



Rheonics Information Deck

Rheonics InkSight

Ink Viscosity Monitoring and Control for Printing Presses

Rheonics

 Winterthur, Switzerland

 Sugar Land, Texas, U.S.A.



Section 01

Introduction

1. Introduction

Motivation for InkSight Development

- Rheonics was founded to solve the issue of lack of robust plug and play instruments for viscosity and density monitoring, two of the key physical properties of a process fluid.
- The SRV inline viscometer technology is a perfect fit to the needs of the printing industry for a **robust, maintenance-free** viscosity measurement device
- Despite the availability of several viscosity control systems on the market, many of these systems, once purchased, were taken out of service by operators, who went back to using efflux cups to measure viscosity
- Rheonics engineers' curiosity about the reasons for this fallback to old technology was the stimulus for development of the **InkSight** viscosity control system



1. Introduction

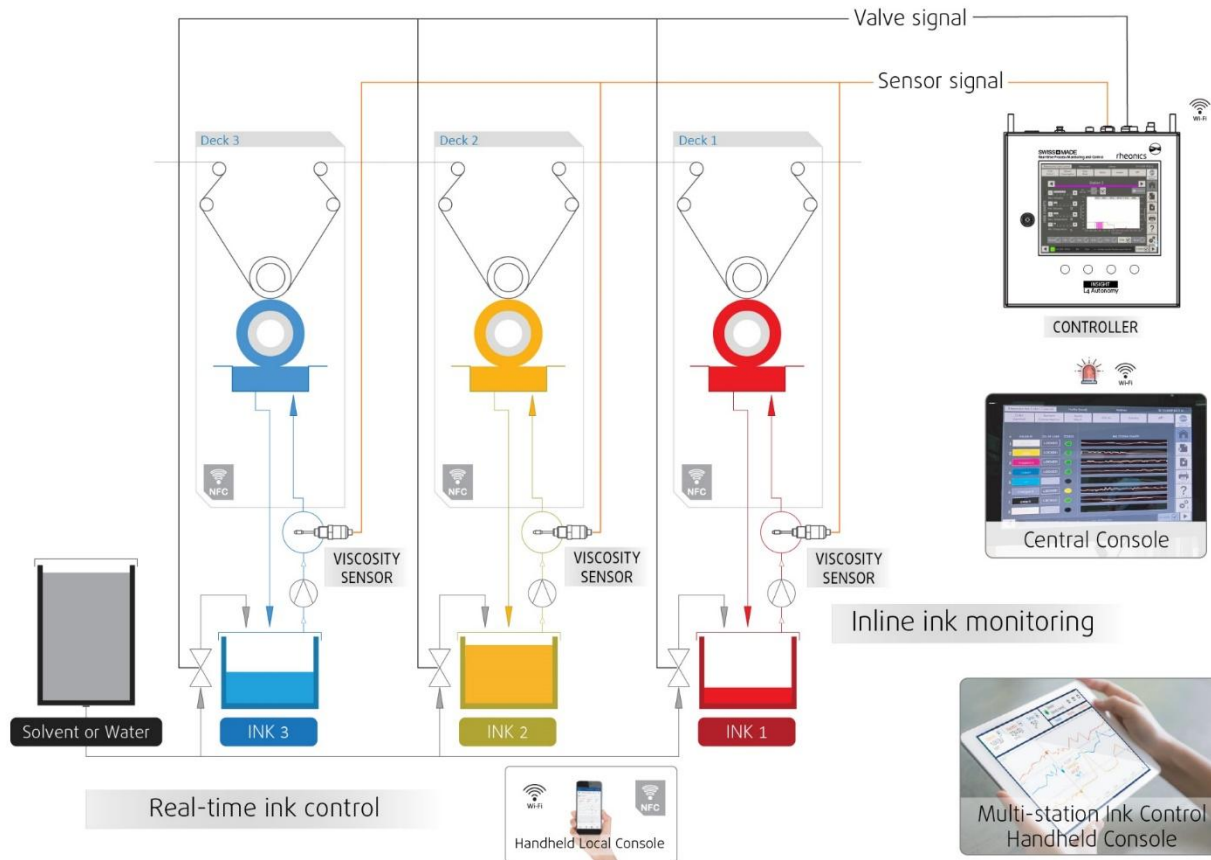
Rheonics moves from Sensors to **Solutions**

- Rheonics had the sensors. The SRV were field tested, precise and reliable. The next step was building a control system that made them useful for operators.
- Rheonics hid all the tech behind a simple, powerful and intuitive user interface. The single-click **RPS InkSight** system was born.



1. Introduction

What is InkSight?



InkSight

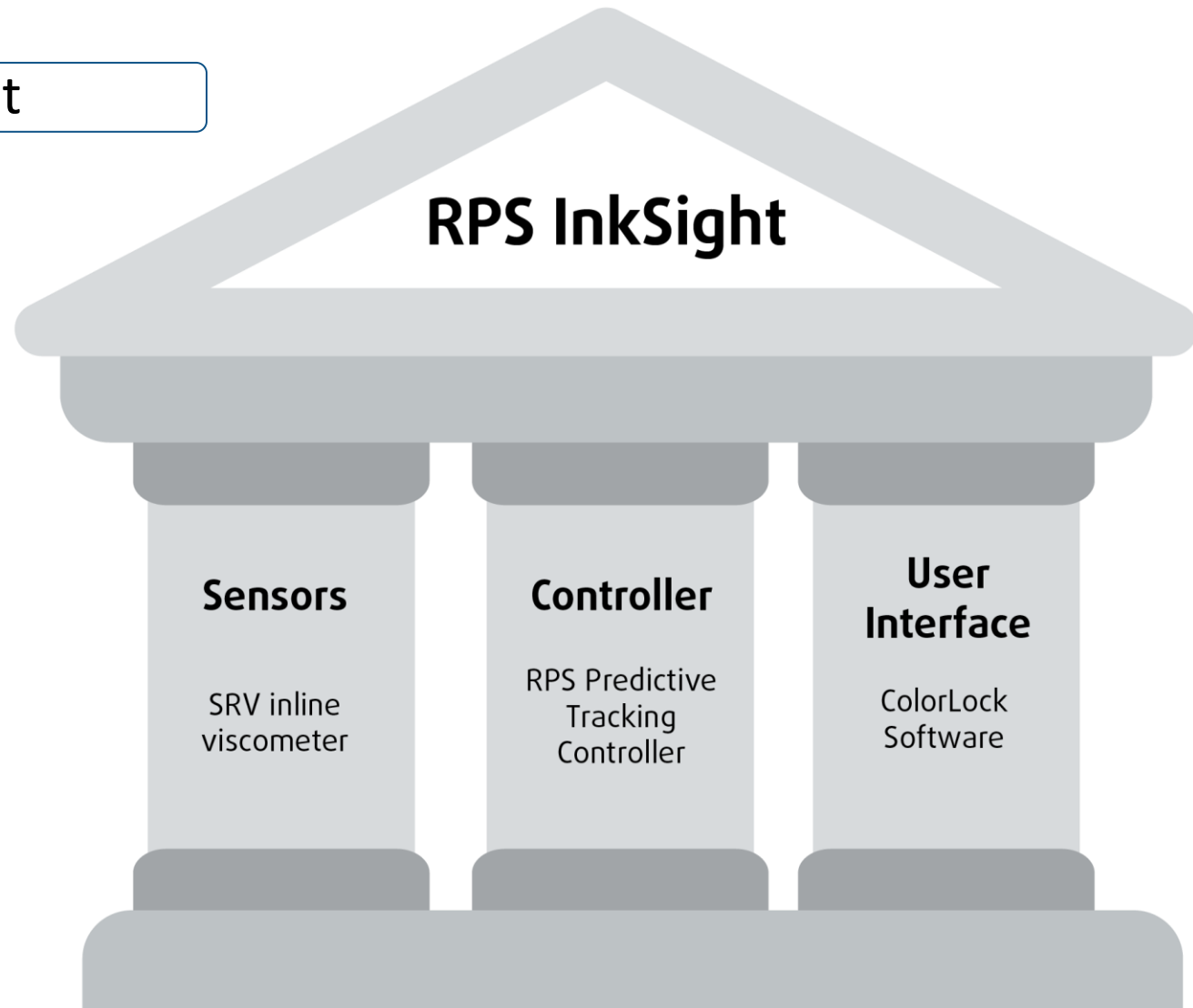
is a highly accurate **Multi-station ink viscosity control system.**

It consists of three subsystems: a viscosity sensor, a predictive tracking controller, and a powerful, intuitive graphical interface.

It delivers color excellence through tight viscosity control.

1. Introduction

The 3 pillars of Rheonics InkSight



1

Rheonics **SRV Sensor** is located directly in the ink line, monitoring and transmitting ink viscosity to main control cabinet in real-time.

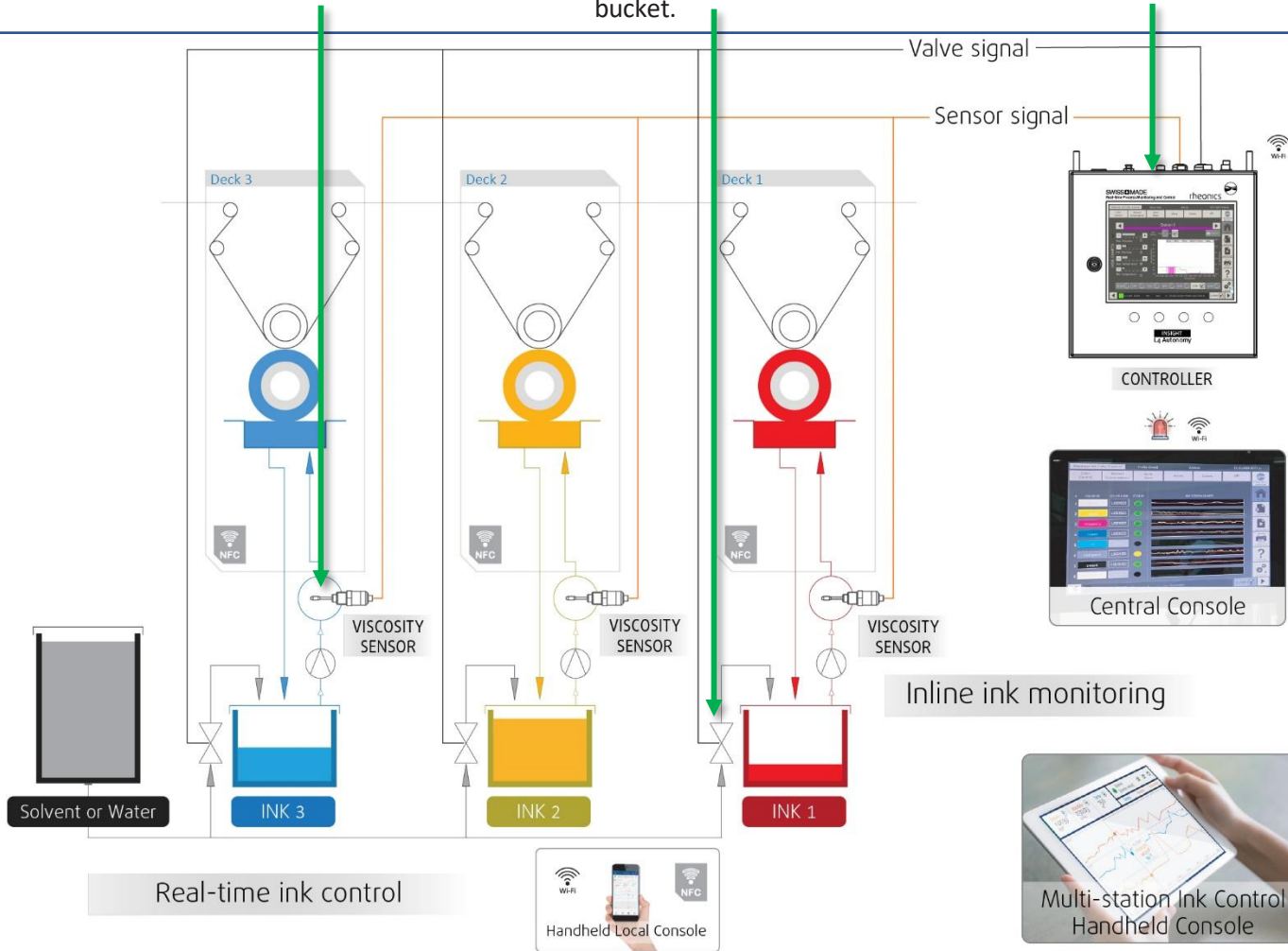
2

Pneumatic **solvent correction valve** connected to main control cabinet with feed line of solvent from central tank to each ink bucket.

3

Rheonics Predictive Tracking **Controller** ensures precise control of ink viscosity on all stations. Operator HMI gives one touch ColorLock functionality.

How does InkSight work?



