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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.

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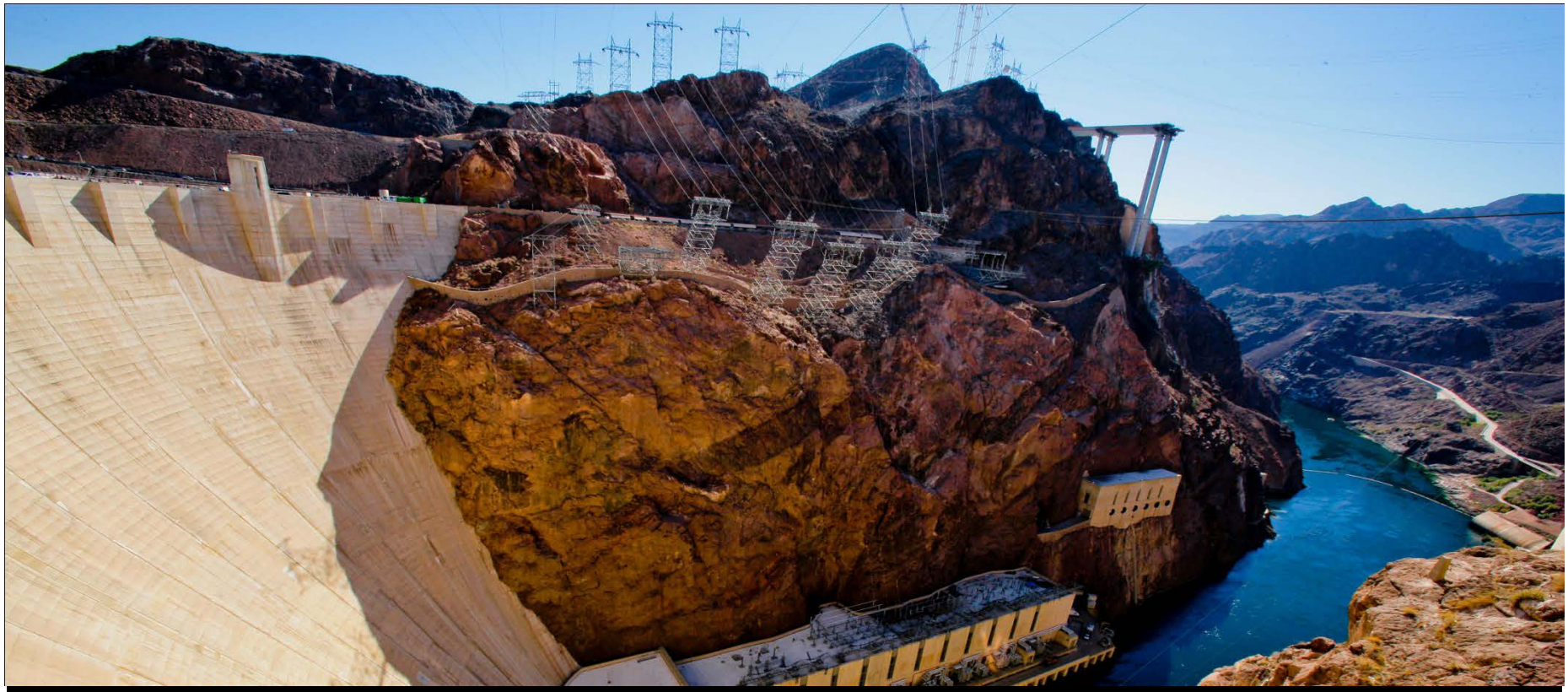


Pre-configured matching unit (PCMU)
Thinking beyond the box

Profile
Michael Fleck, P.E.

- Regional Technical Manager, Midwest USA
- BSEE, Rose-Hulman Inst. of Technology, Indiana
- MSEE, Arizona State University, Arizona
- Professional Engineer (P.E.), Indiana
- IEEE – Power & Energy Society Member & PSRC
- Experiences:
  - ✓ ABB DA Regional Technical Manager, configuration of products to meet customer applications, customer training
  - ✓ Protection and Control Engineer, system modeling, control design, mentoring junior engineers for national consulting company,
  - ✓ Transmission and Distribution P&C engineer, system modelling, system study, design, relay setting, trouble shooting for utility company

