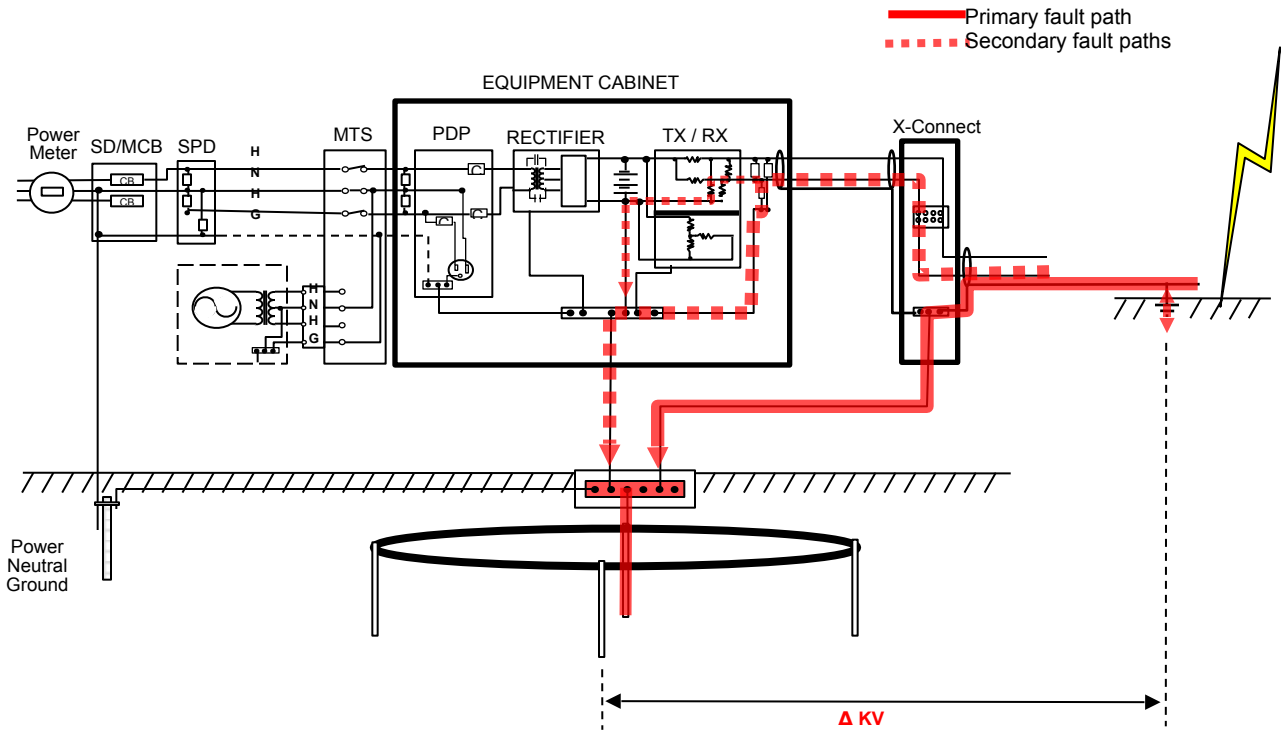
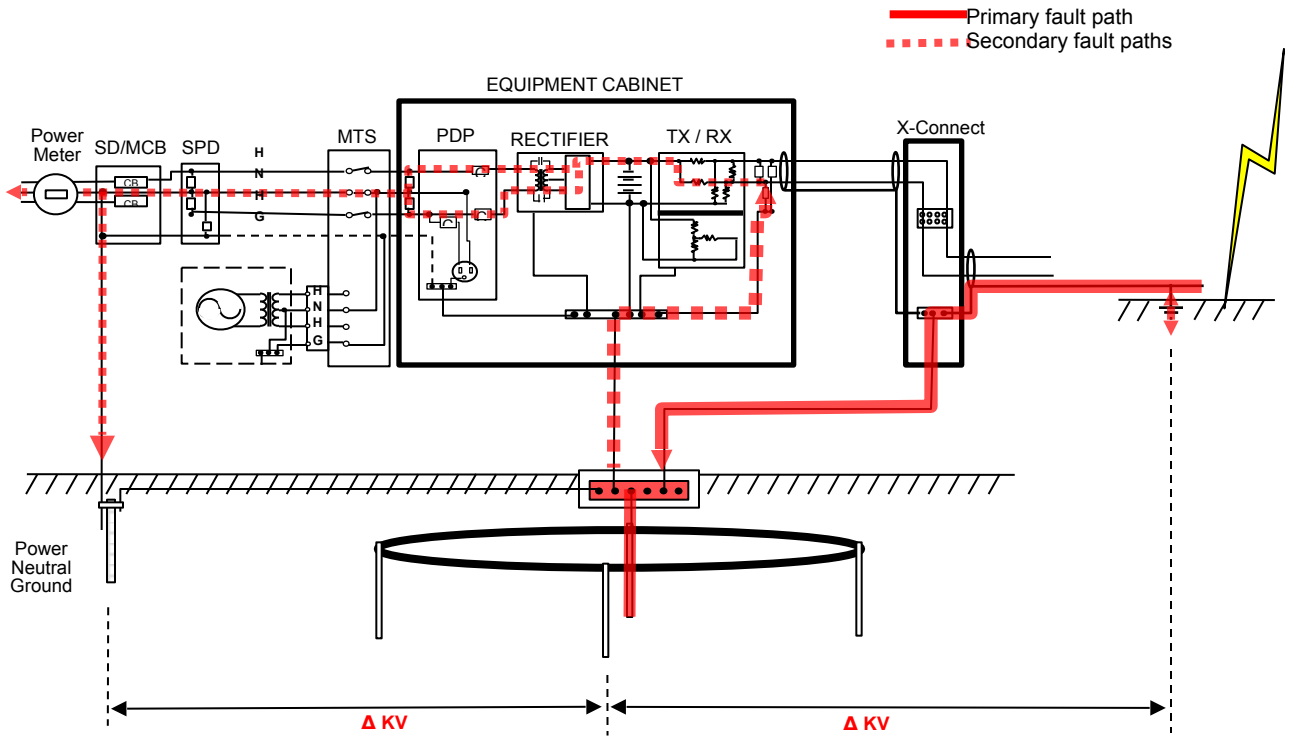
Telecom Transient – Fault Path Analysis

