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1. System Overview

INTRODUCTION

This manual covers the standard set of software applications, data files, and utility programs that form the basis for a Digital Vehicles Trainer Simulation System. This set of software and data files is a product of Digital Vehicles Inc. and its associates, and is licensed for use as part of a complete simulation system produced by an OEM by adding suitable simulation hardware and customizing the scenarios, menus, and multimedia content of the software to suit their intended market. Note that not all simulators produced by OEMs will support all features described herein.

SOFTWARE INSTALLATION AND PC SETUP

The software is designed to be used on a Windows 7 based PC, which must be configured with specific drivers and settings before the system will run properly. The OEM manufacturer of the simulator is responsible for installing and configuring the software and PC, and delivering a complete, working, pre-configured simulator that is ready to train drivers on without the end user needing to understand the technical details.

However, sections at the end of this manual describe the general steps required to bring up the software system on a new PC; configure simulation options using the SimConfig utility; and configure, test, and calibrate the hardware connected to a DVC8 controller using the DVC8UTIL program.

FILES AND FOLDERS ON DISK RELATING TO THE SIMULATION

The simulation system software is stored in several standard folders on the hard drive (normally C:).

The main operating folder for the simulation is called C:\3DPROJECTS\Trainert. The following files are of particular note in this folder:
- Trainer.exe: Main simulation application program
- SimConfig.exe: Utility program for configuring simulation options
- DVC8UTIL.exe: Utility program for testing and configuring a DVC8 interface
- Simulator.cfg: Text file containing the current parameters that configure the simulation
- SimCal.txt: Text file containing calibration values for the hardware driving controls when using a DVC7 board

A folder containing an assortment of files commonly useful in configuring a new Windows 7 computer system is provided is called C:\3DPROJECTS\SUPPORT, and is detailed in the Software Installation section later in this manual.

A folder containing an example Microsoft Access database for importing and reviewing records from student drivers is called C:\SimulatorDatabase. This is covered in more detail later in this manual.

MAIN SIMULATION PROGRAM STARTUP

The main simulation application program is called Trainer.

After the PC boots up and the Windows 7 desktop appears, the Trainer program can be started by simply double-clicking the vehicle-shaped "Trainer" icon that will normally be on the desktop. This is a shortcut to the TRAINER.EXE file which resides in the C:\3DPROJECTS\Trainer folder on the hard drive.

Under special circumstances, it may be necessary to start the Trainer program with special options. There are a couple of standard batch files provided in the \3DPROJECTS\Trainer folder for the most common special cases:
- **TrainerSecurity.bat**: Runs the program with the "-security" command line option to force the security dialog box to appear so that a new license code can be entered (see details below)

- **TrainerLogged.bat**: Runs the program, and captures debugging information into a file called Trainer.log which is then displayed in Notepad when the main program exits

## SECURITY DIALOG

The Trainer program is controlled by a security licensing system that permits various types of usage, including Demonstration, Time Limited, and Unlimited modes. The security system is controlled by a code and key system. Each installation has a System ID Code associated with it, which can be sent back to the producers of the software who use it to create and issue Registration Key codes which may be applied by the user to unlock the various types of usage.

Note that systems that have had an "Unlimited" license code set will also check that a green USB security key is installed. If that hardware key is not detected, those systems will run in "Demonstration" mode instead.

Below is the Startup and Registration dialog box that appears each time Trainer is started, unless the Unlimited License state has already been set. To force this dialog to appear in order to review or change the registration codes, you can start the program with the TrainerSecurity.bat file, which passes "-security" as a command line argument.

### LOADING SCREENS

The program's Version code string and System ID key string are shown along with progress messages as the system loads. It normally takes one to two minutes for all files to be loaded into memory, depending on the speed of the computer.
AUTOMATIC STEERING CENTERING

If so configured, after loading, the Trainer software will automatically find the center point of the simulator's steering wheel by using its force feedback motor to rotate the wheel and bump the left and right hardstop limits. On systems with a STEER_CENTER digital input defined, the automatic centering logic will use that sensor to directly detect the center point instead of bumping the left and right hardstops.

A message is displayed onscreen to warn a driver to keep their hands off the wheel during this process to avoid throwing off the detection logic. Note that the key must be in the RUN position to ensure that the steering column is unlocked and free to move.

On certain simulators without steering hardstops to bump against, the system will simply take whatever position the wheel is in upon power-up to be the straight-ahead center point. As described below, you can manually reset the center point at any time by pressing the C key.
2. Menu System

MAIN MENU

Move the Mouse Cursor to highlight a desired menu button, or press the F1 / F2 keys to cycle through them.

Left Click a button to activate it normally.

Right Click a button to perform its primary function but suppress any onscreen videos that would normally play.

A typical Main Menu screen is shown below. Specific menus and scenarios are detailed in a separate manual for each OEM version.

STUDENT LOGIN

To ensure that each student's driving behavior and assessment results get imported into the Microsoft Access results database, select the Student Login button. Be sure to enter their name before they start driving any scenarios. Otherwise, data will be captured, but stored in a special folder of "Unspecified Student" data which is normally discarded and not automatically imported into Microsoft Access along with data stored by name. Note that you should click the CLEAR button to clear any student's name if you want to just drive the simulator without creating possibly unwanted database records under a previously logged-in student's name.

Use the Alphanumeric keys to enter the student's name and other information where prompted on screen. The Backspace key erases the last keystroke, while the Del key erases the current line to allow entering of a new name. Press the Down Arrow or Tab key to proceed down to the next line, and the Up Arrow or Shift-Tab key to return to the previous line. Press the Esc key or click the DONE button when finished.

The Recall Previous Data Entered and Recall Next Data Entered buttons cycle back and forth through a list of the most recently entered student data. Each student's name and their corresponding course information only
needs to be typed in one time. For subsequent sessions, use these buttons to quickly retrieve their complete data entry without typing.

**WELCOME VIDEO**

Click this button to play a short video which introduces the key features of the simulator to a new student. The video familiarizes them with the driving controls and adjustments available to them, and generally what to expect during the simulation session to follow, saving the instructor from having to go over the same basic things with each student.

**PRINT REPORT**

After each student finishes their driving session, click the **PRINT REPORT** button on the Main Menu to create a printed report of all scenarios driven since they were logged in. The report is sent to whatever printer is configured in Windows as the "default printer" for the system, which can be a networked printer if desired.

Note that each time you visit the Student Login screen, any pending report data for the previous driver is cleared, so be sure to print before logging in the next driver if an immediate paper printout is desired. However, realize
that this only applies to the reports produced directly from Trainer. You can import data into Microsoft Access, then view and print reports from that program at any time.

Some scenarios show a report onscreen (as shown below) at their conclusion. Note that the PRINT button on such screens is functionally the same as the PRINT REPORT button on the main menu. It will therefore produce a report including not only the current scenario results shown onscreen, but also any earlier scenarios driven, if any. To avoid confusion, it might be a good idea to always print from the main menu.

---

OTHER FUNCTIONS AVAILABLE IN MENU MODE

QUIT PROGRAM

Press the Q key to quit the program and exit to Windows.

CENTER STEERING

If you find that the steering wheel is not properly centered while driving, stop, turn the wheel to be perfectly centered left-to-right, then press the C key to reset the center point at the current position.

INTERRUPT VIDEO

Press the Esc key to skip to the end of any playing video clip and proceed quickly to the actual scenario
3. Driving the Simulation

STARTING AND DRIVING THE VEHICLE

This simulator software is designed to generally behave like a real vehicle as closely as possible, and supports a huge variety of hardware options for driving controls, switches, knobs, warning lamps, and whatnot. A complete description of the options on your particular model of simulator is therefore beyond the scope of this section, but the following paragraphs describe some of the more common elements.

To start the engine, move the shifter to either Park or Neutral, then turn the ignition key to the Start position. A voice prompt will remind the driver if they attempt to start the engine in gear. To shut off the engine, move the key out of the Run position and into the Off position.

The software checks the seatbelt, and sounds a reminder chime if the driver moves the key to the Run position with the seatbelt unfastened. The chime stops when either the engine is started or the key is moved to Off. A warning lamp indicator illuminates onscreen whenever the seatbelt is not fastened.

Turn signals cause left and right indicators to blink as standard, and scenarios may check whether they are used when they should be or not.

Most vehicles feature a digital, onscreen display of compass direction and outside temperature, such as the one seen below:

Simulators may be configured (using SimConfig) to show virtual gauges such as the speedometer onscreen, or to use real hardware gauges. Other options control English or Metric units and language selections. There is also an option to show a digital "heads up" type speedometer if desired.

DRIVER VIEWPOINTS

Three main simulator screens normally show a "cockpit" view to the driver. Note that options selected with the SimConfig utility program control exactly what features a driver will see, but the image below is typical of what a driver sees:
The driver's view can be cycled among several other options, either by Center Clicking the Mouse, or using the View Type control on the Operator's Console (if present). Zoom in and out by rolling the Mouse Scroll Wheel.

The "follow view" and "bird's eye view" are two useful alternative viewpoints and shown below:

**MIRROR ADJUSTMENTS**

The driver can adjust the aim of the virtual mirrors using a USB gamepad. Note that certain simulator chassis feature a dedicated automotive-style mirror controller which functions as in a real car and eliminates the need for a gamepad.

![Gamepad Image]

To adjust the virtual mirror aim, first select which mirror you want to adjust using the buttons on the front of the gamepad, then adjust the aim using one of the two joysticks. Different vehicles have different mirror configurations, which can be adjusted as follows:

* For **vehicles with 2 outside mirrors and 1 inside center mirror** (typically passenger cars and light trucks)
  
  - **Center Mirror**: Press Button 5 or 6, then move either joystick
  - **Left Mirror**: Press Button 7, then move left joystick
  - **Right Mirror**: Press Button 8, then move right joystick

* For **vehicles with 4 outside mirror segments** and no inside center mirror (typically heavy vehicles)
  
  - **Left Upper Mirror**: Button 5
  - **Left Lower Mirror**: Button 7
  - **Right Upper Mirror**: Button 6
  - **Right Lower Mirror**: Button 8
For convenience, you can switch between a left and right mirror by simply moving the other joystick.

Note that some scenarios or vehicles use a high performance mirror mode which restricts the number of independent adjustments available. You may select a different Mirror Mode if needed at the start of a scenario by pressing the M key, which cycles through the following available modes:

**Mode 1**: Three Mirrors, all sharing a single camera render. Only up/down pitch is adjustable.

**Mode 2**: Four Mirrors, sharing a two camera renders. Left and right sides are independently adjustable, but their upper and lower segments are linked.

**Mode 10**: Three Mirrors, with three camera renders, allowing fully independent adjustments.

**Mode 11**: Four Mirrors, with four camera renders, allowing fully independent adjustments.
4. Instructor Control of the Simulation

INSTRUCTIONAL POINTER

Press and hold down the Left Mouse Button to bring up a pointer arrow on-screen. This is useful for directing the student's attention to things you're talking about while they're driving, such as traffic signals, hazards, and vehicles in their mirrors. Note that if you are using the optional Operator's Console, when you invoke the instructional pointer, the console's view will automatically change to a cockpit view, and will shift to the left or right when you reach the edge of the view. This allows you to point out things on any of the driver's three screens even though the console is only a single screen.

REPLAY MODE

Press the Right Mouse Button to pause a scenario and enter Replay Mode any time while driving. The scene will pause at the most recent position, and a time bar will appear along the top edge of the screen as shown below.

Move the Mouse Left or Right to advance backwards or forwards through time, and notice how a red indicator moves left and right along the time bar as you do so. The amount of time available to review varies depending on how much scenario activity per frame needs to be stored in the memory the system allocates for storing replay data. A graphical representation of the steering position, throttle and brake pedal position, gear selection, and other inputs will be updated to show what the driver's inputs were at each instant of time during the replay, along with the speed, rpm, compass, turn signals, and other such readouts.
To replay a particular section of driving at "real time" speed, move the mouse to the desired starting time, then **hold down the Left Mouse Button**. This causes a green indicator to appear on the time bar, which advances steadily through time to the right from the starting time point shown in red. Release the mouse button to stop the automatic advance through time and return to the starting point, where you might want to repeat the above several times to illustrate a point.

**Click the Center Mouse Button** to cycle the view between Cockpit, Follow, Bird's Eye, and Reverse views. Zoom any exterior view in or out by rolling the **Mouse Scroll Wheel**.

To restart the scenario from an earlier point in time and give the driver a chance to retry a situation they had difficulty with, move the mouse left or right to the desired point, then press the **R Key** on the keyboard.

Otherwise, normally when you are ready to resume driving, **press the Right Mouse Button** again. It is generally a good idea to first move the mouse all the way to the right end of the time bar to advance the view back to the point the scenario was paused, to help prevent disorientation when they resume driving.

---

**SCENARIO CONTROL KEYBOARD COMMANDS**

**EXIT SCENARIO**
Press the **Esc key** to exit the current scenario, but continue with the next lesson in the sequence (if any). Press the **Shift-Esc key combination** to exit the current scenario, and cancel the rest of a lesson sequence.

**MANUALLY FORWARD OR REWIND THE SCENARIO**
Press and hold the **Space Bar key** to artificially advance time forward in scenario, causing traffic lights and other vehicles to move rapidly forward per the scenario script. Hold the **Shift key along with the Space Bar** to reverse time, for example, if a student gets out-of-sequence and approaches a traffic light that turns yellow that would normally stay green.

**RESTART SCENARIO**
Press the **R Key** to restart the current scenario from the beginning.

**DISTRACTION FEATURE**
Press the **D Key** to trigger the cell phone distraction feature (in vehicle cockpits with a phone).

**DROWSY DRIVING**
Press the **8 Key** to manually trigger the "eyelids" to close or open.

**COPilot MODE**
Press the **F12 Key** to toggles scenario vocal prompts off and on; Also disables "drunk collision"

### CONTROL WEATHER AND TIME OF DAY

Any time during a scenario you can press any of the keys below to change the driving conditions. Please refer to the Operator's Console chapter of this manual for details about each option.

**FOG**
Press the **F1 / Shift-F1 Key** to cycle through amounts 0 (clear) to 5 (very dense)

**RAIN**
Press the **F2 / Shift-F2 Key** to cycle through amounts of rain from 0 to 100%

**SNOW**
Press the **F3 / Shift-F3 Key** to cycle through amounts of snow from 0 to 100%

**DAY/ NIGHT**
Press the **F4 / Shift-F4 Key** to cycle through 10 times of day (day, dusk, night, dawn, etc)

**WIND**
Press the **W Key** to cycles through wind amounts 0 (calm) to 5 (strong gusts).

### SELECT VEHICLE TYPE TO DRIVE

Press one of the keys below to change to a different vehicle. Note that the scenario will automatically restart from the beginning in the new vehicle.

<table>
<thead>
<tr>
<th>VEHICLE TYPE</th>
<th>KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECONOMY CAR</td>
<td>F5</td>
</tr>
<tr>
<td>SEDAN</td>
<td>Shift-F5</td>
</tr>
<tr>
<td>SPORTS CAR</td>
<td>Ctrl-F5</td>
</tr>
<tr>
<td>LARGE SUV</td>
<td>F6</td>
</tr>
<tr>
<td>SMALL PICKUP</td>
<td>Shift-F6</td>
</tr>
<tr>
<td>SEMI-TRUCK</td>
<td>Ctrl-F6</td>
</tr>
<tr>
<td>AMBULANCE</td>
<td>F7</td>
</tr>
<tr>
<td>DUMPTRUCK</td>
<td>Shift-F7</td>
</tr>
<tr>
<td>POLICE CAR</td>
<td>Ctrl-F7</td>
</tr>
<tr>
<td>BUS</td>
<td>F8</td>
</tr>
<tr>
<td>HAUL TRUCK</td>
<td>Shift-F8</td>
</tr>
<tr>
<td>HUMVEE</td>
<td>Ctrl-F8</td>
</tr>
</tbody>
</table>

### OTHER KEYBOARD FUNCTIONS AVAILABLE WHILE DRIVING

**ANTI-LOCK BRAKING**

Press the **F9 Key** to toggles anti-lock braking (ABS) off and on.

**VEHICLE DYNAMICS INFORMATION DISPLAYS**

Press the **F11 Key** to toggle "Football Field", "Friction Circle" and "Traction Gauge" graphics off and on; or if driving the semi-truck or other heavy vehicle with manual transmission, toggle the "Shifting Aids" graphics and readouts off and on.
SCREEN CAPTURE

Press the 9 Key to save a screen capture of the current display as an automatically numbered JPG file. If in replay mode, pressing this key saves a sequence of JPG files which can later be assembled into a movie clip, starting from the position of the red time cursor and advancing forward through time one frame at a time.

GAMMA

Press the G Key to cycle through gamma color map setting 0 to 7 affecting video on all three monitors. This allows you to find an overall color tint that is easiest on their eyes for any driver.

MIRROR MODE

Press the M Key to cycle through the mirror rendering modes available for the current vehicle. Note that higher numbered modes provide true, independent control of each mirror surface and more realistic views to the rear, but consume more computing power which may reduce the overall visual update rate on slower computers.
5. Operator's Console

CONSOLE OVERVIEW

The Operator's Console is an optional feature that can run on a fourth screen if the host PC is suitably configured. It provides an instructor an easy way to remotely monitor and control the student's drive and conditions. Familiar graphical controls such as sliders, radio buttons, and comboboxes become an easy-to-use alternative to having to remember keyboard commands to control the simulation. Move and click with the mouse to adjust sliders and radio buttons to control weather effects and time of day.

CONSOLE FEATURES

Click the **RESTART button** to restart the scenario (same as the R Key).

Click the **END button** to end the scenario and return to the menu (same as the Esc Key).

Click the up and down arrows on the **VEHICLE TYPE combobox** to cycle through the list of vehicles available, then click the combobox itself to activate that vehicle. Note that the scenario will restart from the beginning whenever a new vehicle is selected.

Click the up and down arrows on the **VIEW TYPE combobox** to monitor the driver's progress through the scenario from a variety of 3D viewpoints. The real-time positions of the steering wheel, pedals, shifter, and other controls are shown in a small graphic along with a digital readout of their current speed.

The **PRECIPITATION slider** works in conjunction with the **NONE, RAIN, and SNOW radio buttons** below it to control the amount and type of precipitation. Note that if the RAIN or SNOW button is clicked when the slider is at zero, it will automatically jump to 50% so that a medium level of rain or snow will appear. Similarly, if it is raining or snowing and the NONE button is clicked, the slider will jump to 0% and the precipitation will slow to a stop.

The **FOG slider** controls the density of fog in the scene, from none to a very dense, dark fog. Note that the fog “fades” in and out gradually over time, so allow a few seconds after moving this slider to see the change.
The **DAY/NIGHT slider** controls the time of day through the following positions: "Dawn", "Morning", "Noon", "Afternoon", "Dusk", "Moonrise", "Evening", "Midnight", "Latenight", "Moonset". For daytime options, the angle of the sun changes to affect shading and shadows, and a challenging sun glare effect can obscure the driver's visibility out the windshield at Dawn and Dusk. For nighttime options, the amount and tint of the ambient light changes, ranging from relatively bright and easy to see even without headlights, to very dark where objects not within the pattern of the headlights are quite challenging to see.

The **CLOUDS slider** controls the appearance of the sky, with options of Clear, Partly Cloudy, and Cloudy. Note that turning on any precipitation will automatically select Cloudy skies if not already selected.

The **WIND slider** controls the intensity of the simulated wind effect that affects the vehicle dynamics. The wind is modeled as coming generally from the North, but simulated gusts cause its direction to change up to 45 degrees along with varying the strength. Note that the right limit of this slider simulates close to gale-force winds and can even cause certain vehicles to be blown over in certain handling situations, so use very high levels of this setting with care.

The **LOAD slider** controls the amount of load weight added to vehicles that can carry a load, such as trucks and tankers. As the load amount is increased from 0 to 100%, the vehicle will become more sluggish to accelerate, brake, and corner. Also, the center-of-gravity will typically rise and make the vehicle more prone to roll over.

The **TIRE BLOWOUT radio buttons** are used to cause a flat tire, simulating a blow out. There is one button corresponding to each corner of the vehicle (LF, RF, LR, and RR), plus one to restore normal driving (NONE).

The **SCENARIO EDITING MODE radio buttons** are used to invoke various modes of the scenario editor, and will only be present on systems with that feature enabled. See later chapter for details.

**CONSOLE INSTRUCTIONAL POINTER**

As described in the chapter above, the Instructional Pointer is an on-screen cursor that can be invoked to direct the student's attention to things you're talking about while they're driving, such as traffic signals, hazards, and vehicles in their mirrors.

