The Art of Economy









The Art of Economy



Wire-cutting launches a new era. Neubeck & Wiedemann GmbH



20

12











3D metal printing – product optimisation thanks to additive manufacture. Materialise

The robot you can program yourself with G-codes. Mitsubishi Electric

User reports

- 12 Perfection in function and aesthetics. Inhotec SA
- 20 Wire-cutting launches a new era. Neubeck & Wiedemann GmbH
- 26 Innovation for high productivity. HAGE Sondermaschinenbau
- 32 A tradition of innovation. Wachsmuth & Co.
- 38 Training for industry. SZF Schulungszentrum
- 58 Focus on success. Jäger Erodiertechnik
- 64 In the wake of the pioneer of electricity. ASTES4 SA
- 92 Art or icon ... How much art can be found in your EDM system? Mitsubishi Electric
- 100 Programming machine tools and robots with a CNC control. Mitsubishi Electric & KUKA

Regular items

4 Editorial

- 5 News
- 19 Back issues/change of address

Legal notice

Published by

Mitsubishi Electric Europe B.V. Niederlassung Deutschland Mechatronics Machinery Mitsubishi-Electric-Platz 1 40882 Ratingen • Germany Tel +49 (0)2102 486-6120 Fax +49 (0)2102 486-7090 edm.sales@meg.mee.com www.mitsubishi-edm.de

Exciting reports from the world of EDM - and Mitsubishi Electric.



Precision work from Thuringia. Top-level metalworking. eropräzisa GmbH

102 Keigo – why polite isn't always polite Japan Special

106 Horoscope for hard-wired EDM experts

Copyright

Mitsubishi Electric Europe B.V.

Editorial board

Hans-Jürgen Pelzers, Stephan Barg, alphadialog public relations

Design and layout

City Update Ltd. · Germany

No responsibility is taken for the accuracy of the technical data and information in articles.



4 Profile 02/18

Editorial



"Birthdays are markers on the way between the past and the future.

Helga Schäferling (*1957), German social worke

Hans-Jürgen Pelzers

40 years in Germany, almost 100 years in Japan

Mitsubishi Electric has established itself as a permanent fixture in the EDM sector in Europe, chosen by customers on the strength of price/performance ratio, precision and dependability.

In this issue, I have the pleasure to introduce you to other parts of the company that you will have already encountered without being aware of it. Be it in the new ICE trains (p. 88), internationally in lifts, or in the comfortable interiors (from p. 78) made possible by Mitsubishi Electric air conditioners.

And even specifically in your own field, that of metalworking, many milling machines and lathes are equipped with controls from Mitsubishi Electric. You might be surprised to learn that you can now also directly control robots from KUKA and Mitsubishi Electric with simple G-codes (p. 100).

Find out in what areas Mitsubishi Electric can be found and what exciting EDM projects there are in addition. At the same time, I invite you to acquire a work of "Art of Economy" for your wall - only 40 of the limited anniversary edition are available worldwide (p. 94).

Best regards

Hans-Jürgen Pelzers from the Technology Centre in Ratingen

News



Mitsubishi Electric launches new safety PLC

Mitsubishi Electric's modular PLC* series MELSEC iQ-R is now available as a fully redundant pair of controllers for high performance and extra reliability. To help reduce the total cost of ownership (TCO), the system also integrates various features into the PLC for monitoring and managing safety.

*PLC = Programmable Logic Controller





Mitsubishi Electric's new lighting system mimics blue skies, sunrises and sunsets

Mitsubishi Electric Corporation announced today that it has developed an indoor lighting technology that mimics the daily change of natural light from sunrise to blue sky to sunset. The system, which consists of a thin panel and frame measuring less than 100mm, incorporates a proprietary edge-lit method that emits LED light from the side of the light panel to achieve highly natural light with the depth and colour of the sky.

Enjoy your read of this issue!

Mitsubishi Electric IoT communication gateway wins "Best of the Best" Red Dot Design Award

Mitsubishi Electric Corporation announced today that its Mitsubishi Communication Gateway XS-5R/ XS-5T, an environment-resistant IoT communication gateway, has been selected as "Best of the Best" in the Product Design category of the Red Dot Design Award. This was Mitsubishi Electric's first Best of the Best award for international design and the company's fourth straight year as a recipient of one or more Red Dot Design Awards.

Mitsubishi Electric goes additive - modular manufacturing strategy for high productivity

Mitsubishi Electric Corporation has announced the development of a new product technology for additive manufacturing that facilitates high-precision shaping with novel dot forming technology by combining laser sources, CNC machines and CAM technology in new 3D laser printers. The technology yields high-grade 3-dimensional parts with a homogeneous material structure at high production speeds by applying a laser-wire directed-energy deposition (DED) method. This is an additive manufacturing method that uses focused thermal energy to fuse materials as they are deposited. For this product development unveiled at JIMTOF in Tokyo, Mitsubishi Electric advocates a modular manufacturing strategy. Build-up and further-processing methods are separated but combined on the modular principle where it makes sense. Mitsubishi Electric is convinced that this new technology will help to raise productivity in a large number of applications.



Deciminary procession of the second s

Second Second

A Contraction of the second se

The second secon

大王子

DCAM GmbH

An underestimated product factor. A software solution for process optimisation.

For decades wire-cutting has been synonymous with the efficient, high-precision machining of electrically conductive materials. Machine manufacturers regularly introduce innovative refinements such as automatic wire threading and the Tubular Shaft Motor. However, no less important for cost-effective eroding processes are suitable software solutions. Only with highly evolved software is it possible to make efficient use of a wire EDM system's hardware. The Berlin software company DCAM provides users with a tool that is easy and quick to program even for complex workpieces, ensures maximum process security and permits unsupervised machining over long periods.

Maximum process security and unsupervised machining over long periods.



DCAM GmbH

Wire EDM systems operate with extreme precision, with tolerances of a few thousandths of a millimetre. They generate outstanding finishes, operate with high process security and create the ideal conditions for unsupervised machining for long periods - advantages marginally offset by the longer machining times. What is obvious is that makers of tools and moulds need cost-effective systems. And this is where wire-cutting machines with intelligent software come into their own.

A software company that has been concentrating entirely on wire EDM for almost 30 years is DCAM GmbH domiciled in Berlin. Managing Director Jens Franke is convinced that "for companies that don't constantly use their machines and only cut the simplest contours with them, the software solutions supplied by the machine manufacturer are sufficient. But the more complex the task, the more difficult it becomes to operate profitably with bottom-of-the-range CAM solutions." DCAM has therefore developed an ingenious CAM solution that delivers a number of advantages. Its DCAMCUT software runs with precision, is quick and easy to use and ensures maximum process security.

Less programming effort thanks to templates

When preparing each job, users of most systems have to newly assign the contour characteristics, select the surface finish and enter all production-related parameters. DCAMCUT, on the other hand, operates with templates. With this technology, all machining processes can be stored in catalogued form and can be re-used for different geometries as required.

This reduces the programming effort by 60 to 70% and cuts the error rate.

Deviations are programming errors

These days, most workpieces are designed with 3D CAD programs, but the machine data are often still generated on the dual-level principle. Two levels, an upper and a lower, are generated and averages between them are calculated. This is where Franke sees a definite advantage of his software: "DCAMCUT works directly with the data of the 3D model, in other words on the original faces of the design." This way it is easy to determine early on, during data input, whether a workpiece can be wire-cut or changes to the design

are necessary. It is no longer necessary to derive contours with sections through the component, and this saves a good deal of time for the user. In addition, all the workpiece geometries can be reliably checked before the workpiece is loaded

One program – all wire-cutting machines

DCAMCUT is available for wire-cutting machines from all manufacturers. It has a modular structure and can be adapted to any task. As a solo version, it offers an almost fully fledged CAD system. DCAMCUT is capable of integration into the CAD environments of Solidworks and Autodesk Inventor.

With limited features, the software can be tested free of charge for 30 days or, on request, with all functions for a limited period.



At its modern training centre, DCAM attaches great importance to practical training.

onto the machine. DCAMCUT also identifies minimal deviations and alerts the user so that he can decide whether they are intended or have

been overlooked by the engineer. Workpieces programmed with DCAMCUT are thus produced without any deviations as they are based





An ingenious CAM solution that offers a multitude of benefits.



directly on the 3D model.

Many users use their experience to compensate for these deviations. They are aware of numerous geometries that can give rise to deviations and attempt to offset them. They are often successful, but the user only obtains certainty on the measuring machine. And by this time, several hours of machining have already been invested. "This can be really expensive," says Franke. "And process security is something else. In practice, such deviations are happily attributed to the machine's shortcomings although they are obviously programming errors that DCAMCUT rules out."

New 4-axis clearing process

Wire cutting is not always the fastest machining method in tool- and mould-making, but it does offer high process security and the possibility of unsupervised machining for long periods. And this makes it highly cost-effective. DCAM has optimised

Marcel Schilsky sets up the EDM system for the next training session.

the wire EDM process by introducing new features. These include, for example, 4-axis clearing on any geometry. Cut-outs must not be allowed to drop into the machine in an uncontrolled fashion. They either have to be removed from the machine by the operator by hand or tacked with the new Mitsubishi Electric technology. The first method is labour-intensive, and the second calls for reworking.

To make these steps more economic, DCAM has redesigned the 4-axis

DCAM GmbH

clearing process from the bottom up and focuses particularly on the machining of tiny geometries. In the clearing cycle, the material is 'destroyed' rather than cut out. "This is often cheaper than cutting out the material," Franke explains. Because such processes require much less supervision than processes with dropping parts. Profitability depends also on the geometry.

Cooperation with Mitsubishi Electric works very smoothly.

Jens Franke, Managing Director DCAM GmbH

our software."

tive solution



Standard programs operate with a postprocessor that converts the data into the machine code. DCAMCUT, on the other hand, has an NC processor that generates the data in the machine code itself without going via a postprocessor. The user benefits directly from this procedure, as data conversion is more exact and at the same time faster. If during programming, the geometry is distorted by the offset, for example, DCAMCUT immediately issues a fault message. With standard programs, the error only becomes apparent when the data are transferred to the machine. Downtime and machine stoppages then make themselves felt.

Difficult workpieces wanted

"When we demonstrate our software to the customer," Franke explains, "we ask the customer to give us the data of a current production workpiece that has caused difficulties. On the basis of this workpiece, we show DCAMCUT's features and how it works. We generate the machining data in the customer's presence and then ask him to transfer them to the machine



ing others?" This is something that DCAM's sales employees hear on a daily basis. For Franke, there's only one answer: cost. "What could you save if you compared them? This guestion has to be asked repeatedly in order to arrive at the most cost-effective solution." Franke is convinced that the wire-cutting processes in many companies can be accelerated significantly with DCAMCUT and that process security will be improved as well."

Training at the machine DCAM attaches great importance to practical training. At its





For practical training a Mitsubishi Electric MV1200R Connect is installed.

Teltow Training Centre, the company has installed a wire-cutting machine from Mitsubishi Electric, an MV1200R Connect. This is where training participants can obtain their first experience with DCAMCUT at the machine. "Our cooperation with Mitsubishi



With multi-axis technologies combined with complex clearing strategies, DCAMCUT permits highly intricate machining.



DCAM headquarters in Teltow

Franke. "Mitsubishi Electric involves trol and programming. This way we modify our solutions appropriately." Mitsubishi Electric thus ensures that the machines are launched simultaneously with the new software.

Precise and at the same time fast data implementation.



DCAM GmbH

Founding year 1990

Managing Director Jens Franke

Core business Software development for wire EDM

Contact Potsdamer Strasse 12B 14513 Teltow / Germany

Tel +49 (0) 89-81803-1501 Fax +49 (0) 89-81803-1519

info@dcam.de www.dcam.de

DCAM GmbH

Inhotec SA

Perfection in function and aesthetics.

Swiss watches are considered the epitome of precision, quality and dependability. Exceptional design and aesthetics make them stylish and prestigious timepieces as well. Only the best in the industry receive the much-coveted accolade of the Grand Prix D'Horlogerie de Genève. Inhotec SA in Le Locle (Switzerland) is a component supplier to such customers and decided to purchase a Mitsubishi Electric MX600 wire-cutting machine a year ago.

EDM in the unique world of Swiss clockmaking.





Inhotec SA

"You can gauge our status in the industry from the fact that several of our customers have been awarded the Grand Prix D'Horlogerie de Genève," says Alexandre Eme, Director of Inhotec SA in Le Locle in Switzerland. With his roughly 50 employees, his company produces components and subassemblies for the Swiss clock industry. After serious crises, their business model is similar to that of the car industry where manufacturers rely to a greater or lesser extent on components from outside suppliers. Such small component suppliers can operate more flexibly and cheaply that the big names in the industry. Essential for such cooperation, however, is that the supplier works to the same high standards as the brand manufacturers and shares the same philosophy of quality.

Good isn't good enough...

