Proper Grounding Techniques with Newport Optical Power Meters (1918-C and 1918-R) to Avoid Ground Loops

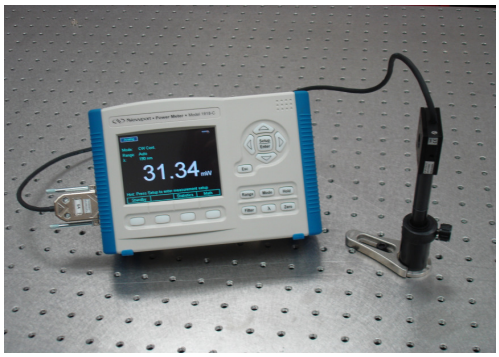
Electrical ground can be described as a common 0V reference value for all nodes within an electrical circuit. Proper use of an electrical ground is a necessity for safety considerations as well as minimization of electrical noise during experimentation.

An optical detector transforms the optical power to voltage (thermopile or pyroelectric detector) or current (photodiode detector). The voltage or current is then measured by the power meter. Light beam powers can be very low, on the order of mW, under ambient conditions. The subsequent transformation by the thermopile of this low beam power can be on the order of µV. At these low levels the signal can be more susceptible to noise from the AC power line. While connected to the AC lines through the wall outlet noise from a ground loop may be noticed if more than two connections to ground are made. This can happen if the power meter is connected to an outlet with its own ground and the optical detector is mounted to an optical table which is electrically connected to a different ground. The noise is picked up by the detector, travels on the detector cable shield to the power meter, capacitively or inductively coupled to the power supply wires and returns back to the optical table through the building ground.

This technical note will highlight proper grounding techniques to be taken into consideration prior to working with Newport power meters. The focus will be on the Newport 1918-C/1918-R power meter, 818P thermopile detectors and 918D semiconductor detectors.

Grounding Techniques for 1918-C/1918-R Optical Power Measurements

1) Optical detectors, such as the Newport 918D semiconductor and 818P thermopile detectors, should be mounted on a post and post holder. The 818P thermopile shown in the image below is mounted on a Newport SPV post and VPH post holder which are both made of thermally and electrically insulated material. The VPH is held in place on the optical table with a Newport PS-F fork clamp. The detector is now electrically and thermally isolated from the optical table. This is especially imperative for 818P detectors as the thermopile is highly sensitive to temperature gradients.



2) A second possible grounding technique would be to bypass the noise current return back to the optical table with a ground wire connected between the provided ground screw (located to the left of the DC input on the 1918-C/1918-R) and the metal optical table

3) A third option would be to connect the ground wire between the metal case of the detector connector and the optical table.

4) An additional option is to make sure that if the optical table is grounded both the optical table and the outlet ground are the same or connected to the same ground.

With techniques 2 and 3 the noise current will go back to the optical table and will not reach the circuitry of the 1918-C/1918-R. Technique 4 ensures that there is no current running between the two grounds that could be generated by nearby machinery. Such current could generate a noisy voltage drop between the detector and the power supply. A typical scenario involves an elevator in the lab neighborhood. Its variable speed and/or load can generate current on the ground wires which could take the path of ground between the optical table ground and the AC outlet to which the power meter power supply is connected. This would depend on the building wiring. Confirming that both the power supply and the optical table grounds are connected to the same ground point ensures the outside lab noise will be bypassed and the measurements will not be affected.