DOC ID: 9AKK107045A9180

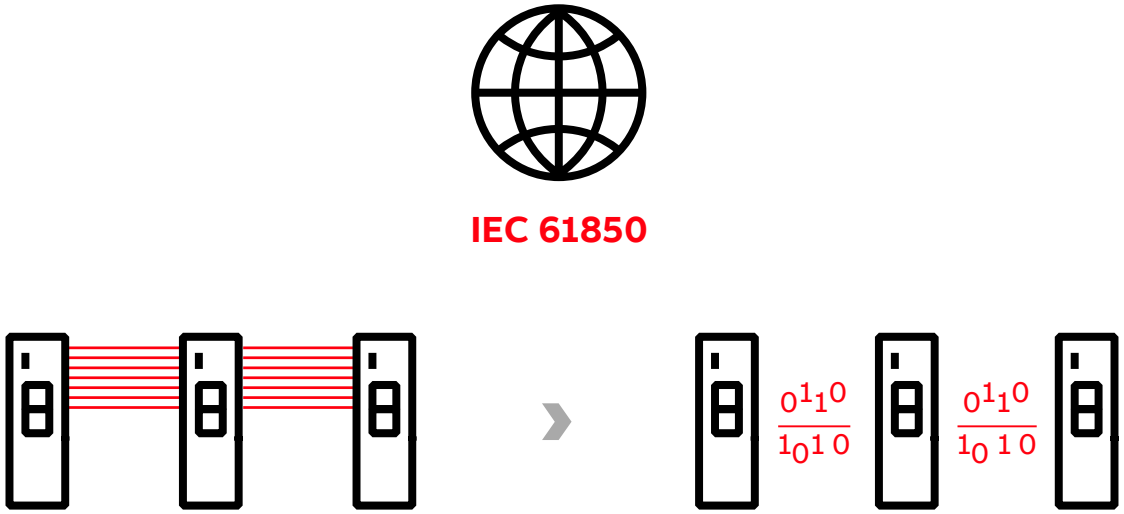
DISTRIBUTION SOLUTIONS

Digital medium-voltage switchgear

Benefits, offering and references

Contents

Digital switchgear for medium-voltage applications



Digital medium-voltage switchgear

Definition

Digital switchgear

What is it?

Definition

As a part of the ABB Ability™ portfolio of connected solutions, and based on ABB's proven switchgear technologies, a digital switchgear enables smart electrical networks that deliver power reliably and efficiently.

Digital switchgear combines the latest digital technologies within ABB's well-known and established medium- and low-voltage switchgear and brings increased flexibility, reliability, safety and efficiency in maintenance to ensure reduced OPEX. Additionally switchgear weight, footprint, and delivery time is reduced.

ABB's digital switchgear solutions integrate innovative protection, control and sensing devices, where all measurements, status and commands are reliably transferred on a real-time Ethernet communication bus over the Modbus TCP, OPC-UA or IEC 61850 protocols, as applicable.

Digital switchgear enables pro-active management of the medium- and low-voltage equipment throughout their entire life cycle. It enables easy plant system and operation integration to increase smart functionality, such as asset management, power management, real-time diagnostics and remote monitoring and services.

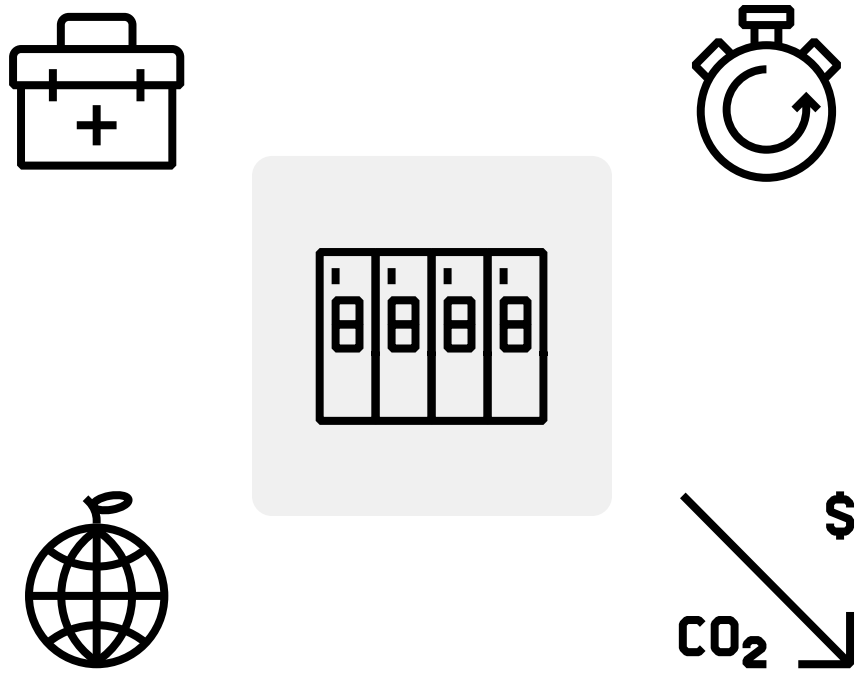
Benefits of digital switchgear

Benefits of digital medium-voltage switchgear

Overview

Main benefits

- Increased safety
- Energy-efficient and climate-friendly
- Increased flexibility
- Reduced footprint: 10% less space needed
- Optimized weight: up to 15% weight reduction
- Faster delivery time: up to 30% faster delivery
- Faster installation and commissioning: 25% reduction
- Increased switchgear reliability
- Increased system reliability



