**CIGRE Study Committee D1**

**PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP**

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|---|---|---|
| **WG [1]N° D1.81** | **Name of Convenor:** Andrew Barclay (UK)<br>**E-mail address**: andrew.barclay@kinectrics.com | |
| **Strategic Directions #[2]: 2** | | **Sustainable Development Goal #[3]:.0** |
| **The WG applies to distribution networks:** ☒ **Yes /** ☐ **No** | | |
| **Potential Benefit of WG work #[4] : 1, 3, 5** | | |
| **Title of the Group:** | **Methods and common data file format for Time-Domain Reflectometry** | |

**Scope, deliverables and proposed time schedule of the WG:**

**Background:**

Time-domain reflectometry (TDR) technique is used in fault location of both land and subsea power cable systems at all voltage levels as well as metallic communication cables. For subsea systems, it is very much a central technique for fault location.

It is not uncommon for TDR records obtained in the field to be of limited useability due to deficiencies in the preparation and execution of the process, which are not reversible at post-processing. The quality of a TDR record is dependent on

- Correct information on the circuit under test,
- Adequate preparation of the circuit under test,
- Selection of a test instrument of adequate performance;
- Good-quality connection between the test instrument and the circuit under test,
- Correct selection of the operating parameters of the instrument, and
- Correct identification of features shown on the record.

Best-practice guidance will be collated to aid in improving these matters. Neither detailed specifications nor any useful level of guidance are contained in any CIGRE TB's to date.

To facilitate TDR in the event of an in-service fault on a cable circuit, a TDR "fingerprint" may be recorded when the new circuit is commissioned. For subsea cables, this is widespread practice and is embodied in standards and CIGRE recommendations, most notably the recent TB773. The original fingerprint trace at commissioning is used for comparison with traces recorded after a later fault to assist in locating the fault.

Comparison between the fingerprint and the post-fault traces is hindered by lack of any method or common format for data interchange between manufacturers. Some instruments can only export data to a proprietary database from which further export in any useful form is difficult or impossible. Test instruments, file formats, database software versions and even test equipment manufacturers have lifetimes typically much shorter than the typical service life of a subsea cable installation.

The possibility and advisability of a Common data file format for TDR instruments was discussed in TB773 (section 5.3.3). Such a format would allow export of traces from instruments of different manufacturers and generations for storage, presentation, manipulation and comparison in a manufacturer-independent way.

For optical TDR (oTDR) (as opposed to the metallic TDR discussed here), the same considerations largely apply and a standard format exists: Telcordia SR-4731, formerly known as GR-196 or Bellcore format. This is a binary format whose implementation in a standardised way by various manufacturers was long and troubled. For metallic TDR, TB773 recommended a modern XML-based (eXtensible Markup Language) format as bringing a number of advantages.

**Purpose/Objective/Benefit of this work:**

The intended outcome is:-

1. a document giving guidance on methods to obtain high-quality TDR records.

2. a manufacturer-independent common data format. This will enable TDR data to be:-

- Exported from the original instrument in a universally-recognisable format;
- Archived in a format likely to be readable throughout the life of the cable asset;
- Reimported into suitable software or onto compatible instruments;
- Redisplayed, re-scaled and enhanced;
- Compared between epochs through the life of the cable asset, including comparisons with data recorded on different instruments.

Consideration could be given to including standards for time-domain techniques other than pure TDR: high-voltage time-domain fault-location techniques such as impulse current, and indeed oTDR.

**Scope:**

1. Gather expert views on TDR methods;
2. Prepare a document with guidance on TDR methods;
3. Identify the functional requirements for a common data file format;
4. Identify candidate approaches;
5. Select the preferred candidate;
6. Generate a specification for the Common data file format for TDR instruments.

**Remarks:**

The possibility and advisability of a Common data file format for TDR instruments was discussed in TB773 (section 5.3.3).

**Deliverables:**

☒ Annual Progress and Activity Report to Study Committee
☒ Technical Brochure and Executive Summary in Electra
☐ Electra Report
☐ Future Connections
☐ CIGRE Science & Engineering (CSE) Journal
☒ Tutorial
☐ Webinar

**Time Schedule**:

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| • Recruit members (National Committees) | Q2 2023 |
| • Develop final work plan | Q1 2024 |
| • Draft TB for Study Committee Review | Q4 2025 |
| • Final TB | Q2 2026 |
| • Tutorial | Q2 2026 |

**Approval by Technical Council Chairman**:

**Date**: April 4th, 2023

Notes:
[1] Working Group (WG) or Joint WG (JWG),
[2] See attached Table 1,
[3]See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work.
[4] See attached Table 3

WG Membership: refer Comments at end of document.

**Table 1: Strategic directions of the Technical Council**

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| **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-of-the-art technological advances |
| **2** | Making the best use of the existing systems |
| **3** | Focus on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG) |
| **4** | Preparation of material readable for non-technical audience |

**Table 2: Environmental requirements and sustainable development goals**

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| | CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0. |
| **0** | Other SDGs or not applied |
| **7** | **SDG 7: Affordable and clean energy**<br>Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology |
| **9** | **SDG 9: Industry, innovation and infrastructure**<br>Facilitate sustainable infrastructure development; facilitate technological and technical support |
| **11** | **SDG 11: Sustainable cities and communities**<br>Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management |
| **12** | **SDG 12: Responsible consumption and production**<br>E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption |
| **13** | **SDG 13: Climate action**<br>E.g. Increase share of renewable or other $CO_2$-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning |
| **14** | **SDG 14: Life below water**<br>E.g. Effects of offshore windfarms; effects of submarine cables on sea-life |
| **15** | **SDG 15: Life on land**<br>E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape |

**Table 3: Potential benefit of work**

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| **1** | Commercial, business, social and economic benefits for industry or the community can be identified as a direct result of this work |
| **2** | Existing or future high interest in the work from a wide range of stakeholders |
| **3** | Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry |
| **4** | State-of-the-art or innovative solutions or new technical directions |
| **5** | Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures |
| **6** | Work likely to contribute to improved safety. |

**Comments:**

**1) CIGRE Official Study Committee Rules: WG Membership**

https://www.cigre.org/GB/about/official-documents

a. Only one member per country (by exception of SC Chair)

b. WG nominees must first be supported by their National Committee (or local SC Member) as an appropriate representative of their country.

c. Acceptance of the nomination is granted by the SC Chair and advised to the WG Convener

**2) Collaboration Space**

https://www.cigre.org/article/GB/collaborative-tools-2

CIGRE will provision the WG with a dedicated Knowledge Management System Space.

The WG will use the KMS for drafting collaboration, capture and retention of discussion and meeting records.

Official country WG Members will be sent registration instructions by the Convener.

Official country WG Members may request the WG Convener to allow additional access for an extra national subject matter specialist to aid in the work at the national level, including NGN members.