



Principles of Cable & Pipe Location

A Vivax Customer Support Group Training Presentation



Theory Presentation vLocPro V1.4

Table of Content

- Locator Theory
- Getting to know the vLocPro
- Using a Locator
- EMS Theory
- Accessories
- Batteries Care & Maintenance
- Safety
- Glossary
- Vivax-Metrotech Contact Details



Locator Theory

The Principles of Cable & Pipe Location



A Typical Locator Consists of



Receiver



Transmitter



Connection Leads



Ground Stake



Signal Clamp

Accessories Provide Additional Functionality...



A-frame

- Cable sheath fault finding
- Pipe coating evaluation



Sondes

- Non metallic pipe location
- Tracing CCTV sewer camera in cast iron or non-metallic pipe



Remote Antenna & Signal Clamp

- Cable identification

Accessories Provide Additional Functionality...

Loc-10Tx-Power Lead (12V DC)

- 30ft (10m) lead to power (NOT charge) the transmitter from a vehicle



vLocPro-Charging Lead (12V DC)

- 12ft (4m) long lead to charge the receiver battery (or aux battery pack) while on the move



LPC Separation Filter

- Apply the transmitter signal to the live domestic wiring system onto the service cable and the supply cable in the street



vLocPro-Aux Battery (12V DC-Ni-MH)

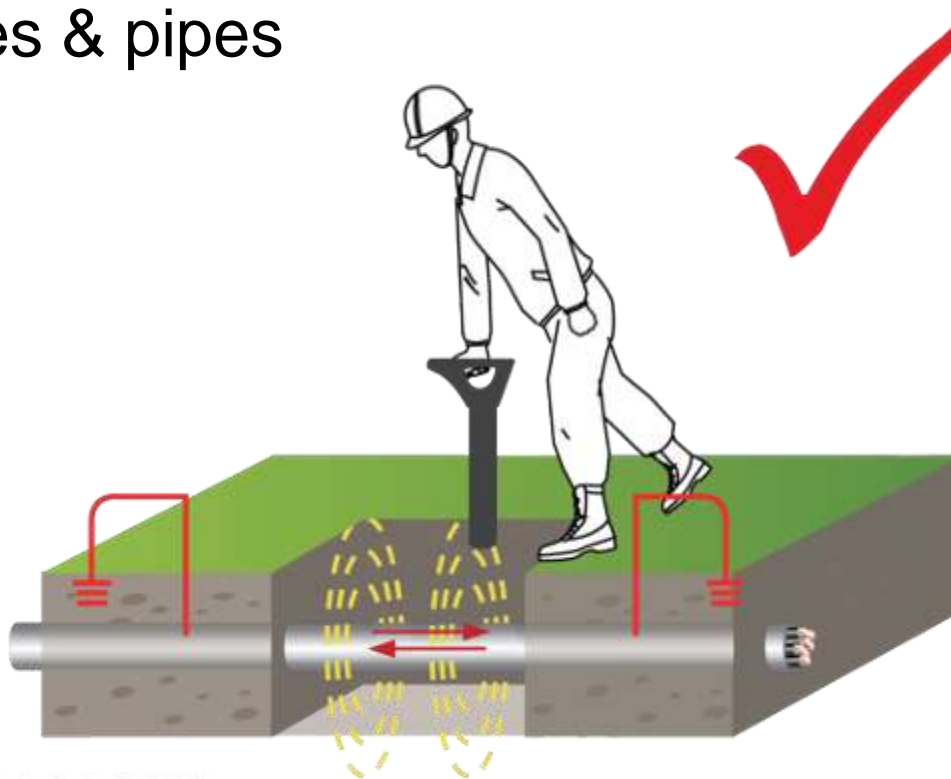


Loc-10Tx-Battery Tray & Charger (100-240V AC – 12V DC-Ni-MH)



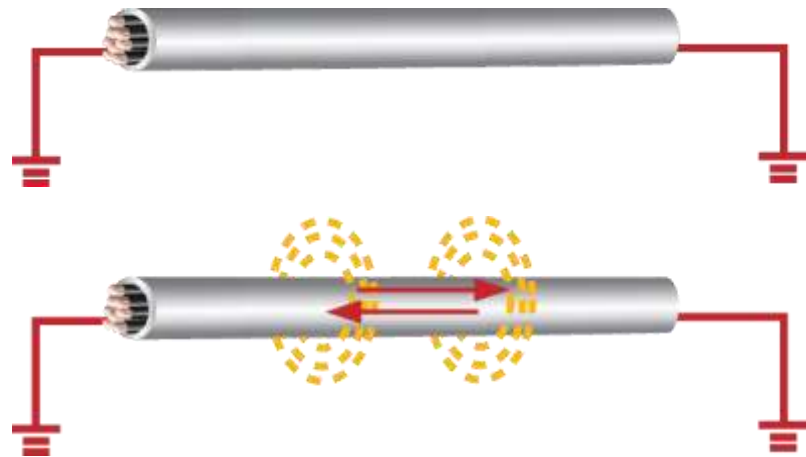
Locators do **NOT** locate buried cables or pipes

Locators **DETECT** electromagnetic **SIGNALS** radiating from metallic cables & pipes



The Locating Signal.....

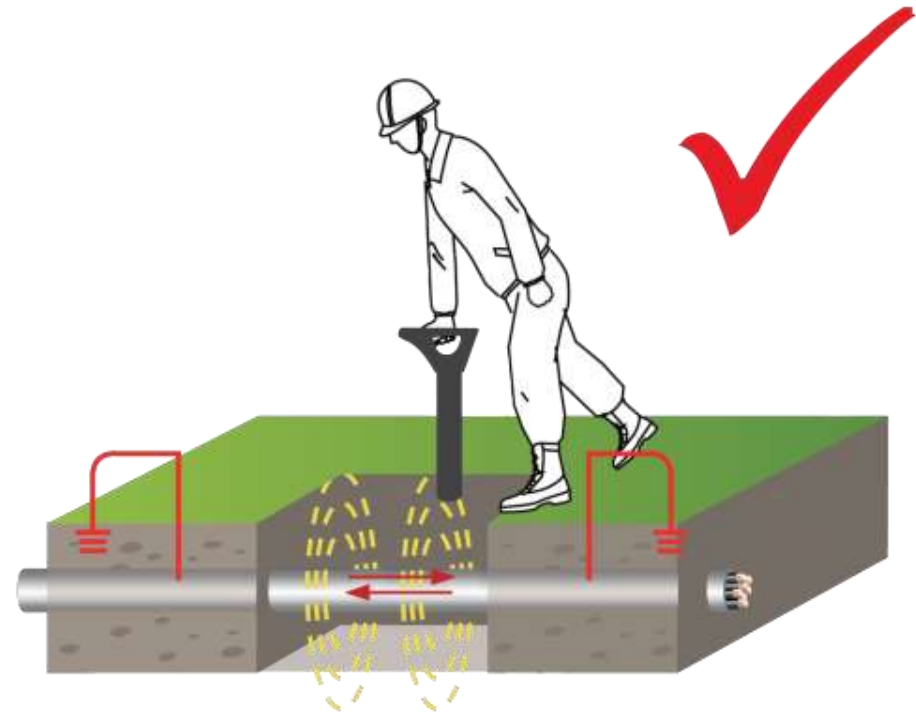
- Is produced by the flow of the alternating current (AC) which creates an electromagnetic field.
- This electromagnetic field *radiates from* the line and is known as the signal.



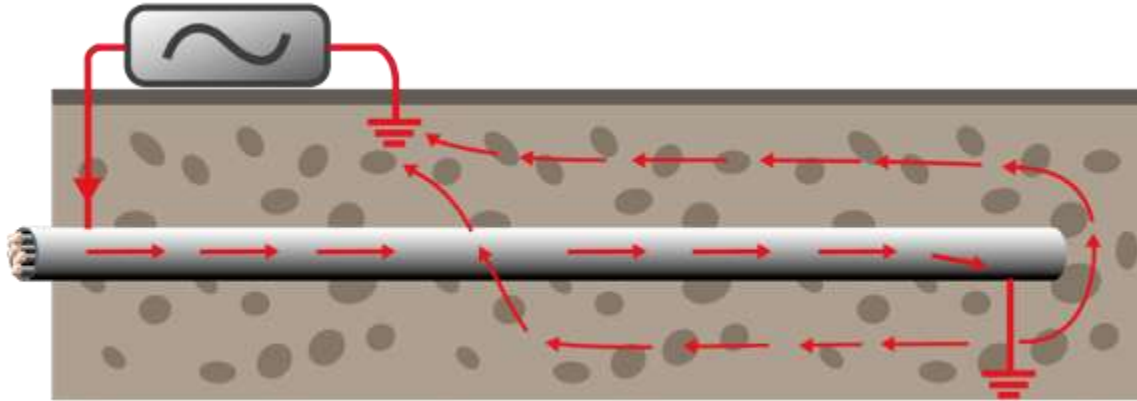
The Locating Signal.....



- if there is **NO AC CURRENT FLOWING**, there will be **NO LOCATING SIGNAL**.

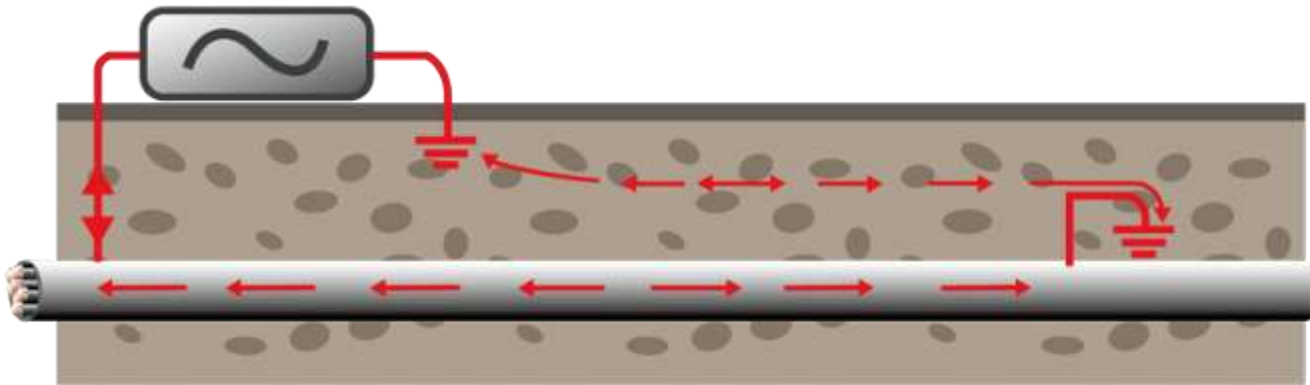


The Locating Signal.....



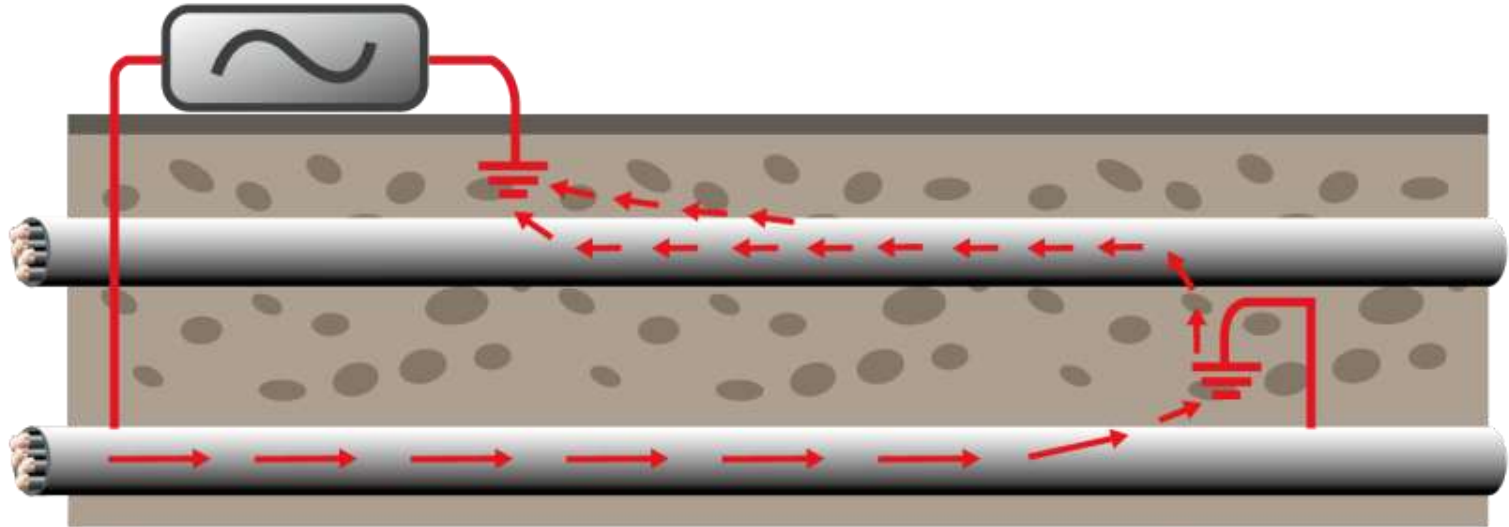
- Signals are created by the current flowing from the transmitter which travel along the conductor (line/cable/pipe) and back to the transmitter.
- The current typically uses the ground to complete the current. The ground stake is used to complete the circuit through the ground.

The Locating Signal.....



- We think of the signal traveling from the transmitter and back to the ground stake. In fact the signal is continually changing direction, flowing back and forth.
- The rate at which it changes is called frequency, so for instance, 50Hz means the signal changes direction 50 times per second, 8000Hz (or 8 kHz) means 8000 times per second. (The “k” denotes 1000)
- The frequency is chosen depending on the application.

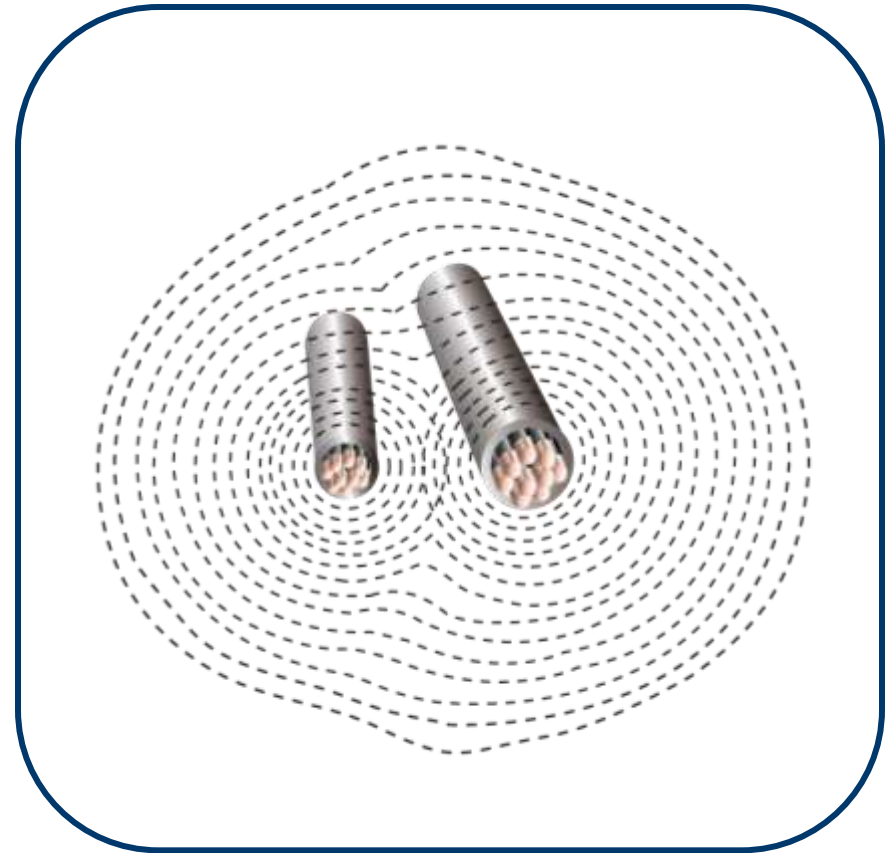
The Locating Signal.....



- Signals may use other pipes and cables to turn to the transmitter because they represent a lower resistance than the ground.

The Locating Signal.....

- Because of these “return” currents the ***ELECTROMAGNETIC FIELDS*** surrounding the line can be ***DISTORTED*** by return currents on other metallic lines.



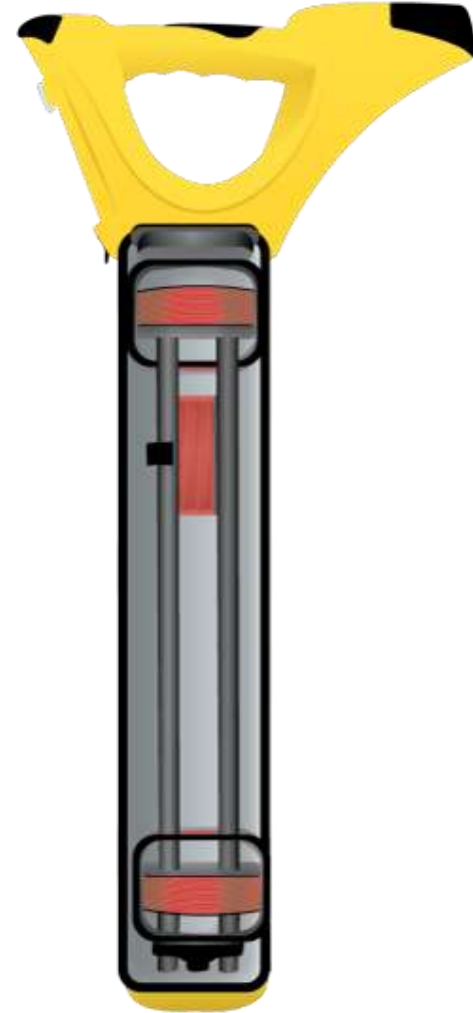
Detecting The Locating Signal.....

- The locator receiver contains sensors that detect the electromagnetic field (the signal).
- These sensors are known as “antennas”.
- The signal induces a “response” in the antennas by electromagnetic induction.



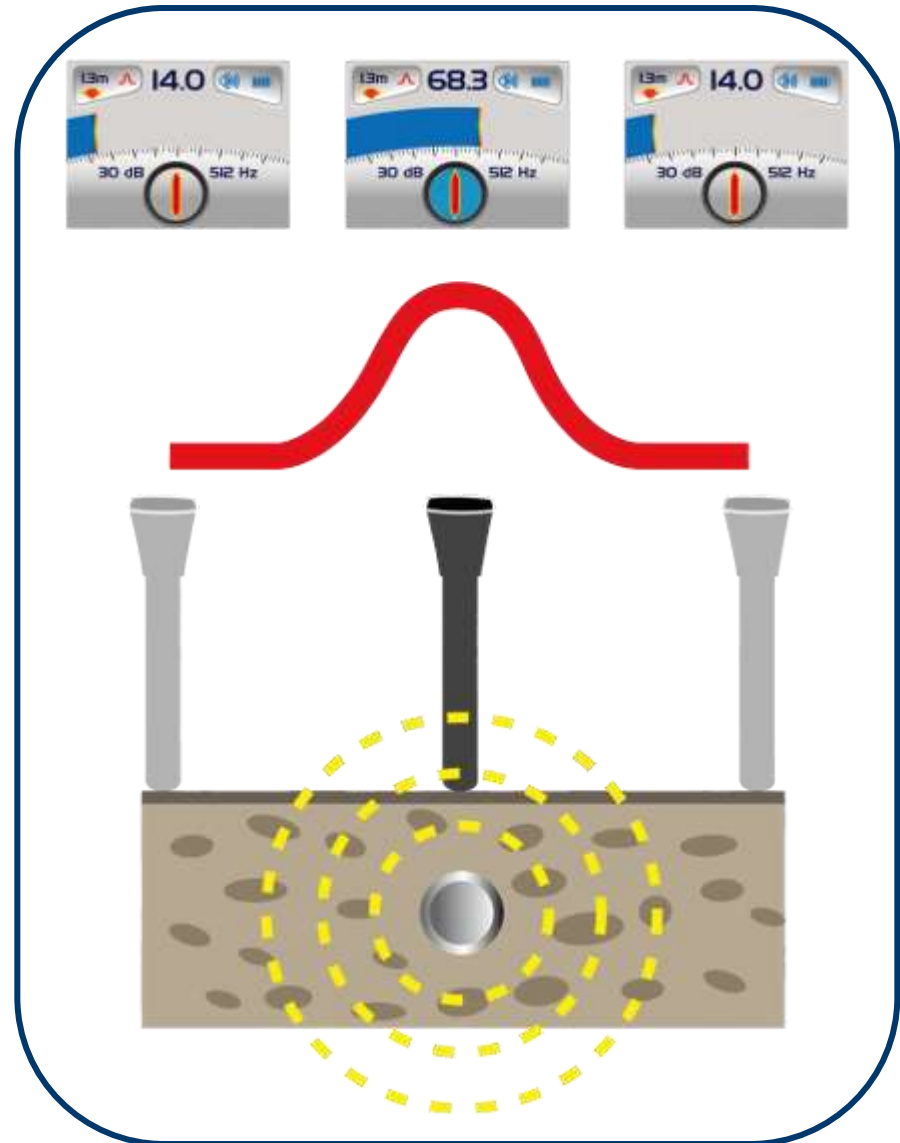
The response to the signal.....

- There are several antennas in a locator, these can be used in different combinations.
- Each combinations (known as modes) provides a different types of response.
- The three main types of response for general locating are “Peak”, “Null” and “Compass LR” indication.
- Two additional modes are often used for specific applications
 - “Broad Peak” (useful when locating very deep lines- operates like peak mode)
 - “Sonde” Mode (for locating Sondes or CCTV inspection cameras – see Sonde section)



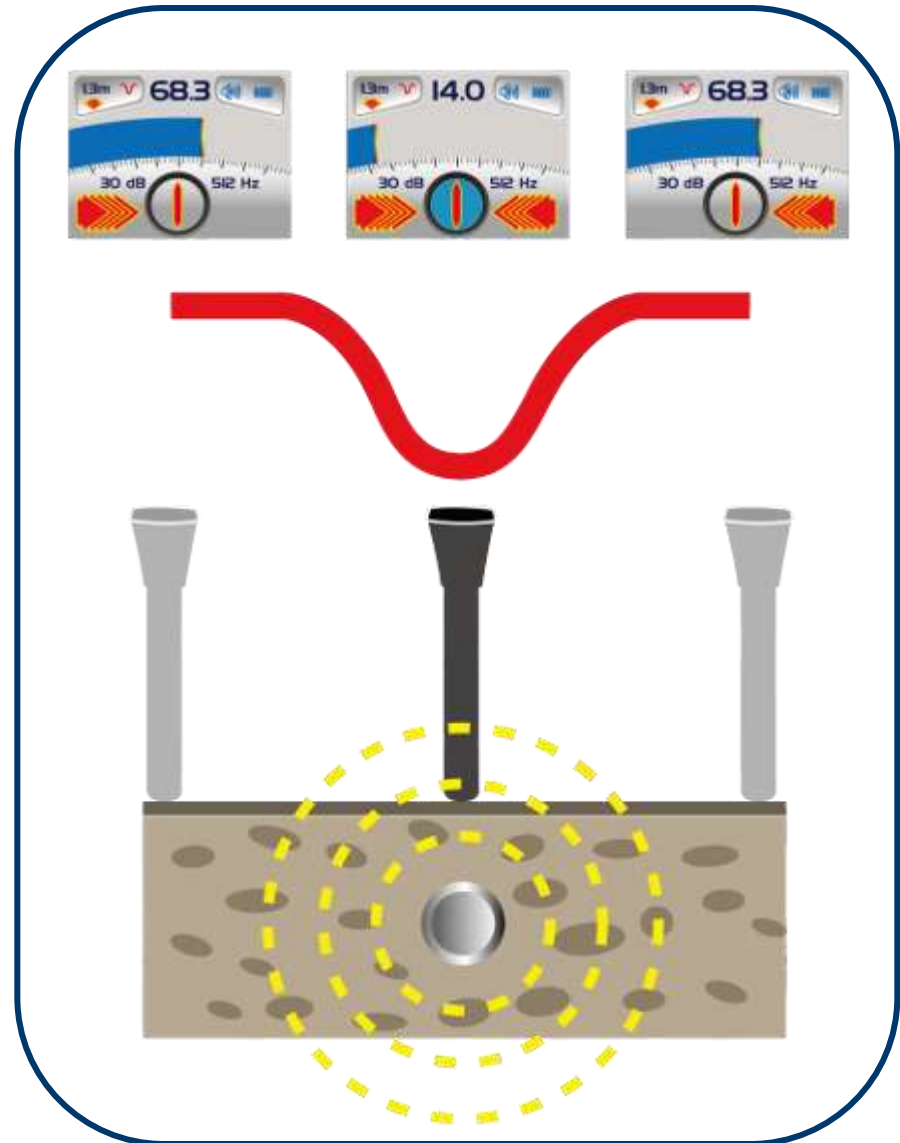
Modes.....

- “Peak” mode
 - provides a maximum response over the line



Modes.....

- “Null mode”
 - provides a minimum response over the line



Modes.....

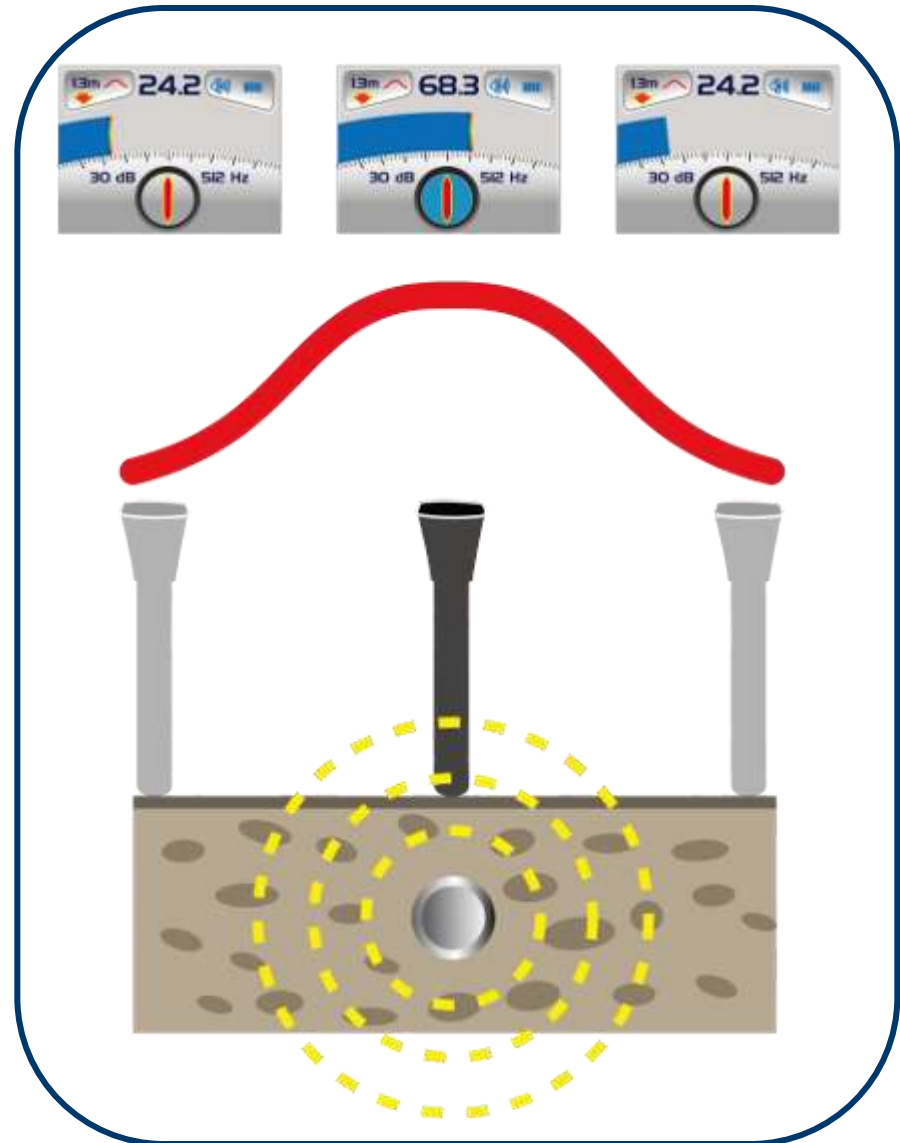
- “Compass LR”
 - Provides “direction” & “orientation” to the line



Modes.....

