



direct process

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POWER

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TELECONTROLLER FOR VIRTUAL POWER PLANTS / Page 04

**GUARANTEEING PROCESS RELIABILITY -
INCREASING ENERGY EFFICIENCY / Page 26**

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EDITORIAL

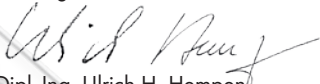
Dear Readers,

In coming years, we will experience a radical change in power supply from the previous energy sources oil, coal, gas, and uranium to renewable energies. This development will change our power supply considerably. The power supplier previously oriented towards consumers is turning into a network oriented towards generators since the regenerative energy sources are only available discontinuously. In the future, various types of energy storage will compensate for generation pauses as they occur. The network supplier regulates the interconnection of the many generators and storage capacities and directs these toward necessary consumption. For better handling, many smaller power generators in relation to overall current consumption will be bundled into virtual power plants. The network operator relies on the communication of all components participating in the network. The intelligent power network "smart grid" arises this way.

Power supply requires reliable connection technology. In power technology, the European association of large-scale power plant operators (VGB) recommends the use of spring-clamp terminals and the avoidance of screw-clamp terminals. For this, WAGO offers a seamless product portfolio from 0.08 to 95mm², and it has therefore established itself in many power technology applications.

The present WAGODirect process focuses on the topic of power supply and shows you current applications and product solutions from our areas of connection technology and automation.

Best regards,



Dipl.-Ing. Ulrich H. Hempen

Head of
Energy & Process Automation

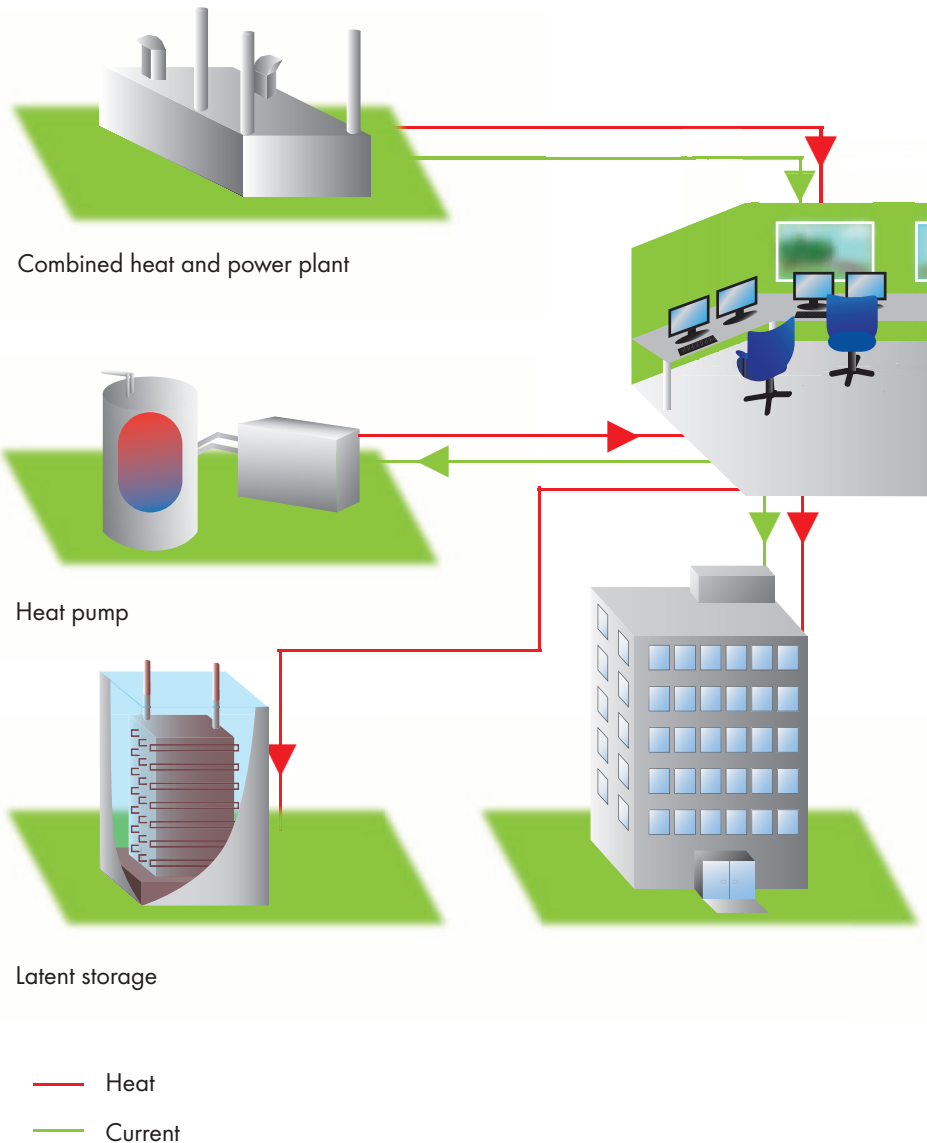


TELECONTROLLER FOR VIRTU

■ Intelligent controllers for local power generators on a smart grid are a central topic of the Transferstelle Bingen (TSB). A current project of the TSB – an institute at the Bingen Technical College – is the control of a virtual power plant. The TSB had been seeking a suitable telecontroller for this.

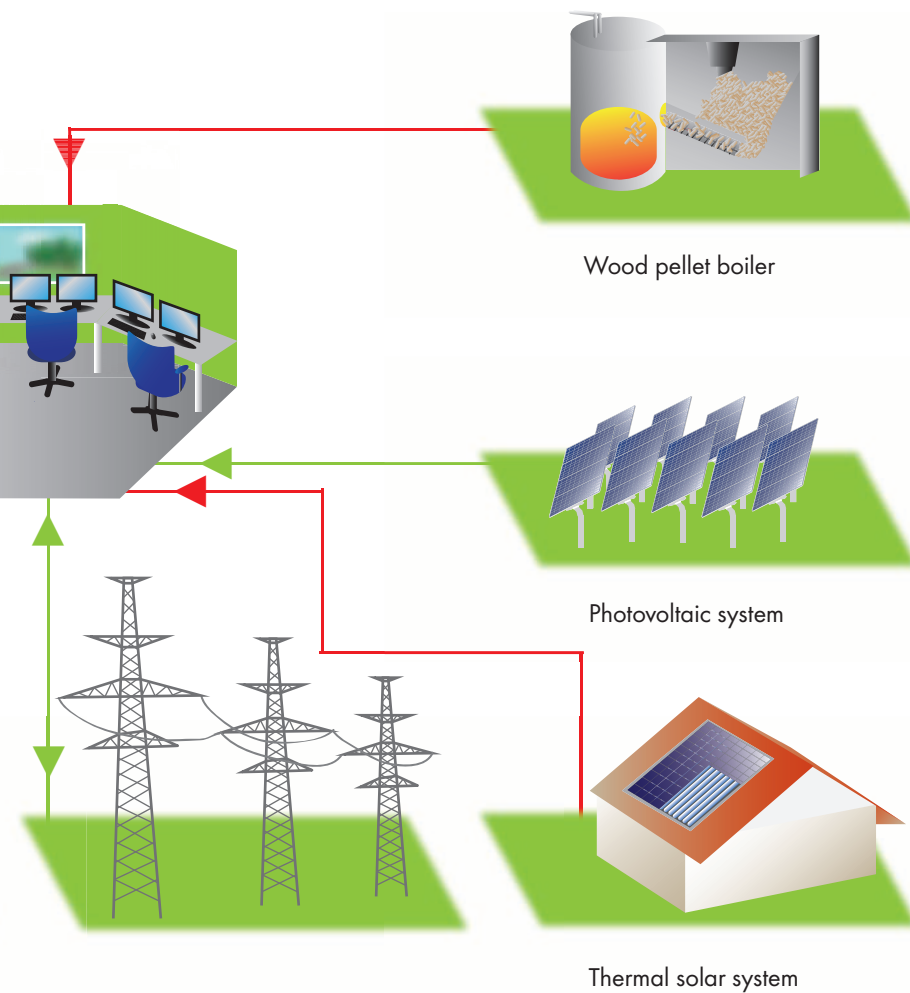
On behalf of the state of Rhineland Palatinate, the TSB established the competence center Smart Grids / Virtual Power Plants and took over network support for it. The focus of this center is on practical technology developments, among other things in the areas of smart grids, virtual power plants, control power, energy storage, and the control of power demand and supply.

■ Distributed power generators in a virtual power plant
Since Fall 2010, two virtual power plants of the TSB have been active on the network. Both together are currently bundling approximately 100 local power generators, such as combined heat and power plants, emergency power units, and gas turbines into a power plant with a total output of more than 20 Megawatts apiece. The energy produced by this system is trad-



Many micro power plants are combined to form a virtual power plant; on the one hand in order to make regulation power available internally and on the other hand in order to trade on the electricity stock exchange.

AL POWER PLANTS



Schematic drawing of a virtual power plant

ed by an electricity trader on the electricity stock exchange as regulating energy to compensate for energy fluctuations or forecast deviations. The technical challenge for the TSB was to unite decentralized control and monitoring units in a large power plant. As a result, these plants can now be continuously monitored from one central point, failures can be managed, signals are bundled and systems switched on and off.

Since the beginning of the project seven years ago, the Transferstelle Bingen has gained a lot of experience in how smart grids are monitored and controlled. Here, TSB's attention was drawn to WAGO as a supplier of automation technology and modular fieldbus systems. From this has come a constant cooperation, among other things with the use of the WAGO 750-872 Telecontroller.

■ Telecontrol technology for virtual power plant

After the auction process on the electricity stock exchange, the output of the virtual power plant must be set to "provision." Subsequently, the call-up by a transmission network operator such as Amprion takes place with the specification of the quantity to be delivered. With the TSB's control technology, the connected distributed systems are then started up. During the start-up process, the output is monitored, totals are formed from the measurement values, and transmitted to the control center in minutes. The specification says that the virtual power plant must achieve its maximum output at the latest within 15 minutes. WAGO's telecontroller ensures the reliable transmission of the measurement values to the transmission system operator.