Learning objectives

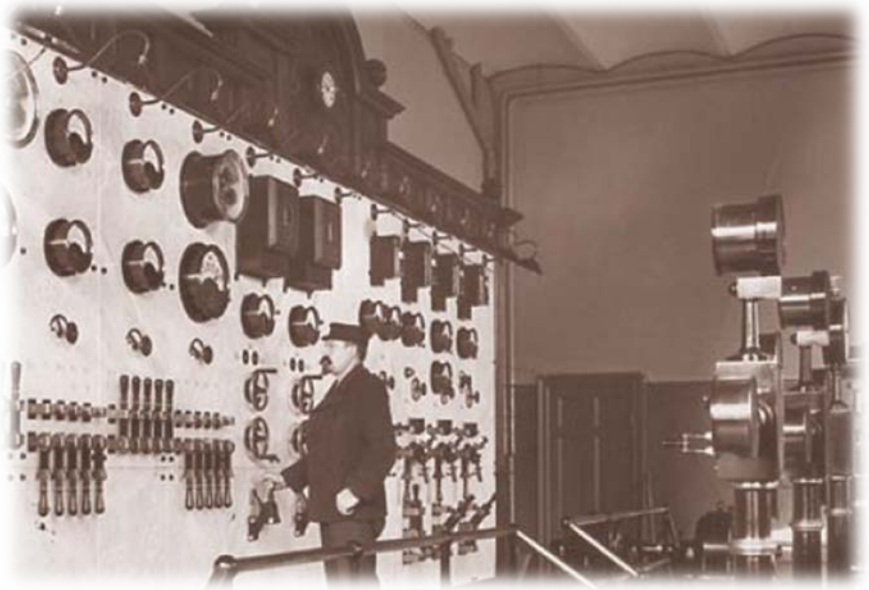
- What we will discuss
  - Utility Constraints
  - Issues and Concerns Meeting those Constraints
  - PCMU
    - Mechanical Compatibility
    - Enhanced Communication & Security
    - Enhanced Performance & Functionality
    - Future Proof & Smart Grid Compatibility
    - Reliability

The new utility
Cost constrained… Risk constrained…

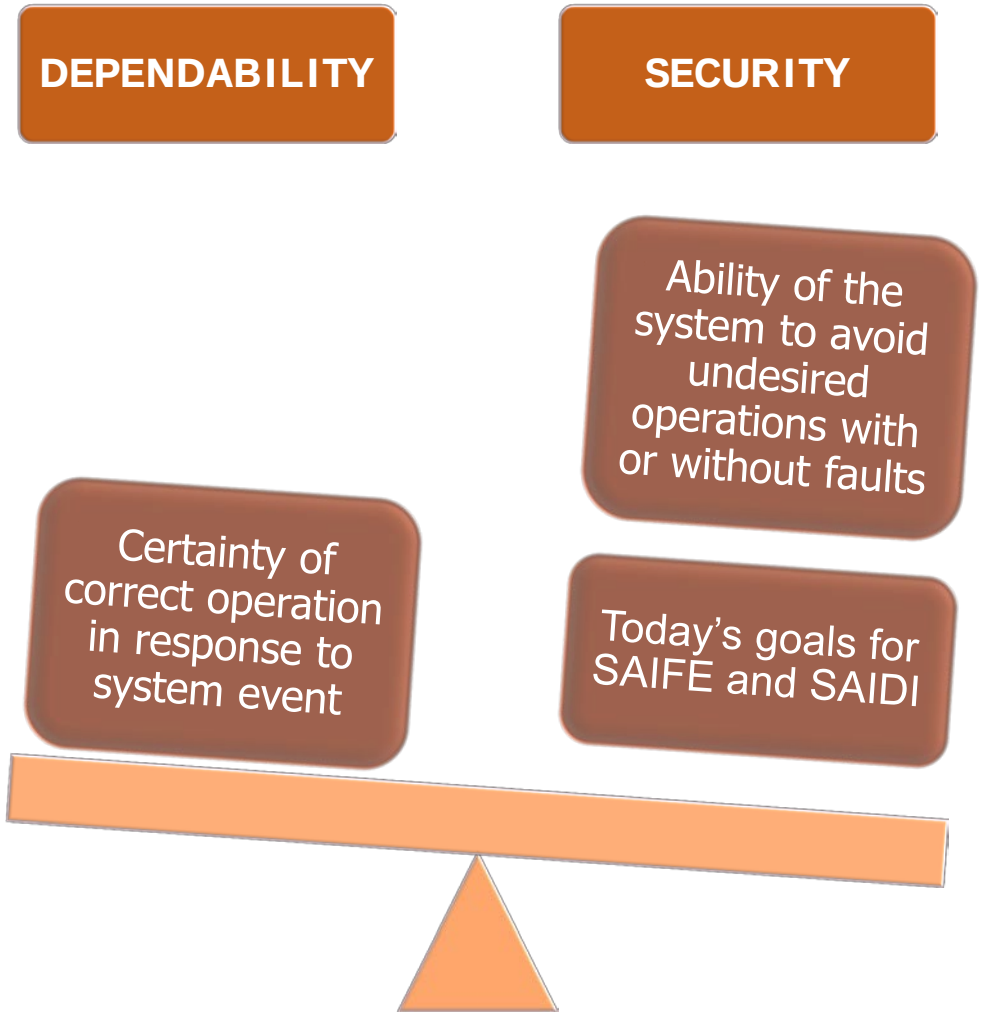
- Capital & Operating budgets under pressure
- Rate case challenges & cost control measures
- Internal competition for money (smart metering & renewable generation higher priority)
- Protection does not have the same access to funds
- Skilled human resource pool shrinking

This is the new normal !

- Older protection schemes designed for dependability
- Protection needs to be dependable & secure (avoid undesired operations)



The new utility
The art of protection …



Why do utilities refurbish relays?

