# **HYDAC** INTERNATIONAL

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**Components and Systems for Agricultural Machinery** 





HYDAC Head Office in Germany



HYDAC China



HYDAC Japan



HYDAC Korea



HYDAC USA



#### HYDAC France



HYDAC Italy

#### Note

EN 10.105.1.2/01.18

The information in this brochure relates to the operating conditions and applications described. For applications or operating conditions not described, please contact the relevant technical department.

All technical details are subject to change.

## **Components and Systems** for Agricultural Machinery

Since it was founded in 1963, HYDAC's constant innovative development has helped it to become a company group with some 9,000 employees, with a presence in nearly all sectors.

In addition to existing components, HYDAC can provide system solutions customised to suit your specific fluid power and electronics requirements.

To help us with this, we have established a mobile technology engineering team that can use our company's expertise to assist you.

HYDAC can thus provide you with worldwide comprehensive engineering services, both in consulting, joint development and trials and in the realisation of your projects and in service.



All of this is based on our extensively tried-and-tested, top-quality hydraulics and electronics programme. We also perform work to DIN ISO 9001 as a matter of course.

> SAFETY QUALITY LICEN ALER AND PRESSU

For detailed information on our products, please do not hesitate to contact us directly. For joint project drafting and systems, please get in touch.

СЕРТИФ

BUNDESREPUBLIK DEUTSCHLAND

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#### Strong Performance and Controllability

In addition to the actual work/rear hydraulics of classic standard and large tractors, there are other functions with individual requirements. As a result, independent actuators and subsystems are developed to meet these specific requirements.



#### Front hydraulics and working hydraulics of compact tractors

- From the individual valves and modular systems to complete subsystem solutions with performance level for frontloaders, front hitch or working hydraulics of compact tractors
- Typical loader configurations with minimal valve leakage for secure load retention
- High control quality with low pressure loss for sensitive load handling and top efficiency in driving operation



#### Tractor cranes and manipulators

- Sectional control valve kit system for OC/CC hydraulic circuits and complete subsystem solutions for high flexibility in crane/manipulator operation
- Specific functionality for remote closed-loop or open-loop control of crane functions such as rotating mechanism and gripper
- High-resolution valve characteristic curve with fine control range for sensitive and precise work

#### **Prioritised Distribution**



In customised central manifolds, variable and fixed displacement pump flows are distributed to actuators such as steering, brakes, suspension and control valves with optimised performance and with the required prioritisation.

The integration of filters and hydraulic accumulators increases the functional range using minimal space requirements.

#### **Transmission Control**



With the specially developed kit consisting of proportional pressure reducing valves, HYDAC meets the most stringent requirements for transmission applications. For optimum utilisation of installation spaces, additional functions can be integrated into the transmission control, such as cooling, lubrication, filtration and fluid power supply.

- Optimised pressure loss
- Rapid switching characteristics even in highly viscous oil
- High dirt resistance

#### Filtration



#### **Increased Safety and More Convenience**



#### Axle suspension

Load-dependent control of the hydropneumatic front axle suspension is provided in conjunction with the level control of the front axle. This involves two different pressures on the rod side of the suspension cylinders being adjusted hydraulically in accordance with the front axle load.

- Hydraulic solution without electronics or pressure sensors
- Consistent driving comfort independent of load
- Vehicle-specific adjustment of the suspension characteristics



#### Active roll stabilisation

The hydraulic active roll stabilisation reduces the tractor's rolling movements during rapid cornering and sudden lane changes.

- Vehicle-specific adjustment of the stabilisation and damping characteristics
- Reduction of pressure peaks due to additional accumulator volume
- Integrated shock valves to protect the suspension system in the event of overload



#### Cab suspension

The cabin is supported by suspension struts on two or four points.

- Reduction of whole-body vibration stress for driver
- Increase in driving comfort
- Suspension and regulation of the cabin according to driving mode
- Available with fixed, switchable and proportional damping



#### **Machine Safety**

Back-up fluid power supply for the steering and braking system in the event of failure of the tractor's main pump.

A DC power unit performs the supply of the braking cylinder and the hydraulic steering system with priority if the tractor's hydraulic pump malfunctions.

- Permanent pressure monitoring of the system to ensure functional efficiency
- "Coming home" function in addition to the emergency brake, the tractor can be manoeuvred to the next service station even in towing mode

Flange-mount pressure filter for transmission lubrication and supply for the working hydraulics. Thanks to the integrated, temperature-controlled thermal bypass valve, a portion of the flow is fed to the cooler as needed.

- Reliable excess-pressure protection for the cooling circuit thanks to integrated cooler bypass valve
- Enormous space savings thanks to compact design based on valve integration
- Cost savings, as no additional piping is required
- Lower leakage risk, as fewer components and ports are used that are prone to leakage

#### **Diesel Filtration**



Suction side pre-filter and water trap for diesel engines up to > 3,000 kW with fully synthetic filter material to protect all components in the fuel system.

- Excellent water separation
- Long service life
- High contamination retention capacity

#### STEER-by-Wire



Superimposed main steering system by means of electro-proportional steering valve with integrated position monitoring for joystick or GPS-supported steering in off-road operation.

#### **Noise Reduction**

Silencers are fluid-based devices for reducing the level of noise in mobile working machines (e.g. tractors).

One cause of noise is mechanical vibration and vibration caused by fluid pulsation, which is generally amplified across large surface areas. Reflections of oscillation within the silencer damps a large portion of the vibrations across a broad frequency spectrum and greatly reduces sound emission.



- No moving parts, no gas cushion --> maintenance-free
- Reduction in oscillation and vibrations
- Extended service life of mounted components
- Reduced noise level for the driver
- Work more comfortable and healthier



#### **Switching Manifold for Front Hitch**

The manifold is used to switch a tractor front hitch from double-acting to single-acting. In double-acting operation the ball valve is open.



The tractor front hitch can lift attachments and also press equipment to the ground. If this is not required and the front hitch should only be single-acting, the ball valve is closed.

- Fully integrated
- Space-optimised design with elongated switching shaft
- High level of functional safety

#### Connectivity



An extensive product range with corresponding interfaces is available for internal machine communication and external communication of digital data.

- ISOBUS communication: HY-TTC 30, HY-TTC 77, HY-TTC 90, HY-TTC 500
- CAN communication: sensors, controls and displays
- Internal data management (CAN Ethernet Gateway): TTConnect 616
- External data communication: TTConnect Wave



## Solutions for Self-Propelled Harvesting Machinery

#### **Working Hydraulics**

Working hydraulics in self-propelled harvesting machinery can be arranged centrally or decentrally. HYDAC can work with you to create the perfect solution for your specific application.



