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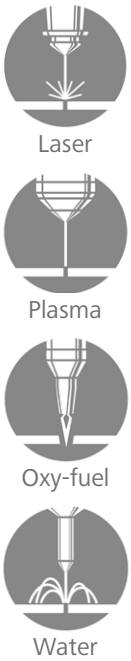
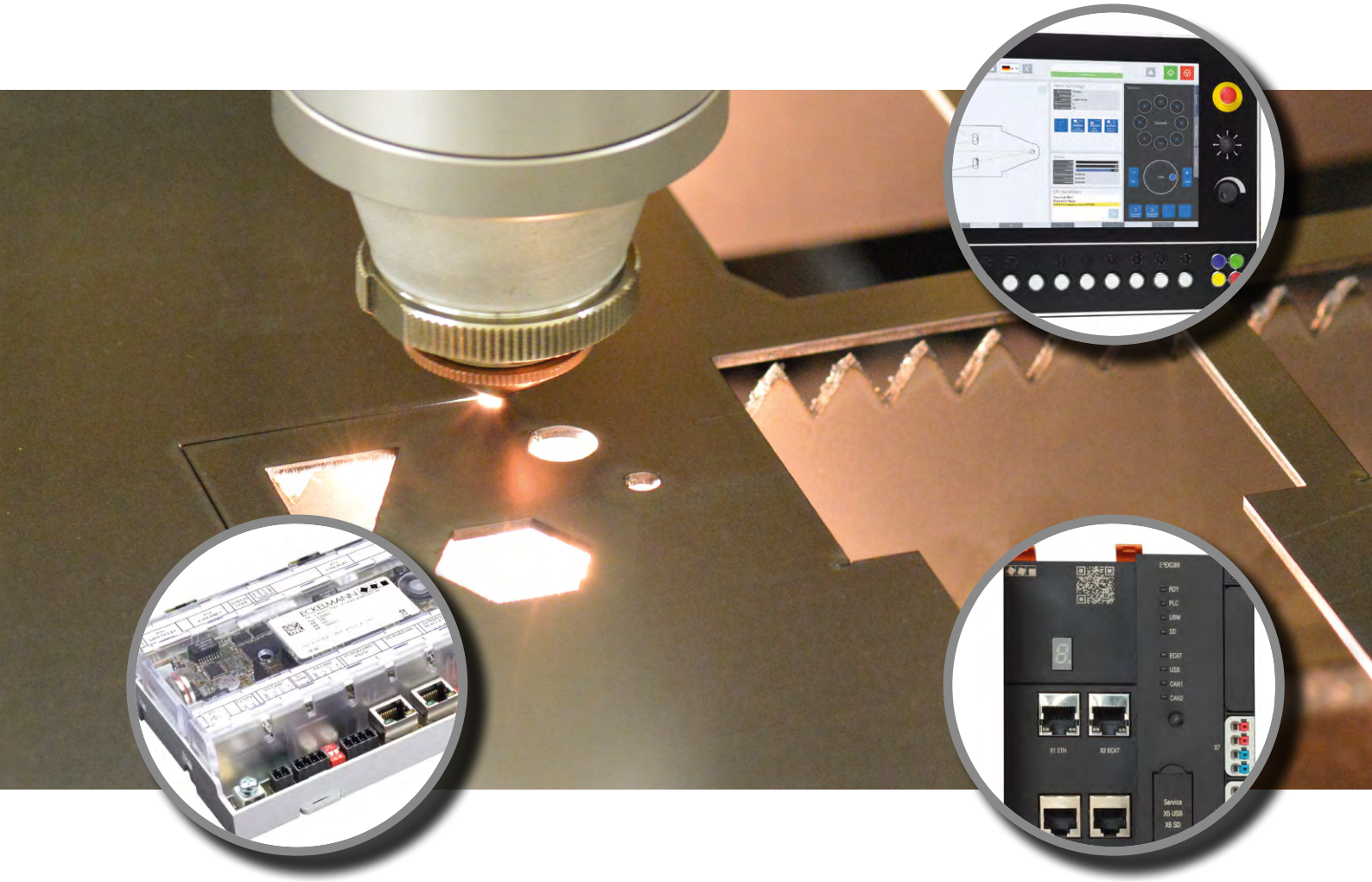


CNC Cutting Solutions
CNC controller for cutting machines



E°CUT: **Automate cutting** with heart and mind

E°CUT is a package for all cutting technologies. It can be expanded according to your individual requirements.

All-in-one

Upon request, E°CUT comprises the complete hardware and software required for automation.

Ready-to-use

E°CUT is a complete cutting solution and is thus operational in no time.

