

Innovations born from light

Who hasn't been fascinated by the complex interplay of dynamics that takes place during a laser light show? What many people may not know is that the same principles are at play in the process industry. The show in this case has nothing to do with fancy lights dancing across an arena, however, but rather the processing of many different types of material at much higher power, at maximum precision and under extreme safety requirements. The company LASERVORM GmbH has mastered this technology in all of its forms.



We're here in central Saxony, a region of Germany more often associated with vacation than advanced technology. Appearances can be deceiving, however. Boasting an excellent technical college (the University of Applied Sciences) and numerous companies involved in machine tool manufacturing, the town of Mittweida has developed into a center for scientific re-search and business.

LASERVORM is one of the companies located here. "Through our own laser-aided subcontracting work, we have become well acquainted with the demands that arise due to new technologies and materials," explains Thomas Kimme, General Manager of LASERVORM. "We use the knowledge we've gained in this way to manufacture state-of-the-art laser systems that can be used for cutting, standard welding and surface-layer welding in many different industries." Standard applications can be found in the automotive branch, but also in precision engineering and pharmaceuticals. Pharmaceuticals? "This industry allows us to show case our flexibility," explains Kimme. "Here, we can use CO₂ lasers in a clean room environment to hatch eggs for the manufacture of vaccines. It was especially challenging to meet the many different standards set forth by both the European and American pharmaceutical industries." LASERVORM works very closely with other companies in the area, forming the FASKAN Group and providing services involving anything to do with lasers. This cooperation allowed LASERVORM to develop a basic concept that can be used to handle a wide variety of laser processing tasks.

Our machines are becoming more modular, more complex and more powerful. At the same time, this increases expectations with regard to technological possibilities, while the demands on safety are becoming increasingly more complex. The solution therefore requires integrated systems with programmable safety functions.

Thomas Kimme, Managing Director LASERVORM

Laser processing machines are distinguished by their complexity, assembled from a wide variety of different components and interfaces. In addition to their primary components – the laser source, optics, and motion systems – various peripheral systems such as those needed for cooling, enclosure, clamping and safety are integrated as well. How this type of machine is put together sounds simple at first. A highly energized beam generated in the laser source is transported via light conductor to a scanning system, where it undergoes high-precision deflection before being shaped as dictated by requirements. A CNC controller is then used to align the beam with the clamped workpiece and guide it according to the task at hand. Safety technology must be in place to ensure that the laser beam can be switched off within milli-seconds if deflected incorrectly.

These few details conceal a large number of technical obstacles. Whereas 7 kW per mm² of light power was possible 15 years ago, 140 kW is the standard today. With a focus diameter of 50 µm and 10 kW of light power, it's now possible to generate 5,000 kW per mm². The total amount of light power has increased to over 700 times what used to be possible! This is more than enough to penetrate even the strongest enclosures in a split second, highlighting once again the risk involved with these applications. At the same time, beam cross sections have been reduced, which requires considerably more precision in the scanner control mechanism. "The requirements put forth by our customers means that our own demands have evolved as well," says Kimme. "In concrete terms, this means that we have to be able to handle the highest requirements available in order to deliver a custom fit solution to our customers." This was also the reason to have another look at the existing machine construction and seek out components that were best suited to the increasing demands on precision, flexibility and integration.

The first part of this process entailed finding a controller that could handle the different levels of light power determined by the various measurement values in the different technological processes. The first step was also important for evaluating different bus systems to find one that allowed the many different components used in the laser processing machine to work as synchronously as possible with the lowest amount of jitter while offering the same performance when handling safety-oriented tasks. Of nearly all the known Ethernet-based bus systems, only POWERLINK and its strict cyclic behavior and jitter < 1 µs was able to meet each and every demand. »



Special machines from LASERVORM can be found in the pharmaceutical industry. One application where they are used involves hatching eggs, which is important in the development and manufacture of vaccines.

After the decision was made to utilize POWERLINK, it was time to evaluate the hardware. For the most part, this concerned the use of standard components that wouldn't impede the flexibility of the system design. One small problem, however: even the fastest bus system isn't powerful enough to be used to control the laser. To find an improved solution that could be offered in this particular area, the LASERVORM developed a new connection module together with the company IMM. This module makes it possible to control the power and position of the laser beam in 32 sub-cycles, with the beam shape able to be adjusted to technological requirements at runtime. The guarantees the maximum flexibility and precision necessary to handle future demands as well.

When it came to the standard components, LASERVORM once again chose to go with B&R. "The decisive factors for us during the decision-making process were the openness of the system all the way down to the kinematics, open protocol interfaces, but especially CNC, safety and control integrated into a complete system," explains Kimme. Since

B&R is a full-range supplier of automation technology, offers the widest range of POWERLINK components and delivers integrated safety and CNC functionality, the decision was actually quite easy. ■



Industry: Specialized machine manufacturing
Location: Altmittweida (DE)

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