

When You Need Action – Drive and Control Systems for Telescopic Handlers

The Drive & Control Company



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Telescopic handlers are very versatile machines. A great deal is expected from them: they should be comfortable, flexible, reliable, powerful and maneuverable – While being as economical as possible they must lift their load and extend and tilt their arm all in one simultaneous motion. What's more, these actions must be precise and smooth, guaranteeing optimal fuel efficiency and maximum safety. Ergonomics is also critical providing user-friendly controls, comfortable ride and the machines must be environmentally friendly. Here at Rexroth, we have set our goals high in order to optimize telescopic handlers in their various operation with our all-embracing solutions.



Solutions don't grow on trees

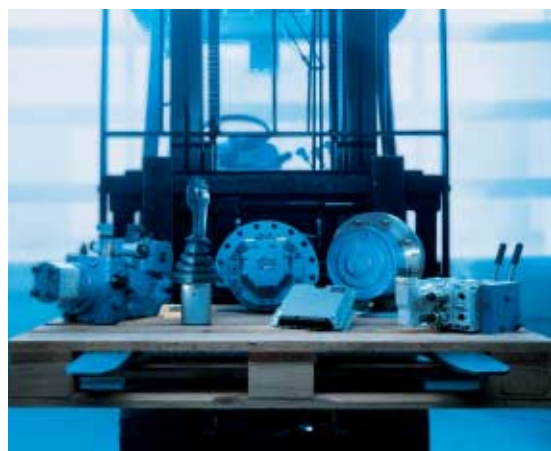
"It's enviable how some expert operators deal with the materials they are working with." Thoughts like this occur almost spontaneously when you observe an experienced farmer handling straw, for example. For him, strength, precision and flexibility seem to pose no problem. And perhaps you then think: "If only a telescopic handler could work like that..." In short, it doesn't matter where you get your ideas from. What's important is that you entrust your ideas to someone who can put them together and make them reality.



And where do you get your best ideas?

Developing a drive and control system
with Rexroth.





Good ideas belong in good hands

You're no longer alone with your idea. It's in good hands with the specialists at the Rexroth telescopic handler application center. This is exactly the right place for trying out, further developing, proving and implementing innovative concepts. Whether it's travel drives, braking systems or working hydraulics – the experts at Rexroth will get to the bottom of it all. That's why we have our own telescopic handler as a flagship for our technology. Your idea is now in fertile soil, growing rapidly and tended by expert hands – just like the hay that originally inspired you.

Top technology relies on trust

Your idea is approaching its goal. The harvest has not yet been brought in, but it won't be long. All those involved have thought hard and discussed their thoughts. This creates an atmosphere of trust. And that's important, for this certainly simplifies complicated development and decision-making processes – processes that can only take place because the application experts and development engineers at Rexroth get completely involved with their customers and their goals. This, too, is an indispensable part of putting ideas into practice at Rexroth.

Certainty grows with experience

The process continues. Solutions are acted out and sketches turn into plans. Just like a seed that grows with the right treatment. How lucky that you can rely on the combined expertise of Bosch and Rexroth! For the knowledge arising from a unique product range of hydraulic drives and controls and our experience with vehicle electronics provide additional certainty. Add to that the fact that many of the results achieved by our Rexroth specialists are complete system solutions that frequently set new standards.

No reason to panic: our tests

The tension mounts. Can the idea really be put into practice? Will it withstand testing? The support provided by Rexroth also includes the answers to these questions. On our own test stands and under defined conditions, our Rexroth experts can give your telescopic handler an all-round check. We certainly have enough experience of such tests. Indeed, our own telescopic handler, as our technological test model, is constantly being further developed. Testing takes place using state-of-the-art measuring technology and including a wireless local area network (WLAN). For a tilled field must also be able to withstand the storm. And telescopic handlers have to withstand a great deal more...

Continued at the end of the brochure.