- Cost to repair/replace obsolete assemblies
- Protection for security (versus just reliability)
- Ability to support automation schemes
- Data source for the Smart Grid applications

Compliance

- NERC PRC
- NERC CIP
- Increase public safety
- Improve outage metrics (SAIFI/SAIDI)

It's obsolete! It does not do what utilities need it to do!
Replace them as fast as practical

PRC	Protection & Control
CIP	Critical Infrastructure Protection
SAIFI	System average interruption frequency index
SAIDI	System average interruption duration index

Understanding the cost of refurbishment

Retrofit incurred costs include:

- Modifying drawings
- Mechanical changes to cabinets, doors or cut-outs
- Wiring and labeling
- Integration into existing substation automation system
- Test & commissioning

  Bay, HMI & control center(s)

Most of these costs exceed the price of a relay

How do we reduce these costs & risks to accelerate refurbishment?

Minimizing retrofit costs & risks
What to ask for from relaying solutions

Mechanical Compatibility

Relay assembly that replaces a legacy relay without modifying the existing cutout and existing CT, VT, I/O wiring.

Communication & Security

Enhanced Performance & Functionality

Future proof for Smart Grid migration

Reliability

Form/Fit mechanical compatibility

PCMU Direct Wire-Like Replacements

DPU 245/445

DPU2000

Vertical Mount

PCMU

REF615R Direct Wire-Like Replacements

DPU2000R

3U, 19” Case

REF615R

Eliminates the need to modify panels/doors or cutouts

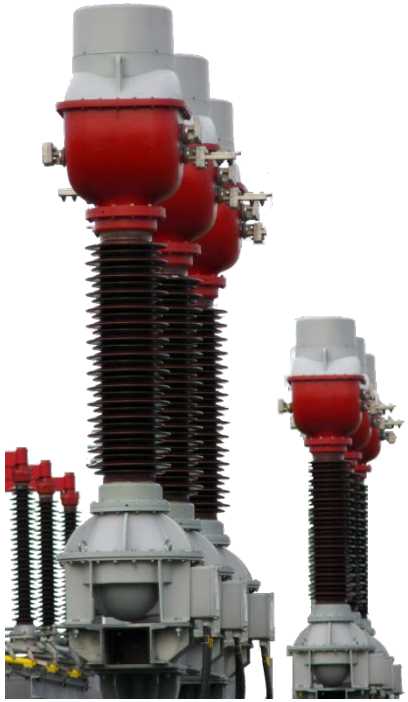
Wire-like compatibility
Different relays, same terminal blocks

