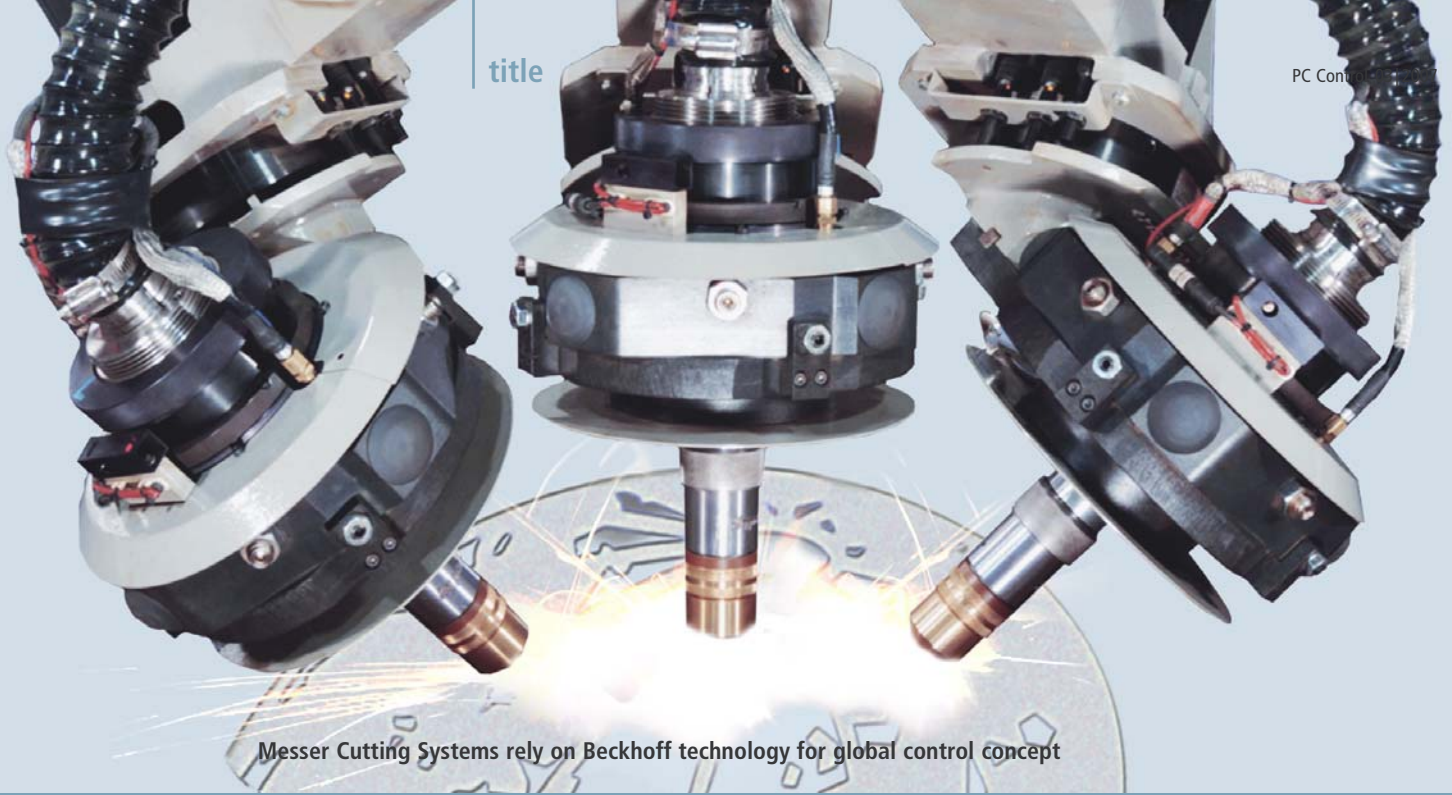


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Messer Cutting Systems rely on Beckhoff technology for global control concept

'Global Control' for plasma cutting machines





- As leading manufacturers of customer-specific machines for thermal cutting applications, the Messer Cutting & Welding GmbH worldwide relies on a uniform control concept. A PC-based CNC system controls all of the company's oxy-fuel and plasma cutting systems, bevel-cutting units and marking systems.

