A MANUAL FOR FORCECONTROL 4.
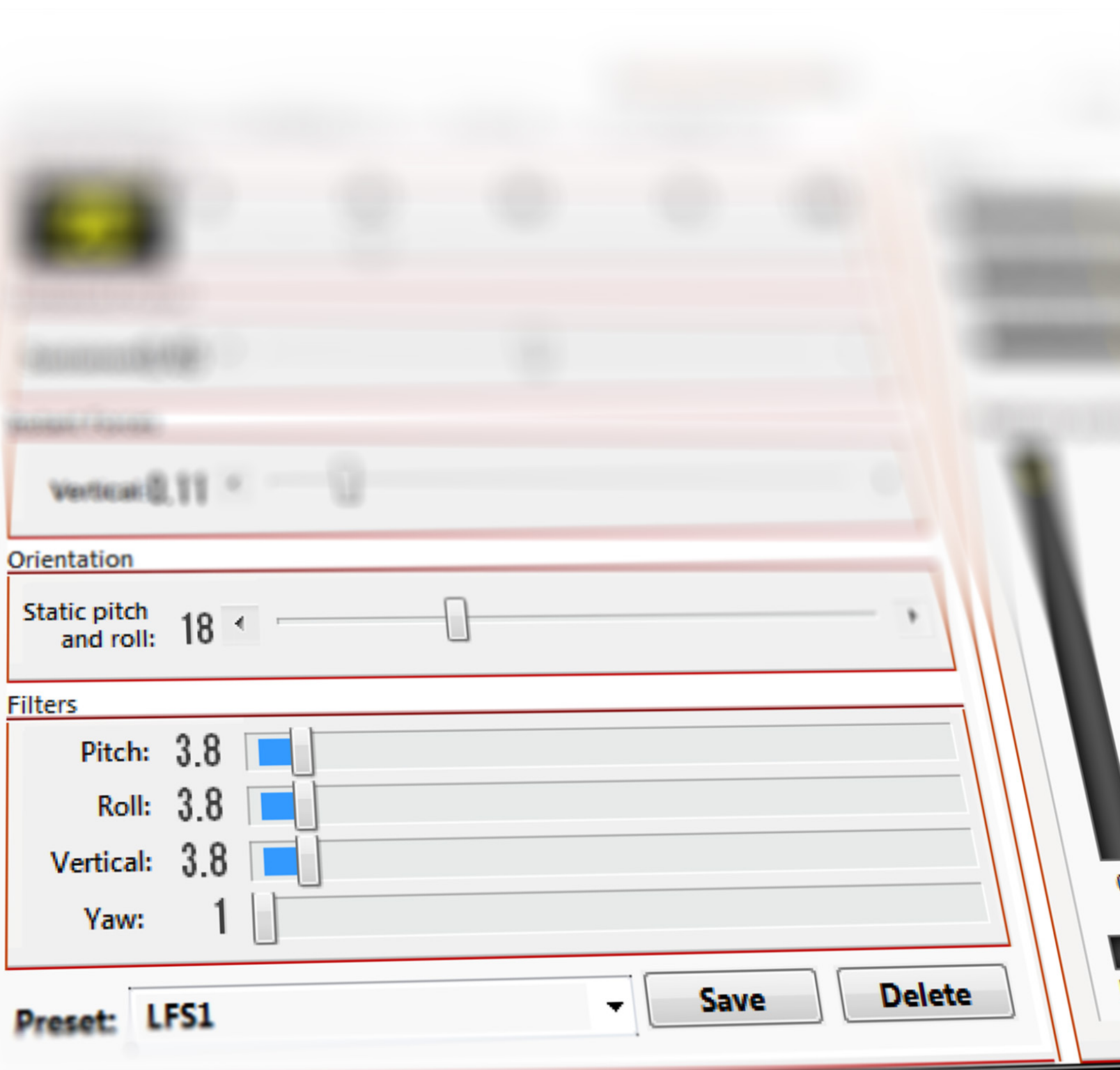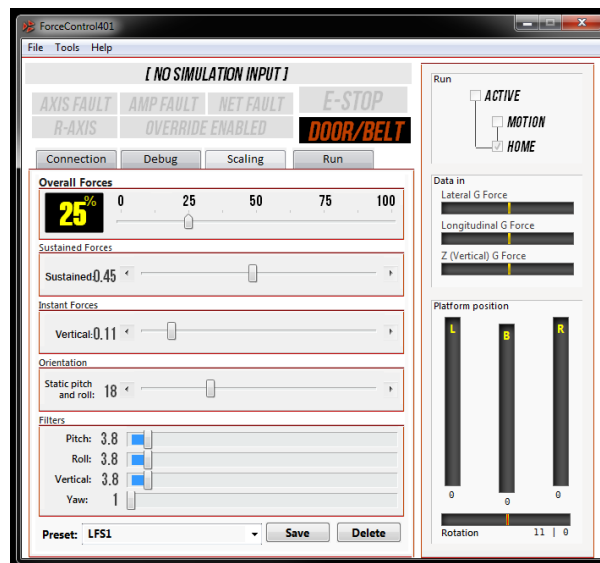
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FORCECONTROL