Solutions from Rexroth
for all the Subsystems of a Telescopic Handler

Steering and control

Fan systems

Electronics; hardware and software

Travel drive

Working hydraulics

Braking systems

Our comprehensive product range enables us to meet any form of challenge with the perfect solution. This is because the range includes every conceivable kind of hydraulic drive and control, as well as both the hardware and software for all the electronic open and closed-loop control systems.

Driving – or How to Get Your Telescopic Handler in Motion

The hydrostatic travel drive is the advanced drive system for telescopic handlers. Even in higher performance classes and speeds. This exhaustively tried and tested technology is continually being further developed and proven on Rexroth's own test handler. In addition, Rexroth offers further technology for a comfortable ride: the stabilization module for suppressing pitching vibrations that telescopic handlers often see at higher speeds.

Few if any switching steps. The large shift range allows driving to be smooth and controlled. Additional advantage: this in turn allows simpler and therefore cheaper transmission solutions.

High performance even at low diesel engine speeds. This delivers high tractive forces while reducing operating costs and fuel consumption.

Faster to respond, more maneuverable. Simple, fast, smooth reversing and full torque in both travel directions with no reversing transmission.

Optimum distribution of power between travel drive and working hydraulics. Any power that is not required on one side is made available to the other consumer.

Less switching. Simplified operation leaves you free to concentrate on the essentials

Power exactly where it's needed. The highly efficient drive provides maximum traction when it's needed – when driving in heavy soil, for example.

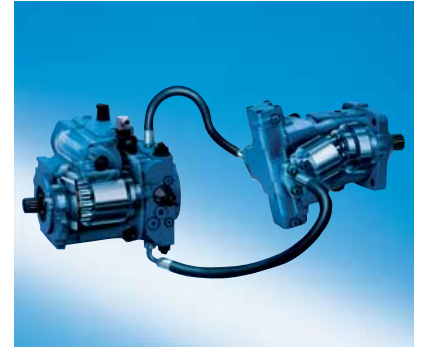
Low heat development in operations involving high tractive force and low speeds.

Installation wherever you wish. With a hydrostatic travel drive you can locate the diesel engine wherever there is sufficient space, since hoses are easier to route than drive shafts.



Hydrostatic travel drive to telescopic handlers up to approx. 60 kW

The system price and size of components are the determining factors with compact telescopic handlers. Optimum solutions make the best possible use of the available power from the diesel engine. One possibility is the A4VG reversible variable displacement pump in conjunction with DA control and A6VM variable displacement motors. Together these produce perfect, high torque and high travel speed throughout the large, common control range. The drive pump and necessary valves for the closed circuit are already integrated.



Find further details at

www.boschrexroth.com/axial-piston-pumps and www.boschrexroth.com/axial-piston-motors

DA control – user-friendly travel drive with load limiting control

The tried and tested, engine-speed-dependent DA drive control makes driving as easy as if you were driving an automobile with automatic transmission. The DA control ensures that the pump power is matched perfectly to the available engine power. The continuous, speed-dependent buildup of torque gives the teles-

copic handler precisely metered but powerful traction in all speed ranges. The hydro-mechanical pump controller, which operates completely independently, significantly simplifies integration in the vehicle.

Find further details under www.boschrexroth.com/da-control

Hydrostatics and manual transmissions for telescopic handlers of all performance classes

When powerful traction forces and high driving speeds count, the shift range of the hydrostatic transmission can be enlarged by the use of mechanical manual transmissions. And especially comfortable gearshifts are achieved by integrating the shift mechanism – together with electronically controlled travel drives – in the overall control concept. Rexroth can also supply electronics application packages comprising robust control units RC, sensors and turnkey software solutions. In this way, an electronic travel drive control DRC can be achieved rapidly and inexpensively, and can readily include power shift, cruise control and speed limitation.