Eliminates the need to modify engineering drawings
& reduce scope of testing

Minimizing test scope
Design for easy validation

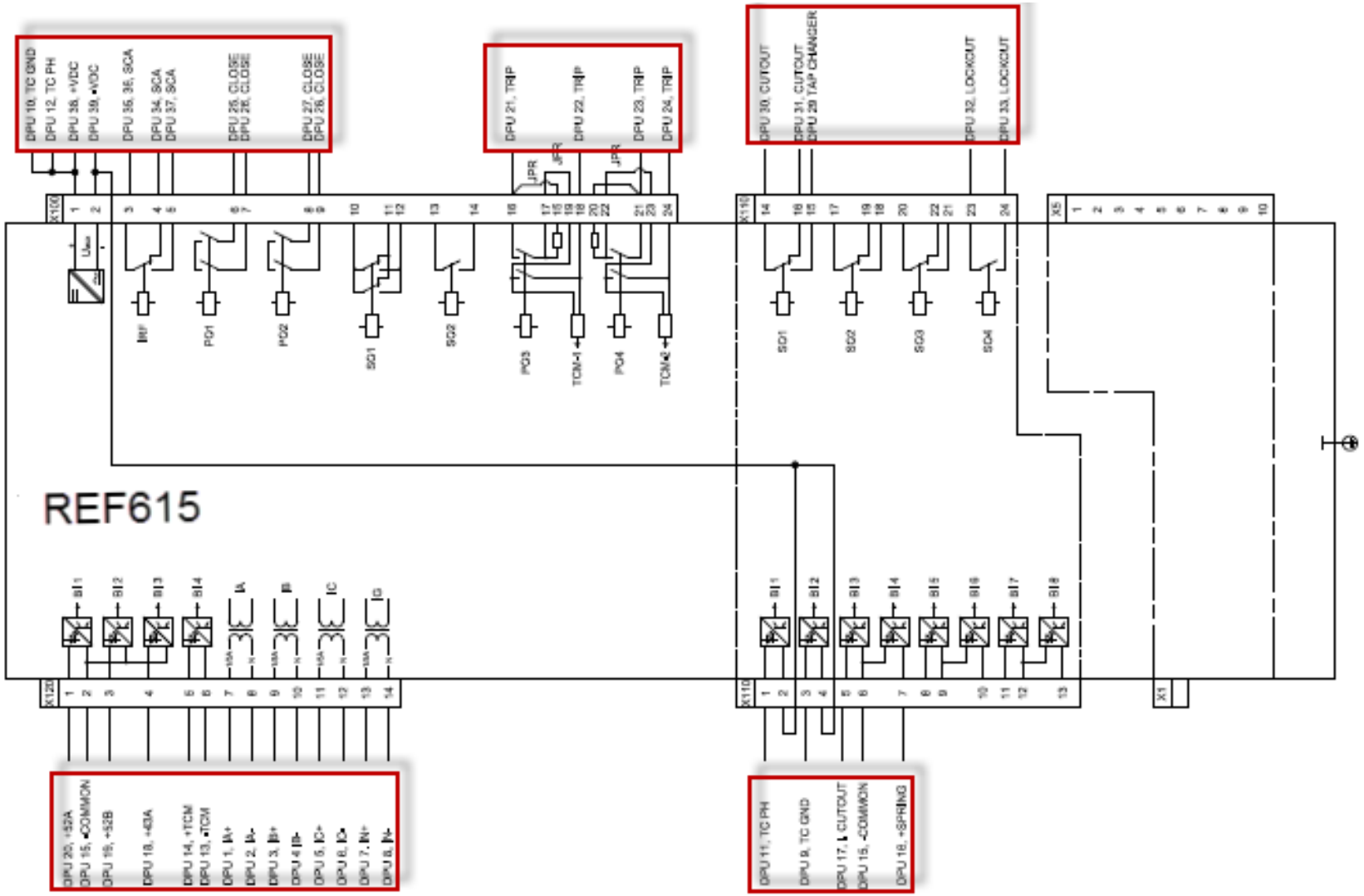
Certify to the test switches …

and not at the CT/PT



(where procedures allow)

Pre-made mapping drawings
Shorten the design effort



Pre-made mapping drawings
Shorten the design effort

Design Effort

- Reduced by up to 70%
- Drawing updates non-existent – Wire alike solution
- Design savings in converting old settings and logic to new devices
- No fabrication of adapter plates needed

	Competitor solution			PCMU		
Engineering of solution	16	hr	$3,200	4	hr	$800
Translate protection settings to match old relays	4	hr	$800	Included in PCMU		
Translate logic settings to match relays	4	hr	$800	Included in PCMU		
New autocad dwgs	8	hr	$1,600	2	hr	$400
Adapter plate	$50	1	$50	Included in PCMU		
Miscellaneous	$100	1	$100	$50	1	$50
Factory prewiring to relay terminals	6	hr	$300	Included in PCMU		
Removing existing relay & associated wiring	1	hr	$50	1	hr	$50
Drill hole, mount plate, wire to terminal blocks	1	hr	$50	0.5	hr	$25
Programming set up of new relay, including protection settings	2	hr	$100	Included in PCMU		
Wire check (ring out)	1	hr	$50	0.5	hr	$25
Updating of drawings by customer	35	hr	$7,000	10	hr	$2,000
	TOTAL		$14,100			$3,350

Note: Calculation is typical and may vary depending on specific customer conditions. Calculation assumes replacement is planned so no utility downtime is considered.

Minimizing retrofit costs & risks
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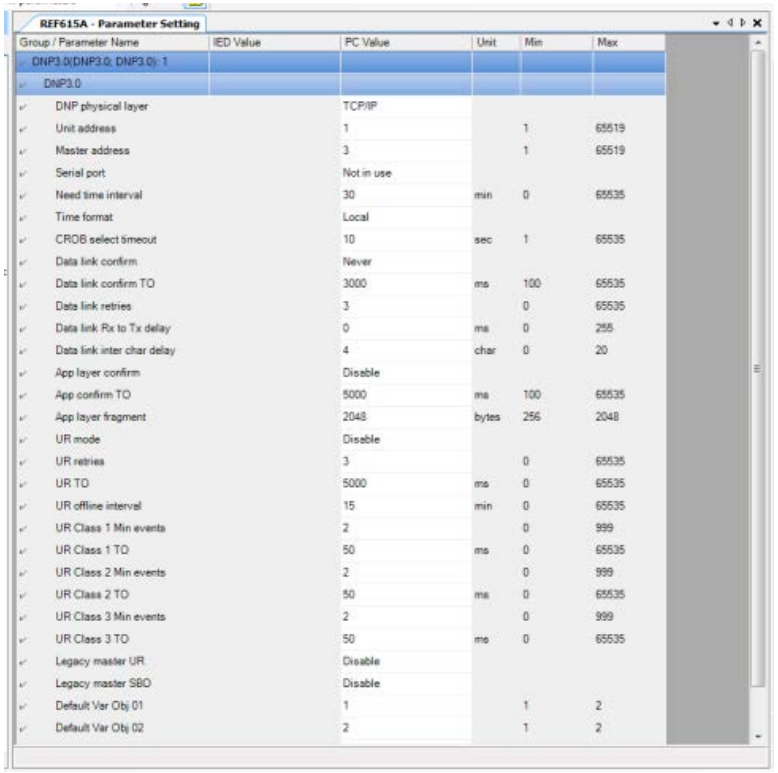
Data-communication compatibility