Rheonics InkSight Components

Core:

1. Rheonics SRV viscometers
2. Pneumatic Solvent Correction Valve
3. Rheonics Predictive Tracking Controller

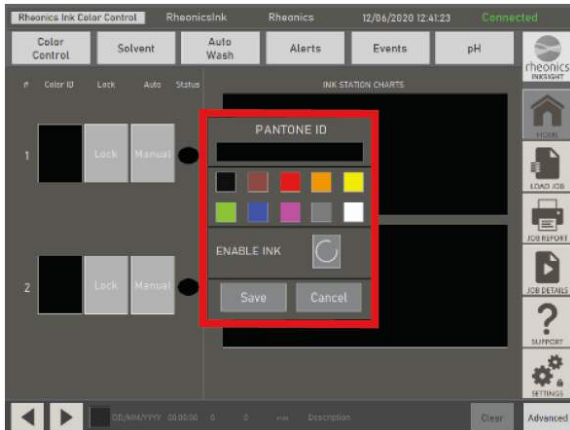
Other components:

- SmartView Press Console
- SmartWash automated cleaning and fouling detection

1. Introduction

How is it used? - 3 Steps to Autonomous Viscosity Control

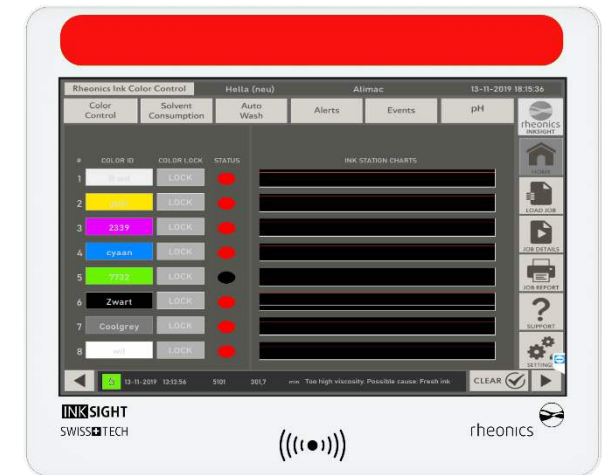
1. Enable ink station in USE



2. Click AUTO button when print is accepted to MASTER



3. System informs operator when intervention is needed

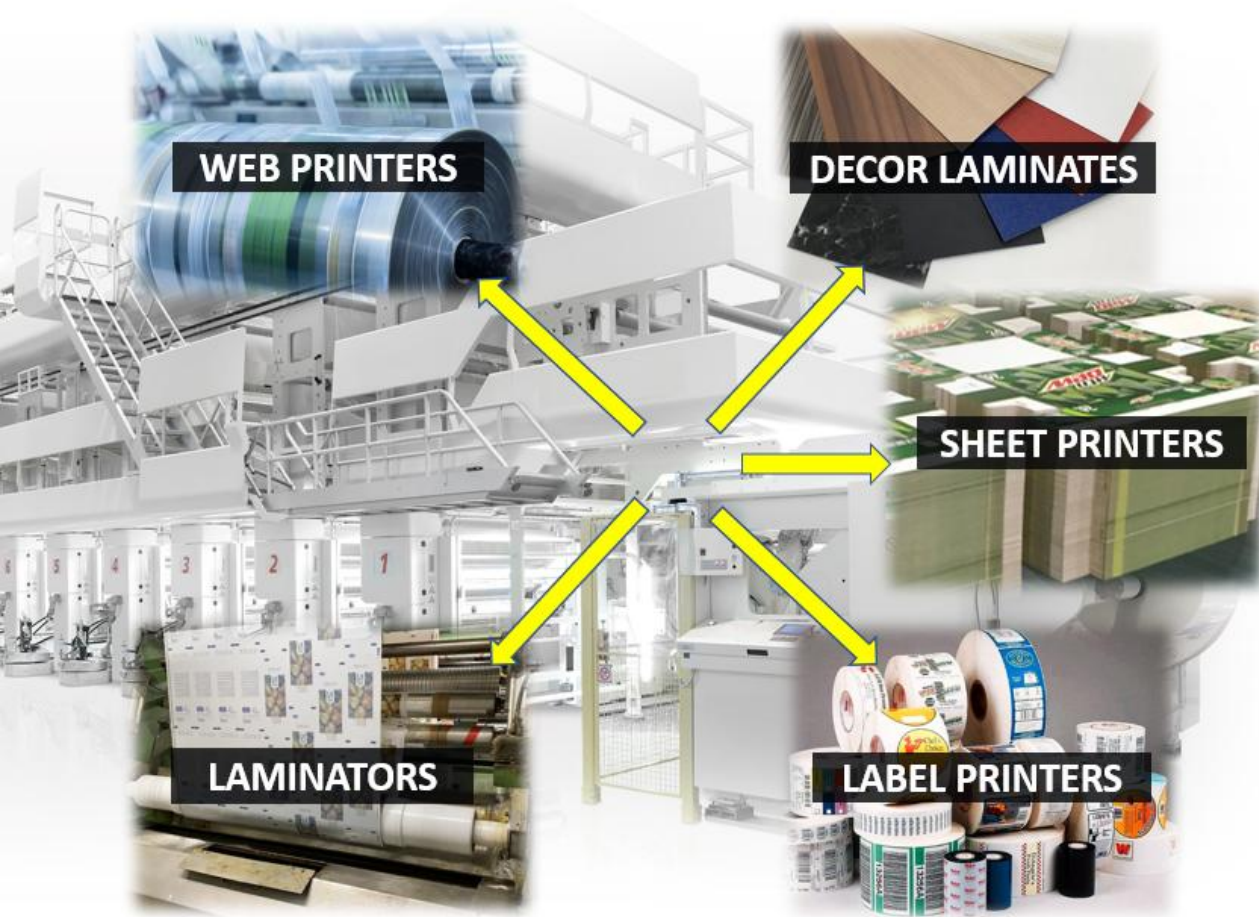


No need for constant monitoring

Level 5 autonomy on Rheonics InkSight means the system will seek intervention only when needed

1. Introduction

Who uses it?



Gravure printing press companies deploy the Rheonics InkSight to achieve excellent reproduction accuracy, print quality and color brilliance.

It is ideally suited for the production of film packaging for food, snacks, confectionery and pharmaceuticals, and also decorative paper for laminate flooring and furniture in addition to the high-gloss magazines, catalogues, advertising flyers and supplements of retail chains.

Printing press manufacturers, machine builders and system integrators easily integrate the modular InkSight system into new and existing machines to give **single click** ink viscosity control to operators.

1. Introduction

Presentation Outline

1. Importance of viscosity for printing

- Why ink viscosity is important in printing
- An evaluation of traditional methods for controlling ink viscosity

2. A reliable inline viscometer for ink viscosity management

- Rheonics SRV viscometer meter as an alternative
- Advantages of SRV for ink viscosity management
- Beyond measurement to real-time control

3. Real-time ink viscosity measurement and control in the press room

- Sensor mounting options
- Integrated solution: sensor, controller and control valves
- A gateway to complete automation in printing, InkSight = sensor + controller + software
- Benefits for the users and technology outcomes for the industry

Section 02

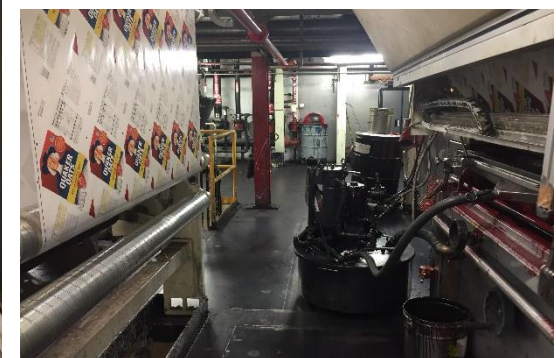
Importance of Viscosity in Printing

2. Importance of Viscosity

Why is Viscosity Optimization and Control important in Printing

Viscosity is a very important parameter in the final print quality:

- If the viscosity is incorrect, the flow behavior and ink layer thickness will vary, leading to deterioration of print and color quality
- Poorly adjusted ink viscosity causes excessive ink and solvent consumption and drives up costs

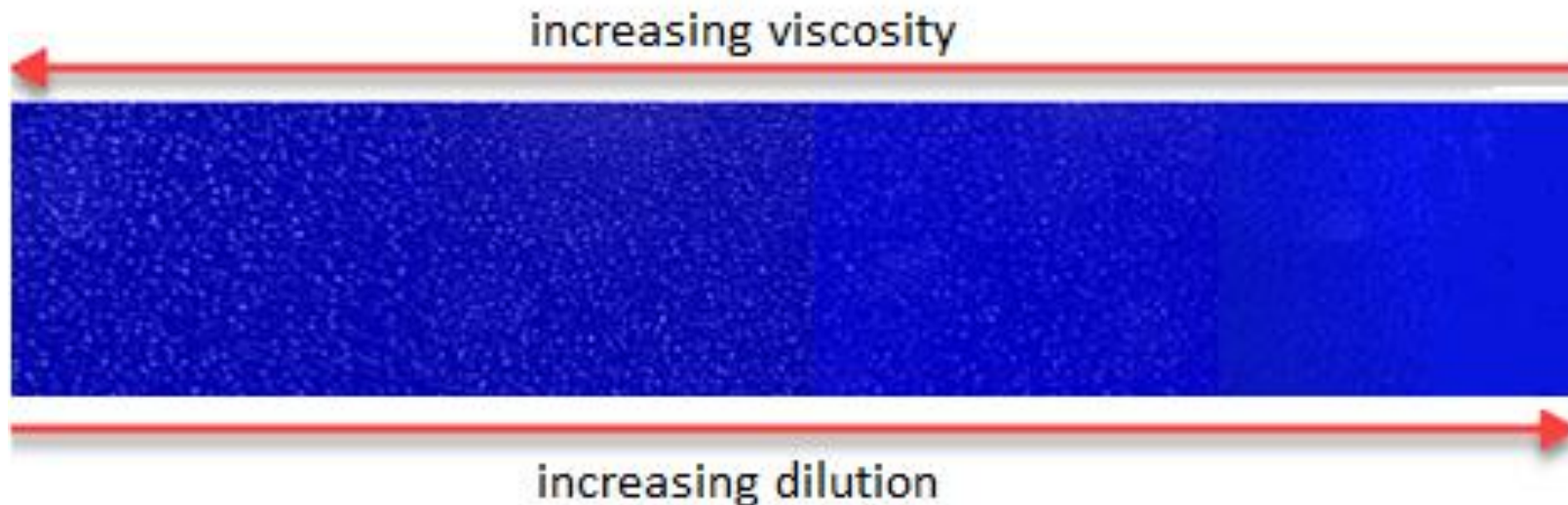


2. Importance of Viscosity

Why is Viscosity Optimization and Control important in Printing

- Viscosity control by solvent addition keeps print quality high, even during long runs
- However, optimizing ink viscosity is time-consuming, even for experienced press operators
- **Viscosity automation and predictive tracking control reduces waste and improves efficiency**

Color density variation with ink dilution and viscosity



2. Importance of Viscosity

Traditional methods and their limitations

Ink Viscosity is still measured by old methods. Two main methods are:

- Efflux cups
- Rotational viscometers

Limitations

- Offline, needs sampling
- Need experienced operators
- Can't supply the data needed for inline process control



Source: Brookfield



Source: Gardco

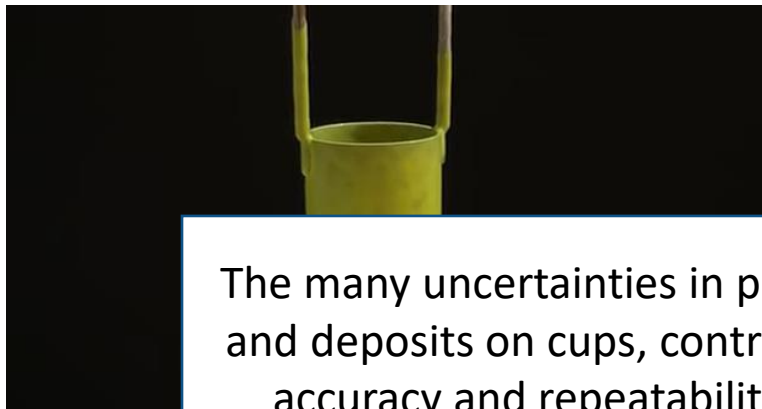


Source: Ransom & Randolph

2. Importance of Viscosity

Are cups suitable for viscosity checks?

- Accuracy issues
- Cleaning issues
- Frequent calibration with a standard DIN cup
- Ink viscosity in 'cup seconds'
- How do you store the data and do long-term optimizations
- When do you start and stop recording the time?
- Non-repeatable even with experienced operators



The many uncertainties in procedures, as well as wear and deposits on cups, contribute to less-than-optimal accuracy and repeatability of cup measurements

2. Importance of Viscosity

Rotational viscometers and rheometers: Limitations of lab measurements

- Measurements **cannot** be made under actual use conditions
- Affected by temperature, shear rate, humidity and other variables
- Difficult to decide what parameters are relevant
- Necessary sampling rates not well established
- Issues with repeatability and reproducibility
- How do you store the data and do long-term optimizations?



