

4 Poster Ride Simulators

The World of Ride Simulators

The Servotest 4 Post servohydraulic test system provides advanced engineering solutions to automobile and race teams alike, employed to determine vehicle durability, ride characteristics and road holding properties, the Servotest 4 Poster ride simulator is equipped with precision actuators, powerful hydraulic supply and unique techniques in digital control. All of which provides the capability of reproducing drive files built up in almost any terrain.

Servotest is proud to have been involved in many prestigious programmes with various vehicle manufacturers and race teams, which span from the four corners of the globe.



A world of experience...

Servotest is a World Class Test and Motion Simulation Company, with experience of operating around the globe, for multi national corporations, smaller specialist companies and Government Departments. Since the 1950's our engineers and equipment have been at the forefront of our industry. Product and Service quality is maintained by a program of continuous training and development of our people and equipment.

We operate in all of the key industry sectors for our marketplace, including Automotive, Marine, Civil Engineering, Aviation, Defence, Aerospace and Traction. The company holds both ISO14001 and 9001 Quality accreditation marks and is a member of many national and international trade organisations



4 Poster Ride Simulator System

Endurance and Durability Testing

After recording performance data from service environment trials or circuit driving, Servotest 4 poster ride simulation system is ideal for creating the required road inputs, paving the way to accurate in laboratory testing of vehicle performance.

The Tyre Coupled Road Simulator is designed to reproduce the vertical tyre motions experienced by vehicles on the road surface. The simulator can be used for development testing of road going vehicles to reducing road testing and model development time.

System Benefits

- Real time history file replication.
- Ability to incorporate mathematical models into 4 poster.
- Sine sweep.
- Axle coupling capabilities.
- Wheel phase variations.
- Recording test data and data logger.
- Constant frequency or frequency sweep generation.
- Data analysing capability.

Control and Software Features

Windows Graphic User Interface providing the following test functionality:

- Recording test information using the Servotest Datalogger.
- Synchronised logging of tests, using the Data logging module.
- Generation of drive files ultising PULSAR ICS Analysis to iterate to replicate track response date measured on the car.
- Selection of servo-valves on multi valve systems. Endurance testing using the Servotest EZflow.
- Control using a hand-held remote unit.
- Selection of Inverse Adaptive Control to perform sweep testing at fixed amplitude.



Safety

As a safety precaution, a low pressure switch is fitted to the actuator manifold. The safety switch provides an electrical interlock, which prevents the electronics from being switched off while there is still pressure in the system. Also, in the event of mains power failure, when the electronics is automatically transferred to UPS for a controlled shutdown, the switch detects the safe low pressure level.

Endurance

By virtue of their design, the hydrostatic bearing actuators are fatigue rated for continuous operation and long trouble free life in excess of 50 x 10⁸ cycles. They are easy to maintain, the only items requiring periodic attention are the oil filters and low pressure seals. The filters can be replaced on site by the customer without any need to dismantle the actuator.

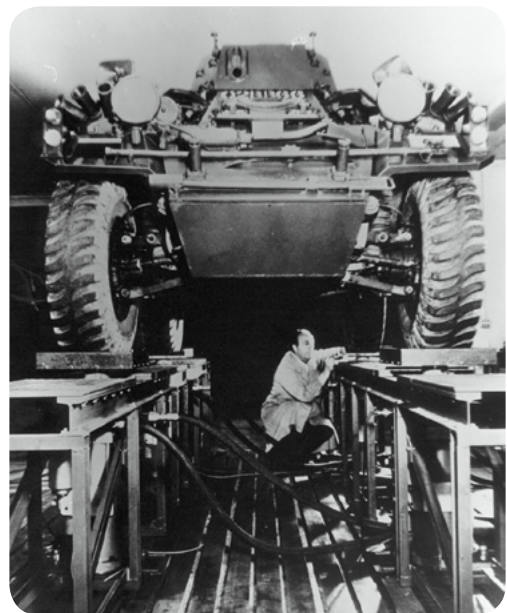


NVH Applications

The 4 Post Road Simulator provides vertical inputs to evaluate the full vehicle and chassis subsystems squeak& rattle tests for all commercial cars and SUVs. The rig offers a lean, flexible, and cost effective system that enhance the test capability of the Lab and both maintainability and serviceability of the equipment.