For the selection of the best-suited telecontrol technology, the TSP defined and checked several criteria in advance. Both the transmission system operator's technical criteria and the smart grid requirements of the virtual power plant had to be fulfilled. Decisive was initially the IEC protocol format for the connection to the transmission system operators' control centers. Within the TSB network, TCP/IP transmission (MODUS) was specified. In the telecontroller, the data was supposed to be transformed from IP format into the IEC telecontrol protocol. Another task was the reporting of faults using digital output modules and the visualization of these via a Web interface of the controller. The technology also had to be demonstrably safe and reliable, and at the same time it had to satisfy the cost frameworks

of small, local systems. The WAGO technology was extremely well-suited for these requirements.

■ Telecontrol and automation in smart grids

"We selected the WAGO telecontroller because it masters the IEC communication and is ideally suited as an element for the automation of infrastructure networks. Furthermore, it had the best price-performance ratio," explains the project director for virtual power plants at the TSB, Tobias Lanshausen. In his experience, for the requirements of smart grids an innovative telecontrol technology is an advantage. The WAGO controller masters the telecontrol protocols IEC 60870-5-101 (serial), IEC 60870-5-104 (TCP/IP-based), and IEC 61850 for safety and control technology in medium and high-voltage electrical switching systems, for example for wind power systems (IEC 61400) and for distributed power generation (IEC 61850-7-420). The WAGO telecontroller is a component of the modular, fieldbus-independent I/O system for the incorporation of sensor and actuator signals. The system has been used successfully in automation technology for many years. Here, the field measurement values are recorded via connected I/O modules. Due to the many and various industrial requirements, there are more than 400 different I/O modules available. Direct contacting is also advantageous, so that the space for an additional terminal strip can be saved. Via the I/O modules, additional functions can be integrated, such as the control of building technology.



- IEC protocol 60870/61850/61400
- Large selection of I/O modules
- System can be used universally
- Good price/performance ratio

From the point of view of the TSB, the modular nature of the system is crucial for its flexible use in a smart grid. Since, as in a toolbox system, there is a module for each signal, everything can be connected to the controller and called up using just one dataset.



■ Technology must be reliable and flexible

“As a relatively small institute, we usually have a hard time with the large manufacturers putting across our special requirements. So we were surprised by WAGO’s support. Our ideas and smart grid experiences were taken up immediately by product development and implemented,” reports Christian Pohl, CEO of the Transferstelle Bingen. The very good support helped us to solve all existing problems quickly and efficiently.

According to the TSB, the telecontroller has proven itself well in practice. “The flexibility that comes from automation technology is a big advantage for us. The system has an easy-to-trace “red thread” and all tasks can be performed well,” says project director Langshausen. He confirms that the telecontroller works absolutely reliably and its handling is clear and logical. The requirements of the transmission system operators are also fulfilled without a problem.

From the point of view of TSB, the modular nature of the system is crucial for its flexible use. Since, as in a toolbox system, there is a module for each signal, everything can be connected to the controller and called up using just one dataset. Additional separate components are not required. In the project director’s experience, the parameterization and visualization with CoDeSys (Code Development System from 3S-Software) is also easy and traceable. The integrated sample projects are very helpful for the implementation.

Text: Volker Allgeier, WAGO
Photo: Martin Ortgies, WAGO

ENERGY STORING DEVICES

An overview

■ Regenerative energy sources are only available discontinuously. The future power network will require energy storage, which as a buffer can make the power available constantly between generators and consumers.

The following storage types are suitable for energy storage of outputs over 100 kW:

- Mechanical: Pump storage, compressed air storage, flywheels
- Chemical: Hydrogen, hydrogen/methane
- Electrochemical: Redox Flow, accumulators
- Electrical: Supraconductive magnetic coils

■ Pump storage

The oldest method for storing electrical energy is the mechanical one, for example with pump power stations. In times of electricity oversupply, they pump water into basins at a higher elevation. In times of electricity scarcity, the running water generates current using generators. This principle achieves efficiency of 75 to 85%.

■ Compressed air reservoir

Electric compressors convey air into closed containers. These containers can be large tanks but also underground chambers. In case of a foreseeable power deficit on the network, the air from the containers or underground chambers is directed in controlled fashion onto turbines with generators. The efficiency of this process is only 45 - 55%.

■ Energy bags

Energy bags are based on the principle of the compressed air accumulator. This method, which is still under development, stores air in large bladders (energy bags) under water and uses the natural water pressure for the compression. The position of the energy bags is at a precisely-calculated depth so that the water pressure corresponds to the accumulator pressure. Applications at 500 m depth, for example, correspond to a pressure of 50 bar. Previous systems

run very successfully and achieve an efficiency of more than 90%. Acquisition and operating costs are up to 80% lower as compared to compressed air accumulators. Energy bags are especially suitable in combination with offshore wind power systems.

■ Flywheel storage

Flywheel storage is based on the principle of mass inertia. An electric motor accelerates a flywheel to 20-50,000 revolutions per minute. In order to prevent friction losses, the flywheel is in a vacuum and it has a magnetic bearing. When energy is required, the flywheel drives a generator. A first large-scale system is in New York, with a storage capability of 20 MW.

■ Hydrogen accumulator

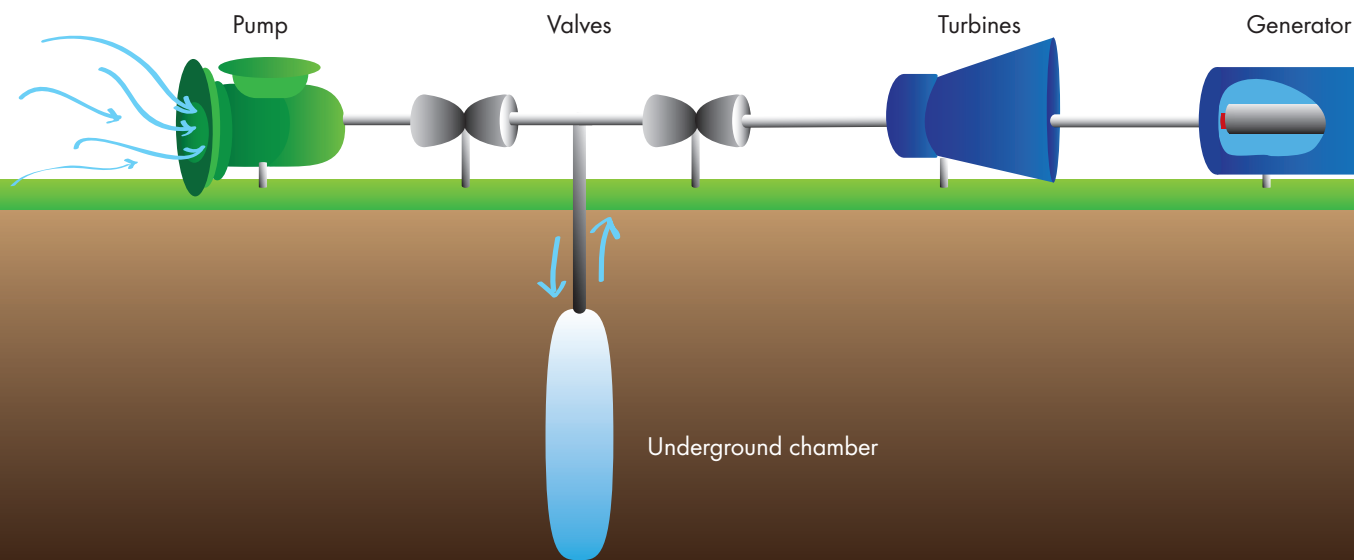
With the hydrogen accumulator, hydrogen is split from water using electrolysis and stored. In return, the gas is transformed into heat energy by burning or used to drive a generator. The efficiency is 50 to 60%. The time-consuming storage of the hydrogen is detrimental.

Hydrogen/methane accumulator

As with the hydrogen accumulator, water is split into hydrogen and oxygen using electrolysis. Then, CO_2 is added to the hydrogen, so that CH_4 , that is, methane, arises. The big advantage is that methane as a combustion gas corresponds to the usual natural gas and can thus be added to current gas-driven autos and gas systems. The gas network could be used as an extended accumulator. The efficiency is reduced by approximately 10% by the downstream methanization, so that the overall efficiency is only 40-50%.

■ Redox Flow battery

With the Redox Flow battery, two electrolytes from separate containers are pumped through a cell. Via the membrane, only an ion exchange is possible between the electrolytes; it causes a positive and a negative charge state of the cells. The decrease of the energy takes place using electrodes in the cells. The efficiency for such a Redox Flow battery is greater than 75%, it is already being used



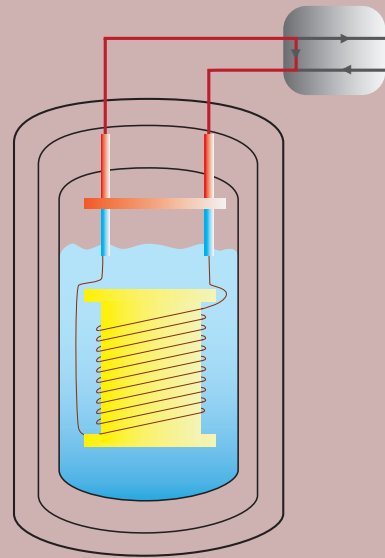
in a large Japanese wind power project. With a wind failure, the Redox Flow battery makes output of 6 MW available for 10 hours.

