

EXTRUSION INDUSTRIES



Advanced Web
Gauging Solutions



NDC and the Extrusion Industry

Superior measurement and control technologies
for consistently high product quality



- ▶ Biax Film and Sheet
- ▶ Blown Film
- ▶ Cast Film
- ▶ Sheet and Foam
- ▶ Multi-layer Films
- ▶ Voided Films
- ▶ Microporous Films

Successful extrusion operations demands running at the highest possible line efficiency. This means maximum process uptime, minimum raw material consumption, low rejects plus quality that meets today's stringent requirements. It is vital to squeeze as much yield as possible out of today's high cost resins and produce a flat, uniform, quality product that exceeds the performance expectations from the downstream processes.

Meeting the extrusion measurement challenge: By definition, extrusion products are a diverse family, as are their measurement requirements. This includes thickness, weight and coextrusion layer measurements, as well as speciality measurements such as density of cavitated films or pre-extraction oil content in porous battery separators. NDC's investment in gauging technology provides the exact system solution for these diverse extrusion application requirements. In fact NDC, offers the widest range of web gauging measurements and controls available today.

Infrared Film and Sheet Measurement

Innovative measurements for the extrusion processes

FG710S

- ▶ Thickness
- ▶ Basis weight
- ▶ Coextrusion components
- ▶ Oil content



TFG710ER

- ▶ Thickness
- ▶ Basis weight
- ▶ Coextrusion components

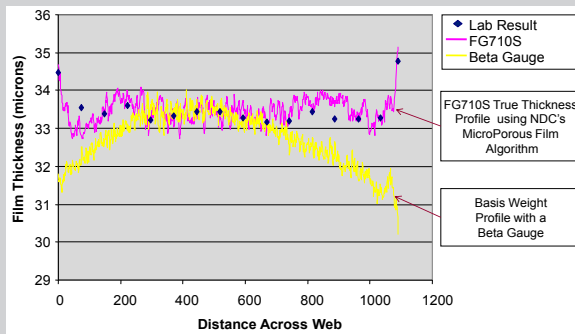


NDC's infrared gauges are designed to measure and control the thickness or basis weight of a wide range of film and sheet products. In addition, these gauges can simultaneously measure the thickness of up to six components of coextruded multilayer polymers plus other unique product characteristics.

FG710S: Applications for this gauge include single or multi-layer composition for most polymeric film and sheet products ranging from 10 microns to 5mm.

The FG710S is able to measure the thickness of structures such as clear, voided, cavitated, porous and translucent films. Thickness

▶ Microporous film thickness measurement

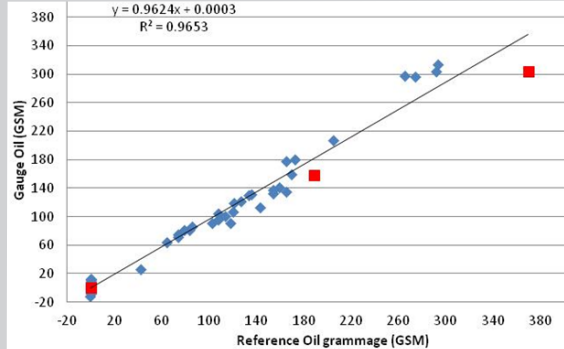


measurement of voided films has proven difficult due to density variation through the product. Now NDC's patented FG710S combines discrete near infrared filters and powerful gauge algorithms that enables direct thickness measurement of these voided films.

In addition the FG710S can measure the oil content in PE battery film across the entire process, beginning with the wet cast film, after the biax stretch and the final film itself.

TFG710ER: Is engineered to measure thin biaxially-oriented

▶ Oil grammage measurement for wet cast PE battery separator film



films, cast films and CPE stretch films.

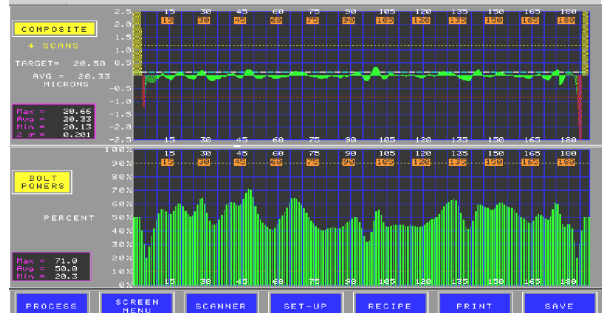
The TFG710ER film gauge incorporates a unique patented optical engine that negates

the effect of thin film optical interference. The TFG710ER can accurately measure across a wide range of film thicknesses from less than 2 microns up to 100 microns. This unique non-nuclear gauge provides high accuracy and overall performance without compromising its measurement range.