A characteristic feature of Swiss timepieces is their immaculate aesthetics outside and inside. The entire movement down to the tiniest components of the mechanism displays a quality of machining that is otherwise only found on high-grade jewellery. This starts with the materials, with classical steels typically playing second fiddle. The preferred materials include Durnico, a stainless maraging steel (X2NiCoMo18-9-5) with high nickel, cobalt and molybdenum contents that undergoes a special heat treatment to give it extreme hardness and strength. Plenty of brass and, in some cases, extra-light yet high-strength titanium are also processed. The demanded tolerances are also well within the

This decorative finish is known as "Côte de Genève".



ranges often expected in precision machining. $\pm 2 \ \mu m$ is typically required and in some cases $\pm 1 \ \mu m$, and this calls for measuring equipment of especially high accuracy.

... because only perfection is accepted.

All the same, precise compliance with the required dimensions is by no means everything in the world of Swiss clockmaking. Pretty well every component must also satisfy high standards of aesthetics. Burrs, coarse finishes and rough-cut edges are absolutely unacceptable, with great importance being attached to the quality of surface finish. During finishing, the parts are therefore subjected to numerous grinding, blasting and polishing processes. These are in many cases special versions of the

> Decoratively machined pearl-effect platelet for a movement

systems otherwise commonly found in industry, adapted to the special needs of clockmaking. In addition, an exceptionally large number of steps are performed by hand, and hand lenses and stereomicroscopes are often employed. Hanging from a wire frame around Inhotec's employees' necks, the regularly used watchmaker's loupe can be said to symbolise this philosophy of quality.

The most important processes include milling ...

The starting point in the process chain at Inhotec is a comprehensive stock of

We have been impressed not only by the excellent performance of the Mitsubishi Electric MX600, but also by the superior price/performance ratio and the rapid and efficient after-sales service by the Swiss agent.

Extra-Ligh accuracy is assumed.

blanks. These are tiny, mostly rectangular platelets of the metals mentioned above, which are ordered in a variety of sizes and thicknesses. Keeping abundant stocks in hand is essential for the swift completion of orders from the moment they arrive. These platelets are machined either in their supplied state or after a prior grinding process on both sides to reduce the thickness or for surface preparation in the milling department. This is where numerous 3- or 5-axis milling centres are in use. In the course of this machining, the guide and fastening holes are given the desired size and are subsequently used for fixing stacks of platelets on the machine's workspace for subsequent wire-cutting. The milling systems employed are of the highest quality and are always in line with the current state of technology.

...and wire-cutting

The electrical discharge machining performed at Inhotec differs fundamentally from what is familiar from other fields of application, e.g. mould-making. In mould-making the emphasis is often on the cutting rate, while the roughness of the cut face is of secondary importance. Resort is made here to "thick" wire, high spark energy and deionised water as the dielectric.

The Mitsubishi Electric MX600 EDM system, which went into operation last year, operates entirely differently. On this system designed specifically for super-fine machining, oil is used as the dielectric. Although this is slower, it is much gentler on the material being machined. This is joined by electronics capable

Inhotec SA

In all aspects of the production of a component, we aspire to perfection. Such a philosophy of quality is essential in the manufacture of super high-quality timepieces.

Alexandre Eme, Managing Director of Inhotec SA

of generating an extremely smooth cut edge with sensitively dosed pulses lasting as little as a billionth of a second. At Inhotec, the cut edge after the first cutting cycle is typically processed seven to ten times more with ever decreasing feed rates and suitably reduced spark energy. The result is exceptionally smooth cut edges that meet even the exacting expectations of clock- and watchmakers. The new machine surpasses the systems from a different manufacturer used to date in two ways, Jacquot stresses: with its good price/performance ratio and with the quick and efficient after-sales service provided by the Swiss agent, Binkert AG in Wallisellen.

64

œ

00

Testimonial

"We're thoroughly content with the new system," says Sylvain Jacquot, head of EDM at Inhotec, summing up. The Mitsubishi Electric MX600 runs with wire electrodes ranging in thickness from 0.2 down to 0.03 mm Ø and has been operating 24/7 since its commissioning a year ago. Thanks to its modern control with its high-resolution graphic display of processes, machine operation was easy to learn intuitively.

Machine operation is easy to learn intuitively.



Inhotec SA

Employees

50

Founding year 2011

Managing Director

Alexandre Eme

Core business

Supply of intricate mechanical components and complete subassemblies for high-grade Swiss clocks and watches, from the prototype through to series of several thousand pieces. All processes are handled so that the customer can use the parts directly in production. Along with meeting the highest quality standards, Inhotec aims for a fast response and flexibility in the performance of any special requests.

Contact

59, Rue de France 2400 Le Locle / Switzerland

Tel +41 32 9311800 Fax +41 32 9311801

info@inhotec.ch www.inhotec.ch

Mitsubishi Electric agent in Switzerland

Josef Binkert AG Grabenstrasse 1 8304 Wallisellen / Switzerland

Tel +41 44 832 55 55 Fax +41 44 832 55 66

info@binkertag.ch www.binkertag.ch

Inhotec SA

Swiss clockmaking

At the mention of Swiss clockmaking, most people think of wristwatches – although this is a relatively modern development, as the first wristwatch was invented only in 1810. The Swiss clockmaking tradition, on the other hand, goes back about 500 years. The Church reformer Calvin, who was obsessed with punctuality, attracted numerous Huguenots, masters of the art of chronometry, from France to Geneva.

> The zealous reformer also gave the industry a further boost by banning the wearing of jewellery. Forced to adjust, the local goldsmiths turned their attention to the manufacture of decorative waches. From Geneva this art quickly spread throughout the Jura Mountains. The product range initially covered everything from church tower clocks to pocket watches. According to entries in the Breguet company archive, the first wristwatch mentioned above was crafted for the Queen of Naples by Abraham-Louis Breguet only in 1810. The first watertight wristwatch was designed by Rolex in the 1920s. In 1926 this was followed by the first automatic wristwatch from a manufacturer in Grenchen in the Canton of Solothurn. What is probably the world's most complicated timepiece artwork ever produced is the Calibre 89 by Patek Philippe, which consists of a total of 1728 components.

The industry made an almost fatal error by inventing the quartz clock. Although the first quartz clock was developed in Neuenburg (Neuchâtel) at the Centre Electronique Horloger (CEH) in 1967, the market was left largely to Japan and the USA, causing the Swiss clockmaking industry to almost collapse in the mid-1970s. Today it is again prosperous, achieving export revenue of almost 20 billion Swiss francs in 2017.

A fine example of the art of Swiss clock- and watchmaking: The Bovet 1822 Récital 22 Grand Récital awarded the Golden Hand of the Grand Prix d'Horlogerie de Genève is produced in a limited edition of 60 and costs 468,500 CHF.

(Image: Grand Prix d'Horlogerie de Genève)



Back issues and change of address.

Back Issues

Current iss	ue 01/18	02/17	01/17
ounontioo		02/11	0000
Address/ 0	Change of address		
Company			
Company			
Surnama		First name	
Sumame		Thattidite	
No road			
140., 10au			
Post code	Town country		
r osi code	Iown, country		
Email address			
Phone			
Yes, I would like	Mitsubishi Electric to keep me info	ormed of its special offers and cam	paigns by email.

Note: Your data will not be passed on to any third parties except companies involved in the processing of your order. You can terminate the storage of your personal data at any time by simply sending a fax to +49.2102.486 7090

From specialist for specialists ...

18 Profile 02/18

Lune

8,7,6

Récital

desired number):



MITSUBISHI ELECTRIC EUROPE B.V. Mechatronics Machinery / Profile Reader Service Mitsubishi-Electric-Platz 1 / 40882 Ratingen / Germany



Order by fax +49 (0) 2102 486-7090



Order online www.mitsubishi-edm.de/profile **Neubeck & Wiedemann GmbH**

Wire-cutting

launches a new era.

Building on its successful company history, Neubeck & Wiedemann GmbH is well equipped and firmly established in the marketplace as a metalworking specialist. For the last eight years, wire-cutting machines from Mitsubishi

The circumstances of the independent family company couldn't be better today, with its location at No. 13, Himmelreich in Stockach, the "Gateway to Lake Constance", as the little town of Stockach with its population of 17,000 likes to call itself, and good transport links to trunk roads and the motorway. In its modern new building with two

attractively integrated production shops providing 2400 square metres of space for over 30 machine tools, some 40 employees mainly produce precision components as one-offs or in series, as well as punching tools for toolmaking and the production of jigs & fixtures.

The foundations for what was

originally a tiny business were laid by two men called Neubeck and Wiedemann in the centre of Stockach in 1970. Since 1994, a new owner family has been investing heavily in the business, with the company relocating to Himmelreich industrial estate in 2008. Production space had doubled by 2015.



Young workforce in a region of attractive employers

Jürgen Läufle, the Managing Director employed by the company's owner family, has been running the company for seven years and is very proud of how things have been developing. "I joined the company as a fully authorised officer ten years ago, and then

switch had been flipped. But our ment prevented us from having to the switch was flipped back and have all of our employees back in pany has grown quickly, almost

Stockach - the "Gateway to Lake Constance".





too quickly, Läufle continues and mentions the problem of the shortage of skilled employees. Located not far from Switzerland as a popular place to work and with large German industrial companies nearby, a small or medium-size business finds it difficult to hold its own. Läufle pins his faith on training and his young workforce. "We

Neubeck & Wiedemann

have a large proportion of apprentices with at least two new trainees per year. With apprenticeships lasting three and a half years, we have up to ten apprentices at peak times doing their training here, with the goal of integrating them successfully in the production team." And Läufle even mentions that he relishes having a young workforce of exclusively permanently employed skilled workers with an average age of 35.

Quality is the defining yardstick for sales among customers

Neubeck & Wiedemann is a service provider. All areas of the company are concerned with metalworking and preferably turning, milling, grinding, hardening, die-sinking and wirecutting. Its core competence is in machine manufacture and mainly with components for machine tools such as flanges, spindles, shafts and bearing housings. It is characteristic, says the Managing Director, "that we have reciprocal business

relations in machine manufacture. which means that we are also the customers of our customers". Between 80 and 90 per cent of output consists of precision parts as single items or in small series and of prototype construction. In toolmaking, the company not only supplies standard solutions but also designs and develops its own punching tools and machines with their own controls and electronics to suit the customer's needs. And these customers can be found in a wide range of sectors, such as machine and special-purpose machine manufacture, micromechanics, electronics, optics, measuring machine manufacture, a few companies in aviation and aerospace plus automotive component suppliers.

Starting off with a used machine seven years ago

Läufle is happy to introduce Dennis Scholter as his factotum for punching

Neubeck & Wiedemann GmbH

Employees

40

Founding year

Managing Director

Dipl.-Ing. (FH) Jürgen Läufle

Core business

Precision parts as single items or in small series, prototype construction, punching tools and jig & fixture construction

Contact

Himmelreichstr. 13 78333 Stockach / Germany

Tel +49 (0) 7771 2872 Fax +49 (0) 7771 2140

info@nw-gmbh.de www.nw-gmbh.de



I'm delighted with the technology. We were late starters, but the machines have moved us forwards quality-wise. It was a technological leap from die-sinking to wire-cutting, particularly as far as machining time and accuracy are concerned. We can now cut a component twice as quickly and much more accurately.

Jürgen Läufle, Managing Director of Neubeck & Wiedemann GmbH



The wire EDM has done a neat job of work. All the pockets of the die plate show high-quality cuts. tools. Scholter is design engineer, developer, measurement engineer and wire-cutter in one. And it is wire-cutting that has become one of the company's success stories. On a customer's recommendation to integrate wire EDM technology in production, it purchased a used Mitsubishi Electric wire-cutting machine in 2011. Läufle explains: "This gave us an excellent opportunity to launch production in this area. The support from Mitsubishi Electric was quick to respond and outstanding. We got off to a very quick and very good start with the used machine. Within four to six weeks we were able to produce parts without assistance.

After only two years we found that the used machine was no longer able to cope with the workload." The volume of orders called for investment in the first new wire EDM, an MV2400S from Mitsubishi Electric. And Läufle explicitly mentions his good contacts with Angel Muñoz, EDM Area Sales Manager at Mitsubishi Electric. Some time later there was another bottleneck, and the second new machine from the Japanese manufacturer, its MV2400R Connect flagship, has been in operation at Neubeck & Wiedemann for the past year. The high workload of the wire-cutting machines has been ensured particularly by press manufacturer Schuler

Technological leap forward from die-sinking to wire-cutting.

Profile 02/18 2



The men at the wire-cutting machines: Thomas Mayer (left) and Dennis Scholter. They both know the machines inside-out, write the programs and set up the machines.

and demand from the company's own punching tool activities, such as for the production of dies, punches and die plates.

Good customer contacts are the key to success

Cutting used to be carried out largely by die-sinking. This worked but wasn't the correct method in Läufle's opinion since it was neither efficient nor economic. He now appreciates the big advantage of wire EDM technology in its high-grade and what he calls "sensational dimensional and shape accuracy coupled with surface quality and flexibility". He uses coated and uncoated standard brass wire,

Neubeck & Wiedemann

usually of 0.25 millimetre diameter. This means the Stockach company complies entirely with the machine manufacturer's recommendations. get quick feedback from the

centre, even when we have

a technology issue with criti-

cal parts, as recently with a component 300 millimetres

high. We solved the problem

together and were given tips

for production. This is by no

means usual and certainly not

commonplace in the present

day and age."