#### **Universal solutions**

- Sectional valves for high flexibility in the machine functions and requirements
- Efficient closed-loop/open-loop flow rate control, paired with innovative fluid power supply functionality, for OC/CC hydraulic circuits up to 240 l/min at actuator connection



#### **Combination solutions**

- Combinable universal and function modules, including special customised solutions, for higher efficiency and flexibility in machine functions, function costs and available space
- Modules for large flow rates up to 240 l/min can be freely combined with modules for very small flow rate down to less than 10 l/min



#### **Customised solutions**

- Dimensioning adapted to suit the required functions
- Integration of valve technology, accumulators, filters, sensors etc.
- Weight- and space-optimised design
- Project planning, consulting and support for the implementation of customer-specific projects provided by experts in in-house application centre
- Tests in customer machinery at in-house testing ground

#### **Controls for Attachments**





Valve technology solutions for application-specific, proportional control of pressure and flow rate for precise guiding of the device above the crop thanks to balancing of the vertical and longitudinal positioning.

Diaphragm accumulators provide optimum contact pressure and ground pressure relief. Attachment oscillations are decoupled from the machine/driver's cab.

#### **System Intelligence**



Electronic actuators for different system concepts and structures in the machine. Controllers and I/O add-on modules available as standard models and models with increased functional safety. Displays with optimum readability even in difficult lighting conditions provide high performance and flexibility.

With the MATCH (Machine Application Tool Chain) development software development, HYDAC offers a tool chain for system-level software development by the customer that is specially suited to the requirements of mobile machinery. MATCH supports development from defining the system at the vehicle level and creating the application software for start-up, testing, and documentation.

#### **Clutch and Transmission Shift Control**





3/2-way spool valve

Pilot-operated and direct-acting valves with screw fitting and plug-in design.

- Optimised pressure loss when relieving the clutch
- Special switching currents for safe switching at low voltages
- Excellent performance in high viscosity oil
- Pilot-operated valves with almost no loss of pilot oil
- Contamination-resistant

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3-way proportional pressure

reducing valve, slip-in version



3-way pressure relief valve



3-way proportional pressure reducing valve





2-way and 3-way flow regulator and pressure-regulated controls for attachment drives, conveyor drives, spreading drives, blower and fan drives.

- Manual to proportional control
- Reversing optional
- Pressure limiting
- Anticavitation function can be integrated
- Application-specific valve technology for precise, stable and energy-efficient control

#### **Professional Tank Optimisation**



New return line filter series, e.g. RFB (in to out filtration) with special degassing concept

Computerised optimisation of tank systems based on flow simulations

Analysis of tank systems in terms of sloshing and air inclusion



Speed [m/s]

Optimum system integration of costand space-optimised filter tank systems

System-optimised reductions in tank size and application-based filter solutions thanks to extensive tank simulations for analysing thermodynamic parameters. Range of services also includes experimental analysis of air separation performance of tank systems as well as measurement and analysis of a wide range of parameters in real hydraulic systems.

- Reduced tank complexity
- Reduced costs thanks to reduction in material use and oil volume
- More space in engine compartment
- Enhancement of machine availability
- Spare parts management

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#### **Diesel Filtration**

Diesel filters with Biomicron® filter elements to protect machine components and diesel fuel.

Biomicron® - diesel filter with antimicrobial effect to prevent diesel bug and fight biofilm-forming bacteria and fungi.



#### Diesel filter with integrated electric pump:

- Excellent water separation
- Long service life
- Air vent and boost function
- Offline filtration to protect the diesel during prolonged downtime
- Ideal in conjunction with Biomicron® filter elements

#### Cooling

#### Combination coolers



Specially customised combination coolers (CMS):

- Combination of various cooling circuits,
- e.g. charge air, coolant, hydraulic oil, transmission oil and diesel For a particularly space-saving and cavity-optimised
- solution, cooler, filter and hydraulic bypass can be combined with the hydraulic tank and ventilation unit to form a cooler-filter-tank unit (KFT)

#### Fan controls



Manifolds to control the speed of the fan motor, optionally with reversing function to reverse the fan's direction of rotation.

- Inverse (fail-safe) proportional pressure relief valve for consistent and stable regulation of the fan speed
- Pressure-loss-optimised 4/2-directional valve for reversing, to free the cooler from contamination

## **Solutions for Tillage and Sowing**

#### **Hydraulic Headland Control**

Modular manifold for coordinated hydraulic sequence control. Turning control and realignment of saved working widths for all mounted plough variants.

can be integrated

- Rapid, uninterrupted plough turning at headland
- Automatic, hydraulic frame swing-in
  - A memory cylinder can be embedded for the adjustment of the working width and frame swing-in at the headland

#### **Electrohydraulic Plough Control**



Headland management and working width adjustment for optimum preparation of the seedbed for the following crop type. Traction boosters can be integrated for efficient tillage with minimal fuel consumption and low slippage.

- Control of the rotating mechanism of mounted and semi-mounted reversible ploughs
- Hydraulic adjustment of working width and depth via ISOBUS or customer-specific terminal
- Change from onland to ploughing in furrow from the tractor cab

**Overload Protection** 



Protection of the main frame from high loads and damage when blades come into contact with obstacles such as stones. Costs for repairs and work interruptions can be reduced.

- Rapid swerve and damped, frame-protecting return of the plough/cultivator blades for a longer lifetime
- Adjustment of min./max. release force via hand wheel integrated in manifold
- Release force can be adjusted rapidly on highly varying soils from tractor cab
- Several blades (plough/cultivator) can be connected to one manifold

#### **Depth Control**



Angle sensor HAT 1000



Hydraulic closed-loop position control by electrohydraulic control of depth control cylinders.

- Optimum work quality and maximum area capacity thanks to sensor-controlled depth guidance using angle sensors or linear position measurement systems integrated in the cylinder
- Working depth can be adjusted on basis of geo-reference data or manually when changing from heavy to light soils
- Optimum fuel consumption thanks to consistent depth control
- Reduces workload for tractor driver



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Counterbalance valve

#### **Rapid and Safe Transition to Working and Transport Position**

Control of folding mechanisms and adjustment of working widths via various on/off or proportional controls:

For maximum control during fold-in and fold-out movements, proportional directional poppet valves are used in a differential circuit. Pressure is applied to the cylinders on both sides (fixing them)

- Hydraulic pressure sequence control
- Counterbalance valves used for smooth movement of actuators for pulling and pushing loads
- Downstream throttling valve for safe handling of negative, pulling loads

and the movement speed is controlled proportionally downstream



Proportional poppet directional valve



- 2- and 3-way flow regulator to drive the seed fan that distributes the seed.
- Even in parallel operation with additional hydraulic functions, the blower's drive speed remains consistent and continuous. This ensures that the seed is distributed evenly
- Stable control even if the hydraulic supply pressure fluctuates



#### **Coulter Pressure Control**

Control of recompaction pressure by means of application-optimised proportional pressure reducing valve series, direct-acting and pilot-operated for precise seeding depth.