Note: Most Force Dynamics systems, including all 301s and all 401cr models, can run ForceControl 5. We strongly recommend upgrading if possible; see the ForceControl 5 manual for instructions. We've moved documentation for legacy versions of ForceControl to this document.

MAIN SCREEN

Despite appearances, ForceControl is a fairly simple application. The best way to understand it is to walk through it visually - so that's what we'll do here - first the main screen, and then each of the four panels (**Connection**, **Debug**, **Scaling**, and **Run**) in turn.

Simulation Input

The top-left text bar shows the status of input to ForceControl. At this time it's worthwhile mostly to determine if data is coming in; its identification of the game in question is determined by the setup of the game's output plugin or by the game-makers themselves, and so is often incorrect. This will be rectified in a future release.
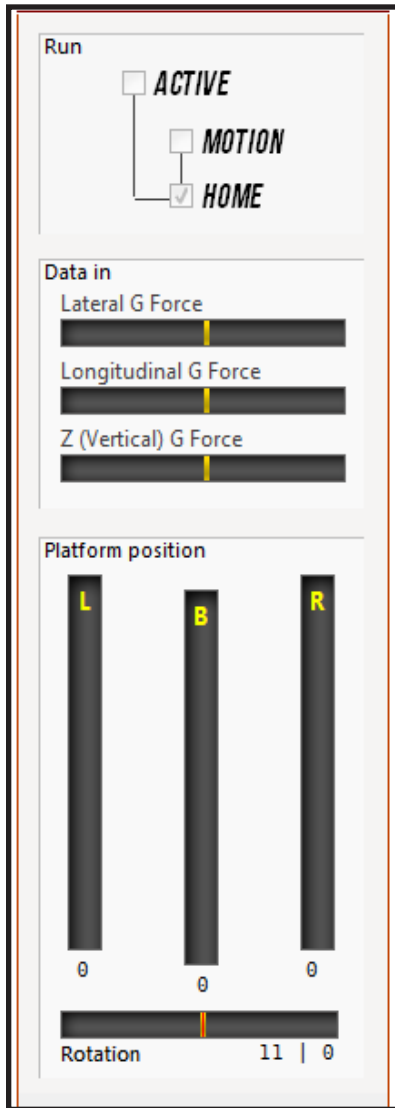
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Idiot Lights

AMP FAULT: An amplifier or motor encoder failure has been detected. This is a severe fault usually indicating fatal hardware damage.

NET FAULT: No connection is available between ForceControl and the simulator. Usually this is caused by a disconnected network cable, or, more commonly, a misconfigured IP address in the **Connection** panel.

E-STOP: An emergency stop button has been pushed, cutting power to the simulator.

R-AXIS: On if the rotation axis of a non-continuous-rotation 401 hasn't been centered.

OVERRIDE ENABLED: The simulator is in manual mode, meaning it can be zeroed, have the rotation axis brake and motor turned off for manual positioning, and so forth.

DOOR/BELT: Either the door is open or the seat belt is unlatched. In either case, the servos will be turned off and movement of any kind will be unavailable.

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Right Panel

The right panel shows overall information and controls for the simulator.

Run

If you're not using the Run pane in the main window, this is the most important part. Each of the *ACTIVE*, *HOME*, and *MOTION* (*REACTION* in older versions of ForceControl) buttons must be checked in order to begin movement. *ACTIVE* enables power to the servo system, *HOME* lifts the platform to its ready position, and *MOTION* starts the machine responding to any input received.

