Reliable Force Measurement

HBM force transducers for industry and research

Versatile and Proven Worldwide

HBM always offers the right solution: in production, for test stands, for experimental tasks, in reference technology and for your OEM applications

Full range of force measurement technology:

- Force transducers for use in production
- Force transducers for test stands and experimental tests
- Highly precise reference force transducers for calibration

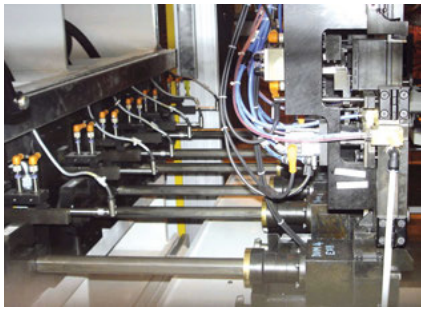
Accumulated expertise:

- Experience since 1956
- Portfolio of strain gauge based and piezoelectric force sensors
- Strain gauge production at HBM Darmstadt
- In-house mechanical manufacturing
- Calibrations from 5 N to 5 MN

Extensive range of services:

- Access to local HBM experts worldwide
- Specialist and technical support including installation and system set-up
- Training and seminars
- Calibration service
- Strain gauge installation

Find out more about HBM force measurement technology here: www.hbm.com/force

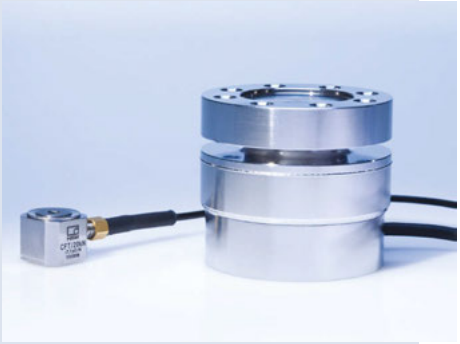


HBM Technology at a Glance

Robust, easy-to-install and flexible to order

HBM force sensors fulfill all you can ask for in this field:

- Robust sensors that are insensitive to lateral forces and bending moments
- Various models available: Compact designs, IP68 degree of protection, easy to mount to flange types
- Many options available: mounted connectors, TEDS, inline/integrated amplifiers
- Force transducers based on strain gauge technology and the piezoelectric effect



Fatigue-rated and precision

Requirements for component tests are increasing constantly. And the quality of the component test stand is a question of the quality of the load cell. HBM helps you with:

- Fatigue-rated load cells
- Huge overload capabilities
- Outstanding reproducibility and highest accuracy
- Double bridges on request
- Many different options on request
- Capacities up to 10 MN available (higher capacities on request)

Maximum precision

Ultimate accuracy is required for force measurement in national institutes and accredited calibration laboratories. HBM precision force transducers for calibration meet these high standards thanks to years of varied experience and close contact with customers:

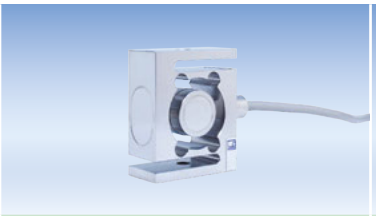
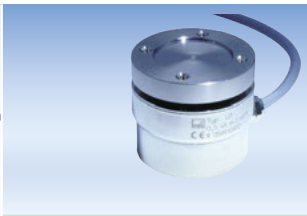
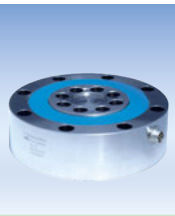
- Technical specifications exceed the requirements of the ISO 376 standard for the top Class 00 by a factor of 10
- Outstanding long-term stability
- Perfect interaction with HBM's DMP41 and MX238B high-precision amplifiers

Sensors for Industrial Applications

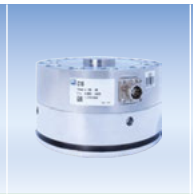
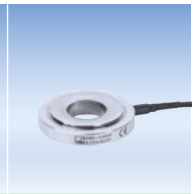
				
Force transducers	**U2B**	**U9C**	**U10M**	**S2M**
Force direction				
Design				
Linearity error (%)	0.2	0.2	0.02 - 0.05	0.02
Capacity from … to				
N		50 N		10 N
kN	500 N – 200 kN	50 kN	1.25 kN	1 kN
MN			1.25 MN 2.5 MN*	
Special features	■ Versatile ■ Flexible configuration ■ Industry standard ■ Available with built-in analog amplifier	■ Miniature force transducer for tensile and compressive forces ■ Hermetically encapsulated ■ For fast measurements ■ Available with analog in-line amplifier	■ Fatigue rated load cell ■ Highly precise ■ Double bridge design and many other options available ■ TEDS IP68 versions available	■ Overload protection in the tensile and compressive directions ■ Highly precise ■ Highly flexible cable, suitable for drag chains ■ High degree of protection (IP67)

**with 200% calibration as an option*

HBM force transducers reliably measure static and dynamic tensile and compressive loading. This page shows you the easy-to-mount, compact and robust multi-purpose industrial versions for your special applications with testing, monitoring and production.