- **Broad Peak**

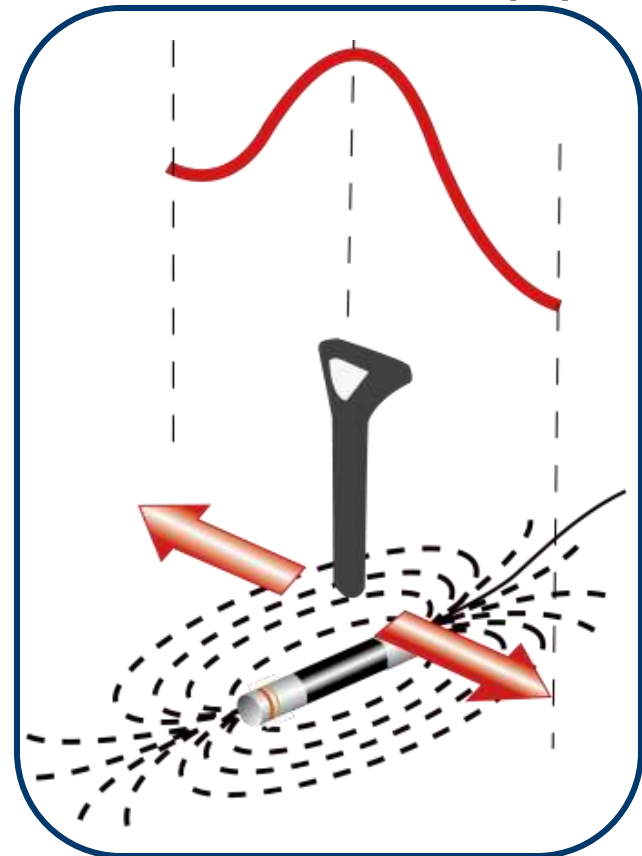
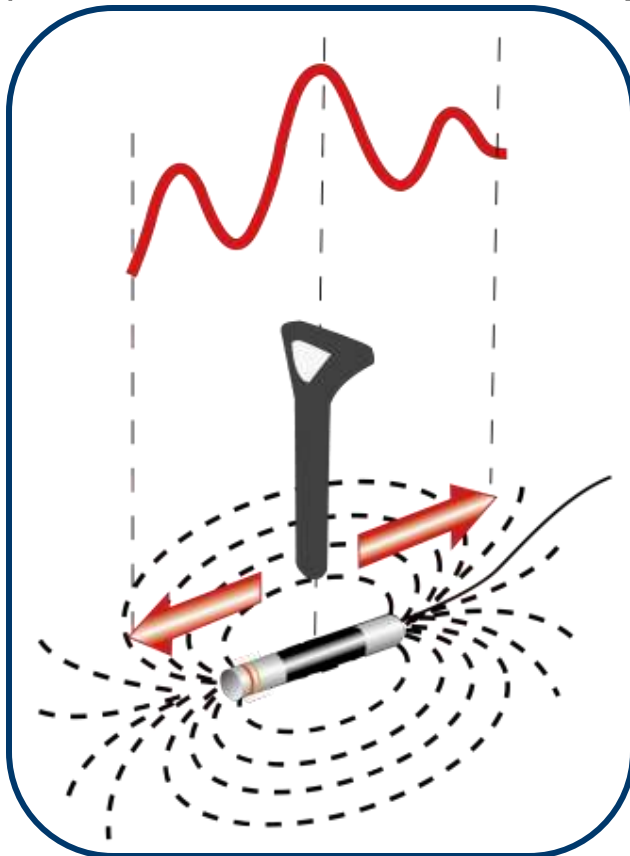
- Provides increased sensitivity locating for deep pipes
- But response is broader, so more difficult to pinpoint



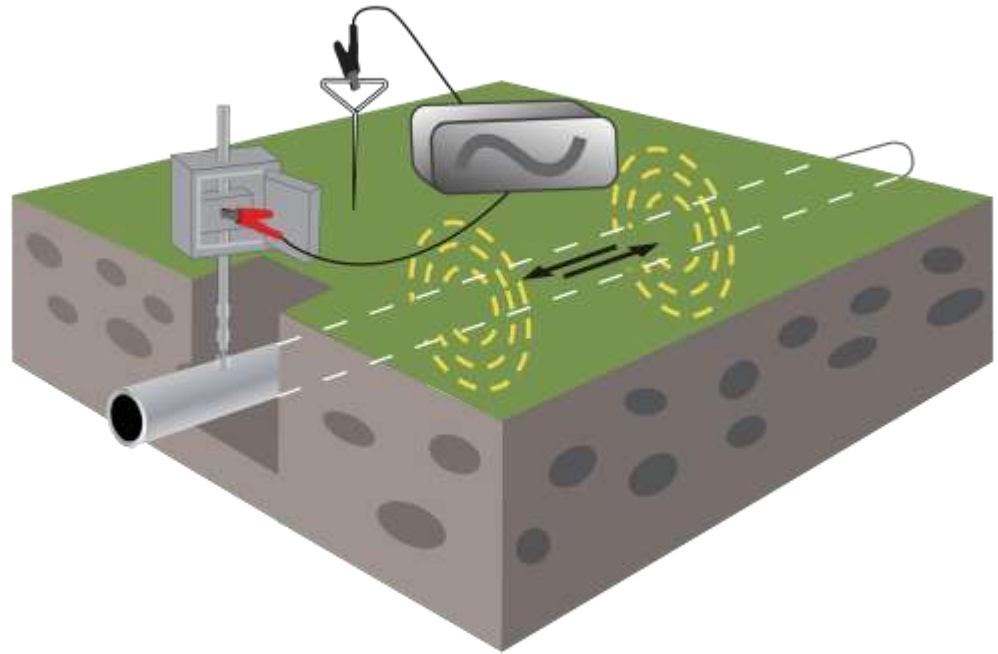
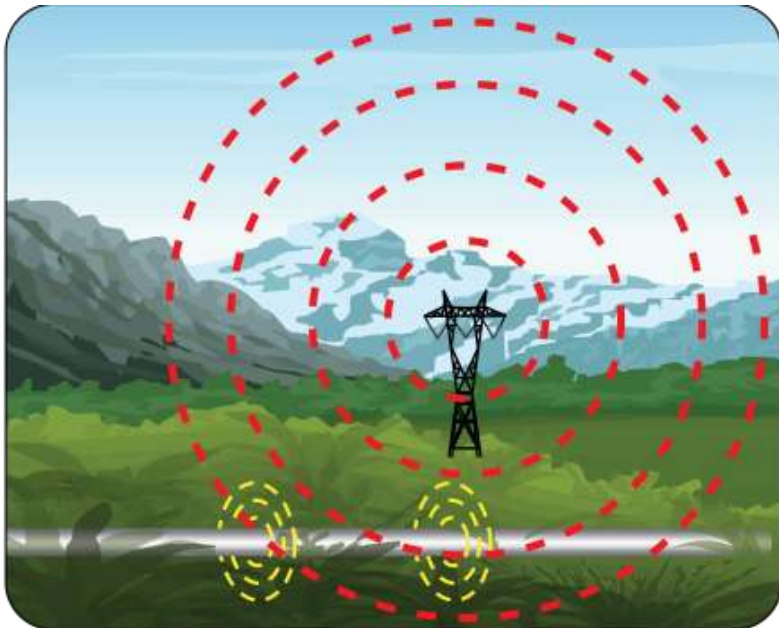
Modes.....

- Sonde

- A way to locate small “self contained” transmitter (used in non metallic pipes & some cast iron pipes)

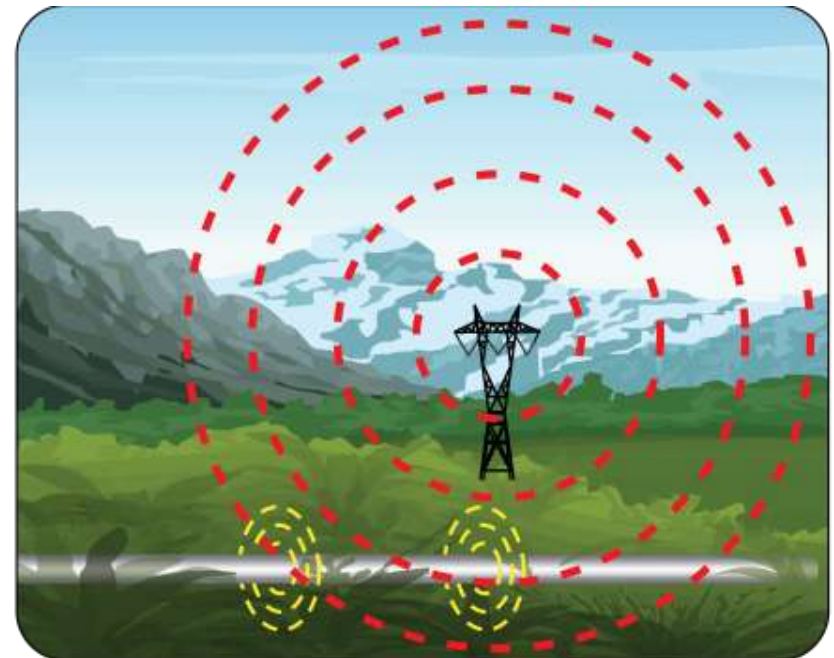


Signals used for locating can originate from a transmitter (active locating), or a variety of other sources (passive locating)

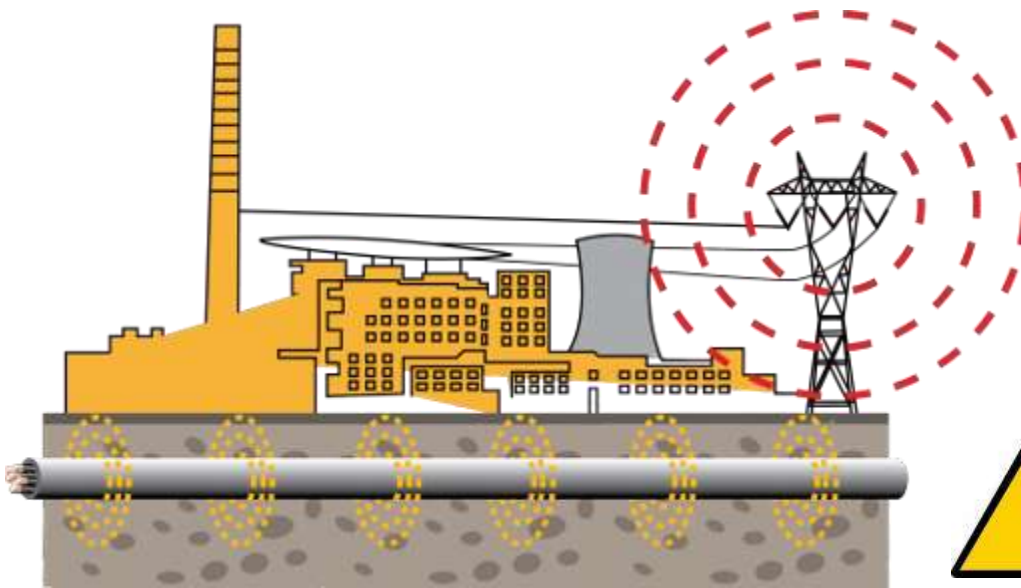


Passive Signals.....

- Power
 - power transmission & distribution networks (50/60Hz & related harmonics)
- Radio
 - radio transmissions (15 kHz – 27 kHz & related harmonics)
- Application specific
 - signals from specific applications (CATV, Cathodic protection etc.)



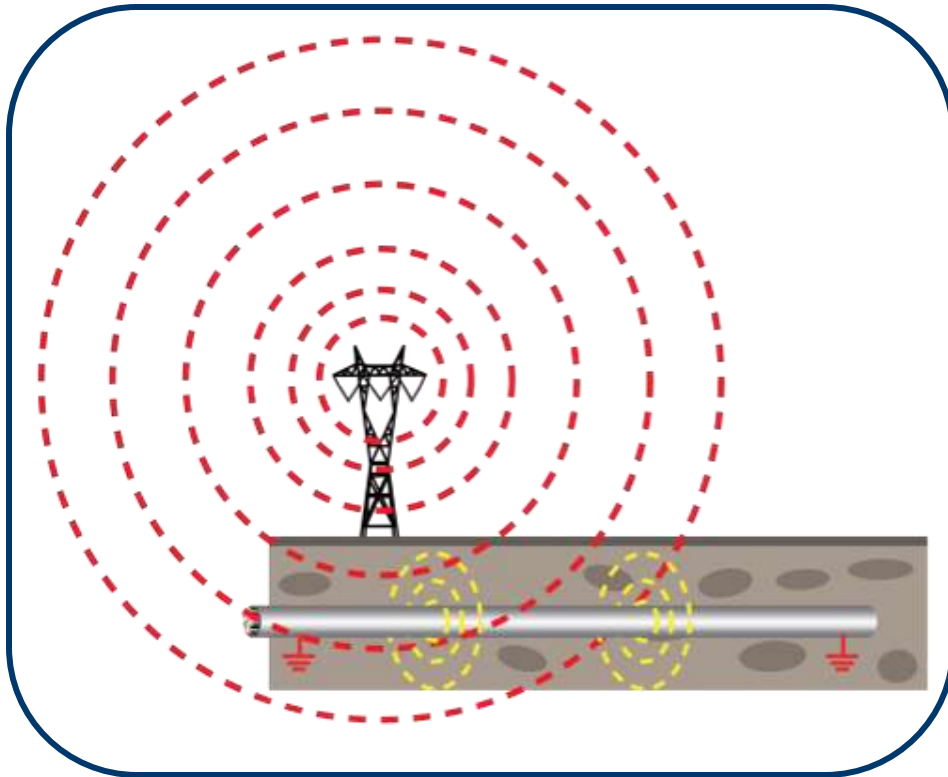
Passive Signals Sources.....



Power Signals

- From cables carry electric current.
- From pipes or cables carrying return electric current.
- Cables may be live but carry *NO* current.
- Pot-ended cables carry *NO* current.

Passive Signals Sources.....



Radio Signals

- Mainly generated by high power, low frequency (LF) communication transmitter.
- Buried cables and pipes act as antennas that re-radiate the signal.
- Radio signals are best re-radiated if the line is grounded at both ends.

Passive Signals Sources.....

Application Specific



- Some cables & pipes radiate signals that are used as a carrier signal such as cable TV (CATV), or to provide cathodic protection to pipes.

Active Signals.....

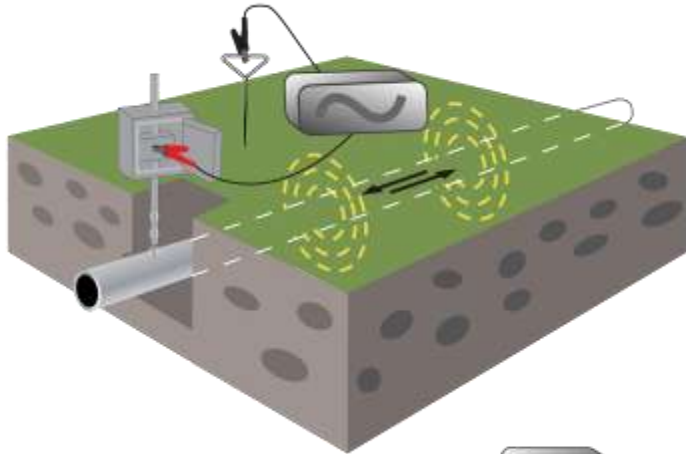


Active signals are applied by a locator transmitter

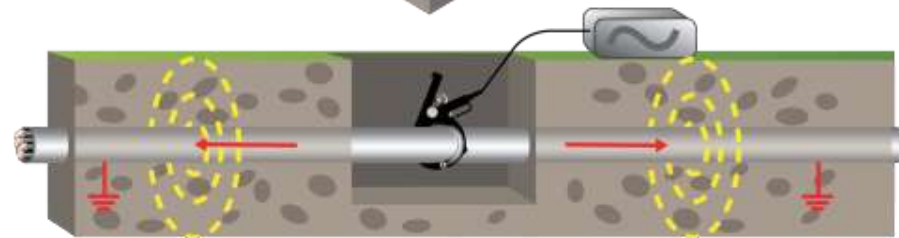
- Transmitter have one or more dedicated frequencies.
- The choice of frequency depends on the line being located, and the method the signal is applied.

(Each manufacture offers slightly different frequencies)

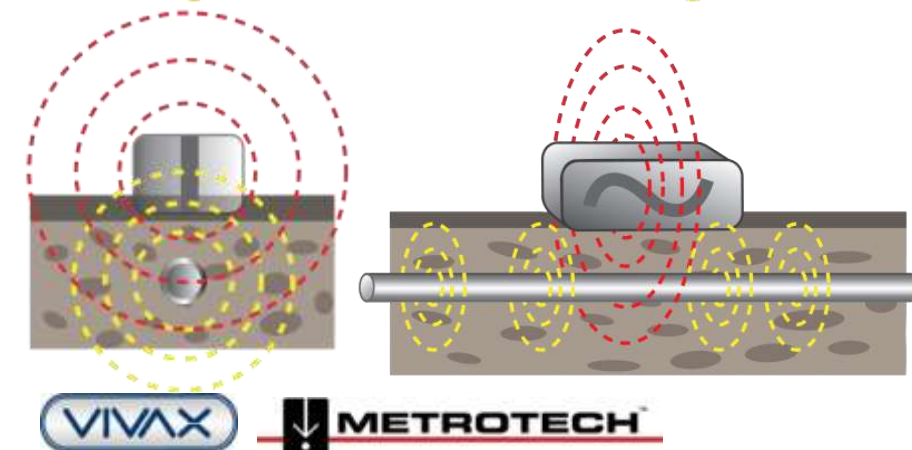
Active Signals.....



Direct connection – one cable to the target line, the other to ground.

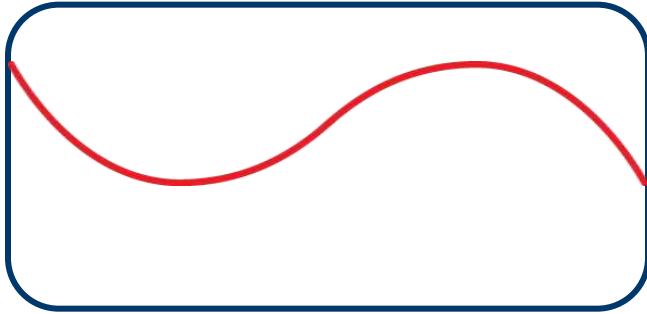


Clamp – induces a signal into a cable, without making a direct connection.

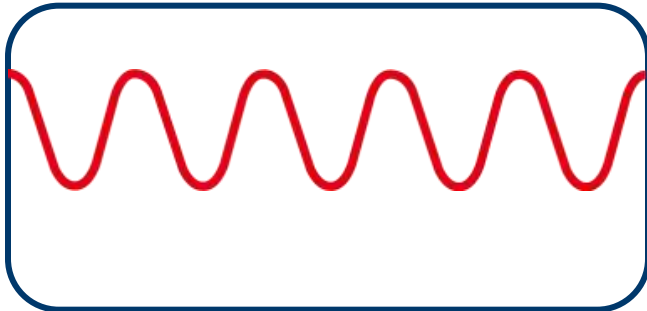


Induction – induces a signal into a cable or pipe, by placing the transmitter on the surface over the target line.

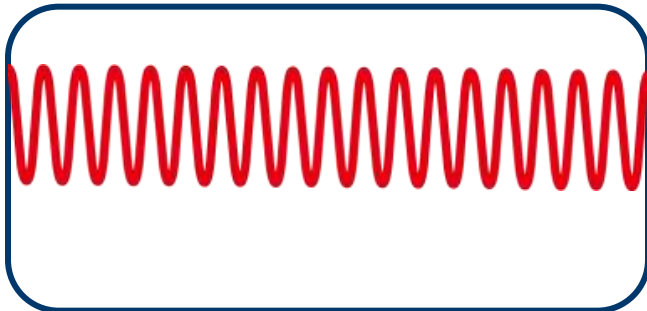
Active Signal Frequency.....



- Low frequency (100Hz – 1 kHz)
 - Cables
 - Direct connection
 - Long distance
 - Low distortion



- Medium frequency (8 kHz – 33 kHz)
 - Cables & pipes
 - Direct connection, clamp & induction
 - Reasonable distance



- High frequency (65 kHz – 200 kHz)
 - Induction
 - Short distance
 - High distortion

Passive verses Active Location...

- Passive Location

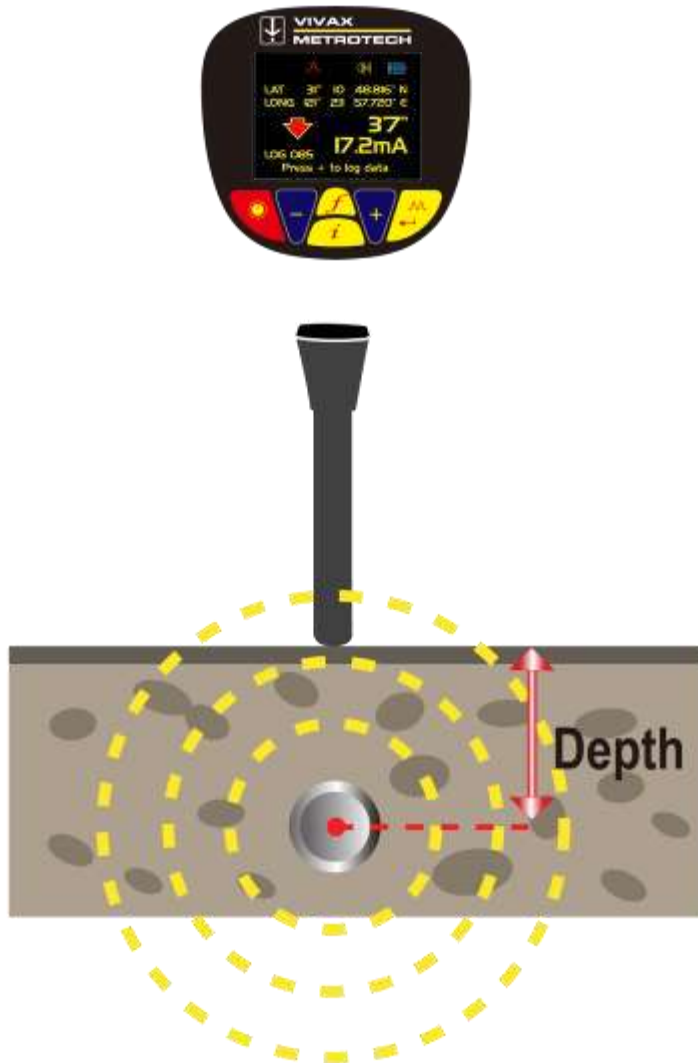
- Use to mark the location of unidentified buried lines before digging (Avoidance)
- Do **NOT** use to identify or trace “specific” lines



- Active Location

- Use to trace, identify & pinpoint a buried line
- Use to measure the depth of the buried line
- Use to measure the signal current on the buried line

Measuring Depth.....

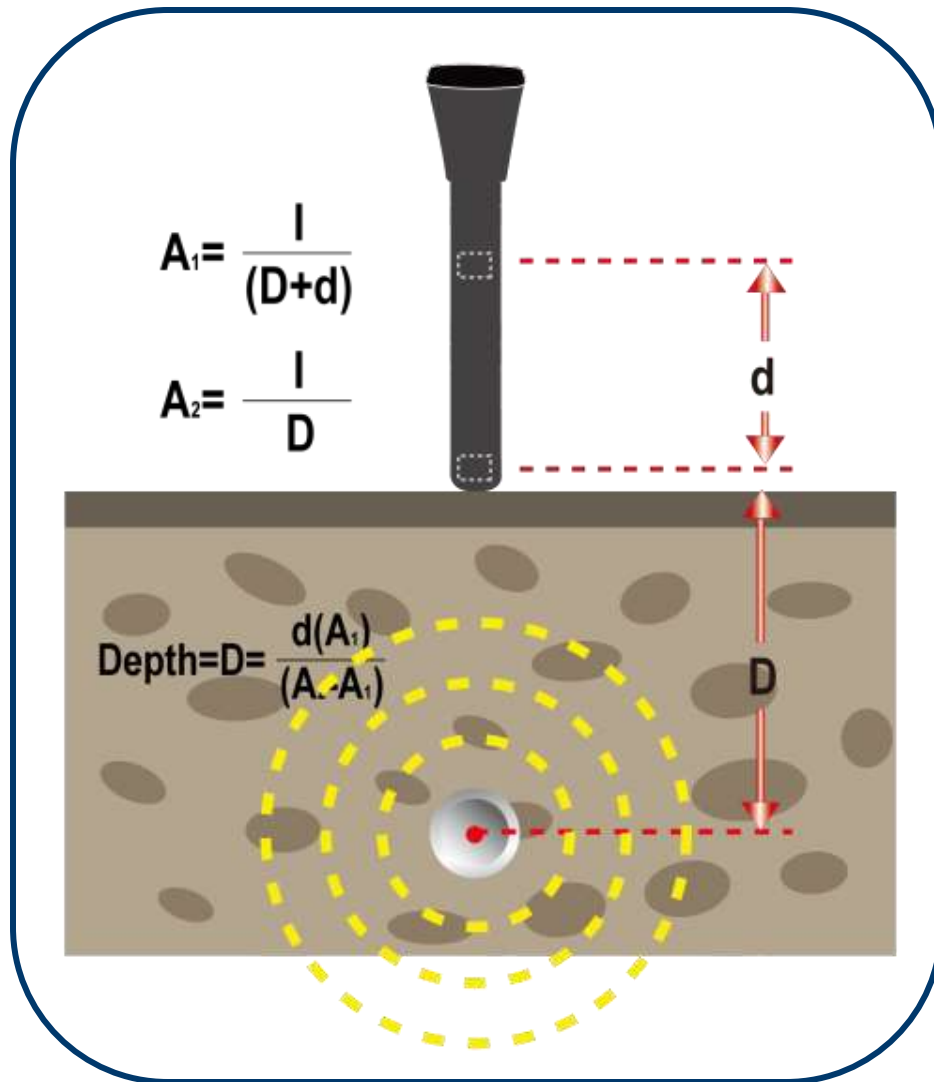


- Depth & signal current can also be measured using a locator
- Depth is measured to the center of the signal – in the case of a large pipe this is considerably different to the top of the pipe
- Some locators provide “continuous” depth – this is only accurate when directly over the line

Measuring Depth.....

1. Pushbutton Depth
2. Triangulation Depth – 70% rule
3. Triangulation Depth – 50% rule

Measuring Depth.....

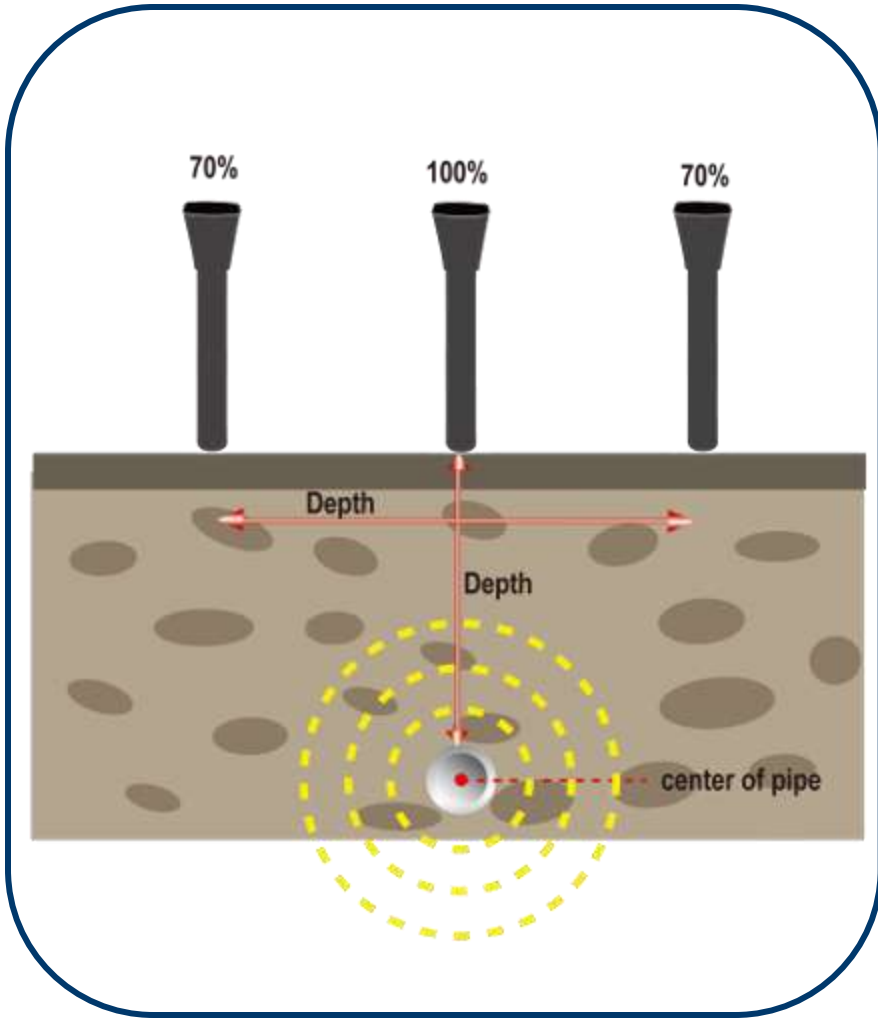


Pushbutton Depth

All locators with pushbutton depth work in a similar way

- Position the locator over the cable using the “Peak” mode
- Press the depth button

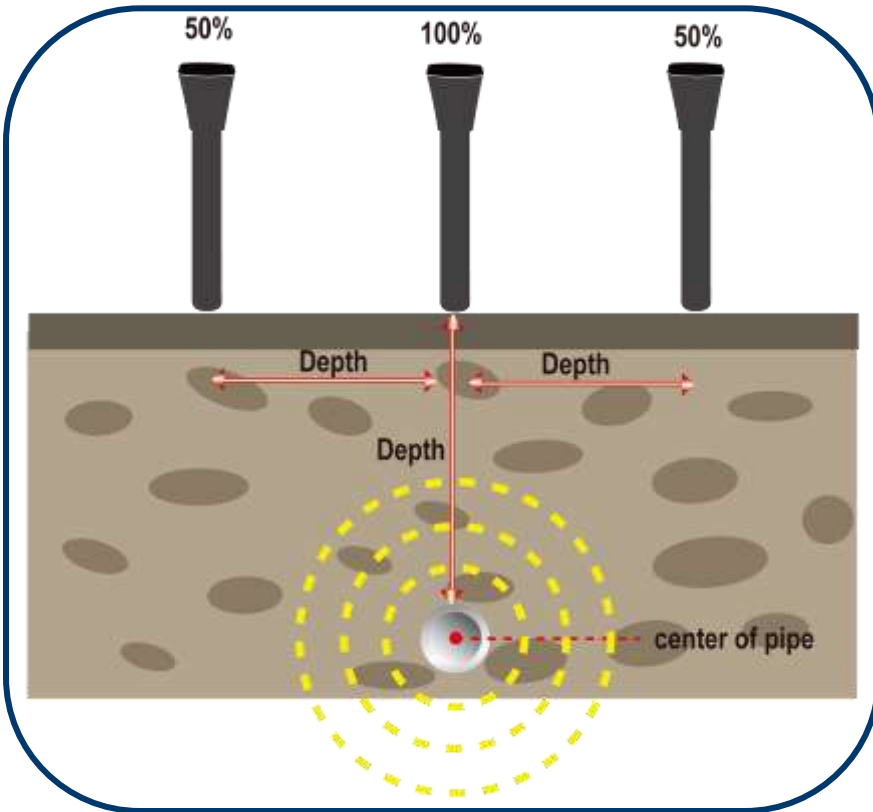
Measuring Depth.....



