

We take care of it.



Global Grid Quality ...

- Transformer Monitoring
- Collapse Prediction
- Fault Disturbance Recording

- Fault Disturbance Recording
- Damping Monitoring
- Transformer Monitoring
- Petersen-coil Controlling & Earth Fault Detection

- Power Quality Analyzing

- Power Quality Analyzing

high voltage



medium voltage



low voltage



Blackouts are preventable

CPR-D: helps to identify critical grid conditions and hence to avoid it



CPR-D



- Detection of collapse-specific frequency patterns
- Frequency monitoring
- Recording of damping events
- Real-time calculation of the Lyapunow exponents
- Disturbance recording

- **SCADA Integration**
according to IEC 61850

The Collapse Prediction Relay CPR-D is a monitoring device for early detection of blackouts, of critical grid conditions, for identifying weak points in the grid and for obtaining indispensable data for safe grid management. This data is obtained from the continuous recording of dynamic processes within the grid.

However, the CPR-D/CPSys has also been designed for long term grid analysis. Comparing grid reaction in different conditions in terms of frequencies below 50/60 Hz is giving a new quality of informations. That is helping to prevent critical constilations for the future.

During normal operation, the damping values provide excellent insight into the dynamic behaviour of the grid. To locate weaknesses, „Damping maps“ of individual grid areas can be established by means of the damping monitor. It is based on the comparison of the data of at least two devices. The effects of

changes of grid topology and grid reactions to changed load dynamics influence the grid's damping properties. Pertinent information is an indispensable parameter for dynamic grid management.

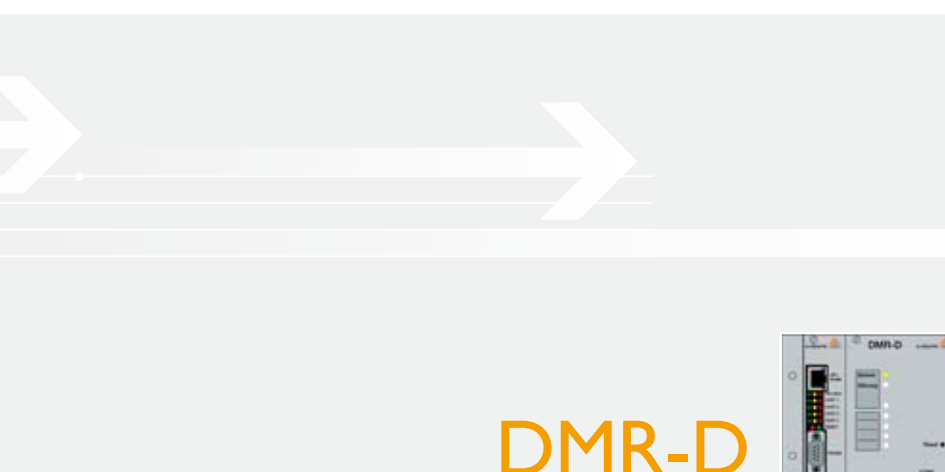
Another essential aspect of dynamic grid management is optimized grid utilization. The variables obtained by means of the CPR-D enable transmission capacities to be linked to the dynamic processes in the network.

Various interface devices (e.g. IEC 61850) help to integrate the CPR-D/CPS-D measurands in power control systems. This provides elementary grid parameters for grid management which, for the first time, take actual dynamic processes within the grid into account.

The „damping maps“ provide important findings for grid planning, and this especially with the current grid change processes in mind.

Grid stability – how is your score?

DMR-D: to identify weak spots quickly



DMR-D



DA-Box 2000

In the future, stricter requirements will be put in place for the economic management of distribution networks. The required optimisation processes in the distribution networks correspond to those that have already been started in the superimposed networks.

In addition to production systems, highly-automated production systems with interfaces to the distribution network are used by customers. Furthermore, additional compensation units for reactive current compensation are installed in the distribution networks. All in all, this leads to a new load situation for the distribution networks.

With the help of the DMR-D damping monitor, weak spots can be identified and a new form of network service can be provided.

The information from the DMR-D can be used, for example, as an input for scenario planning or scenario controls for distribution networks. Data compression via the DMR-D also creates an ideal basis for communication between processes and service personnel, as well as between processes and strategic asset management. The development of damping measures over time and the Lyapunow exponents form the criteria for monitoring the network dynamics. The larger the Lyapunow exponent, the „quicker“ the network will reach the critical management steps; in marginal cases the network will become unstable.

Those new dynamics responsible for these error functions can generally not be identified by the conventional safety system.

