This webinar brought to you by the Relion® product family

Advanced protection and control IEDs from ABB

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 Protective Relay School Webinar Series
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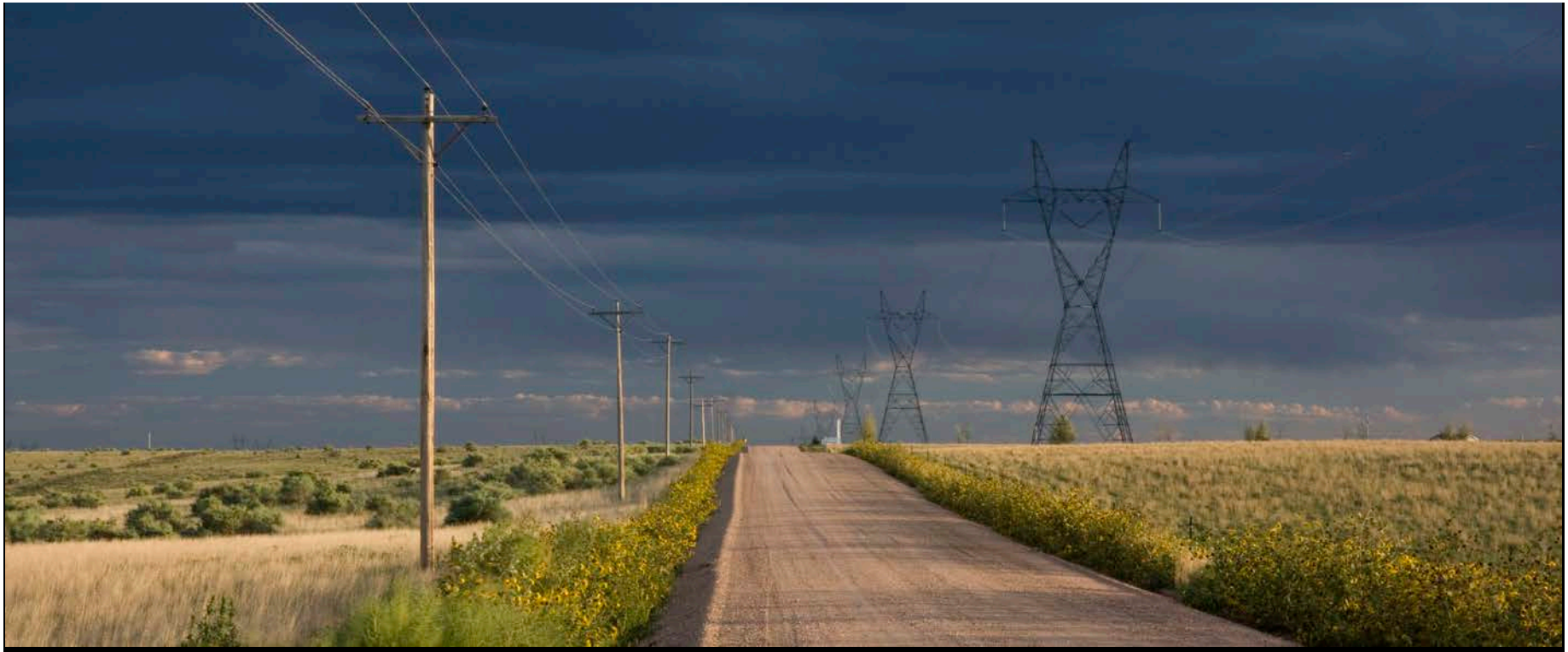


ABB Protective Relay School Webinar Series

RER620 Recloser Control

Presenter

Bob Wilson

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

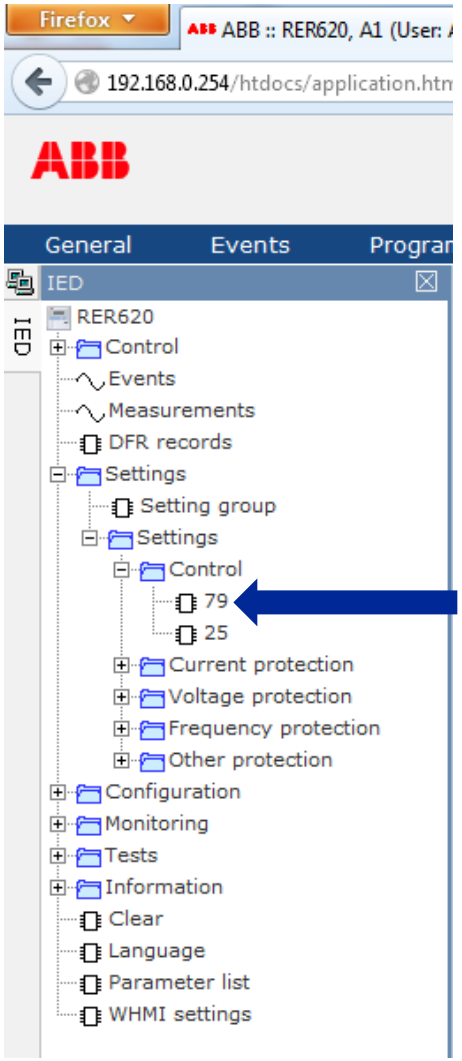
Relion 620 series
RER620 drawout chassis and modular construction

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

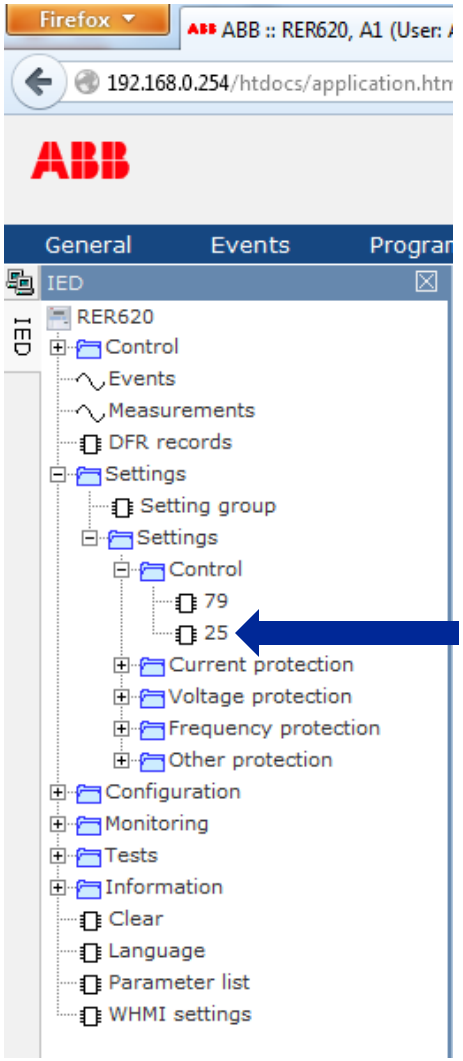
- One standard configuration with dual directional phase and ground overcurrent and directional ground/earth-fault protection
- Single-phase or Three-Phase operation
- Under/over voltage phase and sequence based voltage protection
- Under/over frequency, load shed & restoration schemes
- High Impedance 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

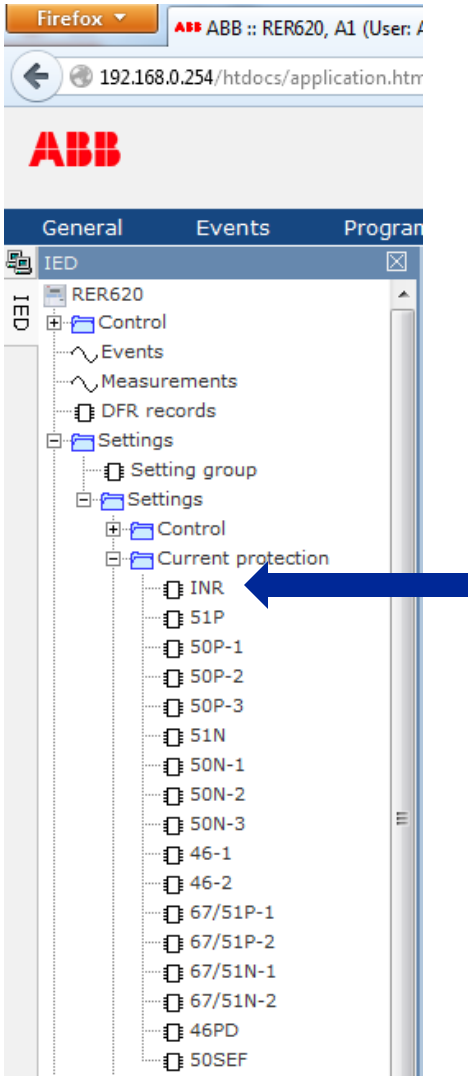
Relion® RER620
Standard configuration – Synch Check



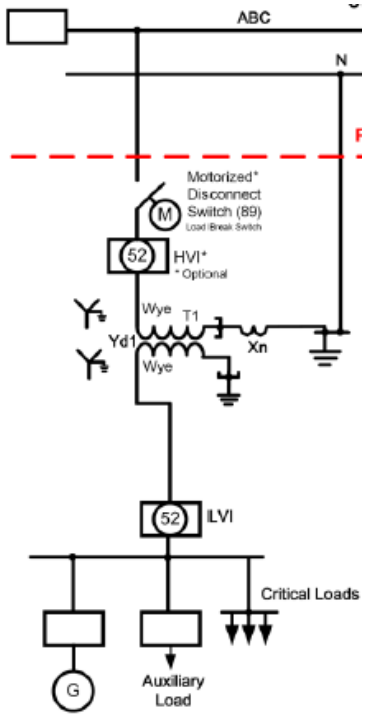
25 synch check function with selectable voltage magnitude and angle difference limits

- 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

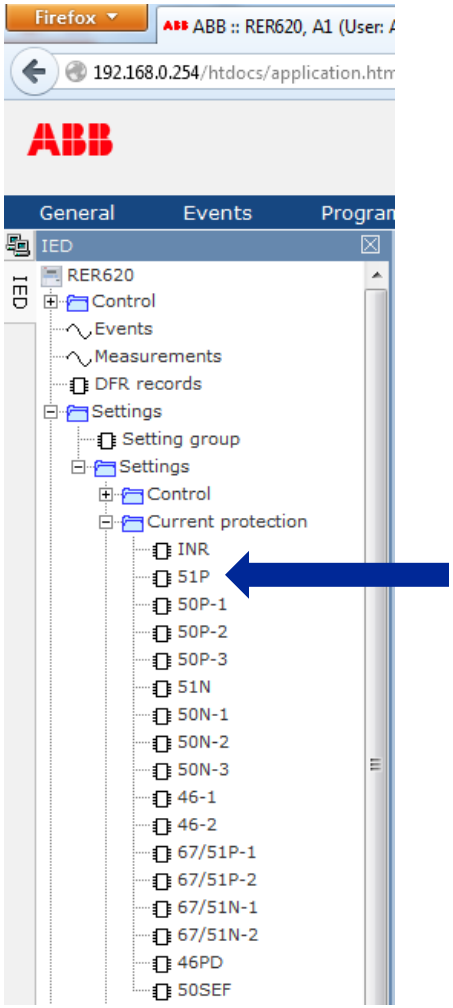
Relion® RER620
Standard configuration – Inrush Detection



- Second harmonic detector can be used to selectively block overcurrent elements from tripping
- Applicable when large downstream transformers are energized, especially DG applications

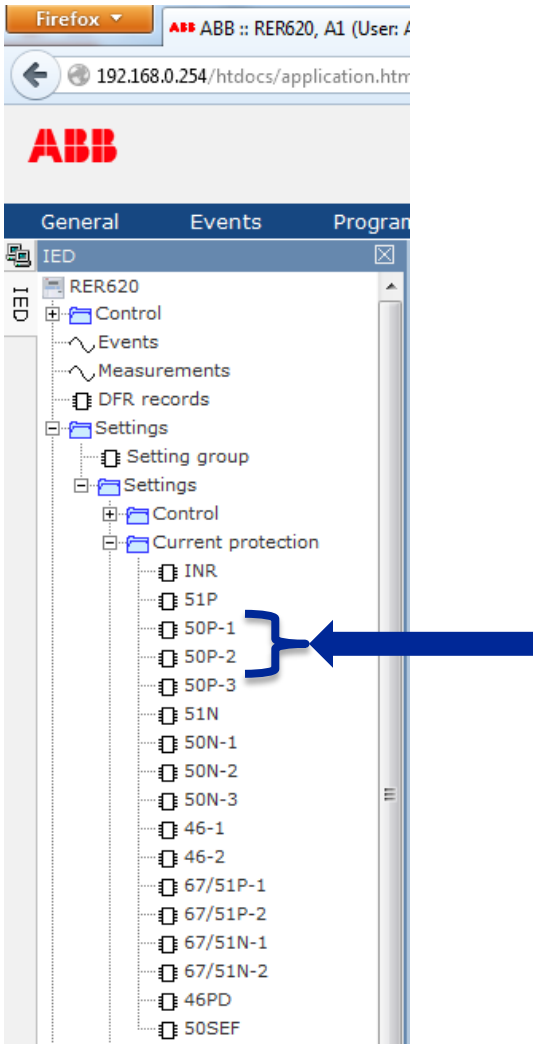


Relion® RER620
Standard configuration – 51P



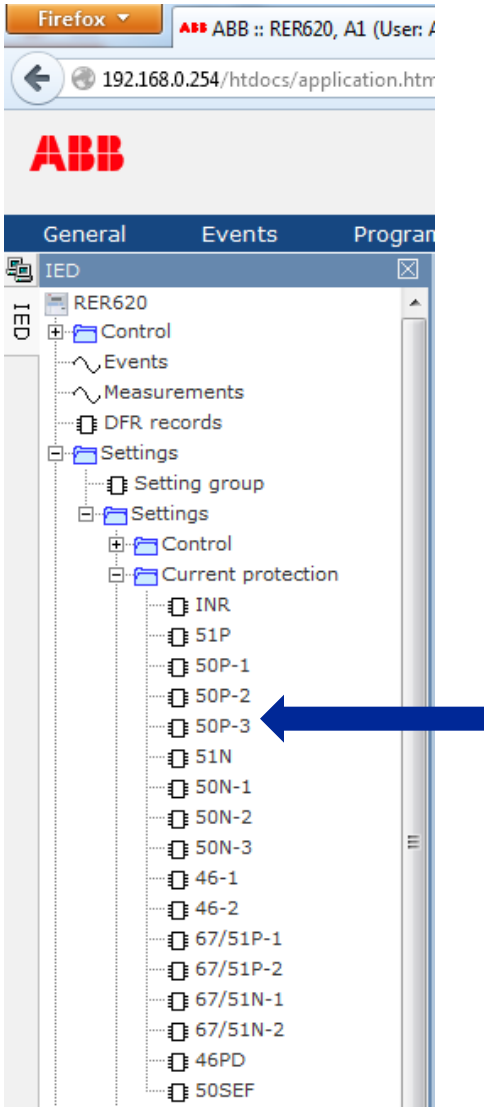
- Non directional phase overcurrent protection
- Extensive curve library includes…
  - 8 standard ANSI curve shapes
  - 7 standard IEC curve shapes
  - 39 “Recloser” curve shapes
  - Programmable curve shape

Relion® RER620
Standard configuration – 50P-1, 50P-2



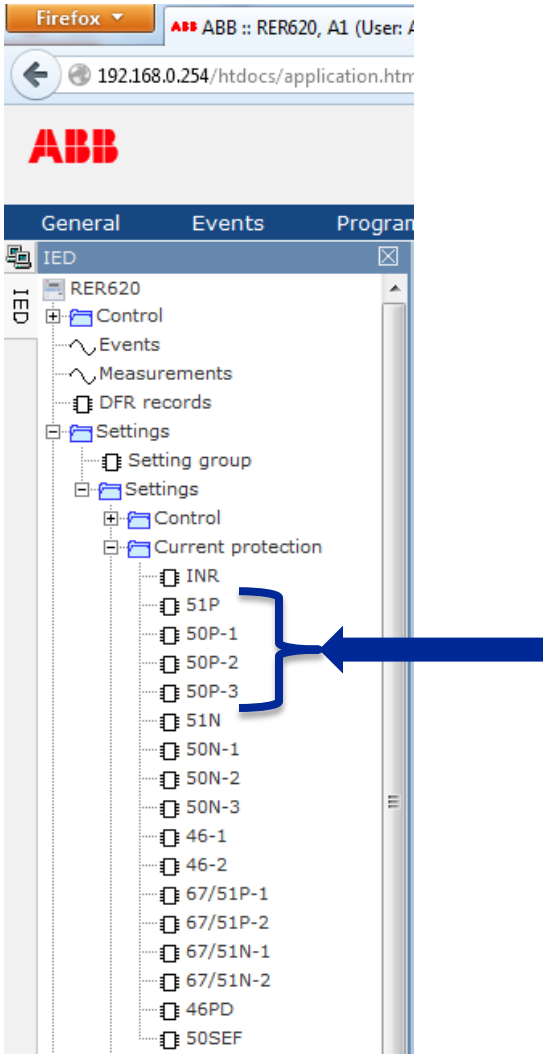
- Non directional phase high-set overcurrent protection can also be used as additional TOC elements
- Extensive curve library includes…
  - 8 standard ANSI curve shapes
  - 7 standard IEC curve shapes
  - 39 “Recloser” curve shapes
  - Programmable curve shape

