

## 02 Data Security BDEW Whitepaper

The requirements currently being made of data transmission are developing very dynamically.

## 04 Solutions Feed-in Management

Different concepts are being pursued in the implementation of telecontrol systems for capacity reduction.

## 06 New Product SG-50 Protective Device

In the guard-line SG-50 combination protective device, we are now also able to offer you protective technology.

## 09 Communication SMART Metering

The energy transition is in need of new structures – not only in power generation.



## 03 News from SAE IT-systems Growing with Success

Editorial by Joachim Schuster

## Who is Financing the Energy Transition?



This issue is again occupying our politicians, but the answer has been known for some time – all of us.

Over 80% of the population wants to move away completely from nuclear power – and so it is not a question of “who pays” but about how such a transition can be realised with the greatest level of cost optimisation. If offshore wind farms must be operated with diesel so as not to rust up, then it is obvious not everything went perfectly. Even with the refinancing models for medium voltage automation there is a need for political action, hopefully followed by deeds soon.

“We at SAE IT-systems are extremely glad to have made excellent progress despite these choppy waters.”

In addition to extensive, internal changes (such as modernisation and expansion of our production facilities and the establishing of a completely new image), we have been working intensively on the development of specific solutions for the requirements of our customers.

A central and cross-discipline focus here was IT data security as laid down in the BDEW Whitepaper. The project was taken very seriously by us and had far-reaching consequences. It ultimately resulted in the development of the performance-enhanced product family “series5+”.

As part of our activities in addressing specific applications such as feed-in management, SMART metering and local network automation, our systems have been enhanced or completely new components developed. With the SG-50, we have broadened our product portfolio in the protection technology sector and the micro format FW-5-GATE is demonstrating real communication proficiency. Additional protocol drivers for linking in intelligent meters (SML and IEC 62056-21) and for the gas industry (DSfG) allow the coupling of our systems to almost every relevant system in the energy sector. Extremely user-friendly integration in setIT means IEC 61850 is no longer daunting.

In addition to these technical improvements, we have been working closely with our customers on the development of implementation concepts for very specific topics. Examples here are concepts for wide-range regulation and direct marketing of energy – which still appear plausible on paper, but make quite some difficulties in their technical implementation. Together we were able to find pioneering solutions. The expertise gained is of course channelled into the on-going development of our solutions. This results in system designs with a high level of practical relevance.

It was for this reason we made the experience gained the topic of our future action and manifested it in the “Solutions in Mind” claim. Many of the solutions discussed are in this issue of SAE News. I trust you enjoy reading this issue.



Joachim Schuster, Managing Director & Shareholder  
Cologne, October 2013

### New Product

net-line FW-5-GATE  
**The communication genius in micro format**



We are always trying to use smart solutions to address the needs of our customers by maintaining close contact with and regularly consulting them. In the net-line FW-5-GATE, we believe we have achieved this once again.

Find out more on [► Page 03](#)

### Communication

IEC 61850  
**“Good things come to those who wait”**

The standard will gain a foothold, but will take some time to establish itself – as is often the case.

Find out more on [► Page 11](#)

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# BDEW Whitepaper

## New Challenges = New Opportunities + New Risks

### Data Security

The requirements currently being made of data transmission are developing very dynamically. New challenges in network management and smart grids are resulting in ever-increasing demands for information and communication, more accurate records and greater data volumes. Modern platforms with exponentially rising capacities are increasingly using modern communication paths. These services conceal considerable risks as well as present opportunities. We too have prepared ourselves however.

Modern communication paths such as internet-based network technologies and mobile services (such as GPRS/EDGE/UMTS and LTE) are offering astonishing capabilities. In the age of Cyber War and StuxNet however, it must be clear that these technologies are a blessing but also conceal considerable risk potential.

#### The Whitepaper Project

The last SAE News made reference to the BDEW Whitepaper in a brief report. The last 24 months have seen us deal intensively with the subject as part of the "Whitepaper at SAE IT-systems" project:

- Shift of awareness in working with data
- Selection and application of IT components
  - within the company
  - in the customer network
  - in project planning and service
- IT infrastructure checked for latest security standards
- Defined processes for support, project planning and remote access
- Technical IT security improving of products

Then we were able to address these requirements with specific solutions.

What did we do?

- Improved Linux kernel security
- Disabled "open" ports
- Replacement of the FTP driver by FTPS (FTP over SSL)
- Replacement of the http drivers by https with the ability to select between our or other certificates
- Update of the PHP version as the basis of the web server for secure web browser applications
- Installation of user management with function enabling in setIT and web browser
  - Profiles based upon BDEW Whitepaper are provided
  - User-defined profile creation possible
- Possibility of disabling means of access (such as Bluetooth, USB, web browser, ...)
- Integration of a firewall into the series5+ system software

Overall these upgrades require a not inconsiderable "+" of performance. Full implementation on the basis of the standard series5 CPU module was therefore not possible.

A new Linux kernel means setIT version 4.008 or higher is required to use the series5+. The full functional scope (VPN encryption in particular) is provided from setIT V5.

#### Auditing by IT Security Specialists

Initial comprehensive auditing of our infrastructures, processes and products took place back in May 2011 at the start of the project. The findings were excellent. Another date was agreed following hardware development of the series5+ and appropriate enhancements of the setIT configuration software. This entailed re-auditing of our systems by IT security specialists at GAI NetConsult GmbH.



### series5+ What's that?

The series5+ represents a performance increase

for the existing series5 product family. For this, a new and more powerful CPU module has been developed that meets the technological requirements for secure data transmission and that is deployed in the following telecontrol systems:

- FW-5
- FW-50
- FW-5000
- New: FW-5-GATE

The series5+ technology is fully backwards-compatible with the series5 and provides an array of additional features such as:

- 400 MIPS RISC CPU with up to 5 times the processing speed
- Up to 512 MB memory, 512 KB SRAM buffered, 4 KB EEPROM
- Real-time clock buffered with lithium ion battery for min. 30 days
- SD card (to 8 GB)

#### setIT V5

The expectation is that Version 5 will be released in the last quarter of 2013. The version also features the following in addition to the security adaptations (in line with the BDEW Whitepaper) already mentioned:

- IEC 61850 and 61400-25
- Meter protocols SML and 62056-21
- Archive query via IEC -101/-104
- DSFG protocol

# net-line FW-5-GATE

## The Communication Genius in Micro Format

### New Product

We are always trying to use smart solutions to address the needs of our customers by maintaining close contact with and regularly consulting them. In the net-line FW-5-GATE, we believe we have achieved this once again.

The FW-5-GATE has no integrated inputs/outputs. It can however be supplemented with extension modules if required as with the "normal" FW-5. This means you only configure the capacity you require -so even none at all in the case of doubt.

A second LAN interface enables separate network segments to be operated and a neat protocol implementation to be realised, such as:

- IEC 61850 mapping to IEC 60870-5-104
- SML or IEC 62056-21 to IEC 60870-5-104
- Modbus RTU/TCP to IEC 60870-5-104
- IEC 60870-5-101 to -104
- IEC 60870-5-104 to -101

Two EIA/RS-485 interfaces enable the simultaneous connection of network analyse systems, short-circuit and earth fault indicators, as well as protective equipment.

