

Drive and Control Systems for Combine Harvesters and Forage Harvesters



Mobile Hydraulics

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Combine Harvesters and Forage Harvesters

Modern harvesters must meet the objective of a high handling capacity combined with high-quality harvesting of the crop concerned. Maximum availability is absolutely essential for these machines, which are only used during a limited harvesting season.

High-performance drive and control systems characterized by reliability, efficiency and easy operation are essential components in these machines and a prerequisite for optimum use of the machines.

The Mobile Hydraulics Division of Bosch Rexroth AG with its product sections Axial Piston Units, External Gear Units, Radial Piston Motors, Mobile Controls, Gears, Mobile Electronics and Mobile Service can provide complete systems from a single source.

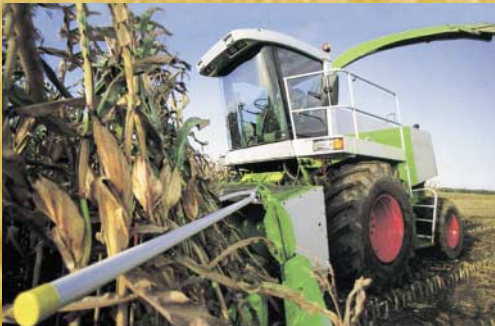
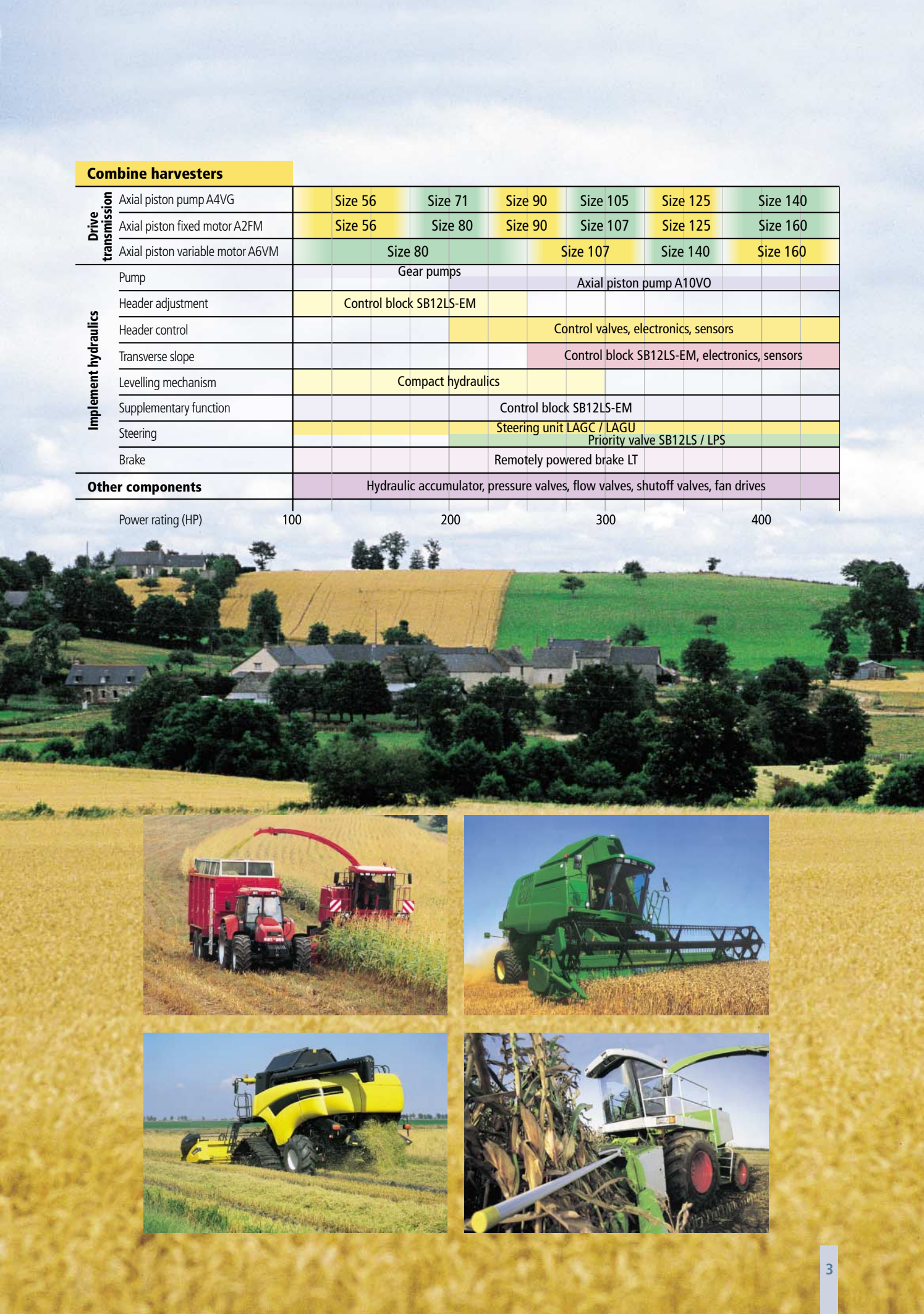
The drive and control components are carefully matched and the system design is optimized by application specialists representing the product sections in the Applications Centre for Agricultural Machinery.

Optimum solutions are selected in close collaboration with the machine manufacturer.