Relion® RER620
Standard configuration – 50P-3



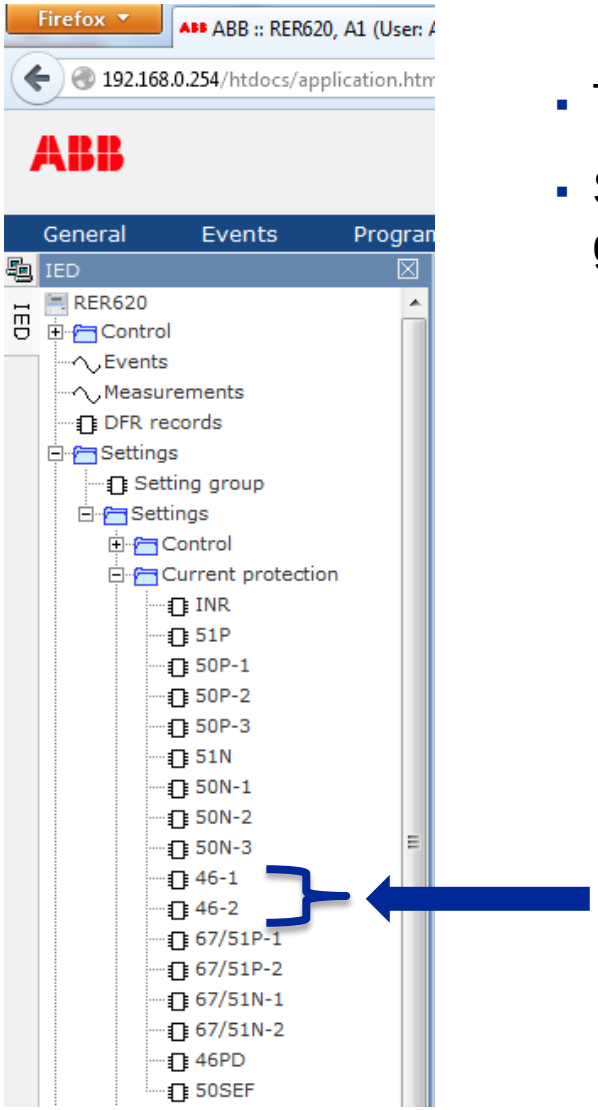
- Non directional phase high-set overcurrent protection
- 50D element with selectable time delay

Relion® RER620
Standard configuration – Ground fault protection



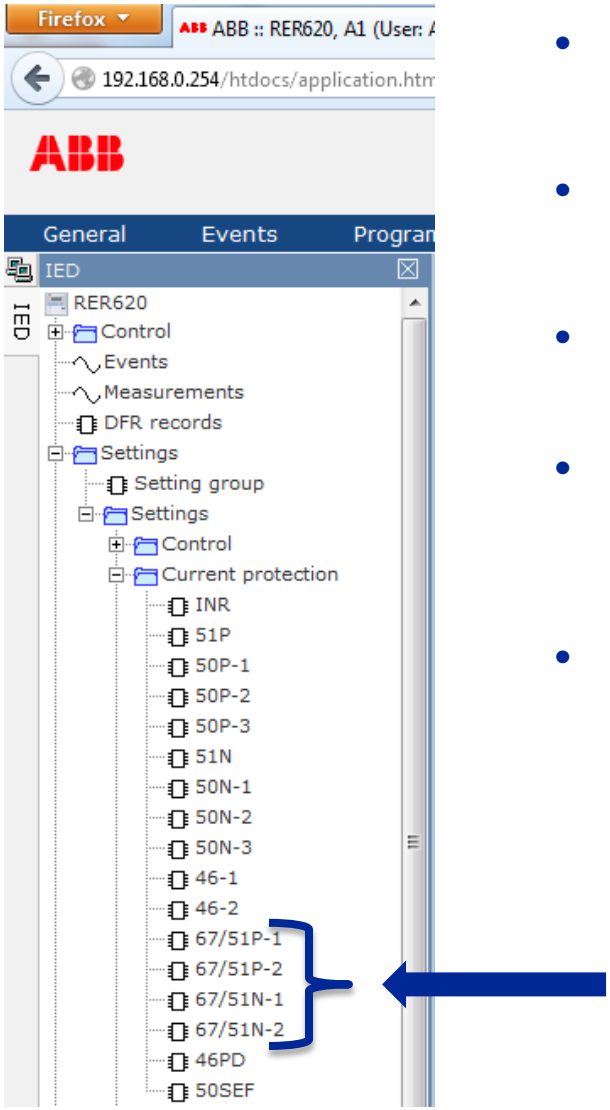
- 51N, 50N-1, 50N-2 and 50N-3 protection elements have similar curve shape possibilities as their phase protection counterparts

Relion® RER620
Standard configuration – unbalance current protection

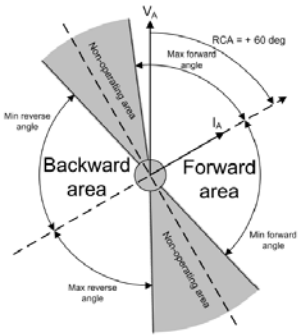


- Two instances of negative sequence (46) protection
- Same curve shape possibilities as the phase and ground overcurrent elements

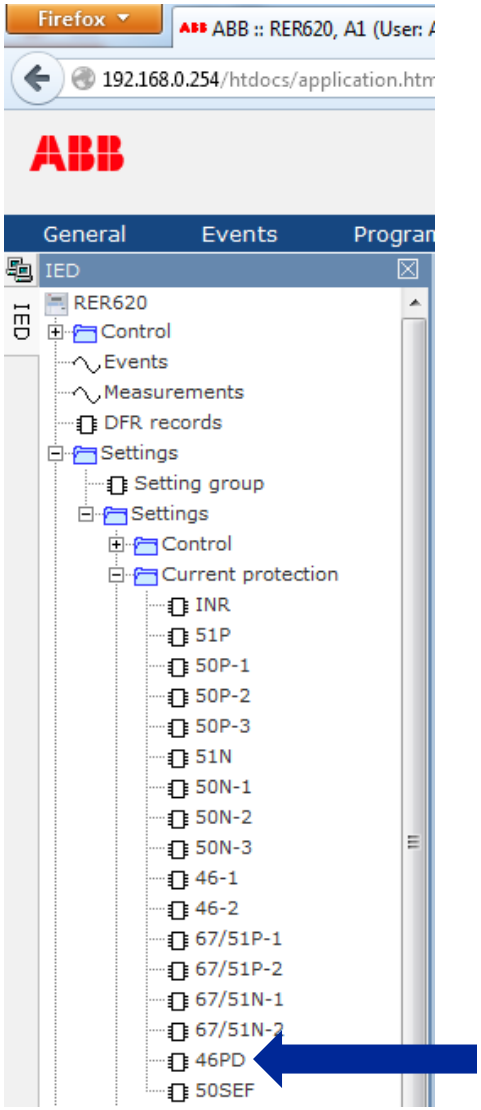
Relion® RER620
Standard configuration – Directional OC protection



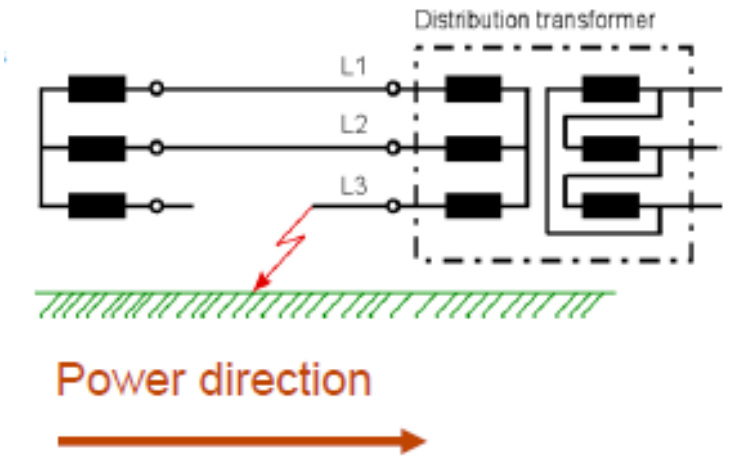
- Two instances directional phase OC elements (67/51P-1 and 67/51P-2)
- Two instances of directional ground OC elements (67/51N-1 and 67/51N-2)
- All elements can selectively take on non-directional characteristics for even more flexibility
- All elements can have any of the same curve shapes available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



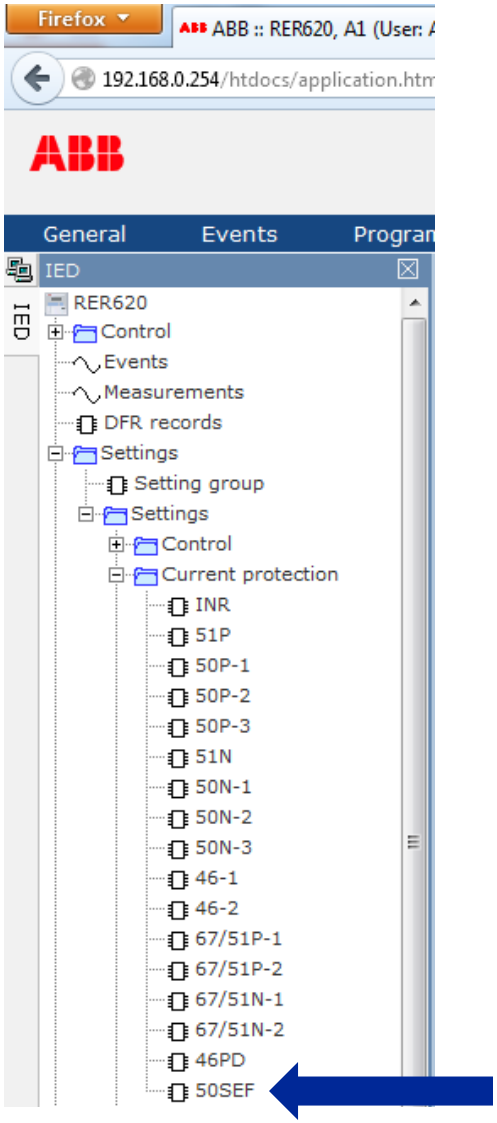
Relion® RER620
Standard configuration – 46 phase discontinuity



- 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

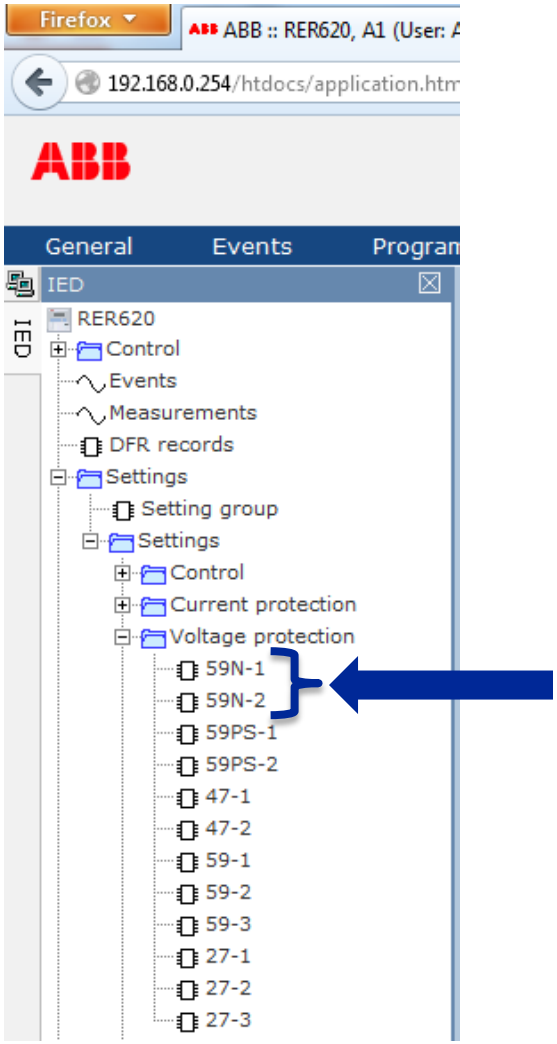


Relion® RER620
Standard configuration – SEF (Sensitive Earth Fault)



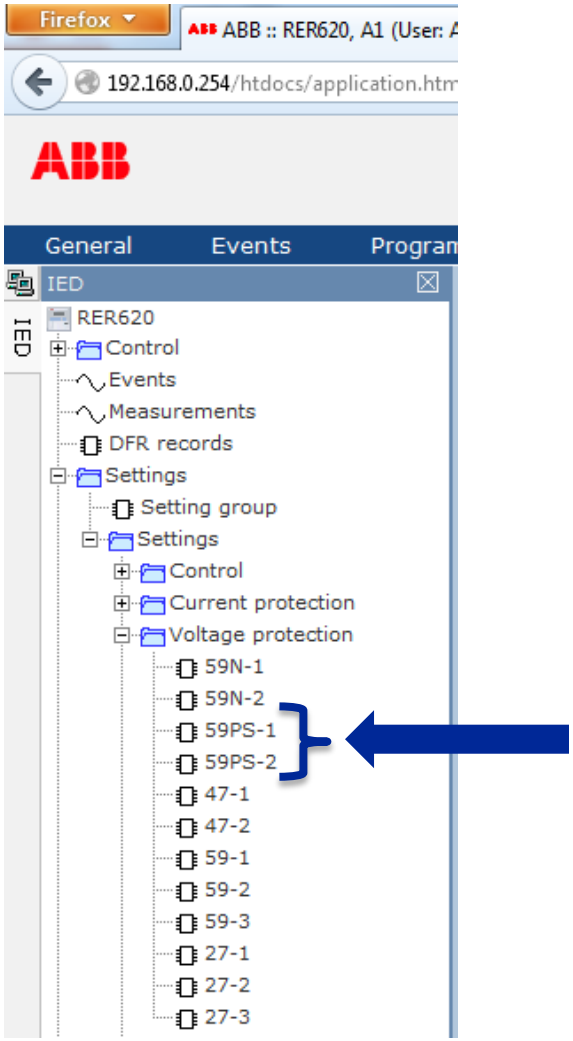
- Overcurrent protection for high-resistance or ungrounded systems where ground fault currents are unusually low
- Can take on any of standard ANSI or IEC curve shapes as well as a programmable curve shape

