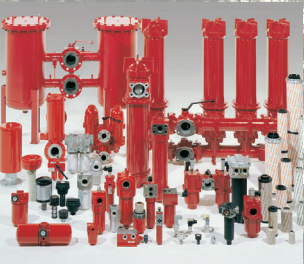




Accumulator Technology 30.000



Filter Technology 70.000



Process Technology 77.000



Filter Systems 79.000



Compact Hydraulics 53.000



Accessories 61.000

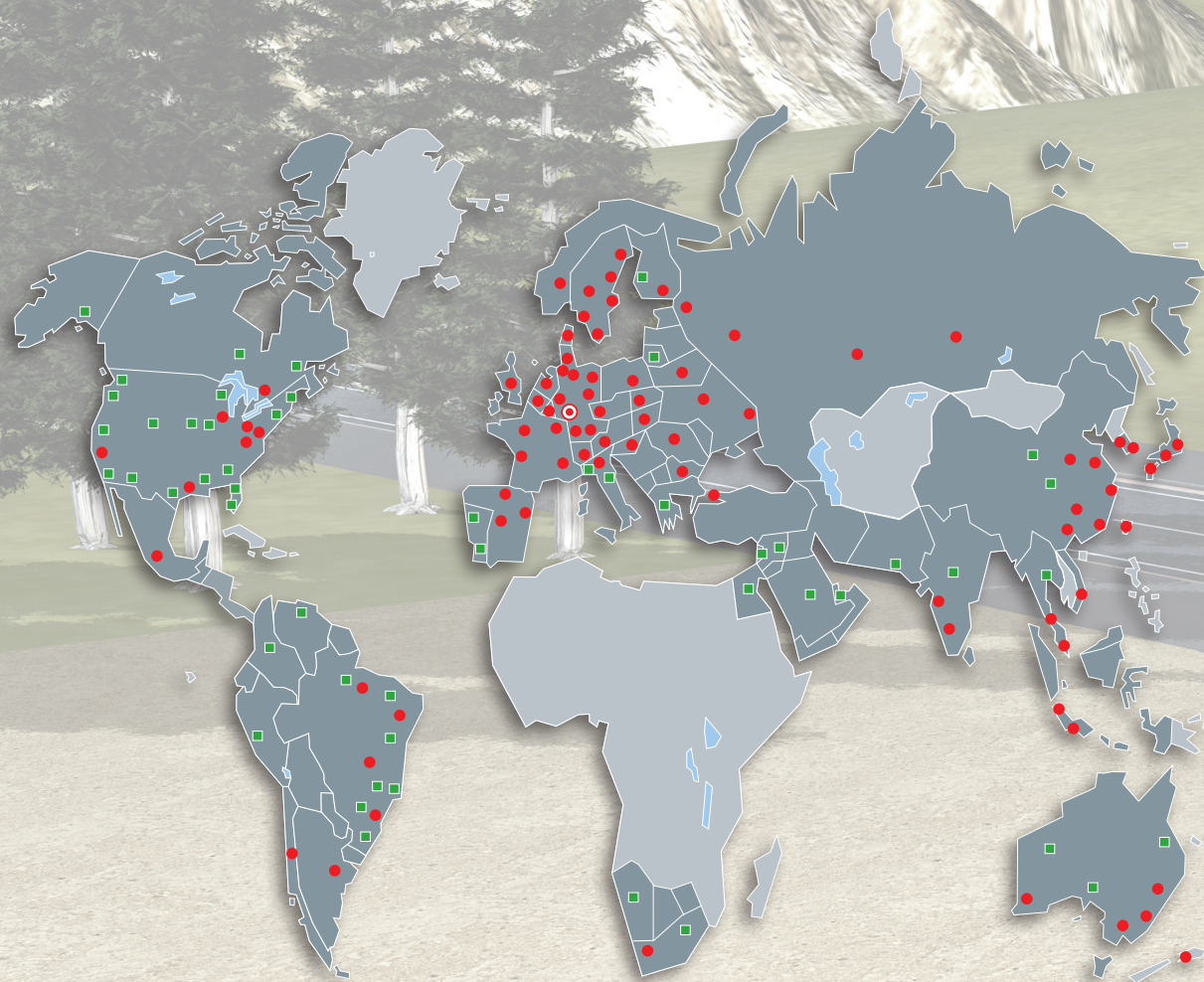


Electronics 180.000



Cooling Systems 57.000

**Global Presence.
Local Expertise.
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GMBH

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Internet: www.hydac.com

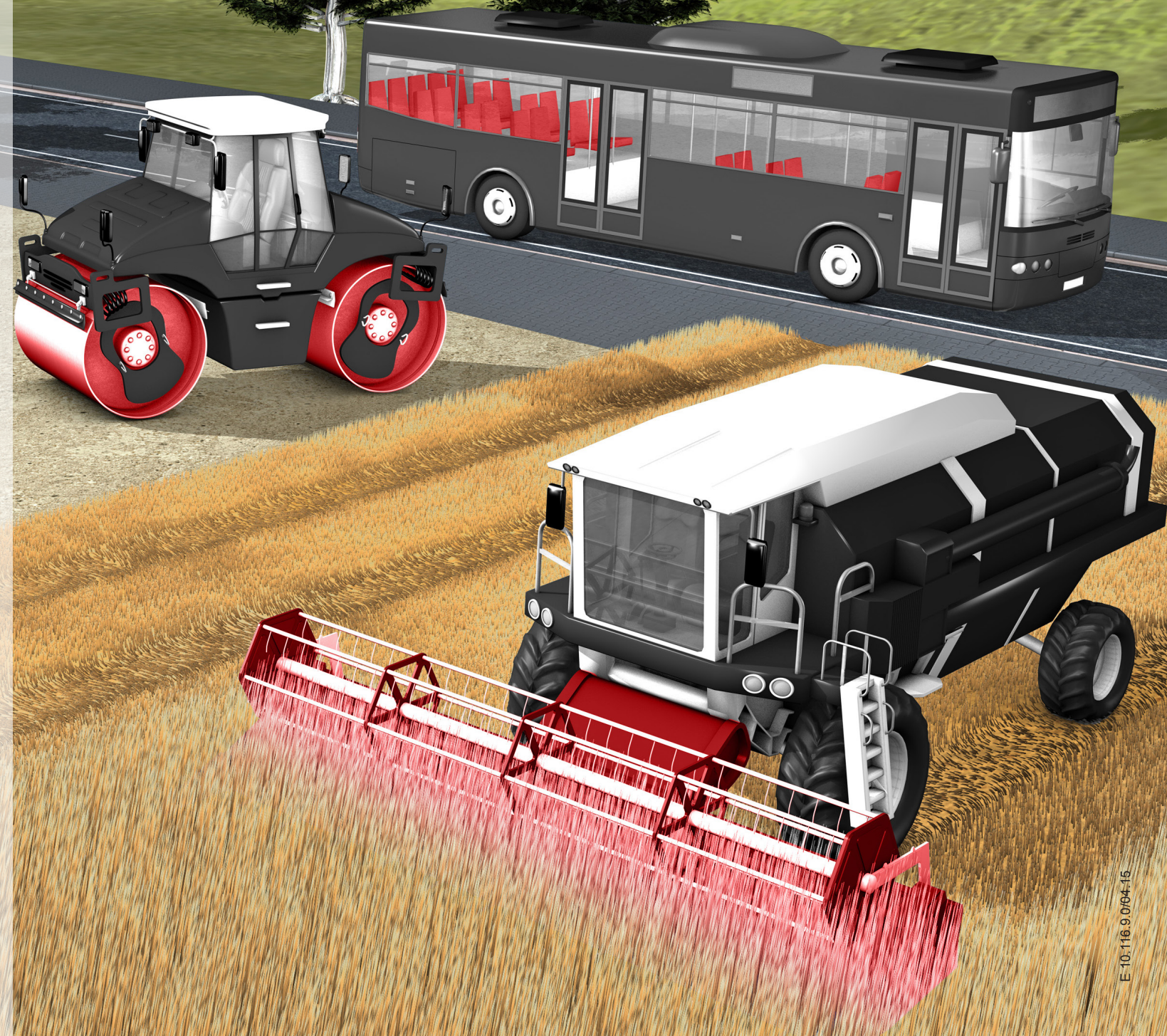
NOTE

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

E 10.116.9.0/04.15

HYDAC INTERNATIONAL

HY-STEER Electro-hydraulic Steering Systems



E 10.116.9.0/04.15

Electro-hydraulic steering and auxiliary steering systems: Direct acting/pilot-operated proportional valves as key components

HY-STEER Electro-hydraulic steering systems in modular design.

HY-STEER by HYDAC:
