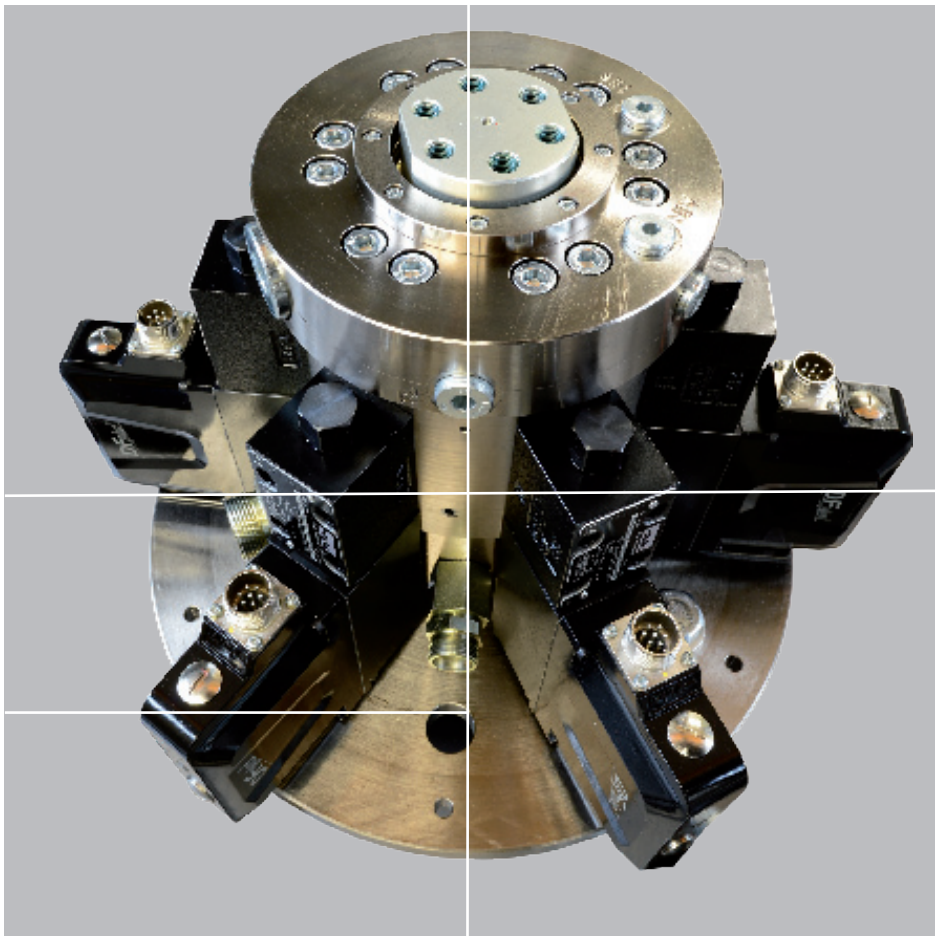
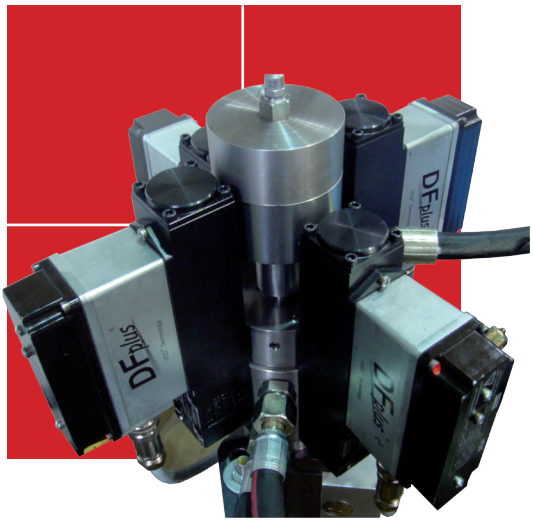
High-Performance-Shaker