Ready-made software solutions for:

Laser cutting

Water jet cutting

Plasma cutting

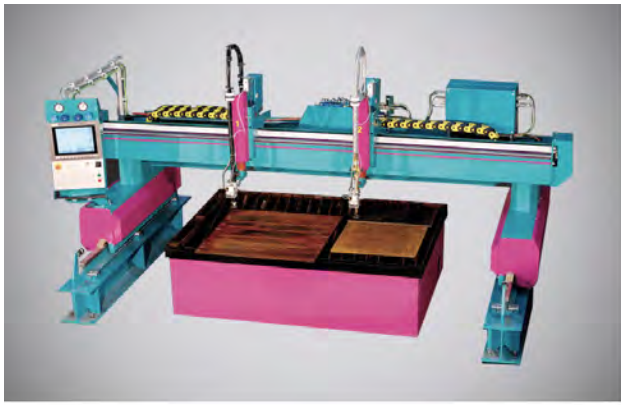
Oxy-fuel cutting

Bevel cutting

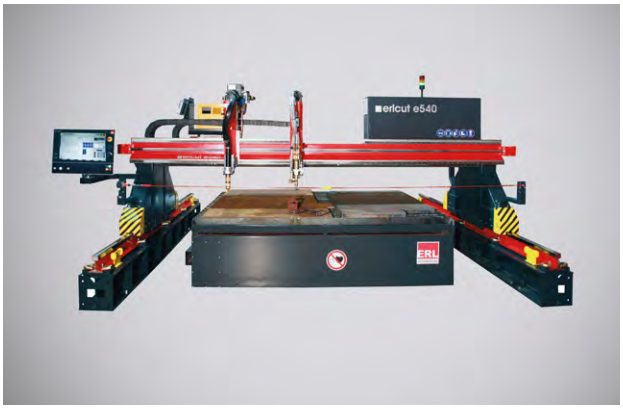
Drilling

Marking

Sawing



Oxy-fuel / plasma cutting system: Sato Schneidsysteme GmbH & Co. KG
▪ Germany ▪



Oxy-fuel / plasma cutting machine: ERL Automation GmbH
▪ Germany ▪

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CNC cutting solutions

More and more cutting machine manufacturers worldwide trust CNC Cutting Solutions by Eckelmann. For them cooperative partnership and economic stability are particularly important, in addition to technical and economic factors.

The same control platform for all machine designs: Streamlined procurement and warehousing as well as training and service.

The Eckelmann Engineering Documentation Platform E°EDP provides 24/7 current and quick online access to all technical information.

Interfaces for all commercial technology providers and thus a free choice of machine cutting equipment.

Comprehensive know-how protection for the machine manufacturer. Thus, your competitive edge is always maintained.

Control technology with long-term availability independent of short generation cycles (unlike IT-based components).

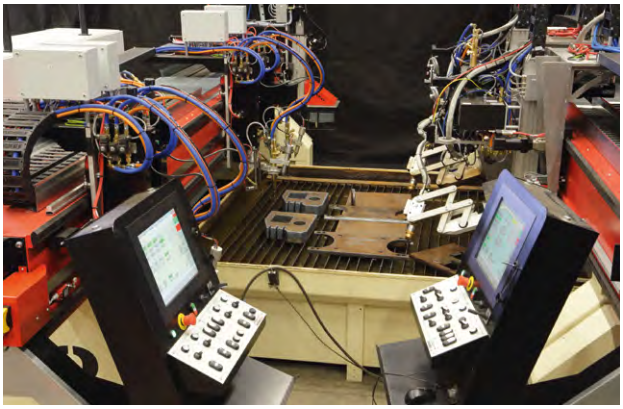
Machine manufacturers can quickly and easily modify or extend the sequential programs of the controllers.

Eckelmann's virtual 3D machine simulator offers machine manufacturers new possibilities in product development and training.

No anonymous hotline, but personal customer service, including technical support, ensure quick problem solving.

Developed and produced for the use in harsh environmental conditions.
Compliance with all relevant national and international standards.
Also with UL-certified switch cabinet construction as per UL File E233027.

For customer care and support abroad, we have Eckelmann branches or representations in export markets such as China, India and Russia.



Dual oxygen cutting machine: Stako B.V.

