In the setting of 60FL, VT supervision, what would be the consequence of setting Non-directional and Inhibition setting for 67 and 67N protections?

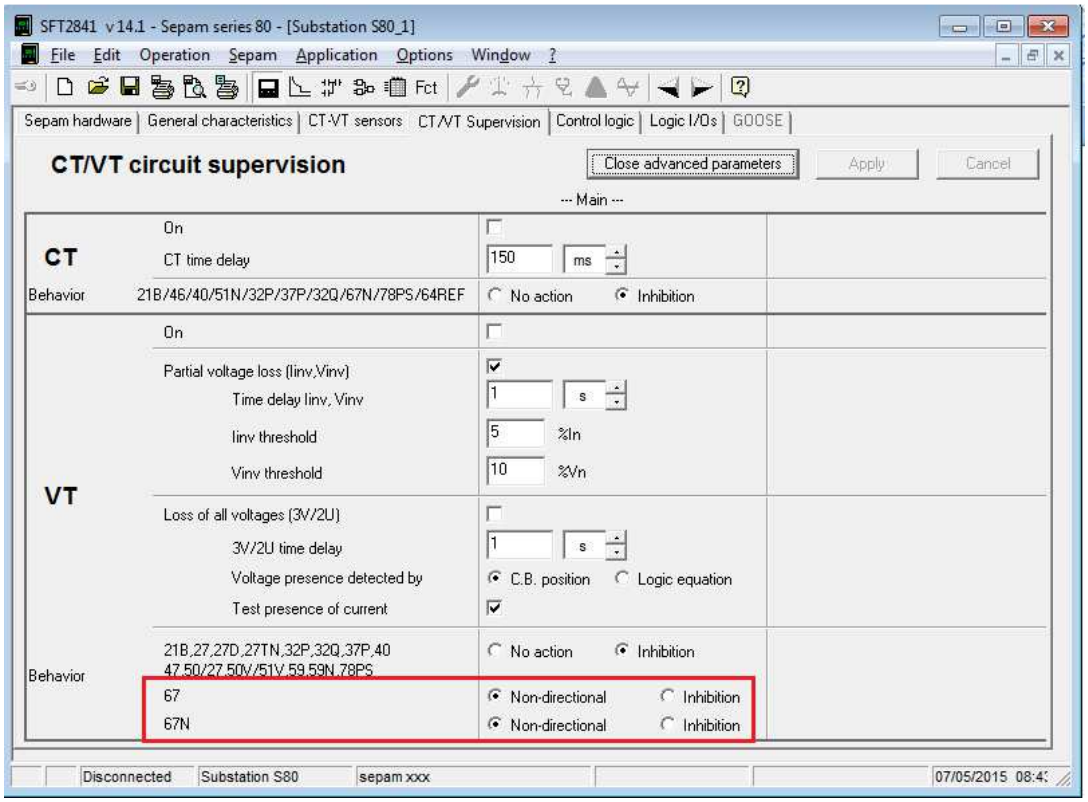

Figure No.1

What is the action of relay if we set it to Inhibition?

By enabling VT supervision and choosing inhibition option for 67 and/or 67N, in case of loss of voltage (either due to fuse being blown off, VT internal fault, loss of connection between VT and relay…) the relay will not trip in directional over current even though there is fault.

What is the action of relay if we set it to Non-Directional?

By enabling VT supervision and choosing Non-Directional option for 67 and/or 67N, in case of loss of voltage, the directional protection will behave as non-directional over current. To be more precise we refer you to see page 71 of Sepam series 80 user manual SEPED303001EN-01/2013. In other words even if voltage and current are in non tripping zone regarding to phase displacement condition of 67/67N protection (please check figure No.3), and just because of passing the threshold limitation, relay will trip.

Just in order to justify these issues, in this FAQ we are going to do demonstrate two tests.

Test 1: We enable directional protection. And set VT supervision with inhibition option. We inject current in faulty condition. The relay should inhibit directional function. It is clear that in order to provoke VT supervision function we do not inject any voltage. In this test, the O1 of Sepam as general trip output should not be activated and the CB position will not change.

