



ELTENS

**Web tension measuring
and
control systems**

Continuous web tension
detection and controlling

Contents

Increased quality and productivity due to web tension controlling	4	Networking/CANMON	24
Control loop	5	Operator panels DO	25
Load sensor function	6	Interfaces DI	26
Flange load cell PD 21	7	Electro-pneumatic converter DP 20	27
Flange load cell PD 23	8	Power output element PK 09	28
Flange load cell PD 25	9	Magnetic particle brakes function	29
Sensor roller PD 30	10	Magnetic particle brakes ELB	30
Sensor roller PD 40	12	Service from A to Z	31
Block load cell PD 7	14		
Flange load cell accessories	16		
Measuring amplifiers CV 22	17		
Measuring amplifiers CV 50/CV 60	18		
Digital displays PA	19		
Web tension controller DC 6	20		
Control structure of electrical drives	21		
Control structure of pneumatic and electrical brakes	22		
Control structure of gears	23		

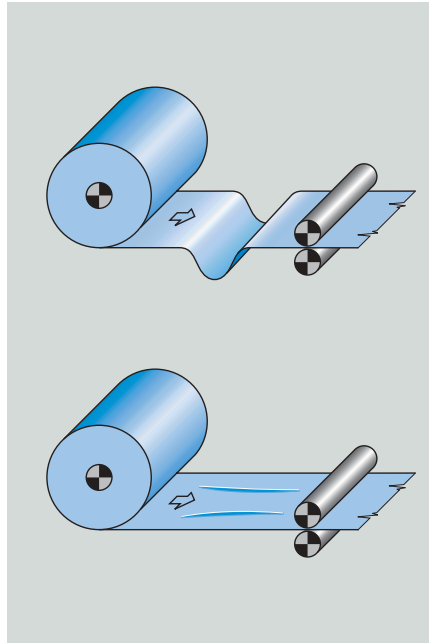


Increased quality and productivity due to web tension controlling

The manufacturers and users of web-type material processing machines are nowadays confronted by increasingly high demands: production processes are required at greater speed yet at the same time should also be more precise. The quality of end results must be further improved while personnel costs, spoilage and, above all, machine downtimes should be minimized.

A decisive contribution to the fulfillment of these requirements is afforded by web tension control systems. Typically, web-type materials are fed from a reel to the machine, finished and then rewound. At each stage web tension errors may occur that may lead to malfunctions and quality impairments.

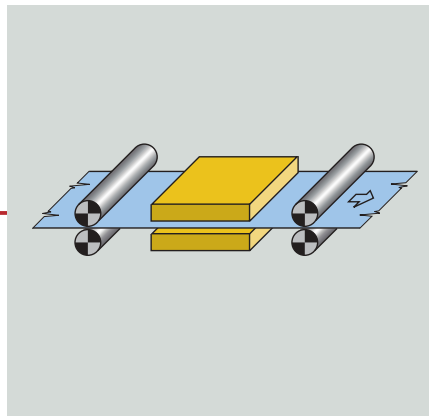
The elimination of these error influencing quantities and assuring a constant web tension during the production process is the task of E+L web tension control systems. Depending on the application and task, Erhardt+Leimer provides various systems with the latest technology: for decisively more quality and productivity that adds up.



Typical web tension errors:

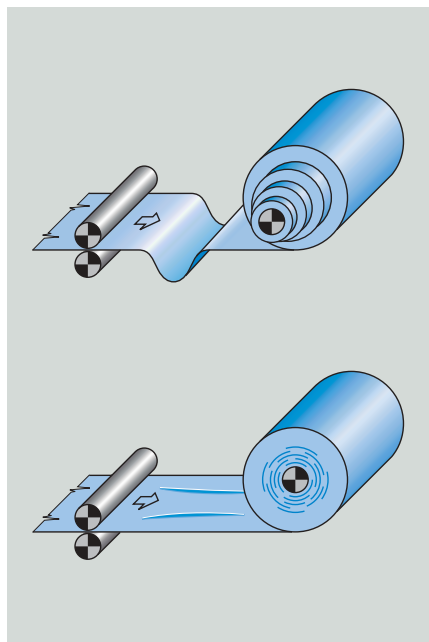
Web tension after the unwinder

- Too little tension causes slacking in front of the transport drive
- If the web tension is too high longitudinal creasing and textile web deformation may be caused



Web tension between clamping points

- Crucial to the quality of the process is a constant web tension between clamping points



Web tension on the rewinder

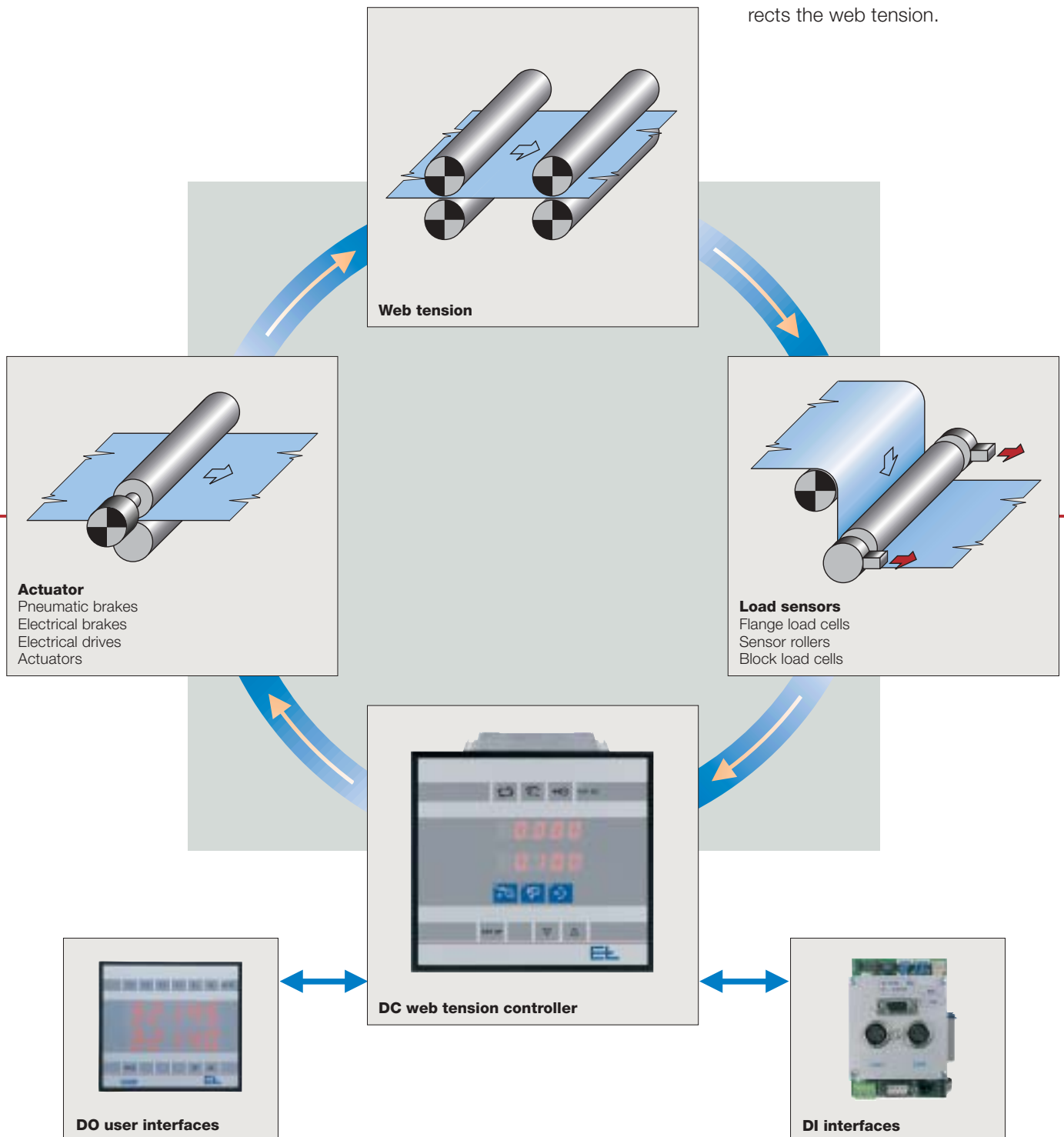
- If web tension on rewinders is inadequate reel telescoping may occur
- Too high tension forces destroy the inner windings

Control loop

All automated control systems are based on the principle of a simple control loop. Even the most sophisticated tasks may be reduced to it.

- Departure point is the current web tension.
- Load sensors continuously and precisely detect the web tension.

- The controller compares the actual web tension value with the specified target value and issues an appropriate corrective signal to the actuator.
- The actuator changes the speed of the pulling unit/winder or braking force of the unwinder and thus corrects the web tension.



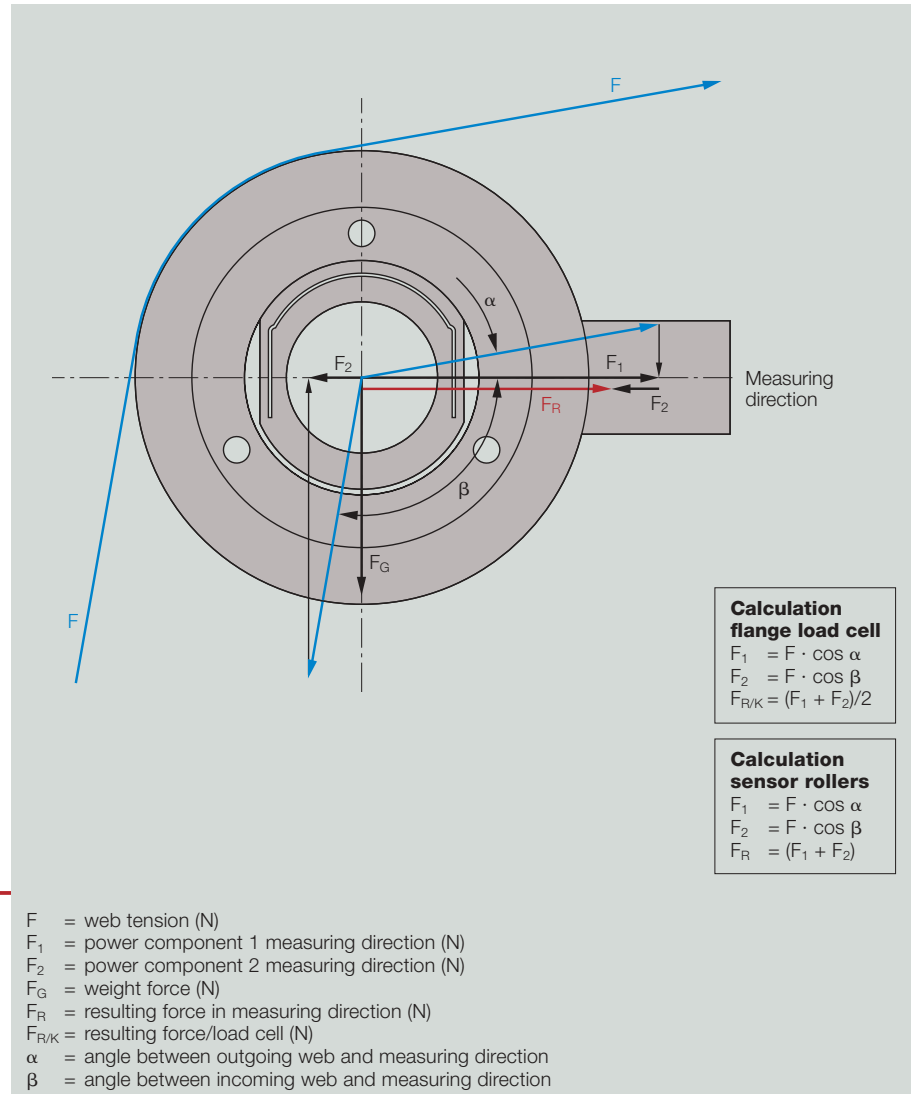
ELTENS load cells

Function

The load cell comprises a stable outer ring with flange cover and centering collar for precision assembly. The inner ring in the shape of a bi-directional strip assures the centred 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 analogue output signal proportional to the web tension.

