

RTDS Simulator Software

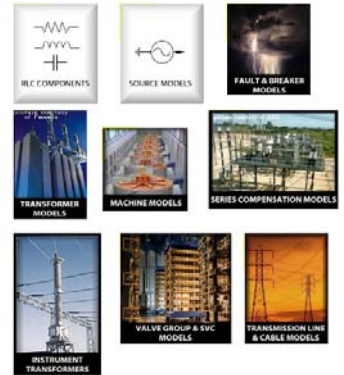
Power and Control System Component Libraries

The RSCAD/Draft module allows the user to assemble power system and/or control system component icons to create the desired simulation circuit. Compilers automatically generate the low-level code necessary to perform the simulation using the RTDS hardware. The low-level code in turn determines the function of the processors for each simulation.

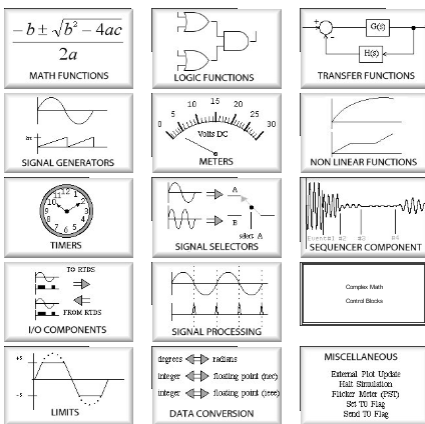
Power System Component Library

The Power System Component Library contains models of the devices that are found in today's power systems. Examples of available models include the following groups of components:

- Real Time Network Solution – solution of the nodal equations including passive components (R, L and C), breakers and faults for a maximum of 66 single phase nodes per subnetwork
- Sources - voltage and current with variable network equivalent series impedance
- Transmission Lines – PI Section (max. 12 cond.), Bergeron traveling wave (max. 12 cond.) and modal or phase domain frequency dependent traveling wave (max. 6 cond.)
- Machines - synchronous (standard and permanent magnet) and induction (wound rotor and double fed) machines with optional multi-mass model (max. 11 masses)
- HVDC – valve groups with improved firing and internal faults for transmission and back-to-back schemes
- FACTS – STATCOM, SSSC, UPFC, etc
- SVC - TCR (with improved firing), TSC and filters
- Series Compensation – TCSC with improved firing and fixed series capacitor with MOV and bypass breaker
- Transformers - 2 and 3 winding transformers with on-load tap changers, saturation and hysteresis and internal faults, phase shifters
- Instrument Transformers - current transducer (CT), capacitive voltage transducer (CVT), potential transformers (PT)



Control System Component Library



The Control System Library allows customized control systems to be created to interact with the model power system and/or the outside world. In addition to individual control blocks, some complex controllers have been assembled as composite controls and are provided (e.g. generator controls). The Control System Software also provides complete flexibility for the development of sequence of events control input. Examples of available models include the following groups of components:

- User-Input - Slider, switch, button, dial, etc.
- Constants – integer, floating point, PI
- Data conversion- deg-rad, rad-deg, int-float, float-int
- Math functions – gain, exp, log, ln, e^x , x^y , sqrt, inverse, abs, sum, multiply, divide, max, min, etc.
- Complex math functions – multiply, divide, add, subtract, etc.
- Trigonometric functions – sin, arcsin, cos, arcos, tan, arctan, arctan2
- Standard control blocks - deadband, pulse generator, edge detector, time, counter, ramp, ramp limits, limiters, phase-locked loop (PLL), flip-flops, fourier transform, integrator, lead-lag, wash-out, lookup table, non-linear gains, etc.
- Logic functions – and, or, nor, bit shift functions, bit -> word, if-then-else, etc.
- Meters – real and reactive power, RMS (single- and three-phase), angle difference, frequency
- Signal processing – sample & hold, down sampler, moving average, FIR, DFT, ABC-DQ0, DQ0-ABC, ABC- $\alpha\beta$, $\alpha\beta$ -ABC, vector rotator, etc.
- Generator controls – exciters (IEEE Type 1 to 5, AC1 to 4, ST1 to 3, X1, X2, 2A, SCR, DC2, IVO, etc.), governors (IEEE Type 1-3, IVO, European BGOV1, Gas turbine, steam turbine, hydro turbine, etc.), power system stabilizers (PSS2A, IEEEEST, IEE2ST)
- Relay models – line (mho & quad), transformer, differential, generator, overcurrent, etc.