Progress requires development
Development promotes progress

At SAE, we look back with pride on a very successful, but eventful year: The industry-relevant technologies and laws are updated in ever shorter cycles and result in complex challenges to our customers, but of course also to us! In these turbulent times, we have made it our mission to continue to serve our customers as a reliable partner. Maintaining and promoting our dependable customer service and flexibility are key factors in helping us provide our customers with the best possible support for their diverse tasks.

To accomplish this, we pull out all the stops and grow with the challenges - and at all levels. For example, we have taken several measures against the increasing requirements in the area of IT security. As a supplier for operators with critical infrastructures, we are taking the threat of hacker attacks seriously. To further increase the safety level, we have decided to seek ISO 27001 certification. In addition to the appointment of an information security officer, including a training as IT Security Coordinator IHK, the process of preparing for certification is supported by professional external security specialists.

We meet the increasing complexity and the growing need for consulting with the enlargement of the SAE team by numerous highly qualified specialists and our innovative service concept, which allows improved transparency and predictability in the preparation and execution of projects.

In the field of hardware and software, the development continues logically, too. The central innovation is the new series5e technology, which enables even faster network communication and process point handling through additional performance, as well as state-of-the-art security functions and encryption algorithms. It is not only the basis for the evolution of our classics, such as the net-line FW-5, FW-50, FW-5000, and BCU-50, but also for new, innovative product variants, such as the net-line FW-5-GATE-4G with integrated LTE modem, which we were very successful in introducing to the market.

Of course, the growing requirements are also reflected in the new functions of our innovative parametrisation software setIT. We have compiled a compact overview for you. With further optimisation of our production resources (e.g. with a new automatic drilling machine) we ensure even better quality and higher capacities.

Last but not least, we also want to do our part for energy efficiency and environmental protection. The comprehensive energetic renovation of our location and the installation of a PV roof system is scheduled for completion this year!

But, with all the changes, we also make sure that some things stay as they are: We are very proud of the satisfaction level and trust of our customers, which is reflected in the continuity of our business relationships. Just like with power grid Hamburg (formerly Vattenfall), which we have already supplied with more than 1,000 systems, or with Kreiswerke Olpe, who upgraded their SAE telecontrol system to the new level of SAE technology after many years of reliable operation.

In the field of telecontrol technology, the net-line FW-5-GATE-4G with integrated LTE modem impresses. An integrated security concept for the connection of telecontrol technology in critical infrastructures.

The 450 MHz frequency band is coming. With the next update you will see many new functions in our parametrisation software.

Behind the Solutions
IT security
With “Behind the Solutions”, each edition of SAE News introduces the job of an SAE employee. This time, we will visit the new information security officer.

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Tailor-made for "one fits all": the FWG-50
The economical solution for large quantities

Product introduction

Stromnetz Hamburg

Particularly in densely populated regions such as Hamburg, where possible grid failures usually affect a large number of households and companies, the grid managers must have a precise overview of the situation in the grid and monitor a large number of stations. The responsibility of the distribution grid operator Stromnetz Hamburg GmbH covers more than 7,000 stations. Although the telecontrol equipment of a certain proportion of these stations (e.g. stations with high importance for grid stability or stations at strategically important or hard-to-reach locations) causes high initial efforts and costs, it represents the most economical solution in the long term: due to the possibility of switching and controlling from the central grid control centre in the event of grid interruptions resulting from short circuits and ground faults, the grid downtime and losses in the secure supply, can be significantly reduced, thus avoiding negative effects on the achievable grid fees.

Standardisation as the key to success

In order to make sure that the telecontrol technology for large distribution system operators like Stromnetz Hamburg not only optimises the supply reliability, but also the implementation of the technology remains economical, SAE has developed a very special product: the telecontrol station net-line FWG-50. A key factor in economic integration of large quantities is the sensible standardisation of the systems. Since compact stations of various makes and designs are used in parallel in the grid area of Stromnetz Hamburg, the definition of a uniform standard based on standard components (e.g. FW-5 or FW-50) was not possible due to the sometimes very limited space in the stations.

The net-line FWG-50 was designed in 2009 according to the requirements of the predecessor company of Stromnetz Hamburg, Vattenfall GmbH, specifically for the automation of 10 kV systems in Hamburg and Berlin. A special feature of this system is its accommodation in a metal housing as a rack drawer and the process connection via a side-mounted Harting connector. Its 8.8 cm height and 60 cm depth has been adapted to the tight space conditions in compact stations and allows the accommodation of the device within the plants. In addition to the telecontrol unit, the housing also has space for a communication component such as a TETRA radio modem, DSL modem, VFT dedicated line modem or another type of interface. The devices can be prepared, parametrised and tested by Stromnetz Hamburg in the central laboratory. Depending on the technical requirements of the destination station, such as transmission route (different modems, V24, Ethernet), number of circuit breakers, etc., the product is equipped and parametrised. The finished telecontrol stations are then delivered to the respective destination stations and installed on site with a few simple steps. In the Hamburg compact stations, the devices can be placed in a slot above the circuit breakers. In the walk-in stations, they are attached to the wall.

