



Miro Ribaric, Production Manager at  
**Baumann GmbH**,  
Lichtenstein (Reutlingen)

## Combined force and acoustic sensors safeguard stamping processes

**Higher and higher speeds and increasingly complex production procedures make process monitoring for stamping applications indispensable. German Baumann GmbH utilizes force-acoustic emission technology and existing eddy-current technology which are both integrated into a press monitoring system by Schwer + Kopka.**

One of the production halls of Baumann GmbH in Lichtenstein near Reutlingen in Southern Germany, smells of fresh paint. The company, headquartered in Switzerland, is sprucing itself up. There is reason to celebrate: the 50th anniversary of the company is just ahead and enough reason for Miro Ribaric, production manager at Baumann, to have the painters drop by to put a new coat of paint on the walls in the production halls. With eleven sites on three continents, and about 1400 employees world-wide, Baumann is a leading manufacturer of springs and stamped parts. In Lichtenstein, the focus is on three areas of production: stamping technology on Bruderer presses, stamping and forming technology on Bihler machines and classic spring production of wire, e.g. on Wafios machines. Baumann develops and produces all stamping tools used in-house depending on the product and the customer's wishes.

### Examining the process during production

In Lichtenstein, most automotive parts, including springs for seat adjustment, are produced in three shifts. Miro Ribaric considers his facility a tier 2 supplier, since Baumann supplies, e.g., seat manufacturers who supply only the OEMs. In strip processing, stamped parts range in material thickness from 0.1 mm and go up to 3 mm; the maximum diameters of the parts can reach 50 mm. Ribaric states that there are currently about 500 active parts being produced in his facility.

If you develop, build and use tools to form parts, you also have to ensure that the parts are definitely okay. This is where Schwer + Kopka comes in. The effective monitoring of tools and production machines, as well as the objective recording of machine and operating data, are focus areas of the medium-sized owner-managed company from Weingarten and Hilden. Until now, Baumann has relied on "classic



**Left:**  
Baumann GmbH produces many millions of small and very small stamped parts, mostly for the automotive industry.

A state-of-the-art machinery complex with Bruderer and Bihler stamping departments is maintained in the Lichtenstein factory.

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controls" such as the worker himself. "Now we want to look into the process during production, listen into the tool and map the condition of the tool," says Ribaric.



On the left: Wolfgang Faulhaber, managing director of Schwer + Kopka GmbH. He supplies the measuring and inspection technology, as well as a hybrid solution with which signals from different systems can be processed. On the right: Miro Ribaric, production manager at Baumann GmbH. For him, quality assurance for his precision stamped parts is indispensable. Therefore, he relies on the SK combination box as well as the SK process monitor and sensors.



The Bruderer stamping machines are nearly all equipped with process monitoring solutions by Schwer + Kopka.

The sensors are practically integrated into the stamping die, in this example, a progression tool.



The monitoring terminal is placed right next to the stamping press. The sensor cables plug straight into the terminal. The following signals are measured: stamping forces and binary signals, such as feed, stock progression, and part ejection. The in-die force-acoustic emission sensors are particularly effective, permitting individual forming, piercing, blanking, and bending operations to be monitored.



This figure shows a classic analog proximity sensor (eddy-current sensor) with its' sensor cable. Both sensor and cable are protected by the recessed installation. SK's state-of-the-art evaluation software significantly increases the monitoring results of the existing sensors as well.



The monitoring system from SK monitors older proximity sensors and hybrid force-acoustic emission sensors in parallel. Thanks to modern monitoring software, the sensitivity of the proximity sensors has been improved as well. For old and new to interact, Schwer + Kopka has developed a unique sensor combination box.



This tool uses both sensing systems in parallel: eddy current and force acoustic emission. The right cable comes from the eddy current sensor, the left one connects to the force and acoustic emission sensor mounted in the top stripper plate.

### Force and acoustic emission sensors notice even the smallest slugs

Up to now, the conventional eddy-current technology has been used to recognize process issues caused by slugs, chips or scrap while the press was in production mode. However, defective forming, cutting and embossing processes, as well as smaller stamping slugs that are fully squeezed into the material, cannot be recognized with the eddy-current method. The eddy-current sensors measure the "tipping" of the stripper plate. When tiny stamped slugs are struck by the tooling, the stripper plate hardly tips and the sensors will not see any deflection. Modern monitoring systems use hybrid force-acoustic emission sensors instead to sense different forming forces or to recognize very small foreign bodies. "The sound of the stripper plate is different when it moves properly than when it contacts something foreign when closing. The SK sensors "listen" and check whether the acoustic signals are correct. In short: The SK system verifies if the acoustic signals and forming forces are as they should be" explains Wolfgang Faulhaber, managing director at Schwer + Kopka. Force-acoustic emission sensors measure, as their name says, force and acoustic emission at the same time.

