



Application Note: RS485 Modbus Communication Wiring Practices – Lightning
Revision: 010219

Inverter Best Installation Practices to Minimize Lightning Vulnerability

Background: A direct lightning strike is nearly impossible for electronic equipment to survive. Understanding the basics of lightning issues is key to providing a robust installation. When a lightning event occurs discharge current from the lightning strike will disperse along the lowest impedance paths to ground. Grounding conductors are used to provide a channeled low impedance path for this current. Lightning current is broadband with significant energy in the high-frequency spectrum. As a result, skin effect becomes a factor and thus stranded wire or even braided wire is better than a solid conductor. Solid conductors are often used for buried ground rings because they are easier to CAD Weld to driven ground rods and tend to better survive the natural corrosion that occurs in buried conductors.

The reactive impedance of the equipment grounding conductors is also critical due to the high frequency content of the discharge current. The routing of the grounding conductors is critical in minimizing the reactive impedance. All bends should have a large radius (greater than 18"). The number of bends should be minimized. The sum of all the bend angles on an equipment grounding conductor should be less than 360°. A 360° bend has a large inductive impedance and will be less effective in routing and dissipating the discharge current. A coil of excess ground cable creates a huge impedance and renders that conductor totally ineffective in mitigating a lightning event. Grounding conductors (cable connected to a grounding rod or driven beam) for lightning suppression should never be run in metal conduit or circumscribed by a metallic clamp or any metallic device.

During a lightning event, the current injected into the ground raises the ground potential at that point and creates a voltage gradient that decays somewhat circularly outward from the point of injection (similar to the waves created by a pebble dropped into a still pool of water). All components connect to ground in that locally elevated potential assume the potential of that point. Therefore, creating a ground potential transient voltage on that conductor. The problem arises when two different pieces of equipment are connected by a conductor that is connected to ground in both ends and one is in the elevated ground potential plane during a lightning event. The potential difference between these two ground planes develops a current in the conductor connecting the two ground planes together. The most common example in Inverter Installations is the shield on the RS485 Modbus Communication cable. If the shield is connected to the equipment ground at both ends and the ground plane at one end becomes elevated by a lightning event, then very high currents can flow trying to equalize these ground planes.

Figure 1 on Page 2 shows the preferred method of addressing the shield or drain conductor on the RS485 Modbus Communication cable.

A handwritten signature in black ink that reads 'Stephen Ballinger'.

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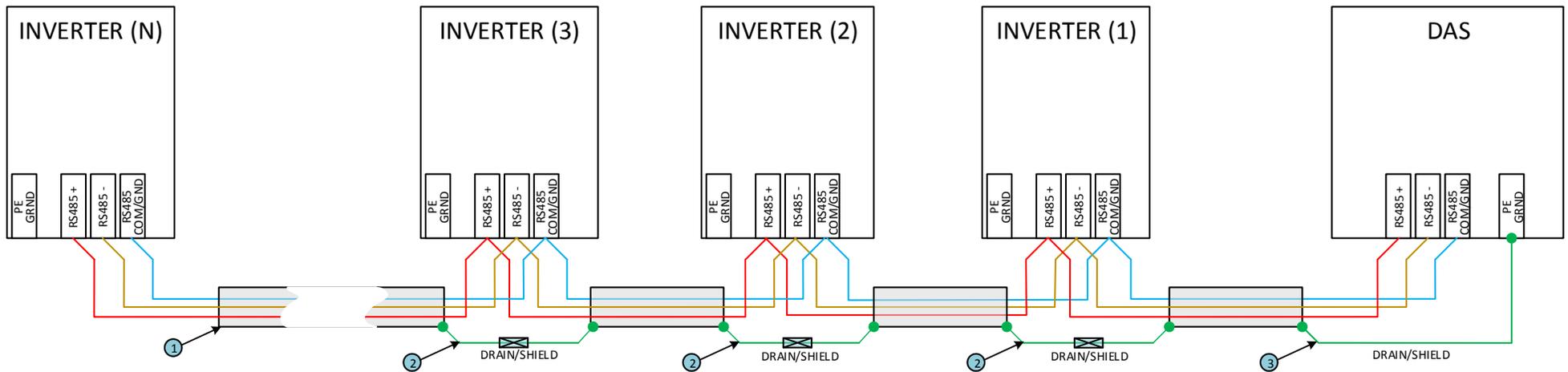


Figure 1

NOTES:

1. Insulate the drain/shield wire that is not connected to protect against incidental contact with chassis or other live components.
2. Connect the drain/shield wires from the RS485 cable with an insulated crimp splice.
3. Connect the drain/shield wire from the RS485 cable to Earth Gnd at one end, and one end only of the daisy chain network (preferably closest to the GES).