUS
2	USB Data -
3	USB Data +
4	N/C
5	Device ground



This USB port does not provide 5Vdc on pin 1. When connected to the PC, the transmitter's display and control logic only are powered from the 5Vdc from the PC USB port.

**IMPORTANT:** Always replace sealed cover over USB connector after use.

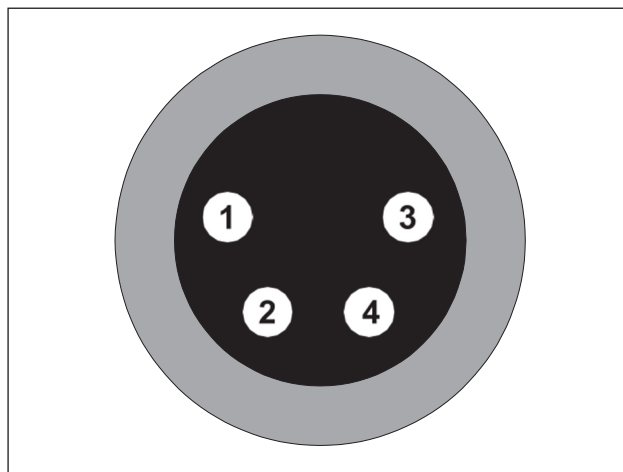
### External Power Connector (2):

This connector is intended to be used for an optional 12Vdc supply to power the transmitter. Only use a power supply with a voltage output rating of 10-15Vdc and with current rating of 2.5A maximum.

Connect only with Megger approved external power cable and fusing (p/n 222-3808).

#### Pinout

Pin	Description
1	10-15Vdc input
2	10-15Vdc input
3	Device ground
4	Device ground



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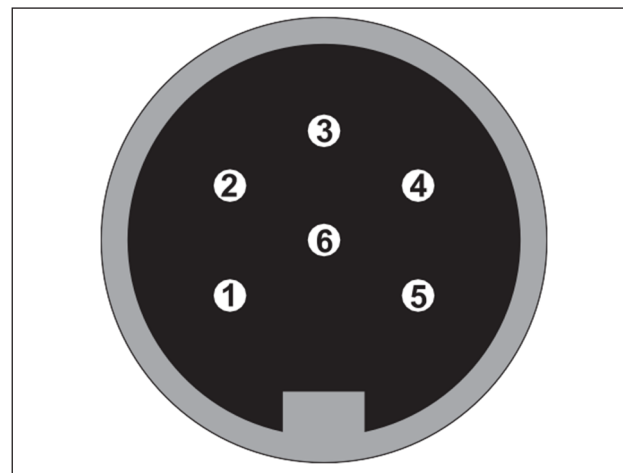
### Active Location Device Port (3)

This port is intended to be used with only Megger approved accessories such as the direct connect cable, Live Power Adapter, or induction clamp.

Only use accessories that meet the specifications of Megger.

#### Pinout

Pin	Description
1	Output 1 (AC 256Hz to 200kHz, 75Vrms max) (500mA max)*
2	Output return
3	Direct connect ID (3.3V or device ground) identifies the direct connect cable when attached
4	Inductive clamp ID (3.3V or device ground) identifies the induction clamp when attached
5	Device ground
6	Output 2 (AC 256Hz to 200kHz, 75Vrms max) (500mA Max)*



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\*Both outputs cannot be used at the same time

## Intended Use

The CARLOC Series receivers are designed to locate buried pipes and cables. Over 70 frequencies and four modes of operation are available to suit your specific locating needs.

The 5W and 12W transmitters place signals on target cables to be detected by CARLOC Series receivers. These units can be configured to send over 70 frequencies as well as custom frequencies. The transmitters place a signal on the cable through either direct connection, induction clamping, or broadcast modes.

The fault probe accessory is designed to locate fault signals generated by transmitters in de-energized cables that are disconnected on both ends. It allows users to find faults on direct-buried power, telephone, cable, and sheathed tracer wire.

The EML accessory is designed to locate electronic markers on pipes and cables. It allows users to find any standard electronic marker, used to mark specific locations for future locating.

The Live Power Adapter is intended to protect the transmitter from damage due to connection to live electrical power.

The stethoscope accessory is used to identify lines in cabinets with multiple lines.

Only connections to safety certified devices are allowed (e.g. IEC 61010, UL/IEC 62368-1) with USB port.

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.

## **EU Declaration of Conformity**

Hereby, Megger declares that the radio equipment type *CARLOC* is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available by request.

## 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.

# SAFETY

## Guidelines

Follow these guidelines before operating any jobsite equipment:


- The CARLOC Series system should be operated only by persons familiar with its particular characteristics and acquainted with the relevant safety procedures, otherwise the protection provided by the equipment in this system may be impaired.
- Locally applying regulations have to be observed!
- 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.
- Use genuine accessories to ensure system safety and reliable operation. The use of other parts is not permitted and invalidates the warranty.





## 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.

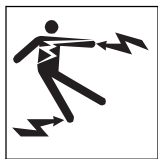
 **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.


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.

**To help avoid injury:**

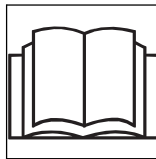
- Do not use live power adapter unless you are properly qualified to work on live power conductors.
- Check that equipment is in good condition and that test leads are clean and have no cracked insulation.
- Have qualified utility personnel disconnect both ends of cable before working.
- Do not operate transmitter near explosive devices or blasting operations.



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



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



**! WARNING** Read operator's manual. Know how to use all controls. Your safety is at stake.



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



**! WARNING HIGH VOLTAGE.** This device produces electric current that could cause death or serious injury. Do not touch the clips on the HV output unless wearing electrically insulating gloves. Follow proper procedures.

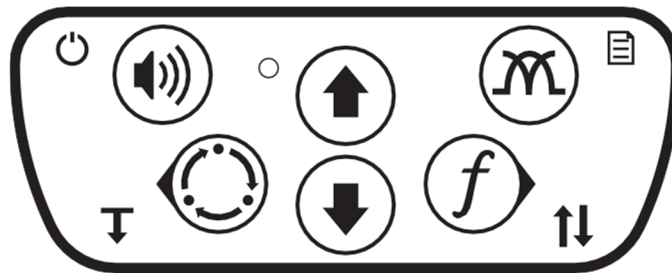


**! WARNING** Battery cells inside may vent or rupture. Do not crush, do not heat or incinerate, do not short circuit, do not dismantle, do not immerse in any liquid. Observe charging instructions.

# CONTROL ICONS













## Receiver

### Receiver Keypad



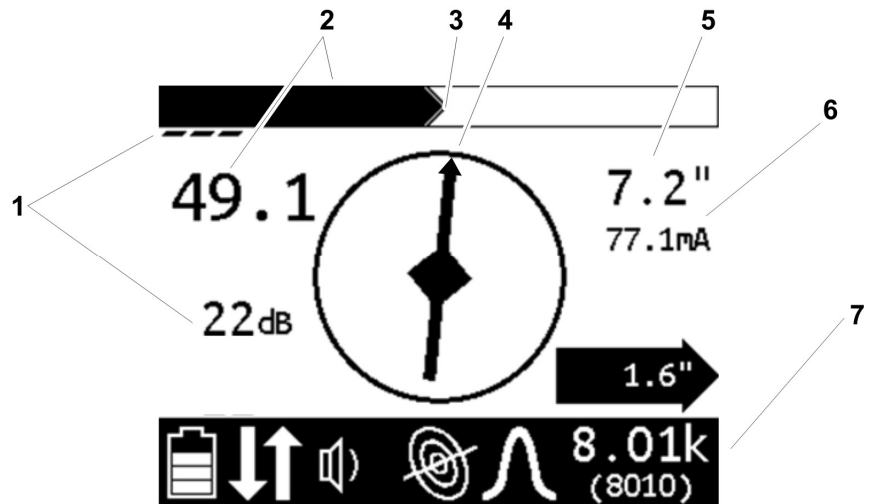
Keypad buttons perform several functions depending on operating mode. To activate most functions, press and release the button. For other functions, press and hold the button until the function activates.

#### Receiver Keypad Icons

 Power ON/OFF (press and hold)		 Antenna Configuration
 Volume Exit Menu	 Up	 Menu (press and hold)
 Location Mode		 Frequency
 Back	 Down	 Select / Next
 Depth (press and hold)		 Set or reset Direction Enable (press and hold)

## Receiver Display

1. Gain
2. Signal strength
3. Peak signal
4. Compass
5. Estimated depth
6. Current meter
7. Unit status bar (see below)




























### Status Bar Icons

Battery level	Line mode	Twin peak antenna
Battery exhausted (receiver will shut off)	Auto Gain mode	Null antenna
Direction enable feature active	Beacon mode	Single peak antenna
Volume level	Radio mode	Total field antenna
No communication from transmitter	Power mode	
Frequency not available from transmitter	Fault mode *	Selected frequency setting
	EML mode *	
	Stethoscope mode *	* Shown when accessory is connected

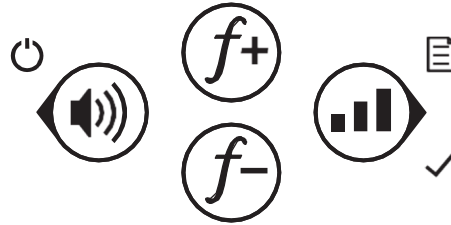
## Receiver Menus

Menus allow the operator to set user interface preferences. Use the up, down, select/next, and back buttons on the keypad to navigate the menu.

Receiver Menu Icons		
 Configuration	 Frequencies	Select frequencies to activate. Icons show which mode is suited for each frequency:  Power  Beacon  Line
	 Modes	Select modes to activate.
	 Antennas	Select antennas to activate.
 Settings	 Language	Select user interface language
	 Units	Select measurement units for distance and depth
	 Backlight	Select backlight setting
	 Shutdown Timer	Set amount of time before unit shuts off
	 Communications	Select communication preference
 Options	 Audio	 Audio Mode - Select audio mode setting
		 Audio Style - Select audio style setting
		 Center Beep - Select center beep options
	 Gain	Select gain options
	 L/R Arrows	Turn left and right arrows on or off
	 Autodepth	Select automatic or manual depth
	 System Information	 System Info
 Ambient Noise	Ambient noise measurement; measures and displays interference (noise) at all frequencies in the selected mode. See page 37.	
 TX Control	Displays transmitter information.	







# Transmitter

## Transmitter Keypad

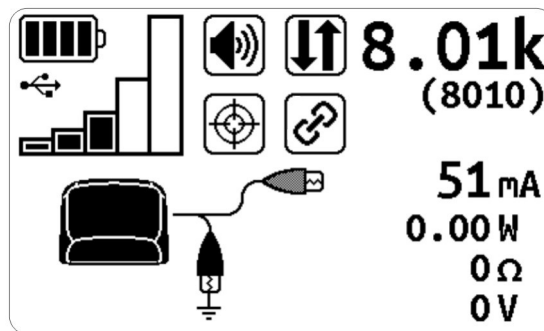


Keypad buttons perform several functions depending on operating mode. To activate most functions, press and release the button. For other functions, press and hold the button until the function activates.

### Transmitter Keypad Icons

 Power ON/OFF (press and hold)	$f+$ Frequency / Up	 Power output
 Volume	$f-$ Frequency / Down	 Select / Next
 Back		 Menu (Press and hold)

### Transmitter Display






















The transmitter display shows the status of selected options as well as the active frequency and meter reading.

#### Transmitter Display Icons

Battery level	Volume on	Linked to receiver
External power connected	Volume off	
USB connected	Direction enable active	Inductive clamp connected
Output power level	Output has reached regulation	Induction active
High power output enabled	Output interrupted	Direct-connect leads connected

## Transmitter Menus

Menus allow the operator to set user interface preferences. Use the up, down, select/next, and back keypad buttons to navigate the menu.

Transmitter Menu Icons		
 Settings	 Backlight	Select backlight setting
	 Output	Select output setting:  Direction enable  Dual output  High power output
	 Meter	Select simple or advanced meter
	 Communications	Select communication preference
 Options	 Language	Select user interface language
	 Defaults	Restores unit to factory default settings.
	 Shutdown timer	Set amount of time before unit shuts off
	 Fault mode	Enable or disable fault mode
 Frequencies	Select frequencies to activate.	Icons show which connection can be used for each frequency:  Induction  Direct connect  Induction clamp, standard  Induction clamp, broadband
 System Information	Displays the unit model configuration, model number, serial number, software version, hour count, configuration date, and calibration date.	

