

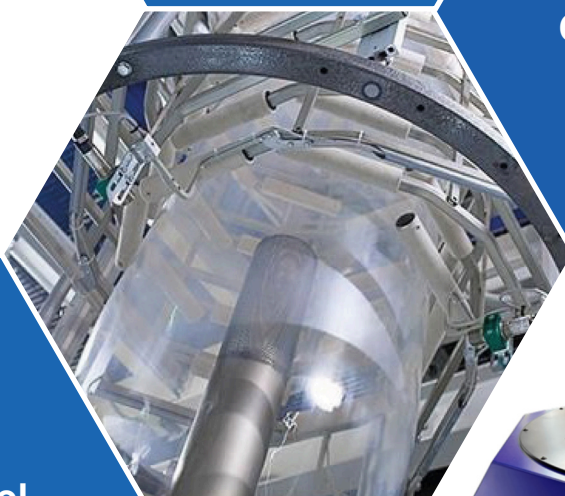


## Solutions Through Partnership

**Gravimetric Blending  
& Extrusion Control**



**Complete Blown Film  
Solutions**



**IBC & Width Control**



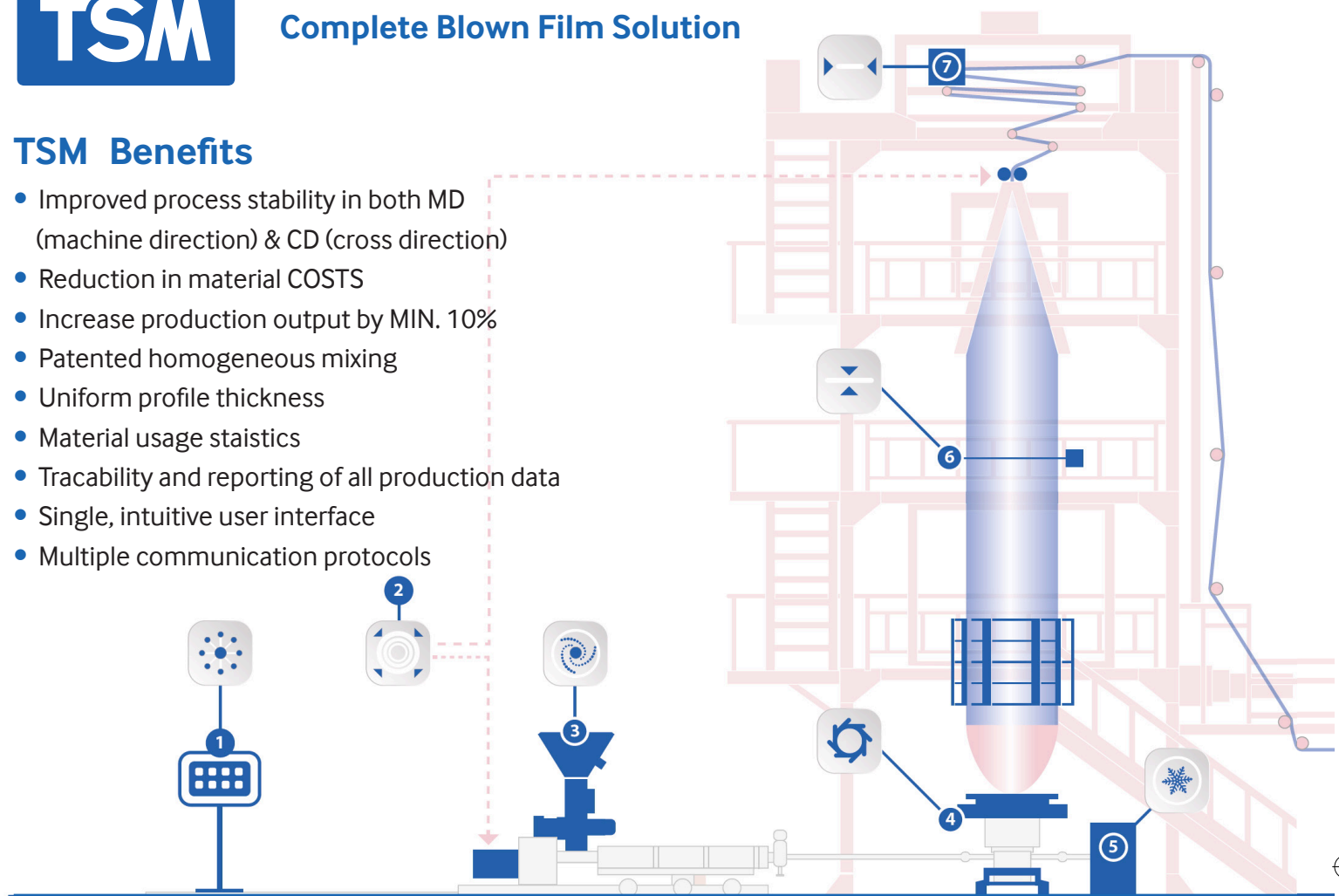
**Automatic Bubble Profile  
Control**

**[tsm-controls.com](http://tsm-controls.com)**



### TSM Benefits

- Improved process stability in both MD (machine direction) & CD (cross direction)
- Reduction in material COSTS
- Increase production output by MIN. 10%
- Patented homogeneous mixing
- Uniform profile thickness
- Material usage statistics
- Tracability and reporting of all production data
- Single, intuitive user interface
- Multiple communication protocols



#### 1 Central Line Control System



Central Overview and visualization of the extruder performance, including; blender recipes, throughputs, shift/daily reports, thickness profiles, layer ratios, alarm management, material tracking. The intuitive user friendly interface with intuitive graphics allows operators to see all critical machine parameters at a glance. Standard communication protocols available to ensure ease of data exchange among all control elements.

- Recipe set up & management
- Blender overview, setup & visualization
- Single Window Visualization
- Management system – not just control !
- Remote diagnostics

#### 2 Extrusion Control



TSM has continually invested in extrusion control technologies for the Blown Film segment, which has allowed TSM to bring to market the fastest & most accurate control technologies available in the industry. Producers can choose from: Throughput Control – varying the extruder RPM to control output rate. Weight / Length Control - maintains product yield by adjusting Extruder or Extruder &/or Haul-off speeds simultaneously.

