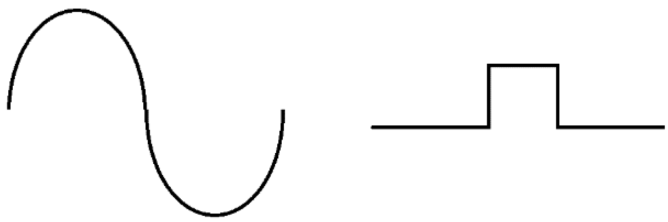
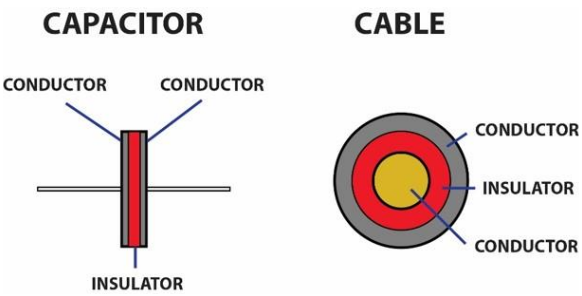
Ground fault tracing: AC tracing vs pulse tracing

When searching for ground faults, a transmitter injects a current through the fault (fault current) and a receiver is then used to trace the path of the fault current.
The injected current can be either an AC signal or it can be a pulsed DC output.



A pulsed output often needs to be synchronised with the receiver. This way the receiver knows when to look for the pulse. This is required due to potential noise on the system. Random noise can look like a pulse. However, on very noisy systems this can still be problematic. In addition, if the sync is lost, then the receiver needs to be reconnected to the transmitter in order to acquire the synchronisation again.

Capacitance can also be a large problem for pulsed outputs. There will always be some amount of capacitance on a DC system. Shielded cables have a capacitive property. They consist of 2 conductors separated by an insulator. This is, in essence, a capacitor.



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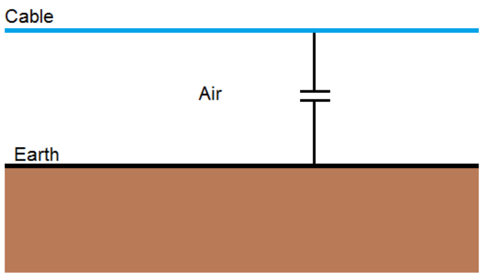
The longer the cable, the greater the surface area of the conductors and the higher the capacitance.

Even unshielded cables form a capacitor from the cable to earth. The cable is a conductor, the earth is a conductor, and the air between is an insulator.



Add this to the capacitance already on the system due to equipment on the system and it is clear that the capacitance on these systems can get to substantial levels.
This capacitance will have little impact on the DC system itself. However, it can have a significant change on the DC pulses that are used to trace ground faults.
When a DC pulse is applied to a capacitive circuit, a charging effect occurs.

This will decrease the pulse width of your trace signal. Enough capacitance and the pulse itself is impossible to discern. This means the signal cannot be traced.

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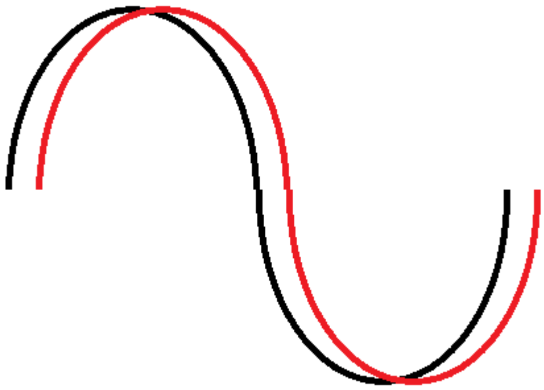
When an AC trace signal is used, high levels of capacitance will not drown the signal. The capacitance will instead cause a phase shift between the voltage and current. This phase shift can be measured and the receiver can then determine which circuit has the real fault and which circuit is only drawing current due to system capacitance.



Real fault current

Current drawn by stray leakage capacitance

When a low frequency AC signal is used (in the 5 Hz area), system noise does not become an issue. The receiver will use a low pass filter, so it will only be measuring signals in the 5 Hz range. Noise on DC systems is typically much higher than this.

It is clear that when tracing ground faults, an AC trace signal is preferred.