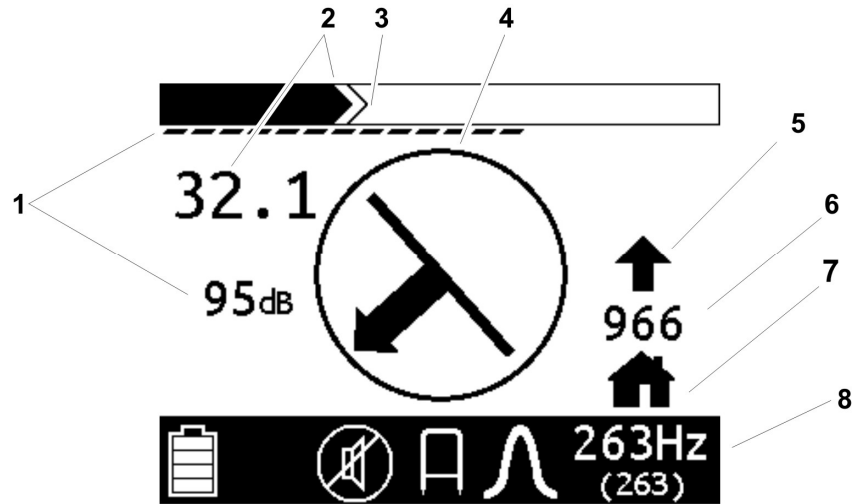


## Fault Finder Accessory





The receiver and transmitter require setup when using the fault finder accessory. Key functions and information displayed will be specific to the fault finder.

### Receiver Display

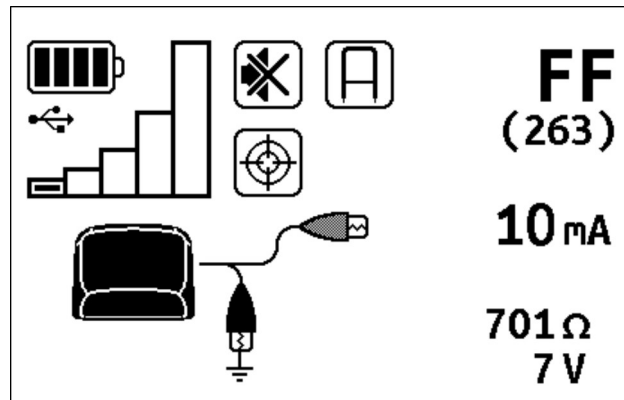
1. Gain
2. Signal strength
3. Peak Signal
4. Compass
5. Fault direction indicator
6. Current meter
7. Homing indicator
8. Unit status bar (see below)



### Status Bar Icons

 Receiver battery level	 Fault Mode indicator	Selected frequency setting
 Volume level	 Antenna indicator	













## Transmitter Display



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The transmitter display shows the status of selected options as well as the active frequency and meter reading.

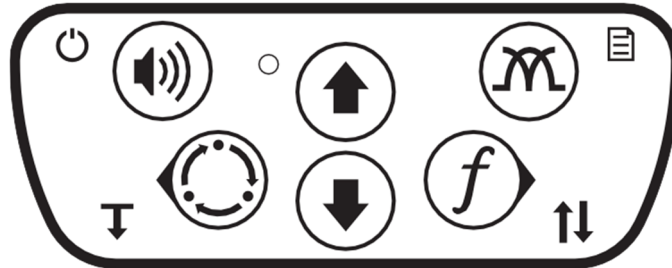
### Transmitter Display Icons

 Battery level	 Volume on  Volume off	 Linked to receiver
 External power connected	 <b>FF</b> Fault finder mode indicator	
 USB connected	 Output power level	 Direct-connect leads connected
 High power output enabled	 Output active	
	 Output interrupted	

## EML Accessory

Receiver key functions and information displayed will be specific to the EML accessory.

### Receiver Keypad

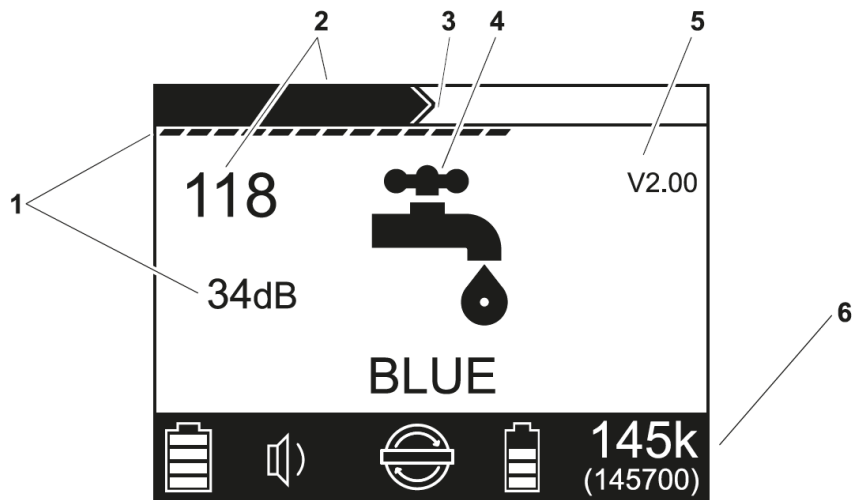


To activate most functions, press and release the button. For other functions, press and hold the button until the function activates.

Receiver Keypad Icons		
Power ON/OFF (press and hold)		not used
Volume	Up	not used
Mode selector		Frequency
not used	Down	not used
not used		not used

## Receiver Display

1. Gain
2. Signal strength
3. Peak signal
4. Marker ball indicator (see below)
5. EML accessory software version
6. Unit status bar (see below)

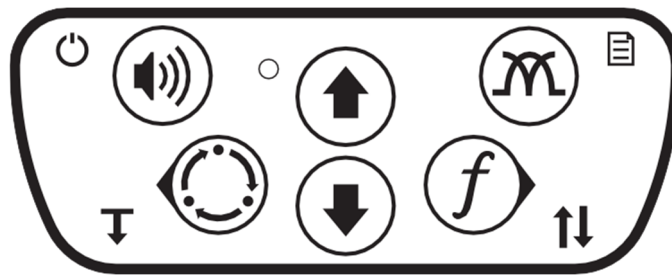


Status Bar Icons	Marker Ball Indicators
Receiver battery level	Water (blue, 145k) Non-potable water (purple, 66.3k)
Volume level	Power (red, 169k, non-EU only) Power (red/blue, 134k, EU only)
EML normal mode indicator	Waste water (green, 121k)
EML search mode indicator	Communications (black/orange, 77.0k)
EML accessory battery level	Phone (orange, 101k)
selected frequency	Gas (yellow, 83.0k)

## Stethoscope Accessory

The stethoscope accessory is used to identify lines in cabinets with multiple lines. It has an adjustable neck to make it easier to identify target lines in tight spaces.






### Receiver Controls Used with Stethoscope



e180m007h.eps

Receiver key functions and information displayed will be specific to the stethoscope accessory.

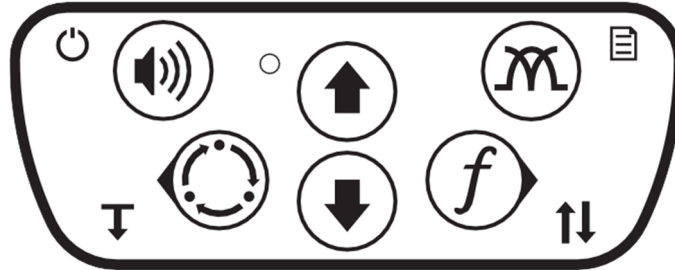
#### Receiver Keypad Icons

	Power ON/OFF (press and hold)	 Up	
	Location Mode	 Down	 Frequency

## GPS Capability

The GPS capability is used to log locate data from the CARLOC receiver to the GPS unit or log data in the receiver. This feature is only available on the CARLOC PLUS receivers.






### Receiver Controls Used with GPS



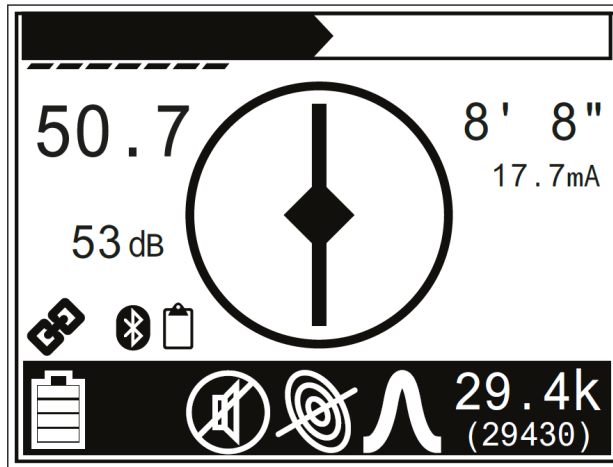
e180m007h.eps

Receiver key functions and information displayed will be specific to the GPS accessory.







#### Receiver Keypad Icons

	Power ON/OFF (press and hold)	 Up	
	Location Mode	 Down	 Frequency

Receiver Display



GPS Indicators

 A Bluetooth® connection is active	 Last data point failed to send data to the GPS device
 Flashes once to indicate a data point was logged  Flashes repeatedly to indicate attempt to call external logging GPS device	 Center dot flashes to indicate GPS data being received, but no GPS lock  Lights solid to indicate GPS data being received and GPS lock established













# LOCATE

## Prepare





### Select Mode

CARLOC Series receivers detect active and passive signals. Select the mode best suited for jobsite and user preference. Depending on the receiver model, all modes might not be available.

Signal Mode/Type	Description	Notes
<b>Active Signals:</b>	Signal placed on a target line with a transmitter	
 Line mode	 Direct Connection	(preferred method) requires a connection directly to the target line
	 Clamp Induction	requires placing an optional induction clamp around the target line
	 Broadcast induction	sends current into lines near the transmitter
 Auto Gain mode	Same as line mode	Fully automatic gain control with the left/right audio
 Beacon mode	Signal transmitted from a beacon inside a pipe or conduit	
<b>Passive Signals:</b>	Signal that a utility line picks up from the environment	
 Power mode	Allows receiver to trace live 50 Hz or 60 Hz power cables	<b>IMPORTANT:</b> Current must be flowing through the cable.
 Radio mode	Allows receiver to trace cables that pick up and radiate very low frequency (VLF) radio waves	

## Select Antenna Configuration

Select the antenna configuration best suited for the locating jobsite.

Antenna	Description	Advantage / Disadvantage
 Single Peak	Uses one horizontal antenna to detect signal. Response is highest at strongest signal.	more range / less precise
 Twin Peak	Uses two horizontal antenna to detect signal. Response is highest at strongest signal.	noise canceling / most precise / less range
 Null	Uses a vertical antenna to detect signal. Search width is narrower than single peak. Response is lowest when receiver is over the line.	sharp response / easily distorted in congested areas
 Total Field	Uses a combined signal measured in all three axes to locate signal.	easy to use when sweeping and eliminates ghost signals / less precise in congested areas

## Link Receiver to Transmitter (CARLOC PLUS Units)

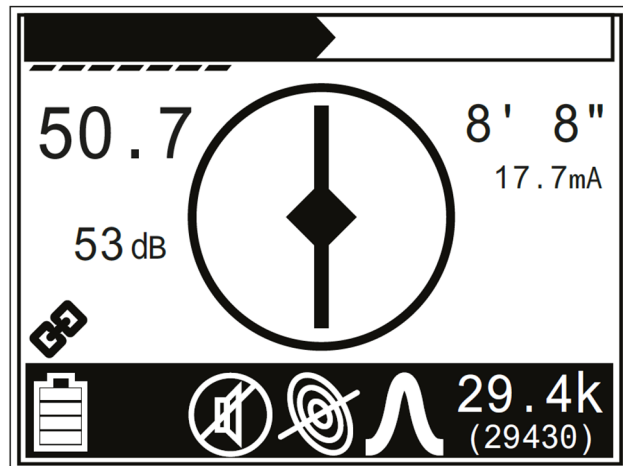
CARLOC PLUS receivers can be linked to CARLOC PLUS transmitters through a wireless connection. This allows the receiver operator to change transmitter settings through the receiver.

To link the receiver to a transmitter via Radio:

1. Turn both receiver and transmitter on and unlinked.
2. Navigate to **Settings>Communications** and select **Link TX**.
3. Select **Link RX** from the **Settings>Communications** menu in the transmitter.
4. Select a device to link. Link is complete when the link icon is displayed.

**IMPORTANT:** Once linked, devices automatically connect when turned on. To unlink devices, navigate to **Settings>Communications** and select **Unlink**.

