

FilmPro™ Infrared Measurement Sensor

A versatile, high-performance gauge for Film, Sheet and Coating

Applications:

- ▶ **Cast Films**
- ▶ **Extruded Sheet**
- ▶ **Biax Films**
- ▶ **Blown Films**
- ▶ **Barrier Layer Films**
- ▶ **Organic and water-based coatings on film substrates**
- ▶ **Voided/pearlized, micro-porous, battery separator and breathable films**

Features:

- ▶ **One gauge provides superior measurement for a wide variety of films**
- ▶ **Improved, more efficient optical design for best precision**
- ▶ **New modular FSO (Fringe Suppression Optics) add-on provides superior measurement of thin, clear films**
- ▶ **Measures thin films to thick sheet, and coatings on film substrates**
- ▶ **Multi-layer discrimination of up to 6 components**
- ▶ **Measures clear or pigmented films; even some black tinted films**
- ▶ **Measures the weight and thickness of voided, micro-porous and breathable films**
- ▶ **Measures oil-content in micro-porous film**



Like its predecessors, NDC's FilmPro™ intelligent infrared gauge is designed to provide accurate, repeatable, high-resolution thickness measurement for film, sheet and coated products covering a wide range of applications and processes. FilmPro delivers optimum measurement performance through its patented infrared design and world-class optical components. FilmPro has been engineered to provide reliable measurements in varying process or ambient conditions, such as:

- ▶ Lighting fluctuation
- ▶ Temperature variation
- ▶ Humidity changes
- ▶ Barometric pressure drift
- ▶ Web flutter
- ▶ Scanner mechanical run-out

Unlike beta or x-ray gauges, FilmPro is easily maintained and does not require special radiation licenses, protective guarding or interlocked safety gates. FilmPro is easy to install and its measurement accuracy is assured with its straightforward calibration techniques. As a result, our worldwide customers benefit from the accuracy, reliability and performance that is the pedigree of NDC's advanced infrared measurement technology solutions.

FilmPro: An Improved Optical Engine...

for high precision measurement across more applications

FilmPro's optical engine takes a significant step forward from our previous generation Infrared sensor. The optical path has been enhanced to improve signal-to-noise, precision and accuracy and tolerance to web flutter.

FilmPro is NDC's most versatile infrared gauge to date. It can measure film and sheet. It can measure products that are clear, pigmented, voided / pearlized, or tinted in total or as stripes in the product. It can measure the true thickness of voided, microporous or breathable films, in addition to their weight, and derive density. It can measure costly barrier materials, such as Nylon, EVOH or PVDC simultaneously with other polymers such as PE, PP or Ionomer.

Perhaps FilmPro's most novel innovation is how it can deal with measuring thin, clear films. These films generate reflected light which creates a phenomenon called Optical Interference (OI). OI can negatively affect the accuracy of infrared film measurement.

FilmPro has been designed with an optional Fringe Suppression Optics (FSO) module which is used for measuring thin films. The FSO module includes a new, more efficient optical system that is not affected by film thickness changes as well as scanner misalignment or run-out. The new FSO optics significantly improve measurement performance compared to our previous generation gauges.

Applications

Biaxially Oriented Films

At the Casting section of the Biax line, FilmPro provides an excellent high resolution profile that can help quickly establish the needed cast profile at start-up to help achieve flatter film on finished products.

After tentering, FilmPro provides a unique direct thickness measurement of clear, filled or voided / pearlescent films. This gauge addresses the issue of measuring the thickness of voided films and materials that exhibit density variation. This is especially important in the TDO section where non-uniform stretching and the cross-web voiding "gradient" create density differences within the product. FilmPro addresses this challenge with its patented optical design, selection of discrete near infrared wavelengths and powerful algorithms that combine to directly measure the true thickness and mass of voided films. Battery separator film thickness can also be measured directly using the same technology. Where

film porosity is achieved via an oil-based extraction process, FilmPro can also measure the oil content of the film.

Biax films can be controlled both in the MD and profile. Special algorithms are used to accurately map the finished film back through the tenter and to the casting die.

Blown Film

FilmPro can measure individual components in a coextruded film including the total thickness of PET, PP/PE, PS, PVC, EVOH, PMMA, PA and Ionomer. FilmPro can simultaneously measure up to six different product components using a single gauge. A FilmPro scanning measurement of the layflat film following the collapse provides a fast, responsive solution for advanced profile control (APC). NDC's scanning blown film system features a Double Layflat Separation Algorithm (DLSA) that accurately differentiates the top and bottom film thicknesses, even for individual components like barrier and sealant layers.

FilmPro can also be used on other high-value blown films such as laminating grades, protective films, and agriculture films. Systems can be provided with both MD and profile controls. Profile can be controlled via the appropriate interface to segmented heated die lips, segmented heated air rings or segmented air flow control of the air ring.

Cast Film

FilmPro provides superior performance on all types of cast film, including CPE, CPP, Cast Stretch Film, Embossed Cast Films, Barrier films, PVB Windshield / Window films, and Breathable Films. With Embossed Films, FilmPro can handle most colors except very dark / opaque films. Cast Stretch film can be measured clear or tinted, even tinted black! For down-gauged cast stretch thinner than 10 microns, the FSO (Fringe Suppression Optics) module can be added to FilmPro to measure even the thinnest films with high accuracy.

