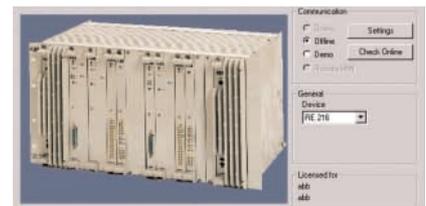


# Enhanced generator and transformer protection for continuous and secure power delivery

Upgrading static generator protection systems GSX with numerical unit protection system REG 216



# Enhanced functionality with the REG216 numerical unit protection system

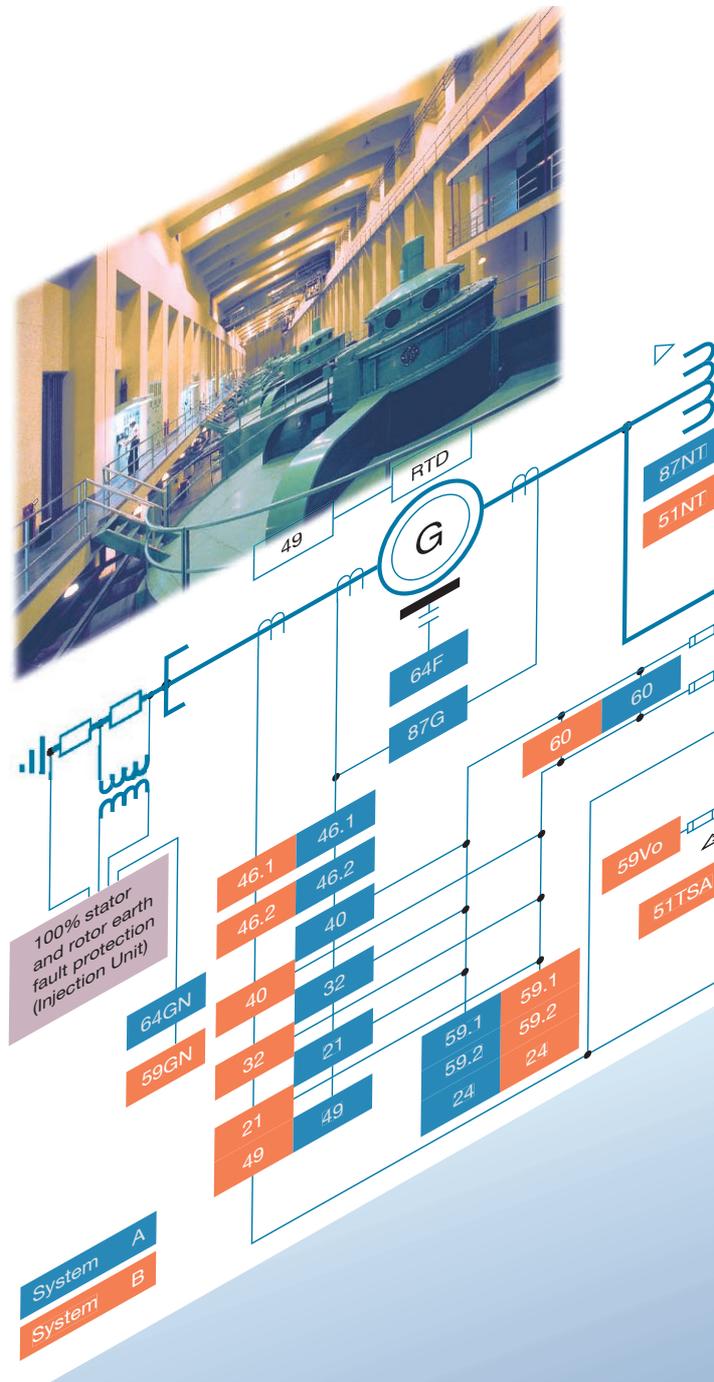


Many utilities all over the world are facing an increase in power demand and the need for more efficient use of existing assets. Cost reductions in operation, maintenance, and service have to be achieved by higher productivity and availability.

Enhancing or upgrading existing static generator and transformer protection schemes (unit protection schemes) with full numerical unit protection solutions is an important aspect in the overall strategy of process optimization.

