

ABB ABILITY™ AIS FOR MV – UNISEC DIGITAL

UniSec Digital

The proven solution for air-insulated medium voltage secondary distribution switchgear up to 24kV, 1250A, 25kA



- Safe and reliable solution
- Energy, space and weight savings
- Reduced delivery time and possible late customization
- Lower environmental impact
- Increased efficiency through condition monitoring

—
Power drives everyday life and distribution networks must comply with very strict requirements in terms of availability of energy supply, safety and reliability.

UniSec Digital is the ABB solution that provides full connection and communication within the network while meeting the latest demanding distribution requirements.

UniSec Digital allows you to face many of the practical challenges in today's complex applications. You simply have less to worry about in your electrical network.

Contents

| | |
|----------------|---|
| 004–005 | UniSec Digital solution An answer to the latest demanding requirements |
| 006–009 | UniSec Digital solution Customer benefits |
| 010 | UniSec Digital solution Protection and communication components |
| 011–012 | Intelligent Electronic Devices (IEDs) Protection and control relay overview |
| 013–014 | Monitoring and diagnostic Continuous monitoring of the health status of the switchgear |
| 015–016 | Current and voltage sensors Accuracy of measurements |
| 017 | Digital documentation Customer interactive support for complete UniSec platform |

UniSec Digital solution

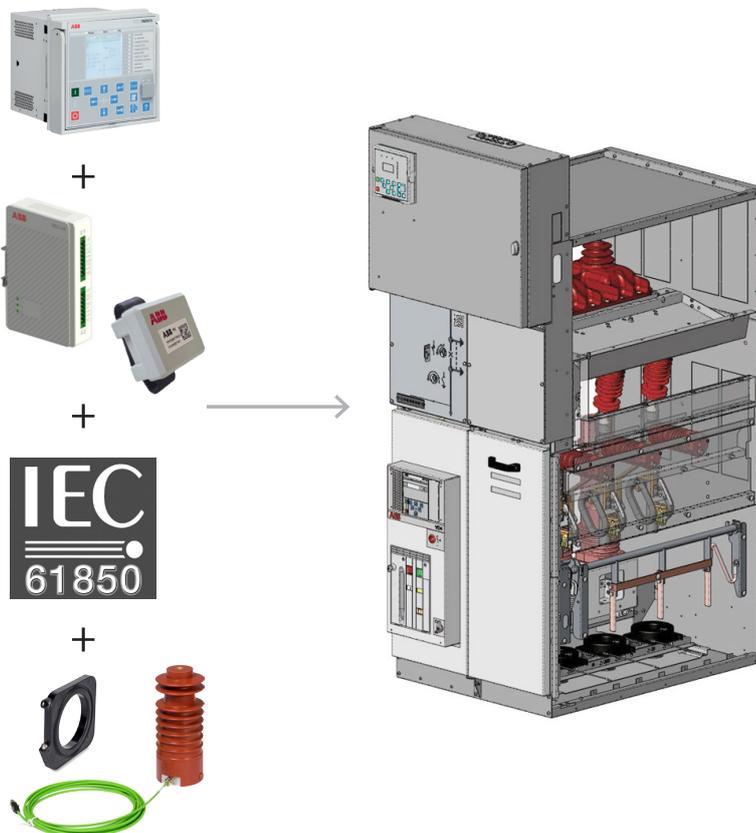
An answer to the latest demanding requirements

Protection, control and automation proven concept

With all the new requirements and challenges that distribution networks must face, medium voltage switchgears are playing an increasingly important role in the grid.

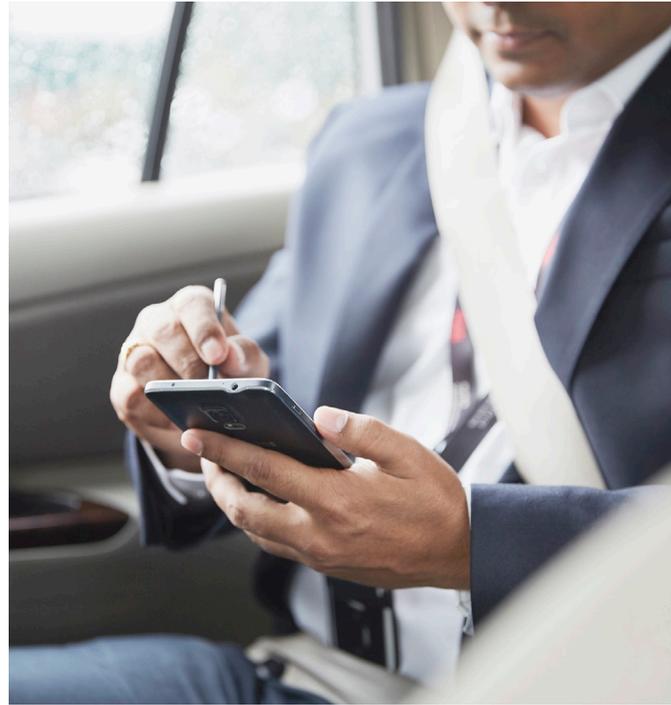
Evolving distribution networks require medium voltage switchgears that are more efficient, safe, smart, reliable and environmentally friendly, as well as being easy to engineer, install and operate. Medium voltage switchgears used for the distribution of electrical energy are a very important part of an electrical network since their function is to ensure uninterrupted power supply to the whole network.

