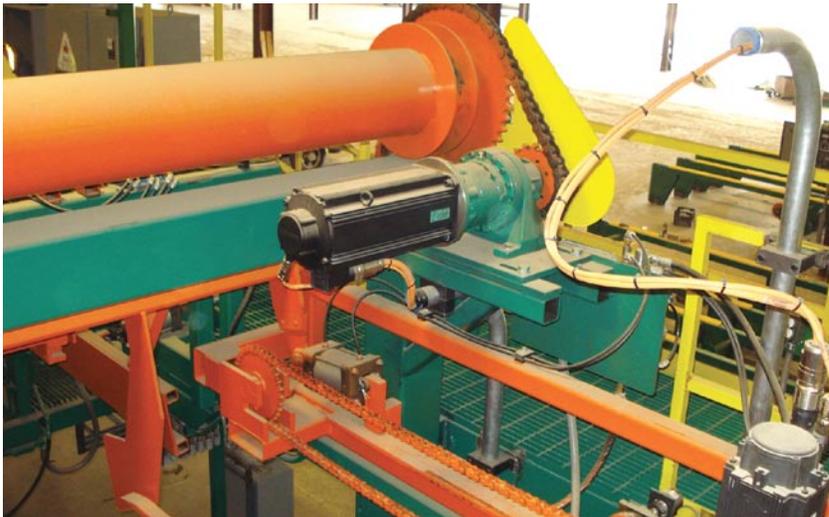


# Drive & Control profile

## Rexroth helps world's first servo-driven lumber sticker stacker save energy, improve productivity



MoCo used a Rexroth drive and control system to create the world's first line-regenerative servo-driven synchronized stickering stacker.

Lumber stacker uses Rexroth regenerative drive system to put excess energy back into the main power grid—and puts “green” efficiency into green lumber stacking

MoCo Engineering and Fabricating ([www.mocoeng.com](http://www.mocoeng.com)) has served the lumber industry for over a decade, building lumber stacking and other machinery for various sawmill applications. However, changing market needs are putting the OEM's reputation for innovation to the test. For [MoCo](#), the challenge was clear:

find a way to increase machine productivity, energy savings and safety on its stacker equipment.

MoCo's flagship 10-axis “[stickering stacker](#)” is the company's most sophisticated machine. Used on sawmill lines, the stickering stacker inserts wooden or aluminum spacers

### Challenge:

Develop all electric servo-driven lumber stacking machine with more productivity, energy savings, and enhanced safety features.

### Rexroth Solution:

- IndraDrive M digital intelligent servo drives with SERCOS III
- HMV-R regenerative power supply
- IndraDyn maintenance-free motors

### Benefits:

- 30 to 40 percent more throughput
- Efficient power regeneration
- 40 to 75 percent energy reduction
- Power consumption dropped from 100-180 kW to 58kW
- 35- to 45-amp draw vs. 270 amps
- Power factor of 1, no line compensation needed vs. AC motors on hydraulic machine
- Lowest harmonics levels from sinusoidal line current vs. standard rectified AC drive
- More precision, easier operation
- Better diagnostics, more safety
- No hydraulic oil concerns/cold weather issues/EPA issues



The Rexroth IndraDrive system and common DC bus with regenerative capabilities can divert excess power from one axis to another, or onto a mill's main power grid rather than dissipating that energy as heat.

(called stickers) on one- or two-foot centers between each course of cut-to-length lumber while simultaneously stacking the courses. Typically, the motion on a stickering stacker was driven either by hydraulics, variable speed AC motors, or a combination of both. For some time, MoCo had been considering an all-electric servo-driven stacker designed to improve performance and reduce energy use. An experiment they conducted a few years ago proved that servos could operate well under sawmill conditions, but MoCo was unsure whether the market would support such a machine.