- Superior Algorithm Improves Quality
- Faster Start Up's
- Reduce Material Usage
- Reduced waste
- Compensates for bulk density variations

#### 3 Gravimetric Blending



TSM's range of Extrusion Control Loss in Weight Gravimetric Blenders for Blown Film provide superior accuracies, blend ratios & mixing homogeneity. TSM's Blenders utilize patented technologies in slide valve design & reverse flight auger mixing with continuous LIW measurement, resulting in ultrafast throughput measurement & control of the extrusion process. TSM's Blender range have throughputs up to 3000kg/hr.

- Fast, accurate Control response
- High Accuracy Dispensing
- Rapid response to process disturbances
- Superior weighing and patented mixing
- Material usage /Inventory statistics

#### 4 Bubble Air-Ring



One of the most critical factors for film quality & performance of blown-film extrusion lines is the air-ring. TSM therefore present the high-performance Dual-Flow air ring, which has been delivering production & quality efficiencies on hundreds of lines, worldwide. The development of the Dual-Flow air ring is based on substantial fluidic studies & thorough practical tests, along with significant input from customers.

- Highest cooling rate
- Improved film tolerances
- Absolute even air distribution
- Excellent bubble stability
- Maximum air flow, minimum pressure drop
- Die sizes 100 - 900mm

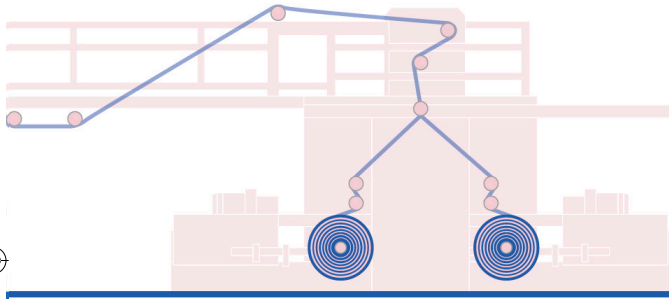
### Bubble Control Systems

- Automatic air ring
- Internal bubble cooling
- Automatic profile control
- Thickness measurement
- Die sizes 100 - 900mm diameter
- Stationary and rotating dies
- Normal or long-neck bubbles
- Optimal retrofitting of gauge control system



### Blending Technology

- Single component LIW's up to 1000 kg/hr
- OptiX multi-component LIW blenders up to 800kg/hr
- Continuous LIW blenders up to 2000 kg/hr
- Material handling and inventory management
- Unique patented reverse flight auger mixing
- Control algorithm allowing down gauging



#### 5 Internal Bubble Cooling



TSM IBC systems are designed to increase cooling efficiency & as a result, achieve production increases of between 10 – 20% & minimize width tolerances. IBC systems can be installed on new mono & co-extrusion lines and can also be retrofitted to existing lines thus controlling exactly the correct exchange of hot and cool air. TSM utilizes a non contact ultrasonic IBC control system which provides continuous monitoring of the bubble maintaining precise lay flat control and can be operated in manual or automatic

- Easy retrofitting to any existing bubble cage systems
- Almost maintenance-free
- Non-contact
- Width tolerances  $\leq \pm 2$  mm
- To be used for interior supply air & exit air

#### 6 Automatic Profile (Gauge) Control



The Automatic Gauge Control System alters the volume of cooling air to provide a uniform thickness around the bubble. TSM ensures uniformity in machine and cross directions of the extruded film. The profile is measured using either a contact or non-contact thickness measurement sensor. Capacitive on the bubble or edge sensors are available. The system maps the bubble to specific control zones on the air ring. Any deviation in film thickness is corrected by automatic adjustment of these control zones.

- Increased Output (10-20%)
- Uniform Cross Direction Thickness profile
- Fast Return on Investment (ROI)
- Contact & Non-Contact profile Scanner
- Optional Barrier Film Thickness Scanner
- Remote Diagnostics

#### 7 Automatic Width Control



The TSM Automatic Width Control System gives you, the customer, several options for maintaining a specific bubble size during normal operation. These options are ideal for managing on-the-fly size changes, reducing the time it takes to get the bubble on size and also minimizing changes in lay-flat due to temperature conditions or film stretch. TSM can also provide systems particularly suited for gusseted film. The lay-flat width scanner is coated in a hard wearing, low friction proprietary PTFE coating, incorporating infrared edge sensors that are unaffected by film colour or ambient light. Status indicators of both width and limit sensors are included for diagnostic purposes