The ABB answer to the latest demanding requirements in distribution networks is the UniSec Digital: it is based on a well proven concept now available also for medium voltage secondary distribution switchgear, which offers significant improvements for customers. The UniSec Digital solution applies to the safe and reliable ABB UniSec medium voltage switchgear family for secondary distribution. UniSec switchgear is used to distribute electric power in a variety of demanding applications such as data centers, utility substations, buildings and infrastructure, industries, off-shore platforms, ships and mines.



Applications

For grids, industries, data centers, buildings and infrastructure



UniSec Digital solution

Customer benefits

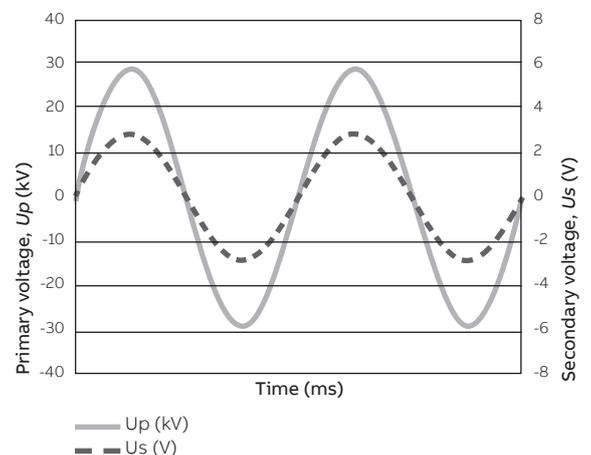
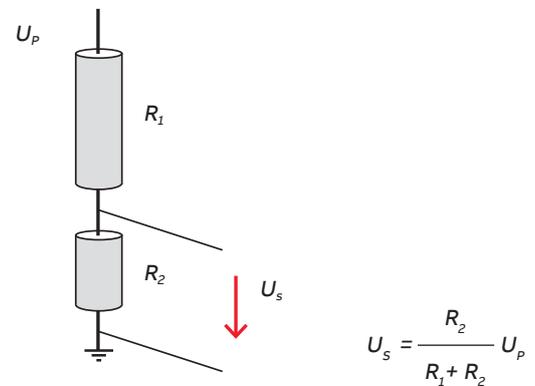
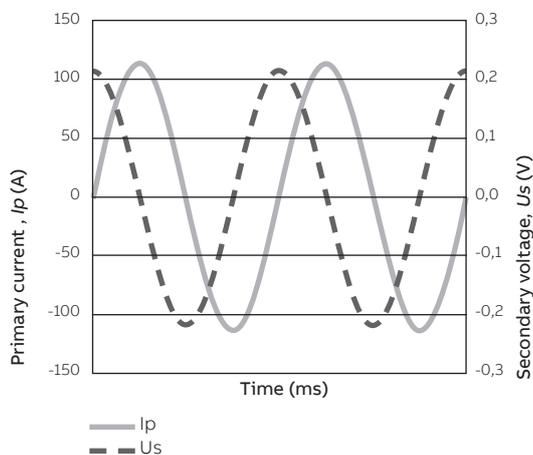
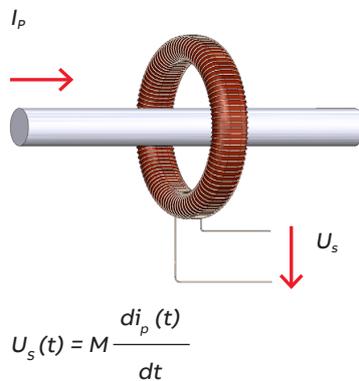
The digitalization of UniSec is based on five key strengths



