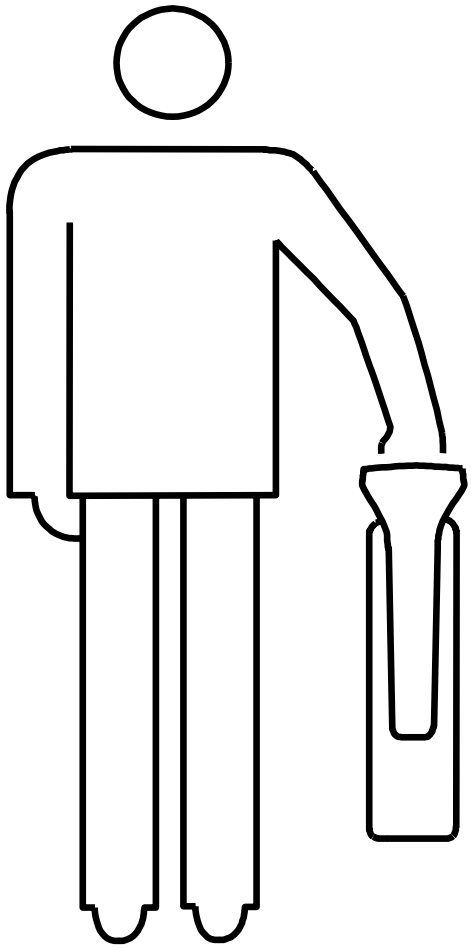
Radiodetection

Fundamental principles and techniques in buried utility location

Radiodetection Canada
344 Edgeley Blvd. Unit 34
Concord, Ontario L4K 4B7
1-800-665-7953

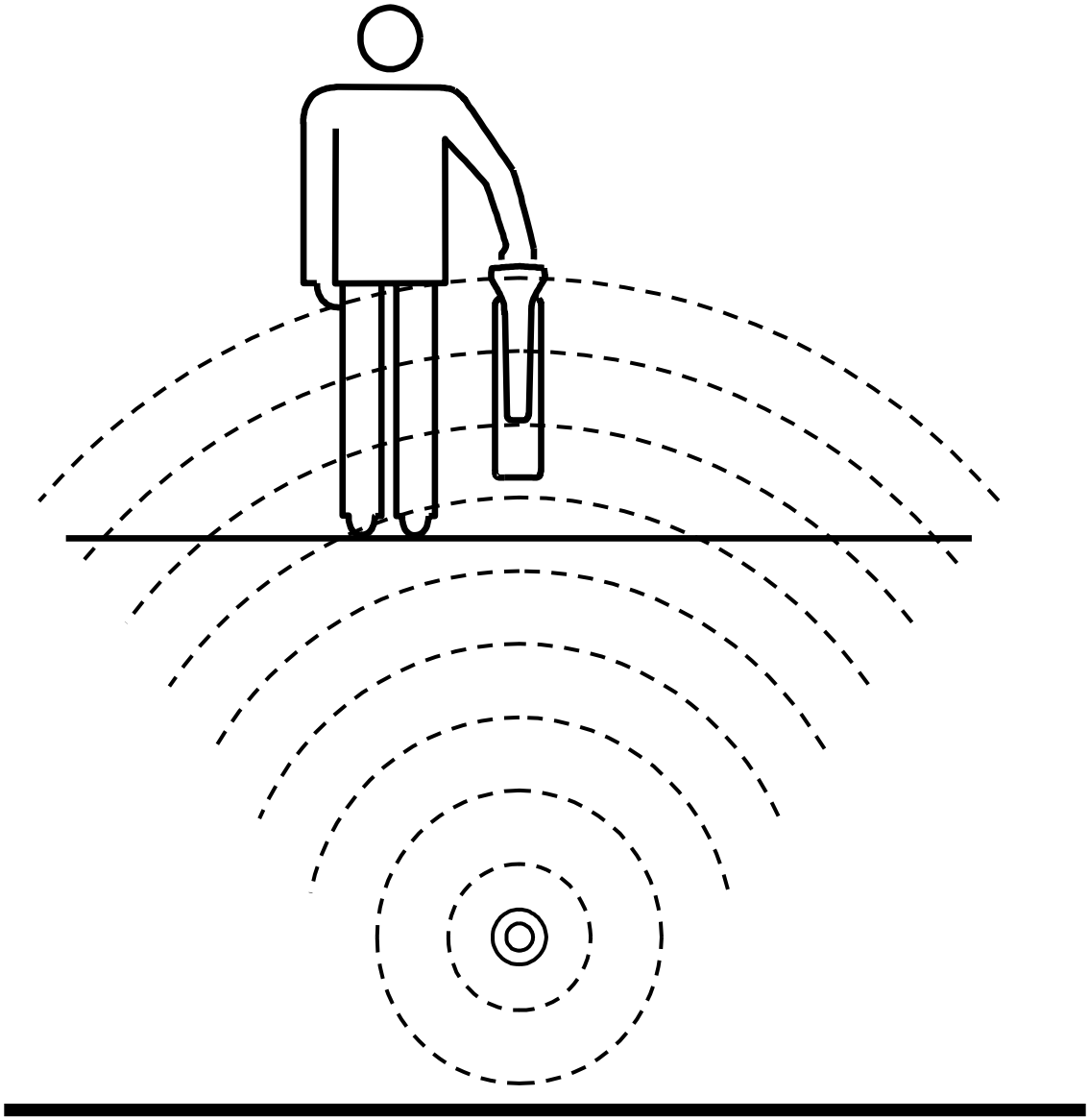
Radiodetection

Pipe and Cable Locators don't find pipes and cables.....



?

....they find electro-magnetic fields.



WHY DOES IT MATTER ?

BECAUSE FIELDS DO THINGS THAT PIPES AND CABLES DON'T DO

WHY DOES IT MATTER ?

BECAUSE FIELDS DO THINGS THAT PIPES AND CABLES DON'T DO

BURIED CONDUCTORS DON'T MOVE, BUT THE FIELDS WE'RE TRACING ARE SUBJECT TO.....

.....DISTORTION

AFFECTED BY

1. METHOD OF SIGNAL APPLICATION

2. GROUNDING

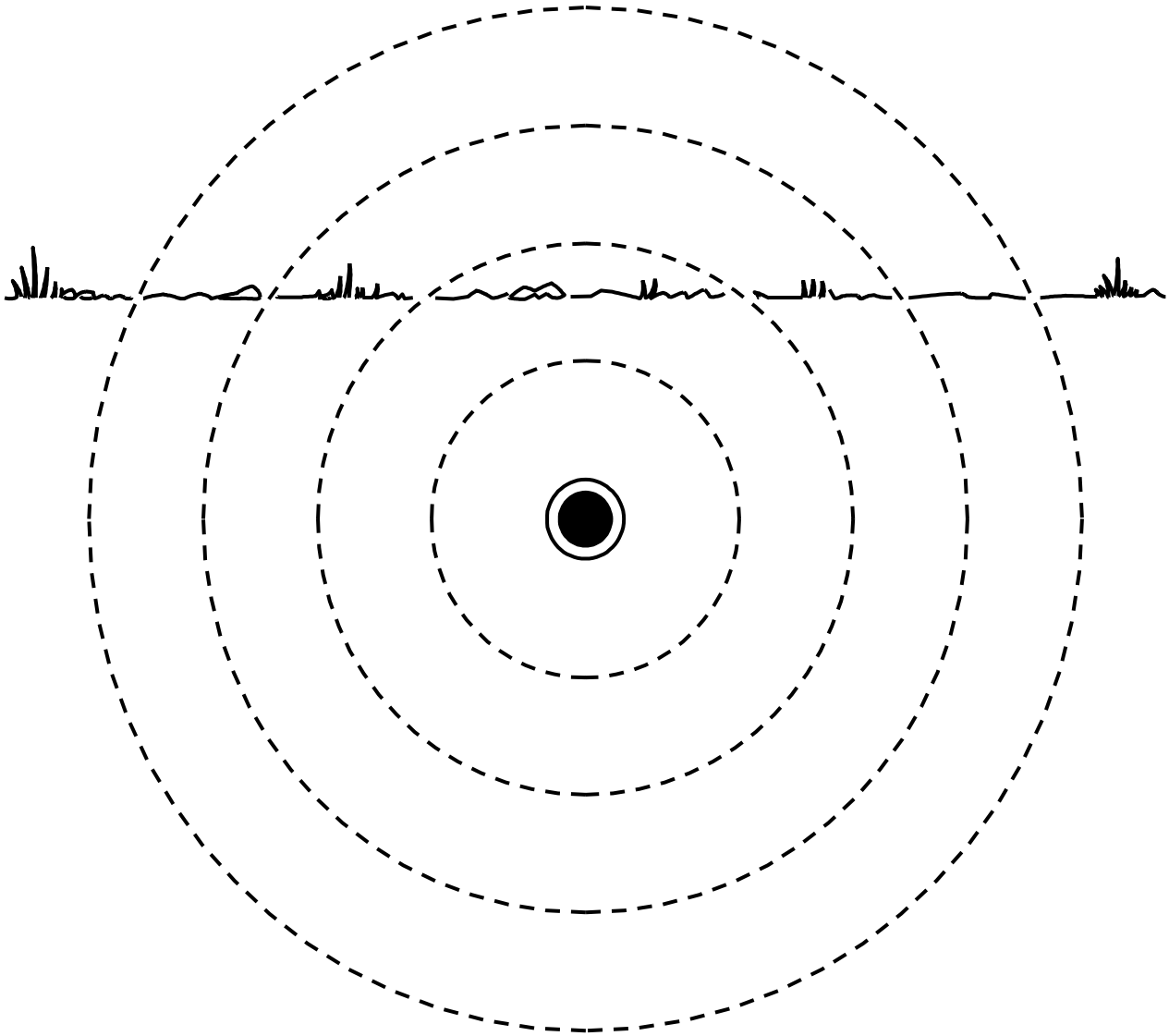
3. PEAK OR NULL

4. CONGESTION

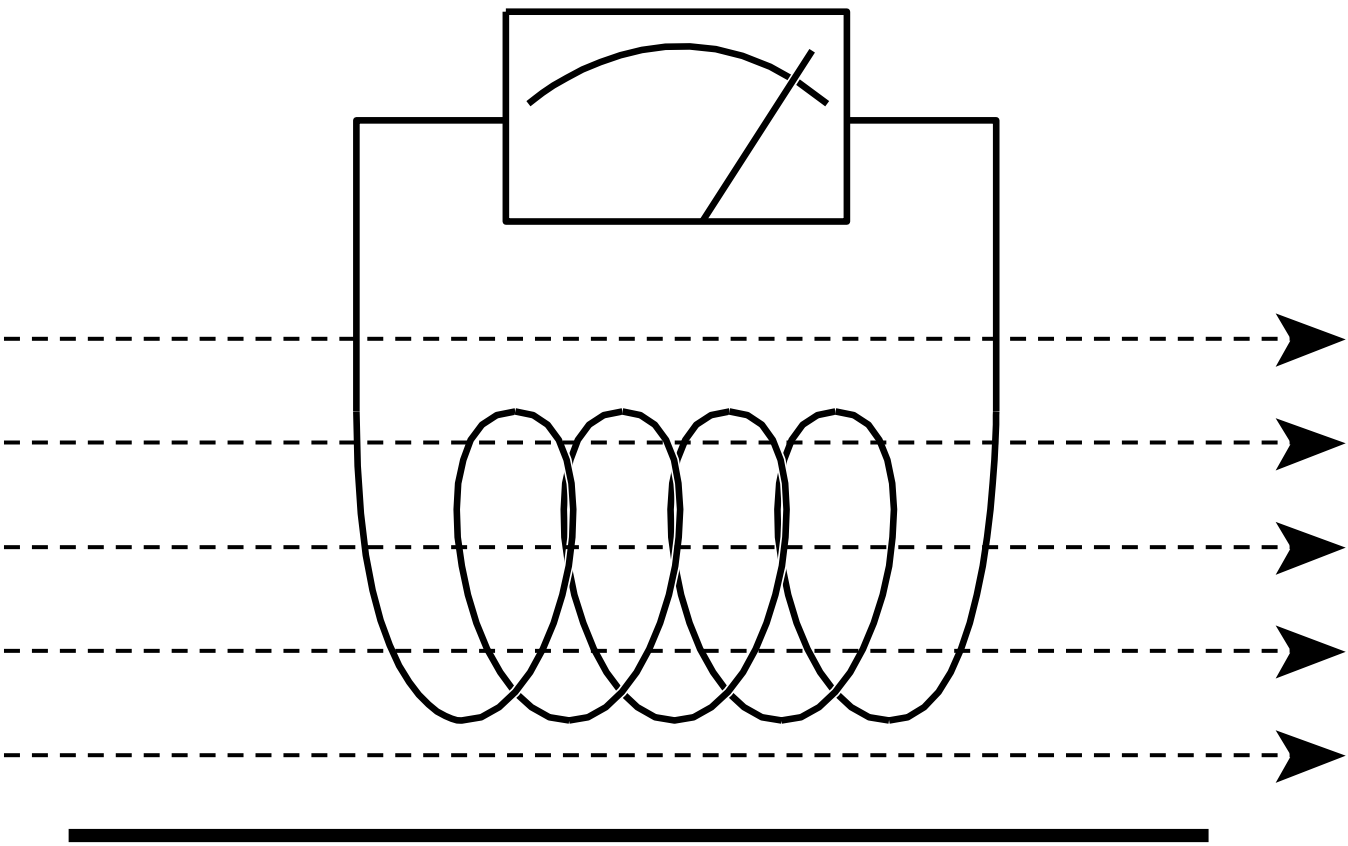
---

5. FREQUENCY APPLIED

What is a Magnetic Field ?



A magnetic field is radiated by a current carrying conductor.



..Which can be detected by a receiving coil which is excited by the expansion and contraction of the field.

THREE WAYS TO LOCATE A BURIED CONDUCTOR;

1. PUT A FIELD *ON* IT.

2. PUT A FIELD *IN* IT.

3. LOOK FOR A FIELD THAT'S *ALREADY* ON IT

Radiodetection

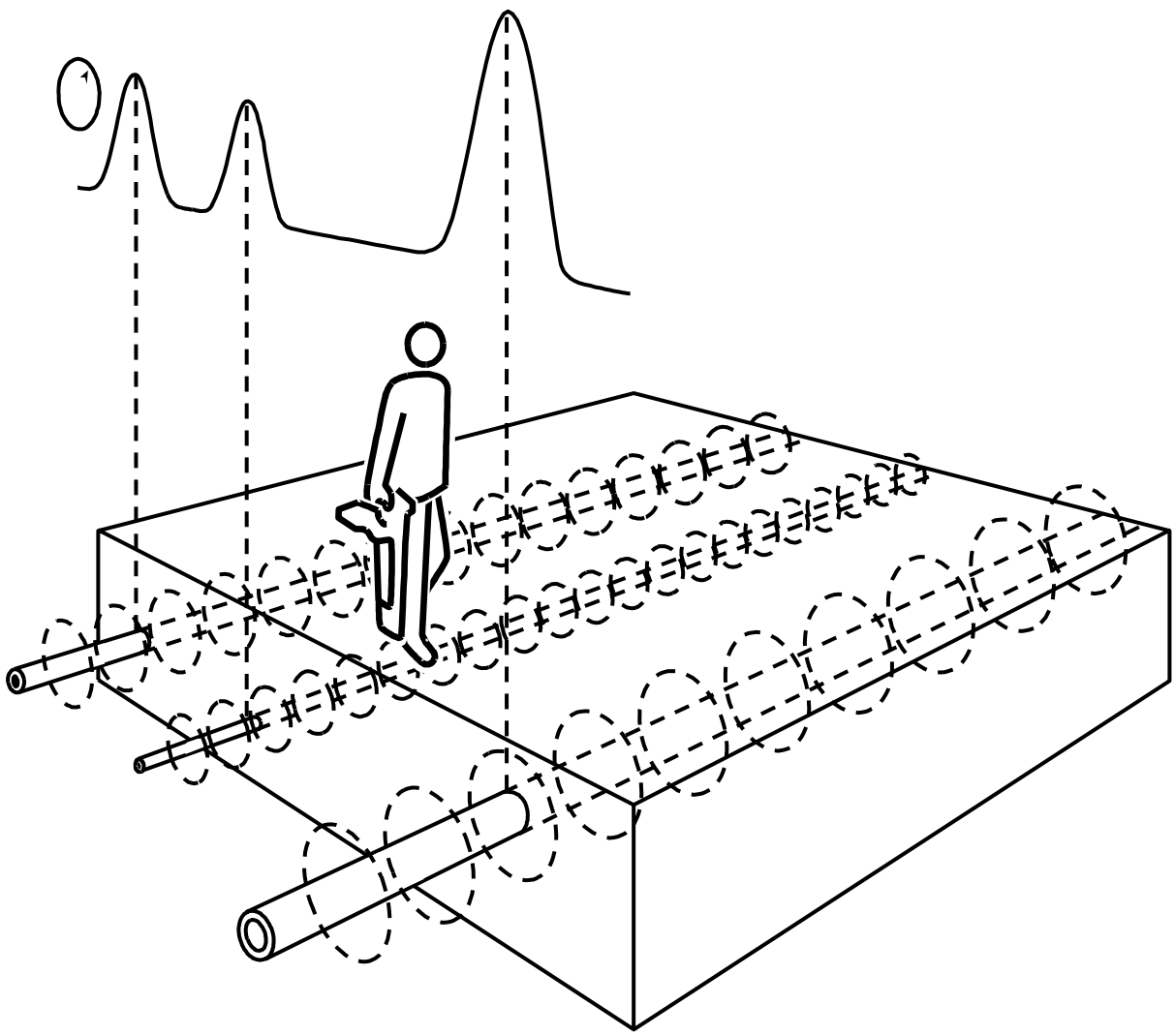
Passive

Active

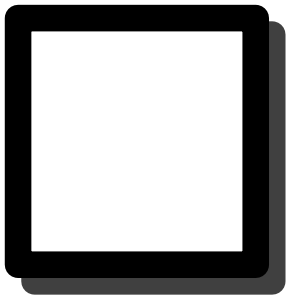
There are two methods of signal detection.