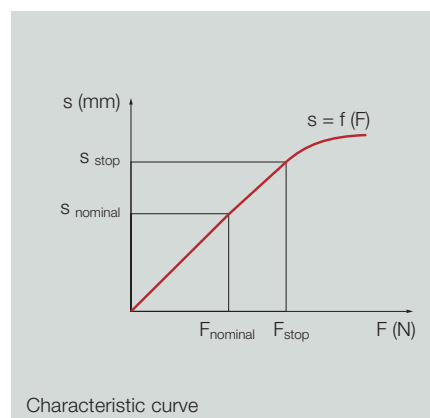
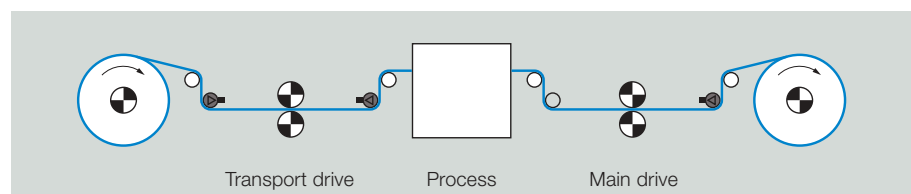
Implementation area

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 textile web is conveyed 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 at both sides can prevent incorrect measurements caused by the web moving sideways and asymmetrical web tension distribution. Load cells incorporated in a closed control loop should be mounted as near to the actuator as possible.



Calibration

The tension – path characteristic curve forms a straight line to the mechanical stop. All 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 50–100 % is taken into account in order to compensate for asymmetrical web tension distribution.

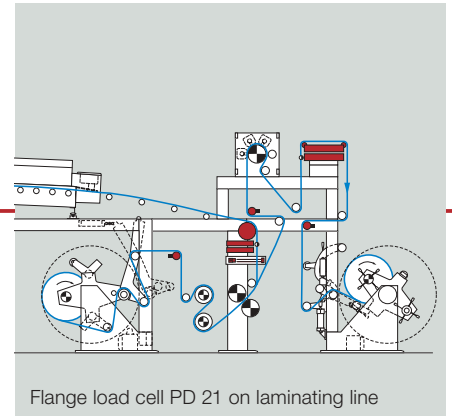
Flange load cell

Flange load cell PD 21/22

- Multi-position, easy mounting due to various assembly options, e.g. flange, pedestal bearings, inner or outer securing
- Maximum operational reliability due to overload protection up to 20 times the nominal measuring force
- Different shaft diameters from 12–65 mm and nominal measuring forces of 0.05–10 kN assure a high degree of flexibility
- No influence of the roller weight on the measuring result given horizontal mounting in the direction of measuring
- Favorable temperature behavior and a high degree of linearity of the measuring elements due to strain gauge application on a level surface
- High permissible operating speed of the measuring roller due to high web tension load cell elastic constant.



Flange load cell PD 21 on re-rolling machine



Flange load cell PD 21 on laminating line

Option table
Flange load cell PD 21/22

Type Drill hole at one side	Type Drill holes at both sides	∅ (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

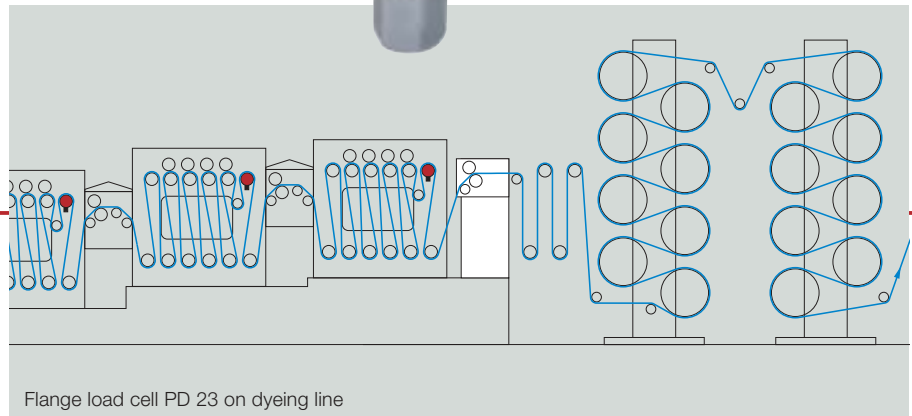
Technical data
Flange load cell PD 21/22

Precision class	0.5
Nominal characteristic value (sensitivity)	1m V/V
Combined error (Hysteresis/non-linearity)	< 0.5 %
Characteristic value tolerance	0.2 %
Measuring principle	full strain gauge bridge
Nominal resistance of the strain gauge bridge	700 ohms
Bridge supply voltage nominal value	10 V
max. permissible value	14 V
Mechanical stop Working load	1.8 to 2.4 F _N dep. on type
Limit load	1.8 to 2.4 F _N 20 x F _N
Nominal measuring path	0.1 to 0.2 mm dep. on type
Nominal temperature range	- 10 to + 60 °C
Working temperature range	- 10 to + 90 °C
Temperature coefficient of the characteristic value of the zero signal	+/- 0.3 %/10 K +/- 0.3 %/10 K
Protection class	IP 50
Max. permissible axial shearing force	1 x F _N
Weight	2.3 kg (d ₁ = 17 mm) 3.6 kg (d ₁ = 25 mm) 8.5 kg (d ₁ = 35 mm)

Flange load cell

Flange load cell PD 23/24

- Flange load cell in high grade steel for difficult ambient conditions such as washing machines and etching units
- Easy flexible mounting with various assembly aids, e.g. flange, pedestal bearings, inner and outer securing
- Maximum operational reliability due to overload protection up to 20 times the nominal measuring force
- No influence of the roller weight on the measuring result when mounted horizontally in the measuring direction
- Favorable temperature behavior and a high degree of linearity due to strain gauge application on a level surface
- High permissible measuring roller operating speed due to high web tension load cell elastic constant.



Option table
Flange load cell PD 23/24

Drill hole on one side	Drill hole on both sides	∅ (mm)	Nominal measuring force (kN)			
PD 2317	PD 2417	17	0.1	0.2	0.5	1
PD 2325	PD 2425	25	0.15	0.3	0.75	1.5
PD 2335	PD 2435	35	0.3	0.6	1.5	3



Flange load cell PD 23 on washing machine

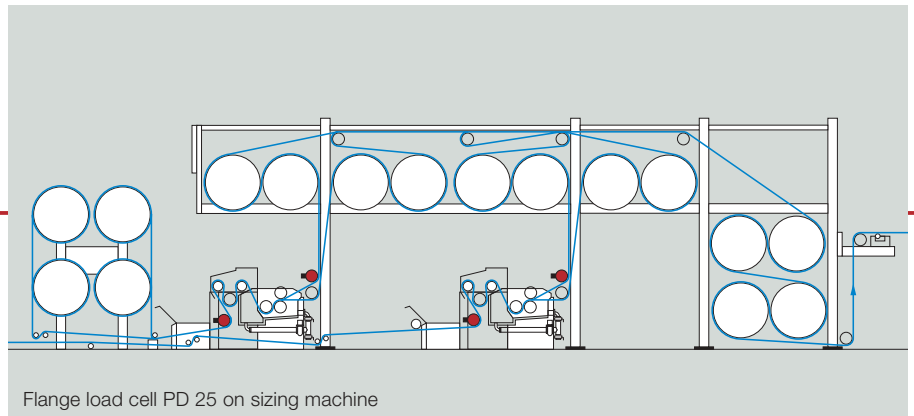
Technical data Flange load cell PD 23/24

Precision class	0.5
Nominal characteristic value (sensitivity)	1m V/V
Combined error (Hysteresis/non-linearity)	< 0.5 %
Characteristic value tolerance	0.2 %
Measuring principle	full strain gauge bridge
Nominal resistance of the strain gauge bridge	700 ohms
Bridge supply voltage nominal value	10 V
max. permissible value	14 V
Mechanical stop Working load	1.8 to 2.4 F _N dep. on type
Limit load	1.8 to 2.4 F _N
	20 x F _N
Nominal measuring path	0.1 to 0.2 mm dep. on type
Nominal temperature range	- 10 to + 60 °C
Working temperature range	- 10 to + 90 °C
Temperature coefficient of the characteristic value of the zero signal	+/- 0.3 %/10 K
	+/- 0.3 %/10 K
Protection class	IP 65
Max. permissible axial shearing force	1 x F _N
Weight	2.3 kg (d ₁ = 17 mm)
	3.6 kg (d ₁ = 25 mm)
	8.5 kg (d ₁ = 35 mm)

Flange load cell

Flange load cell PD 25

- Economical aluminium flange load cell
- Compatible with the PD 21/22 standard series
- Easy flexible mounting with various assembly aids, e.g. flange, pedestal bearings, inner and outer securing
- High operational reliability due to overload protection up to 10 times the nominal measuring force
- No influence of the roller weight on the measuring result when mounted horizontally in the measuring direction
- Favorable temperature behavior and a high degree of linearity due to strain gauge application on a level surface
- High permissible measuring roller operating speed due to high web tension load cell elastic constant.



