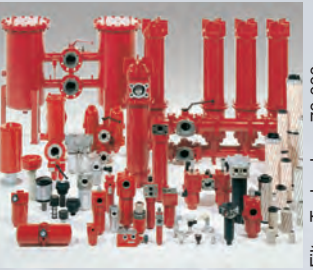




Accumulator Technology 30,000



Filter Technology 70,000



Process Technology 77,000



Filter Systems 79,000



Compact Hydraulics 53,000



Accessories 61,000



Electronics 180,000



Cooling Systems 57,000

Global Presence.
Local Expertise.
www.hydac.com



- HYDAC Headquarters
- HYDAC Companies
- HYDAC Sales and Service Partners

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Note

The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department. All technical details are subject to change without notice.

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HYDAC

INTERNATIONAL

Components, Systems and Service for Wheel Loaders



E 10_123_2/12_16

Your partner for expertise in system solutions in numerous wheel loader applications.

HYDAC has been one of the leading suppliers of fluid technology, hydraulics, electronics and cooling equipment for more than 50 years and has over 8,000 members of staff worldwide.

With our wide range of products, and with our acknowledged expertise in development, manufacturing, sales and service, we provide solutions for the wide range of requirements in the machine tool industry.

For use in various wheel loader applications, HYDAC offers a wide range of sector-specific components and systems from the areas of hydraulics, cooling, electronics, software and control technology in addition to its standard products. Intelligent integration of products also creates innovative and technologically advanced subsystems and complete systems for the increased requirements of specialist machinery.

Customer benefits:

- Cost optimisation achieved by customised system solutions which use standard components
- Reduction in number of models through standardisation and modular construction
- Global yet local: More than 45 overseas companies and over 500 sales and service partners
- Fluid engineering and service: Support in technical design for commissioning, maintenance and training and in the event of claims
- Customised solutions: Designs can be tailored to individual customer requirements, made-to-order solutions for your machines
- Advice on and implementation of the safety requirements in accordance with DIN EN ISO 13849



Wheel loader versions

Farm loaders

up to 37 kW



- Hydrostatic transmission drives
- Hydraulic supply via gear (fixed-displacement) pumps
- Mainly with hand-lever control, direct-acting
- Quickcoupler systems (mechanical & hydraulic)

Compact & swing loaders

38 – 74 kW



- Hydrostatic transmission drives
- Hydraulic supply via fixed-displacement or 'variable-displacement pumps (also in combination)
- Direct hand-lever control and pilot-operated 3/4/5-way main control manifolds with joystick
- Quickcoupler systems (mainly hydraulic)
- Simple hoist suspensions (mainly for high speed loaders > 30 km/h)
- Hydraulic start/stop system

Mid-sized & industrial wheel loaders

75 – 120 kW



- Hydrostatic or hydrodynamic transmission drives
- Hydraulic supply via LS pump systems (also in combination with fixed-displacement pumps)
- Pilot-operated main control manifolds (3/4-way) with joystick (hydraulic or electrical)
- Demand-controlled fan control (hydraulic & electrical)
- Hydraulic quickcoupler systems
- Load-pressure-adjusted hoist suspensions

Large loaders

125 – 275 kW



- Mainly hydrodynamic transmission drives
- Hydraulic supply via LS pump systems (multiple-pump combinations)
- Hydraulically pilot-operated main control manifolds (3/4-way) with joystick (hydraulic or electrical)
- Demand-controlled fan control (hydraulic & electrical)
- Hydraulic quickcoupler systems (the larger the loader, the less frequent the application)
- Load-pressure-adjusted hoist suspensions → standard in larger loaders
- Increasing use of additional joystick steering (with 20 km/h approval/ no road approval)

Mining loaders

>280 kW

- Hydrodynamic transmission drives
- Hydraulic supply via LS pump systems (multiple-pump combinations)
- Hydraulically pilot-operated main control manifolds with electrical joystick control
- Demand-controlled fan control (hydraulic)
- Load-pressure-adjusted hoist suspensions → standard
- Joystick steering mainly used

Wheel dozers

- Mainly hydrodynamic transmission drives
- Hydraulic supply via LS pump systems (multiple-pump combinations)
- Hydraulically pilot-operated main control manifolds (3/4-way) with joystick (hydraulic or electrical)
- Demand-controlled fan control (hydraulic & electrical)
- Increasing use of additional joystick steering (with 20 km/h approval/no road approval)



Wheel loader applications

Digging, excavation & levelling work



Transporting loose material



Handling & transport work



Municipal services



Energy efficient, safe, comfortable.

Challenges in the various wheel loaders

The development of modern machinery is characterised by shared requirements across the various wheel loader sizes. Ever more complex open-loop and closed-loop control processes go hand-in-hand with the enhancement of the productivity and efficiency of the machines. The machine operators are supported and the work process is optimised in this context with the aid of modern electronic assistance and visualisation systems.

Changes to the regulatory framework result in increased investment in the functional safety of the machines and in a further development of the drive and control systems of the wheel loaders. As is also the case with the EU & US exhaust emissions regulations, the emerging markets in the rest of the world are taking up these standards and are introducing new standards at the same time.

HYDAC's contribution

HYDAC offers a variety of components and systems that meet these requirements and fulfil your demands. In addition to standard components, HYDAC offers a comprehensive modular system designed for wheel loader applications. Furthermore, HYDAC will also work with you to develop a customised solution for your device.

HYDAC's key issues

Our development team and application engineers are working continuously to further develop our products. The focus of these developments is on the following key topics:

Our technology

- **Increases in:**
 - ⇒ Excavation & digging performance (high tearing and breakaway forces)
 - The use of energy-efficient pumps and valve technology, optimal positioning in working position with sensitive controls, accurate repeatability for automatic and control functions
 - ⇒ Corrosion resistance owing to surface coating and special materials
- **Reduction in:**
 - ⇒ Piping and installation expenditure due to combined hydraulic function units
 - ⇒ Noise emissions and power consumption through regulated fan speeds
 - ⇒ Driver's exposure to dust due to cabin ventilation systems
 - ⇒ Hydraulic oil tank sizes by optimizing air separation in hydraulic oil, proven through simulation and testing
 - ⇒ Installation space, component weight and electrical power requirement by reducing solenoid valve sizes
 - ⇒ Learning curve of the drivers through intelligent control and visualisation systems
- **Extension of:**
 - ⇒ Maintenance intervals by monitoring the hydraulic oil quality
- **Reduction in:**
 - ⇒ Software development time by using tested and certified software libraries
 - ⇒ Development times by means of HYDAC modular systems and industry know-how
 - ⇒ Assembly times through control technology tailored to customer specifications

Your benefits

- **Energy efficiency**
 - ⇒ Reduced fuel consumption
 - ⇒ Lower hydraulic losses
 - ⇒ Energy saving and recovery
 - ⇒ Precise cooling-requirement temperature control
 - ⇒ Reduced electrical power requirement
- **Reliability**
 - ⇒ Certified software modules
 - ⇒ Systems for functional safety
 - ⇒ Service life increased by protecting materials
- **Noise reduction**
 - ⇒ Lower noise level in partial-load range of fan control
- **Health & safety**
 - ⇒ Reduced exposure to dust for the driver
 - ⇒ Reduced aerosol exposure for the driver
- **Takes up less space**
 - ⇒ Combined functional units
 - ⇒ Integrated tank and filter systems
- **Function integration**
 - ⇒ Reduced number of components
 - ⇒ Reduced weight
 - ⇒ Reduced joints and leakage points
- **Comfort**
 - ⇒ Improved working environment for the driver
 - ⇒ Sustained driver performance on longer jobs
- **NoX**
 - ⇒ Compliance with the Emissions Directive
 - ⇒ Reduced nitrogen oxide and CO₂ emissions

System intelligence Electro-hydraulic system solutions as the interface between actuators and sensors.

