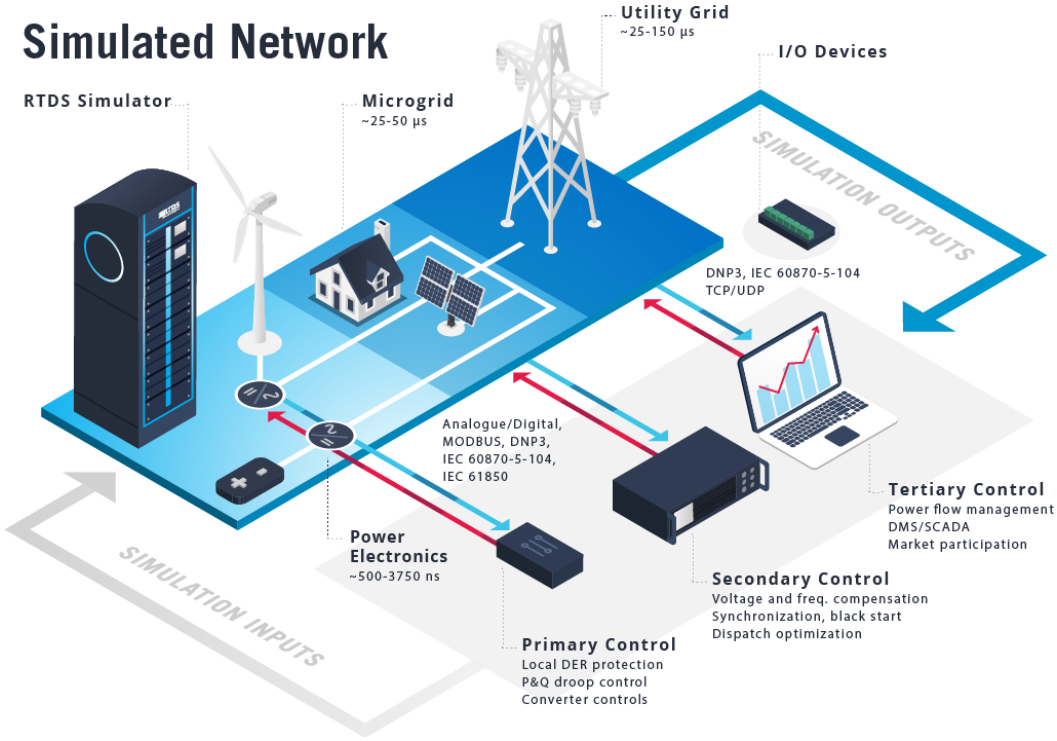
APPLICATIONS

HARDWARE-IN-THE-LOOP TESTING FOR DISTRIBUTION AUTOMATION

RTDS Technologies

Distribution systems have unique topologies, components, and operational requirements that require purpose-built control, protection, and management systems. The RTDS® Simulator allows engineers to model the behaviour of distribution networks over a large frequency range in real time. This allows real distribution system assets to be connected to the simulated grid in a closed loop for safe and comprehensive testing — and optimization — prior to deployment. Hardware-in-the-loop testing allows the engineer to verify the secure operation of distribution automation systems, improve their performance, and decrease deployment time in the safety of a laboratory.



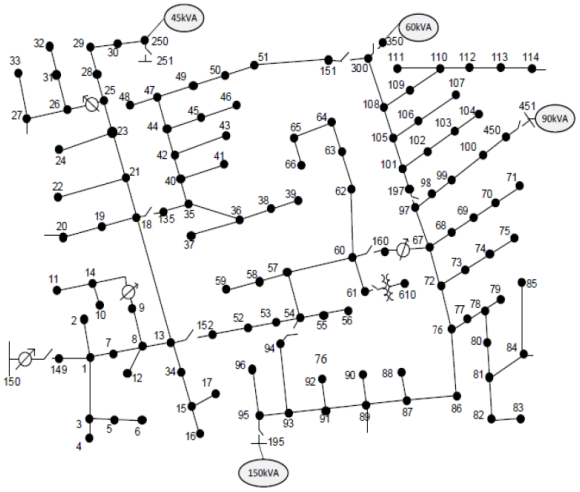
- DERMS, DMS, and SCADA system testing
- VVO, FLISR, and LOV control testing
- Feeder protection scheme testing
- Bay automation control scheme testing
- Testing of renewable energy converters via power-hardware-in-the-loop (PHIL) testing

DISTRIBUTION MODE: SIMULATE LARGER SYSTEMS WITH REDUCED SIMULATION HARDWARE

The RTDS Simulator's software includes a dedicated module designed for simulating large, tightly-coupled distribution feeders. Distribution Mode uses a slightly larger simulation timestep and takes advantage of the radial network structure to allow significantly more power system nodes to be simulated with a given quantity of simulation hardware.

