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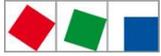
## Laser cutting machines from Dubai - CNC from Europe



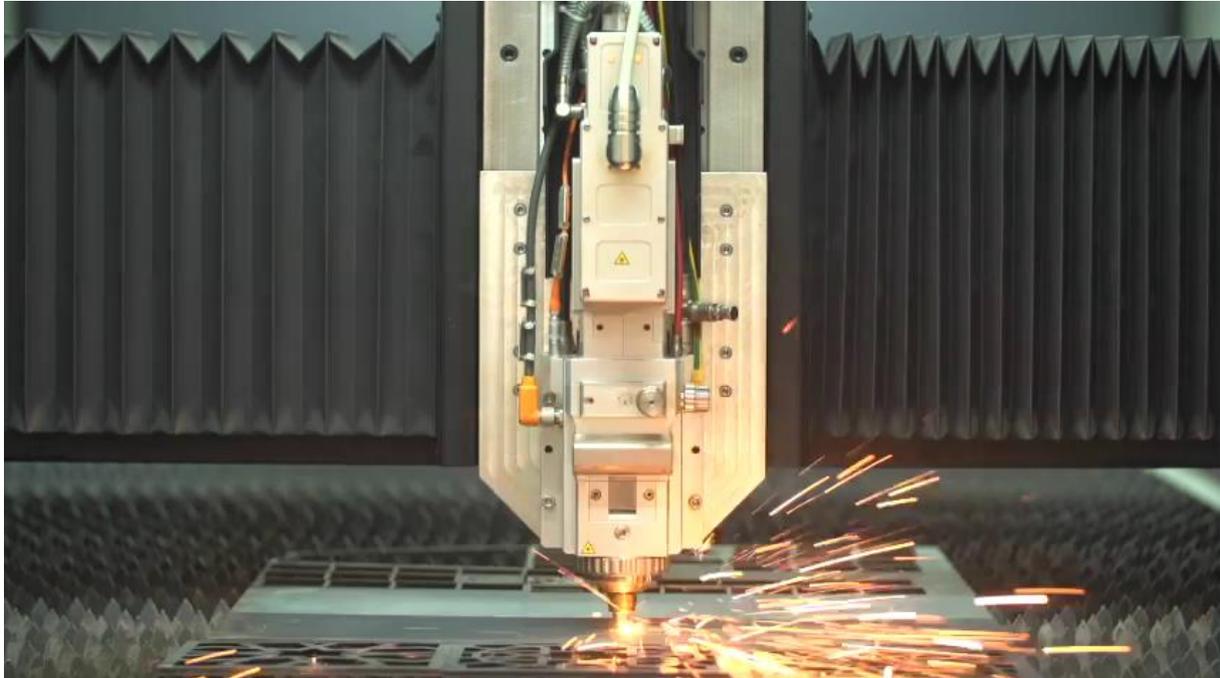
Fig. 1: PESADA CNC laser cutting machine and shuttle table (image: Accumech)

Here's what's happening: With acceleration of up to  $10 \text{ m/s}^2$  and speeds of  $100 \text{ m/min}$ , the laser cutting head on the highly dynamic XYZ positioning system races across the workpiece surface. For comparison: An ICE (German High Speed Train) achieves  $0.5 \text{ m/s}^2$ , a sprinter starts at  $4 \text{ m/s}^2$ . And just as with sprinting, when it comes to laser cutting, every millisecond counts! Not to mention the long travel distances with non-productive times on large gantry machines. Which control concepts enable innovative mechanical engineering companies like [Accumech](#) to get their [machines \(video\)](#) to the top of the podium in terms of dynamics and precision? This article will answer this question using some examples.

CNC laser cutting machines are high-tech and require CNC solutions optimized for specific applications. That is why new, innovative functions are usually developed and tested in close cooperation with the automation partner. This is also evidenced by the successful collaboration between Accumech, one of the leading manufacturers of CNC cutting machines from the Emirates, and [Eckelmann AG](#). Accumech, which was founded in 1990 and is based [www.eckelmann.de](http://www.eckelmann.de)



in Dubai, made a name for itself with solutions for automated cutting in particular. Today, the company, which is continuously growing, employs more than 200 highly specialized experts.



