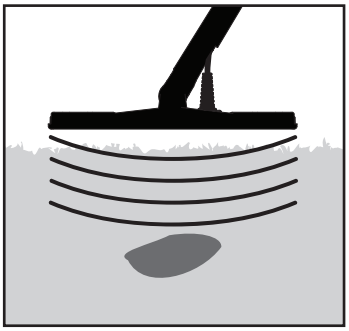
KNOWLEDGE BASE ARTICLE

Basic Metal Detector Operation

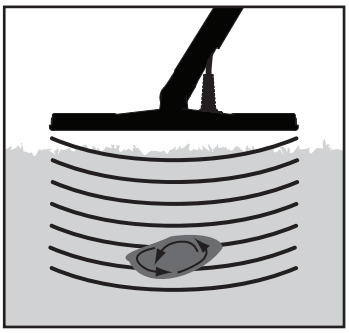
Metal detector operation

Metal detectors operate by transmitting an electromagnetic field from the search coil and then analysing the return signal. The transmitted electromagnetic field cause currents to flow within metal targets. These currents are called 'eddy currents' and produce their own weak magnetic field, which the detector's search coil receives. Electronics in the detector process the signal received by the coil to produce an audio and/or visual response.

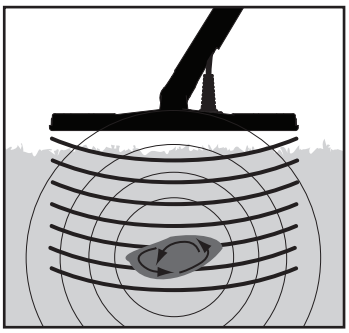
1. The metal detector's search coil transmits an electromagnetic field in to the ground.



2. In the presence of the detector's electromagnetic field, eddy currents are induced in the metal target.



3. The eddy currents flowing within the target produce their own electromagnetic field, which is received by the metal detector's search coil.



The magnetic field produced by a target is dependent on two target electrical characteristics:

1. Electrical resistance – The target's resistance, or conversely its conductivity, determines how easily eddy currents flow within the target.

2. Electrical inductance – The target's inductance causes it to resist rapid changes in current (increases or decreases). This can also be explained as resistance to alternating current, which is called inductive reactance.

The target's resistance and inductance are determined by the target's size, shape, metal type, orientation and amount of impurities present in the target.

The electromagnetic field produced by the target in response to the detector's electromagnetic field has two components based on the target's resistance and inductance:

1. A reactive component (X signal), which is the same as the transmitted electromagnetic field.
2. A resistive or loss component (R signal), which is delayed.

The metal detector's search coil receives these components and the detector's electronics process the signals and indicate the target's properties to the user.