Iris Dynamics Ltd.

RAVEN-6DoF

MOTION PLATFORM DEVELOPMENT KIT

Fact Sheet

Pictured: Raven-6DoF reference design

Overview

Raven-6DoF Development Kits are the essential hardware/software combo required to produce compact, transportable, single-seat motion platforms which meet the challenges posed by virtual reality simulation and entertainment. The Raven-6DoF combines Orca Series™ linear electric motors, a pneumatic offset system, and a high speed motion controller to provide a new and powerful way to realize Stewart platforms.

This kit combats Virtual Reality motion sickness, enables high bandwidth stabilization or vibration, can support payloads up to 350 kg, and can plug into a standard wall outlet drawing only 300 Watts. The Orca Series linear motors operate silently and provide highly dynamic motions in a compact and power efficient package.

The kit enables many combinations of base plate and top plate geometries for designers that want to tailor the form factor or focus on certain DoFs. As a bonus, the motion controller provides position feedback which enables quality VR headset motion cancellation without the need for additional sensors.

Key Features

Custom Geometries
300 W Single-Phase Wall Outlet Operation
Quiet Motion
Low Latency
Highly Dynamic Motions
Flexible API
Flexible Reference Design
Simple USB Graphical Interface
Fast and Accurate Kinematic Models
Force-feedback

Kit Contents

Hardware

- 6x Orca15-48V intelligent linear motors
- FPGA + Linux powered motion controller
- Automated pneumatic solenoid controller
- Bill of materials and reference design

Software

- 6-DoF Kinematic models
- Acceleration onset cueing algorithms (optional)
- Diagnostic, Logging, and Development GUI (USB)

Who should use Raven-6DoF?

Simulator designers, VR entertainment providers, and other OEMs stand to benefit from this development kit.

Why use Raven-6DoF?

Compared to the other options for 6DoF motion, this development kit is smaller, easier to power, provides more customization, and more effectively solves VR motion sickness.

What does Iris Dynamics provide?

We are here to support you over the full course of commercialization and fundamentally measure our success with yours.

Evaluation

Our software development kit contains some examples and demonstrations to get the Raven-6DoF moving without any further software. The reference design and bill of materials provide a good starting point for a generic single-seat platform and our engineers can provide advice and support when implementing it or some derivative.

Adoption

During software integration, our documentation, SDK, and engineers will assist with implementing the API and using the various safety and control features built into the controller.

Our mechanical engineers stand by to advise on custom platform geometries and methods to ensure a rigid and safe structure.

Post-Deployment

Our software can log performance statistics that you can analyze alone or with our team to identify issues with the incoming commands or performance of the device.

What do Platform Designers provide?

The development kit affords customization and the opportunity to be creative. The specific design, manufacturing, and assembly of the completed kit are not provided. A completed kit may deviate as much or as little from the reference design as required for a particular application, which leaves a lot of room for smart designers to set themselves apart in their market.

Talk to our Application Specialists

Orca Series linear motion

Several key benefits of the Raven-6DoF stem from the six Orca15-48V motors combined with their pneumatic offset addons. Orca Series motors are permanent magnetic, air core linear motors which provide several advantages over ballscrew or other competing technologies.

Silent Operation
Cogless and contactless action means riders are propelled only by magnetic fields. Less platform noise promotes better immersion and conversation opportunities for riders.

Low Voltage
Electricians will not be required as the motors are powered by a 48 V battery and a 300 W AC charger.

Energy Recapture
Large motions on the platform result in energy recapture as the back-emf from the linear motors is returned to the battery.

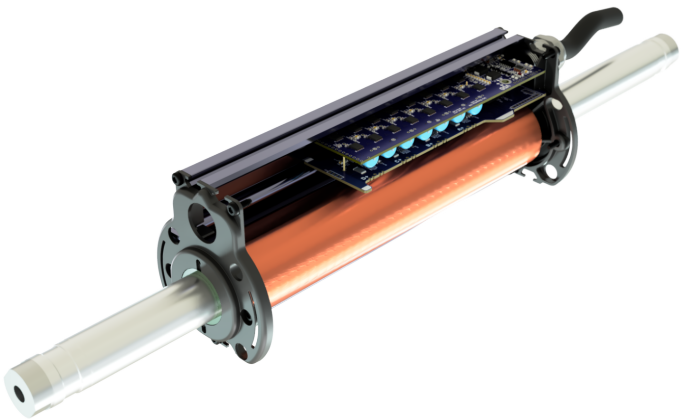
Integrated Sensors
Contactless sensors resolve actuator position to within ±0.1 mm and forces to within 2%. These parameters are resolved more than 3000 times per second in each motor.

Force Controlled
Each motor detects and reports its force output. This means clever simulator designers could use rider leaning as an input to their simulation or game.

High Lifetime
No lubrication is needed and each Orca Series motor is built to outlast any competing actuator available.

Highly Dynamic
Vibrations over 60 Hz and rapid accelerations are made possible by the air core stator and high performance linear bushings

Power Efficiency
Optimized 4-phase geometries, high quality magnets, and precision manufactured parts make Orca Series motors highly efficient.



Talk to an engineer about Orca Series linear motors

Motion Controller

Safety and ease of use are primary benefits of the integrated motion controller. Motor and pneumatic controller communications are handled automatically, while an FPGA rapidly performs the kinematic and optional cueing algorithms with very low latency.

UDP-Based API

The RavenAPI is a lightweight UDP messaging protocol which allows sending DoF position targets, or acceleration cueing to the platform at rates from 20 to 3000 Hz. In response to each message sent from a simulator, the controller responds with the status and measured position of the platform.

