# Applying the SEL-587Z in Switchgear

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## INTRODUCTION

The SEL-587Z Relay provides bus protection using a high-impedance differential technique. Each phase has a separate differential element, providing segregated measurement. Each element has two pickup levels providing six settings in total. The differential elements compare the measured voltage with these settings.

## PROBLEM

In switchgear applications, it is common for the CT secondary lead lengths to be very short and for CTs to not be paralleled to an equidistant junction point. When using the guidelines in the instruction manual, the differential settings calculated for such installations can be very low, in some cases less than 100 volts. A low voltage setting with no intentional time delay can have a direct impact on the security of the differential elements for external faults. High-current external faults can result in enough unbalance current to cause operation of the differential elements for these low voltage settings with no intentional time delay.

## SEL SOLUTION

SEL has analyzed a number of SEL-587Z field events. In all cases, a differential voltage setting of 200 volts would have ensured secure operation. ***Therefore, SEL recommends a minimum setting of 200 volts with no intentional time delay for switchgear applications***.

Using a 200-volt minimum setting does limit the application to:

- CTs with a 200-volt rating or greater

- For impedance-grounded systems that limit LG fault currents, an instantaneous 200-volt setting will not trip for LG bus faults. Therefore, the following settings are recommended for impedance-grounded systems:

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Relay Settings (partial list)
87A1P    = Vs   87A2P   = 200  87B1P   = Vs  87B2P    = 200
87C1P    = Vs   87C2P   = 200
SV5PU    = 1.000 cycle min.
SV5DO    = 0.000
SELogic Control Equations (partial list)
SV5      = 87A1 + 87B1 + 87C1
TR1      = SV5T + 87A2 + 87B2 + 87C2
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where Vs = voltage setting calculated with SEL-587Z Instruction Manual Equation 3.4.

A neutral overcurrent (50N) relay is also recommended for sensitivity.

A system that does not meet the requirements should be protected by an SEL-487B Relay.

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