Switchgear Upgrades
RMU Digital Upgrade
Automating secondary distribution network
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- SafeRing/ SafePlus - Introduction
- Changing face of the grid
- RMU Digital Upgrade
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- Customer benefits
- Technical information for Feeder Automation Devices
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 upto 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
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

- Distributed energy resources at customer sites
- System in which EV sell demand response services to the grid
- Control in-home appliances to switch off high-load components (load disaggregation)
- Collect, store and report residential energy use information
- Underlying communication to support Smart technology
- Health Monitor network parameters & control devices remotely
- Managing voltage levels & reactive power (VAR) with assets owned by the utility and otherwise

Distributed energy resources connected renewables generation and storage
Aggregation of DERs for wide-area grid support and market trading
Load management at customer sites through e.g. dynamic pricing
Regulatory requirements for more granular pricing schemes and markets
Prosumers locally sell excess energy from their distributed energy
Decentralized market platform for charging EVs
Frequency Regulation

EV: Electric Vehicle
DER: Distributed Energy Resource
Grid of the future
Rapid rate of change requires higher velocity of decision making

The world of energy is changing

Supply
- Dramatic renewables growth
- Increasing intermittency
- Greater volatility, less predictability
- More feed-in, take-off points (e.g. data centers and EV-charging)
- Increasing complexity, need for stability. On- and off-grid control
- Automation on “local” level. Energy storage is 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
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)
- Components monitoring
- Battery backup
- Safe communication

SCADA: Supervisory Control And Data Acquisition
DMS: Distribution Management System
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
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.
RMU Digital Upgrade
Feeder Automation (FA) devices – Integrated solution

Digital Upgrades are ready-made packages easily plugable to existing RMUs

Monitoring and control of SWG

- GPRS, 4G, LTE, fiber...
- VPN
- Sensors
- Motor
- FPI’s
- Battery back-up

FA devices
RMU Digital Upgrade packages
For SafeRing/ SafePlus
**RMU Digital Upgrade**

SafeRing/ SafePlus Digital Upgrades packages

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

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).
- Enclosure and heater.
- 2 x batteries and charger

**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

**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

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 $\cos \phi$
- 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

<table>
<thead>
<tr>
<th>Components</th>
<th>Levels features</th>
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<tbody>
<tr>
<td></td>
<td>Level 1:</td>
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<tr>
<td>MV LBS switch position indication</td>
<td>MV switch operation.</td>
</tr>
<tr>
<td>Earth switches position indication</td>
<td>LV measurement.</td>
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<tr>
<td>LV measurement.</td>
<td>MV non-directional OC or EF faults.</td>
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<tr>
<td>MV network faults.</td>
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### Base components

<table>
<thead>
<tr>
<th>Package</th>
<th>Level 1 - Monitoring</th>
<th>Level 2 (plus Level 1) - Control</th>
<th>Level 3 (plus Level 2) - Measurement</th>
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</thead>
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<td>RMU Digital Upgrade ARC600 FA Box</td>
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</tr>
<tr>
<td>BackUp Batteries</td>
<td>Batteries</td>
<td>Batteries</td>
<td>Batteries</td>
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<tr>
<td>FA device ARC600</td>
<td>ARC600</td>
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</table>

### FA device modules

<table>
<thead>
<tr>
<th>Options</th>
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<tbody>
<tr>
<td>1 Binary inputs</td>
</tr>
<tr>
<td>RIO600 Binary inputs</td>
</tr>
<tr>
<td>RIO600 Sensor input</td>
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</tbody>
</table>

### Modem

<table>
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<th>Options</th>
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<tbody>
<tr>
<td>Modern inbuilt</td>
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### Motor

<table>
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<tr>
<th>Options</th>
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<tbody>
<tr>
<td>LBS motor operation</td>
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### FPV/Short-circuit indication

<table>
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<tr>
<th>Options</th>
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<tbody>
<tr>
<td>FPI</td>
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### VPIS/VDS

<table>
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<tr>
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<tbody>
<tr>
<td>VDS</td>
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### LV multi-meter

<table>
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<th>Options</th>
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</table>

### Sensor / Current transformer

<table>
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<tr>
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</tr>
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<tbody>
<tr>
<td>Current sensor: KECA</td>
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<tr>
<td>Voltage sensor: KEVA</td>
</tr>
</tbody>
</table>

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