

Trumpf: IPC technology and EtherCAT elevate 3D laser cutting systems

Open and highly adaptable automation helps optimize machine concept



Interior of the TruLaser Cell 8030

As the pioneer in 3D laser processing technology, Trumpf offers complete machines and systems with optimally coordinated components in addition to beam sources and beam components. The advanced TruLaser Cell series machines utilize Industrial PC technology and EtherCAT I/O components from Beckhoff. The current, second-generation TruLaser Cell 8030 combines maximum production reliability and productivity for 3D laser cutting.

The TruLaser Cell 8030 is designed for the automotive sector and can be flexibly configured. A large version for cutting drawings and complete side parts is available along with a smaller variant for manufacturing individual parts and segments of the bodyshell. The high-speed rotary changer provides a 20% shorter turning time of only 1.8 seconds, minimizing non-productive times and increasing the overall performance. In comparison to the predecessor model, the machine cuts a hot-formed vehicle cross member, for example, with 10% higher machine dynamics, 10% lower non-productive times and 30% faster slug control.

Flexible machines and control systems are essential

The TruLaser Cell 8030 can process large series parts cost-effectively and with high flexibility. The NC programming offers maximum flexibility in terms of the component geometry, which can also be subsequently modified to address new requirements using the variable laser tool. The same applies to the automation specialist chosen to support the project, as Thomas Brauchle, Service Quality Assurance Manager at Trumpf in Plymouth Township, Michigan, USA, and former TruLaser Cell 8030 project manager, explains: "With Beckhoff we have a partner who supplies us with state-of-the-art automation technology and also has the flexibility to address the special requirements of a laser processing system. The broad portfolio offers almost all of the required components. In rare cases, in which the standard range could not provide a solution, they quickly developed the ideal product."

Another key factor behind the decision to choose Beckhoff technology was the underlying EtherCAT communication system. Thomas Brauchle confirms this: "We utilize EtherCAT with all TruLaser Cell machines. The key factor here was that EtherCAT provides an optimal fieldbus system for modular control

cabinet equipment. This enabled us to implement our concept for compact control cabinet modules in an ideal way – only a few I/O signals combined with the secure signals in a single module. The EK1914 EtherCAT Coupler is the concrete result of these requirements. It combines the functions of the EK1100 EtherCAT Coupler with standard and secure digital I/Os in an exceptionally compact design and can be expanded to include additional EtherCAT Terminals as needed. Using the EtherCAT I/O system from Beckhoff, we significantly reduce the space required in the control cabinet compared to other fieldbus systems." Another differentiator for the TruLaser Cell is the high performance of EtherCAT for controlling a highly dynamic laser optic axis while also supplying the servo amplifiers with setpoints fast enough.

EtherCAT offers a number of essential features to the TruLaser Cell, as Thomas Brauchle adds: "The available bandwidth perfectly matches the requirements of a laser processing system. This enables us to utilize EtherCAT for all of the installation technology and we do not have to make any compromises. In addition, there is the advantage of a worldwide communication standard with its widespread use. The transmission of signals to a rotating axis is an essential function in a 5-axis machine and we have developed a contactless and wear-free system for EtherCAT transmission together with a supplier."

Thomas Brauchle also values the extensive EtherCAT diagnostic options as a means of locating the causes of any faults. For example, in one case study a service technician remotely identified a fault in a cable for the power supply: "After the right spare part was received and replaced by the machine user, the system was back up, running smoothly again and the customer was impressed with the service." For some systems, space-saving control components are also important to reduce footprint requirements. As such, the Beckhoff system as a



The TruLaser Cell 8030 laser cutting machine can be conveniently operated via the customer-specific Control Panel built by Beckhoff (left).

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whole provides the assurance that the systems are state-of-the-art, flexible, very reliable, highly productive and also cost-effective.

Demanding requirements on the machine HMI

According to Thomas Brauchle, Trumpf machine control panels have extremely demanding requirements, which ultimately led to the decision to use a customized Control Panel from Beckhoff: "On one hand, the HMI has to be uniformly suitable for diverse machine technologies. On the other hand, our high demands regarding ergonomics and design also have to be fulfilled. This is only possible with a specifically developed Control Panel. Beckhoff's high flexibility regarding the design was a particular advantage. For example, we were able to specify the supplier for the integrated pushbuttons. We also quickly received a fully functional prototype for our own testing. The compatibility of the 'open frame' variant with the design operating panel is another advantage as it enables the new operating panel design to be integrated into an existing machine series."

The C6930 control cabinet Industrial PC with 2 SSDs and the C9900-U330 battery pack is used as the control computer in the TruLaser Cell 8030. According to Thomas Brauchle, Trumpf had numerous selection criteria and considered the IPC and Control Panel package as a whole. In addition to the high performance, the flexible installation on the highest possible number of different machines was a decisive factor. The ability to place the Control Panel in any desired location using the CP-Link 4 single-cable solution was another contributing factor.

Openness and system consistency

A wide variety of fieldbus systems have to be considered, given that Trumpf's OEM customers, in particular, integrate the laser sources into production lines. According to Thomas Brauchle, Beckhoff offers the right solution because of

the open-system design of PC-based control combined with a wide range of different fieldbus controllers, enabling the machines to flexibly adapt to each production environment. For example, PROFINET RT is connected via the EL6631 controller/device terminal as well as EtherNet/IP (EL6652), DeviceNet (EL6752) or PROFIBUS (EL6731).

The TruLaser Cell machines and the laser devices also utilize further EtherCAT I/O components. These include standard I/O terminals, including the high-density (HD) design, the compact EK1818 and EK1914 EtherCAT Couplers, IO-Link Box modules (with IP67 protection class) for connecting diverse sensors (temperature, pressure, level) as well as the EP9214 24 V voltage distribution for EtherCAT Box modules. Machine safety is also integrated consistently across diverse TwinSAFE Terminals and Box modules. The logical links are implemented in the EL6910 TwinSAFE Logic terminal. Thomas Brauchle adds: "TwinSAFE has replaced numerous electromechanical components with wear-free software. This has significantly reduced the number of conventional components and also the amount of wiring required. All non-drive safety functions were implemented via the TwinSAFE Editor and we truly value its graphical overview of the logical links. The ability to show and hide safety functions is essential for standard machines with expansions."

More information:

www.trumpf.com

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