Success goes into the next round

After several years of successful project development, the requirements profile was supplemented and redefined with regard to a few technical specifications. Thus, for example, local short-circuit and earth fault direction indicators or network analysis systems are integrated via an RS-485 interface in the front of the devices via Modbus. As part of the new tender, SAE has also completed the switch to a new CPU generation, which offers additional power reserves and various new features in the area of IT security.

Once again, the decision was made in favour of our in-house solution. We are pleased about the renewed success and the order to deliver the second generation of the FWG-50 to a satisfied customer.

Conclusion

Stromnetz Hamburg does not only benefit technically and operationally from the use of the FWG-50: through clever standardisation and optimised processes, the integration effort was significantly reduced, yielding additional economic benefits. There are already more than 1,000 FWG-50s in use in the Hanseatic city. The FWG-50 is also highly recommended for other grid managers who need to equip and supervise many stations.
Kevin Sarnowski has been assisting us in project planning for almost a year now, and meanwhile, life without him is no longer imaginable! Based on his training as a certified electrical engineer, he was able to familiarise himself extremely quickly with the subject and is already responsible for commissioning and maintaining systems and supporting our customers with his on-site technical know-how. Thanks, Kevin, keep it up!

Kevin Sarnowski

In addition, we welcome our new colleague Benedikt Weidemann in project planning: He recently completed his Master’s in Information Technology and Electrical Engineering and now applies this expertise to SAE projects. He is also always on hand when customers need conceptual or operational support in equipping their grids. We are happy that he is here!

Benedikt Weidemann

To strengthen order processing, we welcome Lena Jecke, who came here all the way from Munich. She moved back to her home region for SAE and now takes care of processing incoming orders as well as the time and delivery requests of our customers, and coordinates everything together with the responsible departments.

Lena Jecke

We always want to keep our customers up to date, so there is also a new addition to marketing: Janina Lüt kemeyer assists with the organisation of events such as our popular Expert Days and ensures that our customers are always kept up-to-date with our newsletter, our website and the SAE News.

Janina Lüt kemeyer

In 2017, a lot has happened at our location in Cologne - not only in the field of telecontrol technology! The three company buildings were completely refurbished, that is: new façade with optimised thermal insulation, new windows and new heaters. In addition, our lighting system will be converted to LED and a large photovoltaic system will be installed on the roof.

In the future, it will cover a good 70% of our own electricity needs. Among other things, it will supply our new e-charging station, which we set up for our customers as well as for our own e-vehicles.

In addition, our system integrator was equipped with a new automated drilling machine. Depending on the order, the machine automatically switches to the integrated tools. This allows us to handle our customers’ orders even faster and more precisely.

All in all, around €1 million was invested for our 45th anniversary so that we can continue to work more efficiently, and especially more energy efficiently, over the next few years.

Dennis Rotte
The Stuttgarter Straßenbahnen AG (SSB) is one of the largest and most modern public transport companies in Germany and has received several awards for its services in recent years. The SSB ensures mobility in the state capital of Stuttgart, thereby ensuring the functioning of the city and the quality of life of its inhabitants. A good 500 buses and trains and around 3,000 employees work every day. Almost 970,000 people live in the traffic area. Every work day, nearly 600,000 people use one or more of the 72 SSB lines.

Since 1986, we have installed telecontrol systems for switching, measuring and monitoring operations in the 10 kV traction substations. To date, about 100 telecontrol systems are in use, which essentially fulfill the following tasks:

- Switching and monitoring the driving voltage, low voltage, tram stop lighting, tunnel lighting and point heating
- Control of escalators, roller shutters, fire doors and ventilation systems
- Monitoring fault voltages, temperatures, error messages

Modernisation

In 2015, the decision was made to modernise the ageing telecontrol equipment. Initially, 60 substations in the substations (UW) were to be renewed and a further 20, mainly smaller ones, to be constructed at the stops. As part of a tender, the net-line BCU-50 and the smaller net-line FW-5 system prevailed over the usual competitors. With a complete solution, SAE offered everything from a single source, including the installation of switchgear cabinets with all the assembly, installation and seamless on-site integration in the substations. The execution was carried out by our experienced plant engineering, with the support of SSB personnel. The customer only wanted to develop the system configuration of the telecontrol stations himself. For this purpose, SAE has an innovative and very convenient setIT parametrisation software. With just a few clicks, the system can be quickly and easily configured and extensive diagnostic functions can be set.

With the BCU-50 we have delivered a very robust, modular bay station controller with high functionality and reliability, which perfectly meets the requirements in the traction substations. Depending on the size, several BCU-50 racks with 19” mounting frames were required for installation in the switchgear cabinet, which are interconnected via integrated Ethernet switches. The whole system is optimised with a special BCU rack, through which all connection cables can be routed cleanly to the rear and intercepted in flexible cable hoses. FW-5 telecontrol systems will also soon be used in the technology cabinets of the stops. They are supposed to take over the switching of the stop light, in case the network connection gets interrupted. For this purpose, a PLC program specially written by the SSB is stored in the FW-5. For another project, a so-called TBUS remote I/O was used. This TBUS extension provides a simple and cost-effective way to place several FW-5 expansion modules in different switch panels, which are then connected to the FW-5 base unit via a patch cable only. This can be bridged up to 1,000m.

