

## Vision Simplifies Laser Welding



Trumpf Laser GmbH Co. KG, based in Schramberg, Germany, develops and manufactures machines and systems equipped with solid-state lasers, that are then deployed in sectors such as automotive or medical technology. One particular industrial application area is precision welding of small components made of different metals.

Trumpf decided to integrate vision technology into the scanner optic for welding on its laser machines. This is known as the PFO (programmable focus optic). Its objective was to improve flexibility and accuracy, as well as to speed up the production process for its clients.

Integrating a vision system was a strategic development decision. Vision would make it possible to automatically adapt the welding position to match each work piece position and size without operator intervention. The vision system would determine coordinate transformation data and would also need to be user-friendly for operators without prior vision experience. Any existing welding systems needed to be retrofitted without causing problems to the newly integrated vision system.

Trumpf needed to find a partner from the vision sector to help solve the application. The company wanted to concentrate on its core business while integrating vision technology effectively with simple installation for its customers. Trumpf decided to work with Rohwedder AG Vision Technology, a company based in Markdorf, Germany, with a staff of experienced vision specialists. The company is also one of Cognex' Partner System Integrators (PSI).

The high-performance In-Sight™ 5100 family vision sensors were chosen as an independent vision system with robust hardware conforming to IP67 (NMEA 6). The In-Sight 5400 is used for more demanding requirements. Its compact design means that the In-Sight can be mounted straight onto the PFO, thus saving space.

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By deploying vision technology in its machines, Trumpf has eliminated the need for clamping and positioning devices. The precise fastening of parts relative to the laser are no longer needed, or they can be much simpler in design thanks to the ability of the vision sensors to find small parts. This means a new flexibility in the operating method, with increased automation and a significant boost in production quality. Waste is reduced and production costs are cut.

Instead of grey-shade correlation, PatMax vision software from Cognex, uses the geometric structures of objects such as edges, dimensions, shapes, angles, curves, and shading to localize their form. The three-dimensional relationships between these central features of the acquired image are compared to the real-time image. Data analysis allows the laser to accurately locate the object. For standard applications, the response time for a complete image evaluation is roughly 180 msec.

Images and coordinate data are gathered by In-Sight and transferred via Ethernet to the laser's FDP server. In-Sight dispenses with the need for an image processing PC and the system solution excels on account of its flexibility. A key advantage of this vision solution is the In-Sight Explorer development environment. Based on the Microsoft Windows XP operator interface, the tools in this software package mean easier programming intervention and easier integration of the vision system to the laser server's fault diagnosis using WinLas software.

The procedure has been designed in such a way that a potential client can quickly receive a detailed feasibility study on his or her application. The user sends some sample parts to both Trumpf Laser and Rohwedder AG Vision Technology with the requirements. Both companies work to determine the viability of the project. The customer is assured of system reliability, aiming accuracy and  $\mu\text{m}$  tolerance, as well as that the system operator will be able to handle the system without any prior vision experience. The laser production system with the vision solution is then tested by Trumpf under production conditions, allowing the subsequent installation and production start-up at the customer's to be implemented quickly.

More than ten PFOs with integrated vision in diverse industrial sectors are already in use. All these system deployments—before official operation—were retrofits or beta systems. Retrofits, in particular, with their backward compatibility to previously installed PFOs have demonstrated positive results as a 'Plug and Play' system.

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