SIEMENS

Ingenuity for life

21 Distance Protection Ground Fault Direction stabilized with 67Ns

www.siemens.com/siprotec5

SIPROTEC 5 Application

Distance Protection ground fault direction stabilized with 67Ns for high impedance resistive grounding

APN-055, Edition 1

Content

1 Distance Protection ground fault direction stabilized with 67Ns for high impedance resistive grounding

1.1 Introduction

In systems with high impedance grounding the short circuit current may have a magnitude in the same order of magnitude as the charging current flowing via the healthy phases to ground via the zero-sequence capacitance. In extreme cases the direction measurement of short circuit protection (21) may be affected by this superimposed charging current due to the significant rise in voltage on the healthy phases. In the equivalent circuit below the actual fault loop current I_{Afault} has the capacitive current of the parallel feeders ($I_{B\text{-}cap}$ and $I_{C\text{-}cap}$) superimposed.

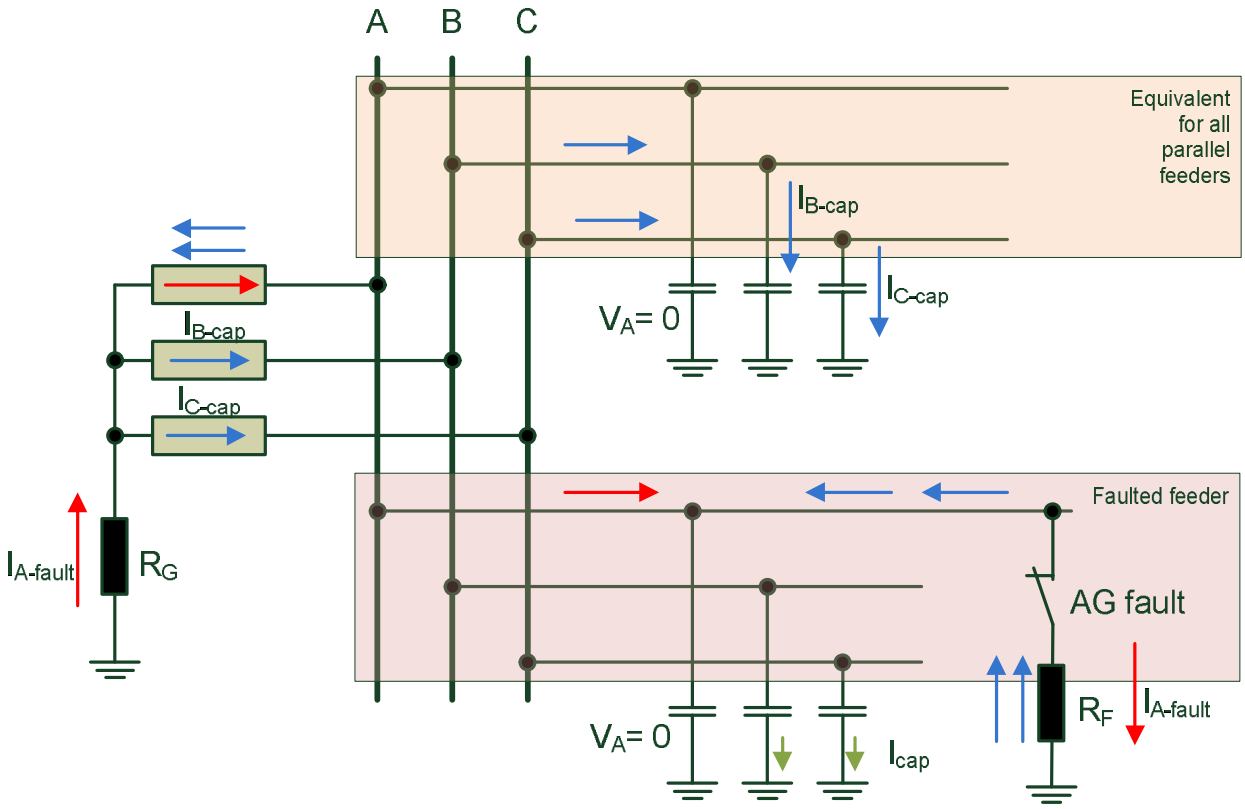
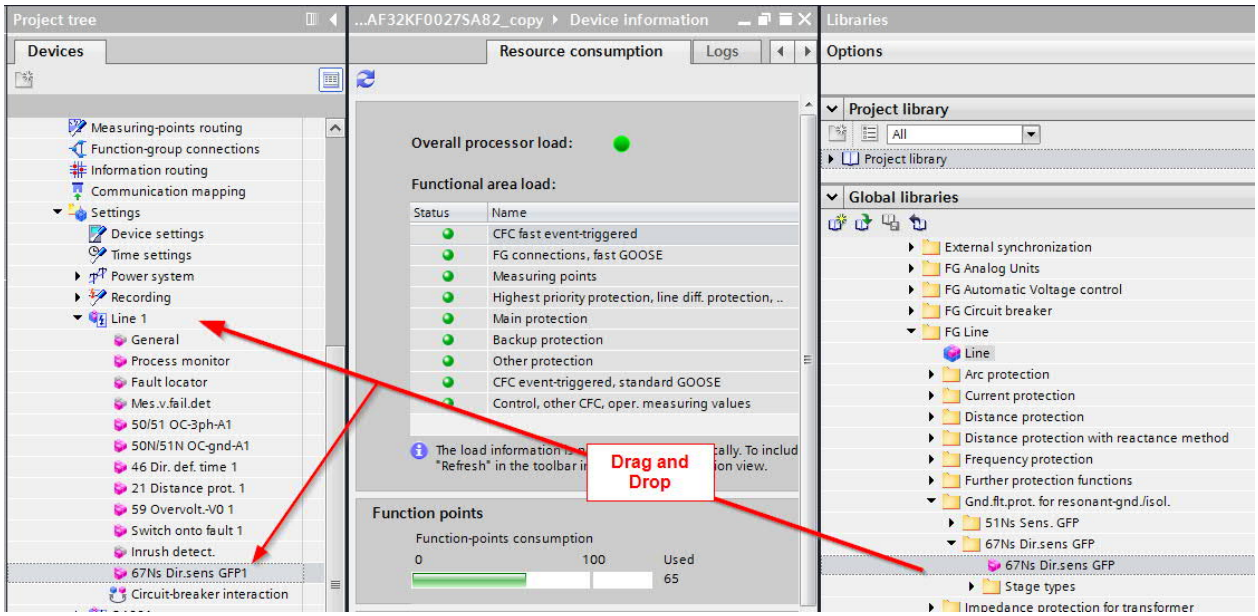


