DISTRIBUTION SOLUTIONS, MARCH 2018

Switchgear Upgrades

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RMU Digital Upgrade

Automating secondary distribution network

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SafeRing/SafePlus

Introduction

SafeRing/SafePlus

IEC Gas-Insulated Ring Main Unit and Secondary Switchgear

- SafeRing is a Medium voltage (MV) SF6-insulated Ring Main Unit (RMU) for secondary distribution network up to 40.5 kV, 630A
 - SafeRing: 12-24kV, 630A
 - SafeRing Air: 12kV, 630A
 - SafeRing AirPlus: 12-24kV, 630A
 - SafeRing 36: 40,5kV, 630A
- SafePlus is a SF6 insulated compact switchgear system for secondary distribution network upto 40.5 kV, 630A
 - SafePlus: 12-24kV, 630A
 - SafeRing Air: 12kV, 630A
 - SafePlus 36: 40,5kV, 630A
- SafeRing combined with the SafePlus concept represent a complete solution for 12-24kV secondary distribution networks
- More than 200 000 units delivered worldwide
 - Manually operated
 - Automated
- RMU Digital Upgrade solution is available for manually operated SafeRing / SafePlus





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SafeRing/SafePlus

IEC Gas-Insulated Ring Main Unit and Secondary Switchgear

- Applications:
- Marine
- Wind power
- Solar
- Hydro power
- Generation
- Distribution
- Metering
- Infrastructure
- Industry



Changing face of the grid

Increasing complexity in Distribution Networks

New challenges for traditional paradigms for control and commerce



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EV: Electric Vehicle DER: Distributed Energy Resource ABB

Grid of the future

Rapid rate of change requires higher velocity of decision making

Assets prosumers The world of energy is changing Grid rtation Supply Dramatic renewables growth Energy Storage Increasing intermittency Wind Greater volatility, less predictability ZZZ More feed-in, take-off points (e.g. data centers Grid of the and EV-charging) Microgrids future Th_{ermal} Increasing complexity, need for stability. Onand off-grid control Automation on "local" level Energy storage is \mathcal{C}_{\otimes} key Demand Continuing electrification of society

Emerging market consumption growth



Customers will increasingly have to deal with very dynamic environments

The need for faster decisions and real-time action requires visibility of the entire business

Digitalization is the answer for the necessary agility and decision-making velocity

Control & information flow is key

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Next generation Smart Secondary Switchgear

Key features

- Quick and accurate location of outages
- Directional fault indication
- Communication SCADA / DMS
- Flexibility
- Remote control of switches
- "Self-healing" network
- Surveillance of the network
- Sensor Technology (MV / LV)

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- Components monitoring
- Battery backup
- Safe communication



RMU Digital Upgrade

For SafeRing / SafePlus

Key Functionalities for the RMU Digital Upgrade

RMU Digital Upgrade covers up to Level 3 of the ABB switchgear automation portfolio

Functionality Levels

Level 1 - Monitoring

- MV switch position indication
- LV measurement
- MV network faults

Level 2 - Control (plus Level 1)

- MV switch operation
- MV network non-directional faults

Level 3 – Measurement (plus Level 2)

- MV network directional faults
- MV network analog values measurements
- Earth switches position indication

Level 4 - Protection (plus Level 3)

- Selectivity using the circuit breakers
- "Self-healing"
- Prediction



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RMU Digital Upgrade

Application concept

- Digital Upgrades are ready-made packages easily pluggable to existing RMUs, enabling the distribution network operator to meet the usually limited out of service time acceptable by the grid consumers.
- RMU Digital Upgrade application is only available for SafeRing/SafePlus 12-24kV switchgears having at least two adjacent CC fields (basic modules)
- Supports up to 4 way SafeRing/SafePlus unit (meaning up to two additional (C/F/V) fields to the basic modules)
- RMU Digital Upgrade offering is applicable only for internal mounting arrangement.