Triangulation Depth – 70% rule

- Use “Peak” mode (two antennas).
- Locate cable, set gain to 100%.
- Without changing the gain setting move locator to one side until the gain reduces to 70% and mark the position.
- Return to the cable, ensure gain returns to 100%.
- Without changing the gain setting move locator to the other side until the gain reduces to 70% and mark the position.
- The depth is equal to the distance between the two points you marked.

Measuring Depth.....



Triangulation Depth – 50% rule

- Use “Broad Peak” mode .(single antenna)
- Locate cable, set gain to 100%.
- Without changing the gain setting move locator to one side until the gain reduces to 50% and mark the position.
- The depth is equal to the distance from the starting position to the 50% point you marked.
- Return to the cable, ensure gain returns to 100%.

- Without changing the gain setting move locator to the other side until the gain reduces to 50% and mark the position.
- This distance should be the same as the first measurement take. If it is not it is a clear indication of a distorted (or bent) field generally cause by signals radiating from adjacent cables.

Getting to Know the vLocPro

The Principles of Cable & Pipe Location

The Receiver.....



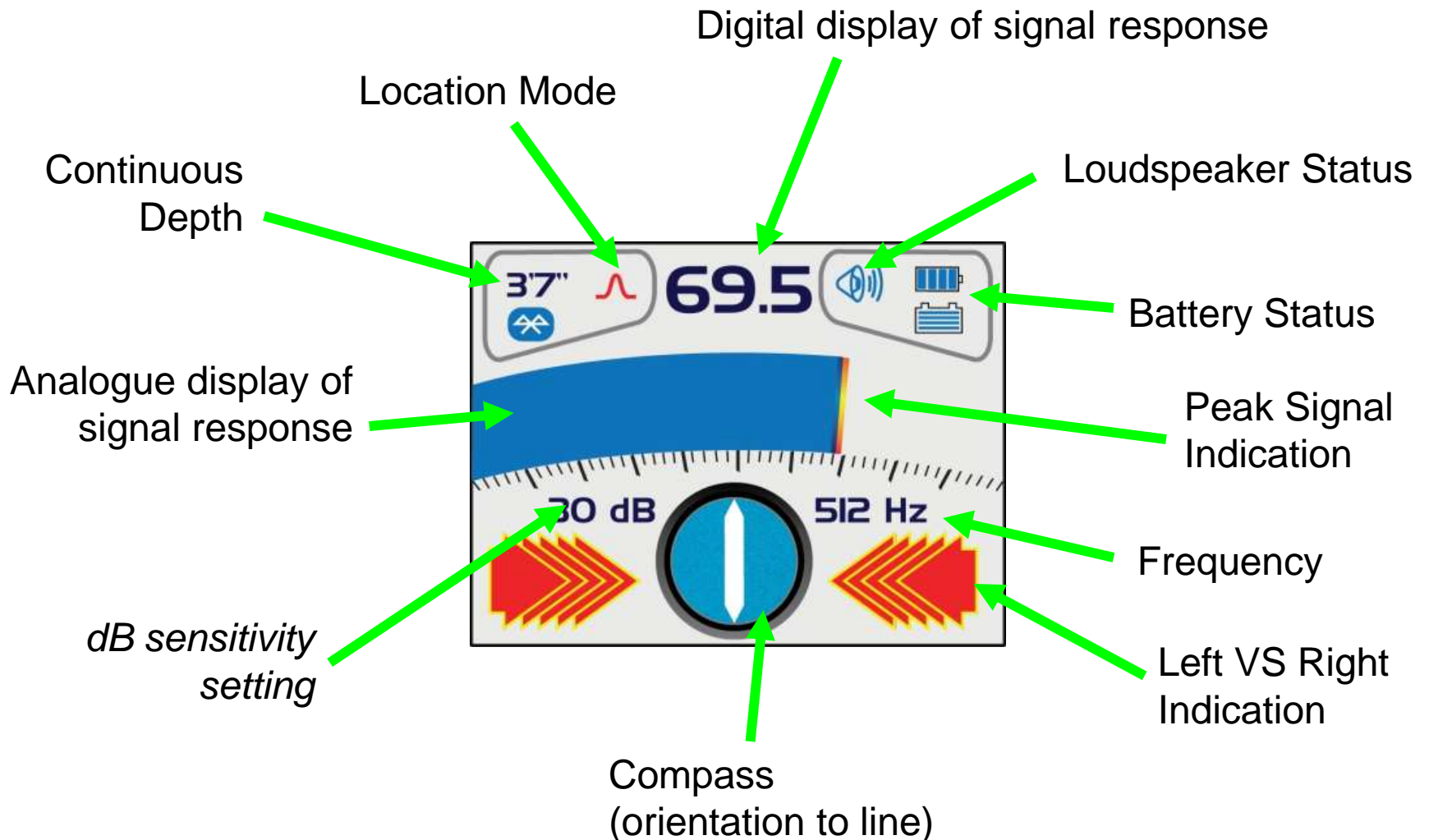
Model &
Serial #



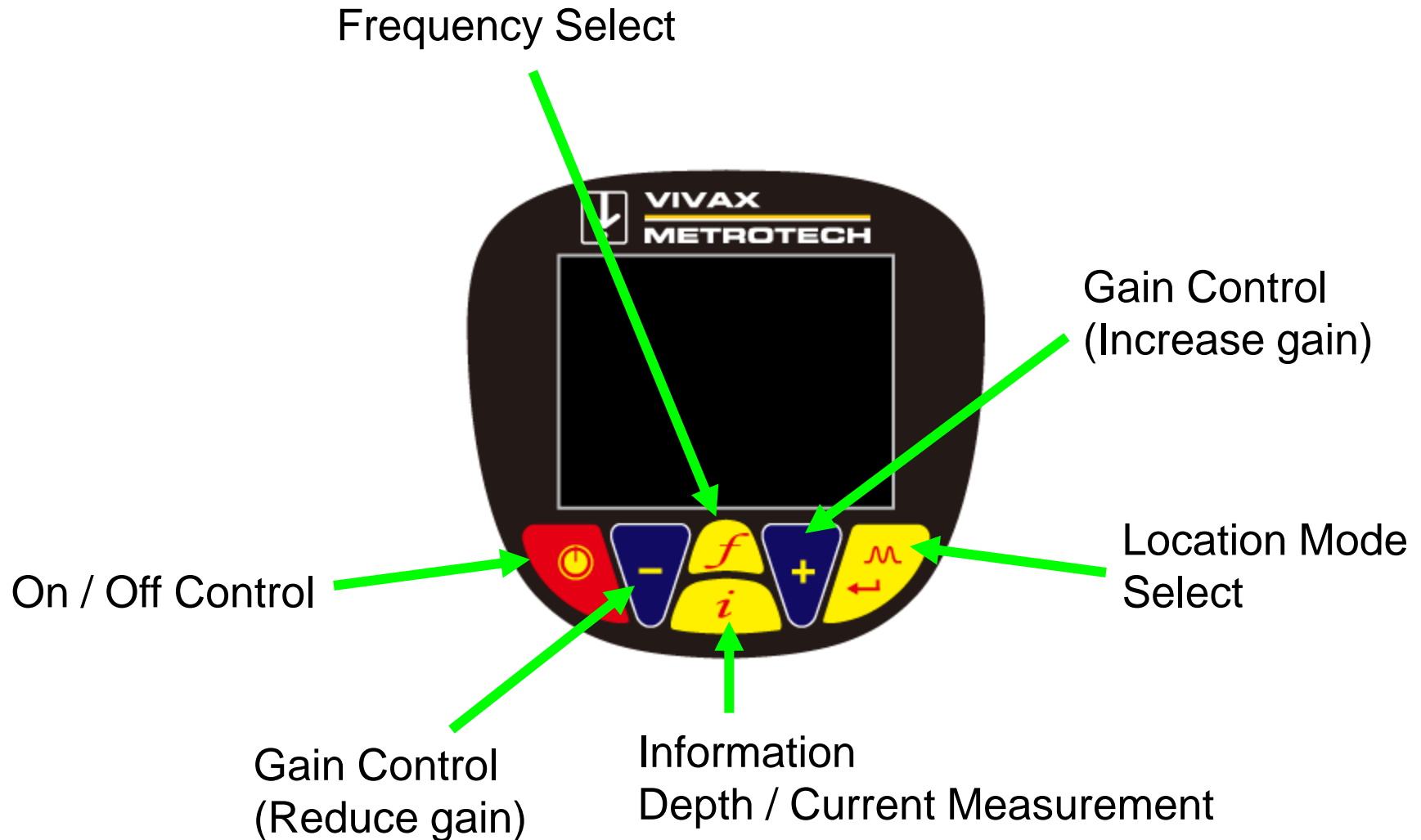
Software
Revision
Number



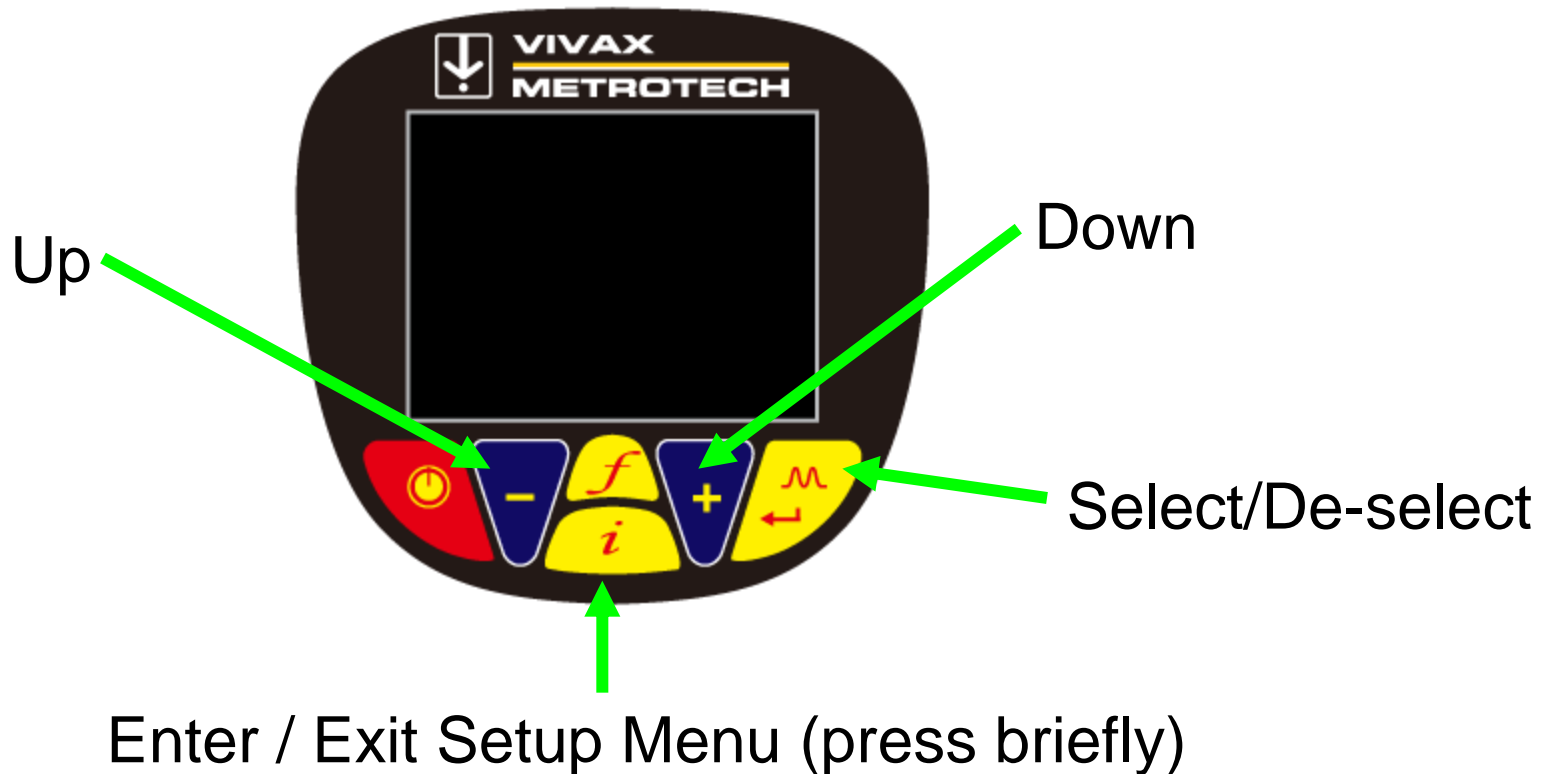
The Receiver Main Display.....



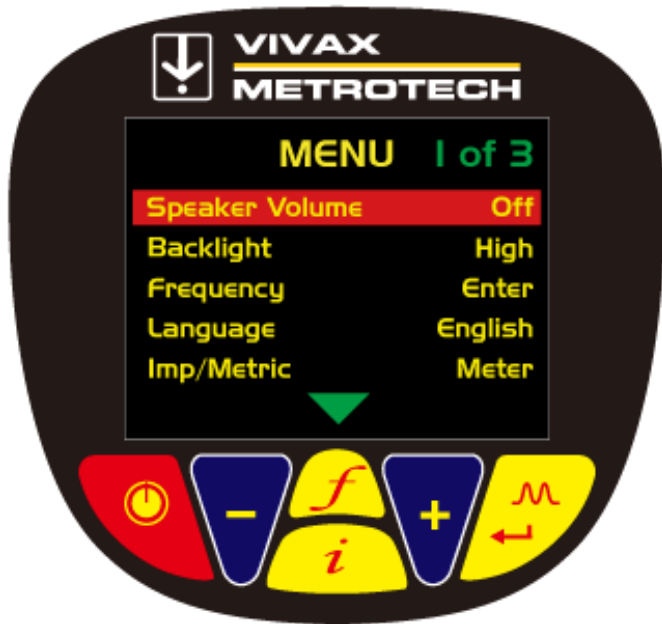
Receiver Controls...Normal Use...



Receiver Controls...Setup Menu...



Receiver Setup Menu.....



- **Speaker Volume** - Off, Low, Medium, High
- **Backlight** - Off, Low, High
- **Frequency** - Enter - "frequently used"
- **Language** - English
- **Imp/Metric** - Meter, Feet
- **Continuous Info** - Depth, Current, Off
- **Power Sound** - Normal, Modulated
- **Radio Sound** - Normal, Modulated
- **Active Sound** - Normal, Modulated
- **Locate Mode** - Enter - Mode Selection - Peak, Null, Sonde, Broad, Peak Arrows
- **Bluetooth Pairing** - to pair with Bluetooth device
- **Bluetooth Search** - to search for Bluetooth device

Receiver Setup Menu.....

Frequency Selection

<input type="radio"/> 380 Hz	<input type="radio"/> 560 Hz
<input type="radio"/> 400 Hz	<input type="radio"/> 577 Hz
<input type="radio"/> 440 Hz	<input type="radio"/> 604 Hz
<input type="radio"/> 484 Hz	<input type="radio"/> 624 Hz
<input checked="" type="radio"/> 512 Hz	<input type="radio"/> 640 Hz

Not selected

Selected

Receiver External Connections...

External connections are as follows:

- **Charging socket**
(for internal rechargeable battery)
- **Data socket**
(for programming & data applications)
- **Accessory socket**
(for receiver accessories)
- **Battery connection lead**
(for connecting AA – alkaline battery pack)



Receiver Batteries...

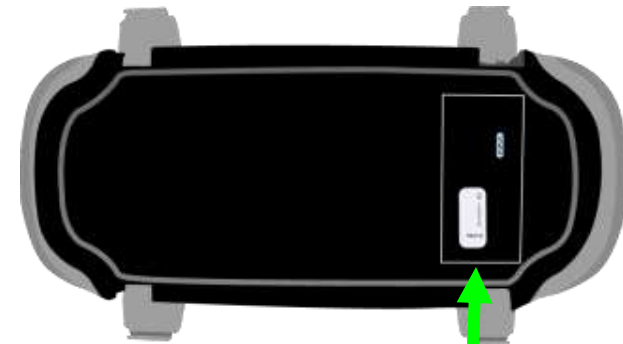
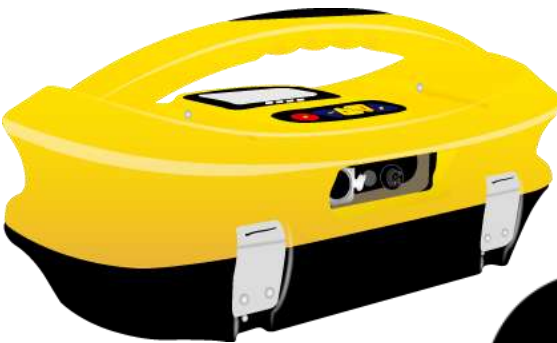
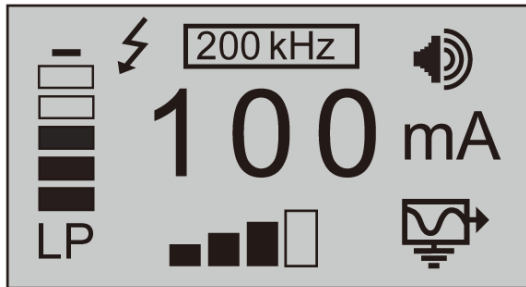
The locator has three battery pack:

- **Rechargeable (internal)**
 - Main power source
- **6 x AA – Alkaline (removable)**
 - Backup power
 - Easily available
- **(Optional) Auxiliary pack (removable)**
 - Replace the AA removable pack with a rechargeable pack
- **(Optional) Vehicle charging lead for internal & external charging is available**



- Inserting the AA backup pack will isolate the internal rechargeable pack.
- The auxiliary battery pack is charged externally.
- Dispose of batteries sensible, never dispose of in fire.

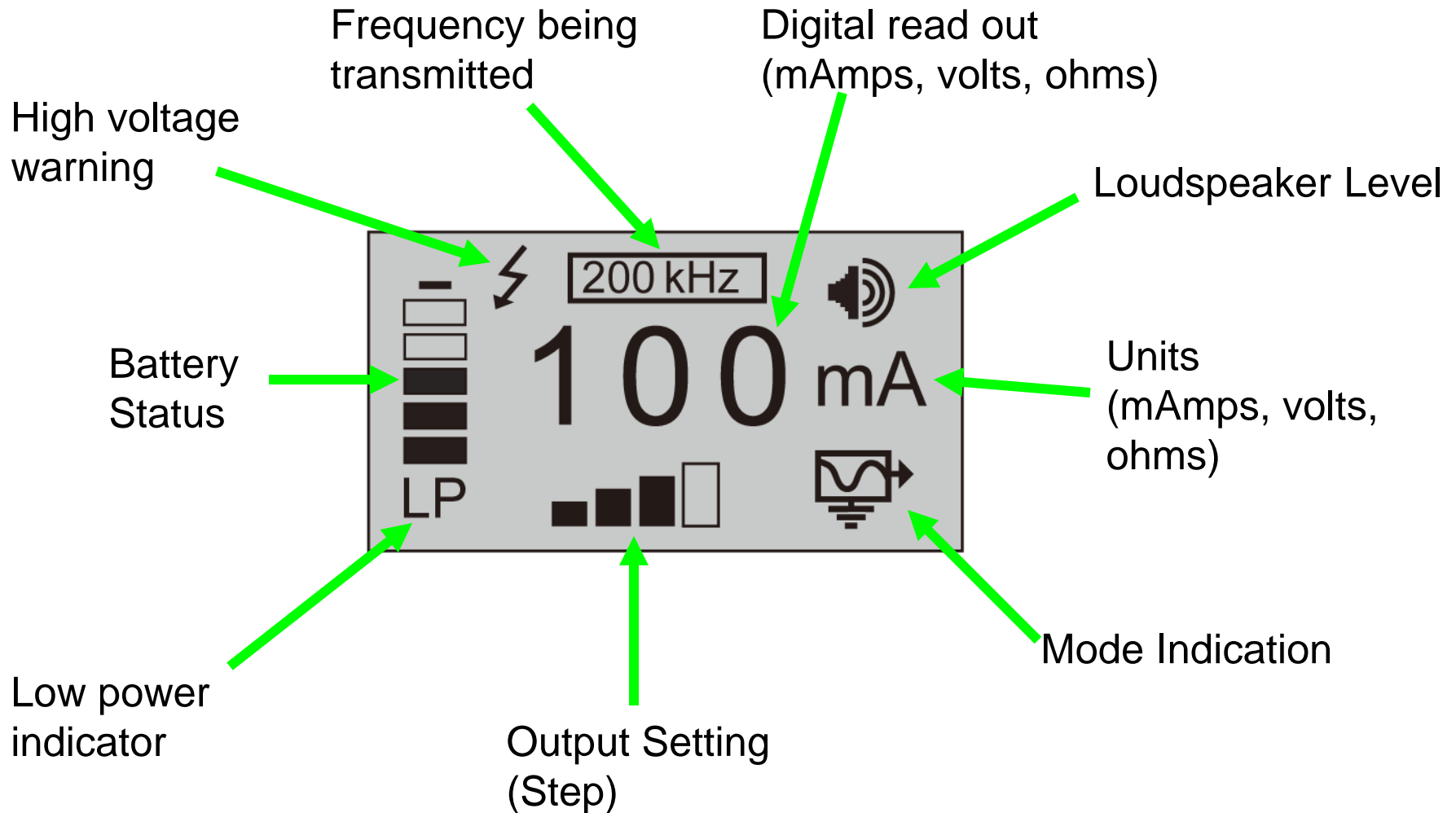
The Transmitter.....



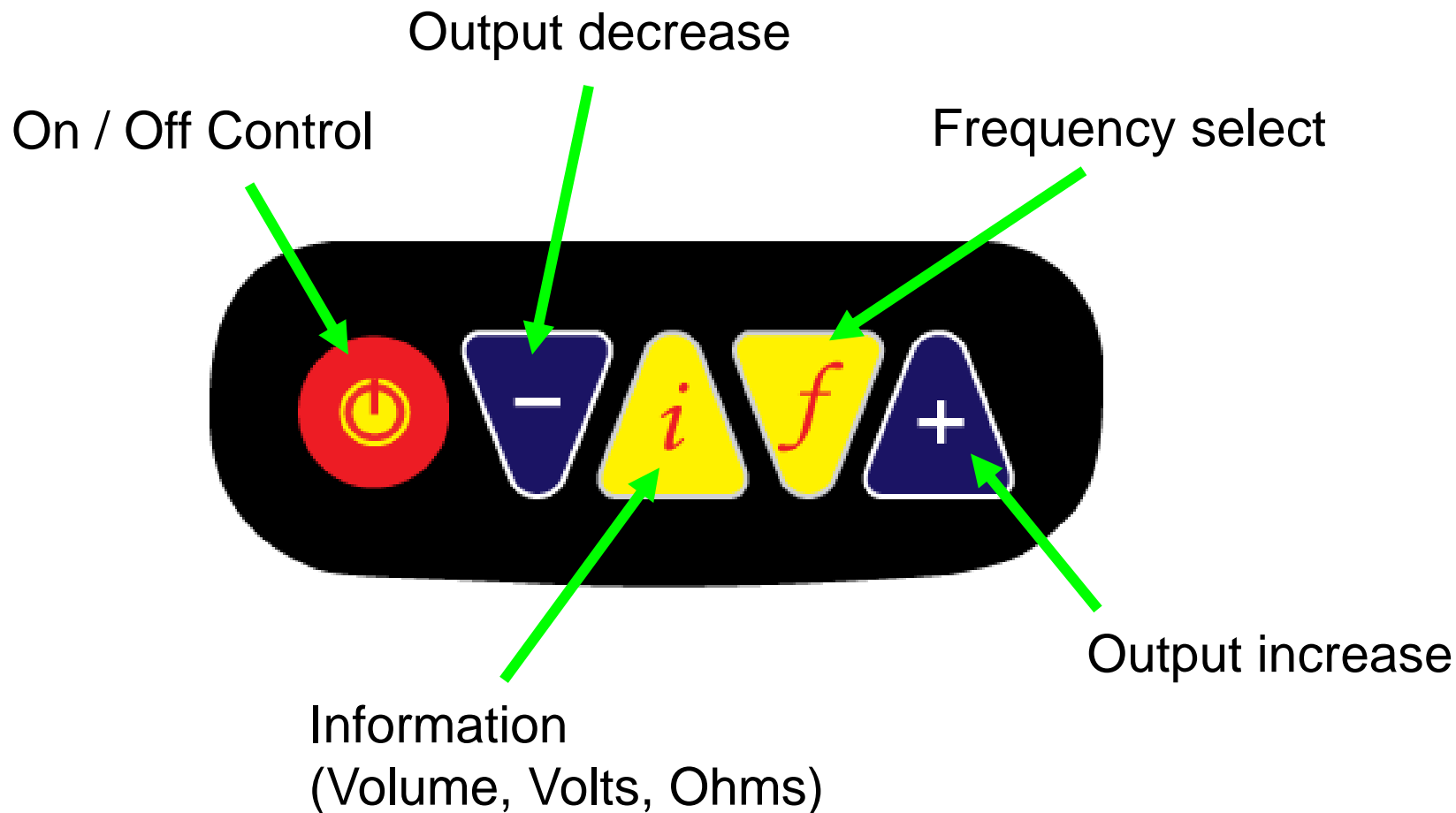
Model &
Serial #
labels

Software Revision
Number

The Transmitter.....



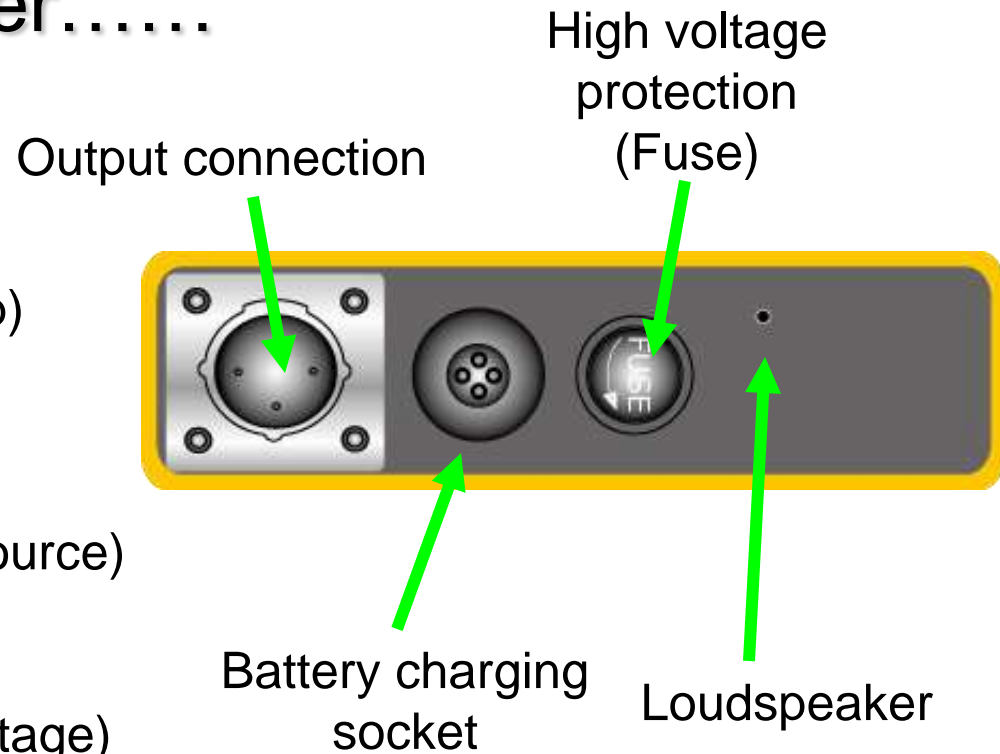
The Transmitter.....



The Transmitter.....