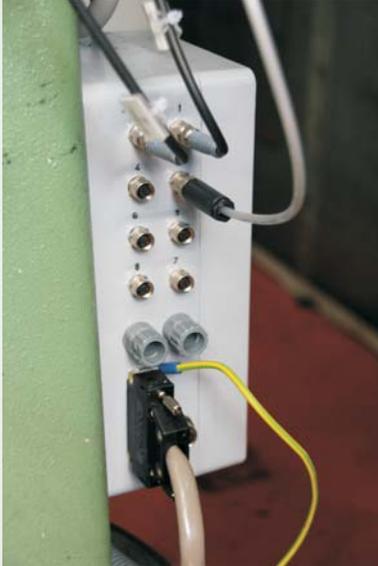
### Special pockets are milled into tool plates to accommodate the sensors

With each stroke, the deflection of the plate is measured in the time and acoustic domains. In typical progression tools, there are several sensors in various stations that each record different data, e.g. the forming forces associated with the punches or the coining process where the sensor is located above the embossing tool. The hybrid sensors are not attached to the tool, but glued into a pocket in the tool with a special two-component adhesive. Faulhaber explains that the excellent sensing results from the integrated tool sensors are achieved because of the unique installation process. This way, part of the tool "becomes" the sensor. Installed on the stripper plate, it can recognize stamping slugs, chips, or even small scrap pieces.

Baumann has also equipped their presses with force-acoustic emission sensors by Schwer + Kopka. A technician from Schwer + Kopka came to Baumann and discussed implementation with the tool maker on site to determine where the sensors were to be inserted into the plate. The pockets for the sensors were then milled, and on the next visit, the sensors were epoxied into the plate using a two-component epoxy consisting of an epoxy and a curing agent. During this same visit, Schwer + Kopka taught the sensor installation techniques to Baumann personnel so that the tool makers could install the sensors themselves. The sensor wireways are also integrated into the plate.



Left: in this case, the monitoring system by Schwer + Kopka is attached below the press control panel. The combination box with the eddy current and force-acoustic-emission-signal processing options helps ensure that the millions of very small precision stamped parts that are produced on the press are all of the highest possible quality.



**The solution:** the combination box from Schwer + Kopka. This unique hardware allows the force-acoustic emission sensors and the eddy-current sensors to be monitored with a single device. The combination box allows older eddy-current sensors to be used until they are ready to be replaced.

### Combination box combines old and new sensor technology for best results

Due to the great number of tool sets in use, many of which have been equipped with eddy-current sensors, a huge investment would be needed for Baumann to completely switch to force and acoustic emission technology. To overcome this obstacle, Schwer + Kopka has developed the SK combination box. It can be connected to stamping tools with eddy-current sensors and tools with integrated force and acoustic emission sensors. Dynamic signal processing also automates the constant adjustment of the monitoring limits for the eddy-current sensors.

Ribaric praises the idea: "The smart combination box automatically recognizes the connected sensor type. Is it a classic eddy-current sensor that measures the deflection of the plate, or is it the new sensor with force-acoustic emission technology? Depending on the sensor recognized, the system switches to force-acoustic emission or eddy-current analysis, saving our employees time and effort." The box is designed to combine sensors by Schwer + Kopka with sensors from other providers. A screen displays the process data: the employee is able to compare the enveloping curve for the eddy current sensor signal to the acoustic emission signal.

The monitoring system is also intelligent: when a machine is retrofitted and equipped with a new stripper plate, the box can be made to load the new parameters with the push of a button and to learn the new correct signals resulting from this. This procedure saves time and effort: when a machine, e.g. a fast press starts, it will first run "cold". It will run unstable for a bit of time and show some stripper plate variation, but eventually, will display more stable results once it warms up. Ribaric sees only benefits in this for his project: "The fact is, a temperature increase will always occur when machines and tools are running quickly, requiring manual corrections to the monitoring system much more often. Required corrections are now automated in the Schwer + Kopka system and performed automatically. This clearly reduces process interruptions and unnecessary downtime."

The part data memory of the combination box can store parameter settings for up to 3000 tool set I.D.s. The target curve of each individual tool can be recalled whenever necessary. For example, the condition of a tool can be reviewed by checking whether the current curve matches the target curve stored.

### The future belongs to the system providers

Baumann GmbH sees its future as a provider of entire assemblies. "We want to push the envelope when it comes to technology," Ribaric explains. This requires well-working process monitoring systems that are adaptable to our production needs. With the force-acoustic emission technology and the combination box by Schwer + Kopka, you feel well prepared to achieve this goal. For example, the Baumann site in Asia is equipped with the same process monitoring technology by the Asian branch of Schwer + Kopka, strictly according to the motto of "globalize and standardize".