

ABB MEASUREMENT & ANALYTICS

Web tension systems

Pressductor PillowBlock load cells
Mini series



Measurement made easy

Web tension systems

Quality tension measurement
for quality tension control

- Accurate
- Rugged
- Reliable

Mini series PillowBlock load cells

Bringing quality and reliability to the measurement of web tension

Introduction

ABB's Pressductor® load cells are sensitive and accurate yet rugged, reliable and compact. They can withstand high overloads and vibrations, and operate over a wide range of tensions: ideal for any web converting application such as coating, laminating, printing, slitting winding/unwinding and many others. The well-proven Pressductor load cells combined with the tension electronics, offer an easy to use/user-friendly web tension measurement system with superior long term performance leading to higher productivity and product quality and higher profit for the converter.

Increased process uptime

In a web process running continuously, every minute of production time is precious. Even so, no production line runs without downtime.

With Pressductor Mini PillowBlock load cells the risk of web 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 Mini PillowBlock load cells, the upcoming web breaks are kept to an absolute minimum level.

Tighter product tolerances

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

Now all web processing machines can have load cells sized for optimal tension measurement performance – even machines with heavy rolls and light tension.



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01 Pressductor technology – mechanical force alters magnetic field.

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02, 03, 04 Typical Mini PillowBlock load cell installations.

Minimize maintenance

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

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 Mini series PillowBlock load cell suitable for most web processing machinery used in the converting, printing, plastic film, textiles, and other industries.

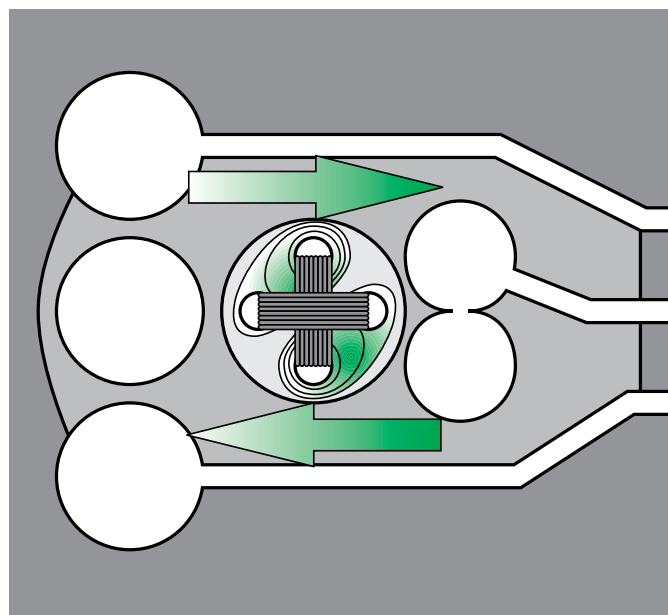
In the converting industry, the Mini series PillowBlock load cells are ideal on machinery for coating, laminating, embossing and many other processes.

- Mini series PillowBlock systems are used on a wide range of printing presses – in both converting and commercial printing as well as newspaper and magazine production.
- In the plastics industry, Mini series PillowBlock Systems are used to optimize the production and processing of blown and cast film.
- And in the textiles industries, machinery applications include nonwovens production as well as finishing operations like bleaching, desizing, dyeing, and printing.
- In all web processing areas, Mini series PillowBlock systems are used on the full range of winding machinery, from unwinders to slitter-rewinders.

The Pressductor difference

Like ABB's other load cells based on Pressductor technology, Mini series PillowBlock load cells rely on electromagnetic changes in the transducer, not on physical movement, to sense fluctuations in web 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, Mini series load cells are rugged and stiff, affording high overload protection as well as an extended measurement range above the nominal load. And they won't 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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03—
02—
04

Mini series PillowBlock load cells

Designed to measure either horizontal or vertical forces in both directions on most types of web processing machinery used in the converting, plastic film, printing, textiles and other industries

These are some of the qualities that contribute to the Mini series' excellent performance:

- **Superior Design:** ABB's exclusive Pressductor technology gives the Mini series PillowBlocks exceptional sturdiness and makes them highly tolerant of operating conditions.
- **Rugged construction:** Machined from a single block of stainless steel, Mini series PillowBlocks provide a high level of protection against overloads and shock impact.
- **Immunity to environmental stress:** Load cell performance is unaffected by environmental factors like dust, fumes, fluids, and radio or electromagnetic interference. Sealing is not required.
- **Overload endurance:** The system can handle overloads ranging up to 300 % of nominal load without affecting load cell calibration.
- **Extended range:** A standard extended range adds another 50 % to measurement capacity for more versatile machine operation. Load cells can be specified for the web's normal tension range, but also accommodate occasional peak loads.
- **Wide measurement range:** The capacity to measure web tension variations of up to 30-to-1 provides valuable operating flexibility in processing a wide range of applications.
- **Vibration-free:** High spring constant and low physical deflection reduce any contributions to machine vibration to negligible levels, even at high operating speeds.