Radiodetection

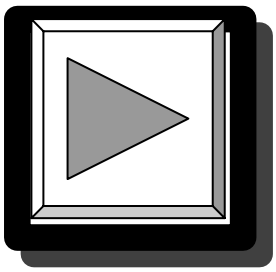
Passive



- Fast
- Easy
- Does not identify



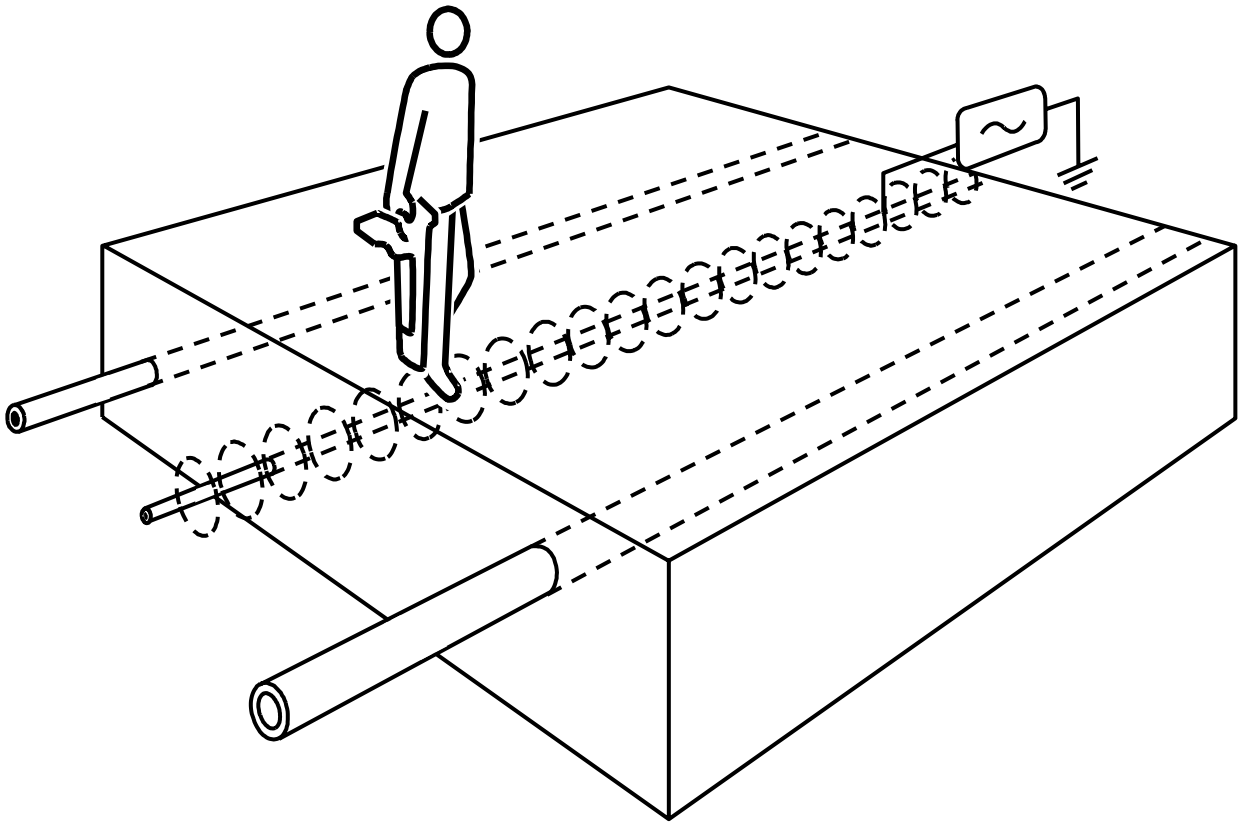
Passive



Active

There are two methods of signal detection.

Active

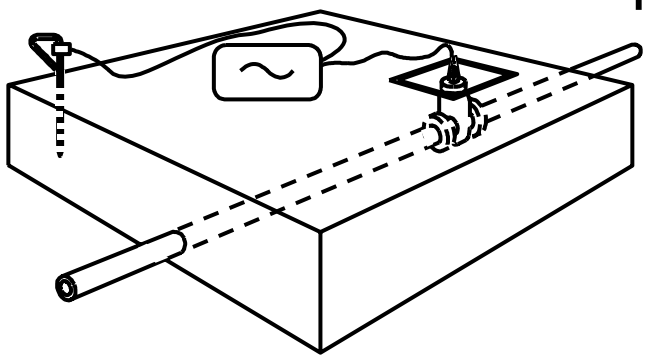


- Increases Locator Versatility
- Depth Measurement
- Positive Identification

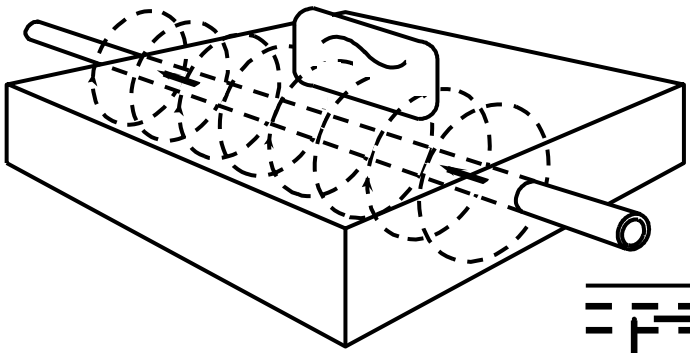
Radiodetection

Applying a Signal

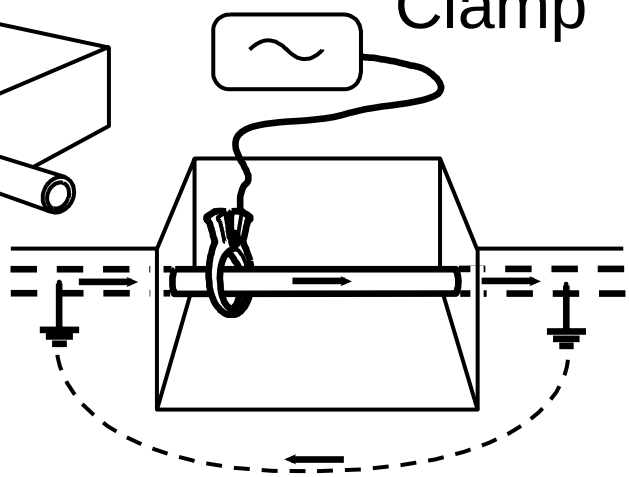
Connection "Clip"



Induction "Spill"



Signal Clamp "Clamp"



There are three main methods of Active Signal Application.

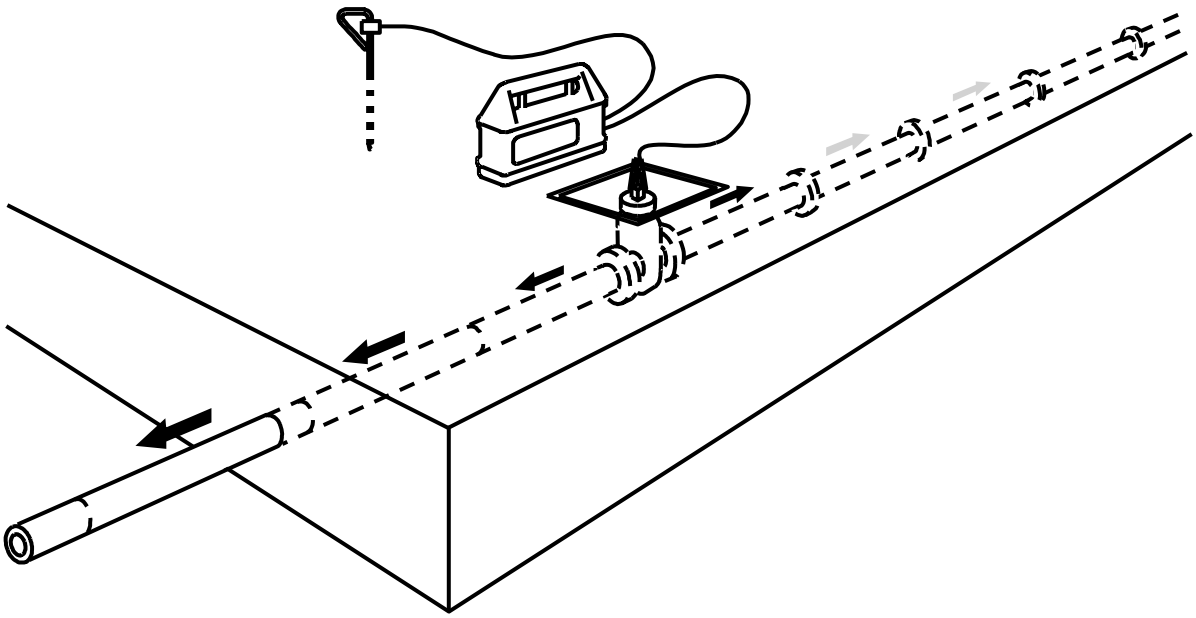
Direct Connection Locating requires
three components;

1. A **transmitter** or signal source

2. A metallic **conductor**

3. A **return path**. Ideally, the earth.

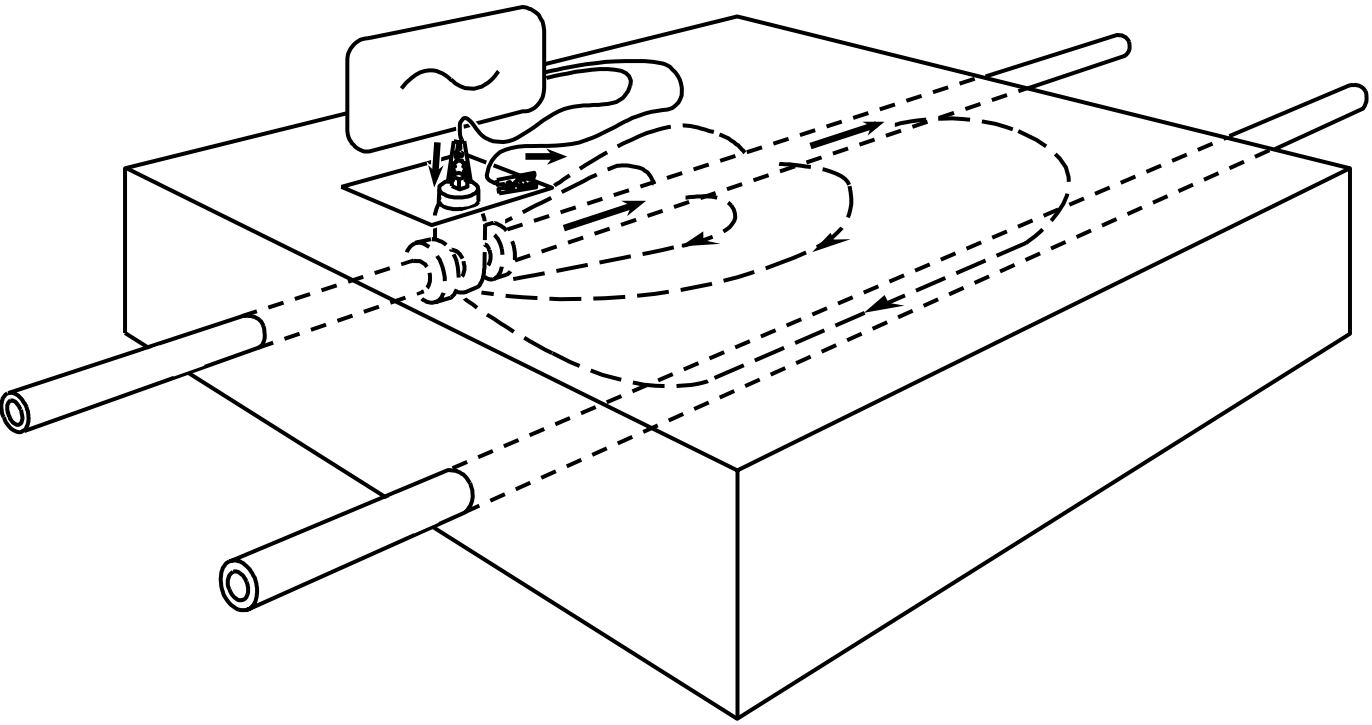
Connection



The ground return point is the "back door" that the outgoing signal returns to. **What you ground to** and **where you place the ground** can significantly affect your results.

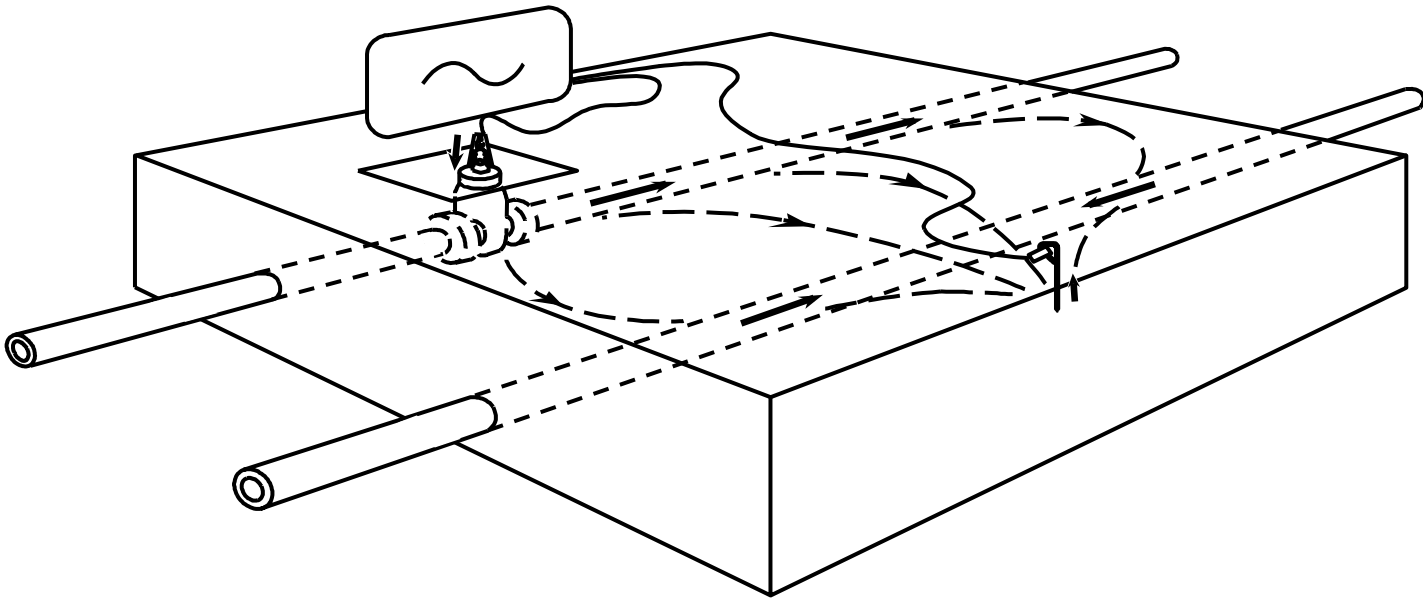
Radiodetection

Connection



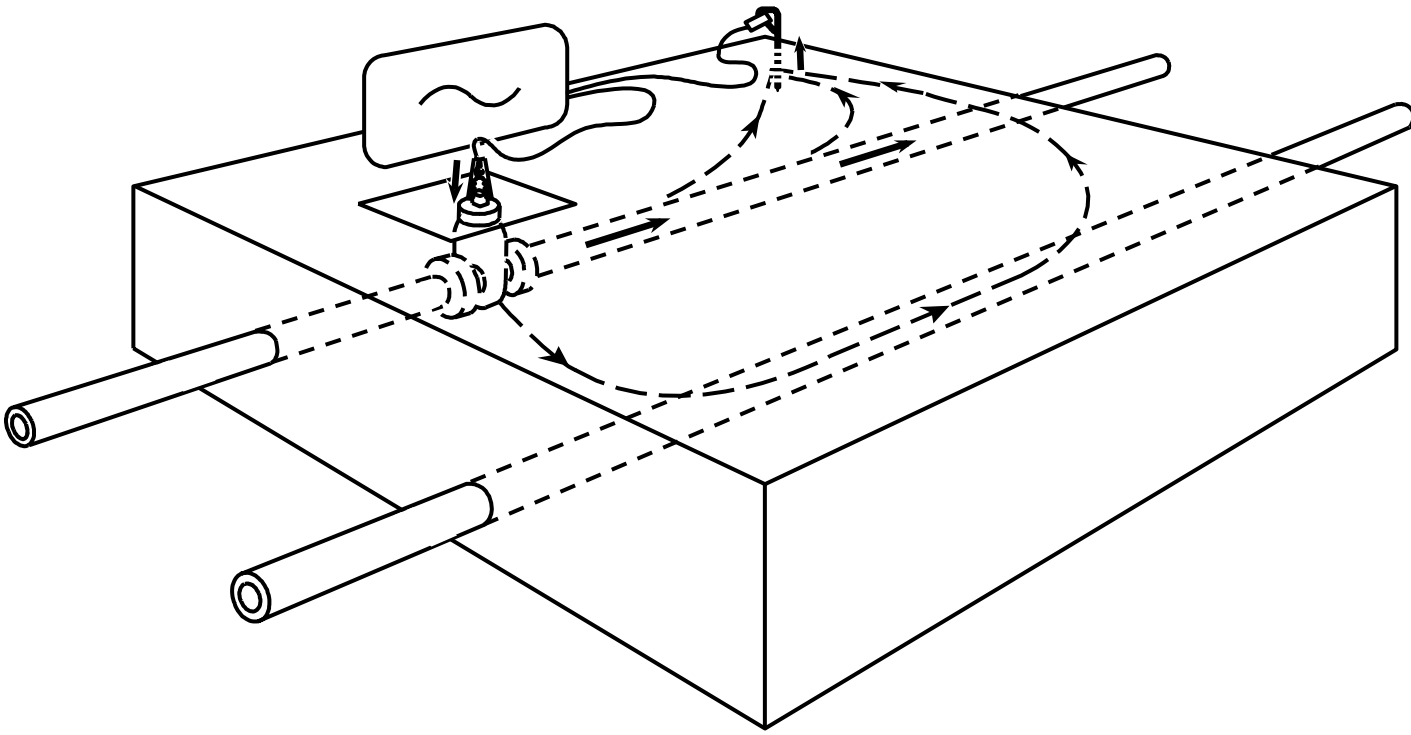
Ground stake too close to target conductor:
Less range, some signal transfer.

Connection



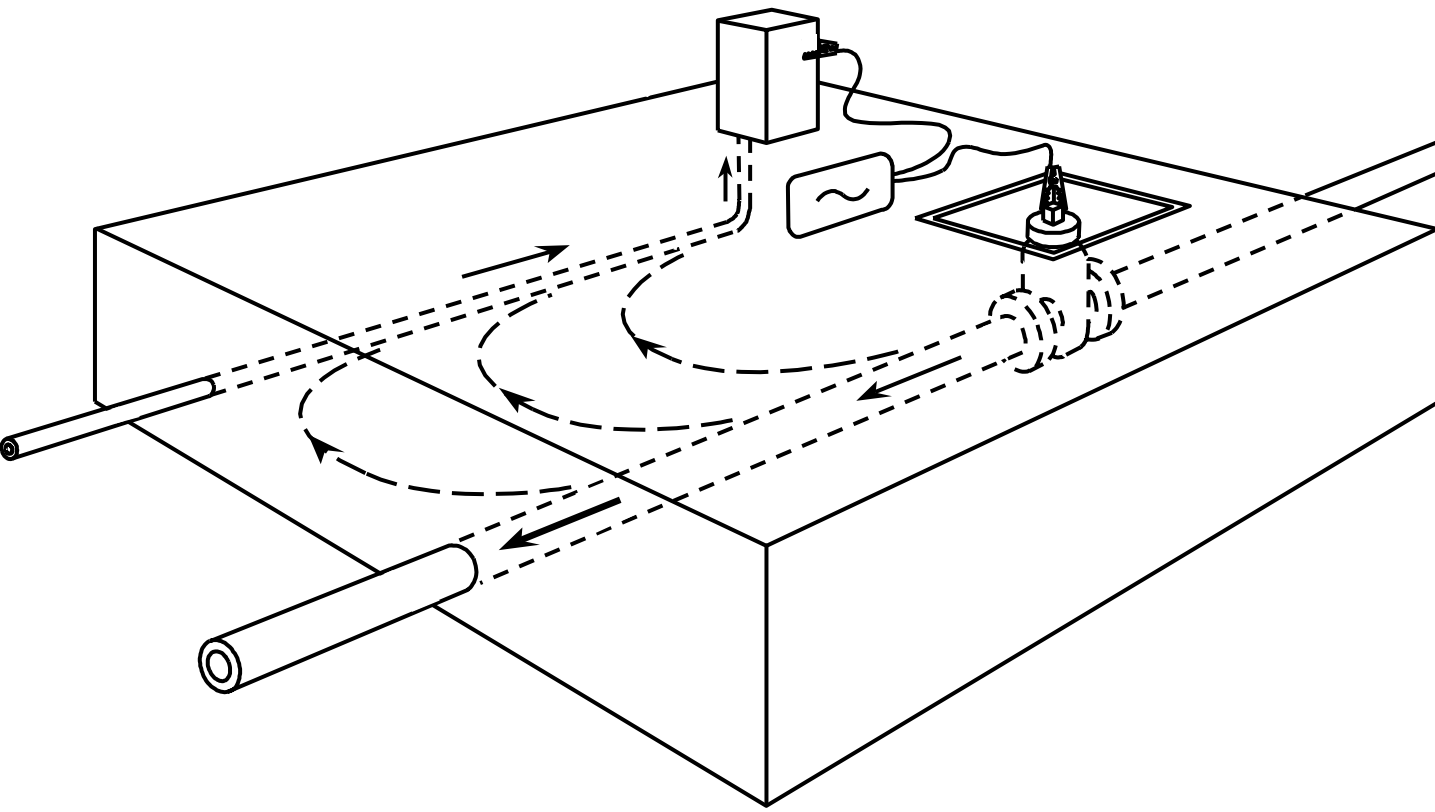
Badly positioned remote ground causes more signal transfer.
Where possible, place ground rod away from known adjacent utilities which may act as return paths.

