Format Messtechnik GmbH

Contactless Precision Thickness Measurement in Foam Cutting Processes

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- **Thickness measurement on reference surface or free hanging**
- **Production control features in software SONIC TOOLS**
- **Self-calibration by using reference bar**
- **0.1mm accuracy with open cell foams**

Fig. 1: The new precision ultrasonic measurement system **Sonic Joker® 275** comprises the controller unit and two ultrasonic sensor heads. The smart ultrasonic sensor head **FX 150** has been specially designed for continuous measurement of the thickness of foam foils after the splitting process.

Established methods of contactless foil thickness measurement, especially in loop cutting machines, use laser or ultrasonic distance sensors to measure the thickness of foam foils after the splitting process. The disadvantages of using laser sensors are measurement errors caused by porous surface and large foam cells. Further disadvantages are the color dependency and the dust sensitivity of laser sensors. Currently available ultrasonic sensors suffer measurement errors by attenuation echo from the foam surface, e.g. if the foam is open celled in combination with a low density or when the foam is sound absorbing.

To overcome this, *Format* Messtechnik GmbH has introduced the new ultrasonic distance and thickness measurement system **Sonic Joker® 275**. Sonic Joker® 275 comprises a controller unit and up to two smart ultrasonic sensor heads **FX 150**. FX 150 features a state-of-the-art echo preamplifier, a memory storage for sensor-specific parameters, and an improved ultrasonic sound generation module. The new controller unit of Sonic Joker® 275 (Fig. 1) is equipped with two individually configurable sensor channels. The echo amplification can be adjusted in small distance steps giving a distance-dependent gain characteristic, thus using the optimal gain in the required range. The ultrasonic distance measurement is carried out according to the pulse/echo method (Fig. 3). The distance between the sensor head and the reflecting object is calculated from the traveling time of the sound pulses from the sensor to the object and their echoes. The velocity of sound is determined via a built-in reference bar giving continuous calibration signals. The integrated ventilation fan homogenizes the air between the sensor head and the object, thus giving definite and unspoilt sound propagation conditions for high accuracy measurements. Due to the high intensity of the ultrasonic pulses and the sensitive echo detection of the preamplifiers, even the thickness of low density, open-celled, and sound absorbing foams can be measured. For dust protection in loop cutting machines, an air filter for the sensor heads is available. Two thickness measurement modes are installed (Fig. 5): The anti-parallel mode - with one sensor “1” from the top and the other sensor “2” from the bottom - measures the foam foil hanging free in between. The parallel thickness mode uses a reference surface over which the foam foil is moved. To integrate the system into the cutting process the controller unit is equipped with several interfaces. The TFT display of the controller unit continuously visualizes the measured foam thickness and relevant measurement parameters. The thickness values can be recorded and evaluated by the PC software SONIC TOOLS (Fig. 2). After the measurement the data can be saved and visualized graphically by the software.

The new ultrasonic distance and thickness measurement system Sonic Joker® 275 can be integrated into most existing foam cutting machines. It is a state-of-the-art and cost-effective measurement device for continuous contactless high precision thickness measurement of open cell foams in an industrial environment.

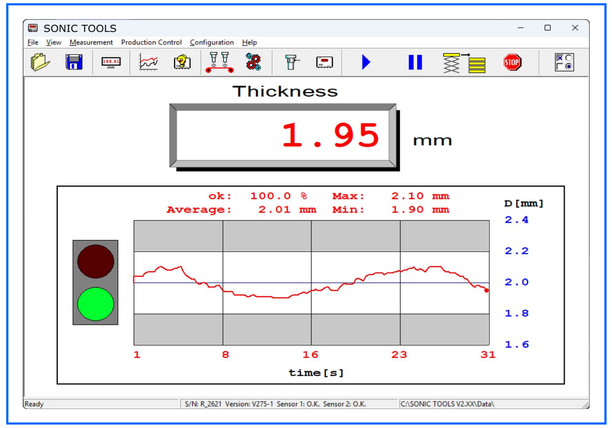

Fig. 2: The PC software **SONIC TOOLS** enables users to change the system parameters according to the measurement situation. A production control mode is available for continuous thickness measurement within defined limits. The measurement results are displayed for quality and production control.

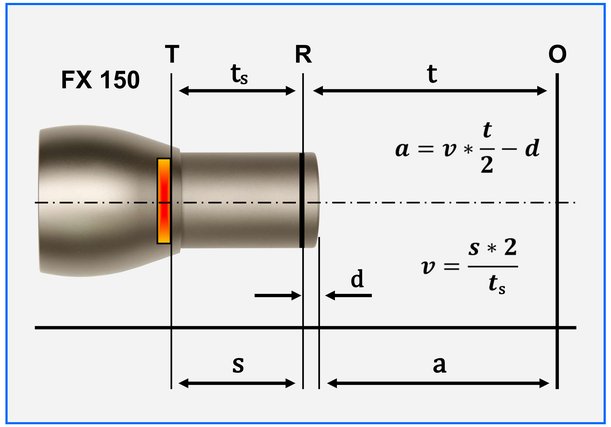

Fig. 3: The measurement principle of **Sonic Joker® 275**: The pulse/echo propagation time **t** and the velocity of sound **v** determine the distance **a** of the object **O**.
T: ultrasonic converter **R:** reference bar
s: reference distance **d:** position of the nozzle

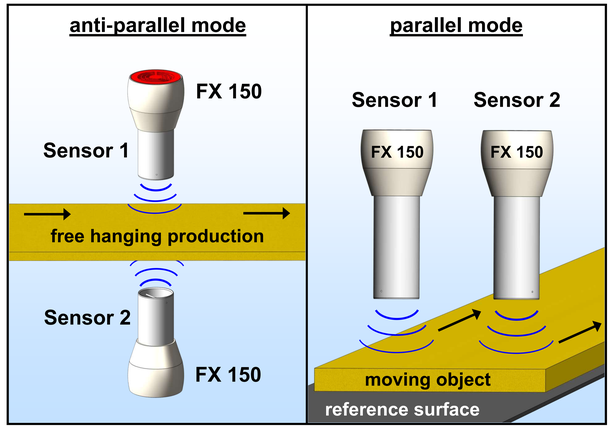

Fig. 5: Two thickness measurement modes are available: The anti-parallel mode (left) enables thickness measurement without support. The direct thickness measurement (right) needs a reference surface over which the foam foil is moved.

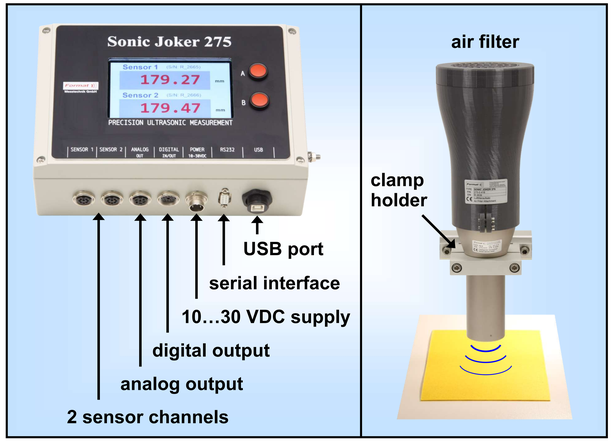

Fig. 4: The **Sonic Joker® 275** controller unit (left) has two ultrasonic sensor channels. Sonic Joker® 275 can be adapted to any process control via a serial interface, two analog and digital outputs, and a USB port. For operation in a dusty environment an air filter (right) can be attached to the **FX 150** housing.