



AUTOMATION-ASSISTED STUDIES FOR ASSESSMENT OF PROTECTION SYSTEM PERFORMANCE

Automated Protection Performance Studies

Quanta Technology’s automated approach provides Protection and Control engineers with the capability to feasibly perform comprehensive evaluations of protection performance across a highly scalable scope – from a single line to the entire system.

These automated study capabilities help improve the reliability of protection system as well as facilitate emerging compliance standards such as NERC’s PRC-027.

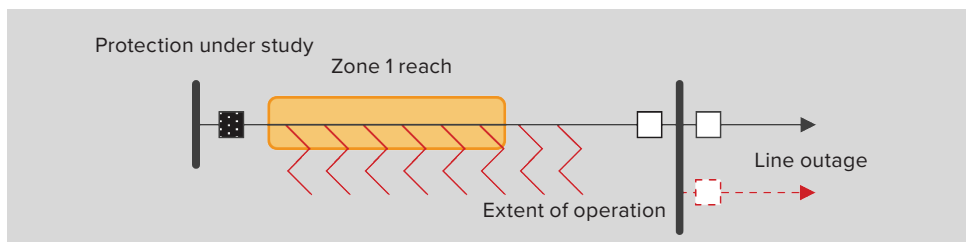
Protection systems are critical components to the safe and reliable operation of the electric grid. With changing operational paradigms, increasingly complex protection hardware and schemes, and new regulatory requirements, ensuring the performance of these protection systems is more important than ever. Quanta Technology’s automated approach to assessing protection performance can help engineers improve the reliability of these systems and better meet the engineering, operational, and regulatory needs of the modern power industry. Leveraging powerful simulation tools along with automation and reporting capabilities, engineers can efficiently perform comprehensive performance evaluations that include system contingencies and challenging scenarios.

Automated Protection Studies Features

- Automation allows for comprehensive studies to cover a wide range of scenarios, including fault types, locations, protection outages, and contingencies.
- Conditions and study scenarios can be pre-defined by the engineer and performed with minimal manual intervention.
- Output data can be post-processed to better organize the study results and help the engineer interpret and key in on important aspects of the protection performance.
- These studies can integrate with other protection and control processes, including relay settings development and compliance evaluations.
- Quanta Technology’s solutions are compatible with industry-standard simulation platforms, including both CAPE and ASPEN.

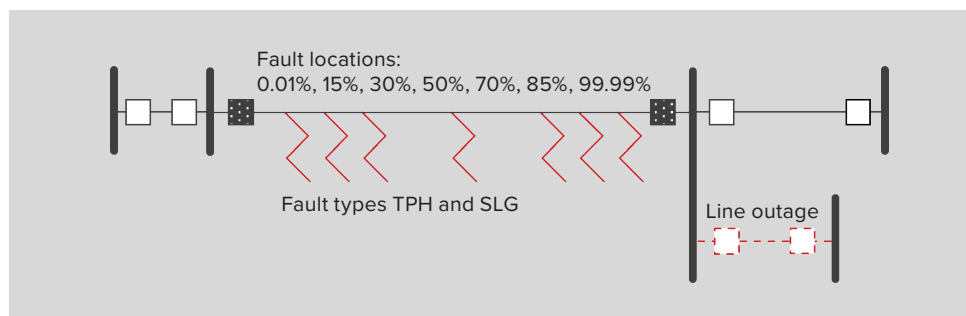
Study Types

Detailed sensitivity analysis: Study of protection element performance against a set of criteria that represents desired protection characteristics, typically defined according to protection philosophy requirements.



PICTURED: Basic sensitivity check may look at the extent of Zone 1 distance operation (typically around 85% of the study line) under a variety of system conditions and contingencies

Wide-area protection coordination: Study of protection operation performance with respect to adjacent protection to determine whether operations occur in the required order. Automation enables a detailed study of different system conditions and contingencies.



PICTURED: Coordination studies ensure that protection responds to events while minimizing the system that needs to be isolated

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Results Post-Processing and Reporting

Automation-based studies offer key advantages in efficiency and comprehensive detail, but may be difficult to review and interpret due to the sheer volume of results. Post-processing operations can better organize the output into forms that are easier for engineers to review. Sensitivity study results can provide users with the maximum and minimum values for each study metric, showing engineers the performance range of each protection element.