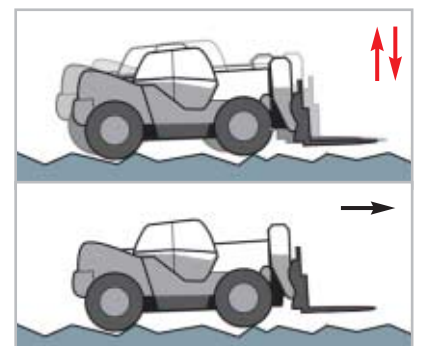


Find out more about our electronics solutions on pages 18–19

Stabilization module for a comfortable ride

You won't get shaken up, thanks to Rexroth's new-generation RSM stabilization module. This reduces pitching independently from the travel drive. The advantages for you:

- Faster transport speeds
- Improved work output
- Greater driving safety
- Shorter braking distances
- Reduced stress on driver and machine



Find out more at

www.boschrexroth.com/mobile-valves

Steering and Braking – or How to Get a Grip on your Telescopic Handler

Easy steering is an absolute essential for manipulating a telescopic handler safely and efficiently. The simultaneous lifting, extending and tilting of the arm must take place swiftly and precisely. Here, finely metered braking movements are particularly vital. For only in this way can the workplace of the telescopic handler be a safe, comfortable environment.



LAG steering units



A10VVO emergency steering pump



LT 31 brake valves

In the LAG steering unit from Rexroth you have what is probably the most versatile steering system on the market. Its large number of variants enables it to be matched perfectly to the vehicle. Whether open-center or closed-center, with standard or special emergency steering functions – we have the right module for every possibility. All versions officially approved and successfully tested thousands of times. Optional Rexroth steering sensors on the steering column or on the steering unit reliably combine steering and electronics. And to ensure that legal requirements are met, very heavy telescopic handlers are additionally equipped with the A10VVO emergency steering pump or the EHP compact power unit.

The LT 31 inch brake valve which, like many other Rexroth power brake valves, has a proven track record and a modular, compact design, provides a smart combination of diesel-engine braking via the travel hydraulics and delay via the friction brake. When the brake pedal is pressed, the hydraulic pump reduces the flow rate from the travel drive. Braking thus takes place using the diesel engine's support torque. Only if the pedal is pressed harder does the brake valve ensure that the mechanical friction brake is applied. A trailer-brake valve for actuating the trailer brake also forms part of the Rexroth range.