- Linear performance curve for pressure regulation between 0 210 bar
- Contamination-resistant valve technology for individual coulter pressure control
- Dynamic response characteristics
- Central control or control of individual rows



Proportional pressure reducing valve direct-acting



Proportional pressure reducing valve pilot-operated



# CAN-BUS

#### Smart Cylinders

For position and pressure regulation of multi-row work units. Individual, row-independent adjustment of working depth on basis of geo-reference or sensor data.

- Application-specific design
- Integrated valve technology
- Integrated pressure and linear position sensors
- Integrated ECU
- Communication via CAN bus
- Uncluttered appearance by reduced piping and electric cabling
- Flexible expansion options in dependance with working width of the specific machine

## Solutions for Fertilisation Technology and Crop Protection

#### Electrohydraulic Speed Control of Fertiliser Spreader Drives



The desired spreading disc speed can be adjusted continuously and precisely. The speeds of both are controlled separately by applicationoptimised proportional flow regulators.

This ensures that the correct amount of fertiliser is applied even for border, boundary and wedge-shaped spreading.

- Stable and precise proportional flow regulator
- Electrohydraulic system solution enables compensation of temperature influences and tolerances by measuring the disc speed signal
- Simulation model for optimum configuration of control parameters
- Can be used in load-sensing or fixed displacement pump systems

#### Modular System for Electrohydraulic Steering Systems

The modular system for auxiliary and additional steering of self-propelled and trailed implements provides the required flexibility for the adjustment of different machine configurations.

- Application-optimised, direct-acting 4/3-directional proportional valve
- Number of steered axles variable
- Different safety concepts possible
- Can be used in load-sensing or fixed displacement pump systems
- In addition to the steering modules, HYDAC supplies individual customised solutions and integration of the electrohydraulic steering system into the working hydraulics



#### Smart Load-Sensing (LS) Interface

#### **Electronic LS creation**



LS pressure signal creation via application-optimised proportional pressure reducing valve.

Proportional pressure reducing valve

- Stable pressure response to the tractor pump regulator
- Independent from the LS-unloading of the tractor and the length of the pressure signal line
- Space optimisation for the manifold design due to elimination of LS chain

#### LS-amplification

Signal amplification via mechanically adjustable amplifier valve.

 Compensation of line losses in long trailed implements

#### Adjustment to tractor hydraulics

 Simple switching from fixed displacement pump to load-sensing pump systems via ball valve or hand wheel



#### **Precise Guiding over the Crop**

The booms of trailed field sprayers are guided accurate over the crop via active distance control, even on rough terrain and slopes. Undesired movements transmitted by the implement of the booms are also balanced out. This is done by measuring the distance via sensors and controlling the hydraulic cylinders precisely via leakage-free proportional valves. As a result the booms are protected from collision and the need-based application is ensured.

Depending on the boom design these systems are dimensioned application specifically. Simulation models can be used to support this process.

#### **Suspension**



#### Boom suspension

Vertical and horizontal suspension of the boom via manifolds with integrated diaphragm accumulator, pressure relief valve and check valves. Mechanical loads will be reduced, boom guidance is improved and controllability is increased.

#### Hydropneumatic axle suspension



Electrohydraulic level control enables consistent suspension compression and expansion movements load-independent and thus optimum suspension configuration. Roll stabilisation and customised controls are included in the system, as well as scope standardised monitoring of the entire system.

#### Hydropneumatic drawbar suspension

HYDAC provides solutions for positive and negative loads with and without load compensation. The hydropneumatic drawbar suspension reduces the mechanical load on the drawbar and increases driving safety and improves driving performance.



#### **Monitoring Machine Parameters**

A wide range of products for the measurement and monitoring of pressure, temperature, distance, position, tilt, angle, level, flow rate and drive speed, as well as contamination and oil condition in the machine.



#### **Efficient Fertiliser Application**

Adjusting the downforce with proportional pressure reducing valves allows the injection blades to insert the fertiliser at the optimum depth.

Downforce increasing and weight relief can be realised.

HYDAC can supply the perfect proportional pressure reducing valve in direct-acting or pilot-operated design.



## Solutions for Forage Harvesting Machinery

#### **Compact Powerhouse for Working Hydraulics in Balers**

Integration of working hydraulics, valve technology, filtration and diaphragm accumulators with highly compact dimensions.





Proportional pressure control with high response sensitivity



Mechanically adjustable variant pressure relief valve DB4E



The counterbalance valves of series is available in three sizes for 60, 120 and 240 l/min.



#### **Monitoring Press Pressure**



Electronic pressure sensors for measuring and monitoring the compacting pressure in the bale chamber of a round baler. HYDAC offers a comprehensive programme from miniature pressure transmitters to customer-specific multiple pressure switches.

#### Forming pressure control

For the central function of forming pressure control in the baler, HYDAC supplies proportional pressure reducing valves for variable adjustment of the bale density in conjunction with pressure sensors.

#### Load-holding function and controllability

With the specially dimensioned RSM series, HYDAC meets the most stringent requirements for the load-holding function and controlled opening and closing of the hatchback.

- Leakage-free valve technology
- Load pressures up to 420 bar
- Different pilot ratios
- Fine control sleeves for optimising the cylinder movement
- Pressure-loss-optimised check function

#### Wrapping process

Proportional flow regulator valves for adjusting the rotation speed depending on film width, bale diameter and number of wrapping layers.

The proportional flow regulators are used for regulating steplessly the speed of motors and cylinders independently of temperature and load.

Independently of the load of the actuator, the flow is constantly adjusted and thus kept stable – a pressure compensator maintains the pressure differential by means of an orifice.

#### Lockable Ball Valve to lock the Round Baler Tailgate

3-way changeover ball valve with locking lever for the closing hydraulics of the round baler tailgate. Pressure is applied to the valve from all sides and the valve can only be switched by actuating the locking lever.



- Ball valve cannot be switched accidentally
- Switching positions defined by locking bolts
- Leakage-free

#### **Fluid Conditioning**



#### Medium pressure flange filter HFM

The filter (up to 350 bar) protects the sensitive valves in the manifold from contamination. The filter can be flange-mounted directly to the block, eliminating the need for additional piping.