A serial interface can be configured as a CL port with S0 pulse input as an alternative.

The enhanced interface with meter connection means the FW-5-GATE represents an economical solution for:

- Intelligent local networks
- Smart metering
- Feed-in Management
- Large scale virtual power plants
- Gas pressure regulator stations with DSfG
- etc.

The net-line FW-5-GATE is available in series5+ technology and is therefore well equipped for the BDEW Whitepaper requirements. It is supported from setIT Version 4.8 onwards. The device is also available with an integrated 230 V power supply (as the FW-5-GATE-230).



## Growing with Success

### SAE Internal

Positive growth over recent years means the requirements made of ourselves have also grown considerably. New employees have been hired and capacities expanded in nearly all company divisions to meet your requirements in the future whilst retaining the accustomed quality. In addition to the strong expansion of our Production and System Integration departments, we have also expanded our teams in the Software Development, Quality Test, Purchasing, Project Planning and Sales departments.

But infrastructures have also been modernised. Relocation of the R.STAHL HMI enabled us to realise the urgently required expansion of the work areas and optimise our processes. Production capacity has increased considerably once again and our often praised flexibility safeguarded.

Lastly we also have a new image – everything has been revamped, from the website to technical documents. The stated objective of the project was to make our image clearer, more intelligible and simpler for you. Take a look:

► [www.sae-it.de](http://www.sae-it.de)



Drilling machine for mounting plates



Series production at cabinet building department



The specifications can essentially be satisfied in two ways:

- Control via digital commands and messages
- Control with the aid of analogue set point and measured values

The latter, with its free scalability, offers a higher level of flexibility and represents a reasonable alternative for users who find the widespread control classes too imprecise for their own applications.

#### The Typical Starter Solution

In the simplest case, the power stages are set as 0/30/60/100% with check back taking place via three digital inputs/outputs (if no output is set, this corresponds to 100% feed-in power). A system disconnection command can optionally be set with a fourth output. The current active power is transmitted by means of an analogue measurand or is applied as a metered value via a digital input.

#### Further Interesting Concepts

**System with intelligent connection option for variable capacity**

In a lockable Rittal cabinet, four or eleven single commands (from 5 kVA system rated power) are used to specify the power stages. Checkback takes place by means of the corresponding number of single-point signals. Even the system disconnection command "Emergency off" and its checkback signal are realised digitally. The actual feed-in of P, Q and U is measured by means of three separate measured values. The reactive power is classified with three single commands as underexcited, neutral or overexcited and acknowledged by single-point information.

A special feature of this configuration is the standardised wiring on Harting connectors. This allows extremely

# Status Quo – Feed-in Management Equipment Constellations and Provision Concepts

Electricity · Renewable energy

Beyond the legal requirements laid down in Renewable Energy Act §6, various strategies are pursued in the technical implementation of telecontrol installations for capacity reduction. These additions of distribution system operators (DSO) to the "Technical Guidelines for Generating Plants Connected to the Medium-Voltage System of BDEW" must be published and contain accurate specifications for the control concept of the respective DSO. In addition to the installed capacity of the plant, the voltage level of the power system connection point (low voltage/medium voltage) also plays a key role.

simple and fast connection to the telecontrol station.

#### System with set point/actual comparison and automatic system disconnection

This design is for installation into meter panels on a Pertinax board for electrical isolation. Two separate 230V power supply units provide the supply and signalling voltage. The active power is set as 0/30/60/100% with corresponding checkback via digital inputs and outputs with an external contact multiplying relays. System disconnection can result both from a command from the control centre and from calculations. For this, the actual active power is calculated from the SO pulse of the meter at 15 minute intervals and compared with the connected load specified contractually. If this value is exceeded, the

respective DSO. Furthermore, a double command is provided to prevent the plant from automatically recoupling to the power system. The installations are already loaded with the customer-specific configuration before delivery. Following installation, the IP and ASDU addresses can be loaded via the web browser individually per system.

#### Provision Concepts

Some of our customers look after some quite complex network areas. The accompanying array of technologically different solutions to connect decentralised producers has become more of a problem and increases the overhead of network integration of these systems.

Many DSOs have therefore made the transition to defining concrete specifications for system operators in their regions in regard to telecontrol systems. Different concepts are being pursued:

- DSO informs the system operator of where it can/must acquire this system
- DSO makes available the telecontrol system to the system operator at no charge
- DSO hires out the telecontrol system to the system operator
- DSO sells on the telecontrol system to the system operator
  - subsidised at a reduced price
  - at the purchase price
  - with pricing surcharge for organisational overhead
- Combined payment concepts with initial procurement costs and ongoing usage charges



system is disconnected by means of a bistable relay. The system disconnection command generated in this manner can only be reset on site.

#### Installation with selection by means of set points for fine-tuning of the power

The active and reactive power is specified by means of analogue set points with corresponding checkback indications by means of analogue measured values. Isolated contacts allow the  $\cos \Phi$  and Q(U) characteristic curves to be used for a reactive power procedure according to Section 2.5.4 of the Technical Guidelines for Generating Plants Connected to the Medium-Voltage System of the

No matter what form of provision is ultimately selected, there is agreement on the enormous benefits of using standardised technology.

Connect up, test, done!

Get in contact with us! We will be glad to provide advice and support in the development of your standard.

## SÜC Energie und H<sub>2</sub>O GmbH

### Feed-in Management and Transformer Monitoring

Electricity · Renewable energy · Local network stations



SÜC in Upper Franconia is a reliable supplier of primarily energy, gas, water and heating for Coburg and the surrounding area. At the end of 2011 we successfully participated in a trial as part of project "Feed-in management for renewable energy and hydroelectric plants of more than 100 kW".

SÜC personnel were won over by the overall telecontrol concept with simple configuration, so at the start of 2012 we received an order to supply renewable energy plants. The net-line FW-5 renewable energy systems were delivered fully pre-installed in a wall-mounted housing and, after initial support with commissioning, could be put into operation independently. Communication as per IEC 60870-5-104 is usually established using a GPRS link. The systems are connected to the RESY central control station via a net-line FW-50 node.

SÜC engineers were so impressed by the renewables project that SAE telecontrol technology was also selected for the planned connection of further transformer stations. The medium voltage plants can normally be reached with their own FO cables, meaning communication was established using IEC 60870-5-104 here too. In addition to the monitoring of transformer switches, gas monitoring, transformer temperature, battery signalling, etc., in this case the 1.5-pole actuation of two isolator switches is provided by double command which is realised by means of

the net-line FW-5 and its extension module DSO-1. The start of 2013 saw SÜC start up into operation a new cogeneration unit for heat and power supply with two



machines. Previously a net-line FW-50 station in a 19" rack was chosen with IEC 60870-5-104 connection. In addition to the relatively large I/O capacity with metered value processing and switch actuation with checkback via DSO modules, two Modbus remote connections for cogeneration plant control and a further PLC were realised.

Products	Protocols	Production period
net-line FW-5 net-line FW-50	IEC 60870-5-104 Modbus	2012 to the present

## Mainfranken Netze GmbH

### Feed-in Management

Electricity · Renewable energy



MAINFRANKEN NETZE GMBH (MFN) is a network company that operates the electricity, gas, water and district heating networks of Stadtwerke Würzburg AG in and around Würzburg. Under the terms of German Renewable Energies Act (EEG) § 6, 2012, MFN equipped its PV plants having an installed capacity greater than 100 kW with a technical installation from SAE for remotely reducing the in-feed power and for accessing the respective actual in-feed.

