COMPASS for digital substations
Smart features to enable digital substations

ABB’s high-voltage switchgear COMPASS can be equipped with control, protection and communication features for smooth integration into substation automation systems using IEC 61850.

Compact substations
COMPASS stands for COMpact Air-insulated SubStation. It’s a high-voltage switchgear module with ratings up to 170 kV. It is suited both for indoor and outdoor installations. Each COMPASS bay can integrate the following functionalities:
- Circuit Breaker (CB)
- Disconnectors and earthing switches (DS\ES)
- Current Transformer
- Voltage Transformer
- Surge Arresters

The transport of the module can be conducted with ordinary vehicles, it arrives pre-fabricated and pre-tested on site ready to energize in 24 hours, thus allowing a faster commissioning time of the whole substation. A COMPASS module requires up to 50% less space compared with a conventional air-insulated switchgear bay.

Easy service intervention
COMPASS can be serviced and inspected easily by lowering a section of the module which includes circuit breaker, current transformer and the mobile contact of the disconnector. The necessary operations are carried out on a ground level so safety and efficiency are ensured.

Digital technology
As an innovative substation concept COMPASS can leverage digital substation features.

COMPASS can be equipped with ABB’s Motor Drive and an intelligent local control cabinet for smooth integration into substation automation systems using IEC 61850-8-1, bringing the technology to continuously monitor the functions of the switchyard, whilst performing real-time simulation and diagnostics, allowing pro-active management of the life-cycle of the asset and remote service intervention.

For connection to the IEC 61850-9-2, SAM600 standalone merging units can be connected to conventional current or voltage transformers for protection and metering.
Substations of the future

ABB’s Digital Substation stands for a break-through innovation in substation technology. It is based on a seamless integration of state of the art IEC 61850 based control and protection Intelligent Electronic Devices (IEDs) with all relevant primary components and sensors of a modern substation. Traditional substations have always relied on copper cables wiring together primary equipment like circuit breakers, conventional current and voltage transformers and protection relays to control of the electricity. Interconnecting substation components with optical fiber replaces wiring them up with hundreds of individual copper cables. Not only are digital systems easier to install, they’ve proven to be safer, more reliable, and can reduce the quantity of copper in a substation by about 80 percent, a substantial cost saving.
Enabling digital substations

Motor Drive

**Precision and reliability**

Motor Drive makes use of a digitally controlled servo-motor that drives the contacts of a high-voltage circuit-breaker (CB) with the highest precision, while the energy necessary to enable the operations is stored in capacitors.

A quiet, compact drive for extended mechanical endurance. With only one moving part, the Motor Drive operates with precise, instantaneous and controlled motion. The dramatic reduction of mechanically moving parts, ensures outstanding reliability, confirmed by the achievement of 30,000 close/open operations.

Local Control Cabinet (LCC)

**Intelligence onboard**

The switchgear is equipped with an electronic local control cabinet which enables the high voltage switching bay (CB and DS\ES) to be digitally operated. Fully compatible with substation automation systems IEC 61850, Motor Drive collects and stores a wide array of data that can be consulted and analyzed locally and remotely.
### COMPASS

<table>
<thead>
<tr>
<th></th>
<th>123 kV</th>
<th>145 kV</th>
<th>170 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated Voltage</strong></td>
<td>123 kV</td>
<td>145 kV</td>
<td>170 kV</td>
</tr>
<tr>
<td><strong>Rated Frequency</strong></td>
<td>50 &amp; 60 Hz</td>
<td>50 &amp; 60 Hz</td>
<td>50 Hz</td>
</tr>
<tr>
<td><strong>Rated Normal Current</strong></td>
<td>2000 A</td>
<td>2000 A</td>
<td>2000 A</td>
</tr>
<tr>
<td><strong>Rated Short-Circuit Current</strong></td>
<td>40 kA, 1s</td>
<td>40 kA, 1s</td>
<td>40 kA, 1s</td>
</tr>
<tr>
<td><strong>Power Frequency Withstand Voltage</strong></td>
<td>230 kV</td>
<td>275 kV</td>
<td>325 kV</td>
</tr>
<tr>
<td><strong>Lightning Impulse Withstand Voltage</strong></td>
<td>550 kV (ph-gnd, ph-ph)</td>
<td>650 kV (ph-gnd, ph-ph)</td>
<td>750 kV (ph-gnd, ph-ph)</td>
</tr>
<tr>
<td><strong>(across open s.d.)</strong></td>
<td>550(+80) kV</td>
<td>550(+100) kV</td>
<td>750(+110) kV</td>
</tr>
<tr>
<td><strong>Min\Max Operating Temperature</strong></td>
<td>-30 °C+40 °C</td>
<td>-30 °C+40 °C</td>
<td>-25 °C+40 °C</td>
</tr>
<tr>
<td><strong>Insulating Gas</strong></td>
<td>SF₆</td>
<td>SF₆</td>
<td>SF₆</td>
</tr>
<tr>
<td><strong>Pollution level (IEC60815-1)</strong></td>
<td>e (Very Heavy)</td>
<td>e (Very Heavy)</td>
<td>e (Very Heavy)</td>
</tr>
<tr>
<td><strong>Leakage Rate</strong></td>
<td>&lt;0.5% / year</td>
<td>&lt;0.5% / year</td>
<td>&lt;0.5% / year</td>
</tr>
<tr>
<td><strong>Circuit Breaker Drive</strong></td>
<td>Spring / Motor Drive</td>
<td>Spring / Motor Drive</td>
<td>Spring / Motor Drive</td>
</tr>
</tbody>
</table>

### Legend

- 1. Local Control Cabinet
- 2. Earthing switch
- 3. Disconnector
- 4. Current Transformer
- 5. Breaking Chamber
- 6. Earthing switch drive
- 7. Circuit breaker drive
- 8. Disconnector drive