■ Accumulators

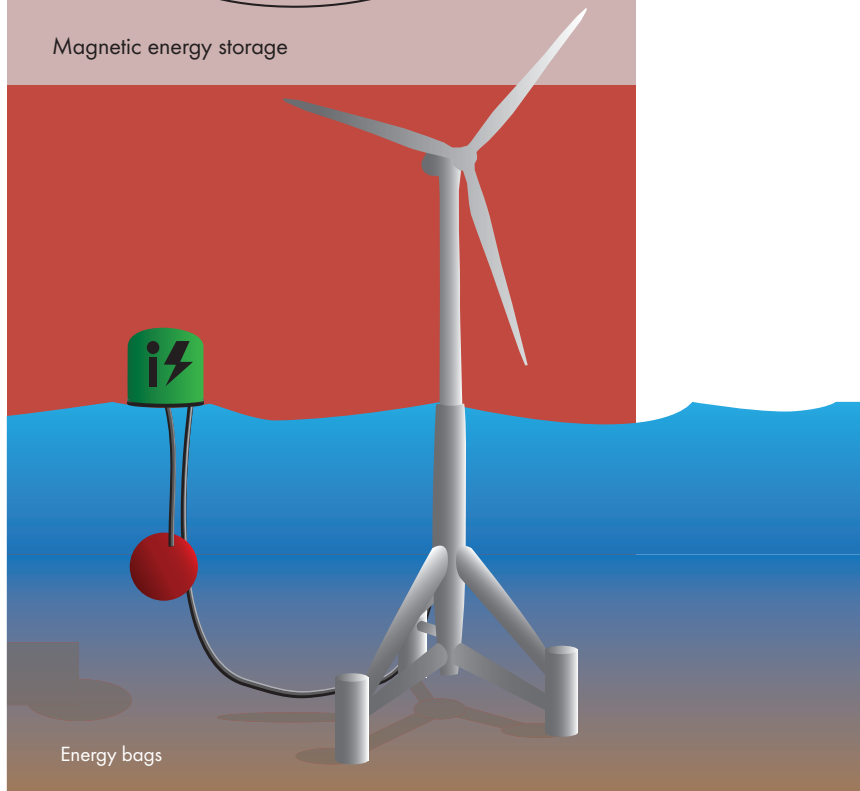
Accumulators are electrically-rechargeable batteries. However, the classic lead-gel based rechargeable batteries are currently not being considered for large energy storage systems. Researchers are working on lithium accumulators since lithium has a high energy density. The structure corresponds to that of a typical rechargeable battery with electrolyte liquid. The overall efficiency is 90%, however with declining effect over 1000 charges. Thus far, the developments have been limited to the consumer market. The lithium extraction from lithium carbonate and other lithium bonds is very complex and has arrested development progress thus far.

■ Supraconducting magnetic energy storage

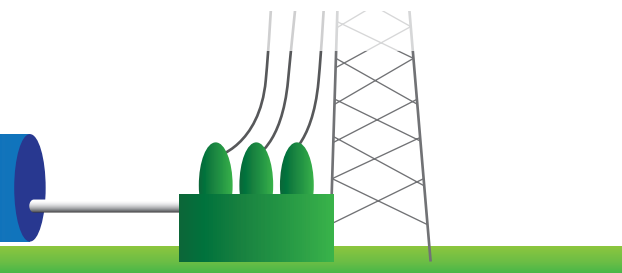
If a metal is cooled below its transition temperature, its electrical resistance drops to zero and conducts electricity without losses. This effect uses the supraconducting magnetic coil in that it is cooled to $-269\text{ }^{\circ}\text{C}$. After that, the energy fed in is retained in the coil. Later on, the current can be removed from the current again. The first systems have a storage capacity of 80 W. A big advantage is the short charging and discharging process, which take only seconds. However, the energy expenditure for the cooling with helium is very high.



Magnetic energy storage



Energy bags



Compressed air reservoir

■ Conclusion

Energy storage is absolutely necessary for a power network that relies on renewable energies. The coming years will show which process will prevail. The storage types presented are in various stages of development. The hydrogen/methane method for on-shore and the energy bag method for offshore have already found great acceptance in industrial use.

Text: Ulrich H. Hempfen, WAGO
Photo: WAGO

COMPACT TELECONTROL TECH



■ At the latest with the introduction of new control systems, the IEC protocol will be introduced at supply companies. When telecontrol stations are renovated, WAGO's technology comes into play. In addition to the IEC communication, it provides a decisive advantage: it is much more compact than usual systems.

The Völklingen Netz GmbH public utility company uses classic telecontrol stations in electricity, gas, and water supply. State messages are transmitted, outputs switched, and measurement and counter values are transmitted to the control system. In the electricity sector, most telecontrol modules still work with the SEAB-1F telegram or other proprietary protocols that are not recognized internationally. After 15 to 20 years of use, they are replaced by the public utility company piece by piece because they no longer work so reliably after this time. For the new technology, the WAGO 750-872 Telecontroller was selected because it fulfills two important requirements: it masters the standardized IEC telecontrol protocol and requires only a little space.



NOLOGY PER IEC STANDARD

■ When space is limited

The new telecontrol technology for serial communication with the control system is based on the standardized IEC telegram structure 60870-5-101. The limited space in most substations played a decisive role in the selection of a suitable supplier. Usual telecontrol technology is too large due to its block construction. Therefore, WAGO was able to persuade with another concept.

The WAGO telecontroller is a component of the modular, field-bus-independent I/O system for the incorporation of sensor and actuator signals. The system has been used very successfully for many years in automation technology. Due to the many and various industrial requirements, there are more than 400 different I/O modules available for the various analog and digital inputs and outputs. The modules are just 12 mm wide and can be added as needed. Thus a complete telecontroller with four modules requires only a space of 111 mm, while traditional manufacturers only offer modules with 16 or 32 I/O inputs/outputs. This is also clear from the difference in the prices. Another advantage is the direct

contacting, so that the space for an additional terminal strip can be saved.

■ Space for power supply requirements

The WAGO telecontroller masters the IEC protocol according to standard. It was initially set up for the first use by the public utility company for point-to-point connections between the control center and a substation. However, the public utility company also needed technology for a network topology with a linear structure. "WAGO adjusted itself to our need and worked with us to find an extended solution together," reports Thomas Klein, authorized officer and department manager for network operation at the Völklingen Netz GmbH public utility company.

When it comes to the cooperation with WAGO, he especially cherishes the quick reaction to requirements and their consistent implementation, although his company is not among the large public utilities. Everything went perfectly. Thomas Klein: "I have never known a well-known manufacturer to be so flexible."



■ Flexible for new requirements

In practice, the public utility company has learned to cherish the flexibility of the WAGO technology. The fieldbus, input and output modules and the programming language can be selected at will. The large selection of I/O bus modules ranges from highly-compact 16-channel digital modules to specialty modules, such as 3-phase power measurement modules for monitoring transformer stations. WAGO can also supply the connection technology, relays, power supply units, etc. And communication via GPRS can be integrated as well.

"We currently have 11 of these systems in operation and we are extremely enthusiastic about them. We only have to connect the modules that we currently need and we can expand these as necessary. For programming, we use the CoDeSys development environment (Code Development System from 3S-Software) with its ready-to-use program function blocks. This works well and fulfills all professional requirements," the director of the network operation division gives good grades for the practical use. From his point of view, it is advantageous for power plant operation that the technology has already proven itself to be flawless, reliable and robust in automation, and that it can be used even under harsh environmental conditions. In addition, the certified Spring Pressure Connection Technology makes the use of telecontrol technology more flexible.

■ Outlook

The telecontrol technology is being replaced step by step with the WAGO technology. 5 to 10 telecontrol stations should be renovated each year. Work is ongoing on an expansion to include GPRS radio transmission.

Text: Volker Allgeier, WAGO

Photo: Martin Ortgies, Völklingen Netz GmbH, WAGO





■ Völklingen public utility company

With 200 employees, the Völklingen public utility company secures power and water supply in the region. The company has also developed from a classic transit and supply company into a holding company with 12 companies, which is also active in additional energy-related fields of business. These include, among others, renovation of the city center; the financing, planning, and construction of heat and cooling generation systems; and mass transit.

The technical and economical operation of power and water supply systems lies in the hands of the Völklingen Netz GmbH company. This includes the planning, construction, operation, maintenance, and service of supply networks.

■ The technology of the WAGO telecontroller

The telecontroller implements telecontrol data according to the IEC telecontrol protocols. The telecontrol solution is scalable from 32-bit controller to industrial PC. The field measurement values are incorporated via connected I/O modules. There are solutions for gas supply and distribution with Ex-i-compliant components (Ex-protected). The time synchronization takes place for IEC, SNTP, NTP, DCF77 or GPS. A wireless communication via GPRS is optional. The data exchange with other configuration tools takes place via the import and export of CSV files. In addition, an incorporation of elements from building technology is also possible. Classic telecontrol and automation applications are implemented with a single system.

■ IEC protocols

The telecontroller supports the telecontrol protocols IEC 60870-5-101 for serial transmission or according to IEC 60870-5-104 for the TCP/IP-based communication. Within these signal-oriented protocols, messages, measurement values, bit patterns, counter values, and (set) commands are exchanged, each with and without time stamp.

Furthermore, the IEC 61850 standard is covered, which describes the safety and control technology in medium and high-voltage electric switching systems. This includes, among other things, monitoring and control applications for wind power and hydropower systems or distributed power generation systems (e.g., combined heat and power plants or PV systems).

- Classic telecontrol and automation application with a single system
- WAGO-I/O-SYSTEM is more compact than usual systems
- Extendable in a flexible way

AUTOMATING INFRASTRUCTURE WITH “STANDARD” CONTROLLERS

■ For optimal load management, classic components such as counters and power switches are used on supply networks in order to complement additional power and voltage monitoring. This, in turn, increases the number of data points required. Meanwhile, programmable controllers are taking on telecontrol tasks in addition to automation tasks and communicating with the control center via international telecontrol protocols according to IEC 60870 and IEC 61850. These modular “standard” controllers with IEC communication have a good price-performance ratio and simplify the automation of infrastructure networks.