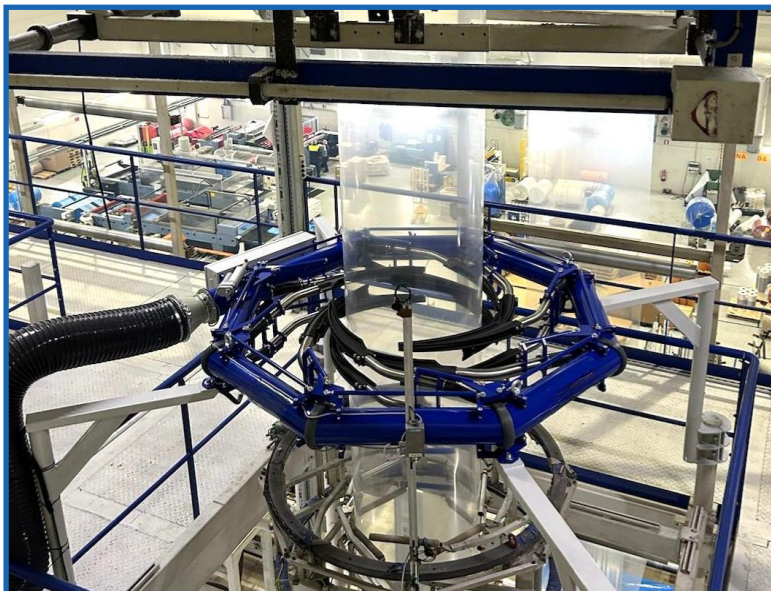
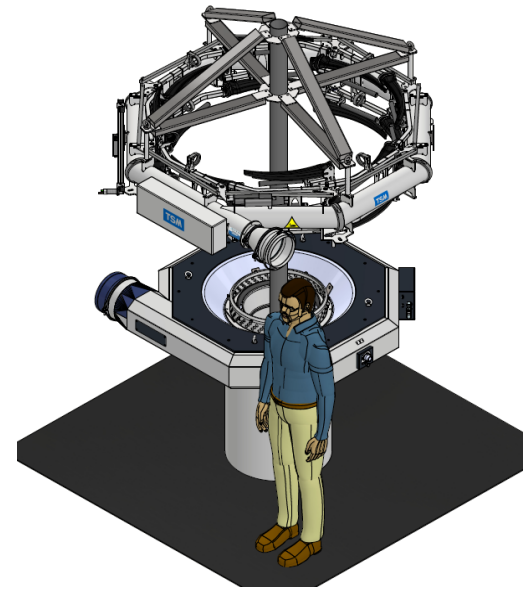
- Measures 0 - 10m
- Lay flat or Ultrasonic measurement available
- Measurement resolution 1mm
- Suitable for all film types and color
- Display resolution 1mm
- Displays instantaneous width and average width
- Readily expandable and upgradeable
- Automatic monitor and failsafe alarm



Solutions Through Partnership

## TSM OPTI-Cool Secondary Cooling Ring

TSM's Opti-Cool is a next-generation secondary air ring designed to improve cooling efficiency, reduce blocking, and enhance film flatness in blown film extrusion. Developed to meet the needs of Blown Film Extrusion, Opti-Cool is available in both single-directional (SDF) and dual-directional (DDF) configurations to meet the evolving needs of global film processors.



- Replaces traditional stabilizing cages with precision airflow control
- Improves film clarity, reduces blocking, and enhances bubble stability
- Easily retrofitted or integrated on new blown film lines
- Compact, self-installable design, ideal for OEMs and Asian market needs
- Real-time adjustment of air gap and automatic retraction when idle
- Supports clean slitting and improved reel geometry

## Available Configurations

Model	Air Flow	Cooling Direction	Max $\Delta T$	Blade Count	Application Focus
Opti-Cool SDF	3000 m <sup>3</sup> /h	Upward Only	Up to 15°C	8 Blades	Blocking reduction, clarity improvement
Opti-Cool DDF	5000 m <sup>3</sup> /h	Up + Down	Up to 30°C	16 Blades	Blocking + output increase, flatness, gusset cooling

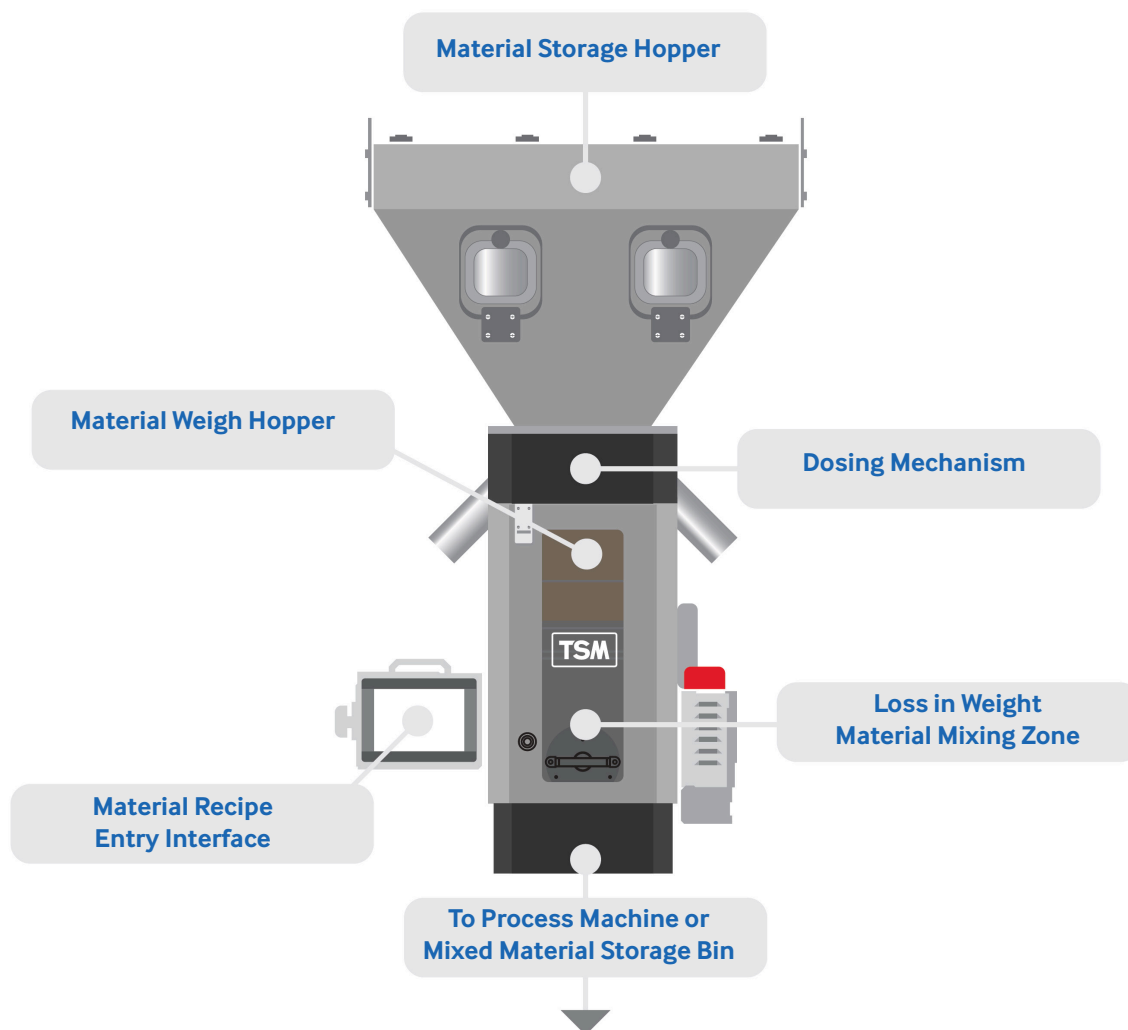
Opti-Cool is engineered for flexibility, available as a complete kit for retrofit projects or integrated into new blown film lines as part of your package. With minimal space requirements and a proven ROI, it's the ideal upgrade to unlock the full potential of your extrusion process.

