Over 40 years of experience and over 40,000 blade type transmitters delivered have been the proven platform for SMART-PULP development. The sensors available today have gone through our intensive research process where sensitivity to fiber consistency and ideal flow compensation have been the goals and the ways to meet the papermakers’ requirements.

To ensure our customers maximum value and to assure the highest level of applications integrity, we have developed software tools such as the Cs-Advisor. Cs-Advisor has made transmitter selection easier than ever before, and clear installation instructions for each specific application guarantee the best possible performance based on the actual process conditions.

SMART-PULP is cost-efficient and easy to install.

**Flow compensated fiber consistency transmitter**

Improvements in mechanics, electronics and software have led to faster installation, calibration and start-up. Calibration can be accomplished before or after installation. In most cases the fine-tuning can be done using single point calibration. “First day calibration is the final calibration” and “the first transmitter that is capable of measuring wide consistency ranges instead of one point” are familiar comments among SMART-PULP users.

SMART-PULP has a library of over 40 ready-made calibration curves for different pulp grades and sensor types. This library can be used to set up the calibration for each application separately. When running different grades in the same process line up to 8 recipes can be contained within the unit. The recipes can be selected using our operator terminal, a HART® communicator or binary inputs, whichever best suits the user.

**Quick installation and start up**
Neles FieldBrowser condition monitoring system.

SMART-PULP is provided with HART® communication and it can be connected to Metso Automation chambers, commonly used with rotor cutting machines. This may sound obvious, but it is a closer look at the flow profile of pulp which makes a difference. Measurement of stock flow profiles is needed. Met- software. The driving force behind this development project has been and continues to be a desire to improve production processes and equipment for improving the pulp and papermaking process.

Superior performance

Obtaining a truly representative measurement signal is one of the primary goals of the product development in Metso Automation. This may sound obvious, but a closer look at the flow profile of pulp shows the need for measurements from the start. This is the only way to ensure a fast and representive measurement. Many flow instruments in high demanding applications and high intensity research with different pulp grades and without understanding of dough flow profiles.

There are several ways to get around this challenging problem. Measurement chambers, commonly used with rotory type shear force transmitters, are one of them. The drawback is an extremely slow and filtered measurement signal. Higher purchase cost, as well as higher installation, maintenance and operating cost can also be associated with rotating type technology. Too often, manufacturers of blade type transmitters claim that one blade is all it takes to get a good measurement. This is clearly not the case. Metso Automation has found out that installing multiple transducers will cause significant sensitivity change due to temperature variations, and these changes can cause significant errors in the measurement signal if not compensated for. We are the only manufacturer of shear force transmitters to recognize this, and have added temperature compensation as a standard feature to our SMART-PULP transmitters.

Saveall

At the saveall, the SMART-PULP transmitter can be used to measure the consistency of disc fiber. Consistency at this point is about 1.2-1.3 %CS. When the feed consistency is below 1.2 %CS, the SMART-PULP transmitter can be used. Chemical pulp fibres fed from the mixing chest are used as an example. With SMART-PULP the maximum 85% chemical pulp consistency is 1.2 %CS.

Small details make the difference

Mechanical construction is the key element in consistency measurement with shear force transmitters. Robust design with a metal diaphragm process seal, golden bearing with journals and overall protection has made SMART-PULP a long lasting transmitter for the harsh process environment. SMART-PULP requires no regular maintenance. Transmitter performance can be easily evaluated if the mill standards require it. Long-term drift, sensitivity and response can be verified quickly in the instrument shop.

Separate temperature compensation for the electronics, shear force sensor and process temperature may sound unnecessary, but machine start up requires accurate and immediate consistency control. Water viscosity and fiber stiffness change due to temperature variations, and these changes can cause significant errors in the measurement signal if not compensated for. We are the only manufacturer of shear force transmitters to recognize this, and have added temperature compensation as a standard feature to our SMART-PULP transmitters.

Doing the right things right, focusing on customer needs, employing dedicated designers and engineers, a strong support organization, maintenance and calibration, and keeping an open eye for new technology have made SMART-PULP the market leader among shear force transmitters.

SMART-PULP sensors

Exhaustive laboratory research is the basis for our sensor (blade) development. The growing demands for recycled fibre have changed the requirements for shear force measurement in this area. There is lower speed to measure better accuracy needed, debris that causes fouling and mechanical damage, etc. We have developed two sensors specifically to cover these OMP and OCC applications. This speaks for our commitment to finding better solutions for stock preparation and papermaking.

Process temperature

Sensor temperature

Electronic temperature

Some of the sensors available:

- The WS sensor was developed for uncoated recycled fibres where strip, micro-ions, plastics, and dusts can cause contamination and disruptions. Aseptic design reduces mechanical damage to the transmitter, temperature measurement and the process piping prevents contamination and erosive damage on the sensor and process protection against mechanical damage.