Connection



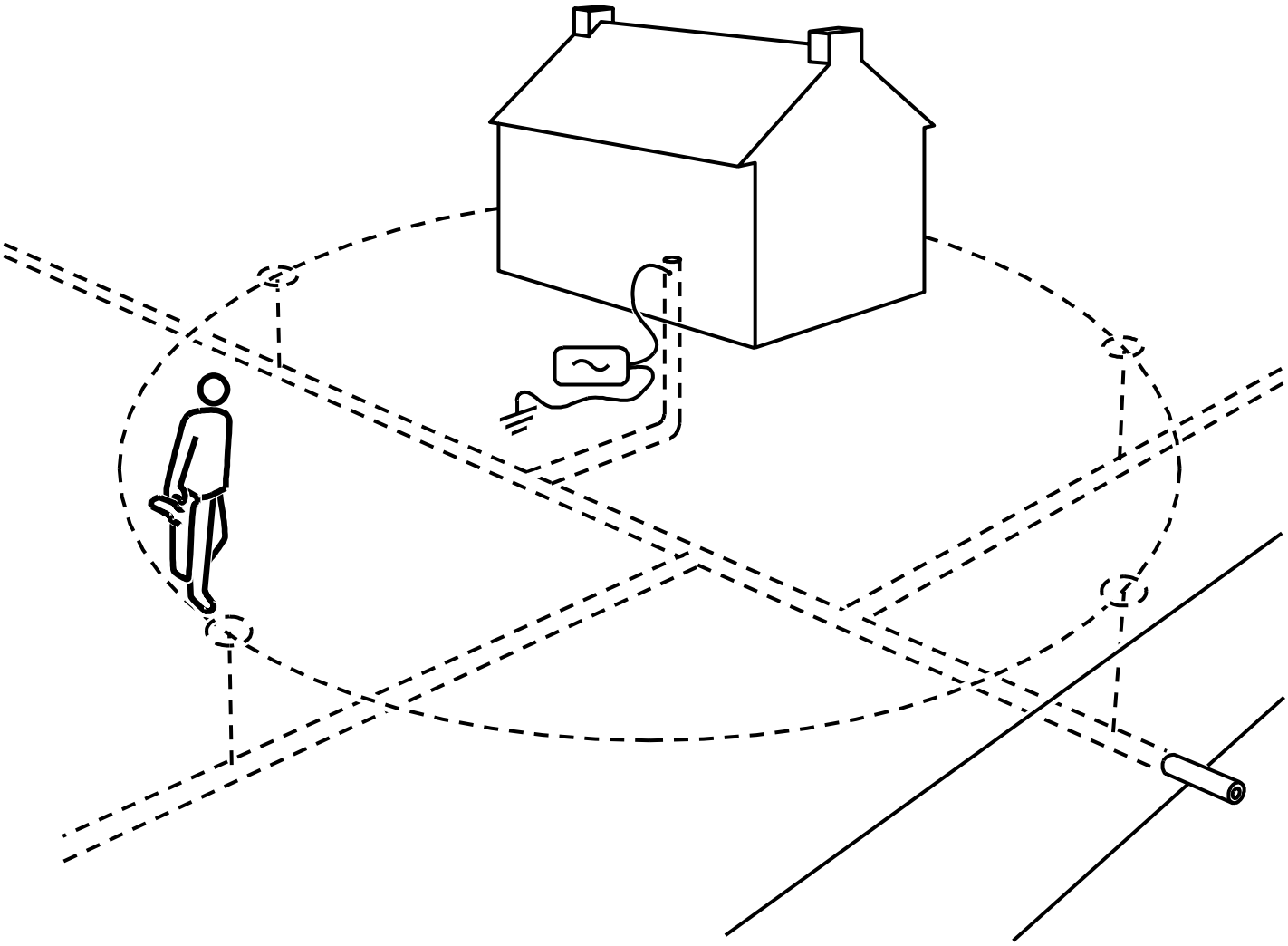
Remote ground = better range, less signal transfer. As a general rule, try to position the ground point at right angles to and 5-10' from the connection point and direction of conductor

Connection



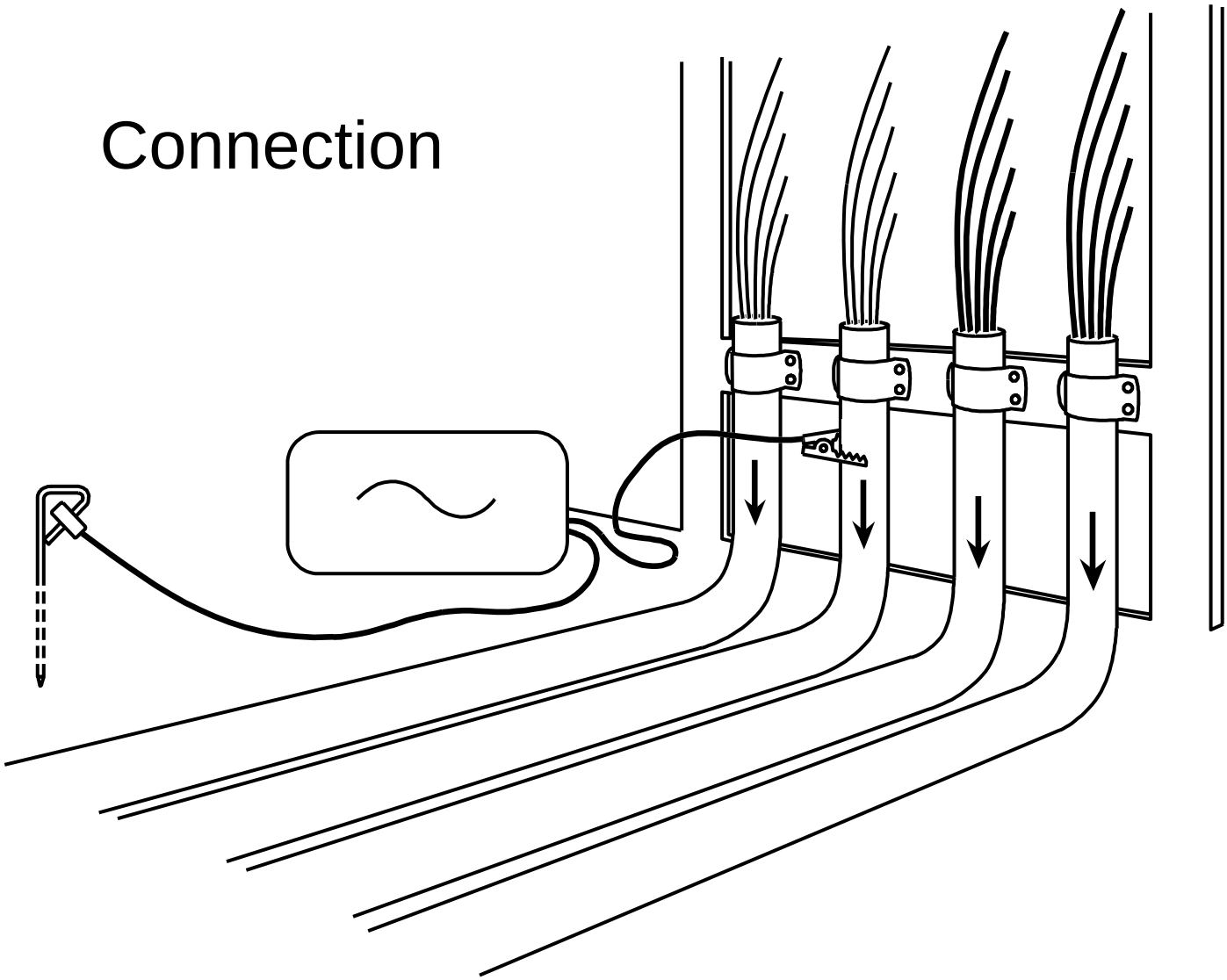
Grounding to a structure which is also grounded can produce multiple signals. The signal returns on every conductor that shares the same ground.

Connection



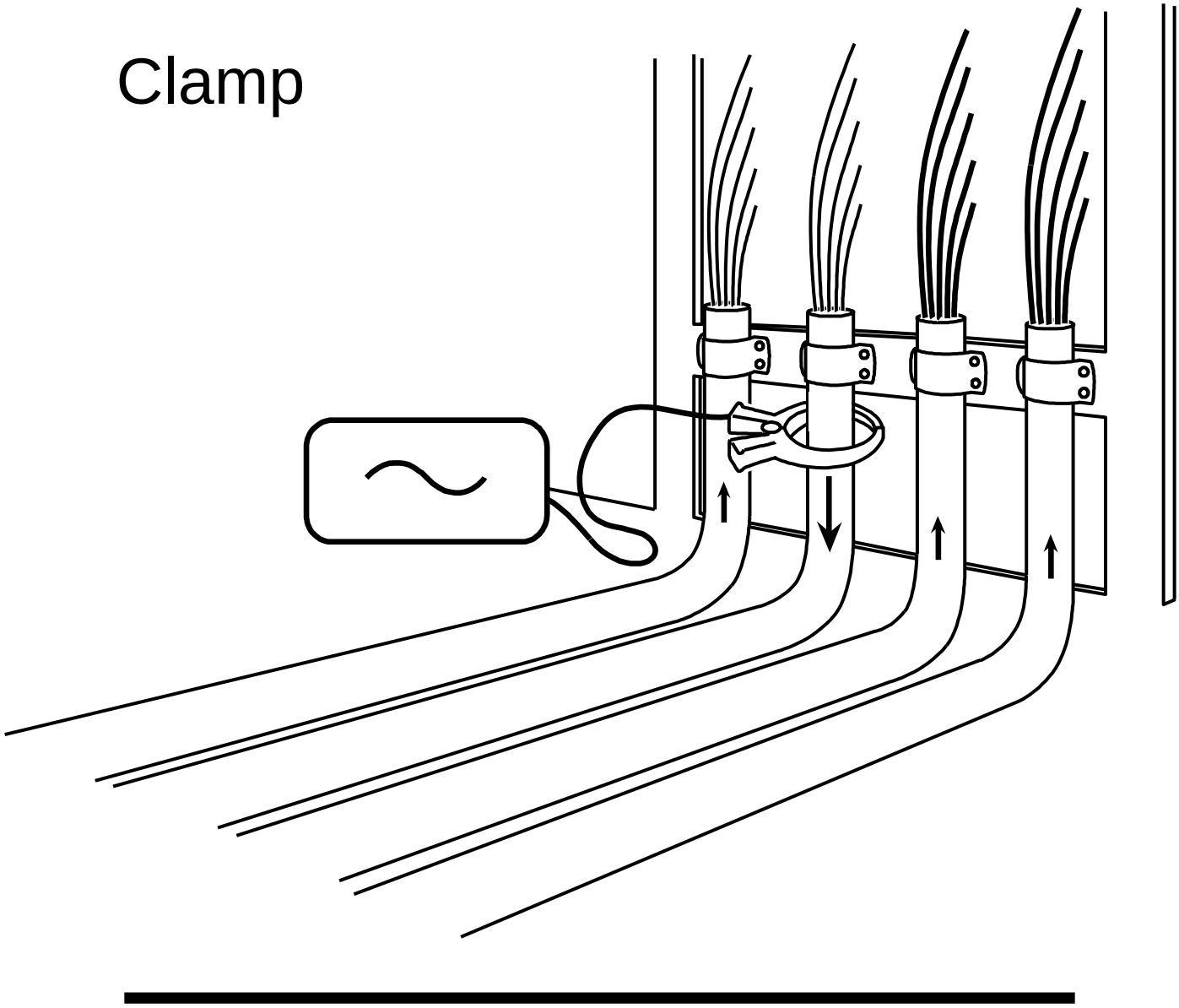
After making a connection, sweep a complete circle around the signal source; measure and mark all occurrences of signal. Repeat to assure accuracy.

Connection

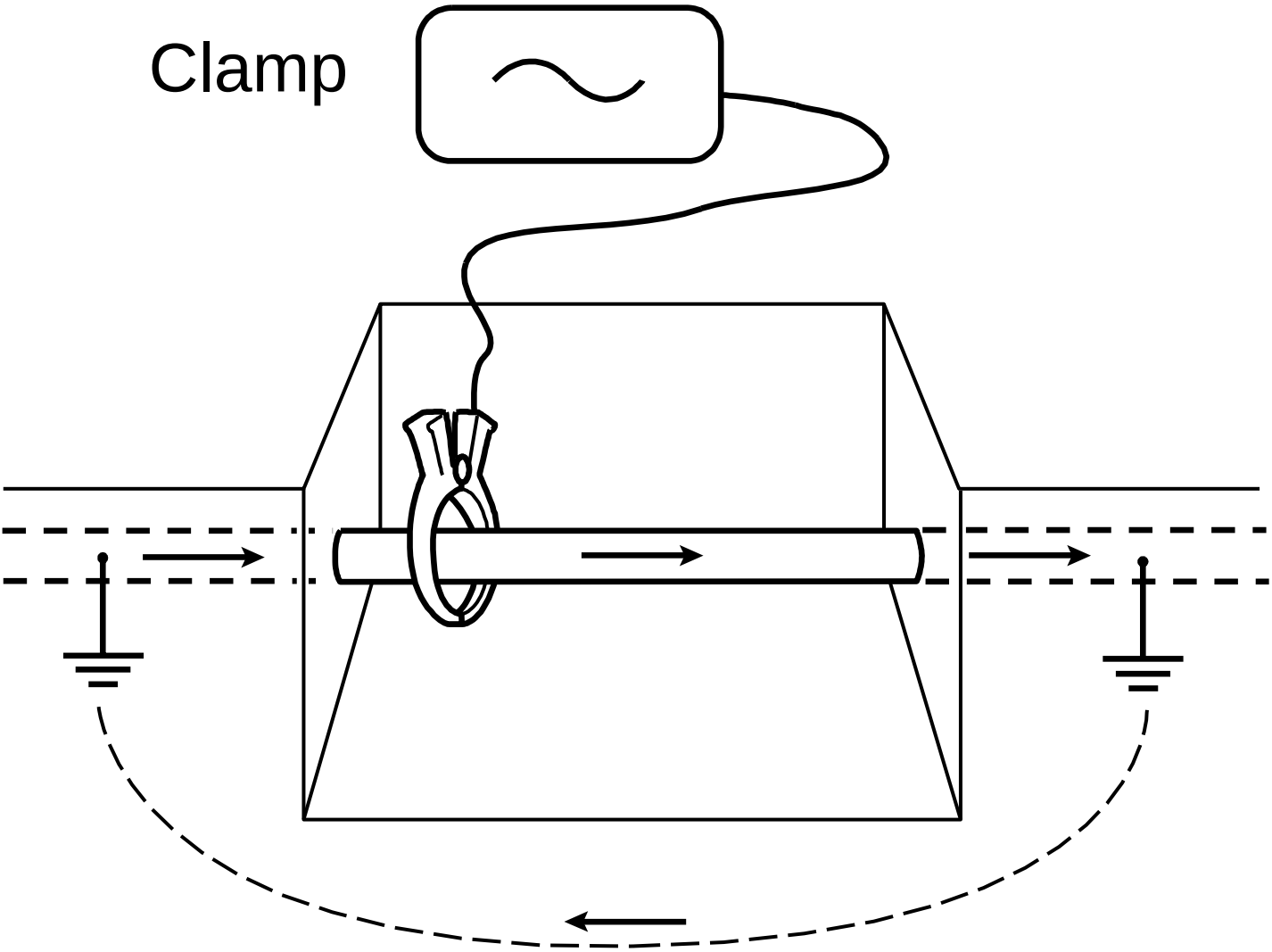


Direct connection does not give reliable identification on multiple bonded lines. As an exception, connection to the bonding ribbon in a manhole will send tone in one direction, allowing the conduit run to be located.

Clamp

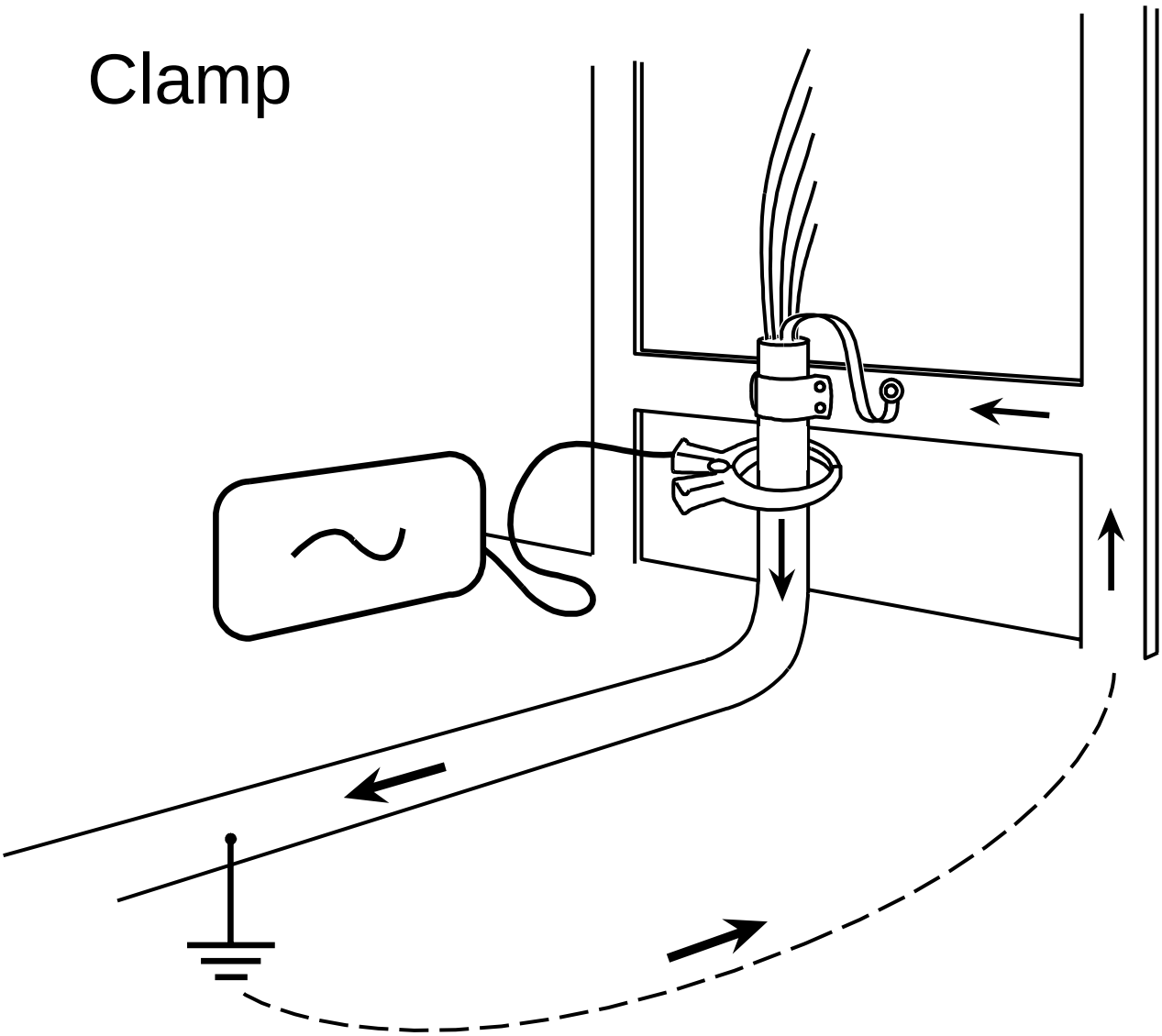


Generally, clamping produces more reliable signal identification.



