



Industrial evolution

Electrical integration using ABB's Extended Automation System 800xA with IEC 61850

ALAN FERNANDES TEIXEIRA, LEANDRO HENRIQUE MONACO – Industrial automation systems have evolved significantly over the past few decades, but they now face new challenges, especially concerning integration. In particular this concern focuses on how different locations and systems can be integrated in a way that reduces costs and increases overall efficiency and safety for the operation. ABB offers a complete integrated platform with Extended Automation System 800xA, which uses electrical integration based on the IEC 61850 standard for substation automation systems. This solution manages the production rates of complete industrial plants – by combining the benefits of different systems and locations into a single platform – as well as the energy consumption for each part of each process. In other words, ABB provides a high-tech solution that helps customers optimize production while increasing energy efficiency.

1 Combining ABB's Extended Automation System 800xA with IEC 61850 integrates different systems and locations into a single platform.



In an industrial environment the demand for higher profitability and process efficiency requires solutions that increase productivity using fewer resources. Included under the umbrella of resources is the need to reduce energy costs while, at the same time, optimizing production rates. To achieve this, industrial automation system solutions need to focus on four main challenges:

- Providing safety for personnel
- Reducing capital expenditure (CAPEX) for new plants
- Connecting in remote and harsh locations
- Dealing with the lack of integration between several systems

To address these challenges, ABB has combined its Extended Automation System 800xA with the IEC 61850 standard for substation automation systems so that the benefits of different systems and locations are integrated into a single platform → 1. This platform not only decreases installation and maintenance costs but also increases plant availability by reducing downtime. Moreover, it provides add-

ed intelligence based on the smart combination of process and electrical data, thus allowing energy efficiency schemes.

Providing safety for personnel

Life is the most important asset. One way to preserve this statement is by reducing the exposure of a maintenance team to electrical danger to ensure a safer working environment. The communication protocols usually applied in electrical installations (eg, PROFIBUS and Modbus) already allow remote supervision and operation of a substation inside industrial plants. However, some activities, such as configuration and parameterization as well as access to disturbance record files (needed for analyzing electrical occurrences, such as voltage drops and overcurrent protection trips) require the physical presence of the maintenance team. For a majority of the protocols currently used, these two procedures can only be executed by connecting laptops locally to the intelligent electronic devices (IEDs).¹ One of the main benefits of using IEC-61850-compliant devices and systems is that the protocols proposed by the standard enable these two procedures to be carried out remotely once the IEDs are connected to an Ethernet

network and all files can be transmitted using this infrastructure → 2. The presence of a maintenance team is therefore only required in cases where there is a mechanical problem.

Reducing CAPEX for new plants

One of the main concerns for a greenfield implementation is CAPEX (capital expenditure). The amount of hardwired connections inside switchgear is one of the factors that make installation expensive. But it is possible to identify a pattern of

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how the cubicles (ie, IEDs) are connected to each other, and this pattern usually repeats several times inside a substation

Footnote

¹ An IED describes a microprocessor-based controller and is a term used in the protection and power system automation industry. It performs electrical protection functions, advanced local control intelligence and can communicate directly to a SCADA system. Examples include a protective relay, circuit breaker controllers and voltage regulators.

Title picture

As a complete integrated platform, ABB's System 800xA solution fulfills the requirements of a true energy management system and increases safety by enabling remote intervention and risk mitigation.

IEC 61850

IEC 61850 provides a standardized framework for substation integration that specifies the communication requirements, the functional characteristics, the structure of data in devices, the naming conventions for the data, how applications interact and control the devices, and how conformity to the standard should be tested.

For more application information on this standard, please refer to *ABB Review* Special Report: IEC 61850, pp. 1–64, August 2010.

Extended Automation System 800xA

System 800xA is an integrated process automation system that can engineer, commission, control and operate automation strategies for process, power, electrical and safety in the same system. Its integration architecture, based on Aspect Object (AO) technology, relates all plant data (ie, Aspects) to the specific plant assets (ie, Objects). One-click navigation allows the efficient engineering and presentation of the right information in the right context to the right user.

