

Hybrid Test System Series LFMHybrid 400

The Hybrid Test System combine the advantages of Electromechanical and Servohydraulic Drive Technology and is well suited for the full spectrum of materials testing from monotonic to fatigue. The LFMHybrid provide you with exceptional capability to simulate the exact loading conditions you desire.

This unique testing machine extends your application range across the spectrum and can determine static properties with high accurate electromechanical actuation and perform cyclic testing for the determination of fatigue data with the flexible and high dynamic servohydraulic drive.

The operator can easily select between the electromechanical testing machine or the servohydraulic testing machine or can also operate both drives together for tests with superimpose functions. w+b offers Hybrid Test Systems up to 2500 kN and frequency range up to 100 Hz.



Combine according your Requirements

Often the force requirements for fatigue applications are lower than for monotonic testing. This test systems offer you to combine the correct fatigue rated servohydraulic actuator size with the needed static force rating. By selecting the suitable servohydraulic actuator you will minimize your power consumption and increase your lab efficiency. When your selected fatigue actuator is with lower force than the electromechanical drive we offer the connecting adapter to bypass the actuator for static testing or alternative the piston-rod clamping system withstanding the maximum static force.

System Configuration

- Fatigue Rated Load Frame
- Electromechanical Drive to move the Crosshead for Monotonic testing
- In the base platen Integrated Hydrostatic Actuator for Fatigue Testing (alternative available with Actuator on upper crosshead)
- Latest 2-Channel Ultra-High-Speed, High-Resolution, digital control electronics with self-identification transducer coding and high data sampling / control loop rate
- High accurate load cell
- Comprehensive, easy-to-use "Dion" software
- Large range of attachable grips, fixtures, extensometers, environmental chamber, high temperature furnaces etc. to suit your testing needs.

This Test Systems is well suited for digital closed loop testing in force, stress, displacement, strain and any other control modes including calculated, virtual channels.

These Hybrid Test Systems offers reliable w+b servo-controlled hydraulic & electromechanical actuation with high-resolution & high-speed, digital closed loop controls.

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Reliable & Durable

w+b Hybrid Test Systems combines proven load-frame design with additional features for static to dynamic testing application using high quality components and assemblies coupled with a generous dimensioning.

Versatile

This test systems can be configured to different force capacities with a variety of grips & fixtures, extensometers, environmental simulation accessories and other components to meet the exacting test needs from quality control to research and development.

Latest Control Technology

The Hybrid Test Systems are closed loop controlled through the latest high-resolution, high-speed digital control system **PCS8000**. The **PCS8000** ultra-high-speed closed loop control and data acquisition rate on all channels combined with 24-bit high resolution transducer conditioning rate is achieved by a 64-bit processor running at 1 GHz.

Advanced Closed-Loop Control

As control channel available are any connected inputs as well as virtual (calculated) channels that might open many new opportunities to your application. The versatile concept of the **PCS8000** is based on latest technology and supports applications with virtually no limits.

Powerful & Electromechanical Drive System

The load frames are equipped with belt drive system with powerful, lifetime lubricated servo-gearbox providing low belt speed for silent and long-term operation combined with exceptional low minimum speeds control and best stability when operating the machine at high speed. The machine is controlled by a brush-less high responsive, maintenance-free AC servomotor to drive.

Space Saving

These compact tests systems are ideal for any lab that needs to perform a wide range of different tests. The machine occupies a very small area compared with installing a monotonic and an additional fatigue rated testing machine.

Cost Effective

The LFMHybrid reduces your investment compared with two independent machines. Additionally, your future maintenance costs, calibration expenses and IT costs will also be reduces.

Energy Efficient

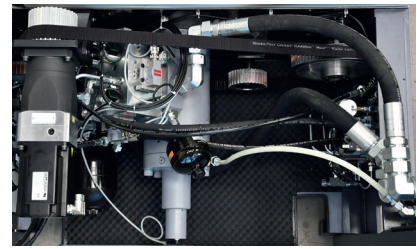
These test systems makes it possible to select the suitable drive system for your related tests. When operating the machine with the high-efficient AC drive for monotonic testing you will reduce your energy consumption and increase your efficient.

Operator Safety

Our Hybrid series of test systems fully comply with the safety requirements of the EC Machinery Directive and are supplied with the related EC Declaration.

