PRECISION ASSEMBLY AND AUTOMATION
Miniaturized mechatronic systems have numerous applications in medical, production or sensor technology, but also find their way into various consumer goods. They place high demands on the applied assembly technologies, which is why production processes are still largely dominated by manual assembly operations, impeding competitive production in high-wage countries.

With this in mind, we are developing solutions for the flexible automation of precision and micro assembly processes, from prototyping to series production.

**Expertise**

- Precision and optical assembly: several years of experience in basic and applied research projects on the assembly of hybrid micro systems and micro-optical assemblies
- Automation of assembly processes: profound understanding of the specific challenges in handling and joining sensitive micro components
- Successful development projects for automation solutions, from single-process stations to entire systems for micro and precision assembly operations
- Comprehensive practical experience with automation solutions for precise handling, positioning and joining of components, as well as measuring and controlling parameters and processes

**Competencies and technologies**

The technical expertise of the Fraunhofer IPT extends over all levels of assembly automation – from analyzing single assembly steps all the way to developing and setting up prototypical systems for the automated assembly of complex mechatronic products.

We provide a wide range of technological products and services for industrial applications, from consultancy and support during concept development for automation solutions, test runs and process optimization on our own automation equipment, to developing customized modules and setting up entire systems for specific assembly tasks.
Most processes in micro and precision assembly exhibit great potential for increasing efficiency by means of partial or full automation. Furthermore, hybrid assembly technologies provide opportunities to combine different materials or production processes to create new products and applications.

In the majority of cases, the technical feasibility first has to be proven and evaluated economically.

Based on our expertise and equipment, we offer feasibility studies and process analyses for your individual challenges.

**Our services**

- Analysis of existing assembly processes with regard to tolerance chains, potential increases in efficiency and degree of automation
- Development of assembly and alignment strategies
- Conception and development of test stands
- Design and manufacturing of specific tools and fixtures
- Assembly test and parameter studies to evaluate technical feasibility
- Realization of automated processes on test stands and assembly systems in our clean room facilities

**Modular grippers and alignment systems**

Core processes of micro and precision assembly include safe and robust gripping of parts as well as precise positioning and alignment of components in several degrees of freedom. Based on our competence in handling solutions for micro and optical components, we offer the adaptation of commercially available systems and the development of fully customized solutions for your specific processes and needs.

**Our skills**

- Evaluation and verification of gripping principles for miniatrurized components
- Design and fabrication of grippers for special requirements
- Development of gripping systems for flexible/modular automation
- Conception and development of multiaxial alignment modules
- Upgrading of existing positioning equipment with additional degrees of freedom or flexibility
- Dimensioning and optimization of parallel kinematic systems
- Calculation and simulation of flexures for highly precise motion
- Setup and control development of modular alignment systems for stationary or robot-based applications
SENSOR INTEGRATION AND CONTROL DEVELOPMENT

Precision assembly processes often require the evaluation and feedback of high-resolution sensor data. Besides applying sensor technologies for monitoring and controlling single assembly steps, many alignment operations are based on sensor feedback to evaluate position or function of the components. The flexible integration of sensors and alignment algorithms into control systems is one major challenge in automation.

Our services
- Integration of image processing, force control or beam evaluation in assembly processes
- Development and implementation of sensor-guided positioning and alignment processes
- Programming of algorithms for an active alignment
- Combination of heterogeneous actuators and sensors into consistent control environments for easier application development

DEVELOPMENT OF ASSEMBLY SYSTEMS

Available solutions for an automated precision assembly in most cases do not provide the necessary flexibility and openness for the development and implementation of individual processes. Especially in the optical and medical fields, the requirements imposed by product technologies are highly individual and hardly realizable using standard solutions. This is why in these fields we offer advice on the application of existing systems and develop customized solutions for and with our customers.

Our services
- Conception of assembly systems for highly precise applications
- Prototypical realization of modules and process stations for tests and studies
- Design and development of individual package solutions for special assembly tasks
- Configuration and setup of assembly systems
Fraunhofer Institute for Production Technology IPT
Steinbachstraße 17
52074 Aachen
Germany
Phone +49 241 8904-0
Fax +49 241 8904-198
info@ipt.fraunhofer.de
www.ipt.fraunhofer.de

Contact

Dr.-Ing. Christian Wenzel
Phone +49 241 8904-220
Fax +49 241 8904-6220
christian.wenzel@ipt.fraunhofer.de

Dipl.-Ing. Dipl.-Wirt. Ing. Nicolas Pyschny
Phone +49 241 8904-164
Fax +49 241 8904-6164
nicolas.pyschny@ipt.fraunhofer.de