Drive and Control Systems for Forestry Machines

From the Gear Pump to Electronic Harvester Management
Unique Variety for Tailor-Made Systems

When it comes to drive and control systems for forestry machines, Rexroth offers the customers a unique variety of components and systems for tailor-made solutions. Cut-To-Length method or Full-Tree-Harvesting – Rexroth has the perfect system for your machine’s particular requirements. With our extensive product range, we are in a position to cover the entire spectrum. At our Forestry Machine Application Centre, specialists from the various product areas work together closely to offer you comprehensive assistance, from selecting the ideal components to planning entire systems.

We Provide:
• Hydrostatic drives with hydraulic or electronic control
• Working hydraulics with open centre or load sensing control
• Hydraulic steering and braking systems
• Mobile electronics for optimum drive management
• Gearboxes for travel and swing drives.

Look no Further
At Rexroth you can find the complete range of drive and control systems for forestry machines – no need to look elsewhere. For the Mobile Hydraulics sector of Rexroth – with its product divisions Axial Piston Units, External Gear Units, Radial Piston Motors, Mobile Controls, Gear Technology, Mobile Electronics and Mobile Service – is able to equip each system in its entirety.
Prerequisite for Optimum Operation
Our high-performance drive and control systems are vital components of these machines, and therefore a basic prerequisite for optimum forestry-machine operation. These systems excel, in particular, in their reliability, economy and user-friendliness. Besides hydraulic systems, electronic control systems are increasingly being employed for drives. With working hydraulics as for drives, economy, performance and user-friendliness are in the foreground. In addition to the classical open centre control, load-sensing systems are becoming ever more popular.

Close to You—Worldwide
The Rexroth sales network extends throughout 80 countries. Further we can boast production plants, sales centres, distributors and service centres on a global scale. In this way, qualified partners are at your side practically the world over when it comes to drive and control systems.

Application Centre: System Advice, Project Planning and Optimization
Rexroth’s Application Centres have the task of analysing present-day and future customer requirements in the field of drive and control technology and working on appropriate solutions – from individual components to the entire system. The future belongs to vehicles and machines that are more productive, more rapidly available and lower in price. This gives rise to the need, among other things, for drive systems which have been optimised for each specific application.
At our Forestry Machine Application Centre, we offer the necessary expertise for each application, plus state-of-the-art simulation programs and powerful test systems. In close co-operation with our customers and partners, ready-to-operate systems with perfectly matched components are developed with the minimum of interfaces. In addition, our Application Centres exploit the synergy factor of the divisions of Rexroth, each oriented towards a different type of technology.
CTL-machines are forestry machines that employ the Scandinavian Cut-To-Length method. According to the CTL principle, the trees are cut and felled, delimbed and cut to certain lengths already in the forest. These machines are mostly so-called harvesters with wheel drives that are purpose-built for this process, but also feller bunchers are used. They are track-mounted, similar to excavators. The logs are carried with so-called forwarders to the roadside. The long-range transport from the roadside to the factory is done with trucks.

Hydraulics plays a significant role in all phases of the forest harvesting process. It would be impossible to design a state-of-the-art machine and at the same time meet the requirements of the users with other technologies available. The proven technology by Rexroth offers efficient and reliable components for any system solution in forestry technology.

**Hydrostatic Drive**

Harvesters and forwarders are nearly always equipped with closed-loop-controlled drive hydraulics. This ensures excellent driving comfort in the forest and very good controllability both in uphill and downhill driving. Today, both, the pump and the motor are usually controlled electrohydraulic pump proportionally by means of an electronic control device. The software used in the micro-controller automates drive characteristics with power limitation. This prevents the diesel engine from stalling in the case of overload situations.
Load-Sensing Working Hydraulics

Today, load-sensing systems are nothing unusual. Pumps of series A10VO and A11V(L)O are widely implemented in these machines. A good machine is characterised by precise crane functions. The spools in Rexroth valves are optimised to offer the operator excellent response characteristics and repeatable controllability under any operating conditions.

The Rexroth M4 load-sensing control block integrates all the advantages of advanced valve technology in a compact form:

- High flow rates
- High maximum pressure
- Integrated LS pressure relief valves and secondary valves
- Wide spectrum of different spool variants
- Compatibility with PWM control
- Integral electronics
Full-tree harvesting (FTH) is primarily a North American tree-harvesting principle whereby the tree is handled throughout the harvesting process in its full-length form. The steps within the process include felling, transporting (within the forest), processing and loading. There are several variations of this process, and consequently several types of machines, depending on terrain conditions and/or tree size. The most common machines are wheeled or track-driven feller bunchers with a special disc saw felling head. Other machines include skidders, delimbers and log loaders.

