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Installing CarSim 2016 DS or TruckSim 2016 DS

The CarSim and TruckSim DS (Driving Simulator) packages include support for real-time operation under Windows with live animation and driver control hardware. They also include a virtual proving ground and example vehicles that have been evaluated over a range of driving conditions in desktop, QuadDS (four-post), and HexDS (hexapod) driving simulator environments.

Parts of the DS Package

CarSim DS and TruckSim DS include four items that are provided in a ZIP archive, ISO disk image, or physical CD.

1. `Installing_CarSim_TruckSim_DS.pdf` (this document)
2. `CarSim2016_DS.cpar` or `TruckSim2016_DS.cpar` file
3. `Logitech_Wheel_Settings.pdf` file
4. `Drivers` folder

A map of the proving ground used in the DS examples is available from the CarSim / TruckSim menu **Help** > **Real-Time and DS Systems** submenu.

Installing the DS software

The Windows core version of CarSim or TruckSim (version 2016.0 or newer) must be installed on your computer. Add the DS capabilities with these steps:

1. Launch CarSim 2016 or TruckSim 2016 using any installed database.
2. Use the menu item **File** > **New Database from a Consolidated Parsfile**. You will be prompted to select a CPAR file. Choose the DS file (`CarSim2016_DS.cpar` or `TruckSim2016_DS.cpar`).
3. You will be prompted to create an empty folder for your new database. Create one (e.g., `C:\CarSim2016_Data_DS`) and proceed.

Installing the Logitech G27 Steering Wheel

1. Install the Logitech G27 hardware and software according to the manufacturer's instructions. The installers for the Logitech G27 drivers are included in the `Drivers` folder, as well as the Logitech website.

2. Open the file `Logitech_Wheel_Settings.pdf` and follow the instructions to ensure the wheel settings are appropriate for CarSim/TruckSim DS: uncheck “Combined (single axis – used for most games)” checkbox in the Logitech settings window; and set the “Degrees of Rotation” to an appropriate value, usually 900 degrees.

Driving the Math Model

In order to run in a driving simulator environment, the VS Solver (vehicle math model) must be slowed down to run in real-time. The VS Solver must import driver control signals from connected hardware such as the Logitech G27; it must also export data to support live video streaming and to provide the CarSim / TruckSim-calculated steering wheel torque to the physical steering wheel.

The DS database has two kinds of **Run Control** datasets: those that run with a Desktop Controller (with the category **“* DS 2016 G27 Desktop**”), and those that run with Simulink (with the category **“* DS 2016 w/ Simulink Control Inputs**”). The choice of real-time controller type is made with the **Models** drop-down control (2) (Figure 1). The two options provided in the desktop DS examples are **Models: Self-Contained Solvers** and **Models: Simulink**.

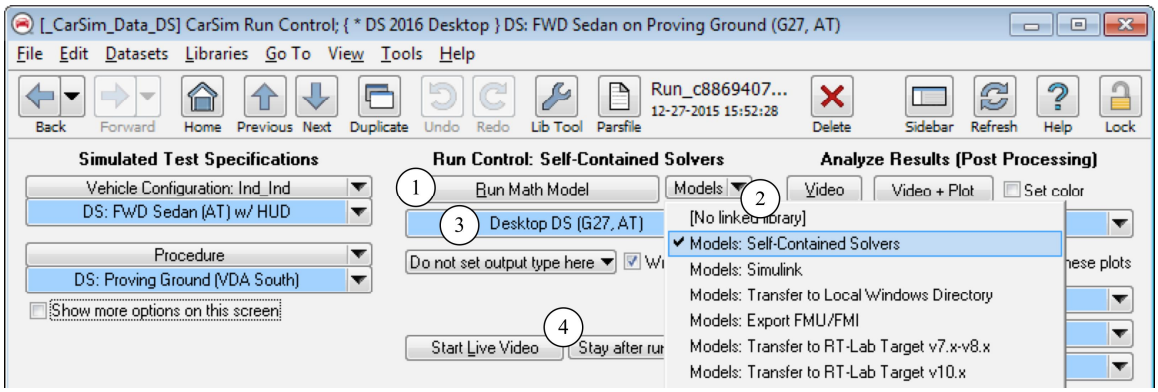

Figure 1. Run Control screen appearance for a dataset using the desktop controller.

Depending on the type of linked library, the **Run Control** screen will show either a single **Run Math Model** button (1) or two buttons to access Simulink (shown later in Figure 5).

