

FG710S, TFG710S & TFG710ER SENSORS

High-performance infrared measurements for the plastics industry

Applications:
▶ Cast Films
▶ Sheet
▶ Biax Films
▶ Blown Films
▶ Barrier Layer Films
Features:
▶ FG710S: The ultimate plastic film thickness gauge:
- For clear, filled and voided or pearlized films
- Single or multilayer composition films
- For most polymeric films ranging from 10 microns to 1.0mm in thickness.
▶ TFG710S: Specifically engineered for measuring thin biaxially-oriented films to high accuracy:
- Measurement range 1-350 microns
▶ TFG710ER: For CPP and CPE stretch films, clear and filled:
- This sensor offers a wide measurement range with seamless performance based on a unique patented optical design
- Measurement range 6-200 microns



NDC's intelligent infrared gauges are designed to provide accurate, repeatable, high-resolution thickness measurement for plastic film and sheet products covering a wide range of applications and processes. These intelligent sensors deliver time-critical process information for both the operators and controls, plus valuable information for process optimization.

The FG710S and TFG710 gauge family deliver optimum measurement performance through their patented infrared designs and world-class optical components. These sensors have been engineered to provide reliable measurements in either process or ambient conditions, such as:

- ▶ Lighting fluctuation
- ▶ Temperature variation
- ▶ Humidity changes
- ▶ Air quality (dust, evaporates content etc.)
- ▶ Barometric pressure drift
- ▶ Head tolerant to x,y & z displacement

Unlike beta or x-ray gauges, these sensors are easily maintained and do not require special radiation licenses, protective guarding or interlocked safety gates. They are easy to install and their measurement accuracy is assured with their straightforward calibration techniques.

As a result, our worldwide customers benefit from the accuracy, reliability and performance that is available from the NDC's advanced infrared measurement technology solutions.

FG710S: Infrared Optical Thickness Measurement for Clear, Filled and Voided or Pearalized Films

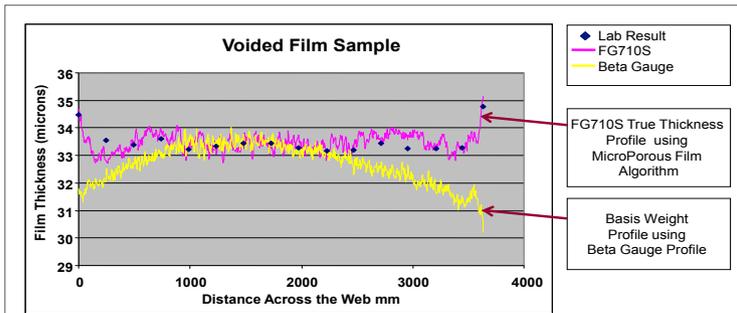
FG710S Overview

The FG710S infrared sensor provides direct thickness measurement of clear, filled and voided or pearlescent films. This new optical sensor 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. The FG710S addresses this challenge with its patented optical design, selection of discrete near infrared wavelengths and powerful sensor algorithms that combine to directly measure the true thickness of voided films.

Battery separator film and porous breathable cast film thickness can also be measured directly using this infrared technology. The unique infrared thickness measurement capability of the FG710S helps produce unrivalled flat film and rolls for products over 10 microns.



FG710S Infrared Transmission Sensor



Profile Measurement of Voided & Micro-Porous Film Thickness: NDC's FG710S vs. Beta

Barrier Layer and Blown Film Measurement

FG710S can also measure individual components in a coextruded film including the the total thickness of PET, PP/PE, PS, PVC, EVOH, PMMA, PA and ionomer. The FG710S can simultaneously measure up to six different product components using a single gauge.

For high value-added multilayer blown film products, NDC's FG710S scanning measurement of the layflat film following the collapser provides a fast, responsive solution for advanced profile control (APC). NDC's 8000-BF scanning blown film system features a Double Layflat Separation Algorithm (DLSA) that accurately differentiates the top and bottom film thicknesses.

Benefits: FG710S, TFG710s and the TFG710ER

- ▶ **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

TFG710S: Infrared Optical Thickness Measurement for Thin Biaxially Orientated BOPP, BOPET and BOPA Films

TFG710S Overview

The TFG710S is primarily designed for accurate, high-resolution thickness measurement of thin biaxially-oriented films, capable of measuring down to 1 micron on clear BOPP and BOPET.

The ability of conventional infrared gauges to measure very thin films is limited by the fact that the passing light through them generates an optical fringe interference effect (OFI) that significantly diminishes their accuracy. This occurs most noticeably when the film thickness decreases to below 10 microns. The measurement technique used in the TFG710S gauge automatically measures and cancels out OFI.

