Relion® Latest technology for Protection, Control, Measurement, and Supervision of T&D systems
Introduction to Relion®

- Contents
  - The Relion® product family
Introduction to Relion®

- Relion®…A strong family name as an identifier for the new generation of Protection and Control IEDs from ABB
- From interconnected transmission grids to secondary distribution networks

- Relion is the globally recognizable product family name, firmly placing ABB protection and control products on top of the customers mind
  - History of strong products from Westinghouse, Brown Boveri, Asea, ITE Imperial Corporation.
  - ABB’s identifier for all new protection and control products
Relion Product Family
Relion Series Family

- **670** - Optimized for transmission applications
- **650** - Optimized for transmission and subtransmission applications
- **620** - Optimized for High end distribution applications
- **615** - Standard series for distribution applications
Relion® family products

**Family Highlights**

- One common tool for all Relion® products, Protection and Control Manager PCM600
- Covers all applications, from intercontinental transmission grids to secondary distribution networks
- The performance of Relion protection and control IEDs meet the comprehensive IEC 61850 communication tasks, for example, GOOSE messaging for peer-to-peer communication
- The Relion IEDs utilize ABB’s unique connectivity package concept
- The Relion product family provides configured, pre-configured or fully customized IEDs
Relion® Protection and Control

670 and 650 Series

- 670 series – optimized for generation and transmission applications provide versatile functionality, maximum flexibility and performance to meet the highest requirements of any application in generation and transmission protection systems.

- 650 series – your best choice for transmission and sub-transmission applications providing “off-the-shelf”, ready to use solutions for line, bus, breaker, generator and transformer protection as well as bay control applications primarily in transmission and sub-transmission networks.
Relion® 650 series

- Your best choice for transmission/sub-transmission applications
  - 650 series
    - Product portfolio addresses functionality in sub-transmission applications
      - REC650 Bay control IED
      - REL650 Line distance protection
      - RET650 Transformer protection
      - REB 650 Bus Bar Protection
      - REQ 650 Breaker control
      - REG 650 Generator Protection
    - Powerful and flexible hardware that is common for the 650 series
    - Protection and control function types are identical in the 650 series
    - Efficient engineering, parameter setting, test, commissioning, and operation
    - PCM600 tool platform is used
Relion® 650 series

- Features

- Off-the-shelf, ready to use solutions
  - Pre-defined functionality, application configuration ready-made at the factory
  - Support for user defined names for signal and function engineering
    - Minimal number of parameters & settings
    - ABB new global base value concept
    - Four setting groups
    - IEDs deployment faster than ever before
Relion® 650 series

**Features**

- Advanced local HMI functionality
  - 15 dynamic and configurable LED in 3 colors and 3 pages
  - 5 configurable pushbuttons
- Extensive condition monitoring
  - Circuit Breaker monitoring
  - Insulation / Gas monitoring
  - Trip Circuit Supervision
  - IED Power Supply monitoring
- One application specific main protection function
- Unified back-up protection functionality
- Supports 3-phase tripping
Relion® 650 series

Hardware

- Platform based
  - Few spare parts needed on module level
  - Common module firmware
  - Easy future hardware addition possibilities
  - Minimized cost for maintenance and training

- I/O flexibility
  - 10 or 20 keyed analog inputs in different configurations
  - CT connections have short-circuits
  - 1A or 5A settable on the same CT inputs
  - Up to 220V on the settable VT inputs
  - 14 –50 binary inputs, 9 –45 binary outputs
  - Compression type or ring lug cable termination
Relion® 650 series

Local HMI

- Efficient interaction with the IED
  - Direct interaction with IEDs from LHMI
  - Graphical display and measurement adapted to the application
  - Control screen can be default
  - National language support, unicode
  - Forcing of binary output when in test mode

- Monitoring
  - IED status indication LEDs
  - Measurements
  - Binary signals via indication LEDs
  - Disturbances and events
Relion® 650 series

Local HMI

- Control in REC650
  - Control of up to 8 apparatus in 1 bay, select before operate
  - The exact presentation of the configured switchgear arrangement on LCD with IEC or ANSI symbols
  - Commands with override operations

