Non-Contact, Laser-Based Technology for Accurately Measuring the Length and Speed of Product in Paper Production

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Presentation Overview

- Intro: Productivity and quality challenges
- Non-contact laser measurement technology
- Application examples
- ROI of measurement accuracy
- Conclusion
- Questions
Introduction

- Global competition is fierce
- Manufacturers are driven to optimize productivity, improve quality, and remain economically competitive
- **Problem:** length and speed measurement inaccuracies cause costly rework, quality issues, material waste, and product returns
**Non-Contact Laser Gauge**

## Need for Accurate Length and Speed

Paper manufacturing segments and applications where length and speed measurement accuracy is critical.

<table>
<thead>
<tr>
<th>Paper Manufacturing Sector</th>
<th>Critical Application Process Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper operations</td>
<td>Continuous length</td>
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<tr>
<td>Packaging</td>
<td>Cut control</td>
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<td>Converting</td>
<td>Speed control</td>
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<td>Laminated paper</td>
<td>Stretch/draw control</td>
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<td>Coated paper</td>
<td>Product positioning</td>
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<tr>
<td>Extrusions</td>
<td>Quality control</td>
</tr>
<tr>
<td>Non-wovens</td>
<td>Index and positioning</td>
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</tbody>
</table>
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Common Measurement Approaches

- Contact measurement systems:
  - Rotary encoders
  - Wheel tachometers
  - Drive encoders

- Problems:
  - Slippage
  - Day-to-day wear
  - Debris build-up
  - Mark/damage product
  - Calibration and service

- Inaccuracies >1 – 2% or greater
## Non-Contact Laser Gauge

### LaserSpeed Non-Contact Technology

for accurately measuring length and speed

- Non-contact encoder
- Measures product directly
- Uses Laser Doppler Velocimetry (LDV) technology
- Highly accurate, repeatable product length and speed measurements
- Better than .05% accuracy, .02% repeatability
- Permanently calibrated
Non-Contact Laser Gauge

How LaserSpeed Works

Laser beam overlap region is where measurements are made. Detects moving product regardless of shape, surface, or color.
Non-Contact Laser Gauge

Laser Doppler Velocimetry (LDV) Theory

\[
d = \frac{\lambda}{2 \sin \kappa}
\]

\[
v = \frac{d}{t}
\]

\[
t = \frac{1}{f}
\]

\[
V = d \times f
\]

\[
L = \int_0^T v dt
\]
Non-Contact Laser Gauge

LaserSpeed Measurement Capabilities

- Measure product speeds to 39,000 ft/min (12,000 m/min)
- Stand-off distances to 39.4 in (1000 mm)
- Depth of field to 3.0 in (100 mm)
- Customizable pulse rates to 5 MHz
Non-Contact Laser Gauge

Application Examples

- **Profile:** Sanitary paper products manufacturing
- **Problem:** Inaccurate length measurement at slitter/rewinder station due to mechanical encoder errors – slippage, debris build-up
- **Solution:** LaserSpeed encoder provides near .05% length accuracy
- **Results:**
  - Eliminated 2% product giveaway
  - Realized $40,000 savings/yr
  - ROI in 3 months
Non-Contact Laser Measurement

Non-Contact Laser Gauge

Application Examples

- **Profile:** Packaging production
- **Problem:** Inaccurate cut control due to tachometer slippage, resulting in 90 ft of scrap with each change-over (25 per day)
- **Solution:** LaserSpeed encoder accurately measures product length/speed; provides precise pulse counts to control cutters
- **Results:**
  - No slippage errors
  - Cuts boards to target length during change-over
  - Potential savings of $202K/yr
  - Reduced maintenance costs
Non-Contact Laser Gauge

Application Examples

- **Profile:** Business paper manufacturing
- **Problem:** Over-supplying and shorting product by 2.5% due to tachometer slippage; also flying splice problem
- **Solution:** LaserSpeed encoder accurately measures length on rewind and controls tension on unwind
- **Results:**
  - Higher length & speed accuracy
  - Reduced product give-away and scrap
  - Precise control of splicing speeds
  - Decreased downtime
### Non-Contact Laser Gauge

**ROI of Measurement Accuracy**

<table>
<thead>
<tr>
<th>Example</th>
<th>Total give-away per line per year:</th>
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</thead>
<tbody>
<tr>
<td>355 production days per year</td>
<td>$88,565</td>
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<tr>
<td>22 hours of production a day</td>
<td></td>
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<tr>
<td>Line rate of 210 ft/min</td>
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<tr>
<td>Cost to manufacture material is $0.06/ft</td>
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<tr>
<td>Current encoder accuracy is 1.5%</td>
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</tbody>
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ROI of Measurement Accuracy

Savings are realized by:

- Minimizing product waste
- Reducing product shortages and overages
- Increasing product quality
- Eliminating maintenance
- Minimizing downtime
- Lowering the cost of ownership
Conclusion

- Important that paper manufacturers look at proven ways to increase productivity, product quality, and bottom-line
- Implementing a highly accurate length and speed measurement system is key
- The LaserSpeed non-contact encoder has been proven on many types of manufacturing processes
- Result is precision length and speed measurements for today’s quality-driven manufacturers
Non-Contact Laser Gauge

Thank You -- Questions