

## December 2019

new control gains for a control system and we need to rerun many simulations that all link to that Simulink model; or the version of CarSim has been updated, the database has been opened in the new version, and the desire is to rerun some or all previously built **Run Control** examples with the new VS Solvers — and executing each run manually from the **Run Control** screen would be extremely time consuming. In these cases, the batch mode of operation is much faster than manually clicking through each **Run Control** dataset and running the math model for each one.

**Note** The **Batch Runs** screen does not facilitate the creation of new **Run Control** datasets. The intended operation is to quickly execute many **Run Control** datasets in an automated fashion.

The process of performing a batch of runs is as follows:

1. Create new simulations from the **Run Control** screen that consist of a vehicle, test **Procedure**, etc.
2. On the **Batch Runs** screen, select which of these **Run Control** datasets will be executed in a batch mode (1) and add them to the bottom field, **Selected Run Control datasets** (3).
3. If needed, specify parameters, variables, and/or links to other datasets to override existing data that's part of the Run Control datasets (7) and (9).
4. Click the button **Make a Batch of Runs** (11) to execute the batch mode.
5. View the results using the **Plot** button (12). Once the Batch Run is complete, results files associated each of the simulations performed will be saved and available for post-processing. Access to the animation of the results via VsVisualizer is accessed from the Run Control screen.

## User Settings and Controls

- (1) **Categories** list, showing all categories in the **Run Control** library of the database. Single-clicking or double-clicking on these categories will have one of several possible results:
  1. Click once to select the category. This will populate the adjacent **Datasets** field (2) with the **Run Control** datasets in the currently selected category.
  2. Double-click to move all the datasets in the category to the **Selected Run Control datasets** list (3). This has the same effect as clicking the **Add whole category** button (4).
- (2) **Datasets** list, showing all datasets associated with the currently selected category (1). Datasets shown here are either moved to the bottom list, **Selected Run Control datasets** (3), or cleared and subsequently replaced when a new **Run Control** category is selected (1).
- (3) **Selected Run Control datasets** list. This is the list of the **Run Control** datasets that will be executed when you click the button **Make a Batch of Runs** (11). Datasets can be moved to this list by:

1. Double-clicking a Category name ①
2. Double-clicking a Dataset name ②
3. Clicking the **Add whole category** button ④
4. Clicking the **Add whole library** button ⑤

Remove an individual dataset from this list by double-clicking on it. Clear the entire list with the **Clear** button ⑥.

- ④ **Add whole category** button. Click this button to move all Run Control datasets in the selected Category ① to the list of runs to be executed in batch mode ③.
- ⑤ **Add whole library** button. Click this button to move all Run Control datasets into the list of runs to be executed in the batch mode ③.
- ⑥ **Clear** button. Click to clear the bottom white field containing the list of Selected Run Control datasets ③.
- ⑦ **Overriding parameters.** This miscellaneous yellow field may be used to define overriding content that will be applied to all **Run Control** datasets executed during a batch of runs. For example, to set the time step in all runs to 0.0005 seconds, enter the line

```
tstep = 0.0005
```

Any parameters specified in this field will be used instead of the ones referenced in the **Run Control** dataset, or in datasets linked to the **Run Control** dataset (vehicle, Procedure, etc.).

This field should be left blank if you do not want to modify the input parameters or model descriptions for the simulations executed in the batch mode.

- ⑧ **Alternate Results Output Folder.** User-specified directory to store the simulation results in a location other than the **Results** folder located in the VehicleSim database. Leaving the field blank ensures the simulation results get written to the standard **Results** folder in the database.

	<b>Note</b> The use of the Alternate Results Output Folder comes with some caveats.
	If the <b>Run Control</b> dataset(s) being executed have never been run before (i.e., they were created, but not run from the <b>Run Control</b> screen), and
	the first time they are run, their results are sent to the <b>Alternate Results</b>
	<b>Output Folder</b> , plots and animation are not available.
	This use of this folder is intended for advanced users who wish to take the simulation results and perform their own post-processing operations without the need for VS Visualizer.

- ⑨ **Overriding link.** Use this link to apply data from many of the libraries available in the database. If the data in the library can be applied to different parts of the vehicle (e.g., a tire description can be applied to any tire of the vehicle), the context must be specified in the Misc. yellow field ⑦ with appropriate keywords (e.g., `iaxle 1, iside 2`).

When in doubt of the correct syntax, perform a simulation from the **Run Control** screen with the configuration you are interested in modifying input parameters for, then check the Echo file with Initial Conditions to see what the VS Solver uses as the syntax for that parameter or variable. This content can then be copied from the Echo file and pasted into the Misc. yellow field on the **Batch Runs** screen (7), and the numerical values of the specified parameters or variables can be changed as needed.

To use a group of overriding datasets that might be assembled from different libraries, link to one of the **Generic** libraries (e.g., **Generic Data Group**).

**Alert** Some limitations exist regarding overriding content. Please see the next section for more information.

- (10) Checkbox to disable popup error messages.

If an error occurs when running a simulation under Windows, the default behavior is that a small window pops up and reports the error. The VS Solver waits for you to click an OK button before continuing, and the error is also reported in the Log file generated for the run.

If you check this box, the interactive error window is disabled. Errors are still reported in the Log file associated with each run, but the batch operation will continue until all specified runs have been made.

- (11) **Make a Batch of Runs** button. Click to run the simulations specified in the **Selected Run Control datasets** list (3).

- (12) **Plot** button. Click to view plots of output variables calculated during the simulation(s). The number of plots is the same as the number of specified **Plot: Setup** datasets.