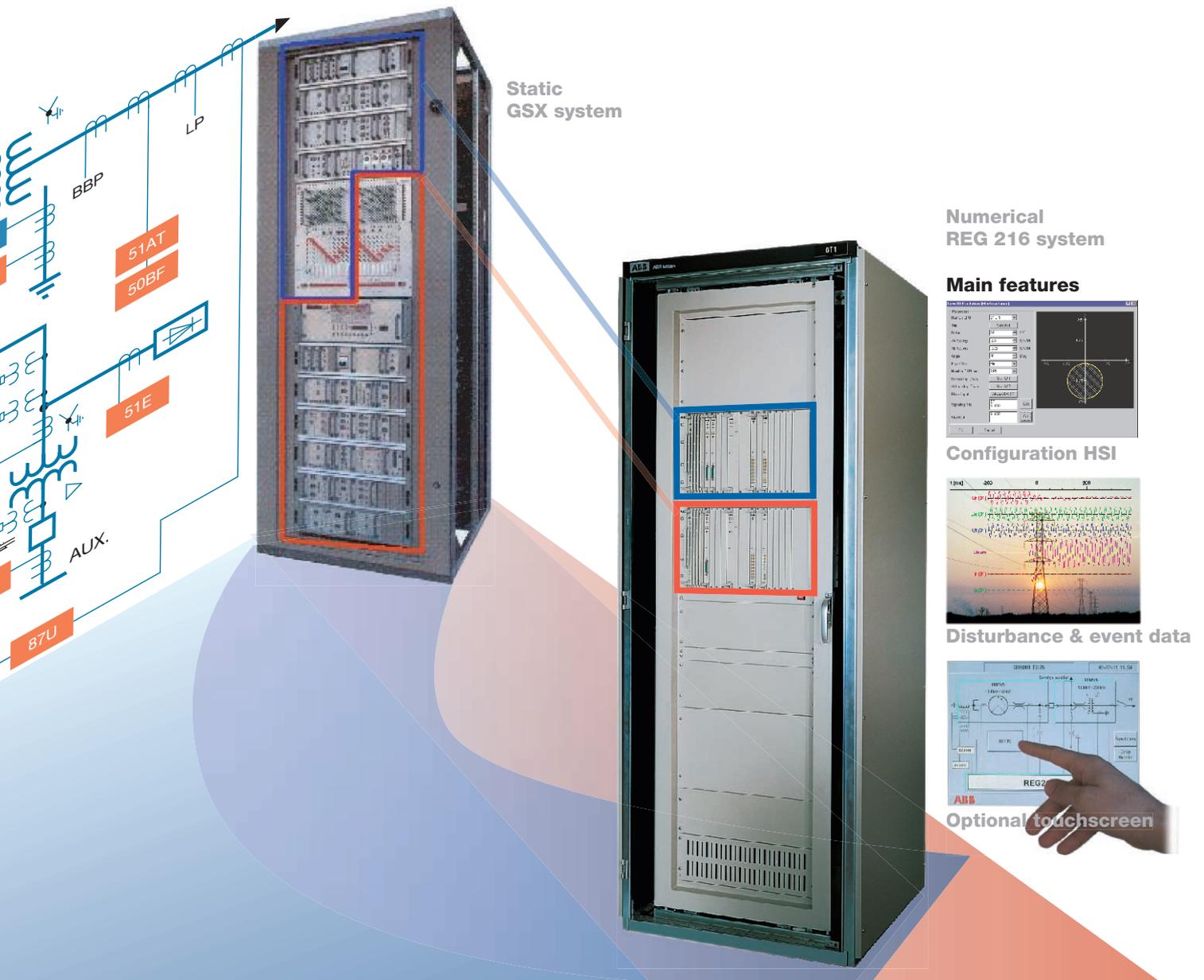
When considering enhancement or upgrade, the major benefits are:

- Higher availability of power supply through enhanced protection scheme
- Prolonged service life with state-of-the-art condition monitoring and protection
- Optimized productivity and maintenance through diagnostic and testing features
- Comprehensive support for operators with on-line measurements and system status supervision
- Reduced outage times through faster and more precise fault analysis using disturbance and event records
- Enhanced service capabilities through local and/or remote communication access