**Feller Bunchers**

The feller buncher is used to cut (fell) and then bunch or pile the trees on the ground. Since these machines operate far away from roads on severe terrain, great emphasis is put on the capability of covering long distances and all-terrain mobility. The origins of the feller buncher come from the excavator. However, the hydraulic system, the machine structure, the tractive effort and boom attachment are all significantly different. A feller buncher may be required to perform as many as seven movements simultaneously with each movement being equally as important as the other. Due to the severe terrain conditions in which this machine must operate, as well as heavier loads it must lift, the machine’s structure is significantly stronger than an excavator. The steep slopes in forests require the machine’s tractive effort-to-weight ratio to be one to one or greater. Finally, a high-speed disc saw felling head mounted on the boom is the most contrasting difference between a feller buncher and an excavator. The travel drive is achieved in most cases by a track drive, but machines with wheel drive are also used.
Hydraulic Systems and Components for Full-Tree Harvesting Machines

Also full-tree harvesters employ the complete spectrum of drive and control systems from Rexroth. The control concepts range from simple power regulations to completely microprocessor-controlled systems. Due to the increased reliability and driver comfort, this technology is gaining in importance.

Rexroth Product Range for Full-Tree Harvesters

A11VO pumps with power control, load-sensing and cross-sensing controls are ideal for feller bunchers and log loaders. For the disc saw felling head on feller bunchers, an A10VO or A11VO is the pump of choice. The track drive is powered by a gear box GFT with integrated A6VE motor. Whereas with skidders an A4VG-pump or A6VM-motors with GFT-gearboxes is the ideal solution. The LUDV concept is already accepted in the FTH machines, primarily in feller bunchers. The reasons for this are the possibility of performing several functions simultaneously, also in the case of undersaturation, and the simple installation. M4 load-sensing control valves are used for controlling auxiliary functions and cylinder functions in the disc saw felling head.
Rexroth offers systems for all types of Harvesting Heads. Engineers attach great importance to high productivity, ease of operation and efficiency. The systems are optimised for the individual application and tailored to the requirements of the operator. Customised solutions – by Rexroth.

Harvester Heads
The head plays a key role in processing the tree. Different types and levels of technology are combined to make a head as effective and reliable as possible. A high feeding force and a high feeding speed must be designed into a construction as possible. There is a clear trend in the market to make this possible by raising the pressure level.

Load-Sensing Control Block
With maximum pressures of 350/420 bar the M4 load-sensing control block provides a reliable basis for high-pressure solutions. In conjunction with MCR radial piston motors, which are suitable for pressure stages up to 420 bar, it is possible to offer a package solution even for the largest harvester head on the market. The M4 controls all the functions of a harvester head. The central inlet element allows the distribution of large flows to up to ten valve functions.
Feller Buncher Heads

The head with sawing blade is the most important element of a feller buncher. The head is the part which cuts the tree and holds or bunches cut trees before they are laid down on the ground. The cutting is done using a flywheel or inertial type disc with saw teeth arranged on the perimeter of the disc. The disc is driven by a hydraulic motor while the grab arms are controlled via cylinders.
Transport Solutions

Transporting is handled by means of machines that are fitted with Rexroth technology in order to remove felled trees from the forest, loading or transporting them. The most common machines used for this purpose are so-called skidders. Serviceability and perfect reliability, even under extreme conditions, are indispensable for harvesting, when transporting the timber and finally for handling in the storage area or in the sawmill.

**Skidders**

To remove a felled tree from the forest, a machine called a skidder is used. By the nature of the name, the machine literally “skids” trees through the forest and then out to a processing site. Although a simple process, the demands put on this machine are unparalleled in the mobile field. Typically these machines are 4 wheel driven, with some designs going to six and eight wheels (bogey systems) and until recently they were almost exclusively mechanically powered using power shift gearboxes and drive axles. The trend over the last couple of years, however, has been to move towards hydrostatic transmissions with more and more manufacturers exploring this avenue.
Log Loaders
The last step in the full-tree harvesting process is to load the fully processed tree or log onto a hauling truck. A log loader accomplishes this function. Much like the feller buncher, a log loader’s origins come from the excavator. Many of the differences between a feller buncher and an excavator also apply to a log loader. However, the difference is that a log loader has a hydraulically powered grapple mounted on the end of the stick. In addition, depending on customer requirements, sometimes the operator cab is elevated in order to provide better visibility.

Log Truck Cranes
As an alternative to log loaders, log truck cranes are used for loading the logs. These cranes – directly mounted onto the trucks – lift the logs onto the platform of the vehicle. The most essential points here are good manoeuvrability and high load-carrying capacity of the crane. Rexroth systems are ideal for handling logs fast and efficiently. SX control blocks of LUDV technology allow the performance of several working movements simultaneously and independently of one another.
Overview of Components

Axial piston units, external gear units, radial piston motors, mobile controls, gearboxes and electronics for mobile applications. Rexroth offers the complete product spectrum from a single source.