*Fig. 2: Laser cutting head in action (Photo: Accumech)*

In 2016, Accumech introduced its first 2D laser cutting machine with a powerful 4 kW fiber laser. Depending on the application, the machines in this series can be used to cut metal sheets up to 6 m long and 2.5 m wide and a maximum of 25 mm thick with high precision. Accumech solutions are used in Arabic and African countries.

„We work on the cusp of innovation and technology to take products from an idea all the way to the end consumer. The result are customized CNC solutions for the largest industrial companies in the United Arab Emirates. To master these challenges, we rely on innovative automation partners with many years of application experience in our technologies”, explains Waiel Alkhouifi, Executive Director at Accumech. “That’s why Eckelmann is much more than just a full-range supplier for the automation of our laser applications. The CNC control system already supports all important laser-specific functions because Eckelmann has offered highly sophisticated [CNC solutions for cutting](#) and laser cutting in particular for many years and continuously develops them. This accelerates our engineering while simultaneously giving our engineers the necessary solution reliability. And wherever we are interested in implementing innovative concepts, we are able to contribute our wishes or special requirements for a new feature directly to the further development of the NC. For a supplier of control systems, such a high level of flexibility and expertise in terms of solutions are by no means a matter of course!”

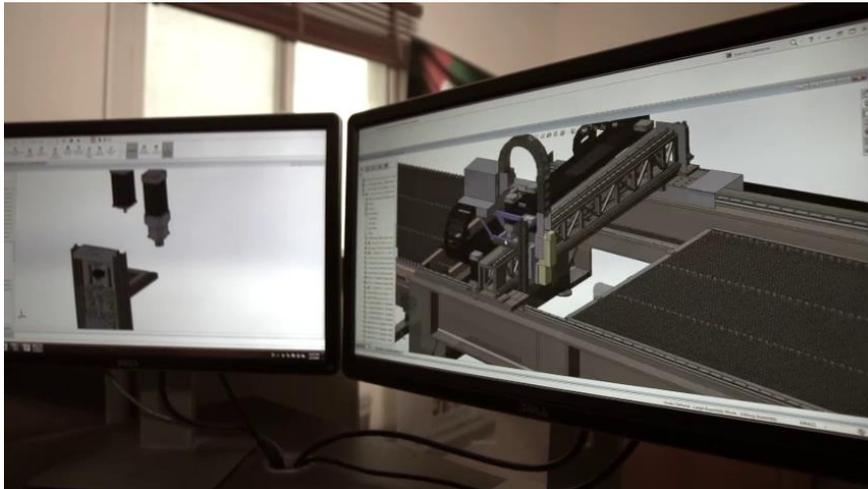


Fig. 3: Digital machine engineering at Accumech (Photo: Accumech)

