Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Pulp and Paper Production at the Highest Level. With Electrohydraulic Drive Technology from Rexroth.

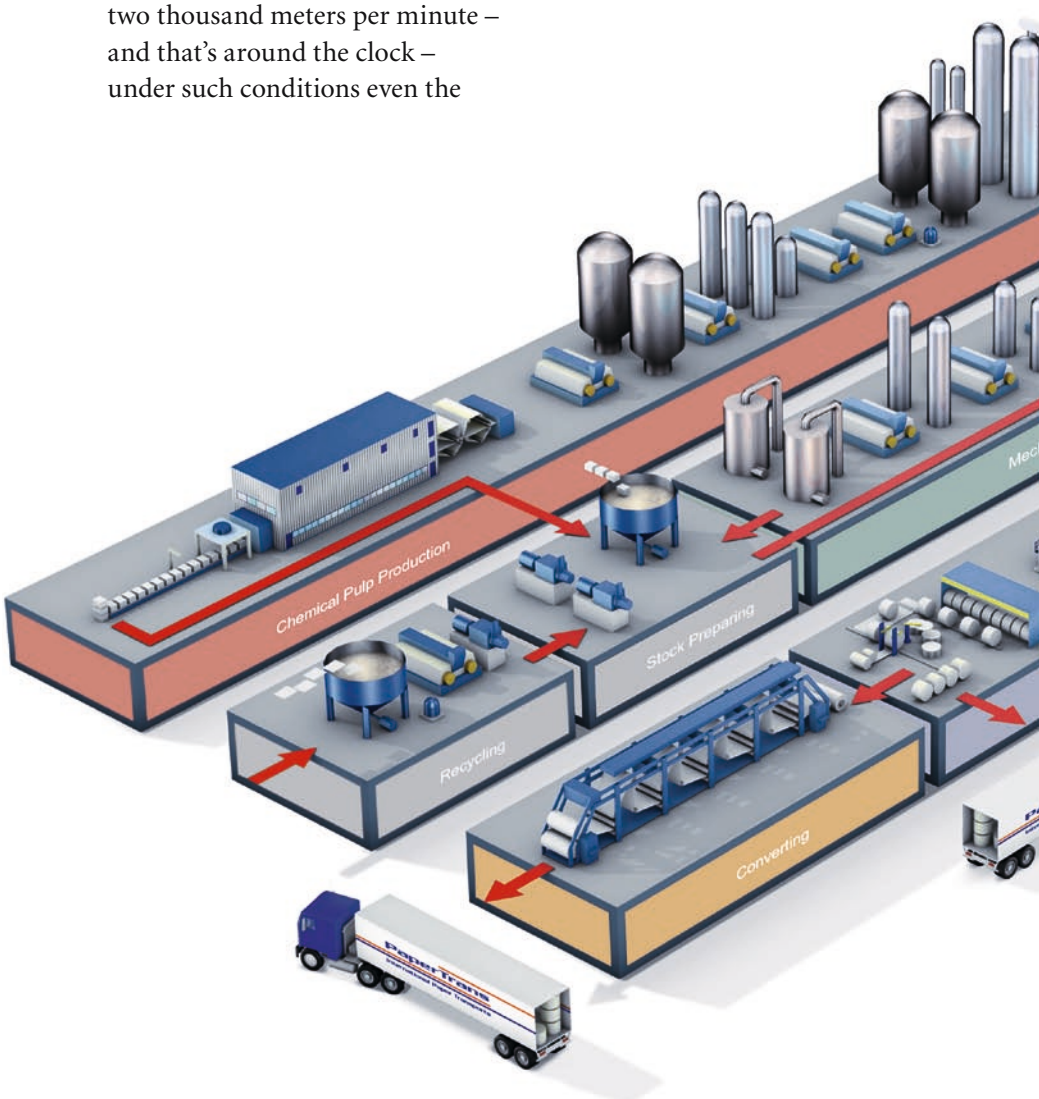
Intelligent, Accurate, Robust and Reliable

From Raw Material to Fine Paper

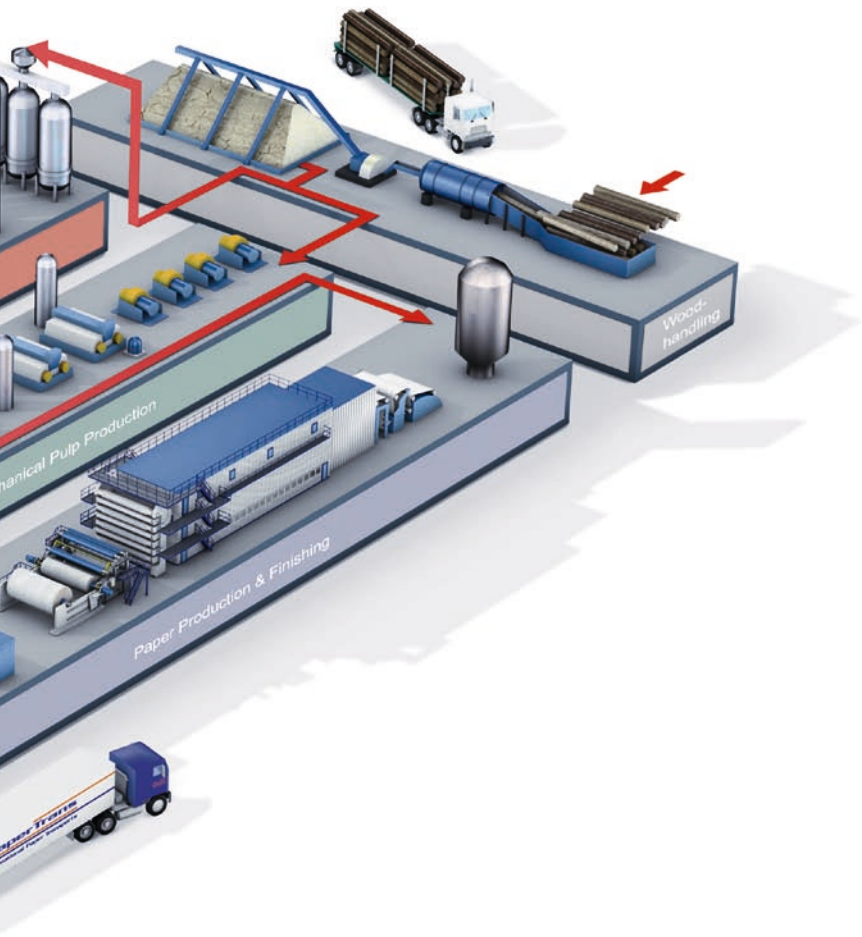
The production of pulp and paper is such a demanding process that only highly qualified specialists working on high-quality automated systems are able to undertake these tasks successfully. Rexroth is setting standards in this field worldwide: Wherever drives and controls are concerned – and if system performance is to be maximized – engineers and operators are opting for the intelligence, precision, reliability and longevity of Rexroth electrohydraulic systems.

Paper and pulp manufacture places exceptionally high demands on the drive technology. In order to ensure smooth interplay between the high forces generated here, the highest level of robustness and absolute precision are demanded simultaneously of machines and systems.

Paper webs of over ten meters in width, production speeds of up to two thousand meters per minute – and that's around the clock – under such conditions even the slightest problem can have far-reaching consequences. A crack in the paper web or a drive malfunction would inevitably result in an emergency shutdown of the complete system, necessitating a restart, which is costly. The technology used must offer maximum preci-



