



IEC 61850 Certificate Level A¹

No. 30530045-Consulting 2005-0555

Issued to:
A. Eberle GmbH & Co. KG
Aalener Straße 30/32
D-90441 Nürnberg
Germany

For the product:
REG-PE controller with REG-D unit
Software version 2, Revision 9,
Build V7.98 2005-09-13

Issued by: 

The product has not shown to be non-conforming to:

IEC 61850-6, 7-1, 7-2, 7-3, 7-4 and 8-1 Communication networks and systems in substations

The conformance test has been performed according to IEC 61850-10 with product's protocol, model and technical issue implementation conformance statements: "IEC 61850 Protocol Implementation Conformance Statement for REGSys® automatic voltage regulators v1.2" and "IEC 61850 Technical Issues Conformance Statement for REGSys® automatic voltage regulators v1.0", and extra information for testing "Protocol implementation extra information for testing (PIXIT) of the IEC 61850 communication interface in REGSys® devices v0.1".

The following IEC 61850 conformance blocks have been tested with a positive result (number of relevant and executed test cases / total number of test cases as defined in the UCA International Users Group Device Test procedures):

1 Basic Exchange (15/23)	12a Direct Control (4/11)
2 Data Sets (2/5)	13 Time Synchronization (3/4)
5 Unbuffered Reports (8/13, without buffer time)	

KEMA grants this Certificate on account of tests performed at the KEMA laboratory in Arnhem, The Netherlands. These tests are performed with UniCASim 61850 version 2.12.01 test system running test suite "61850 Conformance Test v1.17", UniCA 61850 analyzer version 4.11.01. The test is based on the UCA International Users Group Device Test Procedures version 1.1. The results are described in KEMA report: No. 30530045-Consulting 2005-0556.

The tests have been carried out on one single specimen of the above-mentioned products, submitted by A-Eberle. The Certificate does not include an assessment of the manufacturer's production process. Conformity of his production process with the specimen tested by KEMA is not the responsibility of KEMA.

Arnhem, September 13, 2005

S.J.L.M. Janssen
Managing Director KEMA Consulting

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Certification manager

1 Level A – Independent Test Lab with certified ISO 9000 or ISO 17025 Quality System

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New IEC 61850-based solutions

Client functionality on all device families

Reprint from PRAXIS•PROFILINE

IEC 61850 - April 2007, Vogel Industrie Medien GmbH & Co. KG

New IEC 61850-based solutions

Client functionality on all device families

This article explains how the decision to use the new IEC 61850 communications standard benefits the customer, and it shows how flexible, standardized solutions can be deployed in a deregulated market. It will be presented some practical examples and then take a look at what other opportunities the IEC 61850-9-2 process bus standard offers.

■ IEC 61850 - basics and implementation

Interoperability is the main goal of the IEC 61850 standard protocol, which was released in the spring of 2004 as the international standard for substation communications. Interoperability

means that two or more *intelligent electrical devices (IEDs)* supplied by different manufacturers are able to exchange information as defined in the IEC 61850 series of standards, and they are able to interpret and use the information without ambiguity. IEC 61850 does not describe the functions. It merely provides the information and communication mechanisms between the functions.

The IEC 61850-7-4 standard data model for ATCCs (*Automatic Tap Changer Controllers*) includes five mandatory data objects and 29 optional data objects. The ANC (*Automatic Neutral Current Regulator*) data model only has three mandatory data objects and four optional objects. That is far less information than was contained in the standard profiles which the German producer A. Eberle GmbH & Co. KG had been using in its IEC 60870-5-103/101 applications.

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KEMA Certificate for voltage regulators from
A. Eberle GmbH & Co. KG

■ Data model enhancement

An enhancement to the IEC 61850-7-4 data model was necessary to provide implementations which are suitable for practical applications. To ensure that the solution was fully adequate for the product family and the system environment, it was decided to play it safe by including the entire process model plus reserves.

This provides access to all digital and analogue inputs and outputs as well as to control process results. Additional reserves to address customer-specific functions using the REG-L(anguage) were also implemented. The result was unparalleled flexibility in practical applications. The actual interpretation of these additional functions can be defined during the design phase or later an during commissioning. As a result, control systems engineers can work with a standard description (*ICD: Intelligent electronic device Capability Description*).

