dcLFL

Line Fault Location System

The dcLFL System accurately pinpoints line faults ensuring that outages are identified and resources are dispatched to quickly restore power to customers.

The dcLFL manufactured by Manitoba HVDC Research Centre (MHRC) locates faults with an accuracy of ±500 meters on an overhead HVDC transmission line. The dcLFL technology was originally developed to locate faults on Manitoba Hydro’s Nelson River HVDC transmission lines. This system has now been relied on to provide accurate fault location in a variety of HVDC links globally, including Malaysia, Australia, New Zealand, India and China.

How it Works

Two cubicle stations are required for each overhead line section to be monitored, one cubicle at each end of the transmission line. The technology consists of computer-based master stations, GPS timing units, custom wavefront detection electronics, and fibre optic transmitters. When a line fault occurs, the resulting wavefront propagates in both directions from the fault. Upon reaching the end of the power line, the wavefront creates a voltage variation at the surge capacitor. This results in a current flowing through the capacitor to the ground. Proprietary dcLFL equipment detects fault induced currents, transforms the current pulses into light which is sent to an electronic cubicle located in the control station.

At each station, the wavefront signals that result from the line fault are threshold detected and sent to the GPS clock for time tagging. The fault location sequence is then initiated. The wavefront signals are also sampled and stored to disk to allow easy visualization of the amplitude and shape of the faults. The electronic cubicles installed at the end of each overhead section communicate wavefront arrival times to each other and the location of the fault is accurately calculated.

Implementing the dcLFL System will minimize the monetary impact of power outages and ultimately extends the lifespan of system infrastructure.
How it Works Continued...

Once the calculation of the fault location is completed at both stations, the results are displayed on the local monitor installed in the dcLFL cubicle. The dcLFL is typically interfaced with a Sequence of Events Recorder (SER), which alerts the operator of the line fault.

System Components

- PC computer-based master stations
- GPS timing units
- Surge Capacitor and wave front detection unit electronics
- Fibre optical transmitters and receiver communication systems (DC switchyard to main computer)
- Station-to-station communication system
- Alarm interfaces including dry contacts and DNP3. Other high level protocols can be added based on customer requirements.
- Human Machine Interface (HMI)

Features

- The system is capable of resolving the location of a detectable fault to within ± one tower or ± 500m, whichever is greater, for a line less than 1000km long.
- The fault’s location can be calculated within one minute of the fault detection and an alarm is sent to the station SER.
- The fault signal detection equipment is utility grade, highly reliable and maintenance free.
- A communication channel between the two dcLFL stations is required and can be configured to accommodate a variety of communication equipment and protocols.
- The GPS clock, printer, fibre optic receiver, computer and associated equipment are housed in a rack mount equipment cubicle. This provides mechanical and electrical interference protection.
- In case of either an auxiliary power failure or communication failure, wave front triggers continue to be stored and can be used to calculate fault locations once the computer is operational.
- Comprehensive self-check and watch-dog functions monitor the software, hardware and the status of the communication link. In case of an internal fault, an alarm signal is sent to alert the operator.
- The FL1000 software manages the detection of the wave fronts, calculates fault location, displays status information and generates alarms when required.

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For more information about our Engineering Hardware Systems, please contact us.

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