

ABB MEASUREMENT & ANALYTICS

Strip Tension Systems

Pressductor® PillowBlock load cells



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PillowBlock

Quality tension measurement for quality tension control

— 01 Pressductor PillowBlock load cells

— 02–03 There is a ABB Pillow Block load cell suitable for every strip process

— 04 Pressductor Technology: Mechanical force alters magnetic field

Introduction

ABB's Pressductor PillowBlock load cells are sensitive and accurate yet rugged, reliable and compact. The performance of the Pressductor PillowBlock load cells is unsurpassed for rolling mills and process lines characterized by heavy rolls, high speeds and severe conditions – in some instances they are the only viable option. They can withstand high overloads and vibrations, and operate over a wide range of tensions.

The well-proven Pressductor load cells combined with the tension electronics, offer an easy-to-use strip tension measurement system with superior long term performance leading to higher productivity and product quality and higher profit for the strip producer.

Reliable Tension Measurement

- from sheet to foil
- from hot to cold

Increased process uptime

In a strip process running continuously, every minute of production time is precious. Even so, no production line runs without downtime. With Pressductor PillowBlock load cells the risk of strip breaks can be reduced to a minimum, thus leaving as much time as possible for real production.

Thanks to a strong and stable signal deriving from the PillowBlock load cells, the upcoming strip breaks are kept to an absolute minimum level.

Tighter product tolerances

The ability to produce strip to tighter tolerances minimizes the costs associated with non-conforming strip. It also increases the strip producer's accessible market to include products with tighter tolerance requirements.

Minimize maintenance

Share the experience, of virtually maintenance-free load cells, with thousands of other PillowBlock users. A robust load cell design with no fragile or ageing components makes this possible. Thanks to its robust design, the PillowBlock load cells work consistently for many years without any need for maintenance, also in the toughest rolling mills and process lines.



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02—
03

Fast access to support and service

ABB provides customers with superior distinctive After Sales Service that really differentiates from the competition. You obtain advanced solutions to problems, service and professional consultation through our After Sales Service program. Expert engineers with extensive experience of all types of Force Measurement products are available to assist you through our world-wide network.

There is a ABB PillowBlock load cell suitable for every strip process

The PillowBlock load cells are designed for reliable and longterm stable strip tension measurement in processes like hot rolling, cold rolling, pickling, annealing and galvanizing lines.

The Pressductor based load cells have for more than 50 years proven their superior performance in a large number of demanding applications.

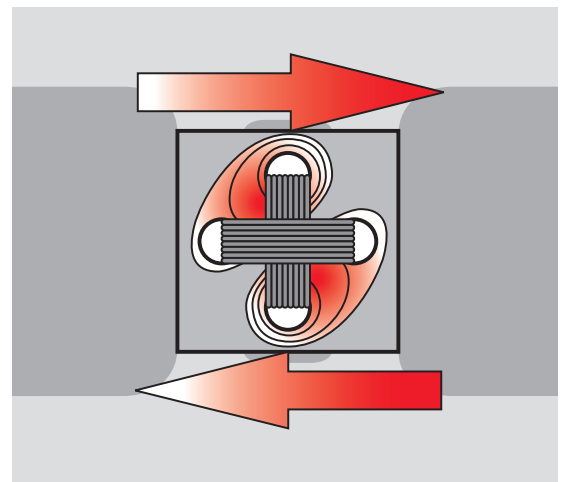
The Pressductor difference

Like ABB's other load cells based on Pressductor Technology, PillowBlock Load Cells rely on electromagnetic changes in the transducer, not on physical movement, to sense fluctuations in strip tension. The Pressductor Technology operating principle provides exceptional improvements in load cell performance characteristics, including reliability (notably absence of drift), durability, repeatability, and wider measurement range.

Machined from a solid block of steel, the load cells are rugged and stiff, affording high overload protection as well as an extended measurement range above the nominal load. And they do not contribute to machine vibration, even at high speeds.

Since the transducer action – the magnetic flux – takes place inside a steel core, environmental factors like dirt or fluids can't degrade performance and reliability. These stainless steel load cells don't require any physical seals.

Furthermore, low transducer impedance – less than a couple of ohms – helps eliminate susceptibility to radio-frequency and electromagnetic interference.

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Performance for any application in any environment

Designers appreciate...

- Remarkably high spring constant
- Wide measurement range
- High reliability
- Performance for any application in any environment

Operators value a load cell with...

- No drift
- No recalibration
- No failures
- High reliability

Measurement essentials

Keeping the tension constant in strip processes is essential for high product quality and productivity. Continuously measuring the tension is an obvious prerequisite for tension control. Drives and operator instruments need quick and accurate input to regulate tension levels and monitor machine performance.

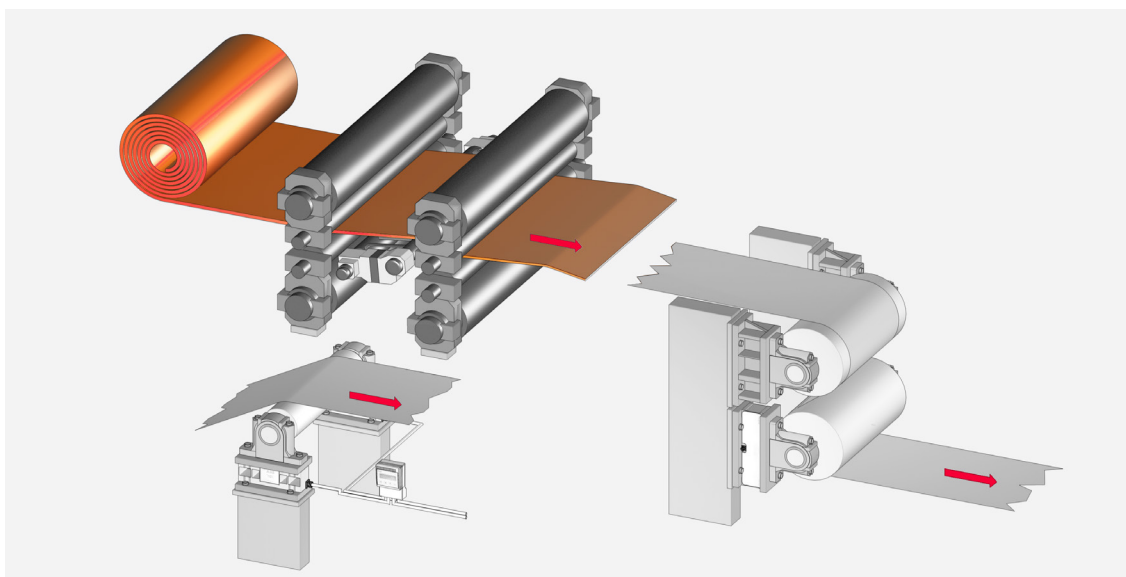
Most strip processing customers put a premium on long-term reliability, in addition to accuracy and overall performance. The measurement system, after all, is the front line of machine control, exposed to all the rigors of the operating environment. The costs associated with downtime and poor product bring out the true value of its components.

Quality measurement technology for superior tension control that will keep your processing lines productive and producing top-notch output... that's what you can expect from us. We are entirely devoted to providing process measurement systems and services, and we have 60 years of experience in the field. We are the experts in web and strip tension as well as force measurement for virtually any purpose.

