

DISTRIBUTION SOLUTIONS

UniGear Digital

The innovative solution for MV switchgear



- Space saving solution
- Quick delivery
- Minimize lifetime costs
- Green solution

Digital solutions in UniGear portfolio offers significant improvements to the customers by providing them with responses to the latest demanding requirements.

The solution is based on an optimized integration of medium voltage sensors for current and voltage measurement into the MV switchgear combined with latest design of protection relays as well as with efficient utilization of IEC 61850 communication means for signal distribution within the switchgear.

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UniGear Digital

Answers to the latest demanding requirements

ABB has reviewed several, currently well market-accepted products as well as the latest available technologies and standards in order to respond to new challenges in distribution networks such as the distributed generation of renewable resources, increased energy demand and requirements for higher reliability and availability of energy supply.

The result is a new innovative solution to Medium Voltage (MV) switchgear called UniGear Digital that offers significant improvements to the customers by providing them with responses to the latest demanding requirements.

The solution is based on an optimized integration of MV sensors for current and voltage measurement into the MV switchgear combined with latest design of protection relays as well as with efficient utilization of IEC 61850 communication means for signal distribution within the switchgear.

Medium voltage switchgear used for the distribution of electrical energy is a very important element of electrical networks the function of which is to ensure uninterrupted power supply to the whole network.

With the new requirements and challenges the distribution networks are to face the MV switchgear assumes an increasingly important role as a part of the grid than ever before.

Evolution in distribution networks asks for a MV switchgear that is more efficient, safe, smart, reliable, environmentally friendly, and easy to engineer, install and operate.

UniGear Digital solution is applied to the large and successful MV switchgear family called UniGear and is available for UniGear ZS1, UniGear ZS2, UniGear 550, UniGear MCC and UniGear 500R units.

UniGear switchgear is manufactured on six continents with more than 500 000 panels installed to operate around the world in more than 100 countries.

UniGear switchgear is used to distribute electric power in a variety of demanding applications such as on off-shore platforms, in container or cruise ships, in mines as well as in utility substations, power plants or chemical plants.

UniGear Digital

Benefits

UniGear Digital represents advanced switchgear solution addressing important requirements of the future:

- Flexibility
- Increased process efficiency
- Lower cost of operation
- Maximized integration
- Reliability and safety

Thanks to UniGear Digital you do not need to face many of the practical challenges in today's more complex applications, and you have less worries in your electrical network.

UniGear Digital makes it easy to focus on applications and create reliable, efficient electrical network due to use of well-proven components: current and voltage sensors, protection and control relays with IEC 61850 digital communication.



SMART GRID FLEXIBILITY

Flexibility towards varying load flows

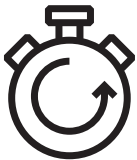
UniGear Digital gives you the flexibility of changing the loads, supplied by power by the switchgear, without changing the measuring equipment (current instrument transformer). Current and voltage sensors, successors of conventional instrument transformers, feature linear characteristics i.e. they can operate with a wide range of primary currents. To provide for the adaptation of switchgear according to the changing load currents it is enough to modify the parameters of the protection relay. It saves the costs to spend on the purchase of current transformer, on its installation and those for coming up for switchgear downtime. UniGear Digital is ready for Smart Grid evolution.



SPACE SAVING SOLUTION

More space in a switchgear room

UniGear Digital uses the space in your switchgear in an efficient way. It reduces its overall footprint by omitting the metering panel from your switchgear. Due to the compact size of voltage sensors they can be installed into the feeder busbar compartment. The switchgear room can thus be smaller or more switchgear panels can fit inside.



QUICK DELIVERY

Shorter time from order issue until putting into operation

You can start using your UniGear Digital switchgear earlier compared to a conventional switchgear. UniGear Digital helps you to eliminate deadlines and make you or your customers satisfied. We are able to guarantee a delivery time shorter by 30% from the manufacturing plant. Thanks to the sensors the client does not need to specify all the technical details required for conventional instrument transformers. E.g. with UniGear ZS1 Digital you just need to specify two types of current sensors and one type of voltage sensor to cover all parameters of a UniGear ZS1 application up to 17.5 kV, 4 000 A, 63 kA and up to 24 kV, 3 150 A, 31.5 kA. The sensors are always available on stock.



GREEN SOLUTION

Reduces the environmental impact

UniGear Digital represents green solution with high potential savings of energy and reduction of CO₂ emissions.

E.g. in a substation of 14 feeders, you can save energy equal to 150 tons of CO₂ during 30 years of the system's service. This corresponds to emissions produced by a mid-size European car over a mileage of 1 250 000 km.

UniGear Digital

Benefits



RELIABILITY AND SAFETY

Less worries about your electrical network

UniGear Digital provides reliable switchgear solution which minimizes the risk of outages and increases switchgear availability. The sensors are not using any iron core, therefore they are immune against grid disturbances such as the ferroresonance. Thanks to their smaller dimensions the sensors contain less insulation material which reduces the risk of isolation degradation in a switchgear. Moreover, UniGear Digital increases the safety of operating personnel thanks to error free connection between sensor and the protection relay. Digital communication continuously supervises all signals. Errors are immediately detected and back-up scenario can be activated. The use of sensors increases the safety for your personnel owing to the maximum level of secondary signals during normal operation amounting to only a few volts.



CUSTOMIZATIONS AND CHANGES

Ready to answer to network requirements

UniGear Digital is always capable of being adapted to your needs, even at the final stage of switchgear production. Moreover, UniGear Digital is ready to provide you with support anytime the requirements of your network change. Thanks to utilizing digital communication and sensors you are flexible with last minute implementation of changes to the switchgear parameters, such as the rated current or modification to switchgear logic schemes.