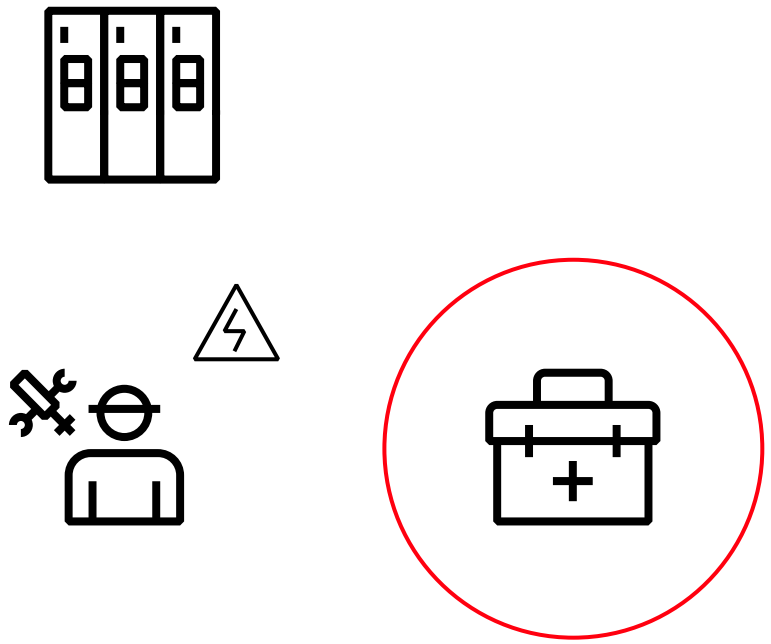
Benefits of digital medium-voltage switchgear

Increased safety

Safer switchgear operation

Sensor technology for current and voltage measurement ensures a safer working environment for personnel

- When testing current and voltage signal secondary circuits, personnel is not exposed to high-voltage
- Sensors are easier to work with compared to conventional
- Metering transformers, minimizing risk of human errors
- Less material exposed to high-voltage electrical stress, decreasing risk of failure



Benefits of digital medium-voltage switchgear

Energy-efficient and climate-friendly

Reduced environmental impact

Energy loss is minimized with the use of sensors

Reduced resource consumption in manufacturing

During 30 years of operation, 14 panels of digital switchgear (incl. 42 sensors, 1250 A)

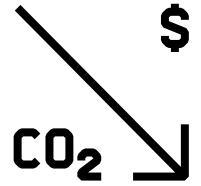
Lowers energy consumption up to 250 MWh

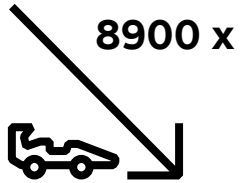
1 MW is equivalent to the power produced by 10 car engines, so the energy saved can power 8,900 Formula-E race cars from start to finish in one race

Saves up to 150 tons of CO_2

- the same amount as the emissions from a mid-size car driven for 1 250 000 km
- It takes 8200 trees one whole year to absorb that amount of CO_2

Cost savings: 51 380 EUR (with price of energy 20 cent EUR/kWh)





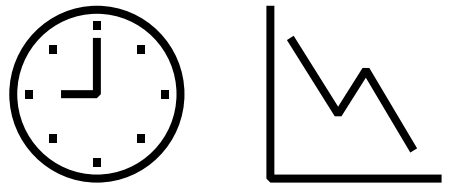
Benefits of digital medium-voltage switchgear

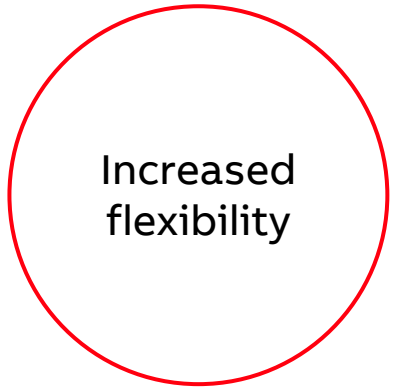
Increased flexibility

Adapt easily when requirements change

You can adapt the switchgear as the requirements in your network change, e.g. feeder current

- Digital switchgear can be adapted even at the final stage of the manufacturing process
- Changes can be applied via updating parameters or logics in a protection relay, no need to replace components
- IEC 61850 is future-proof standard, which ensures efficient future updates





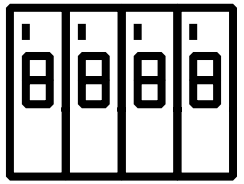
Benefits of digital medium-voltage switchgear

Reduced footprint

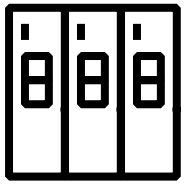
Reduced space requirement

Up to 10% reduced switchgear footprint

- Minimized switchgear footprint as generally the busbar metering cubicle(s) can be omitted, because voltage sensors are more compact and fit to be placed in another panel
- New generation of sensors are a perfect fit in switchgear, requiring less space and they weigh less



Conventional switchgear



Digital switchgear

10%
less space needed

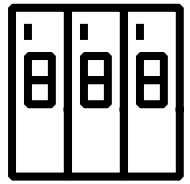
Benefits of digital medium-voltage switchgear

Optimized weight

Reduced switchgear weight

Lowered impact on site

- Metering cubicle is not needed
- Sensors are small and weigh less than current instrument transformers (CT) and voltage transformers (VT)
- CTs and VTs weigh 18-27 kg and sensors only 0.5-2 kg
- Weight reduction is up to 130 kg per bay
- Support structures and room layout can be adapted to lower weight



Digital switchgear

Up to **15%** weight reduction

Benefits of digital medium-voltage switchgear

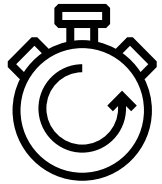
Faster delivery time

30% faster delivery

Shorter time from ordering to operation

Digital switchgear can be delivered faster thanks to

- One size fits all with sensor technology and is faster than engineering CT/VTs
- Range is wider and the same sensor can work for many different needs
- Sensors available on stock
- Need for configuration in hardware wiring is minimized, as changes can be made using the software logic in the protection relays



Up to **30%** faster delivery

30% faster delivery has been calculated for air-insulated switchgear, UniGear Digital

Benefits of digital medium-voltage switchgear

Faster installation and commissioning

Reduced time spent on installation and commissioning

Reduced time spent on installation and commissioning activities on site, thanks to:

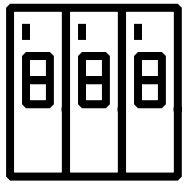
Fewer panels to be installed

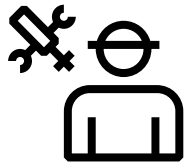
Less inter-panel cabling

Fewer components to test in the low-voltage compartment

- The switchgear is delivered pre-tested, which minimizes amount of time needed for commissioning
- For example, with a 30 panel switchgear line-up, the time saved on installation is up to two working days

