Erhardt+Leimer

EL-THICKNESS

Thickness measurement

Continuous measurement and
determination of material thickness

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Erhardt+Leimer
Global solutions for production of the future

Intelligent technologies and products in the highest quality designed to optimize the production processes of our customers all around the world. This is our claim as the internationally expanding Erhardt+Leimer group of companies.

With our global presence – from development to production and on to service – we are always close to the customer. We develop customer-specific solutions and provide our customers with excellent products either in digital or intelligent versions depending on their preference. Not only this, but we also set new standards for the production of tomorrow. In the process, it is not just our products that are increasingly becoming smart – our entire company is currently undergoing a digital transformation. One visible indication of this is the E+L online shop, which enables our customers to order products and spare parts quickly and easily from our website.

With more than 1,600 employees at sites across Europe, Asia, and America we deliver cutting-edge technology on-time to any location in the world.

In everything we do, we aim to use all company resources responsibly to protect the environment and demonstrate our commitment to increased sustainability.

Higher quality and productivity due to E+L measuring and inspection systems

These days, producers in all industries are faced with increasing demands. Products are becoming more complex, production speeds are supposed to be increased, quality is to be ensured, and rejects and machine downtimes are to be minimized.

Flat webs, profiled webs, webs built up from multiple layers, every web and strip of material must be produced within the required tolerances in order to achieve the desired quality for the application.

E+L measuring systems reliably and precisely measure thickness, profile and length, check the surface for defects, or verify printed samples or images. Regardless of whether this check has to be carried out in a warm or cold environment or under adverse conditions, we will find a solution for your task within our broad, modular portfolio.

Thickness measurement

The EL-THICKNESS system can be used to determine material thicknesses on flat, non-profiled webs. The system is available in different mechanical versions and offers the perfect solution for every application.

Web monitoring

Sophisticated image processing, combined with two high-resolution cameras – this is what the ELSCAN web monitoring systems offer. They allow the display of printed images on moving webs with the greatest detail and color fidelity.

Surface inspection

Flawless surfaces are one of the key quality characteristics in many industries. Defective areas, holes and contamination are reliably detected with our surface inspection systems.

Meter and unit weight scales

Our portfolio of weight recording systems enables the quality of continuous or cut materials to be checked using precise load cells.

Profile measurement

Line laser triangulation sensors measure the external geometry of the material web, which is usually extruded. The system is used for process control in the extrusion line after the extruder and/or at the end of the cooling section for quality assurance.

Print image inspection

SMARTSCAN is the first 200% inspection system developed specially for narrow-web printing and finishing machines. Print defects, damage to the material and missing labels are reliably detected.

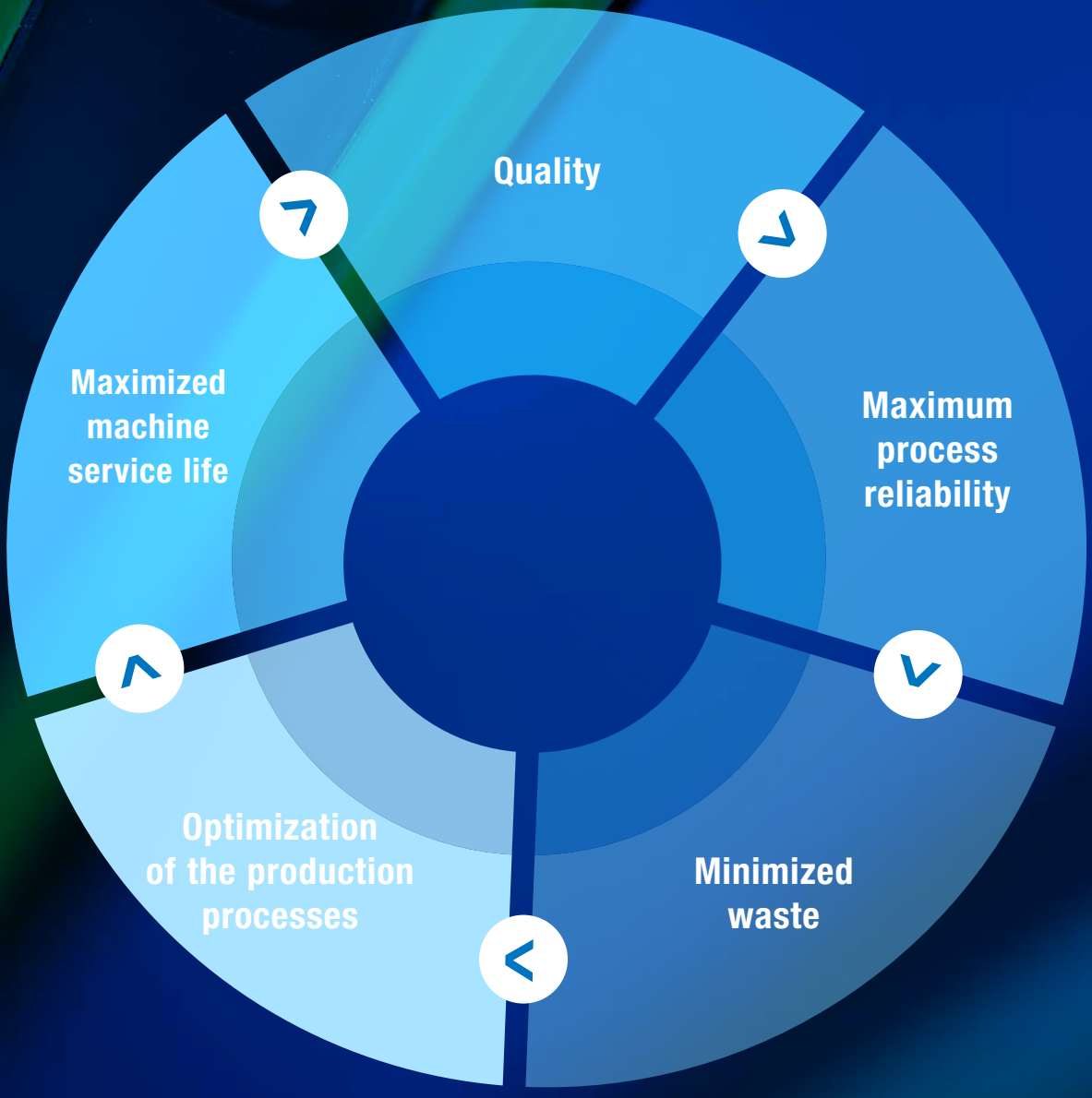
Color line inspection

An RGB CCD camera compares the colors applied to the product against a nominal color sample. This makes it possible to reliably detect irregularities in the color application.