Advantages of hydraulic power-brake systems

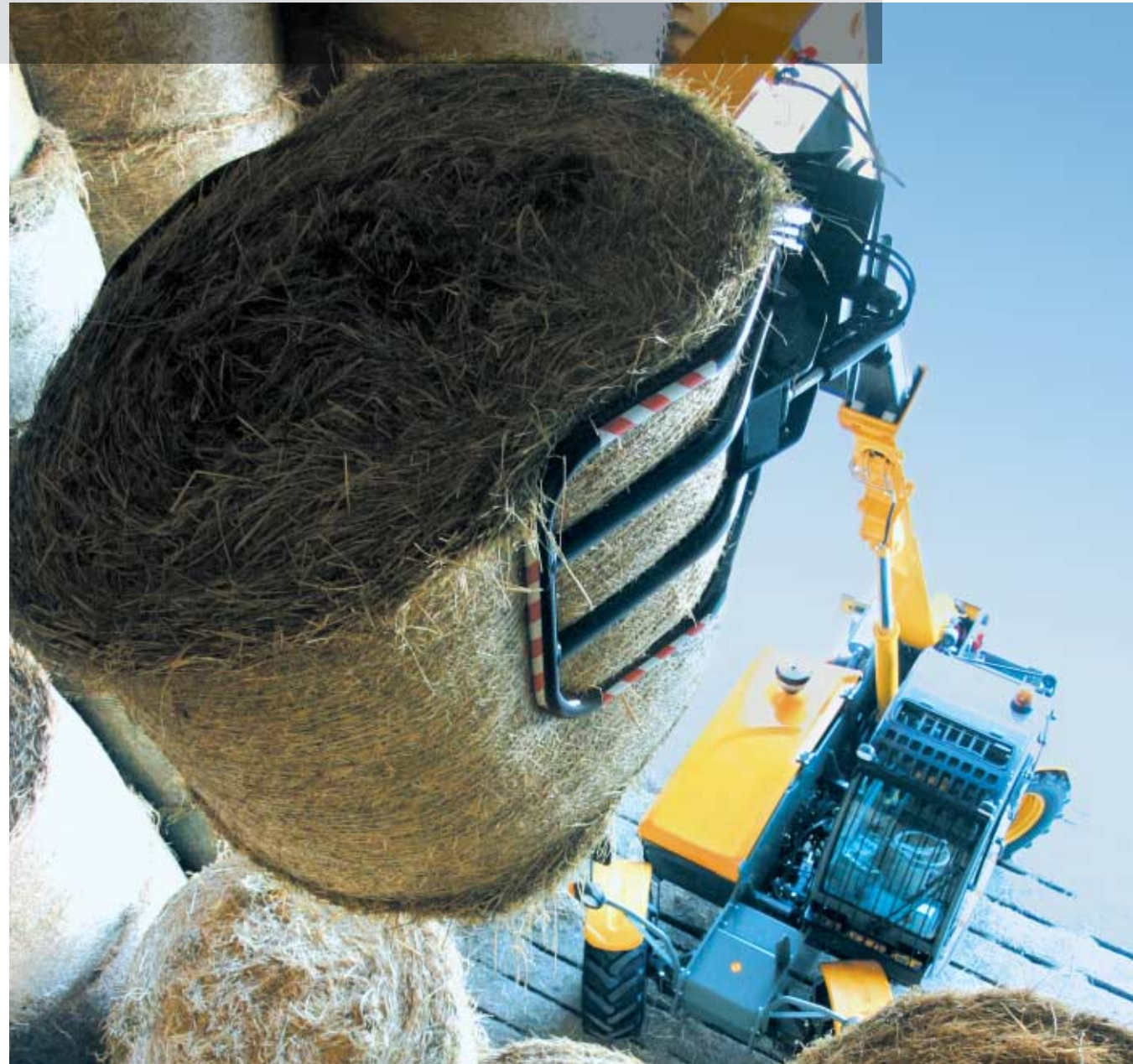
- Supplied from the existing hydraulic system
- Brake system ready immediately when the diesel engine is started
- Highly sensitive regulation of the brakes, even in heavy machines
- Quick response time
- Space saving thanks to modular design
- Minimal pipework required due to compact design (pedal and all brake components combined in a single block)

Find out more at www.boschrexroth.com/power-brakes and www.boschrexroth.com/power-steering

Working Hydraulics – the Ups and Downs of Your Telescopic Handler

The working hydraulics in your telescopic handler face numerous challenges – regardless of whether these are basic functions or the complex requirements of your top-of-the-range model. Rexroth is ready for all these challenges. No matter which size and type of handler, no matter what functional scope. And everything already optimized in our own telescopic handler test model, and then adapted perfectly to your prototype.

For the working hydraulics, too, the criteria of sensitive positioning, work output, safety and ease of operation are becoming increasingly important. This means new challenges in the development of new working hydraulics systems. Alongside conventional systems – gear pump with mechanical throttle control – other increasingly user-friendly technologies with many useful additional functions are being developed: variable displacement pumps combined with sensitive, load-pressure-independent flow distribution (LUDV technology) from Rexroth enable the supply to several simultaneously actuated work functions to be matched to demand, all with minimal fuel consumption.



From small but powerful...



AZP gear pump

The so-called open-center working hydraulics are perfect for less expensive telescopic handlers. They encompass tried-and-tested technology for economic but robust solutions. This system is



SM12 throttle control block

based around AZP gear pumps combined with the SM12 control block. The advantages of this system are its simple layout, compact design and the ease of adding further functions later on

...to the top performance version...