STRUCTURE NETWORKS CONTROLLERS



The reasons for implementing new components on supply networks are many and various. On the one hand, the regulating authorities require the separation of power generation and network operation. On the other hand, distributed power supplies from wind power and photovoltaic systems, combined heat and power plants, and power-heat couplings create new requirements with respect to network operation, billing, and load management. Previously, programmable logic controllers (PLC) automated only the distributed units; now, however, they should also transmit the system state to the control system and implement switching commands in the control direction. Communication protocols such as MODBUS and DNP3, as well as IEC 6087- and IEC 61850 with their subnorms are available for these telecontrol tasks. These protocols distinguish themselves both technically as well as in their global spread. For safety and control technology in medium and high-voltage electrical switching systems, the IEC 61850 standard was published in 2004 as a global standard. With this communication, the functional units are modeled using an object-oriented approach; this is in contrast to the other communication protocols that work in signal-oriented fashion. The consequence of this is that specific extensions must be created for new task areas. Three such expansions for monitoring and control are currently defined: IEC 61400-25 for wind power systems, IEC 61850-7-410 for water power systems, and IEC 61850-7-420 for distributed energy resources, such as those that arise with photovoltaic systems.

■ “Standard” controllers with IEC communication

In order to offer the user a standardized and easy-to-use interface for communication with the control center, WAGO integrated the IEC 60870-5-101/-104 telecontrol protocols and IEC 61850 into modular controllers of the WAGO-IO-SYSTEM. These protocols are signal-oriented in the case of IEC 60870-5-101/104, which means that: messages, measurement values, bit patterns, counter values, and (set) commands are exchanged between control system and modular controller, each with and without time stamp. If you transfer this approach to IEC 61830, then it would correspond to the generic object type GGIO as a basic object. However, an essential added value of this standard is the presence of standardized objects, for example, if a network transformer, a rotor of a wind power system or a photovoltaic system should be automated. If one examines all expansions of the IEC 61850 standard, then approximately 220 additional specific object types are added to the generic object type GGIO. Since the manufacturer of controllers does not know which IEC object types the user will use, the automation solution must be able to operate all specific objects, for example an YPTR object for the integration of transformers. The WAGO solution provides the user with the standardized interface to the control system, however not the internal logic of the object types. In the end it is the user who has the expertise about his application and who implements the logic. The programming of the automation task is done with CoDeSys (Code Development System), developed by 3S-Smart Software Solutions, and it is stored in the programmable telecontroller or on the compact industrial PC (I/O-IPC). CoDeSys is an open programming system according to the international standard IEC 61131-3 and it makes 5 programming languages available to the user.

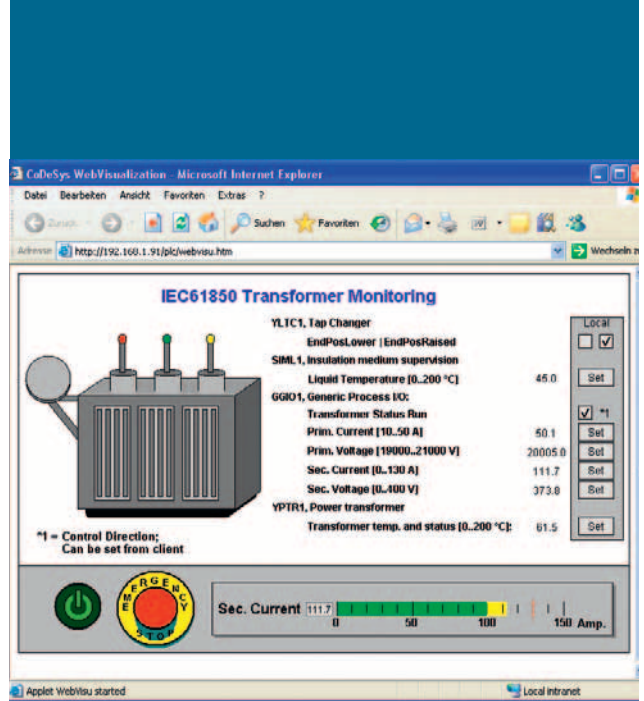


So that the user can prepare the telecontroller (750-872) and the I/O-IPCs (758-870 and 758-875) as easily as possible for the communication with a control system, a configuration tool for both standards (IEC 60870 and 61850) is integrated into CoDeSys. With this tool, the IEC communication is only parameterized – it no longer has to be programmed.

■ Scalable controllers for demanding environments

Regardless of their specific use, modular controllers bring numerous system properties that also offer advantages in smart grid projects. Initially, the user selects the controller according to his output requirements and communication interfaces. Here, the capacity of the CPU of a few MHz for monitoring tasks up to the Pentium class in the GHz range can suffice for complex control tasks.

For communication, there are interfaces for PROFIBUS, MODBUS, and KNX, so that the controllers can also be used as gateways between telecontrol technology and industry or building automation. Depending on the place where they are used, the mechanical and climatic requirements of the system must be regarded as well. Spring Pressure Termination Technology offers vibration-proof connections, which are used in wind power systems and rail vehicles, for example. WAGO uses Spring Pressure Connection Technology in all of its products, and thus also in the WAGO-I/O-SYSTEM with its various programmable controllers, couplers, and input and output modules. Many of these components are also available for an extended temperature range from -20 to +60 °C. In this design, the circuit board interface of the electronics is varnished, which means that it is suitable for use in outdoor cabinets, for example for the monitoring of wells, in charging stations for electric vehicles or near the coast where the air is salty. Numerous ship certifications such as Germanischer Lloyd (GL) are also a guarantee of suitability in ships and in onshore and offshore areas. Another strength of these modular controllers is the large selection of I/O bus modules. It ranges from highly-compact,



16-channel digital modules that save space in the switch cabinet to specialty modules, such as 3-phase output measurement modules to the power monitoring of transformer stations on through to intrinsically safe modules like the ones used in gas distribution stations. With this bandwidth of components, most automation tasks can be performed with a single controller. Thanks to the programmability of the automation system, visualizations can also be created with CoDeSys, which are loaded directly into the Web server of the controller. This way, the end customer has a comfortable diagnostic platform for his solution, which he can access with any browser. As an all-in-one solution, the modular controllers with IEC communication reduce the space requirements and the complexity in the switch cabinet and they thus also reduce the costs of the automation solution.

■ Conclusion

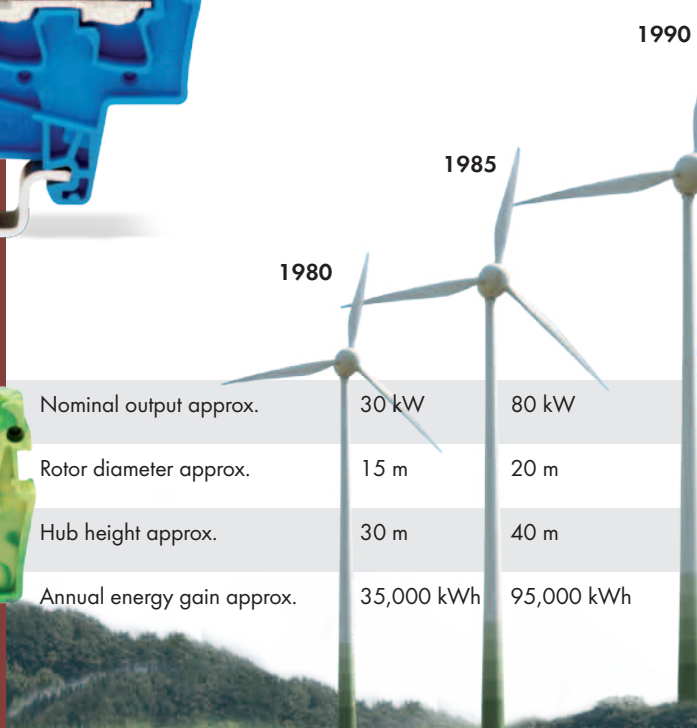
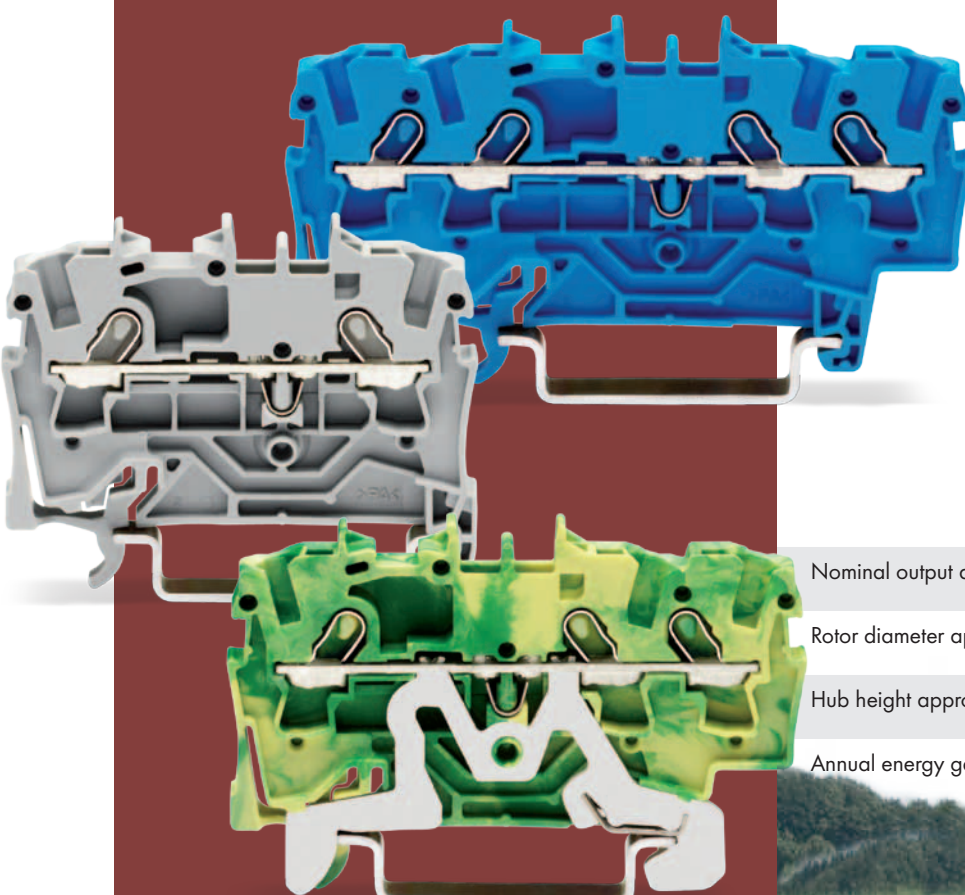
The telecontroller and the I/O-IPCs support, in addition to classic automation tasks, also the internationally-standardized telecontrol protocols according to IEC 60870-5-101/-104 and IEC 61850. Thanks to the CoDeSys configuration tool, the application engineer can concentrate completely on the development of his automation solution in a familiar PLC development environment. The connection to smart grids is already integrated with the telecontrol protocols. Since a single system takes over the automation of a telecontrol station, the need for space is reduced, as are the complexity and the costs per station.