- The HL sensor was designed for consistencies from 4 %CS and up. The fibre flow and line core pulp content, large particles (fibres etc) which can disturb the measurement signal. OMP target is the highest blade with the smallest possible impact area with no rubbing surfaces. The HL sensor needs these challenging requirements.

- The HL sensor was made for short fibres such as OMP and TMD and in a very short time it has taken the market leadership in this process. This would not have been possible without the smallest impact area in real processes all over the world.
The transmitter is also AMS-compatible (AMS = Asset Management Solutions system). Neles FieldBrowser condition monitoring system.

One of them. The drawback is an exchange of stock flow profiles.

There are several ways to get around this challenging problem. Measurement requirements for the technology and replacement supplier worldwide.

As a result of intensive research with different pulp grades and a thorough understanding of each, we have developed two sensors specifically to cover these requirements.

The RL sensor was made for short fibres, such as OCC, OW, TMF and OW. But this is not possible if the mill standards so require. Long-term drifting, sensitivity and repeatability can be verified quickly in the instrument shop.

We have developed a newsprint PM with a lot of variation in consistency control.

The SMART-PULP transmitter is also used on chemical pulp and DIP lines, for example after storage chests and to measure the consistency of pulp fed into refiners.

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The development of consistency transmitter, measuring chest. The kajaaniMCAi transmitter can also be used. Chemical pulp fibres led from the mixing chest are used as sweener. With SMART-PULP, the maximum 0.8% chemical pulp consistency is 1.2%.

Today, during the era of digital technology: development and maintenance have demanded easier start ups, faster tuning and less down time. This would not have been possible without numerous new product development projects in close collaboration with our customers. The driving force behind this development has always and will continue to be a desire to provide solutions and controls for improving the pulp and papermaking processes.

Obtaining a truly representative measurement signal has been one of the primary goals of the product development in Neles Automation. This may sound obvious, but a closer look at the flow profile of pulp shows the need for measurements from the main line. This is the only way to ensure fast and representative measurements. Main line instalations with high requirements for the technology and requiring intensive interaction with different pulp grades and understanding of flow profile.

There are several ways to get around this challenging problem: Measurement chambers, commonly used with rotative type shear force transmitters, are one of them. The drawback is an extreme slow flow and filtered measurement signal. Higher purchase cost, as well as high installation, maintenance and operating cost can also be associated with rotating type shear force technology.

Too often, manufacturers of blade type transmitters claim that one blade fits all pulp grades. This claim is poorly supported and is easiest to reject for the reasons made by Neles Automation. We have found that thicker fibres and pulps with weak sensitivity will cause severe mechanical damage, etc. We have developed several types of transmitters to cover these requirements.

Separate temperature compensation for the electronics, shear force sensor and process coupling prevents any error in the measurement signal if not compensated for. We are adding temperature compensation as a standard feature to our SMART-PULP transmitters.

During the last decade our customers have shown their success with and confidence in our products by giving us SMART-PULP market leader position in these processes. This would not have been possible without numerous new product development projects in close collaboration with our customers.

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The transmitter is also used on chem pulp and DF lines, for example after storage chests and to measure the consistency of pulp fed into refiners.

Experience in this field leads back to the development of mechanical shear force transducers, often called knife blades or blade-type consistency transmitters. The development of consistency transmitters was started at least 50 years ago and it has gone through several technological changes. The names of PulpAIR, PulpFL, and SMART-PULP are well recognized among papermakers.

During the last decade our customers have shown their success with and confidence in our products by giving us over 40,000 reasons to say, “we are the leading manufacturer for consistency measurement products.”

During the era of digital technology, production and maintenance have demanded better data for fast, unfiltered measurement. Higher purchase cost, as well as higher installation, maintenance and operating cost can also be associated with rotating technology. Smart products have made this possible and even more values are on the way. Fieldbus solutions are gaining ground, and we are also supporting Foundation Fieldbus and Profinet.

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Flow compensated fiber consistency transmitter

Over 40 years of experience and over 40,000 blade type transmitters delivered have been the proven platform for SMART-PULP development. The sensors available today have gone through our intensive research process where sensitivity to fiber consistency and ideal flow compensation have been the goals and the ways to meet the papermakers’ requirements.

To ensure our customers maximum value and to assure the highest level of applications integrity, we have developed software tools such as the Cs-Advisor. Cs-Advisor has made transmitter selection easier than ever before, and clear installation instructions for each specific application guarantee the best possible performance based on the actual process conditions.

Quick installation and start up

Improvements in mechanics, electronics and software have led to faster installation, calibration and start-up. Calibration can be accomplished before or after installation. In most cases the fine-tuning can be done using single point calibration. “First day calibration is the final calibration” and “the first transmitter that is capable of measuring wide consistency ranges instead of one point” are familiar comments among SMART-PULP users.

