Reliable force measurement

HBM force transducers for industry and research

Versatile in use, proven worldwide

HBM always offers the right solution

Full range of force measurement technology:

- Force transducers for use in production
- Force transducers for tests and experiments
- Highly precise reference force transducers for calibration

Accumulated expertise:

- Decades of experience in the development of force transducers
- High-end strain gauge production at Darmstadt headquarters
- In-house mechanical manufacturing
- Calibrations from 5 N to 5 MN

Extensive range of services offered by the leading international measurement technology expert:

- HBM expert knowledge on site anywhere in the world
- Individually customized advice, installation and start-up
- Training and seminars
- Calibration service
- Strain gauge installation

Everything about force measurement technology can be found at: www.hbm.com/force

Experiments and tests

Reliable measurements thanks to HBM's decades of experience in diverse sectors of industry including aerospace, automotive or test stand construction.

- Input signal for actuator control
- Reliable measurement of forces applied
- High precision when used in functional testing
- Endurance strength offering high reserves

Production monitoring

Automation ensures uniformly high quality, fast cycle times and reliable processes.

- Utilize custom-made digital electronics to monitor: Press-fit processes, force trends in functional testing, forming processes, web tension measurement, etc.
- Input signal for control
- Reliable measurement of forces applied in the production environment
- Functional testing

Test benches and material testing

International quality guidelines require that material and product properties are checked for safety.

- Testing the required specifications in various types of testing machines and test benches
- Measurement of torques on brakes and engine test benches via lever arms

Calibration

Precise measurement using HBM reference transducers is guaranteed through traceability to National Standards.

- Verification of production and measurement tools
- Reliable and precise calibration of material testing machines and other force sensors
- High-precision measurements in international force comparison
- HBM sensors as reference in your calibration machine

HBM technology at a glance

Robust, compact and easy to install

Force transducers have an important role to play in industrial process control. Force responses or peak forces are monitored inline for fitting or compression processes and provide instant information about quality.

- Robust force transducers that are insensitive to lateral force
- Compact designs
- Easy mounting
- TEDS transducer identification
- Force transducers based on strain gauge technology and the piezoelectric effect

High endurance and precision

Component optimization always raises questions about part durability when reduced use is made of materials. HBM's force measurement technology meets the following requirements:

- Endurance strength
- Vast safety reserves
- High oscillation width (tensile and compressive loading)
- Good reproducibility and reliably high accuracy
- Redundant measuring bridges

Maximum precision from HBM

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 ML38B high-precision amplifiers

Your satisfaction is our commitment

Plug and Measure

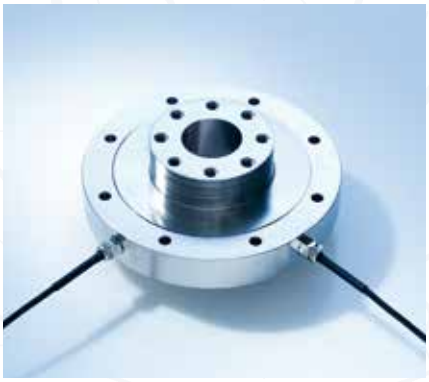
Plug and Measure is to measurement technology what Plug and Play is to computers: technology that makes getting started with your measurement easy. Important characteristics of the transducer are stored internally in the form of an electronic data sheet called TEDS. The measuring amplifier is able to load this data and convert it automatically into the correct settings. This allows the user to start measuring immediately with the right settings for the unit without having to make any adjustments.

- Ease of use in compliance with international standards (IEEE)
- Minimal time required for measurement preparation
- Increased safety, as errors from manually setting up the amplifier are avoided

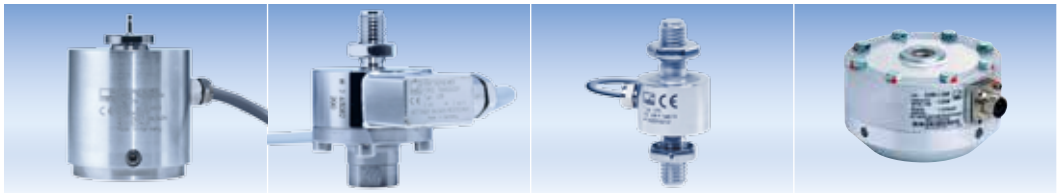
Customized sensors providing maximum quality

We develop and manufacture customized transducers for your order and to your specifications. Custom-made for you, with the experience and competence of the market leader.