Figure 1: Equivalent circuit

When the capacitive coupled current has a similar magnitude as the fault current the direction decision may be incorrect. A work-around solution is presented here. It will stabilize (modify) the direction decision of the ground loop measurement by using the watt-metric direction obtained from the 67Ns function.

1.2 Step 1: Add the function 67Ns to the FG line

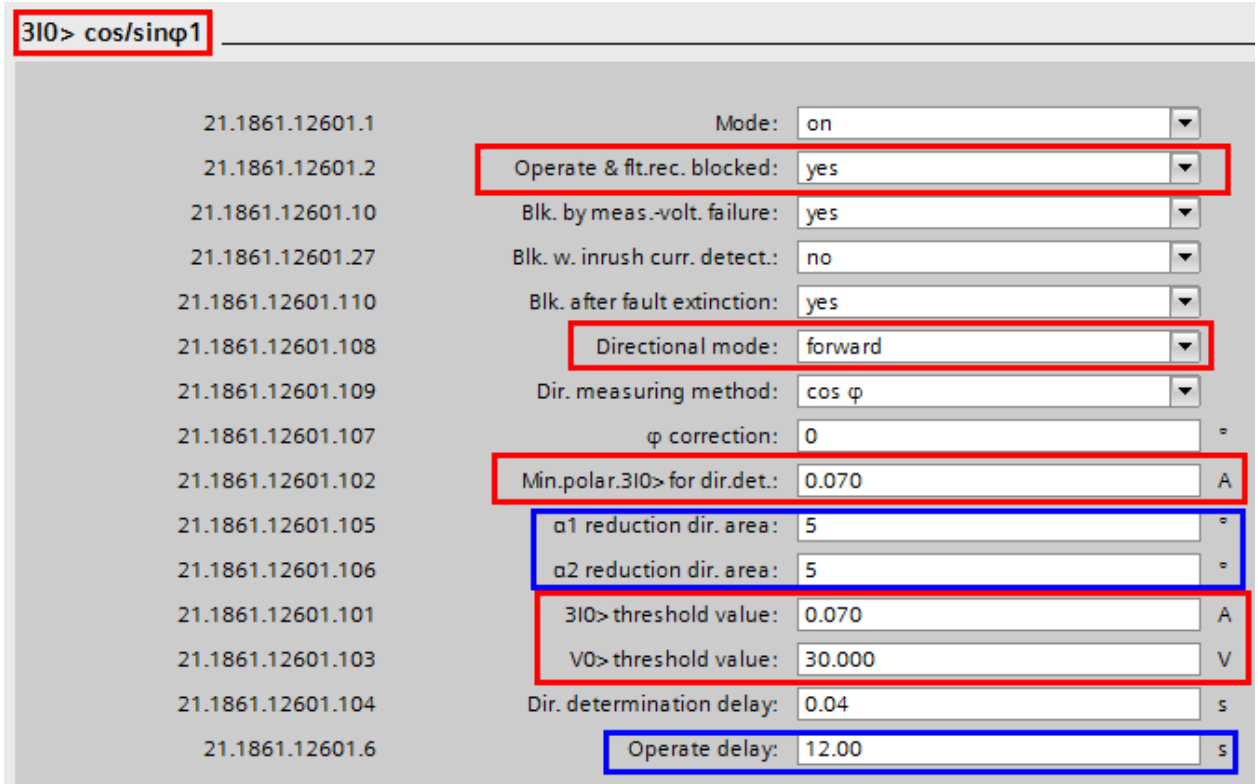
Note: This function requires 30 Function Points