Robust plasma cutting technology for essentially any application characterizes the range of machines created by Messer Cutting & Welding GmbH. The machines are produced at four locations: in Groß-Umstadt (Germany), in Menomonee Falls, Wisconsin (USA), in Kunshan City (China), as well as in São Paulo (Brazil). Distribution takes place globally. The basic principle of the range of machines is similar, and hence it was only natural that the control technology should also be globally uniform.

Although Messer Cutting & Welding GmbH mostly builds customer-specific machines, which differ from one another with regard to their dimensions, the machine type, number of cutting systems and other details, they have been successful in designing all of them with a uniform control system. Naturally, the applicable worldwide machine directives must be taken into account. The Global Technology Team is responsible for maintaining this high standard and for the dynamic reaction to changes in the market. Burkhard Fenner, Technical Director and Manager of Automation Technology, as well as the Project Managers Ingo Göller and Mark Ringgenberg manage the team, which includes additional employees of the internationally operating company from Germany, the United States and China. The main development extends over a period of around two years.

Control technology by Beckhoff

Control technology has a long tradition at the Messer Cutting & Welding GmbH. Beginning in the 80s, the company developed CNC controllers and was one of the first distributors of CNC plasma cutting machines worldwide.

At the beginning of the year 2000, the decision was made to realize a globally uniform control concept on a suitable platform. To this end, as Burkhard Fenner reports, around 50 suppliers of CNC control systems were reviewed, of which almost 10 were selected for the final round of evaluation. A team of colleagues from the United States and Germany carried out detailed tests, in particular with regard to hardware conditions, CNC functionality and the standardization of the PLC. During this procedure, Beckhoff emerged as a suitable supplier, so that further concrete tests, in particular in the EMC-critical environment of plasma cutting machines, were carried out in 2001. Since the start of the project in summer 2002, Messer Cutting & Welding and Beckhoff have been working jointly on the realization of 'Global Control', which has been in use worldwide since the successful introduction of the concept in April 2004. "The first contact with Messer USA was initiated by the US branch of Beckhoff. Both sides called in their respective head offices in Germany, which ultimately developed into a particularly successful international project that led to many additional projects, even after the initial success from the first series introduction," explains Frank Saueressig, CNC expert at Beckhoff Germany.

'Global Control' concept

The Messer Cutting & Welding GmbH uses the term 'Global Control' to describe the worldwide uniform control concept for their plasma cutting machines that is equipped with Beckhoff technology. Messer Cutting & Welding uses various Beckhoff Industrial PCs as well as the TwinCAT CNC automation software. The machine is operated via a customer-specific Control Panel, which has been specially designed to



Skew rotator

meet Messer Cutting & Welding GmbH's needs. The machine peripherals are connected to the Bus Terminal I/O system, which is linked to the Industrial PC via the Lightbus. The number of I/O connections is dependent on the machine type and starts with 32 I/Os for the smallest machine. Both digital and analog I/Os – including encoder inputs – are used.

Among others, the Digital Compact Servo Drives of the AX2500 series with corresponding Servomotors are used as axis drives, which can also be connected to the Lightbus protocol.

Lightbus is used due to its high data transfer rate and fiber optic-based interference immunity, which is particularly important for plasma cutting machines. "Currently, we are testing the increased use of EtherCAT," says Ingo Göller. He foresees further advantages from this fieldbus technology: "The even higher performance and optimum diagnostic properties as well as higher flexibility in the hardware range and architecture speak for EtherCAT."

The ScopeView function is one of the most important TwinCAT properties that Messer Cutting & Welding GmbH utilizes. "Using TwinCAT ScopeView, we can acquire and retrace data in real-time, allowing us to keep an eye on the machine performance and impending errors so that we can take the necessary measures

Plasma cutting machines by Messer Cutting & Welding GmbH

Despite the uniform basic principle, the plasma cutting machines from Messer Cutting & Welding GmbH are for the most part customer-specific designs. For example, a gas cutting machine can be up to 60 meters long and equipped with several tool carriages.