- Axle drives with fixed and variable displacement motors, auxiliary drives for steering axles
- Simple single-wheel drives and single-wheel drives with electronic anti wheel slip control system
- Electronic drive management with control units
- Implement hydraulics with load-sensing control systems
- Hydraulic steering and braking systems
- Electro-hydraulic header control

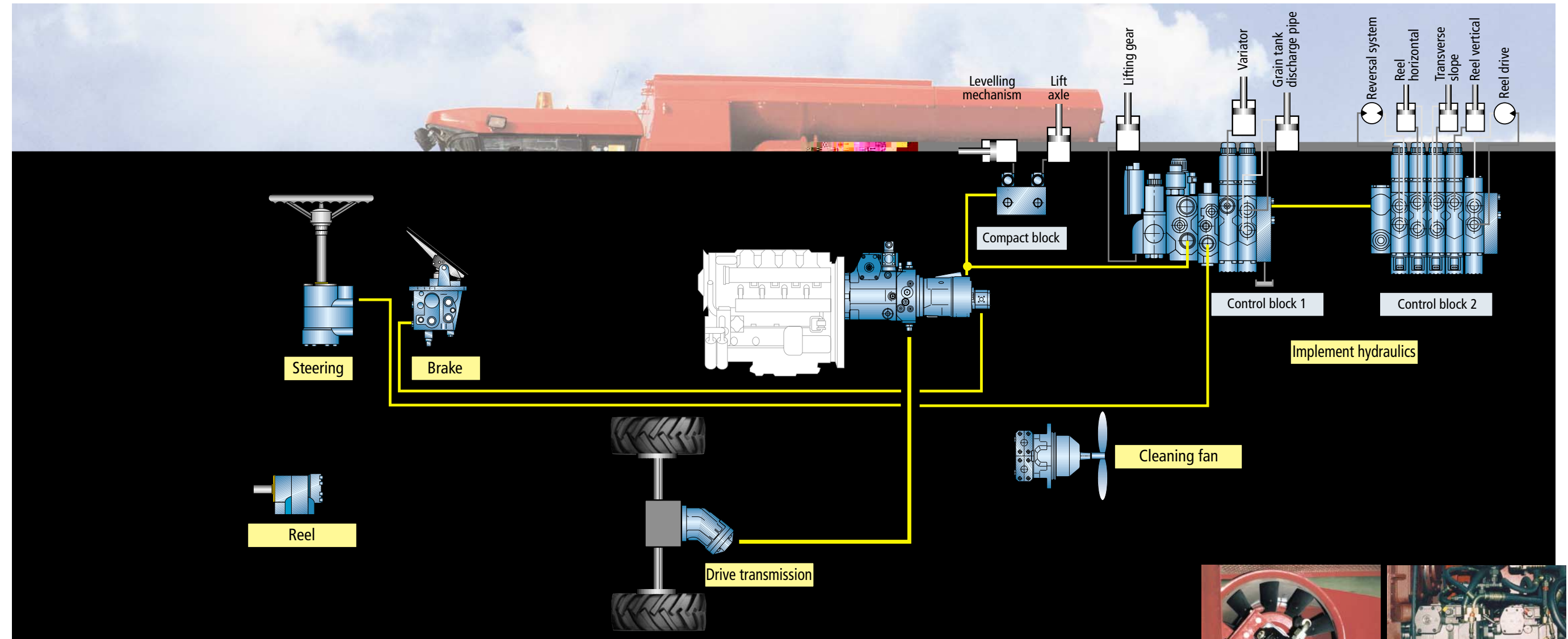


Combine harvesters								
Drive transmission	Axial piston pump A4VG		Size 56	Size 71	Size 90	Size 105	Size 125	Size 140
	Axial piston fixed motor A2FM		Size 56	Size 80	Size 90	Size 107	Size 125	Size 160
	Axial piston variable motor A6VM			Size 80		Size 107	Size 140	Size 160
Implement hydraulics	Pump		Gear pumps		Axial piston pump A10VO			
	Header adjustment		Control block SB12LS-EM					
	Header control					Control valves, electronics, sensors		
	Transverse slope					Control block SB12LS-EM, electronics, sensors		
	Levelling mechanism		Compact hydraulics					
	Supplementary function				Control block SB12LS-EM			
	Steering				Steering unit LAGC / LAGU Priority valve SB12LS / LPS			
	Brake				Remotely powered brake LT			
Other components			Hydraulic accumulator, pressure valves, flow valves, shutoff valves, fan drives					
Power rating (HP)		100		200		300		400