Nationwide connected

The telecontrol systems are distributed over the entire urban area and connected via so-called HIPER rings (high-availability fibre optic networks) via Ethernet LAN TCP/IP to perform switching operations from the control centre (IDS) as well as from the network control centre (KISTERS). The TCP/IP-based telecontrol protocol IEC 60870-5-104 is used throughout.

For the BCU-50 as well as for the FW-5, there is a large selection of modules for individual expansion, as well as numerous communication options that allow the connection of control systems and protection devices by means of different protocols and interfaces, regardless of the manufacturer.

Good feedback

The SSB commented on our efforts to offer solutions that are customer-oriented:

“Sophisticated functionality, practical know-how, user-friendly configuration software, optimal and cost-efficient solutions, a wide range of communication options, high IT security according to BDEW whitepaper.”

Thomas Schulz, SSB
Street lighting in Gronau
A future-oriented application area of telecontrol technology

Due to the more conscious use of resources and the increasingly necessary automation in the supply area, telecontrol technology now takes over the ripple control and other obsolete techniques in many areas of application. Stadtwerke Gronau, for example, is now optimising the targeted control and management of its street lighting using SAE telecontrol technology.

Information is collected in the local network stations of the city using network analysis systems as well as intelligent Compass® short-circuit and earth-fault direction indicators from Horstmann and coupled via Modbus RTU or TCP to the telecontrol system from SAE IT-systems. Short-circuit indicators are also connected in the medium-voltage systems and signal transmissions are set up for the status of the switch positions. The telecontrol system transmits the relevant information to the I/O modules of the road control panels via Modbus RTU. Depending on the station, the data is sent securely to the control centre via the Stadtwerke's own infrastructure (LWL or copper).

The advantages are clearly recognisable in practice: Errors are detected more quickly, and their causes are localised more quickly and visualised in the network control system. This makes maintenance work even more targeted and efficient. Due to the decentralized structure, errors do not result in complete failure of the lighting system, and individual areas or roads can be illuminated more efficiently, depending on the light requirements. Worth mentioning in this context are also the synergy effects for the electricity operation and for the operation of the street lighting.

The public utility organisation “Stadtwerke Gronau” is also progressive in their safety issues: To secure the systems, they use the user management of the SAE software and work with their own VLAN for the control of the local network station and street lighting. Communication with other VLANs takes place exclusively via redundant firewalls.

The project started rolling out at the beginning of 2017 and should be completed by the end of 2018. 135 street lighting switching points and 7,266 lanterns are to be connected by 2018.

Anniversaries & farewells

After 32 years with SAE IT-systems, we now say goodbye to Cornelia Blum-Bader, also known internally as "Blümchen" (little flower), as she is starting her well-deserved retirement. As one of our long-standing employees, she has always kept track of our projects in order processing and coordinated on-time deliveries to customers throughout the world. We would like to thank her for the wonderful time and wish her all the best!

Cornelia Blum-Bader

When it comes to money at SAE, there is no way around Simone. She has been on board for 35 years as our “finance director”. Since the early days of SAE, she has been overseeing and coordinating the processing of incoming and outgoing payments and ensuring that the books are in order. Over the years, a lot of money has run through her hands - including our salaries! Dear Simone, on that note, many thanks and congratulations on your anniversary!

Simone Schulte

What would we be without our “Deddy”? The original from our ranks has now been around for over 30 years. With passion and dedication, Detlef Marx and his team not only ensure reliable material procurement, but also the careful production of our technology. in the end, they ensure the fast delivery times for which SAE is known. Thanks, Deddy!

Detlef Marx
The water supply of the Kreiswerke Olpe supplies the vast majority (around 73% of the inhabitants and the industry) of the Olpe district with drinking water.

Infrastructure in district Olpe

Three treatment plants, around 200 km of drinking water transport lines, pumping stations and storage facilities with a total useful content of around 36,700 m³ ensure that the population is supplied with safe drinking water. 99.9% of the drinking water is supplied by Kreiswerke Olpe to “redistributors”, such as municipal utilities, municipal waterworks and voluntary water supply associations. The remaining 12,000 m³/year go to farmhouses and stand-alone residential buildings, which are difficult to reach by the infrastructures of the redistributors and are located in the vicinity of the transport lines of the Kreiswerke Olpe.

Old acquaintance

In the aforementioned infrastructures, the telecontrol system from SAE has been doing its job reliably since 1996. It was also this reliability that led the Kreiswerke to stay with SAE technology for the modernisation update and to bring it up to the latest state of the art. A particular advantage in this context was that the latest device generation also enables the further use of existing input and output modules (from old SAE stations). This allowed savings in three areas:

1. In the hardware area due to the reduced replenishment demand
2. For the services due to the minimised cabling effort
3. And along with that, of course, time too

Project scope

A total of four master stations were exchanged at three locations and 56 substations. Some pumping stations and high tanks store complicated control functionalities, which were realized by codeIT applications. The substations are connected in large part via their own cables of the county utility organisation and SHDSL distances with the redundantly constructed master systems. They communicate via the IEC protocol 60870-5-104 with the ProCoS control system from KISTERS, which was also updated to the latest version in the course of the project.