Three central elements make up this high-convenience system: pump, valves and control. But it's knowing how these different areas interact with each other that determines how well they perform in practice.



A10VO variable displacement pump for open circuit

The A10VO variable displacement pump offers a great number of control options for optimizing energy consumption – such as pressure and flow control with higher-level power regulation or electro-proportional swivel-angle adjustment. This pump is attached directly to the travel pumps or the diesel engine's power take-offs.

The SX and M6 valve systems form the basic unit of high-quality flow sharing technology for various different types of telescopic



LUDV control block SX14

handlers. In addition to load-pressure-independent regulation of the flow, which enables more than one simultaneous working function to be supplied according to demand, it offers a range of advantages: the integrated priority control for the steering and the integrated control oil supply reduce the amount of pipework. An integrated shut-off valve ensures that the control oil supply is stopped in dangerous situations.

...we've always got a grip.



Sensitive TH and THE joysticks, ergonomic handles EC2000+ and EC4000

The hydraulic and electronic joysticks TH and THE with ergonomic handles EC2000+ and EC4000 make everyday use of the telescopic handler easier and more effective: up to four functions at once can be proportionally controlled by one joystick. Low actuating forces and proportional control behavior permit sensi-



Pilot oil supply system MHSTE

tive control, while various performance curves ensure optimum matching to the working hydraulics. Lock-in positions and reference positions for identifying working points greatly simplify the driver's work. What's more, additional switches, slides and buttons can be incorporated in the joysticks.

Find out more at
www.boschrexroth.com/control-blocks and www.boschrexroth.com/joysticks

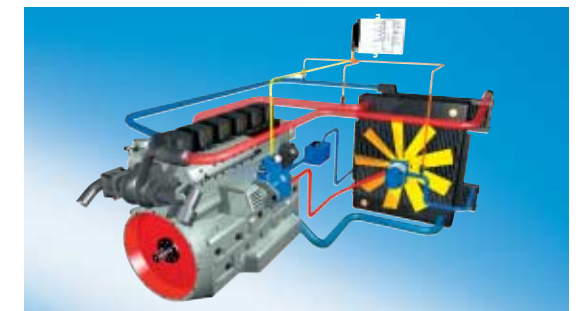
Fan Systems – or How to Avoid Getting in a Spin

Ventilation. This means spending further energy for already lost energy. That's inefficient. And yet another reason to entrust this matter to our Rexroth experts for fan systems. They will ensure that the expense of energy is kept within limits and the ideal solution is found for every size of telescopic handler.



Hydrostatic fan drives allow flexibility when it comes to the layout of the cooling system in the machine. Moreover, they guarantee infinite adjustment of the fan irrespective of the engine speed. Regulation can be either purely hydraulic or electronic – Rexroth offers both. This also includes complete software solutions based on Rexroth electronic control units. This wide range of proven standard modules enables fan systems to be developed quickly and cost-effectively.

From sensors through electronic and mechanical controllers to pumps and motors – Rexroth can supply the right fan system for any type of telescopic handler, whether simple or complex.



Find out more at www.boschrexroth.com/fan-drives

Electronic Management System – or How Your Telescopic Handler Organizes Itself

Traction control, load limiting control, automatic gearshift, electronic parallel fork guidance – these are just a few of the elements of a modern vehicle control system for telescopic handlers. Rexroth has worked in close cooperation with Bosch to produce a comprehensive range of electronic hardware and software, specially developed and tailored for hydraulics and the rugged conditions encountered on construction sites and in agriculture. Where could you find a greater collection of expertise in vehicle electronics and drive management than at Bosch and Rexroth?

