

CarSim Model and License Options

This document summarizes model and license options for CarSim 2023.0. Unless otherwise noted, all optional features are supported on all operating systems and in combination with all other features.

CarSim for Windows

The basic CarSim installer provides a database and browser with a user interface, visualizer (plotting and animation), math model solver libraries, extensive documentation, and many example vehicles, procedures, and simulations. Two versions of the browser, math model libraries, visualizer, and other tools are provided to work with 32-bit and 64-bit environments.

The CarSim math models support a four-wheeled motor vehicle with or without a trailer (with one, two, or three axles), using any combination of independent and solid-axle suspensions, possibly a twist-beam rear suspension, and possibly an independent steered front suspension with a virtual kingpin on the motor vehicle. The model works as-is and can optionally be extended with the built-in scripting language (VS Commands), embedded Python, Simulink, and LabVIEW. The math model can also be extended using external programs written in MATLAB, Visual Basic, C/C++, Python, and other languages that can interact with Windows DLLs. Up to 200 built-in moving objects can be controlled to simulate traffic and safety-related scenarios.

The 32-bit and 64-bit versions of the CarSim math models run at the same speed, with the two versions being provided to support compatibility with third-party software. When CarSim is used alone, there is a choice between 32- and 64-bit browsers (`CarSim.exe` and `CarSim_64.exe`); when used with third-party software (e.g., 64-bit Simulink), the appropriate solver plugin library must be used.

The basic CarSim for Windows package includes two licenses:

1. The CarSim Solver for Windows License is needed to make a new simulation run with a math model.
2. The CarSim Browser and Graphical User Interface License is needed to run the main GUI, manage the database, control runs, view animations, etc.

It is rare for one of the basic licenses to be provided alone; both are needed for normal operation of the software, and both are provided as part of the basic package. (The option for obtaining just one Solver license is to support custom automation capabilities for sites with many CarSim installations.)

The CarSim Solver for Windows License supports all CarSim vehicle configurations based on a single vehicle unit (no trailer) with a rigid sprung mass (no frame torsional flexibility).

CarSim for Linux

CarSim for Linux is identical to CarSim for Windows with two major differences; it does not include the CarSim browser, and the math model is 64-bit only.

CarSim for Linux includes a database, visualizer (plotting and animation), math model solver library, extensive documentation, and many example vehicles, procedures, and simulations.

CarSim for Linux is mostly used for automation for sites with many CarSim installations.

ADAS Sensors

The optional CarSim Sensor License allows activation of up to 99 built-in range and tracking sensors to sense moving objects (up to 200). Calculated sensor detection variables can be sent to external controller models in Simulink, LabVIEW, or other environments.

Multiple Vehicles

The optional CarSim Multiple Vehicle License allows up to 3 additional lead unit vehicles to be used in a single solver instance. The option to configure multiple vehicles is supported via the CarSim Browser.

Trailer

The optional CarSim Trailer License allows use of a trailer with one, two, or three axles. If the multiple vehicle license is used, trailers may be added for all the vehicles in the simulation.

Engine Mount

The optional CarSim Engine Mount License allows the use of vehicle models with an engine and torque rod with additional degrees of freedom (DOF). These are modeled as six mounts: four for the engine and two for the torque rod.

The Engine Mount feature cannot be used at the same time as the Frame Twist model feature.

Frame Twist

The optional CarSim Frame Twist License allows use of models with frame twist DOF that represent the distribution of torsional compliance along the length of the Sprung Mass body and therefore affect the load transfer to the tires. When enabled, the Frame Twist option affects the motor vehicle and a trailer, if linked.

The Frame Twist feature cannot be used at the same time as the Engine Mount feature.

Third-Party Tire Models (Siemens, COSIN, and Michelin Tires)

The CarSim Windows installation includes interfaces for tire models from Siemens (MF-Tyre/MF-Swift), COSIN (FTire) and Michelin (TameTire). Example datasets are included for each of these tire model options. The four license options are:

1. Siemens MF-Tyre v2212 natively connected with CarSim runs under any CarSim license together with all options except the **Enveloping contact**, **Rigid-ring**, **Turnslip** and **Temperature Model** options that run under Windows OS.