To invoke the Instructional Pointer from the Operator's Console, first move the mouse cursor to be anywhere inside the console's 3D view window, then press and hold down the Left Mouse Button to bring up the pointer arrow on-screen.

Note that the console's view will temporarily change to a cockpit view, and will shift to the left or right if you move the cursor off the left or right edge of the view. This allows you to point out things on any of the driver's three screens even though the console is only a single screen.
6. Scenario Editor

SCENARIO EDITOR OVERVIEW

On systems that have the Scenario Editing option enabled (contact your OEM for details), four Scenario Editing Mode Buttons will be added to the Standard Operator Console Screen as shown below.

Note that the scenario's initial settings for Precipitation, Fog, Day/Night, Clouds, Wind, and Vehicle Type are taken from the standard console screen above whenever the scenario is saved from the RECVEH or EVENTS editing modes.

For example, to change a scenario from a clear daytime one to rainy nighttime one, start the scenario, then click the RAIN button and move the DAY/NIGHT slider until it gets dark. Next select either PRKVEH or EVENTS and click its SAVE button. Finally, press Esc to return to the menu and re-run the scenario, and confirm that it now starts dark and rainy.

THE SCENARIO CREATION PROCESS

The process of building a scenario is somewhat similar to making a movie...

Choose the setting

First, select lighting and weather conditions appropriate to the challenge desired of this scenario. Special effects like night, fog, rain, and wind can be used to increase stress and difficulty levels. Set those effects the way you want them on the Standard Console Screen, then enter the RECVEH Edit Mode to start building your scenario.

Next, decide what part of the world you want to set the scenario in. Available areas include an urban downtown, a suburban area, interstate and rural highways, an off-road pit-mine, and several skills areas. Starting from any
empty "Custom Scenario", use the mouse scroll wheel to zoom the map view way out, then use the SELF mode to drop yourself into the virtual world near where you want to set your scenario and drive around from there.

**Develop a script and record the lead actor**

Start by developing a "script" in your mind. Drive around the environment and work out a suitable driving route, focusing especially on finding starting and ending points that seem natural. Practice driving this route until you have a clear idea of where the key events you want to happen will occur, and you are satisfied with the scenario's duration. Take advantage of the TAG and JUMP command buttons to set temporary starting parts and quickly repeat test-driving of different segments of your scenario.

Once your script is generally settled, you are ready to create a recording of your "lead actor", who will be acting out the student's role in the scenario. This is what we call the "Reference Path". This will form the foundation for everything else that happens during the scenario, so you will need to record this as closely as possible to how you expect a student to drive it.

For example: Are they expected to observe or to exceed the posted speed limits? Stop fully for traffic signals or roll through them? Accelerate, brake, turn, and change lanes smoothly or aggressively? Whatever the expected answers are, you should drive that way when recording the reference.

The Reference Path must be captured in a single uninterrupted "take", so it will usually require several takes to get everything just right. While the reference may be re-recorded later to fine-tune things if needed, doing so can cause the timing of interactions to change and trigger a series of other adjustments and re-recordings. So it is best to take your time and keep recording takes until it is as close to perfect as possible, thereby ensuring the rest of the scenario gets built upon a solid foundation.

**Record some supporting actors**

After you have a good reference recorded, you can record the "supporting actors" in the form of moving vehicles (that word here includes pedestrians, animals, and anything else that moves in a scenario). All the moving vehicles will be synchronized to the Reference Path when a student drives the scenario. The software speeds up or slows down all the other actors together to keep them roughly synchronized with the student's progress along the route.

Begin by recording the Key Vehicles that will be encountered during the scenario, such as cars pulling out unexpectedly, pedestrians crossing roadways, or vehicles that create conflicts at intersections. It is often best to start with quick, crude recordings of the key vehicles and test how they sync up with your Reference Path. This way, if you discover fundamental timing issues that require you to re-record the reference and/or vehicle recordings, you will not have invested a lot of effort into making things "look" perfect until you get the basic timings worked out.

It is common to make small adjustments to the timing of each recorded vehicle without having to re-record it. In particular, each vehicle may be moved forward or backward in time in 0.1 second increments by stepping its *Time Offset* parameter up or down. If you find that a vehicle needs more and a few seconds of such adjustment to achieve the result you really want, it is usually a good idea to re-record it until you can set its time offset back close to zero.

After you get the key vehicles roughly working, go back and re-record any that could "look" a little more polished and realistic. Be sure to use controls like turn signals and the horn as appropriate when recording other vehicles, since these details will be replayed and make for a more realistic experience.

**Record some extras**

After you have a solid Reference and the Key vehicles recorded, you can add "extras" in the form of general traffic vehicles that are present along the route primarily to make the world seem alive and realistic. Record a wide variety of vehicle types. Note that many of these vehicles only need to be recorded within the scenario for the limited period of time when they are in view, such as crossing an intersection while the student waits for a red light or passing in the opposite direction, so they are quick and easy to record compared to Key vehicles..

Note that you can create recordings for any vehicle type regardless of what you may currently be driving yourself. For many types this is not a concern, as long as they are relatively close in size and not driven near their limits. For example, you can probably capture a perfectly good recording for a Minivan while actually driving a Sedan; however, you should probably change to a Bus yourself before recording a Bus vehicle, due to the significantly
slower acceleration and wider turning geometry compared to a passenger vehicle. To record pedestrians, select a small car for yourself and drive very slowly.

**Decorate the set with stationary props**

Use the **SYMBOLS and PRKVEH Edit Modes** to fill out the scenes with "props" in the form of Scenario Objects and Parked Vehicles. Things like directional arrows, speed limit signs, bushes, and large trucks can serve as key obstructions to the driver's view. Specific objects like cones, fires, and hydrants can be placed to satisfy specific training objectives such as precision maneuvering or proper approach techniques.

Other objects like trees and parked vehicles can be added along the route to simply add visual flavor and increase realism. However, keep in mind that you should add such props only where they will be clearly seen from the route. For example, parking a bunch of cars in a shopping center parking lot two blocks off the route is probably not a wise use of either your time or the finite computing resources available.

**Create a synchronized soundtrack**

Finally, it's time to add a "soundtrack" of sorts, in the form of Vocal Prompts, Control Events, and Scoring Events. These are triggered at exact times as the student proceeds along the Reference Path route. For this, you will use the **EVENTS Edit Mode**.

Vocal Prompts tell the student where to go and what to do are a key part of most scenarios. The software includes a large set of "canned" vocals for basic guidance. You may also record your own WAV files (using a microphone and separate software) and trigger those during a scenario. For example, you can record a simulated "police dispatcher" describing various situations to respond to using a walkie-talkie to make it sound authentic.

In contrast to the Vocal Prompts above, Control Events trigger changes to the scenario's parameters at specific points along the route. For example, you can trigger changes on-the-fly to the intensity of rain, snow, or fog. You can also adjust certain internal variables like the timing of traffic signals or set what you want the speed limit to be on different parts of the route.

One key variable that can be varied is how tightly or loosely the other traffic tracks the student. This may be adjusted on-the-fly with **SET_SCENARIO_TRACKING** events. For example, the tracking is normally set so it is not very obvious that the other vehicles are matching the student's speed changes. However, approaching an intersection where a pedestrian is going to step out from behind a parked truck, you should set the tracking to a "tight" value so the timing of that pedestrian will appear at the right moment even if the student approaches faster or slower than expected. However, at the point the pedestrian comes into view, the tracking should be set to "loose" so the pedestrian will continue to move and get out of the way even if the student comes to a stop when they really only needed to slow down. Once past the pedestrian, the tracking could be set back to "normal".

The other major class of events often added to a scenario are Scoring Events. These events measure things like the student's speed versus the speed limit at certain points, whether they came to a full stop, or what their following distance is versus a certain vehicle at that point.

**Edit, test, and repeat, to create a final cut**

Building a scenario is an iterative process of adding objects, vehicles, and events; then test-driving the scenario to see how it plays out from the student's perspective behind the wheel; and repeating the editing steps such as re-recording vehicles and adjusting timings until everything looks good and works exactly as desired.

So that's an overview of the process. Next up are the details of each of the four edit mode screens.
Symbol Objects are graphical items (such as signs, cones, foliage, fires, and hydrants) that can be positioned along the route according to the goals of that scenario. Many of these items may be resized as desired also.

**COMMAND BUTTONS**

These buttons cause an action to occur when clicked, as follows:

**DRIVE:** Exits this editing mode and returns to regular driving mode, from which you can test-drive the scenario or choose a different editing mode.

**SAVE:** Saves the current Scenario Symbol configuration to the hard disk.

**REVERT:** Reloads the previous Scenario Symbol configuration from the hard disk. Use this if you make changes to the symbols that you decide you do not want to keep.

**MAP MODE BUTTONS**

These buttons set a mode that controls what happens when you click on the map area of the console screen:

**(ZOOM):** Zoom the map in or out at any time by rolling the mouse scroll wheel.

**PAN:** Click anywhere on the map and drag to reposition the view. Note that you can right-click anywhere on the map and drag to temporarily engage PAN mode from any other mode.

**PICK:** Click on any numbered red dot to make it the Current Symbol selected for editing, which turns green.

**SELF:** In conjunction with the LOOKAT mode below, this allows you to preview how the scene you are creating looks “out the windshield” of the simulator. Click anywhere on the map to move the self vehicle to that location, then drag to change the view position in real-time.
LOOKAT: In conjunction with the **SELF** mode above, this allows you to preview how the scene you are creating looks "out the windshield" of the simulator. Click anywhere on the map to point the self vehicle toward that location, then drag to change the **view angle** in real-time.

**MOVE**: Click anywhere on the map to reposition the **Current Symbol** to that position, then drag if desired.

**ROTATE**: Click anywhere on the map then drag to change the angle of the **Current Symbol**. Try dragging in a circular arc around the green dot, and you should find such rotation to be quite intuitive.

**ADD**: Click anywhere on the map to add a new symbol object at that position. The new object will start with the same type and parameters of the **Current Symbol**. This is handy for creating a series of similar objects whose properties may be individually adjusted afterwards as desired.

**REMOVE**: Note that to help prevent accidental deletion of symbol objects, you must first make the symbol you want to delete current by using either the **PICK** mode or the up/down arrows of the **Current Symbol** number box. Then, select the **REMOVE** mode and click on the green numbered dot to remove that symbol object.

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**CURRENT SYMBOL ID AND PROPERTIES**

Regarding the following items: To adjust numeric value boxes or choose items from a list box, simply click the up/down arrows next to the box, or hold down the SHIFT key while clicking to advance by 10x larger steps.

**CURRENT SYMBOL**: This box determines which symbol object is selected for editing (shown as a green numbered dot on the map). Click the up/down arrows to cycle up/down through the list of symbols. **Tip**: Click the number box itself to re-center the map view on this symbol.

**X, Y, Z**: These represent the coordinates (in feet) of the selected object. The X,Y coordinates are set most easily using the **MOVE** mode above and clicking on the map, but fine adjustments may be made by editing these values directly. The Z coordinate controls the base elevation of the object, which is normally set to ground level, but may be manually moved higher or lower with this number as desired. For example, if may be desirable to sink a sign on a tall pole partially below ground, or to place a fire in an upper window of a building.

**ANGLE**: This controls the rotation angle of the selected object. Make sure to adjust the angle for best visibility of the object when seen from the driver's viewpoint along the route. Some examples: Signs should normally be perpendicular to the roadway; Hydrants should be rotated so the main valve is facing out; Fires should be angled to match the sides of the burning object they are positioned against.

**WIDTH, HEIGHT**: For class 0, 1, 2, and 6 objects ("arrows, 2d cones, signs, fires") these values directly set the width and height of the object in feet. For class 5 objects ("hydrants, trees, bushes") the width is ignored and the height is applied as a scale factor the object's original size (normally 1.0 for objects that were modeled in US units, or 3.2 for objects modeled in metric system. These are ignored for all other classes.

**EVENT TYPE**: Controls what type of EVENT is logged if this object is run over by the user. For most objects, this should be left as the default of "NORMAL (0)". For cones and lines, this should normally be set to **EVENT_HIT_CONE** or **EVENT_HIT_CHALKLINE** if it is desired to log encounters with such objects. It is also sometimes useful to create an object with zero width and height that has an event associated with it. These can serve as invisible beacons that trigger vocals to change lanes, or trigger other scenario actions if the user drives over it.

**SCENARIO SYMBOL**: This box changes the type of the current symbol object. Cycle up/down through the list to pre-select the desired new type, then click on the body of the box to apply your choice to the current object. Note that when adding a new symbol (via the **ADD** mode above), you can first pre-select a desired new type from this list using the arrows but do not click the box body to apply it (which would change the current symbol). Instead, just click on the map to create a new symbol of the type pre-selected in this box.
PARKED VEHICLE EDIT MODE ("PRKVEH")

Parked Vehicles are stationary vehicles rendered without a driver inside, which can be positioned along the route to either create visibility challenges or to simply make the route seem more alive and realistic. Note that the PRKVEH edit mode works very much like the SYMBOLS edit mode.

COMMAND BUTTONS

These buttons cause an action to occur when clicked, as follows:

DRIVE: Exits this editing mode and returns to regular driving mode, from which you can test-drive the scenario or choose a different editing mode.

SAVE: Saves the current Parked Vehicle configuration to the hard disk.

REVERT: Reloads the previous Parked Vehicle configuration from the hard disk. Use this if you make changes to the symbols that you decide you do not want to keep.

MAP MODE BUTTONS

These buttons set a mode that controls what happens when you click on the map area of the console screen:

(ZOOM): Zoom the map in or out at any time by rolling the mouse scroll wheel.

PAN: Click anywhere on the map and drag to reposition the view. Note that you can right-click anywhere on the map and drag to temporarily engage PAN mode from any other mode.

PICK: Click on any numbered red dot to make it the Current Symbol selected for editing, which turns green.
SELF: In conjunction with the LOOKAT mode below, this allows you to preview how the scene you are creating looks "out the windshield" of the simulator. Click anywhere on the map to move the self vehicle to that location, then drag to change the view position in real-time.

LOOKAT: In conjunction with the SELF mode above, this allows you to preview how the scene you are creating looks "out the windshield" of the simulator. Click anywhere on the map to point the self vehicle toward that location, then drag to change the view angle in real-time.

MOVE: Click anywhere on the map to reposition the Current Vehicle to that position, then drag if desired.

ROTATE: Click anywhere on the map then drag to change the angle of the Current Vehicle. Try dragging in a circular arc around the green dot, and you should find such rotation to be quite intuitive.

ADD: Click anywhere on the map to add a new symbol object at that position. The new vehicle will start with the same angle as the Current Vehicle. This is handy for populating parking lots or street parking spaces.

REMOVE: Note that to help prevent inadvertent deletion of vehicles, you must first make the vehicle you want to remove current by using either the PICK mode or the up/down arrows of the Current Vehicle number box. Then, from the REMOVE mode, click on the green numbered dot to remove that vehicle.

CURRENT VEHICLE ID AND PROPERTIES

Regarding the following items: To adjust numeric value boxes or choose items from a list box, simply click the up/down arrows next to the box, or hold down the SHIFT key while clicking to advance by 10x larger steps.

CURRENT VEHICLE: This box determines which parked vehicle is selected for editing (shown as a green numbered dot on the map). Click the up/down arrows to cycle up/down through the list of vehicles. Tip: Click the number box itself to re-center the map view on this vehicle.

ANGLE: This controls the rotation angle of the selected vehicle. You will usually want to align parked vehicles with parking space markings or parallel to a street.

X, Y, Z: These represent the coordinates (in feet) of the selected vehicle. The X,Y coordinates are set most easily using the MOVE mode above and clicking on the map, but fine adjustments may be made by editing these values directly. The Z coordinate controls the base elevation of the vehicle, which is normally set to ground level, but may be manually moved higher or lower with this number as needed.

VEHICLE TYPE: This box changes the type of the current parked vehicle. Cycle up/down through the list to pre-select the desired new type, then click on the body of the box to apply your choice to the current vehicle. Note that when adding a new vehicle (via the ADD mode above), you can first pre-select a desired new type from this list using the arrows but do not click the box body to apply it (which would change the current vehicle). Instead, just click on the map to create a new vehicle of the type pre-selected in this box.
RECORDED VEHICLE EDIT MODE ("RECVEH")

Recorded Vehicles covers all moving items in a scenario, including not only cars and trucks, but pedestrians, cyclists, and animals. Such vehicles will be played back in precise synchronization with each other and approximately synchronized with the student's progress along the scenario's recorded Reference Path.

Note that there is a fixed pool of over 200 vehicles available, of over 30 different types. While it is possible to change the type of vehicle after a recording is saved, it is best to scroll through the list and find an empty Vehicle ID that is already of the desired type.

In this mode, a blue line appears on the map representing the scenario's recorded Reference Path (if any). Two blue dots also appear and move back and forth along the reference path as you adjust the timeline controls back and forth.

The large blue dot corresponds to the time value of the Timeline slider/Timeline box, and lets you see where along the Reference Path the self vehicle is expected to be at that moment in time.

The small blue dot appears whenever the scenario is unpaused, and shows the position along the Reference Path of the self-vehicle as it's being driven in real-time (such as when making a recording).

COMMAND BUTTONS

These buttons cause an action to occur when clicked, as follows:

DRIVE: Exits this editing mode and returns to regular driving mode, from which you can test-drive the scenario or choose a different editing mode.

SAVE: Saves the current scenario definition file to the hard disk.

REVERT: Reloads the previous scenario definition file from the hard disk. Use this if you make changes to the vehicle parameters that you decide you do not want to keep.
TAG: Captures the current point in time along with the position and angle of the self-vehicle into a temporary variable. This starting point can be instantly returned to anytime later with the JUMP button. You should click this when preparing to record each new vehicle, after positioning the timeline control at the point-in-time you want the recording to begin and positioning the self-car near the desired starting point of the recording. This feature greatly streamlines the process of recording multiple “takes” until you get it just right.

JUMP: Resets the time and self-car position to the temporary point captured with the TAG command (see above).

PAUSE/RUN: Toggles the pause/run state of the scenario playback. Note that in RECVEH mode, the other vehicles are normally automatically kept paused except when a recording is in process, but this allows you to override that and preview their movements from within this editing mode.

RECORD: Click once to begin a recording, and again to end it. While recording is in progress, a large red message saying “RECORDING” appears on the screen. Note that this command overwrites a temporary recording file on disk with each activation. Upon finishing a recording, if you know you are unsatisfied with the way you drove, simply repeat the process (normally, click JUMP and RECORD again) until you get a viable temporary recording. At that time, you should use either the KEEP or REFERENCE buttons to save the new recording file as the desired vehicle’s recording file.

KEEP: Saves the most-recent temporary recording file created with RECORD above, as the Current Vehicle's recording file. To confirm the KEEP operation you must also click on the Current Vehicle number box. This helps prevent accidental overwriting of vehicle files, in case you forgot to actually change the Current Vehicle box to the desired new vehicle before making the recording. In that case, simply use the up/down arrows to change the ID, then click the number box when ready to confirm the KEEP.

REFERENCE: Works just like the KEEP command above, but saves the temporary recording as the scenario's master Reference Path. Note that you must still click that box to confirm the save operation just as above, but the value of that box does not matter for this command.

STARTPOS: Captures the current position and angle of the self-vehicle, which will be saved as the Starting Position where students will be placed in this scenario. Note that this should normally be approximately the same place the Reference Path was recorded from, but it is possible to have the student start somewhat before the Reference Path start tracking them and makes other vehicles and events move, such as on the other side of a parking lot.

**MAP MODE BUTTONS**

These buttons set a mode that controls what happens when you click on the map area of the console screen:

(ZOOM): Zoom the map in or out at any time by rolling the mouse scroll wheel.

PAN: Click anywhere on the map and drag to reposition the view. Note that you can right-click anywhere on the map and drag to temporarily engage PAN mode from any other mode.

PICK: Click on any numbered red dot to make it the Current Vehicle selected for editing, which turns green.

SELF: In conjunction with the LOOKAT mode below, this allows you to preview how the scene you are creating looks “out the windshield” of the simulator. Click anywhere on the map to move the self vehicle to that location, then drag to change the view position in real-time.

LOOKAT: In conjunction with the SELF mode above, this allows you to preview how the scene you are creating looks “out the windshield” of the simulator. Click anywhere on the map to point the self vehicle toward that location, then drag to change the view angle in real-time.

