



**Apply coating and glue on substrate  
in closed loop with non-nuclear  
Hammer-IMS basis-weight  
measurements with built-in controller**



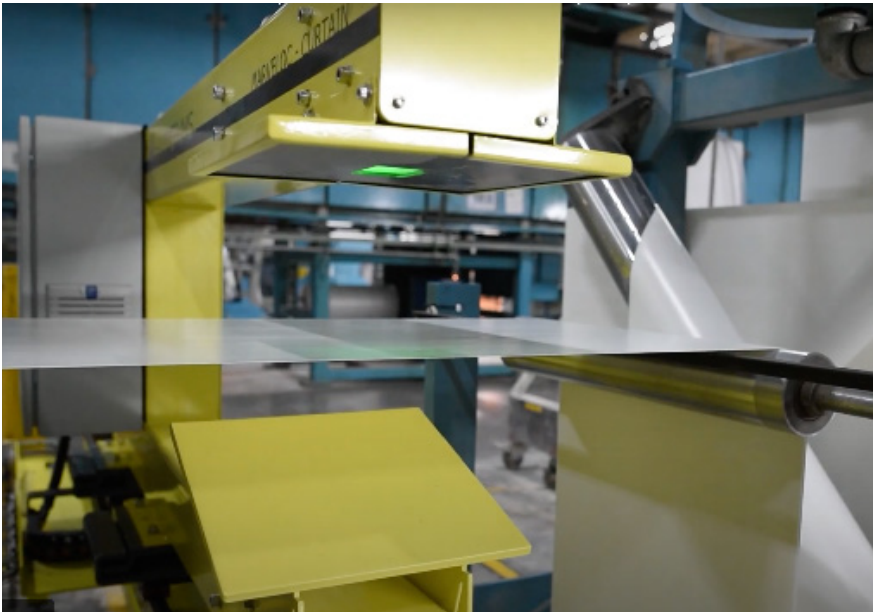
## **Save material and manpower through automated and consistent inline (knife) coating and gluing on textiles, paper, and other substrates**

There is a high demand for consistent inline application of coatings and glues in the serial production of various substrates. End customers are increasingly sensitive to finishing layers applied with constant thickness across the entire substrate surface. To ensure this, Hammer-IMS offers an M-Ray based measurement system which is able to control a doctor blade or coating knife in closed loop. By establishing the correct coating/glue thickness faster and automatically adjusting it, Hammer-IMS saves considerable material and operator effort.

There is a multitude of coated fabrics applications out there in the market. Coated fabrics are produced using various materials to make the substrate strong, waterproof, or resistant to dirt, chemicals, UV light and general abrasion. Fabrics (e.g. based on PVC, polyester, polyamide, glass, aramid) are applied with coatings containing hypalon, silicone, viton, etc. Also glue is applied to paper to produce stickers or other adhesive products.

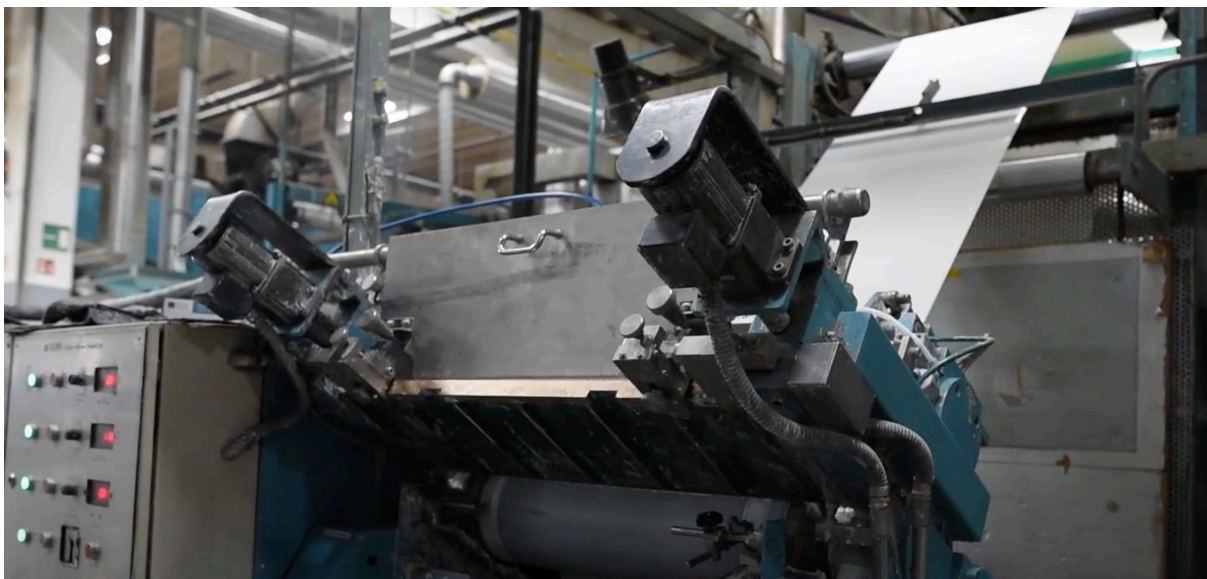
Knife coating is the most popular process in the market, where an excess of coating/gluing material is applied to a substrate (e.g. fabrics, paper) and removed by a blade to achieve the desired coating thickness. Various other coating/gluing methods exist among which kiss coating, calender coating, offset gravure coating, slot die coating, spray coating, reverse roll coating. In principle, most of them can be controlled by a closed-loop controller.

