CIGRE Study committe B2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG B2/B5.98

NAME OF THE CONVENOR
Peng Xiangyang (CHINA)

TITLE
Application of distributed fault location devices for overhead lines

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION
5 / Grids and Flexibility

POTENTIAL BENEFIT OF WG WORK
4 / state-of-the-art or innovative solutions or directions

STRATEGIC DIRECTION
1 / The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-ofthe-art technological advances

SUSTAINABLE DEVELOPMENT GOAL
9 / Industry, innovation and infrastructure

BACKGROUND :
The ability to rapidly and accurately locate faults in overhead transmission lines is highly valuable for grid owners. However, several factors can affect accuracy, such as the type of fault (e.g., short-circuit faults or broken wire faults). Currently, three main technologies are available for fault location based on the following principles:

- Impedance measurement
- Faulted circuit indicators
- Traveling waves

This WG will focus on distributed travelling-wave fault-location devices. Distributed travelling-wave fault-location devices refer to monitoring terminals distributed along the overhead lines (installed on conductors, towers, or cable sections, typically spaced 20–30 km apart) together with a central station, forming a line-deployed monitoring network. This enables precise fault location, fault type identification, and early warning of potential hazards. Other fault-location approaches will be referenced only for background and comparison. The travelling wave principle has the following advantages:

- Improved accuracy. By analyzing wave arrival times at multiple locations, faults can be pinpointed within hundreds of meters or even better.
- It is applicable to both AC and DC lines. Unlike traditional protection methods that rely on system impedance, travelling wave-based protection is less affected by system load, fault resistance, and network configuration. It works well in weak networks.
- Not affected by the transitional resistance, oscillation of the power system, short-circuit current and the errors of the current or voltage transformers.

The travelling wave theory has been developed over many years, and the distributed travelling wave fault location devices have been widely used. There are several areas for improvement of the accuracy of the fault location

- **Accuracy of the surge identification and wave speed**
- **Noise interference:** for example, electromagnetic interference (EMI), switching transients, mutual inductive/capacitive coupling and non-fault travelling-wave disturbances caused by nearby lightning strikes or impulses from adjacent lines. In engineering practice, a common issue is misidentifying non-fault transients as the fault travelling-wave wavefront, or having the first fault wavefront masked/overwhelmed by noise and

interference.
- **Performance of the hardware**

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The working group will evaluate the application of distributed fault location devices in the following types of overhead transmission lines:

- HVDC (LCC / VSC)
- HVAC
- Distribution lines
- Overhead - Cable Hybrid Line that combines both overhead transmission lines and underground cables within the same circuit or network.

SCOPE :

This work will be supported by expertise in overhead-line operation and maintenance, a strong understanding of transmission-line electro-mechanical characteristics, and practical knowledge of lightning protection, pollution/insulation flashover mitigation of transmission lines, as well as conductors and sag/tension and insulators and line hardware. The main areas of study will be:

1. Identify key principles and technologies for distributed fault location devices, including the similarities and differences between the single-ended and double-ended travelling wave techniques and identification of different types of travelling waves.
2. Establish the key performance indicators and evaluation methods, including functions, performances and the comparison among different surge identification algorithms, the measurement of the wave speed and fault location in different fault types.
3. The application of distributed fault location devices in different overhead transmission lines, including the oscillation of wave surge in HVDC lines, the identification of the reflected wave and end bus reflected wave in HVAC lines and the high-accuracy location in distribution lines.
4. Design guidelines for distributed fault location devices, including the guidelines for hardware parameters and software functions of the device, the functional requirements of the background system, monitoring terminal and central station, and the test items and test methods of the device.

Remarks:

A liaison member from SC B1 will be included to address aspects related to underground cables (hybrid).

This JWG will ensure broad international representation of knowledge.

The JWG will establish liaison with the ongoing WG B5.55 and ensure that there is no overlap with its work.

DELIVERABLES AND EVENTS

Deliverables Types

Annual progress and activity report to Study Committee
Electra report
Technical Brochure and Executive Summary in Electra
Tutorial

Time schedule

Q1	2026	Recruit members (National Committees, WiE, NGN)
Q3	2026	Develop final work plan
Q3	2028	Draft TB for Study Committee Review
Q2	2029	Final TB
Q3	2029	Tutorial

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S J Loken
April 23rd, 2026