thermo scientific

What you need to know about Web Gauging Systems

Thickness and basis weight measurement and control systems for the continuous web processing and converting industries

ThermoFisher SCIENTIFIC

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overview

What is a Web Gauging System?

A Web Gauging System is a measurement and control system used for anything manufactured in a continuous web process.Web Gauging Systems ensure efficient production of uniform, reliable, functional products. They come with a wide range of online, non-contact basis weight or thickness measurement sensors for flat-sheet applications in the plastics, rubber, packaging, building products and textiles industries.

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Benefits of a Web Gauging System

Web Gauging Systems help manufacturers meet stringent customer specifications and guarantee the performance of products, while optimizing line investment and minimizing raw material waste.

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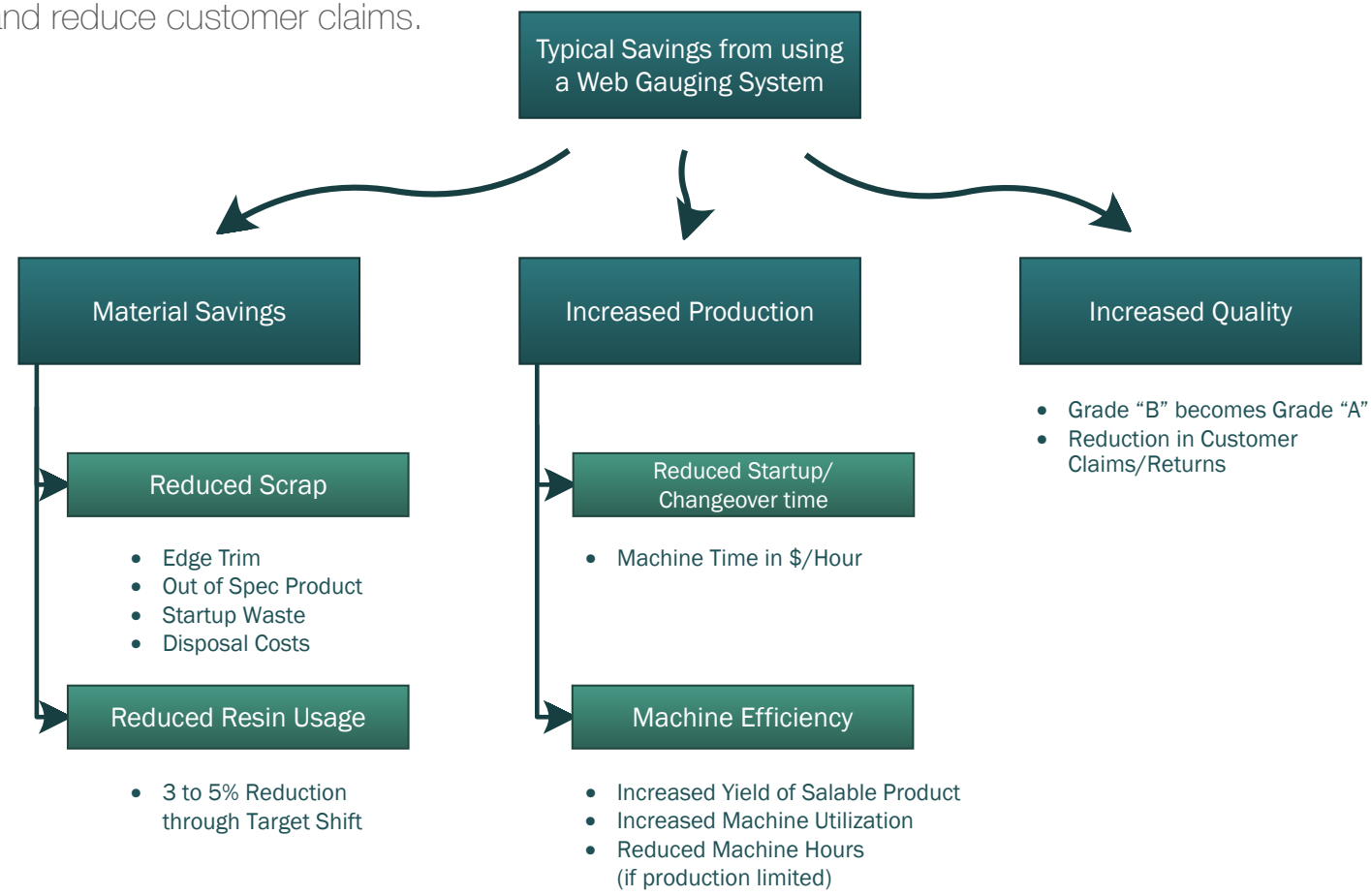
Economics of a Web Gauging System

With the high cost of resins and machine time, typical payback period of a Web Gauging System with automatic control can approach 1 year or less. There are many ways a web gauging system can save money, including reducing scrap by minimizing edge trim, out of spec product, startup waste and disposal costs. As product quality improves, overall resin usage can be reduced by shifting the target thickness down, while maintaining product above the minimum specification requirements. Production yield can be increased due to reduced startup/changeover times and reduced downtime due to web breaks. Savings can be taken due to reduced machine runtime hours or increased production. Also, higher quality goods can be graded higher, and reduce customer claims.



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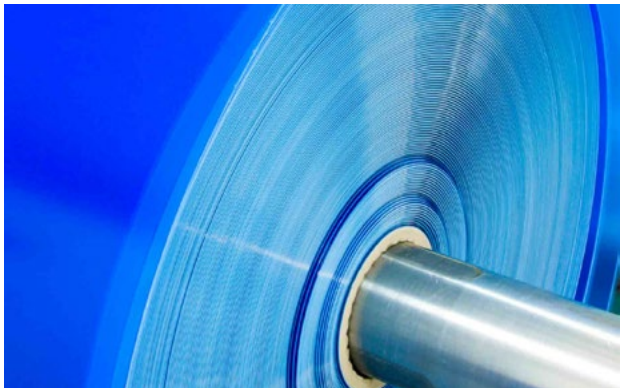
Industries That Use Web Gauging Technology



Extrusion

Improved control performance helps reduce film product variation resulting in superior roll quality for maximum return-on-investment.

