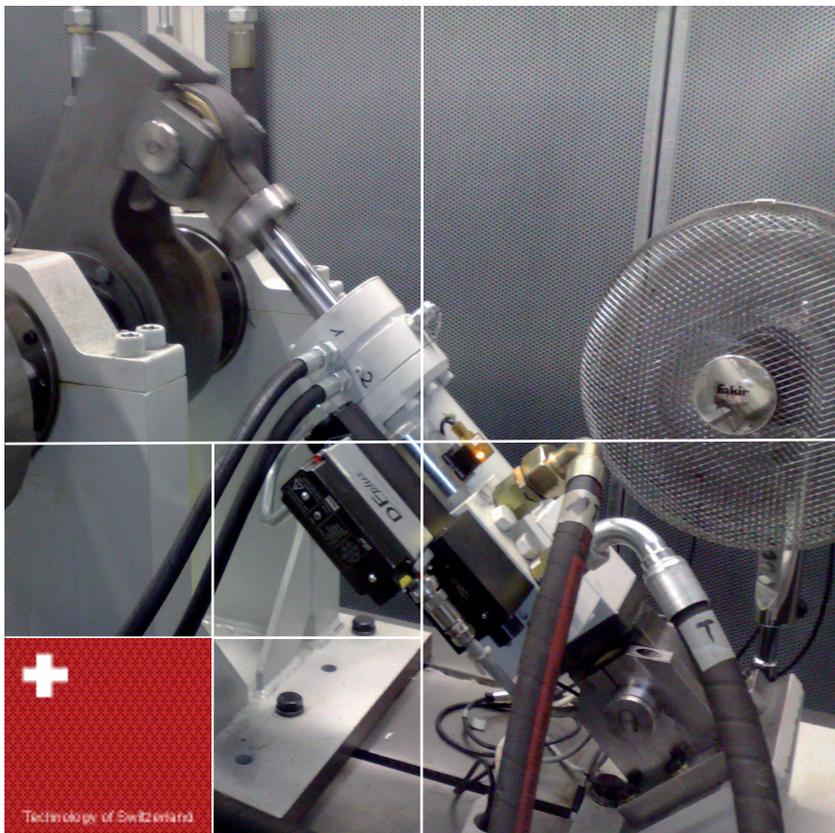


MACS

Multi-Axis-Control-System

Control technology for hydraulic test stands



- Scalable, digital control system for hydraulic test stands
- Adjustments according to customer requirements
- Real time and multitasking system
- Up to 64 axes
- Up to 16 kHz sampling rate
- Comprehensive test stand development with security concept and hydraulic supply
- Extensive software

HAGENBUCH
Hydraulic Systems



MACS

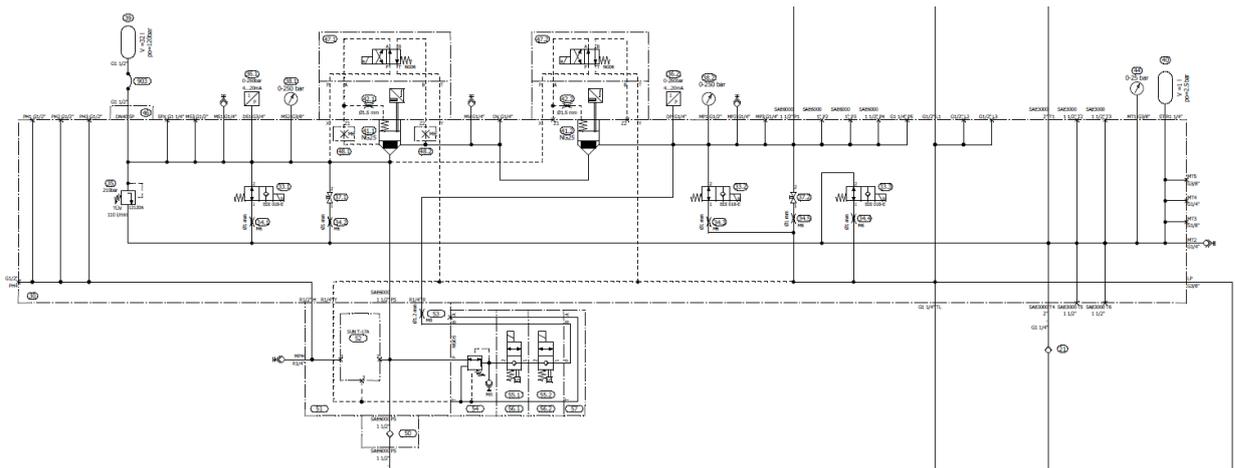
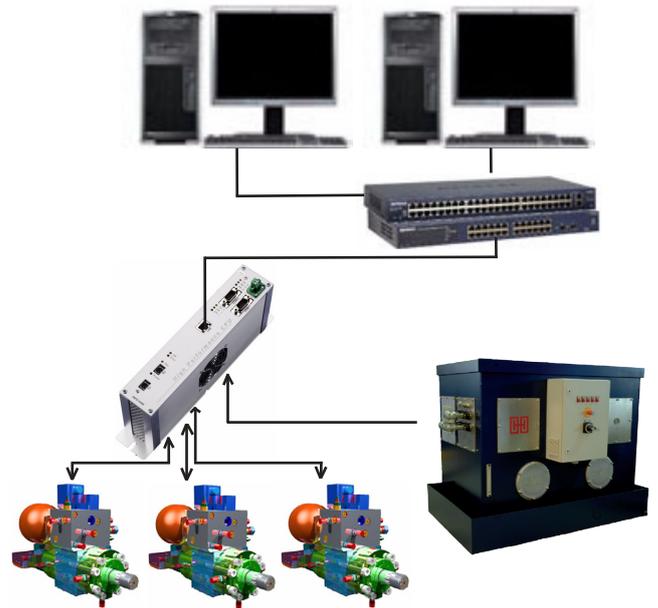
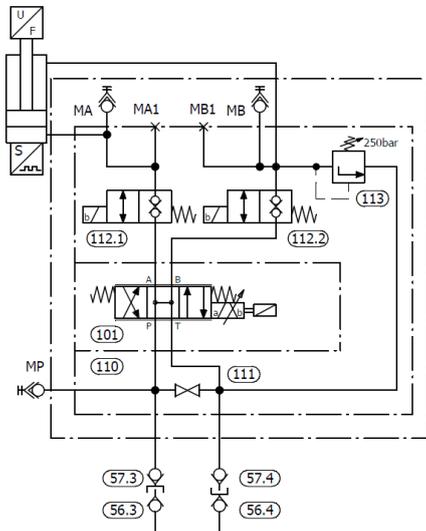
Multi-Axis-Control-System