Relion® RER620
Standard Configuration – 59N Ground OV Protection



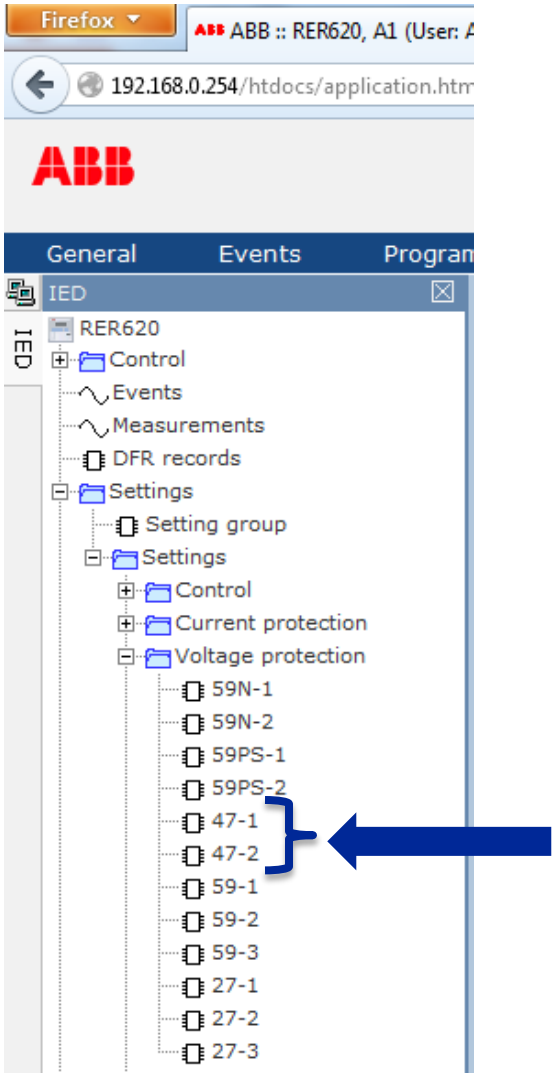
- Two instances of ground overvoltage protection
- Definite time characteristics

Relion® RER620
Standard Configuration – 59PS Positive Sequence OV



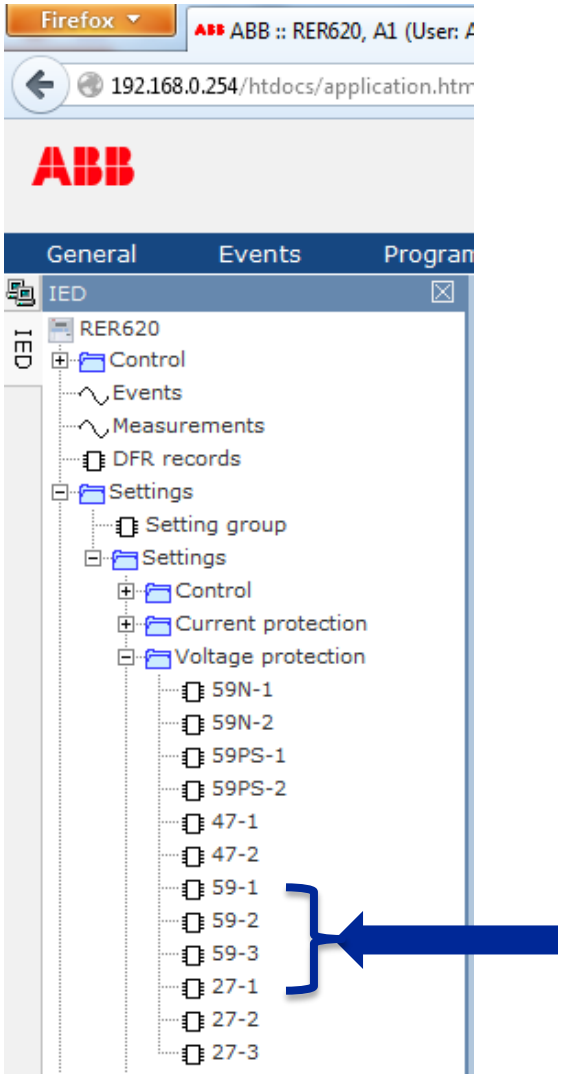
- Two instances of positive sequence overvoltage protection
- Definite time characteristics

Relion® RER620
Standard configuration – 47 unbalanced voltage



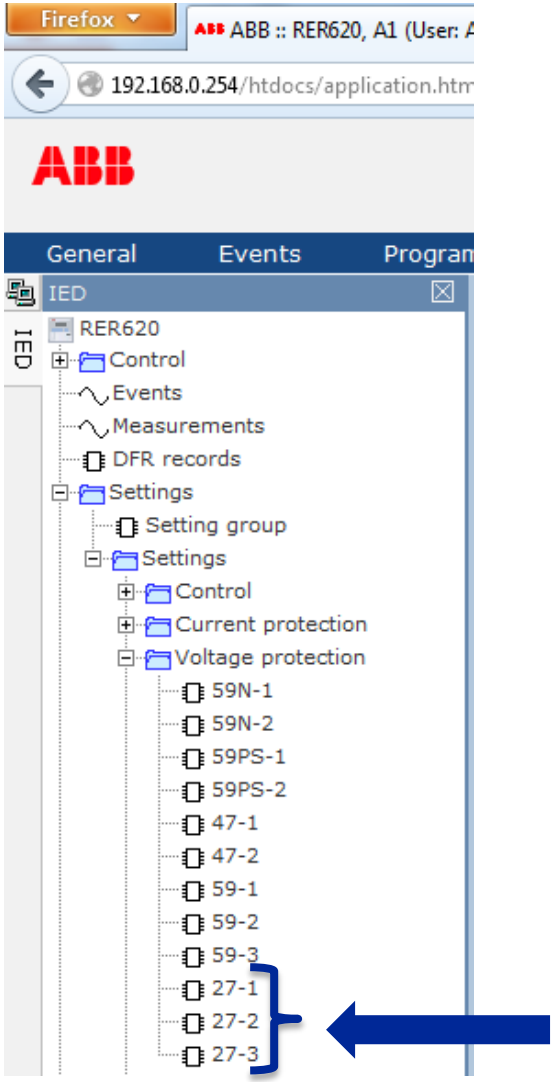
- Two instances of negative sequence voltage protection
- Definite time characteristics

Relion® RER620
Standard configuration – 59 phase overvoltage

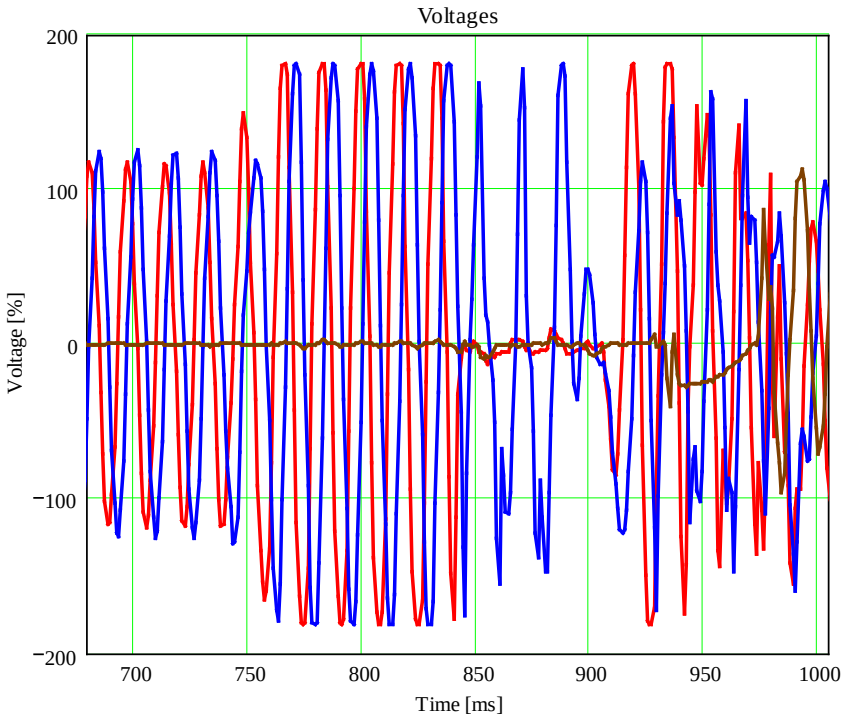


- Three instances of phase overvoltage voltage protection
- Inverse, Definite Time or Programmable curve characteristics

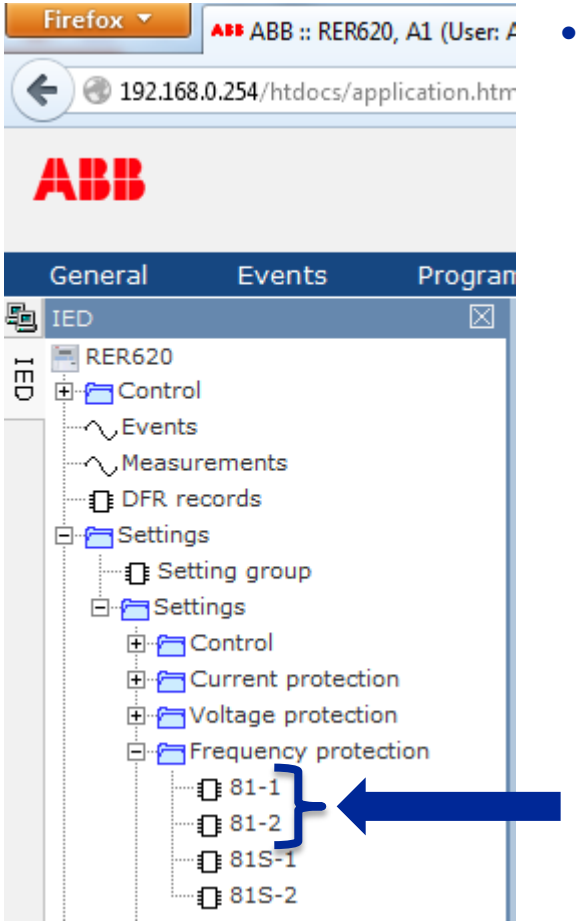
Relion® RER620
Standard configuration – 27 phase undervoltage



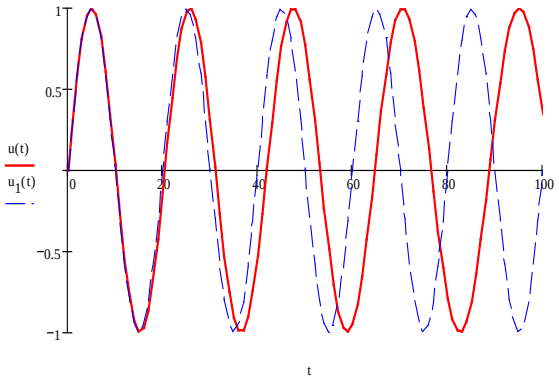
- Three instances of phase undervoltage protection
- Inverse, Definite Time or Programmable curve characteristics



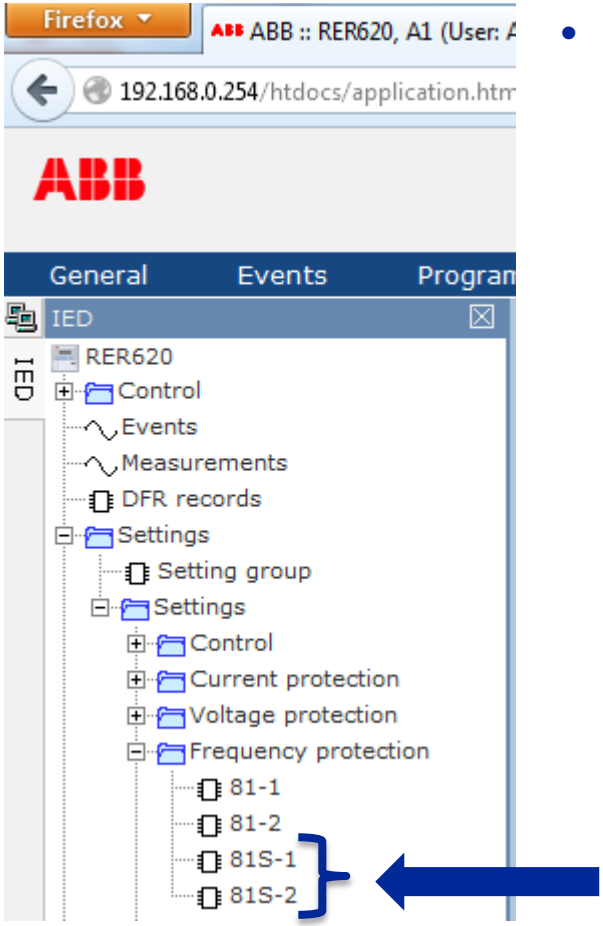
Relion® RER620
Standard configuration – 81 frequency protection



- 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

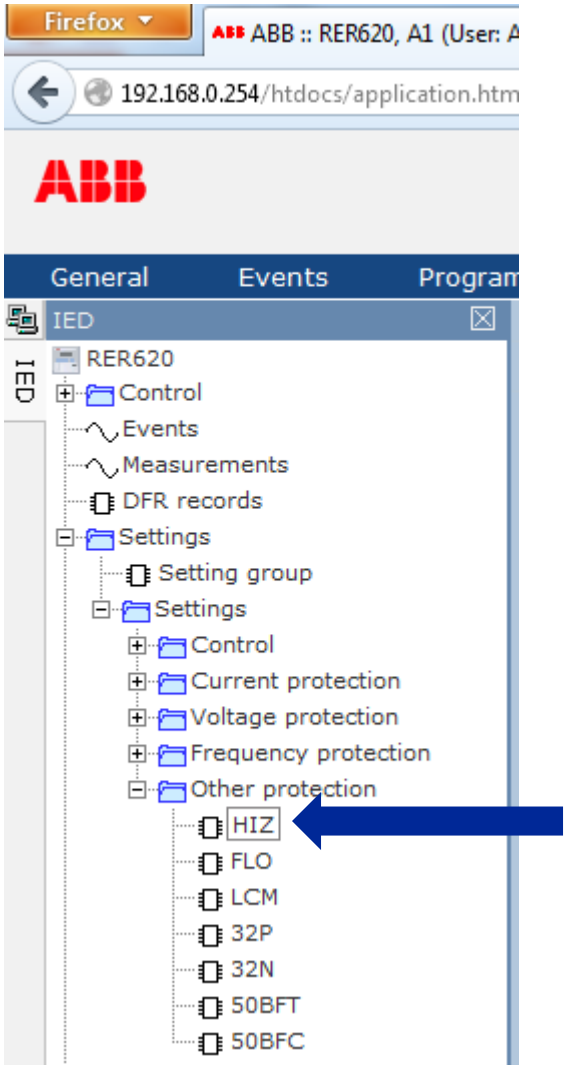


Relion® RER620
Standard configuration – 81S load shed underfrequecy



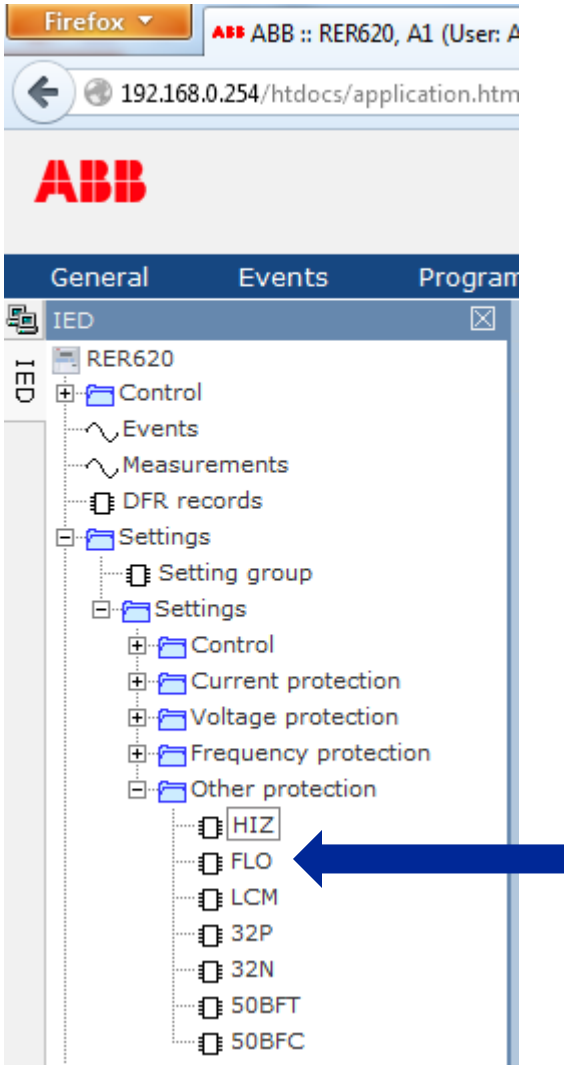
- Two instances of underfrequency load shedding elements can take on the following characteristics
  - <f
  - <f AND df/dt
  - <f OR df/dt