- Settings
  - All parameters can be read and set via the local HMI

- Five configurable push button shortcuts with labels presented on the display for different actions, menu shortcut or commands
Relion® 650 series

Local HMI

Three dedicated LEDs: Ready, Start, Trip

Graphical LCD Display (320 * 240 pixels)

5 programmable function keys for command or Menu shortcut

Escape button

Select command buttons for Open and Close

Three dedicated LEDs: Ready, Start, Trip

Multicolor LEDs

Enter button

Alarm list button

Clear button

Menu button

Help button

Front DHCP comm. port

Navigation buttons

Authorization

Remote/Local
Relion® 650 series

Local HMI

- Status indication LEDs indicate the status of the IED:
  - Green
    - Steady: In service
    - Flashing: Internal failure
  - Yellow:
    - Steady: Disturbance recorder triggered
    - Flashing: IED in test mode
  - Red:
    - Steady: Trip command issued
    - Flashing: IED blocked

- Indication of binary signals via 15 three-color-state indication LEDs on up to three pages. Therefore, 45 LEDs with three colors gives 135 active state indications.
- Steady, flashing, latched, signal following
- Detailed information window on LEDs
Relion® 650 series

Main function

- Each product in the 650 series has 1 main function
  - REC650 main function is bay control
  - REL650 main function is distance protection
  - RET650 main function is differential protection
  - REB 650 main function is bus bar protection
  - REQ 650 main function is breaker control
  - REG 650 main function is generator protection
Relion® 650 series

Other functions

Backup protection and general functions

- Instantaneous phase overcurrent protection
- Instantaneous residual overcurrent protection
- Four step directional phase overcurrent protection
- Four step directional residual overcurrent protection
- Scheme communication logic for distance or overcurrent protection
- Scheme communication logic for residual overcurrent protection
- Sensitive directional residual overcurrent and power protection
- Stub protection
- Pole discordance protection
- Thermal overload protection one time constant
- Thermal overload protection two time constant
- Directional Under-power protection
- Directional Over-power protection
- Directional negative sequence overcurrent protection
- Two step undercurrent protection
- Broken conductor check
- Breaker failure protection
- Fuse failure supervision
- Current circuit supervision
- Breaker close/trip circuit monitoring
- Synchrocheck, energizing check and synchronizing
- Autorecloser
Relion® 650 series

Other functions

Backup protection and general functions

- Two step overvoltage protection
- Two step residual overvoltage protection
- Two step undervoltage protection
- Over excitation protection
- Over frequency function
- Under frequency function
- Rate-of-change frequency function
- Loss of voltage check
- Tripping logic
- Logic rotating switch for function selection and LHMI presentation
- Selector mini switch
- Measurements
- Event counter
- Event list
- Indication
- DR & Event recorder
- General Logics
- Additional Logics with QT
- Trip Circuit Supervision
- Insulation / Gas Monitoring
- Station Battery Supervision
- Metering (Pulse, Energy)
Line protection with REL650

- Fast and reliable distance protection
  - Reliable earth fault protection, for both solid-grounded and high impedance grounded systems.
    - The selection between the two different grounding systems can be made by settings
- Reliable back-up protection over current, over voltage, thermal overload
- Autorecloser with synchrocheck
- Scheme communication
- Three-phase tripping
Line protection with REL650

- Ready made application configurations for:
  - Single breaker, double busbar, quadrilateral distance protection
  - Single breaker, double busbar, Mho distance protection
Line protection with REL650

With quadrilateral or mho characteristics

- ½ of 19” rack
- One 4I+1I*+5V TRM
- 2 BIO cards, each with 9 Binary Inputs and 9 Binary Outputs
- Power Supply Module with 9 Binary Outputs
- COM module with 14 Binary Inputs* one sensitive current input
### REL670/RED670 and REL650