Text: Martin Paulick, WAGO
Photo: WAGO

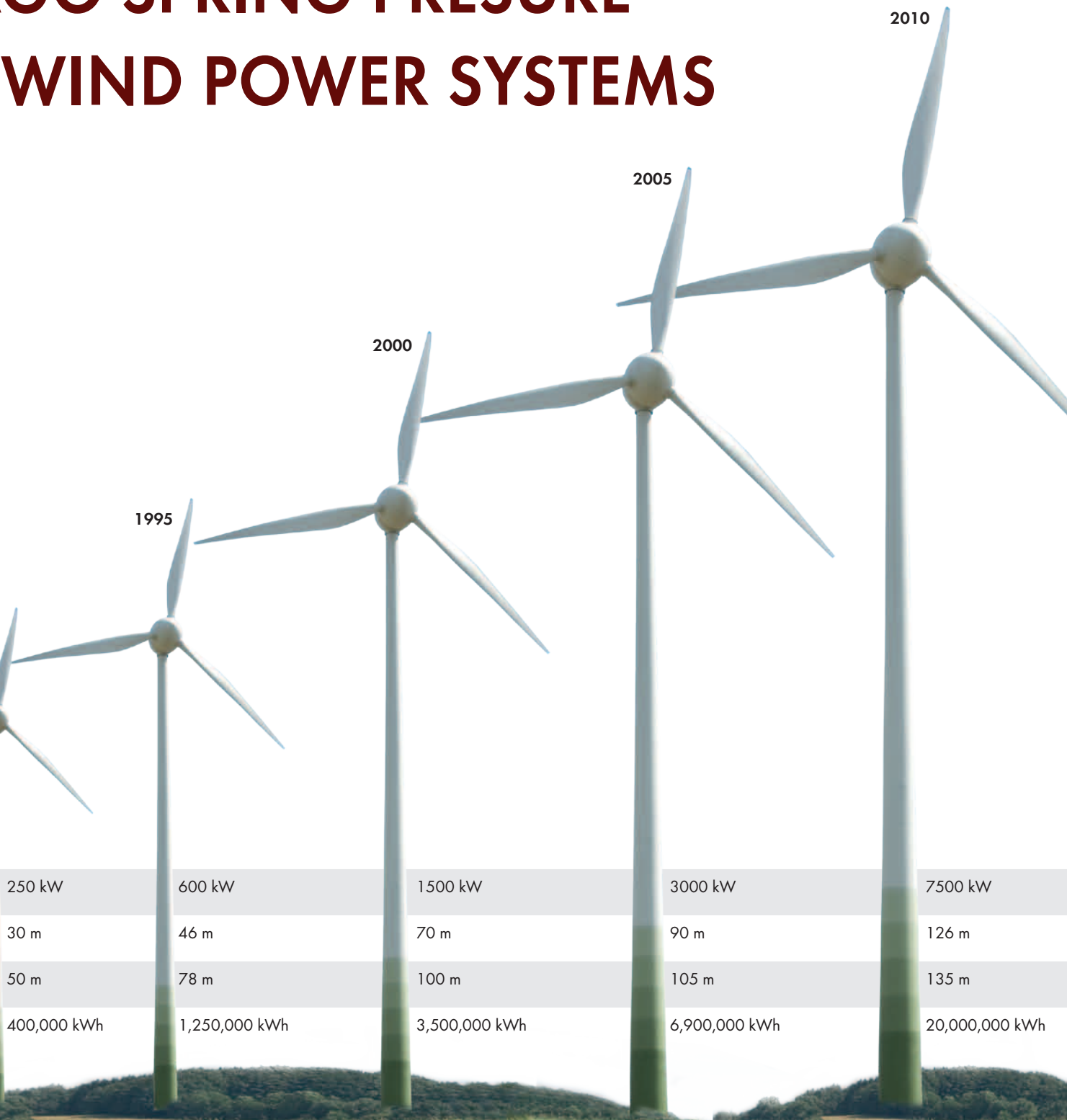


SURELY MAINTENANCE-FREE: WA CONNECTION TECHNOLOGY IN

■ The development of the effective implementation of wind power into electric power began at the beginning of the 1980s, born from the search for alternative energy sources. At the beginning of the 1990s, the expansion of wind power increased dramatically. At that time, a typical wind power system was 750 kW and it stood 50 m tall. Meanwhile, systems with 8 MW, a hub height of 180 m and rotor diameters of more than 120 m have been developed. Hardly any other branch of industry has developed so rapidly in 20 years and can demonstrate this as publicly as wind power



GO SPRING PRESURE WIND POWER SYSTEMS



2010

2005

2000

1995

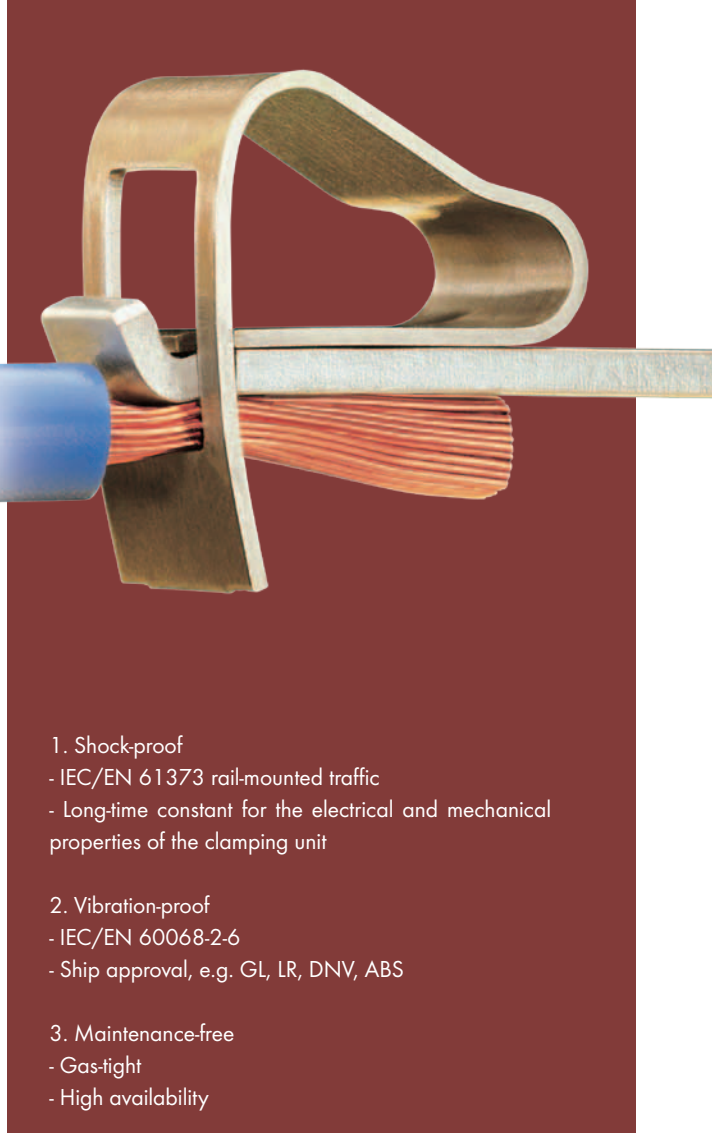
■ Increasing service costs

Since the access to the system is becoming ever more troublesome due to the constant growth, service deployments are very cost-intensive. They must be planned precisely with an exact maintenance plan for the individual components. In offshore systems, these costs increase still more since the weather window during which they can be driven or flown over cannot always be planned. The problem of vibrations in the entire system also develops proportional to the growth of wind power systems. This especially affects mechanical components such as the hub, rotor bearing, and transmission.

■ Safe electrical interconnections

The use of a safe and maintenance-free connection technology for all types of electrical connections in the entire system is an essential protection of investment for the operation across the entire life span of more than 20 years. Naturally this is not a given with screw-clamp terminals, since copper is an element that flows over days and months and it gives under the pressure of a screw connection. The copper "flows" in the hollow places of the screw terminal, which in turn reduces the pressure of the screw on the conductor. The connection becomes loose and the contact resistance increases. For this reason, screw terminals are a frequent cause of fire dangers, so that they have to be maintained cyclically.

The safety gain with a WAGO spring-clamp terminal is therefore enormous, precisely in these demanding environments. The spring-clamp terminal has a completely safe and maintenance-free connection for electrical conductors that has been proven across decades. For this reason, the association of large-scale power plant operators in Europe (VGG) clearly writes in its guidelines for electrical connectors that screw clamps should be avoided and spring clamps used.