Source: Gradco/Brookfield

2. Importance of Viscosity

Desirable features of a viscometer for Ink Applications

- Measures **direct viscosity** of ink in real time
- **Does not require re-calibration** and must be **easily cleanable**
- Provides **repeatable measurements** – to support process quality as well as information for process improvement
- **Fast, reliable response** to ink viscosity changes to enable immediate operator intervention if necessary
- Produces viscosity data and an **intuitive interface (software)** to **visualize the process**
- Enable **viscosity control automation**, to keep pace with the already high degree of process automation

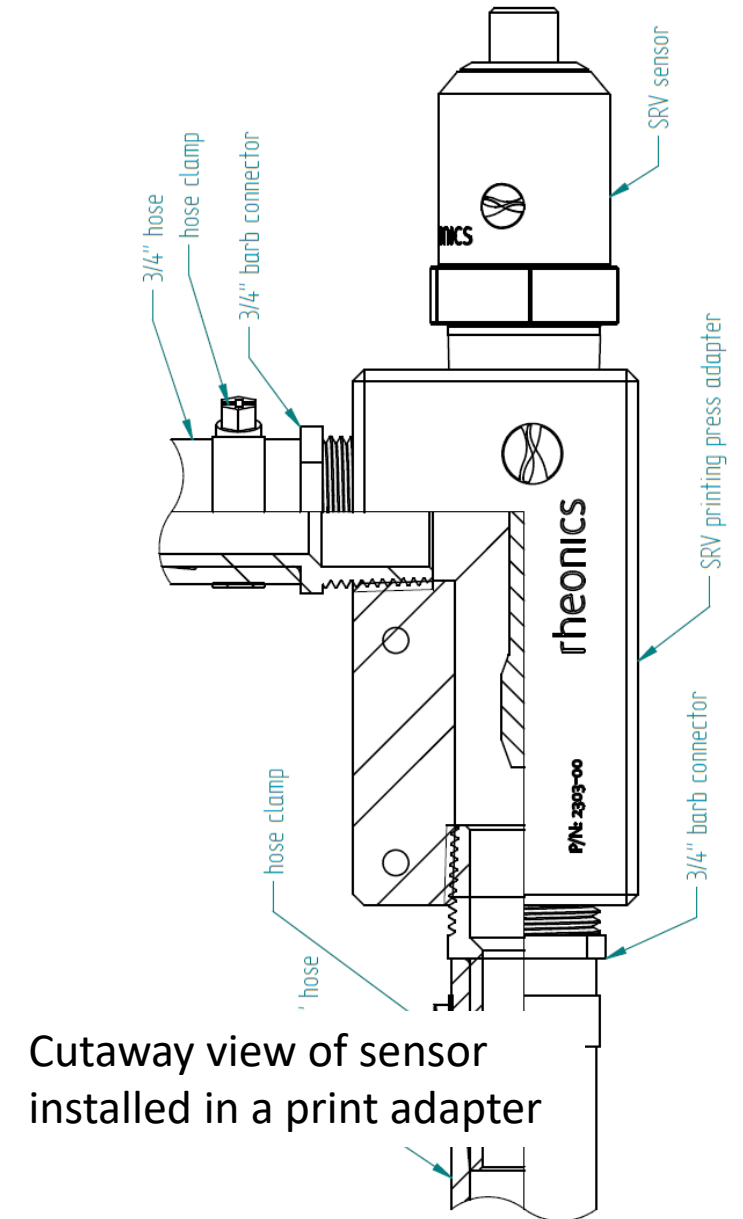
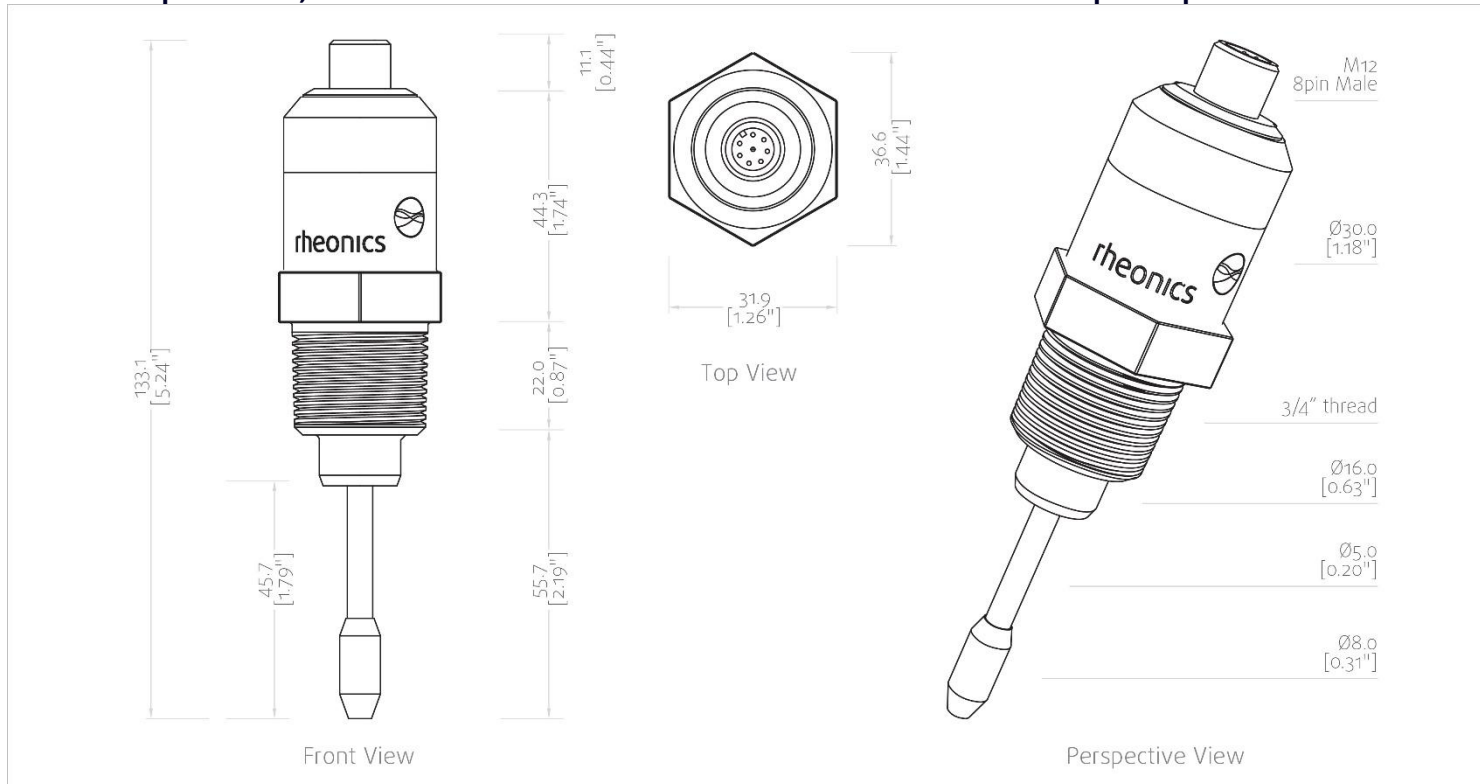
Section 03

A reliable inline viscometer for Ink Viscosity Control: SRV

3. SRV Viscometer

The Technology Revolution

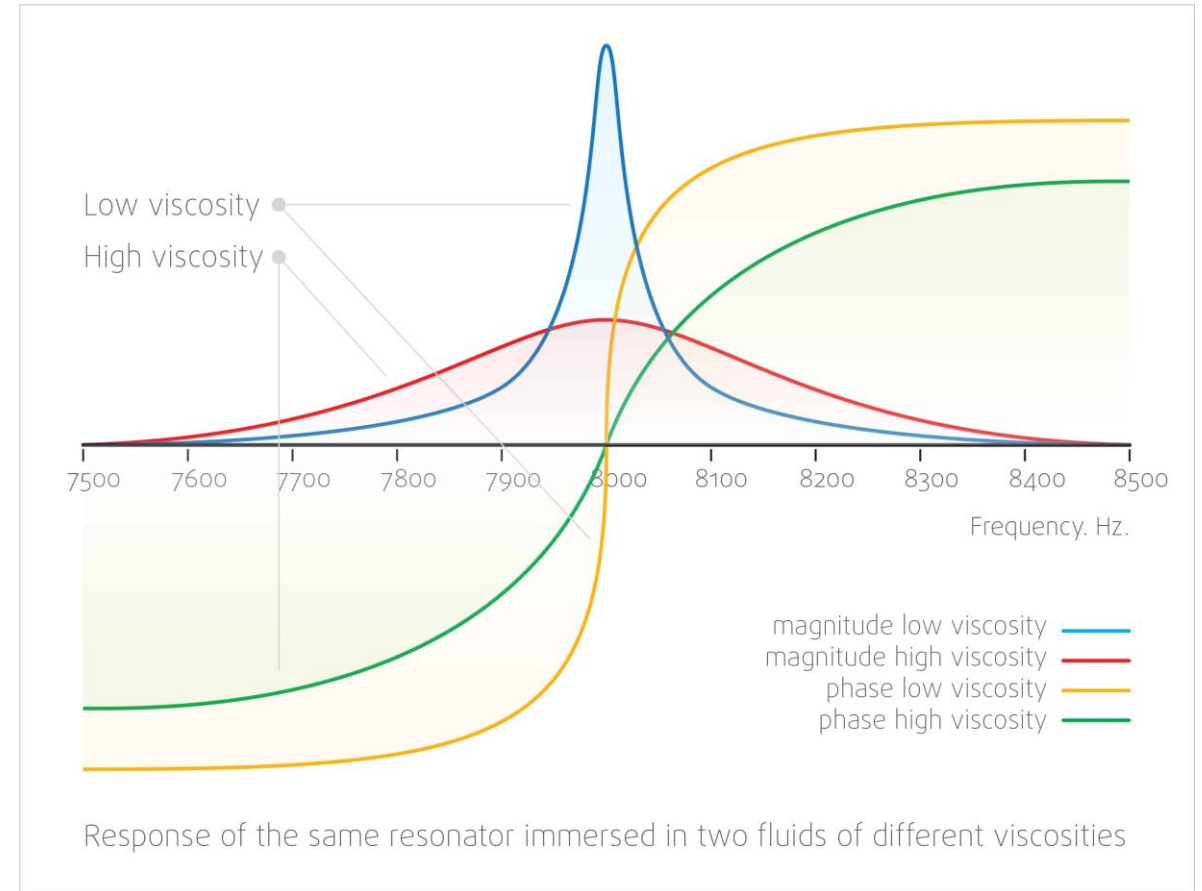
- Small form factor for easy installation without need for additional space in press
- Wide operational range – low to high viscosity, solvent & water –based inks
- Extremely repeatable sensor
- Ultra-precise, stable measurements – no influence of pumps or foam



3. SRV Viscometer

Balanced Torsional Resonator: The game changer in Viscometer Technology

- Rheonics SRV viscosity technology makes use of an ultra-stable torsionally balanced mechanical resonator (US patent 9,267,872) whose oscillations are damped by the viscosity of the ink.
- The more viscous the fluid, the higher the mechanical damping of the resonator. By measuring the damping, the product of viscosity and density is estimated.
- The resonator is excited and sensed by means of an electromagnetic transducer mounted in the sensor's body.
- Damping is measured by Rheonics patented proven and patented gated phase-locked loop technology.
- Based on these two key technologies, the SRV viscosity sensor delivers stable, repeatable and highly accurate measurements of the ink viscosity while being small enough to fit in the palm of your hand.



Sensor Operating Principle

Read more: <https://rheonics.com/whitepapers/>

3. SRV Viscometer

Revolutionizing Ink Viscosity Control in Printing



Source: Digital Fire



The traditional way

Measuring viscosity with cups is unreliable, inaccurate, time-intensive even with experienced operators.

Unlike laboratory viscometers, which require sampling and manual handling, Rheonics SRV provide real-time data without the need to take samples



The Autonomous way:

Continuous viscosity monitoring by Rheonics SRV viscometer

- No operator intervention required
- Measurement is continuous, without having to worry about sampling or accuracy
- The SRV sensor provides 1 reading per second!

3. SRV Viscometer

Truly revolutionary technology for Ink viscosity control

- **No more manual handling or offline sampling of ink:** Replaces cup measurements and offline lab measurements.
- **Independent of operator's skills or judgement**
- **Sensor needs no re-calibration, cleaning or maintenance:** Sensor is permanently calibrated and maintenance free over the expected 25 years lifetime of the sensor.
- **Extremely dependable and reliable data:** SRV-s viscosity data is extremely repeatable and reproducible. Operators can fully rely on viscosity data (trends, changes, disturbances) for making process decisions, reliably and dependably.
- **Provides a direct, stable link between ink viscosity and print quality:** Operators can focus on optimizing print quality instead of manually measuring ink viscosity.
- **Built-in temperature monitoring enables temperature compensation of viscosity**



Comparative analysis of the Rheonics Viscosity Sensor

	InkSight SRV	Falling ball	Efflux Cups	SAW sensor	Other vibrational
Accuracy	Better than 5% absolute	Acceptable, but no temperature control	Depends on operator skill; ca. 10%	Good	Good
Stability	Better than 1% long-term	Acceptable	Must be continually recalibrated	Long-term drift	Long-term drift; must be periodically recalibrated
Ink Type	All ink types, including low-viscosity gravure inks	All ink types	Unsuitable for low-viscosity gravure inks	Zero-point drift with low viscosity gravure inks. Does not work with water-based ink.	Frequent re-calibration needed for low-viscosity inks;
Cleaning Ease	Cleanable inline; deposits can be removed by wiping with no damage. System indicates when cleaning is required	Difficult to clean	Needs cleaning after every measurement.	Can be cleaned inline; deposit removal can damage sensor	Cleanable inline; some sensors will be damaged by mechanical removal of deposits
Temperature	Measured by sensor, compensated in software	Not controlled or measured	Not controlled or measured	Measured	Measured

Excellent
 Good
 Bad

Section 04

InkSight Hardware Description

“You can’t control what you don’t measure”

- 1 Rheonics **SRV Sensor** is a small form-factor sensor built to insert directly in the ink lines. Extremely high accuracy and stability of viscosity measurement enables quick detection of the smallest variation.



MEASURE

- 2 Pneumatic **solvent correction valve** connected to main control cabinet that reacts fast and precisely to add exactly the amount needed.



CONTROL

- 3 Rheonics Predictive Tracking **Controller** predicts and compensates for evaporation before the ink changes. Built on the same physics used to control NASA Mars entry guidance.