The plot(s) shown by the plotter are defined by the linked plot setups (14).

- (13) **Clear Alternate Results** button. Click to delete the simulation results saved to the user-specified directory (8).

- (14) **Plot: Setup** links. Define up to six plots by linking to existing **Plot: Setup** datasets.

## Overriding Data

The **Batch Runs** screen includes several options to override content in the linked **Run Control** datasets: Typing parameters and variables into a Misc. yellow field (7), and linking to datasets from other libraries (9). There are some restrictions, however, regarding what can and cannot be used as overriding content. This section describes some of those limitations.

Generally speaking, the overriding options on the **Batch Runs** screen are intended to modify content of the selected **Run Control** datasets, following the same rules one would expect to follow if using a Misc. yellow field or Misc. library linked from the **Run Control** screen, the **Vehicle: Assembly** screen, **Procedures**, etc. In other words:

- If the Misc. yellow field on the Run Control screen can be used to override the mass of the sprung mass body for the linked vehicle, then the same should be true on the **Batch Runs** screen.
- On the other hand, if the Misc. yellow field on the **Run Control** screen cannot be used to change the vehicle's suspension type (i.e., from an Independent Suspension to a Solid Axle), then we should not expect to accomplish this using the **Batch Runs** screen.

One must also take care when considering why overriding content is being used on the **Batch Runs** screen in the first place: is the goal to create variations to the **Run Control** datasets that are linked such that we modify existing data, or is the goal to try and add content to the model? In other words:

- The **Batch Runs** screen is meant to allow existing data to be overridden, not to add new data to the model or otherwise fundamentally change the content being simulated.

One final note regarding the linking of Import and Export variables from the Batch Runs screen. The Batch Runs screen allows the end-user to link to I/O Channels: Import and I/O Channels: Export datasets. If the I/O Array already exists as part of the Run Control screen dataset links, such as what we would have with a Simulink model, then the presence of the I/O Array on the Batch Runs screen will try to append to the existing array.

Since the Simulink model is launched as part of the batch run and therefore hasn't been updated to support the new I/O Array variables, and the new I/O Array variables might be trying to access parts of the model that haven't been installed (e.g. powertrain differential import variables for the rear axle of two axle vehicle that is only set up to be front wheel drive), the Run Control dataset being executed in the batch mode will launch Simulink, try to run, and then terminate, and no simulation results will be generated. Therefore, it is not recommended to use the overriding options on the Batch Runs screen to change the I/O Array.

## Overriding Content that is Supported

VehicleSim products allow most (but not all) of the content shown in an Echo file to be used as overriding content on the Batch Runs screen. Examples include:

1. Vehicle data (e.g., the mass of the sprung mass body, tire properties)
2. Procedure data (e.g., target speed for the Closed Loop Speed Controller, paths, stopping Station position SSTOP)
3. System parameters (e.g., math model time step, numerical integration method)

Vehicle and/or test Procedure data is the most common use-case for the overriding options.

Linking to datasets that in turn load animation assets (e.g., a **Moving Object** for use as an ADAS Sensor Target, or a new road linked using the **Road: 3D Surface (All Properties)** screen) will not appear in the VS Visualizer, but the data — i.e., the content read and processed by the VS Solver — will appear in the Echo file.

If the overriding dataset is part of a module — e.g., the PAC52 tire model, ADAS Sensors, etc. — then the module must be linked to the Run Control dataset (or one of the datasets in the linked library tree associated with that Run Control datasets) in order for it to be installed for that run.

The overriding data typed into the Misc. yellow field ⑦ and/or linked using the Misc. library ⑨ would then function strictly as data modification to the now-installed module.

A good example is the Sensor Reflectiveness Map that can be used with an ADAS Sensor. If the Run Control dataset that is to be executed in the batch mode does not have an ADAS Sensor linked to it, then linking to the Sensor Reflectiveness Map on the Batch Runs screen will not install the ADAS Sensor for that run. Instead, the correct workflow is to link to the ADAS Sensor(s) and the Sensor Reflectiveness Map from the Run Control dataset (or one of its linked datasets). Then on the Batch Runs screen, the linked Reflectiveness Map dataset would override the content of the Reflectiveness Map that is linked as part of that Run Control dataset. We can check the Echo file before and after running the Batch Run with the overriding content to confirm that our changes were applied.

## Overriding Content that is Not Supported

The Batch Runs screen cannot be used to change certain content. Although the simulation may not end with an error dialog, Mechanical Simulation does not support changes to the following using the Batch Runs screen:

1. License Settings (e.g., adding or removing an active license feature).
2. Vehicle math model configurations (e.g., changing the vehicle math model code, such as adding trailers after the run has started).

Regarding the vehicle math model configurations, VehicleSim products BikeSim, CarSim, and TruckSim each support different vehicle configurations based on the vehicle being simulated and the license options available to the end-user. Examples include (product-dependent):

1. Engine Mount
2. Frame Torsional Flexibility
3. Suspended Cab
4. Suspension types (e.g., Independent suspension, Solid Axle)
5. Three-wheeled vehicle with leaning front fork
6. Trailers, including dollies

These vehicle configurations are based on what is selected on the different vehicle assembly screens, propagated to the **Run Control** screen, displayed in the library link above the blue link for the vehicle (e.g., Ind\_Ind for a two axle vehicle with independent suspensions), and this information is set to the VS Solver to load the necessary vehicle modules. This vehicle configuration code cannot be changed after the run has started, regardless of whether the run is executed from the **Run Control** screen or the **Batch Runs** screen.