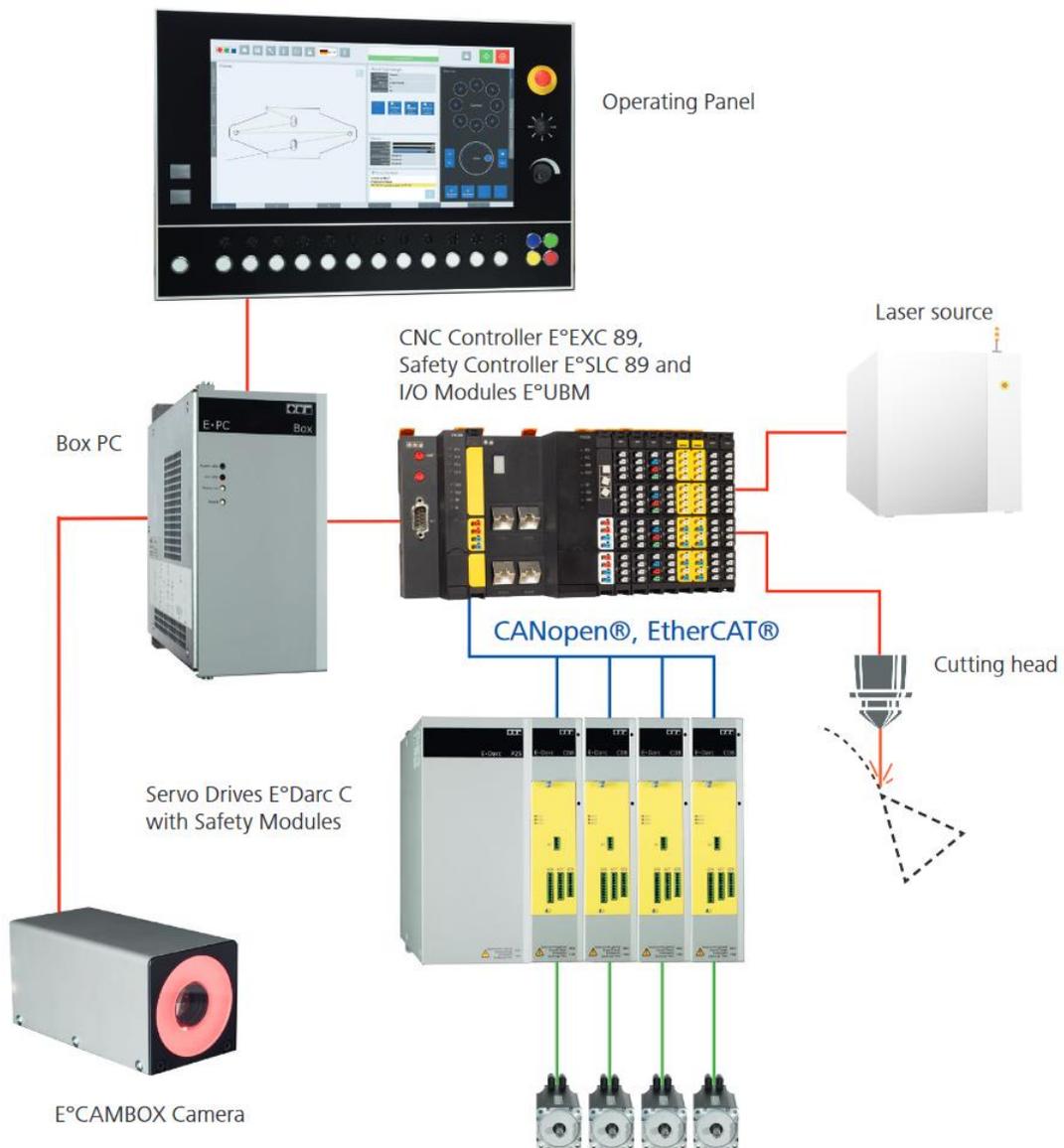


Fig. 4: Complete automation for laser cutting machines. (Graphic: Eckelmann)  
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## Fasten your seatbelt

Dynamic servo drives with high-precision encoders are the be-all and end-all for clean, continuous braking and acceleration ramps. Together with the [E°Darc C drive system](#), which is perfectly tuned to the CNC, Accumech achieves excellent acceleration values of up to  $10 \text{ m/s}^2$  with the X axis and  $10 \text{ m/s}^2$  with the Y axis with its laser gantry machines (see Fig. 5). Eckelmann also assisted the engineers in optimizing the axis system and calibrating it with high accuracy. This allows excellent positioning and repeatability to be achieved.



*Fig. 5: View of the inside of the completely enclosed machine: highly dynamic XYZ positioning system with a laser cutting head (Photo: Accumech)*

In addition to speed and acceleration, time-optimized control strategies can also significantly boost the productivity and precision of laser cutting machines. A few of these will briefly be introduced below.

