

Performing Isolation Tests on High Voltage Power Supplies

Introduction

UltraVolt HV Power Supplies have three ground terminals — a High Voltage Return Ground, a Signal Ground and a Power Ground — as depicted in Figure 1.

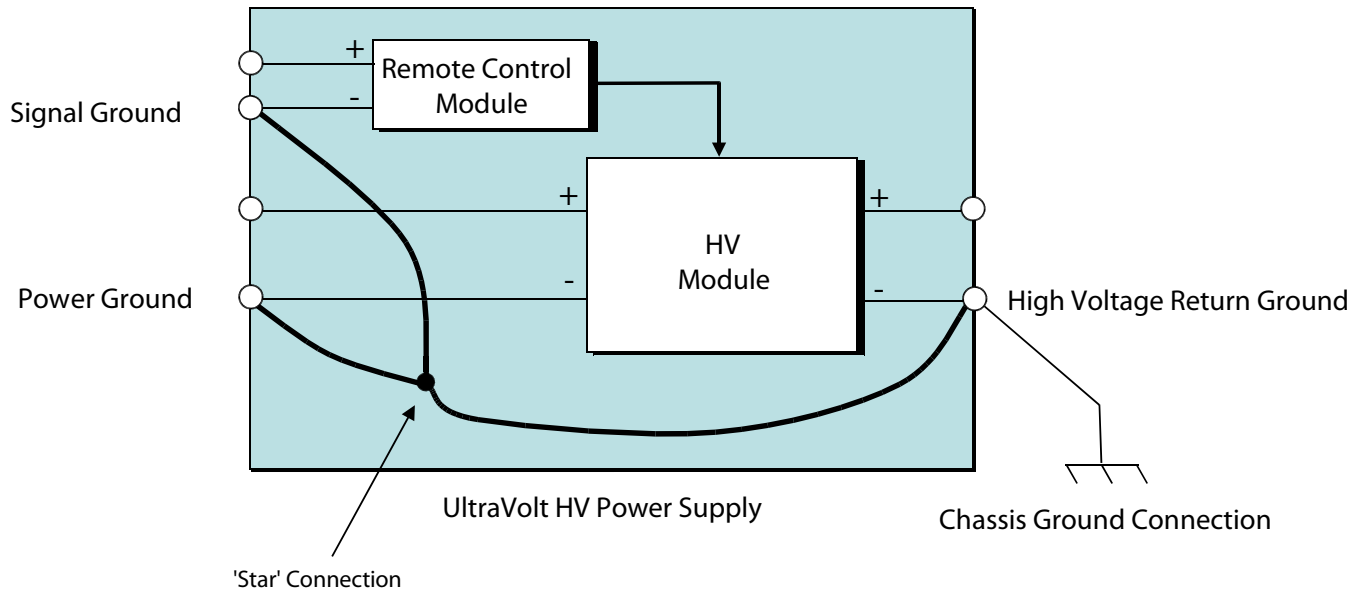


Figure 1. Ground Paths in an UltraVolt HV Power Supply

Note that inside the HV Power Supply these three grounds connect at a single node denoted by ‘Star Connection’ in the figure. When the HV Power Supply is connected to the load, each of the three grounds must connect separately to three corresponding terminals at the load. The grounds must connect separately to the three corresponding terminals at the load so that if a high voltage arc occurs — or any kind of high-voltage discharge — the arc energy will travel via the single chassis ground connection to the High Voltage Ground Return because it is the only ground that is directly connected to the chassis ground.

If the other two grounds were directly connected to the chassis ground and the high-voltage arc were to enter the power supply, it is highly likely that the power supply would be damaged. However, since the arc energy is returning via the Chassis Ground Connection, it enters only the HV Module where each of the components has been selected to withstand the high-voltage energy. If the arc were to travel through any of the other grounds, it would enter low-voltage circuitry which would be unable to survive.

Performing the Isolation Tests

These tests are performed using an Ohmmeter to confirm that the three grounds are connected together only at the Star Connection in the HV Power Supply, which is to say that none of the grounds interconnect within the load. The tests (there are six of them) are specified in Table 1. When performing the ‘Load Disconnected’ tests, make sure all leads from the HV Power Supply are disconnected from the load.

Table 1. Isolation Tests — at the Load Terminals

| Tests | | Signal Ground to Power Ground | Signal Ground to High Voltage Return Ground | Power Ground to High Voltage Return Ground |
|--------------------------------|---------|-------------------------------|---|--|
| Load Connected | Fig. 2a | Continuity ¹ | Continuity ¹ | Continuity ¹ |
| Load Disconnected ² | Fig. 2b | Isolated ³ | Isolated ³ | Isolated ³ |