Settings of this stage are based on the 3I0 thresholds of the distance protection:

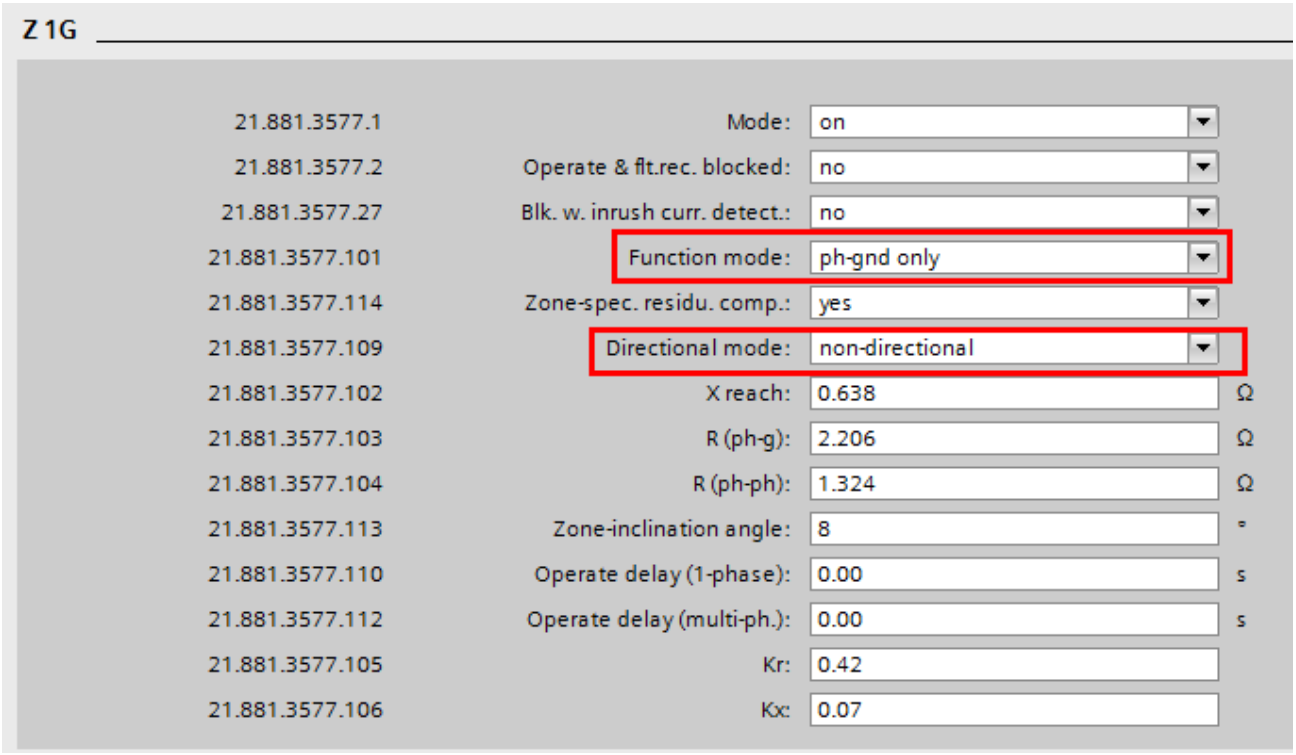
Only the 3I0> cos/sinφ stage is applied. The Operate and flt.rec blocked must be changed to "yes" as this stage is required for release of the new stages only, not for independent operation.

The 3I0 threshold is set to 70 mA which is approx.. 80% of the distance protection threshold (in distance protection it is 85 mA).



1.3 Step 2: Duplicate the set distance protection zones by Copy/Paste:

Below is the copied Zone 1 as example. Change the Function mode to "ph-gnd only" and the direction to "non-directional".



Such a copy is required for all "normal" zones.

