APPLICATION NOTE

Testing G59-3 protection with SVERKER 900

1. Tests included: Pickup, Timing and Stability

Protection type to be tested	Protection setting
Vector shift	6 Degree
ROCOF	0,2Hz/s
Under voltage	95% & 90% of 63,5V
Over voltage	105% & 110% of 63,5V
Under frequency	48Hz & 46Hz
Over frequency	52Hz & 54Hz

Preparations

Make four basic tests and save in one test file called pickup test.
Use start signal in protection or other indication for pickup.

Make two basic tests and save in one test file called timing test.
Use trip signal from protection for time measurement.

Use same basic tests as in timing and save in one test file called stability test.

Each test has to be saved separately and then opened in same instrument.
BI has to be set in each instrument used.

Pickup tests made in ramp instrument, manually changes are needed.

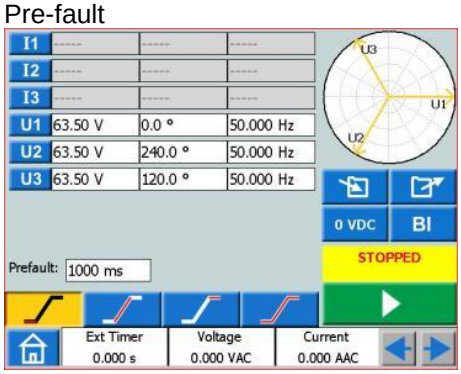
Test files	Ramp speed	Stop value	
	Phase L1/L2/L3	Phase L1/L2/L3	
Vector shift	0,2Δ°/s	10°/250°/130°	Leading angle
	-0,2Δ°/s	350°/230°/110°	Lagging angle
ROCOF	0,21ΔHz/s	51Hz/49Hz	Incr./Decr.
ROCOF (timing)	0,25ΔHz/s	51Hz/49Hz	Incr./Decr.
Voltage	0,20ΔV/s	55V/75V	Under/Over.
Frequency	0,20ΔHz/s	45Hz/55Hz	Under/Over

Tests made in sequence instrument. Timing & Stability

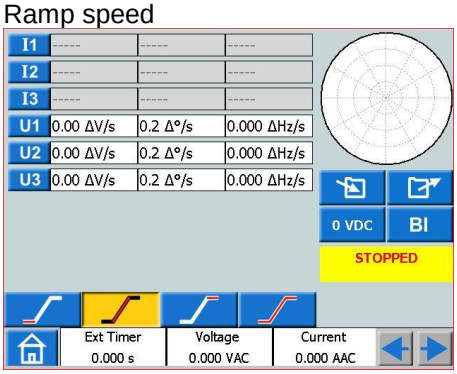
Test files	Pre fault value	Fault value	
	Phase L1/L2/L3	Phase L1/L2/L3	
Vector shift	0º/240º/120º	10º/250º/130º	Leading angle
	0º/240º/120º	350º/240º/120º	Lagging angle
Voltage	63,5V	58V/55V	Under voltage
	63,5V	68V/72V	Over voltage
Frequency	50Hz	47Hz/45Hz	Under Freq

Pickup test - Vector shift leading angle (3phase)
Make one pickup test for leading angle in the ramp instrument.