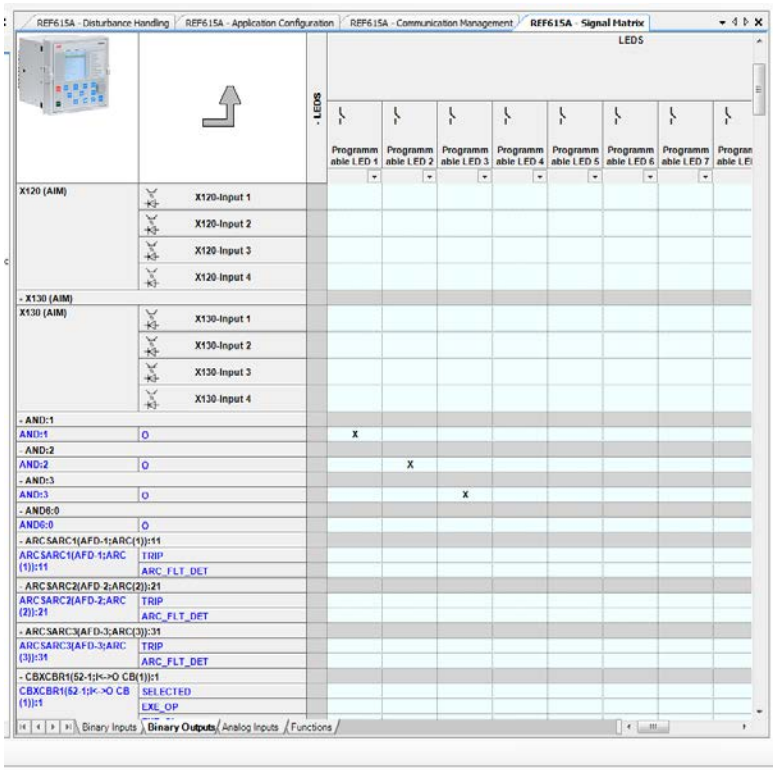
Relays should support multiple communication interfaces:

- Multiple Ethernet 10/100BaseT (RJ45) ports
- RS-232/RS-485 for legacy communication
- DNP 3.0 and IEC 61850 protocol support
- IRIG-B and SNTP for time synchronization
- Cyber-security support for NERC CIP compliance

The future is about secure, shared and actionable data

Data-communication compatibility
Pre-configured data mapping for DNP 3.0





Reduces the substation automation integration effort

Minimizing retrofit costs & risks
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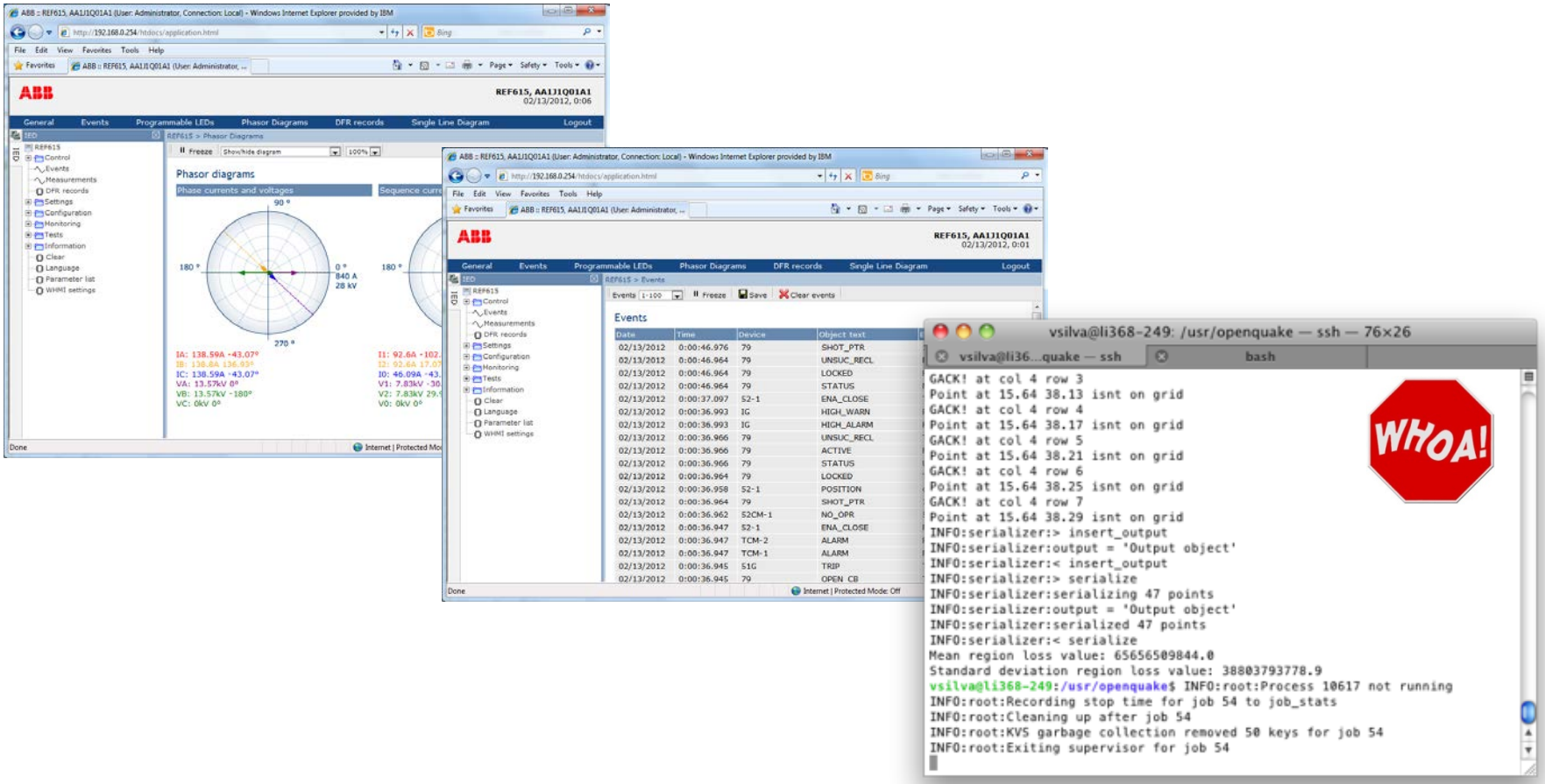
Reliability

