

## Lesson Learned

### Transmission Relaying – Undesired Blocking

#### Primary Interest Groups

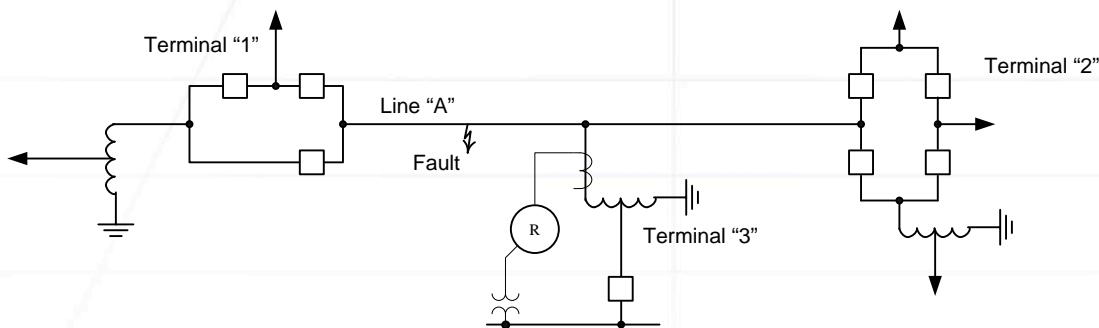
Transmission Owners (TO)

#### Problem Statement

Directional Comparison Blocking (DCB) schemes are dependable communication assisted (or pilot) line protection schemes. However, it is fundamentally important to quickly stop the transmission of the blocking signal for internal Faults.

#### Details

A permanent phase-to-ground Fault occurred on Line A which is a three terminal line. All three ends correctly cleared high speed on the initial Fault. When Terminal 1 reclosed, it cleared by a Zone 2 time delay. The Digital Fault Recorder (DFR) at Terminal 1 confirmed the high speed tripping for the initial Fault and delayed tripping for the subsequent Fault. The DFR also indicated the trip from Terminal 1 upon reclosing was delayed because it was receiving a block signal.



Relays related to the pilot scheme as well as the carrier transceiver were tested. All were found to be working properly and to have the appropriate relay settings applied. Functional tests were performed at all three ends of the line and between all combinations of the line terminals. No problems were identified by these tests.

The cause of the delay in tripping was determined through the process of elimination and modeling the event. The Misoperation resulted from the following circumstances: (1) the design of the older electromechanical relay scheme and (2) the tapped autotransformer at one of the line terminals. At Terminal 3, there is no high side breaker, so the low side breaker of the tapped autotransformer is tripped for line Faults, leaving the primary of the transformer connected to Line A. The pilot scheme interlocks carrier stop with the circuit breaker position. When Terminal 1 reclosed into the Faulted line, the ground source contribution from the autotransformer was sufficient to start the blocking carrier signal by the non-directional ground element at Terminal 3. However, because the low side autotransformer breaker

was open, the carrier stop relays at Terminal 3 could not operate. This resulted in the carrier signal not being stopped which blocked the remote end from tripping high speed.

### Corrective Actions

The line protection scheme was modified at Terminal 3 to stop carrier when the low side breaker is open.

### Lesson Learned

After a Misoperation of a communication assisted protection scheme, it is important to review the conditions that existed during the event. If a non-directional start is used in a DCB scheme, the directional unit that stops the blocking signal should not be compromised during a sequence of normal operations. If the directional unit cannot perform during a Fault, then modifications to the scheme design should be considered.

Click here for: [Lesson Learned Comment Form](#)

For more information please contact:

<a href="#">NERC – Lessons Learned</a> (via email)	<a href="#">Art Buanno</a> (via email) or (330) 247-3442
Source of Lesson Learned:	ReliabilityFirst
Lesson Learned #:	20130401
Date Published:	April 16, 2013
Category:	Relaying and Protection Systems

*This document is designed to convey lessons learned from NERC's various activities. It is not intended to establish new requirements under NERC's Reliability Standards or to modify the requirements in any existing reliability standards. Compliance will continue to be determined based on language in the NERC Reliability Standards as they may be amended from time to time. Implementation of this lesson learned is not a substitute for compliance with requirements in NERC's Reliability Standards.*