

PACeline Piezo technology

Secure results for your measurement and testing tasks



Under control

PACEline from HBM are products used in force and strain measurement technology, and based on the piezoelectric effect. PACEline also has the appropriate solution for your application in all areas of quality or process monitoring. The use of PACEline offers numerous advantages for test engineering, assembly monitoring, function testing or test bench engineering.



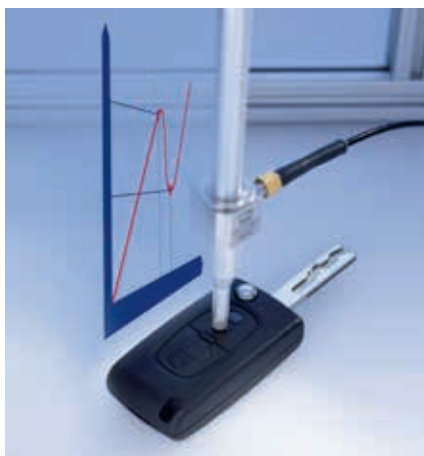
Tests and trials

- Numerous flexible test tasks with one sensor type
- Highly dynamic applications due to sensors with high natural frequencies
- Simple integration of charge amplifier through standardized hardware and software interfaces



Assembly monitoring

- Miniaturization of the systems due to compact sensors
- Low-deformation constructions even under load due to stiff sensors
- Utilization of large sensors even for smaller forces due to sensitivity being independent of the measuring range



Function tests

- Measuring range from less than 1 N up to 700 kN with just one sensor
- Documented quality through proven evaluation methods: 100 % control of components
- High application diversity due to scalable digital amplifier technology for any measuring ranges

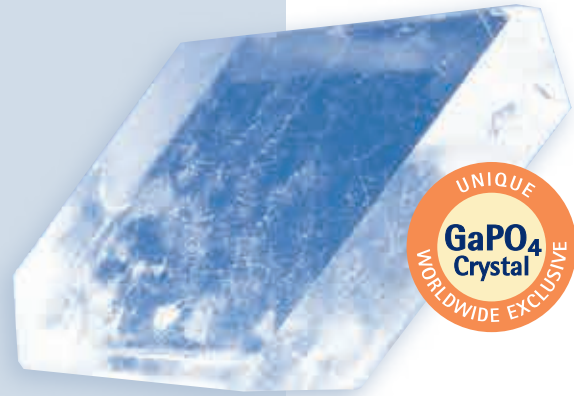
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All clear. Crystal clear.

It all comes down to the crystal. PACeline makes no compromises when it comes to quality.

HBM uses quartz in the PACeline products. They even use gallium phosphate (GaPO₄) for sensors with nominal (rated) force of 5 kN and 20 kN. Both crystals have impressive long-term stability and optimum measuring properties.

In addition to the extraordinary temperature stability, gallium phosphate guarantees high output signals and low-drift measurement, even of smaller forces.



Everything under control

Wherever frequently recurring procedures occur in your processes, PACeline sensors guarantee the best reproducibility and therefore the highest level of security. Regardless of what requirements your production poses. In order to optimally resolve your measurement task, you are provided with perfectly matched electronics and software solutions in addition to the sensors. From fast charge amplifiers with simple monitoring functions right up to complete systems for test bench and assembly monitoring. All sensors and charge amplifiers in the PACeline series are delivered with calibration certificates.



Window lifter
test bench

"The perfectly matched components in the HBM piezoelectric measurement chain helped us to design our test procedures more efficiently and securely in the shortest possible time."

Mr. Soufflet, Mr. Moenne Loccoz and
Mr. Graveline, engineers at Valeo

PACEline at a glance – the calibrated piezoelectric force measurement chain

Complete piezo solutions for your products

PACEline keeps pace at all times, even with the most challenging tasks in your process monitoring. Because PACEline is not just a transducer, it is a measuring chain. Simply put it into operation with the Plug & Measure principle.

You can add other high-performance HBM components to expand the CMC measuring chain – and create your own monitoring system designed specifically for your production lines. A suitable configuration enables peak overload stability.



"We discussed and compared possible measurement technology solutions based on piezo and SG systems with HBM and came to the conclusion that the CFW sensors in the PACEline series are predestined for this application. We were initially skeptical as we have in the past used piezoelectric sensors from other manufacturers without achieving satisfactory results."