Testing machines are always individually tailored to the task. Nevertheless, the basic components are similar time and again, even in different designs. Whether large or small performances, forces, strokes, etc., from an abstract point of view the drives are mostly equipped with similar sensors.

This is where the MACS system, which forms a unitized platform for a variety of testing tasks with hydraulic drives, comes in. It can rapidly adapt and be reconfigured to new tasks, and above all it is prepared for multiple drives.

At its heart is the very powerful master with a PPC processor and a real time and multitasking operating system. The real strength is the very fast bus system Gin link, whereas the intelligence remains central on the master. The MACS Control Center is the interface for the operation, monitoring and adjustment of system.

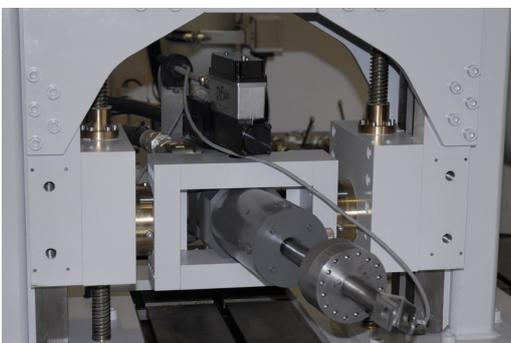
The aim is to enable elaborate tasks without long and expensive development time for you!



Range of functions / Performance

- Position control
- Force control
- Pressure control
- Control of pressure intensifiers
- Control of acceleration
- Measurements of distance/force diagrams
- Measurements of force/distance diagrams
- Soft switching from distance to force control and vice versa
- Preloading of force
- Distance-sine mode with amplitude optimization
- Acceleration sine control with peak optimization
- Comprehensive measurement system with selectable number of measuring inputs
- Oscilloscope function
- Logger function for data recording
- Active absorption of harmonic waves in acceleration sine control
- Descendants of free movement profiles (DriveFiles) distance controlled
- Descendants of free movement profiles (DriveFiles) force controlled
- Parallel operation of several drives
- Comprehensive reporting system with logging of all events
- Variety of possibilities for critical value definitions
- Integration and control of hydraulic connection and safety blocks
- Integration and control of hydraulic supply
- Setup mode with reduced pressure and limited speed

Quality hydraulic cylinder



Cylinder for permanent operation

Testing machines call for completely different requirements for hydraulic cylinders than for standard cylinders, because the test stand must withstand the continual pressure on the test object during continuous operation – that is, 24 hours throughout the year.

For this reason, we fabricate the hydraulic cylinders ourselves, based on decades of experience. Hydrostatic bearings prevent direct contact between piston rods and cylinder, which prolongs the lifetime significantly. Sealing systems, precision components and leak oil drains are additional details to which we pay special attention. Each cylinder is adapted to the task with the goal of a long, trouble-free service life!

