

**Substation Automation and Protection Division**

**Multiple Breaker 52b Contact Inputs to REL301/2 Relays**

**Introduction**

Often times transmission substations are configured in ring bus or breaker and one half schemes. Relays protecting the transmission line need status information from multiple breakers to determine if the breakers are open or closed. In earlier versions of REL301/2 relays, only one 52a and 52b status input is available on the relay.

The question is how does one connect the 52a and 52b contacts from multiple breakers to one set of inputs on the relay?

**52b inputs to Protection functions**

*Protection functions:*

52b contact is used as an input, which indicates breaker status (position) to the relay logic. The REL301/2 relays use the 52b contacts in the following protection logic functions:

1. **Loss of Potential Logic (LOP)** The LOP function is turned off if the breaker is open.
2. **Close Into Fault Trip logic (CIFT)** A breaker just closed enables this function for 100 msec.
3. **Unequal Pole Closing** A 20 msec. window after the breaker has been closed allows unequal pole closing detection.
4. **Load Loss Accelerated Trip (LLT)** A breaker is closed and one of the phase currents is below a low current setting invokes this function.
5. Various **pilot schemes** use the breaker position in the logic to indicate status of the local terminal.
6. **Weak Feed Logic** A closed breaker and low voltage invokes this logic.

In the above applications it's important to know that status of both breakers. More specifically, it's important to know that **both** breakers are open. The 52b contacts are both closed. Therefore, connect the 52b contacts from both breakers in series (Refer to binary input TB4-5, TB4-6 of Figure-1 below) As such the protection functions do not look for 52a status and hence 52a status need not be wired for pure protection purposes.

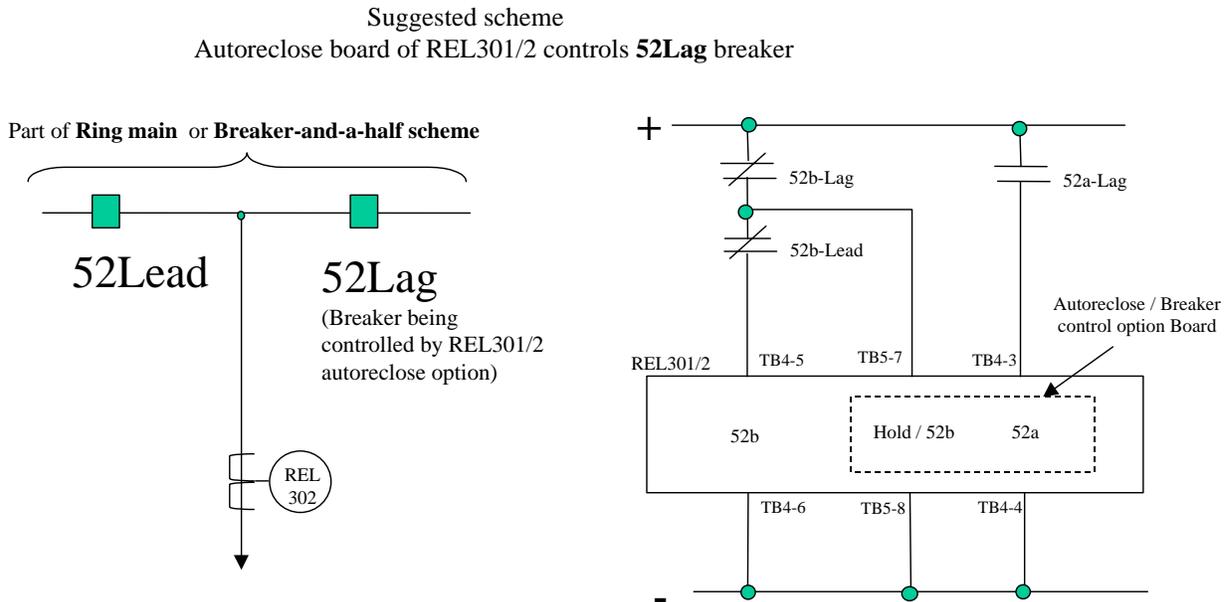


Figure 1. REL301/2 Reclosing Control of one of the Ring-bus Circuit Breakers.