- Monitoring the damping profile of the network
- Real-time calculation of the Lyapunow exponents
- Warning **critical damping reached** can be generated with at least three DMR-D devices
- Fault recorder function
- **SCADA Integration according to IEC 61850**



Convincing control and detection methods

EOR-D/EOR-3D: Earth Fault Detection Relay

REG-DP/DPA: Regulator for Petersen-coils



EOR-3D



EOR-D/EOR-3D
REG-DP/DPA



EOR-D

- Transient-Method with qu-algorithm and qui for intermittent fault detection
- Harmonics-Method
- Wattmetric-Method
- Pulse-Method (location in depth)

EOR-3D

- qu2-algorithm for the directional recognition of transient earthfaults
- Directional detection of intermittent and restriking line-to-earth faults
- Direction detection of active and reactive power of the zero-sequence system
- Harmonics-method
- Pulse-method: Standard and using HPCI
- Indication of short-circuits and double earth-faults
- Identification of ferroresonance

REG-DP/DPA

- Resistor control
- Recording of the Zero-Sequence-Voltage
- Multimaster-System-Architecture

- **SCADA Integration according to IEC 61850**

To make use of the advantages of the various detection methods in different earth fault situations, the freely programmable earth fault detection relay **EOR-D** makes it possible to select and combine the following earth fault detection methods:

- Transient-Method with qu-algorithm and qui for intermittent fault detection
- Harmonics-Method
- Wattmetric-Method
- Pulse-Method (location in depth)

In combination with the PC-Software WinEDC the following functions can be realized:

- Parameterisation of the relay
- Fault-analysis
- Net-analysis

The basic unit has been designed for the supervision of up to four feeders; a 19 inch rack can be equipped with up to four relays (see picture above). Therefore at present up to 16 feeders can be monitored using a 19 inch rack.

In medium- and high voltage networks, the freely programmable regulator **REG-DP/DPA** is used for the automatic control of Petersen coils, which are continuously adjustable on load. Furthermore, the controller can solve a lot of control-, measuring- and recording tasks all around the Petersen-coil.

As a standard feature, the regulator offers different methods for the automatic control of a Petersen-coil. Depending on the requirements, REG-DP/DPA can control either a percentage or absolute detuning-current or a given zero-sequence-voltage.

Furthermore, there are different methods available for the control of several Petersen coils in the same network. Included as an independent functional unit there is a resistor-control for the „increase of the wattmetric current“, which can be freely parameterised and which contains even a thermal model.

New requirements to the control, like hardly measurable U_0 or noisy U_0 respectively, can be covered with the optional current injection unit.

The watchdog for your transformer

REG-D/REG-DA: Transformer Monitoring and Control System



REG-D/REG-DA



REG-DA: wall mounting version

REGSys™ Transformer Monitoring System takes care of all the Monitoring & Control functions on power transformer which help users replacing conventional RTCC (remote tapchanger control cubicle)

Programmable analog inputs facilitates monitoring of tap positions, oil temperature, winding temperature, dissolved gas content & moisture content. REGSys™ offers intelligent fan/pump control on power transformer and thereby it helps in achieving energy conservation as well as equal utilization of all fan/pump groups.

With programmable binary inputs, all relay functions like Buchholz-Alarm/Trip, PRV Trip, Oil Level Low, Tapchanger Motor Trip can be monitored and recorded in the event recorder. All the tap changing operations as well as

voltage violations are recorded in the integrated event recorder.

Tapchanger statistics (how many operation on each tap?) are recorded including the total number of operation. REGSys™ offers facility of recording of voltage, current, oil temperature etc. on continuous basis which can be downloaded at a later date in the event of any requirement of analysis/investigation.

REGSys™ could be easily integrated into the SCADA/DCS system on various protocol including IEC 61850.

All these features bring distinct advantages to the user/network:

- facilitates preventive maintenance
- helps in trouble shooting
- saves space
- no need of separate RTU
- built-in event recorder

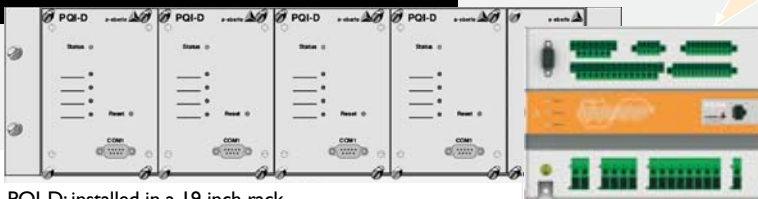
- Control Mode
- Recorder Mode
- Logbook
- Statistics Mode
- Transformer Monitor
- Transducer Mode
- ParaGramer Mode

- **SCADA Integration**
according to IEC 61850



In the blink of an eye ...

PQI-D/PQI-DA: instantaneous values from low, medium and high voltage networks



PQI-D: installed in a 19 inch rack

PQI-DA: wall mounting version

PQI-D/
PQI-DA



- Fault (Disturbance) Recorder
- Event Recorder
- Power Quality Monitor
- Continuous Recorder
- Transnastic
- Transducer
- IEC 61000-2-2
- IEC 61000-4-30, Class A
- EN 50160
- **SCADA Integration according to IEC 61850**

The Power Quality Interfaces PQI-D/PQI-DA can be utilized on the consumer as well as on the distributor or generator side. Consumers can clearly distinguish imported faults from faults generated in their own network, while power suppliers are able to document the voltage quality delivered to consumers at any given infeed point over any period of time selected.