In most production lines, the adjustment of any finishing layer applied to substrates is still performed manually. The adjustment requires operators to stay around and use their skills to repetitively adjust the blade's height and angle. Instead, Hammer-IMS' combined controller enables automatic adjustment of both the height and the angle by exerting a double signal to both the left and the right actuator of the coating head, compensating both height and angle by a single actuator command at the same time. Working with a single command for both angle and height enables a better time resolution and therefore this system can work in highly-dynamic production lines, keeping thickness or basis-weight within specifications. The beating heart of this innovation is the tightly-connected dual PI-controller loop of Hammer-IMS.



Grandeco Wallfashion Group is one of the customers where Hammer-IMS installed a non-nuclear measuring machine with automatic closed-loop control of a knife coating step. The company is a leading worldwide producer of high-end vinyl wall coverings. The picture on the left shows the measuring part of the installation.

A turnkey solution like the one designed for Grandeco Wallfashion Group consists of a Marveloc-CURTAIN measuring system (see previous picture), a panel pc containing Connectivity 3.0 software with the Knife Feedback module, a PLC-based I/O system, and the electronic control signals driving the coating blade's left and right adjustment motors by means of a PWM signal. Optionally, Hammer-IMS can deliver the motor drivers, which generates the power to move the blade up and down or tilt it left to right. A typical motor-powered setup is shown in the picture below.



When setting up a new production, the coating/gluing is first manually adjusted to roughly arrive in the +/- 10% margin range of the blade before switching to automated adjustment. Compare this to a plane's autopilot capability. The pilot will typically use it once airborne and disable it before landing. If a measurement anomaly is perceived, the controller can shutdown itself optionally showing a visual or auditive alert. Key in the closed-loop adjustment is the production line speed. The settling time of the automatic feedback of the controller needs to be in accordance with the governing production line. Keeping track of production line speed is also important in maintaining controller stability over all process

setpoints. The distance between the coating/gluing station and the travel time between both play a role in this regard.

The screenshot displays a control interface for a Knife Feedback module. At the top, there is a window title bar with a close button (X). Below it, a yellow 'Yes' button is next to the 'Enable feedback' label. The interface is divided into several sections:

- SPEED:** Contains three input fields: 'Min allowable speed (m/min)' with a value of 20, 'Current speed (m/min)' with a value of 0, and 'Max possible speed (m/min)' with a value of 250. Each field has a small grid icon to its right.
- MOTOR OUTPUT:** Contains two motor control sections. The first is for 'Motor output left (rpm)' with a value of 0, featuring a red indicator light, an 'Up' button, and a 'Down' button. The second is for 'Motor output right (rpm)' with a value of 0, also featuring a red indicator light, an 'Up' button, and a 'Down' button.
- OFFSET:** Contains three input fields: 'Offset P value (rpm/gsm)' with a value of 5, 'Offset I value (rpm/(gsm\*s))' with a value of 0, and 'Current average value (gsm)' with a value of 0. A 'Reset' button is located below these fields.
- ASYMMETRY:** Contains three input fields: 'Asymmetry P value (rpm\*mm/gsm)' with a value of 50, 'Asymmetry I value (rpm\*mm/(gsm\*s))' with a value of 0, and 'Current asymmetry (gsm/mm)' with a value of 0. A 'Reset' button is located below these fields.

At the bottom of the interface, there is a yellow 'Yes' button next to the 'Refresh status' label, and a grey 'Apply' button next to the 'Apply changes' label.

The Knife Feedback module is straightforward in use with all relevant features and capabilities managed in one location. The entire closed-loop feedback controller is interfaced through a single software window. It gives a visual overview of the line speed, motor output, offset and angle (or asymmetry). For optimal production and compensation headroom, these values should always be mid-range. Note that automatic feedback can be toggled on and off by means of the master switch at the top of the screen. Green indicators show when motor adjustments are taking place.