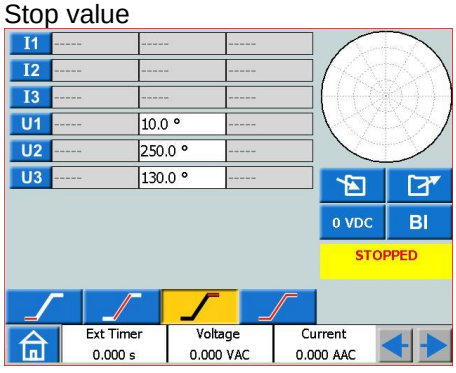
Pre-fault



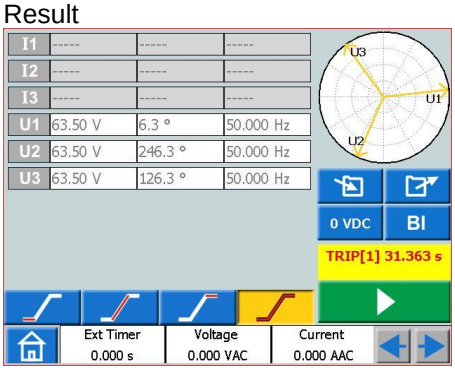
Ramp speed



Stop value

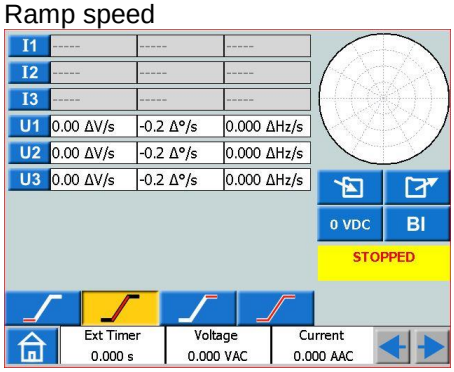


Result

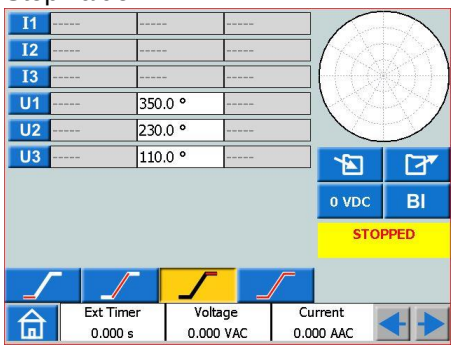


Pickup test -Vector shift lagging angle (3phase)
Use same test as for leading angle but change ramp speed and stop value.

Ramp speed

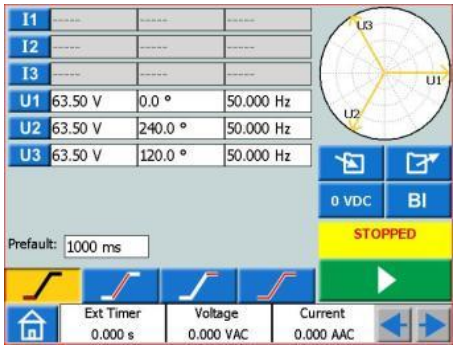


Stop value

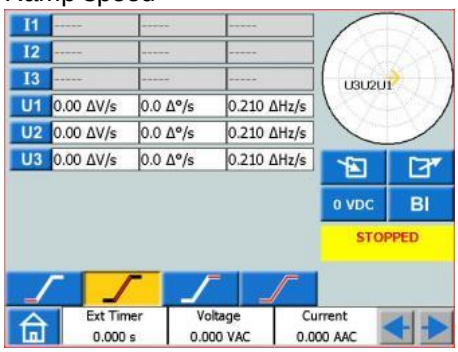


Pickup test - ROCOF increasing Hz (3-phase)
Make one pickup test for increasing frequency in the ramp instrument.

