SERVOTEST

Damper Testing

The World of Damper Test Machines

Servotest has been at the forefront of servo-hydraulic damper test machine development for over 35 years, and it continues to push the boundaries to deliver the ultimate in performance and accuracy. From toplevel motorsport to tanks and trains, Servotest have a solution to suit all customers.
Current applications include research and development, quality auditing, and massproduction. Each of these markets has specific needs.
A production environment necessitates high throughput, repeatability, and exceptional durability, whereas a development laboratory focuses on accurate measurement of in-service characteristics.
All machines are tailored to suit the customers needs, as optimal configuration forms an essential part of both the research and production environment.

A World of Experience…

Servotest is a World Class Test and Motion Simulation Company, with experience of operating around the globe, for multinational 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 & international trade organisations.

Why are Servotest world-renowned leaders in damper test machines?

- Customisable to individual needs.
- Actuator range from 10-80+ kN force and 50 400+ mm total stroke, infinitely variable.
- Optional side-loading actuator on 080 models for realistic testing of struts, and effects of coil springs, for endurance and characterisation.
- Hydrostatic bearings for high side-load capability, minimal friction, and low maintenance.
- High reliability with actuator life rated at over one billion cycles at 100% duty.
- Custom-made, high response servovalves with close-coupled accumulation and filtering. Very high acceleration and velocities up to and over 5m/s possible.
- Actuator in base or crosshead, with inertia compensation if load cell/side-load module needs to be mounted on the piston rod.
- Manual, or automated hydraulic “lift and unlock” crosshead. Hydraulic lock on very heavy duty applications.
- Optional tilting frame for testing dampers in different orientations.
- Low friction anti-rotation device.
- Co-axially mounted velocity transducer for more accurate wide-band velocity measurement than through differentiation of the displacement signal.
- Flat-wound LVDT with 5th order polynomial calibration to achieve greater accuracy than with a segmented transducer.
- Transducers connected directly to upper end of piston rod to virtually eliminate effects of piston rod stiffness.
- Differential pressure transducer on actuator ports to damp hydraulic oil column resonance, and provide feedback for loop gain compensation between bounce and rebound.
- Crosshead-mounted AC load cell, with optional dual-range calibration for accurate measurement of both breakout friction and kerb strikes.
- Automatically switchable 2 to 3-stage servovalves on 065 and 080 models for both low speed characterisation and endurance testing.
- Adjustable low-pressure mode to reduce hydraulic noise effects at low velocities.
- Optional climatic chamber for testing in the harshest of conditions.
- Optional air or water damper cooling for extended endurance testing.
- Latest, retrofitable, Windows XP-based PULSAR digital controller with optical-fibre data cables for minimal electronic noise.
- Optional remote control, with speed limiter, for local positioning of actuator when loading damper.