**52b Inputs to Autoreclose function:**

It is possible to order an additional autoreclose board in REL301/2 relays. The autoreclose board caters to a single breaker control, synchro check, autoreclose etc. When single breaker applications are involved, by default, the internal autoreclose logic reads the same 52b input as used for protection above. However in double breaker applications, it is obvious that the binary input with series connection of both 52b breaker status contacts for reasons explained above for protection purposes, cannot be used for reclosing purposes. The reclosing logic needs the status of breaker whichever it is reclosing as an independent binary input.

The autoreclose firmware V1.27 of REL301/2 addresses this issue. The HOLD input can be alternatively used for this function, selected through a setting **Hold / 52b**. So for double breaker applications, select this setting to 52b and wire the 52b status of the breaker being controlled to Hold binary input. The limitation is that Hold input can no longer be used in such schemes.

The 52a contact is used as another optional input to the reclosing function to indicate there was a change in both the 52b and 52a contacts in the breaker. If there wasn't a change in both, then the reclosing relay locks out the breaker. Wire the 52a status contact of the breaker being controlled to the existing 52a input of the relay. (Please refer to Figure-1, page-1)

**Application considerations:**

Once it is understood that autoreclose board in REL301/2 can still be used to control one of the breakers, the next natural question is how to control two breakers with only one autoreclose scheme in REL301/2. The solutions are varied depending on the type of bus system as follows:

1. In case one uses Main-1 / Main-2 REL301/2 relays, the autoreclose scheme of the first relay can be used for controlling the first breaker and the autoreclose of the second protection can be used to control the second breaker. This scheme is applicable for ring main or breaker-and-a-half schemes equally. The autoreclose logic of REL301/2 is represented as 79+25 since synchrocheck is an additional option with autoreclose.

