

# ServoBelt™ Delivers High-End Performance for Automotive Gantry

*Exploring how innovative ServoBelt technology provides a cost-effective alternative to oversized gantry systems without sacrificing industrial-grade performance.*

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Overhead pick and place gantries are an important part of modern automotive plants, moving and positioning parts with the speed, precision and reliability that high-volume production demands. Traditionally, manufacturers have faced an equipment selection dilemma, with the industry dominated by heavy-duty systems constructed from massive steel fabrications. Designed for extreme payloads, these over-built systems come from large equipment suppliers who offer robust engineering at a premium price, extended lead times and limited room for customization.

Small and medium automotive applications, however, don't require such extreme capabilities, and in these cases, the oversized solutions represent a critical mismatch. Compounding this challenge, the automotive industry's fast-moving production environment demands

suppliers who can adapt quickly, customize gantry systems to specific application needs and deliver within competitive time frames — requirements that many large, established equipment manufacturers are unable to meet.

Fortunately, a motion control solution has emerged that fills this gap. Gantry systems featuring ServoBelt™ technology deliver the industrial-grade durability and customizability automotive production requires — at a fraction of the cost of traditional rack and pinion systems and with lead times that are often less than half of those of larger suppliers. Equally important, advanced beam engineering utilizing T-slot extrusions ensures ServoBelt systems meet the structural performance standards manufacturers expect from traditional rack and pinion equipment.



For these reasons, ServoBelt motion control technology enables automotive manufacturers to implement advanced overhead automation without compromising on the performance their production demands.

## Designing an Overhead Gantry for an Automotive Supplier

Progressive Machine & Design (PMD), a custom automation company based in Ontario County, New York, was tasked with designing an automated production line for a Tier 1 automotive supplier. Part of a diesel engine camshaft manufacturing operation, the line would include a pick and place gantry system to transport parts through multiple machining operations.

The production line consisted of sequential machining operations, with four to five machines at each stage. The gantry's function was to handle the camshafts, from raw stock to final product, transporting them between the various machining centers. The system was designed to pick up the raw camshaft blanks and deliver them to the first set of machines. From there, it would move the parts through different operations, including grinding, lathing and other machining processes. The gantry was specifically designed as an overhead system to interface with the top-loading machining centers and to exist above the machines, saving valuable floor space.

The core challenge during the design process was to engineer a robust overhead gantry system that could navigate a tight plant layout, handle a two-camshaft payload weighing roughly 80 kilograms and provide precise positioning for part delivery into the machines.

## ServoBelt Delivers a Winning Solution

For this gantry system, PMD incorporated ServoBelt technology — a linear drive system that combines the dependable “rack and pinion” drive method with precision and anti-backlash characteristics thanks to a unique belt design. ServoBelt's key features (see sidebar), such as its ease of customization, high performance and avoidance of overly greased steel racks, made it the optimal choice for this project.

**Design Flexibility and Customization:** Unlike rigid, standardized systems, ServoBelt technology allowed PMD to customize the gantry's size, height and beam span to fit the specific plant layout constraints. According to Brent Stratton, Chief Mechanical Engineer at PMD, this flexibility was a critical factor that “tipped the scales” in ServoBelt's favor.

**High Performance Without Over-Engineering:** ServoBelt delivered the required performance specifications without unnecessary over-engineering. Though capable of even tighter precision, it provided the necessary quarter-millimeter positioning accuracy and could handle high-speed travel, operating at 3 meters per second (m/s) — well within its capability of 4 m/s.



*The complete gantry system includes ServoBelt technology, a composite beam and custom safety features to deliver automotive-grade performance.*



*The ServoBelt-powered gantry spans multiple machining centers, transporting camshafts through sequential operations.*

**Long-Distance Capabilities:** A key advantage of ServoBelt is its unique belt-rack design, which eliminates belt stretch over any travel distance. This feature allowed PMD to create a long gantry that spanned multiple machining centers without sacrificing positioning accuracy.

“While we don’t often make systems this long, we would usually reach for a continuous-loop or OMEGA-type drive,” Stratton says. “But the beauty of the ServoBelt belt rack system is that it takes all the stretch out of the equation. You can go really long without worrying about belt stretch at all.”

**Future Scalability:** The modular nature of ServoBelt technology supports future expansion. If the operation eventually requires more machines, for example, the gantry can be extended to accommodate the expanded layout, providing a long-term and adaptable solution.

## Composite Beam Meets the Industry’s Structural Standards

While ServoBelt technology provided the motion control solution, its beam design represented an equally critical engineering challenge. Automotive manufacturers used to traditional rack and pinion systems have specific expectations regarding structural performance.

To meet these requirements, the Bell-Everman engineering team conducted extensive “beam science” work — e.g., analyzing and optimizing multiple structural characteristics like beam stiffness, deflection, torsional stiffness, torsional deflection and area moment of inertia. Each parameter plays an important role in ensuring the gantry maintains positioning under load and throughout its travel range.

Unlike Bell-Everman’s traditional single-piece extrusion designs, this application required a new composite beam construction to achieve the necessary structural performance. The engineers designed a beam assembly using versatile T-slot extrusions skinned in anodized aluminum, creating a structure that eliminated deflection between mounting points.