Length measurement

Two synchronized cameras use a special algorithm to detect the ends of the cut product and use this information to determine the length of the piece of material.

E+L inspection systems



FLEXIBLE

HIGH-PRECISION

USER-FRIENDLY

Thickness measurement

EL-THICKNESS is a system for contactless determination and continuous monitoring of material thicknesses on continuous webs. The modular system is available in different mechanical versions and offers the perfect solution for every application.

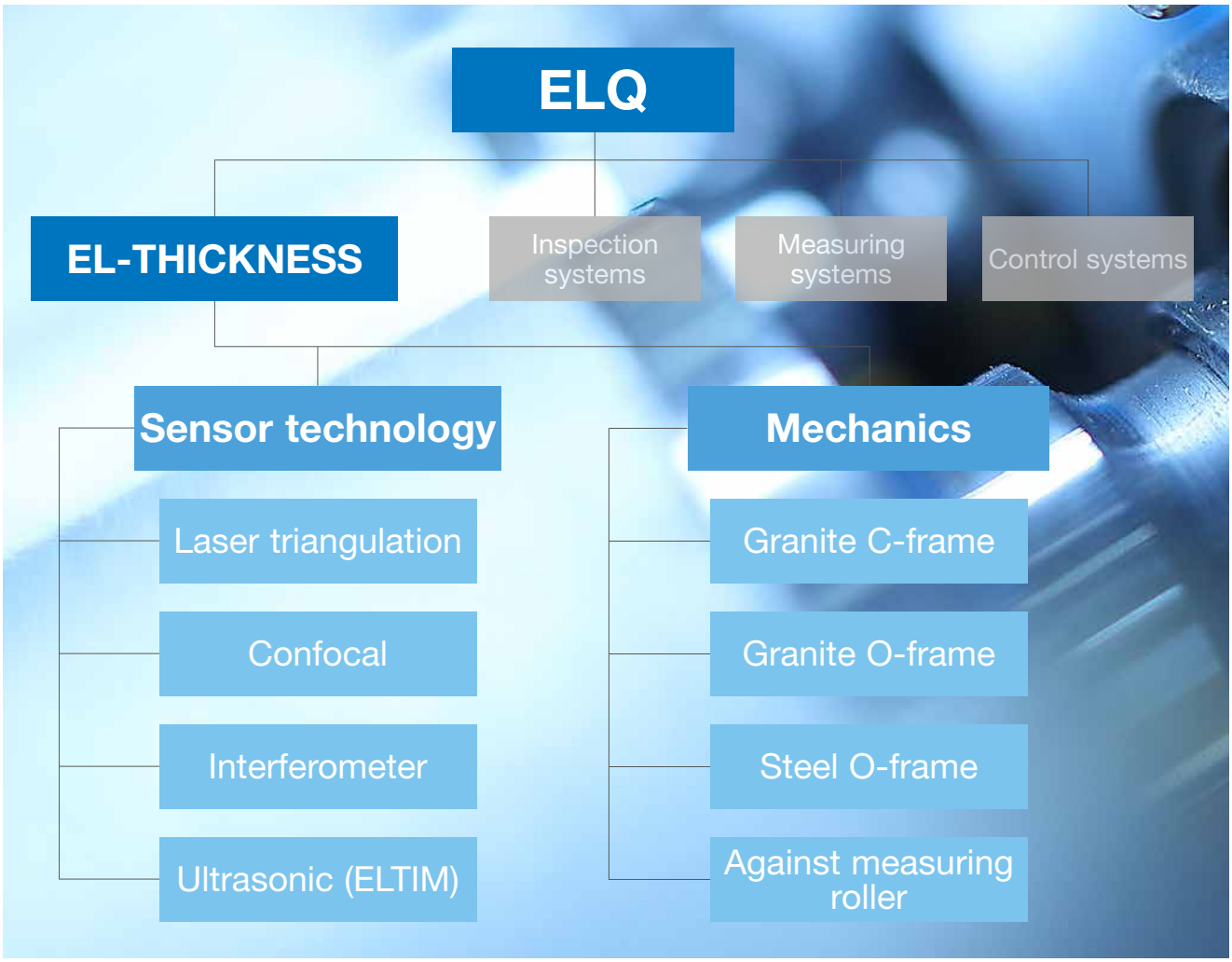
With one or more sensors it is possible to measure against measurement rollers or calender rollers (for reference measurements) or to position opposing pairs of sensors (for differential measurements) in a defined position or to move them across the material with the aid of a granite C-frame or a granite O-frame.

Thanks to the modular layout of the systems, it is possible to use different sensor technologies without changing the basic mechanical setup. These include laser triangulation sensors, chromatic-confocal sensors, interferometric sensors, or combination sensors featuring laser and eddy current technology.

In addition, the systems are extremely robust and resistant to vibrations and temperature effects thanks to the heavy-duty granite measurement frames.

- Precise determination of web thickness using chromatic-confocal, laser triangulation or interferometric sensors
- Lower number of rejects, unrivaled quality control
- Minimized thermal expansion and improved vibration resistance thanks to the use of a granite frame
- Highest accuracy through interval-dependent in-situ alignment
- Measurement data for thickness control
- Real-time measurement
- Smart technologies for drift compensation
- Remote operation and maintenance via Ethernet possible (WBM)

Maximizing modularity with the EL-THICKNESS system



Sensor technologies

	Laser triangulation	Chromatic-confocal	Interferometric
Accuracy Depending on the application and material used	+ (up to ± 3 µm)	++ (up to ± 0.5 µm)	+++ (less than ± 0.5 µm)
Sensor scanning rate Measured value output to PLC below 1 kHz	**+** **(10,000 Hz)**	**++** **(4,000 Hz)**	**+++** **(70,000 Hz)**
Advantages	■ High accuracy for dynamic measurements ■ Robust against environmental influences ■ High scan rate	■ Compact measuring head ■ No electronics - connected via fiber optic cable ■ No shading problems (coaxial beam) ■ Independent of material surface and material characteristics	■ Compact measuring head ■ No electronics - connected via fiber optic cable ■ No shading problems (coaxial beam) ■ Independent of material surface and material characteristics ■ Layer thickness measurement
Example application	Thickness measurement on all opaque films/foils, glossy/non-glossy surfaces and rubber materials	Total thickness measurement for transparent to opaque films/foils and glossy/non-glossy surfaces (limited layer thickness measurement)	Total thickness measurement for transparent to opaque films/foils and glossy/non-glossy surfaces (limited layer thickness measurement)

Laser triangulation

A point laser triangulation sensor is an optical measuring device used for non-contact distance measurement and surface profiling. It is based on the principle of triangulation and uses a laser point as a measuring mark.