Enhanced human machine interface
Improves accuracy of operation

Look for large displays with programmable target LED's to support existing and future protection philosophies

Ease of use
Simplifying the user experience

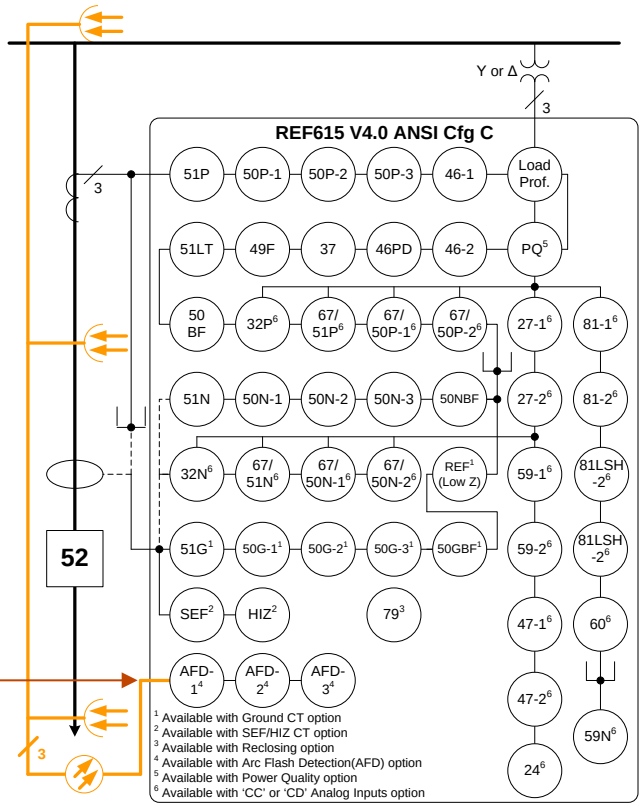


Intuitive “command-less” graphic user interface
Eliminates command driven line access

Enhanced performance & functionality
Value add features to ask for

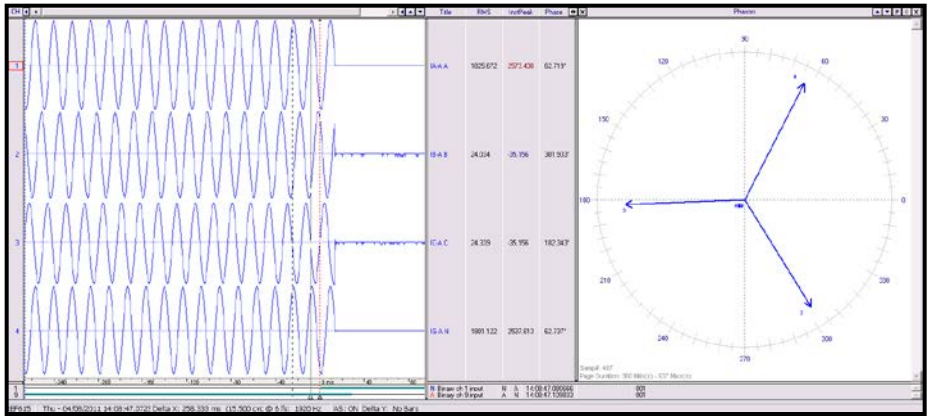
- Added protection functions for better coordination / enhanced feeder protection and control
  - Voltage Protective Functions
  - Arc Flash
  - Frequency Protection