Coordination study results can summarize all issues associated with individual protection elements, helping engineers determine the cause and effect of coordination concerns with those elements.

Test Type	Element ID	Criterion	Min. % (%)	Max. % (%)	Normal % (%)	Evaluation
CT Test	REUSENS_GE_21G_B	<100A	31.89	31.89	31.89	PASS
CT Test	REUSENS_SEL_21P_A	<100A	35.88	35.88	35.88	PASS
Ground IOC Test	REUSENS_SEL_51G1_A	120%< 50%<	167.83	191.97	167.83	PASS
Ground IOC Test 2	REUSENS_SEL_51G1_A	120%< 80%<	209.06	253.65	253.65	PASS
Ground TOC Test	REUSENS_SEL_51G1_A	<50% 0.5< < 1 sec	83.62	101.46	101.46	VERIFY
Phase Zone 1 Test 1	REUSENS_GE_21P_B	<85%	82.75	82.75	82.75	PASS
Phase Zone 1 Test 1	REUSENS_SEL_21P_A	<85%	38.91	38.91	38.91	VERIFY
Ground Zone 1 Test 1	REUSENS_GE_21G_B	<75%	82.75	82.75	82.75	VERIFY
Ground Zone 1 Test 1	REUSENS_SEL_21G_A	<75%	38.91	38.91	38.91	VERIFY
Phase Zone 2 Test 1	REUSENS_GE_21P_B	>120%	116.73	116.73	116.73	VERIFY
Phase Zone 2 Test 1	REUSENS_SEL_21P_A	>120%	66.09	66.09	66.09	VERIFY
Ground Zone 2 Test 1	REUSENS_GE_21G_B	>120%	116.52	116.70	116.70	VERIFY
Ground Zone 2 Test 1	REUSENS_SEL_21G_A	>120%	66.22	66.34	66.34	VERIFY

PICTURED: Sensitivity results

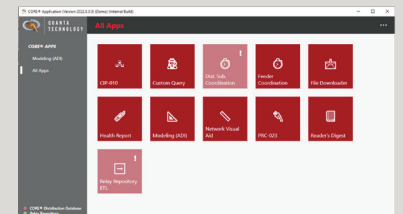
Device:		NEVADA_GE_21P_B																		
Substation:		NEVADA																		
Relay Group:		NEVADA_132 kV-HEMINGWAY_132 kV-1																		
Relay Type:		DS Phase																		
Tested Line:		"Ariz/Reus"																		
Main Branch:		[8000] "ARIZONA" [9120] "REUSENS" CKT[1]																		
3LG Fault				Main																
Pilot Status	Package Status	Network Status	0.01%	15%	30%	50%	70%	85%	99.99%											
No Pilot Out	No Package Out	System Normal	X, 0.017 (1)																	
		Outage Line: "Nev/Reusens"	X, 0.017 (29)	0.091, 0.017 (48)																
		Outage Transformer: "TR8"	X, 0.017 (43)	C0.003, 0.000 (43)																
		Outage Generator: Gen3	X, 0.017 (57)																	

PICTURED: Coordination results

CORE Suite

Automated protection performance study tools, such as sensitivity and wide-area protection coordination, are modules within the CORE (Compliance, Operations, Reliability, Engineering) Suite of automation tools. CORE is Quanta Technology's platform for automation-based solutions to address data, simulation, evaluation, digital transformation, and reporting needs.

The CORE platform enables seamless sharing of data and integration of processes across modules and applications. These protection coordination tools may integrate further with other applications in the CORE platform, such as compliance or relay settings modules.



PICTURED: CORE is a unified platform for digital transformation applications

Further Information

For more information, please visit our website.



[Automated Protection Performance Studies](#)



[Methodologies and Tools for Full-Cycle Automation of Transmission Line Protection Settings Evaluation \(2021 CIGRE Canada Conference & Expo\)](#)



[Practical Implementation of the Stepped-Event Analysis in Protection Evaluation \(2021 Western Protective Relaying Conference\)](#)

Enjoy our publications covering automation in protection performance:

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