Mitsubishi Electric technology

For Läufle, the low-maintenance machines represent a quantum leap forward. "We used to have to obtain quotes from wire EDM specialists and thus lost a lot of orders from our customers. Because of the higher costs, we simply weren't competitive. Since we've been able to quote our own prices, we've expanded, both in our output and in the range of sectors we serve."

He leaves no doubt that he repeatedly resorts with enthusiasm to Mitsubishi Electric. "Basically, we're absolutely satisfied in all areas with the machines, their performance and the after-sales service. When a problem arises, we



Before starting the machine, Mayer programs the machining of a press component for which the wire has to cut an angled contour.

Questions to Managing Director Jürgen Läufle

What does your company philosophy entail? Läufle: As far as our employees are concerned, treating people fairly in every respect has top priority. Anything else results in distrust and ill-feeling.

What is your opinion of Industry 4.0? Läufle: In my view, the subject should be approached with balance and on the basis of feasibility in the case in question. For our production of single parts and small series, we have to think in longer time-scales than a catchword. The obstacles for us as a small business are very high.

According to an allegedly totally surprising, current study by the VDMA, digitisation has not helped to boost productivity. What's your view on this?

Läufle: This is no surprise to me. In the mass production of standard products, digitisation could deliver more. But hardly for us. I like to compare this with my position as a user of Microsoft products. Take the example of Excel: For our needs in our daily use of the software, things don't get better with each new version. In fact, everything tends to get more complicated. Ten years ago, Excel only had a small number of functions, but ones that we actually needed. Today, the program is totally overloaded, which is no use to us. Not everything that's offered actually helps us or improves our productivity.

What are your expectations of the future of Mitsubishi Electric wire EDMs?

Läufle: EDM technology, straightforward and efficient machine control, and the after-sales service are really impressive. For the future, I expect the PC interface to be phased out and programming to be handled entirely by the machine. This certainly won't make any difference



to quality, but it speeds up production. At present, we've got the three stages of design, programming and machining. A direct transfer from design to the machine is theoretically conceivable. Maybe both solutions will have to be made available in the future. In my view, this is not a question of either-or.

What might by a topic of the future for Neubeck & Wiedemann?

Läufle: Our topic will be 3D printing. I like to compare



this to our success with wire-cutting. At the moment, we ourselves don't yet have a market for 3D, but the starting point for wire EDM was the same. The first used Mitsubishi Electric machine was working to full capacity after only a year, so we've since invested in two new machines. That's how we imagine progress will be with 3D printing – exciting prospects!

Neubeck & Wiedemann



HAGE Sondermaschinenbau

Freed

ELF.



100



Producing large components several metres long and wide for trucks and cars, scaffolds and space rockets cost-effectively and in large series calls for ingenious special-purpose machines and automated plant. These are developed, produced, assembled and installed by Hage Sondermaschinenbau GmbH & Co. KG. The stamping and cutting tools required for this are machined by the Austrian specialists on an MV2400S.

"Can do" is the principle put into practice in the company by current Managing Directors Florian and Stefan Hampel. Originally founded by Gerfried Hampel with just three colleagues in a garage, the business is now an internationally recognised special-purpose machine manufacturer under successful secondgeneration management.

Large and complex

The striking feature of the spacious production halls is their sheer size. This is where special-purpose machines and plant that fill shops up to sixty metres long are produced and assembled. The production facilities also encompass all the production steps necessary in metalworking and plant engineering. Among other things, these include steel construction activi-

ties for machine frames, the precision machining of small gear components, the installation of electrical equipment, controls and switch cabinets, and finally the assembly and commissioning of complex plant. Peter Leitner, Executive Manager at Hage in Obdach, explains: "A high degree of vertical integration is one of our competitive advantages. This way, we can bring innovations particularly at

the concept and design stages to fruition quickly and flexibly on our highoutput special-purpose machines." He stresses above all the inventive capabilities of his skilled employees. "Our ideas and our competent design engineers have been instrumental in the achievement of our outstanding position on international markets. We develop specialpurpose machines and plant to order that meet all of our customers'

tre long semi-finished products into components for scaffolds with flexibly alternating programs. This involves the sawing and cutting of tubes and sections of steel and aluminium, the stamping or milling of penetrations, the introduction of bores and threads, and finally the storage of the sorted finished components. The special-purpose machine manufacturer also develops and realises complex plant enabling the customer to fully machine parts for automotive bodies, e.g. bumpers (crash management components), floor pans and boards of truck cargo beds, side walls and sectional beams for rail vehicles, and frames and columns for

We've been machining precision parts on wire-cutting machines from Mitsubishi Electric since 1984. We've been impressed by their optimum combination of technological quality and economy.

Peter Leitner, Executive Manager at HAGE



requirements in terms of economy, rapid cycle times and quality of the finished products," Leitner reports.

The company in Obdach mainly works to customer specification. This applies particularly to plant that continuously converts up to 12-meprocess-engineering and agricultural silos and similarly large items.

Standardised special-purpose machines

In addition, the Austrian specialists have set up a series of large, 5- to 7-axis machining centres in gantry and column designs with workspaces measuring up to 70,000 x 6,000 x 2,000 mm. In addition to the usual conventional machining methods, they are also capable of joining large aluminium components using the friction stir welding process. For this, the manufacturer has developed special tools that will fit into standard toolholders. Such special-purpose machines are mainly used by component suppliers and

manufacturers in aviation and aerospace, in order to machine shaped segments into conical and cylindrical hoods and containers for rockets, for example. The beneficial feature of this is that these aluminium parts can be milled and welded in a single pass on a single machine without reclamping. On such a machining centre operated in Obdach, the specialpurpose machine manufacturer also provides process development and test machining as a service.

Additive manufacturing with plastics

Building on their outstanding expertise acquired from innovative

Gantry machining centre with up to 70-metre X-traverse

production processes and practical machine technology, the specialists at Hage have now also developed and built a series of 3D printers. These operate with filaments of plastics that are supplied from coils, melted in multiaxially positioned heating nozzles and applied in thin layers to build up the programmed component geometry. On these printers, it is possible to produce prototypes and small series of components with unusual geometries that are inca-

pable of being produced conventionally.





As a special innovation, one variant of the 3D printer has a workspace of up to 1750 dm³ and a platform rotating and pivoting (4th and 5th NC axes) in two axes. This makes it possible to build up components with either much less of or even none of the previously required supporting structures. On these 3D printers, it is also possible to extrude metals such as titanium, stainless steel and copper as filaments and additively manufacture components with them.

Wire-cutting precision components of hard materials

For this broad spectrum of specialpurpose machines, a large number of components of hard materials are

needed in small series, Leitner says. This applies among other things to stamps and dies, bearing bushings and guide rails for stamping tools that are installed in high-productivity machines, as well as nozzles and guide elements for 3D printers and similar components.

"We've been machining such precision parts on wire EDM systems from Mitsubishi Electric since 1984. We've been highly impressed by these machines' optimal combination of technological and economic quality," Leitner continues. He tells us that one of the wire-cutting



Machined on a Mitsubishi Electric MV2400S - a perfect fit!

tools. In addition, larger plate can be clamped so that several identical parts can be cut in an unmanned operation. Owing to the dependability of the wire-cutting machine, this can be done trouble-free overnight and into the weekend. The technicians, including Johann Mischlinger, confirm that this is made possible by the extremely dependable and proven automatic wire threader. With its Tubular Shaft Drives and its optical measuring systems, the MV2400S achieves the best compromise between accuracy and working speed for the specialists in Obdach. "Compared to machines equipped with linear drives, the MV2400S is also much more energy-efficient in operation," Leitner adds. Programming in Obdach is performed at external 3D CAD/CAM

software. The NC programs are transferred via a network straight to the wire EDM system. The technioperating strategy. It needed to be take long, they claimed, for them to appreciate the benefits of the new control panel.

Finally, Executive Manager Leitner stresses that the recent investment in the wire-cutting machine from Mitsubishi Electric has been fully vindicated. He sees this decision fully confirmed by his experience of the rapid and competent after-sales service and short-notice supply of maintenance accessories and replacement





parts for the wire-cutting machines from Mitsubishi Electric already in operation in Obdach.

HAGE Sondermaschinenbau GmbH & Co. KG

Employees

120

Founding year

1981

Core business

Turnkey special-purpose machines and automated plant for the high-productivity manufacture of metal and plastics components for road and rail vehicles, aviation and aerospace, and the construction industry

Contact

Hauptstrasse 52e 8742 Obdach / Austria

Tel +43 3578 2209 Fax +43 3578 2209 16

www.hage.at office@hage.at

HAGE Sondermaschinenbau



The consistent commitment to perfection.

A tradition of innovation.

Wachsmuth enjoys a global reputation for precision in toolmaking and metal forming. High-grade engineering services, a consistent commitment to perfection and the highest standards of workmanship are its assurance of long-term and successful customer relations.

possible.



G. Wachsmuth & Co. Werkzeugbau GmbH

Its work for customers in wide-ranging sectors all over the world is founded on numerous patents and inventions. Wachsmuth always finds a solution in making the impossible

Wachsmuth & Co.

An interview with Udo Wachsmuth

What does Wachsmuth do?

We produce tools for the food, pharmaceutical and automotive industries as well as deep-drawing dies.

What is your bread-and-butter business?

Our bread and butter is tools for the food industry. Deep drawing is still one of our specialities, because there are not many in Germany who do it. In this area we've got a strong position on the market. Another important line of business is the production of tools for cutting very thin plastic films.

Has there ever been a project that proved to be a major challenge?

We had a deep-drawing part that proved to be a real headache. But we managed it in the end – because we never give up. In fact we've never had a project that's caused us to throw in the towel. But there have of course been projects where we've said "I've had enough of this!", but we've always seen them through.

What do customers appreciate most about your work?

Our accuracy – that we produce precision results and deliver on time.

Your company is located on a hill near the Ruhr district. What can you tell us about it?

I like to put it this way: We work in an area where others spend their holidays. Our father set up his own business here in 1975, and that's how we came to be working in such a tiny place like Wiblingwerde.

Today you've got a 40-strong workforce and have installed a specialised machine park. What experience have you gathered in the last few years?

The machines have become more and more accurate and reliable, and speed is constantly increasing. There's a lot going on in this area.

When you look back at successive generations of machines, what are the most important developments that you have experienced?

The machines have become so much faster and their precision has increased. Like on the MV4800. It's really good now thanks to its tubular drive.

The MV4800 is a relatively large model – how come you bought this one?

We needed traverses on the X and Y axes - Z wasn't so



important for us. It then turned out that we had a good use for it after all and now want to offer the whole lot as a subcontractor in the marketplace.

You've built up your expertise over a period of decades. Can other businesses come to you and make use of it?

All skills and machines that we have here at the company are available to outside customers. The wire-cutting machines from Mitsubishi Electric in particular are available on

MITSUBISH

Impressive machines for big tasks

So the coffee tastes good .

An all-round package that does the job.

The accuracy of the Mitsubishi Electric machines, the attractive price/performance ratio and reliability. An all-round package that does the job.

Udo Wachsmuth, Managing Director of G. Wachsmuth & Co. Werkzeugbau GmbH

principle for subcontracted jobs. We've got four of them – the FX30-K, FA20S, FA20S Advance and the new MV4800.

An interview with André Kroker

How long have you been wire-cutting?

Since I was 19 - that's 33 years ago.

How many different machine types have you so far worked on?

This is the fourth machine type from Mitsubishi Electric that I've so far worked on.

How do you find machine operation?

Operation is very intuitive. In the past we've had to change from one machine generation to the next. It only took me a few hours to acclimatise.

Do you also run the Mitsubishi Electric wire EDM systems unmanned?

Yes, we see to it that the machines run overnight. It depends of course on the work that you're asked to do. Basically, we prefer to use the Mitsubishi Electric machines unmanned.





What I like most about the new MV4800 is its surface finish and accuracy.

André Kroker, wire-cutter and CAM programmer at G. Wachsmuth & Co. Werkzeugbau GmbH

How does automatic threading work?

Usually perfectly. If you stick to the machines' maintenance intervals, there are never any problems.

You've got four Mitsubishi Electric generations at the company. How have you experienced developments from one generation to the next?

There's steady progress in terms of speed and surface finish. I don't know if there's ever going to be a limit.

The MV4800 is a very large model. What was the biggest workpiece that you've ever machined on it, and how did it go?

The biggest workpiece measured 1200 x 800 mm and was 110 mm thick. It went pretty well.

Have you ever machined any other unusual workpieces that placed special requirements on the Mitsubishi Electric machines?

For a multi-punch, for example, we had to cut 120 star stamps, with each one taking five to six hours - and that went perfectly.

Have there been any other unusual workpieces? For the most part we cut tools for the packaging industry. The procedures here are always very similar. These include die plates with a tiny kerf of 3 to 4 µm - we manage that very well.