The Rexroth hardware module

Electronic hardware in wheel loaders has a lot to endure: vibration and shock up to 25 g, temperatures ranging from -40°C to $+85^{\circ}\text{C}$ (-40°F to 185°F), not to mention dust, gritting salt, mud and electromagnetic radiation from the neighboring transformer station. It must therefore prove in the Bosch laboratories that it can withstand these demands long-term and according to standard test procedure. This is why we carry out production ourselves. Our hardware is manufactured on highly automated production lines at Bosch plants. And all this with maximum flexibility in the application. You will only get this from Rexroth. The Rexroth hardware module incorporates all the components for the electronic control of a telehandler.

- RC control unit for 2 to 12 proportional solenoids and 2 to 18 switching functions, with Rexroth I/O modules virtually expandable as required. Moreover, the protection class is IP65 and IP69K.
- Sensors for measuring engine speed, direction and angle of rotation, pressure, temperature and oil cleanliness.
- One of the few displays for tough outdoor use with protection class IP69K can be found at Rexroth – the DI2. Of course, it is CAN-bus compatible and can even be operated safely with gloves.



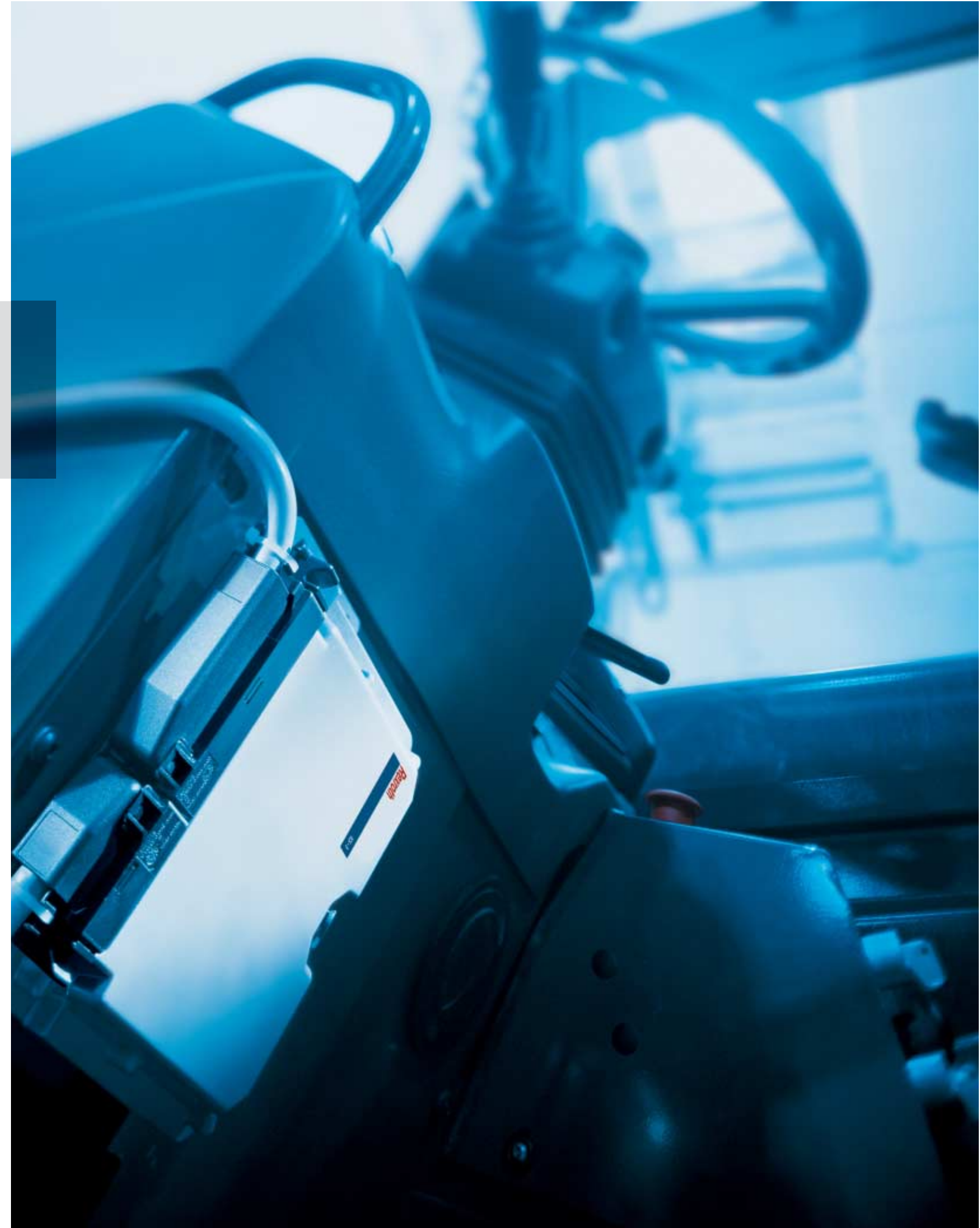
The Rexroth software module

Turnkey, affordable software solutions that can be adapted to your telehandler without any programming skills: This is exactly what we can provide you, upon request extended by individual software customizations or even tailor made software solutions according to your specs. All software packages will have been tested, trialed and provided with detailed operator instructions to enable quick and simple integration. The user-friendly service software is, of course, also included. We supply the most important basic and supplementary modules for your modern telehandler off the shelf in the form of standard software packages:

- DRC Drive control
- AGS Automatic gear shifting
- ASR Anti-slip control
- EDP Electronic drive pedal
- ADC Automotive drive control
- ECO Ecodrive
- LLC Load limiting control
- AFC Automatic fan control



Find out more at www.boschrexroth.com/mobile-electronics



Services – or Why we Don't Leave you All Alone with your Telescopic Handler