If the customer requires modifications in the commissioning phase, they can be done quickly in the protection relays, generally not requiring hardware changes





25%
reduction

Benefits of digital medium-voltage switchgear

Increased switchgear reliability

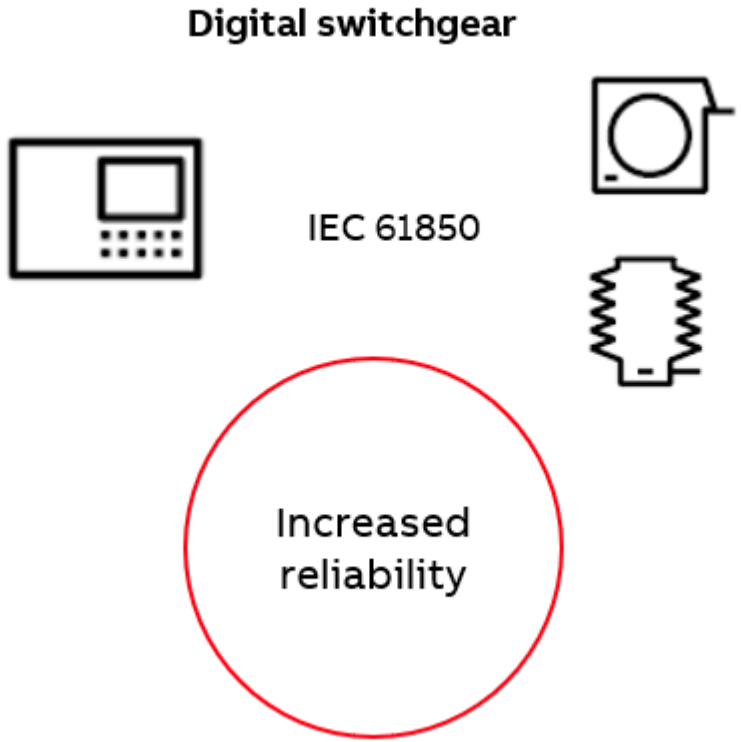
Increased reliability

Digital switchgear is based on ABB's well-known and established switchgear hardware platforms, but uses sensors

- With sensors less human interaction is required, which leads to decreased risk of malfunction
- Sensors are smaller, reduce risk of isolation degradation in the switchgear
- Sensors are immune against grid disturbances, such as ferro- resonance phenomena

Digital communication

- Permanent active supervision of wiring and signal transfer with IEC 61850 digital communication to enable fast and precise actions in case of failures



Benefits of digital medium-voltage switchgear

Increased system reliability

Benefits of IEC 61850 communication

Fast and reliable communication with IEC 61850,
the global standard for communication in substations

- In conventional switchgear, a complex scheme requires large amounts of wires to be connected between the cubicles; with digital switchgear a self-supervised communication cable passes that information from cubicle to cubicle
- Flexibility to adapt and change the switchgear, without costly and time-consuming physical re-wiring and changing panel hardware
- Using the programmable logic in the protection relays changes are done easily and faster
- GOOSE (Generic Object Oriented Substation Event) communication between the station equipment for improved speed and reduced switchgear cabling
- Fewer wires reduces risk of failures

Digital
IEC 61850
communication

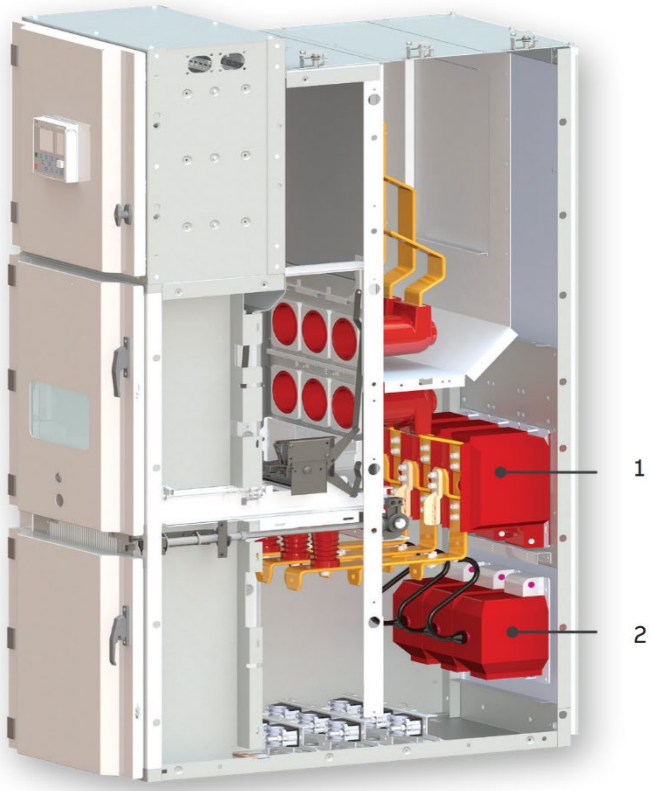
90%
fewer wires
for panel
interconnection