Damper Research Test System and Quality Audit Test Equipment Range

040-DTM

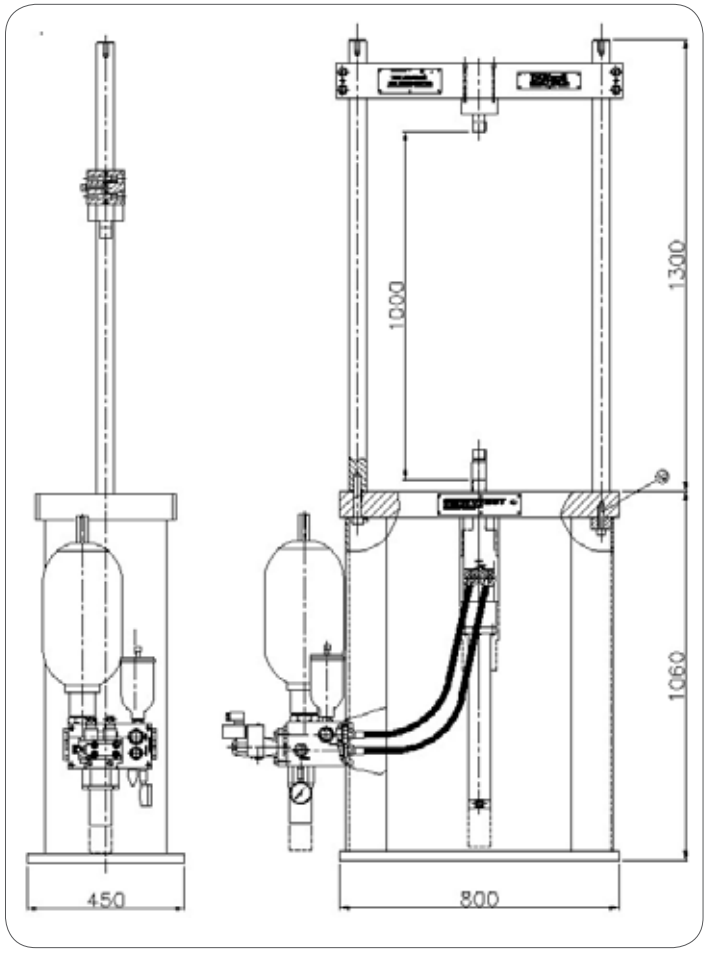
An entry-level servo-hydraulic damper test machine, available with a portable or floor standing frame. The hydrodynamic-bearing actuator features a direct port mounted servovalve, offering high response up to 150Hz in a cost-effective package.

Spyker F1

065-DTM

This machine features a hydrostatic bearing actuator and 65mm diameter piston rod for high velocity testing of dampers. The manifold allows a variety of servovalve combinations, from multiple 2-stage modules to a 500L/min 3-stage module. The 250L/min and 500L/min 3-stage module has an electrical switch block with a single small 2-stage servovalve. For loading, positioning, and low speed tests, this offers unparalleled safety and accuracy. The PULSAR software automatically selects the correct valve for the test depending on parameters entered by the user.

Mitsubishi Motorsport



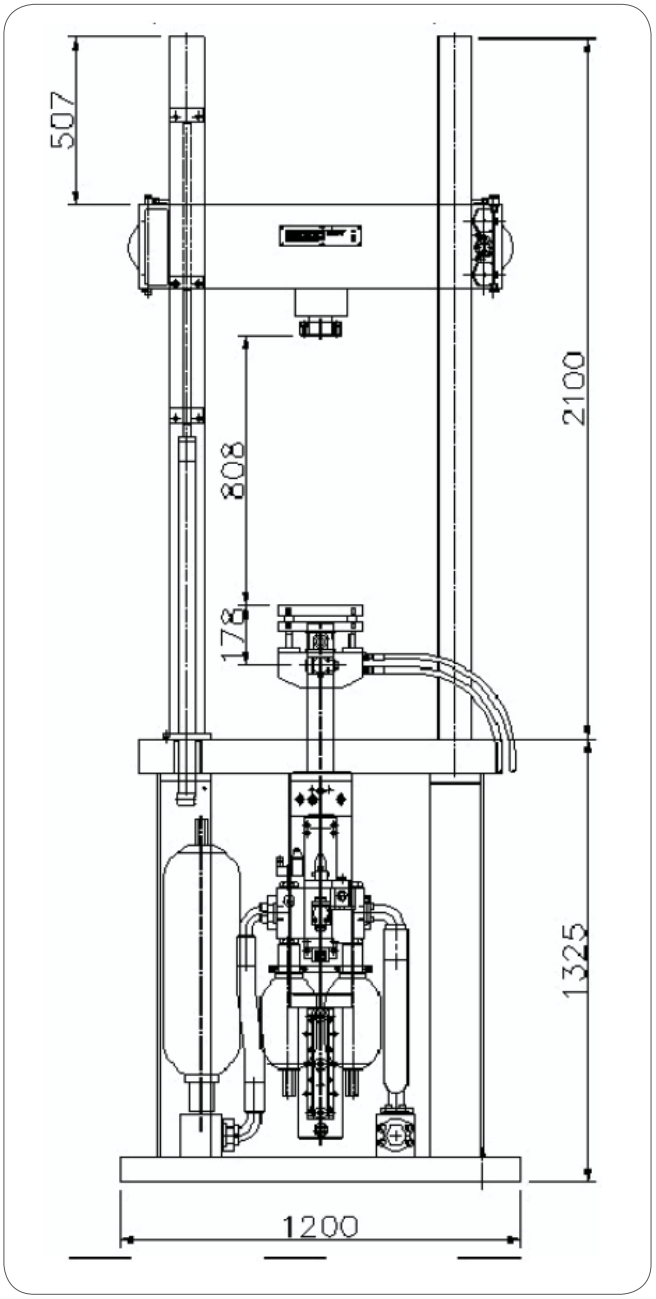
Damper Research Test System and Quality Audit Test Equipment Range (cont.)