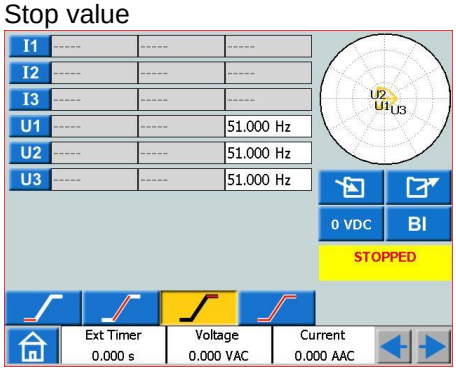
Pre-fault



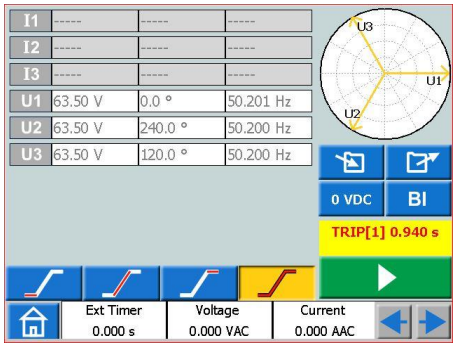
Ramp speed



Stop value



Result

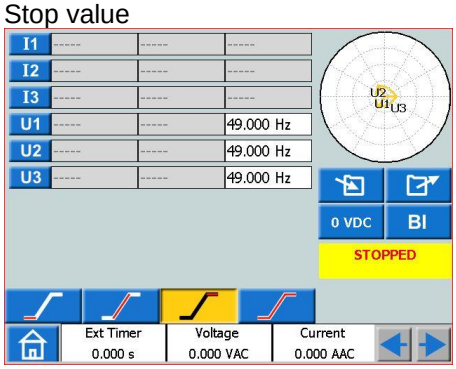


(Block under voltage protection when testing ROCOF)

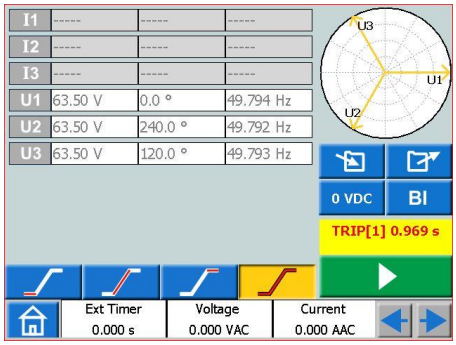
Pickup test -ROCOF decreasing Hz

Use same test as for increasing frequency but change stop value.

Stop value



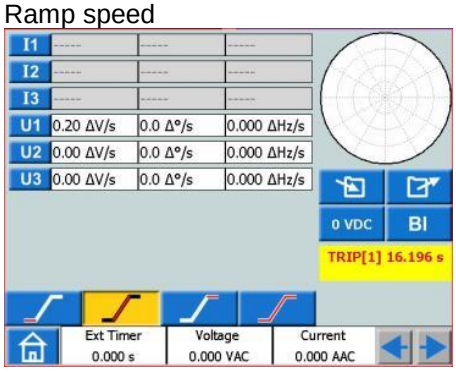
Result



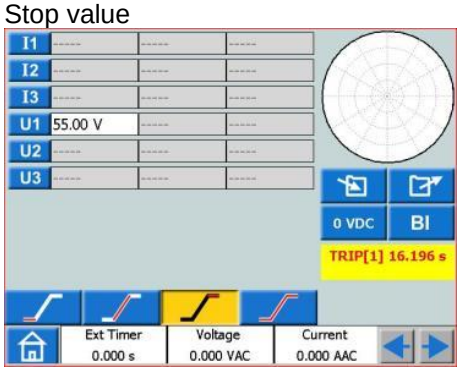
Pickup test - Under voltage

Make one pickup test for phase U1 in ramp instrument use same prefault as in tests above. Use same test and change for U2 and U3.