FLEXIBILITY DURING SWITCHGEAR OPERATION

Easy switchgear adaptation

You may adapt your switchgear easily to changes implemented in your application. There is no need to replace the switchgear hardware. You only update the parameters or logics of the protection relay. This is achieved thanks to digital communication running between panels instead of using traditional hard wired signals. Changes are handled by modifying the software of the digital relays and using the IEC 61850 communication. Thanks to their linear characteristics the sensors can operate over a wide range of primary currents. If the load current of your application changes the only step the user needs to do is to change the parameters of the protection relay.



MINIMIZE LIFETIME COSTS

Efficient use of resources

UniGear Digital uses energy efficiently, without additional losses during switchgear operation. Thanks to increased reliability the risk of outages is minimized. This solution saves your costs during the whole switchgear lifetime. Sensors, both current and voltage, have negligible energy consumption and therefore less energy is needed to operate the switchgear.

E.g. typical substation arrangement with 14 switchgear panels with UniGear Digital saves up to 250 MWh over 30 years of operation compared to conventional switchgear assembly. 250 MWh represent savings of 13 000 EUR.



GLOBAL SOLUTION

Available for projects according to IEC, GOST and CSA standards

UniGear Digital

The innovative solution for MV switchgear

UniGear Digital is a new solution implemented to the traditional UniGear switchgear. It is accomplished by using well-proven components such as current and voltage sensors, Relion® protection relays and IEC 61850 digital communication.

The current sensors used are of highly compact design, optimized for the use in UniGear. Each panel can accommodate two sets of current sensors.

The voltage sensors are very compact as well. They are integrated as part of support insulators housed in the cable compartment or built directly in the busbar compartment.

The current and voltage sensors are of very high accuracy (accuracy class 0.5), however revenue metering might require yet higher accuracy classes or the installation of instrument current and voltage transformers for separation purposes. The transformers can optionally be added to sensor-equipped panels.

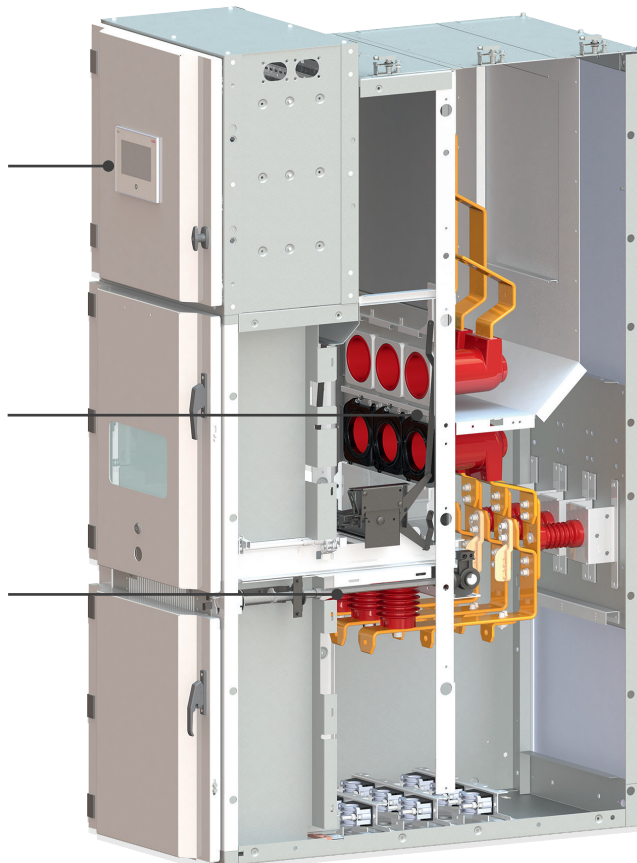
Capacitive voltage detection is enabled by capacitive dividers that are either integrated into the support insulators or into a conventional current transformer used on case-by-case basis.

UniGear Digital
and its key parts

**Protection and
control relay
from Relion®
family with
IEC 61850**

Current sensor

Voltage sensor



UniGear Digital

Benefits of sensor technology

Sensors based on advanced measurement principles have been developed as successors to conventional instrument transformers in order to achieve significant reduction in dimensions, increase of safety and to provide greater rating standardization with a wider functionality range. The sensor technology has been used in ABB since the beginning of the 1990s and there are more than 400 000 sensors installed and operating to date. Conventional instrument transformers with magnetic cores are based on well-known principles that have been utilized with all their advantages as well as limitations for more than 130 years. However the connected equipment (protection relays) has significantly changed during the last 30 years. New modern protection relays can utilize the sensor technology in a more efficient way. These new requirements also open up the opportunity for the utilization of advanced measurement principles that offer a wide range of additional benefits.

Sensors open up a way for current and voltage signals needed for the protection and monitoring of medium voltage power systems. These advantages can be fully used in connection with modern protection relays.

Sensor characteristics

ABB current and voltage sensors are designed without the use of a ferromagnetic core. The current sensor is based on the principle of Rogowski coil, voltage sensor uses the principle of resistive voltage divider. Sensor technology brings several important benefits for the user and the application.

The main benefit is that the behavior of the sensor is not influenced by magnetizing curve which results in a highly accurate and linear response across a wide dynamic range of measured quantities.

The linear and highly accurate characteristic curve of the sensor across its full operating range enables several metering and protection classes to be combined in one particular winding.