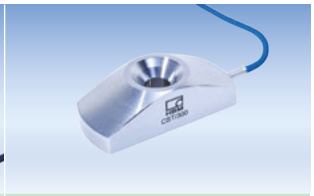
			
S9M	**U3**	**U5**	**U93**
Tension and compression			
			
0.02	0.2	0.2	0.5
500 N 50 kN	500 N 100 kN	100 kN 500 kN	1 kN 50 kN
■ Highly precise ■ Hermetically encapsulated (IP68) ■ Narrow design	■ Insensitive to lateral forces ■ Extremely robust ■ Easy-to-mount flange connection	■ Robust ■ Easy-to-mount flange connection	■ Large bandwidth ■ Robust ■ TEDS ■ Miniature force transducer ■ Insensitive to lateral forces ■ Easy-to-mount flange connection

Sensors for Industrial Applications

					
Force transducers	**C2**	**C9C**	**C10**	**C6B**	**KMR+**
Force direction	Compression				
Design					
Linearity error (%)	0.2	0.2	0.02 - 0.05	0.5	1
Capacity from … to N	500 N	50 N			
kN	200 kN	50 kN	2.5 kN	200 kN	20 kN
MN			1 MN	10 MN	2 MN
Special features	■ Hermetically encapsulated ■ Low overall height ■ High natural frequency ■ Flexible configuration ■ Available with built-in analog amplifier	■ Miniature force transducer for compressive forces ■ Hermetically encapsulated ■ For fast measurement ■ Available with analog in-line amplifier	■ Highly precise ■ Large output signal ■ Many options (double bridge, TEDS, etc.) ■ Low temperature dependence of the zero point	■ High capacities, with small dimensions ■ Internal bore ■ Hermetically encapsulated ■ Robust ■ Flexible configuration	■ Measuring washer based on strain gauge technology ■ Drift-free ■ Hermetically encapsulated (IP68) ■ Compact design

Strain Sensors for Indirect Force Measurement

Screw-on strain sensors for indirect force measurement. With or without integrated amplifier, piezoelectric transducers, or sensors based on strain gauges. For easy mounting, robust design.

			
Sensor	**SLB700A**	**SLB700A/06VA**	**CST**
Principle of measurement	SG, passive	SG, with integrated amplifier	Piezoelectric strain sensor
Mounting	Four M6 screws	Four M6 screws	One M6 screw
Strain ranging from ... to µm/m	-500 µm/m +500 µm/m	-500 µm/m +500 µm/m	-300 µm/m +300 µm/m
Special features	■ Easy mounting ■ Stainless steel materials ■ 6 m or 12 m cable available ■ Robust, tested design	■ Mechanically compatible with the passive SLB700A ■ Integrated amplifier, optionally 4 ... 20 mA or 0 ... 10 V output ■ Teach function for practice-oriented calibration process	■ High sensitivity ■ Easy mounting ■ Compact dimensions ■ With integrated cable

Strain transducers are mounted onto the object to be monitored. The forces acting on the measurement object generate proportional strain that is reliably measured with strain sensors.

The SLB700A/06VA with integrated electronics offers a calibration method using digital switching inputs. Independent of the strain resulting from the force to be measured in your component part, the greatest possible output signal will always be present at the output of the integrated amplifier.
This sensor requires calibration prior to measurement.

Production monitoring

Quality assurance

Monitoring

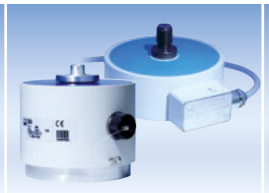
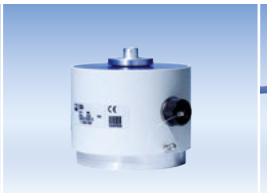
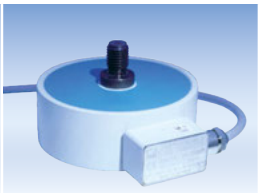
Transducers for Industrial Applications

