SEL Recloser Controls and Feeder Relays Prevent Misoperation Due to Circuit Inrush

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INTRODUCTION

Overcurrent relays are prone to operate on distribution feeder circuit inrush. This causes unnecessary power blinks for utility customers. The SEL-351RS Kestrel® Single-Phase Recloser Control, SEL-651R Advanced Recloser Control, and SEL-351 Protection System family include a second-harmonic blocking feature to detect an inrush condition and block selected tripping elements until the inrush subsides. Applying this easy-to-set feature saves customers from unnecessary power blinks.

PROBLEM

An electric distribution feeder circuit experiences a magnetizing inrush current that is the sum of the inrush of all the transformers in that circuit. This high current can cause fast overcurrent elements to operate unnecessarily. In fact, it can be argued that reclosers rarely close in and hold during a second fast operation due to inrush current.

SEL SOLUTION

The second-harmonic blocking feature of the SEL-351RS, SEL-651R, and SEL-351 can prevent unnecessary operations due to distribution feeder circuit inrush. Figure 1 shows an actual inrush event that occurred on a distribution feeder circuit with an SEL-351RS set with a minimum pickup of 100 A. The reclosing was set for three closing shots to lockout with two fast A curve trips and two slow B curve trips. Figure 1 shows the distribution line inrush after the first reclose.

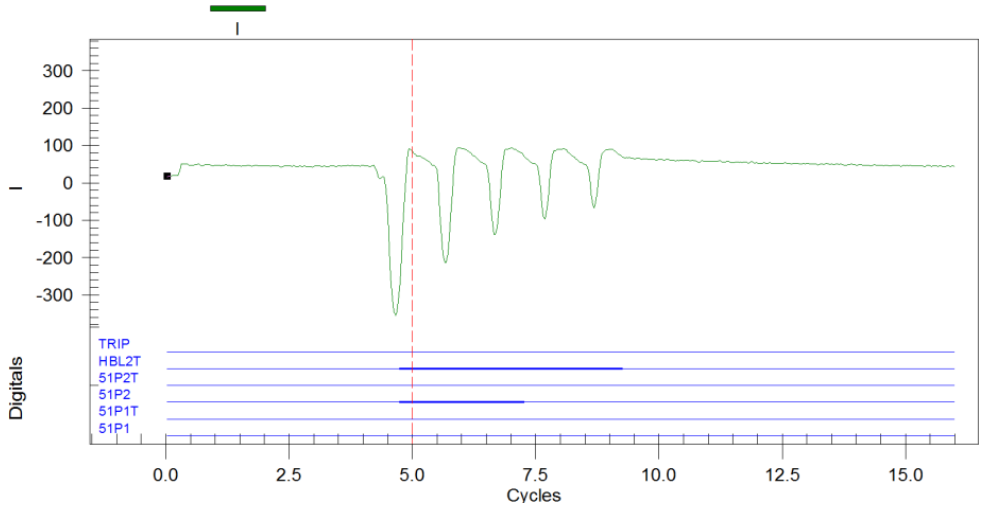

Figure 1 SEL-351RS Experiences Distribution Line Inrush

However, something is missing in the event report in Figure 1—the relay did not trip. That is because the event report is a playback of the offending event into an SEL-351RS with second-harmonic blocking applied. Note that the second-harmonic blocking Relay Word bit HBL2T is asserted and that the fast curve 51P1 never picks up. The fast curve is successfully blocked for circuit inrush.

Second-harmonic blocking is very easy to implement and can be enabled using ACSELERATOR QuickSet® SEL-5030 Software, as shown in Figure 2.

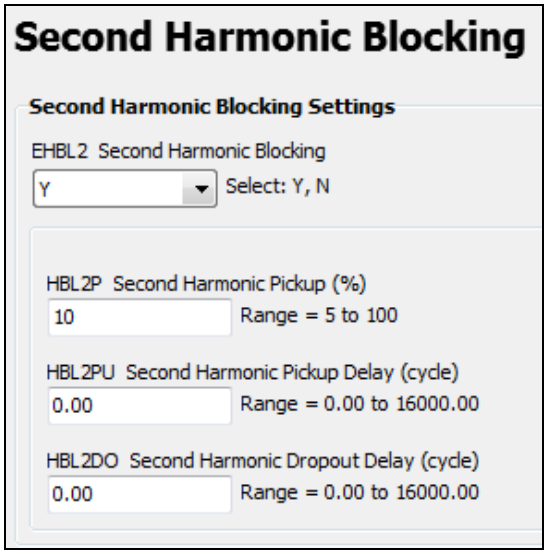

Figure 2 Enabling Second-Harmonic Blocking in the SEL-351RS

The associated Relay Word bit HBL2T should be entered in the torque control equation for the element to be blocked, as shown in Figure 3.

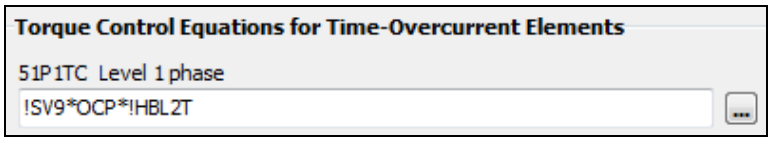

Figure 3 Blocking Fast Curve in the SEL-351RS

Once this is done, unnecessary power blinks for distribution feeder circuit inrush are gone. Consult the device instruction manual for details about applying second-harmonic blocking in a system. Special consideration should be given as to whether it is desirable to block fast or instantaneous tripping that may be applied if hot-line tagging is enabled.

The utility whose event is shown in Figure 1 experienced multiple trips in various locations due to distribution feeder circuit inrush. Now that they have implemented second-harmonic blocking, unnecessary power blinks have stopped. More details on field experience with second-harmonic blocking can be found in the SEL technical paper "Mitigation of Undesired Operation of Recloser Controls Due to Distribution Line Inrush," available at http://www.selinc.com.

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