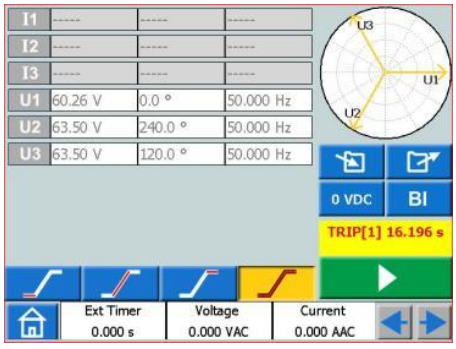
Ramp speed



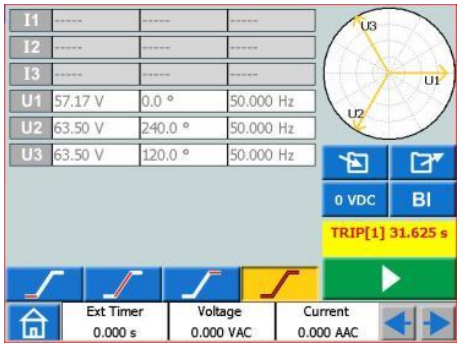
Stop value



Level 1 Result



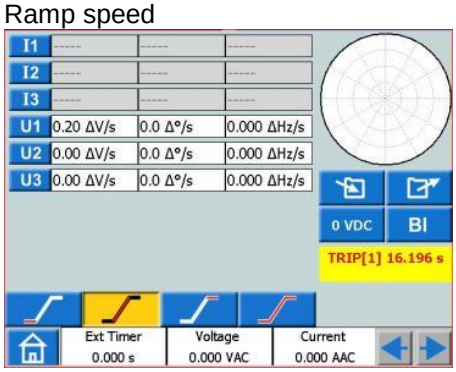
Level 2 Result



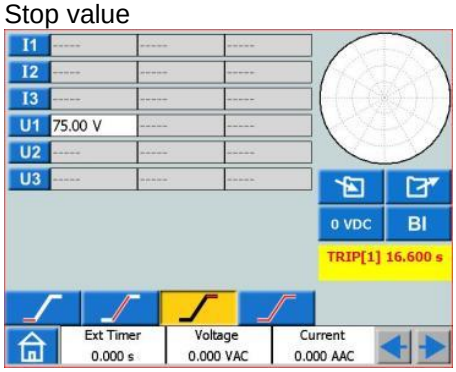
(Block level 1 in protection when checking level 2)

Pickup test -Over voltage
Use the same test as for under voltage and change stop value for phase U1, U2 and U3.

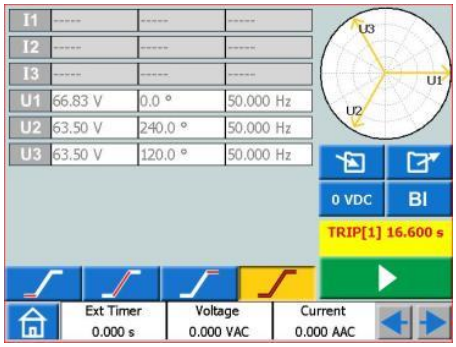
Ramp speed



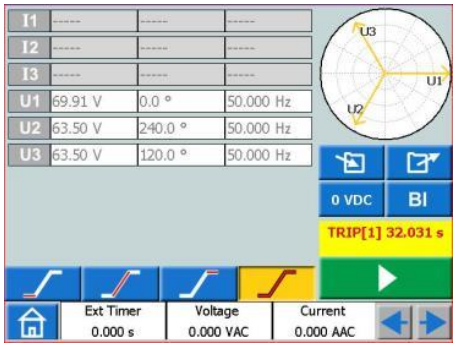
Stop value



Level 1 Result



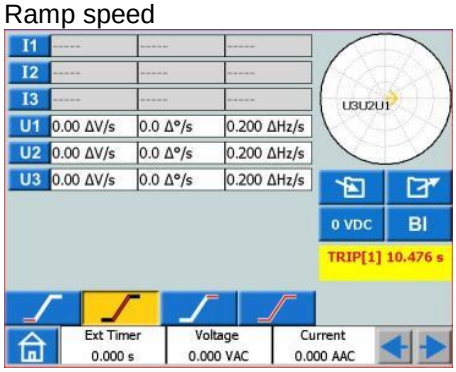
Level 2 Result



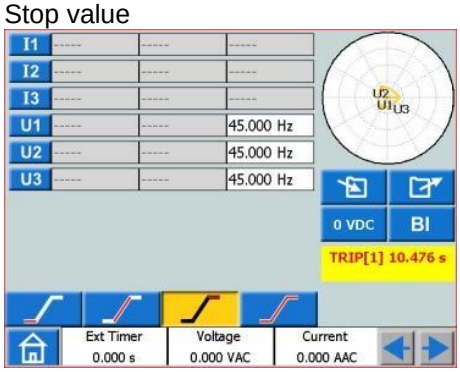
(Block level 1 in protection when checking level 2).

Pickup test -Under frequency (3-phase)
Make one pickup test.in ramp instrument use same prefault as in tests above.

