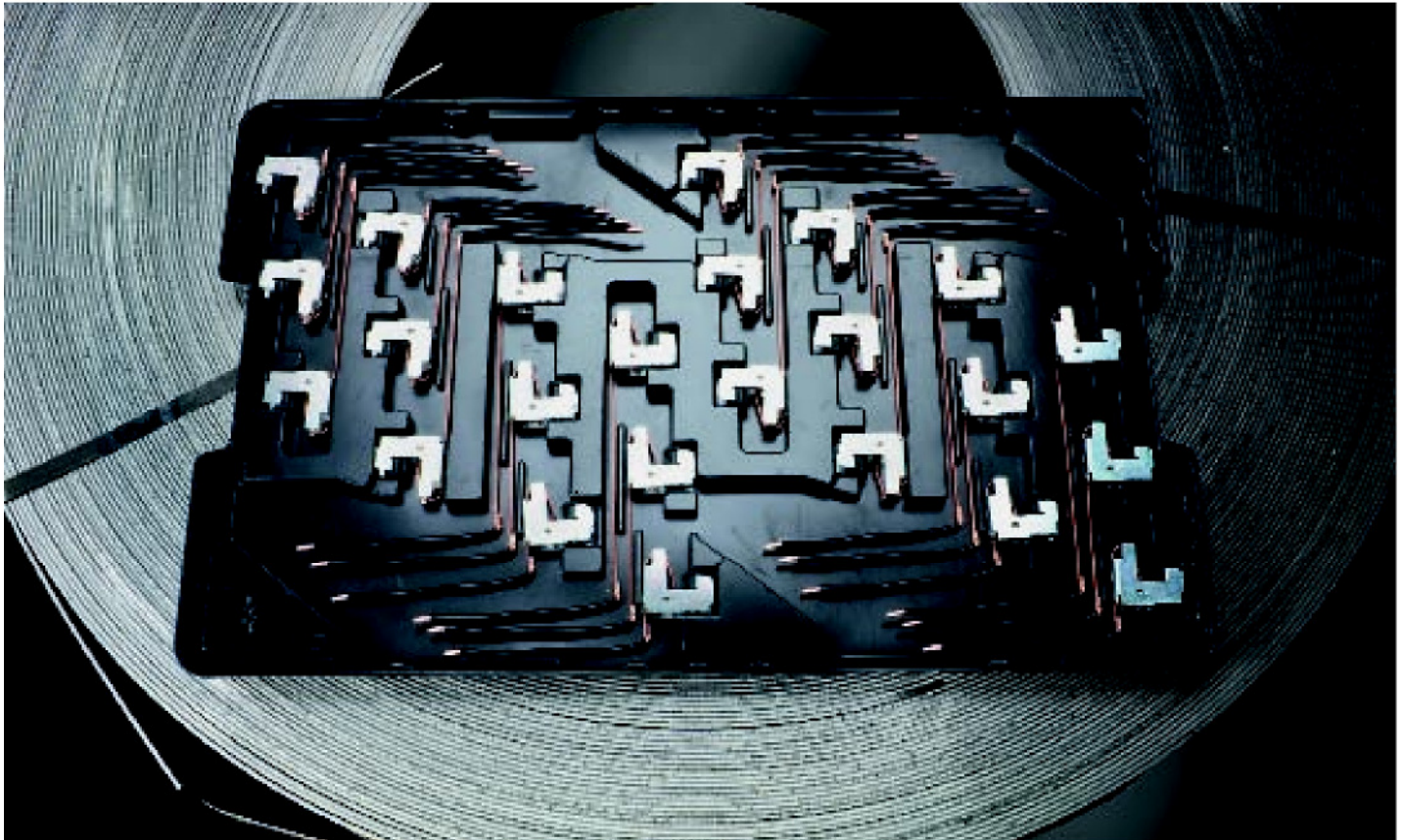


# More productive thanks to Servo

by Jakob Einwag and Stephan Mergner After months of working in three shifts, for one contract manufacturer it is certain: a Servo-press's productivity is noticeably higher, with the same or better quality as with other manufactured products. Set-up and operation have become more convenient and flexible, and both machine and tools are operated more economically than ever.



