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April 2004  
Issue No. 10

# Servo Technology for STEP FOUR Machines

10<sup>th</sup> anniversary  
STEP FOUR

**STEP FOUR now offers models from the 1200 and 1600 Precise range that are fitted with servo drives. But what is actually the technical background and what are the benefits and drawbacks compared to traditional stepper motor drives?**

One of the main advantages is that the servo motor already operates with a closed loop system, so that the position of the motor is continually monitored and re-adjusted whenever necessary. If the drive is overloaded, preventing the motor from reaching the preset position, the feedback signal can be used to react swiftly and effectively to such a failure. This avoids damaging (or even destroying) the workpiece or fixture components.

### Many advantages

Another advantage of servo technology is that the brush-free AC servo motors used by STEP FOUR also provide a much higher torque than stepper motors. In practice this leads to a far higher dynamics than a stepper motor is able to achieve. However, there is one drawback. This particular drive involves a much more complex technical system. Whereas two integrated circuits and a 4-pole power line were sufficient to drive a stepper motor axle, a servo motor requires a com-



■ Servo motor on the Z axle

plex control unit with its own microprocessor to process the encoder and desired signals. In addition, an interface is needed for setting the parameters and to monitor the system. The unit is connected to the motor by way of a 4-pole or 6-pole power line and a second cable that must be 10-pole minimum. Due to the missing quiescent moment when no current is available, the Z axle motor must also be fitted with a brake. Because of the higher dynamics and the acceleration forces this causes, the machine frames must be a good deal more robust and heavier. Understandably, all these prerequisites affect the price.

Customer  
Information



[www.step-four.at](http://www.step-four.at)

# STEP FOUR

### State-of-the-art technology

We were lucky to find the company Angst & Pfister, a competent and cooperative partner, who has helped us overcome the above-mentioned difficulties, and what is more, has enabled us to offer such state-of-the-art technology at a reasonable price. Our servo units have already survived the first baptism of fire, and in fact six of them are already up and running at the automobile supplier, Burg-Design, in Steyr, Austria.



■ Models in the 1200 and 1600 Precise series can now be servo-driven.



## This calls for celebration!

### Editorial



Ernst Ramberger

We've made it! STEP-FOUR is celebrating its 10th anniversary in 2004. To us it seems as if the years have just flown by, and now we are truly proud to have been able to offer top quality, innovative products to our customers for the past ten years.

During this period following the year 1994 (during the first two years the first units were built and sold through the development company INTEC), when the company was founded, a good deal has happened. Our company strategy is based

on gradual, target-oriented growth that is beneficial for everyone involved, whether they are customers or on our team of staff. We believe this to be the only sensible way forward.

Nothing has changed as far as the positive mood of the employees within the company and their commitment to our customers throughout the world is concerned. We aim to keep you satisfied, and our work is very gratifying. As the success of the past year shows, we are on the right road, and now we want to carry on, with your assistance.

In this anniversary year we have great plans in the company and for our clients. These will be revealed in the next edition of our newsletter. There are several highlights to

## Higher Screen Resolution for S4PRO V4

We have found out from several customers that some graphic cards have problems with the resolution of the V4 milling software. One of our clients, Rudi Schneeberger, has thought of a solution to operate the software in the higher resolution modes 800 x 600 and 1024

x 768, respectively. If you look at our homepage at [www.step-four.at](http://www.step-four.at), you will see a link to Rudi Schneeberger's milling reports in the lower right-hand corner. It shows a mouse driver that can be downloaded to solve the problem.

## STEP-FOUR Trade Fair Calender



21-25 April 2004

**INTERMODELLBAU** in Dortmund  
Booth 122/hall 4

This is a classic trade fair for model builders. Do come and visit us.



21-23 October 2004

**PRO SIGN** in Frankfurt

This huge advertising trade fair is a must in our calendar. Our team will be pleased to offer you advice on our products.



19-21 November 2004

**MODELLBAU BODENSEE** in Friedrichshafen, Lake Constance - This is the first time that we will be at this highly promising trade fair, and we look forward to meeting modelbuilders and to talking with them about this fascinating profession and hobby.



1-4 December 2004

**EUROMOLD** in Frankfurt

Moulding and prototyping are what this international, famous trade fair focuses on.

## STEP-FOUR News

### Large Order from BURG Design

The well-known automobile supplier in Steyr (Austria), which has clients such as Audi, BMW, Daimler Chrysler, Ford, Mazda, Mercedes, Mini, Mitsubishi, Porsche, Skoda and Suzuki) has ordered six servo-driven, customized Precise machines to be delivered to their new plant that has a production area of approx. 8,000 m<sup>2</sup>. They are thinking of raising this to 15 units. BURG Design has been a client of STEP-FOUR for many years and it just goes to show that quality is vital, now and in the future.