Digital switchgear

Instrument transfomers versus sensor technology

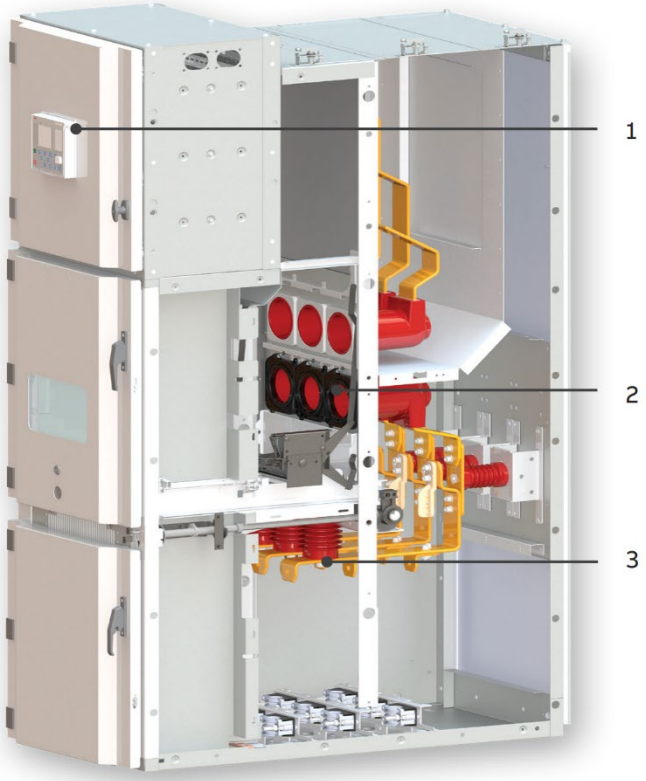
Conventional versus digital switchgear

Sensors require less space



Conventional UniGear with instrument transformers

1. Current transformer
2. Voltage transformer



UniGear Digital with sensors

1. Relion® protection relay with IEC 61850
2. Current sensor
3. Voltage sensor

Digital switchgear offering

ABB offering for digital medium-voltage switchgear

Air-insulated switchgear (AIS) for primary power distribution

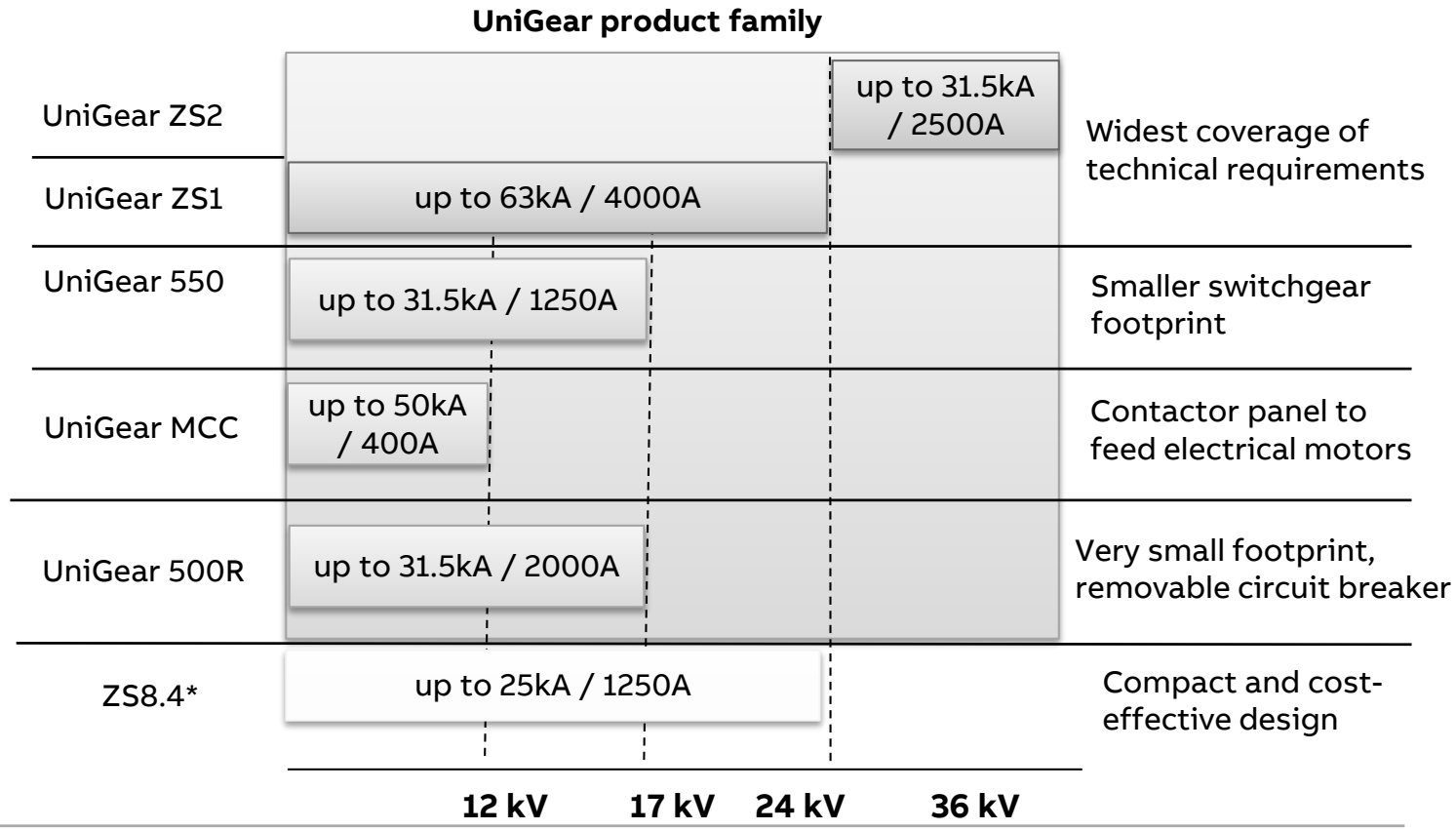
UniGear Digital

Covering ratings up to 24 kV; 63 kA; 4 000 A and 36 kV; 31.5 kA; 2 500 A

Proven safety: all designs internal arc tested

Motor control center (MCC) feeder with contactor

IEC standard



*available in select markets

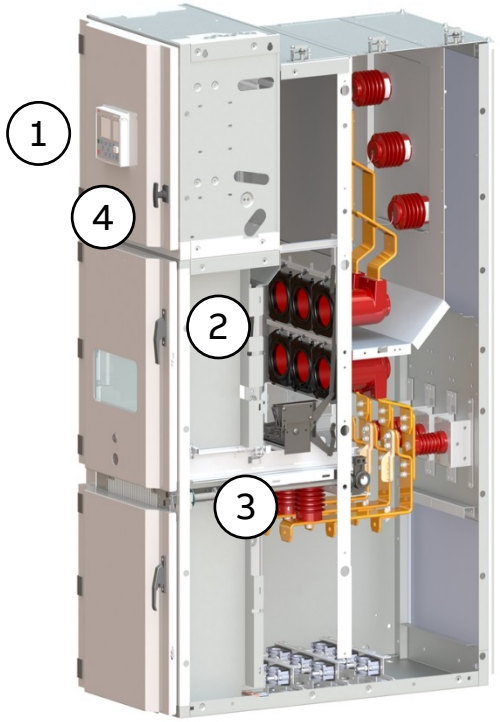
ABB offering for digital medium-voltage switchgear

