



ZX0.2 Digital

Simplicity meets flexibility



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Introductory slide

At the end of this presentation you will be able to understand the benefits and general functioning of ABB's ZX0.2 Digital as part of the ABB Ability™ GIS for MV - ZX concept. This is applicable for ZX0.2 Digital panels as per IEC standard.

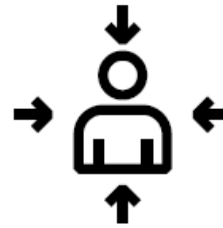
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Typical challenges

Changes during project execution

Tough project timeline

Safety hazards because of possible faults in instrument transformers



Extension of the switchgear line up

Complex and unclear specifications

Safety hazards because of cable breaks in hard-wired interlockings

ZX0.2 Digital offers a solution to all these challenges

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Typical challenges

Changes during project execution

Easy incorporation of changing requirements during project execution thanks to only two sensor variants and streamlined wiring.

Tough project timeline

Shorter delivery time thanks to streamlined engineering processes.

Safety hazards because of cable breaks in hard-wired interlockings

Increased safety because of continuous supervision of communication between protection relays.

Complex and unclear specifications

Complex current and voltage transformer requirements are melted down to just one current and one voltage sensor variant

Safety hazards because of possible faults in instrument transformers

Increased safety because possible faults in instrument transformers are eliminated by utilizing sensor technology

Extension of the switchgear line up

Easy extension of switchgear line ups thanks to IEC 61850 communication standard and reduced wiring

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Customer value

Safe and reliable

- Additional safety thanks to continuously supervised and redundant communication
- No aging effects thanks to fewer insulating components
- No fuse required for voltage sensors because of non-hazardous low-level signals
- No unsafe situations arise because of possible failures in instrument transformers

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Customer value

Simple and efficient

- All ratings are covered by just one current sensor and one main voltage sensor variant
- Streamlined wiring in low voltage compartment thanks to GOOSE¹ interlockings and process bus according to IEC 61850
- Cable testing without removing voltage sensors: sensors sustain cable testing voltages
- Reduced delivery time
- Lower energy consumption by up to 250 MWh representing savings of up to 42,500 EUR²
- Special applications such as tariff metering possible by combination of sensors and instrument transformers

¹ GOOSE = Generic Object Oriented Substation Events – a protocol for communication within a substation, which is part of the IEC 61850 standard

² Compared to a conventional ZX0.2 line up with 14 panels over 30 years and an energy price of 0,17 EUR per kWh

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Customer value

Flexible and intelligent

- Superior flexibility towards grid disturbances and varying load flows thanks to linear sensor characteristic
- Late customization and changes possible without any replacement of sensors
- Interoperability thanks to native support of IEC 61850

ZX0.2 Digital Concept



ABB's innovative
sensor technology



Advanced communication concepts:
- Station bus incl. GOOSE (8-1)
- Process bus incl. redundant network (9-2)



Well-proven ABB switchgear



**Comprehensive
concept for
medium voltage
gas-insulated
switchgear**

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Sensor variants

Current Sensor

KECA 80 C85

- Nominal current up to 2500 A
- Rated primary current 80 A / 150 mV at 50 Hz or 80 A / 180 mV at 60 Hz
- Accuracy class 0.5 / 5P630 for 50 and 60 Hz



Voltage Sensor

KEVA 36 G22/G23

- Rated voltage up to 36 kV
- Rated primary voltage 33 / $\sqrt{3}$ kV
- Rated power frequency withstand voltage 70 kV
- Rated lightning impulse withstand voltage 170 kV
- Transformation ratio 10 000 : 1
- Accuracy class 0.5 / 3P



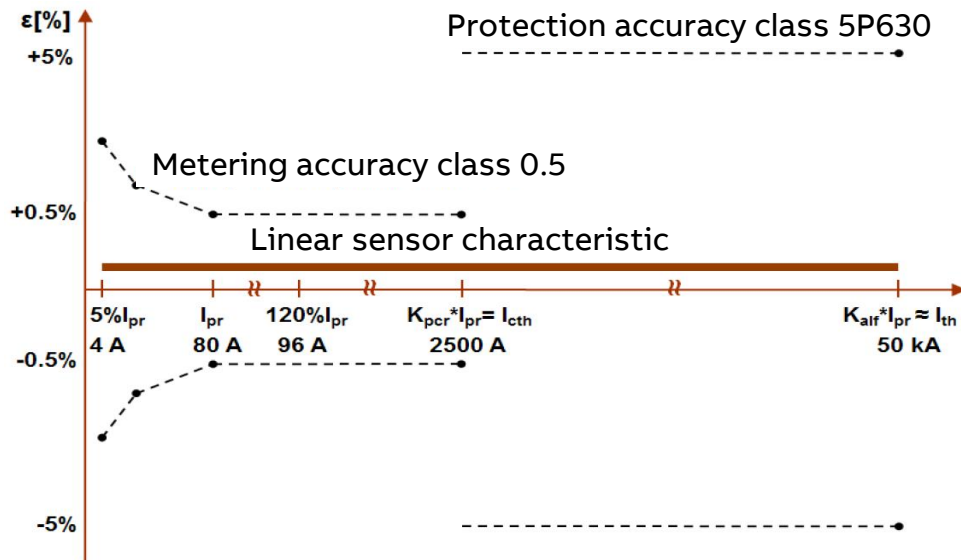
Two sensor variants cover ZX0.2 portfolio

