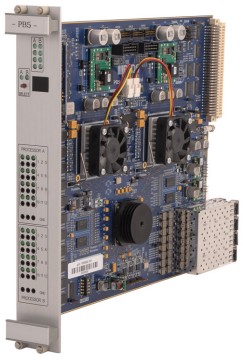
RTDS® Simulator Hardware

The RTDS Simulator takes advantage of a custom parallel processing hardware architecture assembled in modular units called racks. Each simulator contains slot and rail-mounted cards. The specific composition of an RTDS Simulator depends on the processing and I/O requirements of the intended application. A common communication backplane links all slot-mounted cards within a rack to facilitate the exchange of information. In a multi-rack simulator, the backplanes function independently, and in parallel, thereby reducing communication bottlenecks. The communication among racks is then realized through Inter-Rack Communication channels.

The following table shows the major components of a typical RTDS Simulator categorized based on whether they are accessible from the front or the back of the simulator.

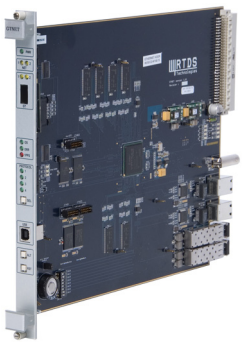
Accessible from the Front		Accessible from the Back *	
PB5	PB5 Processor Card	GTAO	Giga-Transceiver Analogue Output
GTWIF	Giga-Transceiver Workstation InterFace Card	GTAI	Giga-Transceiver Analogue Input
GTNET	Giga-Transceiver Network Interface Card	GTDO	Giga-Transceiver Digital Output
Low Voltage Digital I/O Interface Panel		GTDI	Giga-Transceiver Digital Input
250 Vdc Voltage Digital Output Interface Panel		GTFPI	Giga-Transceiver Front Panel Interface
* For a brief description of these cards please refer to the GT-I/O cards feature sheet		GBH	Global Bus Hub

PB5



- The PB5 has 2 identical RISC processors (Freescale MC7448)
- Each PB5 includes 24 analogue output channels with 12-bit d/a converters.
- Each PB5 is equipped with eight GT optical transceivers for the connection of peripheral I/O devices and direct high speed card-to-card communication.
- Communication to I/O and other PB5 cards is serviced by a powerful on board FPGA
- Up to 2 processors in each rack can be assigned the task of the network solution. The other processors solve the equations of the power system and control components. The software determines the role of each processor in a simulation.

GTNET



- The GTNET card is used to interface Ethernet based communication protocols with the RTDS Simulator.
- GTNET can support various protocols simply by switching between up to four firmware versions installed on the card.
- Unlike other I/O cards that are rail-mounted, the GTNET is installed in a slot and powered from the backplane. It communicates with a PB5 card through a GT optical port.
- The protocols supported by the GTNET card are detailed in the GT-I/O feature sheet and included, IEC 61850 (binary and sampled values), DNP and Playback.

GTWIF

- The GTWIF provides the communication interface between the Local Area Network (LAN) and the RTDS Simulator. Each GTWIF is assigned a unique IP address so that it may communicate with any computer or device accessible on the LAN.
- Communication takes place to load, start, and stop simulation cases; to retrieve results from the simulation while it is running; and to permit the user to interact with the simulation case while it is running.
- Once the GTWIF has started a simulation, it will run continuously in real time until a STOP command is issued.
- The GTWIF provides the timestep clock to all processors, synchronizing their calculations, and coordinates the communication between cards. In multi-rack simulations, one GTWIF is designed to provide the master timestep clock which is passed to other racks via the GBH.
- To ensure true hard real time operation is always maintained, all processors are monitored by the GTWIF to guarantee they complete their calculations and service I/O every timestep.
- The GTWIF performs diagnostics on itself and on all of the other cards in-stalled in its rack
- Each GTWIF has six high-speed Inter-Rack Communication (IRC) channels.
- Each IRC channel is bi-directional and capable of transferring one gigabit of data per second.
- Fibre optic cables with industry standard LC connectors are used to connect IRC channels in different racks.
- Software will automatically determine the data that must be exchanged between racks. Only essential data is exchanged in order to reduce the amount of time required for communication. As well, data exchange between various racks is done in parallel.

Interface Panels

Global Bus Hub

- The GBH is required for simulators with 3 or more racks and allows the timestep clock to be passed from the master GTWIF to all other rack

Low Voltage Digital I/O Interface Panel

- 16 digital input and 16 digital output (max 5V) signals are made available via 4 mm banana plugs mounted in the front of the cubicle for quick connection of digital signals to external equipment.
- The Low Voltage Digital I/O Panel is wired in the back of the simulator to a GTFPI card which in turn is connected to a PB5 via a fibre optic cable.

250 Vdc Voltage Digital Output Interface Panel

- The 250 Vdc Digital Output Interface Panel has 16 solid state contacts rated for a maximum of 250 Vdc. The contacts can be controlled from the GTFPI digital output ports. The interface is configured as a panel that mounts in the front of mid- and full-size cubicles.
- The 250 Vdc Digital Output Interface Panel is connected inside the simulator cubicle to a GTFPI card which in turn is connected to a PB5 via a fibre optic cable.

Cubicles

Full Size Cubicle

- Maximum 3 racks
- Seismic Kit optional
- 209 x 61 x 74 cm (h x w x d)
- Approximately 365kg fully populated

Mid-Size Cubicle

- Maximum 2 racks
- On wheels
- 172 x 61 x 74 cm (h x w x d)
- Approximately 288kg fully populated

Mini Cubicle

- Maximum 1 rack
- On wheels
- Limited space for I/O cards
- 94 x 61 x 43.5 cm (h x w x d)
- Approximately 135kg fully populated

Portable Cubicle

- Maximum 1 rack (7 card slots)
- Limited space for I/O
- 54.5 x 21 x 59cm (h x w x d)
- Approximately 18 kg fully populated

Portable I/O Cubicle

- 155cm DIN rail space to mount I/O cards
- Link to processor cards via optical fibre
- 103 x 30 x 30cm (h x w x d)
- Approximately 26 kg