The system is controlled by the Servotest state-of-the-art PULSAR digital control system, using software designed specifically for this application, as well as a range of generic software designed to give the user greater control over the testing.

The system can be powered by an existing hydraulic supply or hydraulic power supplies integrated into the system.



Actuators

Servotest 080 linear actuators are robust fatigue-rated double-ended actuators designed for dynamic thrust of 10-1000 with stroke lengths of 50-500mm, and are able to operate at pressures up to 28 Mpa (280 bar).

Servotest 80mm rod dia. type actuators are of low aspect ratio design to give high flexural rigidity and low stress levels. Making it an ideal choice for 4 Poster applications. It consists of a hollow, hardchromed precision-ground steel piston rod, a bronze piston, and steel cylinder, front and rear bearing heads incorporating hydrostatic bearing pads, a dual coaxial displacement transducer, two servo valves manifold with pressure and exhaust accumulators, an oil filter, and a low pressure interlock switch.

The piston and cylinder are machined with a finite clearance and no piston seals are fitted. The piston rod supported in hydrostatic bearings, prevents metal-to-metal contact so that coulomb friction and 'stick-slip' are eliminated. The hydrostatic bearings provide a very strong selfcentring effect on the rod which gives the actuator a very high side-load capacity. Pressure equalising grooves are machined in the piston.

A pressure accumulator is fitted close to the servo valve pressure port to provide instantaneous flow to meet peak demands. There is also an exhaust accumulator close to the servo valve exhaust port to smooth pulsations in the return line.

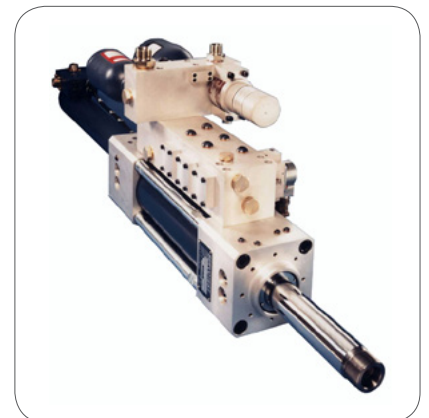
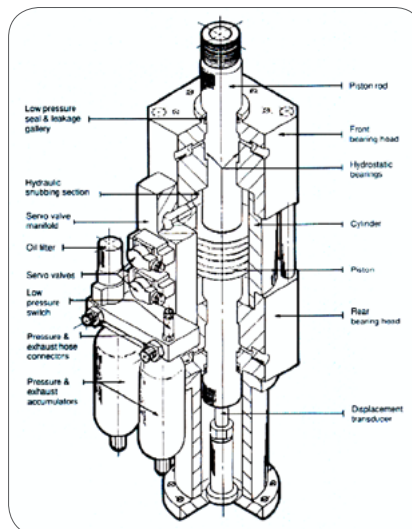
Pressure controlled snubbers will be incorporated at each end of the stroke to dissipate kinetic energy within a controlled acceleration profile.

Actuator Static Force Balance

The static force required to support the vehicle mass (up to 6,000 kg per axle) can be provided by a conventional actuator or one with an additional servo-controlled preload section. This in turn acts as an energy saving device, used particularly with large vehicle "truck" simulators.

The major advantage of a separate pre-load section is that it reduces the hydraulic power requirement.

In application where the actuators are required to accelerate the unsprung mass at (say) 30 g, the actuator has a significant dynamic performance compared to the static support force requirement. For these reasons a conventional actuator is offered with the static support force provided by the dynamic piston.



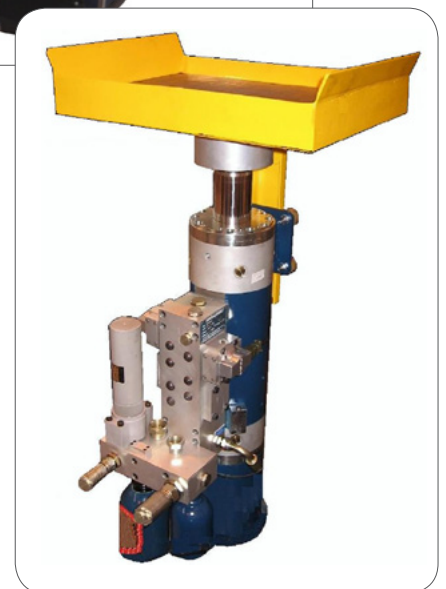
Wheel Pans

The actuator/wheel-pan assemblies are a proven design specifically for high cycle, long life, and low maintenance applications. Servotest Wheel pan design have proven to be extremely reliable in many similar tough applications world-wide.

