Paper makers have limited information from infrequent manual samples to try and optimize refining. L&W Freeness and Fiber Online provides accurate and continuous fiber morphology measurements for the wet end. This enables closed loop control and uniform pulp furnish for better runnability on paper, board or tissue machines, helping make more on spec product at less cost.

Overview
With ABB L&W Freeness and Fiber Online, mills can take advantage of the combined and more frequent online measurement of both freeness and fiber properties, giving the full picture of dewatering status and fiber quality in real time to take immediate action. As a single unit that is both easy to use and maintain with few moving parts, ABB offers exceptional reliability making this one of the lower total cost of ownership options with the highest accuracy and availability.

ABB’s well-proven pulp samplers automatically collect pulp before and after refiners to ensure that the target set point value is being met while also quickly providing multiple pulp quality parameters without any difficult and time-intensive manual sample collection. ABB’s combo freeness and fiber unit can be connected with up to eight samplers and can handle a process consistency of up to 8%.

Data is available on the unit touch screen, integrated with 800xA or via OPC for third-party DCS. With this information readily available and continuously updated, variation can be discovered as early as stock preparation. Mills can easily pinpoint issues, identify trends and make process adjustments sooner, helping ensure specifications are met while optimizing fiber usage and eliminating over refining.

Features
- Automatic online sampling of the process at multiple positions with up to 8 samplers
- Measures according to ISO and TAPPI standards
- Frequent data with up to 300 measurements per day enabling operators to correct control actions
- Automatic cleaning functions using integrated detergent pumps
- Integrated input of manual samples
- Few moving parts
- Integration with ABB Ability™ System 800xA

Benefits
- Provides fast and accurate measurement
- Enables closed loop control for more consistent quality
- Helps optimize refining and reduce energy consumption
- Improves machine runnability with more uniform pulp furnish
- Decreases wet end sheet breaks
- Enables faster grade changes
- Excellent correlation to lab measurement results
- Low maintenance and operational costs
- Enables resources to focus on quality optimization and value-added tasks
Easy to place and maintain
L&W Freeness and Fiber Online is designed to be robust and reliable, and works well even in demanding process environments withstand the harshest conditions. The small footprint electronic cabinet is IP65 classified, which makes it possible to place the unit close to the refiners or the production lines. L&W Freeness and Fiber Online has a touch screen, integrated water house, and separates electronics from the measurement chamber and camera. All components are easily accessible from the front ensuring high uptime and easy-but-minimum maintenance.

Control system integration
L&W Freeness and Fiber Online offers integration to 800xA with dedicated faceplates, alarm handling and trending of measurements – making immediate action by the operator easier. OPC connection to third-party DCS is also available.

According to standards
L&W Freeness and Fiber Online measures Canadian Standard Freeness (CSF) or Schopper-Riegler (SR or MSR), which relates to TAPPI (T-227) and ISO (5267-1 and 5267-2) standards in the following ways:
- Diluted to correct consistency (0.3% or 0.2% depending on standard)
- Screen plate identical to standard
- One liter sample is analyzed
- Compensation for consistency and temperature
- Water measurement between samples
- Double measurement set-up

Fiber properties are measured according to international standards (ISO 16065-2); it is based on ABB's well-known L&W Fiber Tester Plus, a laboratory instrument that is used by hundreds of mills and is a preferred tool of research centers and universities.

Measurement principle
ABB's well-proven sampler automatically takes a representative sample from the process pipe. The sample is pushed to the freeness dilution tank, where the sample is diluted to approximately 0.3% for CSF or 0.2% for SR. To reduce analyzing time, the next sample is pushed forward and is held in its pipe until the sample before it is finished. The first sample is then transported to the freeness measurement chamber and a small part of the diluted sample is transferred to the fiber dilution tank.

In the freeness measurement chamber a pulp pad is created over the screen as it dewaters. The dewatering rate is measured with an ultrasonic sensor. The second sample is then moved to the dilution tank. Mathematical operations are made to calculate the corresponding CSF, SR or MSR value. The result is compensated with the correct consistency from the optical sensor and the temperature is measured and compensated for as well, according to standards. The pulp pad is cleaned out from the freeness chamber by air and water to create turbulence; then it is flushed to drainage. The second sample is transported to the freeness chamber for measurement.

The sample that is transferred to the fiber dilution tank is diluted further. The pulp sample is then passed through a measuring cell where the fibers are detected by the camera. Two-dimensional image technology ensures a good alignment of fibers by using a very small measurement gap (according to ISO standard). After the chosen number of fibers have been detected by the camera, the fiber system is flushed and cleaned with water to minimize residual fibers between measurements.

Measured properties
Fiber length is an important property of pulp, and longer fibers generally improve the strength properties up to a certain point. Very long fibers are more easily entangled with each other, giving the sheet poor formation. This unit is designed to measure true fiber length.

Fiber width decreases when lignin is removed. Thinner fibers, if all other dimensions are constant, provide a better and more even formation in the sheet. A low fiber width will give a sheet a more even surface. In L&W Freeness and Fiber Online the calculation principle allows for detection of variations of parts of µm.

Shape factor is an important measure of pulp quality and is defined as the ratio of the maximum extension length of the fiber to the true length of the fiber. A high shape factor, or form factor, means straight fibers and enables good mechanical properties in the sheet. It is well correlated with tensile strength and tensile stiffness. A gently treated laboratory pulp has quite straight fibers, whereas there are several process stages in a mill that are potential curlers of fibers, like presses, mixers etc.