FilmPro can measure up to 6 unique components in barrier films. For PVB windshield inner liner, FilmPro can measure both the clear film and the tinted edge, whether the tint is grey, green or blue. The moisture content of PVB film can also be measured by FilmPro.

Organic Coatings on Film

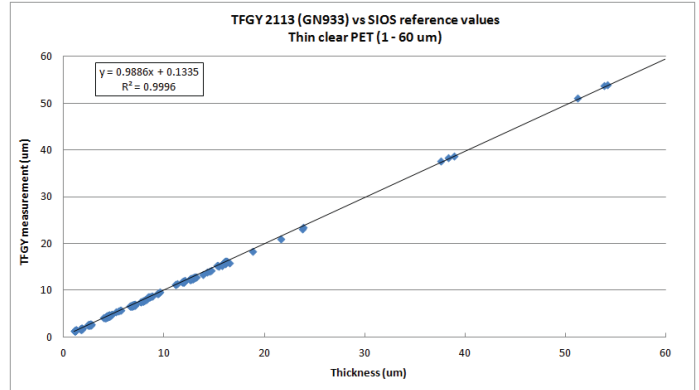
FilmPro performs well when measuring organic or water-based coatings on film, as it can simultaneously measure both the substrate thickness and the coating thickness with a single sensor!

A Single Sensor Solution for film and sheet thickness measurement

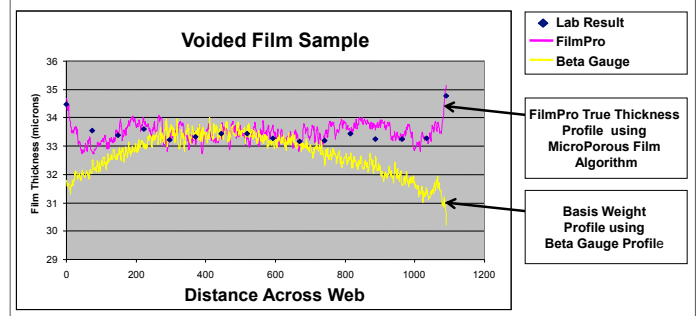
FilmPro Benefits

- ▶ Accurate Thickness Measurement:
 - 1 to 10% raw material savings
 - 10 to 50% reduction in thickness rejects
- ▶ Multi-layer Film Measurement:
 - 5 to 20% reduction in expensive material consumption, such as oxygen barriers
- ▶ Effective Control:
 - CD improved 30 to 80%
 - MD improved 30 to 70%
- ▶ Fast Return on Investment:
 - Payback in months, not years
- ▶ Low Cost of Ownership:
 - Common spare parts
 - Low-risk TDi™ web gauging platform
 - Ability to maintain the system in-house
- ▶ Non-ionizing Radiation Measurement:
 - Safe technology with no licensing requirements

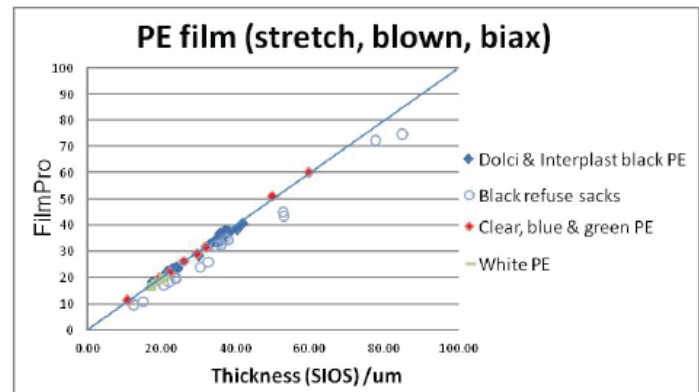
FilmPro measurement performance on thin, clear PET



Profile measurement of voided & micro-porous film thickness: NDC's FilmPro vs. Beta



FilmPro measurement performance on colored plastics including black products



Specifications

Property	Thick Film	Thin Film	Engineering Drawings
Measurement ranges:	Clear BOPP: 12 to 2500 microns (0.5 mils to 100.0 mils)	Clear BOPET: 0.5 to 1000 microns (0.02 mils to 40.0 mils)	
Precision (using Biax films to illustrate)	BOPP: 25 micron thickness ± 0.013µ 2 Sigma @ 1 second response time	Clear BOPET: 12 micron thickness ± 0.018µ 2 Sigma @ 1 second response time	
Repeatability (over 48hrs)	± 0.019µ 2 Sigma	± 0.025µ 2 Sigma	
Gauge to product distance	Transmitter to Web: 24mm (1.0 inch) from airwipe Receiver: 15mm (0.61 inch)		
Beam patch size diameter	10mm (0.40 inch)		
Product pass height tolerance	± 5mm (0.20 inch)		
Ambient light sensitivity	None		
Response Time	7.5msecs, exponential or linear		
Calibration	SpeedCal™ pre-calibrated. No routine re-calibration required		
Reliability	System MTBF of 10 Years, Lamp and Motor have 5 year Warranty		
Network connectivity	Industrial Ethernet		
Electrical	Supply voltage: 24vdc + 10% - 20% Power: 50Watts max. CE Compliant to Electro-magnetic Compatibility: EN61326-1 2013		
Environmental	Ambient Temperature: Up to 50°C. (70°C with water cooling) Cast Alloy Sensor Housing		
Sealing	IP65/NEMA 4		
Maintenance	No routine maintenance is required		

NDC is represented in over 60 countries worldwide. ISO9001:2008 www.ndc.com

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