# Enhanced BioMedical Manufacturing

Precision Loader System Case Study

SEYMOUR
Advanced Technologies

## The Brief

A leader in medical device manufacturing faced critical efficiency and accuracy challenges with their existing loader systems, crucial for assembling complex medical components. The outdated system, which demanded parts to be meticulously arranged for robotic pickup, resulted in production inefficiencies. The fact that the system went down time and time again did not help the manufacturer in any way either.  In pursuit of operational efficiency to take their business to the next level, the company collaborated with Seymour Advanced Technologies to develop a precision loader system to replace the ineffective existing machine, aiming to significantly improve component assembly precision and overall operational efficiency.

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*"We can't solve our problems with the same thinking that we used when we created them."*

*- A. Einstein*

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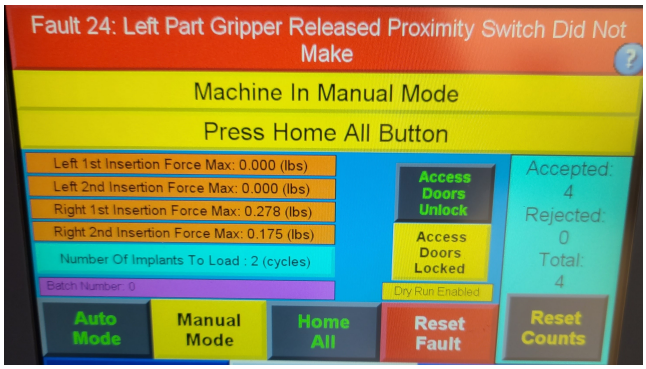
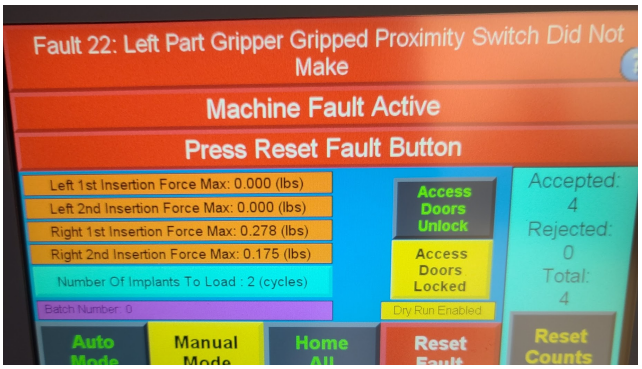
## The Challenge

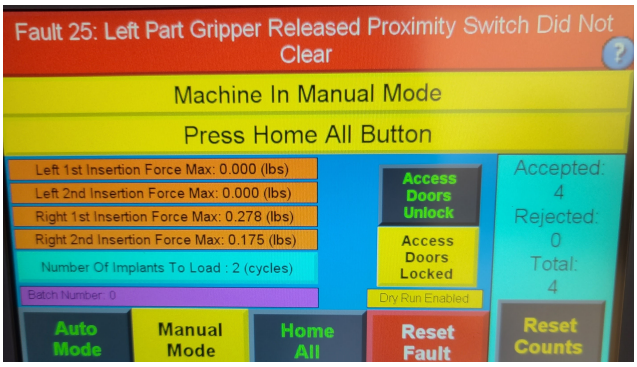
### Pre-Upgrade Operational Bottlenecks

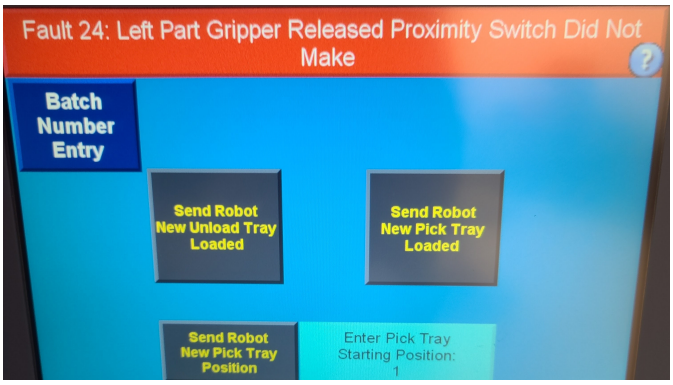
The client's original loader machine required parts to be placed in a specific sequence, limiting the system's flexibility and capacity to handle various product variations efficiently. This method led to frequent operational failures, directly impacting production uptime and the ability to meet demand and their tight deadlines. The need for a consistent, technologically advanced solution was evident, one that could ensure reliability, enhance flexibility, and deliver unparalleled precision in the manufacturing process.