The order to SAE also included the construction of the control cabinets for the redundant master stations and the assembly of all components on site, including commissioning. The project was completed to the fullest satisfaction of the customer.

“As expected, the project ran smoothly with SAE - as always!”

Ralf Steinmeier, Kreiswerke Olpe
Behind the Solutions

IT security at SAE

Markus Dewerny has been with SAE IT-systems for 15 years. Before that he was a customer himself. As a former project engineer, he not only knows the systems and technology inside out, but also understands the concerns and problems of the customers first-hand. Now he is taking over the position of Information Security Officer at SAE to advise and train customers on security issues. We found out during a visit to his office what exactly this job entails and what challenges he faces:

Markus, after 15 years with SAE IT-systems, you have now taken over the position of Information Security Officer. How did your career path and your personal interests lead you to this position?

I’ve always been interested in the topic - I believe that in the 1990s I was the first in my circle of acquaintances to have a paid virus scanner on my computer (laughs). Over the years, I have been confronted with more and more questions about IT security, both in the private and especially in the professional field - and I have researched and found solutions for it. It has become a personal passion. Last year, I made the decision to continue my training beyond the existing points of contact: I applied for an evening school training course at the IT Academy NRW in Cologne and completed an exam as an IT Security Coordinator at the IHK Cologne. At the moment I am still participating in further training courses.

In your opinion, why was it useful and important for SAE to supplement its range of services with safety-related advice from an expert like you?

Most of our customers are operators of critical infrastructures. If they are attacked by hackers, in the worst case, the entire population can be affected. This makes it especially delicate and there is a legitimate interest in a safe installation - on the part of the operator and the state. Since a majority of our customers, who operate these infrastructures, use our technology at key points, it is essential that we offer our customers support and advice in this regard.

What are the major concerns of the customers who turn to you?

There are 2 types of concerns:

One regards the specific security mechanisms that our technology offers. Specific and detailed questions are asked about our software, for example: How strong can I set the encryption? Which transmission procedures or encryption algorithms are supported? How does the firewall work in the devices? How can I ensure that strong passwords are assigned? On the other hand, some people ask quite general, conceptual questions: How can I plan and build a network sensibly? How do certain actions in the network work in harmony with actions that I have taken outside the network? How do I set access restrictions? How do I segment networks? How do I secure the connection to the control centre? A very frequently asked question is: Where can I find the reasonable line between usability and security? If I configure the network so securely that I as the operator, can no longer work freely in it, then I went too far (laughs). In the past, the main focus was on functionality. Security issues were rather secondary. Today, function, handling and safety must be in reasonable relation to each other, taking into account the legal requirements, the recommendations of the BSI and the current risk situation.

What has led to this shift; why has safety suddenly become more relevant?

We are facing a growing threat from cybercriminals. This can be seen daily in the media. And the legislature has reacted to this danger: The IT security law requires the operators of critical infrastructures to introduce information security management systems, or ISMS for short. As a result, many utilities are now more concerned with the security of their network infrastructure. ISMS is a trigger for dealing with this issue.

What role does telecontrol and substation automation play in the security of the network infrastructure?

We often sit at central points of the network with our telecontrol and substation automation technology. The devices have different interfaces to other services, to other manufacturers, to different components and to the physical process. The transmission often takes place to different master stations of several operators. In summary, our technology is often used as a multi-interface device. We are not an island that can be viewed separately, but always part of a larger network.

And the key in information security is: The chain is only as strong as its weakest link. Therefore, you not only have to consider each individual component separately, but also the entire network, right down to the physical conditions and processes in operation - in other words: How do users work with the components? How is the access to the site regulated? Is the building secured? Who receives access to the system and to what extent? Is access logged? Which connections need to be encrypted? Fortunately, these questions have increased dramatically over the past two years. Previously, these issues were rarely a problem - at least not to this extent - because the dangers were not as severe or frequent as today.

Now we all share the same goal: to minimise the attack areas and avoid the risk of disasters.
**Functionality vs. Security**

**A technical balancing act**

Functionality comes first! No network operator can really still have this view today, given the rapidly changing environmental conditions. A balance with security must be established. We have combined the safety and everyday usability of supply infrastructures with a holistic concept for the connection of our telecontrol and substation automation systems.

Growing with the challenges.

Coordinated cyber attacks on station technology are no longer just horror scenarios in dystopian action films, but already part of our reality. For the supply network operators, this risk entails enormous risks for both supply stability, and the possible associated claims for damages, as well as for public reputation: important reasons to look into information security today rather than tomorrow. What specifically does that mean? An optimally protected information systems.