Specimen Safety

Specimen protect function prevents your specimen from being damaged during setup and gripping. The Test System is protected against overload and provide the ability to set limits for load, crosshead travel, strain or any other connected transducer preventing damage to your system, load cell and grip or fixtures. Mechanical end-stops and adjustable travel limits stop the cross-head at set points.



Machine Safety

Provides highest level of machine safety including overload protection of the frame, overload protection of the load cell, maximum and minimum crosshead travel switches, two-channel safety circuit according to the machinery directive.

Crosshead Clamping

For models with high dynamic forces and for increased life-time the LFMHybrid is offered with additional crosshead clamping to the two guidance column. When the crosshead is clamped to most of the test force is absorbed by the two guidance columns reducing the force to the ball-screws considerable.

This passive clamping system can be unclamped for tests performed with the electromechanical drive. A well-defined clearance ensures that the crosshead can move without friction.

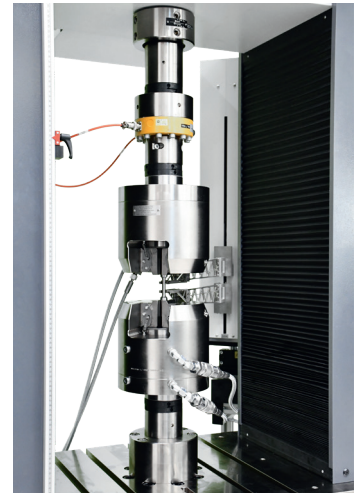
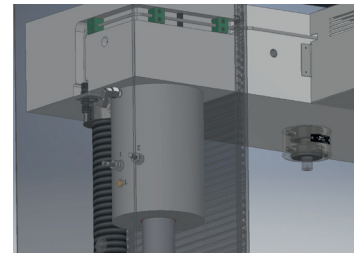
Expandable

Testing Machines powered by **PCS8000** you will be ready for your test demands of today & tomorrow. These test systems can be equipped with up to 26 amplifier cards for control or data-acquisition and up to 20 virtual channels operating at full rate. All physical and virtual channels can be used as data-acquisition as well as control channels. Additional 24 digital outputs and 16 digital inputs to control external devices are provided.

Modular & Flexible

The modular design enables us to adapt these test systems to virtually any of your requirements. Common customizations include:

- Other test speeds
- Extended test space
- Multifunctional T-slot base platen to clamp grips or fixtures, components or finished goods



Load Frame LFMHybr 400.100

The Hybrid Load Frames are specially designed to make this series of load frame suitable for static to fatigue testing up to 100 Hz.

This Series offers ultra-high flexibility and modularity making this model the perfect platform for a wide spectrum of users and applications ranging from monotonic to low cycle fatigue to fracture mechanics to high cycle fatigue application.

The 400 kN Load Frame is designed with application in mind and includes several advanced features make them well suited for static to dynamic testing.

Following advanced features are included compared with static only electromechanical testing machines:

- Increased load frame stiffness
- Increased load frame mass
- Large backlash-free ball screws with high load capacity
- Each ball-screw bearing arrangement with upper and lower fixed bearing for increase frame stiffness
- Optional available passive column clamping system relieve the load on ball-screws for increased lifetime

Load frame in rigid 4-column construction with high axial and lateral stiffness and precision aligned for closed loop controlled static to dynamic testing up to 100 Hz on a wide variety of different specimen and materials.

High Stiffness Load Frame

The load frame provides high axial, lateral and torsional stiffness.

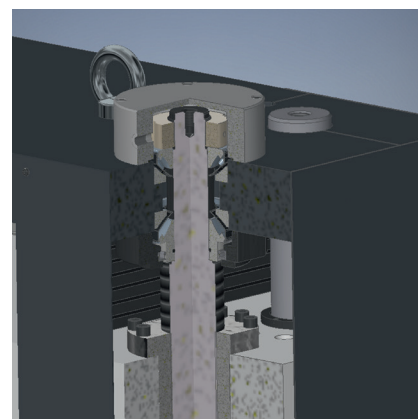
Increased stiffness means higher efficiency as the amount of energy needed to overcome the frame deformation in each loading cycle is less.