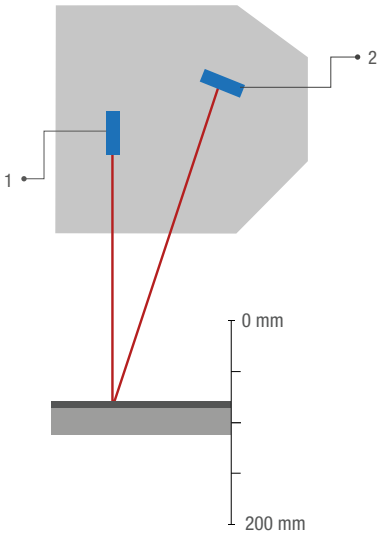
The sensor consists of a laser light source and a CCD element.

With laser triangulation, a laser beam is focused on the measurement object and observed with a camera located in the sensor, a spatially resolving photodiode or a CCD line scan camera. If the distance between the measurement object and the sensor changes, the angle at which the point of light is observed also changes, and with it the position of its image on the photo receiver.

The signal processing unit analyzes the measured position of the laser point and calculates the distance to the measurement object.

This is done using the principle of triangulation, in which the distance between the sensor and the object is calculated from the angle or displacement of the reflected laser point.

- High accuracy for dynamic measurements
- Robust against environmental influences
- High scan rate



Legend

1	Laser
2	CCD element

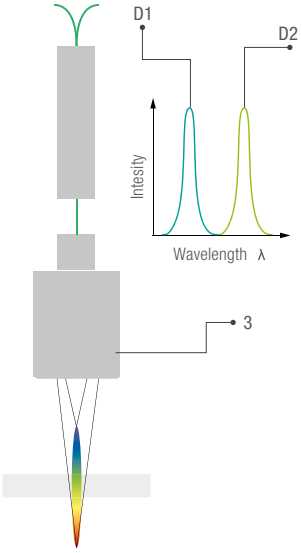
Chromatic-confocal

A chromatic-confocal sensor is an optical measuring device used for non-contact distance measurement. It is based on the principle of chromatic aberration and confocality.

The sensor consists of a light source, an optical system and a detector. The light source sends out a broadband light signal containing different wavelengths. This light is passed through special optics, often a chromatic lens or optical prism. The chromatic aberration in optics causes the different wavelengths to be focused differently.

A white point light source is focused onto the object using a non-color corrected lens. The dispersion focuses the blue light components closer to the lens and the red components further away. The reflected light is imaged again using the same lens, and a spectrometer then determines the dominant wavelength of the reflected light. From the knowledge of the focus widths of the individual wavelengths, the object distance can be determined directly from the dominant wavelength.

- Measurement possible on all materials:
  - Opaque or transparent material
  - Absorbent or colored
  - Diffuse or reflective (specular)
  - Raw or polished
- Coaxial measurement avoids shadow effects
- Very high inclination acceptance, high numerical aperture
  - up to 45° on reflecting surfaces
  - 80° on diffuse surfaces
- No laser inside; no speckle effect, no laser protection class requirements



Legend

D1	Position of the front side of the transparent material
D2	Position of the rear side of the transparent material
3	Chromatic scanning head

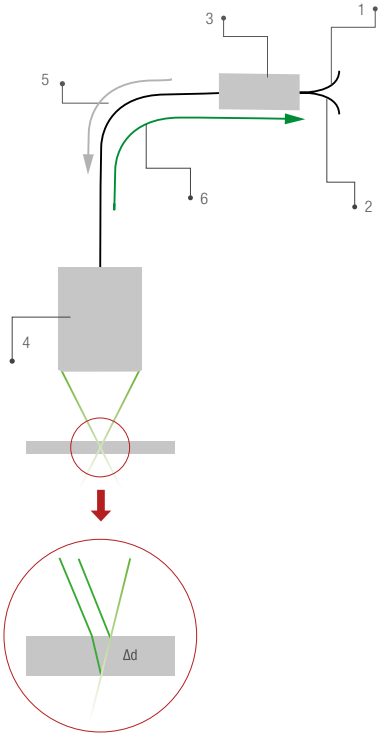
Interferometric

An interferometric sensor is based on the principle of the interference of light waves and is used to precisely measure distances, surface profiles or other physical quantities.

The sensor consists of a light source, a beam splitter, reference and measuring arms, a detector and a signal processing unit.

Broadband infrared or visual light is focused onto the object by optical probes. In the coaxial configuration, the reflections from different surfaces are collected by the same optical probes and then spectrally analyzed. The slightest changes in the light paths lead to a change in the interference pattern, and the thicknesses of all layers are then determined by Fourier analysis of the interference spectrum.

- Ultra-precise thickness measurement using the drift-free direct method (for transparent and semi-transparent materials)
- Thickness measurement of materials:
  - Raw or reflecting surfaces
  - Opaque objects (plastics, adhesives, bonds, etc.)
  - Transparent surfaces (glass, clear plastics, polymers, Si, GaN, SiC, etc.)
- Suitable for measurements in liquids (e.g. water, oil, acids)
- Thickness measurement of multi-layered materials
- Insensitive to heat, moisture or vibration
- Distance measurement possible by using a reference route
- Ideal for high-speed inline testing up to 70 kHz



Legend

1	Infrared broadband light
2	Spectrometer
3	Optocoupler or beam splitter
4	Achromatic scanning head
5	Broadband irradiated light
6	Both reflections

Differential and reference measurement EL-THICKNESS

Function

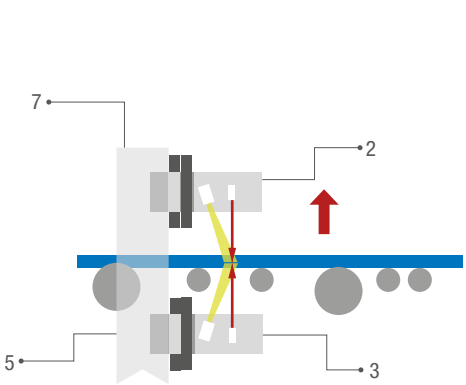
One or more sensors measure the product thickness in one or more locations continuously via differential measurements or reference measurements.

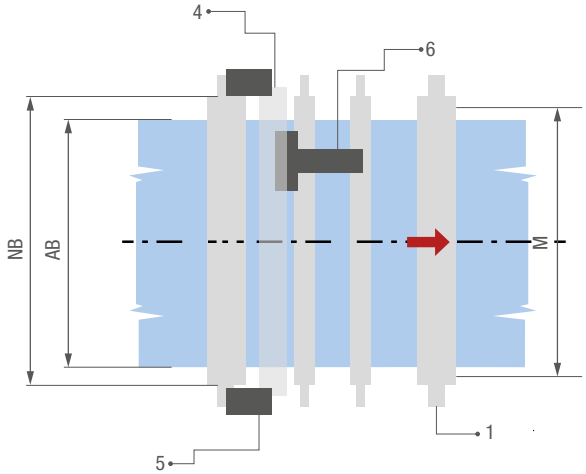
Here, there are different ways in which this system can be used: fixed measurement points or manually/automatically approachable/traversing measurement points.