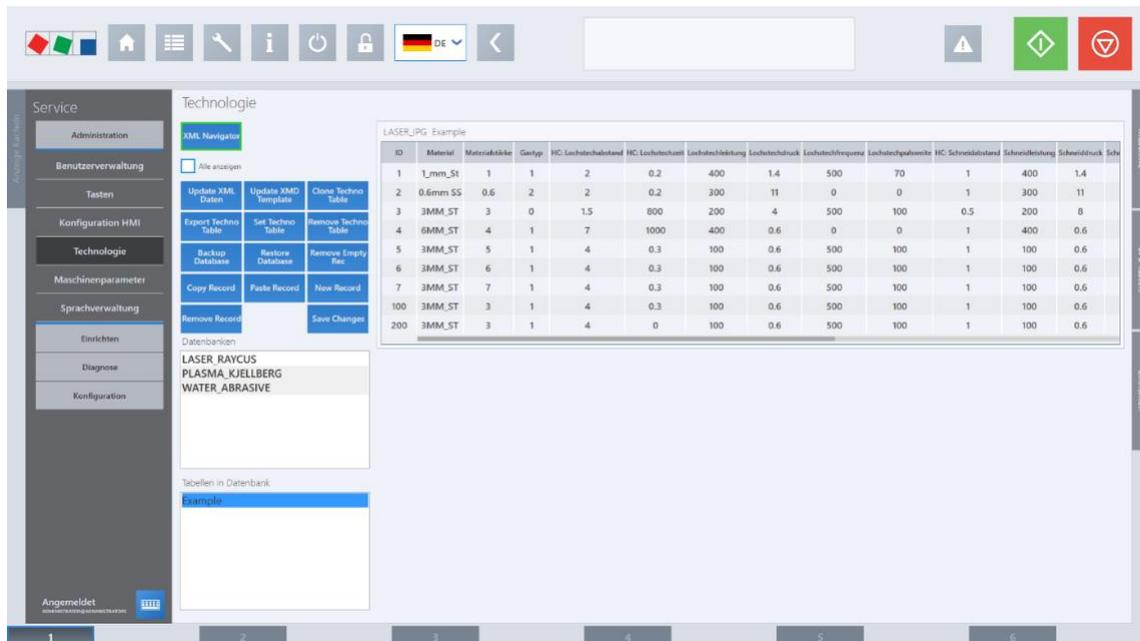


Fig. 6: Technology table for laser cutting applications (Photo: Eckelmann AG)

## Pierce and cut

Piercing is a particularly challenging laser cutting process. The laser beam is focused onto the surface of the workpiece with a lens system. The energy causes the material to melt or be vaporized. To ensure that the workpiece surface is penetrated as cleanly and carefully as possible, the average laser power is usually reduced and the pulse frequency is increased during piercing. As a result, the material is vaporized into plasma as completely as possible and metal spatters, which could damage the cutting tip and focusing optics, are avoided.

The remaining material that was removed is forced out of the kerf with the process gas concentrated by the cutting tip. Only once piercing is complete does the actual cutting process begin. Now, a higher laser output, higher gas pressure, and a lower pulse frequency are used.