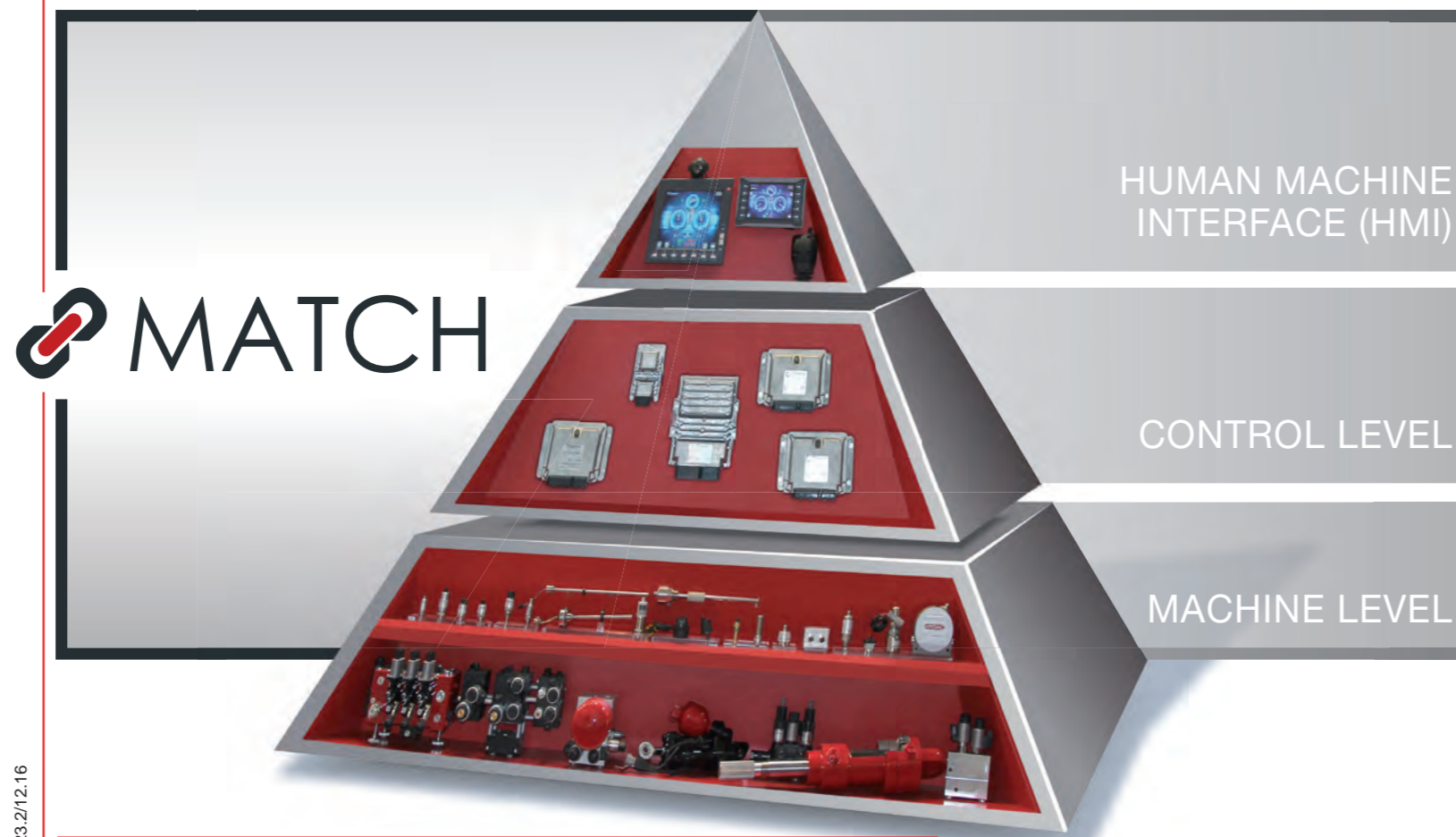
The demands of modern wheel loaders are leading to ever-increasing complexity of control systems. Modern machines require a variety of assistance and control systems wherever simpler operating concepts and a better overview and controllability of the machine functions become necessary.



Electro-hydraulic control technology

From component to intelligent drive solution.

HYDAC offers everything from a comprehensive range of hydraulic and electronic components to subsystems, right through to finished functional solutions that can also include the corresponding application software.



- Displays for the most demanding visual requirements
- Peripherals, e.g., joysticks

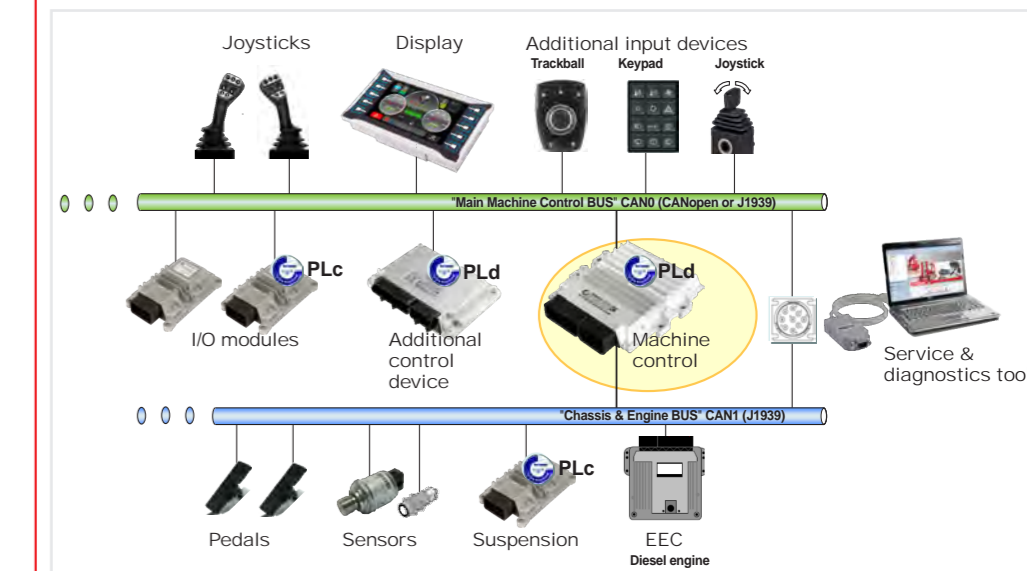
- Controllers in various classes
- I/O expansion modules
- Standard version and versions with increased functional safety available

- **Sensor level**
 - Pressure and temperature
 - Distance, position, angle, inclination and level
 - Drive speed
 - Flow and oil level
 - Standard version and versions with diagnostics and increased functional safety available

- **Actuator level**
 - Pilot-controlled and direct-acting valves
 - Control blocks (monoblock/sandwich)
 - Pilot and primary control systems
 - Intelligent axes
 - Cylinders, pumps and motors

See catalogue 18.500 – Control Technology for Mobile Machinery
See catalogue 180.000 – Electronic Product Catalogue

System development



Example of control architecture

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

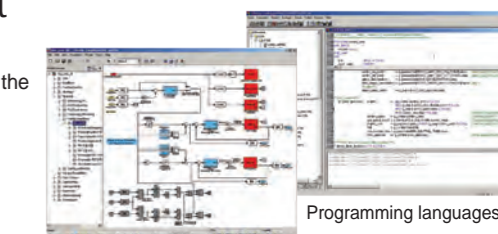
Services can include:

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

Software development

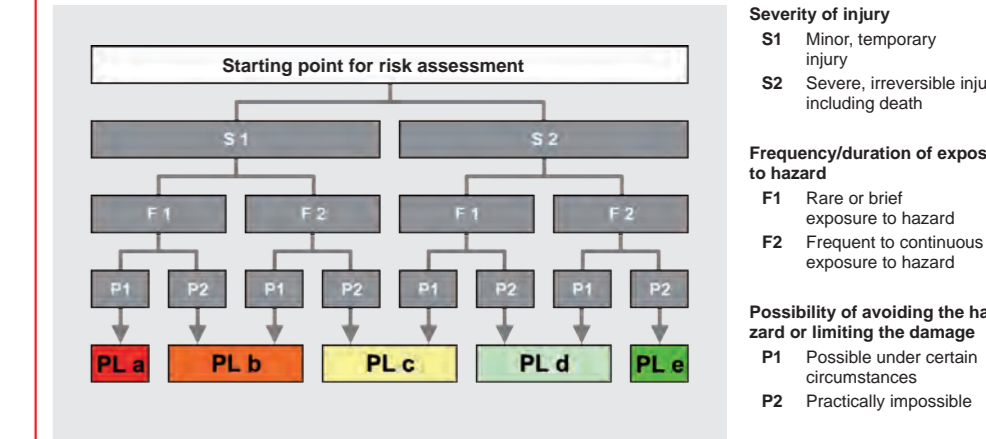
Depending on the hardware, the following programming languages can be used to program the application software:

- CoDeSys 2.3 / 3.5 / 3.5 SIL2
- C
- MATLAB/SIMULINK



Programming languages

System development support

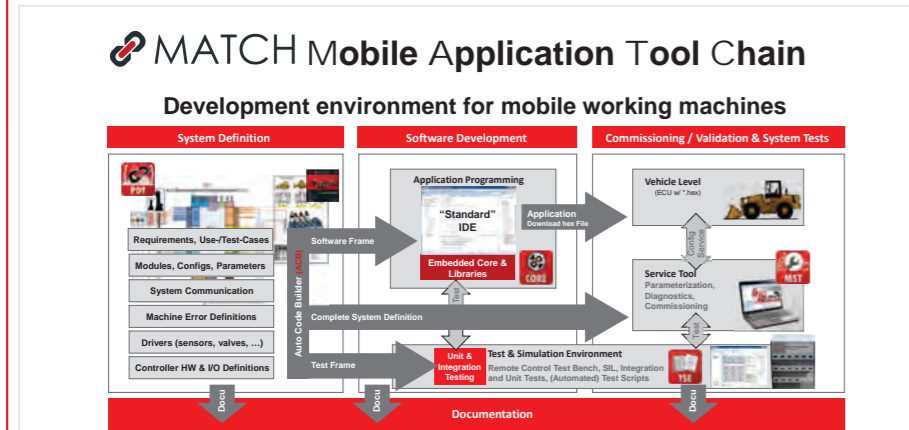


- **Severity of injury**
 - S1 Minor, temporary injury
 - S2 Severe, irreversible injury including death
- **Frequency/duration of exposure to hazard**
 - F1 Rare or brief exposure to hazard
 - F2 Frequent to continuous exposure to hazard
- **Possibility of avoiding the hazard or limiting the damage**
 - P1 Possible under certain circumstances
 - P2 Practically impossible

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)

"MATCH" development environment



Mobile Application Tool Chain

With the "MATCH" (Mobile Application Tool Chain) development environment, 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 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

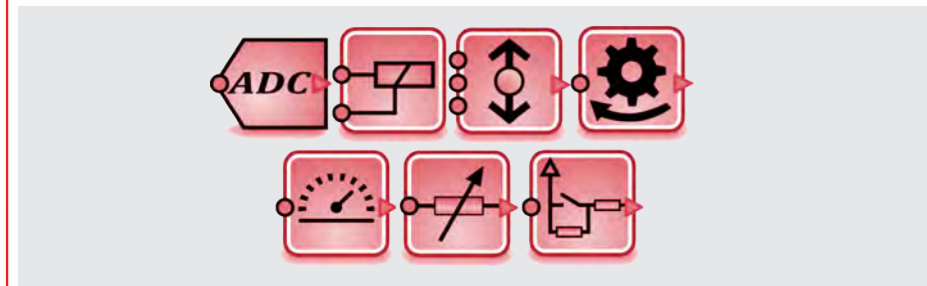
Furthermore, an "embedded Middle Ware" is offered which permits a hardware-independent programming of the application and which contains a multitude of basic functions. A comprehensive selection of library modules (e.g. for sensor and valve drives) is also available for an efficient development of the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

Software library



Selection of library modules

In order to make software development significantly easier for the customer, HYDAC offers software libraries with ready-made modules as part of its "MATCH" development environment. The library modules can be configured and parameterised as desired.

Examples of library modules include:

- Sensors
- Switches
- Proportional and switching valves
- Relays, LEDs
- Transfer functions/signal elements

Special error modules can also be used to detect system errors.

Sensors, system electronics and control systems. Solutions perfectly tailored to the application – all from a single source.



Sensors

Function

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

Electronic sensors and controls to complement the system electronics.

- Max. load regulation
- Electro-hydraulic load sensing
- Working hydraulics
- Positioning
- Controls of special equipment
- Switch-off devices
- Safety systems

Features

- The sensors are available with a variety of output signals, connectors and fluid port connection options
- Robust design
- ECE type authorisation
- Approved for potentially explosive atmospheres
- Separate product portfolio, especially for applications with increased functional safety (SIL 2.3 / PL c.d)

▶ See catalogue 180.000 – Electronic Product Catalogue



e.g.: controller series, e.g. HY-TTC 77 and HY-TTC 500

Mobile controller HY-TTC series

Function

With the HY-TTC family 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 controllers 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 / C++ / CODESYS
- 82 kB, 138 kB, 256 kB or 3MB RAM
- 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 dip in voltage when starting engine
- Aluminium die cast housing with waterproof connection plugs, including a waterproof Gore-Tex membrane for hydraulic balance
- E12 type approval

▶ See catalogue 18.500 – Control Technology for Mobile Machinery



HY-TTC 30X

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

Function

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

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

They provide a simple extension of on-board electronics.

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

The different I/O modules provide a large number of high performance switching outputs or diverse 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 enhanced 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

▶ See catalogue 18.500 – Control Technology for Mobile Machinery



Displays with integrated HY-eVision² controller

Mobile display HY-TTC eVision²

Function

The compact background-lit TFT colour displays with integrated high-end display controller are characterised by a very high image quality, 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® system in the cockpit.

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

Up to two external cameras can be connected to the display via the two integrated composite video ports, 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
- Fast boot-up times
- Impressive display options such as 3D, picture-in-picture, overlapping effects, etc.
- Two pictures can be displayed simultaneously
- Up to 4 CAN, USB and Ethernet interfaces
- Robust housing with appealing design, suited for mobile applications
- WLAN-compatible
- Standby & wake-up

Hydraulic systems

The optimal working hydraulics for fast, precision and efficient control.

Open center directional control valves

HYDAC's open center directional control valves offer you a modular system with robust, energy efficient and cost-effective solutions for mechanical, pneumatic, hydraulic and electro-hydraulic controls.

Features:

- Available in monoblock, multi-section and sectional designs
- Key data: $Q_{max} \leq 180$ l/min; $p_{max} = 350/420$ bar
- Energy efficient Q-inlet option
- Robust, high quality and maximum controllability
- Low internal leakage
- Inlet selector for safe flow distribution
- Electrical shut-off of pump volume
- Main consumer in parallel, series and tandem sections
- Simple integration of secondary valves
- Optional spool position indication of the main spool control
- Optionally also for use with LS variable displacement pumps

Key data for open center directional control valves (see photos on right):

- RS 160 directional control valve $\Rightarrow Q_{max} = 60$ l/min; $p_{max} = 250$ bar
- RS 210 directional control valve $\Rightarrow Q_{max} = 70$ l/min; $p_{max} = 300$ bar
- DX-6 directional control valve $\Rightarrow Q_{max} = 140$ l/min; $p_{max} = 350$ bar



RS 160
Open center directional control valve



RS 210
Open center directional control valve



DX-6
Open center directional control valve

Load-sensing directional control valves

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

Features:

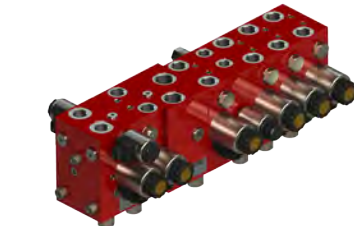
- Multi-section and sectional designs
- Key data: $Q_{max} \leq 180$ l/min; $p_{max} = 350/420$ bar
- Extra-long 10 mm spool stroke for high-precision control
- Independent of the load, parallel operation is possible without mutual interaction
- Simple integration of secondary valves
- Inlet selector for safe flow distribution
- Electrical shut-off of pump flow
- Optional spool position indication of the main spool control
- Possible to shutdown individual sections whilst maintaining full functionality in remaining sections

Key data for load-sensing directional control valves (see photos on right):

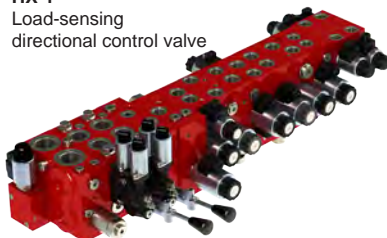
- HX-1 load-sensing directional control valve $\Rightarrow Q_{max} = 120/35$ (prop) l/min; $p_{max} = 250$ bar
- LX-6 load-sensing directional control valve $\Rightarrow Q_{max} = 180$ l/min; $p_{max} = 350$ bar



LX-6
Load-sensing directional control valve



HX-1
Load-sensing directional control valve



LX-6 + HX-1
Directional control valve combination-kit

See brochure no. 5.254 – Mobile Valves
See brochure 5.256 – HX1

1 HYDAC variable displacement pumps are specially designed to suit LS-controlled hydraulic circuits to supply the main functions of a device. With a maximum displacement of 180 cm³/rev and a displacement pressure of 350 bar, they are available in an SAE version, with splined shaft and drive shafts for multiple combinations.