REMOVE: Note that to help prevent inadvertent deletion of vehicles, you must first make the vehicle you want to remove current by using either the PICK mode or the up/down arrows of the Current Vehicle number box. Then, from the REMOVE mode, click on the green numbered dot to remove that vehicle.
CURRENT VEHICLE ID AND PROPERTIES

Regarding the following items: To adjust numeric value boxes or choose items from a list box, simply click the up/down arrows next to the box, or hold down the SHIFT key while clicking to advance by 10x larger steps.

CURRENT VEHICLE: This box determines which vehicle is selected for editing (shown as a green numbered dot on the map). Click the up/down arrows to cycle up/down through the list of vehicles. **Click the number box itself to re-center the map view on this vehicle (it has a recording and is active at the point-in-time currently set).**

TIME OFFSET: Use this number to adjust the playback of the vehicle’s recording forward or backwards in time relative to the other recorded vehicles and the reference vehicle. This is useful for fine-tuning things like when key vehicles arrive at intersections, or when pedestrians emerge from behind obstructions, etc.

CHANGE VEHICLE TYPE: Use the up/down arrows to pre-select a new type of vehicle to associate with this recording, then click the box itself to apply the change. Note that the recording filename will remain the same but will be reassigned to a different Vehicle ID number, which can create confusion later on, so it is best to choose the desired vehicle type by selecting a suitable Vehicle ID from the list before recording each new vehicle.

TIMELINE CONTROLS

TIMELINE SLIDER: This slider synchronizes with with the numeric Timeline Value below, and lets you quickly advance backwards or forwards in time within the scenario. Grab this slider and watch the various recorded vehicles appear, move around, and disappear as their recordings dictate during the scenario. The left end represents the scenario’s start, while the right end corresponds to 30 seconds past the scenario’s natural end which is the duration of the Reference Path recording.

TIMELINE VALUE: This is the value in seconds of the point-in-time currently being shown for all recorded vehicles in the scenario.

Clicking the up/down arrows steps time backwards or forwards and also jumps the self-vehicle to that point-in-time along the Reference Path. This is useful for previewing in slow-motion how the other vehicles will look from the student’s “out the window” view when the scenario is driven.

Clicking on the number box itself jumps the self-vehicle to that point in time along the Reference Path. This is handy for quickly jumping into the general vicinity when preparing to record new vehicles that are active partway during a scenario. Zoom out the map and move the slider until you see the large blue dot near the part of the scenario you are interested in, then click the number box to jump there.
Scenario Events are triggered as a student proceeds along the Reference Path. They are divided into several general categories, including Vocal Prompts, Control Events, and Scoring Events. It is important to understand that even though events appear on the map as red and green numbered dots like the other scenario elements, they are positioned in “time” rather than in space. To position them you actually adjust their timestamps and their position is shown along the Reference Path.

In this mode, a blue line appears on the map representing the scenario's recorded Reference Path (if any). Two blue dots also appear and move back and forth along the reference path as you adjust the timeline controls back and forth.

The large blue dot corresponds to the time value of the Timeline slider/Timeline box, and lets you see where along the Reference Path the self vehicle is expected to be at that moment in time.

The small blue dot appears whenever the scenario is unpaused, and shows the position along the Reference Path of the self-vehicle as it's being driven in real-time (such as when making a recording).

**COMMAND BUTTONS**

These buttons cause an action to occur when clicked, as follows:

**DRIVE**: Exits this editing mode and returns to regular driving mode, from which you can test-drive the scenario or choose a different editing mode.

**SAVE**: Saves the current scenario definition file to the hard disk.

**REVERT**: Reloads the previous scenario definition file from the hard disk. Use this if you make changes to the events that you decide you do not want to keep.
MAP MODE BUTTONS

These buttons set a mode that controls what happens when you click on the map area of the console screen:

(ZOOM): Zoom the map in or out at any time by rolling the mouse scroll wheel.

PAN: Click anywhere on the map and drag to reposition the view. Note that you can right-click anywhere on the map and drag to temporarily engage PAN mode from any other mode.

PICK: Click on any numbered red dot to make it the Current Symbol selected for editing, which turns green.

SELF: In conjunction with the LOOKAT mode below, this allows you to preview how the scene you are creating looks “out the windshield” of the simulator. Click anywhere on the map to move the self vehicle to that location, then drag to change the view position in real-time.

LOOKAT: In conjunction with the SELF mode above, this allows you to preview how the scene you are creating looks “out the windshield” of the simulator. Click anywhere on the map to point the self vehicle toward that location, then drag to change the view angle in real-time.

ADD: Click anywhere on the map to add a new event to the scenario. The new object will be added not where you click on the map, but will be given a timestamp corresponding to the current value of the Timestamp slider (which is represented by the large blue dot).

REMOVE: Note that to help prevent inadvertent deletion of events, you must first make the event you want to remove current by using either the PICK mode or the up/down arrows of the Current Event number box. Then, from the REMOVE mode, click on the green numbered dot to remove that event.

CURRENT EVENT ID AND PROPERTIES

Regarding the following items: To adjust numeric value boxes or choose items from a list box, simply click the up/down arrows next to the box, or hold down the SHIFT key while clicking to advance by 10x larger steps.

CURRENT EVENT: This box determines which event is selected for editing (shown as a green numbered dot on the map). Click the up/down arrows to cycle up/down through the list of events. Click the number box itself to re-center the map view on this event.

Below this box is a string that shows what type this event is currently set to, Please refer to this string when stepping through your list of events, as the EVENT STRING and VOCAL STRING boxes below are not updated automatically and are used only to change this event to one of those types of event.

TIMESTAMP: This determines at what point in time along the Reference Path the selected event will be triggered. Click the up/down arrows to adjust it backwards/forward in time, and observe how the position of the green dot moves back/forth along the blue Reference Path line. Note that any events with a negative timestamp value will be processed before the student turns the key to start the scenario. For example, you can take advantage of this to trigger an introductory vocal prompt, or to set some initial conditions before they even start moving.

PARAMETER, DURATION: Some Control and Scoring Events use these variables to specify things to adjust or score against, such as a target speed limit or an ID number of a vehicle to measure following distance from.

EVENT STRING: Use this box to change the Type of the Current Event to one of the Control Events or Scoring Events listed in the selector list. Click the up/down arrows to select the desired event type, then click the text box to apply it.

VOCAL STRING: Use this box to change the Type of the Current Event to one of the Vocal Prompts listed in the selector list. Click the up/down arrows to select the desired vocal file, then click the text box to apply it.
TIMELINE CONTROLS

TIMELINE SLIDER: Note that to help prevent inadvertent deletion of vehicles, you must first make the vehicle you want to remove current by using either the PICK mode or the up/down arrows of the Current Vehicle number box.

TIMELINE VALUE: Note that to help prevent inadvertent deletion of vehicles, you must first make the vehicle you want to remove current by using either the PICK mode or the up/down arrows of the Current Vehicle number box.

EVENT TYPE REFERENCE

(details of all the available event types and their parameters will be listed here, later)
7. Sample Scenario Debrief

Each simulator system includes a package of scenarios specific to its purpose, which are described separately in another manual. The following is a sample point-by-point debriefing that highlights the sort of things an instructor should be aware of to train effectively with this simulation.

**SCENARIO DEBRIEF: "ScenarioDefensive1"**

This scenario is designed to present a series of potentially hazardous situations, while you're under a little stress trying to keep up with a friend in a red car.

Each potential accident can be easily avoided by recognizing each situation early and taking appropriate action in advance, rather than waiting to react after the danger is fully apparent. Such anticipation of potentially dangerous events, however unlikely, is what "defensive driving" is all about.

Here are the key moments in this scenario:

1. **Hospital Parking Lot Exit**

   Approaching the hospital on the right, you can see several large signs interfering with the view. After your friend passes by, a green minivan wrongly decides the way is now clear and pulls out across the road.

   By scanning the road far ahead, you can see the nose and wheels of a vehicle waiting behind the sign and anticipate that the driver cannot see you coming. Since you don't know this person, you should assume they are a dangerous idiot who might do something stupid like pull out across three lanes without double checking first.

   At that time, you should "cover the brake" by lifting your foot off the gas and moving it over the brake to be ready to stop quickly if needed.

   Of course, in the event of a collision, the minivan driver would probably be found "at fault" for doing such a stupid thing. However, it's much better to avoid the need to hassle with insurance companies and body shops at all, and take defensive actions to not fall victim to the mistakes of others in the first place.

2. **Lanes Merge Approaching Red Light**

   Here a white sedan gets slotted in between you and your friend when two lanes merge. The sedan follows closely behind your friend, blocking him from view as a traffic light emerges from the fog. The light turns red, and the sedan decides to grab "pole position" by pulling quickly into the open left lane, suddenly revealing your friend who has stopped safely (if a bit short) of the red light.

   If you adjusted your following distance when the sedan merged in front of you, it is likely that you were able to stop in time to avoid rear-ending your friend.

   Likewise, if you had scanned your mirrors recently, you would have realized that some other cars were coming up on your left from behind, and known that swerving to the left was not an option.

3. **Lane Change and Left Turn with Interfering Traffic**

   Your friend decides to turn left ahead, and easily changes lanes in preparation. You also need to change lanes, but there's a pesky silver car next to you who doesn't seem to want to slow down and let you in. Eventually, you fall in behind him just as your friend slows down to make the turn.

   The key to safety here is anticipating the chain reaction set off by your friend needing to slow down in front of the silver car making it have to brake right in front of you.

4. **Right Turn on Red with Obscured Visibility of Cross Street**

   Your friend approaches this intersection and rolls uneventfully through a right turn, just as the light changes from green to yellow. Trying to keep up, you approach just as the light changes from yellow to red.
The danger here is that you will naturally follow the action of your friend and roll right through the turn without stopping. In this case, a building obscures your view of cross traffic coming from the left (who now has a green light), and you cannot be sure nobody is coming unless you come to a full stop at the limit line and turn your head to check.

5. Left Turn onto One Way Street

Left turn with need to wait for opposing vehicle to clear, two lanes over.

6. Temptation to Run a Red Light

Trying to catch up to your friend, and baited by a pickup truck that successfully runs the stale yellow light ahead of you, you might be tempted to try and make it through this intersection yourself. If you do, you will likely collide with a previously unseen truck speeding into the intersection from the left (now with a green light).

7. Visibility Obscured by Large Vehicle

In the far left lane approaching a congested area with various parked and moving vehicles, a minivan suddenly noses out halfway into your lane to get a view from behind a parked delivery truck. Without time to stop, your best option is to swerve to the right, then back into your lane. By recognizing this early as a possibly hazardous situation, you can check your mirrors, and realize you have a safe "escape plan" available of swerving to the right if needed.

8. Temptation to Accept Same Gap as Friend Turning Left

Your friend turns decides a gap to an approaching car is large enough and turns left without stopping. If you follow without stopping and checking the gap for yourself, a collision can result.

9. Alley with Unexpected Truck Pullout

A parallel-parked white delivery truck pulls out into the narrow alley between you and your friend. Maintaining a slow speed and covering your brake are essential to survive here. The option to swerve to the left is available in conjunction with braking.

10. Alley exit with Visibility Obscured by Truck Ahead and Buildings Beside

A big rig truck crosses quickly from right after white delivery truck pulls out from in front of you. Failure to come to a full stop and turn your head to check traffic before attempting to cross the street will cost you here.

11. Crossing Street as a Pedestrian Steps into Your Path from Sidewalk

Having checked to the right and confirmed no more traffic is coming in any lane of the one way cross street, you take off across the street, only to find that a pedestrian has stepped into your path from the left while your attention was primarily focused to the right.
8. Microsoft Access Results Database

SIMULATOR DATABASE STARTUP

To start the Simulator Database, double-click to open the simdata.mdb file in the C:\SimulatorDatabase folder. Normally, there will be an icon on the desktop called "Simulator Database" that is a shortcut to this file that makes this easy.

Note that you must have some version of Microsoft Access installed on the system to use the database. The simulator includes a copy of the free "runtime" version of Access that allows basic viewing of results on screen, but provides no reports or editing capabilities whatsoever, and limited printing and formatting abilities.

Proper use of the database requires a full version of Microsoft Access. This can be purchased and installed on the simulator, but preferably, the database will be run on a separate computer that already has Microsoft Access on it (included with many versions of Microsoft Office suite). This "office" computer may then collect data over a network from one or more simulators, allowing all results to be managed in a central location without interfering with actual simulator training operations.

SIMULATOR DATABASE MAIN MENU

The Simdata database Main Menu looks like this:

![Simulator Database Main Menu](image)

To use, follow the three steps shown onscreen and described below:

1. "First click to the right to import any new data from simulator"
   - Pressing this button launches a batch process (CopyAll.bat) that copies all new data files for students who have driven the simulator since the last time an import was done.
2. "Next select a session and scenario"
   - Scroll down through the list of scenarios driven and click to highlight one of interest.
   - You can choose a name from the "Quick Name Filter" dropdown to list only the scenarios driven by a particular student, if desired.
   - Singleclick to highlight it then select an action as below, or doubleclick to bring up its default Data Access Page.

3. "Then choose the action to perform on the selected scenario"
   - Clicking the Show / Edit Session Log Entry button will bring up an MS-Access form containing all the fields for the selected data record. If using a full version of Access (not the free "runtime" version) you can edit and save the data if needed.
   - Clicking the Show Data Access Page button will bring up a formatted report page for the selected scenario. Each scenario has a default style of report, but you can select a different one from the dropdown box below this button if desired (for example, to view a report with only numeric scoring, rather than one with lots of graphs).
   - Clicking the Show Excel Spreadsheet button will launch MS Excel and show the selected data records as a spreadsheet.

IMPORTANT FILES RELATING TO THE REPORTING DATABASE

The Microsoft Access database and related files reside in: C:simulatorDatabase

Within that folder, the following files are of particular note:

- simdata.mdb : Main database file containing forms, queries, reports, and data access pages. This file can be replaced (updated) without affecting existing session data.

- simdataRawData.mdb : Linked database file containing the actual imported data for all sessions driven

- CopyAll.bat: Batch file that copies the raw delimited text files from the simulation for importing into Access. Edit the first two lines as needed to match the drive letters for where you have installed the simulation and the database. For example, the database is often installed on a separate computer from the simulation, and the simulation is mounted as a networked drive.

  set SRCDRV=E:     (where the simulation is installed)
  set DSTDRV=C:    (where the database is installed)

Note that this batch file first separates filenames, taking matching pairs of "Session" and "Scenario" files from the PendingLogs subfolder, and moving any that start with "Unspecified_Student" into a subfolder called UnspecifiedStudentLogs. Those files are generated when someone drives the simulator without being logged in by their own name, and are therefore not normally desired to be imported into the database. It is possible to manually recover such data by renaming the matched pair of session and scenario files to start anything other than "Unspecified_Student", move them back to the PendingLogs subfolder, and re-run the import process.

Otherwise, all files with logged-in student names, are moved into the ArchivedLogs subfolder after being copied to the master file and imported into the database.
9. SimConfig Utility Program

PROGRAM INTRODUCTION

The SimConfig program provides a user-friendly way to edit the multitude of parameters in the Simulator.cfg file which controls most of the customizable aspects of the Trainer software. Click one of the tabs along the top of the dialog box to display one of the available sets of parameters for review or editing. Details of each tab are below.

After making any desired changes, click the OK button to save your changes to the Simulator.cfg file. If you want to exit without saving any changes, click the Cancel button instead.

Clicking the Notepad button will open the Simulator.cfg file with the Windows Notepad program, allowing you to view or edit the raw text data directly if needed. This is normally not needed and should only be done under direction of a qualified technician to avoid possible problems running the simulation.

SIMULATION OPTIONS TAB

This first tab contains several groups of options relating to general simulation configuration, as follows:

The Operational Features group contains the following options:

- Localization:
  - United States (English)
  - Mexico (Spanish)
  NOTES: Has the following effects: a) changes the display language of certain onscreen messages; b) switches between English and Metric units; and c) changes signs between square and rectangular shape.

- Menu Buttons:
  - Show on Simulator and Console
  - Show on Console Screen Only
  NOTES: Choose the second choice if it is desired for the student to not see any menus on the screen in front of them, and instead, have menus appear only on the instructor's console screen off to the side.
The **Vehicle Related** group contains the following options:

- **On-Screen Mirrors:**
  - Disabled (do not show mirrors)
  - Standard (show mirrors with cockpit)
  - Mirrors Only (do not show cockpit)

  **NOTES:** The first choice will completely disable mirror rendering and is only meant for testing purposes. The second choice is the default. The third choice should be selected when the simulator is built in to a full vehicle cab and therefore no 3D cockpit is needed onscreen, only the virtual mirrors.

- **On-Screen Gauges:**
  - Do not show on-screen gauges
  - Show analog gauges only
  - Show digital speed only
  - Show both analog and digital

  **NOTES:** Allows you to not show virtual "analog gauges" (for speed and rpm, with animated needles) onscreen if using a simulator cab with real physical gauges. Also allows you to display a digital "heads up" speedometer if desired, in addition to or instead of either virtual or physical gauges.

- **Override Vehicle:**
  - Use vehicle defined in scenario
  - Economy Car
  - Large SUV
  - E450 Ambulance
  - GMC4500 Ambulance
  - Midsize Sedan
  - Sports Car
  - City Bus
  - School Bus
  - Small Pickup
  - Haul Truck
  - Hot Rod
  - Dump Truck
  - Military Humvee
  - Semi Cabover 40ft
  - Semi Conventional 53ft
  - Police Charger
  - Police CrownVic
  - Police Tahoe
  - Fire Charger
  - Fire CrownVic
  - Fire Tahoe
  - Fire Single Axle Pumper
  - Fire Dual Axle Platform
  - Fire Dual Axle Ladder
  - Fire TDA (Tiller)
  - Fire Telesquirt
  - Navistar EMS
  - Furion Rescue

  **NOTES:** Use this option to force all scenarios start with the vehicle selected here instead of the vehicle defined in the scenario file. This is most useful when the simulator is dedicated to a particular type of vehicle (for example, a Bus) and has a physical cab of that type. If desired, the operator can manually restart the scenario in a different vehicle using the keyboard or console.

---

**HARDWARE CONFIGURATION TAB**

This second tab contains several groups of options relating to the simulator's hardware, as follows:
The Driving Controls group contains the following option:

- **Controller Type:**
  - Keyboard / ACT Labs Wheel
  - Keyboard / Logitech Wheel
  - Keyboard / Microsoft Wheel
  - Digital Vehicles DVC6 ISA Board
  - Digital Vehicles DVC7 ISA Board
  - Digital Vehicles DVC8 USB Interface

  **NOTES:** Choose one of the first three choices to test drive the simulation with either the keyboard or a game type wheel. Only the following specific models are currently supported: Logitech Momo Red or Black, Logitech G25, and Logitech Driving Force Pro. Choose DVC6 or DVC7 for simulators connected through one of those Digital Vehicles ISA cards, and configured through the simcal.txt file. Choose DVC8 for simulators connected through a Digital Vehicles DVC8 USB interface box, and configured with the DVC8UTIL program.

- **CANUSB Cluster Type:**
  - None
  - Ford CrownVic
  - Dodge Charger
  - Pierce Velocity
  - Spartan Fire
  - Chevy Tahoe
  - Navistar EMS
  - Ford E450
  - GMC Savana
  - Navistar ProStar
  - International IMX 1
  - Ford F250SD
  - International IMX 2

  **NOTES:** Choose the type of instrument cluster that is attached via a CANUSB adapter or "None" otherwise. This determines the baud rate and protocol used to communicate with the cluster.

- **Siren Type:**
  - None
  - Whelen (with amplifier)
  - Federal (panel only)
  - Whelen (panel only)

  **NOTES:** Choose the type of siren that is attached the the simulator. If "Whelen (with amplifier)" is selected, the Trainer software will not generate siren sounds itself, and assumes the Whelen is wired into the sound system through the PCs mic input and will make the sounds itself. The "Federal (panel only)" and "Whelen (panel only)" options make Trainer read the siren control switches from a panel and produce sounds through software that correspond.

- **Motion Type:**
  - None
  - Analog (via suitably mapped DVC8 wavdac Analog Outputs)
  - TMBS (aka Termi-Bus / Dyadic / SCN via RS485 interface on COM3)
  - DBOX (via customized dbxLive32.dll library)

The Steering Response Settings group contains the following options, which should be set experimentally by the simulator manufacturer to give the best overall “feel” for that particular design.

- **Sensitivity:**
  - Numeric percentage compared to standard (100%)

  **NOTES:** This allows you to make the dynamics respond more or less sensitively than normal to the physical steering wheel angle. For example, setting this to 150 would cause a 180 degree turn of the steering wheel to be treated as if the wheel had actually been turned 270 degrees.