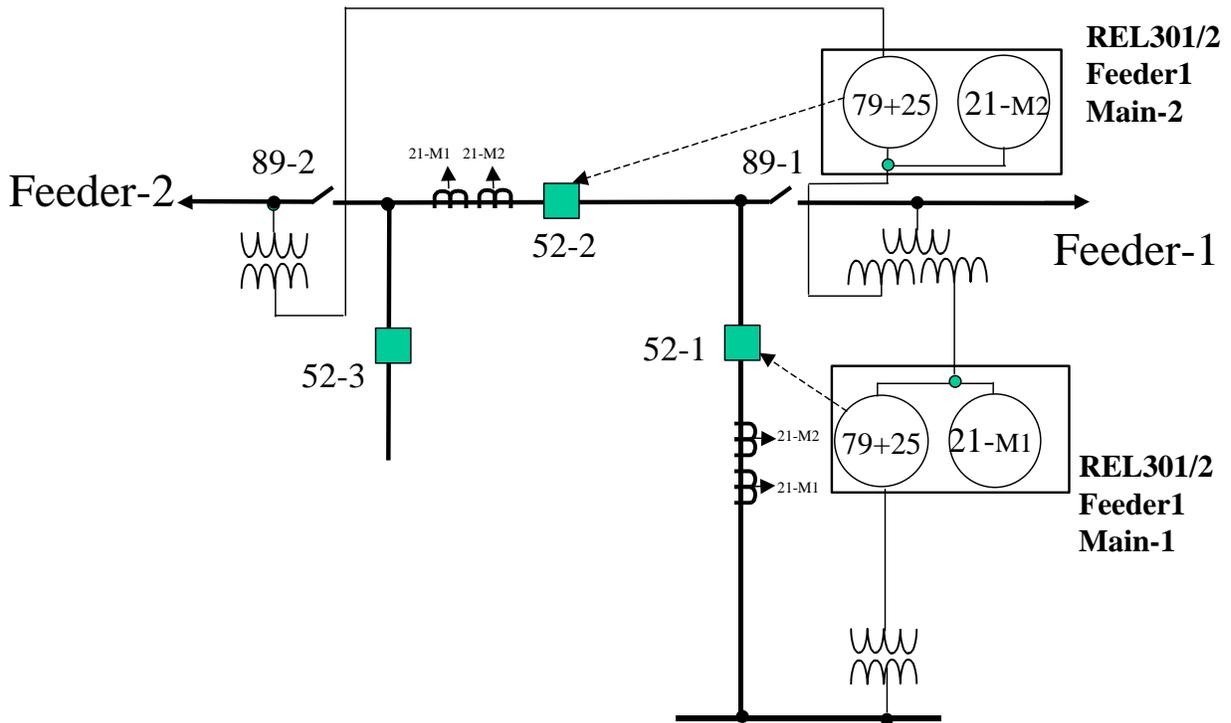


Figure 2. Main1/Main2 relays controlling two breaker autoreclose in Breaker-and-a-half or ring bus

2. There are transmission lines with one main distance protection and with OC backup.
- a. In ring main stations, it is still possible to use the reclose schemes of the Main protection in a cyclic fashion as shown in Figure-3. Additional inputs such as Reclose Initiate need to be wired from the other feeder relay into the autoreclose relay. In case there is a transformer in the ring, its protection will not have autoreclose. One solution is to add a dedicated autoreclose relay for the breaker on one side of the transformer breaker.

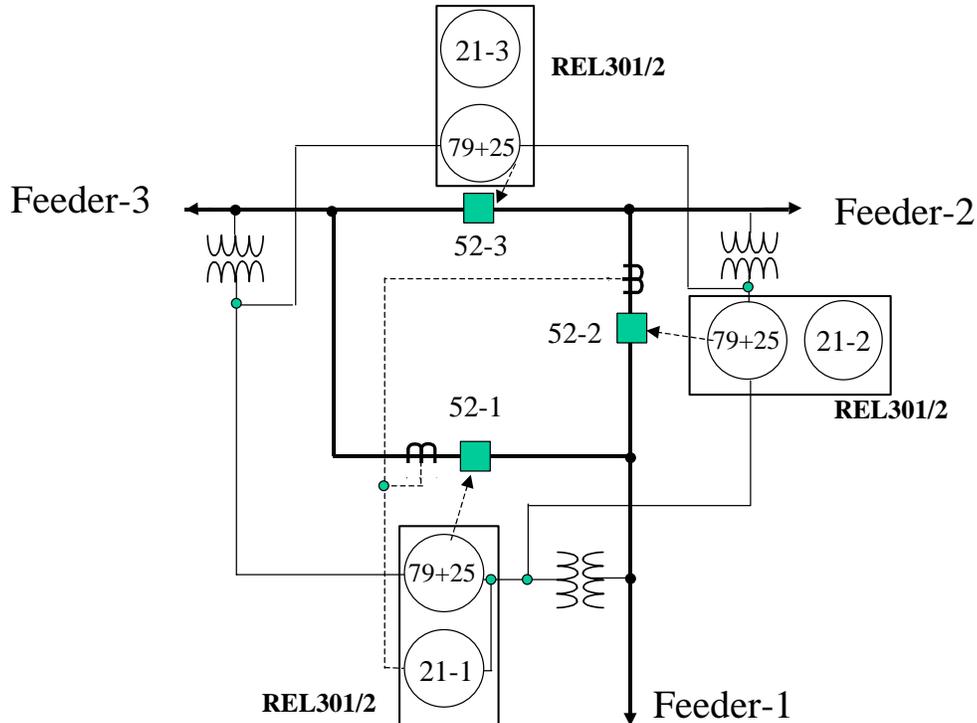


Figure 3. REL301/2 Reclosing Control of Ring-bus Circuit Breakers.

- b. In breaker-and-a-half schemes the bus breakers get autoreclose schemes from respective line REL301/2. The middle breaker needs to have a dedicated reclose relay in such a case. Often the middle breaker is manually closed after successful restoration of supply to the line from the bus, obviating the need for a reclose relay. This is of course at the cost of no autoreclose on the line when the bus breaker is taken out for maintenance. However, the overwhelming simplicity of such schemes is usually considered consistent with lines that need only one main distance protection.

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