What's your assessment of the machining accuracy of large workpieces?

We achieve narrow tolerances - in some cases 2 to 3 µm. And when I work with a technology, I manage that in 5 to 6 cycles.

What materials do you machine most often?

We machine cemented carbides, cold- and hot-work steels, powder steels and stainless steels on all machines.

You're in charge of four machines. Is that a challenge or can you cope with them?

You can cope with a lot of machines if you know how to organise your work. We've got a lot of long-running jobs for which a machine operates continuously for 2 to 3 days. So it's not a major problem.

Are you the only EDM specialist in your company?

At the moment I am. I've got a holiday stand-in who also comes in when things get tight.



G. Wachsmuth & Co. Werkzeugbau GmbH

Employees 40

Core business

from prototypes through to parts produced in series

Founding year 1975

Managing Directors

Udo Wachsmuth





Stamping, toolmaking and laser-cutting,

Contact

Harpkestr. 16 + 25 58769 Nachrodt-Wiblingwerde / Germany

Tel +49 2352 938450 Fax +49 2352 320194

info@wachsmuth.de www.wachsmuth-gruppe.de

Wachsmuth & Co.



Skilled manpower for industry.

SZF Schulungszentrum

Training for industry.

In its initial and further vocational training, Fohnsdorf training centre (Schulungszentrum Fohnsdorf = SZF) in Austria is keen to keep pace with current technologies and the needs of industry, craft enterprises and trade. In the metalworking department, there were compelling reasons to invest in an EA12S die-sinking machine from Mitsubishi Electric.

An open, bright foyer with a coffee bar and comfortable seating is a pleasant place for relaxing. This is how Fohnsdorf training centre presents itself to visitors. As Heimo Gladik, in overall charge of training, reports, this open and inviting atmosphere is part of the centre's concept. "We want to welcome motivated participants to our initial and further training. And that's why we organise our training centre in such a way that participants feel at home and take genuine pleasure in studying hard." The training centre works on behalf of the job centre, i.e. the state-organised system of helping people who are out of work temporarily or long-term to find new employment. "However, with the



training that we've designed, we differ markedly from what is otherwise available. Anyone who comes to us must demonstrate his genuine interest with an application and in a detailed interview," Gladik explains.

Broadly based, with technical and social skills

In return, course participants are

given unusually broad initial and further training. The curriculum is carefully balanced to the needs of industry, craft enterprises and the economy, says Gladik. The roughly 170 highly skilled, full-time instructors teach not only technical content, but also social skills. This includes comprehensive factual knowledge as well as abilities that can be put to practical use in the metalworking, electrical engineering, tourism and office/IT sectors. "We also teach broadly-based knowledge and skills in the interdisciplinary fields of CAD, languages, transport and logistics,"





Not a token commitment: Thanks to the experienced full-time instructors, numerous women also gain a sound training qualification in typical "male" professions at the centre.

Gladik adds. Some 400 participants come to Fohnsdorf every day, and each year about 1500 leave with a certificate documenting successful completion of their initial and further training courses. In doing so, they benefit firstly from the modern furnishings and equipment of the training and seminar rooms and secondly from the large workshops packed with the latest

technology. Unlike comparable institutions elsewhere, the participants attend initial and further training lessons tailored to their personal needs. In Fohnsdorf there are no fixed groups or classes and no strictly timed courses. In accordance with their prior knowledge and expectations of themselves and of the initial and further training, each participant is given a personally

Group learning: The instructors at the centre attach a lot of importance to social skills

structured training package. "We've been highly successful with this approach. Each year, about 150 participants take a final training exam. About half pass with distinction or a good grade," says Gladik. He's proud to note that over 60 per cent of qualified trainees find employment in positions appropriate to their skills within three months of completing their initial or further training.

Individual encouragement and training

Particularly in the present situation in which craft businesses, industry and trade urgently need highly skilled manpower, the strategy of Fohnsdorf training centre is proving to be highly relevant to needs in industry. In

We consciously chose a machine from Mitsubishi Electric, as it reflects perfectly the current state of technology.

Heimo Gladik, Manager and Training Director at Fohnsdorf training centre

consultation with company managers, the centre also offers further training geared to the specific needs of certain companies. It also assists firms with a comprehensive service in the search, selection and upskilling of currently needed and suitable specialist employees.

Always state-of-the-art

To uphold the exceptionally high quality of initial and further training, the instructors and students work of course with the very latest technologies, machines and equipment. As metalworking instructor Robert Wallner reports, this also applies to the machines for metalworking. "We carry out training so that our students can afterwards immediately find appropriate employment. This is why our course participants, and particularly those in further 人間等 FASSe. and advanced training, work on top-level production machines. The same applies, for example, for The EA12S die-sinking machine is a current technology

CAD/CAM systems. We are always state-of-the-art here."

He furnishes immediate proof of this on a tour of the initial and further training workshop for metalworking. This is where there are, among other things, high-grade 3- and 5-axis machining centres for HSC machining that are equipped with all the control and drive technologies currently widespread in industrial practice. In addition, there is an EA12S die-sinking machine from Mitsubishi Electric. "By using this EDM system, we can teach not only EDM itself but also, in combination with the machining centres and milling machines, the entire process in tool- and mouldmaking from CAD to the finished punching die or injection mould ready for use in production," Wallner explains.

Current equipment with the best cost/benefit ratio

Manager and Training Director Gladik adds: "We consciously chose a machine from Mitsubishi Electric, as it





Precision in all areas: At Fohnsdorf training centre, the advisers and instructors adapt the curriculum to the specific needs of students and companies.

reflects perfectly the current state of technology. It also offers an outstanding ratio of performance to investment and operating costs." In addition, Wallner continues, the machine's dependability and the quality of Mitsubishi Electric after-sales service also contributed to this investment decision. "Training for the instructors is also excellently organised. Our specialist employees receive at short notice the necessary training in the current control technology and, in the event of updates, in machine functions," Wallner adds.

Teaching employees can thus base the content of their initial and further training courses on current practice in industry and on the latest technologies – such as current digitisation. "That's one of the main bonuses of our strategy. We are always technologically at the cutting edge. Students who attend our courses can go straight into appropriate positions in industry, crafts and trade," says Gladik summing up. This is entirely in line with Fohnsdorf training centre's own motto: "We train skilled manpower for industry!"

SZF Schulungszentrum Fohnsdorf

Employees

150

Founding year 1975

Managing Director Edmund Müller

Core business

Specialised and interdisciplinary initial and further training in the latest technologies, individually tailored to the interests of trainees and companies, in the fields of metalworking, electrical engineering, tourism and office/IT

Contact

Hauptstrasse 69 8753 Fohnsdorf / Austria

Tel +43 3573 6060 Fax +43 3573 6060 1009

office@szf.at www.szf.at



Outstanding cost/benefit ratio.



We carry out training so that our students can afterwards immediately find appropriate employment.

Robert Wallner, metalworking instructor at Fohnsdorf training centre

Heimo Gladik (left) and Robert Wallner

SZF Schulungszentrum

Interview

with Manager and Training Director Heimo Gladik



How did the training centre in Fohnsdorf come about?

Back in the late 1960s, the regional mining of lignite was increasingly proving to be uneconomic. The coal mined underground was heavily contaminated with sulphur, and because rock had to be cleared away, mining was highly unprofitable. Over the years, many people lost their jobs and were unable to find new ways of earning a living. The surrounding municipalities, together with a private sponsor, therefore decided to found an initial and further training centre.

The first courses and lessons for mature working people who had previously been employed in mining were then held here at the Fohnsdorf site in 1975. The aim was to enable them to take a new career path in tool- and mouldmaking or woodworking and earn their own living. It was not only purely factual information that was to be taught, but also social skills to enable them to work in groups and be able to find their feet in a rapidly changing technical environment. Within a few years, the training proved to be highly successful. Today's Fohnsdorf training centre has evolved out of this. We now have a branch in Fürstenfeld where, working to the same principles, we are highly successful in giving people with varied interests initial and further training.

How do actual and potential course participants find their way to your centre?

The vast majority of participants of our training are sent by the job centre. Some come on their own initia-

tive and about 20 per cent of trainees we obtain through direct cooperation with regional companies. These companies contact us to jointly devise programmes of further training for their employees. This applies, for example, to companies that are introducing new technologies or are restructuring, causing numerous employees to change to different positions and areas in the company.

How does your training centre differ from others? We do not see ourselves as the administrators of a social problem, i.e. unemployment. We focus instead on individually devised initial and further training geared to the interests of participants and commercial enterprises in our area. This means, for example, that we hold detailed interviews with each individual on prior training, interests and personal goals. We tailor personalised training programmes for each participant. This also means that we offer inexpensive accommodation on our premises for the duration of training. As a result we can also take in trainees from further afield and whose economic circumstances would otherwise prevent them from attending the course.

How does the die-sinking machine from Mitsubishi Electric fit into your training strategy?

This is another area in which we want to offer more than other initial and further training centres. We design our courses so that they are always attuned to current technologies and the interests of industry. In the EDM sector, we realised in consultation with nearby produc-

tion firms that this technology tends to be neglected in training for the metalworking trades. This is why we have included a die-sinking machine in our metalworking shop. We can thus give trainees in-depth experience of EDM while also explaining the overall processes in tool- and mouldmaking across the whole spectrum of production technologies.

We opted specifically for the die-sinking machine from Mitsubishi Electric because it reflects current technology with a particularly attractive price/performance ratio and because you can rely on the after-sales service.

Many thanks for the information.





Materialise

3D metal printing – product optimisation thanks to additive manufacture.

Additive manufacture is a fascinating process that differs fundamentally from conventional machining methods. Unlike the classical subtractive procedure in which material is milled or eroded out of a block or plate, additive manufacture involves the addition of material layer by layer, which is melted or bonded to create something new. In almost 30 years, Materialise has evolved into one of the leading companies in additive manufacture. In the 3D printing of metal components, the company resorts to EDM technology from Mitsubishi Electric to separate the components from the build plate.

A fascinating process.



Materialise



Materialise can look back on a success story. Founded by Fried Vancraen in 1990, the high-tech company has developed into one of the world's leading specialists in additive manufacture in the almost 30 years that have since elapsed. Over 1800 highly skilled employees today work for the company. With 24 offices, Materialise is present in 18 countries and, with an array of over 180 printers, has the largest 3D production capability in Europe.

"Materialise is constantly rolling back the boundaries of additive manufacture, and with its partners it is constantly developing new solutions on various levels. We are a highly innovative company, are the holders of over 240 patents in the technology sector and have another 200 pending which we expect to be granted in the immediate future," explains Frank Küchelmann, Marketing Manager Software and Manufacturing at Materialise. The company's success is based on the three business areas of Materialise Software, Materialise Manufacturing and Materialise Medical.

Software for 3D printing When he established the company, Vancraen found that there was no serviceable software in the market for the reliable production of high-grade parts using 3D printing. So Materialise developed the matching software for 3D printers. Today, Materialise offers a broad spectrum of software tools enabling companies to productively exploit and efficiently control their 3D printing processes.

Rolling back the boundaries

Additive manufacture and specifically 3D metal printing offers the design engineer many new opportunities – particularly in areas where conventional machining runs up against its limits. With this new technology, it is possible, for example, to integrate functions and produce extremely intricate structures that are both very

With shared knowledge to preci

light and strong. And it is possible to produce components without tools and moulds. The printer merely needs a suitably processed set of data. "All the same," Küchelmann admits, "the design of such a product calls for highly specialised knowledge and also engineering experience if it is to make full use of the benefits of additive manufacture and be readily printable. So that the customer can exploit the added value of this manufacturing technique, intelligent design is essential for a cost-effective result."

3D printing will not replace classical machining methods in the foreseeable future. But the technology is already being used in areas in which it achieves better results than other machining techniques. New fields of applications are constantly being developed – including replacement parts on demand, aviation components, and the individualised mass production of consumer goods.

Design for manufacturing

"Not every design or construction can be printed straight off and converted into a finished product," Küchelmann explains. "You have to have a complete understanding of the printing process and be aware of the factors that have to be considered at certain points if the desired result is to be achieved." It is not only the dimensions of the printing space that have to be considered. Both the component geometry and its alignment in the printer have an effect on the printing result and dictate the scale of reworking. Ideally, the design takes account of the entire production process.

Titanium, Inconel, stainless steel and aluminium

At its Bremen location, Materialise produces exclusively metal components. The preferred materials are titanium, Inconel, stainless steel and aluminium. This is where the most widely used metal printing method is employed, so-called powder bed fusion or selective laser melting. In selective laser melting, the processed powder material is applied in very thin layers to

Workpieces from additive manufacture being further processed

Freedom of design.

a build plate and locally melted with a laser. After solidification, the build plate is lowered, a new layer of powder is applied and the next shape is melted on. This cycle is repeated until all layers of the component have been applied. For film thickness between 30 and 100 micrometres, this is a protracted process. To prevent contamination of the material with oxygen, the printing process takes place in a shielding gas atmosphere of argon or nitrogen.

The finished components are freed of excess powder, subjected to heat treatment and reworked. By combining 3D printing with the company's own CNC machining centre, design freedom is coupled with exceptional precision.