2 HYDAC fixed displacement pumps are used to supply secondary circuits and for pilot pressure supply. In special combination, they are also suitable for electro-hydraulic fan control. They are also available as multiple-pump combinations.

3 The return line suction filters RKM are ideal for use in mobile machinery with multiple circuits, particularly for vehicles with hydrostatic transmission drive. Via the integrated thermo-bypass, excessively warm oil can be channelled to the cooler directly before it passes through the filter and enters the tank. Thanks to the built-in counter-balance valve, a slight overpressure is built up in the element that has a positive effect on the intake characteristics of the connected pumps (lower cavitation risk in the system).

4 The fillers/breathers (ELF/BF) are important components in all hydraulic systems. They ensure that filtered air always reaches the tank in the event of oil level fluctuations. They also prevent oil from escaping unchecked during off-road driving (integral baffle).

5 Accessories specially designed for various tanks, such as fluid level gauges, clamping bands, clamps of various designs and ball valves.

6 Mobile cooler combinations (CMS) for demand-driven cooling of all kinds of media circuits (water, oil, charge air, diesel, etc.). Available customised to suit individual requirements and installation conditions, and as extra/retrofit cooler.

7 The fan drives can be realised on the basis of electric or electro-hydraulic controls for the speed control of the fan motor. To prevent any drop in cooler power, reversing can be optionally integrated to change the fan's rotation direction, to enable the cooler fins to be "purged".

8 Priority valves (MPV) are needed to distribute flow, with one function given priority and the remaining flow made available to other actuators. A typical application for priority supply is a braking system or a steering system.

9 Pilot control manifolds are used to supply hydraulic joysticks and other low-pressure applications in wheel loaders. They can optionally be fitted with a diaphragm accumulator (to safeguard emergency function) and a pressure filter. In combination with low-pressure valves, additional actuators can be controlled, such as safety shutdown and parking brake.

10 Our directional control valves offer you a modular system that can be used to design complex controls. The main control is based on our modular open center or load-sensing valve systems, with manual, electro-hydraulic or proportional control. The number of additional valves can be reduced by using of special spools.

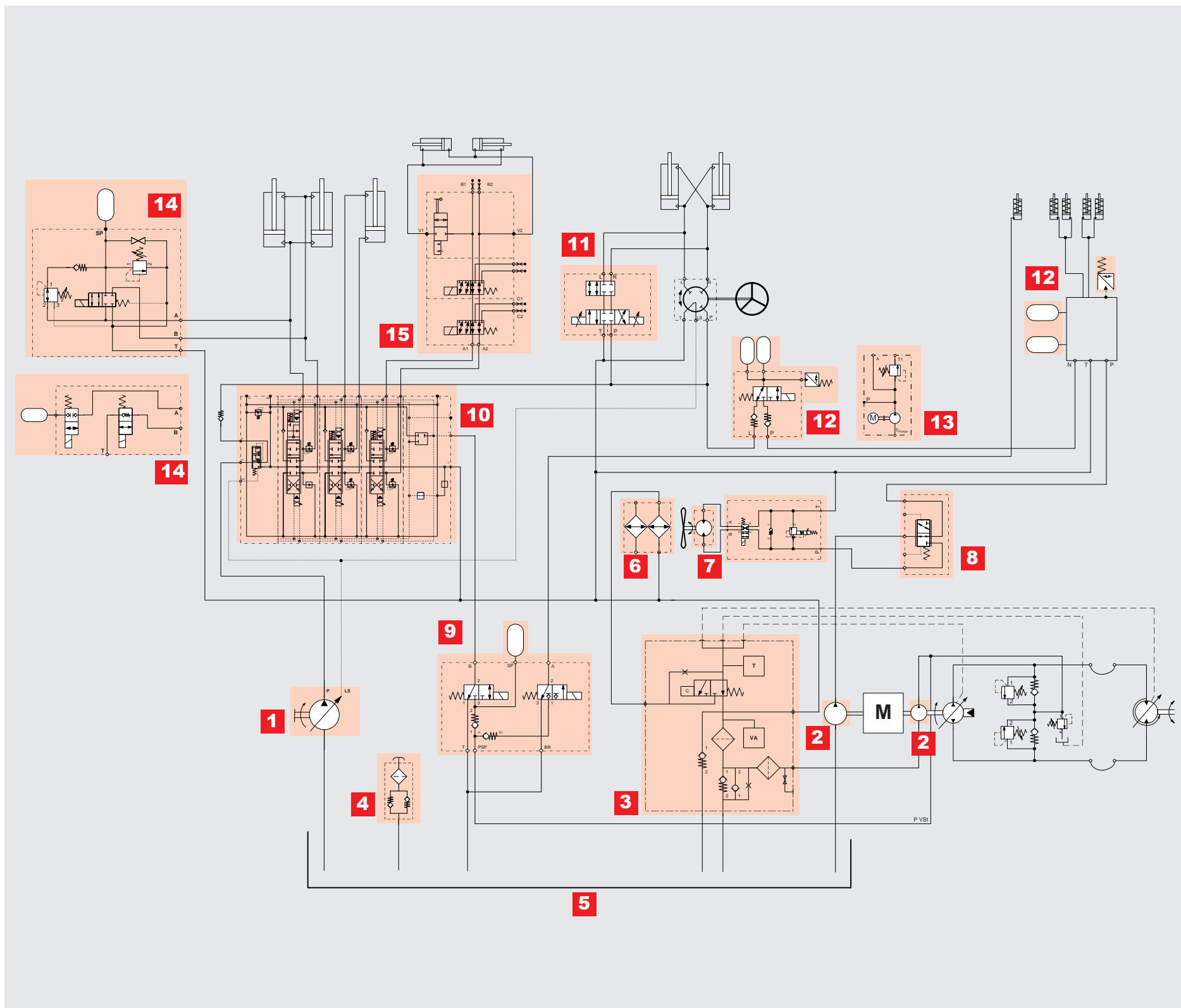
11 Optionally, our electro-hydraulic additional steering systems can enable you to put together all-wheel steering types with various steering modes, above all for excavators and swivel loaders. For larger wheel loaders and industrial loaders, we can also realise additional joystick control with our steering systems.

12 Our energy storage blocks are used in wheel loaders predominantly for emergency supply or to safeguard safety functions, such as the vehicle steering or the vehicle braking system.

13 For medium-sized wheel loaders and larger, we can alternatively provide our motor-pump assembly (DC1) for emergency steering supply. The assembly is a motor-pump assembly with pressure cut-off that is ready for installation, available in a 12-volt or 24-volt version. An integrated temperature switch provides protection from overload.

14 The hydropneumatic hoist stabilising unit (HSE) is used to hydraulically decouple the hoist (boom) from the front carriage of the wheel loader, preventing pitching vibrations from occurring during transport journeys. It can be adjusted to suit any machine and any load conditions. This allows it to significantly increase the driving stability, steering performance and overall driving safety of the wheel loader. Various systems can be provided, depending on the wheel loader size.

15 6/2-way selector valves are used for additional control of further actuators from one single oil supply. Particularly used in retrofits for quick couplers or multi-function attachments (such as sweepers, high-tipping buckets, bottom-dump or grapple buckets and rotating gripper jaws). Available in various power ranges.



Focus on energy efficiency

Hydraulic start-stop technology

In passenger cars, electrical start-stop systems have already become established technology. These systems allow considerable fuel savings to be made. In wheel loaders, switching off the diesel engine when it is idling is also a source of major potential savings.

