L&W Autoline 400 is the fastest and most accurate automatic system for paper testing on the market. More than 50 properties can be measured and calculated within a few minutes. Short feedback time is a very important part of the process control. Everything from newsprint to heavy linerboard and cardboard can be measured by L&W Autoline 400.

L&W Autoline greatly reduces, or even eliminates, traditional sources of variation in paper testing, such as:

- **Operator and instrument variation.** Unlike using individual bench top instruments for testing, L&W Autoline 400 requires no operator involvement and no specialized skills.

Thus, differences in lab results, due to tester changes or different operating techniques, are avoided. With L&W Autoline 400, the operator simply inserts the sample and it is automatically tested and fed through the system.

- **Sample preparation.** Sample preparation is one of the most important and often ignored areas causing testing variation. Manually cutting samples from a jumbo reel is difficult to duplicate from reel to reel, much less from operator to operator. Incorrect cut samples from the reel can affect how the individual test pieces are prepared as well as the orientation of the sample in the test instrument. When using L&W Profile Sample Cutter, samples are collected the same way every time, ensuring consistency and less variability.

- **Testing in the true MD and CD direction.** Manually cutting samples from the reel and then cutting the individual test pieces presents another opportunity for variation. If samples are not cut straight, you cannot test in the true
MD and CD direction. Not testing in the true MD and CD direction will introduce variations as well as poorer test results. With L&W Profile Sample Cutter, the samples are cut in the true CD direction. With L&W Autoline 400 the precise feeding of the sample ensures testing in the true MD and CD direction every time.

- **Same position testing.** Not testing in the same position on the reel every time could simply be showing position variations, rather than an actual quality problem. Contrarily, this fault could also be hiding existing or developing problems. L&W Autoline 400 utilizes a precise feeding mechanism, to ensure measurement at exactly the same position every time. This also facilitates long-term comparisons of a particular cross machine position in order to analyse MD variations.

- **Increasing the number of data points.** Increasing the number of positions tested makes the average of those measurements statistically more reliable. With L&W Autoline 400 testing volume is considerably increased compared to manual testing. It is possible to test every property, every reel, every time.

**Financial benefits**

Highly skilled personnel no longer need to carry out repetitious and routine functions. This type of work can now be performed more cost effectively by automatic paper testing equipment, leaving technicians more time to concentrate on the process and quality improvements, rather than measurement and data collection.

**Increased productivity results**

- Speed increase on dryer-limited grades
- Weight decrease (when sold by area or strength)
- Less downgraded product
- Reduced grade change losses
- Reduced start-up time
- Reduced breaks

**Improved quality**

- Improved market share
- Reduced customer complaints
- Reduced machine-direction variability
- Reduced cross-direction variability

**Reduced costs**

- Reduced steam costs per ton
- Reduced fibre usage
- Total weight increase (when sold by weight)
- Substitution of recycle for virgin fibre
- Substitution of fillers for fibre
- Decreased chemical additive costs
- Reduced refining
- Reduced freight costs
- Manpower optimization

**Benefits**

- Measures and calculates more than 50 different properties, most of them according to international standards
- Warning alert if the measurement results are outside specified targets and limits
- Fast – about 8 minutes to measure a profile at 20 positions
- Results are easily accessible via the mill's local area network
- Several pre-programmed testing sequences available
- Remote viewing station provides real time data
L&W Autoline 400 – code 411

Technical specifications

L&W Autoline 400 is delivered and installed as a complete system, with the following main components:
- L&W Autoline 400
- L&W Autoline 400 software
- Computer and keyboard
- Report printer
- Interface for host computer communication
- Capability for networking with other L&W Autoline 400 units
- Installation, start-up and training on-site by Lorentzen & Wettre personnel

Measurements

- Smoothness, Bekk, Oken
- Roughness, Bendtsen, Sheffield and PPS
- Air permeance, Bendtsen, Gurley and Sheffield
- Thickness
- Bursting strength, version P and J (Paper and board respectively)
- Tearing strength
- Bending resistance
- Moisture
- Gloss
- Grammage/Basis weight
- TSO
- Optical testing
- Dynamic absorption and wettability
- Formation
- Surface formation
- Tensile
- Roughness – stylus type
- Compressive strength (SCT)

Grammage range

15–800 g/m² (3–160 lb/1000 ft²) Depending on sample thickness and stiffness

Measuring time

Depending on which modules are activated, the sample length and the number of positions measured

Installation requirements

Power

Total consumption: depends on the modules included

Instrument air

0.6–1 MPa

Consumption depends on the modules included

Options

- Bar-code reader
- Bar-code printer
- L&W Sample Loading System, code 525
- L&W Profile Sample Cutter, code 148
- L&W Sample Trimmer, code 149

Dimensions

2.85 × 1.5 × 0.9 m

112 × 59 × 35 in

6 m³

210 ft³

Net weight

500–900 kg

1100–1980 lb

Gross weight

600–1000 kg

1300–2200 lb

A complete product specification “L&W Autoline 400 Product Profile” as well as other product information can be obtained from your local Lorentzen & Wettre company or distributor.
Wide choice of measuring modules

L&W Autoline 400 is configured with measurement modules that can be freely selected and combined for the desired cross-profile measurements. The majority of modules measure according to current industry standards.

