Erhardt+Leimer

Battery industry

Product overview

Measuring and control technology
for the battery industry

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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.

We offer special solutions for the battery industry

The production of batteries demands a particularly high level of accuracy and precision in the guidance of material webs through the production process.

For the production and further processing or coating of anode and cathode materials as well as separator films for lithiumion batteries and other storage elements such as fuel cells, we offer tailor-made, complete system solutions, including web guiding and web tension control, inspection systems for checking coatings as well as measuring systems for the measurement of distance, width and basis weight.

We can offer you tailor-made solutions for the following machines in the field of batteries.

Coating system

The coating of copper or aluminum webs is a core process in battery production. The carrier film must always be guided through the center of the coating plant and the machine. Only in this way is it ensured that the upper and lower layer coincide exactly.

Just as important for consistent quality is constant web tension in all the process steps. The ELTIM basis weight measurement before and after the coating head ensures the constant application of the coating.

Calendering system / press

During calendering, the coating on a copper or aluminum foil is compacted between rotating pairs of rollers. A defined line pressure is of crucial importance for the constant thickness of the overall material and a homogenous coating. E+L web guiding control systems ensure accurate web guiding through the calender gap and the web tension control system ensures precise web tension.

Slitter rewinder

Cutting is a separation operation in which a wide electrode strip (mother coil) is divided up into multiple webs. The cutting operation can be thermal using laser cutting or mechanical using rotating blades. With both cutting technologies it is important that the edge of the web is guided exactly into the cutting station. Besides the web position, constant web tension is crucial for consistent quality.

Notching line

During notching, the contact connections are punched out of the coated aluminum or copper strips. This process can be undertaken mechanically or using lasers. During this step, it is important that the strip is fed to the punching tool according to the guiding criterion.

Laminating system

Assembling and laminating systems combine copper foils, aluminum foils and separator films. Here, E+L web guiding and web tension control systems can provide support with the highest level of accuracy and guarantee consistent high quality during the assembly of the cell.

Optimally matched to your production

Attention must be paid to the materials used in the system components during the entire production process for the manufacture of battery cells.

We check in detail which requirements our components must meet for your production process so that the webs can be guided through the systems without degradation. Do you have any questions about what we can offer you? Contact our experts at sd6@erhardt-leimer.com.

Advantages of the EL.NET system

Do you want to increase your productivity, improve your quality and reduce downtimes to a minimum? Your requirements are our motivation to deliver the perfect solution. And what is more: we create the basis for the end-to-end automation of your entire production process and with it significantly higher quality and productivity that pays off!

With EL.NET we provide the tools you need to master Industry 4.0 processes. In our EL.NET control system, digital E+L components connect together consistently in a network and, in this way, make straightforward, quick integration into the customer's network possible. All devices automatically and selectively exchange data relevant for optimal control within a production plant.

With EL.NET, up to 255 control systems can be connected together in a network. Here, the data acquired at all levels of the production process makes up a decisive part of the automation. This data creates high levels of transparency and makes it possible to monitor and to optimize processes in real time – and to therefore minimize downtimes and production waste.

Each EL.NET device is equipped with an integrated web server via which it makes its data and functions available. As such, user-friendly, prompted commissioning, optimization and service are possible via web-based management, i.e. using any standard web browser without the need for special software. EL.NET components include our digital edge and color line sensors, controllers and brushless, and thus wear-free, actuating drives. The wiring and supply of power to the devices are straightforward; commissioning is quick and trouble-free using plug & play.

The components flexibly adapt to new requirements, minimize retooling times and guarantee efficient production. Straightforward connection of the E+L guiding systems to a customer controller is possible via integrated fieldbus interfaces and fieldbus modules.

Digital system

- Fully digital web guiding system
- No drift caused by analog signals
- No analog transmission paths

Web-based management

- Commissioning and service with every standard browser
- No firmware (special software) required
- User-friendly display of the configuration

Ethernet networking

- Maximum 255 bus users
- Increased data rate of up to 100 Mbit/s
- Self-organizing system

Brushless drive technology

- Rotor with lowest mass inertia - increased dynamics
- Wear-free
- Fault-resistant

Determination of absolute position

- Absolute actuator position is always available - no reference run required
- No reference sensor
- No position loss on power off

Controller and output stage integrated into the actuator/actuating drive

- Space saving
- Minimized wiring effort

Self-healing

- Automatic configuration recovery for problem-free replacement of control components

Certifications

- Certified for USA and Canada

Industry 4.0 at Erhardt+Leimer

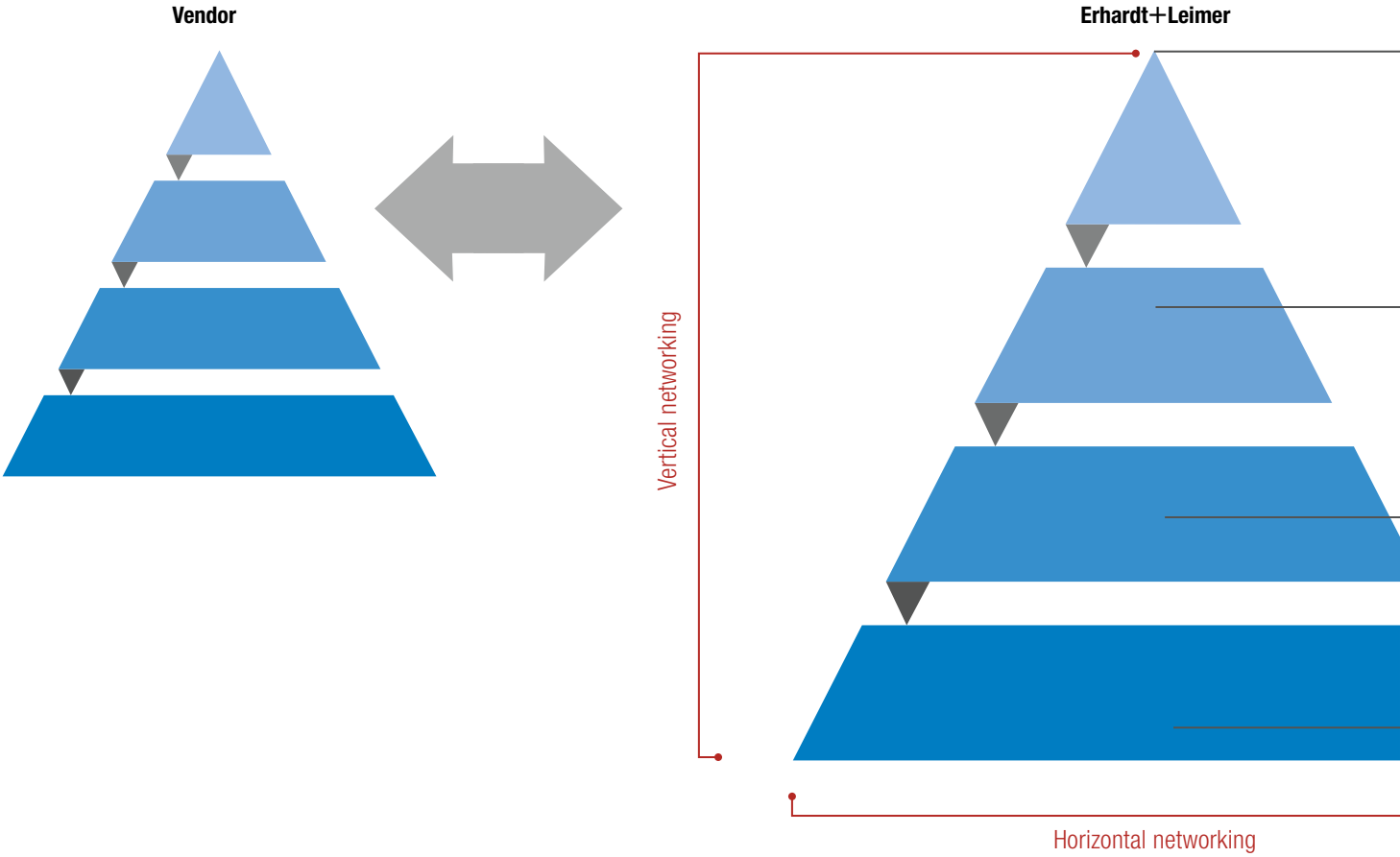
Production meets digitization

Intelligent, self-organizing processes are a key component of Industry 4.0. The digitization and networking of individual components has gained greatly in significance. They create the basis for end-to-end automation of the entire production process – from production sequences involving multiple machines to the overriding delivery relationships between individual companies within a supply chain.

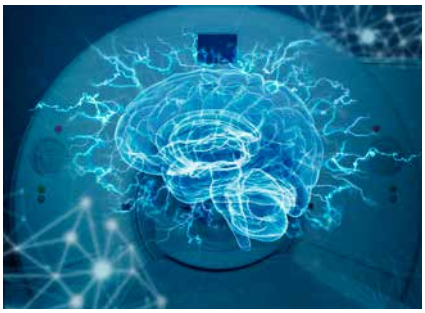
The data acquired at all levels of the production process makes up a decisive part of the automation. The generation, selection and evaluation of digital data create a high level of transparency in complex processes. It helps to optimize processes in real time and creates new machine-related and autonomous value creation processes.

Self-healing system

- Automatic configuration restoration
- Direct restore from the network
- Secure and controlled communication within a web guiding system
- No analog transmission paths



Neural network



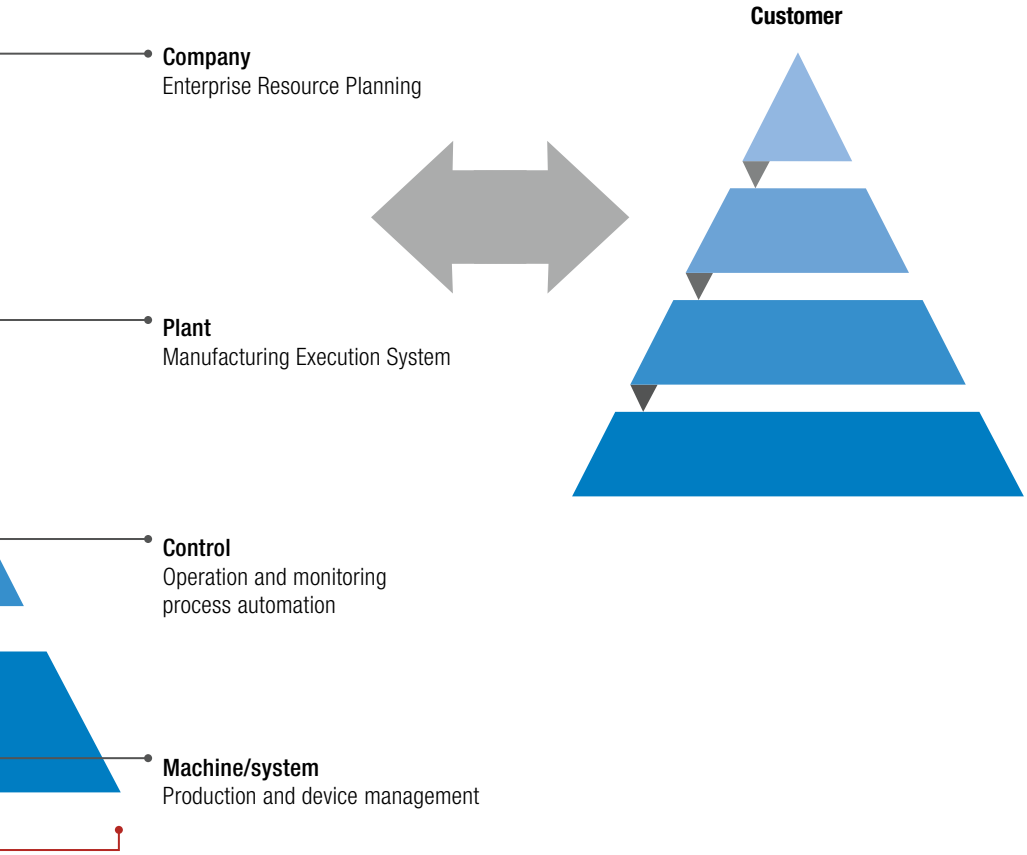
- Self-organizing system
- Intelligent control components
- Continuous digital communication

Interface ability

- Large number of fieldbus interfaces (optional)
- Integrated fieldbus interfaces
- Remote maintenance (optional)

Intuitive system handling

- Web-based management of each control component
- Individual retrieval of the system overview
- Simple, intuitive commissioning



EL.NET
Digital from the sensor to the interface

Coating system with one dryer

Coating systems play an important role during the manufacture of battery cells in the battery industry because it is here that the basis for the quality and the performance of the future battery cells is laid by means of the precise single or double-sided application of the slurries.

A coating system consists of various subsystems. After one or two unwinders comes the actual coating system, which ensures an even coating by means of an application unit, as a rule a slot die. The material applied is dried in drying lines with a length derived from the machine speed as well as the coating to be dried. By means of basis weight measurements, the quantity of coating per unit area is monitored and ensured.

Surface inspection systems also monitor the quality of the surface because even the smallest impurity or defect is to be avoided.

The coating system is completed by highly precise web guiding systems with web guiding by web center to guide the material accurately through the process, as well as web tension measuring and control systems for the synchronization of the drives to ensure constant, consistent quality during production.

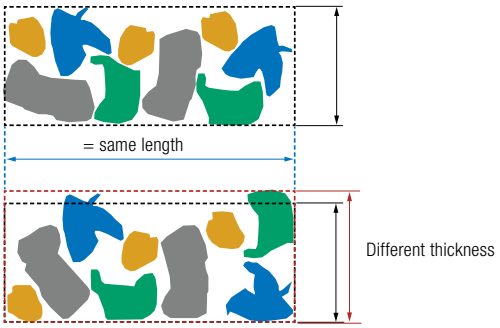
A single or double winder at the end of the system ensures the material is available for subsequent processes precisely wound up.