Axial Piston Pump A4VG
for closed circuits
Nominal pressure 400 bar
Maximum pressure 450 bar
Catalogue page RE 92 003

Axial Piston Pump A10VO
for open circuits
Nominal pressure 250 bar
Maximum pressure 315 bar
Catalogue page RE 92 703

Axial Piston Pump A11VO
for open circuits
Nominal pressure 350 bar
Maximum pressure 400 bar
Catalogue page RE 92 500

Axial Piston Motor A6VM
for open and closed circuits
Nominal pressure up to 400 bar
Maximum pressure up to 450 bar
Catalogue page RE 91 604

Variable Displacement Pump KVA
for open circuits
Nominal pressure 300 bar
Maximum pressure 350 bar
Catalogue page RE 92 250

External Gear Pump/Motor
Constant displacement pumps in standard and silence versions
Nominal pressure 250 bar
Operating pressure 280 bar
Catalogue 1 987 760 100
Catalogue 1 987 760 101

Radial Piston Motor MCR
for open and closed circuits
Nominal pressure up to 420 bar
Catalogue page RE 15 205

Drive GFT
with axial piston actuating motor A6VE
Output torque from 7 – 330 kNm
Catalogue page RE 77 110

Fixed Displacement Motor A2FM
for open and closed circuits
Nominal pressure up to 400 bar
Maximum pressure up to 450 bar
Catalogue page RE 91 001

Swing Drive Gear GFB
with axial piston motor A2FE/M
with axial piston motor A10FD
Catalogue page RE 77 201
Catalogue page RE 77 204
LS Control Block M4-12
hydraulically or electrohydraulically operated
Nominal flow 100 l/min
Operating pressure up to 420 bar
Catalogue page RE 64 278

LS Control Block M4-15
hydraulically or electrohydraulically operated
Nominal flow 150 l/min
Operating pressure up to 420 bar
Catalogue page RE 64 282

LUDV Control Block M7-22
hydraulically or electrohydraulically operated
Nominal flow 350 l/min
Operating pressure up to 420 bar
Catalogue page RE 64 295

LUDV Control Block SX14
mechanically, hydraulically or electrohydraulically operated
Nominal flow 120 l/min
Operating pressure up to 300 bar
Catalogue page RE 64 125

Thermal Relief Valve MHDBDT
Catalogue page RE 64 309

Hydrostatic Steering Unit
LAGC/LAGU/LAGZ
Catalogue page RE 11 867, RE 14 385, RE 11 868

Power Brake LT13/LT17
Dual circuit system
Catalogue page RE 66 200
Catalogue page RE 66 222

Pilot Control Device 2TH6R
foot operated
2 control ports
Control pressure 50 bar
Catalogue page RE 64 551

Pilot Control Device 4TH6
hand operated
4 control ports
Control pressure 35 bar
Catalogue page RE 64 555

Control Unit RC
control of hydrostatic drives and working-hydraulic functions
Catalogue page RE 95 051
Prospects for Forestry Technology

Systems used in the forestry sector are constantly being developed further. Rexroth attaches greatest importance to the possibility of handling higher pressures and speeds. In parallel, development engineers at Rexroth are working on the reduction of weight and size of components. There is also a clear trend towards bus systems. The objective is the development of forestry machines that are more efficient, ecological and user-friendly. This challenge requires a close co-operation between suppliers – such as Rexroth – and manufacturers: A precondition for success in the future.

**Environmental Protection**

The preservation of the environment is a key topic in the forestry sector. The use of bio-degradable hydraulic fluids is a demand. Power consumption also plays an increasingly important role. Load-sensing or electronic control systems are very helpful here. The reduction of the stand-by pressure, shorter response times of the controllers and power pre-selection circuits based on control devices are of major importance. The acquisition of data on the complete machine allows the observation of the machine's productivity and simple troubleshooting.
Electrohydraulic Pilot Control

Today, forestry machines would hardly be conceivable without electrohydraulic pilot control. Due to the multitude of functions that must be controlled and the stringent requirements with regard to comfort and power of forestry machines, the set standards are high. Electrohydraulic systems offer the following advantages: Reduced space requirement, reduced generation of heat and noise and very good adjustability to the operating requirements. With the help of joysticks in conjunction with analogue or digital amplifiers modules that feature versatile programmability control curves can be generated in valves that are tailored to operators and applications.

“The extension by additional technical features can only be achieved with the increased use of mobile electronics!”

The Development of CAN-Bus Systems Reduces the Wiring Effort and the Probability of Errors.

*Diagram showing the connection of various components through CAN-Bus system.*