- **Torque:**
  - Numeric percentage compared to standard (100%)
NOTES: This allows you to make the force feedback torque felt in the steering wheel based on the forces acting on the front tires, either stronger or weaker than normal.

- **Vibrations:**
  - Numeric percentage compared to standard (100%)

NOTES: This allows you to make the force feedback vibrations felt in the steering wheel based on offroad surfaces, road speed, and traction changes, either stronger or weaker than normal.

- **Damping Min:**
- **Damping Max:**
  - Numeric limits within the range of -128 to 127

NOTES: These two values can be used to limit amount of electrical damping commanded to the steering feedback controller. This can be used to fine-tune the software damping to complement the electrical and mechanical damping of the particular simulator's steering feedback system. Allowing high negative damping values can cause the electronics to "lighten up" the feel of a steering column with a lot of physical mass and/or friction, while allowing high positive damping values can give a naturally springy, lightweight system some "weight".

- **Steering Hardstops:**
  - None
  - Use Mechanical Hardstops
  - Simulate Hardstops with Feedback

NOTES: Use this option to let the software know if the attached simulator has physical hard stops that limit the steering wheel to a fixed number of turns lock-to-lock, which can be used to automatically center the wheel at startup by bumping it against the left and right limits. If the simulator has no hard stops, the software can simulate them by engaging a maximum level of force-feedback when the wheel reaches the number of steering turns lock-to-lock programmed for each vehicle type.

### GRAPHICS BOARD SETTINGS TAB

This third tab contains several groups of options for controlling the simulator’s graphics settings, as follows:

The **Video Settings** group contains the following options:

- **Resolution:**
  - 640 x 480
  - 848 x 480
  - 600 x 800
  - 1024 x 768
  - 1360 x 768
  - 1280 x 1024
  - 1920 x 1080
  - 1440 x 900
  - 1280 x 800
  - Other (manually edited)

NOTES: This sets the output pixel resolution for the simulation. Normally, for best image quality, choose the native resolution of the monitors or projectors that will be seen by the driver. However, if using high-resolution monitors with a lower-speed computer, it may be necessary to select a lower resolution to achieve satisfactory frame rates.

- **Refresh Rate:**
  - 60 Hz
  - 70 Hz
  - 72 Hz
  - 75 Hz
  - 80 Hz
  - 85 Hz
  - Other (manually edited)

NOTES: This sets the output refresh rate for the simulation. With CRT monitors, this may be set as high as possible based on how fast the computer can keep up rendering frames. However, with flat panel
monitors or digital projector, this should be set to the display's native internal refresh rate, otherwise annoying motion-stutter effects can appear even if the computer is fast enough.

- **VSync Mode:**
  - Normal (sync all screens)
  - Center Only (do not sync sides)
  - Benchmark Test (disable all sync)
  - Halfspeed (swap every two frames)

  **NOTES:** This controls the vertical sync timing relative to when frames are swapped. Normally, all three screens wait for vsync and swap at the end of each frame. For low-performance computers, choosing the “Center Only” option can boost the overall frame rate somewhat by allowing the side screens to swap mid-frame, although that can lead to a "tearing" visual artifact on those screens. To benchmark a computer's overall CPU and graphics performance, the third option will disable all sync and allow the computer to render frames at its maximum rate, regardless of "tearing" artifacts on all three screens. The final open is a special case that will force the frame rate to be half that of normal, for example, to produce 30 fps marketing videos.

- **Gamma Tint Choice:**
  - Numeric choice between 0 and 7

  **NOTES:** This sets the default “gamma” curve for the simulation session. The value 0 means no adjustment is applied, while the other values shift the overall “color balance” of the image. Press the “G” key while driving to cycle through the options and find the most pleasing tint for your particular displays, then set this value to make that value the default.

The **Rendering Quality Settings** group contains the following options:

- **Anti-Aliasing Type:**
  - D3DMULTISAMPLE_NONE
  - D3DMULTISAMPLE_NONMASKABLE
  - D3DMULTISAMPLE_2_SAMPLES
  - etc.

  **NOTES:** See below.

- **Anti-Aliasing Quality:**
  - Qual-0
  - . . .
  - Qual-7

  **NOTES:** Together with the parameter above, this controls the anti-aliasing mode used during 3D rendering. Note that ideal settings for these parameters are very dependent on the particular models of graphics boards being used, and it is best to consult with Digital Vehicles for assistance.

- **Anisotropic Filtering:**
  - 0%;10%;20%;30%;40%;50%;60%;70%;80%;90%;100%

  **NOTES:** Controls the amount of texture filtering applied during 3D rendering. This setting is also dependent on the particular model of graphics boards used, but can normally be set to 100%, which will give the best image quality with minimal performance penalty with modern hardware.

- **MipMap LOD Bias:**
  - Numeric decimal value between -2.00 and +2.00

  **NOTES:** Causes the "level of detail" mipmap texturing index to be shifted by the given amount during 3D rendering. Negative values sharpen while positive values blur textures by #.## mipmap levels. This can be used to fine tune the tradeoff of sharpness versus smoothness of the final image.

- **Max Texsize:**
  - Numeric value, typically either 128, 256, 512, or 1024

  **NOTES:** Causes textures to the limited to the given maximum pixel dimensions, allowing you to adjust the visual quality of the simulation to match the amount of video memory of the graphics boards. Boards with more memory will allow higher resolution textures to be stored, especially noticeable when running higher output resolutions.

- **Mirror Texsize Fac:**
3D RENDERING CONFIGURATION TAB

This fourth tab contains several groups of options for controlling the display configurations, as follows:

The Simulato Display Configuration group contains the following options:

- **Multi-View Mode:**
  - Singlescreen
  - Tripplescreen (use Windows "[ x] Primary" monitor for left/right)
  - Tripplescreen-Reversed (use "[x] Primary" monitor for center/console)
  - Fivescreen

  **NOTES:** Set this to match number of primary 3D screens to render. Note that for triplescreen mode, the "primary" graphics board in Windows will drive the left and right monitors and must be configured in the "horizontal span" mode, while the "secondary" graphics board will drive the center monitor.

- **Aspect Ratio:**
  - Standard (4:3 = 1.33)
  - Medium (8:5 = 1.60)
  - Widescreen (16:9 = 1.78)
  - Other (manually edited)

  **NOTES:** Set this parameter to match the aspect ratio of the monitors or projection screens seen by the simulator's driver. Used in the calculation of the vertical field of view, as below. Larger values than appropriate will cause objects to appear unnaturally "tall and thin", while smaller values will cause a "short and wide" appearance.

- **Side View Gap:**
  - Seamless, for aligned projectors (0.996)
  - Narrow, for narrow bezel monitors (1.030)
  - Standard, for typical monitors (1.060)
  - Wide, for wide bezel monitors (1.090)
  - CADfile, parms from CAD for each view (0.000) (implements geometrically-correct, optionally shifted and/or rotated display configurations, hardcoded into Trainer.exe)

  **NOTES:** This value controls the angular gap that is calculated between the center and side 3D views, and should be adjusted to match the physical gap between your particular monitors or projection screens.

- **Field Of View Parm:**
  - Numeric integer, degrees

  **NOTES:** This parameter sets the horizontal field of view in degrees for each screen. The vertical field-of-view is calculated by dividing this parameter by the Aspect Ratio parameter above. This parameter is not used with the CADfile option above which calculates a geometrically-correct FOV for each individual monitor.

- **Yon Culling Distance Fac:**
  - Numeric percentage compared to standard (100%)

  **NOTES:** Controls the distance that various objects are culled from view during 3D rendering. Higher values of this parameter cause objects to remain in view further into the distance than normal but should only be used with higher performance CPUs to avoid drops in frame rates. Conversely, with lower powered CPUs, setting this parameter lower can increase frame rates, but cause more visual "popping in" of 3D objects.

- **LOD Distance Fac:**
  - Numeric percentage compared to standard (100%)
NOTES: Similar to the above, this parameter can be used to trade off higher visual quality versus higher frame rates, by controlling the distances when more-detailed versions of 3D objects get switched out for lower polygon-count models.

The **Console Display Configuration** group contains the following options:

- **Console Screen:**
  - No Console Screen
  - Show Console on 4:3 Monitor
  - Show Console on 16:9 Monitor
  
  **NOTES:** The Trainer software optionally supports an Operator’s Console on a fourth display which allows the operator to choose scenarios, change weather and other conditions, and monitor the student’s vehicle from a variety of viewpoints while they drive. If the console is desired, the console monitor will share the same graphics board as the center simulator screen, and that board must be configured in "horizontal span" mode. You can choose either 4:3 or 16:9 aspect ratio here to match the aspect ratio of the console’s monitor, which can be different than the main system monitors.

- **Console Update Rate Factor:**
  - Numeric integer, typically between 1 and 6 (frames between updates)
  
  **NOTES:** This parameter has no effect with current Trainer.exe releases.

**CAMERA CONFIGURATION TAB**

This fifth tab contains several groups of options for controlling attached webcams, as follows:

The **Upper Left Camera, Upper Right Camera, Lower Left Camera**, and **Lower Right Camera** groups each contain the following options:

- **Index ID:**
  - None
  - USB Camera #1
  - USB Camera #2
  - USB Camera #3
  - USB Camera #4
  
  **NOTES:** Set this to choose which of up to 4 USB webcams plugged-in will appear in each 1/4 of the screen on the Console display area. If only one camera is installed, that single camera will be zoomed to fill the entire Console display area.

- **Orientation:**
  - Normal
  - Mirror Horizontal
  - Mirror Vertical
  - Mirror Both (equivalent to 180 degree rotation)
  
  **NOTES:** Set this parameter to mirror and/or rotate the image for the corresponding webcam as needed, depending on how each is mounted and pointed.

The **File Capture** group contains the following options:

- **Save ID:**
  - None
  - USB Camera #1
  - USB Camera #2
  - USB Camera #3
  - USB Camera #4
  
  **NOTES:** Set this to choose which of up to 4 USB webcams will be captured and saved as an MPEG4 AVI video file for each scenario driven. These may be reviewed either via the Simulator Database or just by browsing to the Trainer/Reports/VideoCaptures folder.
10. DVC8UTIL Utility Program

PROGRAM INTRODUCTION

The DVC8UTIL program is a utility for configuring, calibrating, and testing a DVC8 Digital Vehicle Controller and the simulator hardware cabled to it (such as steering, pedals, switches, lamps, etc). The DVC8 is a standard USB PC peripheral and may be plugged into any USB port on the host PC, once the Digital Vehicles VCP driver is installed on the PC as documented earlier.

This is a Windows dialog application featuring multiple "tabs" to group related parameters together. Click along the top of the dialog to select the desired tab, each of which is described in more detail below, after a brief description of the buttons and fields at the lower part of the dialog.

LOWER DIALOG BUTTONS AND FIELDS

This bottom portion of the program screen contains a group of buttons for connecting to and performing overall management of an attached DVC8 controller.

The **DVC8 on USB Virtual Com Port** group contains the following items:

- **"OPEN PORT" button and dropdown menu**
  
  When the DVC8UTIL program starts, it tries to automatically sense and connect to an attached DVC8 by checking all possible virtual com ports (actually USB ports) until it gets a response from a DVC8 board. Normally a message will appear to the right showing which com port the DVC8 was sensed and opened on and there is no need to use this button. However, if you did not have it connected or powered up at startup, or you unplug and change USB ports, you can click this button to force a reconnection to the DVC8. You can also manually choose which com port to connect to from the dropdown menu before pressing the OPEN PORT button. This can be useful if you have more than one DVC8 plugged into the system at once.
    - auto sense
    - com1 ... com 16
"Reset all mappings to default for below:" button and dropdown menu
This button is intended to help configure a new DVC8 box by pre-setting all the input and output mappings to match the standard wiring of whichever simulator type is selected in the dropdown menu. All signals may then be checked to make sure they respond as expected, and calibration factors should be set for any signals that require them. First select the desired option from the dropdown menu, then click the button.

- 0: Custom/Undefined
- 1: DVI Pacesetter
- 2: DVI Trainer
- 3: OEM Trainer (Rev C)
- 4: OEM Trainer (Rev F)
- 5: OEM Trainer (Rev G)

"Passcode" input field
To prevent modification of DVC8 configuration and calibration by casual users, a passcode must be entered here before the "P:put data" or "save datafile" buttons will work. Please contact your OEM simulator manufacturer for assistance. Without this passcode, the DVC8UTIL program is still very useful for testing simulator features without the worry of inadvertently changing critical settings.

"P: put data" button
After making any adjustments, click this button to store the complete set of mappings and calibration factors (from across all DVC8UTIL tabs) to the DVC8’s internal flash memory. Keep in mind that all parameters apply to a particular simulator and "go with the box" even if it is connected to a different computer.

"G: get data" button
Click this button to re-read the complete set of mappings and calibration factors currently stored in the DVC8's internal flash memory. This can be useful if you have made edits but have not stored them yet, and want to revert to the original configuration.

"save datafile" button
Click this button to save the complete set of mappings and calibration factors (from across all DVC8UTIL tabs) to a file on the computer’s hard disk. This may be useful for making a backup copy of a system's configuration before making changes, or for transferring the basic configuration of one DVC8 to another. By default, these files have an extension ".DVC".

"load datafile" button
Click this button to load a previously saved ".DVC" file from disk. If you want to make these settings permanent, you will then need to click the "P:put data" button as above.

ANALOG INPUTS TAB
This tab contains a group of options for testing and configuring the DVC8’s 16 available analog (voltage) inputs. These are designated \texttt{an0-an15}.

The \textbf{Analog Voltage Inputs} group shows the following fields for each input:

- **value**
  This integer corresponds to the real-time analog voltage sensed on each analog input, and is useful for checking if various controls exhibit the expected raw (uncalibrated) responses.
  - Range of values between 0 and 1023 represents input voltages between 0.0 and 5.0 Volts

- **mapped function**
  This tells the simulation software what type of driving control is connected to each hardware input, from the following list:

  - "(none)"
  - Select if nothing is connected to this input
<table>
<thead>
<tr>
<th>THROT</th>
<th>Throttle pedal potentiometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAKE</td>
<td>Brake pedal potentiometer</td>
</tr>
<tr>
<td>CLUTCH</td>
<td>Clutch pedal potentiometer</td>
</tr>
<tr>
<td>SHIFT_COL</td>
<td>Shifter Column potentiometer (either the lever selector for an automatic, or the left/right axis of a manual shifter)</td>
</tr>
<tr>
<td>SHIFT_ROW</td>
<td>Shifter Row potentiometer (front/back axis of a manual shifter)</td>
</tr>
<tr>
<td>WIPERS_ANALOG</td>
<td>Windshield Wiper multi-switch, with several positions electrically mapped into different voltages on a single analog input</td>
</tr>
<tr>
<td>LIGHTS_ANALOG</td>
<td>Headlights multi-switch, with several positions electrically mapped into different voltages on a single analog input.</td>
</tr>
<tr>
<td>CRUISE</td>
<td>Cruise Control multi-switch, with several positions electrically mapped into different voltages on a single analog input.</td>
</tr>
<tr>
<td>EBREAK_ANALOG</td>
<td>Emergency Brake (Parking Brake) potentiometer</td>
</tr>
<tr>
<td>SHIFTER_RPM</td>
<td>Voltage input indicating the rpm of a shifter gear-grinding motor</td>
</tr>
<tr>
<td>TURN_ANALOG</td>
<td>Turn Signals multi-switch, with several positions electrically mapped into different voltages on a single analog input</td>
</tr>
<tr>
<td>DIMMER</td>
<td>Dimmer control knob potentiometer</td>
</tr>
<tr>
<td>SEATBELT_ANALOG</td>
<td>Seatbelt buckle sensor (hall effect or switch)</td>
</tr>
<tr>
<td>PUMP_LEVER</td>
<td>Pump Lever multi-switch for use with fire apparatus, with several positions mapped into different voltages on a single analog input</td>
</tr>
<tr>
<td>STEERSW_VALUE</td>
<td>Smart steering wheel button pods multiplexed &quot;value&quot; input (decoded in conjunction with below)</td>
</tr>
<tr>
<td>STEERSW_BANK</td>
<td>Smart steering wheel button pods multiplexed &quot;bank&quot; input (decoded in conjunction with above; hardcoded values used in code depending on type of simulator chosen)</td>
</tr>
<tr>
<td>AUTOSTICK_ANALOG</td>
<td>Autostick (semi-automatic shifter) multi-switch, with several positions mapped into different voltages on a single analog input</td>
</tr>
<tr>
<td>4WD_MODE</td>
<td>4WD Mode multi-switch, with several positions mapped into different voltages on a single analog input</td>
</tr>
<tr>
<td>SHIFTER_STRAIN</td>
<td>Voltage input representing the amplified signal from a strain gage fitted to a manual shifter lever. (note: Trainer uses the &quot;Autostick Calibration&quot; values when decoding this)</td>
</tr>
</tbody>
</table>

**DIGITAL INPUTS TAB**

This tab contains a group of options for testing and configuring the DVC8's 24 available digital (switch) inputs. These are divided into three banks (A, B, and C), and are designated *swA0-swA7, swB0-swB7, swC0-swC7*.

The [Switch Bank A](#), [Switch Bank B](#), and [Switch Bank C](#) groups show the following fields for each input:

- **signal**
  *This box displays the raw real-time switch status sensed on each digital input, and is useful for checking if various controls are detected as turning on and off when expected to, and whether they are wired with "standard" or "inverted" logic.*
  - An empty checkbox indicates the switch input is "open" (high logic voltage)
  - A checked checkbox indicates the switch input is "closed" (pulled to ground)
  - Note that all digital inputs are internally pulled up to 5V and float to the "open" state

- **invert**
  *This checkbox lets the software know whether to invert the meaning of that signal or not.*
For **standard logic** signals: leave the *invert* checkbox empty, meaning that function should be considered "active" when the switch input is "closed" (grounded to 0 Volts)

- For **inverted logic** signals: place a check in the *invert* checkbox, meaning that function should be considered "active" when the switch input is "open" (pulled to 5 Volts, either by the internal pullups or outside)

### mapped function

*This tells the simulation software what type of driving control is connected to each hardware input, from the following list:*