[www.burg-design.com](http://www.burg-design.com)

### Recent Trade Fairs

From 3-6 December 2003, the EUROMOLD was held in Frankfurt, where we presented our products at our 28 m<sup>2</sup> booth. This fair of international reknown enabled us to make a lot of promising contacts in the field of moulding.

From 4-7 March 2004 our booth represented us at the FASZINATION MODELLBAU in Sinsheim (south-west Germany). This fair gets more interesting every year, and we were delighted to meet many customers who have become good friends over the years.



## Dispensing in Time Saves Nine with STEP-FOUR

Thomas Burger-Ringer from the company Seidel Elektronik GmbH in Deutschlandsberg sent us this letter:

".... Our new avalanche victim search device PIEPS DSP has just been introduced onto the market. Instead of the manually inserted O-ring seal, we want to insert some silicon into the sealing groove and seal the cabinet with it. This saves a lot of time during assembly and means the device is much better sealed.

Since the cabinet contour is curved it was necessary to upgrade the STEP-FOUR software to 3D. Our 3D CAD program (Solid Edge) calculated the necessary polyline as a curved path, and finally Rhino produced the 3D Dxf also needed.



■ Dispensing, another application for which the Basic 540 is eminently suitable.

The dosage needle is activated with pressurized air emitted by a valve and passed through the relay output. The result is really so good that we will probably no longer need a complex dosing unit.....

**From Offshore Suppliers to the Fire Brigade... Anything is possible**



■ Spineboard used by an American fire brigade

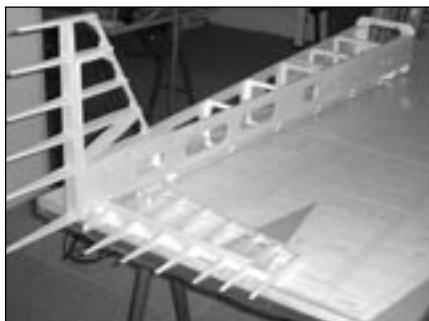
... At the moment the milling machine is at full blast, as I'm working on the design of my customized model for an offshore supplier. The initial milling samples which I sent to the dockyard along with my offer were so successful – in fact they were really enthusiastic – that they have sent me a complete CAD documentation set of the original. For ships built by large shipyards and that are less than 10 years old, this is very rare indeed.

## Large-Scale Model using Basic 540

Mr. Wiesner from Günseldorf has sent us pictures of his new project, a model plane with a wingspan of 2 metres.



■ Basic 540 with fixed material



■ Fuselage and right elevator

### Your good reputation

As you can see, your milling machine and its top results have literally opened doors to high places for me! The model is going to be 1.80 metres long.

I enclose a picture of a spineboard that was milled on my milling machine for an American fire brigade model. These boards are used to stabilize victims who have suffered spine injuries and are rescued from dangerous situations .....

Mr Merten/Lahnstein  
(Germany)



## A Real Delight: Eberhartinger's Piper J3



■ Fuselage and left wing of the Piper J3

.... As I didn't just want to stick some pre-fabricated parts together, but preferred to build the plane straight from the drawing, I looked for a machine that could mill the required parts economically and yet afforded the utmost precision. After trying out various manufacturers, I'm back again in Salzburg with STEP-FOUR.



■ Cockpit

My ultimate choice was the Basic 540 construction kit. All my qualms about the construction and operation being beyond my capabilities soon disappeared when I saw how clearly the detailed assembly instructions had been written. In addition, the sketches made it easy to start assembly. Step-Four employees very kindly answered my queries concerning putting the milling machine into operation and the initial milling steps, for which I am really grateful.

Since then I have had a lot of fun with the Basic 540 of STEP-FOUR, and it is a real joy to keep discovering new possibilities.

Mr Eberhartinger/Salzburg

### PC-CUT 2500



The "big one" by STEP-FOUR. This PC-controlled 4 axle hot-wire cutting machine for the purpose of cutting mould parts from expanded or extruded polystyrene weighing between 15 and 50 kg/m<sup>3</sup> can process blocks up to 2500 x 1250 x 600 mm max.

The mechanic structure of the machine consists of a robust framework made of aluminium system profiles. The material is fed in and out by way of a firmly installed roller belt from the two front panels of the machine.

For cutting contours the cutting wire is clamped directly between the two portals. Any modification in length for conical contours is compensated by an electronic motor clamp fixture.

Please read the article on page 6 on how to use this machine for mould construction.

## Advertisements

Advertise free of charge in the STEP-FOUR newsletter. Send us your ad by email as a text file (not more than 1 column, 4 lines). We reserve the right to publish and edit your ad.