Selecting and sizing load cells

The two types of ABB PillowBlock load cells are designed for either conventional vertical force measurement or for sensing the horizontal force component that may arise as the processed material partially wraps around a measurement roll.

Using the horizontal load cells can be quite advantageous. By design, they can be made exceptionally sturdy, rugged, and stiff. So, requirements for recalibration, other maintenance, or replacement are negligible, and they do not contribute to machine vibration. Since they don't measure the tare weight, but just the horizontal force component of the strip tension, they can be sized smaller than otherwise possible, measuring tension with greater accuracy.



Extended-Range Operation

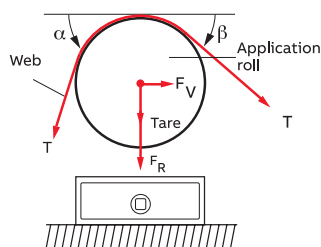
An extended range of measurement beyond the nominal load allows the PillowBlock to be sized for normal, as opposed to maximum tension levels. As a result, they permit greater application flexibility in the strip processing line.

Application requirements may dictate the selection of a vertical load cell. But whenever an adequate horizontal force component is present (or can be developed), the horizontal load cell should be considered.

The size, or nominal load, of a load cell is contingent on the anticipated force it will measure. When a vertical load cell is mounted horizontally (the most common arrangement), the measurement force (F_R) is a function of the tension in the strip (T), the deflection angles (α and β), and the tare weight of the roll and bearings ($Tare$).

The horizontal load cell senses the strip tension's (T) horizontal component (F_R); not the vertical force (F_V).

In this scenario, the measurement force (F_R) is a function of only the tension in the strip (T) and the strip angles (α and β). Since the tare force – the weight of the deflector roll and bearings – will not be measured, it can be very large compared to the strip tension without affecting the accuracy of the tension measurement.



Vertical measuring load cells

$$F_{Rtot} = F_R + Tare = T(\sin\alpha + \sin\beta) + Tare$$

$$F_{Vtot} = F_V + Tare = T(\cos\beta - \cos\alpha) + Tare$$

F_R	=	Force component of Tension in the measuring direction
F_{Rtot}	=	Total force in the measuring direction
F_V	=	Force component of Tension transverse to the measuring direction
F_{Vtot}	=	Total force in the transverse direction
T	=	Tension in web
$Tare$	=	Weight of roll and bearings
α, β	=	Deflection angles

Specifying the load cell

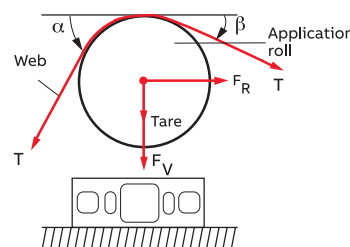
Since load cells are typically used at both ends of a roll, rating the individual cell is usually based on half of the resultant force. The ideal load cell size is usually the smallest nominal capacity rating accommodating that force level, so long as the force exceeds 10 percent of the nominal load. Before choosing a larger size, however, consider using the “extended range” feature of ABB load cells. And always verify that overload specifications will not be exceeded in any direction.

Application Hint

Two “10 percent” application guidelines are useful in selecting load cell sizes:

1. The proportion of strip tension that is actually sensed by the load cell should be at least 10 percent of total strip tension. For operational conditions producing values below 10 percent, consult ABB.

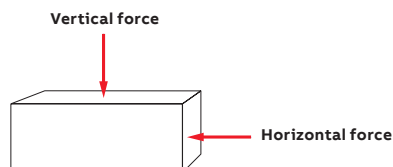
2. During normal operation, the sensed force should not be less than 10 percent of the load cell's capacity.



Horizontal measuring load cells

$$F_{Rtot} = F_R = T(\cos\beta - \cos\alpha)$$

$$F_{Vtot} = F_V + Tare = T(\sin\beta + \sin\alpha) + Tare$$



Furnace section

Design solutions

—
01 Conventional design ABB PillowBlock load cells, type PFTL 201C-20kN, installed in a CAL furnace section, with 90 degree wrap angle.

—
02 Linear bearing design ABB Pillow-Block load cells, type PFCL 201C-20kN, installed in a CAPL furnace section, with 180 degree wrap angle.

Installations in furnace sections

Furnace sections in process lines are very demanding and it is crucial to control strip tension in a correct and accurate way.

The strip tension range is often large; the temperature in the furnace can reach 1000 °C and at the load cell position it can be as high as 90 °C. The elongation of the deflector rolls, from furnace start to process temperature, can be as large as 50 mm. In order to accommodate the large elongation, with a minimum of influence on measurement performance, the deflector roll installation has to be designed with care.

In order to keep up with the competition many mills are continuously working on improvements of the strip quality towards the end-users. To guarantee a high constant strip quality as well as eliminating the risk of strip breaks the mills want accurate control of strip tension in furnace sections. A prerequisite is then reliable strip tension measurement, independent of furnace temperature changes.

ABB offers following design solutions:

- Conventional design
 - With ABB standard load cells:

This solution is recommended when there are low axial expansion forces. The ABB standard load cell have proven outstanding dependability in a number of furnace sections in galvanizing and annealing lines around the world.
- Linear bearing design
 - With ABB standard load cells:

This solution is recommended when high axial forces can occur. In order to eliminate these axial forces ABB has a proven solution with a linear bearing unit on the floating bearing side of the roll.

Following benefits can potentially be achieved when using the ABB solution with linear bearing in furnace installations:

- The combination of ABB Large PillowBlock load cells and Linear Bearing is proven to be very reliable with long-term stable tension measurement.
- The Linear Bearing solution is insensitive to and unaffected by temperature variations.
- The ABB load cells are virtually maintenance-free and the Linear Bearings require a minimum of service.

ABB recommends considering the following issues in order to achieve best possible measurement performance in the furnace sections:

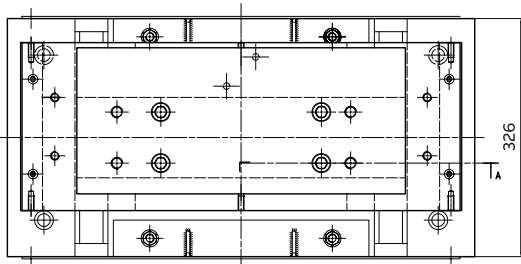
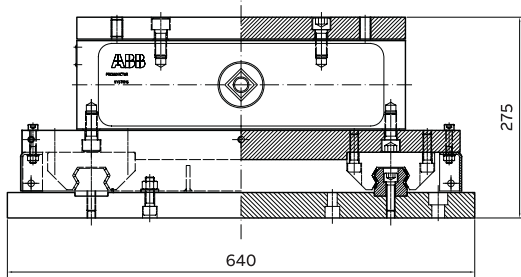
- Protection bellows around deflector roll shafts between furnace and bearing housings must be flexible to avoid axial forces caused by thermal expansions
- In order to reduce the load cell temperature variations, heat radiation shields may be fitted between load cells and furnace
- Deflector roll elongation must be accommodated by the free side bearing. The measurement influence can be minimized in two ways.
 1. Clearance between roll bearings and bearing housings on the free side bearing, as well as lubrication must be designed for actual operating conditions.
 2. ABB's proven solution with linear bearing on the free side of the roll can be utilized to accommodate the roll elongation.