About 300 data points are available for the REG-D and REG-DA voltage regulators and



Stadtwerke Trier GmbH, Werner-Siemens-Str. substation with IEC 61850 connectivities. Three REGSys voltage regulation systems (left) with REG-D voltage regulator, PAN-D monitoring unit, REG-FR tap changer interface and two REG-DP Petersen coil regulators (right), each linked to the control systems via an IEC 61850 REG-PE protocol card.

around 400 data points for the Petersen coil regulators REG-DP and REG-DPA. *Controller templates* (model parameters sets) are available for the control systems, and it is very easy to add customer-specific functions to these templates using REG-L. ICD comments can be modified during commissioning, and this has the advantage that the data points are always fully documented.

Work is currently in progress to include earth fault location and collapse prediction (early detection of blackouts in electrical power grids). The first draft on power quality has now been published, and there are already plans in place for initial implementation.

■ IEC 61850 implementations

A. Eberle recognized the major benefits of IEC 61850 early on and was the first voltage regulator manufacturer worldwide to be awarded the KEMA certificate.

More than 300 voltage regulators and Petersen coil regulators already use the new communication standard. There are installations in Germany, Austria, Italy, Croatia, Switzerland, the Czech Republic, Slovakia, Hungary, Belgium, Luxembourg, Holland, Sweden, Russia, Iran, the United Arab Emirates, Africa, India and New Zealand.

Particularly in Europe, projects with Petersen coils are constantly going online. Initial projects with ground fault and early blackout detection are currently in the planning or commissioning phase.

■ The advantages of multifunctional IEDs

The multifunctional REGSys voltage regulator system is designed to handle nearly the entire range of measurement, control, archiving and visualization functions for transformer and Petersen coil applications. It includes REG-D and REG-DA voltage regulators and REG-DP and REG-DPA resonance regulators. A. Eberle offers a variety of monitoring units additionally for regulators and tap changers, which are useful enhancements to its range of products.

The PQI-D Power Quality Interface can be installed at distribution points to monitor power quality (DIN EN50160) and for fault mode analysis (*transmeter function*). The PQI-D is also a fully functional disturbance recorder which provides 100 μ s and 10 ms error logs.

All of the system components can be merged into a single (logical) device on a data transfer bus, which can be linked to a control center via a protocol interface module. Here again, IEC 61850 offers a big advantage, because different functions can be handled in compliance with the standard on one interface.

The system architecture also offers connectivity to the earth fault location world. The EORSys earth fault location system offers all of the standard detection and location functions including transient, harmonic, wattmetric and pulsing methods. The algorithms can be run sequentially to support the fault location process.

Pulsing is different from the other techniques, because it is normally used to trace faults that are located *deep in the power distribution network*. The system offers the big advantage that users can combine the functions any way they want to match the application and system philosophy. The REG-L programming language can also be used to implement customer-specific solutions. This powerful yet simple tool offers all of the flexibility which is needed in today's applications. Reduced

cost is a very welcome side effect of this system architecture, and it has a positive effect on the bottom line.

Each REG-D and REG-DA also have additional useful functions including transducer display, recorder, statistics, logbook and the ParaGramer. Online display of the switch configuration and automatic setup and activation of parallel transformer circuits (ParaGramer) provides valuable monitoring and control information to the station operator. Transformer aging can be calculated using the IEC 60354 method, and users are able to control the fans and thus the transformer cooling.

By using transformer oil temperature and load current data along with information on transformer characteristics, it is possible to calculate the hot spot temperature. This information is needed to determine the transformer's temperature curve and estimate the resulting loss of life according to the mentioned norm.

■ Control system connectivity and process bus

IEC 61850 contains a number of parts. The definitions go beyond data structures and IED communications (IEC 61850 station bus). They also include Ethernet-based digital transmission of current transformer and voltage transformer signals (Part 9-2). *Merging units* capture converter data (IEC 61850 process bus). The latest idea is to combine the IEC 61850-9-2 process bus with real time Ethernet, which is a recent development in industrial automation. RWE Energy AG, Germany, has launched its *Intelligent Switch Bay* R&D project to investigate the possibilities. This project places extra demands on the REG-D voltage regulator.

During the course of this project, RWE plans to stay in close contact with a range of suppliers as it gains experience with process bus communications and interoperability. In this context, the voltage regulator needs *client functionality* as well as *server functionality*, because it must actively retrieve controller-specific information on the process bus from the station bus Ethernet ring, which is configured as a double Ethernet ring to provide redundancy.