▪ Netherlands ▪

Retrofit of oxygen cutting machines: SAEHSEN Industrie-Service

▪ Germany and global ▪

Range of functions

Supporting diverse **cutting technologies** at one machine

- Up to 12 heads at one machine, any combination of technologies
- 2 different technologies per head configurable for example, plasma and marker
- Automatic technology changing
- Automatic head changing
- No programming skills required for modification or extension of technology tables
- Fully automated burner carriage positioning using band clamping
- Fully automated burner carriage positioning using drives (up to 3 drives)

Non-proprietary – Combine the best **sources** and **tools**

- Various manufacturers of laser sources, laser heads, plasma power sources supported
- Distance controls: E.IHC (internal height adjustment), IHT, capacitive, motor, cylinder

Comprehensive **response options** at the machine

- Manual/automatic position correction
- Automatic storing of cancelation conditions of the last 5 cutting programs
- Freely selectable starting point following program termination
- Reverse from contour and return to origin
- Manual forward and backward motion on the contour

Ready for the **digital shopfloor** thanks to comprehensive **management functions**

- Order management
- Recording of operating hours
- Cutting path calculation
- OPC UA support

Axis correction for increased **precision**

- 2D and 3D correction, sag compensation
- Directional height correction
- Spindle pitch error compensation
- Backlash compensation

Own CNC core offers diverse **customisation options**

- 6 axes transformation (RTCP) for supporting diverse bevel units
- Tube cutting (also bevels)
- Rectangular tube cutting
- Complete access to functionality
- Individual firmware extension, also exclusive

Cutter + Plotter: Lasercomb GmbH

▪ Germany ▪

Router: FlexiCAM GmbH

▪ Germany and United Arab Emirates ▪

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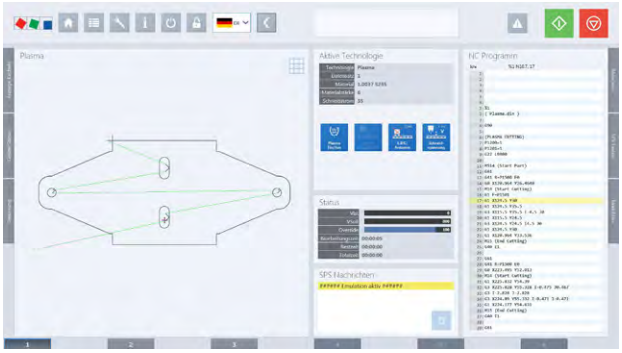
User interface cutting HMI

Operation

A Human Machine Interface (HMI) is well passed being just a machine operation tool. Nowadays, the strategic success factors are ergonomics, flexibility as well as a unique look & feel. Thanks to this, the HMI becomes more and more the business card of the machine and part of the corporate identity of the machine manufacturer.

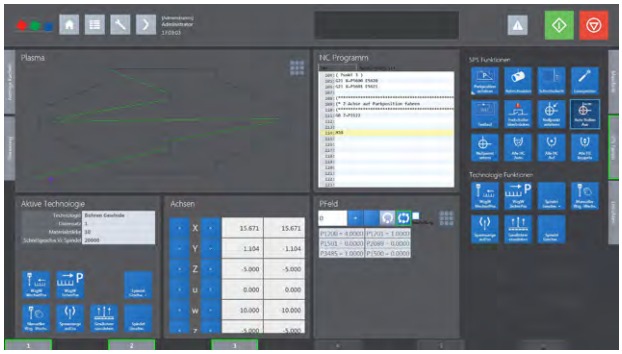


Technologyspecific

Each Eckelmann CNC comes as standard with HMI Software. Based on this standard, we offer solutions customised for the respective technology. A task-oriented and role-specific approach ensures an easy-to-read layout, as only information and operation elements needed by the operator for the current process step are displayed.
The views shown vary and depend on the role and task of the operator. The visual display depends entirely on the individual user requirements.

Individuality

Would you like to create your own user interface for your machine? In this case, we are happy to assist you as well. Thanks to our solution approaches, independent specifications are possible. We are happy to help you with design and adaptation. The possibilities range from simple visual changes to complete customer and technology specific characteristics.