To implement these requirements, the following demands of the plant technology applied in the MAINFRANKEN NETZE GMBH network region:

- Provision of a 4-20 mA analogue signal for transmitting the actual feed-in
- Capability to reduce the feed-in capacity on 4 levels (100%, 60%, 30%, 0%)
- 4 digital inputs for specifying the respective level
- 4 digital outputs for acknowledging the level set
- Control of the technical installation via public domain radio link

A one-off software program has been written for different renewable energy plant faults. The radio modem (Digicomm) was installed by the customer. The link to the Siemens Scala-250 control system is established using the IEC 60870-5-104 protocol.

SAE supplied 40 net-line FW-5-BT telecontrol stations with power supply units, miniature circuit breakers, lighting conductors, etc., installed in a small housing and fully wired to a transfer terminal. MFN configures its own renewable energy boxes using our very convenient setIT configuration tool with diagnostic function. setIT was an appealing solution thanks to its clearly laid out Windows user interface with tree structure, intelligent menu technology and context-sensitive operation – meaning configuration can be learned easily with no training required.

Products	Protocols	Production period
setIT net-line FW-5	IEC 60870-5-104	Since 2012

SAE Expertise

## New Successes

### ovag Energie AG

Around 300 stations in all supply areas are to be replaced within three years. Our expertise and the high level of flexibility of our systems in the connection of external components (such as short-circuit and earth fault indicators) won particular plaudits.

### Thyssengas GmbH

The order comprised the telemetry-related modernisation of 35 gas pressure regulator stations, including the renewal of underlying regulation technology (e.g. PLCs), the on-site visualisation system and the development of a completely new communication path based on mobile radio technology.

### SWN Stadtwerke Northeim GmbH

Design of a new, redundant control system (ProCoS, Kisters AG) and the associated telemetry for 3 substations, 132 transformer stations, 2 water works, 6 pumping stations, 8 water towers, 7 pressure booster systems and 23 water meter chambers.

### Westnetz GmbH

Deployment of flexible wide-range regulation enables network expansion to be averted with intelligent regulation of the busbar voltage on the medium voltage bar. We are glad to be associated with this pioneering project.

### Die Energie

Die Energie became aware of us through various recommendations of SAE at the Thüga user meeting in Homburg. Our high level of expertise in the renewables sector and the simple, convenient connection capability of the ComPass B from Horstmann to local network automation were key in the decision.

### Ormazabal

As part of an infrastructure project, Ormazabal were commissioned with the construction of switching stations for the supply of medium voltage. In the search for an optimal protective equipment with directional IOC and transformer protection function, we were able to come out on top of the market leader with the SG-50.



# Precision Triggering Protection Equipment from SAE

## Protective Equipment

The SG-50 combination protective device is a compact, high-precision all-rounder. It can be adapted to virtually any protection requirement by selecting different software options.

SAE Expertise

## Protective Equipment



Niclas Nitsch  
Protection Technology Sales Focus

Our protection technology expert, Mr. Niclas Nitsch, will be glad to provide you with advice and can assist in selecting the SG-50 service package.

Whether distance protection, QU protection or other protective functions, the SG-50 combination protection device can be set up for new protection tasks even when already installed. There is also the possibility of adapting system visualisation individually to customer requirements, thereby providing optimal representation of the system. An integrated, high-resolution LED colour display makes it possible to see the current system status at a glance directly on site.

The SG-50 can be configured in different ways – from a colour display on site or conveniently from the office at a PC. In both cases the SG-50 features clear, self-explanatory software. Parameters that are not required are not shown. Configurations can be loaded into the combination protective device via USB stick or the USB port. The IEC 60870-5-103 protocol is currently available as the communication path. Optional communication via the IEC 61850 protocol is in development. Implementation

to IEC 60870-5-104 is easily guaranteed by the telemetry. It is therefore possible to use the SG-50 in distributed generation plants such as wind power plants as well.

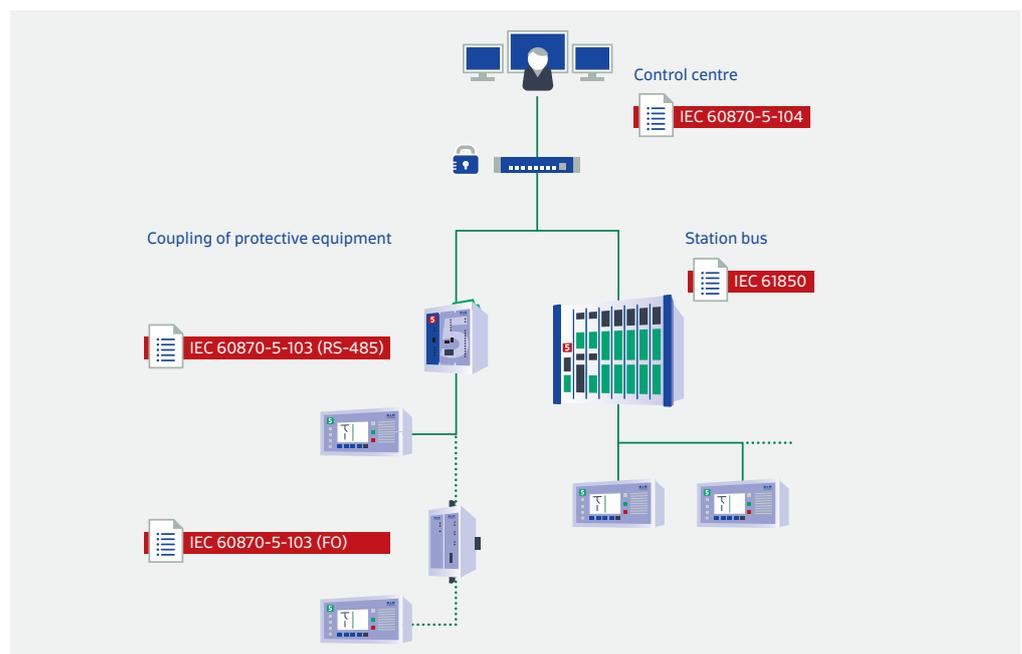
The numerical protection and control device has been developed for use in medium voltage networks, in industry, and for decoupling protection at distributed generation plants. Typical application areas are definite time overcurrent/inverse time overcurrent protection (simple and directional); cable protection with optional ARC is integrated as well as transformer protection with two-body temperature indicator. The SG-50 has machinery and rotor locking protection, and distributed generation plants are monitored (QU protection). Busbar protection can be established with the aid of H2 logic. The earth fault protection system is equipped with intermittent EF detection. The SG-50 can also be equipped with 7-polygon distance protection. All zones can be configured freely and individually in the forward or reverse direction.

## Consulting



Oliver Callegari  
Managing Director Sales

We are in a fortunate position: We must adapt constantly to new situations. We have been doing this for over 40 years. As a result we have not only mastered our own technical field, but also acquired extensive knowledge of related technologies. In this manner we have grown something that our customers can appreciate: Solutions expertise. Total solutions expertise.