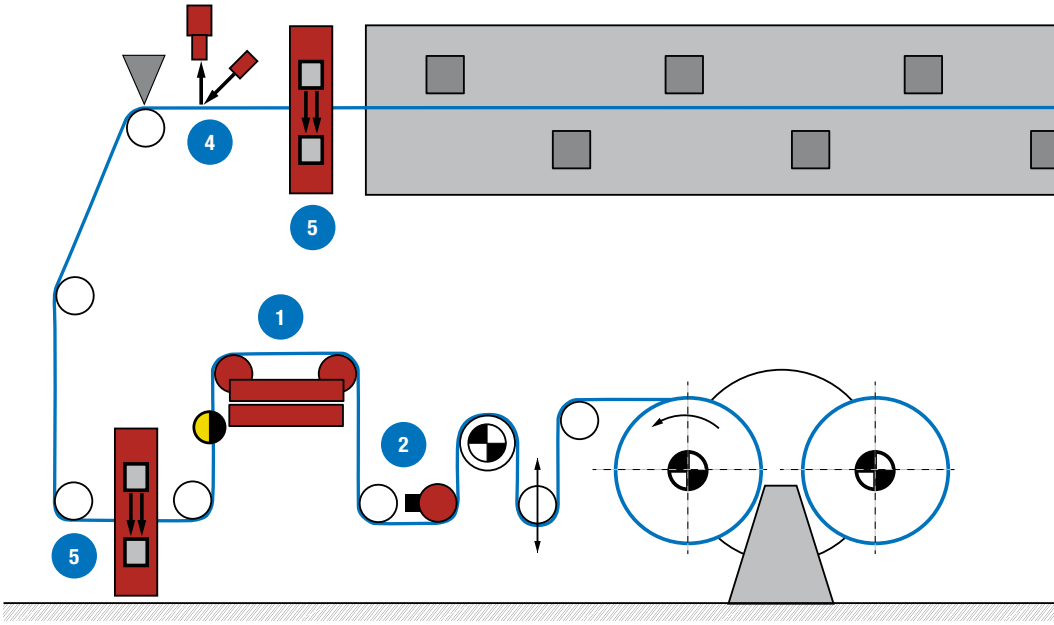
Thickness measurement or basis weight measurement in coating systems?

In single or double-sided coating systems the basis weight plays an important role and not the thickness, as the sketch below attempts to show. The coatings shown at the top and bottom both have the same basis weight due to the same number of elements with the same structures. Due to the varying arrangement, which is affected by the previous mixing, the thickness of the material may differ. The thickness of the material with corresponding basis weight provides the capacity of the battery cell. Because the thickness of material is affected and measured in the press, ensuring the correct basis weight is a priority in the coating system.

Typical technical data	
Operating width	600 – 1400 mm
Line speed	80 – 120 m/min
Web tension	100 – 200 N
Layer thickness, metal foil	4 – 25 µm
Layer thickness, coating	20 – 200 µm

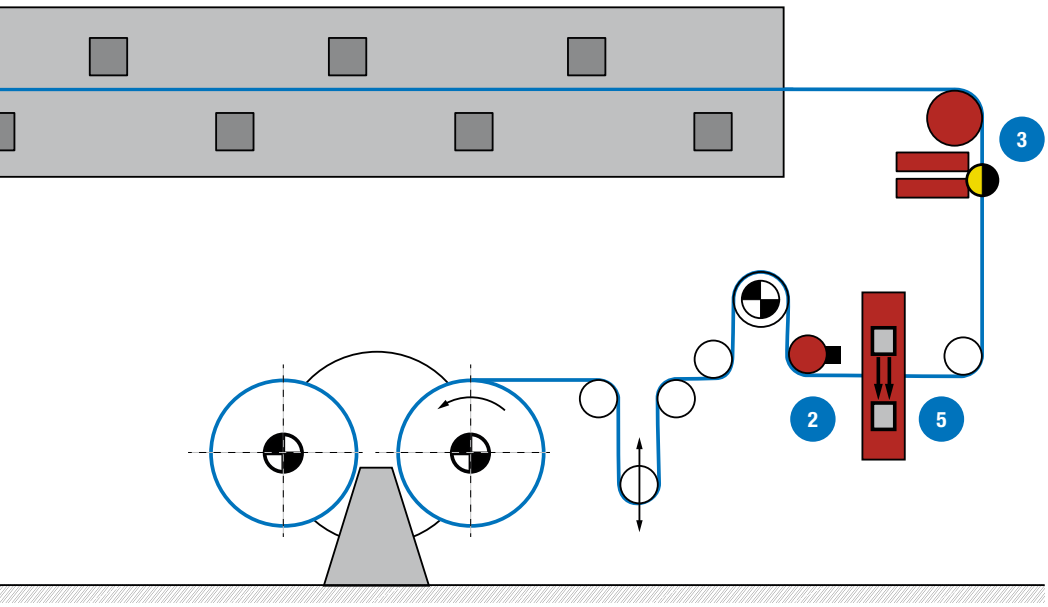
Basis weight and thickness
Same basis weight (total quantity of the same elements), but different height





Coating system with one dryer

Our products			
1	ELGUIDER – DRB33	Precise web guiding with pivoting frame system DRB33 by web center. You will find a detailed description of this product on page 19.	
2	ELTENS – PD 21/PD 50	Flange load cell PD 21/block load cell PD 50 for constant web tension in the coating process. You will find detailed descriptions of these products on pages 27/31.	
3	ELROLLER – SRB43/53	Precise web guiding with steering roller system SRB43/53 by web center. You will find detailed descriptions of these products on page 23.	
4	CCD camera – OL 91	Coating measurement with CCD line scan camera OL 91. You will find a detailed description of this product on page 35.	
5	ELTIM – BWS10	Basis weight measurement with BWS10 based on ultra-sound technology. You will find a detailed description of this product on page 36.	



Coating system with two dryers

Coating systems play an important role during the manufacture of battery cells in the battery industry because it is here that the basis for the quality and the performance of the future battery cells is laid by means of the precise single or double-sided application of the slurries.

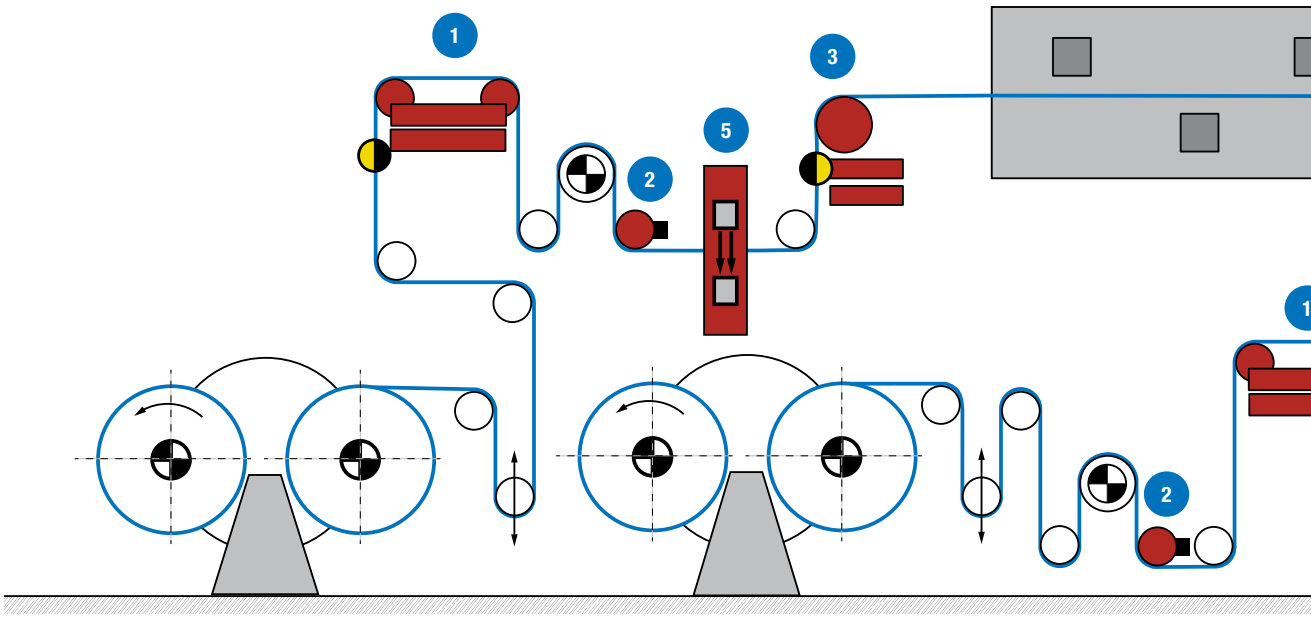
A coating system consists of various sub-systems. After one or two unwinders comes the actual coating system, which ensures an even coating by means of an application unit, as a rule a slot die. The material applied is dried in drying lines with a length derived from the machine speed as well as the coating to be dried. Depending on the requirement, one or two coatings systems are used followed by the corresponding number of dryers.

Due to their design, double-sided coating systems permit a higher material throughput and therefore form an efficient basis for the industrial mass production of electrodes in gigafactories. By means of basis weight measurements, the quantity of coating per unit area is monitored and ensured. Surface inspection systems also monitor the quality of the surface because even the smallest impurity or defect is to be avoided.

The coating system is completed by highly precise web guiding systems with web guiding by web center to guide the material accurately through the process, as well as web tension measuring and control systems for the synchronization of the drives to ensure constant, consistent quality during production.

A single or double winder at the end of the system ensures the material is available for subsequent processes precisely wound up.

Typical technical data	
Operating width	600 – 1400 mm
Line speed	80 – 120 m/min
Web tension	100 – 200 N



Coating system with two dryers

Our products			
1	ELGUIDER – DRB33	Precise web guiding with pivoting frame system DRB33 by web center. You will find a detailed description of this product on page 19.	
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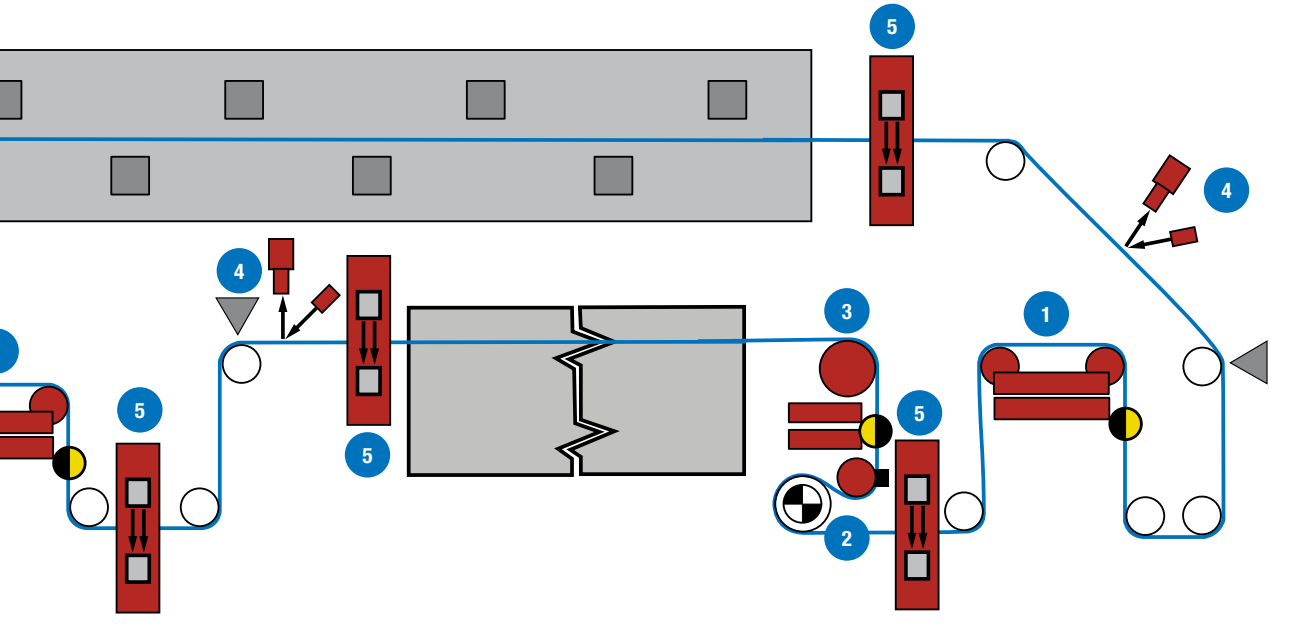
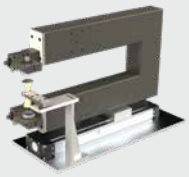


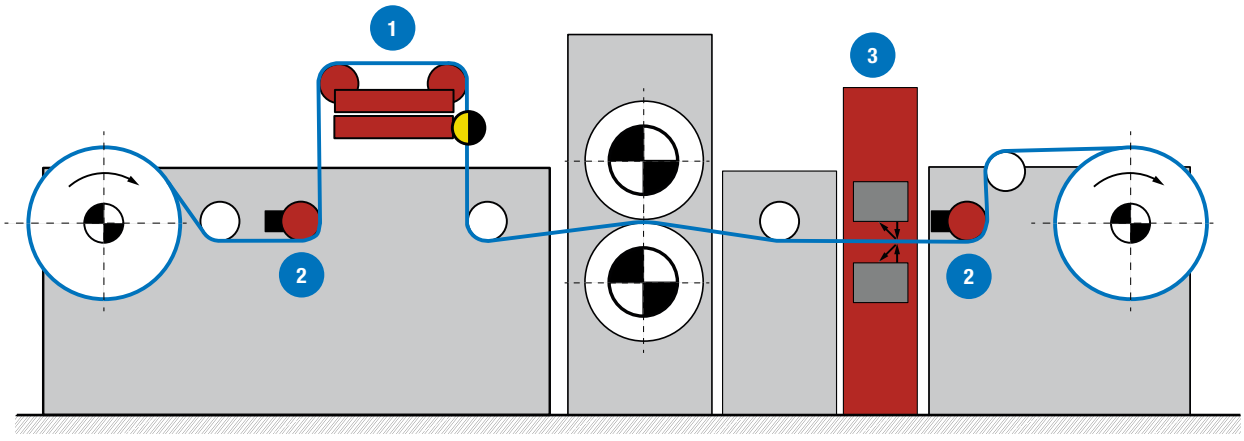
Press/calender
with web guiding system by web edge or web center

The press is used to compact the electrode material, coated accordingly in a previous process, using one or two calender roller pairs. The required porosity of the coated material and therefore the corresponding energy density is achieved by means of the line pressure applied. An excessively high line pressure will destroy the coating due to cracking and is to be avoided as is an excessively low line pressure that will not ensure the necessary material thickness.

Here above all the use of automatic thickness measuring systems is important; due to their special design these systems ensure accuracies in the micrometer range.

Our products			
1	ELGUIDER – DRB33	Precise web guiding with pivoting frame system DRB33 by web center. You will find a detailed description of this product on page 19.	
2	ELTENS – PD 21/PD 50	Flange load cell PD 21/block load cell PD 50 for constant web tension in the coating process. You will find detailed descriptions of these products on pages 27/31.	
3	EL-Thickness C-Frame	Precise thickness measurement over the entire web width. You will find a detailed description of this product on page 38.	

Typical technical data	
Operating width	600 – 900 mm
Line speed	80 – 150 m/min
Line pressure	2,500 N/mm



Press/calender

Slitter rewinder

The slitter rewinder is used to cut the coated and compacted material in the longitudinal direction to suit requirements. During this process the material is unwound, fed to the cutting unit and then wound up again in narrower panels. Erhardt+Leimer web guiders and web tension measuring and control systems ensure the web is exactly positioned and the web tension is correct.