- **650 has single pole tripping**

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<thead>
<tr>
<th>Feature</th>
<th>REL670 / RED670</th>
<th>REL650</th>
</tr>
</thead>
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<tr>
<td>Line distance protection</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Line differential protection</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Series compensated networks distance protection</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Single-phase tripping</td>
<td>☑</td>
<td>☑</td>
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<tr>
<td>Three-phase tripping</td>
<td>☑</td>
<td>☑</td>
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<tr>
<td>IEC61850-8-1 and DNP3.0</td>
<td>☑</td>
<td>☑</td>
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<tr>
<td>Other protocols LON, SPA, IEC 60870-5-103</td>
<td>☑</td>
<td></td>
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</table>
Line protection - REL670 and RED670 highlights

- High speed and reliable line protection functions
- Excellent for series compensation and HVDC vicinity
- Multi-object and multi-terminal capability
- Autorecloser and synchrocheck
- Apparatus control integrated in the line protection
- Full compatibility in scheme communications between 670 series and 650 series
- Full IEC 61850 compatibility
- Full engineering capability to the customer needs
Line protection - REL650 highlights

- Fast and reliable line distance protection
- Back-up protection included
- Autorecloser and synchrocheck
- Full compatibility in scheme communications between 670 series and 650 series
- Advanced Human Machine Interface
- User defined names
- Settable CT, VT ratings and binary input pick up voltage
- Full IEC 61850 compatibility
- Easy ordering of the product as all functionality is available as standard
  - Ready to use for the application with full configuration
Bay control with REC650

- Local and remote control of up to 8 primary apparatus
- Modeled according to IEC 61850
- Select before operate procedure with enhanced security
  - Interlocking:
    - Bay interlocking
    - Station wide interlocking using GOOSE
- Safe and easy-to-use reservation method between apparatus and bays
- Ready made application configurations available and additional glue logics can be added when required
REC650 offering

- Ready made application configurations for:
  - Single busbar single breaker arrangement (REC650 –A01A)
  - Double busbar single breaker arrangement (REC650 –A02A)
  - Bus coupler single breaker arrangement (REC650 –A07A)

- All application configurations include backup protection
- All application configurations include interlocking and by-pass
- Available in ½19” rack 6U height
REC650 apparatus control

- Clear indications of apparatus states on the IED HMI
  - Positions
  - Clear messages to operators
  - Interlocked padlock shown
  - Substituted exclamatory shown

- Commands with overrides from IED HMI
  - Interlock override
  - Synchrocheck override
  - Password protected
## REC670 and REC650

<table>
<thead>
<tr>
<th>Feature</th>
<th>REC670</th>
<th>REC650</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 8 apparatus in single IED</td>
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<td>✗</td>
</tr>
<tr>
<td>&gt;8 up to 15 apparatus in single IED</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>Up to 30 apparatus in single IED</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>Multi bays in single IED and complex network topologies</td>
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<td></td>
</tr>
<tr>
<td>Reservation between bays</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>IEC61850-8-1 and DNP3.0</td>
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<td>✗</td>
</tr>
<tr>
<td>Other protocols</td>
<td>✗</td>
<td></td>
</tr>
</tbody>
</table>
Bay control - REC670 highlights

- Apparatus control for up to 30 apparatus with integrated backup protection
- Available as pre-configured or can be completely customized to your needs
- Multi-object (CB) and Multi-bay control capability for handling several bays with a single IED
- Modeled according to IEC61850 with full compatibility
- Select before operate with enhanced security
- Unique fail safe reservation methods for apparatus control
- Well proven standard interlocking functions
- Transformer tap control and voltage control
Bay control - REC650 highlights

- Apparatus control for up to 8 apparatus with integrated backup protection
- Ready-to-use configured IEDs for 3 network configurations
- Modeled according to IEC61850 with full compatibility
- Safe and dependable reservation method for apparatus control
- Select before operate with enhanced security
- Well proven standard interlocking functions
- Powerful and extensive local HMI functionality eliminates the need for external mimic boards
- User defined names
- Easy ordering of the product as all functionality is available as standard
Transformer protection and voltage control with RET650

- Reliable transformer differential protection function
  - for 2-windings with 2-restraint inputs
  - for 3-windings with 3-restraint inputs

- Reliable low impedance restricted earth fault protection.