Servotest offers a range of wheel pan designs to secure and restrain the wheel.

Wheel-pan design for commercial car 4 poster consists of an aluminium alloy platform (weighing 30 kg) attached directly to the piston rod to apply road profile inputs through the tire patch.

To accommodate a 178 mm (7 inch) variation in track and 356 mm (14 inch) variation in wheelbase, the platform measures up to 637mm (26 inches) wide x 417mm (17 inches long). Front and rear restraint protruding 3 cm above the surface of the platform provide the driver with feedback regarding the positions of the car on the wheel-pan in the fore and aft direction. In addition, proximity detectors mounted off the actuator body provide a visual indication on the local console regarding correct fore and aft positioning of the car. These proximity detectors provide an interlock signal to inhibit operation of the ride simulator if the car is not correctly positioned.



The car is guided laterally by approach rails to ensure the car is situated within the tolerance band of ± 7 " regarding wheelbase variation.

Race car Wheel-pan differs slightly in design and material, made from lightweight aluminium alloy the platform is smaller in size 430 x 430 x 25 mm. 7 Poster wheel-pan design also incorporates low friction contact surface to prevent suspension bind, and Anti-rotation mechanism.

Each actuator is equipped with a magnetic base, allowing for quick and effortless movement of actuators to encompass a variety of wheel pan configurations.

4 Poster PULSAR Digital Controller

The Servotest Pulsar control system offers users the very latest in digital control for servohydraulic test and simulation systems. It employs state-of-the-art real-time control techniques to ensure optimum accuracy.

The system is based on a revolutionary I/O system, using distributed fibre-optic technology. Building on the success and popularity of its predecessor, DCS2000, the Pulsar control system provides a powerful, reliable and flexible total control solution.

4 Poster PULSAR consists of 4 control nodes mounted on each actuator, in turn controlled by a PC. Typically, there will be one hydraulic (powerpack) node, additional nodes can be configured as analogue nodes for analogue input and output signals.

Each actuator control node box can contain up to six transducer modules, in addition to the standard motherboard and FPGA board. Some feature an integral carrier module for transducer excitation.



PULSAR System Features

Synchronised sampling, modelling and control

All signals are synchronised and each can be data logged

Data Acquisition

User transducers sampled in-sync with control loop

Optical Fibre Long Line Cabling

No signal degradation

Short Analogue Line

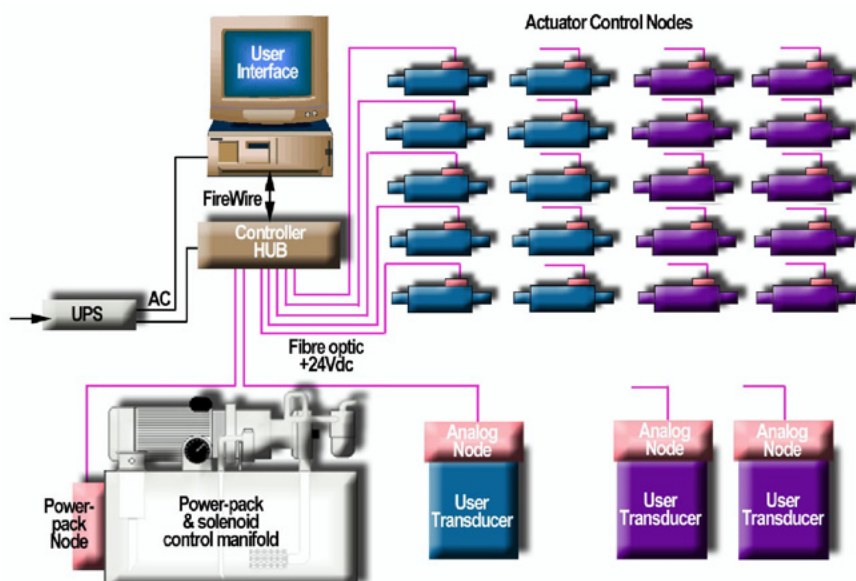
Maximise Signal / Noise ratio

Versatility

System sizes from 1-16 nodes, each with wide choice of I/O and applications

Servo Control Orientated Architecture

High power time coherent DSP maths engine specifically designed by Servotest Systems Ltd.