Air-insulated switchgear (AIS) for primary power distribution

UniGear Digital

Same design platform as conventional UniGear panels

- Same robustness, safety and level of experience as conventional UniGear
- Simplified arrangement for current and voltage measurement, using sensors instead of conventional instrument transformers
- Conventional current and voltage transformers can be added for specific metering and protection requirements
- UniGear Digital features Relion 615 and 620 series protection and control relays
- Horizontal exchange of GOOSE and IEC 61850-9-2 sampled analog values reduces wiring and accelerates testing and commissioning time
- Easy integration to increase smart functionality, such as remote condition monitoring and asset health for electrical systems as part of ABB Ability offering



1. Relion protection relay with IEC 61850
2. Current sensor
3. Voltage sensor
4. MySiteCare for predictive maintenance (option)

Learn more: UniGear Digital web page

ABB offering for digital medium-voltage switchgear

Gas-insulated switchgear (GIS) for primary power distribution

ZX0	ZX0.2	ZX1.2	ZX2
– Up to 24kV, 1250A, 25kA – Not available in digital version	Up to 36kV, 2500A, 31.5kA With solid insulated busbar Compact design for applications with little real estate and light industrial applications Front access enables space saving wall-mounted installation	– Up to 40.5kV, 2500A, 31.5kA – Not available in digital version	Up to 40.5kV, 3150A, 40kA in conventional version Up to 36kV, 2500A, 40kA in digital version With gas-insulated busbar Flexible, modular design for all types of utility, industrial and transport applications Available in single and double busbar design without the need for additional space Innovative plug-in busbar connection enables safe, fast and easy installation

Learn more: ZX Digital web page

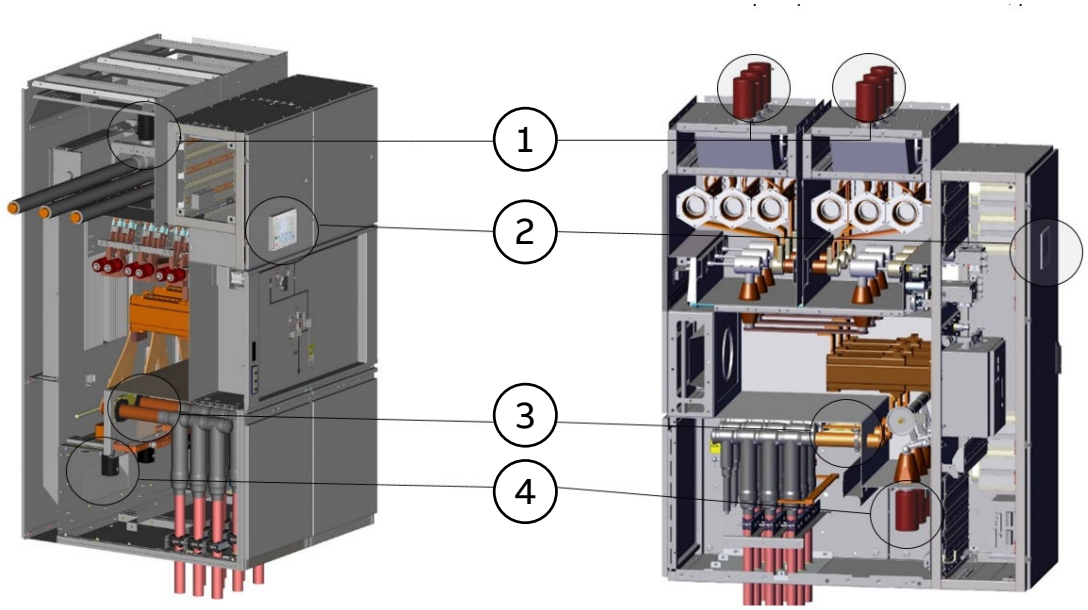
ABB offering for digital medium-voltage switchgear

Gas-insulated switchgear (GIS) for primary power distribution

ZX Digital

Same design platform as conventional ZX panels offering the same robustness, safety and user experience:

- Suitable for applications up to 36 kV
- Continuously self-supervised with GOOSE messaging over the IEC 61850-8-1 protocol
- ZX Digital features Relion 615, 620 and 640 series protection and control relays
- Increased safety during operation, commissioning and operation thanks to sensor technology
- Easy integration to increase smart functionality, such as remote condition monitoring and asset health for electrical systems as part of ABB Ability offering



1. Voltage sensor for busbar voltage measurement
2. Relion protection relay with IEC 61850
3. Current sensor
4. Voltage sensor for cable voltage measurement

Learn more: ZX Digital web page

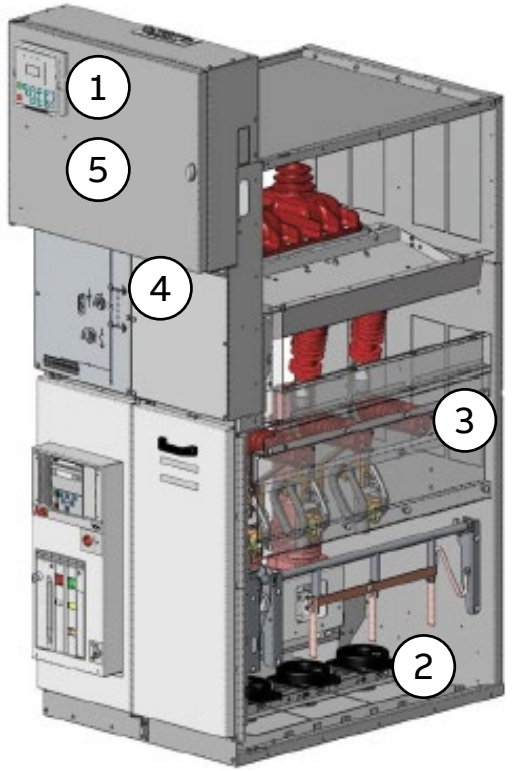
ABB offering for digital medium-voltage switchgear

