Implementing KYZ Outputs in SEL-700 and SEL-2400 Series Relays

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Introduction

Revenue meters frequently support a three-wire output in the form of a Form C contact. This contact is referred to as a KYZ output, and the contact terminals are frequently marked with these letters denoting the contact to which they are connected. KYZ contacts are used to drive external devices such as recording equipment or to provide an input to a supervisory control and data acquisition (SCADA) system. At a predetermined increment of energy or other quantity, the KYZ contact transitions, the closed contact opens, and the open contact closes. The contacts remain in these positions until the next transition.

Problem

Most microprocessor-based protective relays do not directly provide KYZ contacts and the internal programming to support the function. However, the relay may accept potential transformer inputs and internally calculate the quantities that could be used to drive a KYZ contact.

SEL Solution

The programming features in SEL relays, including SELOGIC® Boolean expressions with math variables and comparisons, provide the capability for custom applications such as the implementation of KYZ contacts.

This application note demonstrates the implementation of a MWh KYZ contact. This implementation can be expanded to any other analog quantity available in the SEL-700 and SEL-2400 series relays or any other SEL relay.

A MWh is an energy quantity. If a device draws 1 MW (power) for 1 hour, then the amount of energy consumed is 1 MWh. Energy may be calculated by summing power at a uniform time increment. In the SEL-700 and SEL-2400 series relays, math variables are processed every 100 milliseconds. Assume a device is drawing a constant 1 MW. If power is summed every 100 milliseconds for 1 hour, at the end of that hour, the sum will be 1 • 10 • 60 • 60 = 36,000. Therefore, when the sum equals 36,000, the device has consumed 1 MWh of energy. If the power consumed is a constant 0.5 MW, 1 MWh will be consumed in 2 hours. The sum will still be 36,000.

The following lines of code can be used to implement a KYZ function:

```
SV01PU = 0.00
SV01DO = 0.00
SV01 = NOT (MV01 >= 36000.00) AND NOT PB01
SV02PU = 0.00
SV02DO = 0.00
SV02 = (SV02 OR [NOT SV02 AND R_TRIG SV01]) AND NOT (SV02 AND R_TRIG SV01)
MV01 = (MV01 + P/1000.00) • SV01
OUT101 = SV02
OUT102 = NOT SV02
```

Three-phase real power (*P*) is summed in math variable MV01. *P* is divided by 1,000 to change the units from primary kW to primary MW. This calculation occurs only when SV01 is asserted. If SV01 deasserts, MV01 evaluates to zero, which is a simple reset.

As long as MV01 is not greater than or equal to 36,000, SV01 will be asserted. When MV01 is greater than or equal to 36,000, SV01 deasserts, and MV01 is driven to zero. At this point, SV01 reasserts, and summations in MV01 restart, beginning from zero. PB01 is included in the SV01 logic to provide an external reset. This reset may be deleted or replaced with other logic designed by the user.

SV01 is also used in the latch built around SV02. SV02 is a latch that toggles between logical 0 and logical 1 each time SV01 asserts. In the above logic, SV01 asserts at 1 MWh and causes SV02 to toggle. SV02 is used to drive two output contacts—the KYZ contacts.

This logic can be modified and expanded to provide KYZ contacts for other quantities, such as MVARh, MVAh, IN versus OUT, etc.

This method is reasonably accurate and should be acceptable in applications where load does not rapidly vary and revenue-grade accuracy is not required.

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