<table>
<thead>
<tr>
<th>(none)</th>
<th>Select if nothing is connected to this input</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY_START</td>
<td>Key is turned to the &quot;START&quot; position</td>
</tr>
<tr>
<td>KEY_RUN</td>
<td>Key is turned to the &quot;RUN&quot; position</td>
</tr>
<tr>
<td>KEY_ACC</td>
<td>Key is turned to the &quot;ACC&quot; position</td>
</tr>
<tr>
<td>HORN</td>
<td>Horn button is pressed</td>
</tr>
<tr>
<td>TURN_LEFT</td>
<td>Left Turn signal has been activated</td>
</tr>
<tr>
<td>TURN_RIGHT</td>
<td>Right Turn signal has been activated</td>
</tr>
</tbody>
</table>
| HAZARD        | Hazard (a.k.a. 4-way Flashers) switch has been activated  
  *(note: in many real automotive consoles, the Hazard switch actually just activates both Left and Right turn signal switches together and a separate Hazard input is not available or needed)* |
| LIGHT_SWITCH  | Headlights switch, simple on/off                   |
| HIGH_BEAMS    | Determines whether high beams or low beams should appear.  
  *Used in conjunction with the LIGHT_SWITCH input above on systems that do not use the LIGHTS_ANALOG mapped analog headlight input.* |
| WIPER_SWITCH  | Windshield wiper switch input for systems with simple, non-variable-speed windshield wipers that do not use the WIPERS_ANALOG mapped analog wipers input. |
| AUX (SIREN)   | Auxiliary siren & emergency lights activated, simple on/off |
| SEATBELT      | Seatbelt is fastened                               |
| PARK_BRAKE    | Parking brake is engaged, for simple on/off systems not using the E BRAKE ANALOG potentiometer input |
| RETARDER      | Retarder (a.k.a. Engine Brake or Jake Brake) is activated |
| GEAR_RANGE    | Gear Range selector switch found on heavy-truck shifters:  
  - Active when the switch is "up" / "high range"  
  - Inactive when the switch is "down" / "low range" |
| MIRROR_X_INC; | These four inputs correspond to the four directions of a  
  MIRROR_X_DEC;   | Mirror Adjustment Joystick (right, left, up, down).  
  MIRROR_Y_INC;  |
| MIRROR_Y_DEC; | These inputs correspond to a Mirror Selection switch which determines which mirror the joystick will adjust:  
  MIRROR_SEL_L;   | Left, Right, or center (if neither L or R is active)  
  MIRROR_SEL_R;   |
| MIRROR_SEL_V  | This input corresponds to a Mirror Selection switch that  
  determines which Vertical portion of an over/under truck type mirror the joystick should adjust. Active means the  
  upper (flat) segment; Inactive means the lower (curved wide-angle) segment. |
| STEER_CENTER  | Sensor input indicating the steering wheel is at its exact  
  center point, straight up-and-down. |
<p>| WINDSHIELD_WASH| Windshield Washer button is pressed, for systems where this is not analog mapped with the WIPERS_ANALOG input. |
| EMERGENCY_STOP| Emergency Stop button is pressed                   |</p>
<table>
<thead>
<tr>
<th>SEMIAUTO_UP</th>
<th>Semi-automatic shifter Upshift paddle is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMIAUTO_DOWN</td>
<td>Semi-automatic shifter Downshift paddle is pressed</td>
</tr>
</tbody>
</table>
| OVERDRIVE | Overdrive splitter switch found on heavy-truck shifters:  
- Active when the switch is "forward" / "overdrive"  
- Inactive when the switch is "backward" / "direct". |
<p>| TRAILER_BRAKE | Semi-trailer Air Brake switch is pulled out, which effectively engages the trailer's parking brakes |
| AUX1; AUX2; AUX3 | Different styles of police car light bar flash pattern |
| AUX4; AUX5; AUX6 | Center, Left, and Right police car alley lights |
| AUX7; AUX8; AUX9 | Unspecified Auxiliary police car functions |
| RETARDER2 | Second stage of Retarder is engaged, on systems that support selection of three levels of engine braking. When active, this requests twice the level of engine braking as RETARDER input. (Use both together for full level) |
| PARKING_LIGHTS | Can wire to this light switch but has no current function in the simulation |
| DOME_LAMP | Can wire to this light switch but has no current function in the simulation |
| VIEW_BUTTON | Momentary switch to toggle between regular (cockpit) and birds-eye (overhead) view points |
| TC_BUTTON | Momentary switch to toggle Traction Control on and off |
| HI_IDLE_BUTTON | Momentary switch to toggle High Idle mode on and off |
| AIRHORN | Triggers the air horn sound |
| MASTER_SWITCH | Master control switch for fire apparatus. If defined, this switch must be on for any of the following to run: engine, starter, headlights, wipers, lights/siren |
| PUMPSWROAD | Fire truck Pump Lever in &quot;Road&quot; position |
| PUMPSWPUMP | Fire truck Pump Lever in &quot;Pump&quot; position |
| MUD_SNOW | Engages &quot;MUD/SNOW Traction&quot; mode (disables TC and ABS) |
| FEDERAL0; FEDERAL1; FEDERAL2 | Three binary bits that decode various siren modes from the rotary switches of either a Federal or Whelen &quot;panel only&quot; siren (set type in SimConfig) |
| KEY_RUN_ACC | Indicates the key is in either &quot;Run&quot; or &quot;Acc&quot; position (e.g. as used on some GM steering columns) |
| KEY_RUN_START | Indicates the key is in either &quot;Run&quot; or &quot;Start&quot; position (e.g. as used on some GM steering columns) |
| HEADLIGHTS_OFF | Automatically activated headlights (e.g. as found on some GM vehicles) |
| FLASH_TO_PASS | Momentary switch signal when pull turn signal to cause high beams to come on while held |
| HIBEAMS_TOGGLE | Momentary switch to toggle Hi Beams on and off |
| FOOT_SIREN | Intended for a foot pedal switch that causes the wind-up of a &quot;Federal Q&quot; type siren sound |
| EM_MASTER | Master control override for all lights and siren modes. If this switch is Off, no emergency lights or siren sounds will be generated regardless of any other individual switches |
| ALLSTEER_COORD, ALLSTEER_FIREGROUND | These switches control the optional &quot;All Steer&quot; (rear wheel steering) capabilities of certain fire apparatus. The first enables &quot;Coordinated&quot; mode where the rear wheels steer to enable sharper turning than normal. The &quot;Fireground&quot; mode engages more aggressive rear steering and will either &quot;Crab&quot; or &quot;Coordinate&quot; depending on the position of the first switch. |</p>
<table>
<thead>
<tr>
<th>Decoration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIREN_BRAKE</td>
<td>Foot pedal switch to rapidly &quot;wind down&quot; the Federal Q siren sound</td>
</tr>
<tr>
<td>OPTICOM_ON</td>
<td>Switch input to simulate turning on/off the Opticom emergency traffic light triggering system</td>
</tr>
<tr>
<td>SIREN_OR_HORN</td>
<td>If this signal is on, causes the horn button to be interpreted as a command button to cycle through various siren sounds; when off, the horn button is treated as a normal horn</td>
</tr>
<tr>
<td>ENG_BRAKE_TOGGLE</td>
<td>Momentary switch to toggle engine braking on and off; Can be used instead of RETARDER/RETARDER2 inputs</td>
</tr>
<tr>
<td>AUTO_TRANS</td>
<td>Override switch to temporarily invoke automatic transmission mode even with simulators otherwise based around a manual shifter (e.g. semi trucks)</td>
</tr>
<tr>
<td>DIFF_LOCK</td>
<td>Engages the differential lock mode</td>
</tr>
<tr>
<td>TRAILER_DROP</td>
<td>When active, un-hitches a semi trailer from its tractor</td>
</tr>
<tr>
<td>HAZARD_TOGGLE</td>
<td>Momentary switch to toggle HAZARD mode on and off</td>
</tr>
</tbody>
</table>

### ANALOG OUTPUTS TAB

This tab contains a group of options for testing and configuring the DVC8’s 4 available analog (voltage) outputs. These are called Waveform DAC Outputs because they can be programmed to automatically generate AC waveforms of variable frequency and amplitude, in addition to basic DC voltages. The outputs are designated `wavdac0-wavdac3`.

The **Analog Waveform DAC Outputs** group shows the following four fields for each output, and one option that applies to all four together:

- **AC frequency**
- **AC magnitude**
  
  **These two integers together specify the frequency and magnitude of an AC test waveform to generate on this output, which is useful for checking if an attached device responds as expected to raw (uncalibrated) signals.**
  
  - Allowed values for **AC frequency** are between 0-32000 and correspond to 0-2000 Hz (meaning there is 1/16 Hz per count).
  - Allowed values for **AC magnitude** are between 0-255 and correspond to 0-22 Volts peak-to-peak magnitude of the output (meaning 0.08627 V per count).

- **Test Waveform Style**
  
  - The shape of any test AC waveforms generated by setting nonzero values above is determined by this option, which offers the following styles:

<table>
<thead>
<tr>
<th>Sine Wave (default)</th>
<th>Smoothly cycles between -1.0 and +1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square Wave</td>
<td>Toggles between -1.0 and +1.0 at even intervals</td>
</tr>
<tr>
<td>Sawtooth Wave</td>
<td>Ramps linearly from -1.0 to +1.0, then abruptly restarts</td>
</tr>
<tr>
<td>50-50 Pulses</td>
<td>Stays at 0.0 for 50% of the cycle, then jumps to +1.0 for 50%</td>
</tr>
<tr>
<td>90-10 Pulses</td>
<td>Stays at 0.0 for 90% of the cycle, then jumps to +1.0 for 10%</td>
</tr>
<tr>
<td>0 pct; 10 pct; 20 pct; 30 pct; 40 pct; 50 pct; 60 pct; 70 pct; 80 pct; 90 pct; 100 pct</td>
<td>Generates a 1.0 pulse for the selected percentage of the cycle, then returns to 0.0 for the remainder (basic test of PWM mode signals)</td>
</tr>
</tbody>
</table>

- **DC offset**
This integer specifies a DC offset to generate on this output, and is useful for checking if an attached device responds as expected to raw (uncalibrated) voltages. Note that this parameter can be used by itself to generate a steady DC voltage, or used to offset an AC waveform.

- **Allowed values** are between -128 and 127, and correspond to -11.0 and +11.0 Volts output

- **mapped mode**
  This tells the simulation software which type of signal to produce on each hardware output to match the particular peripheral that is connected. The available modes are as listed in the table below, but refer the mapped function table to see which modes are available for each function:

<table>
<thead>
<tr>
<th>MODE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLTAGE</td>
<td>Output a varying DC voltage proportional to the associated dynamics parameter(s)</td>
</tr>
<tr>
<td>FREQUENCY</td>
<td>Output a sine wave whose frequency varies in proportion to the associated dynamics parameter(s)</td>
</tr>
<tr>
<td>PWM</td>
<td>Output a pulse-width-modulated signal whose duty cycle varies between 0 and 100% in proportion to the associated dynamics parameter(s)</td>
</tr>
</tbody>
</table>

- **mapped function**
  This tells the simulation software what type of driving control is connected to each hardware input, from the following list. Also shown:

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Typical use</th>
<th>Output</th>
<th>Modes supported:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCEL_LATERAL</td>
<td>Data Logger</td>
<td>Proportional to lateral acceleration (cornering)</td>
<td>Voltage: 10.0 V per G</td>
</tr>
<tr>
<td>ACCEL_LONGITUDINAL</td>
<td>Data Logger</td>
<td>Proportional to longitudinal acceleration (accel/braking)</td>
<td>Voltage: 10.0 V per G</td>
</tr>
<tr>
<td>VEHICLE_SPEED</td>
<td>Speedometer Gauge</td>
<td>Proportional to vehicle speed</td>
<td>Voltage: 1.0 V per 25 mph, Frequency: 10V sine, PWM: 5V pulses at 62.5 Hz, duty cycle per calibration table</td>
</tr>
<tr>
<td>ENGINE_RPM</td>
<td>Tachometer Gauge</td>
<td>Proportional to engine RPM</td>
<td>Voltage: 1.0 V per 2000 rpm, Frequency: 10V sine, PWM: 5V pulses at 62.5 Hz, duty cycle per calibration table</td>
</tr>
<tr>
<td>COOLANT_TEMPERATURE</td>
<td>Temperature Gauge</td>
<td>Proportional to engine temperature</td>
<td>Voltage: 5.0 - 7.5 V, depending on load, throttle</td>
</tr>
<tr>
<td>BRAKES_AIR_PRESSURE</td>
<td>Air Brakes Pressure Gauge</td>
<td>Proportional to PSI modeled in the air tank</td>
<td>Voltage: 1.0 V per 15 PSI</td>
</tr>
<tr>
<td>MOTION_LATERAL</td>
<td>Analog Motion Platform</td>
<td>Proportional to lateral acceleration (cornering), subject to internal limiting and smoothing algorithms.</td>
<td>Voltage: 10.0 V per G</td>
</tr>
<tr>
<td>MOTION_LONGITUDINAL</td>
<td>Analog Motion Platform</td>
<td>Proportional to longitudinal acceleration (accel/braking), subject to internal limiting and smoothing algorithms.</td>
<td></td>
</tr>
</tbody>
</table>
Modes supported:
a) **Voltage**: 10.0 V per G

**NOTE**: This output and associated calibration values should be defined when using the digital-interfaced Termi-Bus motion system

**SEAT_SHAKER**

**Typical use**: Seat Vibration Transducer

**Output**: Proportional to road speed, etc.

**Modes supported**:
a) **None**: 0.0 V fixed output for now (use audio instead)

**GEARBOX_SHAKER**

**Typical use**: Shifter “Gear Grind” Motor

**Output**: Proportional to difference in input and output shaft rpms

**Modes supported**:
a) **Voltage**: Varies per calibration factors and RPM difference
b) **Frequency**: Causes “audio only” grinding sound effects

**OIL_PRESSURE**

**Typical use**: Oil Pressure Gauge

**Output**: Proportional to vehicle speed

**Modes supported**:
a) **Voltage**: 0.0 - 10.0 V, depending on engine RPM versus max

**BRAKES_APPLIED_PRESSURE**

**Typical use**: Brake Pressure gauge

**Output**: Proportional to amount brake pedal is pressed

**Modes supported**:
a) **Voltage**: 1.0 - 6.0 V, depending on pedal pressure

**DIMMER_OUTPUT**

**Typical use**: Instrument Cluster Electroluminescent Backlight

**Output**: Proportional to analog DIMMER knob input

**Modes supported**:
a) **All**: 415 Hz sine wave, 0.0 - 1.0 V, proportional to knob

**DIGITAL OUTPUTS TAB**

This tab contains two groups of options for testing and configuring the DVC8’s 16 available digital (lamp) outputs. These are divided into two banks (A and B) and are designated **lmA0-ImA7, lmB0-ImB7**.

The **Lamp Bank A** and **Lamp Bank B** groups show the following fields for each output, and one option that applies only to the Bank A outputs which support onboard variable-frequency square-wave generation:

- **signal**
  Each pushbutton may be pressed up or down with the mouse, to toggle each raw lamp output off or on in real-time, which is useful for checking if the connected device responds as expected.
  - Each digital output is an “open collector” driver that either floats open, or completes a circuit to ground. Connected devices (e.g. lamps) should therefore be wired to power (e.g. +5 or +12 V) on the other side.
  - A button in the “up” or “un-pressed” state makes the lamp output “open” (not grounded)
  - A button in the “down” or “pressed” state makes the lamp output “closed” (grounded)

- **test frequency**
  Entering a nonzero value here causes a square wave to be generated on that output for testing purposes (overriding the simple off or on of the pushbutton above).
  - Allowed values are between 0-32000 and correspond to 0-2000 Hz (meaning there is 1/16 Hz per count)

- **invert**
  This checkbox lets the software know whether to invert the meaning of that signal or not.
  - For **standard logic**: leave the **invert** checkbox empty, meaning that when the mapped function is “active”, the lamp output will be “closed” (connected to ground)
- **mapped function**

  *This tells the simulation software what type of driving control is connected to each hardware input, from the following list:*

<table>
<thead>
<tr>
<th>(none)</th>
<th>Select if nothing is connected to this output</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEFT_BLINKER</td>
<td>Lamp that flashes when the left turn signal is active</td>
</tr>
<tr>
<td>RIGHT_BLINKER</td>
<td>Lamp that flashes when the right turn signal is active</td>
</tr>
<tr>
<td>EITHER_BLINKER</td>
<td>Lamp that flashes if either left or right turn signal is active</td>
</tr>
<tr>
<td>BRAKES_WARNING</td>
<td>Lamp that illuminates to indicate a simulated failure has occurred in the braking system</td>
</tr>
<tr>
<td>TEMPERATURE_WARNING</td>
<td>Lamp that illuminates to indicate a simulated engine overheating condition</td>
</tr>
<tr>
<td>MPH_PULSE</td>
<td>Square wave signal to drive a speedometer with a frequency per the speedometer calibration factor table.</td>
</tr>
<tr>
<td>RPM_PULSE</td>
<td>Square wave signal to drive a tachometer with a frequency per the tachometer calibration factor table.</td>
</tr>
<tr>
<td>SPOTTER_OUT</td>
<td>Output to a data logger that the student has performed a virtual spotter check before backing</td>
</tr>
<tr>
<td>EMERGENCY_OUT</td>
<td>Output signal indicating that the AUX (siren) input is active</td>
</tr>
<tr>
<td>IGN_KEY_ON</td>
<td>Output signal indicating that the key is in the RUN position</td>
</tr>
<tr>
<td>BRAKE_PRESSED</td>
<td>Output signal indicating the brake pedal is currently pressed</td>
</tr>
<tr>
<td>SEATBELT_ON</td>
<td>Output signal indicating the seatbelt is currently fastened</td>
</tr>
<tr>
<td>REVERSE_ENAGED</td>
<td>Output signal indicating the shifter is currently in REVERSE</td>
</tr>
<tr>
<td>ABS_BRAKE_PULSE</td>
<td>Output for a transducer on the brake pedal, causing it to vibrate because the ABS has kicked in during hard braking</td>
</tr>
<tr>
<td>SEATBELT_OFF</td>
<td>Lamp that illuminates to indicate the seatbelt is not fastened</td>
</tr>
<tr>
<td>HIGH_BEAMS_ON</td>
<td>Lamp that illuminates when headlight HI BEAMS are active</td>
</tr>
<tr>
<td>CHECK_ENGINE</td>
<td>Lamp that illuminates when the engine stalls</td>
</tr>
<tr>
<td>LOW_FUEL</td>
<td>Lamp that illuminates if the simulated fuel level gets too low</td>
</tr>
<tr>
<td>DASH_BACKLIGHT</td>
<td>Lamp(s) that illuminate if the key is ON and the headlight switch is ON</td>
</tr>
<tr>
<td>FORCE_INHIBIT</td>
<td>Output signal to disable the steering feedback amplifier under certain conditions (e.g. when Trainer is not running)</td>
</tr>
<tr>
<td>FORCE_ENABLE</td>
<td>Output signal to enable the steering feedback amplifier, as under normal conditions when Trainer is running</td>
</tr>
<tr>
<td>PARK_BRAKE_ON</td>
<td>Lamp that illuminates to indicate the parking brake is on</td>
</tr>
<tr>
<td>SHIFTER_LOCKOUT</td>
<td>Output to engage a lockout solenoid of a manual shifter when the simulation determines moving the shifter should not be allowed due to current engine, clutch, and gearbox states</td>
</tr>
<tr>
<td>SHIFTER_RESET</td>
<td>Output to reset the shifter &quot;grinding&quot; feedback amplifier and clear any error conditions</td>
</tr>
<tr>
<td>SHIFTER_DISABLE</td>
<td>Output to disable shifter &quot;grinding&quot; feedback, such as when the engine is not running, or once a gear is fully engaged</td>
</tr>
<tr>
<td>HORN_PRESSED</td>
<td>Output signal that indicates the horn button is pressed</td>
</tr>
<tr>
<td>FREESCALE_CS; FREESCALE_SCLK; FREESCALE_DATAR; FREESCALE_DATAL</td>
<td>Specialized group of signals for controlling a specially-wired digital instrument cluster driven by Freescale IC chips.</td>
</tr>
</tbody>
</table>
| AIR_FRONT, AIR_REAR                 | Output signals to drive Front or Rear Air Pressure (PSI) gauges or lamps. If assigned to a lamp output on the "A" bank (which support square-wave outputs) this will cause the
| **BTSI** DODGE, | Drives the "Brake Transmission Switch Interlock" in a manner consistent with Dodge, Ford, or GM vehicles. |
|**BTSI** FORD, | |
|**BTSI** GM | |

| **OK** TO **PUMP**, | Lamps that illuminate to signal the current fire apparatus Pump status (either OK to Pump, or Pump Engaged). |
|**PUMP** ENGAGED | |

| **OK** HI **IDLE**, | Lamps that illuminate to signal the current High Idle mode status (either OK to HI IDLE, or HI IDLE Engaged). |
|**HI** IDLE ENGAGED | |

| **MASTER** SWITCH ON | Lamp that illuminates when the Master Switch is ON. |

| **JAKE** SEL **LO**, | Lamps that illuminate to reflect the currently selected amount of engine braking (aka Jake brake / Retarder). |
|**JAKE** SEL **MED**, | |
|**JAKE** SEL **HI** | |

| **SIREN** ON | Signal that indicates emergency siren is currently active. |

| **SHIFTER** IN **PARK** | Signal that indicates the shifter is currently in Park position (needed by some instrument clusters). |

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**STEERING ENCODER TAB**

This tab contains a several group of options for testing and calibrating the steering encoder, which is an up/down digital counter that tracks the angular position of the steering wheel by decoding the signal from an optical quadrature encoder, typically mounted on a steering feedback motor connected to the steering shaft.

The **Steering Encoder** group contains the following fields:

- **Raw Encoder Position**
  - *This number shows the raw value of the 24-bit hardware digital counter, which should increase or decrease consistently as the steering wheel is turned when the encoder is working correctly.*

- **Sensing Direction**
  - *This option lets the system know whether your system is configured in the **Standard** way, where increasing values in the Raw Encoder Position number indicate the wheel is being turned to the left and decreasing values indicate the wheel is being turned to the right, or vise versa. If your system responds the **Reversed** way, you can either fix the problem in hardware by reversing the A and B wires from the encoder, or, choose the second option below:*  
    - **Standard** (++Left -Right)
    - **Reversed** (-Left +Right)
  - *Note that the Sensing Direction should be confirmed to be correct first, before trying to set the Steering Feedback Motor Polarity or use any centering force-feedback effects.*

- **Min / Sensed Midpoint / Max**
  - *This tab automatically keeps track of the encoder position as you turn the wheel back and forth and records the minimum and maximum values registered, along with constantly recalculating the midpoint value between those extremes. Note that these values are reset either by pressing the Zero Encoder button, or changing tabs.*

- **Hardstops Cal Offset**
  - *On simulators with physical hardstops at the left and right limits of the steering wheel range, the Trainer program will attempt to automatically find the steering center point each time it starts by forcing the wheel to the left limit until it bumps, then to the right limit. It then determines the encoder reading that represents exact center ("straight ahead") position, by calculating the midpoint between the sensed left and right encoder limits, and offsetting that by this Hardstops Cal Offset factor. This factor lets you fine-tune the centering process to compensate for hardstop that may physically be a few degrees different between each other and/or a steering wheel that is installed crooked on the shaft.*
• "... click here to autocalc Hardstop Cal Offset" button
  This button provides a semi-automatic way to obtain an appropriate value for the Hardstops Cal Offset parameter above. First, turn the wheel all the way to its left limit, then to its right limit, which will capture those Min and Max limit values, and calculate the theoretical center point value midway in between. Second, turn the wheel until it is actually centered and perfectly straight up and down. Finally, click this button, which will subtract the current Raw Encoder Position from the calculated Sensed Midpoint and enter that into the Hardstops Cal Offset field.