Digital development and production

A MERRE

3D printing offers design engineers a previously unknown scale of design freedom. It can be used for producing topologies that cannot be achieved with conventional machining methods. It is also capable of generating cavities and structures in a body's interior. With honeycomb structures, it is possible to build very lightweight components exhibiting the same external solidity and rigidity as conventional parts. Functions and ducts can also be integrated. Additive manufacture is distinguished by a seamless digital development and production process. The designer can generate his model digitally, share it with all his colleagues worldwide, develop it further and



have it printed at any location worldwide. Changes, modifications and refinements are easy to implement. In addition, the lead time in production is minimal, as no special tools are required. The only tool in production is the printer.

Example of product optimisation

"We always assure our customers of maximum confidentiality," explains Dr Ingo Uckelmann, Technical Manager Metal 3D Printing, "which is why we only publish projects with the customer's explicit consent. The following example illustrates the advantages of the way we work. Our customer was having problems with a suction cup on his production line and took the opportunity to give additive manufacture a try."

Starting point: The customer supplied the original suction cup design, while Materialise contributed the 3D printing. Each suction cup cost about EUR 900 plus the cost of assembly. The cup weighed 237 grams.

First modification: Materialise revised the customer design. In the first draft, the cost of manufacture was cut to EUR 290 plus the cost of assembly, and the cup's weight was reduced to 87 grams.

Second modification: In the subsequent optimisation process, Materialise succeeded in reducing the cost

of production to EUR 275. By integrating the parts requiring assembly, it was possible to eliminate assembly, and the cup's weight was reduced further to 60 grams. "This example clearly illustrates our claim to give the customer comprehensive advice, to optimise the product and generate extra value," Uckelmann explains.

EDM instead of sawing

After printing, a Mitsubishi Electric MV2400S comes into play. "To separate the finished, printed parts from the build plate, we use our Mitsubishi Electric machine in production," Uckelmann explains. "We basically use it like a large band saw and don't make full use of its potential. Before buying the Mitsubishi Electric machine, we closely examined and tested machines from other manufacturers. We attached huge importance to having one of our employees on site for each test in order to produce a complete record. We then opted for the best machine and the best offer – the Mitsubishi Electric MV2400S."

<image>

Intricate additively manufactured structures being cut on the MV2400S

Materialise

Employees 1800+

Founding year 1990

> CEO Fried Vancraen

Managing Director Germany Johan Pauwels, Marcus Joppe

Core business

Technology from Materialise is used in the automotive industry, aviation and aerospace, consumer electronics, the orthopaedic, cardiac and cranio-maxillofacial implant industry as well as in architecture, fashion, jewellery, art etc.

Contact

Materialise HQ Technologielaan 15 3001 Leuven / Belgium

Tel +32 16 39 66 11 Fax +32 16 39 66 00

projekte@materialise.de www.materialise.com



EDM GOES MOVIE!

Scan the code now and watch the film! www.mitsubishi-edm.de/materialise-en

Materialise

HIGH-END PRÄZISIONSLÖSUNGEN

PRÄZISIONSFERTIGUNG

CALIFORNIA / Manufacture of California - Cal

MASCHINENSYSTEM:

SPANNSYSTEME



.....

∈ropräzisa GmbH

Precision work from Thuringia.

Top-level metalworking.

For eropräzisa in Hermsdorf, Thuringia, no metal structure is too intricate and no request too ambitious. The specialist's expertise and machine park are high-end. So it's no surprise that part of the future of wire EDM is being developed here.



eropräzisa GmbH

If there's one term that's become firmly anchored in the vocabulary of eropräzisa GmbH, then it's "micro". Be it micro-tools or micro-bores, the company in the small town of Hermsdorf, situated between Jena and Gera in Thuringia, applies this term to practically every metal part. "Metalworking in the micrometre range is our everyday job," says Managing Director Thomas Richter. The customers come from sectors in which every µm counts. These include companies in the optical industry, medical technology, the semiconductor industry, precision mechanics, and aviation and aerospace. "Some components we've produced are actually floating today in space," Richter proudly claims.

Tolerances of 3 µm

What the company in Hermsdorf produces meets the very highest standards. To achieve them, the working environment itself is of superlative quality. Its production facilities look more like laboratories than workshops. The entire working area is air-conditioned. But this is only one of the preconditions for the tiniest tolerances and finest finishes. Another is the mix of technologies. eropräzisa has always resorted to a combination of wire-cutting, die-sinking and milling. Its repertoire was recently extended to included selective metal sintering, better known as 3D printing. "This is done by a partner company that's capable of producing extremely thin film thicknesses," Richter explains.

eropräzisa selects the technologies that promise the best results. What the various production methods used at eropräzisa have in common is again their exceptional quality. "We work with tolerances of 3 μ m," says Richter quantifying the targets that the company has to reach on a daily basis. He underlines this by referring to a component for the semiconductor industry. Only at second glance do several microscopically thin, needle-like pins on the rectangular component become visible. "It's used for positioning bores in the semiconductor industry," Richter explains.

Tools no thicker than a human hair

The wire EDM systems from Mitsubishi Electric play a large part in the production of such intricate components. Six of the most advanced machines can be found in the machine park, including an MV2400S NewGen, an MV1200R Connect and an MX600 OilTech with which eropräzisa achieves a surface finish of Ra 0.06 even on cemented carbides. On top of these, there are three machines for diesinking and three HSC milling machines – also state-of-theart. By using innovative tools on its HSC milling machines with high-precision 5-axis operations, eropräzisa executes exceptionally intricate and complex 3-dimensional geometries in materials with hardnesses of up to 70 HRC. Used for this are milling tools that at 80 µm are no thicker than a human hair.

> The materials clamped on the machines are also among the finest that the world of metalworking has to offer, e.g. powder metallurgical steel, titanium and Hastelloy. The expertise of the workforce is suit-

ably broad. Each of the total of 18 tool mechanics and technicians is proficient in at least two of the production technologies. At the end of the process chain are high-accuracy measurements. Because a tactile measuring machine at some point no longer met requirements, an optical one was purchased in addition.

It all started with a simple component

eropräzisa has taken some time to get where it is today. Richter and a partner did indeed set up the business in 2002 with the aspiration to be a subcontractor in the high-end range. But business at the beginning was entirely different. "I remember our first job very well. It was a simple component worth 70 euros," says Richter with a smile. However, the business wasn't founded out of nothing. Richter himself is a graduate engineer, a toolmaker and design engineer by training, and spent many years getting to know the EDM sector as a sales employee of a major machine manufacturer.

Surface finish of Ra 0.06 with cemented carbides.





He eventually became sales manager. "And then I was offered the chance to set up my own business as a dealer for EDM systems in central Germany," says Richter. Subcontracting was to be an additional line of business, another being the sale of clamping tools. Over the years, high-end business picked up. "We've grown step by step into this area. This was of course mainly driven by customers wanting ever higher levels of quality. With the most advanced machines and thinnest wires, it's also feasible," says Richter.

His partner left the business in 2015. Richter and his wife Manuela bought up his shares and merged the business areas. Subcontracting, the dealership and clamping systems are now united at eropräzisa. While Thomas Richter is responsible for operational business, Manuela Richter is in charge of clamping systems, project management and marketing.

Its organisation is also high-end In the subcontracting sector, eropräzisa today enjoys a Europe-wide reputation for its high-end metal components and subassemblies. Its vertical integration is far-reaching, covering the entire process chain from the idea, design and production of quality parts through to the construction of subassemblies. Its work organisation is also highly advanced, with all processes being fully digitised. "What we in the design department produce on the monitor with CAD/CAM software can be transferred by the toolmakers straight onto their screens," Project Manager Steve Schmeier explains.

At two workstations in the shop the toolmakers process the data for the wire EDM systems. The finished programs are then sent online to the machines. Management software additionally supplies all the information required for production, such as which clamping tool is needed and in which drawer of which tool cabinet it can be found. Each piece of equipment has its own serial number, and everything has its fixed place.

> To maintain their high standards, all employees attend training and further training, in some cases several times per year. Another important element is the replacement of machines at relatively short intervals. The machines in production are



rarely more than 6 years old. In other words, a machine is replaced at eropräzisa almost every year. "If we want to stay high-end, there's no alternative," says Thomas Richter.

New wires to minimise workpiece contamination Today, eropräzisa is itself advancing the high-end range as a technology developer. Several projects are currently underway, although Richter admits that he's unable to give precise details for reasons of confidentiality. But one project he does mention: "We're currently investigating how workpiece contamination during wire-cutting can be minimised. We're performing tests with various novel wire types. The goal is to exclude the contamination of

eropräzisa GmbH

Employees

Core business

Specialist in high-end metal con and subassemblies

Founding year 2002

Dealership for Mitsubishi Electri systems

Managing Director Thomas Richter

mornasi

High-end business.



Even skilled tool mechanics are often unaware of everything that's possible with wire-cutting machines.

Thomas Richter, Managing Director of eropräzisa GmbH

> the workpiece, as happens due to copper particles from standard grades of wire." So it looks like the future of high-end EDM could soon be coming from Hermsdorf.

	Contact
mponents	Heinrich-Hertz-Strasse 9 07629 Hermsdorf / Germany
c EDM	Tel +49 (0) 36601 9271 0 Fax +49 (0) 36601 9271 19
	www.eropräzisa.com info@eropraezisa.com

eropräzisa GmbH



Focus on success.

Machines from Mitsubishi Electric have been constant companions to subcontractor Reiner Jäger for his whole working life. So it's hardly surprising to learn that the machines from Ratingen played a prominent role when he set up his own business and have had a hand in his success.

Jäger Erodiertechnik



I wouldn't know how the present machines could be improved – they're simply mature.

> Reiner Jäger, Managing Director of Jäger Erodiertechnik

In hindsight, 2009 probably wasn't the most auspicious time – in the middle of the financial crash – to be thinking about setting up his own business. "Many mould makers nearby went broke at the time – yet I took the plunge all the same and haven't once regretted it," says Reiner Jäger, Managing Director of Reiner Jäger Erodiertechnik, recalling the beginnings. With a mixture of expertise, a nose for the market and perhaps a slice of good fortune, he soon managed to build up a broad stock of regular customers. "At the time, we managed to buy a lot of machines and tools inexpensively – among them a used EDM system from Mitsubishi Electric," Jäger smiles. This machine was installed in the 160 m² shop in Cadolzburg in 2010. Only six months after going solo, a second EDM system was required and, at the same time, the business was already looking for a larger location for the rapid growth in customer orders. His wife Stefanie handled the commercial side of the company from the outset. Today, the family business in Rosstal near Nürnberg serves over 140 customers. These include not only small businesses, but also major players in the automotive and toy industries.

The original one-man business has long evolved into a trans-regional specialist in mould- and toolmaking and repairs, offering customised precision solutions from a single source. At the new location, which is fully air-conditioned, two large wire EDM systems from Mitsubishi Electric were quickly purchased. This means that Jäger now has two MV4800 systems, an FA 20 Advance with automation and a MV2400. "We're one of the few jobshops to have two large MV4800s in operation and we were additionally one of the first users when this model first came into the market," says Jäger, who probably knows the machine as intimately as Mitsubishi Electric itself. Even while still doing his apprenticeship at the end of the 1990s, his everyday work included a wire-cutting machine from Mitsubishi Electric. And they have been constant companions in the subsequent stages of his career. It therefore wouldn't currently occur to Jäger to consider a different manufacturer. "I wouldn't know how the present machines could be improved – they're simply mature," is his verdict. His business's central activities are wirecutting and die-sinking, but not only. Jäger also attaches importance to being able to offer his customers the complete machining of workpieces, by also resorting to CNC milling and





high-speed cutting, for example.

When the zero error rate applies Jäger is not one to be intimidated by difficult jobs. "While others may claim a job is impossible, we take the time to find a solution. Wire-cutting may run smoothly, for example, but unexpected problems may arise during milling or a coating causes difficulties," Jäger explains. And sometimes the material is so special that the zero error rate applies. For one job, for instance, wire-cutting is

His wife Stefanie is in charge of the commercial side of the business.



regularly used for removing samples from a block of material. This material only exists twofold - once in a safety-relevant system and once as a retained sample. Since the original cannot be checked, the tests are performed on the retained sample. The cutting process is carried out under the watchful eye of external experts. "This is where you have to be able to rely on the machine," Jäger stresses. As a subcontractor, he is rarely confronted with standard jobs. In fact, every part and every job is special. But one thing they do all have in common: "Complexity continues to increase and as a jobshop we only ever get the parts that are too elaborate for our customers in conventional production," says Jäger describing his everyday work. Another commonality is that the orders - complexity notwithstanding have to be quickly completed. Justin-time also applies to customised components.

So he can keep to deadlines and maintain the necessary quality, Jäger accords high priority to taking good care of his wire-cutting machines. "We work with µm precision, and that has to find expression in the machine's surroundings," says an

uncompromising Jäger – although he admits that weekly maintenance of his machines isn't really necessary. "It rarely happens anyway that they simply come to a standstill. They run very smoothly, which also applies to automatic threading." Even when a glitch occurs, the stoppage doesn't usually last long. "On these machines you can still personally modify the parameters and get them guickly up and running again," says Jäger citing another argument in favour of Mitsubishi Electric.