Area of use

Systems for the measurement of thickness are mostly used in calender and extrusion lines. Our systems are highly modular and can be integrated flexibly into the production lines.

Differential measurement

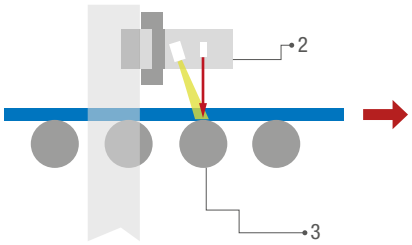


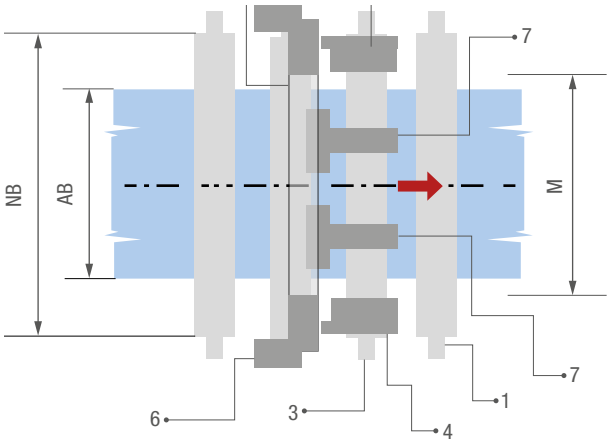


Legend

AB	Operating width
M	Measuring range
NB	Nominal width
1	Guide roller
2	Sensor
3	Sensor
4	Positioning device
5	Granite frame
6	Positionable sensors
7	Differential measurement system

Reference measurement





Legend

AB	Operating width
M	Measuring range
NB	Nominal width
1	Guide roller
2	Sensor
3	Reference roller
4	Reference laser (optional)
5	Positioning device
6	Frame
7	Measuring sensors

Differential measurement O-frame ND 1 and C-frame ND 2

Product description

- Contactless online thickness measurement for material webs
- Precise determination of web thickness based on laser triangulation technology, chromatic-confocal or interferometric sensor technology
- Reduction in the number of rejects, highest quality assurance
- Minimized thermal expansion and susceptibility to vibrations thanks to the use of a granite frame
- Manual or motorized positioning of sensors is possible

EL-THICKNESS O-frame ND 1

EL-THICKNESS C-frame ND 2

Technical data		
	O-frame (traversing)	**C-frame (fixed)**
Profile width	up to 4000 mm	up to 1400 mm
Laser triangulation sensors measuring range	Up to 78 mm	
Accuracy	up to ±10 µm	up to ± 3 µm
Chromatic-confocal sensors measuring range	Up to 4 mm (freely scalable for vertical sensor repositioning)	
Accuracy	up to ±5 µm	up to ±1 µm
Interferometric sensors measuring range	Up to 8 mm (freely scalable for vertical sensor repositioning)	
Accuracy	up to ±5 µm (for layer thicknesses <0.5 µm)	up to ±1 µm (for layer thicknesses <0.5 µm)
Measuring equipment capability (Cg&Cgk): [TW = 10 x accuracy]	> 1.67	
Sensor	Laser triangulation, chromatic-confocal, interferometric	
Measuring points	1 (traversing)	Up to 3
Scan frequency	Sensor technology-dependent	
Laser class	2 (no dedicated laser safety officer required)	
Resolution of profile thickness	0.01 µm	
Displayed resolution	1 µm / 0.01 for chromatic / interferometer	
Relative atmospheric humidity	15 to 95 % (non-condensing)	
Ambient temperature	+10 to +50 °C	
Operating voltage	120 V - 230 V; 50 Hz/60 Hz; 16 A	
Protection rating	IP 54	

Thickness measurement against reference roller ND 3

Product description

- Contactless online thickness measurement for material webs
- Precise detection of the web thickness
- Reduction in the number of rejects, highest quality assurance
- Manual or motorized positioning of sensors is possible

EL-THICKNESS against reference roller ND 3

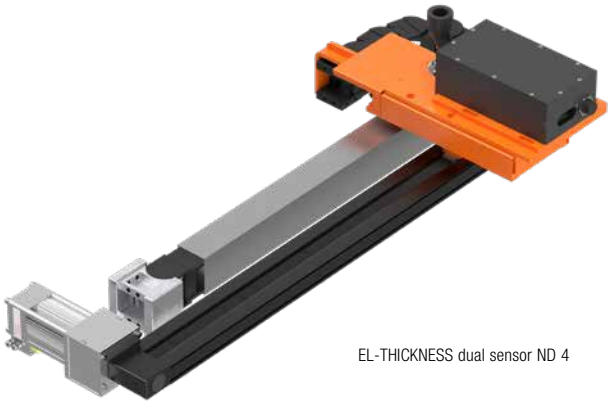
Technical data	
Profile width	Depending on the position and number of measuring points
Max. measuring range for thickness	Up to 78 mm
Accuracy of thickness measurement	to 5 µm (up to 0.5 µm for layer thickness measurements)
Measuring equipment capability (Cg&Cgk): [TW* = 10 x accuracy]	> 1.67
Sensor technologies	Laser triangulation, chromatic-confocal, interferometric
Measuring points	Up to 5 (depending on variant)
Scan frequency	Sensor technology-dependent
Laser class	max. 2 (no dedicated laser safety officer required)
Resolution of profile thickness	0.01 µm
Displayed resolution	1 µm
Max. positioning / traversing speed of the sensor	133 mm/s
Relative atmospheric humidity	15 to 95 % (non-condensing)
Ambient temperature	+10 to +50 °C
Operating voltage	120 V - 230 V; 50 Hz/60 Hz; 16 A
Protection rating	IP 54

* Dynamic testing tool required for verification only

Dual sensor thickness measurement ND 4

Product description

- All three sensor technologies are possible in combination with eddy current sensors
- Measurement against roller with metallic reference surface
- Real-time measurement
- Includes communication to customer PLC
- Provision of data for customer-side control of calender gap and the cross/axis parameters