Relion® RER620
Standard configuration – HIZ High Impedance Fault



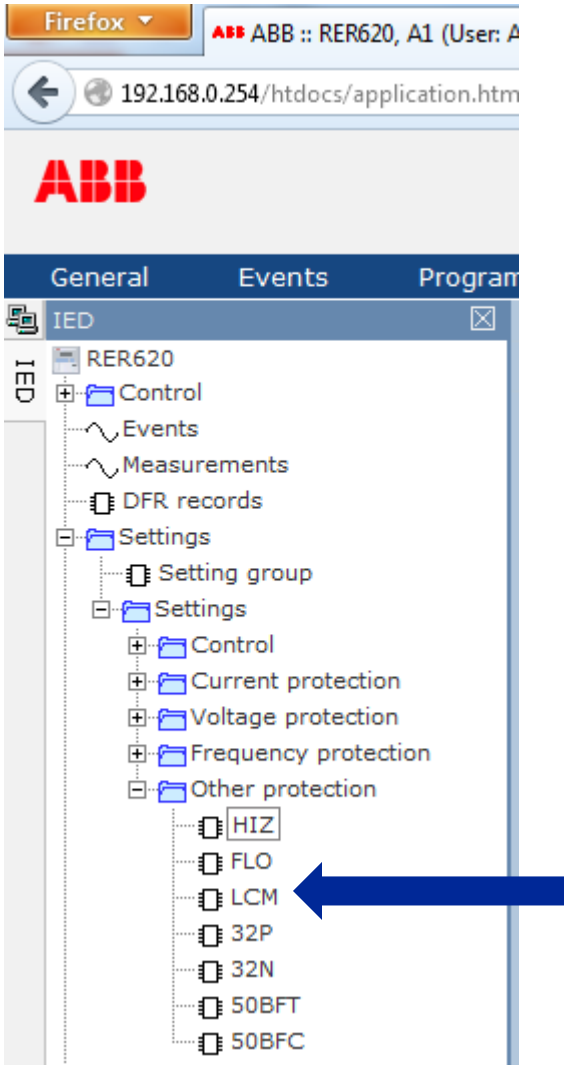
- High impedance fault or downed conductor faults pose a danger to humans and animals
- High impedance faults have been implicated as a root cause in major wildfires
- High impedance faults are impossible to detect by conventional methods
- Ground fault signatures and algorithms resulting from over 7 years of research and testing

Relion® RER620
Standard Configuration – Fault Location



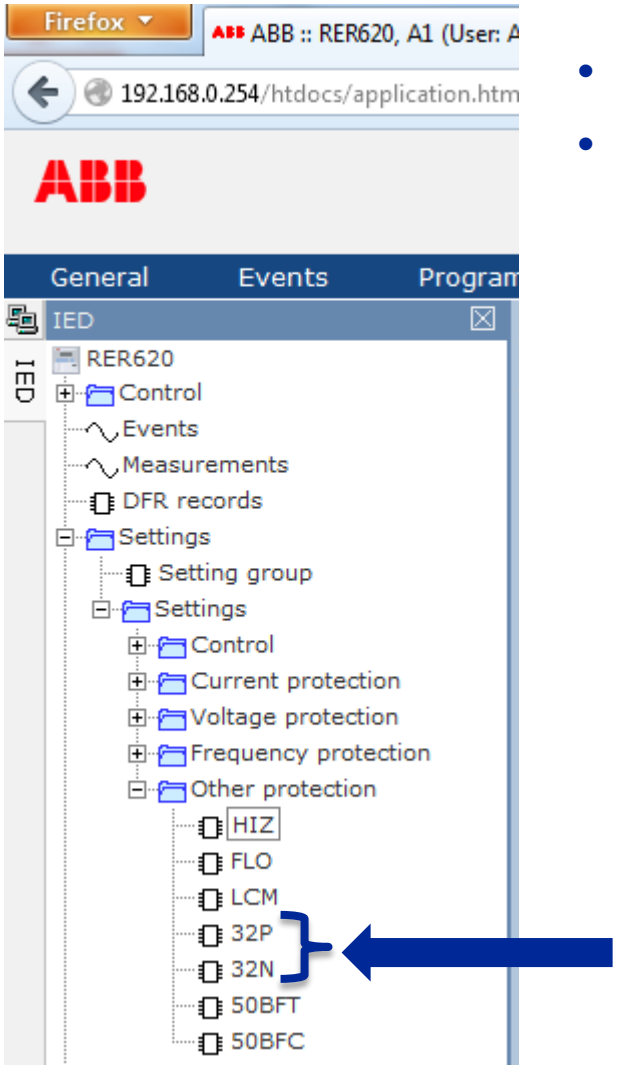
- Determines the distance to the fault based on the calculated impedance to the fault

Relion® RER620
Standard configuration – Loop control module



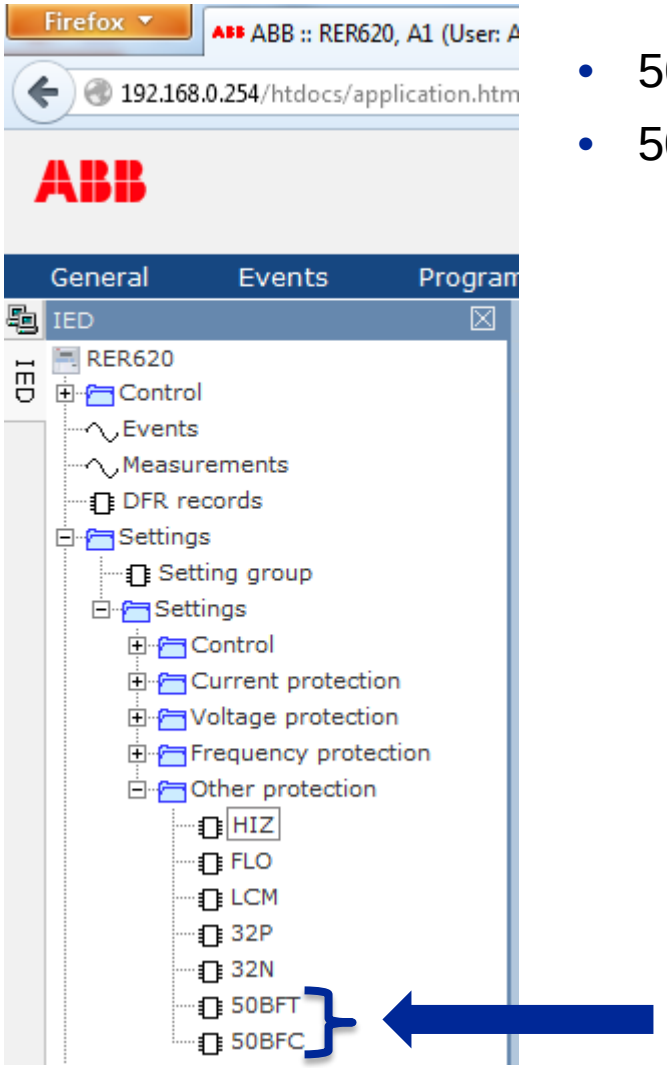
- Built-in loop control logic can open/close reclosers in a loop configuration following a recloser lockout to restore service to the unaffected sections of loop
- Reduces SAIFI
- Requires no communication between reclosers

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

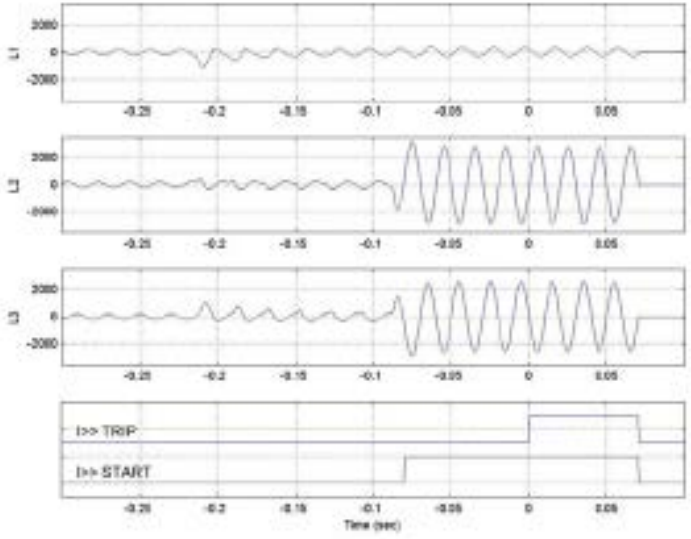
Relion® RER620
Standard configuration – Breaker failure trip & close



- 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

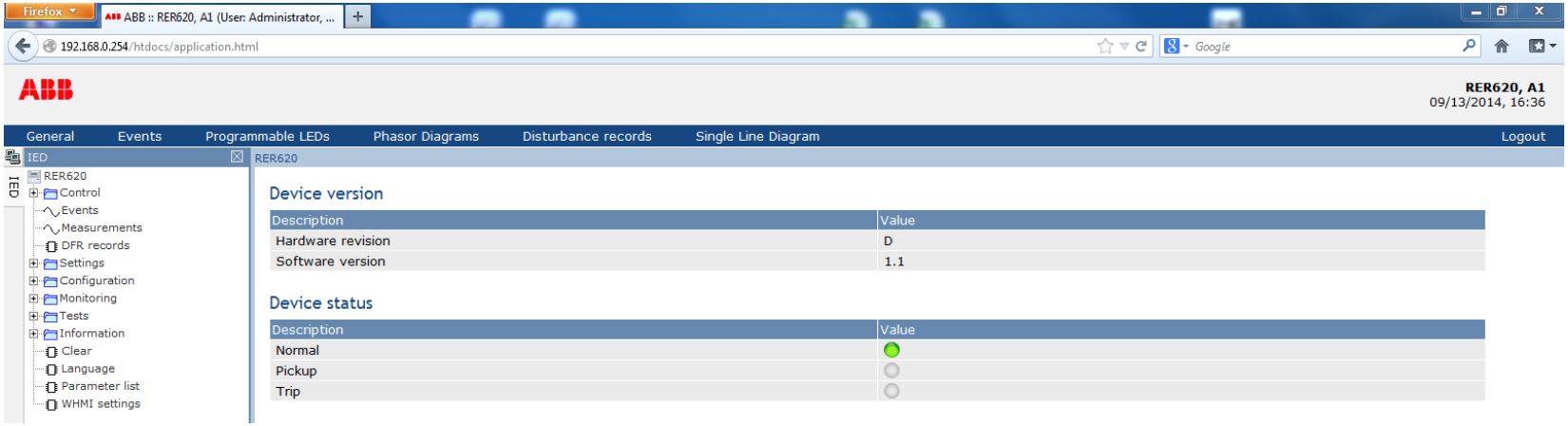


Relion® RER620
Standard Configuration – Communication Protocols

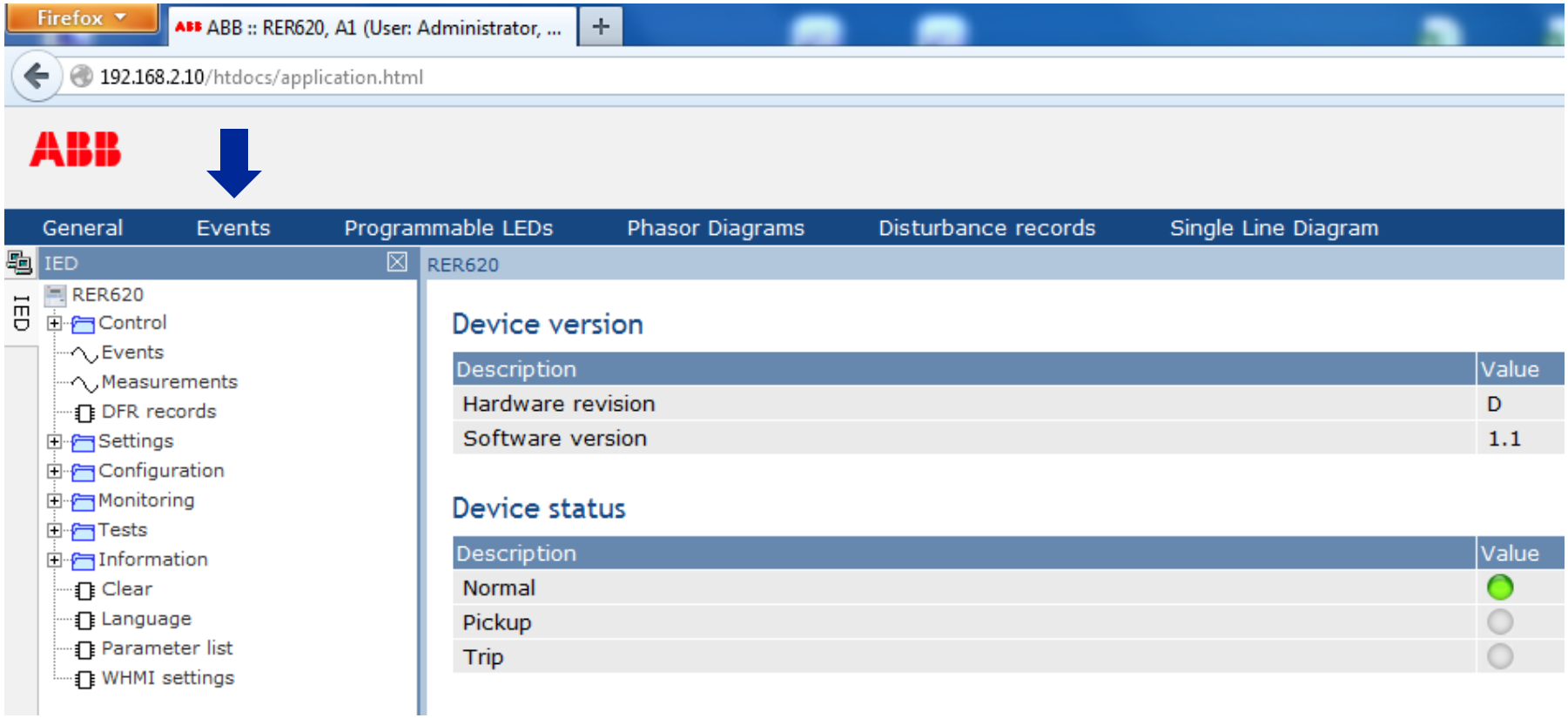
- Includes popular communication protocols
  - Modbus RTU…*standard*
  - DNP 3.0 Level 2 Plus…*standard*
  - IEC61850…*standard*

Relion® RER620
WebHMI web browser

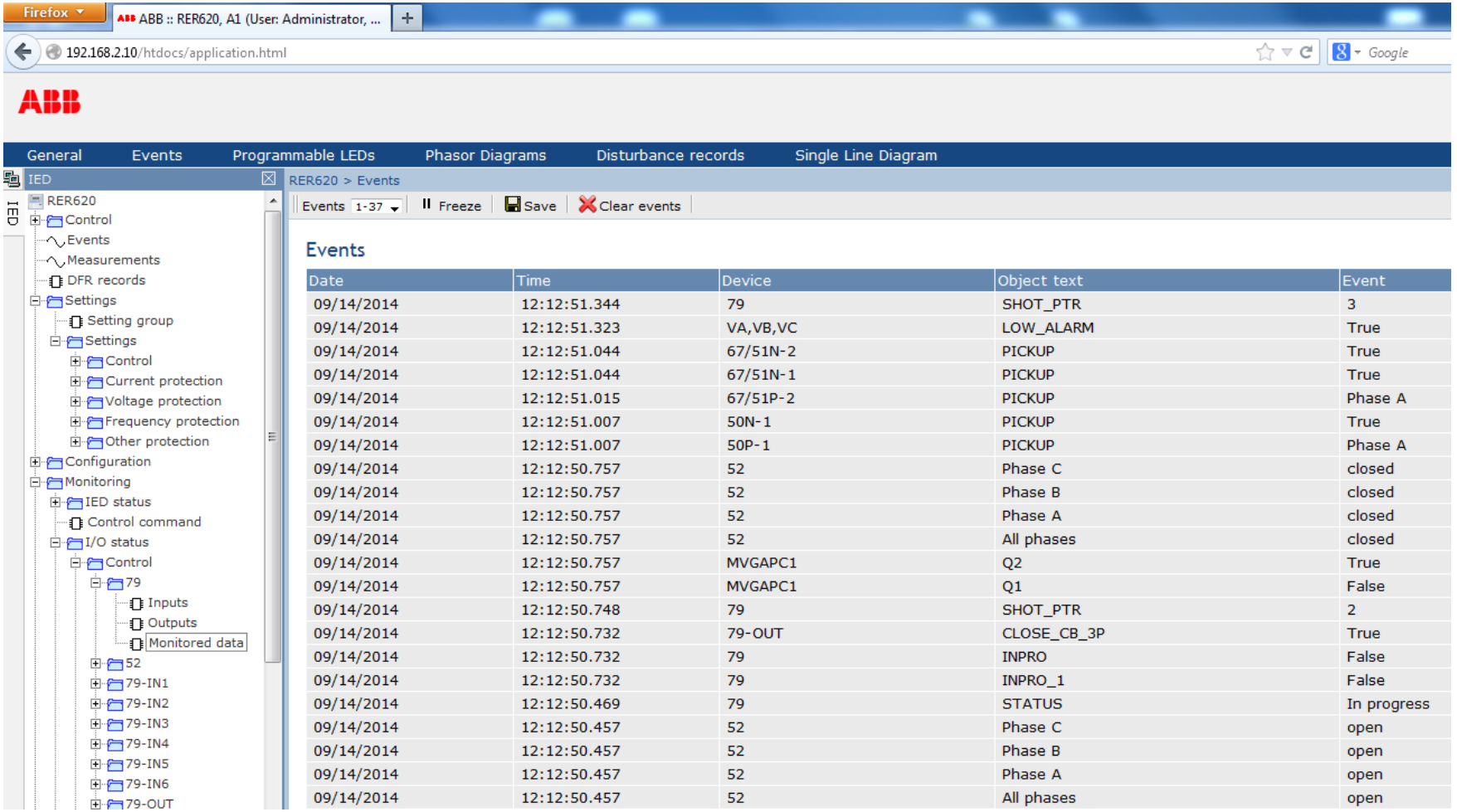
Change settings, retrieve event records and waveform capture files
without proprietary software



