Endeavour Energy

Technical Bulletin

TB 0328 – Early Fault Detection (EFD)

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Purpose

This technical bulletin provides general awareness of Early Fault Detection (EFD) devices being installed on the network.

Background

What is EFD?

EFD is a network monitoring technology designed to detect primary equipment defects prior to them resulting in functional equipment failure. The system can be installed on any network voltage level, however, it is primarily employed on HV overhead distribution reticulation.

Why are we installing EFD?

EFD continuously monitors the condition of network assets within its coverage area, allowing for detection of defects outside of our cyclic inspection programs. Detection of these defects enables us to perform rectification work where required, prior to the defect resulting in an unplanned outage or potential fire ignition event. The technology subsequently reduces the business' reliability risk and bushfire risk profiles.

How does it work?

The system is comprised of multiple EFD units mounted at various poles throughout a feeder. These units consist of a control panel, and sensors that sit beneath each phase conductor on a feeder. The units monitor the network for high frequency micro-arcing produced by defective assets. When micro-arcing becomes prevalent the units can triangulate the location on a feeder where the equipment has become defective with an online dashboard. Units are placed approximately 3-5km apart from one another along a feeder to provide the required coverage. The units communicate via commercial data networks back to a server hosted by the equipment manufacturer.

What types of defects can EFD detect?

EFD is effective at identifying multiple different equipment defect types. These include:

- Damaged conductors
- Damaged insulators
- Defective transformers

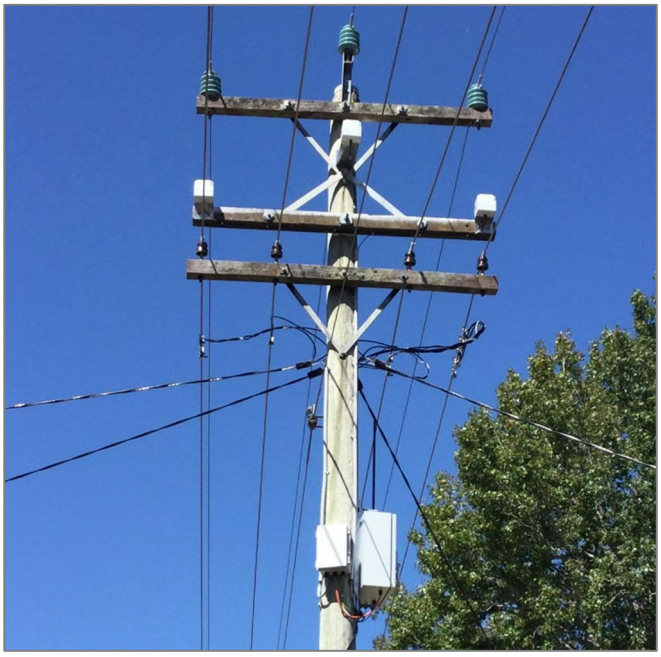

Figure 1 - LV Type EFD Unit Monitoring HV OH

- Defective switchgear
- Vegetation (bark etc.) on mains
- Developing hot joints
- Damaged fittings

Technical Trial

28 EFD units have been operating on 4 feeders within Endeavour Energy's network since mid-2020. To date the units have successfully detected 16 primary equipment defects, which were rectified prior to failure. Most of the defects detected in the trial were damaged conductors. The system also detected bark hanging on mains, and a dead possum on a transformer bushing. Of the defects found, multiple were in heightened bushfire risk areas.

The EFD trial program feeders are:

- CX1210 - Cattai
- BK1299 - Blackheath
- 19857 - Springwood
- 5495 – Dundas

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Design, Construction, & Installation Summary

EFD installations consist of a pole mounted control box connected with sensors that mount on a separate crossarm (on custom brackets) beneath the associated phase conductor. There are two variants of the EFD control units:

- An LV mains powered unit which is connected to a standard single phase LV supply (240 VAC);
- And a solar powered unit with an internal battery for installation in locations where no LV mains supply is available.

Standardised design drawings are under development in conjunction with the trials. Final drawings will be published once sufficient experience is gained dealing with the various existing structures expected to be encountered. Designers completing designs for upcoming locations should leverage the existing designs for various pole arrangements that have been developed for the trial program (including drawing 525545). Existing overhead line design principles and clearance requirements should be applied when producing any designs.

Where standard clearance distances from conductors cannot be maintained during installation of EFD units (such as when working between LV and HV circuits as pictured in Figure 1), approved live work methods shall be used.

Commissioning of the units is to be done in accordance with the provided manufacturer manual. In summary to commission the unit:

1. Power on the control unit device.
2. Once the EFD has power (either mains or solar) indicated by the green LED, wait two minutes and then;
3. Contact IND.T via phone to confirm data flow from the unit to the cloud server.

Operation & Isolation

Figure 3 - EFD GIS Symbol

The EFD units do not interact or send telemetry to any of our existing SCADA systems. The equipment manufacturer currently monitors the devices remotely and notifies Endeavour Energy when a defect is detected. The EFD units will be registered in GIS with their own symbol. At this time there will be no requirement for the control room to interact with the units.

The EFD units are a passive device that draws power from the LV mains (where this type of unit is installed). The units contain a small internal backup battery which

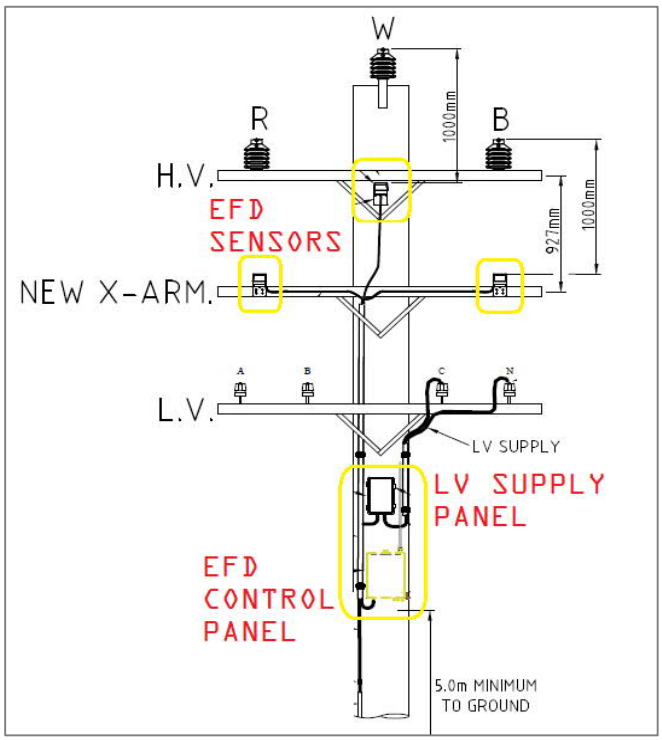

Figure 2 - Example Design of LV Type EFD on Bare HV OH

is charged via an AC/DC rectifier charger. Internal protection circuitry prevents these from back feeding into the LV network. Standard LV access authority procedures as outlined in Section 7 of the Electrical Safety Rules should be followed when performing LV isolations on mains with EFD units installed.

The EFD sensors mounted upon the cross-arm operate at extra low voltage. As such when working on a pole with EFD sensors installed, the cross-arms shall be regarded as a LV carrying cross-arm with standard access procedures applying as mentioned above.

Implementation

39 more units are scheduled for installation in FY24 on 9 feeders. Design documentation and work scopes shall be provided to the work groups installing the units.

Impacted Standards

The standards impacted by this change are

- MCI 0005 – Overhead distribution constructions standards manual

Contacts

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