

TechTopics No. 43

Interposing relay requirements

Remote control of circuit breakers is becoming much more prevalent as the use of monitoring and central control equipment grows. When remote control is used, interposing relays are generally required to avoid a large voltage drop in the close and trip coil circuits. Here are a few thoughts on the proper selection of interposing relays.

Current ratings

Interposing relay contacts used in close and trip circuits must have the ability to make and carry the current of the close and trip coils. For our type GMSG circuit breakers, the control current data is as follows:

The interposing relay contact is directly analogous to a tripping output contact on a protective relay, so it is instructive to review the requirements of ANSI/IEEE C37.90 for tripping output contacts of protective relays.

A few salient points extracted from ANSI/IEEE C37.90 are:

■ 5.7.1 Tripping output performance requirements:

“Tripping output circuits shall meet the following specification for performance: The contacts or output circuit shall make and carry 30 A for at least 2000 operations in a duty cycle... The load shall be resistive for both dc and ac and the current shall be interrupted by independent means...”

■ 5.7.2 Continuous and interrupting ratings of tripping output circuits:

“Tripping output contacts intended by the manufacturer to be for tripping duty only shall be identified as such and may have no continuous or interrupting duty...”

The requirement in ANSI/IEEE C37.90 for a making capability of 30 A is appropriate for older design circuit breakers. However, the operating currents of modern circuit breakers are often much lower than those of the historic designs, as indicated in the table for the type GMSG circuit breaker above.

Nominal rated control voltage	Control voltage and current			
	Control voltage range		Close coil current (A)	Trip coil current (A)
	Close	Trip		
48 Vdc	38-56	28-56	2.9	11.4/30 ¹
125 Vdc	100-140	70-140	1.0	4.8/7.4 ¹
250 Vdc	200-280	140-280	0.5	2.1/4.2 ¹
120 Vac	104-127	104-127	0.9	---
240 Vac	208-254	208-254	0.4	---

Footnote:

¹ First value is for five-cycle (83 ms) rated interrupting time, second value is for three-cycle (50 ms) rated interrupting time.

The philosophy embodied in ANSI/IEEE C37.90 is appropriate for the application to tripping of circuit breakers, and similar logic applies to application of interposing relays in closing circuits. The interposing relay has to have a making capability, but does not have to have a significant interrupting capacity. This is so because the close and trip coil currents are interrupted by the “a” or “b” switch contacts on the circuit breaker.

Therefore, the interposing relay should be able to make the current of the close or trip coil of the circuit breaker. The contacts also need to be able to carry the current for the time necessary for circuit breaker operation, but this is not a severe requirement. The duration of the closing or tripping current with modern circuit breakers is several tens of milliseconds, so the relay is not required to carry the current for a long time. The interposing relay contacts do not need to be able to interrupt the coil currents.