Relion® RER620
WebHMI web browser



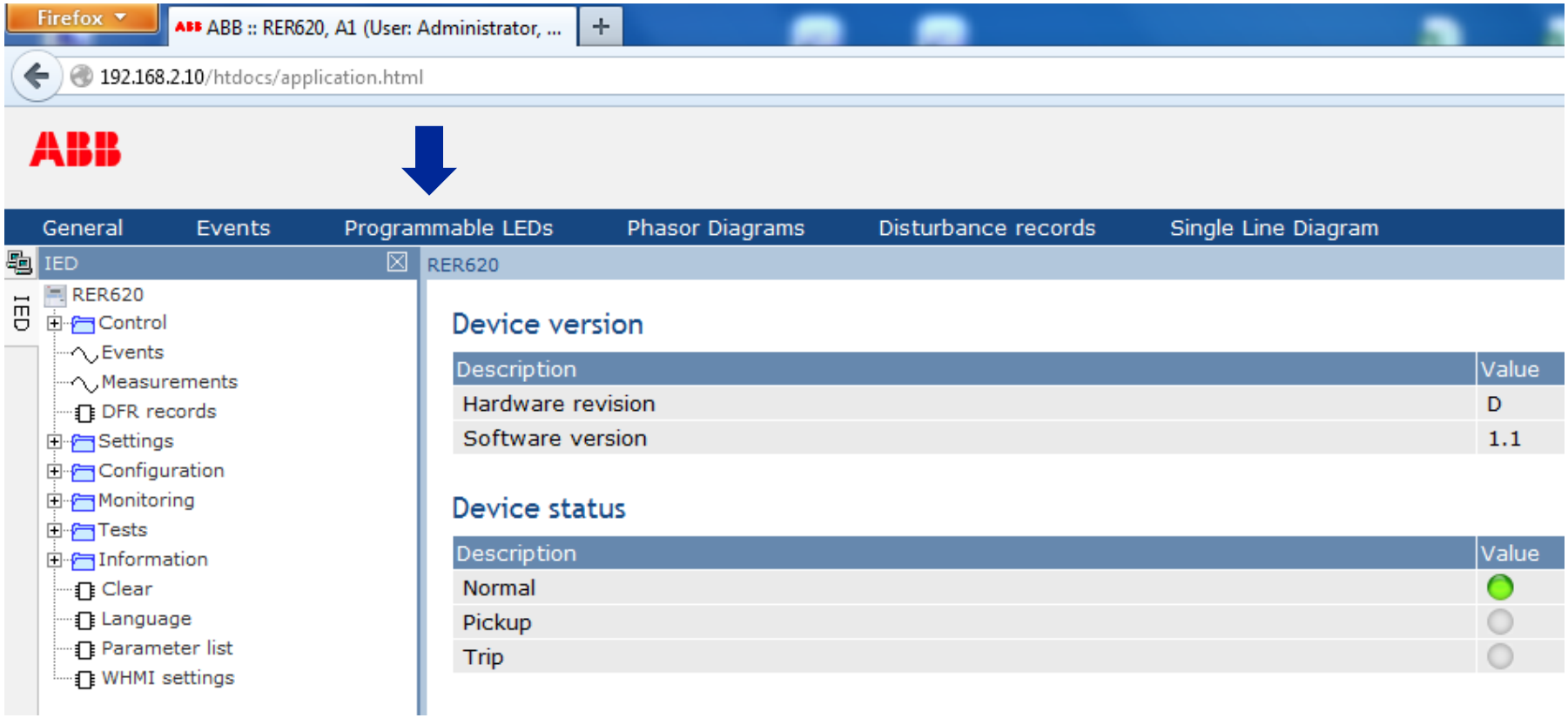
Relion® RER620
WebHMI web browser – event records



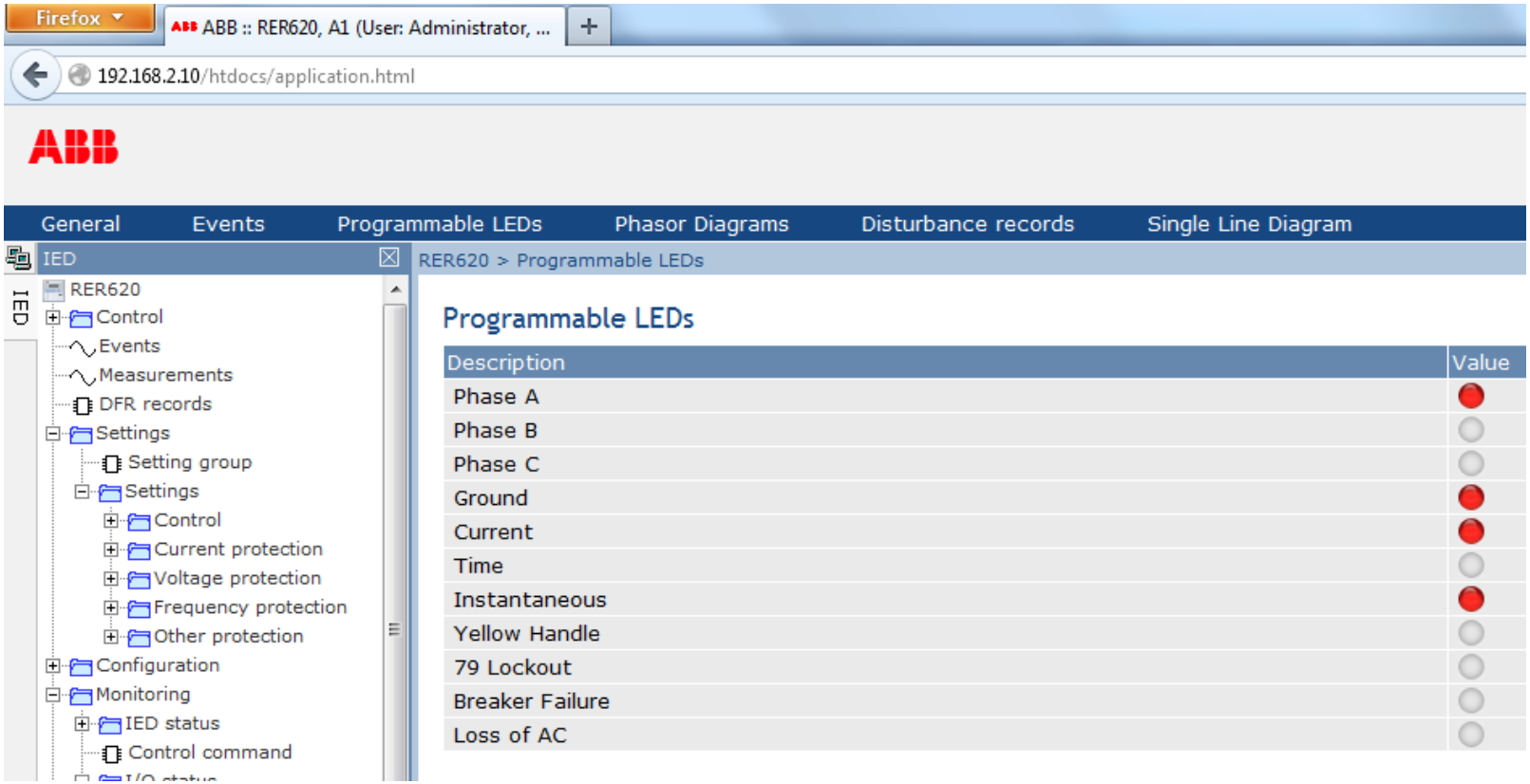
Events

Date	Time	Device	Object text	Event
09/14/2014	12:12:51.344	79	SHOT_PTR	3
09/14/2014	12:12:51.323	VA,VB,VC	LOW_ALARM	True
09/14/2014	12:12:51.044	67/51N-2	PICKUP	True
09/14/2014	12:12:51.044	67/51N-1	PICKUP	True
09/14/2014	12:12:51.015	67/51P-2	PICKUP	Phase A
09/14/2014	12:12:51.007	50N-1	PICKUP	True
09/14/2014	12:12:51.007	50P-1	PICKUP	Phase A
09/14/2014	12:12:50.757	52	Phase C	closed
09/14/2014	12:12:50.757	52	Phase B	closed
09/14/2014	12:12:50.757	52	Phase A	closed
09/14/2014	12:12:50.757	52	All phases	closed
09/14/2014	12:12:50.757	MVGAPC1	Q2	True
09/14/2014	12:12:50.757	MVGAPC1	Q1	False
09/14/2014	12:12:50.748	79	SHOT_PTR	2
09/14/2014	12:12:50.732	79-OUT	CLOSE_CB_3P	True
09/14/2014	12:12:50.732	79	INPRO	False
09/14/2014	12:12:50.732	79	INPRO_1	False
09/14/2014	12:12:50.469	79	STATUS	In progress
09/14/2014	12:12:50.457	52	Phase C	open
09/14/2014	12:12:50.457	52	Phase B	open
09/14/2014	12:12:50.457	52	Phase A	open
09/14/2014	12:12:50.457	52	All phases	open

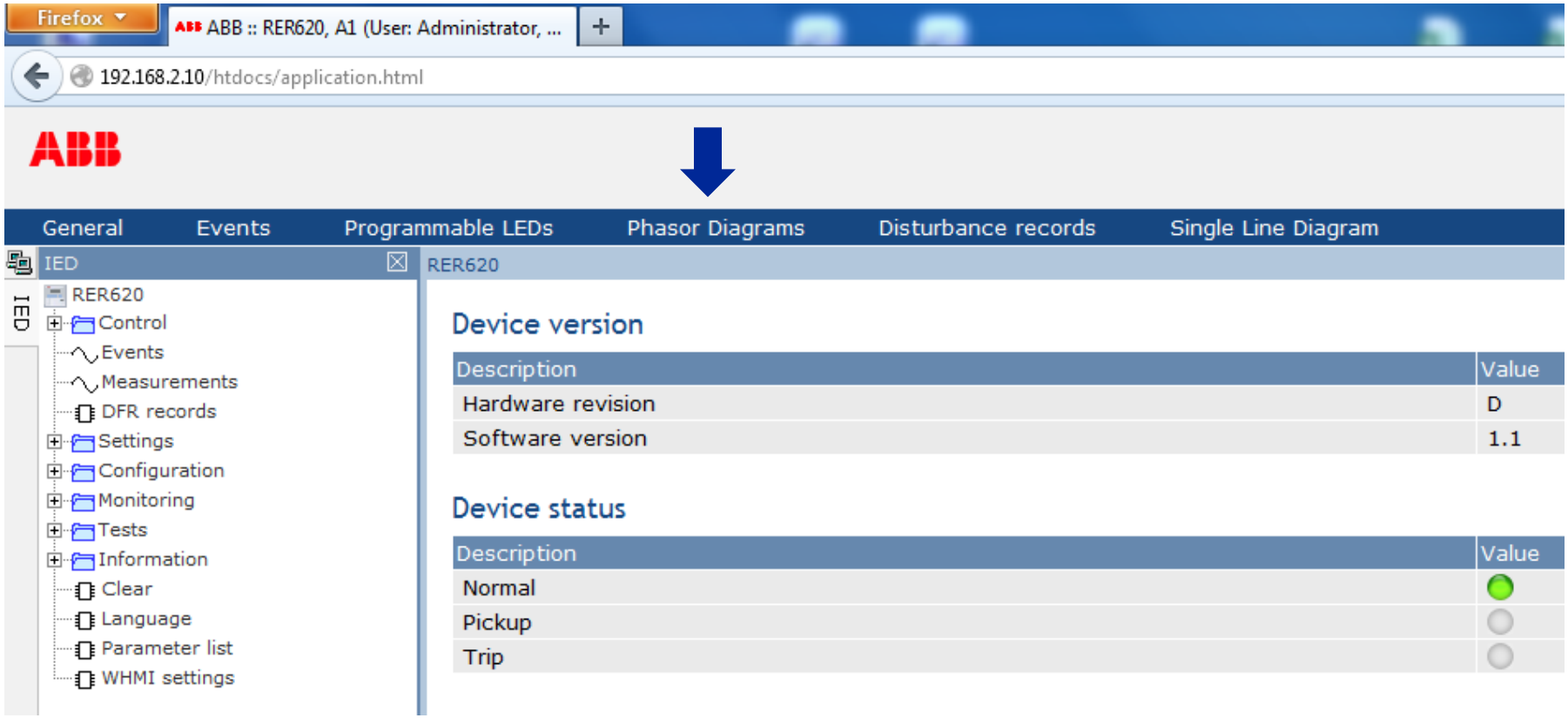
Relion® RER620
WebHMI web browser



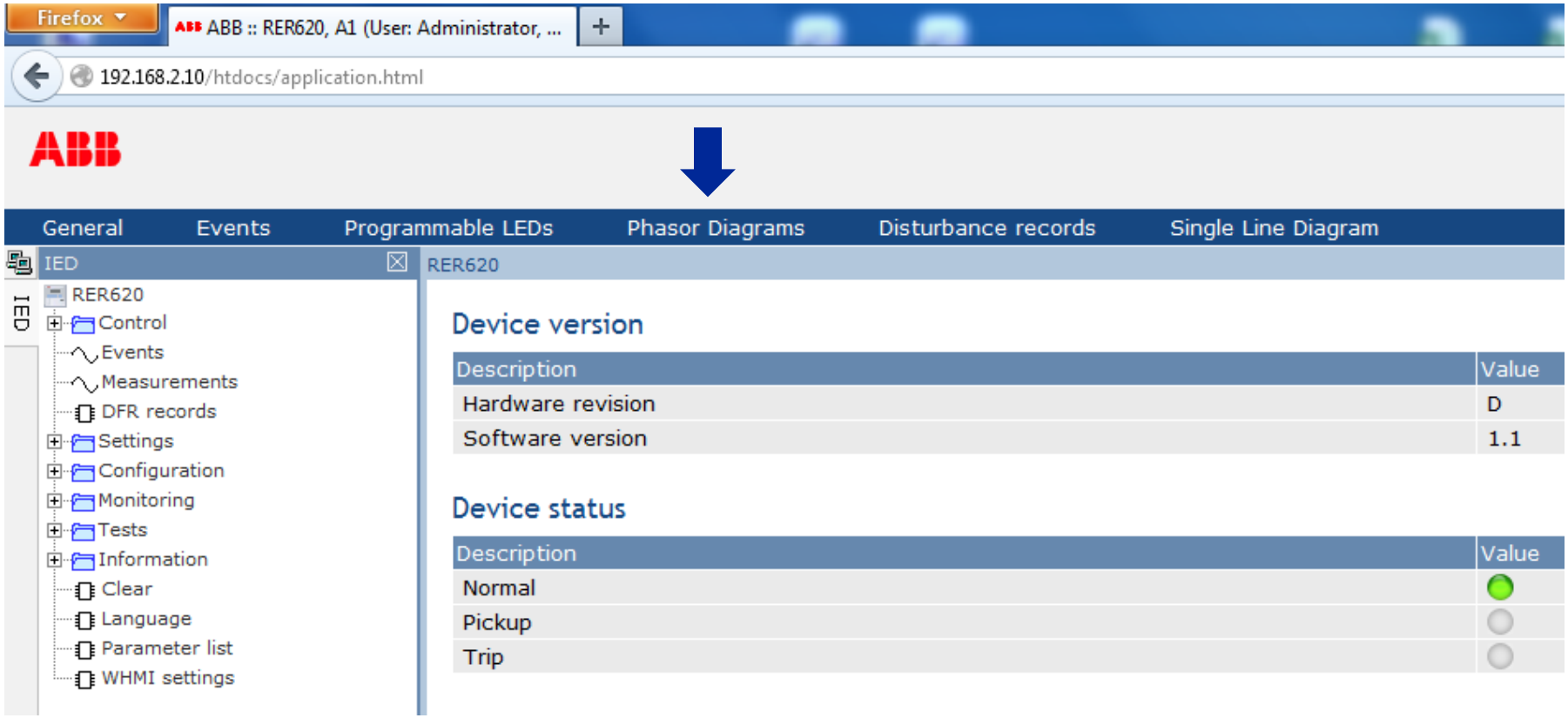
Relion® RER620
WebHMI web browser – view alarm LEDs