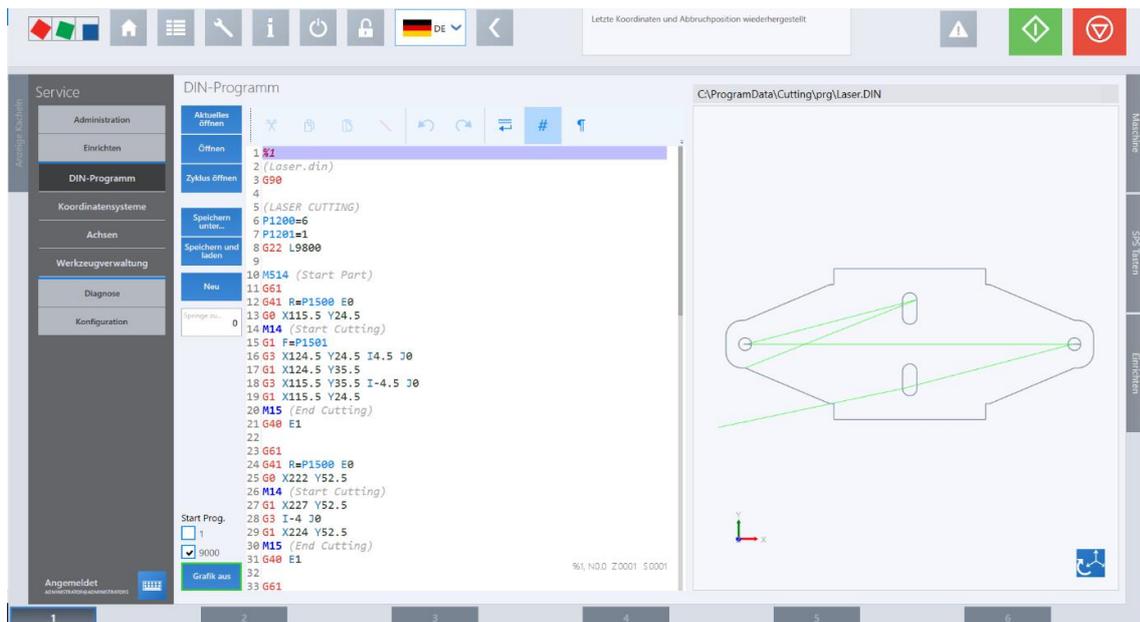


Fig. 7: CNC editor (Photo: Eckelmann AG)

However, especially for contours with a very large number of cutter infeed points (see Fig. 8), this means that it is necessary to constantly switch between the corresponding process parameters (gas pressure, power, pulse frequency) for piercing and cutting. Above all, switching the gases takes a lot of time and puts a heavy load on peripheral units such as the gasbox. As is the case for waterjet cutting, it has proved advantageous to decouple piercing and cutting for contours with numerous cutter infeed points. Eckelmann has also achieved this for laser cutting and offers it as a standard function. What this means is that all recesses are created first and then the contours are cut. For this purpose, only the cutter infeed points need to be defined in the DIN program; the rest is done by the CNC.

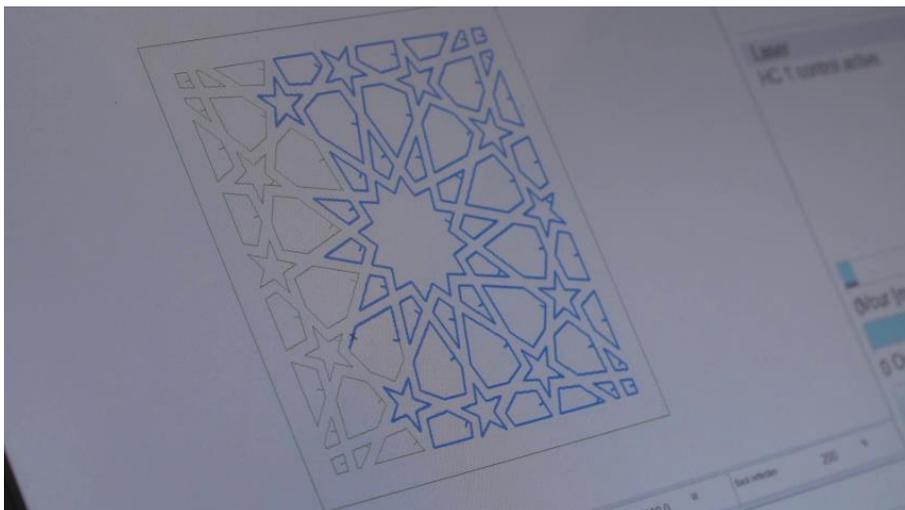


Fig. 8: The cutting program can be followed live in the HMI. Here is a contour with a lot of cutter infeed points (Photo: Accumech)



## Fly cut

The fly-cut option gives you a major speed advantage, especially when it comes to cutting thinner metal sheets. Cutting is done vertically and horizontally “on the fly” at a consistently high speed and without normal piercing. To this end, the laser is switched on and off in the fine interpolation cycle of the controller. For workpieces with a lot of cutter infeed points, the controller is faced with the challenge of properly delaying the activation and deactivation of the signal to ensure a high level of contour accuracy. For this time-critical function it's a matter of milliseconds! During normal operation, the controller switches between piercing and cutting and the cutting head briefly remains idle before each piercing operation.

## Frog jump

The “frog-jump” function also makes laser cutting machines more dynamic (see Fig. 9). Usually, the cutting head moves up along the Z axis at the end of a contour, after which it approaches the next contour section via the XY axis and comes into contact with and pierces the surface again. The purpose of doing so is to avoid collisions with cut parts. However, this discontinuous movement takes up a lot of time. With the frog jump, the controller optimizes the traverse path by transporting the cutting head along a curved path and in a continuous motion. In conclusion, this saves a lot of time.