- Integrated back-up protection (OC, EF, OV, THOL, OVEX, etc.)

- Automatic voltage control for one or two transformers within one IED

- Single line diagram on the local HMI for presentation of apparatus status
Sensitive transformer differential protection in RET650

- Sensitive negative sequence differential protection
  - Unique capability to detect and trip low-level internal faults such as turn-to-turn faults

- On-line reading and automatic compensation for On-Load Tap-Changer position

- Zero-sequence current elimination settable for every winding
RET650 offering

- Configured products with ready made application configurations for single breaker station arrangements:
  - Two-winding transformers including protection and voltage control for a single transformer
  - Three-winding transformers including protection and voltage control for a single transformer
  - Advanced voltage control for two transformers operating in parallel
RET650 for two-winding power transformer

- ½of 19”rack
- One 8I+2V TRM
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- Tap-changer position via BCD code
RET650 for two-winding power transformer

- ½ of 19” rack
- One 8I+2V TRM
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- OLTC position via BCD code
RET650 for three-winding power transformer

- ½ of 19” rack
- Two 6I+4V modules (TRM+AIM)
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- Tap-changer position via BCD code
RET650 for three-winding power transformer

- \( \frac{1}{2} \) of 19” rack
- Two 6I+4V modules (TRM+AIM)
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- OLTC position via BCD code
RET650 for voltage control Two parallel transformers

Two parallel transformers

- ½ of 19” rack
- One 6I+4V TRM
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- Tap-changer positions via BCD code
- Single control for one or two transformers
  - Parallel control based on: Master-follower or Circulating current
- Backup protection for both W2
RET650 for voltage control Two parallel transformers

Two parallel transformers

- ½ of 19” rack
- One 6I+4V TRM
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- OLTC positions via BCD code
- Single control for one or two transformers
  - Parallel control based on:
    - Master-follower or
    - Circulating current
- Backup protection for both W2
RET650 voltage control

- Dedicated LHMI screen per transformer/VCTR function
- Complete overview about transformer/tap-changer status
- All required measurements
- Single / parallel control info
- Auto/man selection
- Raise/lower commands
<table>
<thead>
<tr>
<th>Feature</th>
<th>RET670</th>
<th>RET650</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto-transformers (all sizes)</td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>2- and 3-winding transformers</td>
<td>&gt;100MVA</td>
<td>&lt;100MVA</td>
</tr>
<tr>
<td>Railway transformers (50/60 Hz)</td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Special transformers (Phase shifters, HVDC converter transformers)</td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
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<tr>
<td>SVCs and FACTS devices</td>
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<td>![Checkmark]</td>
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<tr>
<td>Shunt reactors and Shunt capacitors</td>
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<tr>
<td>Shunt capacitors</td>
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</tbody>
</table>

**Transmission**

**Sub-transmission**
High impedance differential busbar protection with Relion® 650 series

- Contents
  - Introduction - Relion® 650 series
  - High impedance differential busbar protection with Relion 650 series
  - Applications
  - Technology Summary
High impedance differential busbar protection with Relion 650 series

- Contents
  - Introduction - Relion® 650 series
  - High impedance differential busbar protection with Relion 650 series
  - Applications
  - Relion – Complete Confidence
  - Technology Summary
REB650 application examples

H-type station

1 1/2 breaker station
Ease of use from ready-to-use solutions
REB650 – A03
High impedance differential busbar protection with Relion® 650 series

- Contents
  - Introduction - Relion® 650 series
  - High impedance differential busbar protection with Relion 650 series
  - Applications
  - Technology Summary
Features
REB650 - Technology summary

- Fully IEC 61850 compliant
- Protection and monitoring integrated in one IED
- Extensive self-supervision including analog channels
- Four independent parameter setting groups
- Large HMI for visualization of single line diagrams and on-line measurements
Features
REB650 - Technology summary

- Integrated or detachable HMI with 1-5 m cable for flexible panel mounting
- Ethernet interface for fast and easy communication with PC
- Accurate time synchronization via SNTP, DNP 3.0, IEC 60870-5-103 and IRIG-B serial interface
- Signal matrix for easy configuration of binary and analog signals
- User management and authority handling
Long life with high availability
Replacement and partial retrofit of existing systems

- Easy and cost-efficient way to replace remote back-up protection with local back-up protection.
  - The original main protection can remain in operation
  - Integrated disturbance recorder improve your disturbance information handling.