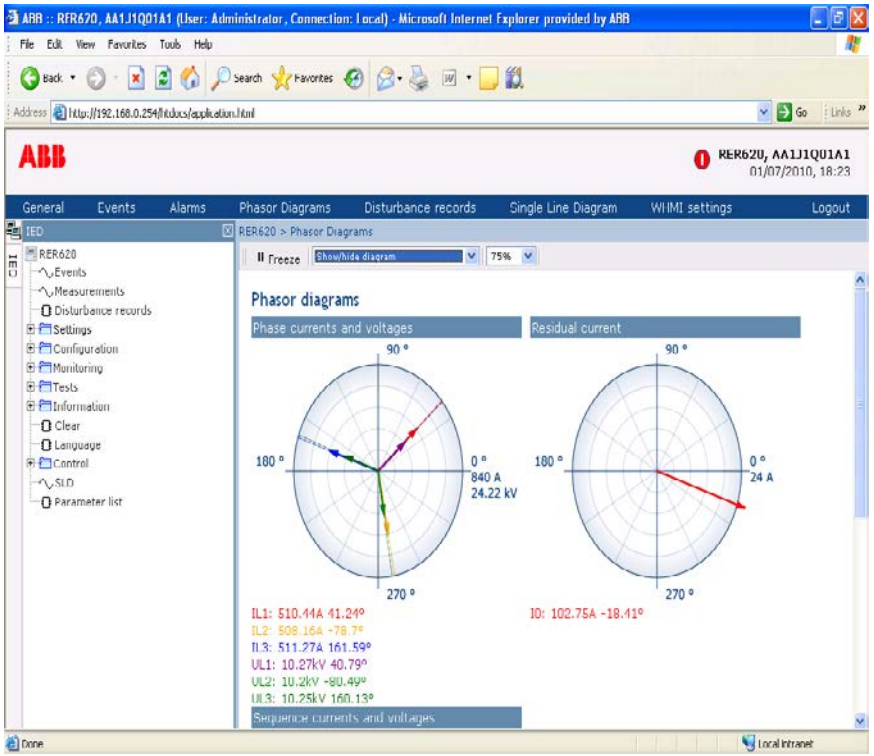
Relion® RER620
WebHMI web browser



Relion® RER620
WebHMI web browser

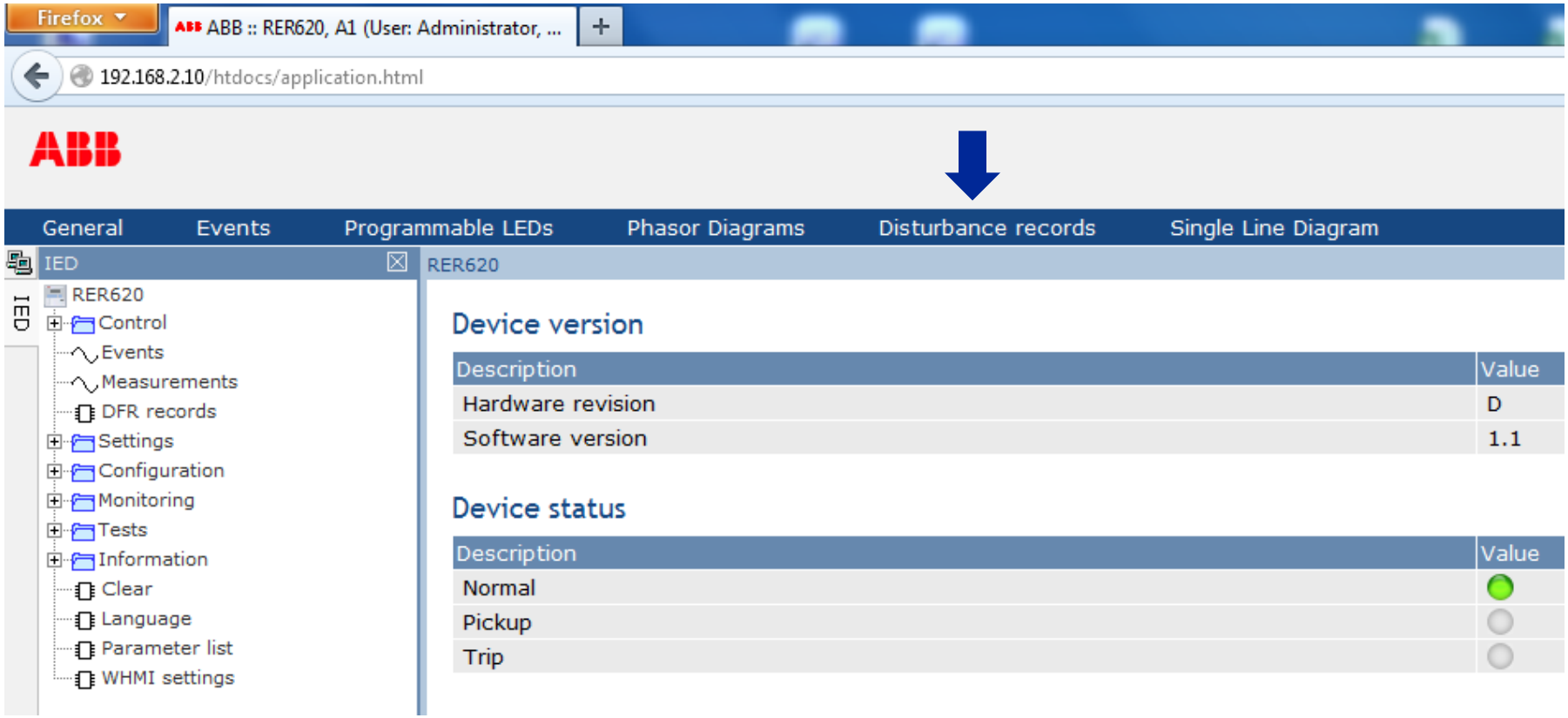


Relion® RER620
WebHMI web browser real-timer phasor plots

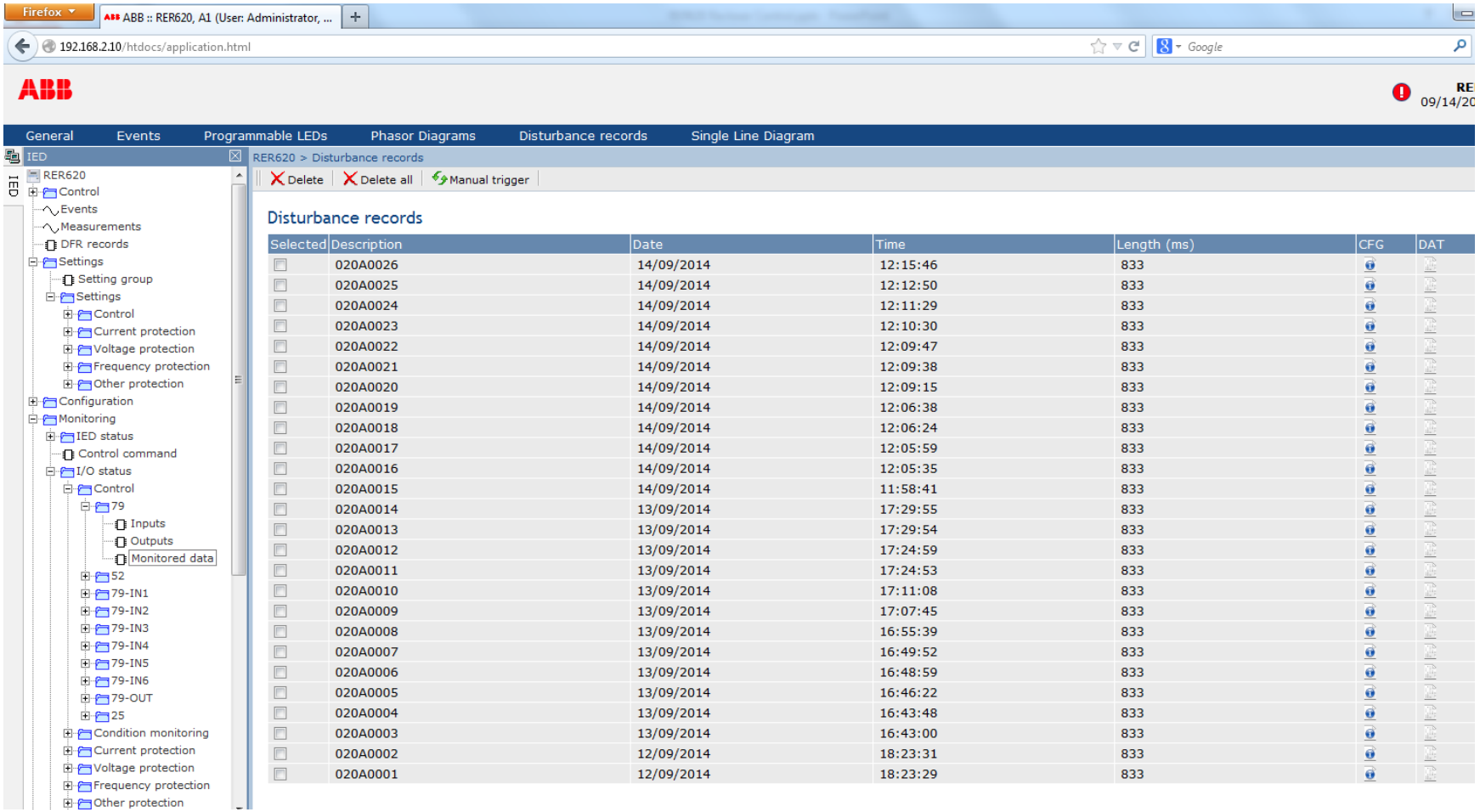


- Phasor plots include…
  - Phase currents
  - Phase voltages
  - Sequence currents
  - Sequence voltages

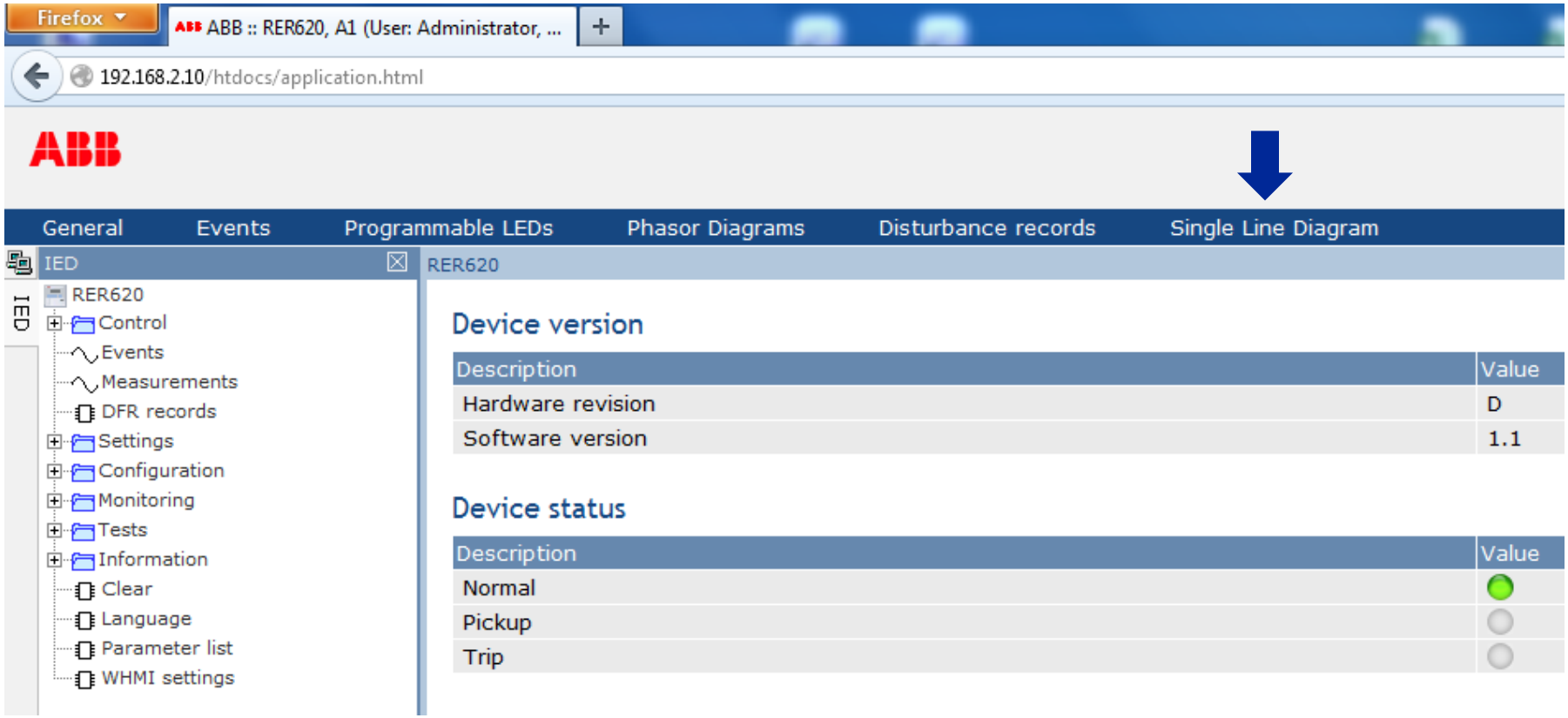
Relion® RER620
WebHMI web browser



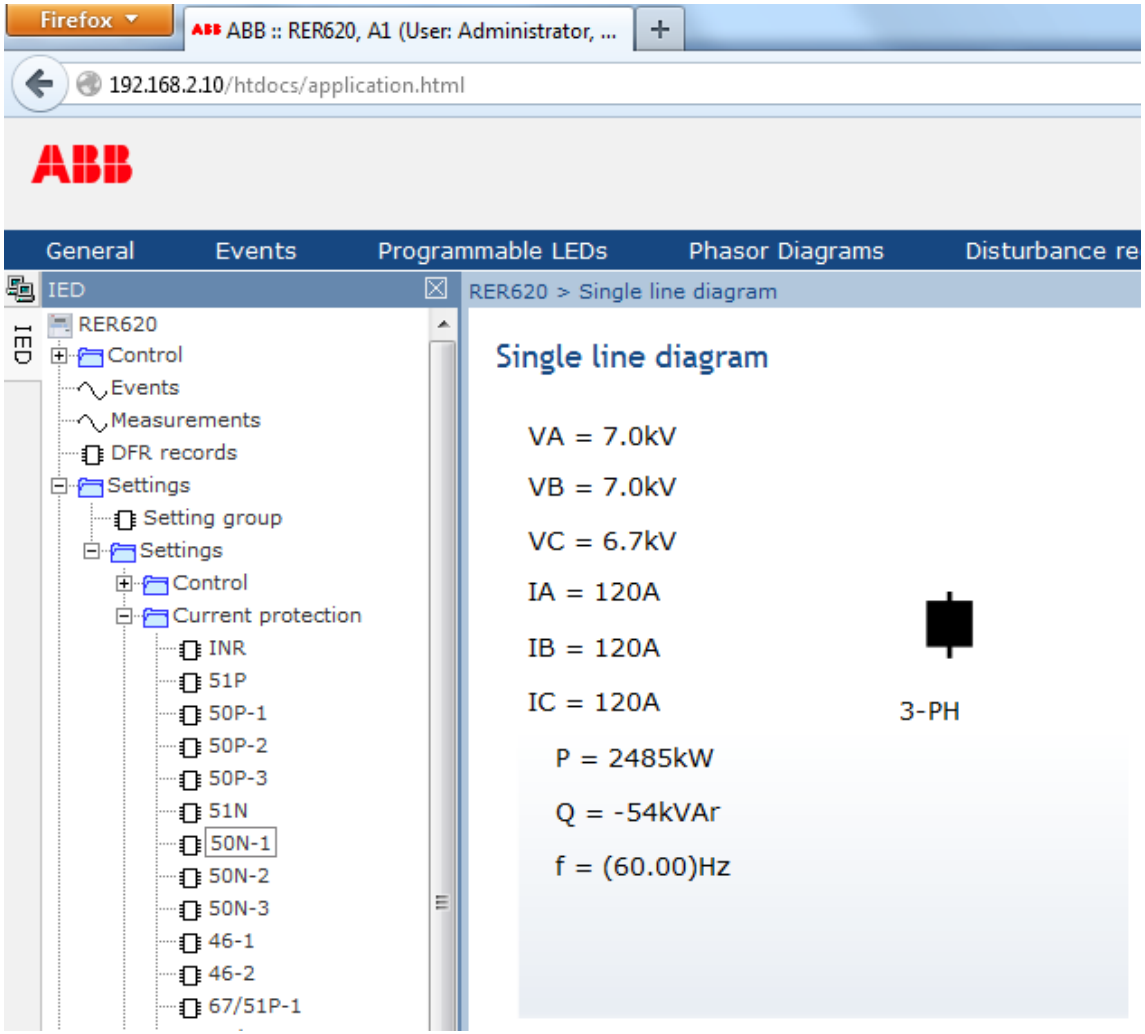
Relion® RER620
WebHMI web browser – retrieve waveform records



