# Detecting Non-moving or Non-powered Trains with DC

Using the Quad Occupancy Detector with DCC is fairly simple. When trains are stopped, there is still power on the rails and locomotives and detectable axles on rolling stock will draw a small amount of current that can be detected. How can this be accomplished with a DC layout?

When a train is stopped, the voltage on the rails is zero, and therefore the current is as well. Also, with block power control, some blocks may have no power applied at all. This would mean that a current-sensing occupancy detector cannot detect anything when one of these situations occurs.

The simple solution to this problem is to apply an AC "bias" voltage to the track. This bias needs to be able to cause a small flow of current that will be sensed by the detector when something detectable is on the rails, but no so much current that will cause a motor to hum, or even to heat it. The source of this bias must have a fairly high impedance to accomplish this.

All it takes is a source of AC voltage, in the range of 8 to 12 volts. This can be from a "wall wart" type adapter, provided its output is alternating current and not direct current, or it can be from a doorbell type transformer. Its current rating can be low: anything from 100 mA to a half amp or so is plenty. To couple this AC voltage to the power going through the occupancy detector, a capacitor is used. Any value from about a half a microfarad (μF) to one or two microfarads should be sufficient. The voltage rating of the capacitor should be at least 25 volts.
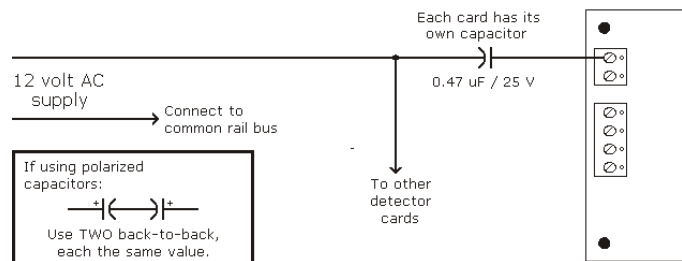
The capacitor blocks direct current, but allows alternating current to pass. It also has a current-limiting impedance that keeps the trickle of current low.

Often with a DC layout, the power feed to each detector card likely comes from a separate block power switch, so it is necessary to have a separate capacitor to couple the AC bias to each detector card.

If you are using a polarized capacitor, such as an electrolytic or tantalum capacitor, two capacitors of the same value should be used in series wired in back-to-back polarity. Without going into the technical details, by doing this, the alternating polarity of the AC bias current will not be damaging to either polarized capacitor.