• Counts Per 360 Degrees
• Calibrated Degrees
  These two fields work together. The first is a calibration factor where you should enter the number of raw encoder Counts Per 360 Degrees revolution of the wheel. You can then confirm the calibration is accurate by rotating the wheel through a full turn and noting if the Calibrated Degrees value changes 360 degrees, as you would expect. Note that the DVC8 uses "full" decoding and counts on any edge transition of both the A and B encoder signals. The calibration factor may then be calculated as:
  - calibration factor = 4 x (lines per rev of encoder disc) x (steering gear ratio)

• Zero Encoder button
  This button resets the hardware counter to zero at the current steering wheel position, which can be handy during testing. Note that this is just a temporary "zero" point, as the encoder is "relative" by nature and the counter gets reset at each power on.

FORCE FEEDBACK TAB

This tab contains four groups of options for testing and calibrating the steering force-feedback system, as follows:

The Test Steering Feedback Effects group allows you to enter values to test the fundamental force effects of torque, damping, and centering, as follows:

• Torque Value
  Enter a value here to cause a steady level of torque to be applied to the steering wheel, causing it to try and move either left or right.
  - Allowed values are -32768 to +32767, which correspond to the maximum levels of force to the right to left, as calibrated with the DAC Calibration Table Parameters (below)

• Damping Value
  Enter a value here to cause the DVC8 to generate a "damping" effect, which is a force proportional to the velocity the wheel is turned. Positive values produce a damping force in the opposite direction of wheel movement, which resists motion and should give a "weightier" feel. Negative values for damping produce a damping force in the same direction the wheel is moved which assists motion and should give a "lighter" feel. Note that large negative values can cause the wheel to gain speed on its own and should be used with caution. When combined with a centering spring effect (see below), negative damping can be used to cause the wheel to bounce repeatedly back and forth by itself after an initial push. Adjust the parameters to change how large the swings are and how quickly it oscillates.
  - Allowed values are between -128 to +127

• Centering Torque Limit
• Centering Encoder Span
  These two integers together control the built-in self-centering effect, which simulates a spring that pulls the steering wheel back to center. The first parameter determines the maximum amount of torque the simulated spring will produce. The second parameter controls how much angular range the wheel moves through before the spring reaches its maximum torque.
  - Allowed values for Centering Torque Limit are -32768 to 32767. Note that negative values will cause the steering to push itself away from center rather than return to center. This is normally not a useful effect, but is allowed for testing purposes.
  - Allowed values for Centering Encoder Span are 0 to 10,000,000. The units are raw encoder counts.

The Test Steering Feedback Vibration Effects group allows you to enter values to test the steering vibration effects that can be produced by the DVC8 hardware, which can be used to deliver sensations ranging from low-
frequency rumbles to high-frequency tingles. There are four independently programmable vibration effects
generators that run simultaneously, designated A, B, C, and D, each of which produces a sine wave vibration
signal controlled by the following parameters:

- **AC frequency**

  These two integers together specify the frequency and magnitude of the sinewave to generate on this
effect generator. Try entering various numbers here, and check that you feel various sensations in the
steering wheel.
  
  o Allowed values for **AC frequency** are between 0-32000 and correspond to 0-2000 Hz (meaning
there is 1/16 Hz per count).
  
  o Allowed values for **AC magnitude** are between 0-255 and correspond to 0-100 percent of
maximum intensity.

- **DC Offset**

  This value can add a steady-state force either to the left or right, on top of the other forces and vibrations
specified elsewhere.
  
  o Allowed values are -128 to +127

The **Steering Feedback Motor Polarity** group allows you to configure and check the polarity of the steering
feedback signals, as follows:

- **Force Direction**

  This option lets the system know how your steering feedback motor is wired. Test it by entering numbers
into the **Torque Value** box and noting which direction the steering wheel turns. For systems wired with
**Standard polarity**, positive numbers will cause it to turn left. For systems wired with **Reversed polarity**, 
positive numbers cause the steering wheel to turn right. If your system is "reversed" you can either
address the problem in hardware by reversing the red and black wires at the servo motor, or, fix it in
software by choosing the second option below.
  
  o Standard (+Left - Right)
  
  o Reversed (-Left +Right)

- **Simple Centering Test**

  Enabling this option causes a low-intensity centering force to be produced as a quick test to check
whether the Force Direction and Sensing Direction are both correct (or at least, in sync with each other).
With this test "on", if you tug on the wheel left or right, it should pull against you trying to remain centered.
If as soon as you move the wheel it starts to spin out of control in the direction you moved it, either the
motor Force Direction or the encoder Sensing Direction is incorrect and needs to be rechecked.
  
  o Off
  
  o On

The **Steering DAC Calibration Table Parameters** group allows you to calibrate the response of your steering
feedback servo electronics to deliver balanced forces left and right of the desired maximum level, and to eliminate
any zero-crossing / DC offset. The following parameters are available:

- **Raw DAC Value to Test**

  Enter test values here to find appropriate values for each of the four calibration factors described below.
The value you enter is sent directly to the DVC8's steering servo DAC circuitry, which produces a DC
voltage that is sent to the simulator's steering servo power amplifier as a control input. That amplifier then
produces a high-powered output that drives the servo motor coupled to the steering shaft.

To calibrate your simulator's force feedback system, connect a voltmeter across the red and black motor
leads, lock the steering column to prevent movement, then enter a value into this test box and note what
resulting DC voltage appears at the motor. Repeat with different numbers until you find test values that
produce the desired final voltages for each of the four calibration factors, detailed below.
  
  o Allowed values are -128 to +127

Note that if your system has an amplifier with Gain and/or DC Offset hardware control pots, you might
want to connect a voltmeter to monitor its input signal instead, and adjust the DVC8 parameters to
produce a smoothly calibrated input signal. Then use the amplifier's hardware controls to adjust the final
motor output signal.
• NegMin
• PosMin
These two calibration factors specify what raw DAC values produce the minimum drive voltage at the motor in each direction. Start with DAC test values near zero, and test values up and down until you find the value that produces as close to 0.0 V as possible. For PWM-type amplifiers with no zero-crossing dead zone, enter this value into both NegMin and PosMin fields and move on. For transistor-type amplifiers such as the DVAMP from Digital Vehicles, keep entering test values several counts on either side of the zero point until you find the value needed to cross -0.1 V on the negative direction which will be NegMin, and +0.1 V in the positive direction which will be PosMin.
  o NegMin corresponds to "right" with Standard Polarity, or "left" with Reversed Polarity
  o PosMin corresponds to "left" with Standard Polarity, or "right" with Reversed Polarity
  o Allowed values are -128 to 127

• NegMax
• PosMax
These two calibration factors specify what raw DAC values produce the maximum drive voltage at the motor in each direction. With the steering column locked, enter increasing DAC test values and the motor voltage should increase steadily for a while before tapering off as the amplifier reaches its current limit (maximum available power). Do this in both directions, then find values for NegMax and PosMax that correspond to approximately 90% of whichever direction has the lower maximum. For example, if you find the absolute limits to be +12.0 V and -11.5 V, your target would be 11.5 * 0.9 = 10.35 V in each direction.
  o NegMax corresponds to "right" with Standard Polarity, or "left" with Reversed Polarity
  o PosMax corresponds to "left" with Standard Polarity, or "right" with Reversed Polarity
  o Allowed values are -128 to 127

PEDALS TAB

This tab contains a group of parameters and a button, for setting calibration factors for the pedal inputs. These calibration factors control the scaling of the inputs from raw voltages, into useful ranges of 0 - 100 %.

The Pedals Calibration group contains four columns of numbers. Each column governs the calibration for a particular "pedal"-type control, and only applies if that control has actually been mapped to an analog input in the Analog Inputs tab. The names on this tab correspond to choices on the Analog Inputs tab where they are mapped, as follows:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ANALOG INPUT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;THROT&quot;</td>
<td>THROT</td>
<td>Throttle pedal potentiometer</td>
</tr>
<tr>
<td>&quot;BRAKE&quot;</td>
<td>BRAKE</td>
<td>Brake pedal potentiometer</td>
</tr>
<tr>
<td>&quot;CLUTCH&quot;</td>
<td>CLUTCH</td>
<td>Clutch pedal potentiometer</td>
</tr>
<tr>
<td>&quot;E-BRK&quot;</td>
<td>E BRAKE_ANALOG</td>
<td>Emergency Brake (Parking Brake) potentiometer</td>
</tr>
</tbody>
</table>

Each column contains the following parameters that govern its calibration and help you determine suitable values:

• Sensed Input
  This value corresponds to the real-time analog voltage sensed on this analog input, and should respond proportionally as you press the pedal through its range.
  o Range of values between 0 and 1023 represents input voltages between 0.0 and 5.0 Volts

• Sensed Min
• Sensed Max
  These values automatically track the lowest and highest raw values sensed on each input as you press the pedal back and forth through its working range.
• **Cal Min**  
  Set this to the value that should correspond to the minimum position of each pedal control. Any sensed values below Cal Min will report as 0 %, and this parameter is therefore normally set a bit higher than the Sensed Min to ensure the control will read all the way "off" when released, leaving some margin for mechanical slop and electrical noise.

• **Cal Max**  
  Set this to the value that should correspond to the maximum position of each pedal control. Any sensed values above Cal Max will be reported as 100 %, and this parameter is therefore normally set a bit lower than the Sensed Max to ensure the control will read all the way "on" when fully pressed, leaving some margin for mechanical slop and electrical noise.

• **Calibrated Results**  
  This value shows what percentage would be reported for each control in real-time, by applying the current calibration min and max values you have entered to the Sensed Input value. Use this to confirm that the calibration factors cause each control to report from 0 to 100 % as moved through its range.

  o Range of values between 0 and 100 %

• **“Press all pedals to min/max limits, then click here to automatically set Cal Min/Max values based on Sensed Min/Max values” button**  
  This button provides a semi-automatic way to set reasonable calibration values for all four pedal inputs when first bringing up a new simulator. As it says on the button, to use this feature, first press each pedal control through its entire range, which will record Sensed Min and Sensed Max readings for each. Then when you click this button, new values will be calculated for Cal Min and Cal Max for all four inputs, by taking the sensed limits and leaving a 15% margin on both ends.

  Note that this will not necessarily produce a "final" set of calibration factors, but should provide a "reasonable" set that you can then fine-tune by editing the calibration numbers until the desired pedal response / feel is achieved.

**SHIFTER TAB**

This tab contains two groups of parameters that configure and calibrate the simulator's shifter control, which can range from a simple automatic shifter with its several selections mapped into one axis, to a complex manual shifter with its many gear positions mapped into two axes.

The Shifter Calibration and Mapping group allows you to calibrate and map the shifter's columns and rows. The names on this tab correspond to choices on the Analog Inputs tab where they are mapped, as follows:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ANALOG INPUT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Columns&quot;</td>
<td>SHIFT_COL</td>
<td>Shifter Column potentiometer (either the lever selector for an automatic, or the left/right axis of a manual shifter)</td>
</tr>
<tr>
<td>&quot;Rows&quot;</td>
<td>SHIFT_ROW</td>
<td>Shifter Row potentiometer (front/back axis of a manual shifter)</td>
</tr>
</tbody>
</table>

The values within this group are as follows:

• **Columns**  
  The uppermost, extra-wide field contains a raw value that represents the real-time voltage sensed on the SHIFT_COL analog input, which should respond as you move the shifter left and right. Below that are boxes where you enter calibration factors that correspond to the raw value sensed for up to eight "detent" positions of the shifter. Enter as many calibration factors as your shifter has "detent" positions for, and enter the special value 1275 in all unused columns.

  o Range of values is between 0 and 1275.
  o These values are stored internally as 0-255 but are scaled by a factor of 5 for use, so all calibration factors entered will be rounded down to the nearest multiple of 5.
The value 1275 is a special case that tells the system that this column is unused and should be ignored when decoding this input.

- **Rows**
  
  The leftmost, extra-tall field contains a raw value that represents the real-time voltage sensed on the SHIFT_ROW analog input, which should respond as you move the shifter fore and aft. Next to that are boxes where you enter calibration factors that correspond to the raw value sensed for up to four “detent” positions of the shifter. Enter as many calibration factors as your shifter has “detent” positions for, and enter the special value 1275 in all unused columns.
  
  - Range of values is between 0 and 1275.
  - These values are stored internally as 0-255 but are scaled by a factor of 5 for use, so all calibration factors entered will be rounded down to the nearest multiple of 5.
  - The value 1275 is a special case that tells the system that this row is unused and should be ignored when decoding this input.
  - For shifters with a SHIFTER_LOCKOUT output defined, you should map 4 rows front/back instead of just 3, with the two middle rows both being mapped as all zeros (neutral), and the calibration values corresponding to the min and max of the neutral row when SHIFTER_LOCKOUT is engaged.

- **Map**
  
  The remainder of this group is an 8 x 4 grid which tells the system which gear selection to map into each detent position. Note that for a single-axis automatic shifter (with no SHIFT_ROW analog input mapped), only the first row of the map is used, and the lower three rows are ignored. The following table lists the gear selection values that you may enter into the map. While not normally done, it is possible to mix-and-match manual and automatic gear selections if using a suitably-wired combo shifter.

<table>
<thead>
<tr>
<th></th>
<th>Manual</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Manual</td>
<td>Neutral</td>
</tr>
<tr>
<td>1 - 7</td>
<td>Manual</td>
<td>1st - 7th Gear</td>
</tr>
<tr>
<td>8</td>
<td>Manual</td>
<td>Reverse Gear</td>
</tr>
<tr>
<td>-1</td>
<td>Automatic</td>
<td>Park</td>
</tr>
<tr>
<td>-2</td>
<td>Automatic</td>
<td>Reverse</td>
</tr>
<tr>
<td>-3</td>
<td>Automatic</td>
<td>Neutral</td>
</tr>
<tr>
<td>-4</td>
<td>Automatic</td>
<td>Drive</td>
</tr>
<tr>
<td>-5</td>
<td>Automatic</td>
<td>2nd Low</td>
</tr>
<tr>
<td>-6</td>
<td>Automatic</td>
<td>1st Low</td>
</tr>
<tr>
<td>-7</td>
<td>Automatic</td>
<td>3rd Low</td>
</tr>
</tbody>
</table>

The **Shifter Motor Calibration** group contains several parameters for calibrating a servo motor attached to a manual shifter that causes a "gear grinding" effect. These parameters apply to whichever Analog Output has its mapped function defined as GEARBOX_SHAKER (if any) and its mapped mode set to Voltage.

- **Test Freqval**
  
  During the calibration process, enter values here to test how the shifter motor reacts to that value.
  
  - Allowed values are between -128 and 127, and correspond to -11.0 and +11.0 Volts output

- **0%**
  
  Enter a value for this that produces the desired minimum level of "gear grinding" effect, for when a "perfect" shift is made. Normally, this should be a level that causes the motor to rotate slowly, which actually facilitates smooth, quiet shifts.

- **100%**
  
  Enter a value for this that produces the desired maximum level of "gear grinding" effect, for when a "poor" shift is made. This will normally correspond to a mismatch of around 200-500 rpm.
ACCESSORY CONTROLS TAB

This tab contains fields for calibrating the several types of accessory controls that can be mapped onto analog inputs on the Analog Inputs tab. Such controls combine multiple switches onto a single analog input, using resistors of various values to produce a distinct voltage for each switch.

- The top number of each group is the real-time raw value of the associated analog input
- To calibrate each control, press buttons or otherwise manipulate the control to activate each available function, note the raw input value, and enter that into the appropriate box below.
  - Range of values is between 0 and 1275.
  - These values are stored internally as 0-255 but are scaled by a factor of 5 for use, so all calibration factors entered will be rounded down to the nearest multiple of 5.
- The special case value of 1275 should be entered into any unused control positions.

The Wipers Calibration group contains calibration factors for decoding the WIPERS_ANALOG analog input into the following functions:

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Wipers switch off</td>
</tr>
<tr>
<td>INT1</td>
<td>Wipers switch on, intermittent speed 1</td>
</tr>
<tr>
<td>INT2</td>
<td>Wipers switch on, intermittent speed 2</td>
</tr>
<tr>
<td>INT3</td>
<td>Wipers switch on, intermittent speed 3</td>
</tr>
<tr>
<td>LOW</td>
<td>Wipers switch on, speed &quot;Low&quot;</td>
</tr>
<tr>
<td>HIGH</td>
<td>Wipers switch on, speed &quot;High&quot;</td>
</tr>
<tr>
<td>WASH</td>
<td>Wash switch is engaged to clean windshield</td>
</tr>
<tr>
<td>MIST</td>
<td>Wiper control activated for a single wipe</td>
</tr>
</tbody>
</table>

The Cruise Calibration group contains calibration factors for decoding the CRUISE analog input into the following functions:

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>No cruise control buttons currently pressed</td>
</tr>
<tr>
<td>OFF</td>
<td>Cruise control &quot;OFF&quot; button pressed</td>
</tr>
<tr>
<td>ON</td>
<td>Cruise control &quot;ON&quot; button pressed</td>
</tr>
<tr>
<td>COAST</td>
<td>Cruise control &quot;COAST&quot; button pressed</td>
</tr>
<tr>
<td>SET</td>
<td>Cruise control &quot;SET&quot; button pressed</td>
</tr>
<tr>
<td>RES</td>
<td>Cruise control &quot;RES&quot; button pressed</td>
</tr>
</tbody>
</table>

The Headlights Calibration group contains calibration factors for decoding the LIGHTS_ANALOG analog input into the following functions:

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Headlights switch off</td>
</tr>
<tr>
<td>LOW</td>
<td>Headlights on, Low beams selected</td>
</tr>
<tr>
<td>HIGH</td>
<td>Headlights on, High beams selected</td>
</tr>
<tr>
<td>PARK</td>
<td>Parking lights on</td>
</tr>
<tr>
<td>FLASH</td>
<td>High beams momentarily on</td>
</tr>
</tbody>
</table>

The Turn/Pump Calibration group contains calibration factors for decoding the TURN_ANALOG analog input into the following functions if it is defined:

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENTER</td>
<td>Turn signal lever in the Center position</td>
</tr>
<tr>
<td>LEFT</td>
<td>Turn signal lever in the Left position</td>
</tr>
<tr>
<td>RIGHT</td>
<td>Turn signal lever in the Right position</td>
</tr>
</tbody>
</table>

The Turn/Pump Calibration group alternatively contains calibration factors for decoding the PUMP_LEVER analog input into the following functions if it is defined (cannot have TURN_ANALOG input defined also):
The **Seat Belt Calibration** group contains calibration factors for decoding the **SEATBELT_ANALOG** analog input into the following functions if it is defined:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Seat belt is not fastened</td>
</tr>
<tr>
<td>ON</td>
<td>Seat belt is fastened</td>
</tr>
</tbody>
</table>

The **Autostick Calibration** group contains calibration factors for decoding the **AUTOSTICK_ANALOG** analog input into the following functions if it is defined:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>No shifter button pressed</td>
</tr>
<tr>
<td>MINUS</td>
<td>Shifter &quot;minus&quot; or &quot;-&quot; button pressed, requesting a downshift</td>
</tr>
<tr>
<td>PLUS</td>
<td>Shifter &quot;plus&quot; or &quot;+&quot; button pressed, requesting an upshift</td>
</tr>
<tr>
<td>TOGGLE</td>
<td>Shifter button pressed to toggle between FULL-AUTO and SEMI-AUTO shifting</td>
</tr>
</tbody>
</table>

The **Autostick Calibration** group alternately contains calibration factors for decoding the **SHIFTER_STRAIN** analog input into the following functions if it is defined (cannot have **AUTOSTICK_ANALOG** input defined also):

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>No shifter button pressed</td>
</tr>
<tr>
<td>MINUS</td>
<td>Shifter &quot;minus&quot; or &quot;-&quot; button pressed, requesting a downshift</td>
</tr>
<tr>
<td>PLUS</td>
<td>Shifter &quot;plus&quot; or &quot;+&quot; button pressed, requesting an upshift</td>
</tr>
<tr>
<td>TOGGLE</td>
<td>Shifter button pressed to toggle between FULL-AUTO and SEMI-AUTO shifting</td>
</tr>
</tbody>
</table>

**GAUGES TAB**

This tab contains fields for calibrating the several types of gauges that can be mapped onto digital or analog outputs on the **Digital Outputs** and **Analog Outputs** tabs. Such gauges are driven by outputting a signal whose frequency or voltage varies based on the calibration factors entered in the tables on this tab.