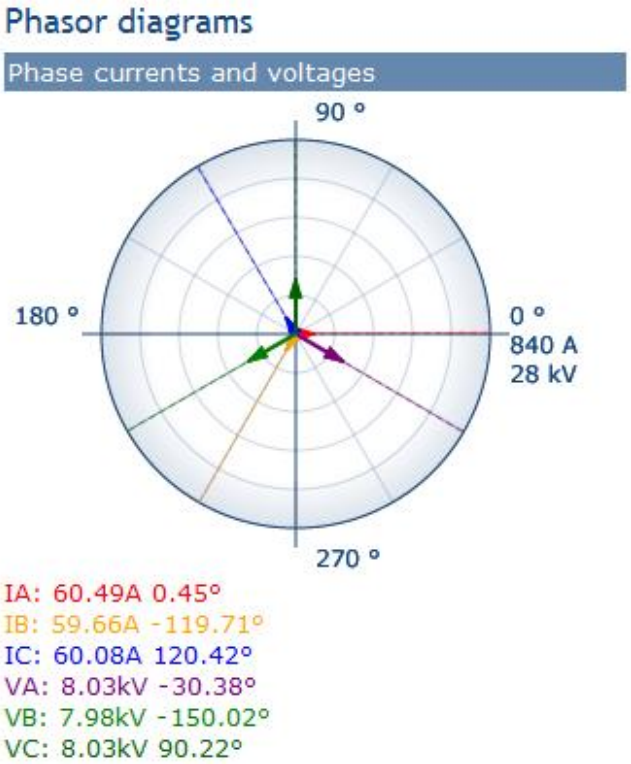
The more ANSI functions supported (circles) the greater the application flexibility



Enhanced performance & functionality
Value add features to ask for

- Integrated sequence of event (SOE), fault and digital fault waveform recording & reporting (open formats)

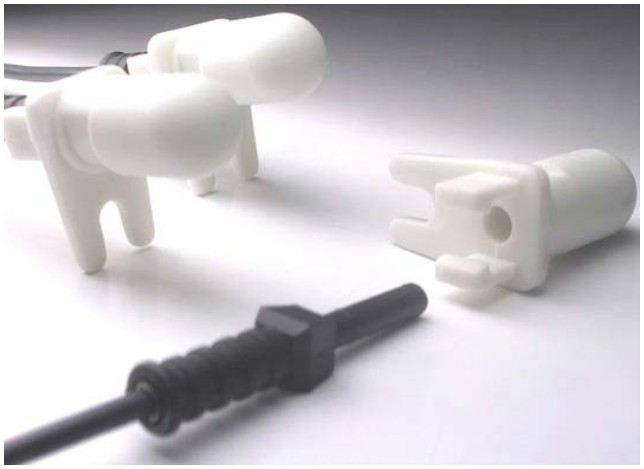




Enhanced performance & functionality
Value add features to ask for

- Enhanced monitoring of Power Quality(PQ)
- Condition Based Monitoring of plant operations
- Cable Fault Detection (CFD) using existing CT input wiring. Detects underground cable faults

Enhanced performance & functionality
ARC Flash protection



Arc Trip based on:
- Current and light
- Current and binary input signal
- Light only

Operate time depends on options:
- 1 / 12 ms (current and light)
- 1 / 10 ms (light only)

Continuously supervises the CB, cable and busbar compartment of metal-enclosed switchgear

* Distribution Feeder specific feature

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Future proof for Smart Grid migration

Reliability

Planning for the future

New relays support multi-object protection and value-add applications … based on signals from other bays

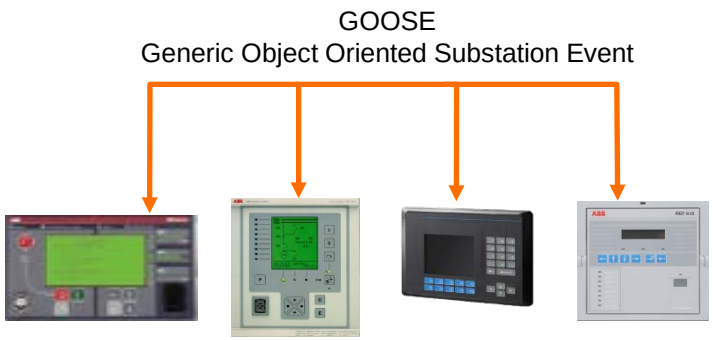
Reality check

- Retrofits and wire-for-wire replacements limit cabling to existing signals
- “Form fit” limits adding of I/O modules
- There is a fixed number of inputs/outputs a relay can support

How to extend the application capability?

- High speed Ethernet communication
- GOOSE messaging, a subset of IEC 61850 (Global Object Oriented Substation Event)

Secure horizontal communication
What is GOOSE messaging?