			
Force transducers	**CFT**	**CFT+**	**CMC**
Force direction			
Design			
Linearity error (%)	1	0.5	1
Capacity from … to N			
kN	5 kN 20 kN	25 kN 120 kN	5 kN 120 kN
MN			
Special features	■ Calibrated piezoelectric force transducer ■ Based on gallium phospate crystals: double sensitivity, very low drift ■ Easy to mount, for fast measurements	■ Calibrated piezoelectric force transducer ■ High stifness - suitable for fast measurements ■ Low drift, low linearity error ■ Easy to mount flange connections	■ Measuring chain calibrated in two ranges ■ Charge amplifier included in the calibration ■ High bandwidth

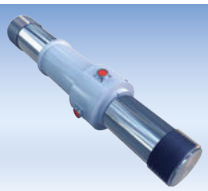
The extremely compact HBM force transducers based on the piezoelectric principle measure quasi-static and dynamic forces where space is a constraint and measuring bodies with high stiffness are used. Compact dimensions, stainless steel materials and an extensive range of accessories facilitate integration.

			
CFW	**CLP**	**CSW**	**CHW**
Compression			
			
1	1	1	1
20 kN 700 kN	3 kN 80 kN	1 kN 8 kN	60 kN
■ Compact force washer ■ High stifness ■ Welded construction	■ Extremely flat force transducer ■ With integrated cable ■ Welded construction	■ Shear force sensor ■ Extremely compact ■ With integrated cable ■ Welded construction	■ Sensor for high temperatures up to 300° C (572° F) ■ With integrated cable

Reference Force Transducers for High-Precision Calibration Tasks

				
Reference force transducers	**U15**	**Top Transfer**	**Z30A**	**Z4A**
Force direction	Tension and compression			
Design				
Class to ISO 376	0.5	Better than 00	00	00
Capacity from … to				
N		100 N	50 N	
kN	2.5 kN	500 kN	10 kN	20 kN 500 kN
MN	2.5 MN			
Special features	■ Fulfills the requirements of the class 0.5 of the ISO376 standard in a force range from 10 % to 100 % of the capacity ■ Different options (double bridge, TEDS, several connectors) available ■ Robust, suitable for industrial use	■ Transfer standards with maximum precision ■ Greatly exceeds the requirements of class 00 ■ Suitable for international comparisons	■ Precision measurements of small forces ■ For use as a calibration standard ■ TEDS	■ Precision measurements of forces up to 500 kN ■ Force measurements with high precision ■ For use as a calibration standard

HBM reference force transducers are the reliable basis for traceability to national standards and for precision measurements comparable to international standards.

				
C15	**C18**	**KD**	**KBD**	**STZ**
Compression				
				
00	0.5	0.5	0.5	0.5
2.5 kN 1 MN	10 kN 5 MN	1 MN 5 MN	2 MN	600 kN 1 MN
■ Fulfills the requirements of the class 00 of the ISO376 standard in a force range from 10 % to 100 % of the capacity ■ Different options (double bridge, TEDS, several connectors) available ■ Robust, suitable for industrial use	■ Compact, low design ■ Ideal for calibration tasks ■ Robust cables	■ Special force transducer for verifying material testing machines ■ With measurement of bending moment	■ Special force transducer for verifying material testing machines ■ With measurement of bending moment ■ Meets the requirements of EN12390-4	■ Special force transducer for verifying material testing machines ■ With measurement of bending moment

Force Calibration at HBM

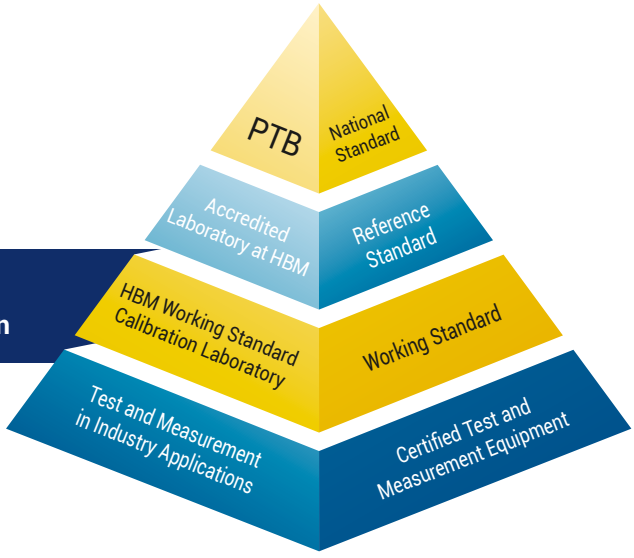
	Accredited calibration				Working standard calibration			
				possible steps 4 6 8 10 A				possible steps 6 10 B
Measuring range								
5 N					X	X	X	■■
10 N	X	X	X	■	X	X	X	■■
20 N	X	X	X	■■■	X	X	X	■■
50 N	X	X	X	■■■■	X	X	X	■■
100 N	X	X	X	■■■■	X	X	X	■■
200 N	X	X	X	■■■■	X	X	X	■■
500 N	X	X	X	■■■■	X	X	X	■■
1 kN	X	X	X	■■■■	X	X	X	■■
2 kN	X	X	X	■■■■	X	X	X	■■
5 kN	X	X	X	■■■■	X	X	X	■■
10 kN	X	X	X	■■■■	X	X	X	■■
20 kN	X	X	X	■■■■	X	X	X	■■
50 kN	X	X	X	■■■■	X	X	X	■■
100 kN	X	X	X	■■■■	X	X	X	■■
200 kN	X	X	X	■■■■	X	X	X	■■
500 kN	X	X	X	■■■■	X	X	X	■■
1 MN	X	X	X	■■■■	X	X	X	■■
2 MN	X	X	X	■■■■	X	X	X	■■
5 MN	X	X	X	■■■■	X	X	X	■■
	Best possible uncertainty: > 0.005 %							