Designers appreciate:

- Remarkably high spring constant
- Wide measurement range
- High reliability

Operators value a load cell with:

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

Extended-range operation

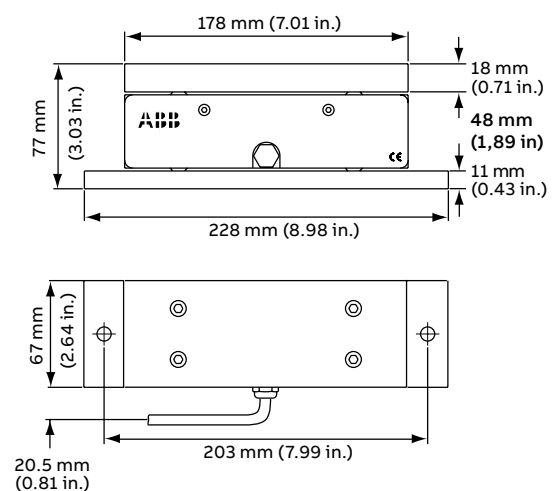
An extended range of measurement beyond the nominal load allows the Mini series PillowBlocks to be sized for normal, as opposed to maximum, tension levels. As a result, they permit greater application flexibility on the web processing machinery.

Easy to apply

Standard assemblies of load cells equipped with top and bottom mounting plates match the overall sizes of most commonly used types of pillow block load cells (see drawings below). They provide for direct substitutions of the UPB series of load cells as well as others.

The topside adapter plate secures the Mini Series load cell to the pillow block bearing housing, and the bottom plate is bolted to the pedestal.

Self-aligning pillow block bearings should be used in conjunction with the load cells. Standard pillow block bearings typically are self-aligning, whereas older, non-standard units may not be.



Mini PillowBlock dimensions in mm (in.)

Simple to size

The size, or nominal load, of a load cell is contingent on the anticipated force it will measure. When ABB's Mini series load cell is mounted horizontally on a pedestal (the most common arrangement), the measurement force (F_{Rtot}) is a function of the tension in the web (T) and the deflection angles (α and β), and for the vertical load cells also the weight of the roll and bearings ($Tare$).

Since load cells are typically used at both ends of a roll, rating the individual cell usually must be based on half of the resultant force. The ideal size of ABB load cells is the smallest nominal capacity rating accommodating that force level, as long as the force exceeds 10 % of the rating. Before choosing a larger size, however, consider using the extended range feature of ABB load cells. F_{Vtot} should not exceed the overload specification for transverse forces.

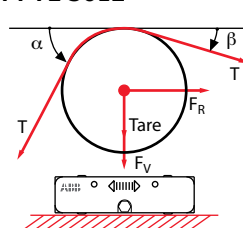
In instances where the force component in the measuring direction is insufficient or non-existent, the Mini series PillowBlocks can be mounted at an angle.

Application Hint

Two 10 % application guidelines are useful in selecting load cell sizes:

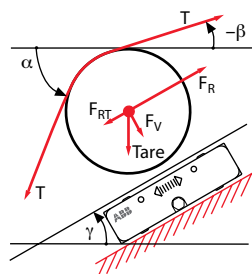
1. The proportion of web tension that is actually sensed by the load cell should be at least 10 % of total web tension. For operational conditions producing values below 10 %, consult ABB.
2. During normal operation, the sensed force should not be less than 10 % of the load cell's capacity.

PFTL 301E



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

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



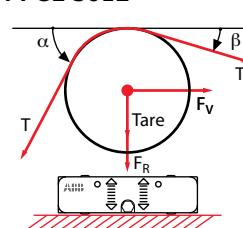
$$F_{Rtot} = F_R - Tare \cdot \sin\gamma$$

$$= T(\cos(\beta + \gamma) - \cos(\alpha - \gamma)) - Tare \cdot \sin\gamma$$

$$F_{Vtot} = F_V + Tare \cdot \cos\gamma$$

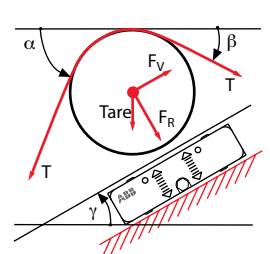
$$= T(\sin(\alpha - \gamma) + \sin(\beta + \gamma)) + Tare \cdot \cos\gamma$$