- Partial replacement and retrofit
  - Combine REQ650 with well-functioning existing relays.
  - Replace the breaker failure protection relay with one REQ650 per bay
  - Additional functionalities will become available
    - Extensive back-up protection functionality, basic control functionality and a disturbance recorder.
  - Saves both time and money
Breaker protection with Relion® 650 series

Contents

- Introduction - Relion® 650 series
- Breaker protection with Relion 650 series
- Applications
  - Relion – Complete Confidence
  - Technology Summary
REQ650 application examples

Line bay in a solidly grounded network, connected to single busbar switchyard.

Line bay in a solidly grounded network, connected to double busbar switchyard.

Transformer bay in a solidly grounded network, connected to double busbar switchyard.
Ease of use from ready-to-use solutions
REQ650 - A01A

- Single busbar single breaker
  10AI (4I+1I+5U)
- Binary Input/Output modules
  - 1 basic
  - 3 optional
- Three phase variant
Ease of use from ready-to-use solutions

REQ650 - A11A

- Single busbar single breaker 10AI (4I+1I+5U)
- Binary Input/Output modules
  - 2 basic
  - 2 optional
- Single phase variant
Ease of use from ready-to-use solutions
REQ650 – B11A

- Double busbar single breaker 10AI (4I+1I+5U)
- Binary Input/Output modules
  - 2 basic
  - 2 optional
- Single phase variant
Breaker protection with Relion® 650 series

Contents

- Introduction - Relion® 650 series
- Breaker protection with Relion 650 series
- Applications
- Relion – Complete Confidence
- Technology Summary
Relion®
Complete confidence

The Relion® product family offers widest range of products for protection, control, measurement and supervision for power systems. To ensure interoperable and future-proof solutions, Relion products have been designed to implement the core values of the IEC 61850 standard. With ABB’s leading-edge technology, global application knowledge and experienced support network, you can be completely confident that your system performs reliably - in any situation.
Relion® protection and control
Highlights in the family

- One common tool for all Relion® products, Protection and Control IED Manager PCM600
- Covers all applications, from generation and interconnected transmission grids to secondary distribution kiosks
- The performance of protection and control IEDs meet the comprehensive IEC 61850 communication tasks, for example, GOOSE messaging for horizontal communication
- The IEDs utilize ABB’s unique connectivity package concept
- The Relion product family provides configured, pre-configured or fully customized IEDs
Breaker protection with Relion® 650 series

Contents

- Introduction - Relion® 650 series
- Breaker protection with Relion 650 series
- Applications
- Relion® – Complete Confidence
- Technology Summary
Features
REQ650 - Technology summary

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- Protection and monitoring integrated in one IED
- Extensive self-supervision including analog channels
- Four independent parameter setting groups
- Large HMI for visualization of single line diagrams and on-line measurements
Features
REQ650 - Technology summary

- Integrated or detachable HMI with 1-5 m cable for flexible panel mounting
- Ethernet interface for fast and easy communication with PC
- Accurate time synchronization via SNTP, DNP 3.0, IEC 60870-5-103 and IRIG-B serial interface
- Signal matrix for easy configuration of binary and analog signals
- User management and authority handling
Configured solutions
REQ650 - Technology summary

- Breaker bay with back-up protection functions, three-phase tripping
- Breaker bay connecting a sub-transmission/transmission line, with back-up protection functions, single-phase tripping, single busbar section
- Breaker bay connecting a sub-transmission/transmission line, with back-up protection functions, single-phase tripping, two busbar sections
Most important protection functions
REQ650 - Technology summary