Possible structure of a communication network

# Absolute Precision

## SG-50 Retrofit in the Substation

Protective equipment · Electricity



### STADTWERKE HEIDE

The Heide public utility has deployed new protection equipment as part of hardware modernisation of the “gas works installation” control station. All project management was transferred into the hands of cooperation partners NSE AG and SAE IT-systems. A comprehensive network analysis was performed at the start so as to realise optimum protection in line with the specifications of the Heide public utility.

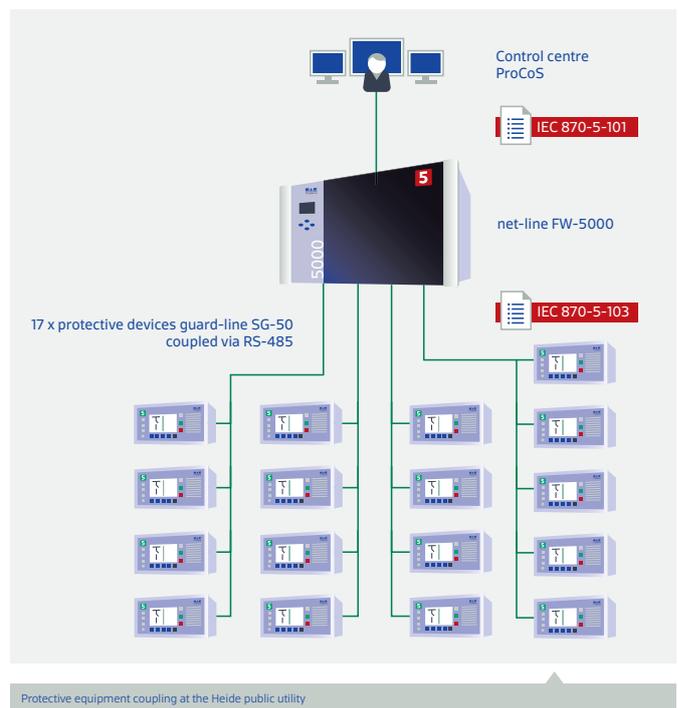
The supply network of the substation has changed over the years; medium voltage protection had to be replaced. A network calculation of the entire 20 kV distribution network was performed as preparation for the protection replacement. The 20 kV control station comprises 17 sections, 13 of which are outgoing sections, one transformer section, two ripple control connections and a coupling section. The calculation includes a load flow calculation with feasibility study and vulnerability analysis, and a 3, 2 and 1-pin error calculation.

The outgoing sections are fitted with model SG-50-RD. With four current and four voltage converters, this combined protection is fully configured and offers simple expansion of protection functions in the fitted state in the future. The SG-50-RN protective equipment is deployed in the transformer section, the two ripple control connections and the coupling section. The system automation software package is included with all protective devices. This enables the individual creation of function schematics and the set-up of logic functions and interlocks in PLC programming.

The protective equipment is connected to the net-line FW-5000 station control system via a IEC60870-5-103 bus and linked into the ProCoS system.

Existing 7S17 protective relays (static time overcurrent protection) were replaced by the Heide public utility itself. To be able to prepare for the installation in the medium voltage cells, a sample protective device was made available to the Heide public utilities. The protective controllers were delivered pre-configured and tested on the secondary side.

After the conversion, specialists Jens Hecht (SAE IT-systems), and Sven Heider (NSE) started up the equipment. In addition to protection testing, they also carried out the data point test for the link to the ProCoS supervisory control centre. The start-up



process also includes comprehensive protection testing with an OMICRON tester and instructions on using the SG-50. The results were nothing to be ashamed of:

“... I would like to take this opportunity to express my thanks once again for the excellent collaboration in the IOC protection renewal project. I believe SAE has, in NSE, found a very good and unusually competent partner in the field of protection technology.

No problems arose – from the very start with the network calculation and project planning to going live. We were provided excellent information at all times, and when questions arose they were answered without delay. Because we do not employ any protection technicians ourselves, it is of course particularly important for us to have a partner who is well versed in and has a command of the technology. In Mr. Hecht and Mr. Heider, we had two experts in house who really understand their trade.

Thank you once again for the collaboration.”

STADTWERKE HEIDE GmbH  
p.p. H. Albrecht  
Head of Measurement and Control Division



SAE Internal

## Dual Leadership



After successfully working as Head of Sales for many years, Oliver Callegari (left) is appointed to Managing Director Sales. We will be facing upcoming challenges with this most capable pair at the top.

### SAE Anniversaries



We extend our heartfelt congratulations to Dirk Peters, Hardware Development Team Leader, on his 25 years' service!



Congratulations are also extended to Burkhard Borkenhagen, Software Development, for 20 years' service.

## Down the Rhine!

The big day arrived again on 19.7.2013 – it was time for this year's company outing. This time we selected the bathing beach in Cologne/Langel as the start and end of the event. After taking on board some calories, we started off with four rafting boats towards Cologne/Poll.



A positive side effect was that any differences built up over the year could be put to one side. The team members were united again by the time they were enjoying a barbecue buffet and a few cool drinks.

Solutions in Mind.

# Protection & Telecontrol in the Mountains of Lenzerheide

Protective equipment · Electricity · Infrastructure

The EWO Lenzerheide generating plant in the Grisons canton of Switzerland is running a 10 kV distribution network with around 150 transformer stations and two 50/10 kV substations. NSE AG KOMBISAVE protective equipment is being deployed in the Dieschen and Muloin substations. Several hundred DIGISAVEs have been installed in the entire region over the last decade and longer.

The substations fitted with KOMBISAVE (same design as the guard-line SG-50) are connected to the Siemens control system via the telemetry of SAE IT-systems. Professional and autonomous support of the entire system is provided by the on-site team. The fact that the number of operational interruptions in the entire region is tending towards zero every year is down to René Stöckli (employee of EWO Lenzerheide) and to the technology fitted (that has been withstanding the elements without failure for more than 10 years now).

One of the biggest customers of GW Lenzerheide is Lenzerheide mountain railways. They source electric energy from GW Lenzerheide for their railways and snowmaking equipment. The cable car from the holiday resort of Lenzerheide (1500m) leads up to the Parpaner Rothorn (2865 metres) via the Scharmoim halfway station. At the top is a panoramic restaurant with sun terrace offering magnificent views. The medium voltage systems were also modernised during the last upgrade of the Rothorn railway. Positive experiences gained with NSE protective equipment, in combination with telemetry from SAE, won over Lenzerheide railways early on in the project. It quickly became clear that it is possible to realise the most technically demanding of requirements with the two suppliers.