Data In

The bar graphs here display information about vehicle data being sent from the game. **Lateral G Force** refers to the car's cornering left and right, with left-hand cornering sending the bar to the right. **Longitudinal G Force** shows acceleration as bar motion to the right and deceleration vice versa, and **Z (Vertical) G Force** shows a vertical rise to the right and a fall to the left.

Platform Position

These bars show the length of each strut - left, back, and right respectively. A fully-red bar means the strut is completely extended.

In the 401, the bottom graph shows rotational position from -180 to +180 degrees; on the 401CR, it shows the angular velocity (speed of rotation).

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CONNECTION

Network and Servo System Status

TCP Connected
UDP Connected

Servo Code On

Network Settings

	IP Address	Port
Motion Platform:	192.168.0.101	200
Game Computer:	Waiting...	25010
This Computer:	192.168.0.67	
Remote Control:		25011
Remote Control Listen Port:		20011

Apply

Network and Servo System Status

The control computer communicates with the simulator via two methods - **UDP** for fast communication and **TCP** for critical information. Both must be connected for the motion platform to function.

In addition, firmware written to the servo controller ('Galil') is in constant contact with ForceControl; if it is corrupted, has been halted, or was erased, **Servo Code On** will change to a red **Servo Code Off**. Likewise, **TCP Connected** and **UDP Connected** change to **TCP Disconnected** and **UDP Disconnected** if a connection has been lost.

The usual culprit for TCP and UDP disconnections (which most often happen together) is an incorrect **Motion Platform IP address**; next-most-likely is a disconnected cable.

Network Settings

The IP address and Port of the motion platform is set here (**Remote Control** is an advanced feature for custom installations, and isn't covered in this manual). Additionally, the current IP address of the Control Computer is shown, as well as the IP address of the game computer (or any other computer sending appropriate data!).

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Code

Erase	code from servo system
	Write code to servo system
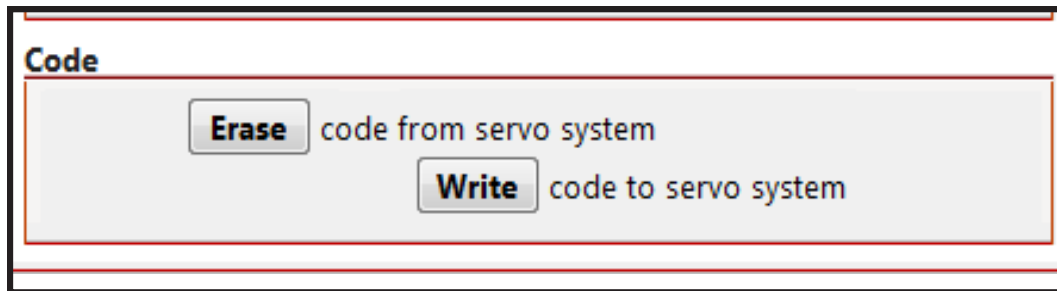
Code

Code refers to the firmware which runs continually on the motion platform. The firmware retains a connection with the control computer, returns data pertaining to the status of the motion platform, and handles internal safety checks. The simulator will not operate without the firmware operational (see above).

A 'matching set' of firmware code is stored in ForceControl, and any copy of ForceControl can update the simulator with its version of code. To do this, click **Erase** to erase the current code, wait until the buttons become available again, and then click **Write**.

It's also possible to click **Write** to restart the code if it's been stopped since the last simulator startup, but doing this will overwrite any existing firmware.

Be sure you don't have customized controller software or settings before writing code!

Erase: Deletes existing code from the servo controller, leaving it 'blank'. The simulator is nonfunctional in this state.
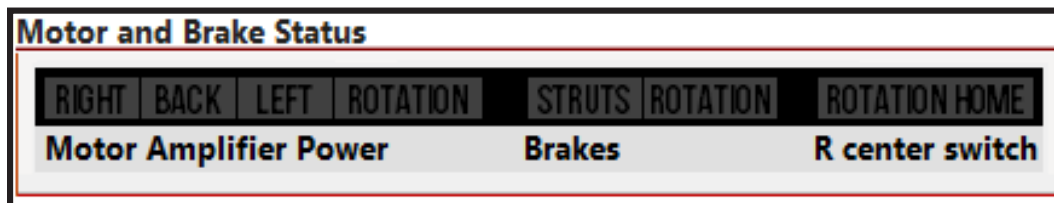
Write: Writes and runs a copy of the servo code.

