Relion. Thinking beyond the box.

Designed to seamlessly consolidate functions, Relion relays are smarter, more flexible and more adaptable. Easy to integrate and with an extensive function library, the Relion family of protection and control delivers advanced functionality and improved performance.
ABB is pleased to provide you with technical information regarding protective relays. The material included is not intended to be a complete presentation of all potential problems and solutions related to this topic. The content is generic and may not be applicable for circumstances or equipment at any specific facility. By participating in ABB's web-based Protective Relay School, you agree that ABB is providing this information to you on an informational basis only and makes no warranties, representations or guarantees as to the efficacy or commercial utility of the information for any specific application or purpose, and ABB is not responsible for any action taken in reliance on the information contained herein. ABB consultants and service representatives are available to study specific operations and make recommendations on improving safety, efficiency and profitability. Contact an ABB sales representative for further information.
ABB Protective Relay School Webinar Series

RER620 Recloser Control
Bob graduated from Purdue University and joined Westinghouse Electric Corp. After receiving a Masters degree in Electrical Engineering from Carnegie Mellon University, Bob was a Systems Analysis Engineer responsible for software designed to automate system-wide coordination. He then transferred to Kansas City where he assumed the role of District Engineer and eventually moved to the Houston area where he currently resides.

In his current role as Regional Technical Manager, he supports ABB’s Substation Automation and Protection Division, providing technical support to customers throughout the South Central United States. Bob is a senior member of IEEE and has authored and presented several papers in power system protection at a variety of technical conferences throughout the United States. He is a Registered Professional Engineer in the states of Pennsylvania and Texas.
Learning objectives

- In this webinar you’ll learn:
  - Overview of the RER620 recloser controller
  - Unique protection elements and their application
  - Overview of WebHMI (web browser interface)
  - Overview of PCM600 configuration/setting tool
  - How to create customized graphics screens
  - How to retrieve COMTRADE waveform files and quickly create condensed color pdf reports
  - How to develop customized logic
Breaker & Recloser…what are the differences?

- **BREAKERS…**
  - have higher interrupting ratings …40kA or more
  - don’t usually include the relay but require only a simple dry trip contact interface, making it easy to mix and match vendors.
  - are generally larger, heavier and more expensive

- **RECLOSERS…**
  - include the relay controller with the capability to automatically close the primary contacts multiple times to restore service automatically.
  - are much smaller and lighter allowing them to be pole-mounted
  - are generally limited to about 16kA or less interrupting current
  - are often equipped with magnetic actuators with relay controllers that match the characteristics of the particular actuator…not a simple a pulse output
Relion® RER620 recloser controller

The RER620 relay controller is used in ABB’s Gridshield Recloser
Relion® 620 protective relay series
RER620 recloser control

- RER620 is a member of ABB’s Relion product family and part of its 620 protection and control product series that also includes transformer, feeder and motor protection.

- The 620 series IEDs are characterized by their compactness and withdrawable design.
Like all members of the Relion 615 and 620 series, the RER620 is both draw-out and draw-in for minimum downtime.
Relion® RER620
Standard configuration

- One standard configuration with dual directional phase and ground overcurrent and directional ground/earth-fault protection
- Single-phase or Three-Phase operation
- Under/over voltage phase and sequence based voltage protection
- Under/over frequency, load shed & restoration schemes
- High Impedance Detection (HIZ) and open conductor (46PD)
- Highly configurable to meet almost any special application
Relion® RER620
Standard configuration – Auto Recloser

- Clears most transient and semi-transient faults
- 79 function accommodates up to 5 shots
- 3 operating modes
  - OPUP – only picked up phases
  - OOAP – one or all phases
  - APAT – all phases all the time
Relion® RER620
Standard configuration – Synch Check

25 synch check function with selectable voltage magnitude and angle difference limits

- Off
- Both Dead
- Live Line – Dead Bus
- Dead Line – Live bus
- Dead Bus – Line Any
- Dead Line – Bus Any
- One Live – One Dead
- Not Both Live
Relion® RER620
Standard configuration – Inrush Detection

- Second harmonic detector can be used to selectively block overcurrent elements from tripping
- Applicable when large downstream transformers are energized, especially DG applications
Relion® RER620
Standard configuration – 51P

- Non directional phase overcurrent protection
- Extensive curve library includes...
  - 8 standard ANSI curve shapes
  - 7 standard IEC curve shapes
  - 39 “Recloser” curve shapes
  - Programmable curve shape
Relion® RER620
Standard configuration – 50P-1, 50P-2