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Sensor variants

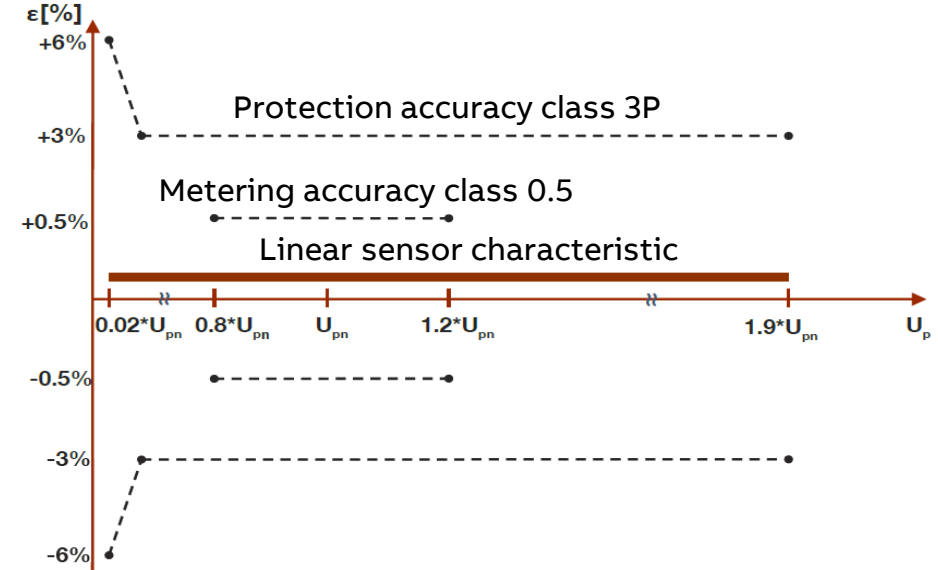
Current Sensor

KECA 80 C85



Voltage Sensor

KEVA 36 G22/G23



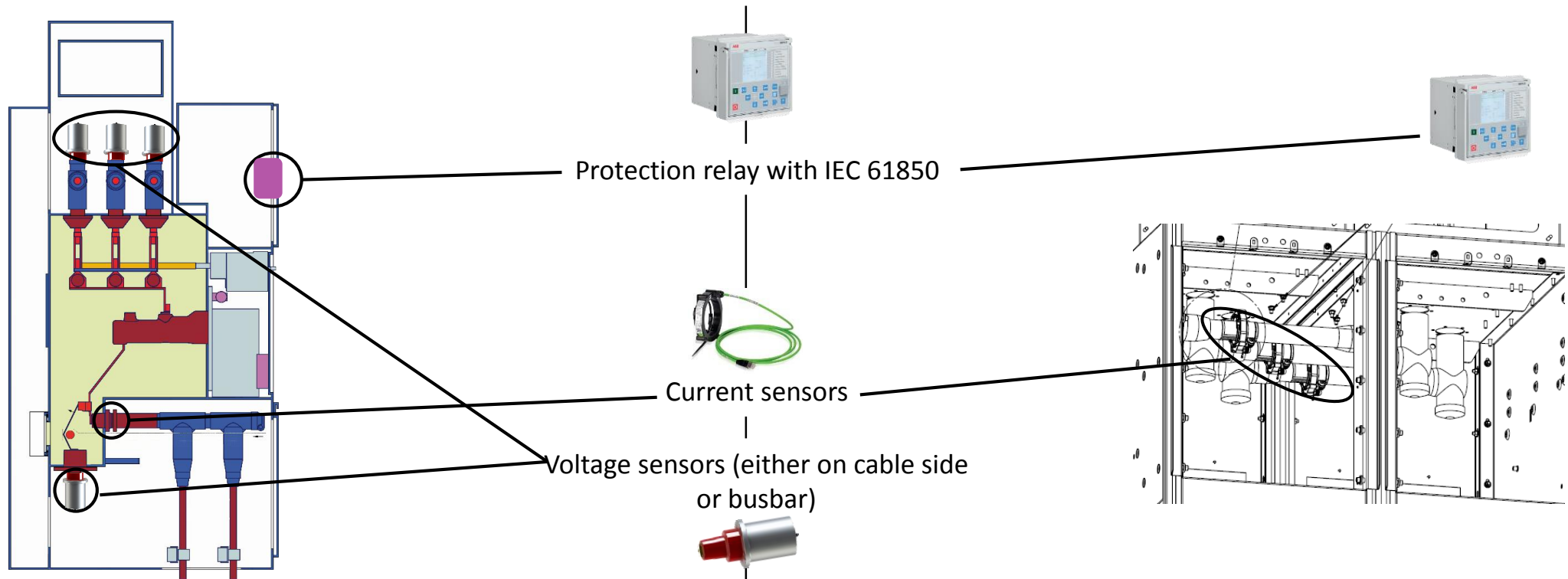
Superior characteristic of voltage and current sensors