- Mono and bi-axial film
- Co-extrusion
- Cast film extrusion
- Film/sheet extrusion

Coating

Typical coating applications include liquid packaging, adhesive coatings, polyethylene, foil, barrier materials, sealants and adhesive layers. Coating weight measurement accuracy is critical for quality, productivity and scrap reduction.

- Blade coating
- Roll coating
- Extrusion coating
- Tandem extrusion coating
- Lamination
- Saturation
- Slot die

Rubber/vinyl calendering

Rubber/vinyl calendering is a complex process that requires a modular measurement and control strategy that can be configured to almost any tire or vinyl calender.

- Rubber calendering
- Vinyl calendering
- Gum calendering
- Textile calendering
- Wire calendering

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Industries That Use Web Gauging Technology

Building materials

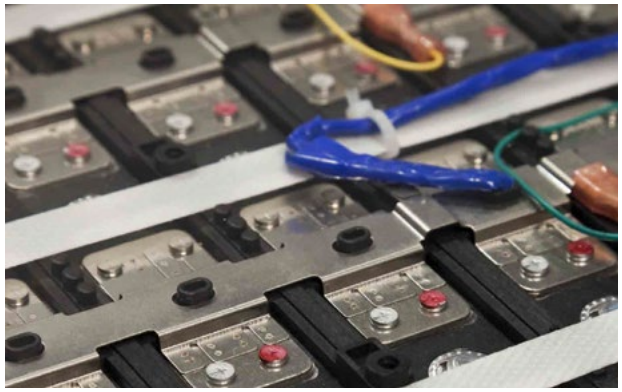
Measurement and control systems for building materials provide repeatable, continuous performance in the manufacturing of:

- Roofing
- Flooring
- Abrasives
- Carpet coating
- Rockwool
- Glasswool
- Oriented strand board
- Carbon fiber
- Fiberglass/fleece
- Insulation mat

Nonwovens

Web measurement and control of nonwoven applications enable you to identify defects, overcome process challenges, and produce high performance products using these processes:

- Air laid
- Carded
- Melt-blown
- Needle-punched
- Spun-bond
- Spun lace
- Wet-formed



Lithium-ion battery

Thickness and weight measurement systems are helping the industry improve the quality, consistency and productivity of lithium-ion batteries, which is critical to the advancement of the battery's safety and technology.

- Separator film
- Separator film coating
- Anode coating
- Cathode coating

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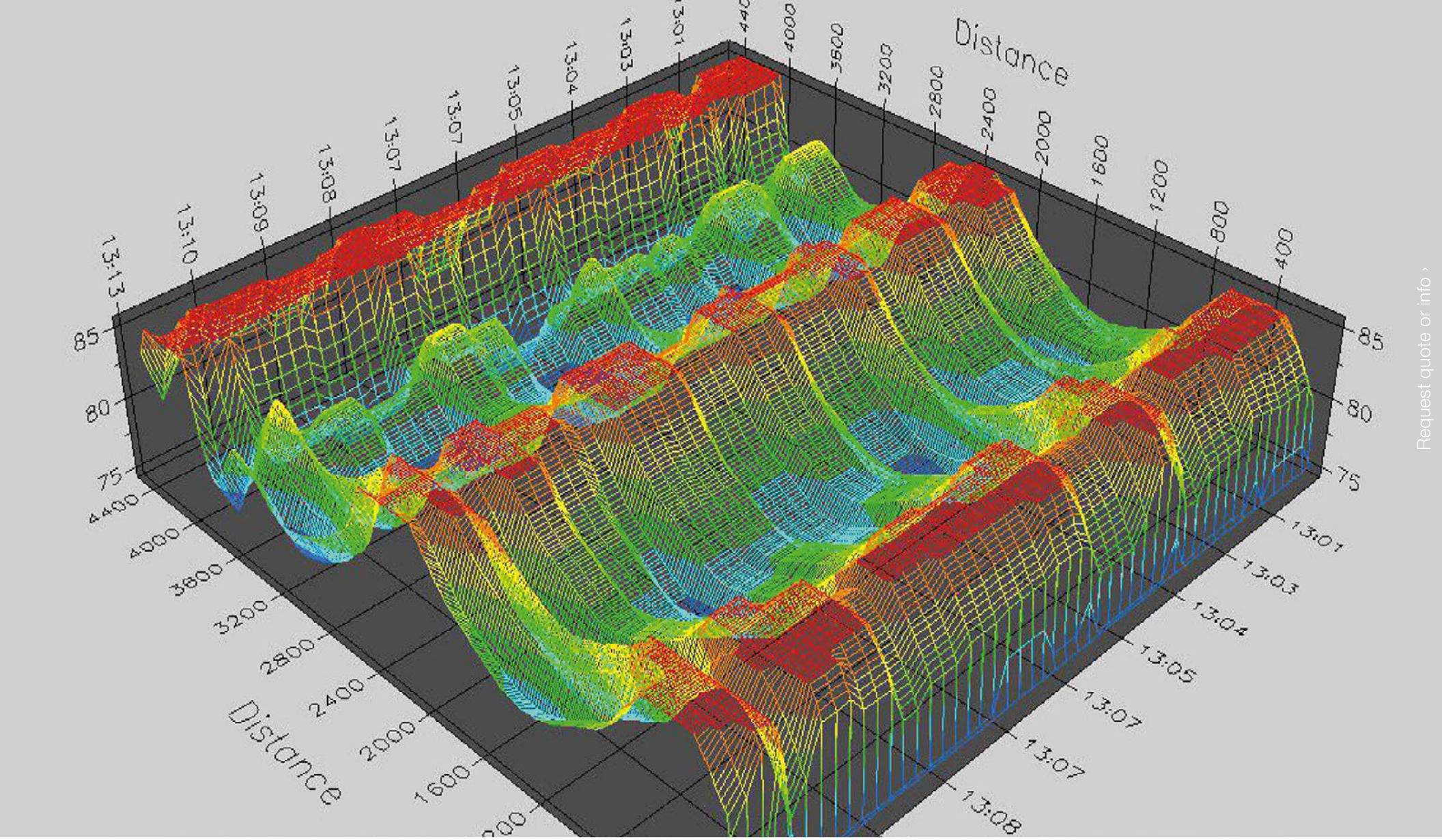

web gauging technology

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Sensors, Scanners, and Process Controls

Gauging platforms utilize infrared, x-ray, nuclear and optical measurements.