Ramp speed

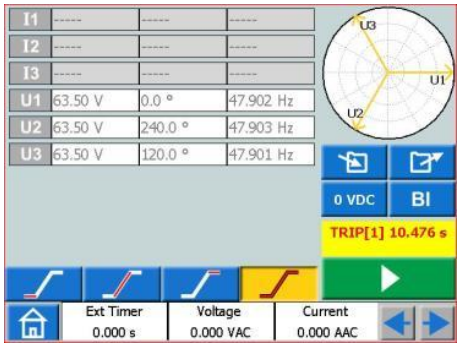


Stop value

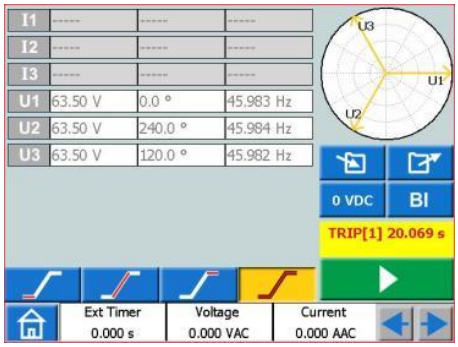


Megger

Level 1 result



Level 2 result

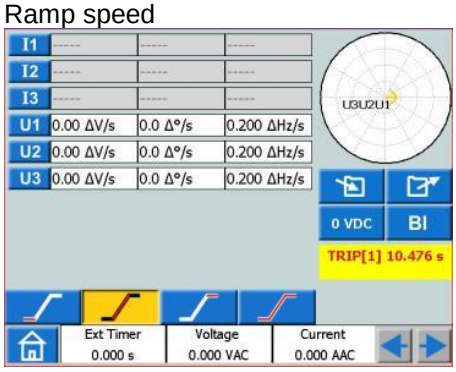


(Block level 1 in protection when checking level 2)

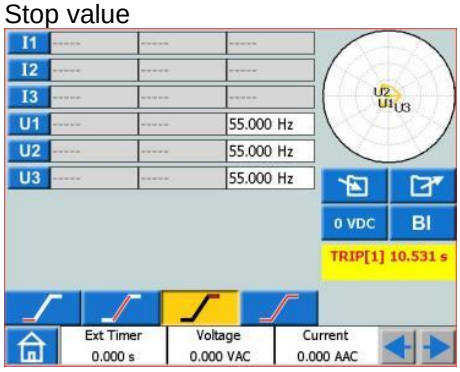
Pickup test - Over frequency

Use same test as for under frequency but change stop value.

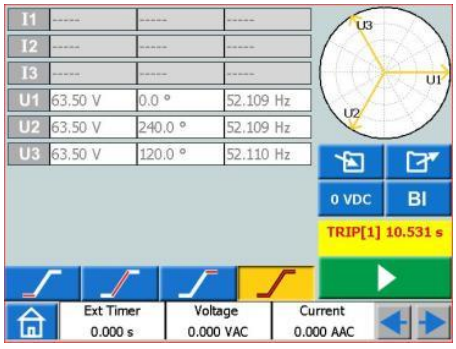
Ramp speed



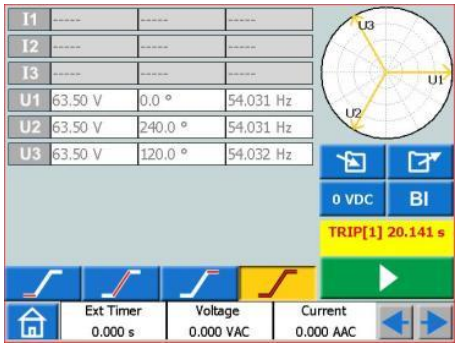
Stop value



Level 1 result



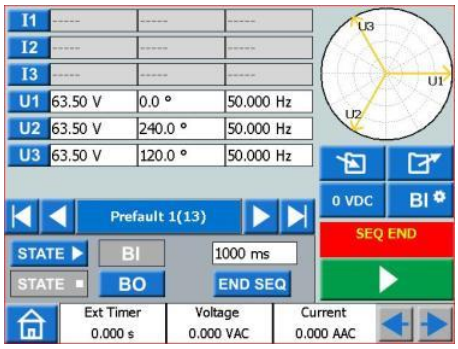
Level 2 result



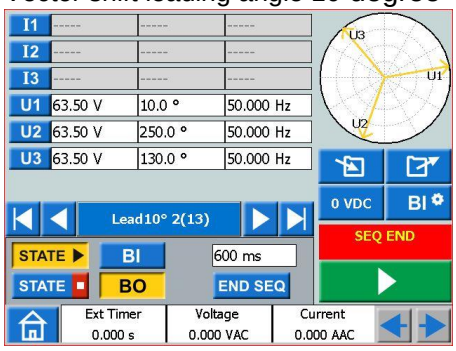
(Block level 1 in protection when checking level 2)

Timing tests: Vector shift / Under frequency (3phase)
Make one time test for Vector shift, Under/Over frequency in the sequencer instrument.

