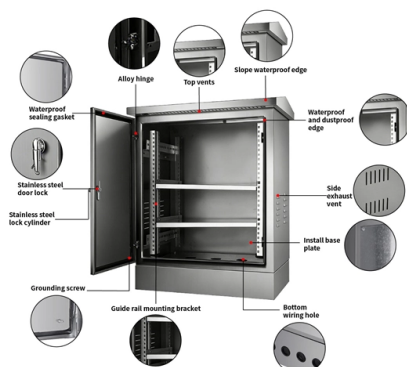


Automation of Low-Resistance Grounding Distribution Networks



Overview

Neutral-Point Voltage Regulation and Control Strategy for Hybrid In this paper, in order to overcome the issue of the low-resistance grounding system being.

Key Takeaways

Automation in low-resistance grounding (LRG) distribution networks enhances fault detection, protection, and operational reliability through hybrid grounding systems, active control, and intelligent fault feeder selection. Overview of Low-Resistance Grounding (LRG) Systems

Low-resistance grounding systems are widely used in urban distribution networks to replace traditional arc suppression coils due to their simplicity, reliability, and improved safety. LRG systems limit fault current during single-phase-to-ground faults, reducing equipment damage and improving personnel safety. However, high-resistance faults may not trigger conventional zero-sequence protection, allowing faults to persist and potentially threaten the network .

Hybrid Grounding Systems and Active Control

To address limitations of traditional LRG systems, hybrid grounding systems combine low-resistance protection devices with fully controlled power modules. These systems employ dual-loop control strategies to actively suppress fault phase voltage and extinguish arcs. The hybrid approach allows for real-time voltage regulation and improved fault response, enhancing the reliability of distribution networks .

Automation and Fault Detection

Automation in LRG networks involves intelligent fault detection and feeder selection. Advanced methods use convolutional neural networks (CNNs) and optimization algorithms, such as the Kepler optimization algorithm, to identify faulty feeders quickly and accurately. This enables timely isolation of permanent faults, minimizing downtime and preventing cascading failures .

Integration with Distributed Generators

The increasing penetration of inverter-interfaced distributed generators (IIDGs) affects fault characteristics in LRG networks. Automation strategies must consider the connection modes of IIDGs to ensure operational safety and protection coordination. Proper integration allows distributed generation to coexist with LRG systems without compromising fault detection or network stability .

Benefits of Automation

- Faster fault detection and isolation, reducing outage duration.
- Improved safety for personnel and equipment.
- Enhanced coordination between distributed generators and grounding systems.
- Support for smart grid applications, enabling real-time monitoring and adaptive control.

Conclusion

Automating low-resistance grounding distribution networks involves combining hybrid grounding systems, active voltage control, and intelligent fault detection algorithms. These technologies collectively improve network reliability, safety, and operational efficiency, particularly in urban areas with high distributed generation penetration .

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