When using a clamp, the applied signal moves away from the nearest ground to a distant ground. For this reason, it's a useful way to put a locate signal on a specific line.

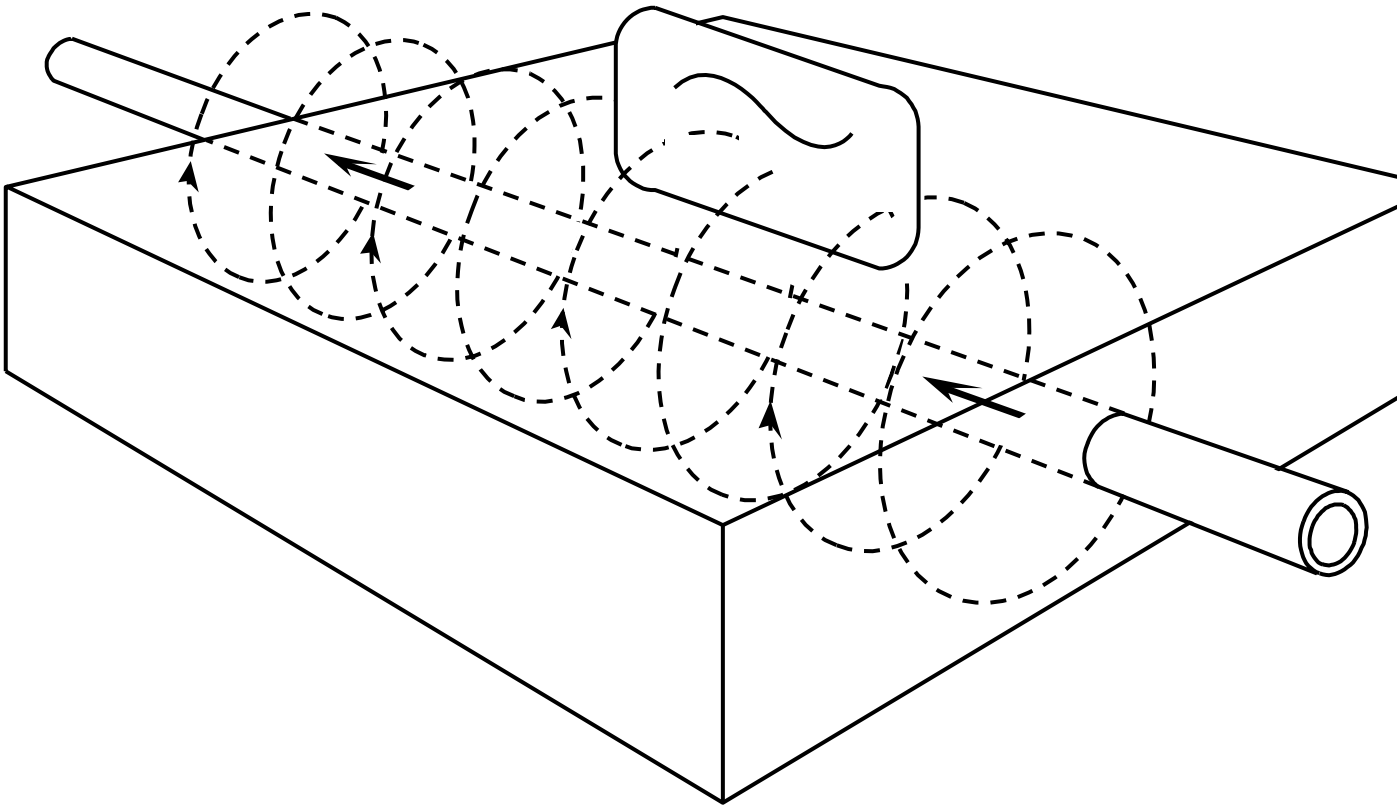
Clamp



Place the clamp below the earth bond when locating cables. Do not place above the earth bond.

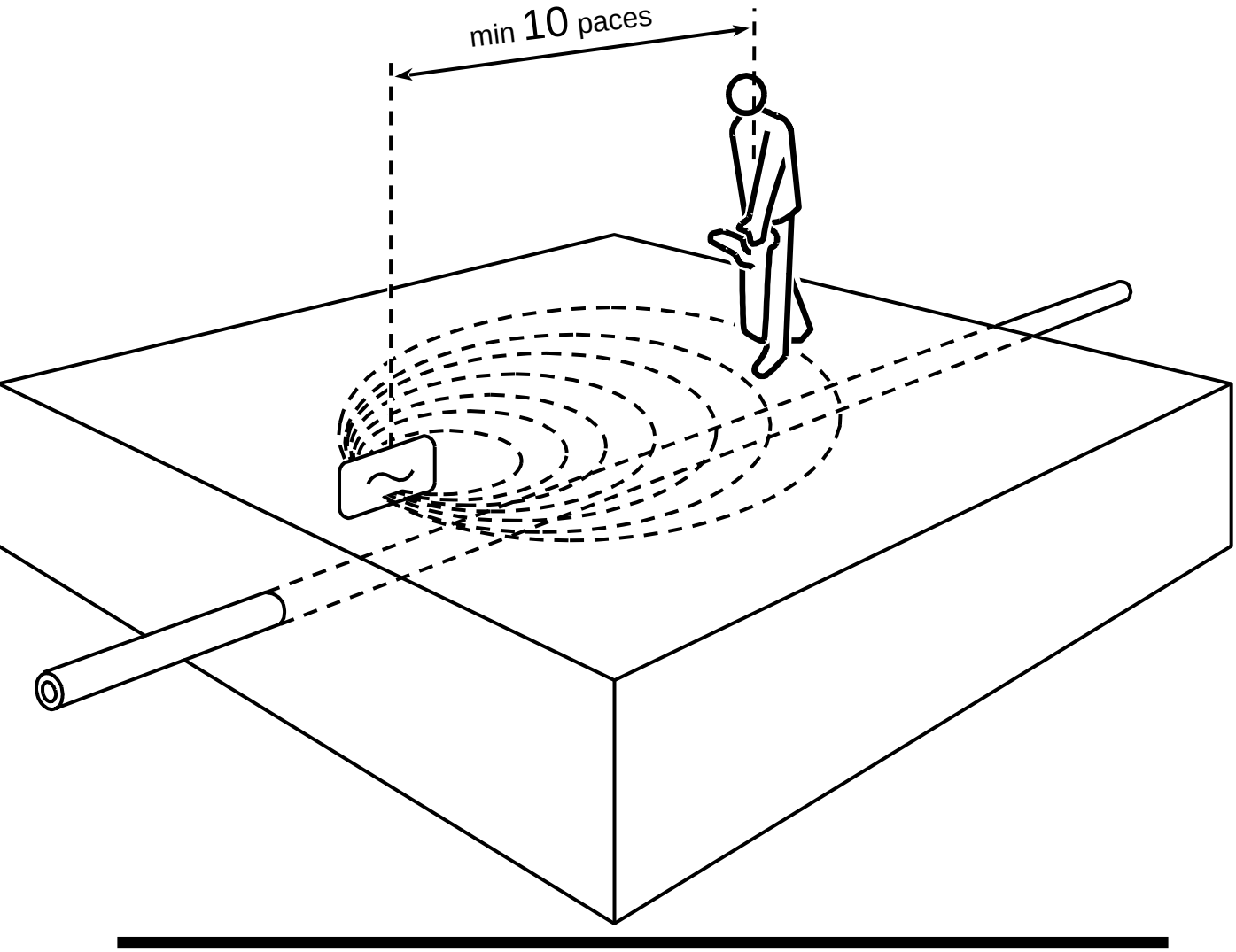
If there is no bonding strap, the clamp may not transmit a signal.

Induction



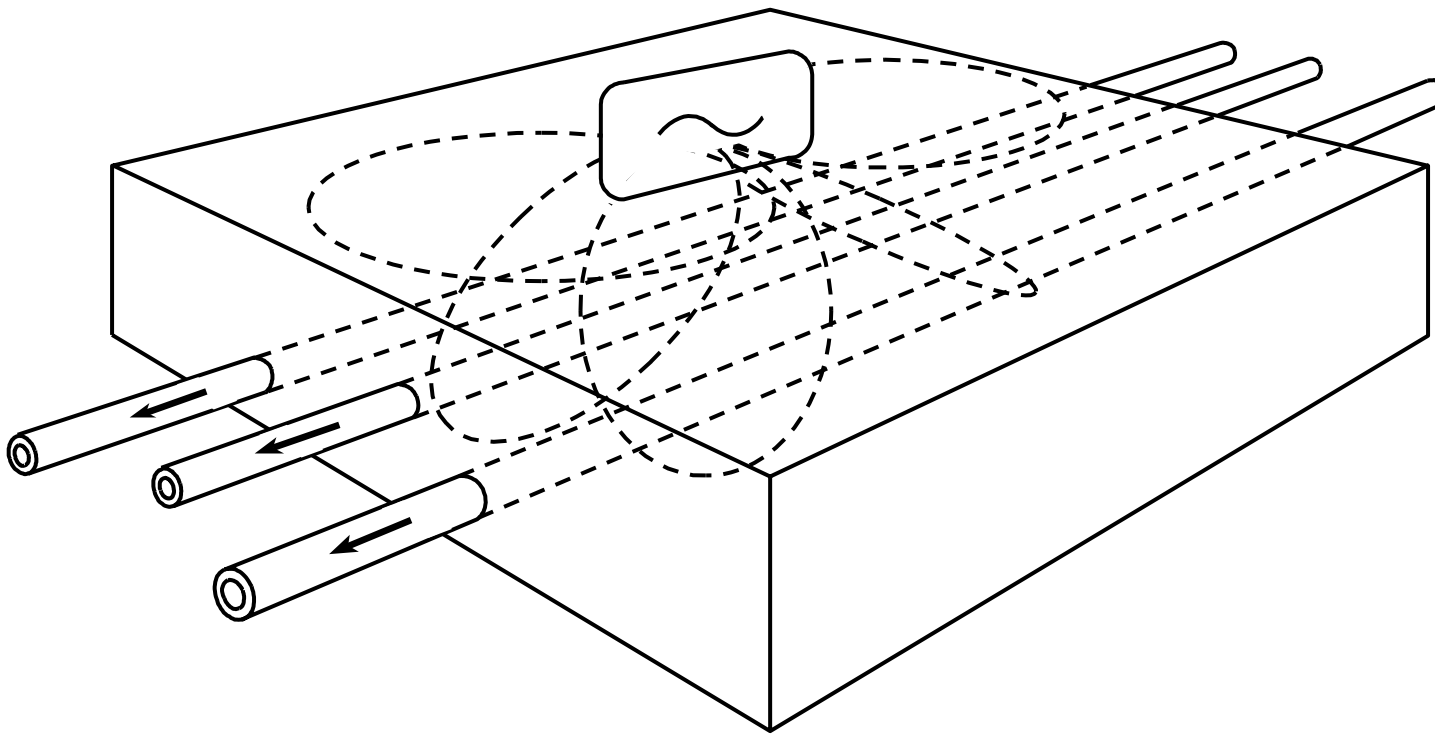
Induction allows the user to quickly and easily apply a locate signal, by placing the transmitter in the vicinity of a known conductor or conductors.

Induction



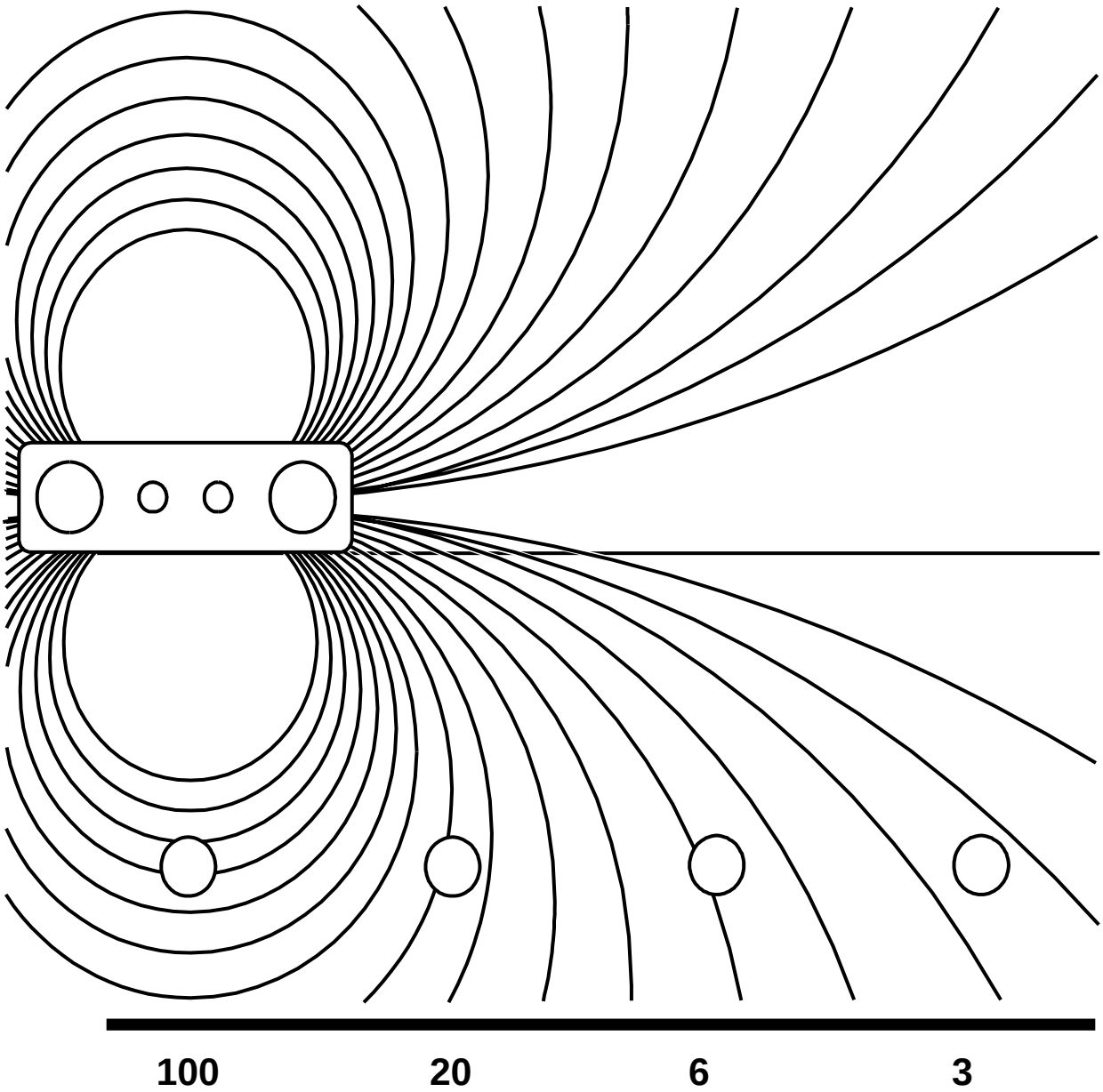
A minimum distance of 10 paces between receiver and transmitter is necessary to avoid the receiver detecting the signal directly from the transmitter. This is known as "Air coupling".

Induction



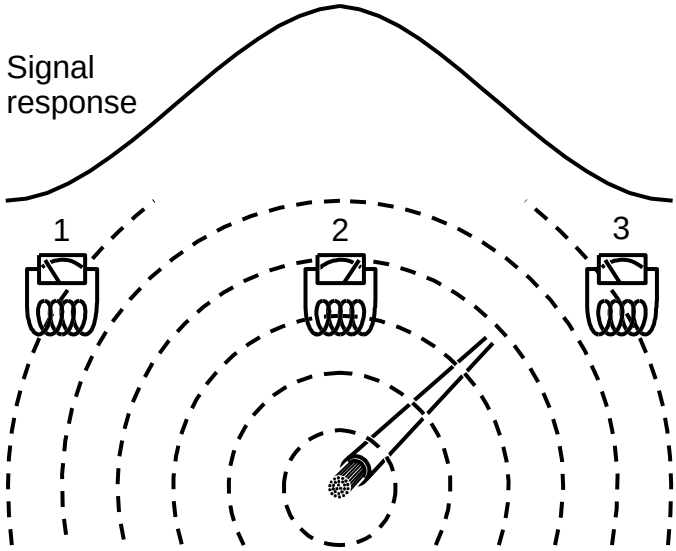
Often induction will energize every metallic conductor close to the transmitter. This is useful for checking an area for buried conductors, but not useful for finding specific conductors in congested areas.

Induction

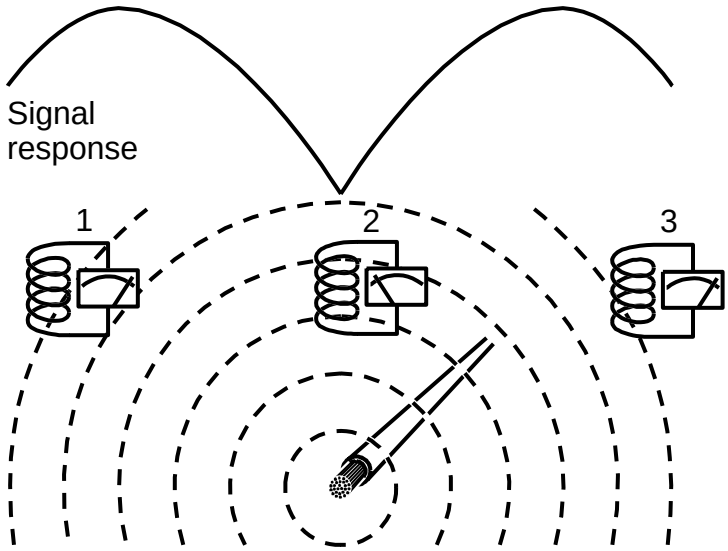


Estimated induction signal ratios.