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Sensor locations

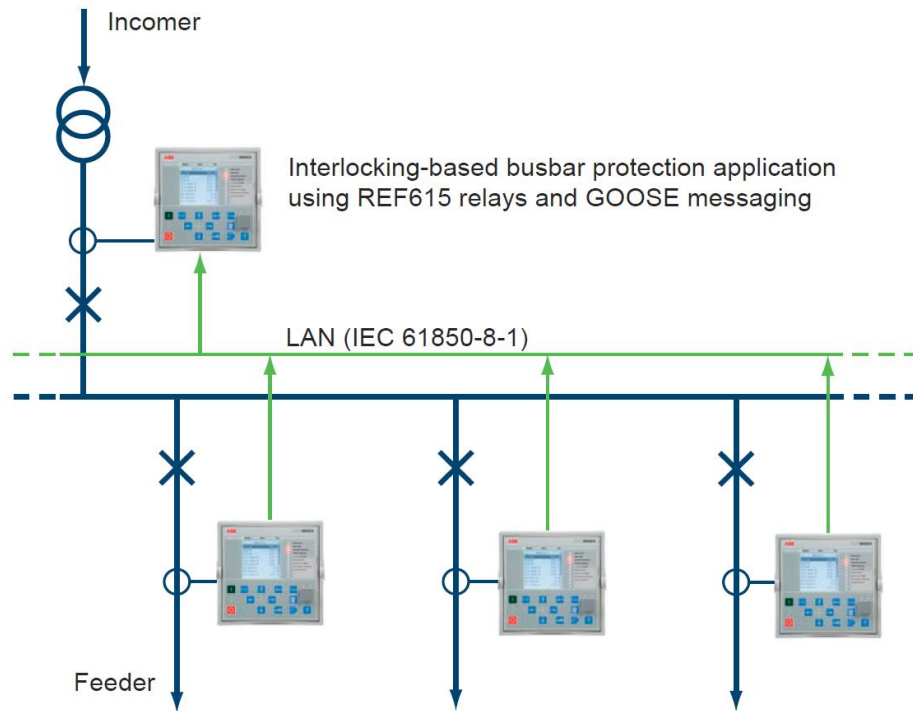
Feeder (450mm panel w/o cable voltage sensor)

Coupler/Riser



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Communication according to IEC 61850-8-1 (GOOSE)



Superior data transmission with GOOSE messaging

On behalf of ABB AG, KEMA tested the performance of GOOSE communications in comparison with direct signal transmission between two devices through conventional wiring. The test programme was based on IEC 62271-3 and was performed with gas-insulated switchgear of type ZX and the REM615 and REF630 protection devices from the Relion® product range.

The results of the KEMA test at a glance:

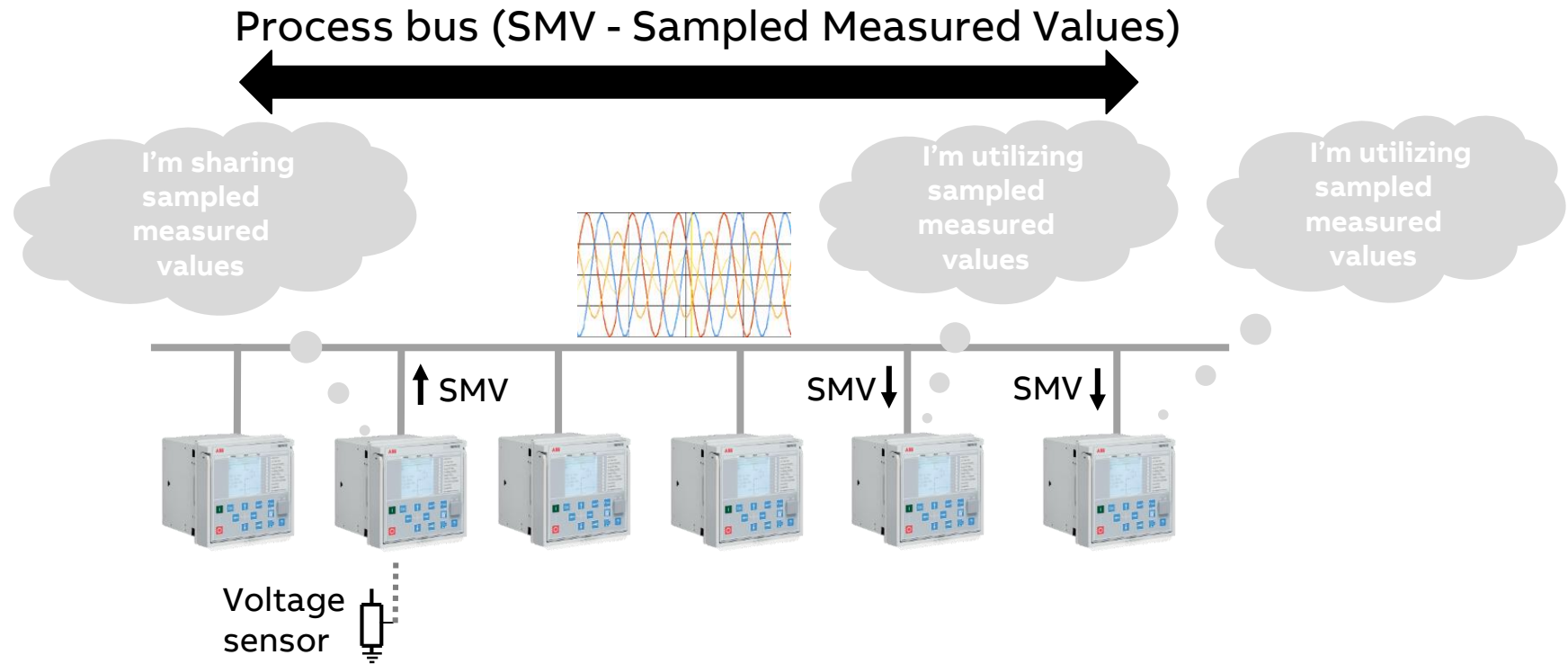
- Data transmission with GOOSE is between 12 ms and 15 ms faster than with conventional wiring.
- In the event of an interruption to GOOSE communication, the system reacts as specified and blocks the set protection functions.
- Interlocks to prevent double switching operations function as specified