Relion® RER620
WebHMI web browser

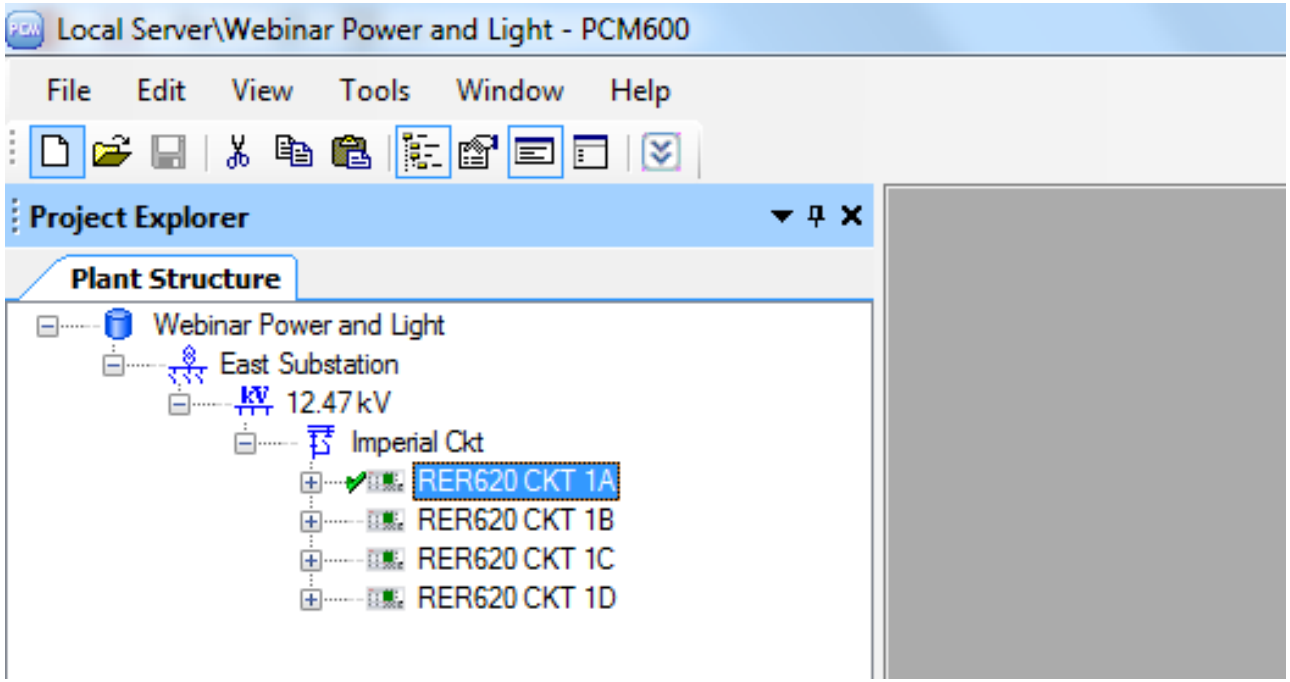


Relion® RER620
WebHMI web browser – view SLD screen

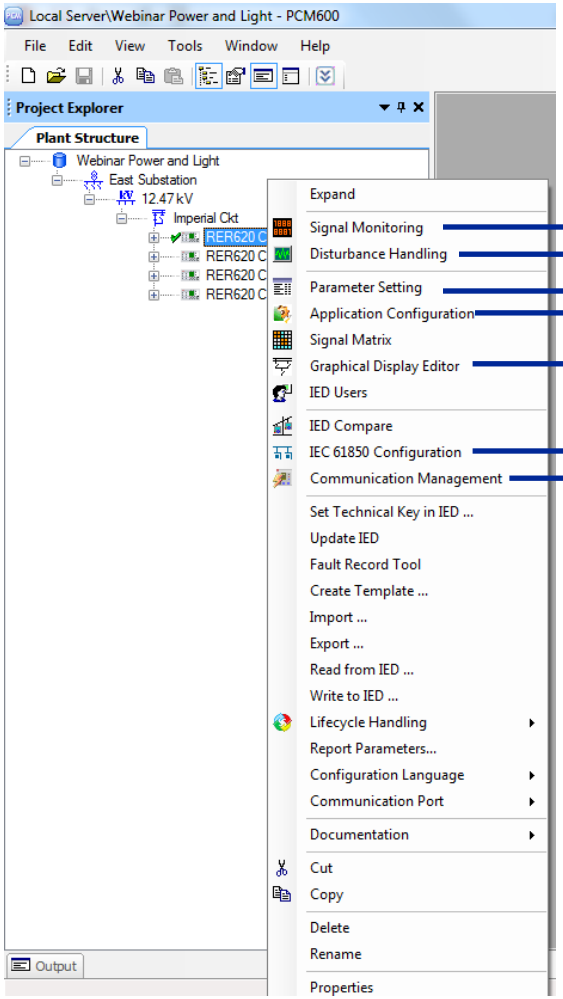


Relion® RER620
PCM600 configuration tool

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

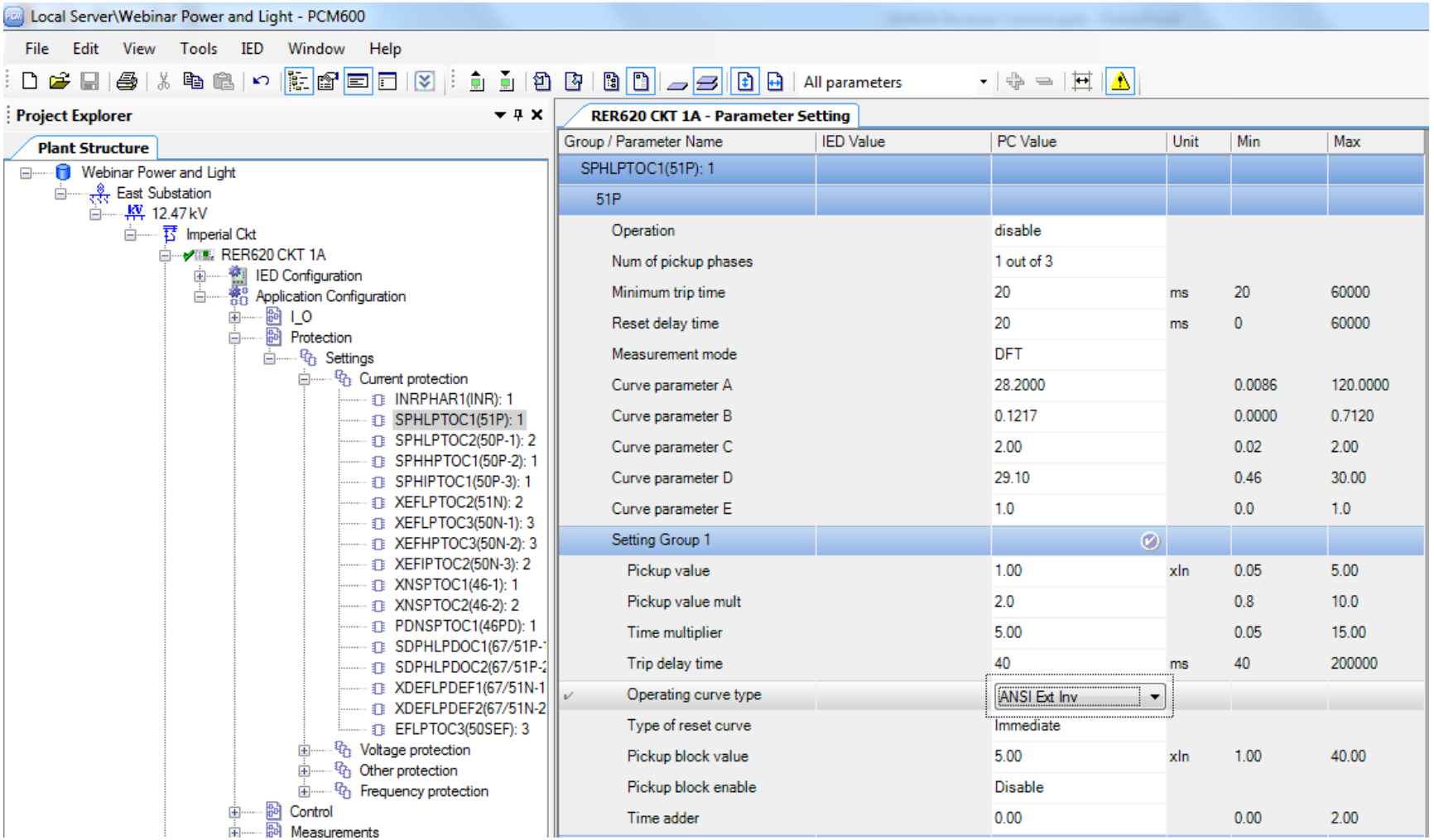


Relion® RER620
PCM600 configuration tool

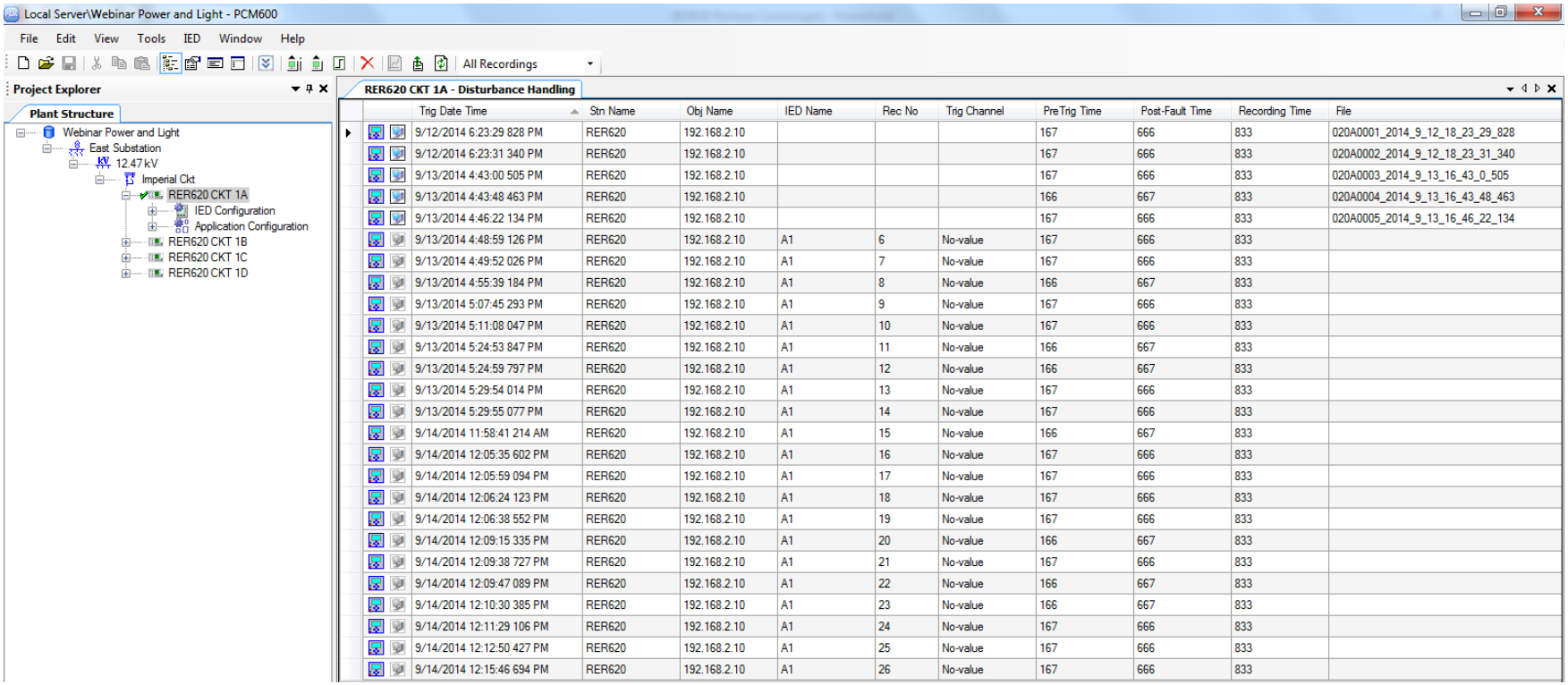


- PCM600 is used for many things…
  - Real-time monitoring of signals
  - Retrieving COMTRADE waveform
  - Creating condensed color pdf fault report
  - Creating parameter setting files
  - Creating customized application logic
  - Creating customized screen displays
  - Creating virtual wires between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

Relion® RER620
PCM600 parameter setting tool



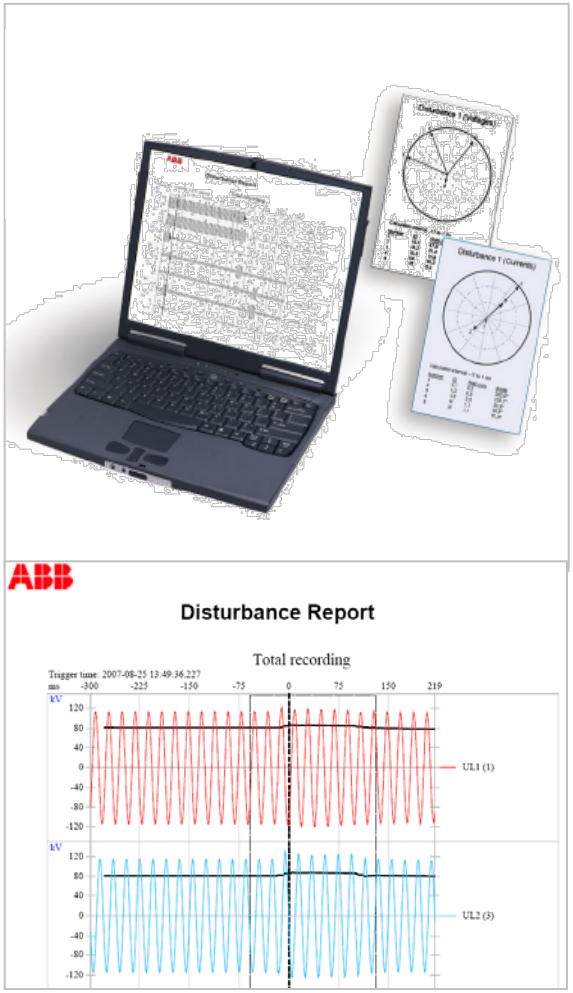
Relion® RER620
PCM600 disturbance handling tool