Option table
Flange load cell PD 25

Type	Drill hole on one side	∅ (mm)	Nominal measuring force (kN)		
PD 2517	17	0.1	0.2	0.5	
PD 2525	25	0.15	0.3	0.75	
PD 2535	35	0.3	0.6	1.5	



Flange load cell PD 25 at infeed into sizing bath

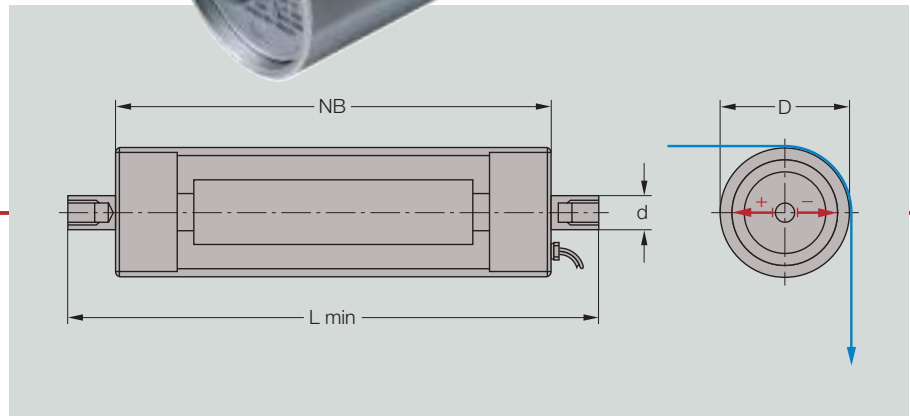
Technical data
Flange load cell PD 25

Precision class	1
Nominal characteristic value (sensitivity)	1 m V/V
Combined error (Hysteresis/non-linearity)	< 1 %
Characteristic value tolerance	0.2 %
Measuring principle	full strain gauge bridge
Nominal resistance of the strain gauge bridge	700 ohms
Bridge supply voltage nominal value	10 V
max. permissible value	14 V
Mechanical stop Working load	1.8 to 2.4 F _N dep. on type
Limit load	10 x F _N
Nominal measuring path	0.1 to 0.25 mm dep. on type
Nominal temperature range	-10 to +60 °C
Working temperature range	-10 to +90 °C
Temperature coefficient of the characteristic value of the zero signal	+/- 0.5 %/10 K +/- 0.5 %/10 K
Protection class	IP 54
Max. permissible axial shearing force	1 x F _N
Weight	0.8 kg (d ₁ = 17 mm) 1.25 kg (d ₁ = 25 mm) 2.94 kg (d ₁ = 35 mm)

Sensor roller

Sensor roller PD 30

- Aluminium roller with fixed axle and two integrated load cells
- For easy mounting between side walls. Optionally with securing kit for snug-fit shoulder screws
- High operational reliability due to overload protection up to 10 times the nominal measuring force
- Different roller diameters from 80–200 mm assure maximum flexibility
- No influence of the roller weight on the measuring result when mounted horizontally in the measuring direction
- Favorable temperature behavior and a high degree of linearity due to strain gauge application on a level surface
- High permissible measuring roller operating speed due to high web tension load cell elastic constant.



**Option table
Sensor roller PD 30**

Type	∅ D (mm)	NB min. (mm)	NB max. (mm)	L min. (mm)	∅ d (mm)	Thread	Nominal measuring force F_N per roller (kN)		
PD 3008	80	300	1200	NB +10	20	M 12	0.2	0.4	1
PD 3010	100	300	1800	NB +10	20	M 12	0.3	0.6	1.5
PD 3012	120	400	2500	NB +10	20	M 12	0.3	0.6	1.5
PD 3016	160	600	3000	NB +10	40	M 16	0.6	1.2	3
PD 3020	200	600	3000	NB +10	40	M 16	0.6	1.2	3

**Option table
Roller surface PD 30**

Surface index	Surface
01	polished RA 3.2 (standard)
02	wound with rubber cork
03	finely sprayed with glass corundum RA 6.3, hard-anodised, layer thickness 30 µm 450 HV
04	hard-anodised, layer thickness 30 µm 450 HV
05	spiralled on left + right, pitch 40 mm, groove radius 6 mm, groove depth 0.25 mm
13	coarse glass corundum sprayed RA 11.5–15, hardanodised, layer thickness 30 µm 450 HV

Sensor roller



Sensor roller PD 30
on rotary offset press

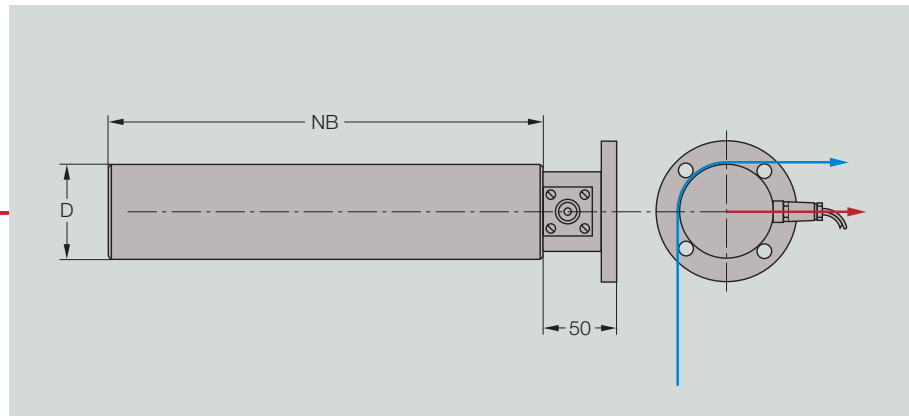
Technical data Roller PD 30	
Material roller tube	AlMgSi 0.5
Bearings	self-aligning ball bearing with locating and non-locating bearing incl. labyrinth seal and lifetime lubrication
Balance quality PD 3008, PD 3010, PD 3012 PD 3016, PD 3020	dynamic precision balancing to VDI 2060 quality grade Q = 2.5 quality grade Q = 6.3
Concentricity	< 50 µm for NB ≤ 1000 mm < 100 µm for NB ≥ 1000 mm
Cylinder form	< 50 µm for NB ≤ 1000 mm < 100 µm for NB ≥ 1000 mm
Max. speed PD 3008 PD 3010 PD 3012 PD 3016 PD 3020	3600 U/min 3000 U/min 2400 U/min 1800 U/min 1500 U/min
Roller weight PD 3008 PD 3010 PD 3012 PD 3016	for NB 600 mm 7.5 kg per 100 mm 0.85 kg for NB 600 mm 10.0 kg per 100 mm 1.05 kg for NB 1100 mm 21.3 kg per 100 mm 1.15 kg for NB 1100 mm 25 kg per 100 mm 1.30 kg

Technical data Load cell PD 30	
Precision class	0.5
Nominal characteristic value (sensitivity)	1m V/V
Combined error (Hysteresis/non-linearity)	< 0.5%
Characteristic value tolerance	0.2 %
Measuring principle	full strain gauge bridge
Nominal resistance of the strain gauge bridge	700 ohms
Bridge supply voltage nominal value max. permissible value	10 V 14 V
Output voltage nominal range max. range	0 to 10 mV (at nominal force and bridge supply voltage 10 V) 0 to 18 mV (at 1.8 x nominal force and bridge supply voltage 10 V)
Mechanical stop Working load Limit load	1.2 to 1.8 F _N dep. on type 1.2 to 1.8 F _N 10 x F _N
Nominal measuring path	0.15 to 0.25 mm dep. on type
Nominal temperature range Working temperature range	- 10 to + 60 °C - 10 to + 70 °C
Temperature coefficient of the characteristic value of the zero signal	+/- 0.3 %/10 K +/- 0.3 %/10 K
Protection class	IP 50
Max. permissible axial shearing force	1 x F _N
Connection cable	6 x 0.14 m ² , 5/10 m long

Sensor roller

Sensor roller PD 40

- Aluminium roller with fixed axle and two integrated load cells
- Assembly flange at one side for cantilever mounting
- High operational reliability due to overload protection up to 10 times the nominal measuring force
- Different roller diameters from 60–100 mm assure maximum flexibility
- No influence of the roller weight on the measuring result when mounted horizontally in the measuring direction
- Favorable temperature behavior and a high degree of linearity due to strain gauge application on a level surface.



**Option table
Sensor roller PD 40**

Type	∅ D (mm)	NB min. (mm)	NB max. (mm)	Nominal measuring force F_N per roller (kN)		
PD 4006	60	150	300	50	100	200
PD 4008	80	200	400	100	200	400
PD 4010	100	100	500	100	200	400

**Option table
Roller surface**

Surface index	Surface
01	polished RA 3.2 (standard)
03	finely sprayed with glass corundum RA 6.3, hard-anodised, layer thickness 30 µm 450 HV
04	hard-anodised, layer thickness 30 µm 450 HV

Sensor roller



Sensor roller PD 40
on re-rolling machine

Technical data Roller PD 40		
Roller tube material	ENAW-6060T66 (AlMgSi 0.5)	
Bearing	self-aligning ball bearing with locating and non-locating bearings including labyrinth seal and lifetime lubrication	
Quality of balance (dynamic precision balancing to VDI 2060)	quality grade Q = 2.5 (standard) quality grade Q = 1 (optional)	
Concentricity	< 50 µm	
Cylinder form	< 50 µm	
Max. web speed for balancing quality Q 2.5	450 m/min	
Max. web speed for balancing quality Q 1	600 m/min	
Max. deflection	at max. nominal measuring force	per 100 mm nominal width
PD 4006	200 N	0.16 mm
PD 4008	400 N	0.21 mm
PD 4010	400 N	0.11 mm
Roller weight		
PD 4006	for NB 150 mm 1.43 kg	per 50 mm 0.23 kg
PD 4008	for NB 200 mm 3.80 kg	per 50 mm 0.40 kg
PD 4010	for NB 250 mm 6.60 kg	per 50 mm 0.72 kg
Mounting flange fixture (centering collar featured)	with central thread with 4 drill holes	

Technical data Load cell PD 40	
Precision class	1
Nominal characteristic value (sensitivity)	1 m/VV
Combined error (Hysteresis/non-linearity)	< 1 %
Characteristic value tolerance	0.2 %
Measuring principle	full strain gauge bridge
Nominal resistance of the strain gauge bridge	700 ohms
Bridge supply voltage	
nominal value	10 V
max. permissible value	14 V
Output voltage	
nominal range	0 to 10 mV (at nominal force and bridge supply voltage 10 V)
max. range	0 to 18 mV (at 1.8 x nominal force and bridge supply voltage 10 V)
Mechanical stop	1.2 to 1.8 F _N dep. on type
Working load	1.2 to 1.8 F _N
Limit load	10 x F _N
Nominal measuring path	0.15 to 0.25 mm dep. on type
Nominal temperature range	-10 to +60 °C
Working temperature range	-10 to +70 °C
Temperature coefficient of the characteristic value of the zero signal	+/- 0.3 %/10 K +/- 0.3 %/10 K
Protection class	IP 50
Max. permissible axial shearing force	1 x F _N
Plug-in connection cable	6 x 0.14 m ² , 5/10 m long