EL-THICKNESS dual sensor ND 4

Technical data	
Profile width	up to 3000 mm
Max. measuring range for thickness	8 mm
Accuracy of thickness measurement	up to 10 µm (for layer thickness measurement up to 1 µm)
Measuring equipment capability (Cg&Cgk): [TW* = 10 x accuracy]	> 1.67
Sensors	all three combined with eddy current sensor
Measuring points	Up to 5 (depending on variant)
Scan frequency	Sensor technology-dependent
Laser class	max. 2 (no dedicated laser safety officer required)
Resolution of profile thickness	0.01 µm
Displayed resolution	1 µm
Max. positioning / traversing speed of the sensor	133 mm/s
Relative atmospheric humidity	15 to 95 % (non-condensing)
Ambient temperature	+10 to +50 °C
Operating voltage	120 V - 230 V; 50 Hz/60 Hz; 16 A
Protection rating	IP 54

* Dynamic testing tool required for verification only

Example of application to a four-roller rubber calender

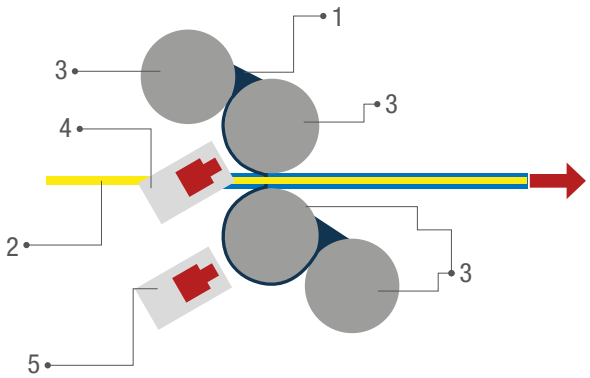
Function

One or more combination sensors (laser triangulation and eddy current technology) use reference measurements to measure product thickness directly on the calender rollers. Several stationary sensors or traversing sensors can be used here. These sensors can be positioned manually or by motor.

Application

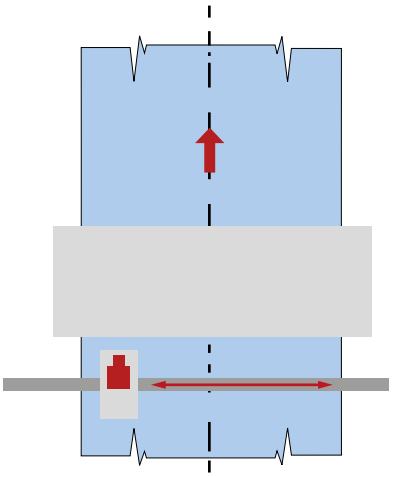
The system is mounted directly on both material-carrying rollers. When placing in the calender system, we recommend performing a final thickness measurement after the calendering process in order to achieve an optimum result.

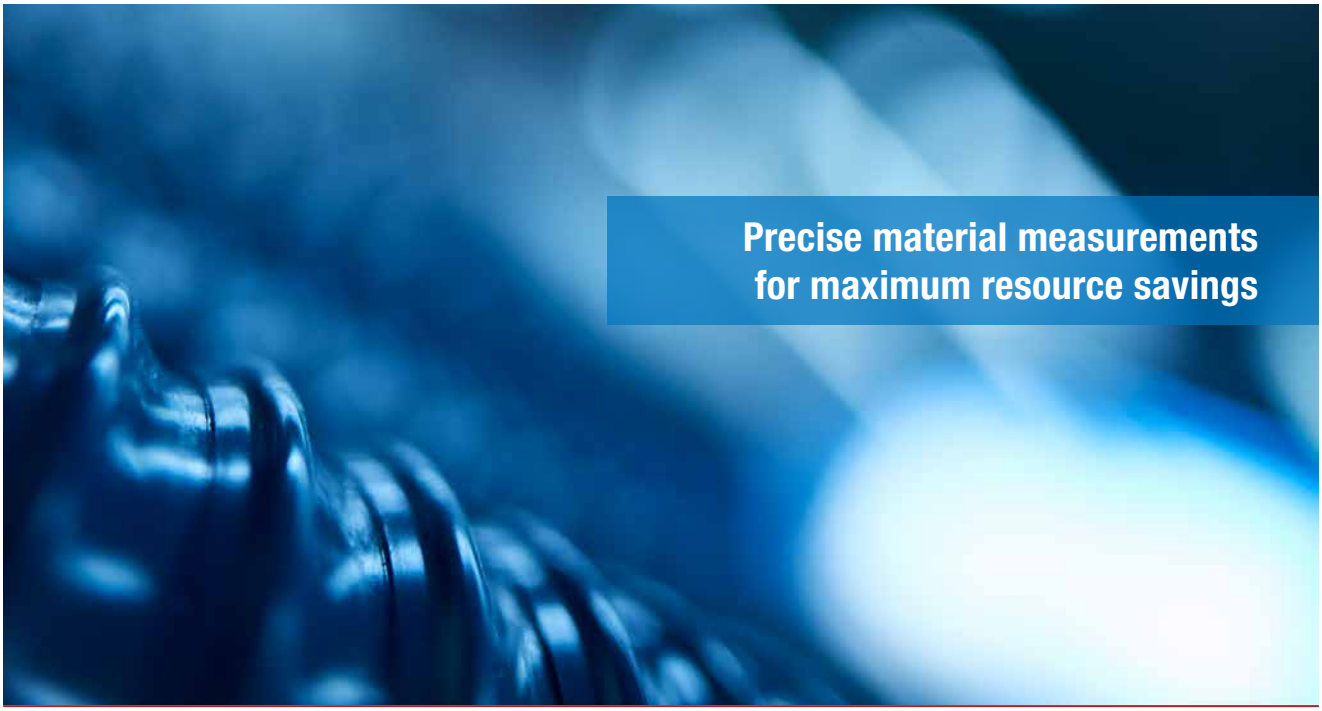
The continuous measurement and monitoring of the material thickness enables the user to regulate the calender gap using precise values. This increases quality and optimizes the use of materials.