**New opportunity for servo-driven machine**

Fast forward to today, as increased energy costs, decreased lumber prices and rising environmental concerns are impacting lumber mill profitability. Mills need greater productivity, less downtime, improved safety features, more energy

efficiency and less potential for environmental cleanup issues. MoCo decided it was time to move forward with an all-electric servo-driven machine that could provide lumber mills with an impressive



Each axis of motion follows its own onboard electronic motion profile while maintaining precise synchronization with other axes. No limit switches, time gears or external encoders are needed to determine or control axis positioning.

return on investment. The company converted an existing 10-axis hydraulic stacker system to the world's first line-regenerative, electric servo-driven synchronized stickering stacker — using a drive and control system from **Rexroth** ([www.boschrexroth-us.com](http://www.boschrexroth-us.com)). As Allan Hahn, MoCo control specialist put it, “The servo-electric concept helps us offer greater efficiency and long-term cost savings. The ability to reduce both energy use and environmental impact makes this stacker well-suited for today’s challenging market.”

**Rexroth delivers**

To obtain the ideal components, MoCo teamed up with local Rexroth automation distributor **Northwest Motion**, ([www.nwmotion.com](http://www.nwmotion.com)) a supplier to MoCo since 2000. Based on their experience with servo designs, Northwest Motion recommended a Rexroth **IndraDrive** drive system, **IndraDyn** servo motors, and a common DC bus with regenerative capabilities so excess power could be diverted from one axis to another, or onto a mill’s main power grid. The final lineup of Rexroth technology included:

- IndraDrive M digital intelligent servo drives with a CCD master communicating with a third-party PLC via DeviceNet. All motion functions and synchronization are handled by parameterizing drive firmware with no PLC code or programming required at the drive level. The IndraDrives are synchronized through

high-speed Ethernet-based [SERCOS III](#) communications protocol and simultaneously control synchronization of the machine's fork lift, carriage, stick shuttle, stick placer, rake off, pull back and other motions.

- Maintenance-free, high-efficiency [IndraDyn MSK](#) synchronous and [IndraDyn MAD](#) asynchronous servo motors with IP65 protection class and easy setup and tuning.
- Common DC-bus with a [Rexroth HMV-R 65kW regenerative power supply](#).

The stacker is impressive in action, with a potential 30 to 40 percent improvement in throughput over the hydraulic machine. Handling eight-foot wide courses up to 12 cycles-per-minute with loads up to 40,000 pounds, the stacker receives lumber while delivering stickers into evenly spaced courses of wood. The lumber is then arranged and stacked automatically on the main hoist to be prepared for kiln delivery. With each new stack of lumber, the hoist lowers incrementally until the unit is complete.

Each axis of motion follows its own onboard electronic motion profile while maintaining precise synchronization with other axes by simultaneously following a Virtual Master (VM). Each drive is capable of hosting a VM and any axis in the system may be directed to follow any VM in the system. Free assignment and sharing of VMs for axis synchronization is a key to the system. Communication between drives is achieved using Rexroth's Cross Communication Drives (CCD) ring, with synchronization



Pre-set torque and force limits are automatically monitored independently at each axis to sense an un-weighted load and prevent the hoist from dropping, which could cause a potentially unsafe condition.

data traveling via [SERCOS III](#) communications protocol over Cat5e Ethernet cable.

Operators may easily adjust stacker speed or switch operating modes on-the-fly to allow independent or synchronized jogging or indexing of an axis. In Auto Mode, axes remain electronically synchronized while reporting position and drive status back to the operator's display panel. No limit switches, timing gears, or external encoders are needed to determine or control axis positioning. The PLC controller monitors the status of all drives in the system, allowing an orderly shutdown in case of an axis fault.