## *Common Failure Messages in Existing Solution*



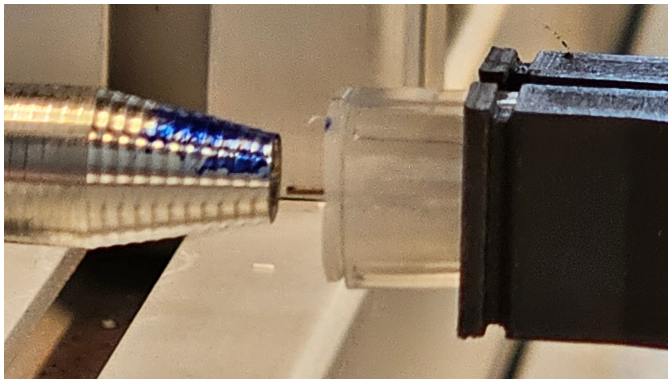



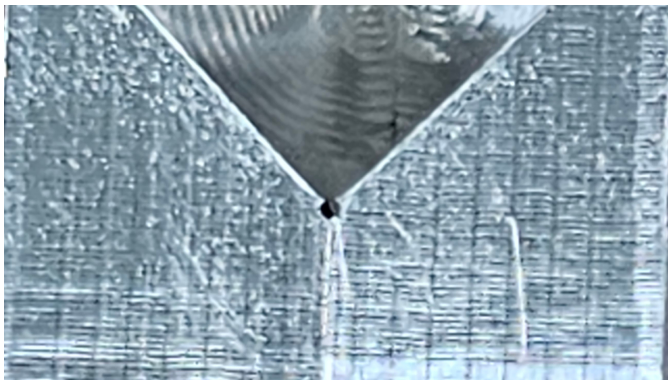

# Engineering and Operational Challenges

The design and implementation of the new precision loader system faced multiple challenges:

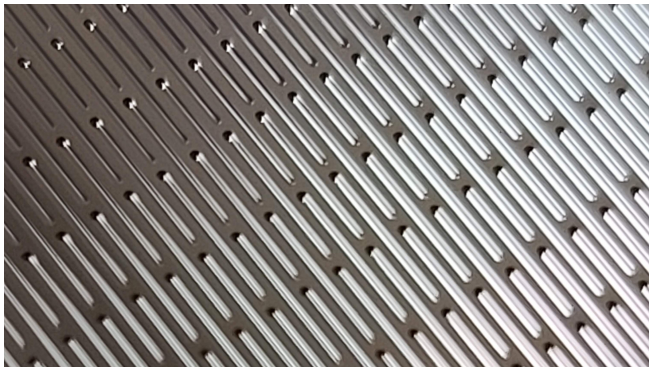
- **Micron-Level Precision:** The primary engineering challenge was designing a mechanism capable of manipulating parts with precision measured in microns. This required the integration of high-resolution vision systems for real-time part inspection and advanced robotics capable of delicate manipulations without damaging the components.



- **Inconsistencies and Flashing from Molding:** Another significant challenge was dealing with inconsistencies in the parts due to flashing from the molding process. Engineering a solution involved developing adaptive algorithms within the machine's control system to detect and compensate for these variances, ensuring consistent part handling.