1. Shock-proof

- IEC/EN 61373 rail-mounted traffic
- Long-time constant for the electrical and mechanical properties of the clamping unit

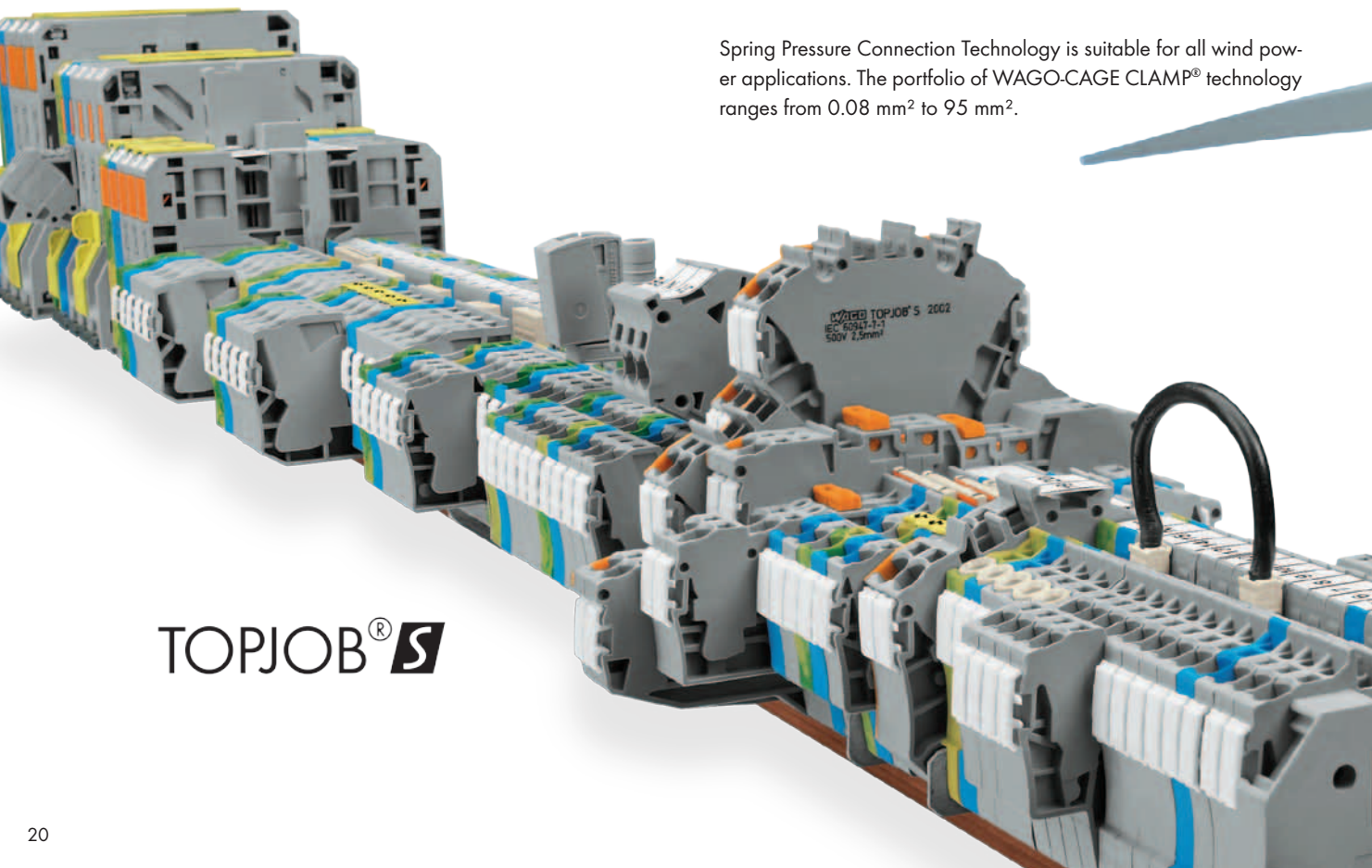
2. Vibration-proof

- IEC/EN 60068-2-6
- Ship approval, e.g. GL, LR, DNV, ABS

3. Maintenance-free

- Gas-tight
- High availability

Spring Pressure Connection Technology is suitable for all wind power applications. The portfolio of WAGO-CAGE CLAMP® technology ranges from 0.08 mm² to 95 mm².

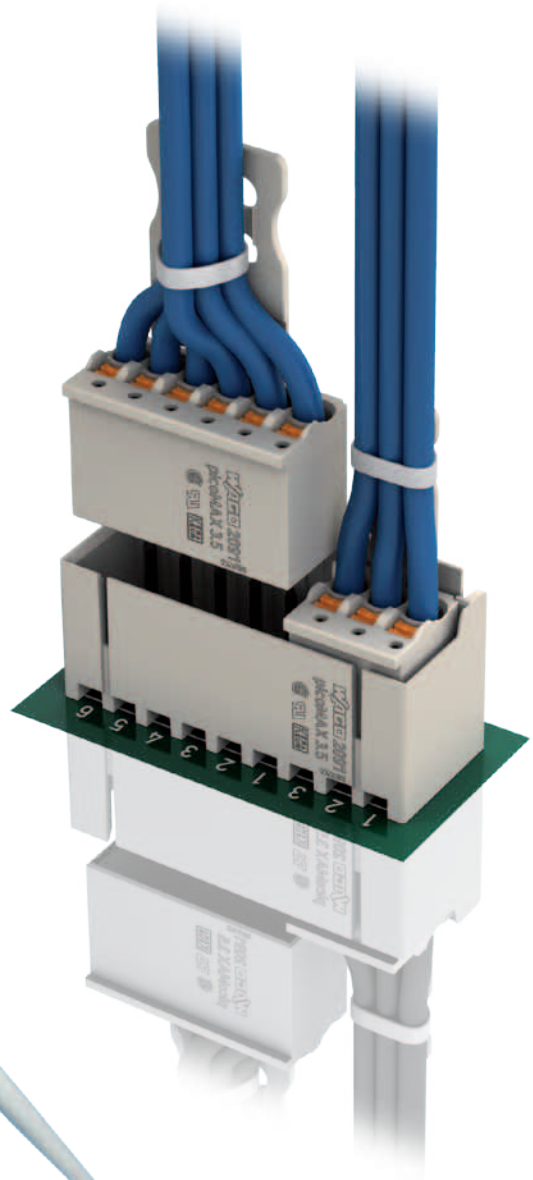
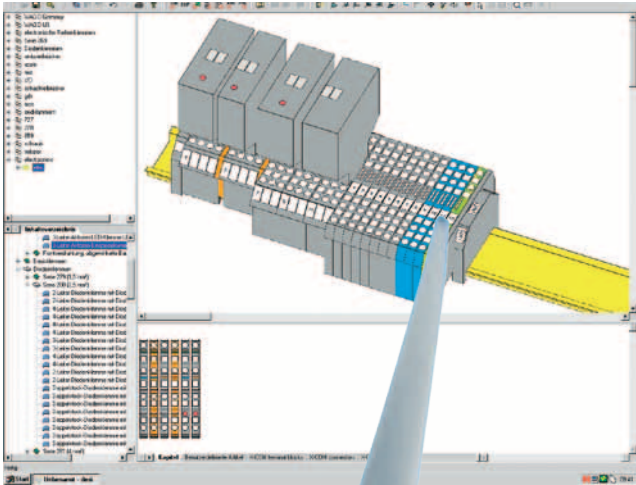


TOPJOB® S

WAGO supports the entire planning of rail-mounted terminal block assemblies with the freeware software "ProServe®." Using a library, the switching system planner can plan and label rail-mounted terminal block assemblies easily. An interface to CAD/CAD systems such as Comos, Eplan, and WS CAD makes additional planning even easier.

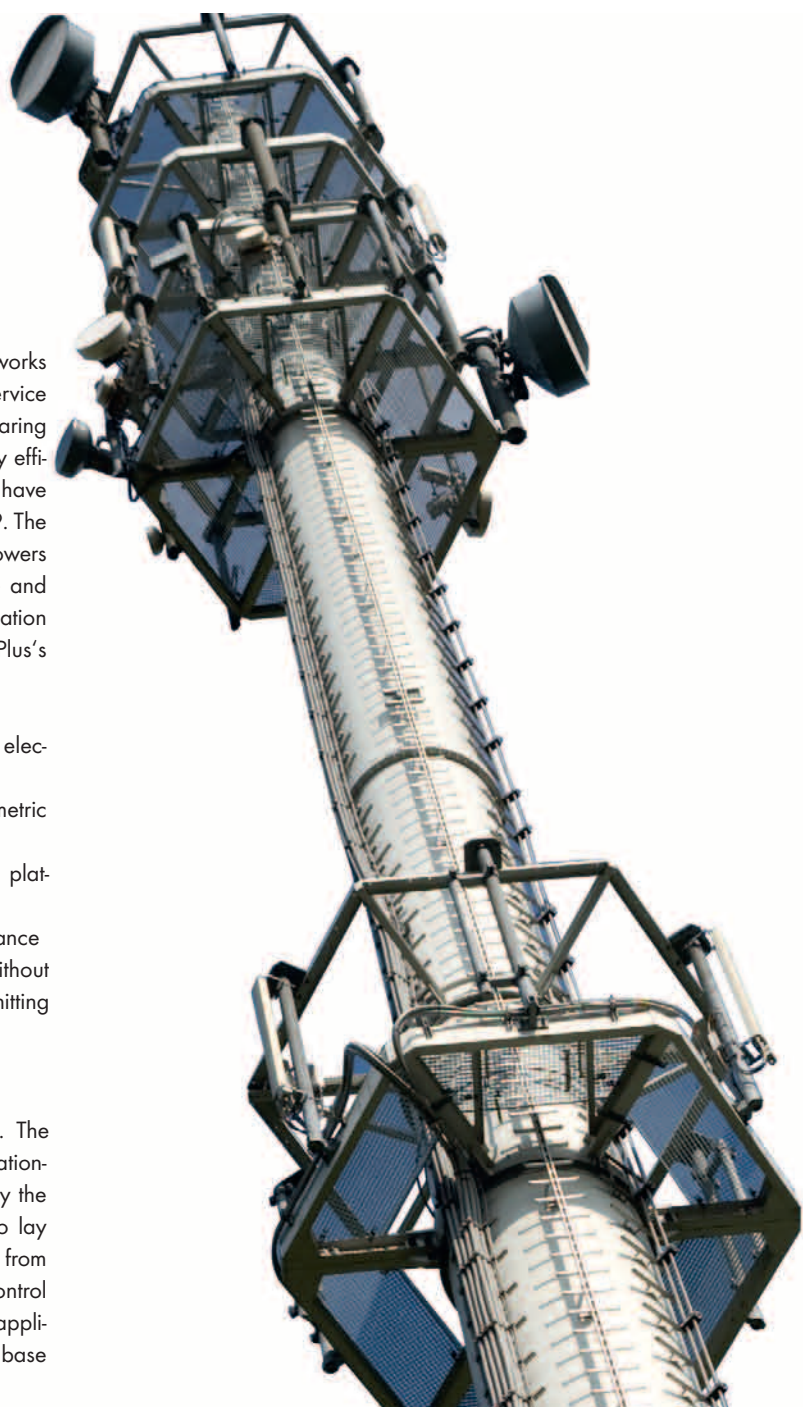
■ Spring clamps for sensors, actuators, and controllers