Safety Features

Several limiting parameters exist to tailor the experience as applications demand. Max travel, speeds, accelerations, forces, and temperatures can all be configured along with several other parameters.

Direct Control Mode

For designers that have their own washout and cueing algorithms, the DoF targets can be commanded directly, bypassing the optional cueing algorithm.

Onset Acceleration Cueing Mode

A traditional onset cueing and washout filter is present which can be tuned according to each application. This algorithm plays the inputted accelerations while gradually returning the platform back to its resting positions.

USB Diagnostics

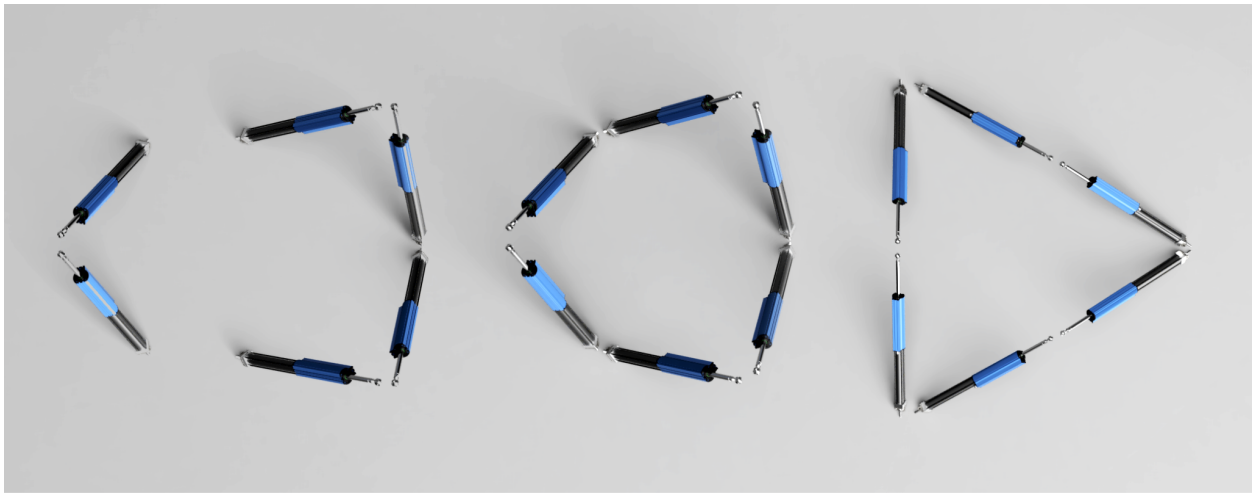
A Windows-based GUI can be connected to via USB which provides a real time readout of all the available parameters and statuses. This can be used to manually control the mode of operation and provides the ability for fast and software-free demonstrations and testing.

Pneumatic Controller

The pneumatic controller box contains solenoids and drivers, pressure sensors, safety valves, and the logic to control everything. This box connects to the motion controller and provides automated control over air pressures to minimize power draw from the platform.

Powerful Kinematics

The Raven6-DoF kinematic models are implemented on a FPGA to be ultra-fast, accurate, and flexible.



Customizable Geometries

The kinematic model can be adjusted to accommodate a wide range of base and top plate geometries which means the kit can be used to emphasize certain degrees of freedom and made to accommodate specific seats and controls or other payloads.

Real-time Forward Kinematic model

Forward kinematics for Stewart platform geometries are complicated, but Raven--6DoF has done it. This allows the actual measured position of the platform (accurate to below 1 mm) to be reported back to the VR headset. This eliminates the need for (and issues that arise from) external platform sensors which are typically used to delete the platform's movement from the headset. Since this is done with such low latency and high accuracy, motion platform movement is totally removed from the VR headset in ways that other technologies can not match.

Industry-leading Latency

Maintaining a very close match between the motion of a platform and the perceived motion in virtual reality is critical in preventing nausea and delivering quality training or entertainment. Raven-6DoF maintains **sub-2 ms latency**, including motor communication, kinematic models and cueing algorithms.

Learn about Forward and Inverse Kinematics

Reference Design Performance Data

Register for CADs, BOM, Reference Manuals, and User Guides

Raven-6DoF Motion Platform Statistics			
Travel			
DoF	*Distance*	*Unit*	*Notes*
Surge	427	mm	
Sway	392	mm	
Heave	277	mm	
Roll	23	deg	
Pitch	21	deg	
Yaw	34.6	deg	
Rated Unloaded Accelerations			
DoF	*Acceleration*	*Unit*	*Notes*
Surge	9.8	m/s²	*Tested at 1.3 Hz, ± 147 mm displacement*
Sway	9.8	m/s²	*Tested at 1.3 Hz, ± 147 mm displacement*
Heave	10	m/s²	*Tested at 1.5 Hz, ± 110 mm displacement*
Roll	1000	deg/s²	*Tested at 1.7 Hz, ± 8.8° displacement*
Pitch	1000	deg/s²	*Tested at 1.7 Hz, ± 8.8° displacement*
Yaw	1000	deg/s²	*Tested at 1.3 Hz, ± 15.0° displacement*
Rated Unloaded Max Speed			
DoF	*Acceleration*	*Unit*	*Notes*
Surge	1.2	m/s	*Tested at 1.3 Hz, ± 147 mm displacement*
Sway	1.2	m/s	*Tested at 1.3 Hz, ± 147 mm displacement*
Heave	1.04	m/s	*Tested at 1.5 Hz, ± 110 mm displacement*
Roll	93.62	deg/s	*Tested at 1.7 Hz, ± 8.8° displacement*
Pitch	93.62	deg/s	*Tested at 1.7 Hz, ± 8.8° displacement*
Yaw	122.43	deg/s	*Tested at 1.3 Hz, ± 15.0° displacement*