Electronics and control system

High-performance control electronics

Only high-performance electronics with equally powerful software bring the precise mechanics in test stands to life.

Our industrial controller is based on hardware, which is designed specifically for use with high speed control tasks. The master CPU connects with the I/O-modules in different nodes on a very fast bus system. This allows for control tasks with cycle times of up to 16 kHz.

The controller can be extended with interfaces for almost all tasks. Typical modules are input modules for analog signals (voltage, current, load measuring bridges), digital inputs and outputs (24 VDC), SSI signals, incremental encoders, TTL signals, etc.

Network integration

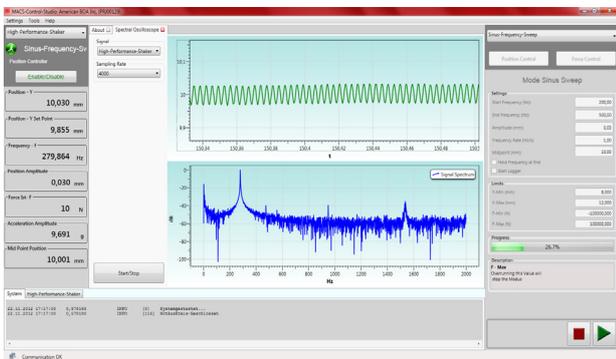
The controller is integrated in your network via Ethernet and can be addressed from any PC. Test stands can thus be monitored from remote computers or via remote access.



- Control voltage 24 VDC
- Professional wiring
- High-quality plugs
- Ultra fast bus system and data transfer
- Incremental inputs
- Inputs for SSI signals
- Sampling rates up to 16 kHz
- Analog inputs, voltage / current
- Analog outputs, voltage / current
- digital outputs, 24 VDC, 2 A max
- digital inputs, 24 VDC signals
- 1000 MBit Ethernet interface
- Backwards compatibility
- Support even for old equipment



Software



Concept for high reliability

The demands on software with security functions are higher than on normal software. For this reason we have separated control and operation / visualization. The real time part with all machine interfaces, the control and security functions runs as firmware (kernel) on the controller.

The visualization, operation, acquisition of data and the programming of the test stand is controlled from any computer with MS-Windows. Both parts communicate via Ethernet. A big advantage of this concept is not only high reliability, but also that controlling can be addressed from multiple PCs.

Using configuration files, the core is constructed so that it can be configured quickly for any number of driving axles. Each drive then immediately has a plurality of function modules for various types of tests. Each new project again creates new functional modules, which are available to other customers in updates later.

User interfaces and other tools

In order to limit the development effort in the customer project, we provide the software MACS Control Center, which is a user interface that already comes with many control and evaluation opportunities. The software allows the operation of several test stand drives individually.

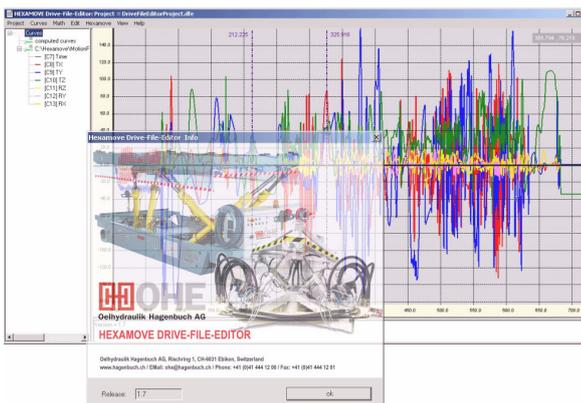
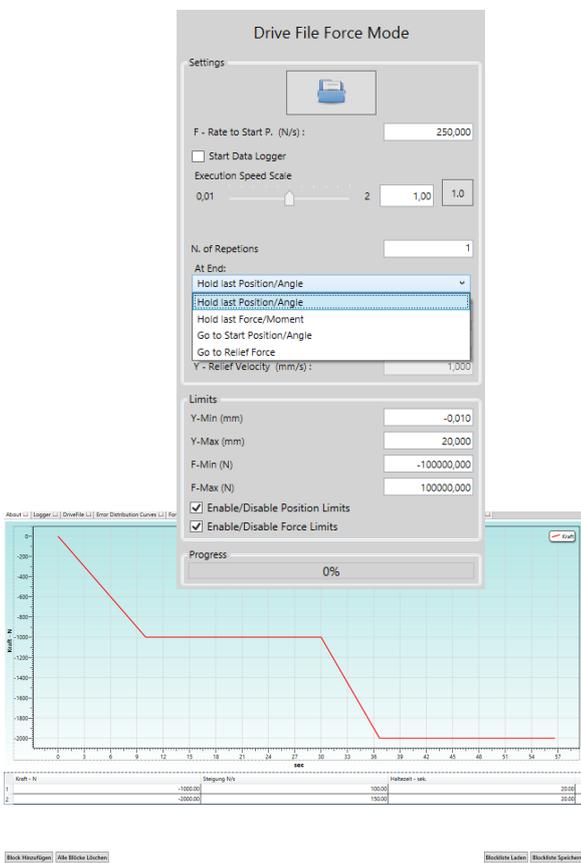
Additionally, there are other programs available to assist the work. For example, the software DriveFileEditor allows editing of free movement programs.