In either case, controls are shown for managing the live video data stream associated with the driving simulator environment (4). Details for managing the live video data stream are provided in the documentation for the **Run Control** screen (use the F1 key to view the document).

Prepare a simulation by clicking a **Run** button (e.g., the **Run Math Model** button (1)). This results in the following:

1. All data associated with the current **Run Control** dataset are written to a new `Run_{...}_all.par` Parsfile (located in the database Runs folder, where {...} represents the UUID for the Parsfile) for the VS Solver, along with a simulation control file (`simfile.sim`).
2. If it is not already running, VS Visualizer is launched in live video streaming mode.

3. If it is not already running, a Windows real-time controller program is launched. The controller is specified in the linked **Models** dataset (3).

If VS Visualizer is already running, it will not re-read the animator shapes and sound files, so this saves time when starting the simulation if you are using the same driving environment from run to run. However, if you are changing to a different driving environment, the VS Visualizer should be closed, and then relaunched after switching to the new driving environment. This action will allow the VS Visualizer to load the shape and sound files associated with the new environment.

Running with Desktop Control

The **Run Control** example datasets that link to a dataset in the **Models: Self-Contained Solvers** library make use of a stand-alone application called Tabletop Driving Simulator (Figure 2).

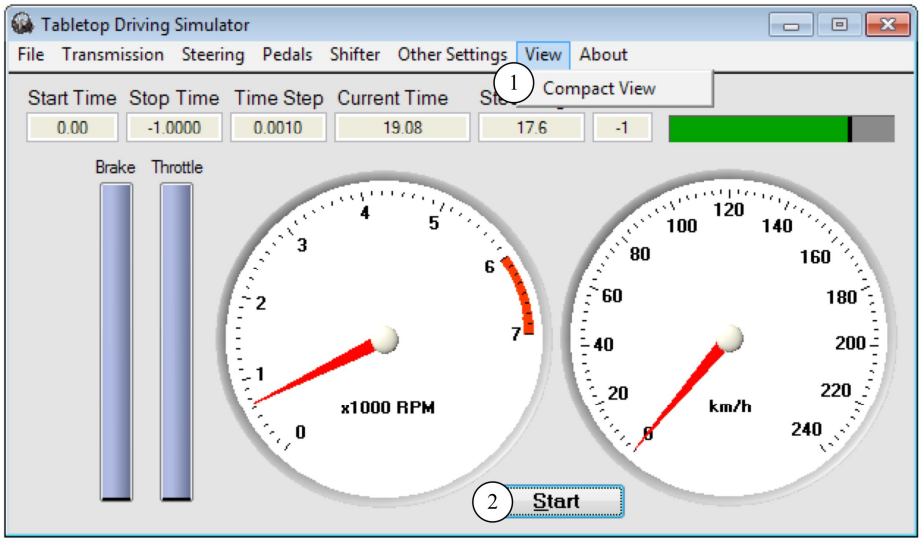

Figure 2. Tabletop Drive Simulator (full view).

Separate **Run Control** example datasets are available for manual and automatic transmissions (Figure 3), as they involve different sets of variables that must be imported into the VS Solver.

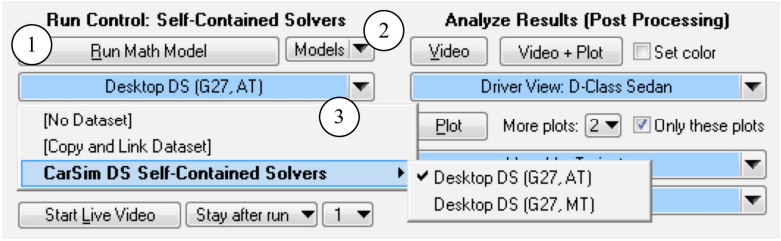

Figure 3. Different model datasets specify links between controllers and VS Solvers.

The Tabletop Driving Simulator has two modes for display. The full mode (Figure 2) includes a menu bar with options for adjusting connections to the vehicle model and hardware controllers. A compact view can be selected using the **View** menu (1) (Figure 2). This is recommended for normal use, as it frees up space on the monitor to provide a more immersive viewing experience

from VS Visualizer (Figure 4). You can restore the full view at any time with the **Full View** button (3).

Start the simulation by clicking the **Start** button (2). When the simulation is running, the name of the button changes to **Stop**, indicating that you can stop the simulation by clicking the same button.

