

TechTopics Topic: 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 GMI circuit breakers, the control current data is as follows:

Control Voltage (ANSI C37.06) and Current				
Nominal Rated Control Voltage	Control Voltage Range		Close Coil Current (A)	Trip Coil Current (A)
	Close	Trip		
48 Vdc	38-56	28-56	10	10
125 Vdc	100-140	70-140	4	4
250 Vdc	200-280	140-280	3	3
120 Vac	104-127	104-127	4	---
240 Vac	208-254	208-254	3	---

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 relays. A few salient points extracted from the latest draft (D14) of PC37.90 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 as described below. 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 C37.90 for a making capability of 30A is appropriate for older design circuit breakers. However, the operating currents of modern circuit breakers are much lower than those of the historic designs, as indicated in the table for the type GMI circuit breaker above.

The philosophy embodied in 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

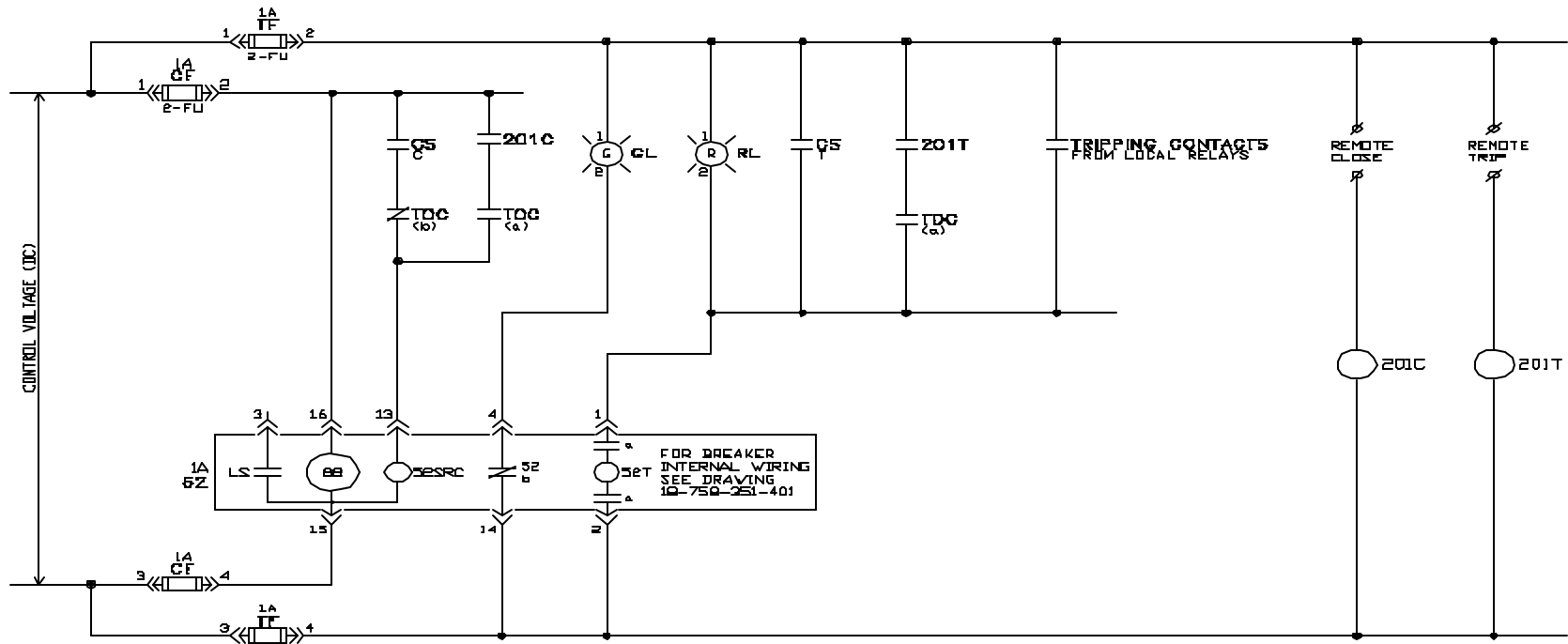
A wide range of relays are suitable for use in interposing relay applications. The most extensively used relays over the decades are the GE type HFA and Westinghouse (ABB) type SG relays. These are ancient designs, and take somewhat more space than newer relays, but have a long record of success. More recently, a number of smaller relays have been used for interposing applications. Among these are relays from Potter & Brumfield (e.g., KRP), Struthers & Dunn (e.g., type 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 relays contacts must provide a signal duration of at least 50ms. 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 C37.06 is 56-112% of the rated voltage. For example, the range for 125Vdc circuits is 70-140Vdc. In contrast, the control voltage range given in ANSI/IEEE C37.90 for relays is 80-112% of rated voltage, or 100-140Vdc for our example.
- In this scheme, the circuit includes TOC (Truck Operated Cell) 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.

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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)