External connections

- **Output socket**
(for direct connection leads & clamp)
- **Power in socket**
(for main charger or powering transmitter from external 12V DC source)
- **Fuse (250V – replaceable)**
(to protect against incoming line voltage)



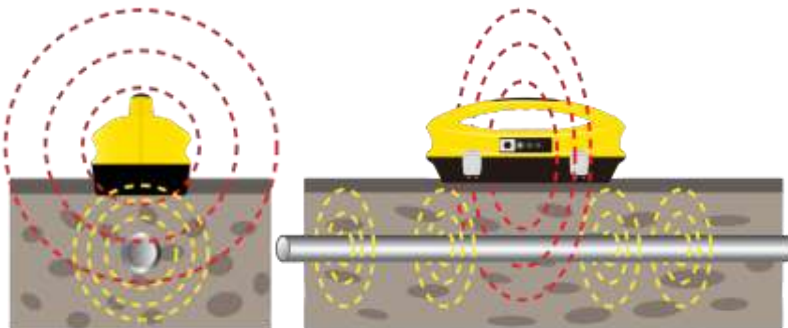
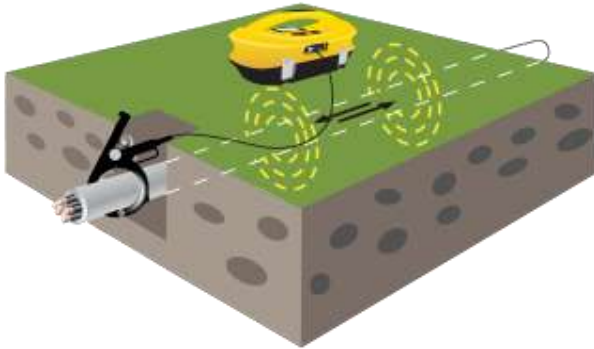
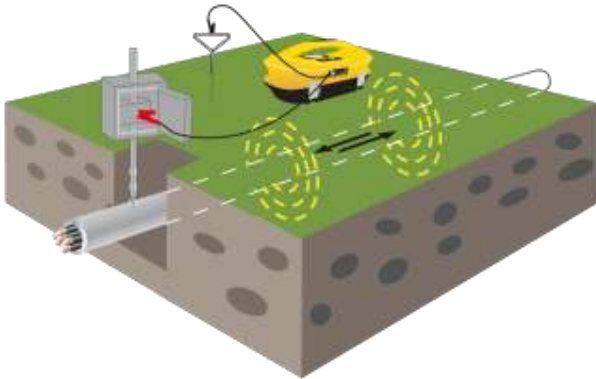
- When powering the transmitter from an external 12V DC source battery charging is disabled.
- The small hole on this panel is to enable the audio to be heard.
- All transmitters are fitted and wired to allow charging of a rechargeable battery tray.



The Transmitter.....

Three ways to apply the signal:

- **Direct connection** – one cable to the target line, the other to ground
- **Clamp** – induces a signal into a cable, without making a direct connection
- **Induction** – induces a signal into a cable or pipe, by placing the transmitter on the surface over the target line

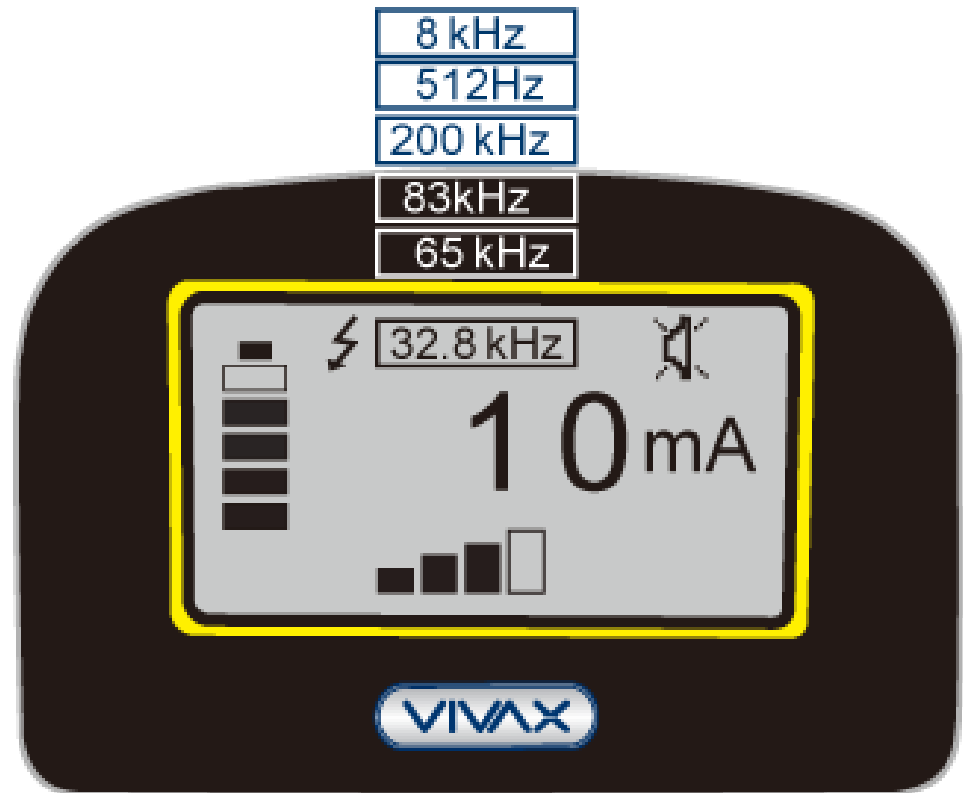


The Transmitter.....

Three transmitting modes:

- **Direct Connection Mode** – selects automatically when plugging in the connection leads
- **Signal Clamp Mode** – selects automatically when plugging in the clamp
- **Induction Mode** – default mode when nothing is plugged in

The Transmitter.....



To select frequency

- Press the “f” button to toggle between the available frequencies until the desired frequency is displayed.

The Transmitter.....

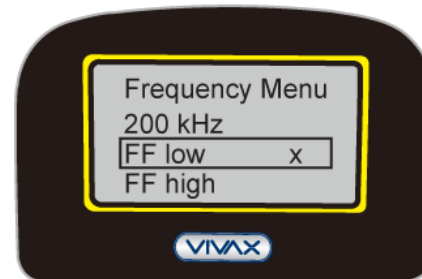


- The “i” pushbutton
- The default setting displays current
- Press once to display the speaker status, adjust using the “-” / “+” pushbutton
- Press again to display voltage (volts)



The Transmitter.....

- Press again to display electrical resistance (ohms)
- Press again to display second frequency menu, use the “+” and “-” keys to scroll through the available frequencies and bring the wanted one in the box. Press “f” key to select the second frequency and exit the submenu to return to the main display.
- Press again to display “Frequency Menu”, use “+” or “-” buttons to scroll through the available frequencies. Once the wanted frequency is inside the box, press “f” button to select or deselect the frequency. An “x” will appear in the box for a selected frequency.



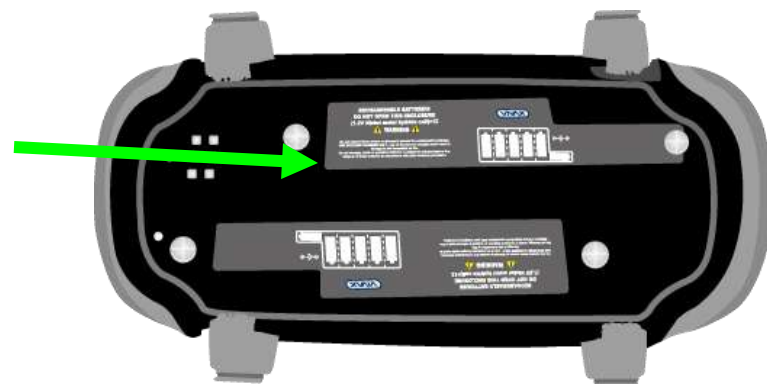
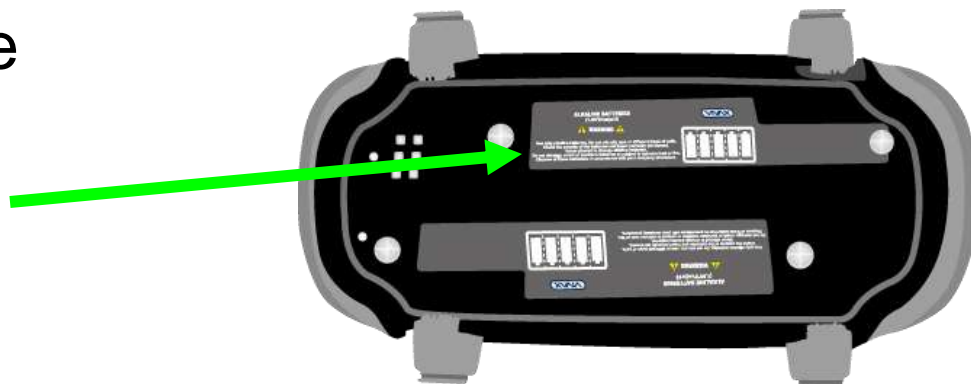
The Transmitter.....

- Protection
- The transmitter checks the line when connected, if the line is carrying in excess of 35V, it will display “High Voltage” and not allow the transmitter to operate.
- In addition the transmitter is protected by a 1.25A / 250V fuse in the event of excessive voltage or voltage spikes on the line.



The Transmitter Batteries.....

- Two battery trays available
 - Alkaline 10 x D cells
 - Rechargeable 12 x D cells (Ni-MH)
- The label differentiate the type of batteries installed



The Transmitter.....

- Removing the batteries trays





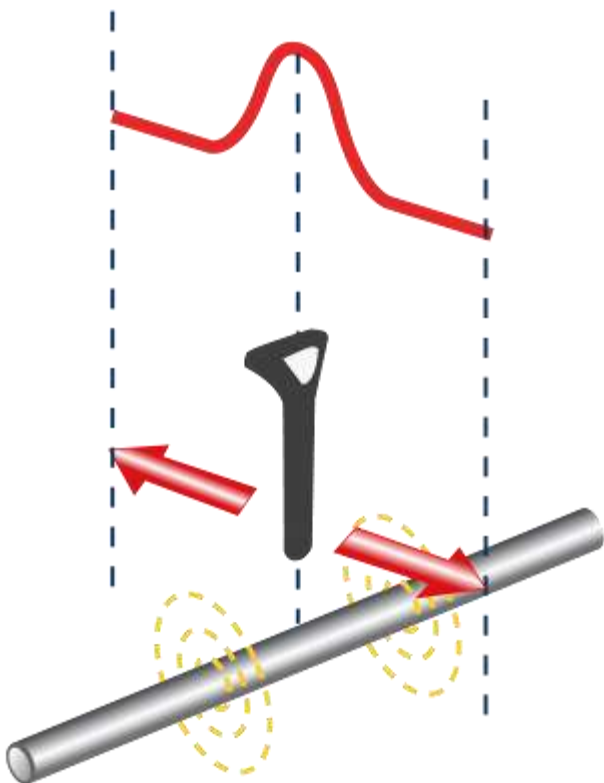
Using A Locator

The Principles of Cable & Pipe Location

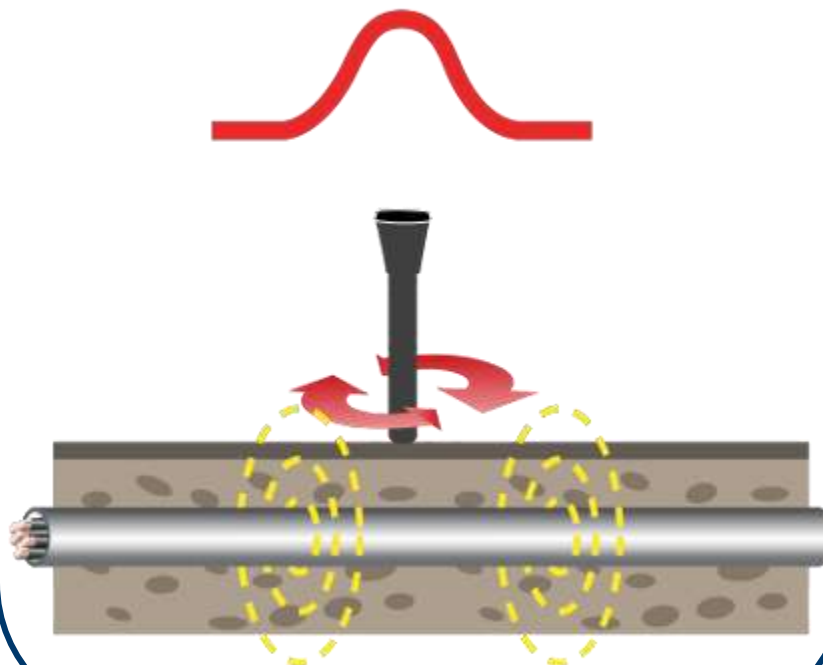


Using the Receiver.....

Move the receiver forwards and backwards across the line in a smooth action

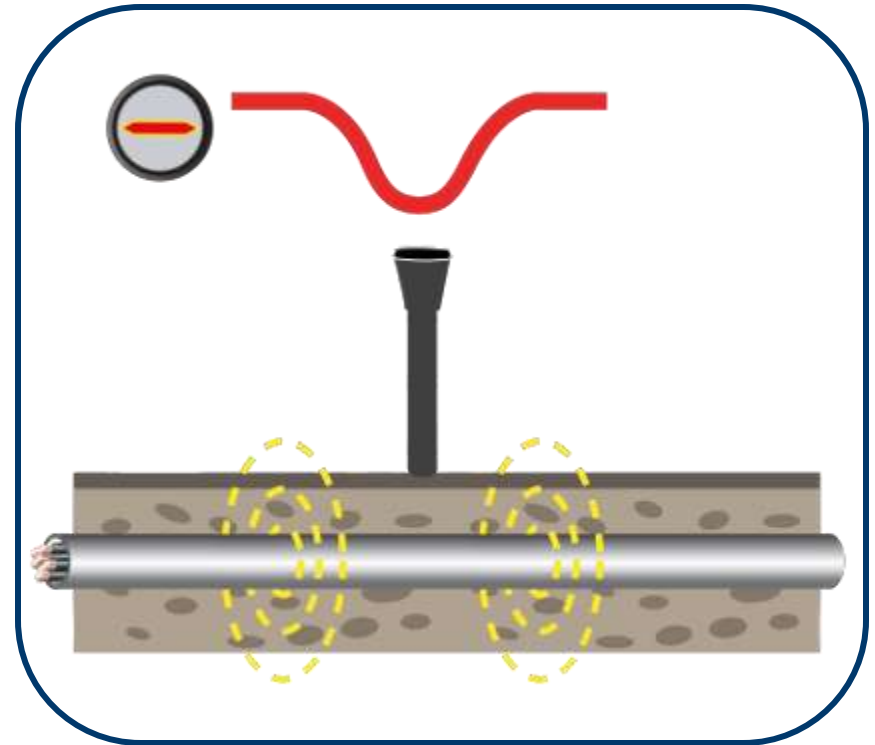
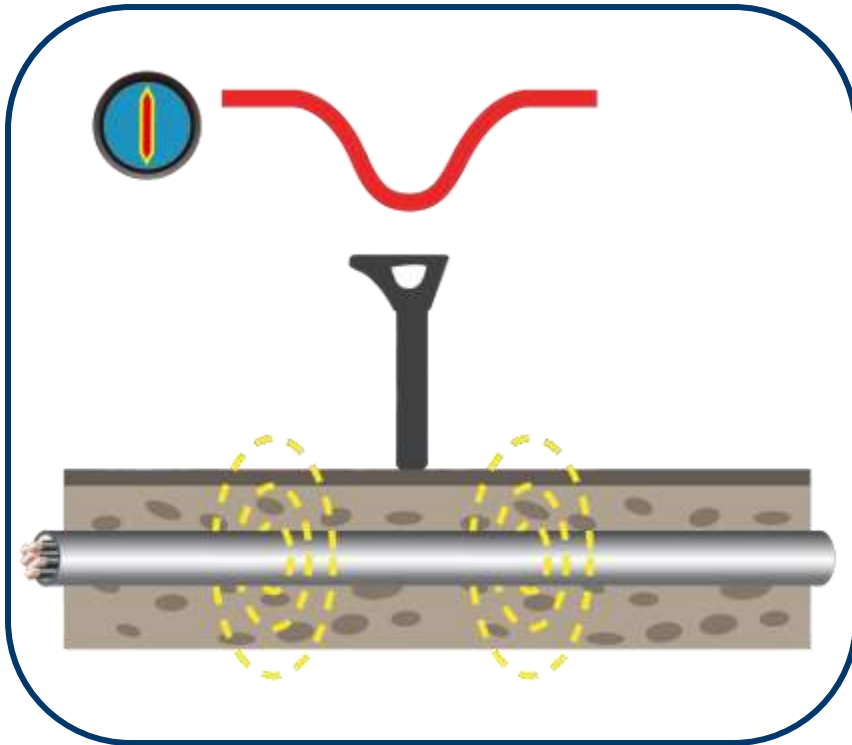


Rotate the receiver to establish the direction of the line



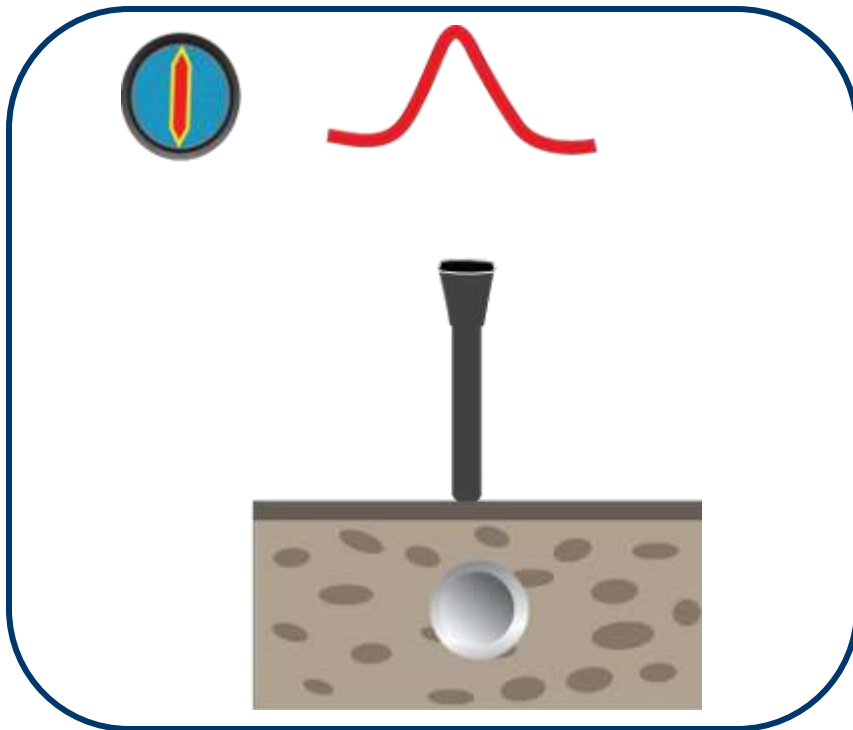
Using the Receiver.....

- The “Null” mode – will **NOT** indicate the direction of the line using the null signal strength alone. The left/right arrows and compass help to orient the locator to the line.

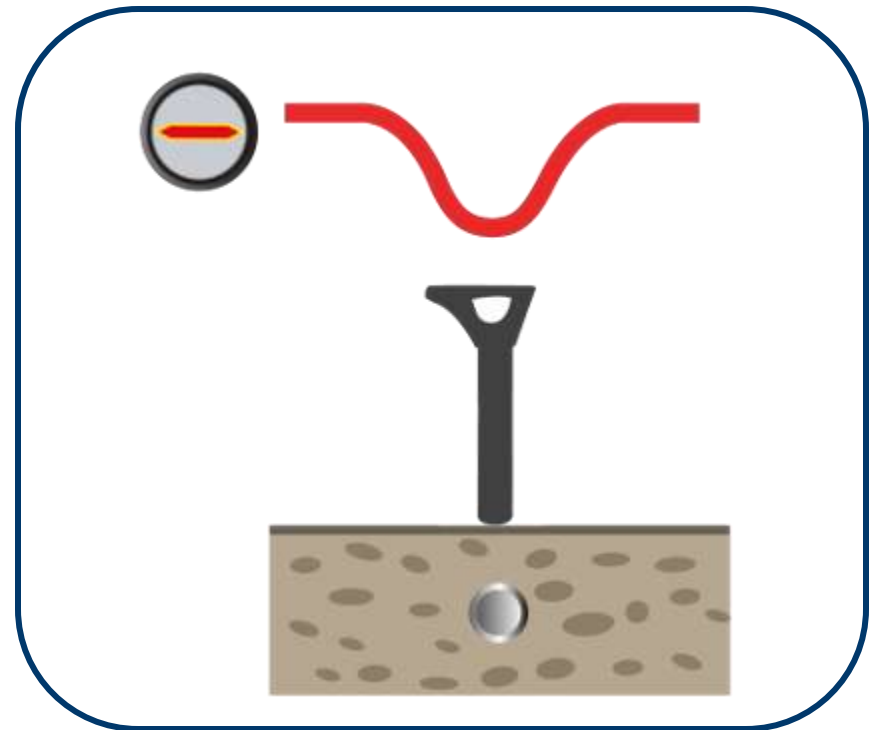


Using the Receiver.....

- The “Compass LR” mode – will indicate the direction of the line, the left/right arrows & compass help you orient the locator to the line.



Peak signal when over the line



Null signal when at 90° to the line

Using the Receiver.....

Select the locating mode:



- “Peak” mode
 - Best for tracing and pinpoint the line in congested areas



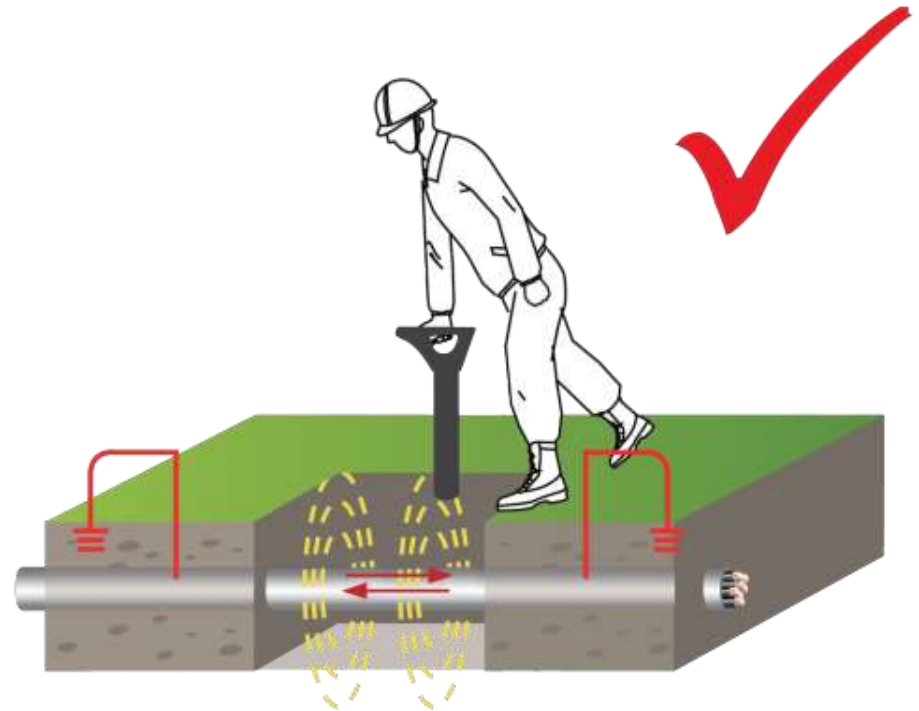
- “Null” mode
 - Best for following a line if tracing for some distance (swap to “Peak” mode to pinpoint)



- “Compass LR” mode
 - Similar use as “Null” mode (swap to “Peak” mode to pinpoint)

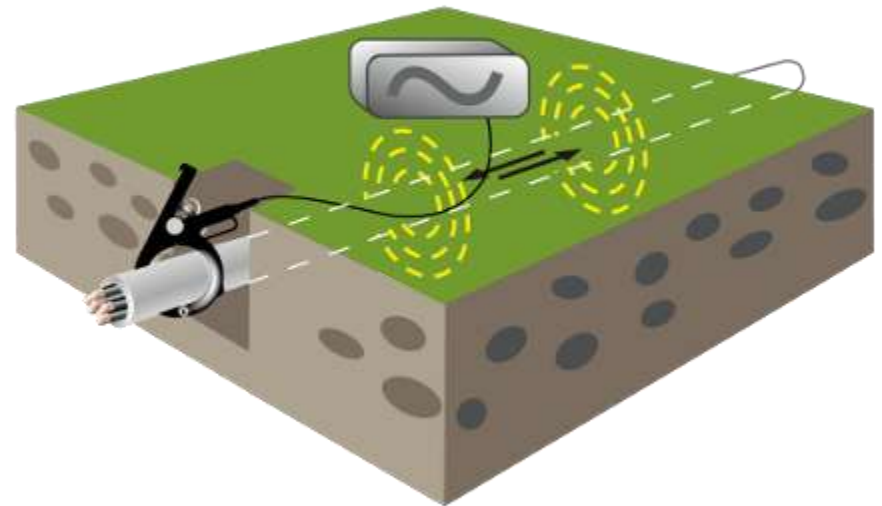
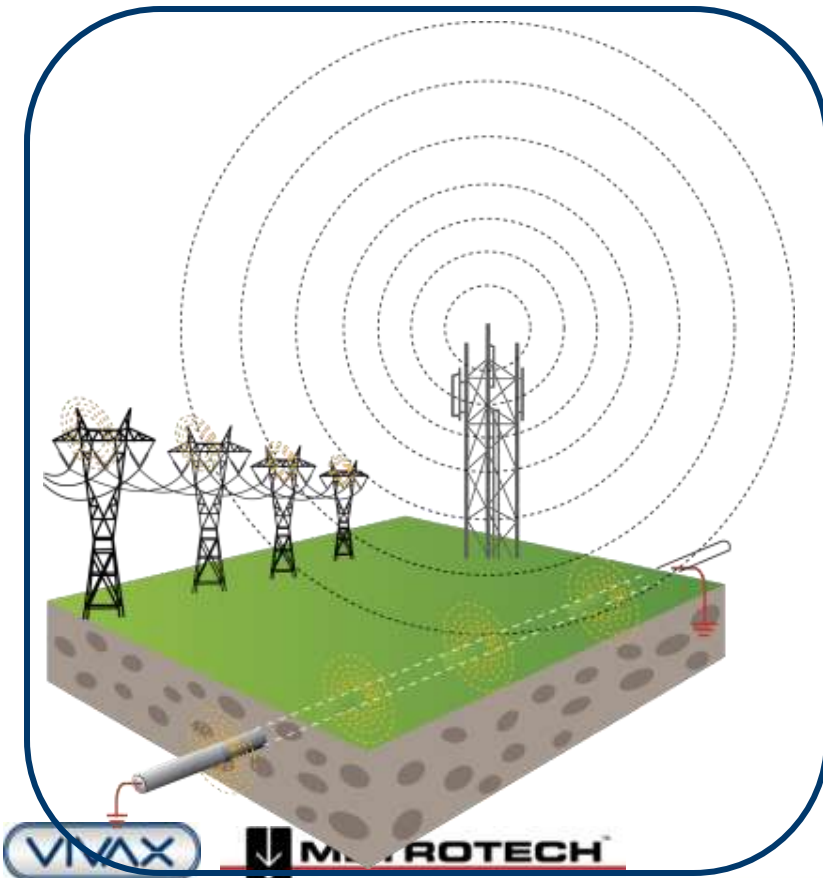


To locate a line an electric current must be flowing.





This electric current may originate from other sources (Passive Locating) or from the transmitter (Active Locating).



When to Use Passive Modes.....



Always **“Call Before You Dig”** and follow your own company’s work & safety practices.

Always follows local, state, national, regulations and your own company safety and work practices.

- Search for unknown buried lines when applying a transmitter signal is not practical to verify the presence of adjacent lines
- A last check before digging
- For small localized digging (planting a fencepost or road sign)

When to Use Active Modes.....

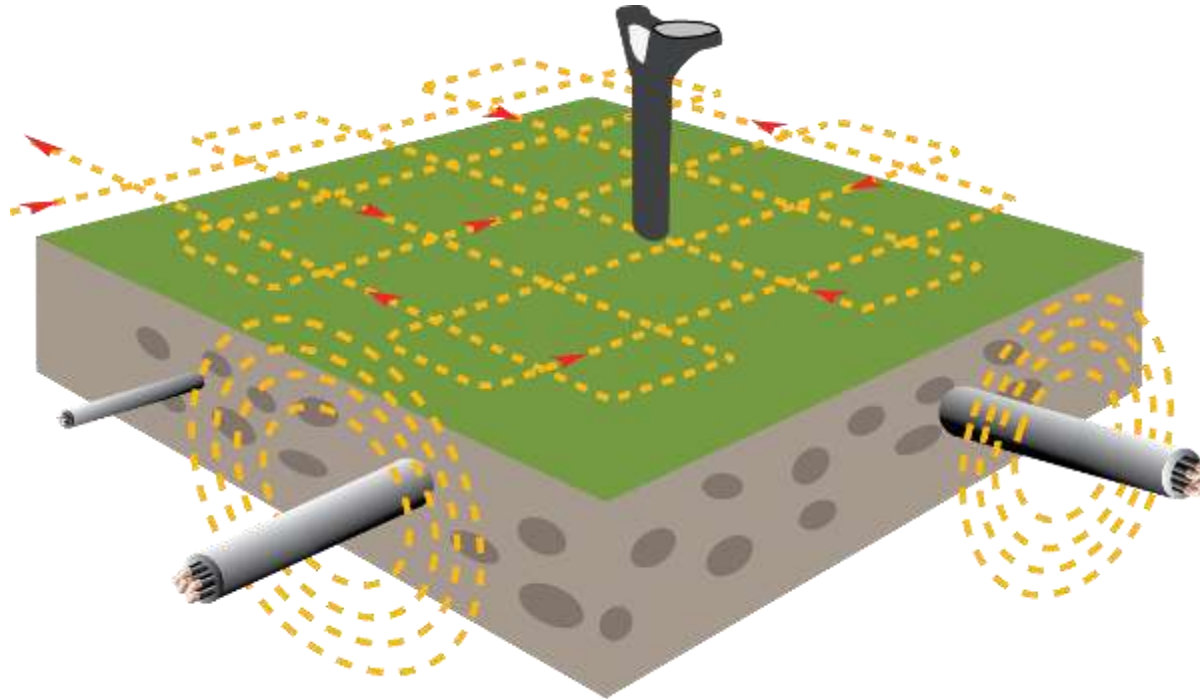


Always “**Call Before You Dig**” and follow your own company’s work & safety practices.

