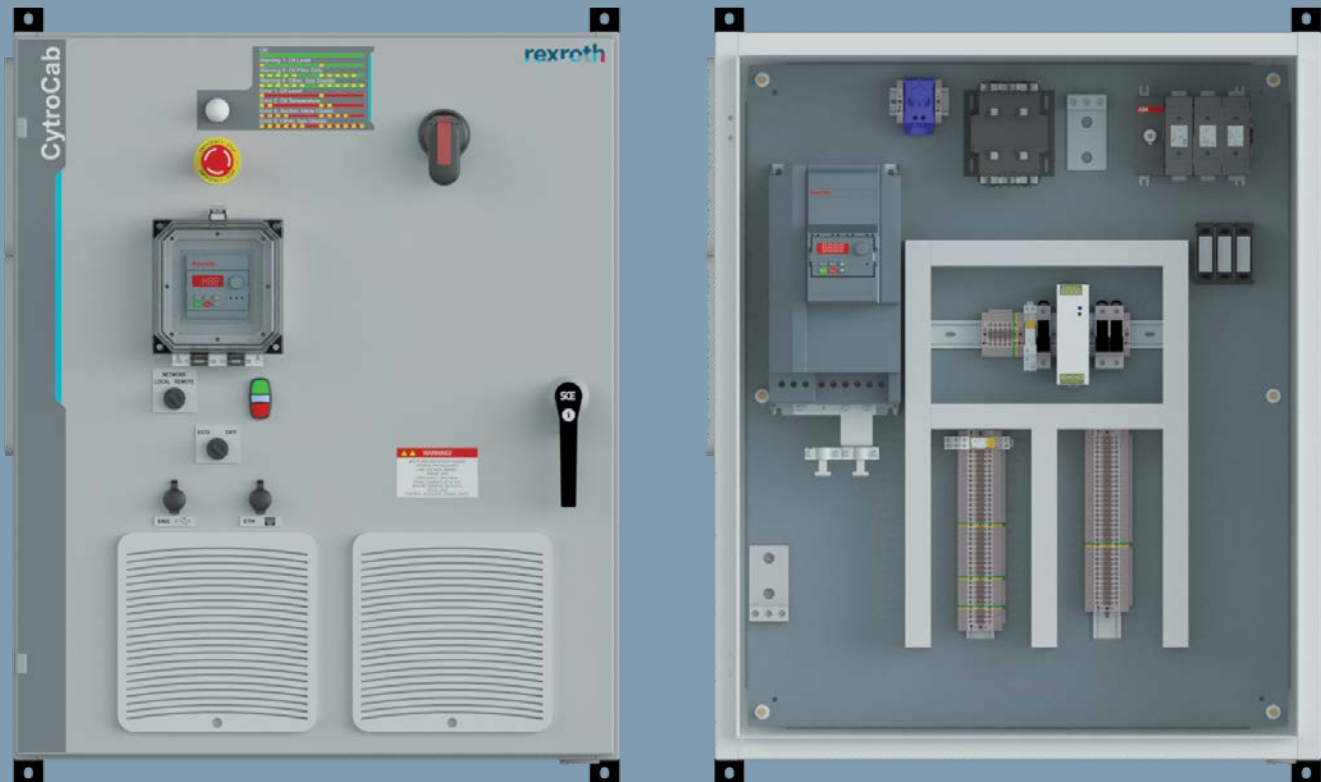


The Shift to Standardized Efficiency: How Pre-Engineered VFD Solutions are Accelerating Hydraulic System Design



An examination of the CytroCab packaging program, which combines the intelligence of Sytronix VFD technology with the speed and reliability of a standardized, ready-to-integrate solution.

For decades, the design of hydraulic power units (HPUs) has been dominated by the “Engineered to Order” (ETO) model, a process that offers high levels of customization but is often accompanied by long lead times, complex quoting, and significant engineering overhead. As market pressures demand faster machine delivery and greater operational efficiency, a new approach is required. This whitepaper details the technical and commercial advantages of pre-engineered, packaged Variable Frequency Drive (VFD) solutions, as exemplified by the Bosch Rexroth CytroCab program. By standardizing the packaging of industry-leading Sytronix VFD technology, CytroCab drastically reduces lead times, simplifies integration, and delivers immediate energy savings, noise reduction, and enhanced pump protection right out of the box.

THE TRADITIONAL CHALLENGE: THE HIGH COST OF CUSTOMIZATION

In the traditional ETO process for building a VFD-driven HPU, the engineering journey is bespoke for nearly every project. It involves a sequence of time-consuming tasks:

- **Component Selection:** Sizing and selecting an appropriate VFD, enclosure, line-side protection, and cooling system.
- **Panel Design & Layout:** Creating custom schematics and panel layouts to accommodate the chosen components.
- **Sourcing & Procurement:** Managing multiple purchase orders for components from various vendors.
- **Assembly & Wiring:** Dedicating skilled technician hours to assemble the panel, wire the components, and ensure compliance with electrical standards.
- **Testing & Validation:** Performing functional tests to validate the custom-built assembly.

While this process provides a high degree of flexibility, it inherently introduces variables that extend project timelines and increase costs. Every custom panel is effectively a new product development cycle, consuming valuable engineering resources that could be focused on core machine innovation.

A PARADIGM SHIFT: PRE-ENGINEERED STANDARDIZATION

The CytroCab program represents a fundamental shift in this paradigm. The core principle is to package the most common and requested drive configurations into a standardized, UL508A-practiced, NEMA 12-rated enclosure. This approach moves the VFD solution from a custom component to a configurable, standard product.