Sensor technology

Basis weight sensors use different methods for multiple applications to determine basis weight. These technologies include beta (nuclear), x-ray and infrared spectroscopy. Direct thickness measurement is possible using optical, interference, laser, and terahertz technologies. Some technologies can measure both thickness and weight, such as terahertz and infrared.

Scanner technology

Solid scanner designs help ensure accuracy and profile repeatability. Each scanner incorporates an embedded iBox processor running the Linux operating system to provide fast, secure, robust measurement.

Control system technology

Advanced process control algorithms help ensure uniform quality product across the entire width of the web, while reducing raw material and maximizing production output.

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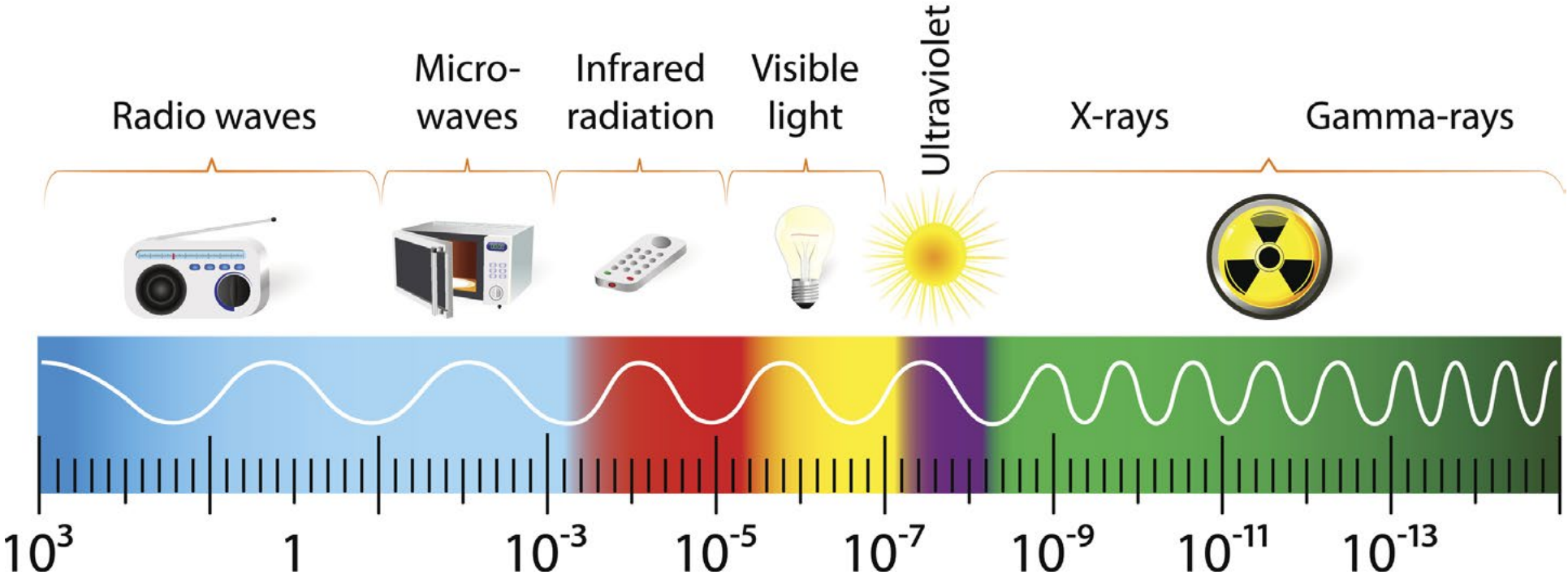
Sensor Technology

Web gauging technologies include infrared, optical, terahertz, nuclear, and x-ray. The sensors are application matched to the types of materials in the web, the web structure and the process environment, as well as the desired measurement requirements such as thickness, basis weight or moisture.