Air-insulated switchgear (AIS) for secondary power distribution

UniSec Digital

Same design platform as conventional UniSec panels offering the same robustness, safety and user experience

- Suitable for applications up to 24kV
- UniSec Digital is available for all UniSec platform switchgear
- Low energy output of the sensors without saturation effect
- Continuously self-supervised with GOOSE messaging over the IEC 61850 protocol
- UniSec Digital features Relion 615 and 620 series protection and control relays
- Easy integration to increase smart functionality, such as remote condition monitoring and asset health for electrical systems as part of ABB Ability offering



1. Relion protection relay with IEC 61850
2. Current sensors
3. Voltage sensors
4. QR code to easily access digital documentation
5. MySiteCare for predictive maintenance (option)

Learn more: UniSec Digital web page

ABB offering for digital medium-voltage switchgear

Gas-insulated switchgear (GIS) for secondary power distribution

SafePlus Digital

A flexible digital solution based on proven components

ABB Relion® REC615 monitoring and control relay

- Controller and advanced protection (AR, MFA, IDMT)
- Conversion to IEC60870-5-104 upwards SCADA communication

ABB RIO600 modules

- I/O extension for REC615 in neighboring panels
- Including motor control and fault passage indication

ABB KEVCY combi-sensors for current and voltage

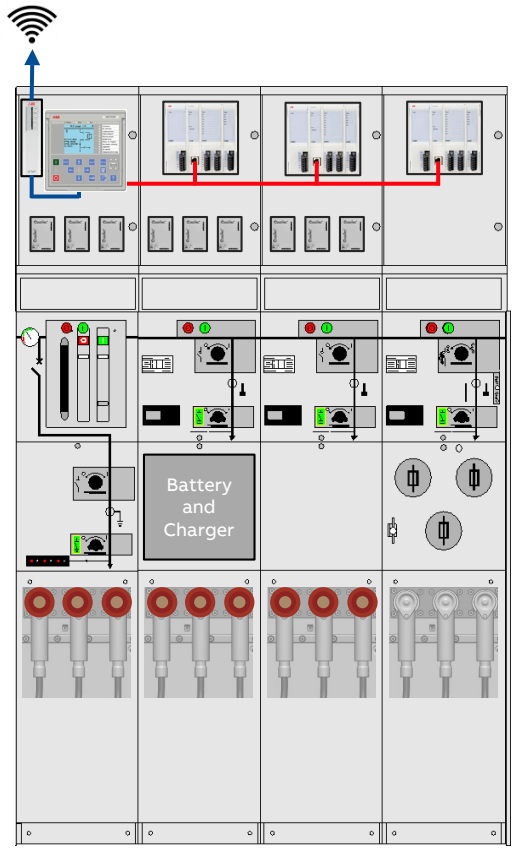
- Current and voltage measurement integrated into bushing for cable connection
- Essaillec test plugs for easy testing and measurements