To increase the stiffness low deformed crosshead and base platen, generous selected ball-screw spindles and guidance columns and the preloaded ball-screws with upper and lower fixed bearing for increased stiffness is included.

This results in increased load frame weights which improves the natural frequency of the load frame and reduces vibration introduced into laboratory floor / building.

The Column are inductive hardened, polished and hard chromium-plated. Hardened surface: avoids any indentation while the crosshead is clamped. Polished execution: accurate straightness of the column allows the parallel height adjustment.

Hard chromium-plated column reduces corrosion of the column and ease cleaning. The column must not be lubricated with oil.



Integrated Servohydraulic Actuator

Double acting, double ended, equal area Servo Actuator with Hydrostatic Pocket Bearings in Round (no tie rod) design integrated in the lower part of the testing machine for dynamic fatigue testing.

Double ended, equal area linear actuator with hydrostatic bearings for the best friction free static and dynamic performance, allows high side-loads and emergency running, and provides virtually unlimited service life. They represent the high-end solution with virtually service-free operation.

Double Ended (Equal Piston Area) Construction

Unlike single rod cylinders, the surfaces for extension and retraction in the actuator with a through piston rod, called double ended actuator, are of the same size. Especially in combination with symmetrical regulating valves, surfaces of the same size allow realizing higher dynamic frequencies as equal oil flows to both actuator chambers occur with positive effect to the control accuracy and accumulator function. Additionally, they feature higher side load resistance than single ended actuators but are about twice the length of the single ended actuators.

Round Design

Round head cylinder design have rotationally symmetric parts and thus can be produced (manufactured) very accurate and are space-saving and rigid (stable). Compared with the simple constructed tie rod cylinders which are equipped with long screws, so-called tie rods, which connect the two covers over the entire length of the cylinder the round design extend the actuators life time because of lower stress on the guides. The simple tie rod construction requires uniform pre-stressing of all tie rods to prevent straining and deformation of the entire cylinder. The longer the cylinder, the more important this gets. Deformation due to incorrect mounting will reduce the cylinder's life time because of excess stress on the guides.

Hydrostatic Pocket Bearings

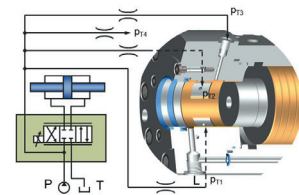
Servo Actuators with hydrostatic bearings are used where the highest dynamic response, accuracy and radial force loading can appear. They are the high-end solution for service-free operation.

An important feature of these servo actuators is low friction as only the viscous friction of the oil in the seal clearance is present at the servo actuators piston. By optimising the installation space required for the seal (at zero pressure) between the bearing oil drain and the outside, the friction here is also kept extremely low within the tolerance range.

If radial forces (as possible by component testing) act on the piston rod, these are absorbed by the servo actuator, the piston rods of which have hydrostatic pocket bearings.

Hydrostatic bearings are primarily used because of the following characteristics:

- High loading permissible
- Considerable static rigidity and high damping
- No starting friction and very low friction at low and high speeds
- No wear
- Little heat produced



Hydrostatic bearings are supplied with system pressure independent of the relative movement between the piston rod and the bearing. Four (4) pockets are situated in the bearing bush. Each pocket is bordered by a bearing land. When under pressure, fluid is continuously fed to the pockets. Fluid flows to the bearing ends via the clearance between the piston rod and the bearing lands. In a bearing under no load, the fluid pressure is about the same in all pockets. Hence the clearances at the bearing lands in the pockets are also about the same. The piston rod is centred in its mid position.

Once the bearing is under load, the piston rod is moved from its mid position in the direction of the load. Hence, the clearance in one pocket becomes larger and the resistance to the flow lower. The clearance in another pocket is forced to become smaller and the resistance to flow increases. If the flow to the individual pockets is kept more or less constant, the pressure will then increase in one pocket, whilst it decreases in the other pocket. As a result of this pressure difference the external loading is absorbed.

The material pairs for bearing and piston rod or piston and cylinder housing are carefully selected and proved through our long-term experience. The clearance between piston rod and pocket bearings or between piston and housing is designed so that no metal-to-metal contact occurs.

A prerequisite for high radial loading is that the bearing diameters are of sufficient size. Larger cylinder strokes require a larger piston rod diameter to buckling.