In mobile machinery, existing hydraulics infrastructure can normally be used to realise start-stop functionalities. For example, work-hydraulics pumps in a modified form can also be used as hydraulic motors.

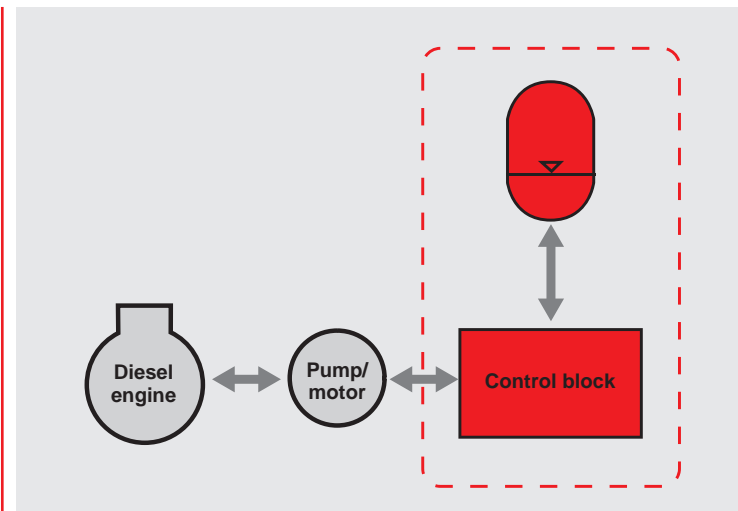
After an automatic "idle stop", the diesel engine is restarted in motor operation as needed, for example by means of the work-hydraulics pump. The energy required for this is taken from a hydraulic accumulator that was previously charged "in the background" during normal machine operation.

The hydraulic start-stop solutions generally provide quicker starting processes than electrical systems, which above all improves operator acceptance.

HYDAC has extensive experience in hydraulic control blocks and is a specialist in hydraulic accumulator solutions. With its extensive product portfolio and in-depth know-how, HYDAC has what it takes to be the perfect development partner for hydraulic start-stop solutions:

- Extensive valve portfolio
- Customised control block solutions
- Optimum hydraulic accumulator solutions
- Robust sensors

Even though hydraulic start-stop systems take up very little space in general, it is often useful to have the option of adjusting the accumulator solutions to suit the particular wheel loader. HYDAC provides the perfect resources for this, with its wide variety of diaphragm accumulator nominal volumes. For long and narrow installation spaces, for example, piston accumulators from the SK280 series can be utilised to create perfect packaging.



The structure of a hydraulic start-stop system



Cartridge valves



Example of a "control block + accumulator" solution



Piston accumulator (series SK280)



Diaphragm accumulator



Pressure sensors

Applications for wheel loader functions

We offer you different solutions for the various primary and auxiliary functions of your wheel loader.

Pilot manifolds with modern multi-function valves – small, efficient and fast

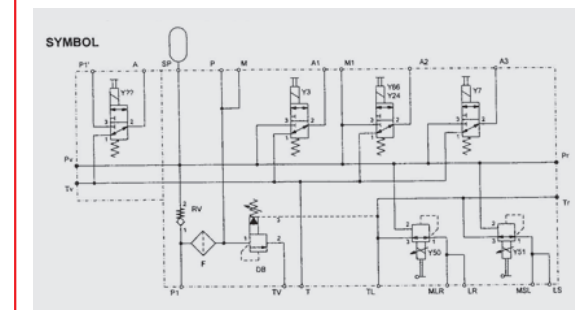


Pilot control manifolds/PCM

To satisfy the requirements in modern working machinery for energy efficiency, available space and safety, the new HYDAC pilot control manifolds are equipped with cutting-edge valve technology. Complex control units with proportional valve technology, integrated diaphragm accumulators and pressure filtration have become standard. As the number of valves increases, the number of functions performed by the valves increases, reducing size and weight. Like the slip-in proportional pressure reducing valves specially developed for pilot circuits, which are used for all axes and controlled directly via the joystick. Or the "mini-valves" that can handle flow rates of up to max. 20 l/min.

The following classic functions can be controlled:

- Supplying hydr. joystick control
- Switching off pilot circuit/joystick
- Proportional control of additional circuits
- 2nd speed change-over, disabling axes, etc.
- Various cylinder actuating functions, support, etc.
- Parking brake or rotating mechanism brake



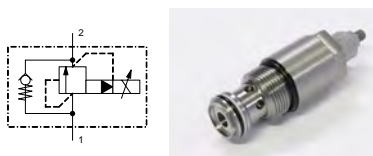
Example circuit diagram

Integratable additional functions

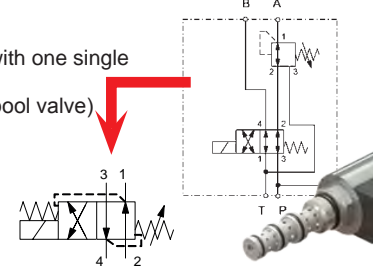
Perfect separation of high pressure and low pressure outside the control manifolds: **DR10X** (pressure reducing valve)



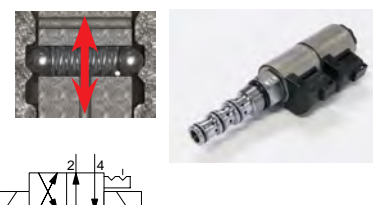
Safeguarding the wheel loader hoist by means of pressure relief & check valve **DBRV16P**



Quick-coupler control with one single valve: **WKDR10YP** (pressure directional spool valve)



Axle oscillation lock with latching function: **WK10X-01R** (4/3-way spool valve)



Cartridge valves for gear applications

Modern driving gears in construction machines need specialised valves for gear and clutch control. The response and filling capacities are just as important as the functional reliability and the ability to withstand contamination.

PDB10SPEZ

3-way proportional valve specially designed for adjustable-system pressure limiting in mechanical driving gears and converter drives

- Maximum pressure setting with high mechanical precision
- Back-pressures from the coolant circuit have no effect on the pressure setting (also DB10SE/SPE)
- Boost function: possible for higher torques
- $P_{max} = 100 \text{ bar}$, $Q_{max} = 120 \text{ l/min}$

DB10SE and DB10SPE pressure relief valves with flat performance curve

- Ideal for clutch applications
- $P_{max} = 350 \text{ bar}$, $Q_{max} = 120 \text{ l/min}$

Gear valve PDR08Z in control manifold

Clutch actuation via inverse proportional pressure reducing valve PDR08Z.

- Exact clutch control thanks to machine-specific valves
- Very rapid response and filling capacities
- $P_{max} = 80 \text{ bar}$, $Q_{max} = 10 \text{ l/min}$

PDMC proportional pressure reducing valve family as slip-in valves in compact design for pilot control and driving-gear applications

- Very good behaviour in cold oil
- High flow rates for direct-acting valves
- $P_{max} = 60 \text{ bar}$, $Q_{max} = 100 \text{ l/min}$

► See brochure 5.300 – Product Overview, Compact Hydraulics

Mobile valves for compact wheel loaders

The RS160 is a proportional open center directional control valve with different control types. With the new compact electro-hydraulic control, this valve is ideal for use in compact wheel loaders.

The RS160 impresses with its compact design and innovative features, such as the innovative manual emergency override connection.

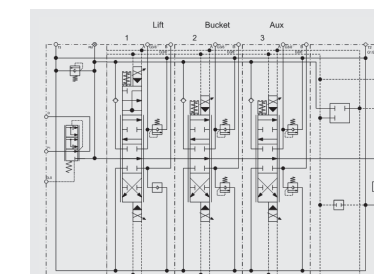
The result is a precision controllability.

Advantages:

- Low hysteresis and high resolution due to innovative manual emergency override connection
- Flow-optimised valve design
- Compact design
- Sections with symmetrical design (hand levers can be mounted on A or B side)
- Electro-hydraulic operation available with or without manual emergency override
- End plate with internal or external pilot oil supply
- Additional functions like a priority valve are available for the standard end plate (on request)

Technical data:

- $p_{max} = 250 \text{ bar}$
- $Q_{max} = 60 \text{ l/min}$



► See brochure no. 5.254 – Mobile Valves

Cooler-filter-tank combination & fan drive

The implementation of the emissions directive is resulting in a significant reduction to the space available inside the machine. More space is needed for the soot particle filter, exhaust gas return and the engine itself. All the components are moving closer together.