Energy savings solution

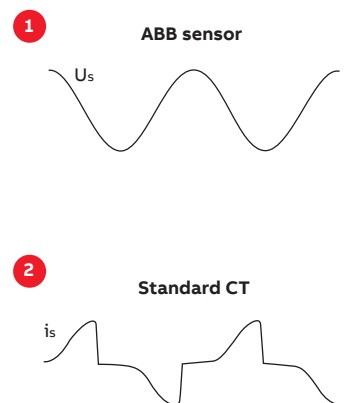
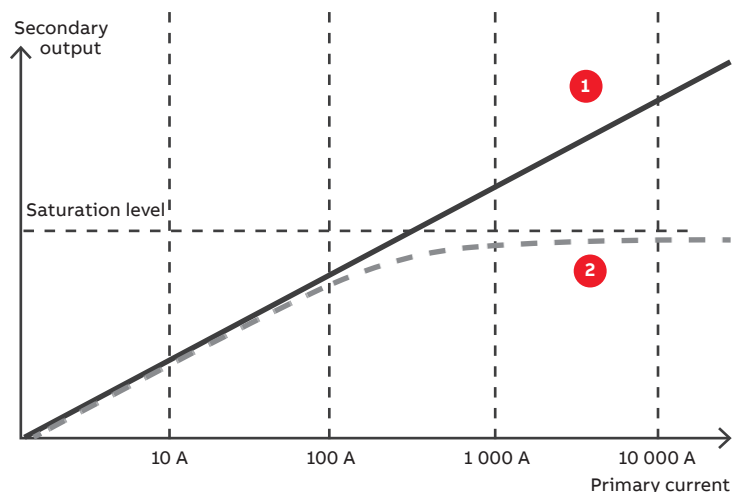
The sensor technology means no transfer of power from the primary to the secondary side, which means negligible power losses. Therefore, the sensors exhibit extremely low energy consumption the value of which is just a fraction of what is converted into heat in a conventional instrument transformer.

This fact contributes to significant energy savings during the system's entire operating life, supporting world-wide efforts to reduce energy consumption.

Easy switchgear integration solution

Since the sensor elements are particularly small and the same elements are used for both measurement and protection, the current and voltage sensors can easily be integrated in the switchgear. These facts enable the sensors to be designed in a highly optimal way, which contributes to a high level of switchgear simplification.

Performance comparison between conventional current transformer and current sensor



UniGear Digital

Evolution of protection relays

ABB medium voltage protection relays installed in more than 120 countries.

—
01 Static relays

—
02 Microprocessor
based protection
and control relays

—
03 Protection and
control REX640

With more than 1 million units installed, ABB is a forerunner in the development of protection and control relays. From the first microprocessor controlled relay in 1982 to the latest all-in-one protection and control relay REX640, ABB provides innovative solutions in line with the emerging market requirements.

ABB Relion® product family offers the widest range of products for the protection, control, measurement and supervision of power systems for IEC and ANSI applications – from generation and interconnected transmission grids over primary distribution to secondary distribution kiosks.

To ensure interoperable and future-proven solutions, the Relion® products have been designed to implement the core values of the IEC 61850 standard. Various after-sales services together with long life cycle and future-proven product design offer the best possible return on investment.



UniGear Digital

IEC 61850 communication, GOOSE and Process Bus

The IEC 61850 standard was released in 2004 as a global international standard representing the architecture for communication networks and systems for power utility automation. It also includes the related system requirements and data model of protection and control functions. Standardized data modelling of substation functions including the communication interfaces pave the way to openness and interoperability of devices. The IEC 61850 defines Station bus and Process bus. The IEC 61850 standard distinguishes between Station bus IEC 61850-8-1 with vertical and horizontal GOOSE communication (real time communication between protection relays) and Process bus IEC 61850-9-2 for the transmission of Sampled Measured Values (SMV) obtained by measurements. The GOOSE and SMV profiles make it possible for the MV substation communication to be designed in a novelized and flexible way to make the protection relay process data available to all other protection relays in the local network in a real-time manner.

Station bus in Medium Voltage switchgear

Protection and control relays generate signals for interlocking, blocking and tripping between panels via horizontal GOOSE communication in UniGear Digital.

Nowadays, GOOSE communication is used increasingly in substations and it offers new additional values like simplicity, functional flexibility, easy scalability, improved diagnostics and faster performance compared to conventional hard wired interpanel wires. Process interfaces to MV apparatus (e.g. voltage sensors) are on the process level. Besides conventional

signal wiring between the process interface and protection relays, IEC 61850 introduces a concept where the exchange of process signals can take place across the process bus, as per IEC 61850-9-2.

In MV switchgear applications the station and the process bus can be combined together to one common bus. When using conventional voltage instrument transformers (VTs) in a MV switchgear these usually are installed in the incoming feeders on the cable side, with busbar voltage measured in any of the outgoing feeders or in a dedicated metering panel. The sharing of the busbar voltage is done by interconnection wires between busbar VTs and the protection relays in all outgoing feeders.

Usage of sensors and IEC 61850-9-2 has a significant effect on the design of the switchgear. The signal from the voltage sensor measuring the busbar voltage in one of the protection relay is digitized into sampled values stream shared over Ethernet network. The interconnection wiring in switchgear becomes simplified as less regular galvanic signal wires are needed. Transmitting voltage signal over process bus enables also higher error detection because the signal transmission is supervised. Additional contribution to the higher availability is the possibility of using redundant Ethernet network over which the GOOSE and SMV signals are transmitted.

Ethernet redundancy

IEC 61850 specifies network redundancy that improves the system availability for substation communication. It is based on two complementary protocols defined in the IEC 62439-3 standard: the parallel

redundancy protocol (PRP) and high availability seamless redundancy (HSR) protocol.

Both protocols are capable of overcoming a failure of a link or switch with zero-switchover time. In both protocols, each node contains two identical Ethernet ports for one network connection.

They rely on the duplication of all transmitted information and provide zero-switchover time in case of failure of a link or switch, thus fulfilling all the stringent real-time requirements of substation automation. PRP and HSR redundancy is supported by our protection relays and the choice between these two protocols depends on the particular application and the required functionality.

Time synchronization

Protection relays utilizing sampled measured values need to be synchronized between the publishing (protection relay sharing the analog value) and the receiving protection relays.

The synchronization in Relion protection relays supports the Precision Time Protocol (as defined in IEEE 1588 standard), with microsecond accuracy.

A protection relay can act as a master clock for Best Master Clock algorithm in case no external master clock is available.

PTP synchronization method enables usage of existing Ethernet network to propagate synchronization messages across the network, which eliminates the need for extra cabling in the substation.

UniGear Digital

Switchgear type overview

Since digital features implemented has proved to be a very successful solution, it has been later extended throughout the whole UniGear portfolio.