Always follows local, state, national, regulations and your own company safety and work practices.

- When locating a specific line in congested areas
- When tracing a specific line for any distance
- When pinpointing a buried line
- When a depth measurement is required

Passive Locating.....



- Passive locating is generally used to **AVOID** rather than identify buried lines.
- Using only the receiver, sweep the area in the search pattern shown.
- Sweep in “Power” mode, then “Radio” mode.

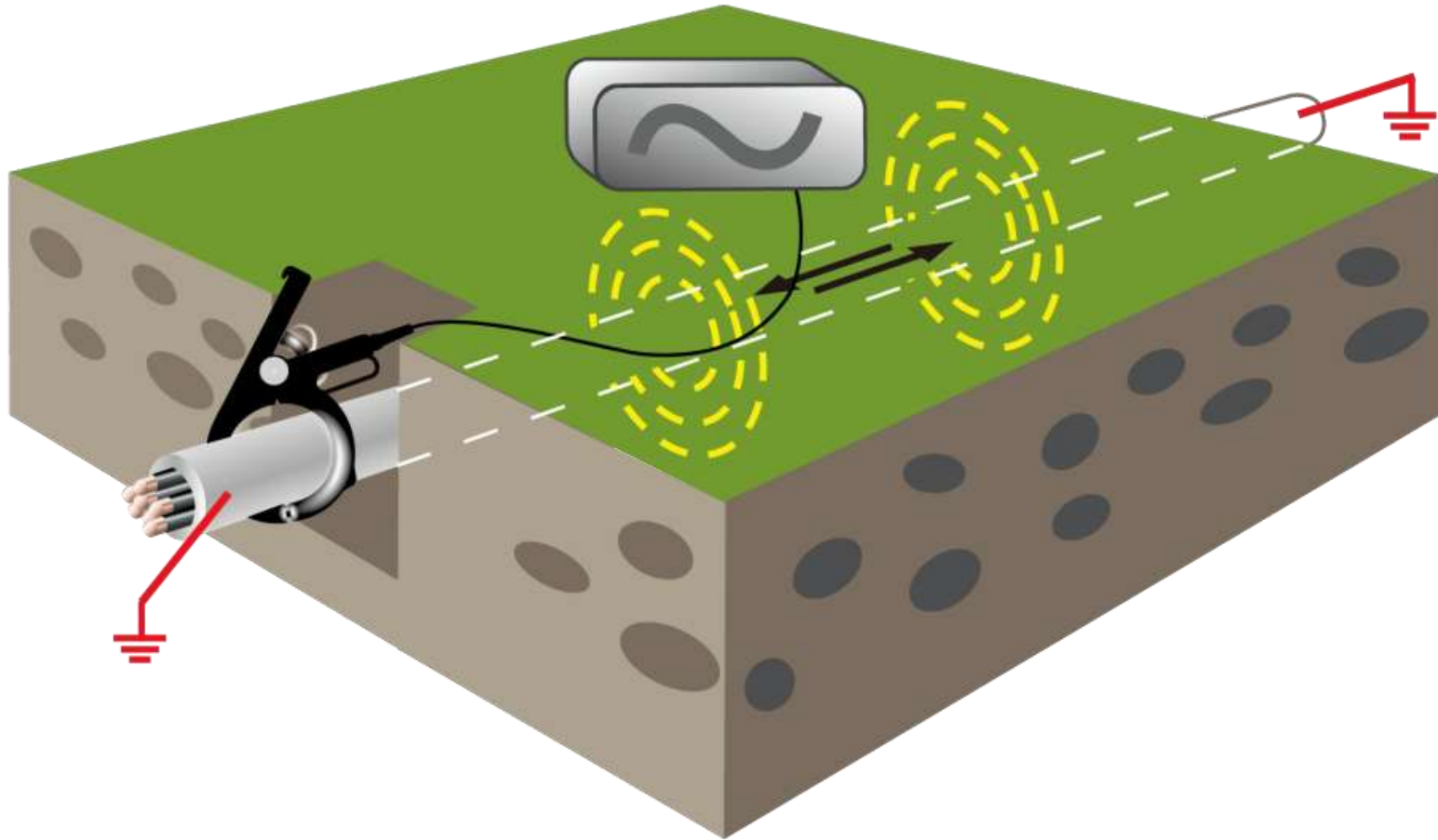
Applying The Transmitter Signal to The Line.....

There are three (3) methods of applying an active signal to a line:

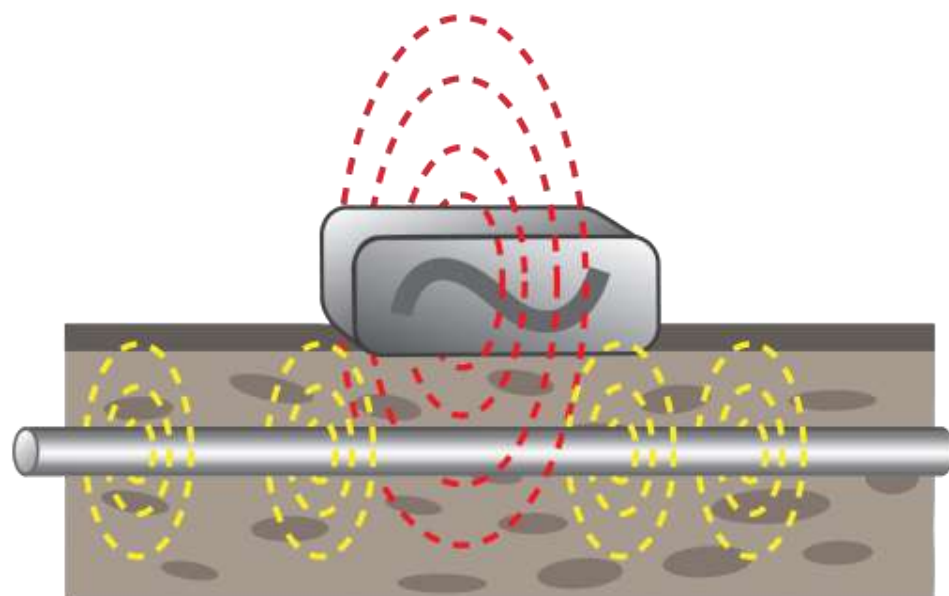
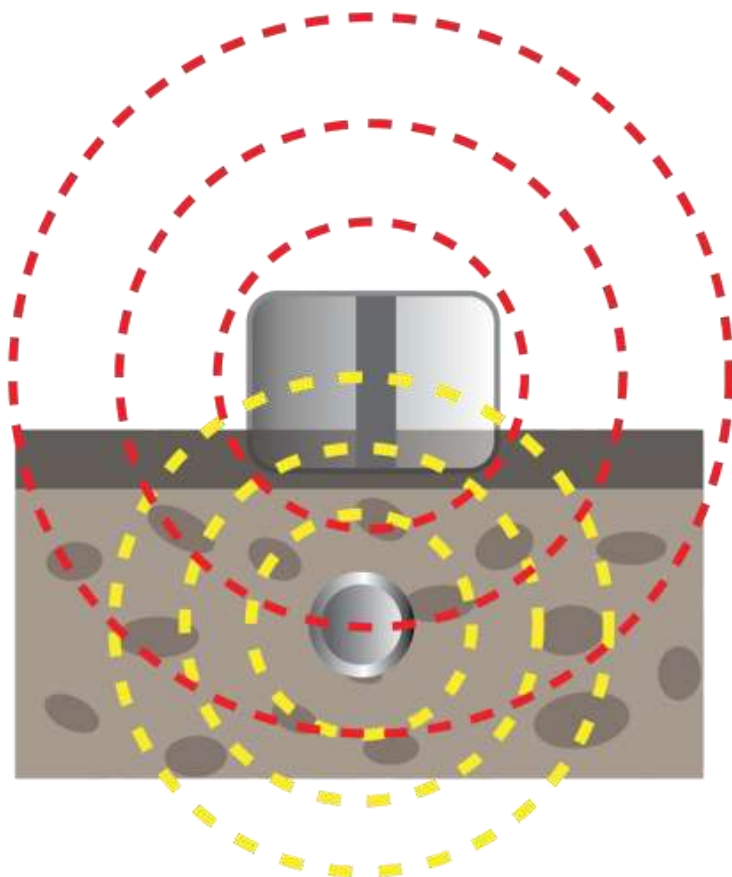
1. Direct connection (preferred)
2. Using a signal clamp
3. Induction



Using A Signal Clamp.....



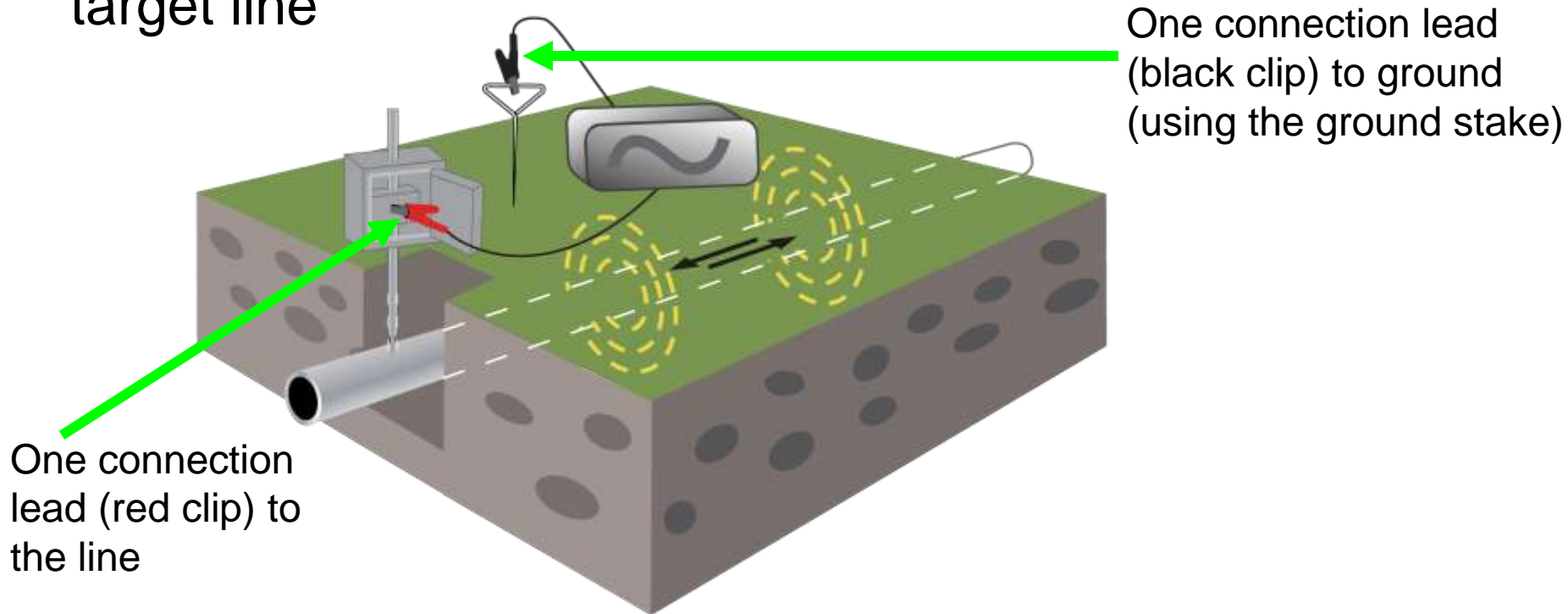
Induction Mode.....



Applying The Transmitter Signal to The Line.....

Direct connection

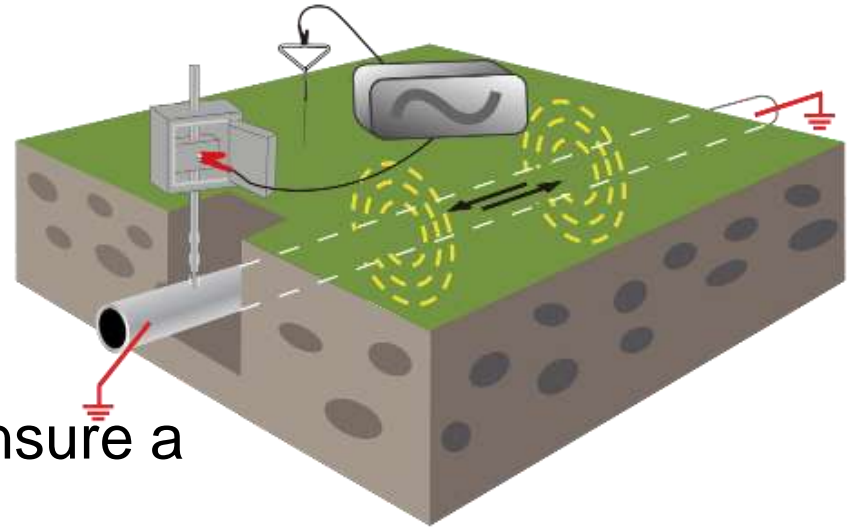
- Direct connection is suitable when there is safe to the target line



Applying The Transmitter Signal to The Line.....

Direct connection

- Plug the connection lead into transmitter
- Remove any rust or paint to ensure a good electrical connection
- Place the ground stake in the ground at 90° to the cable and as far away as practical

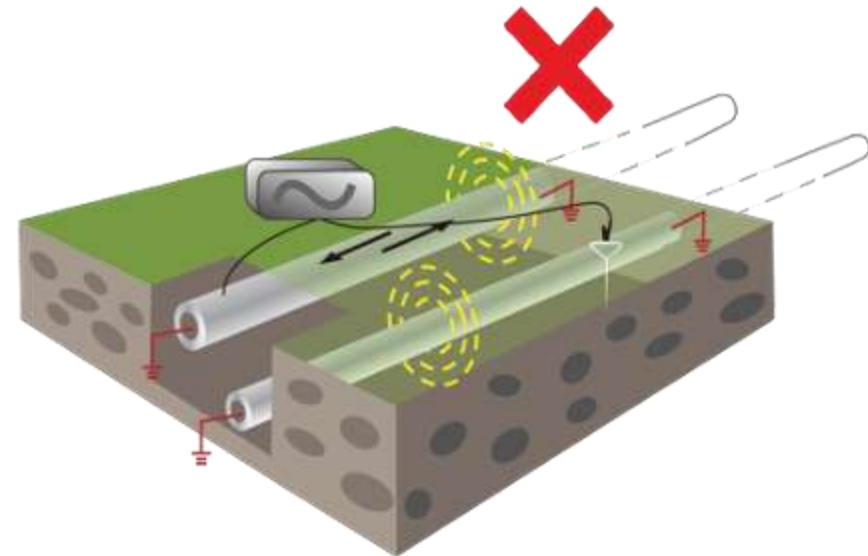


Remember you want good electrical contact to make the current flow

Applying The Transmitter Signal to The Line.....

Direct connection

- When positioning the ground stake – to minimize coupling to other lines
 - Do **NOT** place it close to other lines
 - Do **NOT** place it the other side of adjacent lines
 - Do **NOT** place it close to metallic fences or barriers



Applying The Transmitter Signal to The Line.....

Direct connection

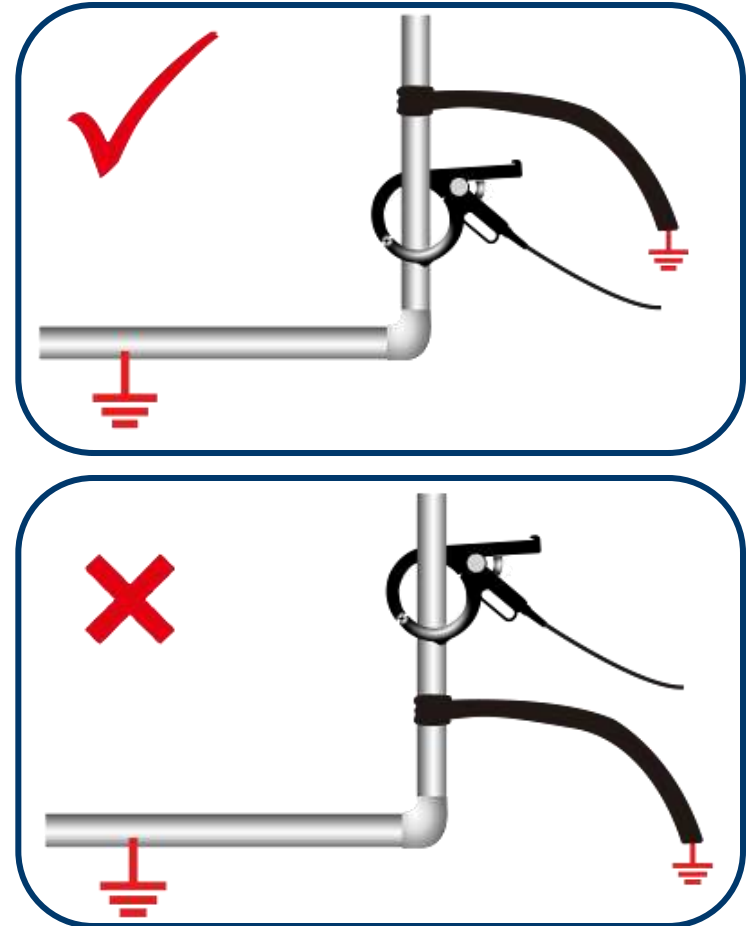


- Use the minimum output power needed to successfully locate the target line
 - Excess power may increase the risk of coupling to other lines.
 - This can make locating more difficult, and increases the risk of mis-locating.
 - More power reduces battery life.
 - The transmitter display will confirm how much current is being applied to the line indicating a good or bad connection.
 - A change in speaker tone also confirms a good or bad connection.
 - If the display shows no current or there is no change of speaker tone check the connection to the target line.

Applying The Transmitter Signal to The Line.....

Using a Signal Clamp

- Use when you cannot connect to a conductor, or insulated sheath or for cable identification.
- Place the clamp around the line.
- Connect below the grounding point.
(to ensure the signal has a signal path between near and far ground points)
- A transmitter ground connection is not required when using the clamp. (target line must be grounded at each end)

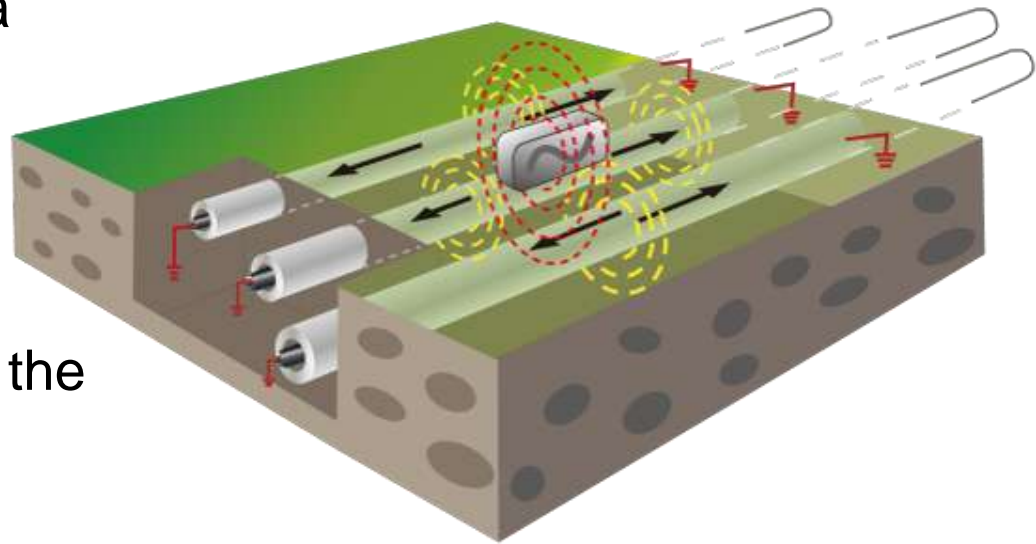


Clamps are designed for specific frequencies only (typically 8 kHz – 83 kHz)

Applying The Transmitter Signal to The Line.....

Induction

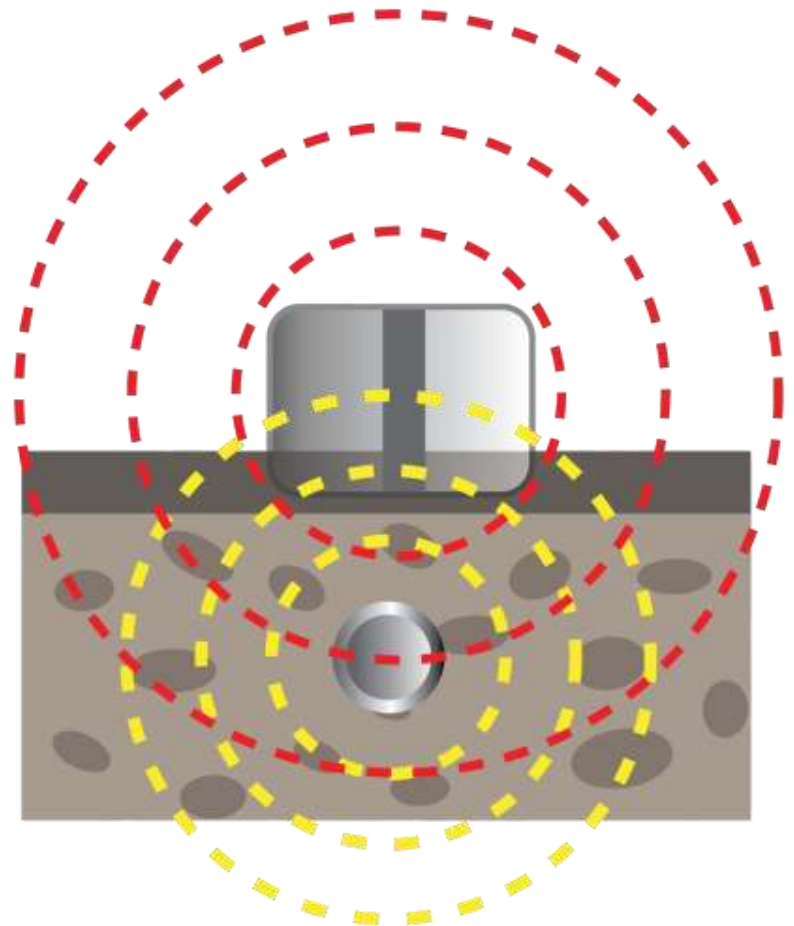
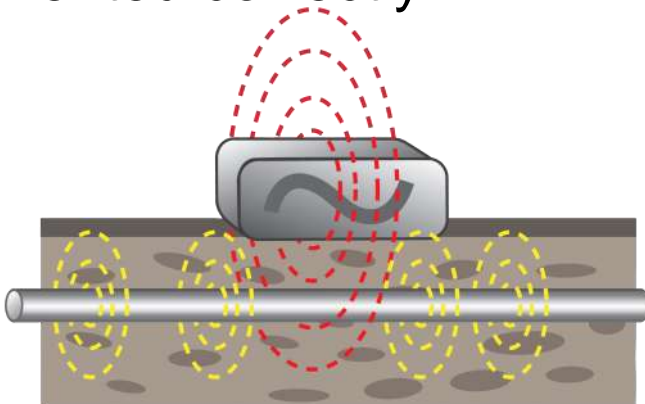
- Allows signal to be applied to a line without access to the line
- The applied signal is generally less than the other connection methods (as the signal has to travel through ground to reach the line)
- It may couple to other metallic lines & structures adjacent to target line



Applying The Transmitter Signal to The Line.....

Induction

- Place the transmitter over and in line with the target line at a known point (close to, but not on an access point such as a manhole, handhold or pedestal)
- Ensure the transmitter is oriented correctly



Applying The Transmitter Signal to The Line.....

Induction



- Never locate within 15ft (5m) of the transmitter (the signal from the transmitter has an airborne element which you will locate)

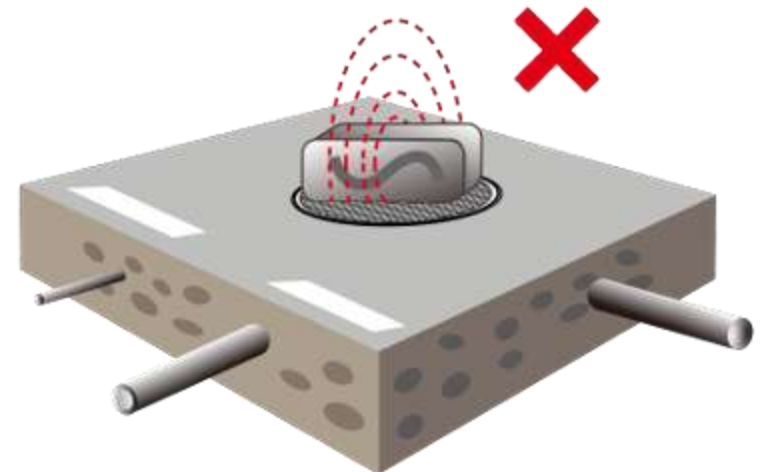
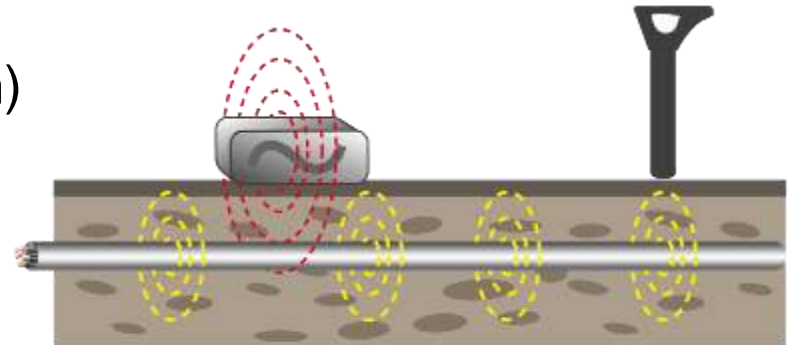


- Never place on top of a manhole cover or metal plate (the signal will not penetrate to the line and may in fact damage the transmitter)



The accuracy of depth readings may be influenced if taken close to a transmitter on induction

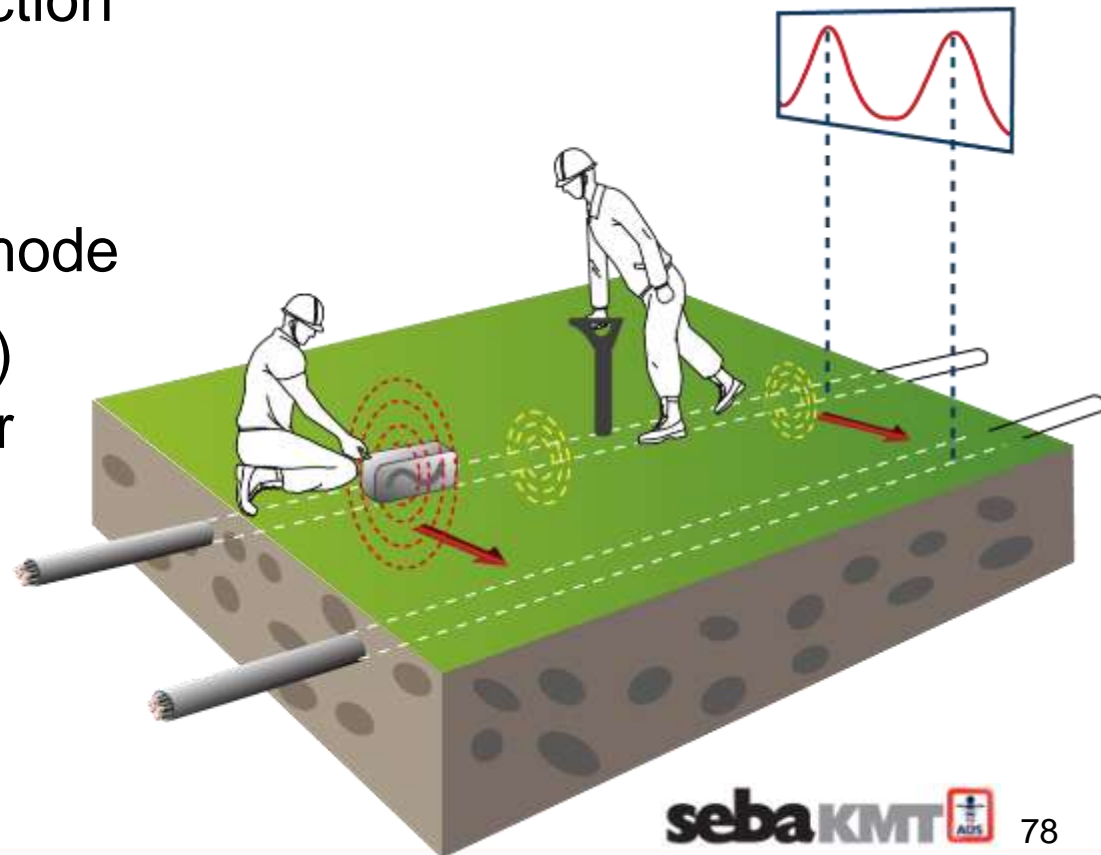
15ft
5m



Applying The Transmitter Signal to The Line.....