5. When linked, changing the receiver frequency will also change the transmitter frequency.



## Select Locating Frequency

**IMPORTANT:** 12 watt power level only available in Direct Connect mode and only for frequencies below 9KHz.

The CARLOC system gives the user the ability to choose from up to 100 different frequencies. Not all frequencies are available at 5 watt and 12 watt power levels. F1/F2 is a dual output of 8k and 29K. Power output is reduced when using F1/F2. This frequency choice is not available when transmitter is set to high output. Optimal frequencies for your area can be configured for each unit using CARLOC software. Use the ambient noise measurement (see next page) to determine suitable frequencies. Then, use the transmitter and receiver frequency menus to activate only the frequencies most suited for a particular jobsite. Be aware of these points:

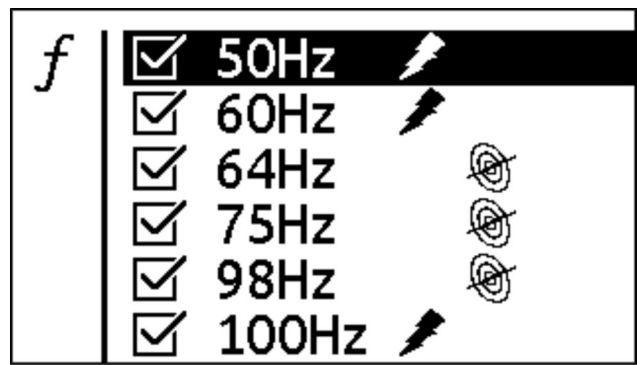
- Lower frequencies travel farther than higher frequencies.
- Higher frequencies couple onto lines more easily.
- Higher frequencies also couple onto lines other than the target line more easily.

### Enable Frequencies

To enable frequencies on the transmitter as well as the receiver:

1. Navigate to **Configuration>Frequency** menu.
2. Select the frequencies best suited for the jobsite conditions. When the box is checked, the frequency is enabled.

**Note:** Power, line, and beacon icons indicate which mode a frequency will be available in.




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3. While locating, press the **Frequency** button to select the next enabled frequency.

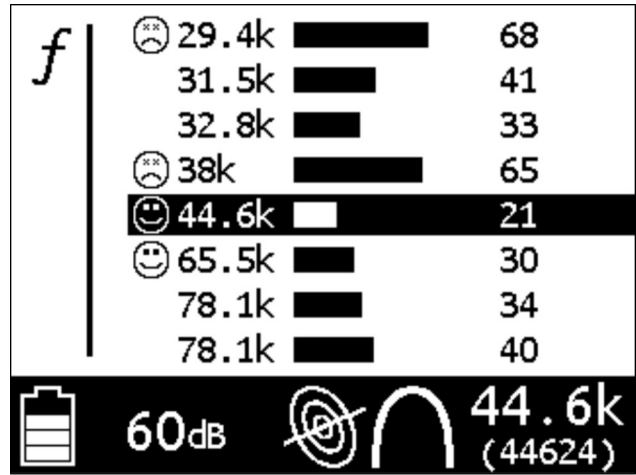
### Measure Ambient Noise (CARLOC PLUS Units)

The ambient noise measurement function measures interference on the jobsite. For best locating, select a frequency with the least amount of interference. Interference levels are indicated numerically and graphically.

To measure ambient interference:



1. Ensure that transmitter output is turned off.  
From the receiver menu, select the ambient noise measurement function (  ).  
The receiver will scan the surrounding area for interference on all frequencies enabled in the selected mode.

-  frequencies with the least amount of interference
-  frequencies with a large amount of interference



2. Highlight the desired frequency and press the Next button to exit the menu.

**IMPORTANT:**

- If a line is connected to an active signal, the ambient noise measurement will be high.
- When a frequency is highlighted, a realtime interference is displayed.
- The  and  are reversed for passive (power) modes.

### Adjust Receiver Gain

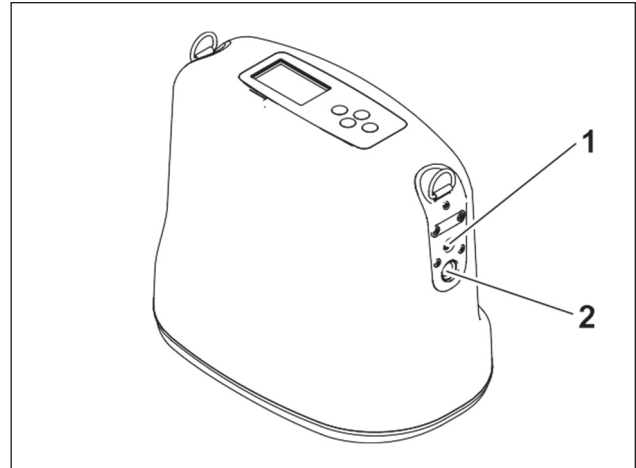
The receiver gain setting controls the sensitivity to the signal.

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

# Locate Active Signals

## Setup

Follow setup procedures for the type of locating you will be doing: direct connection, induction clamp, connecting to live power with live power adapter, or broadcast induction. For all types of active location that require leads, connect leads to transmitter at connector (2). When it is necessary to connect to external power, use connector (1).



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## Induction Clamp



**WARNING**

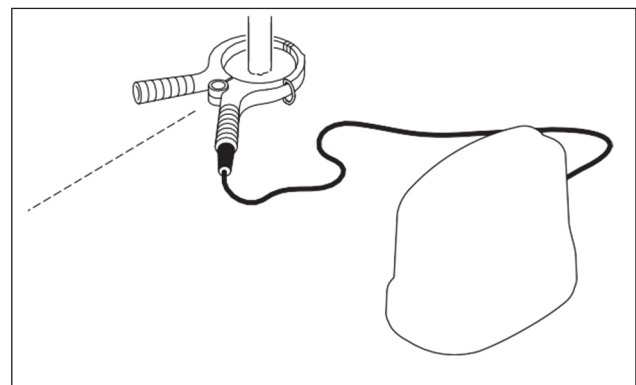
Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

**To help avoid injury:**

- Contact qualified utility personnel and follow all standards and requirements for disconnecting and grounding cables. Electric shock or equipment damage can result if transmitter is connected to live cable.
- Ensure transmitter output is on standby or off before opening broadband clamp.

To set up transmitter for use with induction clamp:

1. Plug cable into transmitter.
2. Place clamp around cable.
3. Turn on transmitter.
4. Check battery level.



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## Direct Connection

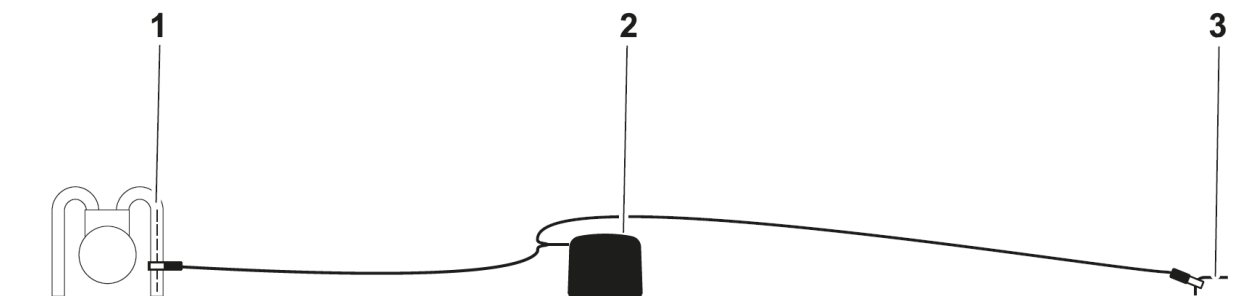


**⚠ WARNING** Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

### To help avoid injury:

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

To set up transmitter for direct connection:



1. Carefully push ground stake (3) into ground.
2. Plug cable into transmitter (2).
3. Connect black lead to ground stake.
4. Connect red lead to cable (1).

**Note:** If using dual location, connect white lead to the additional cable to be located.

5. Turn on transmitter and check battery level.

**IMPORTANT:** Turn off transmitter when connecting or moving ground stake.

### Connect with Live Power Adapter



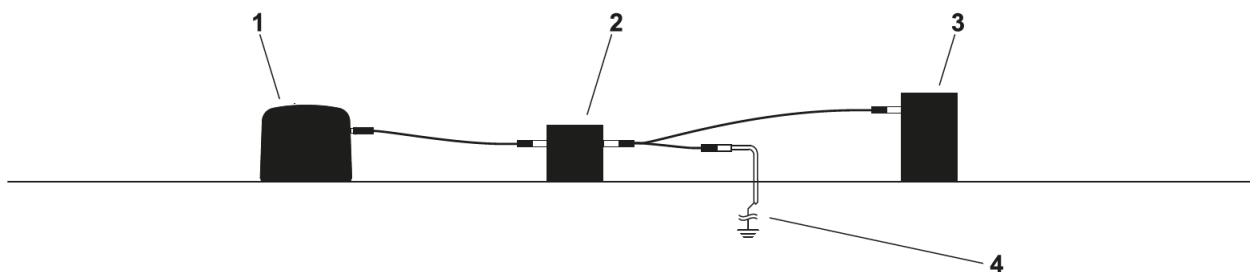
**⚠ WARNING** Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

**To help avoid injury:**

- Read and follow all safety precautions.
- Do not work with this device unless you are properly qualified to work on live power conductors.
- Use proper personal protective equipment for voltage and current of power conductor being connected to as defined by locally applying regulations.
- Do not work with this device unless you have completed proper training and have read the operator’s manual.
- Do not connect to a conductor with a voltage greater than 480V.
- Connect this device to the transmitter before connecting to the live power conductor. Connect only one clamp at a time to live power conductor.
- Inspect cables for damage. Replace accessory if cables are damaged.

To set up transmitter for use with live power adapter:

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



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



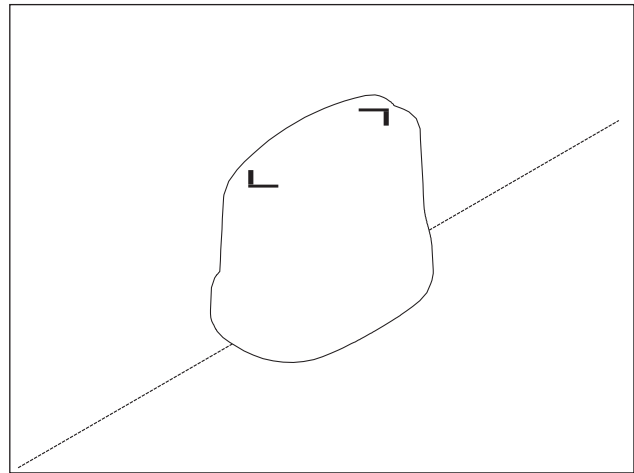
## Induction

To set up transmitter for induction:

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

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

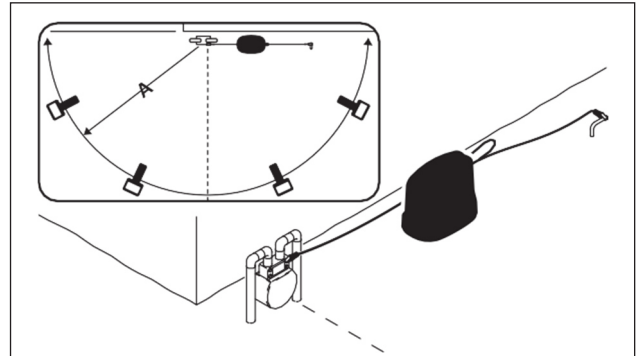
3. Turn on transmitter.
4. Check battery level.



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## Technique

1. Facing away from the transmitter, walk in an arc approximately 25' (A, 7.5 m) around transmitter, as shown above.



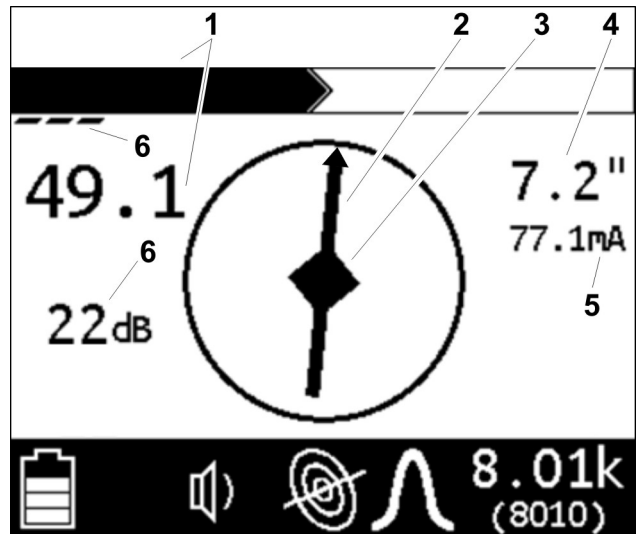
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2. Rotate the receiver and observe the screen:

- Target is located where signal response

(1) is strongest. Signal strength is shown graphically as well as numerically. The signal strength number will flash when the receiver is saturated. Reduce the gain until the number stops flashing.