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RMU Digital Upgrade

Feeder Automation (FA) devices – Integrated solution



RMU Digital Upgrade packages

For SafeRing/SafePlus

RMU Digital Upgrade

SafeRing/SafePlus Digital Upgrades packages

Packages	Options
 Three different packages: RMU Digital Upgrade ARC600 FA Box (for Level 1, 2, 3) RMU Digital Upgrade RTU 540CID01 FA Box (Level 3) RMU Digital Upgrade REC615 FA Box (Level 3) 	 Wireless GSM/GPRS communication as option with ARG600 for the RTU540 and the REC615 FPI remote reset After remote resetting of fault indication, the FPI is again ready to catch, indicate and report another fault
 All standard packages always include: Power supply backup source for automation devices (24V DC batteries and charger) 	 Distribution transformer feeders "Emergency open" remote command Fast trip in case of emergency situations like local flooding, fire etc.
 Communication: Ethernet port/connection on all FA devices Wireless GSM/GPRS communication is included in the ARC600 Wireless communication comes with IEC 60870-5-104 host (slave) communication protocol among others 	 Supervision of the LV side of the Distribution transformer Energy quality, I, U, P, cos phi



Communication overview



RMU Digital Upgrade ARC600

Technical solution: Level 1, Level 2 and Level 3

Base Unit

- ARC600: main controller internal charger and wireless modem.
- Enclosure and heater.
- 2 x batteries





External

- Local remote switch: motor kit.
- LV multi-meter:



- Fault Passage Indicator (FPI):
 - OC and EF non directional
 - OC and EF directional



RMU Digital Upgrade RTU 540CID01

Technical solution: Level 3

Base Unit

- RTU540: main controller + license.
- (Optional) Wireless gateway (ARG600) or GPRS modem (500MDD01).

ARG 600

- Enclosure and heater.
- 2 x batteries and charger

RTU 540

External

- Local remote switch: motor kit.
- LV multi-meter



- Fault Passage Indicator (FPI):
 - OC and EF non directional
 - OC and EF directional

RMU Digital Upgrade REC615

Technical solution: Level 3

Base Unit

- REC615 (main controller, for future protection L4) + one internal FPI.
- Wireless gateway (ARG 600). (Optional)
- Enclosure and heater.
- 2 x batteries and charger





REC615



External

- Local remote switch: motor kit.
- LV multi-meter.
- Fault Passage Indicator (FPI):
 - 1 x inbuilt (+ RIO600).
 - OC and EF directional: Function in REC615
- Sensors
 - Indoor current sensor: KECA
 - Indoor voltage sensor: KEVA



Customer Benefits

RMU Digital Upgrade

Customer Benefits

The fastest way to align with the Smart Grid and the demand for cost efficiency.

Feeder Automation box inside the RMU/Switchgear

- Fully integrated solution in the RMU, less space consuming
- Fewer maintenance objects
- Less affected by the environment
- Fast and plugable installation
- No impact on compact secondary substation IP rating

Benefits of compact secondary substation automatization

- Improved quality of the power supply:
 - Less and shorter outages
 - Improvement of the operational efficiency

Optimal utilization of the distribution network

- Utilize the network more efficiently, minimize the network losses
- Optimal asset management
- Measurements of power flows/quality
- Improves overview of power network
- Extends life cycle of the earlier investments

Improves efficiency and safety of operating personnel

- Less need to travel to places that are difficult to reach
- Less need to work in dangerous environments

Benefits

Scalable solutions – from basic monitoring to more advanced measurement functionality

RMU Digital highlights

- Gain more efficient utilization of the secondary distribution network through automation and thus minimize the effect of power outages.
- Wireless modem GPRS/3G/LTE communicating with your DMS or SCADA system.

RMU Digital Upgrade functionalities enable network operators to

- Obtain real time data for analyzing and decision making, in order to optimize operations and improve power quality.
- Monitor the grid to enable remote fault localization.
- Reconfigure the network so that the faulty part of the network is isolated and ensure faster power restoration reducing the cost of energy loss.