Test 2: We enable directional protection. And VT supervision is set with Non- directional (50-51) option. We just inject current in non faulty condition (meaning that regarding to phase displacement between voltage and current, they are in non tripping zone). Then to show that relay will operate as phase over current and not directional we will increase the current. It is clear that in order to provoke VT supervision function we do not inject any voltage. The O1 of Sepam as general trip output in this regard should be activated and the CB position will be as open.

Just before reporting the result of tests please take a look at following figures. The figure No.2 and No.3 is showing relay setting regarding to CT and directional protection. Moreover figure No.4 is showing Sepam in non-tripping condition regarding to directional protection setting and figure No.5 shows the tripping condition.

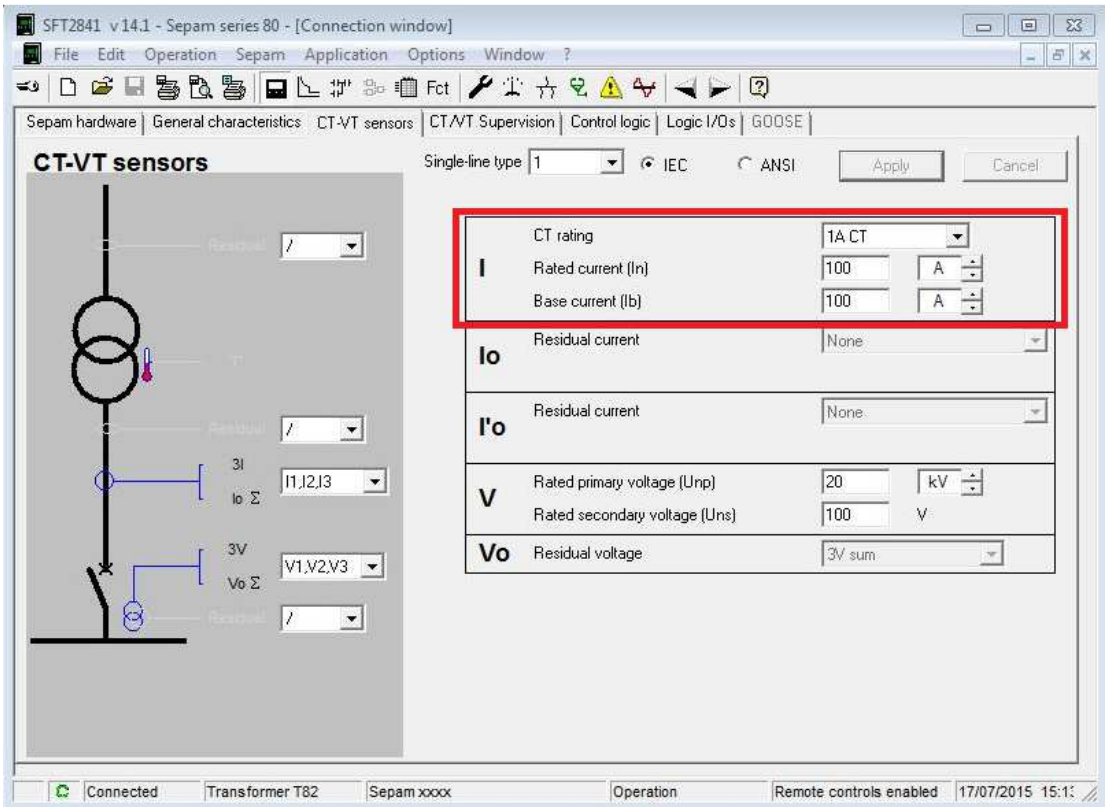

Figure No.2

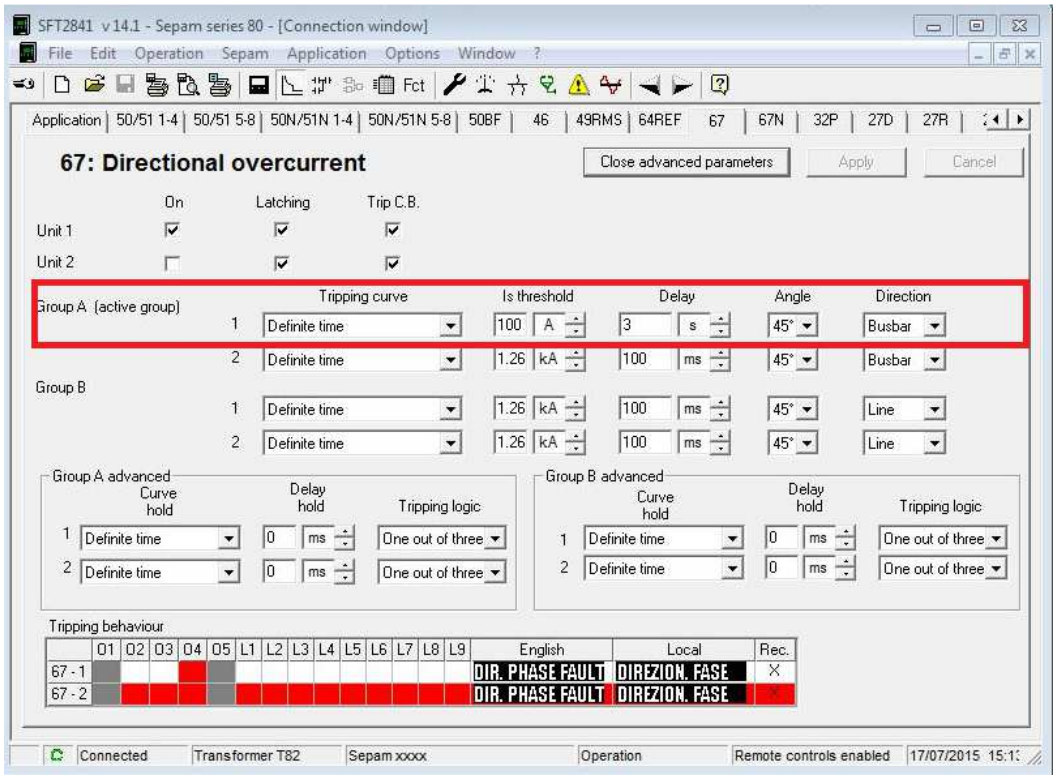

Figure No.3

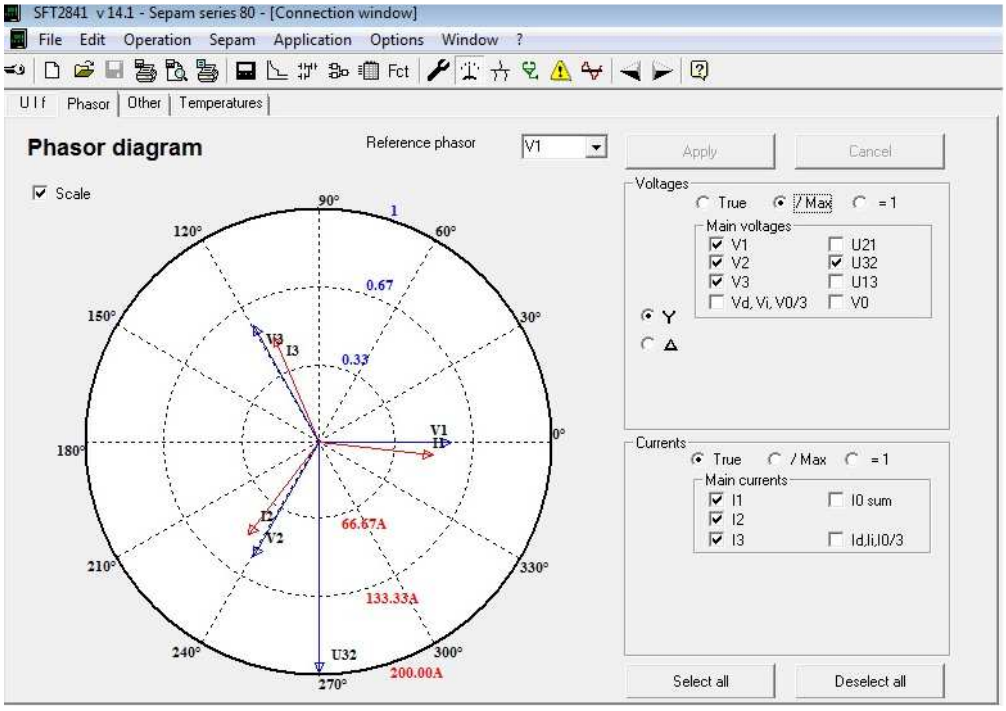

Figure No.4

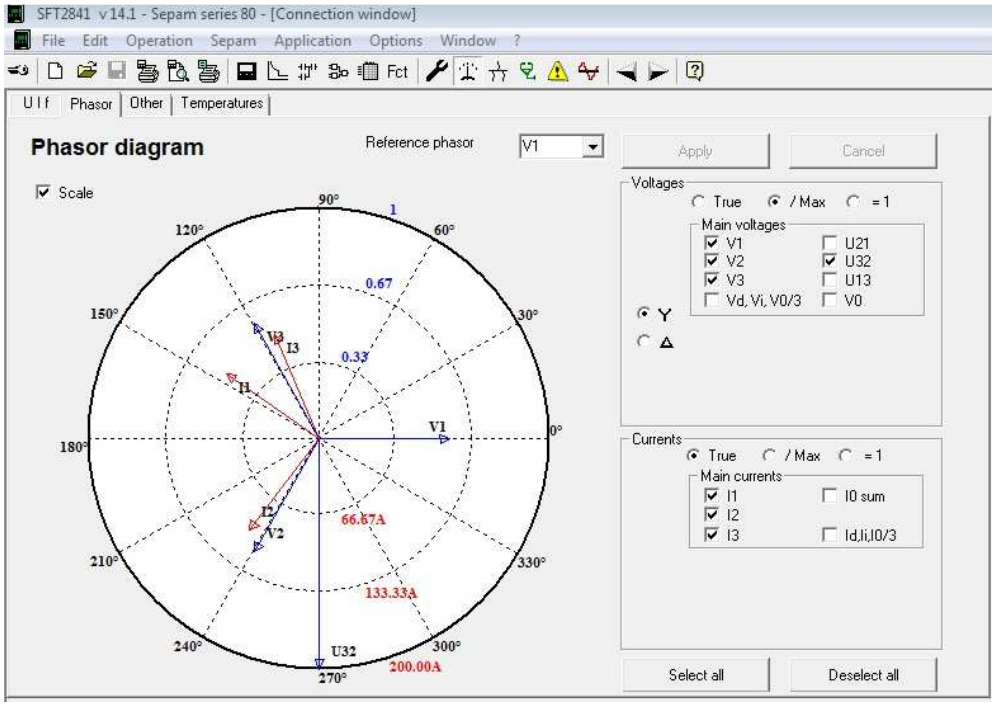

Figure No.5

Although we have pick up signal in disturbance recording, but to make it clearer the P67-1-1 which is instantaneous output (pick-up) signal of directional protection is assigned to REC2. It is reported in all disturbance recordings.

Results for First Test:

Figure No.6 in below is showing the setting of 60FL with inhibition option. Figure No.7 shows the current injected to relay which is 2 amperes in secondary (2 * 100 = 200 Amperes in primary side) and also in tripping zone of directional protection (it is same as Figure No.5). As the current is bigger than threshold and also injected in tripping zone then relay should trip. **But,** as reported in Figure No.8, we did not inject any voltage to the relay. Consequently it provokes VT faults. So the VT fault message on relay screen means that if the inhibited option for 60FL is activated then directional protection will not operate. In another words directional protection is inhibited by 60FL.

The following data is highlighted in Figure No.8:

- Tripping condition
- Voltage injection is zero (some noise, but comparing to nominal voltage 20KV is nothing)
- 67 directional protection inhibited – REC2 signal (Pup for 67) is not operated
- O1 as general trip output is not operated

So as it is clear on Figure No.8 the relay did not operate and 67 directional protection is inhibited.