L&W Autoline Smoothness, Bekk
Code 513
L&W Autoline Smoothness measures the smoothness on both sides of a paper sample, according to the Bekk method. Test results are reported in Bekk seconds. The measurement method is most often used on fine and ultra smooth paper, but can also be used on paper with a coarser surface.

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
</tr>
<tr>
<td>Measurement pressure</td>
</tr>
<tr>
<td>Standards</td>
</tr>
</tbody>
</table>

L&W Autoline Smoothness, Oken
Code 512
L&W Autoline Smoothness Oken measures smoothness according to the Oken method on both sides of the paper. Test results are reported in Bekk seconds. The measurement method is most often used on fine paper.

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
</tr>
<tr>
<td>Measurement pressure</td>
</tr>
<tr>
<td>Standards</td>
</tr>
</tbody>
</table>

L&W Autoline Roughness, PPS
Code 541 U/D (upper/double)
L&W Autoline Roughness measures surface roughness according to the PPS method on the topside, or both sides of the paper sample with one measuring head.

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
</tr>
<tr>
<td>Clamping pressure</td>
</tr>
<tr>
<td>Standards</td>
</tr>
</tbody>
</table>
L&W Autoline Roughness, Sheffield
Code 514 U/D (upper/double)
L&W Autoline Roughness (Sheffield), measures surface roughness according to the Sheffield method. A measuring head is applied to the sheet, from the top side or both sides.

<table>
<thead>
<tr>
<th>Specification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>5–400 Sheffield Units (SU)</td>
</tr>
<tr>
<td>Test air pressure</td>
<td>9.85 kPa</td>
</tr>
<tr>
<td>Standards</td>
<td>APPITA AS 1301.441, PAPTAC D.29P, ISO 8791/3, TAPPI T538</td>
</tr>
</tbody>
</table>

L&W Autoline Roughness, Bendtsen
Code 515 U/D (upper/double)
L&W Autoline Roughness (Bendtsen), measures surface roughness according to the Bendtsen method. A measuring head is applied to the paper sheet, from top side or both sides. The measurement is performed with pressure compensation according to SCAN P84.

<table>
<thead>
<tr>
<th>Specification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>50–4000 ml/min (SCAN P84), 50–2800 ml/min, not corrected</td>
</tr>
<tr>
<td>Measurements pressure</td>
<td>98 or 490 kPa</td>
</tr>
<tr>
<td>Standards</td>
<td>APPITA AS 1301.440, DIN 53108, ISO 8791/3, TAPPI T538</td>
</tr>
</tbody>
</table>

L&W Autoline Roughness, Stylus type
Code 548
L&W Autoline Roughness – Stylus type, measures surface topography of paper and board products. It has the ability to detect, evaluate and analyze surface characteristics that affect printing quality.

<table>
<thead>
<tr>
<th>Specification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning length</td>
<td>76 mm (3 in)</td>
</tr>
<tr>
<td>Stylus radius</td>
<td>25 µm</td>
</tr>
<tr>
<td>Reference head diameter</td>
<td>38.1 mm (1.5 in)</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>25 µm (0.000010 in)</td>
</tr>
<tr>
<td>Standards</td>
<td>TAPPI T575</td>
</tr>
</tbody>
</table>
**L&W Autoline Bursting Strength P and J**
**Code 519 U/L – P type (upper/lower)**
**Code 520 U/L – J type (upper/lower)**
L&W Autoline Bursting Strength measures the bursting strength of paper (P type) or board (J type) from the bottom or top side of the sample.

**Specification**
- **P type**: 70–2000 kPa
- **J type**: 170–5000 kPa

**Standards**
- P type: APPITA AS 1301.403, BS 3137, PAPTAC D.8, ISO 2758, SCAN P24, TAPPI T403
- J type: APPITA AS 1301.438, BS 3137, ISO 2759, SCAN P25, TAPPI T807

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**L&W Autoline Compressive Strength STFI**
**Code 530**
L&W Autoline Compressive Strength STFI measures the compressive strength of liner and fluting, according to the short-span compression test (SCT) method, developed by the Swedish Pulp and Paper Institute (STFI) in collaboration with Lorentzen & Wettre.