PULSAR Software

The Pulsar software uses the latest and most advanced tools and techniques in software engineering, with extensive use being made of object-oriented design and programming to ensure a solid base for future development. Throughout its design, great emphasis has been placed on ease of use, without compromising the power and flexibility of the system. The system configuration is stored within industry standard database files, which are created and updated using a set of simple configuration screens.

The Pulsar software runs within the Microsoft Windows™ environment, providing the user with a powerful, easy to use interface. The software revolves around the concept of signals which are arranged into groups for ease of selection.

Command signals to the actuators can have Cycle Counter and multiple Function Generator inputs applied to them. Signals can be Monitored, displayed on software Oscilloscopes, sent to the Analogue Outputs or the Data Logger which allows triggering and userdefined acquisition rates. Monitored signals can be displayed as Maximum, Minimum, Average and RMS or Instantaneous values, and have a user selectable averaging period. Multiple Safety Limits can be set on any signal with the Limit action selectable between Indicate, Trip or Shut.

A large high resolution colour monitor will be supplied with the control system providing the user with a large screen area to display signals, configure tests and analyse data.

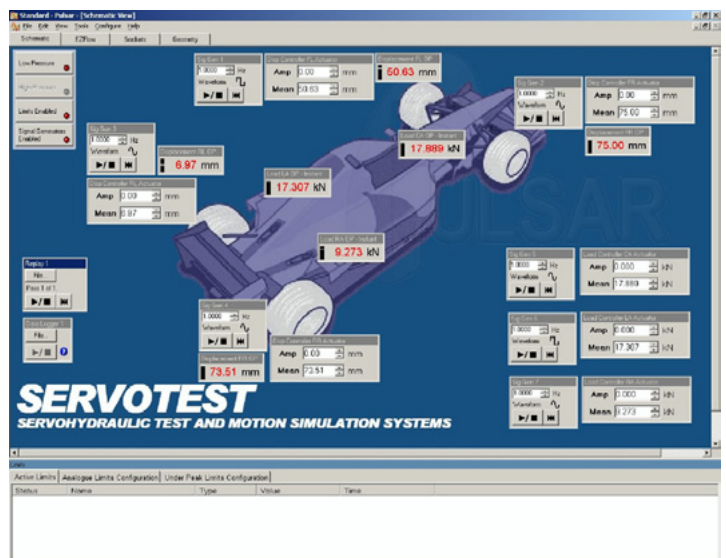
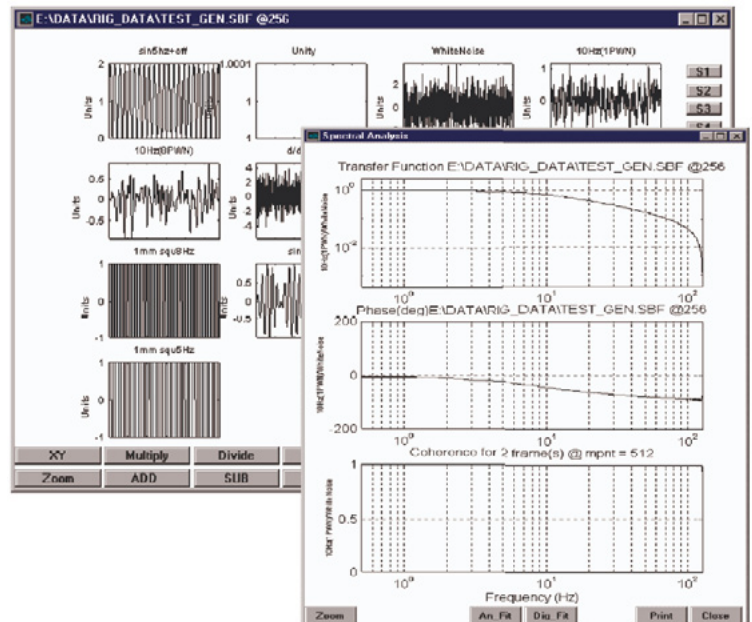
Tyre coupled road simulator software module allows the user to play sine sweeps or real time history files through the system. It also allows the user to control the hydraulics, if available. There are also 2 different user levels, engineer and operator. The operator is locked out of some of the functionality, and a password is required to change to engineer mode.

sDAP

The Servotest Data Analysis Package (SDAP) allows the user to turn test rig data into useful information through editing and analysis.

