# Next Generation Portable "Electronic Feeler Gage" For Maintaining Coater Gap Uniformity in Production

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## The Purpose And Scope Of The Work

Assessment of the advantages of various technologies used in measuring thin gaps in shop-floor coating operations with a concentration on slot die and roll coating. Introduction of a new portable non-contact thin gap sensor system with extended measurement ranges up to 500 microns (0.020 in.) with improved ease-of-use for auditing coater gap uniformity in production facilities. Operators will still be able to achieve repeatable coater gap uniformity better than 0.5 microns (20 micro inches). Simplicity of new system results in lower costs allowing firms to dedicate multiple systems for lower accuracy assessment in all their manufacturing sites. We will show specific application examples currently in use in the production of wall panels, batteries and foam-based products. The full system includes sensor wands, special wand holders and portable signal conditioning electronics with simple-to-use interface software. The presentation is of interest to personnel charged with the job of maintaining repeatable gaps to control product uniformity and quality.

## Contribution To The State-Of-The-Art

Capacitec is continuing to enhance the repeatability in pre-process control of the thinness of the coating applied to a variety of media using various coating methods with a concentration on the measurement of slot die and roller gaps. Several of Capacitec's customers who were using the traditional slot die coater in the lab *(*ref. *System 1)*, and consistently attaining the benchmark level of less than 0.25 micron gap uniformity of slot dies, requested that Capacitec develop a modified system for use on their shop floor. They wanted the new system (ref. *System 2)* to use the same base technology but to focus on the added requirements of lower cost, portability and the ability to survive the production environment. These new requirements were met and the portable instrument was introduced in 2006. The table below lays out the differences between the traditional lab based system and the new simplified portable "electronic feeler gage" system.

| *Feature* | *Lab based system (System 1)* | *Shop floor system (System 2)* | *Benefits of shop floor system* |
|---|---|---|---|
| Calibration/ # of channels | Full set of calibrations for up to 8 channels | *1 or 2 calibrations* | *Simplified for shop floor use* |
| Calibrated range and accuracy | Typical range from starting thickness is 250 microns = 10VDC Resolution: ± 0.025 microns Accuracy: ± 0.5 microns Repeatability: ± 0.25 microns | *Typical range from starting thickness is 500 microns = 10VDC Resolution: ± 0.05 microns Accuracy: ± 1.0 microns Repeatability: ± 0.5 microns* | *Can measure more gaps with fewer sensor wands at lower sensitivity* |
| Power | 120/240 VAC | *±15 VDC supplied by rechargeable portable battery pack* | *Portability, ability to reach limited access locations* |
| Connection to data acquisition and host computer | Analog input to PC laptop based Capacitec Bargrafx software | *• Built-in data logger • RS232 to host* | *Portability, convenience on shop floor* |

Additional benefits of the new system include; same high accuracy, two calibrations, readout in engineering units and a set-to-standard feature.

**Methods Used/ Essential Results Already Obtained**

The results below show lab testing of a GPD-2G (229 micrometers thick) sensor wand with a linear range of 479 micrometers inserted in a 300, 400 and an overscale 500-micron gap at a depth of 5.5 mm:

| Certified Gap: 300.00 microns | Certified Gap: 400.00 microns | Certified Gap: 500.00 microns |
|---|---|---|
| Plastic Guides: 254 microns thick | Plastic Guides: 381 microns thick | Plastic Guides: 483 microns thick |
| 300.17 | 397.09 | 496.58 |
| 300.03 | 397.14 | 496.24 |
| 300.05 | 397.06 | 495.63 |
| 300.08 | 397.07 | 496.01 |
| 300.07 | 397.09 | 495.28 |
| Average | Average | Average |
| 300.08 | 397.09 | 495.95 |
| Max. deviation | Max. deviation | Max. deviations |
| 000.17 | 002.94 | 004.72 |
| Average deviation | Average deviation | Average deviation |
| 0.09 | 0.05 | 0.67 |

**Results To Be Included In The Final Version Of The Paper**

Additional lab test results, new Gage R&R findings and further customer in production results of the new technology will be shared.