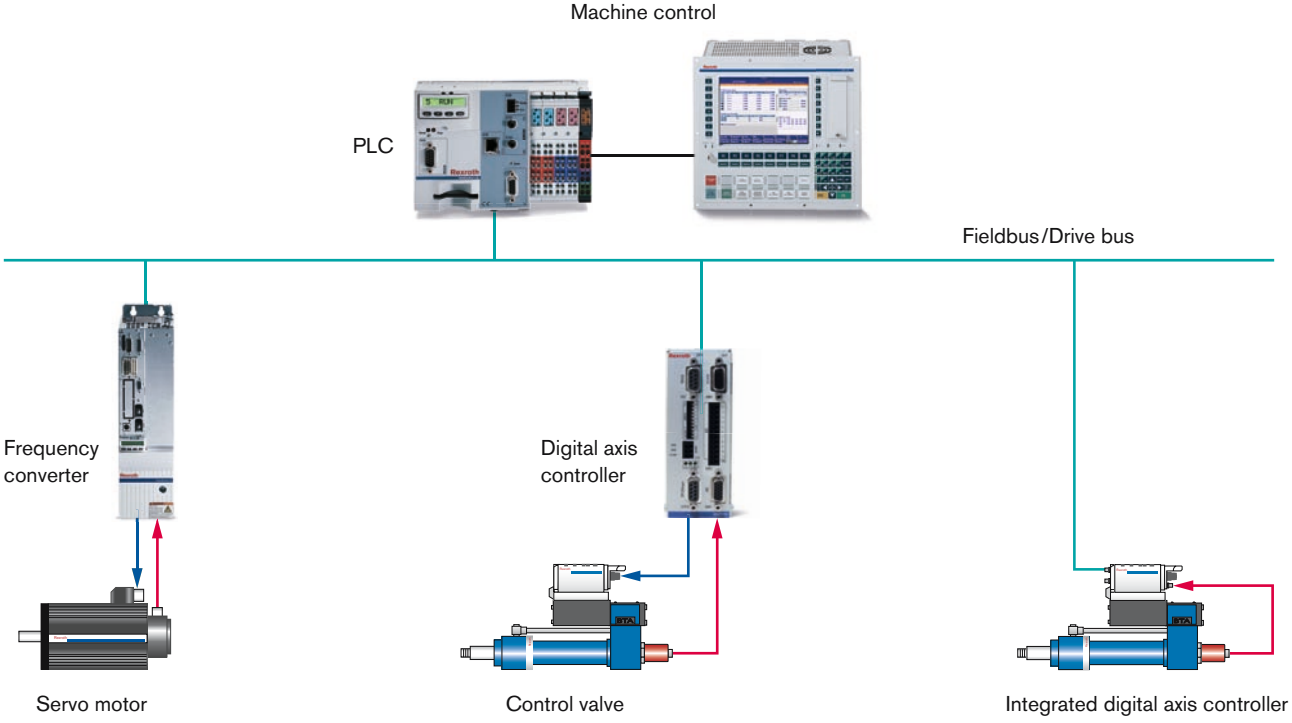
sion, dynamics and reliability at all times if such time- and cost-intensive downtimes are to be avoided. The specialized electrohydraulic solutions from Rexroth meet these requirements – both in the production process and at the finishing stage – and to the highest level.

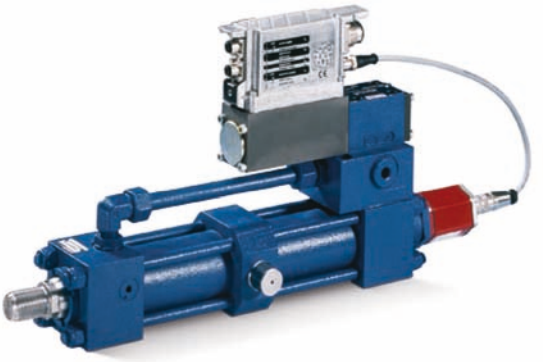


Rexroth Applications Center Paper Industry: Your Specialist for Branch Solutions

Rexroth has set up the Applications Center Paper Industry to develop the best possible results in precision, economy and longevity of production systems. Specialized knowledge of industrial hydraulics, many years of experience in this branch and extensive process competence are all combined here – often in direct, close contact with the users from the industry – to develop highly specialized, individual system solutions.

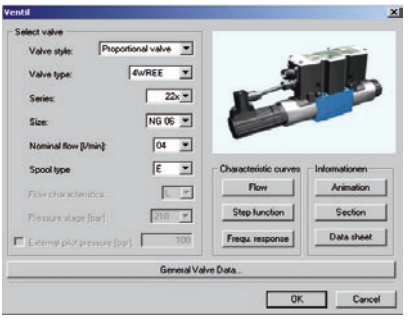
Customer-specific solutions
With its Applications Center Paper Industry, Rexroth offers its partners in this sector the assurance of benefitting from the support of the complete Bosch Rexroth international know-how at all times. Whether this relates to engineering and construction of production systems for optimization of factory configurations or efficient modernization measures – you can always be sure that branch-specific features, individual requirements and local prevailing conditions will be taken fully into consideration.

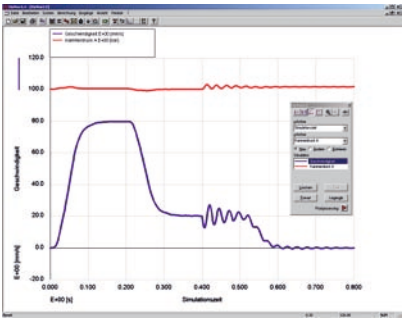




Eliminating problems before they occur

Rexroth develops customized solutions based on a worldwide unique, proven product spectrum. With the aid of modern simulation software the complete, actual production process can be displayed, tested and optimized in detail as early as the planning and development phase of a system. This reduces commissioning time to a minimum and guarantees maximum efficiency of the whole system right from the start.





Electrohydraulics: The best of both worlds

There is virtually no other branch of industry where the particular advantages of electrohydraulic drives really come to the fore, as in the paper industry. Highly complex pressure, force and synchronism control, which are particularly characteristic of papermaking machines, represent a technical challenge and demand intelligently designed electrohydraulic drives.

In its systems Rexroth combines the unique technical advantages of electronic and hydraulic components, offering solutions that promise a maximum degree of economy and high product quality to customers with high specifications. Systems with control cabinet electronics and also integrated axis controllers with intelligence at the valve are setting standards right across the branch with respect to precision, dynamic and control accuracy – and standardized interfaces permit easy integration of the hydraulic-specific motion control into the control architecture.

The DVD “Pulp and Paper Production by Rexroth” contains:

- **Corporate film**
- **Application examples**
- **Paper animation**
- **Information**
- **Contacts**
- **HYVOS Simulation Program**

Chemical Pulp Production: Where Basic Forces Naturally Prevail

The production of pulp places particular demands on the drive technology. This process involves chemically digesting wood particles with the aid of strong alkaline solutions under high pressure, at high temperatures and constant motion. The chemical production process demands an extremely sophisticated technology: powerful, low-maintenance and precision control of the drives with a high degree of effectiveness and a long service life – all typical features of Rexroth electrohydraulic drives.