- Adjust gain as needed to maintain signal strength. Gain is shown graphically (6) as well as numerically.
- The compass line (2) shows the direction the cable runs.
- Move in the direction of the center arrows. When the arrows form a diamond (3), the target is located.



e18om036h.jpg

- AutoDepth reading (4) will appear when target is correctly located. If operating in Manual depth mode, press and hold the **Depth** button.
- Use current measurement (5) to identify target cable. Current on the target cable should be higher than current on another cable that is picking up signal inductively from target cable.

3. Continue to trace the cable and observe depth estimates every few paces.
4. Retrace the cable and mark with appropriate flags or paint.

## Use Advanced Features

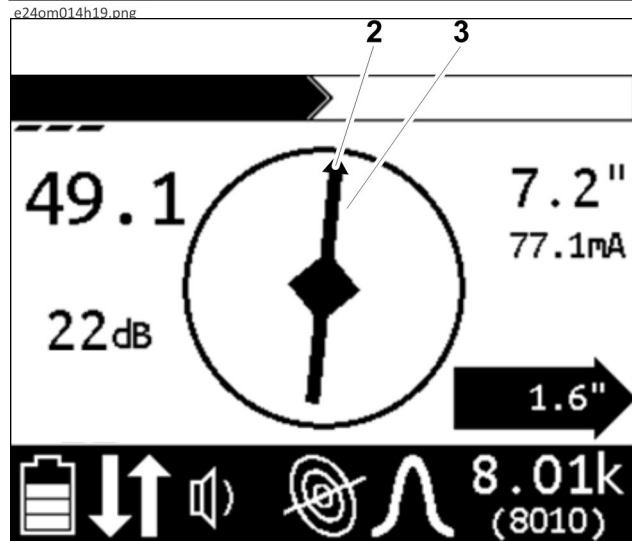
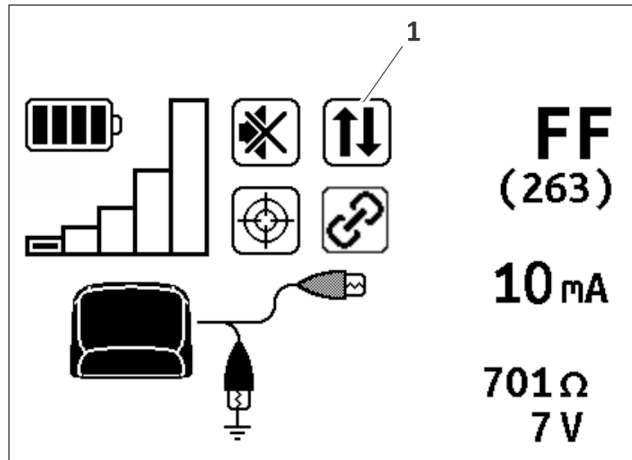
### Direction Enable

Direction Enable allows the operator to set a reference for current flow on a target line. It is useful for maintaining line identity on jobsites where multiple utilities are present. Direction Enable is only available:

- in line location mode and
- at frequencies of 10kHz and below.

To use Direction Enable:

1. On the transmitter menu, navigate to **Settings>Output>Direction Enabled** and select **Enable**.
2. Ensure the function is available by looking for the Direction Enable icon (1) on the transmitter.
3. Stand approximately 10 ft (3 m) from the transmitter with the receiver positioned so that the compass heading (3) is parallel to the target line. Face away from the transmitter.
4. Press and hold the Frequency button to set the direction of current flow. An arrow will appear on the compass heading.
5. Continue locating.



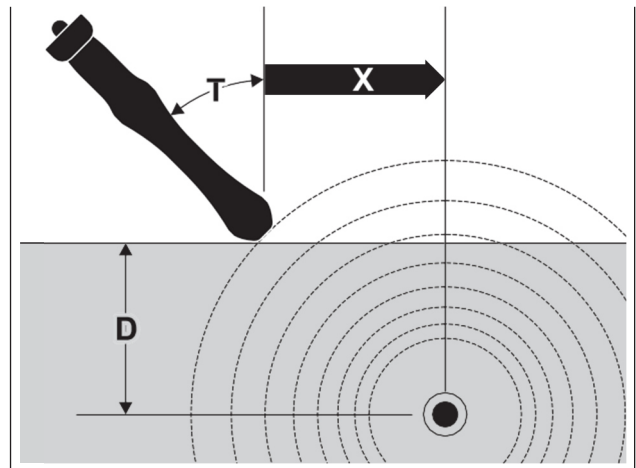
**IMPORTANT:**

- Power output is reduced when Direction Enable is in use.
- Direction Enable is not available when transmitter is set to High Output.

### Offset Depth

Offset Depth assists in locating a target line that cannot be accessed from directly above due to obstruction. The function uses available data to estimate horizontal distance (X) and depth (D). Offset depth is only available in CARLOC PLUS units

1. On the receiver menu, navigate to **Options>Offset Depth** and select **Enable**.
2. Begin by holding receiver parallel to line.

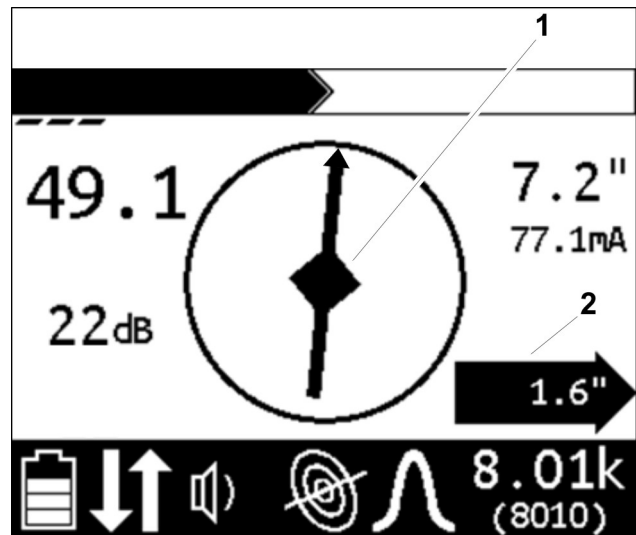


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3. Tilt receiver until center diamond (1) appears.

**Note:** Tilt of unit should be  $>22.5^\circ$  and  $<60^\circ$  (T) to display offset depth.

4. Read the estimated distance (2, X).



e18om038h.jpg

## High Power Output

**IMPORTANT:** When using high power output, either install a Lithium ion battery pack or connect the transmitter to an external power source.

High Power Output is a feature on CARLOC 12W and CARLOC 12W PLUS units. It allows the operator to transmit 12 watts on a line at frequencies less than 9kHz. Use this function on large diameter direct buried steel pipe and long distance locates.

To activate:

1. Navigate the transmitter menu to **Settings>Output>High Power**.
2. Select **Enable** or set timer as desired.

## Mark the Cable

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

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

## Special Situations

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

## Locate Passive Signal

### Setup

Follow setup procedures for the type of locating you will be doing. Always check receiver battery level at startup.

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

### Technique

#### Survey the Site

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

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

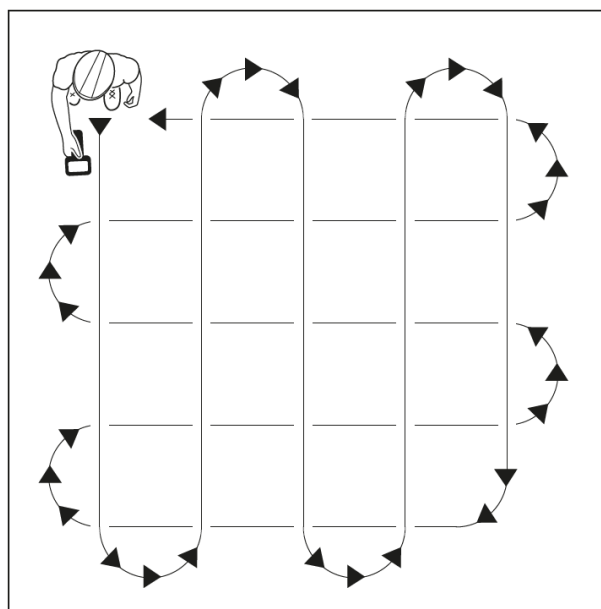
#### Sweep the Site

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

**IMPORTANT:** Keep receiver vertical.

#### Focus the Signal

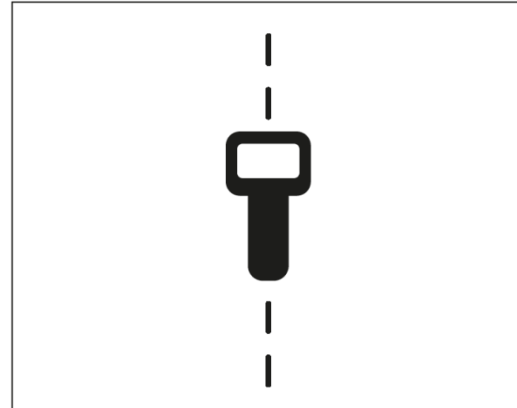
Move receiver over detected signal to find best signal response. If using a peak antenna mode, rotate receiver until signal is best. Best signal indicates cable direction.



### Trace the Cable

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

**IMPORTANT:** Keep receiver handle parallel to the suspected cable path.



### Mark the Cable

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

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

### Special Situations

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



## Locate Beacon Signal

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

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

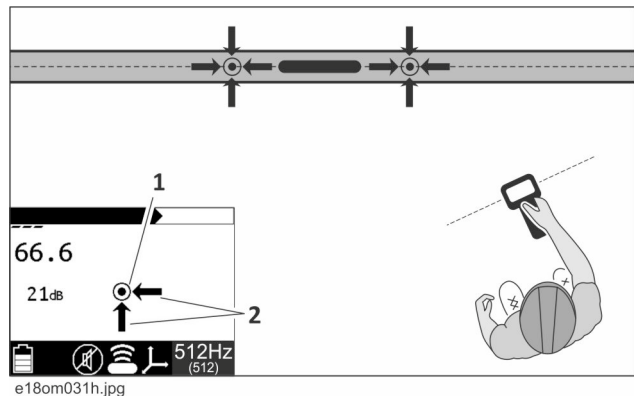
### Setup

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

### Technique

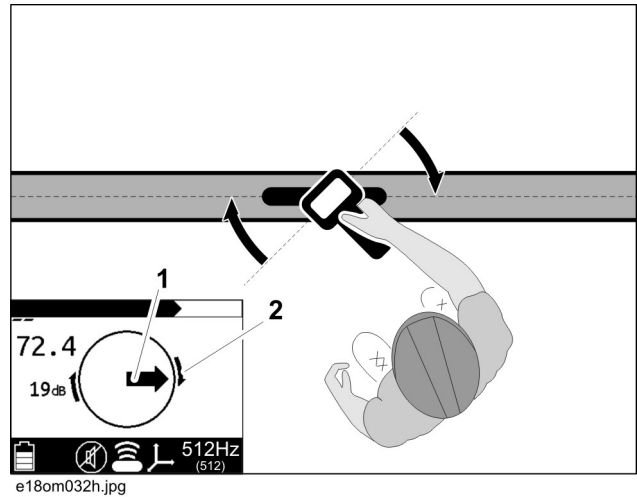
1. Turn on receiver.
2. Set operating mode to Beacon location.
3. Set antenna configuration to Total Field.
4. Place beacon into the pipe and move it down the pipe.
5. Locate beacon using peak or null methods. Peak location is the preferred method in most situations. Null point method is effective for locating deep beacons or for verifying the location of a beacon.

**Null Point Method:** Circle over approximate location. Follow directional arrows (2) to locate the null point (1). The beacon is correctly located at peak signal between null points.

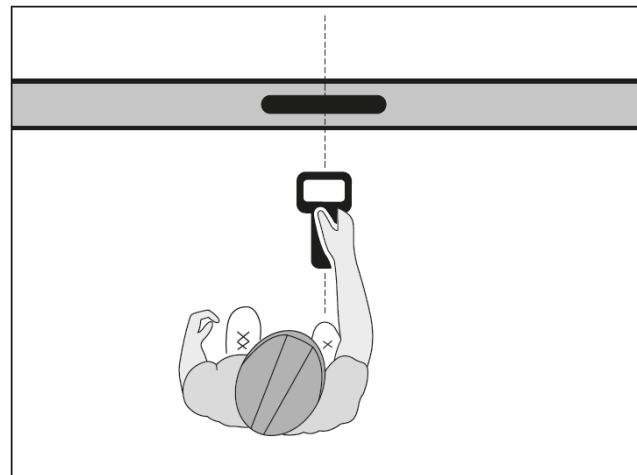


**Peak Signal Method:** When the peak signal is in range, rotation arrows will appear.

- Follow arrows (2) to rotate the receiver handle so that it is perpendicular to the beacon.
- Follow fore/aft arrow (1) to locate the approximate beacon position.