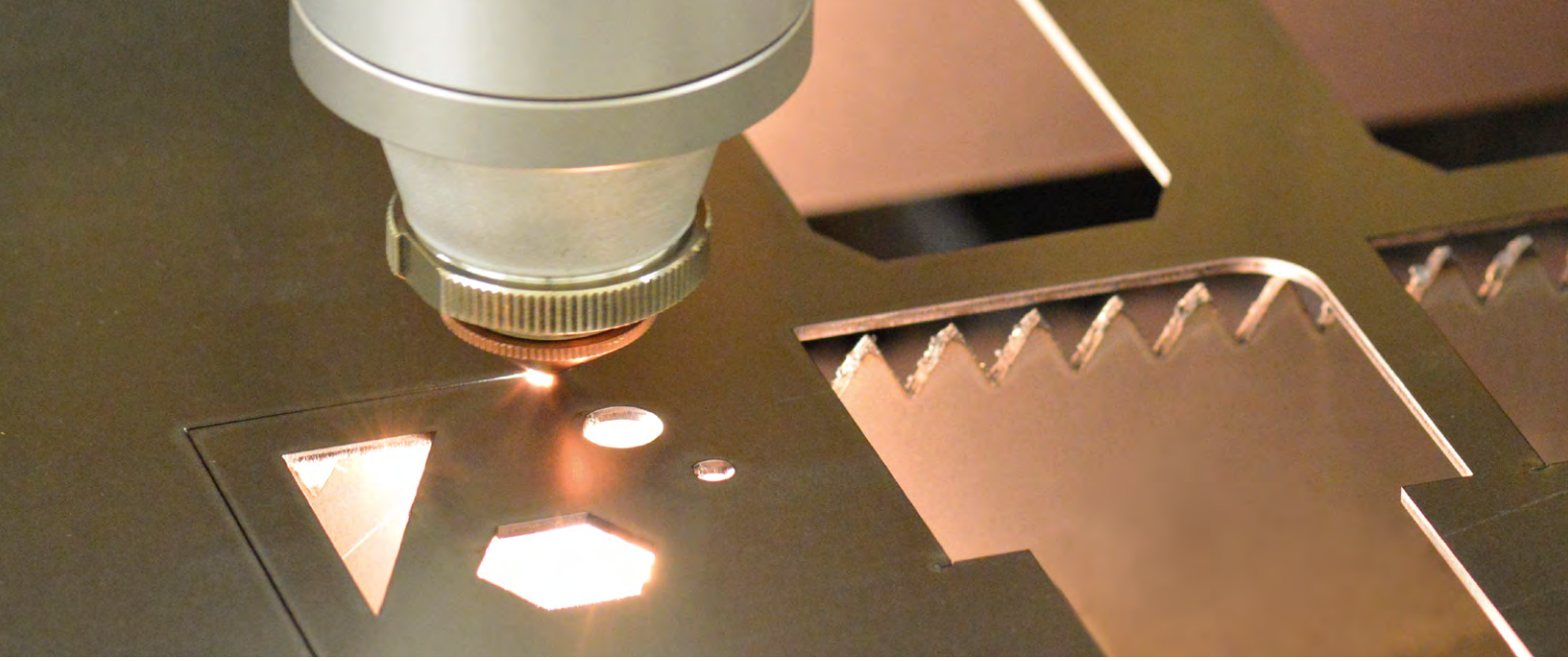


Multifuntional cutting machine: Lind GmbH

▪ Germany ▪

Pipe profile oxygen cutting machine: Müller Opladen GmbH

▪ Germany ▪



Laser cutting

For laser cutting, a focussed laser beam is absorbed at the cutting front and thus applies the required cutting energy to the material. Gases push the ablated material from the cutting kerf. Important components of any laser cutting machine are the laser beam source (resonator), the laser beam guide and the cutting head (focusing optics), including cutting nozzle.

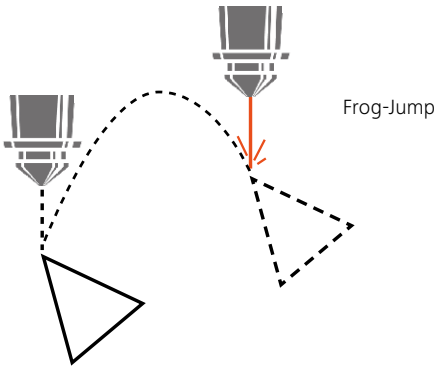
The most important **laser specific functions** in Eckelmann's CNC:

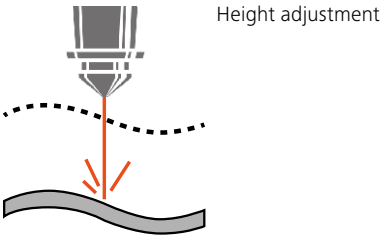
- Controlling the cutting components and the cutting peripherals:
  - Laser sources from IPG, Coherent-ROFIN, SPI Lasers, TRUMPF, nLight & Raycus
  - Laser cutting heads from Precitec, HIGHYAG, Laser Mech and Raytools
  - Shuttle tables of varying designs
- Gas and exhaust air control, nozzle cleaning etc.
- Interfaces for connecting conveyor lines and sheet metal storage systems
- Technology table for all relevant cutting parameters:
  - Material thickness, type and quality of material, cutting speed, laser output power, cutting gas type
- Track speed dependent analogue output and PWM signal for controlling the laser power output:
  - Using the pulse-width modulated output, the laser power can be controlled highly accurately, depending on the material to be processed and the track speed of the guide axes.