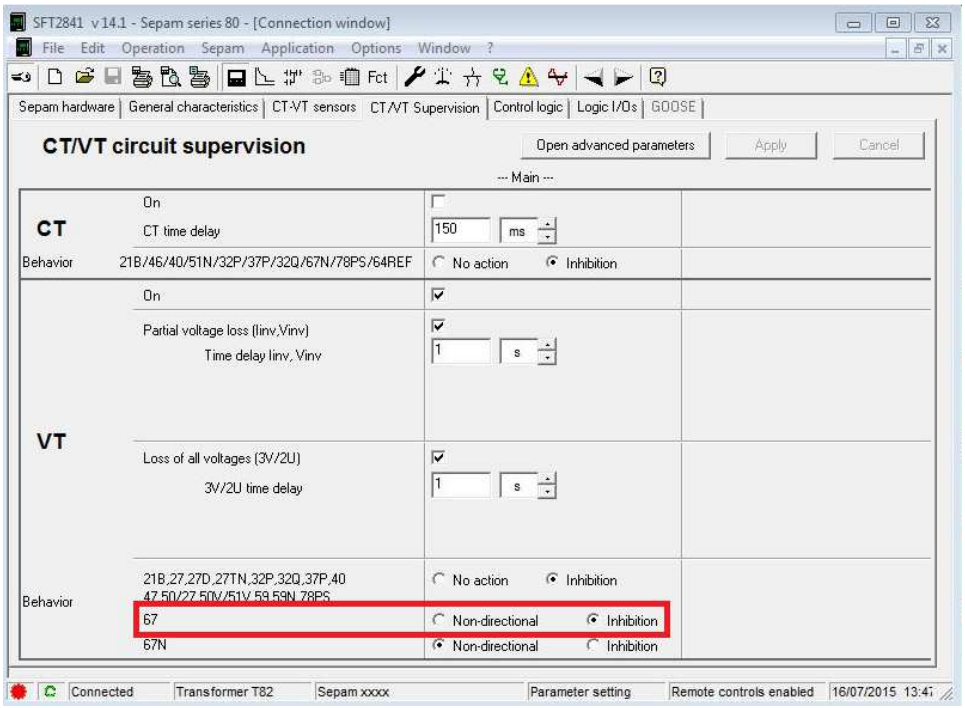

Figure No.6

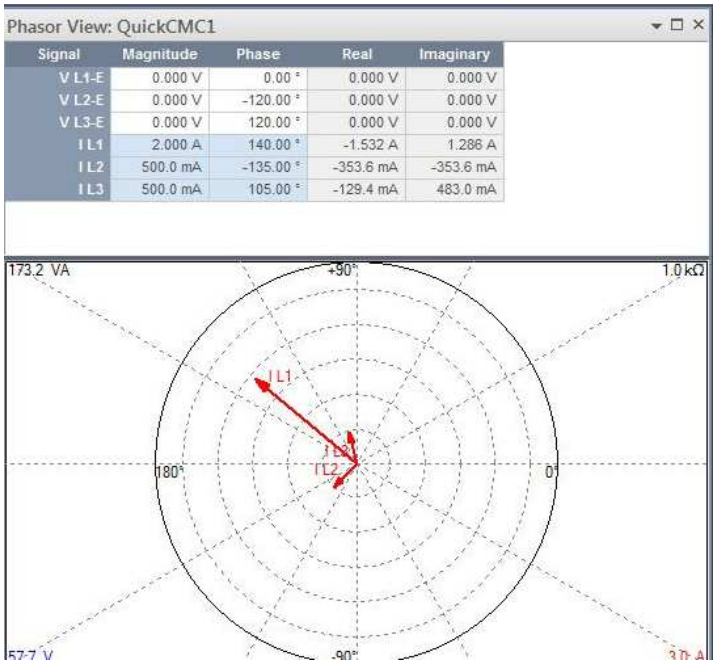

Figure No.7

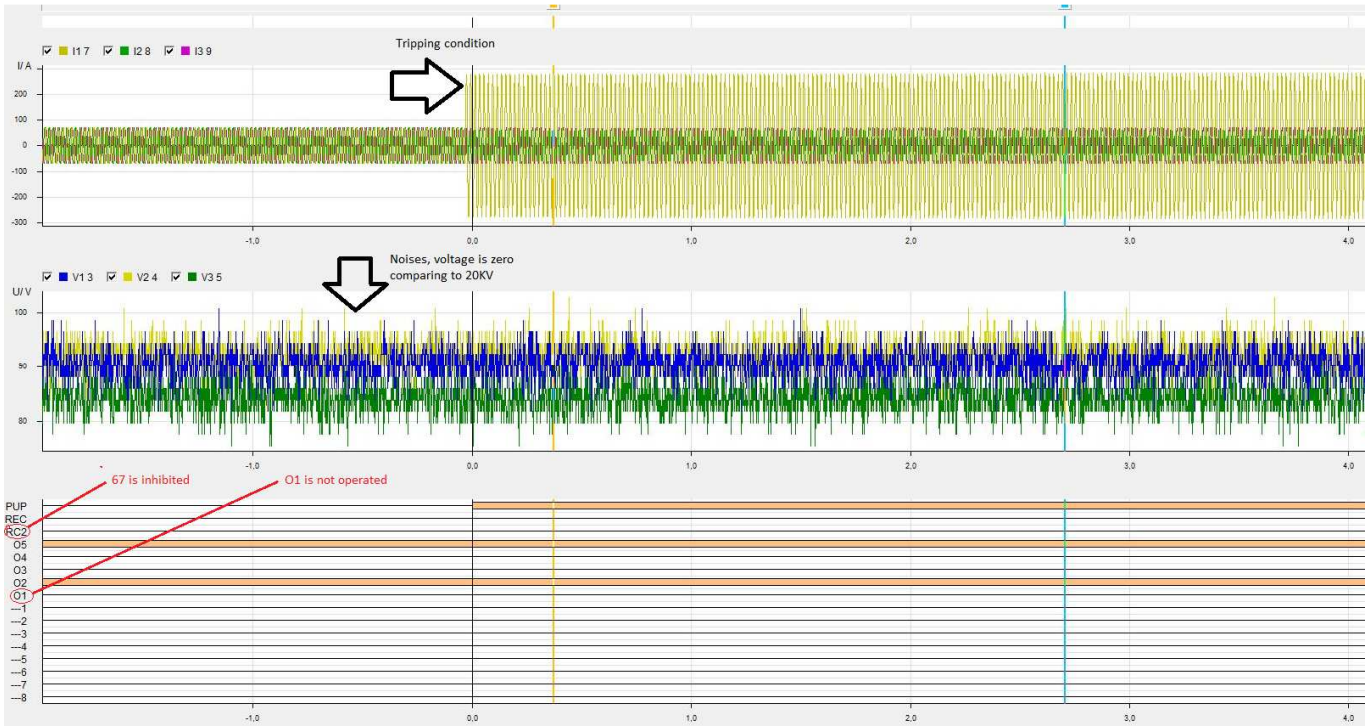

Figure No.8

Results for Second Test:

Figure No.9 in below is showing the setting of 60FL with non-directional option. Figure No.10 shows the current injected to relay which is 2 amperes in secondary (2 * 100 = 200 Amperes in primary side) and also in non-tripping zone of directional protection (it is same as Figure No.4). Although the current is bigger than threshold and it is in non-tripping zone of directional protection then relay should not trip. **But** as reported in Figure No.11 we did not inject any voltage to the relay. Consequently it provokes VT faults. So the VT fault message on relay screen means that if the non-tripping option for 60FL is activated then directional protection would be a 50/51 over current protection. In another words directional protection will operate as 50/51 as current is above its threshold. So in this test directional protection acts as phase over current just because of this setting in 60FL function.