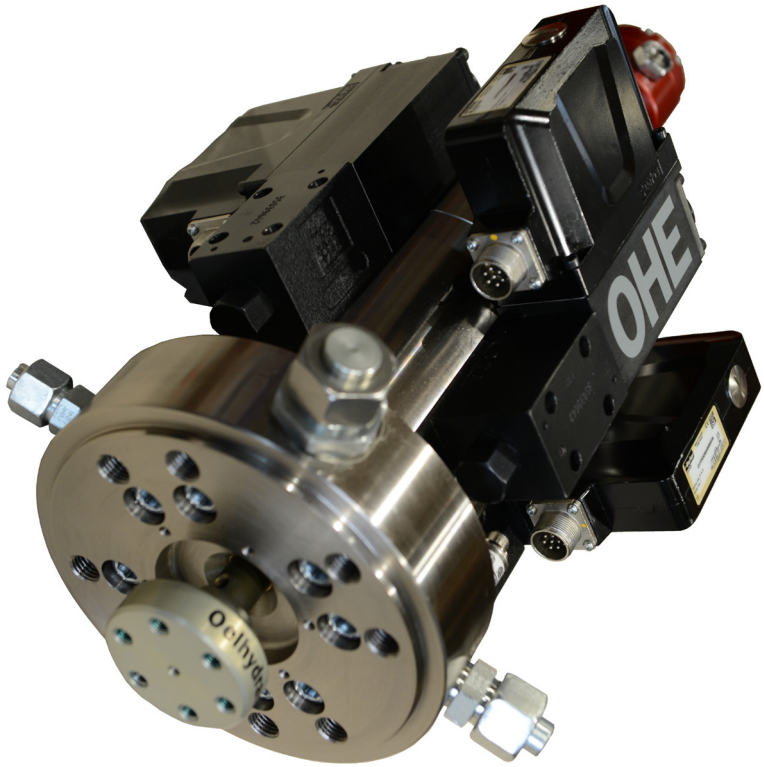
HPS-26/20/20/20 HPS-26/20/20/50 HPS-45/26/26/15



- **High frequency to 600 Hz**
- **Peak acceleration up to 250 g**
- **Compact design**
- **Complete system incl. pressure supply and controller**
- **Controller-cycle time to 16 kHz**
- **Possible anti-rotation device**

HAGENBUCH
Hydraulic Systems





Testing with the High-Performance-Shaker

The High-Performance-Shaker is the ideal test bench drive. The shaker is characterized by high speeds and frequencies. Depending on customers requirements, the High-Performance-Shaker can be built to size.

The High-Performance-Shaker were developed to further expand the limits of traditional hydraulic shakers. The drives allow high frequencies up to 600 Hz can be achieved, peak accelerations up to 250 g and with useful loads up to 50 kg. The drives have proven effective primarily in the automotive and aviation technology in the testing area.

The drives have fully hydrostatic bearings. This means that pistons are always floating on a oil film. This reduces the friction considerably and most importantly there is no bothersome stick-slip effect. With such high accelerations, the moving mass is the deciding factor. This means that as little own mass as possible must be moved and the force befits the useful load as muchas possible. Thus, high-tech materials from aviation and aeronautics are used for all moving parts.

To good Engineering belongs comprehensive electronics and software with rich functionality and interfaces. Even the basic package offers a lot of testing and applications, and additionally offers the possibility to use a comprehensive range of on the market control systems.

Our motivation is to offer a total solution. This includes consulting and supply of aggregates, mechanical connections, security concepts, etc. Our engineers look forward to working with you to plan your new test bench.