Both the FG710S and TFG710ER gauges help the film and sheet producers to meet their

sustainability goals and downgauge their products with NDC's advanced controls, such as Automatic Profile Control (APC) and machine direction controls.

▶ NDC's infrared measurement technology and Automatic Profile Control performance





Company overview

Combining industry-best performance and reliability with a global support structure

NDC develops and manufactures gauging and analyzer systems for a wide range of process industries. The company manufactures in USA, UK and Belgium and has direct sales and support operations in China, Japan, Germany, France, Italy and Brazil, and support and distribution in over 60 countries worldwide.

Our global client base consists of some of the world's most successful companies who rely on NDC to ensure that their product performance, process yield and quality meet the stringent standards demanded by their customers.

NDC product groups:

NDC Systems: web gauging systems for the converting, extrusion, calendering and nonwovens industries, providing real-time measurement of key product parameters such as coating or lamination thickness, basis weight and product thickness.

NDC Sensors: process instrumentation for the food, chemical and pharmaceutical, mineral and bulk materials and tobacco industries, providing on-line and at-line NIR (near infrared) measurements of constituents such as moisture, fat and protein content.

NDC Infrared Engineering sa: rugged in-process gauging systems for the steel and non-ferrous metals industries, delivering rugged measurements of key parameters such as thickness, width and flatness, and sinter permeability and oxidation state.

NDC is part of Spectris plc, the leading supplier of productivity-enhancing instrumentation and controls.



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

a **spectris** company

NDC Infrared Engineering Inc
Tel: +1 626 960 3300
Email: enquiries@ndcinfrared.com

NDC Infrared Engineering sa
Tel: +32 4 239 90 10
Email: sales@ndcinfrared.be

NDC Japan
Tel: +81 3 3255 8157
Email: info@ndcinfrared.jp

NDC France
Tel: N° Azur: 0810 600 400
Email: info@ndcinfrared.fr

NDC Singapore
Tel: +65 91994120
Email: apacsales@ndc.com

NDC Infrared Engineering Ltd
Tel: +44 1621 852244
Email: sales@ndcinfrared.co.uk

NDC China
Tel: 86 20 2887 3860
Email: info@ndcinfrared.com.cn

NDC Germany
Tel: +49 1801 977112
Email: info@ndcinfrared.de

NDC Italy
Tel: +39 0331 454 207
Email: info@ndcinfrared.it

NDC India
Tel: +91 9890800697
Email: NDCIndia@ndc.com

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Accurate, Reliable Measurements

A complete choice of sensors

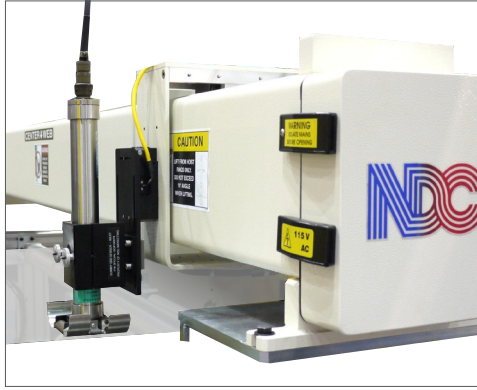
for the sheet and film extrusion processes



► Beta

NDC's Beta transmission gauges feature an ultra high-efficiency detection system and a minimized source activity for safety and performance.

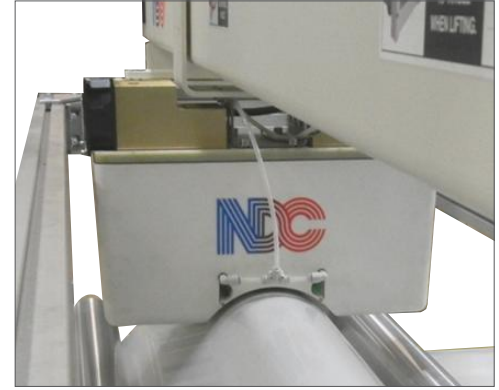
Beta gauges are used to measure extruded sheet, packaging foam and at the cast end of the biax process.



► Gamma Backscatter

NDC's Gamma BackScatter (GBS) gauge family provides a cost-effective thickness measurement. This compact sensor can provide valuable measurements from difficult process locations.

Applications for this gauge typically include blown film, cast film and sheet products.



► OptiMike

The OptiMike OM190 optical micrometer provides direct, single-sided thickness measurement.