The electromagnetic spectrum



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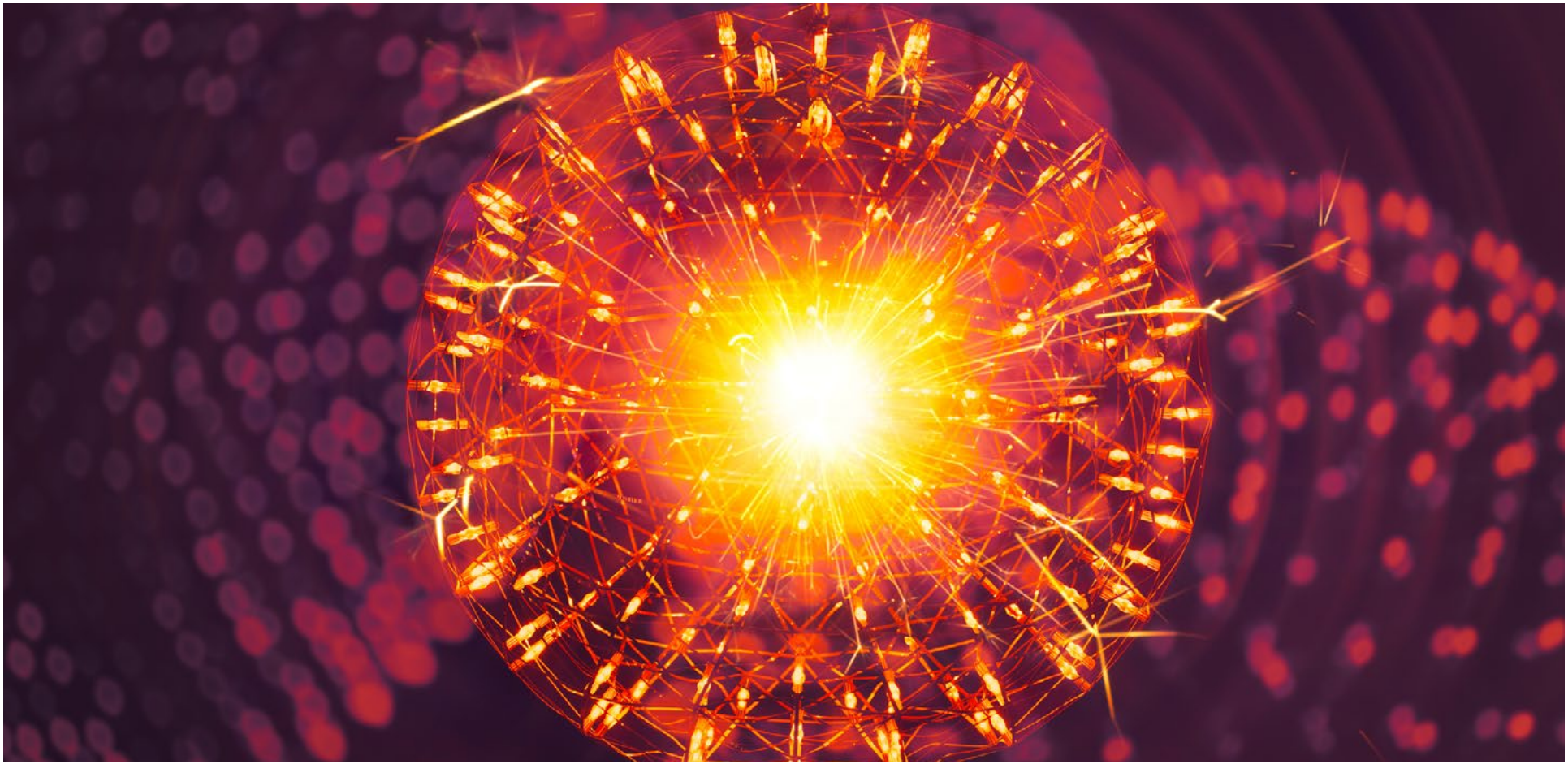
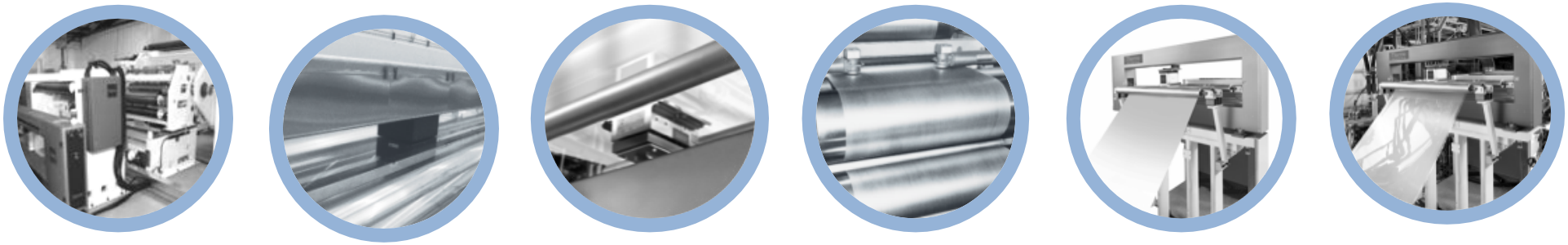
Sensor Technology – Beta

Measurement is based on the absorption of beta particles emitted from the source to determine the basis weight, resulting in superior measurement and the best control for your process, whether it's film and sheet extrusion, extrusion coating, nonwovens, roofing, building products, gum calendering, or vinyl calendering.



Six Critical Factors for Predicting Beta Sensor Performance in Continuous Web Processes

Beta transmission sensors are used in the web gauging industry to measure basis weight and control processes in the polymers and plastics industry. Beta sensor measurement is based on the absorption of beta particles emitted either from a Kr-85 or Sr-90 source (depending on the application) by the web to determine the resulting basis weight of the web. For the best measurement and therefore the best control, there are a number of design elements that are critical to delivering superior sensor performance. As with any measurement technique, the amount of electronic signal generated by the sensor provides the best results.



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Six Critical Factors for Predicting Beta Sensor Performance in Continuous Web Processes

1 SOURCE STRENGTH

High source strength provides the highest signal and lower noise, thus improving the quality of the measurement.

2 PHYSICAL GEOMETRY OF THE SOURCE

Unique slot source geometry (instead of the common circular geometry) of the source capsule improves measurement resolution for optimal edge and gauge band detection. In most cases, better edge measurement leads to smaller edge bead, which saves raw materials and reduces the amount of trim.

3 ALIGNMENT OF THE SOURCE TO THE DETECTOR

Misalignment of the source and detector due to wear-and-tear, mechanical run-out or vibration contributes significantly to measurement noise. Special source and detector optics are used to make the sensor nearly insensitive to X-Y-Z misalignment of up to 6X the normal scanning path run-out.

4 WEB MOVEMENT OR “SHEET FLUTTER” BETWEEN THE SOURCE AND THE DETECTOR

Sheet flutter – the up-and-down movement of the material during a normal operation – causes measurement noise and error. Beta transmission sensors fitted with a special detector optics reduce this measurement error and improve measurement repeatability.

5 MEASUREMENT IMPACT FROM OPERATING TEMPERATURE AND PRESSURE VARIATION

Temperature and pressure fluctuation throughout the day affects the measurement of the web because it changes the amount of air molecules found in between the source and detector. A change of 10°C is equal to a change of about 1gsm of air molecules, thus temperature and pressure compensation are necessary, especially in thin film applications.

6 FULL RANGE CALIBRATION

Does production change frequently? Each sensor is calibrated for its full measurement range capability to ensure the full mix is covered.

Click here to download the full infographic!

