

TECHNICAL GUIDE

# Taking Advanced Distribution Management Systems to The Next Level – Model-Based Single Phase FLISR

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G&W Electric and Survalent are the first to develop a Model-Based Single Phase FLISR solution for the Power Industry's most common fault, a single-phase line to ground fault.

The most important first step is to use reclosers to significantly improve reliability indices because 83% of temporary faults can be cleared with 1-shot reclose and up to 95% of faults can be cleared during a 3-shot reclose cycle, as indicated in the Table 1 below.

Reclosure	Success Rate	Cumulative Success
1 <sup>st</sup> shot (immediate)	83.25%	83.25%
2nd shot (15 to 45 sec)	10.05%	93.30%
3rd shot (120 sec)	1.42%	94.72%
Locked out	5.25%	

Table 1: Source: Electric Power Distribution Handbook, pages. 430-431

According to ElProCus Technologies Pvt Ltd's article, "Types of Faults and Effects in Electrical Power Systems", the following information characterizes all faults that occur on Power Systems.

## 1. Symmetrical faults

These are very severe faults and occur infrequently in the power systems. These are also called balanced faults and there are two types, namely line to line to line to ground (L-L-L-G) and line to line to line (L-L-L).

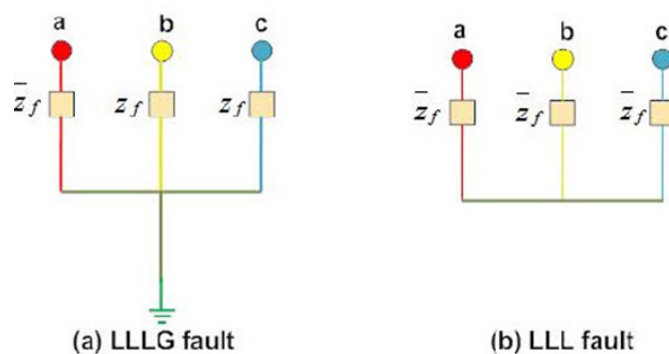


Figure 1: Symmetrical faults

**Only 2-5 percent of system faults are symmetrical faults.** If these faults occur, the system remains balanced but results in severe damage to the electrical power system equipment.

Figure 1 shows two types of three phase symmetrical faults. Analysis of these faults is easy and is usually carried on a per phase basis. Three phase fault analysis or information is required for selecting set-phase relays, rupturing capacity of the circuit breakers and rating of the protective switchgear.

## 2. Unsymmetrical faults

These are very common and less severe than symmetrical faults. There are three main types, namely line to ground (L-G), line to line (L-L) and double line to ground (LL-G) faults.

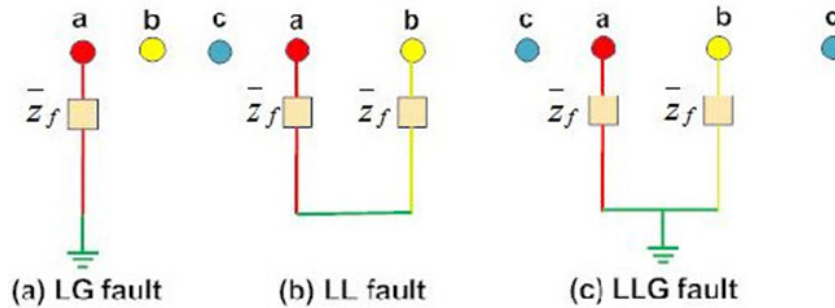


Figure 2: Unsymmetrical faults

65-70% of faults are line to ground, which causes the conductor to make contact with the earth or ground. 15 to 20% of faults are double line to ground and cause the two conductors to contact ground. Line to line faults occur when two conductors make contact with each other, mainly when lines swing due to winds and 5- 10% of the faults are of this type. These are also called unbalanced faults since their occurrence causes an unbalanced system. Unbalance of the system means that impedance values are different in each phase causing unbalance current to flow in the phases. These are more difficult to analyze and are carried by per phase basis similar to three phase balanced faults.

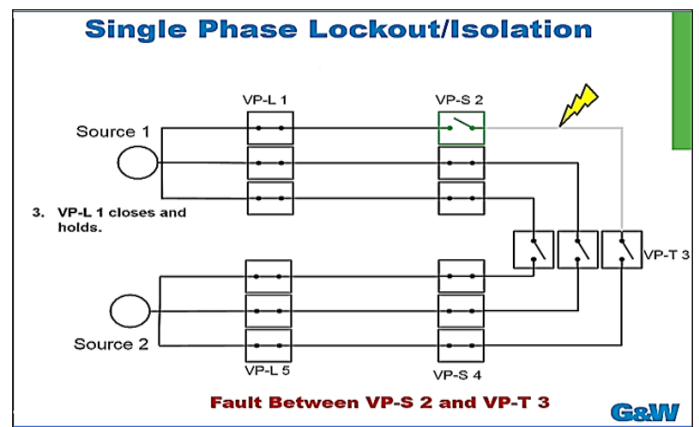
## Application

G&W Electric and Survalent were requested by an innovative utility in Ohio, to develop a solution to this problem. Consequently, we worked closely with the customer to develop and test the solution during a Factory Acceptance Testing. We validated the core functions of the single phase FLISR, but the customer wanted additional features that required the use of our Power Flow module to detect abnormal voltage conditions and provide predictive system conditions to optimize feeder reconfiguration.

## Screen shot of Single Phase FLISR Status Screen

Device	A	B	C	FLISR Status	FLISR Mode	Locked P1 A	Locked P1 B	Locked P1 C	LOV Status	LOV Mode	VA	VB	VC	VA	VB	VC
R13 REC-202001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R5 REC-201901	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R14 REC-201902	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R6 REC-211601	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R7 REC-211602	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R8 REC-202001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R10 REC-202001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R10 REC-211901	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R1 REC-202001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R2 REC-202001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R4 REC-202001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R3 REC-212001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R9 REC-202001	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
R11 REC-211901	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
Substations																
Lexington	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
Northport	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
Spencerville	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V
Unionville	Enabled	Enabled	Enabled	Enabled	Available	Normal	Normal	Normal	Enabled	Available	700	700	700	V	V	V

## Diagram showing one sequence of Single Phase FLISR operation



G&W Electric is also the first vendor to develop a script-based FLISR solution to single phase faults for a major IOU over four (4) years ago. The customer has successfully deployed this solution and received the desired results.

## Contact us today

708.388.5010 or [info@gwelectric.com](mailto:info@gwelectric.com)



Engineered to order. Built to last.

Since 1905, G&W Electric has been a leading provider of innovative power grid solutions, including the latest in load and fault interrupting switches, reclosers, system protection equipment, power grid automation and transmission and distribution cable terminations, joints and other cable accessories. G&W is headquartered in Bolingbrook, Illinois, U.S.A., with manufacturing facilities and sales support in more than 100 countries, including China, Mexico, Canada, UAE, India, Singapore, Brazil and Italy. We help our customers meet their challenges and gain a competitive edge through a suite of advanced products and technical services.

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