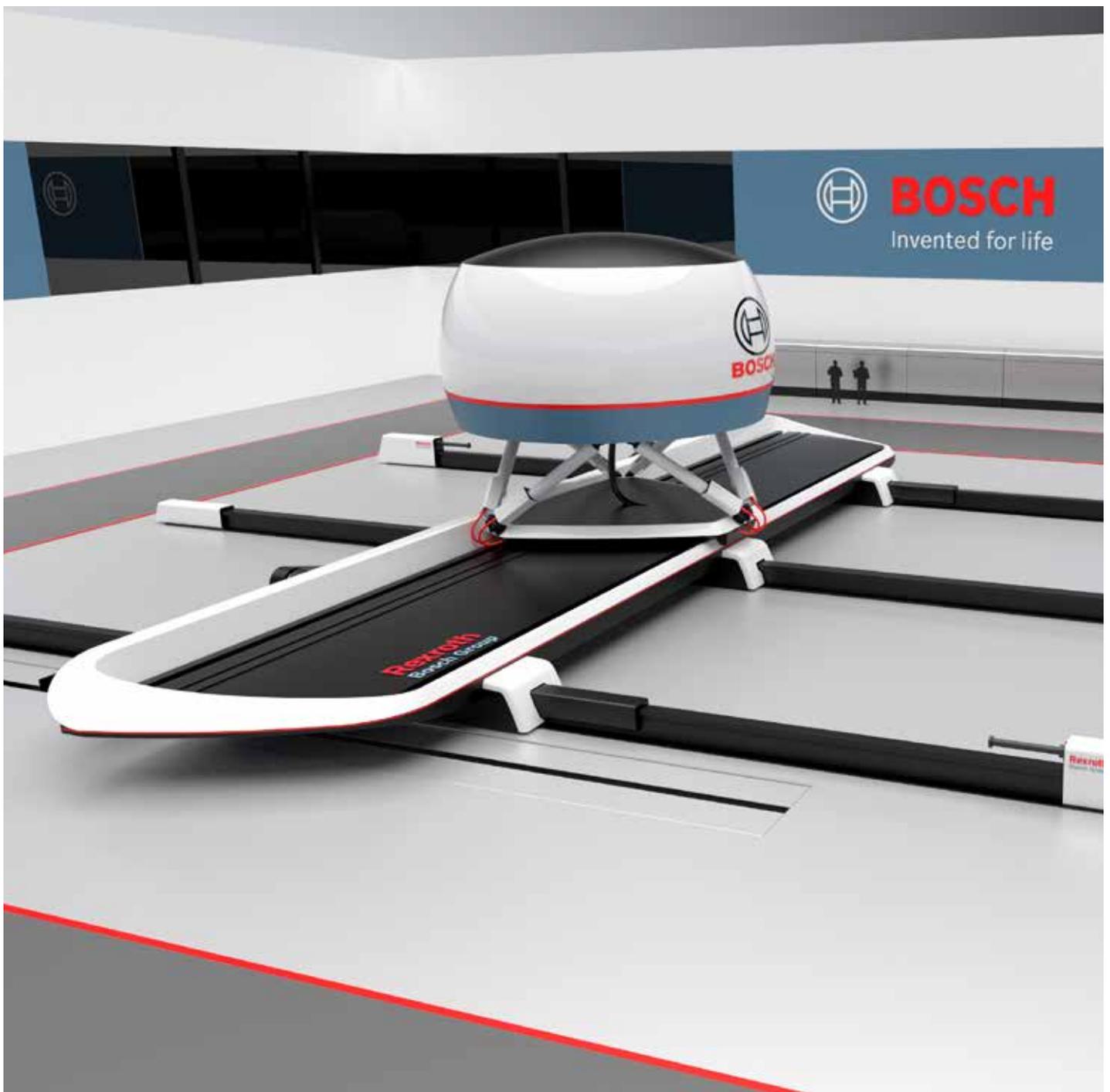


Advanced Driving Simulators

Autonomous vehicle testing under realistic conditions



Advanced Driving Simulators: autonomous vehicle testing under realistic conditions

The automotive industry has always been the one to watch as a technology indicator for the future. One of the most significant changes on the horizon is the widespread adoption of self-driving (autonomous) cars. For many years car makers have already been integrating components into vehicles based on the technologies needed to enable fully autonomous driving capability.