Safety

- The low energy analog output of the sensors prevents the open current transformer secondary circuit hazards of traditional instrument transformers
- Thermal and environmental sensors increase personnel safety, thanks to visual and remote monitoring on external devices (HMI or App), keeping the switchgear energized
- Communication with IEC 61850 protocol reduces the number of wires installed and makes switchgears easier to engineer, build and service
- GOOSE (Generic Object Oriented Substation Event) messaging via the IEC 61850 protocol ensures the switchgears are continuously self-supervised with enhanced error detection
- Safety of the measures

- The output signal from the current sensor is proportional to the derivative of the primary current and this ensures reliable measurements without the saturation effect. It conforms to IEC 61869-10
- The voltage sensor is a passive resistive voltage divider and provides dependable measurements without the ferroresonance effect, in accordance with IEC 61869-11





Savings

- Cost and time maintenance saving by up to 40% of the overall total cost of ownership thanks to the condition monitoring
- Space saving thanks to limited sensor dimensions
- Less weight thanks to limited sensor size
- Fewer parts to keep in stock since the sensors cover a broad application range
- Significant energy saving during operation thanks to the negligible power consumption of the sensors. Potential savings of up to 250MWh over 30 years, according to the calculations in the table

| | Feeder | CTs | Number of panels | Number of CTs | Power consumption | Energy consumption in 30 years |
|----------------------------------|------------|-----------|------------------|---------------|-------------------|--------------------------------|
| CT w/1 A rated secondary current | Incoming | 1000/1/1A | 2 | 6 | 140 VA | 36 698 kWh |
| | Outgoing 1 | 200/1/1A | 8 | 24 | 448 VA | 117 776 kWh |
| | Outgoing 2 | 100/1/1A | 4 | 12 | 102 VA | 26 724 kWh |
| | Total | – | 14 | 42 | 690 VA | 181 198 kWh |
| CT w/5 A rated secondary current | Incoming | 1000/5/5A | 2 | 6 | 172 VA | 45 244 kWh |
| | Outgoing 1 | 200/5/5A | 8 | 24 | 629 VA | 165 208 kWh |
| | Outgoing 2 | 100/5/5A | 4 | 12 | 179 VA | 47 124 kWh |
| | Total | – | 14 | 42 | 980 VA | 257 576 kWh |
| Sensor | Incoming | 1000/1/1A | 2 | 6 | 0,0000 VA | 0,0000 kWh |
| | Outgoing 1 | 1000/1/1A | 8 | 24 | 0,0000 VA | 0,0000 kWh |
| | Outgoing 2 | 1000/1/1A | 4 | 12 | 0,0000 VA | 0,0000 kWh |
| | Total | – | 14 | 42 | 0,0000 VA | 0,0001 kWh |

UniSec Digital solution

Customer benefits



Speed

Reduced lead times with UniSec Digital

- The secondary characteristics of the sensors need not be defined and this speeds up the engineering stage
- The sensors cover a broad range of primary loads, allowing stocks to be used and improving lead times

Reduced time to repair

- Faster detection and location of thermal and environmental problems thanks to condition monitoring

Last minute customization and changes with UniSec Digital

- Thanks to the technology used, loads can be set at the last minute by simply changing the software parameters of the Intelligent Electronic Devices (IEDs)
- Thanks to the ABB Relion® relay platform, the switchgear wiring need not be modified. Just update the software within the IED logic

Traditional voltage transformers in tens of variants



Traditional current transformers in hundreds of variants



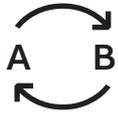
Current and voltage sensors in 2 variants
(combisensors for mounting on DIN rail are also available)