080-DTM

Our top-of-the-range model, which has similar features to our 065 model, but with a 80mm diameter piston rod for higher side-loading capability. With available thrust forces up to 80kN, it is possible to test nearly all types of vehicle dampers, including commercial, military, and railway rolling stock.A tilting frame option provides convenient and accurate testing of dampers, which are not vertically orientated in service.

An add-on module for the piston rod is available, which can exert a bending moment on the damper for realistic loading of strut-type suspension.
This is the lightest, most compact, and highest performance side-load module on the market, thus minimising mass and hence, effect on the main actuator performance. An accelerometer is used to compensate for the increased effective inertia of the piston rod. The generous clearance and substantial table between the frame columns allows a wide variety of climatic chambers and cooling systems to be fitted. Normally, air-cooling is sufficient, but heavy duty applications will require a water jacket. This can be close loop controlled with a thermocouple.

Audi A.G.



080-DTM Outline

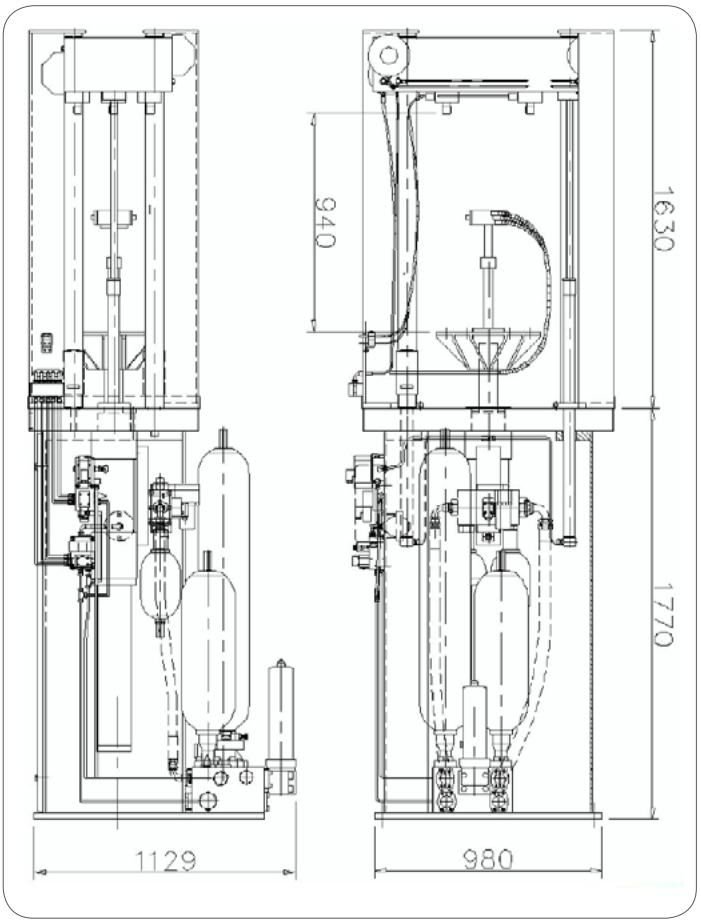
Audi DTM Side Load System

Multistation Damper Test Machines

To improve the efficiency of endurance testing, and carry out more accurate statistical quality auditing, it is desirable to test more than one damper at once. The Servotest Multi Station is available as a two, four or six station model, with individual load cells and tooling to suit both strut and eyelet style dampers. In addition, a centrally positioned radial-piston side-loading module can be incorporated for testing two, four or six struts in combined loading.

