Karlsruhe Institute of Technology

Division III – Mechanical and Electrical Engineering

Institute for Automation and Applied Informatics (IAI)

EDR – Electrical Data Recorder

Monitoring and Analysis Tool for Electrical Power Grids

As a result of the efforts to reduce CO_2 emissions in electrical power generation, the electrical power grid is being subjected to a structural change. More and more volatile producers at the consumption end of the line lead to increasing fractions of replaced central production capacity, but hardly serve the grid, as they neither fulfill tasks like voltage stabilization nor provide control energy. Hence, operation management concepts have to be developed, which go beyond the management of transport capacity and also consider power quality issues. With the help of detailed simulation models and high-resolution measurement data from ongoing grid operation, the required analysis and evaluation studies are carried out.

Continuous Recording

The electrical data recorder continuously scans three voltage channels (three phases) and four current channels (three phases plus neutral conductor) synchronously with a resolution of 16 bits and data acquisition rates of up to 25 kHz. By means of GPS synchronization, temporal allocation of measurement values from distributed measurement locations is ensured. Functionality may be understood as a storage oscilloscope that is operated in the distributed mode. If a data network connection is available, the complete measurement data are stored continuously in the KIT large-scale database for later processing. As an alternative,

EDR prototype

local intermediate storage is possible for an offline recording period of up to eight weeks. A graphic user interface with touch support allows interactive control of the recording process. It displays the scanned data and the derived characteristics (effective values, frequency, min-max values, harmonics, etc.). Buffered power supply also ensures recording during voltage losses. The measurement instruments can be used separately for e.g. single location diagnosis of power quality problems or they can be used in a multi-location, synchronized observation of the power grid. In the latter case, all instruments are controlled and monitored via a central application.

Technical Data

Data Acquisition	
Synchronous scanning	Adjustable up to 25 kHz
Resolution	16 bits
Channels	3 voltage, 4 current

Analog Interfaces	
Voltage input	Range modules for 400 V and 100 V
Current input	Interface for Rogowski coil (300 A, 3 kA), internal: 60 A, alternatively (in preparation): 5 A, 1 A, and +- 10 V

Synchronization	
GPS-PPS signal	Deviation < 3 µs

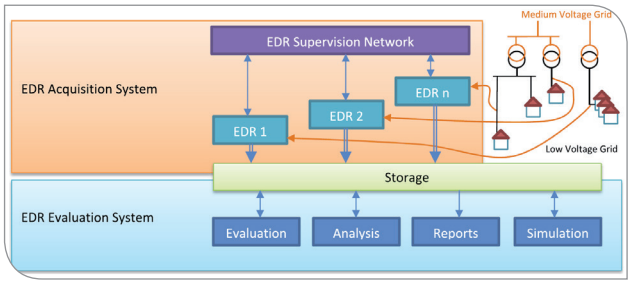
Communication	
LAN	Raw and characteristics data transfer
4G	Monitoring and instrument control

Storage System	
Capacity	Variable, typically 4 TB
Recording time	About 8 weeks, full resolution

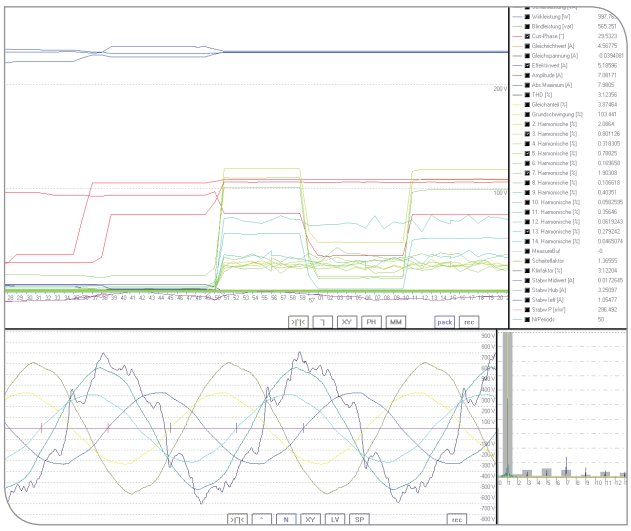
Power Supply	
230 V	Internal buffer

Detailed Propagation Studies

Interconnected operation, together with continuous recording, enables detailed propagation studies of disturbances and their history. Future data acquisition with the electrical data recorder will improve the quality of modeling of grid segments and operating resources.



Simplified representation of the data flow concept



Graphic user interface

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