- Leakage- and cost-optimised flange connection
- Reduced installation time
- All-in-one solution with compact dimensions

#### **Suspension and Damping**



## The HYDAC accumulator portfolio allows you to select the perfect accumulator:

The modular diaphragm accumulator system makes it possible to optimise the pressure range and/or mode of operation without changing the nominal volume:

Overdimensioning is avoided and weight on the mobile machine is reduced

The piston accumulator series SK280 with its select range of variants with identical performance provides great flexibility for choosing an accumulator:

• Specified/present space can be utilised optimally

#### **Loading Cars**



Universal construction kit with different combinable modules. Modules can be also be combined with customised solutions as required.

Main functions, such as scraper floor drive, pick-up control, blade insertion or distributor and hatchback control, can be combined in a central manifold tailored to the machine.

Additional customised function modules can be added to the machines as required.

- Highly flexible thanks to modular design
- Supply via electronic controller or power beyond
- P-input via flange-mounted filter possible

#### On-demand wheel drives for trailers and pull behind equipment

On-demand wheel drives for trailers with one or more axles

to increase traction for heavy attachment loads and wet/hilly terrain.

- Proportional traction control of trailer transmission drive depending on soil
- Forward and reverse operation possible thanks to 4/3 spool valves
- Integrated hydraulic differential lock
- Drive with LS or fixed displacement pump (tractor hydraulics) possible

HYDAC

## Suspension/damping of baling press closing flap

Reduction of mechanical wear

Damping of cylinders of hydraulic cutting unit

Homogeneous harvest

• Cutting unit wear reduced

## **Control Technology and System Intelligence**

#### **System Intelligence**

#### Electrohydraulic system solutions as interface between actuators and sensors.

The demands of modern agricultural machinery are leading to ever-increasing complexity of control systems. Modern machines require a variety of assistance and control systems wherever simpler operating concepts and a better overview and controllability of the machine functions become necessary.



#### **System Development**

Based on the customer's requirements, HYDAC offers support across the spectrum with developing electrohydraulic control systems for mobile machinery. The scope of development is determined together with the customer according to the task.



Services include:

- Creating customer-specific application software (according to technical specifications)
- Integrating intelligent subsystems into the customer's machine (e.g. suspension systems, additional steering systems, fan controls)
- Complete control solutions for mobile machinery (safety functions, electrical/electronic control architecture, application software)

Example of control architecture

#### Software Development

Depending on the hardware, the following programming languages can be used to program the application software:

- CODESYS 2.3 / 3.5 / 3.5 SIL2
- C



#### System Development Support



HYDAC offers extensive consultation and support for customer projects with regard to:

- Hazard and risk (H&R) analysis
- Definition and description of safety functions
- Drafting safe system architectures and user interfaces (HMIs)

#### Severity of injury

- S1 Minor, temporary injury
- S2 Severe, irreversible injury including death

#### Frequency/duration of exposure to hazard

- F1 Rare or brief exposure to hazard
- F2 Frequent to continuous exposure to hazard

### Possibility of avoiding the hazard or limiting the damage

- P1 Possible under certain circumstances
- P2 Practically impossible

## **Control Technology and System Intelligence**

#### **"MATCH"** Development Environment

## MATCH Machine Application Tool CHain

Development environment for mobile working machines



Machine Application Tool CHain

With the "MATCH" (**M**achine **A**pplication **T**ool **CH**ain) software, HYDAC offers a tool chain for system-level software development by the customer that is specially fitting the requirements of mobile machinery.

"MATCH" supports development from defining the system at the vehicle level and creating the application software to start-up, testing, and documentation.

#### "MATCH" offers modules for:

- Defining the system at the vehicle level
- Starting up and servicing the machine
- The software test (e.g. on basis of HYDAC Electronic RTB Box)
- Documentation

Furthermore, an "embedded middle ware" is offered which permits a hardware-independent programming of the application and which contains a multitude of basic functions. A comprehensive selection of library modules (e.g. for sensor and valve drives) is also available for an efficient development of the application software.

#### **Functional safety**

- MATCH can also write application software with increased functional safety according to the following safety standards with TÜV certification:
- SIL 2 to IEC 61508
- PL d to EN ISO 13849
- AgPL to ISO 25119 / DIN EN 16590

#### Simulation Technology







The quality of a hydraulic system is determined by a wellcoordinated interplay of a number of single components, like pumps, cylinders, motors, valves, accumulators, line systems and electronic components.

Particularly when strict requirements apply for the system dynamics, the precision of control processes and safety-relevant functions, it is vital for detailed information on expected operating behaviour to be made available as early on as possible.

Hydraulic simulation makes it possible to perform extensive analyses and optimisations of the systems in early development phases, minimising time-consuming and costly re-design and work in the trial field.

Using hydraulic simulation in conjunction with the simulation of multi-component systems also makes it possible to take into account the effect of complex kinematic structures and their retroactive effect on drive behaviour.

# Sensors, System Electronics and Displays

#### Sensors



#### Function

The range of sensors includes products for the measurement of pressure, temperature, distance, position, level, flow rate, drive speed, tilt and angle as well as contamination and oil condition. In addition to products for standard applications, the product portfolio covers special applications such as explosive atmospheres or applications with increased functional safety.

Electronic sensors and controls to complement the system electronics.

- Max. load regulation
- Electrohydraulic load sensing
- Working hydraulics
- Positioning
- Controls of special equipment
- Cut-off devices
- Safety systems

#### Features

- The sensors are available with a variety of output signals, electrical connectors and connection options
- Robust design
- ECE type approval
- Approved for explosive atmospheres
- Separate product portfolio, especially for applications with increased functional safety (SIL 2, 3 / PL c, d)

#### Mobile Controller HY-TTC Series



#### Function

With the HY-TTC series of controllers, HYDAC offers the right platform for a wide variety of requirements and applications – always efficient, safe, reliable and flexible. The controllers are designed for use both in complex centralised control architectures and in decentralised ones.

HYDAC supplies the right controller for each machine size; based on the number of inputs and outputs, the controllers can be classified into the following groups: the HY-TTC 30 with up to 30 I/Os, the middle group HY-TTC 50/90 with up to 50 I/Os and the HY-TTC 500 family, covering a wide scope, with even up to 96 I/Os. The highly flexible configurations of inputs and outputs make solutions possible for all kinds of functions and machine types.