Features

- Heavy duty two or four column frame.
- Low flow servovalve for friction testing.
- Dynamic side load system with closed loop control.
- Optional water-jackets or air-blast damper cooling.
- Optional rotating frame.



Sachs – USA

Damper Production Test Systems

Off-line

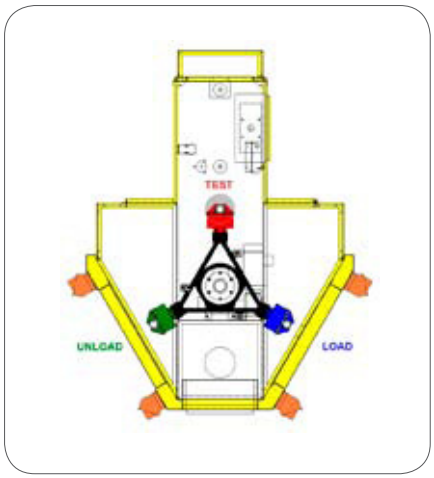
This describes a machine that stands away from the production line, and requires human operators. Safety interlocks and control logic are required, to prevent the automated test sequence from initiating, when the operator is within a pre-determined proximity of the test cell. This can be achieved by using one of the following:
Once the test is complete, a simple instruction tells the operator to pass or fail the damper. Usually, tests are carried out prior to welding or swaging the top cap, so the majority of the unit can be recycled if it fails.

Manual Feed DTM

The Servotest-MF (Manual Feed) DTM is a flexible competitively priced high-specification machine suitable for a production environment. Suitable tooling in the form of “pneumatic grippers” (for strut type dampers) or “sliding pins” (for eye-mounted dampers) can be supplied.

Carousel DTM

The Servotest-Carousel DTM is designed to improve efficiency by allowing simultaneously loading and unloading of dampers, whilst a test is being carried out. The indexing table can hold three dampers, with an integral automated actuator loading system.



Carousel operation

Powerdown Trucks

Safety Features

Moving Guard

A hinged or sliding metal door with a viewable “lattice window”. A latch switch hydraulically isolates the actuator when the guard is open.

Light Curtain

A vertical beam of light shone across the opening to the test cell. When the beam is broken, a control valve shuts off oil flow from the servovalve to the actuator, rapidly halting the test. This is necessary, as it is possible to accidentally enter the cell during testing. A Light Curtain is mandatory where maximum productivity is required, as the total cycle time is faster than with a Moving Guard.

Damper Production Test Systems (cont.)