1.4 Step 3: Apply the blocking of the non-directional zones via CFC

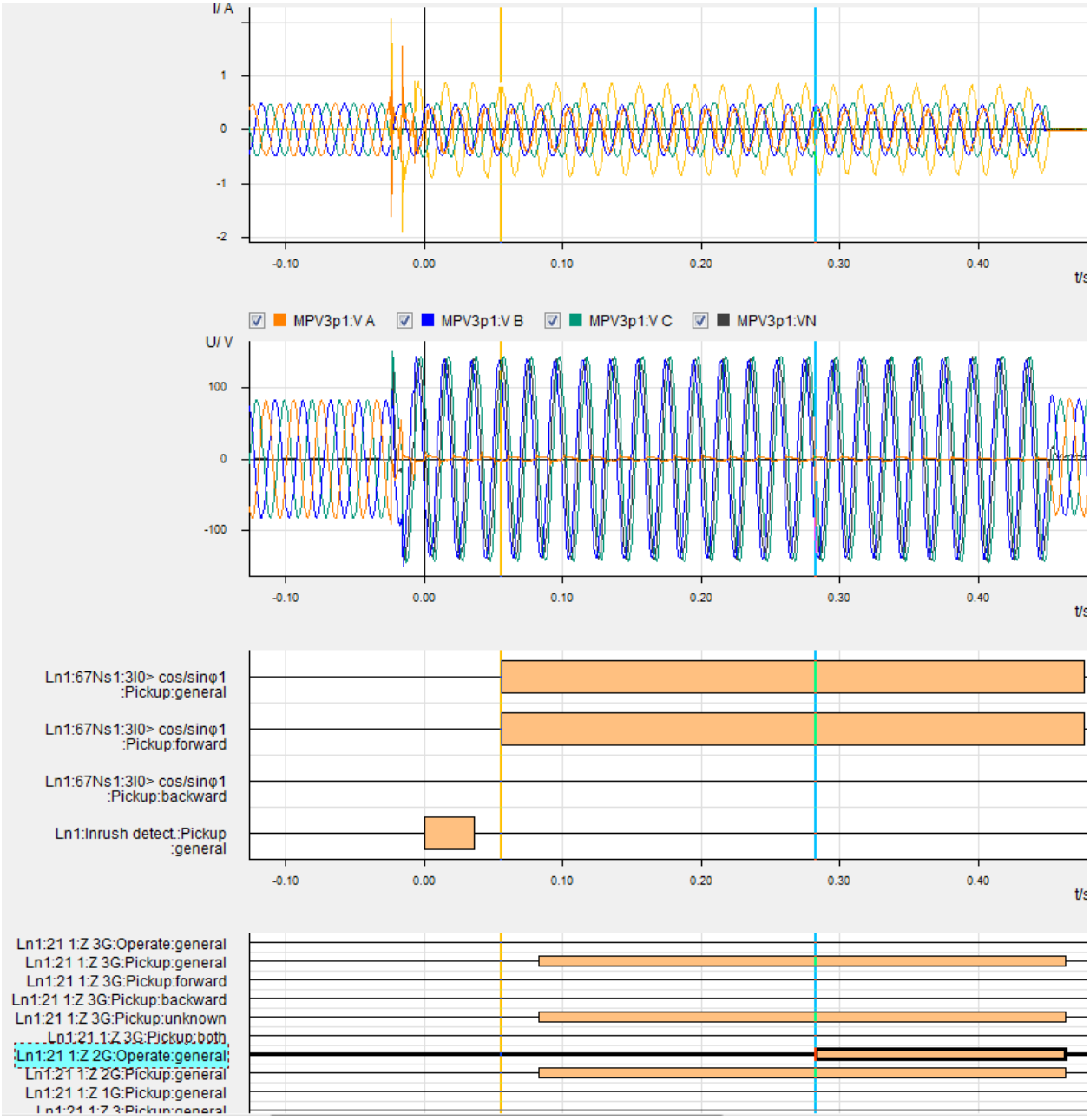
Create a new CFC chart in the "Fast event triggered" task. Insert a NEG gate from the library:

The input to the NEG is the cosφ stage forward pick-up, the output is connected to the blocking input of the 3 new non-directional ground loop distance zones.

In this manner the new zones will only be in "service" when the 67N has detected a forward ground fault.

1.5 Test Case

The following test case (recorded Comtrade) is applied: (AAF32KF001.CFG)



The 67Ns stage correctly determines the forward direction and releases the zones.The Zone 2 operate is activated 200 ms after pick-up. The application ensure the desired operation.

1.6 Conclusion

The condition of, small fault current due to the resistor in the star point and large capacitively coupled current, affecting the forward direction determination of the distance protection is effectively solved with the 67Ns direction release as described in this application.

Published by
Siemens AG 2019
Energy Management Division
Digital Grid
Automation Products
Humboldtstr. 59

90459 Nuremberg, Germany

www.siemens.com/siprotec

For more information,

please contact our

Customer Support Center.

Tel.: +49 180 524 70 00

Fax: +49 180 524 24 71

(Charges depending on provider)

Email: support.energy@siemens.com