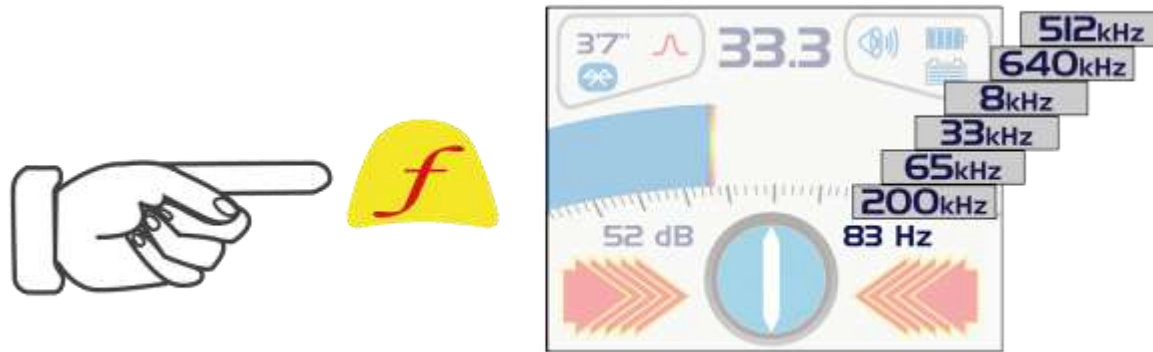
Induction

- One other technique that can be undertaken with induction is an ACTIVE sweep
- One person carries the transmitter in induction mode
- Another person 25ft (8m) away carries the receiver



Applying The Transmitter Signal to The Line.....

Frequency

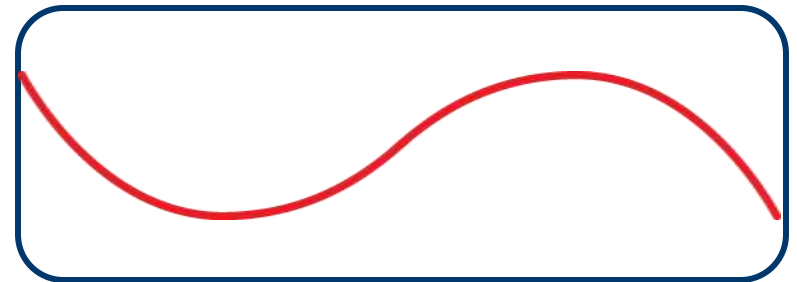


- Most transmitters can transmit several different frequencies
- Different manufacturers use different frequencies
- The best frequency for the job will vary depending on the way the signal is applied (direct connection, signal clamp, induction)
- The distance from the transmitter
- The type of line being located

Applying The Transmitter Signal to The Line.....

Frequency

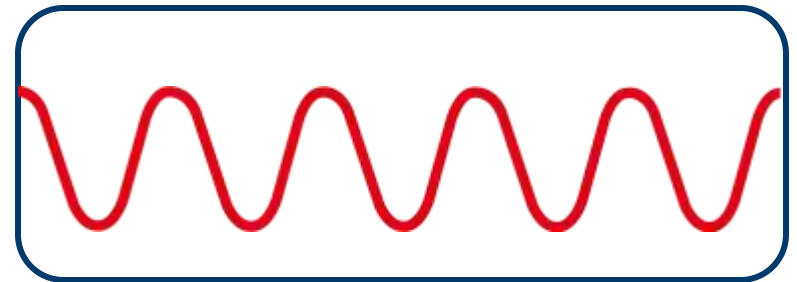
- Low Frequency (100Hz – 1 kHz)
 - Cables & insulated pipes & cable identification
 - Direct connection
 - Long distance
 - Less coupling to adjacent lines



Applying The Transmitter Signal to The Line.....

Frequency

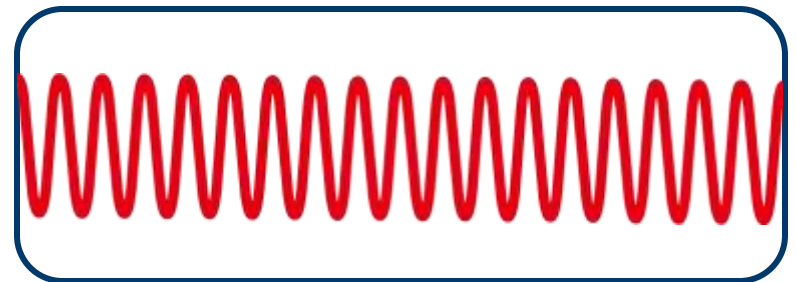
- Medium Frequency (8 kHz – 33 kHz)
 - General purpose
 - Cables & pipes
 - Direct connection, clamp & induction
 - Moderate distance



Applying The Transmitter Signal to The Line.....

Frequency

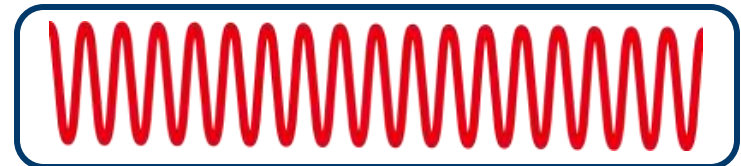
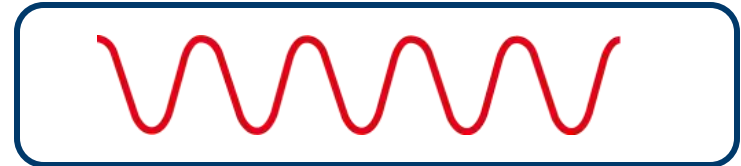
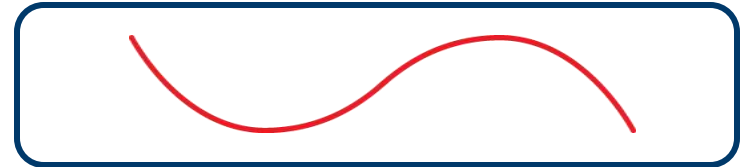
- High Frequency (65 kHz – 200 kHz)
 - High resistance or poorly grounded
 - Good for jumping insulated joints
 - Most suited to induction
 - Generally shorter distance
 - Will couple to adjacent lines



Applying The Transmitter Signal to The Line.....

Frequency Summary

- Low Frequency
 - goes the farthest on cables, insulated pipe and cable identification
 - using direct connection
- Medium Frequency
 - good all round locating frequencies using any method of applying the signal
- High Frequency
 - good for induction, short distance & badly grounded lines



Active Locating.....

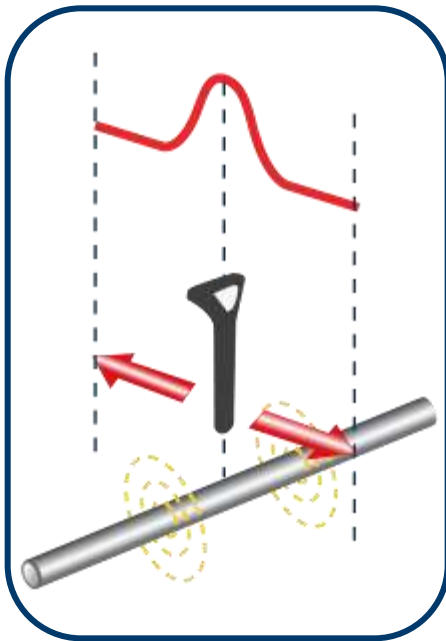
- Active location is generally used to **TRACE** and **PINPOINT** a specific buried line.
- Active location always require a transmitter and receiver.



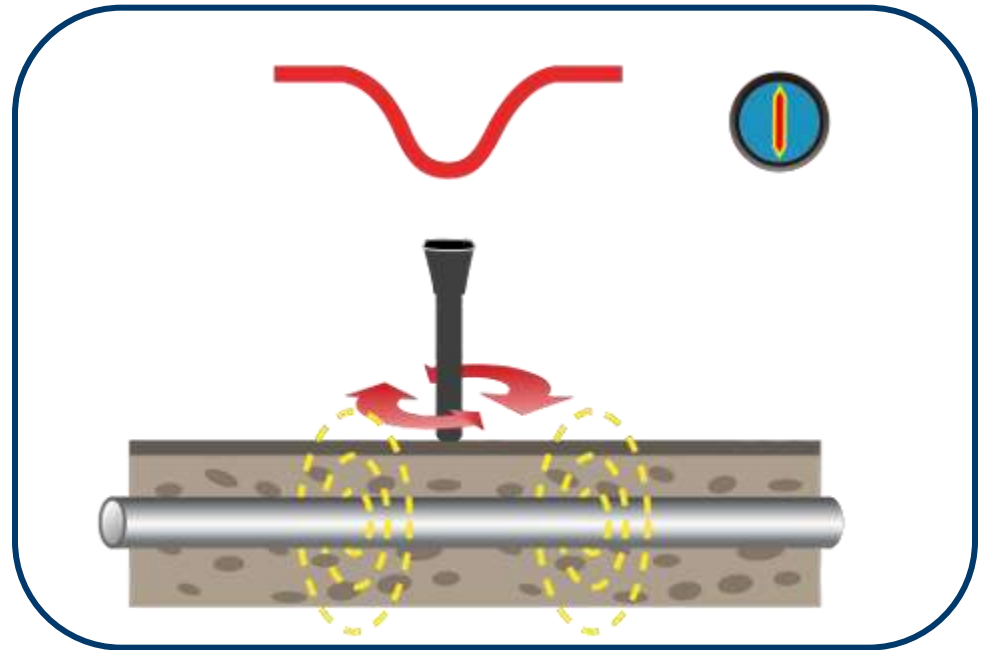
TRACING is following the path of the buried line from, or to, the transmitter.

Active Locating.....

To pinpoint and establish the position and direction of the line:

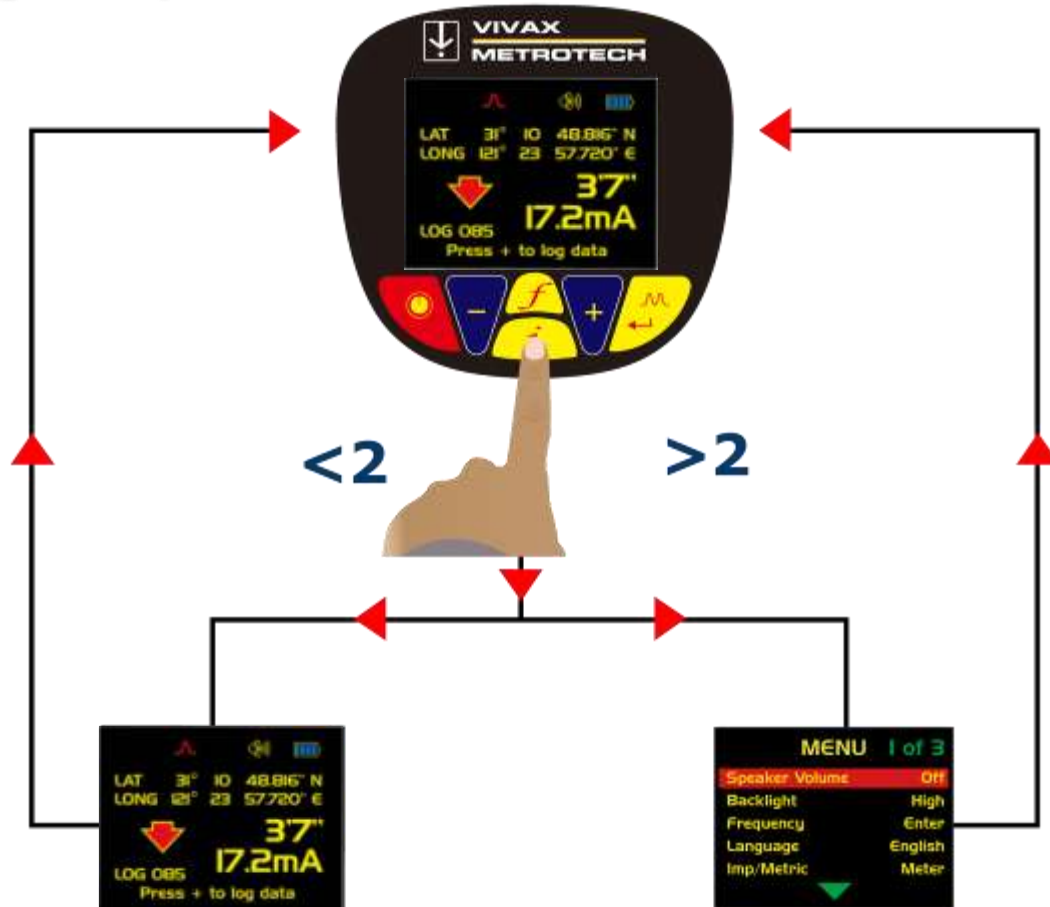
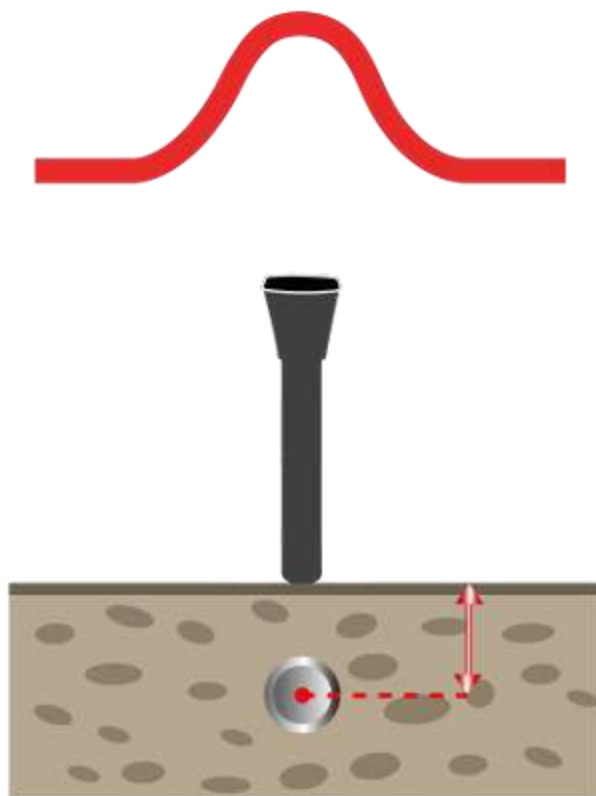


Precisely locate the peak signal



Rotate the receiver until the maximum signal

Measuring Depth & Current.....



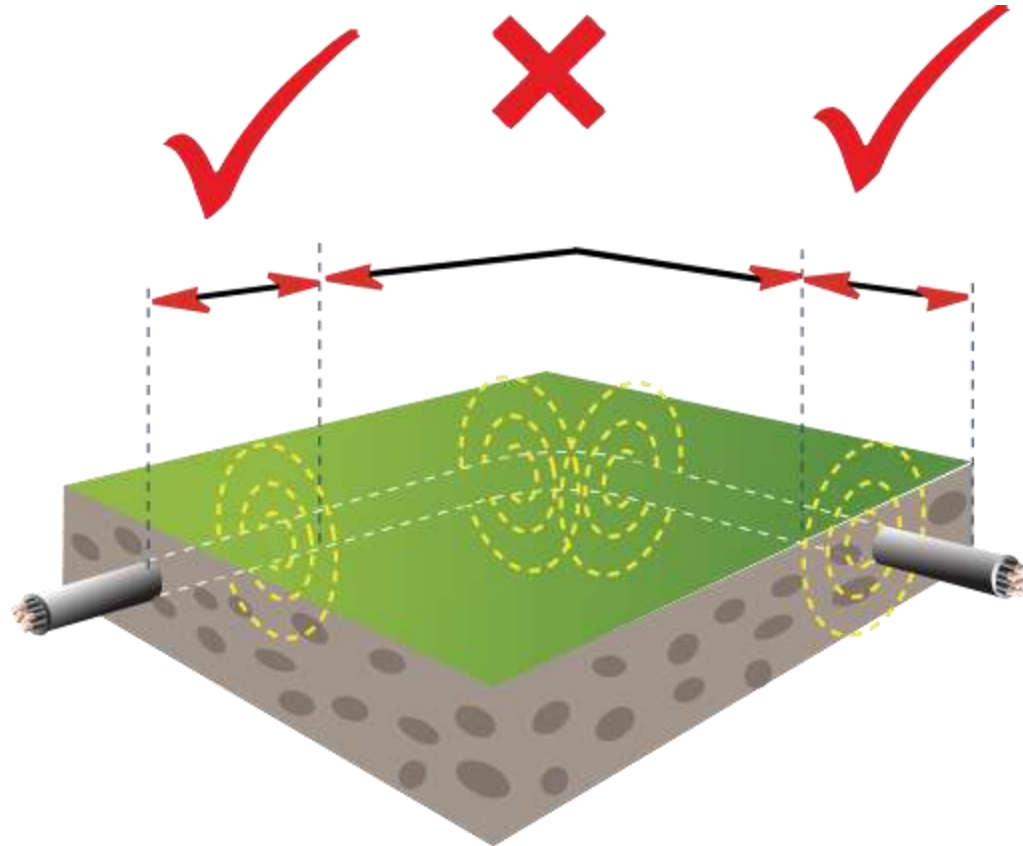
To take a depth & current measurement, first pinpoint the line

Momentarily press & release the "i" button and depth & current will be displayed

Measuring Depth & Current.....

Do **NOT** rely on depth & current measurements made if...

- Close to bends in the line
- Close to “Tee’s” in the line
- Close to the transmitter
- Where the line is changing depth
- Where the field distortion has been identified



All of these factors can result in inaccurate depth & current readings.

Distorted Fields.....

The magnetic field (the signal) radiating from buried lines can be distorted by the presence of adjacent metallic conductors or other signals.

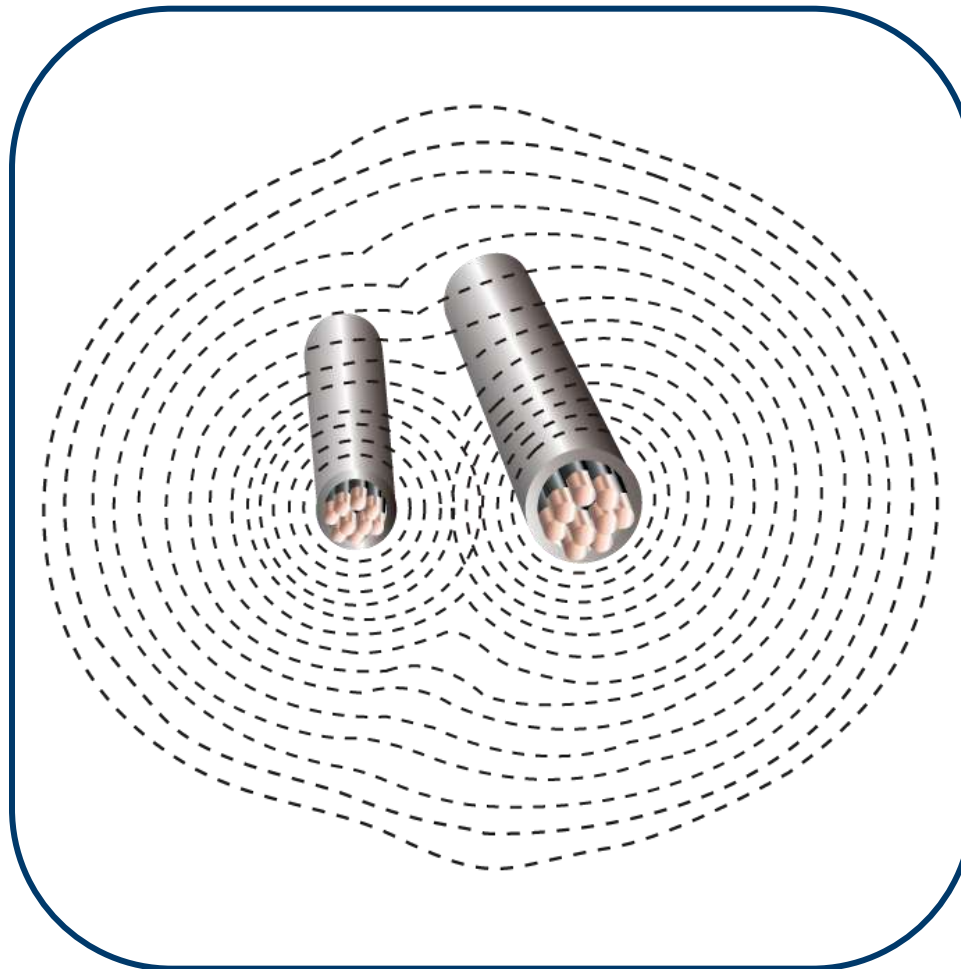
This is caused by:

- Signals induced from the target line to other lines
- Commonly bonded structures
- Badly positioned ground (at the transmitter)

The result is that the locator detects signals from more than one course.

Distorted Fields.....

A typical distorted field...

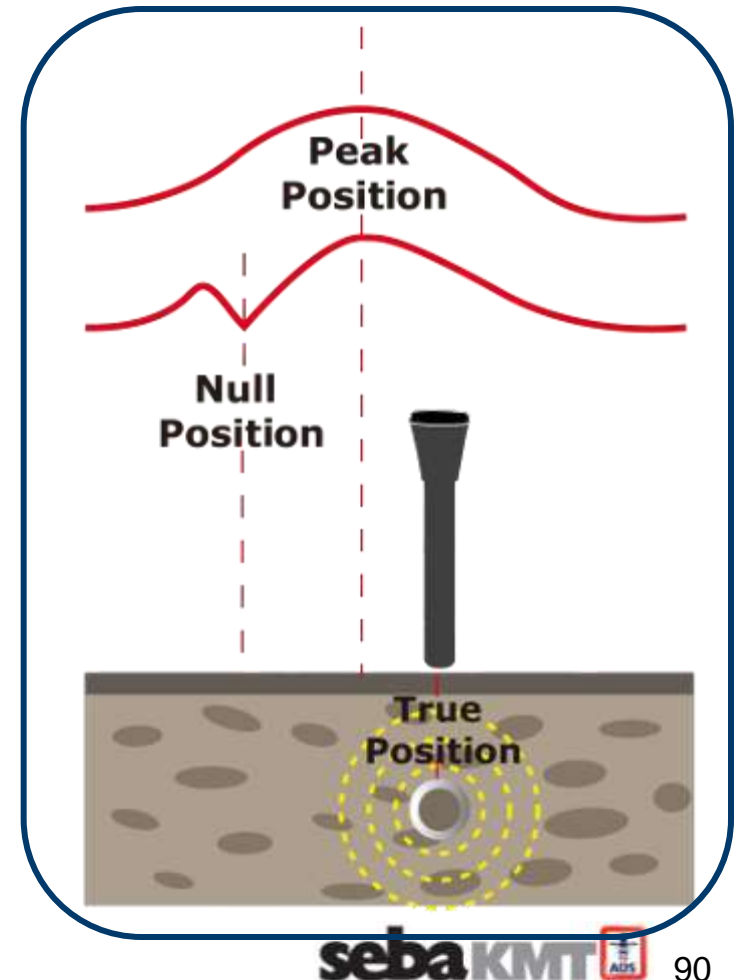


Identifying A Distorted Fields.....

Using “Peak” & “Null” modes to identify a distorted fields

- On a clean undistorted field the “Peak” and “Null” locate response will match
- If distortion is present, the peak and null locate response will no longer match.

Typically, the greater the distortion, the further apart these locate responses will be.

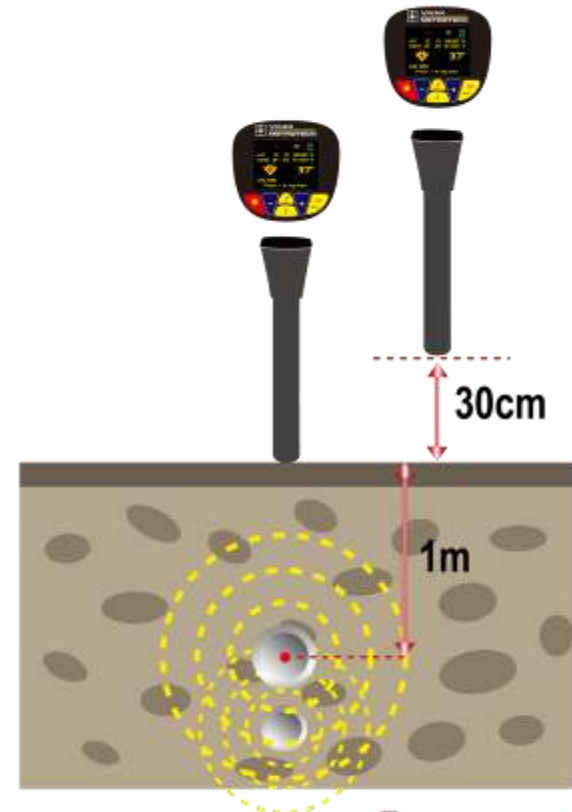


Identifying A Distorted Fields.....

Using Depth Measurement to identify a vertical distorted field

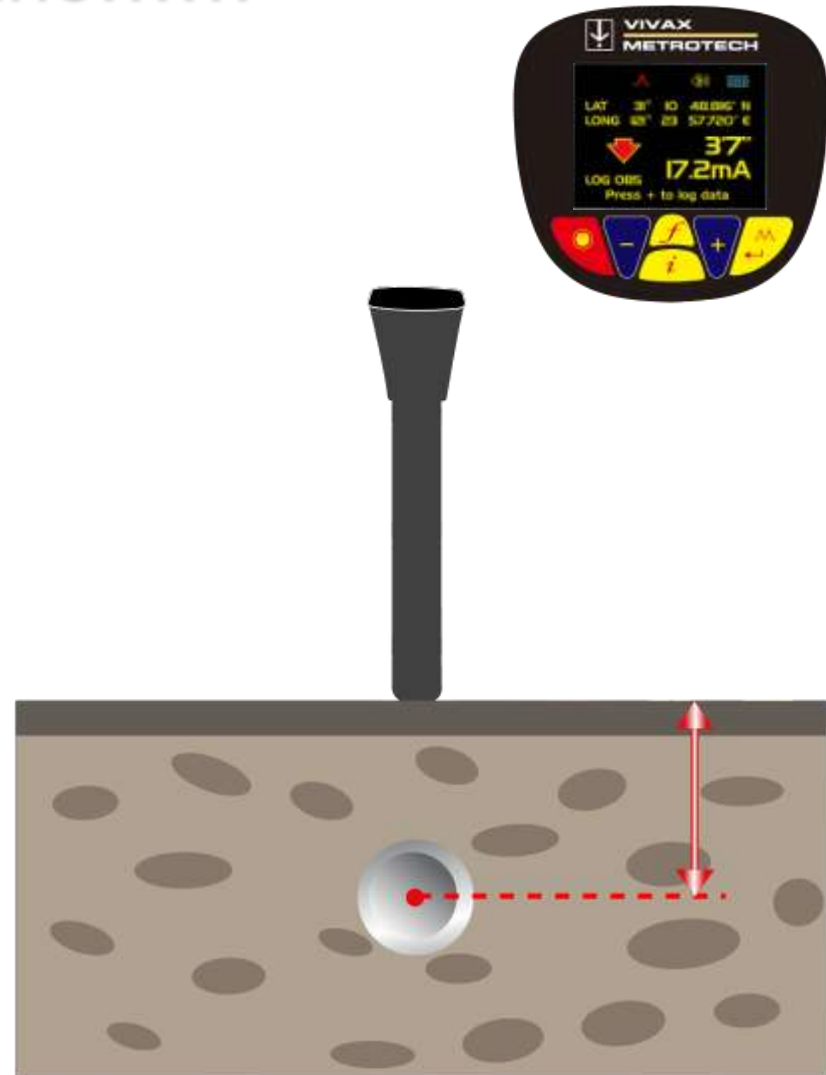
- Locate the line & measure depth with the locator resting on the ground
- Lift the receiver off the ground by a known distance (say) 1ft (30cm)
- Take another depth reading

The depth reading should have increase by the distance you raised the receiver – *if significantly different* – the field is distorted.