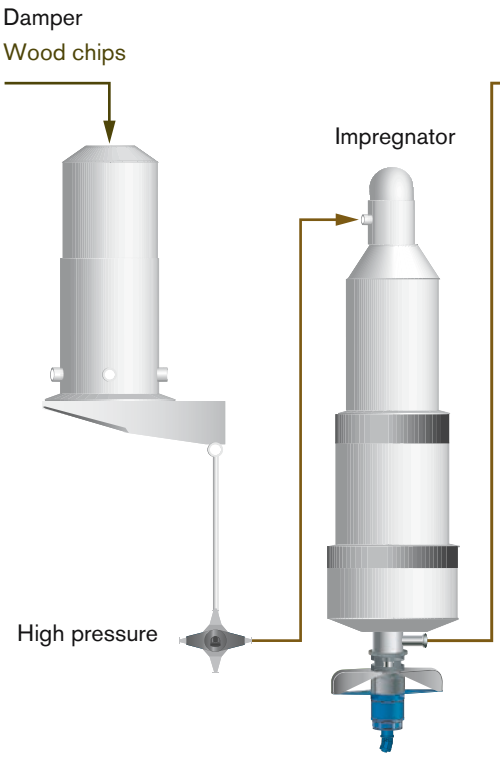
A2FM

GMH

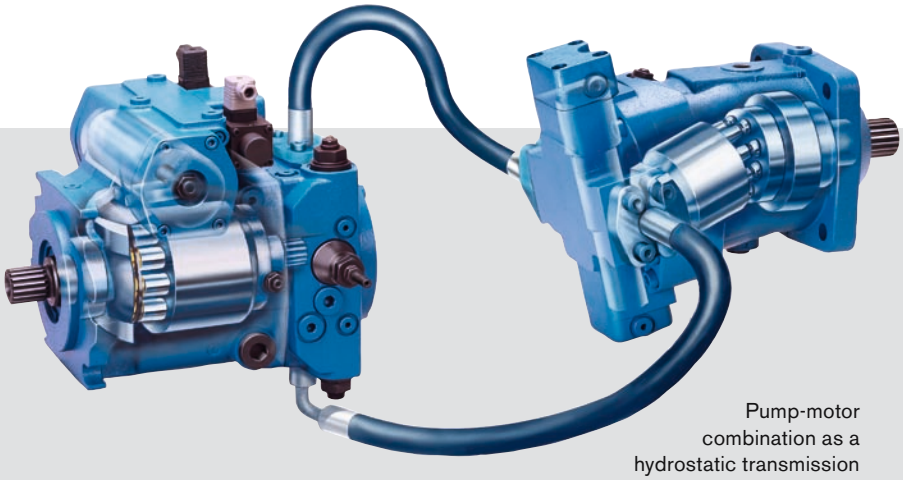
A4CSG

The finite element method in its element

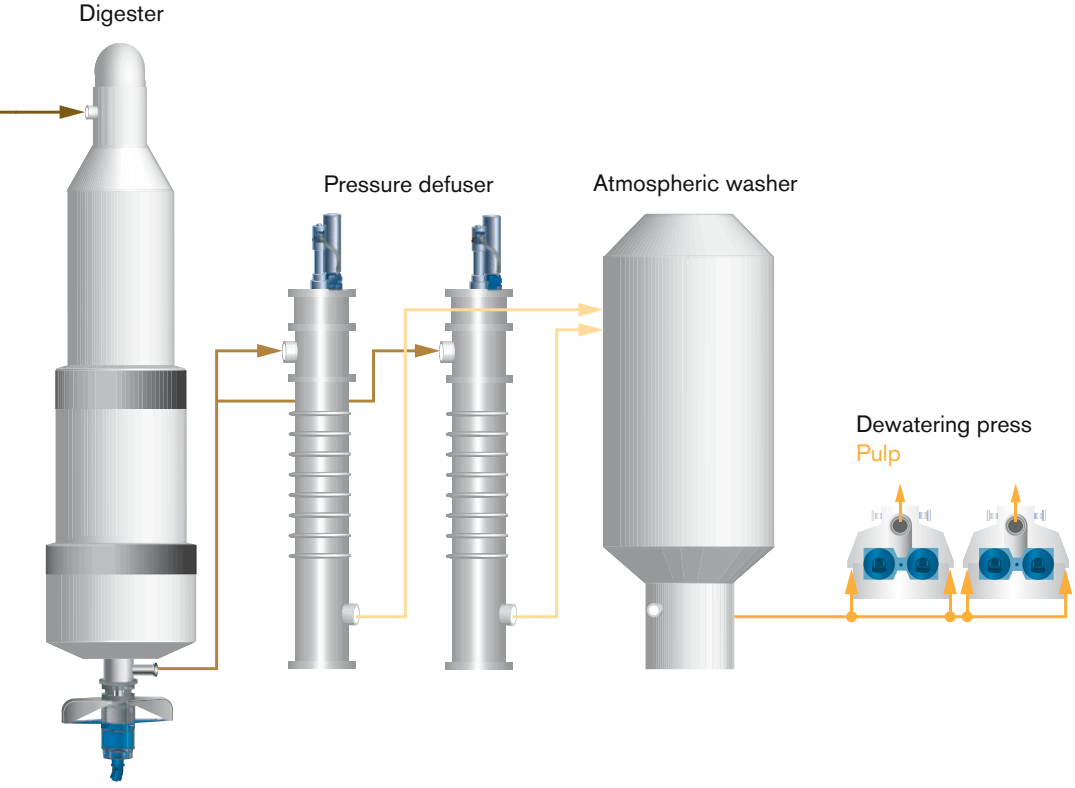
For these exceptional requirements for pulp production Rexroth has developed a branch-specific drive system – comprising the A2FLM Axial Piston Motor with coupled GMH planetary drive and the A4CSG Axial Piston Pump. The Rexroth planetary drive, built to the finite element method, permits long-term stable operation. A perfectly tuned translation for the hydrostatic transmission permits high-speed accuracy, combined with accurate rotation, even at low speeds.



Process sequence of chemical pulp production



Pump-motor
combination as a
hydrostatic transmission

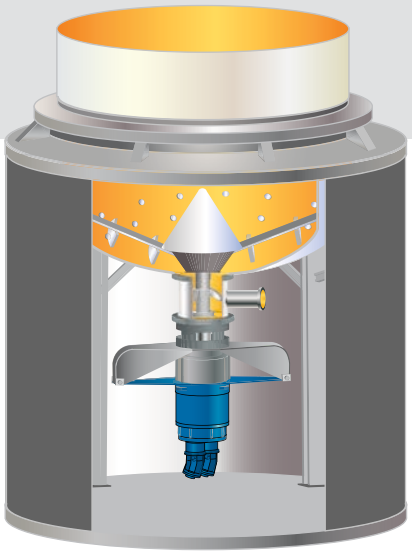


In top form even under the harshest conditions

One of the outstanding features of the electrohydraulic drive concept from Rexroth lies in the closed profile, robust construction method, both of the components and the complete system. This makes it particularly resistant to harmful environmental influences such as moisture, dirt, aggressive chemicals, high pressures and extreme temperatures. These are properties that many users in the industry really appreciate – and it clearly pays off in the form of a minimal maintenance outlay and low service life costs.

Chemical Pulp Production: Precision plus Stability

Whether slow and smooth yet with powerful rotations, or whether accurate and highly dynamic linear motion – Rexroth technology can perform both in the extraction of raw materials: the longest service life of systems and components despite immense loading and simultaneous sensitive open and closed loop controllability.



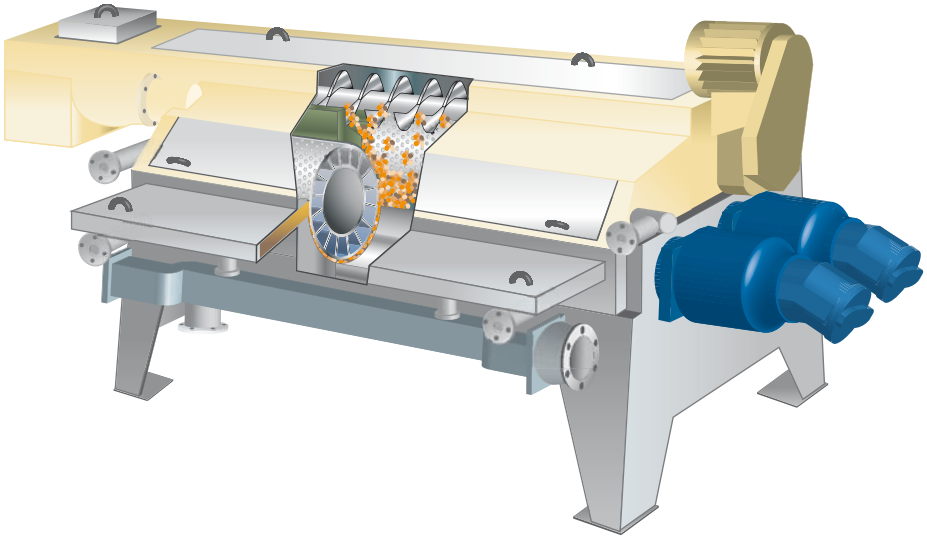
Digester

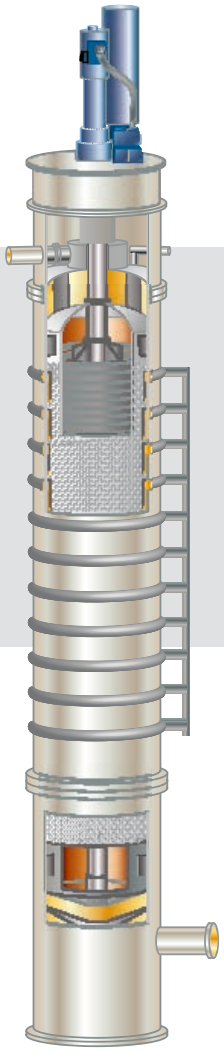
Long service life for series production

Both for the mixing blades in pulp digesters and the rotating drums in dewatering presses, drives that operate slowly and with very high torques are required for even distribution and for pre-dehydrating the raw material.

In order to guarantee stable operation with these extreme loadings over a long period, Rexroth places particular emphasis on a long service life when designing the drives.

Dewatering press

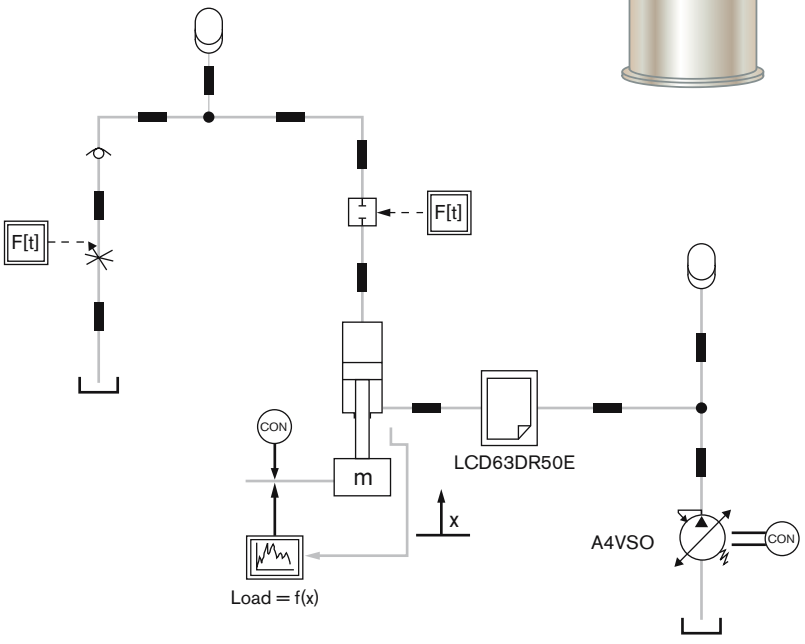




Pressure defuser

Optimized pressure defuser
In order to ensure that the washing process in the pressure defuser achieves the best possible results, precision movement of the screen is of great importance. The Rexroth drive system developed especially to this purpose permits accurate control of these cyclical movements. Special components such as the CYDI cylinder and pressure-compensated FESE proportional throttle valves, as well as a control manifoldblock directly on the cylinder, control the immense dynamic forces continuously and with maximum precision.