- Flexible design and quantities, with or without an integrated amplifier – it's your choice
- Fast development and production – rapid engineering and rapid prototyping provide quick results
- Reliable through calibration, ISO9001 certification, 2-year-warranty and HBM expertise right from the start of your project



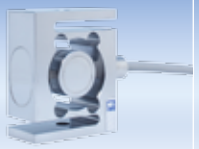
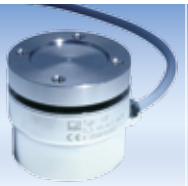
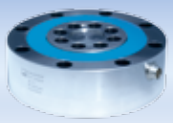
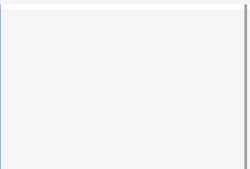
Sensors for industrial applications



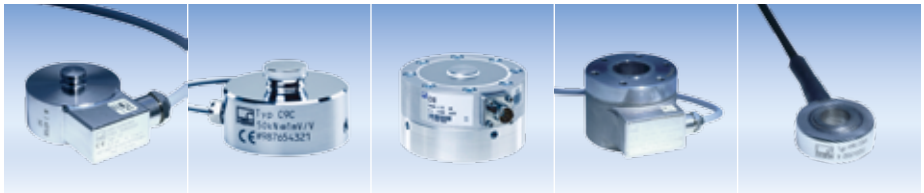
Force transducers	U1A	U2B	U9C	U10M
Force direction				
Design				
Linearity error (%)	0.1	0.2	0.2	0.03 - 0.06
Capacity from ... to N	10 N – 50 N	500 N – 200 kN	50 N – 50 kN	1.25 kN – 500 kN
kN				
MN				1 MN*
Special features	▪ Force transducer for small tensile and compressive forces ▪ Overload protection	▪ Versatile in use ▪ Flexible configuration ▪ Industry standard	▪ Miniature force transducer for tensile and compressive forces ▪ Hermetically encapsulated ▪ High cut-off frequency	▪ High dynamic oscillation width ▪ Highly precise ▪ Double bridge design and many other options available ▪ TEDS

*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 in testing, monitoring and production.

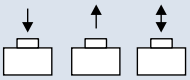
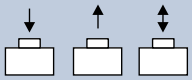
U10S	S2M	S9M	U3	U5	U93
					
Tension and compression					
					
0.03 - 0.06	0.02	0.02	0.2	0.2	0.5
1.25 kN 450 kN 900 kN*	10 N 1 kN	500 N 50 kN	500 N 100 kN	100 kN 500 kN	1 kN 50 kN
▪ High dynamic oscillation width ▪ Highly precise ▪ Double bridge design ▪ TEDS ▪ Threaded connector to UNF standard	▪ Overload protection in the tensile and compressive directions ▪ Highly precise ▪ Highly flexible cable, suitable for drag chains ▪ High degree of protection (IP67)	▪ Highly precise ▪ Hermetically encapsulated (IP68) ▪ Narrow design	▪ Insensitive to lateral forces ▪ Extremely robust ▪ Easy-to-mount flange connection	▪ Robust ▪ Easy-to-mount flange connection	▪ Highly compact ▪ Robust ▪ TEDS ▪ Miniature force transducer ▪ Insensitive to lateral forces ▪ Easy-to-mount flange connection

Sensors for industrial applications



Force transducers	C2	C9C	C10	C6A	KMR
Force direction	Compression				
Design					
Linearity error (%)	0.2	0.2		0.5	1
Capacity from ... to N		50 N ... 50 kN			
kN	500 N ... 200 kN		2 kN ... 1MN	200 kN ... 5MN	20 kN ... 400 kN
MN					
Special features	▪ Hermetically encapsulated ▪ Low overall height ▪ High natural frequency ▪ Flexible configuration	▪ Miniature force transducer ▪ Hermetically encapsulated ▪ High cut-off frequency	▪ Highly precise ▪ Large output signal ▪ Many options (double bridge, TEDS, etc.) ▪ Low temperature dependence of the zero point	▪ High capacities, with small dimensions ▪ Continuous internal bore	▪ Measuring washer based on strain gauge technology ▪ Hermetically encapsulated

Force calibration options 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 %							

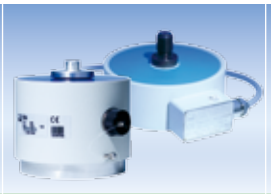
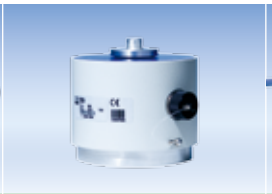
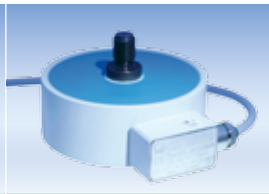
■ Standard offer
□ Not available

8 10 Acc. to ISO 376

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

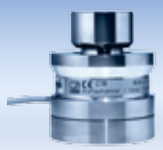
All the calibration quantities and options of the HBM calibration laboratory can be found at: www.hbm.com/calibration