The benefits of this shift are immediate:

- **Reduced Lead Times:** By using our pre-engineered CytroCab configurations, delivery times are shortened from months to weeks.
- **Simplified Ordering:** A clear, modular model code replaces complex quoting. Specifying a complete VFD solution becomes as simple as selecting a base size and adding required options.
- **Reduced Engineering Overhead:** The need for in-house panel design, component sourcing, and validation is eliminated, freeing up engineering teams to focus on higher-value tasks.
- **Guaranteed Quality & Reliability:** Each CytroCab is a factory-assembled and tested Rexroth product, ensuring a level of quality and consistency that is difficult to replicate with one-off custom builds.

THE ENGINE OF EFFICIENCY: SYTRONIX PUMPING SOFTWARE

At the heart of every CytroCab is the EFC 5610 VFD, powered by specialized Sytronix pumping software. This is not a general-purpose motor drive firmware; it is an intelligent control system specifically designed for hydraulic pumps.

On-Demand Power for Energy Savings

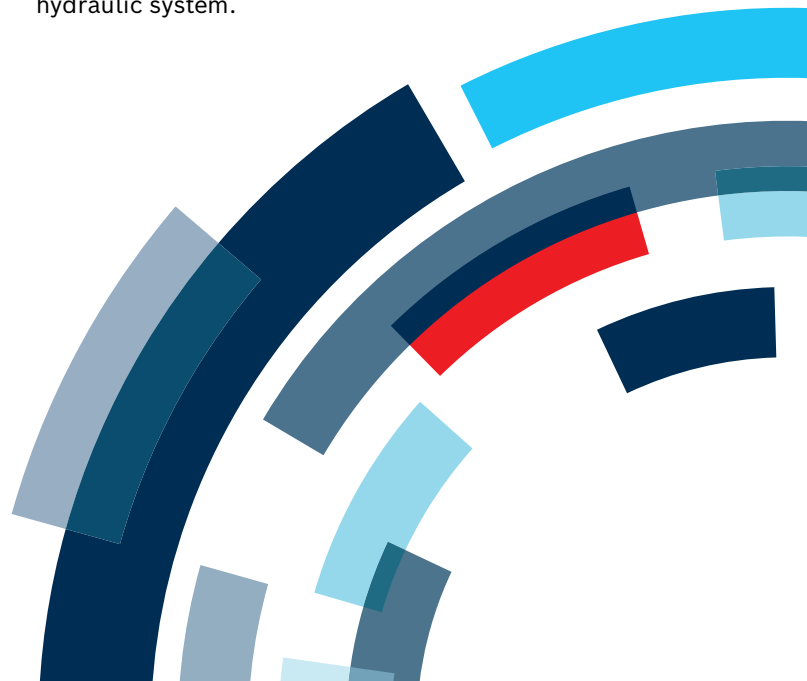
Traditional fixed-speed HPUs run the motor at full speed continuously, regardless of the hydraulic demand. A significant amount of energy is wasted as fluid is passed over a relief valve during low-flow or no-flow portions of the machine cycle.

Sytronix software intelligently matches the motor's speed to the system's instantaneous pressure and flow requirements. During periods of low demand (e.g., part holding or idle time), the motor speed is automatically reduced. This on-demand approach can yield energy savings of 30% to 80% compared to conventional power units.

ADVANCED PUMP CONTROL AND PROTECTION

The Sytronix software variants are optimized for specific pump types:

- **Sytronix DRn:** Designed for variable displacement pumps (e.g., A10VSO, A4VSO). The firmware adjusts motor speed to optimize pump displacement for the highest possible efficiency.
- **Sytronix FcP:** Designed for fixed displacement pumps (e.g., PGH, A10FZO). The firmware provides precise flow and pressure control by directly adjusting the motor's speed.
- **Beyond efficiency,** the software provides a layer of intelligent protection, including pump leakage detection, thermal monitoring, and wire-break detection for transducers, enhancing the overall reliability of the hydraulic system.



CONFIGURATION FOR APPLICATION-SPECIFIC NEEDS

While standardization is the foundation of the CytroCab program, flexibility is achieved through a smart, modular set of options. This allows machine builders to tailor the solution without resorting to a full ETO process.

Key configurable options include:

- Local Control Kit (LC): Adds a door-mounted interface with start/stop buttons, a local/remote selector switch, and a multi-function status light. This is critical for setup, troubleshooting, and operator interaction at the machine level.
- HPU Supervisory Functions (PU): Special firmware that enables monitoring of HPU sensors for oil temperature, level, and filter condition when combined with the local control kit.
- Ethernet Communication Kit (EC): Provides a direct industrial Ethernet connection between the CytroCab and the machine's control system. With options for Ethernet/IP, Profinet, EtherCAT, and Sercos, the CytroCab becomes a fully communicative, Industry 4.0-ready component, enabling remote monitoring and control.

CONCLUSION

The Bosch Rexroth CytroCab is more than just a drive in a box; it is a strategic solution designed to meet the market's demand for faster, simpler, and more efficient hydraulic systems. By packaging the proven intelligence of Sytronix software into a pre-engineered, configurable, and ready-to-integrate cabinet, it solves the primary pain points of the traditional ETO model. For machine builders and system integrators, this translates to a tangible competitive advantage: reduced engineering costs, accelerated project timelines, and the ability to deliver a more energy-efficient and reliable machine to the end-user. The shift to standardized efficiency is not just a trend; it is the smart path forward for modern hydraulic design.

Bosch Rexroth Corporation

Website: www.boschrexroth-us.com

Telephone: (800) REXROTH

(800) 739-7684

Email: info@boschrexroth-us.com

Evolution Motion Solutions

13835 Senlac Dr, Farmers Branch, TX 75234

800-569-9801

info@evolutionmotion.com

www.evolutionmotion.com



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