Rothorn gondola



Connection of DIGISAVE devices to FW-50

### An Ambitious Goal

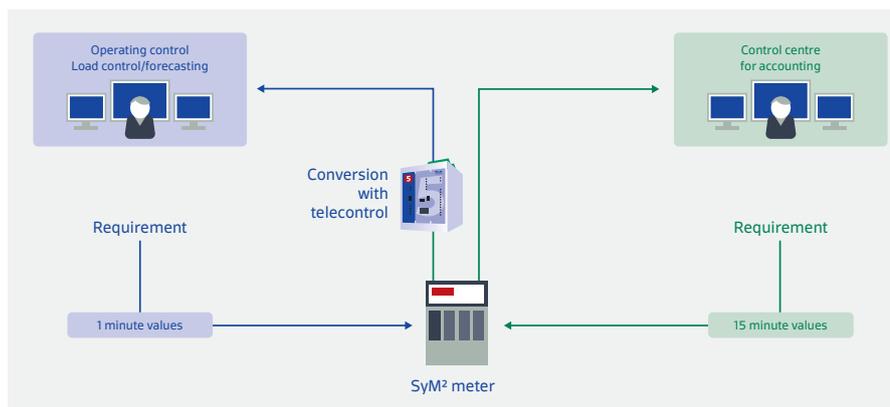
There are often situations in the mountains in which MV systems can only be accessed in extremely hampered conditions. The supply of energy to reservoirs, snow-making equipment and railways, and their infrastructures, is eminently important nevertheless. The author has first-hand experience of just what it means to dig out access to an MV station underneath a metre-thick layer of snow because intervention is required. The declared goal was therefore to be able to monitor and control the MV system remotely at all times. The idea was to connect the systems and the protective equipment to the master terminal via a net-line FW-50, and to use an iPad for remote monitoring. For this the MV systems had to be brought back from the mountains to the assembly plants to upgrade them with drive mechanics and trigger coils, and to fit the secondary equipment required. Transporting the existing medium voltage system on the narrow mountain trails, often wet in spring, was an adventure in itself. Ertech Elektronik AG, a long-standing and reliable sales partner to SAE, assumed delivery and configuration of the SAE telemetry components. This unusual idea was ultimately realised with flying colours!

Lenzerheide is to be connected to the skiing resort of Arosa via the Rothorn. This will create one of the largest skiing and hiking regions in the Alps. NSE AG is to provide professional assistance for this project – from the idea to planning and realisation.

Products	Protocols	Production period
setIT net-line FW-50	IEC 60870-5-103 IEC 60870-5-104	2012

## Smart Metering with IEC 62056-21 and SML in the Smart Grid

Communication · Electricity



SMART meter integration in meter control centre for network management

The energy transition is in need of new structures – not only in power generation. Intelligent distribution of energy must be implemented in a cross brace form with new communication structures based on working protocols. This has meant the revitalisation of an “old favourite” – the proven IEC 1107 protocol for the serial meter connection has been standardised as DIN EN 62056-21 (with a few revisions) and is now available in series5+ telecontrol systems from SAE IT-systems.

### SMART Grid and SMART Metering Growing Together

A full metering connection over SML or IEC 62056-21 is provided with the new Version 5 of setIT. Meters can, depending on requirement, be integrated via a serial protocol to an EIA/RS-485 or CS interface, or be read directly by the telemetry over a LAN connection, and hence be linked into control centres for network control with advanced energy management.

The integration of IEC 62056-21 is based upon protocol types A to D of the standard. It embeds the meter data via OBIS addressing directly in the telecontrol system in a freely configurable manner, thereby realising an open gateway into the power system control with IEC 60870-5-10x structures. Bus-compatibility of the protocol is supported in full, meaning up to 7 meters can be integrated on CS interfaces, 31 via EIA/RS-485 respectively 128 via Ethernet.

The following values can be read:

- Meter readings: tariff-bound cumulatives, averages and maximums
- Load profiles and user load profiles with timestamp transfer and optional storage in archive
- VDEW log book readout with timestamp transfer
- Fault register with configurable message assignment
- Actual values of currents, voltages,  $\cos \Phi$ , frequency, actual active/reactive/apparent power
- Time synchronisation to and of meters

All communication processes can be defined freely and be set up in configurable cycles, and so be aligned perfectly to the meter connection. The open structure of the setIT interface is used for linking into the addressing of the power system control.

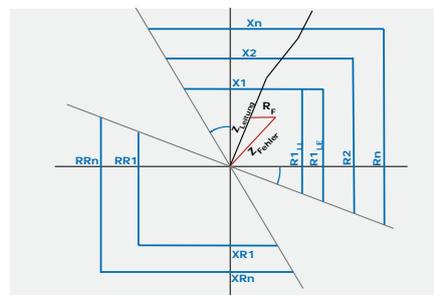
## guard-line SG-50 The World's Smallest Distance Protective Device?

Communication · Electricity

The “Protection day” at the Hamburg Gastwerk saw the first working demonstration of the distance protection of guard5 family SG-50-RZ. And it was very successful by all accounts.

For over 23 years, Andreas Aebersold has been working in the research and development of protection equipment in MV and HV distribution networks. As the owner of our technology partner NSE AG, he has been able to realise his ideas of a compact yet very powerful protective device with self-explanatory operation.

The result is the SG-50 protective equipment family that offers a comprehensive range of functionality – from a cost-effective entry level product as a simple ICO with only 2 current converters, to the mature 6-system distance protective relay with integrated earth contact location and optional, automatic frequency reduction (to FNN) This enables all protective functions to be combined in



Impedance profile

the intelligent protection and controller device. There was neither under nor overexcitation in the OMICRON type approval with 432 internal test scenarios to IEC 60255-121 –

for excitation times of 10 to typically 35 ms (system time). This precision can only be realised with state-of-the-art technology – with new digital/numerical filters based on correlation algorithms of the measurement signals and new converter cores developed by NSE with excellent linear characteristics with low error rate of 0.5% (nominal value) in measuring range 0.05A / 10mV...230V AC. Furthermore, the compact design makes the SG-50 the world's smallest distance protective device.

It was Swiss charm and the confident delivery of Mr. Aebersold that livened up the somewhat dry content on the “Protection day”. This is also reflected in the very positive feedback of delegates, made up of protection engineers and technicians, system integrators and wind farm initiators:

“A contemporary protective device that need not hide itself away.”

“Simple operation presents no problems at all for our workers.”

“Very interesting – we will try it out.”



## NEW Netz GmbH Controlling Short-time Earthing with the net-line FW-5

Electricity · Local network stations

### NEW NETZ | EIN UNTERNEHMEN DER NEW GRUPPE

In the NEW Netz GmbH 10 kV medium voltage network, the neutral point is operated in a compensated manner. For depth location in the event of an earth fault, short-time earthing is used in addition to pulse location in a sub-region. With short-time earthing, in the event of an earth fault, the neutral point is earthed via a resistor for 80 milliseconds. This is sufficient to excite the short circuit indicators situated in the network. The fault can then be located on the basis of the excitation.

The net-line FW-5 and its integrated soft PLC codeIT are used to control the short-time earthing. The short-time earthing can be controlled and monitored both on site and via a control link by the central control station.

Short-time earthing can be started as a single event automatically when an earth fault occurs by monitoring the e-n voltage or also repeatedly during manual operation by control centre personnel or personnel on site. During the short-time earthing cycle, the state change of the circuit breaker is monitored.

The information from a short circuit indicator is used to check in the single-pole branch of the resistor whether the single-pole short circuit current is sufficient to excite the short circuit indicators in the network and whether short-time earthing was successful. If the indicator does not activate, message "short time earthing failed" is signalled and the short-time earthing can be started again in manual mode.