The cutting machines are moved along the longitudinal axes by means of toothed racks and motor-gearbox units. "Linear drives don't come into question for us, because we sometimes have tracks of up to 60 meters in length and linear drives are simply too expensive for such lengths," explains Ingo Göller. In addition to this, the operating conditions for linear motors could become negatively affected due to the metal dust that is created.

Up to sixteen so-called carriages can be built on a plasma cutting machine, each of which has at least one process tool. According to the process requirements of the customer, several tools can be at disposal at the carriage. With regard to the process technology, distinction is made between autogenous, plasma and laser cutting. Although the Messer Cutting & Welding GmbH constructs the latter almost exclusively in the area of large-sized metalworking, the machine construction concepts for autogenous and plasma cutting are available in many metal working sizes. As a result, there are customer-specific gantry or flat bed machines with three-axis bridge superstructures. One or more cutting heads with one or more axes, including the associated energy supply, are fastened to these machines.

The cutting machines by Messer Cutting & Welding are usually used to cut and mark thick sheet metal with both normal vertical cuts and beveled cuts. To this end, the cutting or marking tool is controlled via the classic X-, Y- and Z-axes, whereby the Z-axis merely controls the height position, assisted by a collision or distance detector. In the case of plasma cutting, this process takes place on the basis of arc-dependent height scanning. The sheet metal thickness range starts from 0.5 mm and extends to 150 mm, however 3 mm to 70 mm ranges are typical.

in good time. Besides that, the system provides us with exact performance data, which we could only surmise in the past," says Mark Ringgenberg.

Software CNC

TwinCAT CNC was specially adapted for Messer Cutting & Welding GmbH to meet the needs of thermal cutting technology. "We developed the control software and the entire user interface ourselves," reports Ingo Göller. "In this way, we achieve high flexibility to react quickly and optimally to new requirements."

Messer Cutting & Welding GmbH currently uses up to 18 interpolated CNC axes for the drive axes and the special bevel units. So-called "DAFL units" are used in the autogenous area. This fully-rotatable unit with several torches has two axes, which are able to perform a lateral offset and two additional tilting axes for the adjustment of the torch angle. Highly complex multi-bevel cuts can be executed in one working step using this unit.

For such applications, the so-called "skew rotator" – similarly, a fully-rotatable unit with just one tilting axis and one track axis – that was developed globally for use in plasma cutting. TwinCAT CNC can prove all of its performance capabil-