**Highest consideration is given to customer requirements in terms of scope, functionality, redundancy, flexibility, and implementation:**

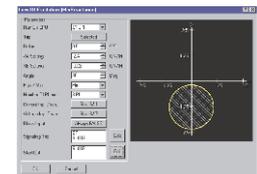
- The scope can range from a minimum device upgrade, possibly by the customer's own staff, keeping the existing cubicle and wiring, to a full retrofit.
- The modular hardware and the comprehensive software function library support the implementation of the existing functionality or adaptation to the latest requirements and philosophies.



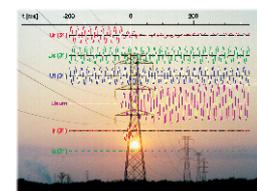
Static GSX system

Numerical REG 216 system

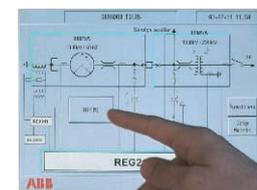
**Main features**



**Configuration HSI**



Disturbance & event data



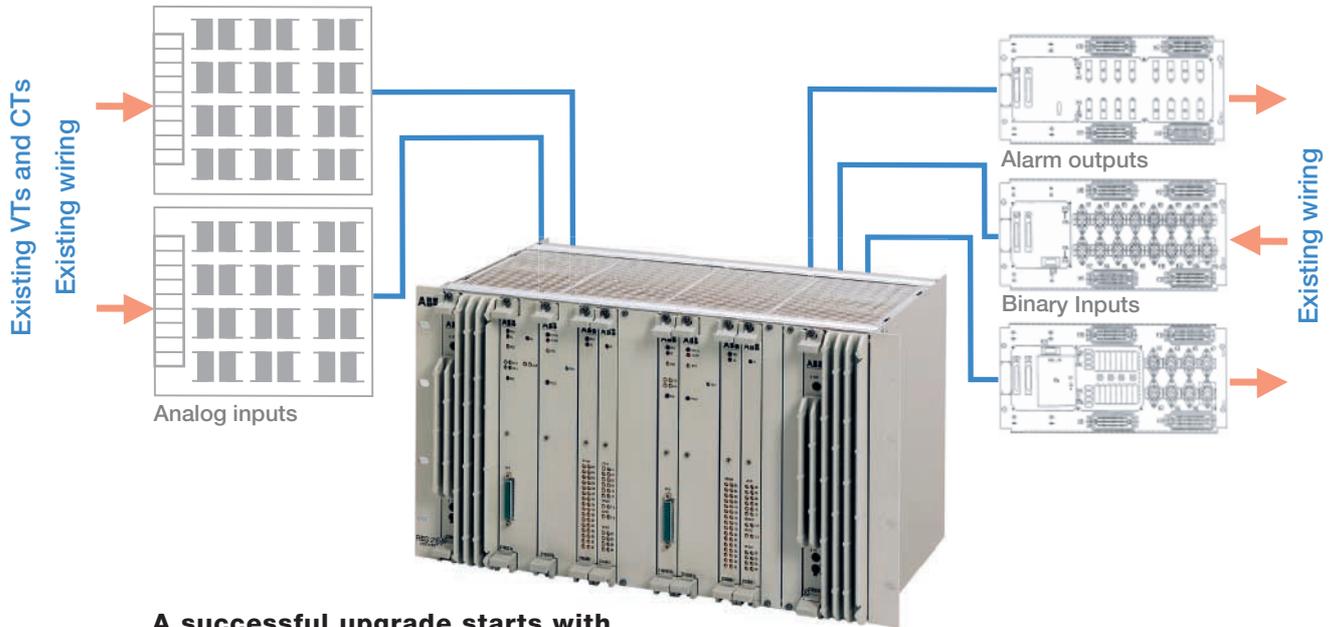
Optional touchscreen

- Single or redundant systems can be selected to suit the customer's availability and maintenance requirements. The latter can be implemented based on overlapping or duplication principles.
- The vast CPU capacity and the software library allow activation of protection and logic functions in any combination and at any time.
- Different maintenance philosophies are accommodated, from testing with generator units in operation to injection testing via isolation terminals during shutdown.
- Tailored implementation is ensured by a close cooperation between customer and supplier.