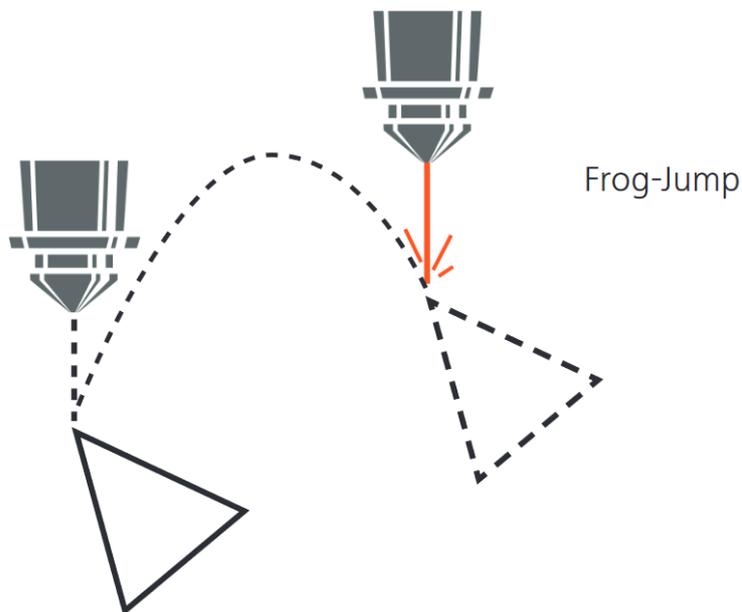
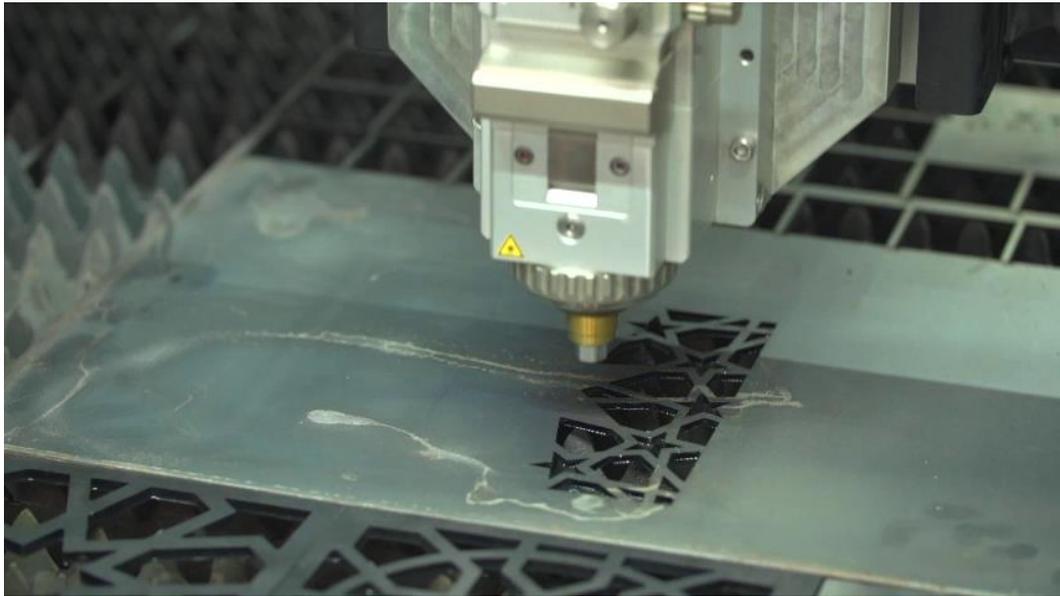
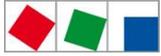