The following data is highlighted in Figure No.11:

- Tripping condition
- Voltage injection is zero (some noise, but comparing to nominal voltage 20KV is nothing)
- 67 directional protection inhibited – REC2 signal (Pup for 67) is not operated
- O1 as general trip output is not operated

So as it is clear on Figure No.9 that the relay operated.

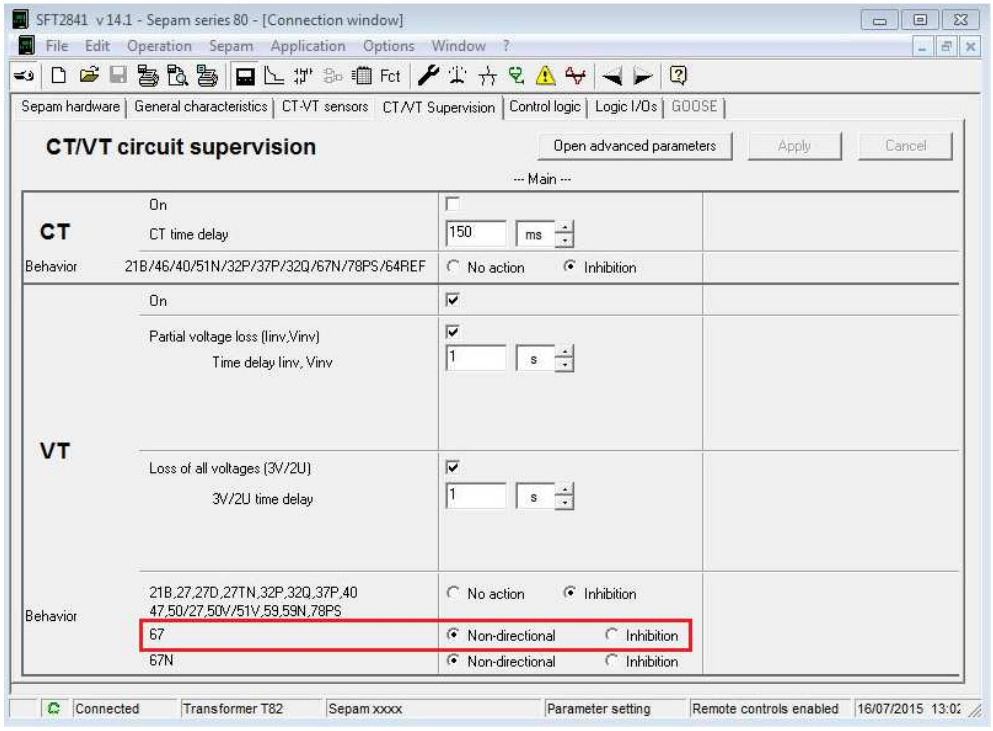

Figure No.9

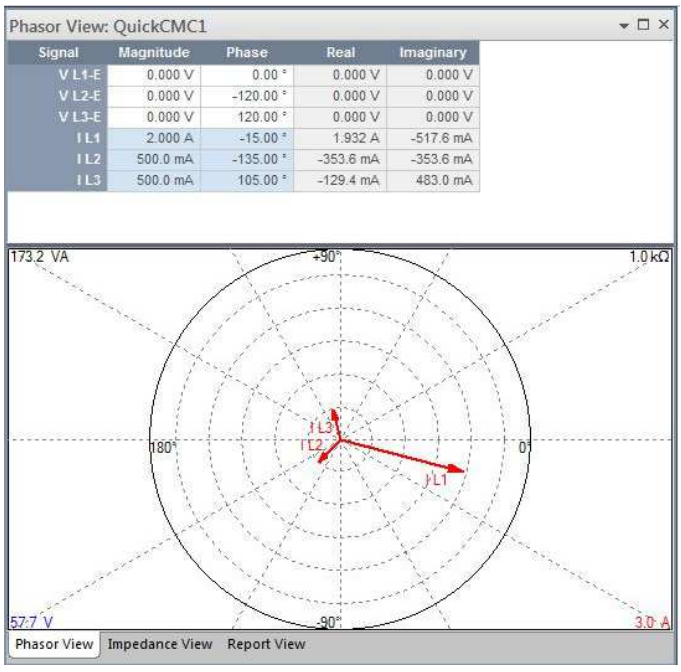

Figure No.10

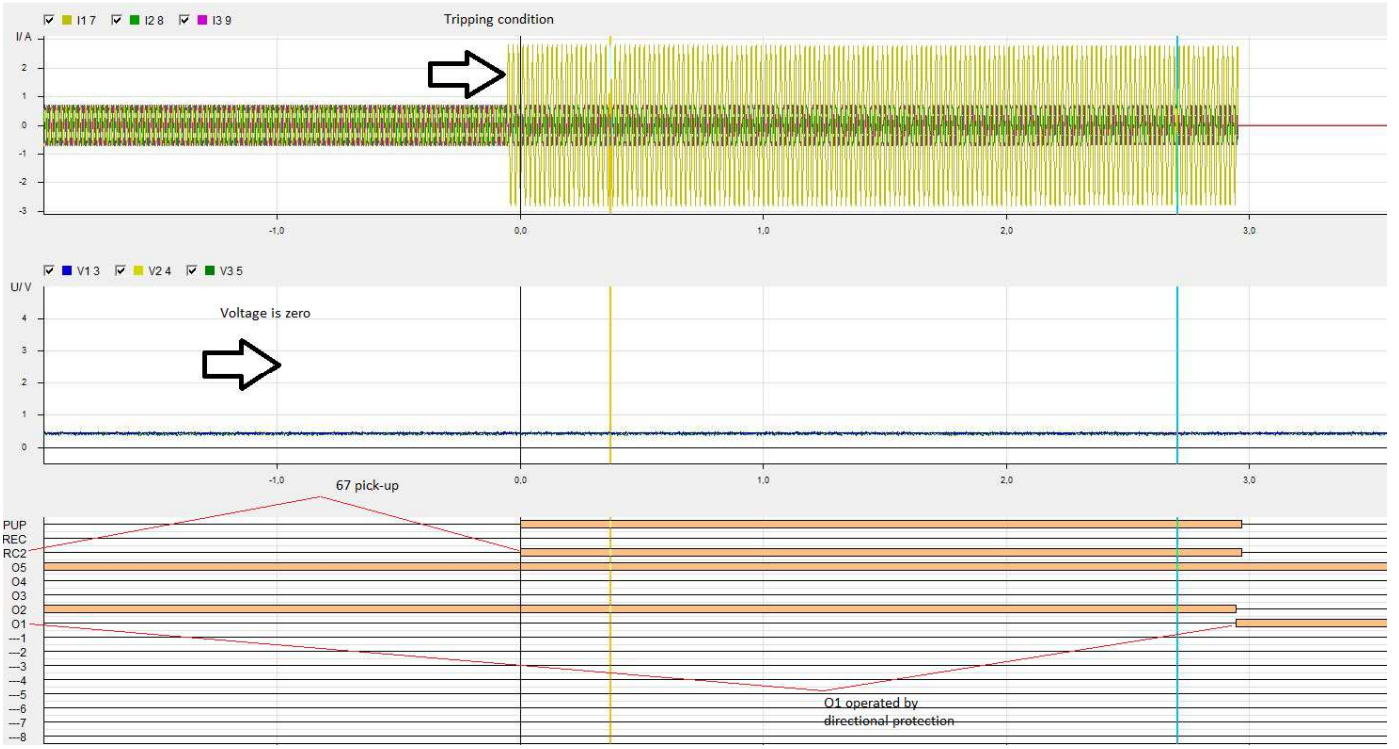

Figure No.11

<u>Final reminder for Sepam series 60 and 80:</u>

As mentioned in VT supervision block diagram, and also in setting page in SFT2841, it is important to have CB position to detect voltage presence. Just make it simple, if we set this parameter to CB position, it means that VT supervision is working when CB is closed. Or if this parameter is set to Logic equation, then correct defined logic should be used to set PVTS_X_117 variable in adequate state representing voltage presence. AEDL3