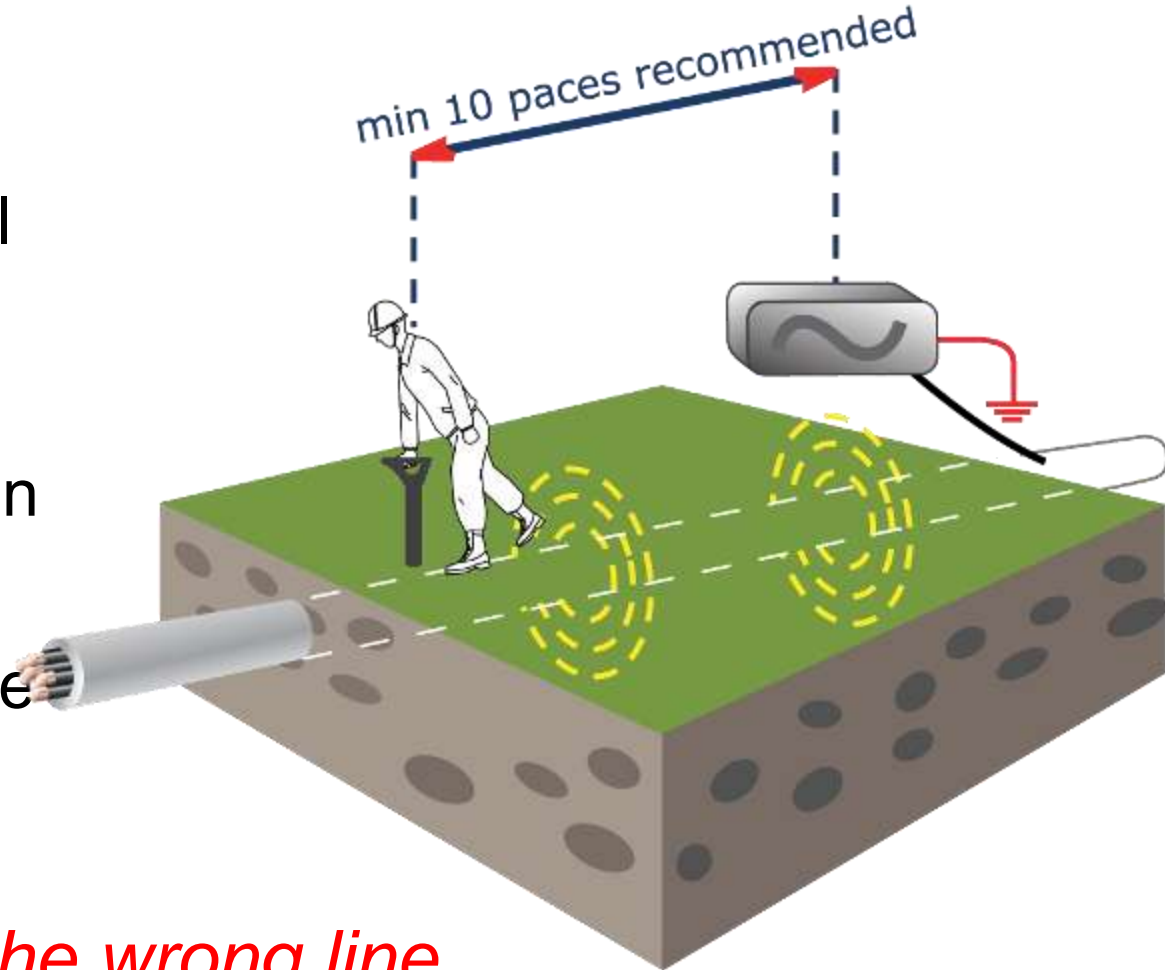
Using Signal Current to Help Identify The Target Line.....

- Current readings are not influenced by depth.
- Current readings should not be higher than the current being transmitted.



Using Signal Current to Help Identify The Target Line.....

- Current readings will reduce gradually unless
 - There is a “Tee” in the line
 - A large fault in the insulation



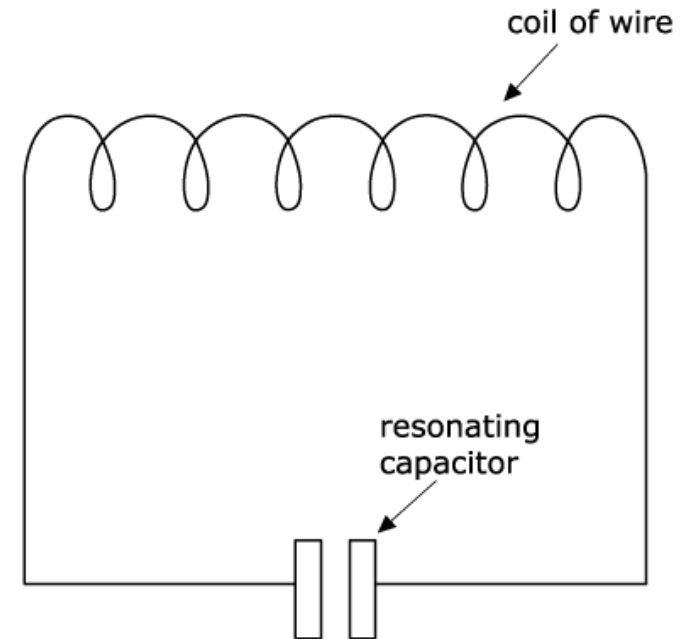
Or you are locating the wrong line

Passive Electronic Marker System (EMS)

EMS markers are used to mark below ground points of interest such as splice joints or buried valves or to mark the position and route of non metallic services such as plastic pipes.

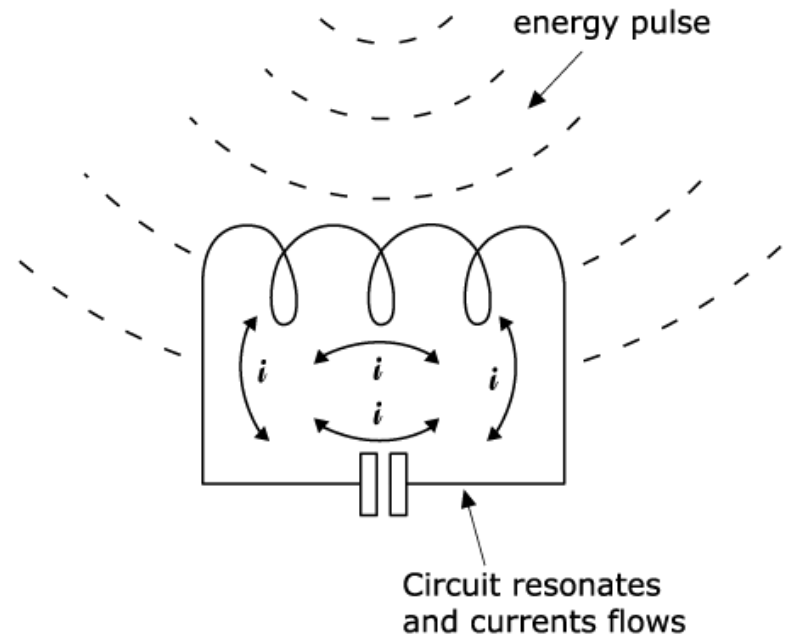
EMS Theory

- An EMS marker consists of a coil of wire which is connected in parallel with a resonating capacitor.



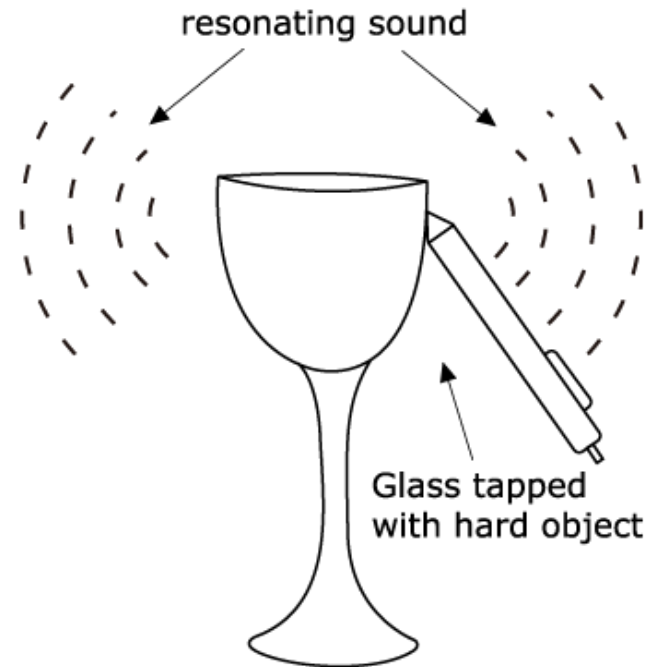
EMS Theory

- The coil and capacitor are chosen so that they have a particular resonant frequency.
- When the circuit is hit with a pulse of electromagnetic energy the circuit resonates causing currents to flow in the circuit.



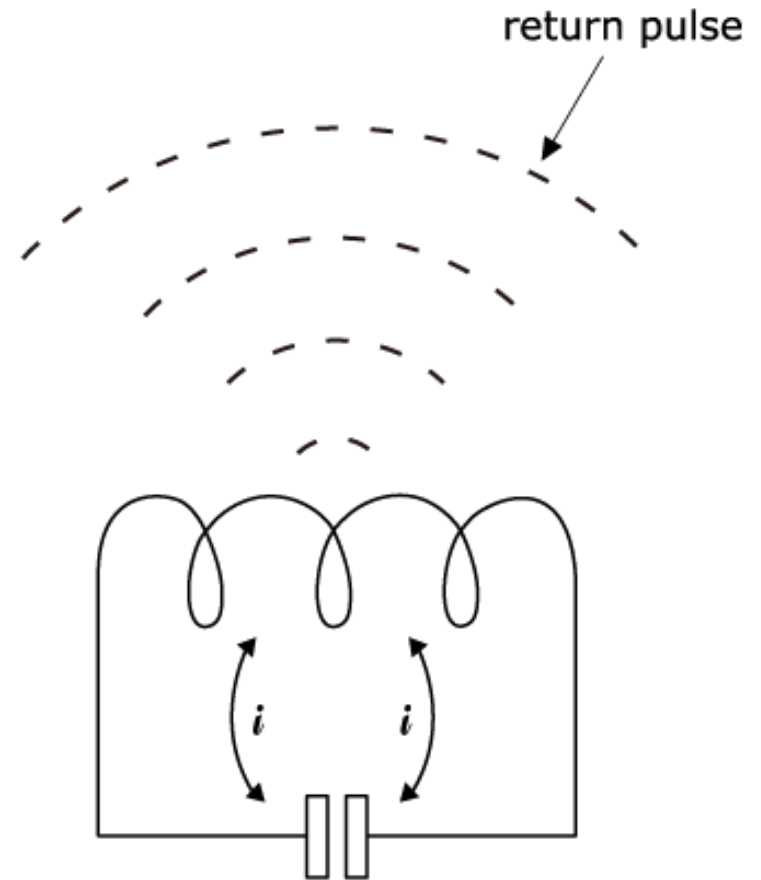
EMS Theory

- To imagine the resonance consider the audio equivalent.
- Imagine a glass being tapped. The glass will resonate at the natural frequency of the glass in a similar way the EMS marker electronically resonates at its resonant frequency.



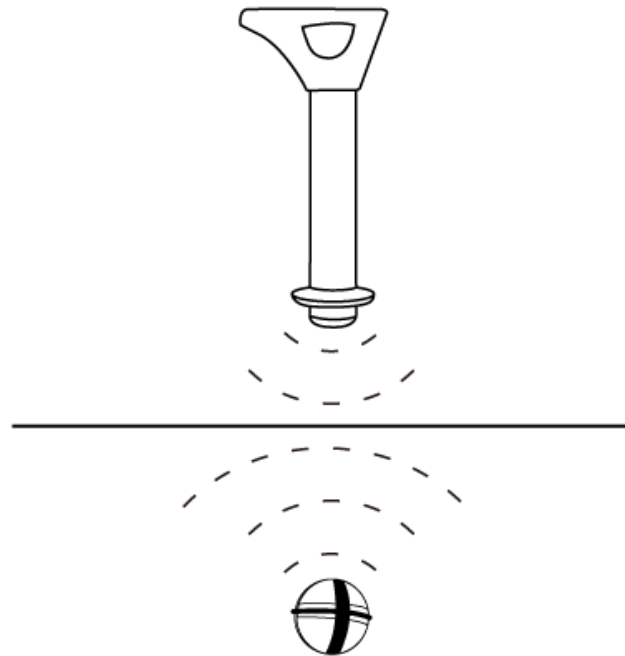
EMS Theory

- Currents flowing in the EMS marker create a return signal.



EMS Theory

- The original pulse is created by an above ground device. It consists of an electronic circuit that energises a transmitting coil.



Vivax vLocML

- The vLocML can detect markers in two modes of operation:

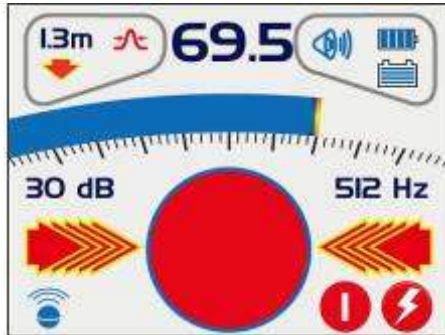
1. *Dedicated*

- The locator is dedicated to locating a predefined marker type.

2. *Dual*

- The locator is used to locate a cable or conductive pipe whilst simultaneously search for a particular marker type.

- Dedicated Screen



- Dual Screen



Types of EMS Marker

- Markers vary in size and shape but typical ones are :

1. Near surface marker –
range 600mm



2. Ball marker –
range 1.5m



3. Full range marker –
range 2.4m



Types of Marker

- Different frequency markers are used to distinguish different utilities and are differentiated by colour.

 TELEPHONE	Cable paths, buried splices, buried service drops, lead coils, conduit stubs, fiber optic facilities, all types of splices, bends, depth changes, manhole covers, road crossings
 POWER	Cable paths, service drops, conduit stubs, road crossings, all types of splices, buried transformers, service loops, street lighting, bends, man hole covers, distribution loops
 CATV	Cable paths, fiber optic facilities, buried service drops, road crossings, buried splices, bends
 GENERAL PURPOSE	Reclaimed water, private campuses, valve boxes, road crossings, path marking, buried valves, tees, meter boxes, main stubs, service stubs
 WATER	Pipeline paths, service stubs, PVC pipeline, all types of valves, road crossings, tees, clean-outs, casing ends
 WASTE WATER	Valves, all types of fittings, clean outs, service stubs, laterals, pathmarking of non-metallic facility
 GAS	Pipeline paths, main stubs, service stubs, tees, road crossings, all types of valves, meter boxes, stopping fittings, depth changes, transition fittings, squeeze points, pressure control fittings, electro fusion couplings, all types of fittings and joints

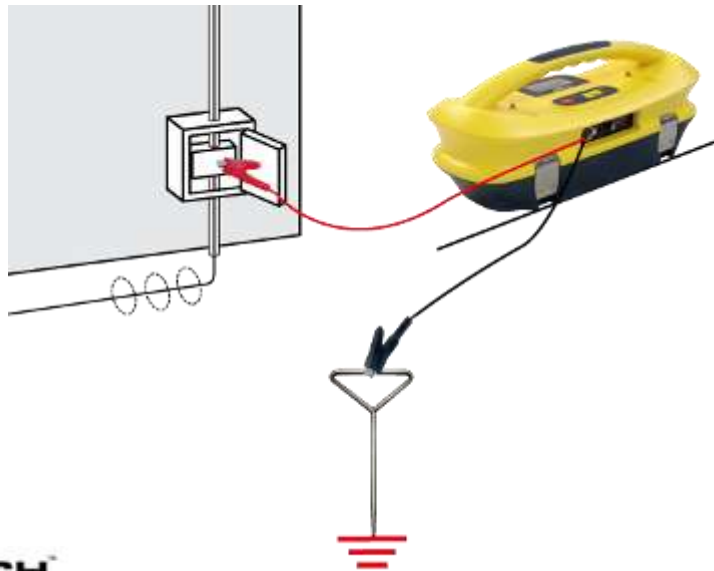


Signal Direction



Signal Direction Identification

- Connect the transmitter to the target line using a direct connection only.
 - If several lines are commonly bonded the Signal Direction will carry through to the other lines. This is useful for locating multiple line installations.
 - When performing a reset, take care to ensure that you have not strayed from the target line.
 - There will be a point at which it is not possible to reset and continue.
 - However beware that if a non target line is commonly bonded to the target line that line will also appear as being “in Sync” with the target line.



Signal Direction Identification

- Turn the transmitter and receiver on and set both to :
 - SD-USA – if in North America or any territory where the power system is 60Hz.
 - SD-EUR – if in Europe or any territory where the power system is 50Hz.
- The receiver may, or may not be flashing the “SD” icon and compass bezel.

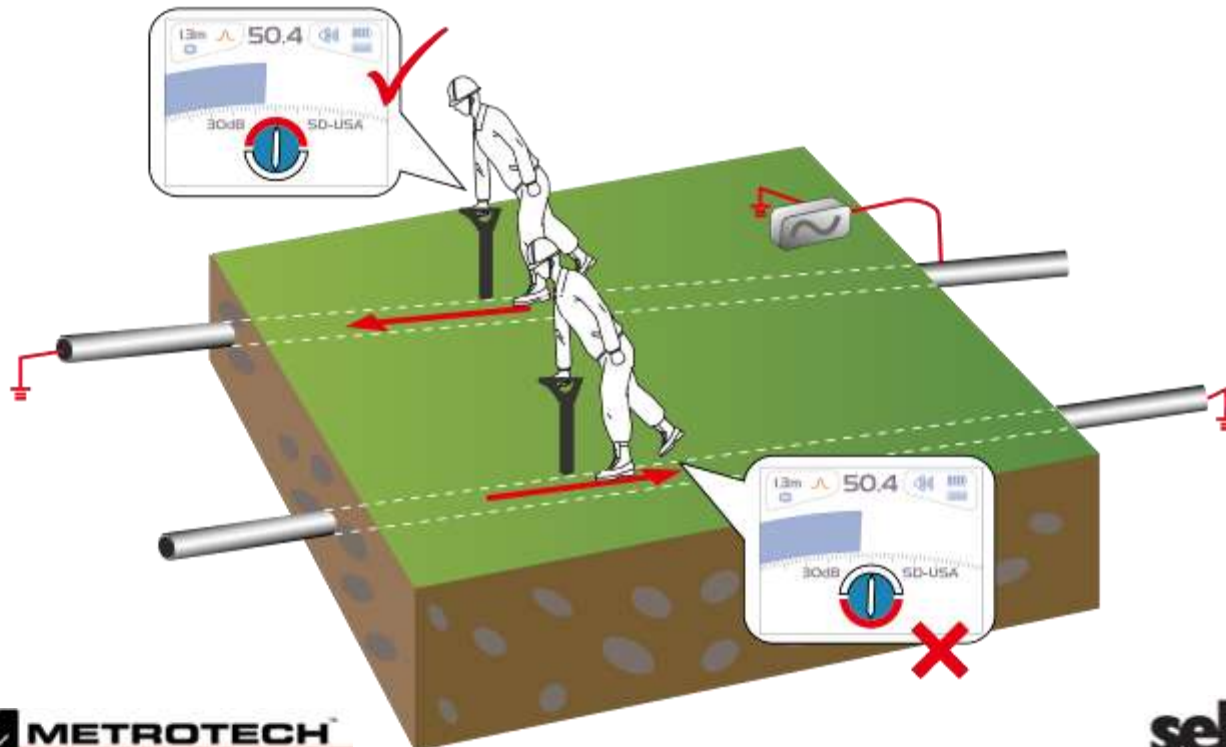
Signal Direction Identification

- To synchronize the receiver to the transmitter at the beginning of a survey, pinpoint the line very close to the transmitter.
 - Stand facing away from where the transmitter is attached and press “i” pushbutton.
 - Press the return pushbutton will synchronize the system, then return the unit to the locate screen.
 - The top portion of the bezel surrounding the compass will light and not be flashing indicating the receiver is locked onto the signal.



Signal Direction Identification

- Proceed to locate, trace, pinpoint as required ensuring at all times the top portion of the compass bezel remains illuminated.
- If at any time top portion of the bezel ceases to be illuminated and the bottom portion of the compass bezel lights up – you are locating the wrong line which is carrying the return signal.



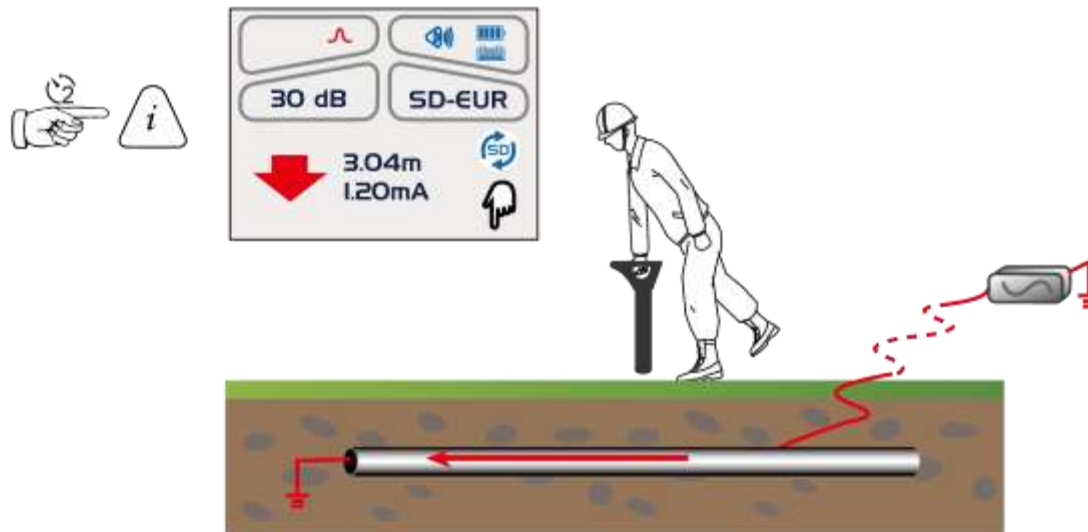
Signal Direction Identification

- The top or bottom portion of the compass bezel together with the SD icon and start flashing – this indicating that synchronization with the transmitter has deteriorated and a reset is required.



Signal Direction Identification

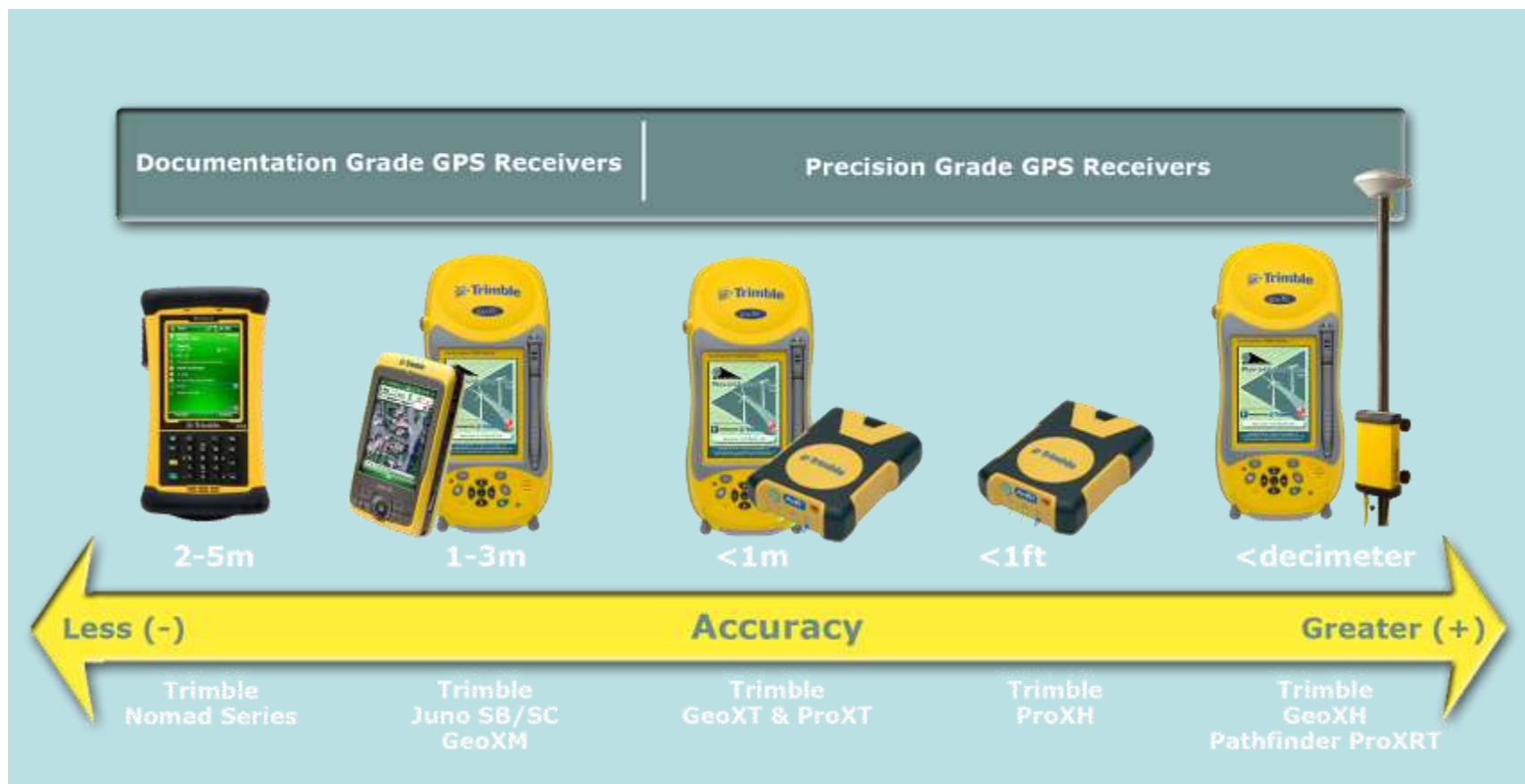
- Re-trace your line back to a point where a solid signal direction is obtained.
 - Precisely pinpoint the line and stand with your back to the direction of the transmitter
 - Press the “ i ” pushbutton
 - Press the enter pushbutton to re-sync with the transmitter signal.

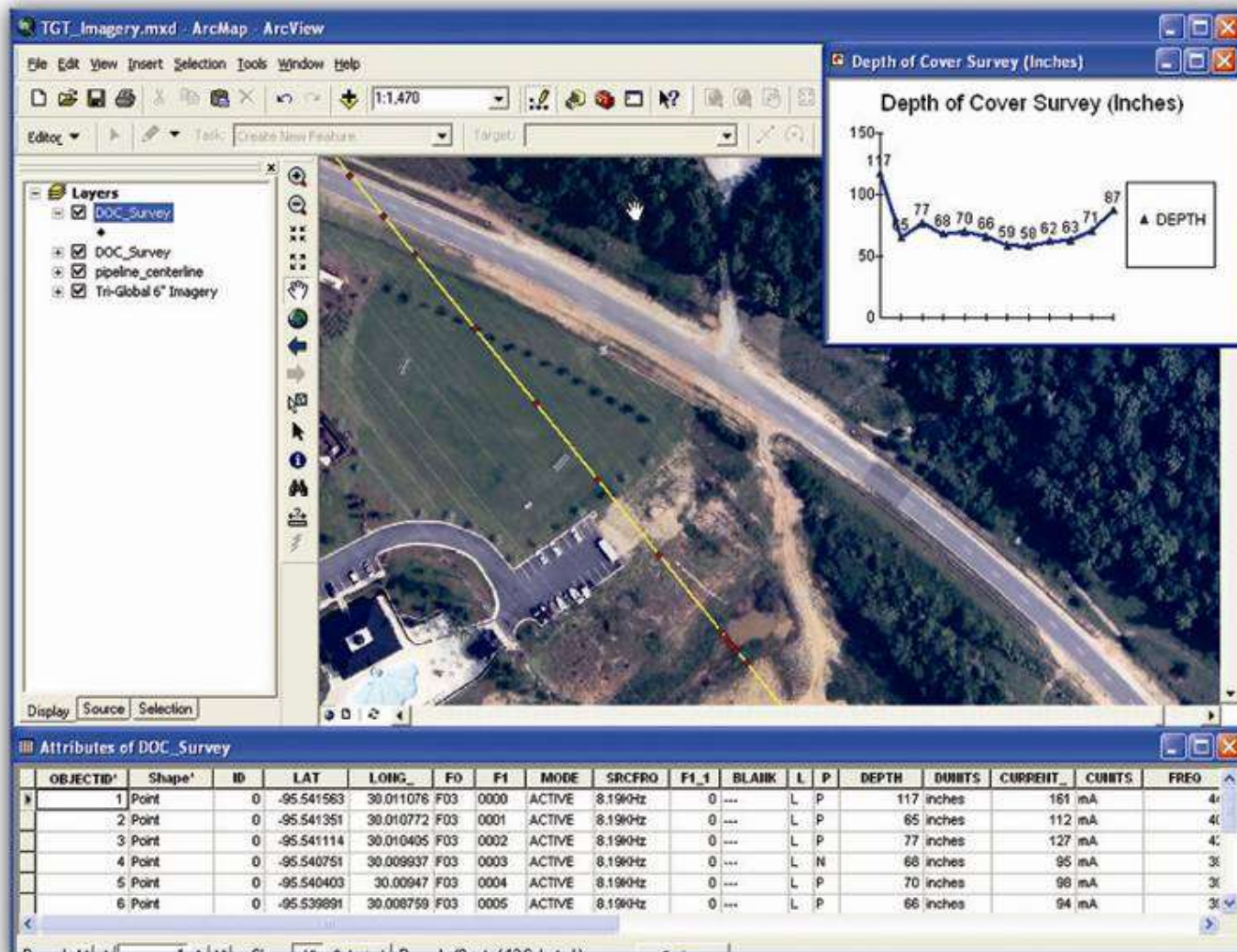


- Continue to locate, pinpoint and trace.