The Relion® devices comply with class P1, message type 1A "Trip" to IEC 61850-5 for message transmission time less than 10 ms.

Easy implementation of protection schemes: e.g. Reverse interlocking, circuit breaker failure protection.

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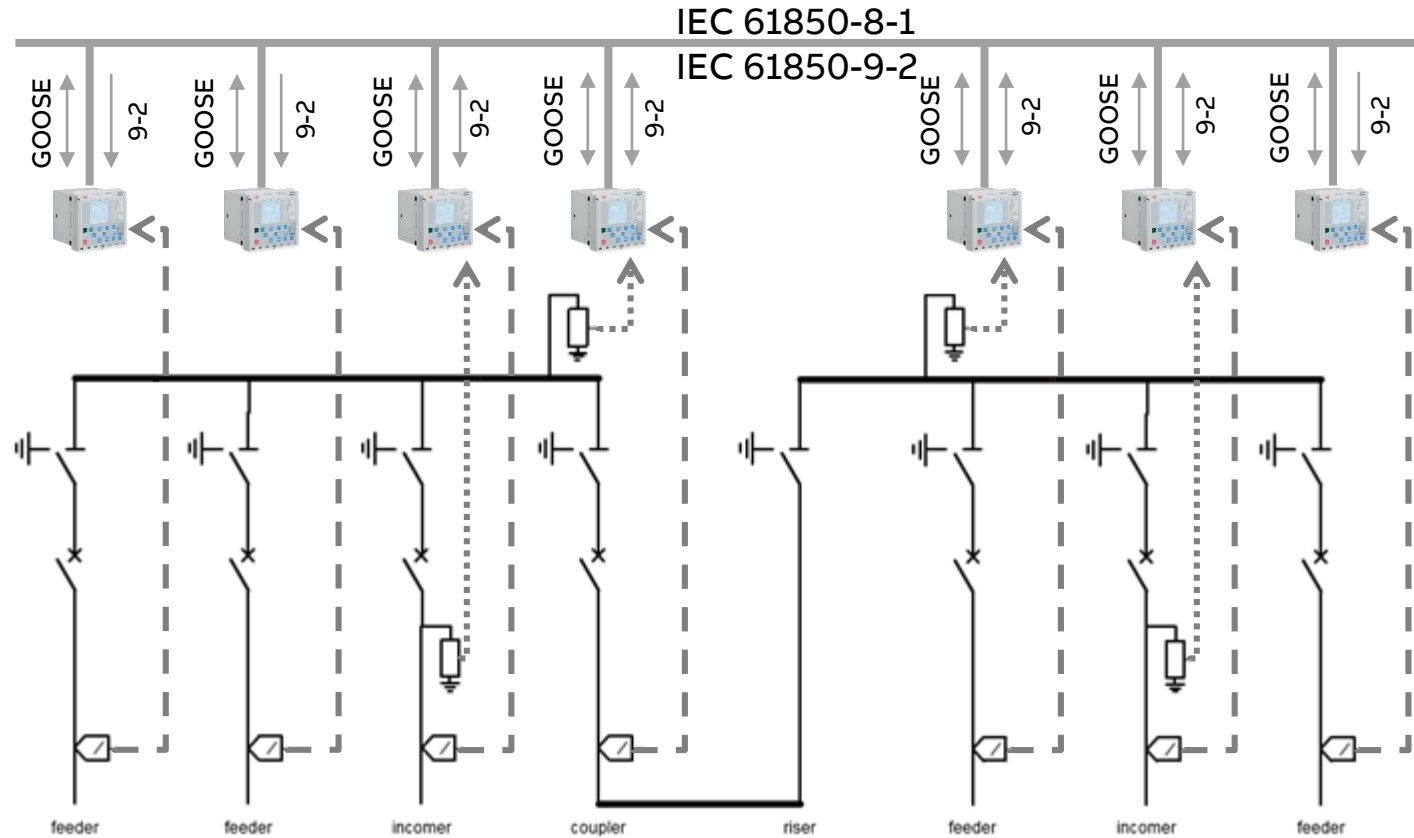
Communication according to IEC 61850-9-2 (Process bus)