PFCL 301E



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

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



$$F_{Rtot} = F_R + Tare \cdot \cos\gamma$$

$$= T(\sin(\alpha - \gamma) + \sin(\beta + \gamma)) + Tare \cdot \cos\gamma$$

$$F_{Vtot} = F_V - Tare \cdot \sin\gamma$$

$$= T(\cos(\beta + \gamma) - \cos(\alpha - \gamma)) - Tare \cdot \sin\gamma$$

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
γ	=	Angle for load cell mounting

Mini series PillowBlock load cells

- Quality load cells that eliminate drift and recalibration
- Wide operating range
- Easy to apply

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01 Measuring and transverse force directions for horizontal measuring load cells (PFTL 301E)

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02 Measuring and transverse force directions for vertical measuring load cells (PFCL 301E)

Horizontal measurement PFTL 301E

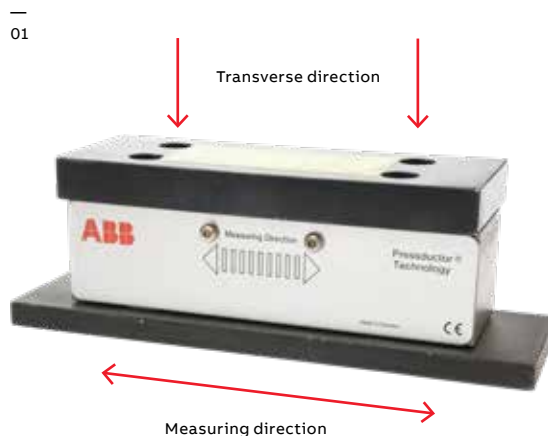
The horizontal Mini series PillowBlock load cells for the web processing industries have the same dimensions as conventional load cells and mount in the same way. But they measure only the horizontal force component of the web tension. Unlike load cells that measure along the vertical axis, they are not forced to sense the roll weight along with the web tension. So these load cells can be sized to the tension level alone, and function at the high end of their measuring range, where load cells perform best. The result: always optimal tension measurement performance – even when rolls are heavy and tension light.

The horizontal Mini series includes four sizes of nominal loads at 0.1, 0.2, 0.5 and 1.0 kN, (22, 45, 112 and 225 lb.). Each model provides an extended measurement range of 50 % above the nominal load, and vertical overload tolerance of five times the nominal load. The load cells come with adapter plates for easy installation and 8 m (26 ft) of hardwired control cable.

Vertical measurement PFCL 301E

The vertical Mini series PillowBlock is a true vertical force load cell, and measures only the total sum of the force components that are at a right angle to its top surface. The load cell is designed to measure vertical forces in both directions in most types of web processing machinery used in the converting, plastic film, printing, textiles, and other industries.

Three measurement sizes are available, with nominal load at 0.2, 0.5 and 1.0 kN (45, 112 and 225 lb.). Each model provides an extended measurement range of 50 % above the nominal load. Equipped with top and bottom adapter plates, they directly replace many other types of load cells.



Technical data			PFTL 301E				PFCL 301E	
Nominal load								
- Nominal load in measuring direction	kN	0.1	0.2	0.5	1.0	0.2	0.5	1.0
	lb.	22	45	112	225	45	112	225
- Permitted transverse direction (vertical)	kN	0.3	0.6	1.5	3.0	0.05	0.125	0.25
	lb.	67	135	337	674	11	28	56
- Extended load in measuring direction ¹ direction	kN	0.15	0.3	0.75	1.5	0.3	0.75	1.5
	lb.	33	67	169	337	67	169	337
- Permitted load axial direction								
Overload capacity ²								
- Measurement direction (horizontal)	kN	0.3	0.6	1.5	3.0	0.6	1.5	3.0
	lb.	67	135	337	674	135	337	674
- Transverse direction (vertical)	kN	0.5	1.0	2.5	5.0	0.3	0.75	1.5
	lb.	112	225	562	1125	67	169	337
Deflection ³	mm	0.05	0.05	0.07	0.13	0.020	0.024	0.040
Spring constant	¹ / ₁₀₀₀ in.	2.0	2.0	2.8	5.0	0.8	0.8	1.2
	kN/mm	2.0	4.0	7.0	8.0	9.0	22.0	34.0
	1000 lb./in.	11.3	22.4	39.7	44.6	52	124	197

All load cells

Operating principle		Electromagnetic Pressductor technology
Accuracy class ⁴	%	±1.0
Repeatability error	%	<±0.1
Operating range		30:1
Stainless steel	SIS	2387 ⁵
	DIN	X4CrNiMo165
Working temperature range		-10 to 80°C 14 to 176 °F
Zero point drift ⁶	%/°C	<±0.015
	%/°F	<±0.008
Sensitivity drift ⁶	%/°C	<±0.025
	%/°F	<±0.014

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 small decline in measurement accuracy may be experienced.