In addition to the switch cabinet with its rail-mounted terminal blocks and controllers in the gondola and in the foot of the tower, wind power systems have a multitude of additional electronic components that are placed outside of the switch cabinet. This affects all of the sensors and actuators, fire protection systems, weather stations, vibration monitoring, elevator controllers, etc. WAGO offers a broad spectrum of PCB terminal blocks for these components. There are still better prerequisites since WAGO has developed the new *picoMAX®* connection system.



picoMAX® is based on the CAGE CLAMP®S principle. It integrates all advantages in the smallest possible space: Contact security even in case of extreme vibrations, compact design with e.g. 17.7 mm height with 12.4 mm depth and easy handling without special tools. With the *picoMAX®* eCOM variant, the pin housing is omitted, which reduces the space requirement still more.

Text: Ulrich H. Hemen, WAGO
Photo: WAGO



■ Optimizing power consumption in radio communications networks
It therefore comes as no surprise that mobile communications service providers and metrology systems manufacturers alike are sparing no effort to create common requirements for enhancing energy efficiency in the mobile communications sector. E-Plus and WAGO have had such a pilot project underway since the beginning of 2009. The network operator equipped a limited number of transmission towers with telecontrol metering stations that were to be adaptable and upgradable with the highest degree of flexibility to the application at hand, owing to the pilot project character of the project. E-Plus's task was:

- to record power consumption and the relationship between electricity consumption and talk volume
- Transmission of data recorded decentrally via a PLC-based metric to a central Web server with database
- Availability of data from the various stations via one data platform, regardless of where the data originated from
- Identification of load peaks, optimization of system maintenance
- Elaboration of a quick and low-cost upgrading concept, without any major influence on ongoing operation of the transmitting towers

■ Implementation

E-Plus selects the WAGO TO-PASS® telecontrol technology. The required customizing, including development of the application-specific Web portal and MySQL database was carried out by the WAGO Solution Provider Arkadon. Project responsibility also lay with Arkadon, as did the hosting of the database. Components from the TO-PASS® Modular and WAGO's I/O-System 750 telecontrol system form the technical basis; these are combined with the application-specific WAGO TO-PASS® Dynamic Portal and a database by Arkadon.

One meter box containing pre-installed modules, transducers, controllers and VPN modem/routers, were delivered to Arkadon for each communications tower. In the second stage, the boxes were provided with the user-specific Arkadon software and a SIM card at Arkadon and a unique serial number was then applied to the outside of the box. This integrated the WAGO TO-PASS® components into an automated Arkadon rollout process, providing the user with the possibility of activating a pre-configured box at any location.

Data from the meters is collected by means of the measured data converters integrated into the module system, conditioned in the controller and transmitted every 10 minutes to the Web server via the GSM link where it is then available for evaluation (individually for each station) on a Web portal. Once a location has been selected, detailed current or voltage phases and active power can be visualized, evaluated against benchmarks and the insights gained from this evaluation used in the decision-making process for optimization measures.

- High system availability thanks to constantly updated information
- Easing of the burden on service personnel thanks to remote access via GSM
- Customer-specific Web platform thanks to TO-PASS® Dynamic Portal

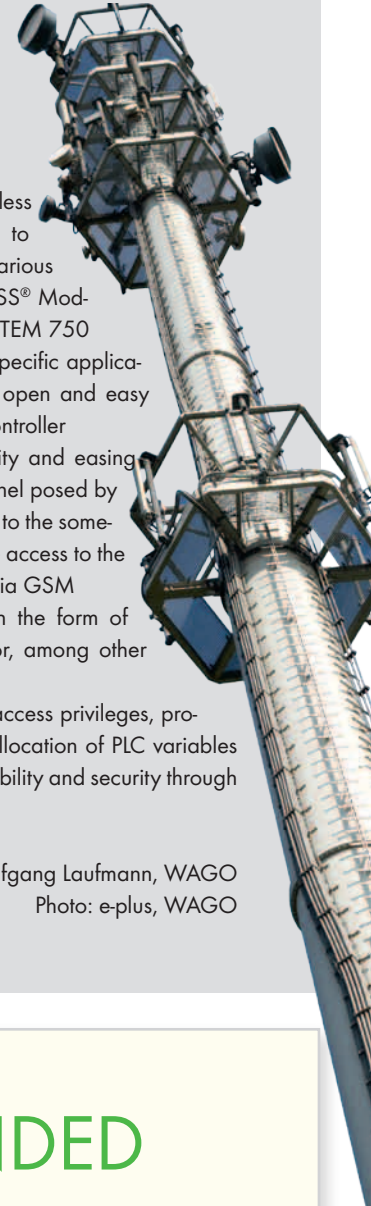


■ User benefits

- The greatest flexibility in wireless transmission of measured data to a Web portal by combining various WAGO components from TO-PASS® Modular System and WAGO-I/O-SYSTEM 750
- Optimal implementation of user-specific applications at the meter stations using open and easy CoDeSys programming for the controller
- High degree of system availability and easing of the load on the service personnel posed by time-consuming check inspections to the sometimes distant stations using remote access to the devices from an external source via GSM
- Custom-tailored Web platform in the form of the TO-PASS® Dynamic Portal for, among other things,

data security through assigning of access privileges, process efficiency through automatic allocation of PLC variables and set points, and operational reliability and security through automatic alarm generation.

Text: Wolfgang Laufmann, WAGO
Photo: e-plus, WAGO



CURRENT SENSOR WITH EXTENDED MEASUREMENT RANGE

■ With 0- 140 A measurement range, WAGO's 789-621 Current Sensors are ideal for monitoring PV systems.

WAGO's 789-621 Current Sensors, which have been available since the beginning of 2011, have an extended measuring range from 0 to 140 A. The new sensors are designed for continuous current measurement of individual lines during operation. The maximum wire size is 35mm², allowing the conductors' current carrying capability to be fully covered. Like the 789-620 model (0- 80A measurement range), the 789-621 sensor features 0.5% full-scale accuracy. Both sensors connect to the following systems: WAGO-I/O-SYSTEM, TO-PASS® telecontrol modules and PERSPECTO® HMI panels.

WAGO's current sensors are ideal for implementing cost-effective and meaningful monitoring applications in photovoltaic (PV) systems. This is necessary because the user cannot always detect the perfect operation of such systems at first glance: power losses are generally only noticed with a precise comparison of the yield data. Using current sensors, technical faults in solar modules such as those that arise due to cell break or lightning strike are detected more quickly and easily. This way, the whole photovoltaic system is operated in an optimal condition, both technically and economically.



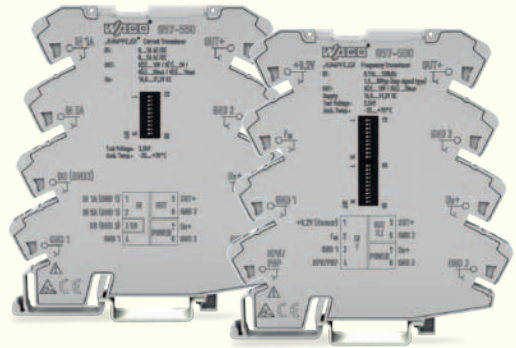
For wire sizes up to 35 mm²: WAGO's 789-621 Current Sensor features 0- 140 A measurement range with 0.5% full-scale accuracy.

EXPANDED JUMPFLEX® FAMILY

New 6 mm-Wide Frequency and Current Transducers

■ WAGO is currently expanding its series of JUMPFLEX® transducers to include both universal frequency and current transducers. The 857-500 Frequency Transducer with 0.1 - 120 kHz frequency range is ideal for all standard frequencies. The transducer converts signals from, e.g., NAMUR, NPN or PNP sensors into analog standard signals. The measurement method switches between pulse time and gate time. The 857-550 Current Transducer measures DC and AC currents ranging from 0 to 1 A (AC/DC) and from 0 to 5 A (AC/DC). The signals can have any type of form, including both sinusoidal and non-sinusoidal signals. The following types of measurement are supported: arithmetic mean value, true RMS measurement, signal mapping or absolute value measurement. On the output side, the current transducer converts the current into an analog standard signal. An FDT/DTM programmable digital output is also available for limit value signalization. For both devices, the analog standard signal can be set to 0-20 mA, 4-20 mA, 0-10 mA, 2-10 mA, 0-10 V, 2-10 V, 0-5 V or 1-5 V. The 6 mm-wide devices are configurable either via FDT/DTM configuration tool or via integrated, easily accessible DIP switches. Measurement range configuration via DIP switch is calibrated. The modules are sup-

plied with 24VDC, which can be efficiently commoned using lateral push-in type jumper bars. Both new transducers meet the requirements for safe isolation of functional areas with 2.5 kV test voltage according to EN 61140. Input, output, and supply voltage.