Fibril area and perimeter are calculated based on area and perimeter respectively. Fiber bonds, which are considered to consist of hydrogen bonds, are rather weak. To increase the bonding strength, the fibers are refined where the fiber surface is roughened (fibrillated) creating a larger contact area for bonding between the fibers. It is also a useful index of the amount of mechanical treatment given to the pulp.

Fines are regarded in two classes, P and S. A coarse fines class (P) and a fines class (S) are reported. Fines often have a different impact on processes and products than the fibers. Before treatment (i.e. beating), only P fines are present and ray cells are included in this classification. P fines have poor bonding properties. S fines are created during beating and may improve sheet strength. Fines have a negative effect on dewatering and pressing.

Canadian Standard Freeness (CSF) measures the rate at which a dilute suspension of pulp may be dewatered. The drainage rate has been shown to relate to the surface conditions and swelling of the fibers. It is a commonly used index to measure the amount of mechanical treatment given to the pulp.

Schopper-Riegler (SR) is another method for measuring the rate at which a dilute suspension of pulp may be dewatered. The SR method is intended for long fibered pulps. It is a commonly used index to measure the amount of mechanical treatment given to the pulp. Modified Schopper-Riegler (MSR) can also be reported.

Example of a gray scale image of a single softwood fiber
### Technical specifications

**L&W Freeness and Fiber Online, code 951**

<table>
<thead>
<tr>
<th>Measurement Frequency</th>
<th>5–7 minutes/sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Samplers</td>
<td>1–8 samplers</td>
</tr>
</tbody>
</table>

**Measurement Freeness**

<table>
<thead>
<tr>
<th>Screen Plate</th>
<th>97 holes per cm², hole diameter 0.5 mm (0.02 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring Range</td>
<td>CSF: 700–20ml, SR: 10–90 SR° (same for MSR)</td>
</tr>
<tr>
<td>Consistency</td>
<td>Controlled and adjusted to 0.2% or 0.3%</td>
</tr>
<tr>
<td>Temperature</td>
<td>Compensating for temperatures differing from 20°C (68°F)</td>
</tr>
</tbody>
</table>

**Measurement Fiber**

| Technical Details     | Monitoring of fibers during measurement. Sample amount typically 0.1 g dry weight pulp, not critical |
| Measurement Results    | Weighted averages for length, width, fibril area, fibril perimeter, shape factor and two classes of fines (S and P) are reported. Number of measured fibers, Number of fibers in sample, Optional measurements: blend, vessel and kink |
| Measurement Range      | Length according to ISO and Tappi standards (ISO: 0.2–7.5mm, Tappi: 0.1–7.5mm), Width from 4 μm, Resolution within measurement range is 0.1 μm for an average SW fibers, Shape factor (0) 50–100%, Fines l < 0.2 mm or l < 0.1 mm depending on used standard for length |
| Repeatability         | Length 1.5%, width 1% and shape 0.5% of average |
| Sample Types          | Up to 8 grades per sampling position |

**Installation Requirements**

| Power                 | 100–120 V or 200–240 V |
| Water                 | Filtered to 10 μm or better with sufficient flow rate |
| Water Pressure        | 0.5–0.8 MPa (5–8 bars) |
| Water Temperature     | 20 ±10°C |
| Water Consumption     | Average water consumption for freeness measurements: 146 L/min (4937 fl oz US/h), Average water consumption for fiber measurements: approx. 150 l/h 10–15 samples á 10 l (5072 fl oz US/h, 10–15 samples á 2.64 US) |
| Instrument Air        | Air supply shall follow standard ISO 5837-1 Air class 2-4-3 |
| Air Pressure          | 0.5–0.7 MPa (5–8 bar) |
| Hoses for Samplers    | Air: Ø 6 mm (1/4 in) water resistant polyurethane ether (PU) or polyamide (PA), Water: Ø 16 mm (5/8 in) water resistant polyurethane ether (PU) or polyamide (PA) |
| Sample Transportation | Ø 16 mm (5/8 in) water resistant polyurethane ether (PU) or polyamide (PA) |
| Cables for Samplers   | 5 x 0.38 mm² |
| Enclosure Class       | Safety and water protection IP65 |

**Connections**

| Data Output           | 4–20 mA OPC UA (optional OPC UA to DA Gateway) |

### Sampling

**Recommended no. of sampling points**

- 2–8

**Pulp Consistency in Pipe**

- Max. 8%

**Min. Pressure in Pipe**

- Consistency 1–3%: 1 bar
- Consistency 3–5%: 1.5 bar
- Consistency 5–8%: 2.5 bar

**Distance between Sampling Point and Cabinet**

- Max. 100 m

### Dimensions

- L&W Freeness and Fiber Online: 2070 × 1750 × 500 mm (81.4 × 69.9 × 9.7 in)
- Sampler: 400 × 340 × 310 mm (15.7 × 13.4 × 12.2 in)

### Net Weight

- L&W Freeness and Fiber Online: 320 kg (706 lb)
- Sampler: 4 kg (8.8 lb)

### Applicable Standards

- ISO 5267-2, ISO 5267-1, ISO 16065-2, and TAPPI T227
Learn more
For decades, as leading supplier of fiber testers and freeness laboratory measurements, we have the knowledge, products and experience to help our customers achieve their measurement objectives. Please contact us to learn more about how our products can help optimize your production.

Inside L&W Freeness and Fiber Online

Sample inlet and control (1–8 units)
Sample handling and dilution to 0.2% or 0.3% according to standards
Touch screen for easy setup and maintenance
Fiber dilution tank
Drain to water or process
Freeness module with screen plate according to standards
Camera and optics measurement cell

The information provided in this data sheet contains descriptions or characterizations of performance which may change as a result of further development of the products. Availability and technical specifications are subject to change without notice.
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