Application Note

SVERKER 900

Application for testing automatic reclosing

Why do we have auto reclose system

Auto-reclosers shorted “AR” are most commonly found in overhead air insulated power lines and they are useful because, in such networks, only around 7% of faults are permanent. In fact, most of the faults – around 80% – are transient, caused by events like lightning strikes and arcing, and will disappear in less than a second if the power line is de-energized. The remaining 13% of faults are semi-permanent and are typically caused by animals or branches bridging the power lines. Even these faults, however, usually burn away and clear in a relatively short time.

A lot of unnecessary time will be lost if the protection scheme simply isolates the section of a network where a fault occurs and then waits for someone to go out into the field, check the fault status and close the breaker. A much more effective strategy is to isolate the affected part of the network and then, after a short delay, re-energise it to determine whether the fault has cleared. If it has, the network can operate normally but if it hasn’t, the affected area can once again be isolated.

This isolation followed by re-energisation process is exactly what the protection relay together with the auto-recloser do. In principle the auto recloser is a simple device. Essentially, it receives a start signal from the protection relays, and after the breaker has tripped the “AR” system sends a closing order to the breaker after a predefined time (also called **“Dead Time”**)

The ANSI standard device number for the controller is 79. The IEC 61850 name for auto recloser Logical Node is RREC.

The function of auto reclose system

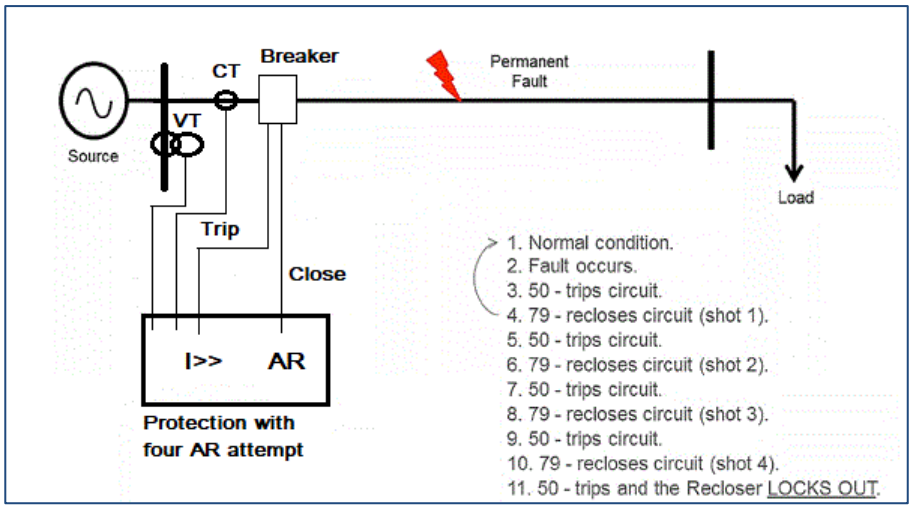
High Voltage lines are often characterized by only one or 2 auto reclose attempts. Medium Voltage systems may have more reclose attempts, also six sometimes, depending on the competence and strategy of the system operator.

The auto recloser may have additionally checks implemented to reclose the breaker. For example, the auto recloser does not continue with next reclose attempt if the signal “CB Ready” has not been received. When the breaker is closed manually or by order from control center the AR system does not go into “System ready” until a predefined time has passed (typically 5 seconds). This to avoid a reclose with the circuit breaker on a probable permanent fault.

There can be more information needed to get “circuit breaker ready” to AR. Some breaker can do OCO; Open-Close-Open sequence and then a spring has to be charged that signal “Spring-Charged” is needed for AR to do the second reclose. If the breaker is gas insulated the signal for normal gas level is also needed.

This advanced behaviour of the auto recloser can be tested by using the Binary Output of the Sverker 900, to simulate the “CB position” this gives the information “circuit breaker ready” to the protection. The signals for “Spring-Charged” or “Normal gas level” can be connected to BI and have to be fulfilled before going to next “State” in the sequence.