PQI-D/PQI-DA records eight input values ($4 \times I$ and $4 \times U$ or $2 \times 4 \times U$) with a time resolution of $100 \mu s$ and a measurement resolution of 24 bits. These instantaneous values are used to determine all of the measured or limit values defined according to EN 50160; IEC 61000-4-30 serves as the basis. The PQI-D/PQI-DA features several fault recorders, which differ mainly in resolution.

The event recorder records all limit violations according to EN 50160 including identification and time stamp.

When using RMS fault recorder, it is possible to record a selection of measurands as event-driven 10 ms average values (TRMS values). The duration of the recording as well as the location of the trigger point can be freely selected.

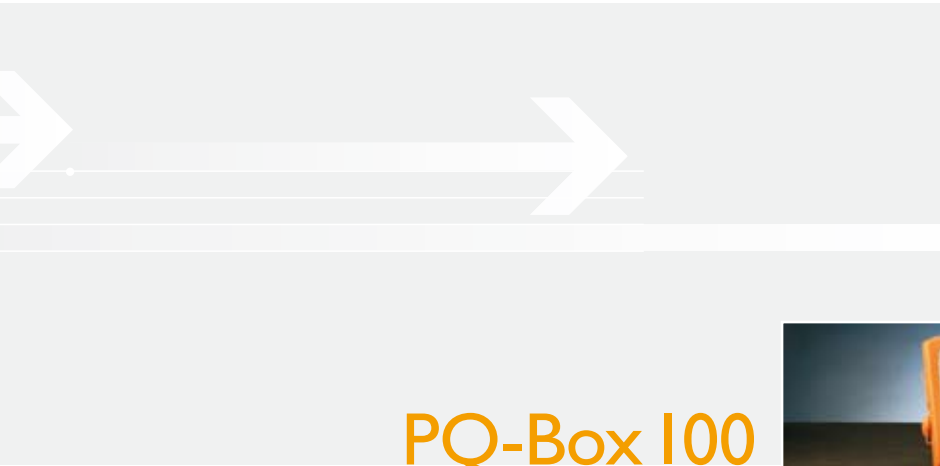
Oscilloscopic fault recorder functions are based on instantaneous values ($100 \mu s$ values). This makes it possible to register the fingerprint of a fault.

The Harmonic recorder stores the 10 minute average values of the harmonics (from the 2nd to the 50th) for a selection of measurands.

When using the Transnastic function, it is possible to decide whether a fault was imported from a high-voltage network or generated on the medium-voltage side.

Tough enough for any job ...

PQ-Box 100: the extremely robust network analyser



PQ-Box 100

The PQ-Box 100 is a high-performance, portable network analyser, power meter and transient recorder in one instrument. The focus of our development was user-friendliness.

The PQ-Box has been developed for mobile operation (degree of protection IP 65), and is intended for measurements in public networks (installation category: CAT IV). The device conforms to all the requirements of the stringent IEC 61000-4-30 measurement device standard for Class A devices.

Thanks to its small size, power supply via measurement cables and application-specific settings, this instrument is extremely easy to use. The device is equipped with a number of triggering options to locate the cause of the fault more quickly. A USB II interface is available to transfer the data.

In the case of power failure, operation is maintained via an integrated, uninterrupted power supply.

Three measurement functions are available.

PQ-Box basic: The device is suitable for load analysis, datalogging and online analysis of the network.

PQ-Box light: This version records additional to the basic device all harmonics and interharmonics. Automatic power quality reports according to EN 50160, IEC 61000-2-2 or IEC 61000-2-4 are produced from the software.

PQ-Box expert: The expert version adds oscilloscope traces and 10ms r.m.s. recordings with advanced trigger functions. Automatic trigger adjust all triggers automatically to the network disturbances. All versions can easily be upgraded via a license.

Robust mechanical construction and the absence of rotating parts (fan or hard drive) make the PQ-Box 100 suitable for the toughest applications.

The device is equipped with a large, 1 GB memory. Thus, measurement values can be stored for up to one year. In the case of power failure, an internal UPS ensures voltage supply. This can be supplied via the measurement cables or externally.

- Automatic power quality reports according to EN 50160, IEC 61000-2-2 or IEC 61000-2-4 for low, medium and high voltage networks
- IEC 61000-4-30 class A device
- Fault recorder function
- Load analysis
- Energy measurement
- Shockproof, waterproof housing
- 1 GByte memory
- CAT IV



Our most important fields are

- Voltage control and transformer monitoring on transformers with tapchanger
- Regulation of Petersen-coils
- Ground fault tracing in medium and high voltage system
- Power Quality Analyzer
- Fault Disturbance Recorder
- Collapse Prediction System
- Damping Monitor
- Calibration and simulation of multiple-wire systems

It is our aim to solve all measuring, control and recording tasks revolving around the transformer and the choke coil.

It goes without saying that we are prepared to tackle and solve new, unconventional tasks for our customers at any time.

Please, take a look at our offer on the website: www.a-eberle.de

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