Without doubt, being prepared with the highest performing and safest autonomous driving solutions will be a market definer. However, getting systems onto the road is difficult: even obtaining a permit can be a challenge. Ideally, autonomous vehicles need to be thoroughly tested in the lab where they can learn how to deal with different driving scenarios before encountering them for real on the road. Simulators provide the answer, allowing everything to be tested in complete safety.

Bosch Rexroth Advanced Driving Simulators hold the key to developing safe and reliable self-driving cars, helping you achieve a market-leading position. We are the only people making simulators with the necessary capability for developing and testing autonomous driving. Several major car manufacturers are already using Rexroth simulators to ensure their vehicles become the benchmark.

Peerless performance

Our latest generation of Advanced Driving Simulators continue to place Rexroth as the leader in autonomous driving simulation. They are built on proven technology, and all motion system components are in-house products from the Rexroth program. They include electrically driven linear servo actuators that are developed and manufactured within Rexroth.

Smooth yet robust, our systems achieve accelerations up to 1 g and speeds up to 9 m/s in both longitudinal and lateral directions. A 6000 kg payload allows complete vehicles with driver and passengers to be tested. The platform incorporates comprehensive mechanical and software motion limiting features, so the system cannot exceed its programmed limits. Among many safety features, drives are equipped with Bosch Rexroth 'Safety on Board' technology which provides additional security measures like guaranteed safe stop.

DOF	Excursions (m, deg)	Velocities (m/s, deg/s)	Accelerations (m/s ² , deg/s ²)
X	15	9.0	10
Y	15	9.0	10
Surge	1.46	0.9	13
Sway	1.4	0.9	12
Heave	1.36	0.8	15
Roll	44	26.0	400
Pitch	42	26.0	400
Yaw	44	28.0	450
Yaw drive	360	60.0	250

▲ motion system specification example for a high end XY table simulator

Evolution of Rexroth driving simulators

Rexroth has been making advanced driving simulators since 2003. With each iteration, our simulators have improved in design and grown in capability, accepting greater payloads, extending XY excursions, and delivering higher accelerations and velocities. All while maintaining the very highest level of safety. The following are among the historical highlights of our driving simulator evolution.

2003 – 1000 kg payload for Renault, France. In accordance with Renault’s specs, our first motion simulator supported only a partial car for simulation with a low field of view. It featured a small hexapod and XY displacement, and used simple rack and pinion drive system. It may be limited compared with our later systems, but it is still running today.

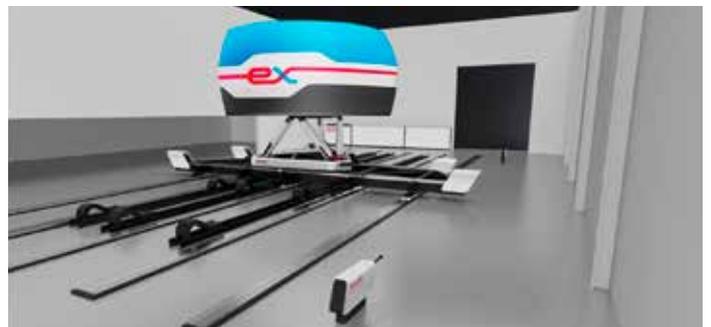
2005 – 2500 kg payload for University of Leeds, UK. Using the same rack and pinion system as the 2003 Renault system, this system has a stronger gantry and is generally bigger and more robust. It can accommodate a full car and has 360 degrees Field of View, and is still being used for research.

2010 – 2500 kg payload for VTI, Sweden. Very similar to our 2005 model, this simulator includes a range of engineering improvements.

2011 – 2500 kg payload for Tongji University, China. Made together with AV Simulation, this full-car simulator incorporated a dome and 360-degree projection using a smart, car-mounted system.

2012 – 4000 kg payload for RIOH research institute, China. A challenging design to fit the limited space available, this Y-table machine has a 360-degree rotating dome.

2013 – 4000 kg payload for FKFS, Germany. An XY design that pushes the rack and pinion technology to the limit. Its large motors still allow it to achieve up to 5 m/s.



2018 – 6000 kg payload for EX, Korea. First of three similar machines offering higher payloads and large X and Y excursions for complete vehicle testing. Rack and pinion has given way to linear motor technology to deliver the increased accelerations and velocities. The EX system attains 5 m/s velocity, with 0,7G acceleration, while the next system, planned for installation at Renault in 2019, is set to provide 9 m/s velocity with 1G acceleration.

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