Hans Georg Conrady, Managing Director of Artis



Utilization in a machine tool



Powerful transducers

Profit from the performance of HBM's piezoelectric sensors. Stainless materials, symmetrical construction, small displacement and extraordinarily compact dimensions. Our sensors can be easily integrated and perform reliably in your application.



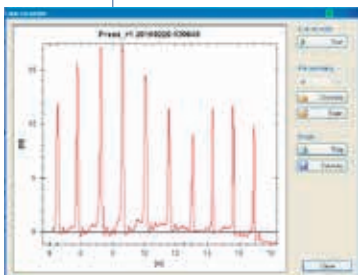
Simply connect

Profit from our experience. In addition to sensor technology, we offer practical accessories. Cables for particularly rough ambient conditions, summing boxes or even mounting aids for piezoelectric force washers. All accessories fit perfectly into the complete piezoelectric solution from HBM. With the usual high quality.



Precise measurement

Assembly without isolation. Charge amplifiers and summing boxes have electrical isolation so that isolated assembly is not required. Metal housings, robust plugs and a high degree of protection provide security even in rugged measurement environments.



Secure evaluation

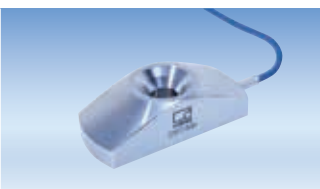
Your measurement data are in safe hands. You can rely on our hardware and software solutions for data acquisition and process monitoring. Irrespective of whether you need solutions for production or tests, get in touch with us.

HBM piezo technology: The facts

PACEline piezo-technology offers you secure results for your measurement and test tasks.
The most important technical data at a glance:

Calibrated force transducers		Calibrated measuring chains		Force washers				
CFT series		CMC series		CFW series		CLP series		
Order No.	Nominal (rated) force	Order No.	Nominal (rated) force	Order No.	Nominal (rated) force	Order No.	Nominal (rated) force	Cable
1-CFT/5kN	5 kN	1-CMC/5kN	5 kN	1-CFW/20kN	20 kN	1-CLP/7kN	7 kN	1m
1-CFT/20kN	20 kN	1-CMC/20kN	20 kN	1-CFW/50kN	50 kN	1-CLP/26kN	26 kN	1m
1-CFT/50kN	50 kN	1-CMC/50kN	50 kN	1-CFW/100kN	100 kN	1-CLP/62kN	26 kN	1m
1-CFT/70kN	70 kN	1-CMC/70kN	70 kN	1-CFW/140kN	140 kN	1-CLP/7kN-0.5m	7 kN	0.5 m
1-CFT/120kN	120 kN	1-CMC/120kN	120 kN	1-CFW/190kN	190 kN	1-CLP/26kN-0.5m	26 kN	0.5 m
				1-CFW/330kN	330 kN	1-CLP/62kN-0.5m	62 kN	0.5 m
				1-CFW/700kN	700 kN			

Main features			
<ul style="list-style-type: none"> · Low displacement · Calibrated in two force ranges (100% and 20%) · Can be used immediately without calibration · Can be mounted with flange screw fitting · Stainless materials · Output signal independent of maximum capacity · High cut-off frequency through peak stiffness · Compatible with market standards 	<ul style="list-style-type: none"> · Sensors in CFT series and analog charge amplifiers with 0...10 V output · Charge amplifier and sensor with two calibrated force ranges · With manufacturing certificate for force → output voltage correlation · High economic efficiency 	<ul style="list-style-type: none"> · Stainless materials · Increased linearity through symmetrical design · Low displacement, high resonance frequency · Rugged charging cable connection and plug protection · Centering sleeve and cable protection in scope of delivery · Simple mounting with pre-stressing sets (option) · Compact ring force sensor 	<ul style="list-style-type: none"> · Ultra-compact · Integrated charge cable · Very high resonance frequency



Strain transducers

CST series

Order No.	Nominal strain
1-CST/300	300 $\mu\text{m}/\text{m}$

- Simple mounting using a screw
- Peak sensitivity of 55 pC/ $\mu\text{m}/\text{m}$ for stiff objects
- Force measurement possible after calibration



