

## Testing negative sequence / unbalance over current protection (ANSI 46)

Unbalance phase currents in a power system that exceed the allowable normal operation limit can indicate abnormal condition or even existence of fault(s) in the system.

The operating principal of unbalance over current protection is normally based on measurement of negative sequence component of unbalance phase currents. Similar to phase over current protection, normally a pick up (start) threshold and a definite time delay for operation can be set.

Main application is in protection of rotating machines where the rotor can be overheated and damaged in a short time due to unbalance stator phase currents.

This protection can also be used as a sensitive main/ back up protection for phase to ground or phase to phase faults in some feeders.



### Connecting



#### Important

Read and comply with the safety instructions in the User's manual.

- 1] Connect the SVERKER 900 according to Fig.1, using the aux supply if needed.
- 2] Select the Binary Input for trip and start, see the section "Binary Inputs" in the SVERKER900 user's manual.

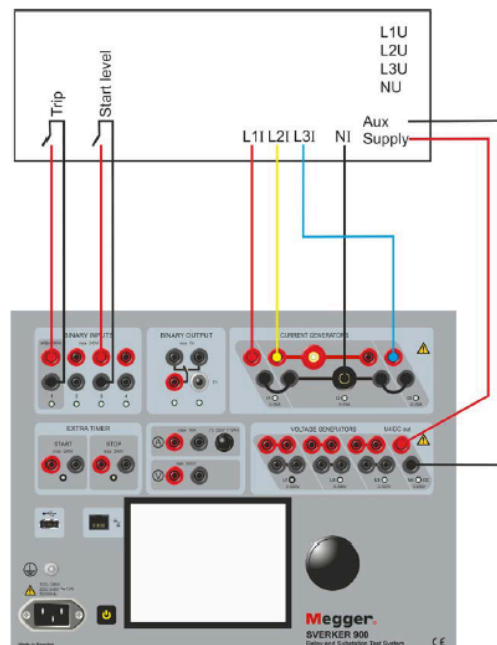


Fig.1 Connecting diagram.

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### Settings

In this example the negative sequence/unbalance protection for generator (Sepam G87) with definite trip time is used.

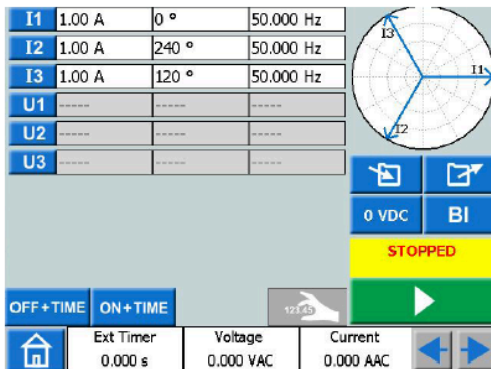
Settings are dependent on the size and type of generator used. The following settings are used for this example:

- Threshold = 0.1 A
- Time Delay = 100 ms
- CT ratio: 100/1 A
- Phase rotation direction: 1\_2\_3

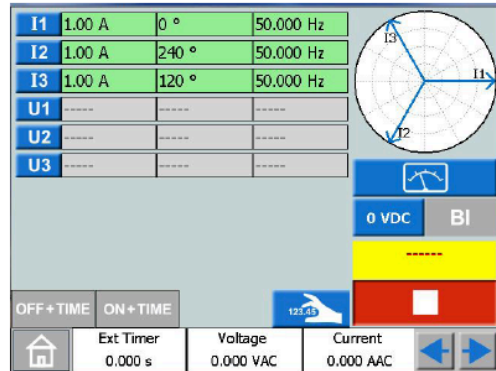
**Note** *Phase rotation direction is very important since it will affect negative sequence component calculations.*

### Wiring check and stability test

- 1] In the "Main instrument" disable the voltage generators if not used and set nominal symmetrical currents as shown below.