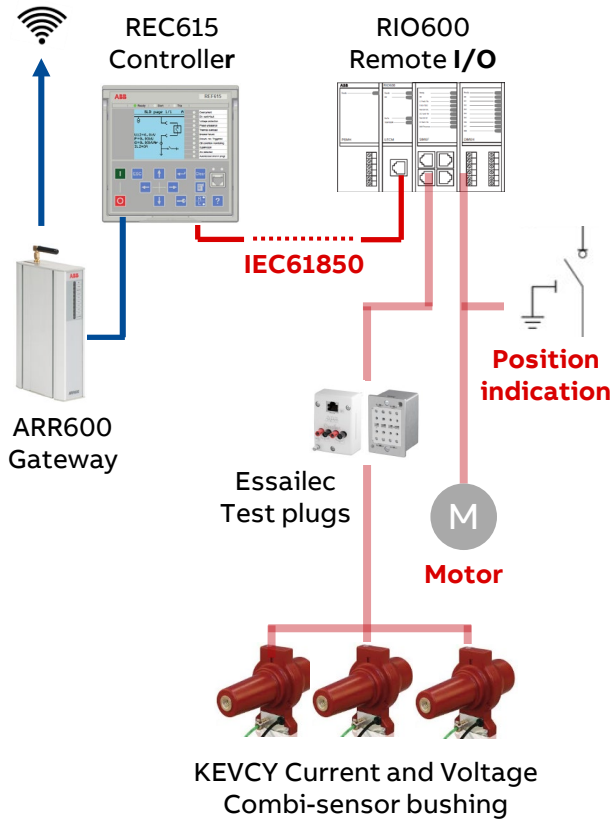
ABB Arctic wireless gateway

- Supervised GSM communication to upwards SCADA system

Battery and charger box

- Robust battery backup and smart charger for continuous operation

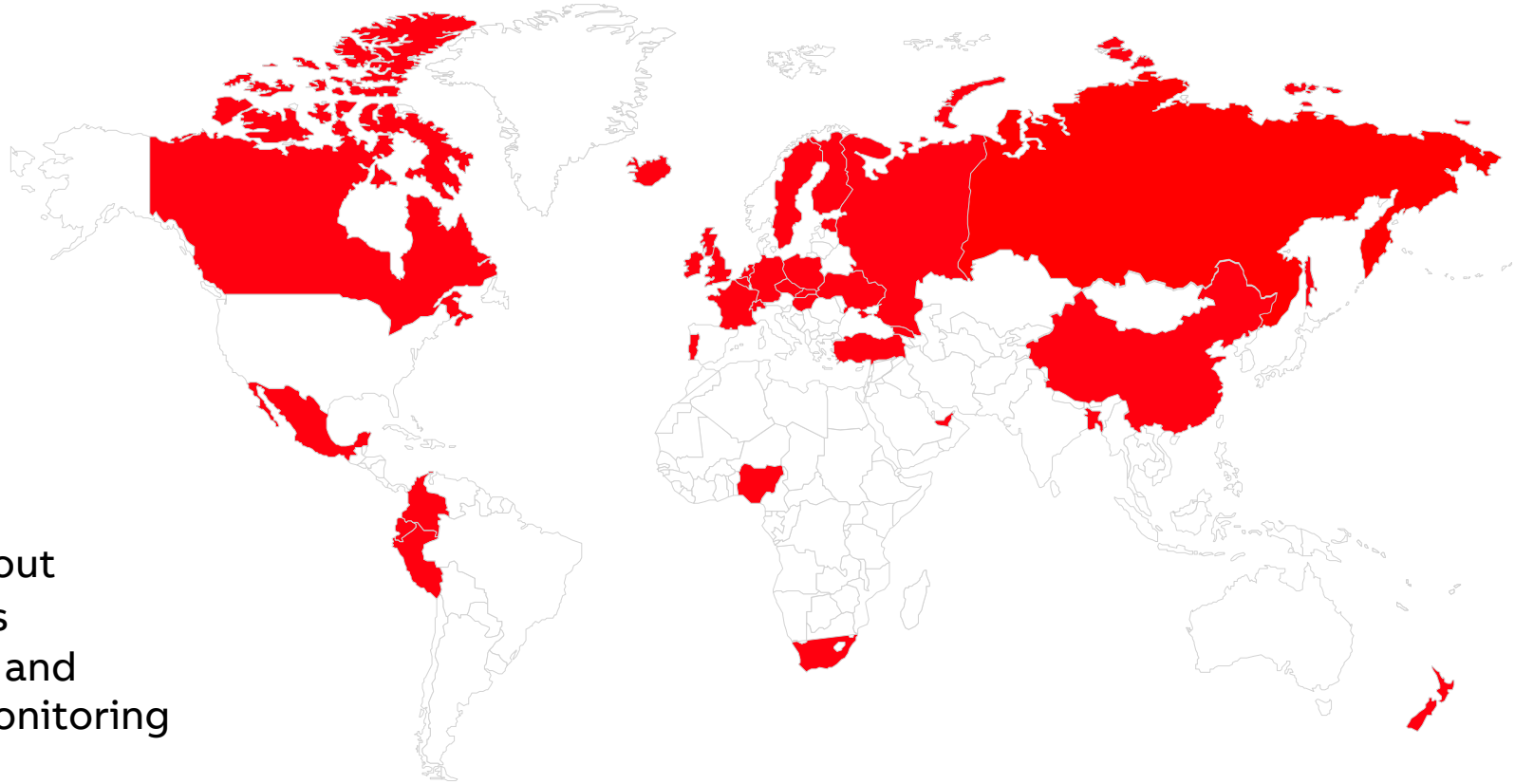




References

Digital medium-voltage switchgear

UniGear Digital references worldwide



By 2019, we have delivered about **10.500** digital UniGear panels containing sensor technology and protection solution, as well monitoring and diagnostic solutions

UniGear Digital to Telia's next generation data center

Case: Telia data center, Finland

Customer challenge

The importance of reliable power distribution within the data center environment to ensure service stability and uptime. Needed a scalable solution as requirements change. Customer also has a green focus and want to improve CO_2 footprint.

ABB solution

ABB's scalable, energy-efficient critical electrical distribution infrastructure solution with maximized redundancy and improved safety. The UniGear Digital solution helps reduce energy consumption by lowering losses in the power distribution.

Customer benefits

- Energy savings with sensors instead of conventional metering transformers
- Fast and precise actions in case of network failures possible with the permanent active supervision feature of IEC 61850
- Higher safety level for operators
- Switchgear is easily adapted when network requirements change

End customer: Telia Finland

Country: Finland

Segment: Data center

Products delivered: UniGear ZS1 digital switchgear, UnISec switchgear, MNS low-voltage switchgear, DPA 500 UPS system

Key result: Reliable power supply and power outage prevention

UniGear Digital to Helsinki's smart city district

Case: Helen Electricity Network, Finland

Customer challenge

In city networks it is crucial that faults are located quickly and accurately to avoid costly power outages. In a smart city, the importance of electricity is further amplified and constantly increasing, and even short power cuts are more damaging. For Helen, the new smart city district, Kalasatama, brings about the need to introduce smart and reliability-improving solutions.

ABB solution

UniGear Digital solution with more complex protection schemes, achieved with Relion® protection relays with IEC 61850 digital communication and GOOSE (Generic Object Oriented Substation Events) messaging; and with the use of sensor technology, the continuity of service is maximized.

Customer benefits

- Fast and precise actions in case of network failures possible with the permanent active supervision feature of IEC 61850
- Minimized inventory with sensor technology-based solutions, all application needs covered with only a few current/combi sensors
- Accurate measurements and easy data management
- Considerable energy savings and higher safety level for operators
- Reduced cost and minimized switchgear footprint
- Switchgear is easily adapted when network requirements change

End customer: Helen Electricity Network Ltd.

Country: Finland

Segment: Utility

Products delivered: UniGear ZS1 digital switchgear, Relion 615 series protection relays, indoor current sensor KECA, indoor voltage sensor KEVA, vacuum circuit breaker VD4, Remote Terminal Unit RTU560

Key result: Secure, efficient power supply. Power failures can be completely avoided or the duration massively reduced.

UniGear Digital to Siberian Coal Energy Company

Case: Vanino bulk terminal, Russia

Customer challenge

A secure and reliable power distribution solution to ensure minimized maintenance needs and downtime. A flexible and compact switchgear installation, which would allow them to make fast load changes and also allow remote operation. A compact and robust eHouse construction that would withstand harsh weather conditions.

ABB solution

Energy-efficient and compact eHouse with UniGear Digital. To ensure fast and reliable communication, the solution uses IEC 61850 and GOOSE communication between the equipment. IEC 61850 communication is also used for remote monitoring and control of the substation from the main control room.

Customer benefits

- Minimized switchgear footprint, as the metering cubicle(s) can be omitted and spare panels can easily be configured for future applications
- A compact and robust switchgear design, and reduced time needed for commissioning and installation with sensor technology
- Supply of a completely integrated and pre-tested eHouse that reduced energization and commissioning time on site

End customer: Siberian Coal Energy Company (SUEK)

Country: Russia

Segment: Mining and minerals

Products delivered: UniGear ZS1 digital switchgear, Relion® 615 series protection relays, Vacuum circuit breaker VD4, Indoor current sensors KECA, Indoor voltage sensors KEVA, all mounted in an eHouse

Key result: Reliable power supply and power outage prevention

Photo courtesy of SUEK

UniGear Digital to a petrochemical plant

Case: Sasol, South Africa

Customer challenge

Ensured plant and process continuity when complete substations needed to be replaced within a limited time frame. An alternative substation solution to ensure personnel safety and avoid damage to equipment.