- Timesteps in the 100-microsecond range
- Conveniently represent single-, two-, or three-phase circuits
- No power electronics can be included in the network
- Ability to import feeder models from CYME™ software

RSCAD® includes a documented sample case with the IEEE 123 Node Test Feeder modelled in Distribution Mode



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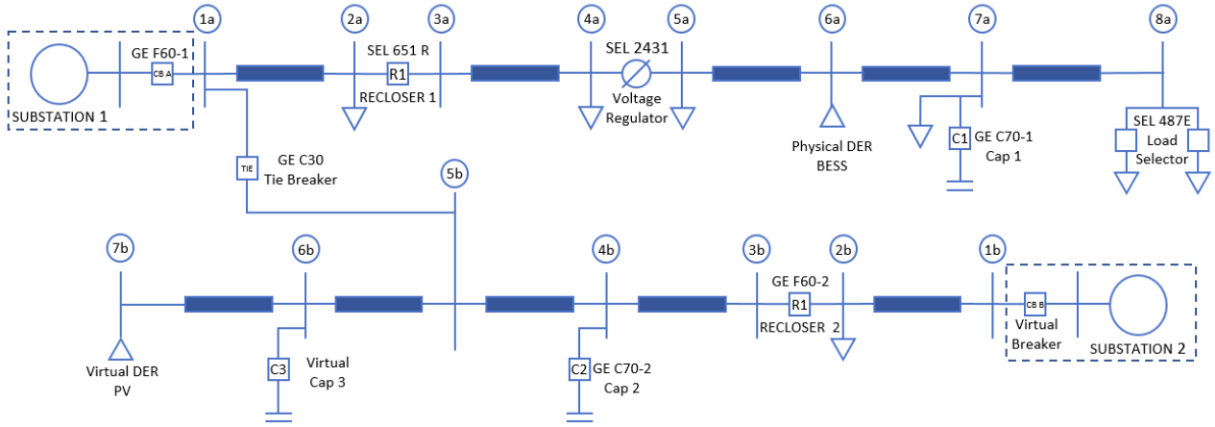
CLOSED-LOOP TESTING: INTERFACING DISTRIBUTION AUTOMATION DEVICES TO THE RTDS SIMULATOR

External devices — protective relays, controllers, or SCADA/DERMS systems, for example — can be connected to the simulation via analogue or digital input and output channels, or using standard-compliant Ethernet-based communication protocols:

- DNP3 and IEC 60870-5-104 for SCADA applications
- MODBUS over TCP/IP (including ASCII or RTU over TCP)
- IEC 61850 Sampled Values and GOOSE Messaging
- Synchrophasor data for PMU applications
- Generic TCP/UDP socket communication

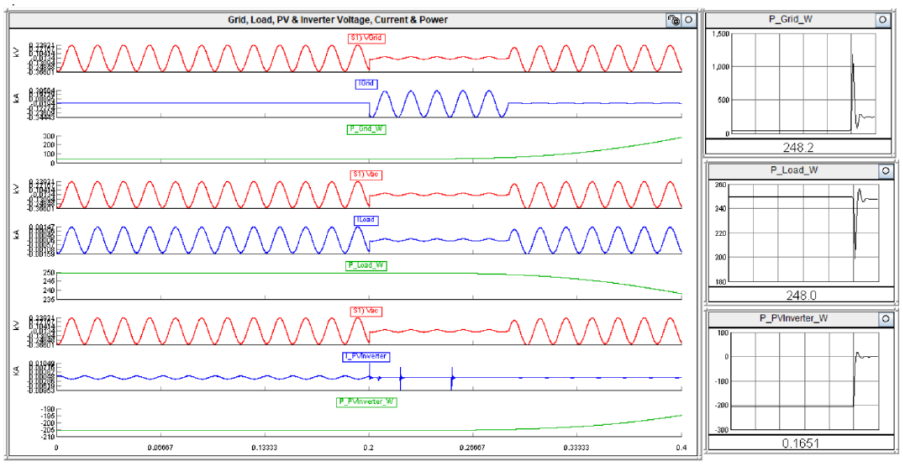
The RTDS Simulator has also been used to test OpenFMB and other frameworks for enabling interoperability in distributed intelligence.



Entire distribution automation schemes including capacitor bank control, bay automation control, feeder protection, recloser control, voltage regulator control, and other components can be connected to a simulated feeder in a closed loop. The interoperability of devices of multiple vendors and functions in a huge variety of contingency conditions can be validated prior to deployment. A combination of virtual and physical assets can be used depending on hardware availability.

POWER-HARDWARE-IN-THE-LOOP TESTING FOR RENEWABLE ENERGY, BATTERIES, AND MORE

The RTDS Simulator can be connected to loads, motors, generators, and renewable energy sources and their inverters. Power-hardware-in-the-loop testing provides an opportunity to characterize the behaviour of power hardware under contingency scenarios in the safety of the laboratory prior to deployment. **A four-quadrant amplifier is required for providing an interface between the RTDS Simulator and external power hardware.**



Simulation results for power-hardware-in-the-loop testing of a PV microinverter for a 5 cycle L-G fault

LEARN MORE ABOUT DISTRIBUTION AUTOMATION TESTING AT RTDS.COM/APPLICATIONS/DISTRIBUTION-AUTOMATION

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