**The REG 216 numerical, multifunctional system has been developed on the basis of the well-proven GSX model. The modular hardware design and comprehensive software function library make it particularly suited for upgrading existing protection systems:**

- It covers a larger protection zone, i.e. generator, step-up transformer, and auxiliary service transformers and feeders.
- It provides simplicity of adaptation to the primary system during the entire life cycle. This is achieved through the software library and hardware modules.
- It poses no additional requirements on the existing current and voltage transformers. In fact, the burdens on the CTs are lower.

# Upgrade concept for static GSX to REG 216 numerical unit protection system



**A successful upgrade starts with proper planning to ensure that the implementation meets the schedule and commitment for on-time power production:**

- The upgrade system REG216 can be connected to the existing hardware interfaces.
- Reuse of the terminal blocks in the existing cubicle reduces drawing design for the interconnection to the primary equipment.
- Well-maintained CTs, VTs and wiring can be reused.
- The REG216 can be adapted to modifications in the primary equipment during the entire life cycle, e.g. the subsequent installation of a generator circuit breaker.

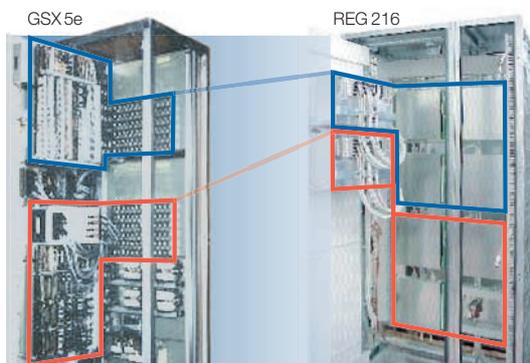
**Depending on the customer's needs, the upgrade may be performed in different ways:**

- The customer may choose to use his own resources to complete the on-site removal and installation work.
- ABB can provide all labor and assume total responsibility for removal and installation.
- A tailored division of work can be agreed upon

*ABB offers*

- Upgrade protection systems including engineering
- Complete cubicle with upgrade system(s) mounted, wired, and tested
- Consulting
- Site survey, studies, and reports
- Project management
- Engineering and design
- Installation, commissioning, and start-up activities
- Training, education, and support

**ABB ensures the complete success of the upgrade in close cooperation with the customer.**



Hardware upgrade in existing cubicle.

# Continuous and secure power delivery with the REG 216 numerical unit protection system

## Operation

As increasing demands are being placed on the generation equipment, it needs to be optimally protected to meet the operational requirements, minimize outages, and prolong its service life.

The unique and comprehensive protection software logic function library of the REG216 allows the user to select the functionality best suited to his installation, philosophy, and current practice.

*The scheme can be complemented by functions such as 100% stator earth fault protection based on the injection principle to protect the unit even during standstill and startup. Protection against inadvertent energizing, application specific logic and supervisory functions, such as voltage balance are further examples that can be considered.*

To further ensure high uptime and productivity, redundancy needs to be given due consideration. Depending on the primary installation, its size or importance, the owner might want to have:

*Hardware redundancy: two REG216 systems with common or separate input transformers can be selected. The systems always have separate binary inputs, signaling and tripping outputs.*

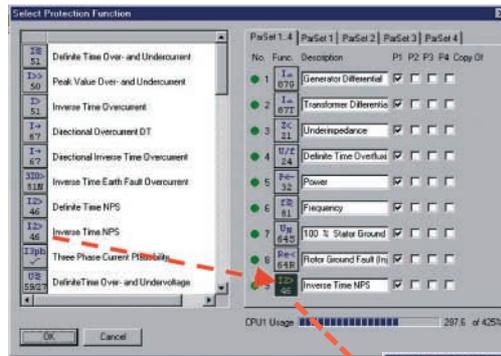
*Functional redundancy: the protection functions can be allocated according to the overlapping principle with main and backup protection systems A and B.*

*Alternatively, the functionality can be duplicated in both systems A and B.*

*Supply redundancy: each protection system can have one or two power supply modules, which can be fed from different batteries.*

In general, it is recommended to have the generation equipment protected by two systems (A and B) for reasons of availability and reliability.