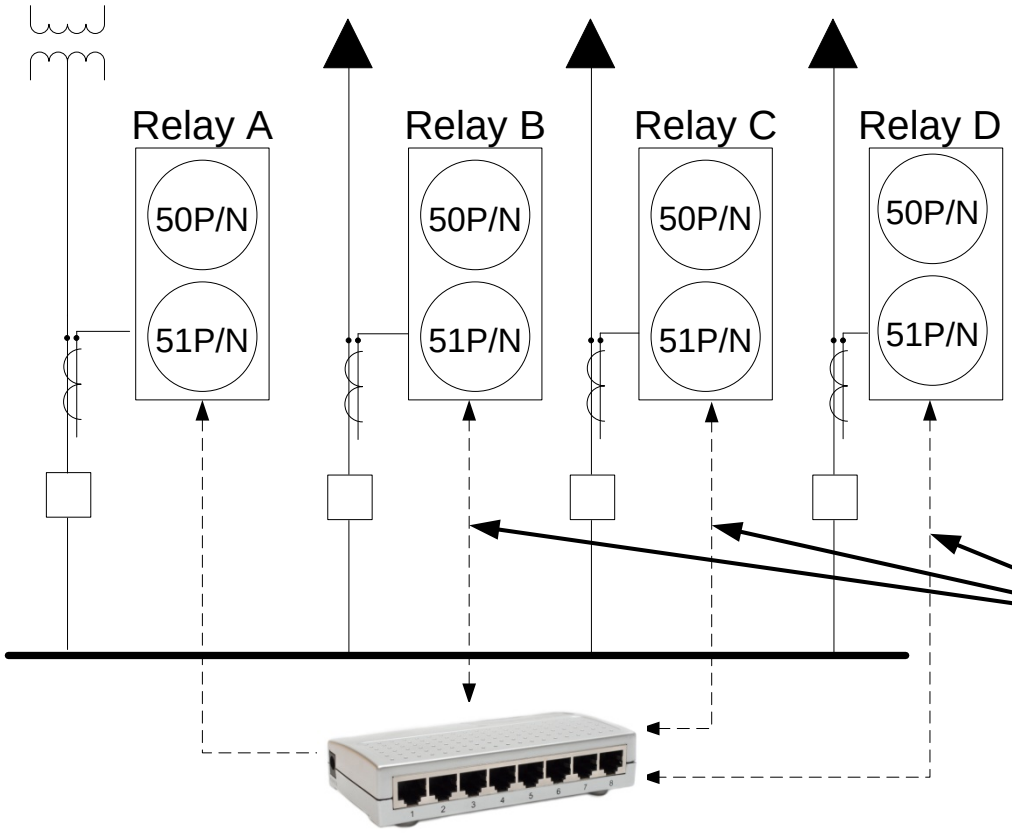


Illustrative purpose only

- Standards based (IEC 61850) horizontal communication
- Replaces hard-wiring between IEDs
- Supports multi-vendor products
- GOOSE broadcasts events to peer IEDs in a substation using Ethernet
- Transmits binary and analogue process data between IEDs
- Should be supported on replacement relays for new applications

- Designed by protection engineers for protection engineers

Application example
Bus blocking on feeder relay, GOOSE driven



- 50P Phase Instantaneous Overcurrent
- 50N Neutral Instantaneous Overcurrent

Blocking Signals are Sent to Relay A over Ethernet via GOOSE

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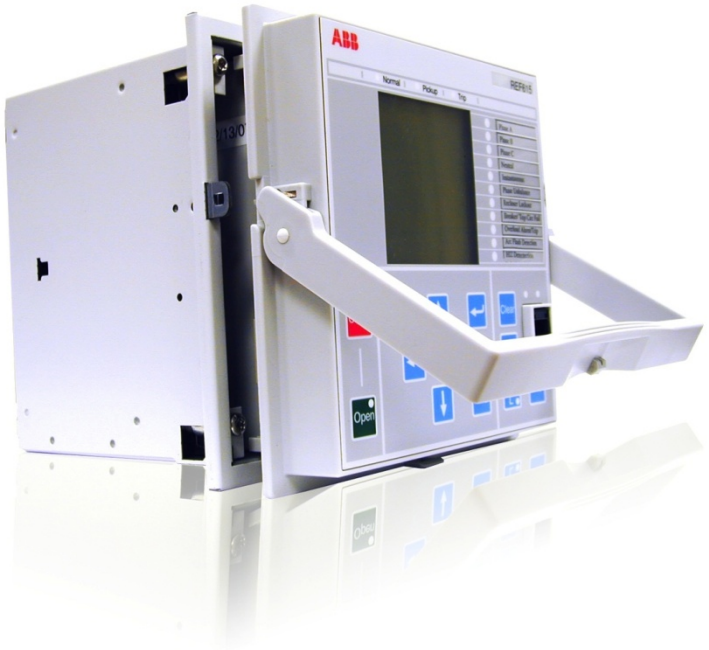
Reliability

Reliability
Is the solution easily repairable?

- Is the relay designed for 15+ years of uninterrupted service by a reputable vendor?
- Are faults easy to diagnose (with limited skills)
- Cost of non-modular repair outweighs benefits of extended warranties

  Draw-out and modular designs improve system maintainability (MTTR)



In Summary …

The PCMU is a direct wire-like, panel cutout replacement for existing ABB relays (DPU245, DPU445, and DPU2000)

The PCMU reduces engineering and installation time while keeping operational functions similar to legacy product and providing added relay functionality when system requirements evolve.

The PCMU is the most cost effective solution for replacement of older 245/445 and DPU2000 relays that takes advantage of the communication required for the evolving smart grid.

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Thank you for your participation

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