- Current
  - Instantaneous phase overcurrent protection
  - Four step directional phase and residual overcurrent protection
  - Four step phase overcurrent protection
  - Instantaneous residual overcurrent protection
  - Sensitive directional residual overcurrent and power protection
  - Thermal overload protection
  - Breaker failure protection
  - Stub protection
  - Pole discordance protection
  - Broken conductor check
  - Directional under- and overpower protection
  - Two step negative sequence based overcurrent protection
Most important protection functions
REQ650 - Technology summary

- Power functions
  - Directional under- and over power protection

- Voltage
  - Two step under- and overvoltage protection
  - Two step residual overvoltage protection
  - Loss of voltage check

- Frequency protection
  - Under- and overfrequency protection
  - Rate-of-change frequency protection

- Secondary system supervision
  - Current circuit supervision
  - Fuse failure supervision
  - Breaker close/trip circuit monitoring
Monitoring
REQ650 - Technology summary

- Disturbance recorder
  - 100 disturbances
  - 40 analog channels
    (30 physical and 10 derived)
  - 96 binary channels
- Event list for 1000 events
- Disturbance report
- Event and trip value recorders
- Event counters

- Supervision of AC input quantities
- Insulation gas monitoring function
- Insulation liquid monitoring function
- Circuit breaker condition monitoring
- Station battery supervision
- Indication of up to 135 binary signals via 15 three-color-state
- Indication LEDs on up to three pages
Measurements, metering and communication
REQ650 - Technology summary

- **Measurements**
  - $U, I, P, Q, S, f, \text{ and } \cos \phi$
  - AC input quantities with accuracy better than 0.5%

- **Metering**
  - Energy metering function for energy statistics
  - Pulse counting support for energy metering

- **Communication**
  - IEC 61850-8-1 including GOOSE messaging
  - DNP 3.0 slave protocol
  - IEC 60870-5-103 serial communication
Tools and hardware
REQ650 - Technology summary

- Setting, configuration and disturbance handling
  - Protection and control IED manager PCM600

- Hardware
  - 1/2 x 19”, 6U height case
  - 10 analog inputs (5 CT and 5 VT inputs)
  - Universal 1A/5A CT inputs
  - Communication and processor module with 14 inputs
  - Binary input/output modules with 9 inputs and 9 outputs
  - Possibility to add up to two optional binary input/output modules depending on the selected configuration
  - Power supply modules from 48 to 250 V DC or 100 to 240 V AC with 9 outputs, 3 of which with trip circuit supervision
RER620 is a member of ABB’s Relion® product family and part of its 620 protection and control product series.

The 620 series IEDs are characterized by their compactness and withdrawable design.
RER620 is a dedicated IED designed for the protection, measurement, control and supervision of ABB GridShield reclosers.
RER620
Recloser Protection and Control

- Designed for general applications calling for over-current and ground/earth-fault protection
- Main application area: Recloser installed on overhead line feeders or cables in solidly grounded/earthed, resistance grounded/earthed, isolated or compensated networks
- Designed for IEC 61850
- Integrated Loop Control Scheme for improved Feeder reliability
RER620
Functional overview

- Directional overcurrent and directional ground/earth-fault protection with phase and sequence-voltage based protection, under/over voltage, under/over frequency, load shed & restoration, High Impedance Detection protection available

- Possibility to add, delete and change signal connections for binary inputs, binary outputs and between function blocks using PCM600