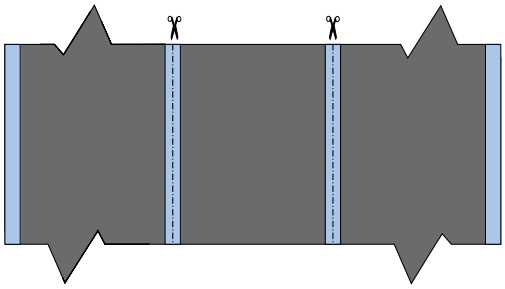
If, due to the design, it is not possible to locate the web guiding as close as possible to the cutting unit and, as a result, the result of the cutting is degraded, a corresponding correction can be determined with the aid of a so-called "final check".

Our products

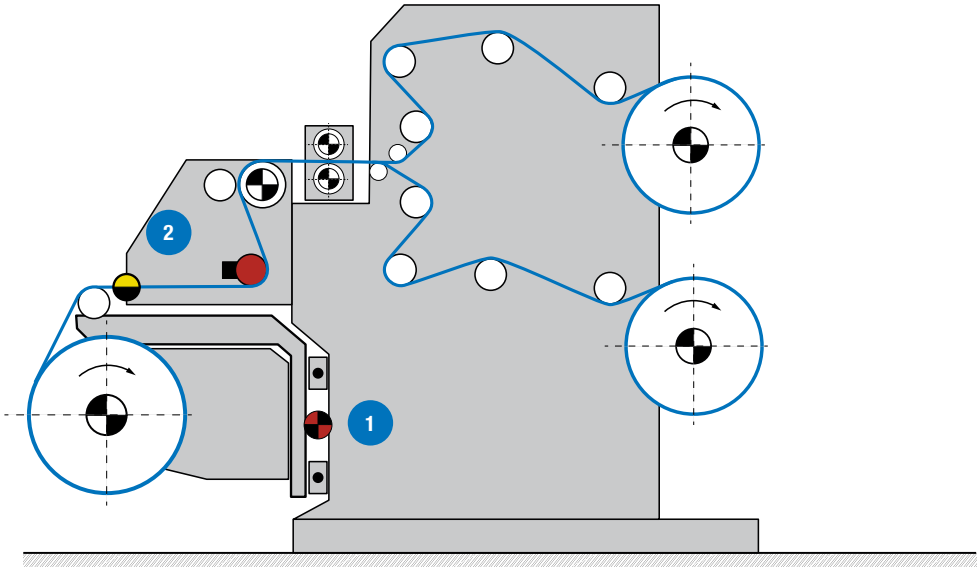
1	Actuating drive – AG9	Precise web guiding with winding station control by web edge or web center. You will find a detailed description of this product on page 25.	
2	ELTENS – PD 21/PD 50	Flange load cell PD 21/block load cell PD 50 for constant web tension in the coating process. You will find detailed descriptions of these products on pages 27/31.	

Typical technical data

Operating width	600 – 900 mm
Cutting width	100 – 300 mm
Line speed	80 – 150 m/min
Web tension	100 – 200 N



Multiple cutting example



Slitter rewinder

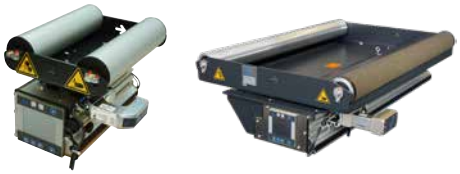
Notching line for prismatic cells and pouch cells

The tabs for the anodes and cathodes are produced on the notching line.

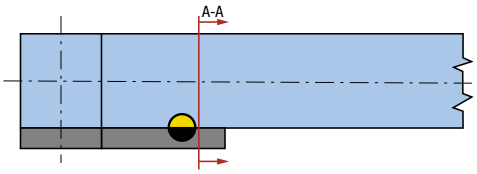
Along with the classic design as a die cutter (punch notching) using which the tabs are produced mechanically using a tool, today laser cutting systems (laser notching) are increasingly used and provide a better result due to the continuous material flow.

Along with the positioning of the webs during unwinding and winding up, pivoting frame web guiders ensure the electrodes are fed precisely to the punching or cutting tools by detecting the contrast edges and ensure a continuous process afterwards by means of accurate positions. The drives are synchronized using web tension measuring and control systems. These systems also make it possible for the machine operator to detect varying web tensions in the edges.

Our products

1	ELGUIDER – DRB14/ DRB25	Precise web guiding with pivoting frame system DRB14 or DRB25 with FE 5 by web center. You will find detailed descriptions of these products on pages 17/18.	
2	ELTENS – PD 21/PD 50	Flange load cell PD 21/block load cell PD 50 for constant web tension in the coating process. You will find detailed descriptions of these products on pages 27/31.	

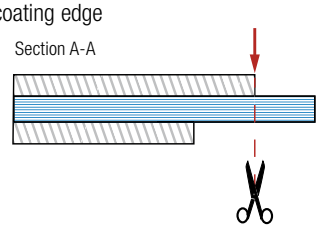
Typical technical data	
Operating width	110 – 650 mm
Line speed	50 – 100 m/min
Web tension	40 – 100 N



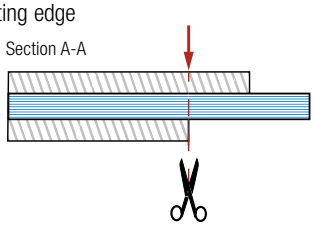
Processing the anode/cathode

Guiding types

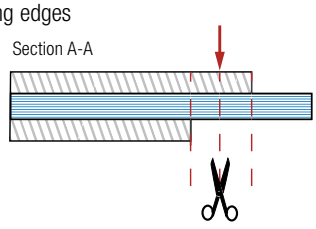
Guiding by the outer coating edge

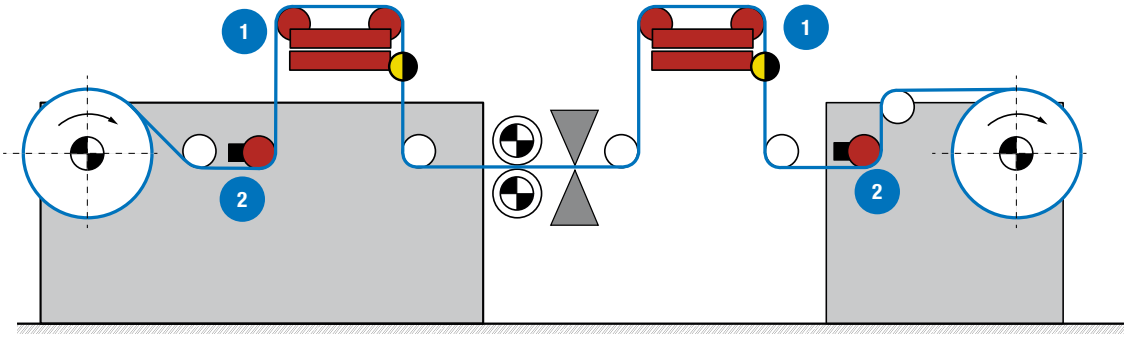


Guiding by the inner coating edge



Guiding by the middle between the two coating edges





Punching machine

Laminating system for prismatic cells and pouch cells

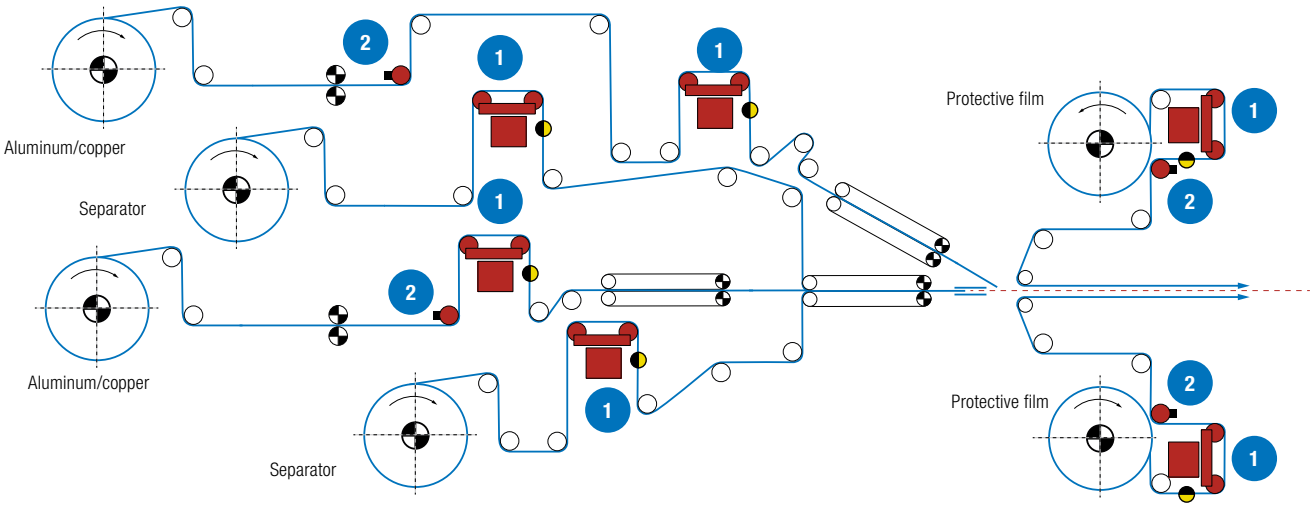
The laminating system is used to combine several layers of material and join them firmly together. The materials involved are the electrodes for anodes (A) and cathodes (C) as well as separators (S); these materials are stacked as A-S-C-S or C-S-A-S composite materials for pouch cells after heating and pressing.

Pivoting frame web guiders use color line sensors to guide the contrast edge of the electrode material highly accurately. Infrared sensors are used to detect the two web edges for guiding the separator films. Web tension measuring and control systems also assist here with the synchronization of the drives.

Alternatively, the individual electrode materials can be combined with a separator film by means of Z-folding and wound to form a prismatic cell. Here as a rule only the separator film is guided by the web edge or web center, while the electrode material is fed mechanically.

Our products			
1	ELGUIDER – DRB14/DRB25	Precise web guiding with pivoting frame system DRB14 or DRB25. Scanning of the electrode materials by contrast with FE 5. Scanning of the separator material by web center. You will find detailed descriptions of these products on pages 17/18.	
2	ELTENS – PD 21/PD 50	Flange load cell PD 21/block load cell PD 50 for constant web tension in the coating process. You will find detailed descriptions of these products on pages 27/31.	

Typical technical data	
Operating width	110 – 260 mm
Line speed	50 – 100 m/min
Web tension	40 – 60 N



Laminating system

Pivoting frame system ELGUIDER

Function

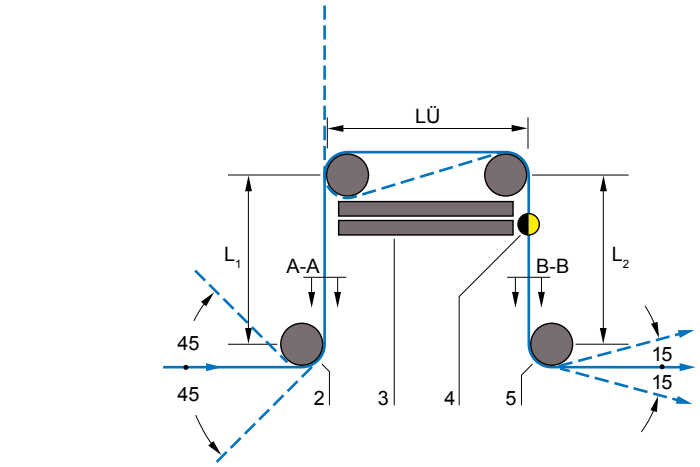
On an ELGUIDER pivoting frame system, the web changes direction four times, each time by 90°. The system is based on a pivoting frame with two path rollers. The imaginary pivot point is located on the infeed plane. Lateral web corrections can only be achieved by pivoting around this pivot point. The prerequisite here is always sufficient tension for traction between the web and the guide roller.

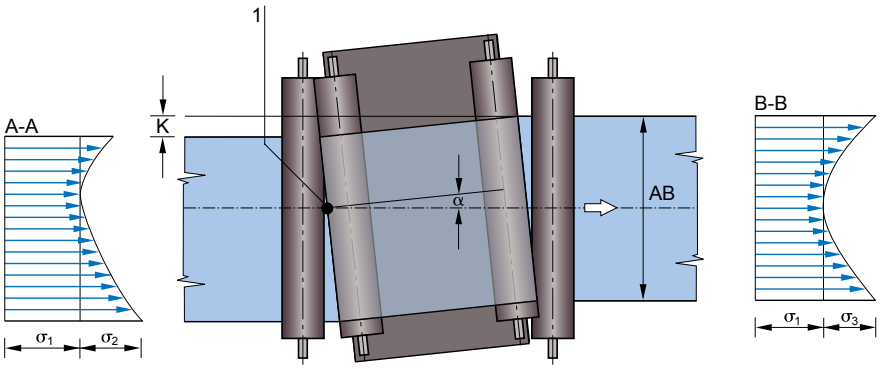
Area of use

Thanks to optimized exploitation of the elasticity ranges, the pivoting frame is particularly suited to use even in really tight spaces.

Application

The greater the web tension, the modulus of elasticity and the required correction, the longer the infeed, exit and transfer paths should be designed. Experience has shown that these paths should be the equivalent of 60 to 100% of the web width. The sensor should be positioned behind the positioning roller, as near to it as possible.





