

# Fabric Density Measurement and Control

## Why finish fabric to density (CPI) instead of weight (GSM)?

Because density can be continuously measured and controlled ...  
**weight cannot!**

Controlling the overfeed of a stenter frame with the Automation Partners Inc. proprietary feedforward technology results in a significant improvement in fabric density—and weight—uniformity.

More uniform fabric results in:

- Higher quality fabric.
- Better prediction of shrinkage.
- Better shade consistency of dyed and napped fabrics.
- Better color and pattern uniformity of printed fabrics.

Automation Partners Inc.

# Stenter Overfeed Control

The Automation Partners Inc. overfeed control systems use fabric density (courses of knitted fabrics and picks of woven fabric) as the measurement and control parameter.

Since linear density is proportional to fabric weight and can be accurately measured while the fabric is wet, it has a distinct advantage over weight measurement devices, such as beta gauges.

## Feedforward Equals Control

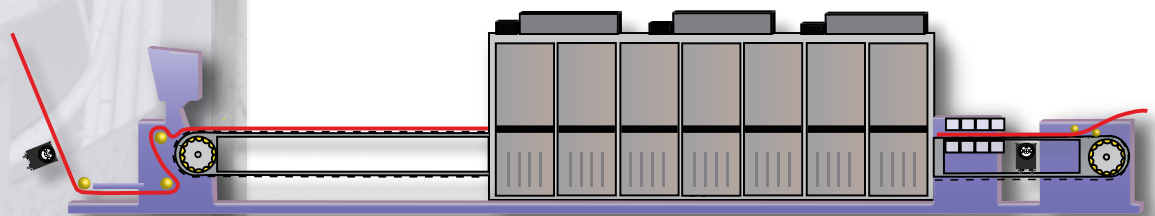
A beta gauge for measuring weight must be placed at the exit of a stenter where the fabric is dry. Thus, the only possible control is feedback, **which will not work because of the length of a stenter.**

An optical sensor for measuring density can be placed at the entry of the stenter allowing for the use of a feedforward control algorithm correcting the overfeed speed before the fabric is placed on the stenter pins.

The continuous monitoring by the sensor provides accurate measurement of every meter of fabric and does not require operator setup or programming.

## The Results

- Fabric produced to the exact density (and weight) desired—for every meter.
- Reduction or elimination of punch-weight measurements.
- Fabric finished to the same quality level for all operators.
- Higher production of fabric—more meters, more garments, more profit.







# How the System Works

The Automation Partners Inc. overfeed control systems use two PSM Sensors to measure fabric density plus a controller to adjust the overfeed of the stenter to achieve uniform fabric density and weight.

Fabric density is measured at the entry of the stenter, and the controller uses the API-developed feedforward control algorithm to adjust the overfeed to achieve the desired finished fabric density and weight.

The result, shown in the graph, is uniform fabric density and weight in automatic control, eliminating the variations typical when the overfeed is held constant after manual operator set up.

## The Functions

-  The entry PSM Sensor measures fabric density and speed prior to the overfeed roll.
-  The fabric speed measurements from the integral tachometers of the entry and exit sensors are used to accurately calculate the actual overfeed of the fabric.
-  The density of the fabric at the entry is compared to the target density to determine the required overfeed.
-  Control signals from the API system change the overfeed so the actual overfeed is equal to the required overfeed.

### Without Yield Control System

Manual control of overfeed

Finished fabric results:

- average density 70.4 CPI
- standard deviation 0.957 CPI
- range 3.4 CPI

**Within specification but not uniform**

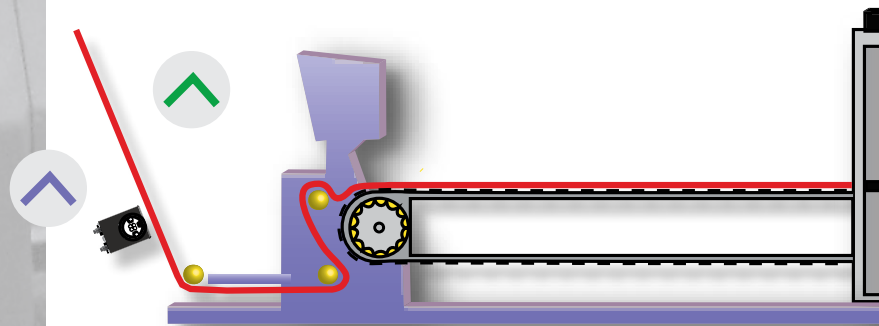
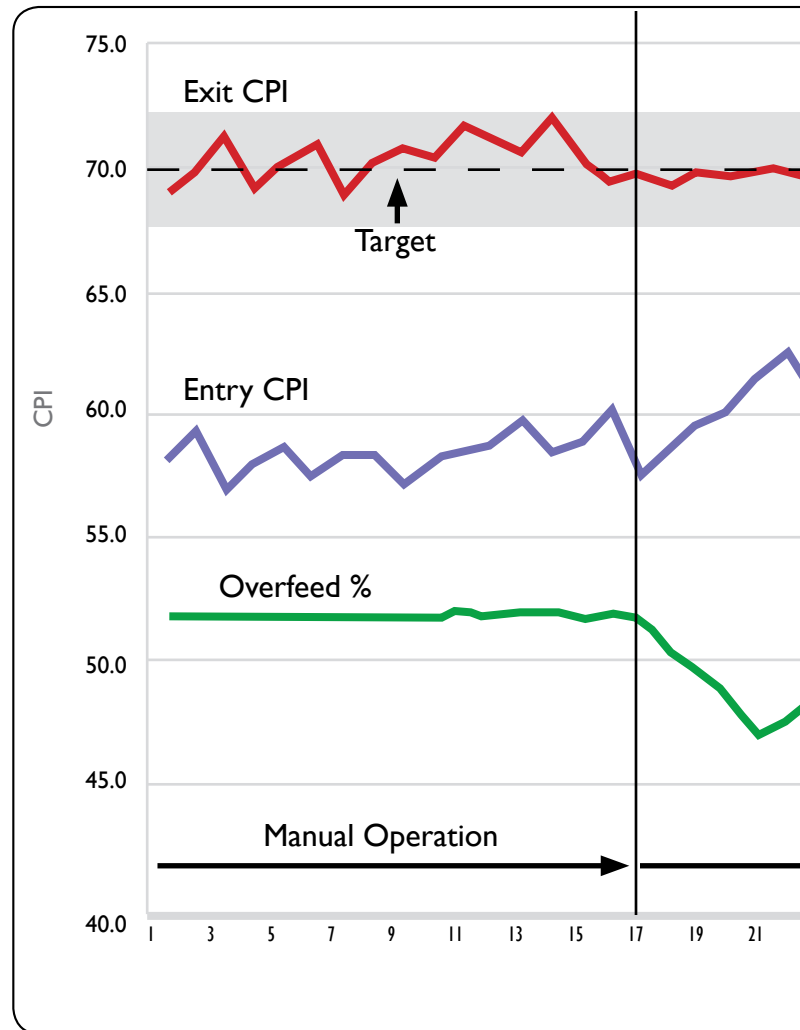
### With Yield Control System

Automatic control

Finished fabric results:

- average density
- standard deviation
- range

**More uniform**



## Control System

control of overfeed

abric results:

ensity 70.0 CPI  
e deviation 0.275 CPI  
1.2 CPI

orm/higher quality fabric

## There's More

Reduce target density to 68.5 CPI

Finished fabric results:

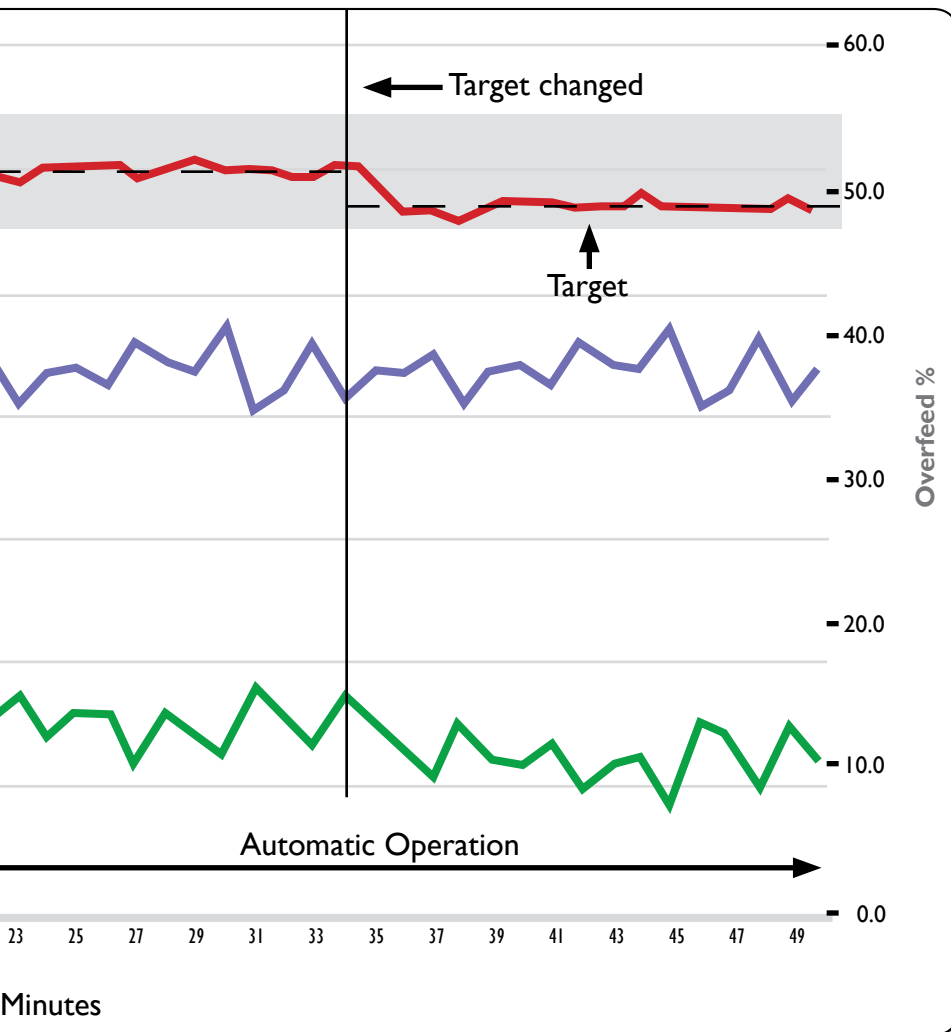
- fabric finished within specification
- 1021 meters of fabric instead of 1000 meters
- 21 meters of fabric at no additional cost

**2.1% more fabric at 100% profit**

## The Benefits

If a finisher producing 500,000 meters per month at an average density of 70.0 CPI reduces the average/target density to 68.5 CPI, he will obtain a 2.1% increase in the length of fabric produced from the same amount of raw material.

If the fabric sells for USD2.00 per meter, this increase in production yield provides added revenue of USD 21,000 per month—**at no additional cost.**



## The Results

The result, as documented by the PSM Sensor at the exit of the frame and shown in the chart, is uniform fabric density (and weight). The variations typical when the overfeed is held constant after manual operator setup are eliminated.

Printed reports record the entry and exit fabric densities, lengths and overfeed.



## Choice of Systems

Two systems are available for stenter overfeed control.



The OCS is a basic control system.

The YCS is a full-featured system.

Both systems use the API-developed feedforward control algorithm to adjust the overfeed.

The table compares the functions of the two systems.

Start with an OCS and upgrade later to a YCS—just plug in the touch screen-based workstation.

Function	OCS	YCS
PSM-200 Sensors	2	2
Operator Display	2.5" x 4.5"/64 x 114 mm monochrome text LCD	15"/380mm color graphic LCD
Operator Input	28-key keypad	Touch screen
Engineering Input	28-key keypad	101-key keypad
% Overfeed Control	✓	✓
Exit CPI/PPI Control	✓	✓
Control Algorithm	Feedforward	Feedforward
Data Records		✓
Control Parameter (Recipe) Storage		✓
Trend Graphs		✓
Printer	42-column dot matrix (text)	Color ink jet (graphics & text)
Production Reports	✓	✓
Downtime Reports		✓
Print Historical Graphs		✓
Computer Interface	✓RS232/485	✓ LAN
I/O Control	2 Digital pulse outputs	Customer specified
Fabric Temperature Measurement		✓ (Option)
Fabric Width Measurement	✓ (Option)	✓ (Option)
Control Processor		

Automation Partners Inc. has provided electronic solutions to the textile industry since 1990. With thousands of sensor systems and control systems installed worldwide, API is the leader in this technology.

You can count on this experience and performance to be assured of getting the best product—and the best service—at a fair price.

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