WHITEPAPER

Evolution MOTION SOLUTIONS

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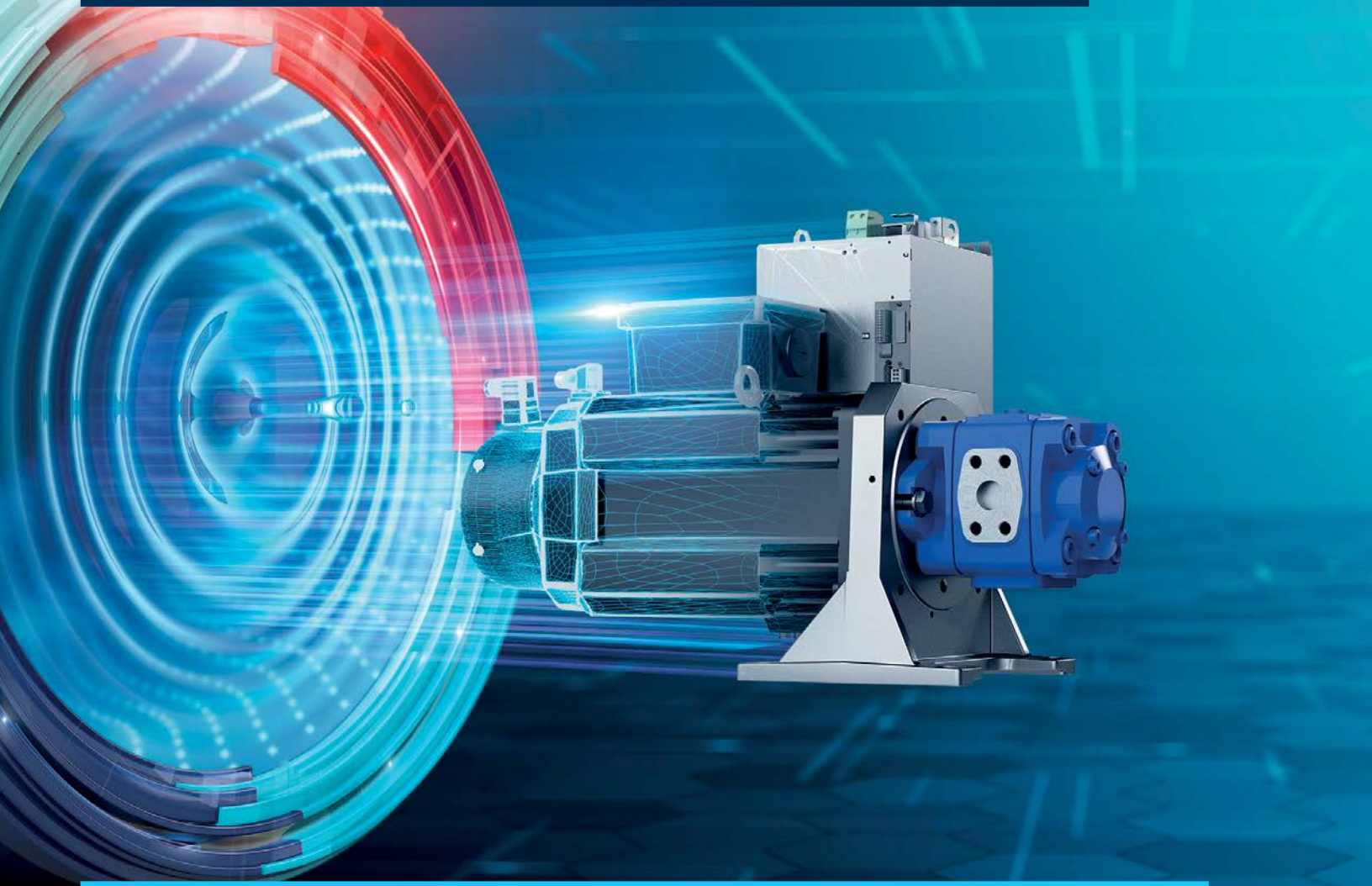
On-Demand Hydraulics



