Subject: Re: IR Remote Control
Posted by Wayne Parham on Tue, 08 Jan 2013 16:11:30 GMT
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It's a mess, isn't it guys?!!

But I gotta leave it that way for now, 'cause I have to move wires around to get my iron into places as I complete the build. When it's done, I'll run the lines nicely as I install it into the chassis.

About grounding, I think Bruce's suggestion of a single-point ground is generally good sage advice. I tend to like using single point grounds, in most cases.

But my experience with industrial control circuits, especially those run by digital control systems, has taught me a thing or three about grounding. There are places where a multi-point ground is preferred. That's an aside though, because for audio amplifiers, I agree generally that a single-point "star" ground arrangement is best. Or most likely, a bus connecting a handful of individual stars.

In addition to the "star" ground, one can use a bus arrangement, where the main ground conductor is necessarily long. A case like that would be a long wire run along, with several drop points. The ground at each drop is taken from a single ground main, and not run individually back to the source (like a really long star). Or a multi-point ground, which is essentially a grid of interconnections. This is a little trickier, because it really requires balancing the conductivity and curent flow in each conductor.

This kind of multi-point grounding system is most useful in situations where high-current circuits must be connected to more sensitive low-current circuits. It's easier to isolate them, but where that isn't possible, a multi-point grounding approach is often used. An example is digital control circuits that drive large motors at high current levels. The switching of the current both induces currents into the digital circuitry and also creates spikes from IR voltage drops at startup and shutdown. That's what causes ground loops, the IR drop between connections as current flows through each leg of the circuit. If there's a difference, then there's a ground loop.

What I see in audio systems is the star approach is generally best within each device, but one should always remember that the system is then a collection of several stars. The best approach, then, is to have each star (the grounding inside each device) connected along a bus. It also can be done as a star of stars - Each device connected to a single point ground. Either can be made to work, but I find in practice, for audio circuits, a bus of stars works best.

The distinction doesn't matter too much until you have to connect your internet or cable TV. You can usually connect all of your equipment to one outlet, and then the grounding is really a star of stars, which is still a single point. But once a cable TV connection is made, we have the earth ground from the power grid connected to the earth ground from the cable TV, and there is generally a large difference in ground potentials. That introduces a ground loop, one that is usually really noisy. The best way to handle this is to isolate the ground from the cable TV using a coupling transformer.

Probably the trickiest ground problems I see are when a large metal body is used as a ground conductor. I see this in factory assembly lines, where the conveyors, rack and tables are grounded. I also see it in automobiles and airframes. This sets up a condition that is not unlike the problem of connecting two physically distant earth grounds - Current flow through the earth (or the metal body, in this case) passes through different impedances depending on the physical distance between connection points, the quality of material between connection points, and the possibility of any anomalies between connection points like microcracks or bolted junctions. So there are ground loops within the body of the ground conductor, itself. This is where multi-point grounds make the most sense.

The bottom line is grounding is truly an impedance matching excercise, done at very, very low impedances. In a hypothetical perfect system, we could have a single superconductive ground where there were no potential differences no matter where we connected to ground and no matter how much current flowed through it. But since all conductors have resistance, this isn't possible, so the grounding exercise is really a way of making any local grounds "float" at exactly the same potential above ground. Where two devices are connected, we want their local grounds to be exactly the same, even if at some other point down the line, the local grounds may be a few picovolts different. Whatever method or methods work best to achieve that goal is what makes the most effective grounding scheme.

Wow, I just went way down the rabbit trail, didn't I?

File Attachments

1) Grounding_Demystified.pdf, downloaded 3033 times
2) Grounding_Layout.pdf, downloaded 988 times