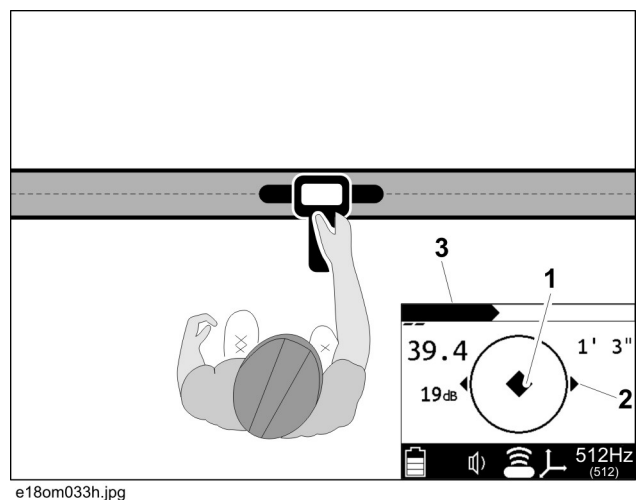
- Walk forward or backward to identify the location with the strongest signal response.



6. When the beacon is correctly located, a diamond (1) will form in the center of the compass, the exterior arrows (2) will appear, and the signal (3) will be strongest. The depth reading will display.
7. If operating in Manual depth, press the **Depth** key to estimate depth.

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

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



## Common Signal Problems

Distortions in the electromagnetic field around a cable can affect location accuracy. Tees, bends, parallel cables, crossing cables, or large metallic objects can distort signals. In areas where there is significant signal distortion or in places where the line being located is not straight, there may be places where the center diamond and the maximum twin signal do not occur in the same place. The left/right arrows and the center diamond are derived from the null antenna signal which is more susceptible to distortion than the peak antennas used for the twin signal. In locations where these signals do not agree, the twin signal is usually more accurate. Use caution when the center diamond and twin signal do not agree.

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

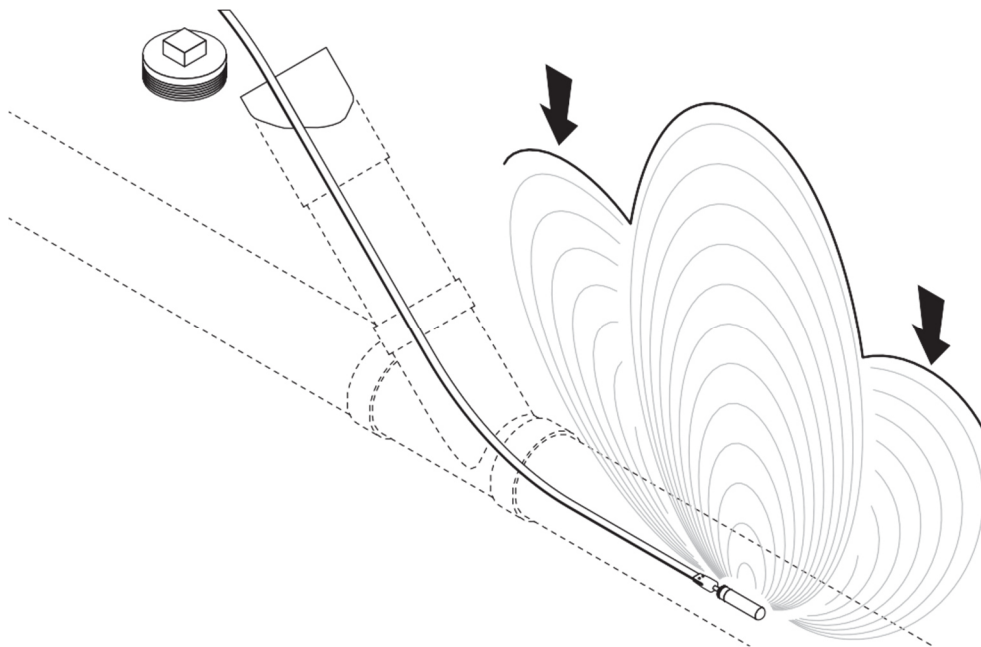
Learn to recognize the following kinds of distortion:

### Shadows

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

### Secondary (Ghost) Signals

A typical beacon signal pattern shows a main signal and two weaker secondary signals. Identify beacon location at the main signal. Familiarity with beacon signal patterns will lessen the effect of ghost signals. Using the Total Field antenna mode will eliminate ghost signals. See “Select Antenna Configuration” on page 34.



# Locate Faults

## Background

### How Earth Return Faults Are Created

When a direct-buried cable's insulation is damaged, the conductor is exposed to contact with the earth which creates a fault. If large enough, the fault can degrade the service provided by the cable. This type of fault is called an earth return fault. These damaged areas interact with the earth which causes corrosion that can further degrade the service.

Faults can be caused by a number of actions.

- Splicing: Corroded or damaged splices may fault to ground.
- Excavation: Cables can be nicked or broken by excavation equipment such as shovel, backhoe, trencher, drill head, auger, fence post, etc. These nicked areas can fault to ground and provide a place for corrosion to start.
- Abrasion: Rocks and other abrasive elements can damage cable when the earth shifts due to soil conditions, climate and above-ground traffic.

**IMPORTANT:** Although there are other types of faults, only earth return faults can be detected with this type of equipment.

### Finding General Location of a Faulted Cable

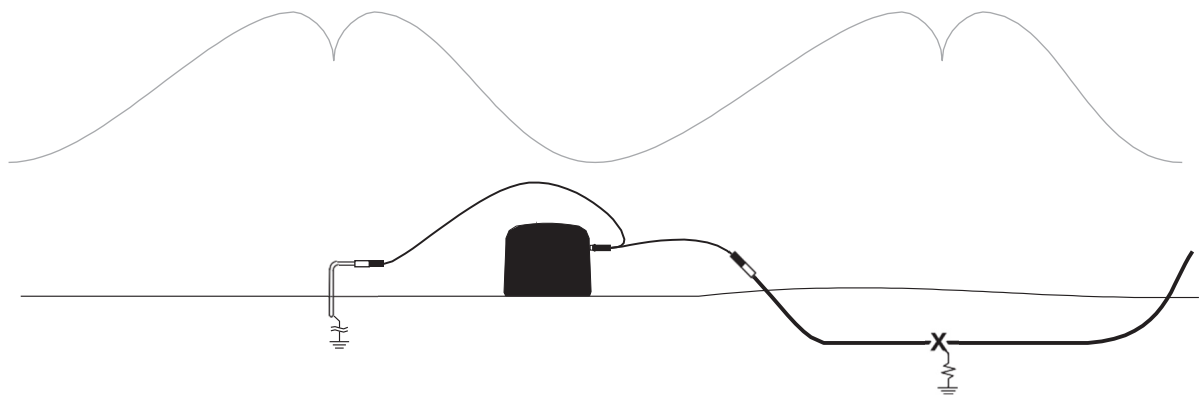
Some things to look for when searching for the general location of a faulted cable are:

- recently disturbed soil
- past splices
- "buried utility" notices
- utility facilities without overhead lines
- junction boxes
- drop boxes
- light poles
- sunken ground

## Fault Locating Concepts

Isolating the cable on both ends and then energizing it with a special signal generated by a transmitter creates an electrical circuit where current flows down the cable and seeks a path back to the transmitter. The path back to the transmitter is along the path of the fault to ground. Current will not flow without a path to ground.

Use a fault probe to probe the earth and measure the signal along the path of the cable. Signal will be highest at the point of the fault where the current enters the ground and at the transmitter ground stake. The arrows on the receiver point toward the direction of the fault.



e18om019h.eps

As you move away from the transmitter, detector may stop indicating transmitter pulses. As you near the fault, detector will resume indicating transmitter pulses. This is normal. Transmitter pulses are strongest near the point of the fault (X) and at the transmitter ground. When probes straddle the fault or transmitter ground, signal will drop.

## Setup

### Transmitter

#### IMPORTANT:

- Transmitter must be running Firmware Version 2 or greater.

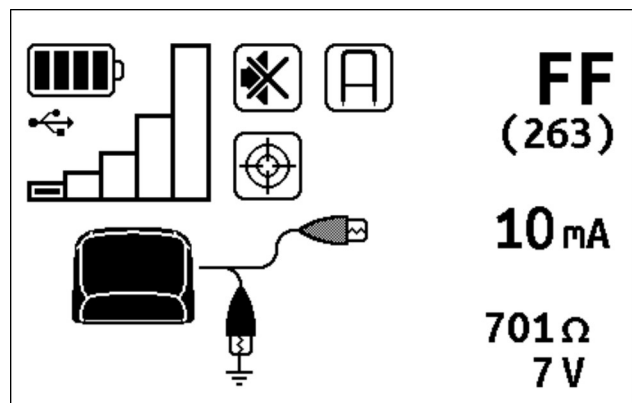
1. De-energize and disconnect the cable at both ends. Turning off a breaker is usually not enough to isolate the cable for fault finding.
2. Plug direct connect lead into transmitter.
3. Connect black lead of the transmitter to the ground stake and connect the red lead to one end of the faulted cable.
4. Press the On/Off key to turn on fault transmitter.
5. Press and hold the Power Level key to enter menu.
6. Navigate down to Options Menu and press Power Level key to select.
7. Navigate down to Fault Mode and press Power Level key to select.

**IMPORTANT:** If direct connect leads are not plugged in, Fault Mode will not appear in menu.

8. Select "Enabled" by pressing Power Level key.
9. Transmitter will return to main screen and be in fault mode.

After the transmitter is connected to the cable, the impedance reading will help verify that a fault exists on the cable. While transmitter is in Fault Mode, the screen will show current, impedance and voltage. It will also be in power level 1. If current is below 5mA, increase power level until it shows 5mA or transmitter is at highest power level.

- Readings > 100k indicate no significant fault exists in the cable.
- Readings < 50k indicate a fault is likely.
- Higher transmitter power levels give better readings. Try a higher power level to ensure the cable is faulted.



e18om066h.jpg

## Receiver and Fault Probe

### IMPORTANT:

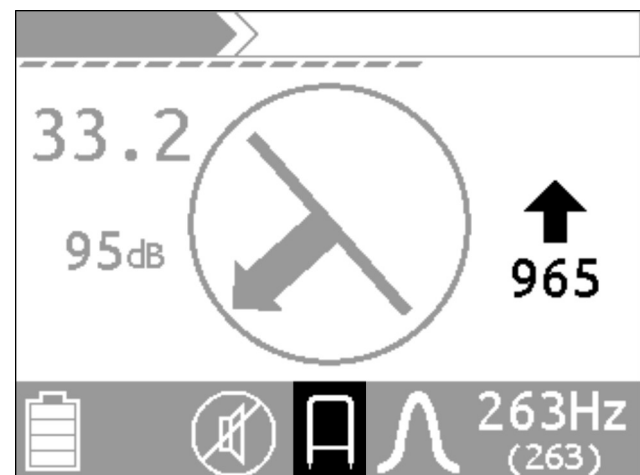
- If receiver does not have 263Hz installed, fault finding will not work.
- Receiver must be running Firmware Version 6 or higher.
- The receiver can also locate cables while in Fault Mode but performance will vary based on the amount of current on the cable.

1. Press On/Off key to turn on receiver.
2. Plug fault probe into accessory port.
3. When fault probe is plugged into receiver, receiver will enter Fault Mode (probe icon will show) and flash a home symbol in the bottom right corner of the locate screen, as shown.
4. Connect transmitter to faulted cable following transmitter setup instructions. Select power level 1 or 2 on transmitter and observe adequate current on the cable (ideally at least 10mA).
5. With back toward transmitter, move down faulted cable a few feet (meters) from transmitter.
6. Center fault probe over the cable and push it into the soil.
7. Numbers will appear above the flashing home icon. Once they do, press and hold Frequency key to home the fault system.
8. After system is successfully homed, a chime will sound and an arrow will appear, as shown. This indicates the fault is located toward the top of the screen.