New 6 mm-wide universal frequency and current transducers join the JUMPFLEX® Series.

NEW MODULES ENHANCE POWER SUPPLY RELIABILITY

■ With two new battery modules and a new redundancy module, WAGO's EPSITRON® power supply system now provides additional uninterruptible and redundant power supply solutions.

WAGO's new DIN-rail mount 787-876 Battery Module features 1.2Ah nominal capacity and bridges short power outages lasting up to several minutes. Despite its compact design, the module incorporates robust AGM (Absorbed Glass Mat) batteries delivering short-term output current up to 7.5A. WAGO's EPSITRON® 787-870 UPS Module (24VDC, 10A) functions as charger and controller. Like WAGO's 7Ah and 12Ah battery modules, the new 787-876 Series has a miniature fuse holder accessible from outside the module.

The 3.2 Ah battery module (787-871) already presented has been upgraded to provide short-term, maximum peak current of 20 A. The 787-871 module also incorporates a temperature sensor for controlled and soft battery charging.

Redundant power supplies significantly increase system availability. Redundancy modules control output voltage of parallel-connected power supplies, preventing reverse current and voltages drops when one of the power supplies fails. In addition to WAGO's 24VDC redundancy module (787-885), a 48VDC module (787-886) is

now available that provides 2x20A load current. The new 787-886 Module is compatible with WAGO's 48VDC EPSITRON® PRO power supplies.



With the new rechargeable battery and redundant modules in the EPSITRON® Series, it is possible to establish reliable power supplies.

GUARANTEEING PROCESS RELIABILITY INCREASING ENERGY EFFICIENCY

■ With the modernization of system parts, Unilever in Heppenheim is aiming for greater process reliability and energy savings at the same time. With the help of the WAGO I/O-SYSTEM, the company replaced the hardware controllers with a software controller. With the new system, it also records energy data; more efficient processes are derived using this data.

In seven locations, Unilever Deutschland GmbH produces foods such as ice cream, prepared dishes, and margarine. One of the locations is the Unilever Deutschland Produktions GmbH & Co OHG plant in Heppenheim, the largest Unilever ice cream factory in the world. From Heppenheim, the company supplies all of Europe with Magnum, Capri, Cremissimo, Viennetta, and other ice cream brands. The company's strengths include the top quality of its products, competitive costs, and the necessary flexibility within the company. With 770 employees, the plant can produce up to 170 million liters of ice cream each year. In the high season, more than 1500 pallets with ice cream packages leave the four production halls each day - when stacked one atop another, this quantity would be as high as the icy peak of the Zugspitze.

■ System Availability on the Test Bench

For warming or cooling of ingredients to be added such as chocolate, the Mixing Department relies on portable tempering devices with hardware controllers and contactors. However, no more spare parts are available for these devices, something that endangers process reliability in the long term. Every contactor in the tempering devices runs through approximately 100,000 operating cycles each year. With this load, they would quickly approach their theoretical wear limit. "The old hardware controllers represent a black box without any documentation or alarming in case of breakdown," adds Thomas Held, Team Director for Electrical Maintenance and System Administrator AT/IT in the Mixing Department at Unilever in Heppenheim. At the end of last year, the starting shot for the remodeling of the tempering devices was heard, whereby the existing infrastructure was supposed to be retained and a coupling to the process control system enabled.

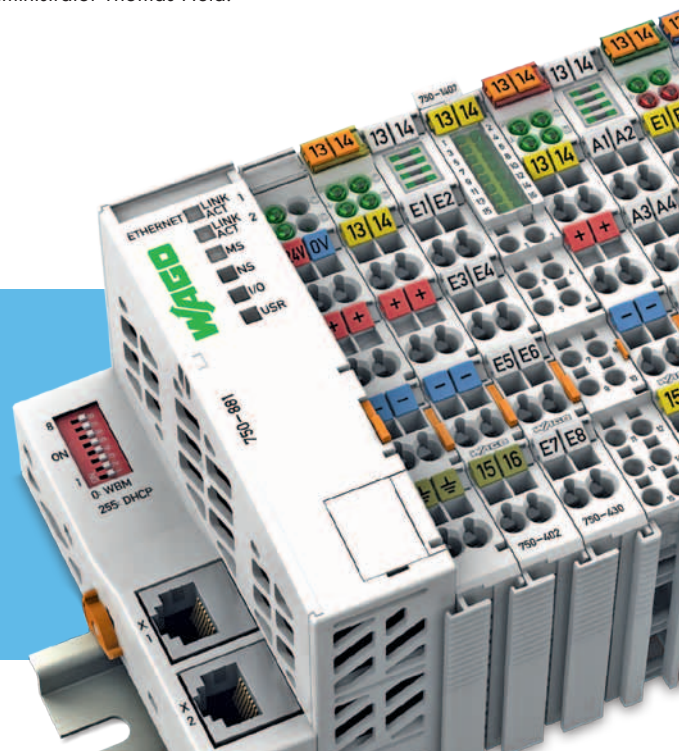
■ New Automation Solution Saves Space

The people responsible in the Mixing Department selected the WAGO I/O-SYSTEM with the 750-871 Ethernet controller as the controller. Thanks to its small dimensions and modular construction, the new controller fit easily into the available installation space in the tempering device. The individually combinable digital input/output modules as well as the analog input/output modules of the system are replacing the old switching devices and nevertheless leaving sufficient space for expansions. With the ETHERNET interfaces integrated into the controller, the tempering device can be integrated easily into the Mixing Department's automation concept. Thus, the tempering devices no longer function as "islands"; instead, they make the process data available to the superior control system via OPC servers. Furthermore, alarm management could be integrated into the controller via e-mail; it monitors errors and limit values and thus contributes to process reliability.

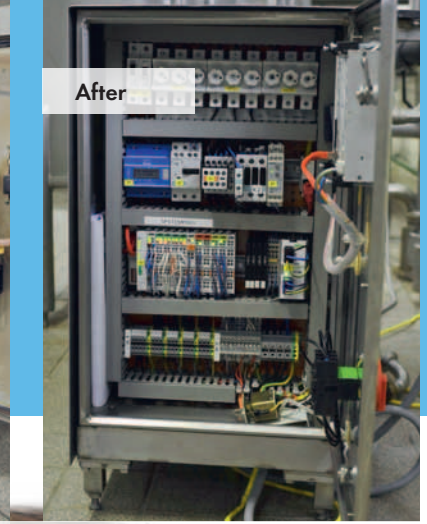
■ On the Trail of Energy Consumption

Thanks to the modernization of the tempering devices, it is now possible to record energy data using the WAGO I/O-SYSTEM. The bus modules arranged on the I/O system record signals from flow meters, temperature sensors, and electricity meters; the PLC calculates the output data on the basis of these. "Thanks to the use of the controllers, our flexibility increased with respect to the utilization of the systems and also the fine-tuning of the tempering. For example, due to the optimization in the control circuits, the energy costs for the tempering devices could be reduced drastically," adds System Administrator Thomas Held.

- WAGO Library Building & E-mail included
- CFC programming syntax as free feature of CoDeSys
- Easy creation of visualization using WAGO AUTOMATION COCKPIT®
- Only 1/3 the cost of the competitors' offerings



ABILITY – CY



The tempering devices before conversion: a lack of spare parts for the hardware controllers forced the company to act.

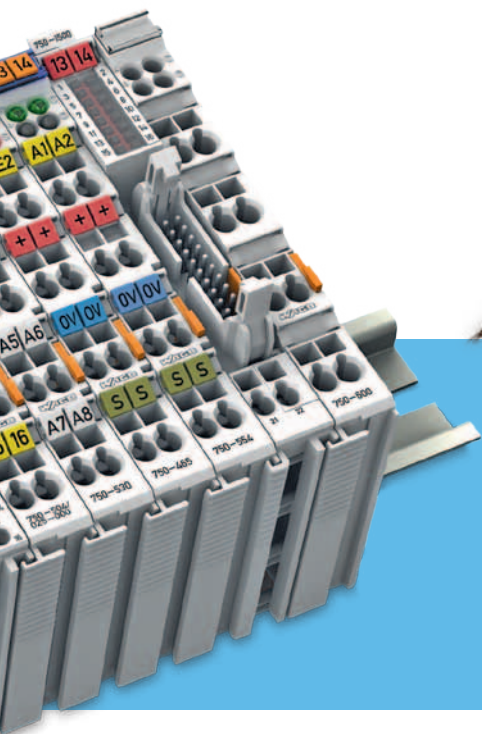
WAGO's ETHERNET controllers incorporate the modernized tempering devices into the automation and thus abolish their "island" position.

■ Programmability Scores Points during Selection

The people responsible weighed both the technical and economic aspects before making the final decision in favor of one system. For the use of the WAGO-I/O-SYSTEM, the investments required were only approximately one-third of those for comparable systems from other manufacturers. Thanks to the programmability according to IEC 6113103 with CoDeSys, all control parameters for the temperature sensor, error monitoring, and limit value settings could be optimized easily. In the course of the modernization, the tempering device got a 5.7" Web panel from the PERSPECTO® product family and a visualization with input screen for the controller, limit, and target values, as well as for the on-site display of actual values, errors, alarms, and limit value violations.

Text: Nils Otterpohl, WAGO

Photo: WAGO



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