Automotive-Industry

Component testing

Technical highlights:

- High frequency up to 600 Hz
- Peak acceleration up to 250 g
- Compact design

Performance

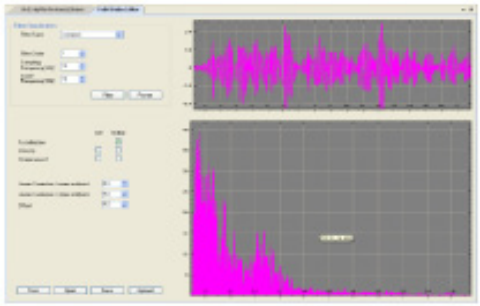
Controller

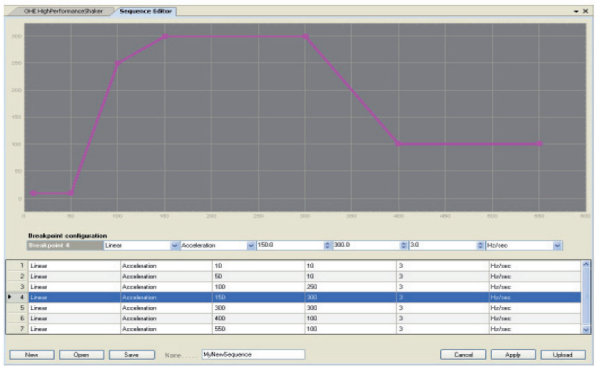
It takes efficient electronics and software for the hydraulic shaker to achieve its full performance. The controller's centerpiece is a Quad Core PPC CPU of 2.2 GHz clock speed and 2 GB RAM. Being combined with an ultra-fast bus system (GinLink), nearly as many interfaces for all kinds of signals can be integrated like is the case with PLC controls. Only, in this case the data transmission is many-times faster and facilitates control sampling rates of up to 16 kHz. In its basic version, the controller provides 16 digital in- and outputs for 24 V DC. Additionally available are 8 analog inputs, 3 of which are intended for measuring functions. Usually, one of these three channels will be used for an acceleration sensor.

Being equipped with BNC plugs, 2 inputs can be used for other measuring functions. The number of interfaces can be increased at any time and at low costs, whereas modules for nearly all kinds of signals are available.

The electronic equipment comes with a high-performance 24 V DC power supply of 30 or 40 A for the servo valves' control. Additionally, a safety circuit that allows for the drive's deactivation at any times has been integrated. The illustrations show the electronic equipment being installed in a convenient PC rack. However, depending on the respective application or number of interfaces it may alternatively be advisable to install it in an industrial control cabinet.

Example: Drive-Files and Sinus-Sweep





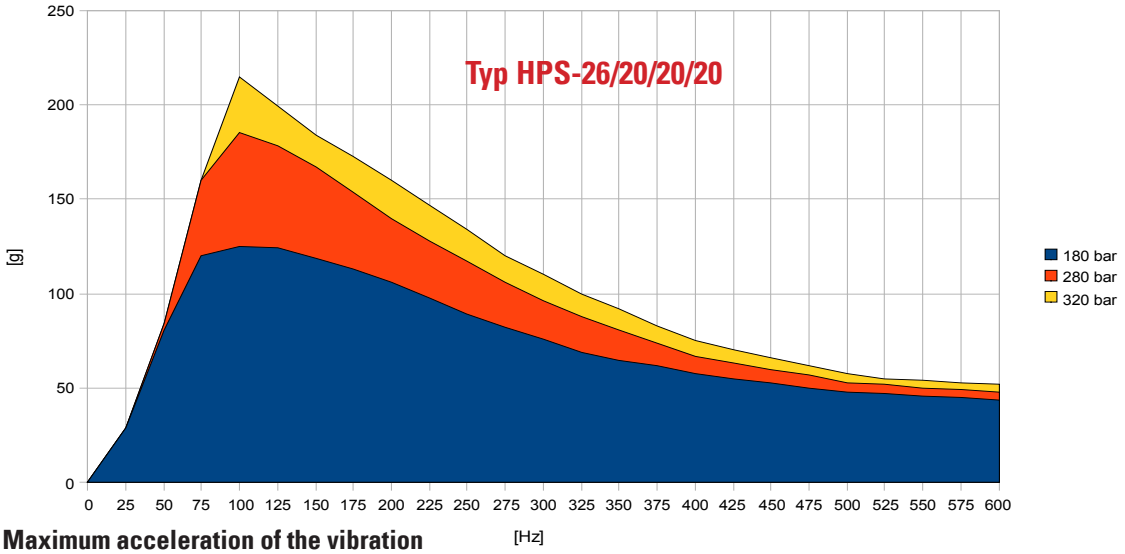
Typical applications for the High-Performance-Shaker: Drive-Files are free motion-profiles which often contain measurement data. The goal is to simulate real load for the specimen on the test-bench.
Other typical applications are frequency-sweep for testing the characteristic of the specimen. The software offers functions to program individual amplitudes for different frequency-ranges.