The robot arm is already firmly established on the shop floor - a clear indication of how the future of EDM could look.

Jäger Erodiertechnik e.K.

Employees 10

Founding year 2010

Managing Director Reiner Jäger

Core business

Innovative processes like wire-cutting and die-sinking, production and repair of moulds and tools, CNC and HSC milling, and various subcontracted jobs

Contact Gewerbering 24 90574 Rosstal / Germany

ANT COOSTIN

Tel +49 9127 9 54 33 54 Fax +49 9127 9 54 33 55 0

info@jaeger-et.de www.jaeger-et.de



The next step towards automation.

Looking ahead

His customers appreciate his reliable machining and the fact that in emergencies they can quickly obtain a helping hand from Jäger in Rosstal. So it is no wonder that he is slowly running out of space at the current location. The plans for a shop extension have therefore already been drawn up. This time, however, the next step will be in the automation sector, i.e. in machining cells incorporating the EDM systems along with milling machines and measuring devices.

For many of his colleagues, automation is not worth it for one-off parts, but Jäger stands firm: "It's not a question of increasing the speed of a machining process, because the sticking point is set-up. At the moment it costs us too much time that the customer is unwilling to pay for. The advantage of machining cells is that set-up can take place during the machining process." He is therefore firmly convinced that the future belongs to automation. Since the interfaces are optionally available on the existing machines, he doesn't see any technical obstacles. Jäger has already gathered his first experience with automation – a Mitsubishi Electric robot arm already hands workpieces to the FA20 Advance EDM system for machining.



EDM GOES MOVIE!

Scan the code now and watch the film! www.mitsubishi-edm.de/jaeger-en

Jäger Erodiertechnik

The first fully integrated system for the cutting, sorting and storage of sheet metal

LASORTING redefines the automation strategy in sheet metalworking: its holistic treatment of the process has brought forth a single integrated multifunctional system capable of controlling the entire production process from cutting and sorting through to the storage of the finished parts.

The outcome of cooperation between Mitsubishi Electric and ASTES4 – LASORTING – is the synthesis of the most advanced technologies in

ASTES4 SA

In the wake of the pioneer of electricity and the unit of measurement named after him.

Alessandro Volta invented the electrical battery and pioneered electricity, with the unit of measurement being named after him. Even today, trailblazing inventions are being developed in the shadow of the Alps.

ASTES4 has developed and globally patented an automation system that goes a long way towards revolutionising production. To work efficiently, laser-cutting systems need a swift supply of material and subsequent sorting. ASTES4's mastery of this task is second to none, and it has now teamed up with Mitsubishi Electric for the handling of large and ex-

tra-large projects. The fact that the systems are in global demand after only a decade and, with their unique capability, often represent the only cost-effective solution shows that Volta has made a lasting mark on the region.

Synthesis of progressive technologies.

E 31

2D laser cutting and flexible automation. A project inspired by the simple idea of increasing the industry's process efficiency and performance to a new level.

The efficient production cell

LASORTING ensures continuity of production in terms of laser workload, sorting and storage. Rapid and dependable processes help you stay competitive. With unmanned operations, LASORTING permits operation 24 hours per day, 7 days per week. The result is increased or stabilised output with lower unit wage costs. The employees, so far responsible for physically demanding sorting, can now be entrusted with valuegenerating activities.

Staying competitive

The orders are intelligently processed without jeopardising efficient material utilisation – thus excluding order-picking errors and time lost between the various process steps. All this brings down the costs that would arise due to downstream manual handling.

Process control

LASORTING features all the benefits of the





ASTES4SORT technology developed and patented by ASTES4. All loading, unloading and sorting processes are controlled by 4 Cartesian grippers. A unique system that combines exceptional versatility with remarkable execution speed and manoeuvrability. The system can be seamlessly integrated in ERP and other management systems.

Fully automatic warehouse

A fully automatic warehouse with a sorting system ensures optimum materials flow and continuous processes. Stocktaking at the press of a button and a complete overview of all critical process data are thus possible.



Only when the downstream process steps (such as bending, welding and painting) are taken into account from the outset can work proceed without lost time. ASTES4 ensures precisely this seamless integration into the production process, regardless of whether the downstream process takes place on your own site or elsewhere.





Different sheet thicknesses are prepared as kits for further processing. This saves time and money and ensures that they are accurately positioned on each pallet.

Selected - the modular principle

Four grippers are better than one or two, particularly when your laser-cutting process depends on sorting speed. This is precisely where the ASTES4 patent comes into play. Each gripper is capable of using vacuum or magnetic tools in a variety of shapes and sizes. These tools are automatically changed to suit the geometry and weight of the part. The grippers can operate individually or collectively to move large or heavy parts and are thus vastly superior to all conventional laser automation systems in terms of productivity and efficiency.





ASTES4 GOES MOVIE!

Scan the code now and see LASORTING in action: www.mitsubishi-laser.de/astes4-en

ASTES4 SA

+

Profile 02/18 67



Mitsubishi Electric

40 years of Mitsubishi Electric – in Europe.

The German Branch of Mitsubishi Electric celebrated its 40th anniversary on 19 October 2018. Based in Ratingen near Düsseldorf, the company has been supplying its customers with high-quality products and solutions in the fields of transportation, air conditioning and heating technology, automotive, communications, semiconductors and automation for four decades now. Its customers are not only located in Germany and other European countries, but also in the Middle East and Africa. Accordingly, the company is positioned internationally. Its employees come from 26 different nations.

After its foundation in 1978, the German Branch developed rapidly. Initially, the focus was on the sale of consumer products, but business activities were continuously expanded. In the 1980s, the company recorded enormous growth and extended the activities of the German branch to other product areas. The investment in and the move to a new, ultra-modern office building in Ratingen-Ost symbolise the Japanese parent company's deep attachment to Germany as a business location, as the German branch is one of our most important locations outside Japan. The company regularly demonstrates this clear commitment to its location with social and cultural engagement.

Since its foundation, the German Branch has been an essential part of Mitsubishi Electric's European business. We owe our great achievements and constant success to our committed employees as well as to our business partners and customers.

Andreas Wagner, President of the German Branch

In addition to the Branch at Mitsubishi Electric-Platz in Ratingen, there are now 16 other sales companies, 12 production facilities and two research and development centres in Europe.

Mitsubishi Electric is active in Europe in areas such as information processing, communications, semiconductors, automotive, industrial technology, energy, transportation, building management, and air conditioning and heating technology. However, rather than stress developments in and the prospects of individual business areas, the company prefers to focus on the overall strategy. "It is one of our strengths to think in terms of solutions that include many



industries and technologies. By dissolving the boundaries of individual business areas, we will create sustainable potential for the further positive business development of our German subsidiary," Andreas Wagner stresses. "We still have a lot to do in the coming decades."





40 years of technological experience.

Profile 02/18 71

40 years of Mitsubishi Electric

100 years of Mitsubishi Electric

Amazing what we're capable of!

Wherever you look, Mitsubishi Electric is there. Everything from trains and lifts carrying you from A to B through to satellites keeping us globally connected – Mitsubishi Electric is changing and improving the world with innovation.

> /isual information systems Gigantic LED screens

Mitsubishi Electric is one of the world's leading names in the manufacture and sale of electrical and electronic products and systems used in a broad range of fields and applications. In Europe Mitsubishi Electric is active in the fields of information processing and communications, automotive, industrial technology, energy, transportation and building equipment, and air conditioning and heating technology.

Thanks to its broad range of innovative products and services, the Ratinger company offers not only single products, but also the key to intelligent complete solutions. By intelligently combining various products and cross-divisional projects, Mitsubishi Electric is able to offer customers entirely new opportunities. Complete data centres, for example, work faster thanks to Mitsubishi Electric's 10 Gbit/s and 25 Gbit/s laser diodes.

e beam treatment system

Public systems

In doing so, Mitsubishi Electric has a clear goal in mind: the holistic conception of complete solutions in the market. The following five areas of technology that are crucial for present and future living have been identified: Transportation, Building, Communication, Energy and Automation. Mitsubishi Electric impresses with precisely adapted products, intelligent comprehensive solutions and first-class service, for example in residential and building construction. Mitsubishi Electric is thus making the five-star lifestyle of the luxurious Mainport Hotel even more comfortable. All rooms are equipped with high-class entertainment electronics. To adhere to the construction period of less than a year. it was decided to install a Mitsubishi Electric heat pump system to make heating and cooling possible at the same time. Elevators from Mitsubishi Electric transport guests quickly and safely to their floors.

The new German Branch of Mitsubishi Electric in Ratingen is also a fine example of the use of the company's various products. Thanks to the City Multi VRF-R2 system the energy consumption is reduced by 40 per cent in the new building. "We want to be perceived homogeneously as a

Part of your life.

40 years of Mitsubishi Electric

Aerospace technology Satellite systems Earthing systems

Building services Lifts and escalators

Air conditioning technology

Transportation systems

Rail system

single coherent company in different market segments. We focus on the future and present solution strategies that help us to master the technical and social challenges of tomorrow, "explains Andreas Wagner, President of the German Branch of Mitsubishi Electric Europe.

Factory automation systems

Vehicle equipment

Space technology.

Exploring the universe with radio-telescopes, networking the sky with communication technology and monitoring our environment with observation technology, Mitsubishi Electric makes use of its unique strengths in the design and production of satellites in ushering in a new era in space applications.

Visual communication.

Image quality is the reason why customers all over the world are turning to Mitsubishi Electric when it comes to the most advanced visual information systems - everything from giant displays like the Ultra HD at Times Square in New York or in stadia, and large-format LED screens to display walls. Our technologies cut costs thanks to their innovative properties and high energy efficiency and set new standards of image brightness and reliability.

The Lanxess Arena in Cologne is a breath-taking events venue. It has 18,000 seats, 83,700 m² of floor space, 1000 employees, large screens for direct video transmission, a restaurant, bistro, bars, shops and much more besides. As Germany's biggest events venue, it sets new standards - and this now also applies to its video cube. What is probably the world's biggest indoor video cube impresses thousands of spectators day after day with its brilliant pictures.

computer centres. 70% of the communication arising in a data centre takes place within the computer centre itself, so it needs high-performance fibre optic transmission links. With its 10 Gbit/s and 25 Gbit/s laser diodes, Mitsubishi Electric

20 tonnes of high tech hovers magically above the playing area.

Building technology.

Lifts and escalators bring people swiftly, safely and comfortably to their destinations. Today, our high-speed lifts are making the construction of ever-higher skyscrapers practicable, while spiral escalators are creating new opportunities in the design of public spaces. Energy-efficient air conditioning systems and heat pumps ensure a pleasant indoor atmosphere and the highest possible comfort in public and private buildings.

Asia's tallest building Shanghai Tower, 632 metres Mitsubishi Electric supplies the world's fastest lift. Speed: 73.8 km/h

Mitsubishi Electric supplies

South Korea's fastest lift.

Mitsubishi Electric has received a contract to supply two lifts designed for a maximum travel speed of 600 m/min. After their installation in the LCT Landmark Tower in Haeundae, Busan, they should then be – according to Mitsubishi Electric's research - the fastest lifts in operation in South Korea.

The two lifts will propel passengers from the ground floor to the 100th floor in about 52 seconds. The distance of 383.5 m will be the longest that a lift has ever covered in South Korea.

Thanks to Mitsubishi Electric's trailblazing innovations in ultra-fast elevators - in drive and control technology, aerodynamically designed cabin covers, active roller guides and various safety features, for example - the elevators offer outstanding travel comfort and maximum safety coupled with low-noise operation.

The world's fastest lift.

Mitsubishi Electric

Exploiting excess energy at **Prizeotel**

with our VRF R2 heat pump system.

New buildings with exciting hotel strategies can be seen going up in many towns. The buildings of the Prizeotel signature brand hotels, for example, offer exclusive interior design with the charm of a private hotel, combining high-grade styling and low room prices in a consistent strategy. The investor is equally consistent in the building services sector where intelligent VRF R2 heat pump technology is being put to use. This technology exploits excess energy in the building so that heating and hot water preparation are inexpensive and environment-friendly. In the hotel with high design aspirations, we keep energy costs low.

The Prizeotel strategy is distinguished by its combination of low prices and exceptional design. The hotel brand founded by hotelier Marco Nussbaum and property economist Dr Matthias Zimmermann in 2006 succeeded in exclusively contracting international designer Karim Rashid in New York for the development of their hotels in Germany. The first Prizeotel opened in Bremen in only 2009. With its 127 rooms, it is now successfully established on the market. It was followed by the second Prizeotel in Hamburg, now with 2016 rooms, in 2014 and the Prizeotel in Hannover with 220 rooms in 2015. In Hamburg, a second Prizeotel has subsequently opened near the well-known Reeperbahn – further Prizeotels in other cities are in the pipeline.

