



## RTDS® Hardware-in-the-Loop Laboratory Testing

### Independent Testing for Device & Application Performance Evaluation



Real-Time Digital Simulator (RTDS®) testing is able to interact with the system under evaluation in real-time in order to find weaknesses and problems as they would appear in the applications, allowing them to be examined and resolved before they cause any misoperation in the power system.

Testing with an RTDS® system has shown significant value in testing power system protection and control applications. RTDS® is primarily developed and utilized for hardware-in-the-loop (HIL) testing of protective relays, digital controllers, and process control devices for performance evaluation and pre-commissioning testing under close-to-real-world conditions. Also, HIL testing is commonly used for prototype development and/or finalizing a new application design involving several digital control, protection, and measurement devices.

#### **Service Offerings**

Quanta Technology experts support all phases of project testing including test plan development, test setup, performance of the tests, and analysis of the test results, as well as identifying and proposing solutions for the problems encountered. Testing can be performed at Quanta Technology's two state-of-the-art RTDS® test laboratories or on-site using customer-owned systems. Quanta Technology can even support our customers in building and specifying their own RTDS test laboratory.

#### **Why Quanta Technology**

Our experts have extensive experience in protection and control applications and come from across the power industry, including utilities, manufacturers, engineering, and consulting companies. Quanta Technology is vendor-neutral and has developed a best-in-class testing procedure that utilizes automation where possible. Our experience and our focus on automation allows for the processing of complex projects in an economic, time-effective, repeatable, and accurate manner.

*Industry-Known Protection Experts • Fully Automated*

*State-of-the-Art RTDS® • Relay-Manufacturer Independent*



### Typical RTDS Test Applications

- End-to-end protection scheme testing
- Interoperability and conformance testing
- Testing of Remedial Action Schemes (RAS)/Special Protection Systems (SPS)
- Testing of Phasor Measurement Unit (PMU)/Phasor Data Concentrators (PDC) systems
- Testing of IEC 61850 systems
- Testing of communication equipment, systems performance, and compliance
- Testing of microgrid protection and control applications
- Testing of renewable energy generation impact on protection performance

### Advanced Automation & Testing Process Used by Quanta Technology

Quanta Technology has extensive experience in RTDS® testing based on our work with utilities and manufacturers from all over the world. We have utilized a combination of testing automation and process enhancements to reduce the time it takes to conduct RTDS® testing, while simultaneously improving the quality of the results. Our goal has been to optimize the process to ensure all necessary tests are conducted as efficiently as possible.

### Quanta Technology Approach

Quanta Technology uses the COMTRADE file format for all test results because of the high degree of flexibility offered in the selection of signals needed for the evaluation without requiring any complex programming in the RTDS®. We have automated the process of interpreting the COMTRADE files, measuring important values and displaying the results in an agreed-upon customer format. The standardized test plan description is used to control the content of the test result report. The evaluation of test results is a task which can never be fully automated – a subject matter expert (SME) is still necessary. However, our experience has shown that, in some cases, simple rules can be used to determine the correct and desired operation for a given scenario. This rule engine can be used to quickly flag obvious problems early in the process and speeds up the process of evaluating the results.

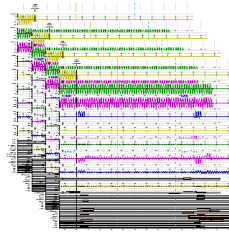
#### Test Plan

Test No.	Fault Position (%)	Fault Location	Type of Fault	Rf (ohms)	Angle (Degree)
1001	0.1	F1	AG	0.05	90
1002	0.1	F1	AG	0.05	90
1003	0.1	F1	AB	0.05	150
1004	0.1	F1	AB	0.05	90
1005	0.1	F1	ABG	0.05	0
1006	0.1	F1	ABG	0.05	90
1007	0.1	F1	ABC	0.05	0
1008	0.1	F1	ABCG	0.05	90
1009	30.0	F1	BG	0.05	120
1010	30.0	F1	BG	0.05	30
1011	30.0	F1	BC	0.05	90
1012	30.0	F1	BC	0.05	0

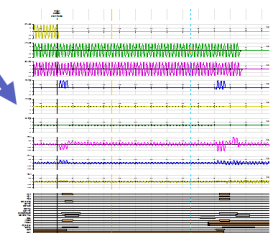
#### Automatically Generated Summary of Test Results

Test Description		Range of Data (min-max)									
Test No.	Fault Position (%)	Fault Location	Type of Fault	Rf (ohms)	Angle (Degree)	Current (A)	Voltage (V)	Power (W)	Energy (J)	Frequency (Hz)	Phase (deg)
1001	0.1	F1	AG	0.05	90	1000	1000	1000	1000	1000	1000
1002	0.1	F1	AG	0.05	90	1000	1000	1000	1000	1000	1000
1003	0.1	F1	AB	0.05	150	1000	1000	1000	1000	1000	1000
1004	0.1	F1	AB	0.05	90	1000	1000	1000	1000	1000	1000
1005	0.1	F1	ABG	0.05	0	1000	1000	1000	1000	1000	1000
1006	0.1	F1	ABG	0.05	90	1000	1000	1000	1000	1000	1000
1007	0.1	F1	ABC	0.05	0	1000	1000	1000	1000	1000	1000
1008	0.1	F1	ABCG	0.05	90	1000	1000	1000	1000	1000	1000
1009	30.0	F1	BG	0.05	120	1000	1000	1000	1000	1000	1000
1010	30.0	F1	BG	0.05	30	1000	1000	1000	1000	1000	1000
1011	30.0	F1	BC	0.05	90	1000	1000	1000	1000	1000	1000
1012	30.0	F1	BC	0.05	0	1000	1000	1000	1000	1000	1000

#### Standard RTDS output -> n-COMTRADE files



#### Hyperlink functionality for detailed review



### About Quanta Technology

Quanta Technology is an independent technology, consulting, and testing company providing business and technical expertise, along with advanced methodologies and processes, to utilities and others in the power and energy industries. Our mission is to provide unparalleled value to our clients in every engagement across the value chain by using advanced software and hardware, laboratories, and custom tools for a holistic approach to practical service and the most insightful thought leadership in the industry.

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### Smart Solutions

### Practical Results

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