

Lesson Learned

Digital Inputs to Protection Systems May Need to be Desensitized to Prevent False Tripping Due to Transient Signals

Primary Interest Groups

Generator Owner (GOs)
Generator Operator (GOPs)
Transmission Operator (TOPs)
Transmission Owner (TOs)

Problem Statement

A converter station was lost due to the erroneous initiation of a top-oil temperature trip signal from a transformer protection system. The operating entity investigated the connections in the transformer cabinet at the time and visually inspected the transformer and temperature gauges. Both the transformer's current temperature and the drag hand for the high-temperature indication were well below the alarm and trip levels. There was no evidence found to indicate any loose or corroded connections in the transformer cabinet.

Multiple events initiated by this type of erroneous input signal have been observed in the event analysis process.

Details

According to design, the control and protection systems acted properly to block the converter and open the main station breaker to de-energize the transformers. The control and protection systems properly responded to the trip signal by isolating the transformers; however, the top-oil temperature trip signal should not have been initiated. Upon review of the sequence of events and additional data collected from the transient fault recorders, it was determined that this event was a false trip based on: (1) there was no indication that the top-oil temperature alarm (which would normally precede a trip signal for an actual high-oil temperature condition) was received from either control system, and (2) there was no trip signal received from the backup protection system.

Corrective Actions

The operating entity identified that transient signals were mistaken as a full-contact closure due to arcing or high-resistive bridging of the trip contact. This was a case of the protection digital inputs being too sensitive to transient signals, signal noise, or high-resistance contact bridging from outdoor mounted devices.

With the assistance of the vendor, it was determined that loading resistors should be installed on the digital inputs to desensitize them to transient signals. The entity reviewed other applications to see if similar issues existed.

Lessons Learned

Outdoor mounted devices that have inputs to protective relays have the potential to be exposed to shocks and vibrations or to be negatively impacted by dampness and corrosion. These events could cause transients to be detected as contact closure by the protection digital input. The protection digital inputs should be designed or modified as necessary to reduce their sensitivity to a possible transient or high-resistance contact bridging being incorrectly detected as a full-contact closure.

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