Legend

A-A	Web tension distribution at infeed	1	Pivot point
B-B	Web tension distribution at exit	2	Infeed roller
K	Web correction	3	Roller frame
α	Correction angle max. ±5°	4	Sensor
s1	Web basic tension	5	Locking roller
σ_2	Tension distribution due to pivoting movement of roller frame at the infeed	LÜ	Transfer length
		L_1	Infeed path
σ_3	Tension distribution due to pivoting movement of roller frame at the exit	L_2	Exit path
		AB	Operating width

Selection table, network compatibility

	Pivoting frame systems ELGUIDER	Steering roller systems ELROLLER	Turning bar systems ELTURNER	Winding station systems ELWINDER
Stand-alone systems	DRS07, DRS10, DRS20	-	-	-
Network-enabled systems	DRB14, DRB23, DRB25, DRB33, DRB73	SRB43, SRB53, SRB63	TGB13/23	WSB90, WSB91, WSB93, WSB96

Pivoting frame system DRB14

- Highly-compact pivoting frame system with wear-free, brushless drive technology for the highest control accuracy and control dynamics
- Can be combined with various sensors
  - FR 46 infrared edge sensor
  - FR 61 infrared wide band sensor
  - FX 46 ultrasonic edge sensor
  - FE 5 color line sensor
- Can be connected to EL.NET control systems via Ethernet in star or line topology
- Optionally with integrated Ethernet/IP, Ethernet UDP or Profinet fieldbus interface
- Simple service and diagnostics option using web-based management with a standard web browser
- Intuitive operation due to graphical touch operating panel
- Optionally with additional command station DO 42
- Optionally with clamping and cutting table

ELGUIDER DRB14 with ultrasonic edge sensor FX 46

Technical data

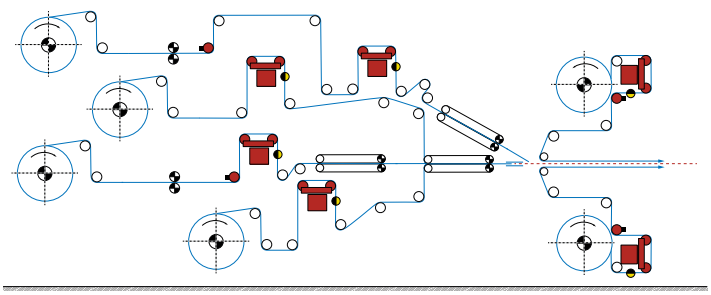
Positional accuracy FR 46/FX 46/FE 5 Positional accuracy FR 61	< ±0.1 mm (material-dependent) < ±0.2 mm (material-dependent)
Error frequency	Max. 8 Hz
Nominal actuating travel TL 180 mm/200 mm Nominal actuating travel TL 250 mm/300 mm	Max. ±19 mm/max. ±21 mm Max. ±14.5 mm/max. ±18 mm
Nominal actuating speed at outfeed roller	Max. 150 mm/s
Web tension	Max. 300 N
Roller diameter D	40/60/80 mm
Ambient temperature	+10 °C to +50 °C
Relative humidity	15 to 95% (non-condensing)
Operating voltage, nominal value Nominal range Nominal range with power supply	24 V DC 20 to 30 V DC (ripple included) 100 to 240 V, 50/60 Hz
Current consumption	Max. 4.5 A DC
Interface	Ethernet EL.NET protocol
Fieldbus interface, optional	Ethernet UDP Ethernet/IP Profinet
Digital I/O interface	5 digital inputs, configurable 1 output, configurable
Certifications	Declaration of incorporation according to Machinery Directive 2006/42/EC NRTL certificate CU 72180310 01
Protection rating	IP 54

Selection table

LÜ (mm)								
300		■	■	■	■	■	■	
250		■	■	■	■			
200	■	■	■	■	■			
180	■	■	■	■				
	160	200	250	300	350	400	450	NB (mm)

LÜ = Transfer length NB = Nominal width

Pivoting frame system DRB14 in laminating system



Pivoting frame system DRB14 in laminating system

Pivoting frame system DRB25

- Highly-compact pivoting frame system with wear-free, brushless drive technology for the highest control accuracy and control dynamics
- Can be combined with various sensors
  - FR 5 infrared edge sensor
  - FR 61 infrared wide band sensor
  - FX 4/5 ultrasonic edge sensor
  - FE 5 color line sensor
- Can be connected to EL.NET control systems via Ethernet in star or line topology
- Optionally with integrated Ethernet/IP, Ethernet UDP or Profinet fieldbus interface
- Simple service and diagnostics option using web-based management with a standard web browser
- Intuitive operation due to graphical touch operating panel
- Optionally with additional command station DO 42
- Optionally with clamping and cutting table

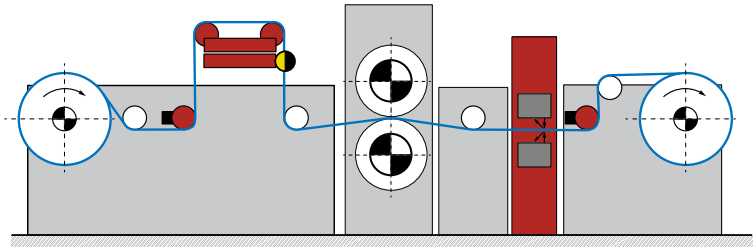
ELGUIDER DRB25 with ultrasonic edge sensor FX 4

Selection table

LÜ (mm)	NB (mm)								
	400	500	600	700	800	900	1000	1100	
600	■	■	■	■	■	■	■	■	
500	■	■	■	■	■	■	■	■	
400	■	■	■	■	■	■	■	■	

LÜ = Transfer length, NB = Nominal width

Technical data	
Positional accuracy FR 5, FX 4, FX 5, FE 5 FR 61	< ±0.1 mm (material-dependent) < ±0.2 mm (material-dependent)
Error frequency	Max. 8 Hz
Nominal actuating travel	Max. ±25 mm
Nominal actuating speed at outfeed roller	Max. 80 mm/s
Web tension	Max. 700 N
Roller diameter	80/100 mm
Ambient temperature	+10 °C to +50 °C
Relative humidity	15 to 95% (non-condensing)
Operating voltage, nominal value Nominal range Nominal range with power supply	24 V DC 20 to 30 V DC (ripple included) 100 to 240 V, 50/60 Hz
Current consumption	Max. 5.5 A DC
Interface	Ethernet EL.NET protocol
Fieldbus interface, optional	Ethernet UDP Ethernet/IP Profinet
Digital I/O interface	5 digital inputs, configurable 1 output, configurable
Certifications	Declaration of incorporation according to Machinery Directive 2006/42/EC NRTL certificate CU 72180310 01
Protection rating	IP 54



Pivoting frame system DRB25 in press

Pivoting frame system DRB33

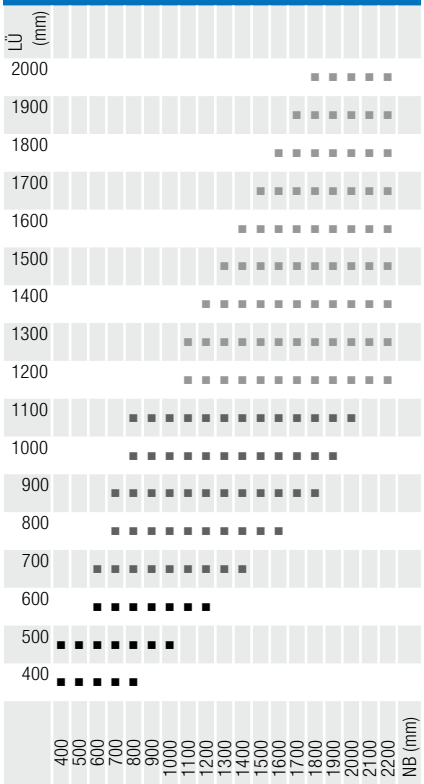
- Pivoting frame system in frame design with wear-free, brushless drive technology for the highest control accuracy and control dynamics in the plastics and packaging industries
- Can be combined with various sensors
  - FR 5 infrared edge sensor
  - FR 61 infrared wide band sensor
  - FX 4/5 ultrasonic edge sensor
  - FE 5 color line sensor
- Optionally with motorized sensor positioning VS 80 for frequent format change
- Can be connected to EL.NET control systems via Ethernet in star or line topology
- Optionally with integrated Ethernet/IP, Ethernet UDP or Profinet fieldbus interface
- Simple service and diagnostics option using web-based management with a standard web browser

ELGUIDER DRB33
with infrared wide band sensor FR 61

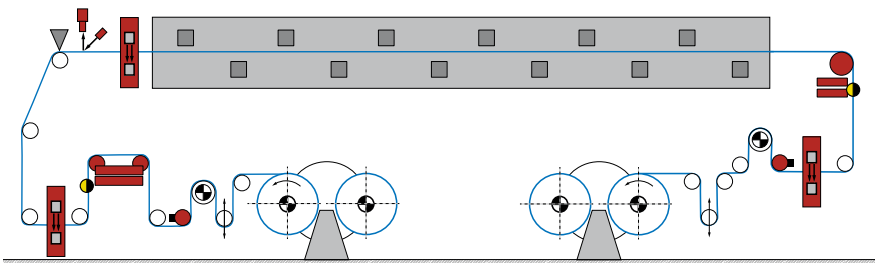
Technical data

Positional accuracy FR 5, FX 4, FX 5, FE 5 FR 61	 < ±0.1 mm (material-dependent) < ±0.2 mm (material-dependent)
Error frequency	Max. 4 Hz
Nominal actuating travel LÜ 400 to 700 mm (DR 3311) LÜ 800 to 1100 mm (DR 3321) LÜ 1200 to 2000 mm (DR 3331) LÜ 2100 to 2500 mm (DR 3341)	 Max. ±20 mm Max. ±30 mm Max. ±55 mm Max. ±80 mm
Nominal actuating speed at outfeed roller	Max. 30 mm/s (AG 90, F=800 N)
Web tension	Max. 700 N
Roller diameter	80/100/120/160 mm
Ambient temperature	+10 °C to +50 °C
Relative humidity	15 to 95% (non-condensing)
Operating voltage, nominal value Nominal range Nominal range with power supply	24 V DC 20 to 30 V DC (ripple included) 100 to 240 V, 50/60 Hz
Current consumption	Max. 2.5 A DC (AG 90, manual sensor positioning) Max. 3.7 A DC (AG 90, motorized sensor positioning) Max. 5.5 A DC (AG 91, manual sensor positioning) Max. 6.8 A DC (AG 91, motorized sensor positioning)
Interface	Ethernet EL.NET protocol
Fieldbus interface, optional	EtherNet/IP™ (ODVA-compliant), UDP/IP, PROFINET
Certifications	Declaration of incorporation according to Machinery Directive 2006/42/EC, NRTL certificate CU 72180310 01
Protection rating	IP 54

Selection table



NB = Nominal width
LÜ = Transfer length
■ = LÜ 400 to 600
■ = LÜ 700 to 1100
■ = LÜ 1200 to 2000



Pivoting frame system DRB33 in coating system

High-precision pivoting frame

The new generation of our high-precision compact pivoting frames

The new pivoting frames DRB1499 and DRB2399 with their brushless drive technology were developed especially for high-precision web guiding for Flex PCBs (Flexible Printed Circuit Boards) and battery manufacturing.

With this technology, a positional accuracy of +/- 0.05 mm can be achieved. Due to its compact design the pivoting frame can be integrated into existing machines without problems.

Sensors

Metal foil edges, paper edges or transparent film edges are detected by means of ultrasonic or infrared edge sensors. Printed webs with lines or color contrasts can be detected precisely and reliably using a color line sensor.

Controller

The digital controller with position and rotation speed control circuit is integrated into the compact pivoting frame in a space-saving manner. A wear-free BLDC actuating drive guarantees a highly dynamic performance with at the same time high actuating forces. The absolute position detection ensures a precise motor position in any operation state.

Networking

E+L web guiding systems can be networked via Ethernet in a star or line topology. In this way, multiple and parallel operation via the integrated or external control unit can be easily implemented.

Customer interface

Optionally, the E+L web guiding system has an EtherNet/IP, Ethernet UDP or PROFINET fieldbus interface. Alternatively, it can be easily connected to customer systems via I/O for the most important operating functions.

Web-based management

The integrated web server makes it possible to perform commissioning, basic service work and diagnostics via a standard web browser in a customer-friendly way.

Operation

The user interface forms the interface between man and machine. The control unit with its graphical user interface makes the operation of a web guider convenient and intuitive. The integrated diagnostics functions provide direct information on the state of the system.

High-precision pivoting frame

Highest quality for battery production

- Highly precise with a positional accuracy of +/- 50 µm if standard sensors are used. Higher customer-specific accuracies are possible
- Highly dynamic
- Ethernet-compatible and completely networkable by means of EL.NET technology
- Wear-free brushless drive technology
- Simplest operation
- Ready for commissioning
- Web-based management via any standard browser

ELGUIDER DRB23
high-precision pivoting frame

Technical data		
	DRB14	**DRB23**
Positional accuracy* FR 46/FX 46/FE 5	±0.05 mm (material-dependent)	
Error frequency	Max. 0.5 Hz	
Nominal actuating travel	Max. ±3 mm	
Nominal actuating speed	20 mm/s	
Web tension	Max. 300 N	Max. 700 N
Roller diameter D	40/60/80 mm	60/80 mm
Ambient temperature**	+10 °C to +50 °C	
Relative humidity**	15 to 95% (non-condensing)	
Operating voltage Nominal value Nominal range	 24 V DC 20 to 30 V DC	
Current consumption	Max. 4.5 A DC	
Measuring range Infrared sensor FR 46 Ultrasound sensor FX 46 Line sensor FE 52	 ±2.5 mm ±3 mm ±10 mm	 ±2.5 mm ±3 mm ±10 mm
Fieldbus interface, optional	Ethernet UDP / Ethernet/IP / Profinet	
Digital I/O interface	5 digital inputs, configurable 1 output, configurable	
Certifications	Declaration of incorporation according to Machinery Directive 2006/42/EC NRTL certificate CU 72180310 01	
Protection rating	IP 54	

* Higher accuracies are possible. Please contact our sales department if required.
** With stable conditions during commissioning and operation

Steering roller system ELROLLER

Function

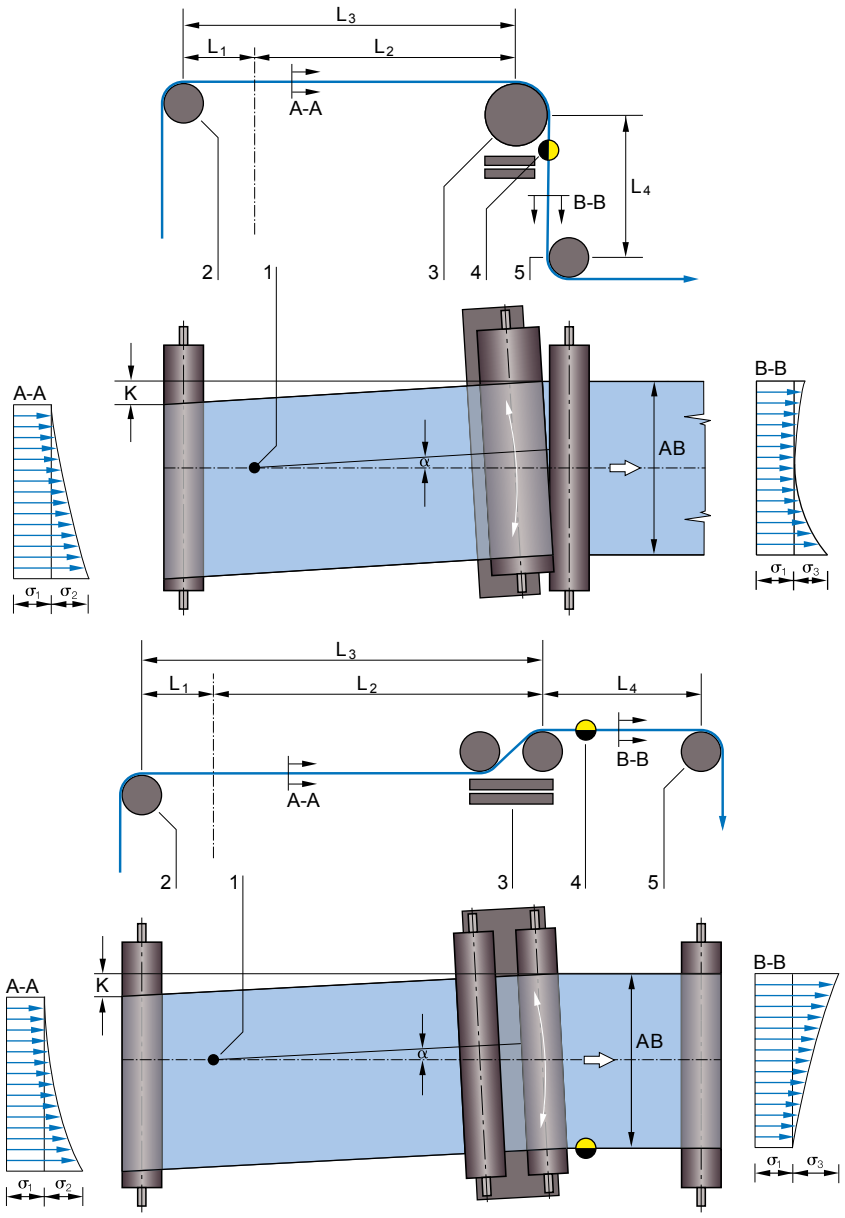
ELROLLER steering roller systems already correct the web position on the infeed plane. They consist of a fixed base frame and a movable guide frame. The latter accommodates one or two positioning rollers and swivels around an imaginary pivot point on the infeed plane. The pivot point should, on the one hand, be far enough away from the infeed roller to ensure that the web correction does not influence the infeed roller. On the other hand, it must be far enough away from the guide roller to ensure that the elasticity of the web may be fully exploited but not over-strained. A steering roller is termed a proportional actuator. It must therefore operate in a friction-locked manner and must not permit any sliding between the web and the guide roller.