**Specification**
- **Grammage**: approx. 100–400 g/m²

**Standards**
- APPITA AS 1301.450 rp, BS 7325, DIN 54518, ISO 9895, SCAN P46, TAPPI T826

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**L&W Autoline Tensile**
**Code 510**
L&W Autoline Tensile measures the tensile strength and the tensile stretch of paper in the machine (MD) and cross (CD) directions of a paper sample.

**Specification**
- **Tensile strength**: up to 83 kN/m (depending on load cell and sample strain)
- **Elongation**: 1–15%
- **Tensile Energy Absorption**: Calculated

**Standards**
- Closely related to SCAN P67, ISO 1924/3

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**L&W Autoline Tearing Strength**
**Code 522**
L&W Autoline Tearing Strength measures the tearing strength of a paper sample, in the machine (MD) and cross (CD) directions. The values obtained can be recalculated to values according to the Elmendorf method using a formula in the L&W Autoline 400 software.

**Specification**
- **Tearing strength**: (measuring range for three different versions)
  - P type: 50–1700 mN
  - J type: 100–3400 mN
  - J type: 200–6800 mN

**Standards**
- Calculated to Elmendorf Tear (APPITA AS 1301.400S, BS 4468, PAPTAC D.9, DIN 53128, ISO 1974, NF Q03-011, SCAN P11, TAPPI T414)
L&W Autoline Bending Resistance
Code 542 and 543
L&W Autoline Bending Resistance measures the bending resistance of paper and board in the machine (MD) and cross (CD) directions of the paper sample and in two directions, upwards and downwards.

**Specification**
- **Bending length**: 10 mm (542), 50 mm (543)
- **Grammage range**: 80–150 g/m² (542), 150–500 g/m² (543)
- **Bending angle**: 5°, 7.5° and 15°
- **Sample width**: 38 mm
- **Bending velocity**: 5°/s
- **Standards**: DIN 53 121, ISO 2493, 5628, SCAN P29, TAPPI T556

L&W Autoline Grammage
Code 538
L&W Autoline Grammage measures the grammage or basis weight of paper samples.

**Specification**
- **Grammage range**: approx. 20–800 g/m²
- **Standards**: ISO 536, ASTM D646-96, SCAN P6, TAPPI T410

L&W Autoline TSO
Code 626
L&W Autoline TSO measures TSO (Tensile Stiffness Orientation) and TSI (Tensile Stiffness Index) properties. It is an ultrasonic measurement, which is a non-destructive and easy method to evaluate a paper’s elastic properties and its orientation.

**Specification**
- **TSI**: 0–25 kNm/g
- **TSI\_AREA**: 0–3000
- **TSO**: 0 to 90 degrees
- **Standards**: N/A

L&W Autoline Gloss
Code 524 U/D (upper/double)
L&W Autoline Gloss measures the gloss value in machine direction (MD) of a paper sample. This is performed either at the reflection angles 75°/20° (according to TAPPI standards) or at 75°/45° (according to DIN).

**Specification**
- **Measuring range**: 0–100 Gloss units
- **Standards**
  - TAPPI 75°: ISO 8254-1, TAPPI T480
  - TAPPI 20°: ISO 8254-3, TAPPI T653
  - DIN 75°: ISO 8254-2, DIN 54502
  - DIN 45°: DIN 54502
**L&W Autoline Brightness, Opacity and Colour**
**Code 539U (upper)**

L&W Autoline Optical (ISO version) measures brightness, opacity and color of paper samples using a diffuse illuminant and a zero degree observation angle.

**L&W Autoline Brightness, Opacity and Colour**
**Code 539L (lower)**

**Standards**

**L&W Autoline Thickness**
**Code 618**

L&W Autoline Thickness, measures thickness/caliper of a paper sample. It is based on the well-proven L&W Micrometer, standalone instrument. The module enables automatic measurements with very high precision. Values obtained during the measurement can be presented in metric or fps units, in accordance with the specified standard.

**L&W Autoline Air Permeance**
**Code 516**

The L&W Autoline Air Permeance module measures air permeance of paper according to the most common method. The values obtained can easily be recalculated to give air permeance values in accordance with Bendtsen Gurley and Sheffield methods.

**L&W Autoline Air Permeance, Low Range**
**Code 517**

L&W Autoline Air Permeance, low range, module measures the air permeance for greaseproof paper, conductor insulation paper, release paper and similar paper grades with low air permeance.

**Specification**

<table>
<thead>
<tr>
<th>Reflectance</th>
<th>0–200%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0.003–100 µm/Pa s, 2–40000 Gurley s, 0.3–8800 Bendtsen ml/min, 0.2–1400 Sheffield units</td>
</tr>
<tr>
<td>Test air pressure</td>
<td>20 kPa</td>
</tr>
<tr>
<td>Standards</td>
<td>APPITA/AS 1301.426, 1301.427, DIN 53105, ISO 534, SCAN P7, TAPPI T411</td>
</tr>
</tbody>
</table>

**L&W Autoline Thickness**
**Code 618**

L&W Autoline Thickness, measures thickness/caliper of a paper sample. It is based on the well-proven L&W Micrometer, standalone instrument. The module enables automatic measurements with very high precision. Values obtained during the measurement can be presented in metric or fps units, in accordance with the specified standard.