The oil supply for the pocket bearings is provided from the hydraulic oil supply (hydraulic power pack).

Actuator End Cushioning

The actuator has integrated cushioning.

Cushioning of some sort is required to decelerate a cylinder's piston before it strikes the end cap. Reducing the piston velocity as it approaches the end cap lowers the stresses on cylinder components and reduces vibration transmitted to the machine structure.

Sealing System functional oil seal

An especially low-friction functional oil seal is installed behind the functional oil port, which seals the rod from the inside. A wiper ring completes the system. Since in this system the seal is only pressurized with the functional oil pressure, the effect of the actuator's friction behaviour is negligible. Thus, this seal is subject to very little wear.

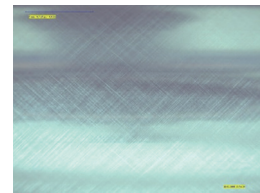
This special seal system does not require the installation of a suction pump to remove the leak-oil. The leak-oil port can simply be connected to the hydraulic power pack tank by suitable sized leak oil hose.

Precision

The piston rod of a hydraulic cylinder moves in the cylinder tube and cover. Reliable functioning requires sufficient guide clearance between the component parts. The guide clearance must be sufficient to allow for the expansion of components parts caused by temperature differences during service. Too much clearance on the other hand would permit too much tilt. This would increase the stress on the guiding elements and thus the wear and tear of component parts. The perfect guide clearance for the hydraulic actuators is reached with ISO standard tolerance grade IT7 in combination with high degrees of roundness of piston rod and actuator tube as made possible by cross-hatching or honing.

Advantages of Cross-Hatching of Piston Rod

- Best lubricating properties for the sealing elements
- No dry-running
- Little wear
- Low friction
- Long life time



Internal Digital SSI Displacement Transducer

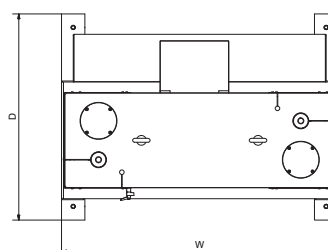
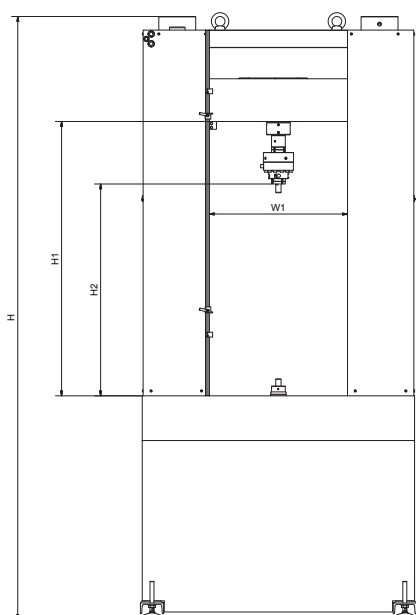
The actuator is equipped with coaxial integrated, digital SSI positional transducer as standard. Using this system, the actuators stroke (position) is measured and then fed as an actual signal via the measuring amplifier to the digital controller for position data acquisition or acquisition and control signal.

Close coupled accumulators to minimize hydraulic pressure fluctuations are mounted direct on the servo-valve manifold direct at the actuator. Processes with a high dynamic response require the use of membrane accumulators of sufficient size in the pressure and return lines in the direct vicinity of the servo valve. The optimal size of the installed accumulators in the pressure and return line varies with the actuator and hydraulic power pack size.