**IMPORTANT:** Keep fault probe and receiver oriented the same while fault finding.



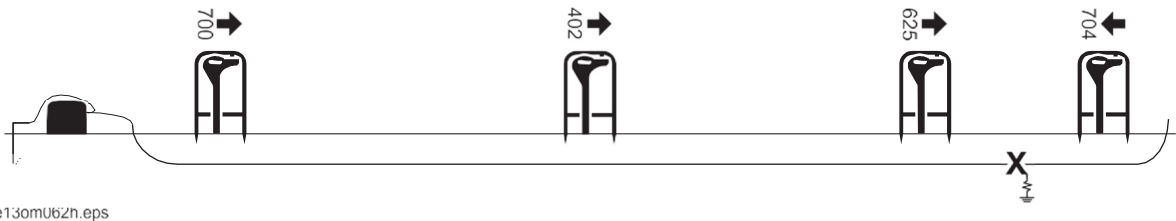
e18om064h.jpg



e18om065h.jpg

### Known Cable Route

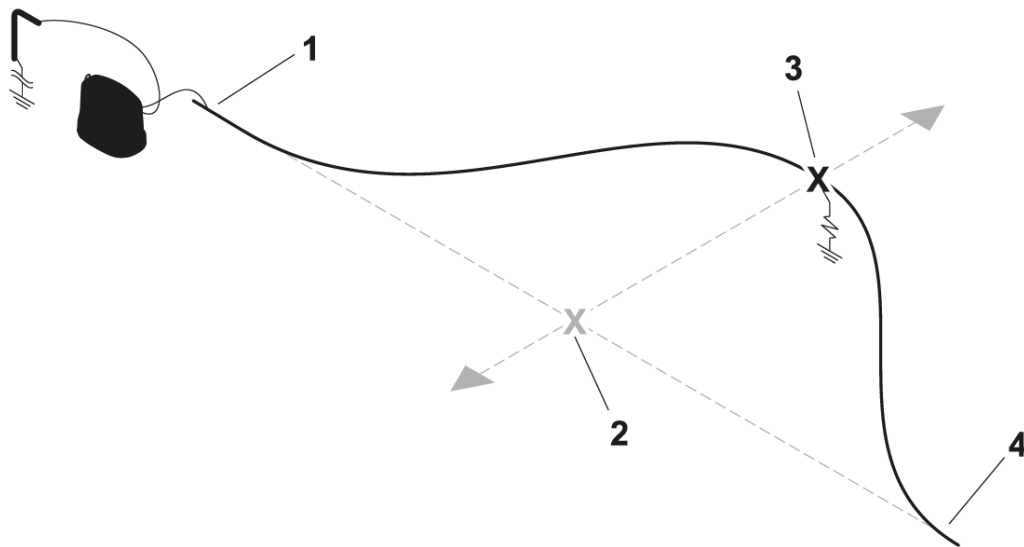
After the receiver is homed, the receiver will display signal strength and direction if sufficient signal is present. If no signal is detected, detector will display “----” in center of screen.



1. Move 10' (3 m) down the cable route and insert fault probe again.
2. After arrows point in the opposite direction, insert detector a few feet (meters) back down the cable.
3. Repeat step 2 moving smaller distances until arrow changes direction after only a few inches (millimeters) of movement.
4. Rotate fault probe 90° and repeat location process until arrow switches direction after a small movement. Fault is directly between probes.

### Unknown Cable Route

**IMPORTANT:** If possible, locate the cable with a receiver and mark the location. Then follow the instructions in “Known Cable Route” on page 56.



1. Draw a straight line between the two disconnected ends (1, 4) of the isolated cable.
2. Follow the instructions in “Known Cable Route” on page 56.
3. Once fault is found (2) on straight line, turn fault probe 90° and find true location of fault (3).

### Multiple Faults

After a fault is located and fixed, check the rest of the cable for other faults using the same process.

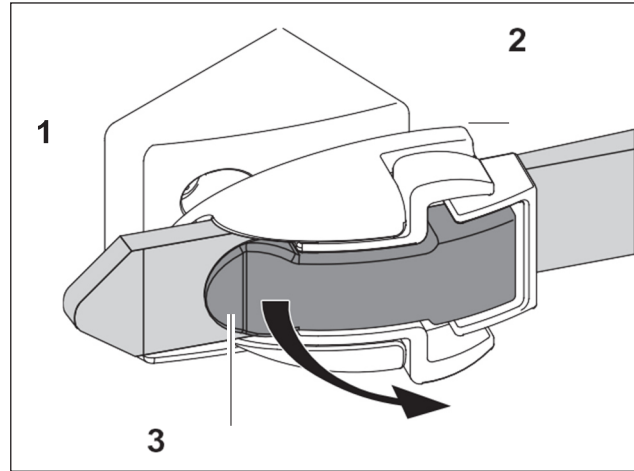


# Locate Markers

## Setup

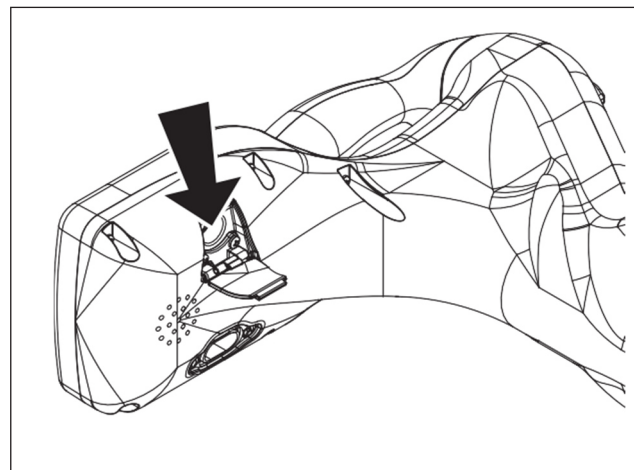
1. Place receiver wand into recess of the EML accessory.
2. Insert strap (1) through buckle (2).
3. Tighten strap using buckle ratchet (3).

**IMPORTANT:** Do not over-tighten.



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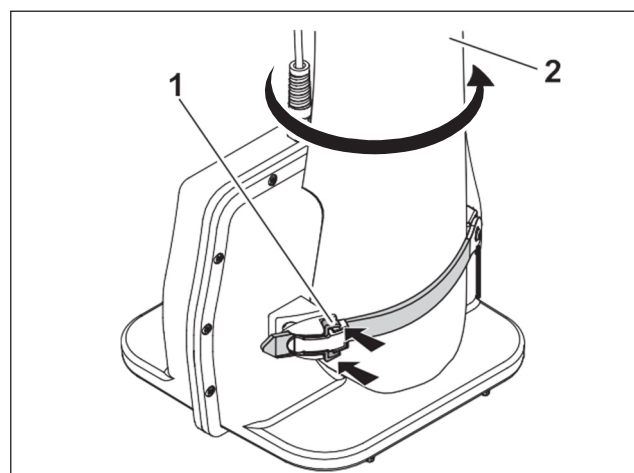
4. Plug cable into receiver accessory connector (shown) behind spring-loaded door.
5. Turn receiver on. The receiver will enter EML Mode automatically and remain in EML Mode as long as EML accessory is plugged in and has sufficient battery power.



e18om076h.eps

## To release:

1. Disconnect the EML cable from the receiver.
2. Place EML accessory on solid surface (ground, tailgate, etc.) and hold receiver wand (2) with left hand while pushing both levers (1) toward EML accessory with the right hand.
3. When buckle clicks, continue pressing levers and twist receiver to loosen strap enough to remove wand.



e18om072h.eps

## Technique

### Normal Marker Locating Mode

1. Attach EML accessory to the receiver.
2. Plug the EML cable into the receiver accessory connector.
3. Select marker type using the Frequency key.

**IMPORTANT:** Test unit for proper operation by passing the wand 3' (1 m) over a marker. Signal strength should increase and the bar graph should close.

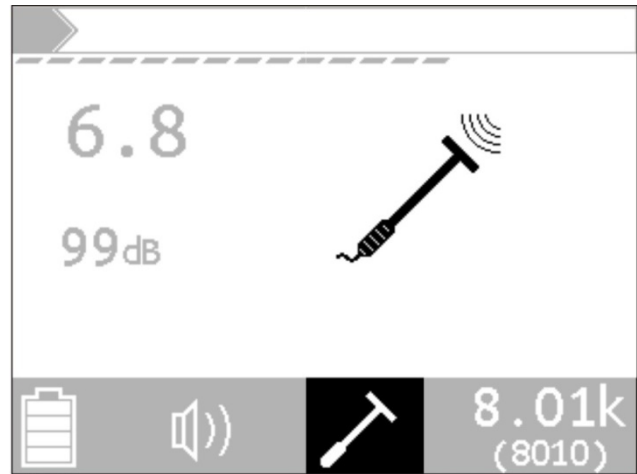
4. Walk over area where you suspect a marker has been buried. Hold EML accessory close to the ground and move it from side to side. Move in the direction of increasing signal strength. Adjust gain as needed. Marker is located where receiver indicates maximum signal.
5. To locate next marker, adjust gain to 30 dB and repeat process.

### Search Mode

If unsure about what markers are in the area, use Search Mode to locate all frequencies. After scanning for each frequency separately, the receiver displays the location information for the marker with the highest signal. Up and Down keys will adjust gain in this mode.

## Locate with Stethoscope

1. Plug the stethoscope cable into the accessory connector on the receiver.
2. Turn on the receiver. When stethoscope is plugged into receiver, receiver will enter stethoscope mode (stethoscope icon will show).
3. Use receiver frequency key to select desired frequency. Use mode key to toggle between active and passive power frequencies.

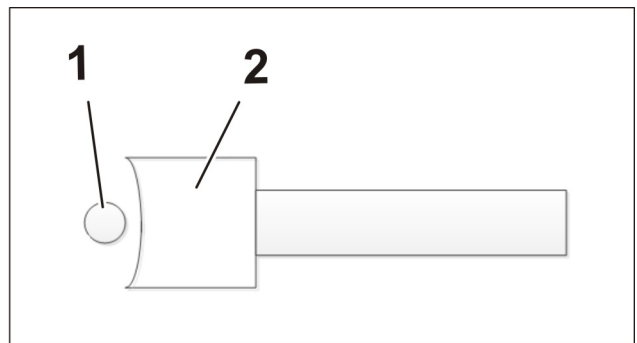


in137d.jpg

4. Grip stethoscope by the handle and place the head (2) as close to the target line (1) as possible. Position the target line in the concave portion of the head as shown.

**IMPORTANT:** Adjust flexible neck as needed to improve positioning.

5. Adjust the receiver gain using the up and down arrow keys to bring the received signal strength into range.



in136d.jpg

## Locate Using GPS

### Connect

#### Mapping Grade GPS

This method of logging location data is available on CARLOC PLUS receivers.

#### Prerequisites

- The GPS unit must have software that will recognize the data that is sent by the receiver.
- The GPS unit must support Bluetooth SPP connections.

#### Initial Pairing

This is required the first time a GPS device is connected to the receiver. To use a different GPS device, repeat this procedure.

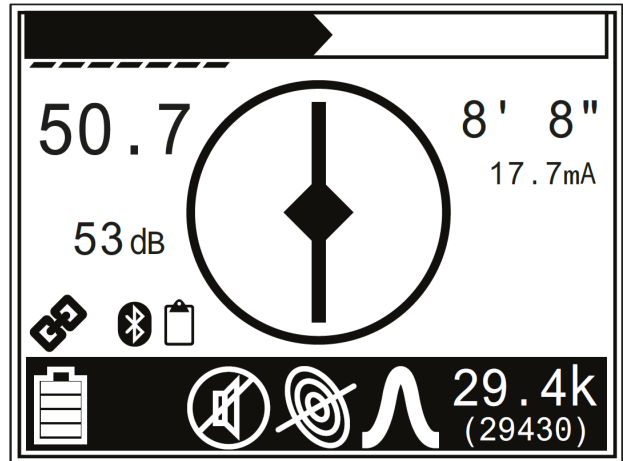
1. Power on the GPS device and ensure its Bluetooth radio is active and discoverable. Refer to the GPS device manual for details.
2. Power on the receiver and go to the **Settings>Communications>Radio On/Off** menu and ensure the radio is “on”.
3. Initiate pairing from the GPS device. Refer to the GPS device manual for details.
  - The receiver will be named “MFLRX\_xxxxxxx” where xxxxxxx is the serial number of the receiver.
  - If prompted for a passcode, it is “0000” (four zeros).
4. If applicable to the selected GPS device, choose “Serial Port” as the service type.

#### Connect to the GPS device

1. Launch the application software on the GPS device.
2. Connect to the receiver in the GPS application software.
  - For applications that connect to a COM port, ensure it is the **incoming** COM port.
3. On the CARLOC receiver, begin scanning for Bluetooth devices. Navigate to **Settings>Communications>Bluetooth>Connect**.