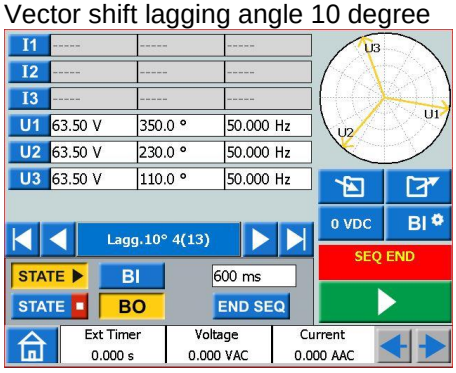
Pre-fault



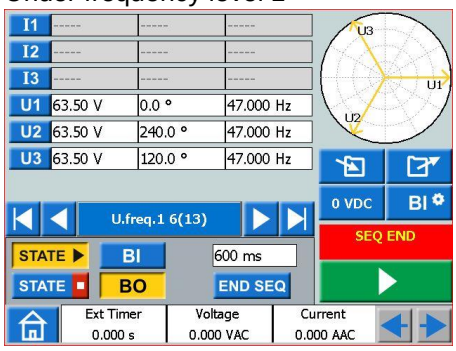
Vector shift leading angle 10 degree



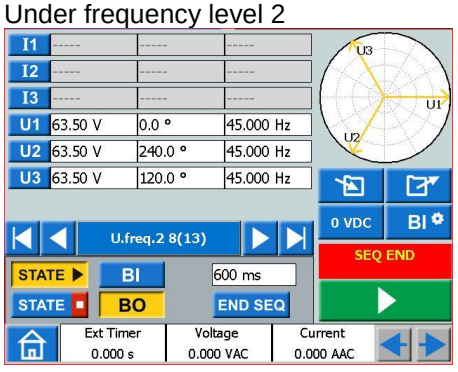
Vector shift lagging angle 10 degree



Under frequency level 1

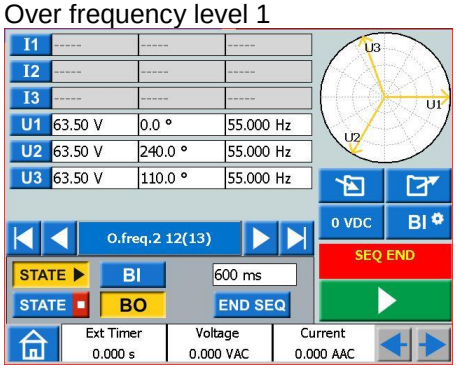


Under frequency level 2

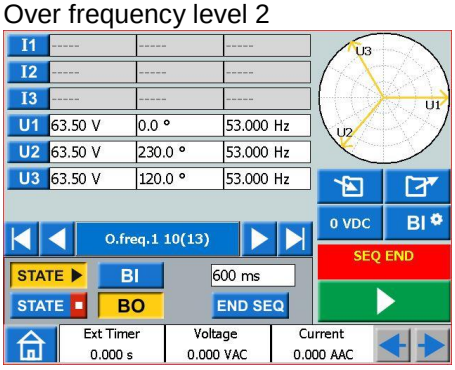


Timing test-Over frequency

Over frequency level 1



Over frequency level 2



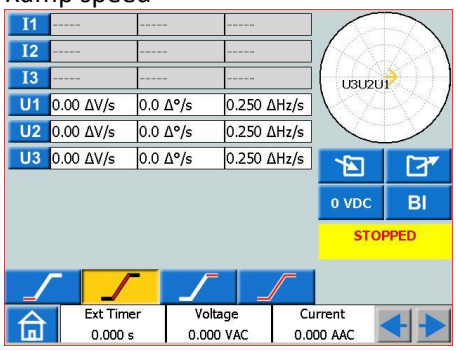
#	U1: V	°	Hz	U2: V	°	Hz	U3: V	°	Hz	BI	Time...	BO
1	63.50	0.0	50.0...	63.50	240.0	50.0...	63.50	120.0	50.0...		1000	0
2	63.50	10.0	50.0...	63.50	250.0	50.0...	63.50	130.0	50.0...	2	337	1
3	63.50	0.0	50.0...	63.50	240.0	50.0...	63.50	120.0	50.0...		1000	0
4	63.50	350.0	50.0...	63.50	230.0	50.0...	63.50	110.0	50.0...	2	329	1
5	63.50	0.0	50.0...	63.50	240.0	50.0...	63.50	120.0	50.0...		1000	0
