

Technical Report

# Cost-effective clamping force monitoring in automatic roll-fed machines – Illig places its trust in Baumer strain sensors.

With its ultra-modern Series RDM-K and RDK thermoforming machines, Illig once again underscores its position as a leading systems provider in the global market. The machines are characterized by innovative drive, heating and cooling systems, forming precision, high degree of repeatability and a flexible machine concept. Short tool change times as well as guided servicing and preventative maintenance increase their efficiency and system availability. The DSRT strain sensors by Baumer make a decisive contribution in achieving these attributes.

For 70 years, Illig, the German family-run company, has been developing, manufacturing and selling tools and high-performance systems for the thermoforming and packaging industry. The machines are used for a wide range of applications in the most diverse branches of industry. Examples include RDM-K and RDK automatic roll-fed machines used in the production of yogurt pots, coffee capsules, plant pots, chocolate box inserts, transparent boxes and underfloor heating. Worldwide there are currently 20 000 Illig machines running around the

clock. Needless to say, quality is paramount.



Coffee capsules are trendy. Today over 95% of thermoformed coffee capsules worldwide are produced on Illig RDM-K machines.



With up to 10 different forming programs, virtually all formed part variants can be produced on high-performance RDK automatic pressure forming machines.

### High quality standards

At Illig, quality assurance begins with the discerning selection of materials used. It extends from consistent monitoring of all individual parts through to final acceptance of the machines. The high proportion of in-house production at the systems provider for all major machine components ensures the highest production and product quality. With all machines and tools undergoing rigorous trials under production conditions, the customer receives an acceptance report with the setting data and agreed performance features. 10 years ago, Baumer strain sensors also underwent these rigorous quality tests. They maintained both their high accuracy and universal versatility even under harsh ambient conditions.

Strain sensors measure force indirectly. Force exerted in a mechanical structure always produces strain. This strain depends on the geometry of the structure to be measured and the modulus of elasticity of the material. During commissioning of each machine, the recorded strain values are calibrated in relation to force. This guarantees optimum interaction between all components and thus effective process reliability. Based on statistical data determined with the strain sensors during qualification and commissioning of the thermoforming machines, Illig compiles design guidelines for machine adaptations and new developments. This paves the way for continuous improvement of the company.

### Force monitoring on the automatic roll-fed machine for forming/punching operation (RDM-K)

The actual forming process involves various steps such as cutting, mechanical drawing, forming pressure build-up and punching. The forming units on the RDM-K machines are moved by a cam-controlled toggle lever system. The DSRT strain sensors mounted on the two toggle levers on the bottom forming table monitor the high forming and punching forces. Depending on the film thickness, the two forming tables exert greater or less force for forming the semi-finished product. A predefined force must not exceed the tolerance limits over the entire cycle. If they deviate, the tolerance limits can be corrected by the machine operator directly at the operator control terminal. This prevents prema-

ture wear of the forming and punching tools while ensuring consistent product quality. The DSRT features long-term stability. Once set, it guarantees precise measurements over the long term.



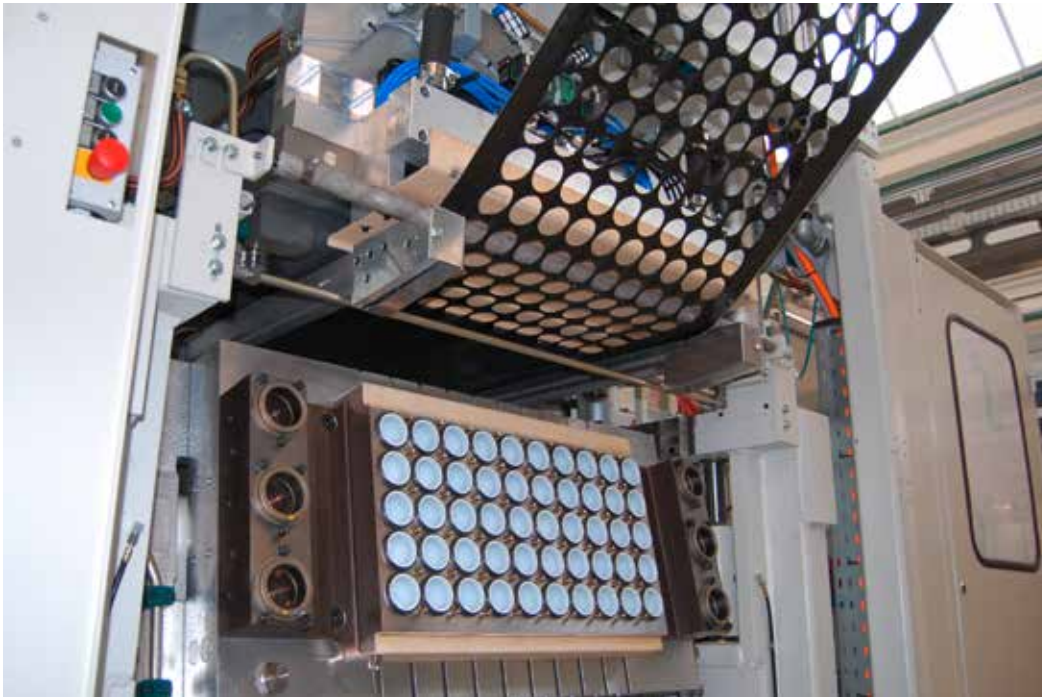
The Baumer DSRT strain sensor on the toggle lever reliably monitors the clamping force of the RDM-K machines.

### Challenge: Separate clamping force at the automatic roll-fed machine for forming and punching (RDK)

Today's tools make it possible to increase the number of cycles by up to 60%. On RDK machines, for example, rectangular trays can be produced at a rate of 55 per minute. A strain sensor on the top bridge monitors the clamping force of the forming units. The sensor is impervious to rapid, hard impact and vibration. Thanks to integrated amplifier electronics, the signals it sends to the controller are less susceptible to interference. Switching errors are reduced and product reliability is increased. In contrast to force sensors, which need to be adjusted individually to the machine's geometry, the DSRT can be easily screw-mounted in difficult to access places on machine structures to be measured. The sensor is designed as a plug-in device. This renders costly rewiring unnecessary in servicing. Thanks to its uniform sensitivity, the sensor can be replaced without the need for recalibration.

### Solution-oriented cooperation

"With the Baumer universal DSRT strain sensors, we have found the ideal components for our in-



The clamping force controlled by DSRT strain sensors contributes to the highest forming and punching precision.

novative automatic pressure forming machines," confirms Andreas Raisch, Development Engineer for Measurement Technology at Illig. "We are very satisfied. We can cover several applications with just one sensor. This keeps our costs low for procurement and logistics. The strain sensors are reliable and rarely fail. This is a key factor for us in terms of worldwide distribution of our machines. Product availability over the entire service life of the machine is also of great importance to us." The unique mechanical design of the sensor is devised to influence the machine structure as little as possible. This allows excellent measurement results as well as reliable and repeatable process control. The sensors are available with different measuring ranges from  $100\ \mu\epsilon$  –  $750\ \mu\epsilon$  and the output signals  $\pm 10$  DVC voltage output, passive and with a CANopen interface.

Further information:  
[www.baumer.com/force-and-strain](http://www.baumer.com/force-and-strain)



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