Thanks to their internal diagnostic and monitoring functions, the actuators are also suitable, and certified, for tasks with increased safety requirements up to SIL 2/PL d.

#### Features

- Depending on version, certified to SIL 2/PL d
- Programming in C/CODESYS
- 30/50 or 96 inputs and outputs
- All inputs and outputs are configurable and are protected against overvoltage and short circuits
- Stabilised sensor voltage supply with internal monitoring
- No reset caused by voltage drop when starting engine
- Aluminium die cast housing with waterproof connection plugs, including a waterproof Gore-Tex membrane for hydraulic balance
- E12 type approval

#### I/O Expansion Module HY-TTC 30X / 30XS



#### Function

The HY-TTC 30X series of I/O expansion modules provides an outstanding power balance combined with extremely compact design.

The HY-TTC 30X series expansion modules are integrated very easily.

They provide a simple expansion of on-board electronics.

The communication and integration of the extension modules takes place via CANopen according to CiA DSP 401. This enables inputs and outputs to be configured and parameterised via the control configuration in a simple and uncomplicated way.

The different I/O modules provide a large number of high performance switching outputs and PWM outputs with internal current measurement as well as configurable analogue and flexible digital inputs.

Our product range includes two additional safety-oriented versions for the implementation of distributed applications with increased functional safety (Safety PL c, EN ISO 13849).

#### **Features**

- PL c (HY-TTC 30XS)
- Freely configurable Node-ID via PIN
- 30 I/Os, with up to 8 PWM outputs, 6 of these with integrated current measurement
- Robust, very compact housing

#### Mobile Display HY-TTC eVision<sup>2</sup>



Displays with integrated HY-eVision<sup>2</sup> controller

#### Function

The compact background-lit TFT colour displays with integrated high-end display controller are characterised by a very high image guality, low reflections and high colour saturation as well as optimal readability, even under the most unfavourable light conditions.

The displays are protected by a robust aluminium or plastic housing and can be either built directly into the instrument panel or surface-mounted in the field of vision of the driver/operator using a RAM Mount<sup>®</sup> system in the cockpit.

Ten programmable illuminated control keys along with the optional touchscreen feature create an easy-to-use humanmachine interface.

Up to four external cameras can be connected to the display via the two integrated composite video ports and also via Ethernet, and controlled via software.

#### Features

- User-friendly, self-explanatory and time-saving graphical design and operation interface
- Good portability via CODESYS platform
- High image brilliance
- High refresh rate
- Rapid bootup time and additional sleep mode
- Impressive display options such as 3D, picture-in-picture and overlapping effects
- Two images can be displayed simultaneously
- Up to four CAN, USB and Ethernet interfaces
- Robust housing with appealing design, suited for mobile applications
- WLAN compatible
- Standby & wake-up

## Valve and Manifold Technology

The perfect working hydraulics for rapid, precise and efficient control.

#### Valve Technology



Components, modules, subsystems as a customised solution.

#### **Pressure valves**

Pressure relief valves, pressure reducing valves, pressure sequence valves Nominal pressure: up to 630 bar, flow rate: up to 300 l/min

#### **Pressure compensators**

Nominal pressure: up to 350 bar Flow rate: up to 150 l/min

#### Flow valves

Needle valves, flow control valves Nominal pressure: up to 420 bar, flow rate: up to 300 l/min

#### Shut-off valves

Check valves, hydr. pilot-operated check valves, shut-off units, counter-balance valves, change-over valves, hose break control Nominal pressure: up to 420 bar, flow rate: up to 600 l/min

#### **Directional poppet valves**

2/2-way poppet valves, 3/2-way poppet valves Nominal pressure: up to 500 bar Flow rate: up to 150 l/min

#### **Directional spool valves**

2/2-way spool valves, 3/2-way spool valves, 4/2-way spool valves, 4/3-way spool valves, Nominal pressure: up to 350 bar, flow rate: up to 35 l/min

#### Proportional valves

Pressure relief valves, pressure reducing valves, needle valves, flow regulation valves Nominal pressure: up to 350 bar, flow rate: up to 250 l/min

#### Open Center Main Control Valves



**RS series** Open center main control valve



Open center main control valve



**DX series** Open center main control valve

#### Load-Sensing Main Control Valves



HX series Load-sensing main control valve



LX series Load-sensing main control valve

HYDAC's open center main control valves offer you a modular system with which to design robust, energy-efficient and cost-effective open center controls for mechanical, pneumatic, hydraulic and electrohydraulic control.

#### **Technical characteristics**

- Structural design as monoblock, multi-section and disc construction
- Key data: Q<sub>max</sub> ≤ 180 l/min; p<sub>max</sub> = 350 / 400 bar
- Energy-saving Q-inlet option
- Robust, high quality and maximum controllability
- Low internal leakage
- Inlet switching for safe flow distribution
- Electrical pump flow cut-off
- Main actuators with parallel, series and tandem control
- Simple integration of secondary safeguards
- Optional switch position monitoring of the main control spool
- Optionally also for the control of LS variable displacement pumps

## Key data for open center main control valves (see images on left):

- RS series -> Q<sub>max</sub> = up to 120 l/min; p<sub>max</sub> = up to 300 bar
- RM series  $\rightarrow$  Q<sub>max</sub> = up to 140 l/min; p<sub>max</sub> = up to 300 bar
- DX series → Q<sub>max</sub> = up to 140 (180) I/min; p<sub>max</sub> = 350/400 bar

HYDAC's load sensing main control valves offer you a modular system with which to design load-compensated, energy-efficient load-sensing controls for mechanical, pneumatic, hydraulic and electrohydraulic controls.

#### **Technical characteristics**

- Structural design as multi-section and disc construction
- Key data: Q<sub>max</sub> ≤ 180 l/min; p<sub>max</sub> = 350/420 bar
- Extra-large 10 mm piston stroke for optimal high-precision control
- Load-independent parallel actuation without reciprocal influencing possible
- Simple integration of primary/secondary safeguards
- Inlet switching for safe flow distribution
- Electrical pump flow cut-off
- Optional switch position monitoring of the main control spool
- Optional switch-off of individual sections with complete functionality of the remaining sections

## Key data for load-sensing main control valves (see images on left):

- HX series → Q<sub>max</sub> = 120/35 (prop) I/min; p<sub>max</sub> = 250 bar
- LX series  $\rightarrow$  Q<sub>max</sub> = up to 180 l/min; p<sub>max</sub> = 350/420 bar

#### See brochure 5.254 – Mobile Valves

#### Modular Combination LS Systems LX6 + HX1



As the various mobile machine functions are arranged on corresponding modules in the HX1 system, functions can easily be added or taken away – via HYDAC directly or via the manufacturer! The module system is selected in accordance with the litre capacity (see above). If you require only one function above 80 l/min or a hand-lever combination, HX1 can be combined with LX6. Anything is possible!