ABB is working very close with the customer and together we always find the best solution. Thanks to the fact that standard load cells are used, the same type of load cells can be fitted both in the hot and cold sections of galvanizing and/or annealing lines. Another advantage is that the standard pedestal bearing houses can be used.

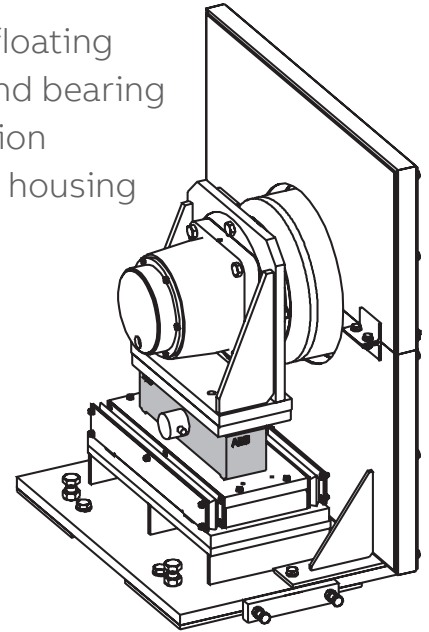
Consult ABB for advice how to design an optimal load cell installation in your furnace section.

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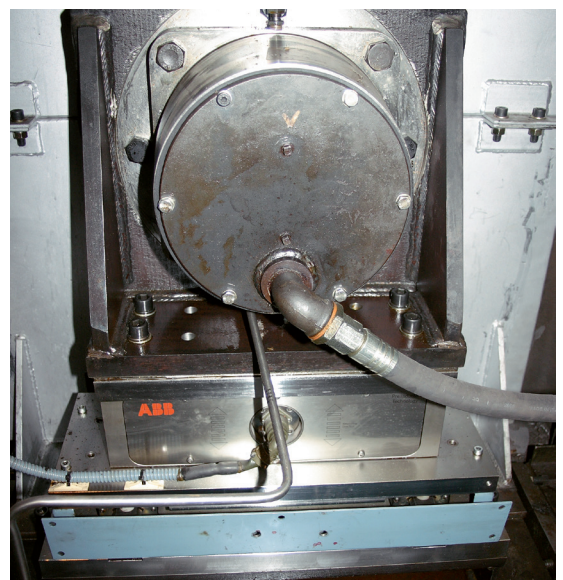
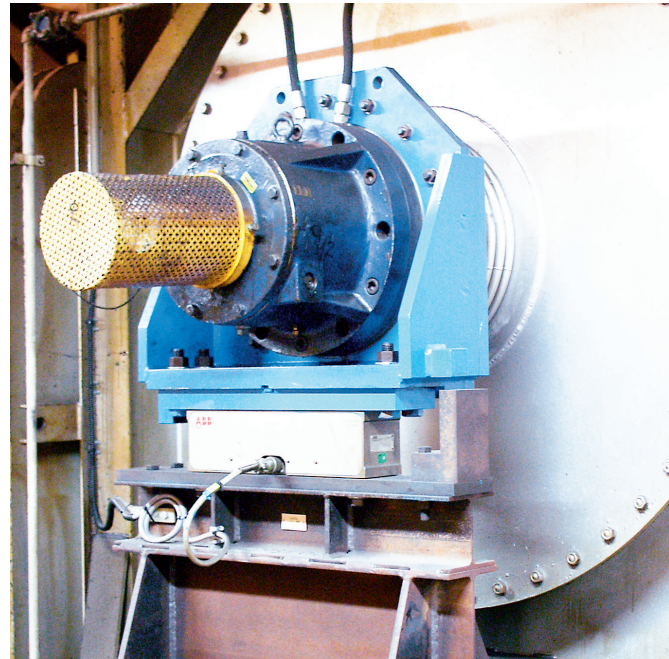
In order to drastically reduce the expansion friction on the floating bearing side, the standard ABB large PillowBlock load cell and bearing housing are fitted on a linear bearing unit. The axial expansion friction coefficient drops from typically 0.2 inside a bearing housing in good condition, to <0.01 in a linear bearing unit.



Dimensions in mm (in.)



01



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02

Pressductor PillowBlock load cells

PFTL 101 Horizontal force measurement, 0.5 to 20 kN

Application hint

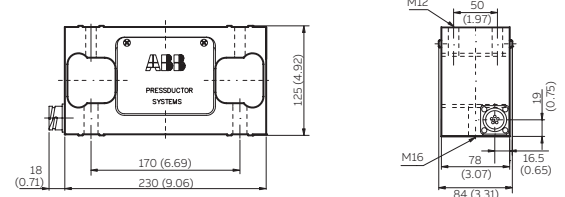
- Horizontally measuring load cells are ideal in applications with high tare loads and relatively small tensions, such as metal processing lines.
- In applications where high overloads can occur in any direction, the high overload tolerance in all directions of ABB's horizontal PillowBlock load cell adds reliability.
- If no horizontal resultant force is present, mounting the load cell on a slant will give rise to one.

ABB PillowBlock horizontal load cells are ideal in applications characterized by low tension levels, heavy rolls and high operating speeds – a scenario often encountered in the metals industry.

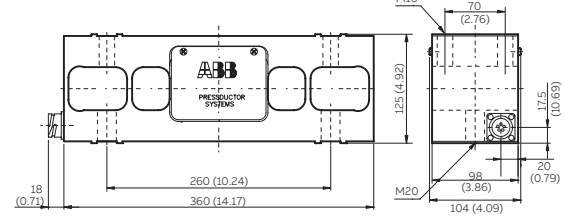
Using the horizontal force component to measure strip tension can be highly advantageous. The load cell can be sized to measure just the strip tension, excluding the tare weight of the roll, which, on a big metal processing machine, for example, can be far greater than the tension in the strip. The result is optimized measurement accuracy.

Solid stainless steel construction combines sensitivity and accuracy with exceptional ruggedness and high spring constant. The units tolerate overloads up to five times their nominal capacity, and combined with the electronics are designed to provide stable output even when subjected to intense vibration.

PFTL 101A



PFTL 101B



Dimensions in mm (in.)

The PillowBlock comes in three versions

The standard Version, PFTL 101A/B, is often used for accurate measurement in basic metal processing applications. Load cells are designed for demanding applications with, for instance, heavy rolls, wide tension range and high speed.

For lighter strip tension measurement applications in cold rolling mills, annealing and galvanizing lines, the mill-duty version, PFTL 101AE/BE, is recommended. This version has a fixed connection cable and a degree of protection of IP 66, which provides accurate and reliable measurement with long service life.

All load cells are delivered standard calibrated.

The acid resistant version, PFTL 101AER/BER, is designed for pickling lines and has a degree of protection of IP66/67.