Protection functions based on voltage signal from process bus (based on sampled measured values)

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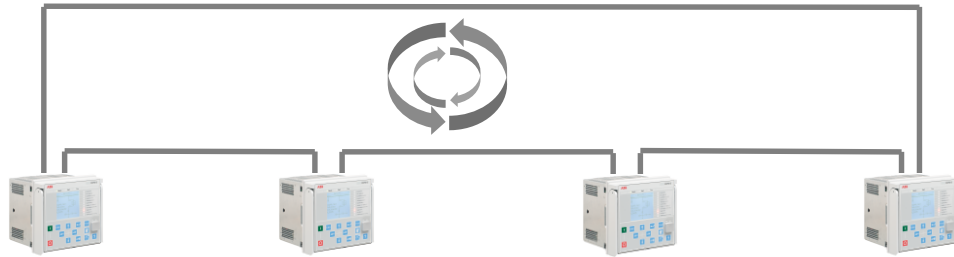
GOOSE and process bus on one glass fibre/ethernet cable



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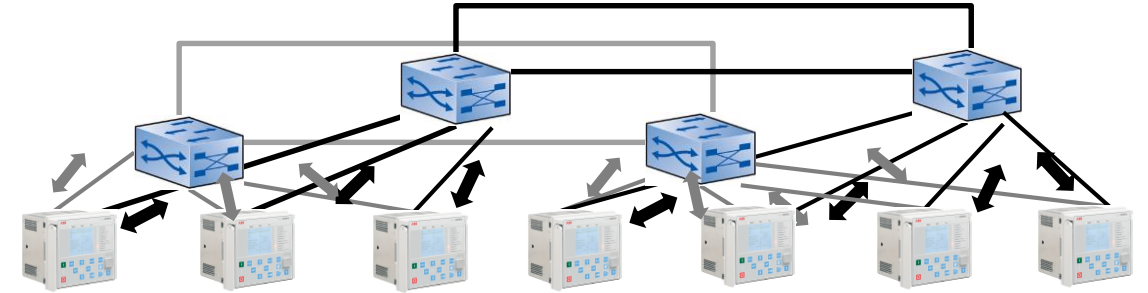
Redundant communication (recommended if process bus used)

HSR (High-availability Seamless Redundancy)



- Each information is twice on the bus
- Zero-time recovery
- Internal switches of relays are sufficient
- Maximum number of relays limited to 30

PRP (Parallel Redundancy Protocol)



- Each relay attached to two independent networks
- Zero-time recovery
- Separate switches needed

Redundant communication recommended when using process bus

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Protection relays



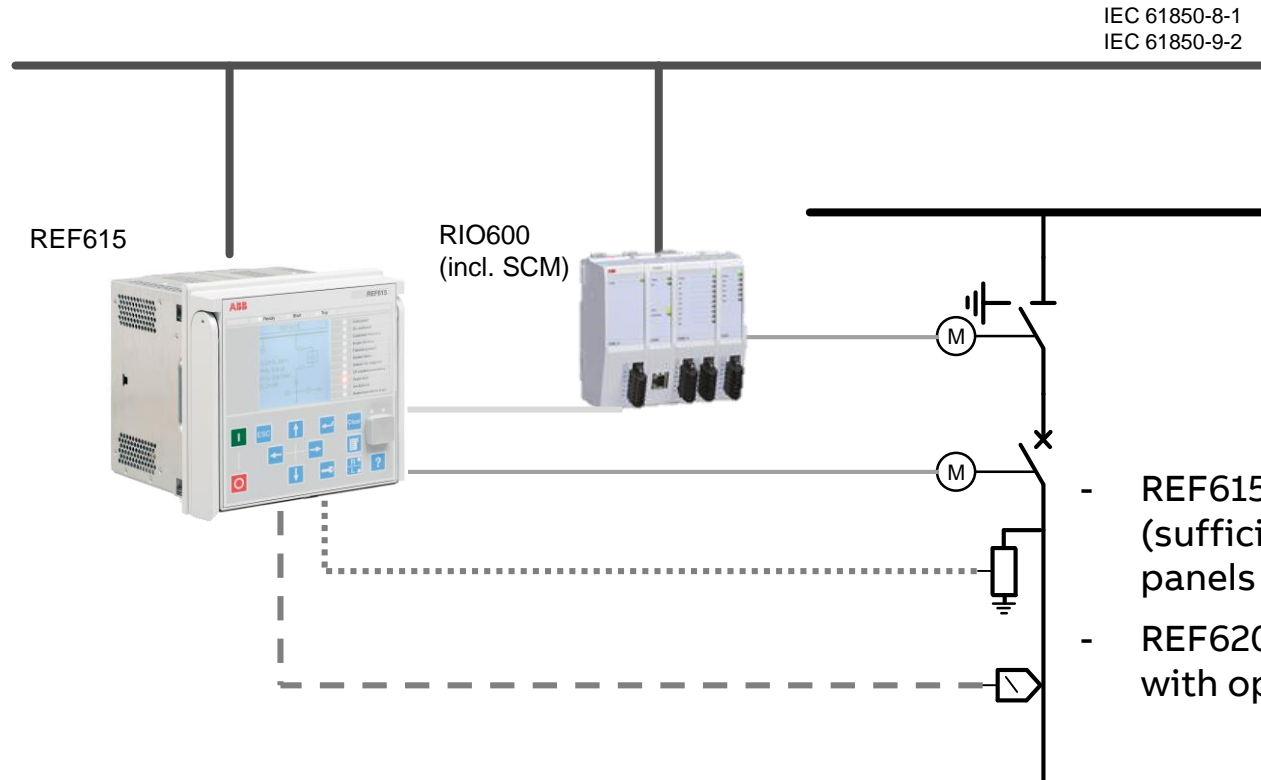
Relion®	Product Type	Standard configuration	Sensor support	IEC 61850-9-2 support
615 series	REF615 5.0 FP1	G	Yes	Yes
		L	Yes	Yes
	REM615 5.0 FP1	D	Yes	Yes
	RED615 5.0 FP1	E	Yes	Yes
620 series	REF620 2.0 FP1	AC (input and output selection)	Yes	Yes
	REM620 2.0 FP1	DA (input and output selection)	Yes	Yes

