Standardization enables photonics industrial production.

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Abstract

Production equipment with high standardization levels and open interfaces provide an easy access to industrial automation of photonic product assembly. By encapsulating highly individual systems within a plug-&-produce system provides the opportunity to manufacturers to focus on their core applications as a unique quality factor of their product.

Industrialized production of photonic products is going to be a game changer soon.

Light-based technologies have become a major aspect in our modern world. Our highly evolved societies rely on it within communication and computing systems, use light as a fabrication tool or use it for measurement systems. Due to the broad range of applications, the availability of high quality and complex products at low costs are a more and more demand, which will be the major challenge for the near future.

One answer to face this challenge is the fully automated production of photonics assembling. Confronted with such a challenge, the question arises: How to get from a mostly manufactory-like production to a highly industrialized automatic production solution for assembling photonic products in a growing and volatile market? This issue is even more relevant because most of the current companies in the photonics market are small or medium-sized ones.

The answer is an open and standardized plug-&-produce production platform.

Today's production systems for the full automation of photonic product manufacturing are still associated with very high investment costs. In addition, it is difficult to find the manufacturing technology or appropriate combinations required for one's own product. It is even more difficult to commit to a system, although the own product to be automated is not yet fully defined but the market opportunity could already be huge. Access is thus hampered by a highly volatile market, high investment costs and low availability of required technologies integrated in fully automated production equipment.

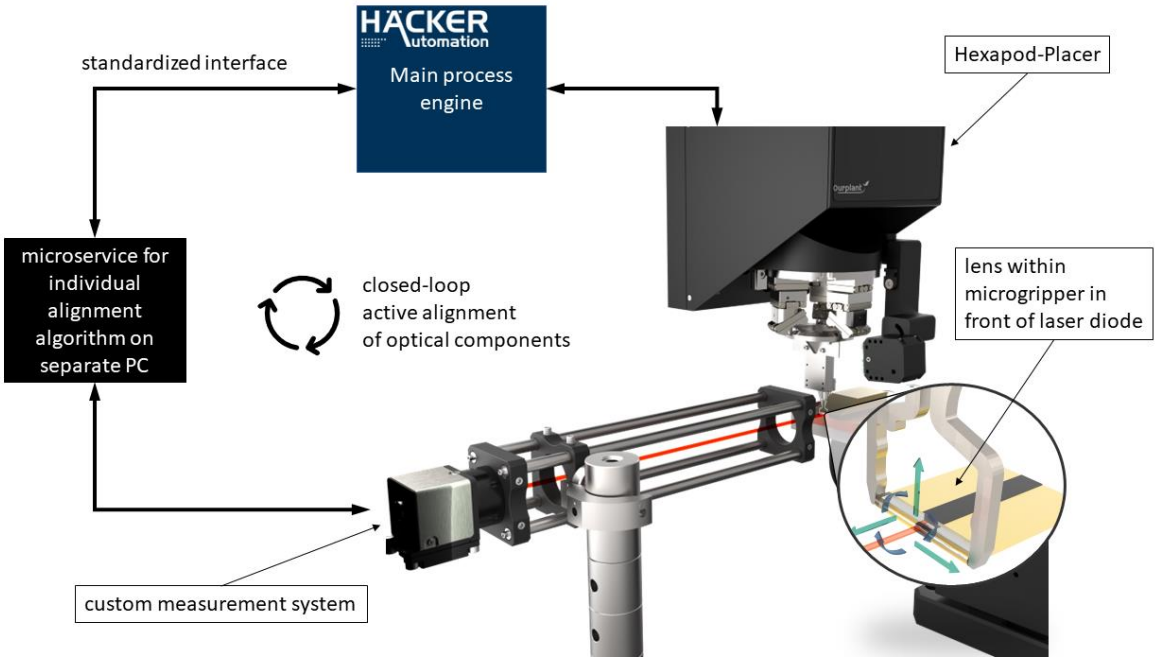
The most suitable answer to the aforementioned challenges of full automation is a platform that offers established basic production skills combined with open, standardized interfaces to adapt almost any required technology. Häcker Automation has developed such a production equipment platform over the last 20 years to realize complex automation tasks in micro assembly.

The platform makes it easy to get started by providing basic machines of different sizes and purposes. All basic machines have highly standardized mechanical, electrical and software interfaces. This means that all machines can be equipped with the same modules. By using standardized main control software, the production process can be transferred very easily from laboratory scale to large-scale systems by the user itself. Another way of scaling up is to start production on a single machine with low throughput and to increase the yield considerably by dividing the sub-processes among individual machines. So, the ramp up of a newly developed product can start small and grow fast.

Due to the standardized interfaces and the small-scale modularity of the platform it is quite easy to adapt new production technologies. This is a major benefit to survive in the volatile, innovative and growing photonics market as a manufacturer.

Encapsulating individual production equipment in a standardized framework enables nearly infinite possibilities.

The platform includes a variety of production modules for inspection, die bonding or dispensing that are already proven in electronics micro assembly. In addition, Häcker Automation has recently expanded the platform with new modules and standardized frameworks that are particularly suitable for photonics production. For instance, a hexapod module combined with microgrippers can be used as a placing system in alignment processes. To implement the possibility of active alignments into the platform a generic contacting system has been created. Further, the standardized and open microservice framework gives the possibility to adopt arbitrary measurement systems and adds the possibility of individual alignment algorithms to the platform.



The common closed-loop alignments of optical components are mostly combined with individual measurement techniques, e.g. characterizing laser beams or measuring relative positions in sub-micrometer range. The production platform provides a standardized interface to adapt any measurement system into the equipment and communicate the results of the evaluation algorithm to the main process engine. From there, any motion system of the platform can react on the new results and creates the closed-loop alignment.

Common integrations of measurement systems can reach from beam profiling cameras for active alignment of FAC and SAC lenses of high-power laser diodes (CoS-Systems) to white light interferometry for passive alignment of laser bars in the sub-micrometer range. In simpler contexts it could be more efficient to integrate scalar measurement systems like power meter or photodiodes to determine the control value of the active or passive alignment.

The complete microservice framework can be manipulated or even completely setup by the manufacturer itself. That means that the microservice encapsulates the individuality of the product within a standardized framework. Doing so, the manufacturer gets the possibility to combine its unique, validated processes with a versatile and standardized production platform.

Due to the standardized interfaces and the easy possibility to combine standard equipment with custom systems, the entry level to full-automation can be easily adopted to nearly every situation: From laboratory setups to high volume production. Starting from open-source systems to turnkey production equipment, the platform provides an all-in-one solution to face a large variety of photonics production challenges.