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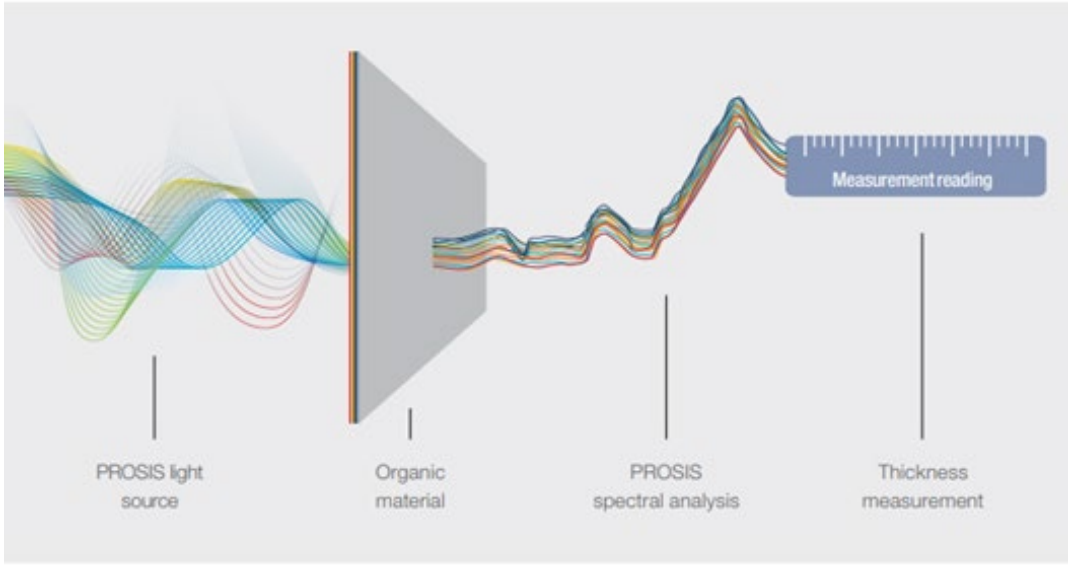
Sensor Technology – Infrared

Sensors utilizing infrared technology are available in both transmission and reflectance modes. The measurement is based on the absorption of light by the materials to determine the resulting thicknesses. Each material exhibits a unique light absorption characteristic and emits a signature waveform (spectra) as light passes through it. As material thicknesses change, the spectra will change throughout the infrared wavelength spectrum. Because of this, the sensor is uniquely designed to inspect the entire infrared spectrum to accurately measure thicknesses of both single layer and multilayer products. This technique enables the sensor to discriminate between different components even if they exhibit very similar IR absorption characteristics, whereas it is almost impossible for competing filter wheel IR sensors with limited resolution to sense the critical differences.



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Sensor Technology – Terahertz

Terahertz sensing technology is a safe online measurement solution for non-nuclear single and multilayer gauging applications. It is used in a wide variety of applications, such as multilayer plastic sheet extrusion, multilayer foam extrusion, rubber tire calendering, multilayer conveyor belt, roofing shingles, single-ply roofing (TPO) and many others. A Terahertz sensor has the capability to provide simultaneous measurement of thickness, basis weight and density, whereas other solutions require the combination of a true thickness sensor and another true basis weight sensor to provide a density measurement. It is also capable of making multilayer measurement of opaque or transparent materials without requiring any product specific calibration and provides direct thickness measurement while being insensitive to color or additives.

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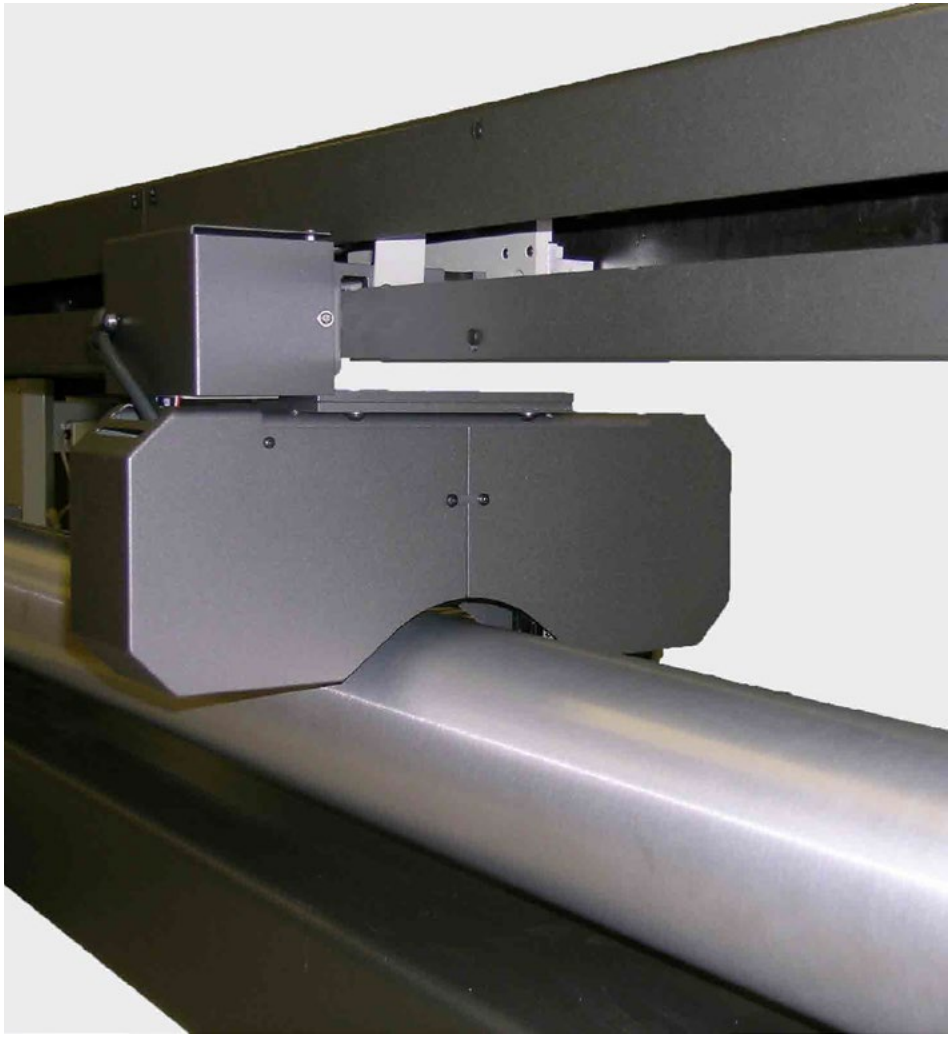
Sensor Technology – Direct Thickness

A direct thickness sensor provides accurate, non-contact online thickness measurement of a moving web. It can measure a variety of materials up to 6500 microns (260 mils), for greater process control, improved quality and increased productivity without calibration or regulatory approval. It is insensitive to product color, transparency and opacity and can also measure the total thickness of single, multi-layer and embossed materials. The measurement package comprises optical, inductive and temperature sensors to measure material with a variety of surface finishes.