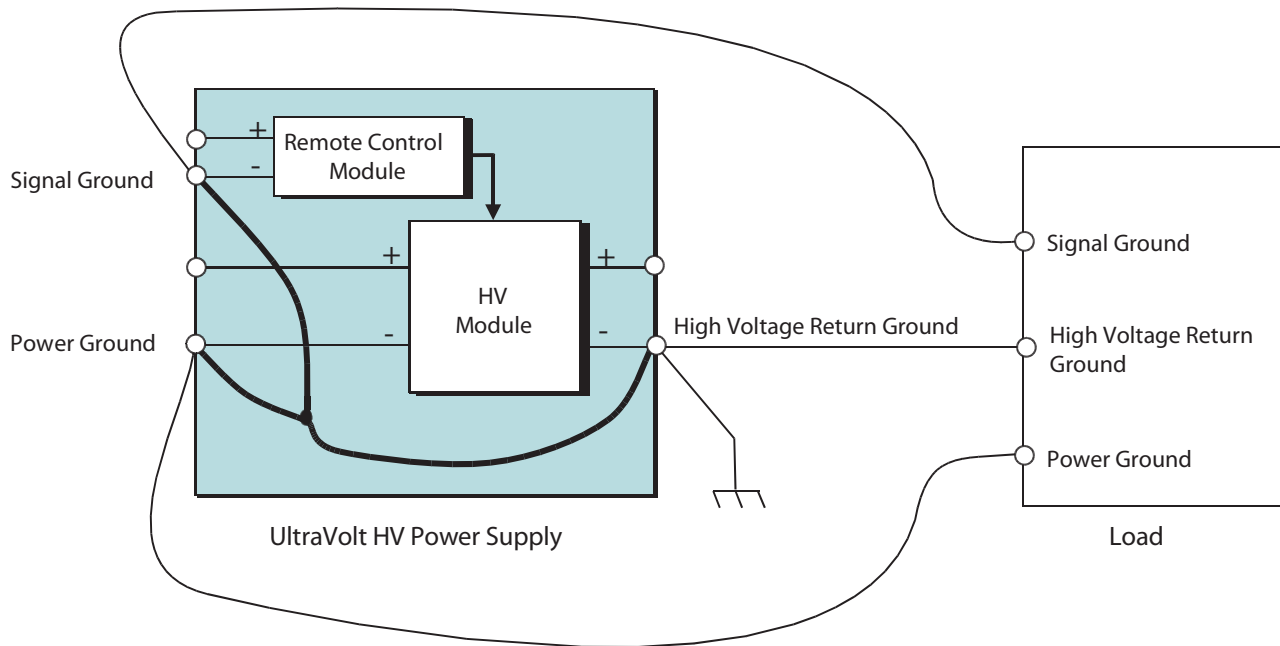
Notes

1. Resistance of 0.5 ohm, or less
2. Make sure that all connections between the load and the HV Power Supply are removed.
3. Resistance of 10 megohms, or more

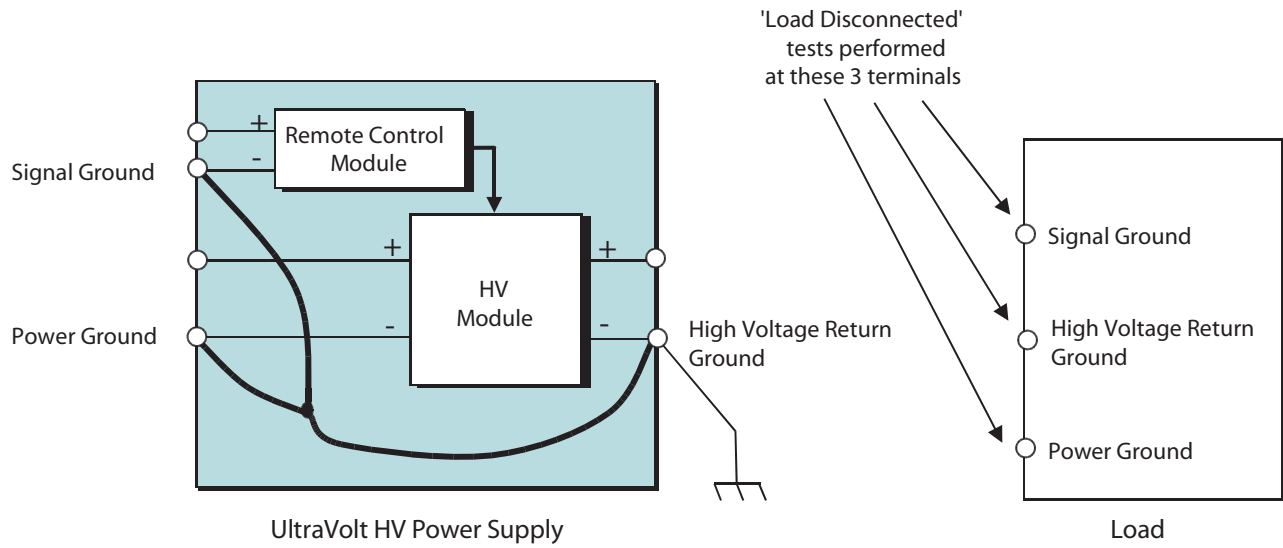
If the power supplies pass all of these tests, the Isolation Tests are successful, confirming that there are no connections between any of the three ground returns either within the load or at the load ground return terminals themselves.

If any of the 'Load Disconnected' tests fail, the circuitry within the load must be checked and any internal connections between the ground return terminals removed. Upon making modifications repeat the 'Load Disconnected' Isolation Tests as outlined in Table 1 to confirm that isolation between the three ground return terminals within the load has indeed been established.

After completing the aforementioned modifications, if any of the Load Disconnected tests fail or if any Load Connected tests fail, please contact Advanced Energy Applications Engineering for further support.



a) Grounds — Load Connected



b) Grounds — Load Disconnected

Figure 2. Isolation Tests

For an in-depth discussion of grounding and protection methods, refer to Application Note 16, which can be downloaded from our website at advancedenergy.com.