Application for testing automatic reclosing



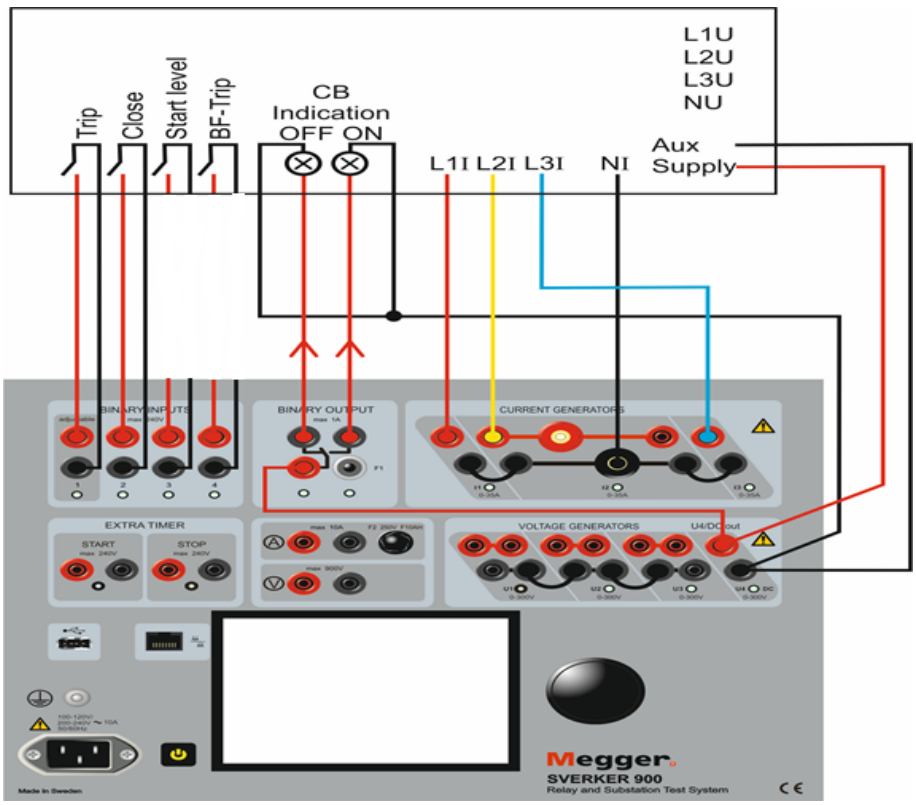
The above picture shows the operating principle of an auto-recloser sequence: when a fault is detected, the breaker trips and auto recloser is started. The "AR" system then waits for a predefined time before reclosing the breaker. If all is well, the breaker stays closed (the fault was a non-permanent fault and the de-energisation of the line was enough to eliminate it), if not the protection relay will trip again, and the AR sequence will make a second reclose attempt.

If the fault is still there the sequence makes two more reclosing attempt before going into lock out and indicating "Final trip".

Testing auto reclose system with Sequential Instrument

Connect relay to SVERKER 900 as below picture shows

Sepam S84



Application Note

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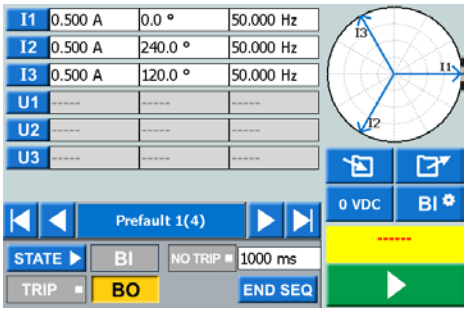
This test is made with Sepam S84 relay connected but is applicable on any AR system.
The start for AR has to be taken from the trip of the overcurrent protection function set to IDMT (constant) time. In this example all states are set to generate three phase current but the relay can also be tested phase by phase. BI.1 and BI.2 is activated in all state dry contact closing.

Protection setting: I>=1A , t>=1s Auto reclose times are t1= 500ms, t2= 2s , t3= 4s

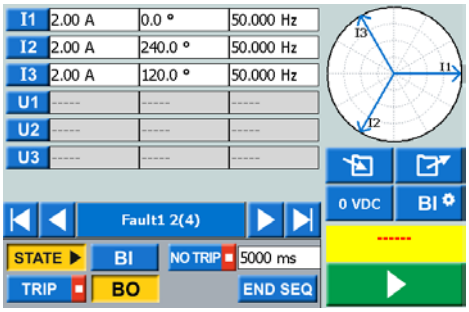
If position of breaker is needed use “Binary output” and set “BO” to “ON” (orange) right position in “Prefault” state all “Fault” states and “No fault” state.
Set “BO” to “OFF” (blue) left position for all “Reclose” states.
Auxiliary supply is connected if needed.

Step 1: Make four basic state setting, Pre fault / Fault / Reclose / No Fault.

