Electrical integration with IEC61850
Benefits for the mining industry
Global trends & challenges
Mining Industry

- Reduce capital investment and operational expenditure
  - CAPEX: Less cabling; Faster commissioning
  - OPEX: Faster troubleshooting; Less spare parts, training and upgrade costs; among others

- Increase availability of the energy supply to the process
  - Reduce downtime

- Safety for staff
  - Remove maintenance team from harsh environment

- Achieve high-standard system for energy efficiency support
  - System with process and power automation integrated
Product Presentation
What is Electrical Integration?

- Electrical integration means integrating Process Automation and Power Automation into the same plant control system.
Product Presentation
What is Electrical Integration?

- Electrical integration means integrating **Process Automation** and **Power Automation** into the same plant control system.
Why 800xA with IEC 61850?
Technical opportunities with IEC 61850

- Vertical integration
  - MMS communication
  - Substation operations, Alarm & Event lists
  - Disturbance recordings automatically uploaded
  - Remote logic configuration & parameterization

- Horizontal integration
  - Protection using GOOSE
  - Real time applications: interlocking, trip commands
  - CI868 board as IED
  - Power Management applications: Load Shedding, Power Demand Monitoring
  - Cabling reduction!
How do we implement IEC61850? Electrical and process integration using 800xA

- Vertical connectivity - MMS
  - Substation operation and supervision
  - Alarm and Event Lists with time stamps from IEDs – perfect SoE (1 ms resolution)
  - Logging operator actions – Audit Trail
  - Disturbance recording automatically uploaded to OPC Server
  - Remote configuration and parameterization through Ethernet network and 800xA aspect

- Redundancy
  - OPC DA redundancy
  - OPC AE redundancy

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How do we implement IEC61850?
Electrical and process integration using 800xA

- Horizontal connectivity – GOOSE:
  - CI868 board on AC800M CEX bus
  - Fast commands to IEDs – useful to contingency local operation (using ABB Process Panel)
  - Real time applications: interlocking, trip commands
  - Power Management applications: Load Shedding, Power Factor Control, Power Demand Monitoring
How do we implement IEC61850? Electrical and process integration using 800xA

- Vertical and Horizontal connectivity integrated - CI868 board on AC800M has MMS interface too, on the same board
  - “Application Suitability” for MMS and GOOSE
  - Time critical and supervision applications with the same hardware. Eg. Loadsheding
  - Only board on the market with this feature
Product Presentation
Minerals and MIDAS Libraries

Minerals Library
- Process Automation
- AC 800 M controller
  - Fieldbuses
  - IEC 61850 (Horizontal)

MIDAS Library
- Power Automation
- IEDs
  - IEC 61850 (Vertical)

Link to Faceplate
MIDAS stands for Mining Integrated Distribution Automation Systems and it is a 800xA library for Electrical Integration with IEC61850.

- Turning your substation into gold (referring to King Midas, Greek mythology)
- MIDAS drives the customer operations to the next level due to its full-environment at the control room: graphical status, interlocks, measurements and phasor diagrams;
- Moreover, the library focuses on engineering efficiency allowing engineers to do projects faster than the conventional method.
MIDAS Library – 800xA Library for Electrical Integration
Turning your substation into gold

- MIDAS presents the following features:
  - Full-information environment: tabs for graphical status, interlocks and measurements;
  - Up to 25 bay types, meeting several project requirements, for ABB or 3rd party IEDs;
  - Bay-typical philosophy, reducing engineering efforts for software development;
  - Same look-and-feel as Minerals Library (process control system), and graphical adaption to standards ANSI and IEC;
  - National Language Support (NLS) (English, German and Brazilian Portuguese already configured).
MIDAS Library – 800xA Library for Electrical Integration

Bay faceplates

- Up to 25 different Bay Types
MIDAS Library – 800xA Library for Electrical Integration
Bay Faceplate Description

- **Faceplate: Normal View**
  1. Alarm Control button
  2. Point of Control (Local, Central or Out of Service);
  3. Alarm List: all Alarms from Bay;
  4. Event List: all Events from Bay;
  5. Bay Configuration Manual;
  6. Operator Note
  7. Bay Graphical Element;
  8. Apply Button
  9. Cancel Button
  10. Position and Interlock Status for the Circuit Breaker and Isolators
- **Faceplate: Normal View**
  11. Position and Interlock Status for the Truck and Earth Switches;
  12. Reduced Measurements;
  13. Extended Info (Substation Alarm List, IED faceplate, etc);
  14. Operation Command Buttons;
  15. Equipment Selection Buttons;
  16. Point of Control Command Buttons;
  17. Maintenance Buttons (Reset commands);
  18. Default Apply Button;
  19. Additional Tabs: Interlock indications, Alarms and Measurements
Faceplate: Normal View