Legend

1	Rubber material
2	Cord material
3	Calender rollers
4	Upper sensor unit
5	Lower sensor unit



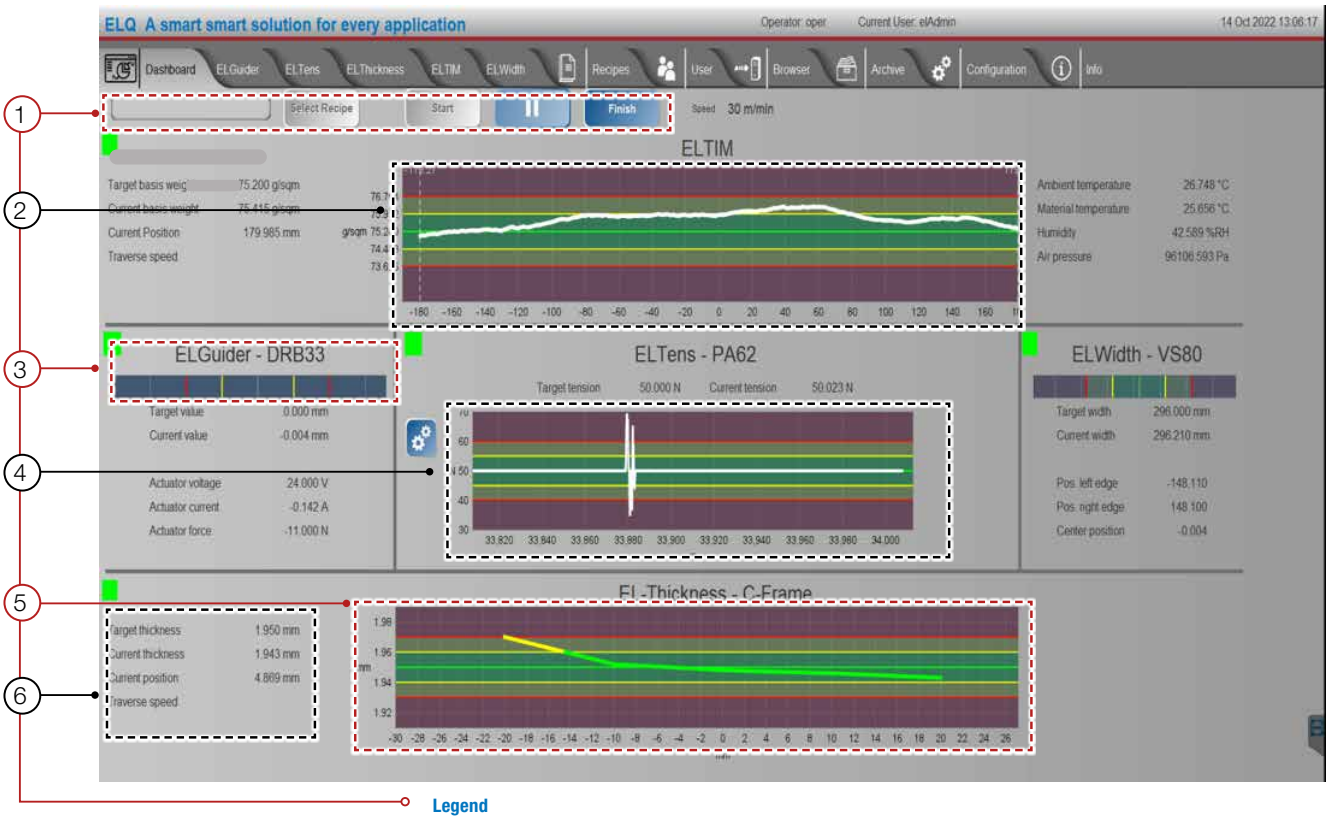


Control and data management software ELQ

Maximize the value of your knowledge

Our central ELQ intelligence software is designed for operation and optimization of your E+L systems and handles data management for all production data, including data recorded from third-party systems via standard interfaces, for comprehensive quality evaluation, analysis, and reporting.

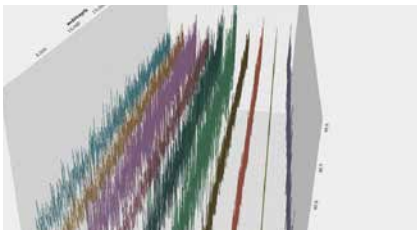
The modular layout means that it is possible to connect a wide range of different systems and sensors, whether thickness measurement systems with confocal, interferometric, or laser triangulation sensors, basis weight measurement systems, closed-loop control systems based on the new EL.NET technology, or web tension measurement systems. All data are displayed in a dashboard on the user-friendly touchscreen.



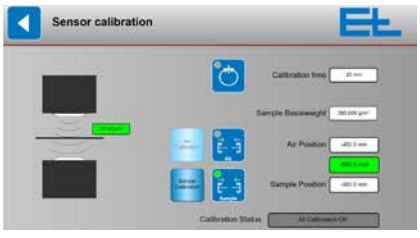
Legend

1 Manual mode
2 Profile view
3 Correction direction and intensity of the web guider
4 Trend display of measured values
5 Numeric display of recipe and current measured values
6 Measurement zones of profile