This is daily business for every contract manufacturer in the pressing and metal forming technologies: cost-effectively manufacturing a growing abundance of widely varying products in a continually decreasing batch size. Those desiring long-term success must operate with flexibility, be more productive than others, and at the same time always be able to offer the quality required. Mechanical presses run with servo engines which, inherent to their functions, combine the productivity of conventional presses with the flexibility of hydraulic ones, and offer in many cases development potential in all three previously mentioned disciplines. As one of the first German press manufacturers, Burkhardt GmbH in Bayreuth (ebu press- and metal forming technology) had, in 2004, already acted on the innovative drive principle, and with the support of innovative servo-drive solutions from the supplier Siemens, had already turned the technology into a machine series.

The ebu press- and metal forming technology product programme encompasses mechanical presses in both C-frame-design with nominal strengths from 60 to 4,000 kN, and in automatic design with nominal strengths from 400 to 10,000 kN. The presses are conceived for efficient pressing, bending, embossing and forming of coil, strip, or blank materials in automatic drive, as well as for single component manufacture in manual operation.

**With the servo-press, the Metalltechnik Annaberg Co. was able to increase their productivity by about 20 percent with all the tools they currently use. With this device, they were even able to go from 45 to 60 strokes a minute: an increase of 33 percent.**

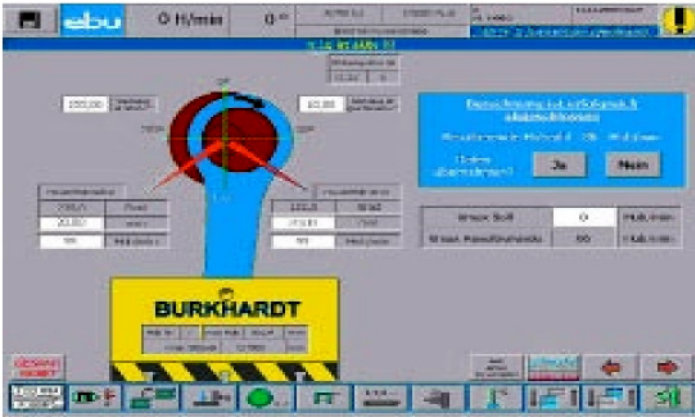
For this purpose, the Bayreuth Co. delivers custom-made strip feeders, made with electronic roll feed attachments, precision straightening machines and/or coilers for band widths up to 1,500 mm. One of the newest developments in material handling is the coiler centre (HCC) for fast, extensive automatic changing of user-defined coils with different thicknesses and widths.

One of the first users of a press with the henceforward third servo drive generation ('Servo III') by Burkhardt is Metalltechnik Annaberg GmbH from Königswalde in the Ore Mountains. This company in Saxony has expanded its capabilities and, since the beginning of 2009, has also been producing superior parts predominantly for electrical use on a 100 ton automatic punching press from the STA series.

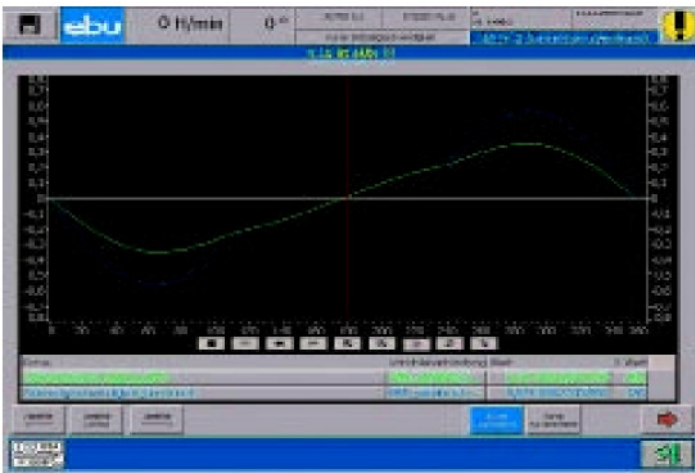


Only Servo-presses enable delicate ram movement at full work capacity with the electronic hand wheel. In this way, production presses can be comfortably adjusted, as well as used as trial presses.