Aerial Responses



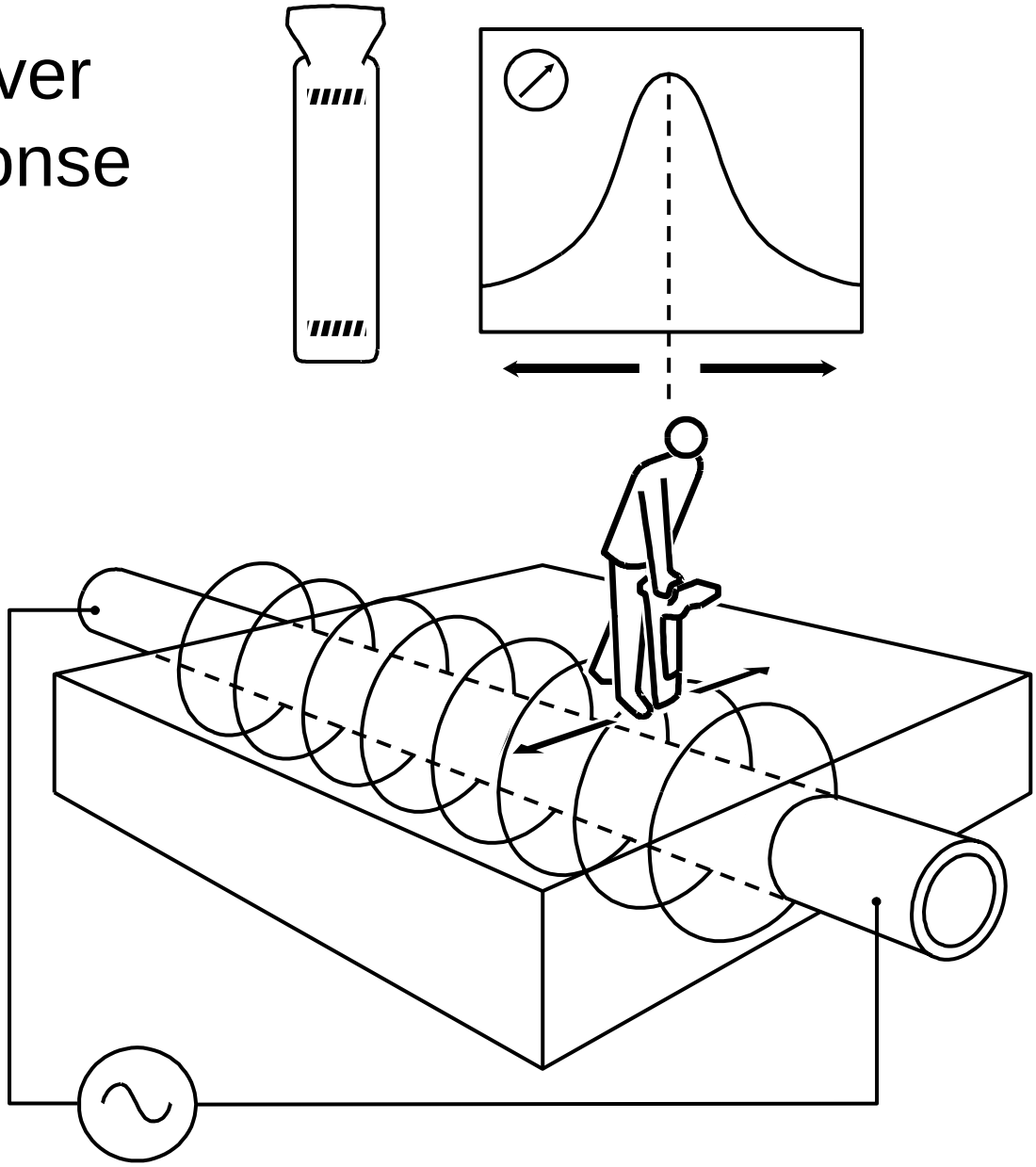
PEAK



NULL

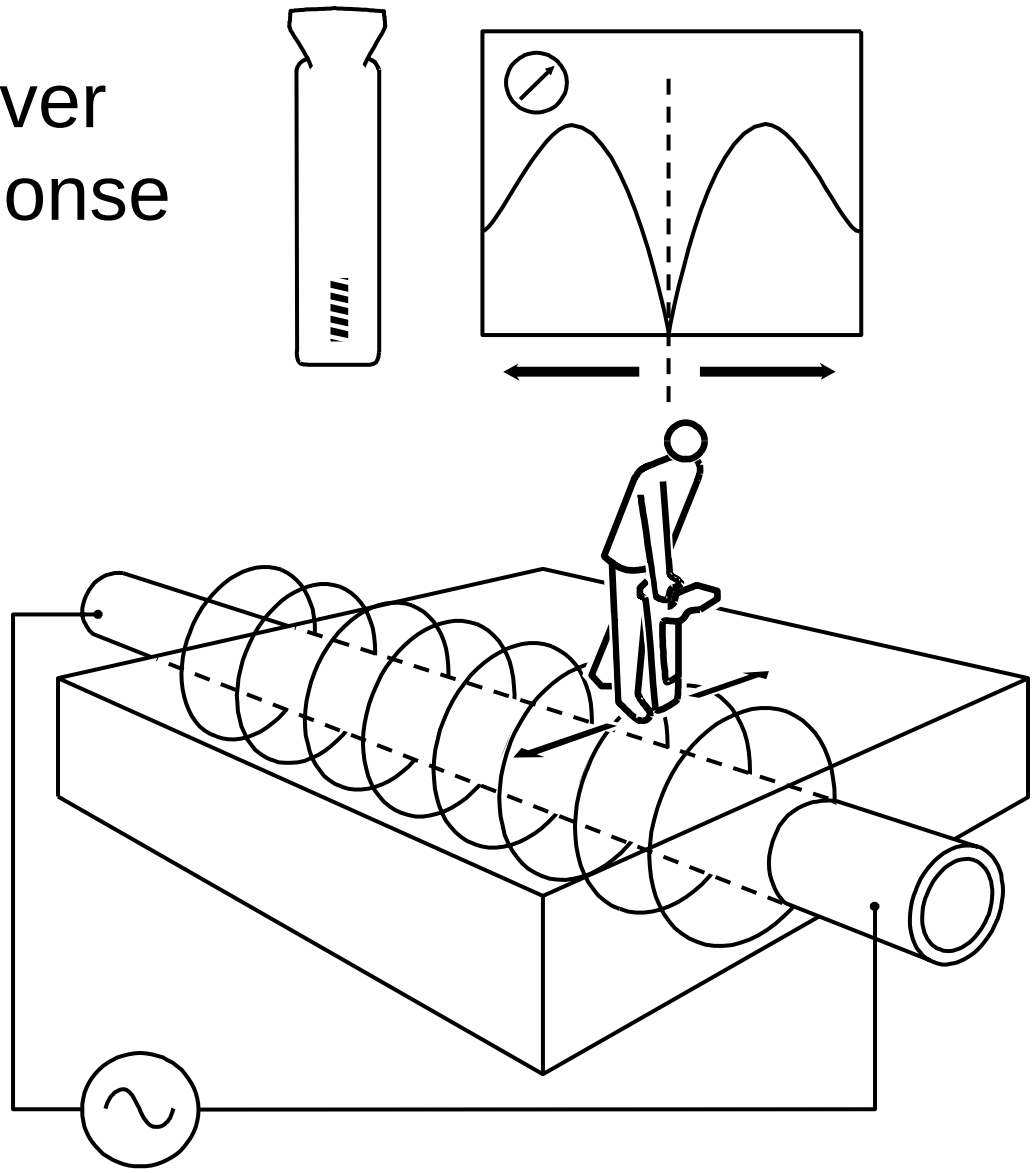
Different aerial orientations can be used for different responses.

Receiver Response



This is a typical peak signal response over a buried conductor. Peak response provides position and direction.
Note that the maximum signal response occurs directly over the center of the underground conductor.

Receiver Response

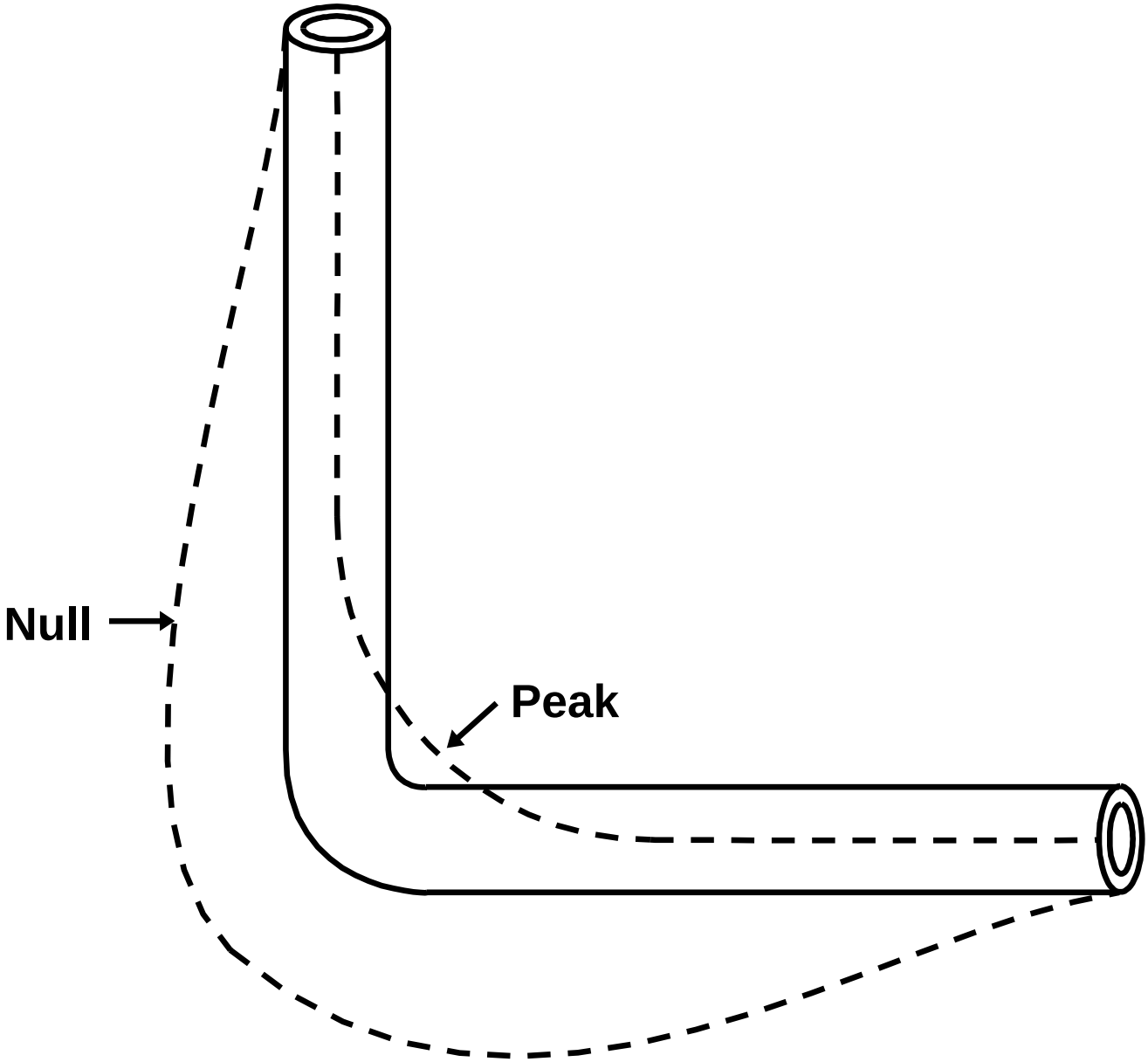


In Null, minimum signal is encountered exactly over the center of the buried conductor field

A maximum signal response will be detected on each side of the minimum. If both of the "shoulders" are symmetrical, the Null point is accurate.

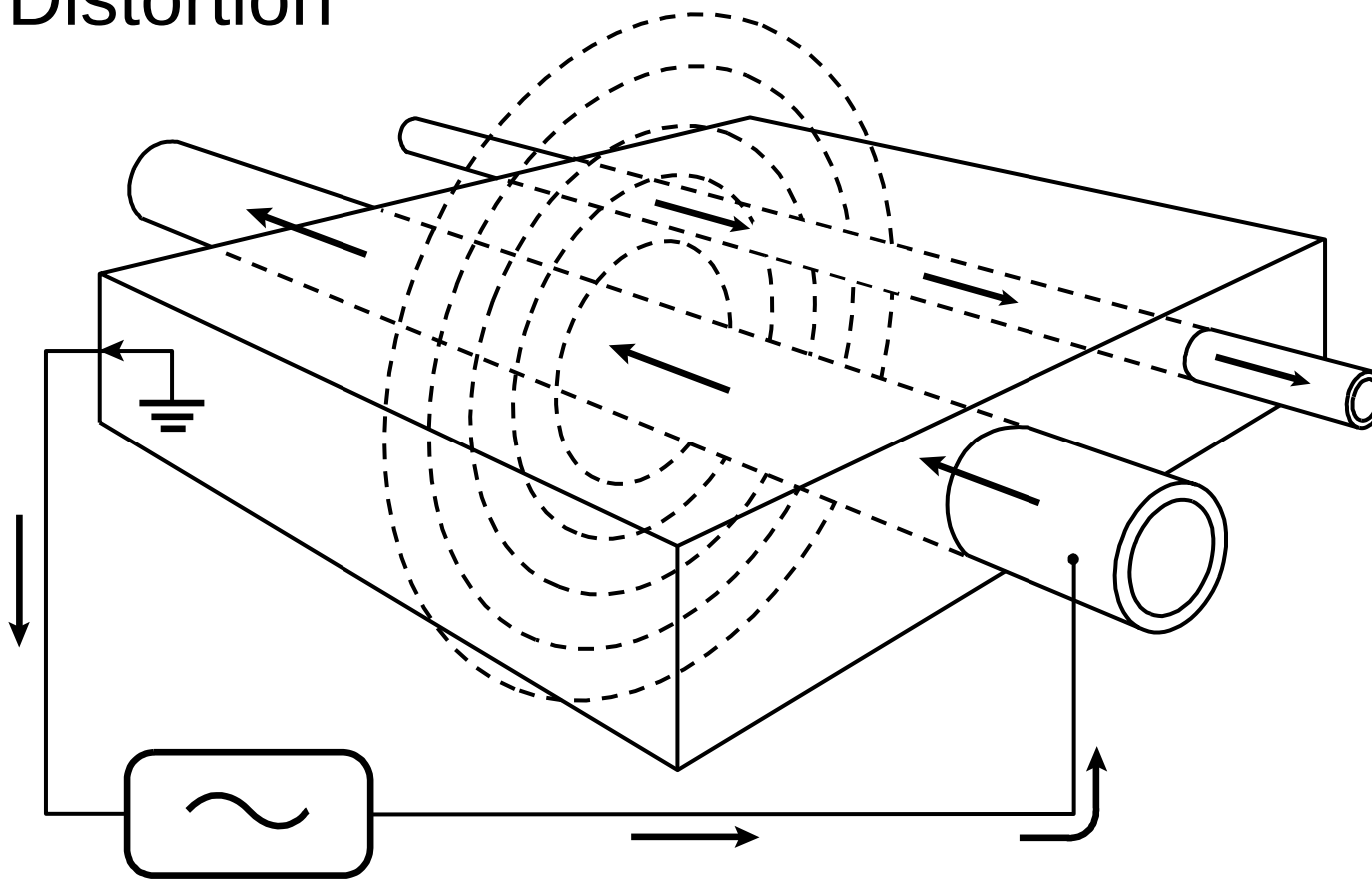
For the most *consistently* accurate results,
remember the 3 P's....

Put the Paint in Peak



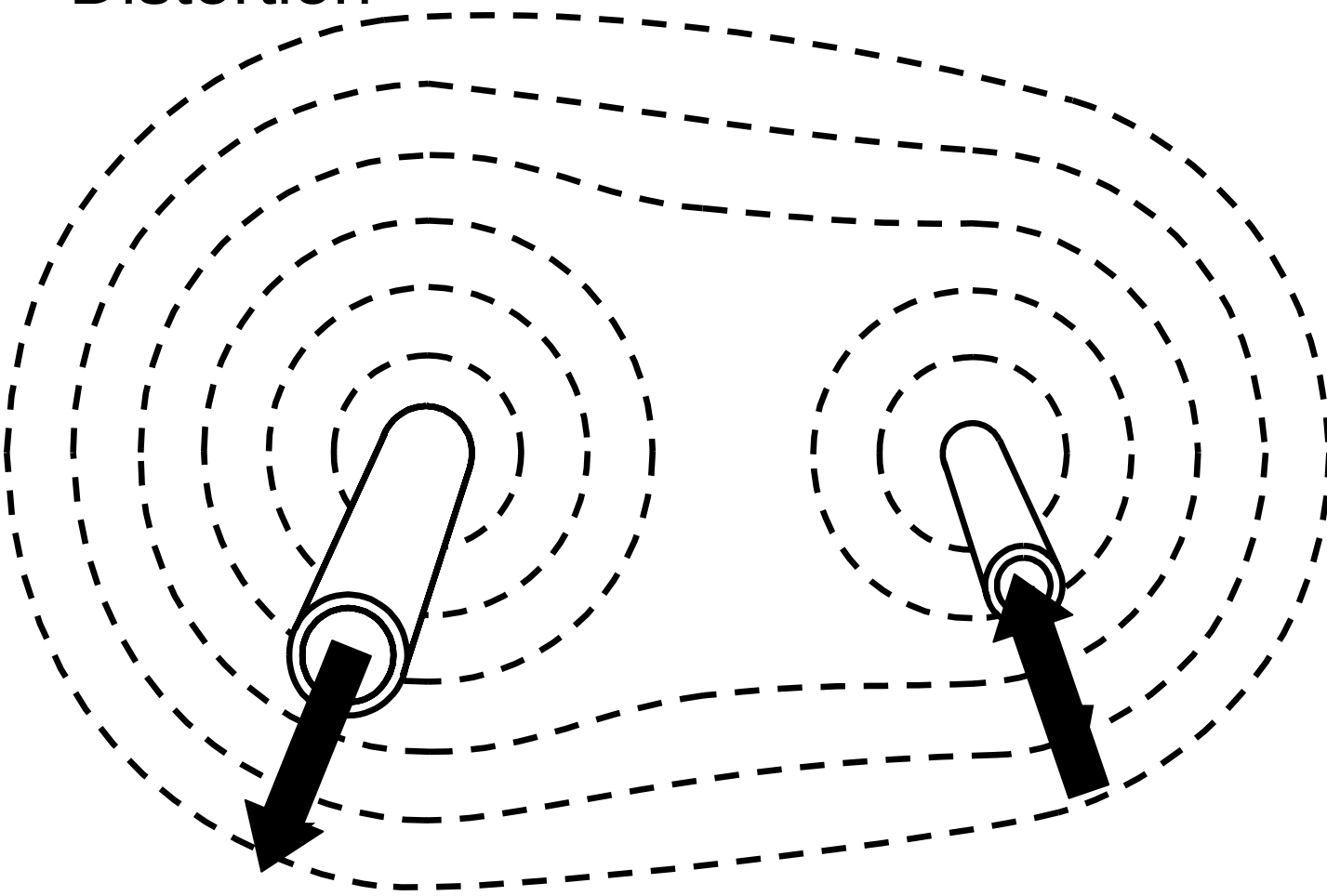
Peak and Null coils produce opposite types of error when tracing bends.