SMART-PULP has a library of over 40 ready-made calibration curves for different pulp grades and sensor types. This library can be used to set up the calibration for each application separately. When running different grades in the same process line up to 8 recipes can be contained within the unit. The recipes can be selected using our operator terminal, a HART®-communicator or binary inputs, whichever best suits the user.

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The SMART-PULP consistency transmitter is used for pulp consistency measurement in the pulp and paper industry. The transmitter’s operation is based on shear force measurement and it is mounted directly on the process pipe.

The transmitter is supplied with an operator unit (may also be supplied without one), a sensor type to suit the specified application, and a process coupling.

**TECHNICAL SPECIFICATIONS**

**Consistency range:**
0.7% to 16% Cs.

**Types:** Refer to type specification chart and applicability table.

**Span**
Min. 0.8 %Cs
Max. 30 N - zero elevation

**Zero elevation:** Max. 30 N - Span

**Damping time constant:** 1 to 60s
Factory setting 2 s (type HL: 20 s)

**Output signal**
Two-wire transmitter (2W):
4-20 mA + HART®

**Power supply:** 18 to 35 VDC

**Load capacity**
18 V / 250 Ω
23 V / 500 Ω
30 V / 850 Ω
35 V / 1050 Ω

**Note:** HART® requires min. 250 Ω load resistance

**Process pressure:** max. 25 bar
If process pressure > 10 bar, see if the coupling’s mounting hole has to be reinforced. Refer to Operating and Installation Instructions.

**Environmental conditions**
Ambient: -20 to 60°C, 0-100% RH (no condensate)
Process: 0 to 120°C
Storage: -50 to 80°C

**PERFORMANCE SPECIFICATIONS**

Tested in reference conditions in accordance with IEC60770.

**Linearity of force measurement:** ±0.5% of span
**Hysteresis:** 0.025 N
**Repeatability:** 0.01 N

**Examples:**
- 0.01 N corresponds to 0.005% consistency variation in bleached softwood chemical pulp (e.g. spruce sulphate) at 3.0% consistency when using the LL sensor.
- 0.1 N corresponds to 0.01% consistency variation in screened recycled fiber pulp at 3% consistency when using the RL sensor.

**Static pressure effect:** 0.02 N per 1 bar
**Process temperature effect:** 1% of reading per 10°C
**Vibration effect:** 2 g per 10-2000 Hz; less than ±0.03 N

<table>
<thead>
<tr>
<th>Applicable ranges of different sensor types (%Cs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensor type</strong></td>
</tr>
<tr>
<td>Softwood chemical pulp</td>
</tr>
<tr>
<td>Hardwood chemical pulp</td>
</tr>
<tr>
<td>Groundwood (SGW, PGW)</td>
</tr>
<tr>
<td>RMP, TMP (CSF&lt;200ml, SR&lt;52)</td>
</tr>
<tr>
<td>RMP, TMP (CSF&gt;200ml, SR&lt;52)</td>
</tr>
<tr>
<td>CTMP</td>
</tr>
<tr>
<td>Recycled fibre, unscreened</td>
</tr>
<tr>
<td>Recycled fibre, OCC, unscreened</td>
</tr>
<tr>
<td>Recycled fibre, screened</td>
</tr>
<tr>
<td>Recycled fibre, OCC, screened</td>
</tr>
</tbody>
</table>

3) Wood raw material: spruce

Notice the following when choosing the sensor type: Applications whose consistency values are given in parentheses are not optimum solutions.

HART® is a registered trademark of HART Communication Foundation.

Metso Field Systems Inc.
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www.metsoautomation.com, Tel. 358 20 483 170,
Fax. 358 20 483 8448
Domicile Tampere, Trade reg. N:o 774. 175, VATFI 15663595
EMC test standards
Radiated interference:
EN50081 - 1: 1993
Reference standard EN 55022:
1987 / Class B
Interference immunity:
EN 50082 - 2: 1995
Reference standards EN 61000-4-2,
-4, -5, -8, -11, ENV 50140, ENV 50204,
ENV 50141

Permissible velocity of flow (m/s)
Min / max
SMART-PULP UL 0.1 / 1-3
SMART-PULP HL 0.4 / 8
SMART-PULP WS 0.4 / 4
Other types 0.4 / 5

For detailed specification of flow
velocities, refer to the Consistency
Advisor (PC) program and Operating
and Installation Instructions.

Materials
Wetted materials: See type
specification chart
Electronics housing: Aluminium alloy
Mounting clamps and screws: AISI316
Wetted gaskets: PTFE and special
rubber material
Operator unit: Plastic

Enclosure class
Transmitter: IP66 (NEMA 4X)
Operator unit: IP65

Weight
SMART-PULP WS: 7.3 kg
Other transmitter types: 6.0 kg

ACCESSORIES

Installation pipe FlowTR-P
The installation pipe will improve the
measurement particularly in highly
demanding applications.