RWE Westfalen-Weser-Ems Netzservice GmbH / Dortmund / Germany, Lüdinghausen substation with different IEC 61850 connectivities



Twin transformers (REGSys voltage regulation systems with REG-D voltage regulator and REG-PE protocol card)



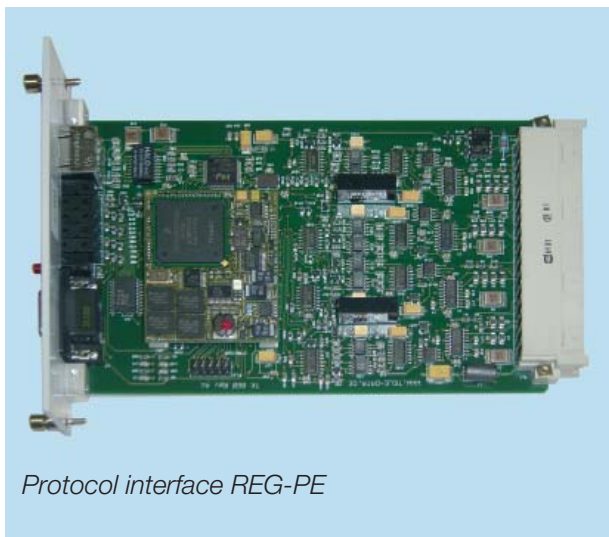
Single transformer (REGSys voltage regulation systems with REG-D voltage regulator and PAN-A1 monitoring unit - RWE version)

The information content includes tap position data and tap change commands. Devices will undergo lab testing during the course of the project which will run until 2008. Devices will then be installed in the *Nehden* substation. Following successful completion of the standby phase, the device will go *live*. Once again, A. Eberle will be one of the pioneers of this innovative new technology.

■ Control system connectivity and innovation

The REG-PE(thernet) protocol interface provides IEC 61850 connectivity for a combination of REGSys components. Any combination of one or more REG-D (REG-DA) and/or REG-DP (REG-DPA) devices or other A. Eberle device families is supported, for example the EOR-D earth fault location relay. As a first step, IEC 61850 hardware (REG-PE) can communicate with control systems using IEC protocols 103,104 and DNP 3.0. The next step is software migration to IEC 61850 without the need to replace the hardware. Ensuring that connectivity is userfriendly was a top priority during the development phase. Electrical connectors (RJ45) or fiber optics with an ST connector are used to make the physical connection.

A COM-server has been added in parallel to the REG-PE as an additional feature. This makes it possible to access or visualize a voltage and/or Petersen coil regulator or change parameters from the control center or any Ethernet node. Operating and parameterization software can access



Protocol interface REG-PE

the devices via the IEC interface. There are three possible operating modes: *IEC 61850*, *IEC 61850 and COM-server* or *COM-server only*. No parameter changes are needed to switch between these operating modes.

IEC mode is always given higher priority. When commissioning is performed from the control center for example, all regulator-specific commands and messages can be checked and modified if necessary, which is an added advantage. There is no longer any need for the commissioning team



Voltage regulator REG-DA



Multifunctional REGSys voltage regulation system

to coordinate with the power distribution grid administrators.

In addition to COM-server functionality, the REG-PE board also offers redundant, prioritizable *double N(etwork)T(ime)P(rotocol)* mode. With this feature, the time of day in the control system can be synchronized with two different time servers to achieve redundancy. A Web-based configuration is also available which supports direct import and export of ICD files. This important feature simplifies commissioning and helps reduce follow-on costs.

■ LITERATURE-TIPS

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■ ABOUT UNS

A. Eberle GmbH & Co. KG, measuring and control engineering, was founded in 1980. The aim of the company was to develop and to manufacture products for the electronic industry. Since 1995 things have changed. A. Eberle GmbH & Co. KG has established its own distribution.

Our most important fields in business comprise today:

- voltage regulation of transformers with tap-changer, transformer monitoring
- regulation of Petersen coils; incl. current injection frequencies
- earth fault detection in medium and high voltage utility networks
- Power Quality in medium and high voltage utility networks
- collapse prediction in high voltage utility networks
- 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 Petersen coil. For this reason our extremely high proportion of qualified employees (engineers) amounts up to 50%. It goes without saying that we are prepared to tackle and solve new, unconventional tasks with our partners at any time.

Employees: approx. 50.

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