Switchgear type	Busbar arrangement	UniGear Digital	Voltage level	Rated feeder current	Rated short-circuit current
UniGear ZS1	Single busbar	•	up to 24 kV	up to 4 000 A	up to 63 kA / 1 s
	Double busbar	•	up to 17.5 kV	up to 4 000 A *	up to 31.5 kA / 3 s
	Back To Back	/	up to 24 kV	up to 4 000 A	up to 50 kA / 3 s
UniGear 550	Single busbar	•	up to 17.5 kV	up to 1 250 A	up to 31.5 kA / 3 s
UniGear 500R **	Single busbar	•	up to 17.5 kV	up to 2 000 A	up to 31.5 kA / 3 s
UniGear MCC	Single busbar	•	up to 12 kV	up to 400 A	up to 50 kA / 3 s
UniGear ZS2	Single busbar	•	up to 36 kV	up to 2500 A	up to 31.5 kA / 3 s

— Overview of UniGear Digital solution in UniGear switchgear family

• Yes
/ No

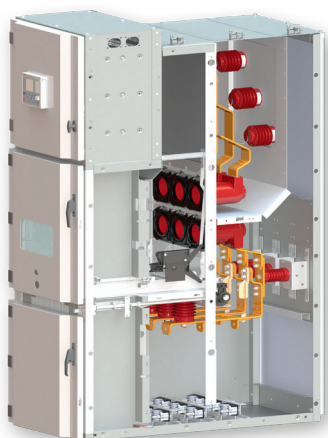
* Double busbar-disconnector feeders rated current: up to 2 500 A; Double busbar feeder rated current: 3 150 A - 4 000 A

** IEC version

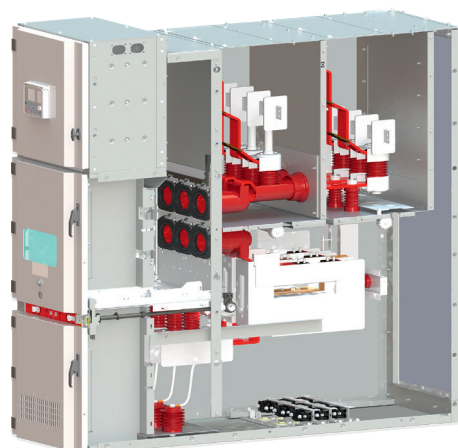
UNIGEAR ZS1 DIGITAL

UniGear ZS1 Digital is suitable for indoor installations and applications with voltage level up to 24 kV, rated feeder current up to 4 000 A, and short-circuit current of up to 63 kA. UniGear ZS1 distributes energy in a variety of demanding applications such as off-shore platforms, on container or cruise ships, in mines as well as utility substations, power plants or chemical plants. Digital solution is available also for UniGear ZS1 Double busbar up to 17.5 kV.

— 01
UniGear ZS1 Digital 12 kV
— 02
UniGear ZS1 Double busbar Digital 17.5 kV



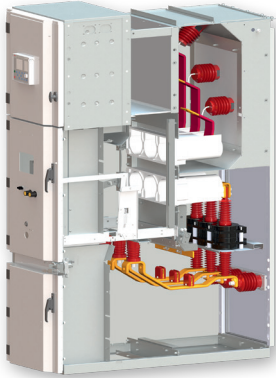
01



02

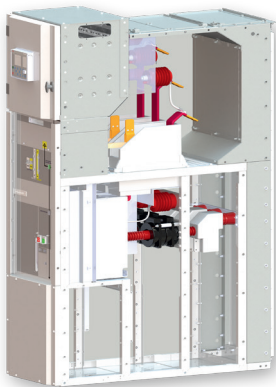
UniGear Digital

Switchgear type overview



UNIGEAR 550 DIGITAL

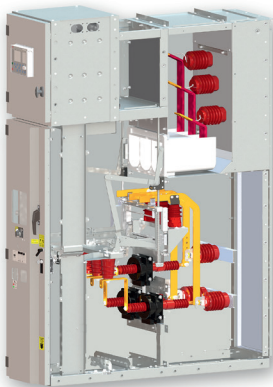
UniGear 550 Digital is suitable for indoor installations and applications with voltage level up to 17.5 kV, rated feeder current up to 1 250 A, and short-circuit current of up to 31.5 kA. It can be used in utility and power plant substations, industry, marine, transport and infrastructure substations.



UNIGEAR 500R DIGITAL

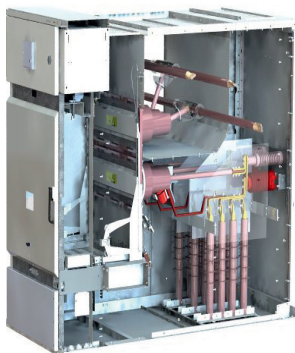
UniGear 500R Digital is suitable for indoor installations and applications with voltage level up to 17.5 kV, rated feeder current up to 2 000 A, and short-circuit current of up to 31.5 kA. It suits to applications such as the utility, industry, transport and infrastructure substations.

On the picture is shown UniGear 500R Digital (IEC version) up to 1 250 A. UniGear 500R Digital (IEC version) up to 2 000 A is available with combined (current and voltage) sensor.



UNIGEAR MCC DIGITAL

UniGear MCC Digital is suitable for indoor installations and applications with voltage level up to 12 kV, rated feeder current up to 400 A, and short-circuit current of up to 50 kA. It can be used in various applications such as the power plant substations, or in industry substations.



UNIGEAR ZS2 DIGITAL

UniGear ZS2 Digital is suitable for indoor installations and applications with voltage level up to 36 kV, rated feeder current up to 2500 A, and short-circuit current of up to 31.5 kA. It can be used in various applications such as the power plant substations, or in industry substations.

UniGear Digital

Current and voltage sensors overview

Sensors for current and voltage measurement are important part of the UniGear Digital. Each switchgear type offering UniGear Digital solution uses particular type of sensors.