Welding guide
We recommend the use of the
welding guide shown in Fig. 5 for the
installation of a standard process
coupling.

Calibration curves and calibration
The transmitter is provided with built-in
calibration curves and linearisation for
all sensor types and recommended
pulp types. There are max. 8
customised recipes, each of which
contains one automatically calibrated
pulp type curve and possible
information on filler content.
Active recipe is selected from the
display unit’s operating keys, through
HART® interface or through binary
inputs.

Sampling and calibration support
Includes calculation of shear force,
standard deviation of consistency and
average consistency during sample
taking. Sampling time can be
synchronised exactly with average
value calculation with a sampler
provided with switch function (Valmet
NOVE). Each of the 8 recipes can be
calibrated automatically with 1 or 2
samples. Recipe No. 1 can be
additionally calibrated with 16
calibration points.

Patents
AT E77961 B FR 0274478
DE 378021 GB 0274478
EP 0274478 SE 0274478
FI 75424 US 4,757,708
Installation

Process connections and deflector plate

The process coupling to be welded on the process pipe, gasket and mounting clamps with screws and nuts are supplied with the transmitter. Apply 25 Nm torque to tighten the nuts. The process pipe’s nominal diameter should be specified in the order. If not, a process coupling to suit a DN200 pipe will be supplied.

Deflector plate is included in the delivery, except for types UL and HL (if HL is supplied with a blow-line coupling).

Installation of process couplings and deflector plate

Refer to Operating and Installation instructions for detailed instructions.

SMART-PULP UL

This type is mounted in a bypass line. Install the process coupling as described above, but omit the deflector plates. If installing in the actual process line, you may need an installation tube without deflectors.

SMART-PULP WS

Weld the process coupling as shown in Fig. 2. Cut a 9 mm by 182 mm hole for the deflector in the pipe.

SMART-PULP HL in digester blow line installations

Install the special blow-line coupling as shown in fig. 3.

SMART-PULP JL

See Fig. 4 for installing the process coupling on a fibreglass-reinforced pipe.

Figure 1 - SMART-PULP LL/LS/GL/RL/HL

(*) For 100 mm pipe 75 mm flow

Figure 2 - SMART-PULP WS

( ) Plate thickness 4 mm

( ) Plate thickness 8 mm

Figure 3 - SMART-PULP HL

(in digester blow line)

Figure 4 - SMART-PULP JL

Flow

Figure 5

Welding guide for process coupling
FlowTR-P pipe
For different process line sizes: DN
Material: AISI 316 L.

<table>
<thead>
<tr>
<th>DN</th>
<th>D x s</th>
<th>(P_{\text{max}})/bar</th>
<th>Product n:o</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>114.3 x 2</td>
<td>18</td>
<td>A4730188V1</td>
</tr>
<tr>
<td>125</td>
<td>139.7 x 2</td>
<td>16</td>
<td>A4730189V1</td>
</tr>
<tr>
<td>150</td>
<td>168.3 x 2</td>
<td>12</td>
<td>A4730190V1</td>
</tr>
<tr>
<td>200</td>
<td>219.1 x 3</td>
<td>16</td>
<td>A4730180V1</td>
</tr>
<tr>
<td>250</td>
<td>273.0 x 4</td>
<td>10</td>
<td>A4730181V1</td>
</tr>
<tr>
<td>300</td>
<td>323.9 x 4</td>
<td>10</td>
<td>A4730182V1</td>
</tr>
<tr>
<td>350</td>
<td>355.6 x 4</td>
<td>10</td>
<td>A4730183V1</td>
</tr>
<tr>
<td>400</td>
<td>406.4 x 5</td>
<td>10</td>
<td>A4730184V1</td>
</tr>
<tr>
<td>500</td>
<td>508.0 x 5</td>
<td>8</td>
<td>A4730185V1</td>
</tr>
<tr>
<td>600</td>
<td>609.6 x 5</td>
<td>6</td>
<td>A4730186V1</td>
</tr>
<tr>
<td>700</td>
<td>711.2 x 6</td>
<td>6</td>
<td>A4730187V1</td>
</tr>
</tbody>
</table>

Electrical connections
The connections are made as shown in the appended wiring diagram. The wire inlets are provided with PG13.5 gland packings or optionally with 1/2-14 NPS adapter for connection alternative 5.

The cable between the transmitter and operator unit is factory connected to the operator unit.

The cable (2) can also be connected to the transmitter end, refer to the Operating and Installation Instructions.

The transmitter can also be used without the operator unit. In that case you perform calibration through HART275® user interface.

Options* - NOVE - state of the valve (4) and recipe selection (3) Refer to the Operating and Installation Instructions.

We reserve the right to technical changes without prior notice.