## Gravimetric Blending

The TSM range of Gravimetric Blenders are compact with a low height profile and are designed and constructed of heavy gauge steel to withstand the most rigorous of operating conditions. The load cells are overload protected and guarded from physical damage while each blender is constructed with high load bearing continuous welding protecting it against vibration and shocks. All TSM blenders include self-optimizing software to give you the most efficient output on every order.



- Continuous homogeneous mixing
- High accuracy dispensing up to  $\pm 0.01\%$  of batch
- Mixing consistency from batch to batch of  $\pm 0.02\%$
- Can handle up to 6 different materials
- Reduced labor costs
- Automatic order changes
- Rugged rigid design, built to last
- Easy to use operator interface

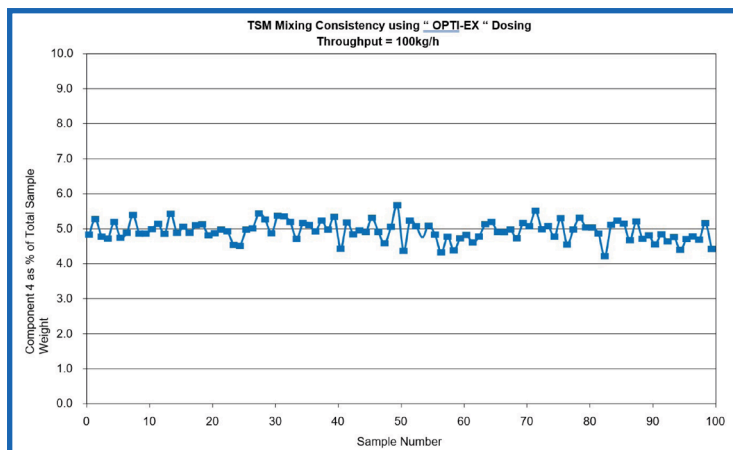




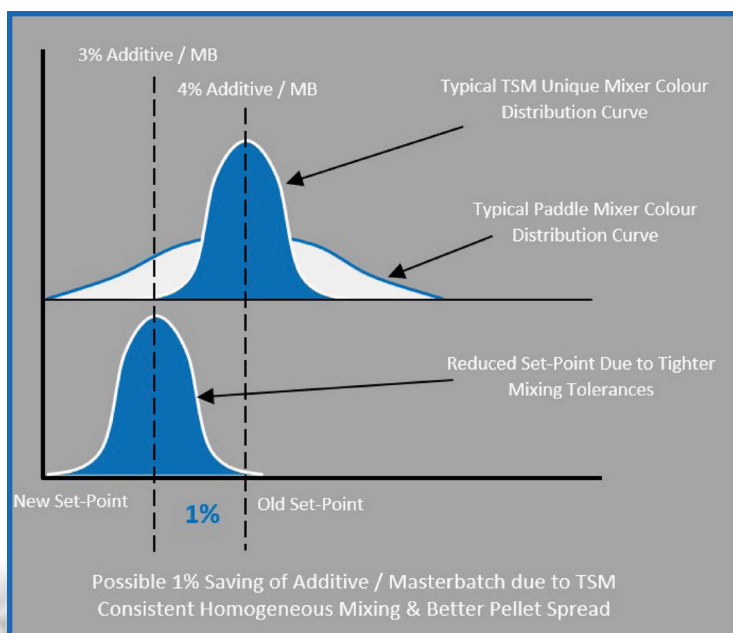
Solutions Through Partnership

## Saving Through Superior Mixing

TSM, utilizing its unique reverse flight mixing auger, can ensure all materials are mixed consistently with no separation, no dead spots in the mixing chamber and no need to adjust mixing times. The downward head pressure generated with our positive displacement mixing technique ensures consistent throughput irrespective of material composition.



- Reduced % of masterbatch from Homogeneous mixing
- Reduced colour variation
- Increased profits from high spec production
- Less wasted product
- Less reprocessing costs
- Reduced labour through automation



- Unique patented mixing auger
- Ideal for varying bulk density materials
- Excellent material dispersion
- Uniform flow of mixed material to extruder screw
- Eliminates surging of the extruder
- Less reprocessing costs
- Better quality products
- Eliminates bridging at the extruder feed throat