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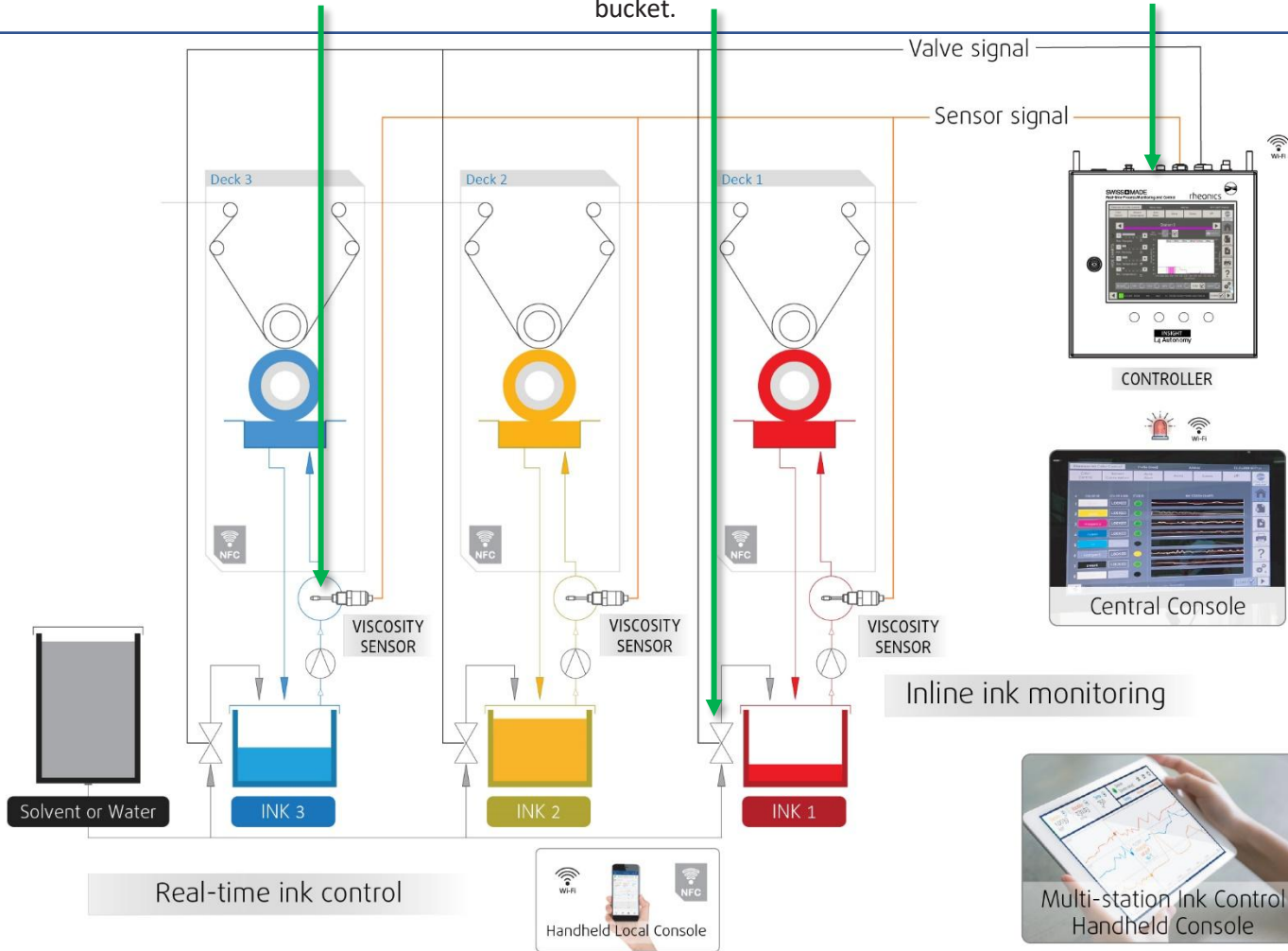
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How does InkSight work?



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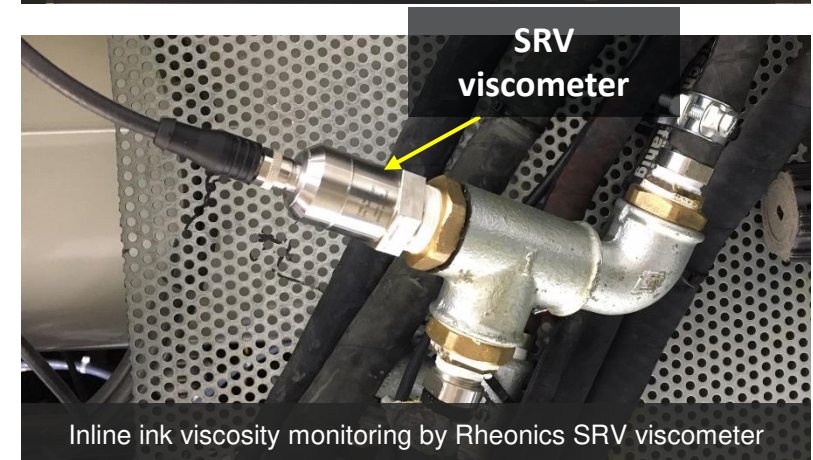
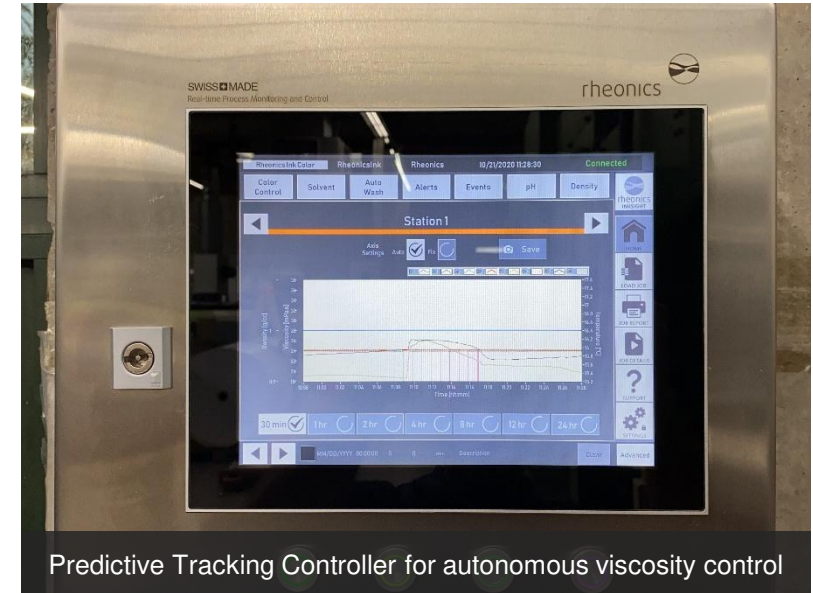
Other components:

- SmartView Press Console
- SmartWash automated cleaning and fouling detection

4. InkSight Hardware

What is unique about Rheonics Viscosity Control?

- Traditional viscosity measuring methods (like efflux cups) are inaccurate, tedious to use, and prone to errors. Continuous viscosity control with such methods is extremely inefficient and unproductive.
- Many common viscosity measuring devices do not provide fine enough viscosity control and require high maintenance and frequent calibration.
- Rheonics InkSight Predictive Tracking Controller and SRV viscometers enable tight viscosity control throughout the print job, due to the system's ability to autonomously maintain viscosity within extremely narrow limits.
- Printers can achieve unmatched color accuracy and quality with InkSight system and **ColorLock** software – which is designed in collaboration with printers, for printers.



4. InkSight Hardware

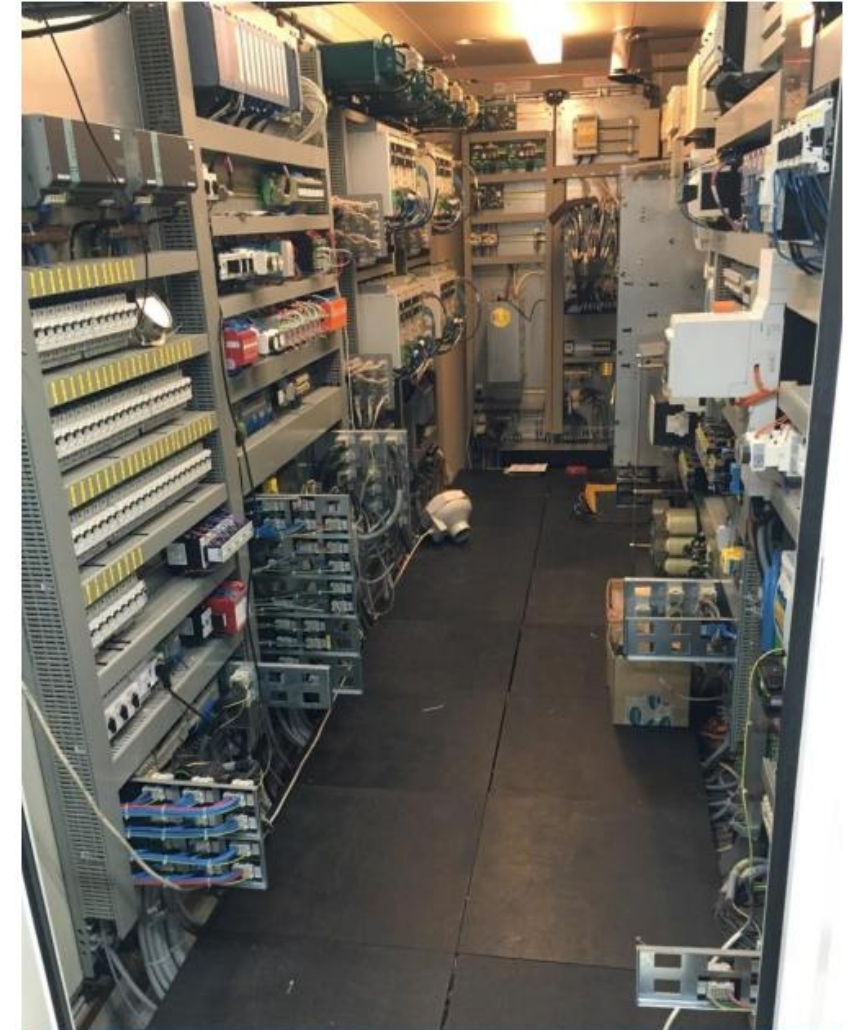
Electronics | RPS Cabinet

The InkSight system is installed in a heavy stainless-steel housing, which is equipped with its own industrial PC and touch screen displays. The operator can choose a viscosity set point from the touch screen interface, and lock the system to that set point.



4. InkSight Hardware

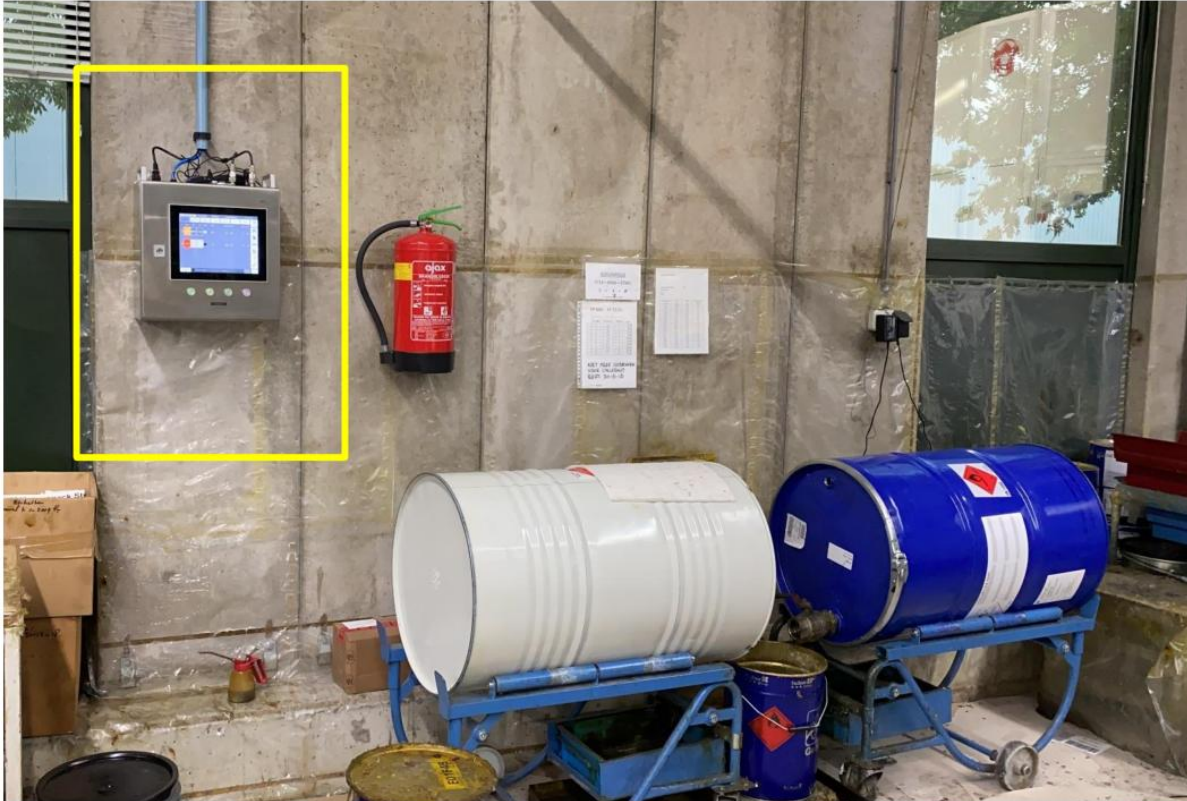
Electronics | Integrated in Printing Machines