■ Standard offer
Not available

8 10 Acc. to ISO 376

A 4+2 increasing/decreasing series
B 1+1 increasing/decreasing series

Available calibration quantities and HBM calibration laboratory options can be found at: hbm.com/calibration



Your Satisfaction Is Our Commitment

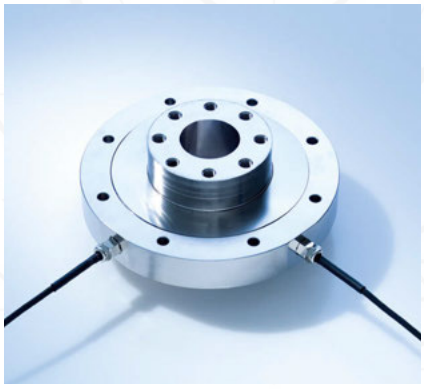
Plug and Measure

Plug and measure is to measurement technology what plug and play is to computers: a technology that facilitates the start of measurements. Important characteristics of the transducer are stored internally in the form of an electronic data sheet called (TEDS). The measuring amplifier loads this data and converts it automatically into the correct settings, allowing you to start measuring immediately without having to make any adjustments.

- Simple operation in accordance with international standards (IEEE)
- Little time required for measurement preparation
- Increased safety, as errors from manually setting up the amplifier are avoided

Customized sensors from the market leader

- Force sensors for: production, reference technology or testing purposes
- OEM sensors for your product, also in huge quantities
- Development and production in close collaboration between you and HBM
- Benefit from HBM quality consistent with our standard product portfolio



For Perfect Interaction

Find the right amplifier system for your specific measurement task

HBM sensors and amplifiers are perfectly matched and offer you an ideal system solution for easy, fast and reliable measurement results.

On this page, you can find amplifier systems for force measurement applications in production, monitoring, quality assurance, machine monitoring and control.

Product		Interface	Characteristics
	**PMX**	Ethernet, Profinet, EtherCAT, ± 10 V	Modular measuring amplifier system for production and industrial test benches
	**ClipX**	PROFINET, EtherCAT®, PROFIBUS, Ethernet/ IP™, Modbus-TCP, Analog (V/mA,) Digital I/O, Ethernet (TCP/IP)	Precise and Easy-to-Integrate industrial signal conditioner
	**MP85**	Ethernet, Profibus, CAN	All-rounder for fitting,testing and press fitting processes
	**CMD**	Ethernet, ± 10 V	Digital charge amplifier for piezoelectric sensors, version with IP65 available
	**CMA**	± 10 V	Analog charge amplifier for piezoelectric sensors

Data acquisition systems for force measurement in research, development and test bench construction

Product		Interface	Characteristics
	**QuantumX**	Ethernet, EtherCAT, PROFINET, CAN, ± 10 V	Universal and distributable data acquisition system
	**MGCplus**	Ethernet, Profibus, CAN, ± 10 V	Centralized instrument
	**SomatXR**	Ethernet, EtherCAT, PROFINET, CAN	Ruggedized and mobile data acquisition systems
	**Genesis HighSpeed**	Ethernet, EtherCAT, ± 10 V	Transient recorder
	**DMP41**	Ethernet	Highest precision measuring instrument

Test and measurement software.

Product		Short description
	**catman**	Data acquisition software for acquisition, visualization and analyzing of measuring data – During and after the measurement

www.hbm.com

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measure and predict with confidence

HBM: public
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