a system solution for electro-hydraulic steering systems. HY-STEER's modular design provides a highly flexible foundation for electro-hydraulic steering in any mobile application, such as road rollers, AT cranes, wheel loaders, self-propelled machines and trucks.

With its flexibility and wide range of variants, the HY-STEER system can be used to create customised solutions that increase the safety of mobile machines. Possible HY-STEER applications range from electro-hydraulic auxiliary steering systems to steer-by-wire configurations.

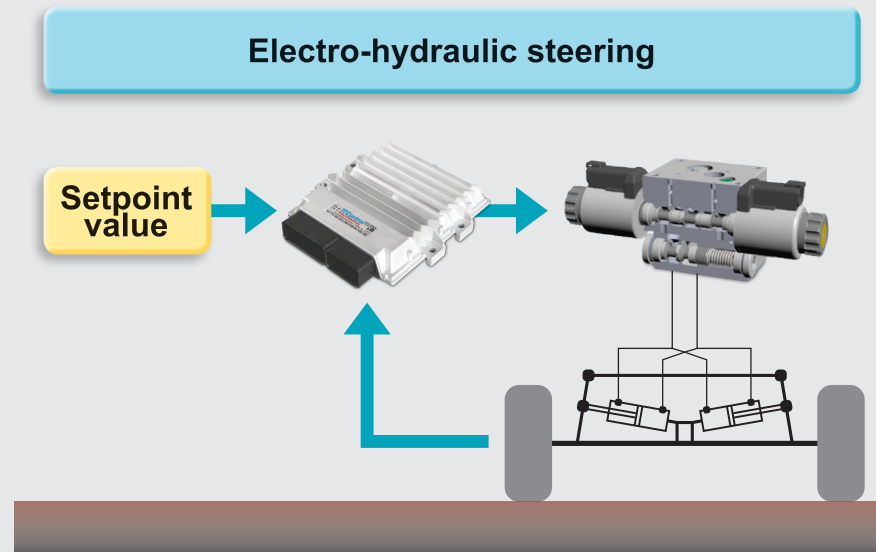
Further reliable HYDAC components such as switching valves, rotary encoders, filters, steering controllers and much more complete the system.

From individual hydraulic components to complex systems and software development, HYDAC meets the specific requirements of each customer and provides special solutions from a single source.

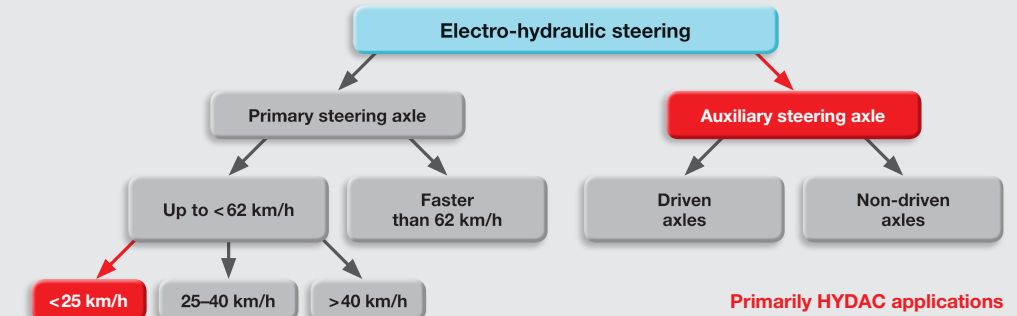
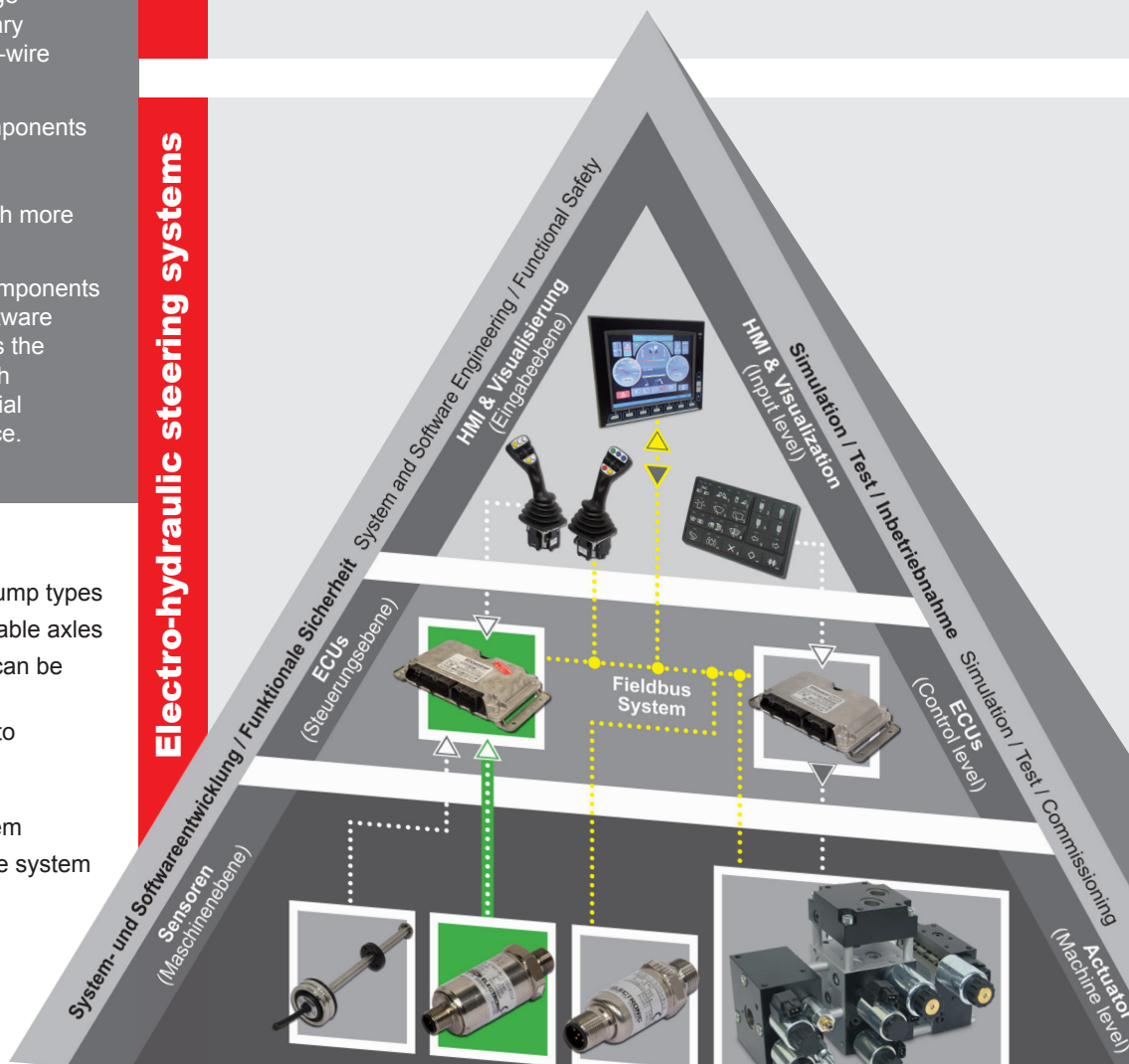
Customer benefits:

- Can be connected to all pump types
- Unlimited number of steerable axles
- Different safety concepts can be selected
- Assistance systems easy to integrate
- Hydraulics and electronics combined in a single system
- From the component to the system – all from a single source

Electro-hydraulic steering

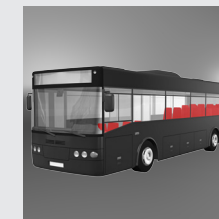


Electro-hydraulic steering systems



Function:

- The steering angle of the main steering is measured by a position sensor.
- According to the particular steering strategy, the setpoint for the auxiliary steering is calculated.
- A position control system compares the setpoint with the measured value on the adjusting cylinder of the auxiliary steering and initiates the steering movement via a proportional valve.
- Additional valves for locking and/or releasing the steering cylinders perform appropriate safety functions.



STEER-by-Wire Main steering

Advantages:

- Working and steering functions performed by same operating element
- Driver's stand easy to move
- Steering sensitivity can be adjusted
- Assistance systems easy to integrate

Application examples:

- Road rollers
- Road pavers
- Forestry machines
- Off-road vehicles/ machines

STEER Additional Auxiliary steering

Advantages:

- Turning circle reduced
- Lower tyre wear
- Various steering programs
- Speed-dependent steering response

Application examples:

- Trailers, forage wagons, field sprayers
- Truck/commercial vehicle trailing axles
- AT cranes
- Vehicles with multiple axles

STEER Assistance Alternative hydraulic steering (orbitrol steering)

Advantages:

- On-road = orbitrol steering exclusively
- Off-road = steer-by-wire
- The fallback is always the orbitrol
- Driver assistance systems reduce work for driver

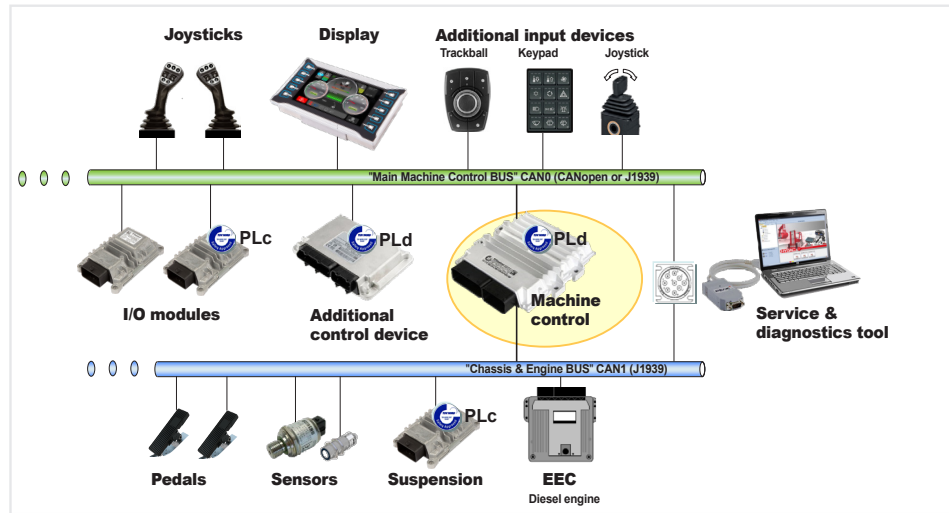
Application examples:

- Self-propelled harvesting machinery
- Wheel excavators
- Wheel loaders
- Mobile machines

System intelligence

Electro-hydraulic system solutions

System development



Example of control architecture

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

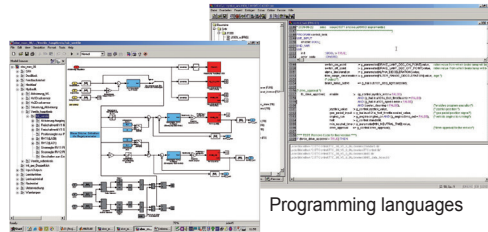
Services include:

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

Software development

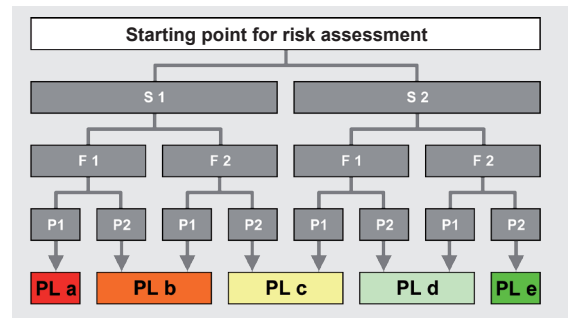
Depending on the hardware, the following programming languages can be used to program the application software:

- 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

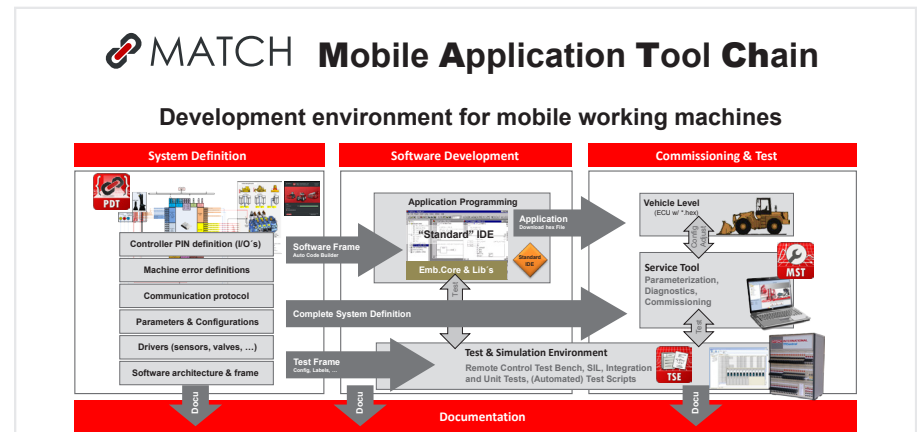
Possibility of avoiding the hazard or limiting the damage

- 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 (HMI)

"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, to 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
- Testing software
- Documentation

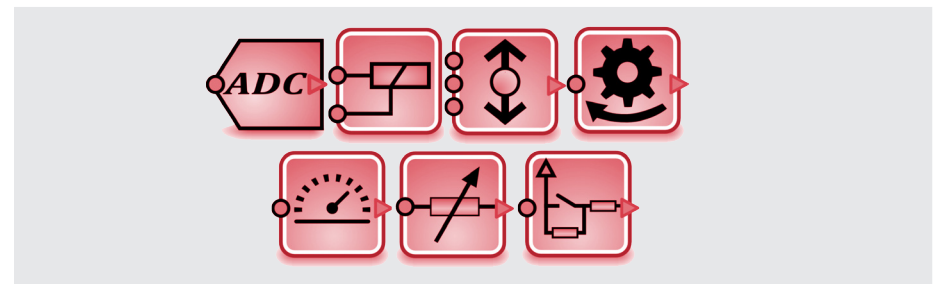
In addition, "embedded middleware" is also offered which allows the application to be programmed regardless of hardware and contains a number of basic functions. A comprehensive selection of library modules (e.g. for sensor and valve drivers) is also available to enable the application software to be developed efficiently.

Functional safety

"MATCH" can also write application software with increased functional safety according to the following safety standards:

- "SIL 2" to IEC 61508
- "PL d" to EN ISO 13849
- "AgPL d" as per ISO 25119 or 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.

See Product Catalogue 10.133 - Control Technology for Mobile Machinery

Electro-hydraulic steering valves

System module

Modular steering valve module

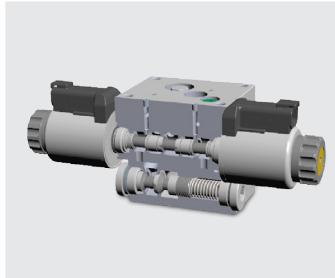
The steering valve module is suitable for use in standard hydraulic systems thanks to its varied designs. Various inlet modules are also possible. The proportional steering valves have been optimised specially for use in steering systems. The model designed for OC-LS systems incorporates bypass spool type pressure compensators that have been optimised for low circulation pressures of between 3 and 10 bar, depending on the nominal flow rate. They also have low hysteresis, good left/right symmetry behaviour and rapid response. This makes it possible to fulfil the increasingly stringent requirements made by vehicle manufacturers for low circulation pressure losses and corresponding fuel savings.

The basic design in both series is intended for use with a steering axle. Adding a second module makes it suitable for two-axle vehicles.

Additional modules can be attached to the valve blocks or installed in the connection to the steering and centring cylinders for locking, release or centring.

To protect the steering cylinders and the connections from excessive external force, internal shock valves in the valve block or flange-mounted modules are available, depending on the design type.

For use in various applications, the valve blocks can be supplied with tried and tested components that are suitable for mobile use – in 12 and 24 V DC coil voltages and with standard coil connectors (DIN/EN, Junior Timer, Deutsch connector, Kostal). The valve coils are fully encapsulated and have an internal coil seal to keep moisture out of the coil, preventing short circuits.



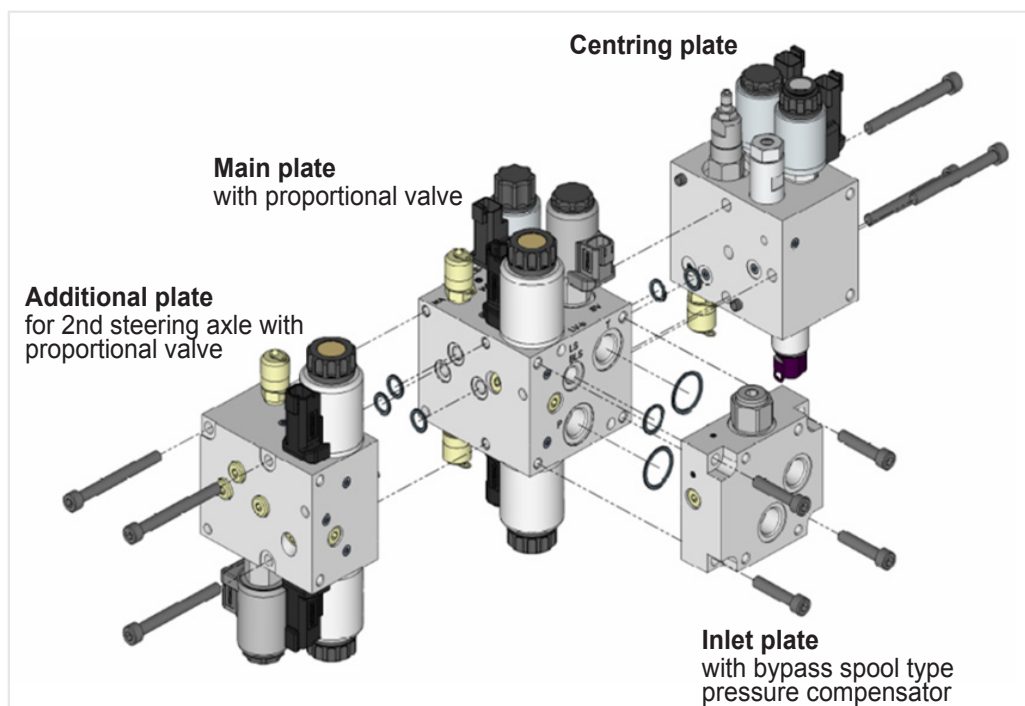
Core component proportional valve with pressure compensator, up to 25 l/min direct-acting, higher flow rates than pilot-operated valve



Modular steering module
Inlet, steering and centring plate

Advantages

- Can be connected to all pump types
- Unlimited number of steerable axles
- Different safety concepts can be selected
- Assistance systems easy to integrate
- Hydraulics and electronics combined in a single system
- From the component to the system – all from a single source