¹ According to IEC 529, EN 60-529

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Technical data		PFTL 101A/AE/AER				PFTL 101B/BE/BER		
Nominal load								
- Nominal load in measuring direction	kN	0.5	1.0	2.0	2.0	5.0	10.0	20.0
	lb.	112	225	450	450	1125	2250	4500
- Permitted transverse direction (vertical)	kN	5.0	10.0	10.0	30.0	30.0	30.0	40.0
	lb.	1125	2250	2250	6750	6750	6750	9000
- Permitted load axial direction								
Overload capacity ¹								
- Measurement direction (horizontal)	kN	2.5	5.0	10.0	10.0	25.0	50.0	80.0
	lb.	563	1125	2250	2250	5625	11250	18000
- Transverse direction (vertical)								
Deflection ²	mm	0.015	0.015	0.015	0.015	0.015	0.015	0.015
	1/1000 in	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Spring constant	kN/mm	32	65	130	130	325	650	1300
	1000 lb./in.	183	371	743	743	1857	3715	7430

All load cells

Operating principle		Electromagnetic Pressductor technology
Accuracy class ³	%	0.5
Repeatability error	%	<±0.05
Operating range		30:1
Working temperature range		-10 to 105 °C 14 to 221 °F
Zero point drift ⁷	%/°C	<±0.005 <±0.003
Sensitivity drift ⁷	%/°C	<±0.010 <±0.006
Standard/Mill-duty version		
Stainless steel	SIS	2383 ⁴
	DIN	X4CrNiMo165
Degree of protection	IP65 ⁵ (standard version)	
	IP66 ⁵ (mill-duty version)	
Acid resistant version		
Stainless steel	SIS	2348 ⁶
	DIN	17440X2CrNiMo17 13 2

¹ Maximum permitted loads without affecting load cell calibration.

² At nominal load.

³ Accuracy class is defined as the maximum deviation, and is expressed as a percentage of the sensitivity at nominal load. This includes linearity deviation, hysteresis and repeatability error.

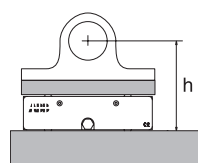
⁴ Corrosion resistance properties similar to AISI 430F

⁵ According to IEC 529, EN 60-529

⁶ Corrosion resistance properties similar to AISI 316L

⁷ Applies for 20 to 80 °C/68 to 176 °F

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Height (h ≤ 300 mm)
from load cell's
bottom surface
to roll center line.

Pressductor PillowBlock load cells

PFTL 201 Horizontal force measurement, 10 to 100 kN

ABB's horizontal Pressductor® load cells are specifically designed for horizontal force measurement.

Key advantages

- Smaller load cell sizes can be specified since the tare weight won't be a factor
- Inherently sturdier designs are virtually maintenance-free
- No contribution to machine vibration

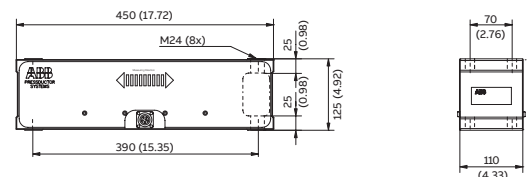
In many strip processes, the strip tension inherently produces a horizontal force component on a roll or by design it can be made to do so.

Using this horizontal force component to measure strip tension can be highly advantageous. The load cell can be sized to measure just the strip tension, excluding the tare weight of the roll, which, on a big metal processing machine, for example, can be far greater than the tension in the strip. The result is optimized measurement accuracy.

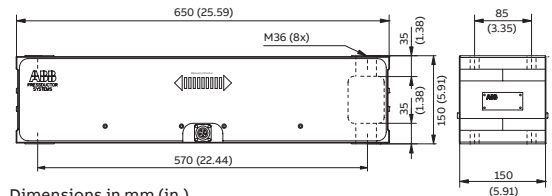
Another advantage is that ABB's unique horizontal load cell – specifically designed to measure this force component – provides stiffness levels and overload tolerances in all force directions that are significantly greater than what can be achieved with vertical load cells.

Solid stainless steel construction combines sensitivity and accuracy with exceptional ruggedness and high spring constant. The units tolerate overloads up to ten times their nominal capacity, and combined with the electronics are designed to provide stable output even when subjected to intense vibration.

PFTL 201C



PFTL 201D



Dimensions in mm (in.)

Several versions of the PFTL 201 are available:

- The standard version PFTL 201C/D equipped with Cannon connector for the connection cable, suitable for process lines in nice dry environments.
- The mill-duty version PFTL 201CE/DE with fixed connection cable in protective hose, comes in three different versions itself:
 - Standard version, suited for most process lines applications
 - Tefzel® insulated cable with kerosene resistant protective hose, best suited for aluminum applications
 - Tefzel® insulated cable with kerosene and acid resistant protective hose, with outer braid of stainless-steel wire, best suited for pickling lines.

The protective hose comes in three version

1. Standard mill-duty version suitable for most applications.
2. Kerosene resistant version for aluminium applications.
3. Acid resistant version primarily for pickling lines and/or TCM's coupled with pickling lines.

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Technical data		PFTL 201C/CE			PFTL 201D/DE	
Nominal load						
- Nominal load in measuring direction (horizontal)	kN	10.0	20.0	50.0	50.0	100.0
	lb.	2250	4500	11250	11250	22500
- Extended load in measuring direction ¹	kN	15.0	30.0	75.0	75.0	150.0
	lb.	3375	6750	16875	16875	33750
- Permitted load transverse direction (vertical) h=300 mm	kN	100.0	200.0	250.0	500.0	500.0
	lb.	22500	45000	112500	112500	225000
- Permitted load axial direction						
Overload capacity ²						
- Measurement direction (horizontal)	kN	100.0	200.0	500.0	500.0	1000.0
	lb.	22500	45000	112500	112500	225000
- Transverse direction (vertical) h=300 mm	kN	100.0	200.0	250.0	500.0	500.0
	lb.	22500	45000	56250	112500	112500
Deflection ³	mm	0.010	0.020	0.050	0.025	0.050
	¹ / ₁₀₀₀ in.	0.4	0.8	2.0	1.0	2.0
Spring constant	kN/mm	1000	1000	1000	2000	2000
	1000 lb./in.	5720	5720	5720	11440	11440

All load cells

Operating principle		Electromagnetic Pressductor Technology
Accuracy class ⁴	%	0.5
Repeatability error	%	<±0.05
Operating range		30:1
Stainless steel	SIS	2387 ⁵
	DIN	X4CrNiMo165
Working temperature range		-10 to 90 °C 14 to 194 °F
Zero point drift ⁶	%/°C	<±0.005
	%/°F	<±0.003
Sensitivity drift ⁶	%/°C	<±0.010
	%/°F	<±0.006

¹ Values indicate the total capacity of the load cells when taking into account their permissible "extended capacity". In the extended range, above the nominal load, some decline in measurement accuracy may be experienced.

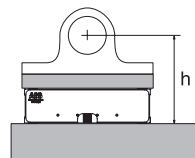
² Maximum permitted loads without affecting load cell calibration.

³ At nominal load.

⁴ Accuracy class i+s defined as the maximum deviation, and is expressed as a percentage of the sensitivity at nominal load. This includes linearity deviation, hysteresis and repeatability error.

⁵ Corrosion resistance properties similar to AISI 304

⁶ Applies for 20 to 80 °C/68 to 176 °F



Height (h ≤300 mm)
from load cell's
bottom surface
to roll center line

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Pressductor PillowBlock load cells

PFCL 201 Vertical force measurement, 5 to 50 kN

Application hint

Vertically measuring load cells are ideal for applications with high speed gradients during acceleration and deceleration in cold rolling.

These units are designed for strip tension measurement in applications where it is essential or advantageous to determine the vertical force component.

Machined from a single block of stainless steel, they have exceptionally high tolerance for overloads, shock and impact, in addition to high immunity to dust and corrosion.