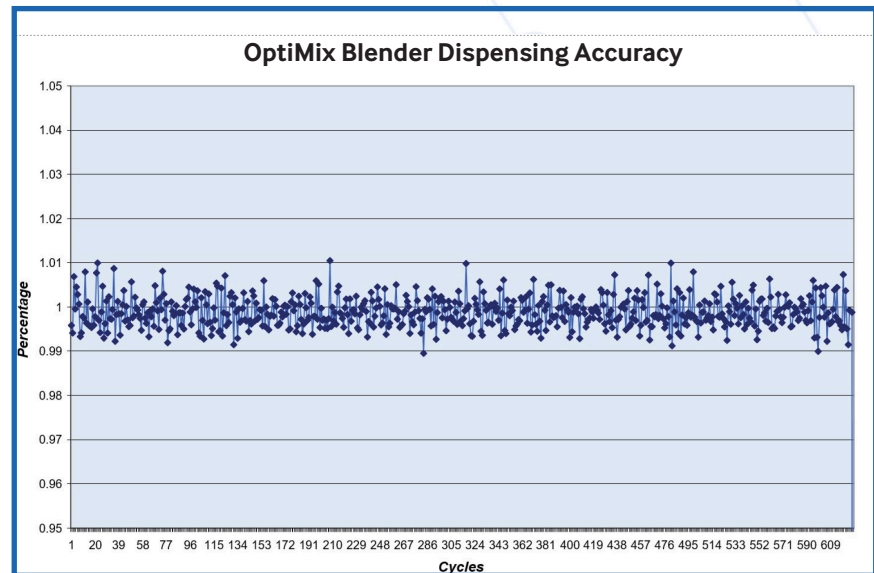
Solutions Through Partnership

## Material Dispensing & Control

TSM, with its distinctive dispensing technologies, can achieve low targets with consistent accuracy. This dispensing knowledge has been obtained through years of experience and with the addition of proprietary hardware components and specifically designed high accuracy software, precise control of each component is a standard feature.

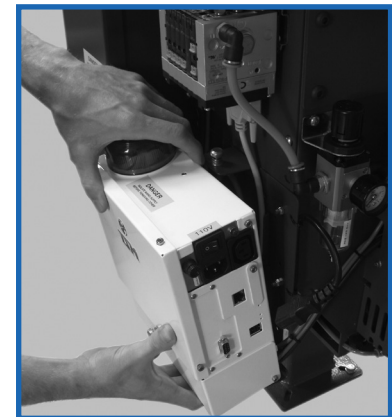
### High Accuracy Dispensing

- Control the dispensing of your materials more precisely
- Reduce usage of expensive materials
- Reduce losses due to over dispensing
- Allows higher value added production
- Reduced setpoints to the absolute minimum
- More consistent setpoint results



### State of the Art Modular Controller

- 7" high resolution remote operator color touch screen
- Easy to use control process with intuitive prompts
- Up to 300 pre-programmed job recipes can be selected and loaded instantly
- Adjust set recipe & view the material weights & throughput values during your order
- General incident log of all blender entries & changes
- Optional automated fill retry for regrind & poor flowing materials
- One touch blender weight calibration & auto test of entire system
- SD memory card / Ethernet / USB ports
- Complete Ethernet connectivity (Modbus / Profinet / Ethernet IP)
- On board real time clock & temperature sensor
- Time and date stamped alarm & data logging
- Built-in power supply
- Precise weight measurement
- 24 bit resolution



Simple & fast controller swap-out - no tools needed





Solutions Through Partnership

## TSM NEXUS Next Generation Controller

**Smarter Control. Faster Decisions. Connected Support.**

Nexus is TSM's next generation blender controller, designed as a seamless upgrade for previous generations of controller and a future-ready platform for connected manufacturing. It combines higher throughput, improved reliability, and cloud-enabled support to deliver maximum uptime and lifecycle value.

- New ARM-based processor with increased memory
- New OS stack: improved diagnostics and reliability
- Faster ML extrusion control algorithm
- Improved blender throughput, up to 200% improvement
- OTA software/config updates & restores (support-focused)
- Backward compatible footprint & connections
- Digital links & addressing (software-controlled)
- Improved output reliability



Customer Value	
Higher Throughput	Optimized control algorithms double throughput on OptiX systems.
Smarter Support	Remote diagnostics, cloud alarms, and OTA updates reduce downtime.
Operator Guidance	Connected alarm help, integrated manuals, and simplified UI.
Upgrade Friendly	Backward compatible with previous generations of controller
Future Proof Platform	Ready for connected services and lifecycle contracts.

### Upgrade & Retrofit Path

- Upgrade Kit: Nexus controller + optional HMI panel
- Replacement Path: Backward compatible upgrade for controller
- Future-Ready: Designed for Insight service integration & cloud-enabled contracts



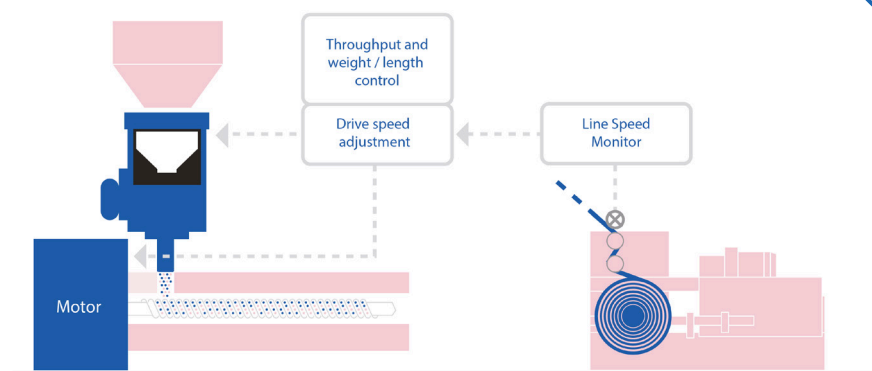
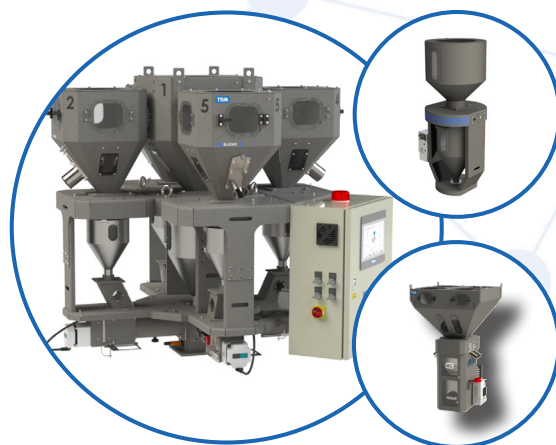
## TSM Extrusion Control

### Maximizing Savings By Reducing Setpoints To A Minimum!

TSM Gravimetric Blenders continuously monitor material throughput (kg/hr) and will optimize yield (weight per length control) on extrusion lines. As part of a job recipe entry, the extrusion / haul-off control setpoints are entered via the remote operator panel. The TSM system monitors the line speed and extruder output to guarantee precise on-specification and consistent output quality, therefore reducing waste considerably while operating at optimum yields. The system also provides roll, order and shift summaries by component, allowing precise calculation of material costs and net profit margin analysis per order.