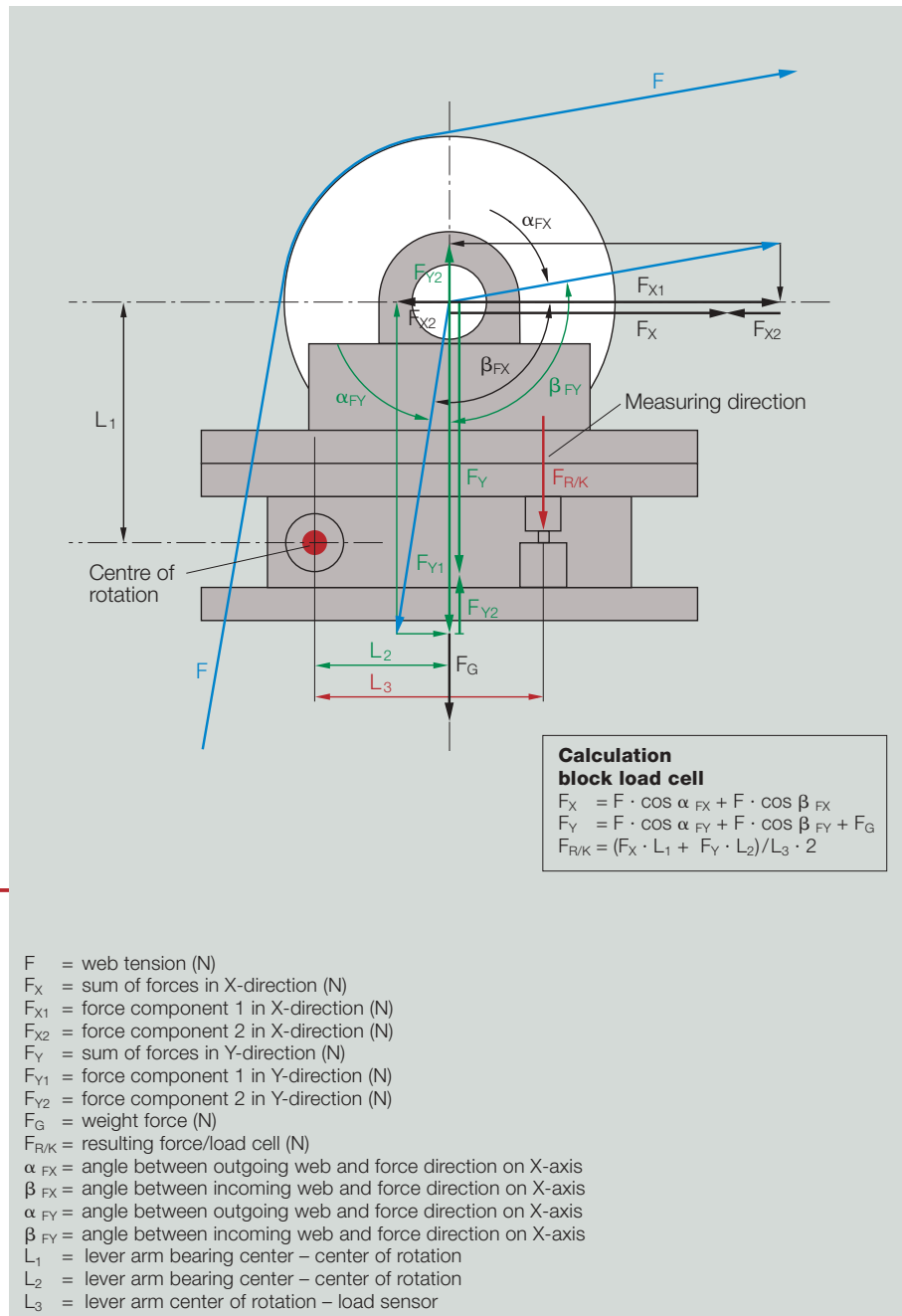
Block load cell

Function

Block load cells comprising a base and rotating plate mounted on bearings to accommodate the pedestal bearing. The pressure-sensitive load cell is integrated between the plates. The radial forces caused by the web act as moment on the bearing center of rotation and, via a lever arm, produce a measuring force on the load cell. The load cell, in the shape of a single bi-directional strip, features strain gauges switched as a measuring bridge. The unbalancing of the measuring bridge results in an analogue output signal proportional to the web tension.

Implementation area

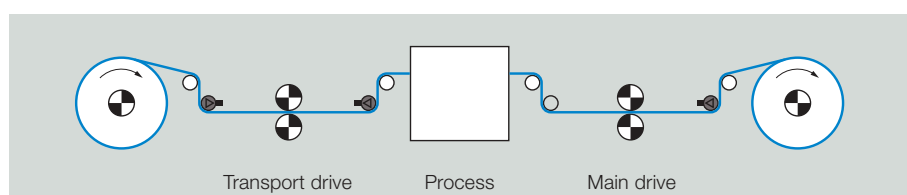
Load cells are used in practically all processing plants where web-type textiles are processed or finished. Block load cells are used if the measuring roller, due to spare parts stocking, must feature the same dimensions as a machine guide roller.



Application

Given a wrapping angle of 90 ° horizontally – vertically and a horizontal direction of measuring, optimum web tension detection is assured. Detection of the bearing forces at two sides alone prevents incorrect measurements caused by the web moving sideways and asymmetrical web tension distribution.

Load cells incorporated in a closed control loop should be positioned as close to the actuator as possible.



Block load cell

Block load cell PD 7

- Mounting option of pedestal bearings with standard guide rollers
- Besides steel version for dry areas also available in high grade steel for wet ambient conditions
- High operational reliability due to overload protection up to 10 times the nominal measuring force
- Various sizes and nominal measuring forces from 0.1 – 70 kN assure maximum flexibility
- Integrated damper against impact strains and machine vibrations.

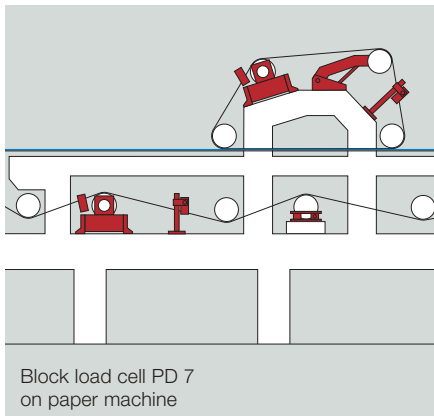


Option table
Block load cell PD 7

Type	Size L x W x H (mm)	Fastening screw	Hole spacing for installation (mm)	Nominal measuring force F_N (kN)										
				0.1	0.5	1	5	10	20	30				
PD 72__T	300 x 150 x 102	M 20	260	0.1	0.5	1	5	10	20	30				
PD 73__T	540 x 150 x 102	M 20	500	0.1	0.5	1	5	10	20	30				
PD 74__T	700 x 220 x 200	M 36	630								30	50	70	
PD 72__N	300 x 150 x 102	M 20	260	0.1	0.5	1	5	10	20	30				
PD 73__N	540 x 150 x 102	M 20	500	0.1	0.5	1	5	10	20	30				
PD 74__N	700 x 220 x 200	M 36	630								30	50	70	

D = dry version

N = wet version



Technical data
Block load cell PD 7

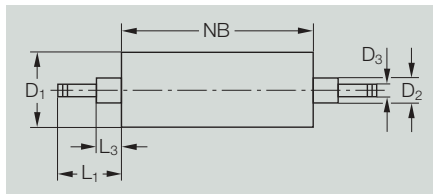
Precision class	1
Nominal characteristic value (sensitivity)	2 m V/V
Combined error (Hysteresis/non-linearity)	< +/- 0,15%
Characteristic value tolerance	0.2 %
Measuring principle	full strain gauge bridge
Nominal resistance of the strain gauge bridge	600 ohms
Bridge supply voltage nominal value max permissible value	10 V 14 V
Output voltage nominal range max. range	0 to 20 mV (at F_{Nnom} and U_B 10 V) 0 to 22 mV (at $1.1 \times F_{Nnom}$ and U_B 10 V)
Mechanical stop Working load Limit load	$1.1 \times F_N$ $1.1 \times F_N$ $10 \times F_N$
Nominal measuring path	0.5 to 2 mm dep. on type
Nominal temperature range	-10 to +140 °C
Temperature coefficient of the characteristic value of the zero signal	+/- 0,3 %/10 K +/- 0,3 %/10 K
Protection class	IP 67
Axial shearing force	not permissible
Weight PD 72 PD 73 PD 74	22 kg 32 kg 125 kg

Block load cell PD 7
on paper machine

Flange load cell accessories

Measuring roller BA 6

- Aluminium roller mounted on outer bearings for PD 21/25 flange load cell assembly
- Minimum concentricity tolerances and high balancing quality
- Roller diameter of 80–200 mm
- Various surfaces for diverse implementation areas.



Option table

Measuring roller BA 6

Type	Roller diameter D_1 (mm)	Nominal width NB min. (mm)	Nominal width NB max. (mm)	Shaft diameter D_3 (mm)
BA 6080	80	200	1200	17/25
BA 6100	100	200	1800	17/25
BA 6120	120	400	2700	25/35
BA 6160	160	600	2700	25/35
BA 6200	200	600	2700	35/45

Option table

Measuring roller surface BA 6

Surface index	Surface
01	polished RA 3.2 (standard)
02	wound with rubber cork
03	finely sprayed with glass corundum RA 6.3, hard-anodised, layer thickness 30 μm 450 HV
04	hard-anodised, layer thickness 30 μm 450 HV

Technical data

Measuring roller BA 6

Roller tube material	ENAW-6060T66 (AlMgSi 0.5)
Balancing quality	dynamic precision balancing to VDI 2060
Quality grade	2.5 (\varnothing 80 mm) 6.3 (\varnothing 100/120/160/200 mm)
Concentricity	< 50 μm for NB \leq 1000 mm < 150 μm for NB \geq 1000 mm
Cylinder form	< 50 μm for NB \leq 1000 mm < 150 μm for NB \geq 1000 mm

Accessory kits for flange load cells

- Accessory kit with self-aligning ball bearing, securing ring and compensating sleeves for different assembly variants.



Option table

Flange load cell accessory kit

Roller version	Shaft/axle version	for load cell	Non-locating bearing accessory kit	Locating bearing accessory kit
	stepped axle	PD 21 PD 25	1	3
	continuous axle	PD 21 PD 25	2	4
	stepped axle	PD 21/23 PD 25	1	1
	continuous axle	PD 21 PD 25	2	2
	stepped axle	PD 22	5	5
	continuous axle	PD 22	6	6

Flange load cell bearing block

- Bearing block for precision mounting of flange load cells on machine frames.



Option table

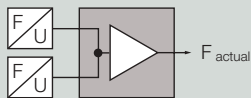
Bearing blocks for flange load cell

Material number	Shaft diameter (mm)												
	12	15	17	20	25	30	35	40	45	50	55	60	65
042594													
042595													
042596													
042597													
042598													

Measuring amplifiers

Measuring amplifier CV 22

- Single-channel measuring amplifier for connecting two load 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 amplification setting
- Internal reference voltage for measuring amplifier calibration without reference weights given exact knowledge of the wrapping angle and mounting position.



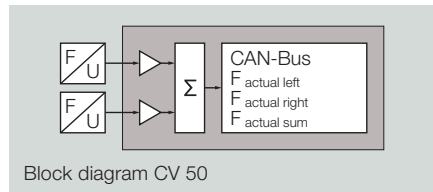
Block diagram CV 22

Technical data Measuring amplifier CV 22	
Precision class	0.1
Amplification 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 0 to +/- 10 V (rise time 5 ms) voltage filtered 0 to +/- 10 V current 0/4 mA to 20 mA
Nominal temperature	0 to 60 °C
Temperature coefficient of the nominal value of the zero signal of the bridge voltage	+/- 3 %/10 K +/- 3 %/10 K +/- 0.04 %/10 K
Operating voltage	24 V DC
nominal value nominal range	20 to 30 V DC
Power input	0.2 A
Bridge supply voltage	10 V DC
nominal value nominal range	9 to 13 V DC
Protection class	IP 00
Top-hat rail mounting to DIN EN50022 With housing	IP 54

Measuring amplifiers

Measuring amplifier CV 50

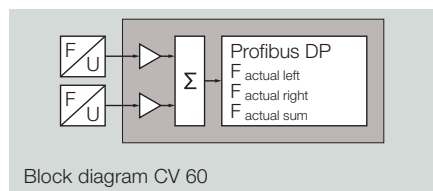
- Digitally operating two-channel measuring amplifier for connection of two load cells with a strain gauge bridge
- High-resolution analogue – digital converter with low temperature drift, high long-term stability and excellent linearity
- Tare adjustment and calibration of the input variable with software module CANMON and command station DO 2001 possible
- Interference-free data transmission even over longer distances via CAN bus connection
- Up to eight measuring systems may be integrated on one network
- Measuring amplifier calibration also possible without reference weight.



