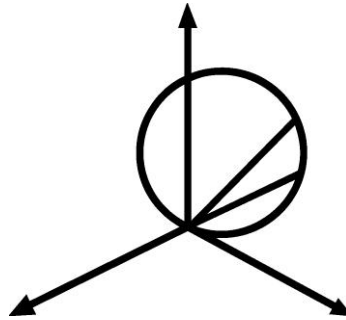


Swedish Neutral

Premium Power Protection



The Ground Fault Neutralizer

Smart Grid Protection for everybody



Power Plants



Transmission



Distribution



Industry



Mining



Railway



Marine

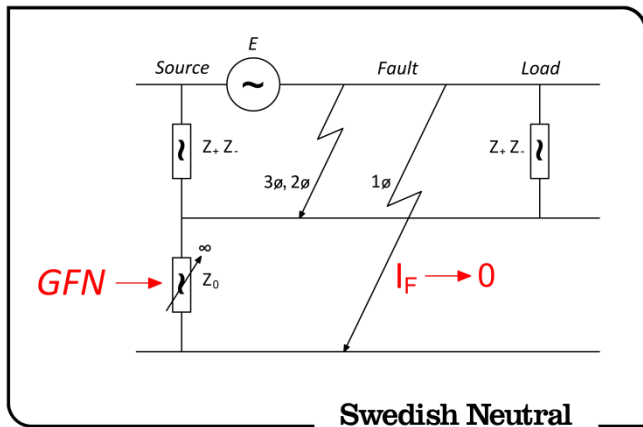


Offshore



Distributed Generation

The Ground Fault Neutralizer – Smart Grid Protection for everybody



GFN basic approach to earth fault protection

In utilizing the inherent - but so far unused - zero sequence properties of the 3-phase system, the GFN Ground Fault Neutralizer elevates grid protection to new levels of performance and takes all the benchmarks of good protection - namely speed, selectivity and last but not least detection sensitivity.

Moreover, the GFN action is smart in the way that voltage injection and fault current can be cancelled out completely without interrupting the power supply - a truly smart grid solution. Instead of feeder tripping "fault surgery" with lots of outages, the GFN now offers "smart medication". The "antidote" - a current equal but opposite to the fault current - is simply injected into the neutral. No immediate interruption of any power supply is required.

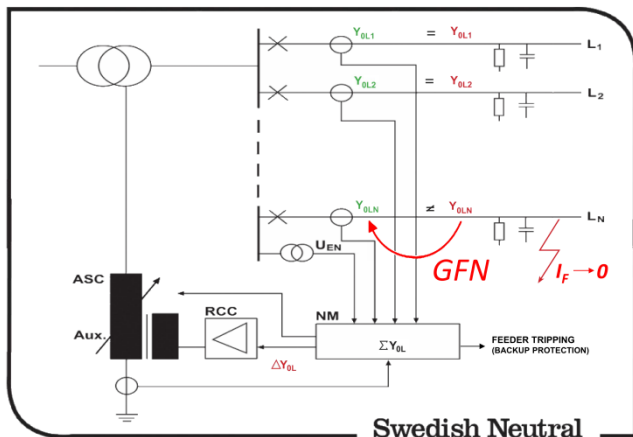
The GFN protects all parts of an interconnected grid - from the power transformer over the bus bar and the outgoing feeders down to the last corner of the grid - a truly overall protection scheme. This overall action is accomplished in a very cost efficient way from one point - the neutral.

The GFN - a paradigm shift in protection by smart neutral treatment

Protection is about safety and minimizing risks to people and property. The risk with an electrical fault is generally described as proportional to the energy injected into the fault site. Therefore the IEC standard defines the risk to be proportional to fault current and interception time - the well-known $I^2 t$ criteria.

Everybody understands - protection must be fast. But fault current levels included by their square are even more decisive to minimize consequential damages. The good news is - both fault current and interception time can be influenced through the neutral.

A benchmarking for different types of system grounding and neutral treatment with respect to fault current levels and interception time clearly proves the superiority of the Ground Fault Neutralizer. Even better - almost all existing grids can be converted to GFN grounding. This conversion offers one of the most cost efficient investments in grid performance, improved SAIDI figures and last but not least safety.



GFN adaptive zero sequence admittance scheme

Neutral Treatment		
Neutral Treatment	Earth Fault Current	Speed of Protection
Solid Grounding	10kA	0.1-1.0 sec
NER Grounding	1kA	0.1-1.0 sec
Ungrounded	100A	0.1-1.0 sec
Resonance Grounding	10A	1.0-(∞)sec
Ground Fault Neutralizer	0A (<50mA)	<60 msec

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GFN Benchmark for earth fault protection

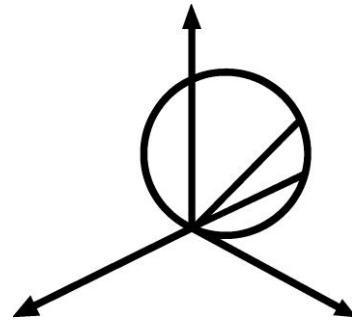


GFN Cabinet -Fault finding at your finger tips

GFN fault finding – a matter of minutes

Even though the GFN immediately eliminates voltage injection and fault current - independent of the location of the fault - the actual fault site must be located for further inspection or repair.

