Improve Distribution Efficiency With Scheduled Voltage Reduction

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INTRODUCTION

Voltage reduction is a scheme used to reduce the demand on a power system through the intentional lowering of the system voltage. Lowering the system voltage achieves short-term energy savings. Recent studies have found that lowering system voltage by 1 percent will result in approximately 0.5 percent reduction in demand. Because many residential and commercial motors are designed to run at 230 V and 460 V and utilities often provide 240 V through 250 V and 480 V through 500 V, these motors run more efficiently at a slightly lower voltage. However, the savings are greatly dependent on the system load, because lowering the system voltage will affect mainly the resistive portion of the load. Maintaining optimal system voltage is a key component in making the grid work as efficiently as possible and may lead to a reduction in peak load on some systems.

PROBLEM

Utilities have been evaluating voltage reduction schemes for several decades. The pressure to make the grid more efficient and reduce energy usage continues to increase. Modern microprocessor-based voltage regulators allow for the use of custom logic to manage voltage reduction schemes. Part of making the grid more efficient is managing a growing load base with limited generation available on the system. While voltage reduction schemes are generally considered to offer load reduction for limited periods of time, there is recent interest in using voltage reduction plans to reduce peak load.

SEL SOLUTION

The SEL-2431 Voltage Regulator Control can be configured for many custom applications using SELOGIC® control equations. The SELOGIC control equations offer the user the flexibility necessary to complete complex logic requirements, such as activating voltage reduction on a daily schedule.

Figure 1 shows an example of a timing diagram for a time-of-day voltage reduction scheme. In this example, the built-in logic is used to control a 24-hour on, 24-hour off cycle. The timing diagram shows that the voltage reduction scheme is in effect (VRIPROG is asserted) from midday Saturday to midday Sunday, off Sunday to Monday, on again midday Monday, and so on. This gives the utility an opportunity to evaluate the benefits of voltage reduction over longer periods of time. The built-in SELOGIC control equations can be used to define a voltage reduction scheme based on any timing or operational condition. SV03 and SV04 are timing variables used for the daily switching, and LT01 and LT02 are latch bits to track the week of a two-week cycle.

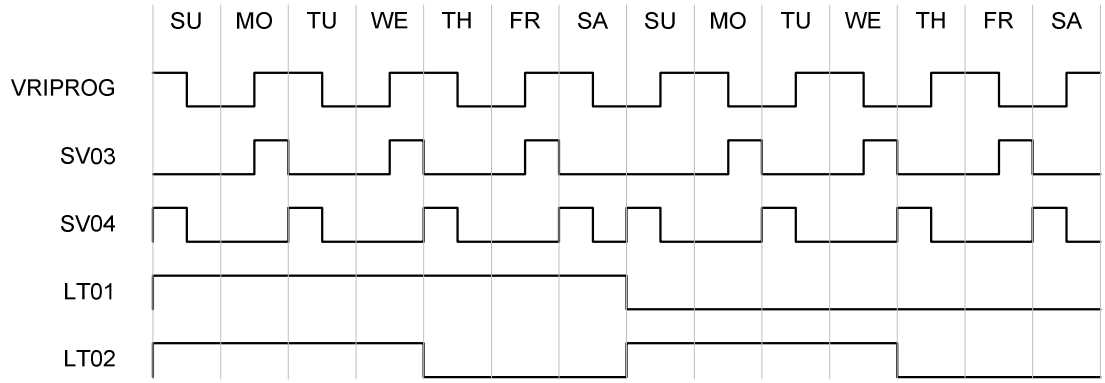

Figure 1 Example voltage reduction timing diagram

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