What specifically does that mean? An optimally protected future-proof infrastructure also requires the ability to provide continuous and detailed monitoring to identify risks and derive protection measures. The practice-oriented solution to this challenge can only be a holistic security concept, which enables continuous further development. We would like to introduce this concept:

**A heart for practitioners**

Advanced security functions were seamlessly integrated into the user interface of our setIT parameterisation software. For example, user-defined profiles with Role Based Access Control (RBAC) prevent system-relevant settings from being changed unintentionally by employees without appropriate authorisation. Furthermore, accesses to service functions in the station can be temporarily activated via a command from the control centre, so they do not run permanently and thus do not provide a constant attack surface. Also when updating a station configuration, the safety cannot fall short. The configuration can be protected from unauthorised modifications and also prevents unauthorised access to the information contained therein.

**System autonomy and transparency**

In a network dependent on third party services, network security is not entirely in the hands of the user. Those who reduce dependencies not only increase the autonomy of the network, but also its security. Our solution: the use of an in-house NTP server for time synchronisation as an alternative to an internet service. In addition, the security concept provides for continuous and detailed monitoring of the network infrastructure with regard to stability changes, accesses and access attempts (diagnostics options with syslog, SNMP, etc.). For this purpose, the telecontrol sends relevant data to a syslog server, which enables the central recording of operating events of many stations and the evaluation of these messages. Depending on the type and the equipment of the Syslog server, alarms may be generated to report, for example, a high number of incorrect password entries, an update outside of operating hours or other unusual events. These observations can be used to derive the causes of current stability fluctuations and to identify potential hazards at an early stage.

**Connectivity options for telecontrol**

Our security concept recommends a VPN gateway as the connecting component. It enables the central control of many stations via only one telecontrol master station. Our telecontrol components allow various connection techniques to the gateway, such as the use of any internet connection, an external router, as well as cellular or LAN. We design solutions for utility companies with different requirements. Therefore, various security products can also be integrated into the security concept: for example, the field device types net-line FW-5, net-line FW-50 and net-line FW-5-GATE-4G shown here. Thanks to the series5e technology, our products have been placed on a new, future-proof platform. In the article on page 10 you will find out what the incentive was to develop this technology and what makes it even safer.

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**All-in-one: Net-line FW-5-GATE-4G with built-in LTE modem**

The FW-5-GATE-4G is a telecontrol station and LTE modem in one. Therefore, there is no need to integrate or adapt an external modem - but that’s not all. There is no need for an additional connection cable between the modem and the telecontrol station - a typical weak point in risk analyses. In addition, the FW-5-GATE-4G impresses with high transmission and reception quality, fast upload and download rates and with the practical fallback option on 3G (UMTS/HSPA) or 2G (GPRS/EDGE) for locations with bad reception conditions. The modem is approved for use in Europe and covers the common frequency ranges in the mobile network. And all that at an attractive price.
A secure connection requires a secure VPN encryption protocol and a key identification mechanism. Based on strong-Swan, IPsec can be activated in the setIT parameterisation software both on protocol version 1 (IKEv1) and on protocol version 2 (IKEv2), described in RFC4306. It should be noted that not only the stations on the ground should be protected against external access of any kind, but also the database itself. The new database format .sdbx enables the encryption of the entire project file with the secure AES-256 algorithm. This encryption is also recommended by the German Federal Office for Information Security (Bundesamt für Sicherheit in der Informationstechnik, hereafter BSI) for cryptic procedures. setIT also allows further definition of advanced firewall rules. Certain services can be activated as well as limited to different interfaces. It is also possible to make deliberate settings that allow more flexibility. In summary, our concept allows diverse and secure connection options via VPN and a high degree of functionality. The safety of our customers and the supply networks has spurred us on to supplement our portfolio with safety-related advice and to develop this safety-optimised connectivity concept.

The safety of our customers and the supply networks has spurred us on to supplement our portfolio with safety-related advice and to develop this safety-optimised connectivity concept.

We are pleased to be able to provide telecontrol systems for the use of this new communication path in a timely manner. The corresponding developments in software and hardware are almost complete. The FW-5-GATE-4G hardware platform contains an integrated 450MHz module. The network parameters are stored in the radio module or can be configured via setIT; a SIM card is not necessary. As with the FW-5-GATE-4G, it offers comprehensive online diagnostics.
One of the basic laws of Cologne says: nothing is as it was. This statement can also be confirmed with regard to the technical requirements for hardware and software in the field of telecontrol and substation automation.

**Objective**

We aim to continuously develop our products to keep up with the times and technical requirements, eliminate weak points, improve performance and integrate the latest technical components. Our goal is to provide our customers with the most up-to-date, future-proof systems while benefiting from our 45 years of experience in product development for telecontrol and substation automation.

We also followed this objective in the development of the series5e. Let’s not just look at the results of the development, but also behind the scenes:

**Development process at SAE**

In order to update the technology of our telecontrol equipment according to our requirements, our product management and our sales department continuously analyse the developments in the industry and thus identify the technical requirements of tomorrow. Together with the hardware and software department, these requirements for the product development of the series5e were translated and a requirement profile was created. Goals like "longevity" were translated into "life-cycle-length-focused component selection," "more performance" has become "optimal processor selection," and so on. This requirement profile resulted in an even more detailed functional specification in the hardware department - and thus the green light for the actual development phase: this resulted in initial circuit diagrams, technical layouts, simulations and finally the composition of a prototype - all in close coordination with the software development. Another classic component of the product development chain is the final step: comprehensive and final quality assurance through our internal stress tests.

