DC ground fault locating under difficult conditions An AC coupling tale…

Megger

CASE STUDY

The solution to chasing wrong causes of ground faults and identifying unwanted coupling

DC ground fault locating in the presence of unwanted AC coupling

Background:

Tennessee Valley Authority (TVA), located in the Southeastern region of the United States, generously supplied this case study.

TVA had a negative ground fault they could not locate. The ground fault was generating an alarm in their distribution substation. They used multiple instruments to trace the fault, including Megger and competitor units. Each one traced the fault back to the battery charger.

They replaced the battery charger, which did not correct the ground fault. The ground fault persisted.

Investigation:

- TVA had used the Megger BGFT and a competitor's unit and traced the fault to the battery charger. They replaced the battery charger, and the fault did not go away.
- Megger assisted with the investigation. We placed a Megger MGFL100 on the string, and it did verify the presence of a negative ground fault (Figure 1).

Figure 1: the Megger MGFL confirming a negative ground fault on the battery string

- With the MGFL100, we injected current and found the resistive value of the ground fault to be about 1.7K. The MGFL100 also showed the leakage capacitance to be about 7uF.

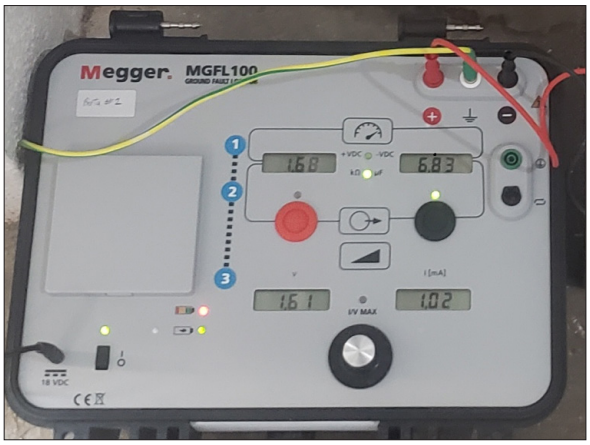
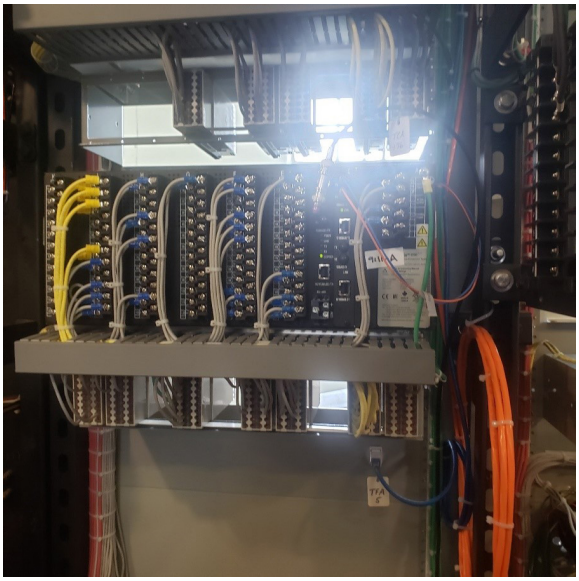


Figure 2: the Megger MGFL test results

- Meanwhile, we observed that the current, resistance, and capacitance values were all unstable.
- The fault current was present on the negative battery cable. The investigating team performed tracing and found that there was also current on the positive buss. Once again, none of these readings were stable.
- Knowing the MGFL100 transmitter will output a stable low-frequency AC current, the unstable measurement indicated an alternate low-frequency AC presence in the system.
- After turning off the transmitter, the MGFL100 receiver still measured an AC current on the positive buss. Therefore, there was AC coupling over to the DC.
- To locate the source of the AC coupling, the team placed the receiver in its 50/60 Hz AC mode, a unique ability of the MGFL100. We were then able to trace the 60 Hz current to its source, which was the battery charger. This is why the other tracers failed to locate the real fault. The team isolated the battery charger from the system to remove the AC.
- We turned the transmitter back on and could now measure the fault current on the negative buss.
- The receiver was then placed back into the normal low frequency tracing mode, and the real fault was traced to a relay. The team removed the ground lead from the relay, and the ground fault vanished.



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- What complicated the ground fault tracing in this case was the presence of an AC current that was coupling over to the DC system.
- The MGFL100 transmitter will fluctuate in the presence of low-frequency AC current. Since an operator can place the MGFL100 receiver in a 50/60Hz mode, it allows the operator to trace stray AC current that may be present on a DC system. So, not only did the operator locate the real ground fault in the relay, but they also discovered a wiring issue in the charger that was coupling AC onto the DC system.

Takeaways:

- Ground fault tracing is complicated when unforeseen or unknown conditions exist in a system. Having equipment that supplies enough information about the system is critical in determining how to trace a fault. Without this, a fault can be traced all day with no results. Worse yet, the maintenance team can draw the wrong conclusion, wasting time and money.

Savings and Value:

- TVA located the real ground fault in the relay, eliminating the alarm in the substation. Plus, they identified a wiring issue in the battery charger that was coupling AC onto the DC system, which could cause further damage and degradation of the DC system.

Product reference(s):

The MGFL100 is a battery ground fault locator. It can locate faults up to 400 kΩ. It can automatically identify real faults as well as leakage current. The until will alarm when it locates the real fault.

The MGLF100 also can trace faults on IT grounded AC systems. In addition, the MGFL100 receiver can be placed in a 50/60 Hz mode to trace any AC current.

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