

Some grounding questions

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Hello,

Today me and a friend took a look at an existing design and finally we got lost in a discussion about grounding issues and how to connect earth ground, signal ground, chassis ground and shields. We talked about the necessity of correct earthing, ESD issues with the different methods and the connection of cable shields for external I/Os. Maybe someone who is a bit more experienced than me can comment on this because I don't feel very safe with all my argumentations and thoughts.

First of all any equipment powered from AC mains will either be double insulated (showing two concentric squares) or will require an earth connector cause of safety reasons. I would like to start with double insulated equipment:

1) Double insulated (Class 2 equipment): No safety connection to electrical earth exists. Because the potential of my internal signal ground is not fixed it can take on an arbitrary value.

Safety: There are no safety concerns because no current will/can flow to any user touching the equipment in case of an electrical fault.

ESD: This is where I am a bit unsure. What happens for example if I would touch a possibly sensitive pin with an external testing equipment charged up to <7.5kV. Because of the isolation I would not expect any problems because no current can flow. Except I would assume that there exists a capacitive connection to earth. On the other hand if the voltage is big enough maybe the voltage could cross the isolation barrier and would take its way to the earth ground.

I would like to claim that isolated equipment has less ESD problems. But I don't think that ESD protection issues can be ignored because a charge could be transferred on the equipment, then it could be taken to another place and somebody touching it could discharge it destroying some devices. In any case the only possibility to connect any ESD protection devices are the internal signal ground if they require such one (like ESD suppressor diodes).

Shielding: Shields can obviously only be connected to the internal signal ground. Letting a shield floating is not an option in my opinion.

2) Earth connection (Class 1 equipment): A safety connection to earth exists. Any conductive component in the device has to be connected to the earth to protect users from any internal faults.

Safety: No safety problems because if a current flows over the earth connection the ac main is cut off. Of course there might be mechanical issues.

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ESD: In my opinion the only good way to connect for example ESD suppressors or other protection devices is to the earth connector because I don't want the current to take the path over my signal ground possibly disturbing the function of my circuit.

Shielding: Shie