Technical data Measuring amplifier CV 50	
Precision class	0.1
Input voltage	2 x 0 to +/- 20 mV resolution 14 bits
Output	CAN bus
Ambient temperature	10 to 50 °C
Scan rate	10 to 200 Hz variable
Bridge supply voltage nominal value	8 V DC
Temperature coefficient of the nominal value	+/- 3 %/10 K
Temperature coefficient of the zero signal	+/- 3 %/10 K
Temperature coefficient of the bridge supply voltage	+/- 0.04 %/10 K
Operating voltage nominal value	24 V DC
Operating voltage nominal range	20 to 30 V DC
Power input	150 mA
Protection class	IP 65
Weight	approx. 0.7 kg
Dimensions (L x W x H)	80 x 120 x 57 mm

Measuring amplifier CV 06

- Digitally operating two-channel measuring amplifier for connection to two load cells with a strain gauge bridge
- Profibus DP connection
- High-resolution analogue – digital converter with low temperature drift, high long-term stability and excellent linearity
- Tare adjustment and calibration of input variable with CANMON software module and command station DO 2001 possible
- Measuring amplifier calibration also possible without reference weight.



Technical data Measuring amplifier CV 60	
Precision class	0.1
Input voltage	2 x 0 to +/- 20 mV resolution 14 bits
Output	CAN bus
Output	Profibus
Connection terminals	terminals
Protocol	Profibus DP slave to EN 50170
Data transfer rate	9.6 – 12 Mbaud
Data content	force – actual value (N) sum/page A/page B
Ambient temperature	10 to 50 °C
Bridge supply voltage nominal value	8 V DC
Temperature coefficient of the nominal value	+/- 3 %/10 K
Temperature coefficient of the zero signal	+/- 3 %/10 K
Temperature coefficient of the bridge supply voltage	+/- 0.04 %/10 K
Operating voltage nominal value	24 V DC
Operating voltage nominal range	20 to 30 V DC
Power input	200 mA
Protection class	IP 65
Weight	approx. 0.7 kg
Dimensions (L x W x H)	80 x 120 x 57 mm

Digital displays for web tension measuring

Digital display PA 0703

Digital display for indicating the current web tension in bright, 3 1/2-place LED – digits. The display, in assembly kit form, is available with 115/230 V AC and 24 V DC connection voltages.



Technical data Digital display PA 0703	
Operating voltage	115/230 V, 50/60 Hz
Nominal value	1 VA
Power	
Nominal value	24 V DC
Power input	50 mA
Measuring inputs	0 to 10 V
Input resistance	approx. 500 kohms
Display	3 1/2-places, 7-segment
Digit height	13,5 mm
Resolution	+/- 1999
Measuring rate	approx. 3 s
Overflow display	only the "1" of first place lights up
Precision	0.1 %
Nominal temperature range	0 to 50 °C
Protection class (when built-in)	IP 50
Dimensions	
Front frame	96x48 mm
Mounting opening	92x45 mm
Mounting depth	72.5 mm
Weight	approx. 160 g

Digital display PA 1401

Digital display for indicating the current web tension in bright, 3 1/2-place LED – digits. The compact, space-saving mounting kit is available with 24 V DC connection voltage.



Technical data Digital display PA 1401	
Operating voltage	24 V DC
Nominal value	150 mA
Power input	
Measuring inputs	0 to 10 V 0 to 20 mA 4 to 20 mA
Display	3 1/2-places, 7-segment
Digit height	14 mm
Resolution	+/- 1999
Measuring rate	approx. 3 s
Overflow display	only the "1" of first place lights up
Precision	0.2 %
Nominal temperature range	0 to 50 °C
Protection class (when built-in)	IP 54
Dimensions	
front frame	96 x 24 mm
mounting opening	92 x 22.2 mm
mounting depth	75 mm
Weight	approx. 110 g

Web tension controllers

Web tension controller DC 60/61

The microprocessor-controlled web tension controller features various software packages for triggering different actuators such as:

- Electrical drives for unwinders and rewinders
- Electrical drives for transport drives
- Electrical and pneumatic brakes for unwinders
- Mechanical variable and super-imposed gear drives for transport drives

Up to 7 variable material-specific parameter records assure maximum flexibility. The CAN bus connection reliably establishes interference-free data transmission and considerably reduces wiring outlay. The measuring amplifier for evaluating the web tension actual value signals is already integrated.



Implementation area

The DC 60/61 is universally suitable for all web tension control tasks regardless of whether it is in the paper, film or textile industrial sectors.

Option table
Web tension controller DC 6

Type	Controller type Universal	Controller type Transport	19" rack	With housing	With operator panel	Without operator panel
DC 6000						
DC 6001						
DC 6011						
DC 6100						
DC 6101						
DC 6111						

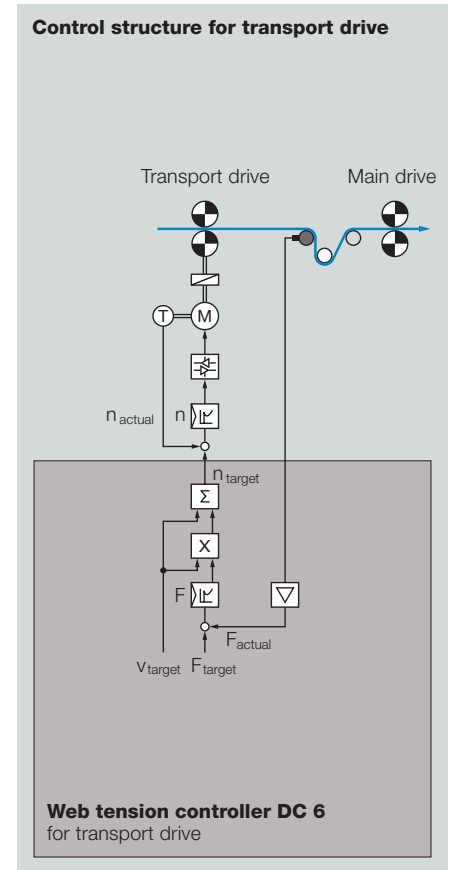
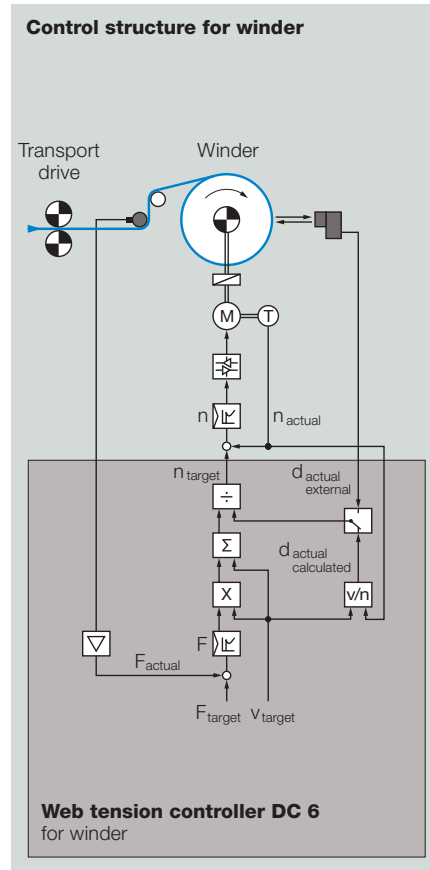
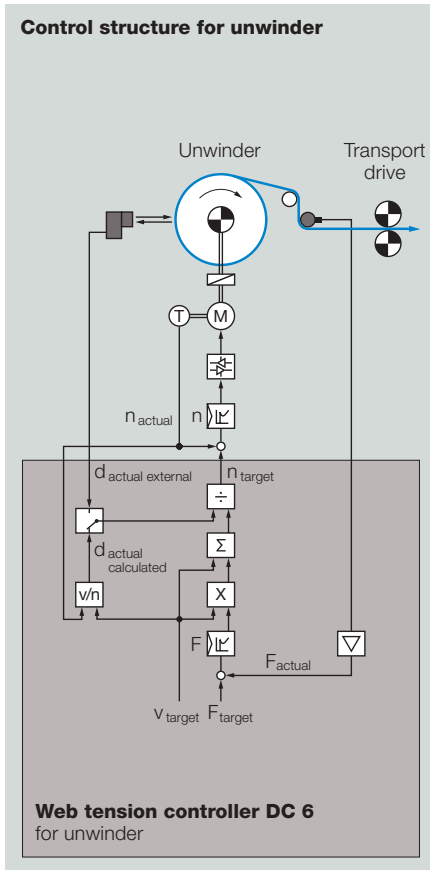
The DC 60 universal controller comprises all control structures. On the other hand, DC 61 only features the control structure for transport drives.

Technical data

Web tension controller DC 6

Operating voltage nominal value nominal range	24 V DC 20 to 30 V DC
Power input (without digital output)	0.2 A DC
Nominal temperature range	0 to 50 °C
Cycle time	10 ms
Digital inputs Power input	7 x potential-free max. 10 mA
Analogue inputs Resolution Input voltage Input current (on request)	3 x potential-free 12 bits 0 to +/- 10 V DC 0 (4) to 20 mA DC
Digital outputs Output voltage Output current	7 x potential-free 24 V DC max. 500 mA DC short circuit-proof
Analogue outputs Positioning signal output - Resolution - Output voltage - Output current (on request)	2 x 12 bits 0 to +/- 10 V DC, 5 mA DC 0 (4) to 20 mA
Monitor output - Resolution - Output voltage	act. diameter/web tension act. value 8 bits 0 to +/- 10 V / 5 mA
Serial interface (CAN bus) level transmission rate	5 V 250 kbaud
Dimensions 19" insert rack (W x H x D) with housing for field mounting (W x H x D)	28 TE, 3 HE, 160 mm 300 x 150 x 80 mm
Protection class 19" insert rack with housing for field mounting	IP 00 IP 65
Measuring amplifier Resolution Input voltage Input resistance Amplification Zero calibration Temperature coefficient	+/- 15 bits 0 to +/- 20 mV DC 10 GΩ via software calibration +/- 100% (software calibration) 0.5% / 10 °K
Bridge supply voltage nominal value nominal range	+ 10 V DC + 6.5 V to + 12 V

Web tension controller



Function of unwinder and rewinder

Two load cells measure the web tension actual value of the moving web. This is compared to the web tension target value and transferred as controlling difference to the PID controller. The PID controller forms the speed correction signal $\pm \Delta$ which is added to the web speed signal v web target. The v web target corresponds to the v web target of the main drive. For unwinders and rewinders the superimposed speed target value is divided by the actual batch diameter. The result is a superimposed speed target value for the speed-controlled unwinder and rewinder.

Special features

- Diameter calculator or connection for diameter sensor
- Speed target value for unwinder and rewinder
- Winder characteristic $F = f(D)$ freely selectable.