As with all new developments, we also invested a large sum in the quality checks of the series5e. As always, the series5e also had to prove our internally set high quality standards, which, of course, comply with national and international product standards. Among other things, the operating conditions, switch-on loads and continuous operation were tested. The result: The series5e technology has clearly convinced us of its quality!

**Product innovation**

The result All in all, the products with the new series5e technology are impressive: each net-line product with series5e technology still offers more performance thanks to the 32-bit RISC processor (ARM Cortex-A8) with floating point unit and the 1GB memory: With 1,200 MIPS, the hardware runs at three to five times the performance of the previous generation series5+. The improved performance in particular has a positive impact on network communication via IEC 61850 and process point treatment according to IEC 60870-5-10x standards. The system boots up much faster and enables the use of state-of-the-art encryption algorithms. For optimum diagnostic options, all LEDs on the new series5e products are implemented on the front and in some cases even freely parametrisable. The overall system was based on a modern linux kernel which allows for greater flexibility and easier maintenance of firmware, especially in terms of IT security.

**Conclusion**

In summary, the devices have an even more improved immunity and isolation concept and meet the complex safety and practical require-ments of today and tomorrow. The series5e technology has also paved the way for a special innovation: the FW-5-GATE-4G is a telecontrol station and LTE modem in one!

Interested? For more information about the FW5-GATE-4G, see page 08 below.

**A quick look at two of our typical testing methods**

During our **dynamic stress test**, more than 10,000 restart cycles per device type are performed over a period of more than 2,000 hours – while monitoring all serial couplings. The test samples were deep-discharged between each cycle. This test is used to check and prove the stability of the interaction between hardware, software and drivers, because for the internal technology, booting is the biggest burden.

In order to finally test the technical design for continuous operation (24/7), our **endurance test** puts our devices into operation at a dry heat of 75 degrees for 2,000 hours – with simultaneous monitoring of all functions and interfaces. Defined restarts are carried out at regular intervals. Thus, in addition to the robustness and the service life, the boot function can also be tested under continuous thermal load.
Stadtwerke Heide GmbH supplies electricity, gas, water and heat to about 35,000 inhabitants, many households and businesses in Heide and the surrounding communities. In addition, it runs the outdoor and indoor swimming pool “Dithmarscher Wasserwelt”. The public utility is traditionally firmly rooted in the region and plays an important role in the economic and social life of the city of Heide.

It are more than just an anonymous supplier of energy and water. Heider Stadtwerke GmbH faces the open market competition with a high level of motivation, competitive prices and well-trained specialists.

Step by step to the goal

A few years ago, Stadtwerke Heide decided to replace the decrepit PLC controls on the waste water treatment plant with modern telecontrol technology from SAE IT-systems. Even after the founding of the waste water special purpose association in Heide, the conversion was continued under the supervision of Stadtwerke Heide. Within the scope of the project, the individual functional units, e.g. the aeration, the equalisation tank, the inlet, the screen, the return sludge, the excess sludge thickening, the secondary clarification, the filtration and the main distribution of low voltage were renewed in stages over several years.

Technical specifications

In total, nine PLC systems with a capacity of approx. 1,200 digital inputs, 250 digital outputs and 100 analogue inputs and outputs were replaced. For this purpose, net-line FW-50 stations, partly cascaded, were set up in the existing cabinets. The systems are operated with a loop concept using SHDSL modems (MiniFlex from FlexDSL) in the TCP/IP frame with IEC 60870-5-104 protocol and forwarded to a ProCoS control system. The ring loop concept represents a substitute routing within the SHDSL modems, thus ensuring data transmission in the event of a data transfer failure.

“Good things come to those who wait. Although the conversion had to be carried out in stages and thus took a long time, SAE kept an eye on the overall goal and completed the project completely smoothly and to our utter satisfaction. That’s the way to work!”

Jan Nagel, Stadtwerke Heide
Stadtwerke Rosenheim is a public utility company in the town of Rosenheim am Inn and, as an energy supplier, provides electricity, gas, district heating and steam as well as water to private and commercial customers. In addition, the public utility is responsible for the waste disposal and management of the Rosenheim baths. In addition, Stadtwerke Rosenheim is pursuing an energy concept with the goal of achieving a CO₂-zero balance for the city by 2025. The implementation contains various building blocks that are constantly being further developed and updated. Since 2005, Stadtwerke Rosenheim has been building a virtual power plant with its own and third party facilities. In 2009, an existing pool, the so-called Pool North, was taken over. Since 2011, the public utility has been marketing tertiary controls independently. The ProCoS process control system from KISTERS is used to control and monitor the wide range of individual systems. Today, Stadtwerke Rosenheim can offer positive and negative tertiary control power and, in addition, negative secondary control power. However, not only the marketing component of the standard benefit, but also the renewable energy plants direct marketing and/or the stock market marketing Day-Ahead and Intraday is very successfully pursued. For the latter types of marketing a timetable-oriented driving style of the systems is necessary. For each plant or technical unit that is integrated into the virtual power plant, a data link for the exchange of process information had to be set up. The public utility company decided early on to rely on SAE telecontrol technology. Not least because older SAE-FW 4/40 devices were already successfully installed in the acquired Pool North for the technical connection of the systems. New, smaller systems are currently mainly equipped with FW-5 device technology. As justification for the use of SAE telecontrol technology, Mr Vogler, the project manager of the virtual power plant at the Stadtwerke Rosenheim, lists the following:

- clear and fast parametrisation of the systems with setIt
- simple integration of control programs into the stations with codeIt, in particular for the rolling storage of set point schedules
- the simplest, needs-based expandability of the stations with additional input/output modules and communication modules
- optimal price/performance ratio for applications of Stadtwerke Rosenheim
- fast/short delivery times

Furthermore, Mr Vogler explains: “Especially the last mentioned point is very important to us, because after conclusion of the contract with a new pool partner of our department the technical connection or the integration into the virtual power plant has to be carried out as fast as possible. From our previous experience, we can say that almost every connection of a technical unit is a small project (‘copy and paste’ is very rare). This concerns:

- Communication interfaces to the customer systems
- Modbus RTU or Profibus or galvanic input/output
- Communication with the headquarters at Stadtwerke Rosenheim
- Installation options of the components on the customer side
- Behaviour of the system in case of power failure

We decided at an early stage to manufacture the necessary control cabinets in our workshop as needed and quickly.” Systems that are outside of Stadtwerke’s communication network are connected via GPRS/UMTS services or directly via DSL. Stadtwerke Rosenheim uses LUCOM modems for mobile communications. The VPN tunnels are set up in the modem or in the FW-5 systems. At the headquarters, the VPN connections are managed via appropriate high-performance routers with a firewall.

In the Stadtwerke Rosenheim’s virtual power plant, external plants are integrated with which renewable energy direct marketing and control power marketing are carried out. Currently, they include about 30 biogas plants in the area of Rosenheim, whose entirety is referred to as virtual land plant. This is where the public utility company attaches especially great importance to a partnership-based cooperation on equal footing with the respective plant operators.
These biogas plants are connected via FW-5 systems. In order to avoid having the higher-level renewable energy feed-in management of the upstream distribution system operator “collide” with the switching measures of the direct marketer, essentially the following concept is implemented:

Switching commands of the distribution system operator are switched as signal inputs on the stations of the direct marketer. At this point, the renewable energy cut-off is prioritised over the switch measures of the direct marketing.

Especially in these applications, Mr. Vogler explains, the control functions that are to be implemented in the FW-5 substations are important. The following functions are required here:

• Implementation of pulse to permanent command
• Behaviour of the station when activated
• Behaviour of the station when the connection is interrupted
• Storage of set point profiles, day-ahead rolling
• Priority switching of the renewable energy control before control commands for direct marketing.

If systems that are currently only part of direct marketing are also marketed in control energy, it is necessary to provide additional information about the system. Here, as Mr. Vogler points out, we are well served with the SAE FW-5 technology, as these devices can be easily expanded in a modular way.

The expansion of the virtual power plant, in particular with the integration of suitable facilities from the region, is constantly being pushed forward, taking into account the various possible market opportunities. The connection of new plants to the headquarters in Rosenheim can now be carried out quickly and efficiently. This is not least due to the successful use of SAE telecontrol technology.
Between the mountain ranges Harz and Solling in southern Lower Saxony, north of the university town Göttingen, lies the district town Northeim. The public utility company Stadtwerke Northeim (hereafter SWN), a wholly-owned subsidiary of the city of Northeim, is a regionally rooted supply and service company with a long tradition. For decades, SWN and its committed employees have been working to supply electricity, natural gas, water and heat to the approximately 30,000 inhabitants and many industrial and commercial enterprises in the city centre and all the associated towns in the city of Northeim. Day by day and around the clock. Always reliable and safe.

As operators of supply grids, SWN has a modern and reliable network infrastructure with state-of-the-art facilities covering an area of about 145 square kilometres. Regular inspections, sustained high investments in maintenance, modernisation and expansion of grids and qualified employees ensure the high quality of care in the district town in southern Lower Saxony.

The implementation of telecontrol in all areas of supply for SWN was a sensible and practice-oriented solution as a first step. The municipal utilities Bovenden - since 2011 cooperation partner of Stadtwerke Northeim - had already implemented the telecontrol of SAE IT-systems, so that the Northeimer relied on the good experiences of the partner. Substations, transformer and local substations, pumping stations, water towers and gas pressure control systems were equipped with the FW-5 and FW-50 telecontrol systems as substations and connected via IEC-104 through a FW-50 telecontrol master station and to the ProCoS control system - all of it of course VPN encrypted.

Regional cooperation in southern Lower Saxony
Joint control centre for Northeim and Bovenden

Electricity · Gas · Water · ProCoS

Reaction to reality

The ever stricter legal requirements for monitoring systems and growing demands in the area of IT security must also be taken into account by these two network operators. In order to use synergies, it was obvious to use a uniform telecontrol system. The plants in Bovenden were connected to the new, central control centre in Northeim via their own FW-50 telecontrol master station. The data is transmitted via DSL.