Area of use

ELROLLER systems are always used where there is a long entry path due to technical process reasons.

Application

Depending on the space available, steering rollers may be fitted with one or two guide rollers. On versions with one roller, the web is guided with a wrap angle of 90°. On versions with two guide rollers less wrapping is possible. In this case, the web runs at almost the same level as the outfeed roller. The following applies when mounting an ELROLLER: the infeed path should be the equivalent of two to three times the web width, the exit path should be between 50 and 100% of the web width. The sensor should be positioned behind the positioning roller, as near to it as possible. As a result, improved control dynamics are achieved thanks to the resulting short response time.



Legend

A-A	Web tension distribution at infeed
B-B	Web tension distribution at exit
K	Web correction
α	Correction angle
σ_1	Web basic tension
σ_2	Tension distribution due to pivoting movement of roller frame at the infeed
σ_3	Tension distribution due to pivoting movement of roller frame at the exit
1	Pivot point
2	Infeed roller
3	Positioning roller(s)
4	Sensor
5	Locking roller
L_1	Infeed path to the pivot point
L_2	Infeed path to the steering roller
L_3	Infeed path
L_4	Exit path

Steering roller system SRB43/53

- Compact steering roller system with one or two rollers for different wrap angles and wear-free, brushless drive technology for highest control accuracy and control dynamics in the converting industry
- Can be combined with FR 5 infrared or FX 4/5 ultrasonic edge sensor for the reliable detection of metal foils
- Optionally with motorized sensor positioning VS 80 for fast format changes
- Integrated digital controller with position, speed and current controller for highest quality of control
- Can be connected to EL.NET control systems via Ethernet in star or line topology
- Optionally with integrated Ethernet/IP, Ethernet UDP or Profinet fieldbus interface
- Simple service and diagnostics option using web-based management with a standard web browser

ELROLLER SRB43
with ultrasonic edge sensor FX 4

ELGUIDER SRB53
with ultrasonic edge sensor FX 5

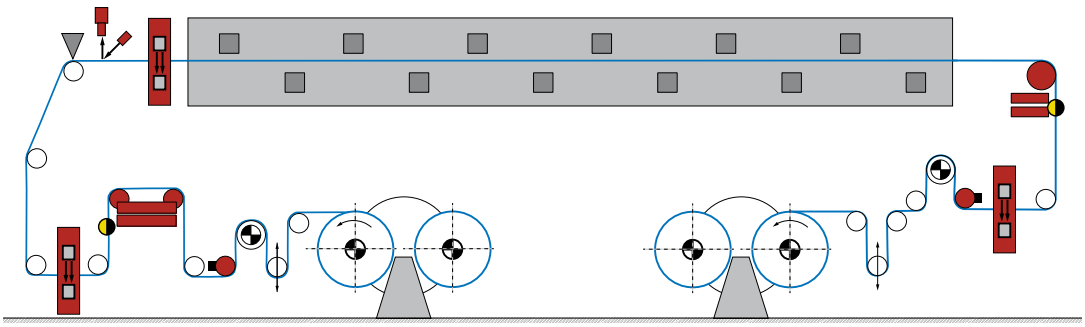
Technical data

	SRB43	SRB53
Positional accuracy	< ±0.15 mm (material-dependent)	
Error frequency	Max. 2 Hz	
Nominal width	400 to 2400 mm	1100 to 4000 mm
Nominal actuating travel (mm)	NB 400 -800 ±30 NB 900 - 1500 ±55 NB 1100 - 2400 ±75	NB 1100 - 2000 ±75 NB 1500 - 3000 ±100 NB 2500 - 4000 ±175
Nominal actuating speed at outfeed roller	Max. 30 mm/s (AG 90 with F=800 N)	Max. 30 mm/s (AG 93 with F=3000 N)
Web tension	Max. 700 N	Max. 2000 N
Roller diameter (mm)	SR 4311 80/100/120/160 SR 4321/SR 4331 100/120/160/200	NB 1100 - 2000 100/120/160/200 NB 1500 - 3000 100/120/160/200 NB 2500 - 4000 160/200
Ambient temperature	+10 °C to +50 °C	
Storage temperature	-20 °C to +80 °C	
Relative humidity	15 to 95% (non-condensing)	
Operating voltage Nominal value Nominal range Nominal range with power supply	24 V DC 20 to 30 V DC (ripple included) 100 to 240 V, 50/60 Hz	
Current consumption	Max. 2.5 A DC (manual sensor positioning) Max. 3.7 A DC (motorized sensor positioning)	Max. 8.2 A DC (manual sensor positioning) Max. 9.5 A DC (motorized sensor positioning)
Fieldbus interface, optional	Ethernet UDP; Ethernet/IP; Profinet	
Certifications	Declaration of incorporation according to Machinery Directive 2006/42/EC NRTL certificate CU	
Protection rating	IP 54	

Selection table

SRB43		
Type	NB min. (mm)	NW max. (mm)
SR 4311	400	800
SR 4321	900	1500
SR 4331	1100	2400

SRB53		
Type	NB min. (mm)	NW max. (mm)
SR 5311	1100	2000
SR 5321	1500	3000
SR 5331	2500	4000



Steering roller system SRB43/53 in coating system

Winding station control ELWINDER

Function

In production processes with moving webs, there is typically an unwinder at the machine infeed and a rewinder at the exit. During unwinding, the winding station is moved via a linear drive to feed the web in the desired position. On the other hand, during rewinding, the winding station follows the constantly changing web position via a linear drive to achieve an evenly wound reel.

Area of use

Web guiders with ELWINDER winding stations are used wherever it is not possible to use ELGUIDER or ELROLLER systems due to lack of space.

Application, unwinding

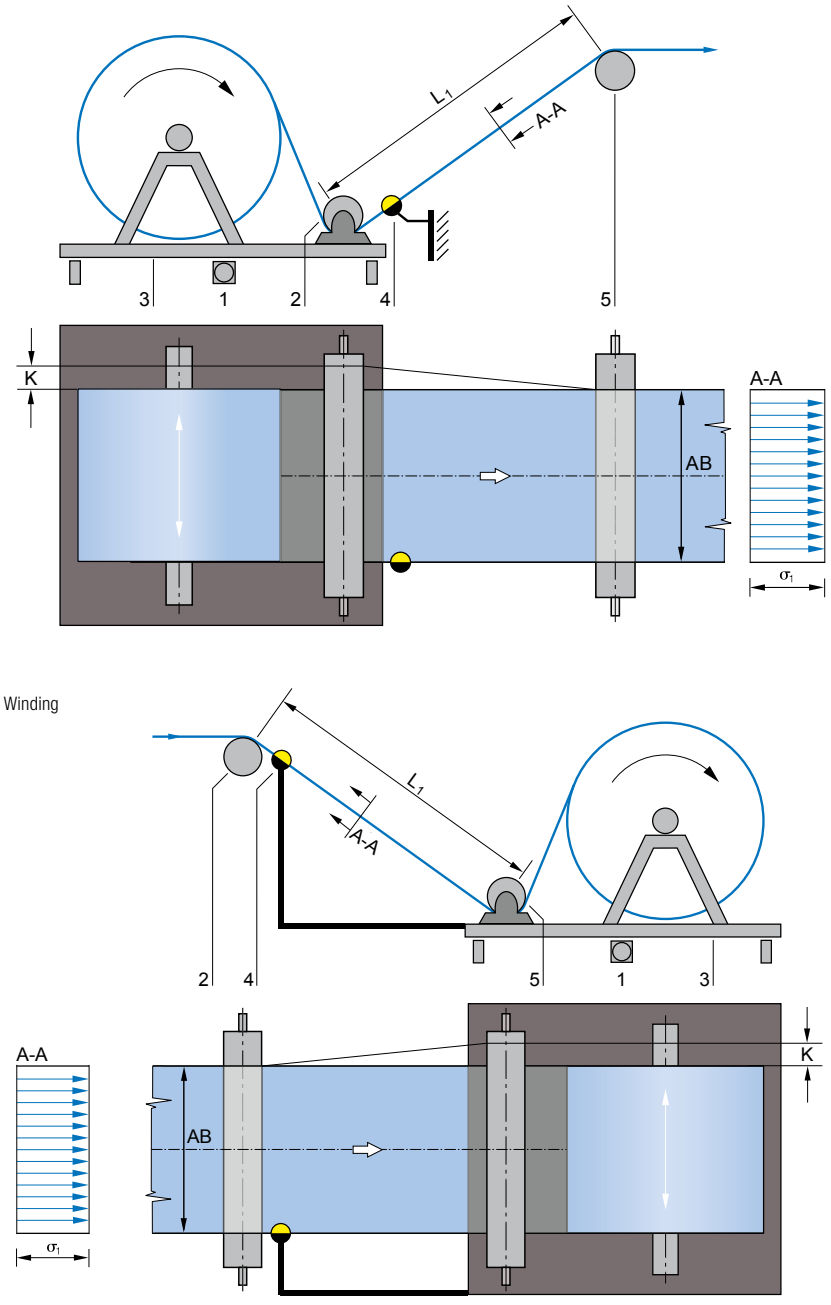
During unwinding, the sensor is mounted on the machine to define the target web position. Here, the position detection system should be located as close to the final winding station guide roller as possible.

Application, unwinding with synchronous roller

If, for space reasons, it is not possible to fit a guide roller to the winding station, it can be designed as a synchronous electrically coupled roller.

Application, rewinding

During rewinding, the sensor is fastened to the winding station to set the target position of the winding station for the controller. Here, the position detection system should be located as close to the final machine guide roller as possible. The guiding path L1 depends on the elasticity of the web. The larger the transverse elasticity range, the shorter the path L1 can be. Experience has shown that the guiding path should be the equivalent of half a web width.



Legend

A-A Web tension distribution on the guiding path
K Web correction
σ_1 Web basic tension
AB Operating width

1 Linear drive
2 Infeed rollers
3 Winding station
4 Sensor
5 Locking roller
L_1 Guiding path

Winding station system WSB91/WSB93

- Control components for winding stations with wear-free, brushless drive technology for highest control accuracy and control dynamics
- Can be combined with various sensors
  - FR 5 infrared edge sensor
  - FX 4/5 ultrasonic edge sensor
  - FE 5 color line sensor
- Optionally with motorized sensor positioning VS 80 for fast format changes
- Integrated digital controller with position, speed and current controller for highest quality of control
- Can be connected to EL.NET control systems via Ethernet in star or line topology
- Optionally with integrated Ethernet/IP, Ethernet UDP or Profinet fieldbus interface
- Simple service and diagnostics option using web-based management with a standard web browser
- Optionally with functional safety in accordance with EN IEC 61508 with SIL3 and EN ISO 13849-1 in Performance Level d, category 3

Color line sensor FE 5 with DO 4021

DN 40 data network center

Actuating drive AG 93

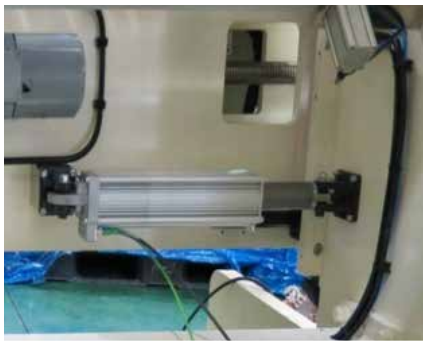
DO 42 command station

Technical data

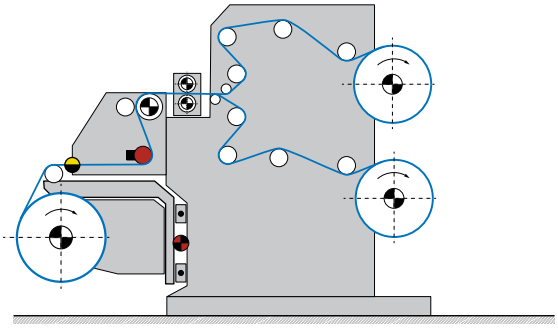
Positional accuracy	< ±0.2 mm (material-dependent)
Error frequency	Max. 2 Hz
Nominal actuating travel	See table
Nominal actuating speed	Max. 30 mm/s (AG 93), max. 60 mm/s (AG 91)
Nominal actuating force	1000 N (AG 91), 3000 N (AG 93)
Ambient temperature	+10 °C to +50 °C (AG91/93 +10 °C to +60 °C)
Storage temperature	-20 °C to +80 °C
Relative humidity	15 to 95% (non-condensing)
Operating voltage Nominal value Nominal range Nominal range with power supply	 24 V DC 20 to 30 V DC (ripple included) 100 to 240 V, 50/60 Hz
Current consumption	Max. 6.2 A DC (AG 91 with manual sensor positioning) Max. 8.3 A DC (AG 93 with manual sensor positioning) Max. 7.4 A DC (AG 91 with motorized sensor positioning) Max. 9.5 A DC (AG 93 with motorized sensor positioning)
Fieldbus interface, optional	Ethernet UDP; Ethernet/IP; Profinet
Certifications	Declaration of incorporation according to Machinery Directive 2006/42/EC NRTL certificate CU 72170613 04 (AG 91/93) NRTL certificate CU 72210743 02 (DN 40)
Protection rating	IP 54

Selection table

Actuating drive AG 9		
Type	Nominal actuating travel (mm)	Nominal actuating force (N)
AG 9103	±25	1000
AG 9113	±50	1000
AG 9123	±75	1000
AG 9133	±100	1000
AG 9313	±50	3000
AG 9333	±100	3000
AG 9343	±150	3000
AG 9353	±200	3000



Actuating drive AG 9 on winding station



Winding station system WSB91 on slitter rewinder

Web tension measuring and control system ELTENS

Function

The load cell comprises a stable outer ring with flange cover and centering collar for precision assembly. The inner ring in the form of a double bending beam ensures centered mounting of the ball bearing. The radial forces created by the web unbalance the strain gauges linked together to form a measuring bridge on the inner ring. This leads to an analog output signal proportional to the web tension.