On-line Test Equipment

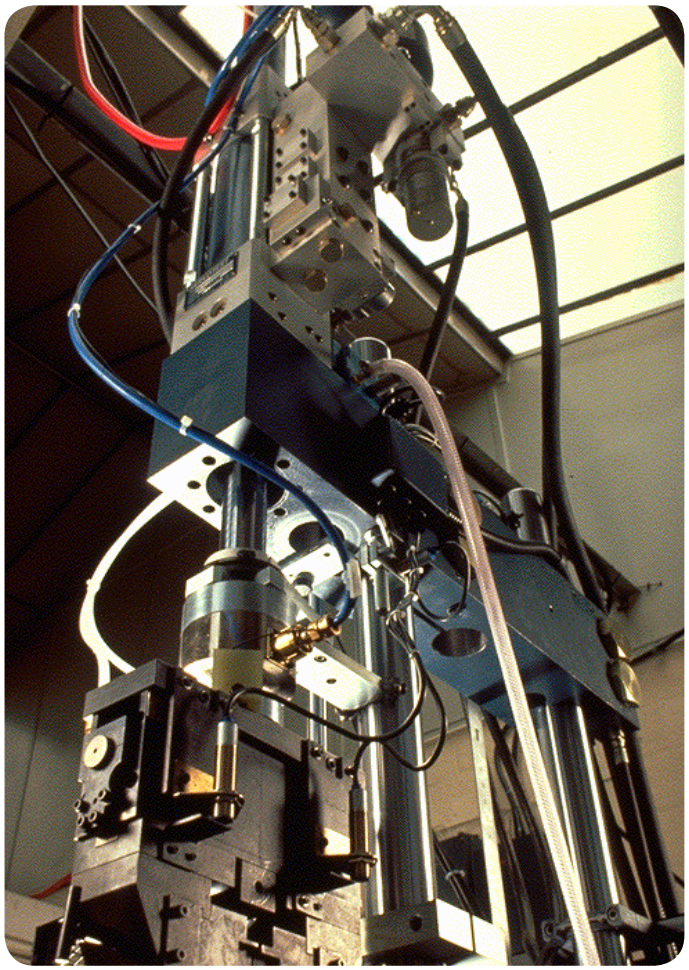
Fully automated testing brings benefits to high volume production by minimising cycle time and maximising efficiency. Loading and unloading from a conveyor takes a fraction of the time, and is not renstricted by features necessary for human interaction. As a result, factory employees can be utilised more effectively in safer environments.

Single Station

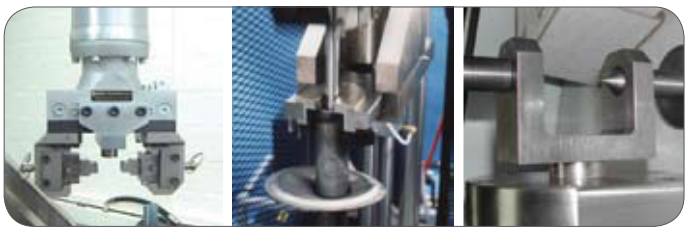
The Single Station DTM is an entry-level conveyor-fed machine. A magnetic slide moves the tooling outwards to retrieve the damper from its upright position on the conveyor. The controller automatically runs the test and calculates the results. Passable dampers are returned to their holder on the conveyor, whilst failed dampers are usually removed by a robot for recycling (robot not included).

Dual Station

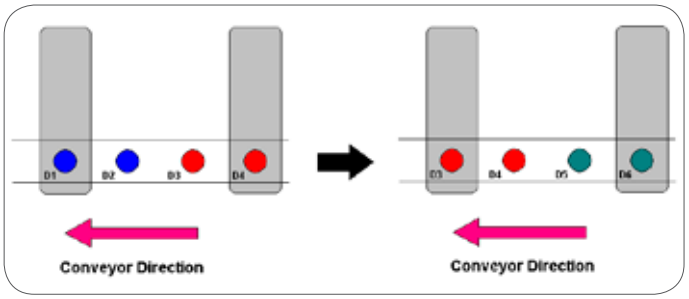
The Dual Station DTM uses two Servotest-SS modules to test two dampers simultaneously. For floor space reasons, the machines are spaced three damper separations apart. Thus, one conveyor index distance equals two damper separation distances, as indicated in the diagram.