Distortion



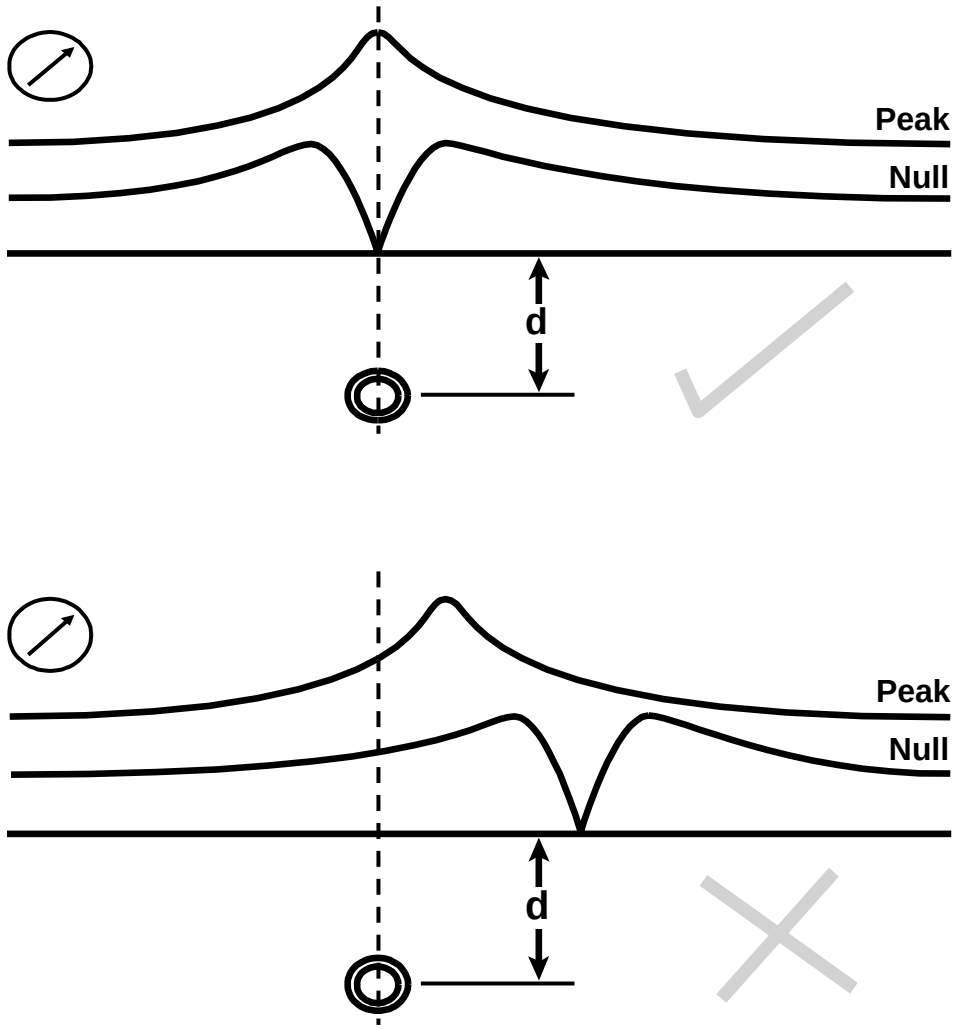
Current on one line may induce 'stray' signals onto nearby conductors.

Distortion



When the conductors are close together, the magnetic fields can interfere with each other, causing a distorted field which is no longer cylindrical. This can lead to poor locate results and inaccurate measurements.

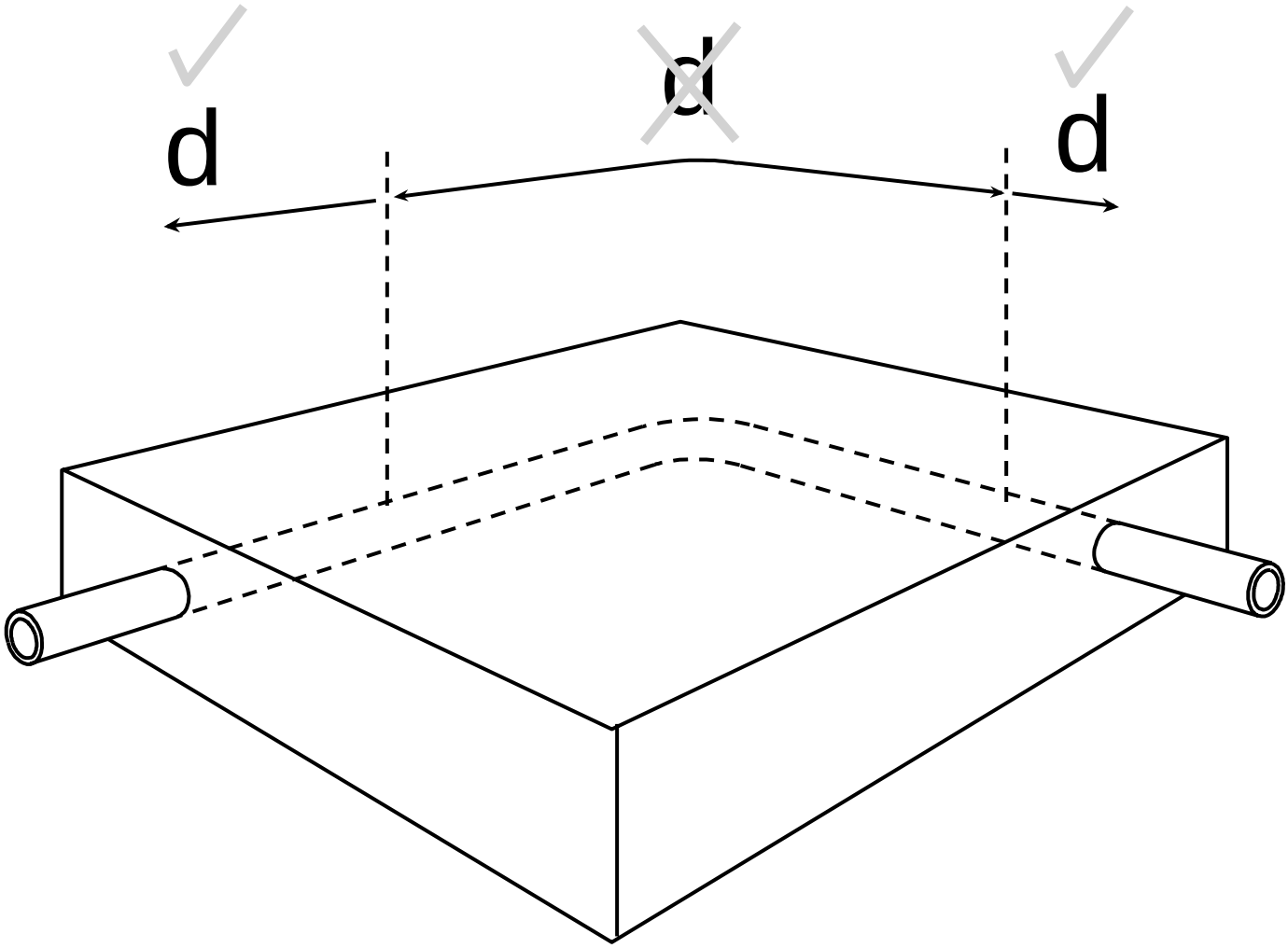
Distortion and Depth



When there is a discrepancy between the aerial responses the following must be observed.

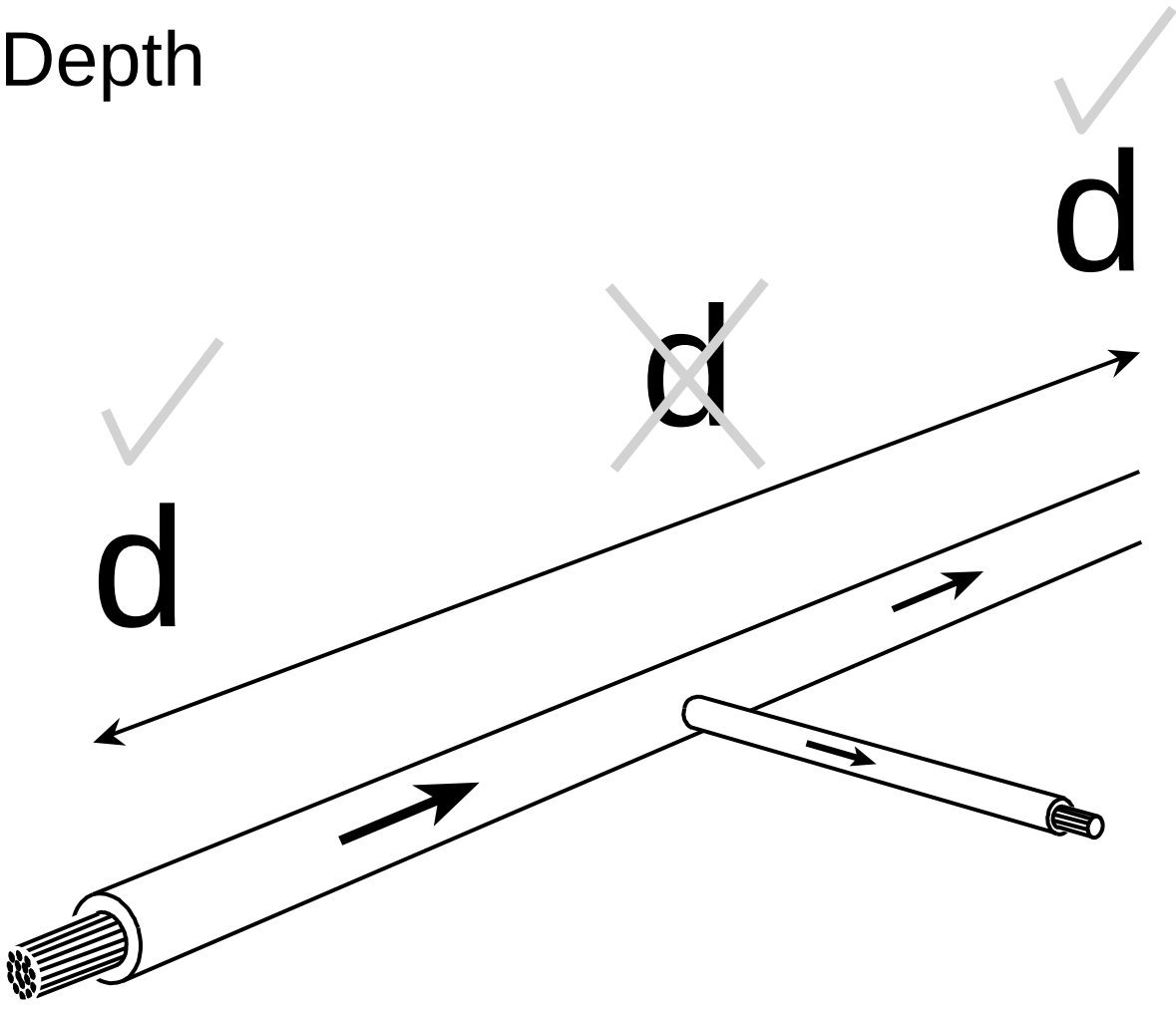
1. The Peak response will always be more accurate.
2. Push button depth estimation should not be used until the two responses agree.

Depth



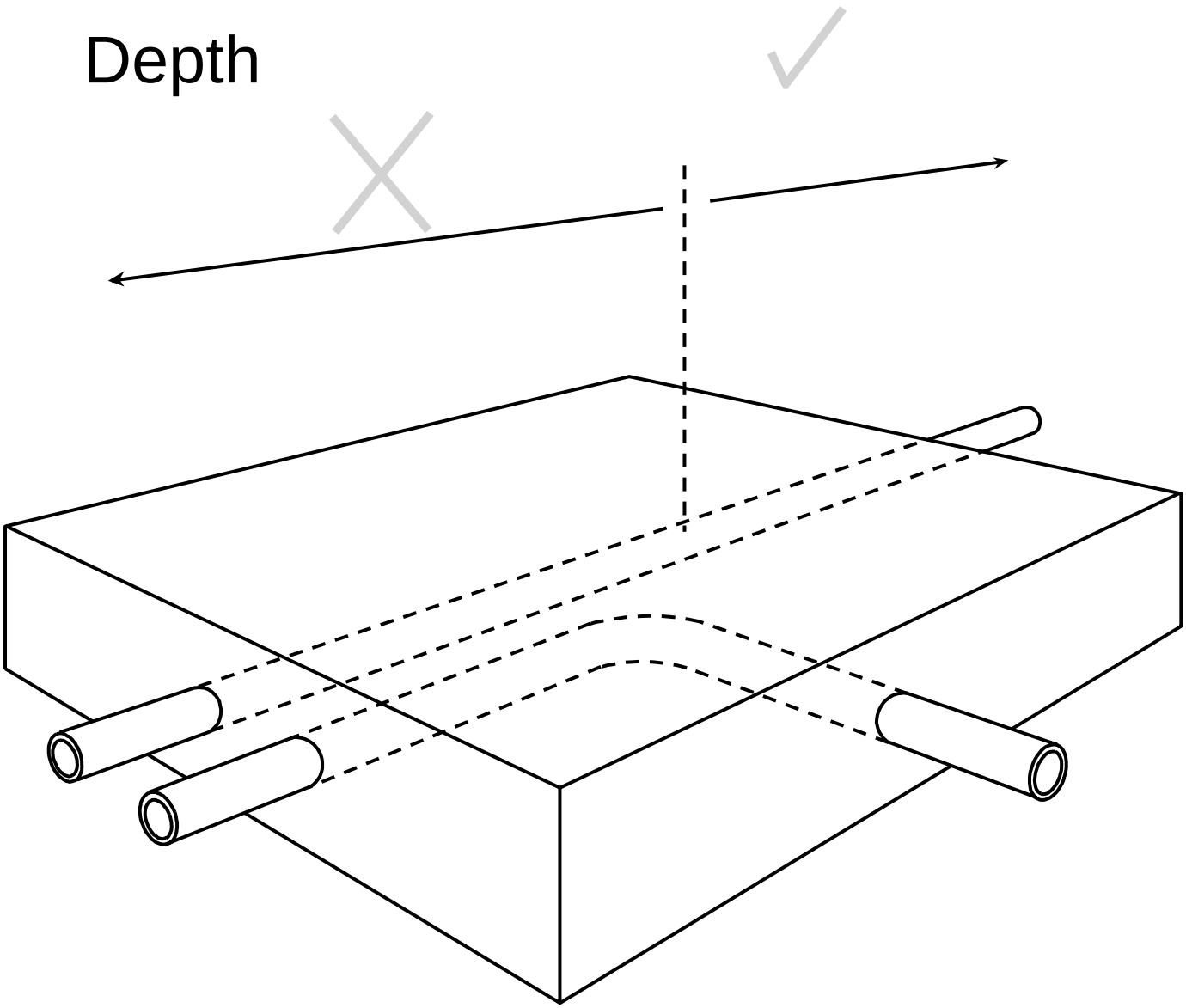
Because we know the field is likely distorted, it's not a good idea to rely on depth readings taken near a change of direction .....

Depth



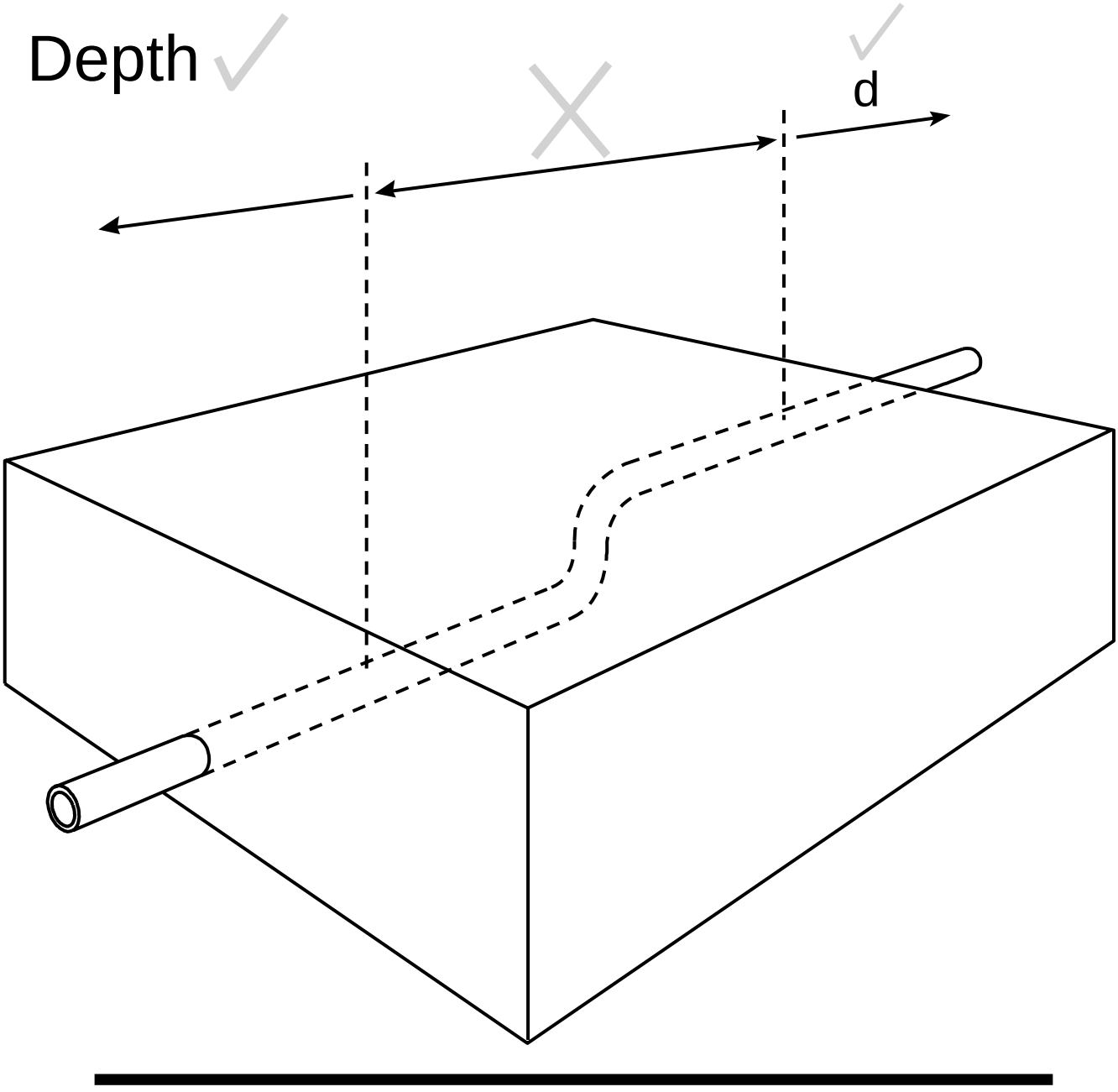
or near a tee,

Depth



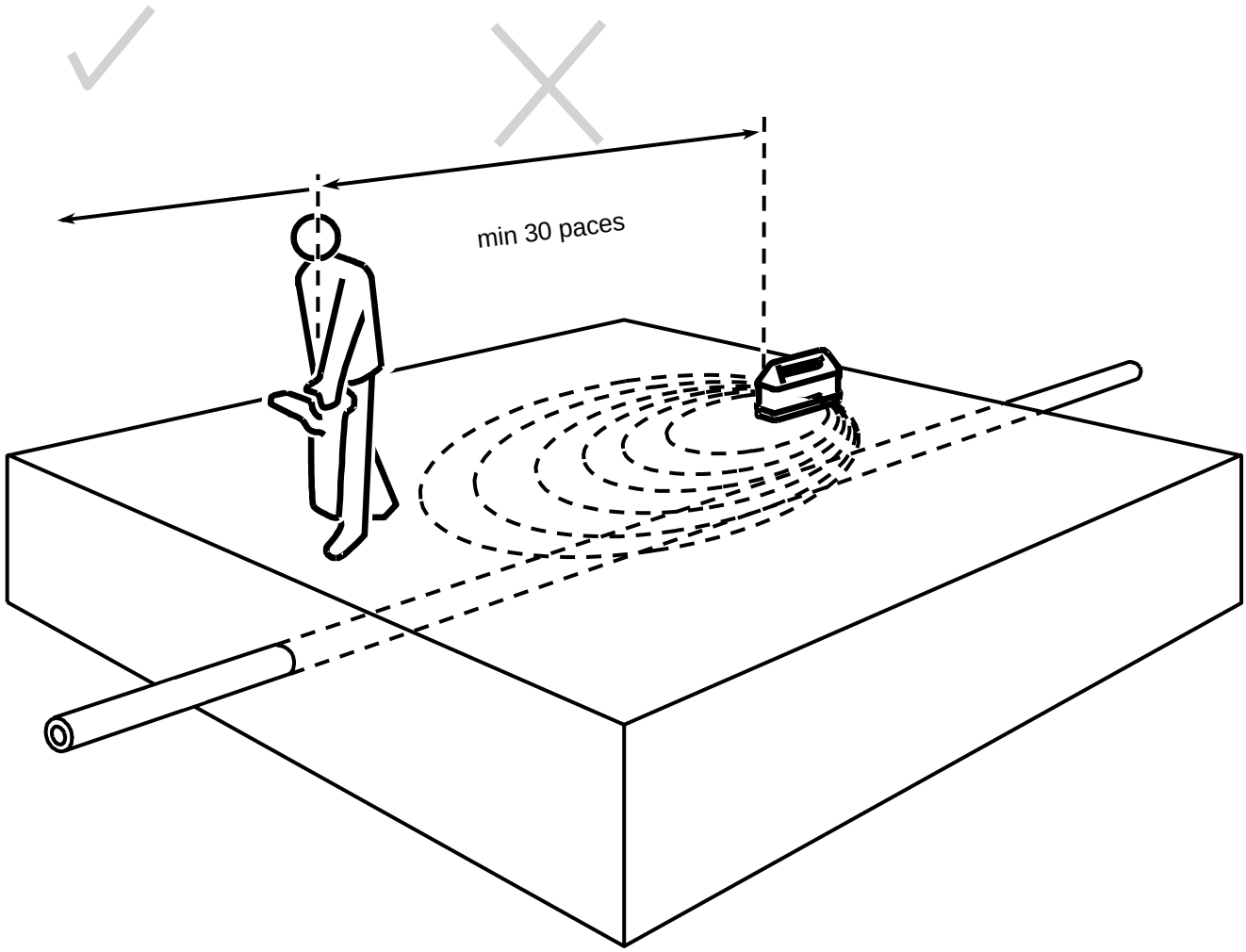
or near another line,

Depth ✓ ✗ ✓



or near a depth change,

Depth



or near an inducing transmitter.