**Easy setting** of the REG216 using the Windows-based human system interface (HSI) program CAP 216.

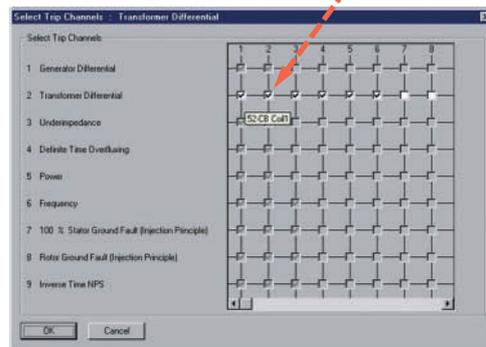
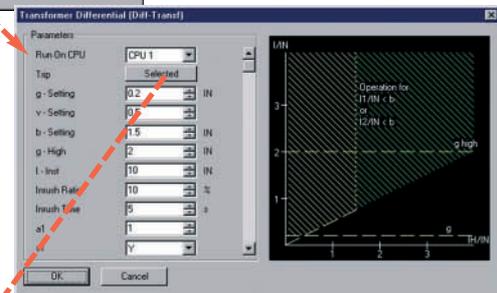


## Easy activation

**of protection functions** from the complete library for generator and transformer protection ("drag & drop").

## Interactive display

of the tripping characteristic reflecting the setting values.



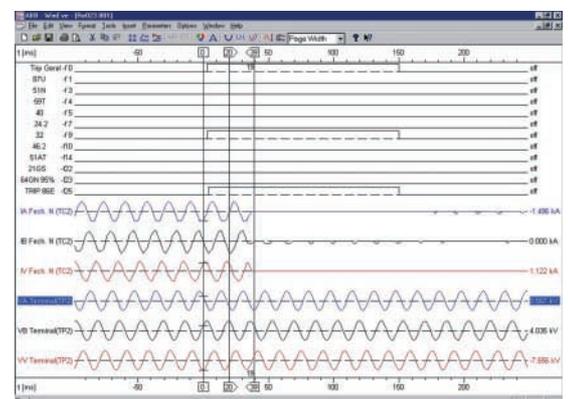
## The software tripping matrix

provides a perfect overview of the tripping scheme.

## Comprehensive fault analysis

The REG 216 system includes event and disturbance recording as well as measurement functions and the interface to coordinate with the station control and/or monitoring systems.

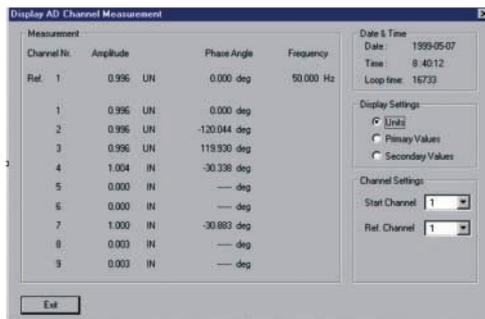
The additional information obtained from these functions allows the user to gain a more complete picture of the situation following a power system fault and thus reduce the time needed for fault evaluation.



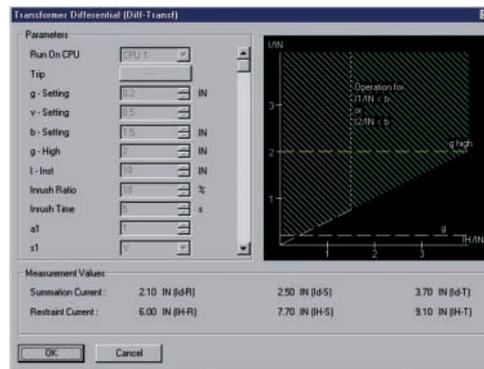
# Self-monitoring and testing

Periodic testing of numerical protection is only necessary in a much-reduced form compared to static protection systems. Furthermore it can be performed with the generator running.