Further views



3D view



Calibration

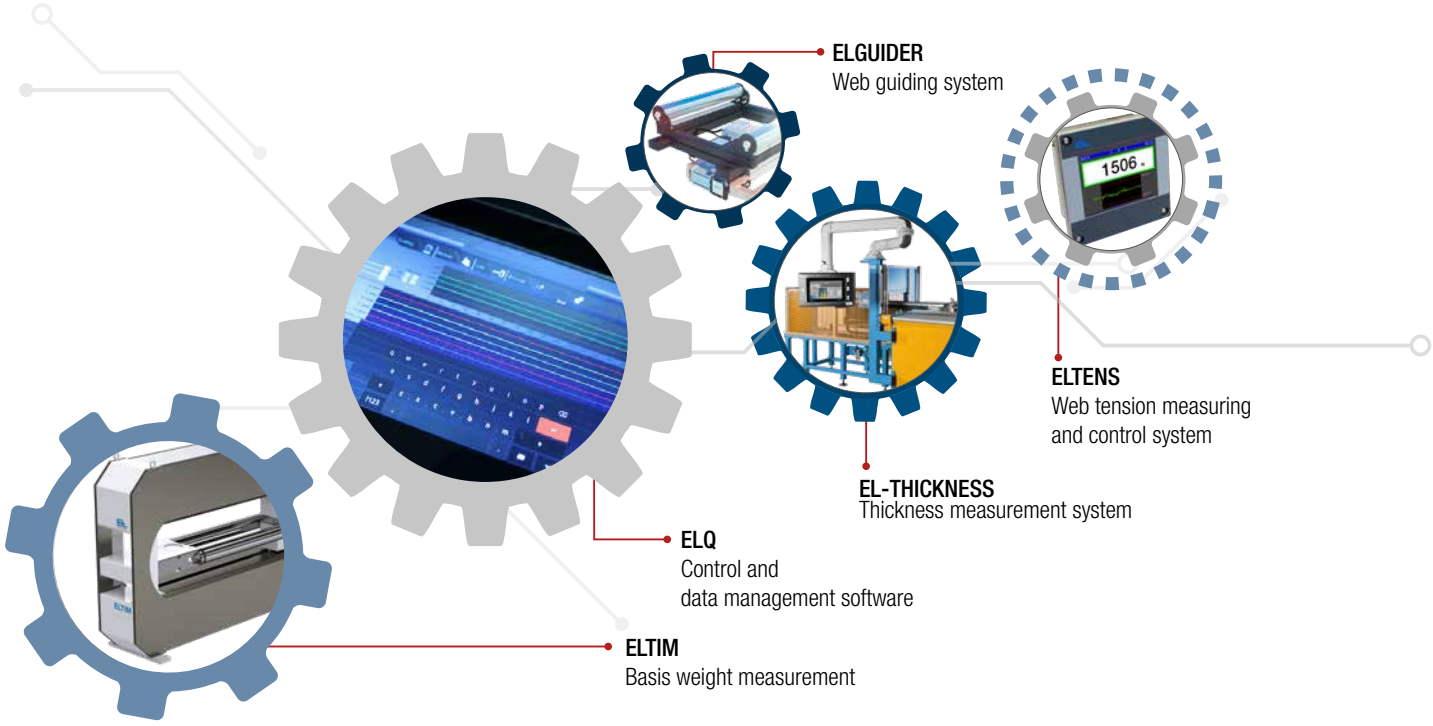
User login

Smart data usage

Product description

- Process display, presentation and comparison of measured data for all connected systems using trend and bar displays
- Evaluation of measured data based on specified recipe data
- Automatic job/roller log
- Automatically printable reports for each job when machine rollers are changed
- Output of CSV and PDF files
- Job archive
- Central recipe management via ELQ panel, PLC or database
- Statistical evaluation (max./min. values, standard deviation, CP, Cpk, etc.)
- Different customer interfaces (Ethernet IP/ UDP, Profinet, SQL, OPC-UA, and many more)
- Platform-independent, can run under Linux and MS Windows
- Minimum system requirements: Intel Core i3 processor, at least 8 GB working memory, at least 512 GB SSD, resolution 1920 x 1080 Full HD (other specifications on request)

Modular systems connected with an intelligent unit

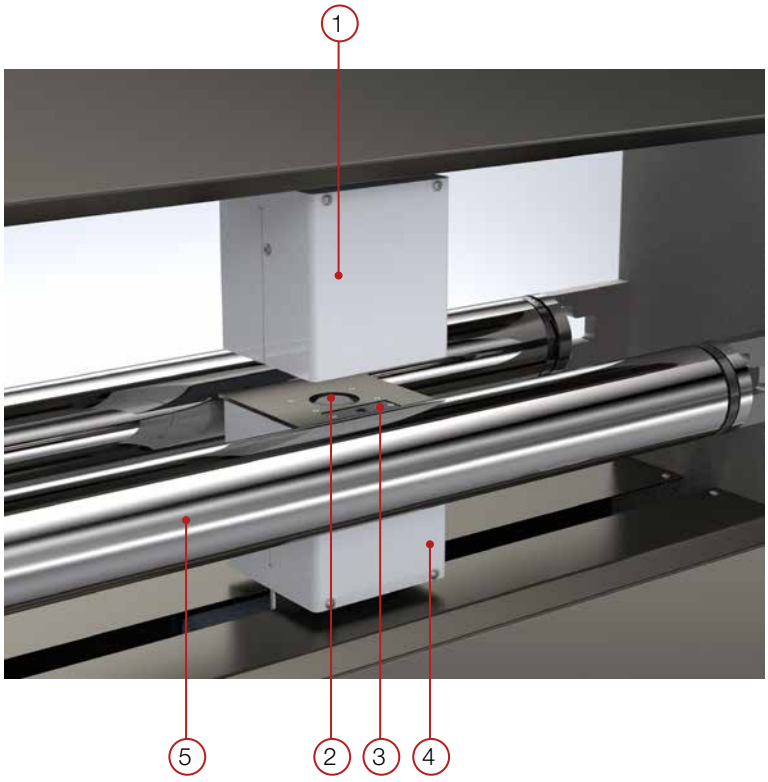


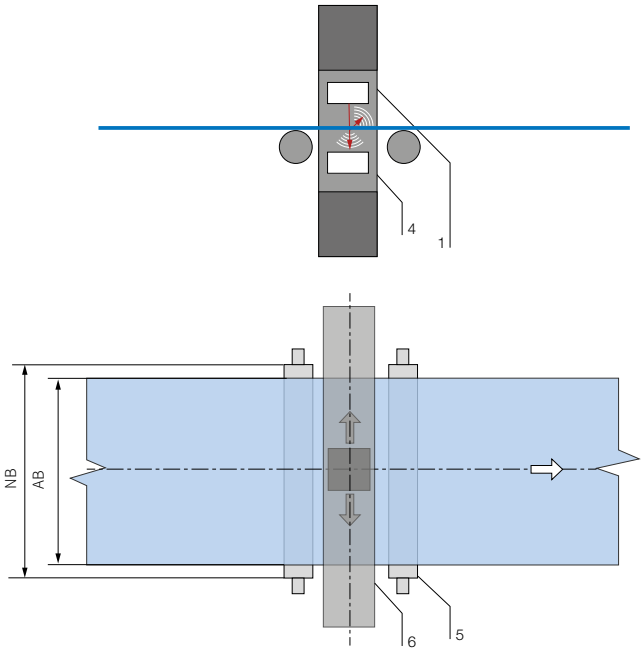
Basis weight measuring system ELTIM

Advantages of basis weight measurement

In all production processes, it is always vital to ensure the quality of materials at the end of the process, and to immediately identify any optimization potential in manufacturing. The ELTIM system allows precise determination of material distribution and of the amount of material consumed from the web on the basis of weight. This enables customers to optimize energy consumption and save costs by reducing material usage.

Unlike other basis weight measurement systems, ELTIM does not use X-rays or radioactive isotopes for measurement. The system works with ultrasonic sensors and can be integrated into existing production lines with considerably less time and cost. In addition, the ultrasound-based, radiation-free sensor reduces occupational health & safety requirements and eliminates the danger of environmental damage due to unresolved radioactive waste disposal issues.





Legend

1	Transmitter
2	Ultrasonic transducer
3	Environmental sensor system
4	Receiver
5	Guide rollers
S6	Area of the basis weight measurement

Basis weight measuring system BWS10

ELTIM is an ultrasound-based, radiation-free sensor for contactless determination of the basis weight of materials such as plastic films/ foils and coatings. It offers highest accuracy especially for thin materials with high frequencies and a small detection area. In addition, special sensors record data such as ambient and material temperature, atmospheric humidity, and air pressure.