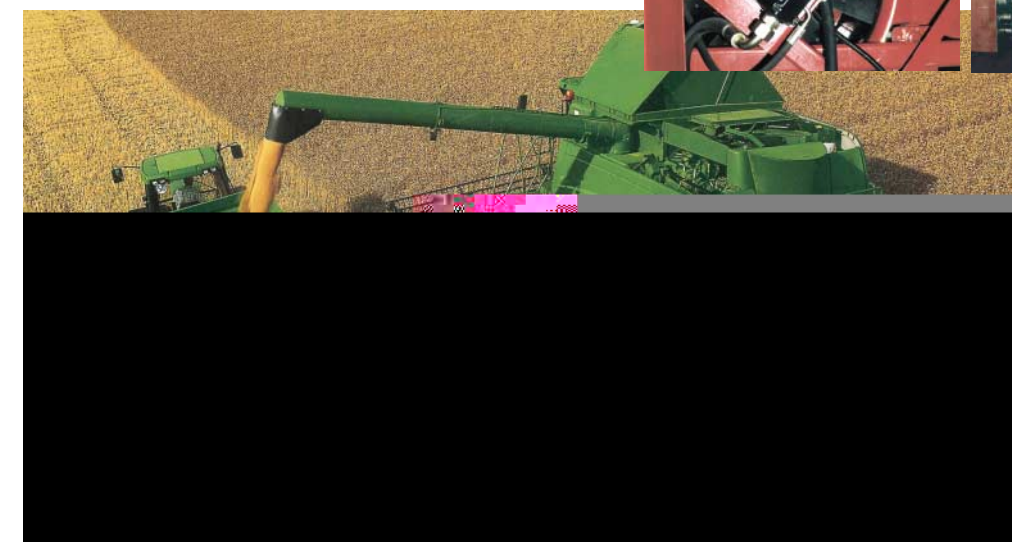


Combine harvester

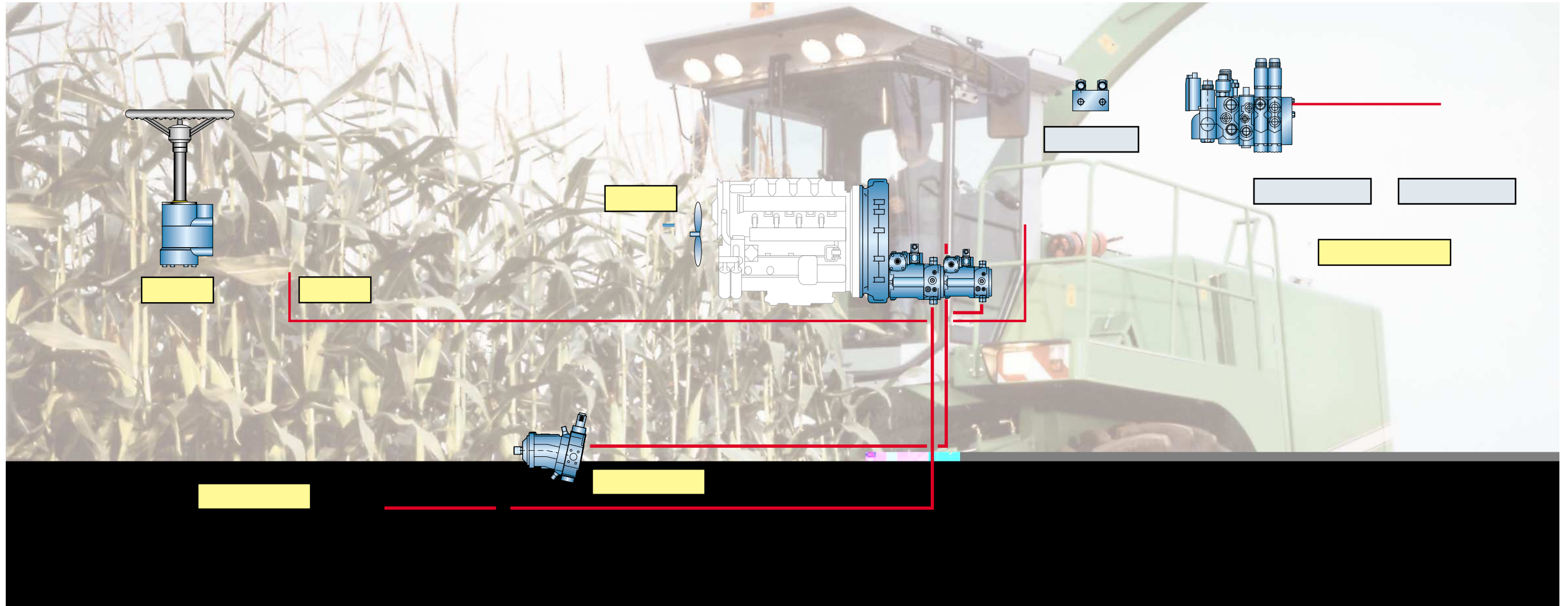
Drive management



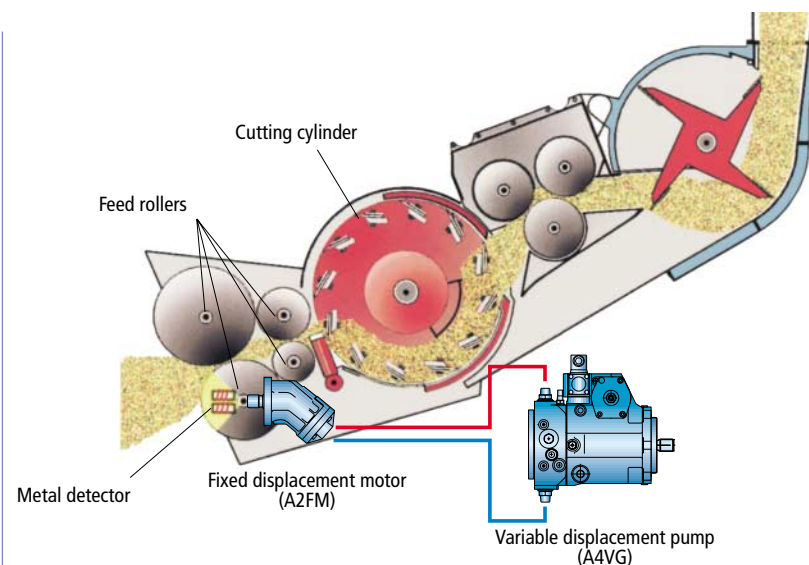
- Travel drive with constant or variable displacement motor
- Implement hydraulics with central, modular hydraulic assembly
- Electro-hydraulic header control
- Electronic management of drive and implement hydraulics
- Fan drives in open and closed loops, with constant or variable displacement pumps
- Steering systems
- Remotely powered brake