Position or Acceleration Amplitudes are controlled by an optimizer. This will guarantee precise motion.

An other special feature of our shaker-system is **the compensation of harmonic waves** with sinus-motion. So not only the peak-values are perfect but also the time-signal looks like a proper sine-motion!

Performance

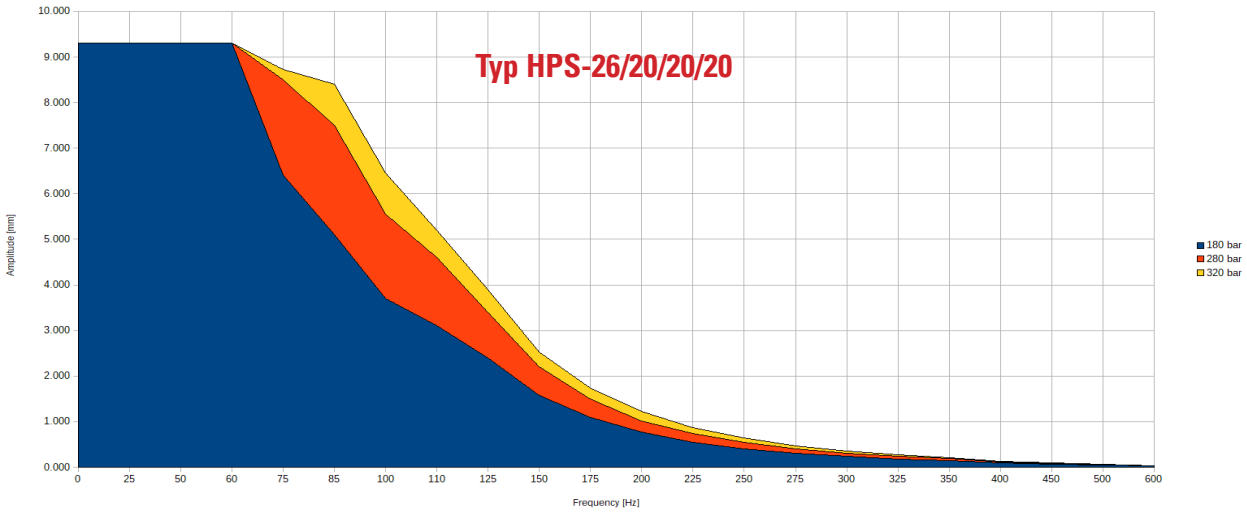
Acceleration curves depend on supply pressure