1. Opens the IED Faceplate
2. Show Trend Display
   - Voltage, Current, Active Power and Reactive Power
3. Substation Alarm List;
4. Substation Event List
   - Summary of all events occurred with the substation equipment
   - Helps the operator to figure out the reasons of a trip
Faceplate: Normal View

- Interlock to Close Open: Shows the interlock messages according to the switch selected
  - Circuit Breaker (up to 20)
  - Isolator and Earth Switch (up to 15)
  - Isolator only (up to 10)
  - Earth Switch only (up to 5)

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MIDAS Library – 800xA Library for Electrical Integration

Bay Faceplate Description

- Faceplate: Normal View
  - Measurements – up to 20 configurable measurements
  - 17 predefined measurements
    - Currents (Phase A, B, C and Neutral);
    - Voltages (Line AB, BC and CA);
    - Frequency;
    - Active Power, Reactive Power and Apparent Power;
    - Power Factor;
    - Active Energy, Reactive Energy and Apparent Energy;
    - Active Demand and Reactive Demand.
  - 3 additional measurements
Faceplate: Extended View

- Graphic measurements:
  - 5 predefined graphic bars
  - Current A
  - Voltage AB
  - Frequency
  - Active Power
  - Reactive Power

- The 1st additional measurement
MIDAS Library – 800xA Library for Electrical Integration
Bay Faceplate Description

- Faceplate: Extended View
- Phasor Diagram
  - Represents the phasor diagrams for energy quality analysis
    - Currents A, B and C
    - Voltages A, B and C
Faster troubleshooting & OHS
Challenges, Functionalities and Benefits

OPEX

1º
Remote Problem Solving

- Faster Troubleshooting
- Safety for Staff

2º
Optimized Systems

- Connect Substations
- Less Maintenance Costs
- Energy Efficiency & Asset Optimization
- Information Readily Available
- Reduces Different Technologies

CAPEX

3º
Optimized Engineering

- Faster Commissioning
- Reduced Wiring & Cabling
Benefit: OHS, Faster Troubleshooting
Remote Problem Solving

- **Improve safety for people**
  - Remove maintenance team from electrical danger

- **Faster Troubleshooting & Maintenance**
  - More information on automation level allows a quicker analysis and problem solving
Remote Problem Solving
Alarm list based on sequence of events

- **Description**
  - Alarms and events chronologically listed
  - Time synchronization protocols per IEC61850 standard (e.g., SNTP - 1ms resolution)

- **Benefits**
  - Easier understanding of cause/effect after an electrical fault, with information available remotely
Remote Problem Solving
Interlocks & Protections on faceplates

- **Description**
  - Easy access to information of active interlocks and fault protection signals
  - Information displayed on the graphical interface of the bay (faceplate), organized in different tabs

- **Benefits**
  - Same information about Interlocks and Protection locally and remotely, in a synthesized manner, allowing faster troubleshooting
Remote Problem Solving
Access to disturbances record files

• Description
  • Disturbance record files are automatically uploaded to the automation system, as they are created on IEDs
  • Online access to disturbance record a right-click away
  • Concentrated database for all IEDs on site

• Benefits
  • No need to go to the substation to upload or view files, allowing faster fault analysis
Remote Problem Solving
IED logic configuration & parameterization

- **Description**
  - Access to IED allows you to check and change logical configuration and parameterization
  - Communication to IEDs using IEC61850 network

- **Benefits**
  - Shortcut to logic and parameterization software a right-click away, allowing fast access, saving time from maintenance team
Remote Problem Solving
Online documentation access

• **Description**
  - Single line diagrams, logic diagrams, technical manuals, a right-click away
  - Better revision control of the available documentation for maintenance team

• **Benefits**
  - Maintenance team only goes to substation when needed, and get to the faulty place with the right amount of information in-hands
Optimized Systems
Less training and spare part costs

- **Less training cost**
  - Reduce costs in training due to one common system

- **Less spare part cost**
  - Optimize common spare parts from same architecture
Unified Process and Power Automation System

- **Description**
  - Process and Power Automation in the same plant control system sharing same database, engineering tools and operator stations.
  - Better standardization for new employees – single system to learn

- **Benefits**
  - Reduced costs in training due to common system knowledge
  - Optimize spare parts from same architecture running into reduced operating costs.
  - Collaborative environment reduces downtime
Optimized Systems
Energy Efficiency Support and Asset Optimization

• Optional Benefits with 800xA system
  • Energy Efficiency Support
    • Power consumption measurements for Energy Management.
  • Asset Optimization
    • Reduce maintenance costs through early problem detection of plant’s assets.
Optimized Systems
Information Integration

• Description
  • Electrical and Process data combined for a better asset management.
  • Integrated strategy for engineering, operation and maintenance.