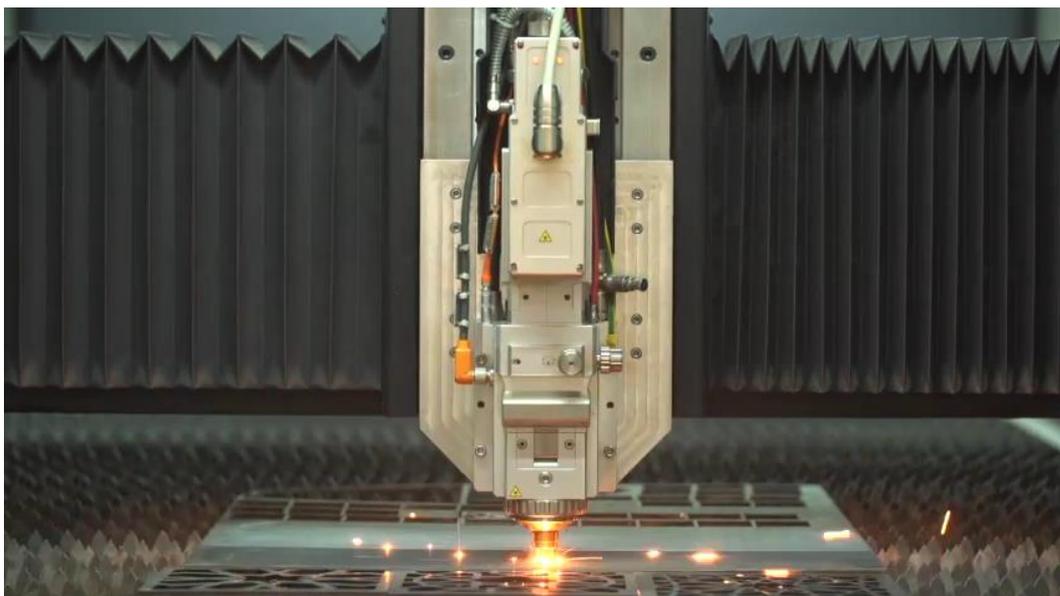
Fig. 9: Frog jump (Graphic: Eckelmann AG)



*Fig. 10: Approaching the next cutter infeed point (image: Accumech)*

## Dynamically optimizing the piercing process

As mentioned above, the laser needs to pulse in order to pierce the material. The pulsing of a laser is defined by the duty cycle and indicates the ratio of the pulse time to the periodic time. To achieve good piercing results (i.e., in particular no frayed holes, slag on the surface next to the hole or microfissures in the surrounding material due to shock waves and high heat input), the Eckelmann's CNC can dynamically adjust (ramp) the duty cycle value during the piercing operation. Thanks to this innovative feature, the engineers at Accumech were able to optimize the piercing operation.

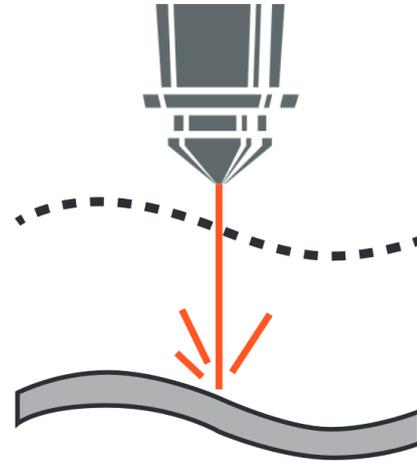


*Fig. 11: The CNC optimizes the piercing process (Photo: Accumech)*



## Distance control

Cutting heads usually have a capacitive distance sensor for measuring distance in a contact-free manner and for quickly adjusting height during cutting. Because the cutting tip is typically only about 0.5 mm to 1 mm from the surface, highly dynamic tracking of the Z axis during laser cutting is especially critical in order to ensure that the distance between the tip and the material always remains constant. Eckelmann's CNC not only integrates fast height adjustment but also supports the fully automated calibration of the distance sensors of all common cutting heads.



## A clean tip for clean cuts

The cutting tip becomes soiled during laser cutting, for example due to metal spatters, slag, etc. To increase the service life of the cutting tip and ensure that the quality of the cut edges remains consistently high, it must therefore be cleaned at regular intervals. For this purpose, a cleaning program was implemented in the CNC. After a defined cutting section, the cutting process is automatically interrupted at the end of a contour and the cutting head goes to a brush station where all soiling is scraped off in a CNC-controlled cleaning routine. The NC program is then automatically continued.