Libraries for own developments

If you want, you can also develop your own surfaces or evaluation functions. We provide you with the necessary libraries (dll) and assist you with a sample code.

Fair licensing policy

You have invested in a test stand for the development of your products. For this investment to bring the greatest possible benefits, you should be able to use all software for the test stand as free as you want. The programs can therefore be installed multiple times on different computers, as long as the software is used in conjunction with the test stand.



Hydraulics and general test stand

Overall responsibility

Cylinders, control electronics and software are the heart of a test stand, however that does not make the test stand prepared for operation yet. In general, it still needs a hydraulic pressure supply, devices, cable installations, electrical installations, security concepts, and other elements. Our goal is to take on both the necessary engineering work as well as the responsibility and supply of these parts, so that the test stand is ready for launch after handover.



- Total project engineering
- Design of the pressure supply / aggregate
- Development of the security concept
- Storage, safety and connection blocks
- Hose connections
- Pipe and cable installations
- Concepts for cooling



Options

With an increasing number of projects, more and more customized solutions and add-on options are available. We are happy to realize special designs or extensions for you, too.

- Remote hand control
- Joysticks and 3D Space Mouse
- Interface Email notification
- Bar code scanner
- ...



Examples of use



Torque control: Testing of bus gearbox

The cylinder is equipped with a load cell and a position sensor. Via the torque test module, the user defines the geometry and amplitude (Nm) and frequency of the test. The system automatically regulates the required path, so that exactly the desired torque is generated on the test object. An additional module monitors changes of amplitude and mean value of the oscillations during the test, so that yielding or even fractures can be identified and documented on the test object.



Highly dynamic force control

For the testing of components in seating designs of vehicles, a special test stand with highly dynamic, power controlled drives is employed. Within less than 150 ms, the hydraulic drive moves along a free force profile predefined as Drive-File and thus deforms the test object. A particular challenge in this project was the control algorithm. As each test runs individually and the components are deformed or destroyed, no usual „learning“ algorithms can be used.



Precise force control for thrust bearing test stand

ABB is a leading manufacturer of turbochargers for diesel and gas engines. An important element in a turbocharger are the thrust bearings. Therefore, a special test stand was developed for the development and testing of these components. The engineers of Hagenbuch were allowed to counsel ABB in relation to the hydraulic drive technology and could successfully equip the plant with a MACS Multi-Axis-Control-System and new sensors. With more precise hydraulic drives, any load profiles can be introduced to the test object.



Shakers for aerospace and automotive industry

Our high-performance shakers are integrated into the MACS system. Built for extreme accelerations and for exceptionally high frequencies to hydraulics of up to 600 Hz, they enable completely unique applications.

The software also allows for spectral representation of the movements. Accelerations and strokes can be controlled precisely in the peak values.

The basis for highest quality standard

Applications:

- Entertainment and pleasure parks
- Automobile and aircraft industry
- Test and positioning apparatus and further applications
- Manufacturing facilities for paper and steel industry
- Equipment for hydro power and power engineering
- General mechanical engineering

Through experience comes success

Clever concepts for customized drives

Assured quality of manpower and technology

Internal knowledge further communicated

Our maintenance and service team never keep you waiting long



Consultation

For us consulting means listening. First we analyse your requirements in discussion. Consequently we develop precise recommendations. With the involvement of our developers your requirements are as good as fulfilled.

Engineering

We offer our customers not only components, but system-solutions inclusive of electronics and software. Our know-how is in demand world-wide because it makes the impossible possible. Together we develop a solution that is optimally tailored to you.

Production and Commissioning

You never stand alone. Hagenbuch supplies not only an optimal product but also the assurance of a perfectly running system-solution. Therefore our highly qualified team are at disposal on location and around the globe.

Training

To know how something works saves money. Our advantage: We know, what you need to know, to ensure reliable operation. To-the-point training ensures the economic function of our technology.

Maintenance and Service

Even after commissioning your system will be attended to by an experienced team of mechanics and Engineers. We offer servicing on-site world-wide or in-house - either on the basis of service contract or on individual specification.



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