Sustainability

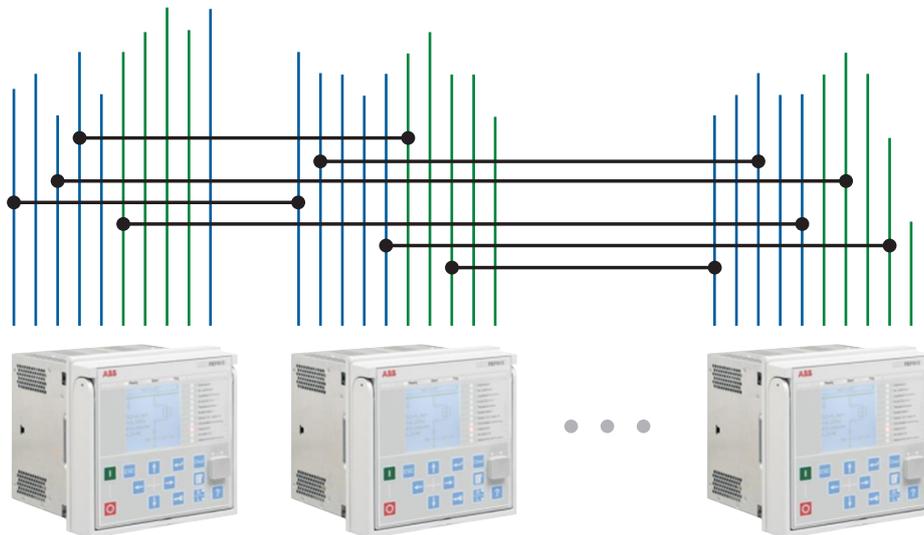
- Universal standard IEC 61850 communication protocol allows the system to be expanded in the future
- Thanks to sensors with broad range capability, future plant load changes can be handled without mechanical reconfigurations or having to replace components, since only a simple modification to the software settings is required, thereby reducing switchgear downtime to a significant extent

- Fewer live parts and materials and less chance of failure reduce aging stress, potential outages and troubleshooting costs
- UniSec Digital has a lower impact on the environment since it requires less material, thereby reducing the amount of waste produced and significantly reducing the CO2 levels by up to 150 tons.



Simplicity

- Temperature sensors with wireless communication without need of wiring in the switchgear
- Fewer wires to install, commission and maintain thanks to IEC 61850 communication protocol and GOOSE messaging
- The presence of fewer wires that could possibly fail and fewer live parts increases reliability



- Conventional approach
 - Twinning the devices must be performed individually per signal

Communication Network (Ethernet)



- Horizontal GOOSE communication
 - Number of interconnections is equal to number of devices

UniSec Digital solution

Protection and communication components

The 3D drawing below shows how the components are configured to enable digitalization to be implemented in UniSec switchgear

A - Protection relay

IEC 61850 communication
GOOSE messaging
Circuit breaker condition monitoring
Internal Arc time reduction (Option)



B - Monitoring and diagnostic

Local HMI and mobile App



C - Digital documentation

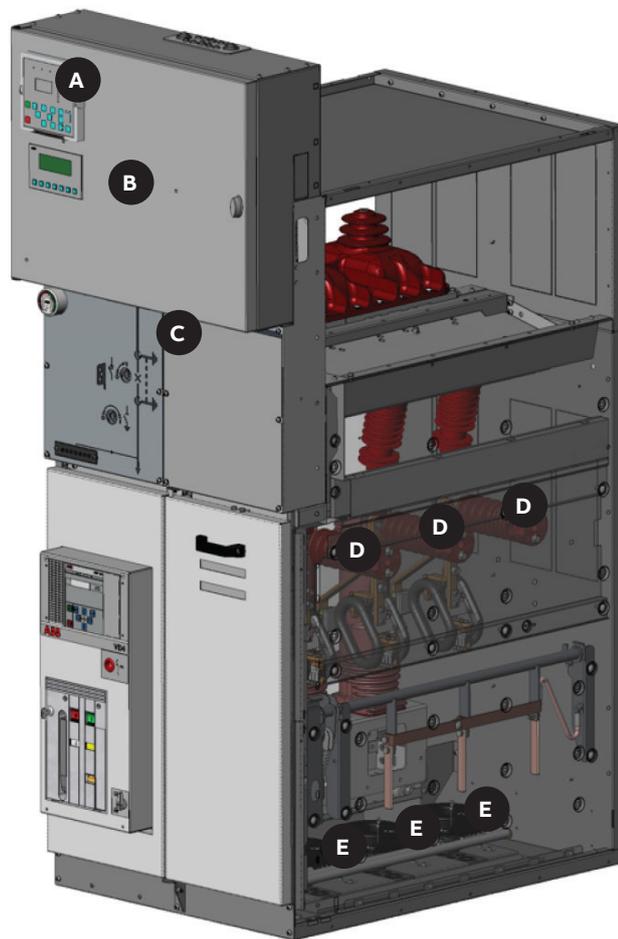
Available via QR code



D - Voltage sensors



E - Current sensors



The complete UniSec platform is available in the Digital version with maximum ratings

| Rated voltage | Rated current | Rated short time withstand current | Internal arc withstand current |
|---------------|---------------|------------------------------------|--------------------------------|
| up to 24kV | up to 1250A | up to 25kA / 3sec | up to 25kA / 1sec |

Intelligent Electronic Devices (IEDs)

Protection and control relay overview

IEC 61850 communication

Relion IED products implement the core values of standard IEC 61850, since they provide interoperable, future-proof solutions. By using these products, customers benefit from ABB leading-edge technology, global application know-how and experienced support network. Relion technology is a trailblazer in the field of protection and control in power systems. These products are continuously improved to meet market requirements and are the result of the vast experience ABB has acquired in developing successful protection and control relays.



