AUTOMATION nth

CASE STUDY

Adhesive Bonding POP Cell

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Introduction

Vision-Triggered Adhesive Jetting Cell Demonstrates Geometric Control and Robust Bonding for Precision Medical Assembly

The proof-of-principle (POP) system was developed to evaluate whether UV-curable adhesive could be precisely jetted to form a functional geometric profile and a structurally sound bond between flexible cylindrical components, under real-time decision-making guided by machine vision. This POP not only confirmed the viability of the process but demonstrated that automation could meet the stringent requirements previously achieved only by skilled manual labor requiring magnification devices.

Overview

A global medical device manufacturer, sought to explore automation for a highly sensitive bonding process involving the inner and outer components of a flexible medical surgical sub-assembly. The manual process required extreme precision and tactile sensitivity, typically performed by operators looking through microscopes. The customer's manual process was no longer sustainable at the volumes they projected. Turnover, inconsistency, and frequent material waste further underscored the need for a repeatable, controlled solution.

Automation NTH responded by developing a proof-of-principle cell using the FLEXBASE platform, showcasing in-house capabilities across robotics, vision, and software integration. The system used jetting valves for adhesive application, vision for in-process inspection, and Ignition HMI for control and live process visibility. By demonstrating that the process was automatable and controllable through feedback-driven logic, the POP cell cleared a key development stage gate, enabling the customer to confidently pursue a full automation roadmap.

Challenges

Several technical and logistical hurdles shaped the project:

1. **Micro-scale variability:** The parts featured micro-tolerance variation, making consistent handling and adhesive application difficult without advanced vision and control.

2. **Precision bonding:** The adhesive needed to form both a structural bond and a repeatable geometry at a specific interface, requiring finely-tuned control.

3. **Footprint constraints:** The system had to meet ISO 7 cleanroom space limitations; using the NTH FLEXBASE, the final design reduced the footprint by 60% compared to the original allocation.

4. **Dispense valve selection:** A series of prolonged repeatability testing helped evaluate and select a valve that delivered consistent results.

5. **Feedback dependency:** Real-time process feedback from a high resolution camera was essential to detect when and where additional adhesive was needed, prior to UV curing, transforming this into a highly adaptive and process sensitive application.

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Solutions

The solution was architectured around the FLEXBASE platform, which enabled fast iteration, compact layout, and integrated process control. Key system components included:

1. **Robotic positioning:** Precision SCARA in conjunction with micro 6-axis robots were used and evaluated to determine optimal adhesive dispense routines and robot path control.

2. **Jetting adhesive:** Our report identified the UV-curable adhesive needed to be dispensed through high-performance jetting valves to achieve superior repeatability.

3. **Vision-guided control:** A camera monitored the adhesive profile in real time and triggered conditional dispensing logic based on inspection results.

4. **Process flexibility:** The system operated on variable timing, not fixed cycle times, adjusting automatically for adhesive wicking differences, caused mainly by surface tension with the adhesives, between parts.

5. **HMI and SCADA:** Using Ignition HMI, the system provided intuitive operator visibility, historical data capture, and scalable integration into broader manufacturing operations.

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Results

The POP system exceeded its core objectives:

- **Feasibility confirmed:** The process was successfully replicated through automation, reducing reliance on manual labor.
- **Quality and waste:** Vision-based control improved first-pass yields.
- **Valve validation:** The jetting valve consistently delivered repeatable performance, eliminating earlier variability concerns.
- **Space efficiency:** The FLEXBASE implementation cut the system's footprint by more than half, meeting critical ISO 7 cleanroom requirements.
- **Strategic confidence:** By validating the process in a low-risk, POP based controlled environment, the customer de-risked their automation investment and now has a clear path to a production-ready solution.

Conclusion

This project transformed an operator-dependent bonding process into a high-precision, vision-guided automation solution. Automation NTH's POP approach allowed the customer to test, iterate, and validate the feasibility of full automation without prematurely locking into a production system.

Through modular robotics, jetting technology, and adaptive vision control, the solution proved that automation could meet or exceed manual performance while enabling scale, consistency, and traceability. It's a clear example of how Automation NTH partners with customers to de-risk complex manufacturing challenges and lay the foundation for long-term automation success.

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About NTH

Founded in 1999, Automation NTH is a trusted partner in automation for manufacturers, with our headquarters located just outside of Nashville, TN and additional offices in San Diego, CA. Our expertise transforms your manufacturing operations from manual processes to semi-automated and fully automated production. Whether scaling up from individual work cells or introducing fully integrated production lines, we deliver solutions that drive cost savings, enhance efficiency, and minimize risks. With a strong focus on robotics and controls, we ensure timely delivery of projects with strict adherence to budget.

Key markets we serve include:

- Medical Diagnostics
- Drug Delivery Systems
- Wearable Devices
- Therapeutic Devices
- Vascular Technologies

Our innovative approaches improve production capacity, product quality, and enable operator autonomy.

Our Solutions:

- Customized Automation: Scalable production solutions for complex products.
- Proof of Principle Creation: Validating manufacturing processes before full automation.
- Scalable Production: From semi-manual cells to full automation.

Services We Provide:

- Custom Automation
- Automation Consulting
- Equipment Optimation

Engineering Your Edge, Together!

Contact Us today at sales@automationnth.com

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