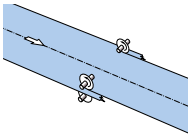
Advantages

- No danger from radiometric radiation or X-rays
- Compact system, easy to integrate in existing machines
- Small detection area for highest accuracy
- Sensors for detection of ambient conditions that potentially impact on processes
- Precise time log synchronization
- Insensitive to fluctuations in the web height
- Insusceptible even to color fluctuations
- For plastics, paper, metals, coatings, and many other materials
- Maintenance-free transmitter and scanner
- Attractive and exceptionally user-friendly graphical user interface
- Machine interfaces for every customer control
- Doctor blade control or applicator roller control depending on customer preference
- Extensive analysis software such as 3D surface profile display

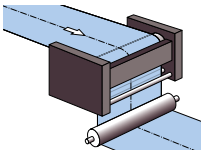
ELTIM BWS10

Technical data	
Measuring range (basis weight measurement)	Up to 400 g/m²
Measuring accuracy	< ± 0.5 % of the basis weight of the calibration piece
Resolution	0.001 g/m²
Sensor type	US ultrasonic sensor
Measuring point size	Ø 23.6 mm (US 20..) , Ø 33 mm (US 10..)
Cycle time of the measuring system	120 Hz
Passage height	40 mm (from measuring head to measuring head)
Height fluctuation of the web	± 5 mm in the middle; no fluttering
Actuating speed of sensor	300 mm/s
Relative humidity	15 to 95 % (non-condensing)
Ambient temperature	+10 to +50 °C
Ambient temperature at the sensor	+10 to +70 °C
Storage temperature	-20 to +80 °C
Protection rating	IP 54, UL 50e: Type 12
Power supply	24 V (optionally 100 to 250 V AC, 3.5 A, 50/60 Hz)
Current consumption	Max. 10 A
Operating width	500 to 2500 mm, larger widths on request
Dimensions	L (NB + 932 mm) x H 960 mm x D 270 mm

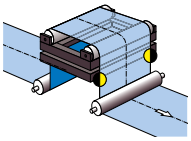
Additional products from Erhardt+Leimer



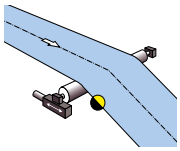
CORDALIGNER – Full width expander systems



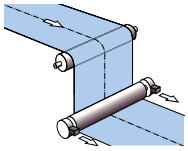
ELSMART – Web guiding systems



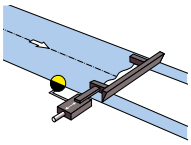
ELGUIDER – Web guiding systems



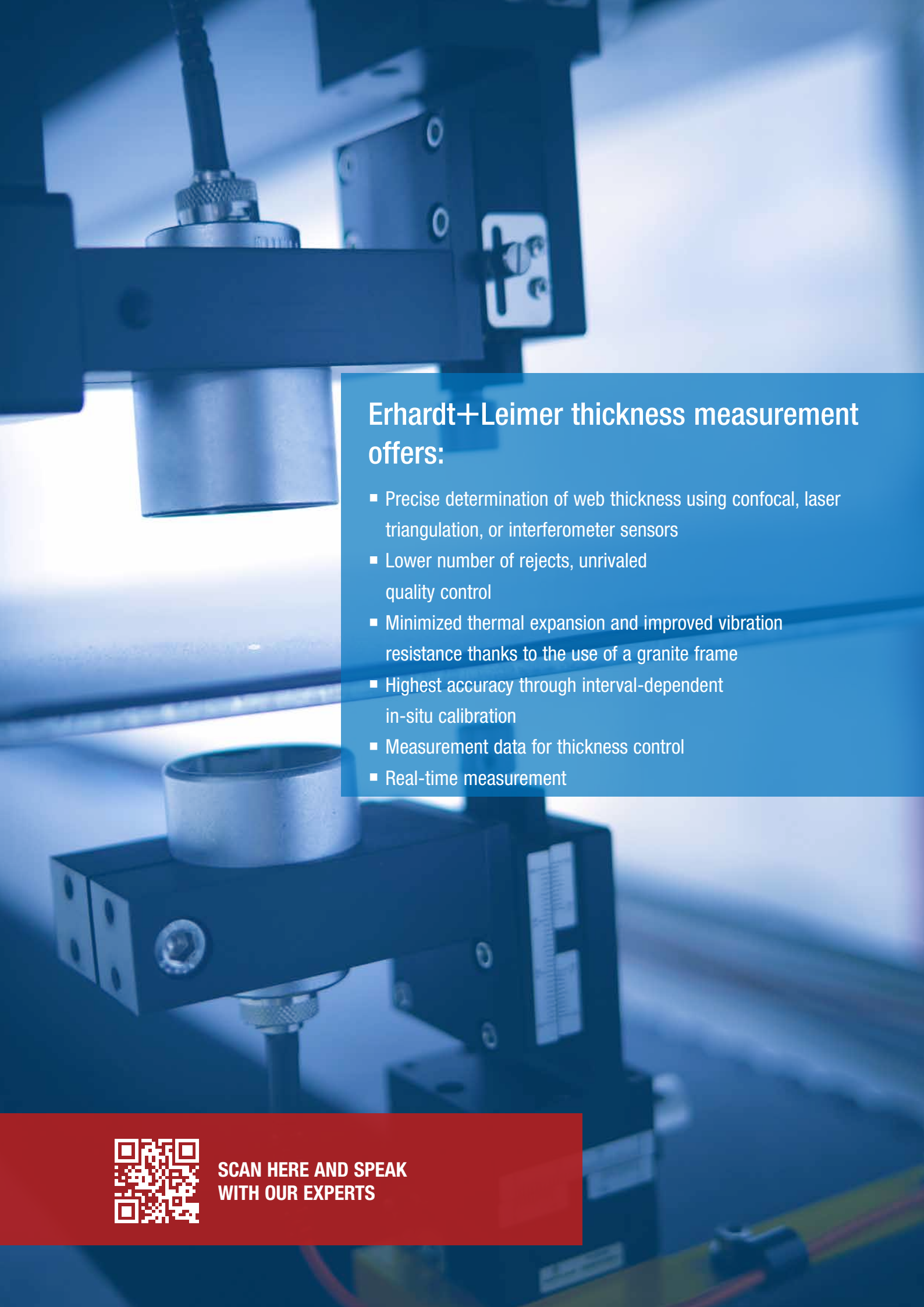
ELBANDER – Fabric position control systems



ELTENS – Web tension control systems



ELPOSER – Positioning and follow-up control systems



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- Lower number of rejects, unrivaled quality control
- Minimized thermal expansion and improved vibration resistance thanks to the use of a granite frame
- Highest accuracy through interval-dependent in-situ calibration
- Measurement data for thickness control
- Real-time measurement

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