### Features

- Mounted directly on extruder throat
- Tighter tolerances allowing down-gauging
- Higher yields of 2 - 3% from your production line
- Run at minimum thickness & improve consistency
- Suitable for batch or continuous gravimetric systems



TSM Blender on an Extrusion Line

### TSM Control Options

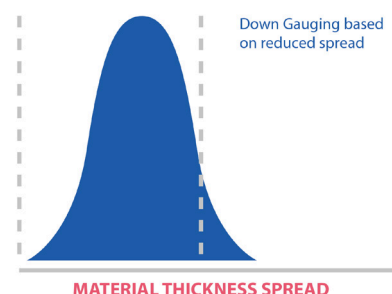
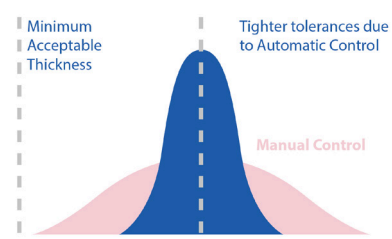
- Kg/hr Control
- Weight per Length Control (g/m)
- Weight per unit Area Control (g/m<sup>2</sup>)
- Average Thickness Control (Micron)
- Haul-Off Control

### Material Down-Gauging

Normally extruder throughput is reduced gradually due to blocking at the screen filter. TSM blenders detect when the product weight per length (yield) or throughput varies from the target setpoint and automatically adjusts the extruder screw speed to bring the throughput back on target.

Furthermore the system allows the process to run at the lower tolerance values for the product while all the time monitoring the output and individual material dosing consistencies. This will result in real savings in your production costs.

Furthermore the system allows the process to run at the lower tolerance values for the product while all the time monitoring the output and individual material dosing consistencies. This will result in real savings in your production costs





**Solutions Through Partnership**

## Film Gauge Control

TSM offer fully automated solutions for the control of cross direction film profile tolerance on Blown Film lines. This allows for enhanced process stability and significantly improved film tolerances. The Automatic Gauge Control System alters the volume of cooling air to provide a uniform thickness around the bubble. The profile is measured using either a contact or non-contact thickness measurement sensor. The system then maps the bubble to specific control zones on the air ring. Any deviation in film thickness is corrected by automatic adjustment of these control zones.

### Air-Rings

One of the most critical factors for film quality & performance of blown-film extrusion lines is the air-ring. The mechanical design of the air chamber and flow channels gives the air-ring an unique edge over competitive systems for better control of the bubble geometry and stability. The rigorous development of the air ring is based on substantial fluidic studies & thorough practical tests, along with significant input from customers.



**Height Adjustable Automatic Air-Ring for Stretch Hood Film running on a Die Ø of 300mm with an output of 350 – 400kg/hr**



**HDPE Long-neck production with Automatic Air-Ring gives maximum performance with automatic and optimum profile improvement**

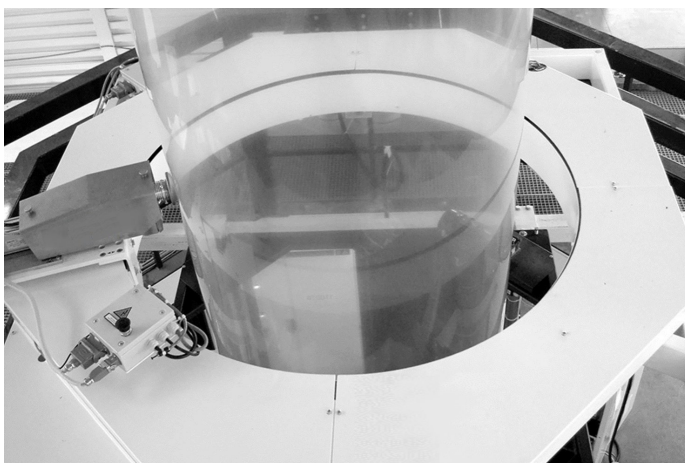




- Improved film tolerances
- High efficient cooling rates
- Quick response times
- Maximum air-flow
- Minimum pressure drop
- Low power consumption
- Quick return on investment
- Optimum productivity and quality
- Absolute even air distribution
- Excellent bubble stability
- Easily to retrofit to existing lines
- Dies Sizes from 100mm to 900mm
- Quick response times

## Profile Measurement

TSM can utilize a variety of on-line measurement instruments to capture the film profile. Dependent on the film's properties and characteristics, TSM can offer contact / non-contact capacitive thickness measuring sensor heads for standard packaging films and / or a capacitive edge contactless unit for barrier film. The gauge profile unit is mounted on a telescopic arm connected to a rotational reversing track surrounding the bubble. Continuously the profile is measurement by the capacitive sensor and fed back to the central control cabinet. At this point the film profile information is used to adjust accurately the air-ring sections to ensure film thickness is maintained.