Technical Information

RMU Digital Upgrade

FA Device: ARC 600

ABB Arctic Wireless controller

- Compact all-in-one wireless control and monitoring device
- Dedicated wireless control unit and protocol converter (IEC101 to IEC104; Modbus RTU to IEC104) with integrated I/O
- Supports GPRS, 3G and LTE connectivity
- Optimized for disconnector control (Control of three disconnectors)
- Indication of three earthing switches
- Support for selected Fault Passage Indicators (fault information can be sent to a central control and monitoring system)
- Built-in intelligent battery charger
- Authentication and encryption (using VPN) and integrated firewall



FA Device: RTU 540CID01

ABB RTU 540CID01: 16 DI, 8 DO

- Compact housing with integrated I/O to integrate hardwired information
- Algorithms, switching sequences and logics can be implemented as logic building blocks
- Interfacing with nearly all types and to large numbers of IEDs in a station via serial telecontrol protocols, such as IEC 60870-5-103, Modbus, SPAbus, or DNP3, or via Ethernet-based protocols, such as IEC 60870-5-104 or IEC 61850
- Standard protocols in combination with wireless communication and PLC capabilities are able to provide fault detection isolation and restoration functionality.
- Maintenance and service costs are kept low since RTU540 DIN rail solution is remotely configurable and maintainable.
- The high product quality and user-friendly service capability reduces life cycle costs.



FA Device: REC615

ABB Relion 615 series IED

- Remote control and monitoring, protection, fault indication, power quality analysis and automation in medium-voltage secondary distribution systems.
- Supports the protection of cable feeders in isolated neutral, resistance-earthed, compensated and solidly earthed networks.
- The adaptable standard configurations allow the relay to be taken into use right after the application-specific parameters have been set, thus enabling rapid commissioning.
- One breaker and up to eight load-break switches can be controlled via the relay's front panel HMI or a remote system.
- Support a variety of communication protocols (IEC 101/104, DNP3 level 2 and Modbus, as well as IEC 61850 with GOOSE).
- High speed outputs (e.g., for arc fault protection)
- Configuration relay logic (for building/customizing applications)



FA (REC615) + Device: RIO600

ABB RIO600 (I/O extension + FPI)

- Modular/extendable architecture (DIN-rail mountable modules)
- Fast Ethernet based IEC 61850 GOOSE communication with IED and substation automation
- Support of ABB sensors
- Fault Passage Indication (FPI)
- Power measurements: P, Q, S and $\cos \varphi$
- Active/reactive energy counters
- Capability to detect the directional and non-directional overcurrent and earth faults
- Support up to 40 Input / Output channels as well as two FPI modules with single power supply module



RMU Digital Upgrade optional table

RMU Digital Upgrade FA box packages						
Base components	Level 1 - Monitoring	Level 2 (plus Level 1) - Control	Level 3 (plus Level 2) - Measurement			
Package	RMU Digital Upgrade ARC600 FA	RMU Digital Upgrade ARC600 FA Box	RMU Digital Upgrade	RUM Digital Upgrade RTU	RMU Digital Upgrade REC615	
	Box		ARC600 FA Box	540CID01 FA Box	FA Box with RIO600 contacts	
BackUp	Batteries	Batteries	Batteries	Batteries	Batteries	
FA device	ARC600	ARC600	ARC600	RTU 540	REC615	
Components	Options					
FA device modules	-	-	-	¹ Binary inputs	¹ RIO600 Binary inputs	
	-	-	-		RIO600 Sensor input	
Modem	Modem inbuilt	Modem inbuilt	Modem inbuilt	ARG600	ARG600	
Motor	-	LBS motor operation	LBS motor operation	LBS motor operation	LBS motor operation	
FPI/Short-circuit indication	FPI	FPI	FPI	FPI	1x FPI inbuilt (RIO600 FPI Sensor input)	
VPIS/VDS	-	-	VDS	VDS	-	
LV multi-meter	LV multi-meter	LV multi-meter	LV multi-meter	LV multi-meter	LV multi-meter	
Sensor / Current transformer					Current sensor: KECA	
					Voltage sensor: KEVA	
	Levels features					
	Level 1:	Level 2 (plus Level 1):	Level 3 (plus Level 2):			
	MV LBS switch position indication.					
	¹ Earth switches position indication.					
	LV measurement.	MV switch operation.	MV analog values measurements.			
	MV network faults.	IVIV non-directional OC or EF faults.	MV directional OC and EF faults.			

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