Machine electronics cabinet

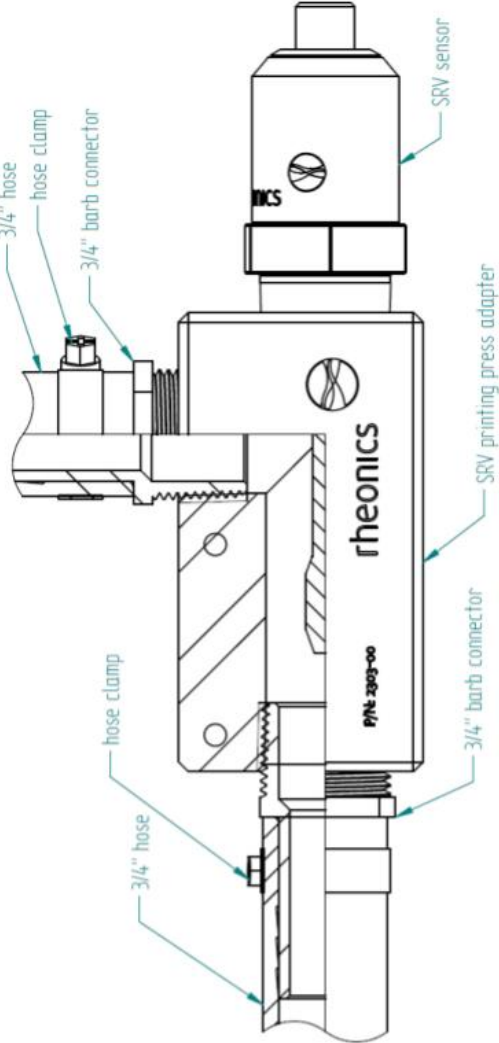
4. InkSight Hardware

Electronics | Installation as a standalone Control Cabinet



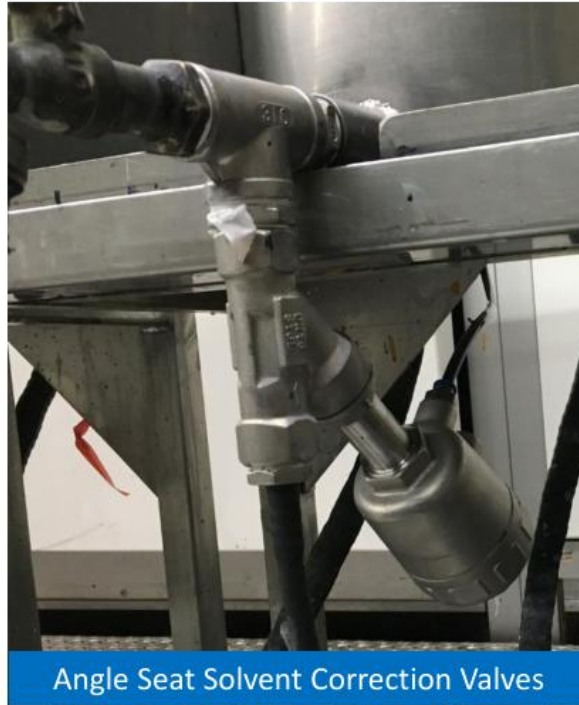
4. InkSight Hardware

SRV | Viscometer Installation



4. InkSight Hardware

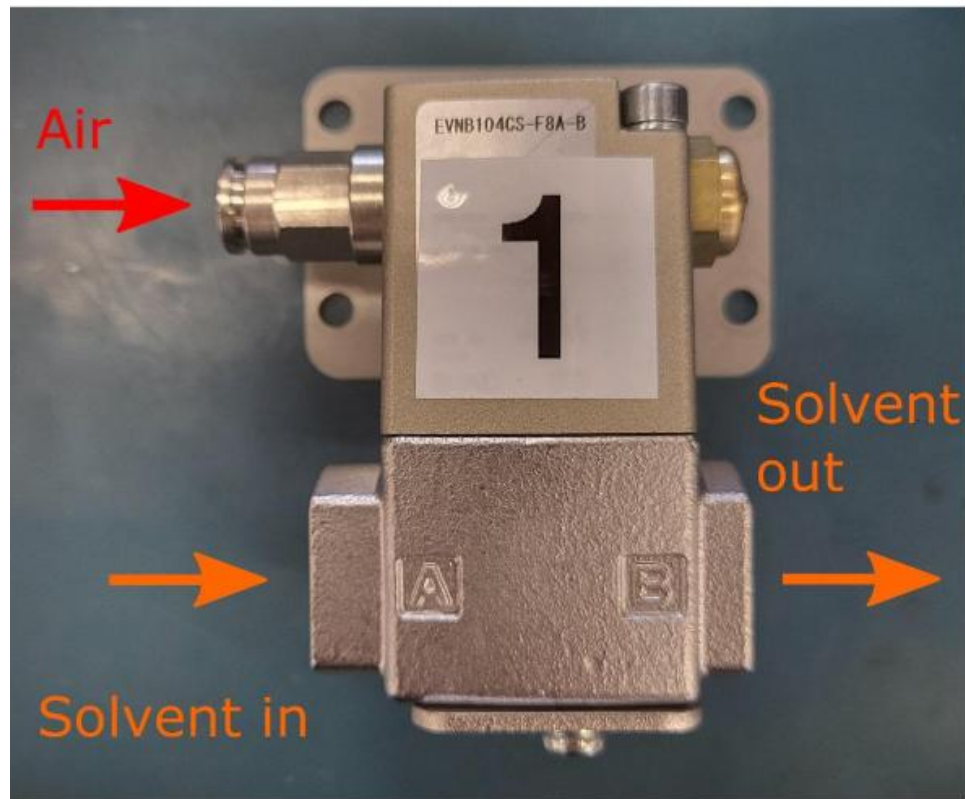
Valves | Solvent Correction Valves and Valve Control Island



4. InkSight Hardware

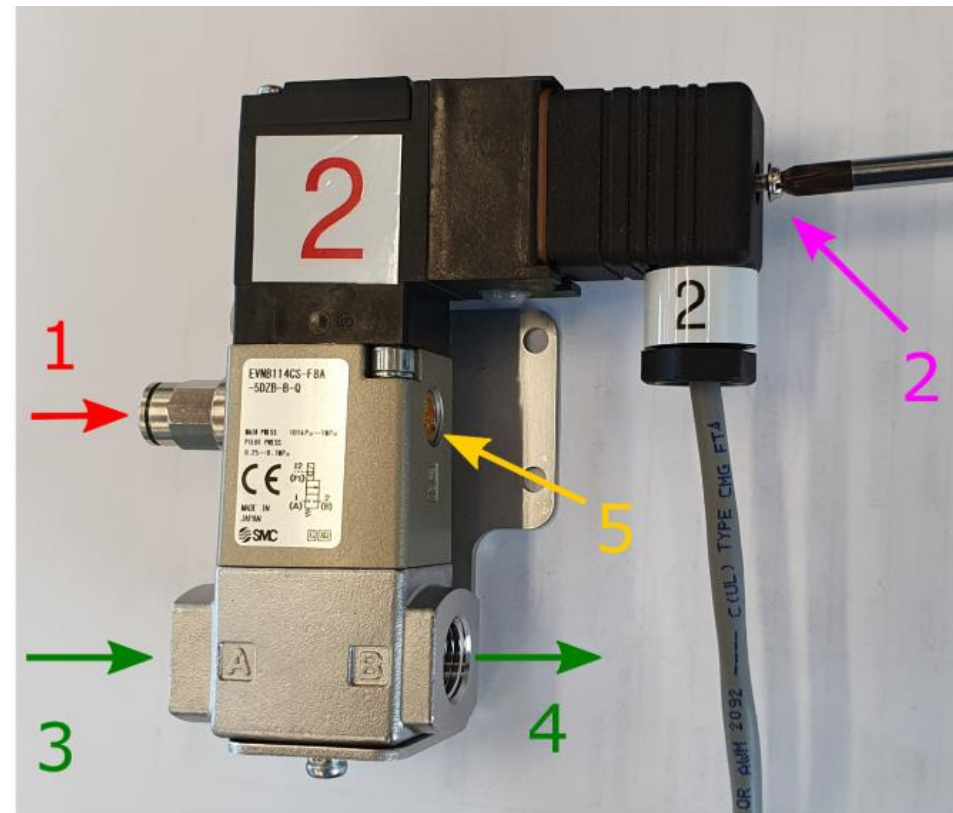
Valves | Valve Options

Pneumatic Valve



2

Pneumatic Pilot Solenoid Valve



4. InkSight Hardware

Display | SmartView Console

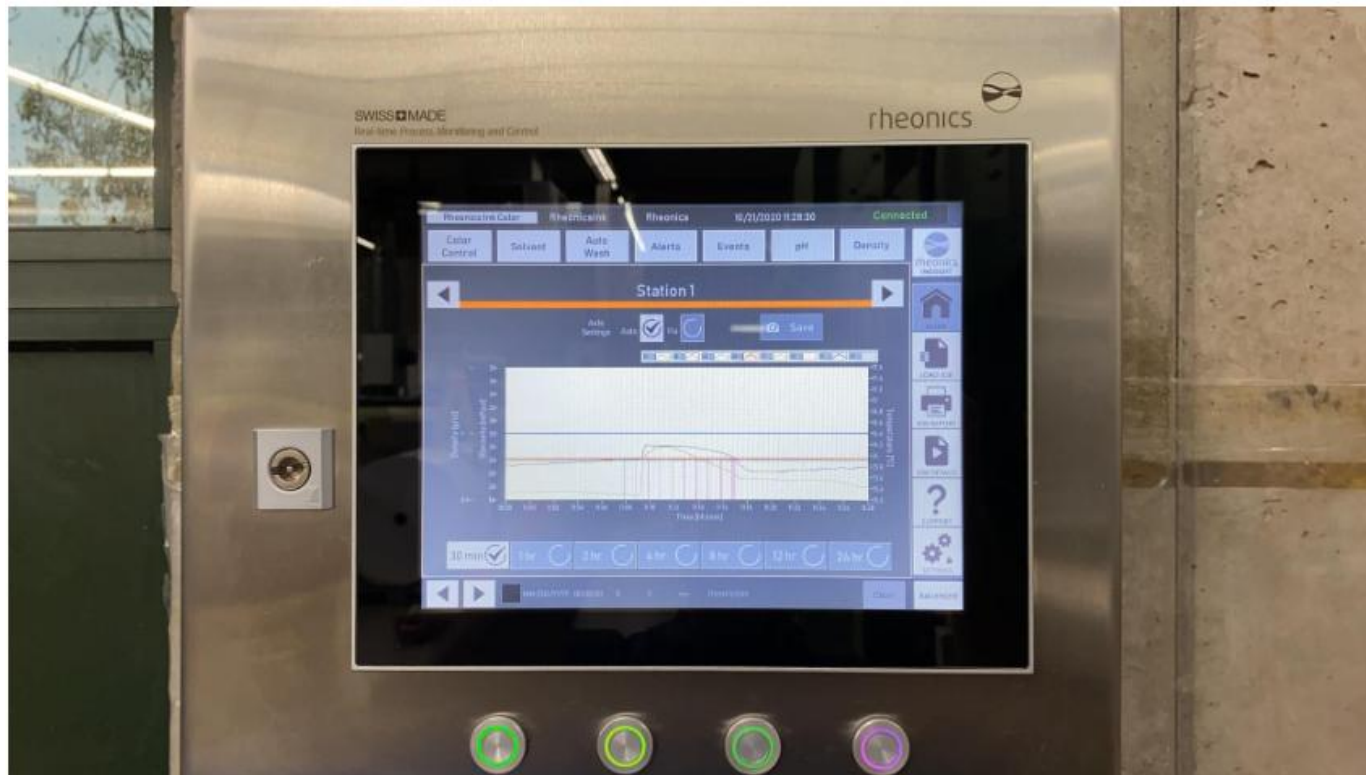
Integrated in the press for operators' overview and control



4. InkSight Hardware

Display | RPS HMI

Built-in HMI on the RPS Box



Section 05

InkSight Software

5. InkSight Software

HMI Overview

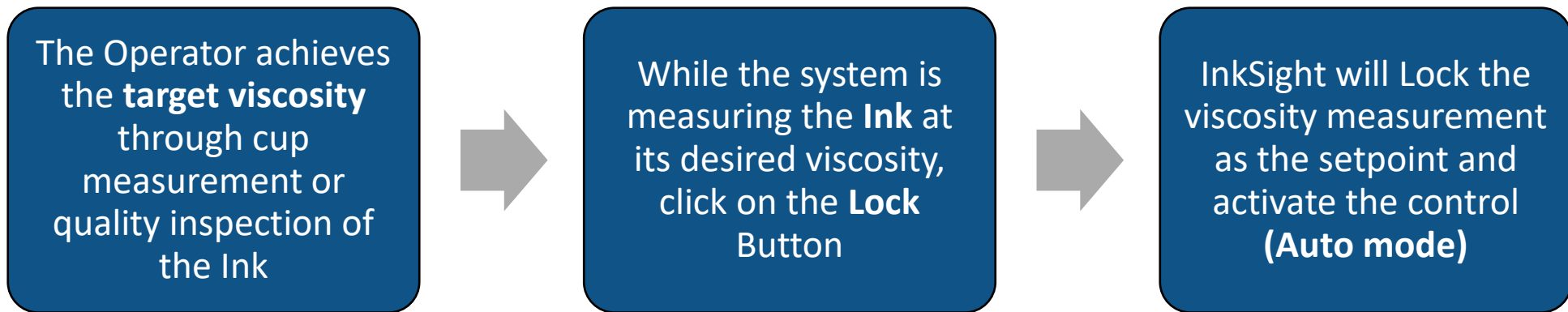
The HMI interface consists on the navigation buttons and the main dashboard.

- **Top Bar:** Displays Job Name, client , Date and time, and the Client server Status which should always say connected.
- **Control Properties:** Navigate through the different control settings and states.
- And the main **Dashboard** area which depending on the view Displays the control parameters and measurements
- **System Properties:** Navigate through system and job settings
- **Active Alarms:** Displays the most recent alarm reported by the control software.



5. InkSight Software

Basic Operation Mode



5. InkSight Software

Enabling a Station



5. InkSight Software

Enabling a Station

Print 3 Co 2 03 Sep 2024 06:05:24 Connected

Control Water Wash Check Alerts Events pH

rheonics SLURRYTRACK

#	Slurry ID	Lock	Auto	Status
1	[Red]	Lock	Manual	●
2	[Green]	Lock	Manual	●
3	[Grey]	Lock	Manual	●
4	[Blue]	Lock	Manual	●

Slurry Station Charts

ID

Station A

Color Selection Grid

Enable

Save Cancel

Type the Station ID

Select the ID color

Click to enable the station

Click to Save

9/3/2024 05:29:41 5201 35.2 min The valve couldn't be opened Clear Advanced

5. InkSight Software

Locking the Setpoint

The screenshot displays the Rheonics SlurryTrack software interface. At the top, it shows 'Print 3', 'Company 2', '03 Sep 2024 05:26:13', and 'Connected'. Below this is a navigation bar with tabs for 'Control', 'Water', 'Wash Check', 'Alerts', 'Events', and 'pH'. The main area contains a table with columns for '#', 'Slurry ID', 'Lock', 'Auto', 'Status', 'Actual', 'Set Point', 'Tolerance', 'pH', and 'Temp'. A callout box points to the 'Lock' button for slurry 1, with the text: 'Lock to the current viscosity by clicking "Lock" button.'

#	Slurry ID	Lock	Auto	Status	Actual	Set Point	Tolerance	pH	Temp
1	[Red]	Lock	Manual	●	23.5	NaN	1	0	30
2	[Green]						1	0	0
3	[Grey]	Lock	Manual	●	0	NaN	1	0	0
4	[Blue]	Lock	Manual	●	0	NaN	23	0	0

Navigation icons on the right include HOME, LOAD JOB, JOB REPORT, JOB DETAILS, SUPPORT, and SETTINGS. The bottom status bar shows a timestamp '9/3/2024 05:06:32', values '5400 19.7 min', and a message 'The station has been Idle for too long'. Buttons for 'Clear' and 'Advanced' are also present.