ABB Relion 615 Series
The ABB Relion 615 Series can also be used if only current sensors are required and without IEC 61850 Communication (modbus).

GOOSE (Generic Object Oriented Substation Event) messaging

Relion products are capable of running multiple communication tasks, including horizontal GOOSE messaging using a process bus inside the switchgear.

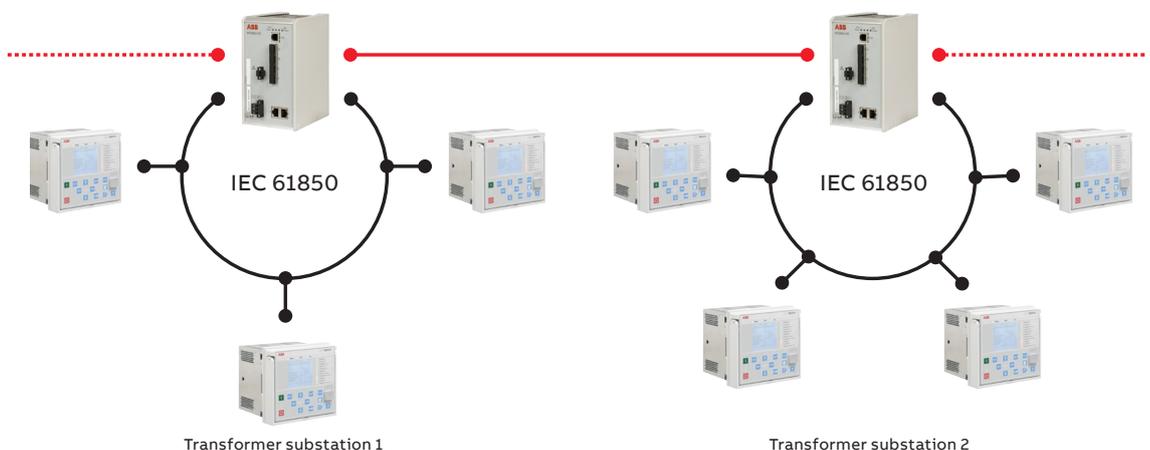
Topology

Standard IEC 61850 integrates redundancy functions via the HSR (High-available Seamless Redundancy) protocol of standard IEC 62439. PRP (Parallel Redundancy Protocol) can be also implemented. With HSR, recovery time after a fault occurs is nil or at "zero time". In addition, thanks to HSR redundancy, faults in a component of the HSR network (relay, switch, connection, etc.) do not prevent information from immediately reaching its destination.

Circuit Breaker Monitoring

Circuit-breaker condition monitoring SSCBR1 supervises the apparatus status based on the connected binary input information and the measured current levels. SSCBR1 introduces various supervision methods. Circuit-breaker condition monitoring function SSCBR is used to monitor different parameters of the circuit breaker. The breaker requires maintenance when the number of operations has reached a predefined value.

Redundancy with HSR protocol



— Optical fiber (network 1)
— Copper Ethernet cable (network 2)

Intelligent Electronic Devices (IEDs)

Protection and control relay overview

Reduced internal Arc duration (option)

When an arc fault initiates, it produces a lightning flash and heat, which create an explosive expansion of air.

Although heat and explosive forces represent the majority of risks in an arc flash, it is the lightning flash that holds the key to ultra-fast detection by Relion 615 relays.

Long fiber-optic sensors installed in the various medium voltage compartments, capture the sudden intense light and, at the speed of light, report the incident to the relay housed in the low voltage compartment.

The relay then causes the circuit breaker to immediately open. Regarding protection against false trips, the system only detects the lower part of the spectrum, including the ultraviolet part. It is also connected to current sensors and can

therefore combine both data items. This minimizes the likelihood of injuries to personnel and damage to the components, while allowing power distribution to be smoothly and safely restored. The advantage of the Relion solution is that no additional devices are required other than the protection and measuring relay.