A common platform decreases installation and maintenance costs, increases plant availability and provides added intelligence based on the smart combination of process and electrical data.

(or in several substations of a plant). If the connections between cubicles of the same type could somehow be made by creating a communication protocol between the cubicles, installation costs would be reduced considerably. To achieve this, the IEC 61850 standard proposes the generic object-oriented substation event (GOOSE)² protocol. Therefore, for each typical cubicle there is a typical IED configuration that can be reused throughout the whole plant—optimizing engineering effort. Moreover, due to the digital protocol used by the IEDs, optical fibers take over from communication cables, and because they are immune to electromagnetic interferences, they can be placed closer to the busbars.

Another advantage is that given a common (software-based) configuration, only one IED needs to be tested, and any configuration adjustment required in the IED is easily replicated in all the other IEDs. Testing and commissioning are also made easier if a prefabricated E-house solution is used. Prefabrication allows for the cubicles to be tested while they are still in the E-house factory.

Remote connection

Many mines are being established far from economical centers, they are getting deeper and ore bodies are becoming more complex. These factors, combined with a shortage of skilled workers,

mean the plants need to become more automated. Regarding substation systems, different substations situated in various locations need to be connected to the same supervision system so that remote control and maintenance is carried out from a central location. Applying the IEC 61850 standard to ABB's System 800xA establishes a digital communication link between the IEDs and the servers in the system to create such a connection → 2–3. This in turn provides maintenance personnel with the information needed to quickly identify the problem and the solution remotely. This means that hardware problems are fixed in the shortest possible time, which has the advantage of increasing plant availability and consequently productivity.

One platform, many systems

With the evolution of digital computing in industrial applications, several information systems were developed to provide a more complete database for the layers inside plants. Nowadays it is almost common to find many different systems in a plant for different applications (supervision, maintenance and production schedule systems), all of which rely on the same information (eg, a circuit breaker position). However, if all applications rely on the same information, one of two scenarios could be playing out, neither of which will lead to good plant management:

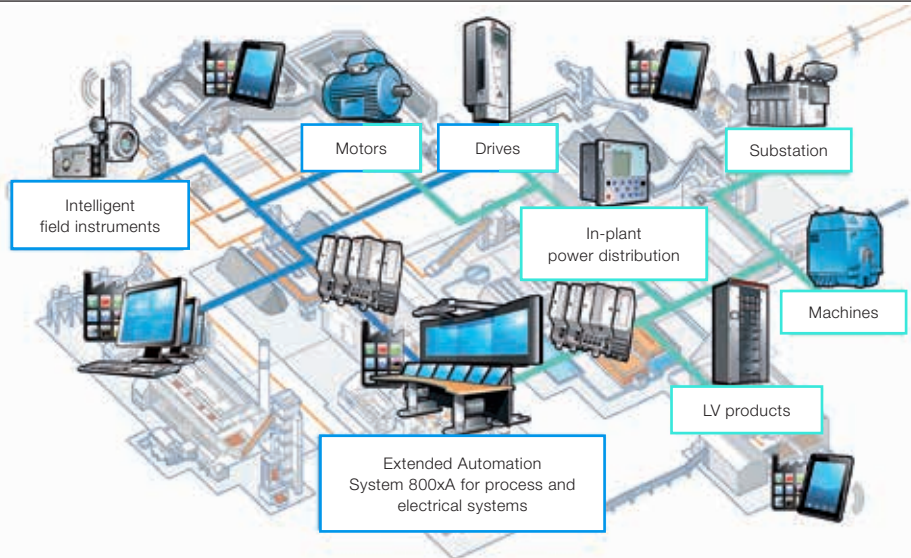
- The same information is input several times into these different systems.
- The “communication” between the systems is actually communication between the people operating those systems.

System 800xA's integrated platform completely eliminates this problem.