2. Siemens MF-Tyre v2212 connected with CarSim on Simulink requires an optional paid license from Siemens in addition to a basic CarSim license that runs under Windows OS.
3. Siemens MF-Swift v2212 (including **Enveloping contact**, **Rigid-ring**, **Turnslip** and **Temperature Model** option) requires an optional paid license from Siemens in addition to a basic CarSim license. With this license the MF-Tyre/MF-Swift model will work together with all options that run under Windows OS.
4. COSIN FTire requires an optional paid license from COSIN in addition to a basic CarSim license. With this license the FTire model will work together with all options that run under Windows OS. Any version older than FTire 2022-3 is not supported with the CarSim 2023.0 release.
5. Michelin TameTire requires an optional paid license from Michelin in addition to a basic CarSim license. With this license the TameTire model will work together with all options that run under Windows OS.

These external tire models support 32-bit and 64-bit versions of their respective solvers.

Siemens MF-Tyre/MF-Swift v2212 is also available for real-time (RT) use on dSPACE DS1006, SCALEXIO and Concurrent RT. The RT versions require a paid license from Siemens.

Note As MF-Tyre/MF-Swift v2212 has technical issue on SCALEXIO/QNX running with CarSim, only v2022.1.1 is supported.

CarSim currently supports COSIN FTire model in standard operation mode on Windows. Accelerated FTire/HIL execution mode is currently being considered for future interface extension.

Parallel Solver

This optional counted license allows additional process instances to simultaneously run CarSim simulations on the targeted machine (process-level parallelism). This is useful for simulations involving multiple vehicle interactions orchestrated by external software such as MATLAB / Simulink, or for custom server deployments of CarSim expected to be running many CarSim simulations.

HPC Licenses

Like the Parallel Solver license, the HPC license is an optional counted license allowing additional process instances to simultaneously run CarSim simulations on a targeted machine (process-level parallelism). Where the HPC license differs is how license deployment is organized and deployed. The HPC license scales to many thousands of parallel instances. The Parallel Solver license does not support this level of scalability. HPC Licensing is best suited for large scale deployments where no single external simulation master is in control and when many thousands of simultaneous simulations are needed.

CarSim Real Time

RT Platforms

The CarSim installer for Windows includes support for seven RT platforms:

1. dSPACE DS1006/DS6001 and SCALEXIO
2. National Instruments LabVIEW RT/VeriStand (ETS OS and Linux RT OS)
3. ETAS LabCar RTPC
4. Opal RT-LAB (QNX RT OS and Linux RT OS)
5. Concurrent Real Time System
6. A&D Technology
7. MathWorks Speedgoat

An optional CarSim RT license is needed to run on any of these RT systems. The same set of optional licensed features that are available for the CarSim Windows installation are also available for CarSim RT: ADAS Sensors, Trailers, Engine Mounts, and Frame Twist.

The CarSim RT solvers do not work with the external component models from COSIN or AVL, with the exception that Siemens tire models are available for dSPACE DS1006/SCALEXIO and Concurrent RT.

Extra Live Animations

CarSim RT supports a live animation license that supports a single connection between the math model and VS Visualizer, which in turn supports up to three monitors. If more connected computers running VS Visualizer are needed, additional live animation licenses can be purchased for all systems except dSPACE.

Windows DS for CarSim

The optional CarSim DS License is available to support a Windows-based desktop driving simulator. Driving hardware is either a Logitech G29 or G920 steering wheel, shifter, and pedal set. Although no longer produced by Logitech, Mechanical Simulation maintains legacy support for the G27.

The DS example datasets include software to support a single live connection between a vehicle math model and the VS Visualizer, which in turn supports up to three monitors. Additional live animation licenses can be purchased if more connected computers are needed to run more VS Visualizer instances.