Instead of complicated engineering, little input is needed: Simotion's input mask by Burkhardt can be customised to individual needs and made flexible using Simatic WinCC.



Simotion automatically and individually generates an optimal energy movement press ram profile for each tool and product, taking into consideration all critical values.



The contract manufacturer has more than 50 years of experience in metal production and tool making, and possesses a special know-how in the manufacture of clamping elements, contact elements for the conduction of strong currents and in the completion of individual parts in an assembly series. Now add to that established practical experience with a directly powered Servo-press.

### Flexibility is the key to higher efficiency

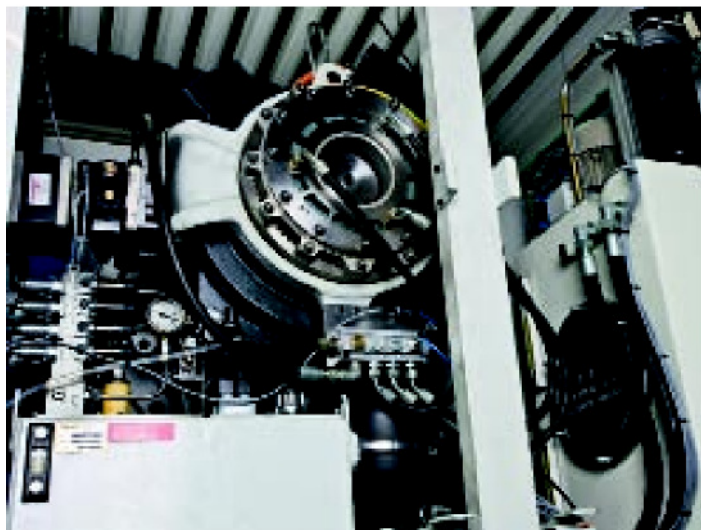
The more flexible a press's drive system, the more versatile both the individual settings and band widths of producible components. With this guiding idea, press manufacturer Burkhardt has applied its tried and tested servo drive concept to another model with direct drive. This allows the ram to move through the entire press cycle away from individual control and likewise move quickly and flexibly to adjust to widely varying tool and component requirements. This ultimately results in higher productivity and/or product quality, as well as in a machine and tools that operate economically.

There had previously been a non-proprietary initiative from Siemens with the goal of optimally aligning all power train components exactly to the mechanics and kinematics of presses, as well as to one another. From this, an integrated system solution for automated mechanical eccentric presses developed. The basis of Burkhardt's universally applicable and complete hardware package is a drive integrated motion control system: Simotion D445 - a main press drive from the Sinamics S120 modular family and a powerful complete torque engine from the 1FW3 series by Siemens.

In the medium term, all secondary axes are to be realised with Sinamics drives and therefore the entire chain of action will be further optimised. For operation and observation, as well as administering formulas directly to the press, a robust industry standard Simatic Panel-PC 677B with a 17" touch screen exists. A Simatic S7-300 undertakes the processing and coordination of press and material loading.

### Automated for optimal ram guiding

To support machine builders and users, Siemens developed 'SimoPress Servo', an applications packet for all of the Servo-press's controls with an integrated's graph generator based on the Simotion systems. With this, the press operator can very easily determine an energetic and procedurally optimised ram movement for each individual tool and its transfer equipment; that is, achieve ideal processing conditions – and all without any complex engineering operation or need to consult either press manufacturing specialists or the control manufacturer. Burkhardt has adapted the curve tool on its Look-and-Feel (as it's known in the field) and a simple input mask for visualising under WinCC is flexibly generated.



The core of the innovative drive concept is a complete torque engine 1 FW3 from Siemens which is ready-to-install upon delivery.



Tested and approved in three shifts: Burkhardt-automatic punching press STA with the newest Servo direct drive 'Servo III' at the Metalltechnik Annaberg Co.

This mask contains input fields for the most important reference values in the forming process; tool aperture and dwell angles, position and stroke before and after the lower dead point, and target number of strokes per minute.