With the help of special Rexroth software, the behavior of the new complete pressure defuser system is displayed at a very early stage. This makes clear any potential improvements in the accuracy of the movement.



Simulation model of a pressure defuser

Mechanical Pulp Production: Performance Advantage for Refiner

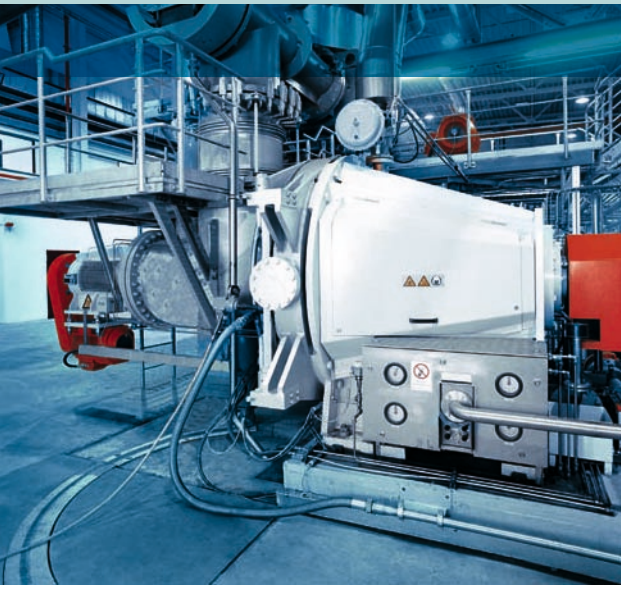
As in all other system components, the refiner also contains proven Rexroth components for maximum efficiency: Reliability and precision are the most important criteria with refiner disc control as far as safe process sequences are concerned; precision electrohydraulic control systems increase productivity and guarantee trouble-free operation.

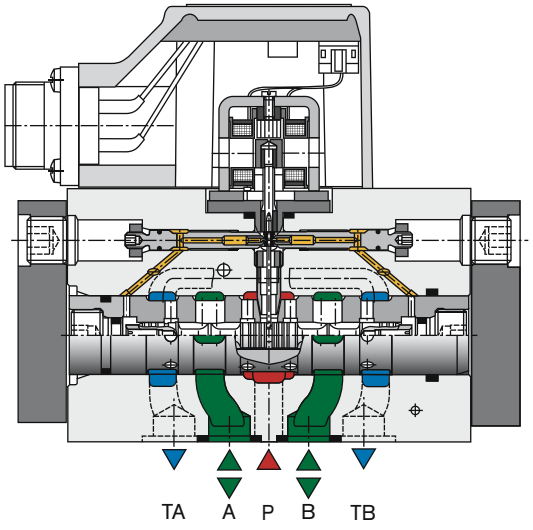
The production of high quality wood fibers made from wood chips in a thermo-mechanical process requires precision control and monitoring of the pressing force between the refiner discs and the gaps in between.

Secure force control
In order to guarantee a safe, reliable production process and swift opening of the nip in the event of an emergency, the Rexroth system offers the 4WSE2EM, a high-dynamic response, two-stage servo valve with mechanical feedback and integrated valve electronics.

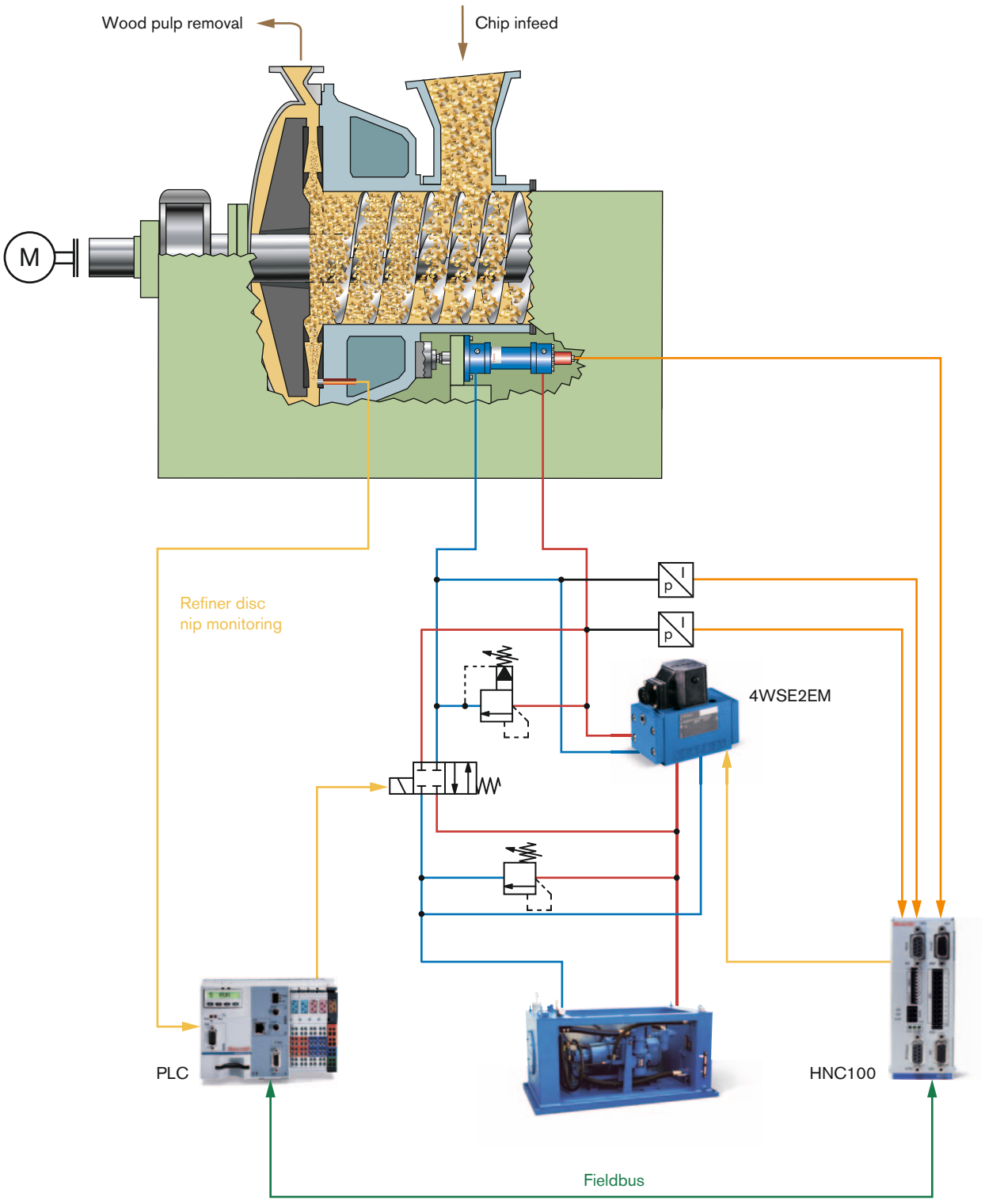
For safety reasons the servo valve can be aligned to support swift opening of the refiner nip in the event of an emergency.

Secure position monitoring
In combination with the HNC 100, the proven digital axis controller, the choice can be made between force and position control with flexible changeover. This enables optimum setting of the refining process to produce a high quality wood pulp.





4WSE2EM


Wood pulp removal
Chip infeed
M
Refiner disc
nip monitoring
4WSE2EM
PLC
HNC100
Fieldbus

Paper Production: Perfect Solutions for Perfect Surfaces

Shine and smoothness on the paper, combined with consistent paper thickness – these are the decisive criteria when setting up the calender. In order to achieve the best results here, precision in force control is required as well as swift opening of the nips in the event of an emergency.