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DEBUG

As the name suggests, the debug panel isn't for everyday use. When you do need to use it, you'll probably be in contact with Force Dynamics - but here's a description of the contents anyway.
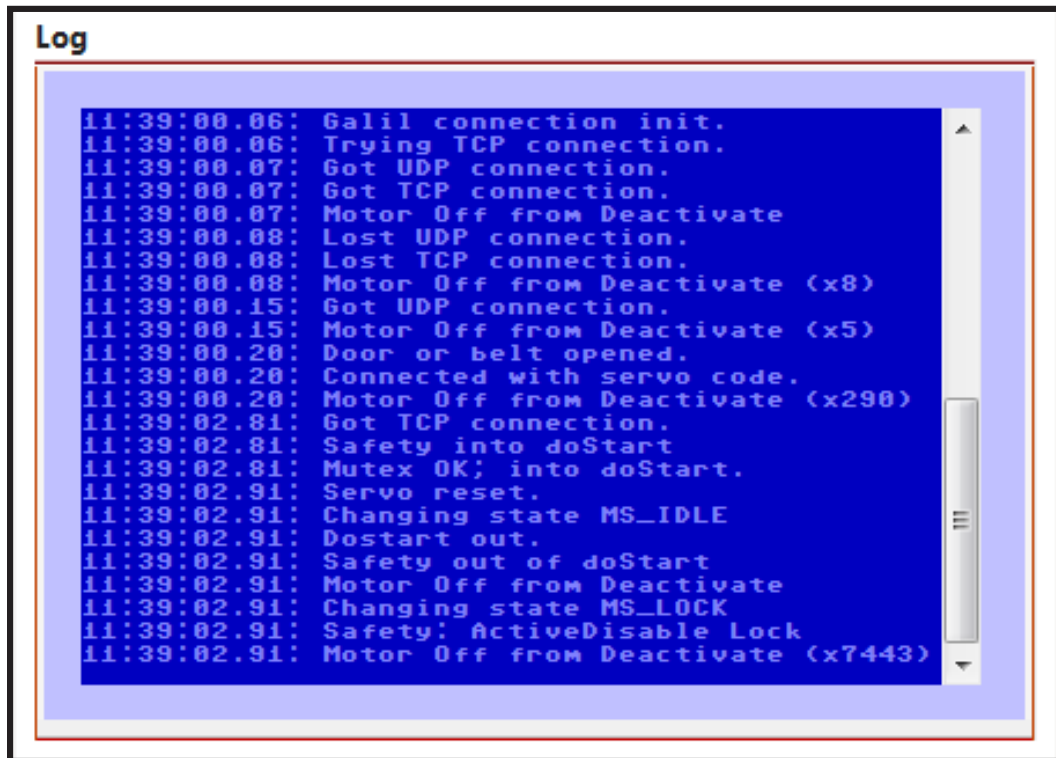
Motor and Brake Status

Motor Amplifier Power displays the power status of the amplifiers for each of the three struts and the rotation axis in the motion platform; a green light indicates a powered (active) servo.

Brakes indicates the status of the strut brakes. Green indicates that the brakes are off, meaning the struts are 'allowed' to move. The brakes and amplifiers should never be off at the same time; this is enforced by the ForceControl software, by the firmware running on the controller, and by hardware circuits built into the simulator's electronics.

The **R center switch** lights in concert with the rotation sensor on non-CR 401s; a transition indicates the center position.

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LOG

Log
```
11:39:00.06:  Galil connection init.
11:39:00.06:  Trying TCP connection.
11:39:00.07:  Got UDP connection.
11:39:00.07:  Got TCP connection.
11:39:00.07:  Motor Off from Deactivate
11:39:00.08:  Lost UDP connection.
11:39:00.08:  Lost TCP connection.
11:39:00.08:  Motor Off from Deactivate (x8)
11:39:00.15:  Got UDP connection.
11:39:00.15:  Motor Off from Deactivate (x5)
11:39:00.20:  Door or belt opened.
11:39:00.20:  Connected with servo code.
11:39:00.20:  Motor Off from Deactivate (x290)
11:39:02.81:  Got TCP connection.
11:39:02.81:  Safety into doStart
11:39:02.81:  Mutex OK; into doStart.
11:39:02.91:  Servo reset.
11:39:02.91:  Changing state MS_IDLE
11:39:02.91:  Dostart out.
11:39:02.91:  Safety out of doStart
11:39:02.91:  Motor Off from Deactivate
11:39:02.91:  Changing state MS_LOCK
11:39:02.91:  Safety: ActiveDisable Lock
11:39:02.91:  Motor Off from Deactivate (x7443)
```

Log

The log displays time-coded events as they happen, often in excruciating detail.