Project manager Mark Ringgenberg,
MG Systems & Welding, Inc. USA

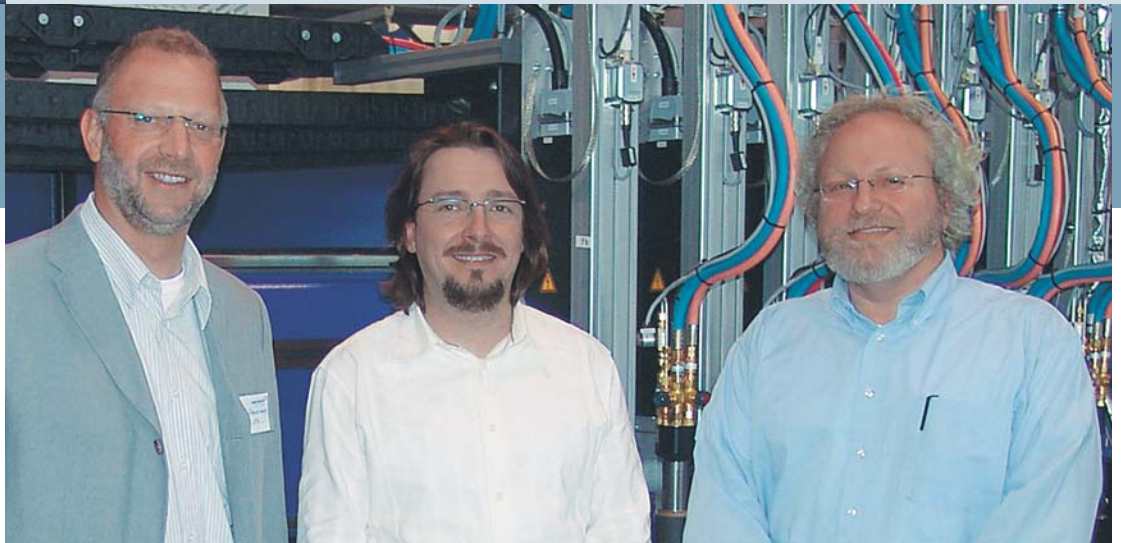
Customer-specific operating concept

Thanks to the use of customer-specific Control Panels manufactured by Beckhoff, Messer Cutting & Welding is able to give the operator interface an aesthetic and user-friendly design. "The personal touch is becoming a more and more important factor for our clients; so the 'Messer look' is very important for a product that is looked at as often as the HMI is. There are a lot of other companies that use Beckhoff Control Panels, but our specific panel design is unique in the industry," explains Mark Ringgenberg.

The operating panel is tailored entirely to Messer Cutting and Welding GmbH's needs. "All the necessary hardware operating elements, e.g. the emergency stop button, are located on the front of the panel," says Ingo Göller. A joystick enables the movement of the machine in eight directions. The speed and the parameters can be changed by a handwheel.

Depending on the number of torch heads that a machine has, up to six switches serve for the height adjustment of the cutting tools and can be mounted on the main panel alongside the stop and start switches.

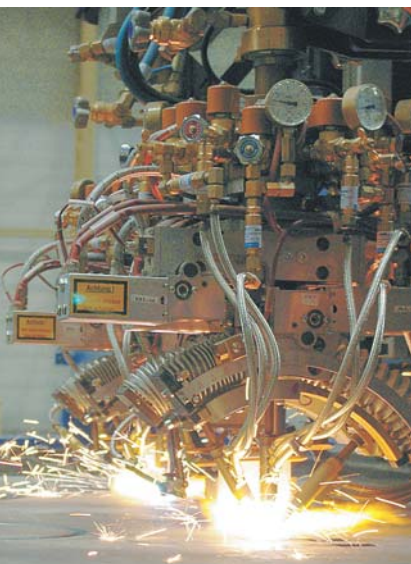
An additional operating panel is available for further cutting tools and special functions. Since the plasma cutting machines do not operate exclusively in the '2-meter class' and, due to their area dimensions, larger distances between the control cabinet and the operating panel play a part, the interface between the two units is of further importance: "Using CP-Link, an operating panel can be situated up to 100 m away from the CNC controller. If USB functionality is required in addition, an operating panel with a DVI/USB Extended interface can be used up to a distance of 50 m," comments Frank Saueressig.



Frank Saueressig, Manager Office Balingen,
Germany, and CNC expert at Beckhoff

Project manager Ingo Göller,
Messer Cutting & Welding GmbH

Burkhard Fenner, Technical Director,
Messer Cutting & Welding GmbH



DAFL unit

Messer Cutting & Welding GmbH

is a traditional German engineering company that can look back on over one hundred years of history. With over 600 employees at four sites worldwide, we produce plasma cutting machines to meet the highest demands of the metalworking industry. The machines are used in all segments of thermal cutting and in many cases represent the first and sometimes the most important step in a modern production process.

ities in the field of interpolation and real-time transformation during these processes. The operating software developed by Messer Cutting & Welding GmbH is based on the Microsoft .NET framework. As Ingo Göller explains: "We use Microsoft Windows XP Professional as our operating system to offer the option of integrating the control into clients' networks."

'Global Control'

Alongside 'Global Control^{plus}', Messer Cutting & Welding GmbH has introduced in the 'Global Control^S' a further controller category for smaller machine types. The design is based on a Beckhoff Panel-PC, which is mounted directly on the operating unit. EtherCAT functions as the communication bus and Beckhoff Bus Terminals are used for the I/O system.

"The 'Global Control^S' is based worldwide on a standardized software and hardware platform," explains Ingo Göller. For Burkhard Fenner, this is part of the continuous process optimization. "The order completion time that was required earlier was drastically reduced." According to Fenner, 'Global Control' has therefore become an important part of the integrated production concept.