System components of the steering valve module

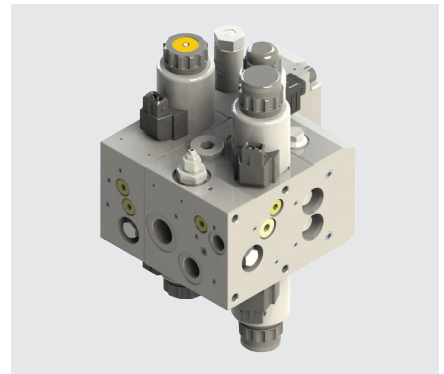
Open center – LS proportional valve block for one steering axle

Flow rate of 7/12/19/25 l/min, depending on pressure compensator spring, with inlet pressure compensator, release and shock valve for 1 steering axle



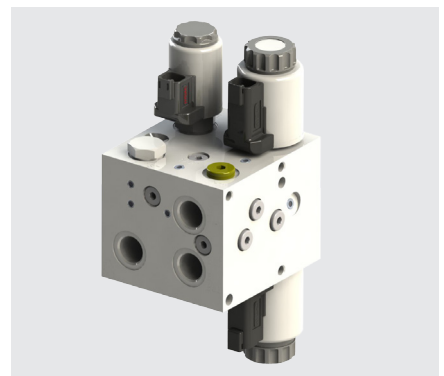
Open center – LS proportional valve block for two steering axles

Flow rate of 7/12/19/25 l/min, depending on pressure compensator spring, with inlet pressure compensator, release and shock valve in the basic module and flange-mounted additional module for second axle with release and shock valve.



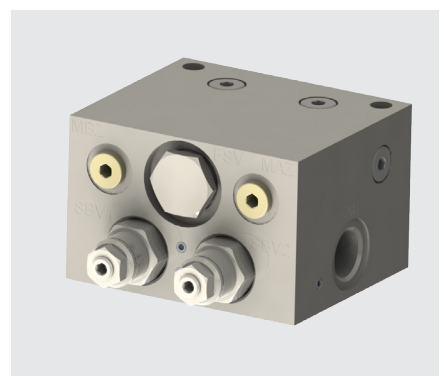
Open center – LS extension module for additional steering axles

Flow rate of 7/12/19/25 l/min, depending on pressure compensator spring, with release valve.



Hydraulic shut-off block

for installation in the connection between steering valve block and steering cylinder



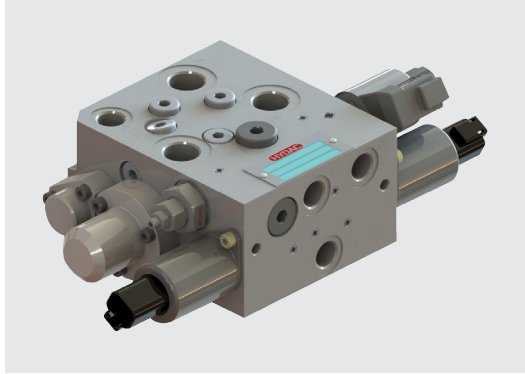
Electro-hydraulic steering valves

Customised solutions and applications

Pilot-operated steering valve blocks

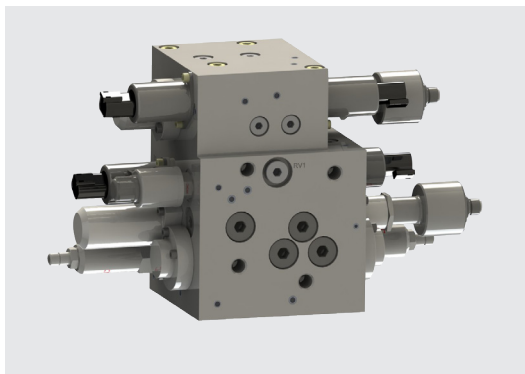
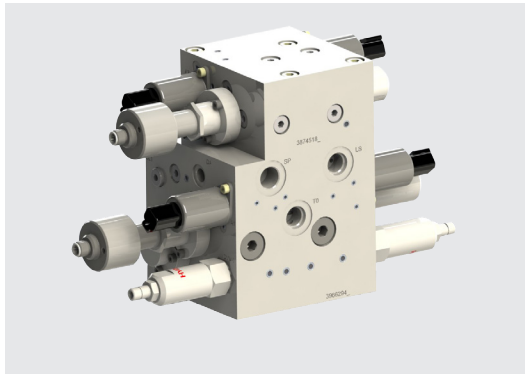
5/3 steering valve block for 40 l/min

The closed centre load-sensing valve block can be used in conjunction with a hydraulic steering valve (orbitrol) in joystick steering systems in construction machinery, for example. It is equipped with a pilot-controlled main spool valve for a flow rate of 40 l/min. The LS pressure is restricted to the maximum steering pressure by an integrated valve. When used with purely hydraulic steering with the orbitrol, an electrically controlled 4/2 valve is also installed to isolate the connection between the main spool valve and the steering cylinder connection.



5/3 steering valve block for 150 l/min

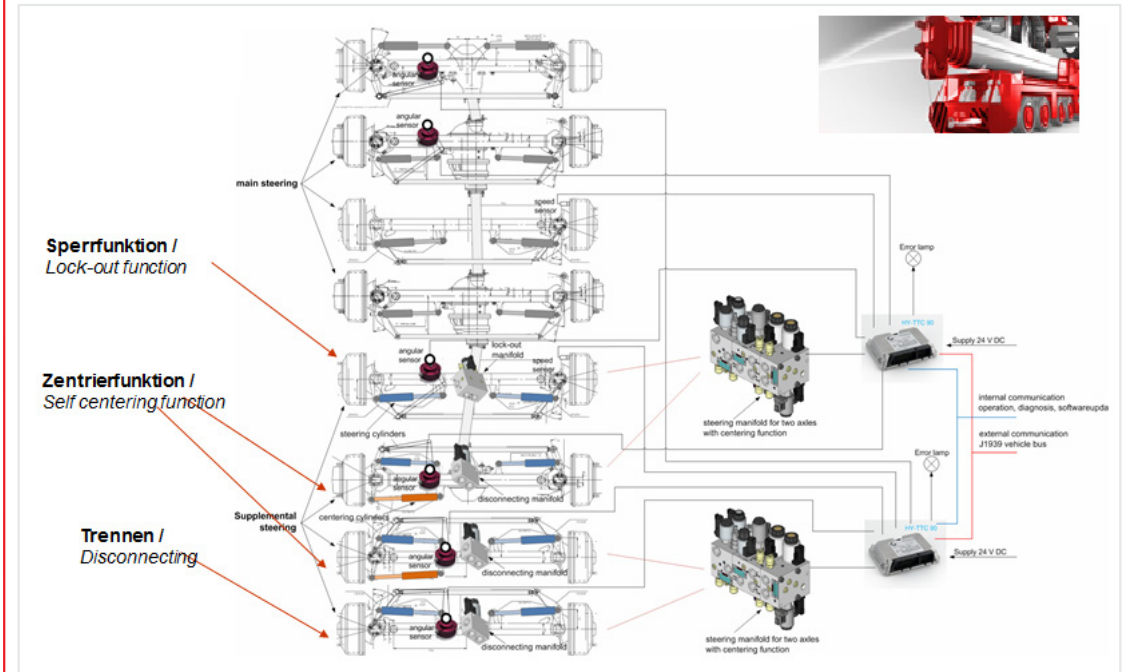
The closed centre load-sensing valve block, which can be used in joystick steering systems in construction machinery, for example, is equipped with a pilot-controlled main spool for a flow rate of 150 l/min. To safeguard the electro-hydraulic steering function in the vehicle, the pilot-controlled main spool valve with the pilot pressure supply is installed in the valve block with redundancy. The position of the main spool is measured by a position sensor and can be evaluated in the vehicle control accordingly. When the main steering valve spool is switched to the second "redundant" spool for emergency steering, an electrically controlled 4/2 is also actuated, which isolates the main spool from the steering cylinder connections. To prevent large external forces from causing damage to the hydraulic components of the steering system, shock valves are installed in the control block on the ports to the steering cylinders.