The standby service and the state of the circuit breaker of the short-time earthing, and the states of the switch-isolators, are monitored. A malfunction is signalled to the central control station and at the same time the short-time earthing is blocked. In the event that the circuit breaker does not interrupt the short-time earthing after the 80



Products	Protocols	Production period
codeIT net-line FW-5 net-line FW-50	IEC 60870-5-101 IEC 60870-5-103 IEC 60870-5-104	Since 2010

milliseconds set, the 110 kV circuit breaker is switched off after a set time by monitoring the current through the resistor, and this is signalled to the central control station.

Message "CB permanently on" signals to the central control station that the circuit breaker of the short-time earthing is permanently enabled. This is necessary for maintenance purposes. However, during normal operation it is absolutely necessary to switch off the corresponding transformer, since the medium voltage network would otherwise be operated earthed at a low resistance.

As there is thermal loading of the resistor during each short-time earthing, a thermal image of the resistor is

stored in the PLC. This is to protect the resistor from thermal damage. When the maximum permissible number of short-time earthing operations is reached, the control system inhibits further short-time earthing operations from being set up and signals this to the central control station. The number of short-time earthing operations still permissible is indicated to the switchgear personnel of the central control station.

#### Further Use of SAE Components at NEW Netz

- 13 x net-line FW-50-14 in
- 7 substations

- 35 x net-line FW-50 in
- 31 network stations
- 3 substations and
- 1 waste water pumping station

- 86 x net-line FW-5 in
- 12 natural gas transfer stations
- 9 smaller pumping stations and rain storage reservoirs
- 2 building services systems
- 5 network stations
- 6 substations for short-time earthing control
- the rest is provided for renewable energy plants.

## IEC 61850

“Good things come to those who wait”

### Communication

Not so long ago the new IEC 61850 standard was regarded as the ne plus ultra of station automation. Pressurised by the market presence of two global corporations, the thinking in Germany was not being able to communicate any longer in a future-proof manner without the new standard.

The world is now a different place, in Germany at least. Given for the most part unsatisfactory experiences in the numerous pilot projects, many customers are now treating the standard with reservation or even rejection. Against the backdrop of the established and technologically mature IEC 60870-5-104, -103 and -101 standards, the necessity of a switch is only justifiable with difficulty – from both technical and economic viewpoints.

We at SAE are certainly not advocates of this standard, but are of course always addressing seriously the market requirements. Ultimately it was the requirements from our business abroad that motivated us towards implementation of the new standard in our setIT configuration software. This was easier said than done because our expectation was to retain the customary simple ease of use of setIT. Under no circumstances did we want to burden our customer with the enormous complexity of the standard. Initial pilot projects have provided proof that we have been successful in doing so.

Taking the implementation of the IEC 61850 in setIT V5, it is hard to believe that no fewer than five man years of development work were invested before the standard was formulated in today's form. Taking an impartial view, the IEC 61850 even offers a considerable gain in ease of use, at least in our nature of implementation. Devices and components deployed in a project can be integrated by reading the ICD or SCD files in setIT. Because these files already provide all relevant parameters of the devices and components, communication between the systems can often be established without any further configuration overhead.

The standard will gain a foothold, but will take some time to establish itself – as is often the case. This is also attributable to the extensive experience and the strict standards of technical personnel – who rightly call for practicable implementation of innovation. After all, just because it has IEC 61850 on it, it does not mean there is a sensible solution inside.

We are proud to now be able to offer you such a solution.

Joachim Schuster

## infra fürth GmbH

### Connection of All Media to the Central Control Station

#### Electricity · Heating · Gas · Water · Renewable energy · Local network stations

Since a manufacturer selection process in 2003, we have been supplying telecontrol stations for all the utilities of the Franconian transport and power generating company. The stations planned by infra fürth serve to monitor transformer stations, link substations, cogeneration plants, gas stations including gas regulator stations, carry out property protection tasks and EDP monitoring and link the water plant to the central control station.



**Products**  
net-line FW-40  
net-line FW-50  
net-line FW-5  
net-line FW-5000

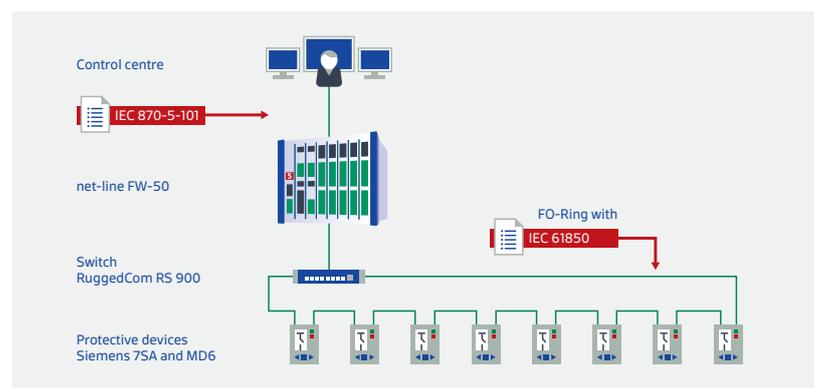
**Protocols**  
IEC 60870-5-101  
IEC 60870-5-104  
IEC 60870-5-103  
Modbus RTU  
Modbus TCP  
Profibus DP  
3964R/RK512  
IEC 61850

**Production**  
2003 to the present

In addition to the net-line FW-40 stations used in the past, recent years have seen net-line FW-50 and net-line FW-5 systems linked autonomously to two redundant net-line FW-4000 interfaces via both dedicated lines and dial-up links using IEC 60870-5-101. The two redundant interfaces are linked to the High-Leit XW control centre with the IEC 60870-5-104 protocol.

In the substations, a wide variety of links have been realised, such as Modbus RTU in cogeneration units, Modbus TCP for building services, Profibus DP and 3964R/RK512 links for automation technology in the water plant and biogas energy centre, and IEC 60870-5-103 connections to protective equipment. Even large substations such as the Vacherstrasse substation (with a total of 39 cells) have been planned autonomously; here a total of 15 IEC 60870-5-103 lines to the protective equipment have been realised with a net-line FW-5000.

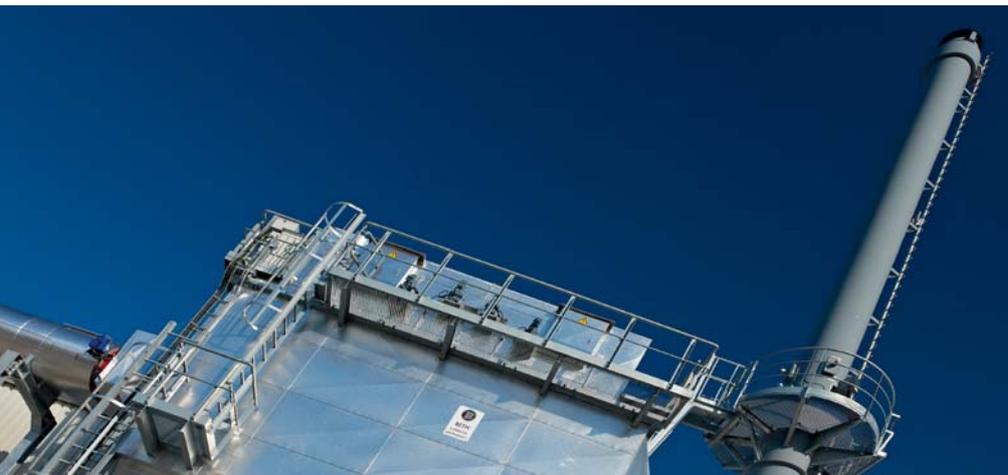
In the local network stations, net-line FW-50 units are usually used, with many local network stations also being equipped to switch the circuit breakers and isolators via dual command. Since 2012, infra fürth gmbh has realised renewable energy plants based on the net-line FW-5 small-scale telecontrol system. Inside a lockable IP 65 compact wall-mounted housing with a UPS module and GPRS modem, 14 messages and 4 measured values (active and reactive power, current and voltage), in addition to the switching commands, are processed via a process connector and transmitted to the control centre in line with IEC 60870-5-104 via the GPRS link.