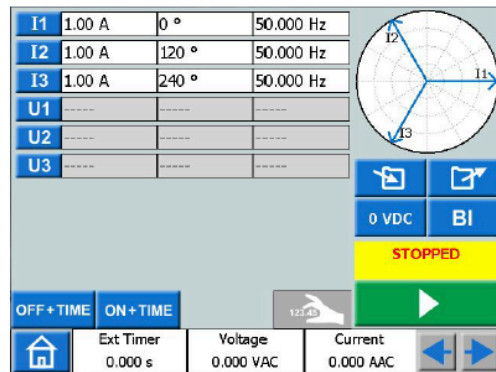


- 2] Press and read the corresponding measured phase current and negative sequence current values from the relay. If the wirings are correct and correct phase angles are set the relay shall not trip and remains stable with zero or close to zero negative sequence current measured.



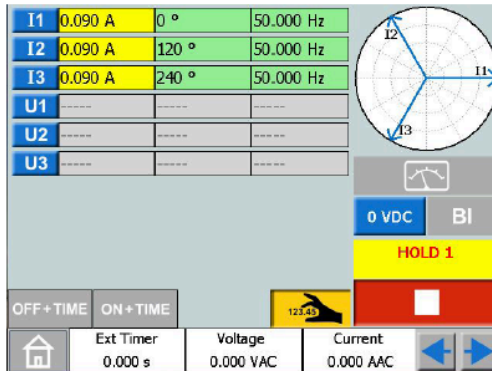
### Pick up and drop off test

- 1] To simulate 100% negative sequence component of phase currents a reverse phase rotation of phase currents is required. This can be achieved by simply swapping two physical connections to current generators on SVERKER900 (e.g. I1<->I2) and keeping the third one (e.g. I3) untouched. Another option (that will be used in this example) is to keep the original connection and swap two phase angles while keeping the third one untouched as following:



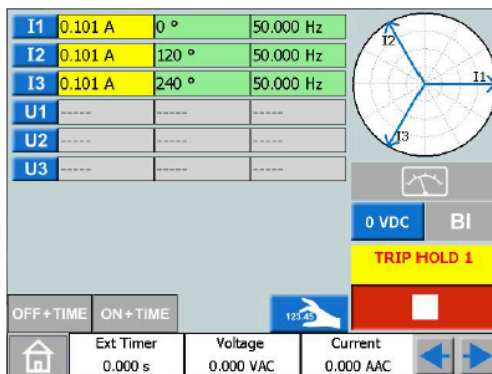
- 2] To manually search for pick-up, set current magnitudes below the "Threshold" and press .
- 3] Press and select all three current magnitudes so that the fields turn yellow.

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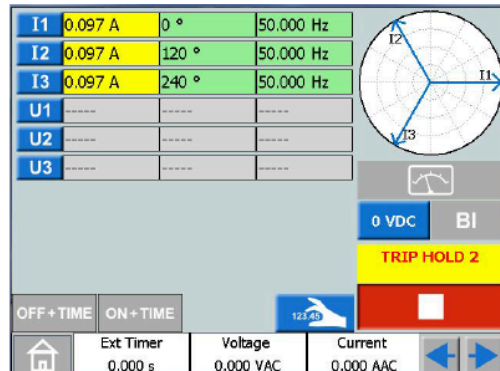


- 4] Slowly turn the main knob clockwise to increase the current magnitudes simultaneously. When a signal is activated on a binary input, the amplitude values are saved and the pick-up value is obtained.

**Note** For long "Delay time" before operation (trip), the start signal can indicate more accurate pick up value.



- 5] Press again and turn the main knob anticlockwise to decrease the current magnitudes simultaneously. When the signal on a binary input is deactivated, the amplitude value is saved and a drop-off value is obtained.



- 6] Press . The resulting pick-up and drop-off values as well as the ratio between these values will be shown on the display.

#	I1: A	I2: A	I3: A
1	0.101	0.101	0.101
2	0.097	0.097	0.097
(2/1)	0.960	0.960	0.960

### Timing test

The operation time (trip time) can also be verified in the same instrument using the ON+TIME function.

- 1] Set current magnitudes above the "Threshold"
  - 2] Press
  - 3] Press
- When a trip has been identified on the binary input the test will be stopped automatically while trip time is registered.