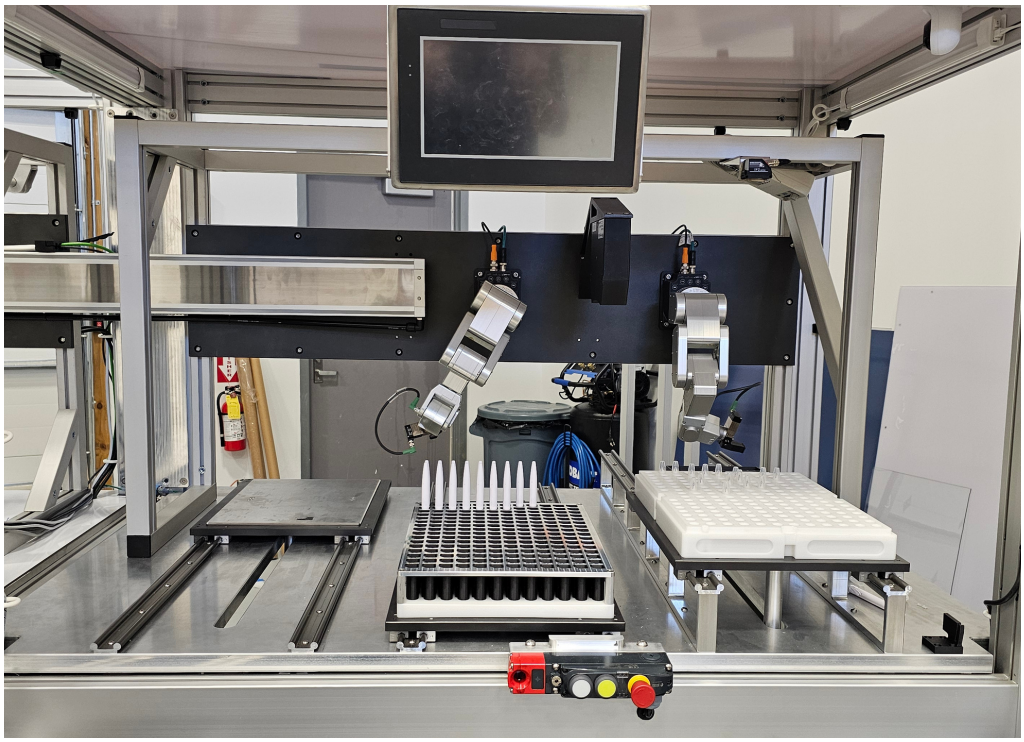


- **Versatility:** The loader needed to be versatile, capable of handling various part sizes and geometries without manual reconfiguration. This demanded a modular design approach, allowing for quick adjustments to the machine's settings to accommodate different product lines with minimal downtime.
- **Precision Placement and Tracking:** Ensuring precise placement of parts into small receptacles and accurate tracking throughout the process required the development of sophisticated software algorithms. These algorithms were designed to integrate seamlessly with the machine's mechanical systems and sensors, creating a cohesive system that maintains accuracy at every step.



- **Integration and Cleanroom Compatibility:** Given the biomedical application, the system had to be engineered to operate within cleanroom environments. This involved selecting materials and designing machine components that would not contribute to contamination, while also ensuring easy sterilization and maintenance.
- **Scalability and Maintenance:** Finally, engineering a system that was both scalable to meet increasing production demands and easy to maintain presented a challenge. The solution required a balance between robust design to withstand continuous operation and modular components for quick replacement or upgrades without significant system downtime.

# Our Solution



## System Overview

The loader system designed for a biomedical device manufacturing client addresses critical challenges in handling very small parts with high precision. It was developed to significantly improve uptime and efficiency in the production process, replacing an older machine that failed to meet operational expectations. The system is engineered to manage parts with micron-level accuracy, ensuring the seamless assembly of medical devices.