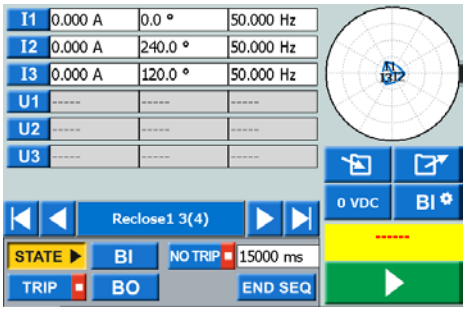
Pre fault



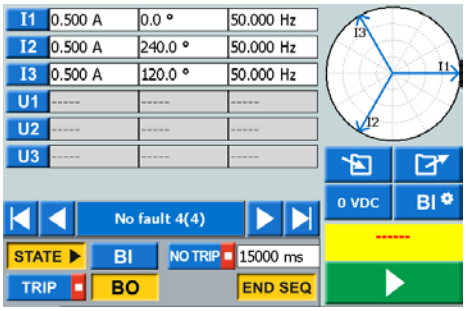
Fault



Reclose



No fault



The above sequence makes 1fault, 1reclose then no fault, back to normal.

To make more reclose cycles in one sequence we just copy state2 “Fault” and state3 “Reclose”.

By copy “state2” into state 4 and 6 and “state3” into state 5 and 7 we get one AR test for 3 reclose and then “cleared fault” .

Copy state 2 into state 4 and 6, select state 2 and push on name field and then on

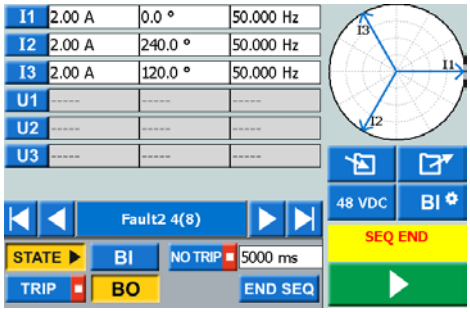
 Select state 4 and push name field and then on  to past state 2 into state 4

Copy state 4 select state 6 and repeat above. Rename state 4 and 6 to “Fault 2” and “Fault 3”.

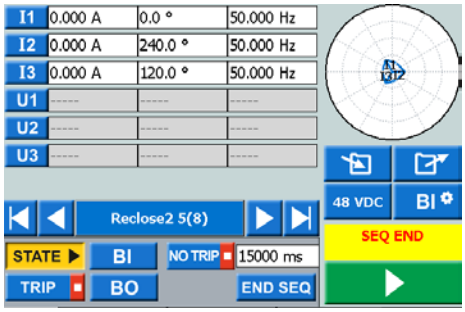
Make the same for state 3 into state 5 and 7 rename to Reclose 2 and 3.

Now you have four more state Fault 2 and 3, Reclose 2 and 3 see picture below.

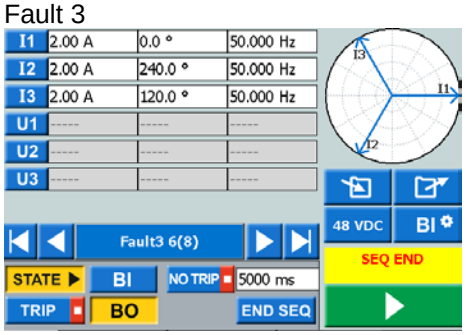
Fault 2



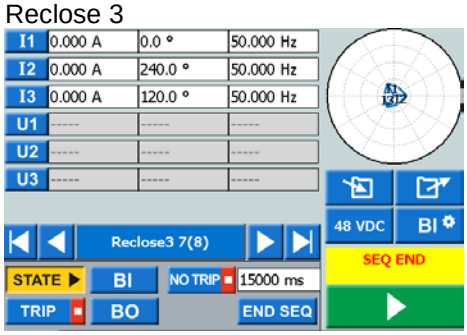
Reclose 2



Fault 3



Reclose 3



Result from SVERKER three reclose times.

#	I1: A	I2: A	I3: A	BI	Time...	BO
1	0.500	0.500	0.500		1000	1
2	2.000	2.000	2.000	1	1010	1
3	0.000	0.000	0.000	2	537	0
4	2.000	2.000	2.000	1	1010	1
5	0.000	0.000	0.000	2	2035	0
6	2.000	2.000	2.000	1	1011	1
7	0.000	0.000	0.000	2	4036	0
8	0.500	0.500	0.500		15000	1
Σt -S1					24639	
Σt					25639	

Result from relay protection

Message	Information
CLEARED FAULT	
CYCLE 3	Phase fault
PHASE FAULT	Phases 1, 2, 3
CYCLE 2	Phase fault
PHASE FAULT	Phases 1, 2, 3
CYCLE 1	Phase fault
PHASE FAULT	Phases 1, 2, 3

Repeat the same to get more AR if needed, do not forget to set maximum trip time in fault state above maximum trip time in your relays and reclose state time above maximum reclose time set in your relays. Save test and use as default.

For more information about “Sequence Instrument” and “Saving” procedure see chapter 4.6 and 4.9 in SVERKER 900 “User manual”