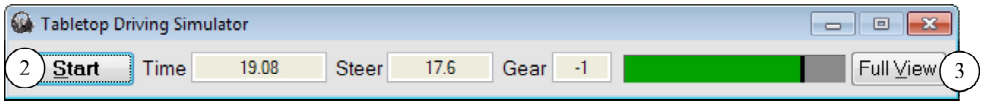

Figure 4. Tabletop Drive Simulator (compact view).

Whenever a change is made to the settings in the Tabletop Driving Simulator – transmission, steering, etc. -- they are automatically saved to a matching configuration file. This means that the next time the Tabletop Driving Simulator program is launched, the settings are saved from the previous session, and only need to be adjusted if there is a change to the configuration, e.g., changing the transmission type from Automatic to Manual. The configuration file has the same name as the program (an EXE file), but with the extension CFG. In order to support independent configurations for examples in the **Model: Self-Contained Solvers** library, multiple copies of the program are provided with names such as `TabletopDS_G25_27_AT.exe`, `TabletopDS_G25_27_MT.exe`, etc. The configurations saved for each are contained in files with the same root names followed by the extension .CFG: `TabletopDS_G25_27_AT.cfg`, `TabletopDS_G25_27_MT.cfg`, etc.

If you wish to match a new configuration to a new dataset in the **Model: Self-Contained Solvers** library, copy the file `TabletopDS.exe`, rename the copy, and specify the new `TabletopDS.exe` in the **Model: Self-Contained Solvers** dataset.

Running Under Simulink

The **Run Control** examples that use Simulink have a link to a dataset from the **Models: Simulink** library. Each of these **Models: Simulink** datasets link to a Simulink model that is intended for use with the Logitech G27 (Figure 5).

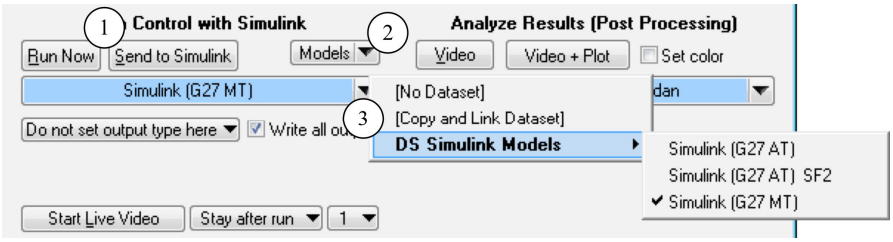

Figure 5. Different model datasets specify links to different Simulink models.

For CarSim Windows DS and TruckSim Windows DS, a simulation is initiated by clicking the **Send to Simulink** button (1). This results in the following:

1. All information needed for the new simulation is written to file, i.e., the Run_{…}_all.par and simfile.sim.

2. If it is not already running, VS Visualizer is launched in live video streaming mode.
3. If it is not already opened, the Simulink controller program is launched.

For the examples that use Simulink, the controller program is the Simulink model specified on the linked **Models: Simulink** dataset (3). Separate models are provided for vehicles equipped with manual or automatic transmissions.

Once the Simulink model is open, begin the driving simulation by clicking the Simulink Play button.

The Simulink models provided with the DS packages include standard Simulink controls, plus DS S-functions that are part of the DS package. For example, Figure 6 shows the library of DS S-Functions provided with CarSim DS.