5. InkSight Software

Locking the Setpoint

The screenshot displays the InkSight software interface for 'Print 3' at 'Company 2' on '03 Sep 2024 05:27:21'. The interface is connected and shows a table of slurry data with various control options.

#	Slurry ID	Lock	Auto	Status	Actual	Set Point	Tolerance	pH	Temp
1	[Red]	Locked	Auto	●	24.4	24	1	0	30
2	[Green]							0	
3	[Grey]							0	
4	[Blue]	Lock	Manual	●	0	NaN	23	0	0






A callout box points to the 'Locked' and 'Auto' buttons for slurry 1, containing the text: "Button changes to 'Locked' and next button changes to 'Auto' This starts automatic control to keep the ink at this setpoint."

The interface also includes a sidebar with navigation options: HOME, LOAD JOB, JOB REPORT, JOB DETAILS, SUPPORT, and SETTINGS. At the bottom, there is a status bar with navigation arrows, a timestamp '9/3/2024 05:06:32', a value '5400 0 min', a message 'The station has been Idle for too long', and buttons for 'Clear' and 'Advanced'.

5. InkSight Software

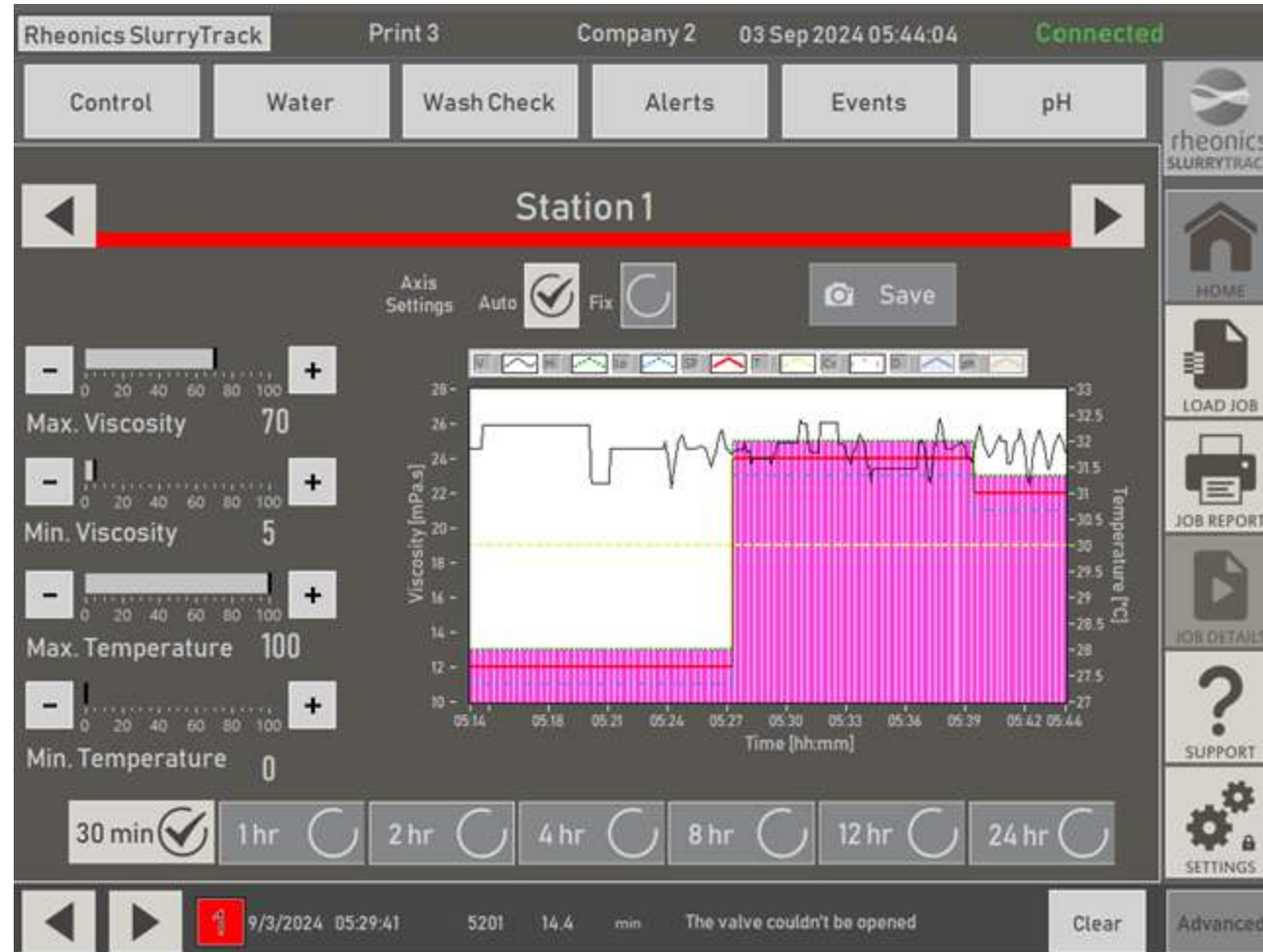
Status Color Indicator



Status Indicator	Description
Green 	Controlling. Inside the tolerance of the setpoint
Yellow 	Controlling. Outside the tolerance of the setpoint
Red 	Controlling. Outside the alarm tolerance
White 	Connected and monitoring
Black 	Station disabled

5. InkSight Software

Runtime Plots



5. InkSight Software

What Info is needed from Customer?

- How many stations are needed?
- Are there solvent pipes, buckets, or lines?
- Do they want to measure solvent level? If yes,
 - Is there a single level sensor in a solvent tank?
 - Or are there multiple level sensors in buckets?
 - What are the tank dimensions?
- What type of solvent is used? (Water-based, other?)
- Do they want to measure pH? If yes,
 - Is it for a single solvent tank?
 - Or are there multiple buckets?
- Are there solvent and cleaning valves in the system?
- Do they need additional client interfaces?
- What's the Customer Time Zone?
- Does the customer want to receive alarm emails?
- Do they want to enable the buzzer for all alarms?
- Should the alarms time out if no one clears them?
- Do they want to map parameters to the SMET 4–20 mA channels?

Section 06

User Benefits & Outcomes

6. User Benefits & Outcomes

Benefits | Key User Benefits of InkSight

INKSIGHT places the focus on print quality instead of measurement skills.

Achieve best in class print quality, dramatically reduce setup time and optimize use of pigments and solvents. Improve productivity and efficiency through complete automation of color control on your press.

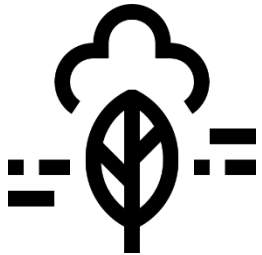
- **Single click**, intuitive control of ink viscosity
- **Reduce setup time** and eliminate setup scrap by loading previously saved job configurations, enabling consistent print quality in repeat jobs with minimal efforts for production
- Robust, **maintenance free** viscosity sensor eliminates need for re-calibration or cleaning by operators
- Better print quality: Tighter, more **accurate color density** and dE control across the complete run
- Edge over competitors by undertaking **higher margin – higher quality print jobs** made possible with the Rheonics InkSight system

6. User Benefits & Outcomes

Outcomes | InkSight Technology lets the operator...

ENVIRONMENT

Reduce Solvent Emissions



Optimized automatic solvent dosing compensates exactly for solvent evaporation, eliminating excess solvent consumption. InkSight technology enables building 'greener' printing presses. Software keeps track of all events such as setpoint violations, alarms averages per-color solvent consumption and the number of doses.

SAFETY

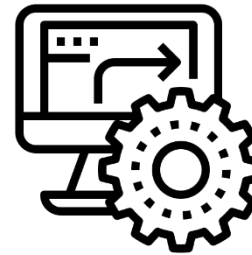
Achieve better operator safety



With InkSight, operators do not need to make manual measurements eliminating all contact with ink and solvent vapors. Furthermore, any new addition of ink does not need pre-dilution, as InkSight system automatically and rapidly brings fresh ink to the proper viscosity.

PRODUCTIVITY

Completely Automate operations



Most all systems in gravure machines are automated except ink control. InkSight completes the circle by bringing fully automating ink viscosity control – one of the most crucial factors in achieving highest print quality and lowest environmental impact with minimal operator intervention.

RESPONSIVENESS

Make data-driven decisions

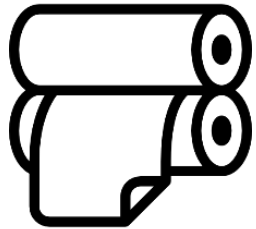


Collected print job data is available for process optimization, quality control and proactive maintenance. Data allows detecting process deviations and facilitates root cause analysis. Rheonics solutions are designed to empower printers with maximum actionable data.

6. User Benefits & Outcomes

Outcomes | InkSight Technology lets the operator...

Highest Print Quality



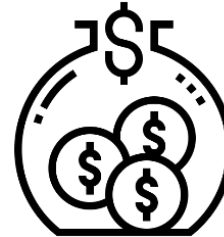
Viscosity is the single most important variable for printing color quality. InkSight system helps maintain the highest color quality standards through tight and accurate viscosity control.

More efficient operations



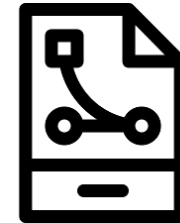
InkSight enables setting up a job to spectrophotometer standards. It offers 100 times greater viscosity resolution than average efflux cups. Operators do not need to make time-intensive and error prone manual measurements of viscosity.

Reduced printing costs



By ensuring correct ink properties throughout a run, tight viscosity control reduces printing errors, paper waste and rejects. Solvent consumption is significantly reduced while improving productivity

Easy scalability



Reduce and eliminate setup times and scrap by loading saved jobs for repeat orders.

Section 07

Technical Achievements

Achieved: robust, repeatable, no-calibration sensor



SRV viscometer



Showing the inline installation of the Rheonics SRV viscometer in an ink delivery system

The Rheonics' SRV Viscometer is the essential foundation upon which InkSight system is built:

Robustness construction

Rheonics balanced torsional resonators together with proprietary 3rd generation electronics and algorithms makes the SRV accurate, reliable and repeatable under all printing conditions. It is free of the rotating parts and narrow gaps that are typical of conventional viscometers.

Zero maintenance, no recalibration

The SRV viscometer exposes only hermetically sealed, mechanically robust sensor elements to the ink. It is free of gaps and cavities, and is cleaned in place (CIP). The sensor monitors cleanliness of the line, and informs the operator of any fouling.

Built-in temperature monitoring for effective temperature compensation of viscosity

The SRV sensor has temperature measurement integrated into the sensing element. This enables characterization of the ink at the point of viscosity measurement, and allows calculation of temperature compensated viscosity – critical for uniform print quality even under daily and seasonal variations.

Achieved: completely automatic, single-click viscosity control



Operator independent measurement

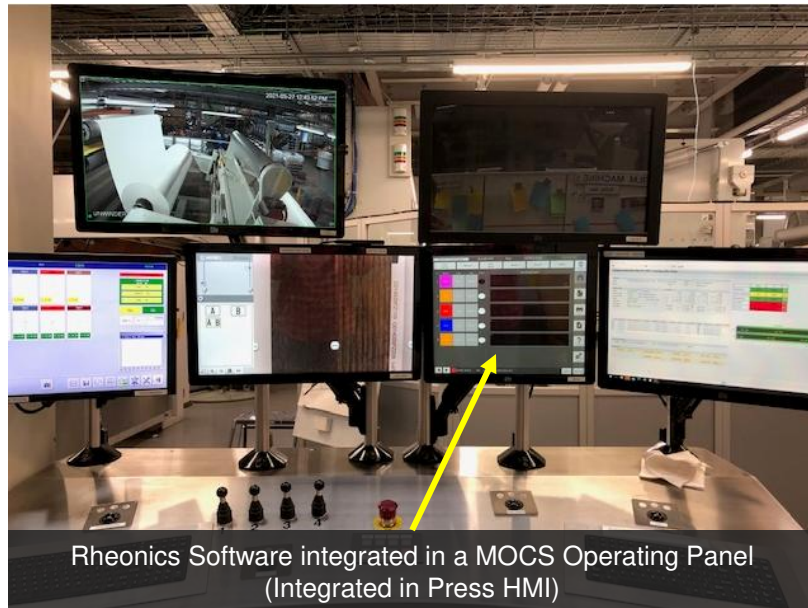
Conventional viscosity measurement systems require intensive operator intervention distracting operators from their core mission. InkSight takes over measurement and control functions placing the full power of today's highly sophisticated printing machines in the hands of the operator. It removes the last hurdle to producing the best possible printed materials.

User focused interface

Operators worldwide told us, they wanted to “set it and forget it”. We rolled their vision into the single-click ColorLock “AUTO” control button. That single button places the full power of InkSight in the hands of the operator.

Seamless integration with machine and factory data system

InkSight monitors, logs and analyzes every aspect of the ink system, carrying out advanced analytics, self-diagnosis, forensics to spot potential problems before they happen. All these data and analytics is shared with machine PLC and factory data acquisition systems in industry standard protocols. Rheonics InkSight can communicate bi-directionally with machine and factory AI systems, enabling plant managers, quality assurance specialists and production supervisors to not only monitor but actively guide the production in their plants.



7. Technical Achievements

Competitive Edge of InkSight & SRV System (1/2)

Major advancements as compared with other ink viscosity measuring devices.