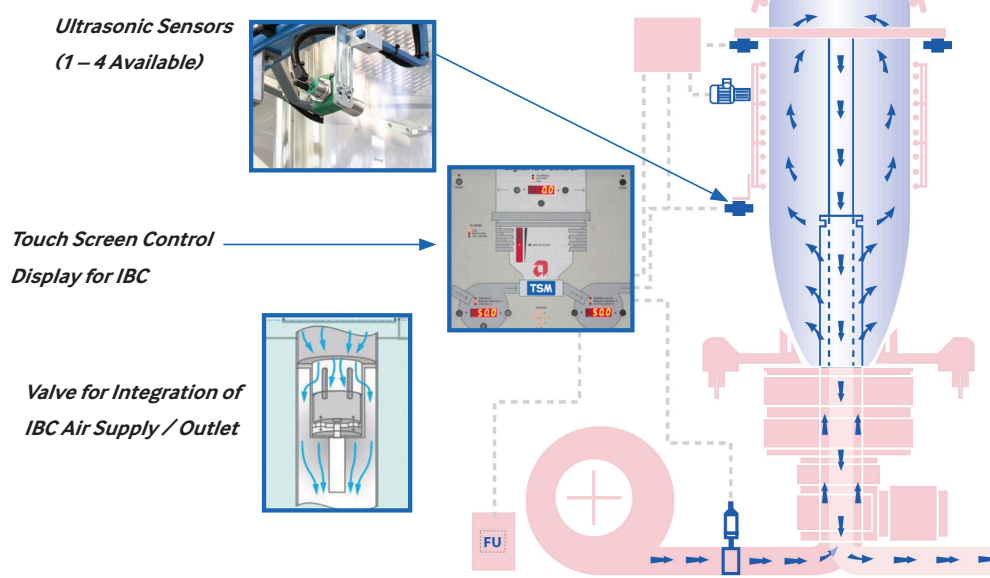
**Contact / Non-Contact Capacitive sensor with Telescopic arm**



**Non-Contact Double Capacitive Layflat Measurement Sensor**

## IBC Control

Patented split sensors enable the air flow intake and exhaust to react to the slightest changes in bubble size at or below the frost line where the bubble size is not yet final. Ultrasonic sensors are aimed at the bubble below the frost line where size changes, particularly with the low melt strength materials like metallocenes and LLDPEs, are quickly noticed. This allows an immediate correction by the intake/exhaust blowers via the ACI (Air Correction Inverter) controlled blowers. An additional ultrasonic sensor is aimed at a fixed target in order to calibrate the other sensors whose readings can be altered due to changes in air temperature.

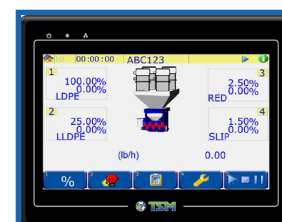


## Width Measurement & Control

The TSM Automatic Width Control System gives you the customer, three options for maintaining a specific bubble size during normal operation. These options are ideal for managing on-the-fly size changes, reducing the time it takes to get the bubble on size and minimizing changes in layflat due to temperature conditions or film stretch.

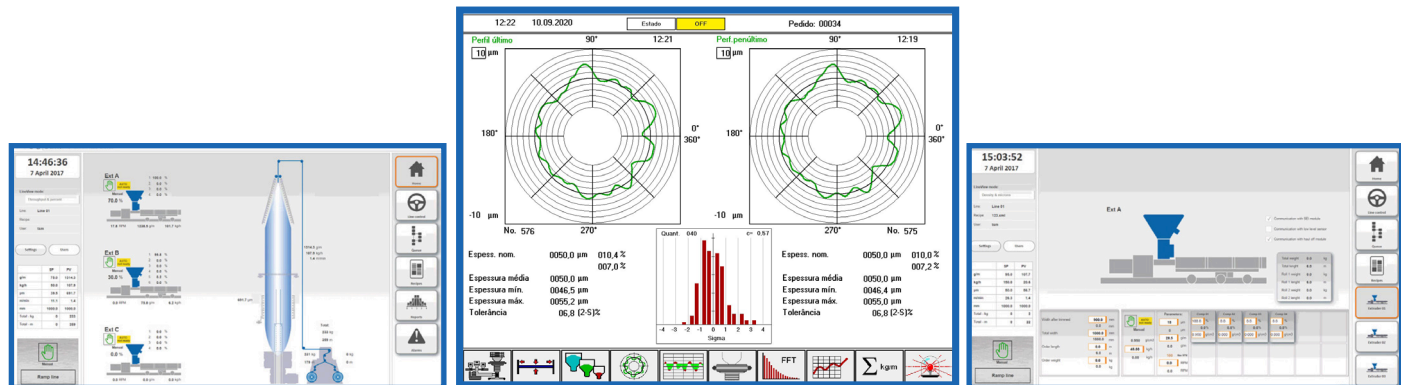
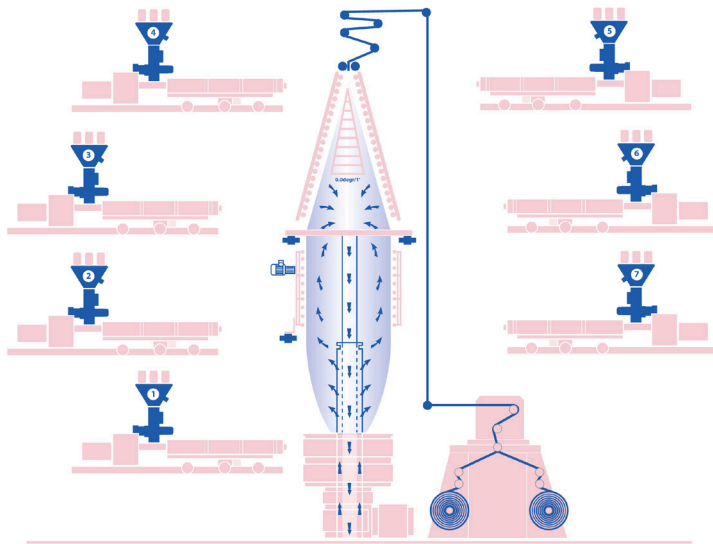
### Features

- Simple to install and operate
- Layflat & Ultrasonic measurement available
- Suitable for all film types and colour
- Displays instantaneous width and average width
- Automatic monitor and failsafe alarm
- Measures up to 10m
- Measurement resolution of 0.1mm
- Display resolution of 1mm
- Readily expandable and upgradeable



## Centralized Line Management

The Central Line Management operator interface allows simple and user friendly monitoring of the extrusion process from a single location. The advanced flexible design permits the operator to quickly visualize the system parameters and adjust essential production settings with ease. Furthermore the compact control cabinet utilizes an Industrial PC with a 'Pinch Zoom' feature. Critically, viewing of historical production data is at the touch of a button.