STEER Additional

Auxiliary steering, application example – steering valve module

Application example: AT crane with multiple axles, max. speed 80 km/h

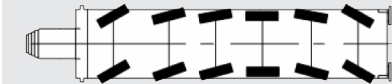


- Description:**
 Modern vehicles have to deal with increasingly high loads. For multiple-axle vehicles, additional flexibility and manoeuvrability is required. This is where the active electro-hydraulic additional steering comes in. In addition to the existing main steering, additional axles are steered according to a vehicle-specific steering strategy. No mechanical connections are required between the steering axles.
- Safety strategies for steering systems:**
 Thanks to the integrated safety function that monitors all operating states of the steering system, system errors are detected and the corresponding safety responses are initiated. The errors detected can be read out when serviced via a diagnostics interface.
- Functions in the event of error:**
 If the system detects an error in the steering system, there are various options for bringing the auxiliary steering axles into a default position, depending on the particular vehicle, type and axle design.
- Locking function:**
 In this error situation, the axle is hydraulically locked in the current position. All movement in the axle is prevented. This option can be used for non-driven axles.
- Centring function:**
 In this error situation, an additional centring cylinder moves the axle to the centre position and holds it there. It is no longer possible to steer the axle. This function can be used for driven and non-driven axles.
- Isolating function:**
 For self-tracking trailing axles, this function can be used in the event of an error. When the axles are released, the cylinders are connected to each other. The external forces move the axle into the middle position.

Possible steering programmes in multiple-axle vehicles:

On-road steering:

In this steering programme, a central axle functions as mid-point and is not steered. The axles behind it are controlled in relation to the main steering axle. This makes it possible to manoeuvre sharp bends at low speeds. The higher the vehicle speed, the lower the possible steering angle of the rear axles.



All-wheel steering:

In this steering programme, all axles are steered when the vehicle is moving slowly to control the vehicle around tight bends or obstacles at walking pace.



Crab steering:

In this steering programme, all axles are steered equally at the same steering angle depending on the main steering axle. This makes sideways movement of the vehicle possible at walking pace.



Tail-swing prevention:

In this steering programme, the last axle is not steered. This prevents tail-swing in the long vehicle on bends. This steering programme is only used for particular speeds and driving situations.



Electro-hydraulic systems

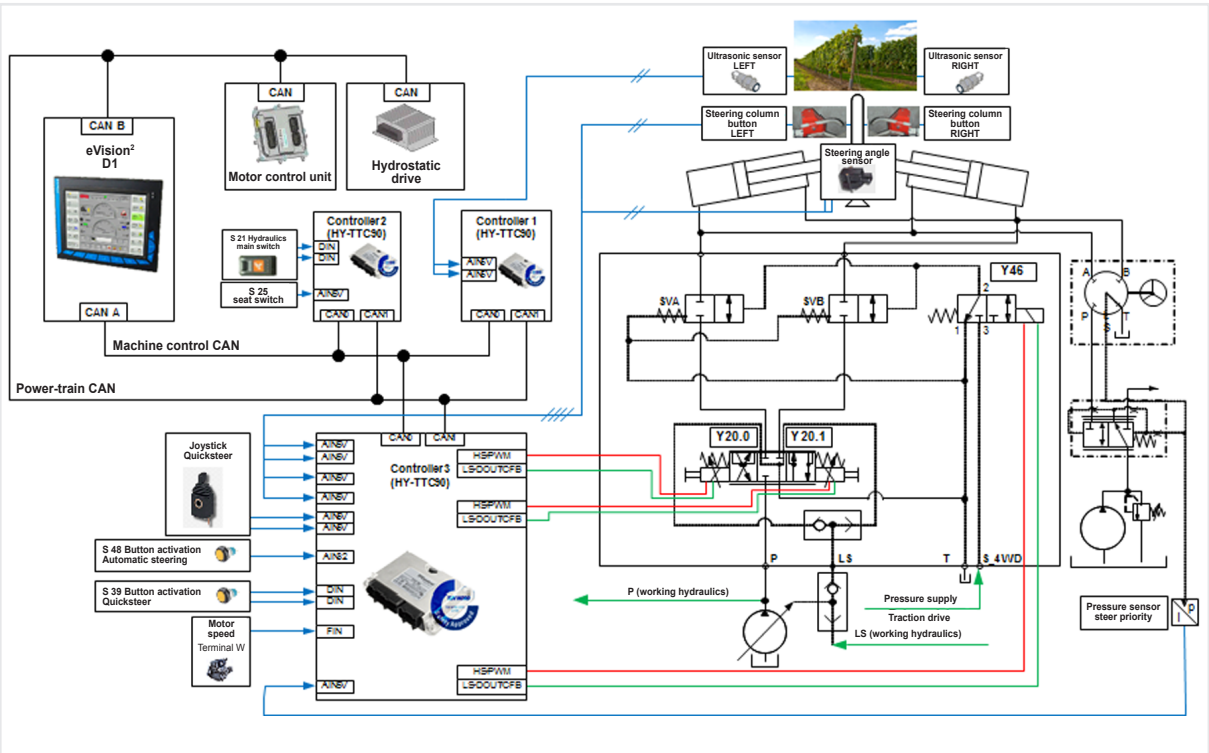
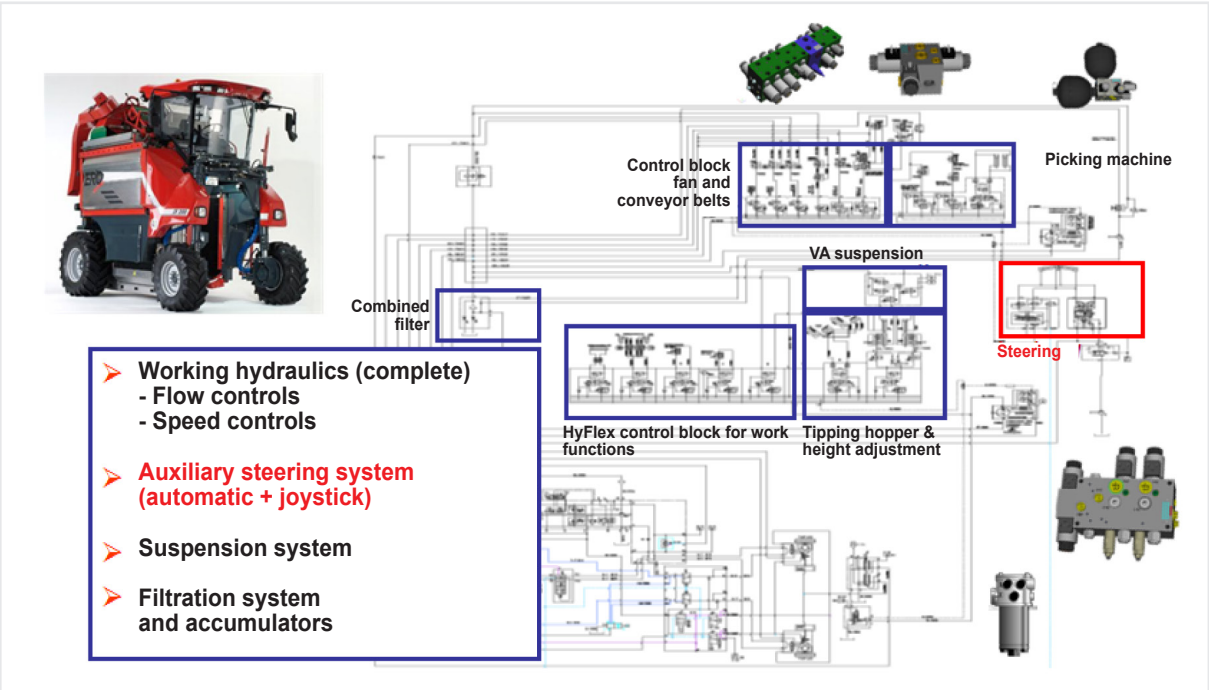
Applications