**IMPORTANT:** Ensure the GPS device is still discoverable.

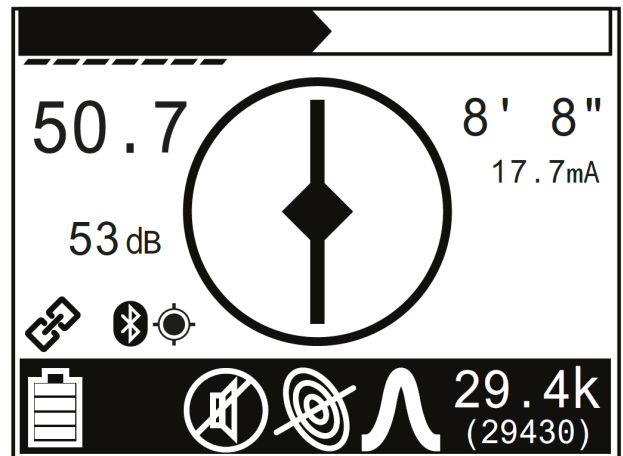
4. Select the GPS device from the list. The receiver will begin the connection process.
5. On the main locate screen, the Bluetooth<sup>®</sup> icon should be on.



### Document Grade GPS

This method of logging location data is available on CARLOC PLUS receivers.

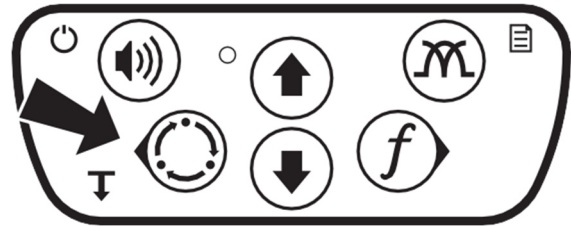
1. Ensure you are in a location that the GPS can see satellites.
2. Turn on the GPS and ensure it is discoverable.
3. Turn on the receiver. Navigate to **Settings>Communications>Bluetooth>Connect**.
4. Once the GPS is discovered, select it from the list.



On the main locate screen, the Bluetooth icon should be on and the GPS receive icon should appear.

## Log Point

To store a point, force a depth from the main locate screen push and hold the bottom left button on the keypad (shown). The user should hear a low tone if data is stored instead of a high tone.



If a high tone sounds when forcing the depth button the receiver is not storing data. Reconnect to the GPS.

Troubleshooting	
Either the GPS device or receiver is "unpaired"	Un-pair or remove the other device from both devices and repeat the "Initial Pairing" procedure.
Pairing fails	If the GPS device does not support Secure Simple Pairing, the passcode consisting of four zeros (0000) must be entered to complete pairing.
The connection fails from the "Connect GPS" menu	Repeat the connection attempt by selecting the GPS device again.
GPS device does not show up in the "Connect GPS" menu.	Ensure the GPS device's Bluetooth® radio is active and it is discoverable. Some devices only remain discoverable for a few minutes. Check the device's Bluetooth settings.
The receiver is not found by the GPS device during pairing.	Ensure the receiver is "On" in the <b>Settings&gt;Communications&gt;Radio On/Off</b> menu. The receiver will revert to "Off" after power-cycling if no devices are paired.
Continued failed or lost connections	Hardware on certain GPS devices may not be compatible with the receiver's Bluetooth.

## Download

### Document Grade GPS

A software package with all applications and drivers relevant for CARLOC devices can be downloaded from the CARLOC product page on the Megger website. This package also contains the "GPS Log Downloader" software, which must be installed on the PC in order to be able to transfer the GPS data.

1. Connect the USB cable from the PC to the CARLOC PLUS receiver.
2. Double click on the locator log downloader icon. The software will automatically connect to the receiver and begin downloading stored information.
3. Once the software has downloaded the GPS information, it will give you an option to save the Log.
4. Click on the save log button. This will pull up a box allowing changing the file name and changing the file type to either a .KML file or a .CSV file.
5. Once finished saving, the log downloader will give you an option to clear the receiver log data or close the utility.

**IMPORTANT:** It is recommended to clear the data off of the receiver after every download.

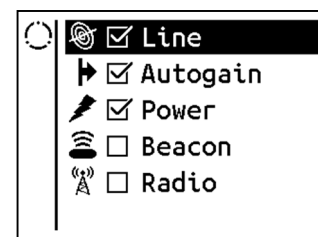
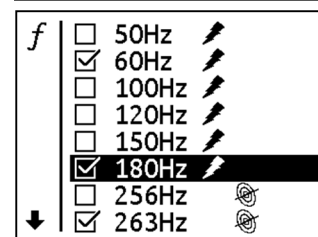
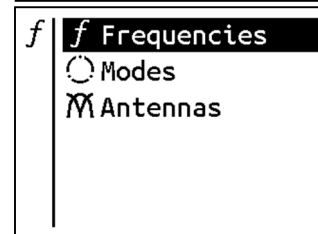
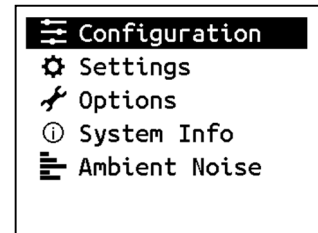
# Use Configuration Management System

The CARLOC receivers allow configuration of the available receiver frequencies, modes, and antenna functions to customize or simplify the operation of the receivers.

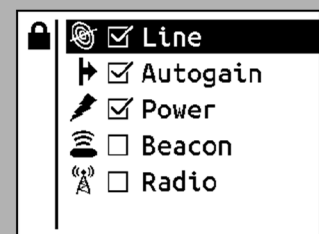
Additionally, operations supervisors can lock access to the configuration menu (see next page) to use the receivers as part of their operator training and competency skills assessment program. Later, they can reconfigure to add in advanced product features for more-skilled users.

## Configure Frequencies, Modes and Functions

1. To enter Configuration Management System, press antenna configuration key until function is enabled. Then press and release the frequency key *f*.
2. From configuration menu, use up and down arrow keys to select frequencies, modes or antennas to configure.
3. Press frequency key to change settings for selected function.
4. Press up and down arrow keys to select items within the selected function.
5. Press frequency key to enable (check) or disable selected feature.
6. Press location mode key to exit the configuration sub menu.
7. Repeat steps for other features until all configuration is finished and press the location mode key to exit the configuration sub menu.
8. Press location mode key again to exit Configuration Management System.



**IMPORTANT:** If a padlock icon is displayed at the top left corner of the display, the settings cannot be altered until configuration is unlocked (see next page).



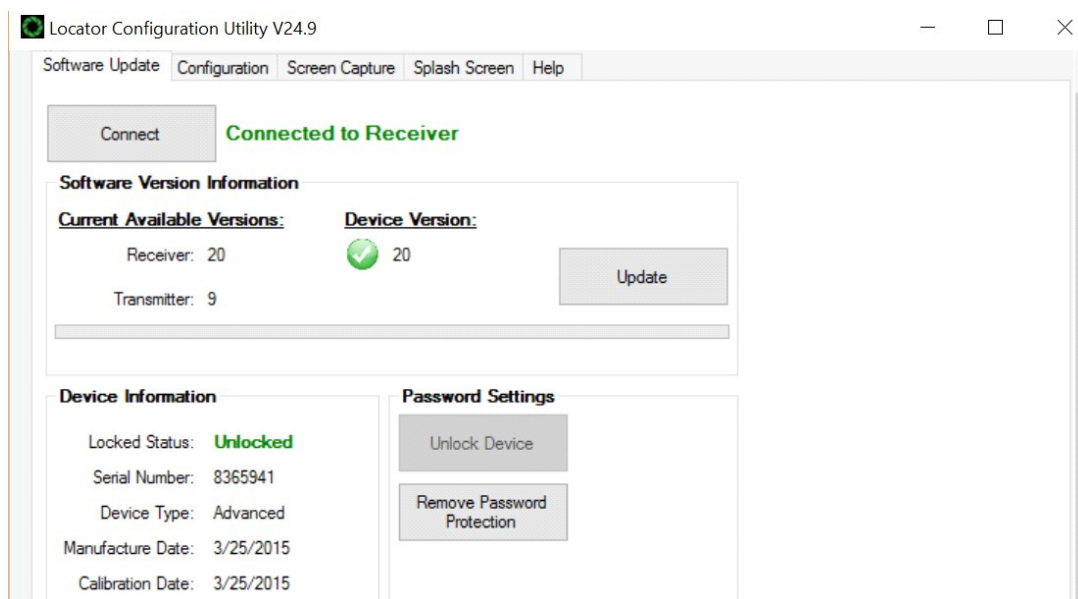


## Lock/Unlock Configurations

### Lock

A software package with all applications and drivers relevant for CARLOC devices can be downloaded from the CARLOC product page on the Megger website. This package also contains the "Configuration Utility" software, which must be installed on the PC in order to lock the configuration settings.

1. After the installation, start the "Configuration Utility" software.
2. Remove receiver USB connection cover and connect supplied USB cable from PC to the CARLOC receiver. The receiver will come on and display the USB icon in upper left corner.



3. Press **Connect**.
4. Press **Password Protect Device**.
5. Enter a password of any length.
6. Confirm password. Once password is accepted, a message will pop up.
7. Confirm on the software update tab that the configuration menu has been locked.
8. Exit the configuration utility, disconnect USB cord from receiver and computer and turn off receiver.
9. Turn on receiver and verify settings are locked.

### Unlock

To unlock configuration settings, launch the configurator utility, follow steps 3 and 4 above and press Unlock Device. Enter password.

**IMPORTANT:** Receiver must be unlocked by Megger Product Support if password is forgotten.

To remove password protection from the receiver, select Remove Password Protection.



# CARE AND MAINTENANCE

## General Care

Under normal operating conditions, receiver, transmitter, fault probe, Live Power Adapter, and stethoscope need only minor maintenance. Following these care instructions can ensure longer equipment life:

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

## As Needed

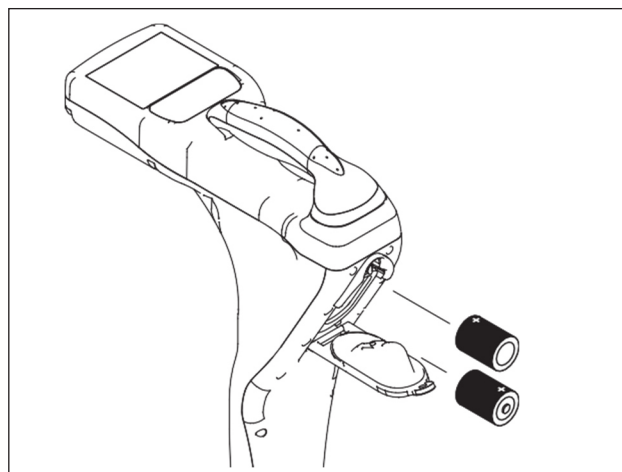
Location	Task	Notes
Receiver Unit	Change batteries	2 "D" alkaline
Transmitter Unit	Change batteries	10 "D" alkaline or Li-ion
EML Accessory	Change batteries	10 "AA" alkaline

## Receiver Unit

### Change Batteries

Use 2 D-cell alkaline batteries in receiver.

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



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## Transmitter Unit

### Change Batteries

Use ten D-cell alkaline batteries or a Lithium-ion battery pack in transmitter.



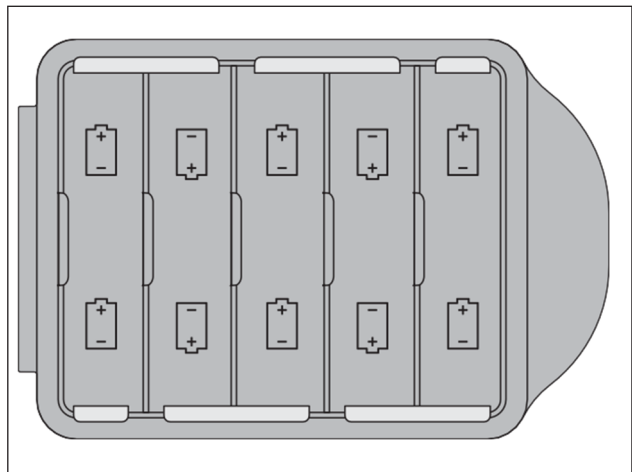
**WARNING** Battery cells inside may vent or rupture. Do not crush, do not heat or incinerate, do not short circuit, do not dismantle, do not immerse in any liquid. Observe charging instructions.

**To help avoid injury**, see battery manufacturer's safety instructions.

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

#### IMPORTANT:

- Installing batteries backwards will cause damage to batteries and unit.
- Ensure that door is closed tightly.
- Do not mix new and used batteries.



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

## Li-ion Battery Pack

### Handling

- Avoid shorting the battery.
- Do not immerse in water.
- Do not disassemble or deform the battery. Never use a battery that appears to have suffered abuse.
- Do not expose battery to fire. Do not dispose of the battery in fire.
- Avoid excessive physical shock or vibration.

### Charging

- Battery must be charged in an appropriate charger only. Never use a modified or damaged charger.
- Charge at 32°F to 113°F (0°C to 45°C) in less than 80% relative humidity.