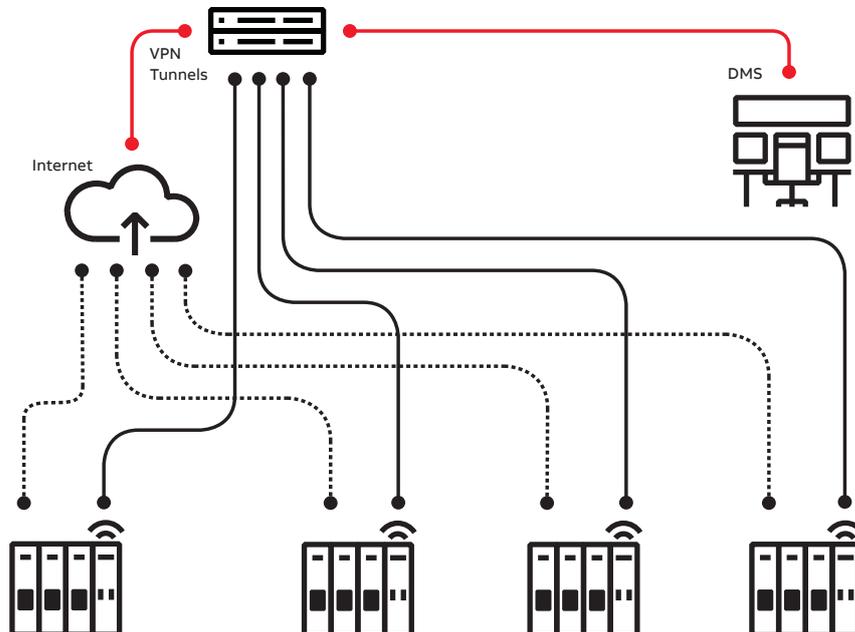
Wireless mobile network

ARG600 wireless gateway (option)

ARG600 can be combined to create reliable, efficient and secure wireless communication solutions. It uses the public mobile telephone networks, which offer excellent worldwide coverage at a reasonable cost. ARG600 can be used instead of the Ethernet switch or in addition to it (as a stand-by communication network).



ABB ARM 600 - M2M gateway VPNs Bridge



Monitoring and diagnostic

Continuous monitoring of the health status of the switchgear

Continuous monitoring of the health status of the switchgear and condition-based maintenance are the best approach for electrification system management.

Developed by ABB for this purpose, UniSec Digital monitoring system is based on on-premise and remote monitoring and diagnostic of switchgears and related assets and apparatus. It allows to the users to supervise equipment conditions and performance trends; failures can be prevented and maintenance can be accurately planned to guarantee the service continuity, eliminating schedule based servicing activities.



Main features and benefits

- to check if the installation activities have been properly carried out
- to easily track parameters to verify that the assets are in good health and working fine

- to have the feedback if performances are going out of range
- to find "out of range" measurements to focus recovering activities for specific root cause
- to guarantee service continuity, properly planning long term maintenance
- to increase personnel safety, thanks to visual and remote monitoring on external devices (HMI or App), keeping the switchgear energized
- to reduce the cost and time of maintenance and the risk to have shut-down

The solution is designed to monitor the following parameters:

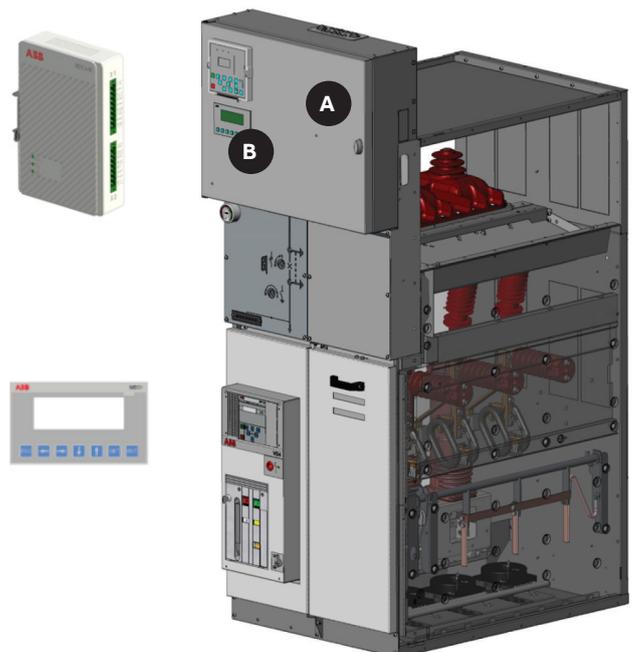
- Temperature of the main circuit of the switchgear: cable, busbar and circuit breaker connection
- Humidity and temperature of the cable compartment
- Gas pressure of GSec switch disconnecter or HySec apparatus

