



FTM Microgrids for Utility Distribution Substations

Grid resilience and secure control networks for remote climate-vulnerable sites

Product Highlights

Substation Ethernet Switch RKS-G4000 Series

- IEC 62443-4-2 Security Level 2 certified for secure substation communications
- Network availability with PRP/HSR and redundancy protocols for mission-critical communications
- Modular design enables flexible and scalable network expansion

Microgrid Controller DA-820E Series

- IEC 61850-3, IEEE 1613, and IEC 60255 compliant
- PRP/HSR technology for network redundancy
- Redundant power supplies (100 to 240 VAC/VDC and 48 VDC) with hot-swappable design

Secure Router EDR-G9000 Series

- IEC 62443-4-2 Security Level 2 certified for secure substation communications
- All-in-one secure router integrating router, firewall, NAT, VPN, and IPS
- Seamless integration with substation network topologies including RSTP, PRP, and Turbo Ring

Network Management MXview One

- Automatic network discovery and topology visualization for quick deployment and troubleshooting
- Centralized configuration and firmware management for Moxa network devices
- Substation-critical packet monitoring (GOOSE) to quickly identify communication issues in IEC 61850 networks

Extreme weather events, aging distribution infrastructure, and increasing penetration of distributed energy resources (DERs) are pushing utilities to strengthen grid resilience. To ensure stable power supply and maintain power quality during grid disturbances, many utilities are deploying Front-of-the-meter (FTM) microgrids especially in mountain regions, islands, remote villages or climate-vulnerable zones.

> What Is an FTM Microgrid (utility-owned microgrid)?

An **FTM microgrid** is a **local, substation-level control architecture** that integrates multiple DER sources such as solar PV, battery energy storage system (BESS), diesel generators, hydropower, and wind. FTM microgrids enables the distribution network to operate autonomously (e.g., islanding / grid-forming) when the main grid becomes unstable or unavailable.

> Overview of a Utility-owned Microgrid Project

Since 2022, a national utility operator has launched microgrid projects to enhance grid resilience while strengthening energy autonomy and renewable energy utilization. Under this initiative, energy storage systems, diesel generators, and an energy management system (EMS) are deployed **at existing distribution substations and connected to distribution feeders**. Renewable data from nearby solar DER sites is also integrated into the microgrid operation. The microgrids are monitored and remotely controlled through the utility's distribution dispatch center.

As this national utility already operates IEC 61850-based digital substations, new system integrations must be implemented within the existing Substation Automation System (SAS) without disrupting operations. The solution in this application note interfaces with the existing SAS PRP network to ensure communication redundancy.

> System Requirements

1. High-availability Communication

Redundancy or PRP-based network paths are essential to ensure uninterrupted EMS-BESS-Substation RTU control signals.

2. Secure Segmentation and Remote Access

Because the microgrid is remotely monitored and controlled by the distribution dispatch center, the network must support secure segmentation and protected remote access to prevent unauthorized entry into the substation environment.

3. Real-time Network Visibility

Utilities need centralized monitoring of device health, link status, and event alarms to accelerate troubleshooting and post-event recovery.

4. Operational Integration Within Existing SAS

The microgrid-related systems must be integrated into the existing SAS network without disrupting ongoing substation operations.

Building a Utility-grade Microgrid Communication Backbone With Moxa

Moxa provides a comprehensive portfolio specifically designed for **utility microgrid control and substations**, delivering the reliability, environmental endurance, and OT-grade security required for remote and climate-vulnerable substations, including:

- **Substation-grade computing platforms** for EMS hosting and DER management
- **Protocol gateways and I/O controllers** for PV, BESS, DG, and legacy devices integration
- **High-availability IEC 61850-ready Ethernet switches** that support PRP and redundant LAN architectures
- **PRP-ready solutions** that integrate seamlessly into existing SAS networks
- **Industrial firewall and secure remote access** that enable zone-based protection and build defense-in-depth architecture
- **OT-Focused network visibility platforms** to ensure transparent monitoring and diagnostics

Our solutions build an **end-to-end microgrid communication and control backbone** that maintains power quality, continuous energy supply, and enables rapid recovery for remote and climate-vulnerable distribution substations.

