



Low-Voltage Switchgear Protection Using the SEL-751

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INTRODUCTION

Modern industrial and commercial low-voltage (480 V) power switchgear systems, such as the system shown in Figure 1, require additional features to ensure power availability, employee safety, and power management. These features include automatic load transfer, generator control, arc-flash protection, and load-shedding applications. Facilities that can find a simple and cost-effective way to incorporate these features have a competitive advantage over facilities that do not have these system features.



Figure 1 Industrial Low-Voltage Switchgear System

PROBLEM

In the past, automatic generator transfer, arc-flash protection, and load-shedding features required separate devices. The system integrator or engineer designed a complex and expensive system to handle all of these functions. These additional devices increased installation costs, maintenance requirements, and the number of components that could fail, possibly derailing the benefits of the system.

SEL SOLUTION

The SEL-751 Feeder Protection Relay incorporates all of those needed features into one single device. Figure 2 shows an example system that includes a utility feed, utility breaker, generator, generator breaker, 480 V bus, shunt trip breaker, and molded feeder breakers.

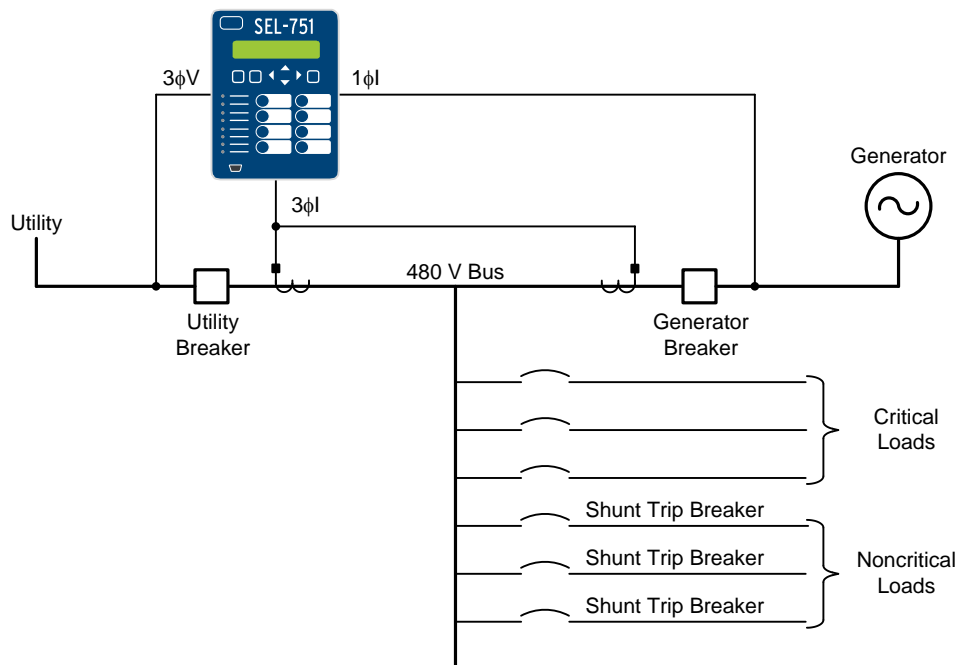


Figure 2 Example 480 V Power Switchgear

This example system uses two motorized circuit breakers for the automatic source transfer scheme. In this system, two motorized breakers replace one automatic transfer switch for reduced cost and increased flexibility.

Protective Functions

The SEL-751 has standard phase and ground instantaneous and time-overcurrent protection elements that provides back up protection for the motorized utility and generator breakers. Current transformers (CTs) on the utility and generator breakers provide source information to the SEL-751. Custom logic in the SEL-751 performs the following functions:

- Changes relay settings depending on system configuration.
- Trips the utility circuit breaker or generator circuit breaker (whichever is in service) when it detects an abnormal current event on the 480 V bus.
- Monitors the status of the trip coils for the utility and generator circuit breakers.
- Monitors and creates event reports for relay trips or closes, breaker statuses, and bus voltages.

Arc-Flash Protection

In the system shown in Figure 2, the SEL-751 has an optional arc-flash input card and high-speed solid-state output card. The switchgear also has built-in fiber-optic light sensors. This arrangement provides arc-flash protection for the 480 V switchgear bus. When the SEL-751

detects fault current and the light sensors see a high-intensity light, the relay trips the utility or generator breaker.

The high-speed solid-state output contact closes much faster than an electromechanical contact, reducing the relay trip time. The SEL-751 also processes the high-speed solid-state contact at 0.0625 cycles versus the 0.25-cycle processing interval of the relay microprocessor. This can help minimize total trip time, which can reduce the amount of energy in an arc-flash event.

Automatic Source Transfer and Generator Control

The 480 V system described previously uses two motorized circuit breakers for the automatic source transfer scheme. In this system, two motorized breakers replace an automatic transfer switch for reduced cost and increased flexibility. Custom logic in the SEL-751 performs the following example processes:

- Monitors the voltage and reclose attempts on the utility line.
- Sends a signal to start the generator on a subsequent loss of power (failed reclose attempt).
- Trips the utility breaker.
- Closes the generator breaker.
- Continues to monitor the voltage on the utility line.
- Trips the generator breaker and closes the utility breaker upon the restoration of utility power.
- Sends a signal to shut down the generator.

Automatic Load Shedding

Facility and consulting engineers need to exercise great caution when selecting an emergency generator. The generator needs to be able to power as much load as possible while remaining as small as possible.

With automatic load shedding, facility engineers can determine what load is critical during a power outage. They then specify shunt trip coils for the noncritical load circuit breakers. Logic in the SEL-751 then trips the shunt trip coils on these circuit breakers when necessary. This could be while the generator is running or during another applicable event. Maintenance personnel can then reset the tripped breakers to restore power to the noncritical loads. Or, if the feeder breakers are equipped with close coils, logic in the SEL-751 can reclose these breakers in an orderly fashion.

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