The sensor is suitable for measuring extruded sheet and non-metallic thick film products.



► Laser Transmission

NDC's laser gauges measure thickness via a distance triangulation computation of a laser beam .

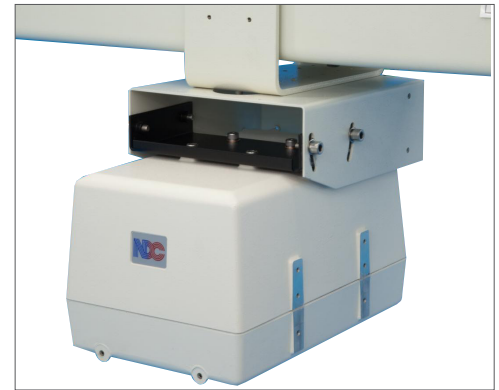
Laser gauges are typically designed to measure thick extruded sheet products. The thickness measurement range for NDC's single-sided sensor is 50 mm, while the dual-sided range extends to 15 mm.



► X-Ray Transmission

NDC's X-ray transmission sensor's energy source is tuned for optimum product measurement sensitivity to provide precise measurement of basis weight or thickness for nonwoven products.

X-ray transmission gauges typically measure extruded film and sheet products up to 8,000 microns.



► X-Ray Backscatter

The X-ray backscatter sensor's compact footprint permits it to be installed in difficult measurement locations on the process.

The X-ray backscatter sensor is able to operate over a wide thickness range for extruded products up to 25,000 microns.

Proven, Capable Solutions

NDC extrusion industry expertise

...a measurement solution for each application

Machine Direction Control

Machine direction (MD) controls compare the current scan average thickness against the target. The difference is used to supervise either the extruder or line speed (user-selectable) in order to drive the average thickness to the target.

Automatic Target Optimization Control (ATO):

Automatic Target Optimization supervises the average film or sheet thickness to run to the lowest acceptable specification. If the thickness variation is high, the average target will be increased to protect against making under-spec product at any point across the profile. If the sheet is flat, then ATO will ensure that no product is manufactured below the minimum quality limit. The combination of APC and MD control will supervise the thickness target downward to the lowest acceptable limit, resulting in significant raw materials savings while avoiding scrap.

Ratio Control

On coextrusion processes ratio control will insure that all extruders maintain the same relative output to maintain layer ratio balance. This is especially valuable during line speed changes.

Automatic Profile Control (APC)

APC works with extrusion dies to supervise the die bolt heaters and control the lip opening across the web width to create a flat profile. This technology can be applied to blown film, sheet, cast film and biax processes. For the biax application, our Asynchronous Integrated Mass (AIM) algorithm insures that the film and cast scanners are appropriately mapped to provide fast, responsive control to film thickness upsets.

Other System Options

- ▶ FFT (Fast Fourier Transform) analysis
- ▶ SPC quality reporting
- ▶ 3D profile analysis displays

Sensor	Range	Application
Infrared TFG710ER	2 microns -100 microns	Biax film Cast film Capacitor film Coextrusion components
Infrared FG710S	10 microns-5 mm	Biax film Cast fillm Blown film Clear, cavitated, porous and translucent films Coextrusion components Oil content (Battery separator)

NDC has specialized in infrared measurement technologies. These non-nuclear gauges provide exceptional performance and are ideal for biax and cast film processes

GBS 101	6,350-26,000 microns	Sheet
GBS 102	1,500-8510 microns	Sheet Cast end biax
GBS103	0-2,000 microns	Sheet Biax Cast Film Blown Film

The GBS Backscatter Gauge is ideally suited for sheet and thick film on narrow processes

Beta 301	100-5,500 microns	Sheet Cast end biax
Beta 302	15-1,200 microns	Film end biax Cast film Thin sheet

The measurement performance of beta gauges is largely unaffected by product composition, hence their wide acceptance on sheet, cast and biax applications

OptiMike OM190	150-5,000 microns	Sheet Non-metallic films
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OptiMike provides non-nuclear direct thickness measurement and is ideal for sheet applications

Laser 170W, 1 Sided	0-50 mm	Sheet
Laser 172, 2 Sided	0-15 mm	Sheet

Laser gauges are intended for use on thick sheet applications

XRT 312A	5-8,000 microns	Sheet Biax Cast film
XRB 318	50-25,000 microns	Sheet Biax Cast film

X-Ray sensors offer a non-nuclear alternative with minimal licensing issues and provide measurement across a wide range of extrusion applications