Delayed Auto-Reclosing On EHV Systems

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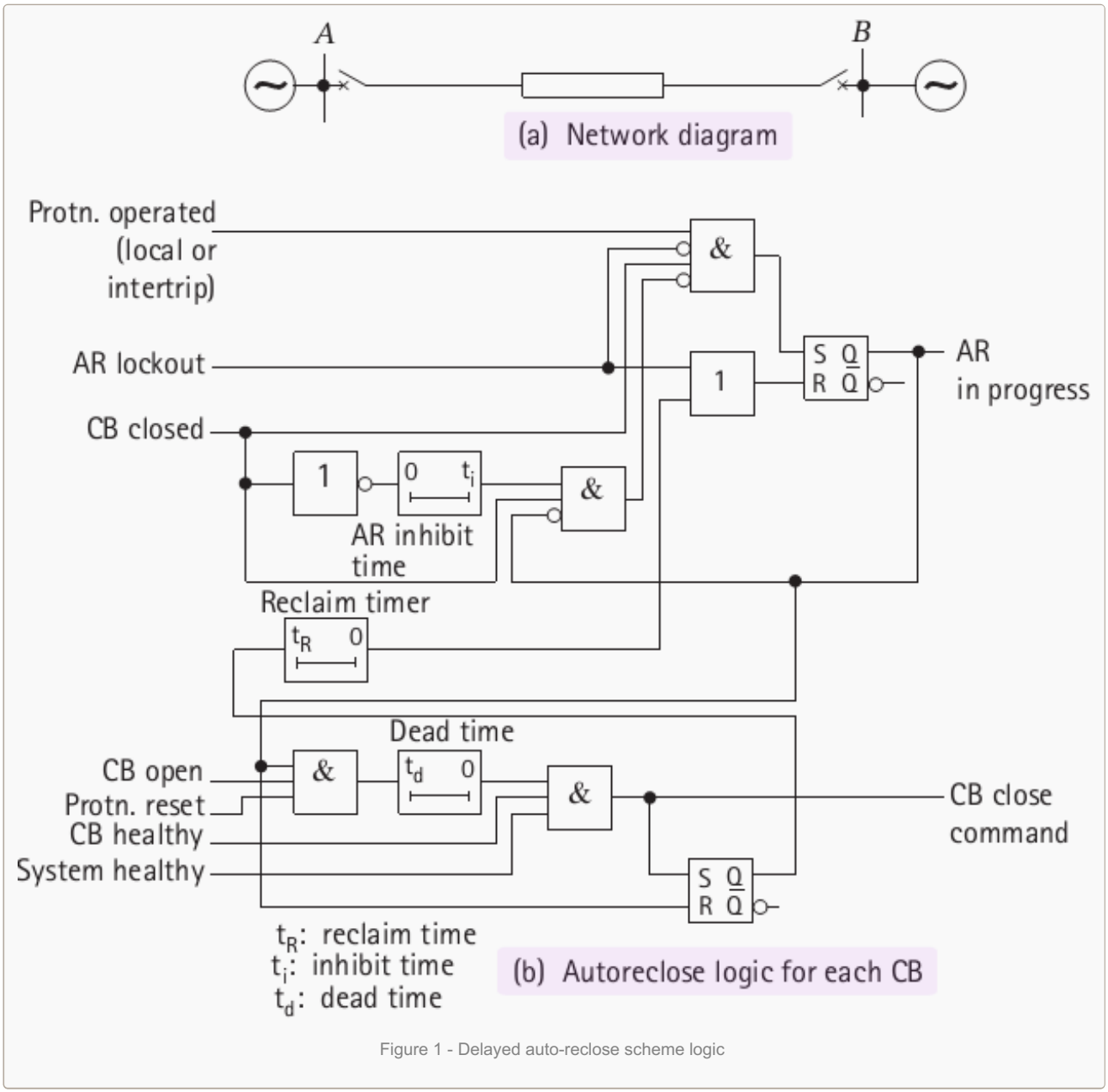

Figure 1 - Delayed auto-reclose scheme logic

highly interconnected transmission systems, where the loss of a single line is unlikely to cause two sections of the system to drift apart significantly and lose synchronism, ***delayed auto-reclosing*** can be employed.