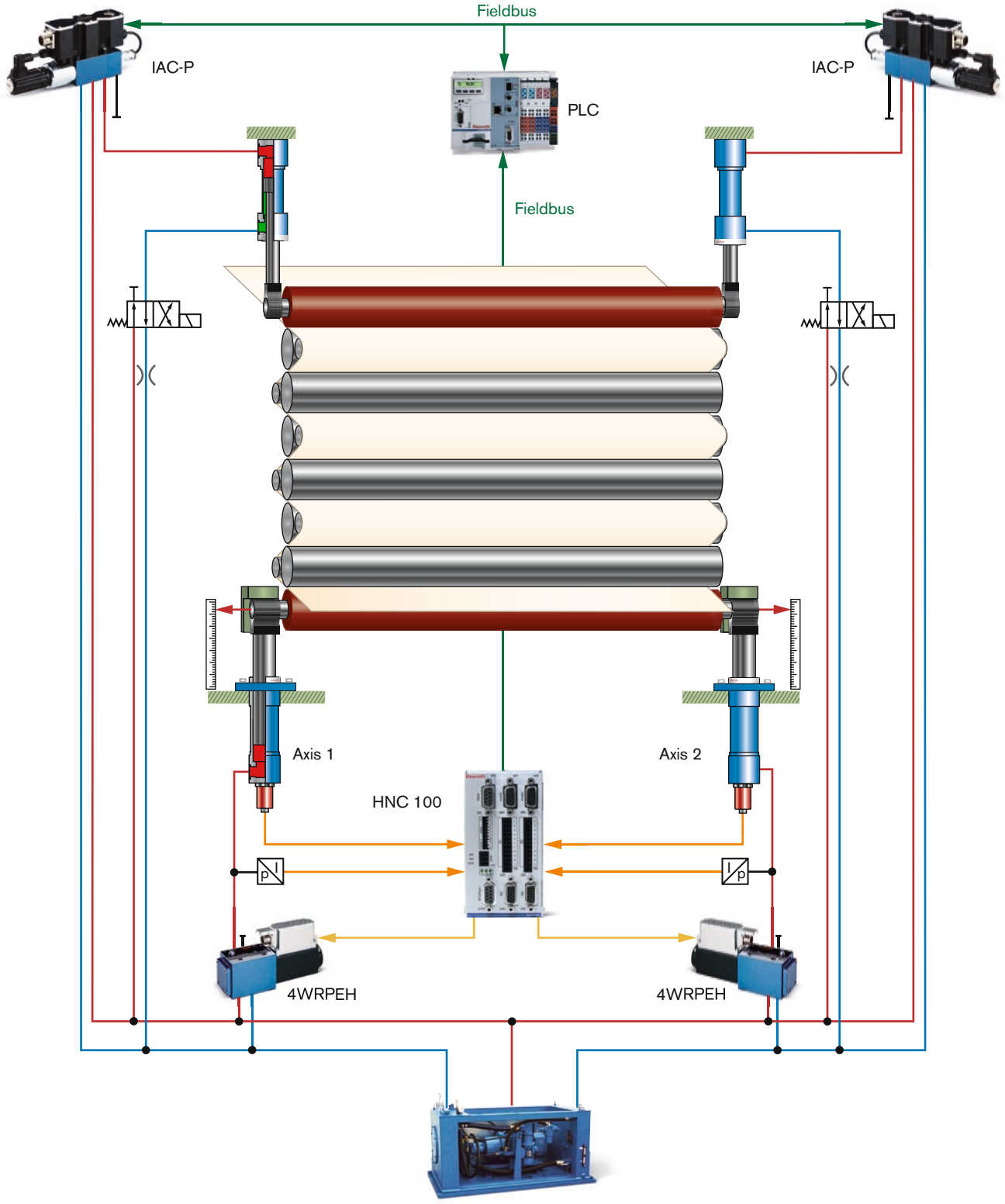
Precision linear force control
As the paper proceeds through the calender between the individual pairs of rollers, the calender generates the required paper thickness and surface quality by means of pressure and temperature. For the linear force control of the upper roller as well as the opening and closing of the calender, Rexroth uses closed loop controlled hydraulic drive systems. Dynamic proportional valves Type IAC-P control the required force in each individual hydraulic cylinder. The linear force required is flexibly adapted during the production process via the integrated fieldbus interface.

Opening and closing – spot on
When closing the calender, the lowest roller, together with the other mechanically coupled rollers, are controlled using two hydraulic cylinders and the associated open loop control via synchronous and alternating force control. The calender is opened in synchronous operation.

The functional control is effected here via an HNC 100 2-axis NC control system. In addition to the extensive controller structures the HNC also has both a synchronous and a pressure controller. This enables it to switch over smoothly between the control modes.

The WRPEH dynamic control valves control the synchronous operation with high precision during the closing operation, as well as alternately the force of both cylinder axes.

HNC 100-3X


Fieldbus
IAC-P
IAC-P
PLC
Fieldbus
Axis 1
Axis 2
HNC 100
4WRPEH
4WRPEH

Paper Production: Deflection Compensation for Uniform Paper Quality

Precision and differentiated closed loop control of the nip using zone-wise deflection-compensated calender rollers is indispensable if uniform paper properties are to be achieved – an essential criterion for paper quality.

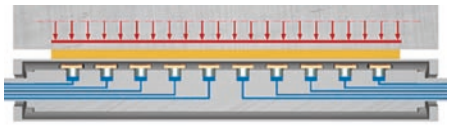
From continual measurements of the paper thickness the machine control can generate individual pressure command values for every single segment of the calender roller. These command values are transmitted to the axis controller either by analog means or via a fieldbus system.

The nip is closed via the flow control function of the integrated axis controller. All zone cylinders travel at the same fast speed following the flow command value. On contact with the roller the axis controller electronics (Rexroth IAC-P) switch automatically into pressure control mode.

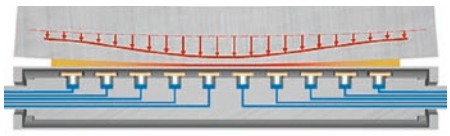
The pressure control command values are set individually for each zone cylinder, thus permitting precision control of the force profile across the complete nip.

Drive-integrated safety technology
A fail-safe setting of the valve piston allows the fastest possible speed for opening the nip – for example if the web cracks. This is effected either by switching off the supply voltage or by removing the release signal, causing a spring to push the valve piston into setting A – T. The large cross-sectional opening thus created means that the zone cylinders can be rapidly exhausted.

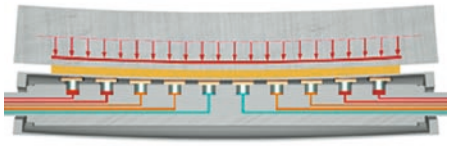
Problem of calender deflection and solution



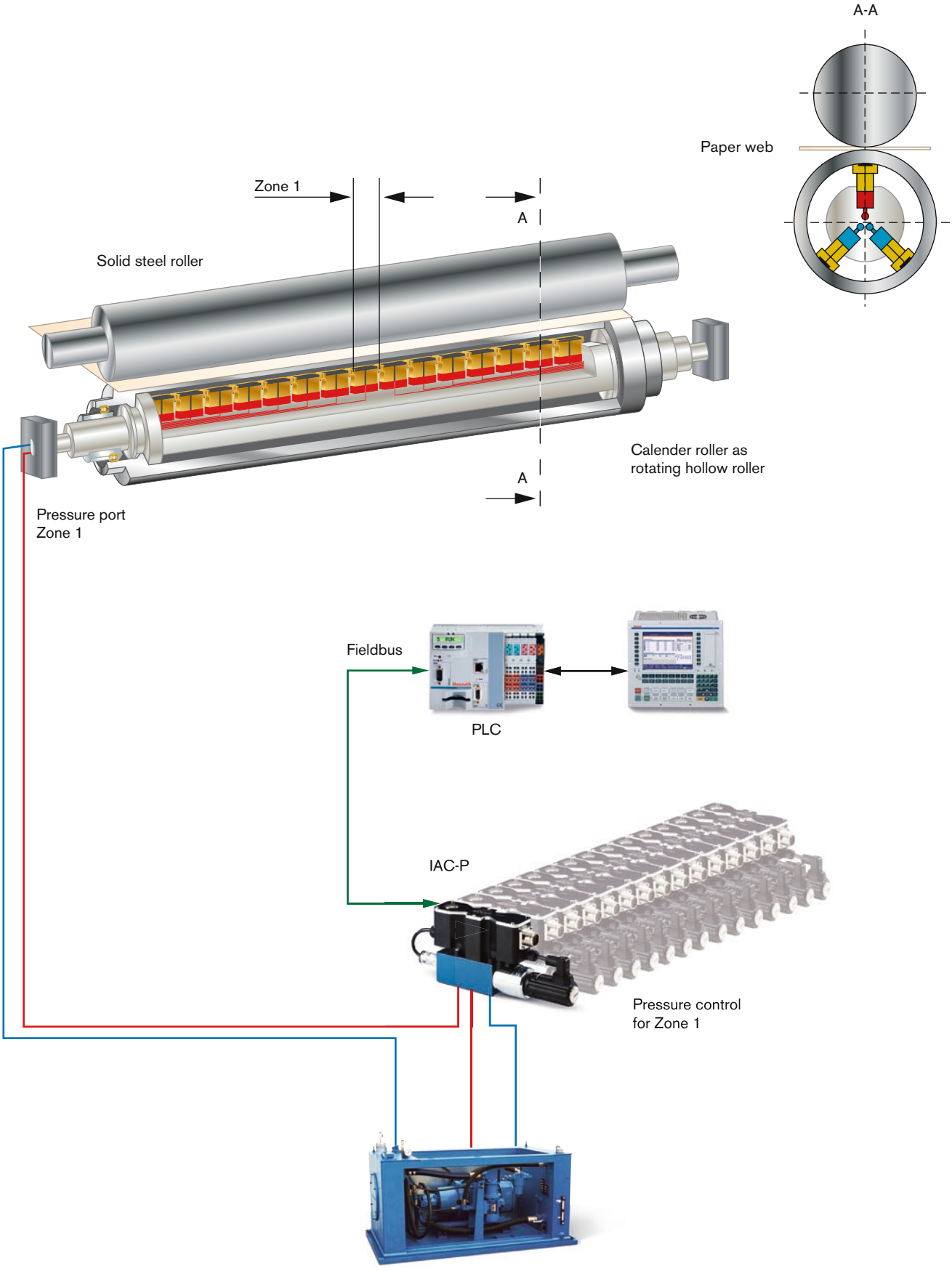
Ideal roller



Actual roller



Compensated roller


A-A
Paper web
Zone 1
A
Solid steel roller
A
Calender roller as
rotating hollow roller
Pressure port
Zone 1
Fieldbus
PLC
IAC-P
Pressure control
for Zone 1