Cables

KAB143

Order No.	Length	Suitable for
1-KAB143-2	2 m	CSB4/1 summing box, sensors from CFT, CFW series, charge amplifier from CMA series, CMD charge amplifier via adapter
1-KAB143-3	3 m	
1-KAB143-7	7 m	
1-KAB176-2	2 m	Connection of the CMD digital charge amplifier with CSB4/1 summing box, sensors from CFT, CFW series, CCO connection adapter
1-KAB176-3	3 m	
1-KAB145-3	3 m	CSB4/1 summing box, sensors from CFT, CFW series, charge amplifier from CMA series, CMD charge amplifier via adapter



Adapters

CCO

Order No.
1-CCO



Summing boxes

CSB

Order No.
1-CSB4/1



Pre-stressing sets

CPS series

Order No.	Suitable for
1-CPS/20 kN	1-CFW/20 kN
1-CPS/50 kN	1-CFW/50 kN
1-CPS/100 kN	1-CFW/100 kN
1-CPS/140 kN	1-CFW/140 kN
1-CPS/190 kN	1-CFW/190 kN
1-CPS/330 kN	1-CFW/330 kN
1-CPS/700 kN	1-CFW/700 kN

Main features

<ul style="list-style-type: none"> · Low noise · Robust · Temperature stable up to 120° Celsius 	<ul style="list-style-type: none"> · Simple integration through flexible connection 	<ul style="list-style-type: none"> · Simple parallel connection of four sensors · Galvanic isolation between cable shields and housing · Direct integration in systems without insulation washers 	<ul style="list-style-type: none"> · Stainless · Hardened · Takes into account suitable bolt pitches
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Compact charge amplifier

CMA series

Order No.	1st measuring range	2nd measuring range
1-CMA1	1,000 pC	100 pC
1-CMA2	2,000 pC	200 pC
1-CMA5	5,000 pC	500 pC
1-CMA20	20,000 pC	2,000 pC
1-CMA39	39,000 pC	3,900 pC
1-CMA158	158,000 pC	15,800 pC
1-CMA210	210,000 pC	21,000 pC
1-CMA287	287,000 pC	28,700 pC
1-CMA482	482,000 pC	48,200 pC
1-CMA2000	2,000,000 pC	20,000 pC
1-CMA5000/2 (*)	5,000,000 pC	50,000 pC

Linearity deviation $< \pm 1\%$ of full scale value
 Signal output ± 10 VDC, measuring bandwidth (-3 dB) 10 kHz
 Sensor connection: 10/32-UNF male
 Degree of protection: IP65 in rugged metal housing for mounting in the field

Main features

- Calibration certificate available for each measuring range
- TEDS sensor detection
- Galvanic isolation between supply voltage and measurement signal
- Low-noise, interference-immune measurement signal for rugged operating applications



Universal charge amplifier

CMD series

Order No.	Measuring range	Degree of protection
1-CMD600	50 ... 600,000 pC	IP60
1-CMD600/P	50 ... 600,000 pC	IP65

Linearity deviation: $< \pm 0.5\%$ of full scale value
 Signal output (analog) ± 10 VDC, measuring bandwidth (-3 dB) 30 kHz
 Signal output (digital) Ethernet (TCP/IP), measuring bandwidth 1 kHz
 Peak values: 3 (min/max/peak-peak)
 Limits values: 2
 Digital inputs/outputs: 1 / 2
 Sensor connection: BNC socket (CMD600), 10/32-UNF male (CMD600-P)

Main features

- Calibration certificate available for each measuring range
- Freely configurable charge amplifier for flexible applications (measuring range, limit values, digital inputs/outputs, peak value acquisition, filter and diagnostic functions)
- Two internal independent parameter sets/measurement programs for time-synchronous measurement of different tasks
- Includes parameterization software for comprehensive functions (strip chart, data logging and parameter/device backups)
- Software integration through command library and LabVIEW driver
- Galvanic isolation between supply voltage and measurement signal
- Low-noise, interference-immune measurement signal for rugged environments
- Degree of protection: IP60/IP65 in rugged metal housing for mounting in the field

(*) The CMA5000 has 2 sensor inputs connected in parallel for the measurement of larger forces

PACeline

The right product for your application

You can find more comprehensive product information and the complete technical documentation available for download at www.hbm.com/paceline. Simply request an offer with a click of the mouse or order your required product directly in our online shop:

www.hbm.com/HBMshop



www.hbm.com

HBM Test and Measurement

Tel. +49 6151 803-0

Fax +49 6151 803-9100

info@hbm.com

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