Communication and control technologies are evolving rapidly, delivering advanced capabilities, efficiencies and opportunities to industries. The digital substation leverages these transformative technologies to provide a future-ready system architecture to your substation of tomorrow while delivering lower cost and increased flexibility and reliability to your substation today.

**From traditional to future-ready digital substations**

The digital substation leverages advancements in Ethernet IP based communications and high speed fiber optics, openly available non-proprietary standards and the advanced capabilities of smart devices and sensors. Implementable in stages, it can provide a scalable migration path from traditional systems to an advanced architecture with the flexibility needed to support the changing demands of your evolving grid.

The opportunities now available with the digital substation through the convergence of information technology (IT) and operation technology (OT) provide a solution to many of the pressures faced by utilities today. Global standards have successfully bridged the separation of slow changing substation-specific applications with the benefits of fast advancing communications technologies. ABB's products and systems embody open standards to deliver the reality of the digital substation for both new and retrofit applications with new cyber security features to support your regulatory compliance.

Our future-ready approach to the digital substation ensures realization of immediate benefits while securing your investments for the future with seamless integration and interoperability.

![Example of migration to a digital substation](image-url)
Simplicity improves reliability and safety
A key benefit of the digital substation is the reduction of copper wiring required for traditional protection and control functionality. By digitizing these controls and interlocks, physical installations become much simpler, resulting in reduced complexity and points of failure, installation and commissioning efficiencies, cost reduction, and better overall system documentation.

As illustrated in the images below, wherein the number of conductors were reduced from 4,500 to 1,500 and the number of terminations dropped from 9,000 to 3,000, digital communications can reduce wiring by more than 50%.

Functional consolidation reduces footprint, hardware and infrastructure
Another key feature of the digital substation is the consolidation of relay functionality. As shown in the line differential protection scheme above, multi-function, multi-object capabilities result in the reduction of 14 traditional protection devices to only two advanced protection and control devices, and decreases the number of control room panels from three to one.

As a protection and control relay innovator, ABB is uniquely prepared to leverage the benefits of functional consolidation, yielding further installation and commissioning efficiencies while reducing the overall substation footprint and simplifying the engineering and design process.

Efficiency is fundamental
Commissioning activities themselves become more intuitive and simplified as well through the utilization of advanced commissioning and diagnostic tools. Consolidation of relay functions allows for more centralized troubleshooting while digitizing the substation allows for software based testing and commissioning.

Savings are real
The digital substation leverages the utility experience to provide digital solutions that deliver significant improvements over traditional approaches at a lower cost, both at implementation and throughout the life cycle.

Integrating NCIT’s in primary substation equipment like Disconnecting Circuit Breakers allows for significant reduction in the switchyard footprint. A 345 kv substation case study realized an 11% capital cost reduction on a $20 million substation.

Additional lifecycle savings can be realized through operational and maintenance improvements as a result of equipment supervision and information visibility.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost impact</th>
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<tbody>
<tr>
<td>Protection and control relays</td>
<td></td>
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<tr>
<td>Panel and cable engineering</td>
<td></td>
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<tr>
<td>Panel manufacturing and testing</td>
<td></td>
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<tr>
<td>Copper material, laying, connecting</td>
<td></td>
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<tr>
<td>Signal testing</td>
<td></td>
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<tr>
<td>Commissioning</td>
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<td>Retrofit outage time</td>
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<tr>
<td>Maintenance</td>
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<tr>
<td>New fiber cable material, laying, connecting</td>
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<tr>
<td>Up-front engineering</td>
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<tr>
<td>Project management/base concept design</td>
<td>no change</td>
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<tr>
<td>Total cost</td>
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</tbody>
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ABB’s digital substation portfolio
The ABB product portfolio for digital substations includes:
- Station level
  - HMI and operator workstations
  - SCADA interfaces
- Bay level
  - Relion® family of advanced protection relays and controllers
  - Hardened Ethernet switches
- Process level
  - Non-conventional instrument transformer (NCIT)
  - Stand-alone merging units

ABB’s innovations continue to evolve the digital substation. We are the leader in the installation and integration of NCITs into the digital substation architecture. You can rely on us to continue to lead in digital substation innovation, with a robust road map for integration of digital substation equipment concepts in traditional substation equipment.

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