Model flyer is looking for milling fans to swap milling files.

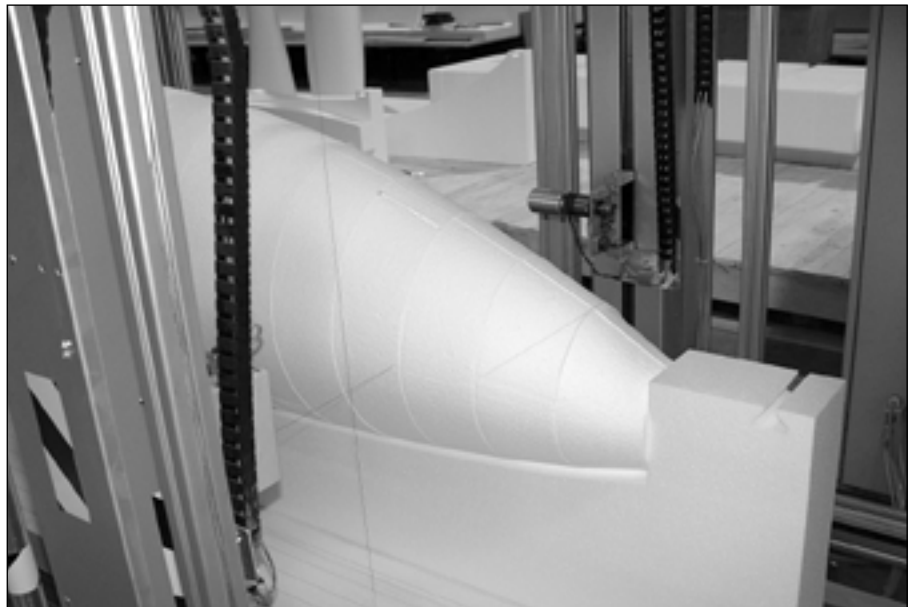
Email: t.schlaich@arcor.de

# Hot Wire Cutting

## The Ideal Method for Constructing Moulds

**One of our Dutch clients, Mr Cock van Driel, wrote the following highly informative article on the subject of mould construction (abridged).**

Fibre-glass strengthened plastics are used in all sorts of products nowadays that need to be more up-to-date, faster, trendier or simply better. Many people do not realize that a product contains fibre-glass material as soon as the shape is somewhat more complex. The era of thermo-plastic materials began more than 50 years ago and was based on a type of bakelite resin. Today most of these resins consist of all sorts of polyester using fibre-glass for extra strength.



■ Hot wire cutting system

### Expensive

Normally negative moulds are used to manufacture fibre-glass plastic parts, which are then reproduced using positive moulds. Smaller models are often solid and more or less made by hand, similar to the casting methods used for hundreds of years. In fact, the larger the models, the more the manufacturing technology involved resembles ship-building. Here templates are used as a framework, which are covered in a thin veneer thereby forming the outer mould. A thick outer skin is laminated over this by hand. This part is given a protective framework and is separated from the model to provide the mould. The big drawback of this technique is the fact that it takes many hours of tedious manual work, which is not only expensive but also increasingly hard to get people to do.

In addition, the results can be unpredictable due to the high error rate. That is why modern CNC machines are preferred nowadays to manufacture models and moulds. Using the latest large-scale CNC machines, designed for light materials such as wood, plastics or aluminium, models can be constructed up to 10 metres in size, in one piece. Manual work is now only required for assembling the basic processing material and for finishing the model, i.e. corrections or painting. The benefits are the invariable high quality, the manufacturing speed and the much lower error rate. Although the costs for CNC machinery and personnel are rather high for modern model building, this is compensated by the very short time it takes to manufacture a finished model.

### New Technology

An economical new technology, or rather an old method that has been “re-invented”, is the hot wire cutting technology. This involves the use of a hot wire to cut parts out of material that has a low melting point. The wire is heated by an electric current and each end of the wire is moved through the material independently. The X and Y movements are carried out with the aid of computer-controlled stepper motors that calculate the distance travelled by the wire very precisely. The result is a so-called “grid” (wire frame) or a 2.5D mould. Apart from certain limitations it closely resembles a slightly cambered 3D mould.