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Sensor Technology – X-ray

X-ray sensors provide a non-contact weight measurement of a material on a moving web. The x-ray absorption characteristics of the product are used to accurately measure its properties, while the sensors deliver accurate, high-resolution measurement over a wide product range compared to nucleonic techniques. Its digitally controlled power source enables the sensor to be precisely tuned to measure specific material properties, allowing a wide range of products to be measured on the same line with a single sensor, resulting in a simple, cost-effective solution.

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Scanner Technology

A solid scanner design combines stability, reliability and maintainability to ensure maximum life cycle performance. It utilizes a proven exoskeleton design, incorporating a tubular steel structure, which provides high stability and isolates internal components from the environment.

A variety of different scanner designs are available to fit any process line configuration, including small and large O-frames, C-Frames, and box beam frames.

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Control Technologies

Automatic profile control (APC)

- For automatic extrusion dies. Delivers quality, flat profiles for extruded film, sheet or coatings.
- Uses high resolution profile measurements to map both linear and non-linear shrinkage regions.
- Die-mapping algorithm continuously aligns each measurement zone.
- For biax, a mass balance control algorithm that accurately maps and controls the film profile from the die through the tenter oven.
- Cascade control automatically adjusts the shape target of the primary die control at the cast end.

Machine direction control (MD)

- Supervises either line speed or screw/pump speed in order to maintain uniform product basis weight or thickness.
- At the end of each scan the thickness or basis weight setpoint is compared to the last scan average. The difference is used to calculate a new setpoint for either the line speed or screw/pump inner control loop.
- Target management control enables 'down-gauging' to ensure that no part of the final product is outside the lower quality control limit.
- Adaptive throughput control optimizes the throughput rate of a process based on a matrix of process and quality constraints to deliver maximum productivity at the highest quality.

Calendar control

- For rubber, vinyl and adhesive calendering processes.
- These control strategies provide fast, stable performance over a broad range of products.
- Delivers significant economic savings through raw material savings, faster start-ups, more rapid product change and scrap minimization.
- Sophisticated control algorithms to compensate for process challenges such as average/ tilt/crown controls, roll gallop, drawdown, backlash.

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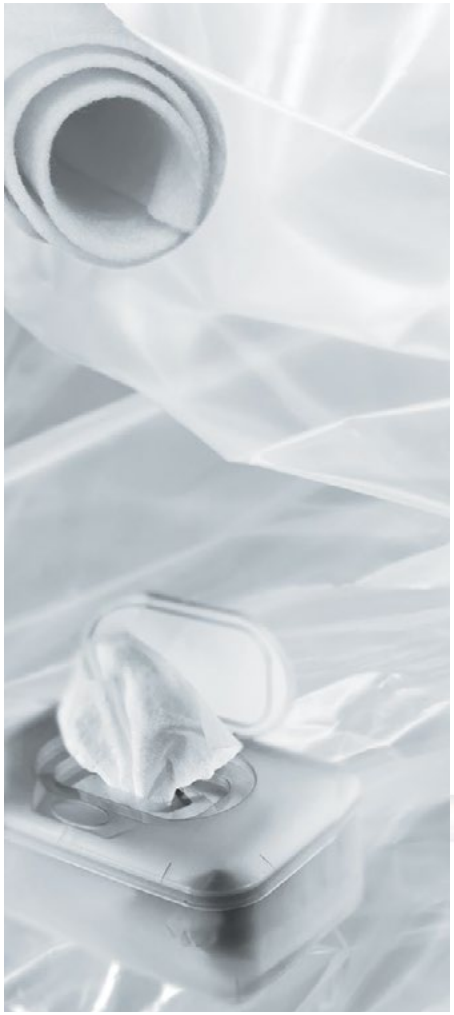
equipment

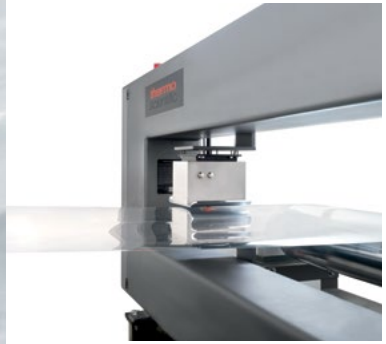
Overview

The following pages show various types of equipment and their applications, considerations before buying, and best practices when you own equipment.



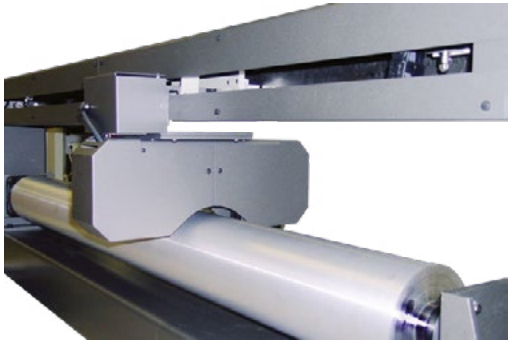
21PlusHD Measurement and Control Systems

IPlus! Measurement and Control Systems



PROSIS Infrared Process Analysis Thickness Sensor

Beta Plus Basis Weight Transmission Sensor



ShadowMaster Direct Thickness Gauge

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21PlusHD Measurement and Control Systems

Measurement and Control Systems utilizing up to 6 scanners with up to 15 real and 5 virtual sensors for advanced process control and high flexibility.

Building materials:
Insulation, roofing, shingles, carpet, flooring, float glass, nonwovens, abrasives and other building supplies that present challenging measurement environments.

Nonwovens:
Spunbond, spunlace, air laid, meltblown or carded, including binder or super-absorbent polymer (SAP) content and moisture.

Extrusion:
Film/sheet extrusion, cast film extrusion, co-extrusion or mono and bi-axial film, for a range of applications, from flexible and aseptic packaging and thermoformed food packaging to lithium-ion battery separator films and technical films.

Coating and converting:
Extrusion coating, tandem extrusion coating, blade coating, roll coating, lamination, saturation or slot die for applications such as liquid packaging, adhesive coatings, polyethylene, sealants and adhesive layers.

Rubber and tire:
Rubber calendering and rubber tire manufacturing including gum, fabric and wire.