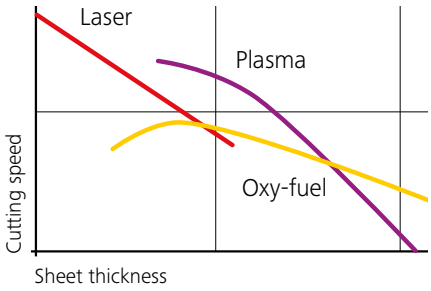
Laser cutting machine: Motofil Equipamentos de Corte, Lda
▪ Portugal ▪

Laser cutting system: Proteck Machinery Pvt. Ltd.
▪ India ▪

- Fly-cut option for significantly shorter cutting times
  - While tracing all horizontal and vertical cuts at a consistently high speed, the laser beam is switched on and off „on the fly“ by activating and deactivating the signal directly in the fine interpolation cycle of the controller. Here, switching times are in the microsecond range.
- Frog-jump function for the parabolic traversing of the laser cutting head between the end and start points of the new contour section in z-direction
  - This prevents any collision between the laser head and the cut parts and reduces the traversing time compared to a separate z-axis movement.
- Quick height adjustment for a constant distance between the workpiece surface and the cutting nozzle by recording the analogue distance signal using characteristic linearization.
- CNC-controlled compensation mechanism for an optimal laser focus position with directional correction. Compensation of deformations in the focus geometry by corresponding corrections.
  Integration of manufacturer specific laser diagnostic tools directly into the HMI.
- Further universal functions for cutting applications:
  - Sheet position detection and offsetting, kerf compensation, reverse travel and returning to the contour
  - Wear part monitoring, operating data acquisition and order management, error log etc.







Laser marker: Baublys Laser GmbH

▪ Germany ▪

Laser cutting system: Lasercomb GmbH

▪ Germany ▪

Plasma and **oxy-fuel** cutting

For **plasma cutting**, the sheets are cut using a conductive gas (plasma), which is generated by an electric light arc.

For **oxy-fuel** or **flame cutting**, the metal sheet containing carbon is first heated to ignition temperature and then burned in the oxygen jet.

- Frequently, both technologies, plasma and oxy-fuel, are used at a single machine.
  Our controller is able to perform both cutting processes and supports possible additional units:
  - Drilling and thread cutting heads with or without automatic tool change
  - Marking devices with pin marker, inkjet printer or plasma marker
  - Lateral rotary axle on flatbed machines for tube cutting
- Universal **functions** for all cutting applications:
  - Sheet position detection and calculation
  - Kerf compensation with automatic overcut
  - Reverse travel and returning to the contour
  - Throttle control at the extraction table
  - Wear part monitoring
  - Operating data acquisition and order management
  - Error log
- Operation with **multi torch carriages**:
  - Individually motor-driven, with automatic band clamping or both on one machine bridge
  - 2 or more bridges on one track are possible thanks to multichannel CNC and collision monitoring

Oxy-fuel bevel cutting machine: Lind GmbH

▪ Germany ▪

Oxy-fuel / plasma cutting machines: QK

▪ China ▪

Plasma cutting

- Basic quality features and control requirements for plasma cutting are:
  - Burr-free cut
  - No or only minimal wave formation in the cross section
  - Rectangular cutting edges
- Plasma power sources and automatic gas consoles of the most important manufacturers such as
  - Kjellberg
  - Hypertherm
  - Thermal Dynamics

  are supported. For an automatic communication, the associated databases of the manufacturers are integrated together with the plasma power source into the CNC controller.
- The distance between the plasma torches and the metal sheet surface can be adjusted using external height control systems, for example from
  - IHT Automation, Kjellberg

  CNC-integrated height control by applying arc-voltage; with corner signal and other special functions.
- Virtually any TCP- as well as non-TCP-oriented kinematics for 3D processing (bevel cutting)

  Several bevel cutting units possible for one machine, also coupled with rotary axes for circular and special section tube cutting

Oxy-fuel cutting

- Technology tables for oxy-fuel cutting
- Configurable speed reduction at cutting start and end
- Variable control of the gas technology depending on valve arrangement and valve type:
  - Switching valves
  - Proportional valves with pressure rise ramps
- Distance control of the oxy-fuel torches using external height control systems or CNC-integrated height control through recording and linearization of a capacitive measuring signal
- Bevel cutting with 3 torches configuration:
  - Automatic motorised torches angle and lateral adjustment
  - Several oxy-fuel bevel cutting units possible at one machine

Oxy-fuel / plasma cutting machine: Rate

▪ China ▪

Oxy-fuel / plasma cutting machine: Ador Welding Ltd

▪ India ▪

Water jet cutting

For water jet cutting, water is pushed through a nozzle with a pressure of 4000 to 6000 bar (60,000 - 90,000 psi) and accelerated to twice the speed of sound.