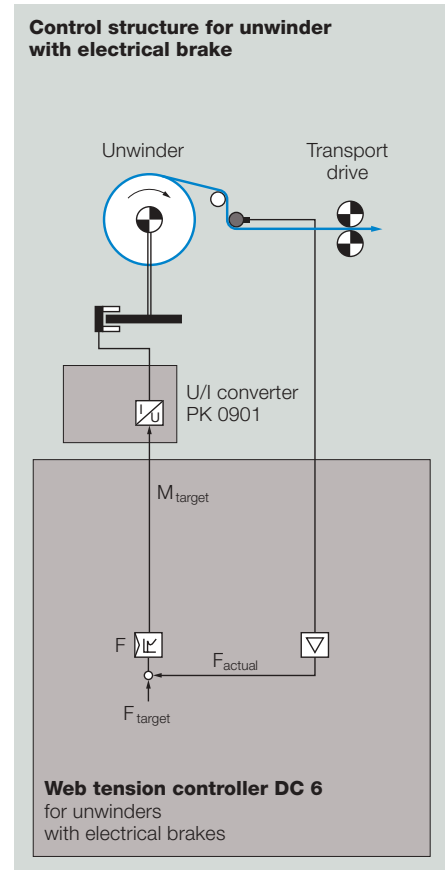
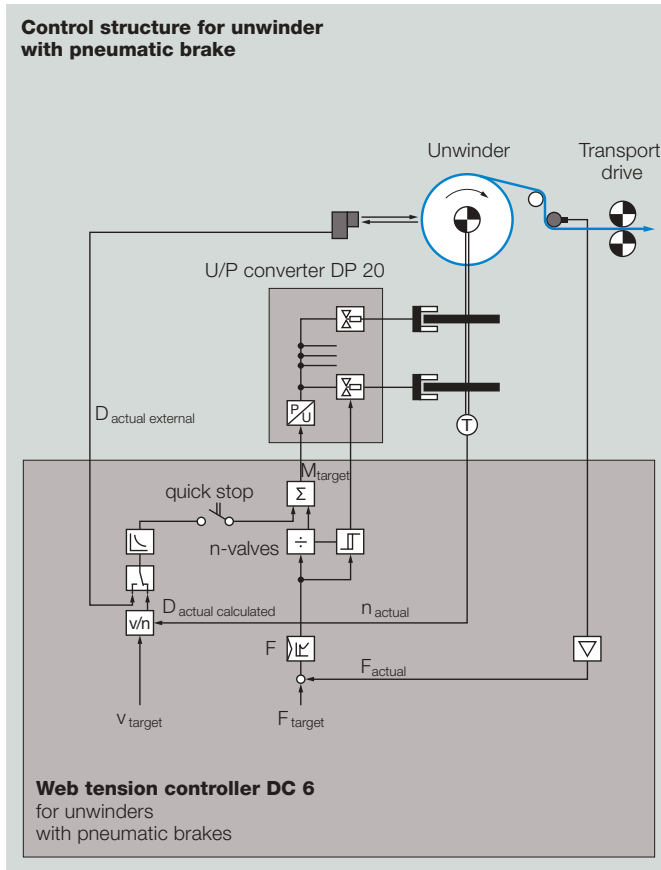
Function of transport drive

Two load cells measure the web tension actual value of the moving web. This is compared to the web tension target value and transferred as controlling difference to the PID controller. The PID controller forms the speed correction signal $\pm \Delta$ which is added to the web speed signal v web target. This signal is transferred to the next drive.

Special features

- Speed target value for transport drive.

Web tension controller



Function of unwinder with pneumatic brake

Two load cells measure the web tension actual value of the moving web. This is compared to the web tension target value and transferred as a controlling difference to the PID controller. The PID controller forms the positioning signal for the follow-up U/P converter. The converter supplies a proportional positioning signal for triggering a pneumatic brake at the output.

Special features

- Diameter calculator or connection for diameter sensor
- Mass inertia compensation for quick stop
- Brake caliper rotation
- Moment target value for unwinders.

Function of unwinder with electrical brake

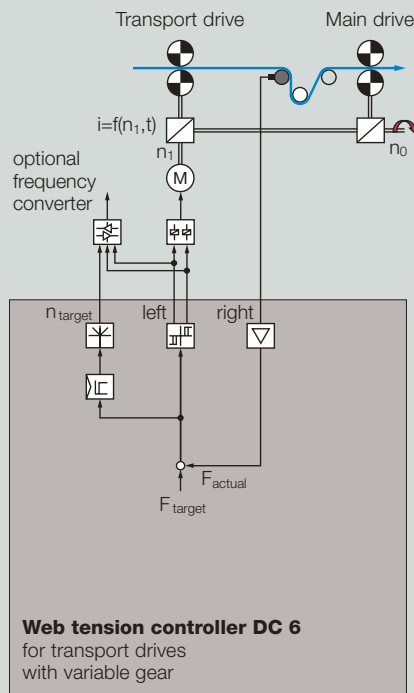
Two load cells measure the web tension actual value of the moving web. This is compared to the web tension target value and transferred as a controlling difference to the PID controller. The PID controller forms the positioning signal for the follow-up U/I converter. The converter supplies a proportional positioning signal for triggering an electrical brake at the output.

Special features

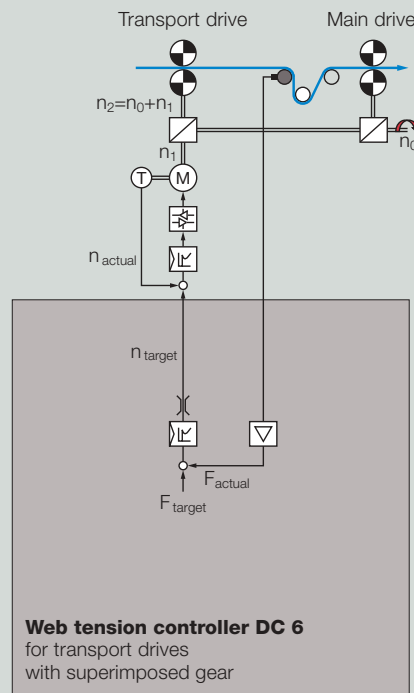
- Moment target value for unwinders.

Web tension controller

Control structure for transport drive with variable gear



Control structure for transport drive with superimposed gear



Function of transport drive with variable gear

Two load cells measure the web tension actual value of the moving web. This is compared to the web tension target value and transferred as a control difference to the three-position controller.

Besides the analogue speed target value two binary outputs for right and left running are available as positioning signals. The two binary outputs are used for contactor controls.

Special features:

- Three-position controller with variable window width and hysteresis
- Optionally with analogue speed target value for frequency converters.

Function of transport drive with superimposed gear

Two load cells measure the web tension actual value of the moving web. This is compared to the web tension target value and transferred as a control difference to the web tension controller.

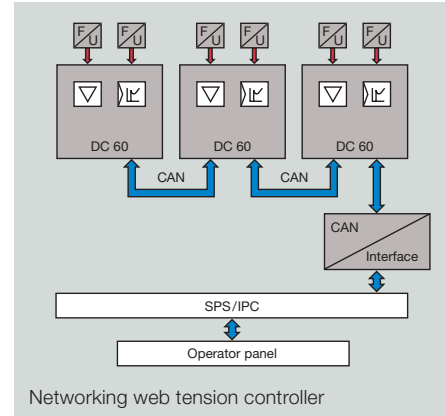
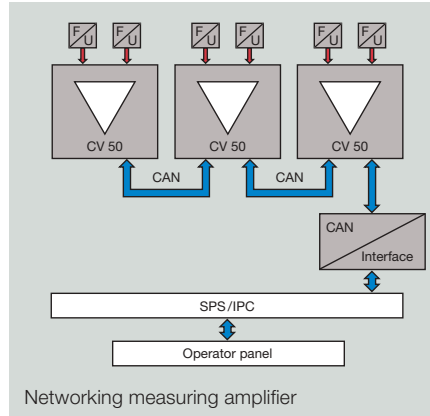
Option table Actuators for web tension controlling applications							
Type	Pneumatic brake	Electric brake	DC-drive	AC-drive with f.c.	Servo-drive	Superimposed gear	Variable gear
Unwinder							
Transport unit							
Rewinder							

Networking

CAN bus

All function modules of the Digital-Control-System DCS feature a CAN bus interface and are networked to each other through it. This assures not only flexible adjustment of the E+L control system to new tasks but also assures a high level of security against interference and a minimum wiring outlay.

A controller group may contain up to 16 parties such as sensors, controllers, interfaces or command stations. Up to eight controller groups may be implemented in a common CAN network up to a length of 160 m. A CAN extension is available for lengths of 160 m upwards. It is simply inserted between two CAN networks.



CAN extension
DI 0010



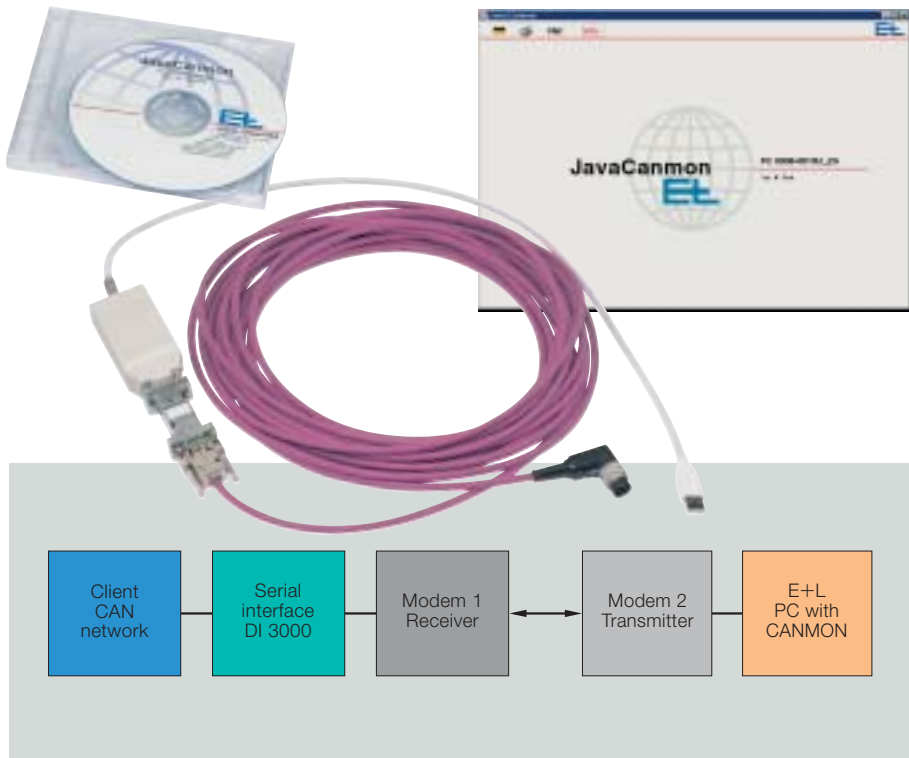
CANMON

Convenient diagnosis

Sophisticated systems require a simple, clearly arranged view of the entire network. The CANMON software tool displays the CAN network in a structured form and at the same time comprises a user-friendly editor for setting all control parameters. Furthermore CANMON enables both the saving and printing out of the entire CAN network.

Worldwide teleservice

A decisive benefit of CANMON is its international suitability for implementation as a service tool. Erhardt+Leimer thus offers an innovative tele-service for commissioning, error diagnosis, malfunction elimination, maintenance and repair of all E+L control systems. This worldwide direct access to machine processes via modem permits long-term cost reduction and minimum response times.