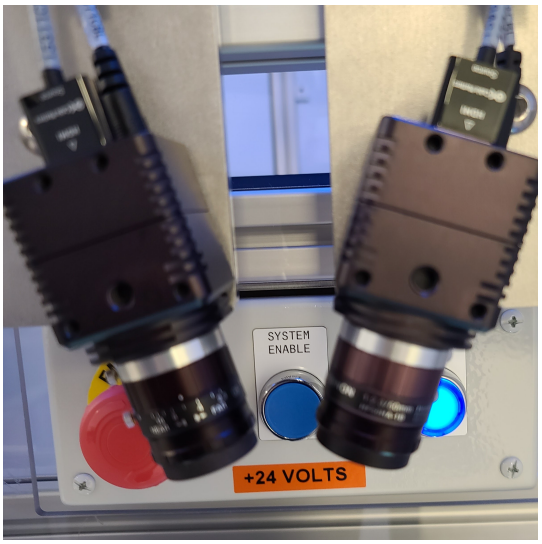
## Technical Specifications

- **Dimensions:** Compact footprint designed for easy integration into cleanroom environments, capable of navigating through office spaces into clean rooms without disassembly. The machine footprint was approximately 5 x 3.5 feet, allowing for optimal space utilization.
- **Operational Speed and Precision:** Engineered to handle parts with precision down to 7 microns, the system adheres to the 'Rule of 10,' ensuring that its measurement and placement accuracy are at least an order of magnitude finer—thus aiming for sub-micron level accuracy in its operational capabilities. This approach significantly enhances the manufacturing process's accuracy and reduces the margin of error, ensuring that the assembly of biomedical devices meets the highest standards of precision.
- **Capacity and Part Handling:** The loader system is designed with the capability to handle a wide range of product variations and quantities, reflecting a versatile approach to biomedical manufacturing needs. It incorporates advanced counting and tracking mechanisms, leveraging both software algorithms and hardware precision to accurately manage and document the flow of components. This system significantly reduces the potential for human error in the assembly process, ensuring each part is accounted for and correctly processed according to stringent quality standards.

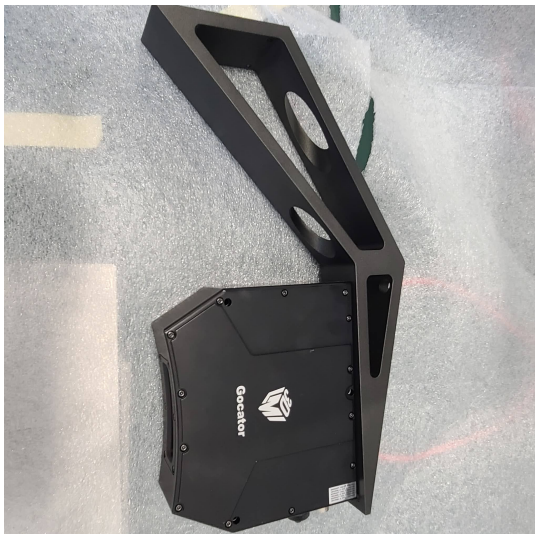
## Advanced Sensing and Vision Systems

- **Types and Models:** Utilizes high-resolution sensors and vision systems, including LMI Technologies capable of capturing down to seven microns, ensuring parts are identified and placed with exceptional precision. This differs from their previous solution, which required parts to be placed in a specific order and sequence for the robot to pick them up based on their location, leading to inefficiencies and limitations in handling various product variations and quantities. This setup necessitated a solution that could improve reliability, flexibility, and precision in their manufacturing process.

**Old System's Limited Vision Solution**




**New LMI Technologies Vision Solution**




- **Integration and Performance:** These systems are integrated to work cohesively with the machine's mechanical components, using machine learning and AI to improve part detection and positioning accuracy over time.

## Adaptive Control Software

- **Software Architecture:** Incorporates a sophisticated software platform that dynamically adjusts operations based on real-time feedback from sensors and vision systems.
- **Unique Algorithms:** The system uses proprietary algorithms designed to handle the variability in part sizes and shapes, ensuring consistent quality and precision across different manufacturing runs.

## Modular Design and Scalability

- **Modular Components:** Designed for easy maintenance and quick reconfiguration, facilitating scalability and flexibility in meeting production demands.
- **Scalability:** The system's modular nature allows for easy expansion and adaptation to new manufacturing challenges and product lines.