Which frequency should I use ?

Very Low
Less than 1khz

Very Long Range
No Induction
Little "Spillage"

High
1-50khz

Easy Induction
Shorter Range
More "Spillage"

Low
1-10khz

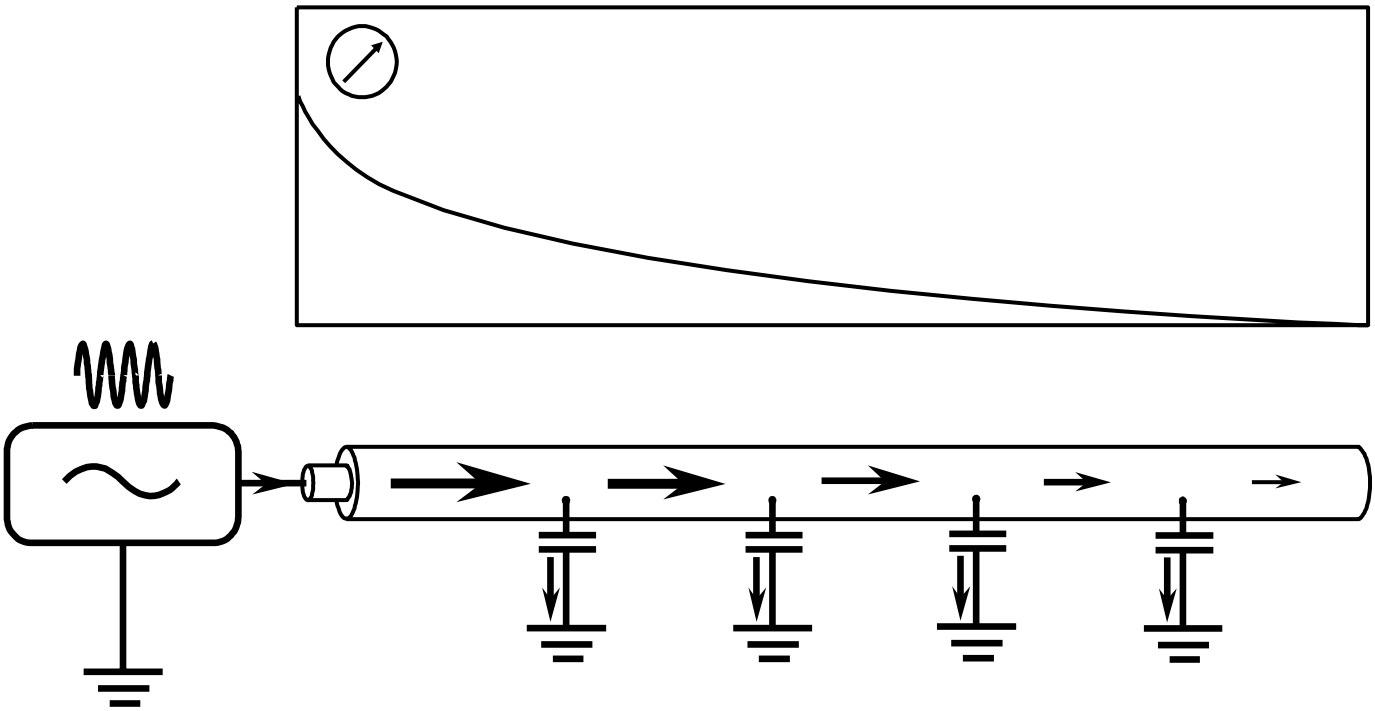
Long Range
Poor Induction
Less "Spillage"

Very High
50khz+

Short Range
Excellent Induction
Severe "Spillage"

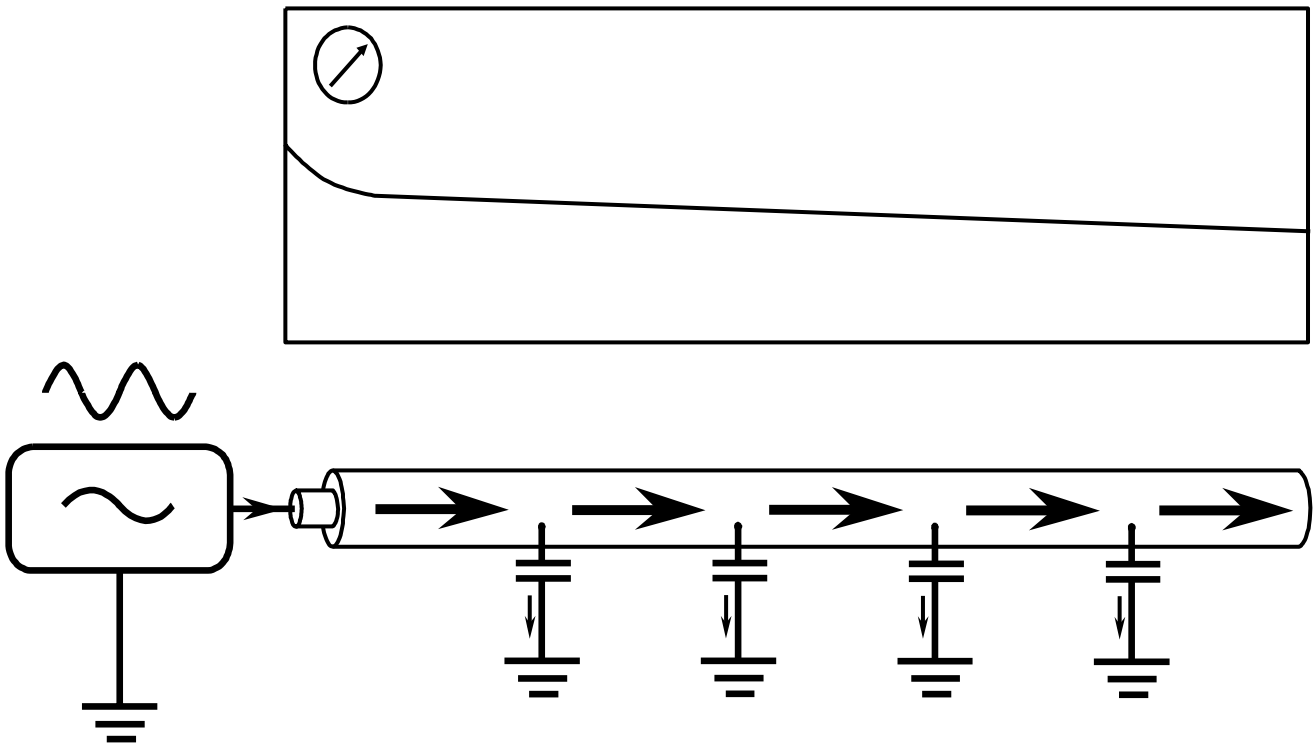
Characteristics of different frequencies.

Which Frequency ?



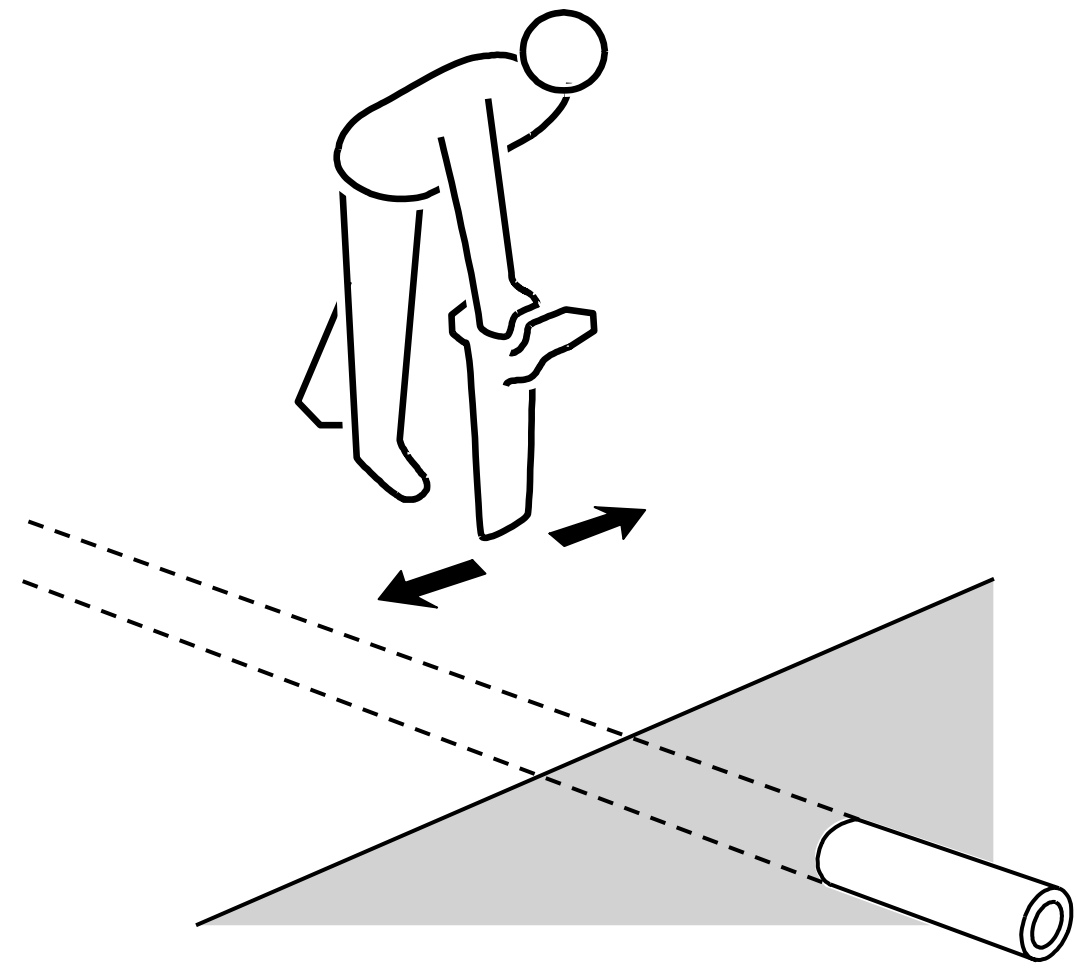
Higher frequency = shorter range (greater capacitive signal loss to ground).
This frequency is better for induction onto small or short length conductors, such as telephone drops, CATV cables or street light cables.

Which Frequency ?



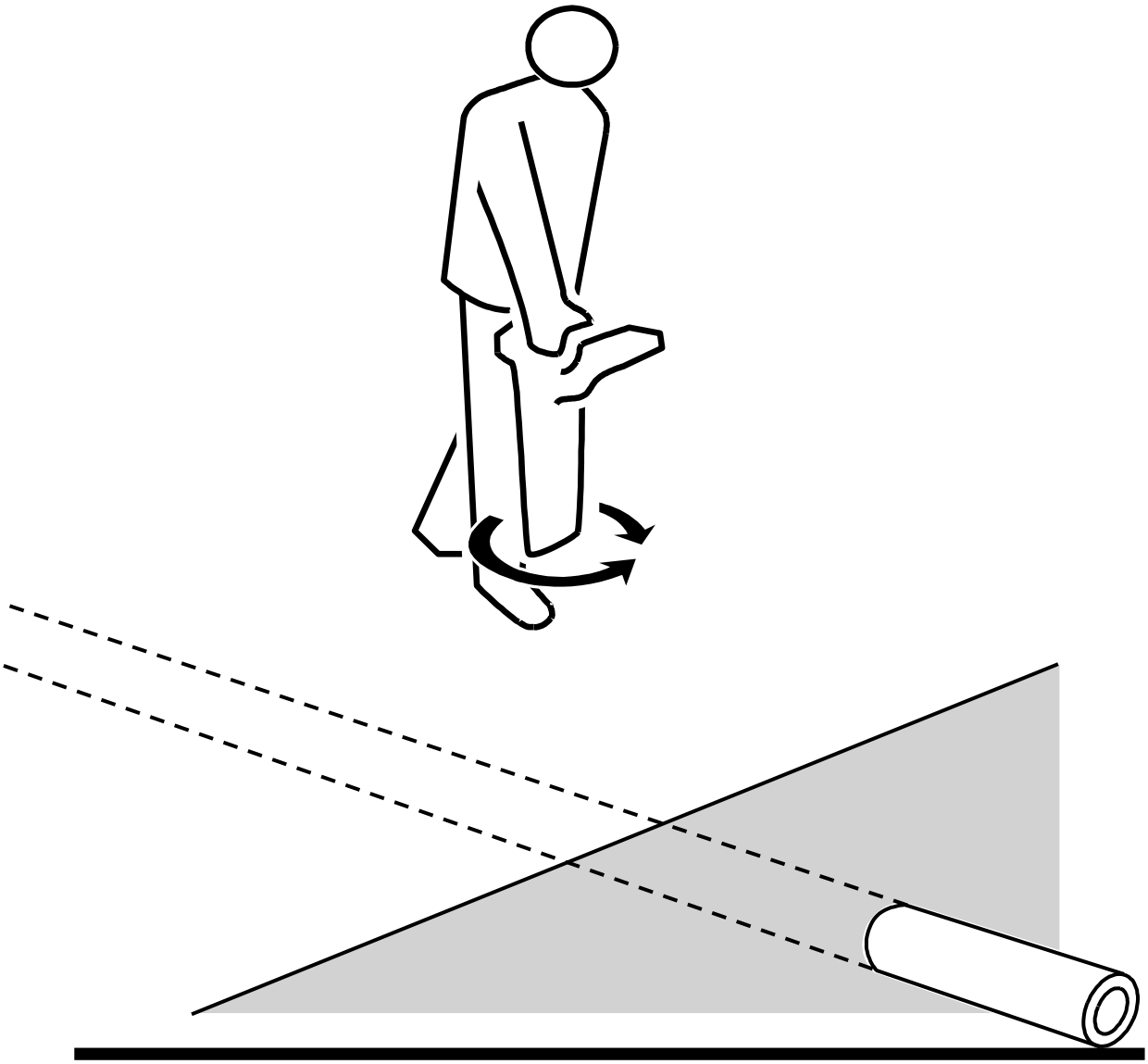
Low frequency = long range (minimum capacitance signal loss to ground).
This frequency is better for connection and locating longer metal pipes or cables.

General Locating



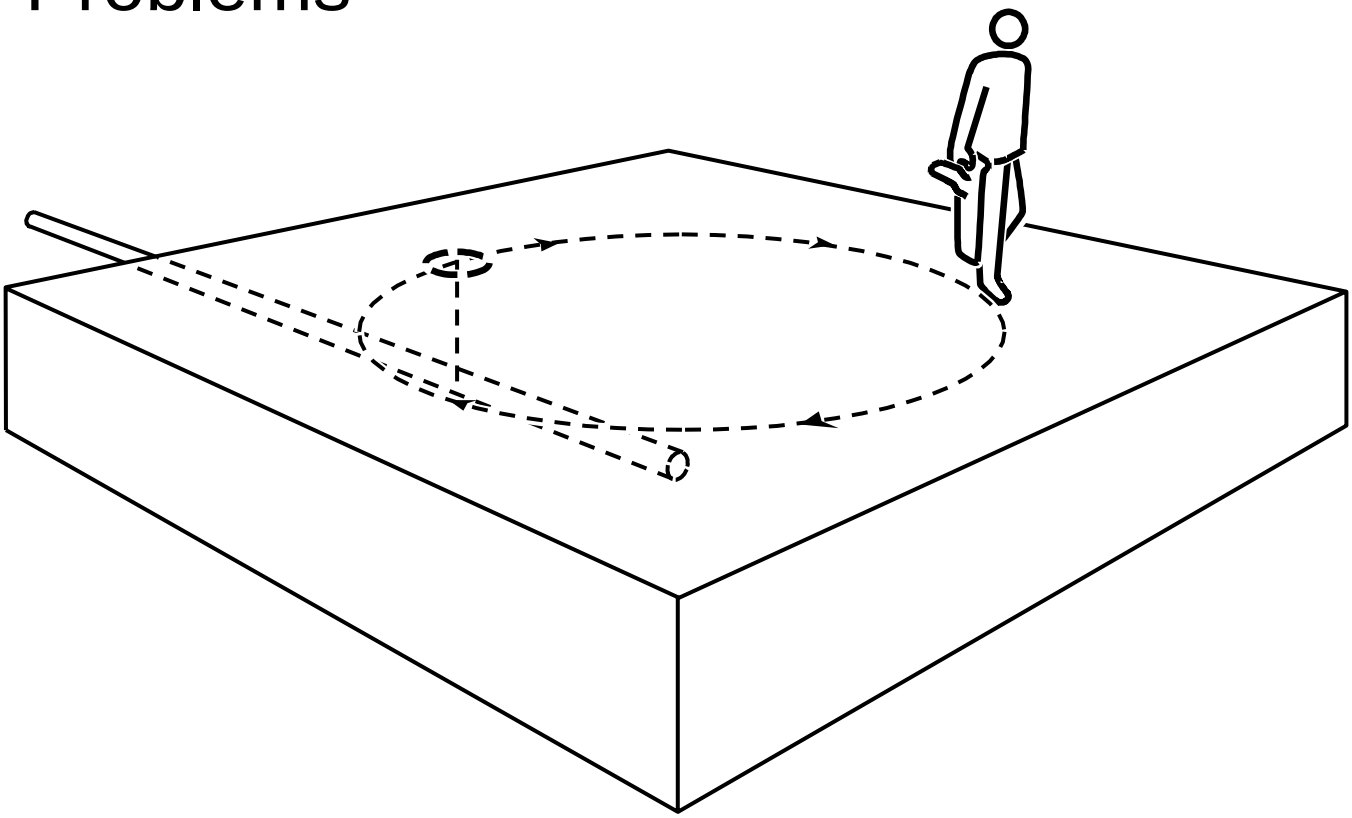
When pinpointing the signal, keep the bottom of the receiver blade close to and parallel to the ground.