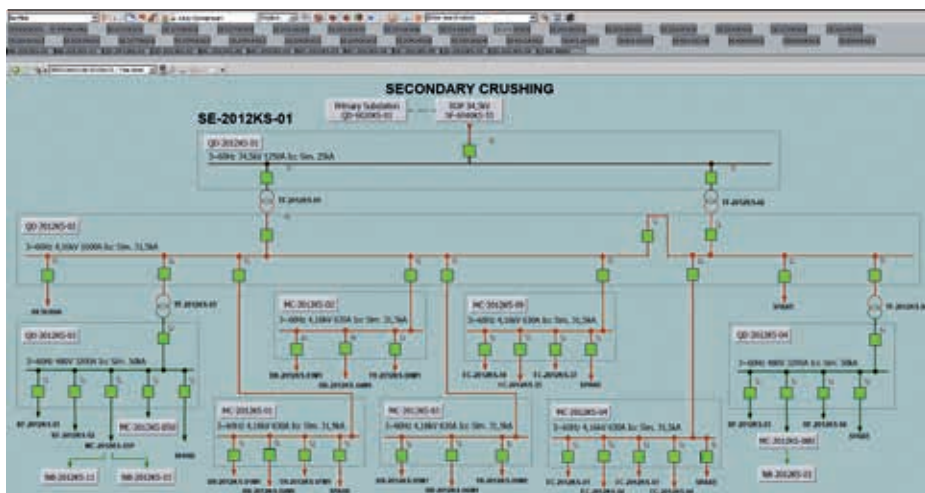
Footnote

² GOOSE is the communication protocol defined by the IEC 61850 standard. It allows one IED to send fast messages to other IEDs independent of any supervisory system or controller. This is done to transmit important trip and interlocking information within 3 ms among IEDs.

3 System 800xA allows plants to integrate their own process control system so that a combined database for process and electrical parts exists.



4 Integrating all voltage levels simplifies the operation and communication between components.



Usually in industrial plants, management of high- and medium-voltage substations is handled by two completely different systems and teams. By applying IEC 61850 to both levels, it is possible to integrate all the substations into the same System 800xA system, thereby simplifying the operation and the communication between high- and medium-voltage switchgear, for example.

Besides integrating different voltage-level substations into the same system, System 800xA also allows the plants to integrate its process control system → 4. Therefore, using IEC 61850 compliant devices inside the same 800xA system that oversees process control, it is possible to have a combined database for both process and electrical parts, enabling the identification of relevant key

performance indicators (KPIs) for the operation.

One of the most important KPIs is process efficiency, ie, the relationship between energy consumption and production rates. This indicator enables comparisons to be made between different process lines and even different equipment in the same process step. This helps to identify problems or discrepancies more quickly.

Overcoming challenges

While the evolution of automation systems has been advantageous for operations, it has also introduced some challenges for the future. For example, scarcity of natural resources is pushing companies to explore in extremely remote and harsh places, increasing operational

expenditures (opex) during the lifetime. Therefore maintenance has become crucial to increase the predictability of the devices' behavior and reduce unproductive time during repair.

In a completely integrated system, information from different perspectives of the plant has a positive influence on decision-making and inevitably on the process itself. However, new systems have created different databases and a lack of integration between these has become critical in an industrial plant management environment. Information published in different systems at the same time can hinder efficient reporting and decision-making during faults or inefficient communication between teams in different sectors can cause an increase in production stops.

As well as providing a completely integrated platform, ABB's System 800xA solution fulfills the requirements of a true energy management system. Most importantly, this solution increases safety because it reduces the exposure of maintenance personnel to potentially dangerous situations by providing complete diagnostics to the control room, enabling remote intervention and risk mitigation before the maintenance team initiates its service.

Alan Fernandes Teixeira

ABB Process Automation, Industry Solutions
São Paulo, Brazil
alan.fernandes@br.abb.com

Leandro Henrique Monaco

ABB Process Automation, Control Technologies
Västerås, Sweden
leandro.monaco@se.abb.com