

POWER GENERATION SERVICE

Maximum reliability for Switzerland's grid control center

Modernization of the Swissgrid grid frequency controller by ABB



ABB Power Generation Switzerland has migrated the existing Procontrol P13 grid controller to the latest state-of-the-art in control and operation technology for Swiss transmission system operator Swissgrid AG. Absolute reliability, availability and security are of paramount importance for both the national and international regulation of current flow.

The 6700 km long Swiss transmission system operates with voltages of 220 kilovolts and 380 kilovolts, as well as a frequency of 50 Hertz. It has more than 121 substations and a total of 12,000 transmission towers. In 2016, a total of 73,775 GWh of energy was transported. The national grid company Swissgrid is responsible not only for operation of the transmission system, but also for its maintenance, modernization and expansion, all under the supervision of the Swiss Federal Office of Energy and Federal Electricity Commission. As a member of the European Network of Transmission System Operators ENTSO-E and as coordination centre for southern European continent, Swissgrid assumes central duties relating to coordination and network utilization in the area of European electricity exchange.

In the network control center a Procontrol P13 grid controller has ensured smooth operation and thus an absolutely reliable and stable power supply in Switzerland for over 25 years.

The power and frequency control guarantees that the power generated and consumed in the Swiss control area is constantly held in balance at a frequency of 50Hz. The current load flows are measured at one second intervals at all cross-border lines between Switzerland and other countries. The data acquisition uses four different measurement sources for each cross-border line. An integrated best of-logic ensures that only the highest quality measurements are used.

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In seven important substations, the frequency of 22 lines is measured with high-precision and its gradient determined. Using these current values, the P13 grid controller calculates the deviation to the planned setpoints (pre-scheduled values) and determines the current power requirement. Swissgrid tenders the required control band on the market each week and contracts the most cost-effective and economically optimum ancillary service providers (ASP). Generally these are hydro-electric power plant operators. The P13 grid controller instructs the contracted ASPs to adapt their power production accordingly. This is done by outputting the production setpoints at two redundant interconnection points. This is a fully automated regulation process, executed at second intervals. In parallel, the frequency and quality system (FQS) continuously monitors the quality of the grid frequency. This acts as a radar for smooth operation of the interconnected grid. A sudden change in frequency indicates possible power station failures or subnetwork disconnections within the ENTSO-E grid. By analyzing the measurements, Swissgrid identifies where the malfunction has occurred and is able to clarify the cause with the relevant grid control center.

Due to technological progress with constantly increasing volumes of data and information flows, in 2015 Swissgrid commissioned ABB with the complete modernization of the existing grid controller. In addition to the P13 controller, ABB's technical solution is based on several RTU 560s for acquisition and distribution of measurements and setpoints. ABB's Extended Automation System 800xA ensures smooth operation and Symphony Plus Historian is used for the integrated and complex data management.



“ABB convinced us with its broad know-how, the strong sense of responsibility of its employees and its ability to meet customer requirements. We need a partner who is reliable in all situations, and who can also provide us with support for highly complex problems”.

Heiko Beck, Swissgrid



Why did Swissgrid choose the proven Procontrol P13 control system?

According to Heiko Beck, P13 stands for robustness and availability, plus a high degree of security in operation. Heiko Beck puts it in a nutshell: “As this project concerns the security of the energy supply in Switzerland, 99% availability of the grid controller is not enough. We must have the highest possible availability!”

The complexity of the project implied an enormous challenge for the seamless integration of all systems and applications into the existing Swissgrid architecture. In addition to the Swissgrid in-house systems, a large number of external systems had to be connected, and their data had to be entered and synchronized. Meticulous engineering guaranteed that all interfaces were connected successfully. Constant attention had to be paid to cyber security requirements and to compliance with a wide variety of software standards. These requirements were fulfilled thanks to close cooperation and constant exchange between both parties. Again and again, the involved teams looked for and found joint solutions throughout the entire project. Only this level of collaboration can deliver such a complex project successfully and on time.

The highest level of security was always ensured during the modification and upgrading of the grid controller – for both hardware and software. The complete system configuration took place on-site at the Swissgrid premises. To prevent any malware

introduction, a clean release management procedure was put in place: All software, including that of third parties, needed to be digitally signed. Swissgrid project manager Heiko Beck summarizes the challenges as follows: “The amount of software in this project was huge. The quantity of applications, which had to be integrated and harmonized, was enormous. The combination of process data (Operational Technology) and different business systems (IT) in particular demanded the greatest attention from both us and ABB”.

Redundancy is of paramount importance: If a system component fails due to damage or malfunction, the redundant component takes over immediately. The fail-safe operation of the grid controller as “critical infrastructure” is of fundamental importance for Swissgrid. As a national company Swissgrid does not just have a partial responsibility – it is responsible for the entire electricity landscape of Switzerland! The grid frequency controller is based on the principle of geographical redundancy, to counter a possible disaster situation in one location. Critical parts even have quadruple redundancy. The overall design must ensure 100% availability. All data points are therefore mirrored and all systems monitor each other.

ABB was chosen as partner because of its high level of expertise and extensive experience in the field of instrumentation and control. Heiko Beck puts it like this: “This project isn’t just about wiring individual

components, but it is a challenging large project, which only a few companies are in a position to handle.

The cooperation between Swissgrid and ABB is not new. In the mid-2000s, ABB helped to establish a solution for customized data processing for Swissgrid’s electricity suppliers. Already in 2009, ABB replaced the old control panel in the “Dispatch Center” with a new System 800xA operator station.

Despite the high degree of complexity of the modernized system, the operators really like the new user interface, as relevant data can be easily accessed thanks to the intuitive handling. “ABB has the ability to easily comprehend the customer’s situation and has always convinced us – particularly in terms of project implementation”, Heiko Beck describes the longstanding cooperation and elaborates: “Where it matters the true professionalism shows”.

From November 4, 2016 to January 9, 2017, the new ABB grid controller ran successfully in parallel operation with the existing one. During this period, ABB had to prove 100% availability of the system in daily operation. The switchover to this parallel operation went without any problem. The planning was carried out with utmost precision, nothing was left to chance. Thanks to the modernization of the grid frequency controller, secure and precise operation is ensured for the future to come.