Leveraging Frequency-Controlled Pump Systems for Efficiency and Performance

As industrial energy costs rise and demand for quieter, more compact machinery grows, the inefficiency of traditional constant-speed hydraulic power units (HPUs) has become a primary target for optimization. This whitepaper details the technical advantages and practical applications of modern frequency-controlled pump drive systems, as exemplified by the Bosch Rexroth Sytronix 5020 platform. We will examine how these systems, which combine a variable frequency drive (VFD), specialized control software, and high-efficiency pumps, deliver on-demand hydraulic power. This approach significantly reduces energy consumption, lowers noise emissions, and enables more compact machine designs, offering a compelling alternative to legacy HPU architectures.

THE INEFFICIENCY OF THE FIXED-SPEED MODEL

A conventional HPU is designed for a single operating point: maximum flow at maximum pressure. The induction motor runs continuously at a fixed speed, and a pressure relief or pressure compensator valve manages the output. In any state other than peak demand—such as pressure holding, partial load, or idle—this architecture is inherently inefficient. Excess hydraulic flow is converted directly into heat as it passes over the relief valve, representing wasted energy that must often be removed by a costly cooling system. This continuous operation also contributes to constant noise levels and accelerated wear on mechanical components.

THE SYTRONIX 5020 SOLUTION: INTELLIGENT ON-DEMAND CONTROL

The Sytronix 5020 platform fundamentally changes this paradigm by decoupling the motor speed from the line frequency. The system consists of three core elements:

- The EFC 5610 Frequency Converter: A robust, compact VFD that provides variable speed control to the motor.
- Application-Specific Firmware (FcP/SvP): Specialized Rexroth software that contains the intelligent control logic for hydraulic systems.
- A High-Efficiency Pump: Typically a quiet and durable internal gear pump.

The system operates in a closed loop. A pressure sensor in the hydraulic circuit provides real-time feedback to the EFC 5610 drive. The Sytronix firmware then compares this actual pressure to the command pressure and instantly adjusts the motor's rotational speed. If the system requires more flow to maintain pressure, the motor speeds up. If the system is holding pressure and requires minimal flow, the motor slows down to a near stop. This ensures the pump generates only the hydraulic power that is immediately required, virtually eliminating the energy losses common in fixed-speed systems.

TANGIBLE ENGINEERING AND OPERATIONAL BENEFITS

- Energy Efficiency: By matching output to demand, energy savings of 30% to 80% are achievable compared to constant-pressure systems. This reduces direct operating costs and lessens the carbon footprint of the machine.
- Noise Reduction: Hydraulic noise is largely dependent on motor speed. By operating at lower average speeds, the Sytronix 5020 system dramatically reduces noise emissions, contributing to a safer and more comfortable work environment. When paired with internal gear pumps, the system is particularly quiet.
- Compact Machine Design: The Sytronix 5020 platform uses the EFC 5610 drive, which has approximately 40% less surface area than its predecessors. This allows for smaller, more cost-effective electrical cabinets and frees up valuable floor space.
- Simplified Commissioning and Maintenance: The system is designed for "universally simple" and fast start-up. Using the intuitive ConverterWorks software or the onboard Mini-USB port, technicians can easily parameterize the drive and perform firmware updates. This reduces engineering time and simplifies maintenance workflows.
- Enhanced Connectivity: As a modern solution, the Sytronix 5020 replaces legacy systems that lacked modern bus communication. With optional Multi-Ethernet capabilities (including Ethernet/IP, Profinet, etc.), the HPU can be seamlessly integrated into today's smart factory control networks for enhanced diagnostics and control.

The shift from constant-speed to on-demand, frequency-controlled hydraulic systems represents a significant step forward in industrial machine design. The Bosch Rexroth Sytronix 5020 platform exemplifies the benefits of this approach, delivering a solution that is not just more energy-efficient, but also quieter, more compact, and easier to integrate. It provides machine builders with a powerful tool to create more competitive, sustainable, and cost-effective machinery without compromising on the reliability and power of Rexroth hydraulics.

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