*Dead times of the order of **5s-60s** are commonly used.*

No problems are presented by fault arc de-ionisation times and circuit breaker operating characteristics, and power swings on the system decay before reclosing. In addition, all tripping and reclose schemes can be three-phase only, simplifying control circuits in comparison with single-phase schemes.

In systems on which delayed auto-reclosing is permissible, the chances of a reclosure being successful are somewhat greater with delayed reclosing than would be the case with high-speed reclosing.

Scheme Operation

The sequence of operations of a delayed auto-reclose scheme can be best understood by reference to ***Figure 1***. This shows a transmission line connecting two substations ***A*** and ***B***, with the circuit beakers at Aand B tripping ou in the event of a line fault.

Synchronism is unlikely to be lost in a system that employs ***delayed auto-reclose***.

However, the transfer of power through the remaining tie-lines on the system could result in the development of ar excessive phase difference between the voltages at points ***A*** and ***B***. The result, if reclosure takes place, is an unacceptable shock to the system.

It is therefore usual practice to incorporate a synchronism check relay into the reclosing system to determine whether auto-reclosing should take place.

After tripping on a fault, it is normal procedure to reclose the breaker at one end first, a process known as '***live bus/dead line charging***'. Reclosing at the other and is then under the control of a synchronism check relay element for what is known as '***live bus/live line reclosing***'.

Example

For example, if it were decided to charge the line initially from ***station A***, the dead time in the auto-reclose relay at ***A*** would be set at, say, ***5 seconds***, while the corresponding timer in the auto-reclose relay at ***B*** would be set at, say, ***15 seconds***. The circuit beaker at ***A*** would then reclose after ***5 seconds*** provided that voltage monitoring relays at ***A*** indicated that the busbars were alive and the line dead.

With the line recharged, the circuit breaker at ***B*** would then reclose with a synchronism check, after a ***2 second*** delay imposed by the synchronism check relay element.

If for any reason the line fails to '***dead line charge'*** from end ***A***, reclosure from end ***B*** would take place after ***15 seconds***. The circuit breaker at ***A*** would then be given the opportunity to reclose with a synchronism check.

Synchronism Check Relays

The synchronism check relay element commonly provides a three-fold check:

1. Phase angle difference
2. Voltage
3. Frequency difference

The phase angle setting is usually set to between ***20° - 45°***, and reclosure is inhibited if the phase difference exceeds this value. The scheme waits for a reclosing opportunity with the phase angle within the set value, but locks out if reclosure does not occur within a defined period, ***typically 5s***.

A voltage check is incorporated to prevent reclosure under various circumstances. A number of different modes may be available. These are typically undervoltage on either of the two measured voltages, differential voltage, or both of these conditions.

The logic also incorporates a frequency difference check, either by direct measurement or by using a timer in conjunction with the phase angle check. In the latter case, if a 2 second timer is employed, the logic gives an output only if the phase difference does not exceed the phase angle setting over a period of 2 seconds. This limits the frequency difference (*in the case of a phase angle setting of 20°*) to a maximum of 0.11% of 50Hz, corresponding to a phase swing from ***+20° to -20°*** over the measured 2 seconds.

While a significant frequency difference is unlikely to arise during a delayed auto-reclose sequence, the time available allows this check to be carried out as an additional safeguard.

As well as '***live bus/dead line***' and '***live bus/live line***' reclosing, sometimes '***live line/dead bus***' reclosing may need to be implemented. A numerical relay will typically allow any combination of these modes to be implemented. The voltage settings for distinguishing between '***live***' and '***dead***' conditions must be carefully chosen.

In addition, the locations of the VT's must be known and checked so that the correct voltage signals are connected to the '***line***' and '***bus***' inputs.

Reference: *Network Protection & Automation – Areva*

Source: http://electrical-engineering-portal.com/delayed-auto-reclosing-on-ehv-systems