Light from a quartz halogen lamp is directed through a light engine. A proportion of this light is directed by a beam splitter to an internal Reference Detector that provides an accurate measurement of the outgoing light from the transmitter head. This ensures the long-term measurement stability by removing the effects of lamp ageing for example.

Following the beam splitter, the light travels through the film and is detected by the Sample Light Detector in the receiver head. Some of the transmitted light is reflected from the surface of the film, which is

then collected by a mirror in the transmitter and sent back through the film onto a Reflected Light Detector in the receiver head. The combined signals from the Sample, Reflected light and Reference Detectors are used to accurately calculate film thickness using proprietary algorithms that eliminate the influence of optical interference.



TFG710S and TFG710ER Infrared Transmission Sensors

TFG710ER: Extended Range Infrared Sensor for Thin CPE, CPP and Stretch Films

TFG710ER Overview

The TFG710ER (Extended Range) has been specifically engineered for measuring clear and filled (not voided) polymeric films across a wide range of products and thicknesses.

The versatile TFG710ER film gauge shares the same unique patented optical engine as the TFG710S that negates the effect of optical fringe interference (OFI). Its discrete near infrared measurement wavelengths and robust sensor algorithms result in an instrument with an extended measurement range that is easy to install, calibrate and maintain. The TFG710ER's optical engine is designed to accurately measure the thickness of PE and PP films between 6 and 200 microns nominal thickness. This unique non-nuclear sensor provides a single gauge solution with high accuracy and overall performance without

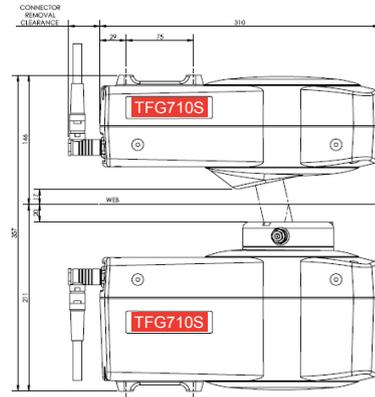
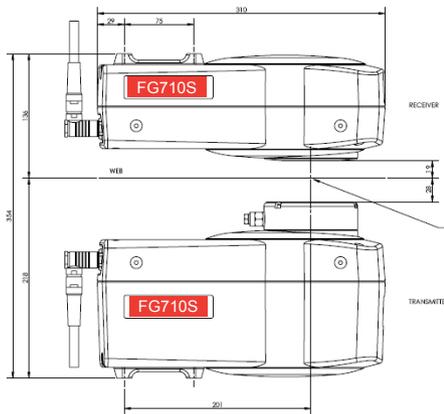
compromising the measurement range.

The TFG710ER answers the needs of many CPE and stretch film producers who are down-gauging their products in order to meet sustainability goals and to remain competitive in the marketplace. For example, some processors are successfully manufacturing these films as thin as 6 microns.

In addition to the traditional clear and filled film markets, the TFG710ER film gauge is targeted at manufacturers of CPE and stretch film processes where material cost, sustainability and competitiveness require an accurate, reliable measurement.

Specifications

Property	FG710S	TFG710S	TFG710ER
Measurement ranges: (application dependent)	Clear BOPP: 12 to 1000 microns (0.5 mils to 40.0 mils)	Clear BOPET: 1 to 350 microns (0.04 mils to 14.0 mils)	Clear CPP: 6 microns to 200 microns (0.25 mils to 8.0 mils)
Gauge to product distance	Transmitter to Web: 28mm (1.10 inches) from airwipe Receiver: 19mm (0.75 inches)	Transmitter to Web: 20mm (0.79 inches) from airwipe Receiver: 17mm (0.67 inches)	Transmitter to Web: 20mm (0.79 inches) from airwipe Receiver: 17mm (0.67 inches)
Precision (using BOPP to illustrate)	BOPP: 25 micron thickness ± 0.013µ 2 Sigma @ 1 second response time	BOPET: 12 micron thickness ± 0.035µ 2 Sigma @ 1 second response time	CPP: 20 micron thickness ± 0.049µ 2 Sigma @ 1 second response time
Repeatability (over 48hrs)	± 0.030µ 2 Sigma	± 0.043µ 2 Sigma	± 0.050µ 2 Sigma
Beam patch size	8mm MD x 6mm CD (0.3ins x 0.2ins)	8mm (0.3ins) circular	8mm (0.3ins) circular
Product pass height tolerance	± 5mm (±0.2ins)	± 3mm (±0.12ins)	± 3mm (±0.12ins)
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	Power 24v DC - Consumption 42 Watts CE Compliant to Low Voltage Directive Eurostandard: EN61010-01 and for Electro-magnetic Compatibility: EN50081-1 & EN50082-2		
Environmental	Ambient Temperature: Up to 50°C. (Cooling Optional) Cast Alloy Sensor Housing		
Maintenance	No routine maintenance is required		



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



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