Maximum acceleration of the vibration

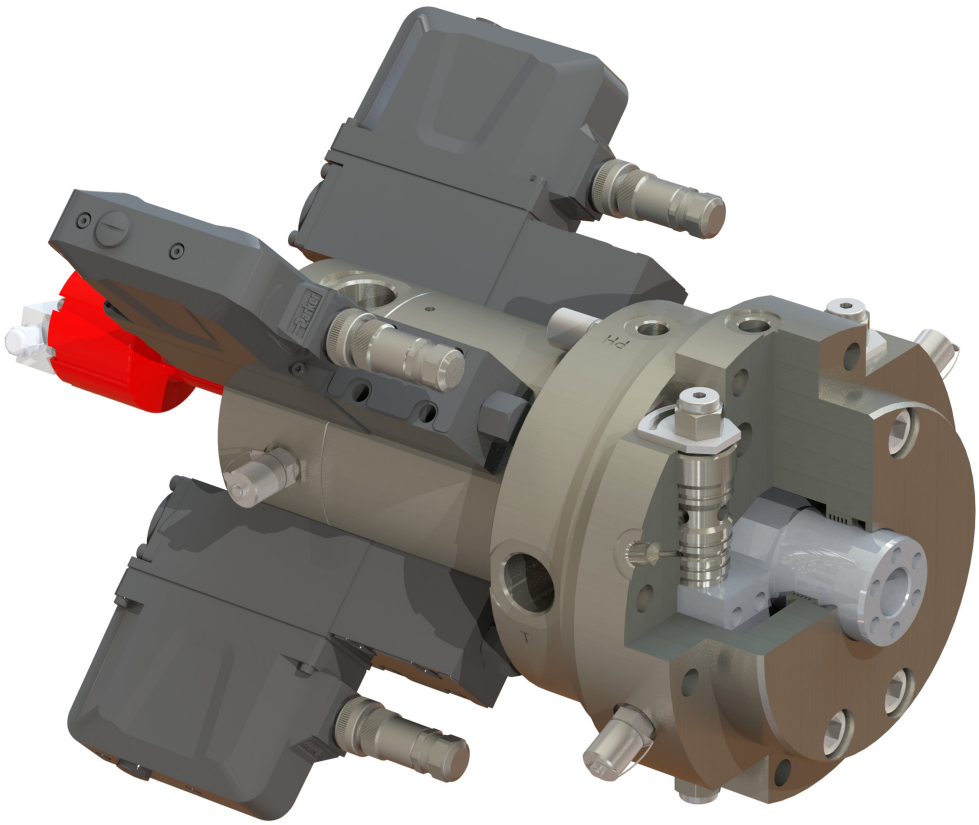
The maximum achievable accelerations depend primarily on the supply pressure from the payload, on the frequency and the working stroke of the actuator. In the lower frequency range, maximum acceleration is limited by the drive stroke. At higher frequencies, maximum acceleration depends on the payload and the relevant inertia forces (mass x acceleration). If limits are reached, parameters such as drive size, drive unit, etc. must be adjusted.

Displacement amplitude depends on supply pressure



Maximum amplitude

Hydrostatic anti-rotation device



As an option, the hydrostatic anti-rotation device can be fitted on the rod side of a High Performance Shaker. Four hydrostatic bearings prevent the piston rod from rotating. The pressure supply for the bearings is taken directly from the shaker so that no additional hose lines are necessary. The anti-rotation device is centered precisely in relation to the piston rod and does not influence the guidance of the rod.

This is a major advantage compared to an external device. Another benefit: the anti-rotation device does not cause any additional friction, so the shaker's performance is not adversely affected. The anti-rotation device for the High Performance Shaker can absorb torques of up to 270 Nm.

Technical data
High-Performance-Shaker

Drive date	HPS-26-20-20-20 / 50	HPS-45-26-26-15
Piston diameter:	26 mm	45 mm
Rod diameter:	20 mm	26 mm
Stroke:	20 mm or 50 mm	15 mm
Max. force:	+/- 7 kN	+/- 33 kN
Masse to be moved:	<= 5 kg	bis zu 50 kg
Frequency range:	600 Hz	500 Hz
Max. acceleration:	250 g	150 g
Max. supply pressure:	340 bar	340 bar
Average volume flow:	43 l/min (bei ~ 80 Hz)	70 l/min (bei ~ 50 Hz)
Oil specification:	ISO VG-46, preferably synthetically	ISO VG-46, preferably synthetically
Max. side load:	10 N	10 N
Umgebungstemperatur:	-10 up to 35 degrees Celsius	-10 up to 35 degrees Celsius
Installation position:	preferably vertically, horizontally possible	preferably vertically, horizontally possible
Mass HPS:	Lenght: 415 mm Ø 420 mm	Lenght: 380 mm Ø 460 mm
Displacement measuring:	integrated in piston rod inductive sensor type IMS, signal 4 ... 20 mA	integrated in piston rod inductive sensor type IMS, signal 4 ... 20 mA
Force measurment:	Load cell optional	Load cell optional
Pressure measurment:	Pressure sensors A and B optional	Pressure sensors A and B optional