See brochures 5.256 – HX1 and 5.282 – LX6

#### **Customised Solutions**

We work with you to develop individual all-inclusive system solutions for your particular application, customised to suit your machine. In addition to the hydraulic components, we can also provide extensive development and manufacturing expertise in relation to electronics and software.

Application-specific - tailored to needs - custom-made.

#### We offer:

- Dimensioning adapted to suit the required functions
- Integration of valve technology, accumulators, filters, sensors and software
- Weight-optimised, space-saving designs
- Project planning, consulting and support for the implementation of customer-specific projects provided by experts in in-house application center
- Tests in customer machinery at in-house testing ground





## **Convenience Systems** and Components

#### Electrohydraulic Main and Additional Steering Systems EHZ

Our EHZ system modules offer a highly flexible foundation for the electrohydraulic steering of all kinds of vehicles.



Electrohydraulic steering and additional steering systems enable various types of steering to be realised in self-propelled and trailed working machines. For selfpropelled vehicles, various special types of driving (such as all-wheel and crab steering) are possible in addition to the normal driving varieties. In combination with the hydraulic steering systems of the front axles, electrohydraulic master control steering systems and additional steering systems for the rear axles are possible. For trailed working machines, we can use our modular steering valves to meet the various steering requirements for additional steering in the second axle with optional free wheel or lock-out circuits of the steering cylinders.

#### Applications

- Front axle steering
- Rear axle steering
- All-wheel steering
- Unlimited number of controllable axles
- Different safety concepts can be selected



#### **STEER-by-Wire**

#### Main steering

#### Advantages

- Work and steering functions provided by one control element
- Driver's stand easy to move
- Steering sensitivity can be adjusted
- Assistance systems easy to integrate

#### Application examples

- Forestry machinery
- Off-road vehicles/machines



#### STEER Additional Additional steering

#### Advantages

- Turn radius reduced
- Lower tyre wear
- Various steering programs
- Speed-dependent steering behaviour

#### Application examples

- Trailers, loading cars, field sprayers
- Truck/commercial vehicle trailing axles
- Vehicles with multiple axles



#### STEER Assistance Alternative hydraulic steering

#### Advantages

- On-road = exclusively hydraulic steering system, off-road = Steer-by-Wire
- Fall-back level is always the hydraulic steering system
- Relief of the driver by driver assistance systems

#### Application examples

- Self-propelled harvesting machinery
- Wheel loaders, telescopic handlers
- Mobile machines
- Handling machines

#### Hydropneumatic Suspension Systems



#### **Chassis suspension**

Intelligent axle suspension system with locking function and adjustable driving characteristics to improve driving stability and thus increase performance.

See brochure 10.116.4 –

Hydropneumatic Suspension Systems for Lightweight Commercial Vehicles

#### **Drawbar suspension**

- Hydraulic drawbar suspension for increased driving safety and driving comfort
- Suitable for positive and negative loads on the drawbar
- For different drawbar configurations with or without height adjustment (e.g. articulated drawbar)





Variant 1 Electrohydraulic switching

Negative loads - manually adjustable



#### **Cab suspension element**

Cab suspension element to reduce driver exposure to oscillations and increase comfort.

#### Accumulator Technology



Bladder, piston and diaphragm accumulators for mobile applications

#### Accumulators

HYDAC offers an exceptionally wide product portfolio of accumulators and dampers for a very wide array of hydraulic applications involving mobile machines. This enhances the working comfort and functionality of the machines and thus minimises stress for both humans and machines.

## Typical accumulator tasks and benefits resulting from them include:

- Power supply for emergency functions

   increase in performance with comparatively equal technical conditions
- Pulsation damping in the hydraulic system
   Ionger service life for attached parts, by minimisation of vibrations
- Energy storage to safeguard the vehicle system and to compensate leakages
  - → vehicle braking systems, rotating mechanism brake, parking brake, etc.
- Emergency and safety tasks in the pilot circuit
   increase in functionality
- Use in hydropneumatic suspensions
   increased driving stability and operator health

#### **Advantages**

Our accumulator specialists have decades of experience in the development and design of all types of accumulator construction at their disposal. This means that they are in a position to select the type of accumulator construction that suits the application out of the comprehensive product range and to dimension it in accordance with operating conditions. The right accumulator is still the best support for an application and with country-specific acceptances, HYDAC accumulators can be used worldwide.

## **Hydraulic Supply**

#### Cooling









Oil cooler OK-ELD with electronic fan contro

#### **Combination coolers**

The Emissions Directive for engines in mobile machinery has been structured to reduce emissions progressively, which can lead to a drastic increase in the required heat dissipation and a corresponding adjustment in cooler size. The generally limited installation space must therefore be utilised efficiently and intelligently.

Various cooling circuits are combined in a CMS mobile cooler, such as charge air, coolant, oil circuits (transmission and hydraulics) and diesel. If required, an air conditioning condenser can also be integrated into the cooling system.

The cooler dimensioning and simulation software KULI, which is also used in automotive applications, allows complex cooling systems to be modulated and calculated. Installation resistances and additional heat sources are thus taken into account in the cooler system calculation.

#### **Cooler-filter-tank**

Integrating the cooler, filter and tank allows multiple functions to be combined in one space-saving unit that is optimised for the installation space.

Hoses and pipes can thus be shortened or eliminated. The plastic hydraulic tank, which simultaneous functions as a fan cover, can be optimised in relation to flow to also enable noise reduction.

#### **Plate heat exchangers**

Compact, copper-brazed plate heat exchangers to dissipate the transmission oil or axle power loss to the hydraulic or water circuit.

#### Hydraulic oil cooling

Air coolers with DC motors (OK-ELD) or hydraulic motors (OK-ELK) are used to cool hydraulic oil. They are specially designed for mobile applications where high performance and easy installation in confined spaces are required.

- Robust and flexible aluminium plate design
- Contamination-tolerant high-performance cooling air fins
- Low-noise fan drives

To keep the oil temperature at a consistent level, the fan drive speed can be continuously adjusted to suit the required cooling capacity by a fan control (with either electronic or hydraulic design). As an option, these controls can also be supplied with a reversing function, to "purge" the cooler of dirt (e.g. dust and debris).

#### **Fan controls**

Hydraulic and electrohydraulic controls for regulating fan drive speed with optional reversal of rotation direction for use with various types of pumps.