The standard construction is of highly resistant stainless steel with potted internal components. Mill-duty versions are available for exceptionally hostile environments in e.g. cold rolling mills, galvanizing lines and pickling lines.

The family of vertical load cells comprises units in four operating ranges offering measurement capacities from 5 kN (1,125 lbs.) to more than 50 kN (11,250 lbs.), covering applications with tensions levels in excess of 1,000 kN (225,000 lbs.).

ABB's vertical load cells, like their counterparts for horizontal measurement, feature an extended operating load range. Up to 50 percent more measurement capacity is available in this range with fully retained performance characteristics, except some decline in measurement accuracy. As a result, in most applications, the load cells can safely be specified for the strip's normal tension range, but still will accommodate substantial peak loads.

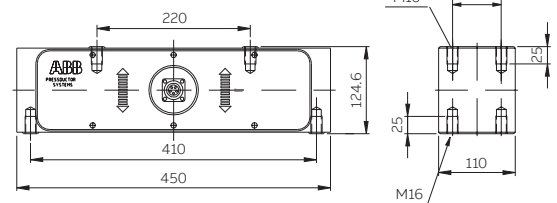
In fact, both types of ABB PillowBlock load cells feature an exceptionally wide measurement range.

Installation in existing equipment can be simplified by use of top and bottom adapter plates, which can be supplied by ABB.

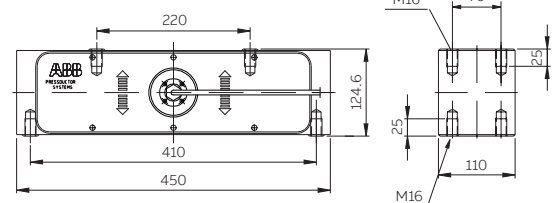
Several versions of the PFCL 201 are available

- The standard version PFCL 201C equipped with Cannon connector for the connection cable

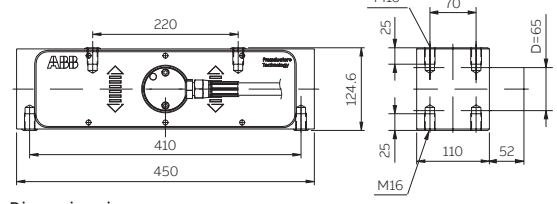
PFCL 201C



PFCL 201CD



PFCL 201CE



Dimensions in mm

- suitable for process lines in nice dry environments.
- PFCL 201CD equipped with a tight cable gland and 20 m TEFLON® insulated connection cable best suited for steel rolling mills.
- The mill-duty version PFCL 201CE with fixed connection cable in protective hose, comes in three different versions itself
 - Standard version, suited for most process lines applications
 - Tefzel® insulated cable with kerosene resistant protective hose, best suited for aluminum applications and for steel rolling mills.
 - Tefzel® insulated cable with kerosene and acid resistant protective hose, with outer braid of stainless-steel wire, best suited for pickling lines and steel rolling mills.

The protective hose comes in three version

1. Standard mill-duty version suitable for most applications.
2. Kerosene resistant version for aluminium applications.
3. Acid resistant version primarily for pickling lines and/or TCM's coupled with pickling lines.

¹ TEFLON is a registered trademark of DuPont



Technical data		PFCL 201C/CD/CE			
Nominal load					
- Nominal load in measuring direction	kN	5.0	10.0	20.0	50.0
(vertical)	lb.	1125	2250	4500	11250
- Extended load in measuring direction ¹	kN	7.5	15.0	30.0	75.0
	lb.	1688	3375	6750	16875
- Permitted load transverse direction	kN	2.5	5.0	10.0	25.0
(vertical) h=300 mm	lb.	563	1125	2250	5625
- Permitted load axial direction					
Overload capacity ²					
- Measurement direction	kN	50.0	100.0	200.0	500.0
(vertical)	lb.	11250	22500	45000	112500
- Transverse direction	kN	12.5	25.0	50.0	125.0
(horizontal) h=300 mm	lb.	2815	5625	11250	28125
Deflection ³		mm	0.02	0.02	0.02
		1/1000 in.	0.8	0.8	0.8
Spring constant		kN/mm	250	500	1000
		1000 lb./in.	1430	2860	14300

All load cells

Operating principle	Electromagnetic Pressductor Technology	
Accuracy class ⁴	%	0.5
Repeatability error	%	<±0.05
Operating range		30:1
Stainless steel	SIS	2387 ⁵
	DIN	X4CrNiMo165
Working temperature range		-10 to 90 °C
		14 to 194 °F
Zero point drift ⁶	%/°C	<±0.005
	%/°F	<±0.003
Sensitivity drift ⁶	%/°C	<±0.010
	%/°F	<±0.006

¹ Values indicate the total capacity of the load cells when taking into account their permissible "extended capacity". In the extended range, above the nominal load, some decline in measurement accuracy may be experienced.

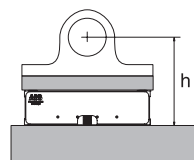
² Maximum permitted loads without affecting load cell calibration.

³ At nominal load.

⁴ Accuracy class i+s defined as the maximum deviation, and is expressed as a percentage of the sensitivity at nominal load. This includes linearity deviation, hysteresis and repeatability error.

⁵ Corrosion resistance properties similar to AISI 304

⁶ Applies for 20 to 80 °C/68 to 176 °F



Height (h≤300 mm)
from load cell's
bottom surface
to roll center line

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Pressductor PillowBlock load cells

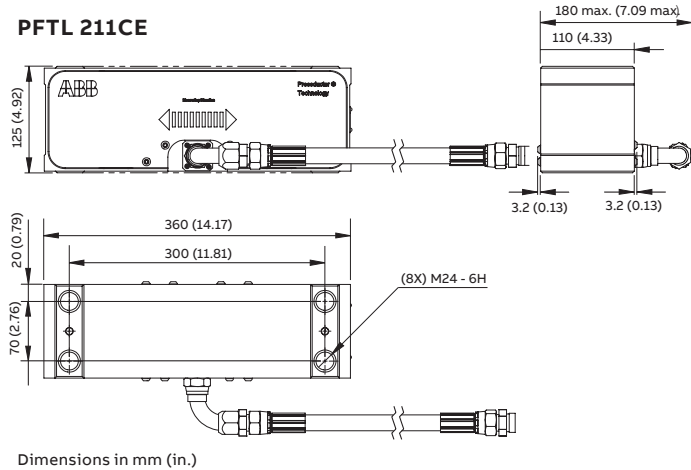
PFTL 211 Horizontal force measurement, 20 and 50 kN

The Looper Tensiometer load cell is used for strip tension measurement in hot rolling mills.

The load cell can be installed as an integrated part of the looper arm and senses the force from strip tension in both directions.

The load cell comes in one version, PFTL211-CE, a mill-duty version with fixed connection cable in a protective hose and mounted at different angular positions.

