ALSET CORP

L-GPR Protection

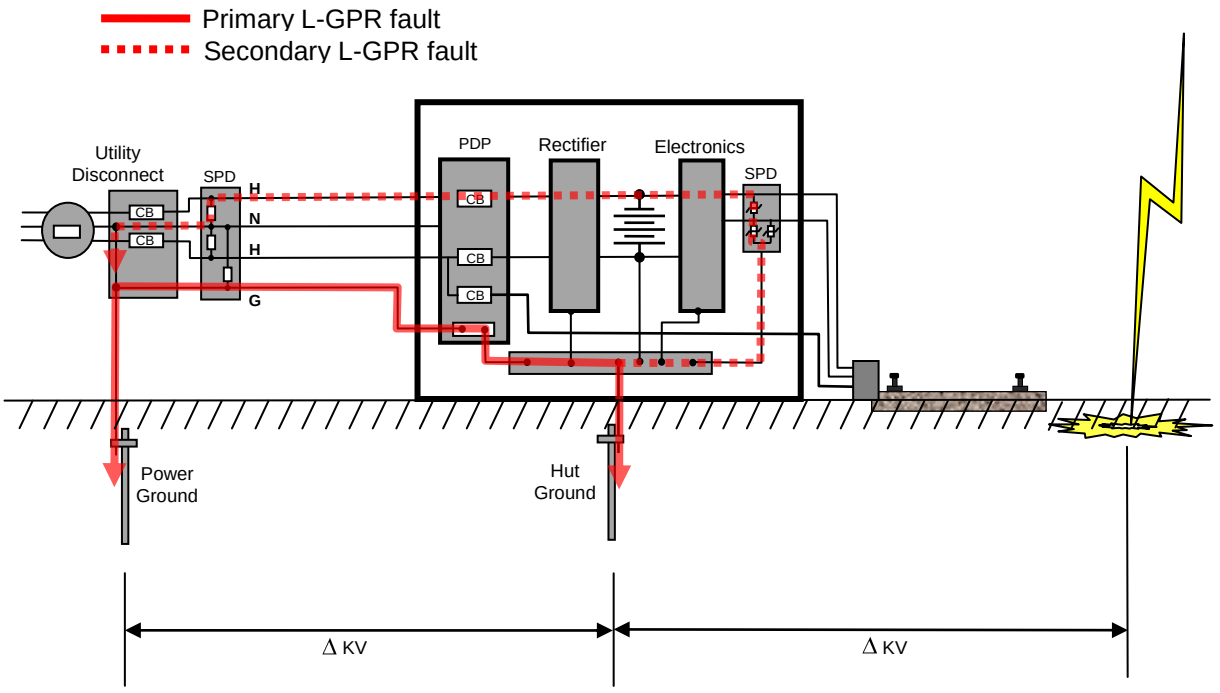
...when conventional protection is not enough

Railway Electronics Protection

Lightning Threat: Railway electronics are exposed to lightning which frequently causes damage to rectifiers, control electronics and communication systems. Rural installations are particularly exposed to Lightning Ground Potential Rise (L-GPR) since they have limited grounding infrastructure to dissipate the severe voltage gradients that radiate through the earth's surface.

L-GPR is created by a rapid charge injection into the ground when a lightning ground strike occurs. The soil cannot instantly dissipate the charge, causing a significant voltage increase at the strike point with respect to other locations. The voltage differences across 10 feet can be tens of thousands of volts for 100 microseconds. This sustained potential difference between ground points elevates the ground bar voltage which can overcome the threshold of the bonded surge suppressors. The elevated potential is connected directly to the I/O communication lines and a secondary discharge path is created through the equipment to remote ground.
See Figure 1 below.