Autonomous despite cooperation

The higher-level on-call service with a well-tuned safety chain and the acknowledgement function of the ProCoS mobile radio notifications ensure that error messages cannot in any case run their course despite different responsibilities. Nevertheless, each of the two still independent companies has its own network master and does its day-to-day business autonomously. Of course, the technology was also of fundamental importance for the successful cooperation: the ProCoS system and the SAE telecontrol technology are flexible and expandable. Especially the possibility of on-site visualisation facilitates the work of the teams from Northeim and Bovenden. The operational and economic performance of both system operators has been improved. The utility companies in Bovenden and Northeim now work together, not only on a technical level in all sectors (electricity, gas, water and heat), but also in commercial administration. Being aware of the responsibility, the certification of the control centre pursuant to ISO 27001 is now pending.

Good news spread fast

Another cooperation is already planned: the water supply from Nörten-Hardenberg (PLC system) should also be connected to the central control system. To secure the on-call service and the operating procedure, this project will be solidified with a cooperation agreement. In the future, it is planned to connect further supply facilities of smaller municipalities in the surrounding area to the control centre of Stadtwerke Northeim so that they, too, can benefit from the advantages.
Up(-to-)date

New setIT functions at a glance

Product development

We continue to further develop our software applications for our customers. The latest functions of our parametrisation software setIT (V5.4.3) can be found here in the overview:

New functions

- An IEC 61850 server is available (series5e)
- If it is not possible to create a memory stick for configuration of a station in a virtual environment, the data can be stored on the file system of the virtual machine
- The current field strength can be parametrised as a system measured value (FW-5-GATE-4G)
- The currently active grid (2G/3G/4G) can be reported via system messages (FW-5-GATE-4G)

Extension & simplification of existing functions

- Automatic measurement value transmissions can be enforced by a digital event (e.g. short circuit, switch case...)
- Simplification of the definition of system messages/commands using the "Select/Deselect All Necessary" wizard
- Special events, such as a burglary, can be sent as a syslog message and thus trigger an automatic reaction of downstream systems
- Second IP address for communication with third-party IEC stations with redundant connection
- For cyclic measurement value transmission, you can choose between two transmission cycles

Security

- The default settings of new stations now default to the secure protocols FTPs/HTTPs
- User management with individual role based access control (RBAC)
- Access to service functions in the station can be temporarily activated via a system command from the control centre
- The station configuration can be encrypted using a project-specific system password.
- VPN encryption over IPsec with IKEv2 (based on strongSwan)
- The new database format .sdbx allows the entire project database to be encrypted
- Simple definition of advanced firewall rules: Services are granular and can be limited to various network interfaces
- Number of possible process points for FW-5000, FW-50 and BCU-50 increased to 20,000 (series5e)

Test & diagnosis

- Simulation of process values parallel to the current operation to test a created configuration
- The expected lifetime of a parametrised SD card can be monitored and displayed in the online diagnostics (series5e)
Around 5% of the electricity demand in the district will be generated in the future by the civil energy project. Together with Bürgerwindpark Hohenlohe GmbH, Netze BW GmbH planned the electrical connection BWP Weißbach. By June 2016, five Vestas V126-3.3 wind turbines, each with a hub height of 137 m, a rotor diameter of 126 m and a rated output of 3,300 kW each, were able to commence operations. 240 citizens annually produce 34 million kWh of environmentally friendly wind power, enough for 9,500 households. Thus, BWP Weißbach is significantly advancing the energy transition in the Hohenlohe district.

Technical specifications

The power grid substation is, in compliance with all technical guidelines of Netze BW, equipped with the latest FW-50 telecontrol technology from SAE. This also includes the remote control by the system operator, in particular the set point specification of the reactive power and the control of the circuit breaker in critical network conditions. In addition, the FW-50 communicates with the VESTAS park controller via the IEC 60870-5-104 protocol in order to provide the system operator Netze BW with data necessary for operational management, such as active power, reactive power, air temperature, wind force, wind direction, etc. Specifically, the regulation or limitation of active power at the grid connection point and the regulation of voltage or reactive power at the grid connection point are thus fulfilled.

Protective devices and IT security

In addition, there is a Siemens protective device in the power grid substation, which automatically switches off the faulty network or the entire substation in the event of a malfunction. All relevant information is sent to the FW-50 directly from the protective device. For reasons of IT security, communication from the telecontrol system to the Netze BW control system takes place via a protocol converter, which is linked to the prescribed IEC 60870-5-101 protocol via an RS-422 interface. SAE IT-systems created the configuration of this project in just a few steps with their powerful and very easy-to-use setIT parametrisation software. Thanks to successful cooperation with the company 3E-Technik, the wind farm was able to go into operation within a very short time.

SAE delivered, on time, a comparatively cost-effective complete solution for the BWP Weißbach renewable energy generation plant for its remote control, based on the technical requirements profile of Netze BW.