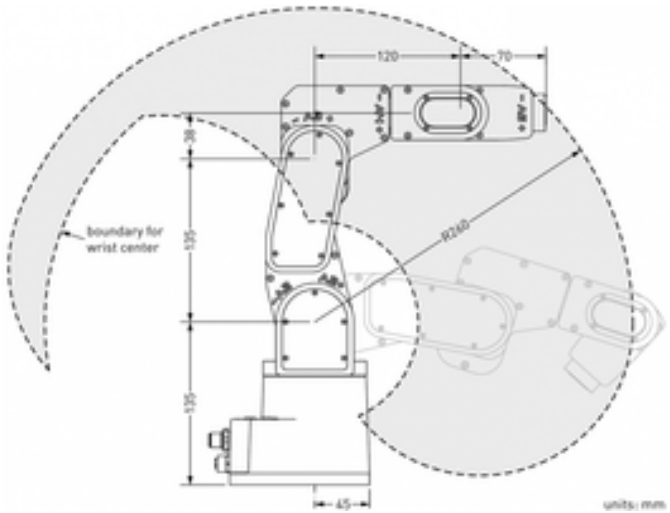
## User Interface and System Integration

- **User Interface**: Features a user-friendly interface that simplifies operation, allowing for seamless integration

into existing production lines and facilitating communication with other manufacturing processes.

## Robotic Manipulation and Precision Handling

- **Robotic Components:** Features advanced robotic arms from Mecademic Robotics with high degrees of freedom and force sensitivity, custom-engineered for the precise manipulation of small parts.
- **Custom Solutions**: The development included proprietary robotic solutions tailored to the specific needs of biomedical device manufacturing, ensuring delicate handling without compromising part integrity.




# Mecademic's Meca500 Industrial Robot

### Minimizing Footprint

The Meca500 is smaller than any industrial robot arm. Featuring an embedded controller, it is also unbelievably compact.

### Facilitated Integration

The Meca500 is a plug-and-work automation component, easy to interface with any computer or PLC. Easily operate the robot using any programming language you prefer.

### Reduced Tolerances

Built with precision-machined aluminum and zero-backlash gearboxes, the Meca500 is the world's most precise six-axis robot. It boasts a repeatability of 5 µm.

### Flexibility Benefits

The robot is easy to mount in any orientation. It automatically compensates for gravity, without requiring any software adjustments. This added flexibility enables easy integration in a wide variety of settings.

## Cleanroom Compatibility and Maintenance

- **Design Choices:** Materials and design specifications were selected to comply with the highest cleanroom standards, including features that minimize particle generation and allow for easy sterilization.

## Compliance and Certification

- **Regulations and Standards:** Engineered to meet stringent industry-specific regulations and standards, with built-in compliance features ensuring the system adheres to necessary certifications.

## Expected Outcomes and Benefits

- **Productivity and Efficiency:** The system is expected to double uptime, virtually eliminate product changeover issues, and significantly boost productivity and efficiency in the manufacturing process.

# Transformation to New Operation Workflow

## Before the New System

Operators were tasked with placing parts in a precise order and location for the robot to pick them up. This labor-intensive process was prone to errors, contributing to significant downtime and inefficiency. The rigid setup limited the system's ability to handle product variations, necessitating a manual and time-consuming reconfiguration for different product lines.