## Lens focusing

To guarantee optimal focusing of the laser beam on the workpiece surface, the CNC controls the lens drives fully automatically. This compensates for deviations from the ideal focus geometry, which ensures clean and narrow kerfs.

## Monitoring functions

All peripheral units (laser head, laser source, gasbox, etc.) and sensors (e.g., the capacitive distance sensor on the cutting head for distance control) are also fully integrated in the CNC and are monitored by it. All important status information is displayed in a straightforward manner in the CNC's user interface. This allows the operator to maintain full control of the entire cutting process and all parameters at all times.

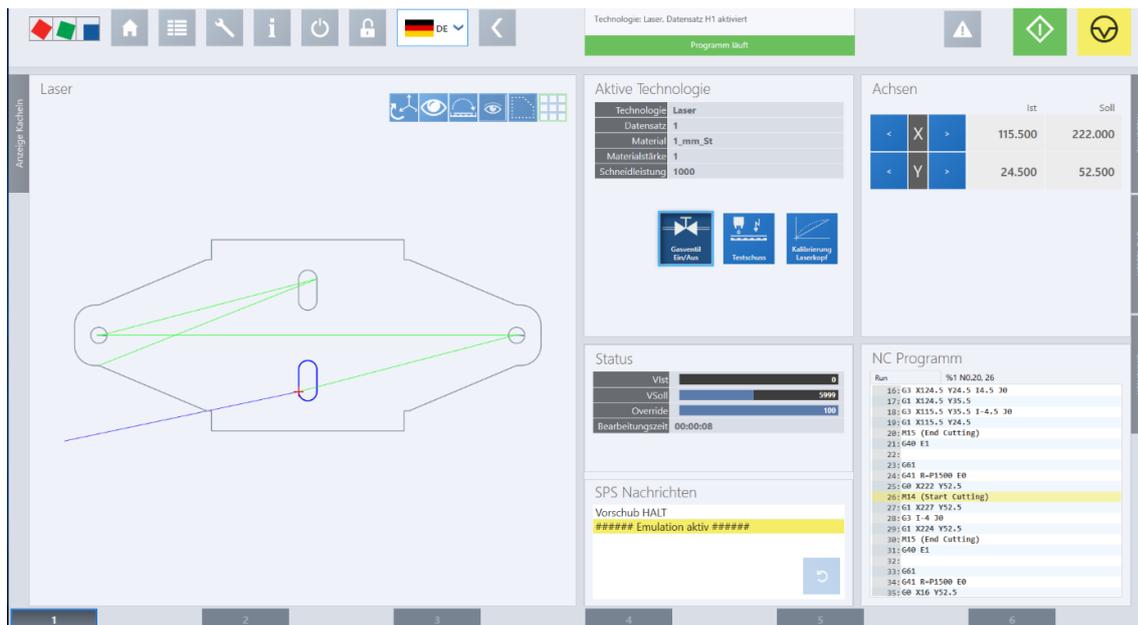


Fig. 12: The monitoring of the peripheral units and sensors is integrated into the CNC user interface (Photo: Eckelmann AG)

## Integrated shuttle table control

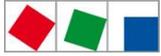
To integrate the machines into the production process, they can also be equipped with a fully automated shuttle table. It was possible to comfortably program the sequential control for loading and unloading the machine with the PLC that is integrated in the CNC. This allows the material handling and the cutting process to be coordinated optimally.

## Film cutting/film evaporation

To cut metal sheets with plastic film adhered to them, Eckelmann's CNC also supports cutting with a low laser output. This makes it possible to carefully evaporate the film with the cutting program without damaging the workpiece surface. Only when this has been done will the cutting program be carried out with the cutting output.

## Conclusion

When it comes to laser cutting, speed and precision matter. When choosing a suitable CNC, it is therefore always important to ask how extensively a controller manufacturer supports certain technologies by means of corresponding functionality in its solutions. Accumech chose Eckelmann as a supplier because the [EXC controller](#) has been used successfully in laser applications for more than 20 years and continues to be developed further. This guarantees that they will benefit from fast engineering and an open ear for innovative functionalities. In keeping with a sustainable innovation partnership on equal terms, both are bringing together their core expertise for a successful market presence.



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