Application Notes

Automated Assembly of Blood-Line Circuits

Industry Insights

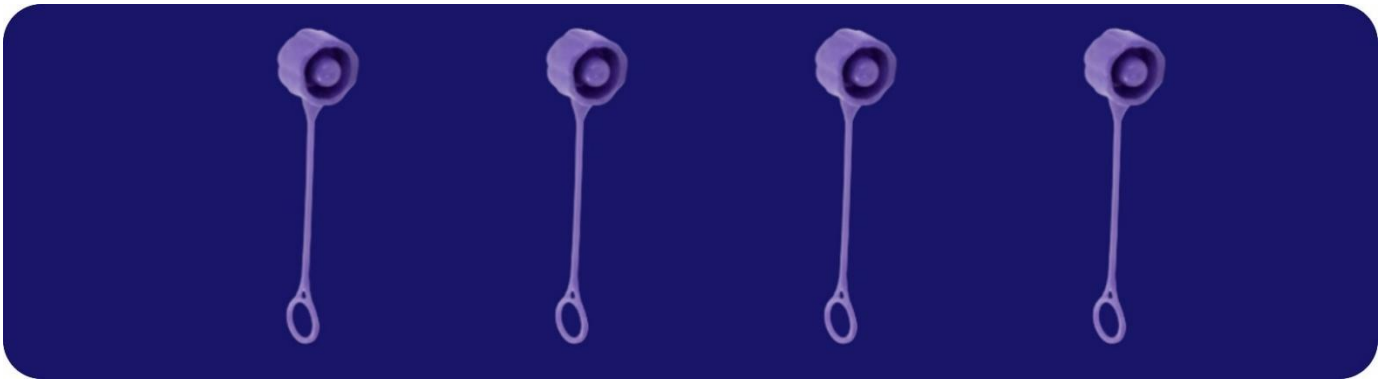
In the medical device sector, production requirements evolve rapidly. Manufacturers must cope with increasing product customization, strict regulatory constraints, and the need for traceability and zero-defect manufacturing. As therapies become more tailored to individual patients, assembly lines must be highly versatile, scalable, and capable of adapting to new product specifications with minimal downtime.
For systems integrators, this means building automated solutions that combine precision, repeatability, and configurability—while ensuring extremely short cycle times and efficient operation

Handled Parts

The automated system assembles multiple parts used in blood-line circuits, a category of medical disposables requiring careful handling.
The parts include:

- Soft silicone medical-grade tubes prone to deformation and tension issues
- Small plastic caps equipped with a very thin lanyard, which can assume unpredictable positions
- Luer connectors to be glued onto pre-wound tube sections

These parts exhibit challenging behaviors, such as twisting, overlapping, and position variability, making traditional feeders unsuitable—especially for the caps with thin laces, which are prone to jamming.



The Configuration

The assembly solution consists of a **dual automated line**, each machine featuring 11 stations (22 total), designed to process four products simultaneously and reach a **1-second-per-piece cycle time**. The system was developed by **Tecnoideal**, in partnership with **SINTA**, integrating flexible feeding and advanced robotics.

The configuration includes:

- **FlexiBowl® 500 Flexible Feeding Systems**
  Used to orient and feed the plastic caps. Their combination of impulse-based agitation and rotational motion, paired with a vision system, allows reliable management of caps whose lace can appear in varying positions. This eliminates feeding jams and reduces scrap.
- **24 SCARA Robots (EPSON Series GX8 and RS4)**
  GX8 SCARA orient the plastic caps on the FlexiBowl®.
  2 RS4 SCARA pick the oriented caps and place them onto satellite tables, operating in dual-cycle mode.
- Additional SCARA units perform tube repositioning to obtain the final shape.
- **Tube Management Units**
  Four unwinders load, feed, and detension the tubing inside the machine for precise control during the winding phase.
- **Automated Gluing Stations**
  Vibratory loaders and pick-and-place units insert and glue luer connectors onto wound tubes.
- **Final Shaping and Wrapping Module**
  Semi-finished products are wrapped with cohesive paper.
- **End-of-Line Quality Control**
  Cameras verify dimensional and assembly integrity, while defective items are automatically rejected.

Precision and Efficiency

The FlexiBowl® 500 enables jam-free feeding of delicate caps with laces, eliminating the need for mechanical adjustments and minimizing downtime. Its combination with SCARA robots ensures:

- consistent orientation
- repeatable pick trajectories
- extremely low scrap (<2%)
- fast product changeovers via simple gripper and software updates

The quadruple-process architecture distributes tasks efficiently, supporting the demanding 1-second cycle time without compromising quality.

Results

The dual-line system delivers:

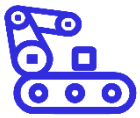
- **1-second cycle time** per finished product
- **Scrap rate below 2%**
- Reliable feeding of delicate medical caps with lace
- Full automation from tube winding to connector gluing and final wrapping

- Scalable, modular architecture ready for future product adaptations
- Reduced energy consumption thanks to SCARA efficiency and optimized software

Key Points

Life science

Epson Robot



Assembly Process

Fast production cycle