6	63.50	0.0	47.0...	63.50	240.0	47.0...	63.50	120.0	47.0...	1	504	1
7	63.50	0.0	50.0...	63.50	240.0	50.0...	63.50	120.0	50.0...		1000	0
8	63.50	0.0	45.0...	63.50	240.0	45.0...	63.50	120.0	45.0...	1	110	1
9	63.50	0.0	50.0...	63.50	240.0	50.0...	63.50	120.0	50.0...		1000	0
10	63.50	0.0	53.0...	63.50	230.0	53.0...	63.50	120.0	53.0...	1	529	1
11	63.50	0.0	50.0...	63.50	240.0	50.0...	63.50	120.0	50.0...		1000	0
12	63.50	0.0	55.0...	63.50	240.0	55.0...	63.50	110.0	55.0...	1	124	1

(Copy state 1 into states 3, 5, 7, 9, 11 (pre fault)

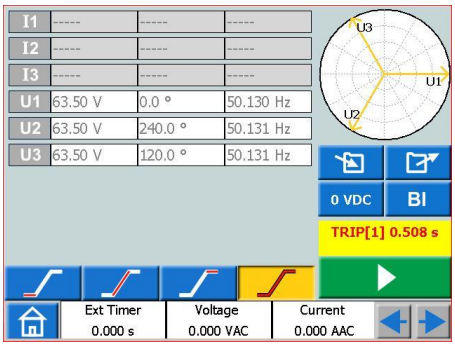
Timing test-ROCOF increasing Hz

Use same test as in pickup increasing and change ramp speed.

Ramp speed

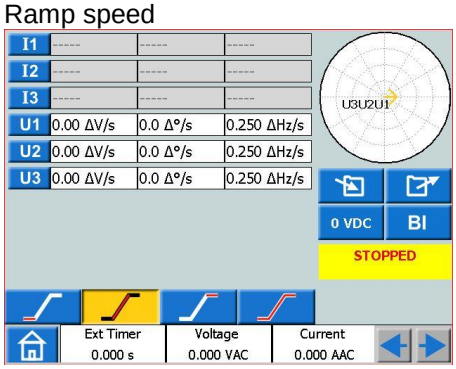


Result

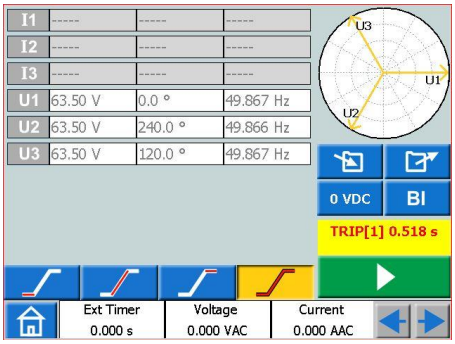


Timing test-ROCOF decreasing Hz
Use same test as in pickup decreasing and change ramp speed.