Summary of Load Frame Features

- Rigid machine frame with high stiffness providing superior axial and lateral stiffness and guarantees robust, durable and long-term operation
- One test area with ergonomically working height
- Two big precise, backlash-free ball screw assembly each ball-screw bearing arrangement with upper and lower fixed bearing for increase frame stiffness provides high load capacity, high positioning accuracy and repeatability
- Spindle drive controlled by a brush-less high responsive, maintenance-free servomotor to drive the mobile traverse (crosshead) providing faster starts and stops, best control, and highest accuracy at an extremely low noise level
- Additional two (2) guiding columns for increased lateral and in combination with upper and lower fixed bearing also for increased axial stiffness
- Spindle with flange double-nut, sealed and greased for long maintenance intervals
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- Spindle, flange double-nut and ball-screw shaft grinded pairwise for reduced pitch error
- Ball Screw Protection over fully travel through oil- and moisture-resistant, sealed bellows made from polyester fabric, coated with polyurethane inside and out
- On-point, in-service ball-screw lubrication
- In the lower base platen integrated double ended, equal area linear actuator with hydrostatic bearings for the best friction free static and dynamic performance, allow high side-loads and emergency running.
- Servo-valves with manifold mounted direct on the axial and actuators with close coupled accumulators to minimize hydraulic pressure fluctuations mounted direct at the actuators
- Ball Screw Protection over fully travel through oil- and moisture-resistant, sealed bellows made from polyester fabric, coated with polyurethane inside and out
- Precision strain gauge load cell mounted on (moveable) crosshead
- Alignment fixtures mounted between crosshead and load cell with related alignment verification equipment optionally available
- Digital crosshead measurement encoder
- Digital piston stroke transducer
- Adjustable stops in both (UP/DOWN) directions for the best protection of operator, test sample and machine
- End stops for maximum travel protection
- Electrical cabinet with complete power supply and control module, relays etc. mounted on rear side of machine's base
- Durable structured coating (paint)
- Use of high-quality components and assemblies of reputable companies
- Bolts for lifting the machine
- Adjustable machine feet to level the testing machine
- The machine is free-standing on shock absorbers, requiring no special foundations
- Specimen protection: The crosshead is automatically soft adjusting preventing damages on specimens, fixtures and load cells during crosshead adjusting.

Model		LFMHybr 400				
		LFMHybr 400.100	LFMHybr 400.200	LFMHybr 400.250	LFMHybr 400.300	LFMHybr 400.400
Force Range Load Frame	kN	400				
System Configured to	kN	100	200	250	300	300
Other Possible Servohydraulic Drives (Actuator)*	kN	25, 50 or 63 kN	25, 50, 63 or 150 kN	25, 50, 63, 100, 150, 200 kN	25, 50, 63, 100, 150, 200 or 250 kN	25, 50, 63, 100, 150, 200, 250, 300 kN
Force Resolution (Analogue to Digital Conversion)		24 Bit				
Force Measurement Accuracy*	ISO 7500-1	Grade 0.5: 1/100 to 100% according to ISO 7500-1 Grade 1: 1/250 to 1/100% according to ISO 7500-1				
Electromechanical Drive						
Distance between connecting details, H2	mm	500 (others available)	750 (others available)	600 (others available)	600 (others available)	600 (others available)
Test Speed Range	mm/min.	500 Any other available on request				
Crosshead Accuracy		Grade 0.5				
Servohydraulic Drive						
Frequency Range**	Hz	100				
Piston Stroke	mm	100 (Optional 150 mm)				
Piston Stroke Accuracy		Grade 0.5 according to ISO 9513				
Piston Stroke Resolution		0.5 µm				
Crosshead Clamping		Option	Option	Standard for Servohydraulic Actuator 250 kN or higher		
Piston Rod Clamping		Available				
Closed Loop Control Rate	Hz	8000	14400			
Data Acquisition Rate	Hz	Adjustable up to 14400				
Test Area Width	mm	710				
Test Area Height, H1 (Vertical Test Space)	mm	1410 (others available)	2150 (others available)			
Distance between connecting details, H2	mm	1050	1650			
Frame Height, H	mm	3100	3700			
Frame Width, W	mm	1420				
Frame Depth, D	mm	1060				
Frame Weight	kg	3910	4420			
Power Requirements Electromechanical Drive	kW	1.5	3	3.5	4	5.5
Operating Temperature Range	°C	5°C to 40°C				
Humidity Range	%	20-92% Non-condensing				



From Customized Systems

«Specific testing tasks demand appropriate testing equipment!»

This is our motto. Therefore, besides of our standardized model lines we have developed an extensive number of customized solutions from miniature systems up to high-force applications.

Should you require a very specific and customized testing system, we are able to design, develop and produce such system for you. We deliver customized solutions and complete installations for physical and mechanical testing laboratories world-wide.

to High LFMHybrid Systems

We are producing our hybrid test system with force capacities up to 2500 kN.

The dimensions and performance of this application designed solution will according your requirements.