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RIO600

RIO600:

- Communication module (LECM)
- Power supply module (PSM)
- Smart control module for control of 3 position switch incl. 4 BI (SCM)
- IO modules:
 - 8 BI (DIM)
 - 4 BO (DOM)



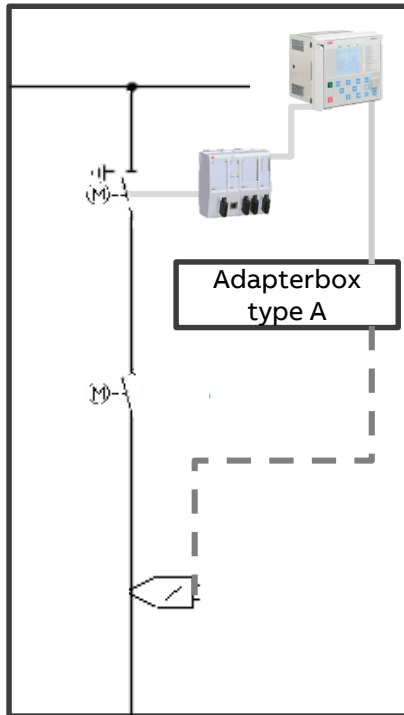
IEC 61850-8-1
IEC 61850-9-2

- REF615 with sensors 8 BI 10 BO
(sufficient for most standard configured ZX0.2 panels **without** motorized 3PS)
- REF620 with sensors 16 BI 14 BO
with optional board +8 BI +4 BO

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Panel variants

450mm Feeder



Typical configuration

- 615 relay series with sensor inputs (8BI/10BO):
 - 2x optic, 1x galvanic (internal switch)
- Adapter box type A
- 3x current sensor on outer cone

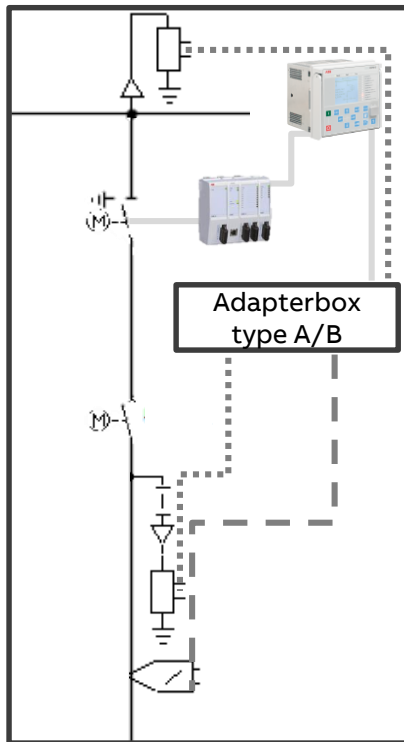
Optional:

- RIO600 incl. SMC for motorized 3PS (requires one communication port at relay)
- External switch
- RC01 CT on outer cone for metering (DTO, max. height 160mm)
- Voltage sensor on cable for max. 2 cables per phase (DTO)

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Panel variants

600mm Feeder



Typical configuration

- 615 relay series with sensor inputs (8BI/10BO):
 - 2x optic, 1x galvanic (internal switch)
- Adapter box type A/B
- 3x current sensor on outer cone