Monroe



Specialist tooling: a range is available to suit different styles of dampers



Servotest D8 DTM operation

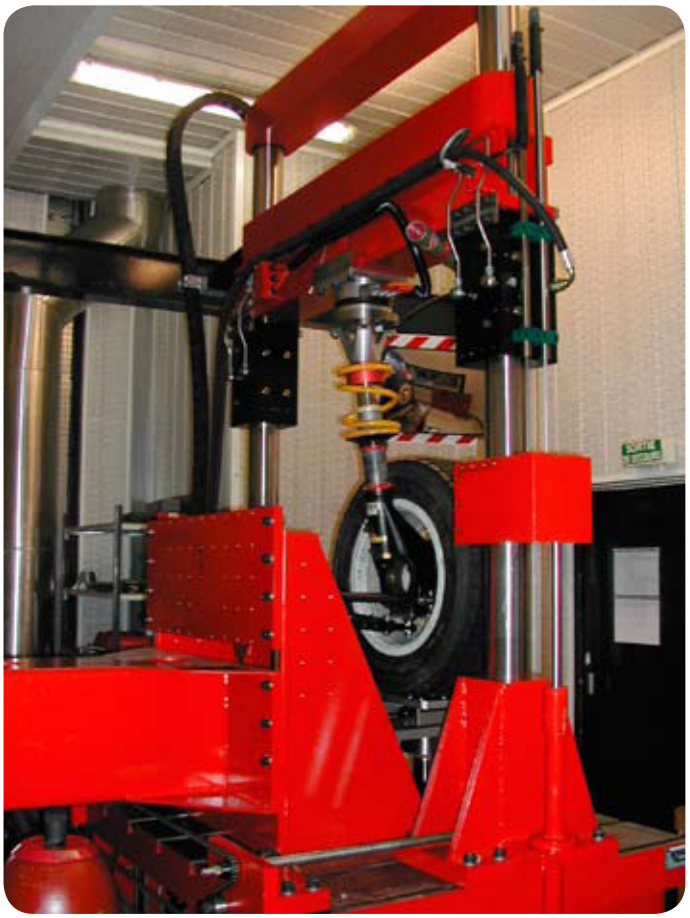
Damper Simulation and Development Equipment

Unsprung Mass Simulator

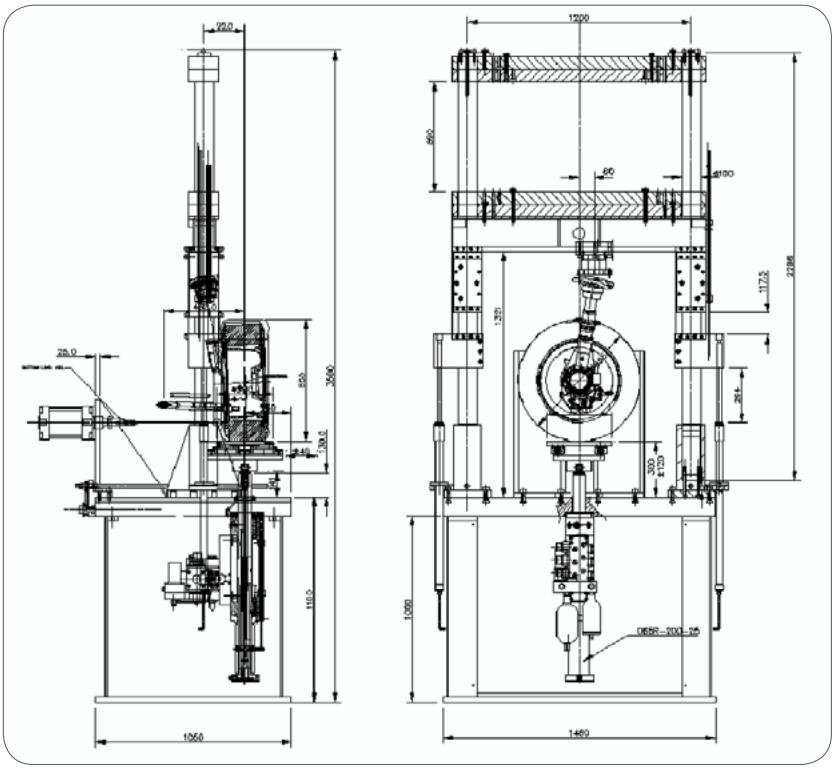
A conventional damper test machine can only test one part of the complex mass-spring-damper system that forms part of the unsprung mass of the vehicle. In reality, accurate modelling of these systems is not always straightforward. This is especially true of the non-linear effects of the tyre. Understanding response, particularly near the wheel hop frequency, is essential for engineering a vehicle with class-leading handling and ride comfort. The Servotest UMS offers convenient, rapid, and cost-effective development of suspension and tyre assemblies.