The hand of the designer Rashid is visible in all the budget design ho-

tels - from the styling of the individual rooms and corridors through to the lounge/lobby area. Treating the hotel as an integrated design object has permitted the creative unfolding of a strategy that is best described as intelligent, pleasant and sensually inspiring as well as cost-effective. The combination of comfort and profitability is of special importance for the group of owners. However, it is not a question of generating rapid extra value from a cost-optimised investment, but of including running costs in the overall business strategy and keeping them low, as expected in the present day.

Our consistent heat recovery

It is widely known that outlay for the operation of a hotel is composed of many items. In addition to manpower, expenditure on building services, such as the heating and air conditioning of a building, is critical for a property's economically sustainable and healthy development. The objective has to be to lower variable costs with a lasting reduction in overall energy consumption in the building. And this applies all the more in times of highly volatile but essentially rising energy prices.

After initial experience at the Bremen Prizeotel with chiller units to air condition the property, the investor went a step further in the Hamburg project and had a modern VRF air conditioning system with heat recovery function installed. This refrigerant-based system exploits the heat energy extracted from rooms with cooling needs. Within the closed system, this heat energy is fed in just 2 pipes to where heat is needed. This contributes not only to greater comfort, but also to considerable savings. With its extremely high energy efficiency and highly flexible heating and cooling, the VRF

R2 heat pump system is absolutely ideal for use in the hotel.

Made for major challenges: technology from Mitsubishi Electric

Since building regulations prevent the installation of outdoor units on the roof of the Hamburg Prizeotel, the building utilises a solution with water-cooled VRF outdoor units that are installed in an interior plant room on the sixth floor of the hotel. Overall, the 17 compressor units achieve cooling output of approx. 290 kW. The VRF R2 heat pump system from the City Multi series from Mitsubishi Electric was developed for large and challenging buildings in need of customised solutions. It is particularly suitable for use in hotels, large public buildings and office blocks. Like their air-cooled counterparts, the units of the R2 series with water-cooled heat exchangers are distinguished by their extremely high efficiency when cooling and heating. The installation in Hamburg has now been in successful operation for roughly four years, and the energy consumption figures speak for themselves. "The initially computed energy savings

The VRF R2 heat pump system is the world's only 2-pipe system

for simultaneous cooling and heating with heat recovery. The energy extracted from rooms being cooled is not released into the ambient air, but is used to heat the rooms that require heat.

Made for major challenges.

of between 30 and 40 % have been achieved," explains Michael Lechte, Product Manager at Mitsubishi Electric.

Abur Littakal

Processes are reliably executed with a repeat accuracy of ±0.02 mm. Cables and compressed air hoses for electric and pneumatic gripper subassemblies have been transferred to the interior of the robot arm so that its room for manoeuvre is not limited. This is also enhanced by the robot's ability to fully fold down into a flat pack so that its six degrees of freedom can be fully exploited. All robots of the RV-F series are supplied in IP67 and can be ordered in a cleanroom version if required.

Conclusion

Everyone involved agrees that small, lightweight articulated robots such as those from Mitsubishi Electric not only boost the efficiency of production machines, but are also capable of cutting development costs and optimising the available installation space.

Super soldering cells

with super robots.

Eutect, a manufacturer of electronics soldering systems, is turning increasingly to 6-axis robots from Mitsubishi Electric for its automation cells. This type of robot is not only capable of performing more complicated tasks than conventional 3-axis kinematics, but is also even faster and exceptionally undemanding as far as its footprint is concerned. The advantages for Eutect's customers are higher process integration, greater flexibility, shorter set-up and cycle times, and savings of space and a reduction in the cost of investment. In addition, the use of robots offers a degree of security for the future which is difficult to quantify but would appear to be more important than ever.

Founded in 1996, Eutect has specialised in modular automation solutions for soldering applications in mini-wave soldering, laser soldering, induction soldering, iron soldering, thermode soldering and lift/dip soldering for computer circuit boards. In 2008, junior boss Matthias Fehrenbach invested in a used 6-axis MELFA robot from Mitsubishi Electric to try out a new idea. The robot was to be fitted inverted in a compact automation cell in order to make space underneath for further processes. The possibilities offered by this arrangement were exhaustively tested, and it was possible to restrict the machine's footprint to 2 m². Since the first customer project in 2009, Eutect has developed and supplied many highly specialised robot cells to German vehicle makers and manufacturers of electronics components.

Current compact solutions

A robot cell with an RV-4FLM articulated robot has been built for drive

manufacturer Faulhaber, for example. The cell with an upright robot processes tiny electric motors. Unlike the kinematics of rival makes, the robots from Mitsubishi Electric can be set up without modification on the floor, overhead on the ceiling or also on the wall, so the configuration can be adapted for efficient use of space in the application in question. The RV-4FLM 6-axis articulated robot with a loading capacity of up to 4 kg and a range of 649 mm displays high mobility and flexibility in all tasks.

In addition, the MELFA controllers are already generously equipped with interfacing for applications of Industry 4.0 and the Internet of Things, which makes the systems a sustainable and sound investment in the future.

26,400 workpieces

are machined each year on Mitsubishi Electric EDM systems at a single Formula One team.

Technological partnership.

The Alfa Romeo Sauber F1[®] Team.

On the race circuit every millisecond counts - and in production every µm. World market leader with wire EDM systems, Mitsubishi Electric has been supporting Formula One for more than a decade.

Sauber C37-Ferrari –

the 2018 Alfa Romeo Sauber F1[®] Team vehicle.

From the technical point of view, the philosophy of the C37 was new, as its aerodynamics differs from that of its predecessor model, the Sauber C36-Ferrari. The C37 is equipped with new and improved aerodynamic parts, responding to the changes in the rules for 2018 involving the elimination of the shark fin and T-wings, for example. What's more, the C37 is equipped for this year's season with the

World market leader.

current 2018 Ferrari engine, which has had a positive impact on performance. Simone Resta, Technical Director, puts it as follows: "As we have seen, the new strategy has offered us new opportunities and helped us to achieve improvements in the course of the season. In terms of performance, we have also benefited from the 2018 Ferrari engine."

Multimedia vehicle components

Navigation systems Display systems Radio and TV tuners Loudspeaker systems Amplifiers etc.

Intelligent mobility

Human-machine interface Connected services Driver assistance systems (automatic parking, lane departure warning systems, emergency brake)

Driving safely with Mitsubishi Electric.

Mitsubishi Electric actively assists its customers with the development and integration of components into the overall vehicle strategy - and with outstanding success. The vehicle equipment technologies from Mitsubishi Electric are, and will remain, essential features of many conventional, hybrid and electric vehicles of the world's biggest car makers. Mitsubishi Electric not only supplies main units (the nerve centres of any vehicle equipment), alternators, starters, electric steering systems and multimedia equipment, but also a multitude of innovative and high-grade electric and electromechanical vehicle components for greater comfort, maximum safety and environment-friendly motoring.

Intelligent vehicles thanks to new technologies

Mitsubishi Electric's Mobile Mapping System uses a combination of sensors, cameras and lasers that are mounted on the vehicle roof and collect data in real time to create three-dimensional maps accurate to the centimetre.

Safety and driver assistance systems

Advanced camera systems Ultrasonic sensors Control units for LED and xenon lights Safer and more comfortable driving

Engine control and servo steering products

Start-stop systems Alternators Electric Power Steering (EPS)

EMIRAI 4 Smart Mobility Concept Car

Under the motto "Feeling with you; convenient, safe and comfortable for each one", the development of the new concept car has been based on three specific areas of research: electrification, autonomous driving and networking. The EMIRAI 4 comes with next-generation driver assistance technologies such as human-machine interfaces, driver condition monitoring and a lighting system.

Mitsubishi Electric on track

for success.

Our equipment is being used in the future Rhine-Ruhr Express - and in many other rail projects in Europe. Mitsubishi Electric is not only one of the leading suppliers of air conditioning systems to railways on the Japanese market, but is also supplying these systems to the Rhine-Ruhr Express. And has since been on course for success in Germany and Europe. The RRX runs smoothly with our air conditioning equipment.

Siemens AG has awarded Mitsubishi Electric the contract to supply air conditioning systems to the Desiro HC (Desiro High Capacity) electric multiple train units. The trains will be operated on the rail network of the Rhine-Ruhr Express (RRX), which links urban and rural areas throughout North-Rhine/ Westphalia.

Overall, Mitsubishi Electric is supplying 328 air conditioning units for the total of 164 middle coaches in 82 multiple units. This is also the first contract awarded by Siemens AG to Mitsubishi Electric for the air conditioning of railway vehicles. Siemens very positively rated Mitsubishi Electric's exceptional reliability and far-reaching experience with such systems. Globally, Mitsubishi Electric sees the biggest demand in Europe.

This contract not only strengthens the Japanese group's position on the

European continent, but also extends its relations with vehicle manufacturers, operators and local customers.

Mitsubishi Electric Europe B.V. opened this business area in Europe in April 2014 in order to strengthen regional sales and after-sales service.

Incidentally, Mitsubishi Electric is the only manufacturer to offer a comprehensive product portfolio of drive and brake systems and equipment for control management.

Modernisation of Deutsche Bahn

Deutsche Bahn AG has contracted Mitsubishi Electric to modernise the drives of 46 high-speed trains of the Intercity Express 2. The DB Group is a major rail transport operator with one of the longest rail networks in Europe. The high-speed train of Deutsche Bahn's ICE 2 series went into operation in 1996. Mitsubishi Electric first supplied railway equipment to Europe in 1967. Over the years, the company has consistently expanded its commitment on the European railway market.

Drive systems for 118 trains

Mitsubishi Electric is supplying high-tech drive systems for 118 trains of the Sprinter New Generation (SNG) of Nederlandse Spoorwegen (Dutch railways). The project awarded by the Spanish railway vehicle manufacturer CAF (Construcciones y Auxiliar de Ferrocarriles, S.A.) is regarded as one of the biggest supply contracts in European rail transport and is being executed in cooperation with the Italian branch of Mitsubishi Electric Europe.

Leading manufacturer of power semiconductor modules.

Continuous further development and modern production facilities are key factors in the high quality of our high-performance modules. Semiconductors are indispensable components of products that are increasingly more efficient. They are the raw material of the future. Mitsubishi Electric is a worldwide leader in the semiconductor industry. Innovative thinking, modern production lines and high-capacity research and development are the key factors in maintaining this leading position. Customers benefit from comprehensive technical services as well as a widespread sales and distribution network.

The German headquarters of Mitsubishi Electric are in Ratingen, North-Rhine/Westphalia. It is responsible for carrying out technical service, sales and marketing activities and also export activities for Europe, Russia and South Africa.

The ongoing success of our power semiconductor technology is based on extensive expertise in four product fields: high frequency, opto electronics, power semiconductors and TFT-LCD modules. In line with our key values of quality and reliability, Mitsubishi Electric Europe B.V. has continuously complied with the strict ISO 9001 and 14001 certification rules. It is no wonder that Mitsubishi Electric is a leading manufacturer of power semiconductors.

Our power semiconductors have a broad spectrum of application fields including high-voltage direct-current transmission, railway technology, regenerative energies, motor control, uninterruptible power supply (UPS), white goods, medical technology, elevators, escalators, welding and pumps. The concept of the intelligent power module (IPM) forms the basis for current switching, current management and current flow. For example, our integrated intelligent modules reduce the development time and cost of frequency inverters for driver, monitor and control circuits. The necessary peripheral electronics is always integrated.

The power semiconductor devices started from the current-controlled GTO (Gate Turn-off Thyristor) and bipolar Darlington transistor (all current controlled) developed by Mitsubishi Electric to the first voltagecontrolled IGBT modules. Their compact form offers distinct advantages for rough environmental conditions such as in the drive technology. Further advantages of the IGBTs compared to predecessor technologies are higher switching frequencies, lower switching losses as well as substantial cost savings due to a simple control mechanism.

The Art of Economy.

Mitsubishi Electric

Profile 02/18 93

Special Anniversary Edition

Interstella

Only EUR 40.40

From a distant galaxy – now also available for EDM on earth

Blue and white

An alpine meadow is an inspiration for any vire-cutter.

More than wall decoration.

The Art of Economy is coming to a growing number of companies and adorning living rooms here and there.

The Art of Economy coming to your wall soon.

The "Art of Economy" for your wall as well.

Limited to 40 copies

- Direct print on acrylic glass
- 60 x 40 cm .
- 4 mm thick acrylic glass panel

Order now at: www.edm-art.de

Warp

A µm step for the wire-cutter but a big step for EDM itself

Erubis

Built for eternity – or thereabouts

Find out more at: www.edm-art.de

Control your robots

with Direct Robot Control

from Mitsubishi CNC

The robot you can program yourself ...

... with G-codes.

Mitsubishi Electric explains what is feasible with its new feature of the M8 CNC series Direct Robot Control.