Trig Date Time	Stn Name	Obj Name	IED Name	Rec No	Trig Channel	PreTrig Time	Post-Fault Time	Recording Time	File
9/12/2014 6:23:29 828 PM	RER620	192.168.2.10				167	666	833	020A0001_2014_9_12_18_23_29_828
9/12/2014 6:23:31 340 PM	RER620	192.168.2.10				167	666	833	020A0002_2014_9_12_18_23_31_340
9/13/2014 4:43:00 505 PM	RER620	192.168.2.10				167	666	833	020A0003_2014_9_13_16_43_0_505
9/13/2014 4:43:48 463 PM	RER620	192.168.2.10				166	667	833	020A0004_2014_9_13_16_43_48_463
9/13/2014 4:46:22 134 PM	RER620	192.168.2.10				167	666	833	020A0005_2014_9_13_16_46_22_134
9/13/2014 4:48:59 126 PM	RER620	192.168.2.10	A1	6	No-value	167	666	833	
9/13/2014 4:49:52 026 PM	RER620	192.168.2.10	A1	7	No-value	167	666	833	
9/13/2014 4:55:39 184 PM	RER620	192.168.2.10	A1	8	No-value	166	667	833	
9/13/2014 5:07:45 293 PM	RER620	192.168.2.10	A1	9	No-value	167	666	833	
9/13/2014 5:11:08 047 PM	RER620	192.168.2.10	A1	10	No-value	167	666	833	
9/13/2014 5:24:53 847 PM	RER620	192.168.2.10	A1	11	No-value	166	667	833	
9/13/2014 5:24:59 797 PM	RER620	192.168.2.10	A1	12	No-value	166	667	833	
9/13/2014 5:29:54 014 PM	RER620	192.168.2.10	A1	13	No-value	167	666	833	
9/13/2014 5:29:55 077 PM	RER620	192.168.2.10	A1	14	No-value	167	666	833	
9/14/2014 11:58:41 214 AM	RER620	192.168.2.10	A1	15	No-value	166	667	833	
9/14/2014 12:05:35 602 PM	RER620	192.168.2.10	A1	16	No-value	167	666	833	
9/14/2014 12:05:59 094 PM	RER620	192.168.2.10	A1	17	No-value	167	666	833	
9/14/2014 12:06:24 123 PM	RER620	192.168.2.10	A1	18	No-value	167	666	833	
9/14/2014 12:06:38 552 PM	RER620	192.168.2.10	A1	19	No-value	167	666	833	
9/14/2014 12:09:15 335 PM	RER620	192.168.2.10	A1	20	No-value	166	667	833	
9/14/2014 12:09:38 727 PM	RER620	192.168.2.10	A1	21	No-value	167	666	833	
9/14/2014 12:09:47 089 PM	RER620	192.168.2.10	A1	22	No-value	166	667	833	
9/14/2014 12:10:30 385 PM	RER620	192.168.2.10	A1	23	No-value	166	667	833	
9/14/2014 12:11:29 106 PM	RER620	192.168.2.10	A1	24	No-value	167	666	833	
9/14/2014 12:12:50 427 PM	RER620	192.168.2.10	A1	25	No-value	167	666	833	
9/14/2014 12:15:46 694 PM	RER620	192.168.2.10	A1	26	No-value	167	666	833	

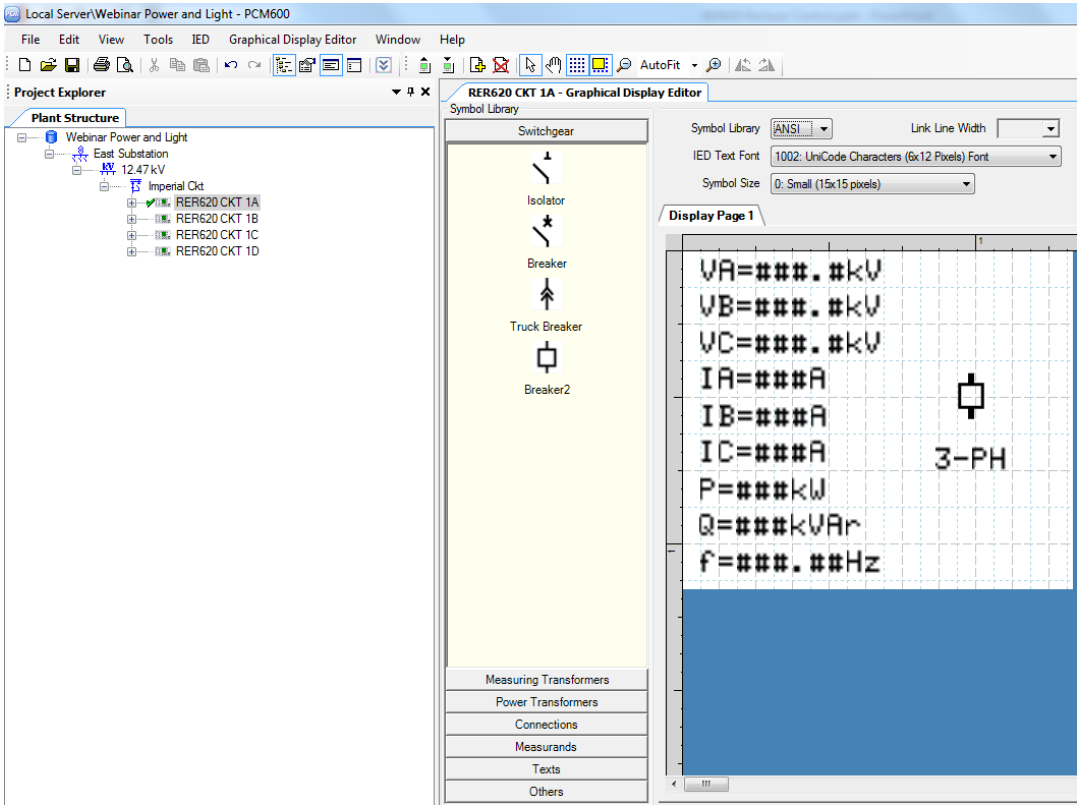
- Disturbance Fault Records (DFR) are stored in COMTRADE format for viewing by any COMTRADE viewer.
- Selectable record length and pre-trigger time
- *Stores 30 records of 50 cycle length (default size)*

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

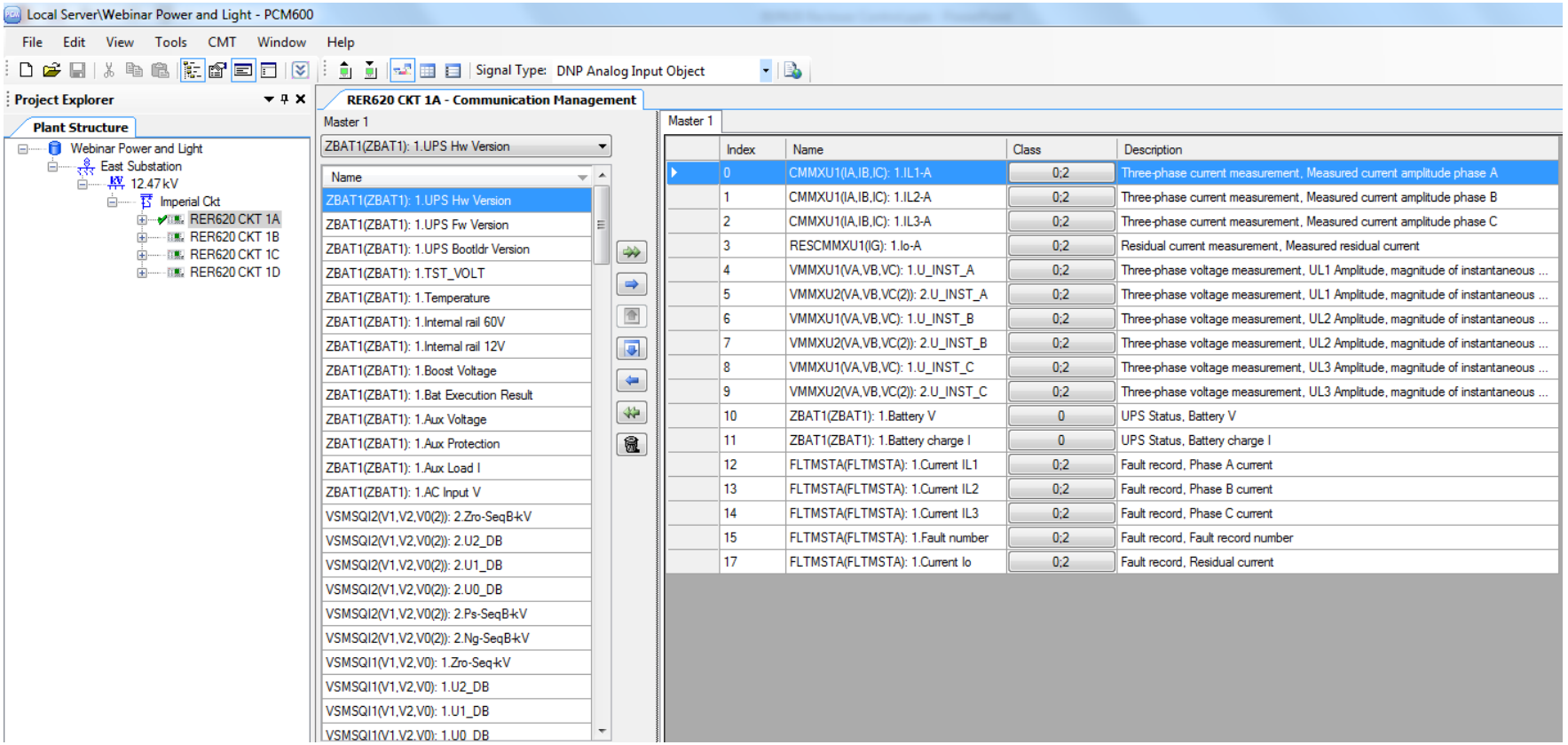
Relion® RER620
PCM600 graphic editor tool



- Single Line Diagram (SLD) screen is configurable
- Combines graphics and text

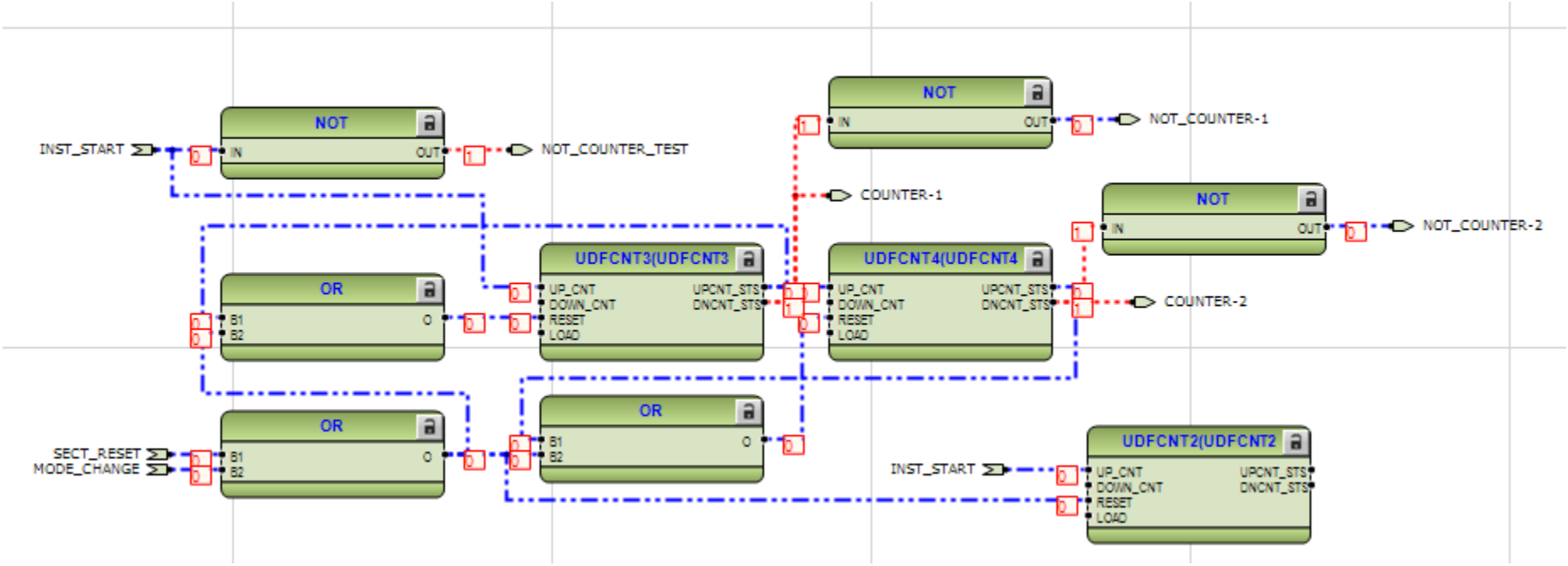
- One of three display screens (Menu, Metering, **SLD**)
- Build a screen that shows what you want to see

Relion® RER620
PCM600 communications management tool



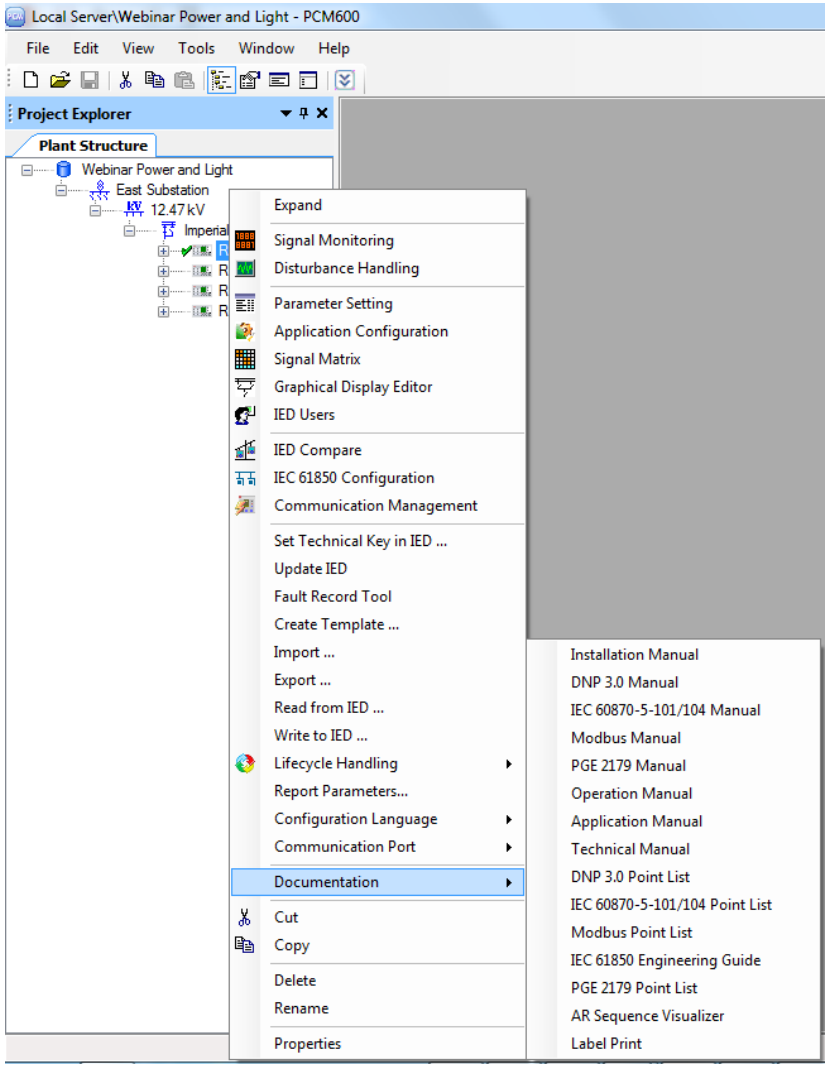
Relion® RER620
PCM600 applications configuration tool

- 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

Relion® RER620
PCM600 – documentation - embedded manuals



- All manuals are embedded in PCM600 in pdf format

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