Measurement type	Sensor type	UniGear ZS1 Digital up to 17.5 kV	UniGear ZS1 Digital up to 24 kV	UniGear 550 Digital	UniGear 500R Digital	UniGear MCC Digital	UniGear ZS2 Digital	Sensor product portfolio for UniGear Digital
Current	KECA 80 C104	• ¹⁾	/	/	/	/	/	
	KECA 80 C165	• ²⁾	/	/	/	/	/	
	KECA 80 C184	/	• ³⁾	/	/	/	/	
	KECA 80 C216	/	• ⁴⁾	/	/	/	/	
	KECA 250 B1	/	/	•	•	•	/	
	KECA 80 C260 ZS2	/	/	/	/	/	•	
Voltage	KEVA 17.5 B20	•	/	•	•	•	/	
	KEVA 24 B20	/	•	/	/	/	/	
	KEVA 36 B20	/	/	/	/	/	•	

1) 650 mm wide panels
 2) 800 / 1 000 mm wide panels
 3) 800 mm wide panels
 4) 1 000 mm wide panels

• Yes
 / No

INDOOR CURRENT SENSORS

Current measurement in KECA sensors is based on the Rogowski coil principle.



KECA 80 C104 / KECA 80 C165

For dynamic current measurement (protection purposes) the ABB sensors KECA 80 C104, and KECA 80 C165, fulfill requirements of protection class 5P up to an impressive value reaching the rated short-time thermal current I_{th} .

With KECA 80 C104 and KECA 80 C165 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 being common for conventional current transformers), but even up to the rated continuous thermal current I_{cth} (1 250 A or 4 000 A).

That provides the possibility to designate the corresponding accuracy class as 5P400 and 5P630, proving excellent linearity and accuracy measurements.

Continuous thermal current	Rated primary current	Rated primary current	Accuracy class
1 250 / 4 000 A	80 A / 150 mV @ 50 Hz	80 A / 180 mV @ 60 Hz	0.5 / 5P400; 0.5 / 5P630

UniGear Digital

Current and voltage sensors overview



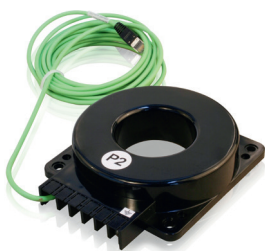
KECA 80 C184 / KECA 80 C216

For dynamic current measurement (protection purposes) the ABB sensors KECA 80 C184, and KECA 80 C216, fulfill requirements of protection class 5P up to an impressive value reaching the rated short-time thermal current I_{th} (31.5 kA).

With KECA 80 C184 and KECA 80 C216 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 being common for conventional current transformers), but even up to the rated continuous thermal current I_{cth} (1 250 A or 3 150 A).

That provides the possibility to designate the corresponding accuracy class as 5P400, proving excellent linearity and accuracy measurements.

Continuous thermal current	Rated primary current	Rated primary current	Accuracy class
1 250 / 3 150 A	80 A / 150 mV @ 50 Hz	80 A / 180 mV @ 60 Hz	0.5 / 5P400



KECA 250 B1

For dynamic current measurement (protection purposes) the ABB sensors KECA 250 B1, fulfill requirements of protection class 5P up to an impressive value reaching the rated short-time thermal current I_{th} (31.5 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 being common for conventional current transformers), but even up to the rated continuous thermal current I_{cth} (2 000 A).

That provides the possibility to designate the corresponding accuracy class as 5P125, proving excellent linearity and accuracy measurements.

Continuous thermal current	Rated primary current	Rated primary current	Accuracy class
2 000 A	250 A / 150 mV @ 50 Hz	250 A / 180 mV @ 60 Hz	0.5 / 5P125



KECA 80C 260-ZS2

For dynamic current measurement (protection purposes) the ABB sensor KECA 80C 260-ZS2, fulfill requirements of protection class 5P up to an impressive value reaching the rated short-time thermal current I_{th} (31.5 kA).

With KECA 80C 260-ZS2 sensor, 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 being common for conventional current transformers), but even up to the rated continuous thermal current I_{cth} (2500 A).

That provides the possibility to designate the corresponding accuracy class as 5P400, proving excellent linearity and accuracy measurements.

Continuous thermal current	Rated primary current	Rated primary current	Accuracy class
2500 A	80 A / 150 mV @ 50 Hz	80 A / 180 mV @ 60 Hz	0.5 / 5P400

UniGear Digital

Current and voltage sensors overview

INDOOR VOLTAGE SENSORS

Voltage measurement in the KEVA sensor is based on the resistive divider principle.



KEVA 17.5 B20

KEVA B sensor can be used in all applications up to the voltage level 17.5 kV.

The sensor fulfills requirements of accuracy class 0.5 for measurement purposes and accuracy class 3P for protection purposes.

Rated primary voltage	Rated power frequency withstand voltage	Rated lightning impulse withstand voltage	Transformation ratio	Accuracy class
15/√3 kV	38 (42) kV	95 kV	10 000:1	0.5 / 3P



KEVA 24 B20

KEVA B sensor can be used in all applications up to the voltage level 24 kV.

The sensor fulfills requirements of accuracy class 0.5 for measurement purposes and accuracy class 3P for protection purposes.

Rated primary voltage	Rated power frequency withstand voltage	Rated lightning impulse withstand voltage	Transformation ratio	Accuracy class
22/√3 kV	50 kV	125 kV	10 000:1	0.5 / 3P



KEVA 36 B20

KEVA 36 B20 sensor can be used in all applications up to the voltage level 36 kV.

The sensor fulfills requirements of accuracy class 0.5 for measurement purposes and accuracy class 3P for protection purposes.

