Moving Securely into the Future

Area-wide fault recording using state-of-the-art technology

The company

As the largest power supply company in the region delivering power to the greater Nuernberg area, N-ERGIE supplies electricity to about 650,000 customers. Each year, N-ERGIE provides an average of 7,300 million kWh of power to a 7,500 km^2 service area.

The starting situation

As an operator in its service area, N-ERGIE needed a state-of-the-art, cost-effective method for recording faults in order to ensure reliable power system management. Because the hardcopy recorders currently in use were both maintenance- and labor-intensive, N-ERGIE was looking for a future-oriented fault monitoring system. They had complete confidence in the expertise and technology of Siemens PTD Power Automation Division.

The concept

The only way to efficiently reduce maintenance and operating costs is through the automatic monitoring of power transmission equipment. To ensure reliable power quality monitoring for the entire service area, N-ERGIE will employ 48 digital SIMEAS R fault recorders and 35 existing OSCILLOSTORE P531 fault recorders in the medium- and high-voltage power systems. In addition, state-of-the-art recording technology will support research into the causes of faults and failures in the power supply system.

The special advantages

Detection of power anomalies

Detailed fault records can now be used to obtain additional, important information on the fault history, even in the case of complex error profiles, thus permitting targeted research into the fault's origins and providing a basis for effective prevention.

Support for fault clearance

Information supplied by the recording system directly supports fault clearance experts in localizing the fault. Resultant costs are significantly reduced when the location and origin of a fault are quickly pinpointed.

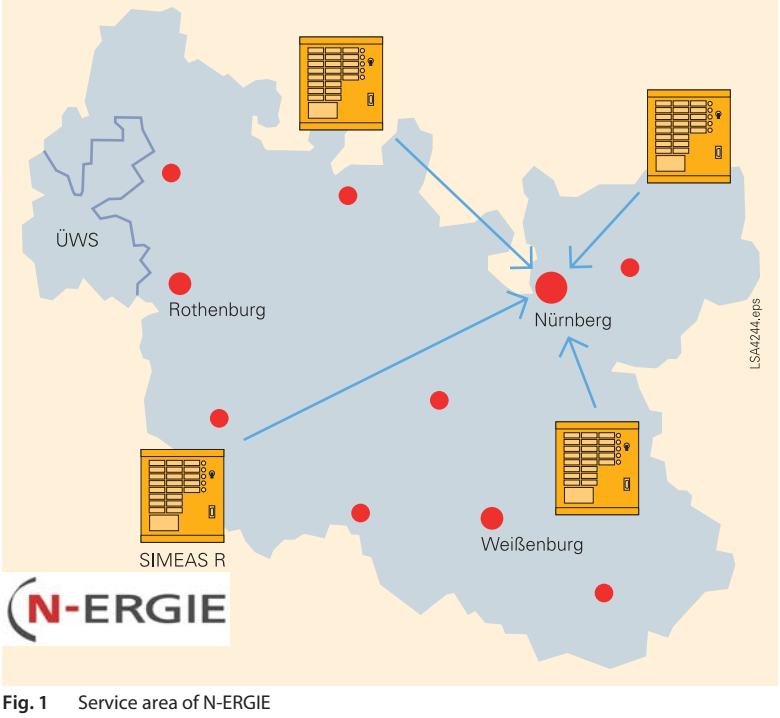

Fig. 1 Service area of N-ERGIE

Load forecasts

The mean-value recorder generates daily, weekly and even annual load curves. The values derived can serve to generate a much more precise forecast for the future – a money-saving advantage when purchasing power.

Protection monitoring

Older substations in particular still have protection relays without fault recording or without long-distance transmission capability. Any information on the cause and history of the fault is completely lost. In such cases, SIMEAS R recordings may be used to verify the correct functioning of the protection relays, e.g. correct tripping behavior/tripping time of the relays.

Additional benefits are achieved by swapping out fault records to the COMTRADE format. This general standard makes it possible, for example, to perform additional tests using Omicron test equipment. Analyses from the fault records also yield important information for optimizing equipment.

Four integrated recorder functions and decentralized data storage mean faster access to all essential data in the event of a fault. Only SIMEAS R can handle such high volumes of data, thanks to its data compression procedure. And excellent system integrity ensures that the extreme ambient conditions under which power is supplied are always taken into account.

■ *From practical experience*

This section describes the sequence of events and exact fault detection process for a complex fault recorded by an OSCILLOSTORE P531. A single-phase-to-earth fault on L3 developed into a two-phase-to-earth fault between L2 and L3:

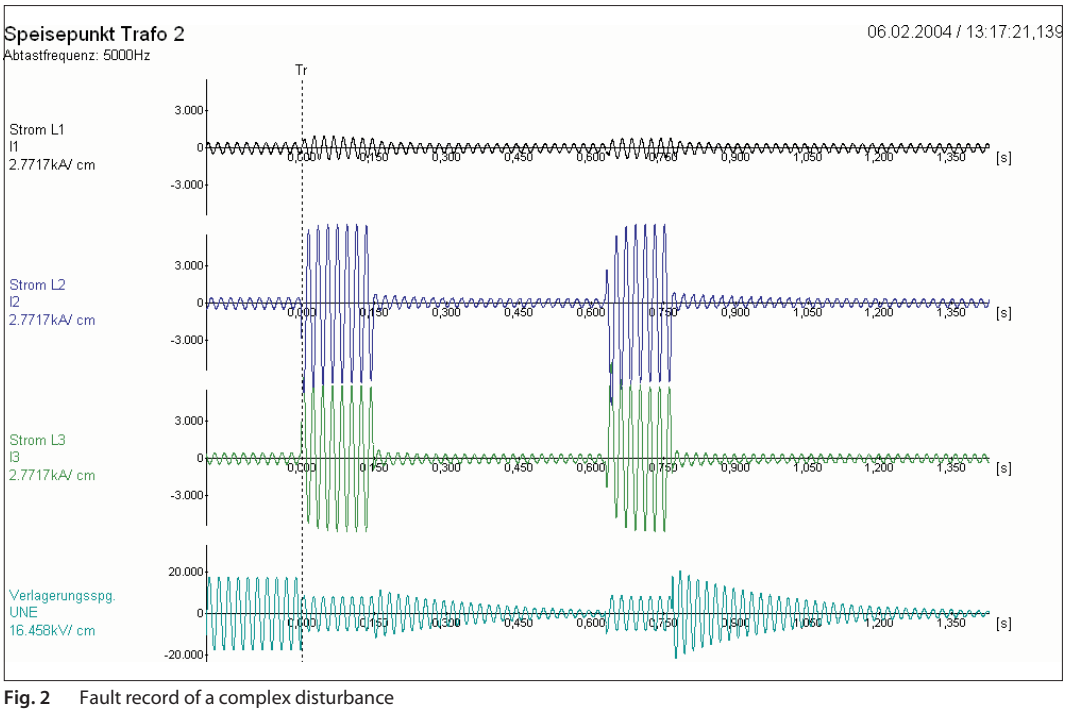

Fig. 2 Fault record of a complex disturbance

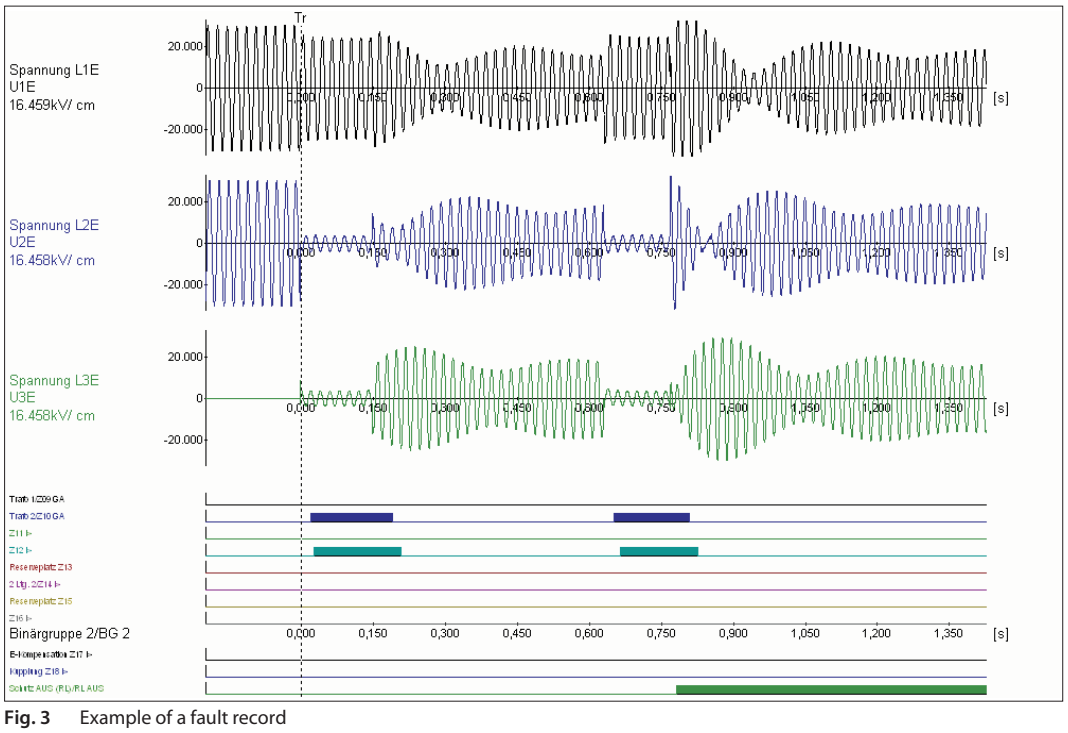

Fig. 3 Example of a fault record

Procedural description

1. Background: Single-phase-to-earth fault on L3, U_{3E} suffered a near total breakdown, U_{1E} and U_{2E} increased by the cube root to approx. 21.3 kV. The displacement voltage U_{NE} rose to 12.5 kV.

2. A two-phase-to-earth fault between L2 and L3 was added (time on trigger line Tr), short-circuit current approx. 4.7 kA. Both the electromechanical distance protection (overcurrent tripping) in the relevant outgoing feeder in bay 12 and the higher-level numerical distance protection (impedance tripping) in the incoming transformer feeder in bay 10 were tripped (see binary traces).
   Feeder protection was tripped instantaneously (approx. 140 ms) and reclosed automatically (duration approx. 460 ms). During this time, the short-circuit current was interrupted and only operating current continued to flow through the remaining system (approx. 400 A).

3. Auto-reclosure (AR) was followed by automatic connection. However, the fault was still present. Both the feeder protection and the higher-level transformer distance protection were re-tripped (see binary traces).
   The outgoing feeder was then instantaneously (approx. 120 ms) and finally tripped (failed AR) – see binary trace protection AUS of the loop feeder (LF).
   This fault recording system is the best way to test the functioning of the electromechanical protection system.

■ *Conclusion*

Lightning-fast detection and correction of faults has not only increased end user satisfaction but has also saved N-ERGIE money. Unique product features such as automatic data transmission and system management, the advantages of a high sampling rate and resolution, and the high-quality, user-friendly software for fault records have all contributed to the complete success of SIMEAS R. The extensive expertise of the Siemens project managers was decisive in achieving the high degree of customer satisfaction.