- ***Build it in the machine instead of building the machine around it:*** Compact sensor form factor means lower footprint and easy integration into new or existing machine. Simple sensor integration reduces installation cost. Measurements are unaffected by environmental disturbance whether vibrations, temperature variations or presence of motors and other large machinery.
- ***Provides a direct, stable link between ink viscosity and print quality:*** Operators can focus on the printing job instead of measurement techniques.
- ***Works with all types of inks, primers, adhesives:*** The Rheonics SRV viscometers work reliably with all types of inks whether solvent-based, water-base, metallic or UV as well as adhesives, varnishes and other coatings. They maintain the same accuracy and repeatability with low viscosity materials, such as gravure inks as with high viscosity coatings.
- ***Reliable Temperature Compensated Viscosity:*** Controls the viscosity parameter that reflects pigment loading, taking out variations due to daily and seasonal ambient temperature fluctuations.
- ***Intrinsically safe sensor:*** SRV comes with fully certified with ATEX, IECEx, CE and others pending. It can be used in any solvent based environment.

7. Technical Achievements

Competitive Edge of InkSight & SRV System (2/2)

Major advancements as compared with other ink viscosity measuring devices.

- **Operator focused interface:** User interface was designed with consultation of operators, so it addresses the day-to-day needs rather than requiring extensive re-training. Operator acceptance was first and foremost in our design process. InkSight gives the full power of the system at the click of a single button in ColorLock software GUI.
- **No need of any sensor re-calibration, cleaning or maintenance:** First sensor that does not need any calibration and is maintenance free over the expected 25 years lifetime of the sensor. Trust in the sensor through InkSight ensures operators move away from using cup to calibrate an ultra-precise, accurate sensor helping achieve consistency during and between print jobs.
- **Printing 4.0 ready - Equipped to enable printing presses achieve full automation:** InkSight ColorLock software keeps track of every process variable during a print run. The print data is stored on the system as well as is made available to the machine PLC and factory data acquisition systems. Bi-directional communication between machine, job servers and InkSight makes loading and running job easy. Plant managers, quality personnel and production supervisors get powerful interface to directly review print job report on InkSight ColorLock web servers or evaluate performance on job dashboards.

Major advances in printing by Rheonics Technology

Thinking beyond cup seconds



Revolutionizing the way printers control ink quality

Measuring viscosity with cups is unreliable, inaccurate, time-intensive even with experienced operators. It's a huge bottle neck for scaling up printing volumes by continuous processes.



“ Due to the knowledge gained and the behavior of the ink on the substrates on which we print, we know which values for the viscosity must be adhered to- this saves a lot of time, reduces scraps and wastage. We have eliminated setup scraps and reduced setup times because of the ability to load previously run jobs. It has significantly boosted our productivity and profitability by increasing our ability to deliver more print jobs.



Bert Verweel
Owner, Maasmond
Paperindustrie BV,
Netherlands

7. Technical Achievements

Precise Viscosity Control

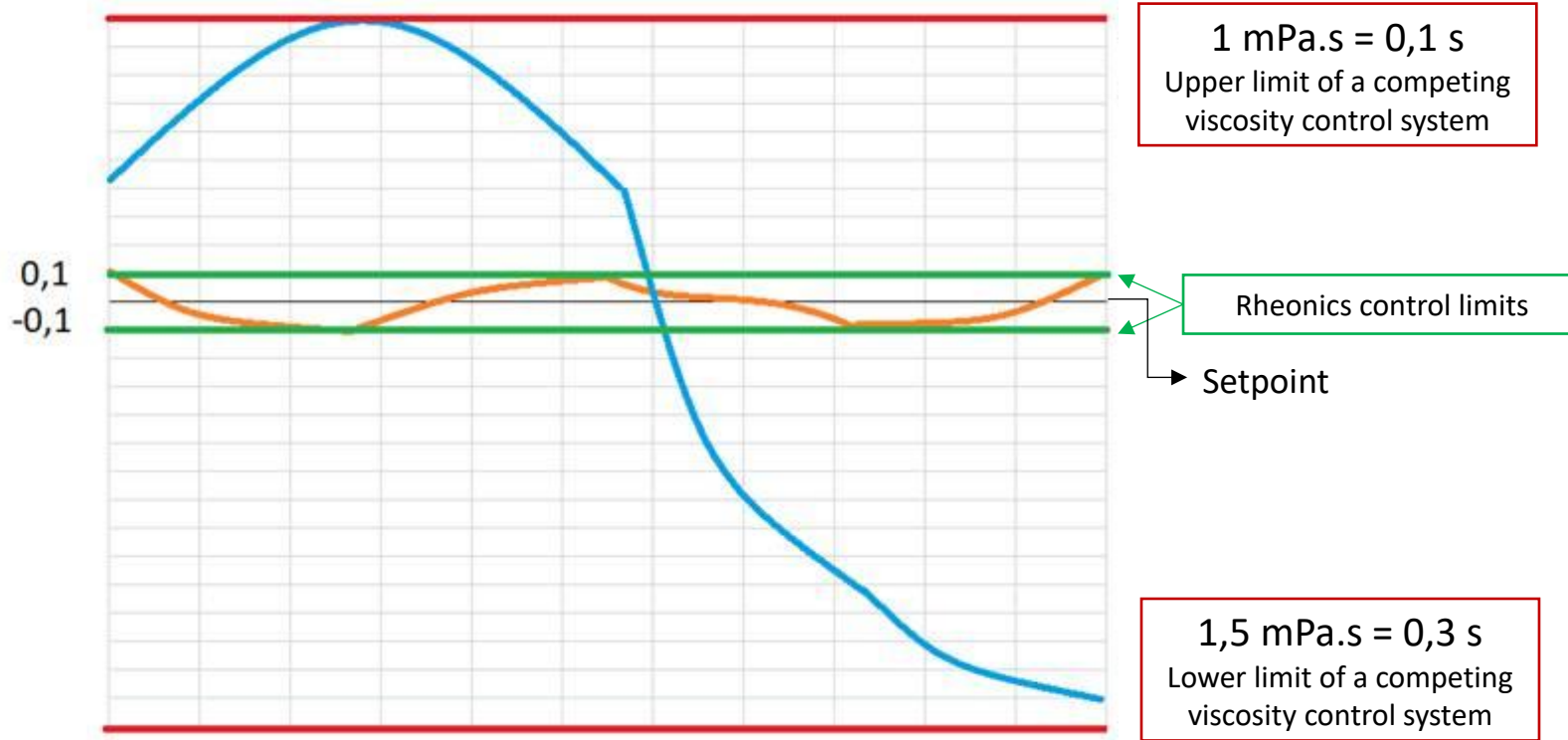


Exhibit – 1. Viscosity control accuracy, Rheonics InkSight Vs. Competitor

Note:

Orange line shows *ink viscosity control with Rheonics InkSight*

Blue line shows ink viscosity control of a competing, industry leading solution

“

InkSight is at least 10-15 times more accurate than competing viscosity systems with repeatable setpoints.



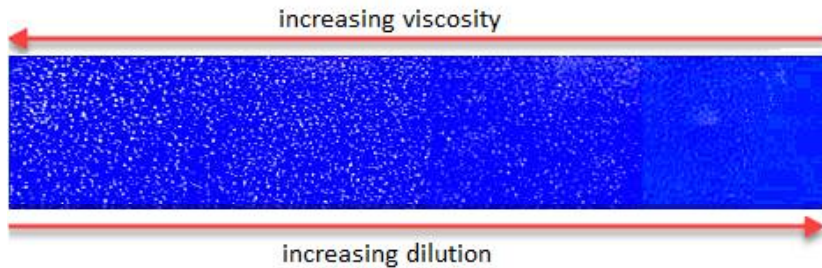
Bert Verweel

Owner, Maasmond
Paperindustrie BV,
Netherlands

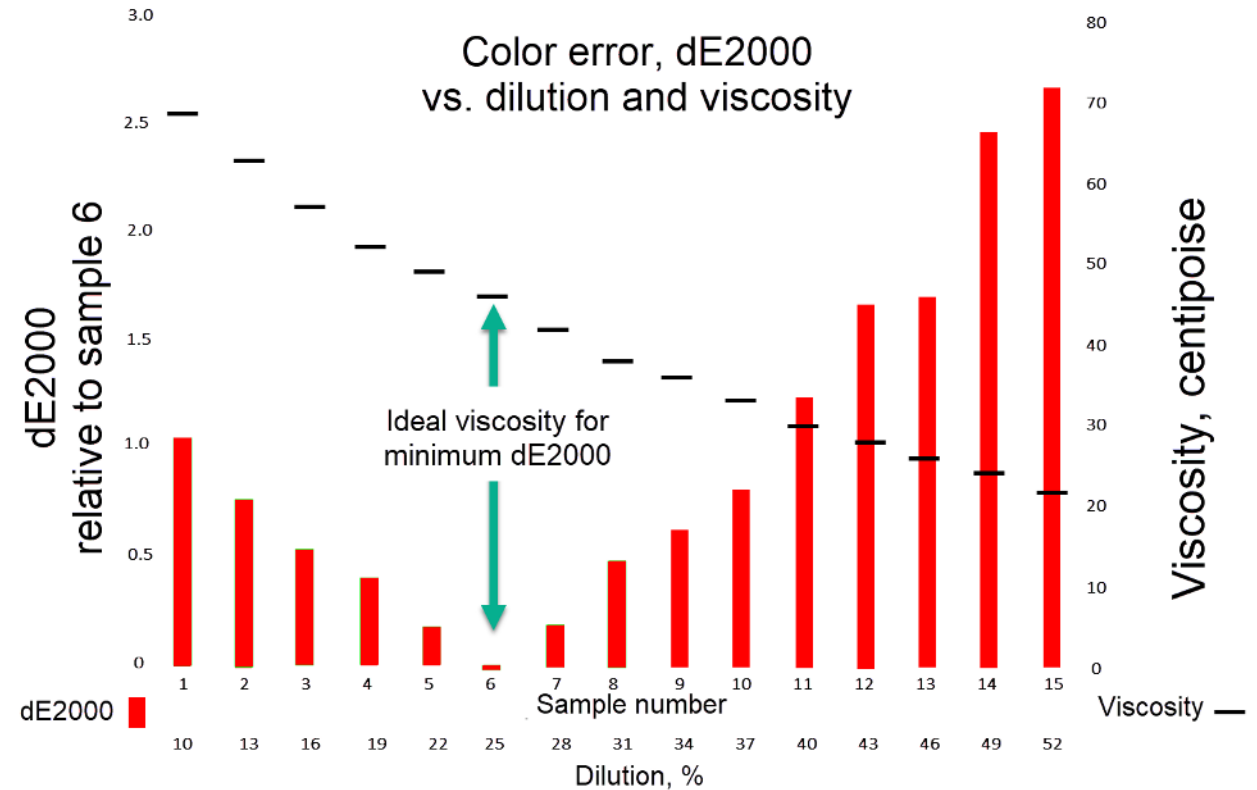
Viscosity control = color quality control

sample	Viscosity (mPa.sec)	din cup	dilution	dE	color strength
1	69	26.2	10%	1.07	94.20%
2	63	24.8	13%	0.79	97.80%
3	57	23.4	16%	0.55	96.40%
4	52	22.3	19%	0.41	98.80%
5	49	21.6	22%	0.19	98.80%
6	46	20.9	25%	0	100.00%
7	42	20	28%	0.2	98.90%
8	38	19	31%	0.5	98.00%
9	36	18.6	34%	0.64	98.00%
10	33	17.9	37%	0.83	97.20%
11	30	17.2	40%	1.26	96.80%
12	28	16.7	43%	1.69	95.00%
13	26	16.3	46%	1.73	95.00%
14	24	15.8	49%	2.49	92.30%
15	22	15.4	52%	2.7	91.60%

Numerical values of dE2000 and color strength vs. dilution.

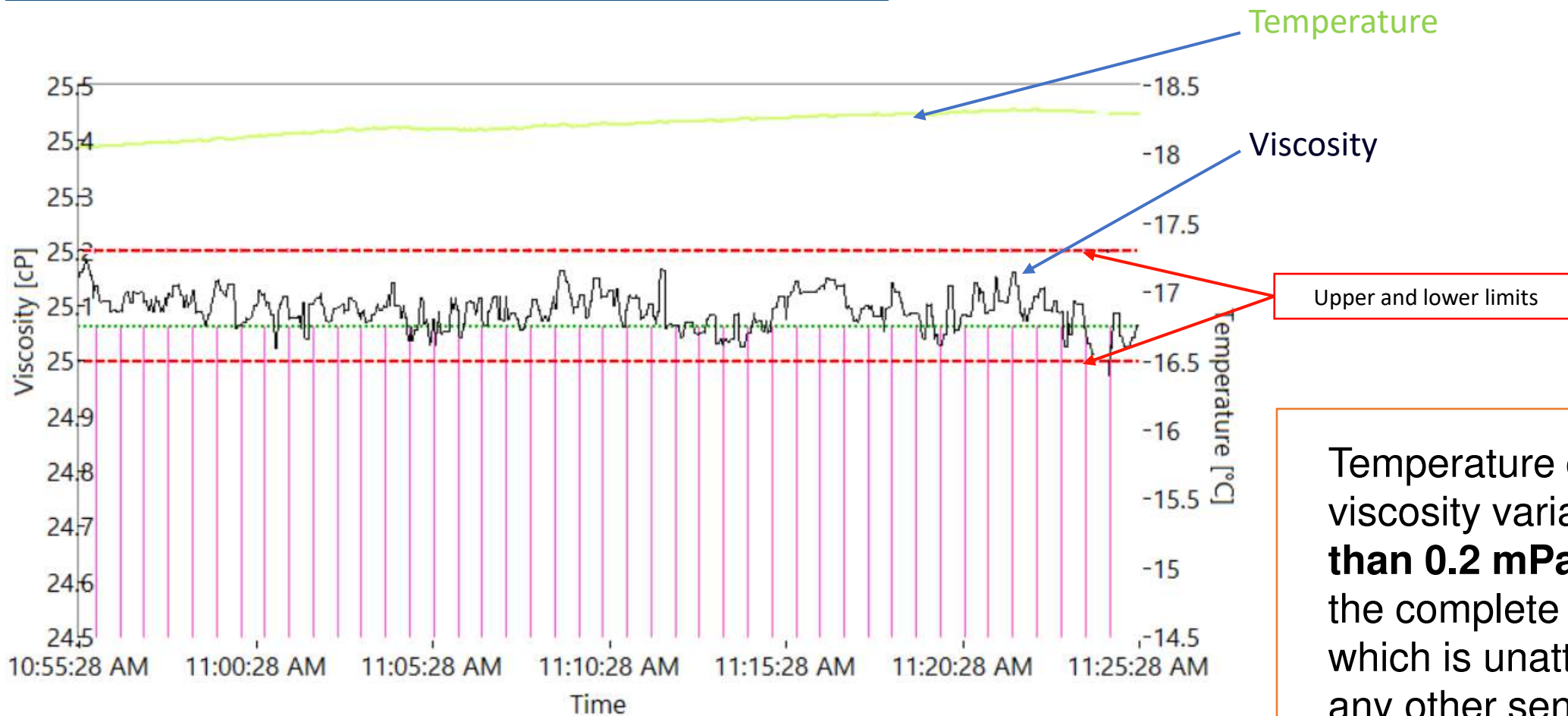


Color density variation with ink dilution and viscosity



Ink was diluted in steps. Viscosity and color strength were measured. Dilution of 25% gave minimum dE2000, at a viscosity of 46 cPs. Using a setpoint of 46cPs for InkSight will give a constant minimum color error throughout the print run.