- The number and type of function blocks is fixed
### Protection

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<th>Protection</th>
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<tr>
<td>Three-phase non-directional time overcurrent protection with 1-ph trip option, low stage</td>
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<tr>
<td>Three-phase non-directional time overcurrent protection with 1-ph trip option, high stage, instance 1 &amp; 2</td>
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<tr>
<td>Three-phase non-directional instantaneous overcurrent protection with 1-ph trip option</td>
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<tr>
<td>Non-directional time overcurrent ground-fault protection, low stage</td>
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<tr>
<td>Non-directional time overcurrent ground-fault protection, high stage, instance 1 &amp; 2</td>
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<tr>
<td>Non-directional instantaneous time overcurrent ground/earth-fault protection</td>
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<tr>
<td>Non-directional sensitive earth-fault</td>
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<tr>
<td>Negative sequence non-directional time overcurrent protection, instance 1 &amp; 2</td>
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<tr>
<td>Phase discontinuity protection</td>
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<tr>
<td>Three-phase inrush detector</td>
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<tr>
<td>Three-phase directional overcurrent protection, low stage, instance 1&amp; 2</td>
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<tr>
<td>Directional ground-fault protection, low stage, instance 1 &amp; 2</td>
</tr>
<tr>
<td>Three-phase overvoltage , source 1 low stage, instance 1 &amp; 2</td>
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<tr>
<td>Three-phase overvoltage , source 2 low stage</td>
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<td>Three-phase undervoltage , source 1 low stage, instance 1 &amp; 2</td>
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<tr>
<td>Three-phase undervoltage , source 2 low stage</td>
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<tr>
<td>Positive sequence overvoltage protection, source1</td>
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### Functional overview

**Protection**
- Positive sequence overvoltage protection, source 2
- Negative sequence overvoltage protection, source 1
- Negative sequence overvoltage protection, source 2
- Zero sequence overvoltage protection, source 1
- Zero sequence overvoltage protection, source 2
- Underfrequency, Overfrequency, Frequency rate of change, source 1
- Underfrequency, Overfrequency, Frequency rate of change, source 2
- Load Shed & Restoration, source 1
- Load Shed & Restoration, source 2
- High Impedance Fault Detector
- Circuit breaker failure protection
- Directional positive sequence power protection
- Directional negative/zero sequence power protection

**Control**
- Autoreclosing, 1ph and/or 3-ph
- Synchro-check/voltage check
- Circuit Breaker 1 (3 state inputs / 3 control outputs)
- Loop control
## Functional overview

<table>
<thead>
<tr>
<th>Condition monitoring</th>
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<tr>
<td>Recloser condition monitoring</td>
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<td>Fuse failure supervision</td>
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<tr>
<th>Measurements</th>
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<td>Three-phase current</td>
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<td>Demand metering, Max/Min metering</td>
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<td>Sequence current</td>
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<td>Ground current</td>
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<td>Three-phase voltage, source</td>
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<tr>
<td>Three-phase voltage, load</td>
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<tr>
<td>Sequence Voltages, Source</td>
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<tr>
<td>Sequence Voltages, Load</td>
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<tr>
<td>Three-phase power and energy (incl. cos θ)</td>
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<td>Frequency</td>
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<th>Recorders</th>
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<td>Disturbance recorder</td>
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<td>Sequence of Events (SER)</td>
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<td>Fault Recorder</td>
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</tbody>
</table>
Designed for GridShield recloser applications calling for over-current, ground/earth-fault protection and automatic reclosing

Main application areas:

- Recloser in overhead line feeders in solidly grounded, resistance grounded, isolated or compensated networks
- GridShield recloser as substation breaker in solidly grounded, resistance grounded, isolated or compensated networks
RER620
Application example 2(4)

- Designed for recloser (breaker) applications calling for *over-current*, ground/earth-fault protection and automatic reclosing

- Main application area:
  - Distributed Generation (DG) in solidly grounded, resistance grounded, isolated or compensated networks
Peer-to-peer relay "Fault Detection Isolation and Restoration (FDIR) control using IEC61850 GOOSE messaging"
RER620
Application with ABB GridShield recloser

Introduction
Application examples
Hardware and options
Functionality
Communication
Mechanical design
Front panel HMI
Tools
Conclusions
Feeder protection and control
REF615 V4.0 ANSI
Five functional application configurations:

4) **Functional Appl**

- **A**: Non-directional phase and ground overcurrent protection for single breaker
- **B**: Non-directional phase and ground overcurrent protection for two breakers
- **C**: Directional phase and ground overcurrent, voltage and frequency protection and power system metering for one breaker
- **D**: Directional phase and ground overcurrent, voltage and frequency protection, synch check and power system metering for one breaker
- **E**: Non-directional phase and ground overcurrent, voltage and power directional protection and power system metering for two breakers
REF615 V4.0 ANSI product release
Functions and features (2)