Mitsubishi Electric has taken big step forward, for it will be easier to automate machine tools from now on, as the robot can easily be connected on the plug & play principle to machine tool controls. The control recognises the robot, and the machine operator can use the robot immediately as an extended automation unit and also directly control it via the NC program. "Essential for this, of course, is that the control belongs to the M8 CNC series from Mitsubishi Electric, our new Direct Robot Control feature is installed and the robot with its basic data is known to the system." Then, says Key Account Manager Frederik Gesthuysen of Division Mechatronics CNC, the robot can indeed be very swiftly commissioned on the plug & play principle at the machine tool. Machine operators can then use the robot even at different machine tools as required and depending on size, either permanently installed in the centre of a production island or in a mobile arrangement in production.

Operation via a Teaching-Box or PLC rendered superfluous

Thanks to the new Direct Robot Control function developed by Mitsubishi Electric, the robot can be controlled by G-codes, thus rendering superfluous operation by Teaching Box and smart panels or starting the robot program via the PLC, Mitsubishi Electric stresses. "Most operators feel immediately at home here. It goes without saying that functions known from CNC technology can also be transferred to the robot." This, says Gesthuysen, creates new and varied applications that were previously impossible.

New and varied applications.

Switching between CNC and robot controls with the 1-touch feature

Controlling the robot with the Direct Robot Control from Mitsubishi Electric couldn't be simpler, on the basis of Gesthuysen's initial experience. Basically the robots can be run without difficulty in jog mode via the integrated robot HMI on the CNC control. Jog mode enables the user to drive individual axes manually. The status of both the robot and CNC are easy to monitor. No additional programming knowledge is necessary. The robots can be controlled effortlessly by G-codes or PLC signal. The programming effort is reduced considerably, Mitsubishi Electric claims. DRC enables the user to synchronise the movements of the robot and CNC machine with minimum touch gestures at the touchscreen. "Incidentally, switching between the CNC and robot controls is very simple and quick - with our 1-touch feature," Gesthuysen stresses. In addition, other features from Mitsubishi Electric such as error logs and process and operation histories help to optimise processes. "The bottom line is that almost any production set-up can be scaled with DRC in such a way that the user is always in a position to

flexibly respond with robot automation to suit his workload," Gesthuysen explains. How the system works is also shown by the film on the Mitsubishi Electric website.

Article from the trade journal NC Fertigung / issue 11/2018

Flexible implementation with a uniform system of coordinates.

Programming machine tools and robots with a CNC control.

Achieving more with fewer skilled workers - this is the challenge facing more and more businesses. The goal is to accelerate cycle times and make production as flexible as possible. Mitsubishi Electric has teamed up with KUKA in now offering an integrated solution for robot control in the shape of the current M8 CNC control series.

The demand for automated production with industrial robots is greater than ever. The integration effort for such solutions is often high. With the integrated robot control, the operator can now operate and control the robot with G-codes on the CNC control via an additional menu.

This not only accelerates commissioning, but also reduces the need for training and skilled employees at the same time, while boosting flexibility - particularly where small batch sizes are concerned. The automation of loading and unloading processes can be implemented with the knowledge already available in the company without external specialists having to be consulted. Whole series of different robot types are available, with loading capacity ranging from 3 to 1300 kg. In addition to the flexible movement of workpieces and tools, they are also capable of handling such work steps as deburring and workpiece measurement.

Andreas Walbert, Business Development Manager Competence Center Handling & Machinery at KUKA Deutschland GmbH, explains: "Our customers in production are all battling basically with the same problem - that of the massive shortage of skilled employees. This means that they have to handle the desired increase in productivity today with a decreasing number of skilled employees."

How does the control strategy work?

The KUKA or Mitsubishi Electric robot is now controlled via the familiar HMI of the M8 series. Additional menus permit a large number of functions and settings. Thanks to the new Direct Robot Control function developed by Mitsubishi Electric, the robot can be controlled with G-codes, which makes operation by Teaching Box or smart panels or starting the robot program by PLC superfluous.

The optional 19" touchscreen makes operation simpler and more straightforward - most operators immediately feel at home here.

Two coordinate systems become one - coordinate system and synchronisation

The familiar teaching method of approaching target points can still be used. As a convenient and highly accurate procedure, it is as of now possible to also directly access the coordinate system of the machine tool axes and even workpiece coordinates can be used without transfer to another system. The workpiece coor-

Today, it is a question of taking the strain off specialist employees in production so that they can concentrate on their value-generating activities.

Andreas Walbert, Business Development Manager Division Industries R-COG Competence Center Handling & Machinery KUKA Deutschland GmbH

With our Direct Robot Control function, we can control not only the machine as standard via the CNC, but also the robot directly. With this application, we can offer everything from simple cycles to complex traverse movements.

dinates can thus be flexibly adopted in each individual case. This reduces programming time, boosts reliability and facilitates shorter cycle times in practice - a simple idea that reduces complexity and makes the integration of robots possible for a growing throng of users and companies. Compliance with tight deadlines and quality standards thus becomes possible.

What other advantages are there of Direct Robot Control?

Via an Ethernet link, the CNC control can communicate with the robot. Thanks to the uniform control strategy, it is now easier to digitally map production processes and implement the data of the machine and robot in IT system landscapes – a simple idea that reduces complexity.

Benjamin Buzga, Specialist CNC Sales & Engineering Europe Mitsubishi Electric

Achieving more with fewer skilled workers

Mitsubishi Electric & KUKA

Keigo – why polite isn't always polite.

Japan differs from Western culture in many areas. One of the most interesting aspects is undoubtedly the pronounced expressions of hierarchy, respect and courtesy, which are very much appreciated by many tourists. Every form of communication in Japan, from body language to lively discussion, takes place with a respect that seems to be more advanced than in many other cultures. Anyone visiting a restaurant in Japan is treated like a celebrity from the first welcome through to departure. The principle of "The customer is king" can be said to apply here par excellence.

So that this politeness can be communicated on all levels, the Japanese language even resorts to a hierarchical system of honorific speech that determines precisely how to address any other person. Although in German a similar distinction is made between the formal and informal words for "you" ("Sie" and "Du"), there is otherwise

little difference between the address and the vocabulary used. one refers to oneself, conversation partners and third parties,

In Japan, on the other hand, sentence structure, vocabulary, how who speaks when and much more are dictated by the Japanese rules of politeness. Each honorific has its own conjugations where a verb is conjugated not only according

to tense but also to honorific.

"Uchi-soto" – relations between the in-group and out-group In the Japanese language, not only the relationship between two conversation partners is included in the language adopted, but one's own relationships, relationship with the conversation partner and the conversation partner's

Japan Special

relationships are acknowledged and closely observed in conversation. For instance, a Japanese uses different words when talking with a workmate about his boss than when talking to him about a partner company. The basic principle underlying this complicated procedure is the Japanese understanding of "uchi", meaning the in-group, and "soto", meaning the out-group.

When someone talks to members of an out-group (soto) about himself or part of his in-group (uchi), humility is expressed. If, on the other hand, he speaks to other members of the in-group

about someone belonging to the out-group, he expresses respect and honour. Since there is nothing equivalent in English, it is difficult to explain - it can perhaps be best accounted for as a distinction between the two conversation partners and an assessment of the relationships of the two conversation partners with persons or groups that are the subject of the conversation. If a secretary, for example, receives a phone call asking her whether the boss is in the office, her reply will depend on whether the caller is the boss's wife or a business client.

It is therefore important not only how the Japanese present themselves towards others, but also how they refer to persons known to them and less known to them in conversation with third parties. This can then be decisive, for example, when a superior wishes to introduce a new employee or customer to his team or if new acquaintanceships are to be struck up at a meeting.

"Teineigo" and "keigo" - how the Japanese use language In addition to the uchi-soto dualism, language can be differentiated into further forms of honorifics - from ordinary language

used among one's friends and acquaintances and a general form of politeness used with strangers in everyday situations through to "keigo", the most extreme form of expression intended to communicate respect and humility and used above all in professional settings. This is also where syntax plays an important role. Whereas one would thus ask a friend directly for help, one would tend to use an expression of the following kind when asking a colleague at work: "I would be much obliged if you could sacrifice a moment of your precious time to tender me your cooperation." With this form of language, which in Europe would sound excessively subservient and cause confusion, the professional and respectful atmosphere of the working environment is upheld. This becomes particularly interesting during celebration with one's workmates at the annual Christmas party, which of course lowers barriers, resulting in agreement on the adoption of more casual forms of interaction. Next day in the office, however, the accustomed respect is re-established. A barrier is thus created to separate work from leisure and ensure a healthy working atmosphere. If individual employees were addressed differently by a superior, employees could gain the impression that favouritism was being practised.

Keeping the customer satisfied Communication plays a very important role in the after-sales service sector as well. Keigo is precisely here the primary tool for upholding the corporate image. While customers talk to employees in the usual honorific, "teineigo", employees will always respond in the keigo form. The employee subordinates him-

self to the customer and treats him with the greatest possible respect. This is where the differences in the linguistic delivery become apparent when a customer speaks in a casual teineigo and the employee repeats the sentence in the formal keigo. The content of the two sentences is absolutely identical, yet the choice of words is highly significant. It makes it obvious to anyone listening that the customer at this moment occupies a higher hierarchical position than the employee. Even if teineigo, the everyday honorific, is perfectly correct, the employee can even expect an official reprimand if a customer feels personally offended by the lack of keigo.

in all its manifestations will enjoy and also benefit from much bet-

However, anyone who masters keigo great respect among the Japanese ter job opportunities. Employees in Japan often undergo special training and coaching to learn the various nuances of keigo and successfully employ them. People who consistently express themselves with perfect courtesy and formality acquire

an excellent reputation and a highly professional image.

Two simple phrases that that can quickly make a surprisingly good impression

"Hajimemashite"

This is comparable to "Nice to meet you" and is used first and foremost when one meets someone for the first time.

"Yoroshiku Onegai Shimasu"

This phrase is somewhat awkward "Please treat me well", although it is often used at the end of a meeting where it means to all intents everything. Be seeing you!"

Japan Special

Horoscope for hard-wired EDM experts.

Capricorn

21 December – 20 January

Strict discipline and true grit are called for - and not only for workpiece cuts with height offsets. Thanks to your balanced blend of ideas, foresight and action, you can outwit fate. So no time to lose – after taking time to study the constellation of the Sleeping Lion.

avarivs

21 January – 19 February

Everyday drudgery is currently getting you down, and the quality of your wire-cutting speaks volumes - you've got to watch out. Unfortunately, Lady Luck won't be back on your side until the next lunar cycle. So until then, the best you can do is treat yourself to a little wellness. After the pressure of the last few months, you certainly deserve it.

Pisces 20 February – 20 March

Be your favourite super hero this month. With or without your costume, you'll find that your forms are very much in demand - so keep up the good work. But caution is advised: don't cut out the woman of your dreams when your wife is looking - sparks of jealousy can spoil the beauty of the finished item.

Aries

20 March – 20 April

Mercury not only heralds the winter, but also fills your bank account to bursting point - the stars are perfectly poised for you. This not only improves your chances with the opposite sex, but you can now easily afford a luxurious swimming pool with the home to go with it. What more could you want?

laurus

21 April – 21 May

Your dependability and commitment make a huge impression. So it's hardly surprising that new customers are queuing up at your door. Business is booming. So why not indulge yourself: grab your sweetheart and take off on your EDM system out of the cold towards the sun, sea and sand.

Gemini

22 May - 21 June

You and your machine are truly bosom buddies. Whether you cut a new workpiece or zip down the ski slope in Switzerland without even touching the snow - nothing can separate you. But now it's time to wake up, for life is calling and skis have got to be bought.

22 June - 22 July

Cancer

You've mastered a mountain of intricate geometries at lightning speed, and now it's time for a break. In fact, you're already in the middle of it, and Deimos, one of Mars's moons, is delighted. Make use of the good cards that life has dealt you to collect the crock of gold at the end of the rainbow. Any other sign of the zodiac would be happy to swap places with you.

23 July - 23 August

Scorpio

Not every Leo loves an EDM system. But once the King of the Jungle is smitten, nothing can tear him away again. With your good work and friendly nature, you can't help being lionised. Pride is the word that comes to a Leo's mind.

Libra

24 September – 23 October

Stop living solely for your work even if you enjoy it - honestly, who needs a wire-cut Easter bunny?! Spend more time with your friends and turn your mind to other things. Saturn will show you the way to a more enjoyable and exciting life in the coming year, so seize the opportunity!

The Sun is now shifting into the sign with a sting in its tail - and this spurs you into action. You're truly sparkling with new ideas. How about a new laser-cutting system, for example? Scorpios know what they want. But make sure you take your breaks - you don't want to burn out.

24 August - 23 September

The Moon as your ally is currently bringing sufficient calm and security back into your life. With brief visits from the Sun and Venus betweenwhiles, you can really sit back and put your feet up. Make good use of the extra time and contemplate the unique floating Tubular Shaft Motor.

24 October - 22 November

Sagittarivs

23 November – 21 December

"Hark, the herald angels sing" sounded so heavenly in your rendition that even the angels envied you - another year has passed and your bank account is bursting at the seams. Treat you and your partner to a lovely winter holiday, as you can easily afford it. But which Winter Wonderland will it be? Your partner keeps a cool head, and you warm to her suggestions.