PFTL 211CE



Technical data		PFTL 211CE	
Nominal load (rated capacity)	kN	20.0	50.0
	lb.	4500	11250
Extended load ¹	kN	30.0	75.0
	lb.	6750	16875
Permitted load			
Transverse direction (vertical) h=300 mm	kN	100.0	250.0
	lb.	22500	56250
Overload capacity ²	kN	200.0	500.0
Measurement direction (horizontal)	lb.	45000	112500
	kN	200.0	250.0
Transverse direction (vertical) h=300 mm	lb.	45000	56250
	kN	200.0	250.0
Deflection ³	mm	0.02	0.05
	1/1000 in.	0.8	2.0
Spring constant	kN/mm	1000	1000
	1000 lb./in.	5720	5720

All load cells

Operating principle		Electromagnetic
		Pressductor Technology
Accuracy class ⁴	%	0.5
Repeatability error	%	<±0.05
Operating range		30:1
Stainless steel	SIS	2387 ⁵
	DIN	X4CrNiMo165
Working temperature range		-10 to 90 °C
		14 to 194 °F
Zero point drift ⁶	%/°C	<±0.005
	%/°F	<±0.003
Sensitivity drift ⁶	%/°C	<±0.010
	%/°F	<±0.006

¹ Values indicate the total capacity of the load cells when taking into account their permissible "extended capacity". In the extended range, above the nominal load, some decline in measurement accuracy may be experienced.

² Maximum permitted loads without affecting load cell calibration.

³ At nominal load.

⁴ Accuracy class i+s defined as the maximum deviation, and is expressed as a percentage of the sensitivity at nominal load. This includes linearity deviation, hysteresis and repeatability error.

⁵ Corrosion resistance properties similar to AISI 304

⁶ Applies for 20 to 80 °C/68 to 176 °F

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Pressductor PillowBlock load cells

PFCL 241 Vertical force measurement, 200 kN

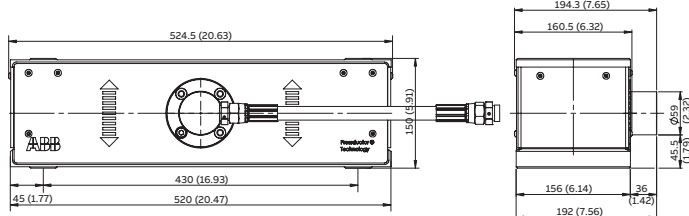
Load cell PFCL241-SE is an excellent choice in cluster rolling mills and other mill applications where strip tensions are high. It can also be used in high tension application in process lines.

The load cell is a solid tensiometer made from stainless steel with exceptional ruggedness and high spring constant in line with other Pressductor PillowBlock load cells. It can be installed under the bearing housing and senses the vertical force, measuring in both directions. PFCL241-SE is available as mill-duty version with fixed connection cable in protective hose. The protective hose/cable can be mounted at desired angular position.

The protective hose comes in three versions

1. Standard mill-duty version suitable for most applications.
2. Kerosene resistant version for aluminium applications.
3. Acid resistant version primarily for pickling lines and/or TCM's coupled with pickling lines.

PFCL 241-SE



Dimensions in mm (in.)



Technical data		PFCL 241SE
Nominal load (rated capacity)	kN	200.0
	lb.	45000
Extended load ¹	kN	300.0
	lb.	67500
Permitted load		
Transverse direction (horizontal) h=300 mm	kN	100.0
	lb.	22500
Overload capacity ²	kN	1000.0
Measurement direction (vertical)	lb.	225000
	kN	500.0
Transverse direction (horizontal) h=300 mm	kN	112500
	lb.	25000
Deflection ³	mm	0.02
	1/1000 in.	0.8
Spring constant	kN/mm	1000
	1000 lb./in.	14300

All load cells

Operating principle		Electromagnetic Pressductor Technology
Accuracy class ⁴	%	0.5
Repeatability error	%	<±0.05
Operating range		30:1
Stainless steel	SIS	2387 ⁵
	DIN	X4CrNiMo165
Working temperature range		-10 to 90 °C 14 to 194 °F
Zero point drift ⁶	%/°C	<±0.005
	%/°F	<±0.003
Sensitivity drift ⁶	%/°C	<±0.010
	%/°F	<±0.006

¹ Values indicate the total capacity of the load cells when taking into account their permissible "extended capacity". In the extended range, above the nominal load, some decline in measurement accuracy may be experienced.

² Maximum permitted loads without affecting load cell calibration.

³ At nominal load.

⁴ Accuracy class is defined as the maximum deviation, and is expressed as a percentage of the sensitivity at nominal load. This includes linearity deviation, hysteresis and repeatability error.

⁵ Corrosion resistance properties similar to AISI 304

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Tension electronics

PFEA – the compact solution

Covering a wide range of applications, the tension electronics comes in four versions, with different levels of performance and functionality.

—
01 PFEA tension electronics.

—
02 IP20 version for control room cubicle.

—
03 Interactive display.

—
04 IP65 version for mounting on machine.

All four versions have multi-language digital display and configuration keys. The configuration keys being used for setting different parameters and to check the status of the tension system. The 2 x 16 character display can present sum, difference or individual load cell signals. All four versions are available in both DIN-rail version and enclosed IP65¹ version for mounting in more severe environments.

PFEA111

A cost effective, compact and user-friendly tension electronics providing an accurate and reliable fast analog SUM signal from two load cells for control and/or monitoring. The display can show the SUM, individual A & B and difference signal. The small size and DIN-rail mount make this unit very easy to integrate into many types of electrical cabinets.

PFEA112/PFEA122

These units provides the same functionality and user friendliness as the PFEA111 with the addition of fieldbus communication via PROFIBUS-DP on PFEA112, and PROFINET RT on PFEA122. On the PFEA122 it is also possible via PROFINET to access the individual A and B signals, besides the SUM signal.

PFEA113

These advanced tension electronics can supply up to four load cells and has six configurable analog out-puts for control and/or monitoring of strip tension. It's possible to see both the SUM, individual A & B and difference signal, not only on the display but also on the output signals. The output signals are also available on PROFIBUS-DP.

Another useful feature is the possibility to switch the gain for two different strip paths. This unit also includes a self-diagnostic function and four configurable digital outputs for alarms and level detection.

By combining up to three PFEA113, the system can handle segmented roll applications, i.e. winders, with up to 12 load cells.

The high level of functionality and user-friendliness make the PFEA113 one of the most complete tension electronics on the market.

¹ According to IEC 529, EN 60-529



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Features and benefits

Interactive menu

The tension electronics has a unique interactive menu which guides the commissioning step by step, eliminating the potential for making mistakes and significantly reducing startup time – a very helpful tool.

Built-in self diagnostics

The electronics continuously supervise a number of important parameters and provides error messages if something goes wrong.

Multi-language display

The multi-language display is a great feature that helps to eliminate mistakes, during start-up and/or operation of the tension system.

Load memory

The resettable load memory stores max. load values. A useful tool for maintenance.

Analog outputs

The PFEA provide a scaled and zeroed tension output ready for use in control or monitoring. Individual scaling and filtering can be done for each of the analog outputs.

PROFIBUS-DP and PROFINET

PFEA112 and PFEA113 have Fieldbus communication via PROFIBUS-DP as standard. PFEA122 comes with PROFINET RT communication.

Regardless of the communication protocol used, measurement values and status information will be available.

Filter function

All units come with a selectable filter function for removal of roll unbalance, machine vibrations and other disturbances.

Commissioning without calibration weights

All Pressductor load cells are standard calibrated to the same sensitivity before delivery from ABB factory. This means that the fastest and most accurate way to commission a tension system is to use a calculated value instead of using calibration weights.

Mounting

To provide flexibility of mounting, all four versions of the tension electronics are available in two mounting alternatives. For mounting on a standard DIN-rail the IP20 and for wall mounting the IP 65.