It is differentiated between **water jet only cutting** for cutting soft materials and **abrasive cutting** with added abrasives for cutting hard materials such a glass, stone and metal.

Important control requirements for water jet cutting:

- Avoiding bevel cuts and maximising cutting speed are important objectives.
  Here, the control requirements are material parameter management using a technology table and bevel cut adjustment through supporting relevant axis kinematics.
- Precise cuts require accurate and quick distance control between the cutting nozzle and the workpiece surface. For this, the height of the workpiece is scanned using displacement sensors, configurable in the control, and various measuring strategies.
- Special speed ramp functions for minimising the "whip effect", in particular for corners and small radii
- Water jet only and abrasive water jet cutting with parameterisable abrasive dosing supported
- Connection of high pressure pumps using varying interfaces and protocols
- Freely programmable sequential control for water preparation can be integrated
- Several cutting heads on one machine bridge and several machine bridges on one track are possible
- 3D workpiece processing thanks to supporting various cutting heads kinematics

Water jet cutting system: STM GmbH, www.stm.at

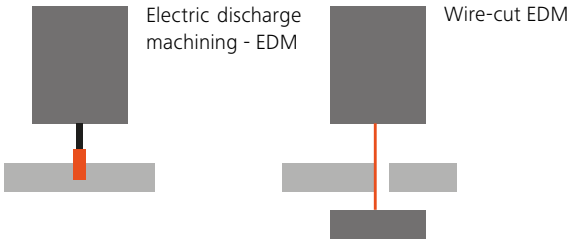
▪ Austria ▪

Water jet cutting system: Sato Schneidsysteme GmbH & Co. KG

▪ Germany ▪

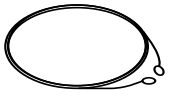
Other **cutting / separation processes**

There are several other material-specific separation processes, in addition to water jet and thermal cutting.
For this, various tools, requiring specific control properties, are used.



- **Brass wire** for wire-cut EDM or **graphite electrodes** for EDM for tool and mould making
  - Discharge gap control
  - Reverse travel on contour

- **Rotation-symmetric tools** for milling and engraving machines for the processing of wood, metal and plastics
  - Tool radius compensation
  - Length compensation



- **Heating wire** for cutting EPS materials (polystyrene)
  - Special thermal functions

- **Revolving band knives** for foam cutting of upholstery, mattress, packaging and insulation materials
  - Tangential tracking
  - Reverse rotation points on the contour

- **Jigsaws** and **knives** for cutting clothing products and technical textiles
  - Tangential tracking
  - Offsetting knife regrinding
  - Special strategies for corners

- **Cutting wheels** for scratching glass in preparation of the subsequent breaking of the glass
  - Tangential tracking
  - Cutting pressure control
  - Special strategies for corners

Textile cutting machine: Kuris

▪ Germany ▪

Glass cutting machine: Hegla

▪ Germany ▪

Complete equipment for **cutting machines**

The range of products and services of the Eckelmann Group comprises all **controller** components required for automation from **IPC** through to **servo controllers** and **motors** as well as **Saftey** and ultimately **camera systems**.

Proven:
E°EXC 66 and **LBM modules**

The E°EXC 66 CNC controller as well as the associated I/O modules (LBM) have long since proven their potential for CNC cutting. With up to 16 CNC axes, EtherCAT® and CAN interfaces as well as programming per CODESYS V2, the E°EXC 66 is ideally suited for all cutting applications. The associated LBM modules allow the connection of additional input and outputs (digital, analogue, serial, PWM).

Future-proof:
E°EXC 89 and **UBM modules**

The E°EXC 89 CNC controller and its UBM I/O modules offer future-proofing. With 32 CNC axes, programming per CODESYS V3, EtherCAT® and CANopen® interfaces. For future-oriented Industry 4.0 operations, the E°EXC 89 offers an additional OPC-UA interface for recording process data.

Customisation:
E°EXC 880

The E°EXC 880 CNC is Eckelmann's compact controller. All modules required for CNC cutting are integrated in the controller. EtherCAT®, CANopen® and serial interfaces as well as digital inputs and outputs are also included. Programming per CODESYS V2 or V3.

Scalability:
E°Darc and E°PC

The range of products and services is complemented by **servo controllers** in the range from 200 W to 16 kW and various **encoder systems** as well as **motors**. Panel PCs, Box PCs and touch panels are available according to customers' individual wishes.
There is a choice of different PC performance levels and panel sizes to meet any requirement.