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

Hose lines and pipes can be shortened or eliminated and the plastic tank, which also functions as a fan casing, can be designed to optimise air flow.

Furthermore, this design has resulted in additional noise reduction.

All in all, we have a compact, powerful and low-noise module with charge air, oil and coolant cooler, with the oil tank integrated with all functions such as the filling level display, breather filter and return line suction filter.

Technical data:

- Hydraulic fan drive: 8 ccm
- Integrated return line suction filter (RKM)
- Integrated combination cooler with 3 cooling circuits:
 - ⇒ Coolant: 50 kW
 - ⇒ Hydraulic oil: 23 kW
 - ⇒ Charge air: 12.5 kW

E 10.123.2/12.16

HYDAC 17

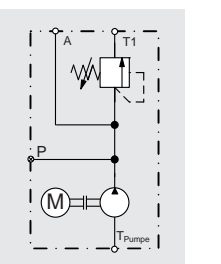
Emergency/safety supply

According to legislation, an emergency steering function must be present in loading machines in the event of drive failure. This must allow continuous steering functions if a certain travel speed is exceeded. Should the power supply for the steering system fail, the vehicle can be brought safely to a halt. The emergency steering can be realised by means of either a manifold with an adequately large accumulator volume or a DC pump unit to supply the steering valves.

Our emergency steering unit (DC1) is an integrated motor-pump assembly that is supplied ready for installation, with a temperature switch to protect it from overload. Thanks to its compact design, it requires little space.

Technical data:

- DC = 12 / 24 V
- $P = 50 \text{ to } 250 \text{ bar}$
- $Q_{max} = 18 \text{ l/min}$
- $P_{nom} = 2.2 \text{ kW}$
- Drive speed = 2500 rpm



Circuit diagram DC-1



Accumulator block for emergency steering supply

► See brochure 5.307 – DC1 Compact Power Units

HYDAC 18

Hoist suspension

The hoist stabilising units from the HSE series, in combination with diaphragm and piston accumulators, reduce the pitching vibrations in the wheel loader. Depending on the size of the HSE units, they are equipped with valves for load-pressure adjustment and turning on the lifting cylinder of the wheel loader. The units are available in the sizes HSE-10 to HSE-16, depending on the lifting cylinder sizes.



The HSE-SK400 units are made up of a piston accumulator and integrated pressure valves for load adjustment and switching on the spring damper units up to a permissible operating pressure of 400 bar.



The reduction in pitching vibrations in the wheel loaders improves their driving stability. This makes it possible to achieve higher transport speeds and material handling capacities. The diaphragm and piston accumulator design and harmonised dimensioning of the HSE valve series, from a single source, enables optimum adjustment to suit the machine and the work application.

▶ See brochure 10.116.8 - Hoist Stabilising Unit HSE-10
▶ See brochure 10.116.5 - Hoist Stabilising Unit HSE-16

Hydro-pneumatic cab suspension

The specifications set down by the European Vibration Directive 2002/44/EC and the German Noise and Vibration Safety and Health at Work Ordinance (Lärm/VibrationsArbSchV) limit the permissible exposure values and action values for whole-body vibrations affecting the machine operator.

The current solutions involving elastic cab bearings are only able to reduce the higher frequencies of engine vibrations. Reducing the accelerations in the low-frequency vibration range can only be achieved by cab suspension systems with floating bearings. We supply hydro-pneumatic cab suspension units adjusted to suit the various cab weights. Depending on the design and the version, the units are equipped with fixed, switchable or proportionally controllable damping devices for various application types. The streamlined form with integrated piston accumulator enables space-saving installation in the pillars of the wheel loader cabs.

The reduction in whole-body vibrations inside the cab improves the relative movements between human and machine and the comfort, efficiency and health protection for the machine operator.

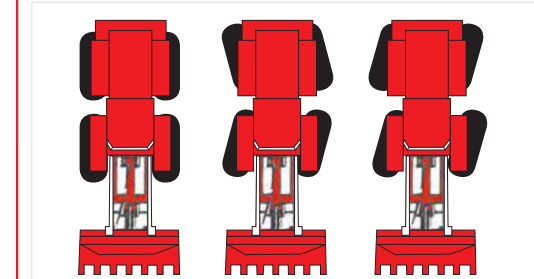
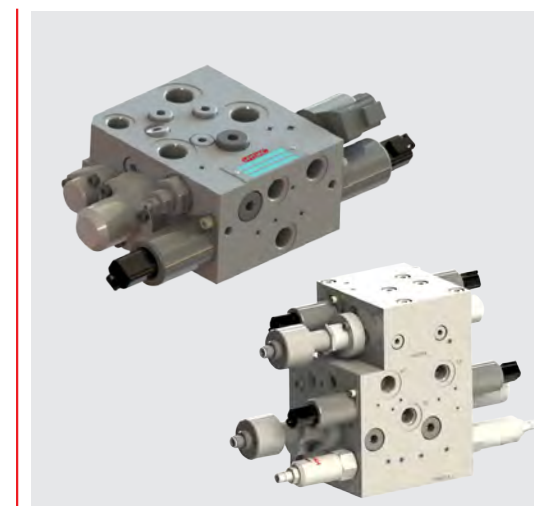


▶ See brochure 10.116.6 - FDE2 Cabin Suspension Element

Electro-hydraulic steering

The wheel loaders are designed with Ackermann or articulated steering, depending on their type and size. The steering cylinders of the external-power steering system are controlled by the hydraulic steering valve (orbitrol), in accordance with the steering wheel movement. In the Ackermann-steering machines, the wheels move at the front and the rear axle.

The vehicles with articulated steering have an articulated joint between the front and the rear sections. The front and rear sections are twisted hydraulically with one or two steering cylinders. In the event of hydraulic supply system failure, in small machines, the emergency steering properties of the hydraulic steering valve enable emergency steering to be carried out. In large machines, energy storage blocks or DC-driven emergency pump units are provided, to ensure that the permissible operating forces at the steering wheel are complied with. To increase the materials-handling capacity and the comfort for the operator, the machines can be fitted with electro-hydraulic superimposed joystick steering. In this case, an electro-hydraulic valve island is incorporated, parallel to the hydraulic steering valve. In off-road operation, the steering cylinders are controlled via a joystick and the electro-hydraulic proportional steering valve. In on-road operation, the steering is achieved via the hydraulic steering valve (orbitrol), which currently still requires approval. To satisfy the corresponding safety requirements and performance level, the electro-hydraulic proportional control blocks are equipped with position monitoring of the main spools, redundant pilot-pressure generation and/or redundant main spools, depending on the version and the requirements. Additionally, electrically controlled shut-off valves are provided to disconnect the main spools from the steering cylinders in the event of an error. The steering valve islands can be fitted with shock valves in the steering cylinder connections to protect the steering system in the event of large external forces.



Electro-hydraulic auxiliary steering for all-wheel & crab steering

▶ See brochure 10.116.9 - HY-Steer

Hydraulic supply Optimal solutions from the HYDAC technology platform.



PGE100

PGI100



PPV100S and PPV101

MGE102

Drive technology

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 controller program. 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.

▶ See catalogue 2.902.6 - Pump Overview
▶ See catalogue 2.902.1 0 - Motor Specification

HYDAC



Bladder, piston and diaphragm accumulators for mobile applications

Accumulators

HYDAC offers a 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:

Energy provision with accumulators

- Used in braking/steering systems to relieve the pump in operation
⇒ increases machine's working efficiency
- Used in the pilot circuit to improve functionality and for safeguarding in emergency operation
⇒ machine availability even at full performance
- Emergency and safety tasks for brake and steering
⇒ safeguards safety-relevant functions of the working machine

Damping tasks

- Bucket damping
⇒ increases driving stability and comfort
- Pulsation damping
⇒ reduces pressure pulsations in the hydraulic circuit
⇒ extends service life of machine components
- Cab suspension
⇒ reduces vibrations in the driver's cab
⇒ increases operating comfort

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 you are able to select the type of accumulator construction that suits the application out of the comprehensive product range and to lay it out in accordance with the operating conditions. The correct accumulator is still the best support for an application and HYDAC accumulators can be used worldwide with country-specific acceptances.