Ramp speed

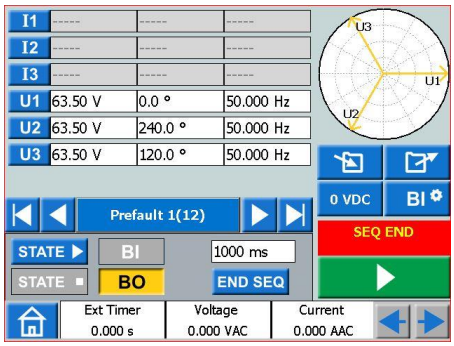


Result

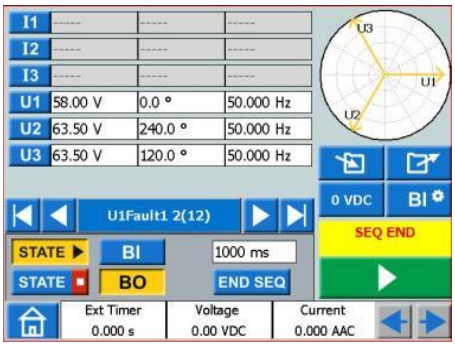


Timing test-Under voltage
Make one time test for U1, U2 and U3 in the sequencer instrument.

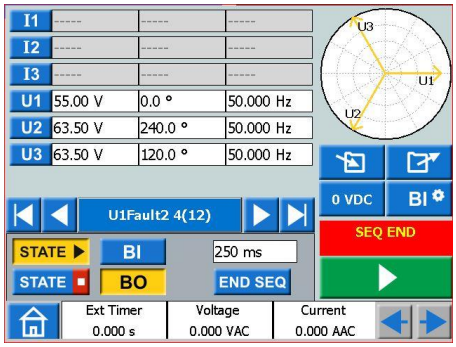
Pre-fault



Level 1



Level 2

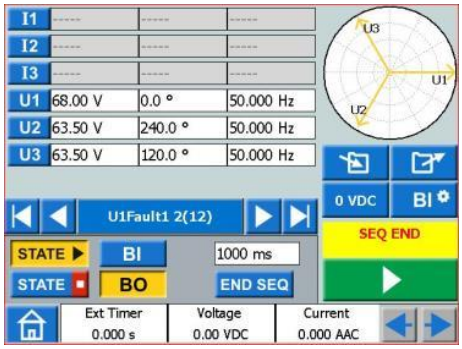


Copy state 1 into state 3, 5, 7, 9 and 11 (pre-fault)
Copy state 2 into state 6 and 10 change to phase U2
Copy state 4 into state 8 and 12 change to phase U3

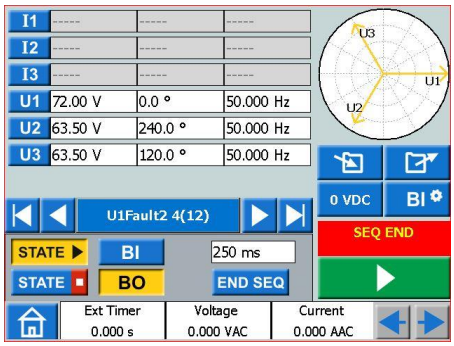
Timing test-Over voltage

Use the same sequence as in under voltage but change voltage level.

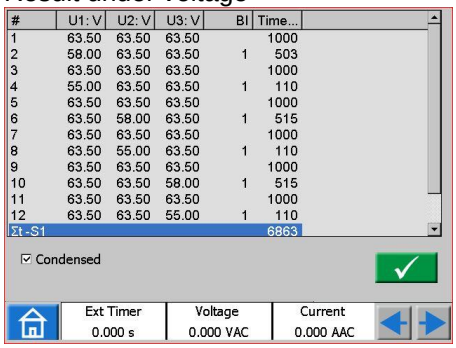
Level 1



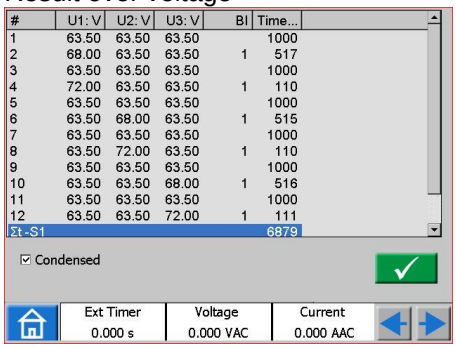
Level 2



Result under voltage



Result over voltage



Stability test

Use same test file as in time tests but change stop time to shorter than trip time