**L&W Autoline Thickness**
**Code 618**

**Specification**

| Range       | 0.1–15000 µm |
| Resolution  | 0.1 µm |
| Lifting height | 15 mm |
| Measuring surface | 2 cm² |
| Cleaning function | Automatic cleaning and zero setting before profile start |
| Standards   | APPITA/AS 1301.426, 1301.427, DIN 53105, ISO 534, SCAN P7, TAPPI T411 |

**L&W Autoline Air Permeance**
**Code 516**

The L&W Autoline Air Permeance module measures air permeance of paper according to the most common method. The values obtained can easily be recalculated to give air permeance values in accordance with Bendtsen Gurley and Sheffield methods.

**L&W Autoline Air Permeance, Low Range**
**Code 517**

L&W Autoline Air Permeance, low range, module measures the air permeance for greaseproof paper, conductor insulation paper, release paper and similar paper grades with low air permeance.

**Specification**

| Measuring range | 0.003–100 µm/Pa s, 2–40000 Gurley s, 0.3–8800 Bendtsen ml/min, 0.2–1400 Sheffield units |
| Test air pressure | 20 kPa |
| Standards | See page 206-207 |

**L&W Autoline Air Permeance**
**Code 516**

The L&W Autoline Air Permeance module measures air permeance of paper according to the most common method. The values obtained can easily be recalculated to give air permeance values in accordance with Bendtsen Gurley and Sheffield methods.

**L&W Autoline Air Permeance, Low Range**
**Code 517**

L&W Autoline Air Permeance, low range, module measures the air permeance for greaseproof paper, conductor insulation paper, release paper and similar paper grades with low air permeance.
L&W Autoline Moisture
Code 523
L&W Autoline Moisture measures the water content in the paper using the well-proven microwave method with double-frequency resonance. The moisture content of the paper is calculated with the help of grammage information from L&W Autoline Grammage Module, code 538.

<table>
<thead>
<tr>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>Moisture</td>
</tr>
<tr>
<td>Standards</td>
</tr>
</tbody>
</table>

L&W Autoline Dynamic Absorption and Wettability
Code 544
L&W Autoline Dynamic Absorption and Wettability is used for the rapid optical evaluation of contact angle (wettability), volume (sorption) and drop base diameter (spreading) as a function of time. Applications include the evaluation of printing problems such as mottling, feathering, and bad ruling. Other applications such as coating, sizing, gluing with hot melt and water based glues, surfactants, bio-sensors, and powders can also be studied.

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Droplet size</td>
</tr>
<tr>
<td>Droplet accuracy</td>
</tr>
<tr>
<td>Contact angle, measuring range</td>
</tr>
<tr>
<td>Timing precision</td>
</tr>
<tr>
<td>Number of images</td>
</tr>
<tr>
<td>Standards</td>
</tr>
</tbody>
</table>

L&W Autoline Formation
Code 545
L&W Autoline Formation is a camera based image analyzer. The analyzing software uses advanced algorithms to quantify formation quality at several different scales of formation. The values at these various levels of formation have been found to strongly correlate with important properties of paper and board.

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammage range</td>
</tr>
<tr>
<td>Standards</td>
</tr>
</tbody>
</table>

L&W Autoline Surface Formation
Code 545S
L&W Autoline Surface Formation is a camera based image analyzer. The analyzing software uses advanced algorithms to quantify formation quality at several different scales of formation. The values at these various levels of formation have been found to strongly correlate with important properties of paper and board. Measurements are made on the surface of the sample and therefore not affected by grammage. This method was developed in order to measure white-top linerboard and to quantify the ‘show through’ from the brown layer underneath.

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammage range</td>
</tr>
<tr>
<td>Standards</td>
</tr>
</tbody>
</table>
L&W Autoline S-Test
Code 534
L&W Autoline S-Test measures the failure strength of a test piece loaded in compression, when the initial span width is 4 mm and the offset is 1 mm. One of the critical strength properties for Fluting medium is Concore Medium Test (CMT). The S-Test simulates the initial failure in a CMT test, known as the CMT first peak value.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammage</td>
<td>Approx. 70–400g/m²</td>
</tr>
<tr>
<td>Standards</td>
<td>N/A</td>
</tr>
</tbody>
</table>

For more information, please contact:

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P.O. Box 4
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Sweden
Tel: +46 8 477 90 00

www.abb.com/pulpandpaper

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