Forage harvester



- Convenient drive transmission with variable displacement motor (large control range)
- Length of cut can be infinitely adjusted from the driver's cab via hydrostatically driven feed rollers
- Feed rollers and header can be reversed without difficulty
- Emergency stop function via the hydraulic pump without additional valves
- Cooler can be freely positioned via hydrostatic drive
- Control system with CAN bus
 - Control units can be networked with little effort
 - Relevant machine data are available to all control units

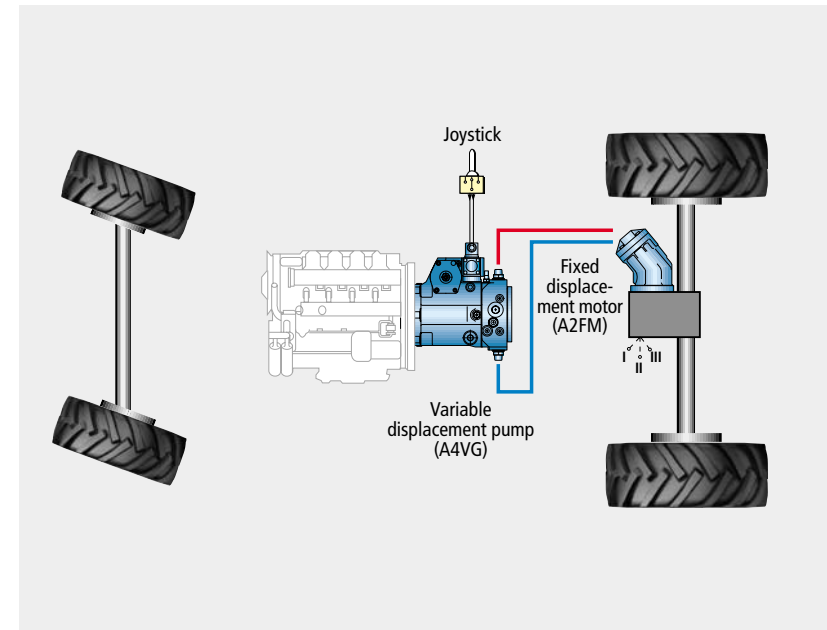


Emergency stop (before metal reaches cutting cylinder) from max. to zero in less than 100 milliseconds

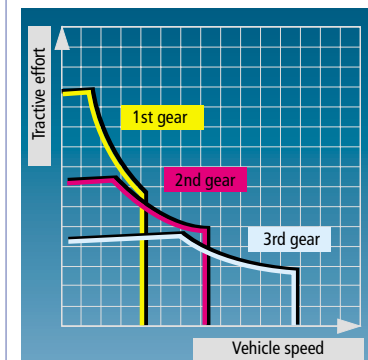


Hydrostatic drive transmission

Drive transmission with axial piston fixed displacement motor with shift gearbox



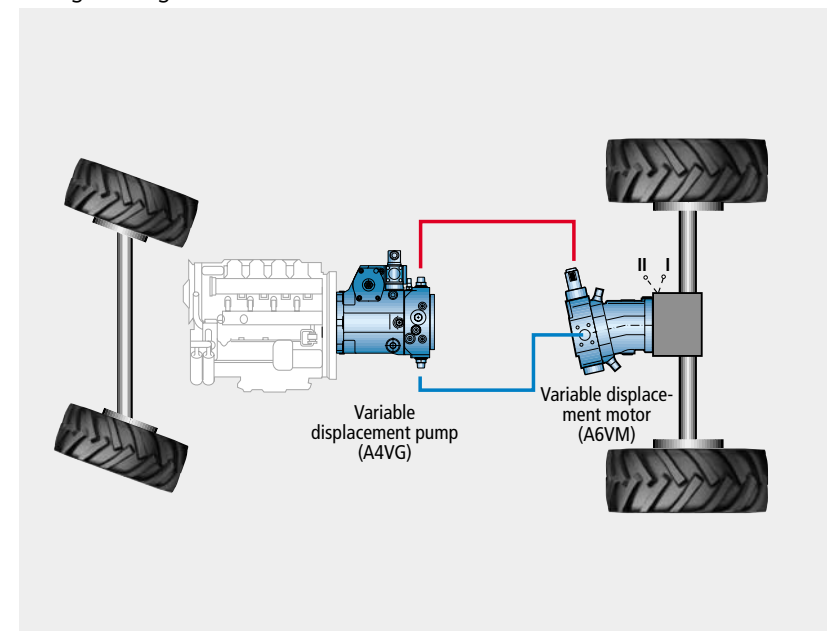
- Pump with hydraulic control, mechanical servo HW or electrical control EP
- Pressure cutoff as standard
- Zero-position switch on control unit as starting interlock



