



Digital real time simulator

Real time digital simulator (RTDS) for testing and training



At a glance

Increased demands on the network availability, with simultaneously increased complexity, e.g. lines in Y-joint or series compensation, result in high demands on the protection devices, but also on the reliability of the setting values which cannot be verified theoretically. Safety is provided by a real time simulator, but that is not all.

Siemens Power Technologies International (Siemens PTI), your provider of network consulting, network planning software and trainings on the Siemens T&D portfolio, offers protection simulation tests with the following benefits:

- Setting values of different fault cases can be optimized, verified and discussed with experts
- Customers can learn to operate the devices by means of DIGSI and to evaluate the fault printouts by means of SIGRA
- Transient processes in the network during short circuit can be analyzed to gain deeper insights
- The performance of the protection devices is validated by explicit measurements, e.g., triggering times

The challenge

When a new system is installed, the appropriate protection devices need to be selected and the settings determined. Depending on the size of the network this may be a complex task, not least because the functionalities and the operation of the different protection devices may vary substantially. Therefore, it can be helpful to learn how to operate a certain device in order to be able to decide whether it is suitable for application in a certain system. Real time digital simulation allows you to learn about the operating principles of different protection devices and to decide on their suitability.

In an existing protection system, the setting values determine if and when the circuit breaker

disconnects the faulted grid element. Disconnections due to wrong protection setting values can lead to unnecessary, often fairly high expenses for the network operator. Such unnecessary costs can be avoided by optimizing the setting values of the installed protection devices. These values can be optimized and verified for different fault cases by means of digital simulation.

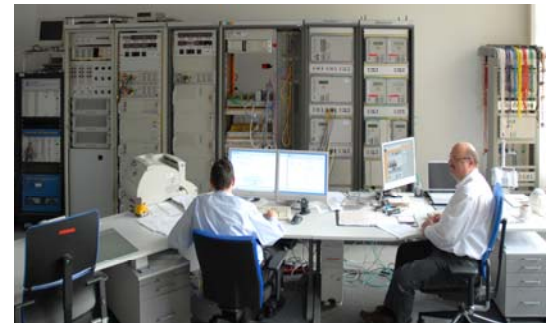


Figure 1: Technical equipment of the simulator (from left to right): RTDS, amplifiers, signal distributor, protection devices

Our solution

Technical details

Our Real Time Digital Simulator performs calculations for networks with up to 100 single nodes with a sampling rate of around 20 kHz. You can simulate generators, sources, multi-circuit lines, transformers, loads, current transformers with saturation, capacitive voltage transformers, circuit breakers etc. Real protection devices work with the simulator in closed loop to be able to carry out complex sequences like unsuccessful and 1-pole re-closings or secondary faults. Voltage amplifiers and current amplifiers up to 40 A as well as a documentation system complete the simulator.

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Evaluation

After the system disturbance has been simulated, the malfunction messages are analyzed and the fault printouts evaluated. This is very important for understanding the processes in the system and the behavior of the protection devices. Unlike real malfunctions, the solution is known in the simulator and the customers can train this analysis while considering the behavior at both line ends.

To get more informative details about complex configurations or sequences, DIGSI often ranks more events in malfunction messages. The analysis via SIGRA in the impedance level also helps to understand physical influences, e.g. of the distance measuring. The resulting report in form of a PDF file often consists of several thousand pages.

Specification tests

Depending on whether the simulations are more concentrated on tests or on the training aspect, approximately 50 to 150 tests can be carried out for a period of several weeks in a row. Working in small groups of typically up to three participants ensures efficient discussion and know-how transfer.

Workshops

In the scope of the Siemens Power Academy TD, experts are offered workshops with an emphasis on exchange of

experience and training; as well as fault simulation.

Application example

Figure 2 shows an example of a results page. Test results will be documented in our data acquisition system. Current and / or voltage wave forms as well as binary output contacts including trip

times of the relays will be recorded. This ensures an accurate storing of the simulated network faults and shows the reaction of the protection device. The results thus comprehensively validate the required protection system performance and form the basis for optional procedures and training.

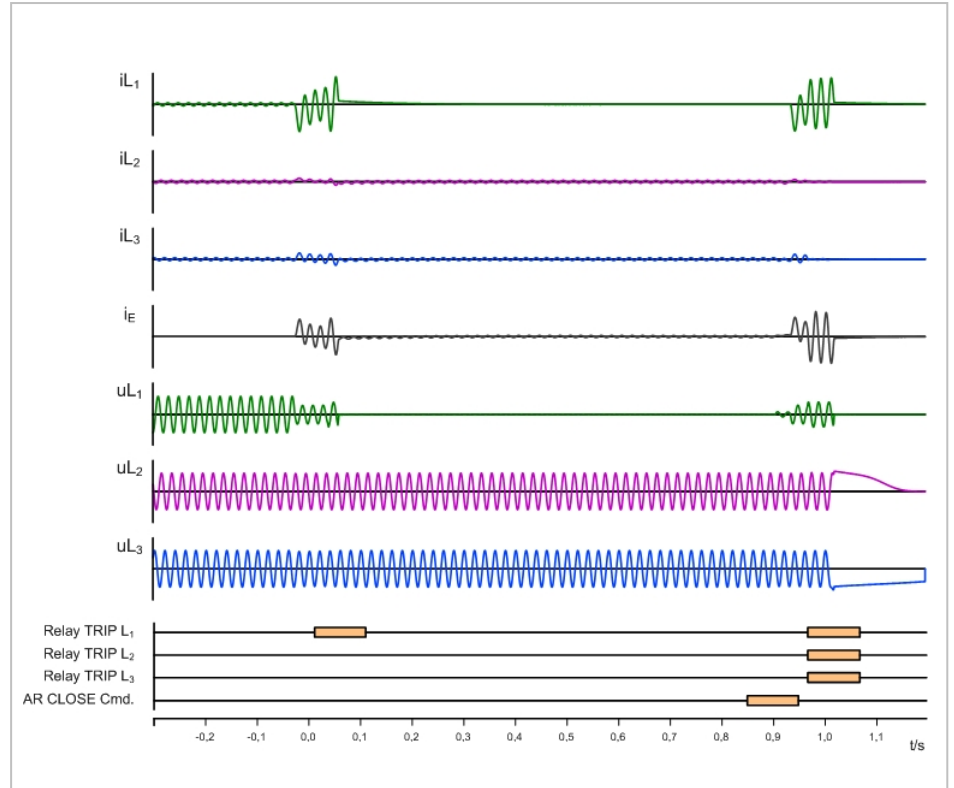


Figure 2: Example of a simulation results page