Title:	Automatic Calculation of Relay Settings for a Blocking Pilot Scheme
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Abstract:
(Your abstract <u>must</u> use Normal style)

Automa ted relay setting can improve productivity significantly by applying utility rules consistently, simplifying routine data handling and allowing more thorough fault studies than are feasible by hand. Here we are setting the relays at the ends of a transmission line in a directional-comparison blocking scheme, using a protection database as a starting point.

A blocking scheme has two zone-1 elements for direct tripping and four pilot elements: one tripping and one blocking element at each terminal (bus 1 or 2). Zone -1 elements must trip only for faults within the protected line. A tripping pilot element at bus 1 should see faults all along the protected line. The blocking pilot element at bus 2 must detect at least all external faults that would cause tripping at bus 1.

For instantaneous ground overcurrent elements, the tripping element at bus 1 should pick up for 40 -ohm ground faults all along the protected line. The blocking element at bus 2 is given 50% of this setting, both settings being limited by the available relay taps.

A pilot tripping distance element is set to cover the protected line plus 50 percent of the shortest downstream line, with a minimum reach of 120 percent of the protected line. The blocking distance element is set to detect solid faults all along the longest line behind its local bus.

The relay settings are reported as primary network values and actual relay taps. Then an automatic coordination study tests many solid and resistive faults on the relay line, adjacent lines and separate coupled lines. A table shows the operation or non-operation of the tripping and blocking elements and highlights potential misoperations, allowing an engineer to focus on the most critical cases.   Examples show how an actual utility (Tennessee Valley Authority) sets and checks relays in a group of mutually coupled 161kV lines.

Tripping and blocking pilot elements