- The leftmost number of each group is where you enter raw values for the output being tested and make the connected gauge move
- To calibrate each gauge, repeatedly enter test values until you find the raw numbers that cause the gauge needle move to each position in the calibration table for that gauge.
  - Range of values is between 0 and 32767

The **Speedometer Calibration** group contains calibration factors for driving a speedometer gauge, mapped to either the **VEHICLE_SPEED Analog Output**, or the **MPH_PULSE** or **FREESCALE_DATAL** Digital Output. The speedometer logic provides for a calibration entry at each of the following speeds: 0, 10, 20, 30, 40, 50, 60, 70, 80 mph (0, 16, 32, 48, 64, 81, 97, 113, 129 km/h). Speeds beyond that will be calibrated by extrapolating the last two entries.

The **Tachometer Calibration** group contains calibration factors for driving a tachometer gauge, mapped to either the **ENGINE_RPM Analog Output**, or the **RPM_PULSE** or **FREESCALE_DATAR** Digital Output. The tachometer logic provides for a calibration entry at each of the following engine rpms: 0, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000.

The **Fuel Gauge Calibration** group contains calibration factors for driving a fuel level gauge, mapped to the **FREESCALE_DATAL** Digital Output. The logic supports a calibration of "empty" (0%) and "full" (100%) levels.

The **Temp Gauge Calibration** group contains calibration factors for driving a temperature gauge, mapped to the **FREESCALE_DATAR** Digital Output. The logic supports a calibration of "full cold" (0%) and "full hot" (100%).
MOTION TAB

This tab contains a group of options for testing and calibrating a 1 or 2 axis motion platform mapped onto the MOTION_LATERAL and/or MOTION_LONGITUDNIAL analog outputs from the Analog Outputs tab. These outputs are driven with a DC voltage that varies in proportion to the filtered accelerations of the simulated vehicle. The motion base is assumed to respond proportionally to the voltage it receives.

The Motion Factors group includes the following parameters:

- **Accel Gain**
  Controls the amount of MOTION_LONGITUNAL output due to forward acceleration.
  - Units are Volts per G

- **Braking Gain**
  Controls the amount of MOTION_LONGITUNAL output due to braking.
  - Units are Volts per G

- **Lateral Gain**
  Primarily, controls the amount of MOTION_LATERAL output due to cornering. Also controls an amount to add to the MOTION_LONGITUNAL due to cornering, which can be a surprisingly effective motion cue to include with a single-axis (fore/aft) motion base.
  - Units are Volts per G

- **Vertical Gain**
  Controls the amount of MOTION_LONGITUNAL output due to vertical accelerations (e.g. bumps).
  - Units are Volts per G

- **Pos Limit**
  Specifies the maximum Positive voltage allowed on the MOTION_LONGITUNAL or MOTION_LATERAL output. Use this value to set the maximum safe mechanical travel of a simple motion base that lacks its own limiting circuitry.
  - Units are Volts
  - The Test Val parameter (below) can be used to help find an appropriate value for this limit.

- **Neg Limit**
  Specifies the maximum Negative voltage allowed on the MOTION_LONGITUNAL or MOTION_LATERAL output. Use this value to set the maximum safe mechanical travel of a simple motion base that lacks its own limiting circuitry.
  - Units are Volts
  - The Test Val parameter (below) can be used to help find an appropriate value for this limit.

- **Test Val**
  Enter a value here to send that voltage to the MOTION_LONGITUNAL and MOTION_LATERAL analog outputs and observe how far the motion platform moves in response to that voltage. It is recommended to start with voltages near 0.0 and work gradually higher to prevent possibly damaging the motion platform or simulator by commanding it to move beyond its design envelope. Also try toggling between positive and negative values to check the dynamic response which can lead to overshoot and needs to be accounted for when setting safe limits.
  - Units are Volts

- **Vibrations Amount**

- **Vibrations Frequency**
  These parameters together adjust the relative magnitude and frequency of a sine wave signal added to the MOTION_LONGITUNAL output in response to the texture of the road surface being driven on. Test drive the simulator across a variety of surfaces (dirt, gravel, grass, etc) and use these parameters to fine-tune the vibrations felt in the motion platform.
  - Units are Percentage of "standard".
  - Set to 100 % for "standard" level of vibration effects.
- Set Vibration Amount > 100 for stronger effects, or < 100 for weaker effects.
- Set Vibration Frequency > 100 for faster vibrations, or < 100 for slower vibrations.
- Set to 0 % to disable road surface vibration effects in the motion base.
11. Software Installation and PC Setup

This section describes the general steps for installing and setting up the Digital Vehicles simulation system from scratch on a new PC. This includes installing Windows 7, configuring the general system settings, installing drivers to support the specific motherboard and peripherals, installing a set of standard utilities useful with the simulation, and finally, installing and configuring the Trainer software itself.

WINDOWS 7 INSTALLATION AND GENERAL SETUP

For initial PC setup, plug in only a single monitor and use the standard Windows 7 video drivers until all the basic system configuration is complete. The VIDEO section below will describe how to install specific drivers and configure multi monitors.

Boot the new PC from a Microsoft Windows 7 Home or Professional OEM Edition disc, and follow the prompts to set-up Windows 7. It is best if you start with a custom-burned install disc of 7 that has SP3 and all hotfixes since then already integrated (for example using RyanVM Integrator and the QFE Post SP3 Update Pak from ryanvm.net). The following points are of particular note:

- Create and format a new NTFS partition on the hard disk which will become the C: drive.
- When prompted to "Personalize Your Software", enter a user name of "Simulator User", then the actual name of your Organization (e.g. "Simulation Technology").
- When prompted, enter the five part Product Key from the holographic coded sticker from the Microsoft wrapper, then stick it to the PC case, as directed.
- When prompted to enter the computer's name, enter something that fits a logical scheme, such as "OEM00001", where "OEM" is an abbreviation for your company's name, and "0001" is the serial number of this particular simulator PC.
- When prompted, set the correct date, time, and time zone.
- When prompted for "Networking Settings", choose "Typical settings".
- If prompted for a workgroup name, typically enter "MSHOME".

After the setup program finishes and the PC automatically reboots, Windows 7 will start for the first time and a wizard will prompt for several things:

- When prompted to "Help protect your PC", choose "Not right now".
- When prompted for "Who will use this computer?", enter "Simulator User" in the first box.

When the Windows desktop appears, set up some standard items:

- Click "Start", right-click "My Computer", then select "Show on Desktop".
- Click "Start", right-click "My Documents", then select "Show on Desktop".
- Click "Start", click "Accessories", right-click "Command Prompt", then select "Pin to Start menu".

Set standard Windows 7 Taskbar options:

- disable the "Language Bar" taskbar icon if present
- Click the balloon to start the "Tour of Windows 7" then Cancel to exit the tour
- right-click on the Taskbar, then select "Properties"->"Taskbar":
- uncheck "Lock the Taskbar"
- uncheck "Group similar taskbar buttons"
- uncheck "Hide inactive icons"

Turn off disruptive automatic Windows 7 Security Center alerts:

- click the Security Center icon in the taskbar, or use "Start", "All Programs"->"Accessories"->"System Tools"-> "Security Center"
- on the right, under "Manage security settings for:"
- on the left, click "Change the way Security Center alerts me"
- uncheck all three of "Firewall", "Automatic Updates", and "Virus Protection", so Windows will not pop up warnings that can disrupt the simulation while it is running.

Set some Control Panel options and change the User Account icon:
At this point, click "Start", then "Control Panel".

Choose "Switch to Classic View", then change the "View" to "Icons".

Set up the User Accounts:
- On the Control Panel, double-click "User Accounts".
- If present, change the name of the "Owner" account to "Simulator User".
- For the "Simulator User" account, use "Change my picture" and choose the old car.

Set up the Accessibility Options for minimal intrusiveness:
- On the Control Panel, double-click "Accessibility Options" and choose "Keyboard" tab.
- Click each of the three "Settings" buttons, and uncheck "[ ] Use shortcut".
- On the "Display" tab, uncheck "[ ] Use High Contrast"; also click "Settings" and uncheck "[ ] Use shortcut".
- On the "Mouse" tab, uncheck "[ ] Use MouseKeys"; also click "Settings" and uncheck "[ ] Use shortcut".

Set some standard Desktop options:
- Right-click on the Desktop, then select "Properties".
- On the "Desktop" tab, select the "Prairie Wind" background and apply.
- On the "Desktop" tab, click "Customize Desktop..." -> "General", then uncheck "Run Desktop Cleanup Wizard" every 60 days.
- On the "Screen Saver" tab, choose the "Mystify" screen saver.
- Click "Power" button then choose the "Presentation" Power Scheme.

Set standard, default Windows Explorer folder view options:
- Double-click "My Computer", double-click "C:" then "show contents of this folder".
- Right-click upper bar and check "Address Bar" = "Show".
- Click the "Views" button, then select "Details".
- Click "Tools" -> "Folder Options..." -> "View".
- Uncheck "Hide extensions for known file types".
- Uncheck "Hide protected operating system files".
- Click "Apply", then click "Apply to All Folders".

Enable network file sharing:
- Double-click "My Computer".
- Right-click "Local Disc C:"., then select "Properties".
- Click the "Sharing" tab.
- Click "If you understand the risk but still want to share the root of the drive, click here" (also "Just enable file sharing" -- no wizard).
- Check the box for "[x] Share this folder on the network" and accept "C" as the "Share name".
- Check the box for "[x] Allow Networked Users to Change My Files".

Enter a meaningful description and change some options for this computer:
- Right-click "My Computer", then select "Properties".
- Select the "Computer Name" tab and enter a description of this particular computer, with information like what kind of simulator it is or where it will be installed.

Disable Error Reporting to Microsoft, and Set a static virtual memory file:
- Continue with "My Computer" -> Properties" dialog, and choose the "Advanced" tab.
- Click the "Error Reporting" button and check the box for "Disable Error Reporting" and uncheck the box for "But notify me when critical errors occur".
- Click the "Settings" button in the "Performance" section, then "Advanced", then "Change" under the "Virtual memory" section. Enter a custom size with "4000" for both Initial and Maximum, then "Set".
- Eject the Windows installation DVDROM and restart the PC when prompted.

**WINDOWS 7 SYSTEM-SPECIFIC SETUP TASKS**

At this point, copy the complete Digital Vehicles installation DVDROM to the hard drive.
This will create full C:\3DPROJECTS and C:\SimulatorDatabase folder structures. Of particular interest during installation is the C:\3DPROJECTS\SUPPORT folder, which contains a wide variety of drivers and utility programs. Some of these items should always be installed on any new simulator. Others are provided as a convenience for dealing with particular hardware devices or certain versions of software.

It is beyond the scope of this manual to provide exact step-by-step details on installing and configuring all the hardware that goes into a new simulator PC, as there are simply too many variations. However, in general, each component will come with disks (or will have drivers downloadable from the internet) and you should follow the instructions provided by the peripheral manufacturer. Whenever possible, install only the minimum set of drivers needed to get a peripheral running, and decline to install other commonly bundled software like games or demos or desktop search toolbars and such.

Install registry patch to enable both "old" and "new" style NVIDIA control panels:

- go the folder C:\SimulatorDatabase\Video\Win2KXP
- follow the prompts to install the NVIDIA drivers, proceeding until the system restarts. With recent releases, choose a "custom" install, then uncheck "[ ] PhysX" and "[ ] NVIDIA Update", leaving checked "[x] HD Audio" and "[x] Nview" and "[x] Graphics Driver". Also check "[x] Clean Install".

Install NVIDIA drivers for the graphics board(s) being used

- plug in and power up all monitors (including mains and console) that will be used with the simulator system, and restart Windows so they are recognized as being attached at startup.
- note that it is usually best to use the disc provided with the boards, or download the latest drivers from the NVIDIA website, but there are several versions provided for convenience in the folder C:\3DPROJECTS\SUPPORT\Video
- follow the prompts to install the NVIDIA drivers, proceeding until the system restarts. With recent releases, choose a "custom" install, then uncheck "[ ] PhysX" and "[ ] NVIDIA Update", leaving checked "[x] HD Audio" and "[x] Nview" and "[x] Graphics Driver". Also check "[x] Clean Install".

### VIDEO

The simulation is optimized to run on graphics boards based on NVIDIA chipsets (from 5200 series through 8800 or greater). Other brands of graphics chips may work in single-screen mode, but using non-NVIDIA graphics is not supported or covered here.

Note that Windows 7 automatically detects what monitors are plugged-in and attached to the video board outputs each time it starts. If you ever power up the system with one or more monitors unplugged after following the instructions below to configure multiple monitors, Windows 7 will default back to a single moniters configuration and retain that incorrect configuration even if the additional monitor is later plugged in again. In that case, it will be necessary to repeat the steps below to restore the special multi-monitor configuration.

Install NVIDIA drivers for the graphics board(s) being used

- install chipset drivers (e.g. nvidia nforce 680i or Intel X58)
- install onboard Ethernet controller drivers (if applicable)
- note that copies of installation support files for several commonly-used simulator motherboards can be found in the folder: C:\3DPROJECTS\SUPPORT\Motherboard

Configure network drivers and get the system online:

- install drivers for either onboard Ethernet, or a plug-in card, as applicable
- on "Control Panel"->"Network Connections", right-click the connection, click "Properties", then:
  - uncheck "Show icon in notification area when connected"
  - uncheck "Notify me when this connection has limited or no connectivity"

Once online, activate Windows 7:

- click "Start", "All Programs"->"Accessories"->"System Tools"->"Activate Windows"
- follow the steps to Activate Windows over the Internet

Disable "Microsoft Update" in addition to "Windows Update":

- Internet Explorer->Tools->Microsoft Update->Change Settings->Disable Updates

Once online, download latest Windows 7 system updates from Microsoft:

- skip this step if using a custom Windows CDROM with pre-installed service packs
- start Internet Explorer and go to the URL: www.windowsupdate.com
- follow instructions to download and install all required updates listed by Microsoft
- restart and repeat until www.windowsupdate.com reports that no more updates are required
Configure graphics boards for multiple monitors and set the display resolutions:
- right-click the desktop, then click "Properties", then select the "Settings" tab:
  - for each graphics board that will be used, (e.g. "1", "2", and "3") right-click and choose "Attached" to enable that board (do this even if no monitor is physically plugged in yet).
  - click and drag the monitors shown to arrange them left-to-right into the order that makes the most sense, understanding that the left and right monitors will be both attached to the same board and configured in a "horizontal span" mode so that the mouse will move directly from the left to the right, skipping the center monitor which is on a separate board.
- right-click the desktop, then "NVIDIA Control Panel"
- choose "Manage 3D Settings" and set "Maximum pre-rendered frames = 2"
- for more graphics boards, select antialiasing options of Mode="Override any application settings"; Setting="16xQ": and Transparency="4x"
- confirm "Texture Filtering - Negative LOD bias" is set to "Allow"
- choose "Set SLI and PhysX configuration" and set PhysX="Enabled"; SLI="Do not use SLI"
- if using multiple monitors (3, 4, or 6), choose "Display" -> "Set up multiple displays" on the left:
  - for each graphics card with more than one monitor attached (select in the first menu):
    - choose "As one large horizontal desktop (Horizontal span)"
    - click "Apply" to apply the change
    - click "Yes" when prompted if you would like to keep the changes
- choose "Display" -> "Change resolution"
  - for each display connected (select in the first menu row):
    - set the resolution to match the native resolution of that monitor
    - click "Apply" to apply the change
    - click "Yes" when prompted if you would like to keep the changes
- close the NVIDIA Control Panel
- optionally, use the automated "RestoreDisplayConfiguration-XXX.bat" helper files

Manually install nView utility if it was not automatically installed
- extract a downloaded NVIDIA driver package to, say, "C:\NVIDIA\DisplayDriver\195.62\WinXP\English"
- go to that folder and open nView.cab, then copy all files to "C:\Program Files\NVIDIA Corporation\nView"
- go to that folder and run nViewSetup.exe
- after installation completes, open the Control Panel and "NVIDIA nView Desktop Manager"
- click "Enable" button

Configure nView utility in a standard way:
- nView is NVIDIA's desktop utility that helps manage multiple monitors; while not strictly required for running the Trainer program itself, it is generally helpful when working at the Windows desktop and the following standard options are recommended:
- right-click FixNViewStartupPathInRegistry.reg file to patch a bug that sometimes keeps nView from starting when Windows starts
- right-click the desktop, then select "nView Properties" (if not present, go to "Control Panel (classic view) > NVIDIA nView Desktop Manager")
- on the "Desktop Management" tab:
  - click ["Enable"] to enable the nView Desktop Manager
- on the "Windows" tab:
  - check ["x"] Prevent windows from opening off-screen"
  - check ["x"] Limit taskbar to a single display"
  - keep check of ["x"] Enable window spanning across multiple displays"
  - under "Open windows on" select "Start button display"
  - under "Reposition dialog boxes on:" select "Move to cursor display"
- on the "Hot Keys" tab:
  - click "Windows and Applications" -> "Move window to next display" and press "Alt + 0"
  - click "Window Manager" -> "Sent all windows to display" then "Add..."
  - select the 1st monitor listed then "Hot keystroke" and press "Alt + 1"
  - select the 2nd monitor listed then "Hot keystroke" and press "Alt + 2", etc.
- on the "Desktops" tab:
  - uncheck [" ] Enable multiple desktops"
- on the "Applications" tab:
  - note: this optional step prevents a BSOD crash when using ‘q’ to Quit on certain systems
  - click "Add", enter "trainer.exe", and click OK
select the new line, click "Disable" button, and uncheck "Enable nView desktop manager for this application"
repeat the above for "trainernetworked.exe", "trainerstandalone.exe", and "trainerdebug.exe"

Move the Taskbar to the "console" screen:
- Click and drag the Taskbar and drag it left or right, dropping it at the bottom edge of whichever monitor you want to be the "console" for controlling the simulator from Windows.

After successfully configuring the graphics boards and multiple monitors, restart Windows XP so the configuration will be "remembered" as the default going forward.

