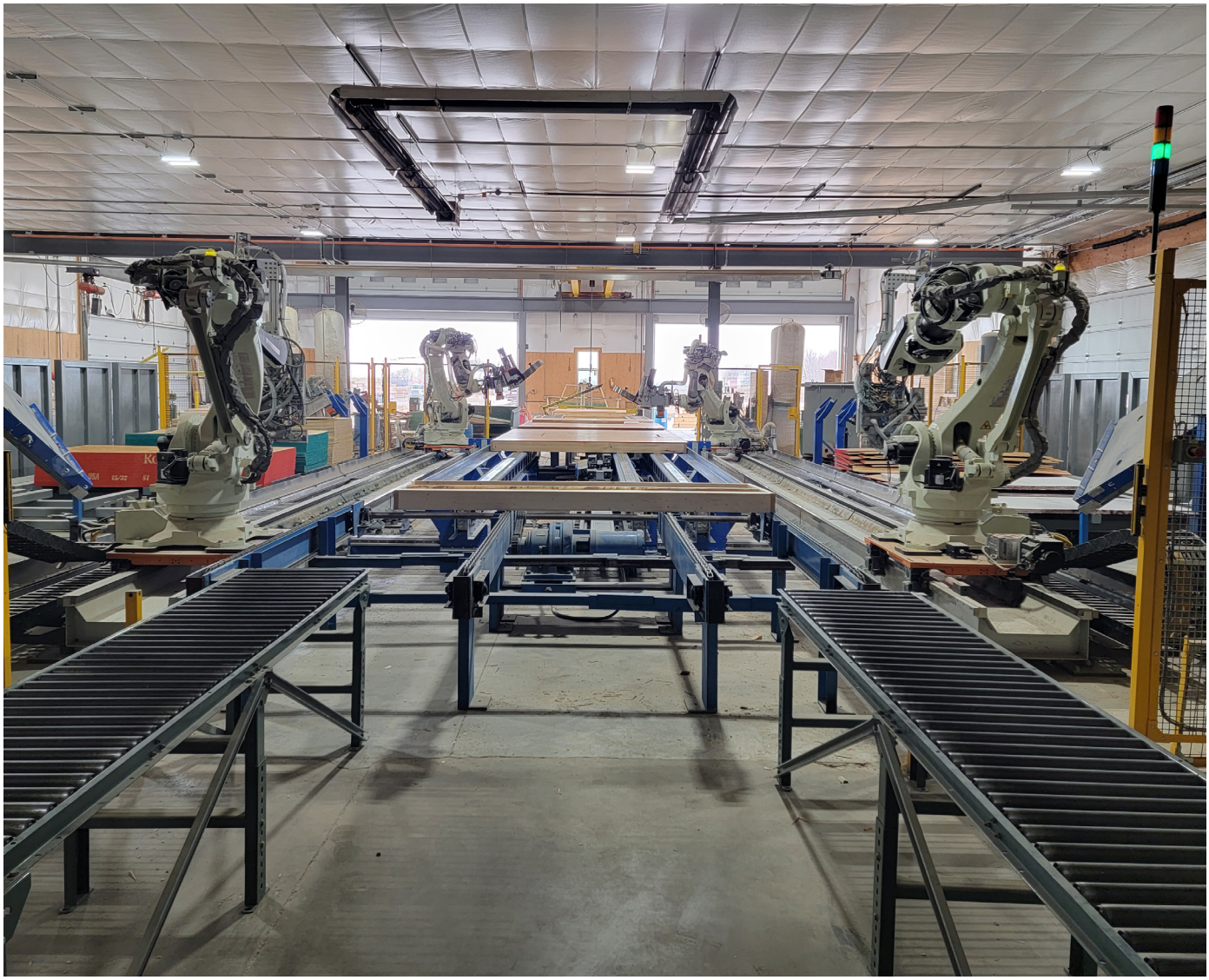
GÜDEL



Automating Building Components for Prefab Home Assembly

Güdel opens new doors for a prefab homebuilder.

