

## ENEAS distribution automation

# Self-healing solution

## for distribution grids

### ENEAS self-healing solution: Integrated approach for higher supply reliability

High supply reliability for the customer – a major requirement for electricity supply systems – is mainly determined by the distribution networks, which typically feature a low degree of automation only. Here, even the automation of a smaller part of the network can realize significant improvements. Intelligent automation equipments in primary and secondary substations allow for effective monitoring and decision making without human intervention.

Scalable distribution automation solutions start with simple monitoring and control of distribution substations, and end with closed-loop self-healing (Fault Location Isolation and Service Restoration). In cable networks, mainly RTUs and short-circuit detectors are used for the automation of ring main units. For overhead line networks, IEDs and protection relays ensure control and monitoring of reclosers and sectionalizers. Self-healing automation can provide secure and reliable operation of overhead lines and cable networks and can be used for all types of primary equipments: circuit breakers, reclosers, disconnectors, sectionalizers and load break switches.

The ENEAS self-healing solution ensures effective fault detection and fast reaction to specific circumstances within the distribution network. It can be implemented using two different concepts: via centralized regional controller at the primary substation communicating with IEDs on the feeder level, or via decentralized IEDs using peer-to-peer interaction. Furthermore, the self-healing solution can interact with the central SCADA system for reporting of network status.

### ENEAS distribution automation (semi-decentral): Self-healing implementation via centralized regional controller with IEDs on the feeder level

The regional controller based on the SICAM substation automation system ensures local self-healing automation and also provides additional supervisory information. It is located in the primary substation as a link between the central SCADA system and the intelligent field devices. Protection relays like SIPROTEC monitor and protect distribution feeders in the primary substation. Disconnectors and switches at the ring main units can be controlled and monitored via a customized ENEAS distribution automation box including SICAM RTUs and SICAM FCM.

Standard ANSI protection functions in the SIPROTEC relay handle critical fault situations by tripping circuit breakers at the in-feed point. ENEAS distribution automation box sends the status of the distribution network to the regional controller to analyze and take further actions. The regional controller is set up to:

- Detect fault location using fault indications from the field
- Manage standardized switching sequence for fault isolation
- Handle further actions for reconfiguration and service restoration

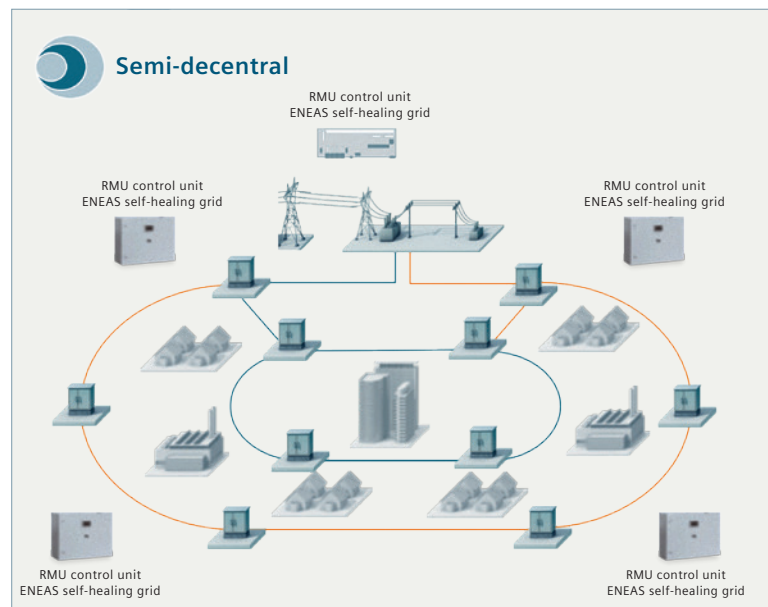
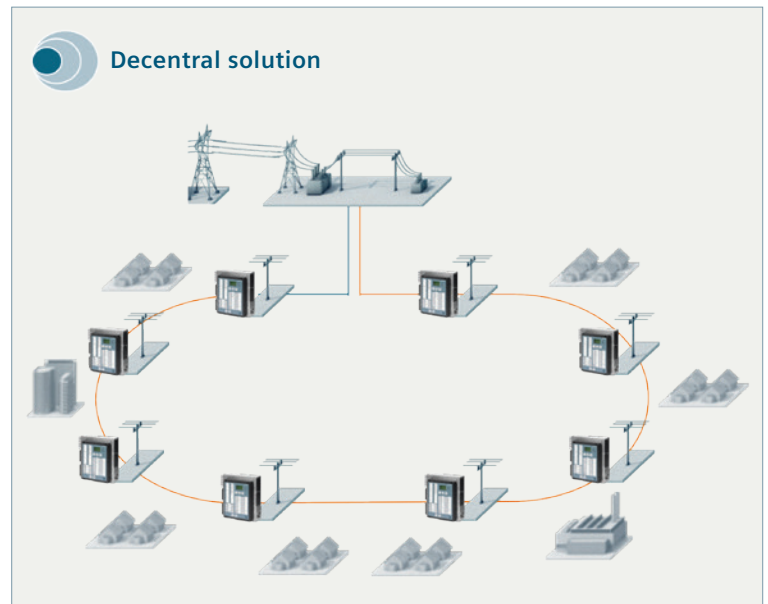
## ENEAS distribution automation (decentral solution): Self-healing implementation via decentralized IEDs with peer-to-peer interaction

The system is designed to work using independent automated devices. The self-healing logic resides in individual SIPROTEC 7SC80 feeder automation controllers located in the feeder level. Each feeder section contains a SIPROTEC 7SC80 with a powerful programmable logic controller (PLC) that can be easily configured by the utility to operate the switching devices in response to local or network conditions. Because the relays communicate with each other in a peer-to-peer fashion, the system operates autonomously with no need for a master controller.

Modern communication systems primarily use the open IEC 61850 standard to support this decentralized application. IEC 61850 provides the required logic and flexibility for the realization of the self-healing functionality. Peer-to-peer functionality via IEC 61850 Generic Object Oriented Substation Events (GOOSE) messages not only provide binary data, but also analog values. Each SIPROTEC 7SC80 unit contains extensive programmable logic, which is designed with the FASE (Feeder Automation Sequence Editor) engineering tool to realize the automation functionalities. The IEDs then handle the self-healing functionality, attempting to clear and isolate the faults in order to initiate the service restoration logic.

### Benefits at a glance

- Cost-effective and future-proof solution for automatic and rapid fault analysis, fault location and restoration of power supply
- Flexible solution supporting centralized and decentralized configurations
- Easy to configure and maintain with dedicated tool landscapes like FASE (Feeder Automation Sequence Editor)
- Automated switching procedure to return to normal operation
- SCADA system connectivity to self-healing solution for monitoring and control purposes
- Improvement of distribution grid reliability indicators (e.g. SAIDI, SAIFI) by reduction of outages
- Avoid penalties and secure power supply for critical loads like hospitals and data centers



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