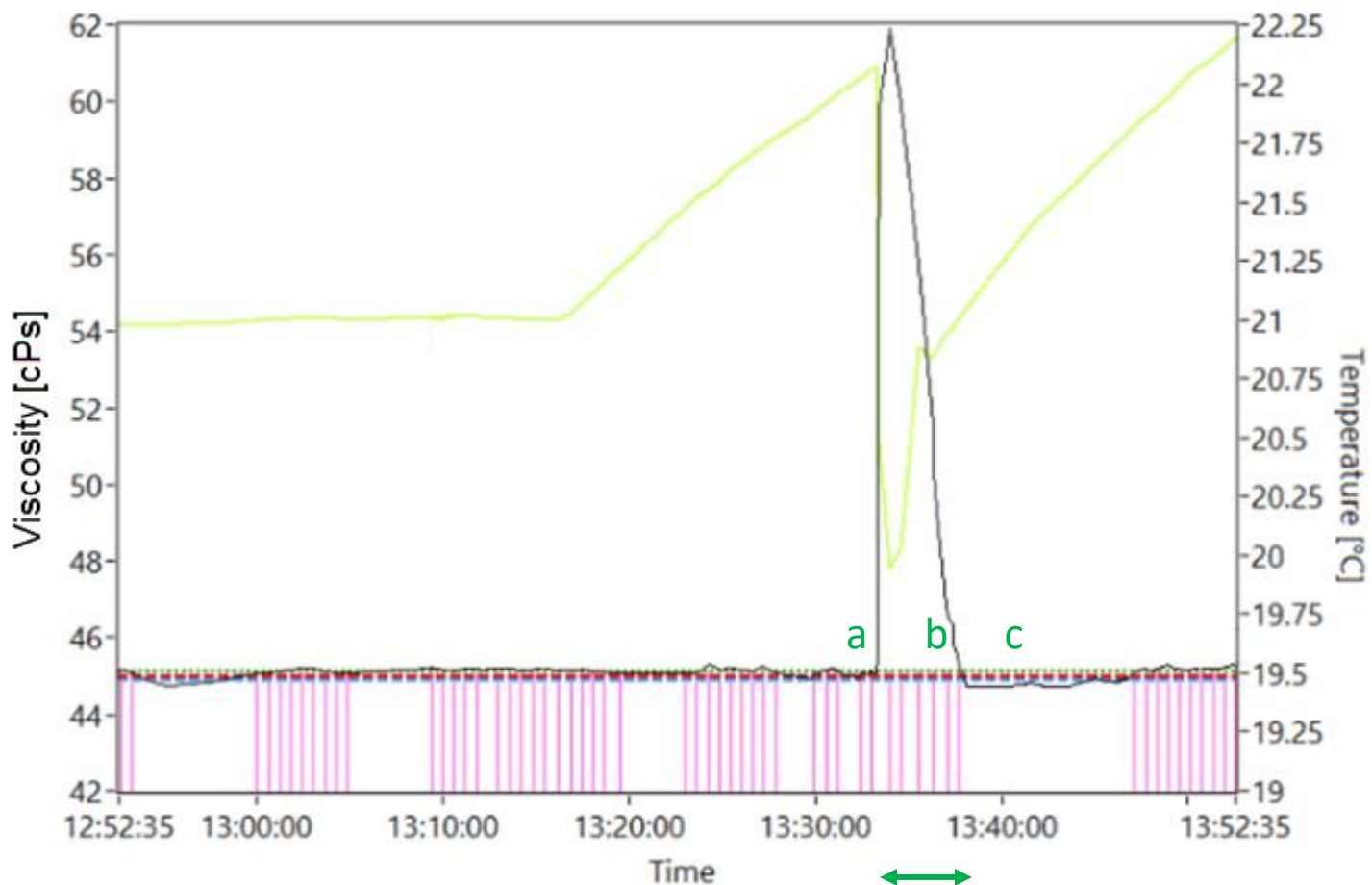
Control stability



Temperature Compensated Viscosity Vs Time. Software screenshots collected from a press using InkSight for Viscosity Management.

Temperature compensated viscosity variation is **less than 0.2 mPaS** throughout the complete print run; which is unattainable with any other sensor or traditional instruments.

System responsiveness



InkSight brings new ink to setpoint within 5 minutes

Response of the system to adding a large volume of cool ink to a system running at 21 deg. C. The spike in viscosity is because of cool ink addition.

InkSight viscosity control system ensures *rapid recovery of the temperature compensated viscosity to the setpoints.*

- On addition of new, cool ink (a), InkSight brings the ink viscosity to the setpoint quickly (b), with minimal overshoot and without overdilution (c).
- The dosing of solvent to make viscosity adjustment is completely autonomous: no manual intervention is required.
- The operator does not need to worry about ink's viscosity prior to addition, since the system can automatically adjust the viscosity very fast and accurately.

Reduction in Solvent Consumption

Rheonics InkSight Commissioned in Laminating Machines – April 2020

Solvent Consumption Data on laminating machine								
	2013	2014	2015	2016	2017	2018	2019	2020
Ratio (Solvent: Adhesive)	2,05	1,94	1,96	1,93	1,96	2,09	2,02	1,22

Rheonics InkSight Commissioned in Printing Press – June 2018

Solvent Consumption Data on printing press									
	2013	2014	2015	2016	2017	2018	2019	2020	
Ratio (Solvent: Ink)	1,26	1,05	1,23	1,02	1,00	0,57	0,84	0,65	

Note: There is a ~ **40% reduction in solvent consumption** after InkSight system integration in customer application.

Solvent consumption per unit adhesives & per unit ink data reported by a customer after commissioning of Rheonics InkSight (Source – Maasmond B.V.).

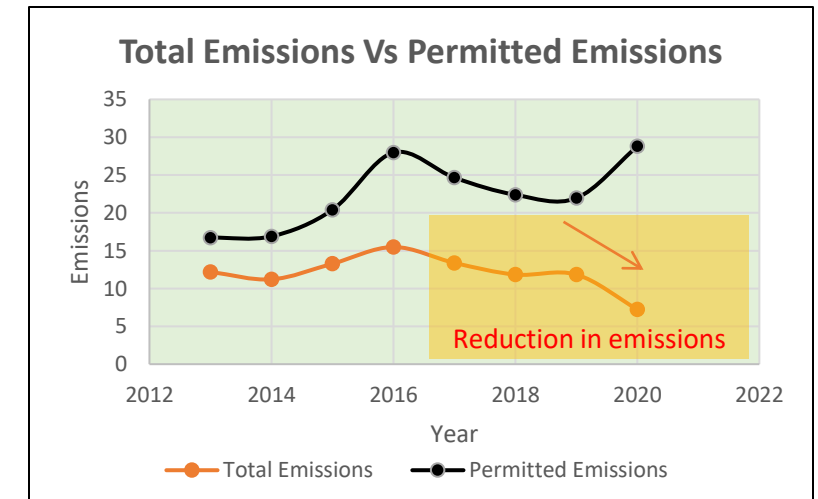
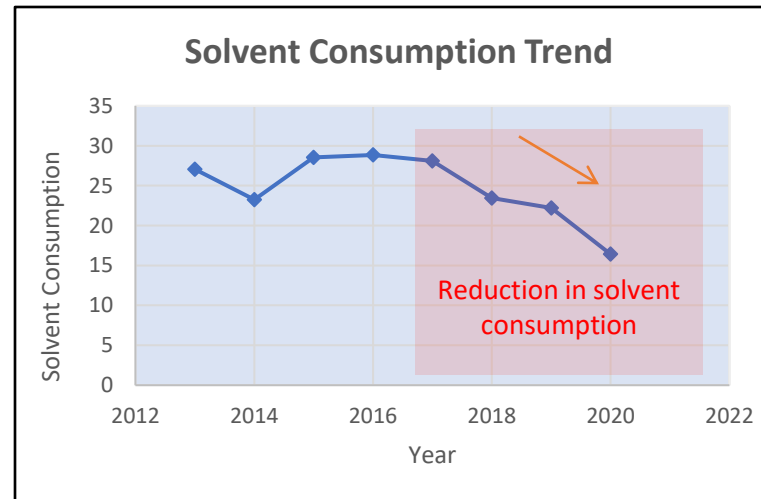
Emissions reduction

Rheonics InkSight introduced in Maasmond
B.V. Operations – June 2018

	2013	2014	2015	2016	2017	2018 ¹	2019	2020 ²
Solvents consumption	27.045	23.239	28.532	28.848	28.112	23.442	22.197	16.420
Total emission	12.193	11.214	13.281	15.487	13.389	11.841	11.841	7.240
Permitted emission	16.727	16.896	20.400	27.971	24.655	22.388	21.954	28.798

Notes:

1. InkSight Commissioned on printing press ink stations in June 2018
2. The second InkSight system commissioned on the laminator units in April 2020



Solvent consumption and emissions data reported by a customer after commissioning of Rheonics InkSight
(Source – Maasmond B.V.)

Rheonics Resources Available

[Rheonics Web Page](#)

Science articles, Whitepapers, access to all resources of Rheonics sensors

[Rheonics Resources Library](#)

Brochures, CAD models, Certifications, etc.

[Rheonics Support Portal](#)

Multiple electronics, mechanic, integration articles

[Rheonics Partner Training](#)

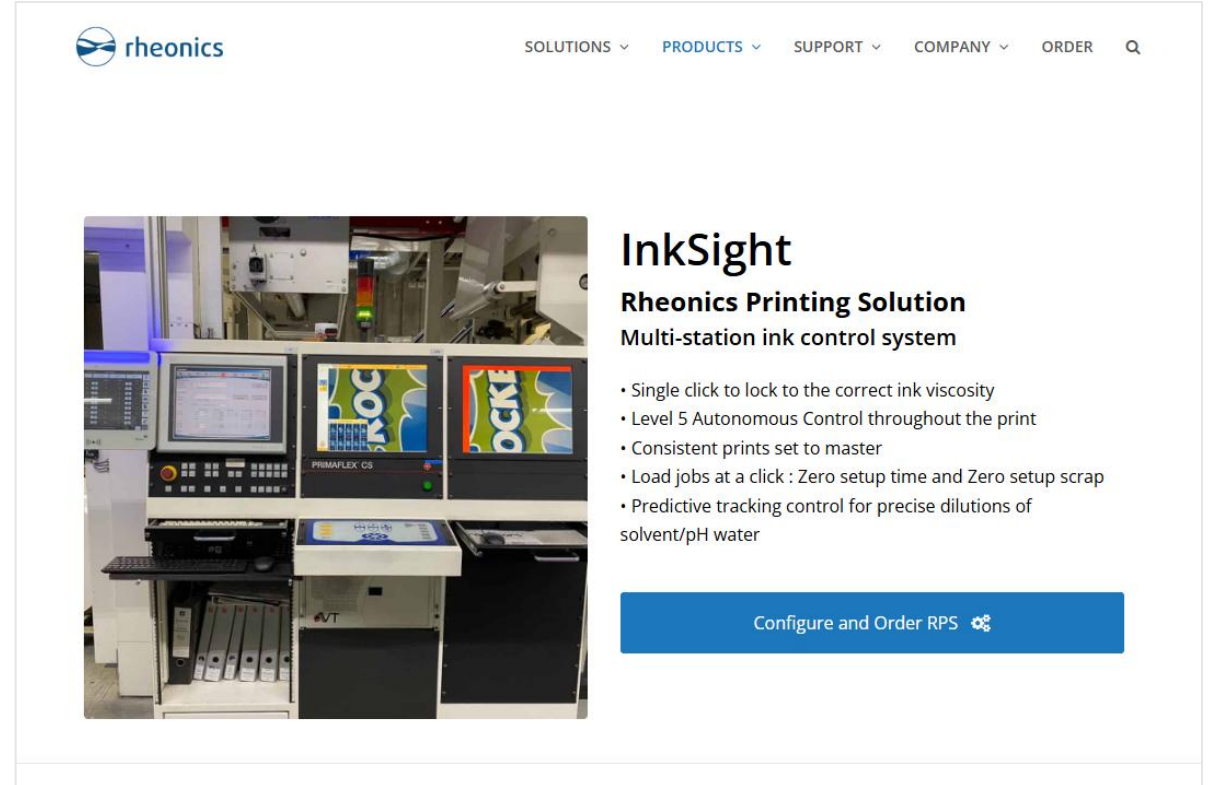
Presentation videos

Section 08

How to Order?

8. How to Order?

1. Visit Rheonics InkSight Website: [RPS InkSight](#).
2. Click on “Configure and Order RPS”
3. Fill and send the Form
4. Our Sales Team will contact to you soon.



InkSight
Rheonics Printing Solution
Multi-station ink control system

- Single click to lock to the correct ink viscosity
- Level 5 Autonomous Control throughout the print
- Consistent prints set to master
- Load jobs at a click : Zero setup time and Zero setup scrap
- Predictive tracking control for precise dilutions of solvent/pH water

Configure and Order RPS ⚙️

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