COMPENSATING GRID FLUCTUATIONS AT HIGH SPEED

Modular battery storage system from Schäfer Elektronik provides low-voltage-ride-through in real time

The worldwide supply of energy is in a state of transition due to the several international programs for reaching climate targets. Regenerative energy, such as wind power, photovoltaics and biogas, will play a decisive role in the energy supply mix of the future. Schäfer Elektronik GmbH is a company that has developed a modular battery storage system that also offers »low-voltage-ride-through« operation in real time.

Schäfer Elektronik GmbH, with headquarters in Achern, South Germany, has around 230 employees, and has been a technology leader in power supplies, converters, active harmonic filters and charging systems for almost 50 years. The solutions are used in application areas such as electric mobility, railway technology and energy technology.

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Klaus Riekötter, sales manager at Schäfer Elektronik, sees an expanding future market for battery storage systems: »For example, a stable grid infrastructure is a necessary requirement for electromobility. Although electricity comes out of the power outlet, the requirements for energy generation and distribution must be fulfilled. This is where Schäfer and its systems make a contribution.« The new battery storage system from Schäfer consists of at least two containers. The control container contains the power electronics from Schäfer and the control system from Bachmann. The battery container houses the battery systems for storing energy. A modular concept enables the Schäfer PCU (Power Conversion Unit), which is the basic system (1 MW), to be expanded with two additional containers in order to achieve a total capacity of 3 MW. Alexander Spengler, project manager at Schäfer Elektronik explains:

> **» For demanding developments, we take Bachmann into account from the beginning. «**
>
> Hansjürgen Schäfer, CEO at Schäfer Elektronik

»As is known, batteries operate with DC voltage. To store the energy, we use an active charging circuit with compact rectifier systems. The energy output is regulated in the opposite direction via a power inverter.« As this storage system is designed for the compensation of sudden fluctuations in the grid, the energy flow in both directions has to be constantly regulated. The system can also be used for brake energy regeneration in the railway sector and for regulating peak loads in industrial plants. Whatever the case, the power feed-in has to be synchronized with the grid.

Multi-flexible for all grid variables

To implement the control application, Schäfer relies on the latest technologies of the Bachmann portfolio. The proven and robust decentralization via the fiber-optic based FASTBUS is thus used in the control area. This queries status information and temperatures in the battery container in real time. Different analog sensors and temperature sensors can be connected to each channel of the new and versatile AIO216 module. The GMP232 (grid measurement and protection module) provides all grid-relevant information. This ensures availability in the control program of all grid variables, such as voltage and current values, power data and frequency information. Besides measurement, grid protection is also ensured and the grid is stabilized (LVRT) in the event of

▲ **Clear visualization:** The status of the batteries and any errors are clearly shown.

a voltage drop in accordance with the relevant grid codes. The integrated data recorder helps to analyze the causes of faults if they occur. All functions are performed in real time in the MC210 CPU. These are programmed with the Bachmann programming systems, particularly the PLC Developer, which is a new tool that enables very efficient software development. Stefan Breitkopf, responsible for the software at Schäfer, was able to master all facets of the system with very little training.

Precise interaction required

The cooperation between Schäfer and Bachmann started with the development of a 3 MW converter for the wind industry. As the engineering company, Schäfer developed the key parts of the design. »This was when we gathered our first experiences with the M1 automation system,« says Hansjürgen Schäfer, CEO of Schäfer Elektronik GmbH. This project involved very extreme reaction times and placed some very demanding requirements on the communication technology and visualization. »With the development of the battery storage system we drew on our experience and considered the Bachmann controller from the start,« he recalls. The power electronics ultimately required very precise interaction between the grid conditions and the connected battery systems. Another requirement was for the communication to the operator to be flexible and adaptable. In this specific case, Schäfer's customer stipulated the use of the DNP3 protocol. Bachmann offers this and also all standard communication protocols such as: IEC 61850, IEC 60870, IEC 61400 or MODBUS. The protocols can be adapted to customer requirements with little effort. The webMI pro web-based visualization is another benefit, as this enables the graphical operation and parameter setting of the system to be implemented. »We therefore had all the elements required for this demanding development together in one place,« says a delighted Hansjürgen Schäfer.

The face of the system

The ability to operate the system intuitively and to display operating data is very important. »A high-resolution graphical user interface basically acts as the face of the system. On the one hand, it has to impress the customer, on the other hand, it has to provide a full overview of plant status and clearly indicate any faults,« explains Alexander Spengler. Schäfer implements full graphics visualization with an industrial computer and a 15 inch display from the OT1200 series. The webMI pro visualization software enables Schäfer to implement an intuitive operator interface. As webMI pro is web-based, the information can also be transferred to mobile terminal devices. This naturally requires appropriate access rights and security mechanisms, which are in turn defined in different groups in the M1 controller.