Valves specially developed for the application:

- Switch-over valves
- Suction valves
- Manually adjustable pressure relief valves
- Inversely proportional pressure relief valves







Example of fan control application

See catalogue 57.000 - Cooling Systems See brochure 5.812 - CMS Mobile Coolers

#### Drive Technology





MGE102

The pump range includes fixed and variable displacement pumps of various designs from 0.25 ccm/rev to 560 ccm/rev and setting ranges of up to 400 bar. The motor range includes displacement motors from 1.07 ccm/rev to 28.21 ccm/rev and a setting range of up to 300 bar.

## HYDAC fixed displacement pumps for auxiliary circuits and pilot pressure supply:

- External gear pump PGE from 0.25 ccm/rev to 60 ccm/rev, nominal pressure up to 250 bar and peak pressure up to 300 bar. Also available in multiple pump combinations.
- Internal gear pump PGI from 3.8 ccm/rev to 250 ccm/rev, nominal pressure up to 330 bar and peak pressure up to 400 bar. Also available in multiple pump combinations.

#### HYDAC variable displacement pumps for main functions:

- Axial piston pump PPV100S from 16 ccm/rev to 180 ccm/rev, nominal pressure = 315 bar and peak pressure = 350 bar. High speed reserves, finely graduated flow levels, control range constantly being expanded. Design standard in accordance with DIN ISO 3019-2 and SAE. Also available in multiple-pump combinations.
- Axial piston pump PPV101 from 45 ccm/rev to 200 ccm/rev, nominal pressure = 320 bar and peak pressure = 350 bar. High speed reserves, versatile control range. Design standard in accordance with DIN ISO 3019-2 and SAE. Also available in multiple-pump combinations.

## HYDAC displacement motors for transmission drives, e.g. fan systems

• External gear motor MGE from 1.07 ccm/rev to 28.21 ccm/rev and peak pressure up to 300 bar.

#### **Diesel Filtration**



Diesel PreCare filter with integrated pump

Biomicron® filter element

HDP BC600 is a modern system for diesel pre-filtration. It has two-stage water separation and outstanding solid particle filtration characteristics. As air can also be a major problem in fuel supply, an electric pump has been integrated. The pump can be used both for fuel supply during machine operation and for offline filtration during downtime.

#### Advantages:

- Air vent for the fuel system, by means of integrated electric pump in the bypass
- Booster function to improve start-up performance (particularly for cold start)
- Deloading of the machine's low pressure pump
- Desinfection of the tank and thus effective against diesel bug, thanks to optional innovative Biomicron<sup>®</sup> filter media technology (e.g. for offline filtration in seasonal machines)
- Long service life, as pump is brushless
- Flexible connection options

See brochure 7.125 – Diesel PreCare



Engine performance class [kW]

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# Filtration, Air Separation and Tank Optimisation

#### Filtration



Filter ≤ 100 bar

Filter > 100 bar

Air filters, filter elements and accessories

Our broad filter range offers inline filters (LF, MDF, DF) with various pressure ratings and materials in addition to fillers/ breathers (ELF) for the hydraulic tanks. We also have a broad range of in-tank return line filters (RF) and return line and suction boost filters (RKM). Specially designed in-tank return elements (RMTR) offer good distribution of oil flow in the tank, highly effective air separation and thus a reduction in the size of the hydraulic tank.

The filters can also be used in explosion-hazard areas (ATEX).

#### Advantages

- High level of operating safety thanks to first class filtration
- Protection of system components
- Element is easy to change and filter housing is easy to install
- Low operating costs thanks to low pressure drops across the filter and filter element
- Improvement in operating safety through the use of filter clogging indicators
- Brand labelling to protect the spare parts business
- Tank/filter complete systems, optimised for component protection, system cleanliness and air vent
- Ultra-modern laboratory and test rig technology

#### Hydraulic load cycle test (HLCT)

Filter performance data measured in accordance with practical flow conditions (dynamic flow) rather than static multi-pass test to DIN 16889.

The practical flow rate can, for example, be measured at the wheel loader and then simulated on a 1:1 basis on the test bench.



#### Tank and filtration systems

A comprehensive range of hydraulic and breather filters, equipped with elements made from high-quality materials, provide a high level of operating safety and long intervals, for example:

#### Return/return-suction filtration

Using the RFM and RKM filters (optionally with temperature bypass valves integrated into the head). Tank-mounted or tank-integrated filters

#### Supply circuit filtration

With inline filter LPF and LPFP

#### Pressure oil filtration

With inline filter MFM, HFM, DF

#### Transmission oil filtration

Suction filter for transmission and hydraulic oil

Removal of coarse particles With inline filter ILF

#### Air filtration

With ventilation filters BF, ELF, ELFL, BDE. wide standard range of products, optionally with duo valve for tank pre-tension, anti-swash protection possible, version with air drying function, air filter systems for motors

#### Filter clogging indicators (CI)

For improvement of operating safety and, if applicable, display of maintenance intervals

#### Brand labelling to protect the spare parts business

Marking of the filter elements for improvement of the product identification and to ensure spare element availability

#### Tank filter solutions from one supplier

Complete systems ready for installation, optimised with reference to component protection, system cleanliness and ventilation

#### Filtration solution for AdBlue® and SCR cooling

See catalogue 70.000 – Fluid Filters See brochure 10.777 – Filtration and Fluid Care

#### **Return Line Filters**



Maximum air separation in a hydraulic system can only be achieved with a combination of optimised filter and tank.

Accordingly, our standard series for optimised air separation provides the best possible foundation for protecting the hydraulic system from excess air in the oil and the problems this causes.

For all filters in the series, flow passes from inside to out, so the filters air the main factor in helping to calm the flow to the tank. The filter's larger outlet surface area makes the oil

flow out of the filter at a much slower speed.

This gives the air bubbles in the oil more time to rise to the surface slowly and evenly, helping to calm the oil level in the tank.

#### **RKT: Return Line Kit – Top**

- Integrated into the tank
- Flow enters from top
- High variability in connections
- Optionally with cover
- Optionally with magnetic core
- Optionally with quality protection

#### **RKB: Return Line Kit – Bottom**

- Integrated into the tank
- Flow enters from bottom
- Bypass valve integrated into element
- High variability in connections
- Optionally with non-return valve
- Optionally with quality protection

#### **RFT: Return Line Filter – Top**

- Complete filter solution
- Flow enters from top
- Filter head version
- Bypass valve integrated into element
- Optionally with magnetic core
- Optionally with quality protection

#### **RFB: Return Line Filter – Bottom**

- Complete filter solution
- Flow enters from bottom (or side)
- Bypass valve on cover and element (split)
- Optionally with non-return valve
- Optionally with quality protection

See brochure 7.422 – Return Line Filters









#### Hydraulic Tanks



Unlike welded steel tanks, customised plastic tanks - as a complete solution including breather and return line filters and fill-level and temperature indicators - are mainly used when installation space is extremely limited and very lightweight construction is required.