Floor cubicle

Floor cubicle type MNS Select is available for housing of up to 24 pcs. of PFEA111/112/122 or 12 pcs. of PFEA113 when mounted on 19 inch plates. Exact numbers depend on the combination of different tension electronics and the number of optional units used.

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Options and dimensions

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Options

To meet certain special application requirements the following options are available:

Insulation amplifier PXUB 201

The insulation amplifier can be used when galvanic insulation is required for analog output signals. The insulation amplifier can be connected to all versions and PFEA113 – IP65 can hold up to four PXUB 201.

Supply voltage	24 V (20 to 253 V AC/DC)	
Current consumption	10 mA + external load	
Signal range	Input	Output
	0 to ± 10 V	0 to ± 10 V
	0 to ± 10 V	0 to ± 20 mA
	0 to 10 V	4 to 20 mA
Rated insulation voltage	600 V (basic)	

Relay board PXKB 201

PXKB 201 is DIN-rail mounted and can be mounted in the IP65 versions of the tension electronics together with the insulation amplifier. PFEA113-65 can hold up to four PXKB 201.

Supply voltage	24 V DC	
Power consumption	18 mA	
Contact data	AC	6 A at 250 V
	DC	6 A at 250 V

Power supply unit

When using the DIN-rail IP20 version of the electronics and 24 V main supply is not available, ABB offers optional power supply units.

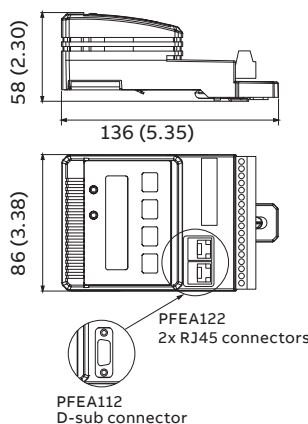
The compact units transform main supply from 110 to 120 V/207 to 240 V AC to 24 V DC for supply of the PFEA tension electronics.

Three power supply units with different power ratings are available. The table below indicates max. number of electronics per power supply unit.

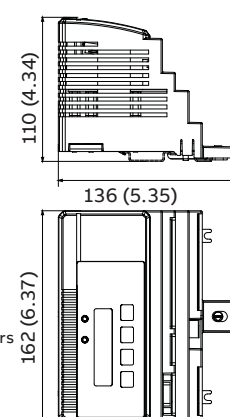
	PFEA111/112/122	PFEA113
SD831 3 A	6	3*
SD832 5 A	12	6*
SD832 10 A	24	12*

* Supply of digital outputs are not included

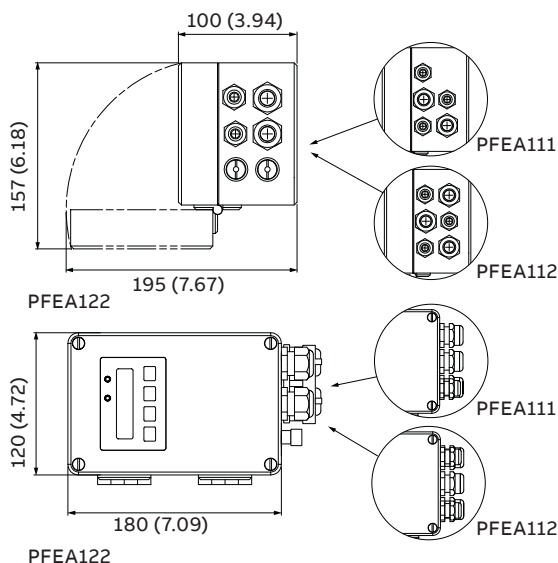
PFEA111/112/122 IP20 version (unsealed)



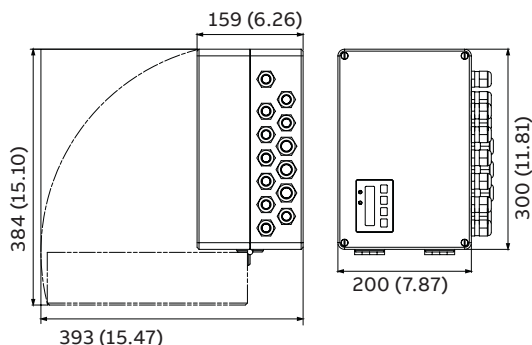
PFEA113 IP20 version (unsealed)



PFEA111/112/122 IP65 version



PFEA113 IP65 version



Dimensions in mm (in)

Technical data

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Data	PFEA111/112/122	PFEA113
Power supply		
IP 20 voltage		24 V DC (18 to 36 V)
Power requirement	7.5 W	12 W
IP 65 main voltage		24 V DC (18 to 36 V), 100 (–15 %)
Frequency		45 to 65 Hz
Number of load cells	2	4
Load cell excitation		
Current	0.5 A RMS, 330 Hz	0.5 A RMS, 330 Hz
Max. load	2 load cells plus 5 Ω cable resistance	4 load cells plus 10 Ω cable resistance
Inputs		
Digital inputs (remote zero or gain scheduling)	—	1
Analog inputs (connection of multiple PFEA113 units)	—	2
Outputs		
Analog outputs (voltage or current)	—	6
–5 to 11 V (max.load 5 mA)	1	—
0 to 21 mA (max. load 550 Ω)	1	—
Selectable filter		
Step response (0 to 90 %) can be set for each output	15, 30, 75, 250, 750, 1500 ms	5, 15, 30, 75, 250, 750, 1500 ms
Scaling function of analog outputs	Yes	Yes
Digital outputs (Status OK and/or Level detectors)	—	4
Self diagnostics, Status OK		
LED (green/red)	Yes	Yes
Alarm on Digital output	—	Yes
Alarm via PROFIBUS (for PFEA122 via PROFINET)	Yes	Yes
Multi-language interactive display ¹	Yes	Yes
Selectable tension units on the display		N, kN, kg and lbs, N/m, kN/m, kg/m, pli
Maximum load memory	Yes	Yes
Zero offset memory	Yes	Yes
Communication		
PROFIBUS DP, baud rate up to 12 Mbit	PFEA112 (GSD-file ABB_0716.GSD) ²	PFEA113 (GSD-file ABB_0717.GSD) ²
PROFINET RT	PFEA122 (GSDML-V2.42-ABB-PFEA122-20230330.xml) ²	
Environmental tolerance		
Electrical environment		
Electrical interference environment		As per EMC Directive 2014/30/EU
Electrical safety		As per Low Voltage Directive 2014/35/EU As per UL508 Industrial control equipment ³
Ambient temperature		5 to 55 °C
Degree of protection		IEC 529 Protection class IP 20 or IP

¹ English, German, Italian, French, Japanese, Portuguese

² PFEA112: Sum signal, PFEA122: Sum, individual A & individual B signal, PFEA113: Sum, difference, individual A & individual B signal

³ UL508 approval available for PFEA111, PFEA113 and PFEA112 IP20

Control unit

Millmate Controller 400

—
01 Millmate Controller
with Operator unit

The control unit supplies the load cells with power, processes the signals from the load cells and communicates the result to other systems. Communication can take place via digital inputs/outputs, analog inputs/outputs, TCP/IP-communication, RS-232 and as an option, via high-speed fieldbus.

The control unit can be manually operated using the Millmate Operator Unit 410 and by external units via a serial interface or digital/analog inputs. Setup and commissioning are easy following step-by-step menus.