ABB solution

Flexible power supply solution: a mobile substation, built on UniGear switchgear with Relion relays and ABB's advanced sensor technology. To allow for easy relocation, this equipment was placed in an E-house and installed on a mobile truck trailer

Customer benefits

A robust and flexible solution to meet customer's need.

Reduced engineering time for cost-efficiency.

End customer: Sasol

Country: South Africa

Segment: Oil, gas and chemicals

Products delivered: UniGear ZS1 , Relion 615 series protection relays, Remote I/O unit RIO600, Vacuum circuit breaker VD4, Indoor current sensors KECA C, Indoor voltage sensors KEVA B, Arc fault detection system REA, truck trailer mounted E-house

Key result: Reliable power supply and power outage prevention

UniSec Digital to Switzerland’s largest data center

Case: Safe Host 2, Switzerland

Customer challenge

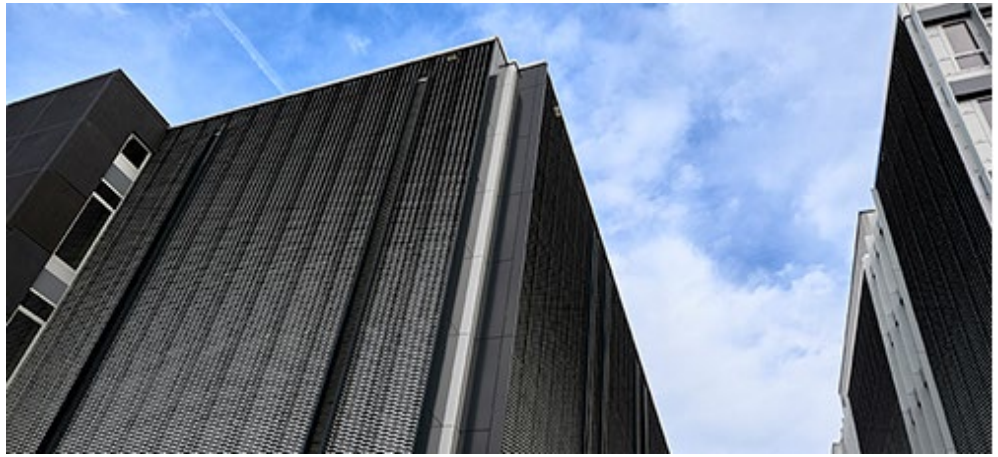
A flexible and energy-efficient medium-voltage solution to ensure continued operation at the data center. The solution was also to meet the stringent requirements set for safety and internal arc protection, and offer optimized total cost of ownership (TCO). The customer also has a firm commitment to making environmentally sound choices.

ABB solution

Energy-efficient and modular UniSec switchgear for scalability, and sensor technology to maximize the continuity of service. Reliable communication with IEC 61850. To ensure safety, the switchgear meets the IAC AFLR internal arc classification.

Customer benefits

- Flexibility to expand the power system and seamlessly add more switchgear panels
- Accurate measurements and easy data management in the power system with sensor technology
- Native IEC 61850 communication between the station equipment for improved speed and reliability of the power system and reduced switchgear cabling
- Energy savings with sensors instead of conventional metering transformers



End customer: Safe Host

Country: Switzerland

Segment: Data center

Products delivered: Air-insulated switchgear UniSec, Relion 615 and 620 series protection and control relays, indoor vacuum circuit breaker VD4, KEVCD combisensors, Remote Terminal Unit RTU 540, Vacuum cast coil transformers

Key result: Reliable power supply and power outage prevention

ZX Digital to a green substation

Case: SÜC Coburg, Germany

Customer challenge

For renewal of their Schweighof substation, SÜC Coburg was looking for a solution meeting the requirements of increased flexibility and safety during commissioning and operation, as well as a lower energy consumption.

ABB solution

ZX2 AirPlus Digital supports SÜC Coburg to employ environmentally-friendlier technology while the switchgear panels increase the reliability of the power supply in its power distribution grid. An innovative technology in the market since 2015, AirPlus is a sustainable alternative to SF_6. AirPlus insulation gas reduces the global warming potential (GWP) by almost 100 percent. ZX2 AirPlus is designed for primary power distribution to ensure grid reliability, efficiency and safety. It has the same compact dimensions as a regular ZX2 switchgear.

Customer benefits

The ABB solution is

- Safe: The switchgear meets the IAC AFLR internal arc classification
- Smart: REX640 features an innovative touch-screen as HMI
- Sustainable: GWP* of AirPlus is <1

End customer: SÜC Coburg

Country: Germany

Segment: Utility

Products delivered: Gas-insulated switchgear ZX2 with AirPlus™, Relion REX640 series protection and control relays, indoor vacuum circuit breaker VD4X

Key result: Safe and sustainable power distribution

*GWP = Global warming potential

SafePlus and REX640 to German utility

Case: Stadtwerke Münster, Germany

Customer challenge

A compact switchgear for secondary distribution applications, with two deviations was needed. It had to be based on circuit breakers, and distance protection was a requirement.

ABB solution

Equipping ABB's compact SafePlus switchgear with REX640 creates a unique switchgear solution. Combining advanced protection technology with sensor technology for current and voltage measurements, the focus being on secondary power distribution applications, allows Stadtwerke Münster to meet their changing network requirements.

Customer benefits

ABB's sensors ensure perfect linearity throughout the whole measurement range. This allows high-accuracy current and voltage measurements, which maximizes the performance of advanced protection functionality such as distance protection. The sensors are compact, lightweight and immune to saturation. Stadtwerke Münster was able to reduce switchgear dimensions by 25 percent as no metering panel was required.

End customer: Stadtwerke Münster

Country: Germany

Segment: Utility

Products delivered: SafePlus and Relion® REX640

Key result: Safe and sustainable power distribution


ABB