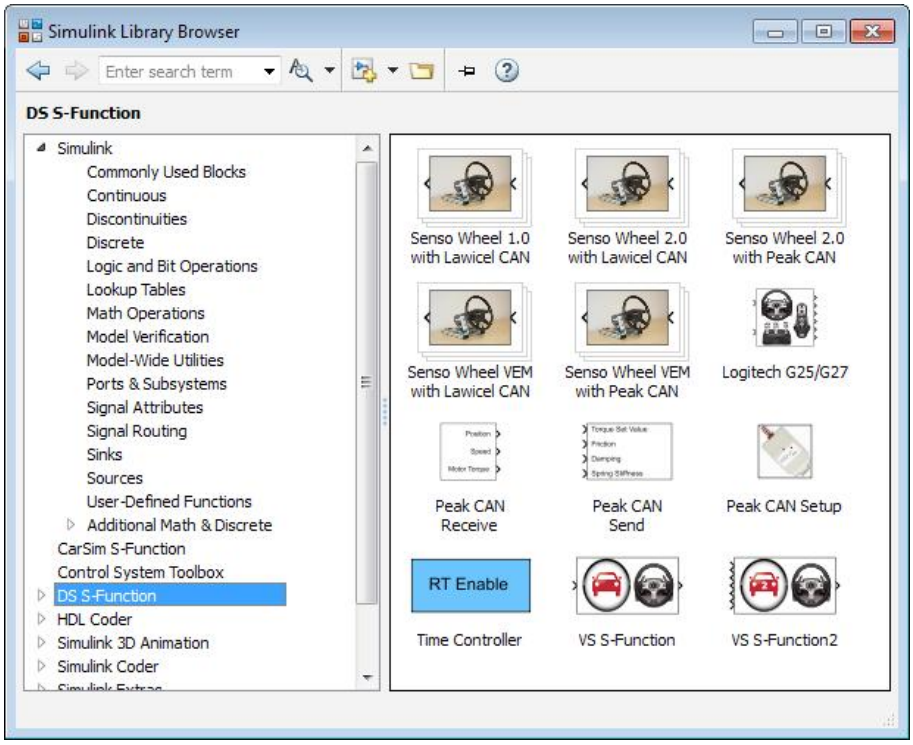

Figure 6. The library of DS S-Functions.

As with the core CarSim and TruckSim packages, two VS S-Functions are provided. One is the original (VS S-Function), and the other is "Generation 2" (VS S-Function2) introduced in 2014.

Figure 7 shows the Simulink model provided for an automatic transmission using VS S-Function2, along with connections for the Logitech controllers and the **RT Enable** block that slows the simulation down to real-time.

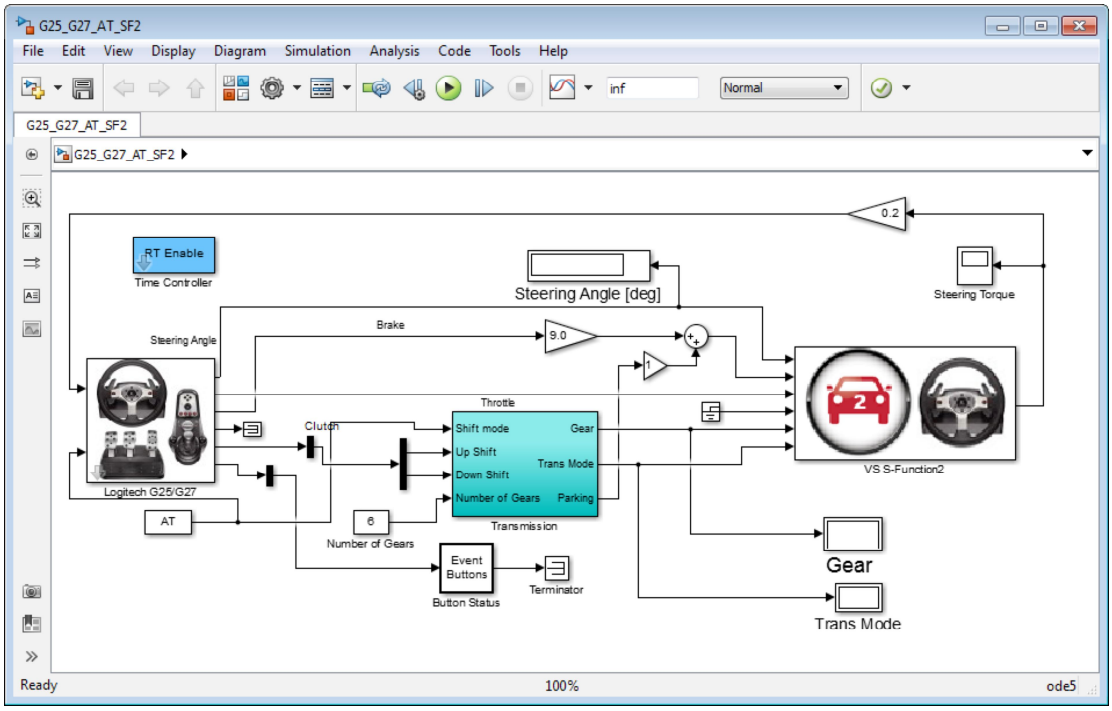

Figure 7. A Simulink model linked to CarSim and Logitech controls.

Optional Driver Control Hardware

In addition to the Logitech G27 hardware, CarSim Windows DS and TruckSim Windows DS support other steering wheels. If you are interested in these options, please contact your Mechanical Simulation account manager for details.

1. SensoDrive steering wheel with G27 shifter and pedals. Note that the G27 shifter and pedals are connected to the G27 steering wheel, and there is a USB cable that is then connected to the computer. Therefore, the G27 wheel is still in place, but not used.
2. SensoDrive steering wheel with the Peak USB CAN-Card