This composite approach delivered multiple benefits. It provided the structural rigidity required for the application, offered the aesthetic appearance of premium industrial equipment and maintained the customizability that made the ServoBelt solution attractive in the first place. In addition, the extensive design and testing work

proved that the gantry system could meet the same structural standards as heavy-duty steel equipment while maintaining cost and lead time advantages.

## Ensuring Safety and Reliability With Custom Enhancements

In addition to the core gantry and beam, PMD designed and integrated several custom features to ensure the pick and place system operated safely and reliably. The controls included Allen Bradley drives and motors with Neugart gearboxes. To handle the payload, PMD selected Schunk grippers with a safety lock feature that prevents them from opening if air pressure is lost. Engineers also designed a small Y-axis shift into the gripper design to accommodate minor positional misalignments of the machines.

For safety, PMD conducted a risk assessment. After identifying the need for redundant Z-axis brakes, engineers tasked Bell-Everman with integrating these brakes into the gantry’s design. Bell-Everman engineers provided a clean design for the integration of these brakes. The system’s drives also featured Safe Torque Off (STO) to meet safety requirements.



*The composite beam construction uses spliced T-slot extrusions to achieve the structural rigidity of traditional steel beams at a fraction of the cost.*

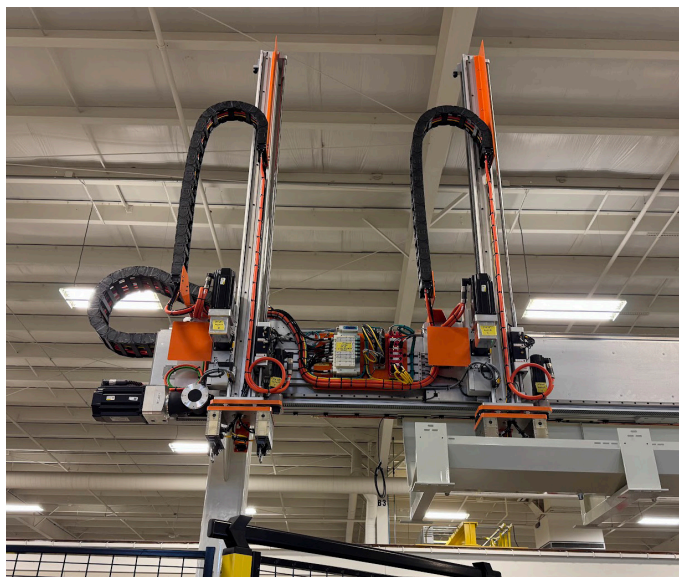


To address the issue of oily parts and dripping coolant, PMD designed a series of drip trays, which served two purposes: they kept coolant contained and prevented workers' hands from entering the gantry's moving parts. Bell-Everman delivered the gantry with a bolt pattern to facilitate the integration of these custom-designed trays.

## Results: High-End Automation at a Lower Cost

The ServoBelt-powered gantry system successfully automated the camshaft transport process, integrating seamlessly with the existing machining centers and the customer's manufacturing execution systems (MES) database.

- **Operational Success:** The gantry system now handles the complete camshaft workflow — from the initial raw blank to the final ground unit.
- **Safety and Reliability:** The gantry includes many safety enhancements, including custom drip trays to contain coolant and redundant brakes on the Z-axis. The gantry's robust construction and low maintenance requirements also ensure long-term reliability.
- **Cost-Effectiveness:** By providing high-end linear motor performance at a significantly lower cost, ServoBelt technology has enabled the implementation of advanced automation without the price tag of over-engineered systems.



*The overhead gantry design saves valuable floor space while interfacing with top-loading machining centers throughout the production line.*

## Key Features of ServoBelt

**High Performance and Low Cost:** ServoBelt technology offers speeds up to 4 meters per second and unidirectional repeatability of  $\pm 15$  microns. This performance is comparable to high-end linear motor drives but at a significantly lower cost.

**Limitless Scalability:** The system can be engineered for travel distances up to 50 meters or more, making it suitable for large-format motion systems such as Cartesian transfer robots and large gantry systems.

**Multiple Independent Carriages and Axes:** ServoBelt supports multiple, independently controlled carriages on a single axis, enabling complex motion control tasks. This feature is beneficial in automotive manufacturing, where simultaneous operations on multiple parts are often required.

**Durability and Maintenance:** The ServoBelt system features anodized aluminum construction with stainless steel hardware, along with a high-performance polyurethane/steel-reinforced belt.

## Learn More

The ServoBelt-powered gantry now delivers the precise, high-speed automation the supplier needed while keeping costs under control. It also fills a critical gap in the market, providing manufacturers with a high-performing alternative to oversized systems for small to medium payload applications that previously would have required defaulting to large, heavy-duty equipment.

“What made this project work was our collaborative approach with Bell-Everman and their ability to meet our unique requests — that’s what won us over,” explains Stratton. “Even beyond just meeting our immediate requirements, together we built something that could adapt and expand as needs change.”

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