Rated primary voltage	Rated power frequency withstand voltage	Rated lightning impulse withstand voltage	Transformation ratio	Accuracy class
33/√3 kV	70 kV	170 kV	10 000:1	0.5 / 3P

UniGear Digital

Test blocks

ESSAILEC® RJ45 TEST BLOCKS

The Essailec® RJ45 test blocks have been especially designed to fit the customer requirements for safe and reliable testing of current and voltage sensors. It allows to safely and easily perform test operations such as current and voltage measurement, monitoring, injection, repair or replacement of meters and protection relays installed in secondary circuits of current and voltage sensors.



SOCKET

- Built-in part (on the switchgear)
- Automatic “Make before break” design
- 4 silver plated circuits
- IP40 with lid (IP20 without lid)
- RJ45 connections 1 input + 1 output (Cat.5)
- Shielded body
- Grounding point



PLUG

- Testing part
- 1 RJ45 input (Cat.5)
- Equipped with 4 Ø4mm sockets
- Locking screw



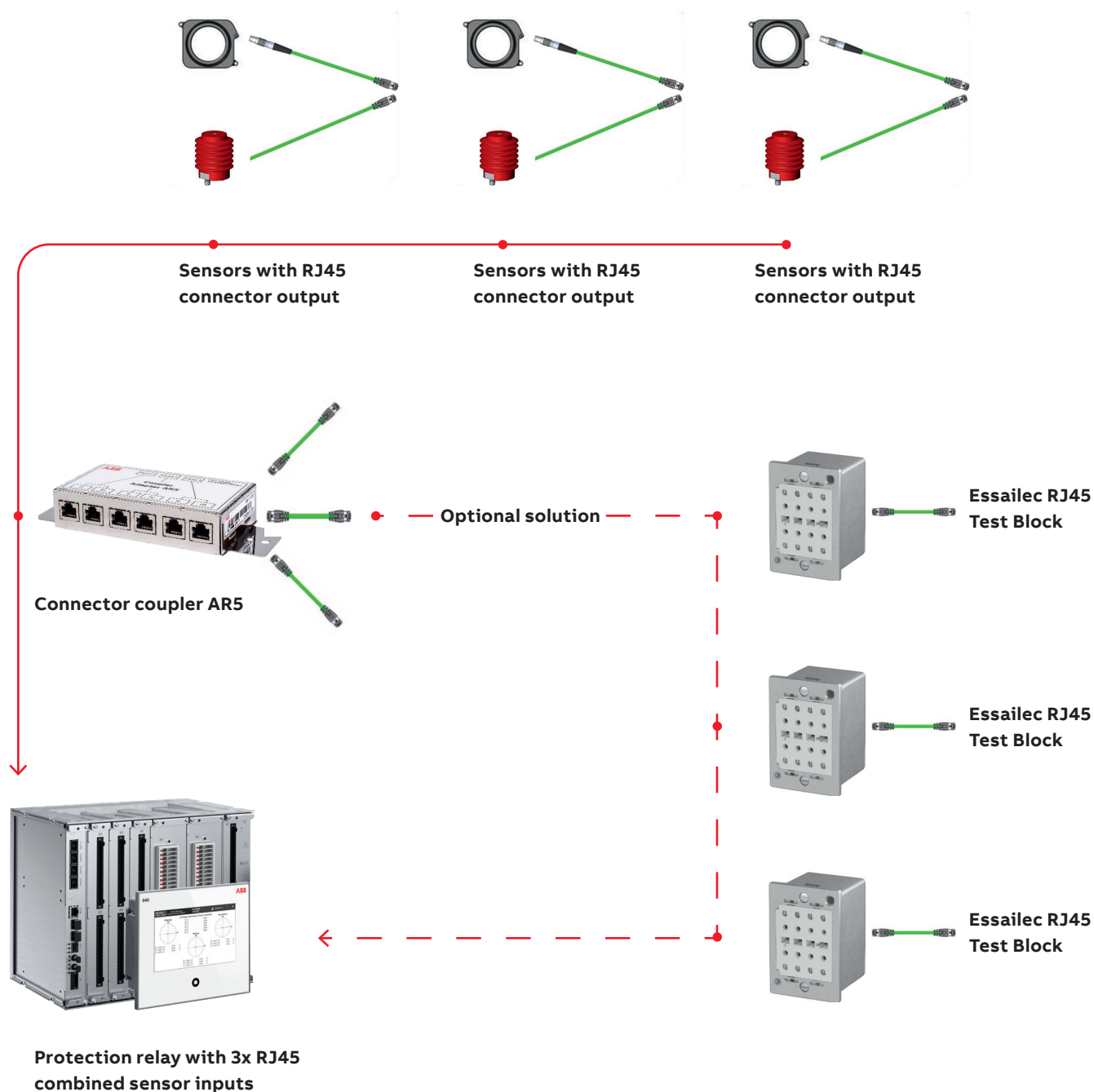
LID

- Installed on the socket during normal operation
- Locking screw with sealing possibility
- Rearside shielded
- Furnished with sockets

UniGear Digital

Sensors connection to protection relay

Sensors are connected to protection relay via cable with RJ45 connector. In case both current and voltage sensors are connected to a protection relay, standard connector coupler AR5 is used. AR5 is three phase connector coupler with 6x Female RJ45 to 3x Female RJ45 connectors.



UniGear Digital

Protection and control relays overview

Protection and control relays represent the control center of a switchgear panel. UniGear Digital uses following types of protection and control relays - see table below.

Relion®	Product type	Standard configuration	Current and voltage sensor inputs	Arc protection	IEC 61850-9-2	Synchrocheck *
615 series	REF615	G	•	•	•	•
		L	•	•	•	•
	REM615	D	•	•	•	/
	RED615	E	•	/	•	•
620 series	REF620	N	•	•	•	•
	REM620	N	•	•	•	•
640	REX640	/	•	•	•	•

* Only available with IEC 61850-9-2

— Protection and control relay key functionality overview for UniGear Digital

• Yes
/ No

615 SERIES PROTECTION AND CONTROL RELAYS

The Relion® 615 series protection relays is a compact and versatile solution for power distribution in utility and industrial applications. The 615 series provides standard configurations, which allows you to easily adapt and set-up your applications, still allowing you to adapt the configuration according to application-specific needs. The 615 series combines compactness and powerful features in one smart package.