## After Implementation

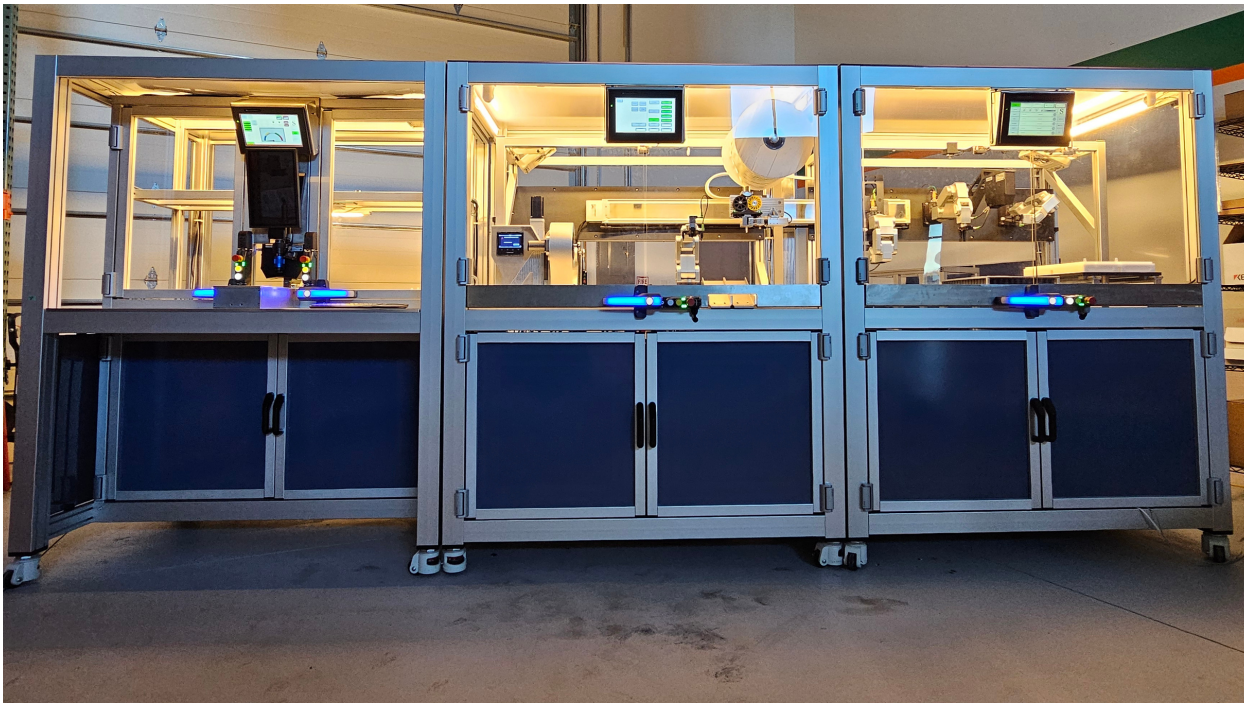
The introduction of the precision loader system revolutionized the operator workflow in several key ways:

- **Simplified Initial Setup:** Operators now perform a straightforward calibration and configuration based on the specific components being assembled, significantly reducing setup time.
- **Flexible Loading Process:** The advanced sensing and vision systems allow parts to be placed in the loader without a predetermined sequence, eliminating the need for meticulous pre-sorting and significantly speeding up the loading process.
- **Autonomous Operation and Monitoring:** Once components are loaded, the system autonomously manages counting, tracking, and precise placement. Real-time feedback mechanisms enable operators to monitor the process and intervene only when necessary, shifting the focus from manual handling to supervision and quality control.
- **Maintenance and Scalability:** The modular design simplifies maintenance, and system updates or expansions can be easily managed, ensuring the loader system evolves with the company's needs.

This workflow transformation has not only optimized efficiency and reduced the potential for human error but also empowered operators to focus on more critical aspects of the manufacturing process, enhancing overall productivity.

# In Summary

The implementation of the precision loader system in medical device manufacturing marked a significant leap forward. By addressing the pre-existing operational inefficiencies and introducing a flexible, efficient, and precise loading solution, the client was able to dramatically improve production uptime, flexibility, and product quality. This case study exemplifies how innovative engineering solutions can transform manufacturing processes, setting new industry standards for operational excellence.



# Have a Similar Process to Automate?

Reach out to our team to speak with our team of engineers about how we can set your business up for success with our failproof automation systems!

| *Point of Contact* | *Phone* | *Email* |
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Learn More at www.seymouradvancedtechnologies.com