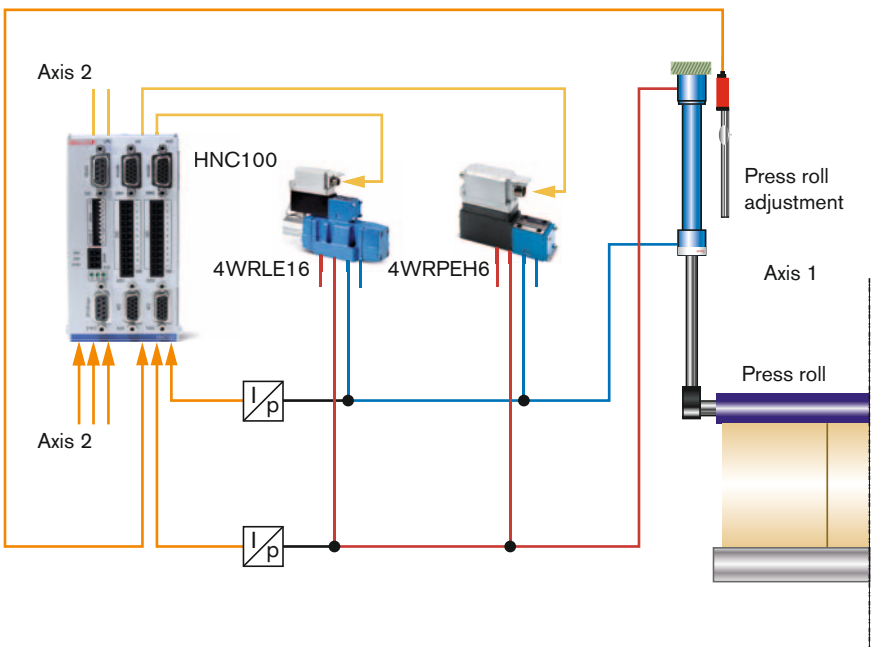
Paper Production: Smooth Reeling Thanks to Flexible Press Roller Adjustment

The force between roll and rider roll must be kept constant to ensure even winding in the paper roll – by precision, sensitive force control of the press roll.

Press roller adjustment
Low-friction hydraulic cylinders with control valves Type 4WRPEH are used both sides for the press roller. As the winding process begins the HNC 100 2-axis NC-control undertakes the task of positioning the roll onto the tube via synchronous control and then switches smoothly into force control. The increasing diameter of the paper roll increases the roller weight – the contact force therefore needs to be reduced continually to the same extent. The diameter-dependent force command values are transmitted flexibly from the master PLC via fieldbus to the HNC 100.

Clamping of the cores
Secure clamping of the individual cores for the reeling process is achieved through electrohydraulic control of the core chuck. The clamping cycle for this is programmed in the HNC 100 with NC sentences. One position- and one pressure controller switch over smoothly from one control mode to the other, when either closing or opening the core chuck.

Control valves Type 4WREE6 with integrated valve electronics reduce the wiring required.

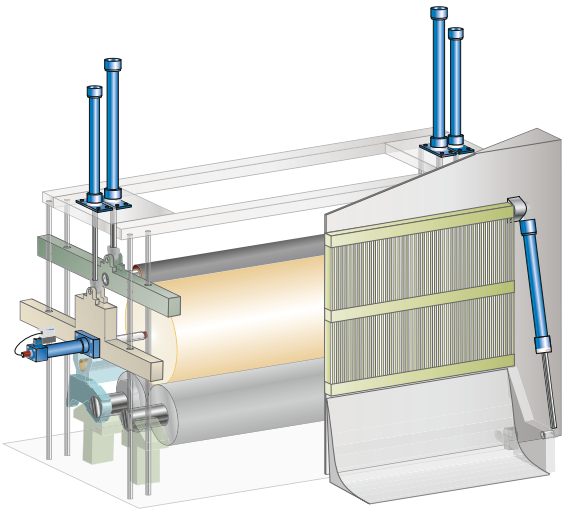


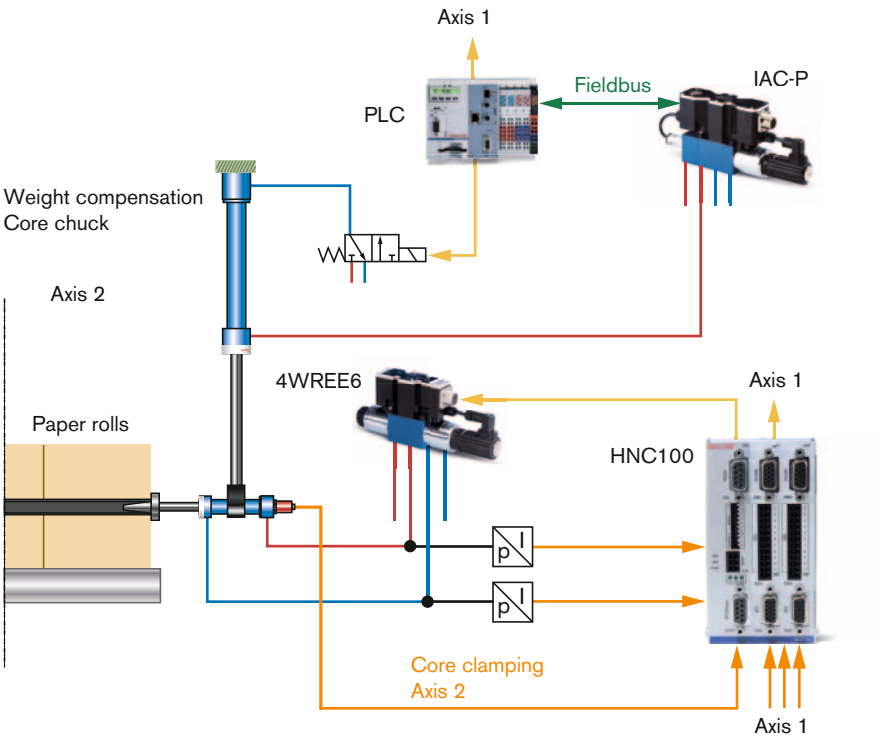
Weight compensation of the core chucks

To prevent overloading during the paper reeling operation, the intrinsic weight of the core chucks is hydraulically compensated. To this purpose the low-friction cylinders, which drive these during the roll change operation, are pressurized in compensation mode so as to virtually correspond to the intrinsic weight of the chucks.

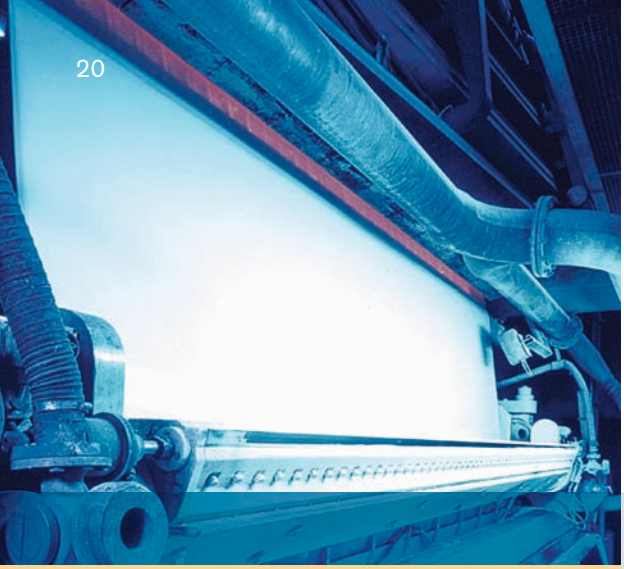
Rexroth developed the IAC-P for this specific task. In Q-operating mode it drives the cylinder proportionally to the adjustable Q-command value. On selecting operating mode p it regulates the required compensation pressure.

The integrated digital pressure controller and the pressure sensor make the IAC-P unique for its type. The p- and Q-command values can be specified as 4 – 20 mA-signal or via the fieldbus.