Area of use

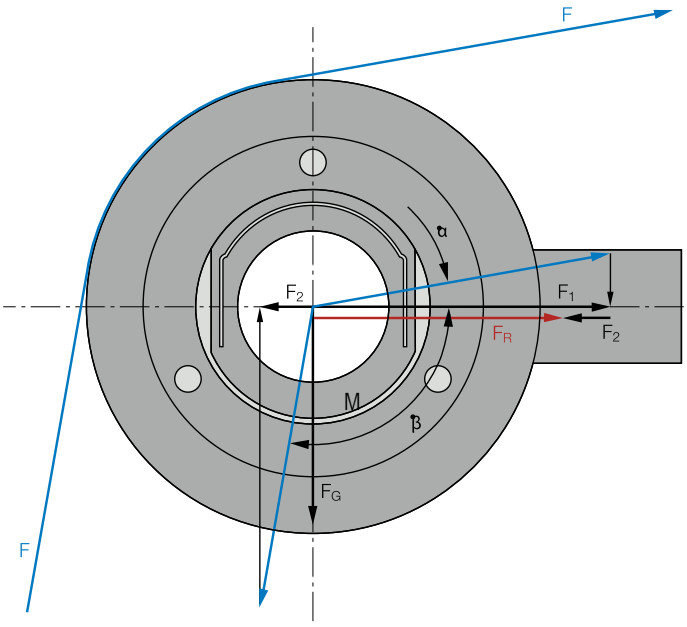
Flange load cells are used in practically all processing plants where web-type materials are processed or finished. In front of processing stations, in particular, it is of fundamental importance that the web is transported with a continuous web tension.

Application

With a 90° horizontal-vertical wrapping angle on the measuring roller and a horizontal measuring direction, optimum web tension detection is assured. Only detection of the bearing forces on both sides can prevent incorrect measurements caused by the web moving sideways and asymmetrical web tension distribution. Load cells incorporated into a control loop should be mounted as near to the actuator as possible.

Calibration

The tensile force–path characteristic curve forms a straight line to the mechanical stop. All the load cells with the exception of the PD 25 series are calibrated to the nominal measuring force. Between the nominal measuring force and mechanical stop, a safety factor of 50 to 100% is taken into account to compensate for asymmetrical web tension distribution.



Legend

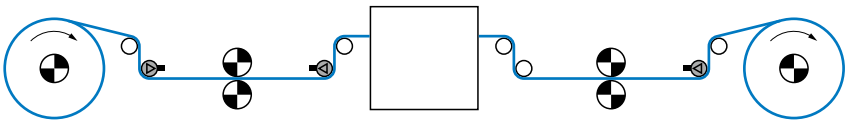
F	Web tension (N)
F_1	Force component 1 measuring direction (N)
F_2	Force component 2 measuring direction (N)
F_G	Weight force (N)
F_R	Resulting force in measuring direction (N)
$F_{R/K}$	Resulting force/load cell (N)
α	Angle between outgoing web and measuring direction
β	Angle between incoming web and measuring direction
M	Measuring direction

Calculation, flange load cells

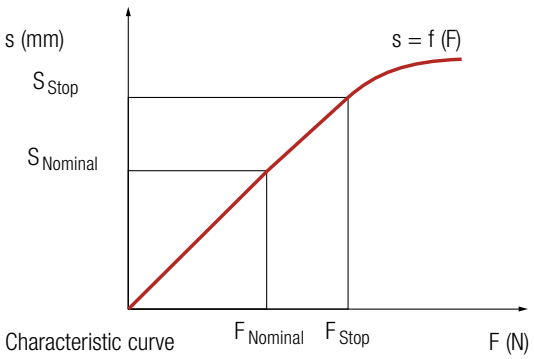
$F_1 = F \cdot \cos \alpha$
$F_2 = F \cdot \cos \beta$
$F_{R/K} = (F_1 + F_2)/2$

Calculation, sensor rollers

$F_1 = F \cdot \cos \alpha$
$F_2 = F \cdot \cos \beta$
$F_R = (F_1 + F_2)$



Transport drive Process Main drive



Characteristic curve

Flange load cell PD 21/22

- Various mounting options such as flange bearings, pedestal bearings, or inner/outer fastening enable position-independent installation
- Highly reliable in operation thanks to overload protection up to 20 times the nominal measuring force
- Different shaft diameters from 12 to 65 mm and nominal measuring forces from 0.05 to 10 kN ensure a high degree of flexibility
- For measurements in a horizontal direction, the weight of the roller does not affect the measured result
- Good temperature behavior and a high degree of linearity of the measuring elements thanks to application of the strain gauge on a flat surface
- High permissible operating speed of the measuring roller due to high web load cell spring constant
- Best surface protection due to chemical nickel plating

Flange load cell PD 21

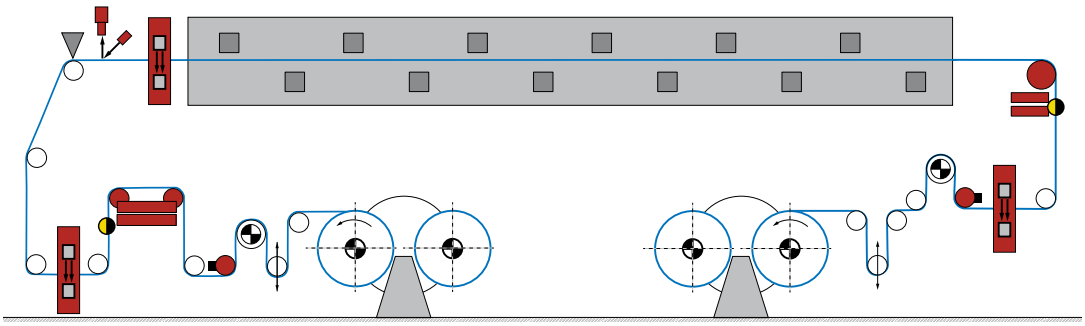
Selection table

Type, bore on one side	Type, bore on both sides	D3 (mm)	Nominal measuring force (kN)				
PD 2112	PD 2212	12	0.05	0.1	0.2	0.5	1
PD 2115	PD 2215	15	0.05	0.1	0.2	0.5	1
PD 2117	PD 2217	17	0.05	0.1*	0.2	0.5*	1
PD 2120	PD 2220	20		0.15	0.3	0.75	1.5
PD 2125	PD 2225	25		0.15*	0.3	0.75*	1.5
PD 2130	PD 2230	30		0.3	0.6	1.5	3
PD 2135	PD 2235	35		0.3*	0.6	1.5*	3
PD 2140	PD 2240	40		0.6	1.2	3	6
PD 2145	PD 2245	45		0.6	1.2	3	6
PD 2150	PD 2250	50		0.6*	1.2	3*	6
PD 2155	PD 2255	55		1	2	5	10
PD 2160	PD 2260	60		1	2	5	10
PD 2165	PD 2265	65		1	2	5	10

*Preferred sizes

Technical data

Accuracy class	0.5
Nominal characteristic value (sensitivity)	1 mV/V
Combined error	< 0.5%
Characteristic value tolerance	0.2%
Measuring principle	Full bridge strain gauge
Nom. resistance of strain gauge bridge	700 Ohm
Bridge supply voltage	10 V (nominal value) 14 V (max. permissible value)
Mechanical stop	1.8 to 2.4 x F_N depending on type
Operating load	1.8 to 2.4 x F_N
Limit load	20 x F_N
Nominal measuring deflection	0.1 to 0.2 mm depending on type
Nominal temperature range	-10 to +60 °C
Operating temperature range	-10 to +90 °C
Temperature coefficient	±0.3%/10 K (characteristic value) ±0.3%/10 K (zero)
Protection rating	IP 50
Max. permissible axial lateral force	1 x F_N
Weight	2.3 kg (D3 = 17 mm), 3.6 kg (D3 = 25 mm), 8.5 kg (D3 = 35 mm)



Flange load cell PD 21 on laminating line

Web tension measuring and control system ELTENS

Function

The flange load cell for cantilever machines consists of an outer and inner ring for one-ended mounting on the machine wall. The inner ring is designed as a double bending beam for force acquisition. A single-ended low bearing friction roller with inner bearings can be mounted on the front. The position of the web or an asymmetric web tension distribution has no effect on the measured result.

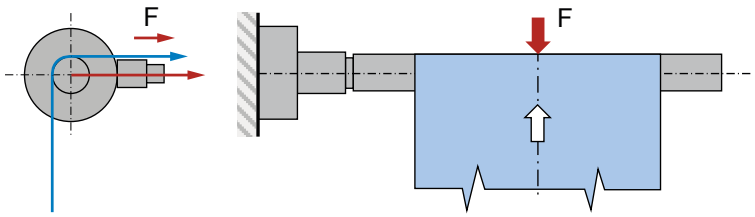
Area of use

Flange load cell for mounting low bearing friction rollers with bearings on one end are used especially in the hygiene and battery industry. In front of processing stations, in particular, it is of fundamental importance that the web is transported with a continuous web tension.

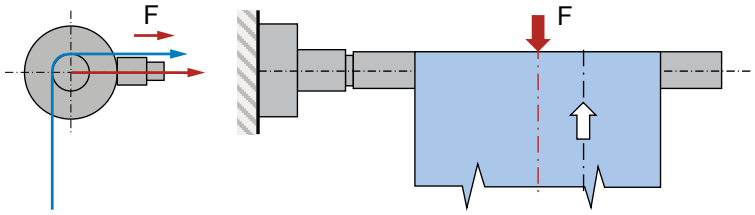
Application

With a 90° horizontal-vertical wrapping angle on the measuring roller and a horizontal measuring direction, optimum web tension detection is assured. Load cells incorporated into a control loop should be mounted as near to the actuator as possible.

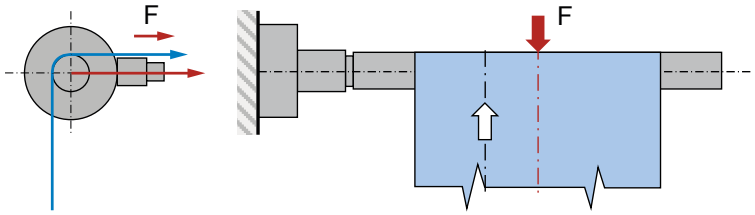
Flange load cell with web centered in relation to the center of the machine

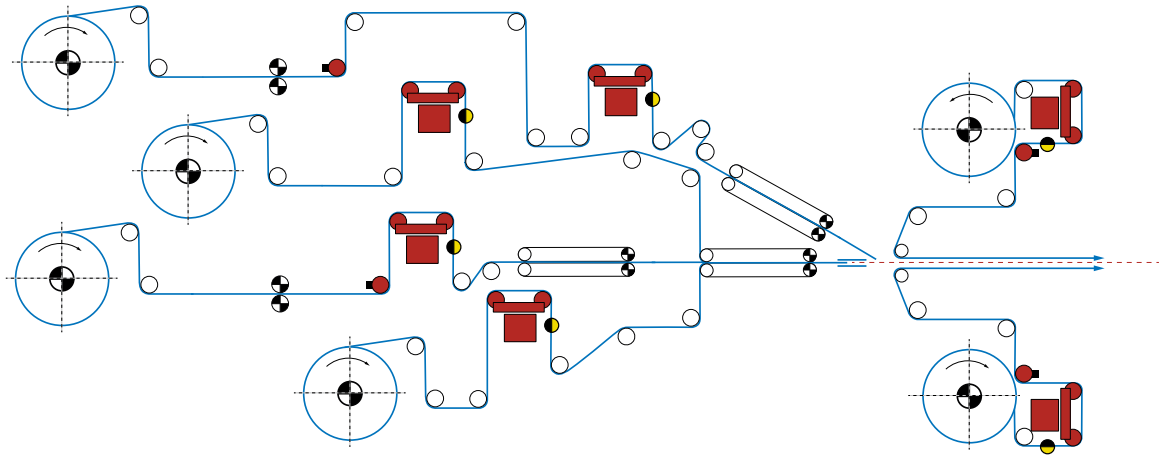


Flange load cell with web displaced to the left (referred to the center of the machine)



Flange load cell with web displaced to the right (referred to the center of the machine)





Flange load cell PD 27 on laminating system

Flange load cell PD 27

- Flange load cell with a nominal measuring force of 60 N for mounting on rollers with bearings on one end
- Precise web tension measurement independent of the force applied to the roller
- Highly reliable in operation thanks to overload protection up to 10 times the nominal measuring force
- For measurements in a horizontal direction, the weight of the roller does not affect the measured result
- Nominal characteristic value calibrated in the factory to 1 mV/V

Flange load cell PD 2718

Technical data	
Nominal measuring force	60 N
Accuracy class	0.5
Nominal characteristic value (sensitivity)	1 mV/V
Combined error	±0.5%
Characteristic value tolerance	±0.2%
Measuring principle	Full bridge strain gauge
Nom. resistance of strain gauge bridge	700 Ohm
Bridge supply voltage	**10 V (nominal value)** **14 V (max. permissible value)**
Output voltage Nominal range Maximum range	 0 to 10 mV (at nominal measuring force) 0 to 15 mV (at 1.5 x nominal measuring force)
Mechanical stop	1.5 x F_N
Operating load	1.0 to 1.4 x F_N
Limit load	10 x F_N
Nominal measuring deflection	0.3 to 0.4 mm
Nominal temperature range	-10 to +60 °C
Operating temperature range	-10 to +90 °C
Temperature coefficient	±0.3%/10 K (characteristic value) ±0.3%/10 K (zero)
Ambient conditions	Usage in dry and dusty environment
Protection rating	IP 50
Axial transverse force	0.5 x F_N
Roller nominal width, max.	400 mm
Roller weight, max.	1 kg
Weight	3.3 kg

Web tension measuring and control system ELTENS

Function

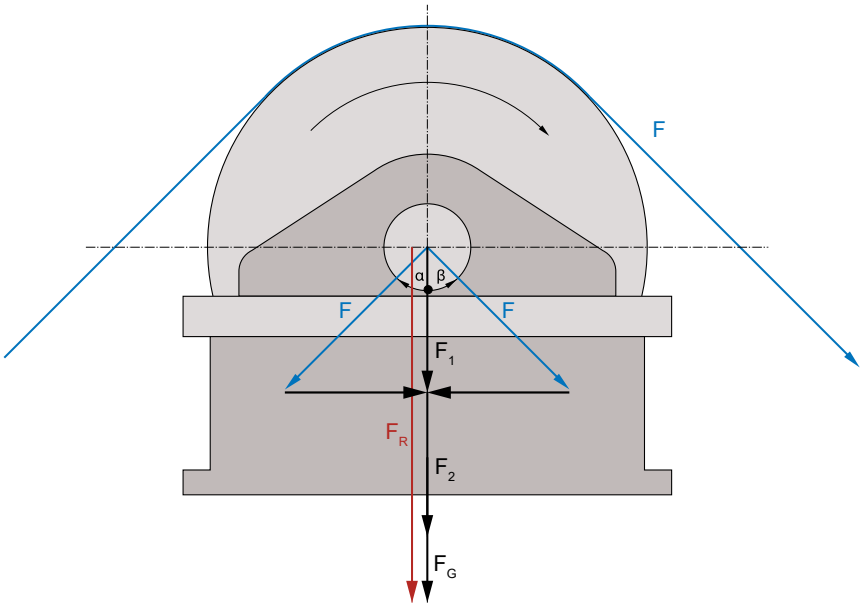
Block load cells comprise a cast housing for adaptation to the customer's machine and a mounting plate to accommodate the pedestal bearing. The measuring force is acquired via a double bending beam to which the strain gauges are applied and, in this way, an analog measured signal proportional to the web tension output.