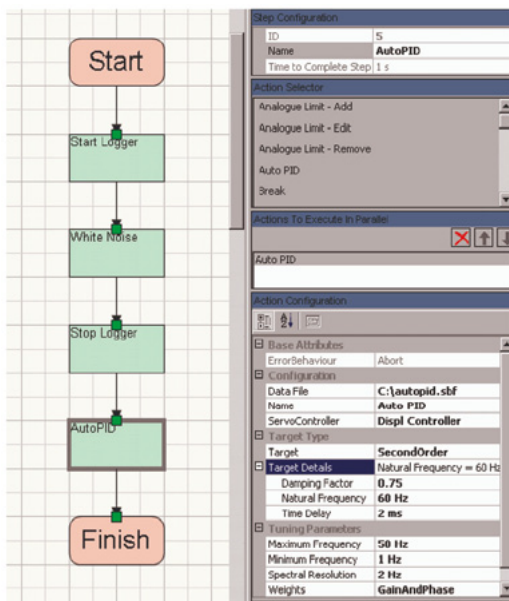
sDAP can be used at any time during the test cycle from editing raw data to plotting histograms to performing frequency analysis.

This package provides powerful and comprehensive signal analysis, visualisation and processing features, with the ability to import files and export results in various formats.



EzFlow

This powerful high level software tool allows sophisticated test sequences to be programmed simply and effectively. The programming sequence can incorporate logic functions and comprehensive test reports are automatically generated. In many cases this will become the main test set-up and run panel for customer tests. Once prepared and saved the test can be run by the operator by selecting the test and hitting the run button.



This block programming software enables sequences of various drive files (e.g. SBF, ADF, RPCII) to be created. Each sequence is made up in the form of a block diagram with each block being a signal generator, real time drive file, a synthesised drive file or an existing imported sequence. This way individual files can be concatenated, looped and nested to construct a durability schedule. Events can be triggered by EzFlow manually or by an external signal.

Signal Processing and Fatigue Analysis Package

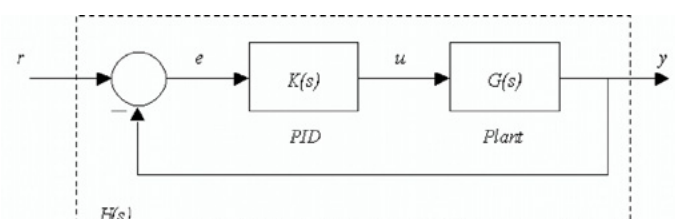
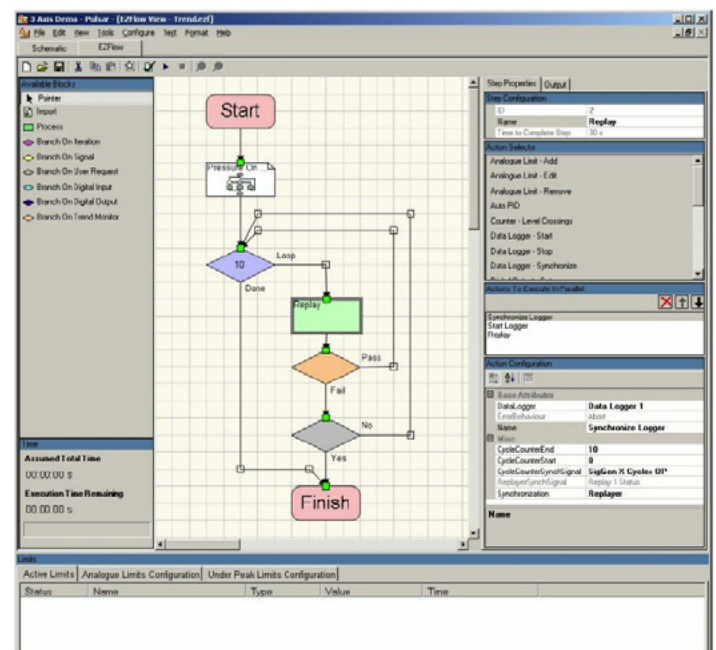
Servotest offers a host of fatigue analysis software packages, please consult with our sales team to discuss your software requirements.