Down-time is lost time. For this reason, service and after-sales support are gaining in importance. We at Rexroth ensure that your telescopic handler remains in use for a long time. To do this, we place our mobile hydraulics service, your competent, flexible and experienced partner for all aspects of drive and control solutions for telescopic handlers, at your disposal. At over 80 sites around the world. So Rexroth's unique product range comes hand in hand with expert advice and comprehensive service that leave nothing to be desired.



Service



We offer a comprehensive range of services for making the crucial moment a successful moment:

- Engineering support provided by a specially trained field service team
- Acceptance testing of new projects
- Commissioning of systems and equipment
- Tests and trouble-shooting as service support

Repairs



The replenishment of supplies says a great deal – if not everything – about the quality of an efficient partner. We offer:

- Rapid and reliable repairs and modifications
- An international network of modern repair workshops with qualified personnel and online access to the latest design data
- On-the-spot repair by our field technicians
- Warranty as for new parts
- Remanufactured parts system

Spare parts service



This Rexroth service is known for its prompt and skilled response:

- Quality original spare parts
- Pre-assembled subassemblies and kits
- Well-developed, international logistics system
- Spare parts even after a series has been discontinued

Training and consultancy



The more knowledge you have, the more you can make a difference – this statement sums up our basic and advanced training courses in mobile hydraulics.

At www.boschrexroth.com/mobile-seminars you can find out about courses currently on offer.

Just before the starting line – your telescopic handler



Your telescopic handler is now ready. The starting pistol is about to be fired. All those involved now have a few exciting weeks ahead of them. How will the prototype prove itself in practice? The commissioning procedure is exciting – and time-consuming. To ensure that all goes well and no unpleasant surprises occur, we monitor this phase with the utmost care and attention. Always ready to provide and implement solutions when necessary.

Always at the starting line – Rexroth

We're now entering the decisive phase. But you can be sure – even now in the last few seconds – that Rexroth's experienced commissioning engineers are on hand. And not just anywhere, but at your premises. As a global player with service and production sites in more than 80 countries, we are always close by when you need us. In other words: whenever you come up with a good idea for your telescopic handler, we won't be far away. Just talk to us.



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