Earth Ground And The Grid

Originalartikel

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<html> <p>The electrical grid transmits power over wires to our houses, and our Bryan Cockfield has covered it very well in his Electrical Grid Demystified series, but what part does the earth ground play? It’s commonly known to be used for safety, but did you know that in some cases it’s also used for power transmission?</p> <h2>Typical House Grounding System</h2> <figure id=„attachment_265800“ style=„width: 810px“ class=„wp-caption aligncenter“><img data-attachment-id=„265800“
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1187w“ sizes=„(max-width: 800px) 100vw, 800px“/><figcaption class=„wp-caption-text“>Grounding system normal case</figcaption></figure><p>A pretty typical diagram for the grounding system for a house is shown here, along with a few of the current carrying conductors commonly called live and neutral. On the far left is the transformer outside the house and on the far right is an appliance that’s plugged in. In between them is a breaker panel and a wall socket

of the style found in North America. The green dashed line shows the normal path for current to flow.</p> <p>Notice the grounding electrodes for making an electrical connection with the earth ground. To use the US National Electrical Code (NEC) as an example, article 250.52 lists eight types of grounding electrodes. One very good type is an electrode encased in concrete since concrete continues to draw moisture from the ground and makes good physical contact due to its weight. Another is a grounding rod or pipe at least eight feet long and inserted deep enough into the ground. By deep enough, we mean to include factors such as the fact that the frost line doesn’t count as a good ground since it has a high resistance. You have to be careful of using metal water pipes that seemingly go into the ground, as sections of these are often replaced with non-metallic pipes during regular maintenance.</p> <p>Notice also in the diagram that there are places where the various metal cases are connected to the grounding system. This is called bonding.</p> <p>Now, how does all this system grounding help us? Let’s start with handling a fault.</p> <p/> <h2>Handling A Fault</h2> <figure id=„attachment_265801“ style=„width: 810px“ class=„wp-caption aligncenter“><figcaption class=„wp-caption-text“>Ground fault</figcaption></figure><p>One purpose of the grounding system is to cause a breaker in the breaker panel to trip if there’s a short circuit somewhere. That happens if there’s an appliance with a metal case and the insulation on the live wire in the appliance is damaged, causing the copper wire inside to touch the metal case. The case becomes an extension of that live wire. This is called a fault.</p> <p>But the metal case is connected to an electrical path consisting of the ground wire in the power cord plugged into the wall socket, as well as the wire from the wall socket to the breaker panel. In the US National Electrical Code (NEC) these are referred to as the equipment grounding conductors.</p> <p>In North America at least, in the box where the service first enters the house, the equipment grounding conductors are connected to the neutral wire. In this case that box is the main breaker panel. In most breaker panels this connection is made by having both the wires go to metal bars that are screwed, or bonded, to the panel’s case, thereby making the electrical connection through the case.</p> <p>Following the red dashed line from the fault, a high current now runs through the live wire, through the appliance’s case, and uses the equipment grounding wires as the return path to the breaker panel. From there the current goes through the panel’s case to the neutral bar and neutral wire back to the transformer. Along the way, the live wire runs through a breaker in the breaker panel and the current is high enough to trip that, opening the circuit and making it safe again.</p> <p>But where does the earth ground come into it? Often it doesn’t. Sometimes, however, as shown by the blue dashed line, a little current will flow through a parallel path including the grounding electrodes and the earth ground.</p> <h2>Discharging Stray Charge</h2> <figure id=„attachment_265802“ style=„width: 410px“ class=„wp-caption alignright“><figcaption class=„wp-caption-text“>Discharging stray charge</figcaption></figure><p>There’s a purpose for earth ground that many here on Hackaday are quite familiar with, and that’s stray charge and problems with electrostatic discharge to electrostatic-sensitive devices and components such as MOSFETs, CMOS ICs, and TTL chips. Methods for handling this are to wear an antistatic strap or to work on an antistatic mat. These usually have a clip or a dedicated socket for connecting to earth ground.</p> <p>The charge on your body will put you at a different potential than the ground and so current will flow between you and ground. The earth ground is largely electrically neutral and will easily absorb the charge, leaving the combination of the ground and you neutral.</p> <p>Not all electrostatic discharge is accidental. We previously covered experiments by [Kevin Darrah] where he deliberately tested the effect of it on various components as well as tried out circuitry for protecting against it.</p> <p>Metal cases can also become energized by indirect lightning strikes and any charge build-up will drain to earth ground in the same manner.</p> <h2>Single-Wire Earth Return (SWER)</h2> <figure id=„attachment_265803“ style=„width: 410px“ class=„wp-caption alignleft“><img data-attachment-id=„265803“ data-permalink=„http://hackaday.com/2017/07/25/earth-ground-and-the-grid/swer/“ data-orig-file=„https://hackadaycom.files.wordpress.com/2017/07/swer.jpg“ data-orig-size=„409,217“ data-comments-opened=„1“ data-image-meta=„{"aperture":"0","credit":"","camera"

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