A - MDC4-M Concentrator

The system is based on the MDC4-M concentrator that gets all the inputs from the sensors, then the measurements and assets conditions can be read in real time from the local HMI or nearby the switchgear on the mobile App or sent to SCADA via Modbus

B - LHMI

Each MDC4-M data concentrator has its own local HMI available on the low voltage compartment: it eases the User Interface displaying all the measurements from the sensors. In addition, it's possible to visualize data via Mobile App



Monitoring and diagnostic

Continuous monitoring of the health status of the switchgear

C - Temperature monitoring

Temperature monitoring is based on wireless sensors.

The sensors can be positioned and the temperature measurement can be provided in different switchgear points, as:

- cables
- busbar
- circuit breaker connection



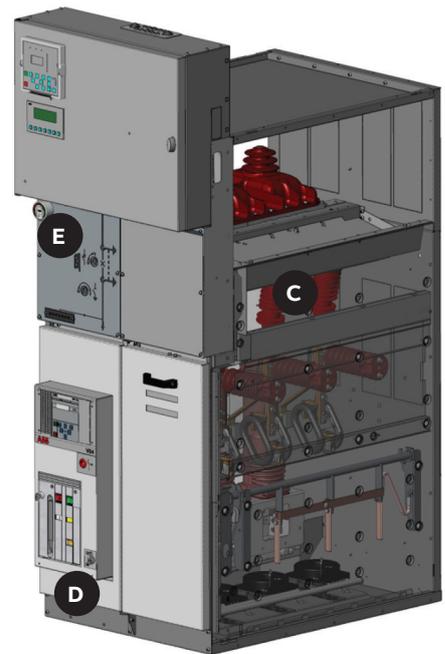
D - Environmental sensor

Temperature and humidity into the cable compartment can be tracked through a dedicated sensor installed in the cable compartment and wired to the MDC4-M concentrator. This measurement indicates whether to ventilate the installation room



E - Pressure monitoring

A dedicated manometer installed on GSec switch disconnecter or on HySec Multifunctional apparatus monitors the actual value of the gas pressure



Monitoring and diagnostic modular architecture

To enhance the diagnostic of the Digital system, there is the possibility to combine the solution here described with the Swicom and its sensors and Relion Series. This integration allows to extend the features available with the MDC4-M

- Possibility to configure the interface with respect to different solutions
- Control of the complete monitoring system from a single point
- Communication with Relion relays for circuit breaker monitoring
- Possibility to monitor the partial discharges values with PDCOM

Current and voltage sensors

Accuracy of measurements

UniSec Digital can be equipped with various ABB sensors and combisensors, either toroidal or to DIN requirements, whichever is the most suitable for your configuration

KECA 250 B1

Toroidal current sensor

For dynamic current measurement (with protection purposes), ABB KECA 250 B1 sensors conform to protection class 5P requirements up to a very high value, since they reach rated short-time thermal current I_{th} (25 kA).

With KECA 250 B1 sensors, measuring class 0.5 is reached for continuous current measurement in the extended accuracy range from 5% of the rated primary current I_{pr} (not only up to 120% of I_{pr} , as is common for conventional current transformers, but even up to the rated continuous thermal current I_{cth} (1250 A)).

This allows the corresponding accuracy class 5P125 to be designated, testifying to the excellent linearity and accuracy of the measurements.



Technical parameters

| | |
|----------------------------|------------------------|
| Continuous thermal current | up to 1250 A |
| Rated primary current | 250 A / 150 mV @ 50 Hz |
| Rated primary current | 250 A / 180 mV @ 60 Hz |
| Accuracy class | 0.5 / 5P125 |

KEVA 24 B20

Voltage sensor

Sensor KEVA B can be used in all applications up to 24 kV. The sensor conforms to accuracy class 0.5 requirements for measurement purposes and accuracy class 3P for protection purposes.



Technical parameters

| | |
|---|-------------------------|
| Rated primary voltage | up to 22/ $\sqrt{3}$ kV |
| Rated power frequency withstand voltage | up to 50 kV |
| Rated lightning impulse withstand voltage | up to 125 kV |
| Transformation ratio | 10.000:1 |
| Accuracy class | 0.5/3P |

Current and voltage sensors

Accuracy of measurements

KEVCD A

DIN current and voltage sensor

KEVCD is a combined sensor that can be used when the toroidal sensor cannot be installed owing to the number of cables per phase. Similarly to the other two types, the technology is based on the Rogowski coil and resistive divider principle.