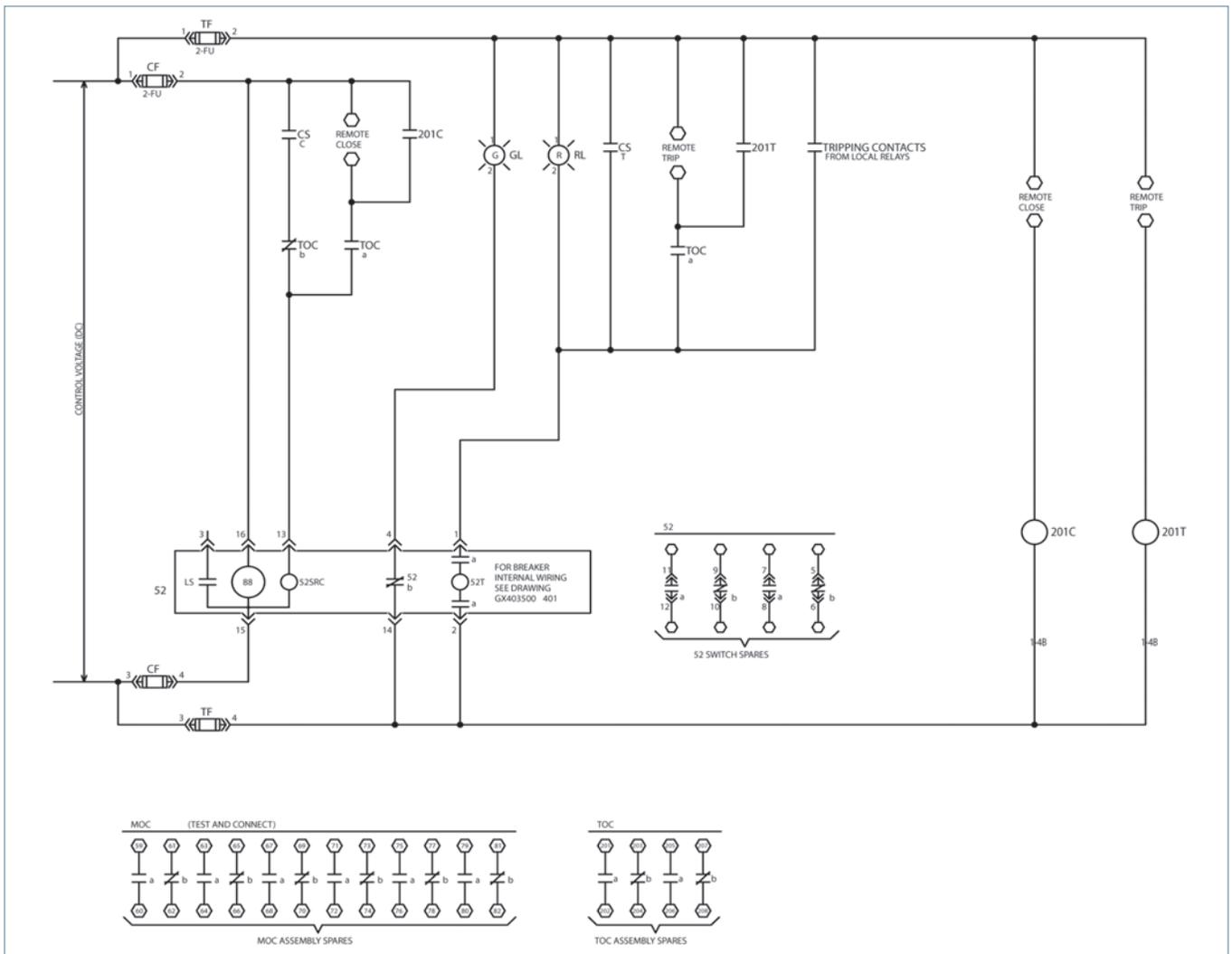
Typical interposing relays

A wide variety of relays are suitable for use in interposing relay applications. The most extensively-used relays over the decades are the GE type HFA and Westinghouse (ABB) type SG relays. These are older designs, and take somewhat more space than newer relays, but have a long record of success. More recently, a number of smaller relays have been used for interposing applications. Among these are relays from Potter & Brumfield (KRP), Struthers & Dunn (219) and even some of the miniature (“ice cube”) relays from several suppliers. Any of these relays are suitable provided they meet the voltage and current requirements of the application.

Typical control scheme

The basic elements of typical controls are shown in the schematic diagram. A few observations on the control scheme:

- Interposing relays are connected to the same control voltage supply as is used for the circuit breaker. Many contacts used to initiate remote closing or tripping, particularly PLC contacts, cannot handle the higher control voltages (e.g., 125 Vdc) used in the circuit breaker control scheme. In such cases, the interposing relay coil should be connected to the lower control voltage of the PLC (typically, 24 Vdc), and actuated by the contact from the PLC. The interposing relay output contact should be connected in the circuit breaker control circuit.
- Interposing relay contacts must provide a signal duration of at least 50 ms. Latched-type relays must not be used. Maintained contacts must never be used to actuate a circuit breaker close or trip circuit.
- The interposing relay coil should have a very low operating current, to minimize voltage drop in the control circuit from the remote actuating contact to the interposing relay coil.
- The minimum pickup voltage for the interposing relay must be compatible with the minimum control voltage specified in ANSI/IEEE standards for the switchgear. For dc tripping circuits, the control voltage range in ANSI/IEEE C37.06 is 56 percent to 112 percent of the rated voltage. For example, the range for 125 Vdc circuits is 70 to 140 Vdc. In contrast, the control voltage range given in ANSI/IEEE C37.90 for protective relays is 80 percent to 112 percent of rated voltage, or 100 to 140 Vdc for our example.
- In this scheme, the circuit includes truck-operated cell (TOC) contacts responsive to the position of the circuit breaker in the cell. These contacts are used to make the local control switch close contact (CS/C) operative only in the TEST position. The local control switch trip contact (CS/T) is operative in both the TEST and CONNECTED position. The TOC contacts are used to make the remote control contacts (201T and 201C) operative only in the CONNECTED position. Most users prefer that remote control contacts be operative only in the CONNECTED position. User preferences are less pronounced regarding local control circuits, with some users desiring that local circuits be operable only in the TEST position, and others desiring that local control circuits be operable in both CONNECTED and TEST positions.



Symbols	
52/a	Aux switch (open when CB open)
52/b	Aux switch (closed when CB open)
52SRC	Close coil
52T	Trip coil
CS/C	Control switch (local) close contact
CS/T	Control switch (local) trip contact
RL	Red indicating lamp
GL	Green indicating lamp
201C	Interposing relay, close
201T	Interposing relay, trip
TOC/a	Truck operated cell switch, closed when CB in connected position
TOC/b	Truck operated cell switch, open when CB in connected position
LS	Limit switch (spring charged)

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