### Storage and Disposal

- Dispose of in accordance with local regulations.
- Store in a cool, dry, and well-ventilated area. Storage limits: -4°F to 140°F (-20°C to 60°C), <80% relative humidity.
- For best results, store battery pack in an environment free from corrosive gas at a temperature less than 70°F (21°C). Extended exposure to temperatures above 113°F (45°C) could degrade battery performance and life.
- If storing battery pack for an extended period, charge or discharge to pack to 30-50% remaining capacity. This will give at least 6 months of shelf life at room temperature before electronics go into shutdown mode. Charge the battery every 6 months if longer storage is required.
- After the battery has self-discharged for an extended time, the electronics will disconnect from the internal cells. The battery will exist in this storage state for approximately one year at room temperature before the cells discharge to the point beyond which they should not be charged.

## EML Accessory

### Change Batteries

Use ten AA-cell alkaline batteries in transmitter.



**WARNING** Battery cells inside may vent or rupture. Do not crush, do not heat or incinerate, do not short circuit, do not dismantle, do not immerse in any liquid. Observe charging instructions.

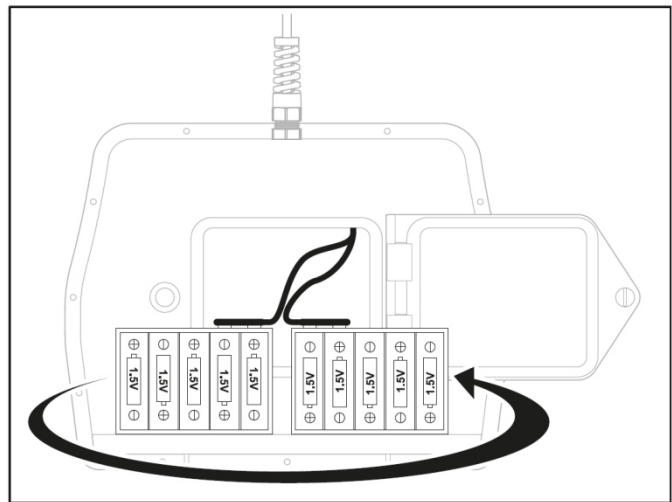
To help avoid injury, see battery manufacturer's safety instructions.

1. Open battery cover.
2. Remove battery holder.
3. Insert batteries in holder as shown.

#### IMPORTANT:

- Installing batteries backwards will cause damage to batteries and unit.
- Do not mix new and used batteries.

4. Place battery holder in battery compartment.
5. Close and tighten battery cover.



## **Live Power Adapter Accessory**

### **Replace Fuse**

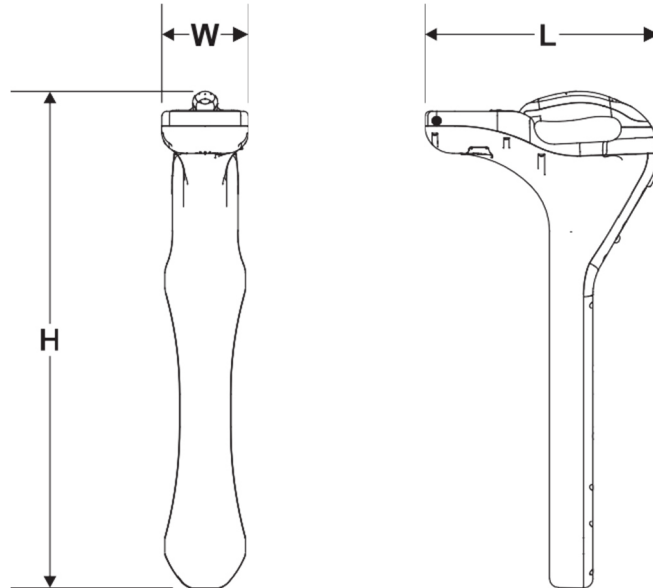
Disconnect the live power adapter from the transmitter and the target line before replacing the fuse. With a flat blade screwdriver, turn fuse cap counterclockwise. Remove cap and remove fuse. Place the new FF2.5A 500V fuse in the cap. Replace cap and attach by turning cap clockwise.

## **Repair**

Repair and maintenance work has to be carried out by Megger or authorised service partners using original spare parts only. Please contact your service centre if needed.

# SPECIFICATIONS

## Receivers



Dimensions		U.S.	Metric
H	Height	27.2"	69.09 cm
L	Length	12.8"	32.50 cm
W	Width	4.8"	12.19 cm
	Weight	4.8 lb	2.18 kg

Operation		U.S.	Metric
Operating temperature range		-4°F to 122°F	-20°C to 50°C
Storage temperature range		-25°F to 158°F	-32°C to 70°C
Depth, max autodepth		20'	6 m
Depth, max forced		40'	12 m

IP rating:	IP65
Antenna configurations:	single peak, twin peak, null, left/right (cable only)
Audio output:	speaker
LCD backlight:	LED
External ports:	Mini USB

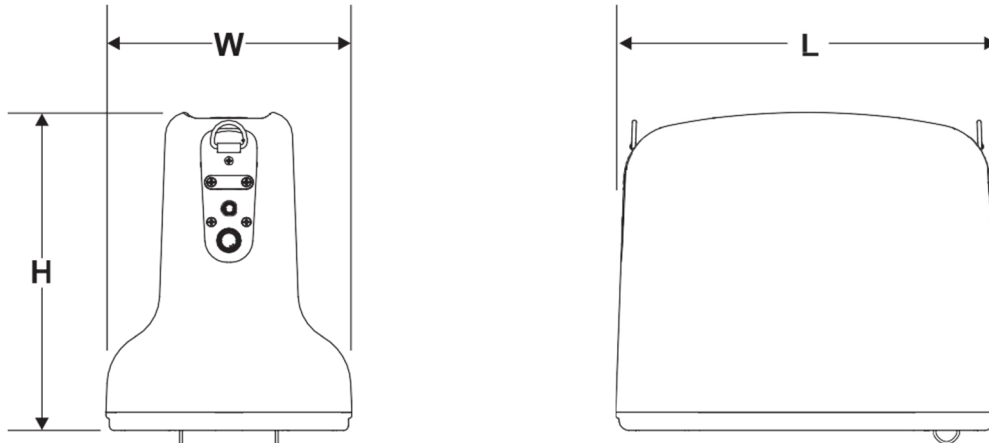


**Batteries**

Type: 2 D-cell alkaline (continuous use at 70°F/21°C, approximately 30 hours; intermittent use, approximately 60 hours)

Battery saver: unit shuts off after 5, 10, 20, or 30 minutes inactivity according to user setting, if selected

## Transmitters



Dimensions		U.S.	Metric
H	Height	10"	25.40 cm
L	Length	12"	30.48 cm
W	Width	7.8"	19.1 cm
	Weight	7.8 lb	3.54 kg
Operation		U.S.	Metric
Operating temperature range		-4°F to 122°F	-20°C to 50°C

IP rating: IP65

Maximum power output: 12 watts (only available in Direct Connect mode, below 9kHz)

Timer: unit runs continuously or shuts off after 2, 4 or 8 hours of inactivity, according to user settings.

Batteries	U.S.	Metric
Type: 10 D-cell alkaline or 1 lithium ion battery pack (p/n 220-2221)		
Life (continuous use at power level 2): approximately 100 hours (Alkaline) or 80 hours (Lithium ion)		

Performance	U.S.	Metric
Bluetooth® standard	Bluetooth v2.1 Class 1	
Operating frequency	2.402-2.480 MHz	
Operating range	2132.5 ft	650m
Transmit power	17dBm	

## System Operation

### Operating Modes and Frequencies

Active cable, standard: Up to 100 frequencies

Passive cable, standard: 60 Hz, 120 Hz, 180 Hz, 50 Hz, 100 Hz, 150 Hz

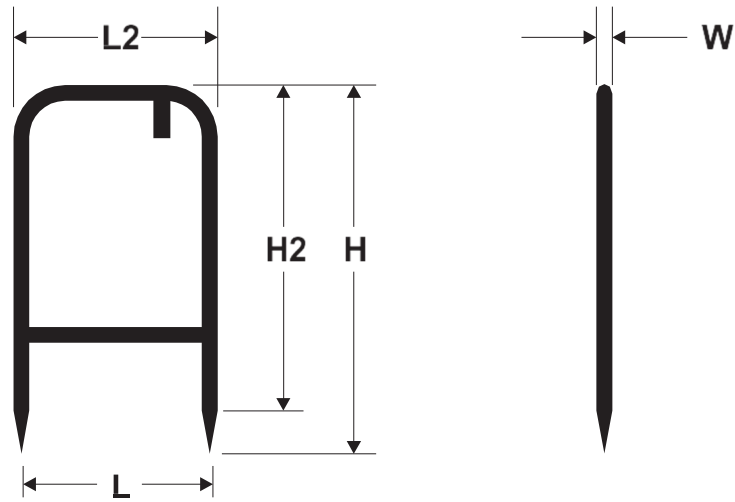
Beacon, optional (locate/depth only): any frequency

Radio, optional (locate only)

Locating Ranges	U.S.	Metric
Cables	15'	4.6 m
Beacons	10'	3 m
Depth Estimate Tolerances*	U.S.	Metric
Passive cable $\pm 10\%$	0.5-10'	0.15-3 m
Active cable $\pm 5\%$	0.2-10'	0.2-3 m
Beacon $\pm 5\%$	0.5-10'	0.15-3 m

\* Locators are calibrated at factory frequencies to these tolerances under ideal test conditions. Actual operating conditions may have signal distortions or noise sources which result in depth estimate errors. Above tolerances do not apply to offset depth estimates.

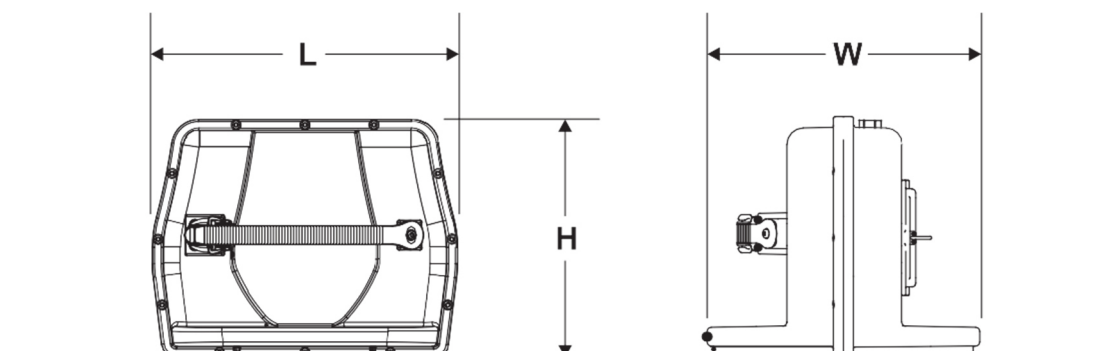
## Fault Finder



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Dimensions	U.S.	Metric
L, length between probes	12 in	305 mm
L2, handle length	13 in	330 mm
H, height from probe tip to carrying handle	29.2 in	742 mm
H2, height from probe base to carrying handle	24.3 in	617 mm
W, width	1.0 in	25 mm
Weight	4.8 lb	2.2 kg
Compatibility		
Transmitter must be running Firmware Version 2.0 or higher. Receiver must be running Firmware Version 6.0 or higher.		

## EML Accessory



Dimensions	U.S.	Metric
L, length	9.3 in	236 mm
H, height	7.3 in	185 mm
W, width	8.2 in	208 mm
Weight, without batteries	2.5 lb	1.2 kg
Weight, with batteries	3.0 lb	1.4 kg

### Operational

Marker frequencies: 66.35 kHz (non-potable water), 77.0 kHz (cable television), 83.0 kHz (gas), 101.4 kHz (telephone), 121.6 kHz (sewer); 134.0 kHz (electric power - EU countries); 145.7 kHz (water); 169.8 kHz (electric power - non-EU countries)

IP rating: IP65

Operating temperature range: -4°F (-20°C) to 122°F (50°C)

### Battery

Type: 10 AA-cell alkaline. Life: 20 hours at low power

### Compability

Receiver must be running software version 7.0 or higher.

## Live Power Adapter Accessory

<b>Dimensions</b>	<b>U.S.</b>	<b>Metric</b>
L, length	4.9 in'	124 mm
H, height	1.9 in	48 mm
W, width	3.2 in	81 mm
Weight	2.0 lb	0.9 kg
Cable length, transmitter side	10 in	254 mm
Cable length, utility side (retracted coils)	25 in	635 mm
<b>Operational</b>		
Operating temperature range: -4F (-20C) to 122F (50C)		
Input: 480V 50/60 Hz		
Output: 10VAC 50/60 Hz		
Fuse: F2.5A 500V		