- Lightning GPR is often miss-diagnosed as telecom signal line transients, The two fault conditions may originate from the same lightning ground strike but propagate in a different manner. Refer to "Lightning GPR – Fault Path Analysis".
- A lightning ground strike injects energy into the ground and propagates across the earth's surface.
- Surface ground potentials can vary dramatically (several KV/FT) between separate ground points which elevates the potential of the telecom shield and multiple ground points.
- Shield fault currents develop from the potential differences between the shield ground points, producing two principle fault paths to the cabinet electronics:

1. The generally assumed source of the fault path is the signal line(s) -
    - The shield currents induce currents on the signal lines producing voltage transients at the equipment signal I/O lines.
    - The telecom surge protection shunts the transients on the signal lines to the grounding system.
    - If the surge protection fails the signal cards may be damaged. Common mode transients may create a fault path through the electronics to the equipment ground.
    - If the surge protection does not fail yet the signal cards are damaged, fault currents on the telecom shield or lightning GPR may be the cause



2. The less familiar source of the fault path is the shield –
    - The telecom shield may carry significant current between the shield ground and the site grounding system.
    - The telecom shield may be floated between the x-connect and the cabinet to mitigate the conduction of fault current to the equipment cabinet. However, the x-connect ground is typically bonded to the site ground and there may be significant potential differences between the shield ground at the x-connect and the site grounding system. This produces the same reaction as lightning GPR:
        - Grounding systems react inductively to the high lightning frequencies, Current from the the X-connect ground forces the potential of the site ground to momentarily rise.
        - Telecom surge protection is intended to shunt transients on the signal lines to the grounding system. However, surge protectors are bi-directional; voltage elevation on the site ground forces the surge protection to conduct, attaching the elevated site ground to the telecom signal lines. This creates a high potential difference between the signal I/O pins and remote grounds, creating a fault path through the electronics to remote, lower potential ground.
        - Fault current through the electronics flows to the remote ground through the power neutral system which is the most conductive path to the lowest ground potential.



- **Lightning Shield**: pre-emptive disconnection of the AC utility circuit opens the secondary fault path through the electronics and creates a single point ground condition. Eliminating the lower potential ground reference creates a high impedance path that blocks the flow of fault current through the electronics.
- During isolation the fault current is forced to dissipate through the single point ground system.