STEER Assistance

Alternative hydraulic steering (orbitrol steering)

Application example: grape harvester, max. speed 40 km/h

The electro-hydraulic auxiliary steering system is installed in parallel to the hydraulics of the primary steering system. The integrated shut-off valves in the customised control block are used to securely isolate the primary steering system to allow full functioning of the secondary steering system. In on-road operation, only the primary steering system is activated. The grape harvester also has joystick steering in addition to the electro-hydraulic auxiliary steering function.

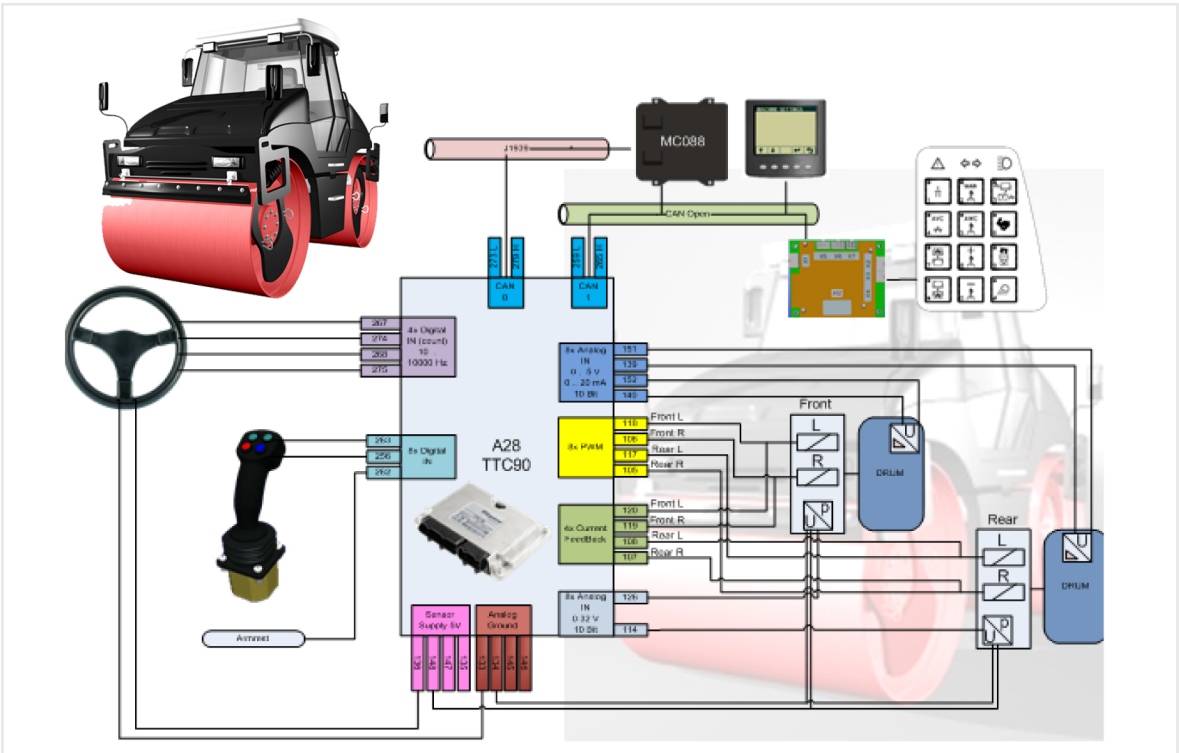
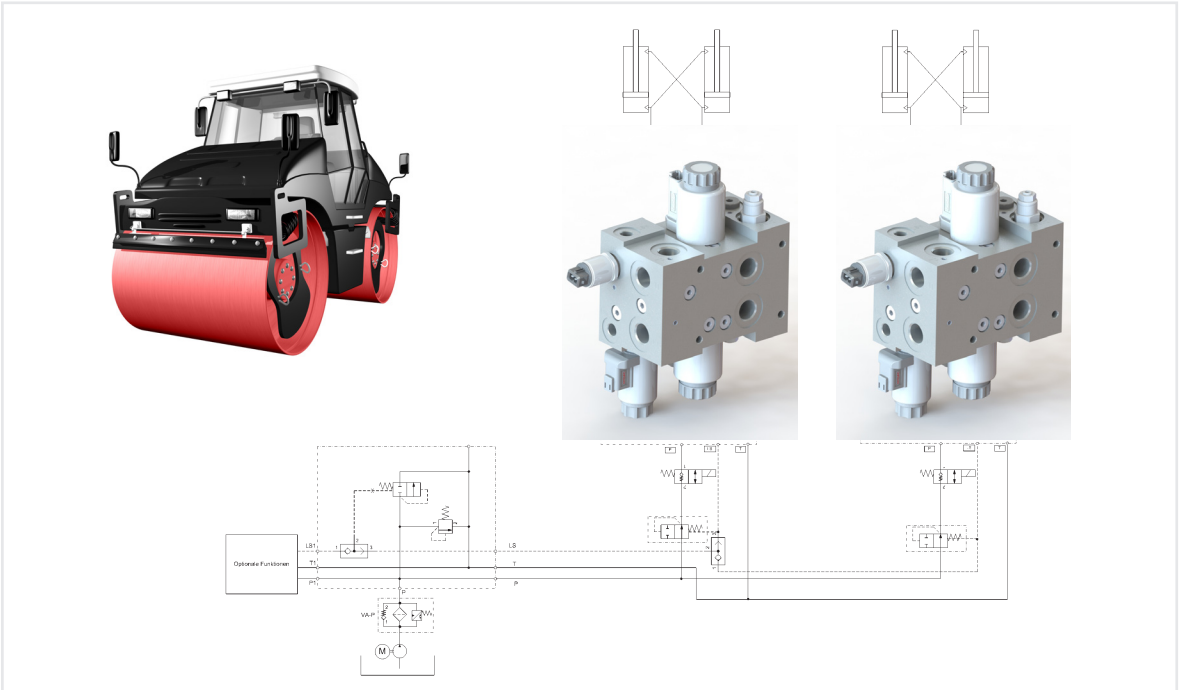


