CIGRE Study Committee B5

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG* N° B5.52	**Name of Convenor :** Sepehr Sefidpour (SE) **E-mail address**: sepehr.sefidpour@se.abb.com
Technical Issues # (6): 1, 9	**Strategic Directions # (2): 1, 3**
The WG applies to distribution networks (4): Yes	
Title of the Group: Analysis and comparison of fault location systems in Substation Automation Systems	

Scope, deliverables and proposed time schedule of the Group :

Background:

Rapid and precise location of line faults is becoming more important in modern power systems. Reasons for this are among others to shorten forced line outages with permanent faults and prevent weaknesses from evolving into new faults by early discovery and repair. Weaknesses could be caused by a flashover followed by a successful auto-reclose. Among technologies available today for fault location, several principles can be recognised. One is based on impedance measurement, a second one on the travelling wave principle A third method based on the knowledge of the short circuit level and recorded fault currents is also used. Topology-based approaches for fault location are also used in distribution networks.

Fault locators using impedance measurement are fairly simple and this function is usually supplied with modern line protection devices. Issues of this approach are limited accuracy, particularly for faults with high fault resistance and when influenced by mutual coupling plus the importance of correct line data.

Fault locators based on the travelling wave principle have a main benefit of high accuracy. However, the line propagation time has to be known. Drawbacks of this approach are more related to costly equipment requirements and the fact that the travelling wave principle is more difficult to be applied on underground lines. In addition, the need for time synchronisation and communication between individual units has to be taken into account.

The main focus of the work is to evaluate and compare different available concepts and make recommendations for adequate application of fault location systems in transmission and distribution networks.

The work shall not be limited to substation equipment, but also include functions in dispatch centre and back office system. In addition, work processes should be analysed and described.

Scope

The objective of this WG is to provide guidelines for the application of fault location systems for transmission and distribution networks. The work will be limited to AC systems.
In a first step, the WG should elaborate a list of requirements, challenges and limitations for fault location with regard to different applications (e.g. overhead lines, underground cables, mixed lines, radial feeders, multi-terminal lines, series-compensated lines, rural/urban networks, operation constraints for re-energising and repair).

The WG will consider all types of available fault location approaches (impedance [one-ended or two-ended measurement], travelling wave, current measurement, topology-based,

standalone vs relay embedded). The entire system incorporating these approaches will be described in detail, including the required functional chain (instrument transformers, interfaces, algorithms, analysing tools, the associated data acquisition technologies, etc.)

For each approach an evaluation of the performance regarding the following criteria will be given :

- Availability
- Speed of estimation
- Reliability
- Accuracy (including parameters influencing on accuracy)
- Required measurement equipment and its accuracy
- Required network parameters (e.g. line impedance) and their accuracy
- Ease of implementation and upgrade
- Adaptability to Grid evolvement
- Maintainability
- Cost/Benefit

The WG will also elaborate a recommendation which approach is best adapted to every application identified in the initial phase and discuss the possible new approaches.

Interaction with other B5 WGs and with other SCs

WG B5.51, which has focus on remote access to SAS for maintenance purpose, may interact with this WG, since remote access to information is essential for fault location as well.

SC B5 members are invited to nominate experts with knowledge in this area to contribute to this WG, and their contribution will be acknowledged in the TB in the usual way, with the mention of their name and the SC to which they belong.

Deliverables :

- Technical brochure
- Summary in Electra
- Power Point slides for Tutorial

Time Schedule : start : 2014 **Final report** : 2016

Comments from Chairmen of SCs concerned:

Approval by CIGRE Technical Committee Chairman :
Date : 19/11/2013 M. Wald

(1) Joint Working Group (JWG) - (2) See attached table 1 – (3) See attached table 2
(4) Delete as appropriate

Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows within distribution level and to the upstream network.
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (cf. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
3	Focus on the environment and sustainability
4	Preparation of material readable for non technical audience