▶ See catalogue 30.000 - Accumulator Technology

HYDAC



Fuel pump for diesel fuel

Fuel pumps

- Fuel pump for diesel or hydraulic oil
- Flow rate
 - Diesel: up to 80 l/min
 - Mineral oil: up to 15 l/min
- Installation position optional

HYDAC fuel pumps are compact units with direct current drive for quick and simple tank-to-tank transfer of diesel fuel or hydraulic oil.

Advantages:

- Filling the fuel tank is possible on the vehicle independent of a stationary tanking system.
- Self-priming up to 2.5 m in height; no initial filling prior to commissioning required
- Compact design; saves on both space and weight
- DC motor with protection rating IP65
- Good efficiency, low current consumption
- Suitable for dry running; Safe also for short run periods without fluid
- Optionally with non-return valve, leak-tight

HYDAC



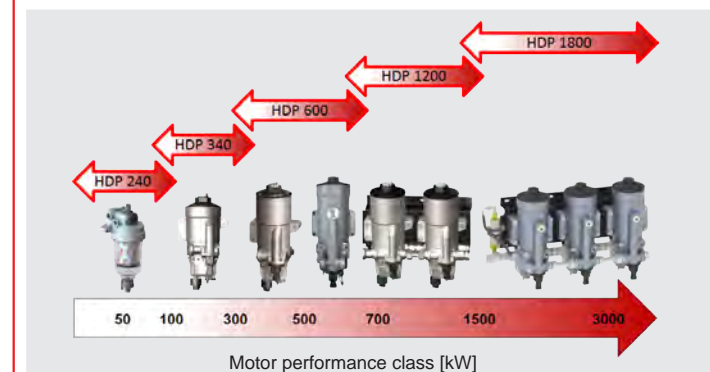
Diesel PreCare filter

Diesel filtration

- Suction-side pre-filter and water trap
 - Manual or automatic water discharge
 - Option: water sensor, fuel pre-heater, manual/electrical filling/booster pump
 - Variants for diesel engines up to >3000 kW
- Guarantees the fuel purity required of modern common rail diesel engines to meet the requirements of the exhaust emissions standards Euro6 and Tier4, and component protection of the fuel system through the use of the latest, fully synthetic filter media and continuously reliable water separation. Reduction of the Life Cycle Cost (LCC) by extending the service life and service intervals.

Advantages:

- Protection of all of the components of the fuel system, e.g.: suction pump, common rail injection pump, diesel injectors, by:
- Excellent water removal
- Maximum contamination retention capacity
- Very long service life
- Very low pressure drop



▶ See Brochure 7.125 - Diesel PreCare

HYDAC



Filtration

Our broad filter range offers inline filters (LF, MDF, DF) with various pressure ratings and materials in addition to filler/breathers (ELF) for the hydraulic tanks. We also have a broad range of in-tank return line filters (RF) and return line & 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 bleeding
- 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, fitted with high-quality filter element material ensures high operational safety and extended maintenance intervals, e.g.:

Return line / return line suction filtration

Using RFM and RKM filters (with optional thermal bypass valve built into head). Tank-mounted or tank-integrated filters

Supply circuit filtration

using inline filters LPF and LPFP

Pressure oil filtration

using inline filters MFM, HFM, DF

Gear oil filtration

Suction line filters for gear oil and hydraulic oil

Removal of coarse contamination

using inline filter ILF

Air filtration

using breather filters BF, ELF, ELFL, BDE. Extensive standard product range, optionally with duo-valve for tank pressurising, anti-sloshing protection possible, version with air drying, air filter systems for motors

Filter clogging indicators (VA)

to improve safety of operation and possibly display maintenance intervals

Brand labelling to protect the spare parts business

Marking of the filter elements to improve product identification and to secure spare parts demand.

Tank/filter solutions from a single source

Ready-to-install complete systems, optimised for component protection, system cleanliness and venting

Filtration solution for AdBlue and SCR cooling

▶ See catalogue 70.000 - Fluid Filters
▶ See brochure 10.777 - Filtration and Fluid Care

HYDAC

Cooling

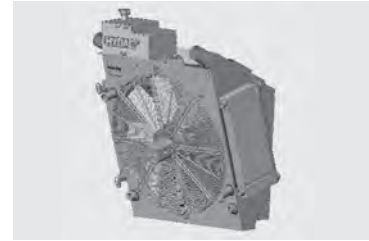
Hydraulic oil cooling

- Oil/air cooler with DC or hydraulic motor
- Electro-hydraulic fan controls

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

Properties:

- ⇒ Robust aluminium plate construction
- ⇒ High performance air fin with very good anti-contamination properties
- ⇒ Low-noise fan



CMS oil/air cooler – hydraulic drive motor



CMS oil/air cooler with fine filter grid, folding design, for easy, tool-free cleaning

Combination coolers

- CMS combination coolers for hydraulic oil, transmission oil, charge air, coolant, diesel fuel

The following cooling circuits can be combined together in various ways in a CMS mobile cooler:

- ⇒ Charge air cooling (CAC)
- ⇒ Coolant cooling (RAD)
- ⇒ Oil circuits: transmission, hydraulics, fan drive
- ⇒ Fuel cooling

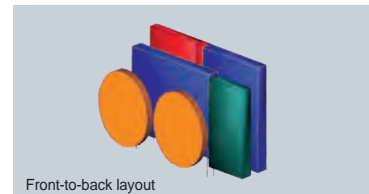
The dimensioning and simulation software KULI, which is also used in automotive applications, allows complex cooling systems to be modulated.

The cooling system is considered as a whole. Installation resistances and additional heat sources such as driving-gear and diesel coolers can be included in the calculations and taken into account in the air flow.

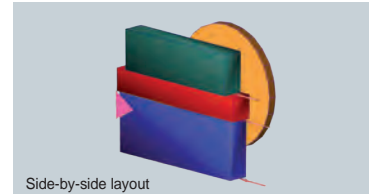
The efficiency of a cooler also depends greatly on the fan control. In general, fan drives are divided into three different drive concepts:

- ⇒ Direct fan drive
- ⇒ Electric fan drive
- ⇒ Hydraulic fan drive

HYDAC offers the latter two designs. They regulate the speed of the fan depending on the temperature of the medium. As an option, these controls can also be supplied with a reversing function, to "purge" the cooler of dirt (e.g. dust and debris).



Front-to-back layout



Side-by-side layout

Individual cooler requirements for combination cooler systems – oil, water and charge-air cooling

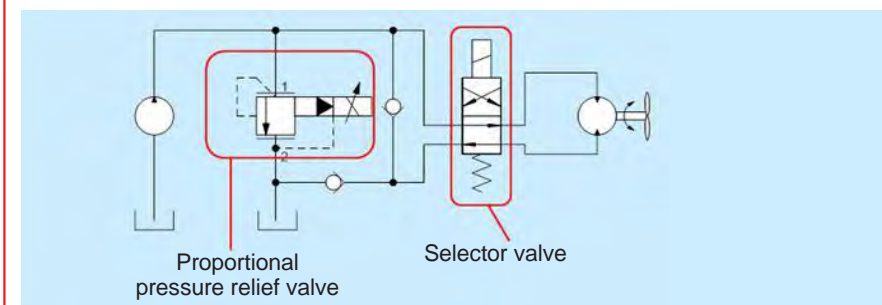
- ▶ See catalogue 57.000 – Cooling Systems
- ▶ See brochure 5.812 – CMS Mobile Coolers

Fan control components and control blocks

Hydraulic and electro-hydraulic controls for regulating fan motor speed with optional reversal of rotation direction for use with various types of pumps.