Innovative Features:

- Floating crosshead with hydrostatic bearings, hydraulic lift system, and detachable mass blocks.
- Wheelpan on low-friction linear guide bearings to prevent suspension bind.
- Optional sideload actuator to simulate lateral loads through the wheel hub.
- Mounting points for suspension linkages.
- Tri-axial load cell on the crosshead to measure suspension strut top loads.



Peugeot Sport



State-of-the-art Control System

All our damper test machines are fitted with our latest digital controller, which uses a 200Mhz bespoke DSP board to provide up to 5 kHz servo-control and up to 10kHz data-logging. The central hub structure allows up to 16 nodes to be controlled simultaneously, thus allowing many actuators, or multiple machines, to be controlled from one PC, through the use of Multisys software. Hence, one PC station could run many machines at once.

Damper test software benefits from over 30 years experience in damper testing. It encompasses everything from simple characterisation and assurance, to the development of the latest active and electro-rheological dampers. Integral Adaptive Sine Control can tune the actuator/system response to compensate for changes in the dynamic performance, whilst offering peak control of force and velocity. The processor feeds a direct velocity signal in to the software, and compares with that received from the LVDT.

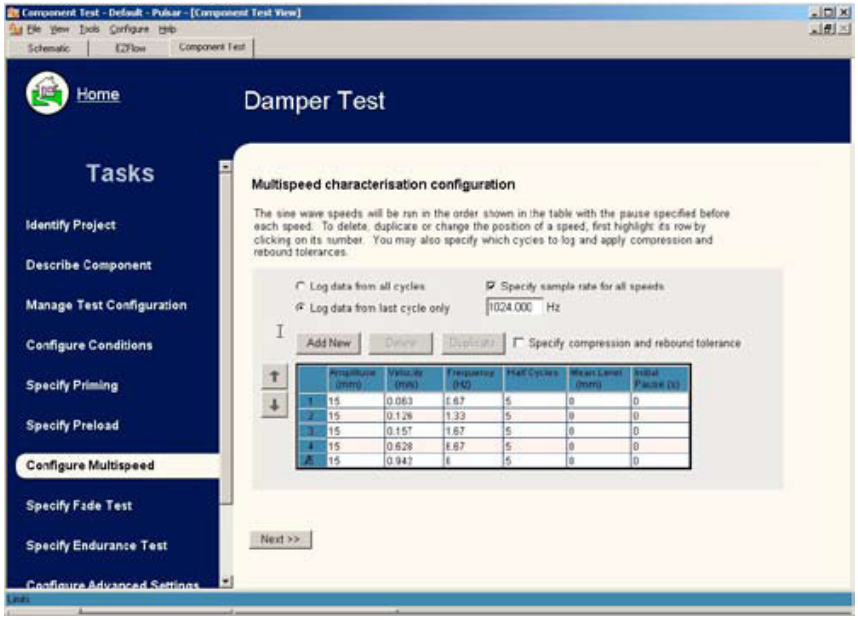
This is important for accurate damper characterisation, as differentiation of the displacement signal amplifies non-linearities and generates high-frequency noise that can not be low-pass filtered, without inducing phase lag.

Performance Testing Features:

- Target temperature warm-up cycle.
- User-configurable priming cycle.
- Preload measurement.
- Friction measurement.
- Multi-speed test (up to sixteen velocities)
- Fade test between multi-speed tests.
- Endurance test between multi-speed tests.
- Side-load and current (active damper) addition.
- Low-pressure mode to limit effect of hydraulic noise at low velocities.
- Four channel oscilloscope for monitoring of any signals.