- vLocPro Receivers
 - Optional Bluetooth Connectivity
 - Connects to most GPS receivers
- ESRI SHP files (SHP, DBF, SHX)
- CSV generic text file format (CSV)
- Google Earth KML file format (KML)







- vLocML
 - SebaKMT, 3M (EMS) & Omni Marker's





Accessories

The Principles of Cable & Pipe Location



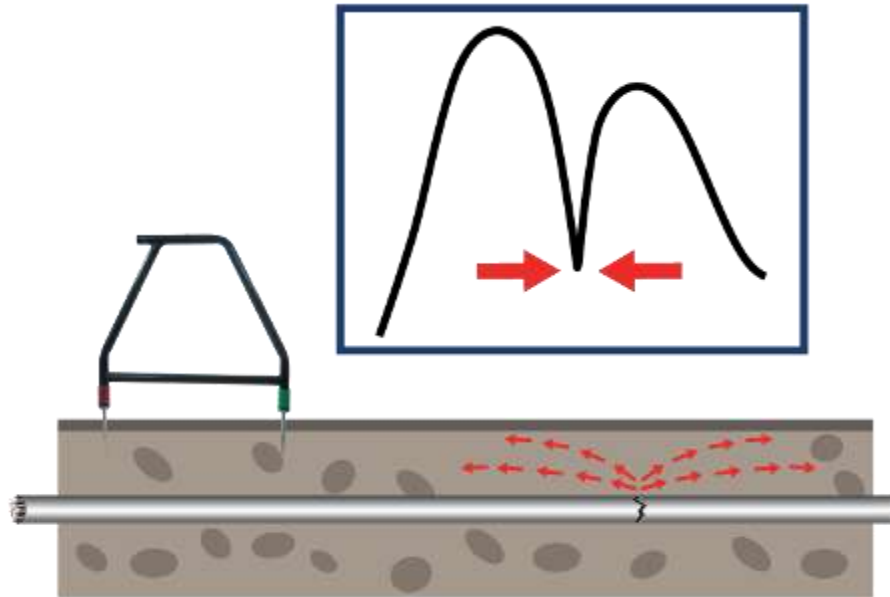
Typical uses

- Finding faults to ground on cables
- Evaluating the condition of pipe coating



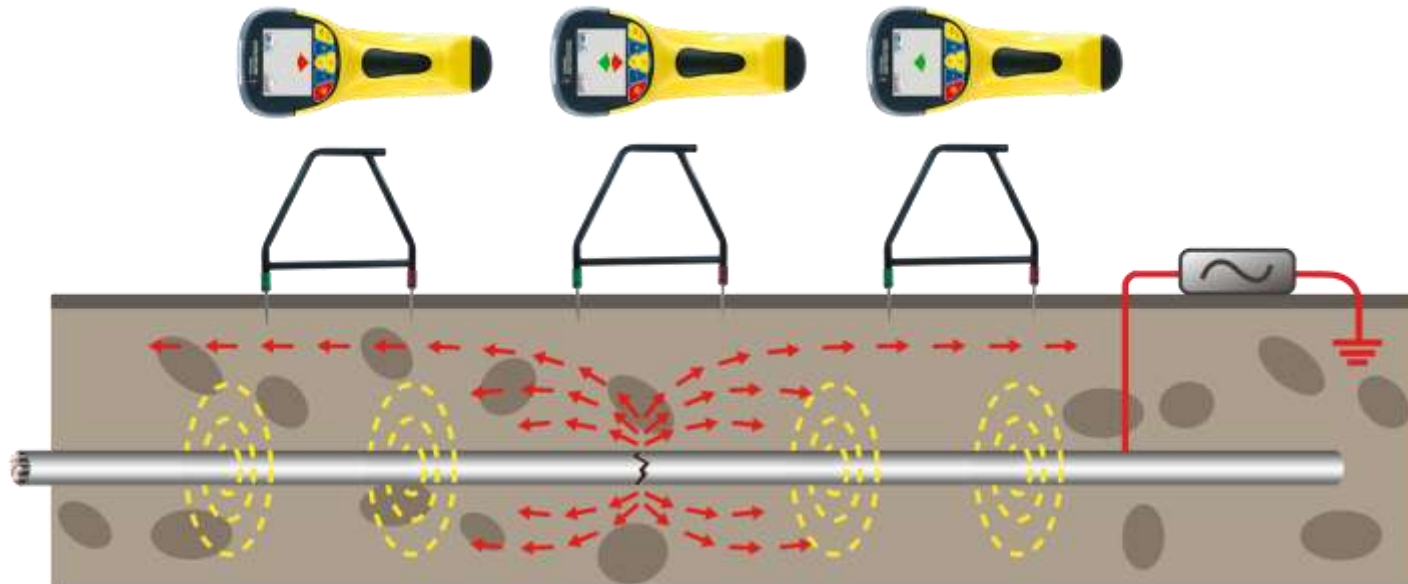
Accessories... A-frame...

Cable and Pipeline Faultfinding



The accessory A-frame can be used to detect the position of cable and pipeline defects where they are in contact with the ground.

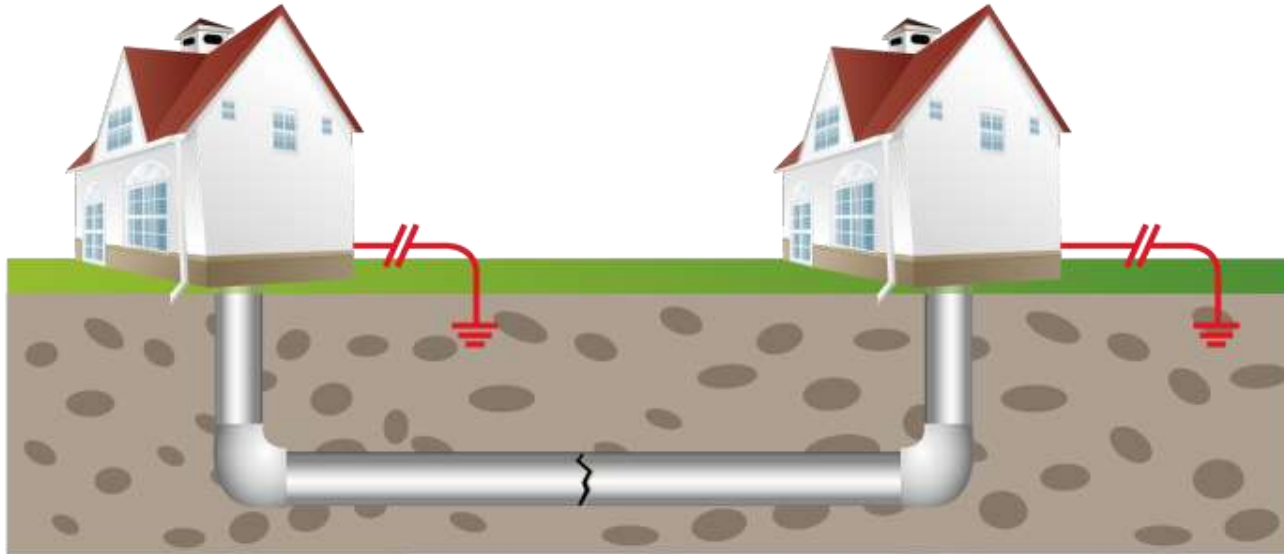
Accessories... A-frame...



Disconnect any ground connections other than the transmitter ground, to “encourage” the signal to return through the fault

Use FF mode on transmitter and receiver

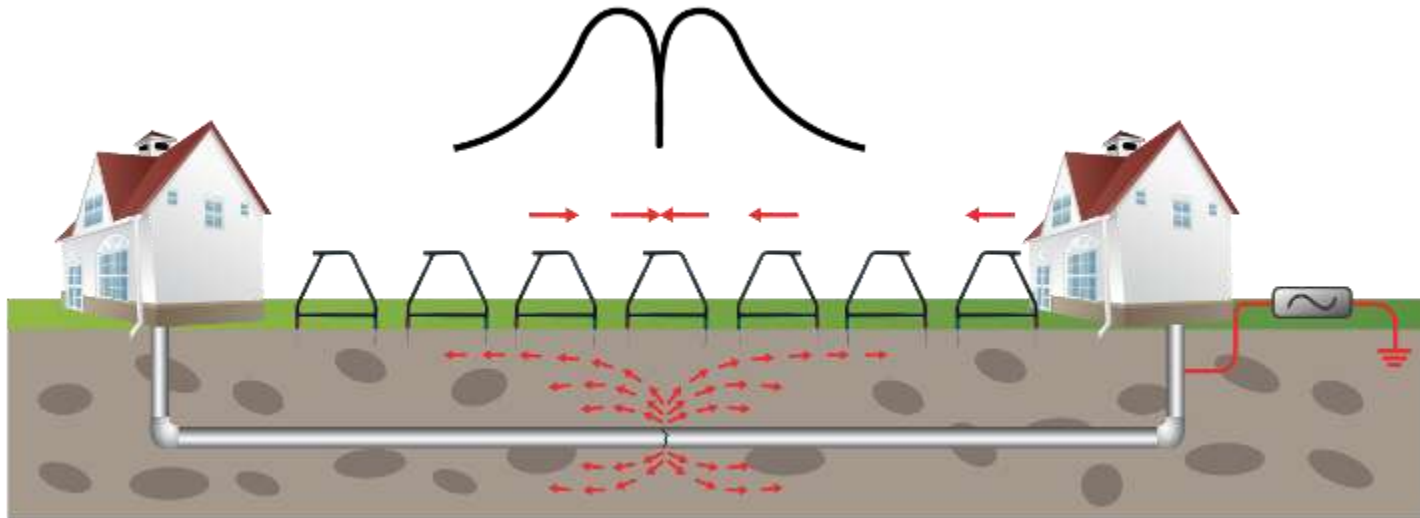
Cable and Pipeline Faultfinding



- For best results the target line should be isolated and all ground bonds removed.
- Failure to isolate the line will allow the signal current to enter the ground at these points and will results in misleading results.

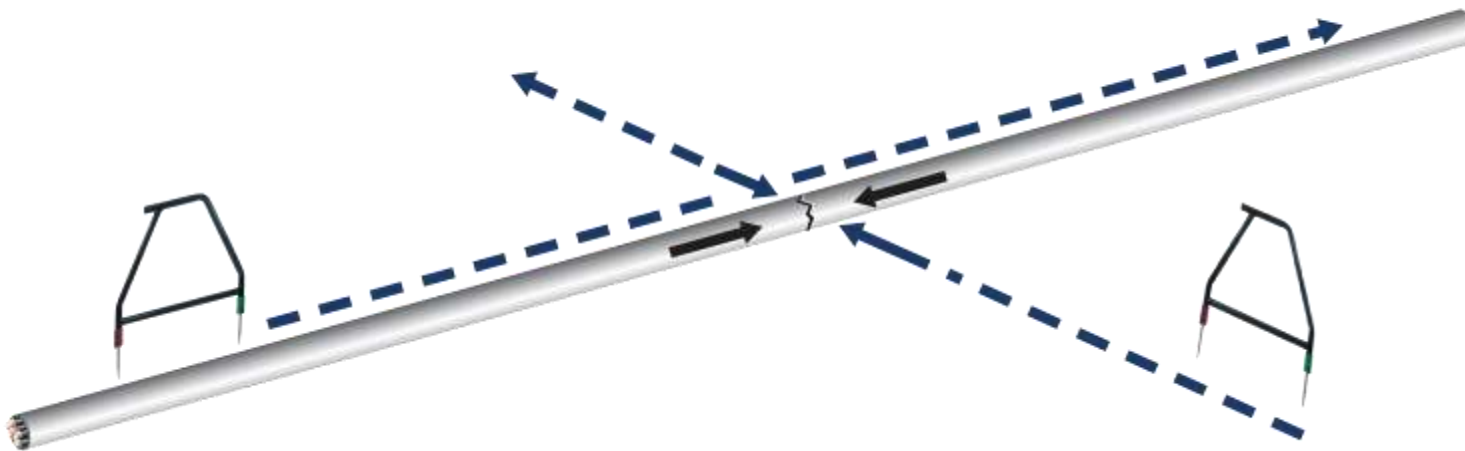
Accessories... A-frame...

Cable and Pipeline Faultfinding



- As the fault is neared, the “arrow” on the locator display will point forward and the dB reading increase.
- As the fault is passed the arrow will flip to point in reverse. When the spikes of the A-frame are exactly straddled the fault, the dB reading will drop dramatically and the arrows will either, both be on, or will flip forwards and backwards.

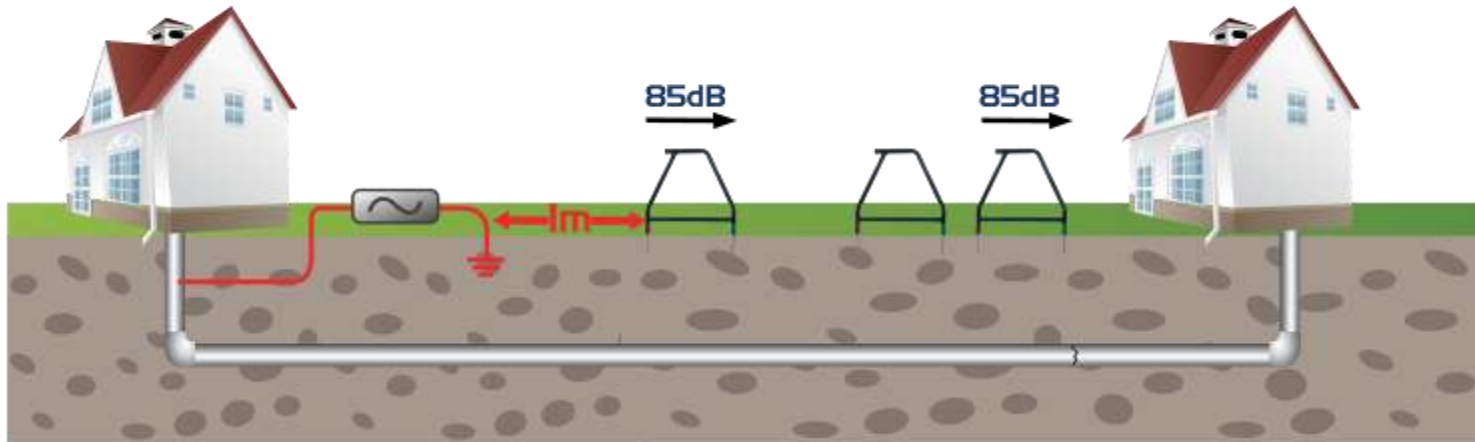
Cable and Pipeline Faultfinding



- Repeat the process at 90° to the position of the fault to identify the position laterally. Where the two lines cross is the position of the fault.

Accessories... A-frame...

Cable and Pipeline Faultfinding



- If it is suspected that there is just one fault on the line, the A-frame can be used to estimate the magnitude of the fault.
- Position the A-frame approximately one meter from the earth stake. Note the dB reading which will be similar to the maximum dB reading at the fault.

Accessories... Live Plug Connector...

- Apply the Live Plug Connector to a normal household power socket (100V – 250V AC) to apply the transmitter signal
- The transmitter is protected by an isolating transformer built into the accessory
- Use with the receiver or the remote antenna to detect the signal as it leaves the premises

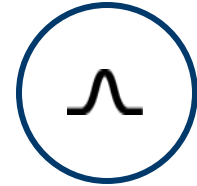


Accessories... Remote Antenna & Signal Clamp...

Used to identify cables



Accessories... Remote Antenna & Signal Clamp...



Signal Clamp

- Set transmitter & receiver to 8 kHz / 33 kHz / 65 kHz
- Select the “Peak” mode on the receiver



Remote Antenna

- Place the remote antenna onto the cable
- Locate the cable with the strangest source of your signal

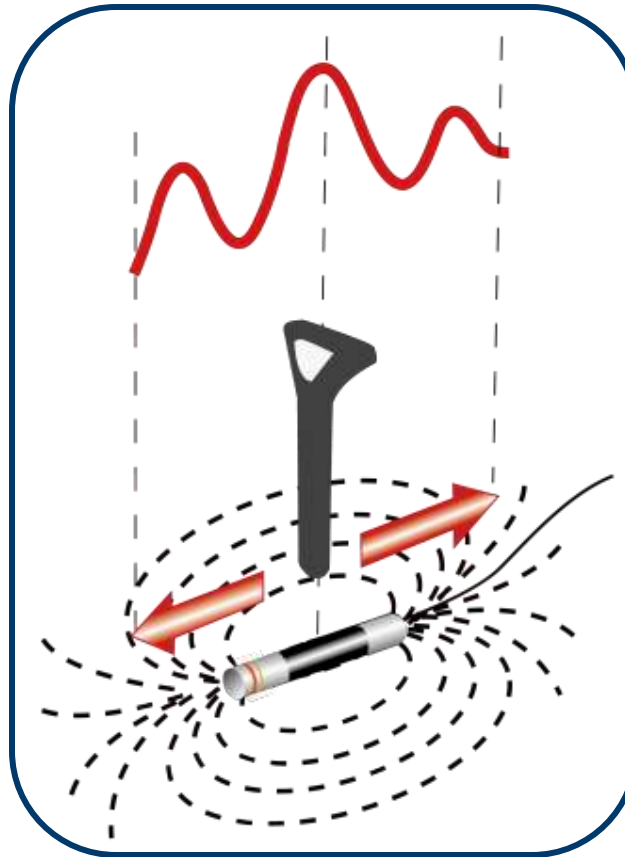
Accessories... Sondes...

- A Sonde is a small self contained transmitter.
- Sondes are inserted into non metallic pipes or ducts to make them locatable or to find blockages.



- Higher frequency (33 kHz) are used for non-metallic pipes.
- Some low frequency Sondes (512Hz/640Hz) will transmit through cast iron pipe.

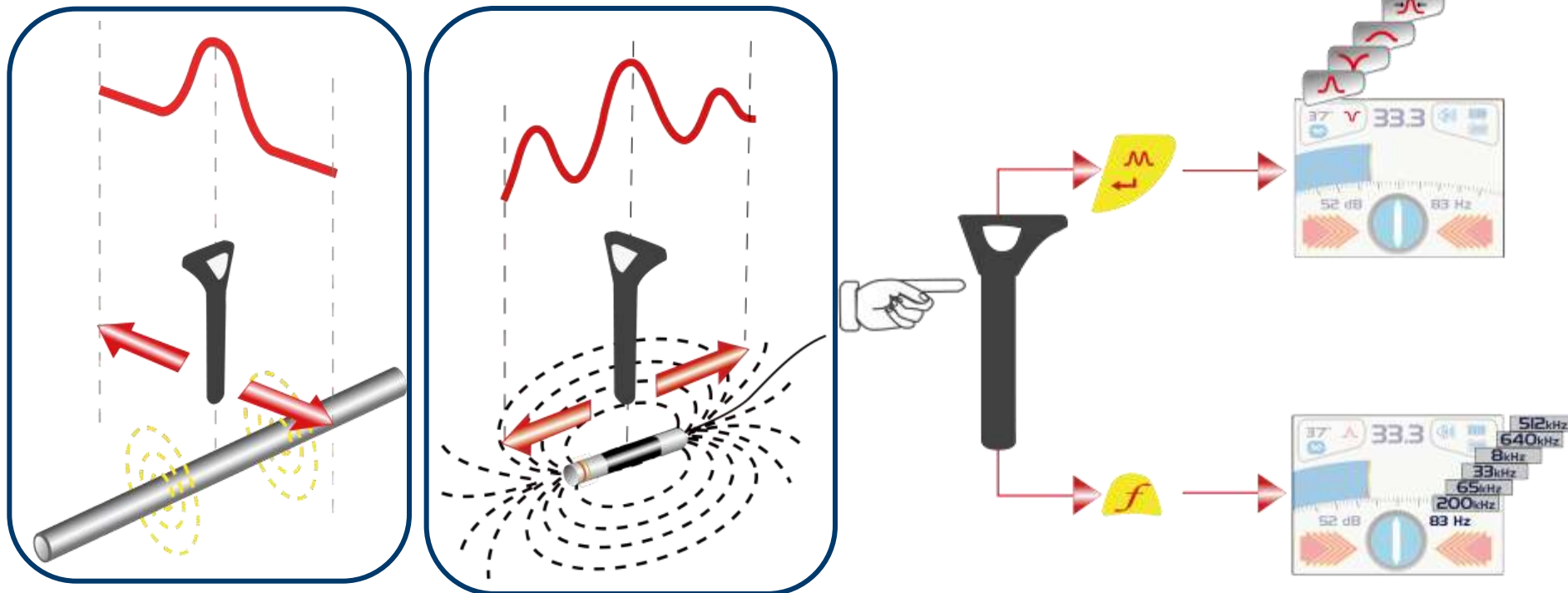
Accessories... Sondes...



- Sondes radiate a signal with a different shape to the signals radiated from cables

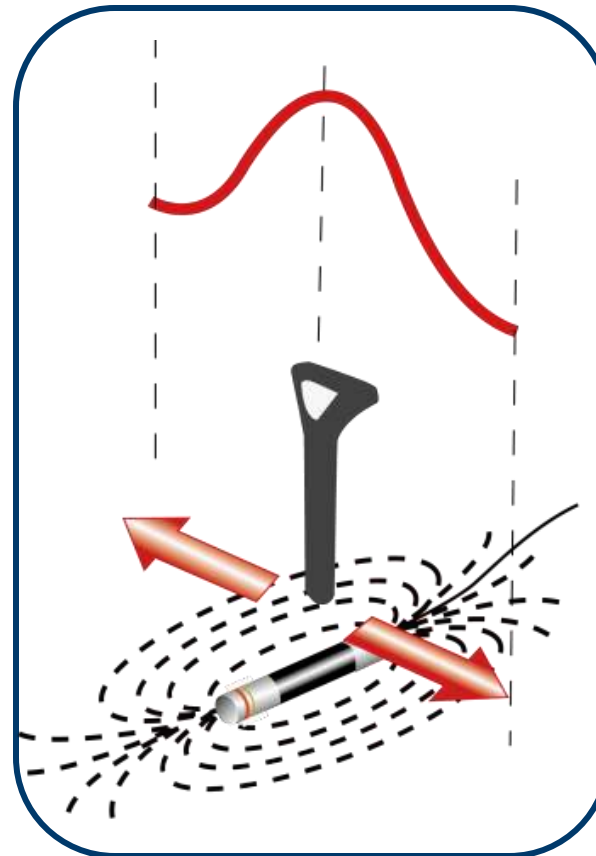
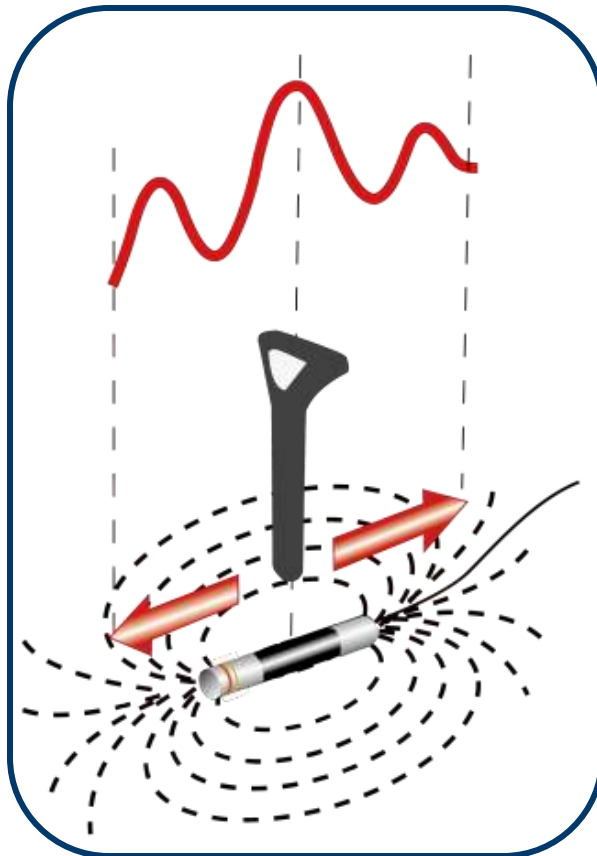
Accessories... Sondes...

- Because the signal radiates differently, we orientate the receiver differently & use a specific “Sonde” mode. (on the receiver)
- Take the receiver and select both the “Sonde” mode and the correct Sonde frequency.



Accessories... Sondes...

- The Sonde signal gives three peaks in line with the path of the Sonde.
- And a single peak across the line of the Sonde.



Accessories... Sondes...



- The compass can be used to efficiently locate the position of a Sonde.
- Position the locator in the approximate area of the Sonde.
- Rotate the locator so that the compass is pointing at 12 o'clock.
- Walk forward keeping the compass at 12 o'clock.
- Adjust the gain as the signal strength increases.
- The position of the Sonde is indicated by the maximum signal strength.

Accessories... Sondes...

- Sondes are fitted or taped to pushrods. (snakes)
- They are often incorporated in other equipment.
- Typical examples are:
 - CCTV (Sewer) Inspection Cameras
 - Jetters
 - Horizontal boring devices

(These Sondes may be powered by batteries or by other devices)



Depth to the Sonde can be measure by pressing the depth button, however you **MUST** be in **"SONDE" MODE**.

Battery Care & Maintenance.....

The following will help you extend the life of your rechargeable batteries

- Only use the correct charger provided by Vivax
- When you first get the units – charge them for a minimum of 8 hours, during that period do not switch off or disconnect
- If at any time the battery life per charge reduces – run the rechargeable until they are completely dead, then charge for 8 hours, use the unit for 15 mins and then charge for another 8 hours.
- A heat sensing switch is included in both the transmitter and receiver rechargeable battery packs to immediately stop the charging cycle if the temperature of the batteries rises to unacceptable levels.



Additional battery packs that can be placed in the Alkaline compartment of the receiver are also available. These must be taken out of the unit for charging.

Vehicle cigarette type charging leads are also available for the Receiver internal rechargeable battery and the accessory rechargeable pack.

Safety.....

Locators are precision well engineered tools, however the environment we locate in is not perfect.

- Always be aware of the influence of distorted fields
- Always take account of visual clues (manholes, pedestals etc)
- Always use “as built plans” if available
- NEVER use digging machinery over marked out pipes or cables
- Do NOT give “depth” information unless authorized by your company
- Follow all Federal, State, and company rules and regulations particularly as regards safety
- Dispose of Batteries in line with Federal, State or company regulations
- Never submit batteries to extreme heat or fire.

CALL BEFORE YOU DIG - ALWAYS DIG CAREFULLY

Glossary.....

Active Locate	A locate where a transmitter is used to apply a signal to a buried pipe or cable, the position of which is then located by a receiver tuned to the same frequency.
Active Signal	A signal applied by the locator transmitter to a buried line. Typical this is a very precise frequency.
Attenuation	The reduction of an electromagnetic signal from a pipe or cable.
Clamp (or Coupler)	An accessory used to apply the transmitter signal to an insulated line, removing the need to connect the transmitter signal directly to a conductor or cable sheath.
Coupling	The act of signals transferring to lines to which they were not originally applied. Coupling can be “direct” where the target line has an electrical connection to another line, or “induced” where the signal radiates from the target line to another line or lines.

Glossary.....

Display	The information visually available on the dot matrix display.
Line	A generic term for any buried pipe or cable.
Null	A minimum response to a buried line.
Passive Locate	A locate where the receiver searches for a wide range of signals that radiate from buried pipes or cables. These signals come from a variety of sources in the environment and couple to the buried (& overhead) lines. Typical examples 50/60Hz and LF/VLF radio.
Passive Signals	A wide range of signals that radiate from buried pipes or cables. These signals come from a variety of sources in the environment and couple to the buried (& overhead) lines. Typical examples 50/60Hz and LF/VLF radio.
Peak	A maximum response to a buried line.
Compass	Line direction indicator. (Although visually like a compass, this is the only relation to a compass.)

Glossary.....

Pinpoint	Using a receiver to identify the exact position of a buried line.
Target Line	The buries pipe or cable to be located.
Trace	Using a locator to following the path of a buries line.
Response	The indication that the receiver gives which is caused by the signals it is receiving. This can be visual, audio or both. Typically it is displayed on the locators dot matrix display and audibly from a loudspeaker in the receiver housing.
Search (sweep)	This describes the act of looking for a buried line within a given area.
Sonde	A small transmitting coil which may be built into a product such as a sewer camera or packaged as a small self contained battery powered transmitter. A receiver tuned to the same frequency can locate the position of the Sonde and hence whatever it is attached to or in. Frequently used for locating sewer cameras and the non metallic pipes.

Vivax-Metrotech Contact Details...

Vivax-Metrotech works throughout the world with skilled professionals experienced in cable and pipe location...

United State of America

Vivax-Metrotech Corporation

3251 Olcott Street,

Santa Clara, CA 95054, USA

Website : www.vivax-metrotech.com

Sales & Sales Support:

T/Free : +1-800-446-3392

Tel : +1-408-734-1400

Fax : +1-408-734-1415

Email : sales@vxmt.com

Service & Repairs:

T/Free : +1-800-638-7682

Tel : +1-408-962-9990

Fax : +1-408-734-1799

Email : service@vxmt.com

Application Support:

T/Free : +1-800-624-6210

Tel : +1-408-454-7159

Fax : +1-408-743-5597

Email : applications@vxmt.com

All Other Department:

T/Free : +1-877-330-1647

Tel : +1-408-734-3880

Fax : +1-408-962-9993

Canada

Vivax Canada Inc.

400 Esna Park Drive,

Unit 17, Markham,

Ontario, L3R 3K2, Canada

Tel : +1-289-846-3010

Website : www.vivax-metrotech.com

Email : CanadianSales@vxmt.com

Vivax-Metrotech Contact Details...

Europe SebaKMT

Seba Dynatronic
Mess-und Ortungstechnik GmbH
Dr.-Herbert-lann-Str. 6,
96148 Baunach, Germany

Tel : +49-9544-680
Fax : +49-9544-2273
Website : www.sebakmt.com
Email : service@sebakmt.com

Australasia SebaKMT AUS

Unit 1, 176 South Creek Road,
Cromer NSW 2009, Australia

Tel : +61-2-9972-9244
Fax : +61-2-9972-9433
Website : www.sebakmtaus.com
Email : sales@sebakmtaus.com
 service@sebakmtaus.com

China

Leidi Utility Supply (Shanghai) Ltd.

Rm405 3rd Building No. 641, Tianshan Rd,
Shanghai, China 200336

Tel : +86-21-5187-3880
Fax : +86-21-5168-5880
Website : www.leidi.com
Email : info@leidi.cn



The End

The Principles of Cable & Pipe Location