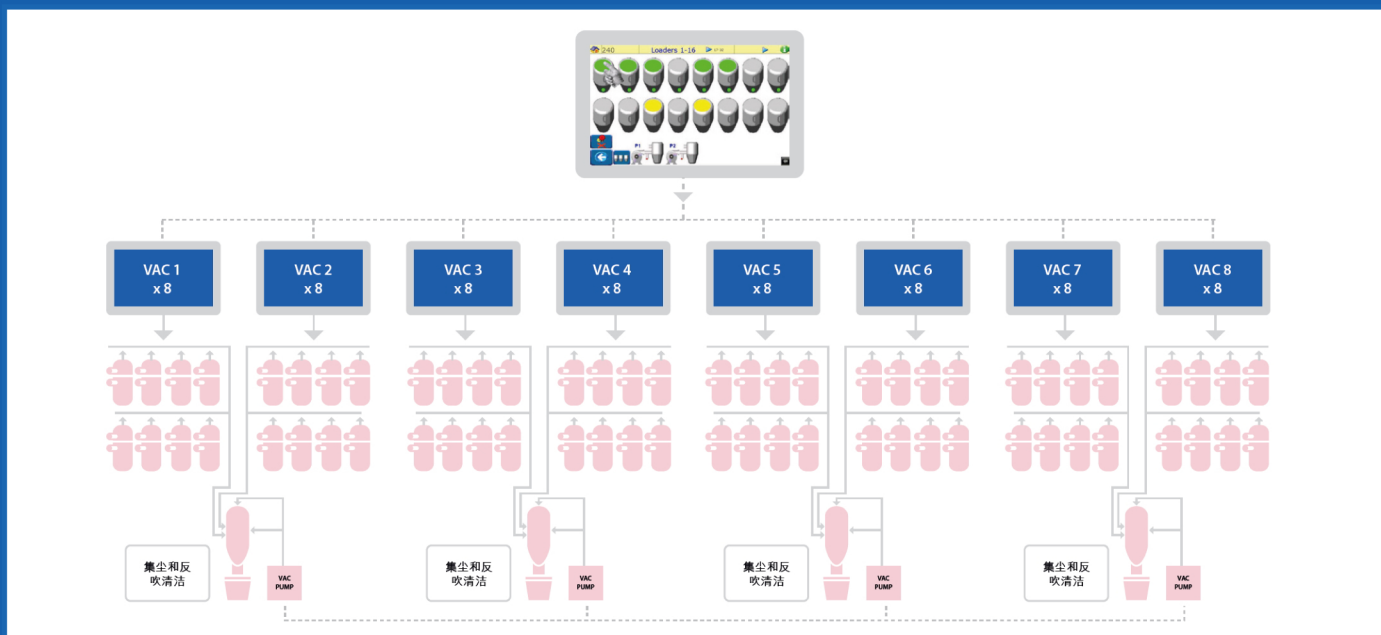
- Central overview of the co-extrusion processes
- Design to monitor up to 12 layers
- Monitor blender data and extruder data on individual extruders of the multilayer process simultaneously.
- Manage resin-blend percentages & extruder throughputs Simultaneously
- Individually or simultaneous ramp all layers
- Download & retrieve individual layer & blender information
- Incident log, material & alarm reports
- Time of alarm activation & reset is recorded, displayed and logged
- Linear & polar charts with parameters for gauge profile measurement & control
- Remote modem assistance for diagnostic of the entire system through a network connection
- Monitor the process in real time
- Trending and profile statistical analysis
- Process parameter storage databases so as to create, modify or store recipes for on-the-fly download.
- Availability of Job orders containing useful data for identifying and tracking each order
- Recording of raw material quantity used in the process.

**TSM**



## Centralized Material Handling System

Ease of expansion is key to any material handling system. The TSM vacuum system includes VAC8 modules which can be connected to the sequencing control panel allowing multiples of 8 vacuum receivers to be connected to the system. The system also allows easy integration with existing non-TSM vacuum receivers. The typical systems include a microprocessor-based central sequencing control panel with a communications connection to TSM VAC8 remote I/O modules that supervise up to eight vacuum receivers each. The central console touch screen display is operator friendly and provides full process visibility.



- Touch screen interface uses intuitive graphical illustrations
- Easy to maintain and clean with access door and removable sections
- Reduced lifetime running costs
- Stainless steel vacuum receivers
- Available in sizes from 6lt to 120lt
- Patented self-cleaning screen filter
- Reduced hardware costs



### European Office (Headquarters)

**TSM**  
Finnabair Industrial Estate  
Dundalk, Co. Louth  
A91 PC2D, Ireland

**Tel:** +353-42-9335560

**Email:**  
**General:** info@t-sm-controls.com  
**Sales:** sales@t-sm-controls.com  
**Support:** service@t-sm-controls.com

### North American Regional Offices

**TSM Inc.**  
1505 Johnson Ferry Road,  
Marietta, Georgia 30062, USA  
1404 Joilet Road,  
Romeoville, IL 60446, USA

**Tel:** (770) 886-6630

**Email:**  
**General Info:** info@q-us.t-sm-controls.com  
**Sales:** sales@q-us.t-sm-controls.com  
**Support:** service@q-us.t-sm-controls.com

### Asia-Pacific Regional Office

**TSM Taiwan**  
No.13 Siangshang 1st Street,  
West District, Taichung City,  
403,  
Taiwan

**Tel:** +886-4-2472-8185

**Email:**  
**General Info:** info@q-sm-controls.com.tw  
**Sales:** sales@q-sm-controls.com.tw  
**Support:** service@q-sm-controls.com.tw

### China Regional Office

**TSM China**  
Room 2423, No. 983, International Port  
Center (IPC), Huangpu Avenue (East),  
Huangpu District, Guangzhou City,  
China

**Tel:** +86-139-2506-2596

**Email:**  
**General Info:** china@q-us.t-sm-controls.com  
**Sales:** china@q-us.t-sm-controls.com  
**Support:** china@q-us.t-sm-controls.com