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IPlus! Measurement and Control Systems

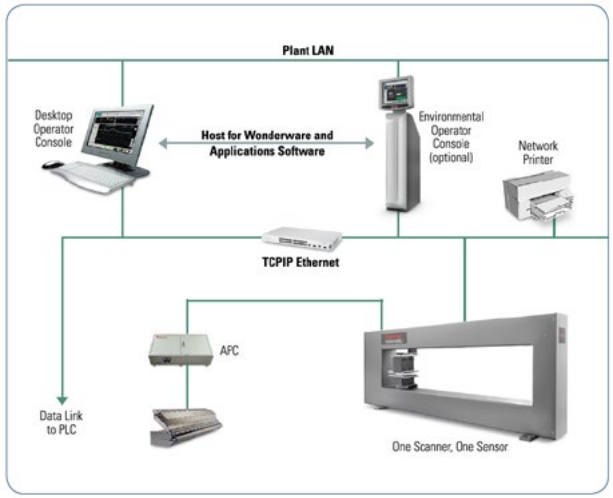
Measurement of basis weight, direct thickness, or moisture weight using a single scanner and sensor.

Coating and converting:
Extrusion coating and simple blade or roll coatings for flexible packaging and faux leather applications

Nonwovens:
Fabrics that are resilient, liquid repellant, and leakproof, including spunbond, spunlace, carded, airlaid, and needlepunch processes

Extrusion:
Extruded films for thermoformed food, beverage, medical, pharmaceutical, consumer good and industrial product packaging

Standard IPlus! system configuration schematic:



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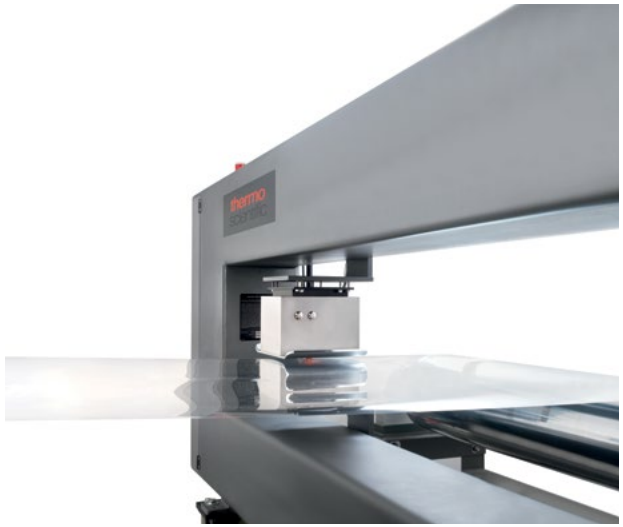
PROSIS Infrared Process Analysis Thickness Sensor

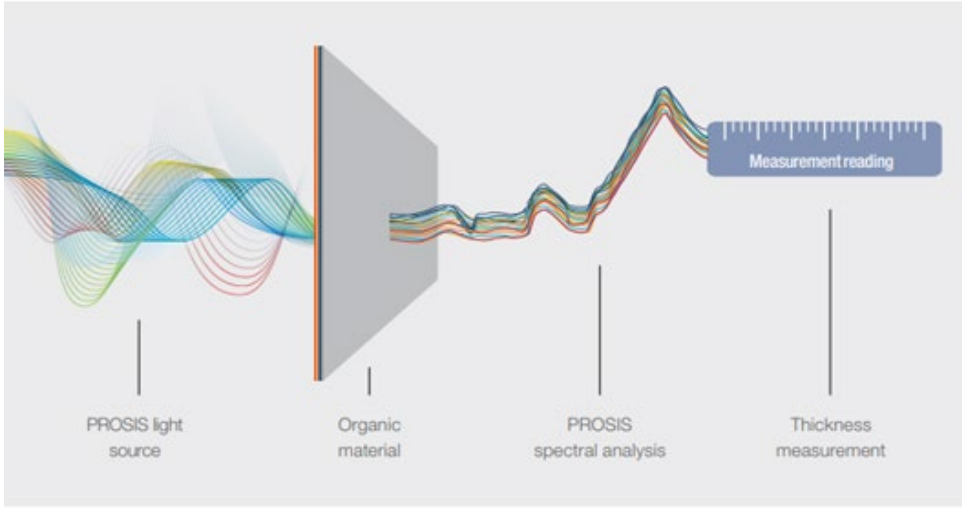


Innovative infrared measurement and control solution for single and multilayer gauging applications.

Applications:

- Blown film
- Paint coatings
- Coil coatings
- Roll coating
- Biaxial extrusion
- Cast film
- Extrusion coating
- Sheet extrusion
- Stretch and shrink film
- Optical film
- AC film
- Non-woven
- Cavitated films

PROSIS IR Gauge basics:



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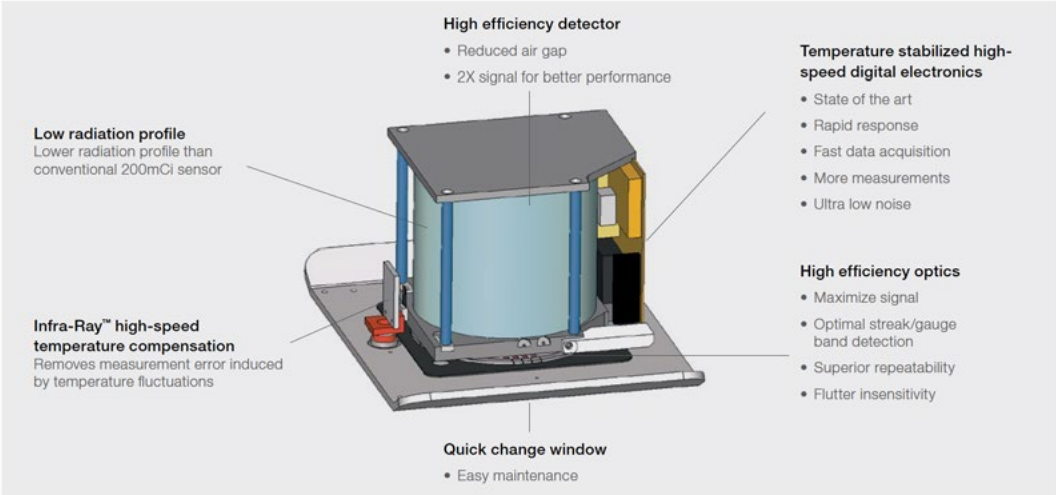
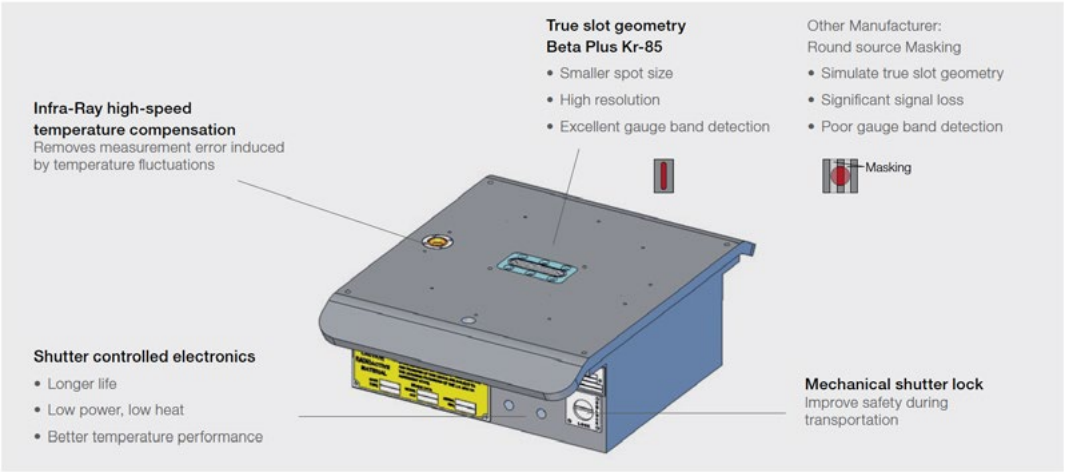
Beta Plus Basis Weight Transmission Sensor

Sensor measurement based on the absorption of beta particles emitted from the source to determine the basis weight.

Detector assembly:



Source assembly



Applications:

- Film and sheet extrusion
- Extrusion coating
- Roofing
- Building products
- Gum calendering
- Vinyl calendering

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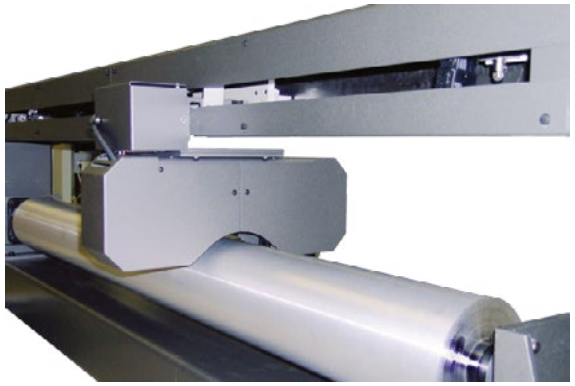
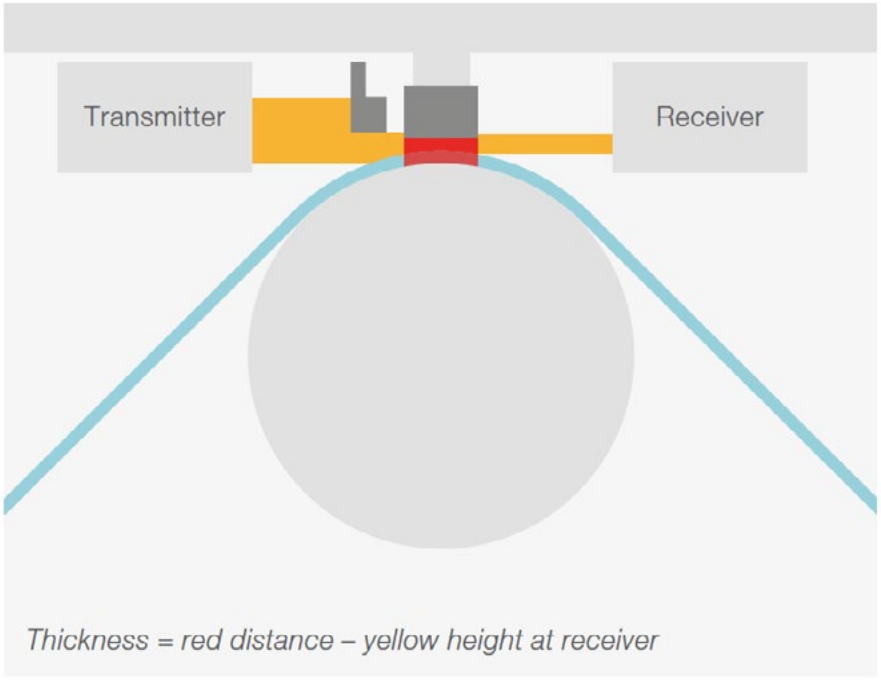
ShadowMaster Direct Thickness Gauge



Measurement system utilizing optical, inductive and temperature sensors to measure material with a variety of surface finishes.

ShadowMaster method of operation



Applications:

- Extruded sheet
- Calendered sheet
- Foam
- Rubber
- Composites
- Coated substrates
- Multilayer and embossed materials

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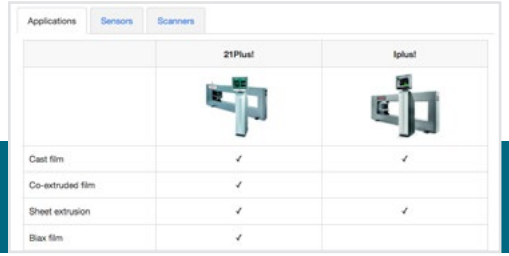
Choose the System That's Right for You

	21PlusHD	IPlus!
		
Cast film	✓	✓
Co-extruded film	✓	
Sheet extrusion	✓	✓
Biax film	✓	
Converted products	✓	
Extrusion coating (total only)	✓	✓



Click here to access the full product selection guide

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Thermo Scientific Web Gauging

We are the measurement and control specialists serving the continuous web processing and converting industries. Our success is driven by our superior sensing technologies coupled with extensive application knowledge.

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For additional information or to request a quote, please click below.

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