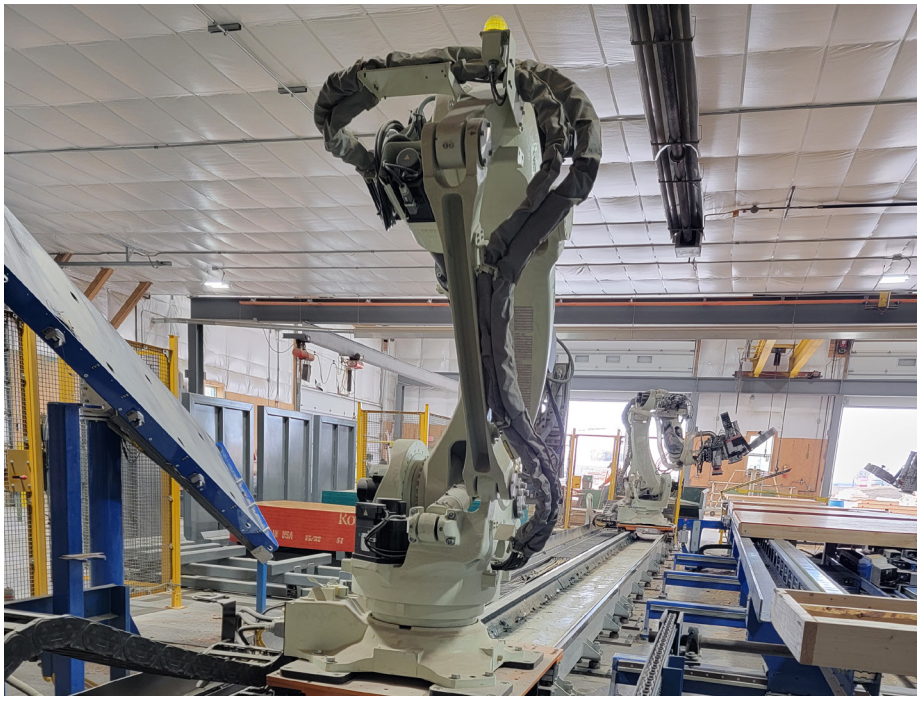
Güdel TrackMotion technology enables four robots to precisely apply and affix OSB sheathing to wooden frames for building component manufacturer designed for prefab housing.

Güdel Precision Allows Assembly of an Imprecise Material

The greater affordability of prefabricated homes has contributed to a growing demand for houses and apartments that can be manufactured quickly and inexpensively in a plant and assembled on-site. But that affordability translates into thinner margins for building component manufacturers, especially when they are bidding against each other for the same projects. As many in the industry have learned, the more automated the manufacturing process, the more competitive they become at the bidding table.

Sharpening its competitive edge was only one reason Illinois-based prefab home builder Rehkemper & Son contacted integrator SCADAware to help automate its prefab assembly operations. The builder's other motivation was the difficulty of finding reliable employees to perform the labor-intensive work on its shop floor.

After reviewing Rehkemper's manual processes, SCADAware teamed with



SCADAware created a one-of-a-kind system to automate much of this prefab assembly process using Güdel TrackMotion Technology.

Kawasaki Robotics, Mitsubishi, and Güdel to innovate a one-of-a-kind system for automating much of the prefab assembly process.

Robot vs. Wood

Factory assembly of prefab homes typically unfolds in two stages. In the first, wooden studs and beams are sawn and assembled to form the skeletal walls, roof, and floor trusses. The next phase — for which SCADAware enlisted Güdel's motion control expertise — involves applying oriented strand board (OSB) sheathing to pre-framed walls, nailing the panels to the framework, and carving out holes for windows and doors. The component parts are then shipped to the building site, where they are assembled into a standing structure.

OSB sheathing comes in panels measuring 4 x 8, 4 x 9, or 4 x 10 feet, made of heavy pressed wood material that can be difficult to manually maneuver and place. The challenge for SCADAware and Güdel was creating a robotic solution that could accurately place nails to affix it to the wooden studs and beams hidden underneath. What made this task so difficult is that, compared to other building materials, wood is notoriously imprecise.

"When I was in the trades, everybody knew that two-by-fours aren't really 2 inches wide," says Rick Caldwell, president of SCADAware. "They were typically 1¾ inches and are now somewhere around 1½ inches wide. Plus, wooden boards are often warped; and once you lay OSB down, you can no longer see the where the stud is located. If the nail only holds air, then we're in trouble."

Driving nails through OSB and into concealed boards that may or may not be warped is not an ideal task for robots. "If you have four jobs for a robot to do, then you develop four routines," Caldwell explained. "But the nature of this application is that no two walls will ever be the same. How do you teach the robot where the studs are?"