In slitter winders the paper is cut lengthwise to the customer's requirements and wound onto transportable rolls. This is effected by means of two drum rollers, for which Rexroth offers a comparable, complete drive concept with hydraulic press roll adjustment, core clamping and weight compensation of the core chucks.



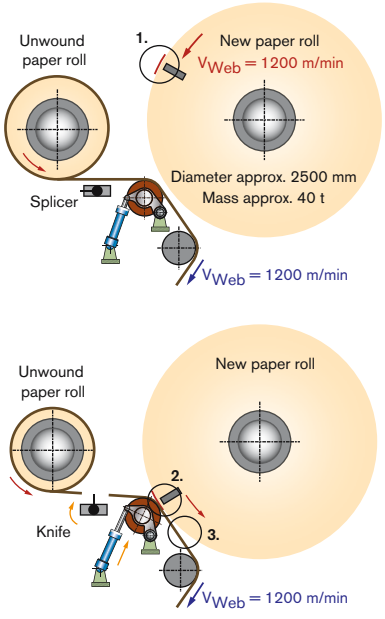
Paper Finishing: For Greater Precision and Reliability – The “Flying Splice”

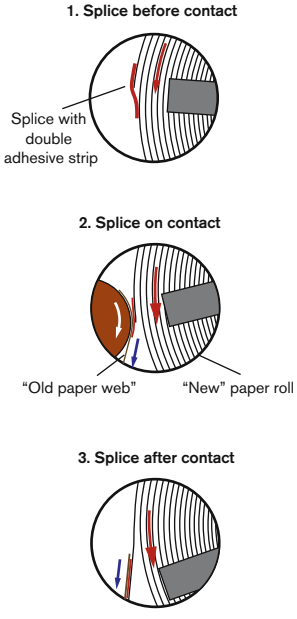
The “flying splice” from the end of the old paper web to the beginning of the new one – and this is at full web speed – constitutes a major challenge for the drive and control technology in coating machines. By using Rexroth solutions this process runs smoothly with precision, repetitive accuracy and reliability.

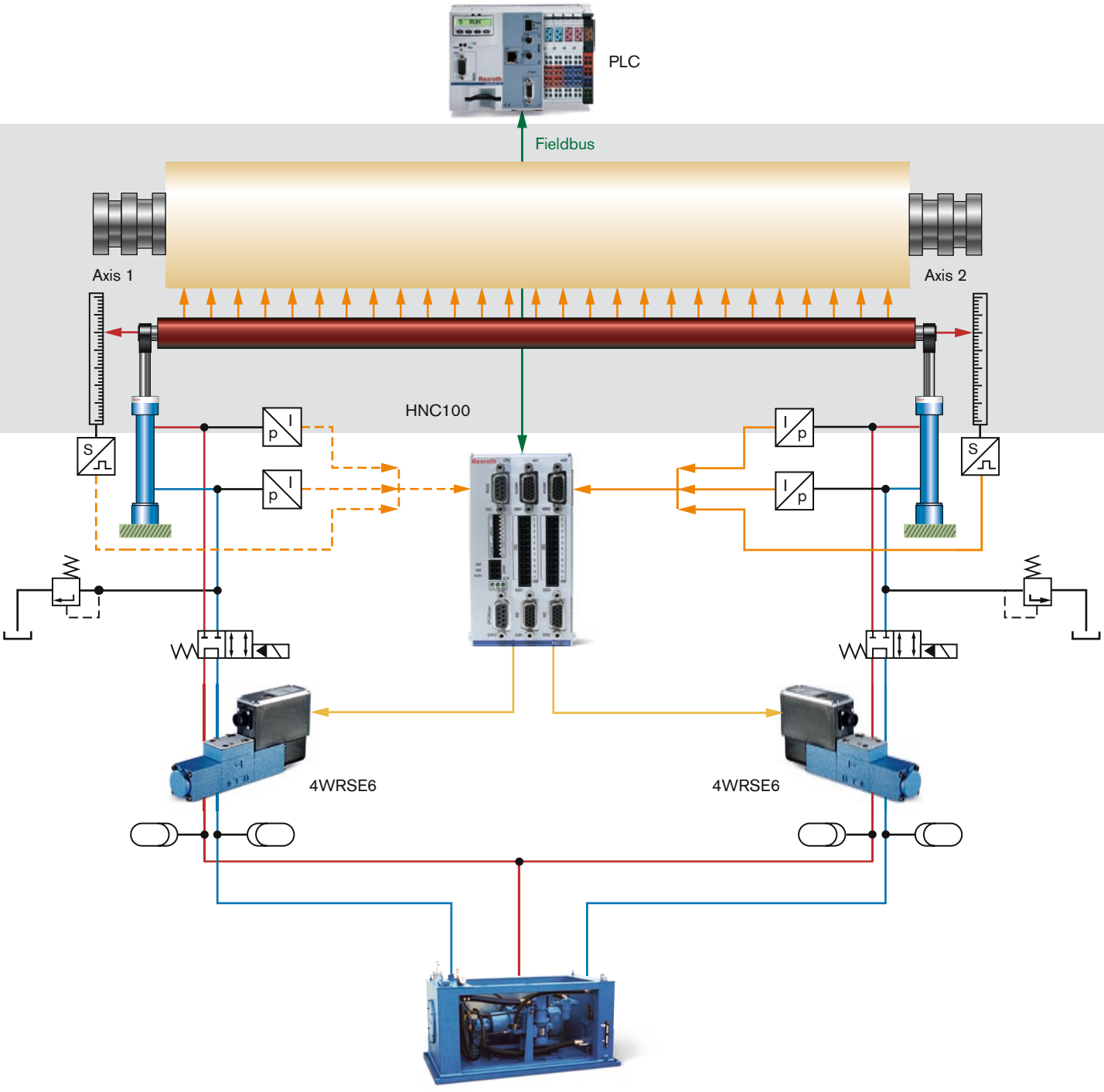
If the old paper web is separated, then a press roller has to join it to the new web using adhesive strips. The task of the electrohydraulics of the press roller here is as follows: the roll is brought into contact with the paper roll in synchronisation control and on contact and without excess force the specified force in both cylinders is precisely adjusted. In less than one second after start of the motion both roller drives must dynamically return the roller to prevent the paper web from fulling and thus damaging the paper.

An innovative electrohydraulic system of dynamic adjusting elements, combined with intelligent closed loop control technology coordinated with the hydraulics, is proving its outstanding performance capability in new machines, as well as in conversion projects, by a marked improvement in the quality and reliability of the process.

For the machine builder there is, over and above this, the possibility of combining standardized products with customer-specific software. In this way the benefits of standard solutions in the hardware are combined with the protection of customer-specific know-how.






PLC
Fieldbus
Axis 1
Axis 2
HNC100
4WRSE6
4WRSE6

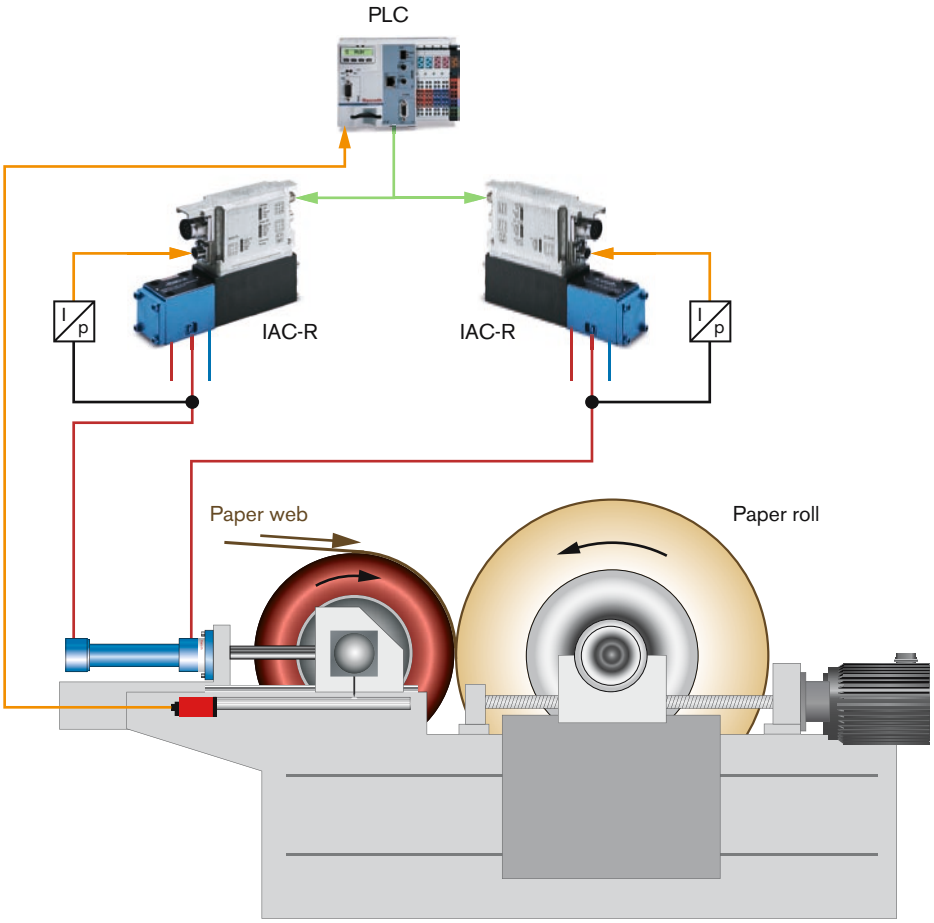
Paper Finishing: The Art of Reeling

As it is essential when reeling to prevent the paper web from going askew, or bubbles or creases forming and allowing air to be trapped in the rolls at the infeed, one of the most important processes in the roller is the control of the drum.