Most entries are self-explanatory for anyone who is already interested. For the curious, MS_ BLANK statements refer to the state of the machine (Machine State) as it changes; some entries which appear redundant (such as 'Motor Off') refer to actions internal to the source code and, for example, don't necessarily indicate that the motors have been turned off more than once without having been turned on in between!

Where a given event occurs more than once in a row, a multiplier appears at the end of the line and the timecode updates to the most recent event.

In this screenshot, Motor Off from Deactivate is shown as having happened 7443 times in a row; this is due to a quirk in the way the state system works. It is useful during internal code debugging — and at just about no other time at all!

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UDP Reply:		30	TCP Reply:		10	
inFault:	0	Timer Rate:	8	erCount:	510	

Bottom area

This area contains cryptic and detailed information which is useless to a normal user.

UDP Reply: The time, in milliseconds, since the last UDP-protocol message from the simulator.

TCP Reply: The same as UDP, but for the TCP protocol instead.

inFault: The recent number of input faults reported by the servo controller. If you don't know what that means, you don't need to.

Timer Rate: The overall rate, in milliseconds-per-cycle, at which the control software is operating. Numbers over about 25 indicate slowdowns in processing or other serious problems.

erCount: The number of recent errors reported by the servo controller. An 'error' does **not** necessarily mean there is a problem outside the bounds of normal operation!

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SCALING

You'll be spending a lot of your time here, since it's where you set up and save profiles for various games (and various vehicles within games). These sliders control how the simulator responds to different aspects of vehicle motion.

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Overall Forces

Overall Forces acts as the volume knob for the simulator's strut motions (yaw is independant in the 401 models). Turn it down to zero, and you get nothing - turn it up to 100% and the maximum available range is used.

An important point to remember is that, as with the volume knob on an amplifier, turning the 'volume' down won't smooth out a signal which is 'distorted' at the input phase. In other words, if the game is sending signals which max out the individual force sliders, a harsh clip will be felt in the simulator - even if low overall forces are used. Overall Forces is useful to set the maximum motion of impacts or other transients (sharp spikes in force).

For example, if you set overall forces to 100% and Sustained Forces to an arbitrary .50, a motion to .25 on the sustained sustained scale will move the simulator to half scale, and a sudden impact will spike the simulator to full scale. However, if Overall Forces is set to 50% and Sustained Forces is set to .50, a motion to .50 on the sustained scale will also move the simulator to half scale - but a sudden impact will move the simulator the same amount.

If you think this seems a little difficult to conceptualize, you're not wrong. The best way to get a feel for things is to take a car out on a skid pad in Live For Speed or iRacing, and play with the motion sliders in a controlled environment. And, conveniently, both Live For Speed's and iRacing's skid pads have walls all around them to provide a test area for those big transients!

Sustained Forces

Sustained Forces scales the continual lateral and longitudinal accelerations experienced by the vehicle. If a car corners consistently to the left, the driver feels a pull to the right hand side, and this pull is constant as long as the acceleration force is constant. A higher Sustained Forces value will tilt the simulator more, to give the feel of continual acceleration.

Instant Forces

Our term for vertical forces. Set this slider higher for more road surface feel, curb feel, and so forth; set it lower to smooth things out. Our feedback from drivers and trainers suggests that a little goes a long way, so start low and work your way up. If it feels like too much, it probably is.

In certain games such as rFactor, it can be helpful to turn off these forces entirely if you encounter 'porpoising' or other violent up-and-down motions that don't seem to go away no matter how smoothly you drive.

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Chassis Reference

Chassis Reference refers to the static (motionless) orientation of the car. Park your car on a slope, and it will tilt one way or another; Chassis Reference scales how much of that slope is felt.

In oval racing, the balance between Chassis Reference and Sustained Forces is particularly important. Include too much Chassis Reference and the car will tilt to the left while cornering, which is obviously incorrect. Include too little Chassis Reference and the car will tilt to the right even under low-speed cornering when the feel of the banking would normally overcome the lateral acceleration.