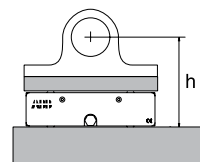
² Maximum permitted loads without affecting load cell calibration.

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.

⁶ Applies for 20 to 60 °C/68 to 148 °F.



Height (h≤135 mm)
from load cell's
bottom surface
to roll center line.

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.

PFEA112/122

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 have six configurable analog out-puts for control and/or monitoring of web tension. It is 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 web 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.

² PROFIBUS is a registered trademark of PROFIBUS and PROFINET International (PI).





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, PROFINET and EtherNet/IP

PFEA112 and PFEA113 have Fieldbus communication via PROFIBUS-DP as standard. PFEA122 comes with PROFINET 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 IP 20 and for wall mounting the IP65.

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 in. plates. Exact numbers depend on the combination of different tension electronics and the number of optional units used.

Options and dimensions

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 IP 65 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.

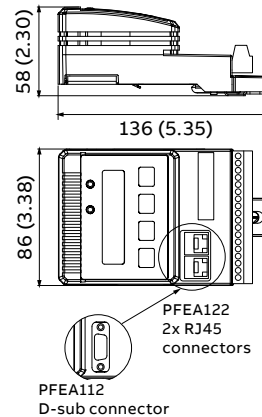
The compact units transform main supply from 110 to 120 V/207 to 240 V AC to 24 V DC for supply of the PFEA tension electronics.

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

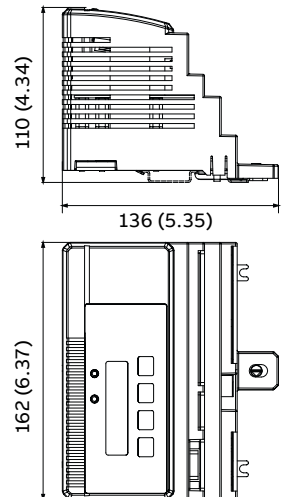
	PFEA111/112/122	PFEA113
SD831 3 A	6	3*
SD832 5 A	12	6*
SD832 10 A	24	12*

* Supply of digital outputs are not included

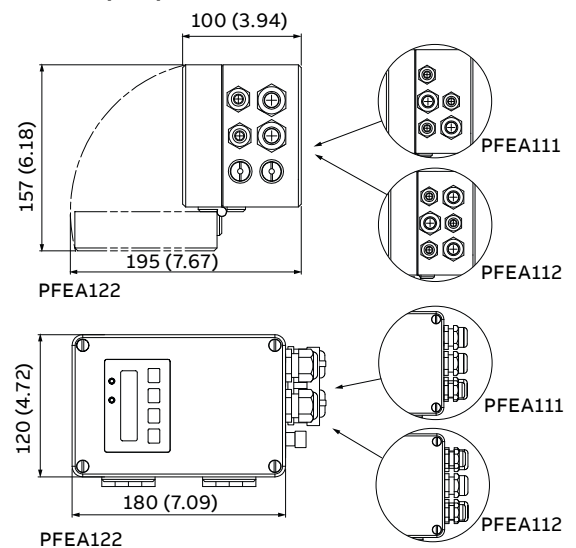
PFEA111/112/122 IP20 version (unsealed)



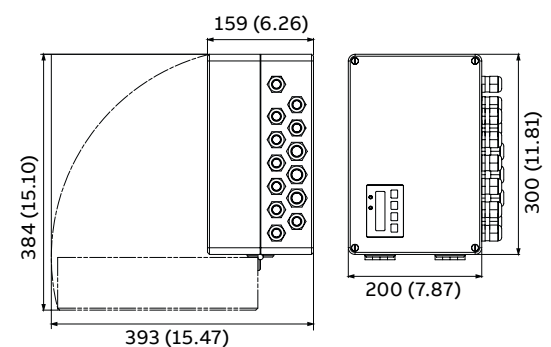
PFEA113 IP20 version (unsealed)



PFEA111/112/122 IP65 version



PFEA113 IP65 version



Dimensions in mm (in)

Technical data

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 PFEA 113 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, pl
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 IP20 or IP

¹ English, German, Italian, French, Japanese, Portuguese² PFEA112: Sum signal, PFEA122: Sum, individual A & individual B signal, PFEA113: Sum, difference, individual A & individual B signal³ uL508 approval available for PFEA111, PFEA113 and PFEA112 IP20



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