The paper is placed onto the reel by means of the press roller. During the reeling process the reel pulls back, with the paper web wound on, while the press roller presses the web, applying the specified force with two parallel cylinders. By using IAC-R axis controllers the linear force between press roller and paper roll is regulated precisely to the command value specified by the master control. The pressure differential in the cylinder chambers and the area ratio of the cylinders have to be taken into account here. The IAC-R axis controllers are operated both as pressure controllers and as dynamic proportional directional control valves. Depending on the command value from the master control, it can be determined during the process which needs to be activated – pressure control or position control with pressure reduction. When changing the paper rolls it is necessary to do a press roll run with synchronous monitoring.

Communication of the IAC-R with the master control is effected via a standardized fieldbus interface. This permits easy integration into the system and an exchange of command and actual values.

The press roller drive design permits extremely smooth and tautly wound paper rolls with diameters of more than 3,500 millimeters and masses of up to 150 tons.



Modernization: Better Than Ever Before

In addition to service and maintenance of existing systems Rexroth also offers modernization and conversion based on its own current, extensive branch know-how, combined with state-of-the-art technology.

Existing machines and systems with their obsolete drive technology are frequently no longer able to match today's requirements, yet they are capable of performance enhancement. Modernizing the drive and control technology makes the machines more productive and economic.

The performance spectrum can range from service and maintenance of existing systems right through to the conversion of electrohydraulic drives and their control systems. The reference list below gives some examples of conversion projects undertaken by Rexroth in recent years.

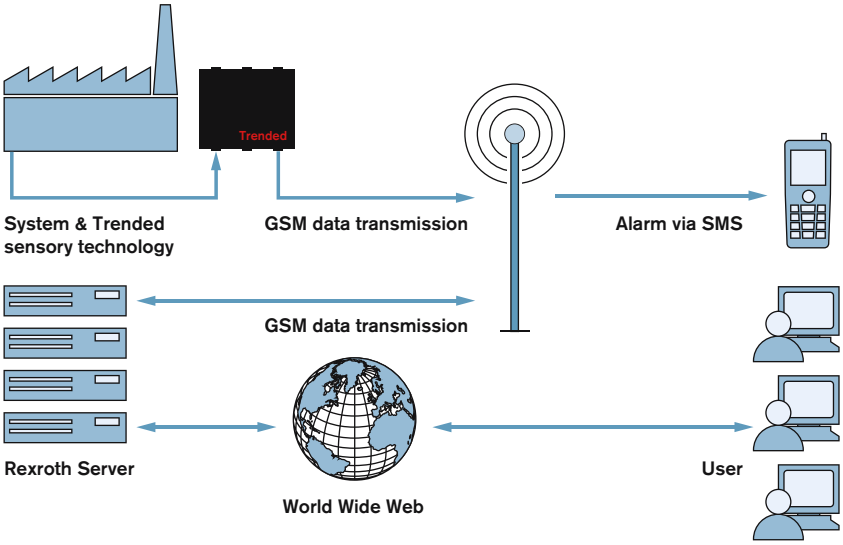
Rexroth references for modernization projects

Country	Customer	Project
Belgium	Burgo Ardennes	Splice roll drive
Germany	MD Albbruck	Calender sensomat drive
Germany	MD Albbruck	Calender control, S-roller and additional pressure
Finland	UPM Jämsänkoski	Super-calender drive
Finland	UPM Lappeeranta	Coating machine drive
Finland	Stora Enso Varkaus	Unwinder tensioning system
Finland	UPM Walki	Special calender drive
USA	International Paper	Roller transport drive
USA	International Paper	Calender roller drive
USA	International Paper	Wet press system
USA	BBA Nonwovens	Calender roller drive

Service: As Much as You Like!

Condition Monitoring
Machine data is received, transmitted and evaluated via Trended, the special data capture and evaluation system from Rexroth. This means that servicing and maintenance work is condition-oriented and is only undertaken when required. By using current status information available online to machines and drives, the service life can be utilized to the maximum without breakdowns resulting in unplanned downtime.

Modular and made-to-measure – from one-off service through to complete package
Anyone wishing to manufacture economically must be sure that the machines and systems are always operating optimally. Only this way can productivity be exploited to the maximum and downtimes reduced. With Rexroth all the technical services required are obtained from a single source, with a single point of contact. This can range from one-off jobs, such as servicing, maintenance or repair jobs, customized modular combined services, such as customer-specific repair and spare part concepts, right through to complete packages with a service station situated on your own premises.



Intelligent Hydraulics in New Dimensions

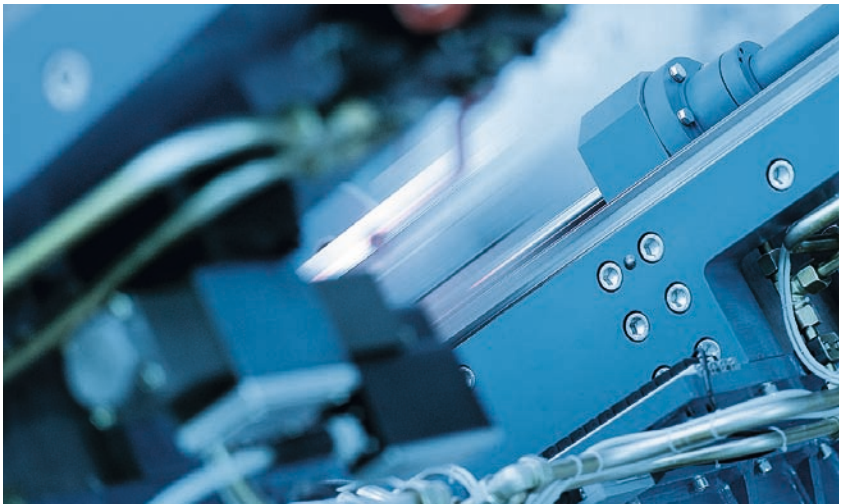
Whether it's a case of raising or lowering loads smoothly, undertaking linear or rotational movements, achieving even acceleration or accurate positioning, maintaining preset speeds, transmitting power or linking motion sequences – in fact, wherever economical power is required, this is where hydraulics comes into its own.

Rexroth is technology and market leader in industrial hydraulics with an extensive product program and proven applications know-how. With the widest selection of hydraulic products in the world, Rexroth will provide you with standard products, application-orientated systems and customized solutions of the highest quality. Furthermore, with the aid of the latest microelectronics, Rexroth has made hydraulics even more powerful than ever.

Rexroth is the ideal partner if you want to develop highly efficient machines and production facilities – from the first point of contact right through to commissioning and across the complete life cycle. Teams operating worldwide will take on the complete project design work of your systems, even producing a turnkey solution if required.

Whether it's competent support on the telephone, urgent repairs or supply of spare parts, or a callout by one of our engineers – whichever service you require, experienced personnel and a worldwide service network will guarantee that the problem is swiftly solved.

Using hydraulic drive and control technology from Rexroth will help you become more competitive than ever.



The Drive & Control Company
Rexroth is unique. No other brand on the world market can offer its customers all drive and control technologies, both on a specialized and integrated basis. We are considered to be the worldwide benchmark when it comes to drives, controls and motion. Our technological leadership is continually setting us new challenges, with approximately 30,000 employees in more than 80 countries around the world. This is possible thanks to an infrastructure designed with partnership and customer proximity in mind.

As a company Bosch Rexroth can look back on more than 200 years of tradition. As a wholly owned subsidiary of Robert Bosch GmbH, we are part of a globally operating technology group. All this is both our drive and our commitment. And it is unique – just like Bosch Rexroth. The Drive & Control Company.

Electric Drives and Controls

Hydraulics

Linear Motion and Assembly Technologies

Pneumatics

Service

Rexroth
Bosch Group

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr, Germany
Phone: +49(0)9352/18-0
Fax: +49(0)9352/18-1638
info.bri@boschrexroth.de
www.boschrexroth.com

Printed in Germany
RE 09957/10.07