#### **Substantial energy savings**

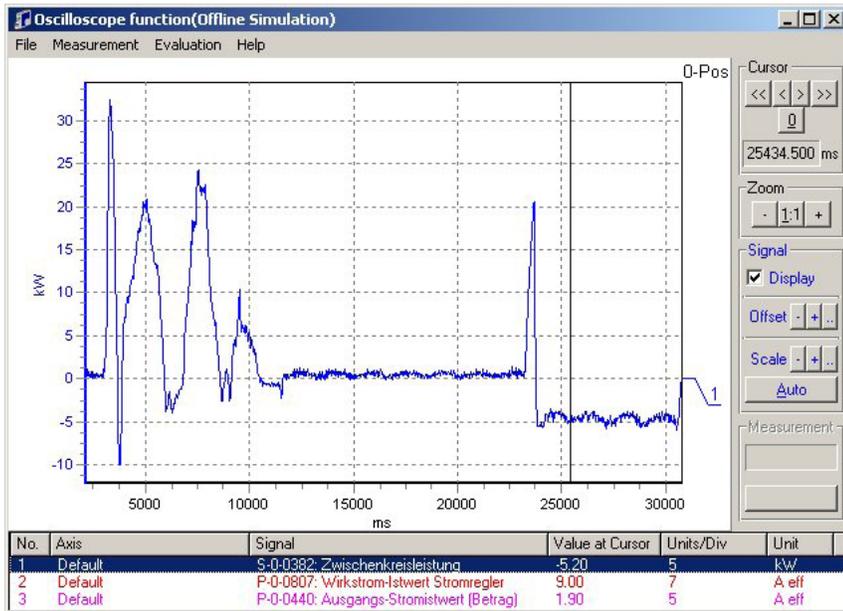
The regenerative power bus puts the servo-electric stacker in another league for energy savings. Rexroth's servo drives use a common rail line-regenerative power supply to capture energy from the stacker's machine cycle. The stacker can regenerate power from any motion cycle—horizontal or vertical—and share the power with other axes as needed. Drives

that are regenerating power (such as a lowering hoist) can dump this power back on the common power bus so other drives can use that energy. Power from multiple drives can be directed to the main incoming line. On a typical hydraulic stacker this regenerative power would be dumped to a resistor bank and dissipated in the form of heat.

MoCo's documented tests indicate substantial energy savings. Energy consumption drops from the 100-180 kW range for a previous hydraulic machine to 58 kW or less for the new servo-driven machine. The stacker draws about 35-45 amps of power when running at 10 cycles-per-minute, compared with 270 amps for a hydraulic machine.

"The stacker uses power only when cycling," said Hahn. "At the end of the day this machine cycles only 40 percent of the time compared to a hydraulic machine, which typically runs a 75 hp electric motor all the time powering the hydraulic pump even when it isn't needed," said Hahn. Energy reductions of 40 to 75 percent, with savings of up to \$45,000 per year have been documented. The line-regenerative power supply puts approximately 5kW of power lasting several seconds (see Figure A) back onto the AC power grid during deceleration of the main hoist axis alone. The other vertical axes also contribute regenerative power savings.

"The electric stacker's regenerative capability represents a major



**(FIGURE A)** Power savings area is shown in kW, when the line is at or below +0 kW. From approximately 24,000 ms to 32,000 ms (6 full seconds) the power supply is regenerating approximately 5 kW back onto the AC power grid. In addition, the 11.5 seconds between 11,000 and 22,500 ms, drawing no power, would have required 56kW on the hydraulics machine.

step forward in the effort to save energy,” said Hahn. “And replacing the hydraulics removes the potential environmental concern regarding oil spills or leaks while making it a lot quieter, too.”

#### Diagnostics and safety benefits

The all-electric servo system provides other benefits for diagnostics and safety. “We can isolate the amp draw in the motors and quickly determine if there’s a problem,” said Hahn. “In addition, pre-set torque and force limits are automatically monitored independently at each axis, so the

machine can monitor and sense an un-weighted load and prevent the hoist from dropping, causing a potentially unsafe condition,” he said. “Plus, any jams result in quick shutdown of all the drives at once, avoiding a situation where a hydraulically driven stacker might keep building pressure until a cylinder reached the end of the stroke or stalled out, potentially damaging essential hardware. With the servo system, the machine can easily be restarted in a slow mode so the operator can check for additional problems and make sure

the system is running smoothly,” said Hahn.

Hahn added that the transition from hydraulics to electric went smoothly due to the support Rexroth and Northwest Motion provided. “Within five days of training on the new machine, we were fully proficient with setup, commissioning and operation of the Rexroth components.”

Once the electronic synchronization was set up, very few readjustments were required—unlike with analog hydraulics. That saved a minimum of three days in both building the new machine and bringing it on-line.

#### Servo-driven success

MoCo’s servo-electric stickering stacker shows the value of innovative thinking in machine building. The new stacker gives lumber mills more productivity, reduced maintenance (no plumbing or oil freeze-ups, fewer limit switches, preventive diagnostics, no temperature related timing issues) and improved safety (reduced fire hazard, less risk of jams and splintering). And the environmental benefits of the new machine show that today’s “green” focus can save considerable energy, waste, and cleanup.

**Rexroth**  
Bosch Group