Reference force transducers for high-precision calibration tasks

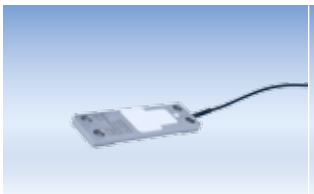
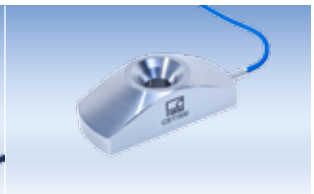
Reference force transducers	U15	Top Transfer	Z30A	Z4A
Force direction	Tension and compression			
Design				
Class to ISO 376	0.5	Better than 00	0	0
Capacity from ... to N		100 N	50 N	
kN	2 kN	500 kN	10 kN	20 kN 500 kN
MN	1 MN			
Special features	▪ Precision force transducer ▪ For a wide range of calibration tasks in industry and research ▪ TEDS ▪ Numerous options available	▪ 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.

			
C18	**KD**	**KDB**	**STZ**
Compression			Tensile
			
0.5	0.5	0.5	0.5
10 kN 5 MN	1 MN 5 MN	2 MN	600 kN 1 MN
▪ 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	▪ Special force transducer for verifying material testing machines ▪ With measurement of bending moment

Strain transducers for indirect force measurement

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

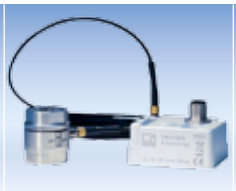
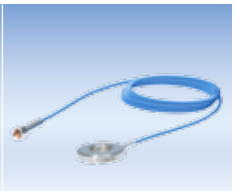
			
Sensor	**SLB700A**	**SLB700A/06VA**	**CST**
Principle of measurement	SG, passive	SG, with integrated amplifier	Piezoelectric strain sensor
Mounting	Four M6 screws	Four M6 screws	One M6 screw
Strain ranging from ... to µm/m	-500 µm/m +500 µm/m	-500 µm/m +500 µm/m	-300 µm/m +300 µm/m
Special features	▪ 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.

Transducers for industrial applications

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.

				
Force transducers	**CFT**	**CMC**	**CFW**	**CLP**
Force direction	Compression			
Design				
Linearity error (%)	1	1	1	1
Capacity from ... to				
N				
kN	5 kN 120 kN	5 kN 120 kN	20 kN 700 kN	7 kN 80 kN
MN				
Special features	▪ Calibrated piezoelectric force transducers ▪ High stiffness ▪ Easy-to-mount flange connections	▪ Measuring chain calibrated in two ranges ▪ Charge amplifier included in the calibration ▪ High bandwidth	▪ Compact force washers ▪ High stiffness ▪ Welded construction	▪ Extremely flat force transducer ▪ With integrated cable ▪ Welded construction

For perfect interaction

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

Find the right amplifier system for your specific measurement task:

Application	Product		Interface	Special features
Amplifier systems for force measurement in production, monitoring, quality assurance, machine monitoring and control		PMX	Ethernet, Profinet, EtherCAT, ± 10 V	Modular measuring amplifier system for production and industrial test benches
		PME	Profibus, CAN, Interbus S, ± 10 V, 0/4 ... 20 mA	Industrial measurement electronics with fieldbus connection
		MP85	Ethernet, Profibus, CAN	All-rounder for fitting,testing and press fitting processes
		DigiClip	Profibus, CAN, DeviceNet	Modular measuring amplifier system with fieldbus connection for industrial environments
		AED	RS485, Profibus, CAN, DeviceNet	Digital transducer electronics with field housing
		Clip	± 10 V, 0/4 ... 20 mA	Electronics for industrial measurement tasks
		CMD	Ethernet, ± 10 V	Digital charge amplifier for piezoelectric sensors
		CMA	± 10 V	Analog charge amplifier for piezoelectric sensors

Application	Product		Interface	Special features
Amplifier systems for force measurement in research, development and test bench construction		QuantumX	Ethernet, EtherCAT, CAN, ± 10 V	Measuring amplifier system for universal measurement data acquisition
		MGCplus	Ethernet, USB, Profibus, Canbus, ± 10 V	Universal and scalable measuring amplifier system for laboratory and test bench
		SOMAT	Ethernet, CAN	Rugged, mobile data acquisition systems
		Genesis	Ethernet, ± 10 V	Data logger with high sampling rate
		DMP41	Ethernet, USB	Digital precision measuring instrument – used around the world by nearly all national testing facilities

Professional software is the key to successful test and measurement.

Software	Product		Short description
Test and measurement software	catman	catman	Professional software for data acquisition and processing

www.hbm.com

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measure and predict with confidence

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