From these few reference values, the Simotion system calculates in seconds and with the push of a button the optimal ram kinematics for the inserted tool: once when first inserted and then after editing. The result is a movement profile with seamless, flexible tools and economical material transfer, which eliminates undue peaks in power and torque and thus alone keeps drive performance within its necessary limit. The machine specific maximum values, e.g. for engine speed, acceleration, and performance, for sudden movement, ram speed and acceleration, as well as for the optimal forming speed, all of which are defined by the curve calculation in the drive system design, are automatically accounted for.

This guarantees that the limits allowed the press and power train are fully actualised, but not exceeded. The field weakening range of the 1FW3 engines is also thereby fully utilised. With reduced torque, these may be operated up to double their nominal speeds, during which time they are suitable for dynamic ram movement outside of the actual operating range.

Non-defined way or change-over points can be started with the electronic hand wheel on the control console and, with the press of a button, assumed into the calculation, optimised movement curves saved, and re-imported. This makes the setting of new tools very easy and convenient, and enables the production press to also be used to manufacture initial samples with minimal risk. The motion sequence therefore, is always performed with optimal time, process, and energy which, at the same or even reduced ram speed at the lower dead point, leads to a substantially higher number of strokes per minute, giving a consistent - in many cases even better - forming quality.

The complete torque engine 1FW3 (currently available with a torque up to 11,400 nm) is constructed to be mechanically simple and robust, thus simplifying the mechanic and the electronic construction, as well as the infrastructure and practical transfer. This in turn accelerates

the start of on site operation and reduces investment volume. Just as with other applications, advantages in reliability and maintenance requirements are to be expected, since the number of parts experiencing wear and tear, such as connectors, as well as the number of moving parts, have been further reduced.

#### The intermediate circuit as energy saver

The press manufacturer also finds innovative ways to deal with energy management, which in this case is based exclusively on two capacitor banks in the control box replacing the usual fly wheel. This allows the energy generated in the converter's intermediate circuit when slowing down to be saved without much adjustment to the settings, and then recalls that energy during forming and acceleration. Each capacitor bank contains six memory banks and increases the memory capacity of the intermediate circuit by approximately 800  $\mu$ F at a time.

This type of energy management reduces the system load, and with it, the amount of wattage and power supply needed. Consequently, this can be planned and exactly dimensioned from the outset. Thus, an upgrade of existing presses with servo drive is also possible: in many cases without exchanging all the existing power feeders (load feed, including transformer).

## Approved in every respect

The Metalltechnik Annaberg Co. has been alternately manufacturing superior press and flexible parts on Burkhardt's Servo-press since implementing one, along with Siemens, at the beginning of 2009. 'After good, intensive discussions with Burkhardt, we finally decided on what is effectively the only alternative requested press with direct servo drive, and are happy with our decision every day', said Wolfgang Rickart, the managing director of the Metalltechnik Annaberg Co. 'Changing tools is the rule, rather than the exception, so the presses often have to be retooled and adjusted. With the new Burkhardt press, this is considerably simpler and more convenient.'

So far, it comes equipped with just under 20 tools including feeding equipment for operating the Servo-press; more will follow after coordination with the manufacturer. With faster stroke movement following the working stroke, the productivity of all tools used thus far is increased by an average of approximately 20 percent, as compared to a similar Burkhardt model with a conventional engine and fly wheel drive press. 'In doing so, we can also use optimal individual settings to drive the working stroke more slowly than previous capabilities, which reduces stamping force, preserves the tools, and increases durability,' according to Wolfgang Rickart. The press itself has enough reserves; pulling more out would make little sense, however, as the time saved would sooner or later be lost again in tool production.

Fitter Jens Linke has learned, in addition to simple, intuitive touch-screen operation, to especially appreciate the new press's electronic hand wheel. This allows the ram to move slowly and, above all, rather more precisely in its full working capacity than it previously could with two-hand operation. This makes fitting much more convenient.

Concept and results align, and the management, as well as the fitters/operators at the Metalltechnik Annaberg Co. are completely satisfied with their first Servo-press, and are already seriously considering investing in another – again from Burkhardt, and again with Simotion and direct servo drive by Siemens.

[www.siemens.de/umformtechnik](http://www.siemens.de/umformtechnik)  
[www.burkhardt-bayreuth.de](http://www.burkhardt-bayreuth.de)  
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