Auto PID

AutoPID allows quick and accurate optimisation of PID controllers, in the frequency domain, based on the system response to a sweep excitation. Once this response is collected, the PID optimisation takes place off-line. Most conventional PID tuning methods (Ziegler-Nichols,...) consider only one frequency when setting the PID terms. As a result, only around this particular frequency can the behaviour of the closed loop system be accurately controlled.

AutoPID on the other hand uses an optimisation algorithm that lets the user specify:

1. A target frequency response for the closed loop system.
2. The frequency range over which the optimisation takes place.
3. The relative importance of gains and phases in this optimisation.



Seismic Mass

A reaction mass is required to attenuate the transmitting vibration from the foundation whilst maintaining accurate simulation of motion on the specimen.

Servotest prides itself on being a turnkey solution provider, capable of providing full designs and recommendations towards building a seismic mass for 4 poster ride simulators.

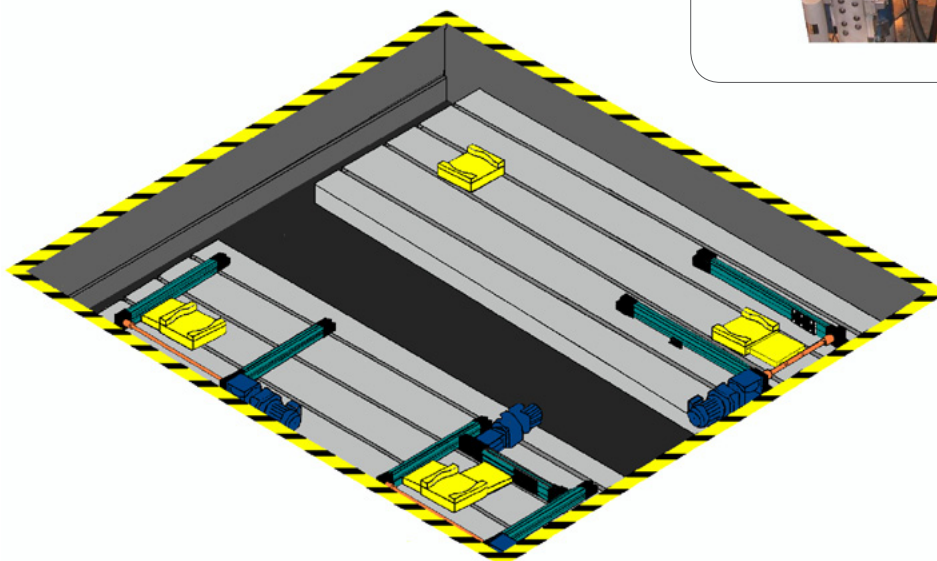
Options

Track & Wheel Base Adjustment

Electric actuators with motors and brackets providing X-Y movement of actuator mount plates which are magnetically clamped onto the test bed.

The x-y adjust provides flexibility and adaptable to allow testing of vehicles with varying wheelbase configurations, and is designed to provide positional accuracy of +/- 1mm and easily adjustable.

The X-Y adjust system consists of 3 stations each with 2 off 750/450 stroke heavy duty belt driven linear actuator. Integrated to each actuator are guide rails with precision track and calibrated bearing rails. An integrated permanent magnet provides means of detecting the position of the actuator bases.

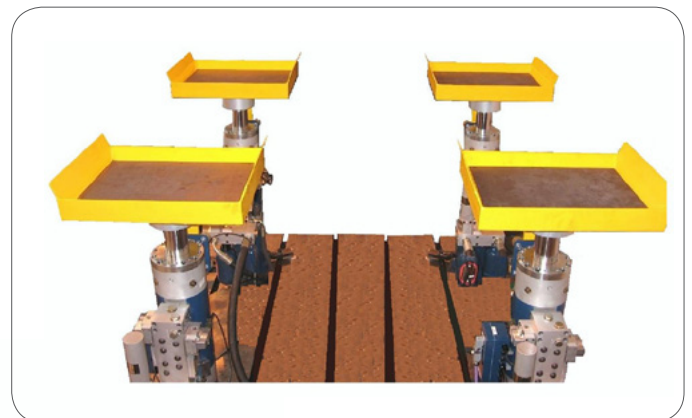


Benefits:

- Electrical supply means, no additional hydraulic flow required.
- Fully integrated into the Control System allowing ease of operations.
- Fully programmable to any test sequence – e.g. Operating Sequenced:
 - Unlock the actuator bases;
 - Choose Wheel base configuration, adjust XY position;
 - Lock the magnetic base into the steel bedplate;
 - Test.