- Power quality
  - Available for all five functional applications A – F
- Load profile
  - Available for functional applications A, C and D
- Fault location
  - Available with VT Inputs for protection
REF615 V4.0 ANSI product release
Functional application B – example 1

Bus A

REF615 V4.0 ANSI Cfg B

1 Available with Arc Flash Detection option
2 Available with Power Quality option
REF615 V4.0 ANSI product release
Functional application B – example 2

1 Available with Arc Flash Detection option
2 Available with Power Quality option
REF615 V4.0 ANSI product release
Functional application C

1 Available with Ground CT option
2 Available with SEF/HIZ CT option
3 Available with Reclosing option
4 Available with Arc Flash Detection(AFD) option
5 Available with Power Quality option
6 Available with ‘CC’ or ‘CD’ Analog Inputs option
REF615 V4.0 ANSI product release
Functional application D
REF615 V4.0 ANSI product release
Functional application E – example 1

1 Available with Arc Flash Detection option
2 Available with Power Quality option

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REF615 V4.0 ANSI product release
Functional application E – example 2

1 Available with Arc Flash Detection option
2 Available with Power Quality option
Motor protection and control
REM615 V4.0 ANSI
### Six functional application configurations

<table>
<thead>
<tr>
<th>4) Functional Appl</th>
<th>A: Overcurrent and load loss protection for small motors</th>
<th>B: Differential, overcurrent, load loss and RTD protection for medium to large motors</th>
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<tr>
<td></td>
<td>C: Overcurrent, load loss, phase and ground voltage and frequency protection and power system metering for medium motors</td>
<td>D: Overcurrent, load loss, phase and ground voltage, frequency and RTD protection and power system metering for medium motors</td>
</tr>
<tr>
<td></td>
<td>E: Overcurrent, load loss, phase and neutral voltage and frequency protection and power system metering for medium motors</td>
<td>F: Overcurrent, load loss, phase and neutral voltage, frequency and RTD protection and power system metering for medium to large motors</td>
</tr>
</tbody>
</table>
REM615 V4.0 ANSI product release
Functional application A

REM615 V4.0 ANSI Cfg A

1 Available with Arc Flash Detection (AFD) option
REM615 V4.0 ANSI product release
Functional application B

1 Available with Arc Flash Detection (AFD) option
2 Available with RTD option
REM615 V4.0 ANSI product release
Functional application C

Available with Arc Flash Detection (AFD) option
REM615 V4.0 ANSI product release
Functional application D

1 Available with Arc Flash Detection (AFD) option
2 Available with RTD option
REM615 V4.0 ANSI product release
Functional application E

Available with Arc Flash Detection (AFD) option

1 Available with Arc Flash Detection (AFD) option
REM615 V4.0 ANSI product release
Functional application F

Available with Arc Flash Detection (AFD) option
Available with RTD option
Power transformer protection and control
RET615 V4.0 ANSI
Four functional application configurations

- **A**: Differential and overcurrent protection for two-winding transformers
- **B**: Differential, overexcitation, overcurrent, voltage (winding 1 or 2) and frequency protection and power system metering for two-winding transformers
- **C**: Differential, overexcitation overcurrent, voltage (winding 1 or 2), frequency and RTD protection and power system metering for two-winding transformers
- **D**: Differential, overexcitation, overcurrent, voltage (windings 1 and 2) and frequency protection and power system metering for two-winding transformers
RET615 V4.0 ANSI product release
Functional application A

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RET615 V4.0 ANSI Cfg A

Available with Arc Flash Detection (AFD) option
RET615 V4.0 ANSI product release
Functional application B – VTs on LV-side
RET615 V4.0 ANSI product release
Functional application B – VTs on HV-side

1 Available with Arc Flash Detection (AFD) option
RET615 V4.0 ANSI product release
Functional application C – VTs on LV-side w/RTDs
RET615 V4.0 ANSI product release
Functional application C – VTs on HV-side w/RTDs
RET615 V4.0 ANSI product release
Functional application D – VTs on LV- and HV-sides

1 Available with Arc Flash Detection (AFD) option
Power and productivity for a better world™