Configuration for infra fürth

At the start of 2013 the Hätzerstraße distribution station was realised as an IEC 61850 project with project support from Cologne. A net-line FW-50 station with IEC 60870-5-101 coupling to the control centre is connected to 8 SIPROTEC combi units by FO ring via a RUGGEDCOM switch in line with IEC 61850. One benefit of this is the simple, familiar configuration environment with the setIT tool. Further IEC 61850 projects in the distribution station and substation field are planned for the future.

The excellent collaboration was reinforced with infra fürth gmbh providing the venue for the 2009 and 2012 "SAE IT-systems – User and expert days".



# “Poor Point” Regulation for the EVI Wood-fired Power Plant

Infrastructure · Heat

November 2011 saw the EVI wood-fired power plant on the site of the Hildesheim public utility enter operation. The state of the art, environmentally-friendly power plant produces central heat and electricity, and feeds this energy into Hildesheim's district heating and grid network.

The basic principle of the plant is combined heat and power generation (CHP) – electricity is generated and heat is provided at the same time. This minimises all possible energy losses. The installation is certified to FW 309-1 with primary energy factor 0 from AGFW (German Heat & Power Association). This is a measure of the energetic assessment of district heat supply systems.

The operator of the new wood-fired cogeneration plant is Energiezukunft Hildesheim (EZHI). The Lower Saxony forestry administration, the Hameln public utilities and EVI Energieversorgung Hildesheim have a 25%, 10% and 65% share of Energiezukunft Hildesheim (EZHI) respectively. The wood-fired cogeneration plant is another key component in the overall strategy of EVI Energieversorgung Hildesheim, in which power generation from renewable energy sources (previously only from wind, water and sun) assumes a pivotal role.

Total investment amounts to € 16m, € 7.2m of which is for the power plant itself and the remaining € 8.8m for the new district heating network. The planned annual energy turnover of the new wood-fired power plant is 33 million kWh of heat, and, using CHP, at an additional 3.6 million kWh electricity per annum. 20% of this bio-energy is made up of natural gas and 80% of wood chips.

### How the wood-fired cogeneration plant works

The plant comprises two firing systems with boilers. One system heats up only water with which peaks are absorbed for heat provision in winter-time. The other

has a thermo-oil boiler for the base load and power generation. The wood chips are burnt in the wood-based firing system with the thermo-oil boiler at temperatures of around 950°C. The smoke gas generated heats the thermo-oil boiler to around 310°C via a heat exchanger. This boiler heats up a silicone oil circuit to 270°C, again using a heat exchanger. The silicone oil evaporates and drives a turbine that, coupled to a generator, generates electricity. After the turbine, the silicone vapour is fed to a large tank that absorbs the residual energy by means of a heat exchanger once again, and that heats up the water for the district heating. The silicone oil condenses and starts its circulation from the beginning. This thermodynamic cycle is called the Organ Rankine Cycle (ORC) process. The principle corresponds to a conventional steam turbine but is considerably more environmentally friendly because much less energy is required for steam generation than water - and the heat generated in the conversion process is not simply released to the environment but re-used.

### The district heating network and associated media lines

A new underground district heating cabling system has been built in parallel to the construction of the EVI

wood-fired cogeneration plant. This system supplies connected customers with district heating. Housed in the new district heating route is a pipe system for transmission lines. Fed into this are the cables necessary for the leak detection system of the district heating lines and a communication cable. For a telecontrol connection, the communication cable was also routed to the system for major consumers.

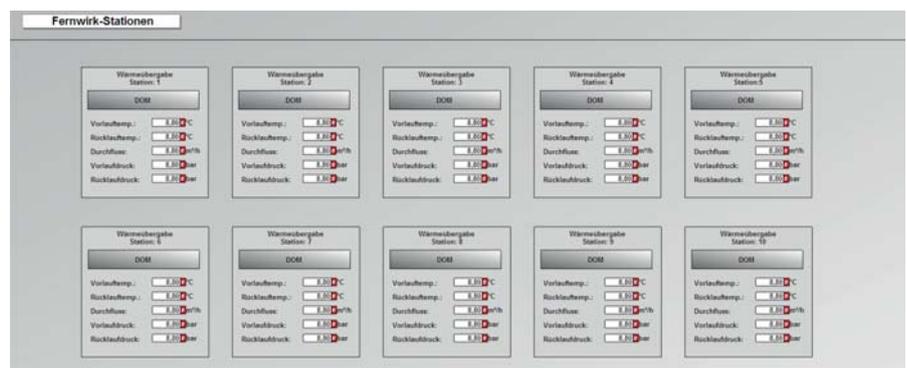
### Telecontrol connection using SAE technology

The role of the Network service department at EVI is now to make available the data of selected heat transfer core stations of the wood-fired cogeneration plant controller that has a relevance to regulation. At the beginning these were 12 heating stations for major customers, to provide the input and output temperatures, the volume flow, and in part the input and output pressures of the wood-fired cogeneration plant controller.

Using this information, the wood-fired cogeneration plant is to regulate the heat quantity and temperature for the district heating network such that the heat supply parameters stipulated contractually can also be rendered at the “worst” heat transfer point in the district heating network. This is the reason why this type of control is called “poor point regulation” at EVI.

The infrastructure for the technical layout was in place very quickly. The wood-fired cogeneration plant has a S7 controller – RK3964R was defined as the interface. This “old” and simple interface is already being deployed at EVI on several S7 controllers as a connection to SAE equipment, and is to be used here too for this reason. The net-line FW-50 is being used as the super-imposed telecontrol interface to the S7 controller of the wood-fired cogeneration plant and to the net-line FW-5 telecontrol units at the district heating stations. The information to be sent to the S7 of the wood-fired power plant should also be relayed to the control centre at EVI – it is for this reason that the net-line FW-50 deployed also has a connection to a net-line FW-5000 of the EVI control centre connection.

The copper communication cable also laid (8×2×0.8 mm<sup>2</sup>) on the heat section is used as the transmission paths for the telecontrol connection. A twin wire is



Depiction of the data transmitted in the control centre of the wood-fired power plant

used to connect a ring to all district heating transfer stations, over which the net-line FW-5 devices of the stations can be connected to the net-line FW-50 device over Ethernet using an SHDSL modem. If this transmission ring is interrupted at one place, the technical layout still means all the information is sent to the wood-fired cogeneration plant.

500×500mm Rittal cabinets have been used for the telecontrol for all district heating stations. Heat transfer meter information has been included using the Modbus RTU protocol over the RS485 port of the net-line FW-5. Because the heat quantity meters only make available one M-Bus interface, it was necessary to deploy an M-Bus to Modbus converter. The fitted pressure cells for the input and output pressures of the station are connected directly to the analogue inputs of the net-line FW-5. A small battery is used to power the telecontrol in the event of a voltage drop.