The integrated GFN fault locating is based on two superior detection schemes – a very fast transient detection mainly for re-striking cable faults and a highly sensitive adaptive zero sequence admittance scheme to detect both low and high impedance faults on overhead lines and cables.



In urban grids distribution feeders are normally arranged in open rings with ring main units to provide safe power supply. For these grids the GFN works with its well proven distance-to-fault scheme. After closing the NOP - normally-open-point – the fault site can be pin pointed with high accuracy.

Rural distributions generally have radial structures with many lateral spurs. Earth fault locating in these grids is rather difficult and often based on either time consuming trial-and-error methods or simple overcurrent fault passing indicators with insufficient sensitivity.

The new GFN FPI working with access to modern internet communication technology provides a substantial improvement. Due to its adaptive scheme, the GFN FPI can detect much more sensitively than traditional FPI's. This is an important step ahead, as many of the line faults in overhead grids are high impedance mid-span faults with poor ground contact and high risks for bushfire ignition.

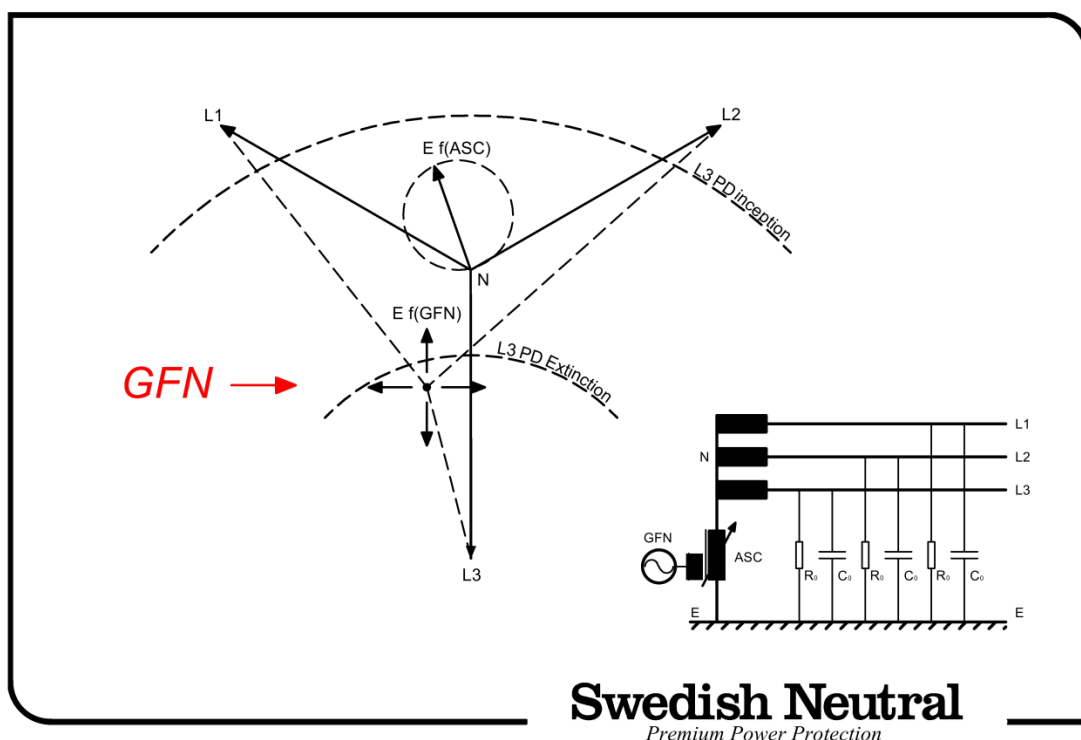
The GFN FPI can be combined with any type of sectionalizing equipment. All fault confirmation and sectionalizing controls are available at the central GFN terminal, but can also be transmitted to a dispatch center or a handheld field monitor.

GFN PD monitoring & control - the next step in grid protection

The GFN Ground Fault Neutralizer, originally developed to solve the problem with re-striking cable faults in resonant grounded networks, offers combined with state of the art on-line PD measurement a new powerful tool for grid insulation monitoring and pre-fault protection. By means of voltage/current injection into the neutral, the GFN controls all phase-to-ground voltages and - if necessary - quickly quenches discharge activities by lowering the voltage in the suspected phase, thus preventing further development into a full dielectric breakdown.

Furthermore the full control of phase-to-ground voltages during plant operation also admits for new online PD testing methods at levels above normal operating voltages, thus enabling systematic fore-checking strategies for the early detection of defective components. This is done without affecting the power supply to end-users.

Distribution network owners and operators looking for new and cost efficient means to monitor the condition of their aging cable grids may benefit from this novel tool to support their ongoing CBM activities. The GFN enhanced monitoring works on all type of plant - rotating machines as well as transformers, switchgears and cable feeders. The method can also be used before, during and after commissioning of new plant to verify the quality of workmanship on cable joints and terminations.



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