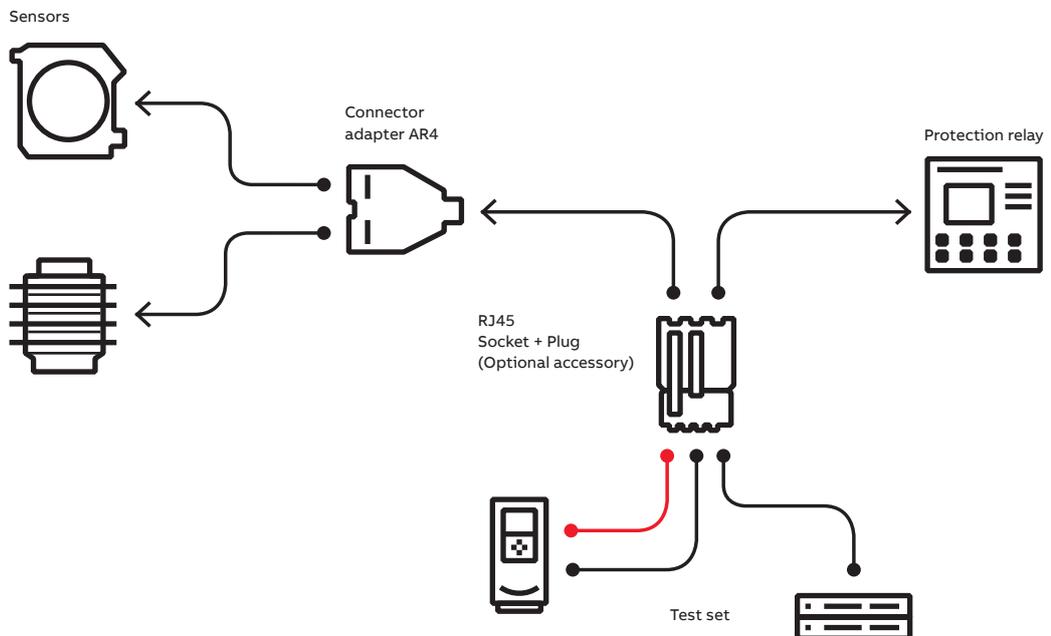
Technical parameters

| | |
|---|------------------------|
| Rated primary voltage | up to $22/\sqrt{3}$ kV |
| Rated power frequency withstand voltage | up to 50 kV |
| Rated lightning impulse withstand voltage | up to 125 kV |
| Transformation ratio | 10.000:1 |
| Accuracy class | 0.5/3P |
| Continuous thermal current | up to 1250 A |
| Rated primary current | 80 A / 150 mV @ 50 Hz |
| Rated primary current | 80 A / 180 mV @ 60 Hz |
| Accuracy class | 0.5 / 5P630 |



Connection layout

The connection components required per phase are illustrated below.



Digital documentation

Customer interactive support for complete UniSec platform

Movies are also part of the ABB digital developments, and are focused on supporting customer needs:

- Movie with 3D panel: simulates the switchgear installation conditions, saves time during the design phase, cuts design costs and minimizes risks (contact ABB for additional formats)

- Manuals: provide detailed information about installation, operations and maintenance
 - Installation videos: support and facilitate activities on site in self-explanatory videos
- All documentation applies to the complete UniSec platform and is not limited to the Digital version.

UniSec Movie 01 - 2RDA029735 - Busbar earthing assembly

UniSec Movie 02 - 2RDA029740 - Busbar assembly 12-17.5 kV 630 A

UniSec Movie 03 - 2RDA029741 - Busbar assembly 12-17.5 kV 1250 A

UniSec Movie 04 - 2RDA029742 - Busbar assembly 24 kV 630 A

UniSec Movie 05 - 2RDA029743 - Busbar assembly 24 kV 1250 A

UniSec Movie 06 - 2RDA029744 - End cover IAC assembly

UniSec Movie 07 - 2RDA029745 - Panel floor fixing

UniSec Movie 08 - 2RDA029746 - Gas duct assembly

UniSec Movie 09 - 2RDA029747 - Operating sequence



Manuals and videos are easily available on site using the QR code printed on every panel.





ABB Spa
Via Friuli, 4
24040 Dalmine
Italy

abb.com/mediumvoltage
abb.com/contactcenters

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB. Copyright© 2022 ABB
All rights reserved