Endurance Testing Features:

- Customisable heterodyne (sine-on-sine) waveforms.
- Scheduled multi-speed tests at user-defined intervals.
- User-selectable data-log channels with stop-test limits.
- Chamber interfacing and damper temperature control.

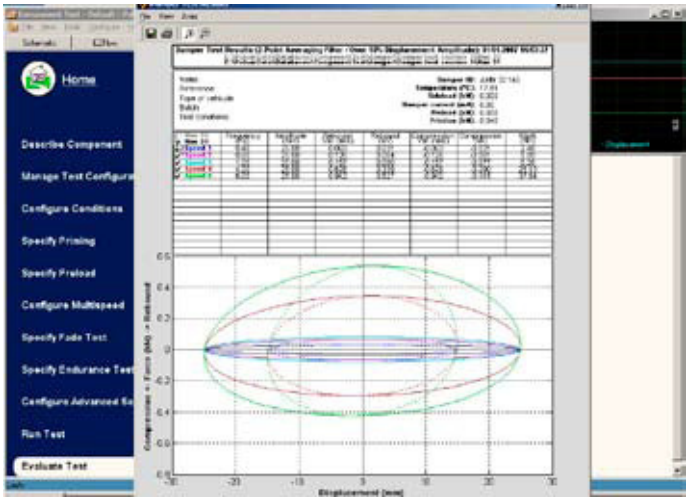


PULSAR Damper software interface

State-of-the-art Control System (cont.)

Results Features

- Force-velocity, force-displacement, and peak force-peak velocity graphs.
- Spring rate and preload compensation on force-displacement graphs.
- Compare results from two multi-speed tests (same or different damper).
- Compare up to sixteen different dampers at a single test speed (limitation imposed by graph clarity rather than software capability).
- High quality MATLAB table and graph format with image save and print options.
- Raw data available for export to other analysis packages.
- Operating envelopes can be superimposed to automatically highlight pass/fail data points with different colours.
- Dynamic zoom function on graph.
- Individual damper configuration-results folder system with archive and retrieve.

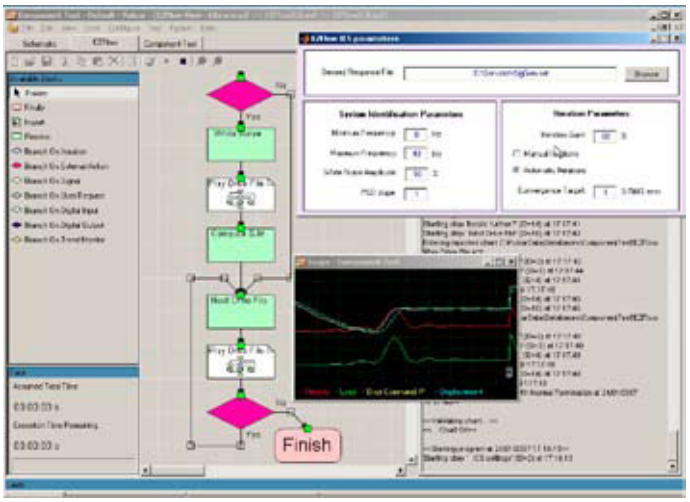


EzFlow

As a powerful alternative to Damper test software, EzFlow offers total flexibility to construct complex test sequences, using straightforward block diagrams. Matlab algorithms and external drive file data can be imported and manipulated as required.

EzFlow ICS

Where the user requires the ultimate in endurance testing simulation, the EzFlow ICS software module can be used within EzFlow to import road load profile data. The loop function within EzFlow then iterates the desired response in to a drive file. This can be set to perform repeatedly and automatically during a test sequence, thus adapting to any undesirable changes in machine or damper characteristics e.g. higher oil temperatures due to cooling constraints.



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