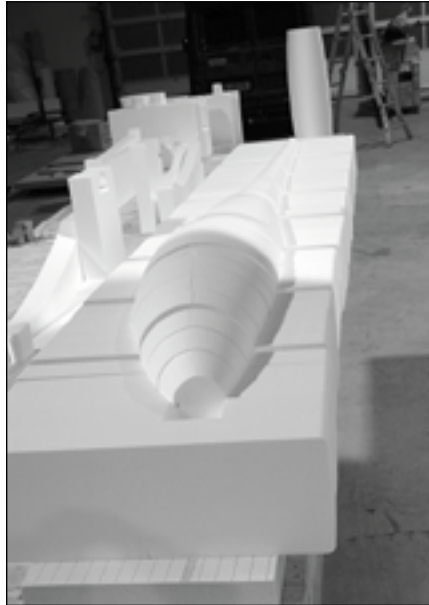
Using hot wire technology, models can be constructed from layers that are pre-cut and then stuck together. The material must have a low

melting point such as for example EPS. Like other models, fragile EPS models can be covered in fibre-glass plastic and also offer other advantages. For one thing, they can be used to produce fibre-glass moulds and secondly, they are extremely light and therefore better suited for long-term storage in normal conditions.

### Size? The Sky's the Limit

All sorts of models and moulds are produced nowadays with dimensions reaching approx. 40 x 5 x 2 metres. However, the sky's the limit as far as size is concerned, as the sections can be positioned anywhere with the aid of cleverly set reference points and then stuck over or next to each other until a complete model is created. Hot wire technology, however, has its limitations, just like any processing technology: a 3D mould that is cambered over a short distance cannot be cut directly. In practice this means that it is easy to produce the model of a rotorblade, but the extreme edge known as the triplet should preferably be constructed by means of a CNC machine.

Where hot wire cutting comes up trumps is in the price. The investment costs are minimal compared



■ Cut out fuselage

to CNC machines, and the products (e.g. models) can be virtually any size.

One fascinating development is the fact that hot wire cutting can be implemented as well as CNC processing for certain models. Although CNC processing requires a lot of machine time to produce the basic, raw mould, the hot wire method can be used at once to precision-cut prepared sections. It also has a special feature in that segments cut by hot wire can be hollowed out wherever necessary. This is not possible

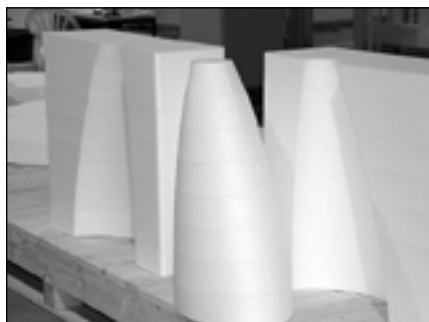
with CNC machines, so that many options are now available that designers had not even thought of previously. This means, for instance, that enormous free-formed structures can be built standing on lightweight EPS parts, which are then covered in fibre-glass veneer to obtain the necessary rigidity. This kills two birds with one stone: the designer not only has a good deal of freedom regarding the shape, he can also add structured fibre-glass plastic layers at the right places to ensure a long lifespan due to the robust material.

Many applications, which previously seemed far too expensive, are now possible – and at a relatively low cost – thanks to hot wire cutting.

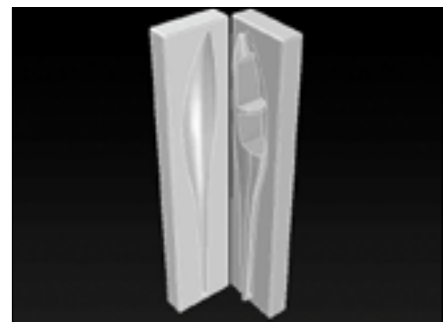
**10<sup>th</sup> anniversary**  
**STEP FOUR**



■ Cockpit



■ Cockpit



■ 3D model

## Hints & Tricks

### Milling

A hint on milling carbon-fibre plastics, fibre-glass plastics and printed circuit boards (epoxy):

Use spiral or diamond-toothed routers (also known as "micro-spiral" routers), because the results are better and the service life is much higher than using traditional single and double cutters, which of course helps save money...

### Cutting

How is polystyrene ((Trade R-Zeichen)) actually recycled?

In order for the material to be reusable it needs to be prepared, in other words chopped up. This is then mixed with new material to produce insulation materials, and can be re-used to manufacture blocks and moulded parts.

Ground polystyrene can be used to strengthen polystyrene light concrete, insulating plaster and light plaster, and also in the ceramics industry.

Polystyrene flakes, made of ground foamrubber waste and used packaging, have acted as auxiliary material to improve floors since the 70s. Polystyrene flakes are odour-free, chemically neutral and suitable for plants. They are used in planting earth substrates, compost, to loosen soil and in drainage systems.

So: Take your polystyrene waste to your local recycling area, and do something beneficial for your environment.

# SPRING OFFER

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ware products\***

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## Tell us what you think

Please do not hesitate to send us your questions, demands, hints or complaints. Send us photos of pieces produced with STEP-FOUR machinery. Tell us about your milling and cutting projects. Give us some hints on milling and cutting. We will be happy to print your contribution and look forward to hearing from you.

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