High-Power Test Laboratory Automation
AC500 PLC Increases Efficiency and Safety

The ABB Ability™ engineering tool Automation Builder for AC500 PLCs features a Process Control Object library for integration into System 800xA. As it contains pre-tested function blocks for each object as well as matching symbols and faceplates for these, it significantly reduces commissioning – a decisive factor in automation projects.

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01 Extended Operator Workplace (EOW) from which the equipment and processes are monitored

The customer
The ABB Testing Laboratories in Ratingen (Germany) are PEHLA-accredited and have over 60 years of type testing experience of low and medium voltage switchgear and controlgear. They conduct high-power, high-current, high-voltage, mechanical or environmental testing for customers either in the lab, including an assembly and installation service, or in the customer's facilities.
The high-power laboratory performs short-circuit making and breaking tests, switching capacity and load switching tests, peak and short-time withstand current tests, internal arc fault tests and cable tests. For this purpose, the lab is equipped with a 2800 MVA short-circuit test generator, oil-insulated power transformers, a dry-type power transformer, as well as different reactors, capacitors and resistors, dedicated measurement equipment and more.

The application
The high-power test bench for low-voltage and medium-voltage components, circuit breakers and switchgear includes the following equipment:
- Power supply: a short-circuit generator (2800 MVA / 12 kV) and power transformers (oil-insulated)

- A three-phase asynchronous motor (1500 kW / 6.6 kV) with ABB frequency converter ACS2000 as drive for the short-circuit generator.

- Excitation set for the generator consisting of a slip ring motor (185 kW / 6.6 kV), a flywheel and two DC generators (1000 kW / 750 V).

This setup makes testing with performance ratings of maximums up to 40 kV, 100 kA RMS and 250 kA peak current possible.

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> "The Automation Builder Process Control Objects (PCO) library was easy to understand and the Function Blocks, faceplates and display elements were essential for engineering. They significantly shortened commissioning."

> Heribert Koch, Project Engineer at ABB High Power Laboratory, Ratingen

The technology
For safe and flexible operation, the ABB Testing Laboratories required automation of the generator and test circuit controls and the medium-voltage circuit breakers. For this purpose, the AC500 CPU PM591 was set up with a decentralized I/O system connected via PROFINET (14 remote I/O stations CI502). The ACS2000 frequency converter and a medium-voltage switchgear with eight panels controlled by REF615 relays connect via PROFIBUS DP and Modbus TCP/IP respectively to the AC500. This way, the AC500 PLC can control and interact with the frequency converter and the circuit breakers and react instantly to any demands. Additionally, the generator is protected by REX640 protection relays which connect via Modbus TCP/IP to the integrated Ethernet interface of the AC500 CPU.

The whole setup is operated via an Extended Operator Workplace (EOW) in order to centrally control all devices. The EOW uses the distributed control system (DCS) ABB Ability™ System 800xA version 6.0 with a PLC Connect license.
In addition to the generator and test circuits, from the EOW you can also monitor the ventilation and cooling system, as well as the oil circuit to ensure proper bearing lubrication of the short-circuit generator. The automation solution therefore allows for the data collection required to conduct predictive maintenance and on-line failure analysis and, with this, prevent breakdowns and reduce downtimes.
The automation system was not only designed to increase the test center's efficiency by controlling the functionality of the devices but also to make its operation safer. Via safety I/O modules, the AC500-S safety PLC SM560-S receives input signals from the safety switches on the doors. Entering the test bench room during operation constitutes a serious safety risk because of active busbars and potential arcing effects in case of a failed test. Therefore, if the doors to the test bench room are opened during operation, the emergency stop circuit is triggered and the machines will be shut down. This way, the safety PLC already protects people and investments, allows the customer to reach a specific safety level required for the operation in question, and thanks to its modularity it is ready for an extension of the safety functions in the future.

The automation solution was programmed using the AC500 engineering tool ABB Ability™ Automation Builder 2.2. It comes with a Process Control Objects (PCO) function block library for integration of the AC500 application into System 800xA. Ready-made symbols and faceplates for System 800xA are used in the process graphics. The symbols and faceplates match the function blocks in the PCO library. A variety of control loops with motor and valve control is included in the PCO library and was used as well in the application. The communication between the objects in System 800xA and the function blocks in AC500 is configured with the Bulk Data Manager, which is part of the System 800xA Engineering toolset. The multi-engineering tool Automation Builder offers six different programming languages based on IEC 61131-3. In this project, the programming language Sequential Function Chart (SFC) was chosen to program the up-and-down automatic for the process. In addition, Automation Builder also incorporates tools for configuration and parametrization of fieldbuses and network communications.

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