

REAL-TIME SIMULATION HARDWARE

FOR THE RTDS® SIMULATOR

Maintaining a real-time electromagnetic transient simulation with a timestep in the 25-50 microsecond range is much too demanding for a regular PC. A dedicated parallel processing hardware platform, called **NOVACOR 2.0™**, carries out the real-time simulation, while **INPUT AND OUTPUT CARDS** are used for hardware-in-the-loop testing of external equipment.

NOVACOR 2.0: CENTRAL MULTICORE PROCESSING HARDWARE

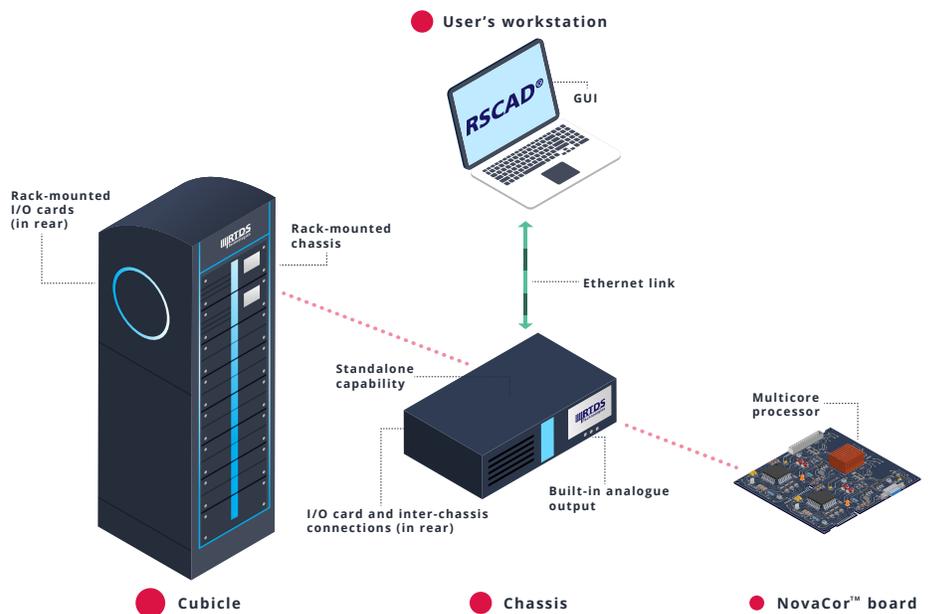
NovaCor 2.0, the RTDS Simulator's current hardware generation, is the custom-integrated parallel processing hardware responsible for carrying out the real-time simulation. Simulations run directly on the processor (no operating system) for unparalleled speed and efficiency. Full control of the hardware platform allows RTDS Technologies to provide customers with higher-fidelity simulation and the best support in the industry.

SCALABILITY THROUGH CORE LICENSING

Inside each NovaCor 2.0 chassis is a custom-built board featuring IBM®'s POWER9™ multicore processor. The processor includes 10 cores, any number of which can be licensed depending on the user's simulation requirements and budget. A higher number of licensed cores means that larger and more complex circuits can be represented. Core licenses are provided digitally, meaning expansion is quick and easy.

FURTHER EXPANSION FOR LARGE-SCALE SIMULATION

Multiple NovaCor 2.0 units can be used in parallel or can be connected together to represent larger networks. NovaCor 2.0 units are also compatible with the previous hardware generation, NovaCor 1.0. **UP TO 144 UNITS** can be fully connected to represent massive networks.



NOVACOR 2.0 BOARD



NOVACOR 2.0 CHASSIS



NOVACOR 2.0 CUBICLE

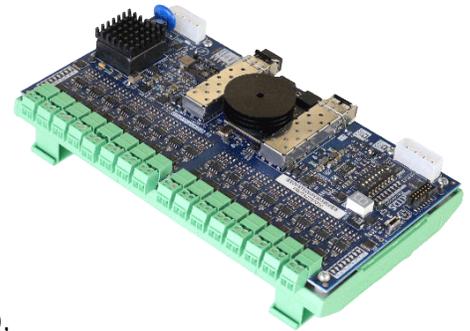


INPUT AND OUTPUT CARDS (I/O): CREATING A CLOSED-LOOP INTERFACE

I/O cards receive signals from the simulation or an external device, respectively, and interface the device under test to the simulated network in a closed loop. The RTDS Simulator's I/O is highly scalable and is connected to the main simulation hardware via fibre optic cable.

ANALOGUE I/O

Analogue I/O cards operate at $\pm 10 V_{\text{peak}}$. The analogue output card has 16 channels, and the analogue input card has 12 channels. In the case that external equipment requires a higher-level signal (for example, secondary-level relay inputs), power amplifiers can be added to the interface. Each NovaCor chassis also includes 12 built-in analogue output channels (12-bit).



ANALOGUE OUTPUT CARD

DIGITAL I/O

Digital I/O cards have 64 channels each. The cards are designed for interfacing with external equipment in the $+5$ to $+30 V_{\text{dc}}$ range. Dry-contact input and output channels are also provided as part of the RTDS Simulator cubicle's front panel. The RTDS Simulator can provide breaker status output up to $250 V_{\text{dc}}$.



DIGITAL INPUT CARD



GTNETX2 NETWORK INTERFACE CARD

COMMUNICATION-BASED I/O

The GTNETx2 card, the RTDS Simulator's network interface card, provides an interface to external equipment via various Ethernet-based communication protocols, including MODBUS, TCP/UDP, IEC 61850 GOOSE and Sampled Values, DNP3, IEC 60870-5-104, and synchrophasor data.

GTSOC V2: MULTI-FUNCTION AUXILIARY SIMULATION HARDWARE

The GTSOC V2 is an optional auxiliary hardware component that enhances the capabilities of the RTDS Simulator for certain applications. The rack-mountable enclosure houses a powerful FPGA board and system-on-a-chip architecture capable of high-speed calculations in parallel with the power system simulation running on the central RTDS Simulator processing hardware. The GTSOC V2 connects to the main simulation hardware via fibre optic cable.

The GTSOC V2's functionalities include:

- Black box control integration
- Modular Multilevel Converter (MMC) simulation for HVDC and FACTS
- IEC 61850-9-2/61869-9 Sampled Values (SV) streaming
- Generic Power Electronics Solver for custom-topology converters
- Frequency dependent transmission line and cable modelling



GTSOC V2