Precision Squared

SCADAware engineers wrote custom software that looks at the electronic version of the design of the wall. This software shows the robot where to nail and cut. The system it developed employs a large, motorized table able to adjust in size to accommodate framed walls measuring 8 to 14 feet high and 1 to 20 feet wide. Single walls are conveyed onto SCADAware's table where they are squared against a fixed end stop at the far end, and the table's adjustable edges come together to align the frame top to bottom.

This ensures the wooden stud nearest the end stop is straight with its physical centerline aligned to within a 16th of an inch or better of the digital design that the robots are programmed to work with. There are servo-controlled fingers, directed by SCADAware's custom software, under the wall to straighten any warped studs. These fingers help align the next 3 studs by sliding up the table's central rail and applying pressure to straighten each stud.

Industries

Construction, materials handling, assembly

Processes

Güdel's motion control technology provides the precision and repeatability required for four robots to apply and affix OSB sheathing to wooden frames for prefab housing.

Key Data

- Working with integration partner SCADAware, Güdel enables a novel new robotic system to automate building component manufacturing for prefab home assembly.
- The speed and precision of Güdel motion control technology cut assembly cycle times by at least 50%.
- The automated solution significantly improves productivity and operational costs for a building component manufacturer for prefab home assembly while helping bridge a local labor gap.

Meanwhile, two pairs of Kawasaki BX250L robots – each with a reach extending 2,812 millimeters, or just over 9 feet – are mounted on corresponding Güdel TrackMotion Floor-3 (TMF-3) units extending the length of the table on either side. Each Güdel track measures 15 meters and delivers a 12-meter working stroke, allowing all four robots to work together along the entire length of the table.

After the wall is in place, one of the rear robots next to the conveyor uses vacuum heads to pick up a 4 x 8-foot OSB panel and place it over the now straightened studs. Once the first panel is fully attached, the robots and fingers repeat the process until the wall is completely sheathed.

All four robots have the ability to switch tooling. As one set of robots carves windows and doors into the OSB panel, the other two remove the cut sheathing and transfer it to the scrap heap.

Fast Wall Assembly

The ±0.02-millimeter accuracy and repeatability of Güdel's TMF-3 technology was instrumental to achieving the speed and tight tolerances that SCADAware's automated system needed to deliver. "All the losses in accuracy that you might get from the rail would transfer to the axes of the robots, to the nail driver, to the piece of wood," said Caldwell. "So Güdel's TrackMotion technology needed to far outperform the precision of the overall system because we're dealing with wood and wood is not that accurate."

In simulations, the system has shown it can finish assembly of an 8 x 20–foot wall in considerably less time than it would typically take two human operators to complete — including placing and affixing OSB sheathing and cutting it to form windows and doors. With additional optimization, Caldwell believes the system can do even better.

"A big impetus behind Rehkemper reaching out to us was the difficulty they were having in hiring workers to do these sorts of jobs," said Caldwell. "But our collective goal was also to help them to compete better and get the job done quicker for less of a cost."

The speed, versatility, and precision enabled by Güdel's rail promises to increase throughput by at least 25% with no loss in quality. The improved productivity and reduced labor costs enable contractors like Rehkemper and Son to save money and offer more competitive bids. Currently the track and robot system has increased the linear footage produced each day by 25% with no loss in quality; further adjustments are expected to increase efficiency to 35-40%. An additional benefit is the removal of human labor resulting in less downtime, more precision, and no injuries.

Güdel Technology

- **TrackMotion Technology**
- **Rack and pinion drives**
- **High-performance gearboxes**

Güdel Group AG

The Güdel Group is a manufacturer of high-precision machine components and provider of sophisticated automation solutions. Its spectrum of products ranges from linear guideways, racks, pinions and drives right through to linear axes and gantry robots. Güdel assembles its products into systems with a high degree of control intelligence and complete plant installations, which can be used in the automotive, tire, metal, rail, intra-logistics, pharmaceutical, renewable energy, wood, and aerospace industries. Güdel's technology is characterized by its innovation, quality and modularity. The Güdel Group has a workforce of approximately 1,000 employees worldwide in over 20 locations. The Group has been owned by the same family since its foundation more than 60 years ago. The Güdel Group has its headquarters in Switzerland.

Cont

pr@ch.gudel.com

Güdel Group AG
Industrie Nord
4900 Langenthal
Phone +41 62 916 91 91
Fax +41 62 916 91 50
info@ch.gudel.com
gudel.com