

Lesson Learned

Use Loading Resistors When Applying Solid State Contacts to High-Impedance Input Devices

Primary Interest Groups

Generator Owners (GO)
Generator Operators (GOP)
Transmission Owners (TO)
Transmission Operators (TOP)

Problem Statement

Due to solid state-type contacts being applied to high-impedance input devices without the use of loading resistors, erroneous indications were introduced into the protection and control schemes and caused SPS/RAS misoperations.

Details

Modern protective devices employ the use of solid state components to increase capacity to make or break currents and decrease operating time of output contacts. These types of contacts have a risk of providing false contact closure indications when applied to high-impedance input devices without the use of a loading resistor. NERC Event Analysis received two reports in which SPS/RAS misoperated due to these types of contacts falsely indicating open breakers.

In one event, the contacts acted as inputs to a SPS processor, which was a high-impedance input that sensed voltage. In the other event, a solid state-type contact was applied as an input to communication equipment, which was also a high-impedance input that sensed voltage for activation. Noise on the control circuit, due to capacitor switching, triggered the contacts to falsely indicate as closed. In both events, the contacts erroneously indicated the closed condition long enough for the SPS scheme to detect what it thought was a transmission line open condition and result in a trip of generation.

Corrective Actions

After consultation with the manufacturer, a resistor was installed in the circuit to alleviate the transient indications of contact closure. As illustrated in Figure 1, the resistor acts as a loading resistor to eliminate erroneous contact closure indications.

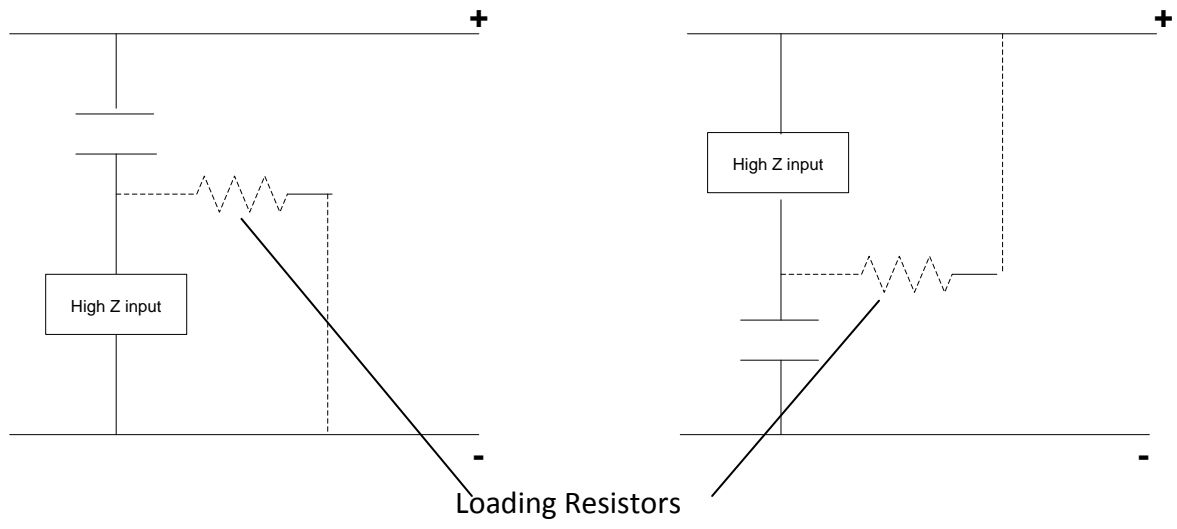


Figure 1: Schematic of Loading Resistor Application

Lesson Learned

When applying any contact that achieves high speed or high current operation through the use of electronic or transistor-switched circuits in conjunction with traditional contact outputs, detailed consideration must be given to manufacturer installation recommendations.

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Source of Lesson Learned:	Western Electricity Coordinating Council
Lesson Learned #:	20130703
Date Published:	TBD
Category:	Relaying and Protection Systems

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