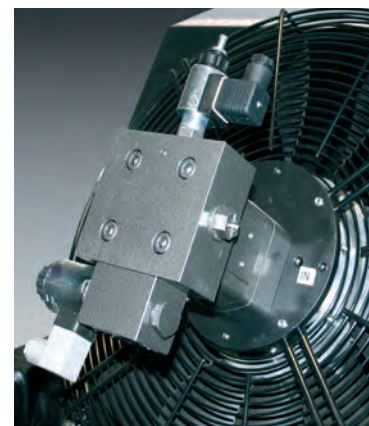
Valves specially developed for the application:

- Directional control valves
- Non-return anti-cavitation valves
- Manually adjustable pressure relief valves
- Inversely proportional pressure relief valves (fail-safe valves)



Example of fan control application

- ▶ See Brochure 5.315 - A Breath of Fresh Air in Electro-Hydraulic Cooling Control



Additional solutions Perfectly tailored to the HYDAC Technology Platform.

Cab-air filter for very fine and nano dust: CabinAirCare.

Construction machines must not be used in contaminated areas unless the driver's cab is equipped with filtration and/or compressed air systems to ensure an air supply of sufficient breathing quality.

For tasks such as landfill sealing or encapsulation or land rehabilitation, a CabinAirCare module can be retrofitted to existing vehicles to provide optimum protection for the driver without having to make drastic changes to the existing air-conditioning system or the cab.

For a healthy environment that promotes performance, HYDAC Filter Technology already offers highly effective air filtration systems that can be equipped or retrofitted.

- ▶ See brochure 7.016.1 – CACR CabinAirCare

Customer benefits:

- ⇒ Easy to install and expand (on existing air conditioning or filter systems)
- ⇒ Sufficient system reserve (fan power, media sizing) for common cabin sizes in construction and agriculture
- ⇒ Robust and simple construction
- ⇒ Filters airborne pollutants, including nano-particles and gases



Fine dust filter



HEPA filter



Active carbon filter

Accessories for every sector

For the completion of hydraulic systems

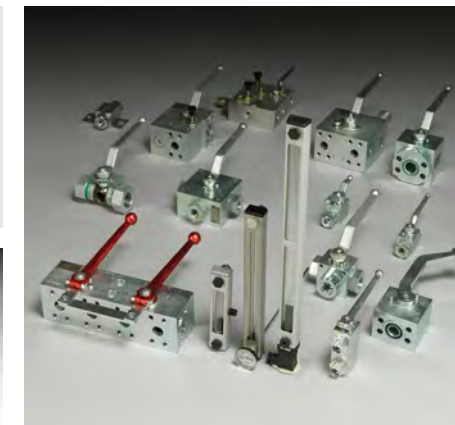
- Pipe fitting and ball valves (high pressure, low pressure, coaxial valves, standard & special solutions)
- HY-ROS – Mounting clamps for hydraulic hoses and lines, pipes and cables
- Clamping bands for mounting hydraulic, air and other reservoirs in round or rectangular shape
- Special clamps, e.g.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

Customer benefits:

- ⇒ Partner for expertise in customised modifications and special solutions
- ⇒ In-house engineering
- ⇒ In-house manufacture
- ⇒ Provision of standards and special components, even in stainless steel



Product selection, mounting technology



Product selection, pipe fittings

- ▶ See catalogue 61.000 - Accessories

Cylinder systems

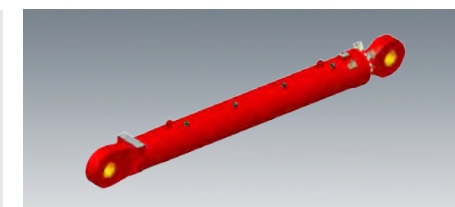
Our cylinder systems are notable for their versatility and extreme compactness. We offer cylinder drives with integrated valve technology and guarantee optimal operation of your machine, even with increased operational loads:

- Special mobile cylinders for large wheel loaders and mining wheel loaders, with integrated distance measurement system and special coating for the forged piston rod.
- Special suspension cylinders (low-friction design)
- Steering cylinder with integrated distance measuring system
- Locking and clamping cylinders
- Telescopic and special cylinders

The cylinders can also be designed with weight-optimisation, end cushioning or distance measurement system.

Customer benefits:

- 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, e.g. by using special surface coatings for the piston rod. FE simulations or fatigue strength calculations also come under our Engineering Standard.



Cylinder with distance measuring system



Steering cylinder with integrated distance measuring system

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

Fluid conditioning systems

To provide flexible servicing on machines, there are convenient mobile units for removing solid particles

- Portable filtration units
- Mobile filtration units
- Built-in filtration units (offline)

Customer benefits:

- ⇒ Clean filling and flushing
- ⇒ Versatile design – can be used on a variety of systems
- ⇒ Relief for the in-line filter
- ⇒ Greater system availability
- ⇒ Reduction in Life Cycle Cost



Mobile filtration systems

- ▶ See product catalogue 79.000 – Filter Systems

FluidCareCenter

We get involved in the process early on. With our clean room in the FluidCareCenter, we promise you exceptional cleanliness, from the component to the system: Technical Cleanliness is becoming ever more important in mobile hydraulics. Phrases such as "reduction and prevention of production-stage breakdowns" and the difficulty of longer warranty periods are driving up the demands for component cleanliness.

Customer benefits:

- ⇒ By understanding the relevant cleanliness data of your components, you will be a step ahead of your competitors.
- ⇒ A laboratory approved and recommended by well-known automotive suppliers
- ⇒ Many years' experience in the area of technical cleanliness owing to active collaboration on VDA Volume 19 and ISO 16232
- ⇒ Analysis with the help of extraction units developed at HYDAC
- ⇒ High-quality analysis equipment
- ⇒ Ongoing continual development of equipment and processes to meet the increasing requirements and needs of customers



FluidCareCenter

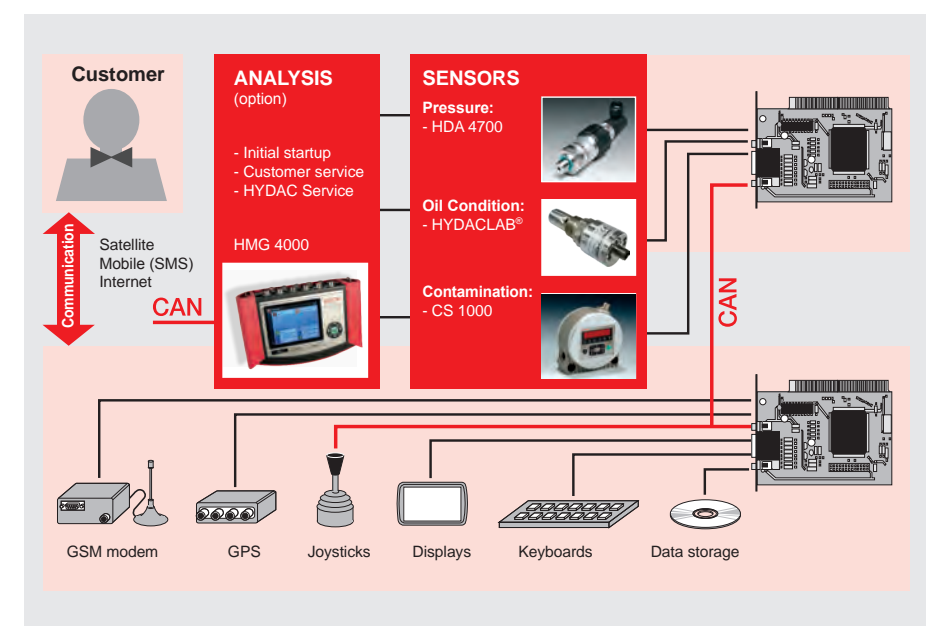
- ▶ See brochure 7.128 – FluidCareCenter

Condition Monitoring and Service

Constantly growing demands for operational availability, reduction in downtime, detailed load and service management (economic viability, wear, service, warranty) require innovative and comprehensive monitoring, service and control concepts. A variety of sensors provides the ideal basis for the development of such integrated system solutions.

- Oil condition, e.g. time deterioration or presence of contaminating fluids can be determined via the saturation level, temperature, change in electrical conductivity, change in dielectric constant (HYDACLAB®)
- Saturation level (AS)
- Particle contamination (CS)
- Pressure (HDA)
- Flow rate (EVS)
- Fluid level (ENS, HNT)

In combination with portable measuring instruments (HMG series), this data can be recorded and analysed to supplement the machine electronics (service).



- ▶ See brochure 10.122 – Condition Monitoring for Efficient Life Cycle Cost Management, see catalogue 180.000 – Electronics Product Catalogue