- Non directional phase high-set overcurrent protection can also be used as additional TOC elements
- Extensive curve library includes...
  - 8 standard ANSI curve shapes
  - 7 standard IEC curve shapes
  - 39 “Recloser” curve shapes
  - Programmable curve shape
Relion® RER620
Standard configuration – 50P-3

- Non directional phase high-set overcurrent protection
- 50D element with selectable time delay
Relion® RER620
Standard configuration – Ground fault protection

- 51N, 50N-1, 50N-2 and 50N-3 protection elements have similar curve shape possibilities as their phase protection counterparts.
Relion® RER620
Standard configuration – unbalance current protection

- Two instances of negative sequence (46) protection
- Same curve shape possibilities as the phase and ground overcurrent elements
Relion® RER620
Standard configuration – Directional OC protection

- Two instances directional phase OC elements (67/51P-1 and 67/51P-2)
- Two instances of directional ground OC elements (67/51N-1 and 67/51N-2)
- All elements can selectively take on non-directional characteristics for even more flexibility
- All elements can have any of the same curve shapes available to the non-directional phase and ground elements
- Maximum torque angles are adjustable from 0 to 360 degrees in 1 degree steps
Relion® RER620
Standard configuration – 46 phase discontinuity

- 46PD function operates on $I_2/I_1$ for more sensitive detection of open phase conductor events
- More sensitive than $I_2$ or $I_0$ alone due to setting limitations associated with natural load unbalances
- Set in percentage of phase current
Relion® RER620
Standard configuration – SEF (Sensitive Earth Fault)

- Overcurrent protection for high-resistance or ungrounded systems where ground fault currents are unusually low
- Can take on any of standard ANSI or IEC curve shapes as well as a programmable curve shape
Relion® RER620
Standard Configuration – 59N Ground OV Protection

• Two instances of ground overvoltage protection
• Definite time characteristics
Relion® RER620
Standard Configuration – 59PS Positive Sequence OV

- Two instances of positive sequence overvoltage protection
- Definite time characteristics
Relion® RER620
Standard configuration – 47 unbalanced voltage

- Two instances of negative sequence voltage protection
- Definite time characteristics
Relion® RER620
Standard configuration – 59 phase overvoltage

- Three instances of phase overvoltage voltage protection
- Inverse, Definite Time or Programmable curve characteristics
Relion® RER620

Standard configuration – 27 phase undervoltage

- Three instances of phase undervoltage protection
- Inverse, Definite Time or Programmable curve characteristics
Two instances of general frequency protection which can take on the following characteristics:

- underfrequency ($<f$)
- overfrequency ($>f$)
- $df/dt$ (rate of change of frequency)
- $<f$ AND $df/dt$
- $<f$ OR $df/dt$
- $>f$ AND $df/dt$
- $>f$ OR $df/dt$
Two instances of underfrequency load shedding elements can take on the following characteristics:

- \( f \)
- \( f \) AND \( \frac{df}{dt} \)
- \( f \) OR \( \frac{df}{dt} \)
• High impedance fault or downed conductor faults pose a danger to humans and animals
• High impedance faults have been implicated as a root cause in major wildfires
• High impedance faults are impossible to detect by conventional methods
• Ground fault signatures and algorithms resulting from over 7 years of research and testing
Relion® RER620
Standard Configuration – Fault Location

- Determines the distance to the fault based on the calculated impedance to the fault
Relion® RER620
Standard configuration – Loop control module

• Built-in loop control logic can open/close reclosers in a loop configuration following a recloser lockout to restore service to the unaffected sections of loop
• Reduces SAIFI
• Requires no communication between reclosers
Relion® RER620
Standard configuration - directional phase and ground power

- Used for fast control of other elements
- Maximum torque angle can be set from -179 to 180 degrees, forward or reverse
Relion® RER620
Standard configuration – Breaker failure trip & close

- 50BFT – slow/failure to trip
- 50BFC – slow/failure to close
Relion® RER620
Standard configuration – Oscillography

- Up to 10 **seconds** of recording times
- Variable pre and post trigger times
- Default storage time is 50 cycles
- Records up to 12 analog channels and 64 binary channels
- Typically storage is 30 events at 50 cycles in length
- Stored in COMTRADE format
Relion® RER620
Standard Configuration – Communication Protocols

• Includes popular communication protocols
  • Modbus RTU…standard
  • DNP 3.0 Level 2
    Plus…standard
  • IEC61850…standard
Relion® RER620
WebHMI web browser

Change settings, retrieve event records and waveform capture files without proprietary software
Relion® RER620
WebHMI web browser
Relion® RER620
WebHMI web browser – event records