Oxy-fuel / plasma cutting machine: Pro Arc Cutting Systems Pvt.Ltd.
▪ India ▪

Water jet cutting system: Atech GmbH
▪ Germany ▪

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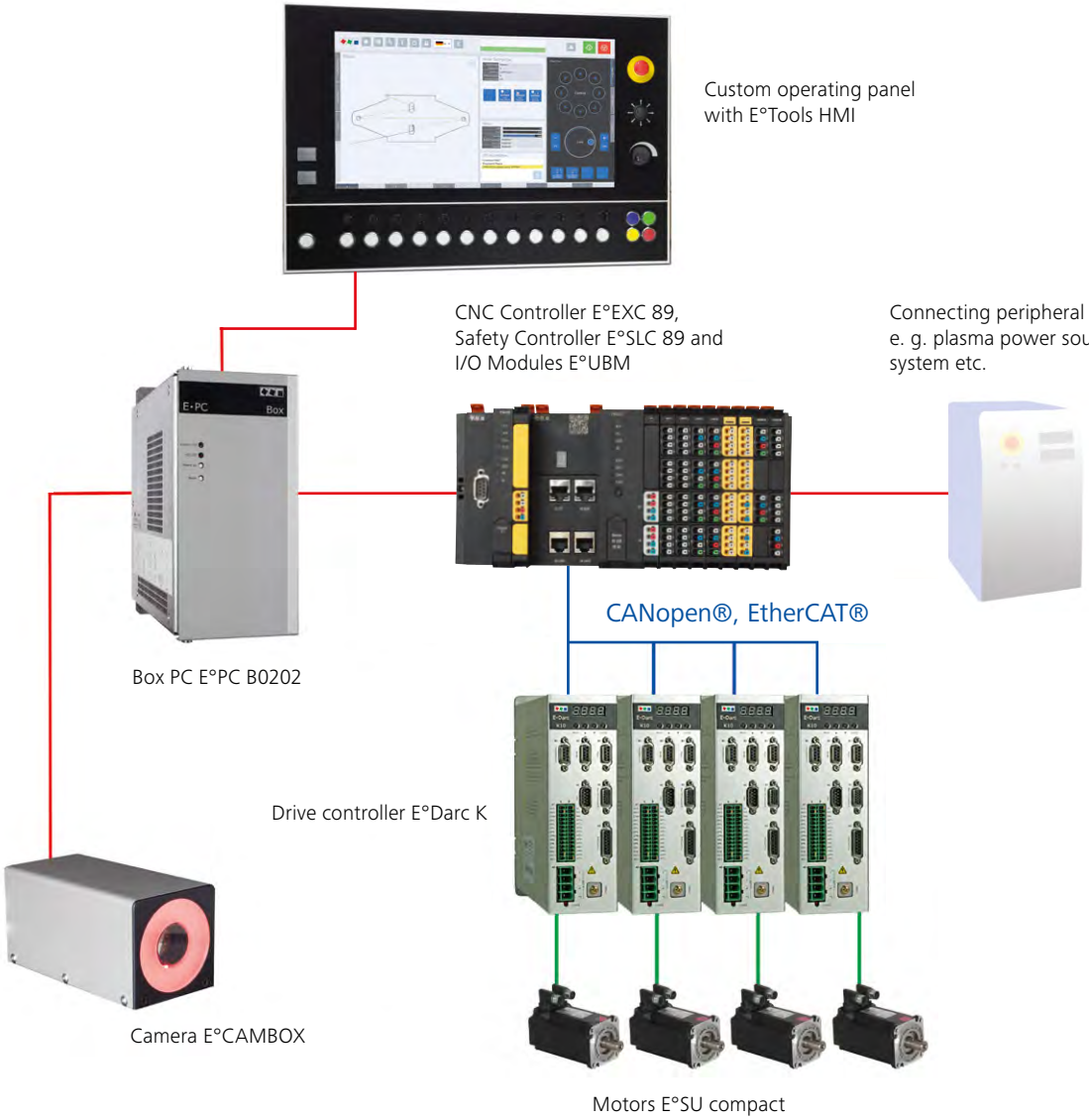
Application example



Sample **complete equipment** for a **4 axes cutting machine** (CNC supports up to 32 axes)

EPS cutting system: Pantel + Brömser GmbH

▪ Germany ▪

Foam contour cutting machine: Albrecht Bäumer GmbH & Co. KG

▪ Germany ▪

E°SEE: **Image processing** for machines

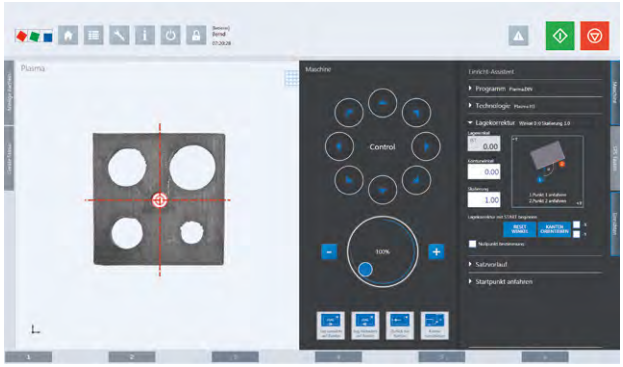
Industrial image processing has developed into an important catalyst for increasing the level of automation in production processes and is regarded as one of the key technologies for Industry 4.0.