Operator panels

Command station DO 60

The distinctive user interface comprises all functions for operating a web tension controller. The target and actual value of the web tension is indicated on a five-place, 2-line digital display. The standardized CAN bus assures reliable data transmission between the controller and command station.

Multiple command station DO 002

Up to six web tension controllers may be connected to the multiple command station. The user may select various controllers via function buttons, display all parameters and change them as required. Communication with the web tension controllers is via a standardized CAN bus. The five-place 2 line display indicates the target and, underneath, the current actual value of the web tension as standard.



Option table User interface DO				
Type	Web tension contr. command station	Multiple command station	Mounting kit	With housing
DO 6000				
DO 6001				
DO 0020				
DO 0021				

Technical data User interface DO	
Operating voltage	24 V DC
Nominal value	20 to 30 V DC
Power input	0.2 A DC
Nominal temperature range	0 to 50 °C
Serial interface (CAN bus) level	5 V
transmission rate	250 kbaud
Dimensions	
Mounting kit	
front frame	152 x 138.4 mm
mounting opening	121 x 111.5
mounting depth	120 mm
housing for field mounting (W x H x D)	180 x 200 x 95
Protection class	
mounting kit	IP 54 (when built-in)
with housing for field mounting	IP 54

Interfaces

Interfaces DI

Modern processing plants feature a central command station or control console. In this case the web tension systems must be linked to different bus systems or to a PLC/IPC. Here, E+L offers a highly diverse range of interfaces with standard protocols. Each interface comprises a CAN connection with the appropriate bus drive module.



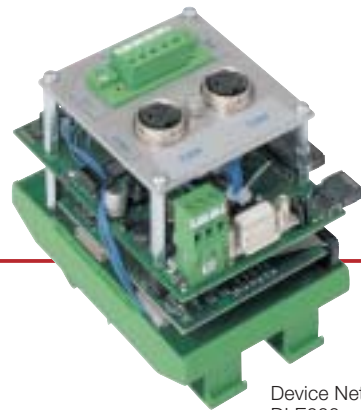
Interbus-S
DI 4000



Control Net
DI D000



Profibus
DI B000



Device Net
DI E000

**Option table
Interface DI**

Type	Interface type	PC/IPC	Siemens PLC	Allen Bready PLC
DI 4000	Interbus-S			
DI B000	Profibus DP			
DI D000	Control Net			
DI E000	Device Net			

**Technical data
Interface DI**

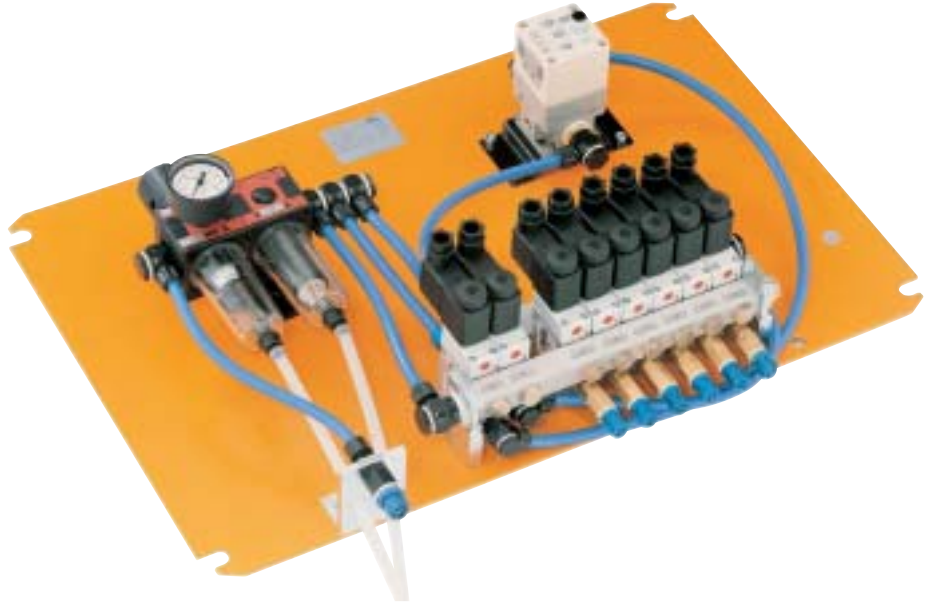
Operating voltage nominal value	24 V DC
Operating voltage nominal range	20 to 30 V DC
Power input	0.2 A DC
Nominal temperature range	0 to 50 °C
Serial interface (CAN bus) level	5 V
Serial interface (CAN bus) transmission rate	250 kbaud
Dimensions (W x H x D)	75 x 111 x 130 mm
Top-hat rail mounting	to EN 50022
Protection class	IP 00

Electro-pneumatic converter

Pneumatic unit DP 2000

On web tension controllers with pneumatic brakes the DP 2000 pneumatic unit is implemented between the web tension controller and brake. Depending on the version, one, two, four or six brake calipers are triggered. In the interests of safety the unit is equipped with a double filter system.

The pneumatic unit is modularly designed and as such may be easily extended in many respects. Operation is direct, via an on-site control or E+L command station.



Terminal box SZ 2040



Operating panel RE 6010 for air supply ON-OFF



Operating panel RE 6030 for air supply ON-OFF and manual braking torque setting

Option table Pneumatic unit DP

Type	No. of brake valves	Pressure control valve for emerg. off	Size assembly plate (mm)	Size housing (mm)
DP 2010	1	Without	334x355x150	380x380x210
DP 2020	2	Without	334x355x150	380x380x210
DP 2040	4	Without	334x355x150	380x380x210
DP 2060	6	Without	549x355x150	600x380x210
DP 2011	1	With	334x355x150	380x380x210
DP 2021	2	With	334x355x150	380x380x210
DP 2041	4	With	334x355x150	380x380x210
DP 2061	6	With	549x355x150	600x380x210

Technical data Pneumatic unit DP

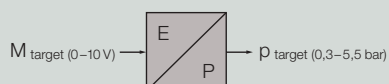
U/P converter operating voltage	15 V DC
Valve operating voltage	24 V DC
Power input per valve	2.5 W
Input voltage	0 to 10 V DC
Operating pressure	6 to 10 bar (oil-free)
Output pressure	0.3 to 5.5 bar
Output pressure for emergency-off	5.5 bar
Ambient temperature	0 to 50 °C
Protection class	IP 54

Terminal box SZ 2040

Housing dimensions (W x H x D)	200 x 150 x 80 mm
Protection class	IP 54

Operating panel RE 6010/30

Display instrument braking torque	0 to 100 %
precision class	2.5
input voltage	0 to 10 V DC
Housing dimensions (W x H x D)	150 x 150 x 80 mm
Protection class	IP 54



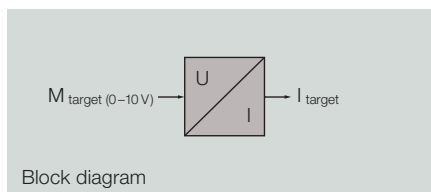
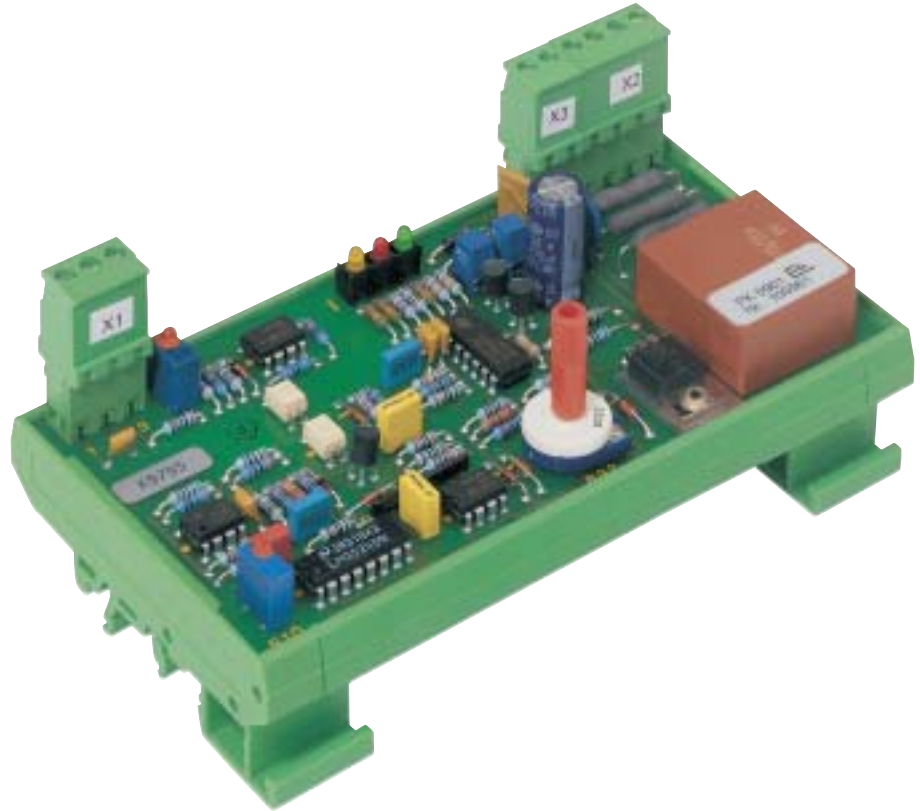
Block diagram

Power output element for electrical brakes

Power output element PK 0901

The power output element converts the web tension controller positioning signal of 0 V to 10 V into an exciting current. All electrical brake versions may hereby be controlled up to 1.6 A. Brakes and braking behaviour may be set via the variable current and voltage characteristic curve.

- Easy mounting on EN 50022 support rails
- Variable transmission characteristic value (I-out/U-in) of 0.08A/V to 0.16A/V
- Low temperature drift
- Diagnosis outputs for output short circuit, overload and open power output
- Electrical isolation of input voltage and output current via optocouplers.