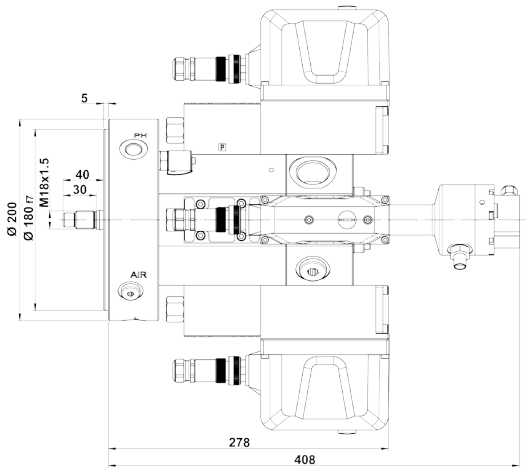
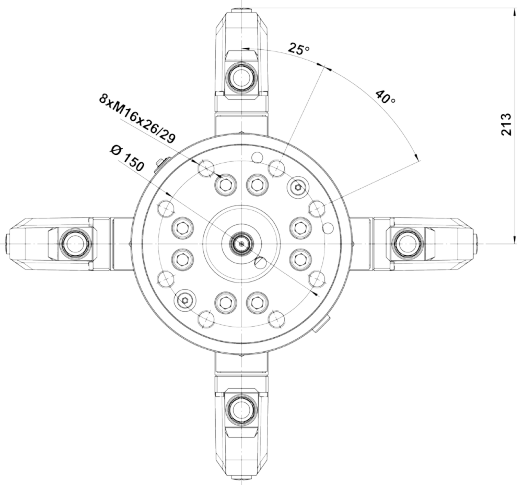
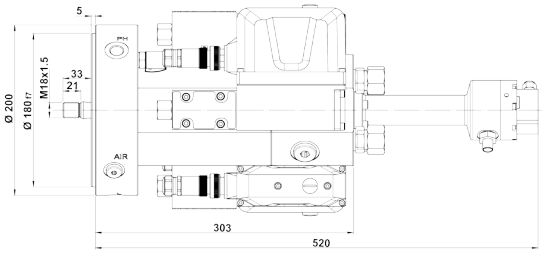
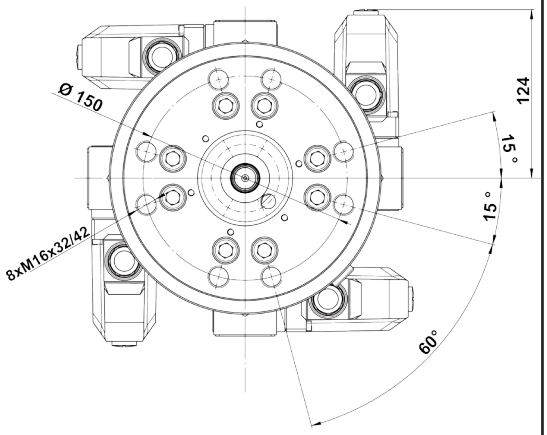
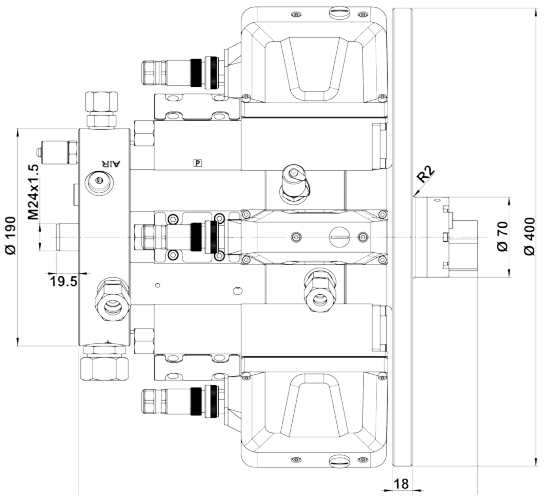
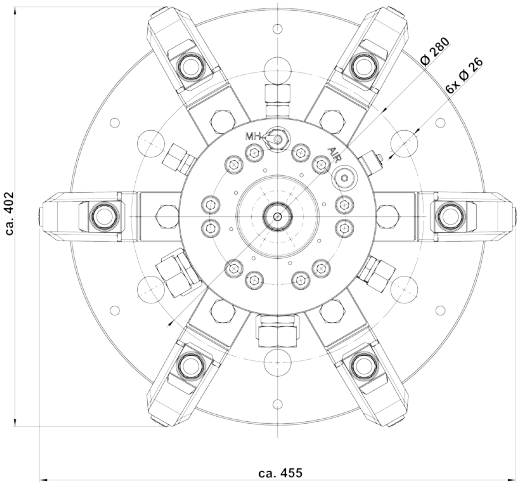
Electronics / Control system:

Controller:	Quad Core PPC CPU
Clock rate:	2.2 GHz
RAM:	2 GB
Ethernet:	1 GBit/s
Bus-system:	2x Gin-Link
Sampling-rates:	16 kHz
Number of analog inputs:	8 (3 free)
Number of analog outputs:	8 (4 free)
Digital inputs:	16 (24 V DC)
Digital outputs:	16 (24 V DC)
Power:	230 Volt 50 Hz or 110 Volt 60 Hz (USA)

Software / Module

Operating system:	Microsoft Windows 7 (or higher - recommended Windows 10)
Manual Sine:	Function generator for displacement / speed / acceleration Simple manual adjustment
Sweep Sine:	Sweep rates defined in Hz ./. sec, decades ./. min. or octaves ./. User-defined sweep tables
Drive Files:	Acceleration, displacement and force curves
Noise:	White Noise, Power spectral density
Spectral Analyzer:	Spectral analysis and signal representation
Data Formats:	ASCII, MTS RPC-Format, *.tim
Data acquisition:	Fully integrated with basic software

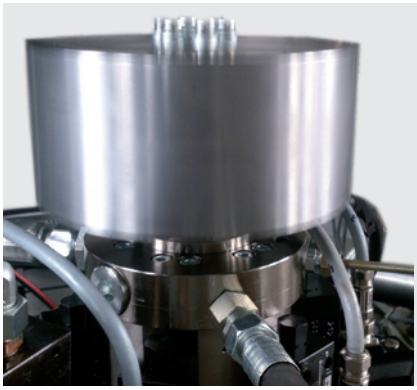
Mass

Mass / Article	Side view	Face view
HPS-26-20-20-20		
HPS-26-20-20-50		
HPS-45-26-26-15		

Application examples

Test bench for component testing

This compact test bench is ideal for component testing. The shaker is mounted vertically under the clamping plate and the rod end protrudes upwards from the plate. Components for testing can be affixed to the large clamping plate and connected to the shaker.
In addition to the shaker, various items of equipment are also integrated in the test bench: a safety and shut-off block, two small accumulators (one in the pressure port and another in the return line), together with operating controls and pressure indicators. Built-in BNC plugs also make it possible to import external measurement signals into the control and record them.



Determining resonant frequencies

The High Performance Shaker features a wide frequency range that makes it an excellent choice for determining the resonant frequencies of any desired components. For this purpose, the shaker can be connected directly to the component, which is then excited. As another option, the shaker can move a mass so that targeted vibrations are generated.

Lifetime endurance testing

The High Performance Shaker has a major advantage over conventional hydraulic cylinders: testing periods can be significantly reduced thanks to the high frequencies that are possible. Because the piston rod is mounted on hydrostatic bearings and the cylinder is only fitted with a gap seal, there are no dynamic seals subject to extensive wear. This reduces maintenance effort and ensures high machine availability.

Hagenbuch Hydraulic Systems AG, Rischring 1, CH-6030 Ebikon, Tel. +41 (0)41 444 12 00, Fax +41 (0)41 444 12 01

info@hagenbuch.ch
www.hagenbuch.ch

HAGENBUCH
Hydraulic Systems

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