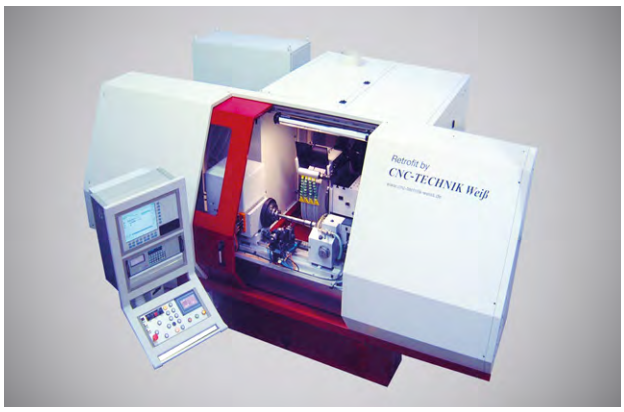
It has become indispensable in quality control and identification of products as well as in process control and monitoring. Only when using modern image processing systems can the current requirements for traceability, quality, cycle time and safety be implemented.

Functions at a glance

When using Eckelmann industrial cameras and image evaluation software, in addition to the pure process visualisation, the position of the sheets on the machine table, the offset and angle correction are also automatically calculated in the cutting program.

E°SEE enables you to scan or digitalise directly at the machine bed, for example contour tracings and drawings – as DXF file for CAD/CAM software or as G code for NC programming. Furthermore, the E°SEE package makes reading and verifying production codes and markings in plain writing possible.





Circular and non-circular grinding machine: CNC-Technik Weiss GmbH

▪ Germany ▪

Wire bending and forming machine: Post

▪ Germany ▪

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Machine Management System (MMS)

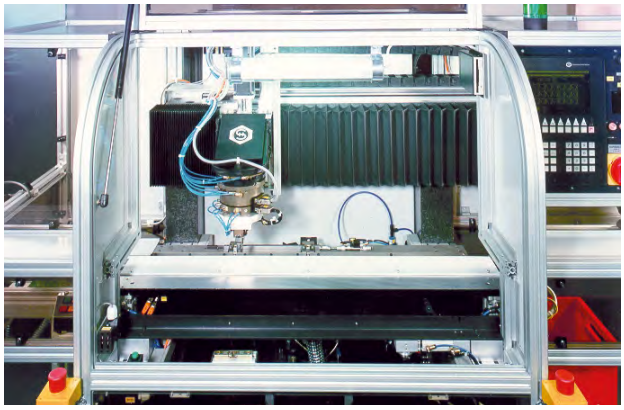
More transparency for a more efficient production. Improved order management for higher machine utilisation.

MMS for the shopfloor of the future. The MMS is a powerful Industry 4.0 Framework for the implementation of an agile, future-oriented shopfloor management system.
With MMS, machines can be networked efficiently and transparently, **independently of manufacturer**, using **IoT** technologies. This creates an interface between machine level and the higher-level MES and ERP systems.
Numerous functions are available to the user: **machine dashboard**, **operating data acquisition**, **order management** as well as **reporting** and **real-time alert features**. The web application provides these function for stationary terminals or mobile devices.

The **machine dashboard** provides **real-time** production insights.
One screen shows an overview of all machines as well as the currently processed and queuing orders.

Furthermore, you can generate orders and allocate those to the machines using the **order management** function. Automatic nesting and intelligent material management simplify planning and ensure efficient utilisation of materials and resources.

Use the MMS on mobile devices such as smart phones and tablets with the **MMS App**. Main function: **Real-time** monitoring of the machinery and detecting events.
Once an order is complete, the machine operator immediately receives a **push message**.
Thus, new orders can be allocated to free machines more quickly to minimise downtime and optimise production capacity.



Depaneling machine: Systemtechnik Hölzer GmbH
▪ Germany ▪

PCB processing: ASYS Automatisierungssysteme GmbH
▪ Germany ▪

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Networked intelligence – machine automation@Eckelmann Group

We are always there for you – **globally**. With diverse know-how the experts in machine innovation within the Eckelmann Group offer you innovation partnership as equals.
If you have any questions, **please contact** us.

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