SOUND
Install and configure audio device
- install drivers for whatever audio hardware is being used (usually part of motherboard CD installation)
- it is normally best to install drivers from the disk that came with the hardware being used or to download the latest version from the manufacturer's website; however, several subfolders with common drivers may be found in C:\3DPROJECTS\SUPPORT\Sound:
  o Creative Labs (popular plug in sound cards)
  o RealTek High Definition Audio Drivers (integrated on many motherboards)
- after installing the appropriate drivers and software, connect the speaker system to the audio jacks, and use the appropriate manufacturer's utility to set up the sound system:
  o for example, open the RealTek "Sound Manager" taskbar icon and choose the "Audio I/O" tab
  o select the speaker configuration used ("2CH Speaker", "6CH Speaker", etc)
  o run a diagnostic to output a sound to each speaker individually and confirm that the test sound comes from the proper speaker
  o once all jacks from the sound system being used are plugged in and correctly identified, choose the "wrench" icon above the graphical jacks then check "[x ] Disable front panel jack detection" and uncheck "[ ] Enable auto popup dialog, when device has been plugged in"
- set the master software volume control to a suitable level (typically 100%) for use with whatever external hardware volume adjustments are being used

REQUIRED SUPPORT ITEMS
Install Dot Net Framework 2.0 and SP1 if needed (this step is normally not needed any more because it gets automatically installed above):
- go to folder C:\3DPROJECTS\SUPPORT\Required\Microsoft Dot Net Framework 2
- double-click and run "dotnetfx.exe"
- double-click and run "NetFx20SP1_x86.exe"

Install Adobe Acrobat Reader 8.0:
- required to view simulator documentation files in PDF format
- go to folder C:\3DPROJECTS\SUPPORT\Required\Adobe Acrobat Reader
- first, double-click the "disableupdates.reg" file to disable automatic updates
- run "AdbeRdr80_en_US.exe"
- follow prompts to install with default options
- let Adobe Reader start, accept the license, then check "[x] do not show at startup" and cancel the "Beyond Adobe Reader" dialog
- if present, "Help->Check for Updates->Preferences" uncheck "[ ] Automatically check for Adobe updates"
- delete "Adobe Reader SpeedLaunch" and "Adobe Reader Synchronizer" from the START->All Programs->Startup folder

Install DirectX 9.0c:
- only need to install this separately on Windows 7 versions prior to SP2 (pre-installed on later versions)
- go to folder C:\3DPROJECTS\SUPPORT\Required\DirectX9C
- run "DXSETUP.exe"

Install DivX 5.2.1 and other codecs:
- required to display embedded training videos encoded in DivX format
• go to folder C:\3DPROJECTS\SUPPORT\Required\DivX
  run "DivX521.exe"
• select "No thanks, just give me DivX" at the first prompt to decline the Pro version trial
• when prompted to choose which features of DivX to install:
  o check [x] DivX and [x] Generic MPEG-4 Playback Component
  o uncheck [ ] DivX Player 2.6
• wait a sec to be prompted to install the "Google Toolbar", choose "NO"
• the following is required to save webcam files into MPEG4 format:
• open subfolder, right-click "MicrosoftMPEG4/MPEG4VKI.inf" and choose "Install"
• the following is required to play back certain video files including the "Teens & Trucks" series:
  run "K-Lite_Codec_Pack_1020_Basic.exe", [x] Normal mode, UNCHECK all boxes for [ ] DirectShow subtitle filter", [ ] Tools", [ ] Explorer Shell Extensions", [ ] Miscellaneous"; then UNCHECK all boxes on the "Additional Tasks and Options" screen

Install Keylok security device driver:
• required to permit checking for the "Unlimited License" security dongle plugged into a USB port
• IMPORTANT: Do not plug in the USB key until prompted to do so!
• go to folder C:\3DPROJECTS\SUPPORT\Required\KeyLok Protection Dongle
• run "install.exe"
  o for "Dongle Type" choose "USB Dongle"
  o for "Installation Type" choose "Standalone"
  o click "Begin Install" and follow instructions
• when prompted, plug in the dongle and let the wizard automatically install it on that port; unplug and repeat for all available USB ports, to avoid future prompting to install drivers if the port is ever changed.
• note that dongle must be programmed with the appropriate type of profile file by DVI

Install "LCD" true type font:
• required for certain text to show in this specialty font, as intended
• copy C:\3DPROJECTS\SUPPORT\Required\LCD.TTF to C:\Windows\Fonts

Install Logitech Gamepad and/or Steering Wheel driver:
• required to support a gamepad controller which is used for adjusting the onscreen mirrors.
• supported models are either "Logitech Dual Action USB" or "Logitech RumblePad 2 USB"
• go to folder C:\3DPROJECTS\SUPPORT\Miscellaneous\Logitech Wheel
• run "lg509.exe " and follow prompts
• plug in a gamepad and let it recognize
• run the Logitech Profiler (from the toolbar) and select Options, then uncheck [ ] Start Profiler at system startup", then Exit the Profiler
• for the Logitech G27 steering wheel on a Rabbit Sim, use the Gamepads control panel to set "900 degrees" of rotation; also set the option to "[x] Start Logitech Profiler at Windows Startup"

MISCELLANEOUS SUPPORT ITEMS

Install the IconRestore and DesktopRestore utilities and save the desktop arrangement:
• go to folder C:\3DPROJECTS\SUPPORT\Miscellaneous\Icon Restore Utility
• run "icon_restore.exe" and install the utility with default options
• run "DeskInstU.msi" and install the utility with default options
• after arranging icons in the standard layout described below, save the arrangement by:
  o right-click "My Computer"-›"Save Desktop Icon Layout"
• if the icons ever get messed up, easily restore the standard layout by:
  o right-click "My Computer"-›"Restore Desktop Icon Layout"

Create and arrange a standard set of desktop icons:
• For each item in the table below, create a desktop shortcut and rename it as shown in the table:
• Create each shortcut by right-clicking the item and selecting "Send To"-›"Desktop (create shortcut)"
• Arrange the icons from left-to-right across the top of the "console" screen in the standard order shown.
Optionally install the PDF Redirect printer driver

Optionally install

Optionally install Mozilla

Optionally install

Optionally install TeamViewer Remote Access software:

Optionaly install the PDF Redirect printer driver

Optionaly install

Optionally install

Chapter 11. Software Installation and PC Setup

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• go to folder C:\3DPROJECTS\SUPPORT\Miscellaneous\PDF_Redirect Printer Driver
• run "Install PDFR.exe" and accept the defaults

Install a dummy default printer driver
• this is to serve in case the PRINT REPORT button is clicked from Trainer, there won't be any dialogs trying to pop up and crash Trainer.
• go to Control Panel->Printers and Faxes and "Add a printer"
• choose "Local printer" but uncheck "[ ] Automatically detect and install..."
• choose "LPT1:" and "HP LaserJet 4", then "Yes" to use as default printer.

Optionally install the Acronis True Image WD Edition hard disk utility:
• go to folder C:\3DPROJECTS\SUPPORT\Miscellaneous\Western Digital
• run "iih_s_e.exe" and accept the defaults for a "Complete" installation
• afterwards, delete the Acronis shortcut from desktop (automatically-created and bogus)
• right click the shortcut "Start Menu->All Programs->Acronis->XX->Acronis True Image WD Edition" and "Pin to Start Menu"

INSTALL MICROSOFT ACCESS RUNTIME AND TEST SIMULATOR DATABASE

Install the free version of Microsoft Access Runtime (if desired)
• this may be installed to allow student records to be imported into a database and basic report pages viewed onscreen, without requiring purchase and installation of the full version of Microsoft Access
• go to folder C:\SimulatorDatabase\SupportingItems\Access2003Runtime
• install the base version: run "SETUP.EXE" and follow prompts
• install the service pack: run "Office2003SP2-KB887616-Client-ENU.exe"
• copy a custom Banner.jpg file into C:\SimulatorDatabase for your company (if available)
• double-click the “Simulator Database” icon on the desktop (points to simdata.mdb), and observe that database loads and runs with the newly-installed Microsoft Access Runtime version
• choose "restore" to un-maximize database and size and center the default window appropriately

INSTALL SIMULATOR INTERFACE DRIVERS AND CONFIGURE SIMULATION

Download and install latest Simulator Updates:
• if downloading a ZIP file directly from the internet, right-click on the ZIP, choose Properties, then click the "[ Unblock]" button to let Windows know the EXE and BAT files within the ZIP are safe.
• typically you will "Extract All..." the ZIP to the "C:" directory to install, but check instructions for the specific update.

Install the Digital Vehicles DVC7 ISA port driver (if needed):
• this is only required for older systems with a DVC7 ISA card instead of a DVC8 USB controller
• to allow direct access to the ISA I/O ports from Trainer, install the PortTalk driver
• go to folder C:\3DPROJECTS\SUPPORT\Motherboard\PortTalk
• run InstallDriver.bat, then restart Windows.
• systems using the DVC7 interface are calibrated using the DVC7TEST program and editing the simcal.txt file (please contact Digital Vehicles for details of setting up these systems).

Install the Digital Vehicles DVC8 USB driver:
• the Digital Vehicles DVC8 is communicated through a Virtual Com Port ("VCP") driver that makes USB ports addressable as regular serial ("COM") ports.
• the drivers are installed "on demand" for each USB port the first time a DVC8 gets plugged into that port:
  o plug in the DVC8 to a USB port
  o a Windows "new hardware found" wizard will appear for a "USB Serial Converter" device
  o when prompted, choose "Install from a list or specific location (Advanced)"
  o check "Include this location in the search" then browse to the folder C:\3DPROJECTS\SUPPORT\Required\FTDI USB Drivers for DVC8 and CANUSB\CDM20802_plus_CANUSB
  o it should then automatically install the drivers (choose "Continue Anyway" if shown a Windows Logo testing warning)
  o another wizard will automatically run for the "USB Serial Port"; repeat the above steps
Run the DVC8UTIL hardware test and configuration utility:
- connect the simulator cab to the DVC8 controller and power on the simulator
- connect the DVC8 controller to a USB port
- run the DVC8UTIL program to map, test, and calibrate the driving controls of the attached simulator cab
- refer to the **DVC8UTIL Utility Program** chapter of this manual for full details

Install the CANUSB driver:
- the CANUSB is an optional interface to certain instrument clusters
- to install drivers, **plug the CANUSB into a USB port** and a wizard will appear. follow the same steps as when installing the DVC8 driver above, as this device uses the same FTDI driver files
- after driver installation, confirm the CANUSB works by running **CANUSBtest.exe**; choose "Get Adapters"; then ">>>"; then whichever button corresponds to the cluster that will be connected (e.g. "Spartan"); then "Open" and "Start/Stop Test Tick"; then "Exit"

Configure special sets of files for mirrors and menus, if needed:
- from `3DPROJECTS\altFiles`, run a "GET-XXX-sides-XXX.bat" file as appropriate for portrait or landscape side monitors
- from `3DPROJECTS\Trainer\dataFiles\Vehicles`, run a "GetMirrorsXXX.bat" file as needed for rabbits or other cabs with special eyepoints

Add items to Windows startup (except on Rabbit Sims):
- create and move Shortcut to **TrainerVideoCamsInitializer.exe** to All Programs->Startup
- create and move Shortcut to **CancelPrintJobs.bat** to All Programs->Startup

Run the SimConfig software configuration utility:
- run the **SimConfig** program to set up the desired options for the Trainer program
- refer to the **SimConfig Utility Program** chapter of this manual for full details

Run Trainer.exe and test for full operation of the simulation:
- send System ID Code to Digital Vehicles, and enter the **Registration Key** that's returned to unlock the software (defaults to 2 day grace period license otherwise)
- see the other chapters of this manual for full details

Configure Windows Firewall to allow network traffic from Trainer versions:
- go to "Control Panel->Windows Firewall->Exceptions", click "Add Program...", then browse to "3DPROJECTS\Trainer\Trainer.exe" and add that exception.
- Repeat for "TrainerNetworked4.exe", "TrainerStandalone.exe", "TrainerDebug.exe" to make sure any version of Trainer can communicate through the firewall.
- enable exceptions both "]x] Remote Assistance" and "]x] Remote Desktop" (on port 3389)

Run **Start Trainer Networked** and enter a unique PC name:
- the first time either "Start Trainer" batch file is run, you will need to accept the license agreement for Sysinternals pskill by choosing "OK"
- go to initial network dialog (click Cancel once)
- enter the name of this PC (e.g. "OEM0014") in place of the default "StudentName"
- choose "Start with Networking", "Create and Host a Session", then **Cancel** to save that name

**APPLY FINAL TOUCHES THEN BACKUP THE HARD DISK**

After everything is installed, updated, registered, and tested, it is recommended to make a complete backup clone copy of the main hard disk C: to the backup hard disk D:

Set special **BIOS/CMOS settings** and burn-in test the system:
- if appropriate, download and flash the motherboard with the latest BIOS
- press the Del key during initial bootup to access the BIOS/CMOS setup menus, as follows:
  - First, perform a "Load Defaults" to ensure a standard default starting state
  - Standard CMOS Features: "Halt On=All, But Keyboard"
- Advanced BIOS Features: "Boot Up NumLock Status=Off"
- Frequency/Voltage Control: "Dummy O.C. =Enabled"
- Memory Control: select "XMP1" profile if available
- boot the system and select the "final" SimConfig options you intend to ship the system with (done from "SimConfig->Load File" of the appropriate default "Simulator-XXX.cfg" file)

After overclocking, stress-test and burn-in the system:
- Run "prime95" for a while to apply maximum stress to the CPU and memory subsystems
- Run SimConfig and set "VSync Mode" = "Benchmark Test"
- Run Trainer for a while with all screens active and running at max framerate to apply maximum stress on the video subsystem.
- Be sure to return "VSync Mode" = "Normal" when done with the burn in.

Organize the Desktop and Start menus:
- Arrange icons per standard arrangement on the console screen
- Delete any unnecessary icons from the desktop
- Press Ctrl-Alt-Del and move the Task Manager window to the console screen then close it
- from Start menu, right-click on the "All Programs" list and select "Sort by Name"
- make the list of items pinned to the Start Menu be as follows:
  - Firefox, Internet Explorer, Command Prompt, Acronis True Image, RestoreDisplayConfigXXX.bat
  - remove MSN, etc from lower part of list
- Empty the Recycle Bin

Create a "System Restore" point by name when everything is set up and working
- click "Start->"All Programs"->"Accessories"->"System Tools"->"System Restore"
- select "Create a restore point" then click "Next"
- enter a description, such as "Pre-shipment Snapshot" and click "Create"
- if ever needed in the future to recover from inadvertent or malicious tampering with the system:
  - run System Restore
  - select "Restore my computer to an earlier time"
  - choose this named restore point

Use the Acronis True Image WD Edition software to clone the hard drive:
- add a new folder "C:\Acronis Backups"
- launch the Acronis software and choose "No" if when asked if you want to prepare a blank disk drive that was found
- choose "Backup" then "My Computer" then "Disks and Partitions" then click the "C:\Acronis Backups" folder and enter a filename such as "OEM0014 System State" then "Next" several times and perform the system state backup.
- choose "Backup" again, then "My Computer" then "System State" then click the "C:\Acronis Backups" folder and enter a filename such as "OEM0014 Full Backup" then "Next" several times and perform the full backup.
- choose "Clone" and accept defaults to Automatically clone Drive 1 (C:) to Drive 2 (E:)
- after cloning finishes, restart and rename the hard drives as below:
  - double-click "My Computer"
  - rename C: from "Local Disk" to "Main Disk 00XX" (where XX is this serial number)
  - rename E: from "Local Disk" to "Backup Disk 00XX"
12. Maps of the Simulated Environment

MAP OF OVERALL SIMULATED ENVIRONMENT

Simulator Overview Map
Chapter 12. Maps of the Simulated Environment

MAP OF WESTON TOWN

WESTON TOWN MAP
MAP OF BUS/TRUCK TRAINING AREA
Figure 9: Competency course diagram.
### Keyboard and Mouse Functions Available while Driving

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Esc</strong></td>
<td><strong>EXIT SCENARIO</strong>&lt;br&gt;Exit the current scenario, but continue with the next lesson in the sequence</td>
</tr>
<tr>
<td>Shift-Esc</td>
<td><strong>EXIT ENTIRE LESSON</strong>&lt;br&gt;Exit the current scenario, and cancel the rest of a lesson sequence</td>
</tr>
<tr>
<td>SPACE</td>
<td><strong>FAST FORWARD SCENARIO</strong>&lt;br&gt;Rapidly advance time in scenario (affects traffic lights and other vehicles)</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td><strong>RESTART</strong>&lt;br&gt;Restart the current scenario</td>
</tr>
<tr>
<td>Q</td>
<td><strong>QUIT PROGRAM</strong>&lt;br&gt;Quit program and exit to Windows</td>
</tr>
<tr>
<td>X</td>
<td><strong>EXIT PROGRAM</strong>&lt;br&gt;Exit and restart program</td>
</tr>
<tr>
<td>D</td>
<td><strong>DISTRACTION</strong>&lt;br&gt;Triggers cell phone distraction (in cockpits with a phone)</td>
</tr>
<tr>
<td>W</td>
<td><strong>WIND</strong>&lt;br&gt;Cycles through amounts 0 (calm) to 5 (strong gusts)</td>
</tr>
<tr>
<td>G</td>
<td><strong>GAMMA</strong>&lt;br&gt;Cycles through gamma color map setting 0 to 7</td>
</tr>
<tr>
<td>C</td>
<td><strong>CENTER STEERING</strong>&lt;br&gt;Re-centers steering wheel at current position</td>
</tr>
<tr>
<td><strong>F1 / Shift-F1</strong></td>
<td><strong>FOG</strong>&lt;br&gt;Cycles through amounts 0 (clear) to 5 (very dense)</td>
</tr>
<tr>
<td><strong>F2 / Shift-F2</strong></td>
<td><strong>RAIN</strong>&lt;br&gt;Cycles through amounts of rain from 0 to 100%</td>
</tr>
<tr>
<td><strong>F3 / Shift-F3</strong></td>
<td><strong>SNOW</strong>&lt;br&gt;Cycles through amounts of snow from 0 to 100%</td>
</tr>
<tr>
<td><strong>F4 / Shift-F4</strong></td>
<td><strong>DAY/NIGHT</strong>&lt;br&gt;Cycles through 10 times of day (day, dusk, night, dawn, etc)</td>
</tr>
<tr>
<td><strong>F5 / Shift-F5 / Ctrl-F5</strong></td>
<td><strong>ECONOMY CAR / SEDAN / SPORTS CAR</strong>&lt;br&gt;Change to new vehicle and restart scenario</td>
</tr>
<tr>
<td><strong>F6 / Shift-F6 / Ctrl-F6</strong></td>
<td><strong>LARGE SUV / SMALL PICKUP / SEMI-TRUCK</strong>&lt;br&gt;Change to new vehicle and restart scenario</td>
</tr>
<tr>
<td><strong>F7 / Shift-F7 / Ctrl-F7</strong></td>
<td><strong>AMBULANCE / DUMPRUCK / POLICE</strong>&lt;br&gt;Change to new vehicle and restart scenario</td>
</tr>
<tr>
<td><strong>F8 / Shift-F8 / Ctrl-F8</strong></td>
<td><strong>BUS / HAUL TRUCK / HUMVEE</strong>&lt;br&gt;Change to new vehicle and restart scenario</td>
</tr>
<tr>
<td><strong>F9</strong></td>
<td><strong>ANTI-LOCK BRAKES</strong>&lt;br&gt;Toggles ABS braking off and on</td>
</tr>
<tr>
<td>F10</td>
<td><strong>unavailable</strong></td>
</tr>
<tr>
<td>F11</td>
<td><strong>VEHICLE INFO READOUTS</strong>&lt;br&gt;Toggles &quot;Football Field&quot;, &quot;Friction Circle&quot; and &quot;Traction Gauge&quot; graphics off and on</td>
</tr>
<tr>
<td>F12</td>
<td><strong>COPILOT MODE</strong>&lt;br&gt;Toggles scenario vocal prompts off and on; Also disables &quot;drunk collision&quot;</td>
</tr>
<tr>
<td>1</td>
<td><strong>NORMAL DRIVING MODE</strong>&lt;br&gt;Return to normal driving mode from special modes below</td>
</tr>
<tr>
<td>2</td>
<td><strong>CAR INFO MODE</strong>&lt;br&gt;Display numeric data about current vehicle state</td>
</tr>
<tr>
<td>3</td>
<td><strong>SCENARIO SYMBOL EDITOR</strong>&lt;br&gt;For internal use only</td>
</tr>
<tr>
<td>4</td>
<td><strong>PARKED VEHICLE EDITOR</strong>&lt;br&gt;For internal use only</td>
</tr>
<tr>
<td>5</td>
<td><strong>MOVING VEHICLE EDITOR</strong>&lt;br&gt;For internal use only</td>
</tr>
<tr>
<td>6</td>
<td><strong>unused</strong></td>
</tr>
<tr>
<td>7</td>
<td><strong>SCENARIO EVENT EDITOR</strong>&lt;br&gt;For internal use only</td>
</tr>
<tr>
<td>8</td>
<td><strong>SNOOZE MODE DEMO</strong>&lt;br&gt;Makes fatigue demo eyelids close and open</td>
</tr>
<tr>
<td>9</td>
<td><strong>SCREEN CAPTURE MODE</strong>&lt;br&gt;Toggles saving of screen images to BMP files off or on</td>
</tr>
<tr>
<td>0</td>
<td><strong>unused</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mouse Left Press</th>
<th>POINTER ARROW</th>
<th>Displays a pointer arrow on screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse Right Click</td>
<td><strong>PAUSE / REPLAY</strong>&lt;br&gt;Pauses driving and invokes replay mode</td>
<td></td>
</tr>
<tr>
<td>Mouse Center Wheel Press</td>
<td><strong>CHANGE VIEW</strong>&lt;br&gt;Cycle through DRIVER'S EYE / BIRD'S EYE / TRACKING CAMERA views</td>
<td></td>
</tr>
<tr>
<td>Mouse Center Wheel Roll</td>
<td><strong>ZOOM IN/OUT</strong>&lt;br&gt;Zoom in or out (when in bird's eye or tracking camera view)</td>
<td></td>
</tr>
</tbody>
</table>