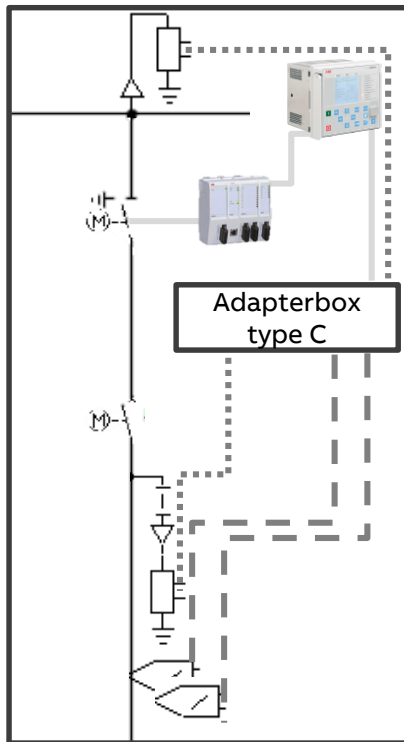
Optional:

- 3x either voltage sensor on cable or on busbar (Adapter box type B required)
- RIO600 incl. SMC for motorized 3PS (requires one communication port at relay)
- External switch
- RC10-188-150-75 CT on outer cone for metering (DTO, max. height 160mm)
- Voltage sensor on cable for max. 2 cables per phase (DTO)

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Panel variants

1200mm Feeder



Typical configuration

- 615 relay series with sensor inputs (8BI/10BO):
 - 2x optic, 1x galvanic (internal switch)
- Adapterbox type C
- 6x current sensor on outer cone

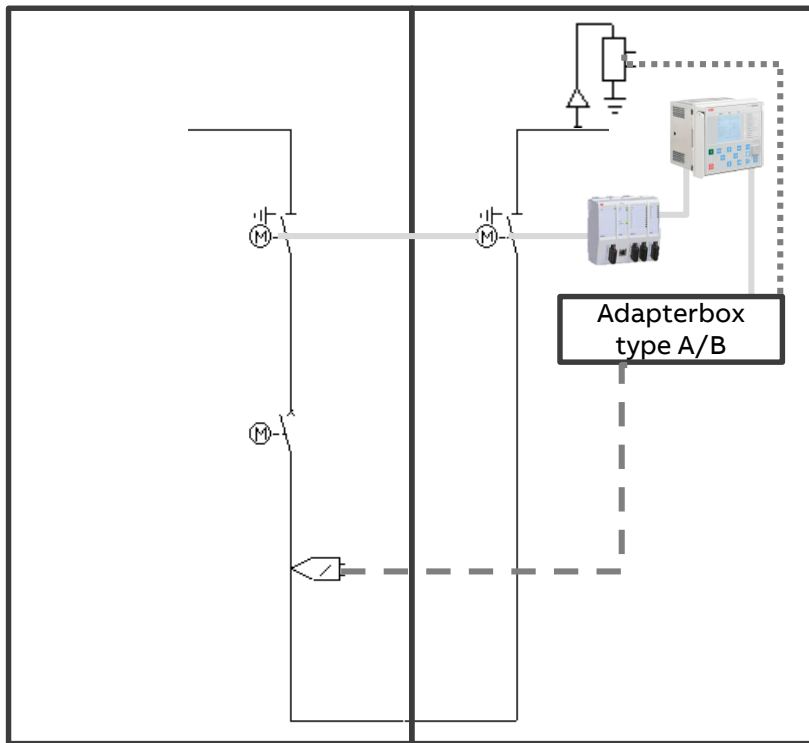
Optional:

- 3x either voltage sensor on cable or on busbar (Adapterbox type B required)
- RIO600 incl. SMC for motorized 3PS (requires one communication port at relay)
- External switch
- RC11-378-160-75 CT on outer cone for metering (DTO, max. height 160mm)
- Voltage sensor on cable for max. 2 cables per phase (DTO)

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Panel variants

Coupler/Riser



Typical configuration

- 615 relay series with sensor inputs (8BI/10BO):
 - 2x optic, 1x galvanic (internal switch)
- Adapter box type A/B
- 3x current sensor on outer cone

Optional:

- 3x voltage sensor on busbar (Adapterbox type B required)
- RIO600 incl. 2x SMC for motorized 3PS (requires one communication port at relay)
- External switch

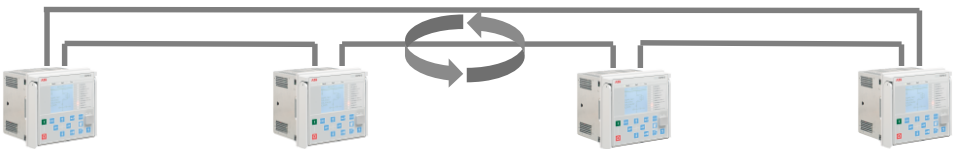
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Communication options