• Benefits
  • Operators are able to have full insight into the correlation between power and process automation systems for optimized production and power consumption.
Optimized Systems
Reduced number of different technologies

- Information in the Right Place at the Right Time
  - Information readily available where you need it.

- Reduced number of different technologies
  - Control, supervision, protection and measurement with just one standard: IEC 61850
More Intuitive Systems

**Description**
- Displaying more, and relevant, data in well-designed interfaces facilitates the plant supervision, operation and maintenance.

**Benefits**
- Enable operators to take faster and more accurate decisions
- Faster troubleshooting for maintenance team
Optimized Systems
MV Motor Control with IEC 61850 (no gateways)

- **Description**
  - Process controllers can send GOOSE and MMS commands directly to MV Motors IED.

- **Benefits**
  - No need of hardwired or serial buses between Process and Power automation systems
  - Easier engineering, commissioning and maintenance
Optimized Systems
Reduce wiring & cabling

Integration **without IEC 61850** (hardwired)

- **Reduce wiring & cabling**
  - IEC 61850 allows IEDs to use digital infrastructure instead of wired approaches
Optimized Systems
Reduce wiring & cabling

Integration with IEC 61850 (digital)

- Reduce wiring & cabling
  - IEC 61850 allows IEDs to use digital infrastructure instead of wired approaches
Optimized Systems
Connect Substations

- Connect Substations
  - Substations in different locations integrated under the same system
  - Substations may be far away. Remote control and maintenance provides a real time monitoring at the control room allowing a much faster troubleshooting
Connect Substations

- **Conceição mine**
- **Middle mine**
- **Cauê mine**

*VALE – Iron mining – Itabira/MG, Brazil*

*Maintenance team goes to substation with the right information of the problem allowing a much faster troubleshooting*
Optimized Systems
Ethernet / Digital protocols (including GOOSE)

• **Description**
  - Connect substations from different and distant locations due to use of Ethernet / Digital protocols for communication between IEDs (IEC 61850)

• **Benefits**
  - Remote access allows maintenance team to only go to the substation when needed
  - Less cabling reduces capital expenditure
• **Less Upgrade Cost**
  
  • Upgrade to just one system: 800xA Extended Automation
  
  • System 800xA dramatically improves plant-wide productivity through the following powerful, integrated core functions:
    
    • Operations software
    
    • Engineering
    
    • Knowledge management / Batch management, Asset management
    
    • Control and I/O
Optimized Systems
Faster commissioning

• Faster commissioning
  • Typical philosophy for IED programming optimizes test procedures and reduces errors
Optimized Systems
Standardized Engineering

- **Description**
  - Engineering methodology for a faster project development
  - IEDTypicals pre-programmed templates allowing a faster configuration

- **Benefits**
  - Faster project development and commissioning reducing your project’s risks and decreasing maintenance efforts for mid to big-sized projects
With IEC 61850 and 800xA you can:

- Reduce capital investment and operational expenditure
  - CAPEX: Less cabling; Faster commissioning
  - OPEX: Faster troubleshooting; Less spare parts, training and upgrade costs; among others

- Increase availability of the energy supply to the process
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## References

### Mining

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Oil & Gas / Pulp & Paper

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Customer’s need
- Integrate Process and Power Automation on a common interface for a huge plant.
- 100 Mega ton per year of Iron ore.

ABB solution
- Fully Integrated Process and Power Automation: System 800xA
  - 100 AC800M for both Process and Power
  - 135 E-houses
  - 1000+ IEDs
  - Minerals and MIDAS library
  - GOOSE integration through AC800M
- Complete Portfolio from ABB
  - DCS, IEDs, E-Houses, LV & MV Switchgears, EOW
Customer’s benefits

- Unique information database for automation. Cross data between power and process.
- Traceability: historical information for data analysis and action planning
- Reduced number of operational staff needed, due to system integration and intelligence
  - 9000 to 2500 people
- Savings in installation costs with standardization of solution
  - 110 km reduction of control cables
- Savings with reduction of interruption of production time
- Less exposure to electrical hazard. Increased safety for maintenance team
  - 0 accidents goal

Reference
S11D, Iron Mining – VALE, Brazil

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