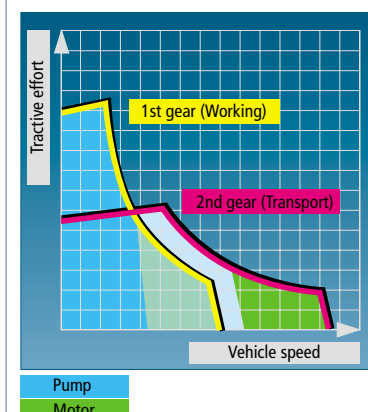
3-speed mechanical shift gearbox with fixed displacement motor A2FM



Drive transmission with axial piston variable displacement motor and 2 stage shift gearbox

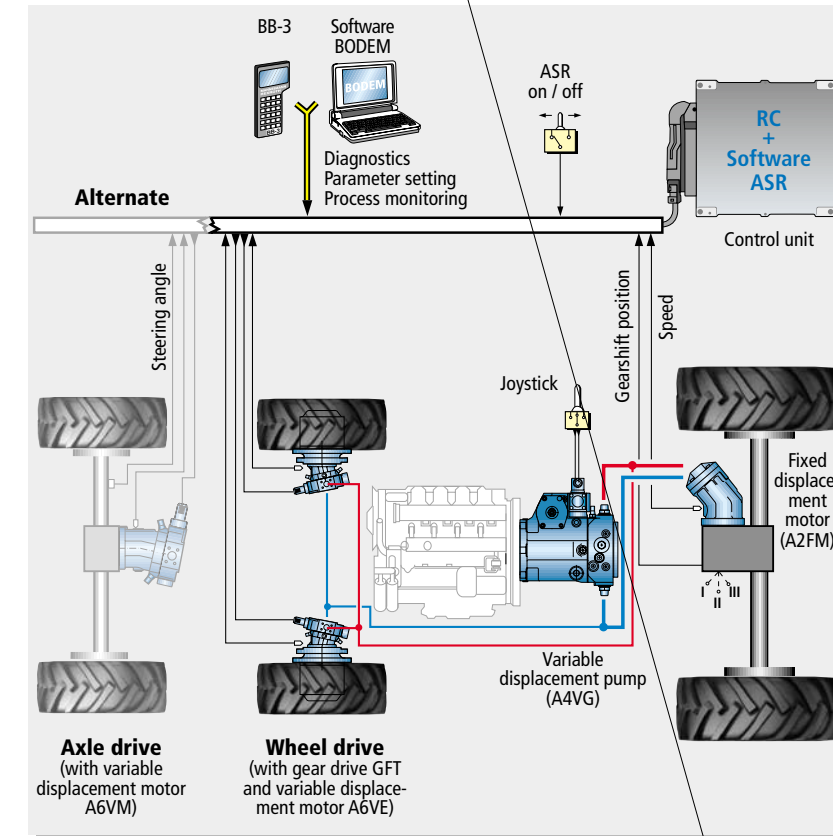


- only two gear shift stages necessary (working mode, transport mode)
- no gear shifts during transport mode

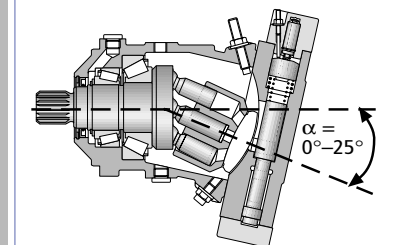


Speed range in working mode from 0 to maximum without interruption for gear shifts