Typical Track & Wheel Base Adjustment system performance:

Characteristics	Value	Units
Max Speed	2-5	(m/s)
Max Acceleration / deceleration	10	(m/s ²)
Max Standard Stroke length	3-5	(m)
Repeatability	+/-0.05	(mm/m)



Remote Control

Optional accessories to the Servotest 4 poster ride simulator also include a wireless handheld remote control unit, which allows full control of the system and access to every available software function.

The remote control unit works off the digital control data acquisition system, PULSAR, and is displayed separately on a large LCD screen located near by the 4 poster. The computer is standard PC hardware and uses Microsoft Windows graphic user interface. Please see our brochures section on www.servotest.com for a description of the Pulsar control system.

The remote control properties are full customisable and offer control features such as:

- Raise: Ramps to working position. Switches on limits. Switches on all actuators. Sets amplitude to 100%.
- Lower: Moves to park position. Disable limits. Switches off pressure.
- Replay: Items are added to the queue and then the queue is played.



Sound Proofing

Servotest offers various options and accessories to reduce the noise from the system:

- Sound deafening jackets – the jackets consist of a foam/rubber sleeve wrapped and secured around the actuator using Velcro for easy removal for maintenance.
- Sound deadening material is wrapped around the hydraulic supply pipes to the system or the channel in which these supply pipes run are filled with sound deadening material.
- The hydraulic supply is fitted with an output attenuator to reduce the noise generated from the flow of oil.
- The hydraulic supply is fitted with sound reducing panels.
- Specially designed hydraulic power packs.



Specification – NVH 4 Poster

Actuator:				
Quantity	4	4	4	4
Force	25KN @ 155bar 34KN @ 210bar	25KN @ 155bar 34KN @ 210bar	40KN @ 155bar 54KN @ 210bar	40KN @ 155bar 54KN @ 210bar
Displacement	150	300	300	300
Servovalves Per Actuator	2 x SV80	2 x SV80	1 x SV500- 5	1 x SV500- 5
Aeroloaders:				
Quantity	-	-	-	-
Force	-	-	-	-
Displacement	-	-	-	-
Servovalves Per Actuator	-	-	-	-
Performance:				
Max. Velocity	1.9	1.9	4.7 (m/s)	4.5 (m/s)
Max. Acceleration	30g	27g	27g	30g
Payload	60Kg	60Kg	60Kg	100Kg
Static Load	550Kg	550Kg	550Kg	1000Kg
System Pressure	210bar	210bar	210bar	210bar
Recommended Power Supply:				
Flow	1 x 222 l/min	1 x 222 l/min	1 x 222 l/min	1 x 444 l/min
Power	125HP / 93KW	125HP / 93KW	125HP / 93KW	250HP / 185KW

Actuator:			
Quantity	4	4	6
Force	25KN @ 155bar 34KN @ 210bar	25KN @ 155bar 34KN @ 210bar	150KN @ 155bar 270KN @ 210bar
Displacement	250	250	300
Servovalves Per Actuator	2 x SV80	1 x SV500-5	1 x SV1200-10
		2 x SV80	
Aeroloaders:			
Quantity	3	3	-
Force	20KN @ 155bar 27KN @ 210bar	20KN @ 155bar 27KN @ 210bar	-
Displacement	300	300	-
Servovalves Per Actuator	2 x SV63 EFB	2 x SV63 EFB	-
Performance:			
Max. Velocity	1.9	5.3	3.0 (m/s)
Max. Acceleration	27g	27g	26g
Payload	60Kg	60Kg	650Kg
Static Load	550Kg	550Kg	5000Kg
System Pressure	210bar	210bar	280bar
Recommended Power Supply:			
Flow	1 x 222 l/min	1 x 222 l/min	2 x 444 l/min
Power	125HP / 93KW	125HP / 93KW	250HP / 185KW
Cooling:	Airblast	Airblast	Water cooled

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