Telemetry in the heat transfer station

The system fitted has since proven itself in practise. The control centre of the wood-fired cogeneration plant can now assess the heat generation parameters in real time in all district heating transfer stations, and adapt generation regulation on the basis of the information sent.

The EVI control centre, manned around the clock, receives the same data as the wood-fired cogeneration plant, and also the monitoring signals of all SAE telecontrol units and the battery supplies. All heat readings are assigned threshold values in the control centre, meaning fault clearance can be initiated instantaneously when faults occur. The signals of the leak detection system of the heat sections are also recorded by the net-line FW-50 device and sent to the control centre.

The “poor point controller” system is designed such that new heat transfer stations can be incorporated at any time without major overhead.

## Aachen University Medical Centre Station Supervisory Control & Telecontrol

Infrastructure · Electricity



Aachen University Medical Centre is the clinical centre for RWTH Aachen. It is located in one of the biggest hospital buildings in Europe in the West of Aachen in the Laurensberg suburb, in close proximity to Vaals in the Netherlands. Every year, in excess of 4,667 full-time staff in 33 clinics and 25 institutes look after around 40,000 in-patients and around 220,000 out-patients. A reliable power supply is quite literally “a matter of life and death”.

It is the role of the “Power supply” department to ensure power to the UBFT/PF building, the power supply building including all ancillary buildings, nurses’ homes and worker flats is not interrupted, and to carry out all necessary checks and maintenance, thereby guaranteeing reliable operation.

Power is provided via three supply lines on the 10 kV level from the DSO (STAWAG) from the Melaten switching station. Supply line E1 is used as the normal network (NN), E2 as the equivalent network (EN) and E3 as the reserve for the equivalent/normal network. The 10 kV supply in the University Medical Centre is designed in the form of two ring systems, with the 1st ring being used for the general power supply and the 2nd ring providing backup power.

The NN ring runs from the station in-feed via station KR 4 and station VER to station BTZ North and back again to the station in-feed. The EN ring runs from the station in-feed via station KR 4 to station BTZ North and via stations Dach 7, Dach 6 and Dach 5 back to the station in-feed. Housed in the stations are the medium voltage switching stations, the transformers and the low voltage switching stations, including all network protective equipment. Power is provided to consumers from the low voltage switching stations over busbars and cable systems. Installed at the end points of the busbars and cable systems are main area distributors or main machine distributors (depending on usage). Sub-distributors are fed from the main area distributors.

The following emergency power units are continually on standby in the event of outage of the DSO power supply:

- for emergency supply to the UBFT/PF building, three 10 kV equivalent network units each with a capacity of 3 MW in operational Control Centre North
- for emergency supply in the power supply building, three 400V equivalent network units with a capacity of 1 MW / 1.5 MW

For real-time containment of a potential power cut from outside, a wide range of computer systems are installed that automatically detect the individual failure variants and connect up the equivalent network within 15 seconds by starting up the aforementioned units with appropriate switching operations.

For the continued, uninterruptible supply to systems and equipment critical to life, battery-aided converter systems are deployed that, in the event of power cuts, continue to power the blue power sockets in the operation and intensive care areas for life-sustaining medical equipment and operation theatre lights, the safety lighting, the green power sockets for the IT network and components connected in part, the computer systems and their components for monitoring and control of technical installations.

To monitor the power supply, net-line FW-50 telecontrol systems (and other systems) are being deployed at the Aachen University Medical Centre. All signals and measured values are recorded in parallel and sent to the process control system. The connection to the control system is established via manageable switches on the FO ring using the IEC 60870-5-104 protocol. A 15" touch panel on site is used to visualise all the data points of a telecontrol station. The main menu in which the telecontrol station is represented enables branching into every component. It is therefore possible to see each and every process point on site. In line with the strict stipulation of UMC Aachen to specify a 13 character name for the process data, an activity text can also be stored here for every piece of process data. A bargraph is used in addition to display the measured values.

Products	Protocols	Production period
net-line FW-50	IEC 60870-5-104, Modbus	From 2011 to the present

# BASF SE

## Monitoring of Low Voltage Supports

Industry · Electricity



BASF SE is the world's leading chemicals company. With approx. 110,000 employees, six sites and around 380 production

locations worldwide, it services customers and partners in nearly every country. Since it was founded in 1865, the Ludwigshafen site has grown into the world's largest interconnected chemical facility with about 2000 buildings on a site over 10 square kilometres in size. The site now employs more than 36,000 people.

For industrial networks, a high reliability of supply is commonly required, primarily to prevent consequential damage as a result of power loss. BASF SE operates at its Ludwigshafen site 1000 "low voltage supports", a combination of high voltage switchgear field (ring cable field)/transformer/low voltage switching station. The alarms from these systems have previously been reported to the central control centre as "support alarms". Switching operations were not possible from the central control centre. In the future, single-point information of support components are to be relayed to the central control centre and remote control of individual components is to be possible.

We have proposed our net-line FW-5000 telecontrol interfaces complete with switchgear cabinet for the 14 nodes to implement these requirements. The unit can be configured individually with 20 serial interfaces. This means the customer has a large selection of communication options to link the secondary SAE substations to the central control centre.

Functions such as time synchronisation via NTP, diagnostics via the integrated web server and linking to multiple control centres via a TCP/IP connection are also possible. For the telecontrol signal cabinets of the low voltage supports, the scalable net-line FW-50 telecontrol system complete with switchgear cabinet was proposed. A special feature here is that if a telecontrol hardware replacement becomes necessary, it must be possible to immediately reload the configuration of the station on site with an SD card. There is no time-consuming acquiring of configuration files from the central configuration database using a laptop and loading into the CPU processor card.

Another special feature was that special EVU cards were to be used for secure command control and command termination. Our EVU-2-0 cards were used here. They have multi-level monitoring functions such as 1 out of n monitoring, measuring circuit test for monitoring the external contact multiplying relay coil resistance, individually adjustable measuring circuit resistances, adjustable post command lag time, etc. The protocol to IEC 870-5-101 is used for the substations, and for the control system the protocol to IEC 870-5-104.

As part of a tender, we received a 3-year framework agreement for the supply of telecontrol systems for the signal and node cabinets for monitoring and control of low voltage supports. We proposed the most convincing and cost-effective solution. We have since supplied 14 FW 5000 telecontrol interfaces and 40 net-line FW-50 remote terminal units complete with switchgear cabinet technology.

### Requirement profile

- Remote control and monitoring of low voltage supports
- The concept is to be designed for 14 nodes and a maximum number of substations
- Remote terminal units are to communicate over IEC 60870-5-101/104
- Transmitting medium Cu lines or FO
- Linking to the central control centre
- Integration of remote terminal units from different manufacturers in one line
- Use of standardised modems
- The control direction is to be with measuring circuit test and 1 out of n testing
- Configuration and commissioning are to be carried out by local personnel
- High degree of standardisation



Products	Protocols	Production period
codeIT net-line FW-5 net-line FW-50	IEC 60870-5-101 IEC 60870-5-103 IEC 60870-5-104	Since 2010



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New Challenges!

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