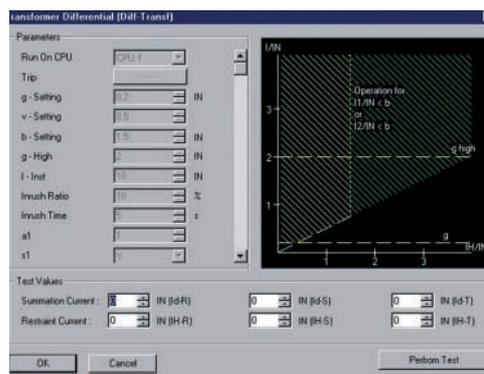
The self-monitoring and testing routine philosophy of the REG216 is quite different from conventional testing techniques. Periodic injection testing can be replaced by the provision to view various operating measurements combined with the self-monitoring functions of hardware and software. Online testing and monitoring is facilitated for:



- Analog input channels displayed with primary and secondary values
- Load values as measured by the protection functions
- Binary input status display
- Signaling and tripping outputs display



Protective function measurement within tripping characteristic display.



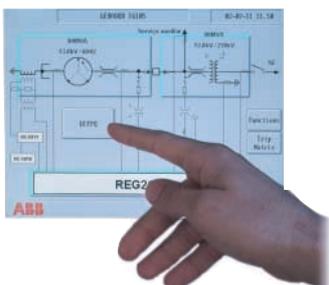
Testing of protection functions based on the setting values.

Additionally a password-protected test generator in the HSI is provided for commissioning.

Injection testing can also be carried out. Therefore isolating terminals are provided.

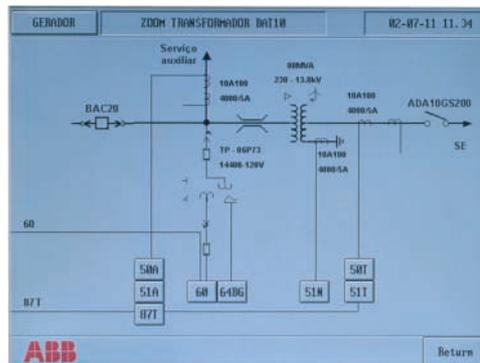
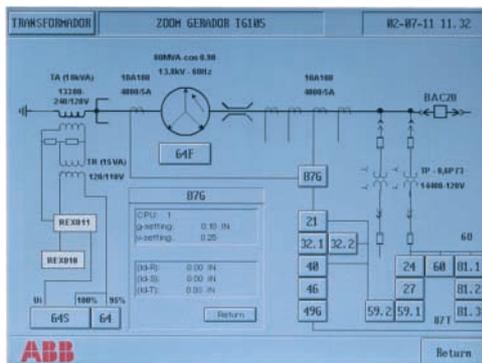
# Local monitoring display

Touch Screen.



The optional Touch Screen solution provides the operator with a fast and precise update about the protection zone based on the information from the REG216. The user is guided through:

- Single-line diagram with protection scheme and CT/VT configurations
- Settings, measurements, and reported trip values of each protection function
- Analog input measurements
- Unit measurements (U, I, P, Q, f, cos phi)
- LED function identification with user descriptions



# The REG 216 numerical unit protection system can be fully integrated into a protection and monitoring concept

*Example of a protection and monitoring system solution:*

## Integration of the unit protection into a power system monitoring concept

### GPS

Time synchronization of the individual protection equipment allows a system-wide analysis of its event and disturbance recording information.

### SMS 530

Communication to the station monitoring system SMS 530 provides fast and precise evaluation of automatically uploaded disturbance records and event lists. Measurement and status displays as well as setting enhance operation.

### Remote communication

Data for remote monitoring can be sent to utility headquarters or directly to dedicated specialist engineers, e.g. via modem.

### Synchrotact 5

Automatic and manual synchronizing unit integrated in protection and monitoring concept.