Why can't we just force the 'correct' amount? It's not that simple, unfortunately: Lateral loads in real race cars significantly exceed the maximum sustained force we can generate with a rotating motion platform; even if the 301 or 401 were to rotate 90 degrees to the side, it wouldn't help, since many race cars can easily generate more force. Since different kinds of motorsport have different requirements, and since different aspects are more (or less) important, we leave the compromise up to the user in order to leave maximum flexibility.

Filters

These filters act to smooth out rough or buggy game output (or game output of rough buggies, if that's your thing).

Numbers under 3 and over 9 are almost never used; the smoothest games, such as Live For Speed, tend to react best at around 3.8 or 4.0 for each setting, whereas some mods for rFactor require pitch settings of between 7 and 9 to be comfortable.

As always, there's a tradeoff: The higher the number, the smoother the output. But the longer it will take to feel forces. Pitch filters over about 6 start to dull the feel of braking and acceleration; roll filters over 6.5 cause problems with lateral accelerations and cornering.

Vertical filtering is more forgiving, but beware of large Instant Force settings combined with large filter settings, as seasickness can become a problem!

The same caveat, incidentally, goes for pitch and roll. Compensating for filtering by turning up force amounts can sometimes yield positive results, but more often than not, it will leave your car simulator feeling like a boat simulator. Proceed with caution!

Presets

This is pretty much self-explanatory. Click in the box to name your preset, and click **save** to store it. To delete a preset, load the preset you wish to delete and then click **delete**. All done!

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QUICK RUN
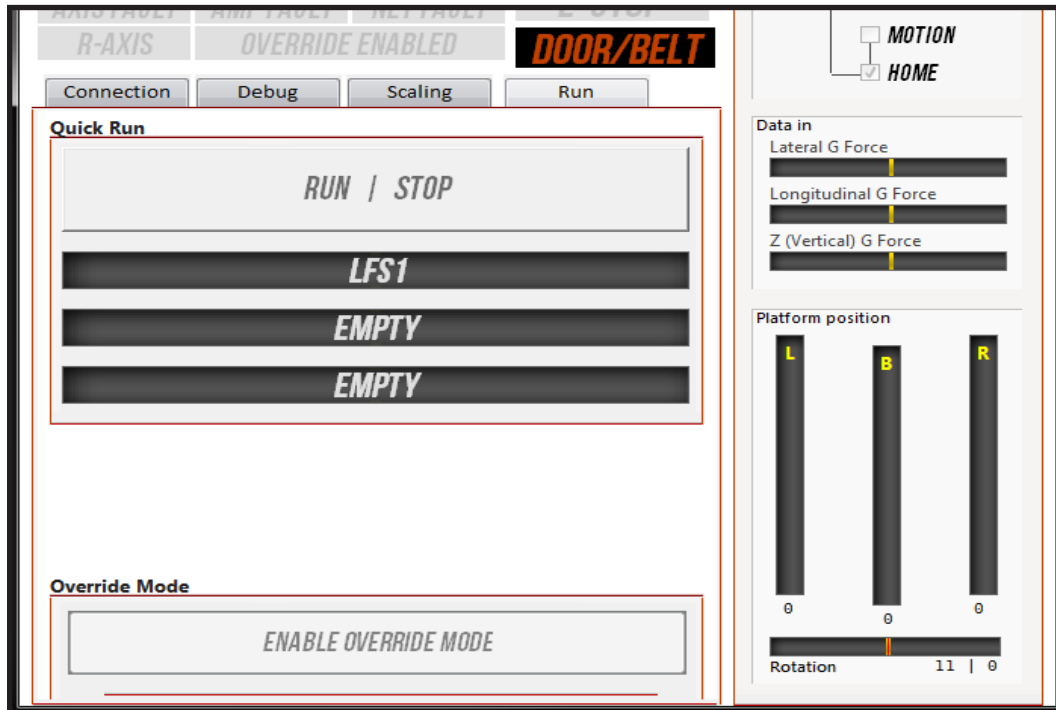
Run / Stop

Essentially, this automates the check **ACTIVE**, uncheck **HOME**, check **MOTION** sequence. It's a shortcut to starting machine motion without multiple steps.

Preset List

This list is, like before, a shortcut — in this case, to the three most-recently-used presets. Click on one to activate that preset; if you return to the **Scaling** panel, it will be selected and ready to modify, replace, or delete.