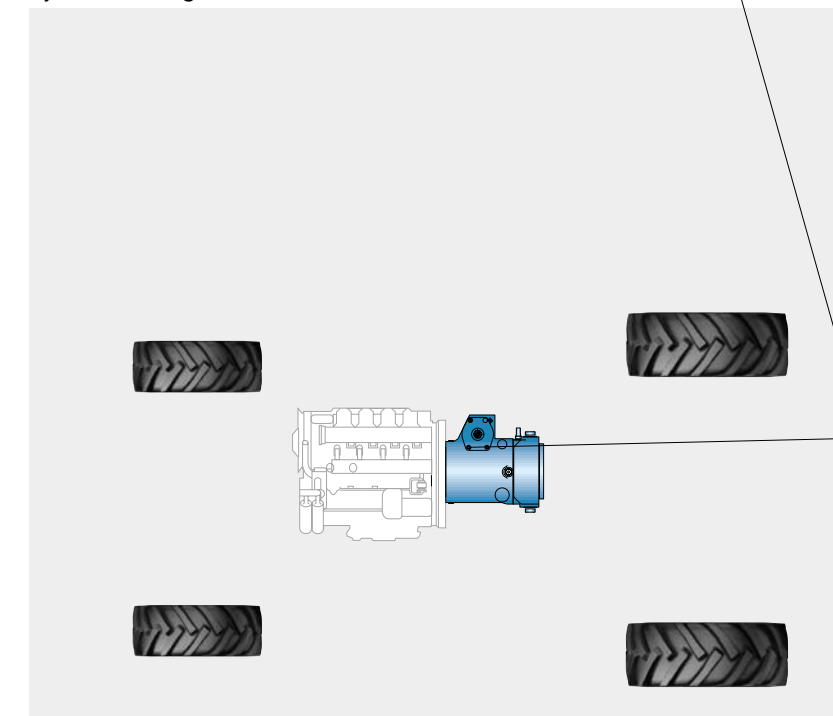
All-wheel drive with electronic control



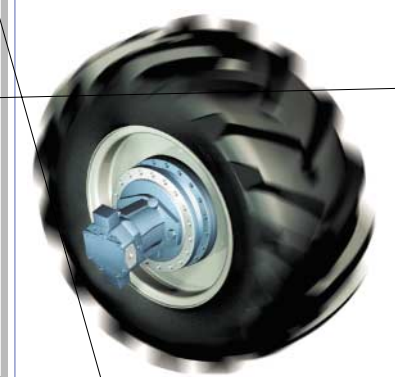
- Auxiliary drive for steering axle with axle or wheel drive
- Traction control
- The control unit RC compares the speed of the wheels and adjusts the variable displacement motor to a lower displacement if any discrepancies are found
- When driving on roads, the variable displacement motor is set to a swivel angle $\alpha = 0^\circ$ to prevent a reduction in final speed



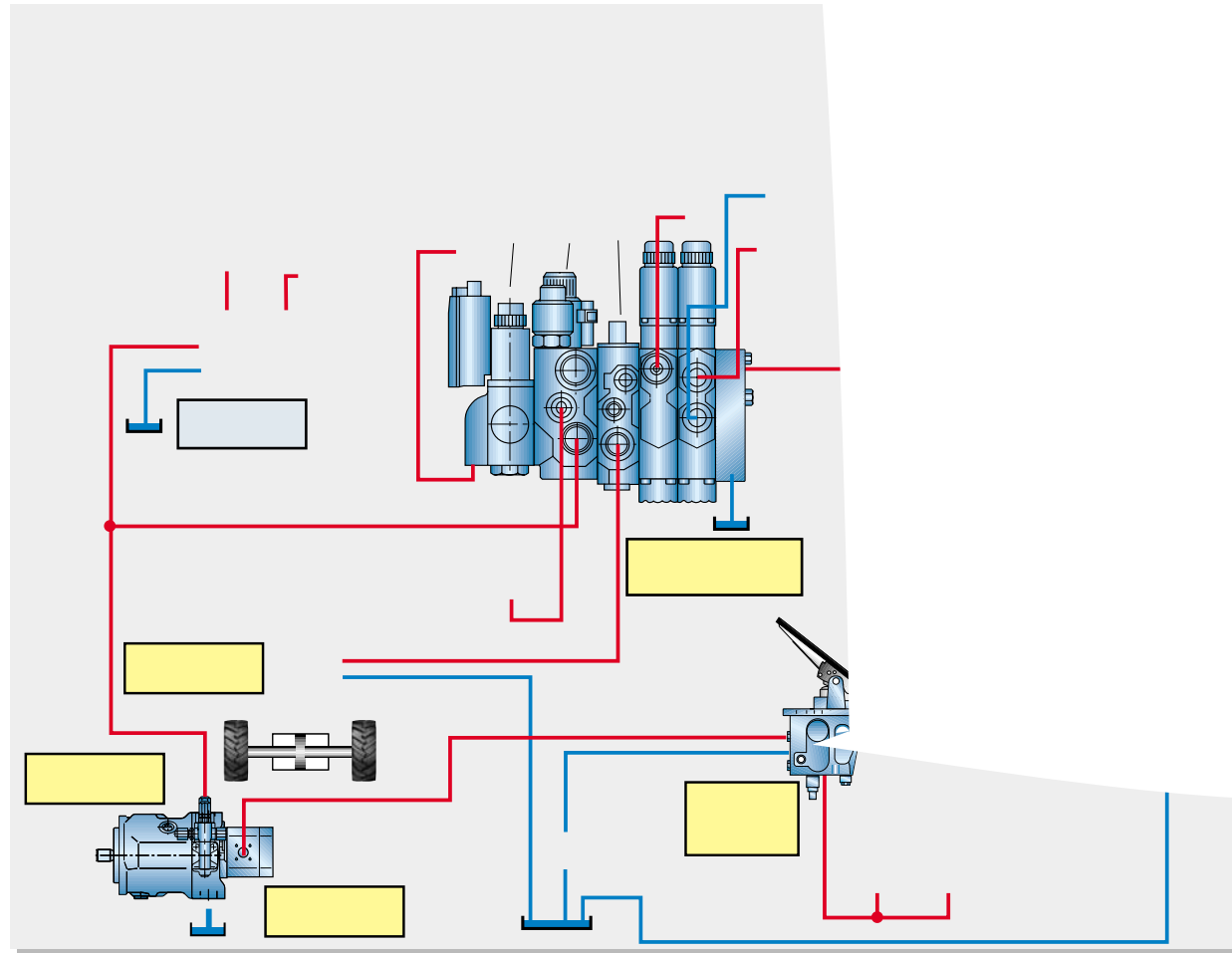
Hydrostatic single-wheel drive with electronic control



- Use of wheel motors ensures optimum utilization of the space between the wheels
- Electronic anti wheel slip control with control unit RC and ASR software to prevent one or more wheels slipping
- Optimum anti wheel slip control through the use of variable displacement motors which can swivel to zero ($\alpha_{\min} = 0^\circ$)