### PQ

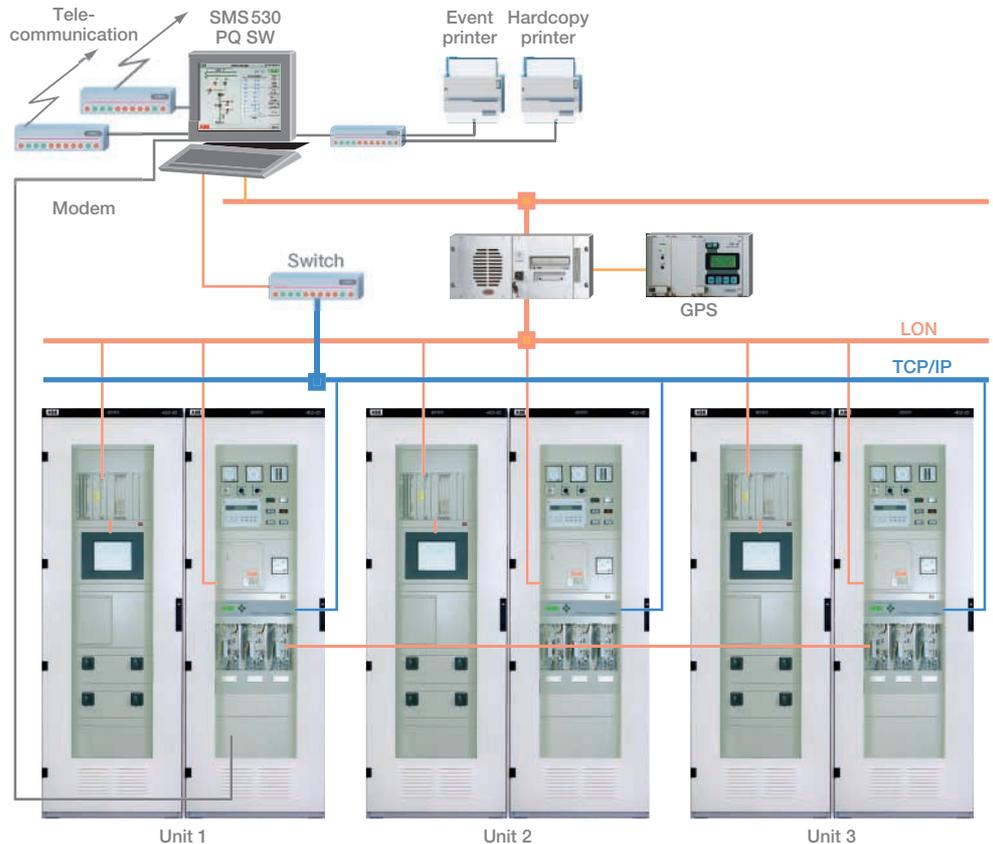
Power quality measurement of the generated power.

### Indactic 650

In case separate high-performance disturbance recording is required.

### Communication gateways

For special communication requirements in terms of protocols and hardware, gateways (such as COM 581, OPC server, etc.) are available.



## Conclusion

The REG 216 numerical protection system is worth favorable consideration as an upgrade for GSX because of the benefits outlined above. An upgraded system extends the life cycle and improves the availability of the generation system. In addition, better spare parts management and support capabilities are benefits that should be taken into account. There is no time like the present to consider an upgrade to a numerical protection system.

### Technical literature:

- 1MRB520004-Ben, Numerical generator protection REG 216
- 1MRB520268-Ben, Station monitoring system SMS 530
- 1MRB520153-Ben, Fault analysis and evaluation system WinEve
- 1MRB520255-Ben, Fault recording system for professional fault analysis, Indactic 650
- 1MRB520206-Ben, Communication gateway for high- and medium-voltage substations COM 581



## **REG 216** numerical generator protection system

**More than 2700 generator protection systems have been delivered to all parts of the world since 1964. A total of 1400 REG 216 numerical protection system units have been supplied to date. Its renowned flexibility and adaptability to accommodate customer needs are unique and make it the most advanced solution the world over.**

**Based on the vast field experience and knowledge of increasing customer demands, the REG 216 is continuously being improved.**

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