FEEDER PROTECTION AND CONTROL REF615

REF615 is a dedicated feeder protection relay perfectly aligned for the protection, control, measurement and supervision of utility and industrial power distribution systems including radial, looped and meshed networks, also involving possible distributed power generation.



MOTOR PROTECTION AND CONTROL REM615

REM615 is a dedicated motor protection relay perfectly aligned for the protection, control, measurement and supervision of asynchronous motors in manufacturing and process industry. REM615 offers all the functionality needed to manage motor starts and normal operation also including protection and fault clearance in drive and network disturbance situations.

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Protection and control relays overview



LINE DIFFERENTIAL PROTECTION AND CONTROL RED615

RED615 is a phase-segregated, two-end, line differential protection and control relay. With in-zone transformer support and voltage protection, it is perfectly harmonized for utility and industrial power distribution networks. The RED615 relays communicate between substations over a fiber-optic link or a galvanic pilot wire connection. Protection of ring-type and meshed distribution networks generally requires unit protection solutions, also applied in radial networks containing distributed power generation.

620 SERIES PROTECTION AND CONTROL RELAYS

The 620 series of relays offers a wide range of protection and control functionality, characterized by functional scalability and flexibility, for more advanced power distribution applications.

The 620 series relays are delivered with default configurations which can be used as examples of the 620 series engineering with different function blocks.



FEEDER PROTECTION AND CONTROL REF620

REF620 is a dedicated feeder IED perfectly aligned for the protection, control, measurement and supervision of utility and industrial power distribution systems, including radial, looped and meshed distribution networks.



MOTOR PROTECTION AND CONTROL REM620

REM620 is a dedicated motor IED perfectly aligned for the protection, control, measurement and supervision of medium size and large asynchronous motors, requiring also differential protection, in the manufacturing and process industry. Typically, the motor protection IED is used with circuit breaker- or contactor-controlled MV motors and with contactor-controlled, medium-sized and large LV motors, in a variety of drives.

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Protection and control relays overview

PROTECTION AND CONTROL REX640

REX640 makes protecting all your assets in advanced power generation and distribution applications easy. The fully modular design allows unequalled customization and modification flexibility, and easy adaptation to changing protection requirements throughout the relay life cycle. This is asset management at its best.



REX640 – INNOVATIVE, FLEXIBLE AND EASY TO USE

- Complete application coverage with one device for optimal flexibility and cost-effectiveness
- Ready-made application packages for convenient and smooth ordering
- Customization freedom with modular and scalable design
- Fully modular hardware and software for maximum flexibility throughout the entire relay life cycle
- Easy adaption to changing protection requirements
- Continuous access to the latest software and hardware developments
- Ready-made application-based LHMI pages – saving both time and efforts
- Increased situational awareness and optimal usability with application-driven LHMI
- Designed to support the increasing digitalization of substation's distributed power generation

REMOTE IO UNIT RIO600

The remote inputs/outputs unit RIO600 is designed to expand the digital and analog inputs/outputs of ABB's Relion® protection relays and to provide inputs/outputs for the station automation device COM600 using the IEC 61850 communication.

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Smart substation control and protection SSC600

Centralized protection and control for distribution substations

ABB Ability™ smart substation control and protection for electrical systems SSC600 centralizes all protection and control functionality in one single device on distribution substation level for minimal engineering, station-wide visibility and optimal process management. Combining SSC600 with merging units creates an IEC 61850-compliant centralized protection and control solution. The modular software can be flexibly modified for the entire lifetime of the digital substation and allows SSC600 to change with the evolving grid. SSC600 builds on ABB's solid and proven technological foundation manifested in the renowned Relion® protection and control family of relays.

Key features

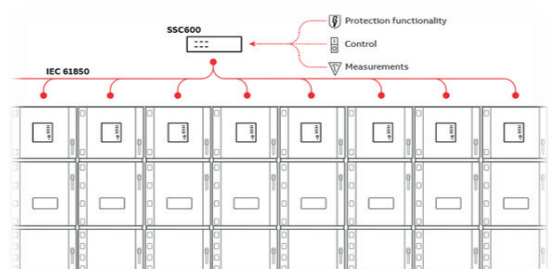
- IEC 61850-compliant communication and interoperability between substation automation devices
- Centralized protection and control in one single device for up to 20 feeder, motor and transformer bays

- Comprehensive Web HMI (human-machine interface) including station-wide HMI functionalities
- Disturbance recordings for the entire substation
- IEC 61850-3-certified with inbuilt redundancy and self-supervision
- Extensive digital services throughout the substations entire lifecycle

Key benefits

- Centralized protection and control in one single device for reduced network complexity
- Easy and efficient process management with station-wide process visibility
- Extensive application coverage with one device for flexibility and optimal cost-effectiveness
- Fully modular software for maximum flexibility throughout the substation's entire life cycle
- Fast, easy and cost-effective substation system upgrade with centralized protection and control solution for changing network protection requirements
- Designed to support the increasing digitalization of substations

SSC600



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Statistical energy and power quality meters

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Energy and power quality meters represent an important role in very accurate measurement of electrical energy in the electricity distribution systems.

ABB extended compatibility of Medium-voltage sensor portfolio for applications where the solution based on combination of ABB MV Current and Voltage sensors with dedicated Energy and power quality meters provide the most accurate data from the grid.

Satec PM174/175

PM174/175 multifunctional measuring device acts as a statistical energy meter and power quality analyzer.

The devices in chain with ABB Sensors operate in accuracy class 0.5 and provide a power quality profile of the network in the range of below mentioned limits*.