Implement hydraulics



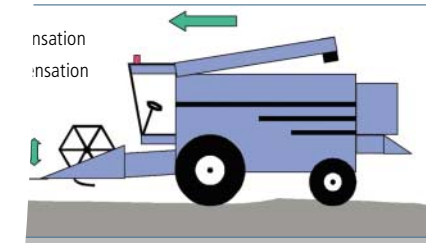
Control block SB12LS-EHR5-OBE

Central, modular hydraulic assembly for such essential functions as header control, steering and auxiliary drives

- Electronics for header control integrated directly in the valve
- Optimally adapted, flexible software
- Robust, future-oriented hardware including flash memory and CAN
- Priority valve for the steering hydraulics can be integrated
- Supplementary valves for discharge pipe, reel functions, etc. can be added as required
- Tested system ready for installation

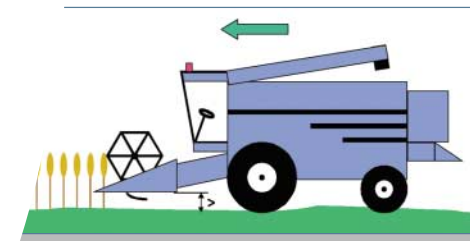


c header control EMR



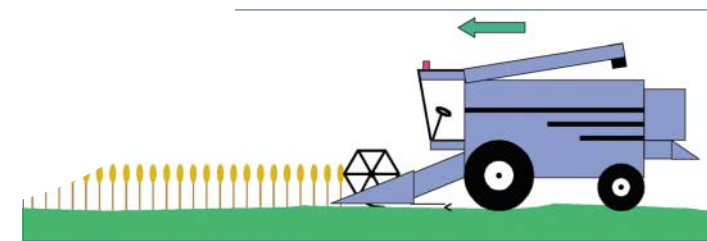
Active damping of header vibration while driving

- Prevents machine becoming uncontrollable while driving on public roads
- Permits higher driving speeds, relieves the driver
- More comfortable driving, greater safety



Header is controlled in the preset position

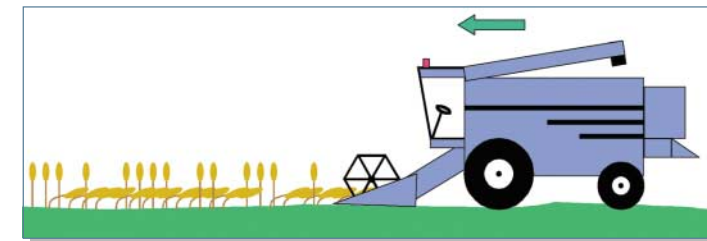
- For harvesting tall crops (maize)
- Pitching movement is reduced by active vibration compensation
- Detection of ground contact to prevent damage to the header



Header is controlled at the preset height

- For harvesting short crops
- Pitching movement is reduced by active vibration compensation
- Detection of ground contact to prevent damage to the header
- Transverse slope compensation of the header (optional)

Automatic ground pressure control



Header controlled to ensure constant ground pressure

- For harvesting laid crops
- Main weight of table is borne by the lifting hydraulics (little friction, prevents „fretting“)
- Transverse slope compensation of the header (optional)



Control valve EHR5 or EHR5LS-OBE

- Single-acting flanged valve for header control
- Optionally available with onboard electronics for CAN communication during operation and diagnosis



Control valve EHR23LS or EHR23LS-OBE

- Single-acting flanged valve for header control (higher flow)
- With onboard electronics for CAN communication during operation and diagnosis



Electronic control unit EMR

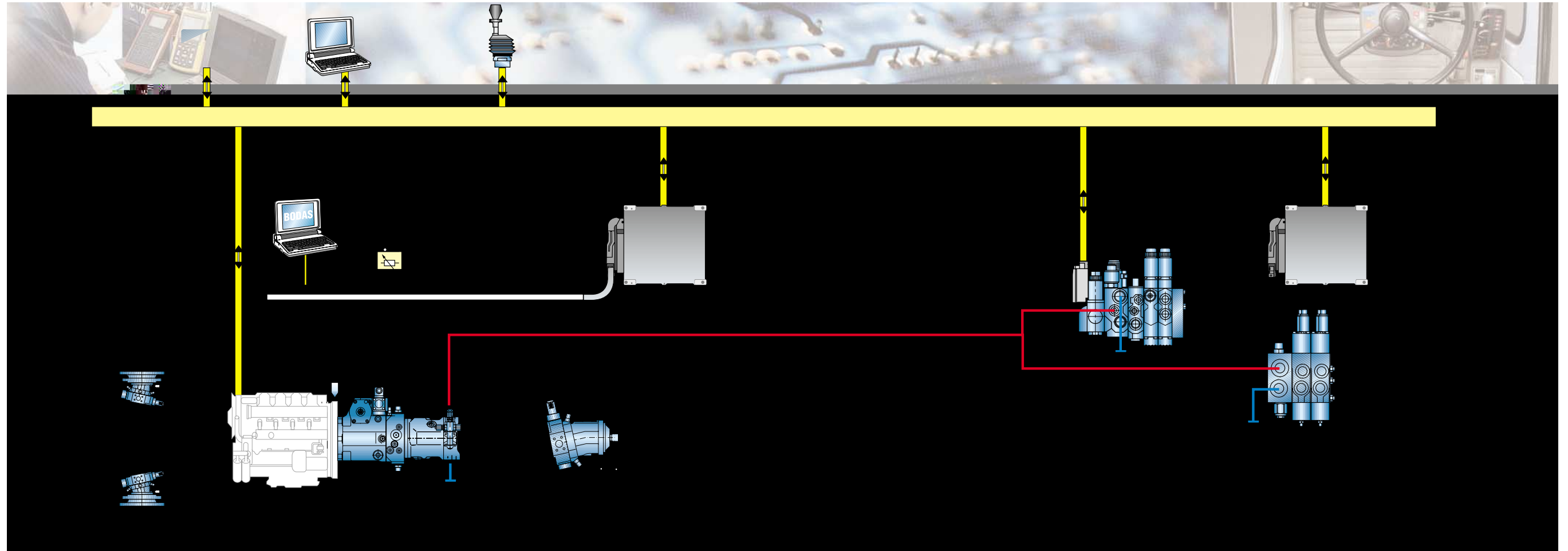
- Position control / clearance control
- Ground pressure control
- Vibration compensation
- System diagnosis