Trident Steel from South Africa relies on Messer technology

The world's largest high-performance plasma cutting machine is located in South Africa: At Trident Steel, two 8.8 meter wide and 78 meter long OmniMat® cutting systems developed by Messer Cutting & Welding ensure economical sheet metal processing. A decisive advantage of the new plasma technology is the constantly outstanding cutting quality. The stable construction of the OmniMat® plants ensures reliable results: low-play, high-power AC drives guarantee positioning speeds of up to 35 m/min with high acceleration and absolute precision.

In addition, the new machines do not need to be monitored by the operator during the cutting process: The processes run fully automatically. As a result, there is more time to prepare the next process, which further improves the production flow and quality. "Global Control" is at the heart of this automation. It makes the work much easier, because it controls virtually all of the processes itself. It is such a user-friendly design that it can be mastered even after a short training period," says Jimmy Claven, Divisional Director at Trident Steel.

By using three HPR260 plasma cutters simultaneously, Trident Steel achieves high quality and outstanding productivity.



Transparency in operation and service

A high degree of operational safety exists for the operator of the plasma cutting machine. Depending on the operating mode of the machine, the functions for each respective working step, e.g. hole punching or similar, are illustrated on the screen together with the associated operating buttons. Once the operating condition changes, function buttons that can no longer be used are masked out. "This design leads to a very short learning phase. For further simplification, we have used an absolutely identical user interface globally," says Ingo Göller, explaining the advantages.

The 'Global Control' solution must naturally also be usable by service personnel. "We have been offering Teleservice functionality since 1989," Ingo Göller emphasizes. However, Teleservice at Messer Cutting is also more than the standard web-based access of today. As Göller explained, Messer's Global Technology Team is currently developing a special concept for secure access.

Globalization of the supply chain

The global orientation of his client, Messer Cutting & Welding GmbH, is extremely interesting to Frank Saueressig: "Beckhoff supplies the entire platform for 'Global Control' worldwide and, in fact, from each respective Beckhoff branch office. Our colleagues in the USA and China supply the same components that we do in Germany. We have uniform article numbers for the components that are supplied



Precise, rapid cuts proceed fully automatically thanks to Messer's 'Global Control'.

to Messer Cutting & Welding and that doesn't just simplify cooperation, but safety as well." Ingo Göller is also enthralled by the positive cooperation: "We have attained the goal that we jointly set four years ago and we appreciate the discipline of our supplier too because without it, 'Global Control' would not be feasible in the long run."

Open control platform for all cases

Messer Cutting & Welding GmbH's range of machines places very large demands on the control equipment: on the one hand, a large number of units, including their variants, must be adapted into the machine superstructures; on the other hand – considered from an operations point of view – complex positioning tasks with interpolation and the interaction of several drives must be realized. In addition, communication technology and the harsh operating environment of plasma cutting technology place particular demands on the control system.

The complexity extends even further for Ingo Göller: "The Beckhoff platform offers a high degree of freedom, for example in the driving of axes by the PLC with the transfer of the transformations from the CNC to the PLC and vice versa. It is therefore possible to execute a part of the CNC tasks in the PLC and subsequently to transfer the functionality from the PLC back to the CNC, e.g. after setting up or offsetting a machine."

"Messer Cutting & Welding's requirements for the new control concept were enormously high because it wasn't just about using a standard platform, but

about a worldwide, uniform, high-quality CNC controller," says Frank Saueressig in summary. As Burkhard Fenner mentions, the close cooperation and Messer Cutting's profound know-how were decisive for success: "We were able to bring in our special CNC functionality and avoid the otherwise usual ballast." Besides these aspects, there were further reasons for the company to use Beckhoff technology as a platform. "The high degree of standardization, from the Industrial PC level through the modularity of the I/O system to the bus design, operating panel and drive technology, corresponds to our needs for a scalable control solution for our customer-specific machines," says Fenner. It was and is the particular desire of the thermal cutting technology specialists to integrate their own know-how optimally in the machines in the form of the process and control technology. "That is what makes the actual difference between you and your competitors," comments Fenner, "because this is the only way we can offer our customers a process technology that allows them to cut faster, more accurately and more productively."

—> Messer Cutting Systems, Europe www.messer-cw.com

—> MG Systems & Welding, Inc. USA www.mg-systems-welding.com

Part 2 of the 'Global Control' report follows in the 1/2008 PC Control issue.