General Locating



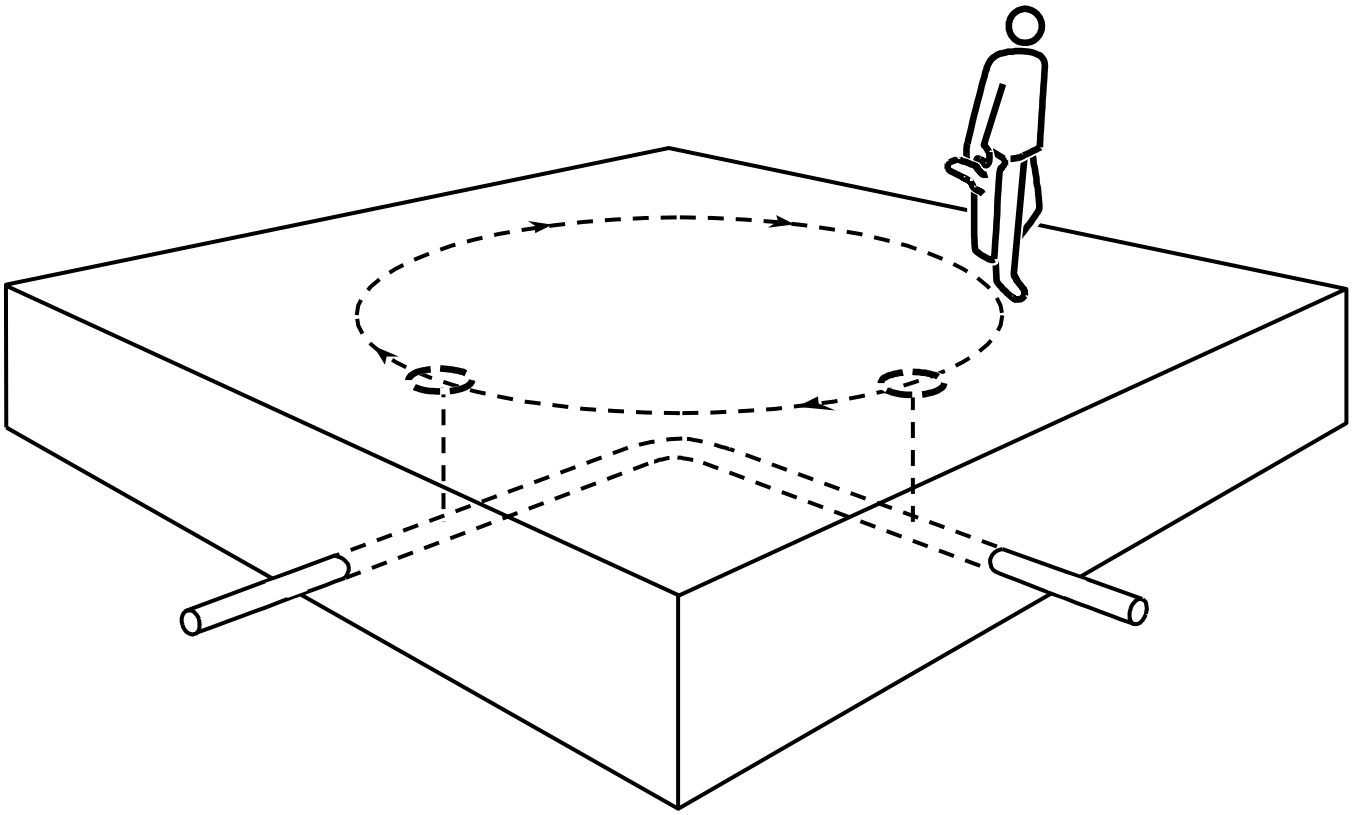
Always pivot receiver to ensure maximum signal is received. This is particularly true prior to taking a depth reading.

Problems



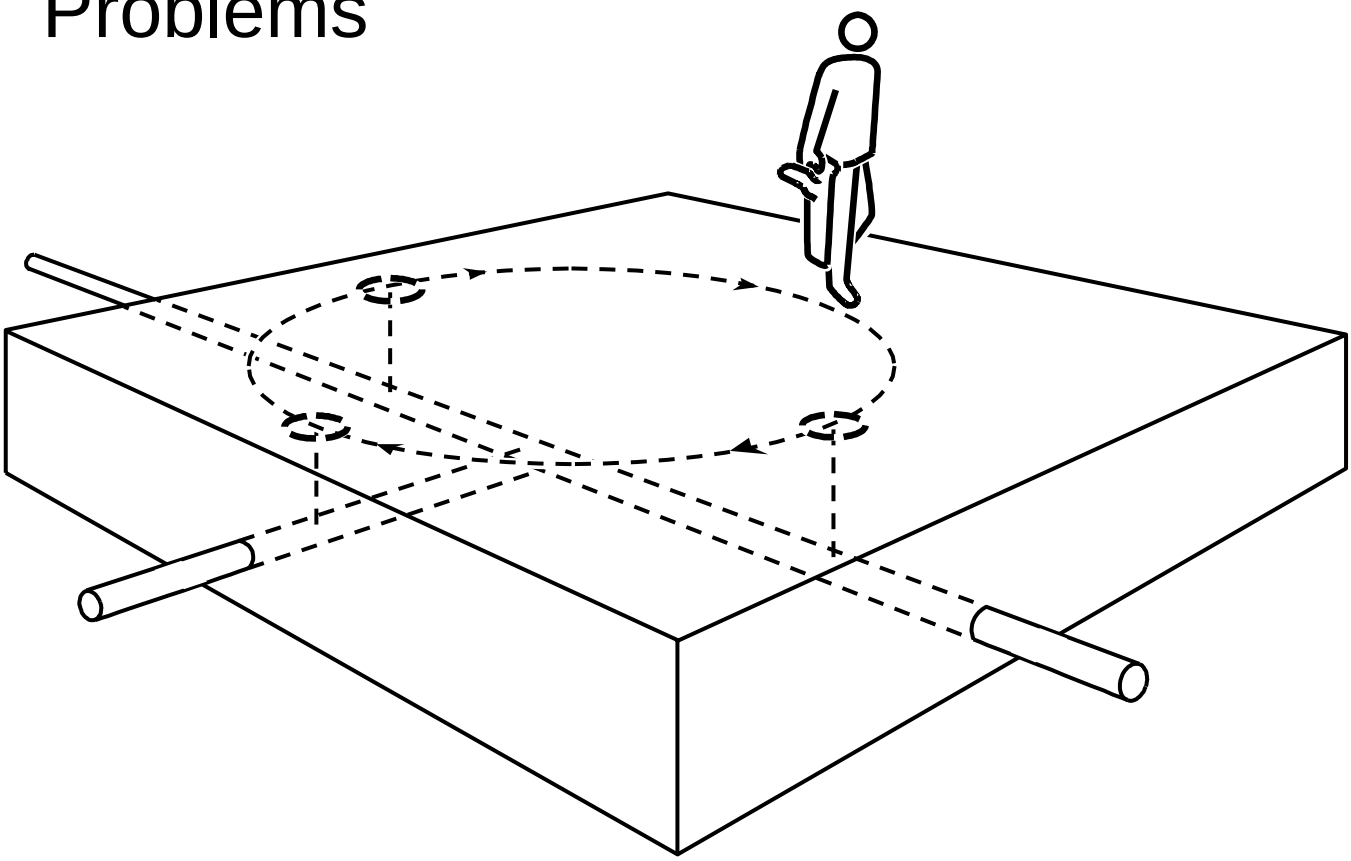
Lost signal must be either: End of line,

Problems



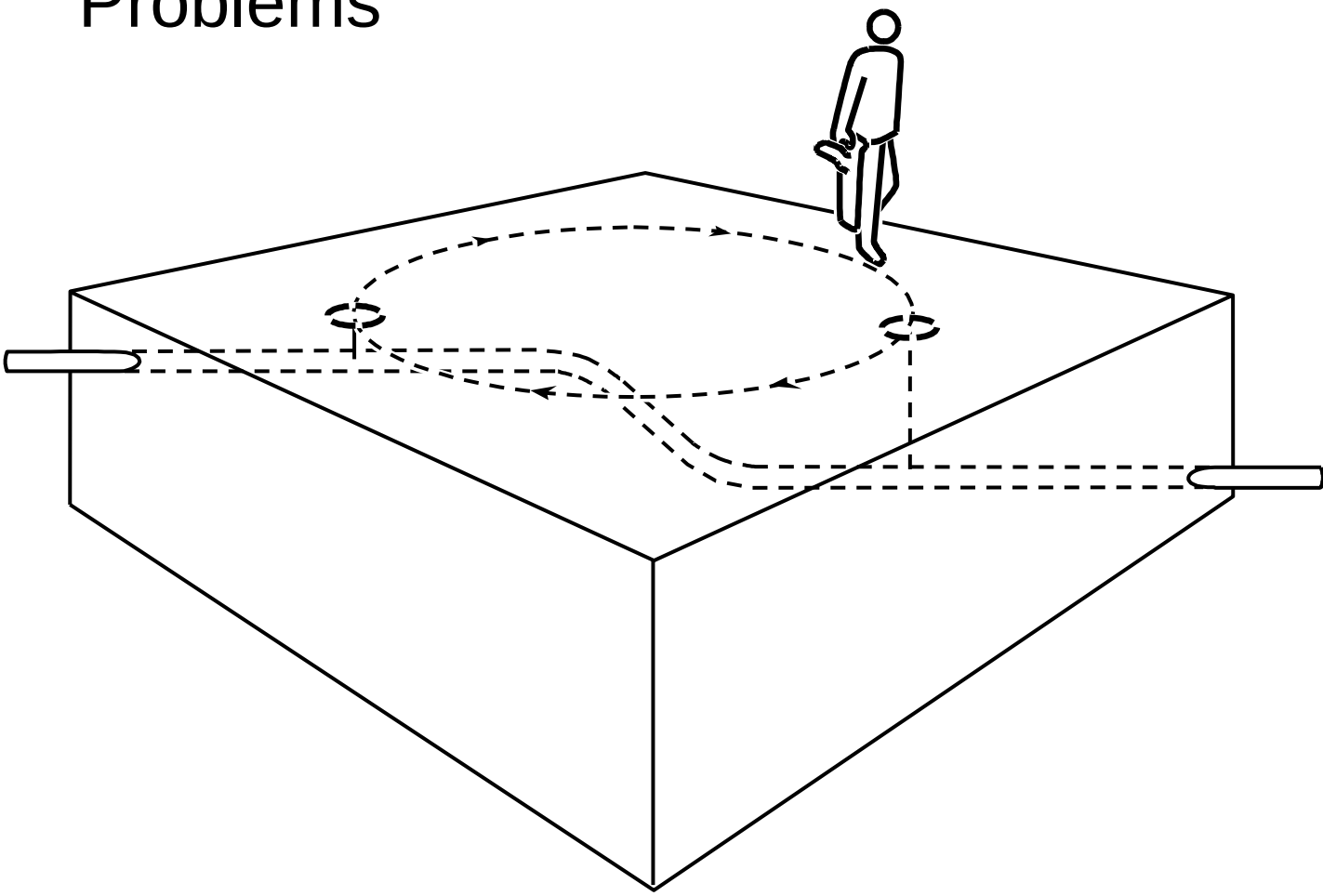
OR: a bend,

Problems

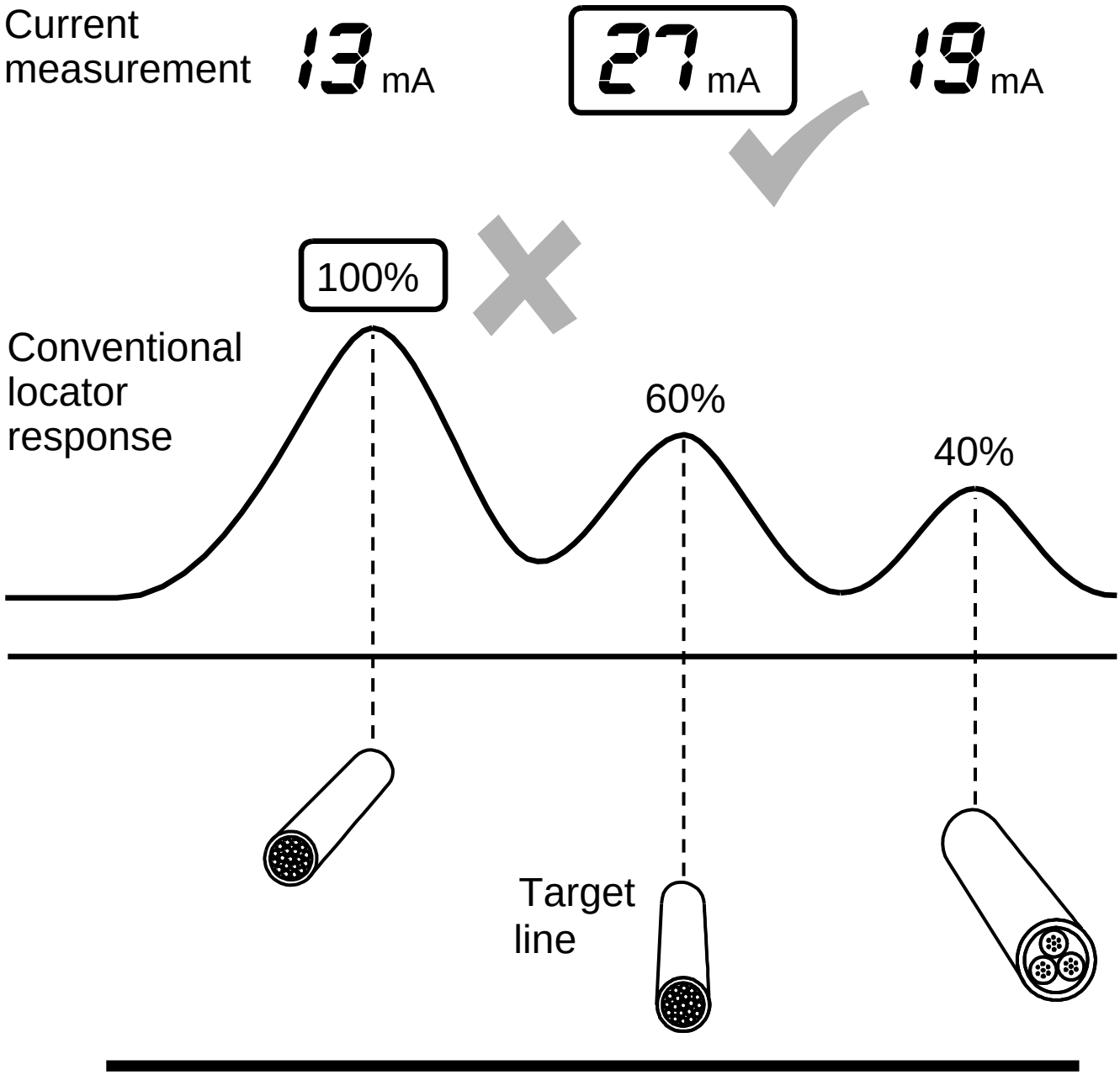


OR: a T lateral,

Problems

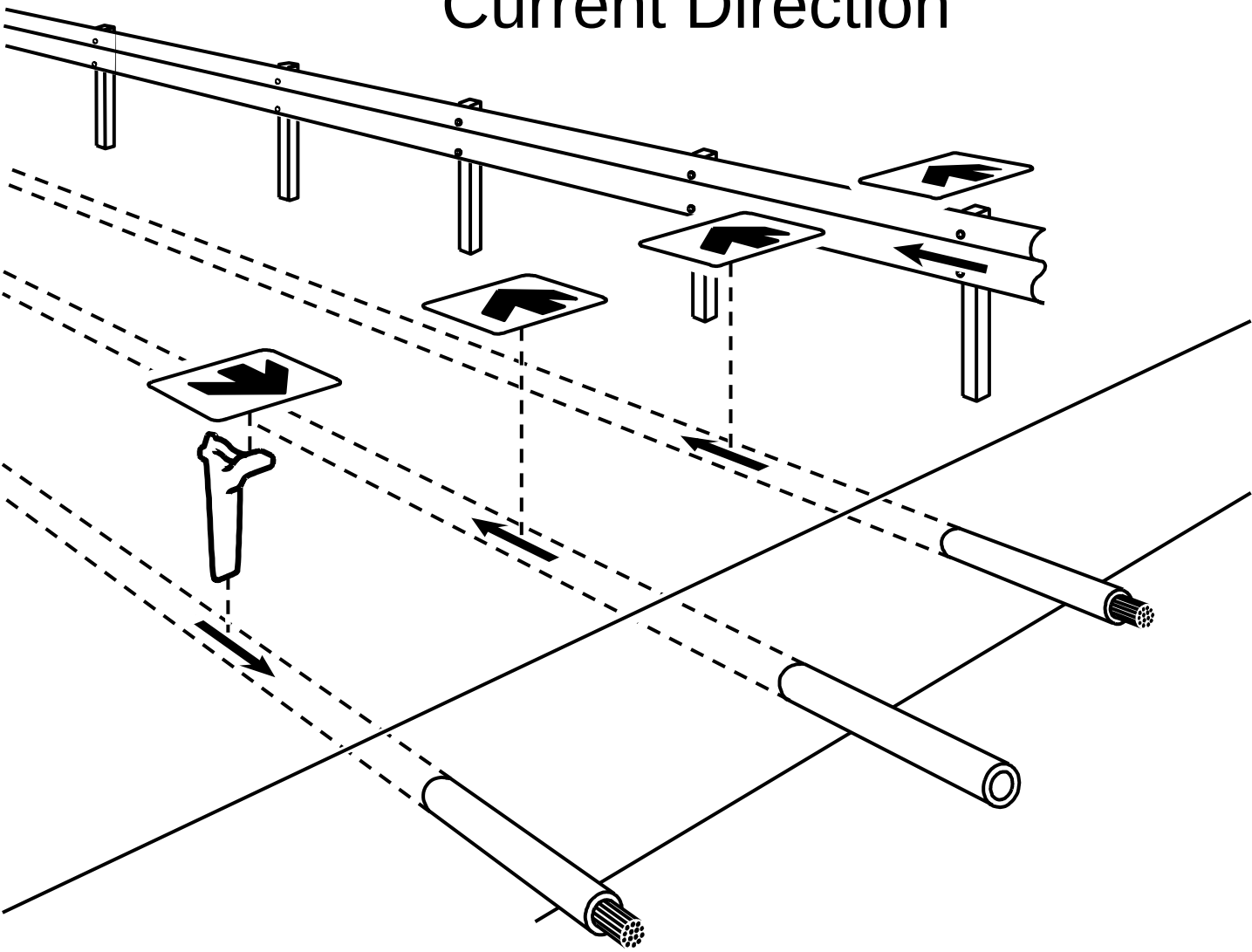


OR: a depth increase.
The field has simply become weaker at the coils because of the change of depth.



Comparison between conventional RX responses and RD400 Digital RX responses.

Current Direction



Current Direction technology identifies and separates outbound, “target” signals from return path signals in congested areas.