Inductive position sensor Inductive angle sensor Pressure sensor



Electronic drive management



The trend towards integrating electronic components in the hydraulic system of combine harvesters and forage harvesters is greater than ever. Together with leading manufacturers of agricultural machines, we are working on revolutionary hydraulic systems which operate economically and reliably even under the toughest conditions.

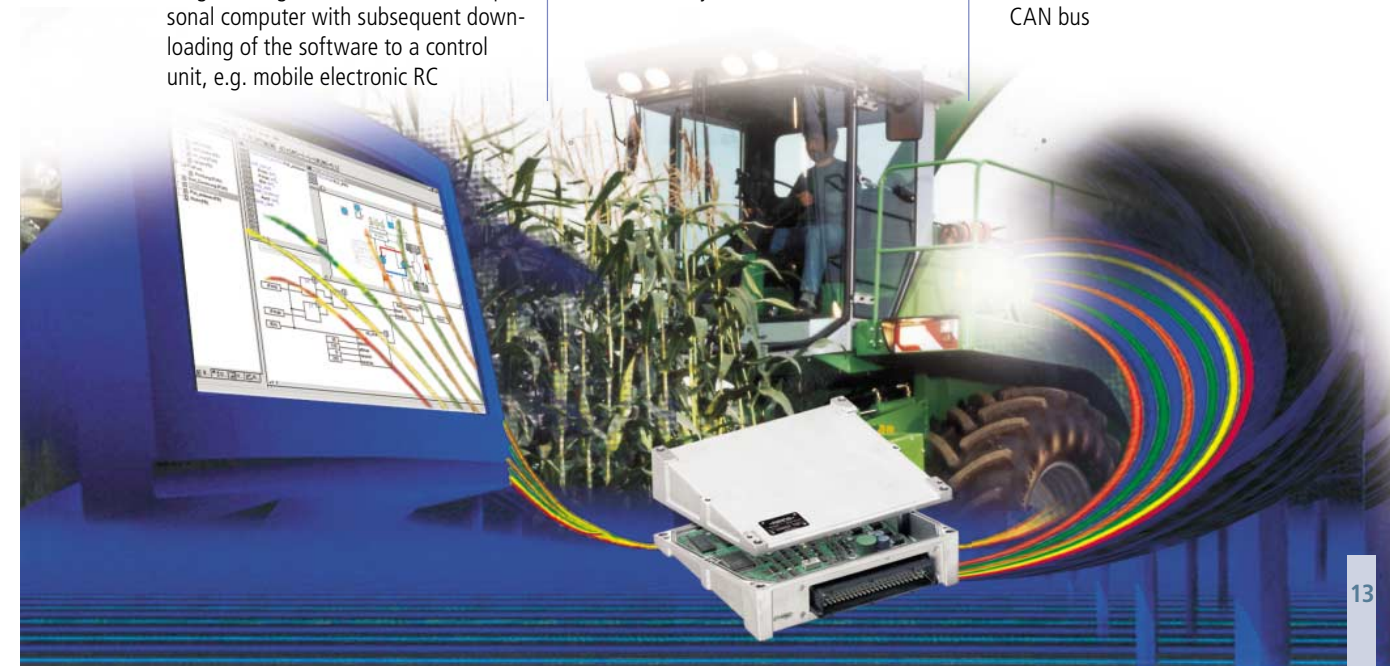
The CAN bus as the basis for consistent system management is a perfect example of these efforts.

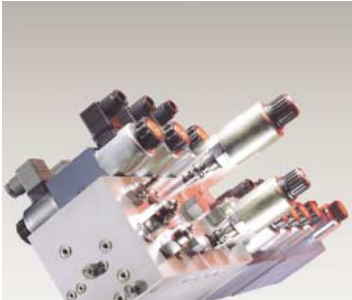
Control system with CAN bus

- Stations with the same rights are connected via a serial data bus
- Relevant machine data are available to all control units
- Several sensors, control units and displays can be connected and communicate simultaneously
- Transmission errors due to electromagnetic interference are detected and corrected automatically by retransmitting the data

Graphic programming interface BODAS

- Graphic programming interface for flexible development of system solutions for hydraulic drive systems
- Programming of user software on a personal computer with subsequent downloading of the software to a control unit, e.g. mobile electronic RC
- Based on standard IEC 6 1131-3
- User software programmed on the basis of templates and software modules from a library
- Functions are optimized by simulation on the PC without control unit
- Software downloaded from the PC to the control unit via a serial interface or CAN bus





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