Area of use

Block load cells are used in practically all processing plants where web-type materials are processed or finished. Particularly in the converting sector they offer significant advantages, as the rollers can always be replaced easily thanks to the very good accessibility of the pedestal bearings.

Application

A horizontal mounting position is preferred with symmetrical wrapping between 60 - 180° in relation to the vertical measuring direction. Measurement of the web tension on both sides prevents incorrect measurements caused by the web moving sideways and asymmetrical web tension distribution. Load cells incorporated into a control loop should be positioned as near to the actuator as possible.



Legend

F	Web tension (N)
F_1	Force component 1 in measuring direction
F_2	Force component 2 in measuring direction
F_G	Weight force
α	Angle between outgoing web and measuring direction
β	Angle between incoming web and measuring direction
$F_{R/K}$	Resulting force on a block load cell

Calculation, block load cell (horizontal mounting position)

$F_1 = F \cdot \cos \alpha$
$F_2 = F \cdot \cos \beta$
$F_G = F_G$ Roller / 2 + F_G Pedestal bearing
$F_{1/2} = (F_1 + F_2)/2$
$F_{R/K} = F_G + F_{1/2}$

Block load cell PD 50

- Can be mounted easily on a machine platform or on the side of a machine wall
- Fastening thread for pedestal bearings
- Straightforward guide roller replacement thanks to optimum pedestal bearing access
- Highly reliable in operation thanks to integrated 10-fold overload protection
- Good temperature behavior

Block load cell PD 50

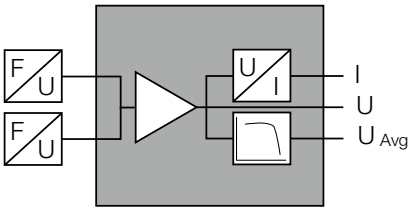
Selection table				
Type	Size L x W x H (mm)	Nominal measuring force F_N per block load cell (kN)		
PD 5010	134 x 48 x 78	0.08	0.2	0.4
PD 5020	150 x 68 x 78	0.5	1.0	2.0

Technical data	
Accuracy class	0.5
Nominal characteristic value (sensitivity)	2 mV/V
Combined error	±0.5%
Characteristic value tolerance	< ±0.2%
Measuring principle	Full bridge strain gauge
Nom. resistance of strain gauge bridge	700 Ohm
Bridge supply voltage	10 V (nominal value) 14 V (max. permissible value)
Mechanical stop	1.2 x F_N
Operating load	1.2 x F_N
Limit load	10 x F_N
Nominal measuring deflection	0.2 to 0.3 mm depending on type
Nominal temperature range	-10 to +60 °C
Operating temperature range	-10 to +90 °C
Temperature coefficient	±0.3%/10 K (characteristic value) ±0.3%/10 K (zero)
Protection rating	IP 54
Axial transverse force	1 x F_N
Weight	1.5 kg
Pedestal bearing installation	2x M10, drilling distance 95 mm
Connection	300 mm with 7-pole M9 straight connector (male type)

Measuring amplifier CV 22

- Single-channel measuring amplifier for connecting one or two fabric tension sensors with a strain gauge bridge
- Precision instrument amplifier with low temperature drift, high long-term stability and excellent linearity
- With potentiometer for zero point and tare adjustment as well as gain setting
- Internal reference voltage for measuring amplifier calibration without reference weights given exact knowledge of the wrapping angle and mounting position

Measuring amplifier CV 22



Block diagram CV 22

Technical data	
Accuracy class	0.1
Gain range	990 to 3400 V/V 400 to 1250 V/V 600 to 2050 V/V 300 to 1025 V/V
Input voltage	0 to ±20 mV
Output signals Voltage Voltage filtered Current	 0 to ±10 V (rise time 5 ms) 0 to ±10 V (rise time 2 s) 0/4 mA to 20 mA (rise time 5 ms)
Nominal temperature	0 to +60 °C
Temperature coefficient of the nominal value of the zero signal of the bridge supply voltage	 ±0.3%/10 K ±0.3%/10 K ±0.04%/10 K
Operating voltage Nominal value Nominal range	 24 V DC 20 to 30 V DC
Current consumption	0.2 A
Bridge supply voltage Nominal value Nominal range	 10 V DC 9 to 13 V DC
Protection rating Top-hat rail mounting to DIN EN 50022 With housing	 IP 00 IP 54

Digital measuring amplifier with display PA 62

- Digital two-channel measuring amplifier for connection of 2 fabric tension sensors with a strain gauge bridge
- Menu-based, language-neutral commissioning wizard
- Online diagnostics for load cells including wiring
- X-t plotter for long-term display of the web tension
- Monitoring of the web tension for adjustable limits with digital alarm output
- Signal output analog or using Ethernet interface

Digital measuring amplifier with display PA 62

Selection table

Type	Front panel installation	Housing	Top-hat rail mounting	Fieldbus
PA 6200	■			
PA 6210	■			■
PA 6201		■		
PA 6211		■		■
PA 6202			■	
PA 6212			■	■

Technical data	
Operating voltage, nominal value Nominal range (ripple included)	24 V / 0.2 A 18 to 30 V DC
Ambient temperature	+10 to +50 °C
Relative humidity	15 to 95% (non-condensing)
Input voltage (strain gauge bridge)	2 x 0 to ±25 mV, 14 bits, t_{cycle} = 1 ms
Analog outputs	2 x voltage, 0 to +5/10 V DC, I_{max} 10 mA 1x current, 0/4 to 20 mA, R_{max} 500 Ω
Filter	f_g = 0.2 to 20 Hz Total signal/ channel 1/ channel 2/ difference signal (configurable)
Digital outputs	3 x floating, short circuit proof, 24 V DC, I_{max} 0.5 A Limit/alarm/status (configurable)
Digital input	1 x floating, 24 V DC Tare/recipe/stop recording (configurable)
Display and control unit	Color touch display (LCD) (Not PA 62.2)
Interface	RJ45 Ethernet 100 Mbit (ODVA-compliant) for - Integrated web server - Fieldbus Ethernet IP
Protection rating	PA 62.0: IP 54 (in installed state), PA 62.1: IP 54 (with housing) PA 62.2: IP 20 (top-hat rail mounting)

Coating measurement

Function

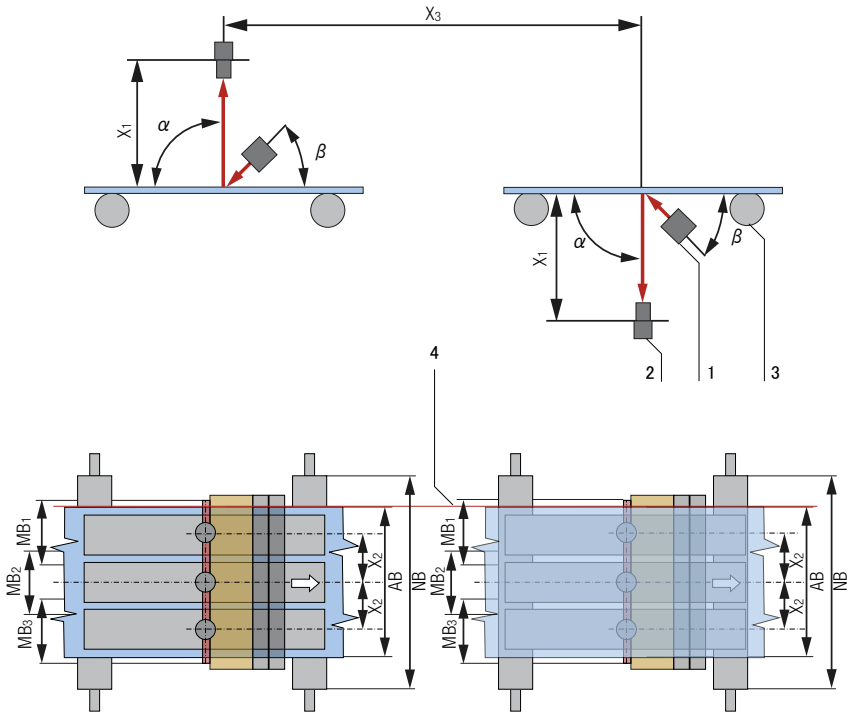
Line scan cameras measure the position of the coating in relation to the outer edge (reference edge) using the incident light principle. Positions and widths of the coating are transferred to the customer's control system via Ethernet.

Area of use

Typically 3 coating strips are applied to the top and bottom of the substrate in the battery industry. Coating width and lateral position must be measured with a measuring accuracy of down to +/- 0.05 mm. The coating must be positioned in the same place on both the top and bottom.

Application

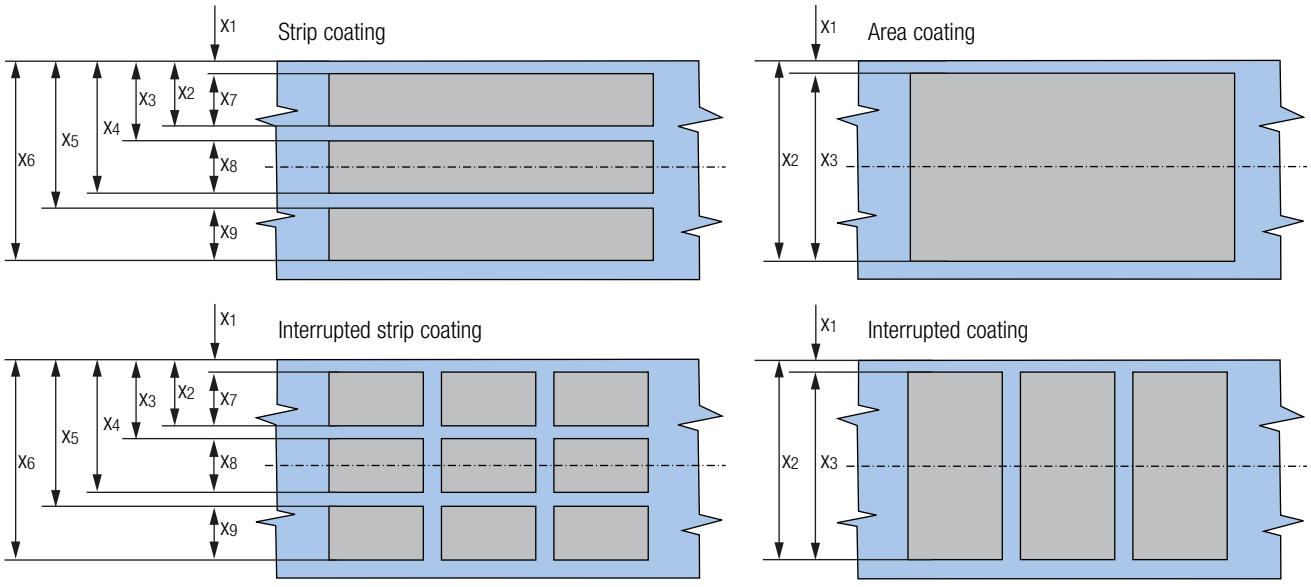
The position of the coating is measured immediately after the first and second coating application. The opaque substrate (aluminum or copper) is acquired using the incident light principle. The cameras are to be positioned at an angle of approx. 90° and the light transmitter at an angle of approx. 45° in relation to the surface of the web. A camera is to be provided for each coating strip to obtain optimal measuring accuracy.



Legend

AB	Operating width	1	Light transmitter
MB	Measuring range	2	CCD line scan camera
NB	Nominal width	3	Guide roller
X_1	Distance web surface - camera	4	Reference edge
X_2	Distance camera - camera	α	Angle web surface - camera
X_3	Distance coating top - coating bottom	β	Angle web surface - light transmitter

Measuring options



CCD line scan camera OL 91

CCD line scan camera OL 91

- CCD line scan camera for the acquisition of the coating positions on moving webs
- High resolution with monochrome CCD array chip including subpixel evaluation
- Complete image processing integrated into the camera

Light transmitter FS 41

- Compact LED light transmitter for the acquisition of the coating edges using CCD line scan camera
- Straightforward mounting by means of integrated slots in the aluminum profile

Network center DN 1002

- Data network center with E+L computer and Masterlogic for customer-specific applications
- Web-based management for simple commissioning and operation

Command station OP 36

- Cost-effective operating panel with touch panel for the display and operation of customer-specific applications
- Touch screen browser-based for web-based management

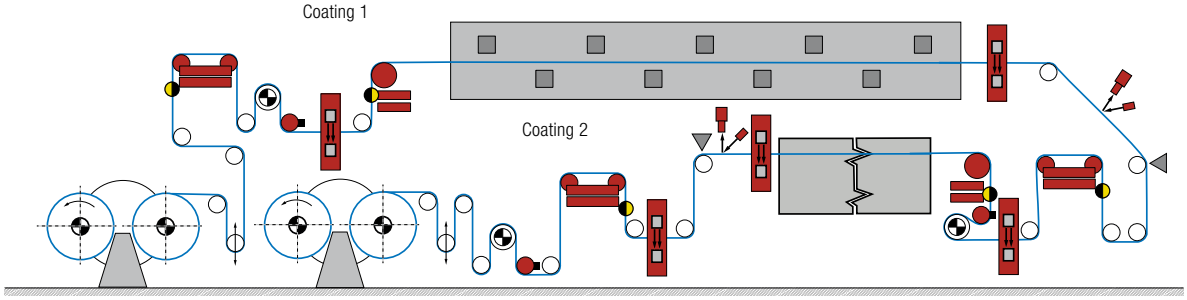
CCD line scan camera OL 91

Network center DN 1002

Incident light transmitter FS 4106

Command station OP 36

Technical data CCD line scan camera OL 91	
Number of pixels	6144
Resolution in sub-pixels	8-fold sub-pixeling
Lens	f = 50 mm
Minimum distance to web	500 mm
Active chip length	43 mm
Spectral maximum	660 nm
Weight	2.0 kg
Protection rating	IP 54
Ambient temperature	+10 °C to +55 °C
Dimensions (camera)	197 x 135 x 171 mm
Operating voltage Nominal value Nominal range	 24 V DC 20 to 30 V DC
Power consumption	16 W
Operating system	Linux
Soft-PLC	Optional
Application software	Optional
Scanning rate	Up to 10 kHz
Interfaces	1 Gbit Ethernet/100 Mbit Ethernet/Encoder/I/O