Compatibility ensured with following ABB sensors complying with IEC 60044-7 / IEC 60044-8 standards:

- Current sensors KECA 80 C104, C184, C260 & KECA 80 D85 up to 650A and KECA 80 C85, KECA 80 C216 & KECA 80 C165 up to 4000A with rated primary current 80 A & rated secondary output 150/180 mV @ 50/60 Hz
- Voltage sensors KEVA 24 C, KEVA B (both with transformation ratio 1:10 000, 10 MOhm)
- Combined sensors KEVCY/KEVCD with 150/180 mV @ 50/60 Hz for current measurement and ratio 1:10 000, 10 MOhm for voltage measurement

Type of connection: RJ45

* Limitation on the measurement of individual harmonics in current. Maximum measurable harmonic is 21st for 50Hz and 18 for 60Hz (1050Hz).

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Full compliance with IEC standard

UniGear switchgear with implemented UniGear Digital solution involving current and voltage sensors as well as the protection relays has successfully passed all mandatory electromagnetic compatibility (EMC) tests.

The tests have been conducted at an accredited EMC test laboratory, in accordance with IEC 62271-1 and EN 50121-5 standards. UniGear panels, with UniGear Digital solution implemented, have been tested up to approximately 200% of the nominal voltage with positive results for disturbance immunity according to the EMC standards. EMC tests were also conducted with successful results for both the current sensors and voltage sensors. The tests were performed in an accredited EMC test laboratory, in accordance with IEC 60044-8 (current sensors) and IEC 60044-7 (voltage sensors) standards. With the purpose of proving the superior EMC performance of the UniGear Digital, specific EMC real live tests have been conducted at the HV laboratory of the University of Stuttgart. These tests are even more demanding compared to the above mentioned IEC standards. Furthermore, testing simulating the arcing at the truck contacts during switching operations as well as the switching of a reactor load with re-ignitions have been conducted. Both of these tests passed without findings of arcing in the switchgear environment. During all these tests the process bus traffic has been monitored with no effect recorded.

Also a specific robustness test of Ethernet traffic transmitted over the metallic Ethernet wires has been conducted at ABB during internal arc testing of the UniGear at CESI laboratories. No influence on the GOOSE Ethernet traffic was recorded.

UniGear Digital solution complies with the following standards:

- IEC 62271-1 for general purposes
- IEC 62271-200 for the switchgear
- IEC 62271-102 for the earthing switch
- IEC 62271-100 for the circuit-breakers
- IEC 60071-2 for the insulation coordination
- IEC 62271-106 for the contactors
- IEC 60265-1 for the switch - disconnectors
- IEC 60529 for degree of protections
- IEC 60044-7 for electronic voltage transformers (sensors)
- IEC 60044-8 for electronic current transformers (sensors)
- IEC 61869-2 for instrument current transformers
- IEC 61869-3 for instrument voltage transformers
- IEC 60255 for electrical relays
- IEC 61850 for Ethernet technology in substation automation communication

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Visit our web application to learn more

abb.com/unigeardigital

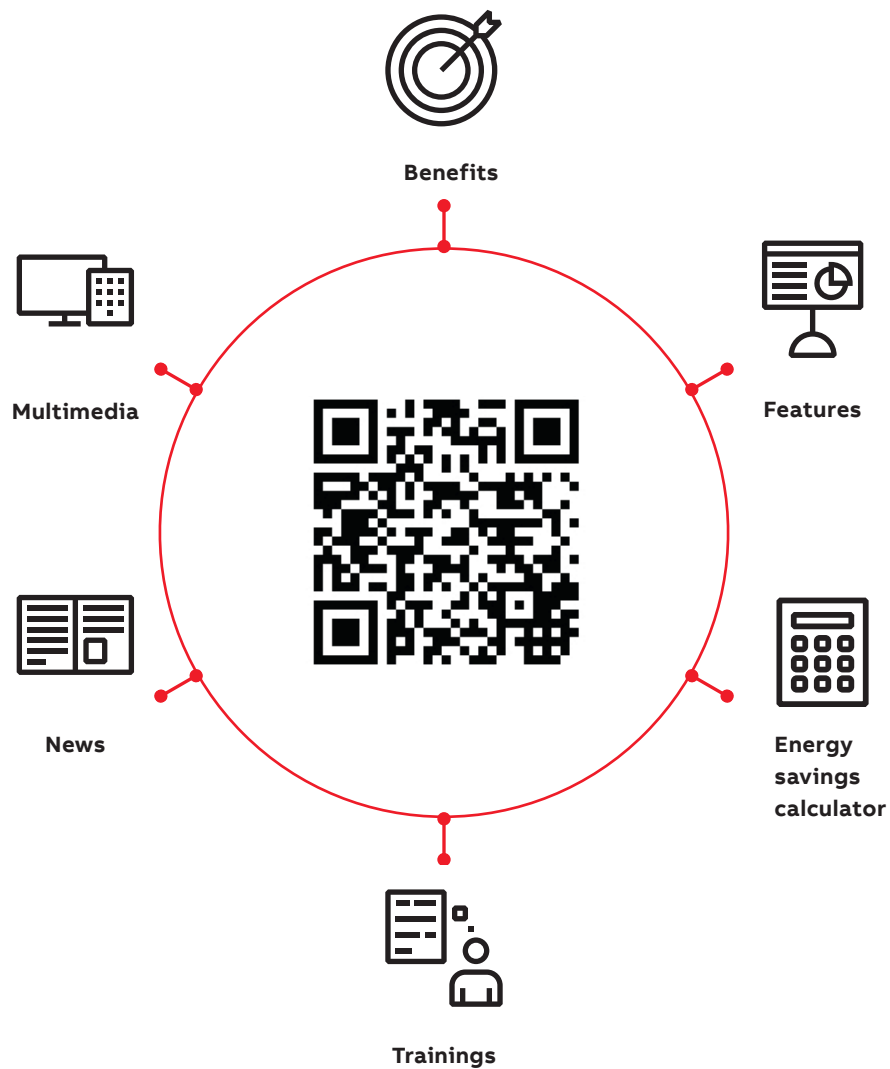




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