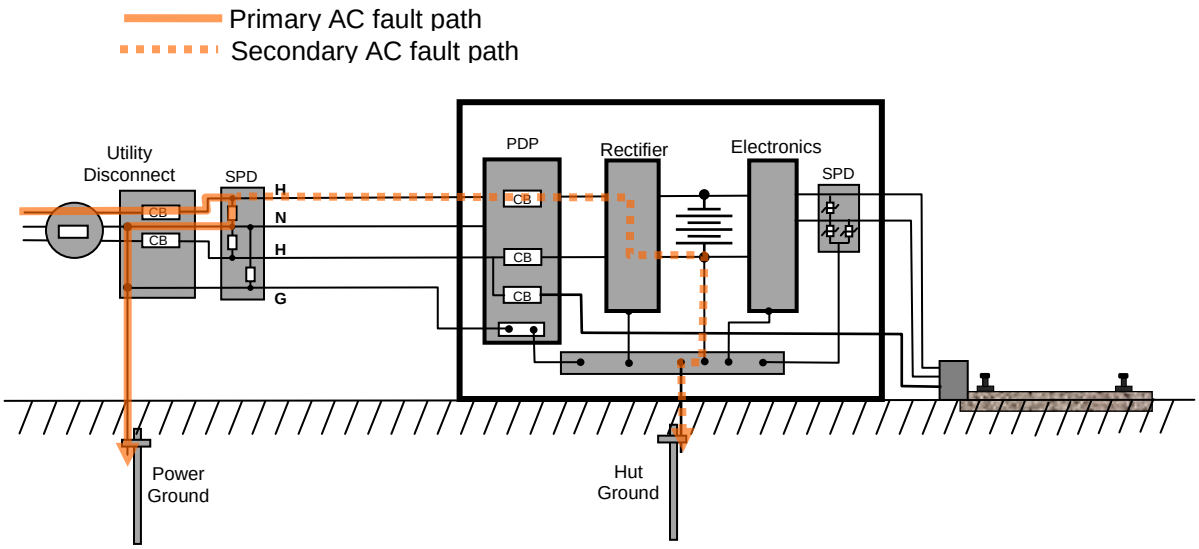
Figure 1



Soil resistivity has a significant bearing on L-GPR. Resistive soil (sandy clay, limestone, gravel) inhibits the earth's dissipation of lightning energy; causing a dramatically higher L-GPR. Dehydration of soluble metal compounds (e.g. salt) in the earth has a similar effect – lower conductivity increases the severity and propagation of L-GPR. "Dry lightning" throughout many regions is a certain prescription for electrical and electronic damage.

AC Threat: Lightning strikes on power distribution systems, capacitor bank switching and other utility events can also produce severe transients and surges on the commercial power service – refer to Figure 2. Fatigue and eventual failure of the AC surge protection exposes the electronics to damaging voltage gradients across modules and components. Power recovery from sags and outages may also produce repetitive transients from sequential attempts to re-establish service.

Figure 2



Solution: Disconnecting the AC utility circuits for the duration of the threat eliminates all the potential fault paths through the equipment. Fault current can not flow across the open circuits and is forced to dissipate in the grounding system. The key is detection of the threat and isolation of the electronic site before the fault occurs. **Lightning Shield** combines detection and isolation capabilities:

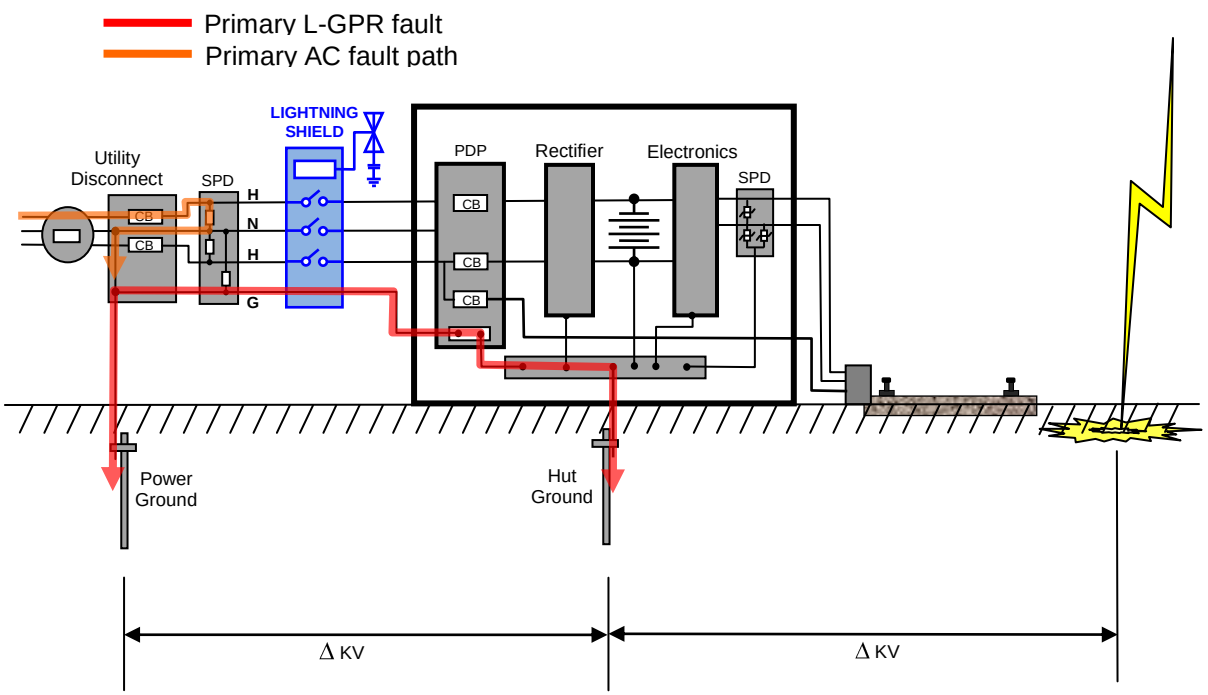
a. Lightning GPR is anticipated by detection of the electric field changes from near-proximity lightning formation or ground strikes from an approaching storm.

b. Voltage window comparators detect the high speed transients and surges that breech the AC surge protection. Power sags and outages are detected.

Figure 3 presents the installation of the **Lightning Shield** system.

Detection of an impending threat activates isolation within 15 mSec. Threat detection is continuously active and maintains isolation until the lightning storm passes, or until the commercial power stabilizes, assuring complete protection from power recovery transients. After the threat passes the AC circuits are automatically reconnected. The duration of the isolation will vary, a few seconds for a single power line event or hours for sustained lightning activity.

Figure 3



Lightning Shield is user configurable. L-GPR sensitivity may be set for local soil and storm conditions. The AC voltage comparator thresholds may set between 90V and 145V for each phase line. NO/NC relays communicate power status and threat notifications. Two models are available to accommodate utility breakers rated up to 50 Amps and 200 Amps.

Lightning Shield – 50 Amp

Hot Box Installation