Drive and Control Systems for Combine Harvesters and Forage Harvesters

Mobile Hydraulics
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.

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### Drive and Control Systems

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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

Drive management

- 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

Variable displacement pump (A4VG)

Hydrostatic drive transmission

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

Variable displacement pump (A4VG)

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 ($\alpha_{\text{min}} = 0^\circ$)
Electro-hydraulic header control EMR

Transport mode
- 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

Position control
- 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

Clearance control
- 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)
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.

The CAN data bus is an acknowledged standard throughout the world with the following performance profile:

- Very high functional reliability
- Very fast data transmission
- Simple connection of control units, sensors and attachments
- Fewer cables and interfaces
- Lower investment and installation costs
- Diagnostic functions for maximum availability

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
- Based on standard IEC 61131-3
- User software programmed on the basis of templates and software modules from a library
- Software downloaded from the PC to the control unit via a serial interface or CAN bus
- Functions are optimized by simulation on the PC without control unit
Components

A4VG
Variable displacement pump
for closed circuits
Nominal pressure 400 bar
Peak pressure 450 bar
For further information
see data sheet RE 90 003

A10VO/5
Variable displacement pump
for open circuits
Nominal pressure 250 bar
Peak pressure 315 bar
For further information
see data sheet RE 92 703

A6VM
Variable displacement motor
for open and closed circuits
Nominal pressure up to 400 bar
Peak pressure up to 450 bar
For further information
see data sheet RE 91 604

Wheel drive GFT
with integrated axial-piston variable displacement motor A6VE
(Optionally with fixed displacement motor A2FE)
For further information
see data sheet RE 91 604

Gear pump
– Compact mounting space
– Common suction port (optional)
– Optional: Silence pump version (optimized pressure pulsation)

Control block SB12-EHR5-OBE
with on-board electronics
Volumetric flow:
Input 110 l/min
Header control 60 l/min
Priority valve 40 l/min
Implement hydraulics 50 l/min
(max. per segment)
Service pressure 250/220 bar

Control valve EHR23LS / EHR23LS-OBE
Volumetric flow:
Raising 90 l/min
Lowering 90 l/min
Service pressure 220 bar
CAN communication for operation and diagnostics

Compact hydraulics
Function blocks with cartridge or CETOP valves to customers’ specifications
For further information
see data sheet RE 90 188

Steering unit LAGC / LAGU / LAGZ
For further information
see data sheet RE 11 867, RE 14 365 and RE 11 868

Brake
Accumulator loading valve LT 06
Remotely powered inching brake valve LT 31
For further information
see data sheet RE 66 226 and RE 66 191

Applications Center Agricultural Machines at Bosch Rexroth Mobile Hydraulics – System’s Support, Project Engineering, Optimization

System solutions – today and in future
The purpose of the Application Centers at Bosch Rexroth Mobile Hydraulics is to analyze customers’ present and future requirements in the field of drive and control systems and to develop appropriate solutions – from the individual components to the complete system.

Stronger – faster – better
The future belongs to those vehicles and machines which are more powerful, more rapidly available and more cost-efficient. Among other things, this also requires drive systems which have been optimized for the specific application in question. Our Application Centers provide the required practical know-how, state-of-the-art simulation programs and efficient test systems. Complete operational system solutions are developed in close cooperation with our customers and partners and with a minimum of interfaces, using perfectly matched and coordinated components. In addition, our Application Centers also make use of the synergistic effects generated by the various divisions of Bosch Rexroth AG and their different technologies.

Bosch Rexroth worldwide
The Bosch Rexroth sales organization spans more than 78 countries. Our global presence is additionally ensured by 45 own sales and service offices in 36 countries, as well as 85 production facilities.
That means you and your customers dispose of competent Drive and Control partners almost anywhere in the world.