Redundant vs. non-redundant ring

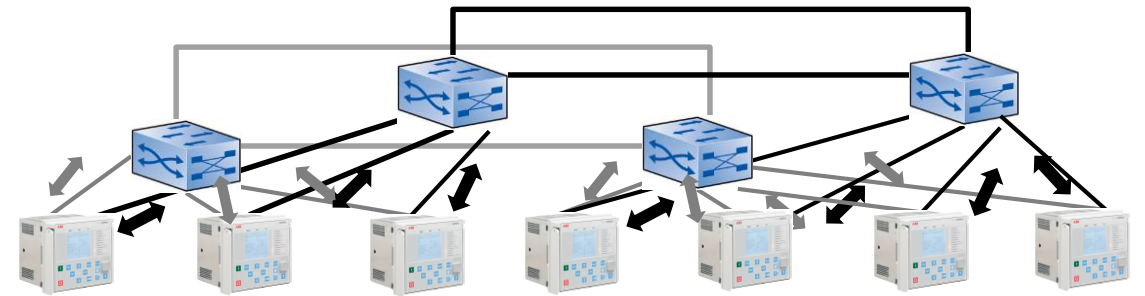


- Internal switch with HSR (2x optic for ring, 1x galvanic for RIO600 connection)

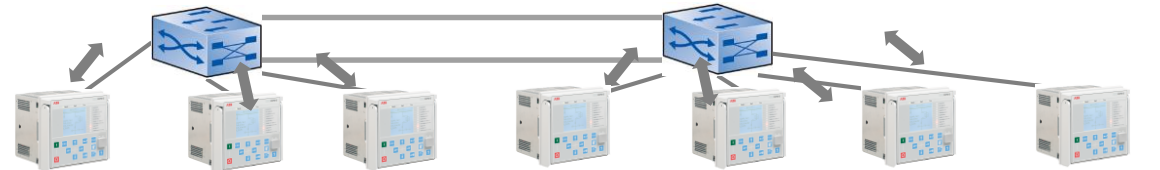


- Internal switch with HSR (2x optic for ring, 1x galvanic for RIO600 connection)

Redundant vs. non-redundant star



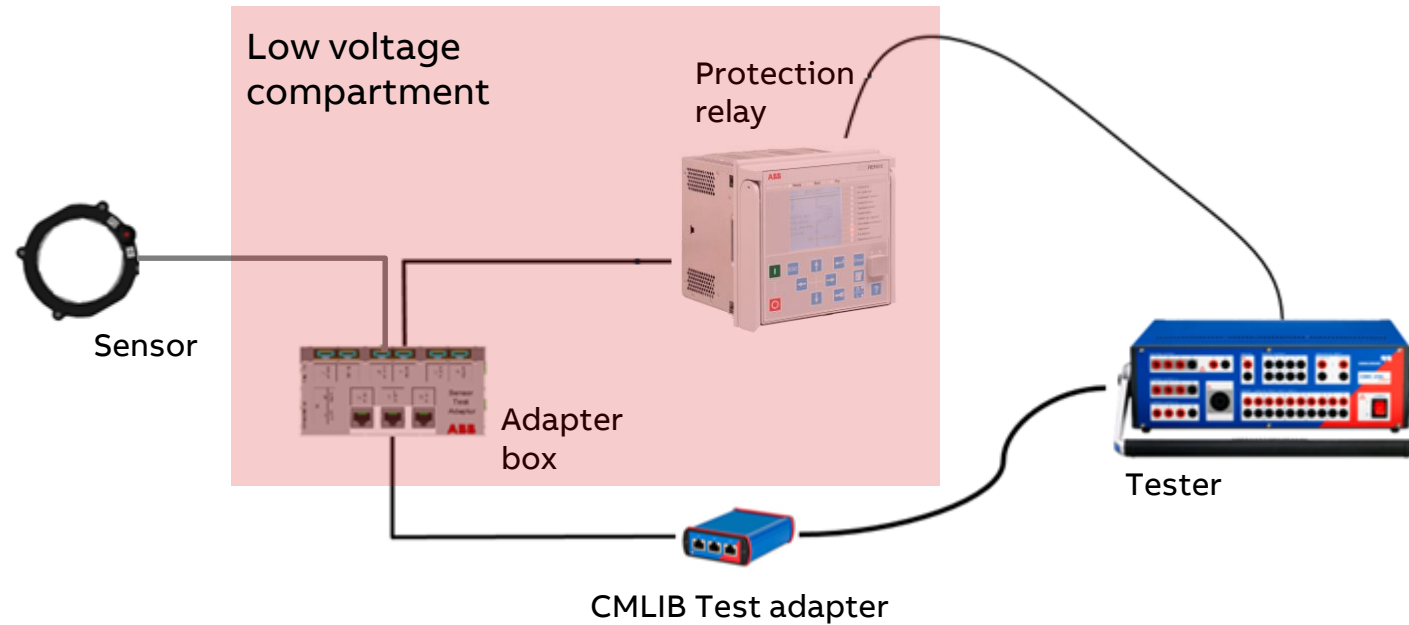
- Managed external switches
- Internal PRP connection ports (2x optic for PRP, 1x galvanic for RIO600 connection)



- Managed switch, Connect RIO600 to switch or order internal switch as well

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Testing setup



ZX0.2 Digital enables advanced testing schemes



ABB