Technical data

Power output element PK 09

Operating voltage primary	15 V DC
Power input primary	50 mA
Operating voltage secondary	24 V DC
Power input secondary	2 A
Input voltage	0 to 10 V DC
Output current max.	1.6 A
Linearity	1 %
Temperature drift	+/- 0,5 %/10K
Nominal temperature range	0 to + 50 ° C
Dimensions (L x W x H)	136 x 80 x 55 mm
Top-hat rail mounting	to EN 50022
Protection class	IP 00

Legend for page 29

F _{max.}	= Web tension max.	(N)
F _{min.}	= Web tension min.	(N)
r _{max.}	= Radius max.	(m)
r _{min.}	= Radius min.	(m)
M _{max.}	= Braking torque max.	(Nm)
M _{min.}	= Braking torque min.	(Nm)
v _{max.}	= Web speed max.	(m/min.)
v _{min.}	= Web speed min.	(m/min.)
n _{max.}	= Speed max.	(1/min.)
n _{min.}	= Speed min.	(1/min.)
n ₁	= Speed output shaft	(1/min.)
n ₂	= Speed brake	(1/min.)
D _{max.}	= Reel diameter max.	(m)
D _{min.}	= Reel diameter min.	(m)
i	= Transformation ratio	
P	= Power loss	(W)

Magnetic particle brakes

Function

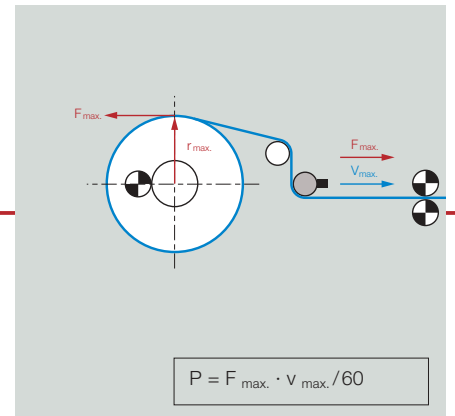
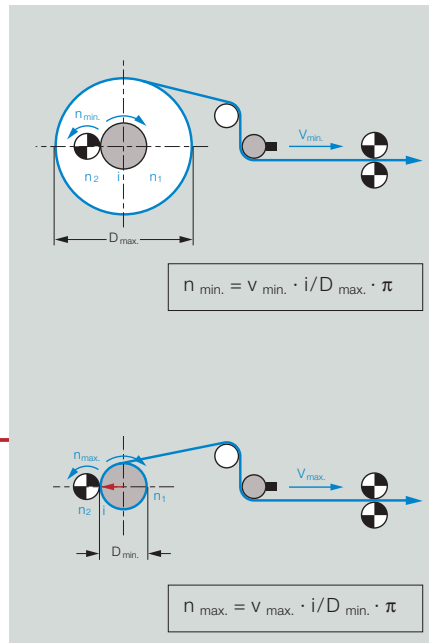
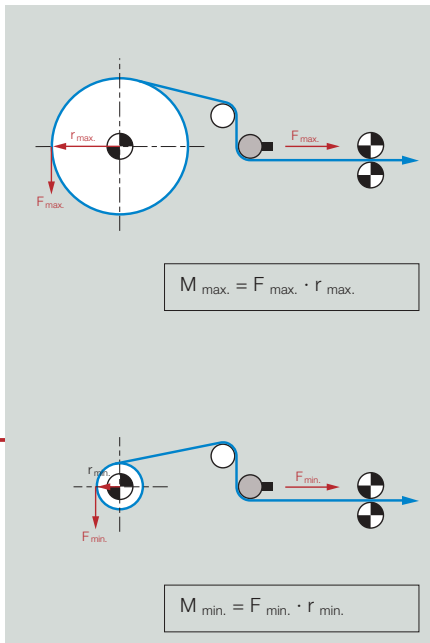
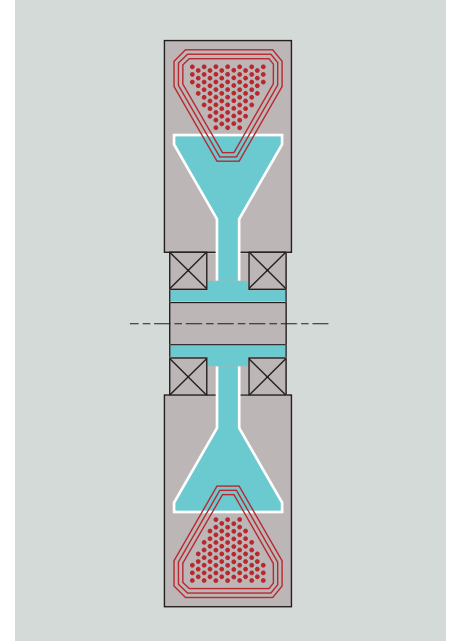
The magnetic particle brake consists of a stator and rotor. The ring coil integrated in the stator produces a magnetic field which influences the magnetisable powder in the air gap proportionally to the exciting current. The different viscosity of the powder thus causes a changeable braking torque.

Implementation area

Magnetic particle brakes are predominantly implemented in processing plants on unwinders with a maximum braking torque of up to 250 Nm.

Application

E+L magnetic particle brakes are designed for mounting on horizontally running shafts.



Braking torque calculation

When designing the magnetic particle brake it should be taken into account that the required braking torque lies within the characteristic curve. Each brake features a minimum and maximum braking torque.

- The maximum braking torque is determined by the saturation of the magnetic powder in the magnetic field generated.
- The minimum braking torque is limited by the residual torque caused by mechanical friction without the magnetic field.

Speed calculation

The rotational speed of the rotor has the physical effect of distributing the magnetic powder in the operating area. If the rotational speed is very low, distribution of the magnetic powder and thus the braking torque created will no longer be achieved. It should therefore be assured that even given minimum web speed and a maximum reel diameter, the lower magnetic particle brake speed does not fail to be attained. The speed may possibly be increased by an interposed gearing. The maximum speed is limited by the power loss and dynamic alignment of the magnetic powder in rotation.

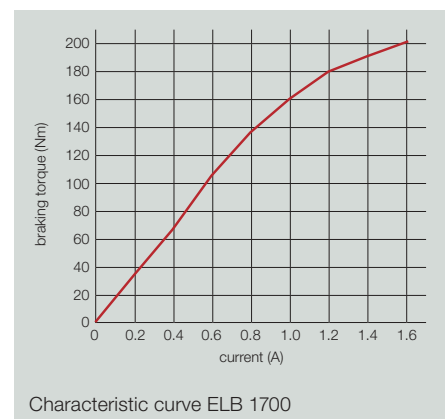
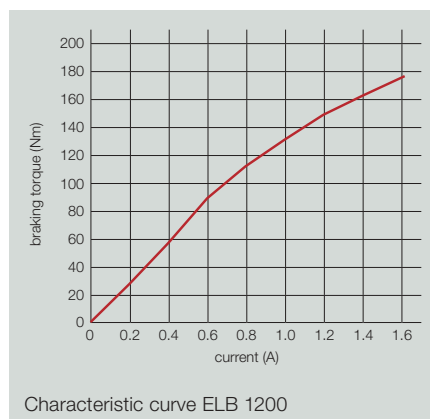
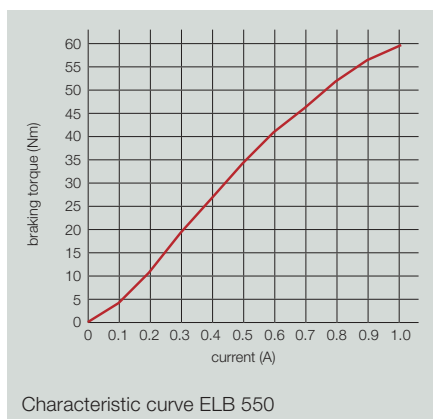
Power loss calculation

Through the generation of a braking torque mechanical energy is converted into thermal energy. This must be discharged into the environment. The specified power losses are different for each brake and must not be exceeded. Power loss may be considerably increased by an additional fan.

Magnetic particle brakes

ELB magnetic particle brake

- Magnetic particle brakes operate soundlessly without dust development and are designed for a long service life
- They assure precision controlling of the braking torque independently of the speed
- High brake torque controlling range of approx. 1 : 50.



Option table
Magnetic particle brakes ELB

Type	With fan	Fan operating voltage (V) AC	Braking torque max. (Nm)	Braking torque min. (Nm)	Speed min. (r/min.)	Speed max. (r/min.)	Operating voltage (V)	Power input (A)	Coil resistance (Ω)	Power loss (W)	Weight (kg)
ELB 0550			55	0,4	50	3000	24	1	16.5	180	6.5
ELB 1200			120	0,6	50	3000	24	1.8	11	400	18
ELB 1700			170	0,7	50	3000	24	1.6	11	500	24
ELB 0550 F		230	55	0,4	50	3000	24	1	16.5	720	8.8
ELB 1200 F		230	120	0,6	50	3000	24	1.8	11	1600	24
ELB 1700 F		230	170	0,7	50	3000	24	1.6	11	2000	28

Service from A to Z

Planning based on sound experience

The planning team at our headquarters in Augsburg will develop a customized solution for you even for the toughest jobs. With the experience gained from a diverse range of installations all over the world, our specialists do not handle web guiding and web tension controlling tasks in isolation but look at them as part of the overall process.

Fully rounded solutions

Erhardt+Leimer supplies all components: if required, systems are supplied complete with electric drives and programmable controllers, the controller is installed in the control cabinet. Our experts on programmable controllers and drive engineering will be happy to adapt your new system

to individual on-site conditions once it has been installed.

Worldwide service

Once we have installed your system, we do not see our job as being finished. For, at E+L, intensive after sales service comes as standard. Our extensive worldwide service network uses the latest diagnostic systems, e.g. teleservice or modem-controlled remote diagnosis. Be it assembly work or commissioning, repairs or maintenance – a phone call suffices for us to cater to your needs.

Training for any application

To make sure you get the most out of your new E+L system, even on complex applications, we offer machine manufacturers and users of our products a "self help" course. One or several day courses for assembly and service engineers may be held whenever you wish at our headquarters in Augsburg or in your company.

At your service – right from the start

The first step towards your new digital web tension system is a thorough analysis by your personal E+L consultant. As he is a specialist for the entire product range of Erhardt+Leimer, he will be pleased to advise you also on other questions relating to your production.

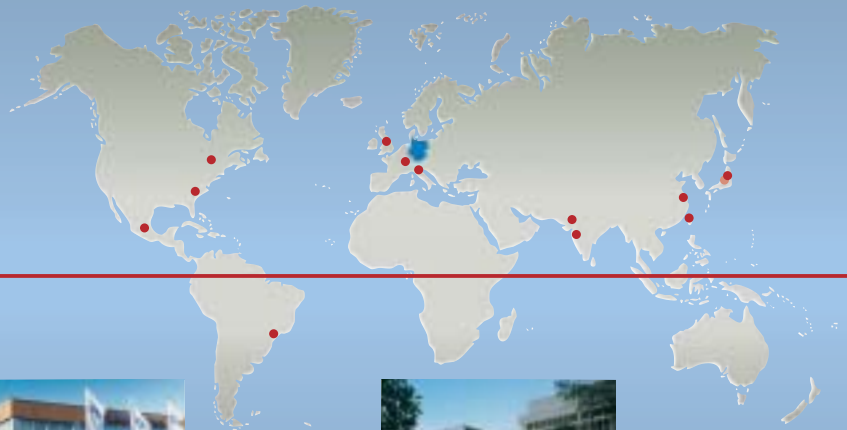


Erhardt+Leimer GmbH
 Postfach 1015 40
 D-86136 Augsburg
 Telephone +49 (8 21) 24 35-0
 Telefax +49 (8 21) 24 35-666
 Internet <http://www.erhardt-leimer.com>
 E-mail info@erhardt-leimer.com



Head office
 E+L
 Augsburg
 Germany

**Erhardt+Leimer
 worldwide presence**



E+L
 Duncan, S.C.
 USA



Duncan
 Technologies
 Duncan, S.C.
 USA



E+L
 Burlington
 Canada



E+L
 Mexico D.F.
 Mexico



E+L
 Guarulhos-São Paulo
 Brazil



E+L
 Bielefeld
 Germany



E+L
 Ahmedabad
 India



E+L
 Bradford
 Great Britain



E+L
 Komatsu
 Japan



E+L
 Mulhouse
 France



E+L
 Tao Yuan
 Taiwan



E+L
 Stezzano
 Italy



E+L
 Shanghai
 China