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Device</th>
<th>Object text</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/14/2014</td>
<td>12:12:51.344</td>
<td>79</td>
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<td>67/51P-2</td>
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<tr>
<td>09/14/2014</td>
<td>12:12:50.757</td>
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<td>Phase C</td>
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<tr>
<td>09/14/2014</td>
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<td>52</td>
<td>Phase B</td>
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<td>12:12:50.757</td>
<td>52</td>
<td>Phase A</td>
<td>closed</td>
</tr>
<tr>
<td>09/14/2014</td>
<td>12:12:50.757</td>
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<td>All phases</td>
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<tr>
<td>09/14/2014</td>
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<td>Phase B</td>
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<td>09/14/2014</td>
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<td>Phase A</td>
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<tr>
<td>09/14/2014</td>
<td>12:12:50.457</td>
<td>52</td>
<td>All phases</td>
<td>open</td>
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Relion® RER620
WebHMI web browser

### Device version

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Hardware revision</td>
<td>D</td>
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<tr>
<td>Software version</td>
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</table>

### Device status

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Normal</td>
<td>✅</td>
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<tr>
<td>Pickup</td>
<td></td>
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<tr>
<td>Trip</td>
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</table>
Relion® RER620
WebHMI web browser – view alarm LEDs
Relion® RER620
WebHMI web browser
Relion® RER620
WebHMI web browser

Device version
- Description
  - Hardware revision: D
  - Software version: 1.1

Device status
- Description
  - Normal
  - Pickup
  - Trip
Phasor plots include…

- Phase currents
- Phase voltages
- Sequence currents
- Sequence voltages
Relion® RER620
WebHMI web browser
Relion® RER620
WebHMI web browser – retrieve waveform records
Relion® RER620
WebHMI web browser
Relion® RER620
WebHMI web browser – view SLD screen
Relion® RER620
PCM600 configuration tool

- PCM600 is the common configuration tool for all Relion relays including the RER620
- One database file can contain accommodate many relays
Relion® RER620
PCM600 configuration tool

- PCM600 is used for many things…
  - Real-time monitoring of signals
  - Retrieving COMTRADE waveform
  - Creating condensed color pdf fault report
  - Creating parameter setting files
  - Creating customized application logic
  - Creating customized screen displays
  - Creating virtual wires between relays (aka IEC61850 GOOSE signals)
  - Creating communication class files
Relion® RER620
PCM600 parameter setting tool

![Parameter Setting Tool](image)

<table>
<thead>
<tr>
<th>Group/Parameter Name</th>
<th>IED Value</th>
<th>PC Value</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
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<td>Operation</td>
<td>disable</td>
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<tr>
<td>Num of pickup phases</td>
<td>1 out of 3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Minimum trip time</td>
<td>20</td>
<td>ms</td>
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<td>Reset delay time</td>
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Setting Group 1

<table>
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<th>Value</th>
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<th>Max</th>
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<td>0.05</td>
<td>5.00</td>
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<td>Pickup value mult</td>
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<td>0.6</td>
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<td>Time multiplier</td>
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<td>Trip delay time</td>
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<td>ms</td>
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</table>

Operating curve type

- ANSI Est Pri
- Immediate

Type of reset curve

- Pickup block value
- Pickup block enable
- Pickup block enable
- Time adder

- 5.00  xin  1.00  40.00
- Disable
- 0.00  0.00  2.00
Disturbance Fault Records (DFR) are stored in COMTRADE format for viewing by any COMTRADE viewer.

Selectable record length and pre-trigger time

Stores 30 records of 50 cycle length (default size)
Relion® RER620 PCM600 disturbance handling tool

- More time for analyzing complicated disturbances instead of data processing
- Fast corrective actions enabled by
  - Easily creating a concise color pdf file containing a summary of the phasor plots and protective elements that asserted during the fault
-one of three display screens (Menu, Metering, SLD)

- Build a screen that shows what you want to see

- Single Line Diagram (SLD) screen is configurable

- Combines graphics and text
Relion® RER620
PCM600 communications management tool
Relion® RER620
PCM600 applications configuration tool

- Insert a variety of logic blocks, gates, timers, counters etc. to configure customized logic applications
- Debugging tool allows real-time monitoring of signals between logic blocks to aid in building logic
Relion® RER620
Example of customized configuration
All manuals are embedded in PCM600 in pdf format.
Relion. Thinking beyond the box.

Designed to seamlessly consolidate functions, Relion relays are smarter, more flexible and more adaptable. Easy to integrate and with an extensive function library, the Relion family of protection and control delivers advanced functionality and improved performance.
Power and productivity for a better world™
Thank you for your participation

 Shortly, you will receive a link to an archive of this presentation. To view a schedule of remaining webinars in this series, or for more information on ABB’s protection and control solutions, visit:

www.abb.com/relion