- Improved component cleanliness,
  - since plastic tanks are very clean following production
- Air from oil.

special tank geometry allows guick and optimal air separation (RMTR)

- Improved use of existing installation space Due to optimised design (complex, curved designs available)
- Inexpensive
- The costs depend on tank volume and not design complexity
- **Clean tank surface**

Due to integral baffle designed to prevent fluid spill from the breather filter onto the tank

Element does not block,

due to dry air filter element and partial cleaning whenever air is expelled - dust is purged from the filter material



## **Additional Solutions**

#### Accessories



#### For the completion of hydraulic systems

- Pipe fittings and ball valves (high pressure, low pressure, coaxial valves, standard and special solutions)
- HY-ROS mounting clamps for hydraulic hoses and lines, pipes and cables
- Clamping bands for mounting hydraulic, air and other reservoirs in round or rectangular shape
- Special clamps, e.g. for particle filters (clamping band and console)
- Fluid level gauges FSA and fluid level sensors FSK along with temperature switches TS

#### Advantages

HYDAC Accessories is your expert for modifications and special solutions at all times, and especially when custom jobs are required because standard parts are unsuitable. HYDAC's in-house engineering, coupled with our multidisciplinary approach and worldwide know-how, guarantees state-ofthe-art technology and rapid development times.

HYDAC Accessories provides the final perfect touch to your machine with a broad range of standard and special components, also available in stainless steel.

#### Cylinder Systems



Cylinder with linear position measurement system



Steering cylinder with integrated linear position measurement system

Our cylinder systems are notable for their versatility and extreme compactness. We offer cylinder drives with integrated valve technology and guarantee optimal operation of your machine, even with increased operational loads.

- Special cylinders, optionally with integrated linear position measurement system, special coating or end cushioning
- Special suspension cylinders (low-friction design)
- Steering cylinders with integrated linear position measurement system
- Locking and clamping cylinders
- Differential and telescopic cylinders
- Cylinders with integrated piston accumulator

#### **Advantages**

Our own Service Center offers you a comprehensive customer service. We support you with the design, assembly, maintenance and commissioning of your system.

We begin working closely with the customer right from the development stage. Because of our knowledge, we can achieve the best cylinder solution for your product. FE simulations or fatigue strength calculations come under our Engineering Standard.

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See brochure HS-D 10.102 – Cylinders and Cylinder Systems for Mobile Hydraulics

#### Fluid Condition Monitoring and Fluid Conditioning



#### Service Tools



For a system to be fully efficient and reliable, it needs a sophisticated filtration strategy and continuous online monitoring, combined with temperature-controlled cooling. Only a holistic approach can permanently improve the state of the used fluids and decrease the operating costs (cost reductions of up to 30 % are not uncommon). Accordingly, HYDAC provides the complete package of condition monitoring, filters, coolers and systems for detecting fluid stresses and rectifying them. You can plan service work in advance, avoid unnecessary costs for maintenance and repair and benefit from optimised costs for system maintenance.

One example of this is the Optimicron<sup>®</sup> element with Stat-Free<sup>®</sup> technology for the prevention of electrostatic discharge. If oils are subjected to electrostatic discharge, they age more quickly and in the long run systems become damaged. The VarnishMitigation Unit (VMU), which removes oil degradation products from the fluid and the CM-Expert for online monitoring of production systems also increase the service life of the fluids used.

See catalogue 180.000 – Electronics

- Tools for documenting the oil cleanliness and water saturation, e.g. after service work
- Bypass filter for optimising existing hydraulics and lubricating systems to remove oil degradation products, particles and water

See catalogue 79.000 – Filter Systems See catalogue 180.000 – Electronics

## **Additional Solutions**

#### **Technical Cleanliness**



CTU 1000



More efficient components and systems, increasing warranty claims and the reduction in start-up breakdowns are steadily driving up the demands for cleanliness management and cleanliness monitoring of production components. Tracing the source of damaging particles on surfaces which are in contact with the fluid and the removal and appropriate analysis of these particles are areas where HYDAC does extensive research within the framework of technical cleanliness.

The specially developed extraction units CTU (ContaminationTest Unit) and CTM (ContaminationTest Module) for analysing technical cleanliness have numerous applications in a wide variety of industries. Individually designed adaptations for carrying out cleanliness analyses provide solutions from a single source.

#### ContaminationTest Unit CTU

The ContaminationTest Unit CTU 1000 series is designed to analyse the technical cleanliness of components and systems in accordance with guideline VDA 19 (ISO 16232 or ISO 18413).

#### **ContaminationTest Module CTM**

The ContaminationTest Module CTM is a modular system designed to analyse the technical cleanliness of components.

The CTM series consists of different modules:

- Supply Module CTM-SC (Supply and Control): Module for fluid supply, control and data storage.
- Extraction Module CTM-EB: The modules vary according to the size/model and extraction process. They feature four types of extraction in different combinations.
- Extraction Flushing CTM-EF: By adapting to the geometry of the components being sampled, the module can be used for flushing components in contact with fluid.
- Fluid Analyzer CTM-FA: Module for determining the particle count according to ISO 16232 by conditioning the fluid and evaluating via visual particle counter.

#### Electro-Cylinders for Mobile Applications



#### Description

The HEZ KineSys electro-cylinders in U design are suitable for use in mobile machines and devices. The compact, closed housing provides protection from environmental influences. The selectable operation voltages of the motors provide a wide range of possible automotive and industrial uses. Furthermore, it is possible to integrate a linear position measurement system.

#### **Product advantages**

- Compact design
- Maintenance-free
- Limit switches can be attached to cylinder
- A linear position measurement system can be integrated
- Plug&play-ready solution
- Positioning force up to 10 kN dynamic, 18 kN static
- Protection class up to IP 69 K
- Operation voltage 12, 24 and 36 V DC/ 230 and 400 V AC

#### Solutions for Electromobility

#### **Fields of application**

- Cooling systems for inverter cooling, electric motor cooling, battery cooling and heating
- Sensor technology
- Fluid care
- Accumulator technology for energy recovery
- Control technology



#### Further fields of application:



















## **Global Presence.** Local Expertise. www.hydac.com

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