STEER-by-Wire

Main steering

Application example: road roller, max. speed 12 km/h

The tandem-vibratory road roller is equipped with an electro-hydraulic Steer-by-Wire steering system. The various steering programmes enable transport and manoeuvring in restricted spaces. The crab steering enables drum offset (sideways movement).



Sensors, system electronics and control systems.

Solutions perfectly tailored to the application

– All from a single source.



Linear position and distance sensors



Inclination and angle sensors



Pressure transducers/
pressure measurement switches



Sensors for increased functional safety requirements (e.g. PL d, SIL 2)

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 also 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)



Controller for mobile applications HY-TTC 500

Mobil controller HY-TTC 500

Function

The HY-TTC 500 controller series is based on a 32-bit processor with a modern micro-controller platform.

The controller is notable for its impressive 96 inputs and outputs and for its high performance capability. This new HY-TTC 500 controller series is therefore especially suitable for complex control tasks in centralised and decentralised control architectures.

The controller has three alternative PWM shut-off groups for differentiated safety functions.

Features

- SIL 2 / PL d
- Three alternative PWM shut-off groups
- Up to 36 PWM power outputs with current measurement
- Numerous and highly flexible IO groups
- Excellent processor performance
- Large number of interfaces, communication and information interfaces
- Four to seven CAN-bus interfaces
- Ethernet interface for extremely fast software download and debugging



HY-TTC 90

Mobil controller HY-TTC 90

Function

The safety-certified HY-TTC 90 and HY-TTC 94 are the most powerful controllers in the 16-bit controller family. They meet all the technical requirements of modern vehicle technology in off-highway applications.

The HY-TTC 90 was developed in accordance with the international standards IEC 61508 and ISO/EN 13849 and is certified by TÜV Nord. It thus fulfils the requirements of the safety levels SIL 2 (Safety Integrity Level 2) and PL d (Performance Level d).

The CPU used is the safety CPU, XC2287M, specially developed for safety applications by Infineon. This offers enhanced safety features for the protection of the internal RAM and flash memories.

Features

- SIL 2 / PL d certified
- Additional Watchdog CPU
- Programming in CODESYS® 2.3 or C/C++
- 570 kB RAM
- 48 inputs and outputs, including
 - 16 power outputs
 - 4 current measuring inputs
 - 8 analogue inputs: voltage/current
- - 8 analogue inputs: voltage, configurable
- All inputs and outputs are configurable and are protected against overvoltage and short circuits
- Stabilised, adjustable sensor voltage supply with internal monitoring
- No reset caused by dip in voltage when starting engine
- Robust aluminium die cast housing with a waterproof 80-pole connection plug and pressure equalization via a waterproof Gore-Tex® membrane
- e12 type approval



Displays with integrated HY-eVision² controller

Mobil display HY-TTC eVision²

Function

The compact back-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 either be 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, together with the optional touchscreen feature, provide 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 user 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 and visually attractive housing design, suitable for mobile applications

Additional solutions

Perfectly tailored to the HYDAC Technology Platform.



Filtration

Function

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 venting
- Ultra-modern laboratory and test rig technology



Accessories for every sector

To make hydraulic systems complete

- Standard fittings and ball valves (high pressure)
- Mounting clamps for hydraulic hoses and pipes, cylinders, electrical cables and accumulators
- Tamper-proof inductive proximity switch (high pressure resistance)
- Fluid level sensors
- Temperature switch TSE
- Standard clamp 3015
- Air/water reservoir clamping bands
- Test points
- Quick-release couplings
- Special clamps for particle filters

Advantages

HYDAC 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, guarantee state-of-the-art technology and rapid development times.

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



Electronic controls with integrated or separate keypad or integrated display

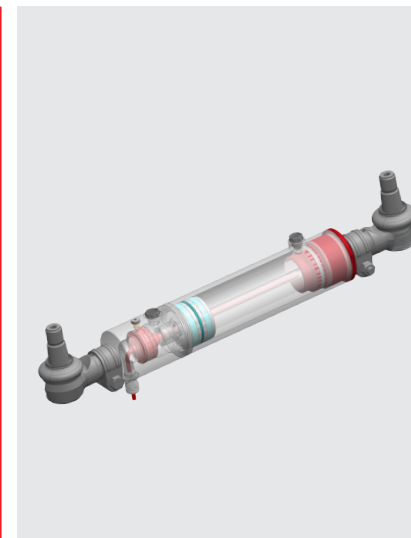
Control modules

Wide range of remote controls available in single, dual or triple axis. Joysticks / hand levers with different electrical function transmitters available according to customer requirements.

Advantages

- Space-saving
- Diverse characteristic curves
- Outstanding steering properties in combination with HYDAC main control unit
- Ergonomic design
- Can be programmed via standard micro-USB as required
- Integrated display

See brochure no. 5.254 – Mobile Valves



Steering cylinder

In the chassis of mobile vehicles, hydraulic cylinders are used for steering.

HYDROSAAR steering cylinders feature low-friction guide and sealing systems and coatings to suit the operating conditions. Integrated position sensor systems from the HYDAC HLT series and HYDAC pressure sensors are available for the cylinders.

Advantages

- Low-friction design
- Integrated end position damping
- Integrated position sensor technology
- Weight-optimised design

See brochure no. 10.102 – Cylinders and Cylinder Systems for Mobile Hydraulics



FluidCareCenter

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 pre-delivery breakdowns" and the difficulty of longer warranty periods are driving up the demands for component cleanliness.

Advantages

- 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
- Sophisticated analysis equipment
- Continual advances in equipment and processes to meet the increasing requirements and needs of customers

See brochure no. 7.128 – FluidCareCenter