Measured values are displayed on the operator unit, connected to analog outputs or transmitted via a serial interface to an external display or to other external units.

Features

The Millmate Controller 400 has been designed to offer a lot of functionalities and at the same time very easy to use.

The control unit covers most mechanical arrangements. This means the user only has to follow the step-by-step menus in order to set up the control unit and to obtain correct strip tension calculated.

Some examples of the built-in functionalities:

- Easy to install
 - Industrial grade electronics, operating temperature up to 70°C
 - Fulfills EMC legislation without additional enclosures
 - Detachable screw terminals located at the bottom of the Control unit for easy access
 - Built in Earth point for cable screens
 - Supply voltage 100–240 V AC
- Easy to commission
 - Step-by-step instructions to set up the control unit
 - Predefined standard measurement modes
 - Easy configurable analog/digital inputs/outputs
 - Level detectors
 - Unit selection (N, kN, MN, kp, t, lb, T)
 - Simulation mode for easy check of system integration
 - Easy maintenance/monitoring
 - Self-diagnostics test system including transducer test
 - Load and dump set-up to connected PC
 - Network connection for remote access



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Data

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External connections:

- Excitation current to the load cells
- 2 or 4 analog inputs for load cell signals
- 4 analog outputs, voltage or current
- 8 digital inputs for control signals
- 8 digital outputs
- +24 V supply for external units, max 0.5 A
- Ethernet for connection to:
 - other Millmate control and operator unit
 - other control systems with VIP protocol
- 2 serial interfaces of type RS-232 for external displays, control, etc.
- High-speed PROFIBUS (optional)

Analog/digital inputs and outputs are galvanically insulated as groups.

Vendor Internet Protocol (VIP)

Other control systems can send control data and monitor measurement data with TCP/IP-communication. The Ethernet connection together with the Vendor Internet Protocol (VIP) is used for communication. The protocol uses configurable predefined data telegrams and the Millmate Controller 400 acts as a server. The sending procedure is cyclic and thereceiving procedure reacts on incoming messages.

The PROFIBUS option

As an option the control unit can be equipped with PROFIBUS. The PROFIBUS interface in the Millmate Controller 400 is updated with a new complete set of measuring values every 1.5 milliseconds.

Millmate Controller 400		PFXA 401	PFCA 401
Dimensions (H x W x D)		380 x 235 x 90 mm	
Weight		5 kg	
Protection class ¹⁾		IP 20	
Main voltage		85 to 264 V, 100 (-15 %) to 240 V (+10 %)	
Power consumption		140 VA	
Wrap angle compensation		Yes	No
Excitation current		2 A, 0.5 A	0.5 A
Operating temperature		0 to +70 °C	
Storage temperature		-40 to +70 °C	
Analog inputs		0 to 10 V, ± 10 V differential inputs	
Analog outputs	Voltage	0 to ± 10 V	
	Current	0 to ± 20 mA, 4 to 20 mA (insulated as group)	
	Step response	5 ms (0 to 90 %)	
Digital inputs		0/+24 V insulated 4 + 4	
Digital outputs		0/+24 V insulated 4 + 4	

1) According to IEC 529, EN 60-529

VIP

Network	10 Mbit/s Ethernet
Communication rate	10 messages/s
Error handling	Automatic retransmission

PROFIBUS-DP

Station type	Slave
Maximum speed	12 Mbit/s
Configuration	Printable GSD-file in control unit

Control unit accessories

- 01 Millmate Operator Unit 410. Dimensions 143 x 204 x 50 mm (H x W x D), IP 65 from the front when mounted on a panel acc. to IEC 529, EN 60-529, IP 20 in all other directions acc. IEC 529, EN 60-529, weight 0.8 kg.
- 02 Relay board PFVK 128
- 03 Insulation amplifier PXUB 201. Voltage output: 0 to ± 10 V or current 0 to ± 20 mA
- 04 Switch SDI-880
- 05 Switch with opto SDW-541

Millmate Operator Unit 410

The Millmate Operator Unit 410 provides communication with the control unit and is designed for panel mounting.

The operator unit(s) and control unit(s) are interconnected on a common network. This common network can be a separate network for measuring objects or it can be part of a local area network (LAN).

The communication on the network is in accordance with the IEEE 802.3 standard and uses TCP/IP protocol.

Relay board PFVK 128

Fitted with four relays with one changeover function per relay.

Insulation amplifier PXUB 201

The insulation amplifier can be used when improved electrical insulation is required. Selected voltage or current output.

Switch SDI-880

Connects MC400 control units and operator units in one network.

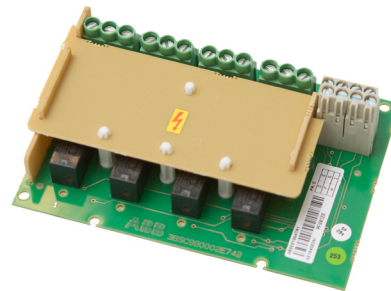
Switch with opto SDW-541

Opto interface and network switch for external communication.

01



02



03



04

05



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Installation options

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- 06 Wall cabinet
- 07 Junction box PFXC141
- 08 Floor cabinet

Wall cabinet

A control unit can be installed in the dust- and hose-proof wall cabinet. The operator unit can be mounted on the inside of the door or through the door.

Floor cabinet

The MNS floor cabinet can contain a combination of control units with Roll Force, Strip Tensiometer and Strip Scanner applications. They can be operated by one operator unit, optionally mounted through the door or inside the cabinet.

Junction box PFXC141

A junction box can be used for efficient cable connection of up to four load cells.

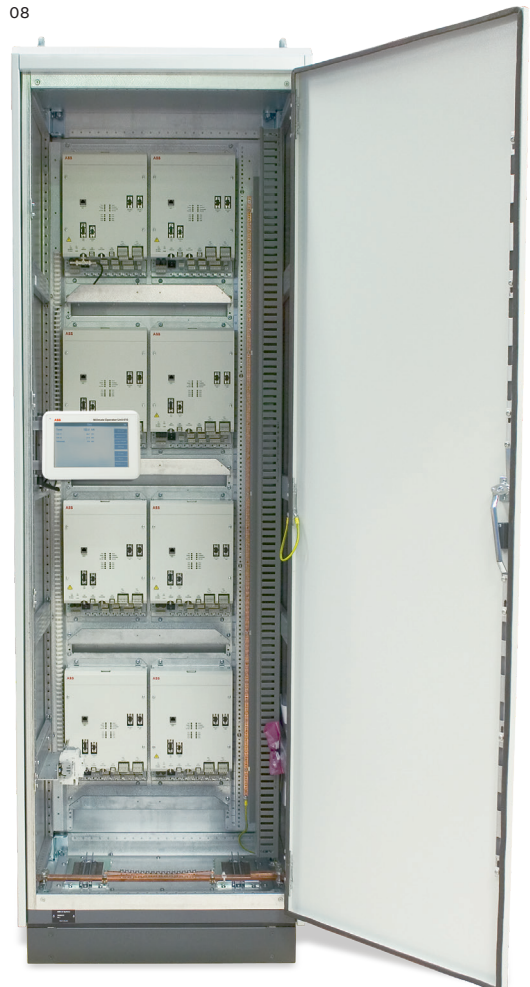
06



07



08





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