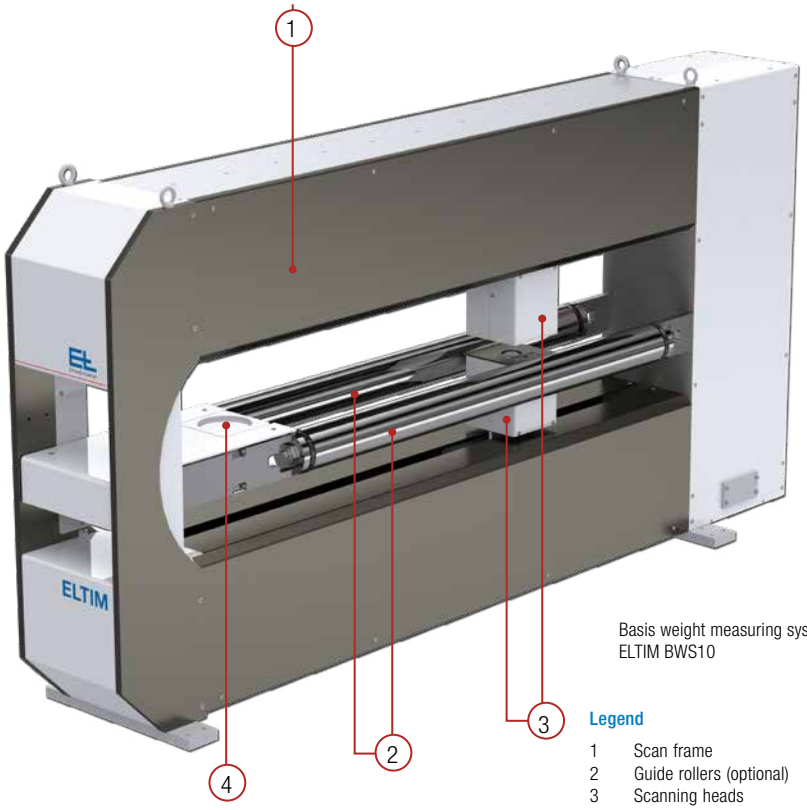


Line scan camera OL 91 in coating system

Basis weight measuring system ELTIM

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 coated and uncoated metal foils for anode and cathode 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 e.g. 3-D surface profile display



Basis weight measuring system ELTIM BWS10

Legend

1 Scan frame
2 Guide rollers (optional)
3 Scanning heads
4 Calibration table for reference material

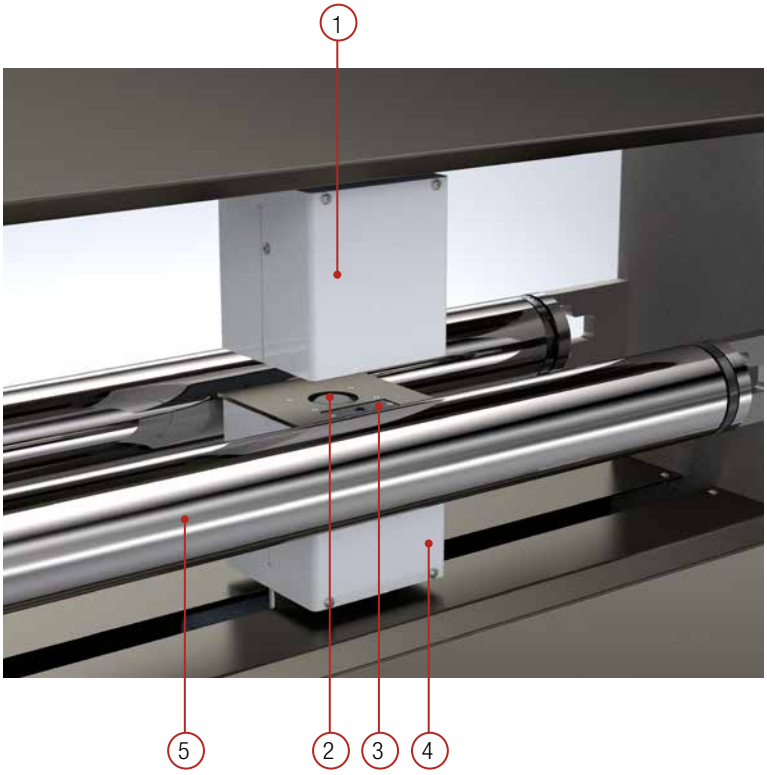
General functions	
Measurement of the basis weight (current, average, min. & max., basis weight profile over the entire width)	
Comparison of nominal and measured values	
Tolerances	Tolerances for values Warning / rejection limits
Data output	To PLC, to ELQ, to I/O
User levels/pass-word	Operator level: limited access rights Engineer level: full access rights
WBM Interface	Web-based management. Configuration and value display accessible via web browser. Web-browser-compatible hardware not included in the scope of supply and is provided by the customer (PC or similar)

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
Measurement spot size	Ø 23.6 mm (US 20..) , Ø 33 mm (US 10..)
Passage height	**40 mm (from measuring head to measuring head)**
Height fluctuation of the web	± 10 mm in the middle; no fluttering
Measuring system cycle time	120 Hz
Operating speed 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
Power supply	24 V (optionally 100 to 250 V AC, 3.5 A, 50/60 Hz)
Current consumption	Max. 10 A
Operating width	500 - 2500 mm, larger widths on request
Dimensions	L (NB + 932 mm) x H 960 mm x D 270 mm

Sensors

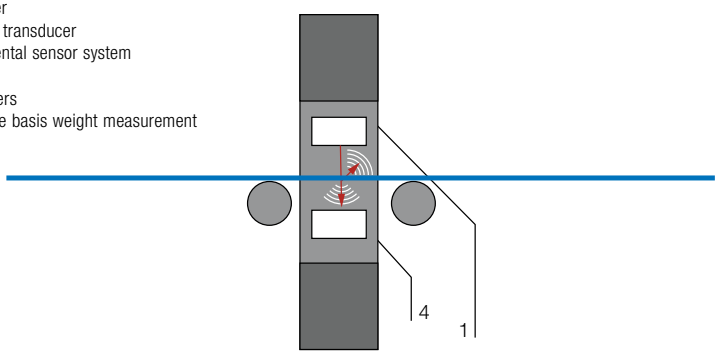
Principle of the ultrasonic measuring process

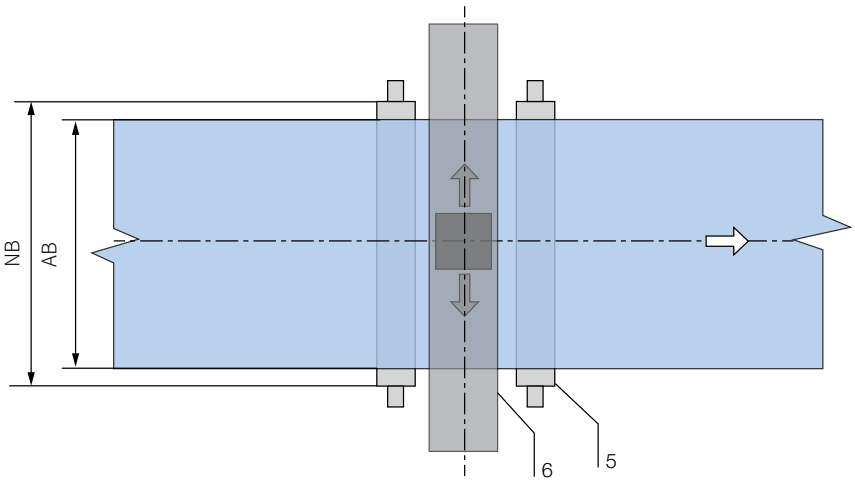
In this process, the transmission absorption of an ultrasonic pulse penetrating a web is determined without contact using an ultrasonic transmitter and an ultrasonic receiver. The basis weight is calculated from the absorption and a calibration factor.



Legend

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





Thickness measurement EL-THICKNESS

Function

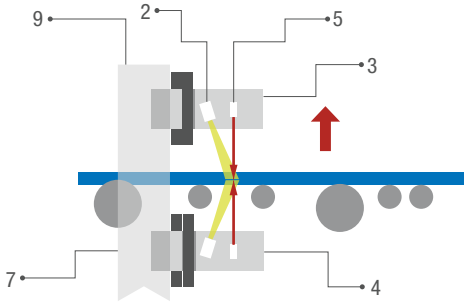
One or more sensors measure the product thickness in one or more locations via differential measurements. Here, there are different ways in which this system can be used: fixed measurement points or manually/automatically approachable measurement points.

Area of use

Thickness measurement systems are mostly used in calender lines or roller head calenders and after calendering to check the thickness and adjust the calender gap.

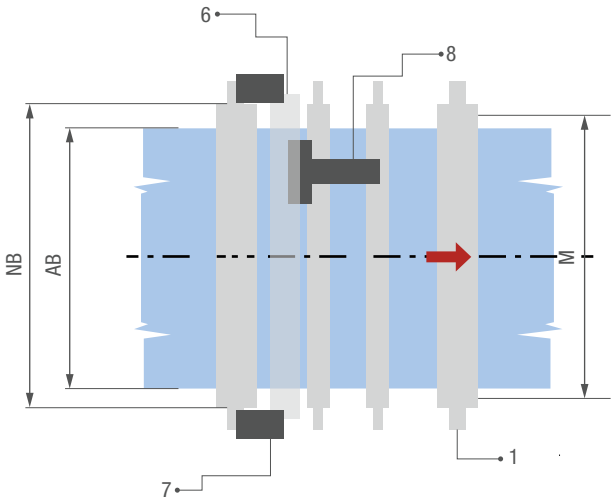
Application

Thickness measurement systems can be integrated at almost any position in roller head lines, calender lines and extrusion lines.

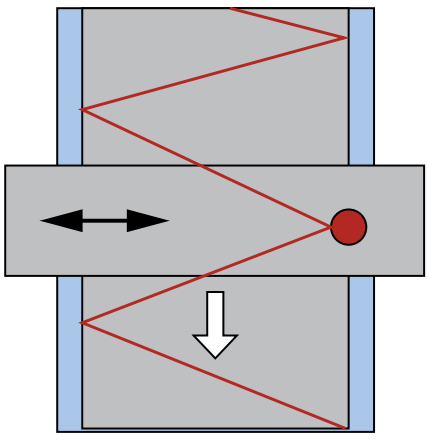


Legend

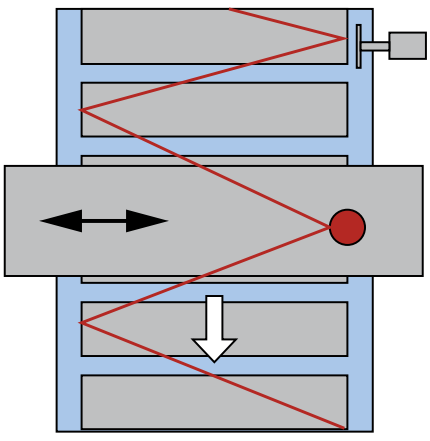
AB	Operating width
M	Measuring range
NB	Nominal width
1	Guide roller
2	CCD sensor
3	Laser sensor (top)
4	Laser sensor (bottom)
5	Laser diode
6	Positioning device
7	Granite frame
8	Positionable sensors
9	Differential measurement systems



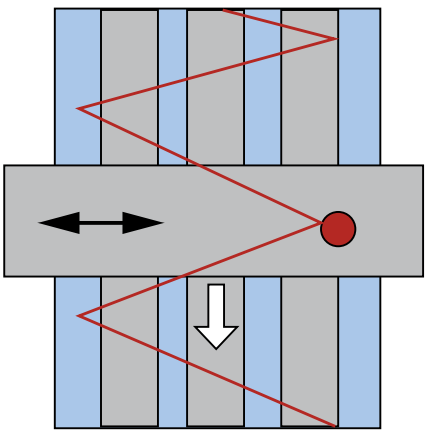
Traversing system for area coating



Traversing system for interrupted coating (blanking of the gaps in the coating)



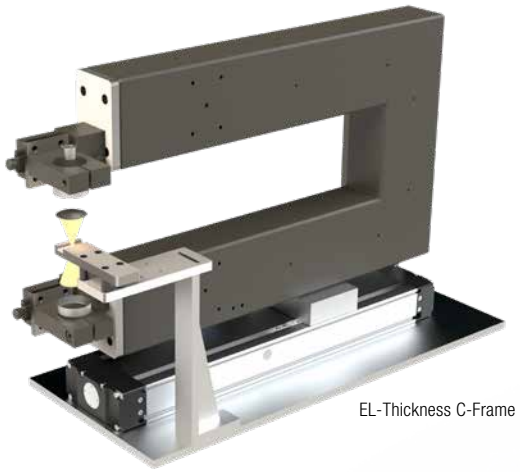
Traversing system for strip-shaped coating (blanking of the gaps in the coating)



EL-THICKNESS C-Frame

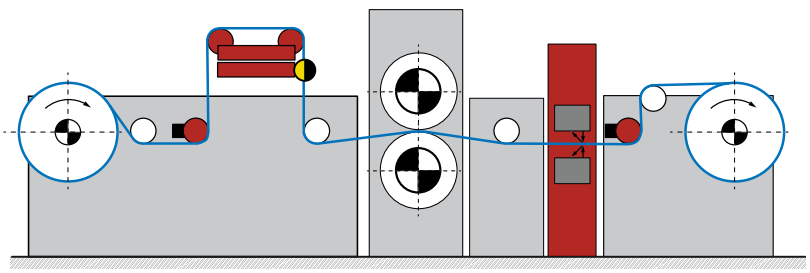
Contactless thickness measurement based on difference method

- Contactless online thickness measurement for coated metal foils
- Precise determination of web thickness based on laser triangulation 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 C-Frame

Technical data		
Profile width	Depending on the position and number of measuring points	
Max. measuring range for thickness	Up to 34 mm	Up to 78 mm
Accuracy of thickness measurement	± 1 µm	± 1 µm
Measuring equipment capability (Cg&Cgk): [TW = 10 x accuracy]	> 1.67	
Laser sensor	Point sensor	
Measuring points	Up to 3	
Scan frequency	1 kHz	
Laser class	2 (no dedicated laser safety officer required)	
Resolution of profile thickness	< 1 µm	
Displayed resolution	1 µm	
Relative atmospheric humidity	15 - 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 EL-THICKNESS in press

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